

## Supporting Information

### **Transition-metal-, oxidant- and additive-free multi-component synthesis of alkyl heteroaryl BCPs enabled by visible-light-induced phosphine-catalyzed halogen-atom transfer**

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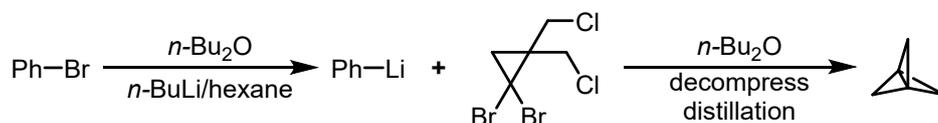
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## General Information

All reagents and deuterated solvents were commercially available and used without further purification. All products were separated by silica gel (200-300 mesh) column chromatography with petroleum ether (PE) (60-90°C) and ethyl acetate (EA).  $^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{19}\text{F}$  and  $^{31}\text{P}$  NMR spectra were recorded on a Bruker Advance 500 spectrometer at ambient temperature with  $\text{CDCl}_3$  as solvent and tetramethylsilane (TMS) as the internal standard. Melting points were determined on an X-5 Data microscopic melting point apparatus. Analytical thin layer chromatography (TLC) was performed on Merk precoated TLC (silica gel 60 F254) plates. Compounds for HRMS were analyzed by positive mode electrospray ionization (ESI) using Agilent 6530 QTOF mass spectrometer.

## 1. Experimental Section

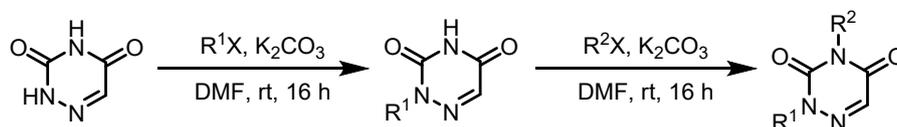
### 1.1 Preparation of the solution of [1.1.1]propellane in hexane



A 150 mL three-neck round bottom flask equipped with a magnetic stirring bar was charged with bromobenzene (100 mmol, 1.0 equiv.) and  $n\text{-Bu}_2\text{O}$  (20 mL). Then the reaction mixture was cooled down to  $-30\text{ }^\circ\text{C}$  and  $n\text{-BuLi}$  (100 mmol, 1.0 equiv., 2.5 M in hexane) was added dropwise. After the addition was completed, the reaction mixture was allowed to warm to room temperature, and stirred at room temperature for 1 h. The reaction mixture was used directly in the next step.

A solution of the above prepared PhLi in  $n\text{-Bu}_2\text{O}$ /hexane (65 mL) was added dropwise to a suspension of 1,1-dibromo-2,2-bis(chloromethyl)cyclopropane (45.0 mmol) in anhydrous  $n\text{-Bu}_2\text{O}$  (20 mL) at  $-20\text{ }^\circ\text{C}$ . After the addition was completed, the reaction mixture was allowed to warm to  $0\text{ }^\circ\text{C}$  and stirred for 2 h. Then the addition funnel was swapped out for a distillation head with attached 100 mL round bottom flask in a bath (liquid nitrogen). A vacuum was slowly applied to the system and the distillate was collected, while maintaining the reaction/distillation flask below  $0\text{ }^\circ\text{C}$ . Approximately 30 mL of distillate was collected. The concentration of [1.1.1]propellane (0.4-0.6 M) was measured by  $^1\text{H}$  NMR using dichloromethane as the standard.

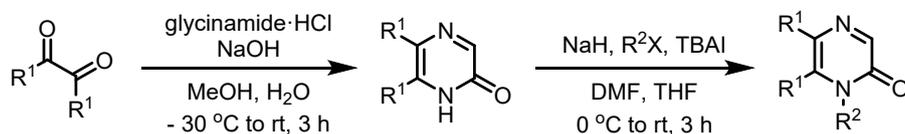
### 1.2 Preparation of the starting material azauracils



All the azauracils are known compounds.<sup>1</sup> The general synthesis procedures were described as follows: To a round bottom flask charged with 6-azauracil (4.0 mmol),  $\text{K}_2\text{CO}_3$  (2.0 mmol) and DMF (40 mL) was added alkyl halides (3.6 mmol) dropwise. The reaction mixture was allowed to stir at room temperature for 16 h, and then quenched by water and extracted with EtOAc. The combined organic layer was washed with brine, dried over  $\text{MgSO}_4$ . The solvent was removed *in vacuo*, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel). To a round bottom flask charged with N-1-alkyl-6-azauracils (2.0 mmol),  $\text{K}_2\text{CO}_3$  (1.0 mmol) and DMF (20 mL) was added alkyl halides (2.0 mmol) dropwise. The reaction mixture was allowed

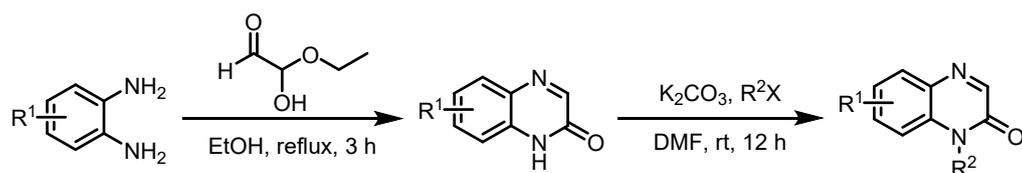
to stir at room temperature for 16 h, and then quenched by water and extracted with EtOAc. The combined organic layer was washed with brine, dried over MgSO<sub>4</sub>. The solvent was removed *in vacuo*, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel).

### 1.3 Preparation of the starting material pyrazinones



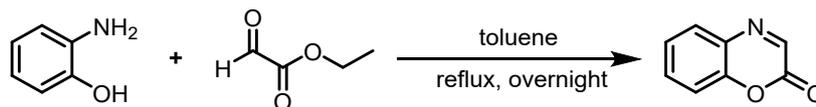
All the pyrazinones are known compounds.<sup>1</sup> The general synthesis procedures were described as follows: To a round bottom flask charged with glycine hydrochloride (20.0 mmol) and MeOH (18 mL) was added water (4.4 mL). To the above suspension was added 12.5 M aqueous NaOH solution (28.6 mmol) at -30 °C, followed by a solution of NaOH (20.0 mmol) in MeOH (9 mL). Glyoxal monohydrate (20.0 mmol) was then added at -30 °C and the resulting mixture was allowed to stir at -30 °C for 2 h. The resulting mixture was further stirred at room temperature for 1 h. The reaction mixture was cooled in an ice bath and acidified with AcOH. The precipitate separated was collected by filtration and dried to afford pyrazinones as a pale red solid. To a round bottom flask charged with sodium hydride (5.2 mmol, 60% dispersion in mineral oil) was added DMF (2 mL) under N<sub>2</sub> atmosphere. To the above suspension was added a solution of pyrazinones (3.5 mmol) in DMF (2 mL) and THF (2 mL) dropwise at 0 °C. A solution of the corresponding alkyl halide (4.6 mmol) in THF (1 mL) was added dropwise after 15 minutes at 0 °C. Then *tetra*-butyl ammonium iodide (0.35 mmol) was added to the reaction mixture. The reaction mixture was allowed to stir at room temperature for 3 h, and then quenched by ice water and extracted with EtOAc. The combined organic layer was washed with brine, dried over MgSO<sub>4</sub>. The solvent was removed *in vacuo*, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel).

### 1.4 Preparation of the starting material quinoxaline-2(1H)-ones



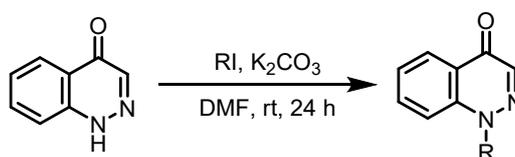
All the quinoxaline-2(1H)-ones are known compounds.<sup>2</sup> The general synthesis procedures were described as follows: To a round bottom flask charged with *o*-arylenediamine (10 mmol) and ethanol (50 mL) was added ethyl glyoxylate (12 mmol). The mixture was stirred at reflux for 3 h. The precipitated solid was filtered and washed with ethanol, then dried to give the first step product. To a suspension of the first step product (10 mmol) in DMF was added potassium carbonate (12 mmol) and halogenoalkanes (16 mmol). The mixture was stirred at room temperature for 12 h. The reaction was quenched by water and extracted with EtOAc. The combined organic layer was washed with brine, dried over MgSO<sub>4</sub>. The solvent was removed *in vacuo*, and the obtained residue was purified by silica gel column chromatography (200-300 mesh silica gel).

### 1.5 Preparation of the starting material 4-azacoumarin



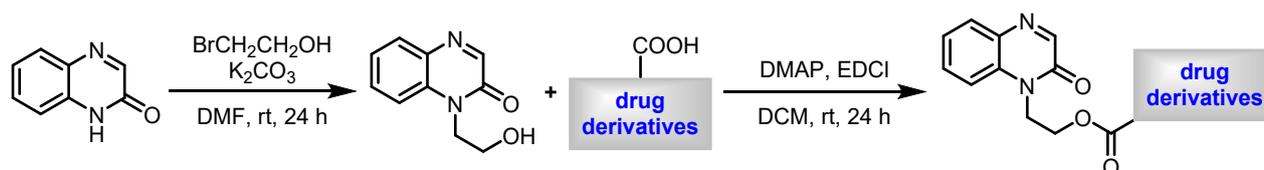
The 4-azacoumarin is a known compound.<sup>3</sup> The general synthesis procedure was described as follows: To a round bottom flask charged with 2-aminophenol (10.0 mmol), ethyl glyoxylate solution (~50% in toluene) in anhydrous toluene (0.25 M), and dried 4Å molecular sieves (0.6 g/mmol). Then reflux the reaction overnight, cool the mixture to room temperature and filter the resulting mixture through a plug of celite. Then the solvent was removed in vacuo. The residue was purified by flash column chromatography on silica (pentane/acetone 20:1), affording the compound **3a** as a yellow crystalline solid.

### 1.6 Preparation of the starting material cinnolinones



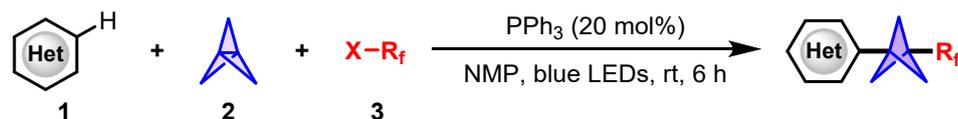
The cinnolinones are known compounds.<sup>4</sup> The general synthesis procedure was described as follows: To a round bottom flask charged with cinnolin-4(1H)-one (2.0 mmol), K<sub>2</sub>CO<sub>3</sub> (3.0 mmol) and DMF (20 mL) was added alkyl halides (2.6 mmol) dropwise. The reaction mixture was allowed to stir at room temperature for 24 h, and then quenched by water and extracted with EtOAc. The combined organic layer was washed with brine, dried over MgSO<sub>4</sub>. The solvent was removed *in vacuo*, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel).

### 1.7 Preparation of the starting material drug derivatives



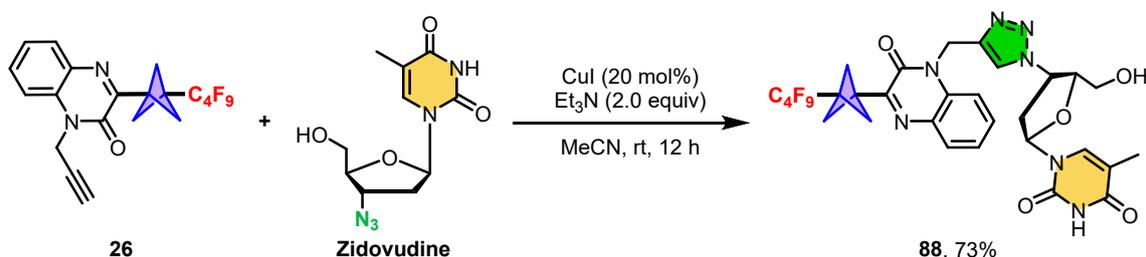
All the drug derivatives are known compounds.<sup>5</sup> The general synthesis procedures were described as follows: To a round bottom flask charged with quinoxalin-2(1H)-one (10 mmol), K<sub>2</sub>CO<sub>3</sub> (30 mmol) and DMF (50 mL) was added 2-bromoethanol (12 mmol). The mixture was stirred at room temperature for 24 h, and then quenched by water and extracted with EtOAc. The combined organic layer was washed with brine, dried over MgSO<sub>4</sub>. The solvent was removed *in vacuo*, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel). To a round bottom flask charged with 1-(2-hydroxyethyl)quinoxalin-2(1H)-one (4.0 mmol), DMAP (0.4 mmol), EDCI (10 mmol), and DMF (50 mL) was added carboxylic acid drug molecules (4.4 mmol). The mixture was stirred at room temperature for 24 h, and then quenched by water and extracted with EtOAc. The combined organic layer was washed with brine, dried over MgSO<sub>4</sub>. The solvent was removed *in vacuo*, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel).

## 1.8 General procedure for the multicomponent reaction



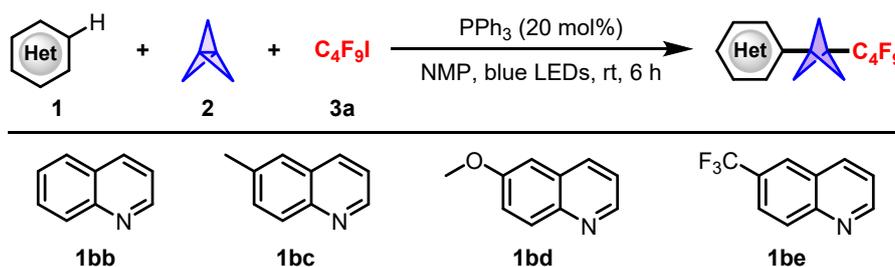
A mixture of heteroarene (1) (0.2 mmol), [1.1.1]propellane (2) (0.5 mmol), alkyl halides (3) (0.4 mmol), PPh<sub>3</sub> (20 mol%) and NMP (2.0 mL) in a 25-mL Schlenk tube was stirred with the irradiation of blue LEDs (10 W) at room temperature under a nitrogen atmosphere for 6 h. After completion of the reaction, a saturated NH<sub>4</sub>Cl solution was added to the mixture. The mixture was then extracted with EtOAc, and the collected organic layer was washed with brine, and dried with MgSO<sub>4</sub>. The solvent was removed *in vacuo*, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel).

## 1.9 General procedure for the synthesis of compound 88

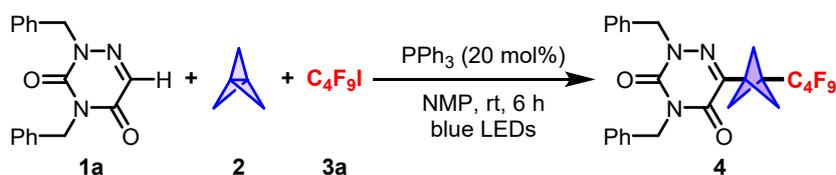


A mixture of compound (26) (0.2 mmol), zidovudine (0.3 mmol), Et<sub>3</sub>N (0.4 mmol), CuI (20 mol%) and MeCN (10 mL) in a round bottom flask was stirred at room temperature for 12 h. After completion of the reaction, the reaction mixture was filtered and the solution was concentrated *in vacuo*. The obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel).

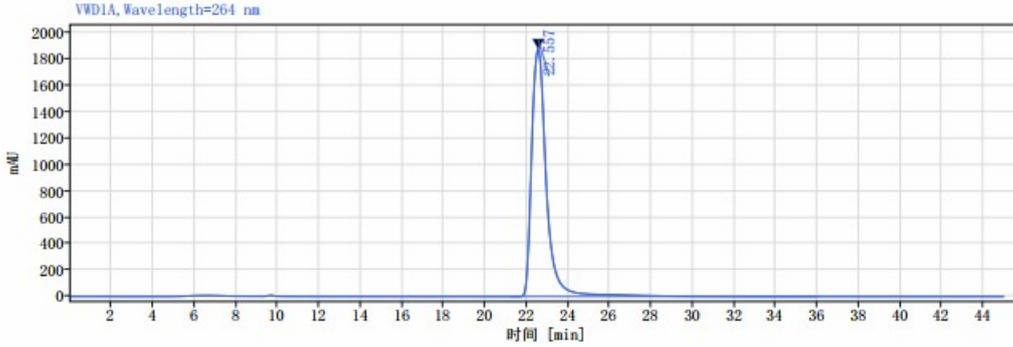
## 1.10 Ineffective substrates for the multicomponent reaction



## 1.11 Determine the amount of phosphine residues in the product by HPLC



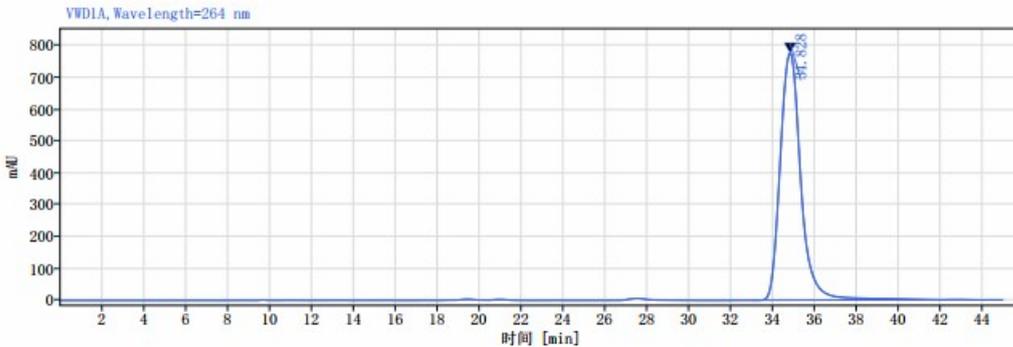
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 仪器: HPLC1260 进样日期: 2024-08-10 11:46:14+08:00  
 进样体积: 10.000 µL 位置: 62  
 采集方法: HY-CH3OH. amx 类型: 样品  
 处理方法: GC\_LC 面积百分比\_DefaultMethod. pmx 样品含量: 0.00  
 手动修改: 手动积分



信号: VWD1A, Wavelength=264 nm

保留时间 [min]	类型	峰宽 [min]	峰面积	峰高	峰面积%	名称
22.557	BB	14.81	93439.63	1879.21	100.00	
总和			93439.63			

数据文件: 2024-08-10 12-31-19+08-00-02. dx  
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 样品名称: 4 操作者: SYSTEM  
 仪器: HPLC1260 进样日期: 2024-08-10 12:32:44+08:00  
 进样体积: 10.000 µL 位置: 63  
 采集方法: HY-CH3OH. amx 类型: 样品  
 处理方法: GC\_LC 面积百分比\_DefaultMethod. pmx 样品含量: 0.00  
 手动修改: 手动积分



信号: VWD1A, Wavelength=264 nm

保留时间 [min]	类型	峰宽 [min]	峰面积	峰高	峰面积%	名称
34.828	BB	8.92	53346.02	776.86	100.00	
总和			53346.02			

## 1.12 Visible light irradiation on/off experiments

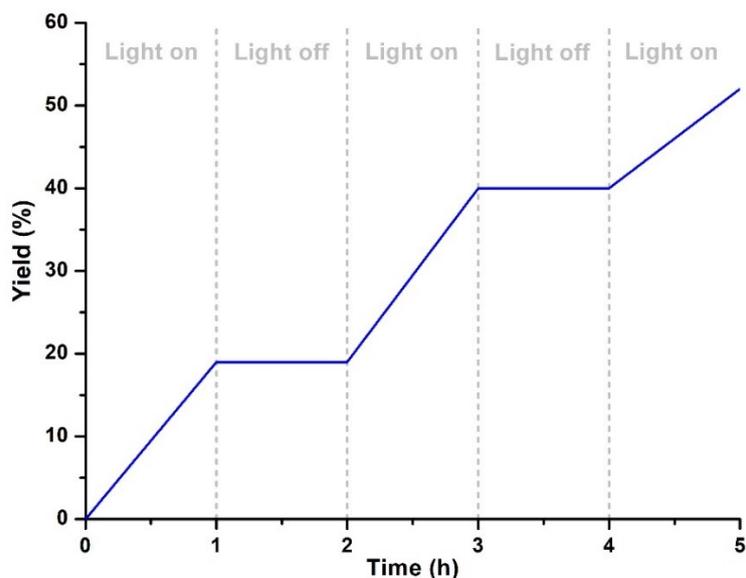
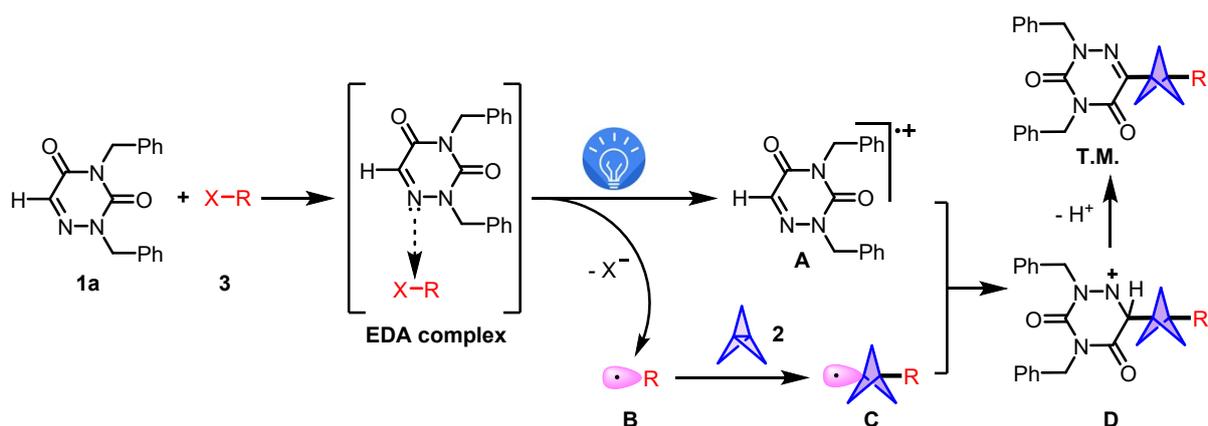


Figure S1 Visible light irradiation on/off experiments.

## 1.13 Proposed mechanism

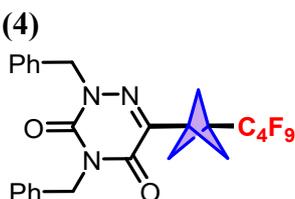


## 2 References

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3. J. H. Ye, P. Bellotti, T. O. Paulisch, C. G. Daniliuc and F. Glorius, *Angew. Chem. Int. Ed.*, 2021, **60**, 13671.
4. P.; Marshall, B.; Mooney and R. Prager, *Aust. J. Chem.*, 1981, **34**, 2619.
5. J. Zhu, Y. Guo, Y. Zhang, W. Li, P. Zhang and J. Xu, *Green Chem.*, 2023, **25**, 986.

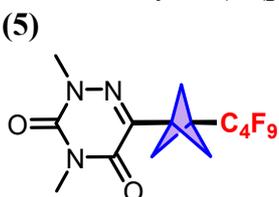
### 3 Characterization of Products

#### 2,4-Dibenzyl-6-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2*H*,4*H*)-dione (4)



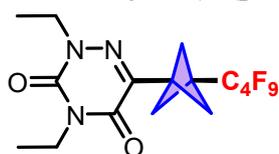
Obtained as a light yellow solid (X = I, 78 mg, 68% yield); M. P. = 115-116 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.48 (d, *J* = 6.5 Hz, 2H), 7.42 – 7.27 (m, 8H), 5.06 (d, *J* = 17.5 Hz, 4H), 2.39 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 149.0, 140.6, 135.5, 135.5, 129.6, 128.8, 128.8, 128.6, 128.4, 128.2, 55.5, 51.0, 44.1, 38.9, 38.2 (t, *J* = 30.2 Hz), <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.05 – -81.10 (m), -116.60 – -116.66 (m), -122.26 – -122.32 (m), -126.01 – -126.08 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>26</sub>H<sub>20</sub>F<sub>9</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 600.1304, Found 600.1303.

#### 2,4-Dimethyl-6-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2*H*,4*H*)-dione (5)



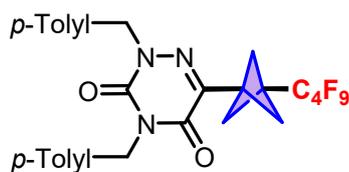
Obtained as a light yellow solid (X = I, 55 mg, 65% yield); M. P. = 98-99 °C; IR (KBr)  $\nu$ /cm<sup>-1</sup> 2965, 2924, 1763, 1604, 1467, 1296, 1186, 1096, 1018, 753, 717; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 3.62 (s, 3H), 3.33 (s, 3H), 2.40 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.8, 149.2, 139.9, 51.0, 39.6, 38.8, 38.2 (t, *J* = 30.2 Hz), 26.9, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.05 – -81.10 (m), -116.60 – -116.68 (m), -122.28 – -122.35 (m), -126.02 – -126.09 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>14</sub>H<sub>12</sub>F<sub>9</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 448.0678, Found 448.0679.

#### 2,4-Diethyl-6-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2*H*,4*H*)-dione (6)



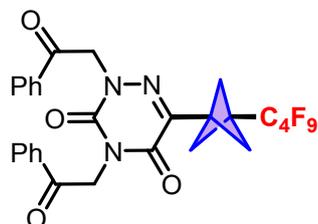
Obtained as a white solid (X = I, 56 mg, 62% yield); M. P. = 92-93 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 3.98 (dq, *J* = 21.1, 7.1 Hz, 4H), 2.40 (s, 6H), 1.32 (t, *J* = 7.2 Hz, 3H), 1.24 (t, *J* = 7.1 Hz, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 148.5, 140.2, 51.0, 46.9, 38.9, 38.2 (t, *J* = 30.2 Hz), 35.9, 13.3, 12.4, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.02 – -81.14 (m), -116.63 – -116.69 (m), -122.35 – -122.38 (m), -126.05 – -126.11 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>16</sub>H<sub>16</sub>F<sub>9</sub>N<sub>3</sub>O<sub>2</sub>: [M+H]<sup>+</sup> 454.1172, Found 454.1171.

**2,4-bis(4-Methylbenzyl)-6-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2H,4H)-dione (7)**



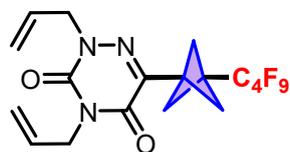
Obtained as a white solid (X = I, 77 mg, 67% yield); M. P. = 188-189 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.40 (d, *J* = 7.9 Hz, 2H), 7.31 (d, *J* = 7.9 Hz, 2H), 7.15 (dd, *J* = 15.5, 7.8 Hz, 4H), 5.04 (s, 2H), 5.01 (s, 2H), 2.40 (s, 6H), 2.35 (s, 3H), 2.33 (s, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 149.0, 140.5, 138.2, 138.0, 132.5, 132.5, 129.6, 129.4, 129.3, 128.8, 55.2, 51.0, 43.8, 38.9, 38.2 (t, *J* = 30.2 Hz), 21.2, 21.2, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.05 – -81.09 (m), -116.62 – -116.67 (m), -122.30 – -122.34 (m), -126.01 – -126.08 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>26</sub>H<sub>20</sub>F<sub>9</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 628.1617, Found 628.1612.

**6-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-2,4-bis(2-oxo-2-phenylethyl)-1,2,4-triazine-3,5(2H,4H)-dione (8)**



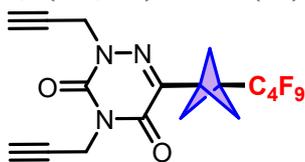
Obtained as a light yellow solid (X = I, 87 mg, 69% yield); M. P. = 112-113 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.98 (dd, *J* = 7.1, 5.8 Hz, 4H), 7.63 (dd, *J* = 15.5, 7.6 Hz, 2H), 7.51 (dd, *J* = 15.7, 7.9 Hz, 4H), 5.42 (s, 2H), 5.36 (s, 2H), 2.41 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 191.4, 190.3, 155.1, 149.0, 141.1, 134.5, 134.3, 134.3, 134.2, 129.0, 128.9, 128.2, 128.1, 57.6, 51.1, 46.3, 38.8, 38.2 (t, *J* = 30.2 Hz), <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.07 – -81.11 (m), -116.60 – -116.68 (m), -122.30 – -122.37 (m), -126.03 – -126.09 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>28</sub>H<sub>20</sub>F<sub>9</sub>N<sub>3</sub>O<sub>4</sub>: [M+H]<sup>+</sup> 634.1383, Found 634.1375.

**2,4-Diallyl-6-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2H,4H)-dione (9)**



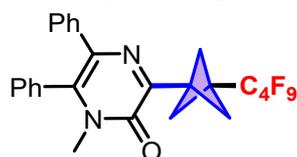
Obtained as a yellow solid (X = I, 57 mg, 60% yield); M. P. = 63-64 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 5.98 – 5.81 (m, 2H), 5.36 – 5.23 (m, 4H), 4.53 (dd, *J* = 18.4, 6.1 Hz, 4H), 2.40 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.1, 148.5, 140.5, 131.2, 130.2, 119.6, 119.3, 54.3, 51.0, 42.8, 38.8, 38.2 (t, *J* = 30.2 Hz), <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.04 – -81.09 (m), -116.61 – -116.69 (m), -122.32 – -122.38 (m), -126.01 – -126.08 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>18</sub>H<sub>16</sub>F<sub>9</sub>N<sub>3</sub>O<sub>2</sub>: [M+H]<sup>+</sup> 478.1172, Found 478.1170.

**6-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-2,4-di(prop-2-yn-1-yl)-1,2,4-triazine-3,5(2H,4H)-dione (10)**



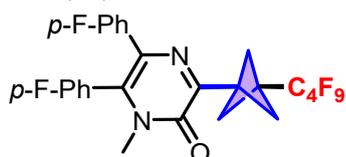
Obtained as a white solid (X = I, 60 mg, 63% yield); M. P. = 124-125 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 4.74 (d, *J* = 2.4 Hz, 2H), 4.68 (d, *J* = 2.4 Hz, 2H), 2.44 (s, 6H), 2.37 (t, *J* = 2.4 Hz, 1H), 2.24 (t, *J* = 2.4 Hz, 1H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 154.3, 147.5, 141.2, 76.5, 76.3, 73.7, 71.9, 51.1, 41.6, 38.7, 38.3 (t, *J* = 30.2 Hz), 29.9, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.04 – -81.08 (m), -116.62 – -116.69 (m), -122.30 – -122.34 (m), -126.00 – -126.07 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>18</sub>H<sub>12</sub>F<sub>9</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 496.0678, Found 496.0680.

**1-Methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1H)-one (11)**



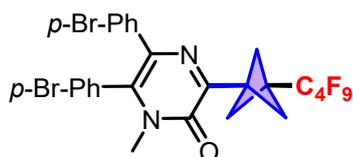
Obtained as a light yellow solid (X = I, 47 mg, 43% yield); M. P. = 146-147 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.40 (d, *J* = 6.7 Hz, 3H), 7.21 – 7.18 (m, 2H), 7.13 (s, 5H), 3.30 (s, 3H), 2.55 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 154.3, 150.6, 136.9, 136.6, 131.6, 131.5, 128.9, 128.6, 128.3, 128.1, 126.7, 126.0, 50.0, 40.8, 36.9 (t, *J* = 30.2 Hz), 32.6, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.04 – -81.08 (m), -116.49 – -116.57 (m), -122.27 – -122.32 (m), -125.98 – -126.05 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>26</sub>H<sub>19</sub>F<sub>9</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 547.1426, Found 547.1427.

**5,6-bis(4-Fluorophenyl)-1-methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)pyrazin-2(1H)-one (12)**



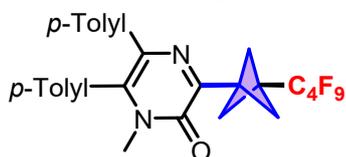
Obtained as a light yellow solid (X = I, 47 mg, 40% yield); M. P. = 116-117°C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.20 – 7.15 (m, 2H), 7.13 – 7.06 (m, 4H), 6.84 (dd, *J* = 12.0, 5.4 Hz, 2H), 3.29 (s, 3H), 2.54 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 163.5 (d, *J* = 165.1 Hz), 161.5 (d, *J* = 160.0 Hz), 155.2, 152.1, 136.9, 133.5 (d, *J* = 165.1 Hz), 132.0, 131.9, 131.0 (d, *J* = 7.6 Hz), 128.4 (d, *J* = 3.8 Hz), 116.6 (d, *J* = 8.8 Hz), 114.9 (d, *J* = 8.8 Hz), 51.0, 41.8, 37.9 (t, *J* = 30.2 Hz), 33.6, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.08 – -81.12 (m), -109.6, -114.6, -116.55 – -116.62 (m), -122.28 – -122.33 (m), -126.01 – -126.08 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>26</sub>H<sub>17</sub>F<sub>11</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 583.1238, Found 583.1238.

**5,6-bis(4-Bromophenyl)-1-methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)pyrazin-2(1H)-one (13)**



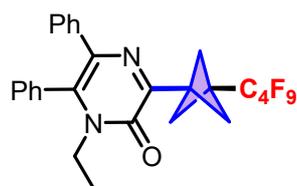
Obtained as a light yellow solid (X = I, 59 mg, 42% yield); M. P. = 134-135 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.57 (d,  $J = 8.3$  Hz, 2H), 7.29 (d,  $J = 8.5$  Hz, 2H), 7.07 (d,  $J = 8.3$  Hz, 2H), 6.99 (d,  $J = 8.5$  Hz, 2H), 3.28 (s, 3H), 2.53 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.1, 152.3, 136.9, 136.3, 132.7, 131.5, 131.5, 131.1, 131.0, 130.9, 124.4, 121.6, 51.0, 41.7, 37.9 (t,  $J = 30.2$  Hz), 33.7,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.07 (m), -116.58 – -116.66 (m), -122.27 – -122.31 (m), -125.98 – -126.04 (m); HRMS (ESI+): Calculated for  $\text{C}_{26}\text{H}_{17}\text{Br}_2\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  702.9637, Found 702.9641.

**1-Methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-5,6-di-p-tolylpyrazin-2(1H)-one (14)**



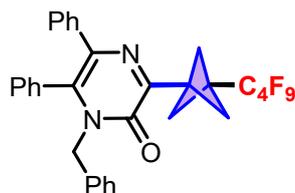
Obtained as a light yellow solid (X = I, 56 mg, 49% yield); M. P. = 168-169 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.20 (d,  $J = 7.9$  Hz, 2H), 7.05 (dd,  $J = 17.1, 8.1$  Hz, 4H), 6.94 (d,  $J = 8.1$  Hz, 2H), 3.28 (s, 3H), 2.53 (s, 6H), 2.38 (s, 3H), 2.25 (s, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.4, 151.2, 139.6, 137.8, 136.7, 134.9, 132.7, 129.8, 129.8, 129.7, 129.1, 128.5, 51.0, 41.8, 37.9 (t,  $J = 30.2$  Hz), 33.6, 21.4, 21.1,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.08 (m), -116.48 – -116.55 (m), -122.27 – -122.34 (m), -125.98 – -126.04 (m); HRMS (ESI+): Calculated for  $\text{C}_{28}\text{H}_{23}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{Na}]^+$  597.1559, Found 597.1557.

**1-Ethyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1H)-one (15)**



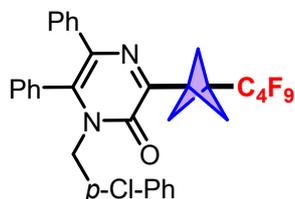
Obtained as a yellow liquid (X = I, 50 mg, 45% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.42 – 7.37 (m, 3H), 7.23 (dd,  $J = 7.9, 1.6$  Hz, 2H), 7.11 (s, 5H), 3.86 (q,  $J = 7.1$  Hz, 2H), 2.55 (s, 6H), 1.17 (d,  $J = 7.0$  Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.6, 152.0, 137.8, 137.7, 132.8, 132.2, 130.1, 129.5, 129.3, 128.9, 127.7, 127.0, 51.1, 41.3, 37.9 (t,  $J = 30.2$  Hz), 29.7, 13.6,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.04 – -81.08 (m), -116.50 – -116.59 (m), -122.26 – -122.35 (m), -125.97 – -126.05 (m); HRMS (ESI+): Calculated for  $\text{C}_{27}\text{H}_{21}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  561.1583, Found 561.1587.

### 1-Benzyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1H)-one (16)



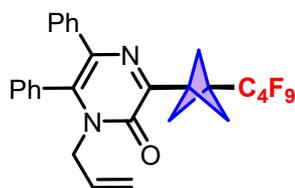
Obtained as a light yellow solid (X = I, 62 mg, 50% yield); M. P. = 89-90 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.35 (t,  $J$  = 7.5 Hz, 1H), 7.26 – 7.19 (m, 5H), 7.14 – 7.08 (m, 5H), 6.99 (d,  $J$  = 7.3 Hz, 2H), 6.86 (dd,  $J$  = 6.5, 2.8 Hz, 2H), 5.11 (s, 2H), 2.58 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.0, 152.5, 137.9, 137.5, 136.0, 132.9, 131.9, 130.5, 129.5, 129.3, 128.6, 128.5, 127.7, 127.5, 127.2, 127.0, 51.1, 48.7, 41.9, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.07 (m), -116.50 – -116.57 (m), -122.27 – -122.33 (m), -125.96 – -126.02 (m); HRMS (ESI+): Calculated for  $\text{C}_{32}\text{H}_{23}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  623.1739, Found 623.1736.

### 1-(4-Chlorobenzyl)-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1H)-one (17)



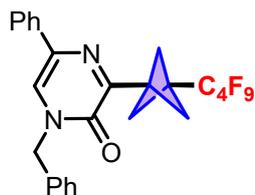
Obtained as a light yellow solid (X = I, 66 mg, 50% yield); M. P. = 145-146 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.37 (t,  $J$  = 7.5 Hz, 1H), 7.29 – 7.26 (m, 2H), 7.18 (d,  $J$  = 8.4 Hz, 2H), 7.11 (s, 5H), 7.00 (d,  $J$  = 7.2 Hz, 2H), 6.80 (d,  $J$  = 8.4 Hz, 2H), 5.07 (s, 2H), 2.58 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.0, 152.6, 137.6, 137.4, 134.5, 133.5, 133.1, 131.8, 130.5, 129.7, 129.3, 128.8, 128.8, 128.7, 127.7, 127.1, 51.1, 48.1, 41.9, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.07 (m), -116.51 – -116.58 (m), -122.27 – -122.30 (m), -125.96 – -126.03 (m); HRMS (ESI+): Calculated for  $\text{C}_{32}\text{H}_{22}\text{ClF}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  657.1350, Found 657.1351.

### 1-Allyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1H)-one (18)



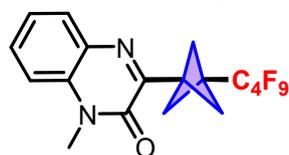
Obtained as a light yellow solid (X = I, 53 mg, 46% yield); M. P. = 136-137 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.37 (dt,  $J$  = 14.6, 7.2 Hz, 3H), 7.24 – 7.19 (m, 2H), 7.12 (d,  $J$  = 1.9 Hz, 5H), 5.80 (ddd,  $J$  = 22.6, 10.6, 5.4 Hz, 1H), 5.16 (dd,  $J$  = 10.3, 0.8 Hz, 1H), 4.91 (dd,  $J$  = 17.2, 0.8 Hz, 1H), 4.42 (d,  $J$  = 5.4 Hz, 2H), 2.56 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.6, 152.2, 137.9, 137.6, 132.8, 132.0, 131.4, 130.4, 129.7, 129.3, 128.7, 127.7, 127.0, 118.3, 51.1, 48.2, 41.8, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.04 – -81.08 (m), -116.52 – -116.59 (m), -122.30 – -122.35 (m), -125.98 – -126.05 (m); HRMS (ESI+): Calculated for  $\text{C}_{28}\text{H}_{21}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  573.1583, Found 573.1584.

### 1-Benzyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-5-phenylpyrazin-2(1H)-one (19)



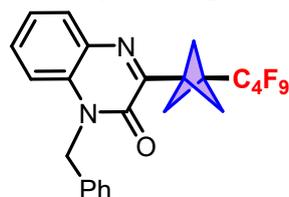
Obtained as a yellow liquid (X = I, 42 mg, 38% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.70 – 7.67 (m, 2H), 7.45 (s, 1H), 7.39 (d,  $J$  = 6.3 Hz, 4H), 7.36 (dd,  $J$  = 6.5, 3.3 Hz, 3H), 7.32 (d,  $J$  = 7.4 Hz, 1H), 5.13 (s, 2H), 2.54 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.7, 153.8, 135.5, 134.8, 132.7, 129.2, 128.8, 128.7, 128.5, 128.1, 124.9, 123.7, 52.1, 51.1, 41.9, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.07 (m), -116.53 – -116.61 (m), -122.28 – -122.33 (m), -125.98 – -126.05 (m); HRMS (ESI+): Calculated for  $\text{C}_{26}\text{H}_{19}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  547.1426, Found 547.1429.

### 1-Methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (20)



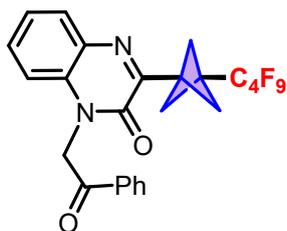
Obtained as a light yellow solid (X = I, 62 mg, 70% yield); M. P. = 70-71 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.88 – 7.83 (m, 1H), 7.59 – 7.53 (m, 1H), 7.35 (t,  $J$  = 7.6 Hz, 1H), 7.30 (d,  $J$  = 8.4 Hz, 1H), 3.68 (s, 3H), 2.56 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.8, 154.5, 133.5, 132.8, 130.5, 130.2, 123.7, 113.6, 51.2, 42.1, 37.9 (t,  $J$  = 30.2 Hz), 28.6,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.04 – -81.08 (m), -116.57 – -116.65 (m), -122.26 – -122.34 (m), -125.98 – -126.06 (m); HRMS (ESI+): Calculated for  $\text{C}_{18}\text{H}_{13}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  445.0957, Found 445.0957.

### 1-Benzyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (21)



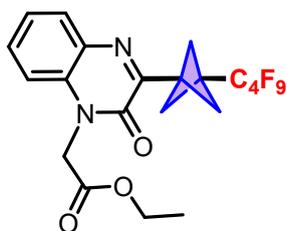
Obtained as a light yellow solid (X = I, 68 mg, 65% yield); M. P. = 93-94 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J$  = 8.0, 1.2 Hz, 1H), 7.44 – 7.41 (m, 1H), 7.33 – 7.29 (m, 3H), 7.27 (d,  $J$  = 7.2 Hz, 1H), 7.23 (t,  $J$  = 8.1 Hz, 3H), 5.46 (s, 2H), 2.59 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.0, 154.5, 135.1, 133.0, 132.9, 130.5, 130.3, 129.0, 127.8, 126.9, 123.8, 114.5, 51.3, 45.6, 42.1, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.07 (m), -116.56 – -116.63 (m), -122.27 – -122.31 (m), -125.96 – -126.03 (m); HRMS (ESI+): Calculated for  $\text{C}_{24}\text{H}_{17}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  521.1270, Found 521.1266.

**1-(2-Oxo-2-phenylethyl)-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl) quinoxalin-2(1H)-one (22)**



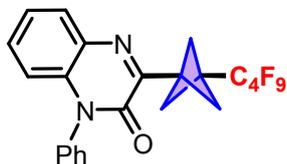
Obtained as a yellow liquid (X = I, 70 mg, 64% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.07 (d,  $J$  = 7.3 Hz, 2H), 7.89 (dd,  $J$  = 8.0, 1.2 Hz, 1H), 7.68 (t,  $J$  = 7.5 Hz, 1H), 7.55 (t,  $J$  = 7.8 Hz, 2H), 7.48 – 7.40 (m, 1H), 7.33 (t,  $J$  = 7.6 Hz, 1H), 6.94 (d,  $J$  = 8.3 Hz, 1H), 5.70 (s, 2H), 2.56 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  191.0, 154.5, 154.2, 134.5, 134.4, 132.9, 130.5, 130.5, 129.1, 128.2, 123.9, 113.5, 51.3, 48.0, 42.0, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.05 – -81.09 (m), -116.56 – -116.64 (m), -122.28 – -122.34 (m), -125.99 – -126.06 (m); HRMS (ESI+): Calculated for  $\text{C}_{25}\text{H}_{17}\text{F}_9\text{N}_2\text{O}_2$ :  $[\text{M}+\text{H}]^+$  549.1219, Found 549.1219.

**1-Ethyl-2-(2-oxo-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-1(2H)-yl)acetate (23)**



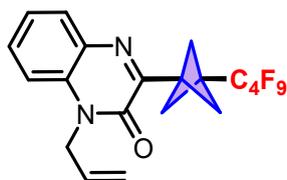
Obtained as a light yellow solid (X = I, 72 mg, 70% yield); M. P. = 88-89 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.87 (dd,  $J$  = 8.0, 1.1 Hz, 1H), 7.55 – 7.49 (m, 1H), 7.35 (t,  $J$  = 7.6 Hz, 1H), 7.06 (d,  $J$  = 8.3 Hz, 1H), 4.99 (s, 2H), 4.26 (q,  $J$  = 7.1 Hz, 2H), 2.56 (s, 6H), 1.29 (t,  $J$  = 7.1 Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  167.0, 154.7, 154.0, 132.8, 132.6, 130.6, 130.5, 124.0, 113.1, 62.2, 51.3, 43.1, 41.9, 37.9 (t,  $J$  = 30.2 Hz), 14.1,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.04 – -81.08 (m), -116.58 – -116.66 (m), -122.30 – -122.35 (m), -125.99 – -126.05 (m); HRMS (ESI+): Calculated for  $\text{C}_{21}\text{H}_{17}\text{F}_9\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  517.1168, Found 517.1170.

**3-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-1-phenylquinoxalin-2(1H)-one (24)**



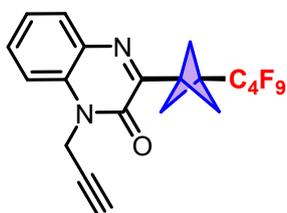
Obtained as a yellow liquid (X = I, 53 mg, 52% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.92 – 7.88 (m, 1H), 7.65 – 7.61 (m, 2H), 7.59 – 7.54 (m, 1H), 7.34 (ddd,  $J$  = 14.3, 7.2, 1.7 Hz, 2H), 7.31 – 7.29 (m, 2H), 6.72 – 6.67 (m, 1H), 2.58 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.6, 154.2, 135.4, 134.3, 132.6, 130.4, 130.1, 129.8, 129.6, 128.2, 123.9, 115.5, 51.4, 42.0, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.06 – -81.11 (m), -116.59 – -116.65 (m), -122.33 – -122.37 (m), -125.99 – -126.06 (m); HRMS (ESI+): Calculated for  $\text{C}_{23}\text{H}_{15}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  507.1113, Found 507.1110.

### 1-Allyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (25)



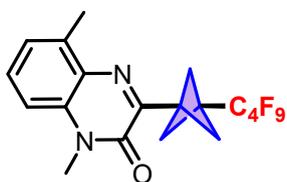
Obtained as a yellow liquid (X = I, 53 mg, 56% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J$  = 8.0, 1.3 Hz, 1H), 7.54 – 7.50 (m, 1H), 7.35 – 7.31 (m, 1H), 7.28 (d,  $J$  = 8.4 Hz, 1H), 5.93 (ddd,  $J$  = 22.3, 10.4, 5.2 Hz, 1H), 5.23 (dd,  $J$  = 50.4, 13.9 Hz, 2H), 4.87 (d,  $J$  = 5.1 Hz, 2H), 2.56 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.9, 154.0, 132.9, 132.7, 130.5, 130.4, 130.3, 123.7, 118.3, 114.2, 51.3, 44.2, 42.0, 37.9 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.05 – -81.10 (m), -116.60 – -116.66 (m), -122.31 – -122.35 (m), -125.99 – -126.06 (m); HRMS (ESI+): Calculated for  $\text{C}_{20}\text{H}_{15}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  471.1113, Found 471.1101.

### 3-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-1-(prop-2-yn-1-yl)quinoxalin-2(1H)-one (26)



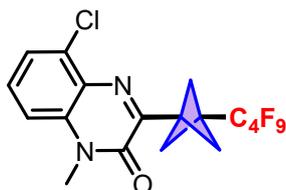
Obtained as a yellow liquid (X = I, 54 mg, 58% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J$  = 8.0, 1.2 Hz, 1H), 7.61 – 7.56 (m, 1H), 7.46 (d,  $J$  = 8.4 Hz, 1H), 7.40 – 7.35 (m, 1H), 5.02 (d,  $J$  = 2.5 Hz, 2H), 2.56 (s, 6H), 2.30 (t,  $J$  = 2.5 Hz, 1H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.7, 153.4, 132.9, 132.0, 130.6, 130.3, 124.1, 114.1, 76.6, 73.3, 51.3, 42.0, 37.9 (t,  $J$  = 30.2 Hz), 31.1,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.08 – -81.13 (m), -116.61 – -116.68 (m), -122.30 – -122.34 (m), -126.01 – -126.09 (m); HRMS (ESI+): Calculated for  $\text{C}_{20}\text{H}_{13}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  469.0957, Found 469.0957.

### 1,5-Dimethyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (27)



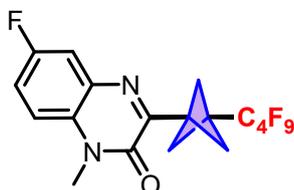
Obtained as a light yellow solid (X = I, 66 mg, 72% yield); M. P. = 133-134 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.46 – 7.40 (m, 1H), 7.20 (d,  $J$  = 7.4 Hz, 1H), 7.13 (d,  $J$  = 8.4 Hz, 1H), 3.66 (s, 3H), 2.66 (s, 3H), 2.54 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.4, 152.8, 139.1, 133.6, 131.3, 130.2, 125.0, 111.5, 51.1, 42.3, 37.8 (t,  $J$  = 30.2 Hz), 28.7, 17.3,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.04 – -81.08 (m), -116.53 – -116.62 (m), -122.26 – -122.31 (m), -125.98 – -126.06 (m); HRMS (ESI+): Calculated for  $\text{C}_{19}\text{H}_{15}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  459.1113, Found 459.1114.

### 5-Chloro-1-methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (28)



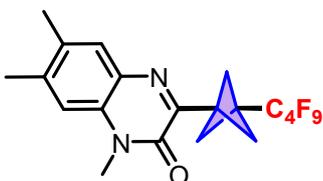
Obtained as a light yellow solid (X = I, 62 mg, 65% yield); M. P. = 81-82 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.45 (t, *J* = 4.9 Hz, 2H), 7.22 (dd, *J* = 7.6, 2.0 Hz, 1H), 3.68 (s, 3H), 2.58 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.2, 154.1, 135.2, 135.0, 130.4, 129.4, 124.7, 112.5, 51.3, 42.2, 38.0 (t, *J* = 30.2 Hz), 29.1, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.03 – -81.08 (m), -116.56 – -116.66 (m), -122.26 – -122.33 (m), -125.97 – -126.06 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>18</sub>H<sub>12</sub>ClF<sub>9</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 479.0567, Found 479.0563.

### 6-Fluoro-1-methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (29)



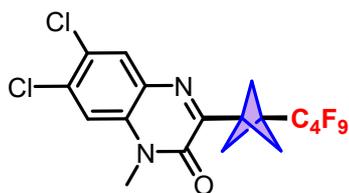
Obtained as a yellow solid (X = I, 62 mg, 67% yield); M. P. = 95-96 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.55 (dd, *J* = 8.7, 2.7 Hz, 1H), 7.33 – 7.28 (m, 1H), 7.26 (dd, *J* = 9.3, 4.6 Hz, 1H), 3.67 (s, 3H), 2.55 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 158.7 (d, *J* = 244.4 Hz), 156.3, 154.1, 133.3 (d, *J* = 11.3 Hz), 130.2 (d, *J* = 2.5 Hz), 118.2 (d, *J* = 23.9 Hz), 115.6 (d, *J* = 22.7 Hz), 114.7 (d, *J* = 7.6 Hz), 51.2, 42.1, 37.9 (t, *J* = 31.5 Hz), 28.9, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.05 – -81.09 (m), -116.63 – -116.70 (m), 118.80 (s), -122.30 – -122.34 (m), -126.01 – -126.07 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>18</sub>H<sub>12</sub>F<sub>10</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 463.0863, Found 463.0866.

### 1,6,7-Trimethyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (30)



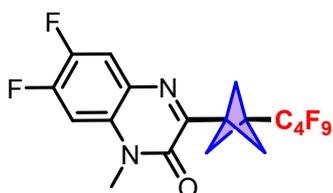
Obtained as a yellow liquid (X = I, 65 mg, 69% yield); <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.62 (s, 1H), 7.06 (s, 1H), 3.65 (s, 3H), 2.54 (s, 6H), 2.42 (s, 3H), 2.35 (s, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 154.6, 153.5, 140.4, 132.7, 131.5, 131.1, 130.2, 114.2, 51.2, 42.1, 37.9 (t, *J* = 30.0 Hz), 28.5, 20.6, 19.1, <sup>13</sup>C NMR for C<sub>4</sub>F<sub>9</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -81.03 – -81.07 (m), -116.52 – -116.60 (m), -122.27 – -122.34 (m), -125.96 – -126.04 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>20</sub>H<sub>17</sub>F<sub>9</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 473.1270, Found 473.1264.

**6,7-Dichloro-1-methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (31)**



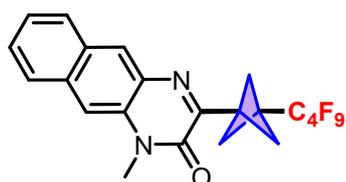
Obtained as a light yellow solid (X = I, 53 mg, 52% yield); M. P. = 94-95 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.94 (s, 1H), 7.39 (s, 1H), 3.63 (s, 3H), 2.54 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  156.3, 153.9, 134.6, 132.9, 131.8, 131.0, 127.6, 115.2, 51.3, 42.0, 37.9 (t,  $J = 30.2$  Hz), 28.9,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.08 (m), -116.63 – -116.70 (m), -122.23 – -122.35 (m), -125.95 – -126.09 (m); HRMS (ESI+): Calculated for  $\text{C}_{18}\text{H}_{11}\text{Cl}_2\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  513.0177, Found 513.0185.

**6,7-Difluoro-1-methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (32)**



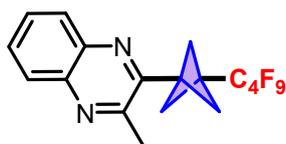
Obtained as a light yellow solid (X = I, 50 mg, 50% yield); M. P. = 89-90 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.66 (dd,  $J = 10.1, 8.2$  Hz, 1H), 7.09 (dd,  $J = 11.2, 7.0$  Hz, 1H), 3.62 (s, 3H), 2.53 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.4 (d,  $J = 3.8$  Hz), 154.0, 151.6 (dd,  $J = 277.2, 13.9$  Hz), 146.7 (dd,  $J = 262.1, 13.9$  Hz), 130.7 (dd,  $J = 11.3, 1.3$  Hz), 129.0 (dd,  $J = 11.3, 2.5$  Hz), 117.8 (dd,  $J = 20.2, 2.5$  Hz), 102.3 (d,  $J = 22.7$  Hz), 51.2, 41.9, 37.9 (t,  $J = 30.2$  Hz), 29.1,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.06 – -81.10 (m), -116.64 – -116.71 (m), -122.30 – -122.34 (m), -126.01 – -126.08 (m), -130.06 (d,  $J = 18.8$  Hz), -141.79 (d,  $J = 18.8$  Hz); HRMS (ESI+): Calculated for  $\text{C}_{18}\text{H}_{11}\text{F}_{11}\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  481.0768, Found 481.0769.

**1-Methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)benzo[g]quinoxalin-2(1H)-one (33)**



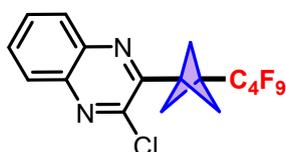
Obtained as a light yellow solid (X = I, 59 mg, 60% yield); M. P. = 126-127 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.37 (s, 1H), 7.97 (d,  $J = 8.2$  Hz, 1H), 7.90 (d,  $J = 8.3$  Hz, 1H), 7.60 – 7.56 (m, 2H), 7.51 – 7.47 (m, 1H), 3.73 (s, 3H), 2.59 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.4, 154.4, 133.8, 132.0, 131.8, 129.8, 129.5, 128.5, 128.1, 127.2, 125.4, 110.0, 51.4, 42.2, 37.9 (t,  $J = 30.2$  Hz), 28.6,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.02 – -81.06 (m), -116.55 – -116.64 (m), -122.24 – -122.28 (m), -125.97 – -126.04 (m); HRMS (ESI+): Calculated for  $\text{C}_{22}\text{H}_{15}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  495.1113, Found 495.1103.

### 2-Methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxaline (34)



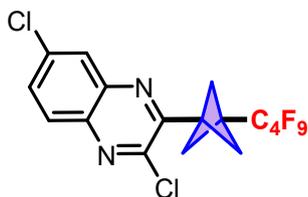
Obtained as a colourless liquid (X = I, 24 mg, 28% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.02 (t,  $J$  = 9.4 Hz, 2H), 7.75 – 7.66 (m, 2H), 2.83 (s, 3H), 2.61 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  152.4, 151.1, 141.1, 141.0, 129.8, 129.2, 128.9, 128.2, 51.4, 43.1, 38.0 (t,  $J$  = 30.2 Hz), 23.9,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.00 – -81.04 (m), -116.60 – -116.66 (m), -122.17 – -122.23 (m), -125.96 – -126.04 (m); HRMS (ESI+): Calculated for  $\text{C}_{18}\text{H}_{13}\text{F}_9\text{N}_2$ :  $[\text{M}+\text{H}]^+$  429.1008, Found 429.1004.

### 2-Chloro-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxaline (35)



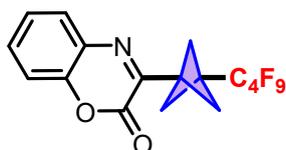
Obtained as a colourless liquid (X = I, 30 mg, 33% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.11 – 8.04 (m, 1H), 8.04 – 7.97 (m, 1H), 7.77 (dd,  $J$  = 6.3, 3.5 Hz, 2H), 2.67 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  149.9, 146.2, 141.3, 140.8, 130.9, 130.4, 129.0, 128.1, 51.5, 42.5, 38.0 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.01 – -81.06 (m), -116.58 – -116.67 (m), -122.21 – -122.26 (m), -125.97 – -126.05 (m); HRMS (ESI+): Calculated for  $\text{C}_{17}\text{H}_{10}\text{ClF}_9\text{N}_2$ :  $[\text{M}+\text{H}]^+$  449.0462, Found 449.0456.

### 2,6-Dichloro-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxaline (36)



Obtained as a light yellow solid (X = I, 44 mg, 46% yield); M. P. = 49-50 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.07 (d,  $J$  = 2.2 Hz, 1H), 7.92 (d,  $J$  = 8.9 Hz, 1H), 7.70 (dd,  $J$  = 8.9, 2.3 Hz, 1H), 2.66 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  150.0, 145.4, 140.0, 138.7, 135.3, 130.9, 128.2, 127.0, 50.5, 41.4, 37.1 (t,  $J$  = 30.2 Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.07 (m), -116.63 – -116.70 (m), -122.21 – -122.26 (m), -125.99 – -126.06 (m); HRMS (ESI+): Calculated for  $\text{C}_{17}\text{H}_9\text{Cl}_2\text{F}_9\text{N}_2$ :  $[\text{M}+\text{H}]^+$  483.0072, Found 483.0079.

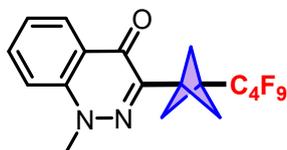
### 3-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-2H-benzo[b][1,4]oxazin-2-one (37)



Obtained as a light yellow solid (X = I, 63 mg, 73% yield); M. P. = 117-118 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.67 (dd,  $J$  = 7.9, 1.2 Hz, 1H), 7.47 – 7.37 (m, 1H), 7.29 (dd,  $J$  = 11.1, 4.2 Hz, 1H),

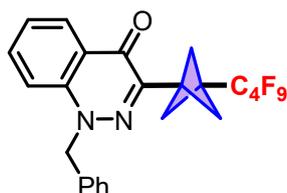
7.20 (d,  $J = 8.2$  Hz, 1H), 2.46 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  152.2, 151.8, 146.7, 131.4, 131.1, 129.2, 125.6, 116.4, 51.3, 41.3, 37.9 (t,  $J = 30.2$  Hz),  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.12 – -81.16 (m), -116.75 – -116.78 (m), -122.33 – -122.35 (m), -126.06 – -126.13 (m); HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{17}\text{H}_{10}\text{F}_9\text{NO}_2$ :  $[\text{M}+\text{H}]^+$  432.0641, Found 432.0648.

### 1-Methyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)cinnolin-4(1H)-one (38)



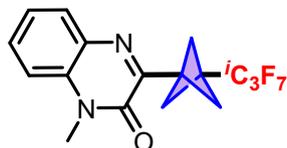
Obtained as a light yellow solid (X = I, 38 mg, 43% yield); M. P. = 88-89 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.32 (d,  $J = 7.9$  Hz, 1H), 7.74 (dd,  $J = 11.5, 4.2$  Hz, 1H), 7.42 (dd,  $J = 12.4, 6.0$  Hz, 2H), 4.08 (s, 3H), 2.49 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  170.8, 145.3, 141.4, 133.7, 125.9, 124.8, 124.1, 114.8, 51.0, 43.6, 37.8 (t,  $J = 30.2$  Hz), 29.7,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.07 (m), -116.51 – -116.59 (m), -122.27 – -122.31 (m), -125.96 – -126.03 (m); HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{18}\text{H}_{13}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  445.0957, Found 445.0958.

### 1-Benzyl-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)cinnolin-4(1H)-one (39)



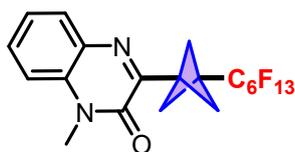
Obtained as a light yellow solid (X = I, 58 mg, 56% yield); M. P. = 111-112 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.31 (d,  $J = 8.3$  Hz, 1H), 7.76 (d,  $J = 8.5$  Hz, 1H), 7.69 (ddd,  $J = 8.4, 6.8, 1.3$  Hz, 1H), 7.52 (ddd,  $J = 8.0, 6.9, 1.0$  Hz, 1H), 7.35 (t,  $J = 8.0$  Hz, 3H), 6.99 – 6.91 (m, 2H), 5.89 (s, 2H), 2.66 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  171.4, 148.1, 139.5, 134.7, 132.6, 129.3, 128.4, 128.3, 126.4, 125.4, 125.2, 123.8, 65.0, 53.5, 39.2 (t,  $J = 30.2$  Hz), 38.5,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.06 – -81.10 (m), -116.63 – -116.70 (m), -122.24 – -122.30 (m), -126.03 – -126.10 (m); HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{24}\text{H}_{17}\text{F}_9\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  521.1270, Found 521.1270.

### 1-Methyl-3-(3-(perfluoropropyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (40)



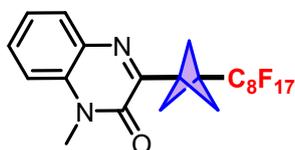
Obtained as a light yellow solid (X = I, 54 mg, 68% yield); M. P. = 72-73 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.85 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.56 (ddd,  $J = 8.6, 7.4, 1.5$  Hz, 1H), 7.38 – 7.33 (m, 1H), 7.30 (d,  $J = 8.4$  Hz, 1H), 3.68 (s, 3H), 2.58 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.7, 154.5, 133.5, 132.7, 130.5, 130.2, 123.8, 113.6, 52.2, 42.0, 36.5 (d,  $J = 25.2$  Hz), 28.6,  $^{13}\text{C}$  NMR for  $^i\text{C}_3\text{F}_7$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -74.63 (d,  $J = 9.4$  Hz), -183.23 – -183.40 (m); HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{17}\text{H}_{13}\text{F}_7\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  395.0989, Found 395.0988.

### 1-methyl-3-(3-(perfluorohexyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (41)



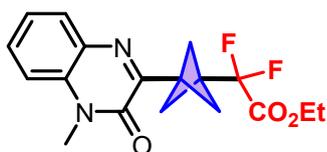
Obtained as a light yellow solid (X = I, 78 mg, 72% yield); M. P. = 85-86 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J$  = 8.0, 1.1 Hz, 1H), 7.59 – 7.52 (m, 1H), 7.38 – 7.33 (m, 1H), 7.30 (d,  $J$  = 8.4 Hz, 1H), 3.68 (s, 3H), 2.56 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.8, 154.5, 133.5, 132.8, 130.5, 130.2, 123.7, 113.6, 51.2, 42.1, 38.0 (t,  $J$  = 31.5 Hz), 28.6,  $^{13}\text{C}$  NMR for  $\text{C}_6\text{F}_{13}$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -80.77 – -80.82 (m), 116.34 – -116.41 (m), 121.28 – -121.38 (m), 121.84 – -121.93 (m), 122.86 – -122.93 (m), 126.07 – -126.16 (m); HRMS (ESI+): Calculated for  $\text{C}_{20}\text{H}_{13}\text{F}_{13}\text{N}_2\text{O}$ :  $[\text{M}+\text{Na}]^+$  567.0713, Found 567.0710.

### 3-(3-(Perfluorooctyl)-1-methylquinoxalin-2(1H)-one (42)



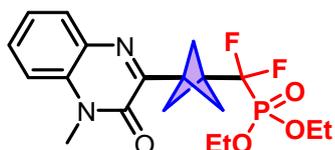
Obtained as a light yellow solid (X = I, 85 mg, 66% yield); M. P. = 99-100 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.78 (dd,  $J$  = 8.0, 1.1 Hz, 1H), 7.53 – 7.45 (m, 1H), 7.28 (dd,  $J$  = 11.3, 4.0 Hz, 1H), 7.23 (d,  $J$  = 8.4 Hz, 1H), 3.61 (s, 3H), 2.49 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  154.8, 154.5, 133.5, 132.8, 130.5, 130.2, 123.7, 113.6, 51.2, 42.1, 38.0 (t,  $J$  = 30.2 Hz), 28.6,  $^{13}\text{C}$  NMR for  $\text{C}_8\text{F}_{17}$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -80.73 – -80.78 (m), -116.32 – -116.40 (m), -121.20 – -121.31 (m), -121.61 – -121.68 (m), -121.87 – -121.96 (m), -122.64 – -122.75 (m), -126.05 – -126.12 (m); HRMS (ESI+): Calculated for  $\text{C}_{22}\text{H}_{13}\text{F}_{17}\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  645.0829, Found 645.0828.

### 1-Ethyl-2,2-difluoro-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)acetate (43)



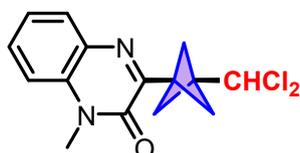
Obtained as a light yellow liquid (X = I, 42 mg, 60% yield; X = Br, 31 mg, 45% yield; X = Cl, 16 mg, 23% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.85 (dd,  $J$  = 8.0, 1.4 Hz, 1H), 7.55 (ddd,  $J$  = 8.6, 7.4, 1.5 Hz, 1H), 7.37 – 7.33 (m, 1H), 7.30 (d,  $J$  = 8.4 Hz, 1H), 4.37 (q,  $J$  = 7.1 Hz, 2H), 3.67 (s, 3H), 2.44 (s, 6H), 1.38 (t,  $J$  = 7.1 Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  163.3 (t,  $J$  = 32.8 Hz), 155.3, 154.5, 133.5, 132.8, 130.4, 130.2, 123.7, 113.6, 112.2 (t,  $J$  = 249.5 Hz), 62.8, 50.5 (t,  $J$  = 3.8 Hz), 41.5, 39.2 (t,  $J$  = 31.5 Hz), 28.6, 14.2;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -111.56 (s); HRMS (ESI+): Calculated for  $\text{C}_{18}\text{H}_{18}\text{F}_2\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  349.1358, Found 349.1357.

**Diethyl-(difluoro(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)methyl)phosphonate (44)**



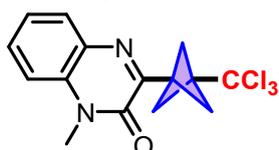
Obtained as a yellow liquid (X = Br, 31 mg, 38% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.84 (dd,  $J$  = 8.0, 1.4 Hz, 1H), 7.53 (ddd,  $J$  = 8.6, 7.4, 1.5 Hz, 1H), 7.34 – 7.31 (m, 1H), 7.28 (d,  $J$  = 8.4 Hz, 1H), 4.32 – 4.25 (m, 4H), 3.66 (s, 3H), 2.48 (s, 6H), 1.38 (t,  $J$  = 7.1 Hz, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.6, 154.6, 133.4, 132.8, 130.3, 130.1, 123.6, 113.6, 64.3 (d,  $J$  = 7.6 Hz), 51.0 (d,  $J$  = 2.5 Hz), 42.0, 39.0 (td,  $J$  = 27.6, 15.9 Hz), 28.6, 16.4, 16.4;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -114.77 (s), -115.01 (s);  $^{31}\text{P}$  NMR (202 MHz,  $\text{CDCl}_3$ )  $\delta$  6.25 (t,  $J$  = 111.4 Hz); HRMS (ESI+): Calculated for  $\text{C}_{19}\text{H}_{23}\text{F}_2\text{N}_2\text{O}_4\text{P}$ :  $[\text{M}+\text{H}]^+$  413.1440, found 413.1440.

**3-(3-(Dichloromethyl)bicyclo[1.1.1]pentan-1-yl)-1-methylquinoxalin-2(1H)-one (45)**



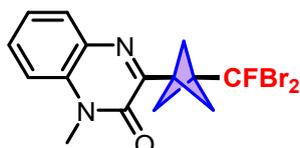
Obtained as a light yellow solid (X = Br, 22 mg, 36% yield); M. P. = 193-194 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J$  = 8.0, 1.4 Hz, 1H), 7.54 (ddd,  $J$  = 8.6, 7.3, 1.5 Hz, 1H), 7.36 – 7.32 (m, 1H), 7.29 (d,  $J$  = 8.4 Hz, 1H), 5.89 (s, 1H), 3.67 (s, 3H), 2.38 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.8, 154.6, 133.4, 132.8, 130.3, 130.1, 123.7, 113.6, 71.9, 50.6, 45.2, 40.8, 28.6; HRMS (ESI+): Calculated for  $\text{C}_{15}\text{H}_{14}\text{Cl}_2\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  309.0556, found 309.0553.

**1-Methyl-3-(3-(trichloromethyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (46)**



Obtained as a yellow solid (X = Br, 25 mg, 37% yield; X = Cl, 20 mg, 29% yield); M. P. = 189-190 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.87 (dd,  $J$  = 8.0, 1.3 Hz, 1H), 7.58 – 7.54 (m, 1H), 7.38 – 7.34 (m, 1H), 7.32 – 7.30 (m, 1H), 3.69 (s, 3H), 2.51 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.5, 154.5, 133.5, 132.8, 130.4, 130.2, 123.7, 113.6, 97.9, 52.5, 50.9, 38.9, 28.7; HRMS (ESI+): Calculated for  $\text{C}_{15}\text{H}_{13}\text{Cl}_3\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  343.0166, found 343.0162.

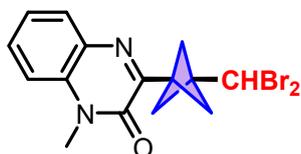
**3-(3-(Dibromofluoromethyl)bicyclo[1.1.1]pentan-1-yl)-1-methylquinoxalin-2(1H)-one (47)**



Obtained as a yellow liquid (X = Br, 33 mg, 40% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J$  = 8.0, 1.3 Hz, 1H), 7.59 – 7.53 (m, 1H), 7.35 (t,  $J$  = 7.6 Hz, 1H), 7.30 (d,  $J$  = 8.3 Hz, 1H), 3.68 (s,

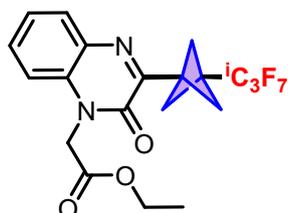
3H), 2.52 – 2.43 (m, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.0, 154.5, 133.5, 132.8, 130.4, 130.2, 123.7, 113.6, 57.9, 51.4 (d,  $J = 1.3$  Hz), 50.9, 39.0, 28.7;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -52.97 (s); HRMS (ESI+): Calculated for  $\text{C}_{15}\text{H}_{13}\text{Br}_2\text{FN}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  414.9451, found 414.9454.

### 3-(3-(Dibromomethyl)bicyclo[1.1.1]pentan-1-yl)-1-methylquinoxalin-2(1H)-one (48)



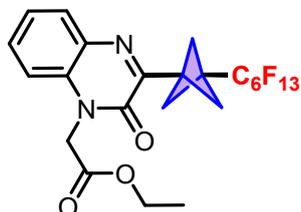
Obtained as a yellow solid (X = Br, 34 mg, 43% yield); M. P. = 186-187 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.58 – 7.52 (m, 1H), 7.37 – 7.32 (m, 1H), 7.30 (d,  $J = 8.3$  Hz, 1H), 5.90 (s, 1H), 3.68 (s, 3H), 2.37 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.6, 154.6, 133.4, 132.8, 130.3, 130.2, 123.7, 113.6, 51.2, 46.7, 45.8, 39.8, 28.6; HRMS (ESI+): Calculated for  $\text{C}_{15}\text{H}_{14}\text{Br}_2\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  396.9546, found 396.9547.

### 1-Ethyl-2-(2-oxo-3-(3-(perfluoropropyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-1(2H)-yl)acetate (49)



Obtained as a yellow liquid (X = I, 61 mg, 65% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.56 – 7.48 (m, 1H), 7.39 – 7.32 (m, 1H), 7.06 (d,  $J = 8.3$  Hz, 1H), 4.98 (s, 2H), 4.26 (q,  $J = 7.1$  Hz, 2H), 2.58 (s, 6H), 1.29 (t,  $J = 7.1$  Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  170.0, 154.5, 154.0, 132.8, 132.6, 130.6, 130.5, 124.0, 113.1, 62.2, 52.3 (d,  $J = 2.5$  Hz), 43.1, 41.8, 36.5 (d,  $J = 25.2$  Hz), 14.1,  $^{13}\text{C}$  NMR for  $^i\text{C}_3\text{F}_7$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -74.6 (d,  $J = 9.4$  Hz), -183.37 – -183.44 (m); HRMS (ESI+): Calculated for  $\text{C}_{20}\text{H}_{17}\text{F}_7\text{N}_2\text{O}_3$ :  $[\text{M}+\text{Na}]^+$  489.1020, Found 489.1018.

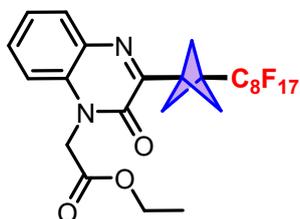
### 1-Ethyl-2-(2-oxo-3-(3-(perfluorohexyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-1(2H)-yl)acetate (50)



Obtained as a yellow solid (X = I, 86 mg, 70% yield); M. P. = 89-90 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.87 (dd,  $J = 8.0, 1.1$  Hz, 1H), 7.55 – 7.48 (m, 1H), 7.35 (t,  $J = 7.6$  Hz, 1H), 7.06 (d,  $J = 8.3$  Hz, 1H), 4.99 (s, 2H), 4.26 (q,  $J = 7.1$  Hz, 2H), 2.56 (s, 6H), 1.29 (t,  $J = 7.1$  Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  167.0, 154.7, 154.0, 132.8, 132.6, 130.6, 130.5, 124.0, 113.1, 62.2, 51.3, 43.1, 41.9, 38.0 (t,  $J = 25.2$  Hz), 14.1,  $^{13}\text{C}$  NMR for  $\text{C}_6\text{F}_{13}$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -80.81 – -80.86 (m), 116.40 – -116.47 (m), 121.32 – -121.40 (m), 121.88 – -121.96 (m),

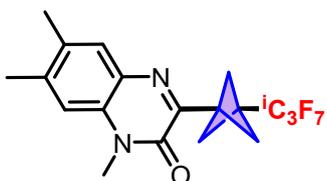
122.88 – -122.98 (m), 126.10 – -126.18 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>23</sub>H<sub>17</sub>F<sub>13</sub>N<sub>2</sub>O<sub>3</sub>: [M+H]<sup>+</sup> 617.1104, Found 617.1094.

**1-Ethyl-2-(2-oxo-3-(3-(perfluorooctyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-1(2H)-yl)acetate (51)**



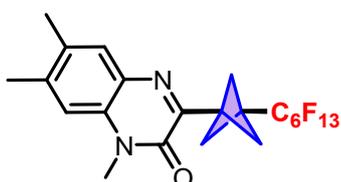
Obtained as a light yellow solid (X = I, 103 mg, 72% yield); M. P. = 123-124 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.87 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.55 – 7.48 (m, 1H), 7.39 – 7.32 (m, 1H), 7.06 (d, *J* = 8.2 Hz, 1H), 4.99 (s, 2H), 4.26 (q, *J* = 7.1 Hz, 2H), 2.56 (s, 6H), 1.29 (t, *J* = 7.1 Hz, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 167.0, 154.7, 154.0, 132.8, 132.6, 130.6, 130.5, 124.0, 113.1, 62.2, 51.3, 43.1, 41.9, 38.0 (t, *J* = 31.5 Hz), 14.1, <sup>13</sup>C NMR for C<sub>8</sub>F<sub>17</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.79 – -80.84 (m), -116.39 – -116.47 (m), -121.25 – -121.34 (m), -121.65 – -121.73 (m), -121.91 – -121.99 (m), -122.71 – -122.79 (m), -126.10 – -126.16 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>25</sub>H<sub>17</sub>F<sub>17</sub>N<sub>2</sub>O<sub>3</sub>: [M+H]<sup>+</sup> 717.1040, Found 717.1045.

**1,6,7-Trimethyl-3-(3-(perfluoropropyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (52)**



Obtained as a light yellow solid (X = I, 53 mg, 63% yield); M. P. = 146-147 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.60 (s, 1H), 7.06 (s, 1H), 3.64 (s, 3H), 2.56 (s, 6H), 2.42 (s, 3H), 2.34 (s, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 154.6, 153.4, 140.4, 132.7, 131.5, 131.2, 130.2, 114.2, 52.2 (d, *J* = 3.8 Hz), 42.0, 36.4 (d, *J* = 25.2 Hz), 28.5, 20.6, 19.1, <sup>13</sup>C NMR for C<sub>3</sub>F<sub>7</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -74.6 (d, *J* = 9.4 Hz), -183.31 – -183.39 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>19</sub>H<sub>17</sub>F<sub>7</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 423.1302, Found 423.1306.

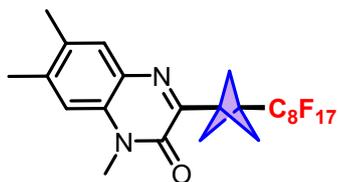
**1,6,7-Trimethyl-3-(3-(perfluorohexyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (53)**



Obtained as a light yellow solid (X = I, 74 mg, 65% yield); M. P. = 114-115 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.61 (s, 1H), 7.06 (s, 1H), 3.65 (s, 3H), 2.54 (s, 6H), 2.42 (s, 3H), 2.34 (s, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 154.6, 153.5, 140.4, 132.7, 131.5, 131.2, 130.2, 114.2, 51.2, 42.1, 37.9 (t, *J* = 30.2 Hz), 28.5, 20.6, 19.1, <sup>13</sup>C NMR for C<sub>6</sub>F<sub>13</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.77 – -80.82 (m), 116.34 – -116.41 (m), 121.28 – -121.38 (m), 121.84 – -121.93 (m),

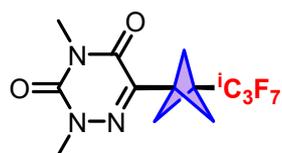
122.86 – -122.93 (m), 126.07 – -126.16 (m); HRMS (ESI+): Calculated for C<sub>22</sub>H<sub>17</sub>F<sub>13</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 573.1206, Found 573.1207.

**1,6,7-Trimethyl-3-(3-(perfluorooctyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (54)**



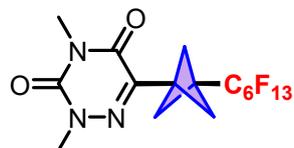
Obtained as a light yellow solid (X = I, 91 mg, 68% yield); M. P. = 83-84 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.61 (s, 1H), 7.06 (s, 1H), 3.65 (s, 3H), 2.54 (s, 6H), 2.42 (s, 3H), 2.35 (s, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 154.6, 153.5, 140.4, 132.7, 131.5, 131.2, 130.2, 114.2, 51.2, 42.1, 37.9 (t, *J* = 30.2 Hz), 28.5, 20.6, 19.1, <sup>13</sup>C NMR for C<sub>8</sub>F<sub>17</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.73 – -80.77 (m), -116.32 – -116.40 (m), -121.20 – -121.31 (m), -121.61 – -121.68 (m), -121.87 – -121.96 (m), -122.64 – -122.75 (m), -126.05 – -126.12 (m); HRMS (ESI+): Calculated for C<sub>24</sub>H<sub>17</sub>F<sub>17</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 673.1142, Found 673.1139.

**2,4-Dimethyl-6-(3-(perfluoropropyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2H,4H)-dione (55)**



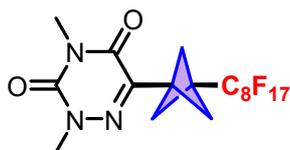
Obtained as a light yellow solid (X = I, 26 mg, 63% yield); M. P. = 77-78 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 3.62 (s, 3H), 3.33 (s, 3H), 2.42 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.8, 149.2, 139.8, 52.0 (d, *J* = 3.8 Hz), 39.6, 38.7, 36.8 (d, *J* = 25.2 Hz), 26.9, <sup>13</sup>C NMR for <sup>i</sup>C<sub>3</sub>F<sub>7</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -74.69 (d, *J* = 9.4 Hz), -183.31 – -183.35 (m); HRMS (ESI+): Calculated for C<sub>13</sub>H<sub>12</sub>F<sub>7</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 398.0710, Found 398.0707.

**2,4-Dimethyl-6-(3-(perfluorohexyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2H,4H)-dione (56)**



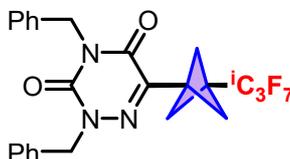
Obtained as a light yellow solid (X = I, 69 mg, 66% yield); M. P. = 59-60 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 3.62 (s, 3H), 3.33 (s, 3H), 2.40 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.8, 149.2, 139.9, 51.0, 39.6, 38.8, 38.3 (t, *J* = 25.2 Hz), 26.9, <sup>13</sup>C NMR for C<sub>6</sub>F<sub>13</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.78 – -80.83 (m), 116.40 – -116.48 (m), 121.30 – -121.39 (m), 121.89 – -121.98 (m), 122.89 – -123.00 (m), 126.08 – -126.16 (m); HRMS (ESI+): Calculated for C<sub>16</sub>H<sub>12</sub>F<sub>13</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 548.0614, Found 548.0619.

**2,4-Dimethyl-6-(3-(perfluorooctyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2*H*,4*H*)-dione (57)**



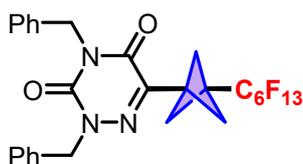
Obtained as a light yellow solid (X = I, 85 mg, 68% yield); M. P. = 99-100 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 3.62 (s, 3H), 3.33 (s, 3H), 2.41 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.8, 149.2, 139.9, 51.0, 39.6, 38.8, 38.3 (t, *J* = 30.2 Hz), 26.9, <sup>13</sup>C NMR for C<sub>8</sub>F<sub>17</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.75 – -80.80 (m), -116.40 – -116.48 (m), -121.24 – -121.32 (m), -121.64 – -121.74 (m), -121.89 – -121.99 (m), -122.67 – -122.77 (m), -126.06 – -126.16 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>18</sub>H<sub>12</sub>F<sub>17</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 648.0550, Found 648.0545.

**2,4-Dibenzyl-6-(3-(perfluoropropyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2*H*,4*H*)-dione (58)**



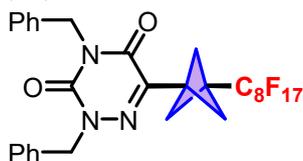
Obtained as a light yellow solid (X = I, 47 mg, 65% yield); M. P. = 92-93 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.52 – 7.46 (m, 2H), 7.41 (dd, *J* = 7.8, 1.4 Hz, 2H), 7.39 – 7.28 (m, 6H), 5.07 (d, *J* = 16.7 Hz, 4H), 2.42 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 149.0, 140.5, 135.5, 135.4, 129.6, 128.8, 128.8, 128.6, 128.4, 128.2, 55.5, 52.0 (d, *J* = 3.8 Hz), 44.1, 38.7, 36.8 (d, *J* = 25.2 Hz), <sup>13</sup>C NMR for <sup>i</sup>C<sub>3</sub>F<sub>7</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -74.66 (d, *J* = 9.4 Hz), -183.28 – -183.35 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>25</sub>H<sub>20</sub>F<sub>7</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 550.1336, Found 550.1346.

**2,4-Dibenzyl-6-(3-(perfluorohexyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2*H*,4*H*)-dione (59)**



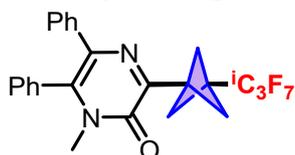
Obtained as a white solid (X = I, 99 mg, 73% yield); M. P. = 101-102 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.52 – 7.47 (m, 2H), 7.41 (dd, *J* = 7.8, 1.4 Hz, 2H), 7.38 – 7.29 (m, 6H), 5.07 (d, *J* = 17.9 Hz, 4H), 2.41 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 149.0, 140.6, 135.5, 135.4, 129.6, 128.8, 128.8, 128.6, 128.4, 128.2, 55.5, 51.0, 44.1, 38.8, 38.3 (t, *J* = 25.2 Hz), <sup>13</sup>C NMR for C<sub>6</sub>F<sub>13</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.80 – -80.84 (m), 116.42 – -116.48 (m), 121.29 – -121.37 (m), 121.90 – -121.98 (m), 122.89 – -122.96 (m), 126.09 – -126.17 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>28</sub>H<sub>20</sub>F<sub>13</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 700.1240, Found 700.1244.

**2,4-Dibenzyl-6-(3-(perfluorooctyl)bicyclo[1.1.1]pentan-1-yl)-1,2,4-triazine-3,5(2*H*,4*H*)-dione (60)**



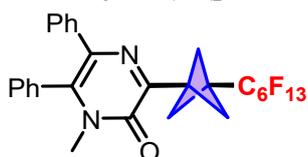
Obtained as a white solid (X = I, 113 mg, 73% yield); M. P. = 123-124 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.49 (d, *J* = 6.6 Hz, 2H), 7.40 (d, *J* = 6.5 Hz, 2H), 7.38 – 7.28 (m, 6H), 5.07 (d, *J* = 17.6 Hz, 4H), 2.40 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 149.0, 140.6, 135.5, 135.5, 129.6, 128.8, 128.8, 128.6, 128.4, 128.2, 55.5, 51.0, 44.1, 38.8, 38.3 (t, *J* = 30.2 Hz), <sup>13</sup>C NMR for C<sub>8</sub>F<sub>17</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.77 – -80.81 (m), -116.42 – -116.47 (m), -121.26 – -121.30 (m), -121.68 – -121.76 (m), -121.90 – -121.96 (m), -122.69 – -122.73 (m), -126.09 – -126.15 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>30</sub>H<sub>20</sub>F<sub>17</sub>N<sub>3</sub>O<sub>2</sub>: [M+Na]<sup>+</sup> 800.1176, Found 800.1172.

**1-Methyl-3-(3-(perfluoropropyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1*H*)-one (61)**



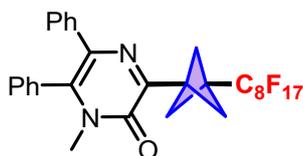
Obtained as a light yellow solid (X = I, 43 mg, 43% yield); M. P. = 175-176 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.42 – 7.37 (m, 3H), 7.19 (dd, *J* = 7.5, 1.8 Hz, 2H), 7.12 (s, 5H), 3.30 (s, 3H), 2.57 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 151.4, 138.0, 137.6, 132.7, 132.5, 130.0, 129.6, 129.3, 129.2, 127.7, 127.1, 52.0 (d, *J* = 2.5 Hz), 41.7, 36.5 (d, *J* = 25.2 Hz), 33.7, <sup>13</sup>C NMR for <sup>i</sup>C<sub>3</sub>F<sub>7</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -74.62 (d, *J* = 9.4 Hz), -183.23 – -183.30 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>25</sub>H<sub>19</sub>F<sub>7</sub>N<sub>2</sub>O: [M+H]<sup>+</sup> 497.1458, Found 497.1457.

**1-Methyl-3-(3-(perfluorohexyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1*H*)-one (62)**



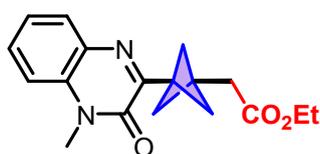
Obtained as a light yellow solid (X = I, 58 mg, 45% yield); M. P. = 125-126 °C; <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.44 – 7.36 (m, 3H), 7.22 – 7.17 (m, 2H), 7.16 – 7.08 (m, 5H), 3.30 (s, 3H), 2.55 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.3, 151.6, 138.0, 137.6, 132.7, 132.5, 130.0, 129.6, 129.3, 129.1, 127.7, 127.0, 51.0, 41.8, 38.0 (t, *J* = 25.2 Hz), 33.7, <sup>13</sup>C NMR for C<sub>6</sub>F<sub>13</sub> could not be assigned; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>) δ -80.79 – -80.83 (m), 116.29 – -116.36 (m), 121.27 – -121.36 (m), 121.82 – -121.95 (m), 122.85 – -122.96 (m), 126.08 – -126.16 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>28</sub>H<sub>19</sub>F<sub>13</sub>N<sub>2</sub>O: [M+Na]<sup>+</sup> 669.1182, Found 669.1178.

**1-Methyl-3-(3-(perfluorooctyl)bicyclo[1.1.1]pentan-1-yl)-5,6-diphenylpyrazin-2(1*H*)-one (63)**



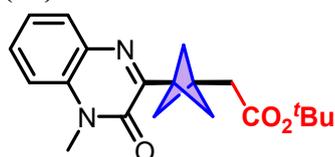
Obtained as a light yellow solid (X = I, 69 mg, 65% yield); M. P. = 159-160 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.40 (qd,  $J = 5.8, 1.7$  Hz, 3H), 7.21 – 7.17 (m, 2H), 7.13 (s, 5H), 3.30 (s, 3H), 2.55 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.3, 151.6, 138.0, 137.6, 132.7, 132.5, 130.0, 129.6, 129.3, 129.1, 127.7, 127.0, 51.0, 41.8, 38.0 (t,  $J = 30.2$  Hz), 33.7,  $^{13}\text{C}$  NMR for  $\text{C}_8\text{F}_{17}$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -80.75 – -80.80 (m), -116.29 – -116.36 (m), -121.23 – -121.29 (m), -121.61 – -121.68 (m), -121.89 – -121.96 (m), -122.67 – -122.75 (m), -126.06 – -126.14 (m); HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{30}\text{H}_{19}\text{F}_{17}\text{N}_2\text{O}$ :  $[\text{M}+\text{Na}]^+$  769.1118, Found 769.1111.

### 1-Ethyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)acetate (64)



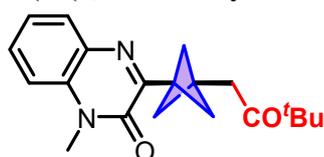
Obtained as a light yellow liquid (X = I, 36 mg, 58% yield; X = Br, 19 mg, 30% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.85 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.55 – 7.49 (m, 1H), 7.34 – 7.30 (m, 1H), 7.28 (d,  $J = 9.4$  Hz, 1H), 4.17 (q,  $J = 7.1$  Hz, 2H), 3.66 (s, 3H), 2.62 (s, 2H), 2.30 (s, 6H), 1.30 (d,  $J = 7.1$  Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  171.3, 156.5, 154.7, 133.4, 132.9, 130.1, 129.9, 123.5, 113.5, 60.3, 53.0, 42.5, 37.8, 36.9, 28.6, 14.4; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{18}\text{H}_{20}\text{N}_2\text{O}_3$ :  $[\text{M}+\text{Na}]^+$  335.1366, Found 335.1367.

### tert-Butyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)acetate (65)



Obtained as a yellow solid (X = Br, 23 mg, 34% yield); M. P. = 104-105 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.85 (dd,  $J = 8.0, 1.4$  Hz, 1H), 7.55 – 7.49 (m, 1H), 7.34 – 7.30 (m, 1H), 7.28 (d,  $J = 7.9$  Hz, 1H), 3.66 (s, 3H), 2.53 (s, 2H), 2.29 (s, 6H), 1.48 (s, 9H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  170.7, 156.6, 154.7, 133.4, 132.9, 130.0, 129.9, 123.5, 113.5, 80.4, 53.0, 42.4, 39.2, 37.1, 28.6, 28.2; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{20}\text{H}_{24}\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  341.1868, found 341.1864.

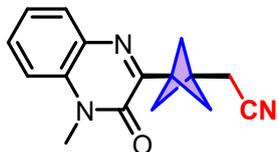
### 3-(3-(3,3-Dimethyl-2-oxobutyl)bicyclo[1.1.1]pentan-1-yl)-1-methylquinoxalin-2(1H)-one (66)



Obtained as a yellow liquid (X = Br, 21 mg, 32% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.84 (dd,  $J = 8.0, 1.2$  Hz, 1H), 7.53 – 7.48 (m, 1H), 7.33 – 7.28 (m, 1H), 7.26 (d,  $J = 4.0$  Hz, 1H), 3.65 (s, 3H), 2.77 (s, 2H), 2.28 (s, 6H), 1.13 (s, 9H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  213.9, 156.6, 154.7, 133.4,

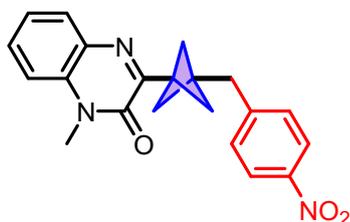
132.9, 130.0, 129.8, 123.5, 113.5, 53.3, 44.4, 43.0, 38.3, 37.4, 28.6, 26.0; HRMS (ESI+): Calculated for C<sub>20</sub>H<sub>24</sub>N<sub>2</sub>O<sub>2</sub>: [M+H]<sup>+</sup> 325.1911, found 325.1913.

**2-(3-(4-Methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)acetonitrile (67)**



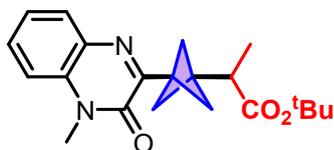
Obtained as a brown liquid (X = I, 30 mg, 57% yield; X = Br, 19 mg, 36% yield); <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.85 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.57 – 7.50 (m, 1H), 7.36 – 7.31 (m, 1H), 7.29 (d, *J* = 8.4 Hz, 1H), 3.67 (s, 3H), 2.69 (s, 2H), 2.35 (s, 6H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 155.6, 154.6, 133.4, 132.8, 130.2, 130.1, 123.6, 117.3, 113.6, 52.5, 42.1, 35.6, 28.6, 21.2; HRMS (ESI+): Calculated for C<sub>16</sub>H<sub>15</sub>N<sub>3</sub>O: [M+H]<sup>+</sup> 266.1288, Found 266.1280.

**1-Methyl-3-(3-(4-nitrobenzyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (68)**



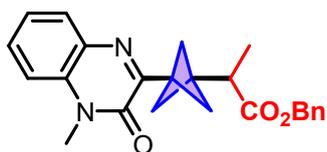
Obtained as a light yellow solid (X = Br, 33 mg, 46% yield); M. P. = 174-175 °C; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.17 (d, *J* = 8.6 Hz, 2H), 7.82 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.55 – 7.48 (m, 1H), 7.32 (t, *J* = 7.3 Hz, 3H), 7.27 (d, *J* = 5.2 Hz, 1H), 3.64 (s, 3H), 2.14 (s, 6H); <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 156.5, 154.6, 147.2, 146.5, 146.5, 133.4, 132.8, 130.0, 129.8, 123.7, 123.6, 113.6, 52.0, 42.8, 40.4, 39.0, 28.6; HRMS (ESI+): Calculated for C<sub>21</sub>H<sub>19</sub>N<sub>3</sub>O<sub>3</sub>: [M+H]<sup>+</sup> 362.1499, Found 362.1503.

***tert*-Butyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)propanoate (69)**



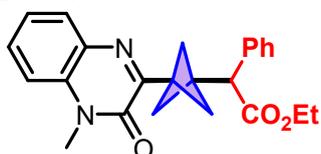
Obtained as a yellow liquid (X = Br, 28 mg, 40% yield); <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.85 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.56 – 7.49 (m, 1H), 7.35 – 7.30 (m, 1H), 7.28 (d, *J* = 9.4 Hz, 1H), 3.67 (s, 3H), 2.22 (s, 6H), 1.48 (s, 9H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>) δ 173.5, 156.9, 154.7, 133.4, 132.9, 130.0, 129.9, 123.5, 113.5, 80.2, 51.1, 41.7, 41.3, 28.6, 28.3, 13.3; HRMS (ESI+): Calculated for C<sub>21</sub>H<sub>26</sub>N<sub>2</sub>O<sub>3</sub>: [M+Na]<sup>+</sup> 377.1836, Found 377.1832.

**1-Benzyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)propanoate (70)**



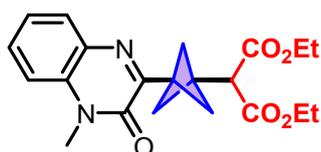
Obtained as a brown liquid (X = Br, 31 mg, 40% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.84 (dd,  $J$  = 8.0, 1.4 Hz, 1H), 7.51 (ddd,  $J$  = 8.6, 7.3, 1.5 Hz, 1H), 7.37 (s, 2H), 7.36 (d,  $J$  = 4.5 Hz, 2H), 7.35 – 7.32 (m, 1H), 7.31 (dd,  $J$  = 6.2, 2.2 Hz, 1H), 7.27 – 7.25 (m, 1H), 5.14 (s, 2H), 3.65 (s, 3H), 2.77 (q,  $J$  = 7.0 Hz, 1H), 2.21 (s, 6H), 1.20 (d,  $J$  = 7.0 Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  174.0, 156.6, 154.6, 136.1, 133.4, 132.8, 130.0, 129.9, 128.6, 128.3, 128.2, 123.5, 113.5, 66.2, 51.1, 41.5, 41.3, 40.9, 28.6, 13.4; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{24}\text{H}_{24}\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  389.1867, found 389.1865.

**1-Ethyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)-2-phenylacetate (71)**



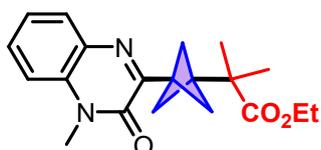
Obtained as a yellow liquid (X = Br, 30 mg, 39% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.82 (dd,  $J$  = 8.0, 1.4 Hz, 1H), 7.50 (ddd,  $J$  = 8.6, 7.4, 1.5 Hz, 1H), 7.36 – 7.30 (m, 5H), 7.29 – 7.27 (m, 1H), 7.25 (s, 1H), 4.19 (dd,  $J$  = 17.2, 7.1 Hz, 2H), 3.84 (s, 1H), 3.64 (s, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  171.8, 156.7, 154.6, 136.5, 133.4, 132.9, 130.0, 129.9, 128.6, 128.4, 127.1, 123.5, 113.5, 60.7, 53.4, 51.7, 42.5, 41.5, 28.6, 14.3; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{24}\text{H}_{24}\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  389.1860, found 389.1856.

**Diethyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)malonate (72)**



Obtained as a brown liquid (X = Br, 29 mg, 38% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.85 (dd,  $J$  = 8.0, 1.3 Hz, 1H), 7.52 (ddd,  $J$  = 8.5, 7.3, 1.5 Hz, 1H), 7.35 – 7.31 (m, 1H), 7.28 (d,  $J$  = 8.4 Hz, 1H), 4.23 (q,  $J$  = 7.1 Hz, 4H), 3.67 (s, 3H), 2.40 (s, 6H), 1.30 (t,  $J$  = 7.1 Hz, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  167.6, 156.2, 154.6, 133.4, 132.9, 130.1, 130.0, 123.5, 113.5, 61.3, 53.6, 52.5, 42.5, 37.7, 28.6, 14.2; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{21}\text{H}_{24}\text{N}_2\text{O}_5$ :  $[\text{M}+\text{Na}]^+$  407.1577, Found 407.1572.

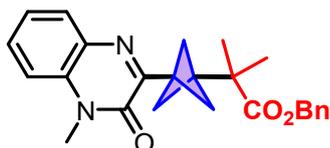
**Ethyl-2-methyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1] pentan-1-yl)propanoate (74)**



Obtained as a brown liquid (X = Br, 22 mg, 32% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.85 (dd,  $J$  = 8.0, 1.4 Hz, 1H), 7.55 – 7.49 (m, 1H), 7.33 (dd,  $J$  = 11.7, 4.6 Hz, 1H), 7.28 (d,  $J$  = 8.4 Hz, 1H),

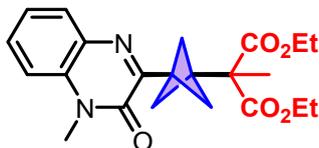
4.15 (q,  $J = 7.1$  Hz, 2H), 3.67 (s, 3H), 2.19 (s, 6H), 1.28 (t,  $J = 7.1$  Hz, 3H), 1.20 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  176.0, 157.0, 154.7, 133.4, 132.9, 130.0, 129.9, 123.5, 113.5, 60.3, 49.7, 45.6, 42.1, 40.0, 28.6, 21.7, 14.4; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{20}\text{H}_{24}\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  341.1860, Found 341.1860.

**1-Benzyl-2-methyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo[1.1.1]pentan-1-yl)propanoate (75)**



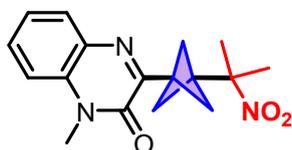
Obtained as a yellow liquid (X = Br, 35 mg, 44% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.83 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.53 – 7.49 (m, 1H), 7.37 (d,  $J = 5.1$  Hz, 2H), 7.35 (d,  $J = 2.3$  Hz, 2H), 7.35 – 7.32 (m, 1H), 7.30 (dd,  $J = 4.2, 2.6$  Hz, 1H), 7.27 – 7.25 (m, 1H), 5.13 (s, 2H), 3.64 (s, 3H), 2.17 (s, 6H), 1.23 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  175.9, 156.9, 154.7, 136.3, 133.4, 132.9, 130.0, 129.9, 128.5, 128.0, 128.0, 123.5, 113.5, 66.2, 49.7, 45.6, 42.4, 40.0, 28.6, 21.8; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{25}\text{H}_{26}\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  403.2016, found 403.2014.

**Diethyl-2-methyl-2-(3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)bicyclo [1.1.1]pentan-1-yl) malonate (76)**



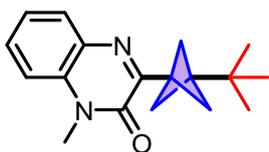
Obtained as a brown liquid (X = Br, 32 mg, 40% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.85 (dd,  $J = 8.0, 1.4$  Hz, 1H), 7.52 (ddd,  $J = 8.6, 7.4, 1.5$  Hz, 1H), 7.35 – 7.31 (m, 1H), 7.28 (d,  $J = 8.4$  Hz, 1H), 4.22 (qd,  $J = 7.1, 1.2$  Hz, 4H), 3.67 (s, 3H), 2.35 (s, 6H), 1.46 (s, 3H), 1.29 (t,  $J = 7.1$  Hz, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  170.8, 156.6, 154.6, 133.4, 132.9, 130.1, 130.0, 123.5, 113.5, 61.1, 54.1, 51.0, 42.3, 41.3, 28.6, 18.4, 14.2; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{22}\text{H}_{26}\text{N}_2\text{O}_5$ :  $[\text{M}+\text{H}]^+$  399.1914, Found 399.1908.

**Methyl-3-(3-(2-nitropropan-2-yl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-2(1H)-one (77)**



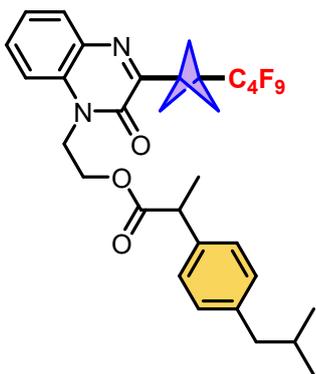
Obtained as a yellow solid (X = Br, 28 mg, 45% yield); M. P. = 167-168 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.84 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.57 – 7.51 (m, 1H), 7.36 – 7.32 (m, 1H), 7.29 (d,  $J = 8.4$  Hz, 1H), 3.67 (s, 3H), 2.27 (s, 6H), 1.62 (s, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  155.8, 154.6, 133.4, 132.8, 130.2, 130.1, 123.6, 113.6, 86.8, 49.9, 45.2, 39.0, 28.6, 22.8; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{17}\text{H}_{19}\text{N}_3\text{O}_3$ :  $[\text{M}+\text{H}]^+$  314.1499, Found 314.1499.

**3-(3-(Tert-butyl)bicyclo[1.1.1]pentan-1-yl)-1-methylquinoxalin-2(1H)-one (78)**



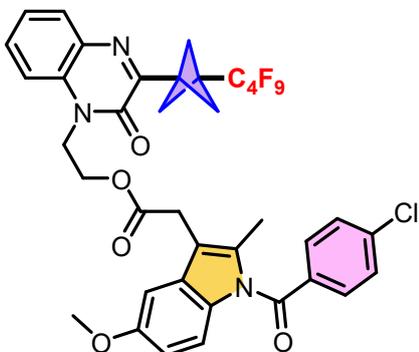
Obtained as a yellow liquid (X = I, 13 mg, 23% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.88 (dd,  $J = 8.0, 1.1$  Hz, 1H), 7.55 – 7.49 (m, 1H), 7.34 – 7.30 (m, 1H), 7.28 (d,  $J = 8.6$  Hz, 1H), 3.67 (s, 3H), 2.10 (s, 6H), 0.92 (s, 9H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  157.8, 154.7, 133.4, 132.9, 129.9, 129.8, 123.4, 113.5, 48.8, 48.5, 39.6, 29.6, 28.6, 25.9; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{18}\text{H}_{22}\text{N}_2\text{O}$ :  $[\text{M}+\text{H}]^+$  283.1805, Found 283.1805.

**2-(3-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-2-oxoquinoxalin-1(2H)-yl)ethyl 2-(4-isobutylphenyl)propanoate (79)**



Obtained as a light yellow solid (X = I, 81 mg, 61% yield); M. P. = 80-81 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.84 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.50 – 7.45 (m, 1H), 7.37 – 7.31 (m, 2H), 7.08 (d,  $J = 8.1$  Hz, 2H), 7.04 (d,  $J = 8.1$  Hz, 2H), 4.49 (ddd,  $J = 9.9, 6.9, 2.2$  Hz, 1H), 4.45 – 4.35 (m, 3H), 3.58 (q,  $J = 7.1$  Hz, 1H), 2.54 (s, 6H), 2.43 (d,  $J = 7.2$  Hz, 2H), 1.83 (dt,  $J = 13.5, 6.8$  Hz, 1H), 1.42 (d,  $J = 7.2$  Hz, 3H), 0.89 (d,  $J = 6.6$  Hz, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  174.7, 154.6, 154.3, 140.8, 137.2, 133.0, 132.9, 130.5, 130.4, 129.4, 127.1, 123.8, 113.8, 61.0, 51.2, 45.0, 45.0, 41.9, 40.6, 37.9 (t,  $J = 30.2$  Hz), 30.2, 22.4, 18.3,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03– -81.08 (m), -115.59 – -116.67 (m), -121.29 – -122.33(m), -125.97 – -126.04 (m); HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{32}\text{H}_{31}\text{F}_9\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  663.2264, Found 663.2262.

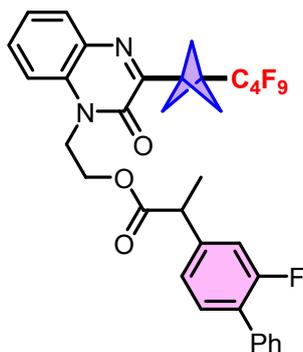
**2-(2-Oxo-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-1(2H)-yl)ethyl 2-(1-(4-chlorobenzoyl)-5-methoxy-2-methyl-1H-indol-3-yl)acetate (80)**



Obtained as a yellow liquid (X = I, 80 mg, 49% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 – 7.79 (m, 1H), 7.67 – 7.58 (m, 2H), 7.50 – 7.45 (m, 2H), 7.45 – 7.40 (m, 1H), 7.31 (t,  $J = 7.6$  Hz, 2H),

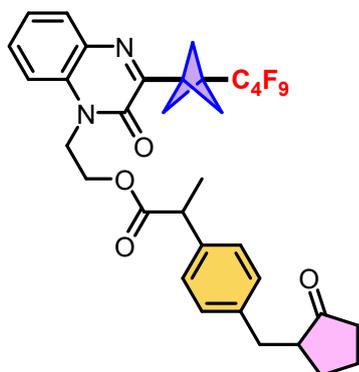
6.88 (d,  $J = 2.4$  Hz, 1H), 6.84 (d,  $J = 9.0$  Hz, 1H), 6.66 (dd,  $J = 9.0, 2.5$  Hz, 1H), 4.48 (s, 4H), 3.80 (s, 3H), 3.60 (s, 2H), 2.55 (s, 6H), 2.28 (s, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  170.8, 168.2, 156.1, 154.6, 154.3, 139.4, 136.0, 133.8, 132.9, 131.2, 130.8, 130.5, 130.5, 130.5, 129.2, 123.8, 115.0, 113.4, 111.9, 111.6, 101.3, 61.2, 55.7, 51.3, 41.9, 40.7, 30.1, 14.2, 13.3,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.02 – -81.06 (m), -116.58 – -116.64 (m), -122.27 – -122.32 (m), -125.97 – -126.04 (m); HRMS (ESI+): Calculated for  $\text{C}_{38}\text{H}_{29}\text{CF}_9\text{N}_3\text{O}_5$ :  $[\text{M}+\text{Na}]^+$  836.1544, Found 836.1547.

**2-(3-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-2-oxoquinoxalin-1(2H)-yl)ethyl 2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoate (81)**



Obtained as a yellow liquid (X = I, 77 mg, 55% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 – 7.81 (m, 1H), 7.53 (d,  $J = 7.9$  Hz, 2H), 7.45 (dd,  $J = 16.2, 8.4$  Hz, 3H), 7.35 (dt,  $J = 17.2, 7.6$  Hz, 4H), 6.99 (t,  $J = 9.4$  Hz, 2H), 4.53 – 4.42 (m, 4H), 3.64 (q,  $J = 7.1$  Hz, 1H), 2.54 (s, 6H), 1.46 (d,  $J = 7.2$  Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  173.9, 159.6 (d,  $J = 249.5$  Hz), 154.6, 154.3, 141.2 (d,  $J = 7.6$  Hz), 135.3, 132.9 (d,  $J = 10.1$  Hz), 130.9 (d,  $J = 3.8$  Hz), 130.5, 130.4, 128.9 (d,  $J = 2.5$  Hz), 128.5, 128.0, 127.9, 127.8, 123.8, 123.4 (d,  $J = 3.8$  Hz), 115.2 (d,  $J = 23.9$  Hz), 113.7, 61.3, 51.2, 44.9, 41.9, 40.6, 37.9 (t,  $J = 30.2$  Hz), 18.2,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -80.02 – -81.06 (m), -116.60 – -116.66 (m), -117.25 (s), -122.29 – -122.33 (m), -125.98 – -126.05 (m); HRMS (ESI+): Calculated for  $\text{C}_{34}\text{H}_{26}\text{F}_{10}\text{N}_2\text{O}_3$ :  $[\text{M}+\text{H}]^+$  701.1857, Found 701.1857.

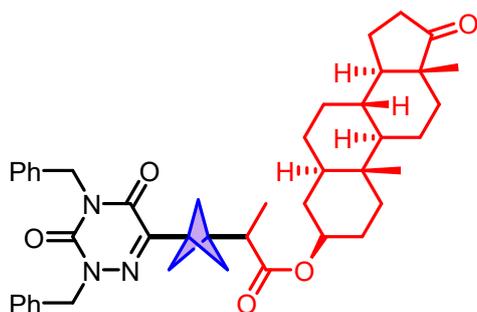
**2-(3-(3-(Perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)-2-oxoquinoxalin-1(2H)-yl)ethyl 2-(4-((2-oxocyclopentyl)methyl)phenyl)propanoate (82)**



Obtained as a yellow liquid (X = I, 63 mg, 45% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.84 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.50 – 7.45 (m, 1H), 7.37 – 7.31 (m, 2H), 7.08 (d,  $J = 8.1$  Hz, 2H), 7.04 (d,  $J = 8.1$  Hz, 2H), 4.49 (ddd,  $J = 9.9, 6.9, 2.2$  Hz, 1H), 4.45 – 4.35 (m, 3H), 3.58 (q,  $J = 7.1$  Hz, 1H), 2.54 (s, 6H), 2.43 (d,  $J = 7.2$  Hz, 2H), 1.83 (dt,  $J = 13.5, 6.8$  Hz, 1H), 1.42 (d,  $J = 7.2$  Hz, 3H), 0.89 (d,  $J =$

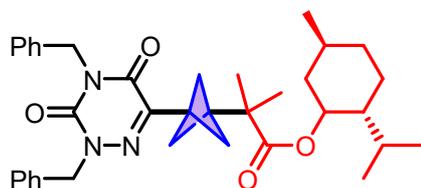
6.6 Hz, 6H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  220.1, 174.5, 154.6, 154.3, 139.1, 137.8, 132.9, 132.9, 130.5, 130.4, 129.2, 127.4, 123.8, 113.7, 61.0, 51.2, 51.0, 45.0, 41.9, 40.5, 38.2, 38.2 (t,  $J = 30.2$  Hz), 35.2, 29.3, 20.5, 18.3,  $^{13}\text{C}$  NMR for  $\text{C}_4\text{F}_9$  could not be assigned;  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -81.03 – -81.08 (m), -116.59 – -116.67 (m), -122.29 – -122.33 (m), -125.97 – -126.04 (m); HRMS (ESI+): Calculated for  $\text{C}_{34}\text{H}_{31}\text{F}_9\text{N}_2\text{O}_4$ :  $[\text{M}+\text{H}]^+$  703.2213, Found 703.2218.

**(3*R*,5*S*,8*R*,9*S*,10*S*,13*S*,14*S*)-10,13-Dimethyl-17-oxohexadecahydro-1*H*-cyclopenta[*a*]phenanthren-3-yl-2-(3-(2,4-dibenzyl-3,5-dioxo-2,3,4,5-tetrahydro-1,2,4-triazin-6-yl)bicyclo[1.1.1]pentan-1-yl)propanoate (83)**



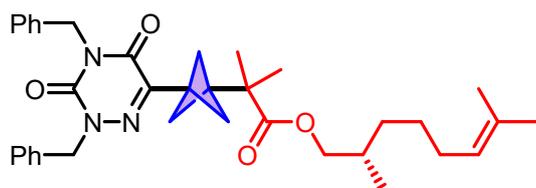
Obtained as a light yellow solid (X = Br, 55 mg, 39% yield); M. P. = 70-71 °C;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.39 (d,  $J = 6.9$  Hz, 2H), 7.32 (d,  $J = 7.0$  Hz, 2H), 7.29 – 7.17 (m, 6H), 4.99 (s, 2H), 4.95 (s, 2H), 4.78 – 4.55 (m, 1H), 2.53 (q,  $J = 6.8$  Hz, 1H), 2.36 (dd,  $J = 19.3, 8.8$  Hz, 1H), 2.03 – 1.98 (m, 1H), 1.96 (s, 6H), 1.88 – 1.83 (m, 1H), 1.72 (d,  $J = 12.3$  Hz, 3H), 1.67 (d,  $J = 13.3$  Hz, 1H), 1.59 – 1.52 (m, 2H), 1.48 – 1.39 (m, 3H), 1.32 (s, 1H), 1.27 (s, 1H), 1.23 (d,  $J = 3.0$  Hz, 1H), 1.16 (ddd,  $J = 14.5, 9.5, 4.5$  Hz, 4H), 1.03 (d,  $J = 7.0$  Hz, 3H), 0.98 (dd,  $J = 13.7, 3.8$  Hz, 1H), 0.91 (dd,  $J = 12.2, 4.8$  Hz, 1H), 0.78 (s, 6H), 0.68 – 0.62 (m, 1H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  173.5, 155.4, 149.1, 142.3, 135.7, 135.7, 129.5, 128.8, 128.7, 128.6, 128.2, 128.0, 73.4, 55.3, 54.3 (d,  $J = 1.3$  Hz), 51.4, 50.9, 47.8, 44.7 (d,  $J = 2.5$  Hz), 43.9, 42.0, 40.8, 37.9, 36.7 (d,  $J = 1.3$  Hz), 35.9, 35.7, 35.1, 34.2 (d,  $J = 12.6$  Hz), 31.5, 30.8, 28.3, 27.7 (d,  $J = 15.1$  Hz), 21.8, 20.5, 13.8, 13.3, 12.3; HRMS (ESI+): Calculated for  $\text{C}_{44}\text{H}_{53}\text{N}_3\text{O}_5$ :  $[\text{M}+\text{Na}]^+$  726.3877, Found 726.3875.

**(2*S*,5*R*)-2-Isopropyl-5-methylcyclohexyl-2-(3-(2,4-dibenzyl-3,5-dioxo-2,3,4,5-tetrahydro-1,2,4-triazin-6-yl)bicyclo[1.1.1]pentan-1-yl)-2-methylpropanoate (84)**



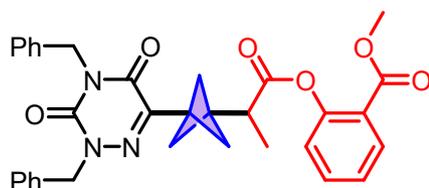
Obtained as a light yellow liquid (X = Br, 40 mg, 34% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.50 – 7.46 (m, 2H), 7.41 (dd,  $J = 7.8, 1.4$  Hz, 2H), 7.36 – 7.27 (m, 6H), 5.07 (s, 2H), 5.04 (s, 2H), 4.66 (td,  $J = 10.9, 4.3$  Hz, 1H), 2.00 (s, 6H), 2.00 – 1.95 (m, 1H), 1.95 – 1.88 (m, 1H), 1.82 – 1.57 (m, 3H), 1.49 (ddd,  $J = 8.6, 7.3, 4.5$  Hz, 1H), 1.43 – 1.38 (m, 1H), 1.15 (d,  $J = 8.8$  Hz, 6H), 1.06 (dd,  $J = 12.8, 2.9$  Hz, 1H), 0.96 (d,  $J = 11.2$  Hz, 1H), 0.91 (dd,  $J = 6.8, 2.1$  Hz, 6H), 0.80 – 0.71 (m, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  175.4, 155.5, 149.1, 142.6, 135.8, 135.7, 129.6, 128.8, 128.7, 128.6, 128.2, 128.0, 74.3, 55.3, 49.5, 47.1, 46.0, 43.9, 42.1, 41.1, 36.9, 34.3, 31.4, 26.0, 23.1, 22.1, 22.1, 21.8, 20.9, 16.0; HRMS (ESI+): Calculated for  $\text{C}_{36}\text{H}_{45}\text{N}_3\text{O}_4$ :  $[\text{M}+\text{Na}]^+$  606.3302, Found 606.3300.

**(R)-3,7-Dimethyloct-6-en-1-yl-2-(3-(2,4-dibenzyl-3,5-dioxo-2,3,4,5-tetrahydro-1,2,4-triazin-6-yl)bicyclo[1.1.1]pentan-1-yl)-2-methylpropanoate (85)**



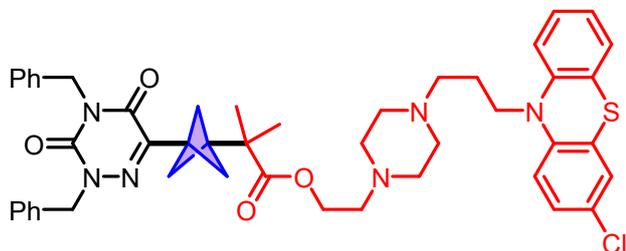
Obtained as a light yellow liquid (X = Br, 44 mg, 57% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.50 – 7.45 (m, 2H), 7.39 (dd,  $J = 7.9, 1.3$  Hz, 2H), 7.36 – 7.26 (m, 6H), 5.05 (d,  $J = 13.8$  Hz, 4H), 4.15 – 4.06 (m, 2H), 2.00 (s, 6H), 2.00 – 1.86 (m, 2H), 1.68 (d,  $J = 5.6$  Hz, 1H), 1.66 (s, 3H), 1.59 (s, 3H), 1.57 – 1.52 (m, 1H), 1.44 (dd,  $J = 13.4, 6.3$  Hz, 1H), 1.35 (ddd,  $J = 8.6, 6.4, 3.1$  Hz, 1H), 1.15 (s, 6H), 0.92 (d,  $J = 6.6$  Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  175.9, 155.5, 149.1, 142.5, 135.7, 135.7, 131.3, 129.6, 128.8, 128.7, 128.6, 128.2, 128.0, 124.6, 62.9, 55.3, 49.5, 46.0, 44.0, 42.1, 37.0, 36.7, 35.6, 29.5, 25.7, 25.4, 21.8, 19.4, 17.7; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{36}\text{H}_{45}\text{N}_3\text{O}_4$ :  $[\text{M}+\text{H}]^+$  584.3483, Found 584.3482.

**1-Methyl-2-((2-(3-(2,4-dibenzyl-3,5-dioxo-2,3,4,5-tetrahydro-1,2,4-triazin-6-yl)bicyclo[1.1.1]pentan-1-yl)propanoyl)oxy)benzoate (86)**



Obtained as a light yellow liquid (X = Br, 51 mg, 45% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.01 (dd,  $J = 7.8, 1.5$  Hz, 1H), 7.56 (td,  $J = 7.9, 1.6$  Hz, 1H), 7.52 – 7.47 (m, 2H), 7.44 – 7.39 (m, 2H), 7.37 – 7.28 (m, 7H), 7.09 (d,  $J = 8.0$  Hz, 1H), 5.08 (s, 2H), 5.06 (s, 2H), 3.87 (s, 3H), 3.01 (q,  $J = 7.0$  Hz, 1H), 2.19 (s, 6H), 1.33 (d,  $J = 7.1$  Hz, 3H);  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  172.5, 165.0, 155.5, 150.5, 149.1, 142.3, 135.7, 135.7, 133.7, 131.7, 129.5, 128.8, 128.7, 128.6, 128.2, 128.0, 126.0, 123.8, 123.6, 55.4, 52.2, 51.0, 44.0, 41.7, 40.7, 38.3, 13.5; HRMS (ESI<sup>+</sup>): Calculated for  $\text{C}_{33}\text{H}_{31}\text{N}_3\text{O}_6$ :  $[\text{M}+\text{Na}]^+$  588.2105, Found 588.2104.

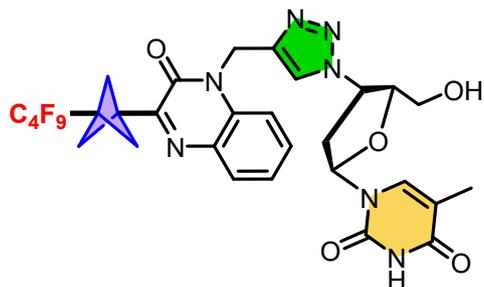
**2-(4-(3-(3-Chloro-10H-phenothiazin-10-yl)propyl)piperazin-1-yl)ethyl-2-(3-(2,4-dibenzyl-3,5-dioxo-2,3,4,5-tetrahydro-1,2,4-triazin-6-yl)bicyclo[1.1.1]pentan-1-yl)-2-methylpropanoate (87)**



Obtained as a brown liquid (X = Br, 66 mg, 40% yield);  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.46 (d,  $J = 6.8$  Hz, 2H), 7.38 (dd,  $J = 7.9, 1.4$  Hz, 2H), 7.35 – 7.27 (m, 6H), 7.16 – 7.12 (m, 1H), 7.10 (dd,  $J = 7.6, 1.4$  Hz, 1H), 7.00 (d,  $J = 8.1$  Hz, 1H), 6.92 (td,  $J = 7.5, 0.8$  Hz, 1H), 6.89 – 6.85 (m, 2H), 6.83 (d,  $J = 2.0$  Hz, 1H), 5.05 (s, 2H), 5.01 (s, 2H), 4.19 (t,  $J = 5.8$  Hz, 2H), 3.88 (t,  $J = 6.7$  Hz, 2H), 2.61 (t,  $J = 5.8$  Hz, 2H), 2.50 (d,  $J = 29.5$  Hz, 10H), 2.01 (s, 6H), 1.97 – 1.90 (m, 2H), 1.14 (s, 6H);  $^{13}\text{C}$

NMR (126 MHz, CDCl<sub>3</sub>)  $\delta$  175.6, 155.4, 149.1, 146.5, 144.5, 142.5, 135.7, 135.7, 133.3, 129.5, 128.8, 128.7, 128.6, 128.2, 128.0, 127.9, 127.5, 127.5, 124.8, 123.6, 123.0, 122.3, 115.9, 115.9, 61.7, 60.4, 56.7, 55.4, 55.4, 53.2, 49.5, 46.0, 45.3, 44.0, 42.1, 36.7, 25.5, 21.8; HRMS (ESI<sup>+</sup>): Calculated for C<sub>47</sub>H<sub>51</sub>ClN<sub>6</sub>O<sub>4</sub>S: [M+H]<sup>+</sup> 831.3454, Found 831.3451.

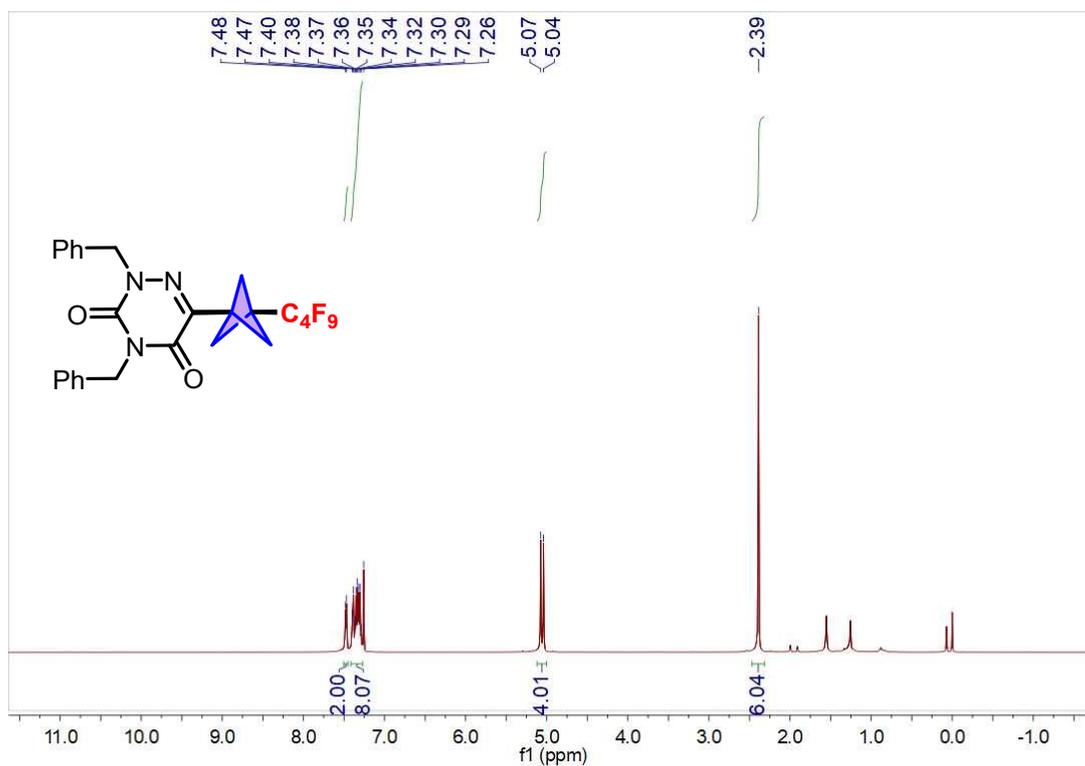
**1-(5-(Hydroxymethyl)-4-(5-((2-oxo-3-(3-(perfluorobutyl)bicyclo[1.1.1]pentan-1-yl)quinoxalin-1(2H)-yl)methyl)-1H-1,2,3-triazol-1-yl)tetrahydrofuran-2-yl)-5-methylpyrimidine-2,4(1H,3H)-dione (88)**



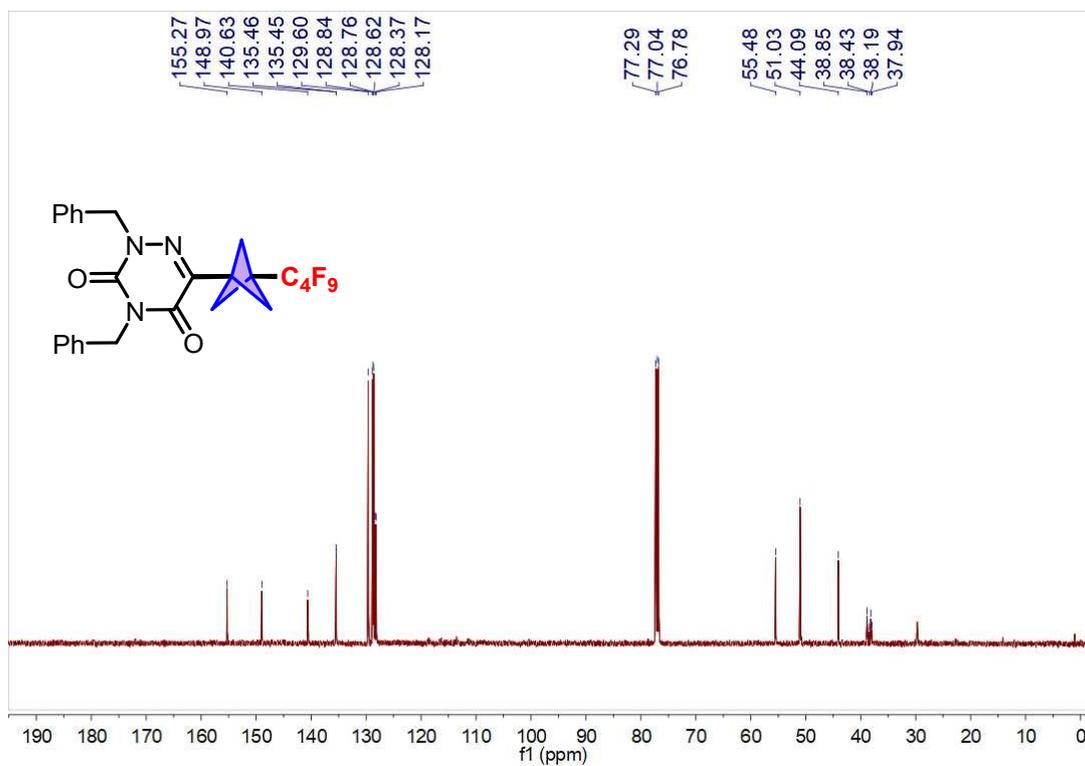
Obtained as a yellow liquid (100 mg, 68% yield); <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)  $\delta$  7.97 – 7.74 (m, 3H), 7.56 (t, *J* = 7.8 Hz, 1H), 7.48 (s, 1H), 7.33 (t, *J* = 7.5 Hz, 1H), 6.24 (t, *J* = 6.5 Hz, 1H), 5.48 (dd, *J* = 24.1, 15.3 Hz, 2H), 5.40 (dd, *J* = 13.3, 5.5 Hz, 1H), 4.44 – 4.32 (m, 1H), 3.96 (d, *J* = 12.2 Hz, 1H), 3.83 – 3.67 (m, 1H), 2.89 (dd, *J* = 15.1, 7.0 Hz, 4H), 2.54 (s, 6H), 1.89 (s, 3H); <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)  $\delta$  163.8, 154.2, 150.5, 142.5, 137.5, 132.9, 132.5, 130.8, 130.2, 123.9, 114.7, 111.2, 88.2, 85.2, 61.5, 59.5, 51.3, 46.0, 41.9, 37.7, 37.6, 12.4, 9.6; <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)  $\delta$  -81.03 – -81.07 (m), -116.58 – -116.65 (m), -122.26 – -122.32 (m), -125.98 – -126.05 (m); HRMS (ESI<sup>+</sup>): Calculated for C<sub>30</sub>H<sub>26</sub>F<sub>9</sub>N<sub>7</sub>O<sub>5</sub>: [M+H]<sup>+</sup> 736.1924, Found 736.1916.

## 4 Copies of $^1\text{H}$ , $^{13}\text{C}$ , and $^{19}\text{F}$ NMR Spectra

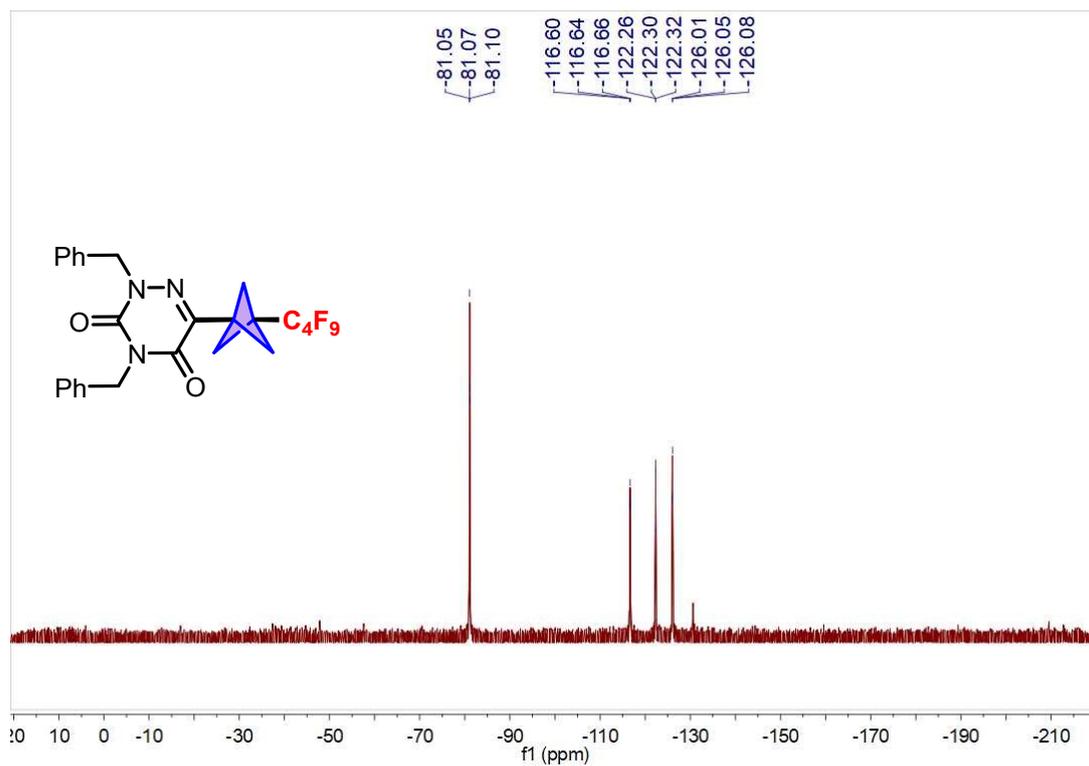
### 4 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



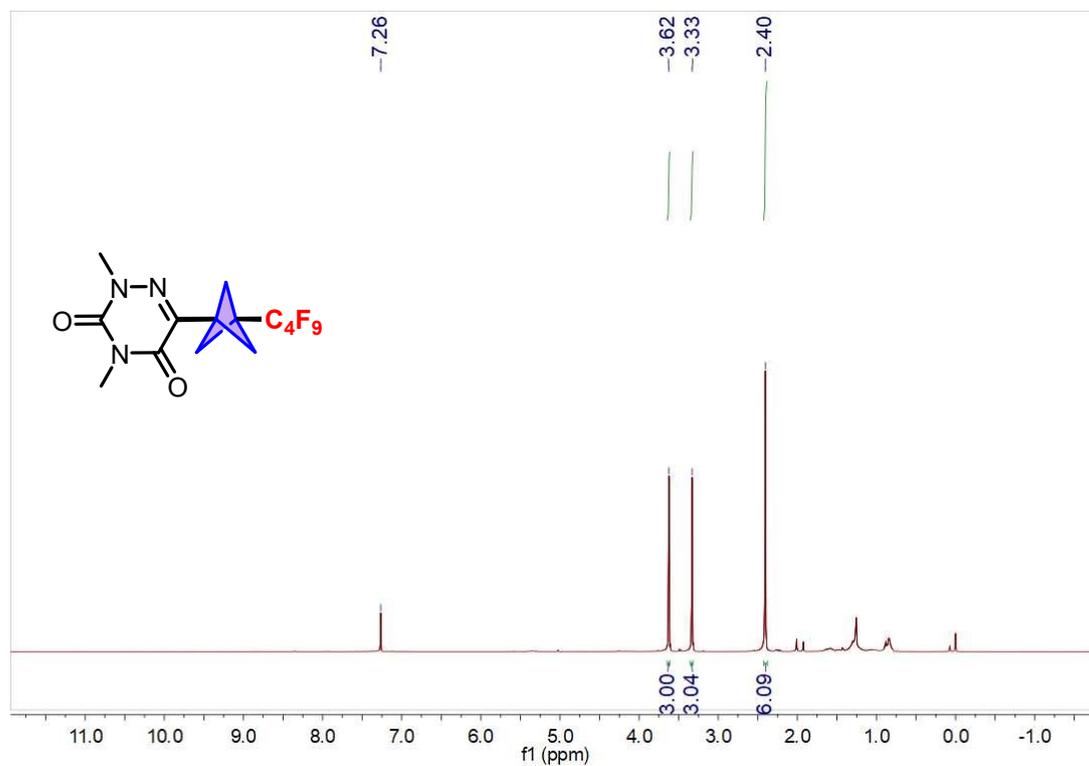
### 4 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



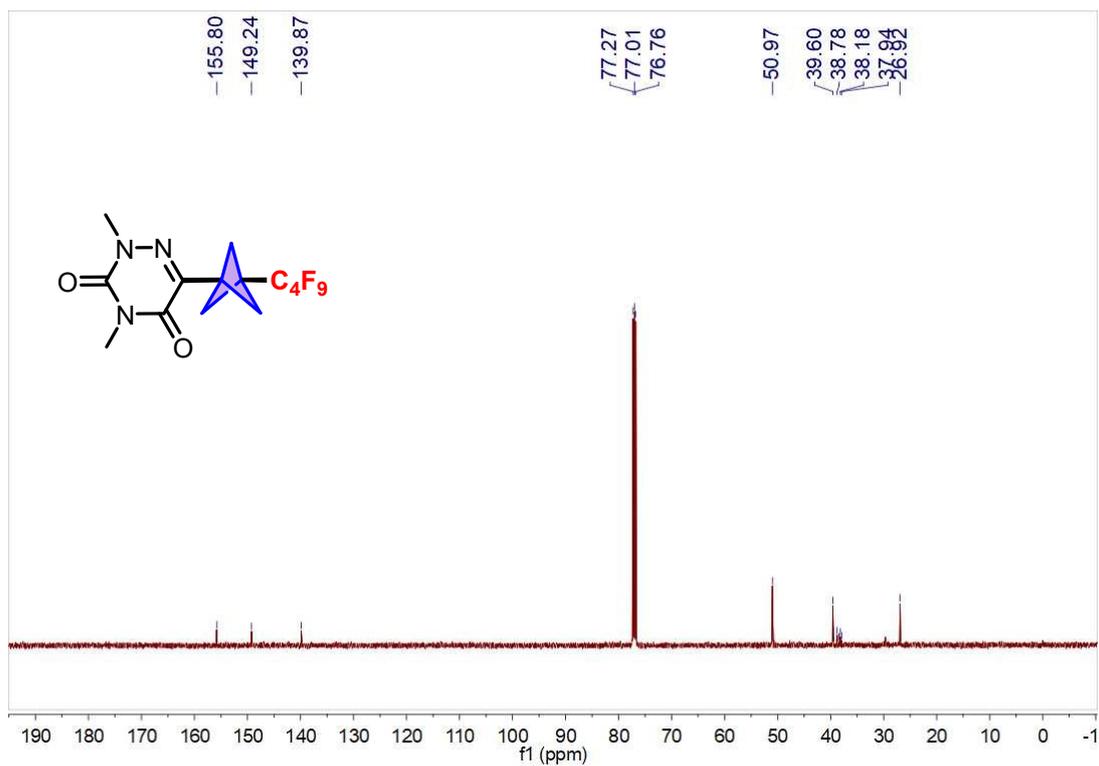
### 4 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



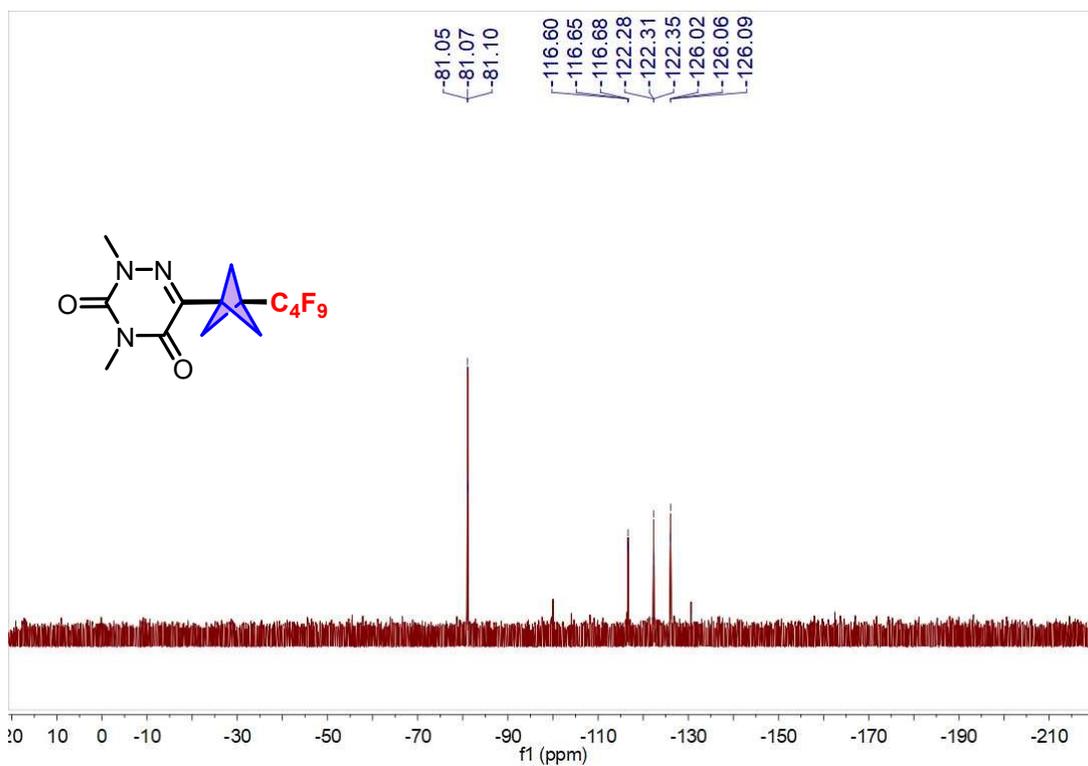
### 5 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



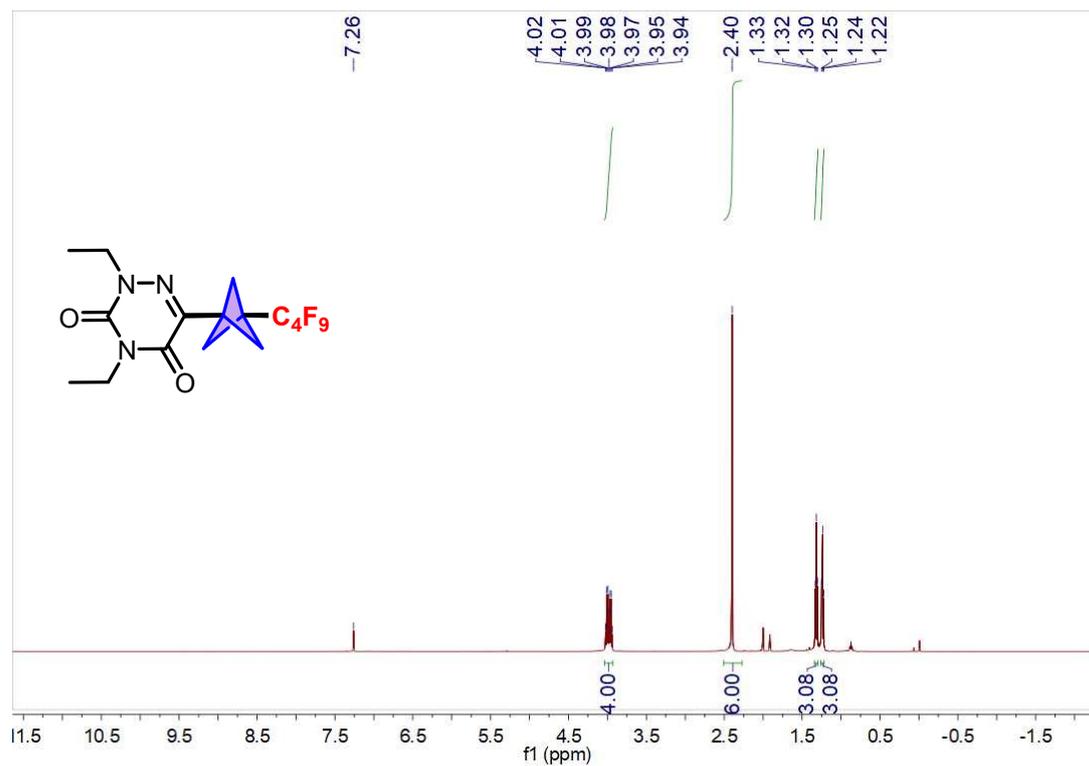
5  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



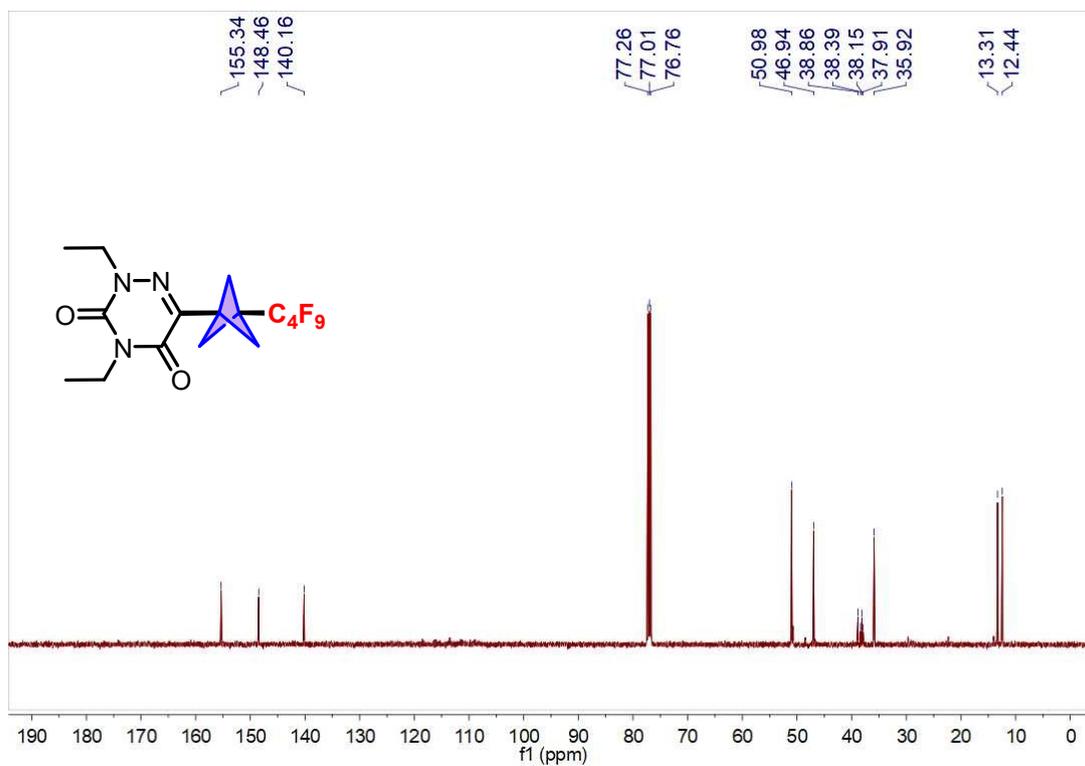
5  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



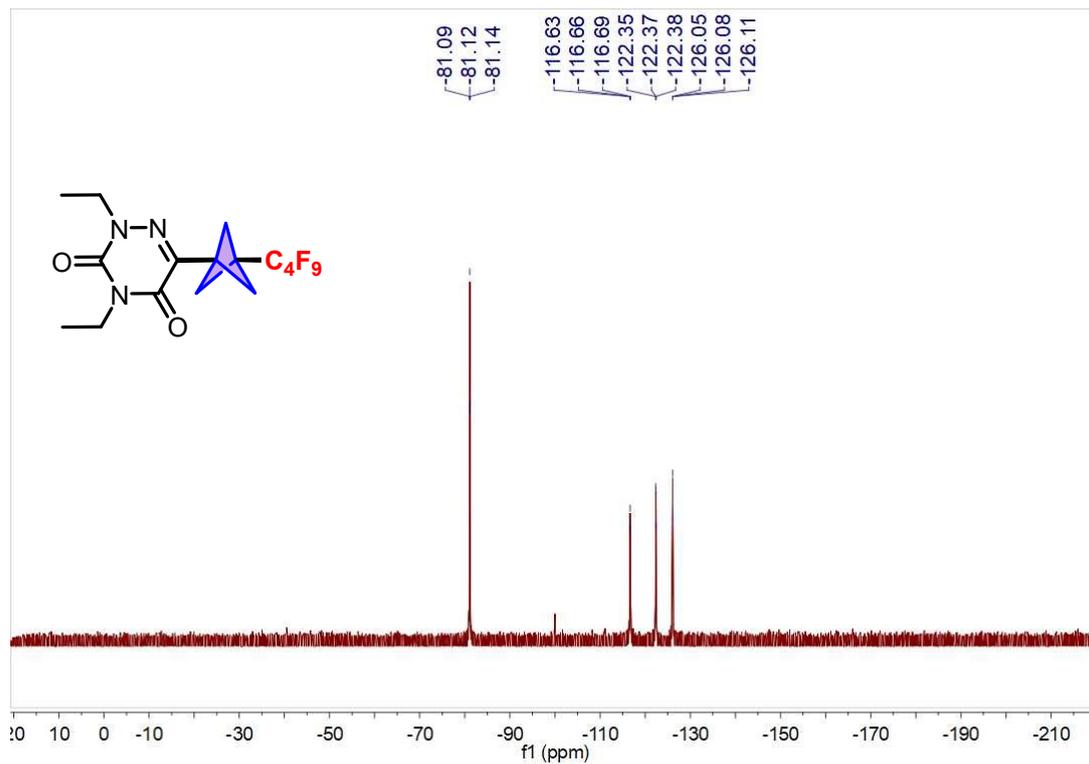
### 6 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



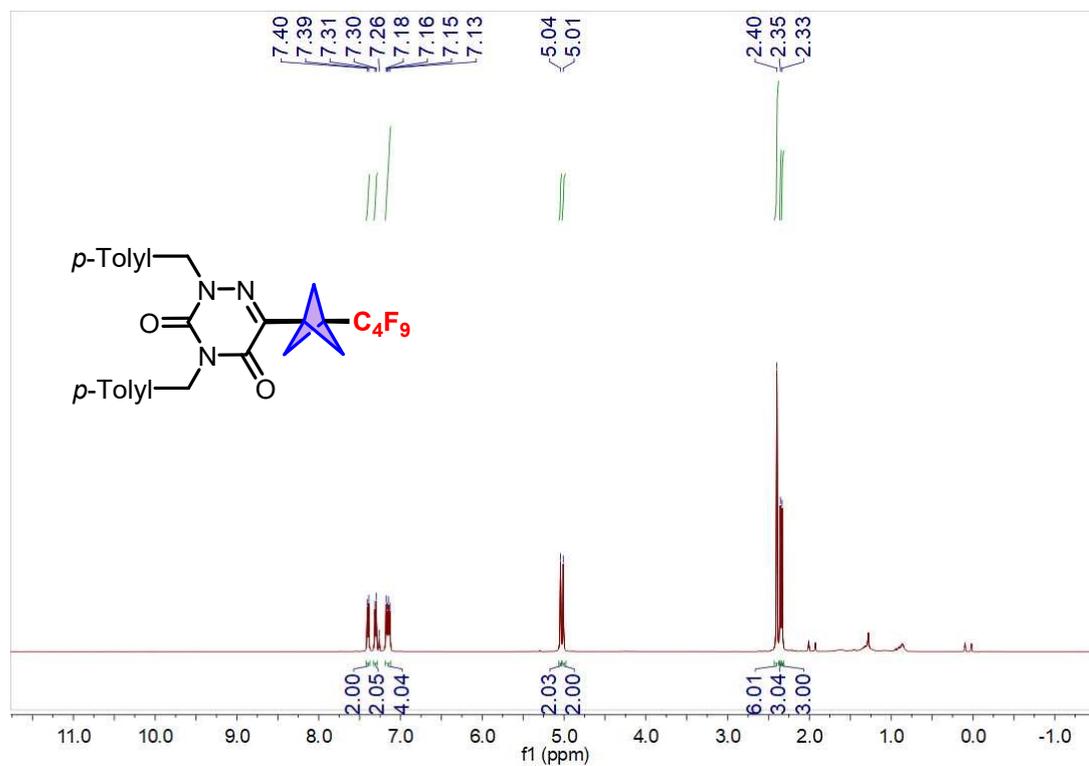
### 6 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



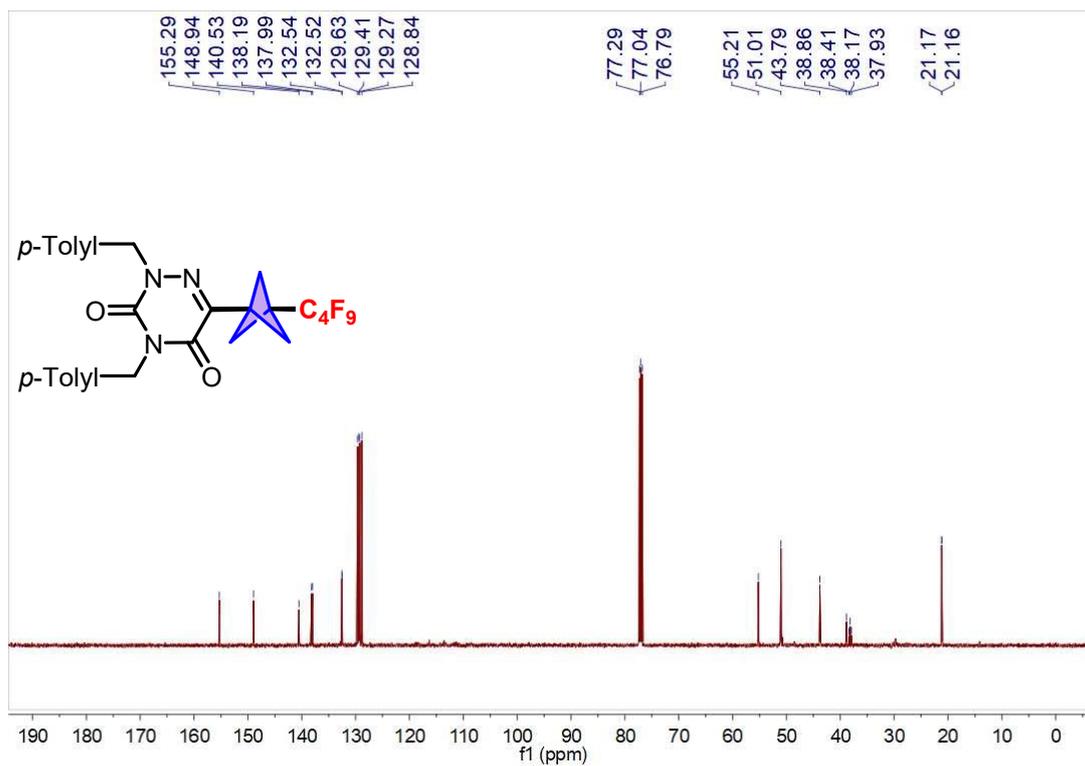
6  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



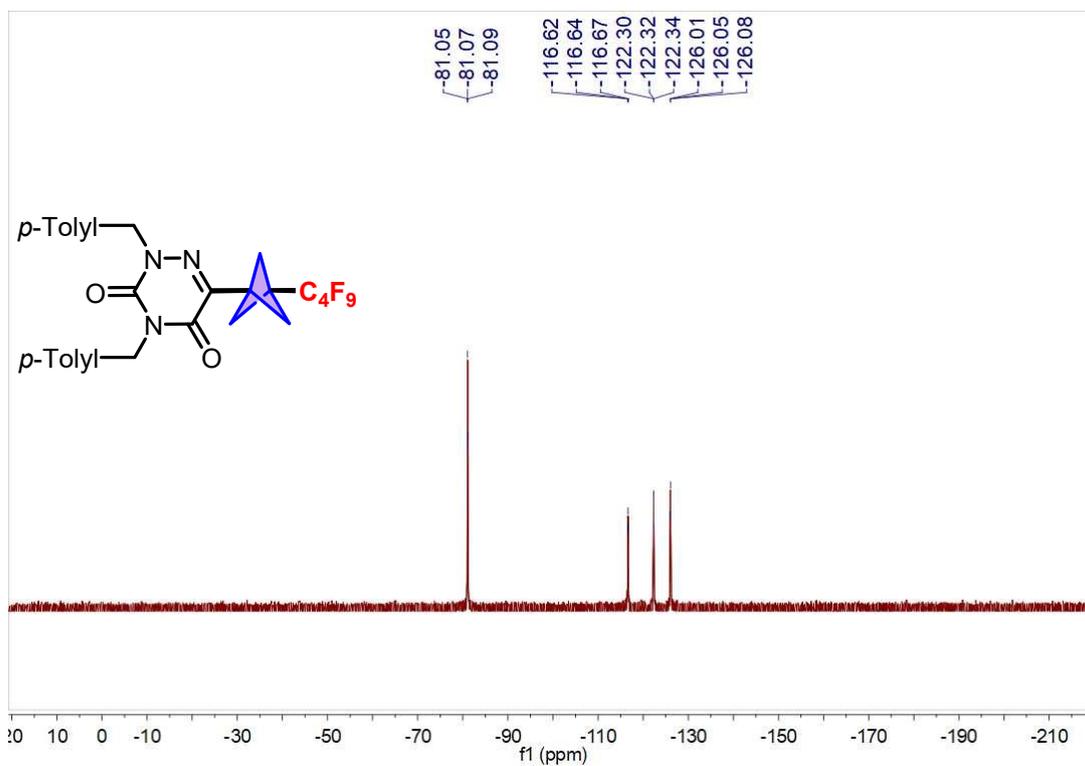
7  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



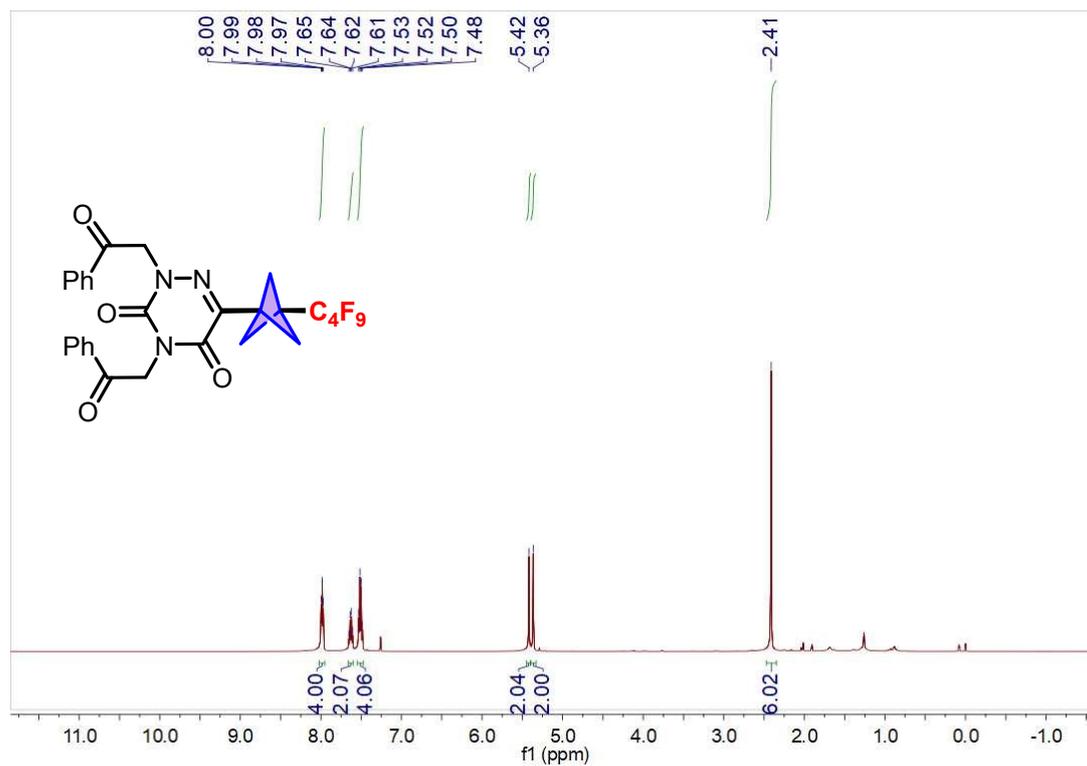
### 7 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



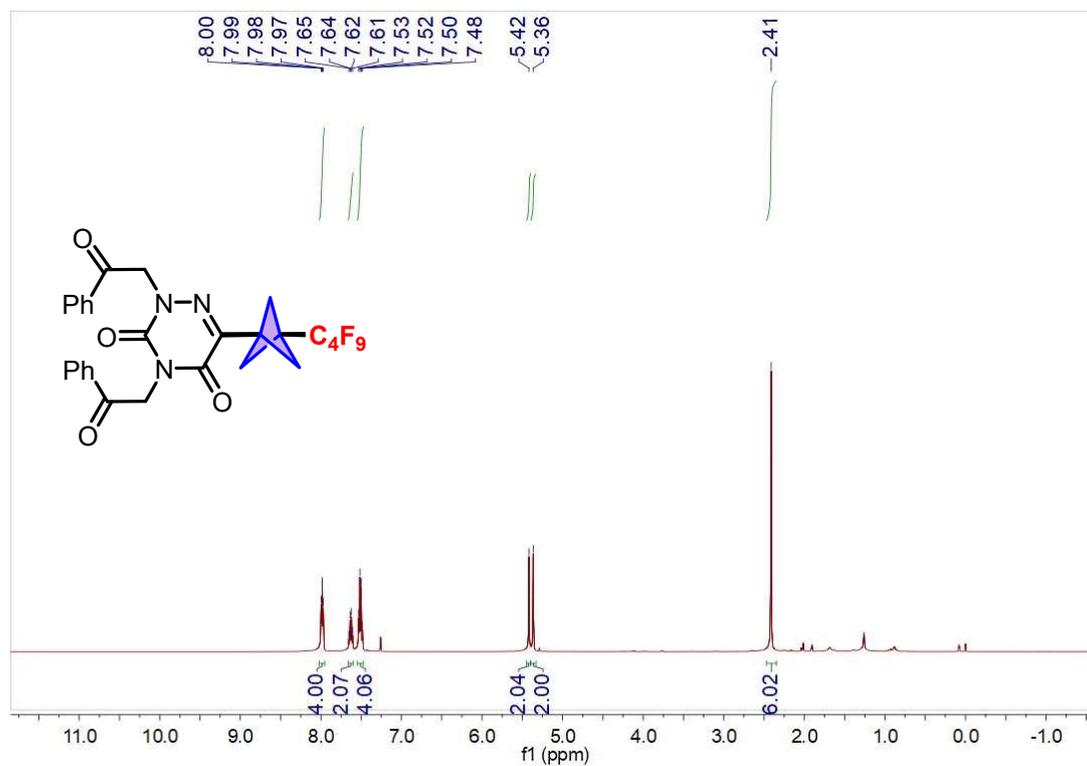
### 7 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



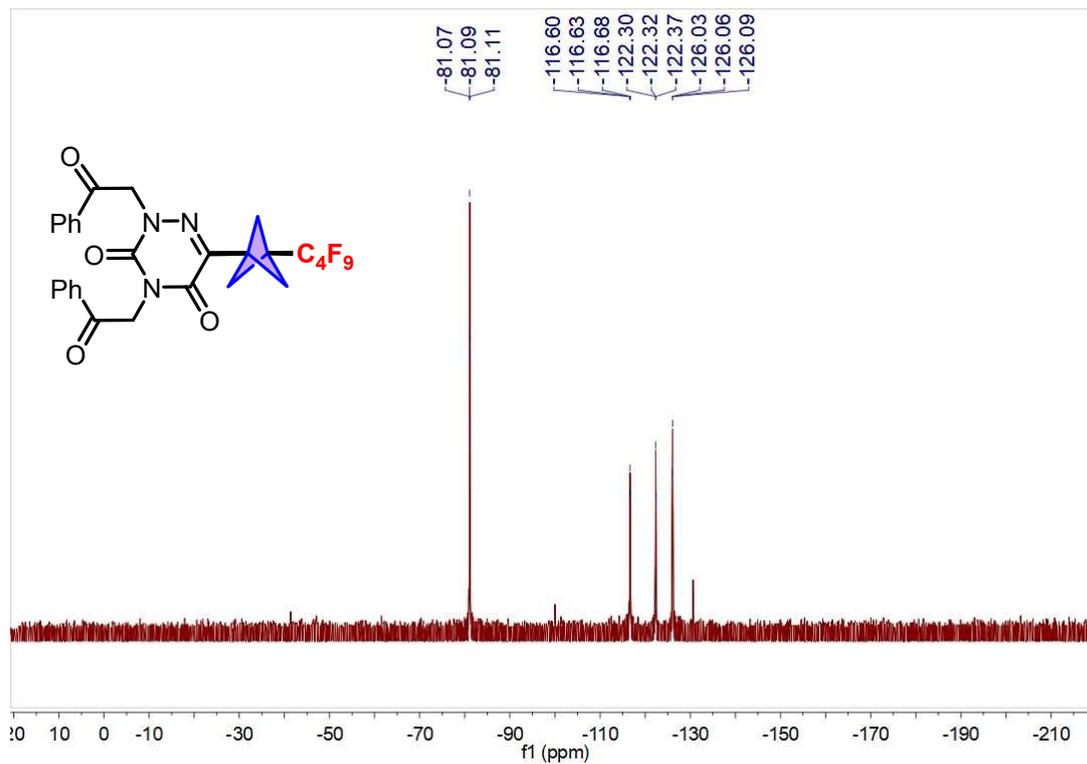
### 8 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



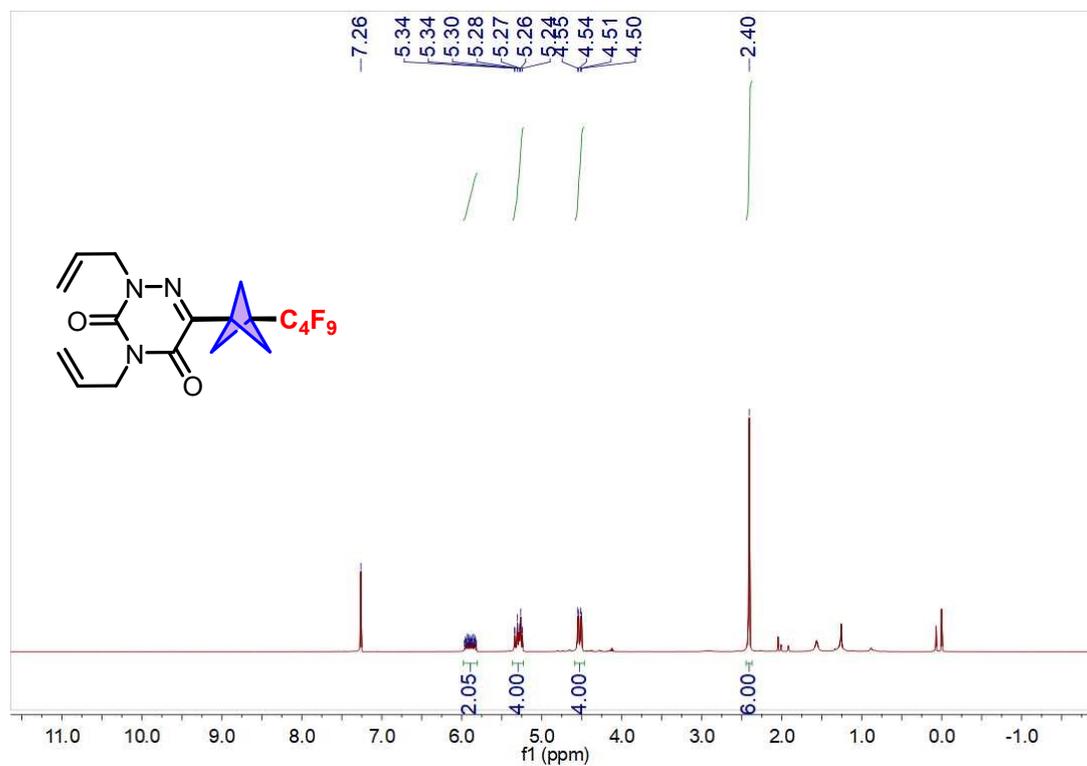
### 8 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



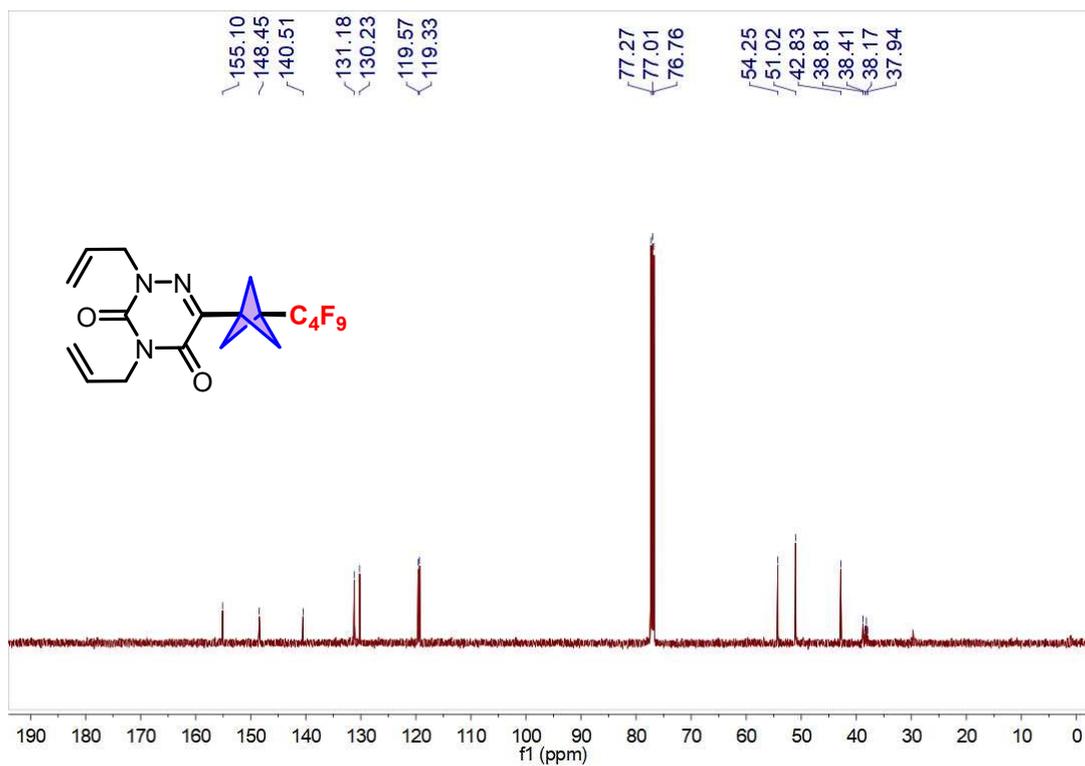
### 8 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



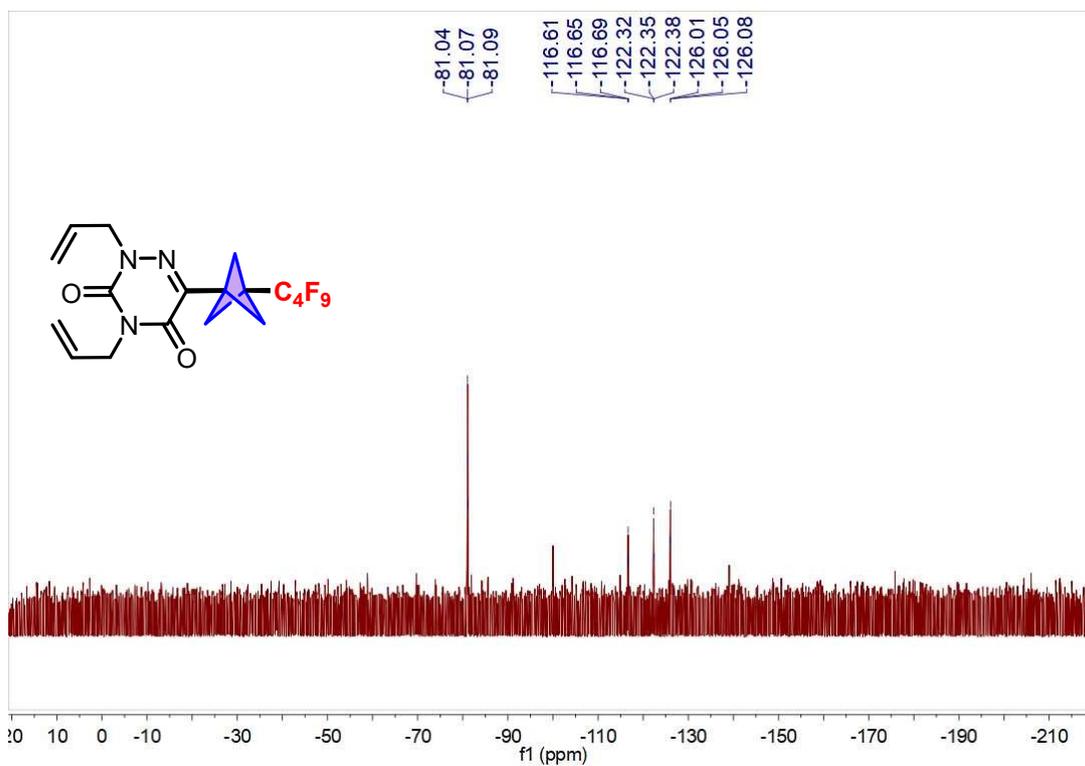
### 9 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



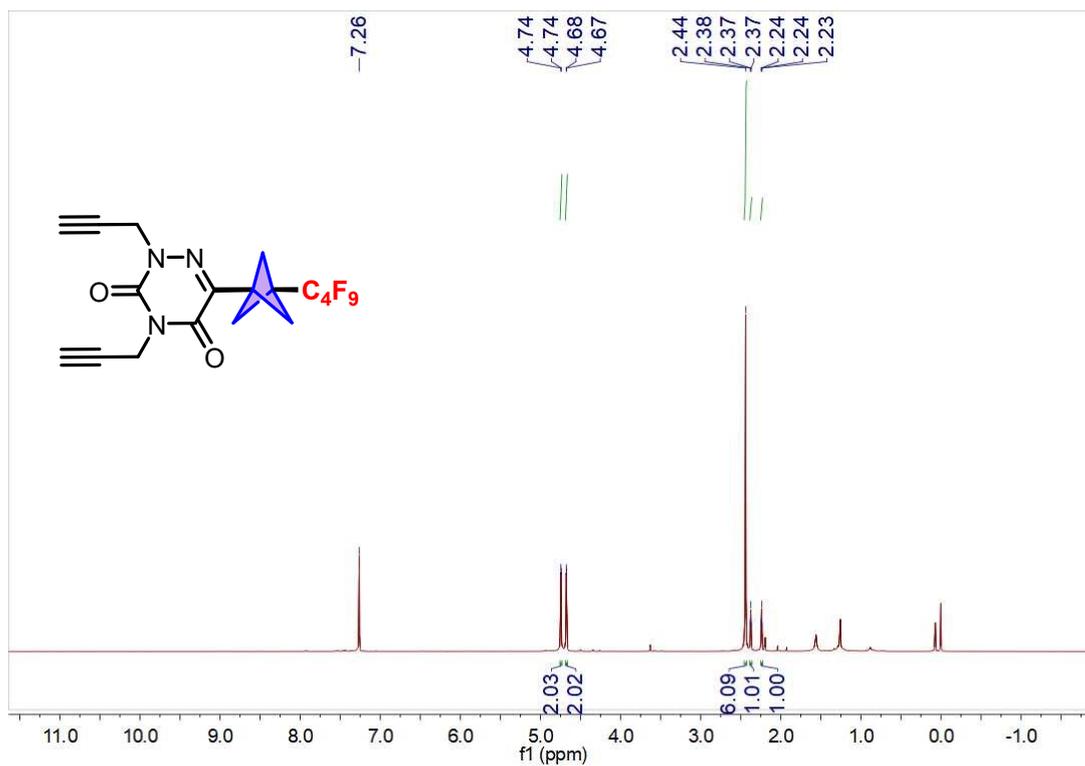
9 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



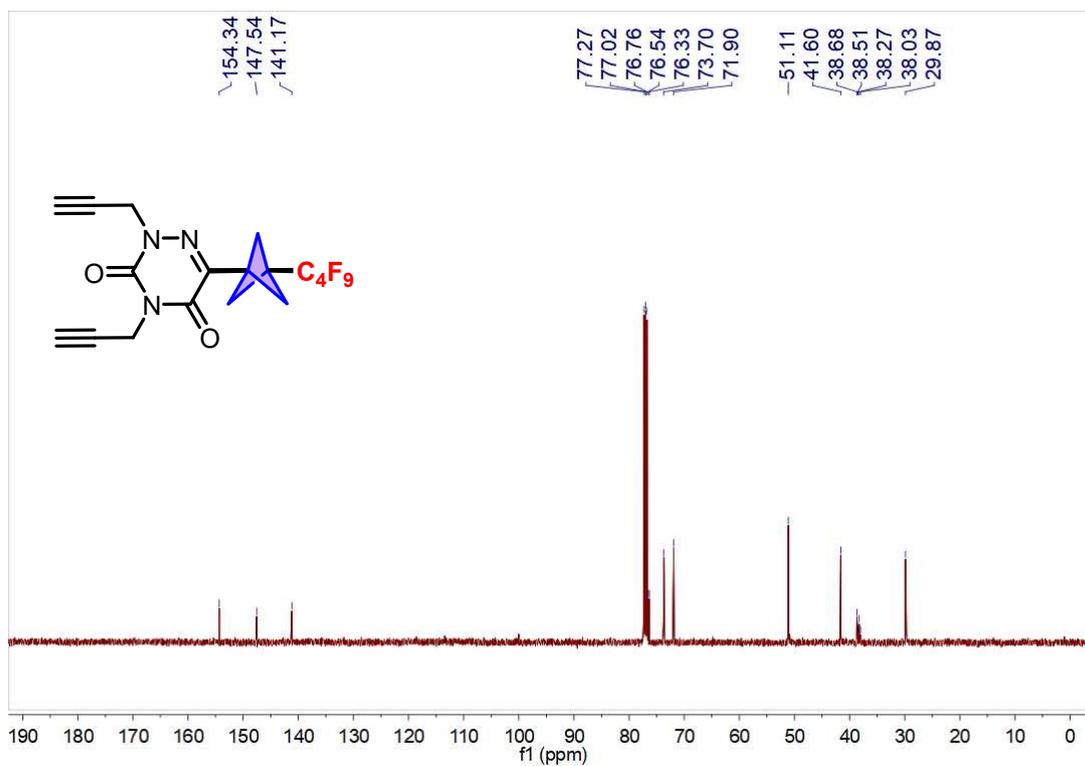
9 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



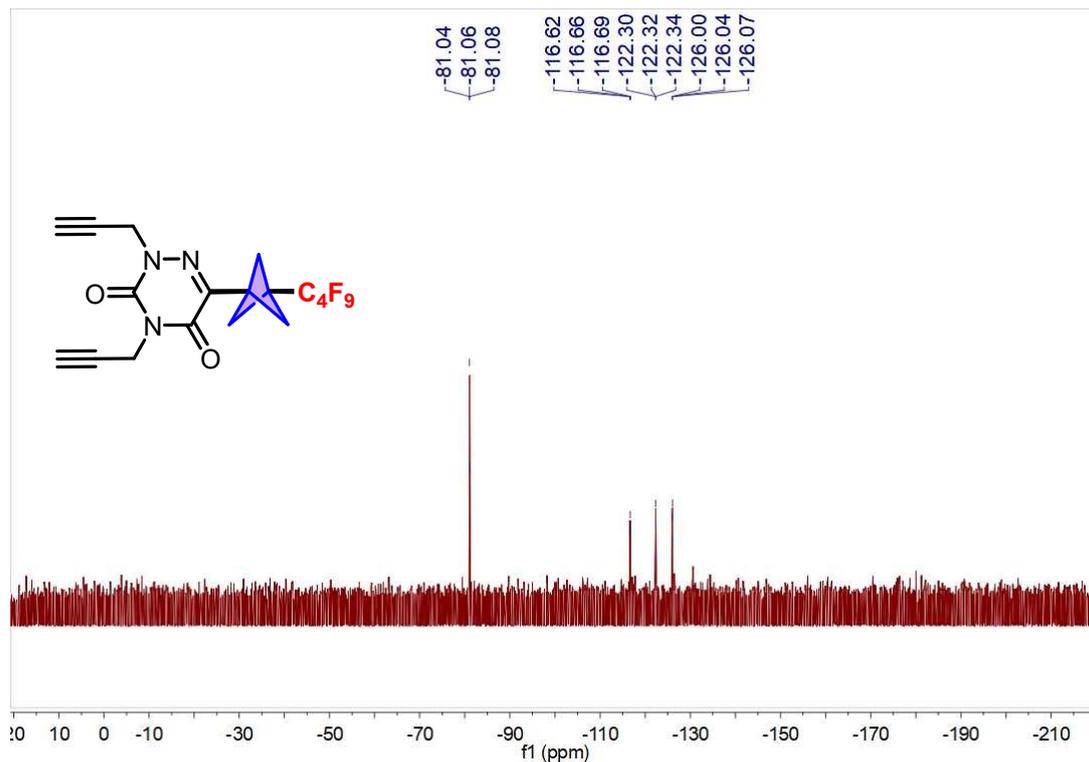
### 10 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



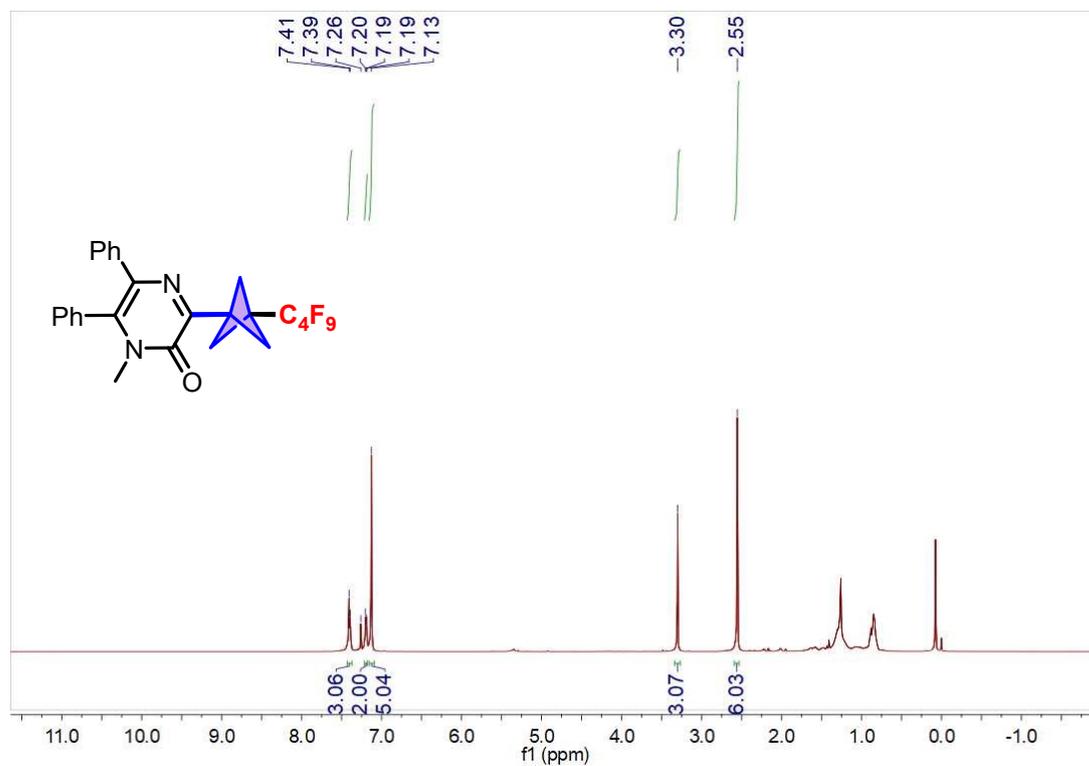
### 10 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



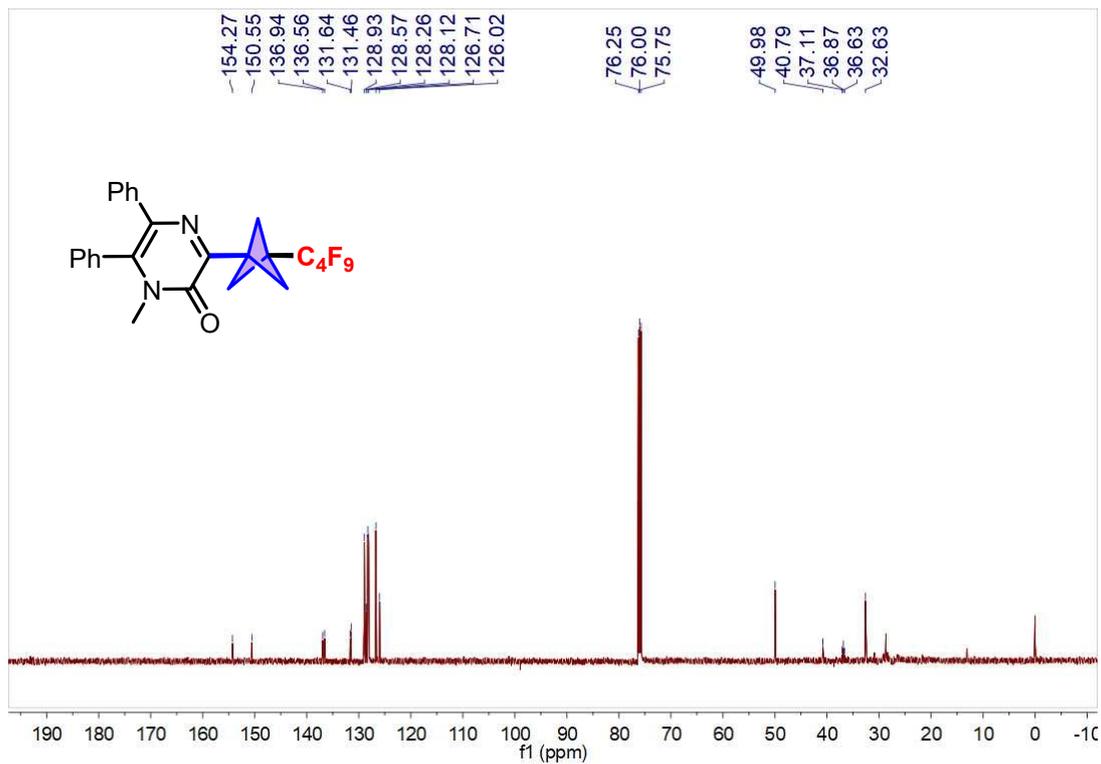
10 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



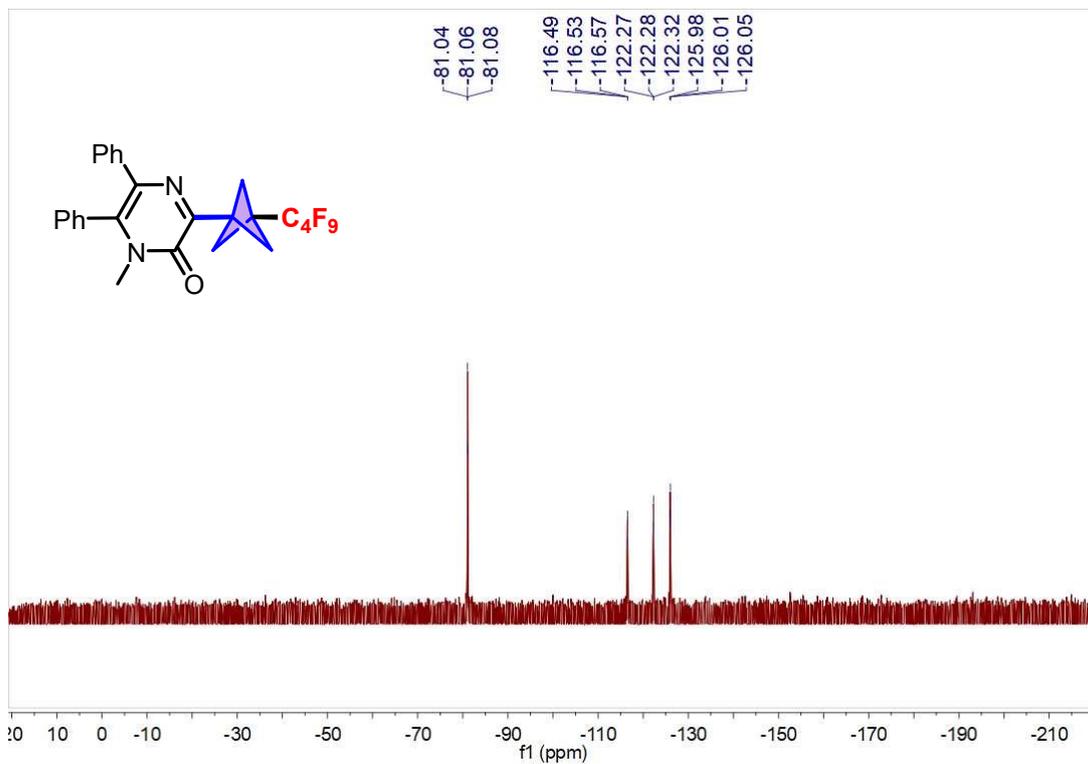
11 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



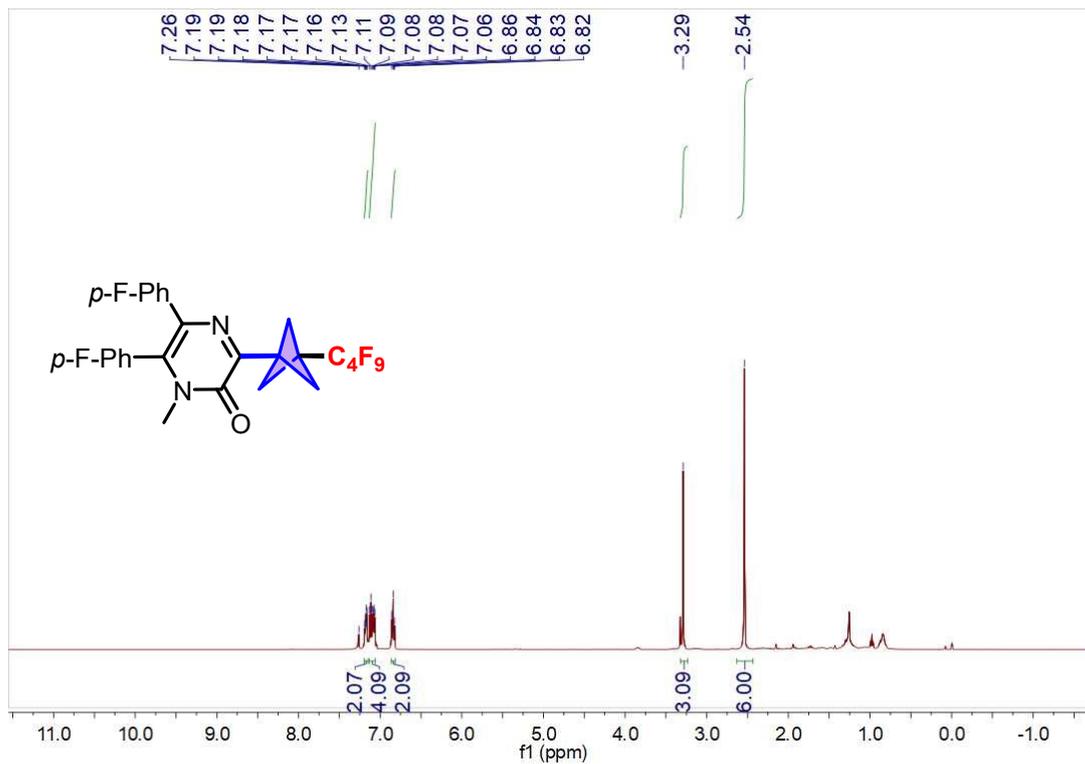
11 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



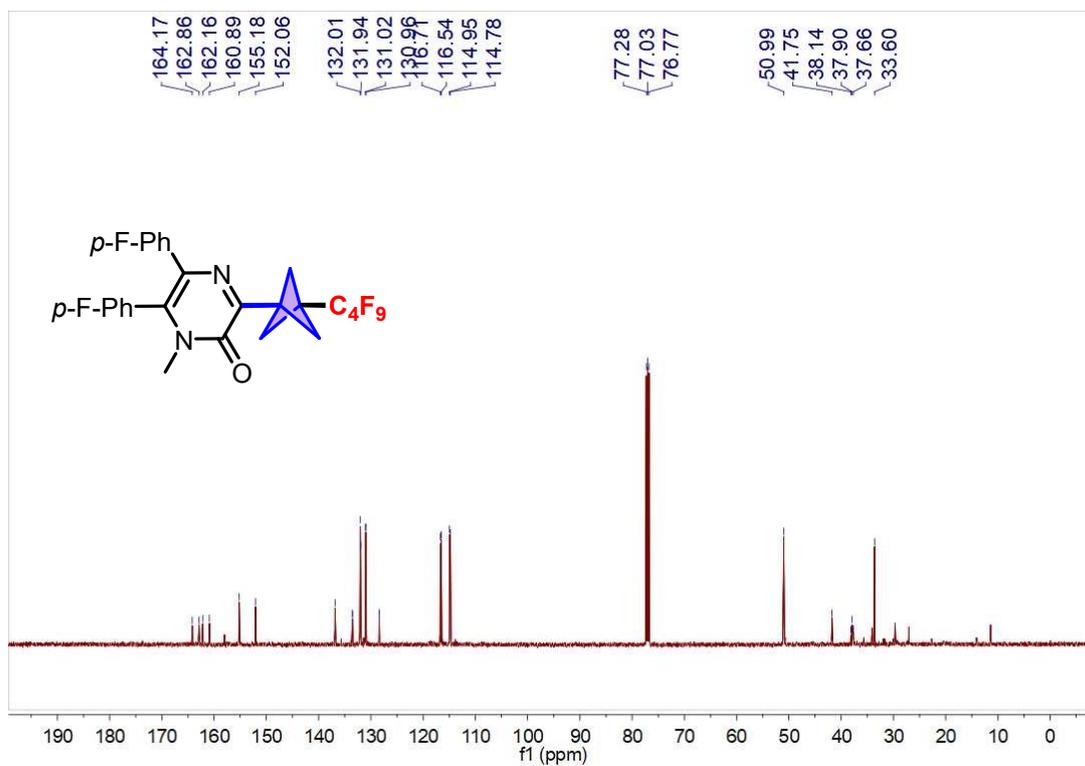
11 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



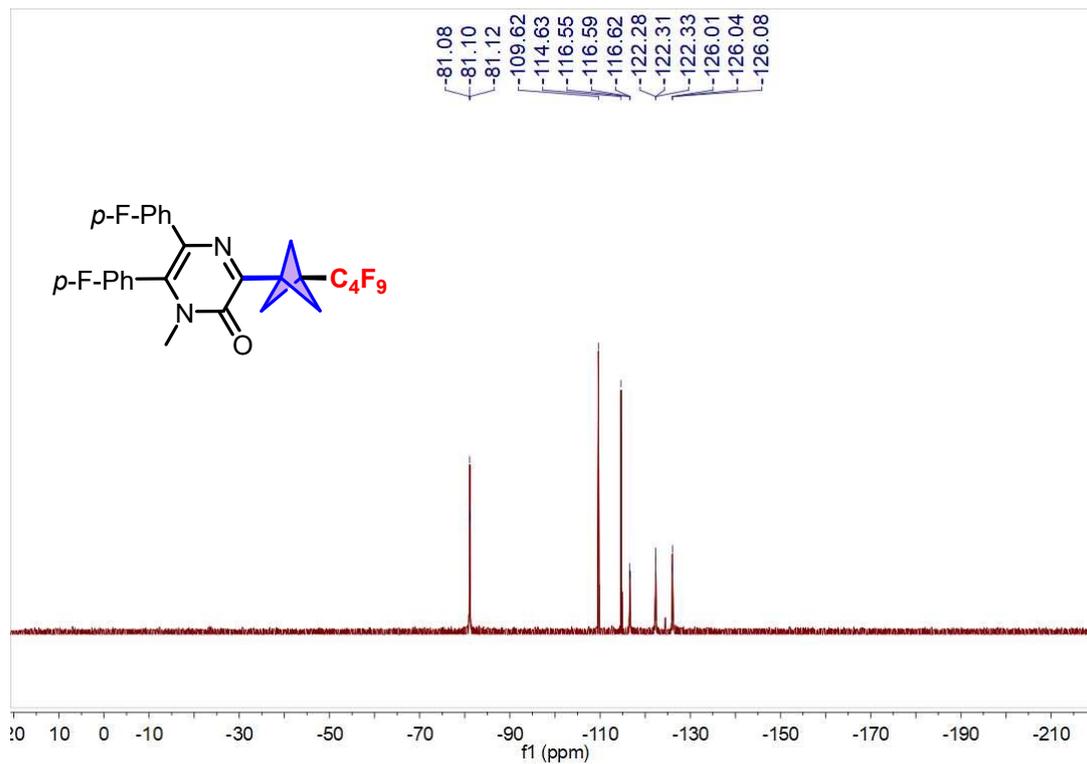
12 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



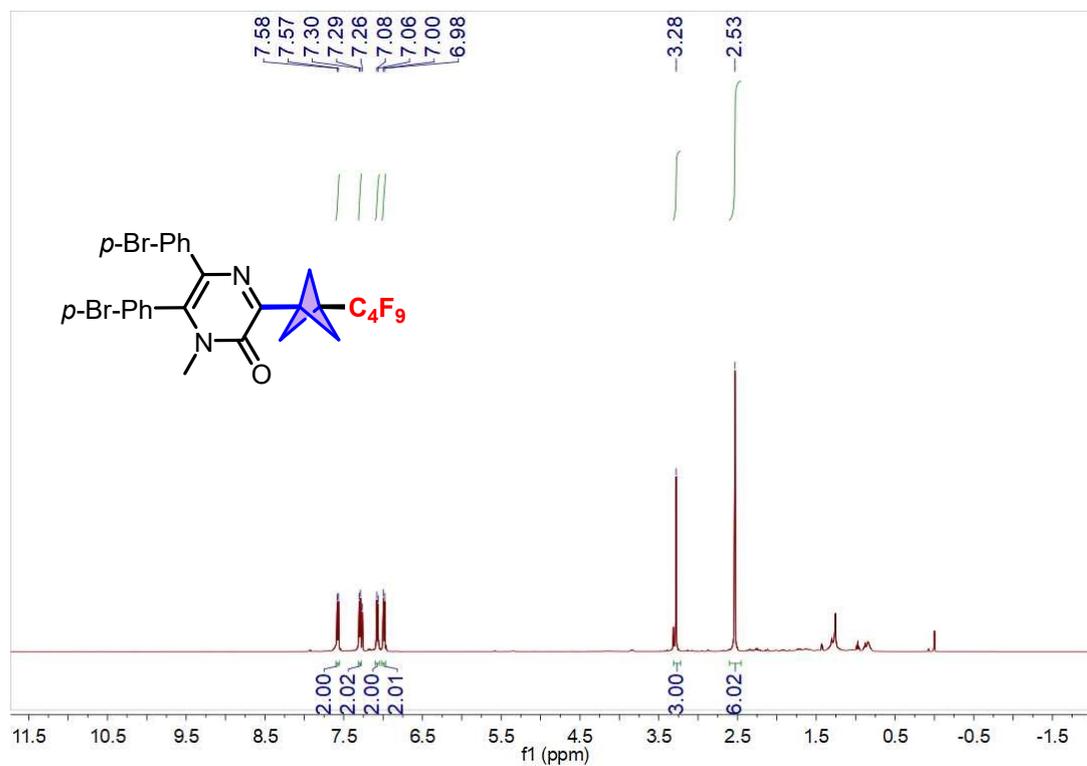
12 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



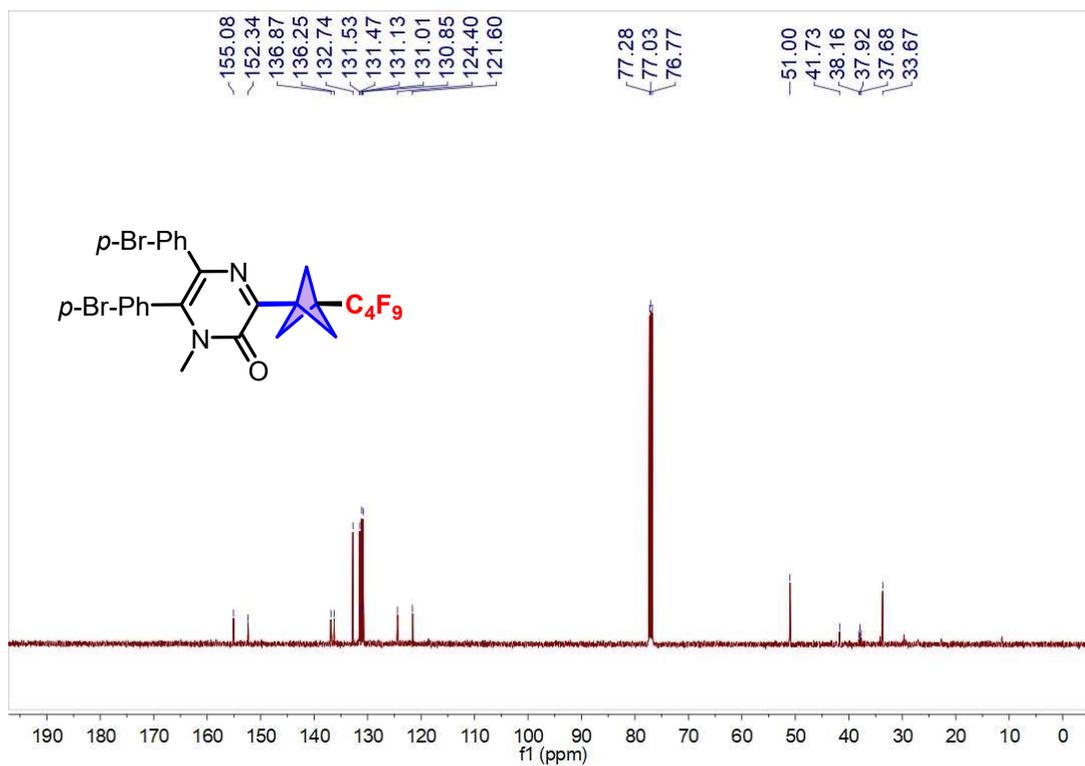
### 12 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



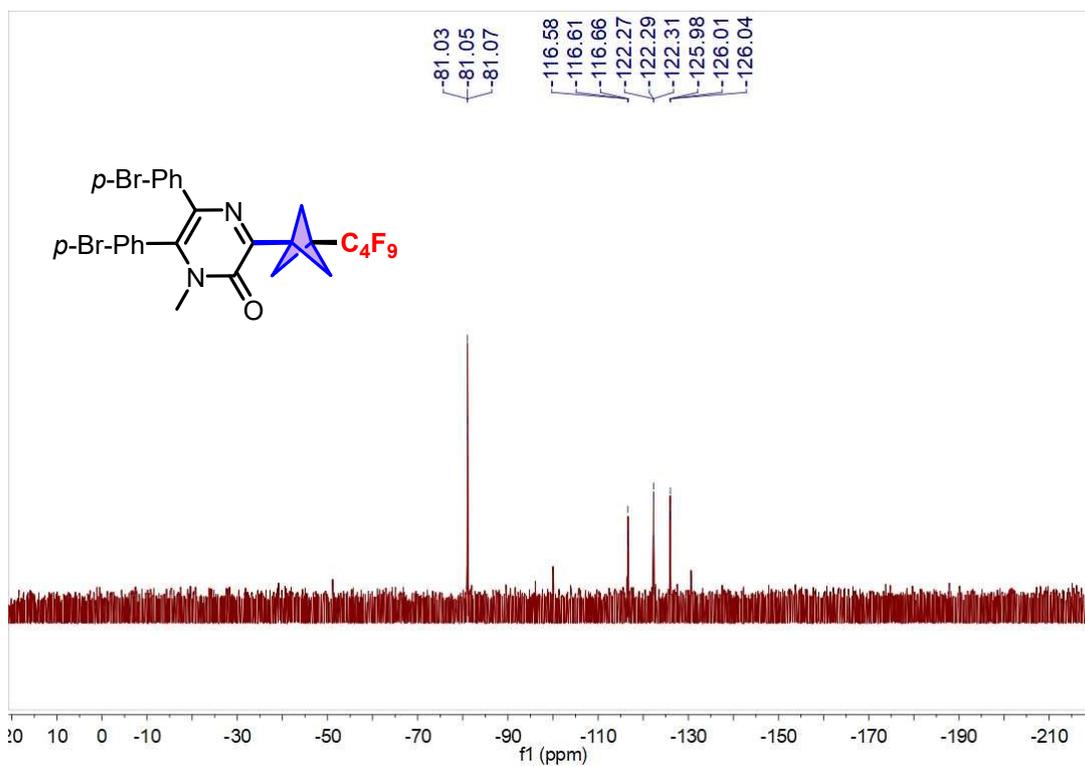
### 13 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



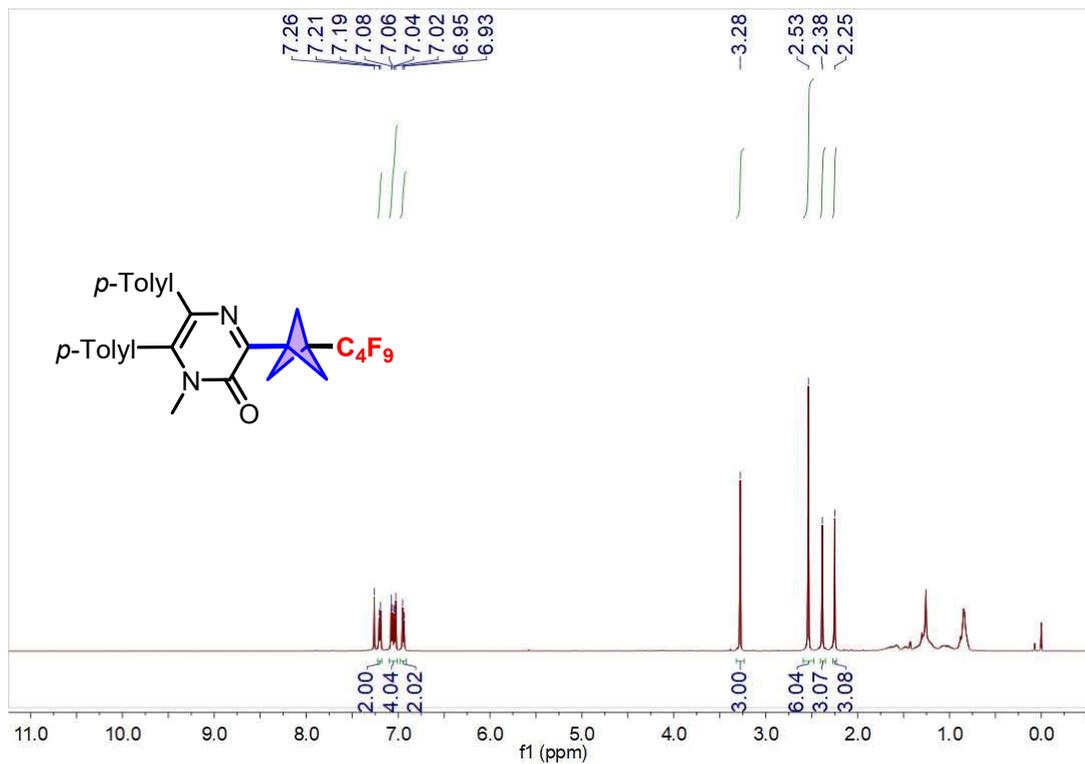
### 13 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



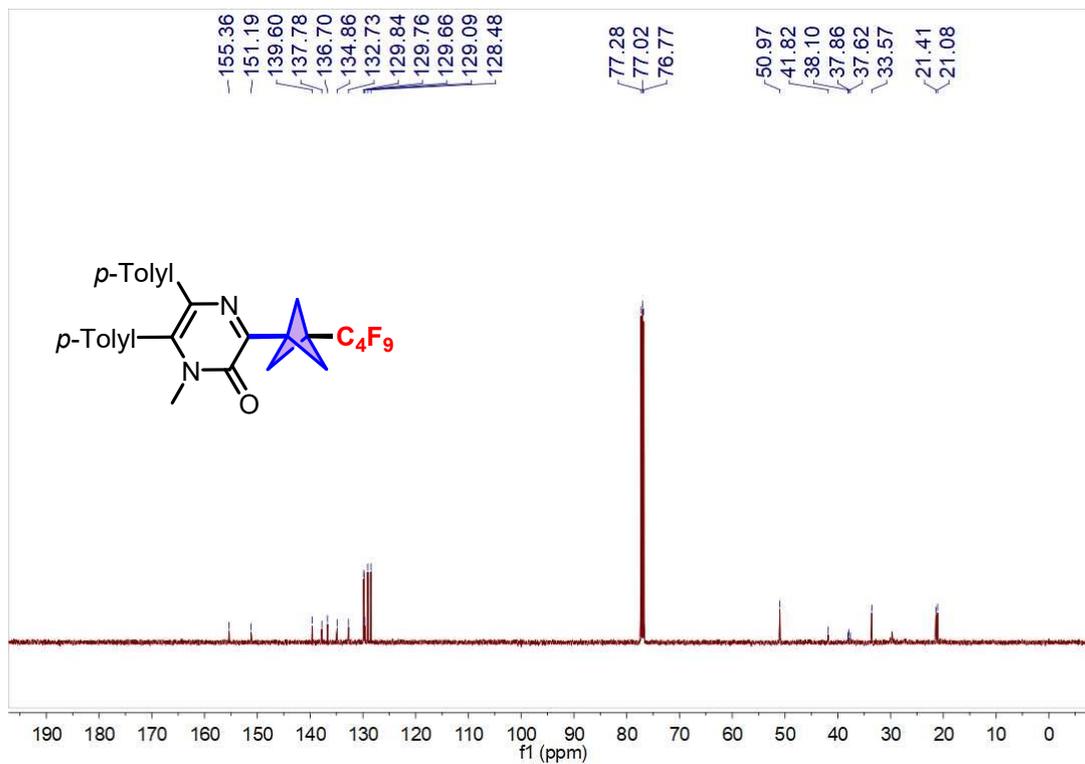
### 13 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



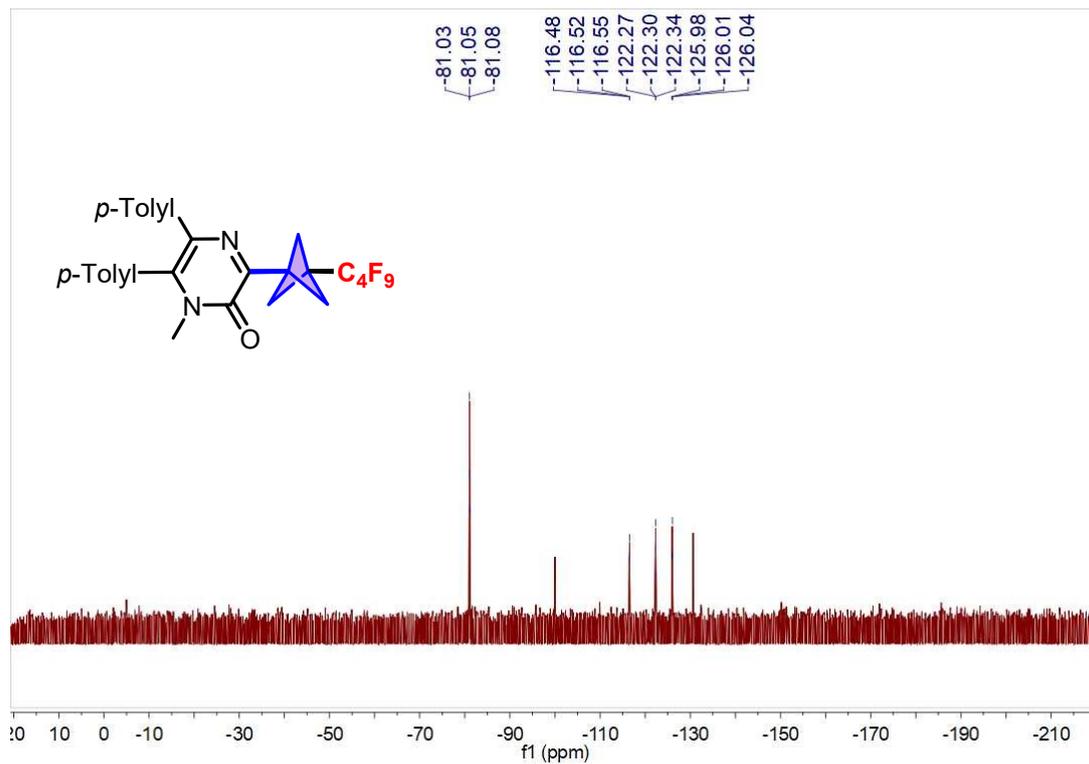
14 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



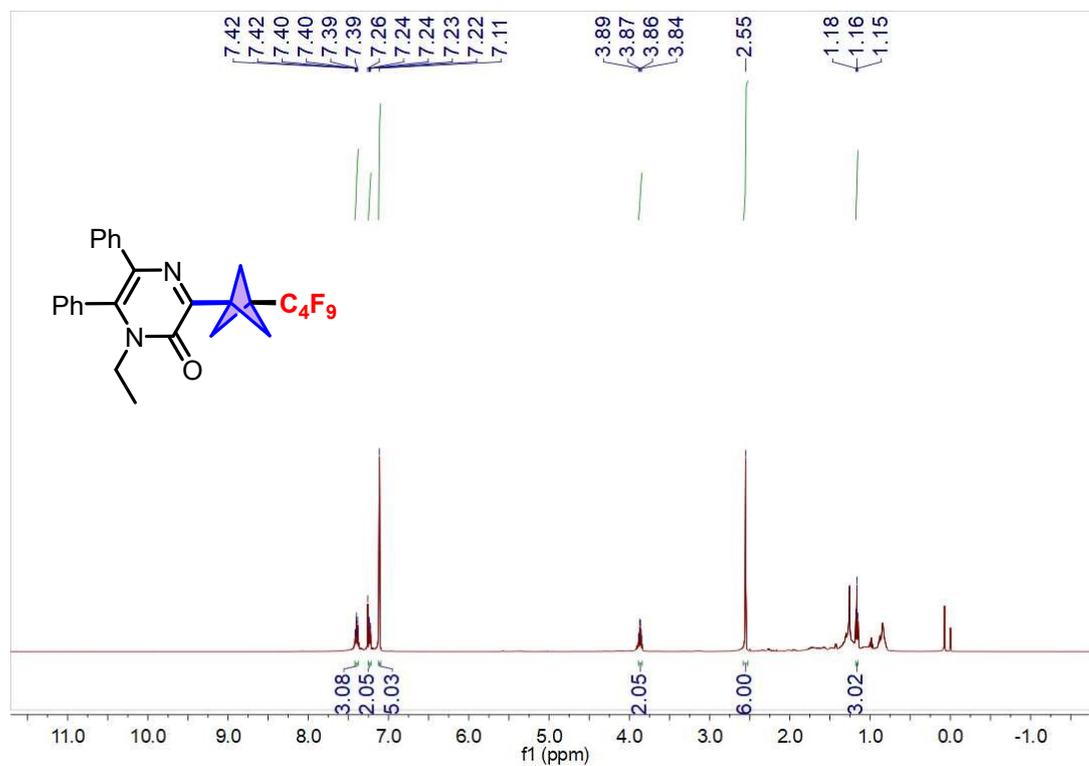
14 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



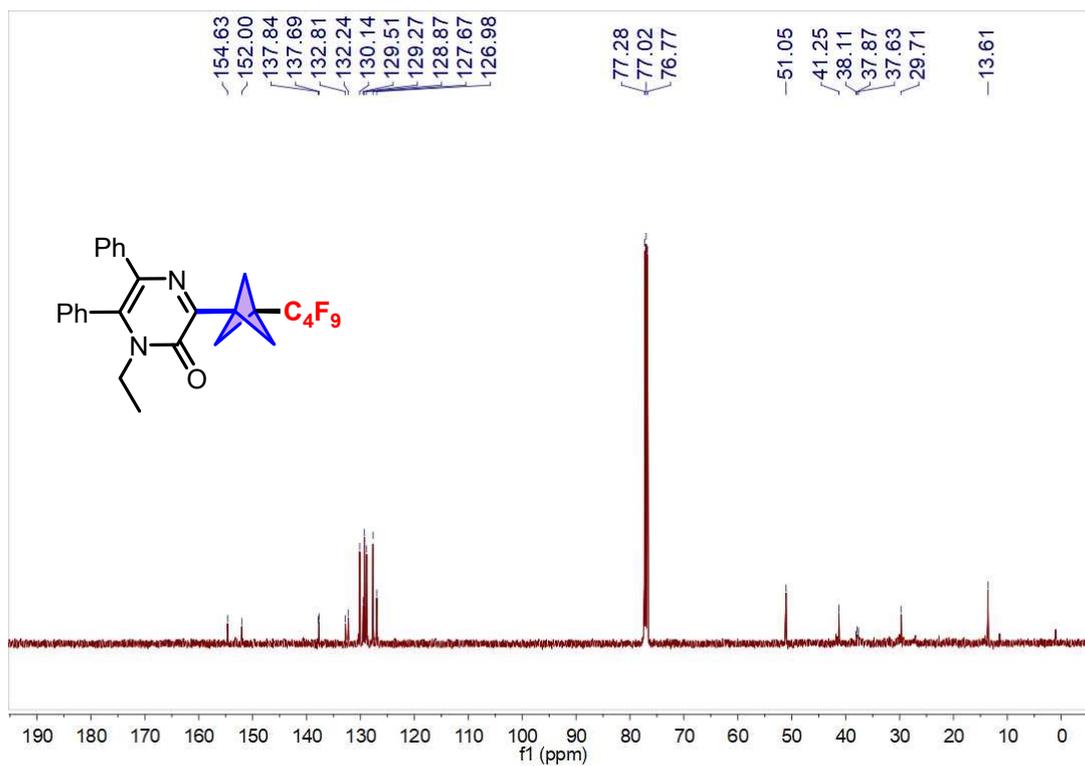
14  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



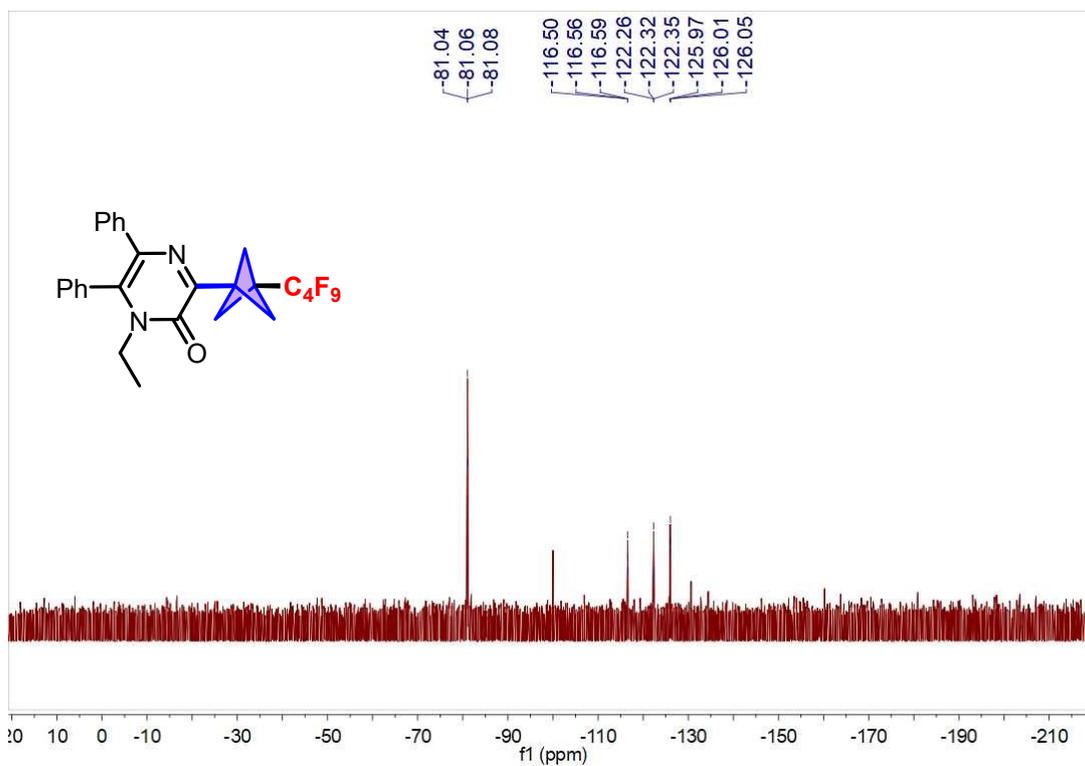
15  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



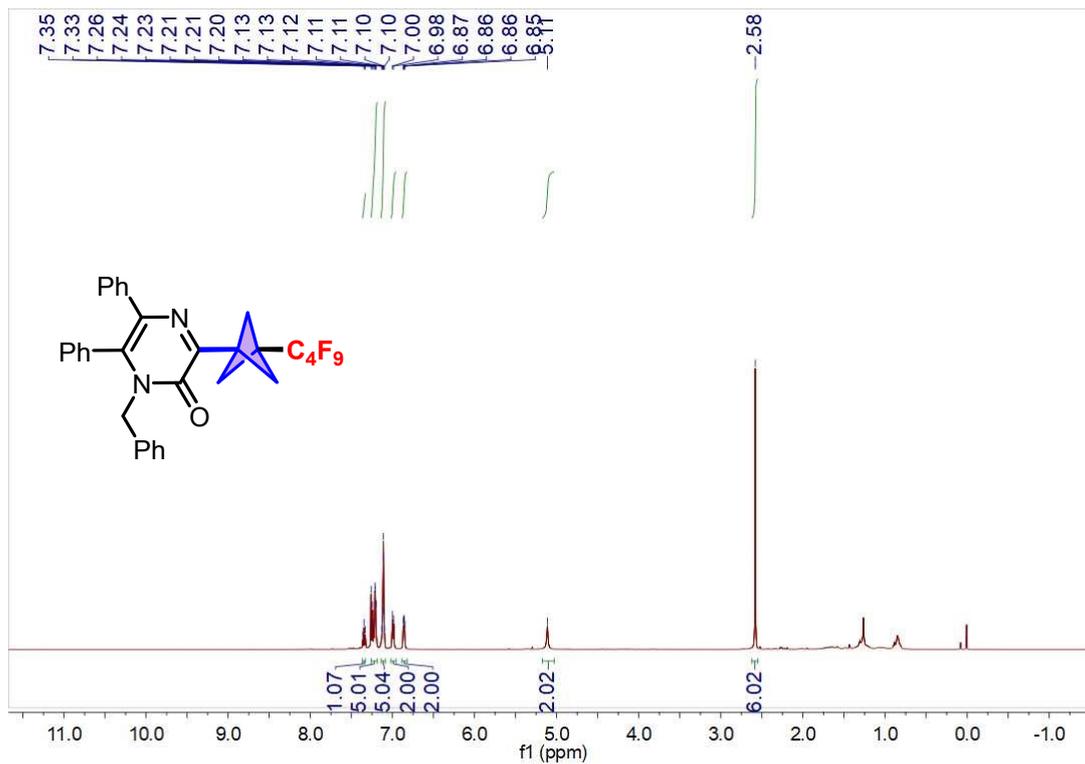
### 15 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



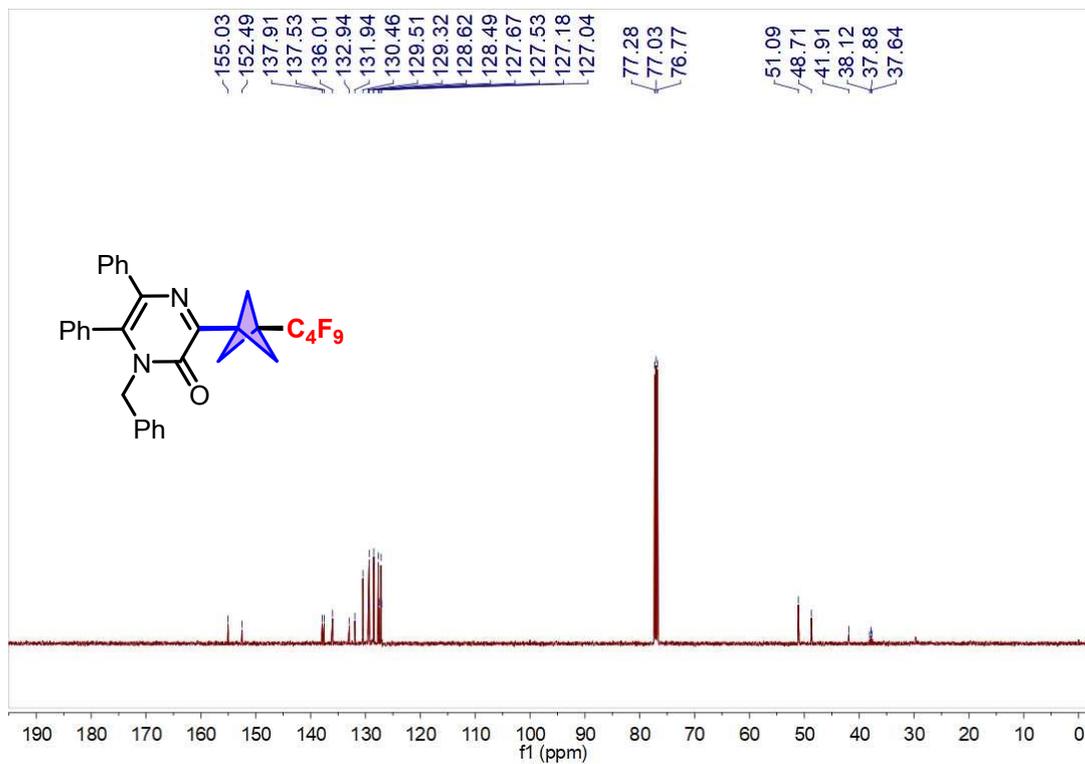
### 15 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



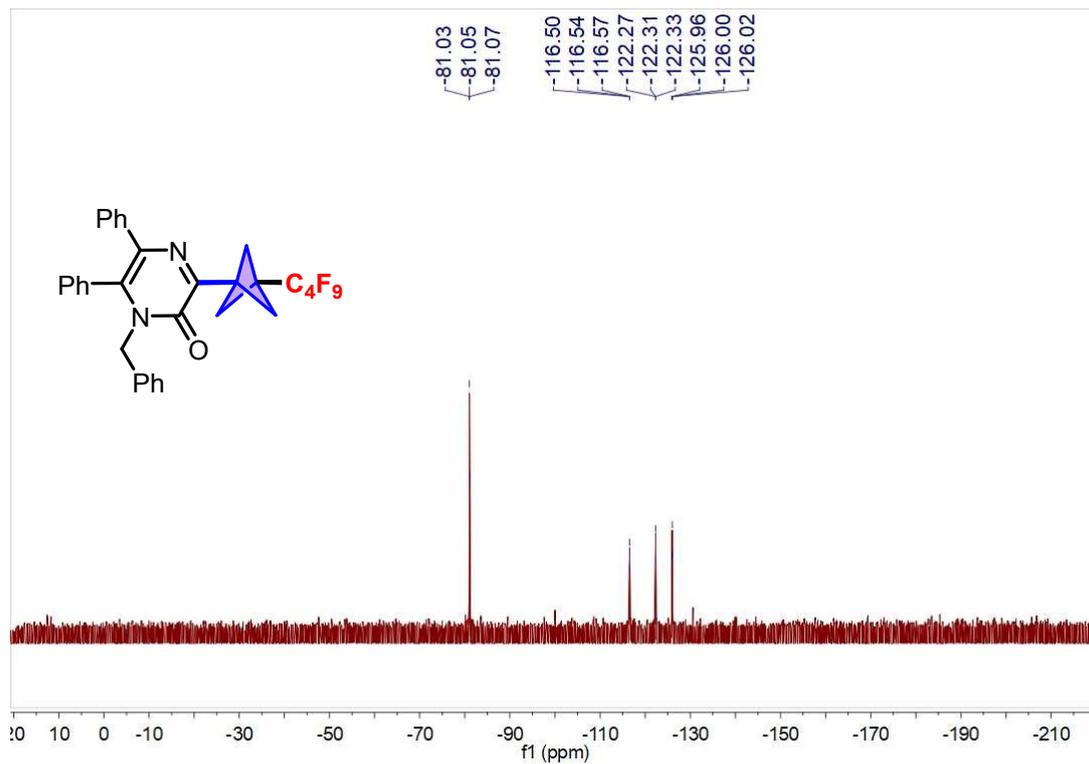
### 16 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



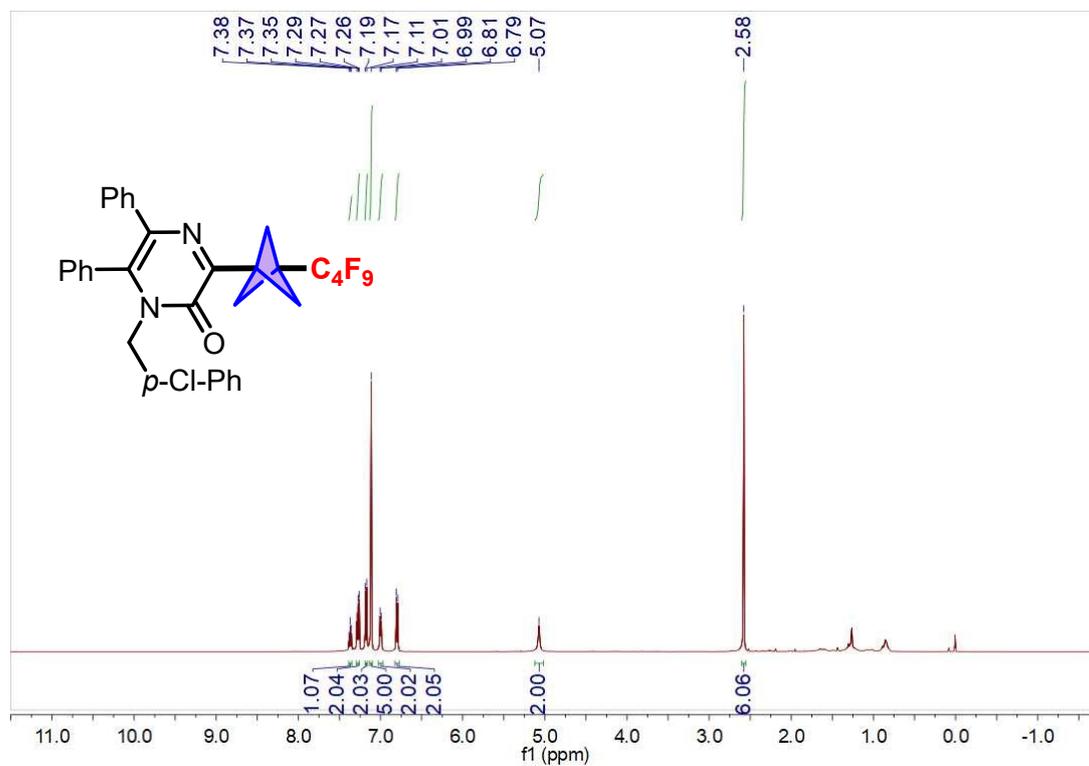
### 16 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



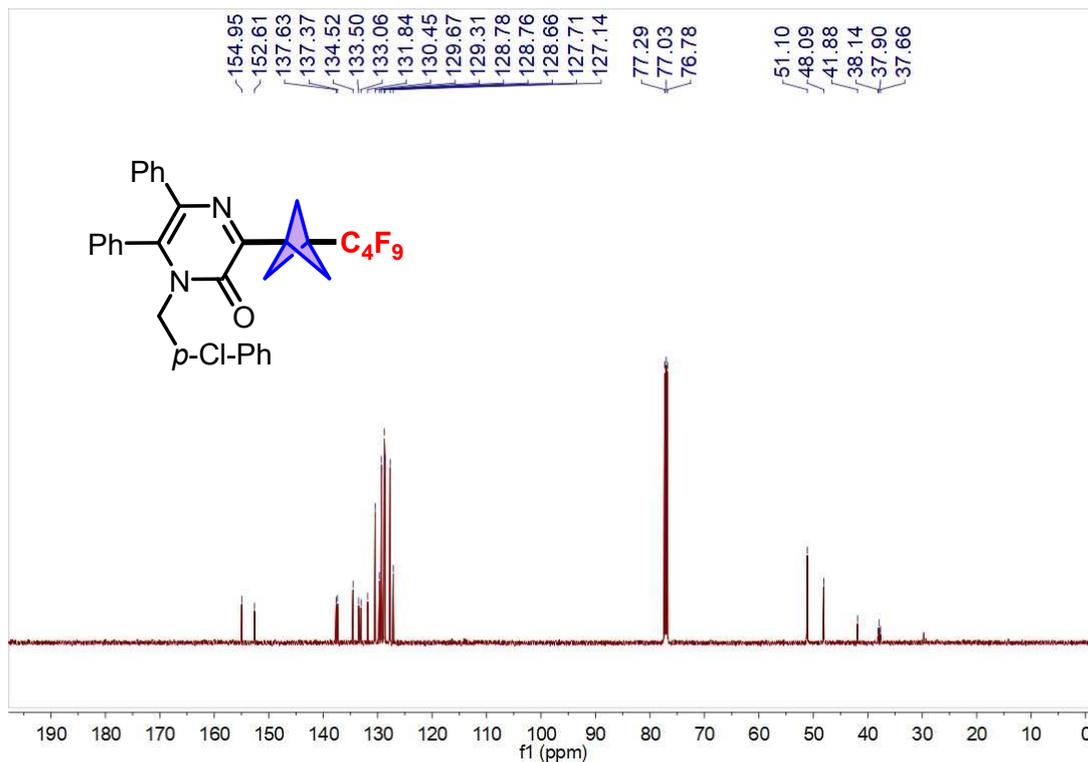
### 16 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



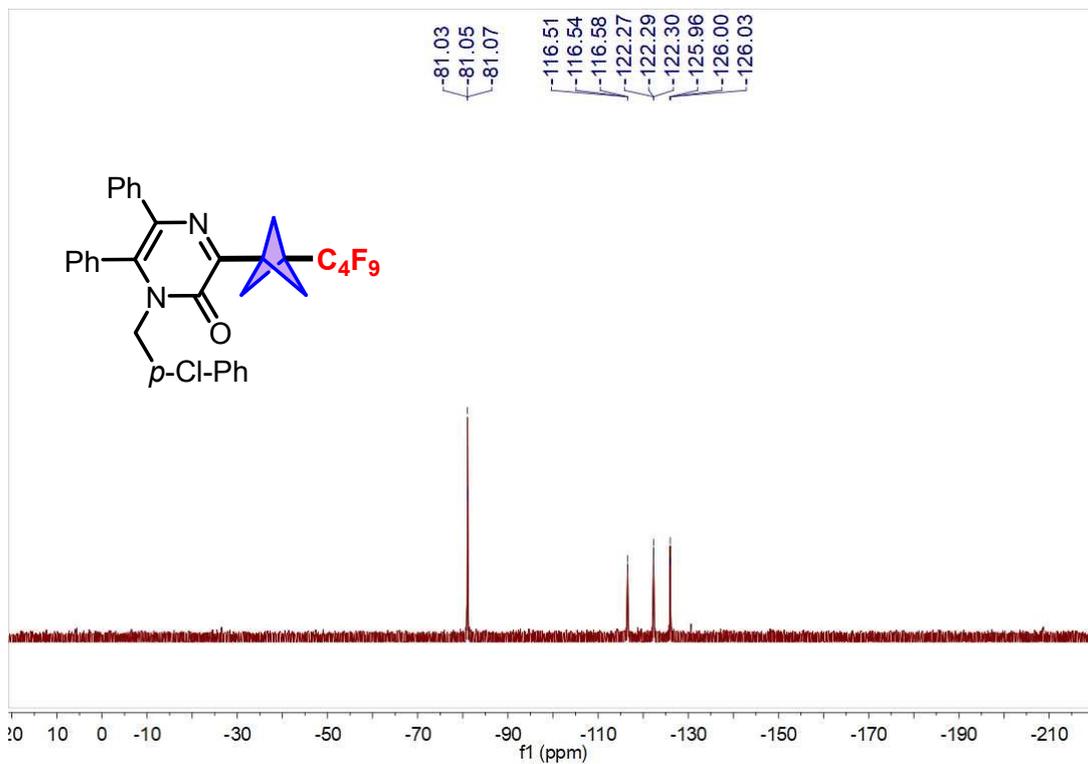
### 17 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



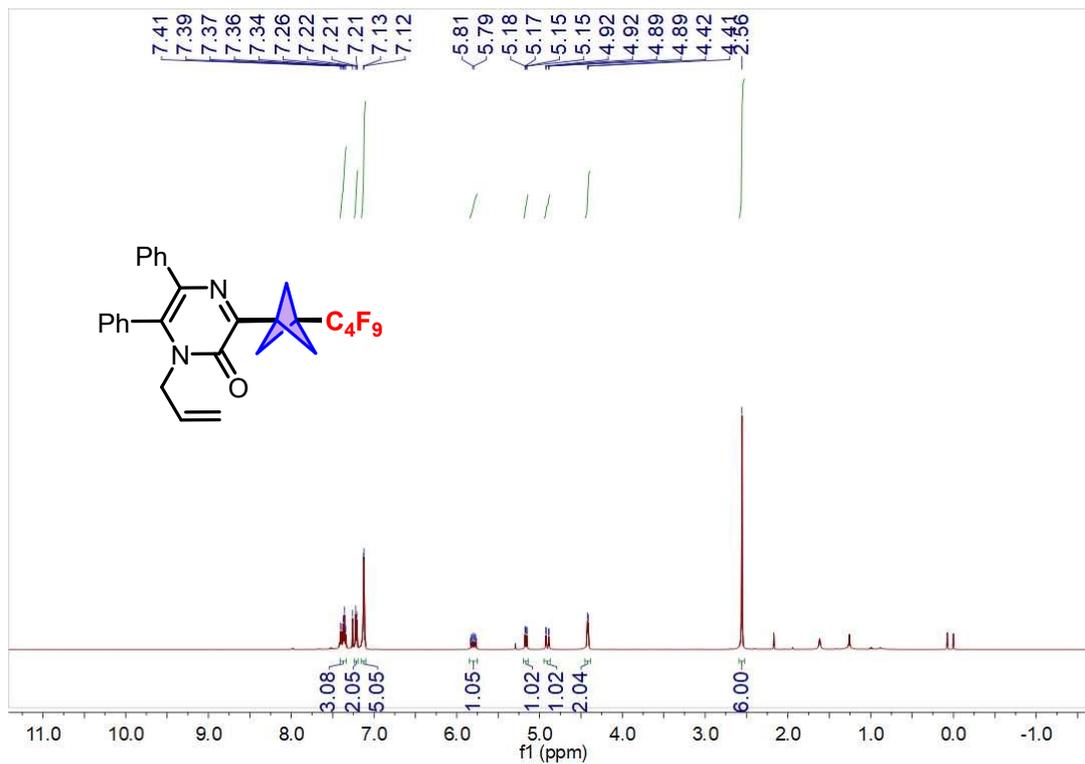
17 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



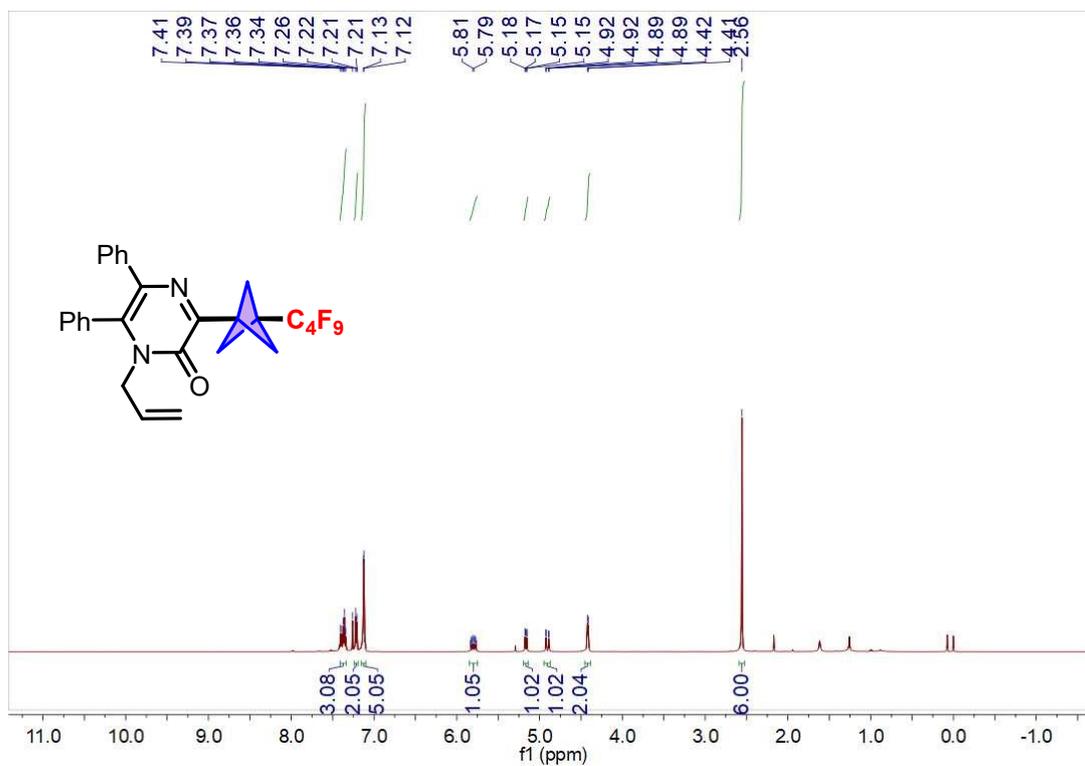
17 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



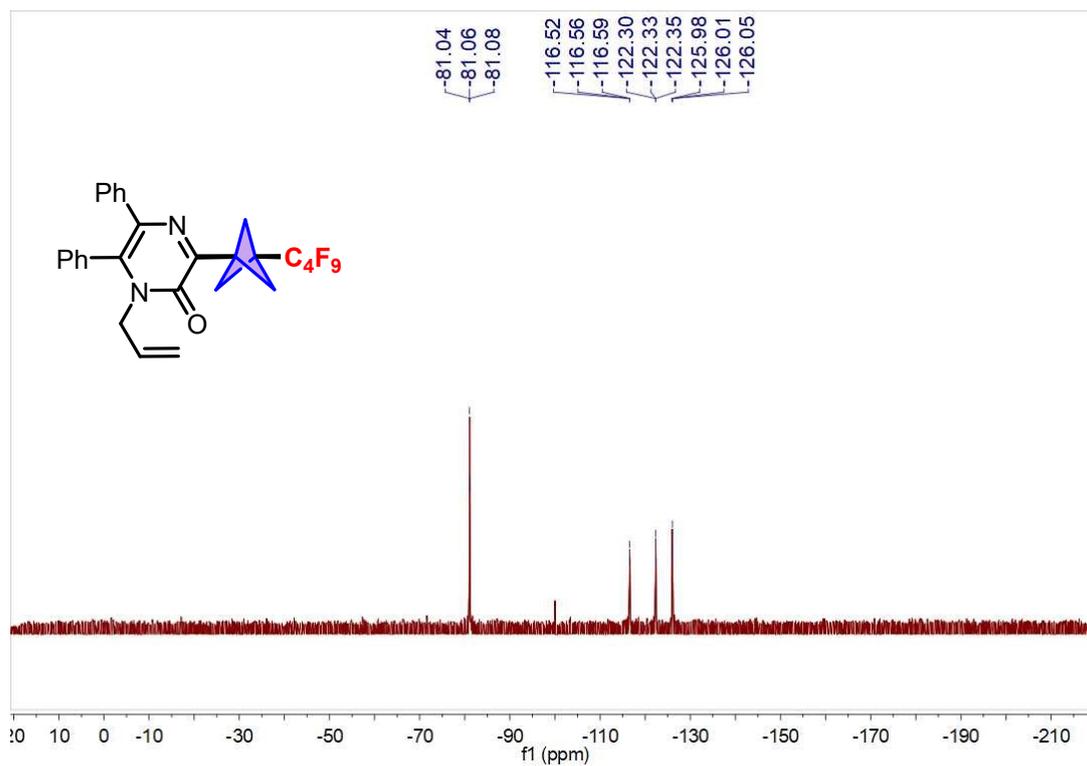
### 18 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



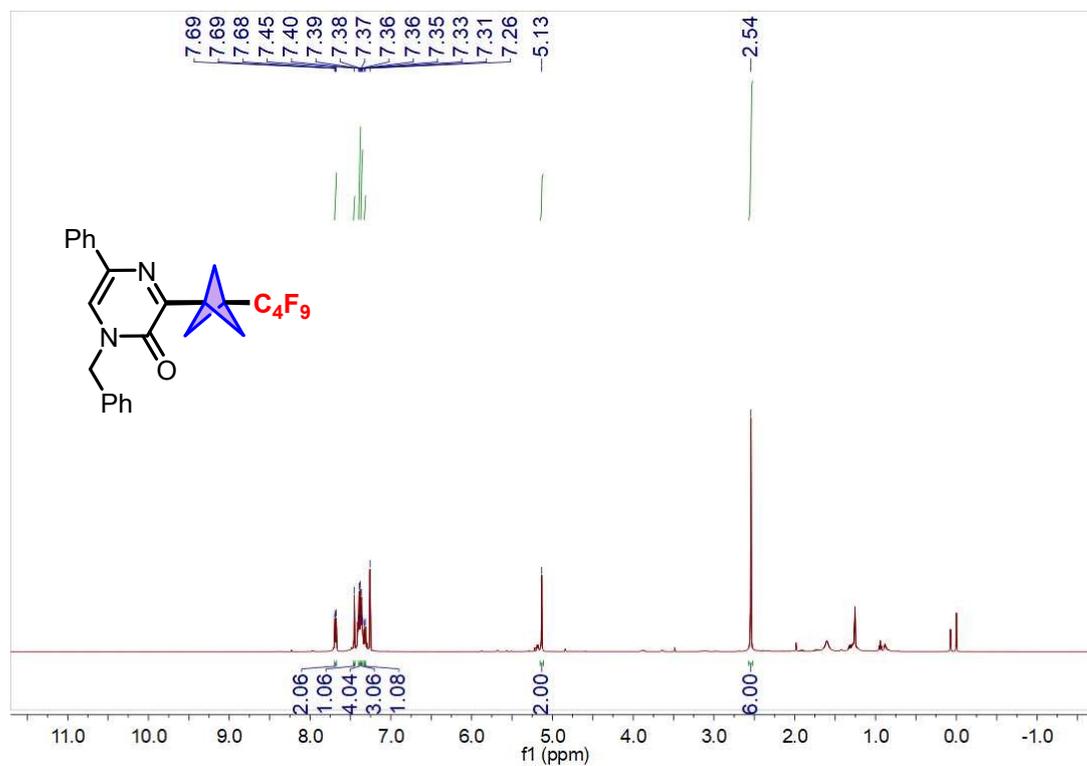
### 18 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



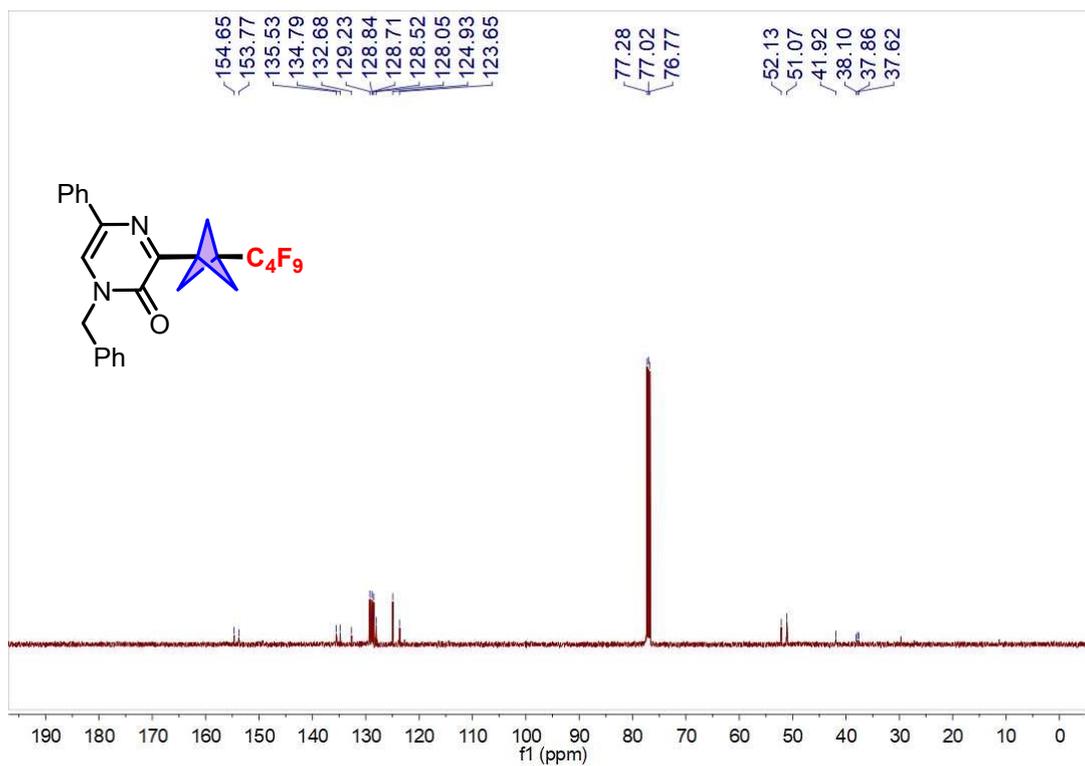
### 18 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



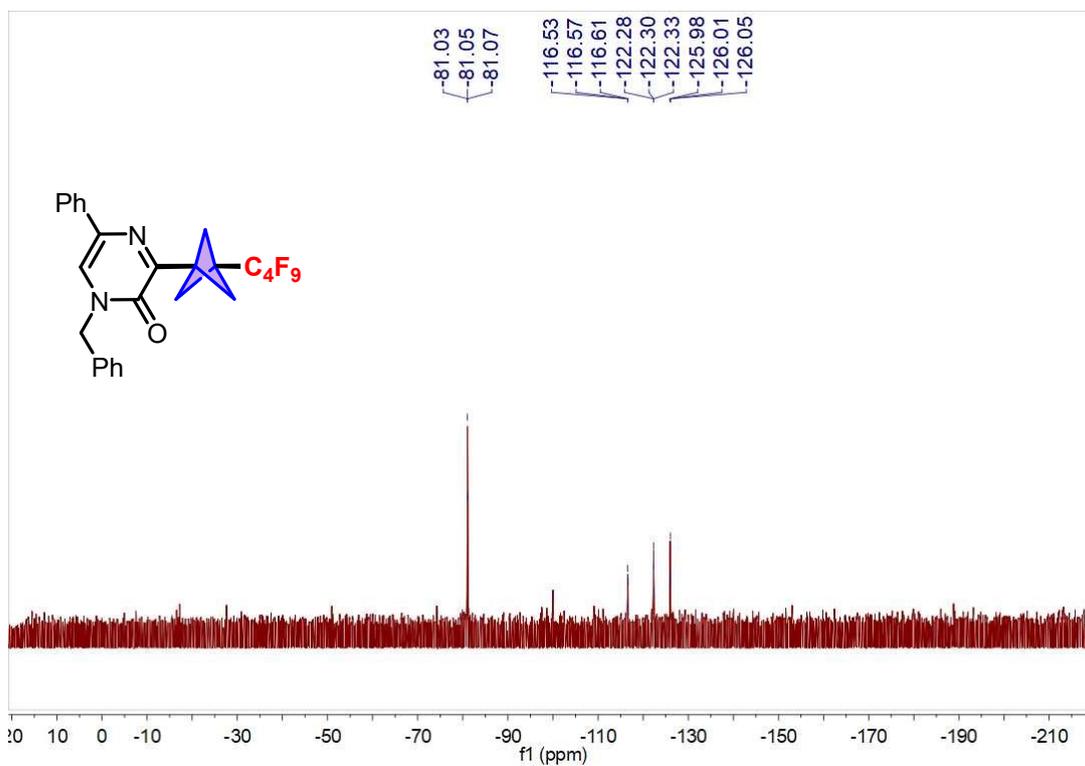
### 19 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



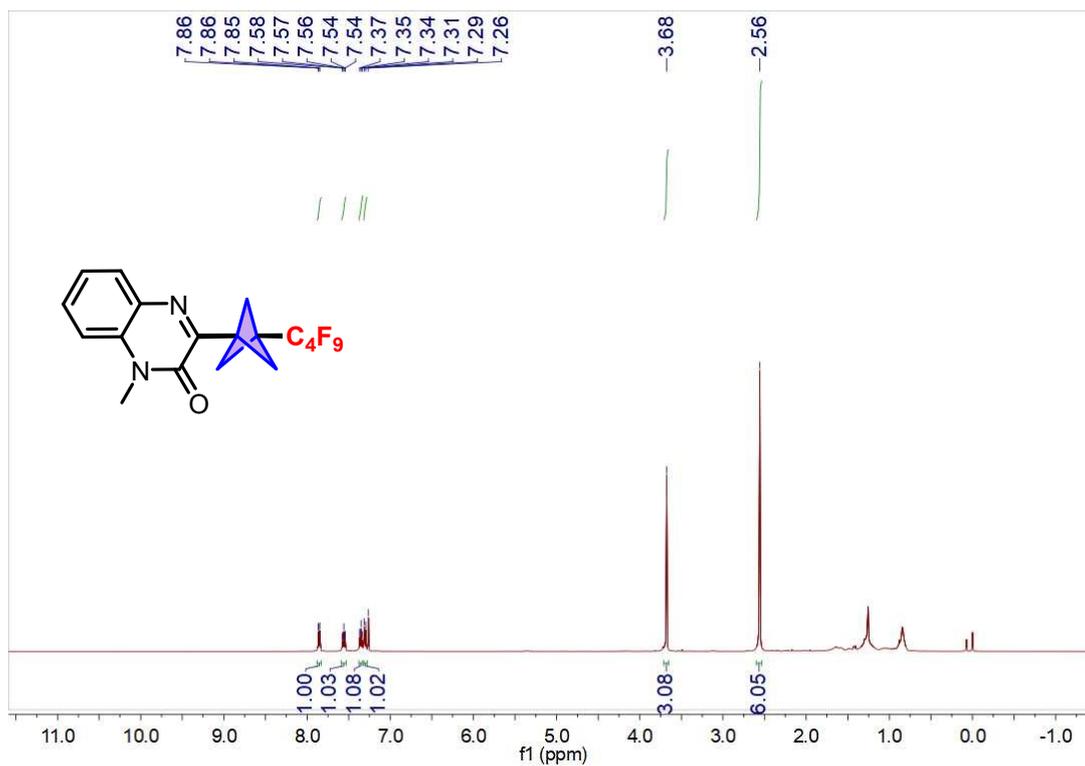
19 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



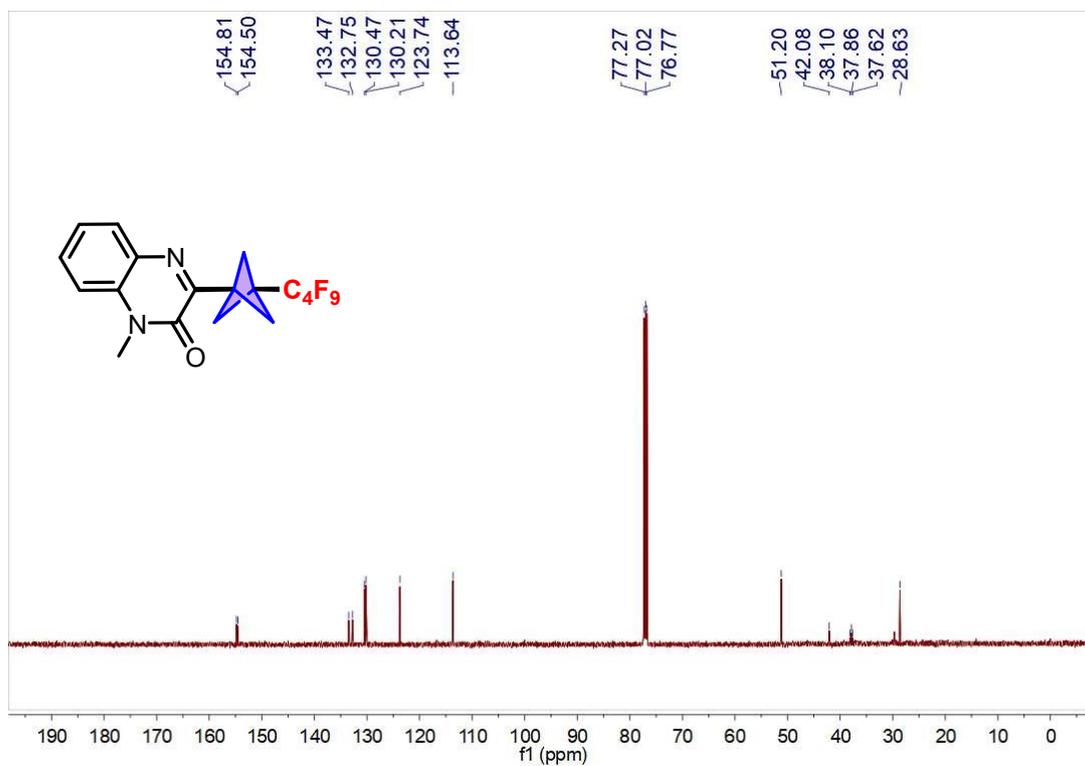
19 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



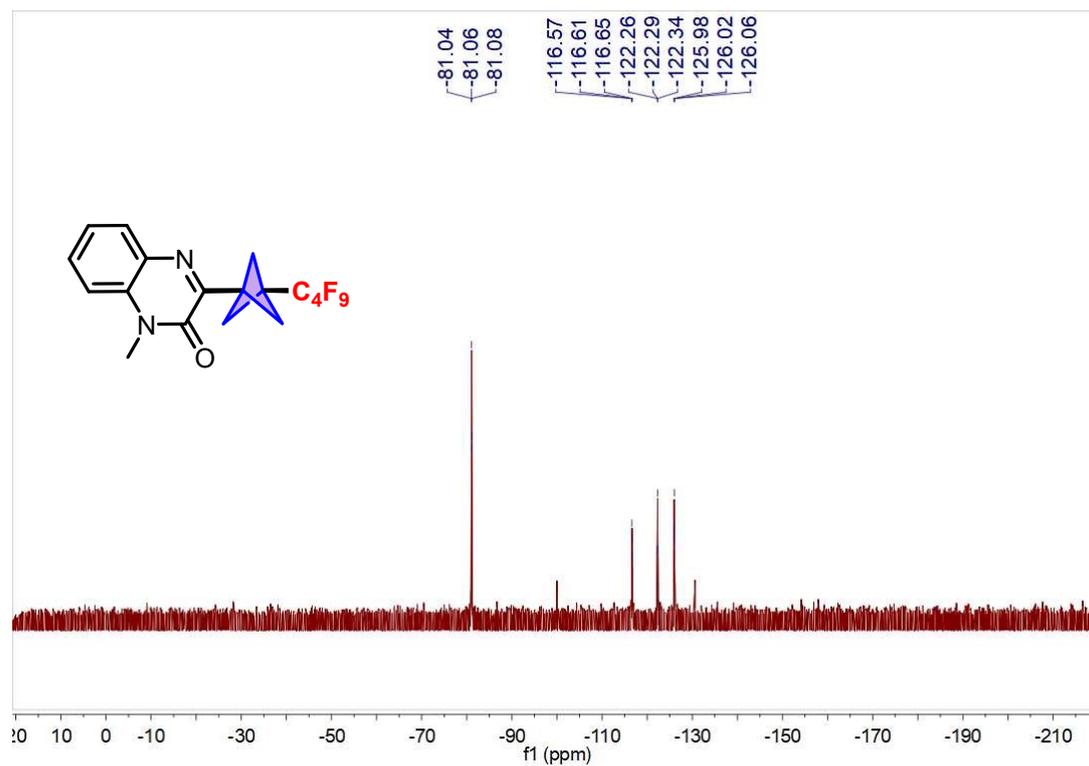
### 20 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



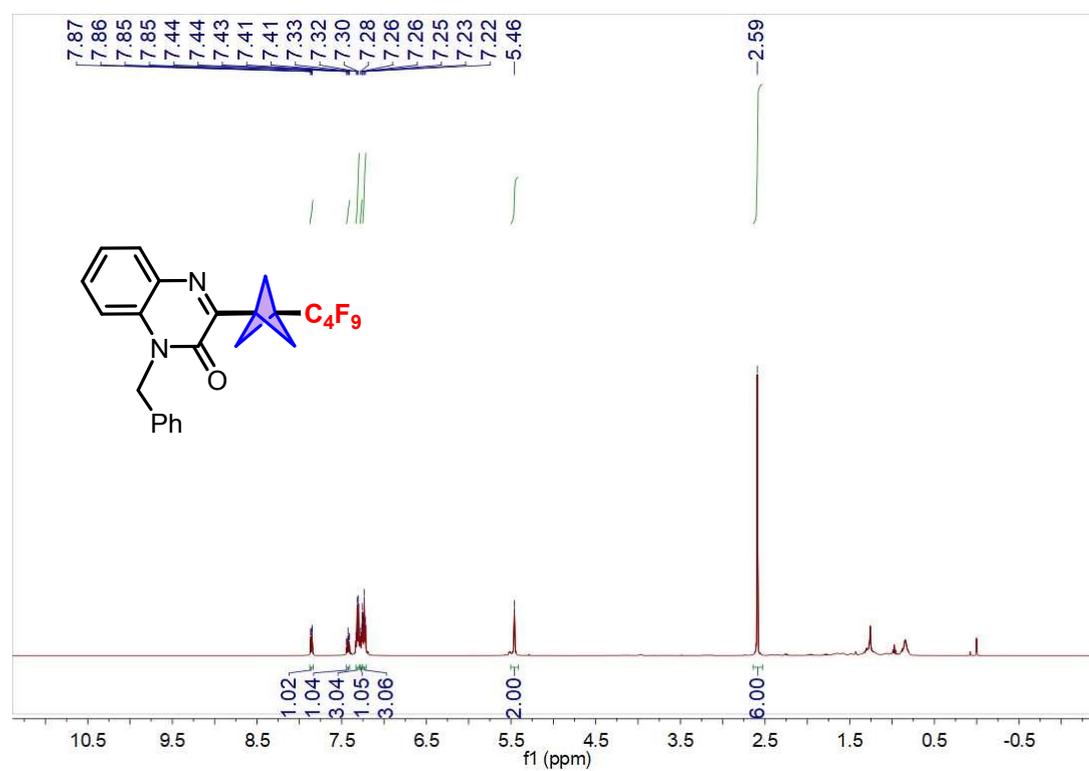
### 20 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



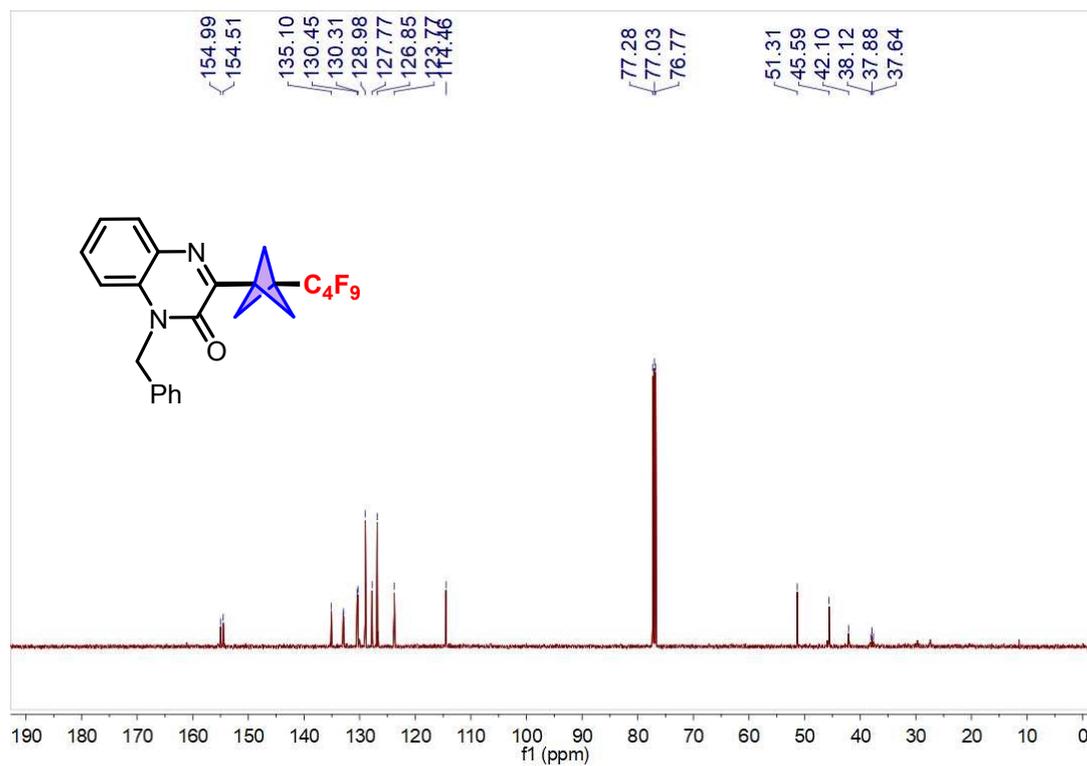
## 20 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



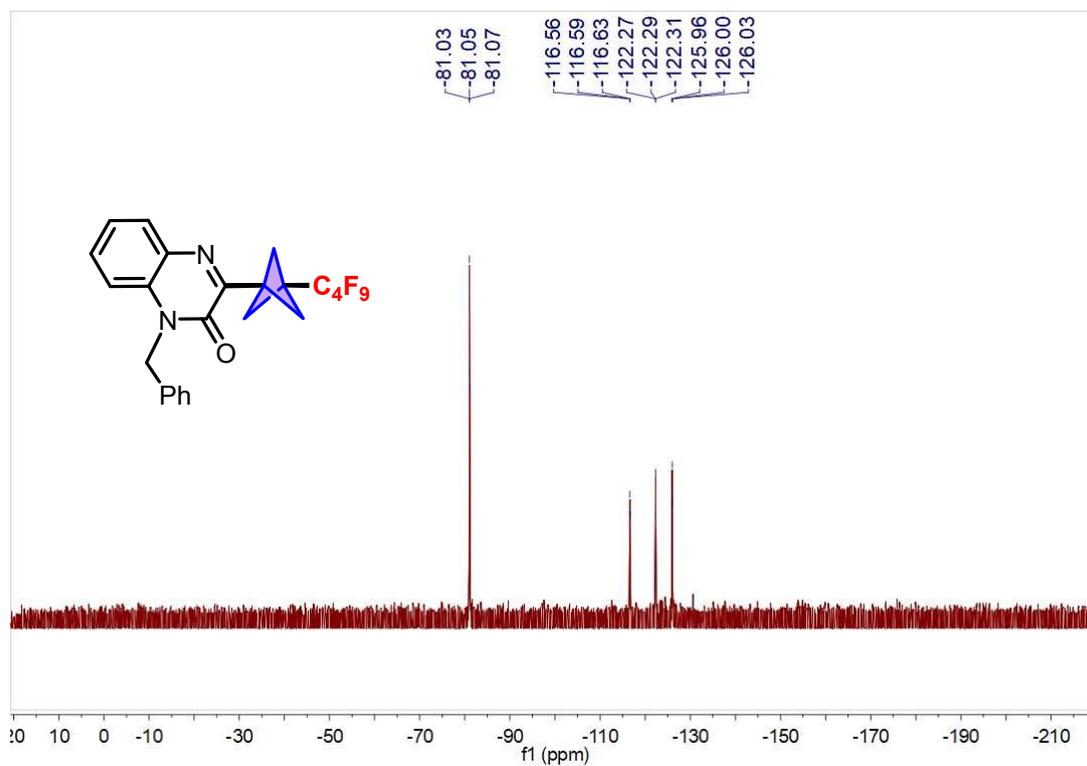
## 21 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



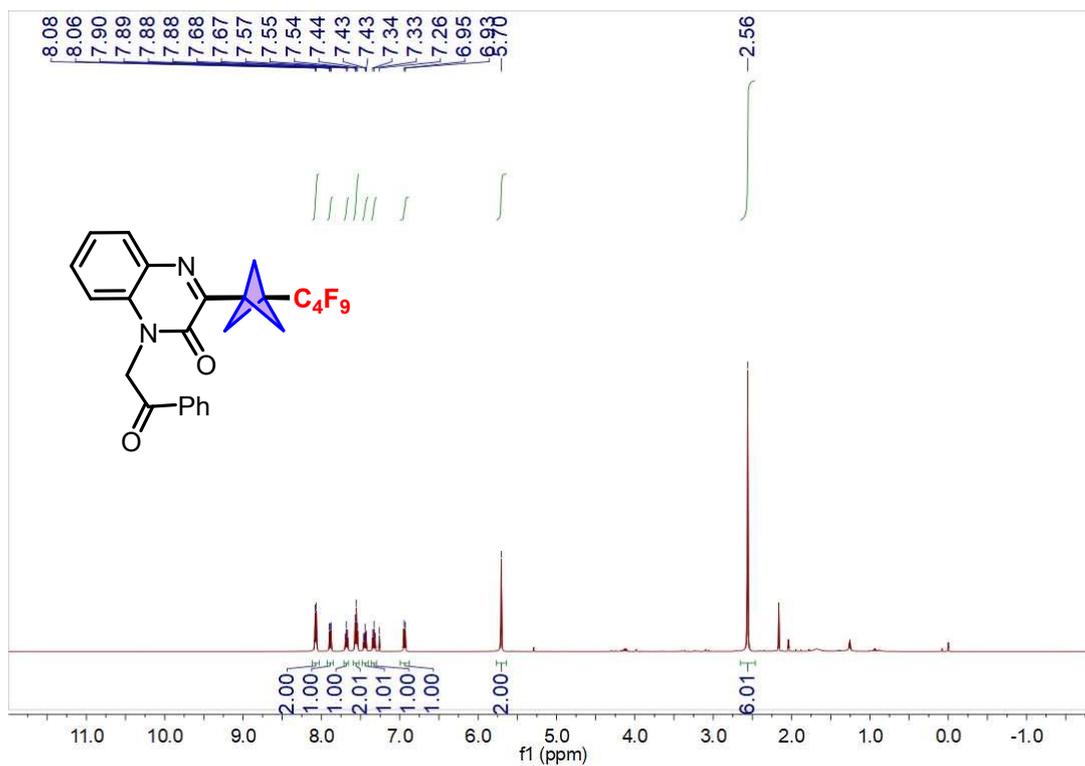
21 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



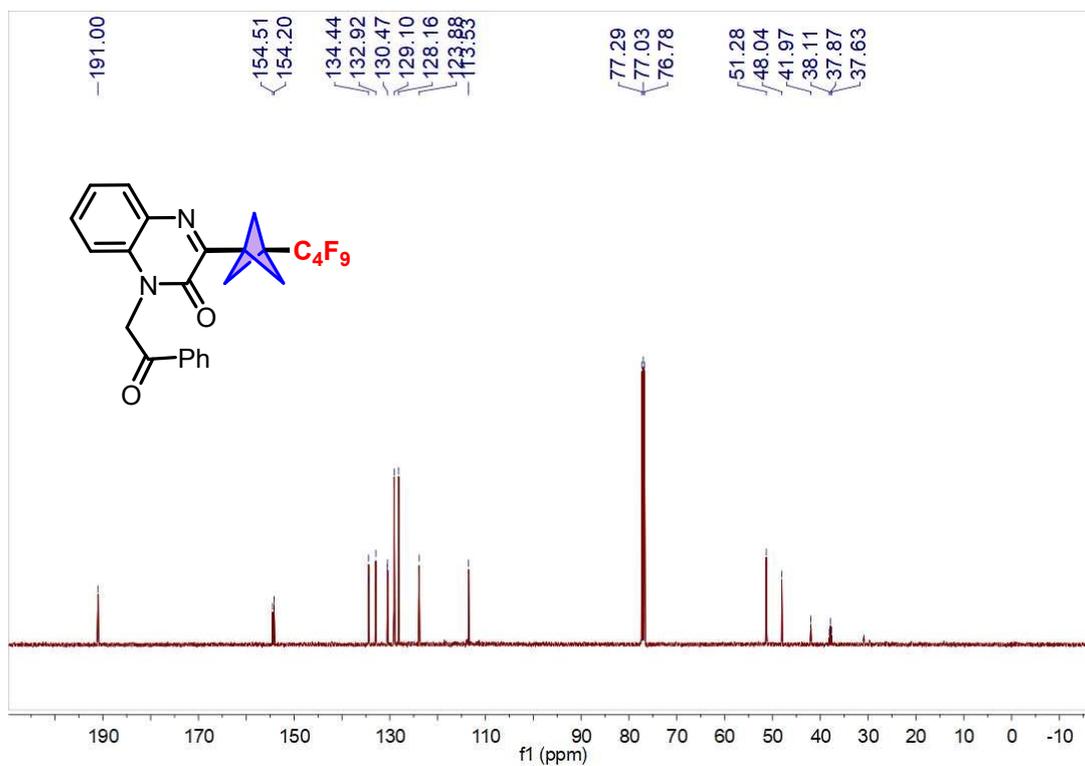
21 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



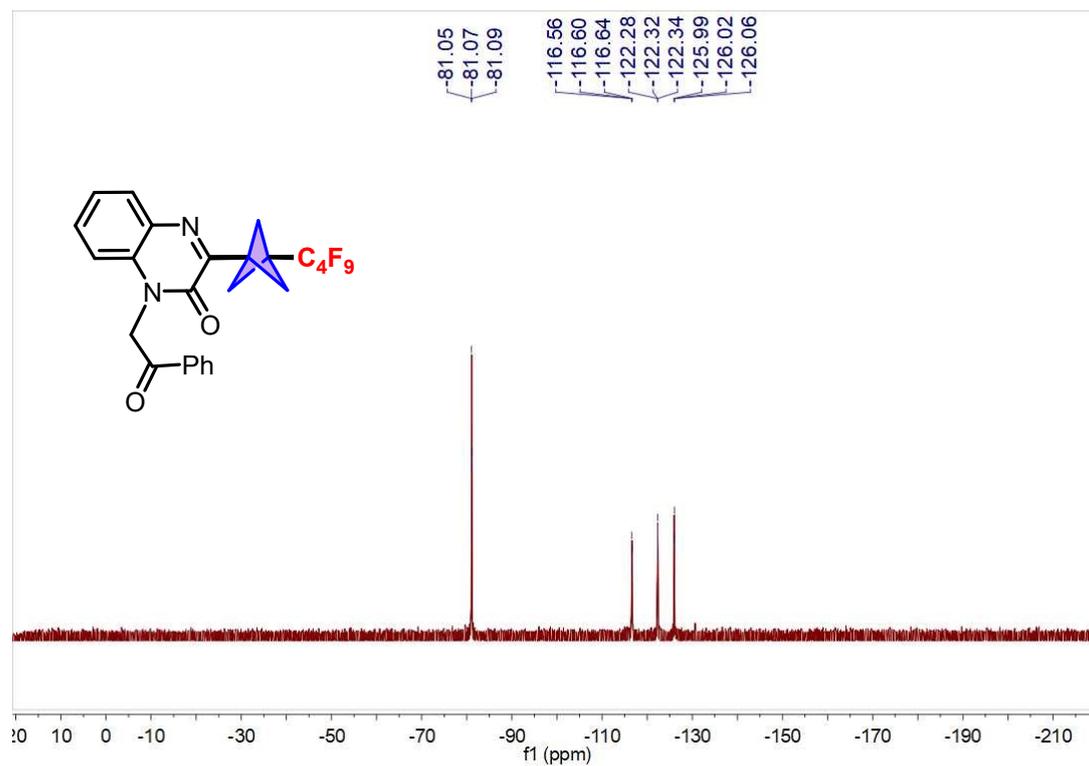
## 22 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



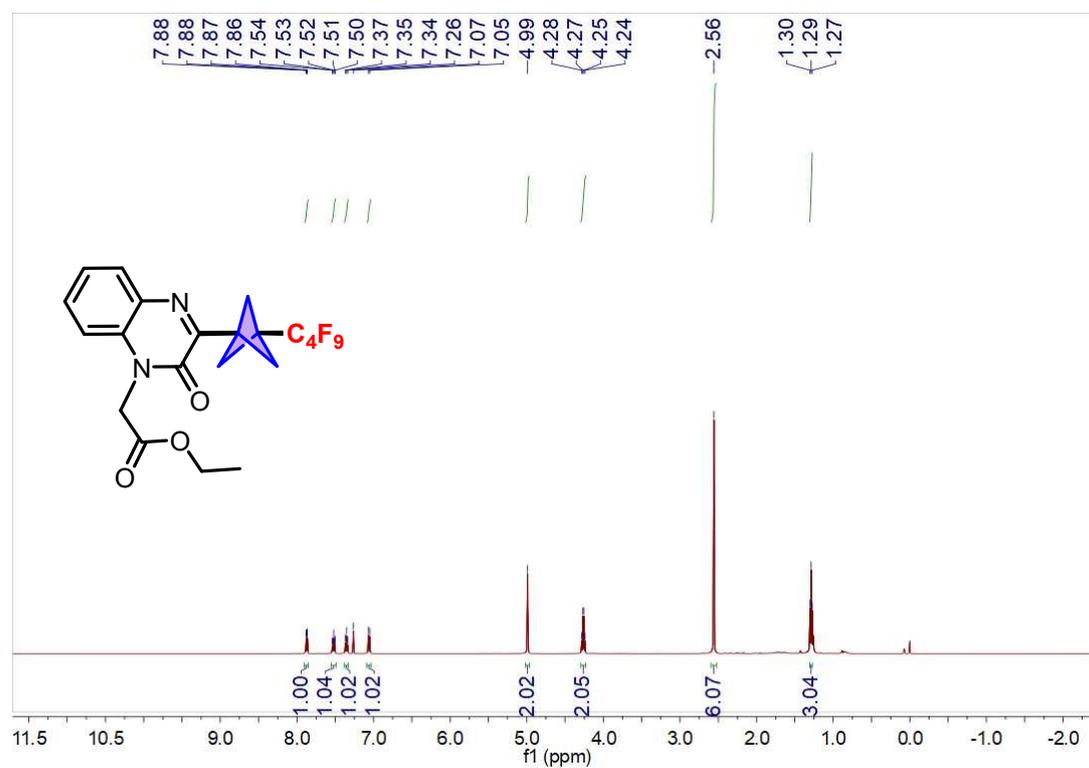
## 22 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



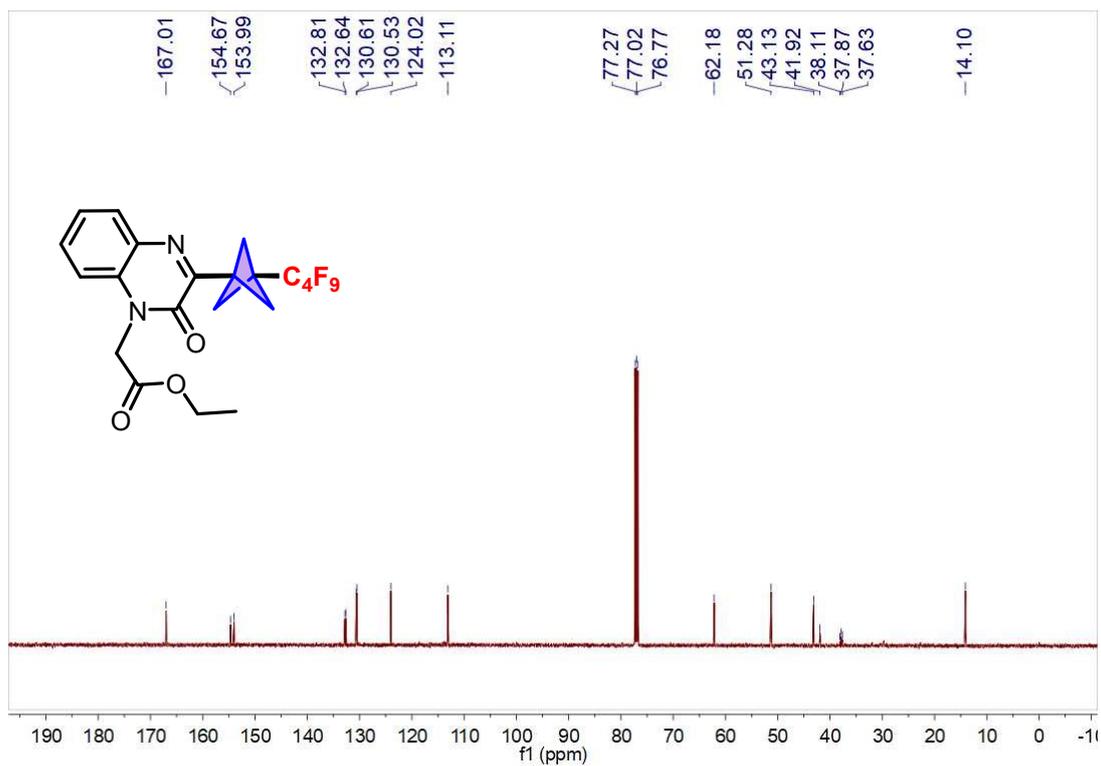
### 22 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



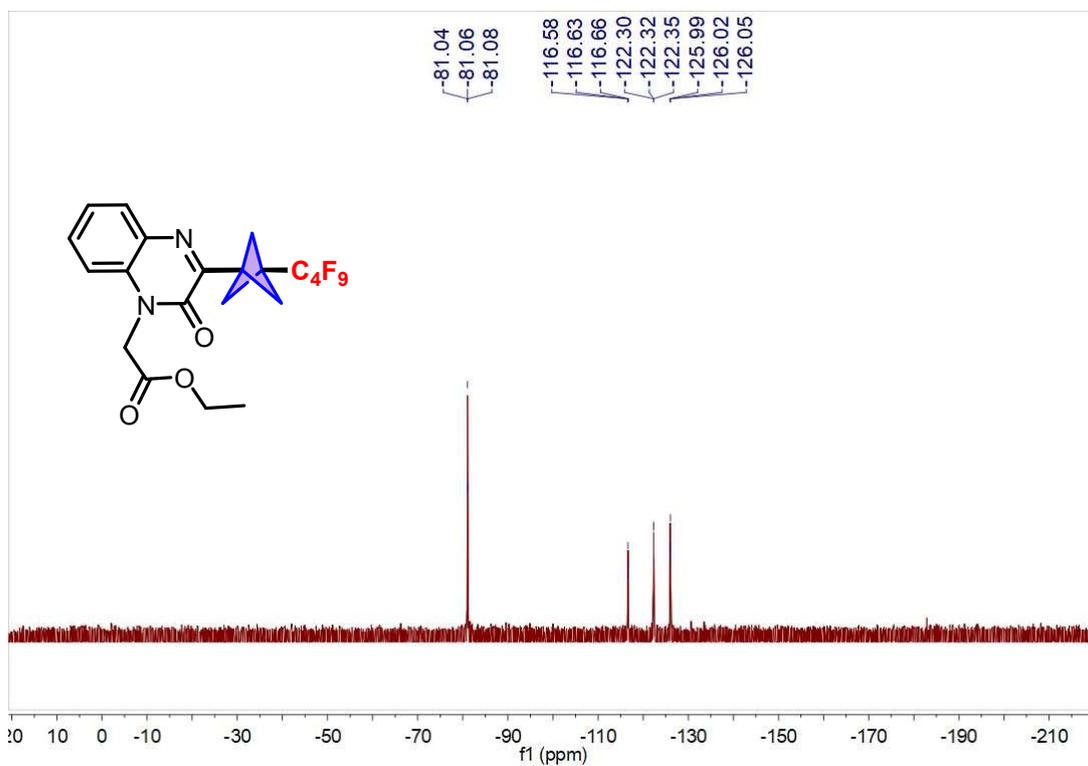
### 23 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



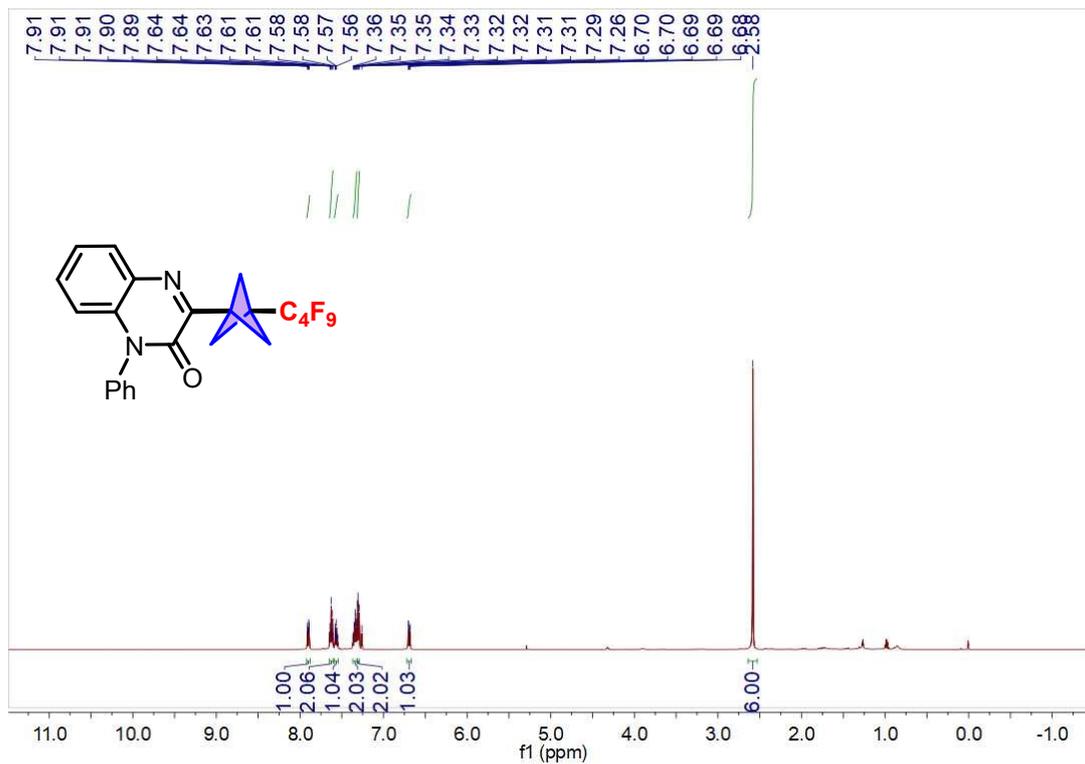
23 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



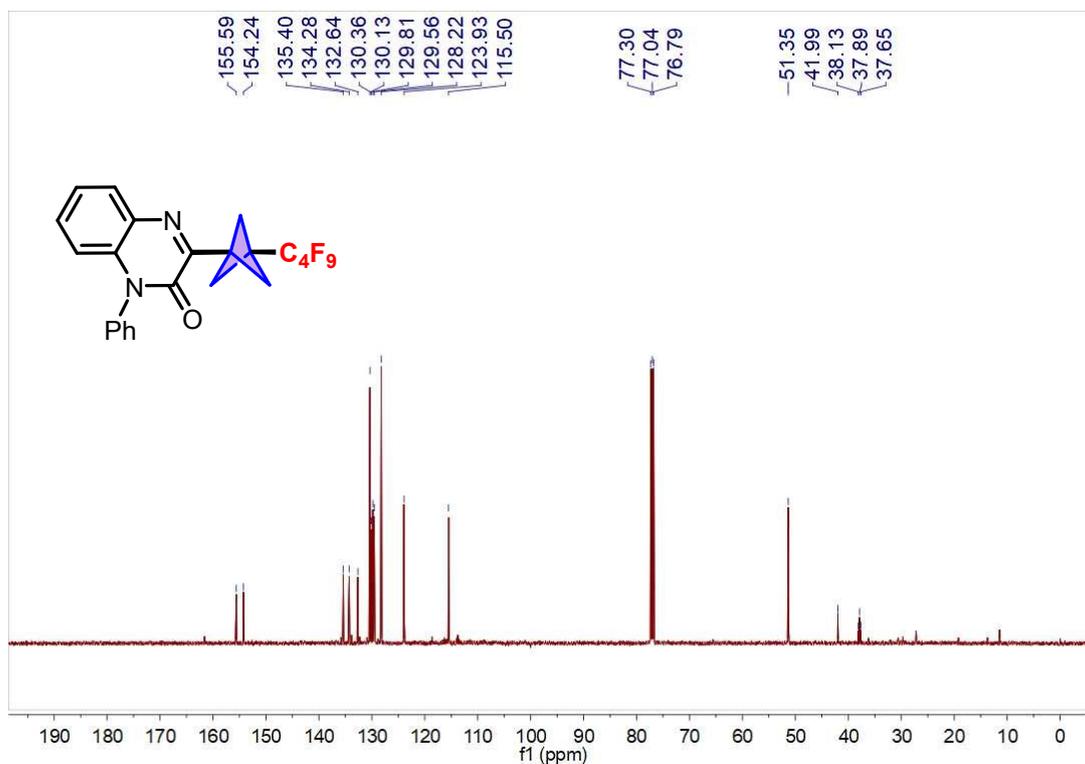
23 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



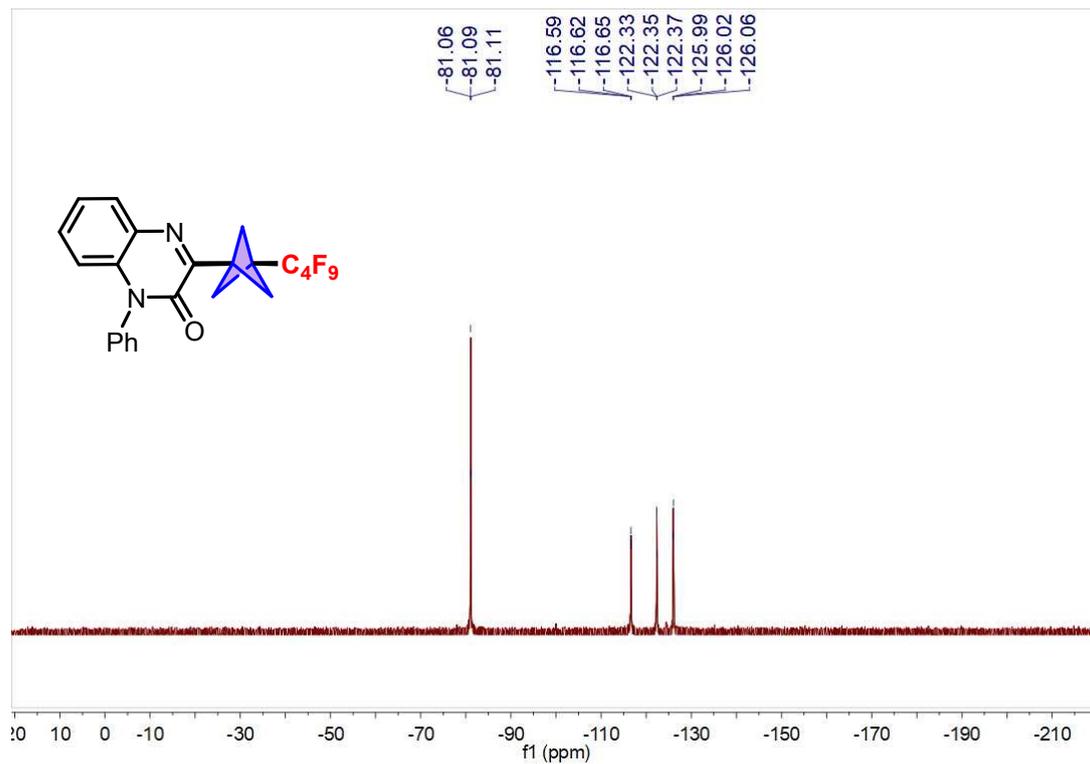
### 24 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



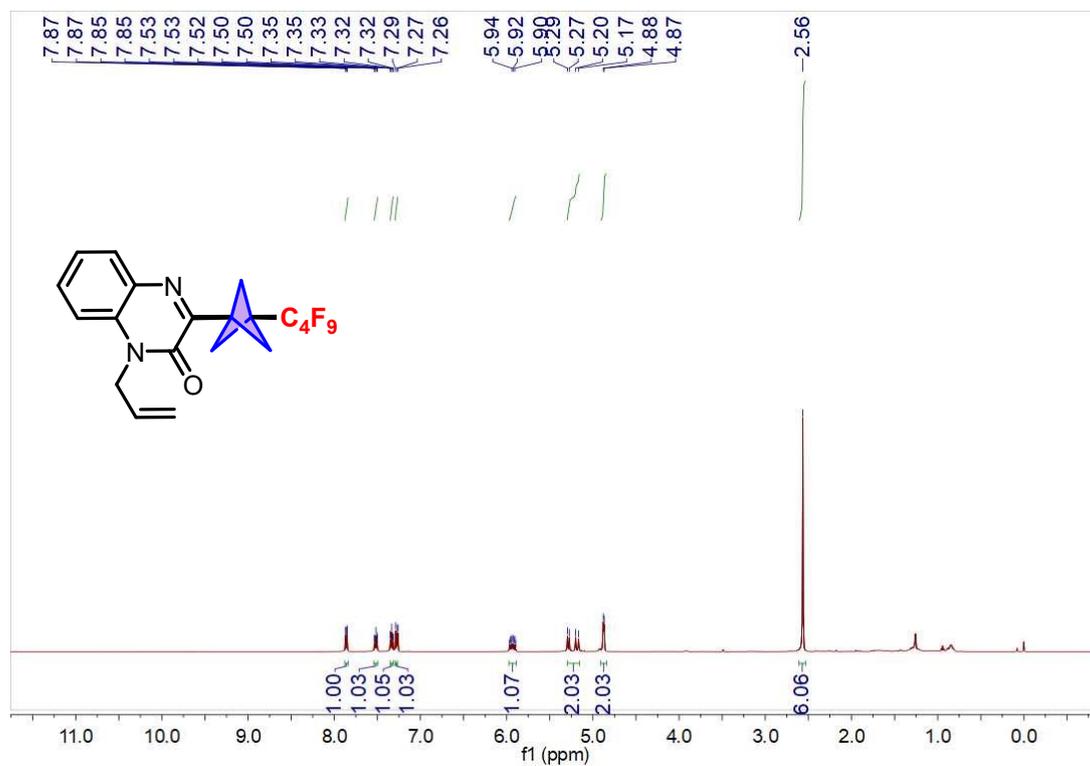
### 24 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



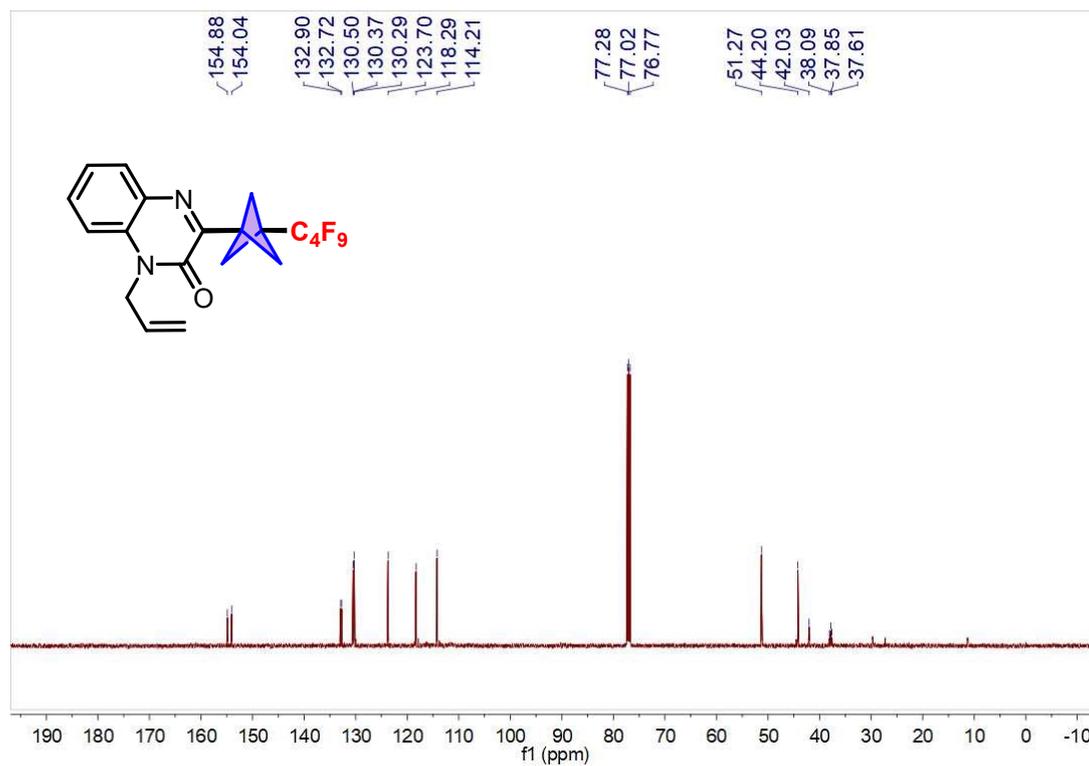
24  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



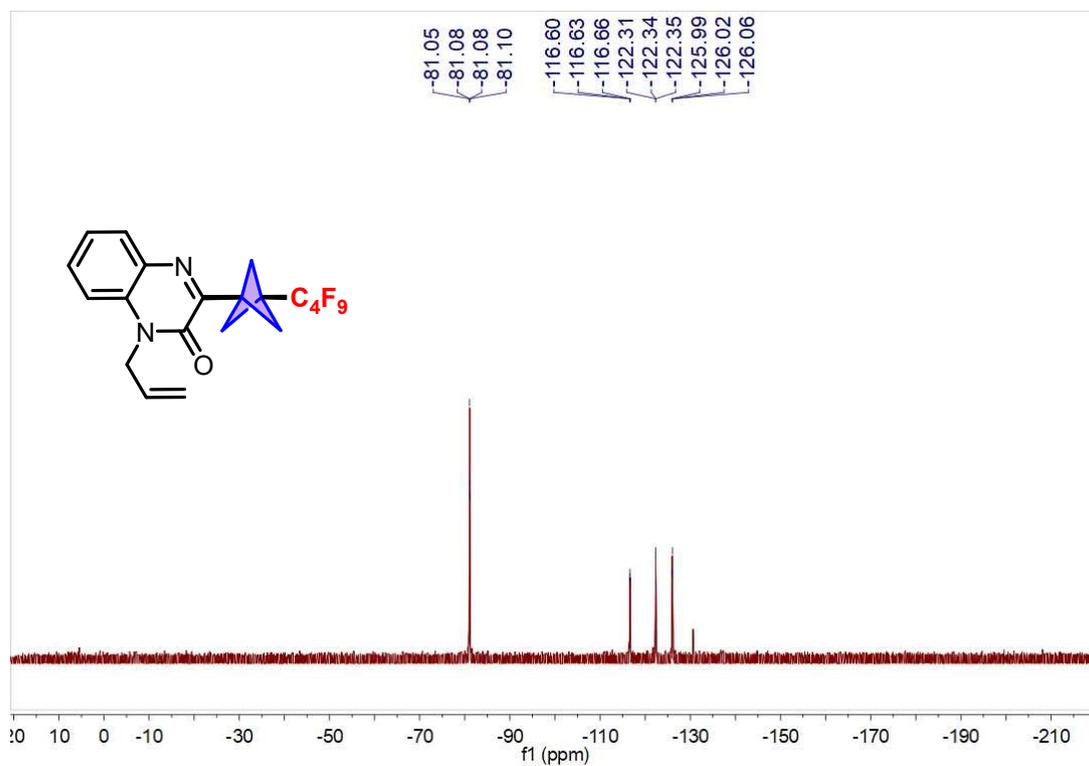
25  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



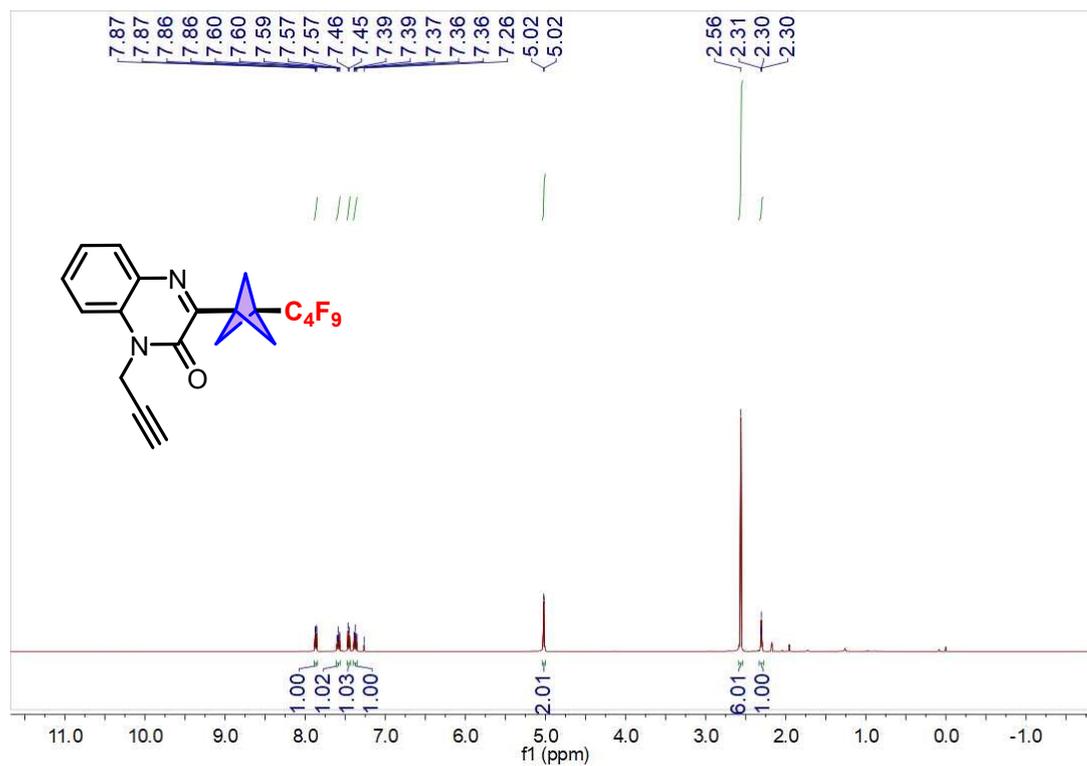
25  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



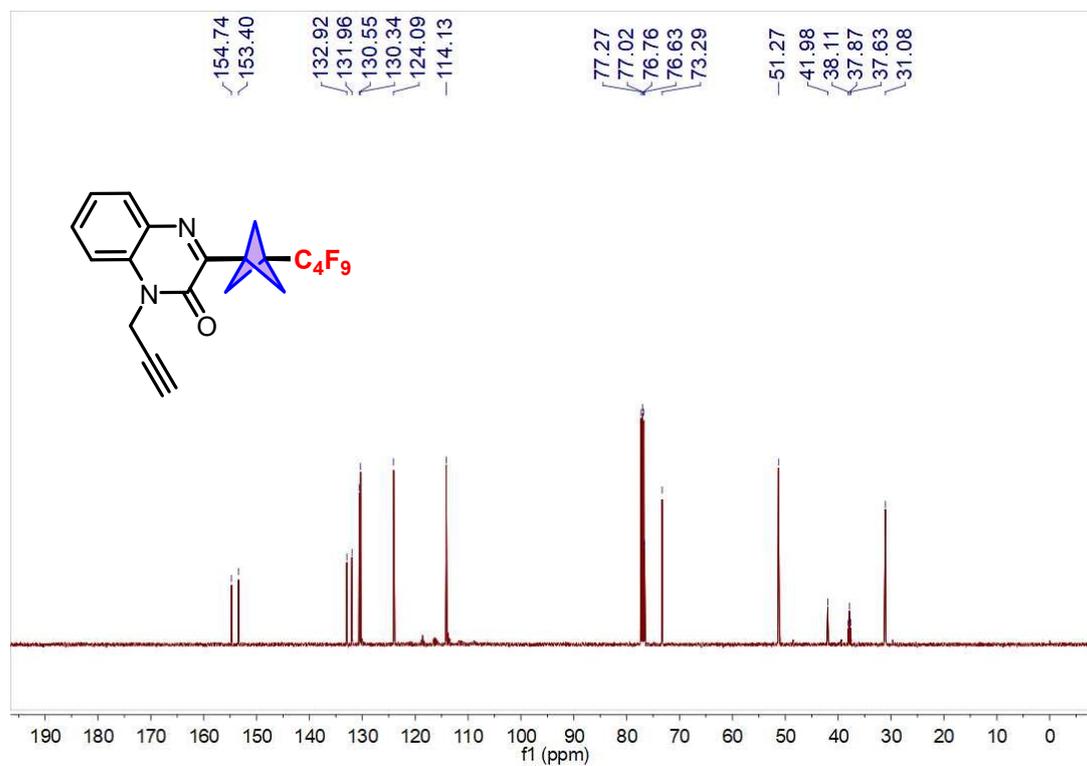
25  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



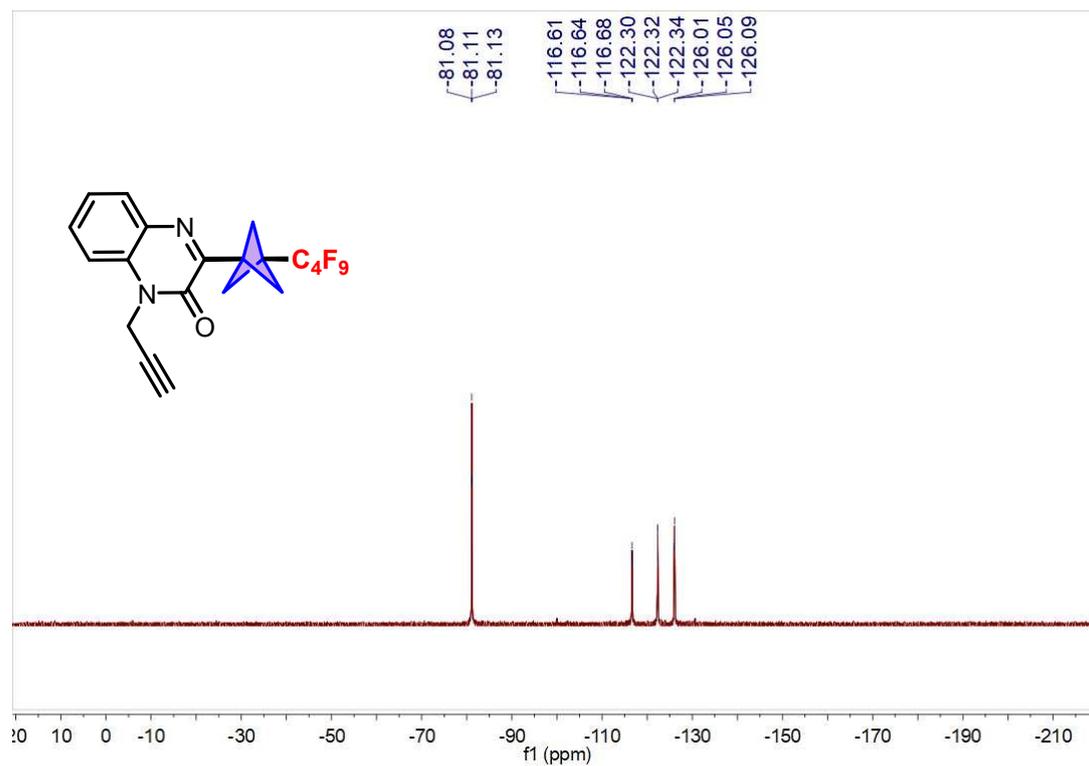
### 26 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



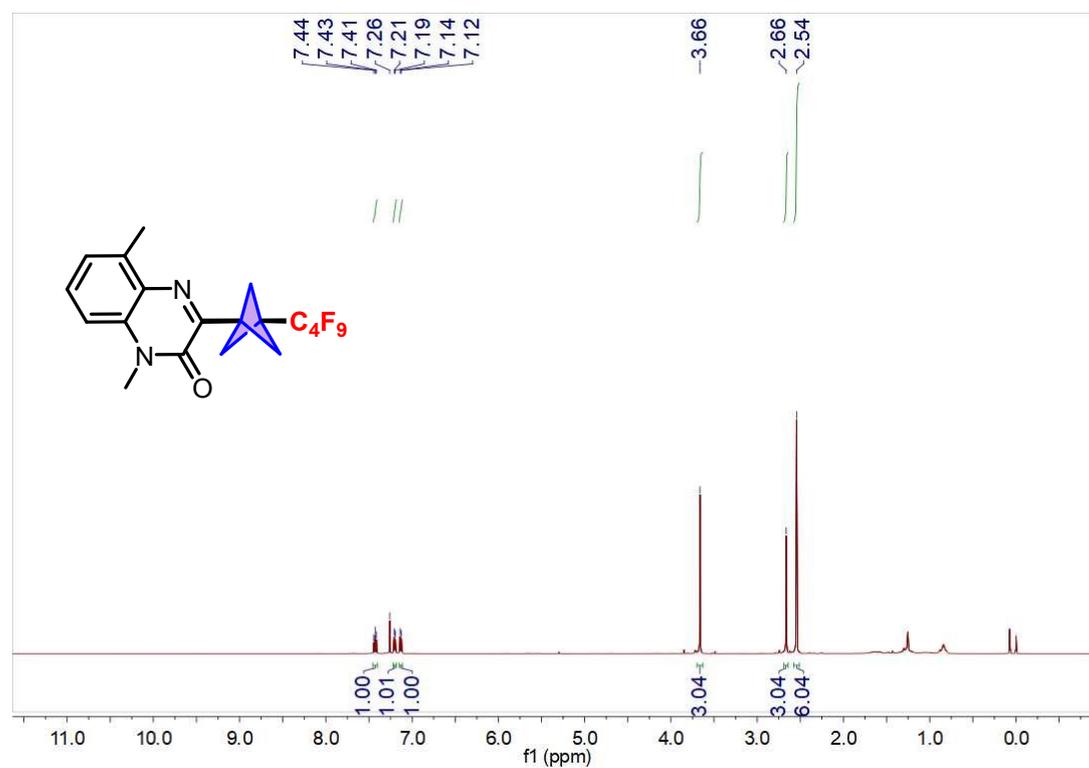
### 26 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



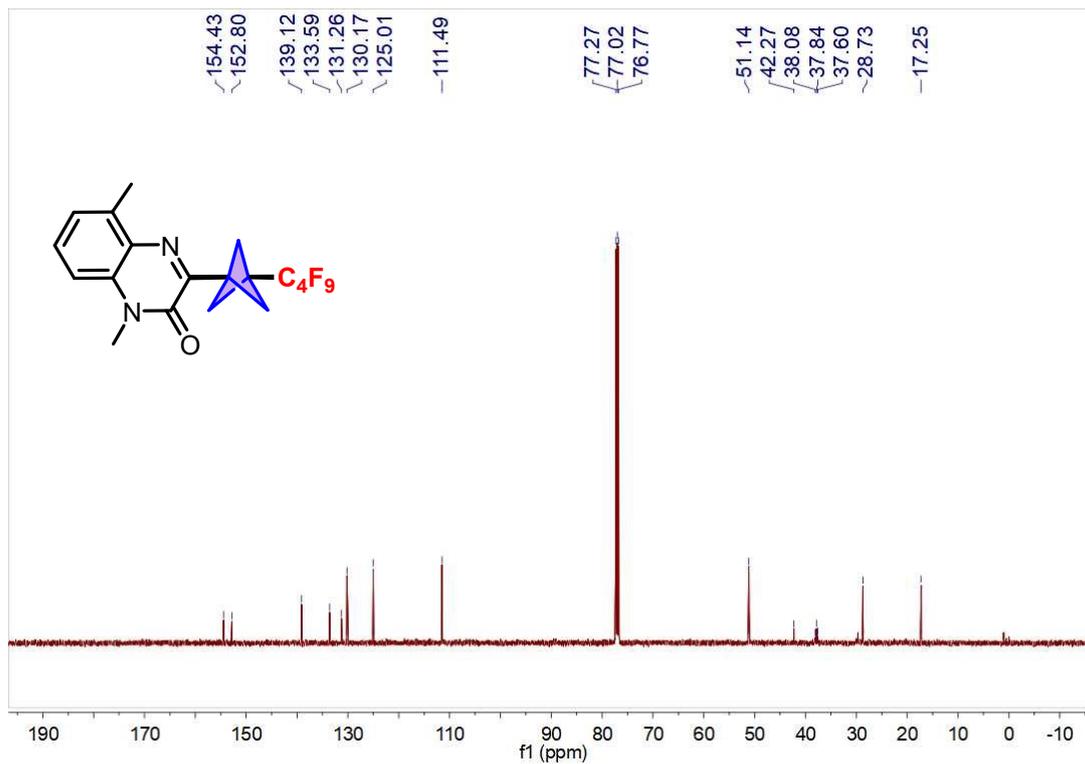
### 26 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



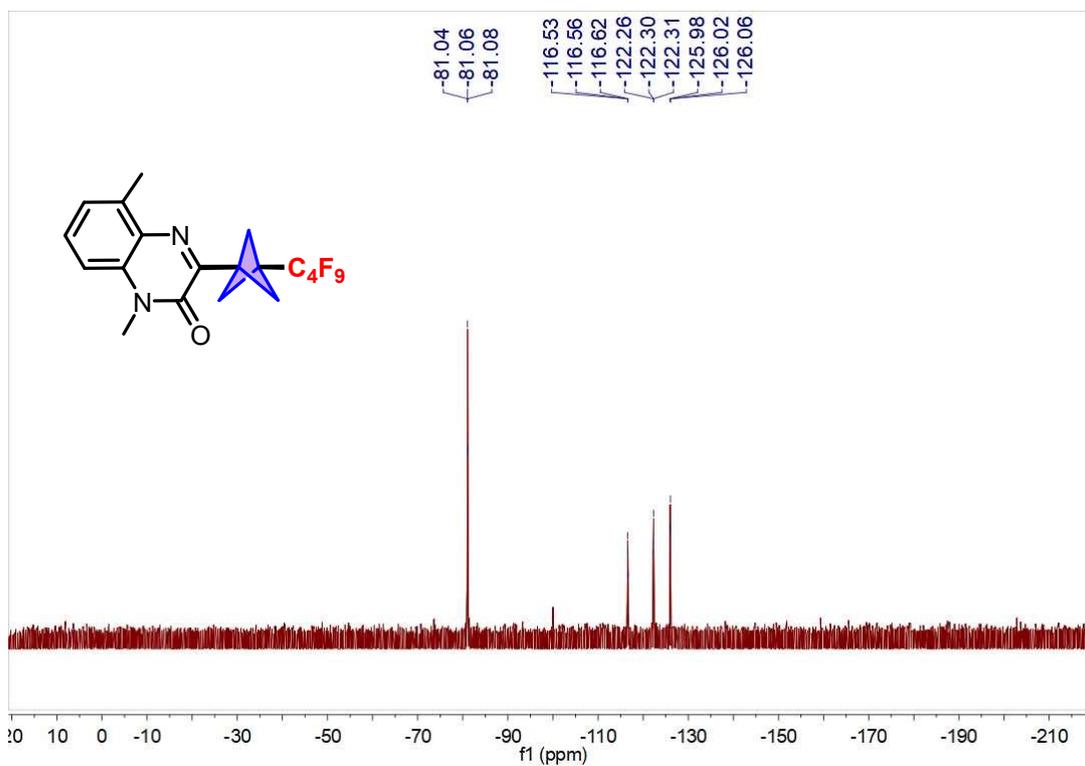
### 27 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



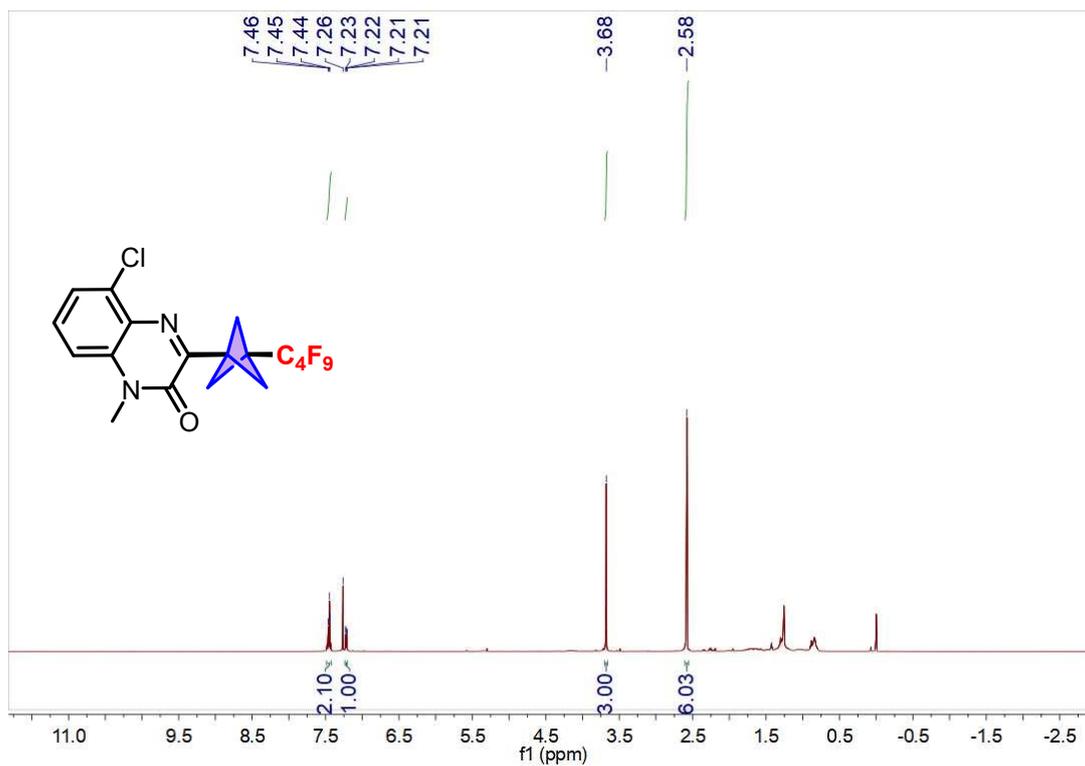
27 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



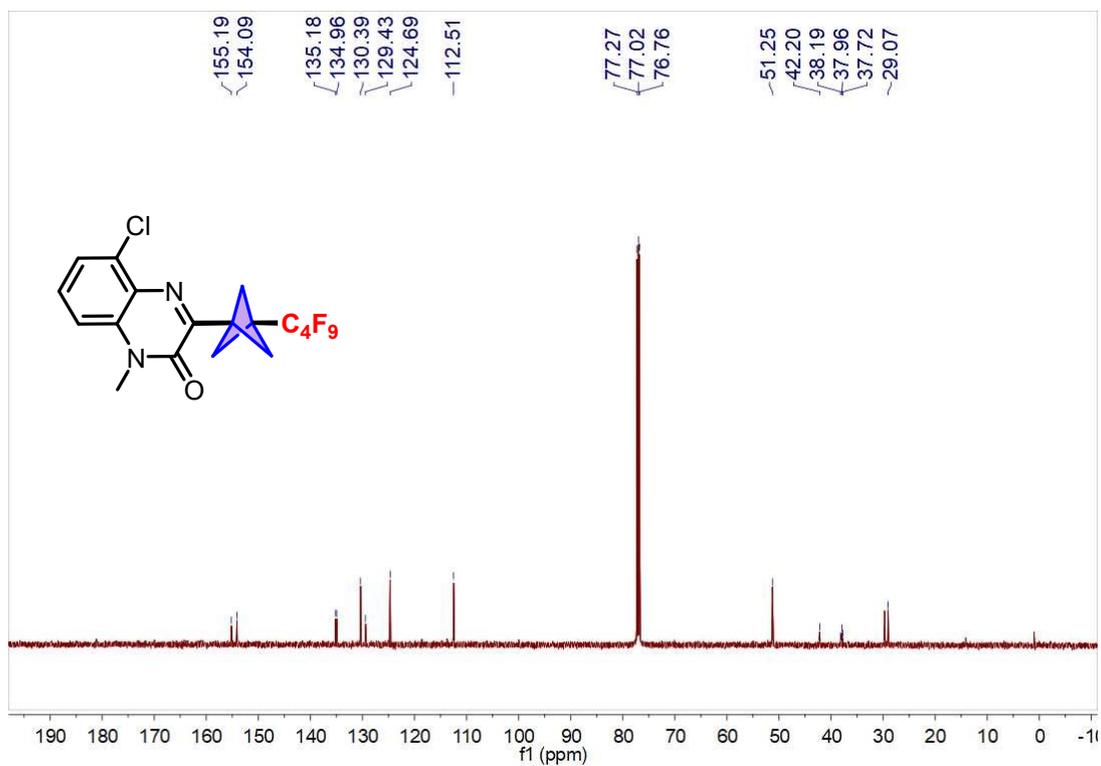
27 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



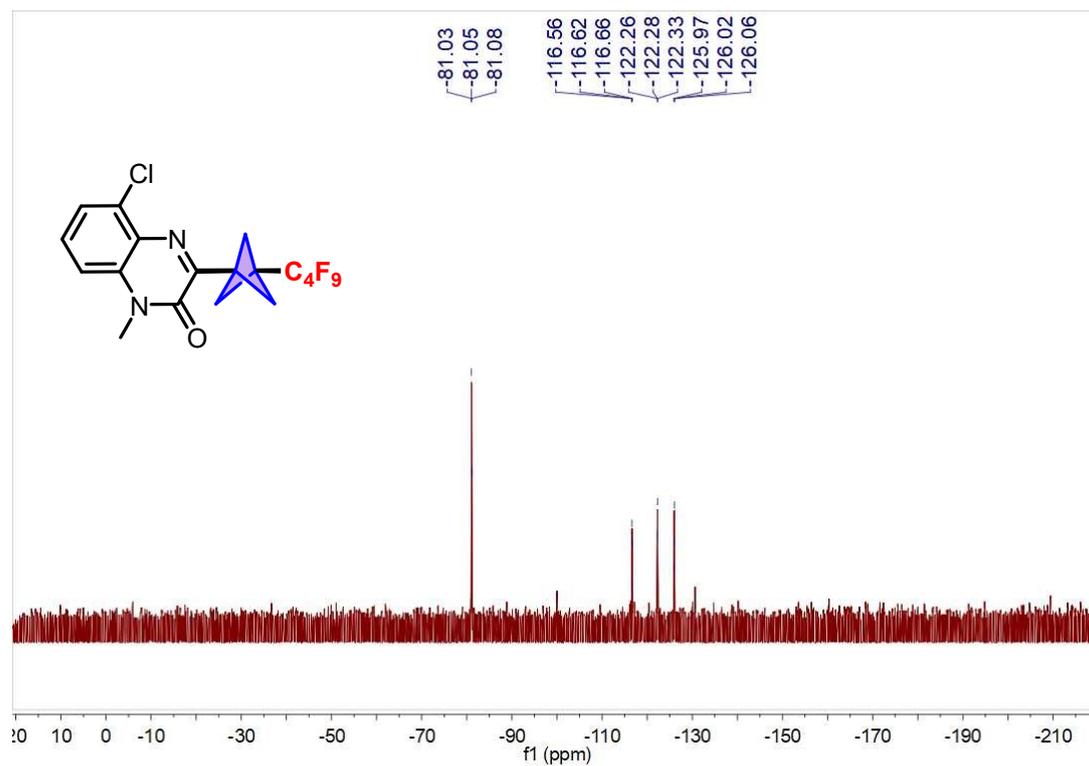
### 28 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



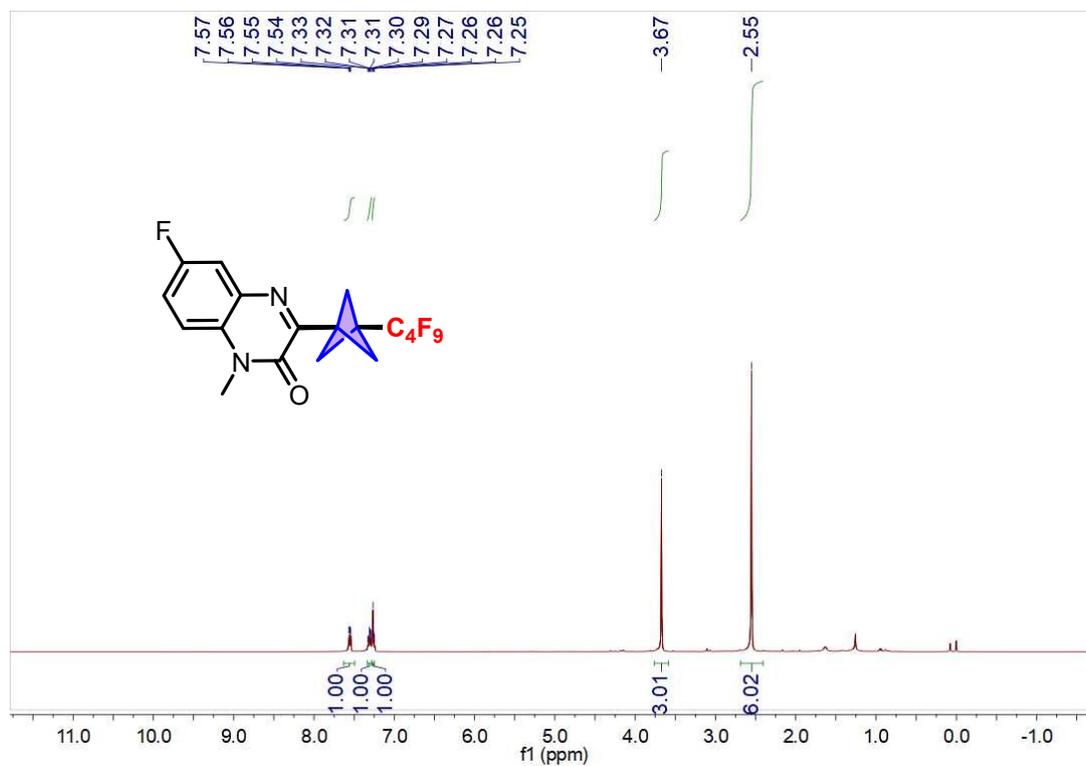
### 28 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



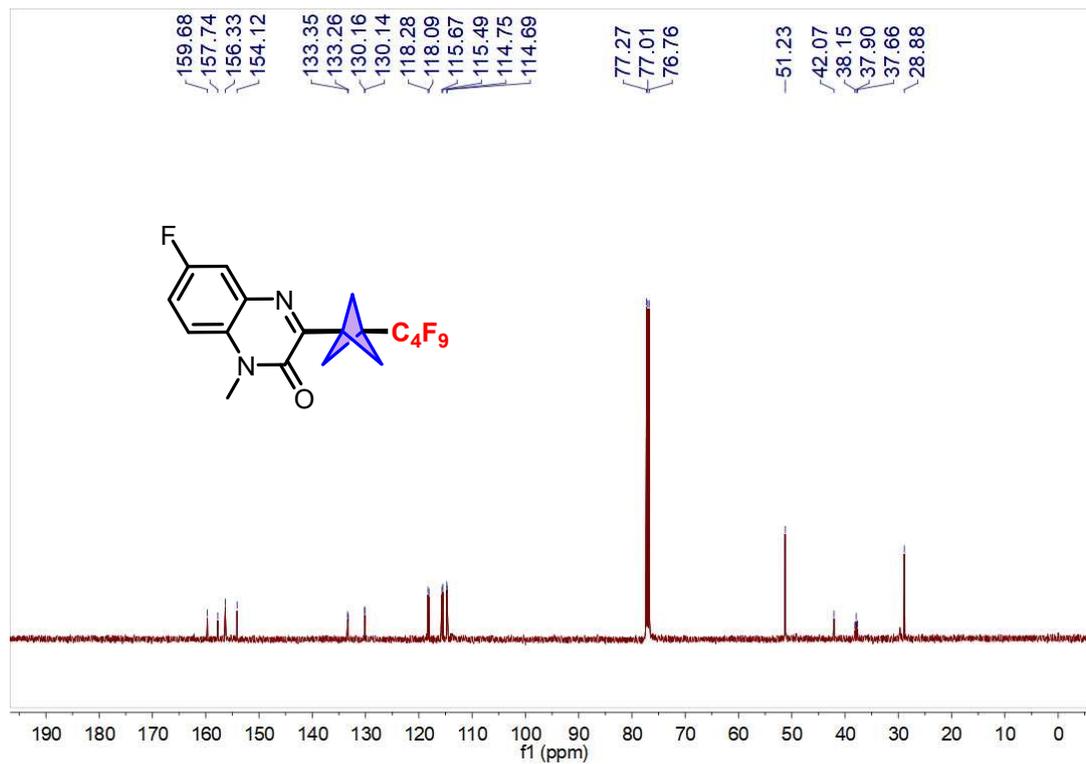
### 28 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



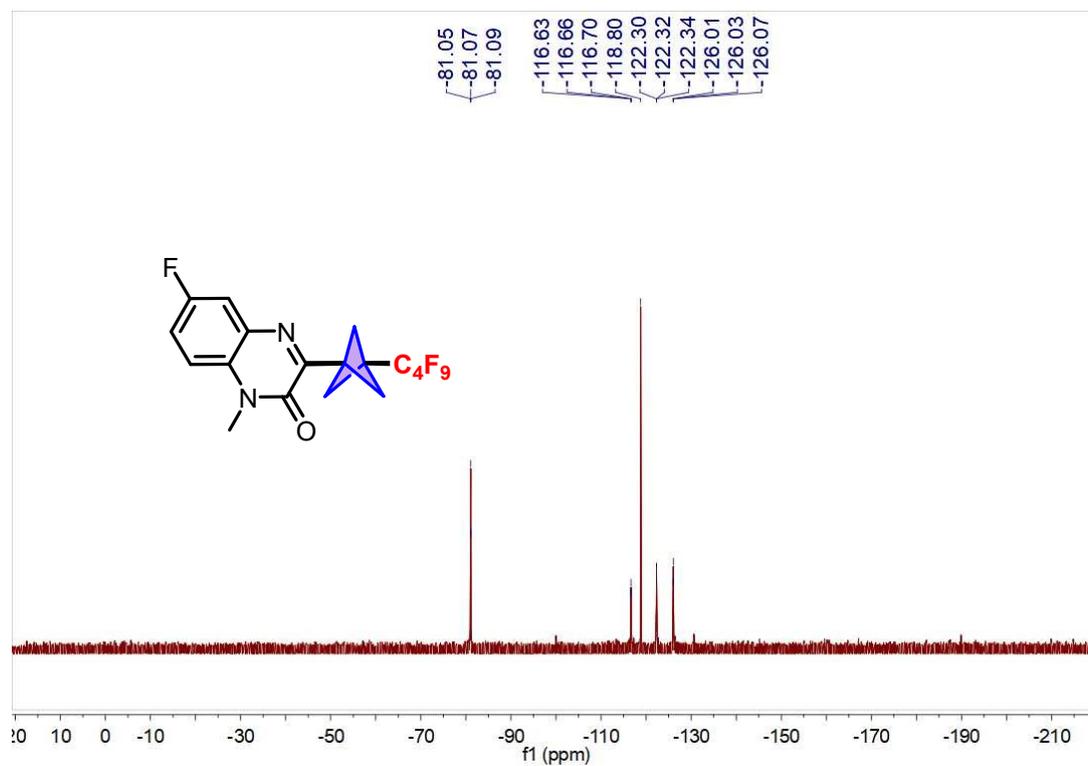
### 29 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



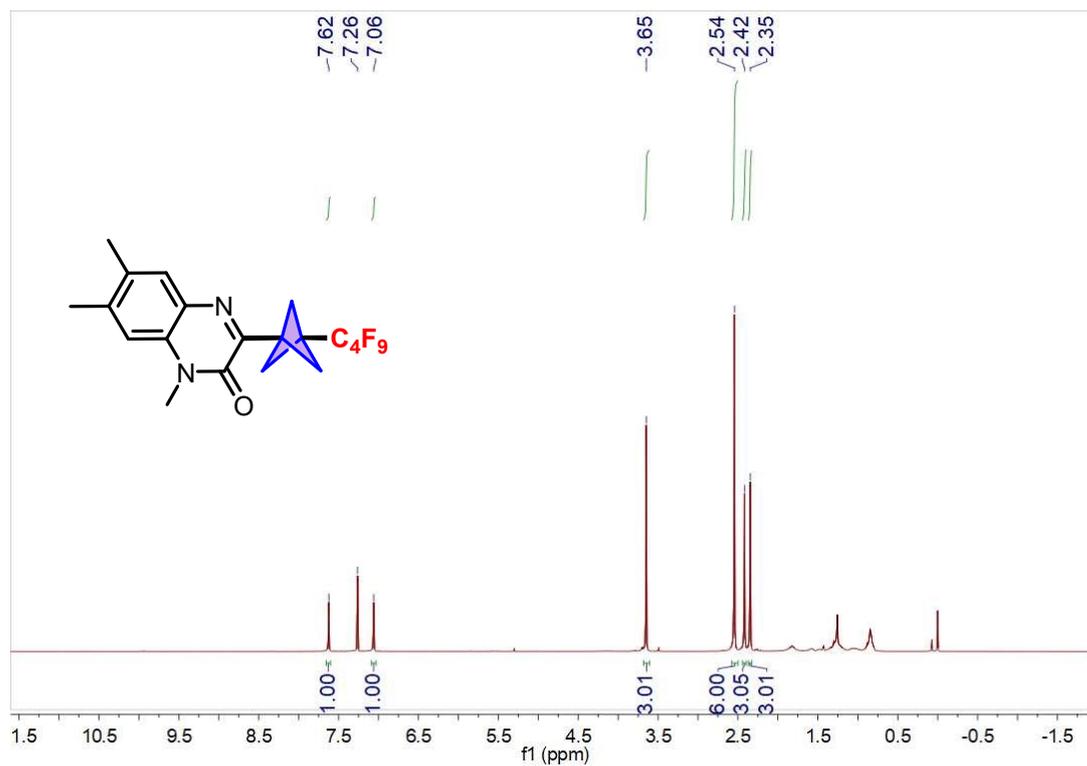
### 29 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



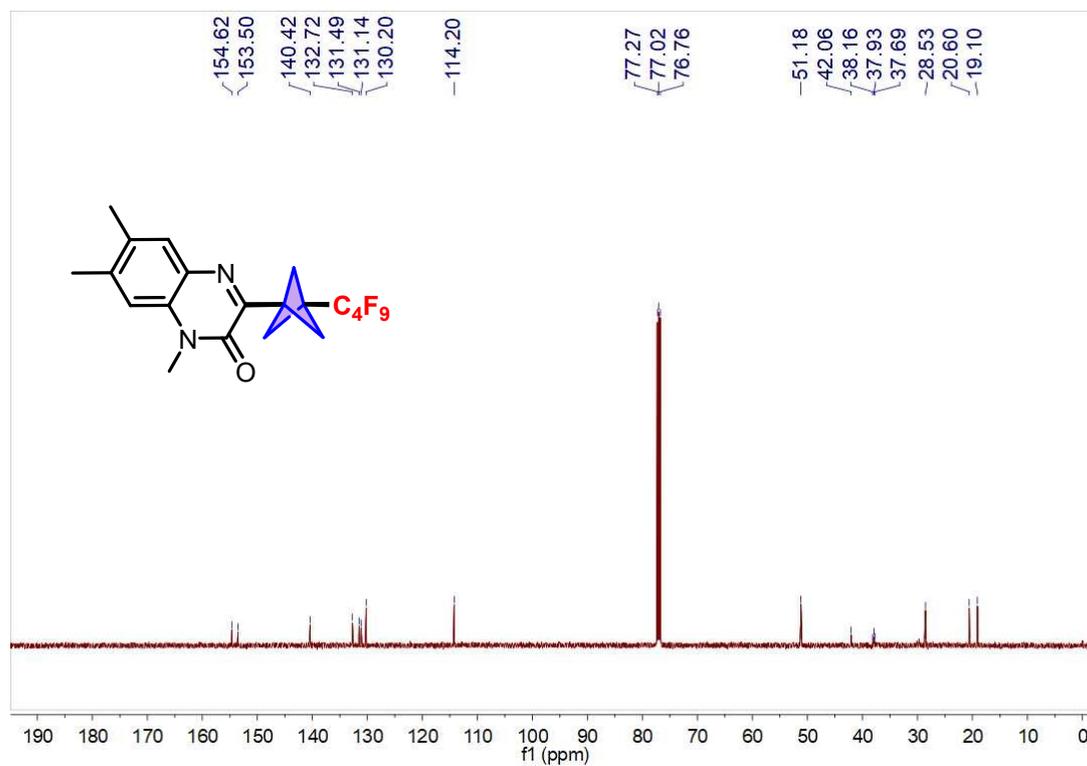
### 29 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



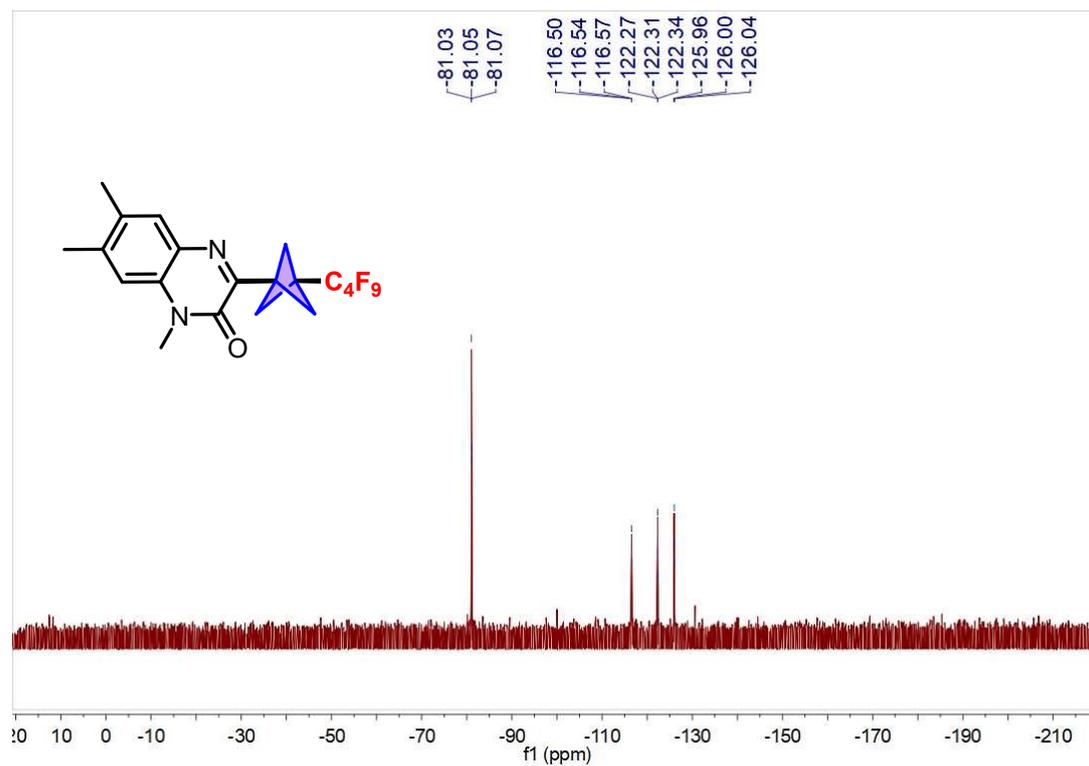
### 30 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



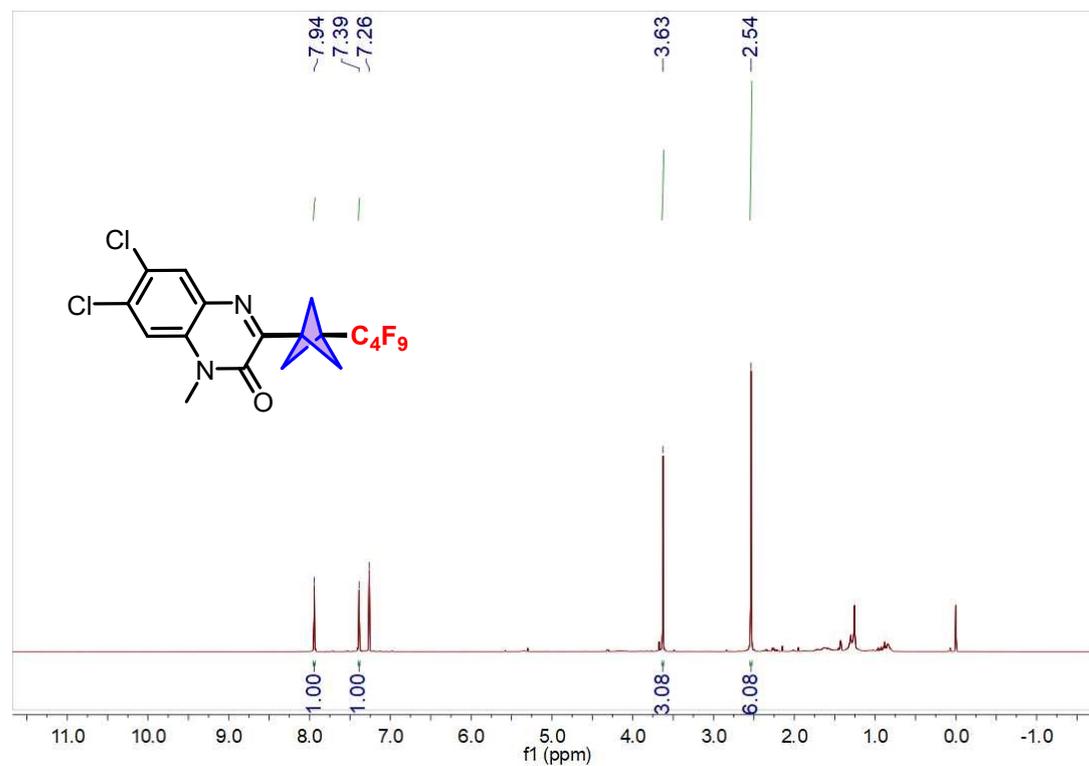
### 30 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



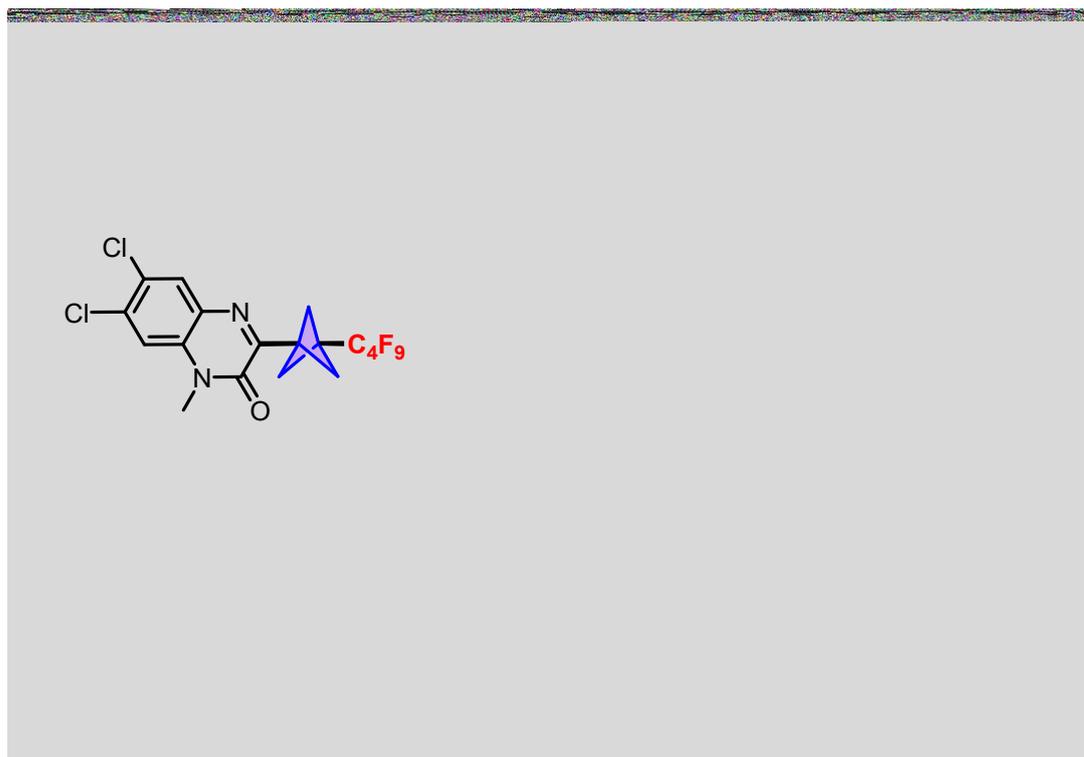
### 30 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



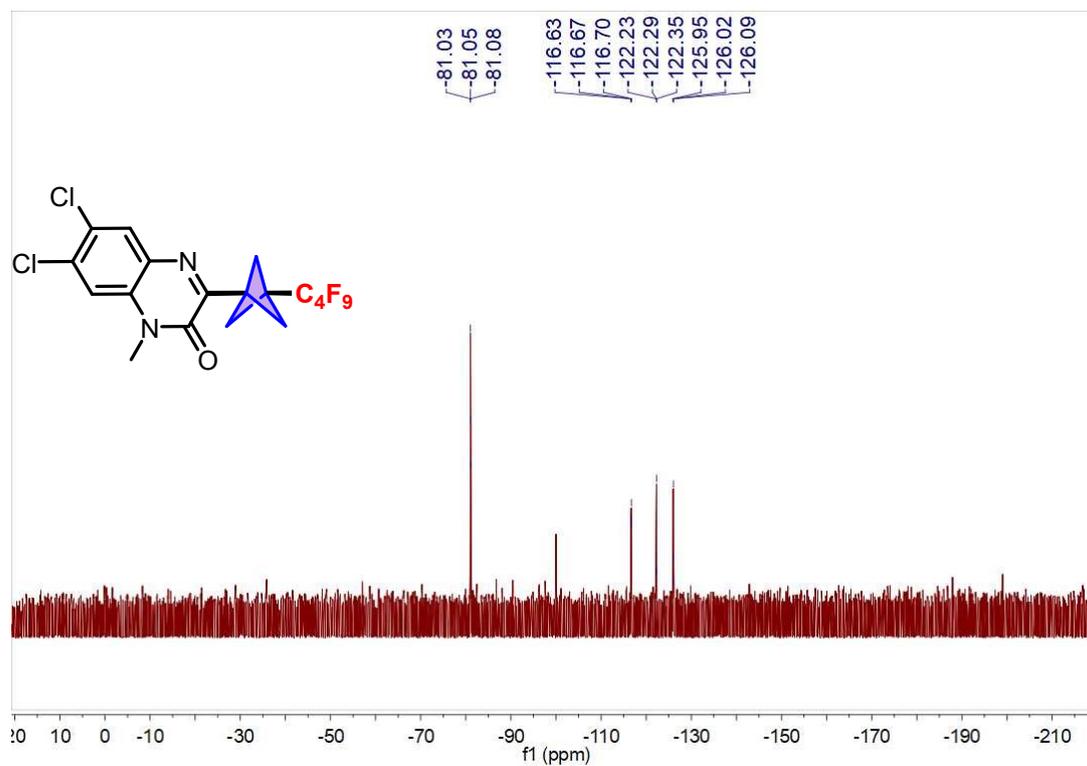
### 31 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



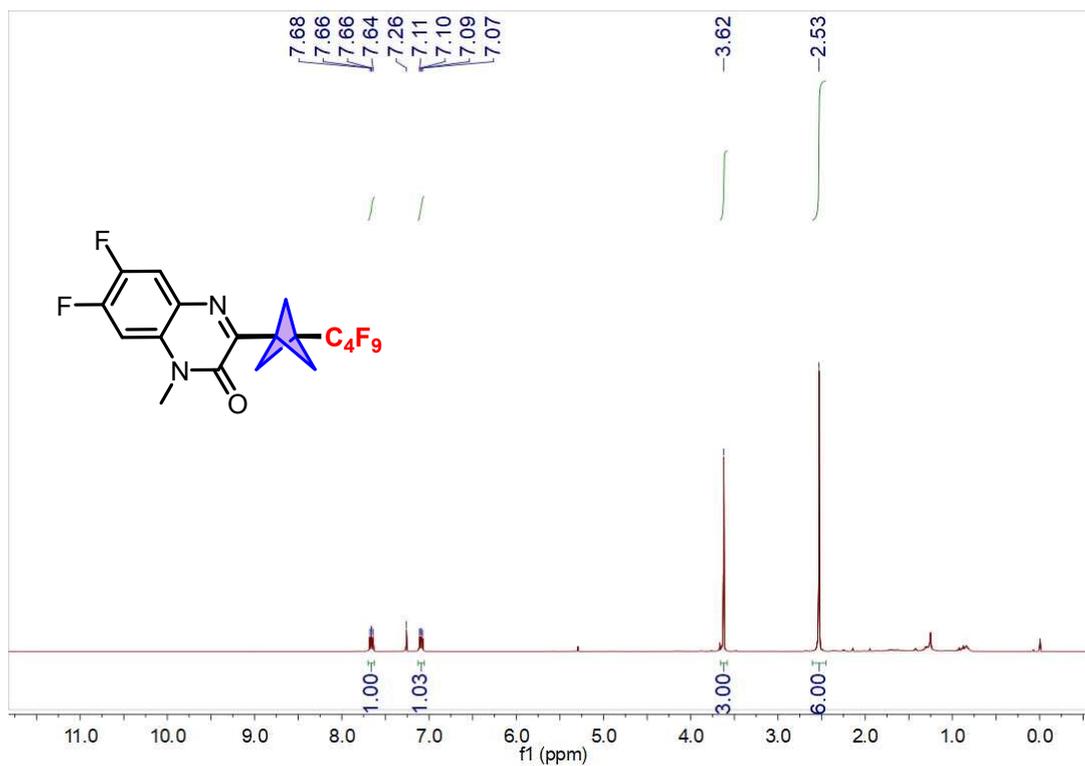
31 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



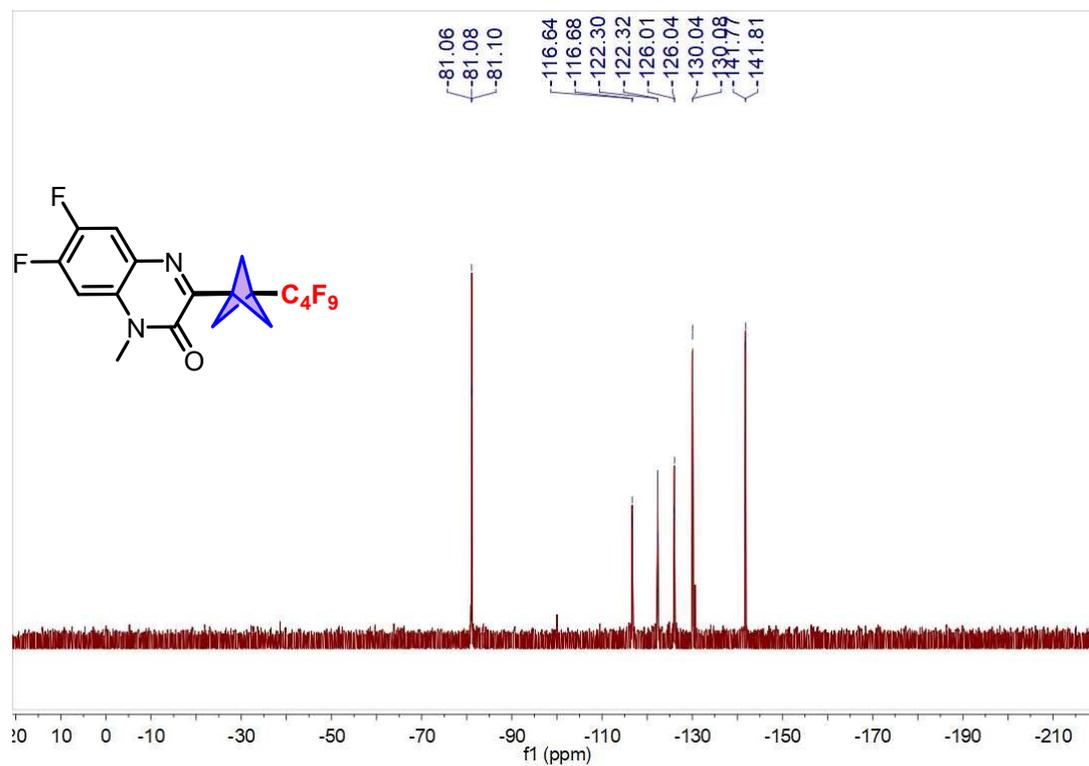
31 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



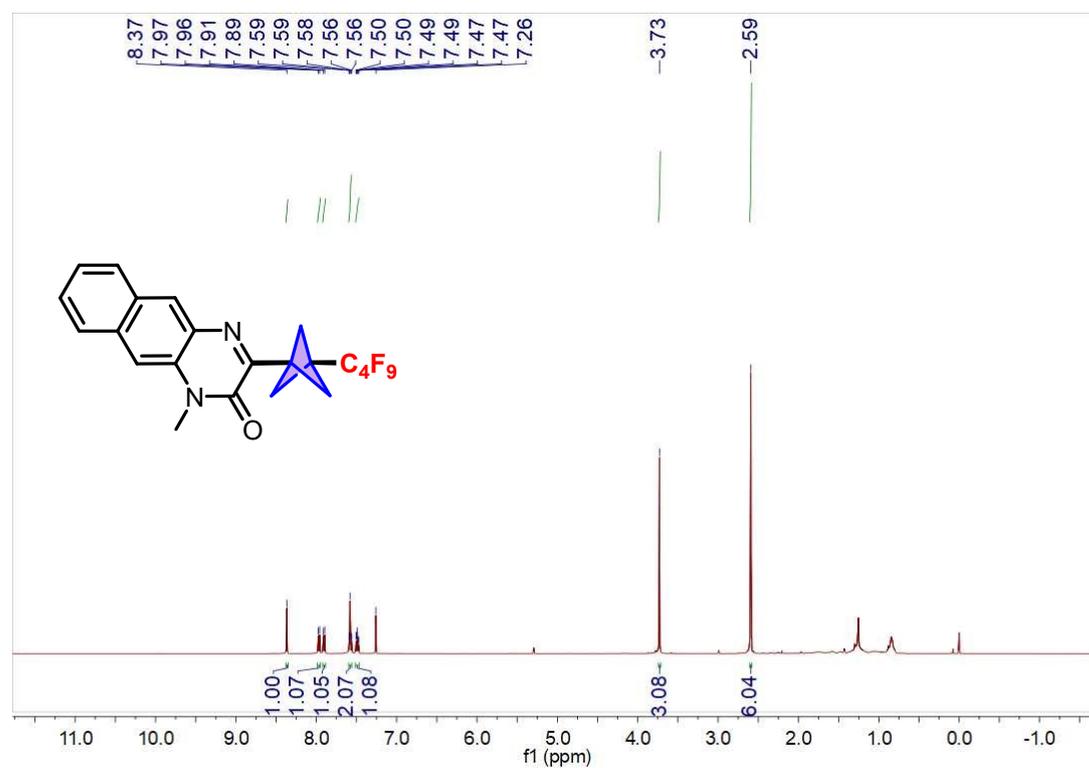
### 32 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



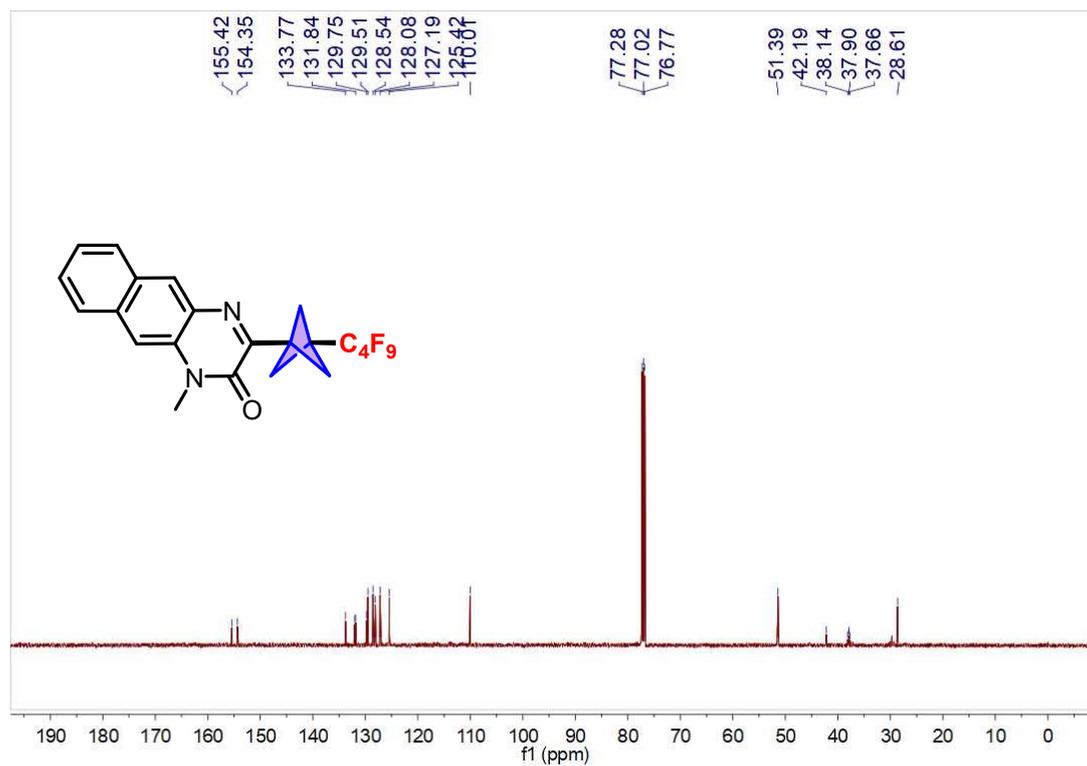
### 32 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



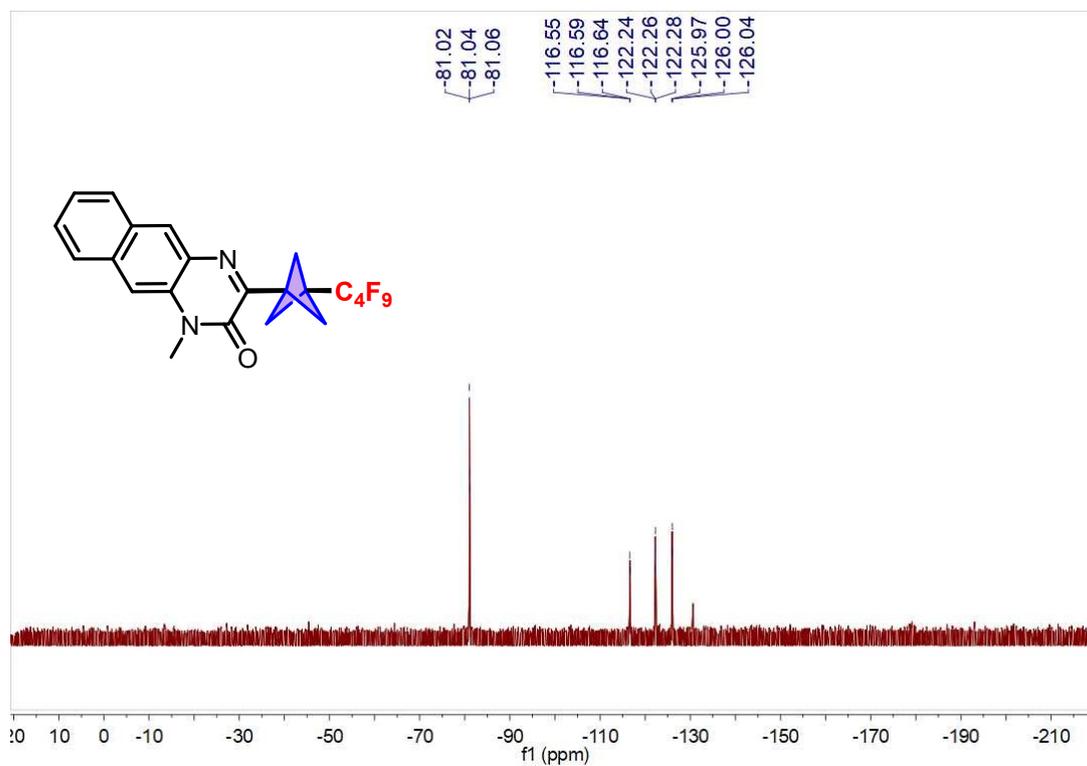
### 33 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



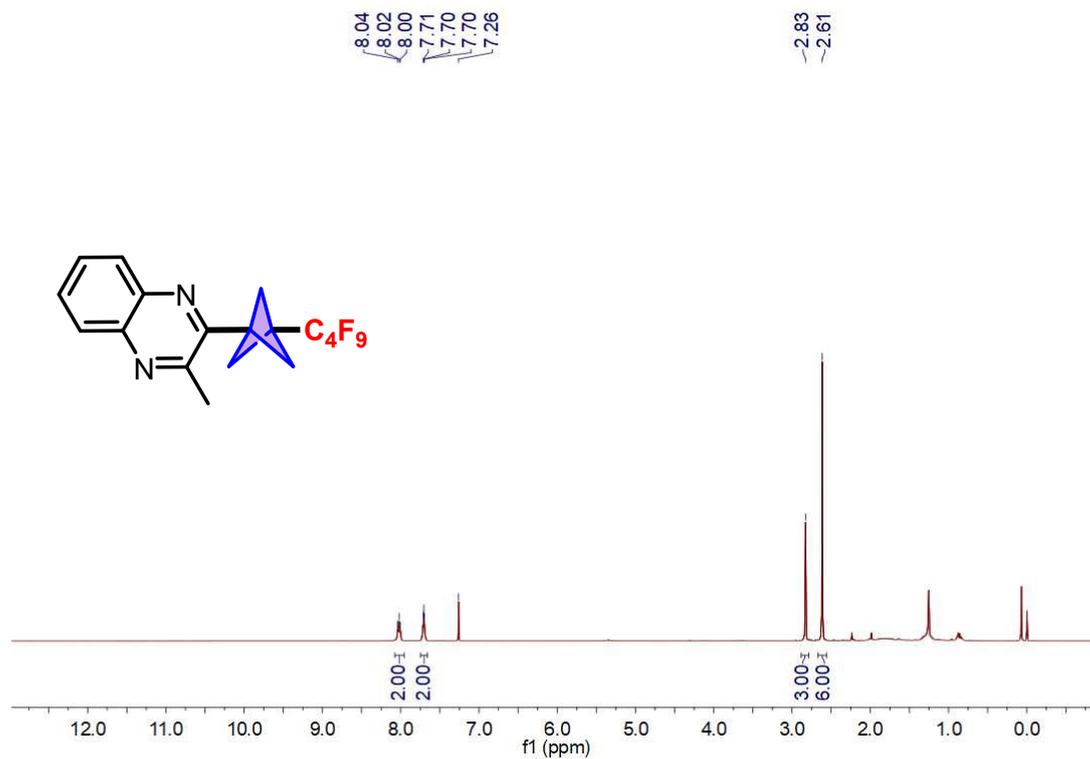
### 33 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



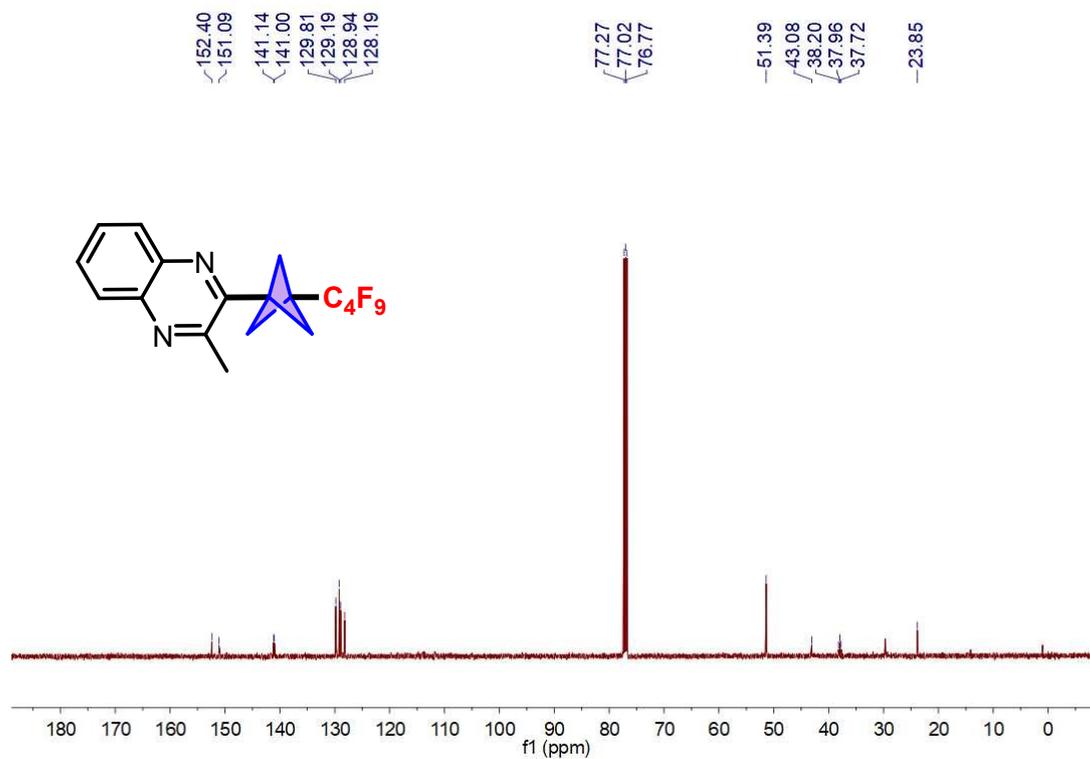
### 33 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



### 34 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )

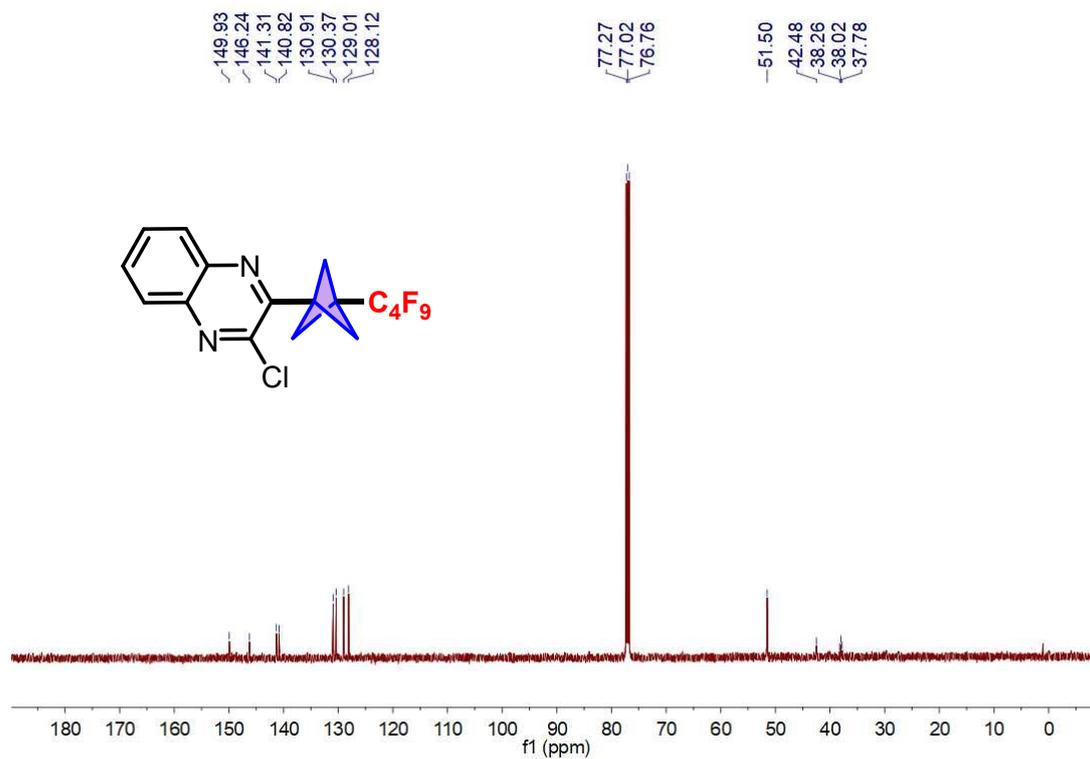


### 34 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )

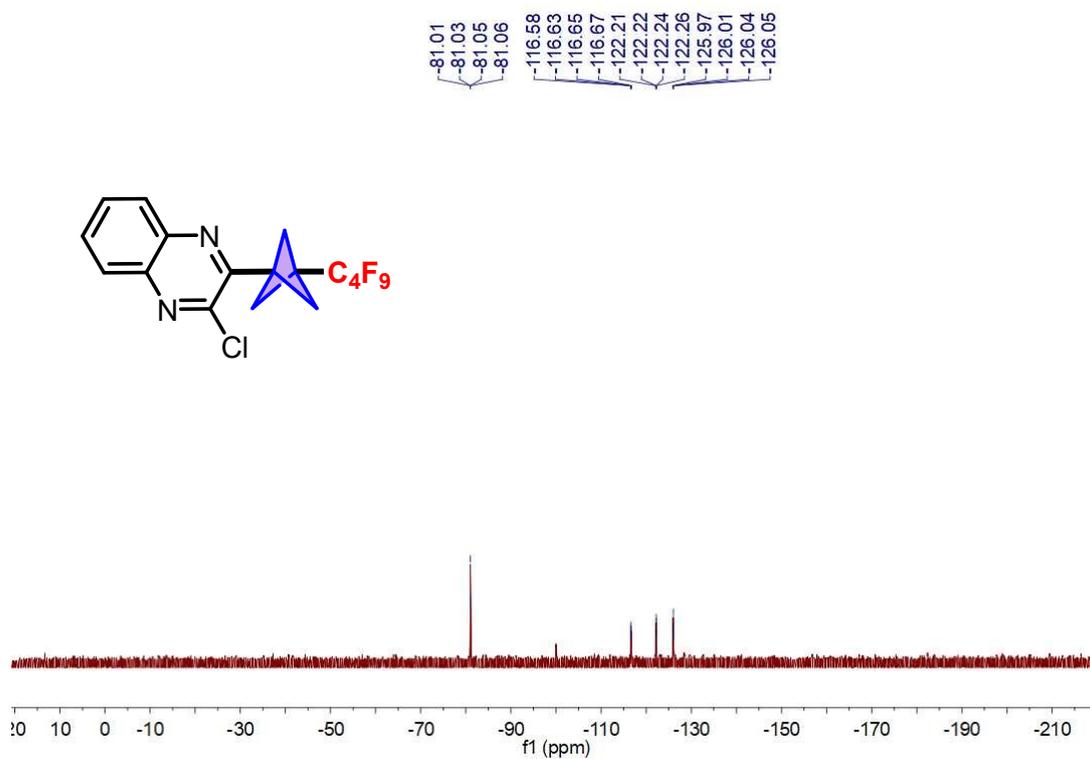




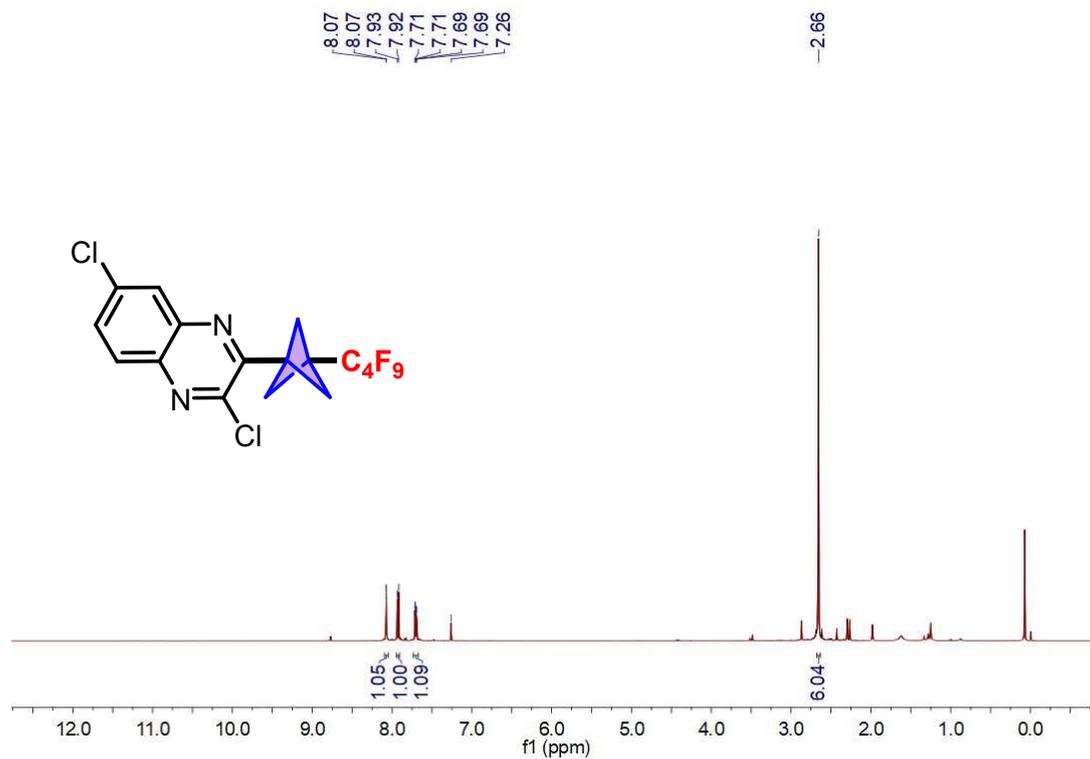
### 35 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



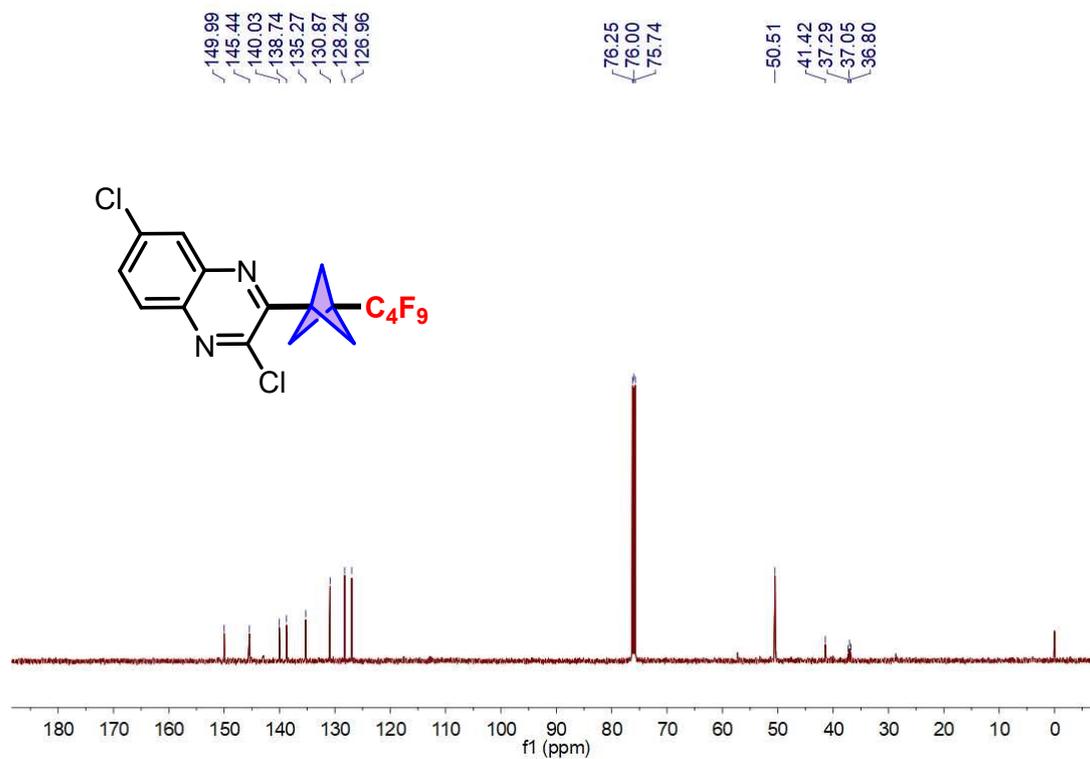
### 35 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



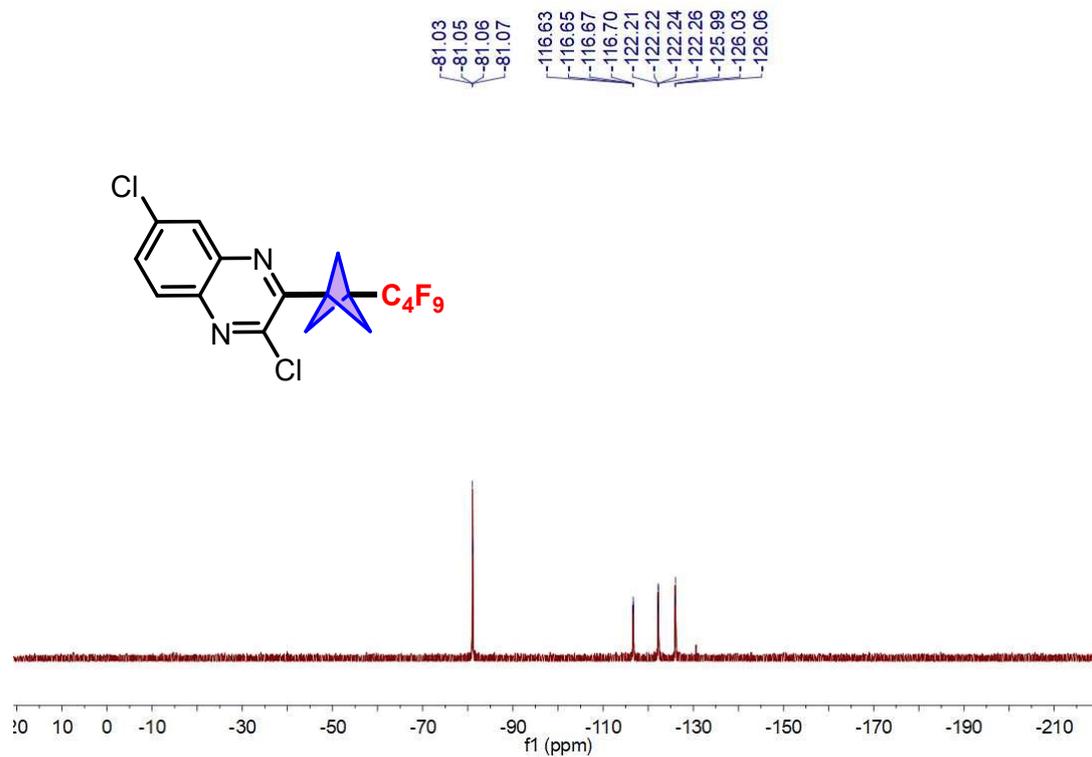
### 36 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



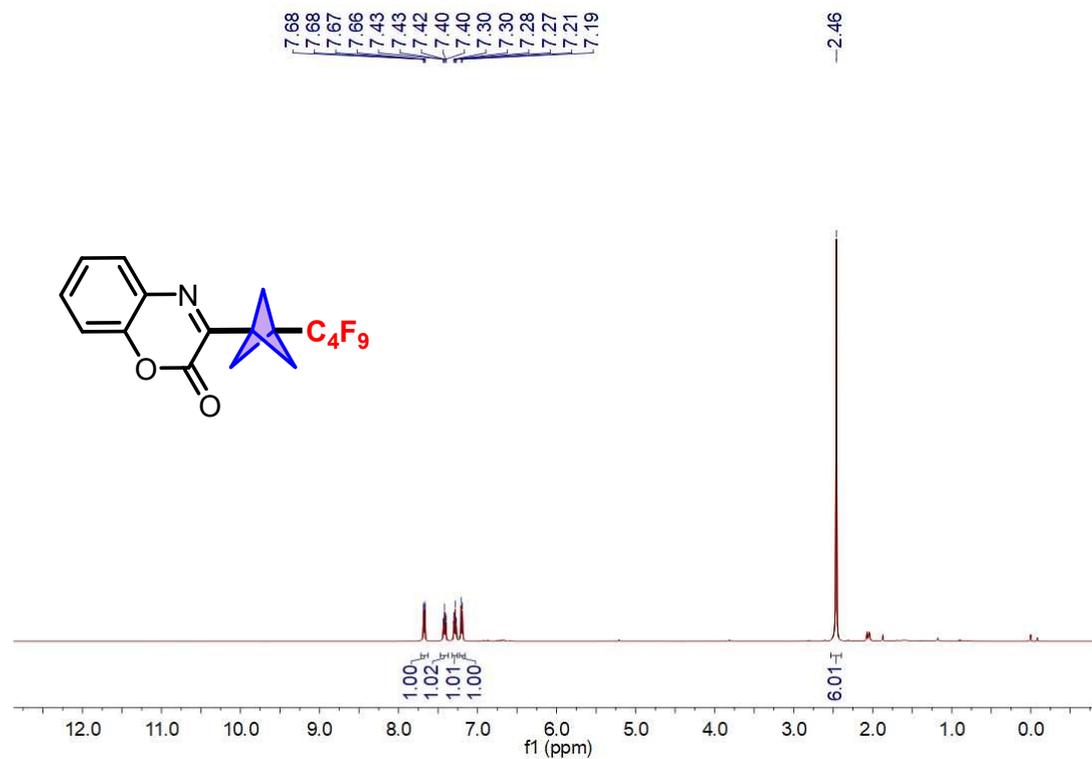
### 36 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



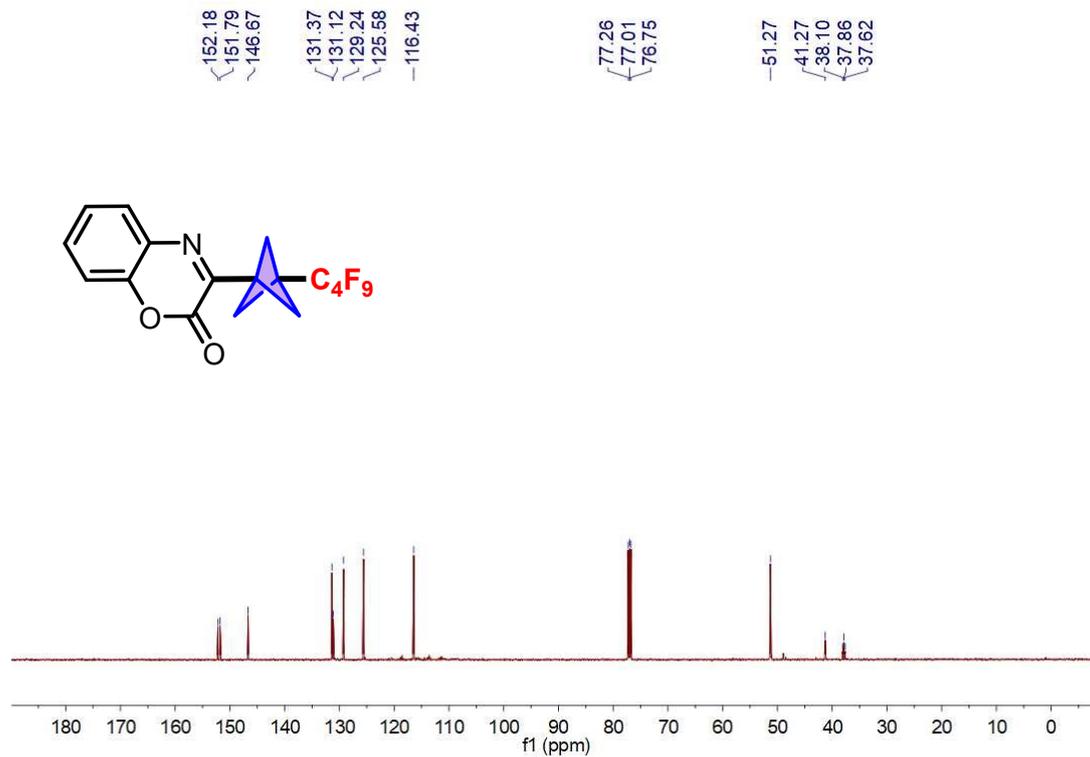
### 36 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



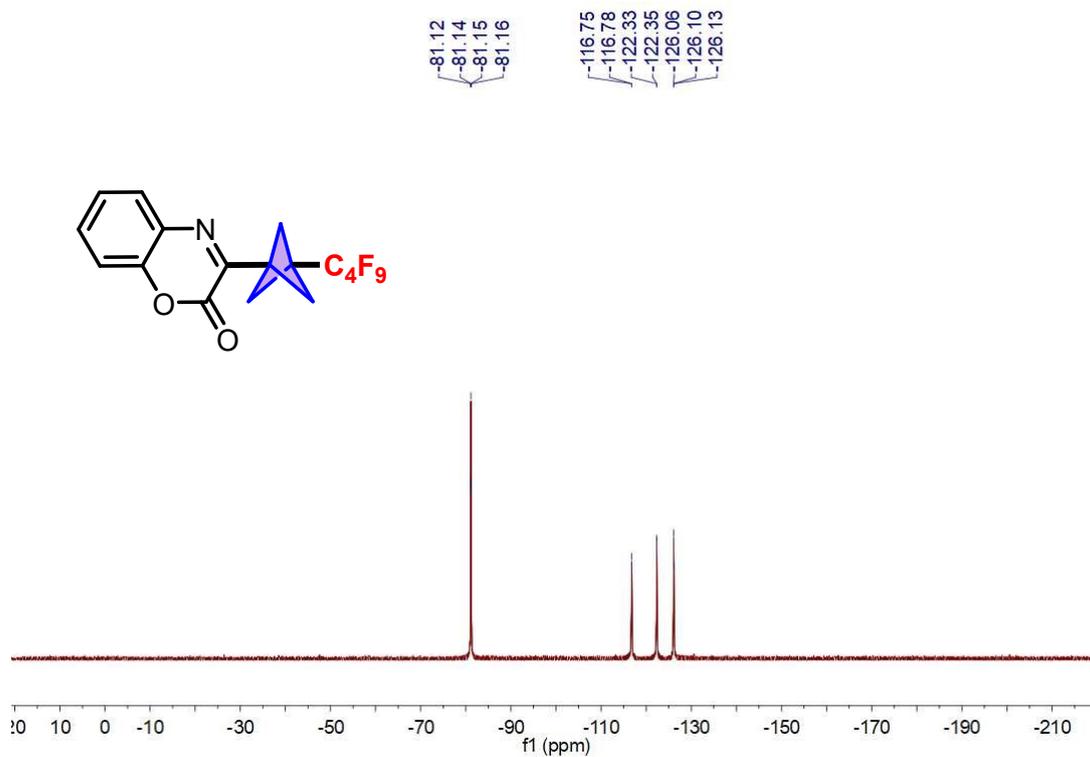
### 37 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



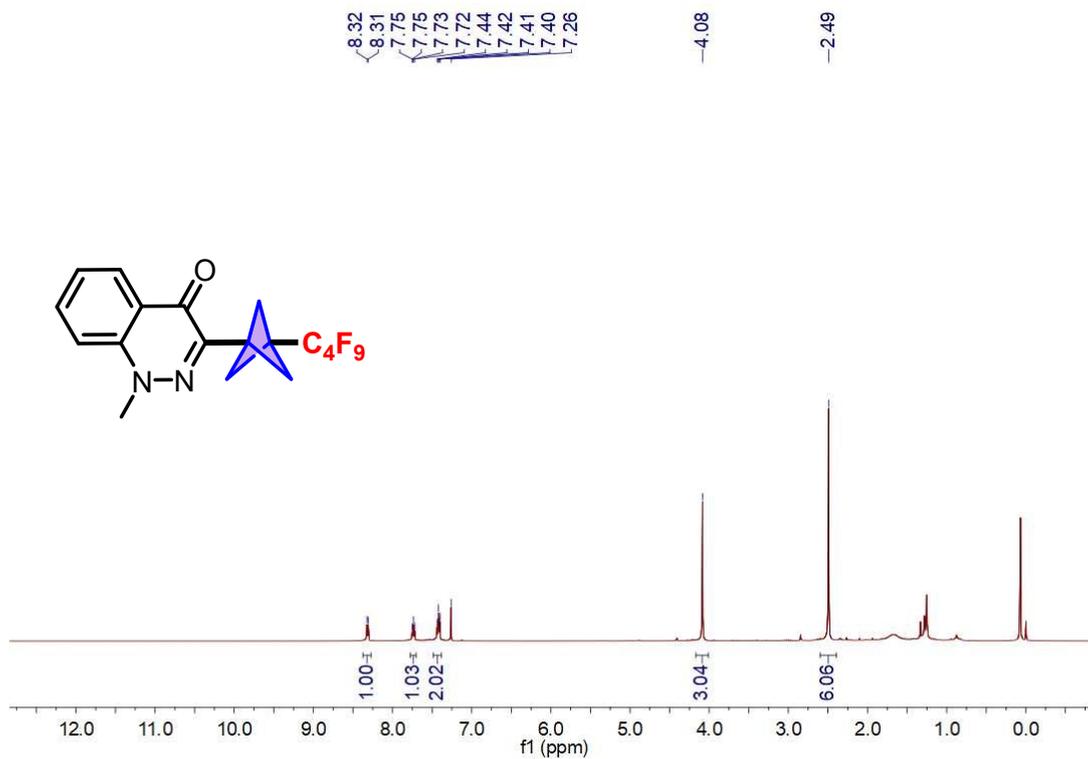
### 37 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



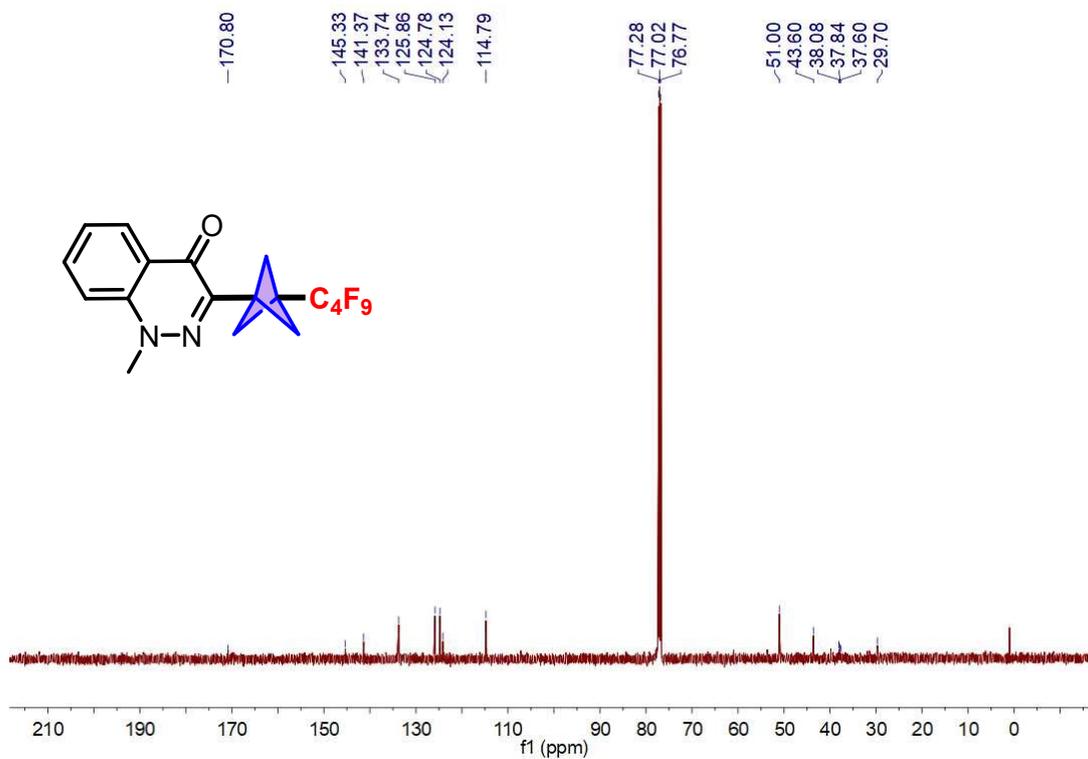
### 37 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



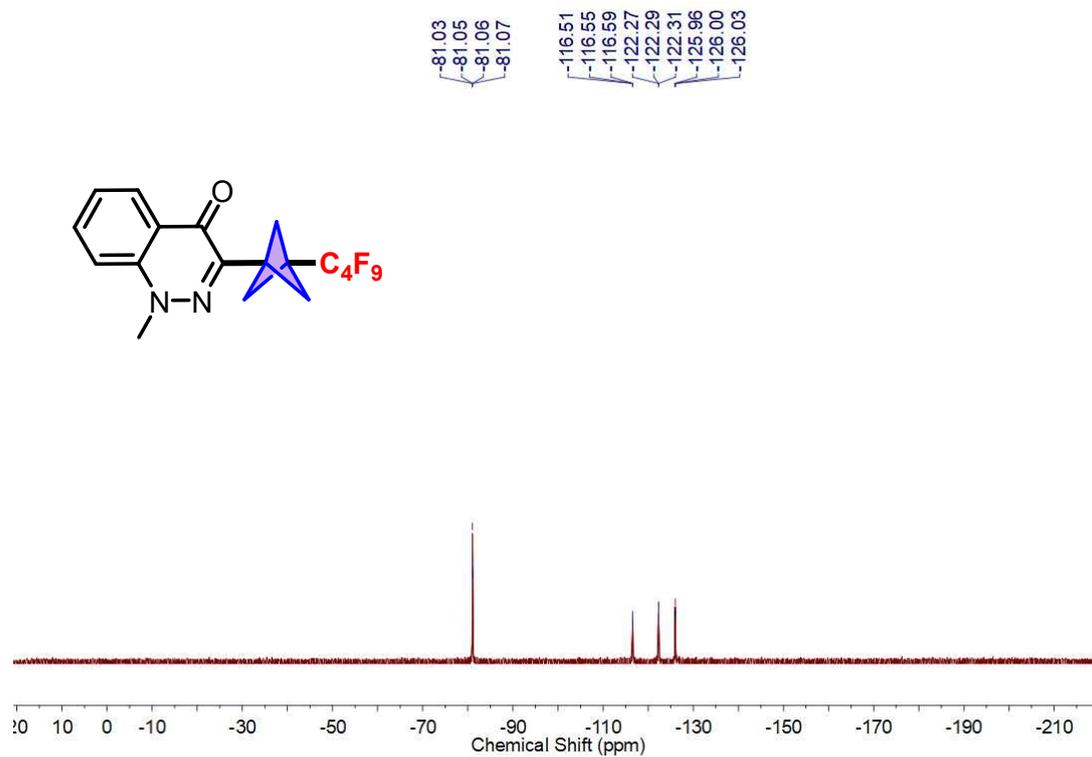
### 38 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



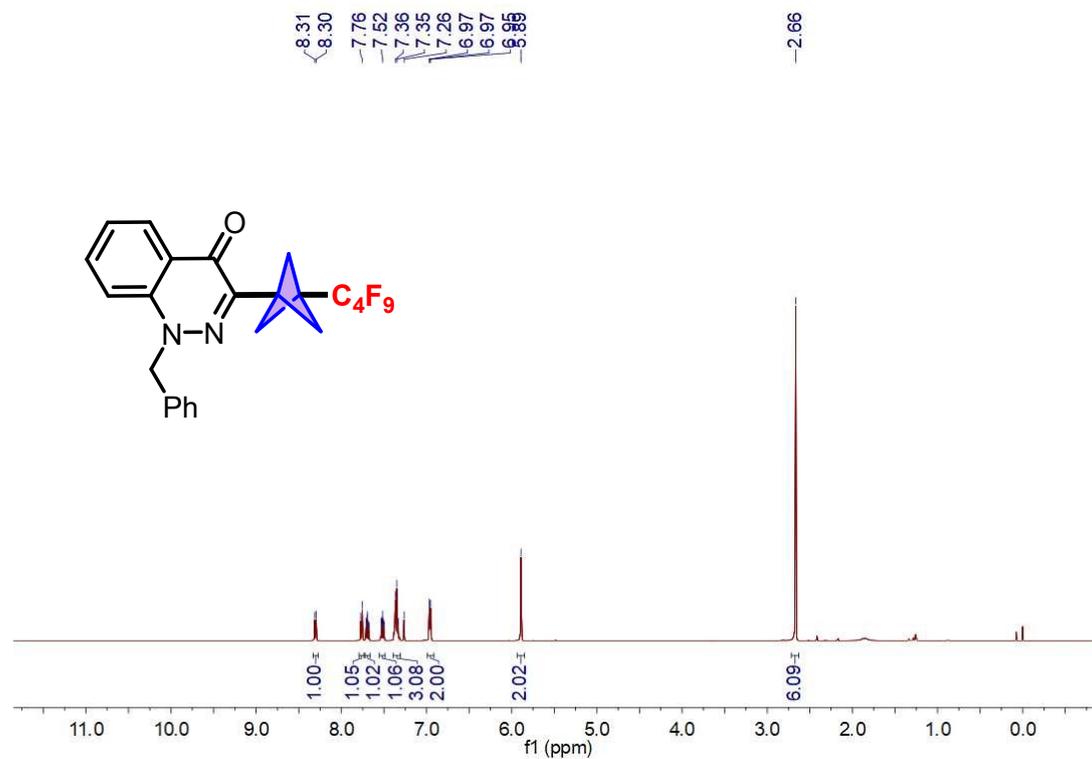
### 38 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



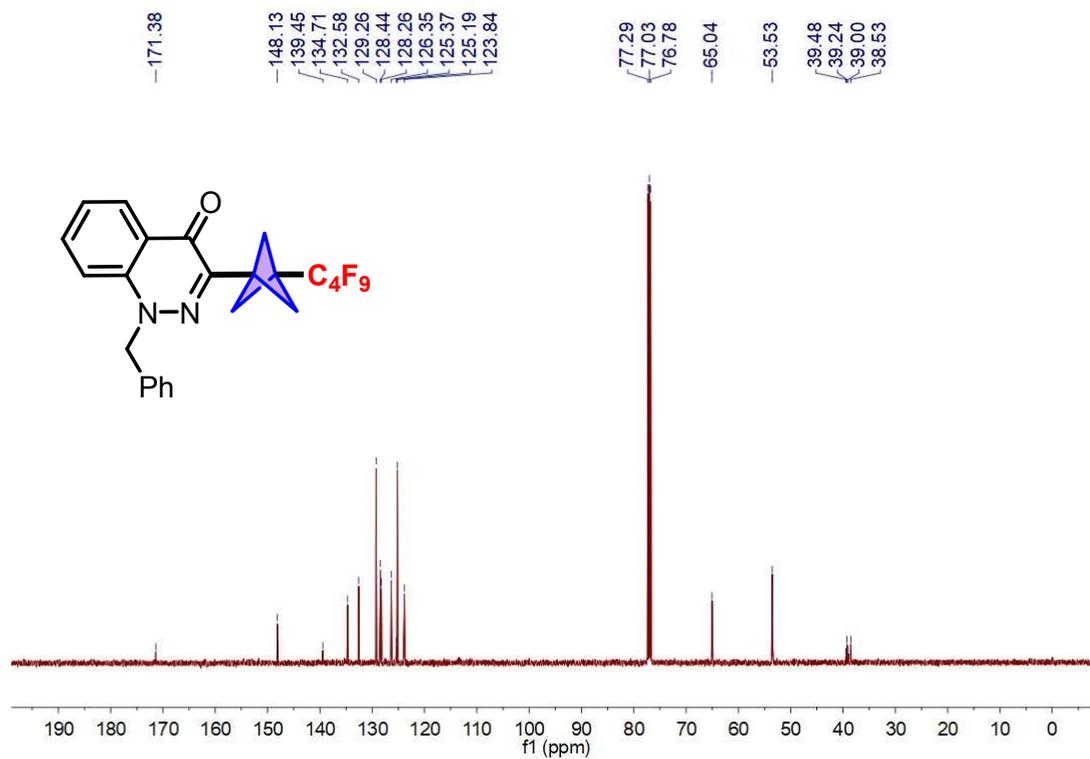
### 38 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



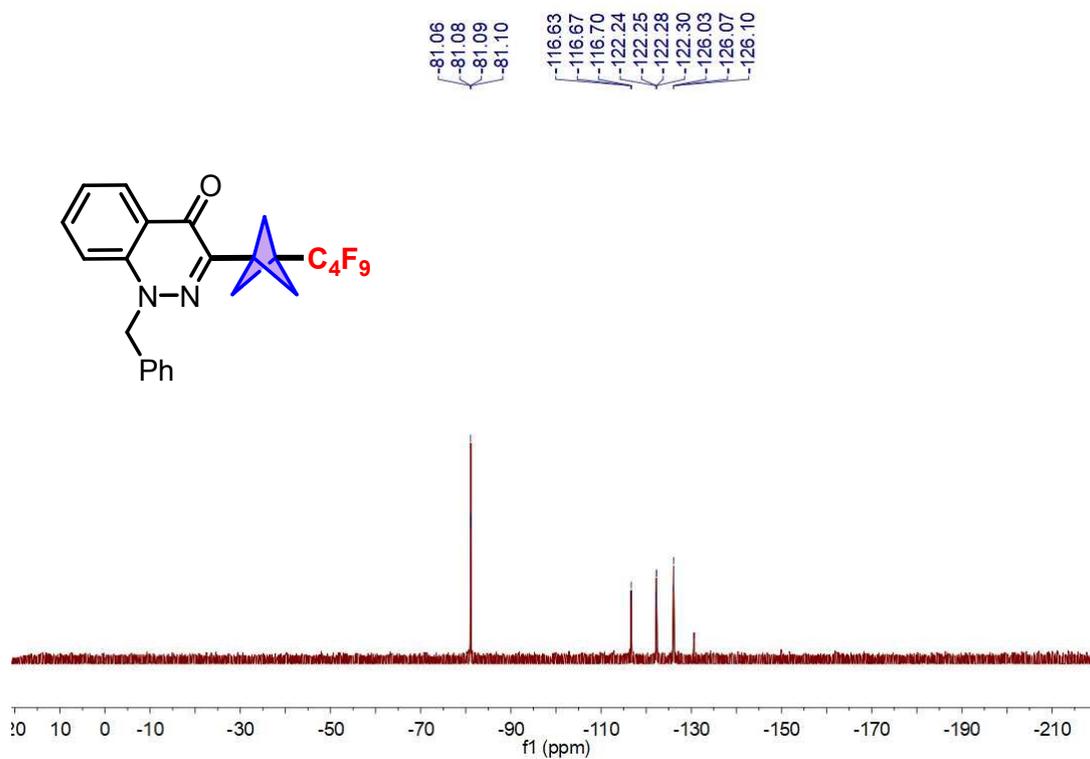
### 39 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



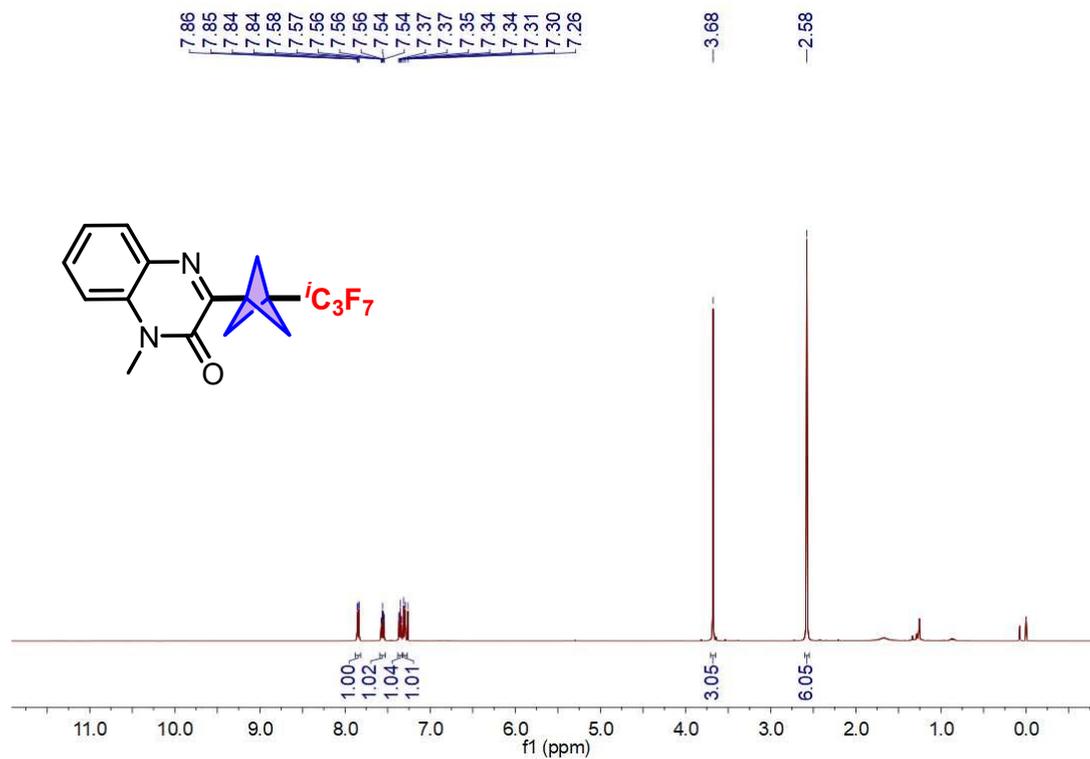
### 39 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



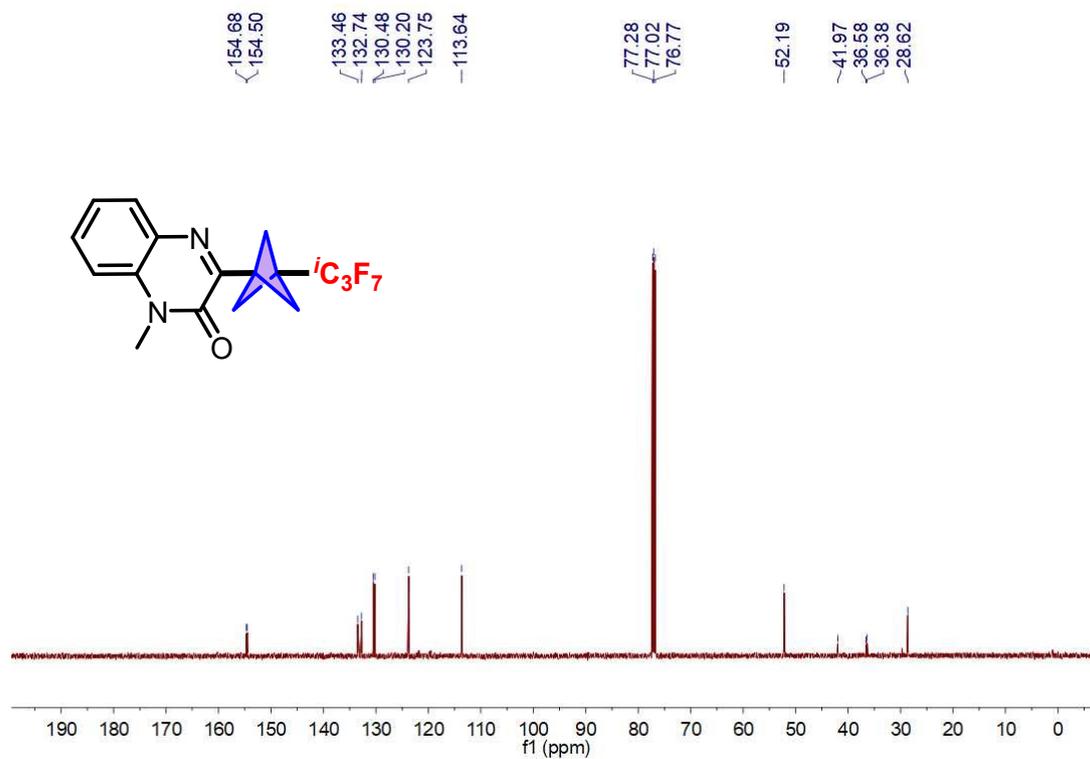
### 39 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



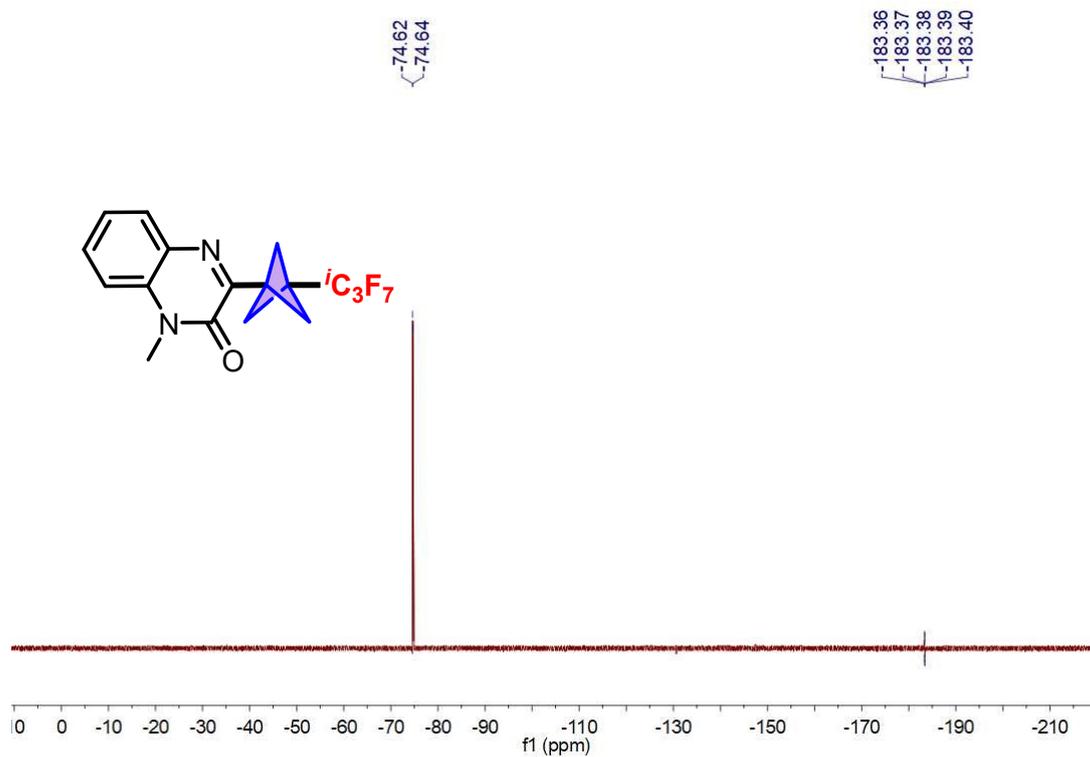
40 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



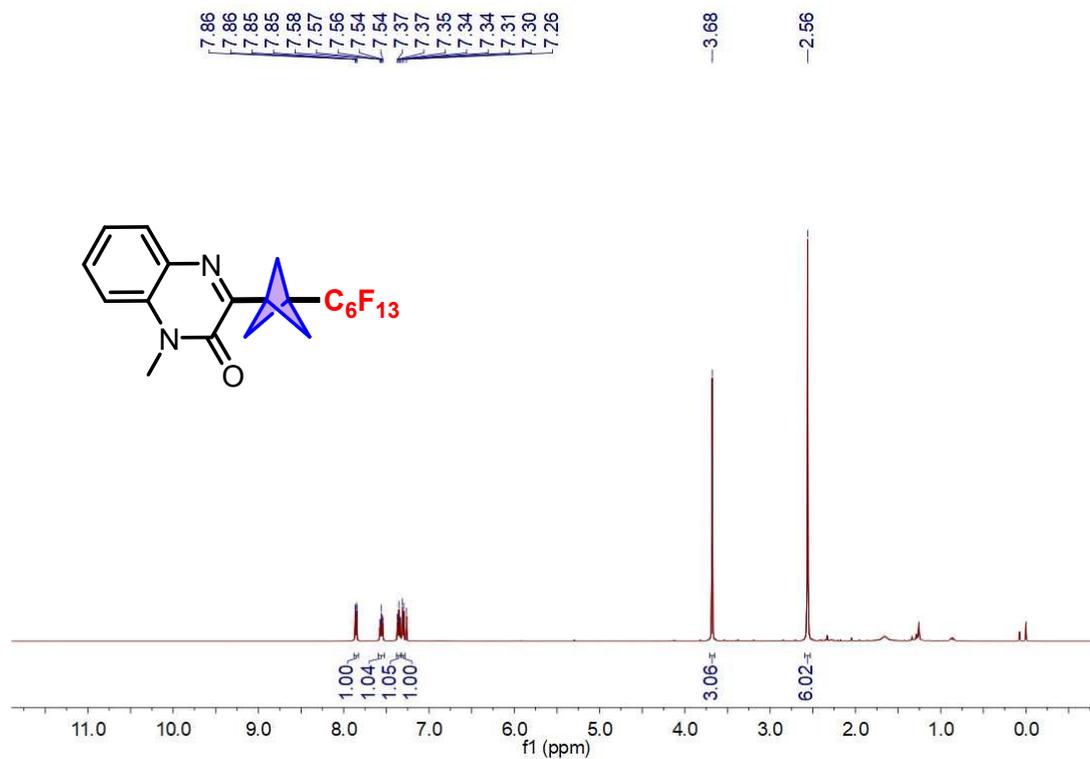
40 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



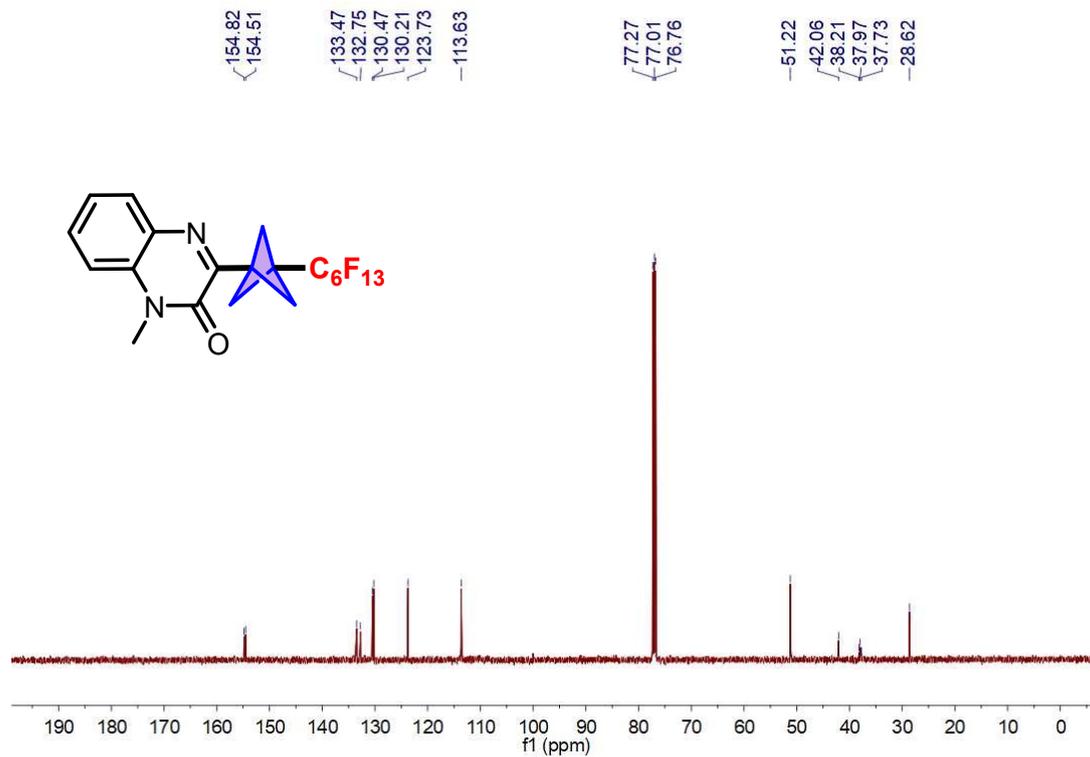
### 40 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



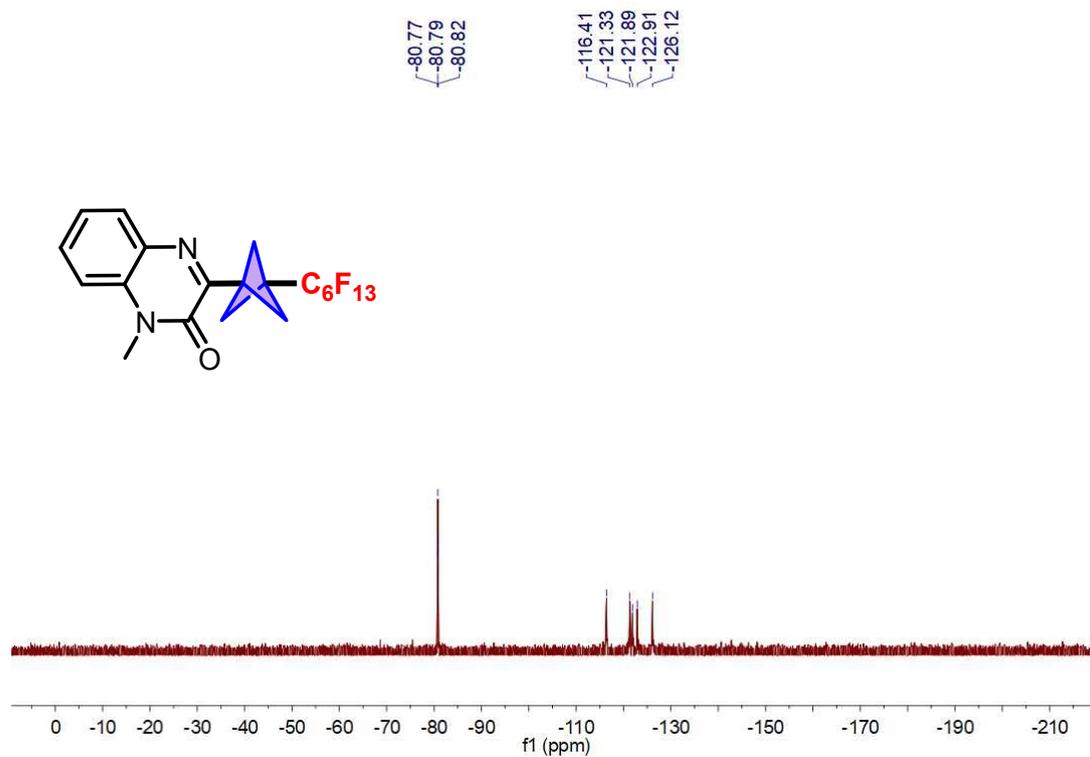
### 41 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



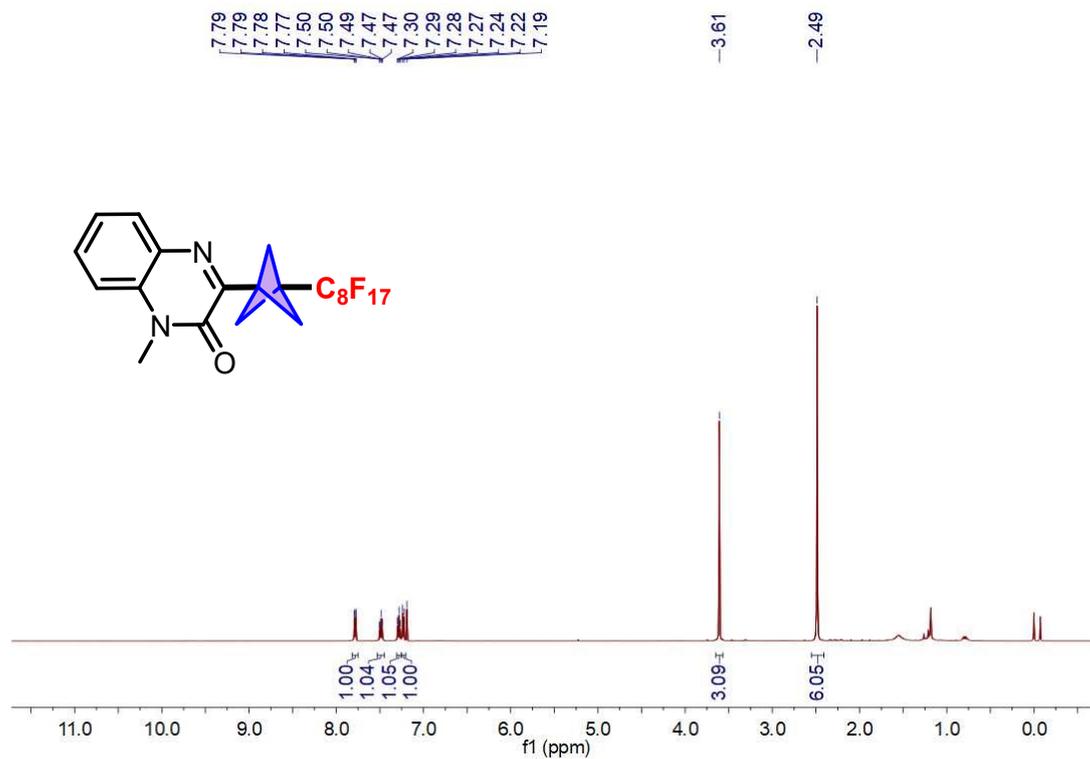
### 41 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



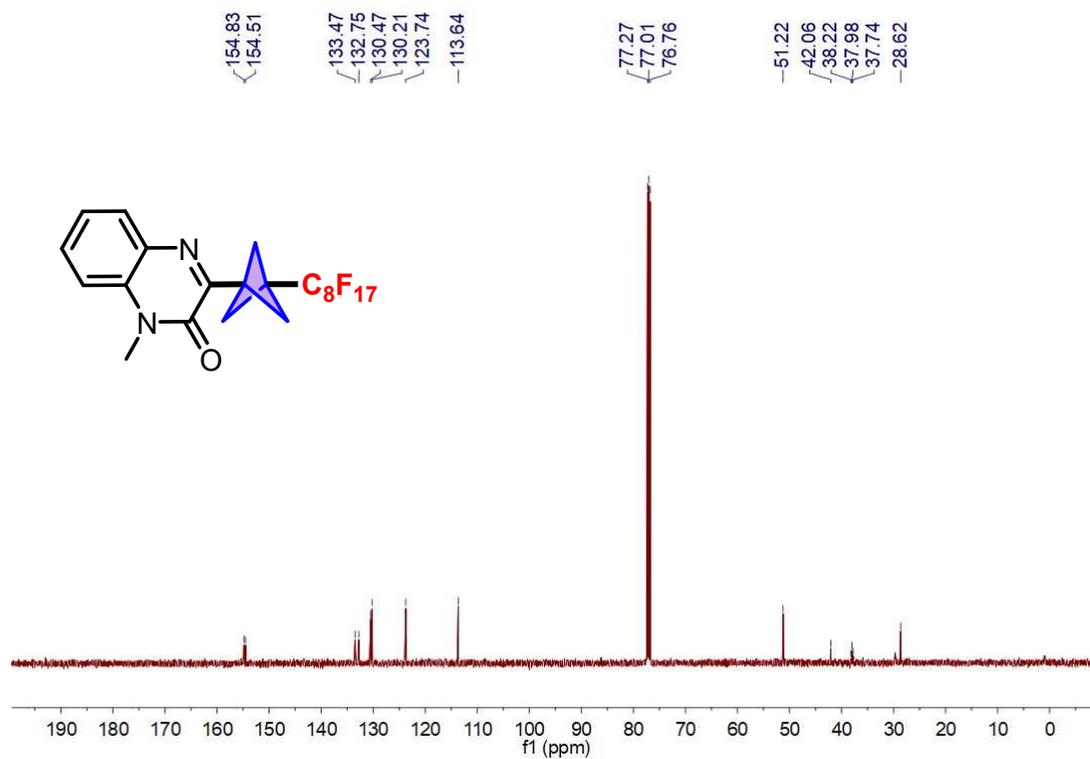
### 41 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



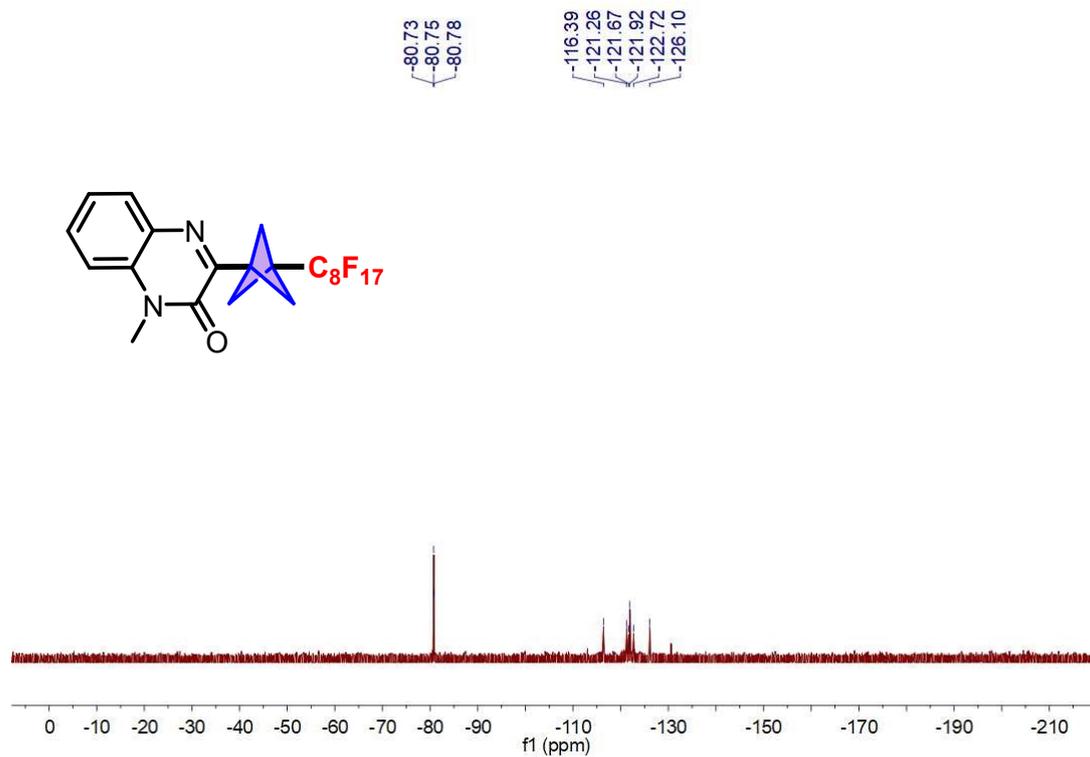
### 42 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



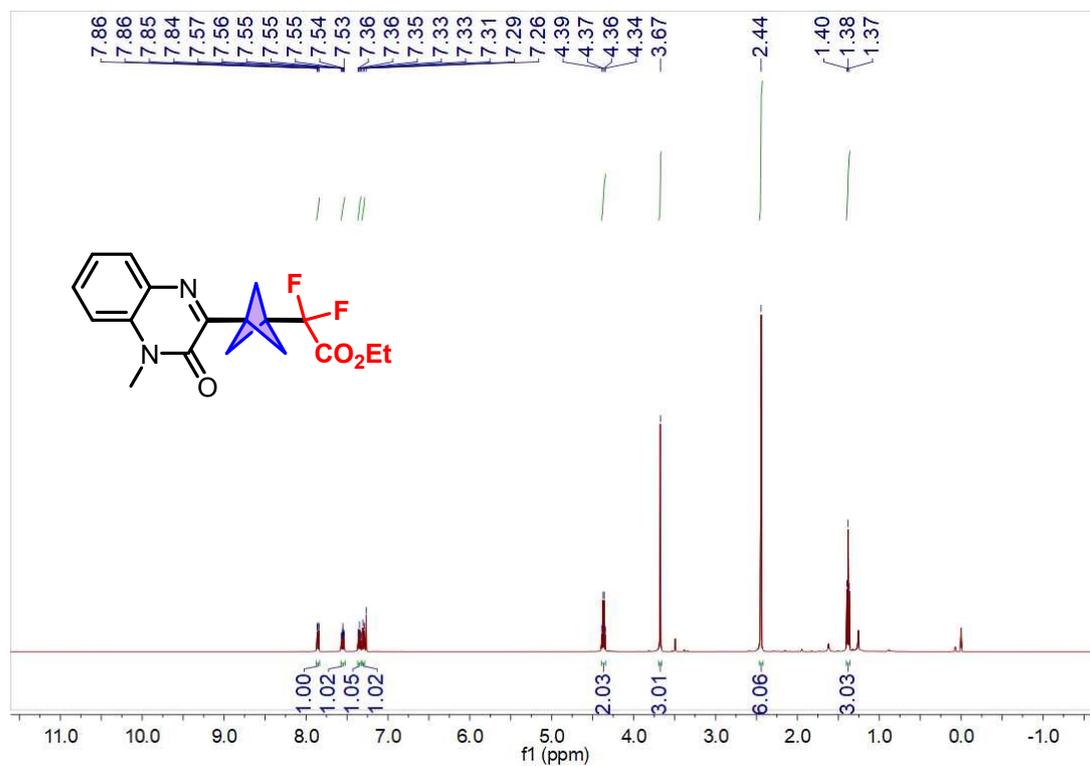
### 42 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



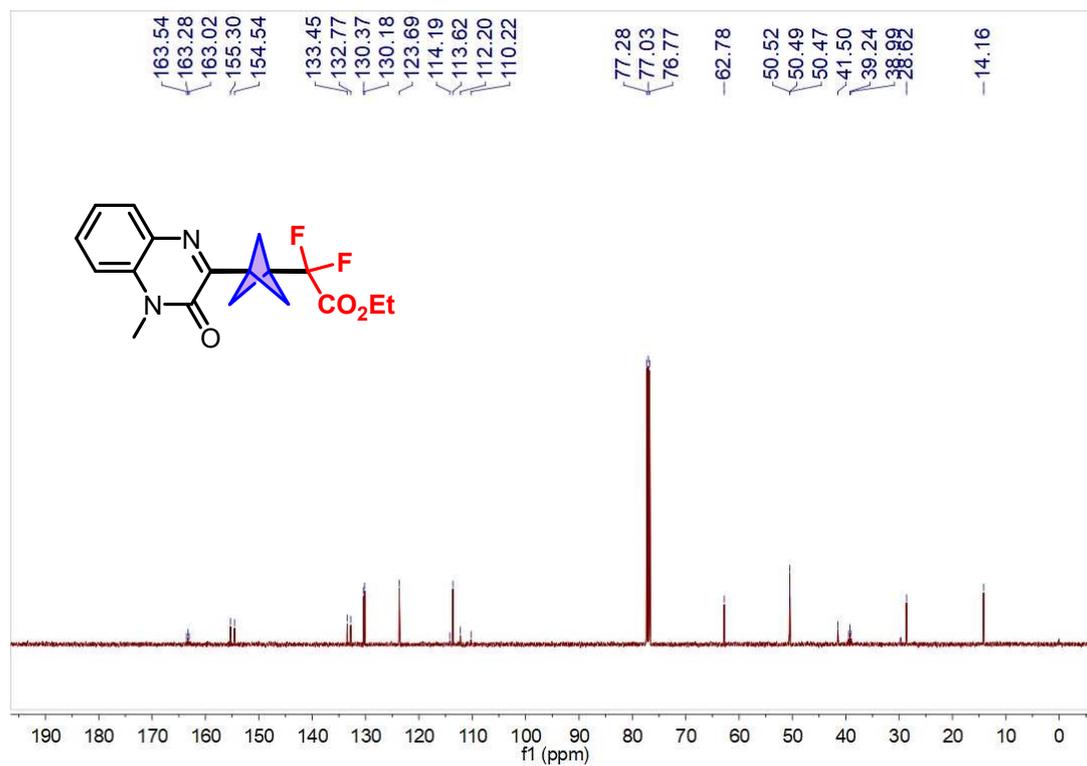
### 42 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



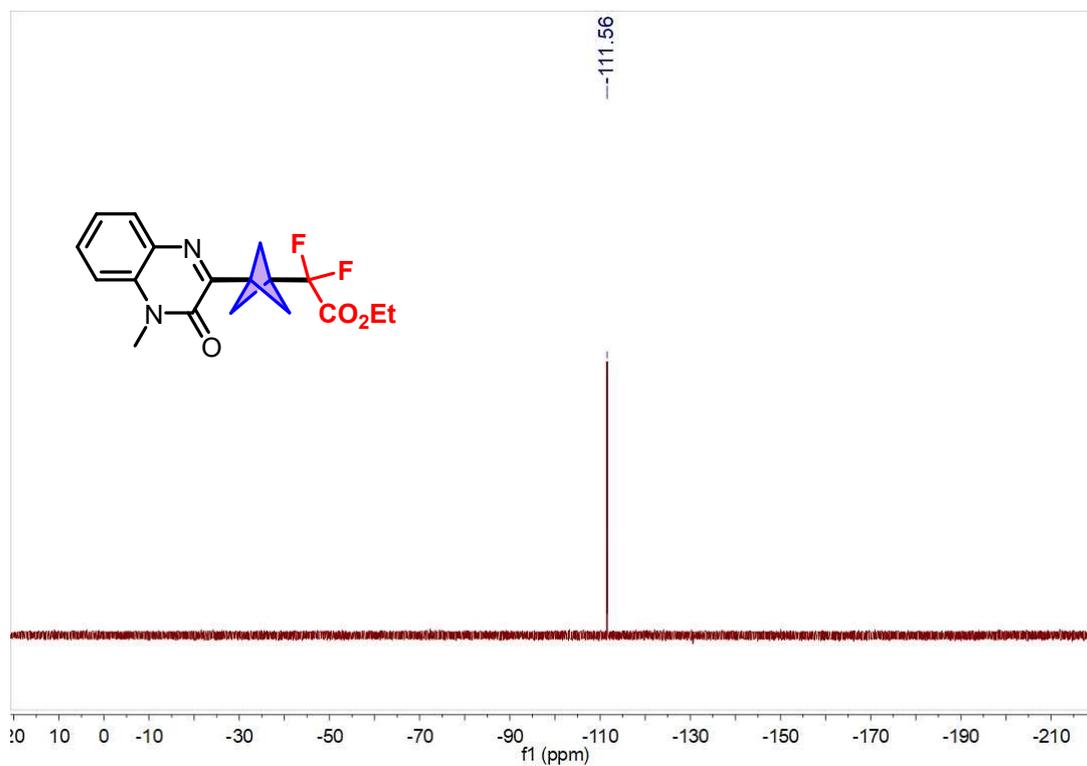
### 43 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



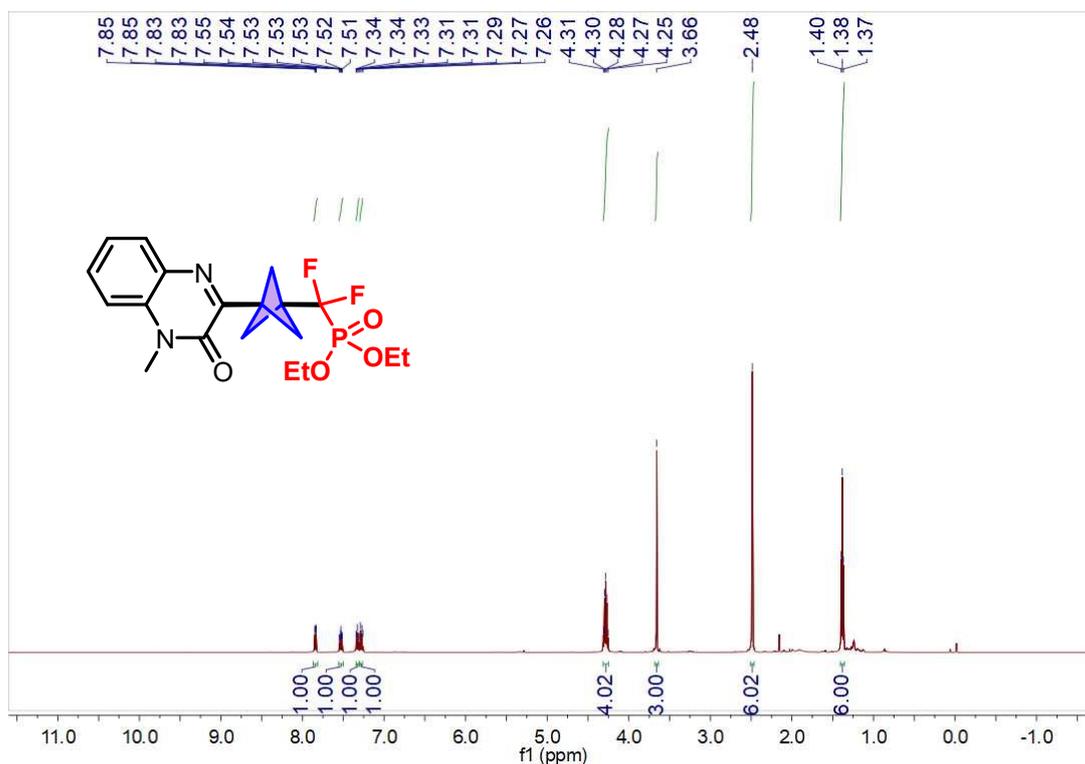
43  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



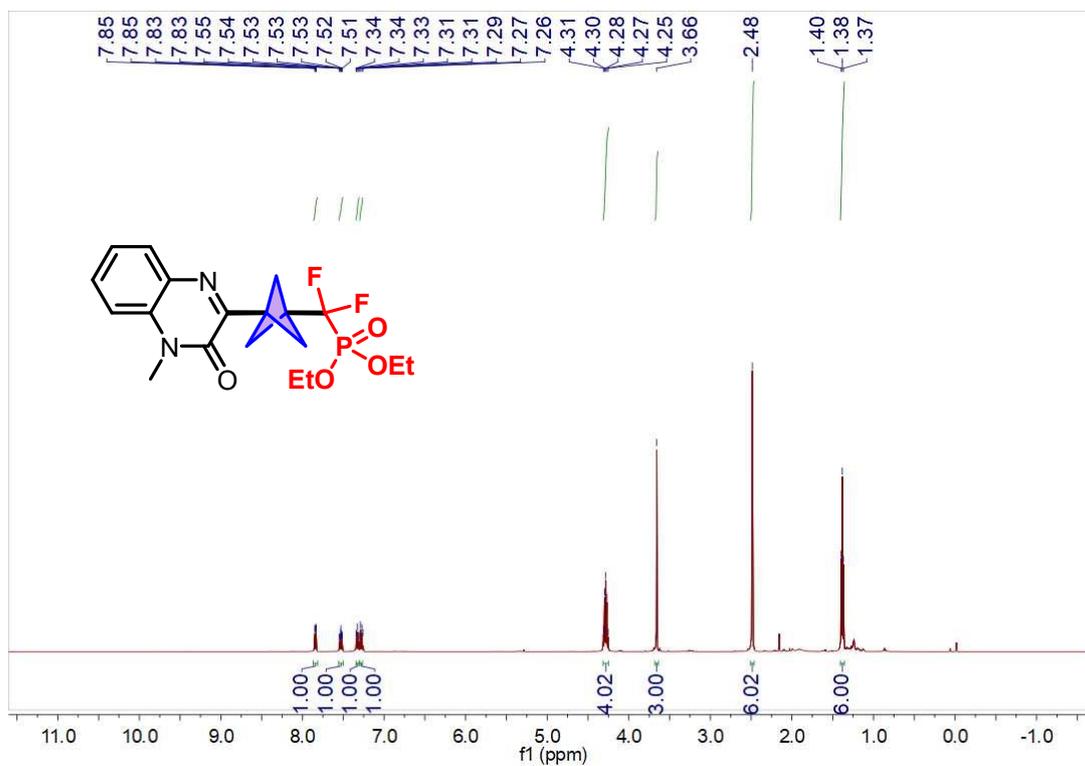
43  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



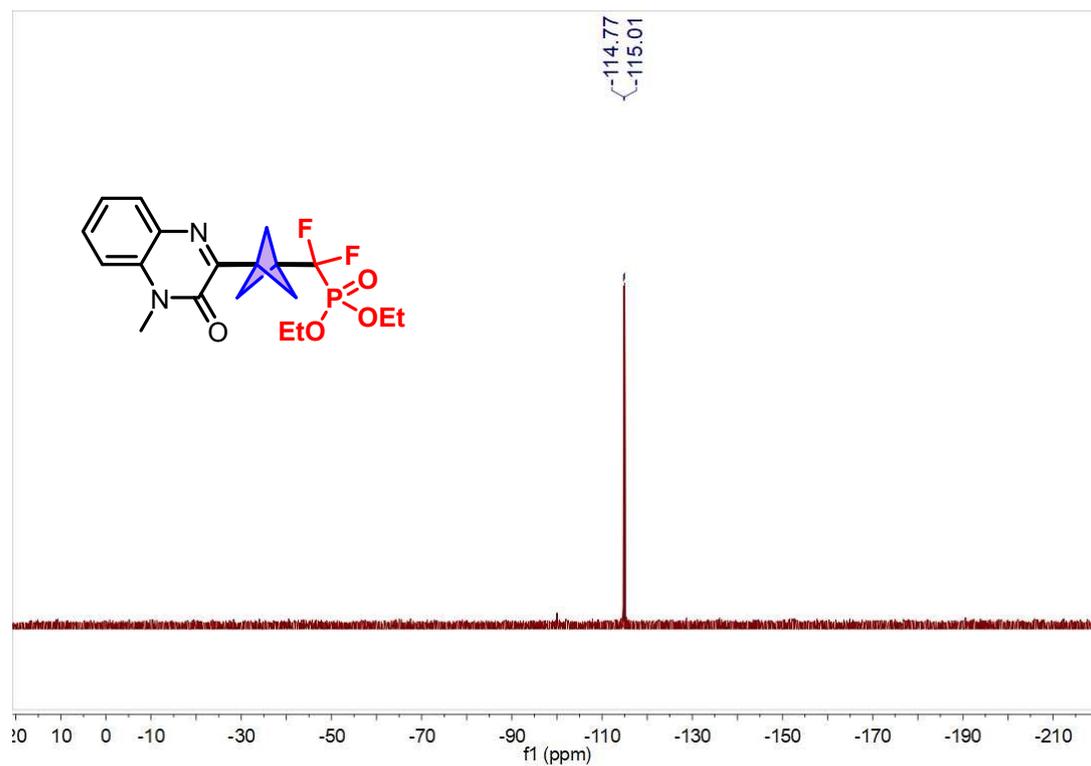
### 44 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



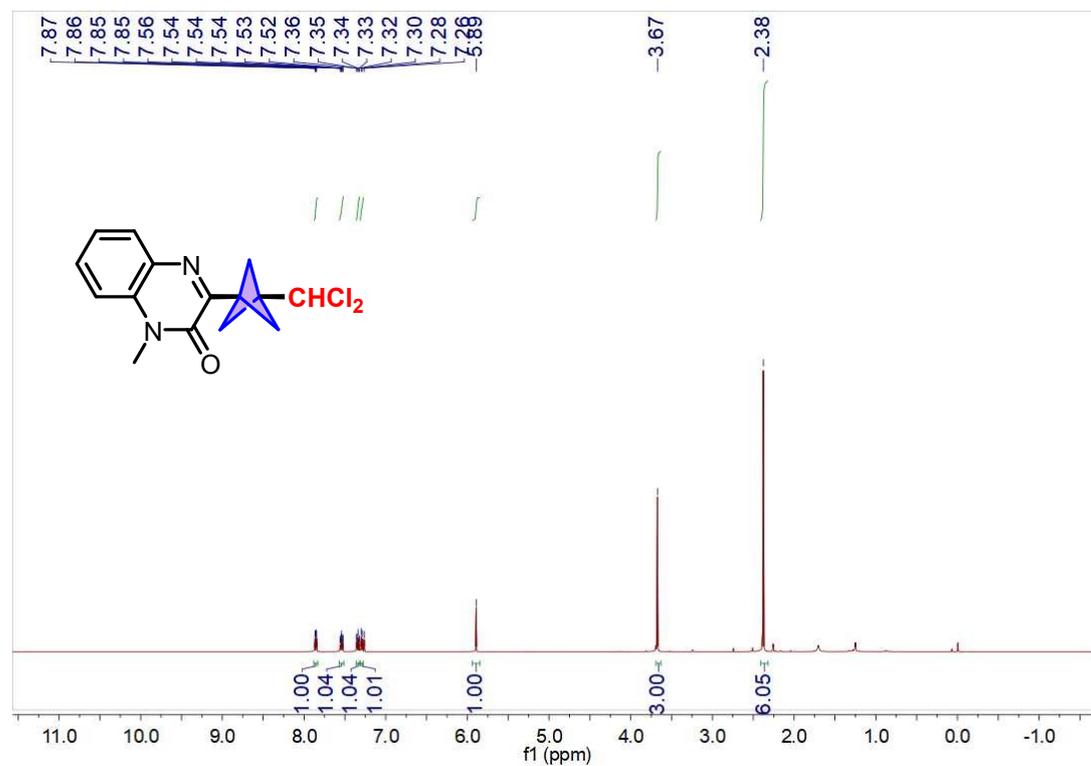
### 44 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



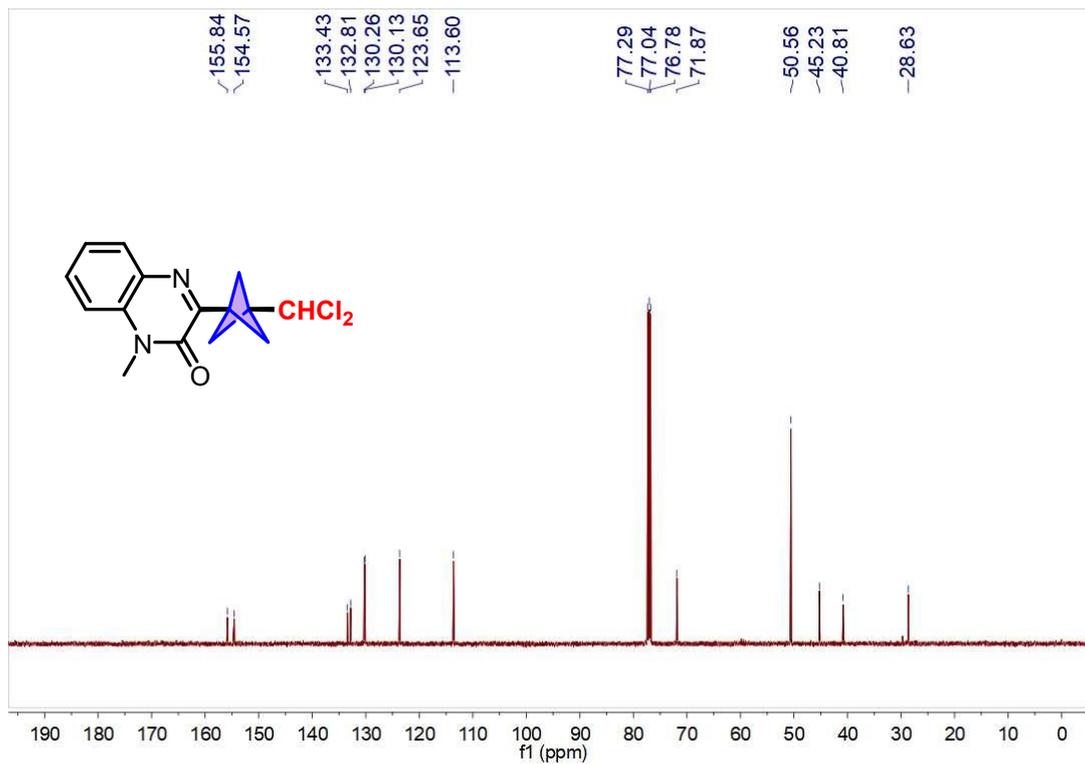
#### 44 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



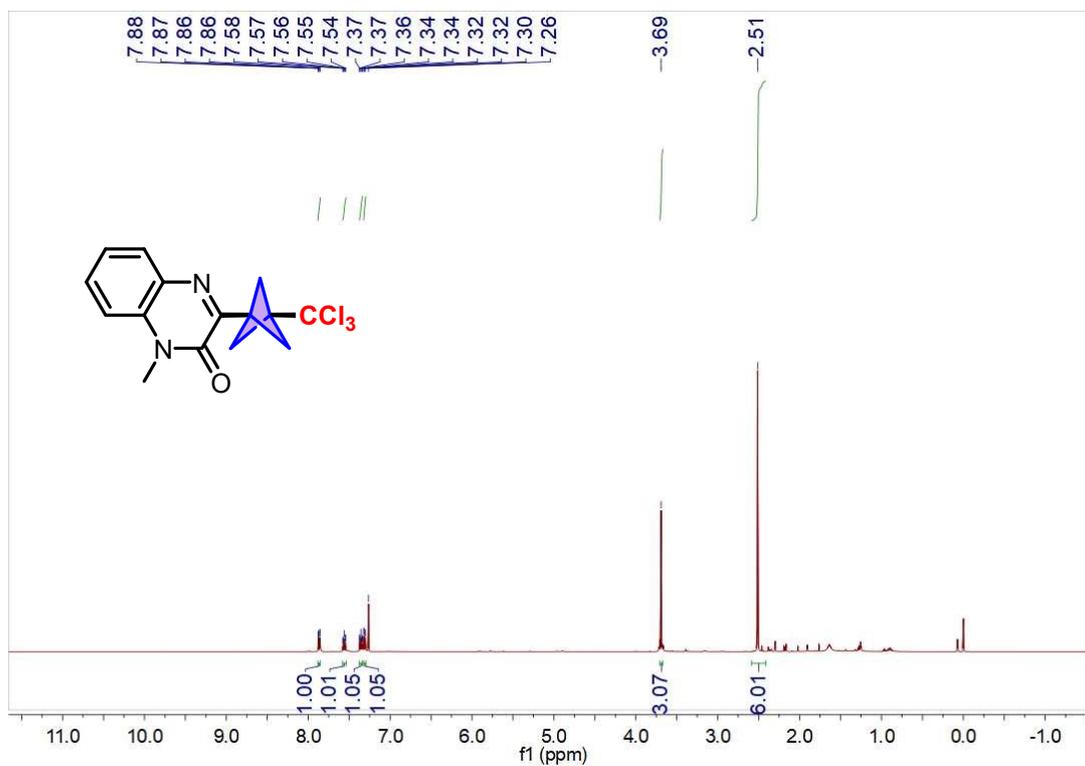
#### 45 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



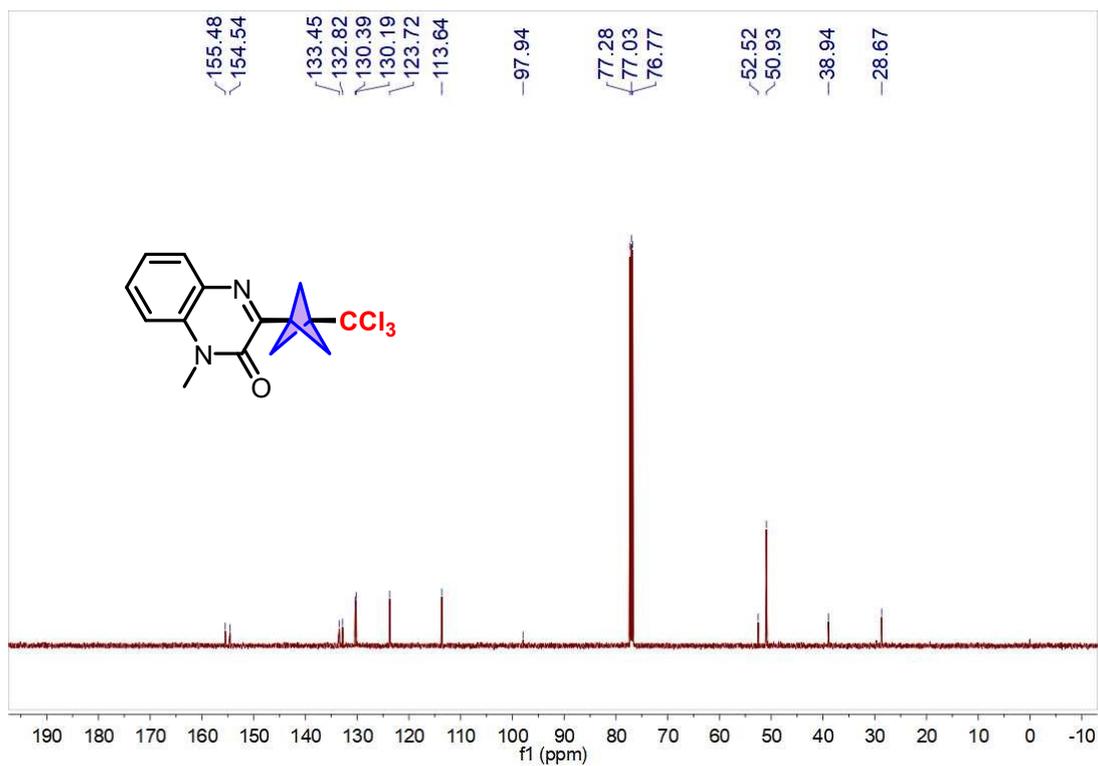
45  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



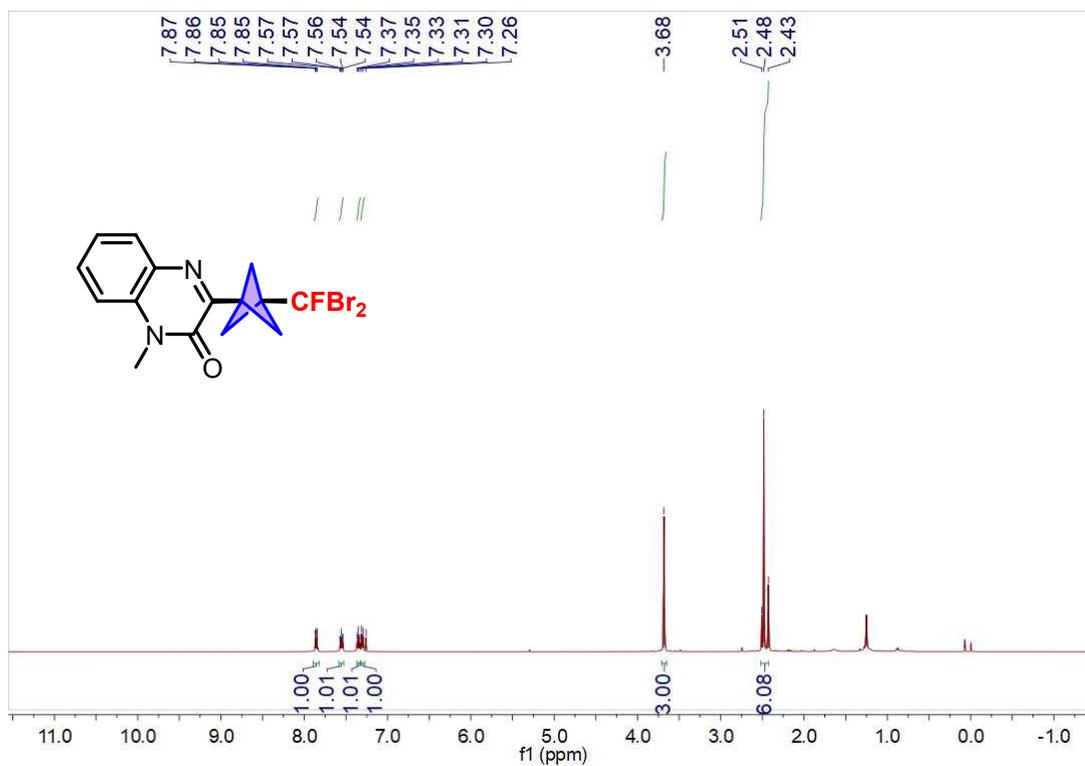
46  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



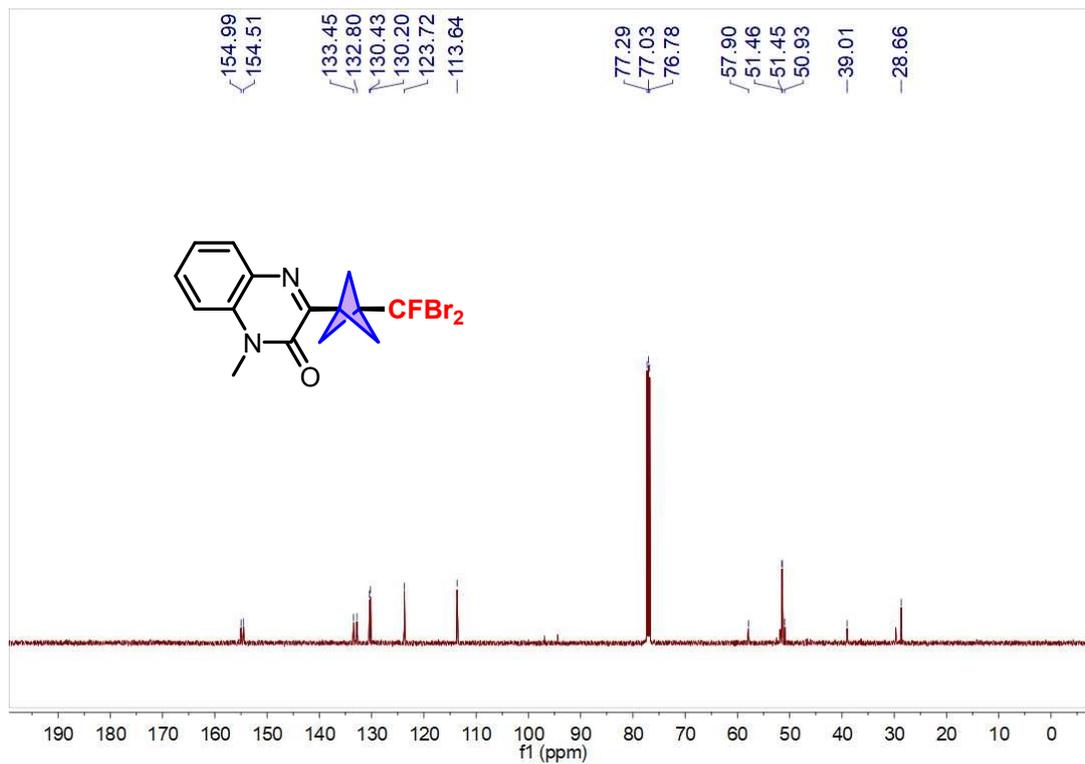
46  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



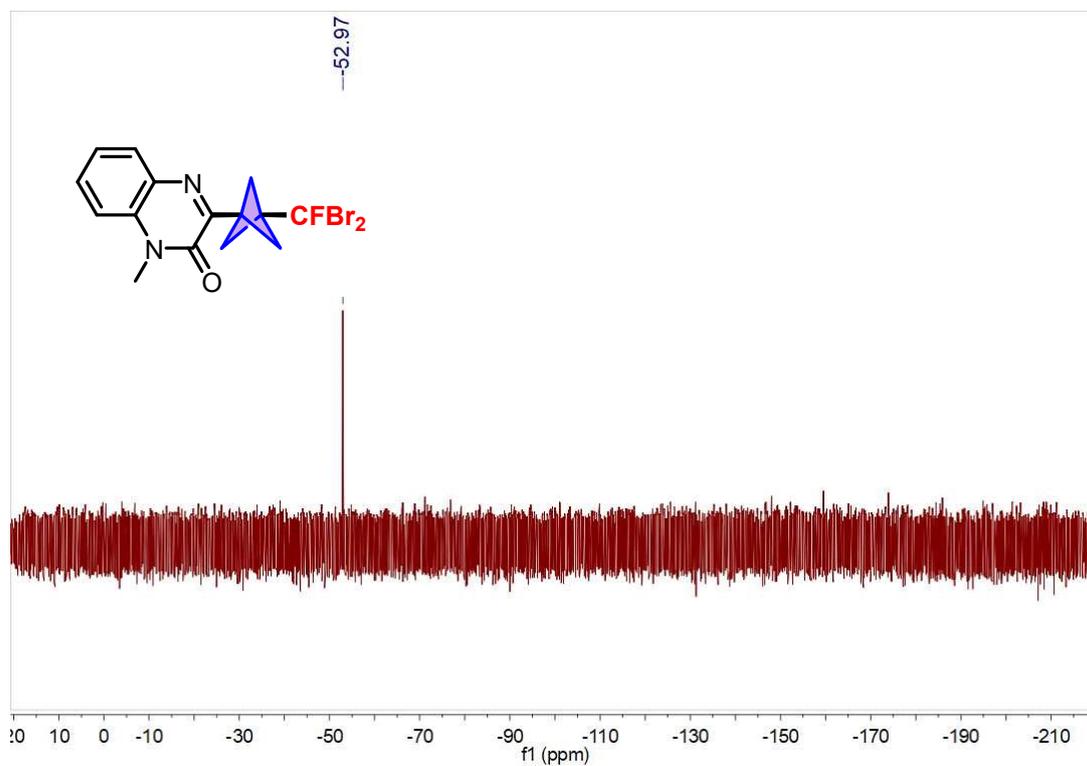
47  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



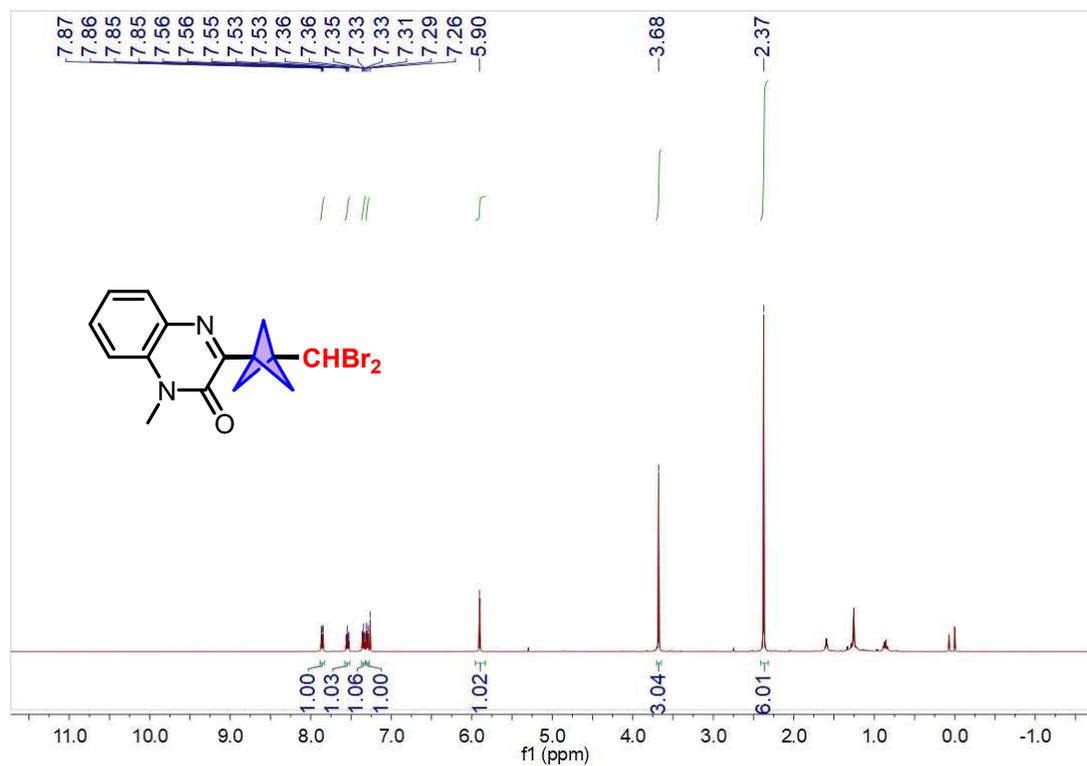
47 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



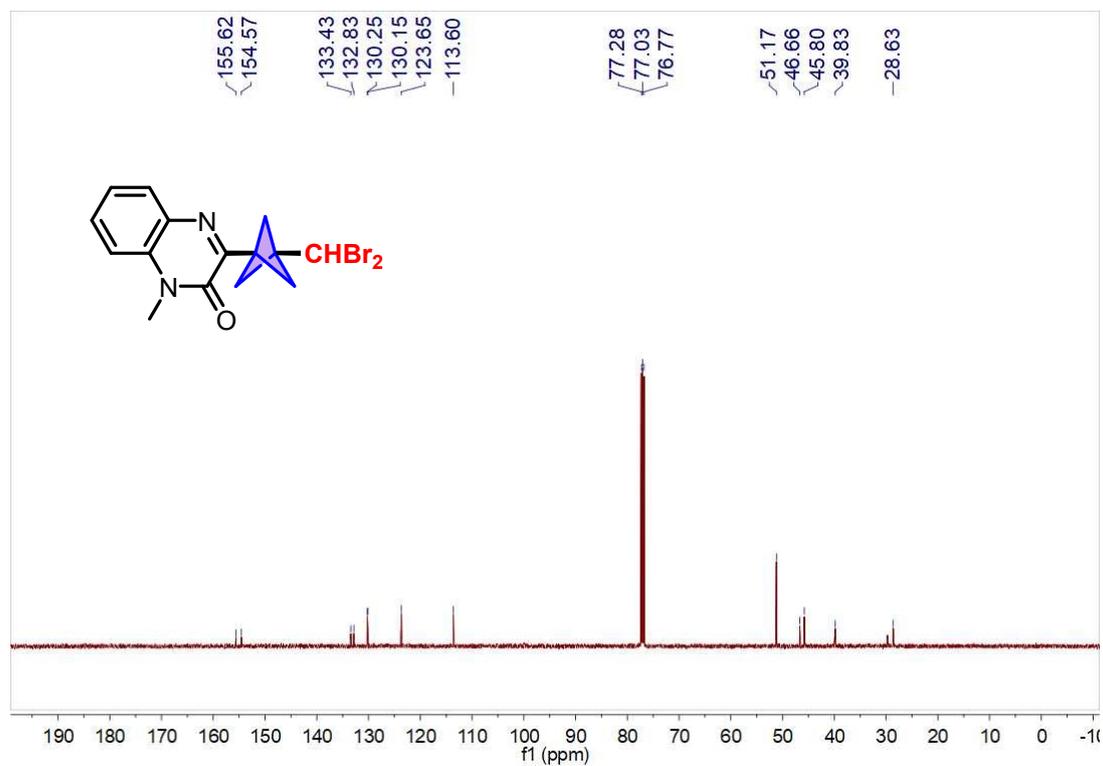
47 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



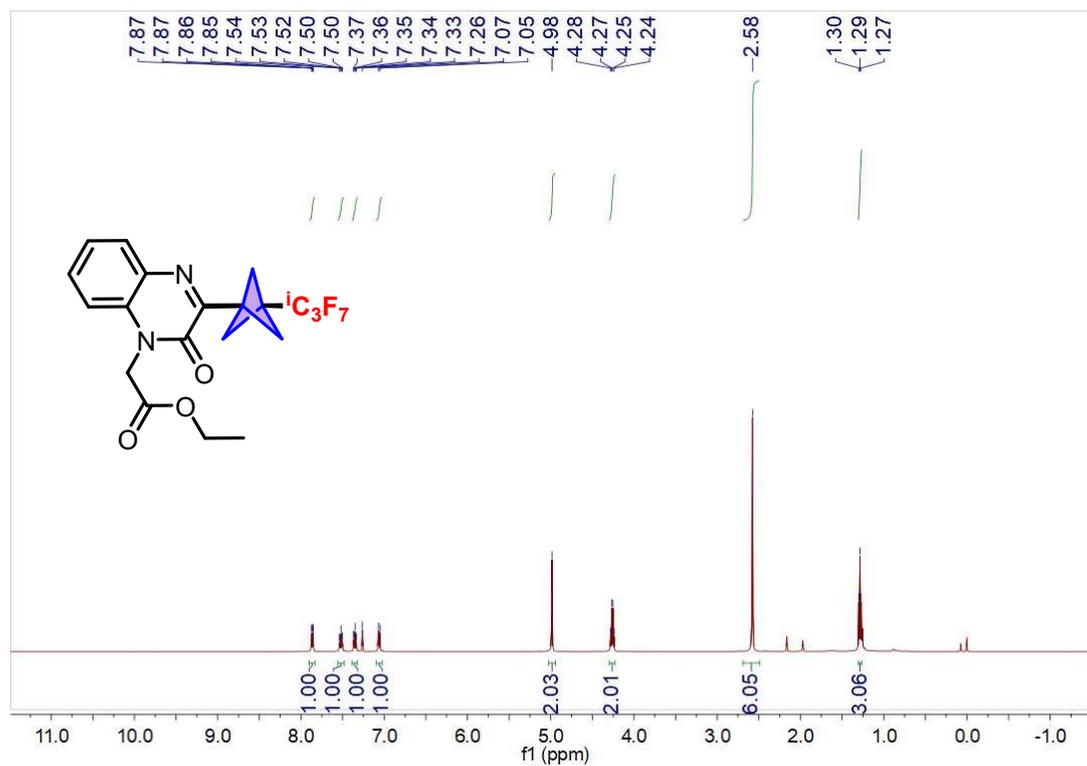
### 48 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



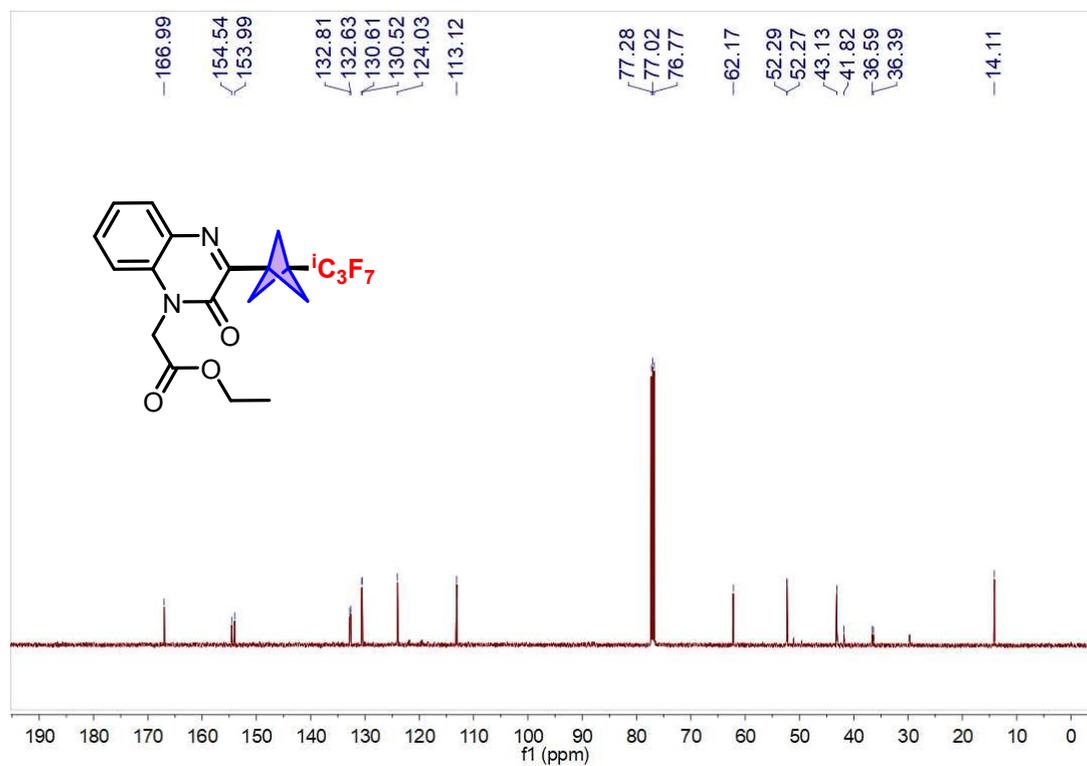
### 48 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



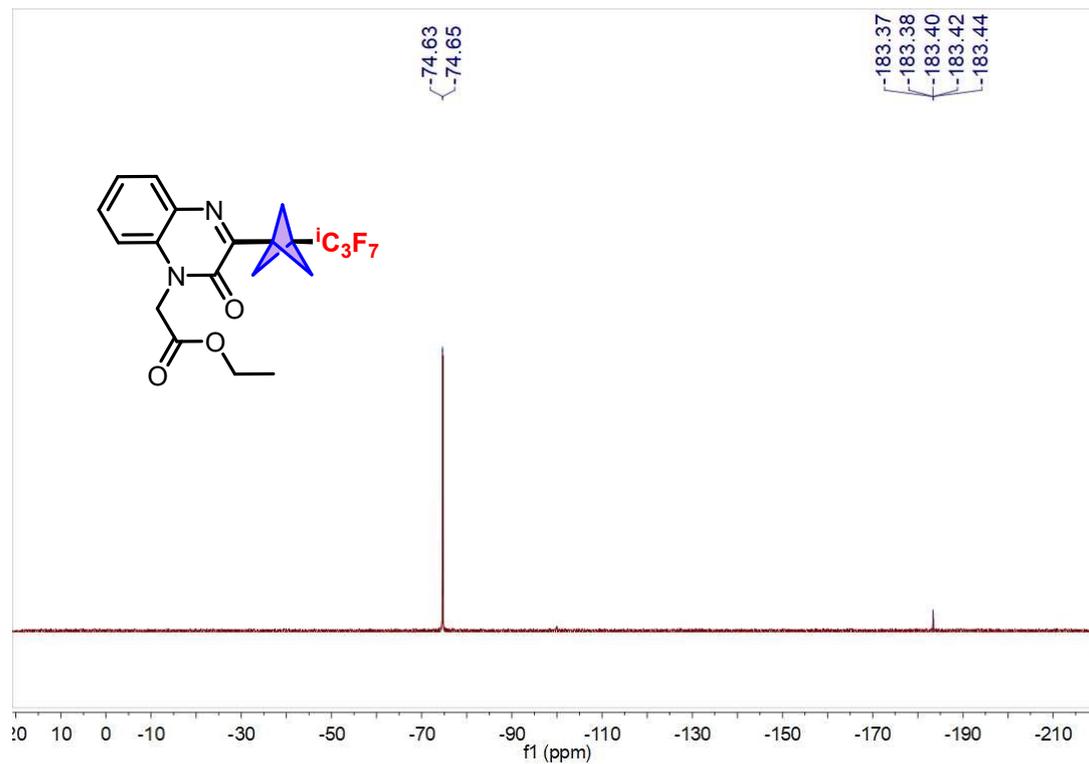
### 49 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



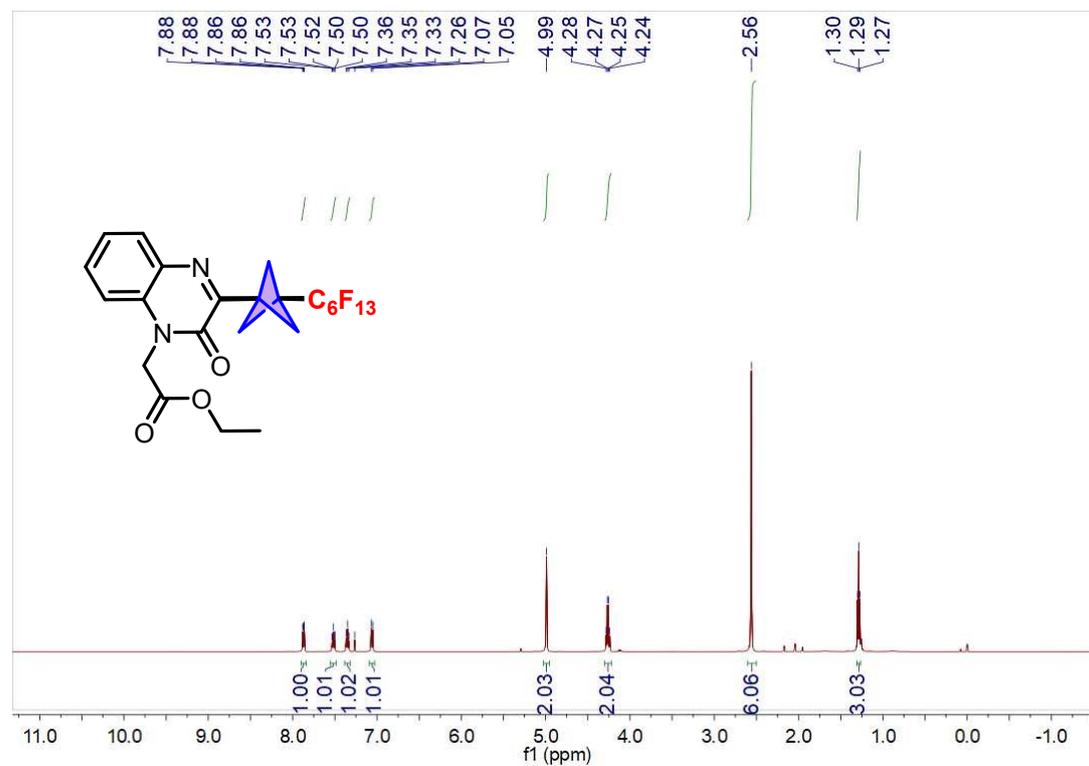
### 49 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



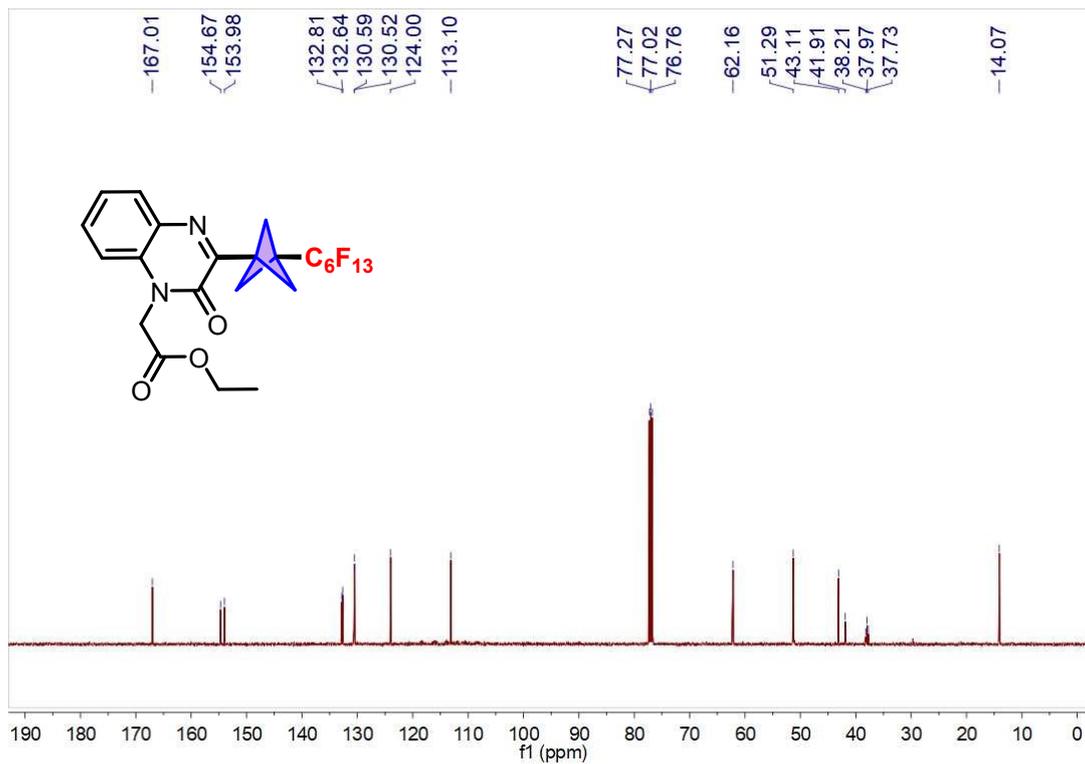
49  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



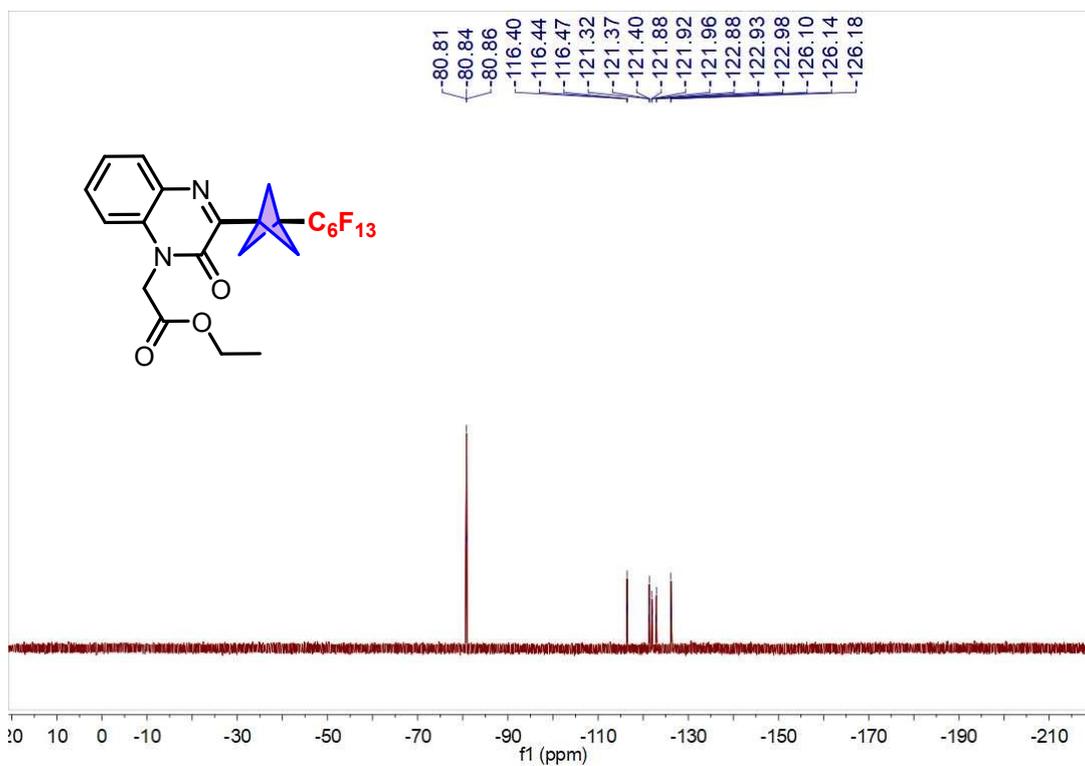
50  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



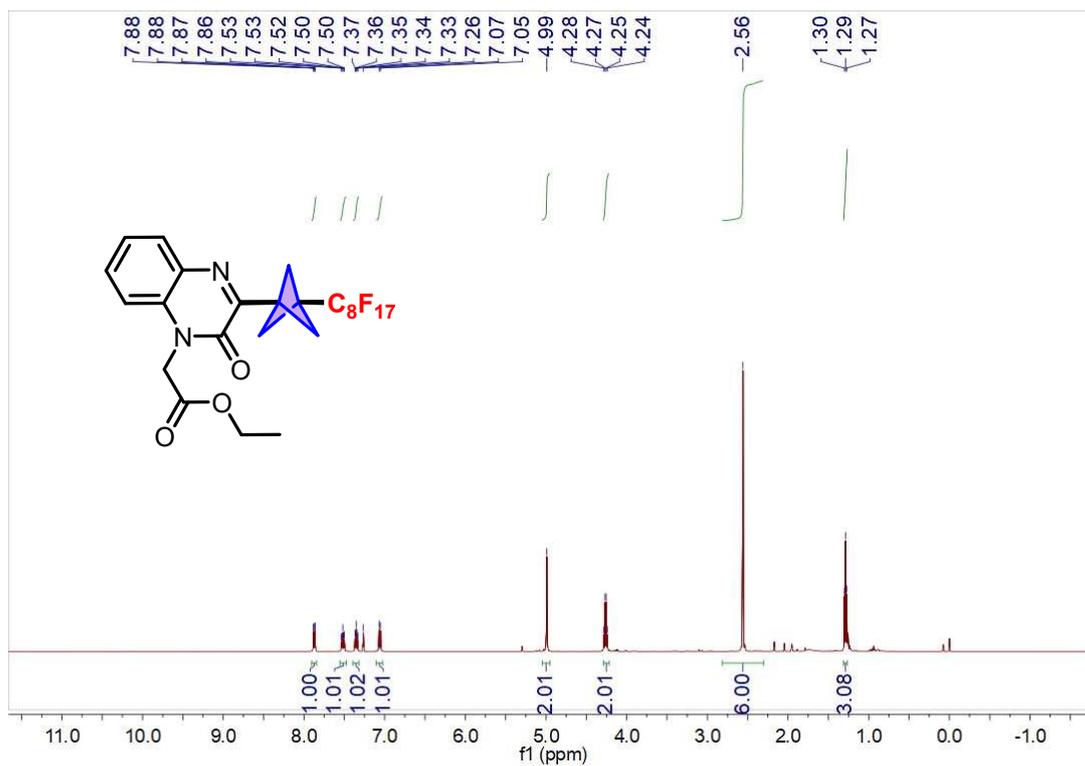
### 50 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



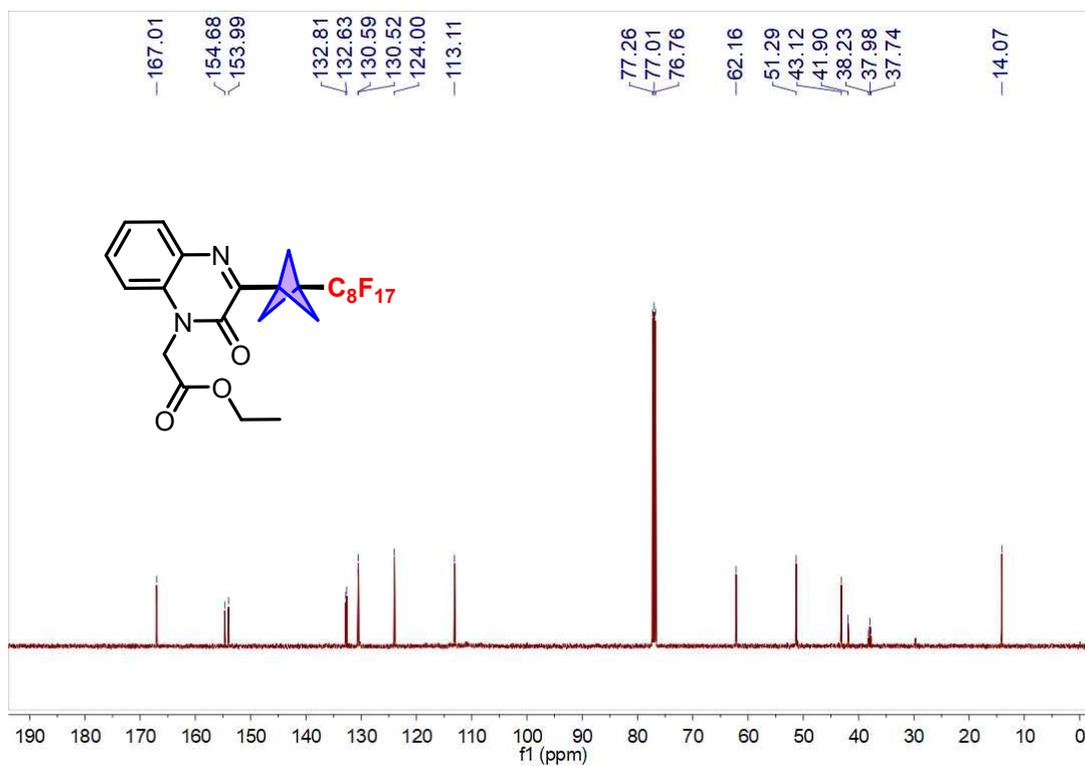
### 50 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



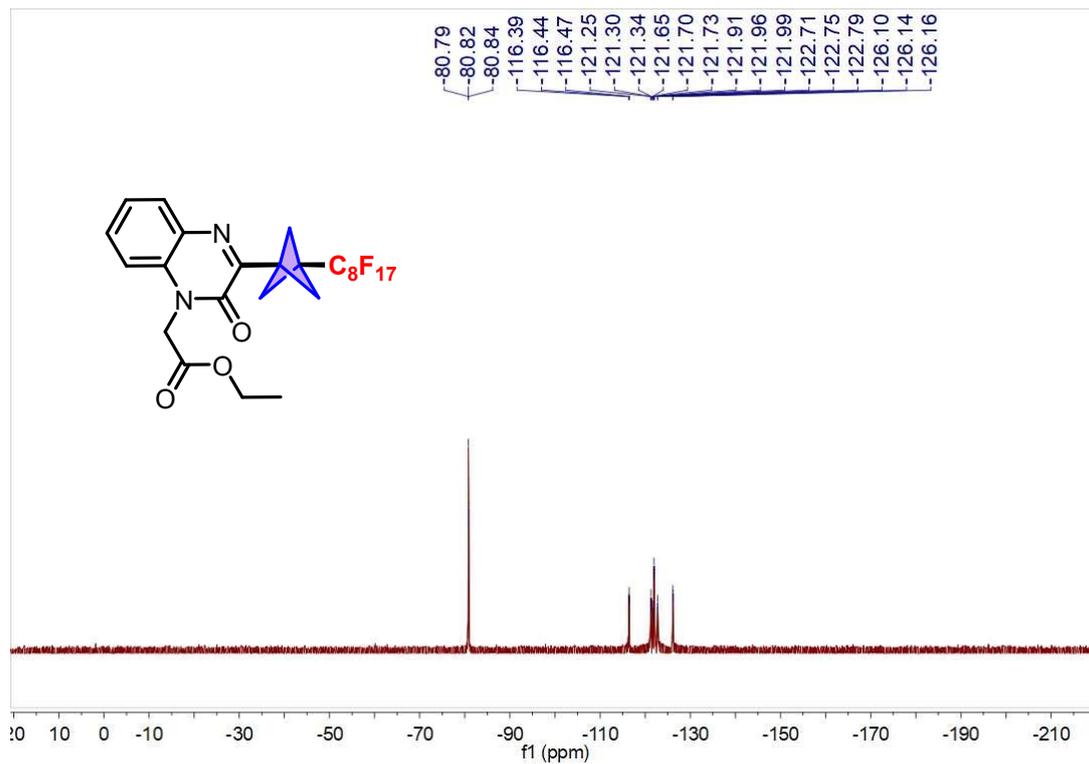
51 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



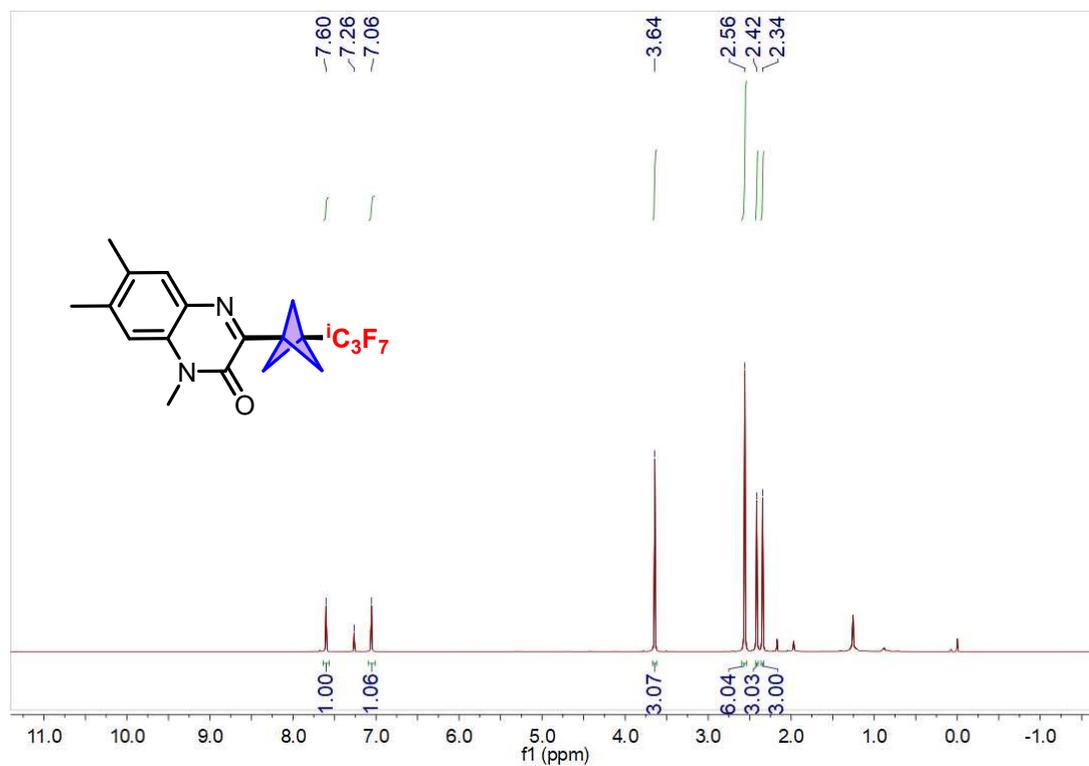
51 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



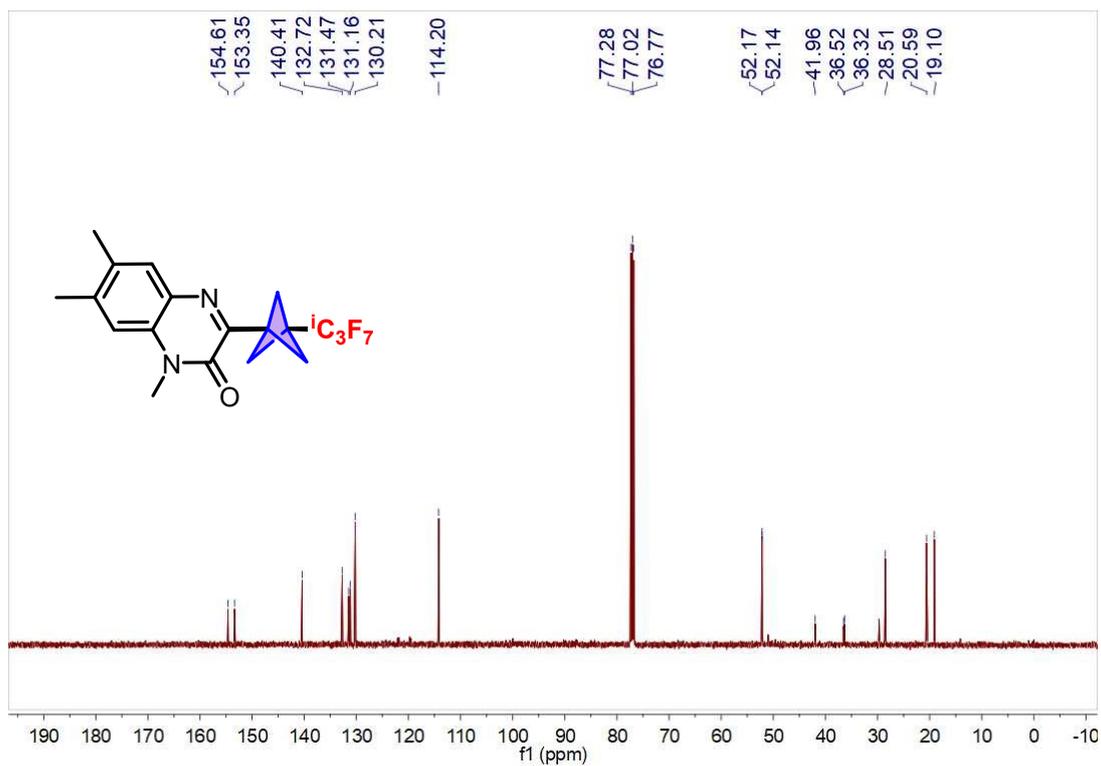
51  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



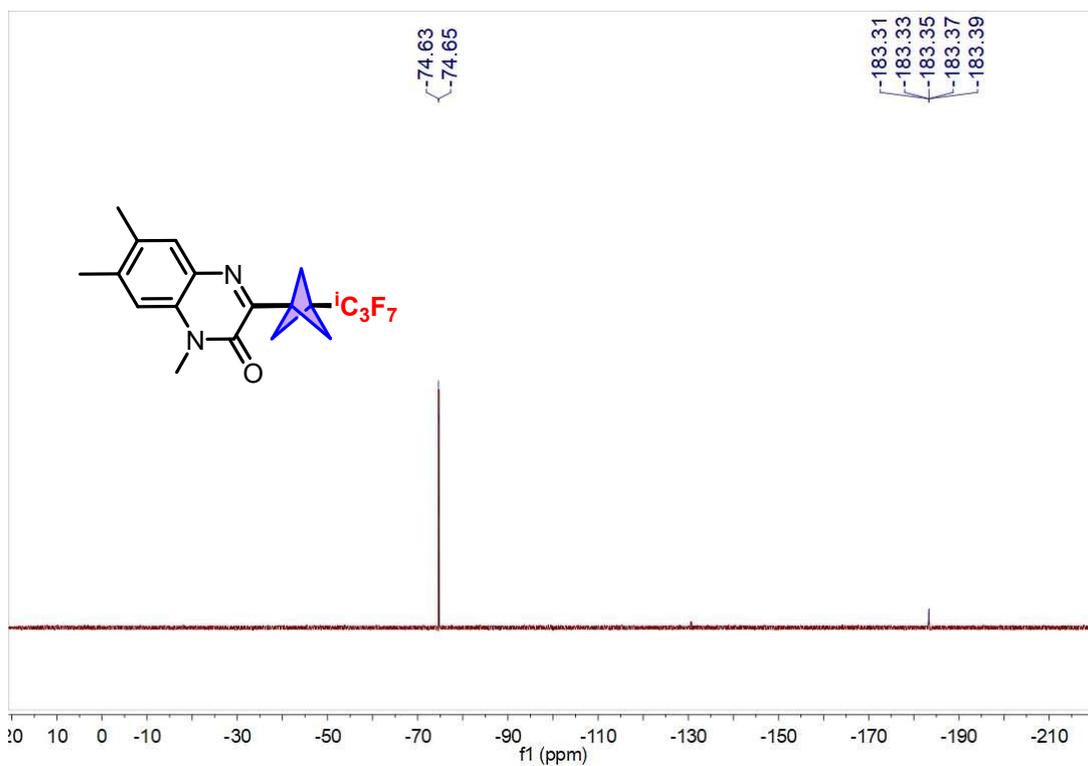
52  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



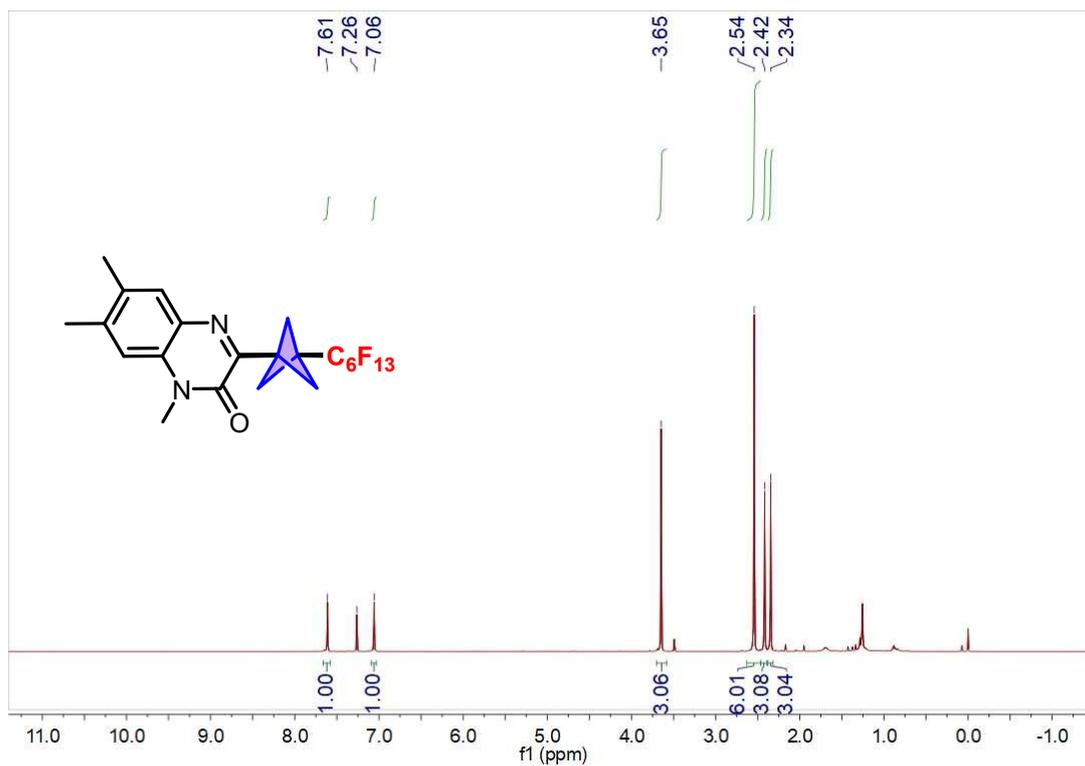
52 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



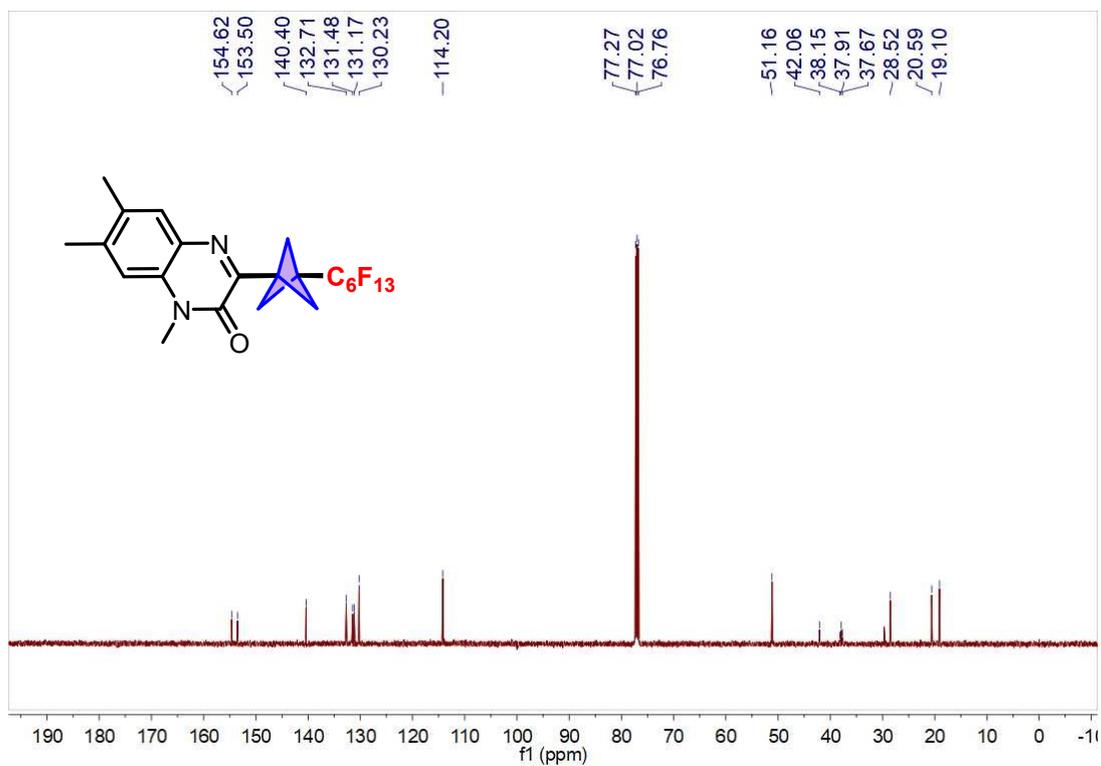
52 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



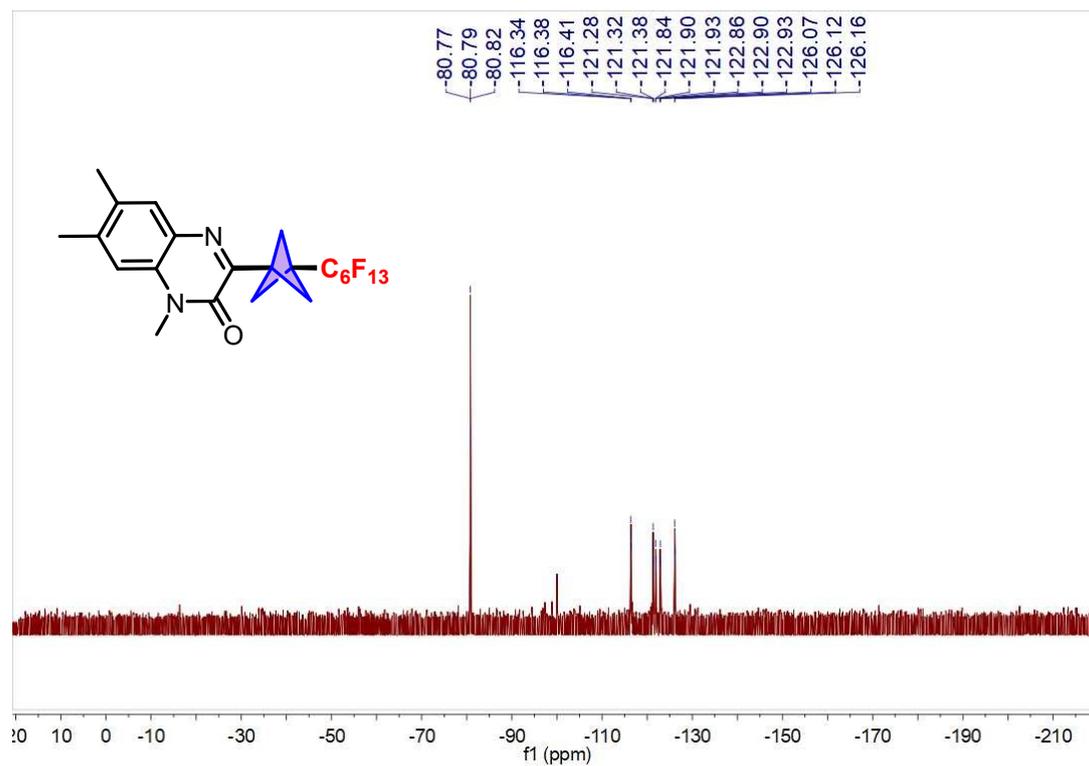
53 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



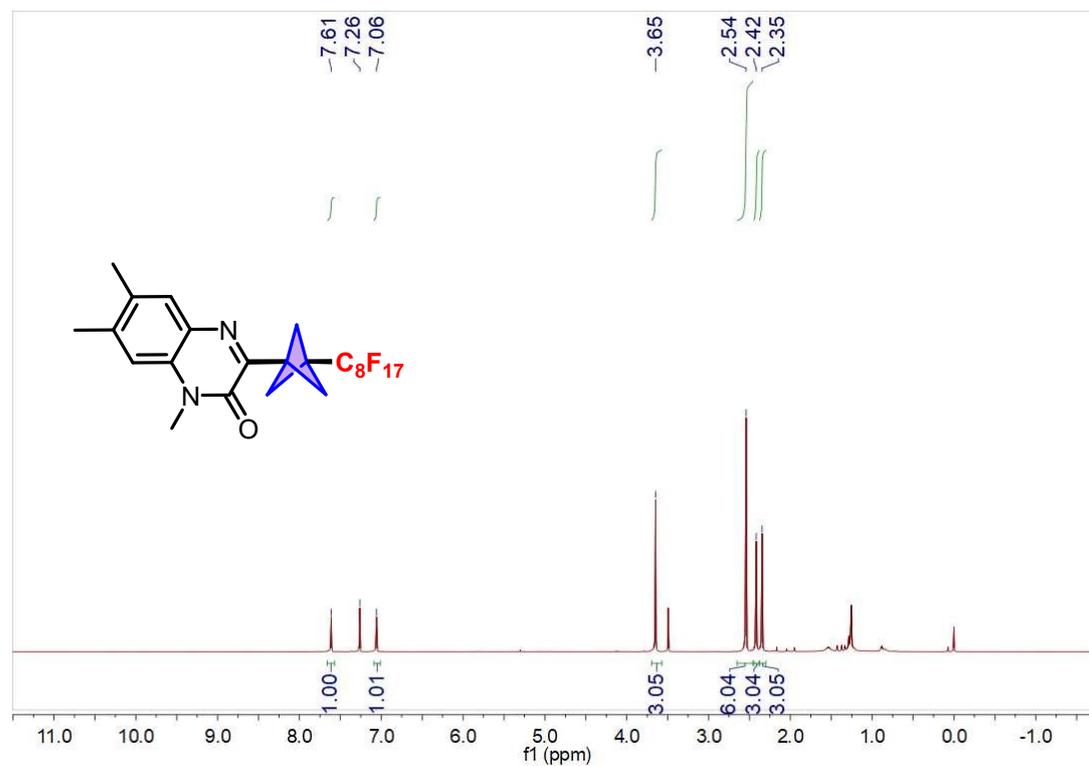
53 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



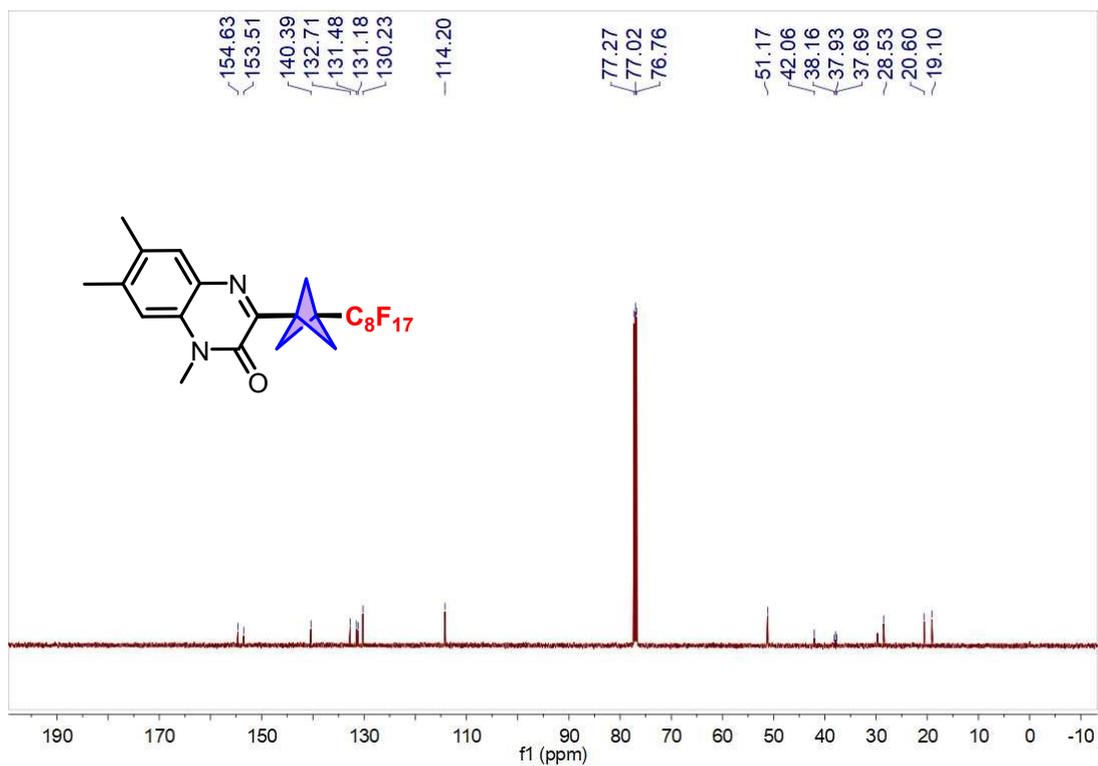
53  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



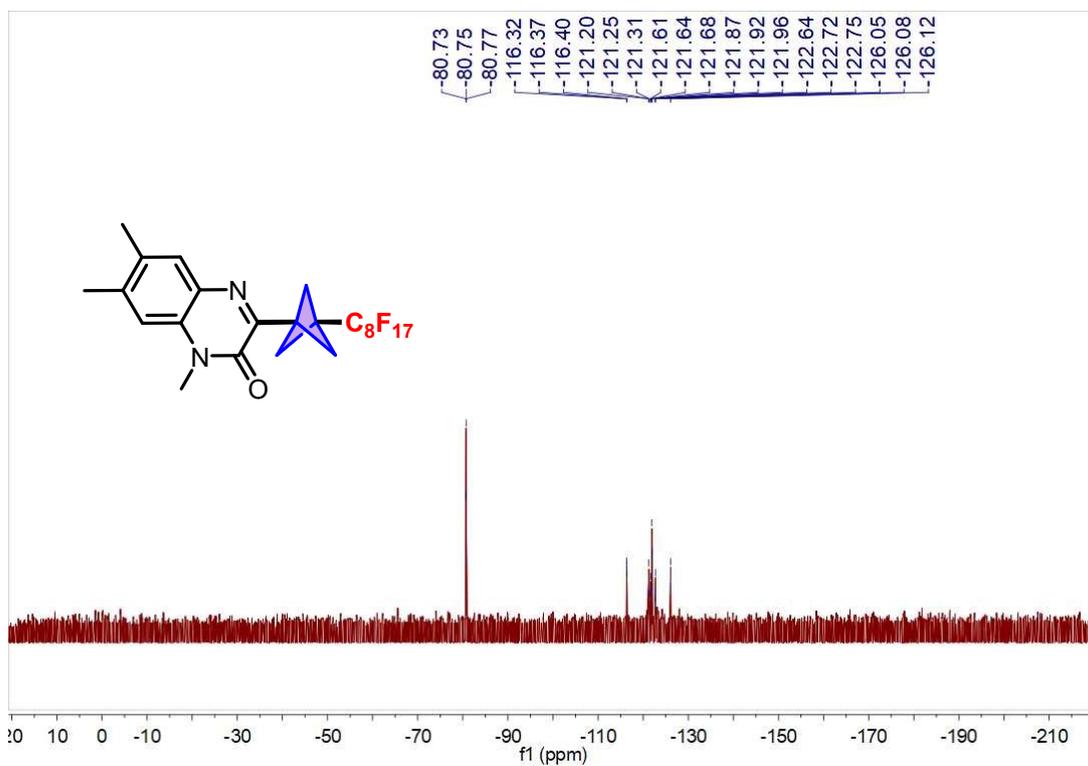
54  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



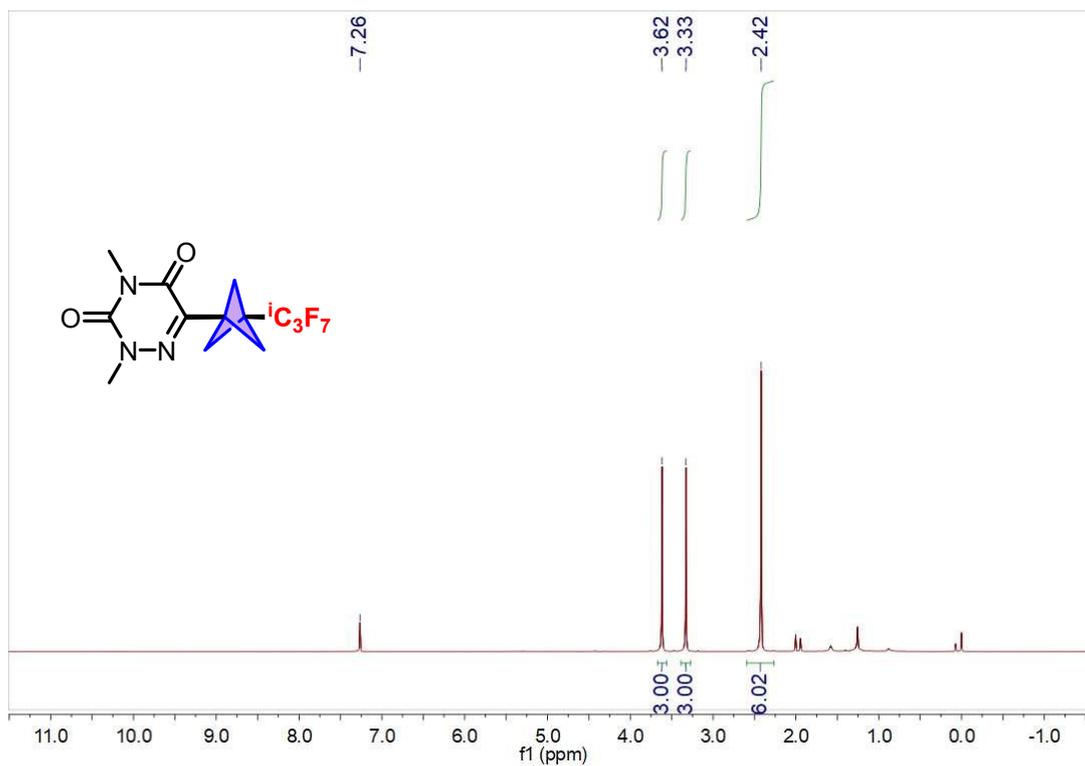
54  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



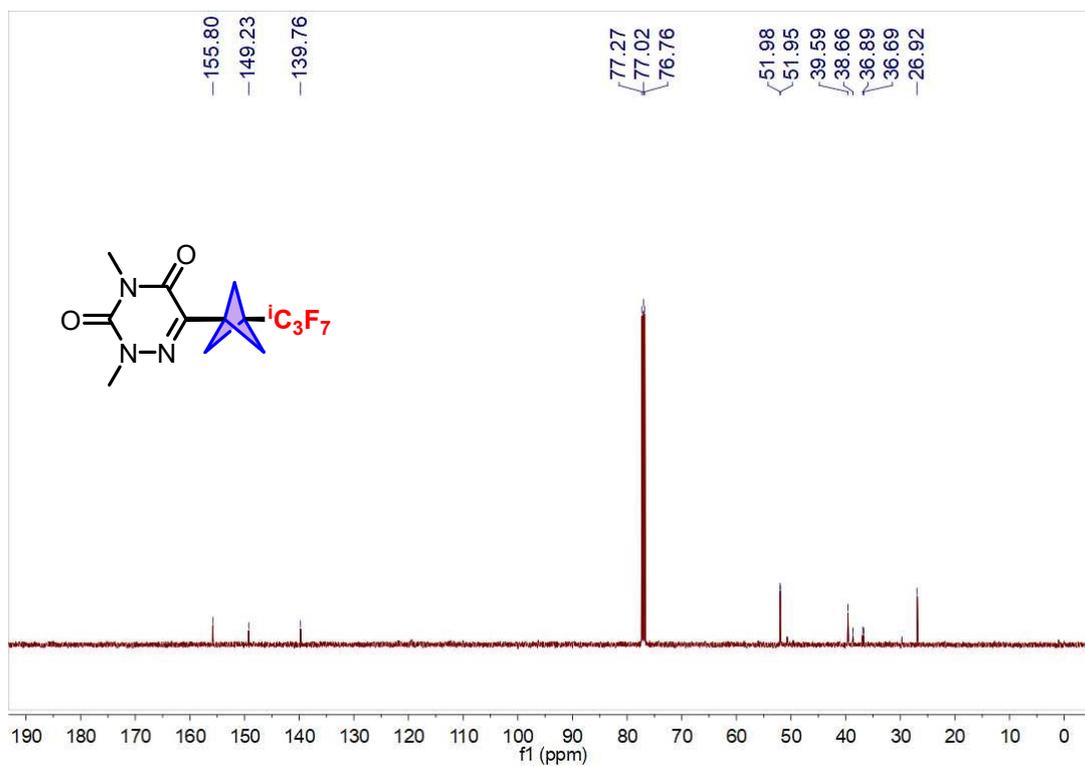
54  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



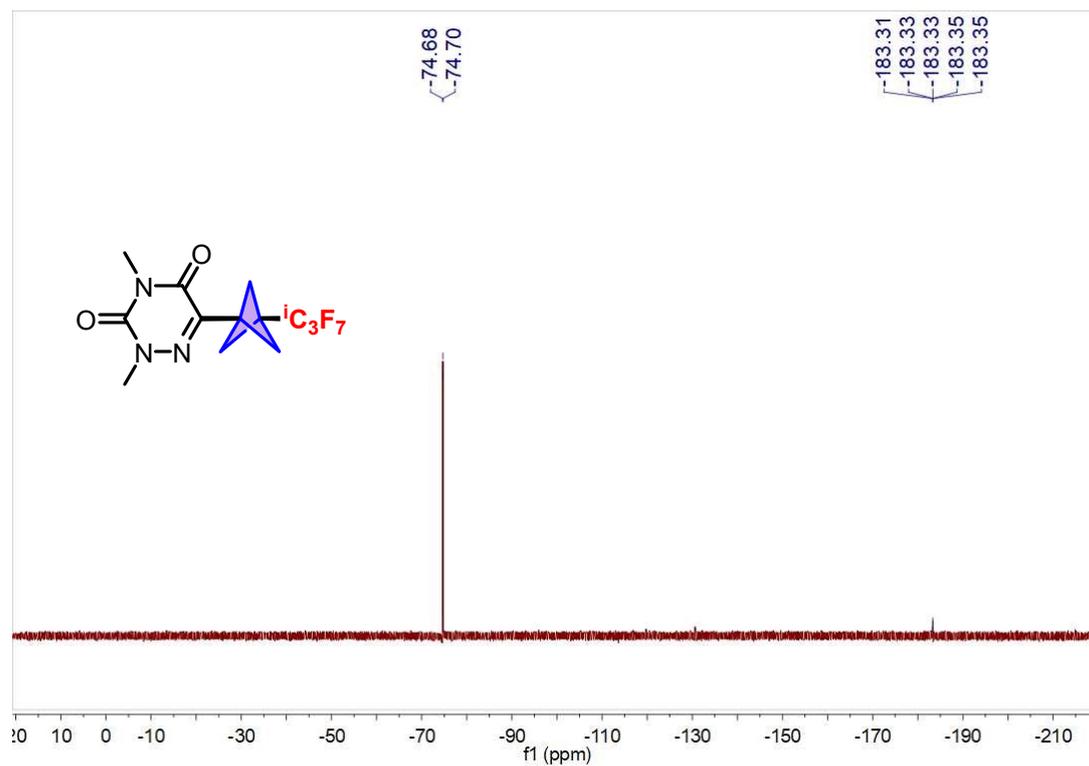
55 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



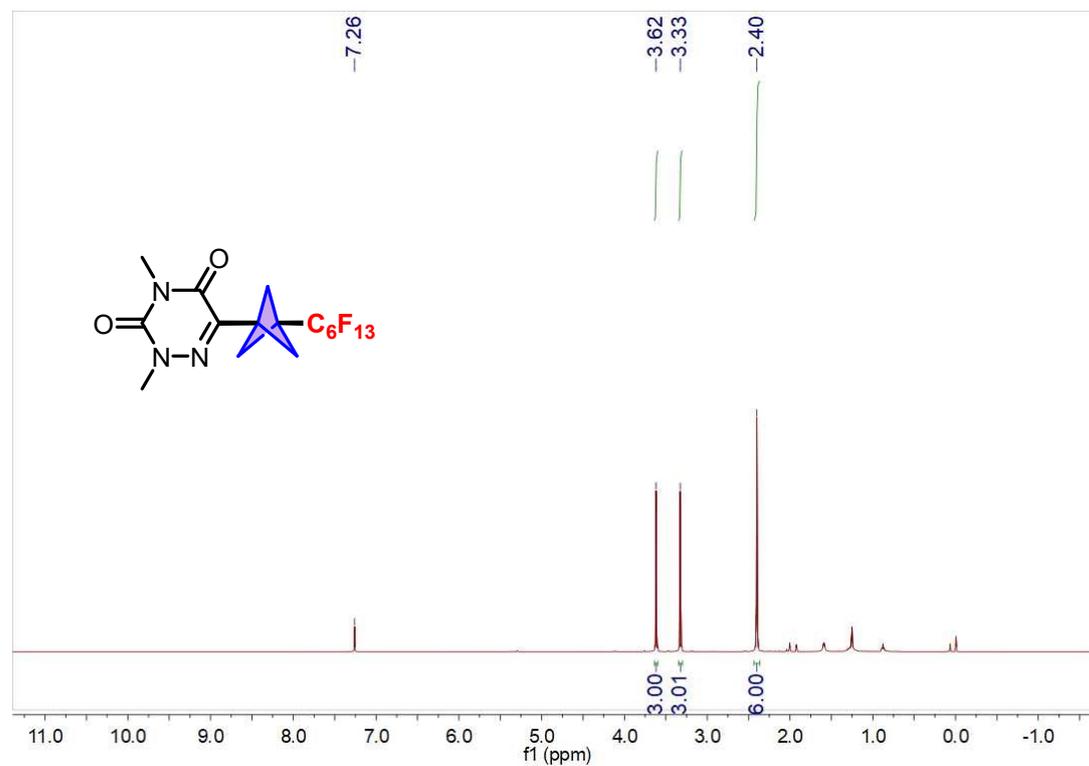
55 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



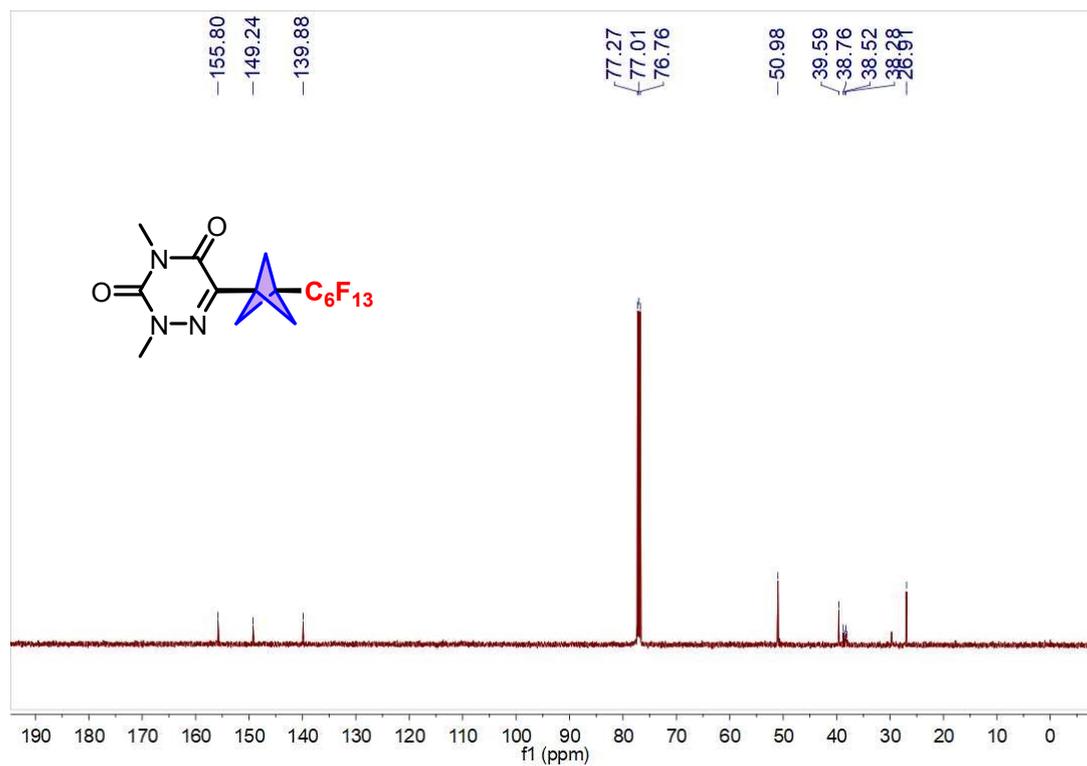
55  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



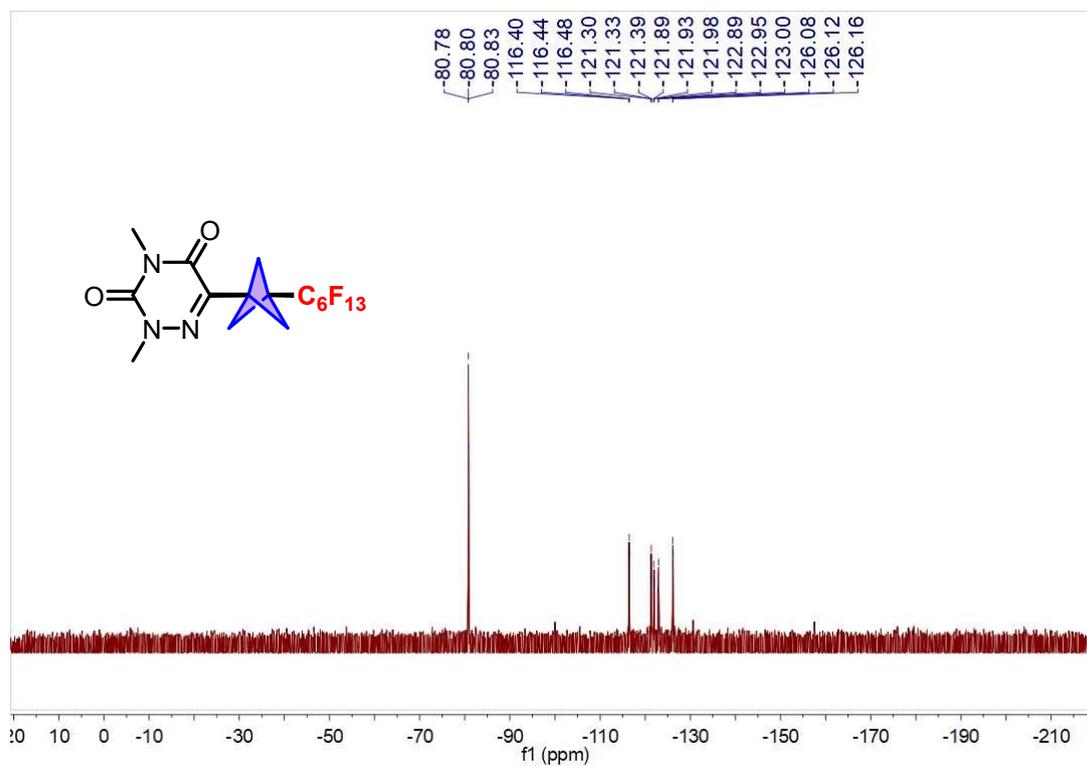
56  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



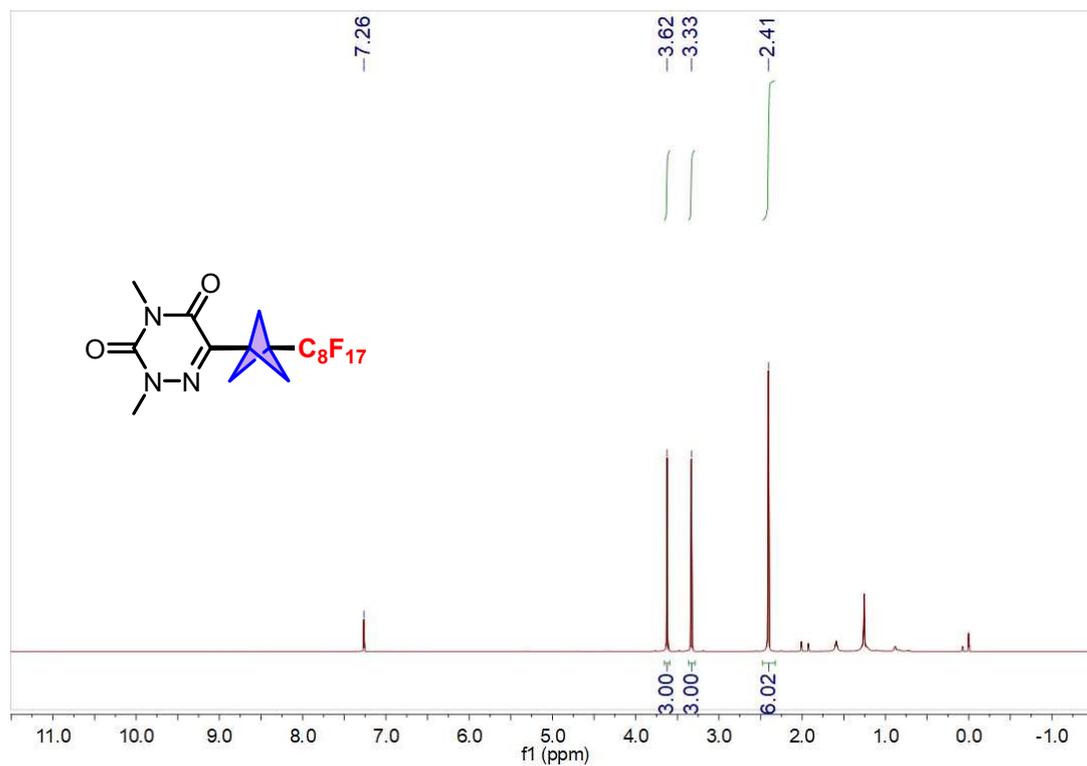
56  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



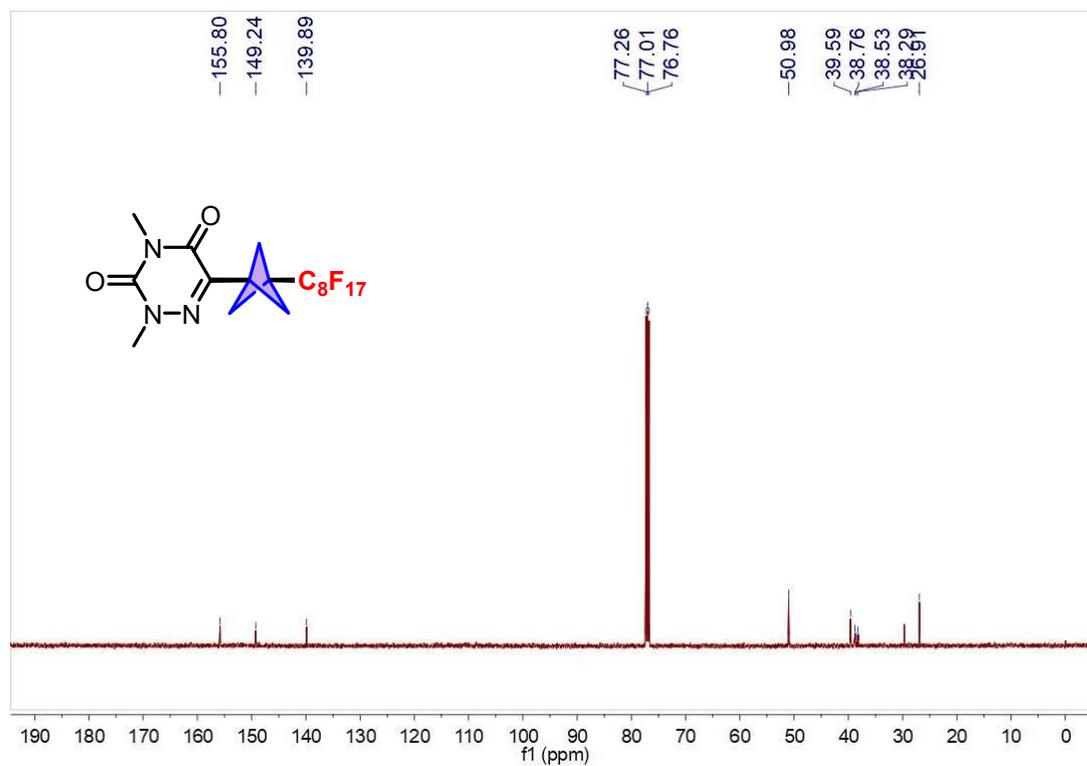
56  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



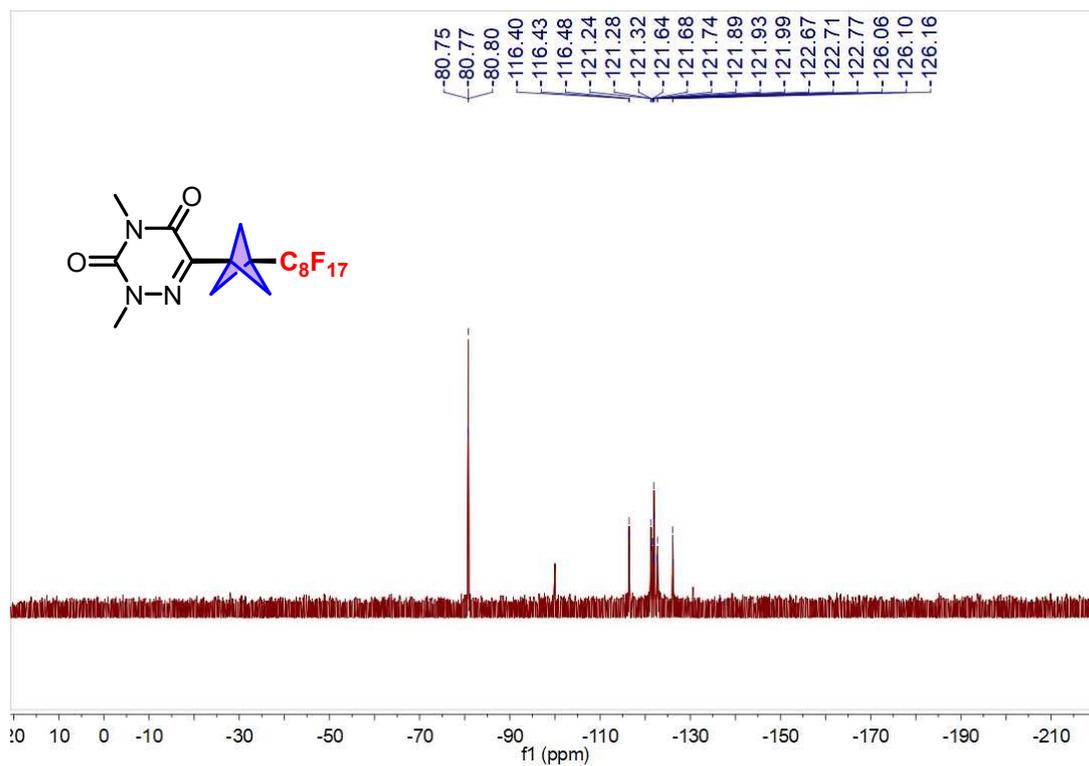
57 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



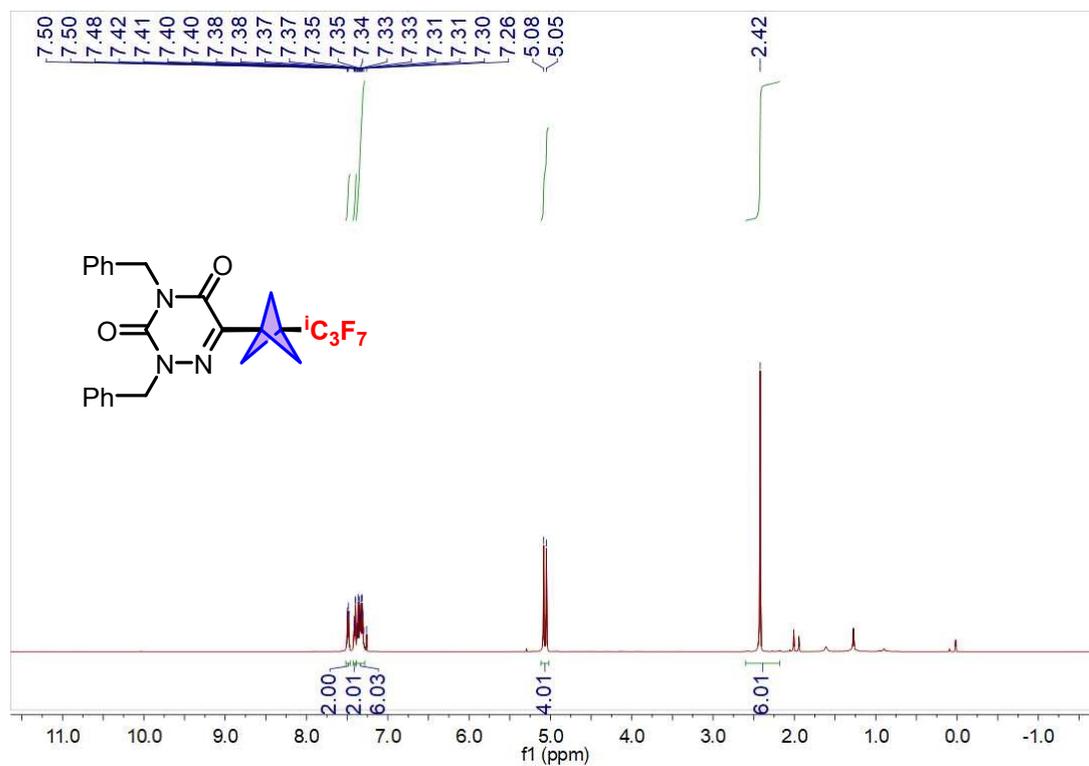
57 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



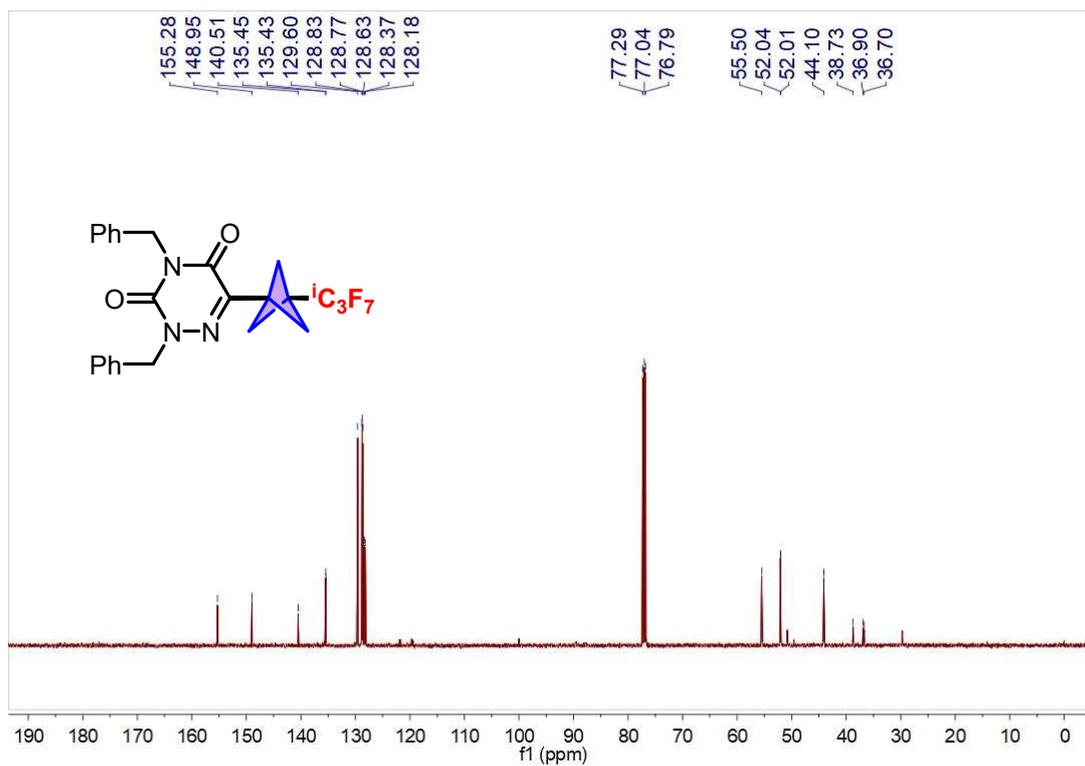
57  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



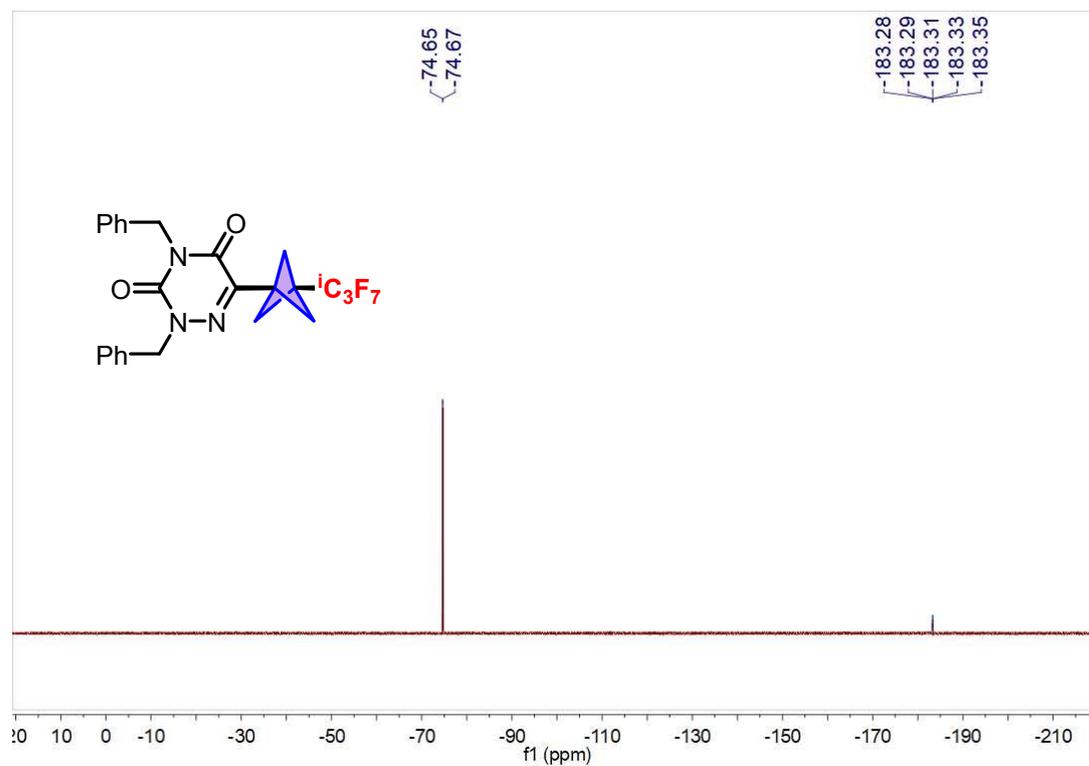
58  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



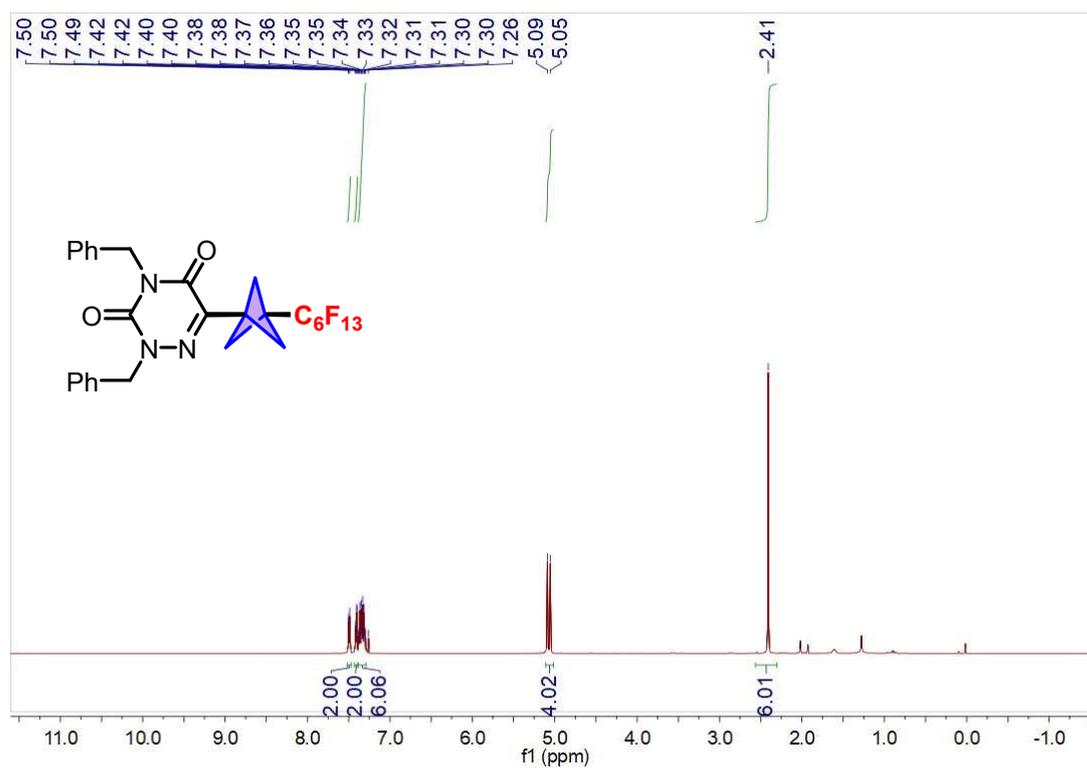
### 58 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



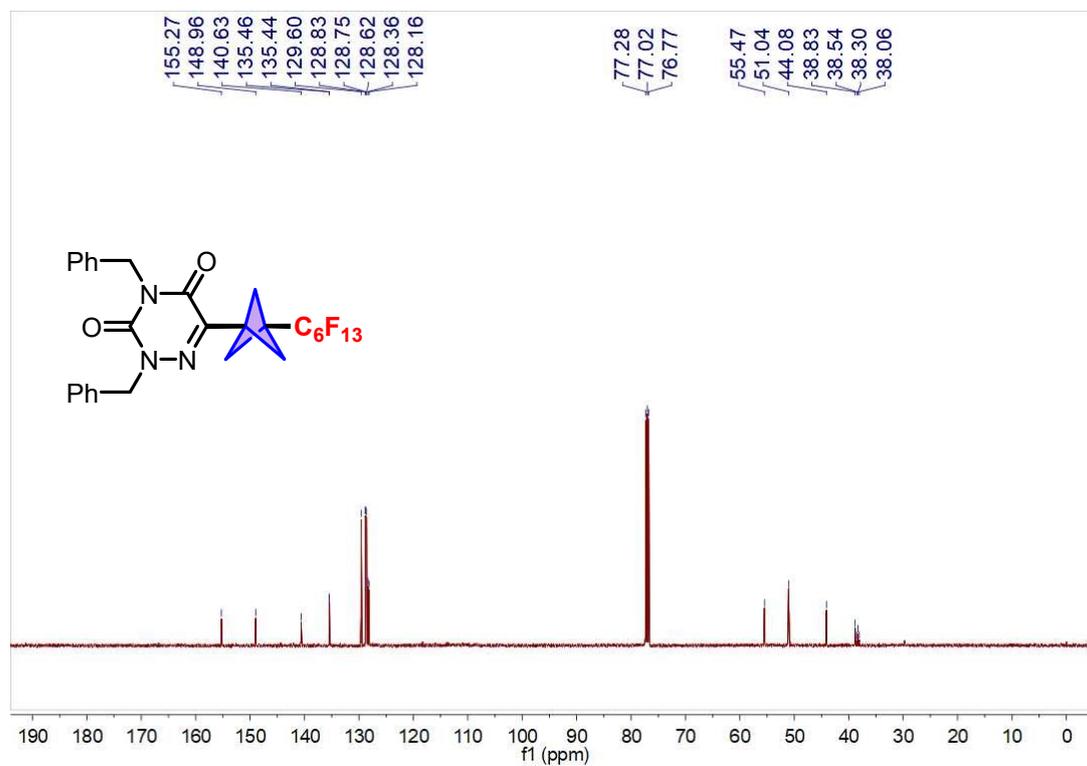
### 58 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



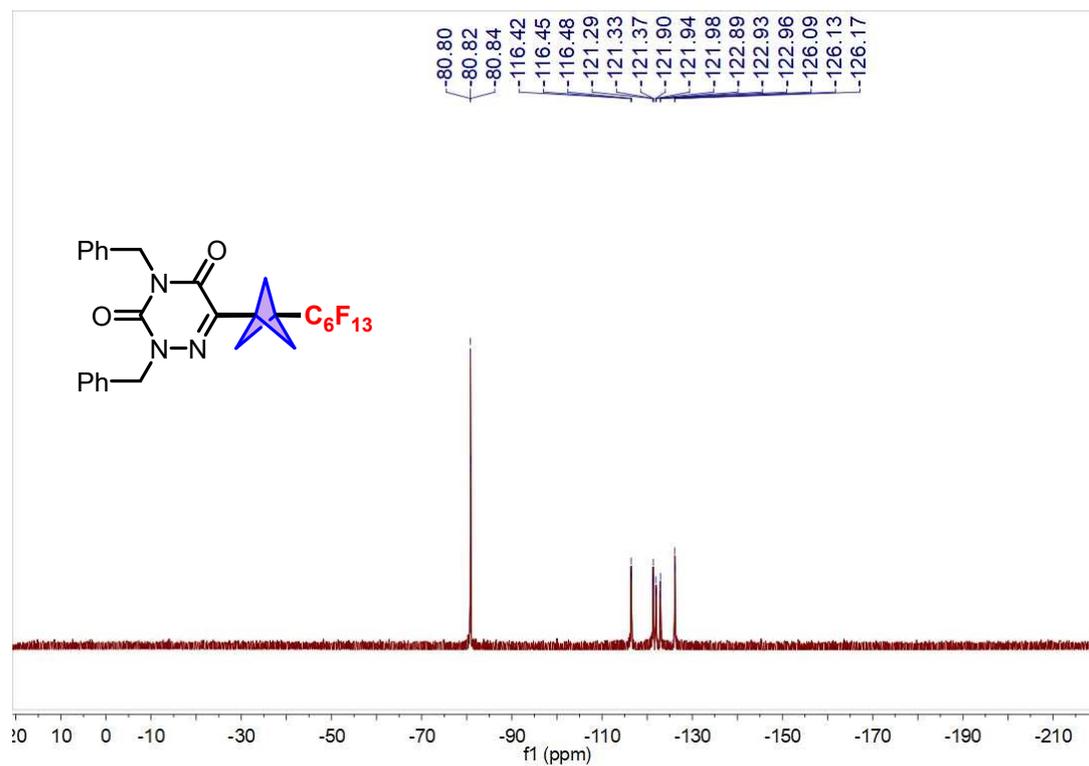
59 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



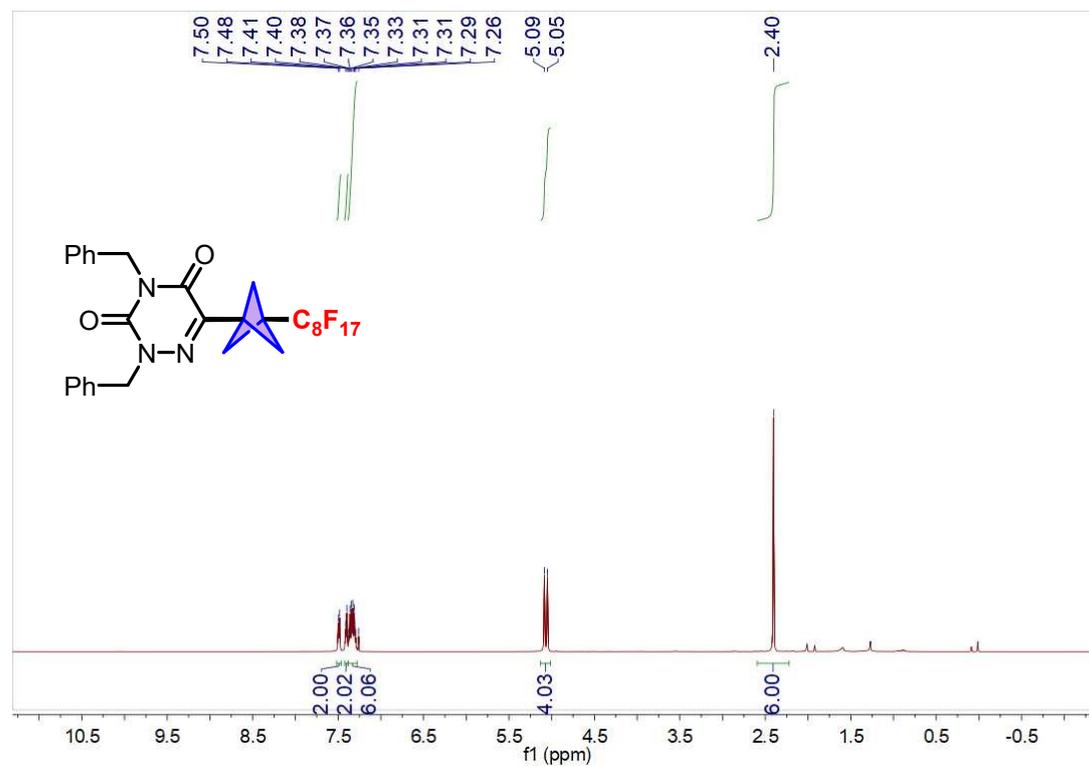
59 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



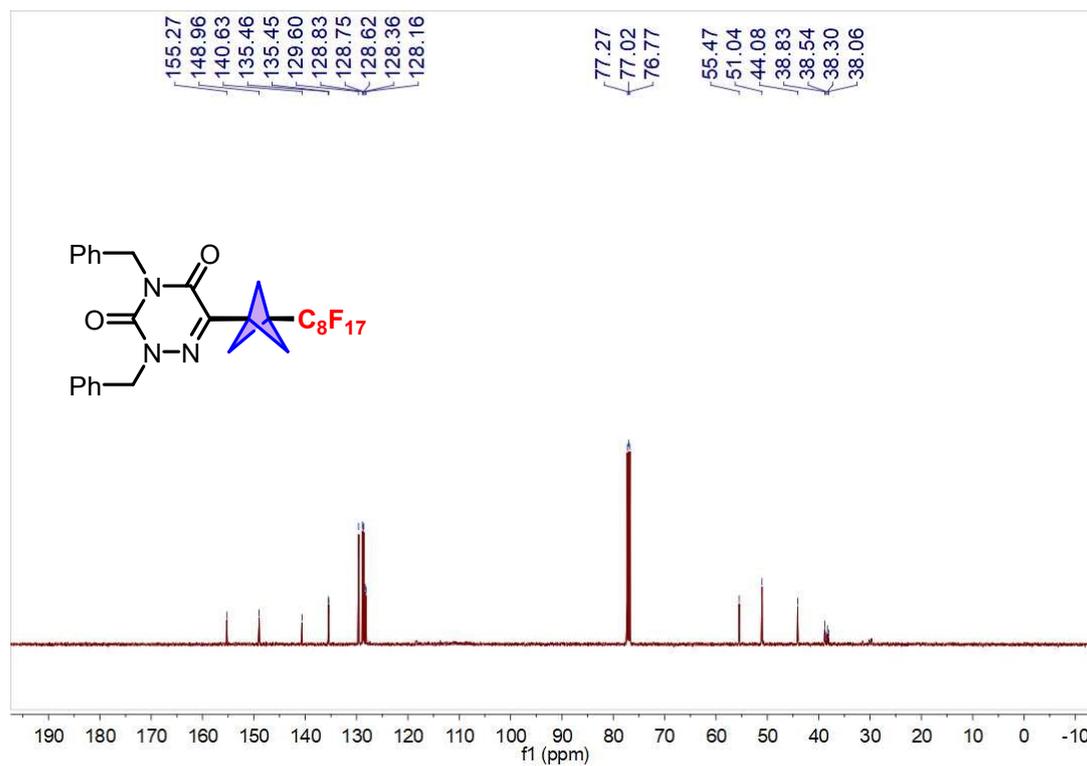
### 59 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



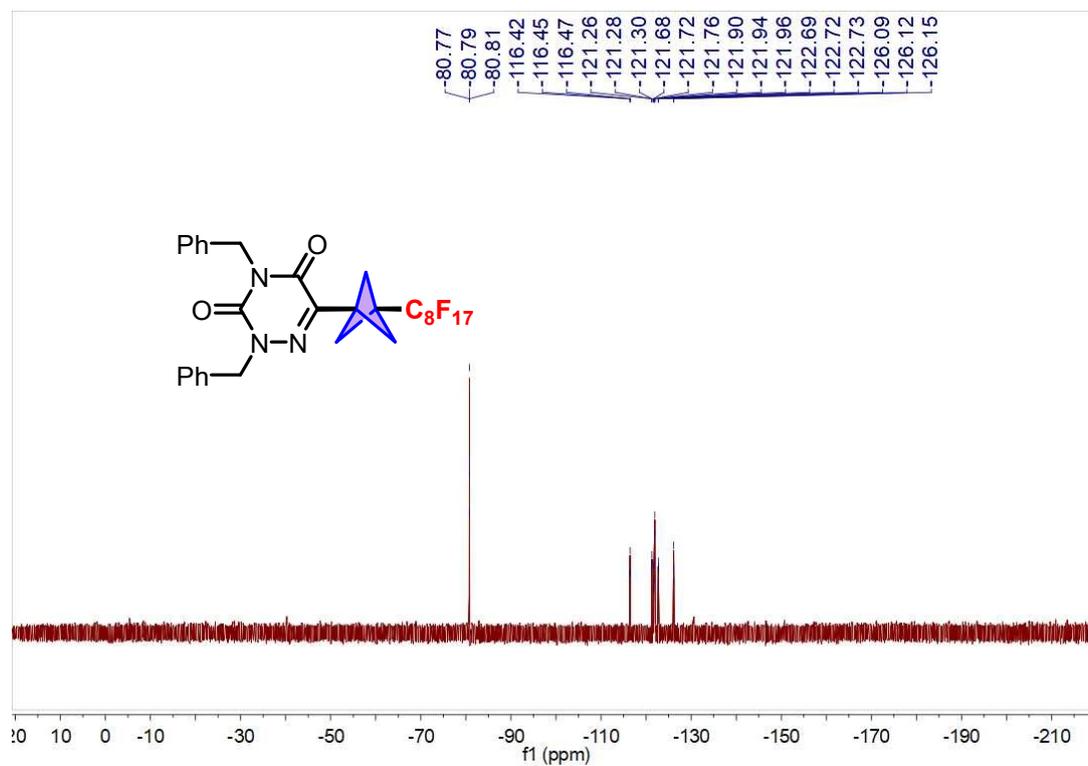
### 60 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



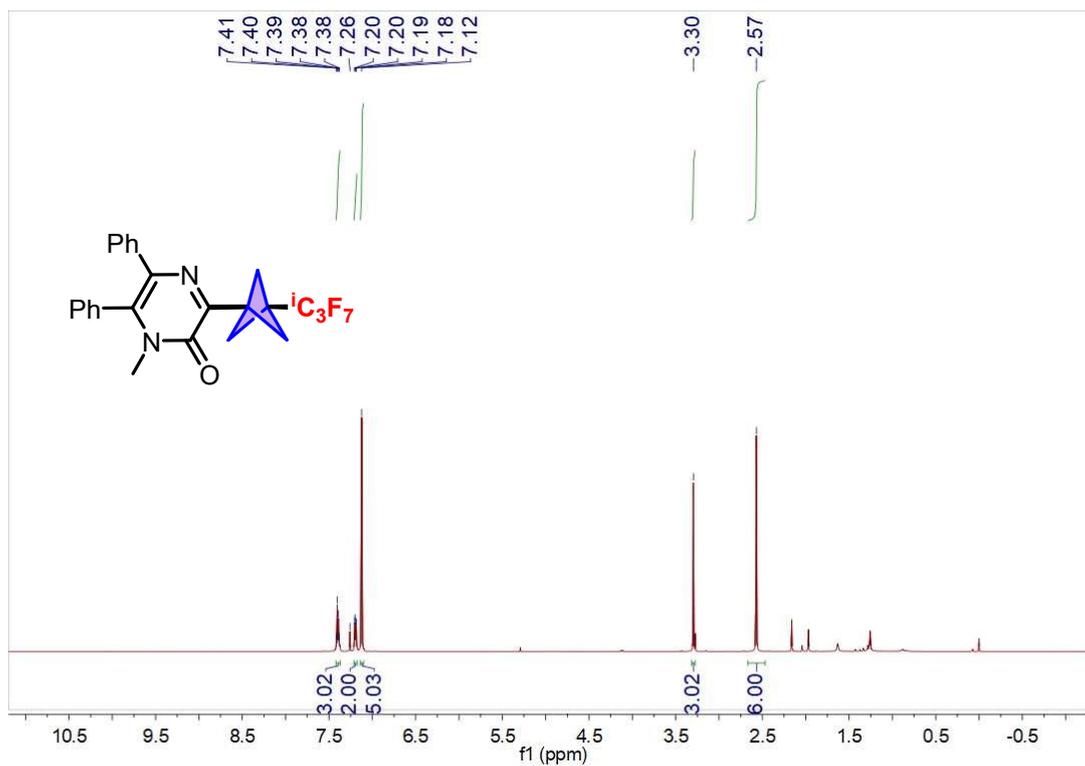
### 60 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



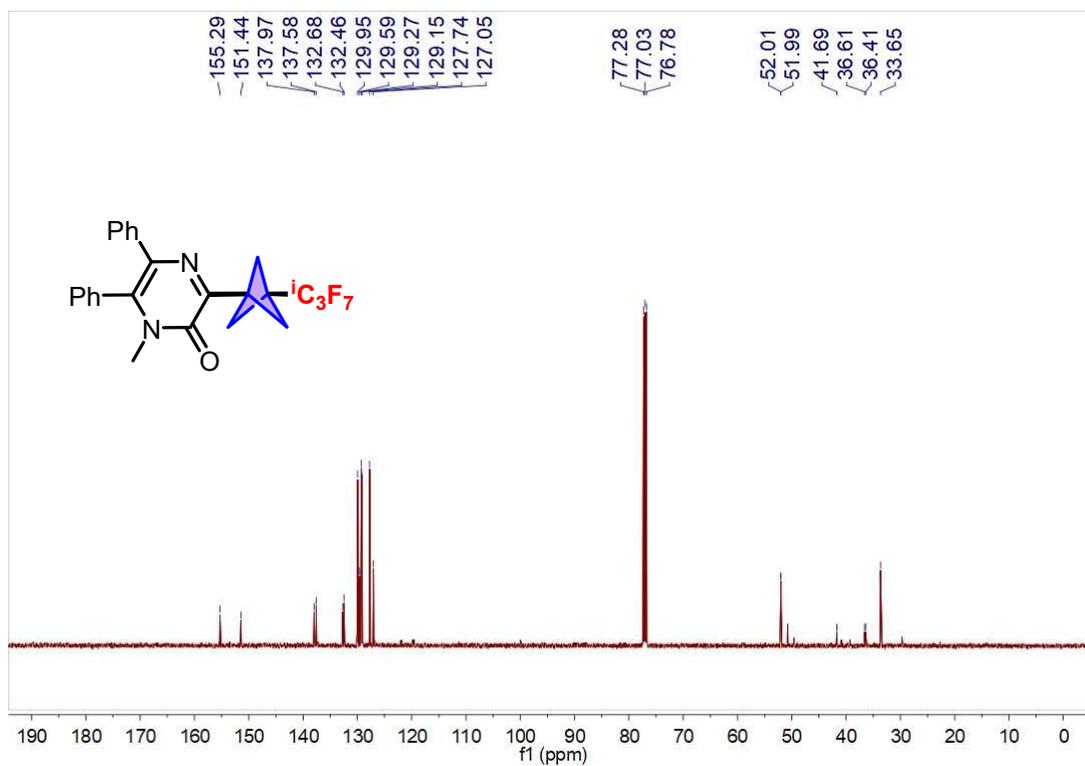
### 60 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



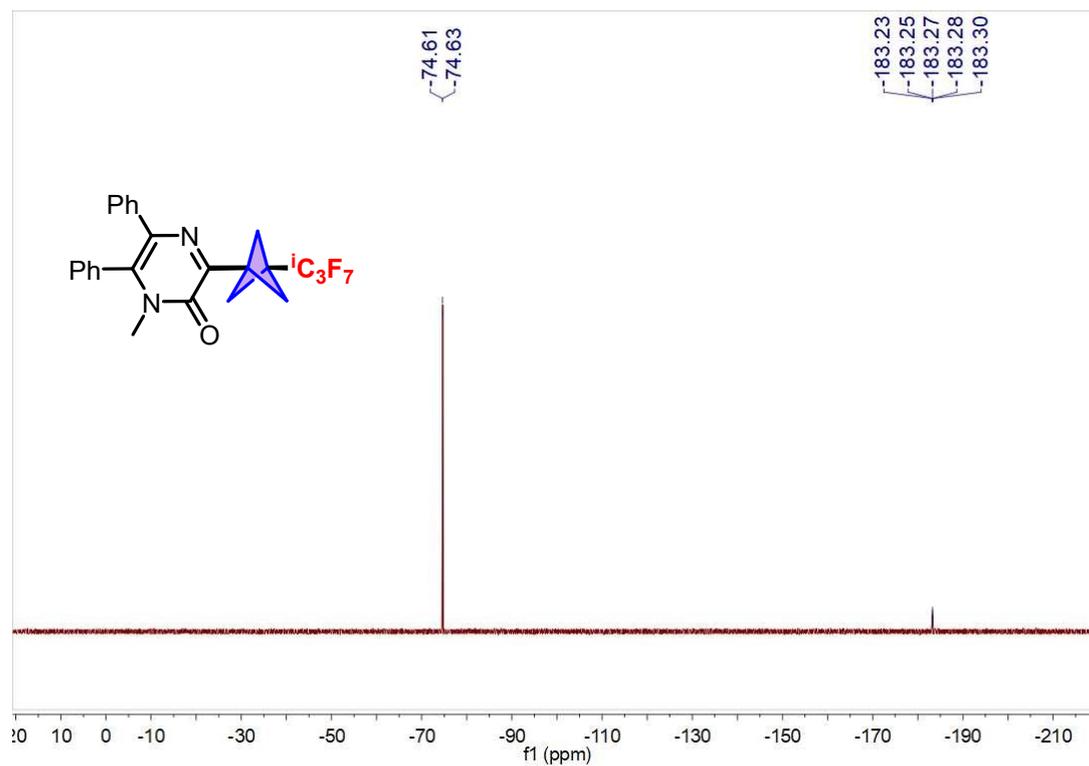
### 61 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



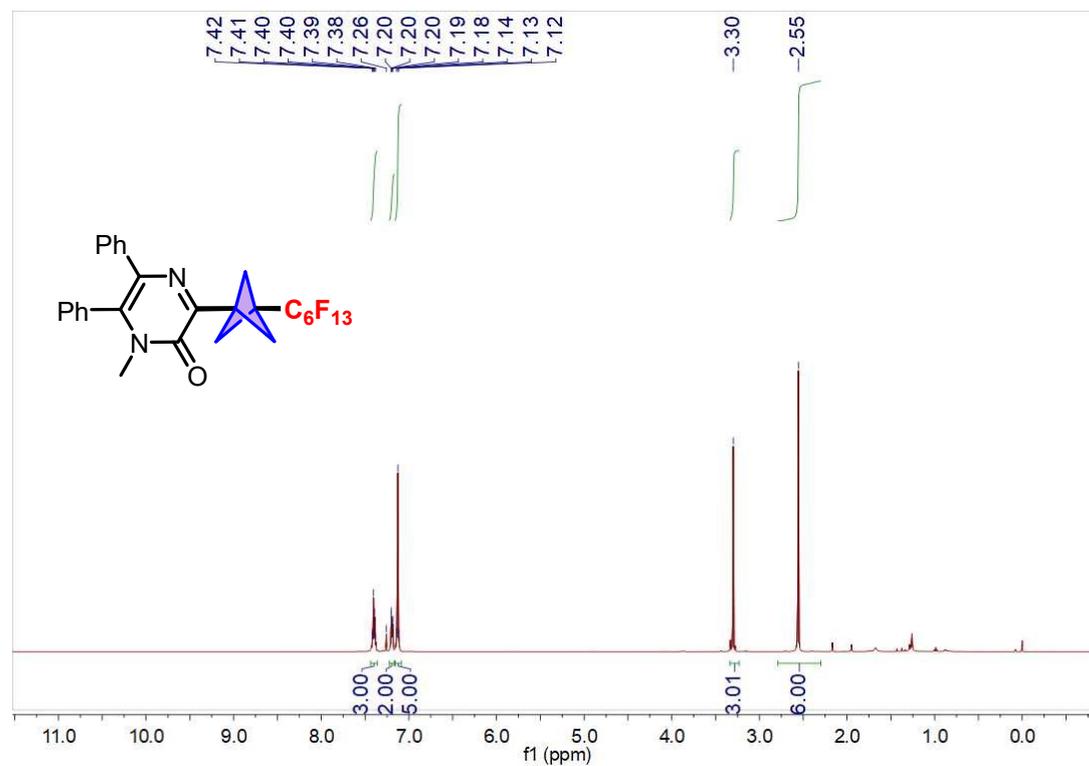
### 61 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



### 61 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )

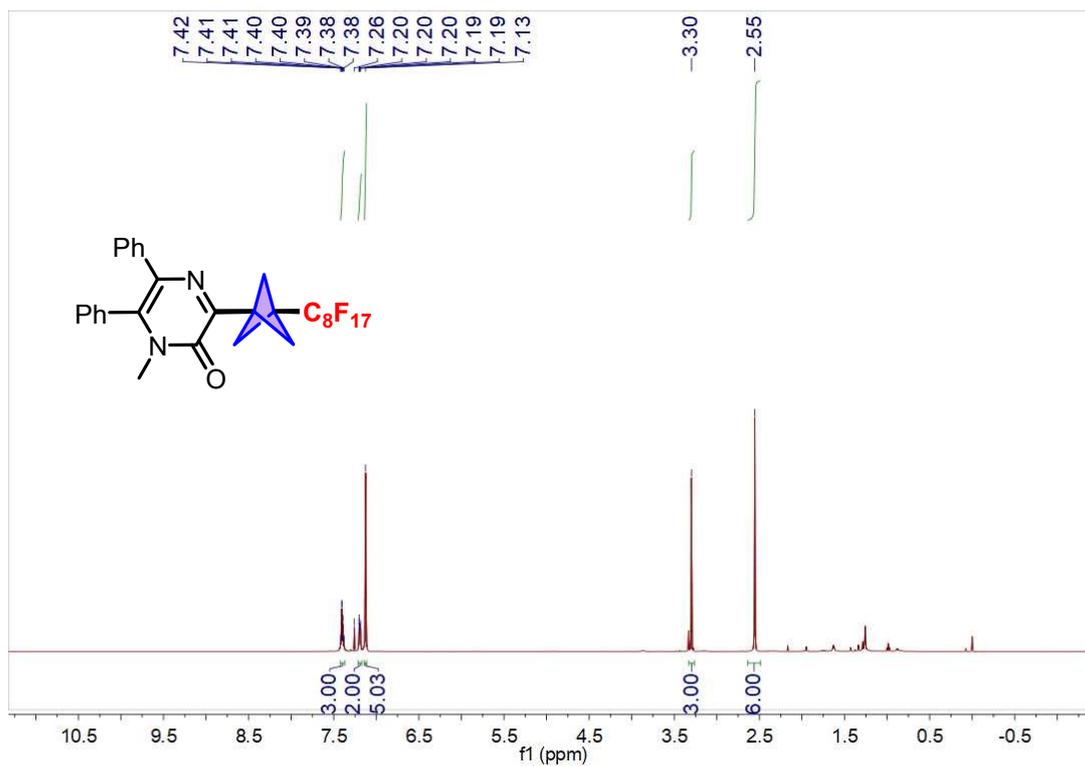


### 62 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )

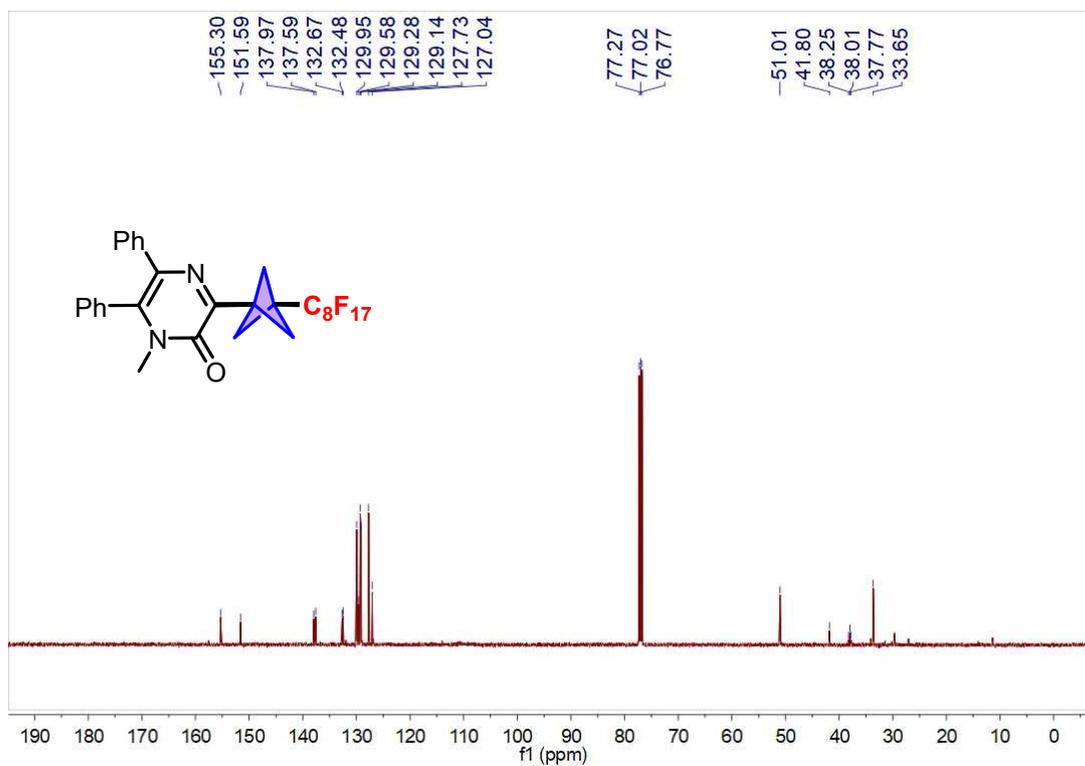




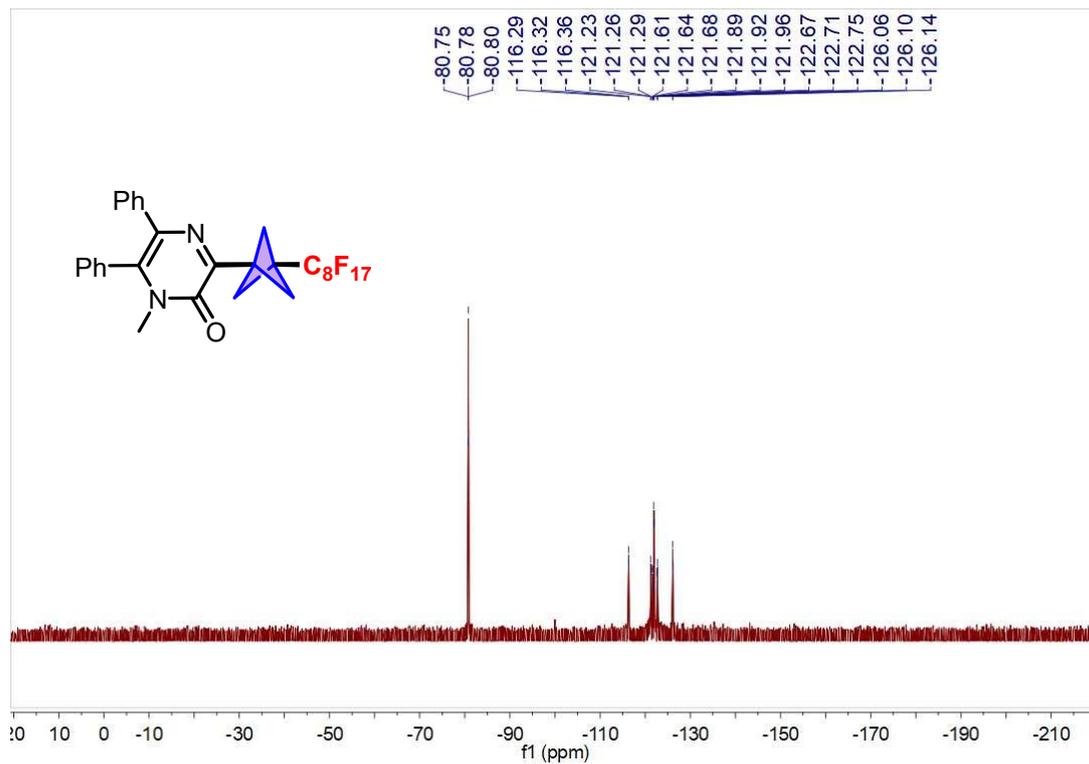
### 63 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



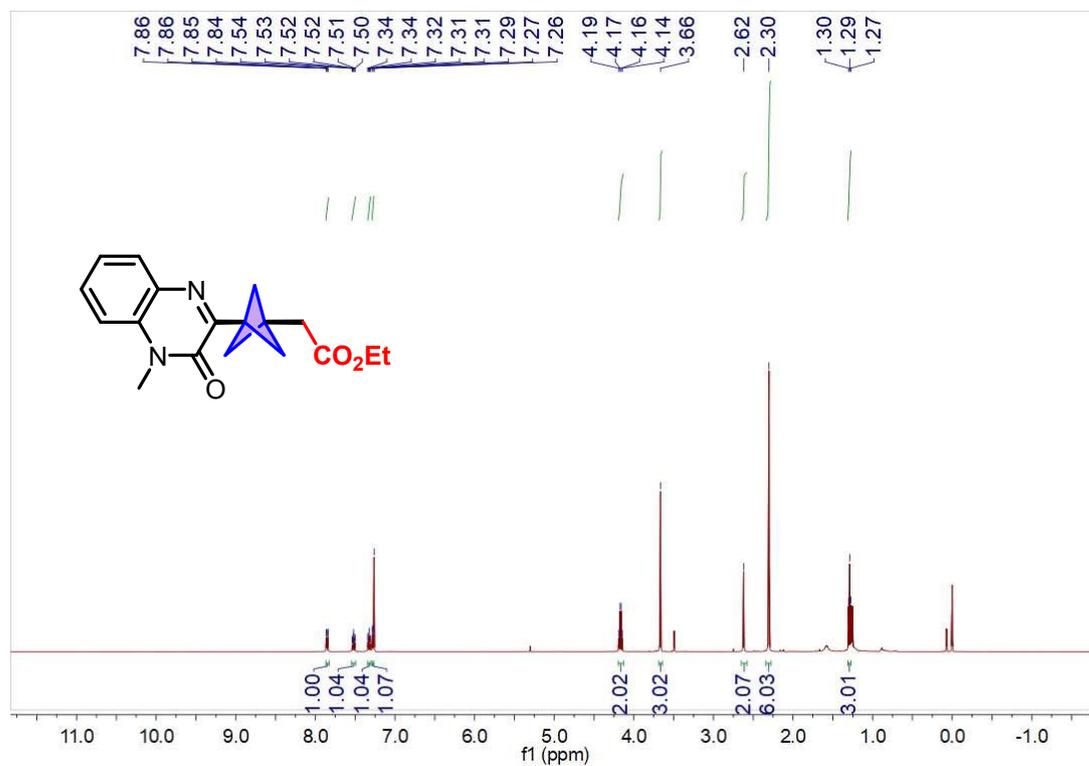
### 63 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



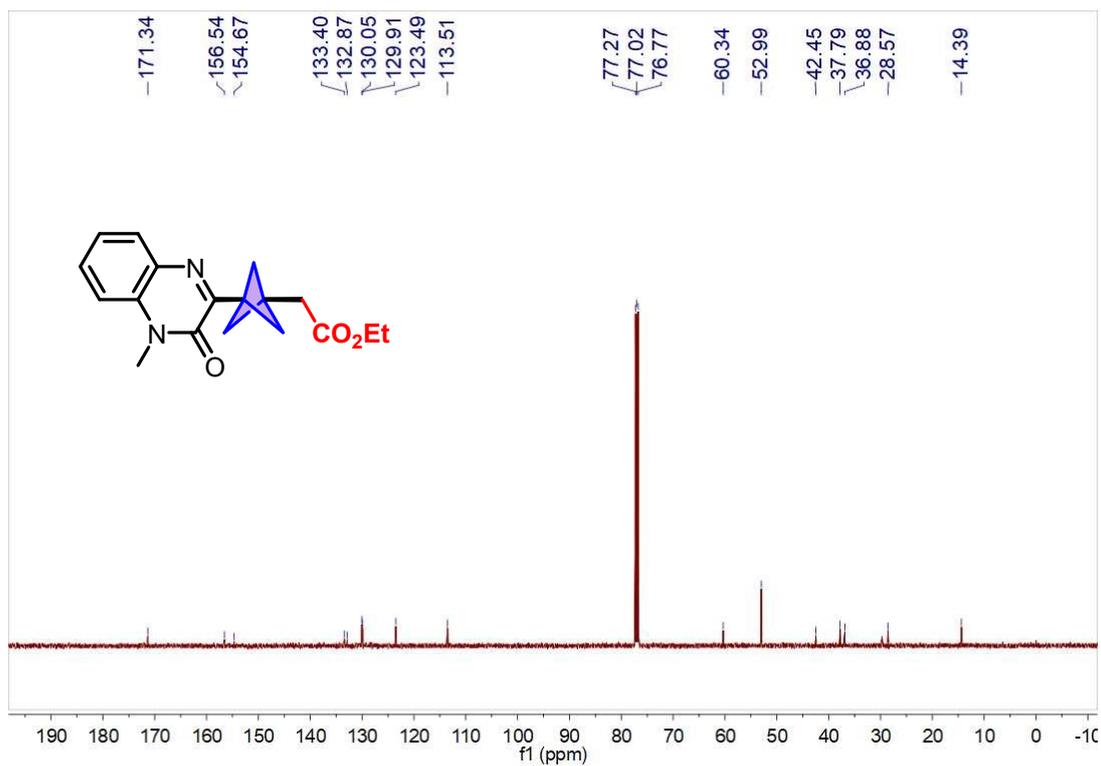
### 63 $^{19}\text{F}$ NMR (471 MHz, $\text{CDCl}_3$ )



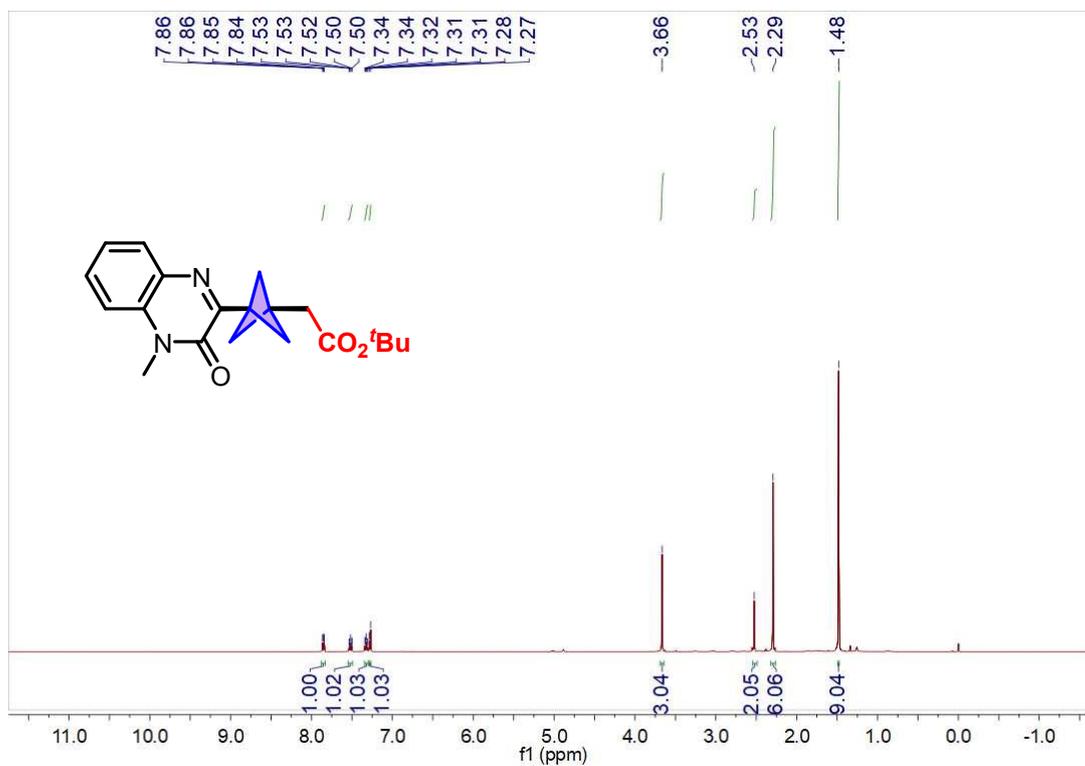
### 64 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



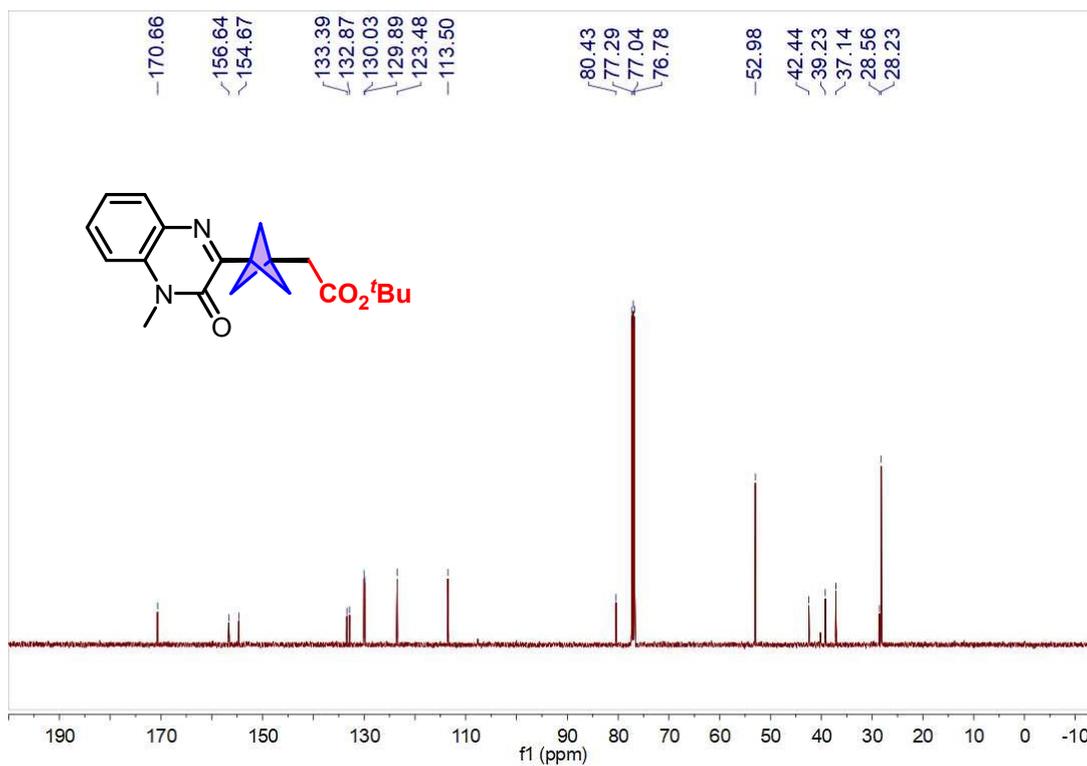
64  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



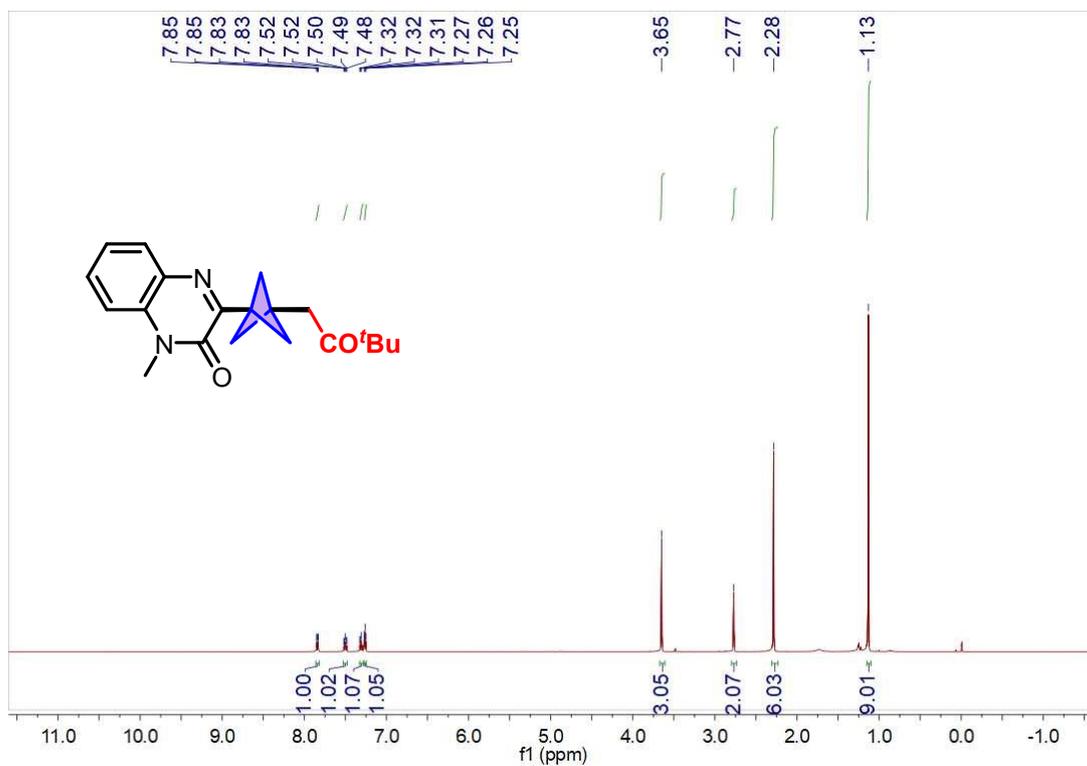
65  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



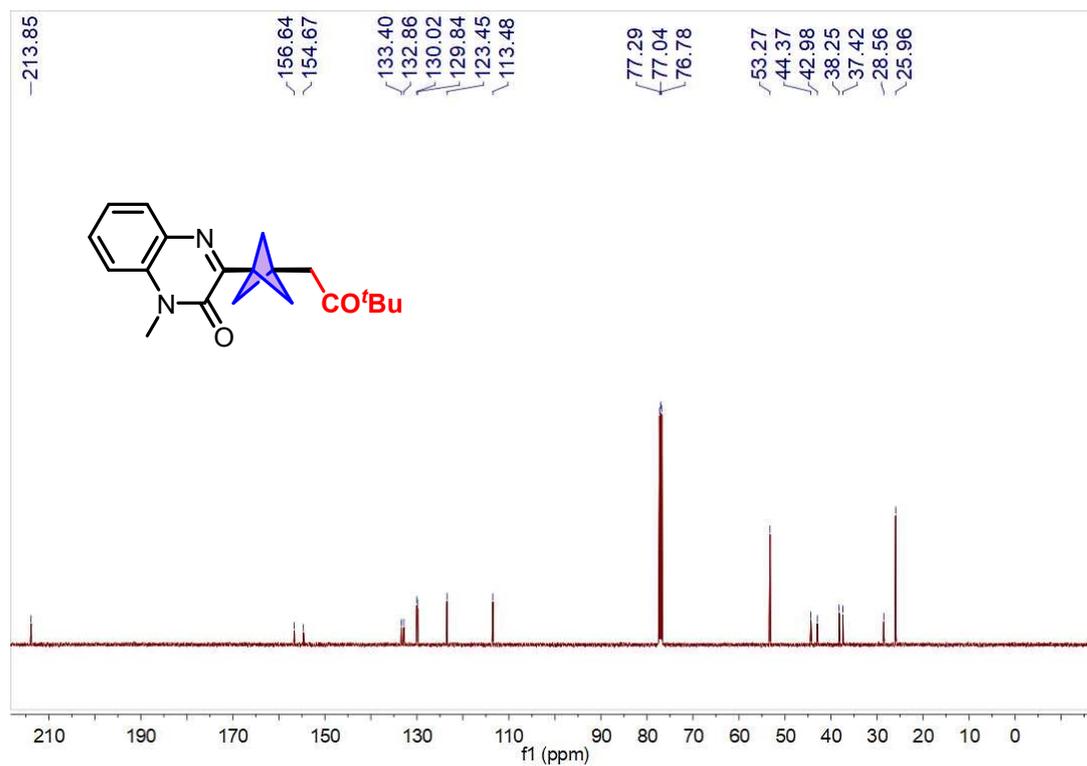
65  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



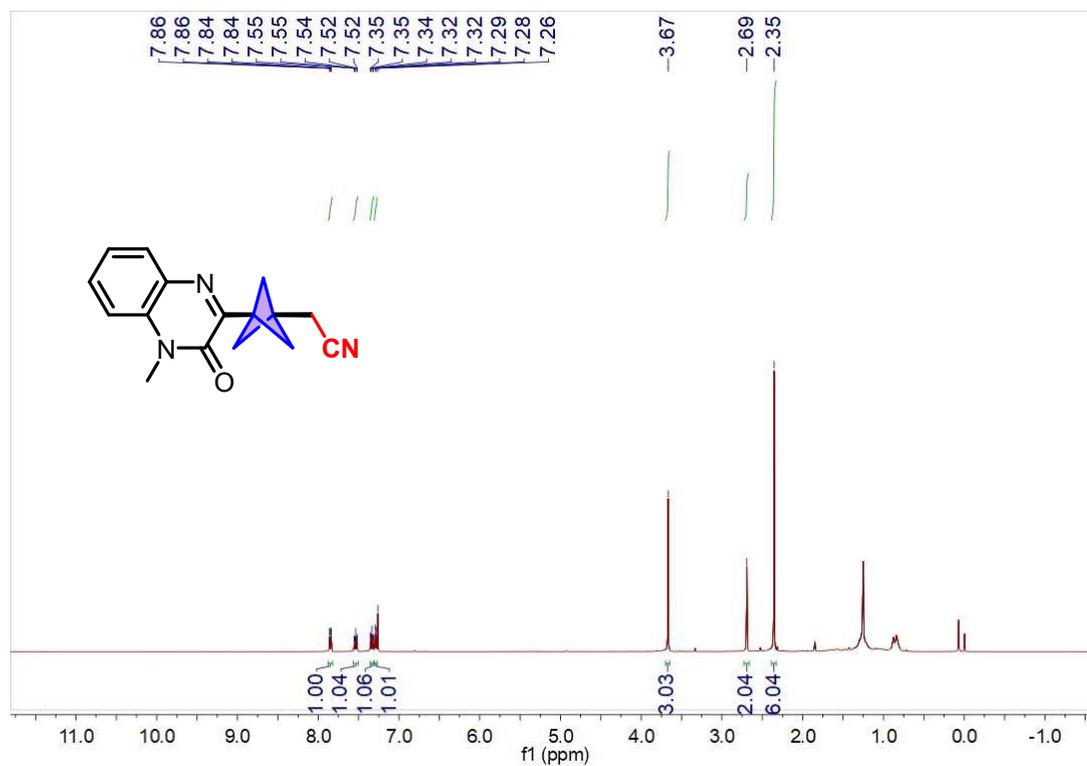
66  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



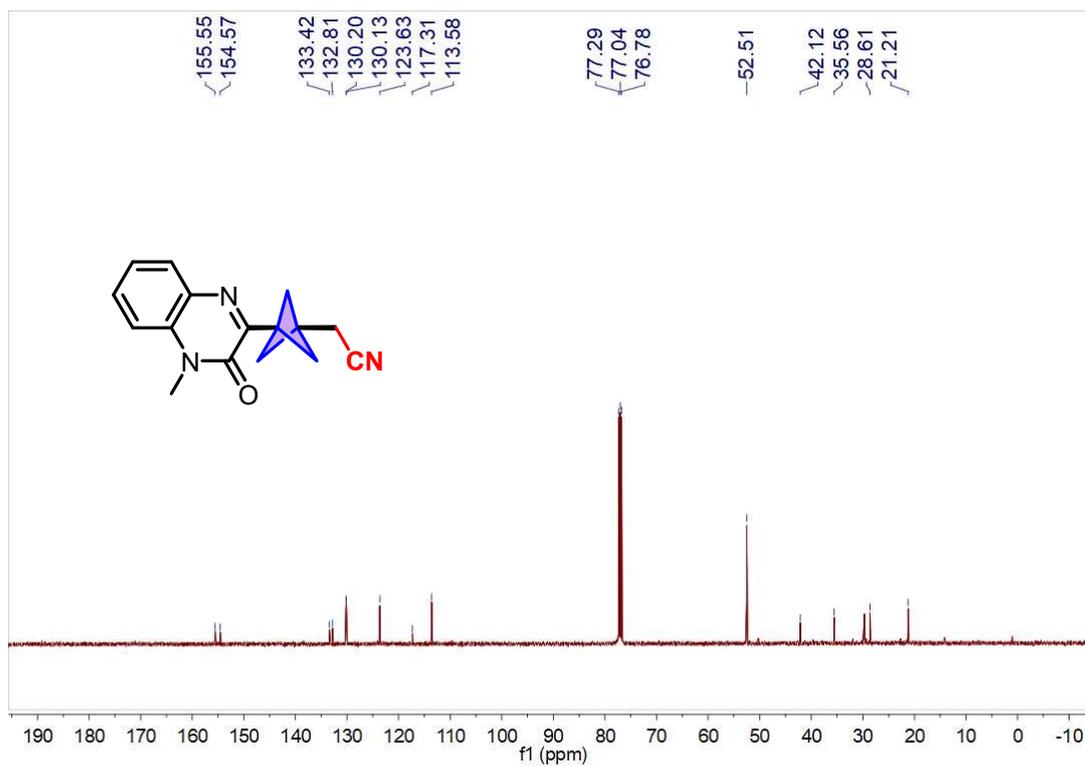
### 66 $^{13}\text{C}$ NMR (126 MHz, $\text{CDCl}_3$ )



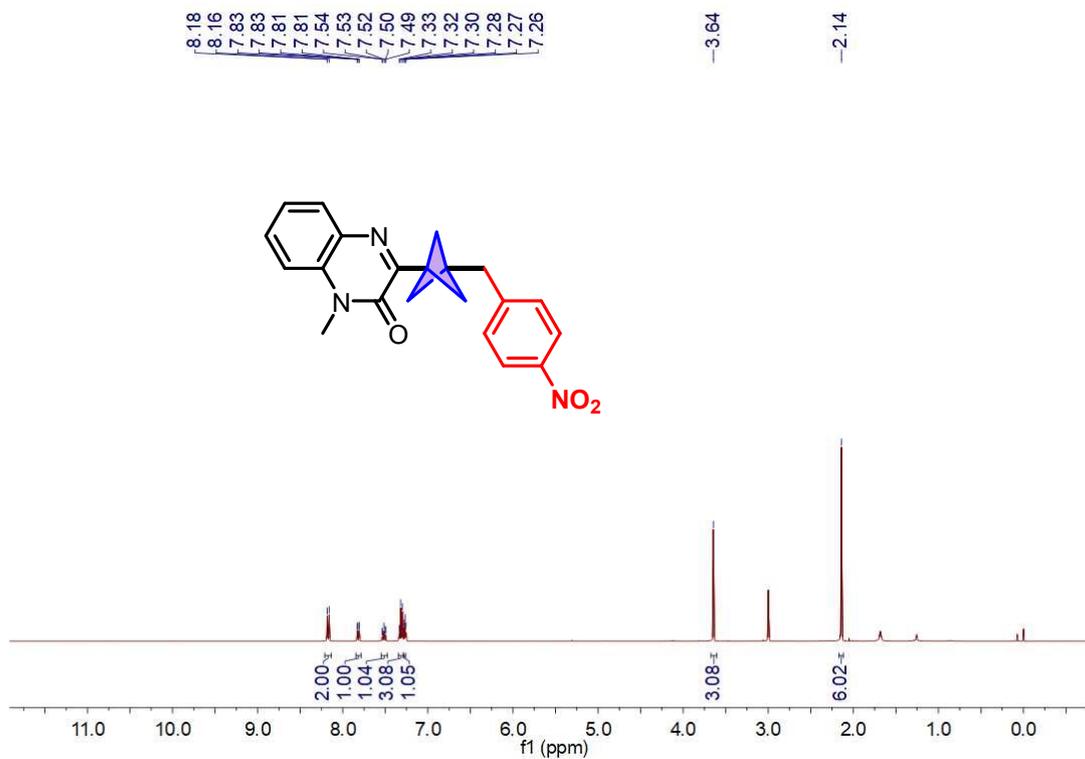
### 67 $^1\text{H}$ NMR (500 MHz, $\text{CDCl}_3$ )



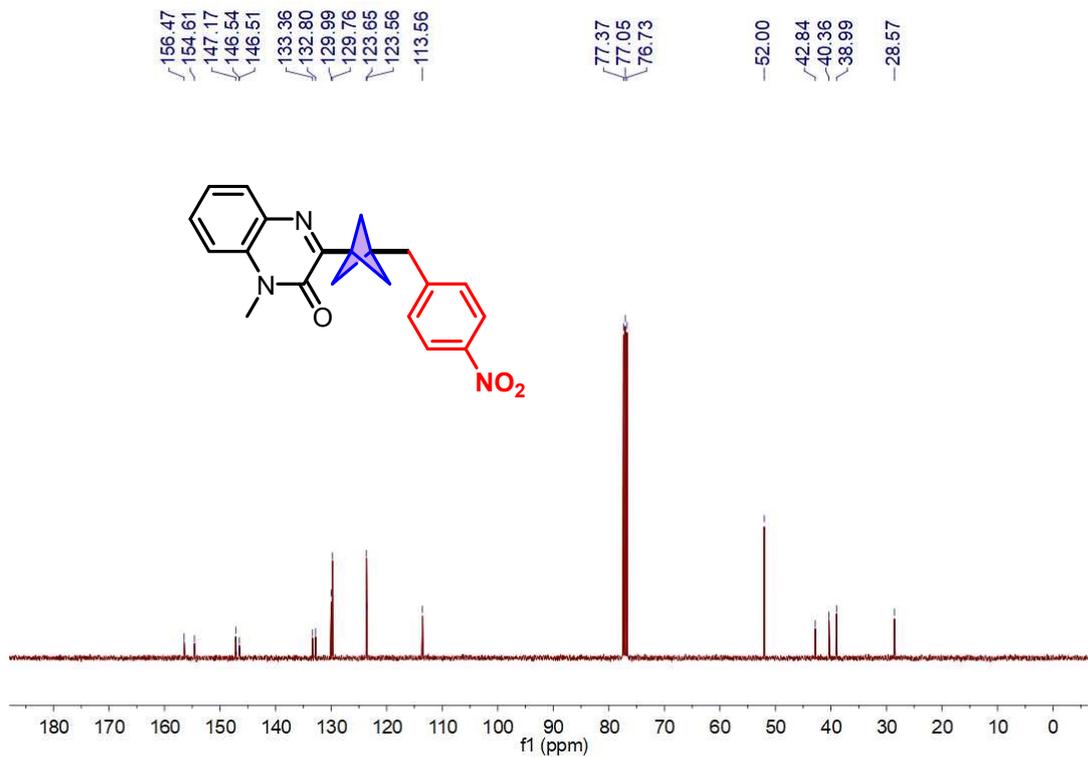
67 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



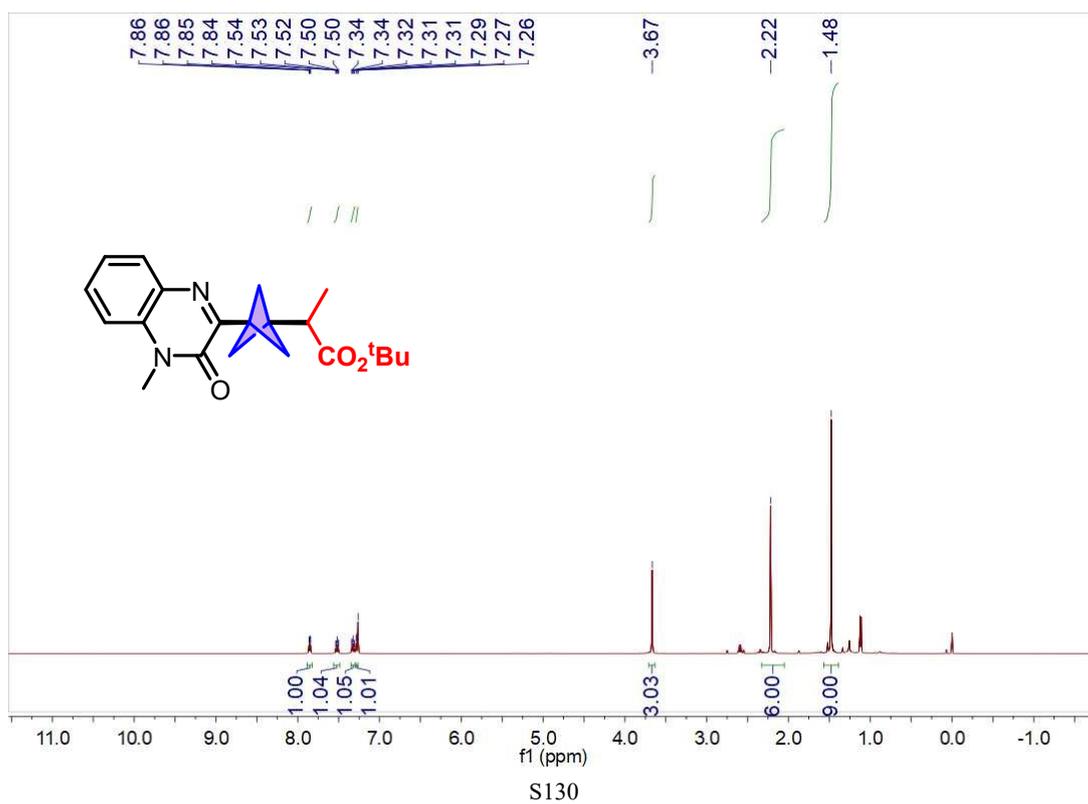
68 <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



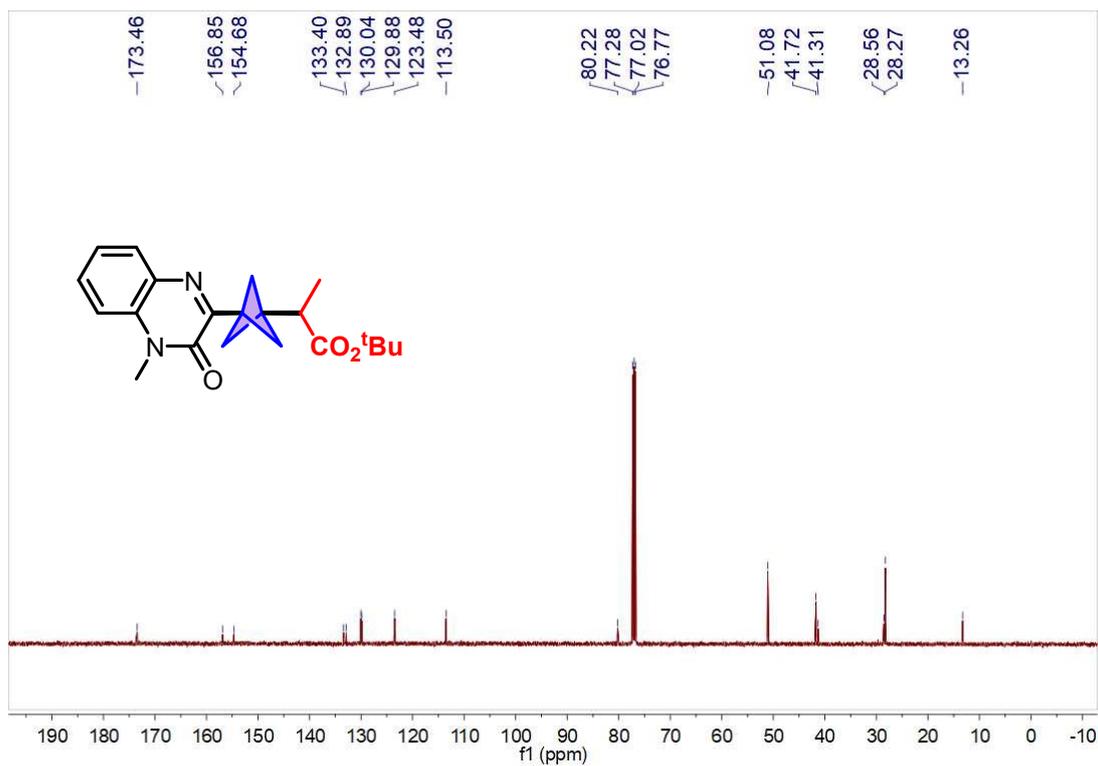
68  $^{13}\text{C}$  NMR (101 MHz,  $\text{CDCl}_3$ )



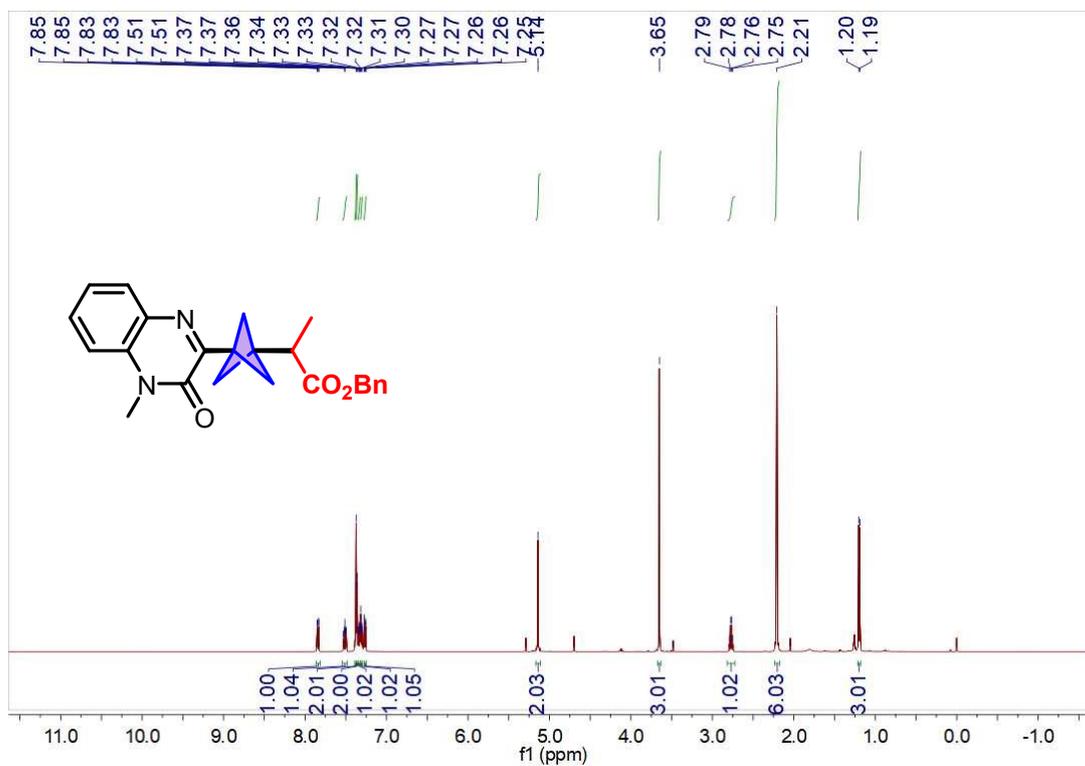
69  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



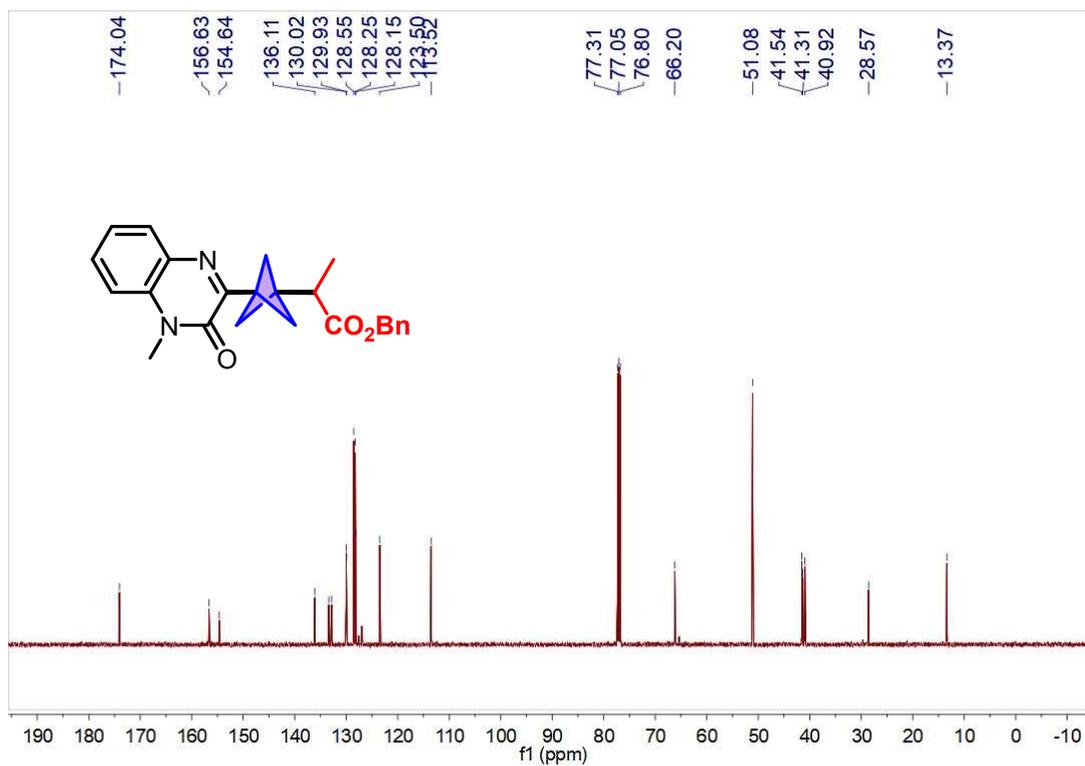
69 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



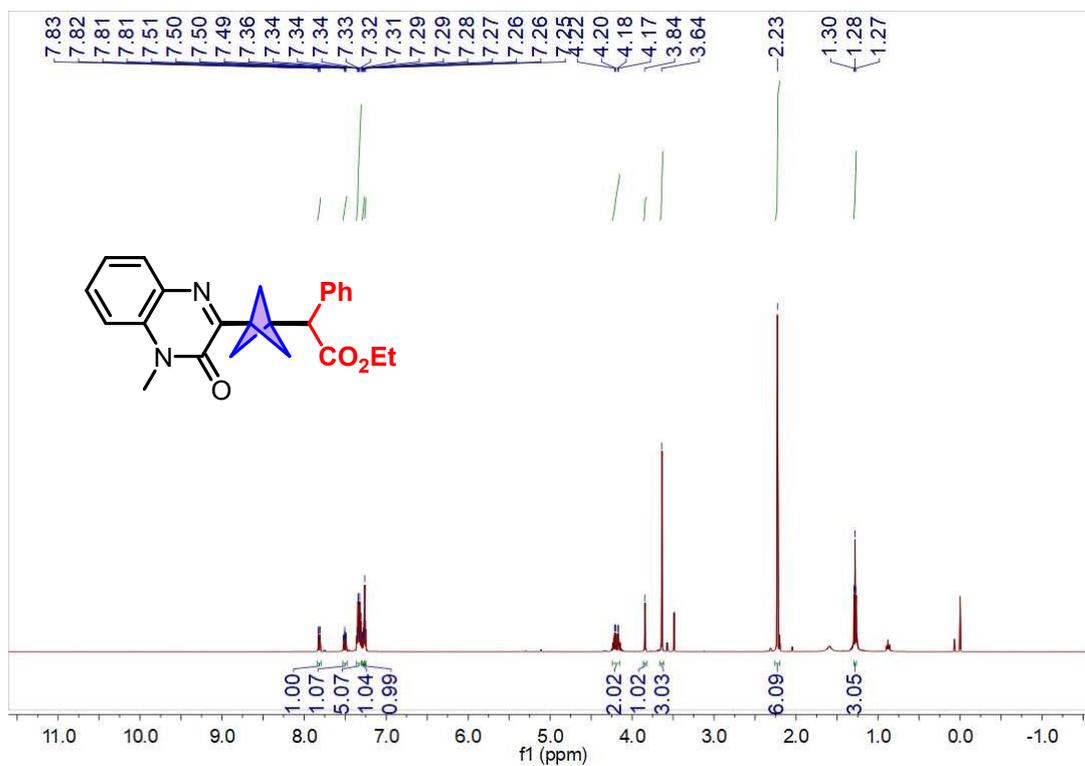
70 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



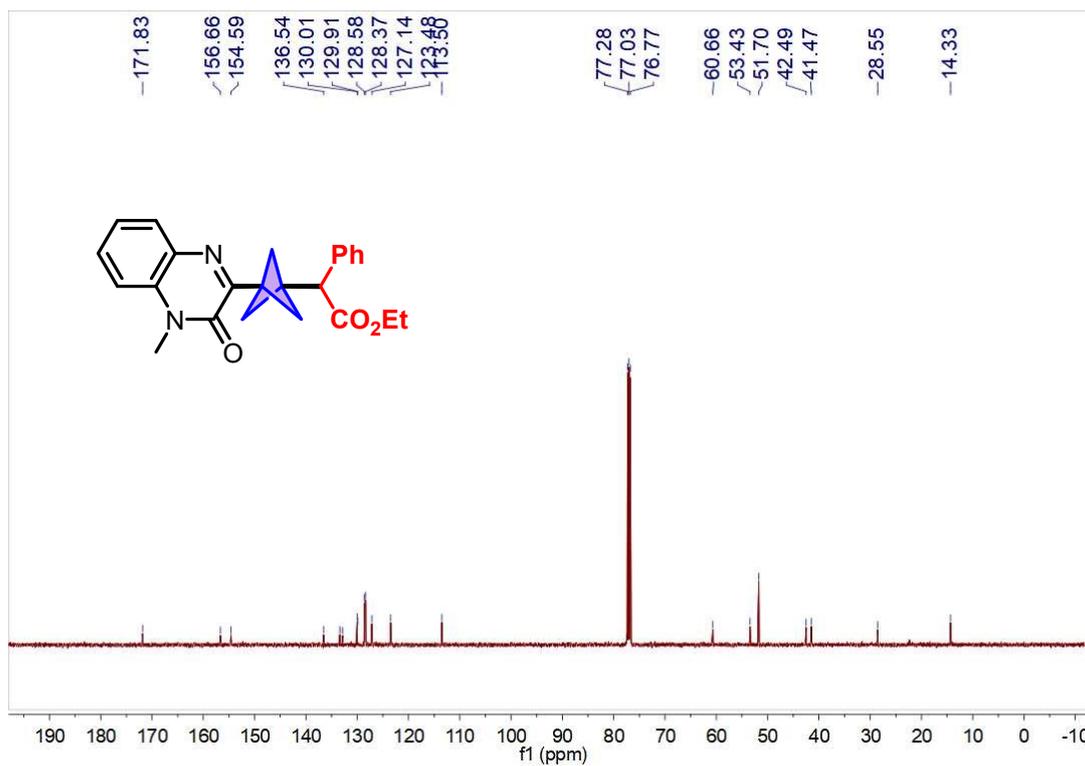
70 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



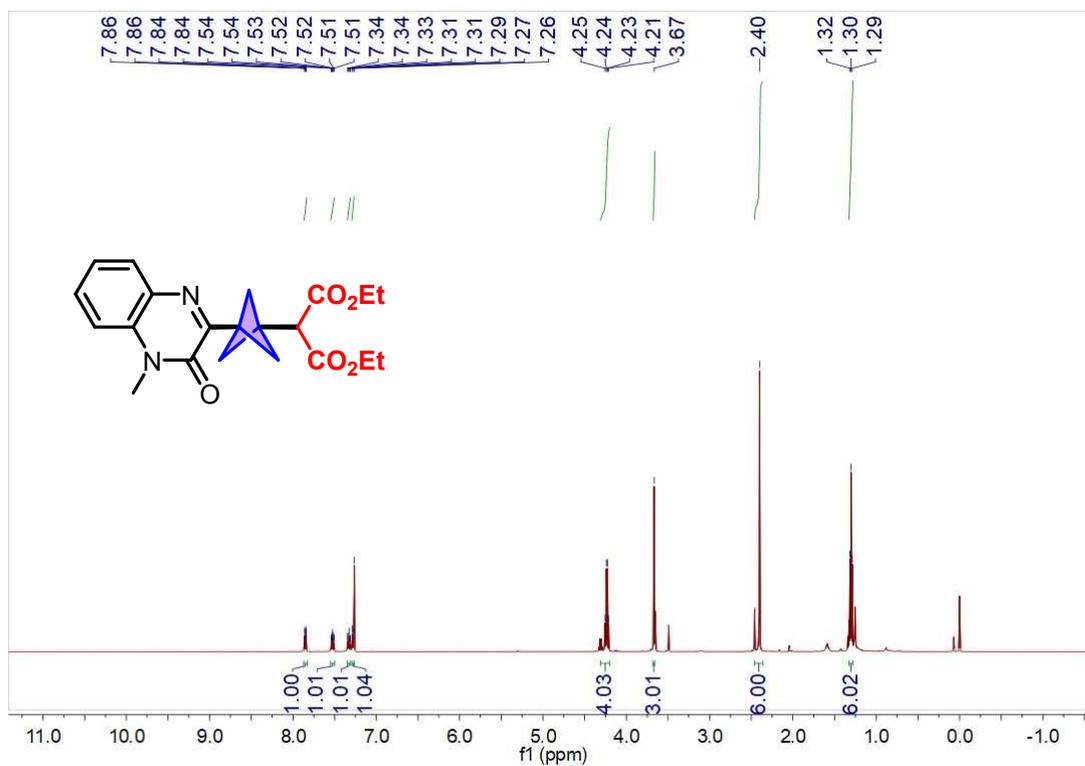
71 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



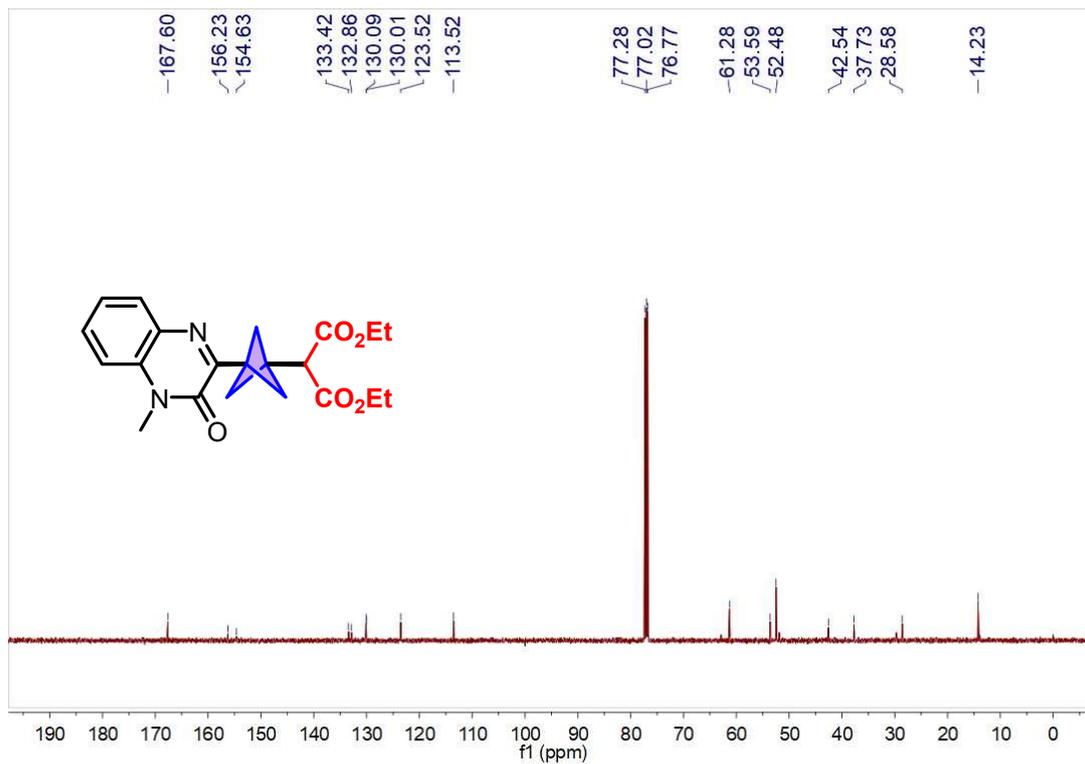
71 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



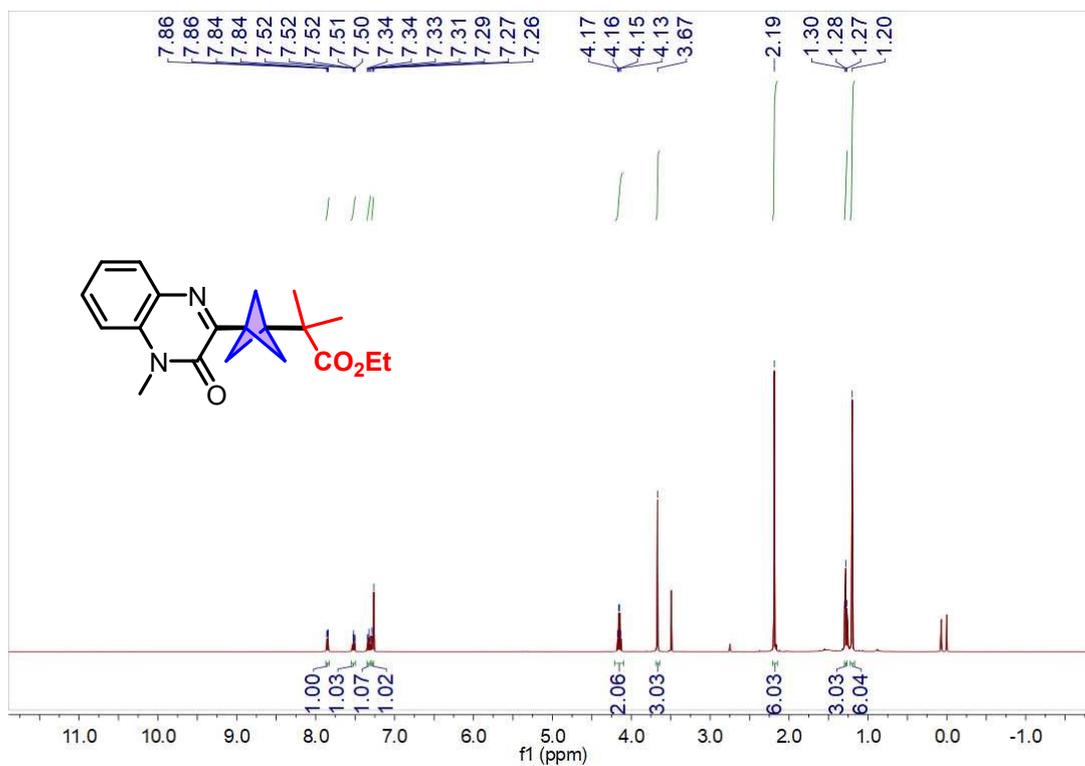
72 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



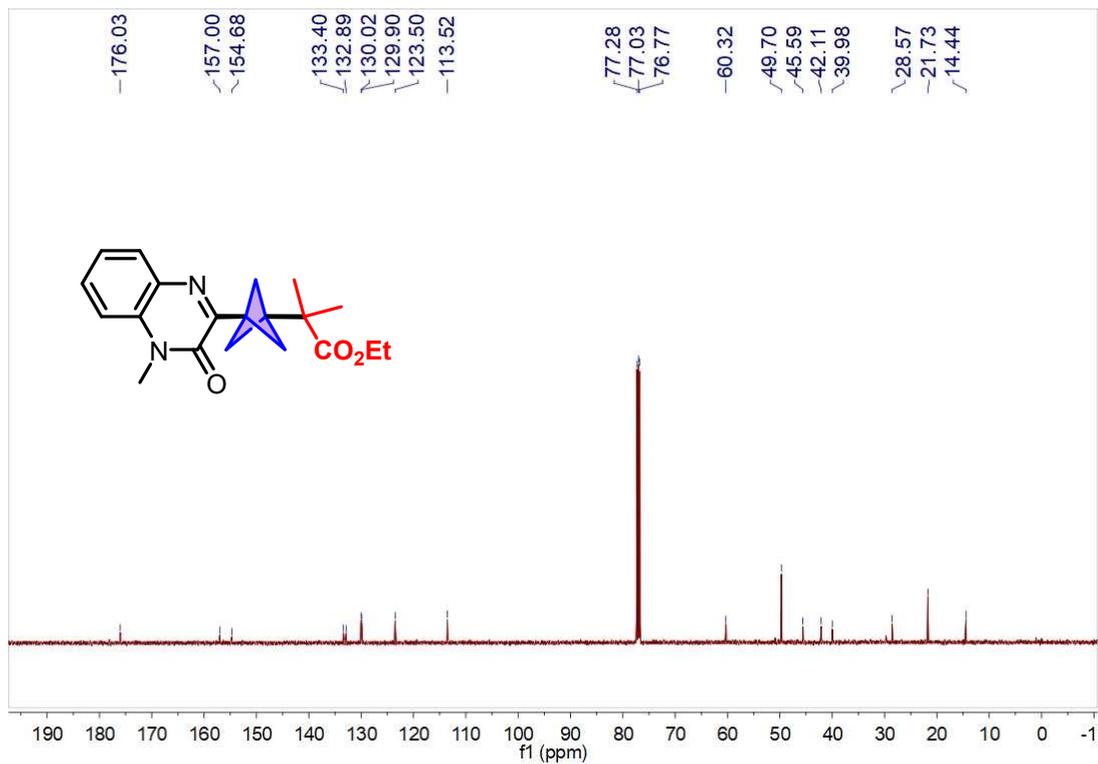
72 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



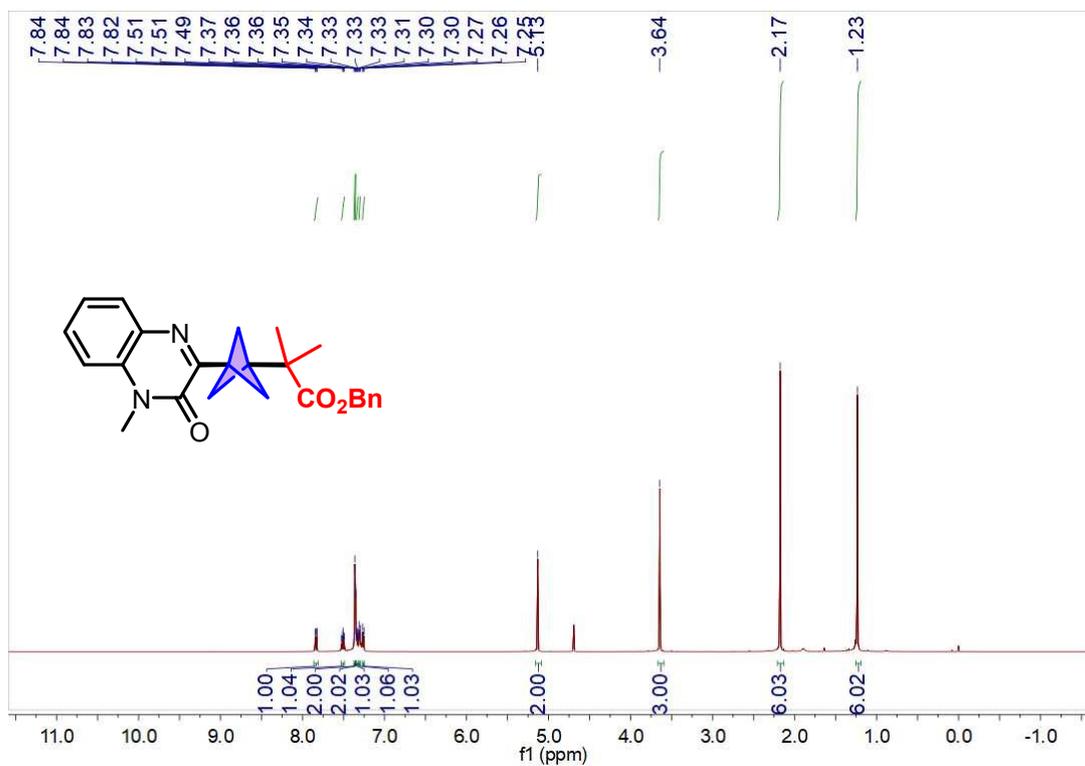
74 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



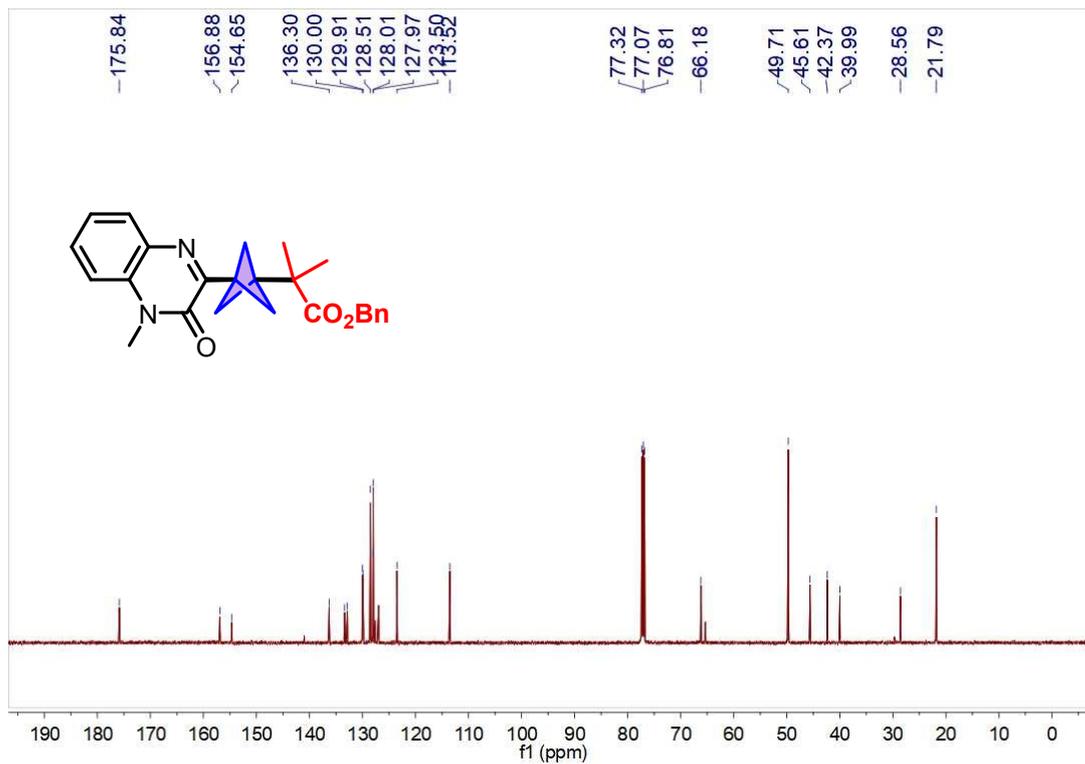
74  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



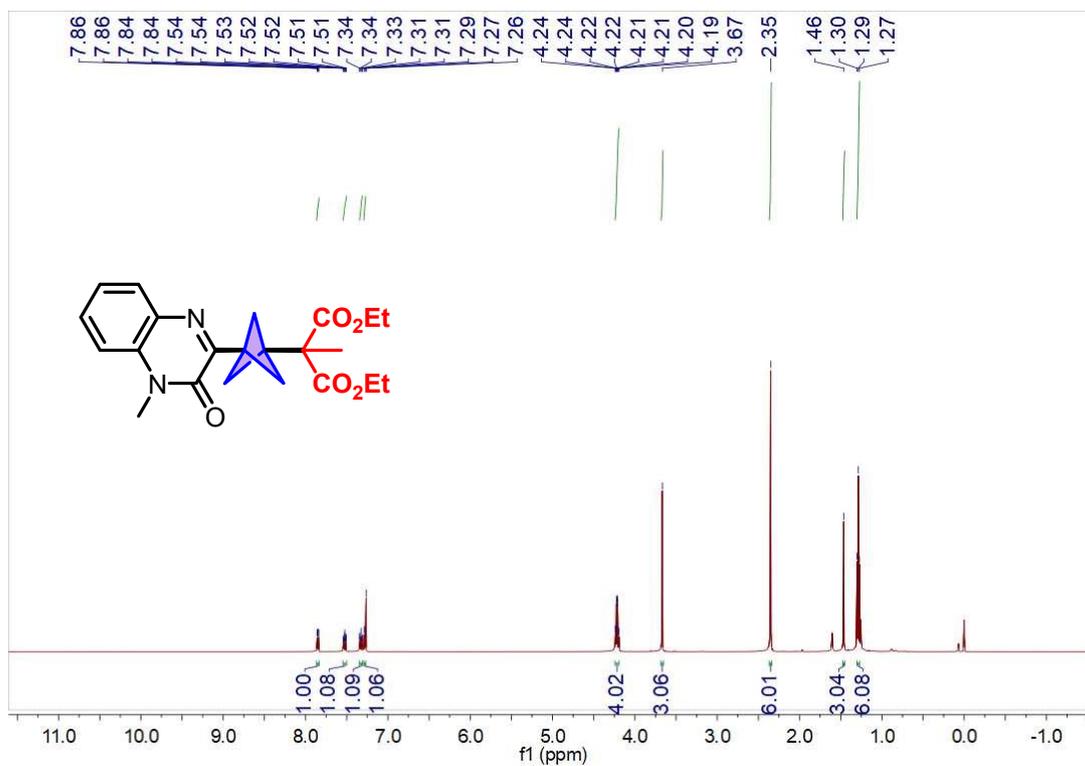
75  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



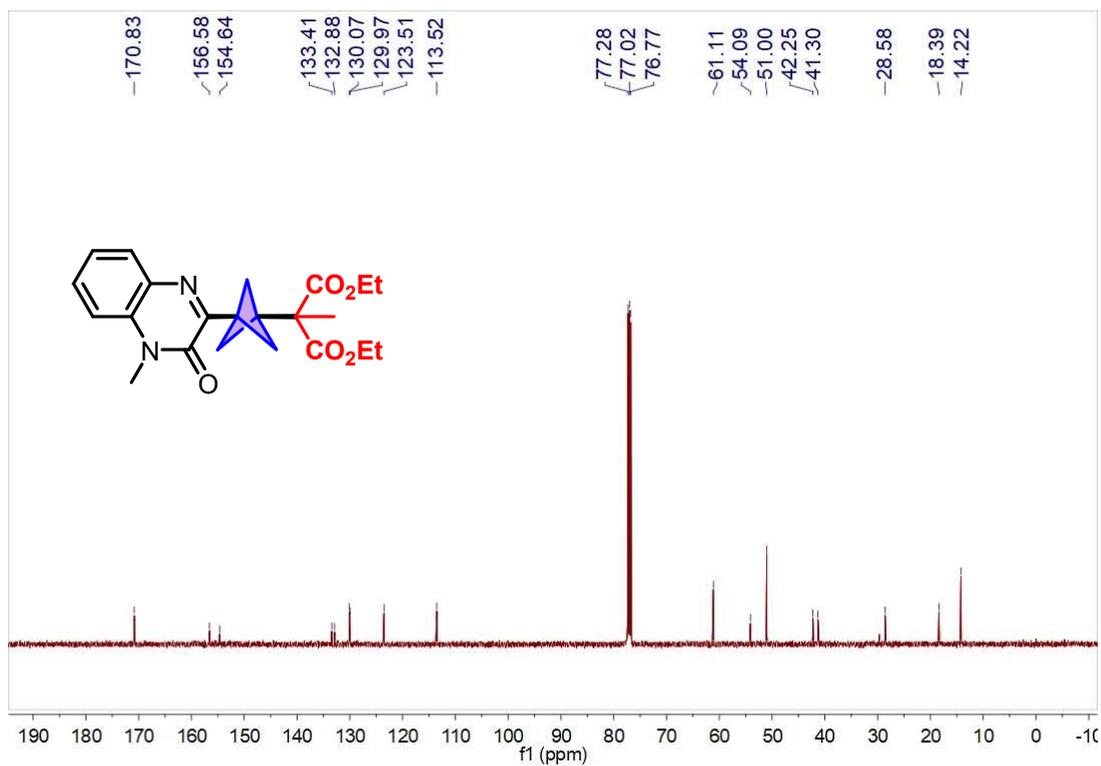
75 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



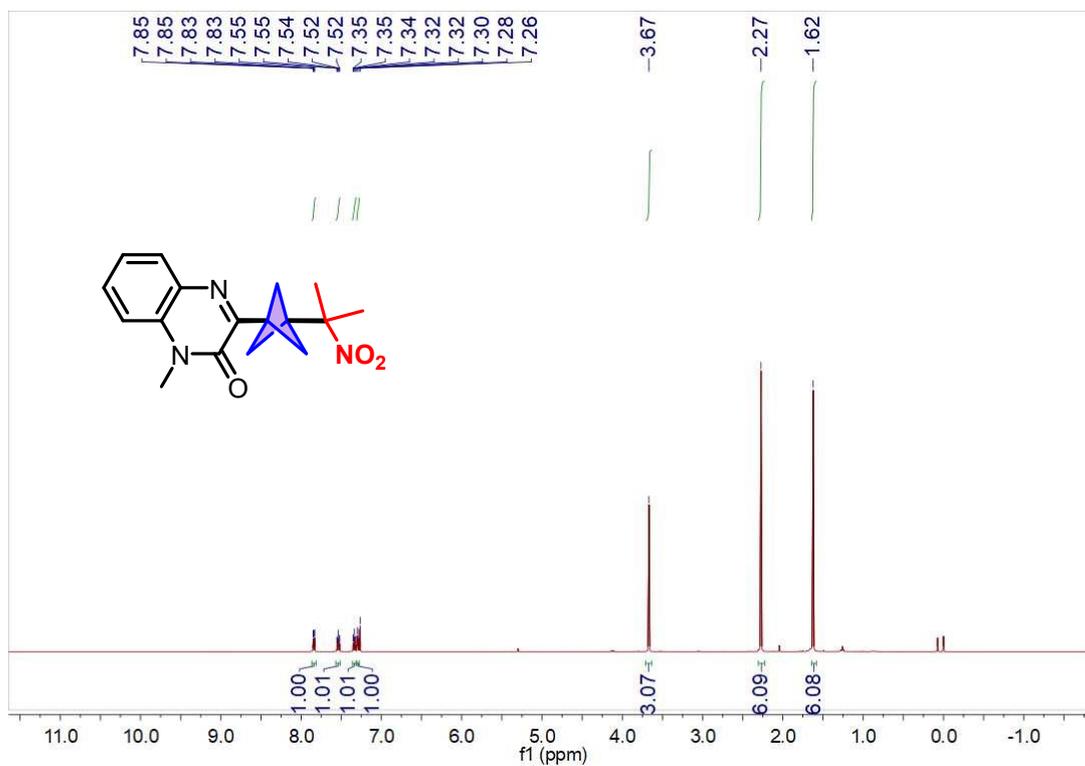
76 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



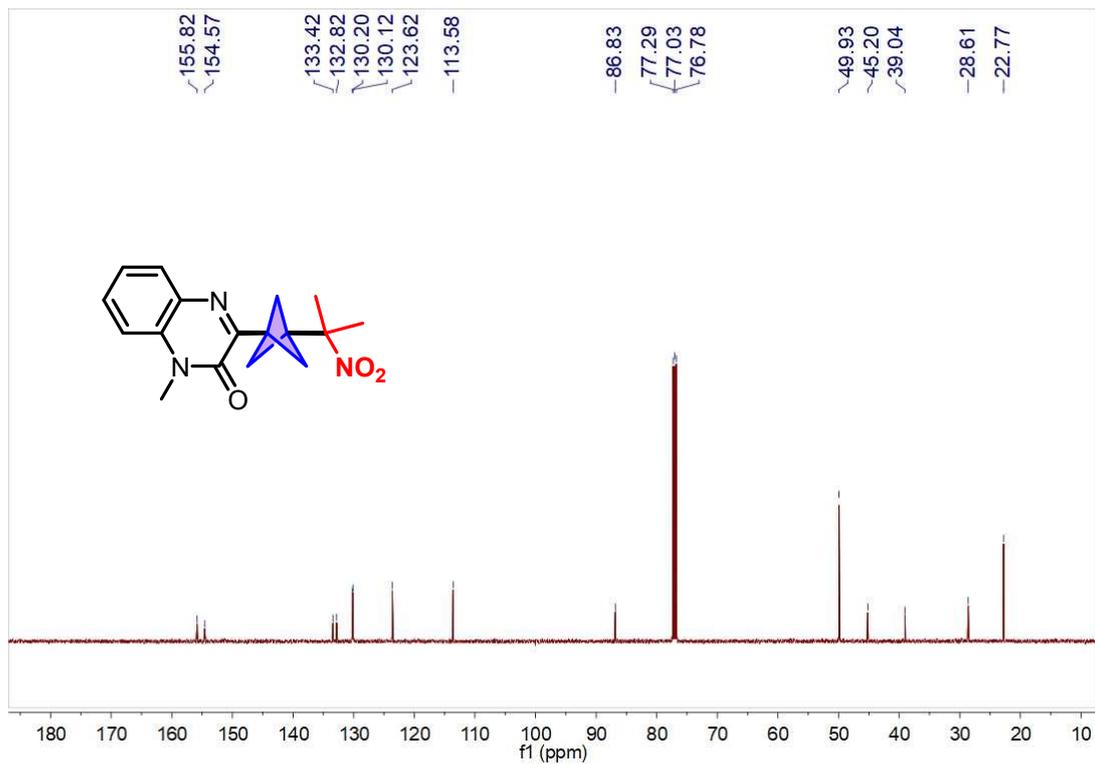
76 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



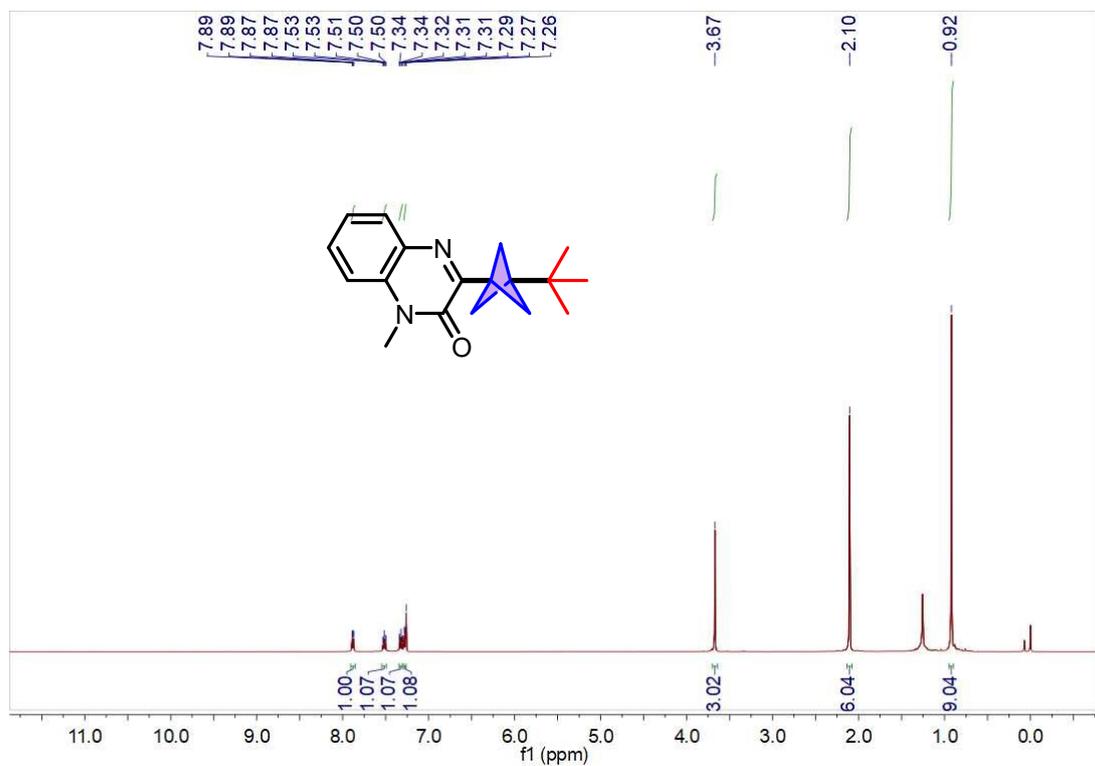
77 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



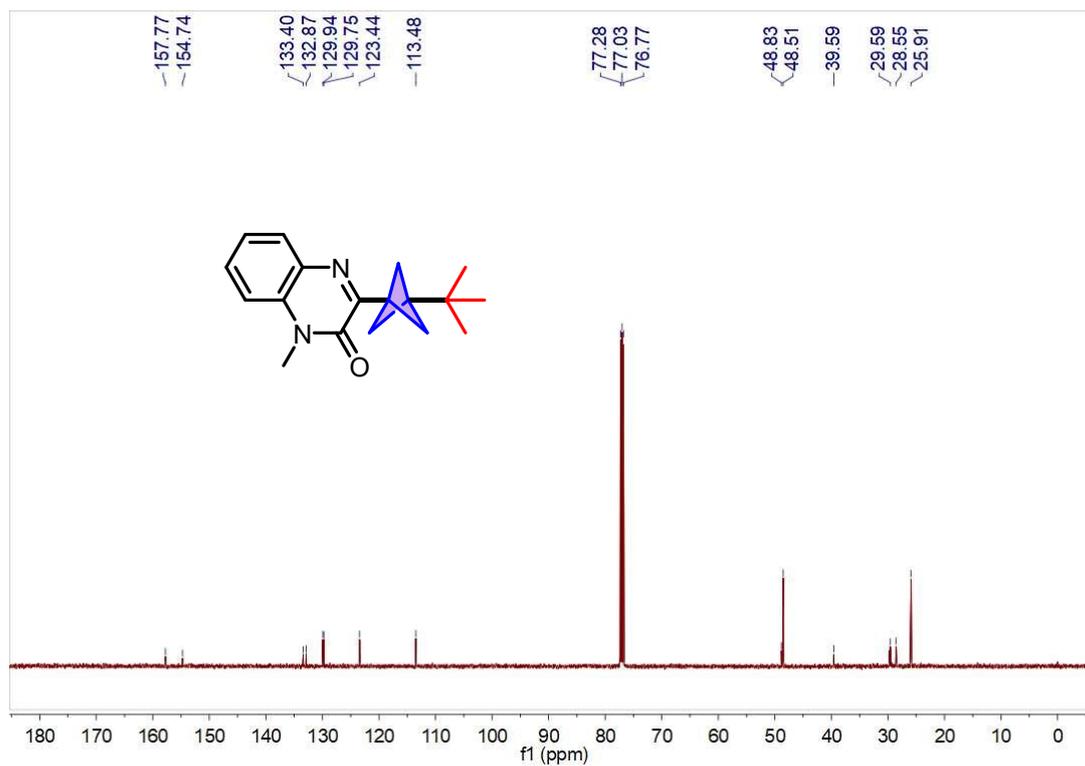
77 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



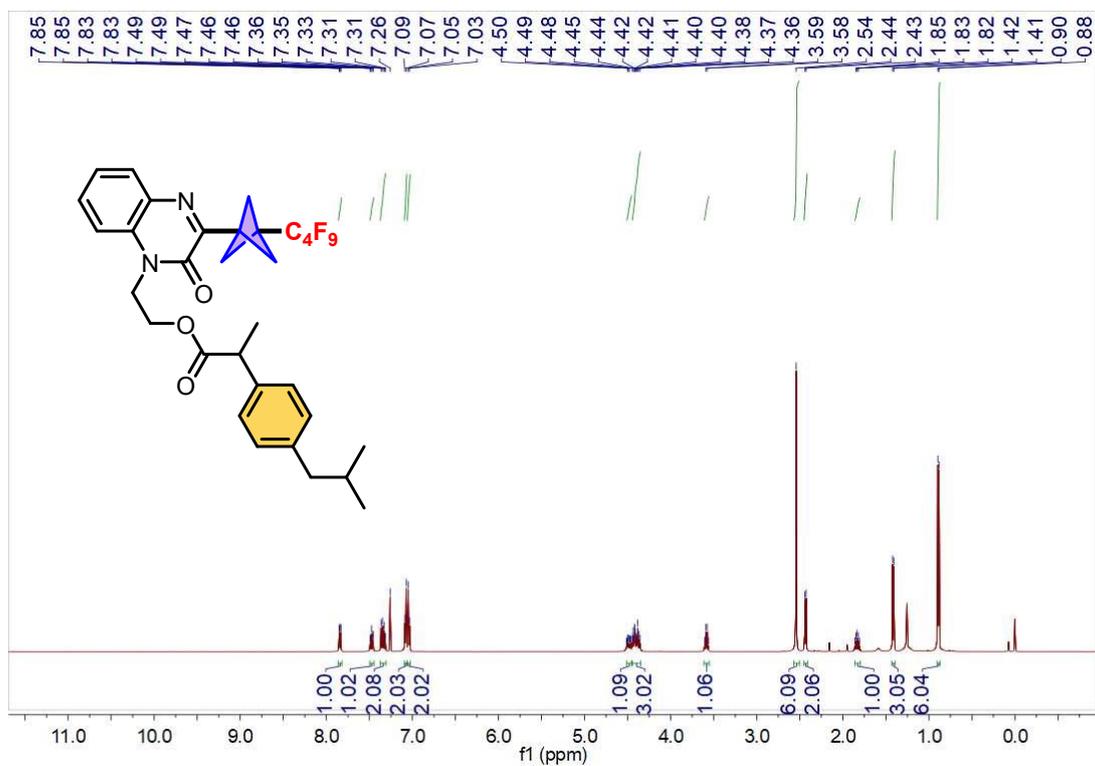
78 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



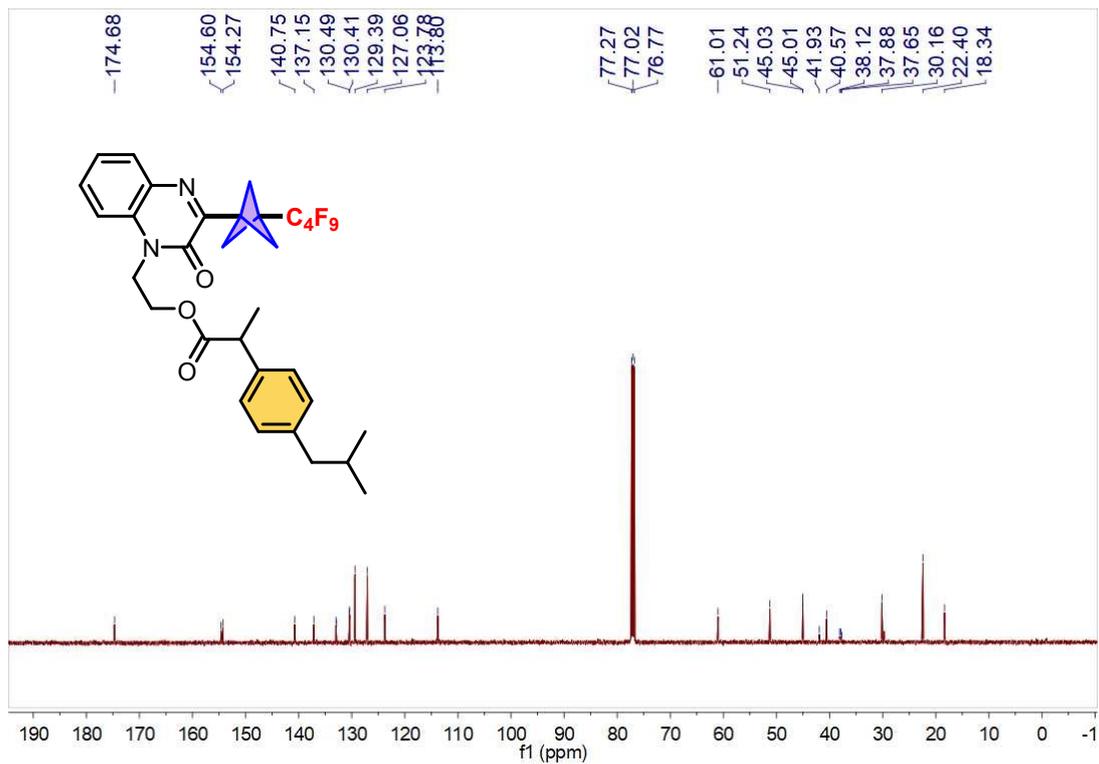
78  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



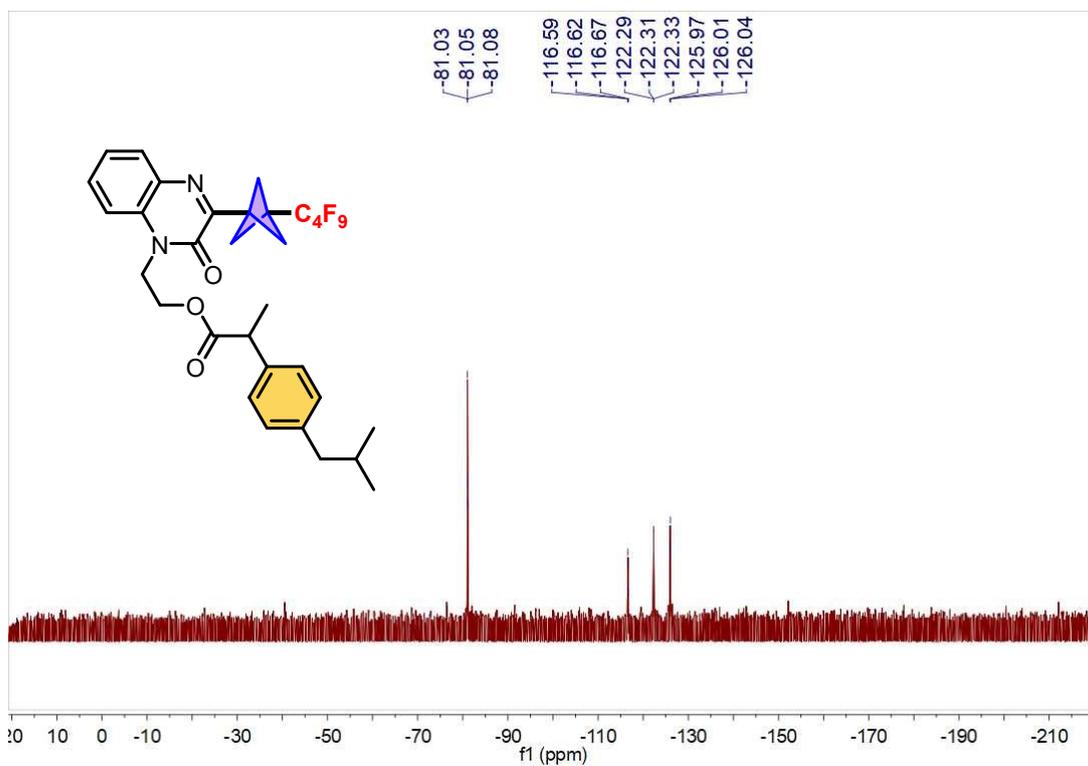
79  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



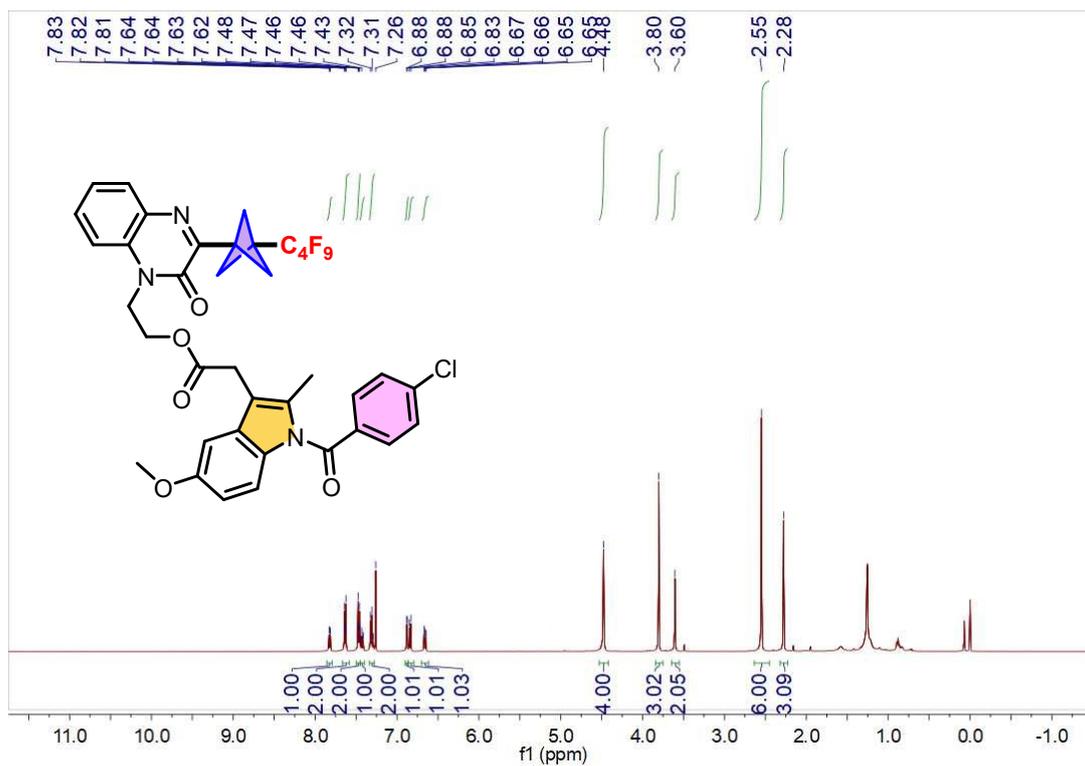
### 79 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



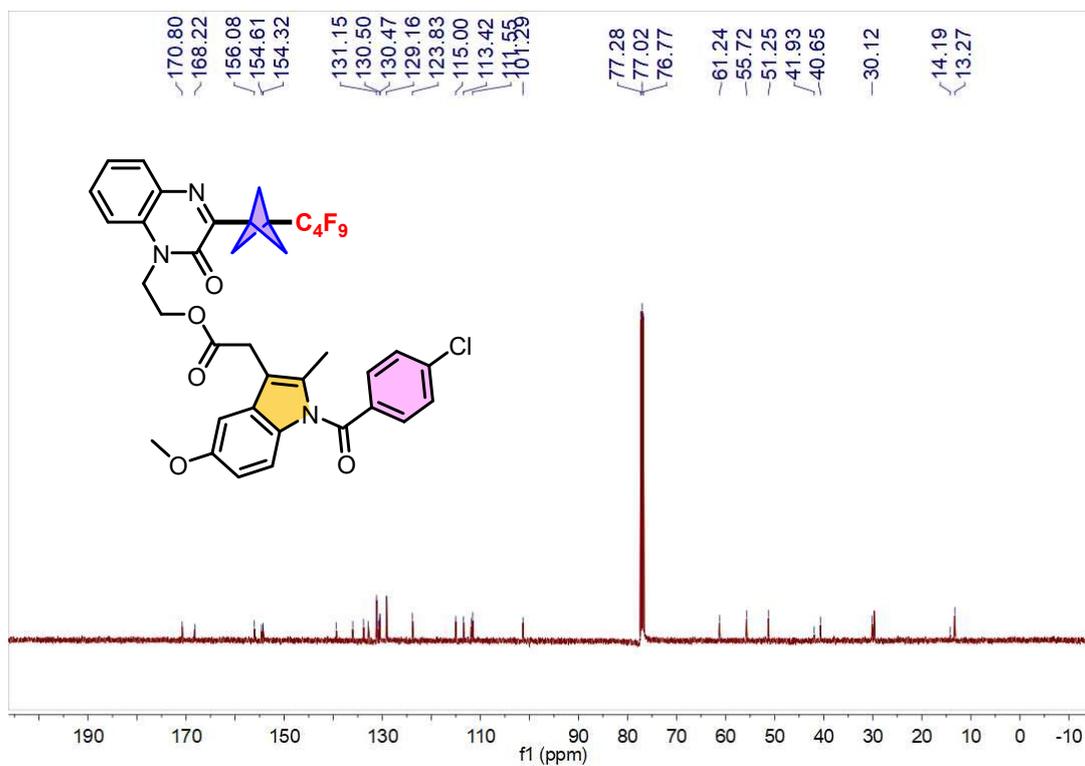
### 79 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



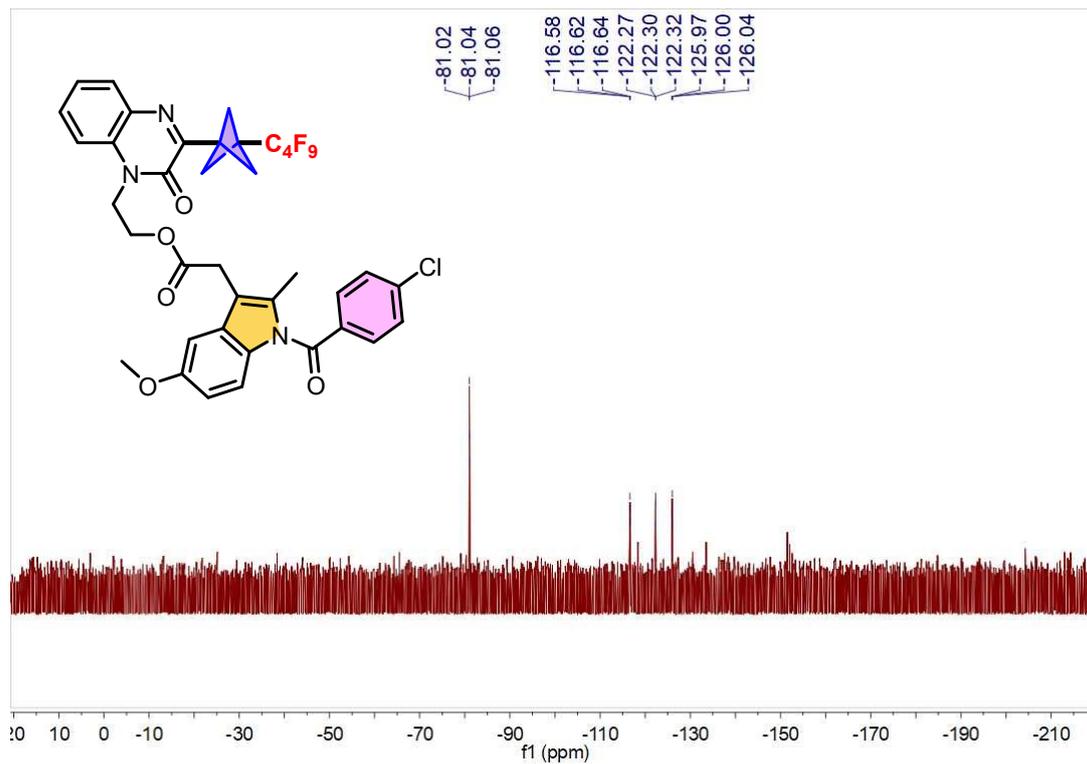
80 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



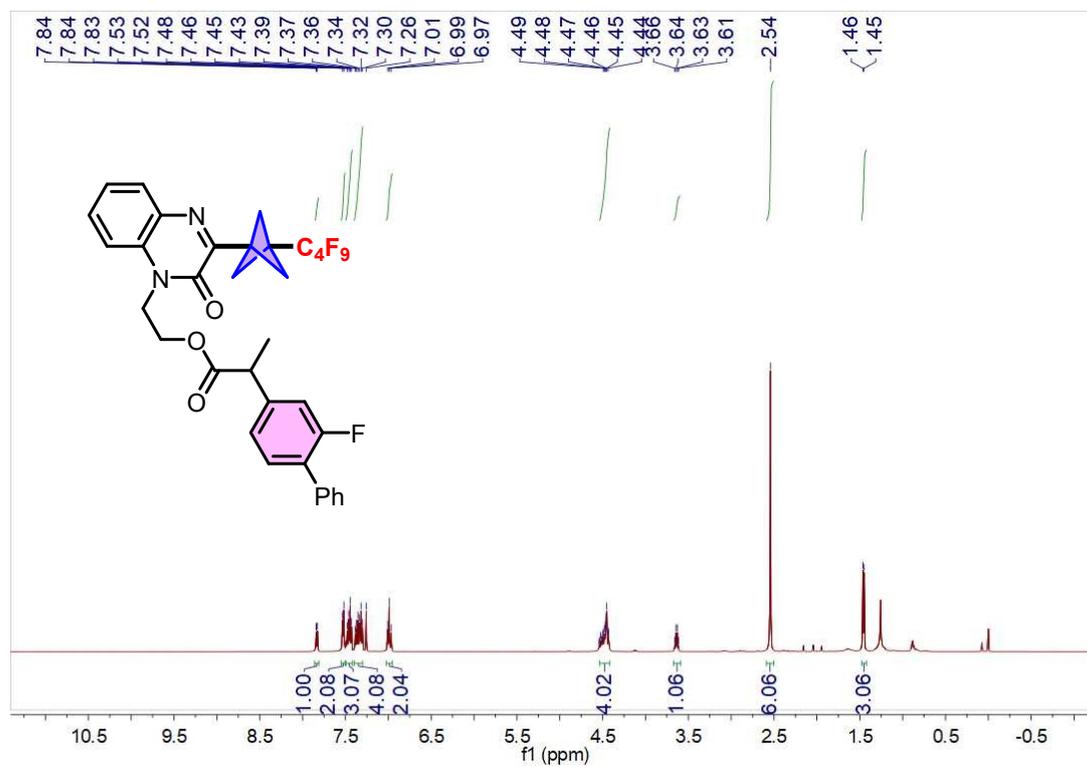
80 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



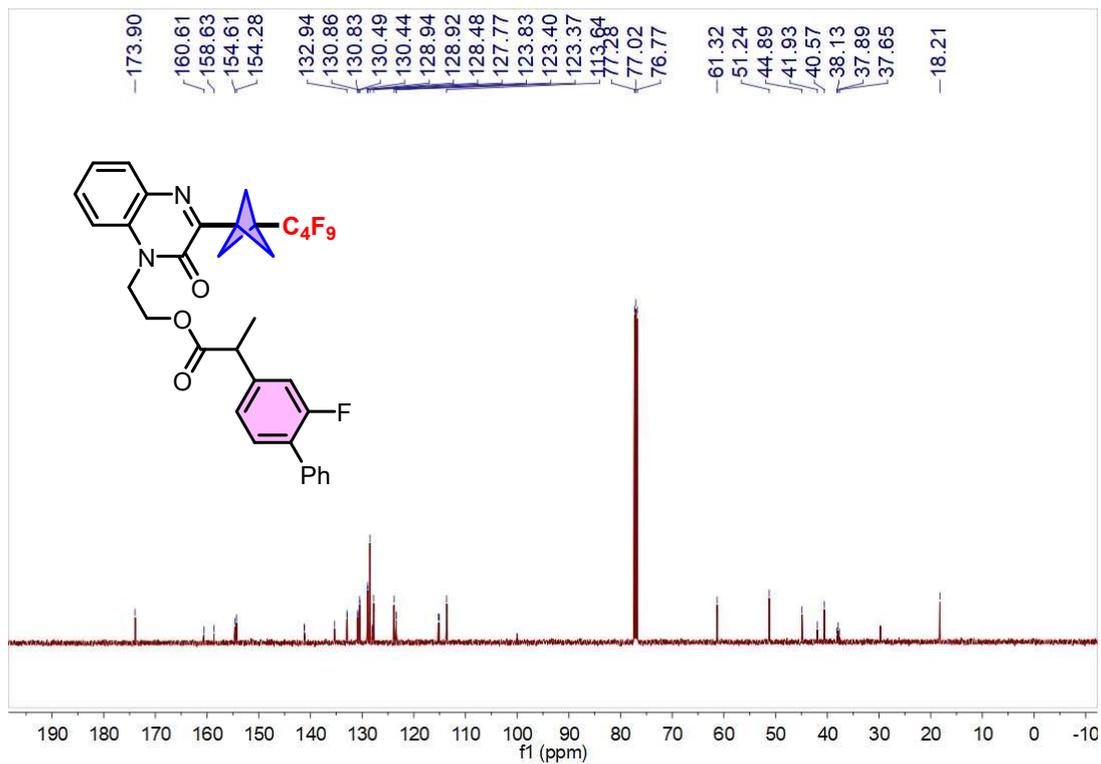
80  $^{19}\text{F}$  NMR (471 MHz,  $\text{CDCl}_3$ )



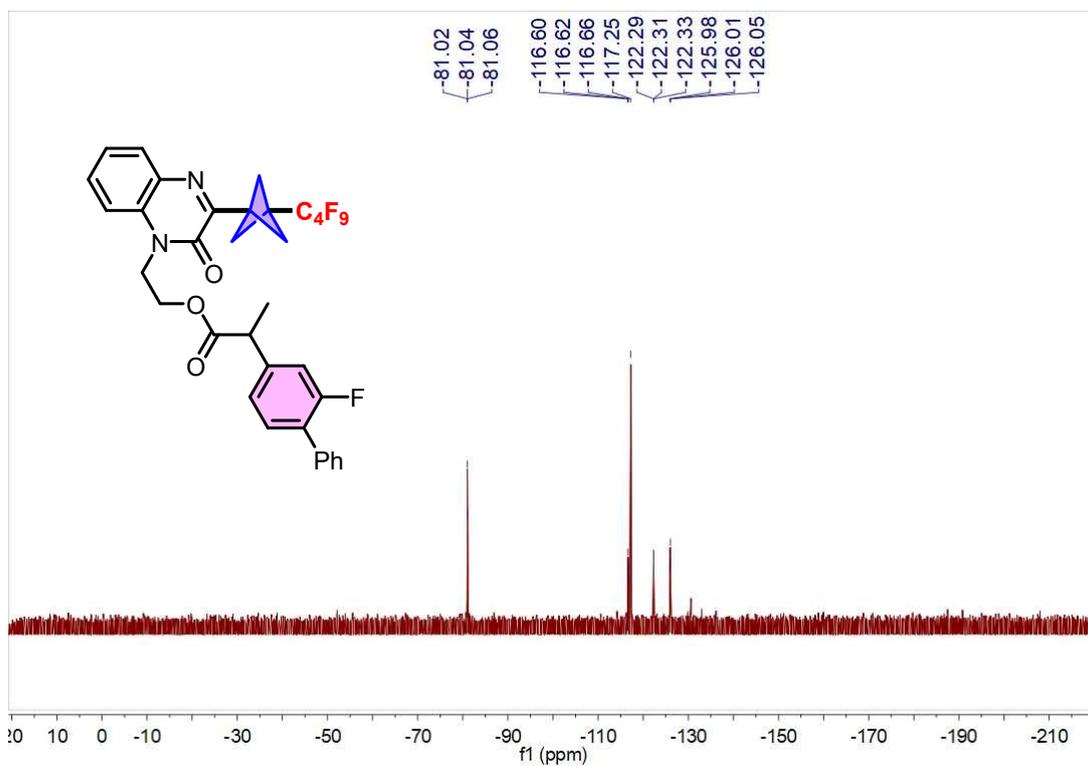
81  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



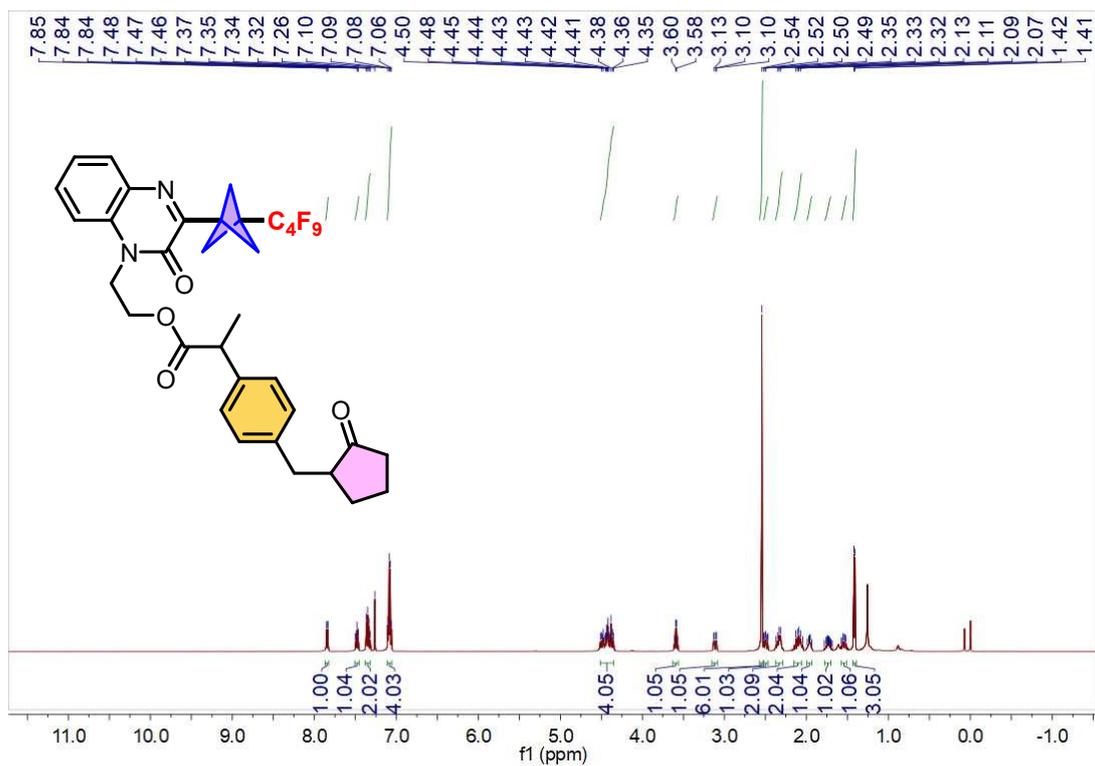
### 81 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



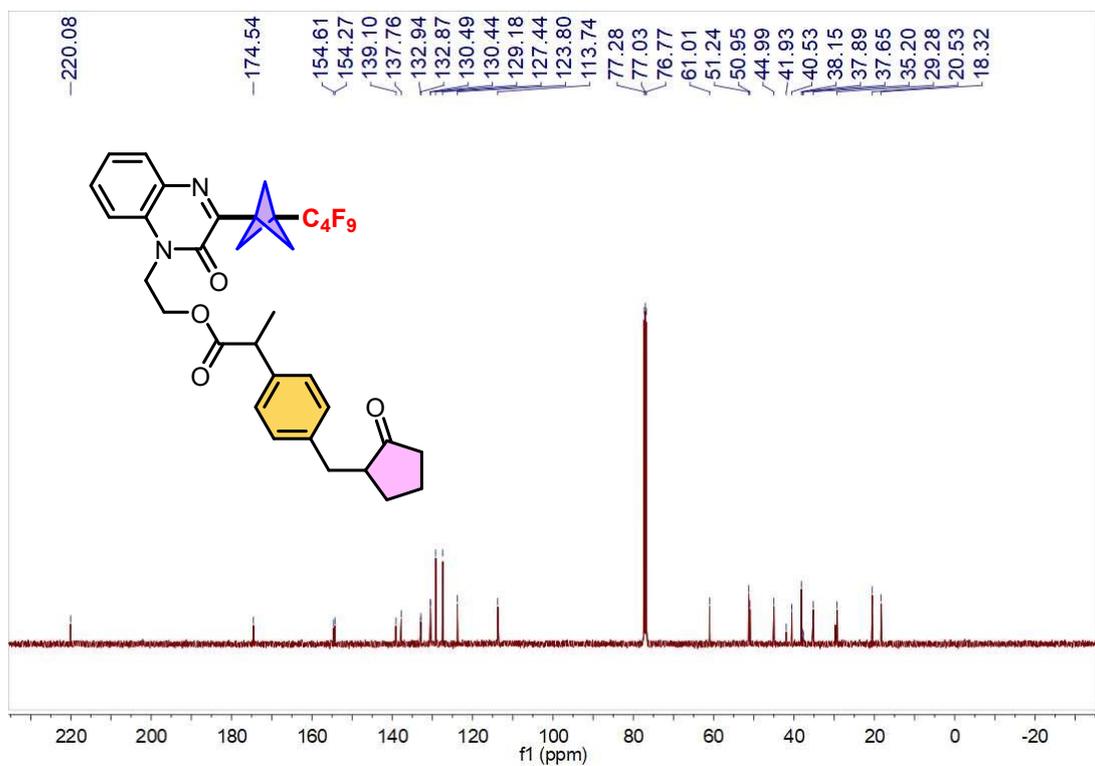
### 81 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



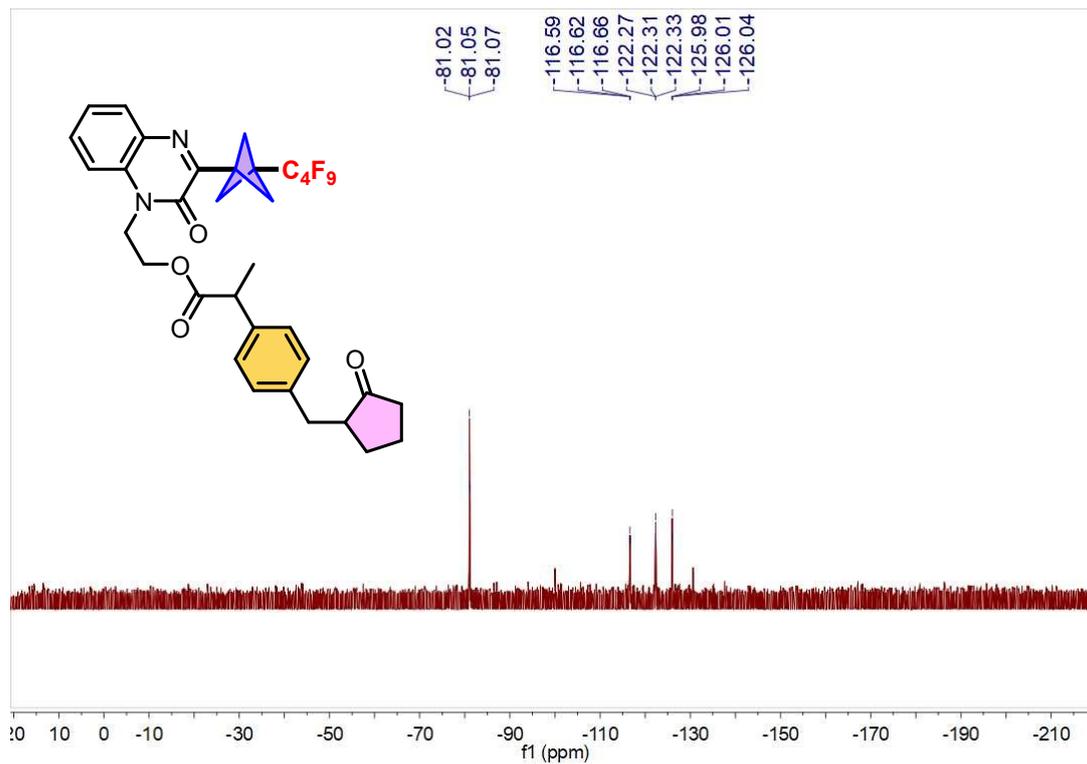
82 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



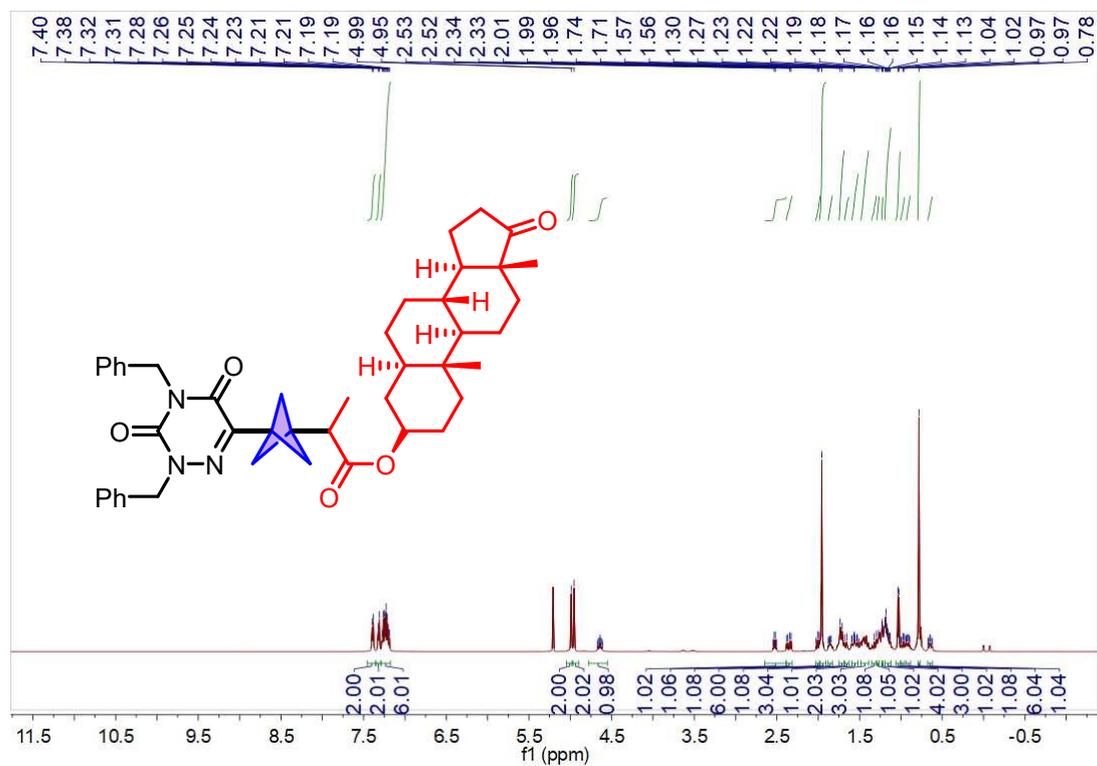
82 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



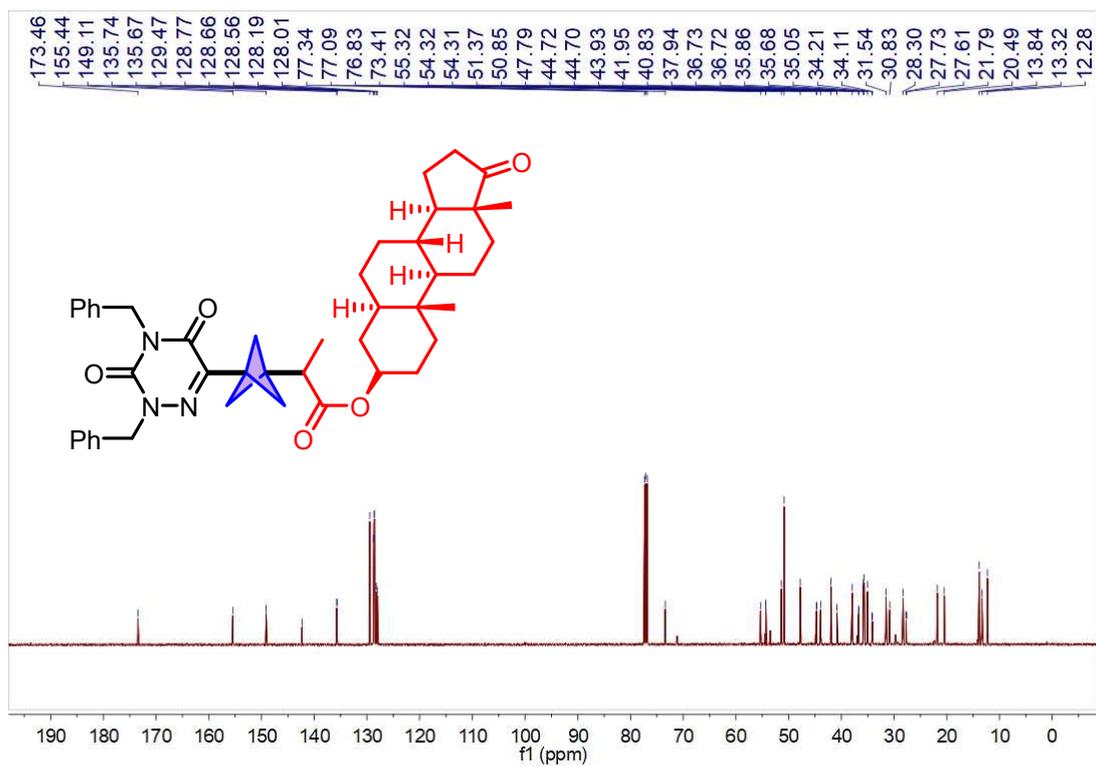
82 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)



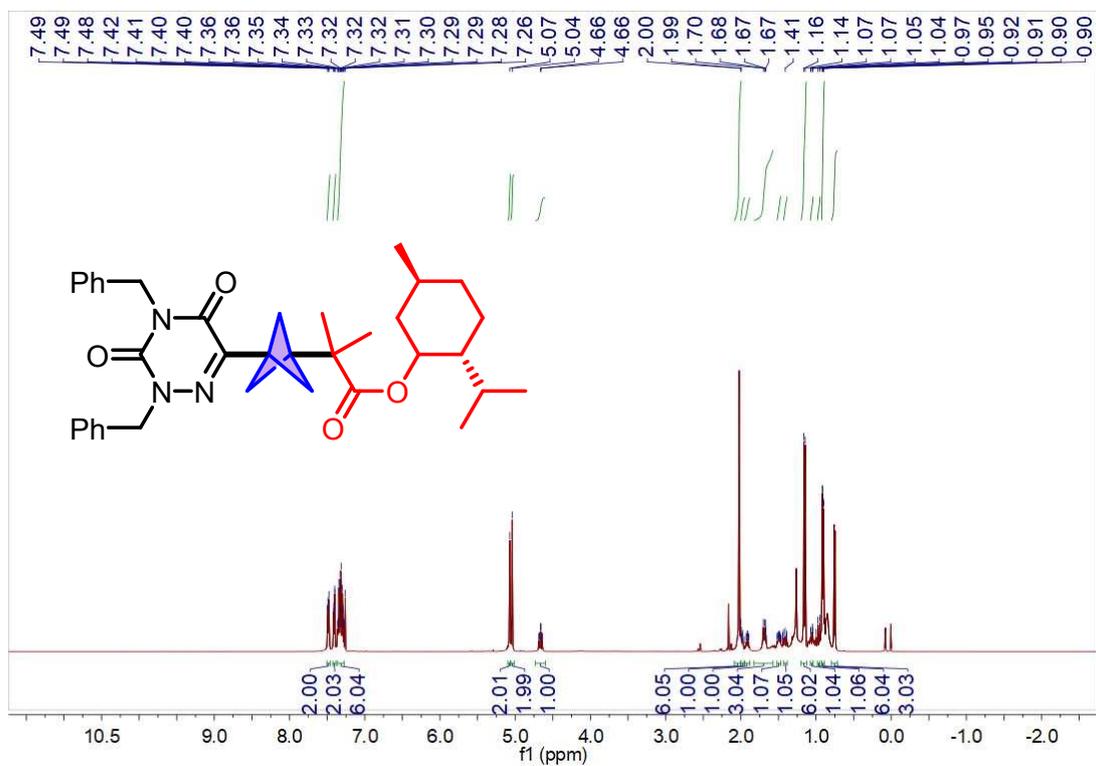
83 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



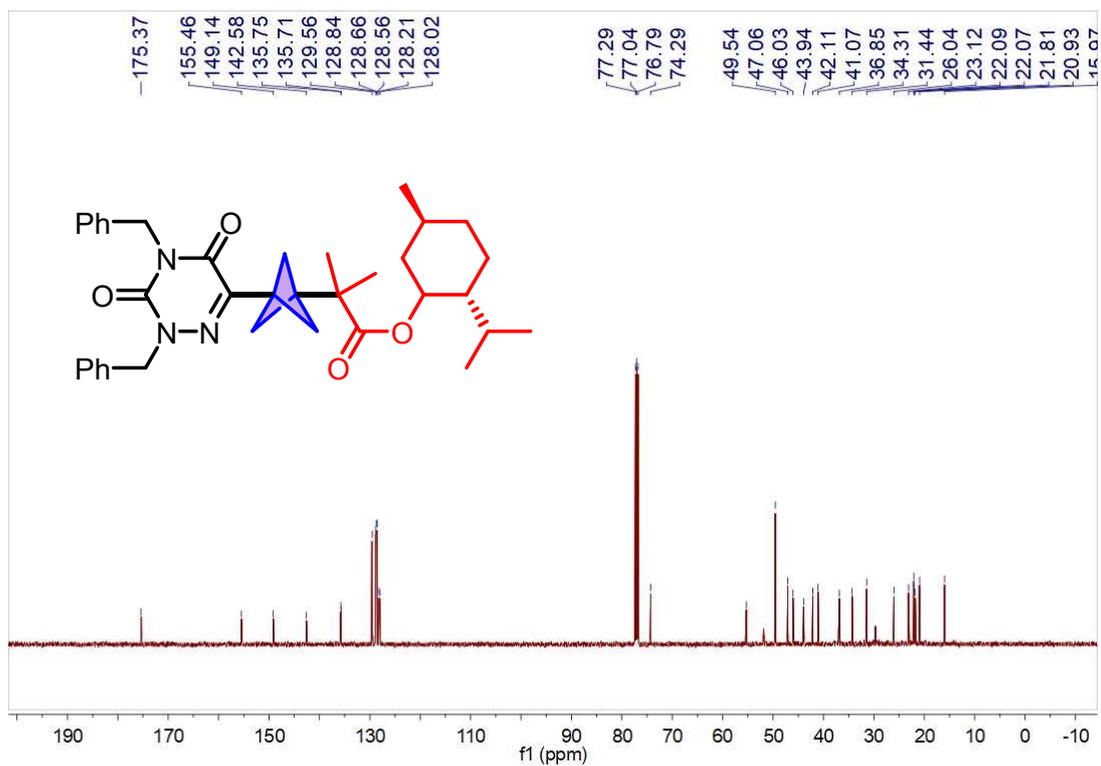
83 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



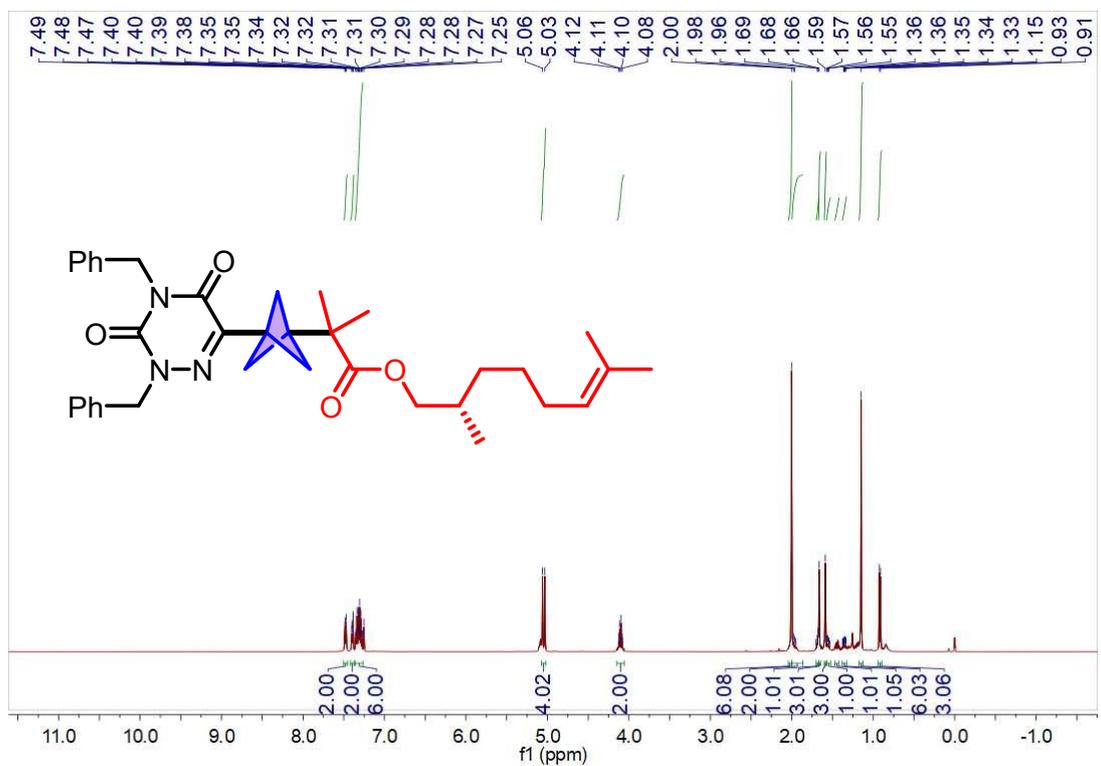
84 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



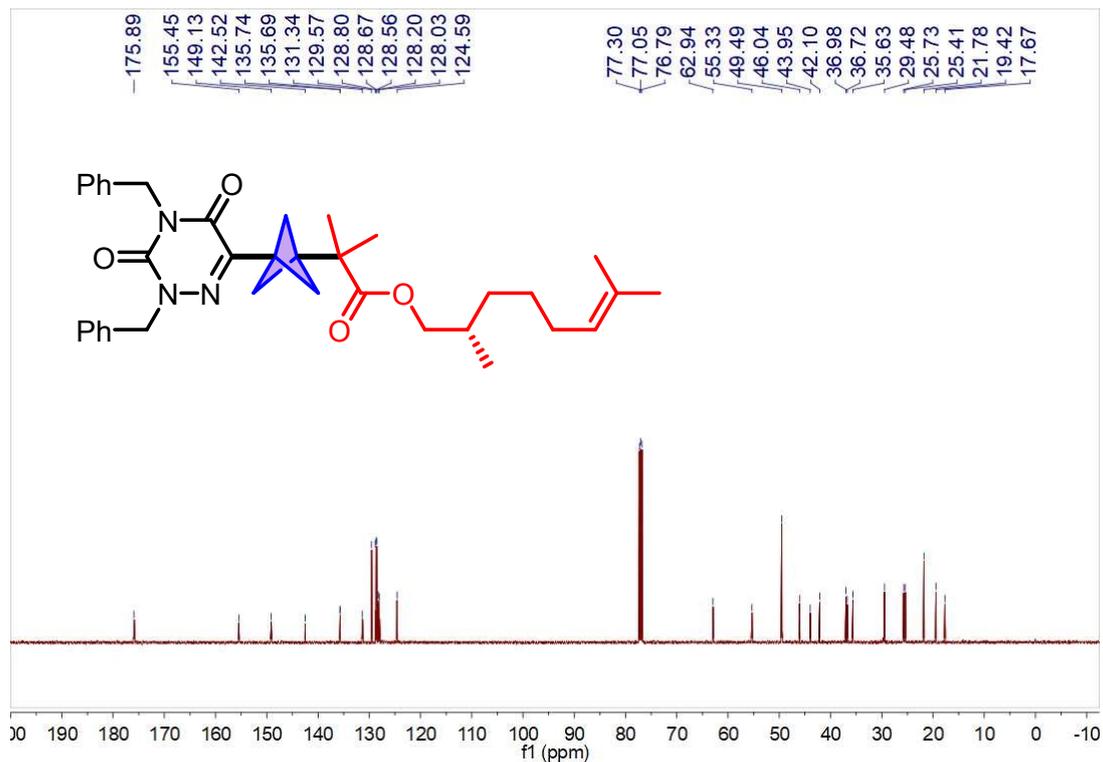
84 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



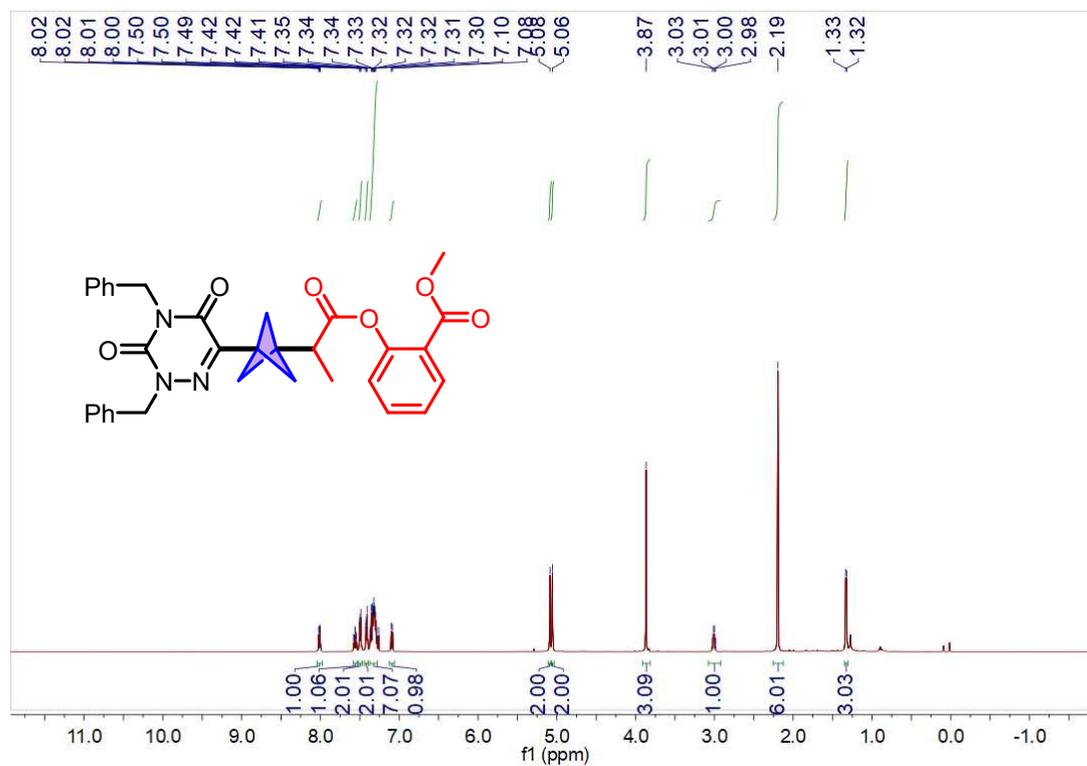
85 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



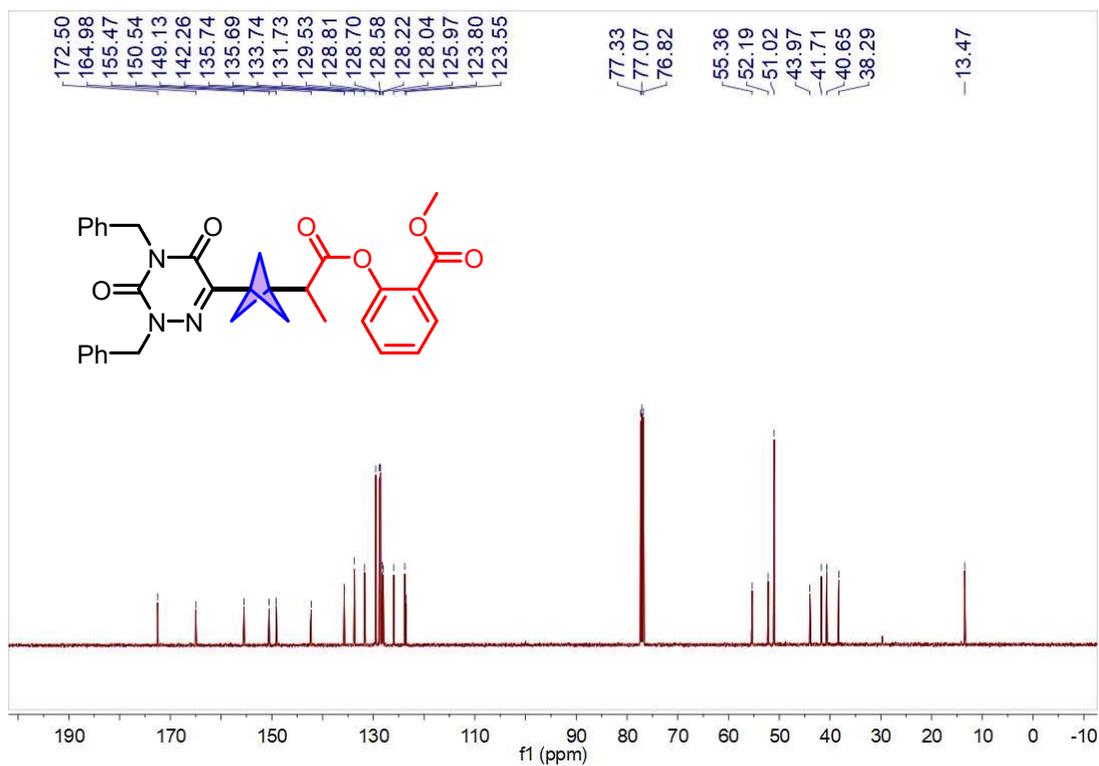
85  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



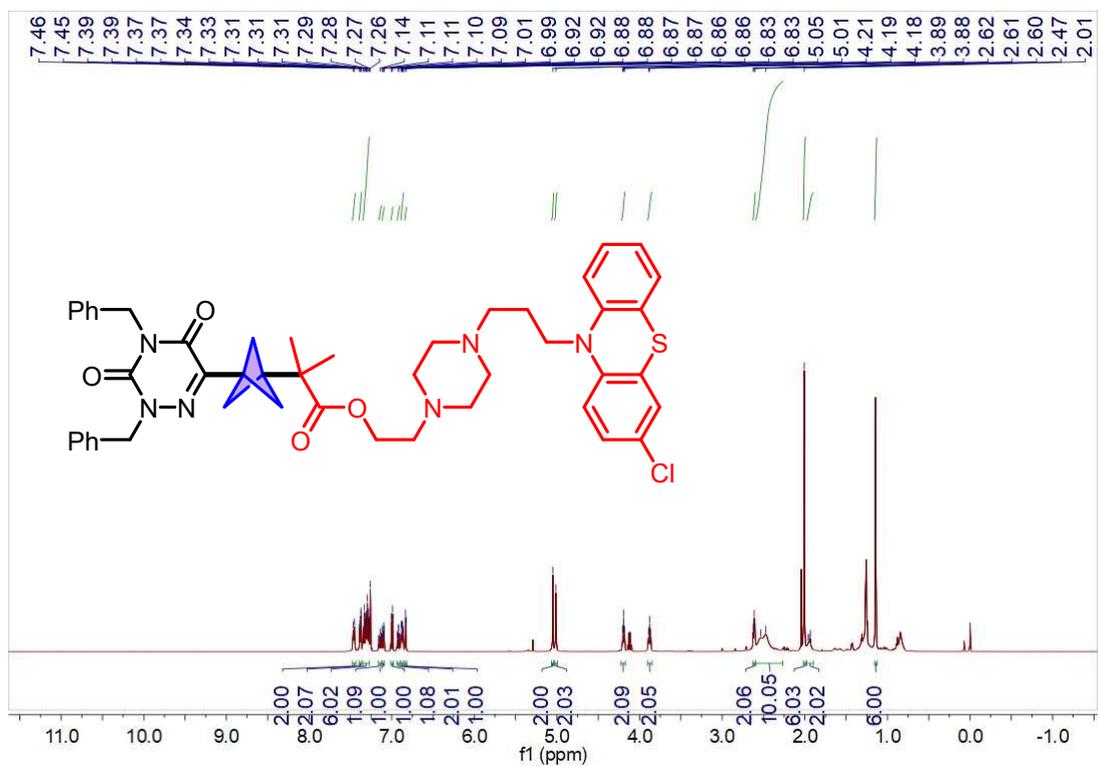
86  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



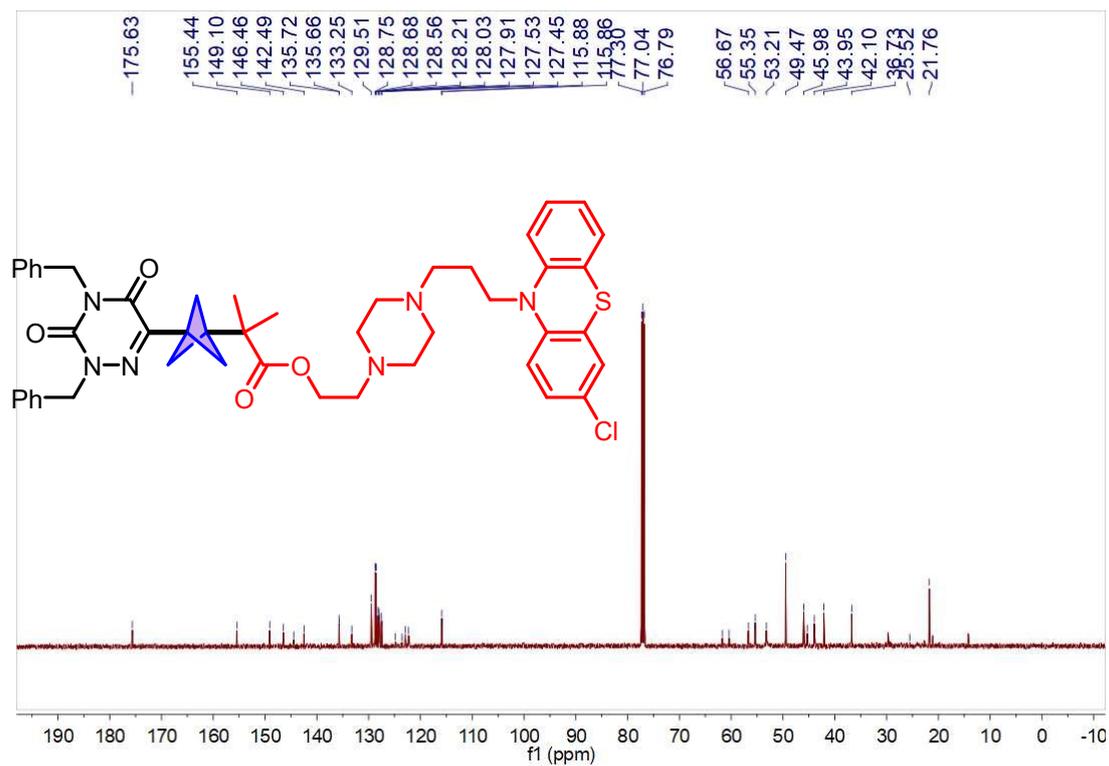
86 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



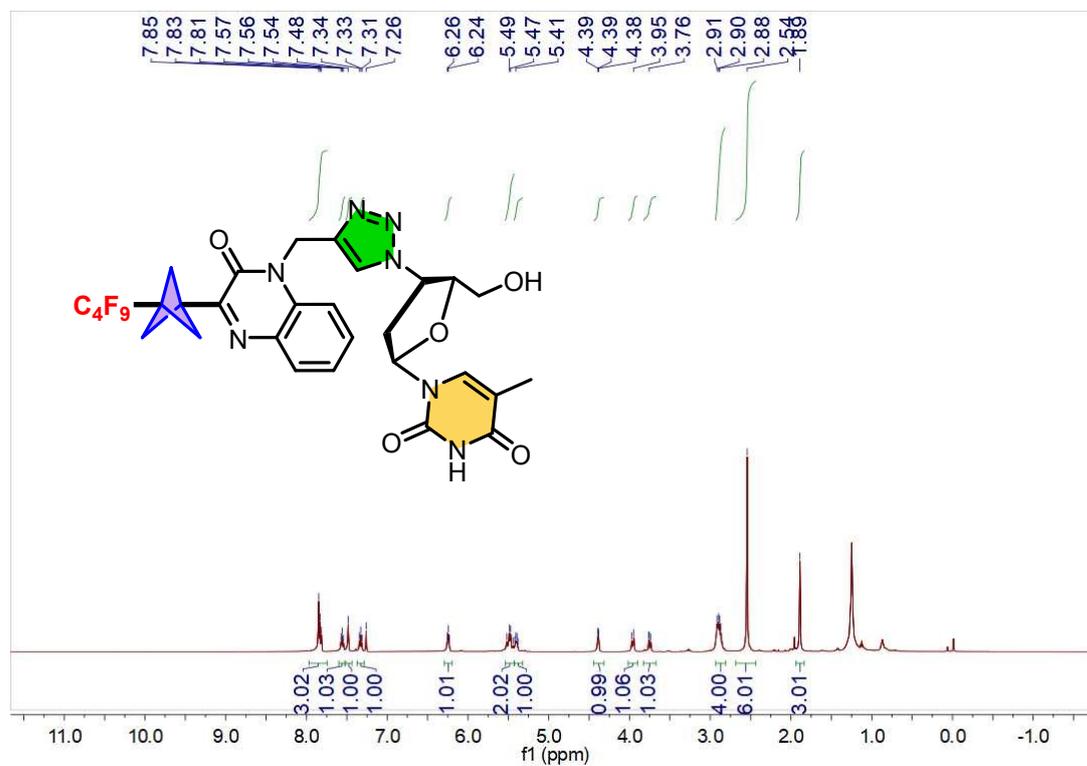
87 <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>)



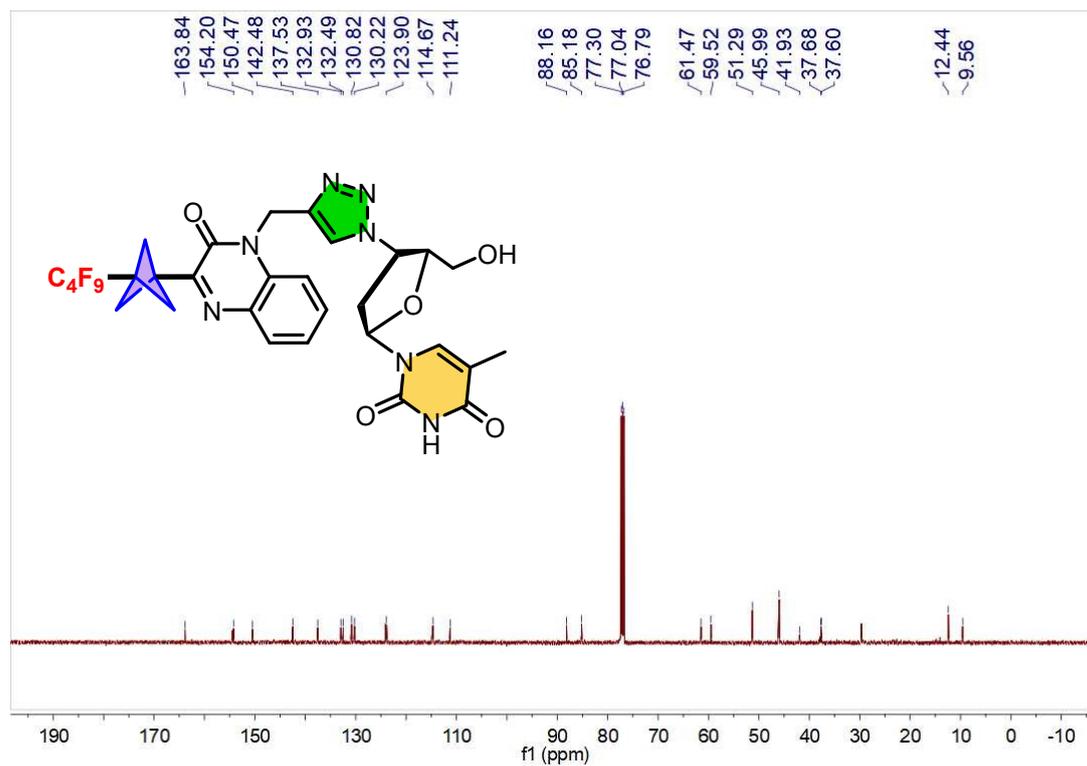
87  $^{13}\text{C}$  NMR (126 MHz,  $\text{CDCl}_3$ )



88  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



### 88 <sup>13</sup>C NMR (126 MHz, CDCl<sub>3</sub>)



### 88 <sup>19</sup>F NMR (471 MHz, CDCl<sub>3</sub>)

