

# Supporting Information

## A palladium-catalyzed 4CzIPN mediated decarboxylative acylation reaction of O-methyl ketoximes with $\alpha$ -keto acids under visible light

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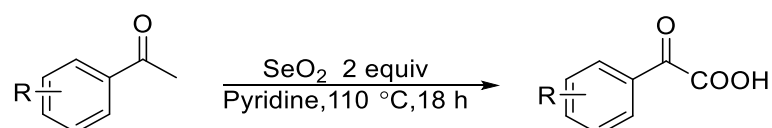
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## 1. General Information

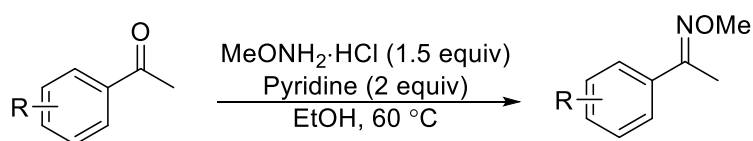
Unless otherwise noted, all reagents were purchased from Acros, Alfa and Adamas and used without further purification. Column chromatography purifications were performed using 200–300 mesh silica gel. NMR spectra were recorded on Varian Inova-400 MHz, Inova-300 MHz, Bruker DRX-400 or Bruker DRX-500 instruments and calibrated using residual solvent peaks as internal references. All heating reactions were conducted in an oil bath. Multiplicities are recorded as follows: s = singlet, d = doublet, t = triplet, dd = doublet of doublets, m = multiplet. HRMS analyses were carried out using a TOF-MS instrument with an EI source. ESR: JES-X320 electron spin resonance spectrometer.

## 2. Procedure for Preparation of 2b–2l



A flame-dried pressure tube was charged with the specified acetophenone (4.0 mmol, 1.0 equiv.) and selenium dioxide (0.89 g, 8.0 mmol, 2.0 equiv.). Dry pyridine (5 mL) was added, the tube was sealed, and the reaction mixture was heated at 110 °C for 18 h. Afterwards, the reaction was cooled to room temperature and filtered. The filtrate was acidified with 1 M HCl solution and extracted three times with EtOAc. Subsequently, the combined organic layers were extracted three times with 1 M NaOH solution. The combined aqueous layers were acidified with conc. HCl and extracted three times with EtOAc. The combined organic layers were dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated in vacuo. Purification by column chromatography yielded the products **2b–2l**. The characterization results are consistent with the references.

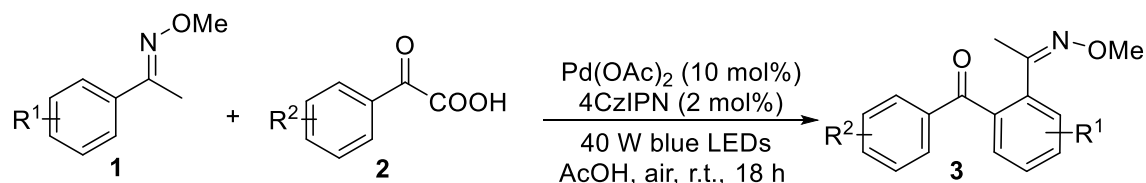
## 3. Preparation for Preparation of 1a–1w



To a solution of ketones (22.0 mmol) and pyridine (5.0 mL, 61.8 mmol) in EtOH (10 mL), NH<sub>2</sub>OMe·HCl (2.29 g, 33.0 mmol) was added in one portion, and the reaction

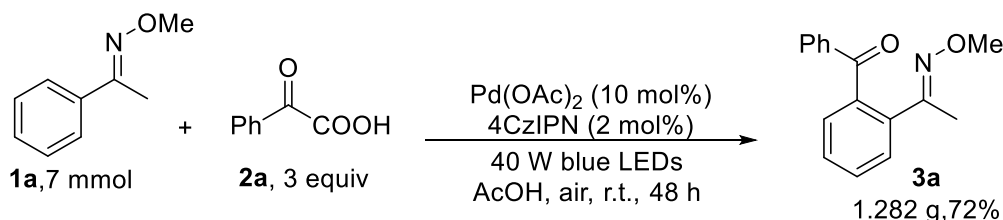
mixture was stirred at 60 °C for 6 h. The reaction was quenched by adding water and extracted twice with ethyl acetate. The combined extracts were washed with aqueous HCl and brine and dried over MgSO<sub>4</sub>. The solvents were removed under reduced pressure. Further recrystallization was conducted from ethyl acetate-hexane to provide O-methyl ketoximes.

#### 4. General Procedures for Ortho-Benzoylation of Acetophenone Oxime Ether



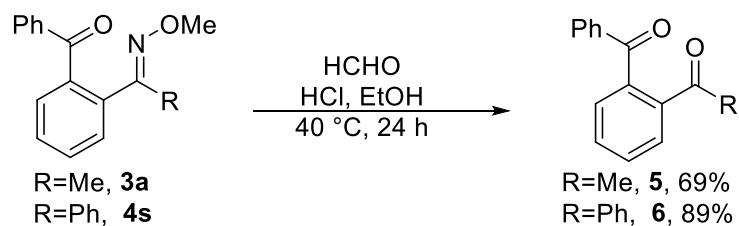
Ketoxime ether (**1**, 0.10 mmol), aroylformic acid (**2**, 0.30 mmol), Pd(OAc)<sub>2</sub> (10 mol%), 4CzIPN (2 mol%) and AcOH (0.2 M) were added to an oven-dried reaction vessel equipped with a magnetic stirring bar, and the reaction vessel was irradiated using 40W blue LEDs at r.t. for 18 h. After the reaction was completed, the reaction solution was concentrated under reduced pressure to yield crude product **3**, which was purified by flash chromatography (silica gel, petroleum ether/ethyl acetate).

#### 5. Gram-Scale Reaction

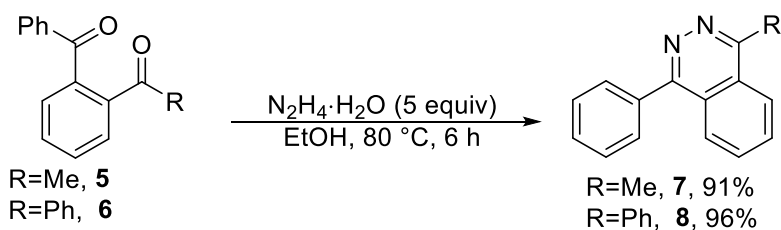


Acetophenone oxime ether (**1a**, 7 mmol), benzooylformic acid (**2a**, 21 mmol), Pd(OAc)<sub>2</sub> (10 mol%), 4CzIPN (2 mol%) and AcOH (0.2 M) were added to an oven-dried reaction vessel equipped with a magnetic stirring bar, and the reaction vessel was irradiated using 40W blue LEDs at r.t. for 48 h. After the reaction was completed, the reaction solution was concentrated under reduced pressure to yield crude product **3a**, which was purified by flash chromatography (silica gel, petroleum ether/ethyl acetate = 50:1).

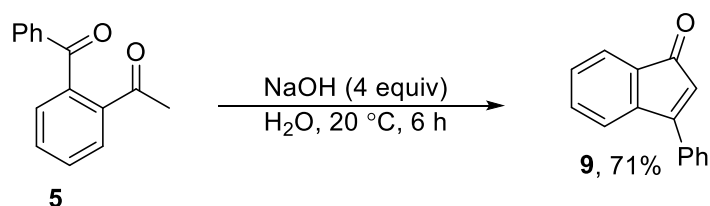
#### 6. Further Transformation



A 15-milliliter vial equipped with a magnetic stirrer was charged with **3a** (or **4s**) (0.2 mmol) and EtOH (1 mL). Then, 37 wt.% formaldehyde solution (1 mL) and concentrated hydrochloric acid (160  $\mu\text{L}$ ) were added, and the mixture was stirred and heated at 40  $^\circ\text{C}$  for 24 h. The reaction was diluted with ethyl acetate. The mixture was concentrated under reduced pressure and then purified by flash column chromatography to give product **5** (or **6**).



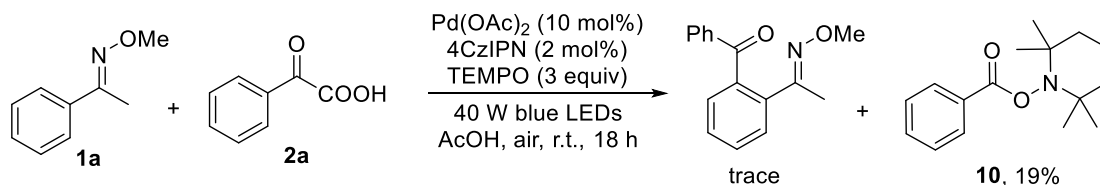
To the solution of the 1,2-diacylbenzenes (**5** or **6**) (0.2 mmol) in ethanol (2 mL) was added hydrazine hydrate (1 mmol), and the resulting mixture was heated at reflux for 6 h under nitrogen. After cooling to room temperature, ethanol was removed under vacuum to give the crude product, which was purified by silica gel column chromatography (ethyl acetate, hexane and methanol) to give the phthalazines (**7** or **8**).



To the solution of the 1-(2-benzoylphenyl)ethan-1-one **5** (0.2 mmol) in  $\text{H}_2\text{O}$  (1 mL) was added sodium hydroxide (1 mmol), and the resulting mixture was heated at 20  $^\circ\text{C}$  for 6 h. The reaction was diluted with ethyl acetate. The mixture was concentrated under reduced pressure and then purified by flash column chromatography to give product **9**.

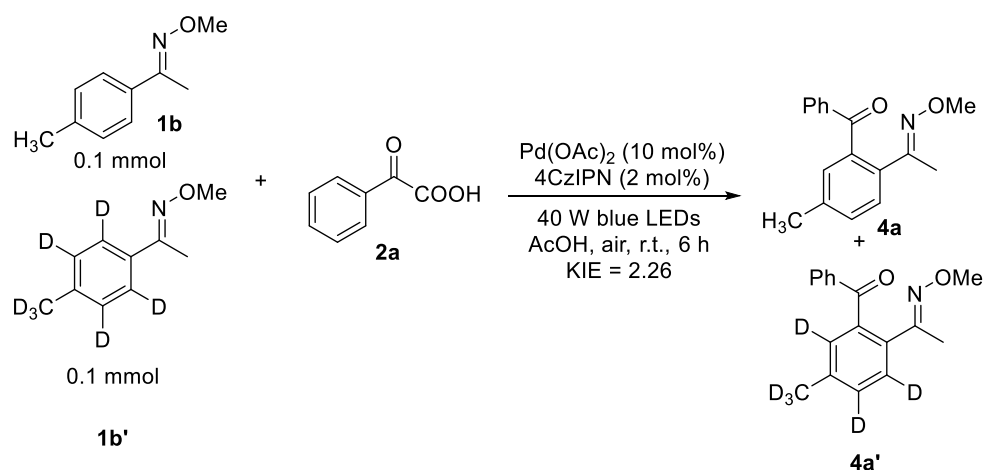
## 7. Mechanism Exploration Experiment

### 7.1 Radical Capture Experiment

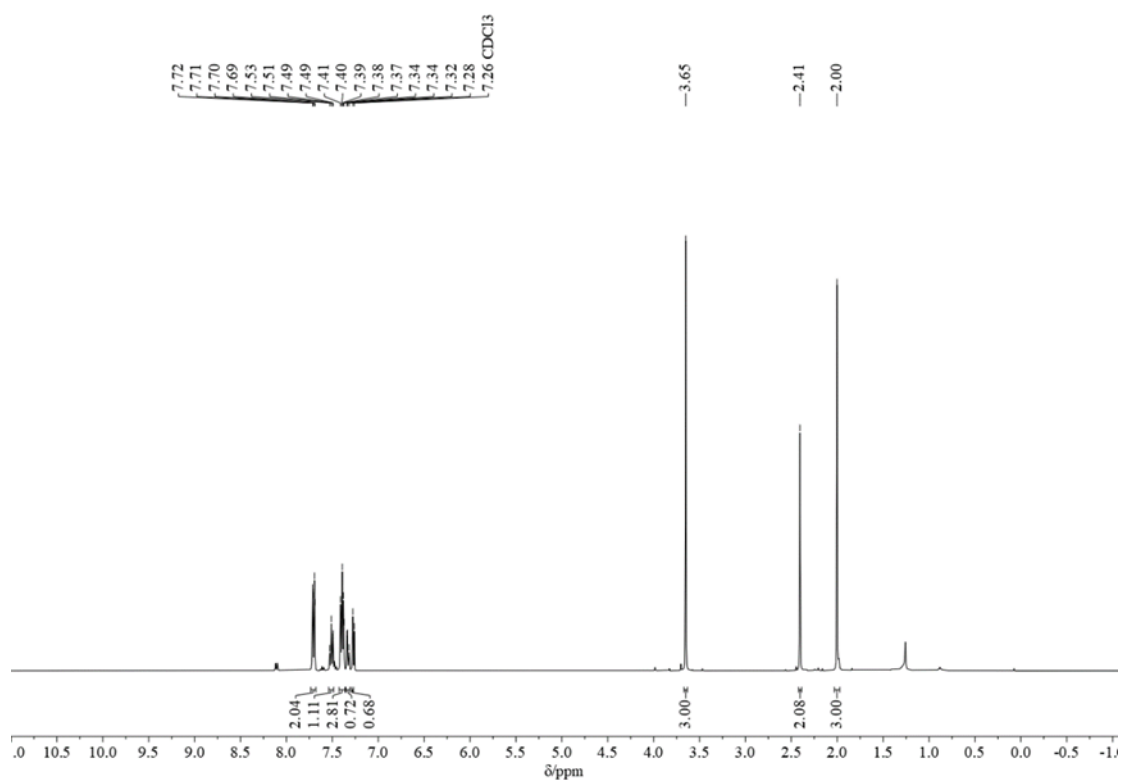


Acetophenone oxime ether (**1a**, 0.1 mmol), benzoylformic acid (**2a**, 0.3 mmol),  $\text{Pd}(\text{OAc})_2$  (10 mol%), 4CzIPN (2 mol%), 2,2,6,6-tetramethyl-1-piperinedinyloxy (TEMPO) (0.3 mmol) and AcOH (0.2 M) were added to an oven-dried reaction vessel equipped with a magnetic stirring bar, and the reaction vessel was irradiated using 40W blue LEDs at r.t. for 18 h. After the reaction was completed, the reaction solution was concentrated under reduced pressure to yield crude product **10**, which was purified by flash chromatography (silica gel, petroleum ether/ethyl acetate = 30:1).

## 7.2 Experimental Procedure of Kinetic Isotope Effect

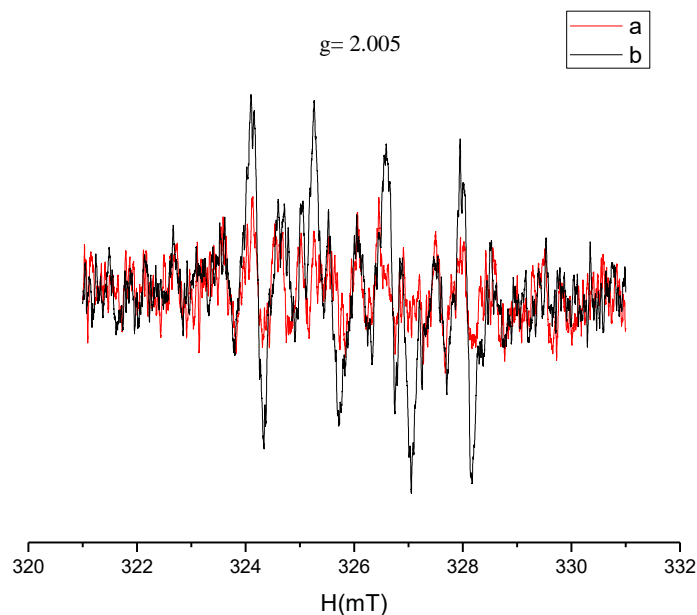


$\text{Pd}(\text{OAc})_2$  (0.01 mmol, 2.3 mg), 4CzIPN (0.002 mmol, 1.6 mg), **1b** (0.1 mmol), **1b'** (0.1 mmol), benzoylformic acid (0.3 mmol) and acetic acid (0.5 mL) were added in sequence to a 5-milliliter glass reaction flask with a magnetic stir bar, and the reaction flask was irradiated under 40W blue LEDs and stirred at r.t. for 6 h. After the reaction, the reaction solution was diluted with ethyl acetate and filtered through Celite. The filtrate was concentrated in vacuo and purified by silica gel column chromatography to obtain the target products **4a** and **4a'**. According to the  $^1\text{H}$  NMR results, we calculated  $\text{KH:KD} = 2.26$  ( $2.08 \div (3 - 2.08) = 2.26$ ).



### 7.3 Determination of Superoxide Radical Anion

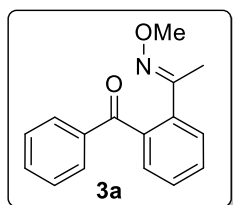
A superoxide radical anion ( $\text{O}_2^{\bullet-}$ ) was generated from molecular oxygen by single electron transfer (SET). We used 5,5-dimethyl-1-pyrroline-N-oxide (DMPO) as a probe to capture the active species  $\text{O}_2^{\bullet-}$ . As shown in Figure 2, when the solution of DMPO, 2a and 4CzIPN was in chlorobenzene solution without irradiation, no signal was detected. In contrast, when the same solution was irradiated with blue LEDs, the signal showing that  $\text{O}_2^{\bullet-}$  was trapped by DMPO was observed.



**Figure 2.** ESR spectra of air-saturated chlorobenzene solution of **2a** ( $1.0 \times 10^{-3}$  M), 4CzIPN ( $2.0 \times 10^{-5}$  M) and DMPO ( $2.0 \times 10^{-2}$  M). (a) Without blue LEDs irradiation; (b) under blue LEDs irradiation for 60 s. ESR setting parameters (cf: 326.000; st: 30; rmfirst fq: 100.00; md:  $0.3 \times 0.1$ ; am:  $8.00 \times 100$ ; tc: 0.03; uF: 9150.577000 MHz; uP: 0.99800 mW; accumu = 3).

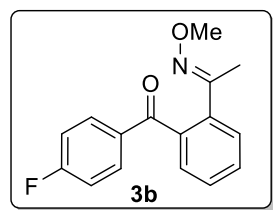
## 8. Spectroscopic Data of Compounds

### (*E*)-(2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (**3a**)



white solid, m.p. 93-95 °C. 21.5 mg, 85%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.72-7.69 (m, 2H, ArH), 7.54-7.45 (m, 5H, ArH), 7.42-7.38 (m, 2H, ArH), 3.67 (s, 3H,  $\text{CH}_3$ ), 2.03 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  197.7, 154.1, 138.9, 138.3, 136.5, 132.7, 130.3, 129.4, 129.1, 128.7, 128.3, 127.8, 61.8, 14.5. HRMS Calcd for  $\text{C}_{16}\text{H}_{16}\text{NNaO}_2$   $[\text{M}+\text{H}]^+$ : 254.1176; Found: 254.1168.

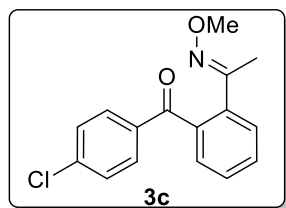
### (*E*)-(4-fluorophenyl)(2-(1-(methoxyimino)ethyl)phenyl)methanone (**3b**)



Colorless liquid. 16.5 mg, 61%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.75-7.72 (m, 2H, ArH), 7.56-7.48 (m, 2H, ArH), 7.47-7.42 (m, 2H, ArH), 7.09-7.05 (m, 2H, ArH), 3.67 (s, 3H,  $\text{CH}_3$ ), 2.05 (s, 3H,  $\text{CH}_3$ ).  $^{19}\text{F}$  NMR (377 MHz,  $\text{CDCl}_3$ )  $\delta$  -106.02.  $^{13}\text{C}$  NMR

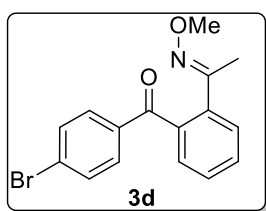
(100 MHz, CDCl<sub>3</sub>)  $\delta$  196.2, 166.8, 164.2, 153.9, 137.5 (d,  $J_{\text{C-F}} = 242$  Hz), 134.7 (d,  $J_{\text{C-F}} = 3$  Hz), 133.0 (d,  $J_{\text{C-F}} = 9$  Hz), 132.0, 131.9, 130.4, 128.9, 128.8, 127.8, 115.5 (d,  $J_{\text{C-F}} = 22$  Hz), 61.8, 14.4. HRMS Calcd for C<sub>16</sub>H<sub>14</sub>FNNaO<sub>2</sub> [M+Na]<sup>+</sup>: 294.0901; Found: 294.0890.

**(E)-(4-chlorophenyl)(2-(1-(methoxyimino)ethyl)phenyl)methanone (3c)**



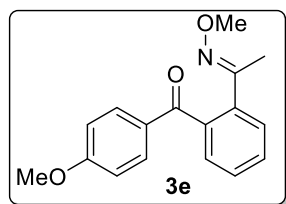
Colorless liquid. 16.1 mg, 56%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  7.65-7.63 (m, 2H, ArH), 7.56-7.42 (m, 4H ArH), 7.38-7.36 (m, 2H, ArH), 3.67 (s, 3H, CH<sub>3</sub>), 2.05 (s, 3H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>)  $\delta$  196.5, 153.8, 139.0, 138.6, 136.8, 136.3, 130.7, 130.5, 129.0, 128.8, 128.7, 127.8, 61.9, 14.3. HRMS Calcd for C<sub>16</sub>H<sub>14</sub>ClNNaO<sub>2</sub> [M+Na]<sup>+</sup>: 310.0605; Found: 310.0619.

**(E)-(4-bromophenyl)(2-(1-(methoxyimino)ethyl)phenyl)methanone (3d)**



Colorless liquid. 25.2 mg, 76%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  7.58- 7.51 (m, 6H, ArH), 7.49-7.42 (m, 2H, ArH), 3.66 (s, 3H, CH<sub>3</sub>), 2.05 (s, 3H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>)  $\delta$  196.6, 153.7, 138.5, 137.2, 136.2, 131.7, 130.8, 130.5, 128.9, 128.8, 127.7, 127.6, 61.8, 14.3. HRMS Calcd for C<sub>16</sub>H<sub>14</sub>BrNNaO<sub>2</sub> [M+Na]<sup>+</sup>: 354.0100; Found: 354.0104.

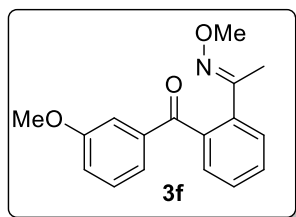
**(E)-(2-(1-(methoxyimino)ethyl)phenyl)(4-methoxyphenyl)methanone (3e)**



Colorless liquid. 13 mg, 46%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  7.71 (d,  $J = 8$  Hz, 2H, ArH), 7.50-7.49 (m, 2H, ArH), 7.44-7.43 (m, 2H, ArH), 6.89 (d,  $J = 8$  Hz, 2H, ArH), 3.86 (s, 3H, CH<sub>3</sub>), 3.70 (s, 3H, CH<sub>3</sub>), 2.04 (s, 3H CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>)  $\delta$  196.5, 163.3, 154.4, 139.3, 136.5, 131.9, 131.1, 130.0, 128.9, 128.6, 127.9, 113.6, 61.8, 55.6, 14.8. HRMS Calcd for C<sub>17</sub>H<sub>18</sub>NO<sub>3</sub> [M+H]<sup>+</sup>: 284.1281; Found: 284.1287.



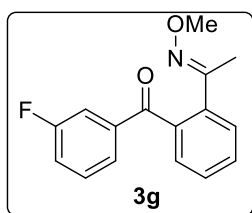
*(E)*-(2-(1-(methoxyimino)ethyl)phenyl)(3-methoxyphenyl)methanone (**3f**)



Colorless liquid. 11.9 mg, 42%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.53-7.45 (m, 4H, ArH), 7.34-7.33 (m, 1H, ArH), 7.29-7.25 (m, 1H, ArH), 7.17 (d,  $J = 8$  Hz, 1H ArH), 7.07-7.05 (m, 1H, ArH), 3.82 (s, 3H,  $\text{CH}_3$ ), 3.70 (s, 3H,  $\text{CH}_3$ ), 2.03 (s, 3H,  $\text{CH}_3$ ).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  197.4, 159.7, 154.2, 139.7, 138.9, 136.6, 130.3, 129.3, 129.1, 128.7, 127.8, 122.4, 119.2, 113.4, 61.8, 55.5, 14.6. HRMS Calcd for  $\text{C}_{17}\text{H}_{18}\text{NO}_3$   $[\text{M}+\text{H}]^+$ : 284.1281; Found: 284.1289.

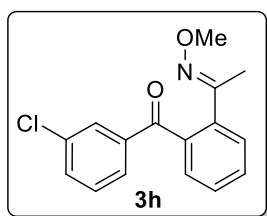
*(E)*-(3-fluorophenyl)(2-(1-(methoxyimino)ethyl)phenyl)methanone (**3g**)



Colorless liquid. 17.0 mg, 63%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.57-7.33 (m, 7H, ArH), 7.24-7.19 (m, 1H ArH), 3.67 (s, 3H,  $\text{CH}_3$ ), 2.05 (s, 3H,  $\text{CH}_3$ ).  $^{19}\text{F}$  NMR (377 MHz,  $\text{CDCl}_3$ )  $\delta$  -112.40.

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.3, 196.3, 164.0, 161.6, 153.8, 140.7 (d,  $J_{\text{C-F}} = 6$  Hz), 138.4, 136.3, 130.6, 130.0 (d,  $J_{\text{C-F}} = 8$  Hz), 129.1, 128.9, 127.7 (d,  $J_{\text{C-F}} = 267$  Hz), 125.1 (d,  $J_{\text{C-F}} = 3$  Hz), 119.6 (d,  $J_{\text{C-F}} = 22$  Hz), 115.8 (d,  $J_{\text{C-F}} = 22$  Hz), 61.9, 14.2. HRMS Calcd for  $\text{C}_{16}\text{H}_{14}\text{FNNaO}_2$   $[\text{M}+\text{Na}]^+$ : 294.0901; Found: 294.0910.

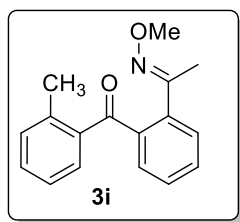
*(E)*-(3-chlorophenyl)(2-(1-(methoxyimino)ethyl)phenyl)methanone (**3h**)



Colorless liquid. 13.2 mg, 46%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.67-7.66 (m, 1H, ArH), 7.57-7.54 (m, 2H, ArH), 7.52-7.31 (m, 4H, ArH), 7.35-7.31 (m, 1H, ArH), 3.68 (s, 3H,  $\text{CH}_3$ ), 2.04 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.3, 153.8, 140.1,

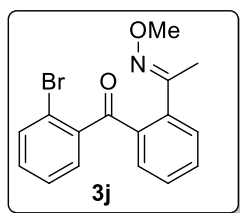
138.3, 136.4, 134.7, 132.5, 130.7, 129.7, 129.2, 129.1, 128.9, 127.8, 127.3, 61.9, 14.3. HRMS Calcd for  $\text{C}_{16}\text{H}_{14}\text{ClNNaO}_2$   $[\text{M}+\text{Na}]^+$ : 310.0605; Found: 310.0596.

*(E)*-(2-(1-(methoxyimino)ethyl)phenyl)(*o*-tolyl)methanone (**3i**)



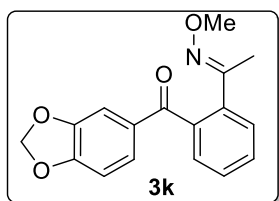
Colorless liquid. 16 mg, 60%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.54-7.51 (m, 2H, ArH), 7.46-7.41 (m, 2H, ArH), 7.37-7.33 (m, 1H, ArH), 7.28 (s, 1H, ArH), 7.21-7.19 (m, 1H, ArH), 7.12 (t,  $J = 8$  Hz, 1H ArH), 3.80 (s, 3H,  $\text{CH}_3$ ), 2.55 (s, 3H,  $\text{CH}_3$ ), 1.95 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  199.3, 155.9, 140.0, 139.2, 138.2, 137.7, 131.7, 131.4, 130.9, 130.5, 130.1, 128.7, 128.4, 125.2, 61.8, 21.2, 15.6. HRMS Calcd for  $\text{C}_{17}\text{H}_{17}\text{NNaO}_2$   $[\text{M}+\text{Na}]^+$ : 290.1151; Found: 290.1152.

**(E)-(2-bromophenyl)(2-(1-(methoxyimino)ethyl)phenyl)methanone (3j)**



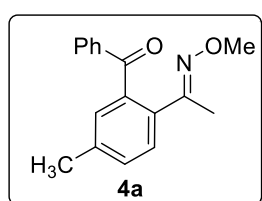
Colorless liquid. 6.9 mg, 21%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.64-7.62 (m, 1H, ArH), 7.57-7.54 (m, 2H, ArH), 7.43 (t,  $J = 8$  Hz, 2H, ArH), 7.38-7.36 (m, 1H, ArH), 7.35-7.27 (m, 2H, ArH), 3.90 (s, 3H,  $\text{CH}_3$ ), 2.01 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  197.9, 172.6, 154.2, 133.9, 132.7, 130.3, 129.5, 129.4, 129.1, 128.6, 128.4, 127.8, 61.8, 14.5. HRMS Calcd for  $\text{C}_{16}\text{H}_{14}\text{BrNNaO}_2$   $[\text{M}+\text{Na}]^+$ : 354.0100; Found: 354.0113.

**(E)-benzo[d][1,3]dioxol-5-yl(2-(1-(methoxyimino)ethyl)phenyl)methanone (3k)**



Colorless liquid. 13.9 mg, 47%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.51-7.40 (m, 4H, ArH), 7.32 (s, 1H, ArH), 7.21-7.18 (m, 1H, ArH), 6.77-6.75 (d, 1H, ArH), 6.04 (s, 2H,  $\text{CH}_2$ ), 3.72 (s, 3H,  $\text{CH}_3$ ), 2.05 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.1, 154.2, 151.6, 148.1, 139.1, 136.4, 133.0, 130.1, 128.9, 128.6, 127.9, 126.3, 109.0, 107.8, 101.9, 61.9, 14.7. HRMS Calcd for  $\text{C}_{17}\text{H}_{15}\text{NNaO}_4$   $[\text{M}+\text{Na}]^+$ : 320.0893; Found: 320.0890.

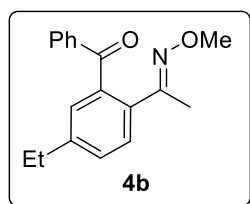
**(E)-(2-(1-(methoxyimino)ethyl)-5-methylphenyl)(phenyl)methanone (4a)**



white solid, m.p. 98-100 °C. 21.1 mg, 79%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.71-7.69 (m, 2H, ArH), 7.53-7.49 (m, 1H, ArH), 7.41-7.37 (m, 3H, ArH), 7.34-7.31 (m, 1H, ArH), 7.28-

7.27 (m, 1H, ArH), 3.65 (s, 3H, CH<sub>3</sub>), 2.40 (s, 3H, CH<sub>3</sub>), 2.00 (s, 3H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 197.9, 153.9, 138.9, 138.4, 133.6, 132.5, 130.9, 129.6, 129.3, 128.3, 127.6, 61.7, 21.3, 14.3. HRMS Calcd for C<sub>17</sub>H<sub>17</sub>NNaO<sub>2</sub> [M+Na]<sup>+</sup>: 290.1151; Found: 290.1158.

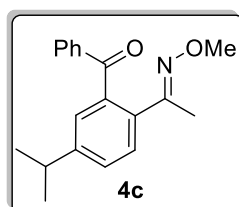
**(E)-(5-ethyl-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4b)**



yellow liquid. 23.6 mg, 84%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.72-7.70 (m, 2H, ArH), 7.53-7.49 (m, 1H, ArH), 7.42-7.30 (m, 5H, ArH), 3.66 (s, 3H, CH<sub>3</sub>), 2.71 (q, *J* = 8 Hz, 2H, CH<sub>2</sub>), 2.01 (s, 3H, CH<sub>3</sub>), 1.26 (t, *J* = 8 Hz, 3H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>)

δ 197.8, 155.1, 153.9, 138.5, 136.8, 136.1, 132.6, 129.5, 129.3, 128.3, 125.8, 125.0, 61.8, 35.1, 31.3, 15.2. HRMS Calcd for C<sub>18</sub>H<sub>19</sub>NNaO<sub>2</sub> [M+Na]<sup>+</sup>: 304.1308; Found: 304.1316.

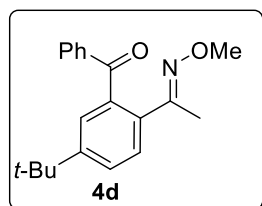
**(E)-(5-isopropyl-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4c)**



Colorless liquid. 25.9 mg, 88%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.72-7.70 (m, 2H, ArH), 7.53-7.49 (m, 1H, ArH), 7.43-7.37 (m, 4H, ArH), 7.34 (d, *J* = 2 Hz, 1H, ArH), 3.66 (s, 3H, CH<sub>3</sub>), 3.00-2.93 (m, 1H, CH<sub>3</sub>), 2.00 (s, 3H, CH<sub>3</sub>), 1.27 (d, *J* = 8 Hz, 6H, 2×CH<sub>3</sub>).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 198.1, 154.0, 149.8, 138.9, 138.4, 134.0, 132.6, 129.4, 128.4, 128.3, 127.7, 127.3, 61.7, 34.0, 23.9, 14.4. HRMS Calcd for C<sub>19</sub>H<sub>21</sub>NNaO<sub>2</sub> [M+Na]<sup>+</sup>: 318.1465; Found: 318.1469.

**(E)-(5-(tert-butyl)-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4d)**

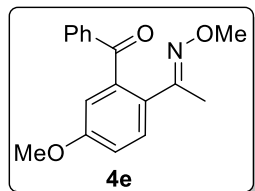


yellow liquid. 21.6 mg, 70%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.72-7.70 (m, 2H, ArH), 7.56-7.53 (m, 1H, ArH), 7.52-7.49 (m, 2H, ArH), 7.42-7.38 (m, 3H, ArH), 3.66 (s, 3H, CH<sub>3</sub>), 2.00 (s, 3H, CH<sub>3</sub>), 1.34 (s, 9H, 3×CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ

198.2, 154.0, 152.2, 138.6, 133.7, 132.6, 129.4, 128.3, 127.5, 127.3, 126.2, 61.7, 35.0,

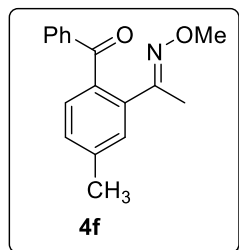
31.3, 14.4. HRMS Calcd for  $C_{20}H_{23}NNaO_2$   $[M+Na]^+$ : 332.1621; Found: 332.1630.

*(E)*-(5-methoxy-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (**4e**)



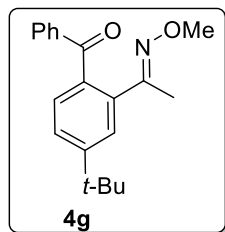
Colorless liquid. 25.5 mg, 90%.  $^1H$  NMR (400 MHz,  $CDCl_3$ )  $\delta$  7.72-7.69 (m, 2H, ArH), 7.53-7.49 (m, 1H, ArH), 7.44-7.37 (m, 3H, ArH), 7.06-7.03 (m, 1H, ArH), 6.99-6.98 (m, 1H, ArH), 3.85 (s, 3H,  $CH_3$ ), 3.63 (s, 3H,  $CH_3$ ), 1.99 (s, 3H,  $CH_3$ ).  $^{13}C$  NMR (100 MHz,  $CDCl_3$ )  $\delta$  197.4, 159.9, 153.5, 140.4, 138.2, 132.7, 129.3, 129.1, 128.8, 128.4, 116.1, 114.1, 61.7, 55.7, 14.3. HRMS Calcd for  $C_{17}H_{17}NNaO_3$   $[M+Na]^+$ : 306.1101; Found: 306.1113.

*(E)*-(2-(1-(methoxyimino)ethyl)-4-methylphenyl)(phenyl)methanone (**4f**)



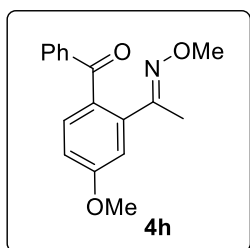
white solid, m.p. 96-98 °C. 18.9 mg, 71%.  $^1H$  NMR (400 MHz,  $CDCl_3$ )  $\delta$  8.12 (d,  $J$  = 8 Hz, 1H, ArH), 7.71 (d,  $J$  = 8 Hz, 2H, ArH), 7.51-7.48 (m, 2H, ArH), 7.41-7.38 (m, 2H, ArH), 7.29 (s, 1H, ArH), 3.70 (s, 3H,  $CH_3$ ), 2.45 (s, 3H,  $CH_3$ ), 2.00 (s, 3H,  $CH_3$ ).  $^{13}C$  NMR (101 MHz,  $CDCl_3$ )  $\delta$  197.75, 154.74, 140.83, 138.55, 136.97, 136.10, 133.88, 132.56, 130.34, 129.51, 128.63, 128.32, 61.80, 21.60, 14.96. HRMS Calcd for  $C_{17}H_{18}NO_2$   $[M+H]^+$ : 268.1332; Found: 268.1337.

*(E)*-(4-(tert-butyl)-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (**4g**)



yellow liquid. 24.7 mg, 80%.  $^1H$  NMR (400 MHz,  $CDCl_3$ )  $\delta$  7.74-7.72 (m, 2H, ArH), 7.54-7.49 (m, 3H, ArH), 7.44-7.38 (m, 3H, ArH), 3.70 (s, 3H,  $CH_3$ ), 2.03 (s, 3H,  $CH_3$ ), 1.38 (s, 9H,  $3 \times CH_3$ ).  $^{13}C$  NMR (100 MHz,  $CDCl_3$ )  $\delta$  198.0, 154.0, 145.2, 139.0, 138.4, 133.9, 132.6, 129.8, 129.4, 128.6, 128.3, 127.7, 61.7, 28.7, 15.4, 14.4. HRMS Calcd for  $C_{20}H_{23}NNaO_2$   $[M+Na]^+$ : 332.1621; Found: 332.1632.

**(E)-(4-methoxy-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4h)**

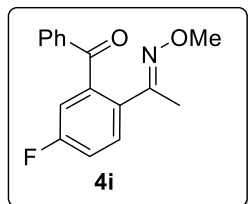


Colorless liquid. 22.9 mg, 81%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.70-7.68 (m, 2H, ArH), 7.53-7.48 (m, 2H, ArH), 7.40 (t,  $J=8$  Hz, 2H, ArH), 6.98-6.94 (m, 2H, ArH), 3.89 (s, 3H,  $\text{CH}_3$ ), 3.73 (s, 3H,  $\text{CH}_3$ ), 1.99 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  197.0, 161.4, 155.0, 139.4, 138.9, 132.4, 131.8, 131.3, 130.3, 129.5, 128.3,

114.1, 113.5, 61.9, 55.7, 15.3. HRMS Calcd for  $\text{C}_{17}\text{H}_{18}\text{NO}_3$   $[\text{M}+\text{H}]^+$ : 284.1281; Found: 284.1289.

**(E)-(5-fluoro-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4i)**

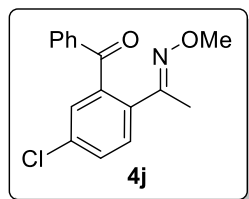
yellow solid, m.p. 96-99  $^\circ\text{C}$ . 16.5 mg, 61%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.71-7.69



(ArH, m, 2H), 7.56 - 7.51 (ArH, m, 1H), 7.50-7.47 (ArH, m, 1H), 7.43-7.39 (ArH, m, 2H), 7.24- 7.16 (ArH, m, 2H). 3.65 ( $\text{CH}_3$ , s, 3H), 2.01 ( $\text{CH}_3$ , s, 3H).  $^{19}\text{F}$  NMR (377 MHz,  $\text{CDCl}_3$ )  $\delta$  -111.72.

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.1, 162.6 (d,  $J_{\text{C-F}}=250$  Hz), 153.1, 141.1 (d,  $J_{\text{C-F}}=6$  Hz), 137.7, 134.5, 133.0, 132.6 (d,  $J_{\text{C-F}}=3$  Hz), 129.8 (d,  $J_{\text{C-F}}=8$  Hz), 129.4, 128.5, 117.1 (d,  $J_{\text{C-F}}=22$  Hz), 116.3 (d,  $J_{\text{C-F}}=23$  Hz), 61.8, 14.5. HRMS Calcd for  $\text{C}_{16}\text{H}_{15}\text{FNO}_2$   $[\text{M}+\text{H}]^+$ : 272.1081; Found: 272.1085.

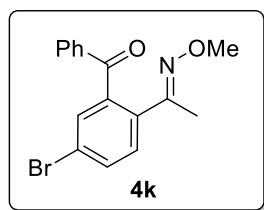
**(E)-(5-chloro-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4j)**



Colorless liquid. 16.1 mg, 56%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.71-7.69 (m, 2H, ArH), 7.56-7.48 (m, 2H, ArH), 7.45- 7.39 (m, 4H, ArH), 3.64 (s, 3H,  $\text{CH}_3$ ), 2.01 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.1, 152.9, 140.5, 137.7, 135.0, 134.8, 133.0,

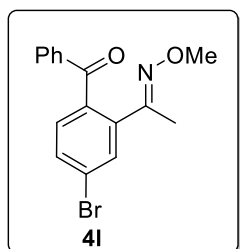
130.2, 129.4, 129.0, 129.0, 128.5, 61.9, 14.2. HRMS Calcd for  $\text{C}_{16}\text{H}_{15}\text{ClNO}_2$   $[\text{M}+\text{H}]^+$ : 288.0786; Found: 288.0787.

**(E)-(5-bromo-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4k)**



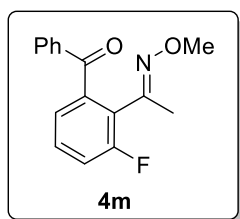
yellow liquid. 15.3 mg, 46%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.71-7.68 (m, 2H, ArH), 7.66-7.64 (m, 1H, ArH), 7.59 (d,  $J$  = 4 Hz, 1H, ArH), 7.55-7.51 (m, 1H, ArH), 7.43-7.36 (m, 3H, ArH), 3.64 (s, 3H,  $\text{CH}_3$ ), 2.01 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.0, 153.0, 140.7, 137.7, 135.2, 133.2, 133.0, 131.9, 129.4, 129.2, 128.5, 123.0, 61.9, 14.2. HRMS Calcd for  $\text{C}_{16}\text{H}_{14}\text{BrNNaO}_2$   $[\text{M}+\text{Na}]^+$ : 354.0100; Found: 354.0113.

**(E)-(4-bromo-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4l)**



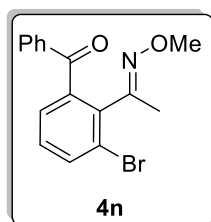
Colorless liquid. 11.9 mg, 36%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.70-7.68 (m, 2H, ArH), 7.64 (m, 1H, ArH), 7.61- 7.58 (m, 1H, ArH), 7.53 (ArH, m, 1H), 7.41 (ArH, t, 2H), 7.34 (d, 1H, ArH), 3.68 (s, 3H,  $\text{CH}_3$ ), 2.00 (s, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.7, 152.9, 138.5, 137.9, 137.7, 132.9, 131.7, 130.9, 130.7, 129.4, 128.5, 124.6, 62.0, 14.4. HRMS Calcd for  $\text{C}_{16}\text{H}_{14}\text{BrNNaO}_2$   $[\text{M}+\text{Na}]^+$ : 354.0100; Found: 354.0108.

**(E)-(3-fluoro-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4m)**



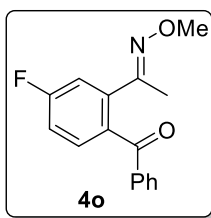
Colorless liquid. 6.2 mg, 23%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.71 (d,  $J$  = 8 Hz, 2H, ArH), 7.56-7.52 (m, 1H, ArH), 7.44-7.40 (m, 3H, ArH), 7.30-7.22 (m, 2H, ArH), 3.68 (s, 3H,  $\text{CH}_3$ ), 2.03-2.04 (s, 3H,  $\text{CH}_3$ ).  $^{19}\text{F}$  NMR (377 MHz,  $\text{CDCl}_3$ )  $\delta$  -114.27.  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.3 (d,  $J_{\text{C-F}}$  = 2 Hz), 160.8 (d,  $J_{\text{C-F}}$  = 249 Hz), 151.8, 141.8 (d,  $J_{\text{C-F}}$  = 2 Hz), 138.0, 133.0, 130.1 (d,  $J_{\text{C-F}}$  = 9 Hz), 129.6, 128.4, 124.7 (d,  $J_{\text{C-F}}$  = 3 Hz), 118.1 (d,  $J_{\text{C-F}}$  = 22 Hz), 61.9, 16.2 (d,  $J_{\text{C-F}}$  = 4 Hz). HRMS Calcd for  $\text{C}_{16}\text{H}_{15}\text{FNO}_2$   $[\text{M}+\text{H}]^+$ : 272.1081; Found: 272.1093.

**(E)-(3-bromo-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4n)**



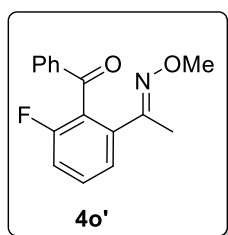
white solid, m.p. 108-110 °C. 13.9 mg, 42%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.71 (d, *J* = 8 Hz, 2H, ArH), 7.54-7.46 (m, 4H, ArH), 7.40 (t, *J* = 8 Hz, 2H ArH), 3.68 (CH<sub>3</sub>, s, 3H), 2.03 (CH<sub>3</sub>, s, 3H). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 197.8, 154.1, 139.0, 138.3, 136.5, 132.7, 130.3, 129.4, 129.1, 128.7, 128.4, 127.8, 61.8, 14.5. HRMS Calcd for C<sub>16</sub>H<sub>14</sub>BrNNaO<sub>2</sub> [M+Na]<sup>+</sup>:354.0100; Found: 354.0096.

**(E)-(4-fluoro-2-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4o)**



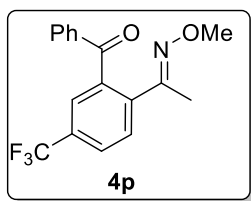
white solid, m.p. 154-155 °C. 16.3 mg, 60%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.70-7.67 (m, 2H, ArH), 7.55-7.47 (m, 2H, ArH), 7.43-7.39 (m, 2H, ArH), 7.21-7.13 (m, 2H, ArH), 3.69 (s, 3H, CH<sub>3</sub>), 2.00 (s, 3H, CH<sub>3</sub>). <sup>19</sup>F NMR (377 MHz, CDCl<sub>3</sub>) δ -109.35. <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 196.6, 163.7 (d, *J*<sub>C-F</sub> = 249 Hz), 153.3, 139.3 (d, *J*<sub>C-F</sub> = 8 Hz), 138.2, 135.0 (d, *J*<sub>C-F</sub> = 3 Hz), 132.8, 131.5 (d, *J*<sub>C-F</sub> = 8 Hz), 129.4, 128.5, 115.6 (d, *J*<sub>C-F</sub> = 21 Hz), 115.1 (d, *J*<sub>C-F</sub> = 23 Hz), 62.0, 14.5. HRMS Calcd for C<sub>16</sub>H<sub>15</sub>FNO<sub>2</sub> [M+H]<sup>+</sup>: 272.1081; Found: 272.1091.

**(E)-(2-fluoro-6-(1-(methoxyimino)ethyl)phenyl)(phenyl)methanone (4o')**



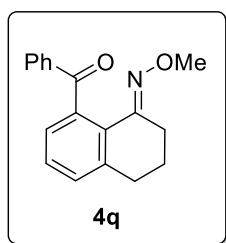
white solid, m.p. 146-148 °C. 4.9 mg, 18%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.81-7.79 (m, 2H, ArH), 7.56-7.52 (m, 1H, ArH), 7.48-7.41 (m, 3H, ArH), 7.33-7.31 (m, 1H, ArH), 7.18-7.14 (m, 1H, ArH), 3.56 (s, 3H, CH<sub>3</sub>), 2.08 (s, 3H, CH<sub>3</sub>). <sup>19</sup>F NMR (377 MHz, CDCl<sub>3</sub>) δ -114.54. <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 193.4, 159.8 (d, *J*<sub>C-F</sub> = 246 Hz), 152.4, 138.2, 137.6, 133.1, 130.9 (d, *J*<sub>C-F</sub> = 9 Hz), 129.2, 128.6, 123.5 (d, *J*<sub>C-F</sub> = 3 Hz), 116.4 (d, *J*<sub>C-F</sub> = 22 Hz), 61.8, 13.8. HRMS Calcd for C<sub>16</sub>H<sub>15</sub>FNO<sub>2</sub> [M+H]<sup>+</sup>: 272.1081; Found: 272.1092.

**(E)-(2-(1-(methoxyimino)ethyl)-5-(trifluoromethyl)phenyl)(phenyl)methanone (4p)**



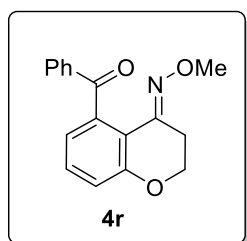
Colorless liquid. 12.8 mg, 40%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.78 (d,  $J = 8$  Hz, 1H, ArH), 7.72- 7.68 (m, 3H, ArH), 7.63 (d,  $J = 8$  Hz, 1H, ArH), 7.57-7.54 (m, 1H, ArH), 7.45-7.41 (m, 2H, ArH), 3.67 (s, 3H,  $\text{CH}_3$ ), 2.05 (s, 3H,  $\text{CH}_3$ ).  $^{19}\text{F}$  NMR (377 MHz,  $\text{CDCl}_3$ )  $\delta$  -62.76.  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  196.3, 152.8, 139.7 (q,  $J_{\text{C-F}} = 10$  Hz) 137.6, 133.2, 131.4, 130.7, 129.4, 128.4 (q,  $J_{\text{C-F}} = 34$  Hz), 127.0 (q,  $J_{\text{C-F}} = 3$  Hz), 125.9 (q,  $J_{\text{C-F}} = 4$  Hz), 122.5 (q,  $J_{\text{C-F}} = 263$  Hz), 62.1, 14.2. HRMS Calcd for  $\text{C}_{17}\text{H}_{14}\text{F}_3\text{NNaO}_2$   $[\text{M}+\text{Na}]^+$ : 344.0869; Found: 344.0860.

**(E)-(8-(methoxyimino)-5,6,7,8-tetrahydronaphthalen-1-yl)(phenyl)methanone (4q)**



Colorless liquid. 16.5 mg, 59%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.72-7.70 (m, 2H, ArH), 7.50-7.46 (m, 1H, ArH), 7.39-7.33 (m, 3H, ArH), 7.28 (m, 1H, ArH), 7.21-7.19 (m, 1H, ArH), 3.54 (s, 3H,  $\text{CH}_3$ ), 2.80 (t,  $J = 8$  Hz, 2H,  $\text{CH}_2$ ), 2.57 (t,  $J = 8$  Hz, 2H,  $\text{CH}_2$ ), 1.88-1.82 (m, 2H,  $\text{CH}_2$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  198.0, 151.8, 140.7, 138.8, 138.4, 132.2, 129.7, 129.1, 128.9, 128.6, 128.3, 126.5, 61.7, 30.5, 24.3, 21.2. HRMS Calcd for  $\text{C}_{18}\text{H}_{17}\text{NNaO}_2$   $[\text{M}+\text{Na}]^+$ : 302.1151; Found: 302.1147.

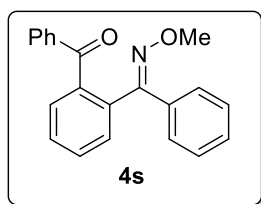
**(E)-(4-(methoxyimino)chroman-5-yl)(phenyl)methanone (4r)**



Colorless liquid. 20 mg, 71%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.76-7.74 (m, 2H, ArH), 7.52-7.48 (m, 1H, ArH), 7.41-7.37 (m, 2H, ArH), 7.35-7.31 (m, 1H, ArH), 7.03-7.01 (m, 1H, ArH), 6.91-6.89 (m, 1H, ArH), 4.22 (t,  $J = 8$  Hz, 2H,  $\text{CH}_2$ ), 3.52 (s, 3H,  $\text{CH}_3$ ), 2.80 (t,  $J = 8$  Hz, 2H,  $\text{CH}_2$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  197.4, 157.0, 146.1, 139.0, 138.0, 132.5, 130.5, 129.2, 128.3, 121.1, 118.9, 116.4, 65.1, 61.9, 24.1. HRMS Calcd for  $\text{C}_{17}\text{H}_{16}\text{NO}_3$   $[\text{M}+\text{H}]^+$ : 282.1125; Found: 282.1135.

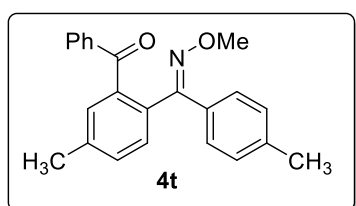
**(E)-(2-((methoxyimino)(phenyl)methyl)phenyl)(phenyl)methanone (4s)**





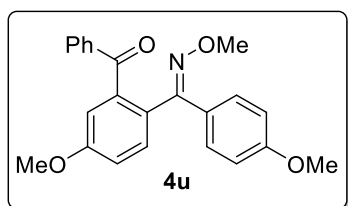
white solid, m.p. 79-81 °C. 22.1 mg, 70%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.74-7.72 (m, 2H, ArH), 7.51-7.43 (m, 4H, ArH), 7.40-7.35 (m, 2H, ArH), 7.32-7.27 (m, 6H, ArH), 3.69 (s, 3H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 197.6, 154.9, 140.1, 138.1, 136.0, 132.8, 132.7, 130.3, 129.9, 129.7, 129.5, 129.3, 129.0, 129.0, 128.3, 128.0, 62.3. HRMS Calcd for C<sub>21</sub>H<sub>17</sub>NNaO<sub>2</sub> [M+Na]<sup>+</sup>: 338.1151; Found: 338.1163.

*(E)*-(2-((methoxyimino)(*p*-tolyl)methyl)-5-methylphenyl)(phenyl)methanone (**4t**)



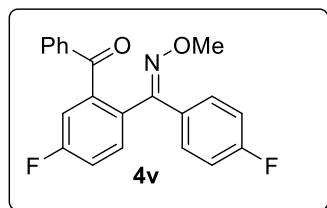
white solid, m.p. 106-108 °C. 19.9 mg, 58%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.66-7.63 (m, 2H, ArH), 7.41-7.37 (m, 1H, ArH), 7.30-7.26 (m, 2H, ArH), 7.21 (s, 1H, ArH), 7.18-7.15 (m, 1H, ArH), 7.09-7.08 (m, 3H, ArH), 7.03 (d, *J* = 8 Hz, 2H, ArH), 3.59 (s, 3H, CH<sub>3</sub>), 2.33 (s, 3H, CH<sub>3</sub>), 2.24 (s, 3H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 197.9, 154.8, 140.1, 139.4, 139.3, 138.2, 133.3, 132.6, 130.6, 130.2, 130.0, 129.7, 129.6, 129.5, 128.7, 128.2, 62.2, 21.5, 21.3. HRMS Calcd for C<sub>23</sub>H<sub>21</sub>NNaO<sub>2</sub> [M+Na]<sup>+</sup>: 366.1465; Found: 366.1460.

*(E)*-(5-methoxy-2-((methoxyimino)(4-methoxyphenyl)methyl)phenyl)(phenyl)methanone (**4u**)



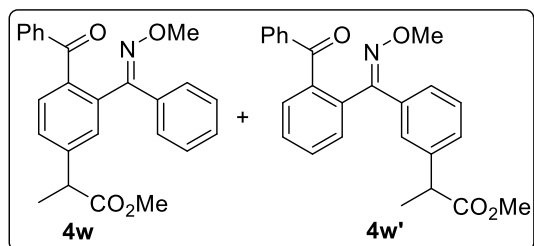
Colorless liquid. 19.1 mg, 51%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.72 (d, *J* = 2 Hz, 2H, ArH), 7.48 (m, *J* = 8 Hz, 1H, ArH), 7.36 (m, *J* = 8 Hz, 2H ArH), 7.26-7.21 (m, 3H, ArH), 7.03-6.96 (m, 2H, ArH), 6.81 (d, *J* = 8 Hz, 2H, ArH), 3.85 (s, 3H, CH<sub>3</sub>), 3.79 (s, 3H, CH<sub>3</sub>), 3.68 (s, 3H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 197.3, 160.2, 154.3, 141.6, 137.9, 132.8, 131.8, 131.6, 129.5, 128.8, 128.6, 128.2, 125.3, 115.8, 114.2, 113.3, 62.1, 55.7, 55.4. HRMS Calcd for C<sub>23</sub>H<sub>21</sub>NNaO<sub>4</sub> [M+Na]<sup>+</sup>: 398.1363; Found: 398.1352.

(*E*)-(5-fluoro-2-((4-fluorophenyl)(methoxyimino)methyl)phenyl)(phenyl)methanone  
(**4v**)

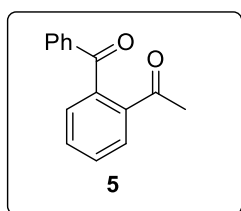


Colorless liquid. 20 mg, 57%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.63 (d,  $J = 2$  Hz, 2H, ArH), 7.45 (t,  $J = 2$  Hz, 1H, ArH), 7.32 (t,  $J = 2$  Hz, 2H, ArH), 7.24-7.17 (m, 3H, ArH), 7.14-7.06 (m, 2H, ArH), 6.91 (t,  $J = 2$  Hz, 2H, ArH), 3.62 (s, 3H,  $\text{CH}_3$ ).  $^{19}\text{F}$  NMR (377 MHz,  $\text{CDCl}_3$ )  $\delta$  -110.39, -110.93.  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  195.8, 163.0 (d,  $J_{\text{C-F}} = 249$  Hz), 162.8 (d,  $J_{\text{C-F}} = 251$  Hz), 153.2, 142.2 (d,  $J_{\text{C-F}} = 6$  Hz), 137.3, 133.3, 132.3 (d,  $J_{\text{C-F}} = 8$  Hz), 132.1 (d,  $J_{\text{C-F}} = 4$  Hz), 132.0 (d,  $J_{\text{C-F}} = 9$  Hz), 130.4, 129.6, 128.4, 117.0 (d,  $J_{\text{C-F}} = 21$  Hz), 116.3 (d,  $J_{\text{C-F}} = 23$  Hz), 115.2 (d,  $J_{\text{C-F}} = 22$  Hz), 62.4. HRMS Calcd for  $\text{C}_{21}\text{H}_{15}\text{F}_2\text{NNaO}_2$   $[\text{M}+\text{Na}]^+$ : 374.0963; Found: 374.0971.

methyl (*E*)-2-(4-benzoyl-3-((methoxyimino)(phenyl)methyl)phenyl)propanoate (**4w**)  
and methyl (*E*)-2-(3-((2-benzoylphenyl)(methoxyimino)methyl)phenyl)propanoate (**4w'**)



Colorless liquid. 23.3 mg, 58%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.65-7.62 (m, 2H, ArH), 7.42-7.35 (m, 4H, ArH), 7.31-7.26 (m, 2H, ArH), 7.23-7.17 (m, 4H, ArH), 7.14-7.10 (m, 1H, ArH), 3.68-3.63 (m, 1H, CH), 3.62 (s, 3H,  $\text{CH}_3$ ), 3.57 (d,  $J = 4$  Hz, 3H,  $\text{CH}_3$ ), 1.41-1.35 (m, 3H,  $\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  197.5, 197.2, 174.7, 174.4, 154.8, 154.6, 140.2, 140.1, 138.1, 137.9, 132.8, 132.7, 130.2, 129.9, 129.8, 129.7, 129.6, 129.5, 129.4, 129.4, 129.0, 129.0, 128.7, 128.3, 128.3, 128.2, 128.0, 127.9, 62.3, 52.2, 52.1, 45.3, 45.3, 18.6, 18.6. HRMS Calcd for  $\text{C}_{25}\text{H}_{24}\text{NO}_4$   $[\text{M}+\text{H}]^+$ : 402.1705; Found: 402.1696.

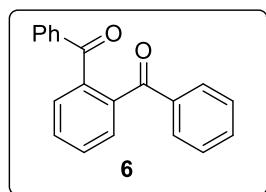


1-(2-benzoylphenyl)ethan-1-one (**5**)

white solid, m.p. 95 - 97 °C. 30.9 mg, 69%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.88-7.86 (m, 1H, ArH), 7.74-7.72 (m, 2H, ArH), 7.63-

7.55 (m, 2H, ArH), 7.53-7.49 (m, 1H, ArH), 7.41-7.37 (m, 3H, ArH), 2.49 (s, 3H, CH<sub>3</sub>).  
<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 198.5, 197.8, 140.8, 137.5, 137.2, 132.9, 132.2, 129.8, 129.3, 129.2, 128.4, 128.2, 27.4. HRMS Calcd for C<sub>15</sub>H<sub>12</sub>NaO<sub>2</sub> [M+Na]<sup>+</sup>: 247.0730; Found: 247.0726.

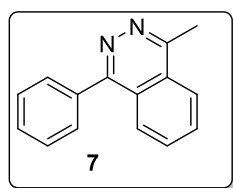
#### 1,2-phenylenebis(phenylmethanone) (**6**)



white solid, m.p. 144 - 146 °C. 50.9 mg, 89%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.72-7.70(m, 4H, ArH), 7.60(s, 4H, ArH), 7.51-7.47(m, 2H, ArH), 7.38-7.34(m, 4H, ArH). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 196.6, 140.0, 137.1, 133.0, 130.4, 129.8, 129.7, 128.3.

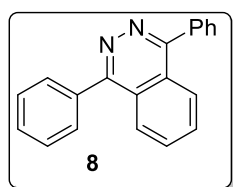
HRMS Calcd for C<sub>20</sub>H<sub>14</sub>NaO<sub>2</sub> [M+Na]<sup>+</sup>: 309.0886; Found: 309.0889.

#### 1-methyl-4-phenylphthalazine (**7**)



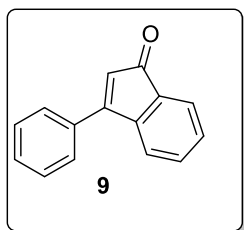
white solid, m.p. 125-126 °C. 40 mg, 91%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.13 (d, *J* = 8 Hz, 1H, ArH), 8.04 (d, *J* = 2 Hz, 1H, ArH), 7.92-7.88 (m, 1H, ArH), 7.84-7.80 (m, 1H, ArH), 7.73-7.71 (m, 2H, ArH), 7.55-7.53 (m, 3H, ArH), 3.05 (s, 1H, CH<sub>3</sub>). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 159.3, 156.6, 136.6, 132.0, 132.0, 130.2, 129.2, 128.6, 126.9, 126.7, 125.2, 124.7, 20.0. HRMS Calcd for C<sub>15</sub>H<sub>12</sub>N<sub>2</sub>Na [M+Na]<sup>+</sup>: 243.0893; Found: 243.0885.

#### 1,4-diphenylphthalazine (**8**)

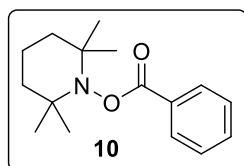


white solid, m.p. 195-196 °C. 54.1 mg, 96%. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.15-8.13(m, 2H, ArH), 7.86 - 7.81(m, 6H, ArH), 7.61-7.56(m, 6H, ArH). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 159.2, 136.5, 132.1, 130.3, 129.4, 128.7, 126.7, 126.0. HRMS Calcd for C<sub>20</sub>H<sub>14</sub>N<sub>2</sub>Na [M+Na]<sup>+</sup>: 305.1049; Found: 305.1059.

#### 3-phenyl-1H-inden-1-one (**9**)



Yellow solid. m.p. 97 - 98 °C. 29.3 mg, 71%.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.60-7.58 (m, 2H, ArH), 7.47-7.43 (m, 4H, ArH), 7.32-7.30 (m, 2H, ArH), 7.26-7.22 (m, 1H, ArH), 5.93 (s, 1H, CH).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  203.9, 158.4, 145.4, 136.0, 135.9, 129.6, 128.6, 127.5, 125.4, 125.2, 123.3, 78.6, 56.2. HRMS Calcd for  $\text{C}_{15}\text{H}_{10}\text{NaO}$   $[\text{M}+\text{Na}]^+$ : 229.0624; Found: 229.0620.

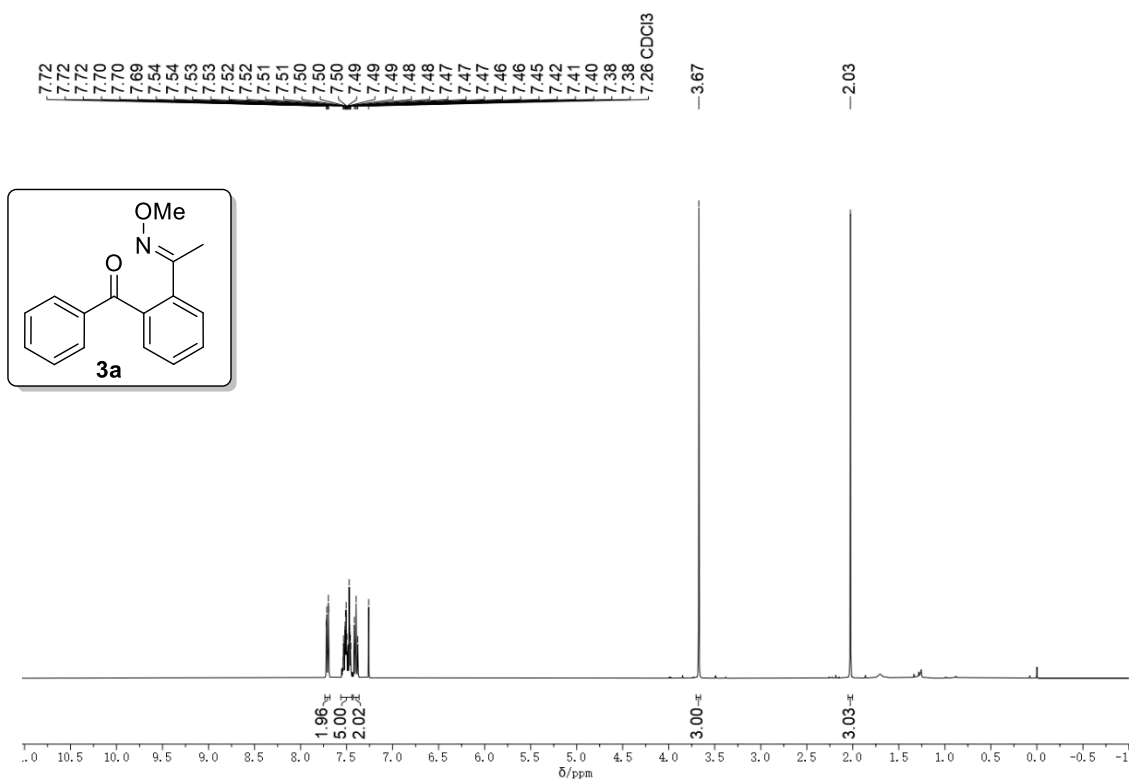


**2,2,6,6-tetramethylpiperidin-1-yl benzoate (10)**

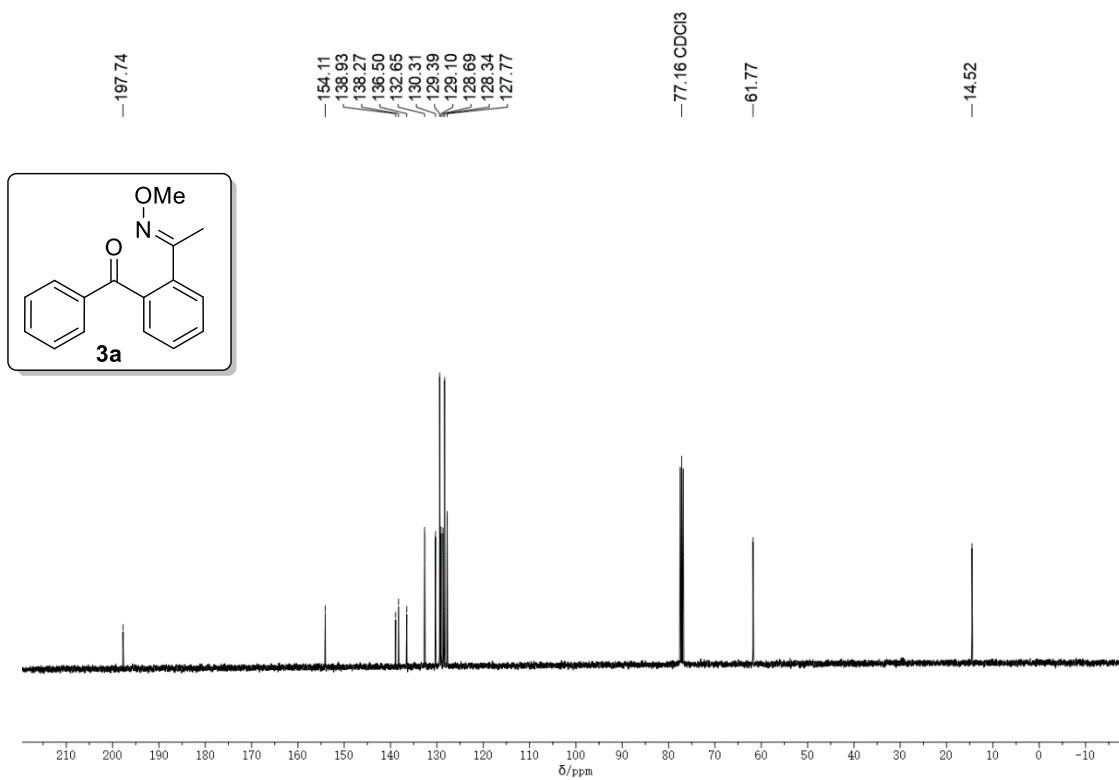
Colorless liquid.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  8.09-8.06 (m, 2H, ArH), 7.60-7.55 (m, 1H, ArH), 7.48-7.44 (m, 2H, ArH), 1.78-1.71 (m, 3H,  $\text{CH}_2$ ), 1.61-1.57 (m, 2H,  $\text{CH}_2$ ), 1.48-1.42 (m, 1H,  $\text{CH}_2$ ), 1.28 (s, 6H,  $2\times\text{CH}_3$ ), 1.12 (s, 6H,  $2\times\text{CH}_3$ ).  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  166.6, 133.0, 129.9, 129.7, 128.6, 60.6, 39.2, 32.1, 21.0, 17.2. HRMS Calcd for  $\text{C}_{16}\text{H}_{24}\text{NO}_2$   $[\text{M}+\text{H}]^+$ : 262.1802; Found: 262.1791.

## 9. NMR spectra

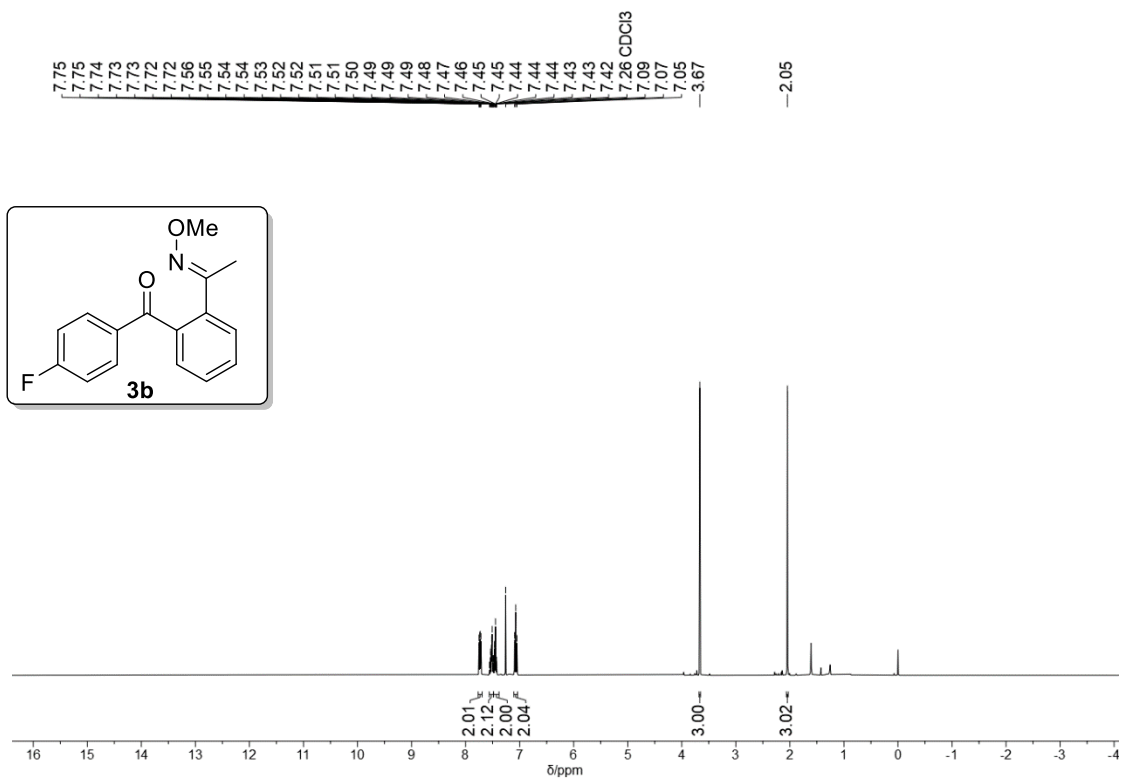
$^1\text{H}$  NMR of compound **3a**



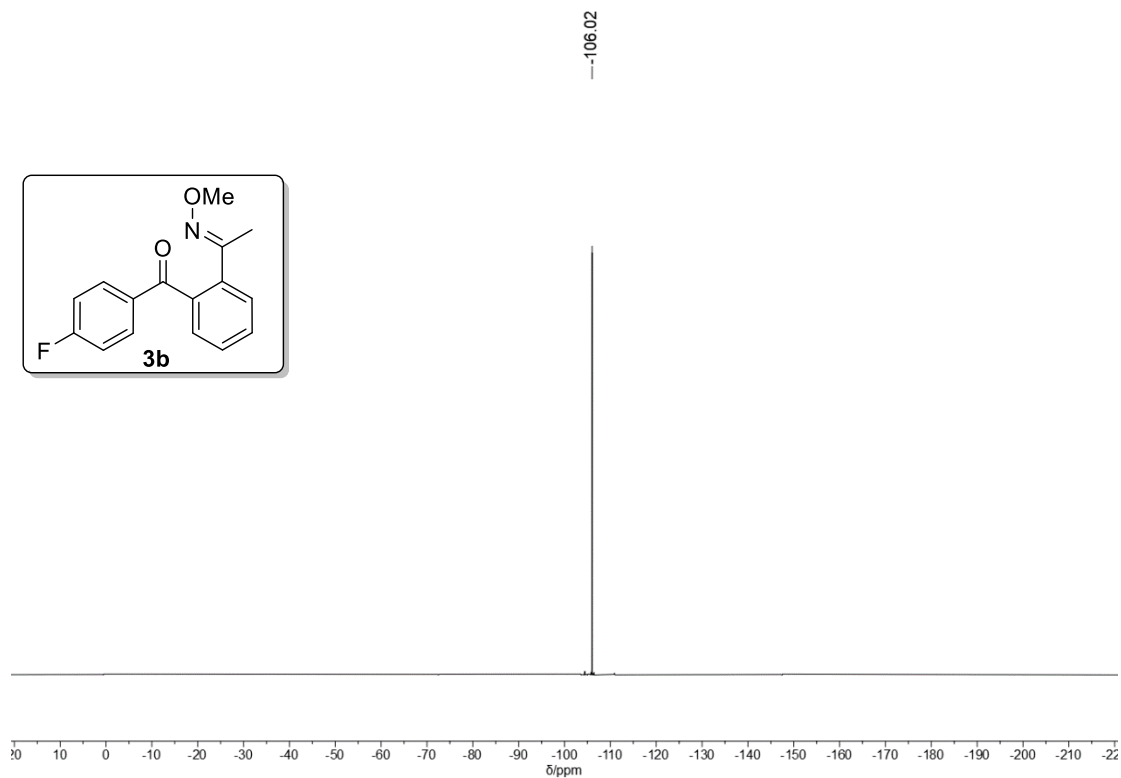
$^{13}\text{C}$  NMR of compound **3a**



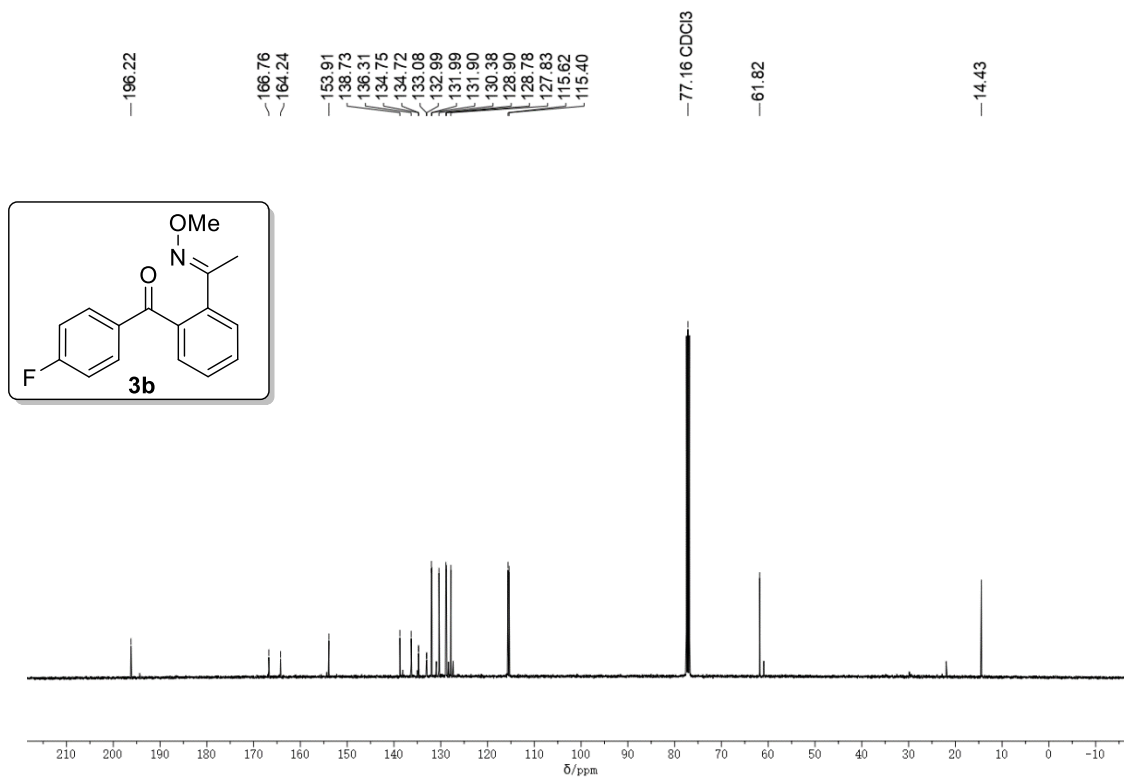
<sup>1</sup>H NMR of compound **3b**



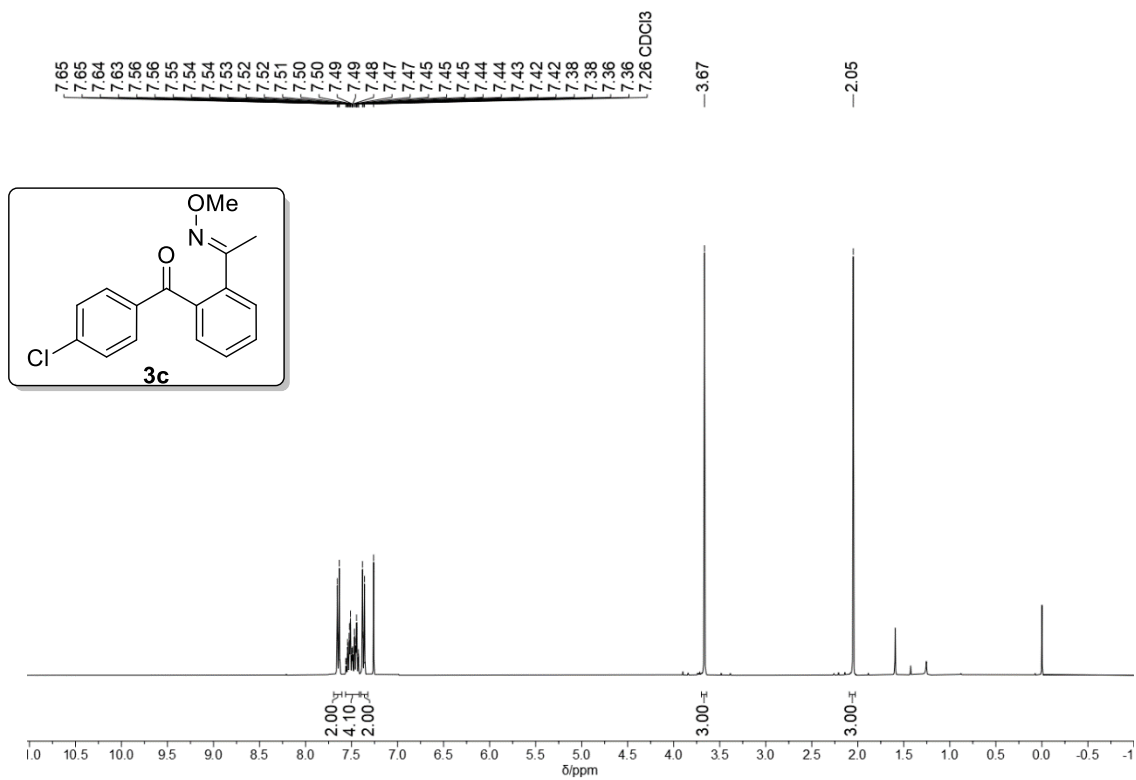
<sup>19</sup>F NMR of compound **3b**



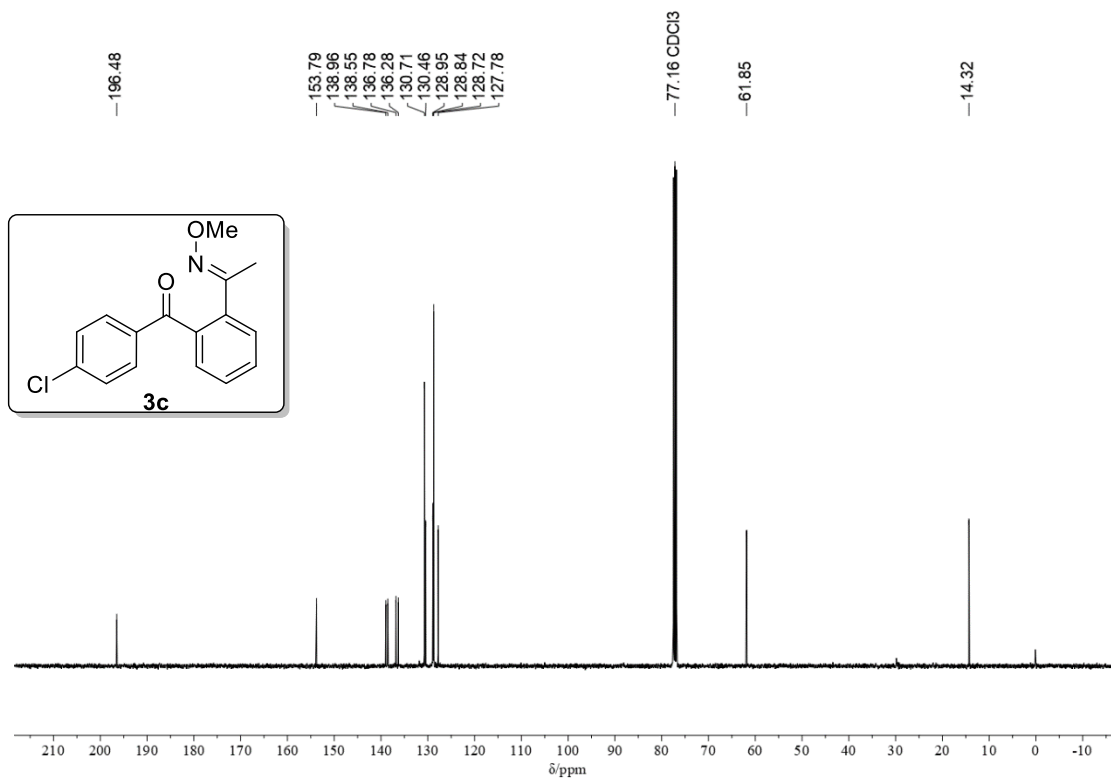
$^{13}\text{C}$  NMR of compound **3b**



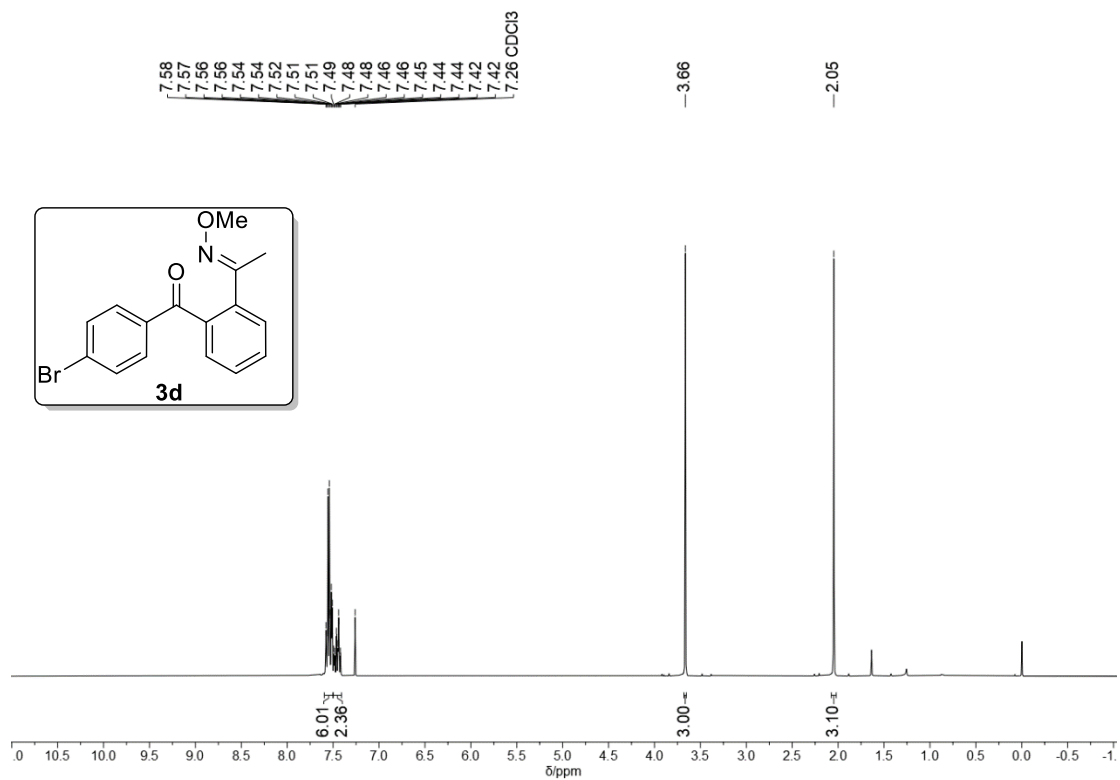
$^1\text{H}$  NMR of compound **3c**



$^{13}\text{C}$  NMR of compound **3c**

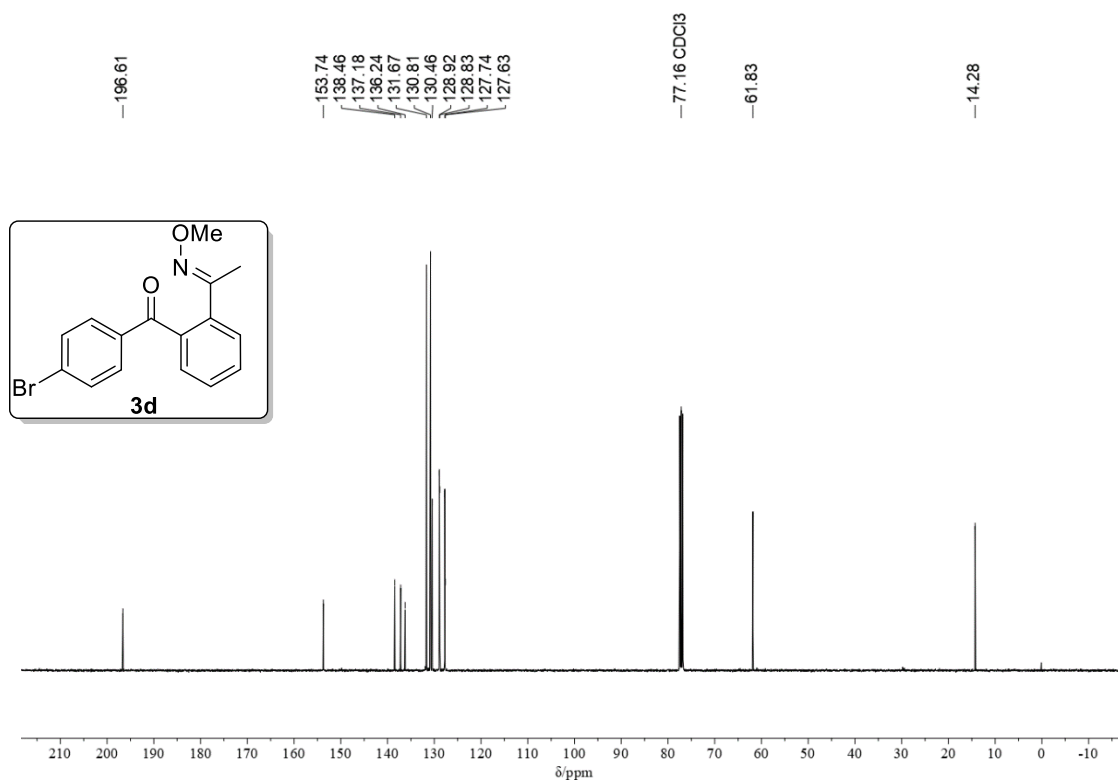


$^1\text{H}$  NMR of compound **3d**

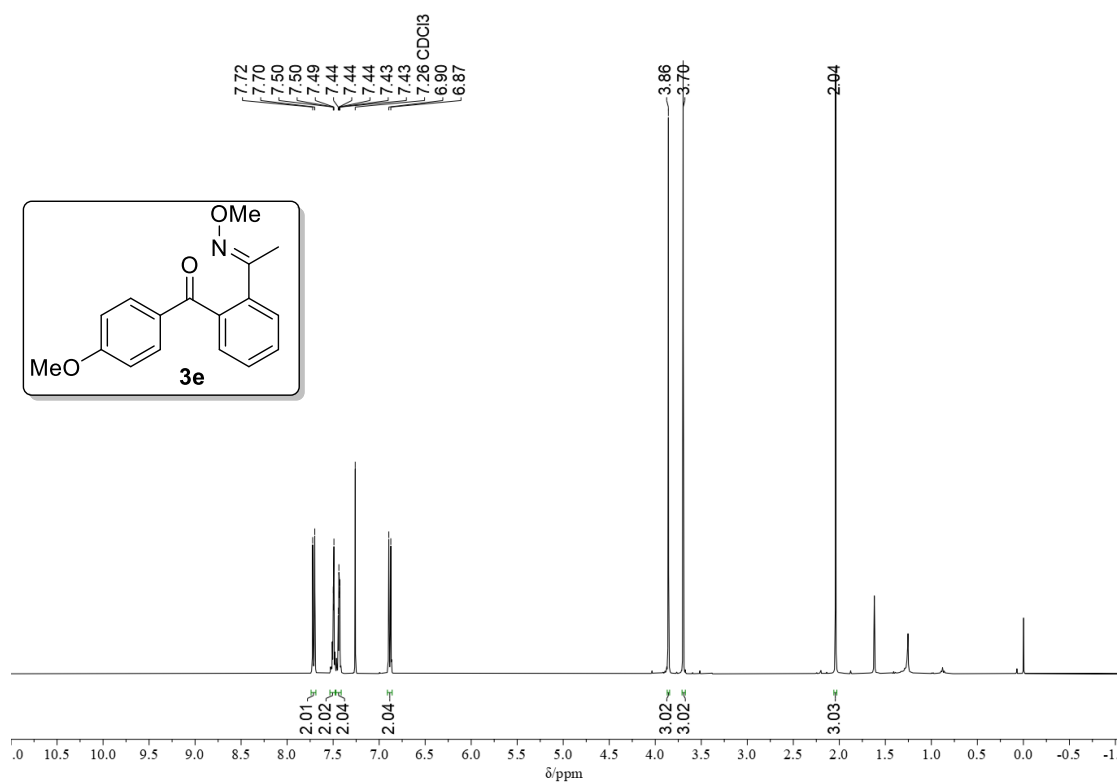




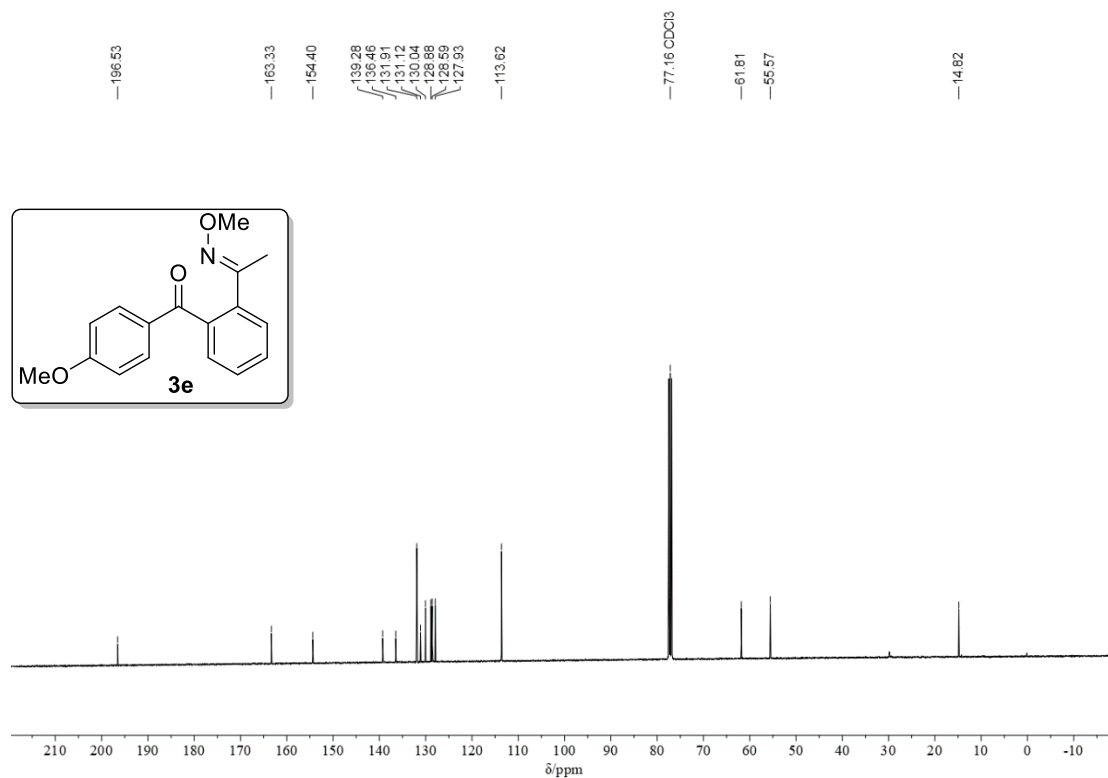
$^{13}\text{C}$  NMR of compound **3d**



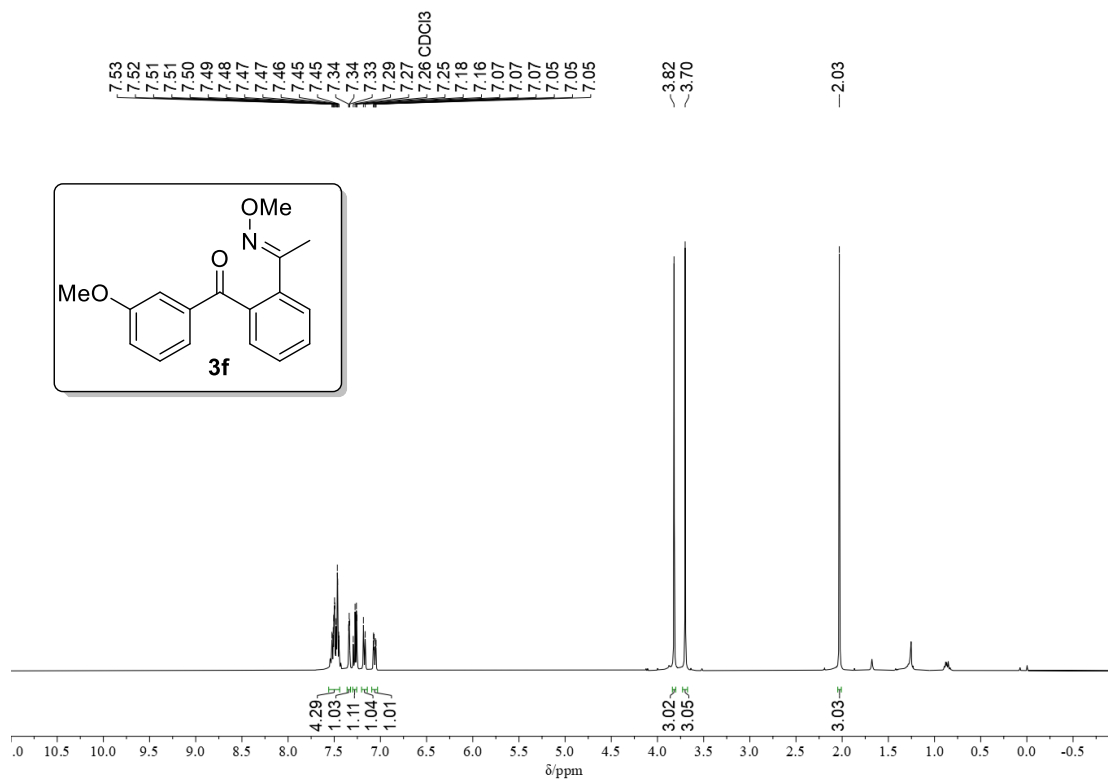
$^1\text{H}$  NMR of compound **3e**



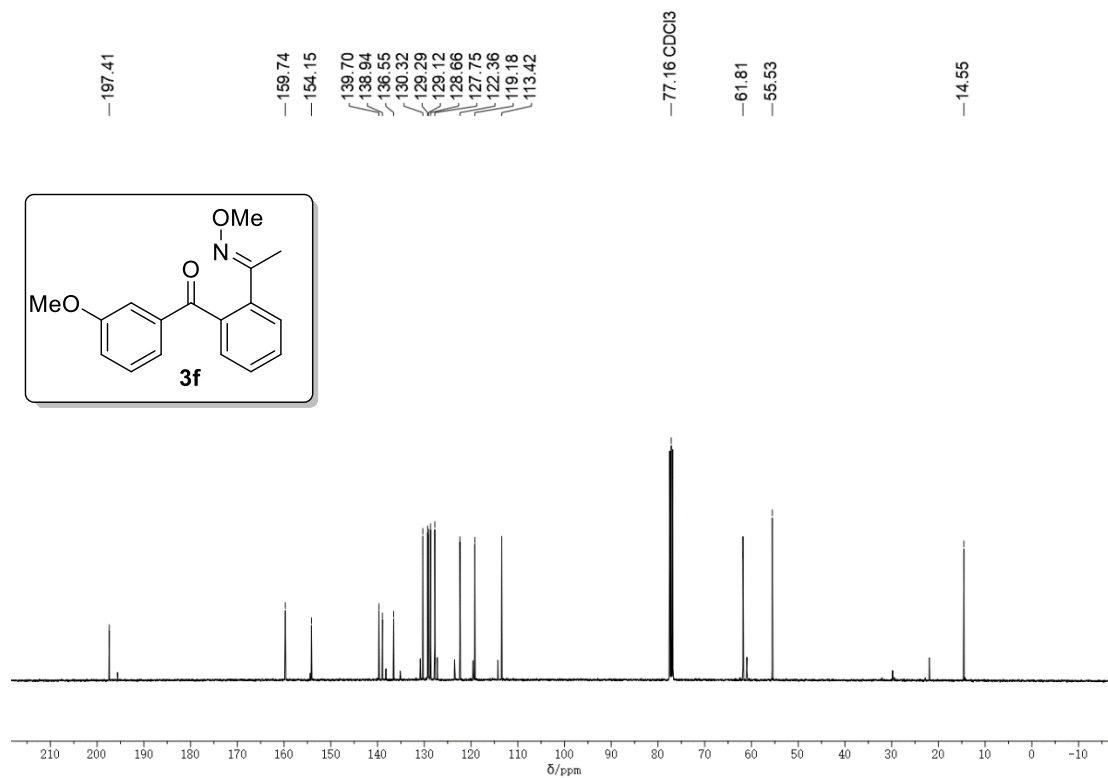
<sup>13</sup>C NMR of compound **3e**



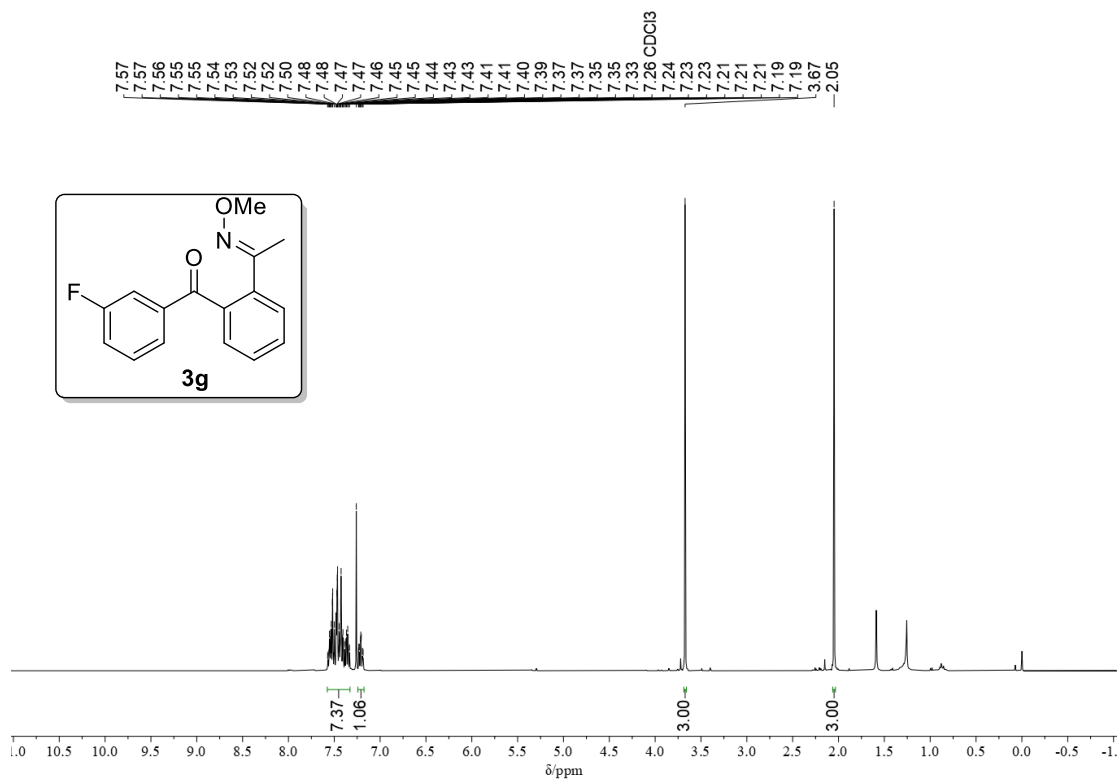
<sup>1</sup>H NMR of compound **3f**



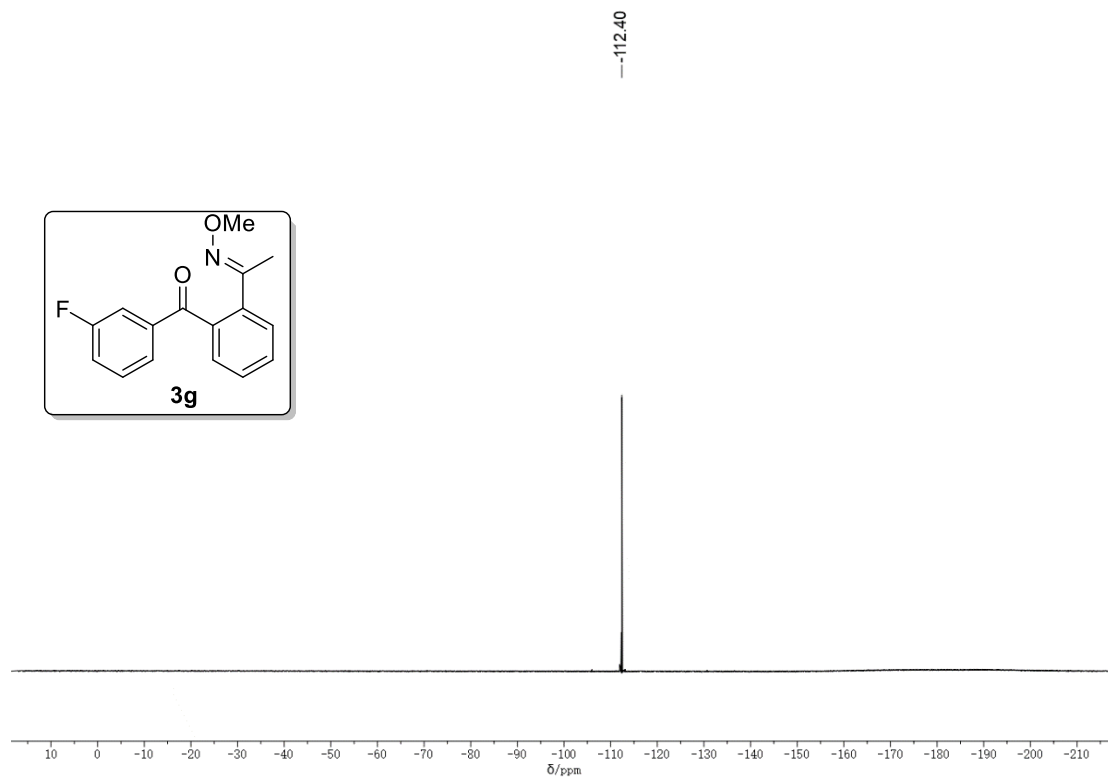
<sup>13</sup>C NMR of compound **3f**



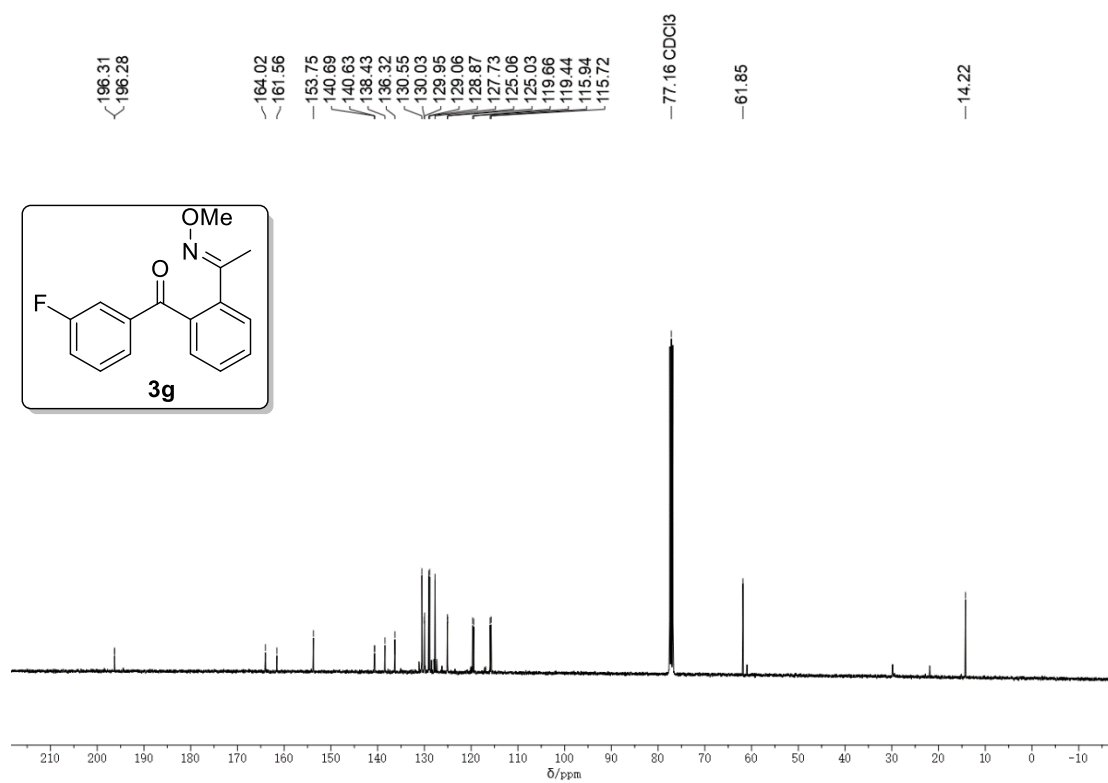
<sup>1</sup>H NMR of compound **3g**



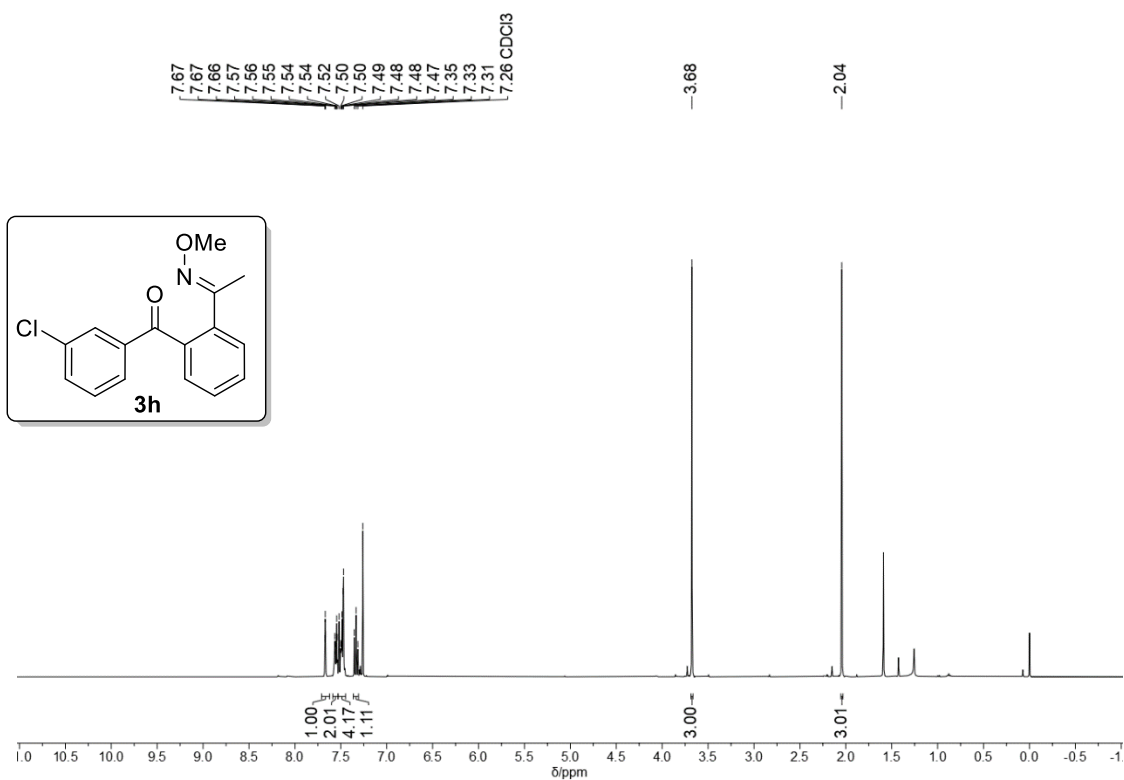
$^{19}\text{F}$  NMR of compound **3g**



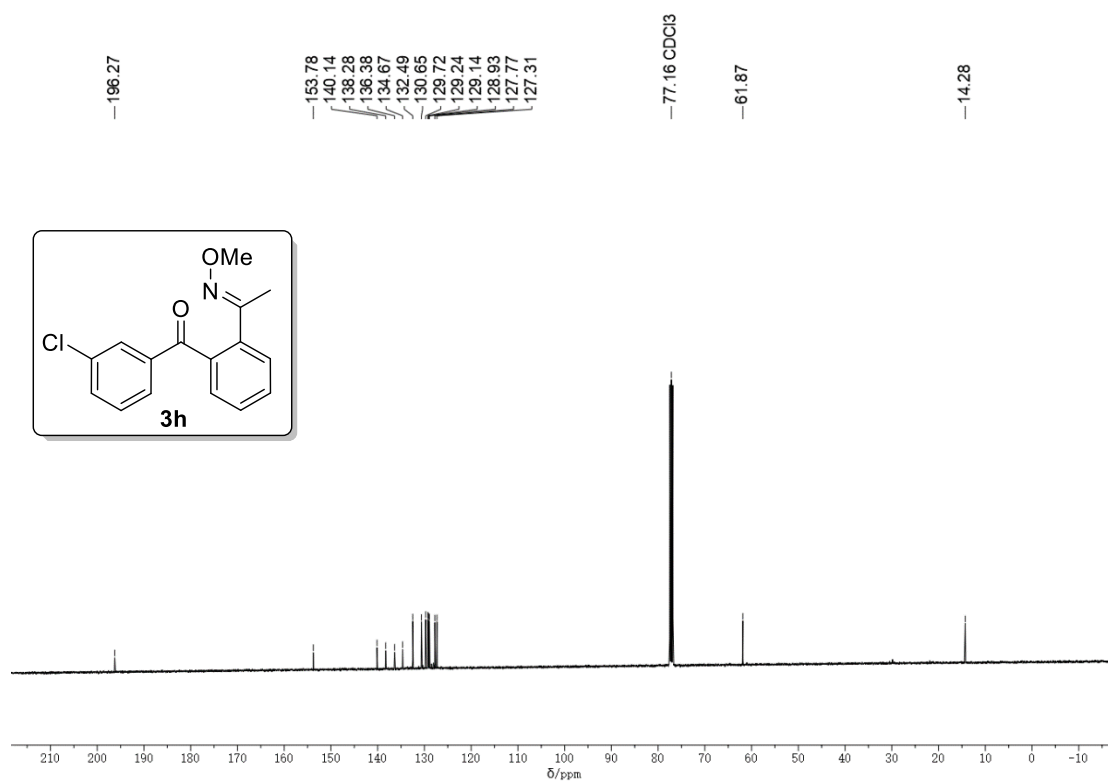
$^{13}\text{C}$  NMR of compound **3g**



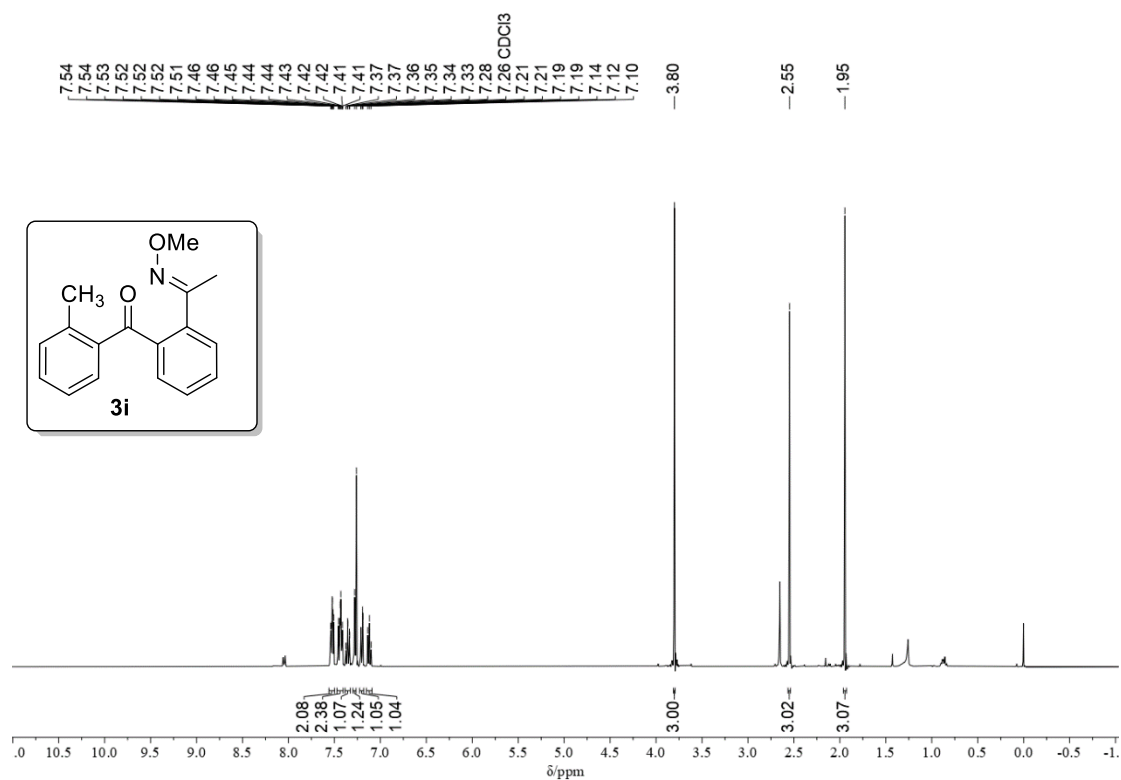
<sup>1</sup>H NMR of compound **3h**



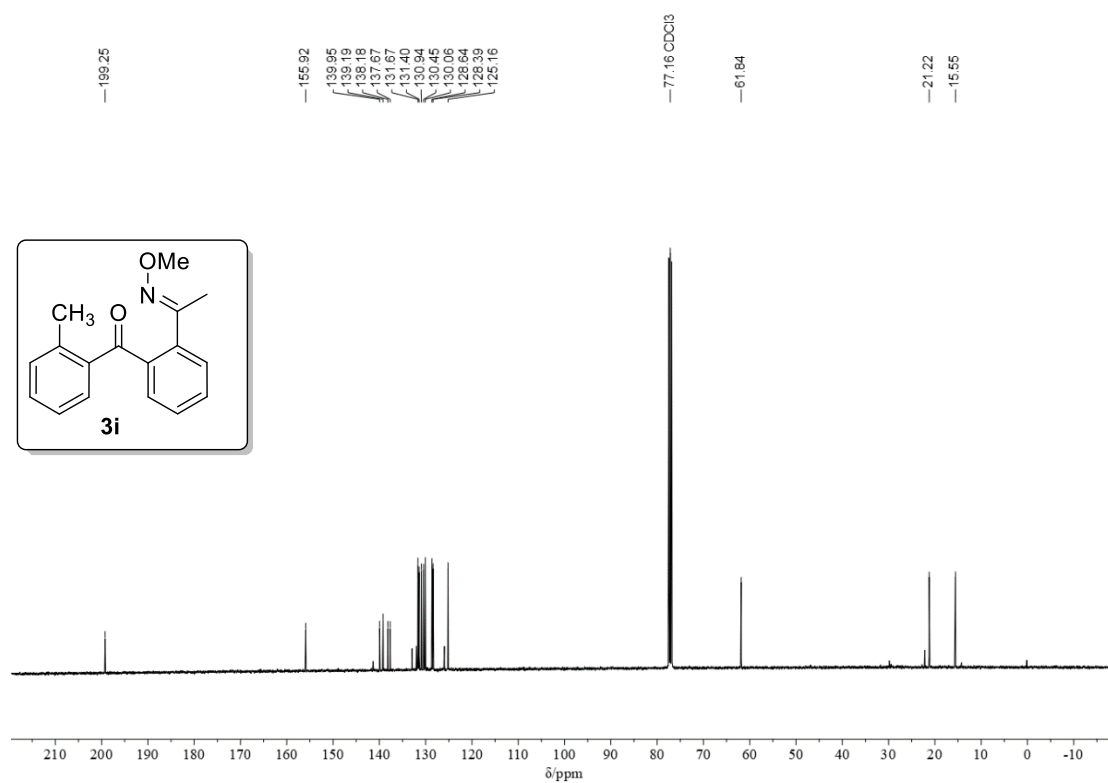
<sup>13</sup>C NMR of compound **3h**



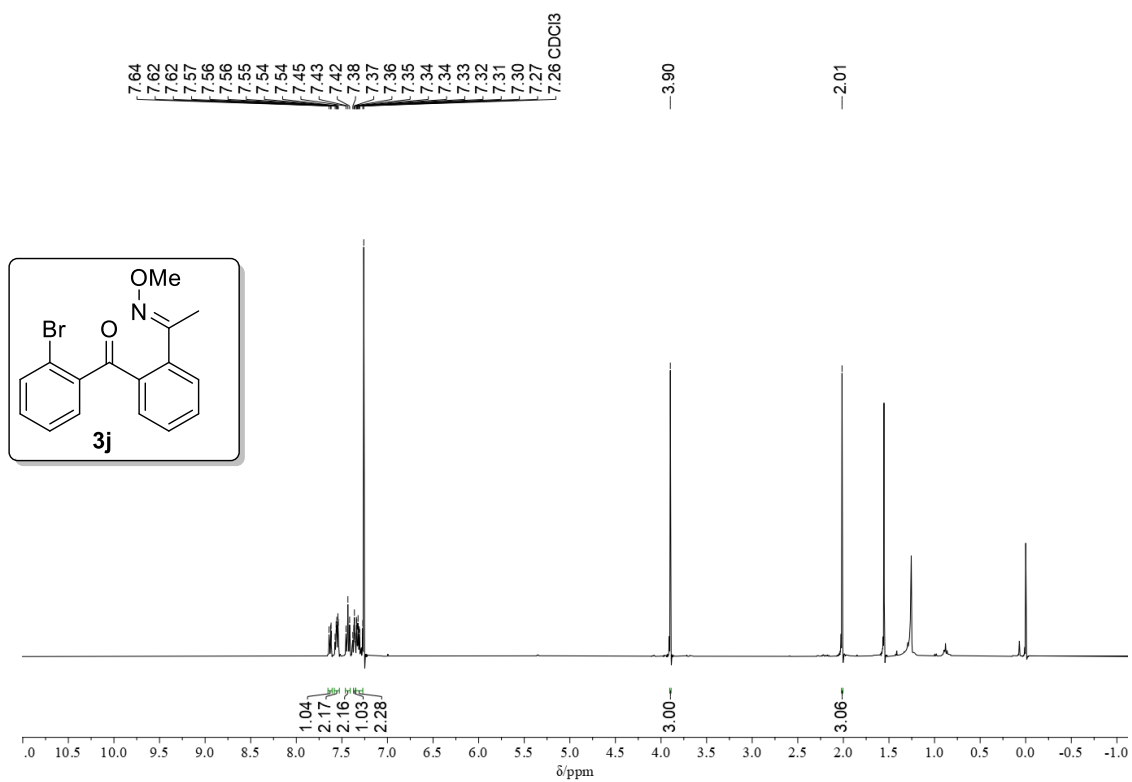
<sup>1</sup>H NMR of compound **3i**



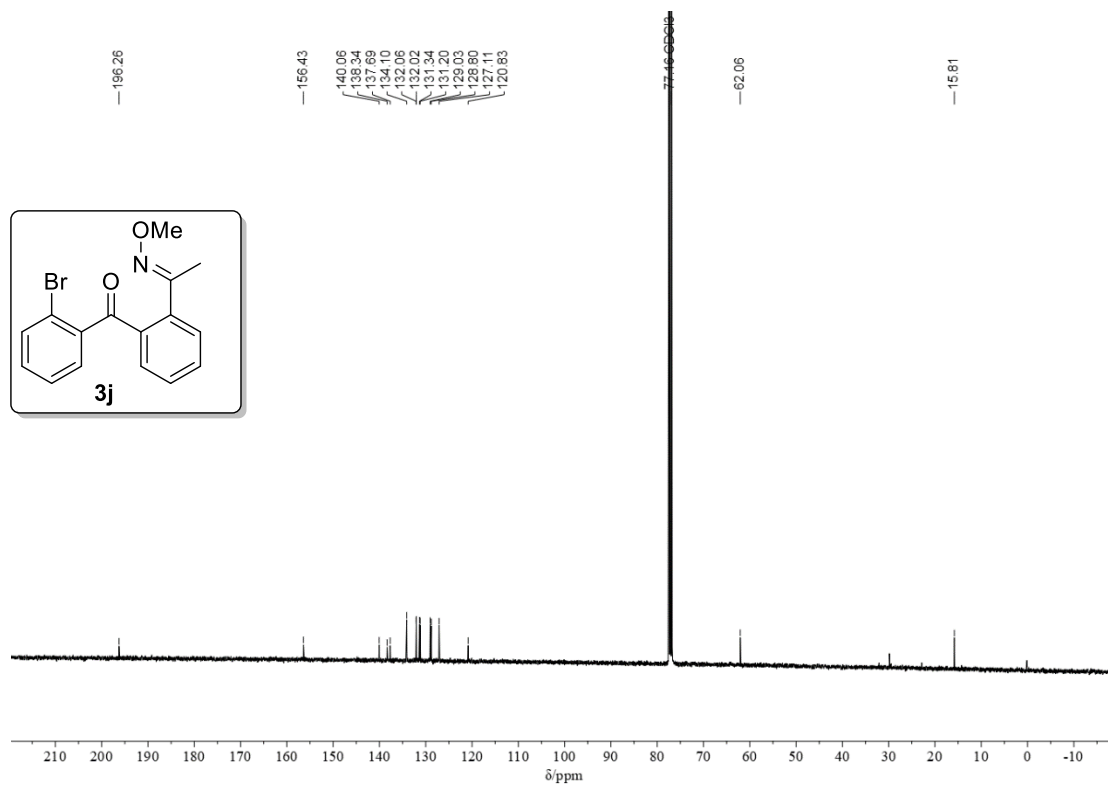
<sup>13</sup>C NMR of compound **3i**



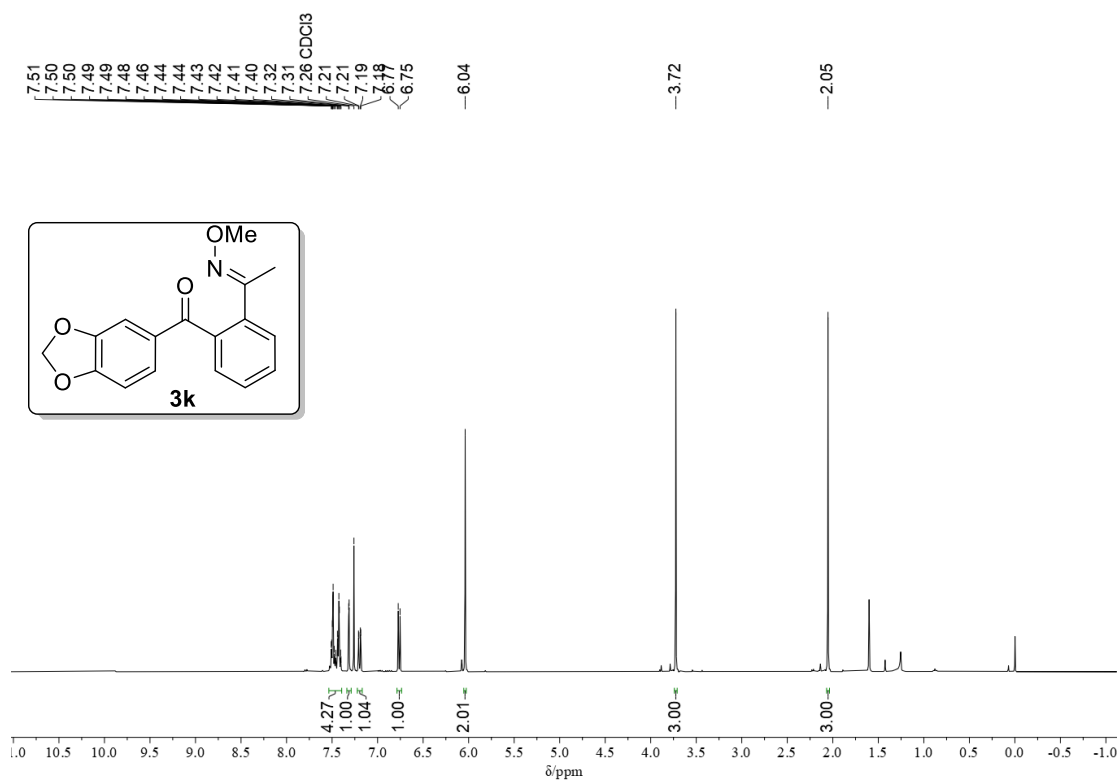
<sup>1</sup>H NMR of compound **3j**



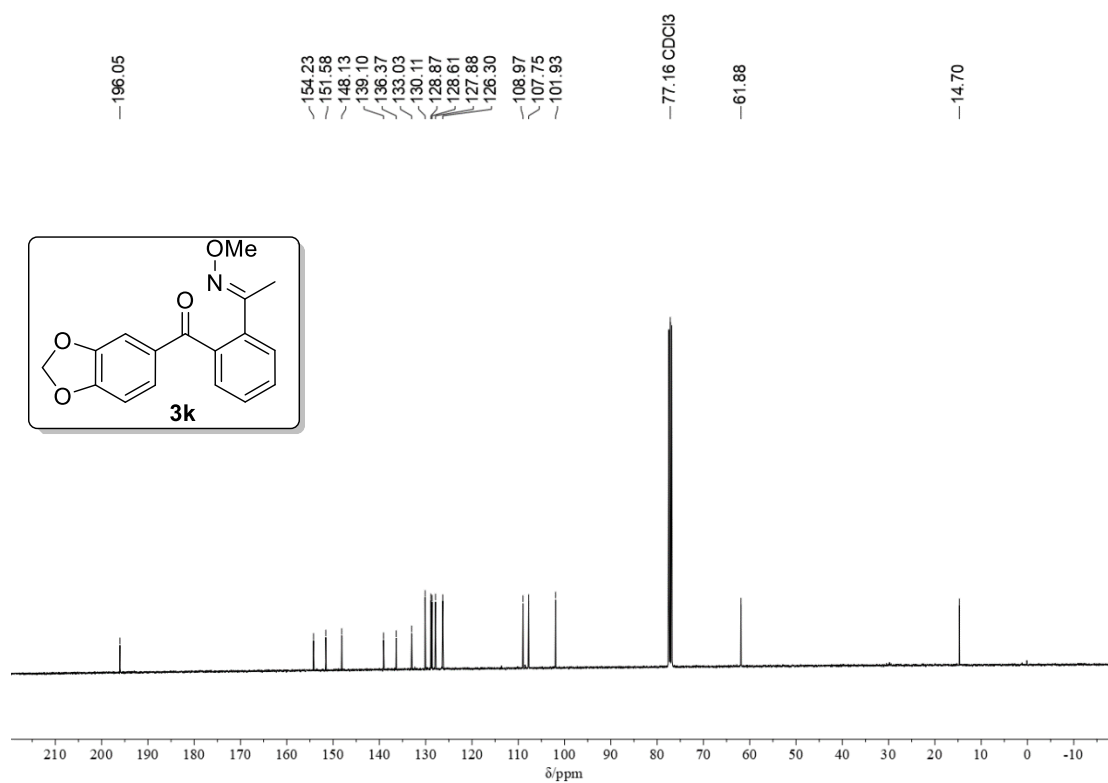
<sup>13</sup>C NMR of compound **3j**



<sup>1</sup>H NMR of compound **3k**

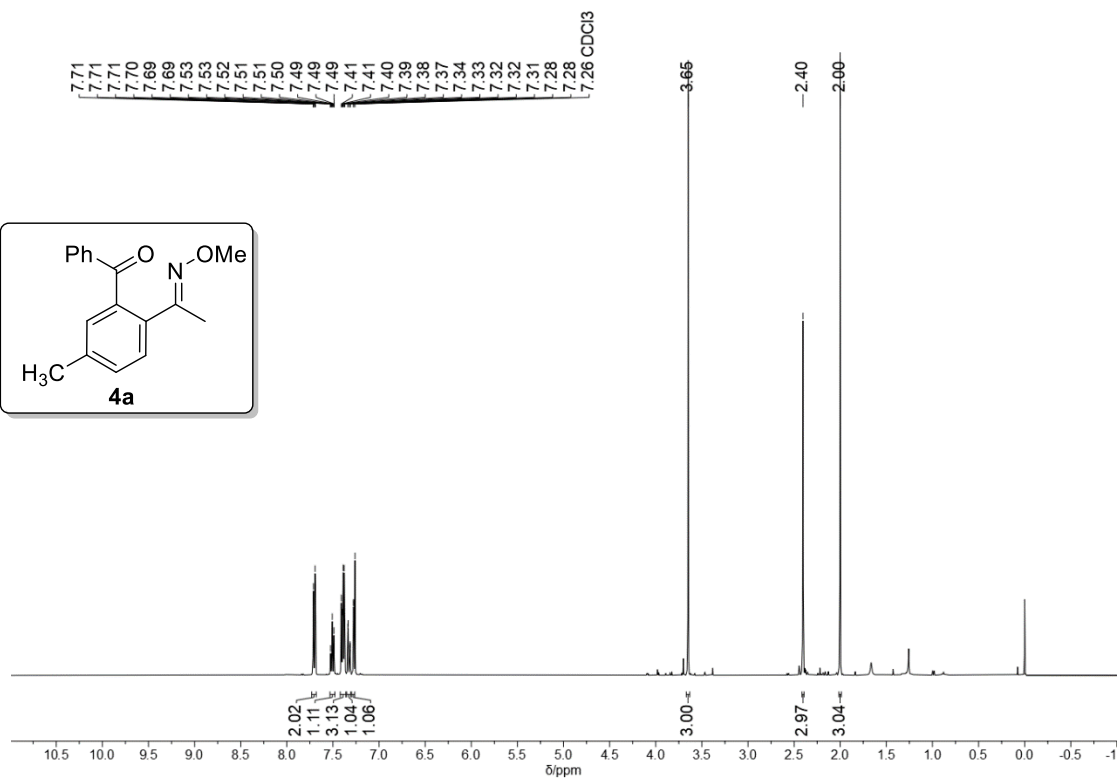


<sup>13</sup>C NMR of compound **3k**

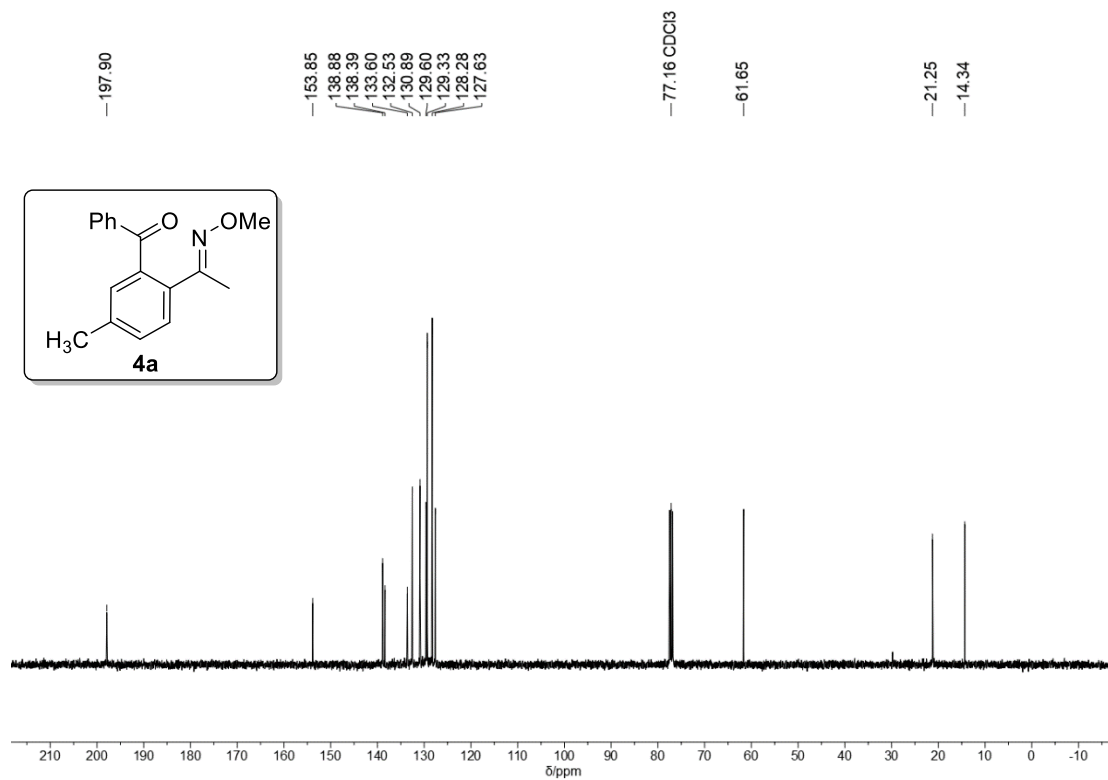




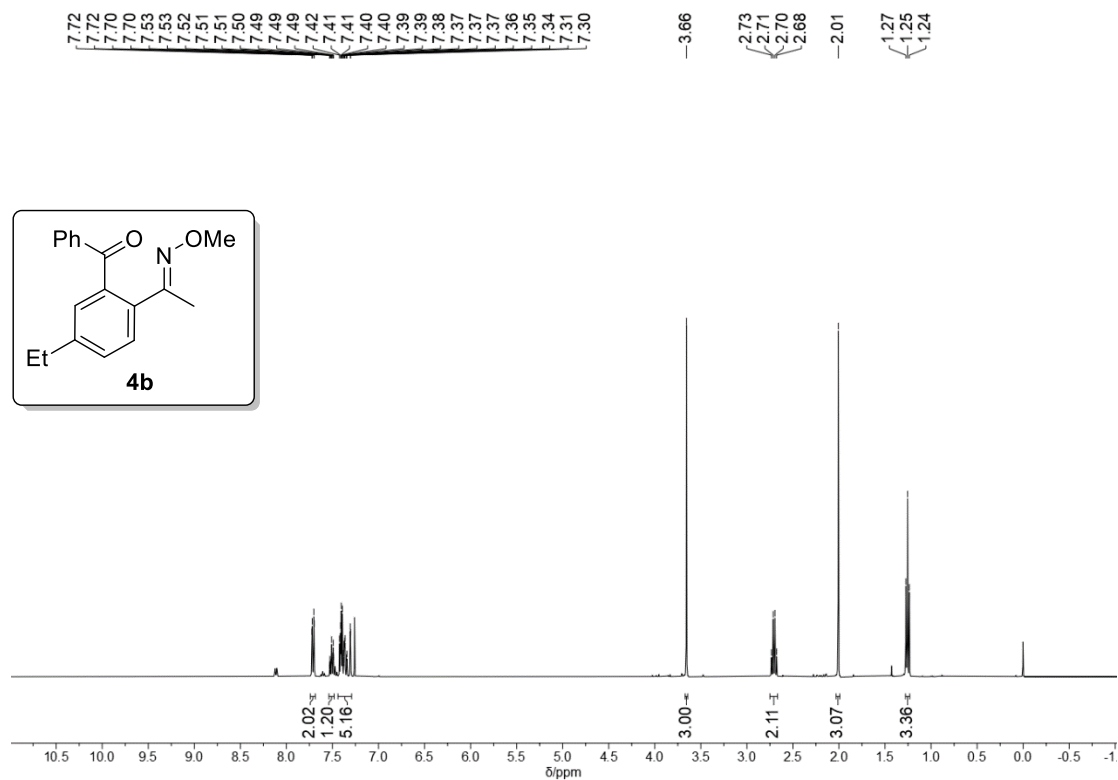
<sup>1</sup>H NMR of compound **4a**



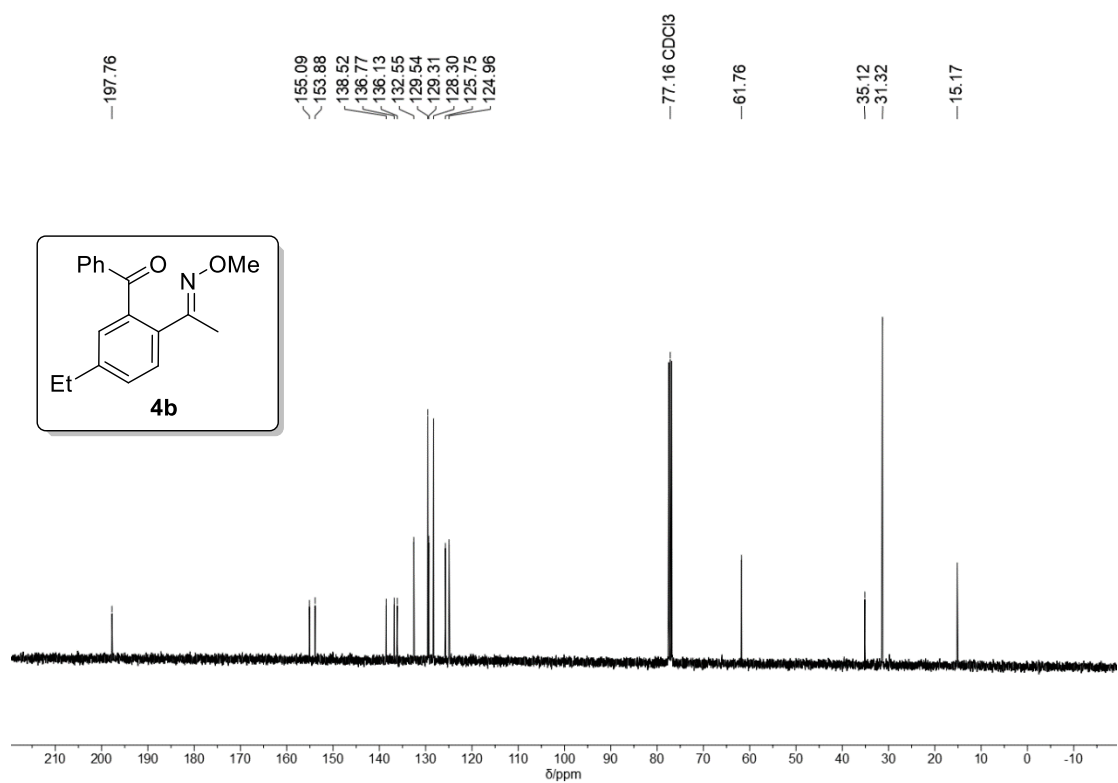
<sup>13</sup>C NMR of compound **4a**



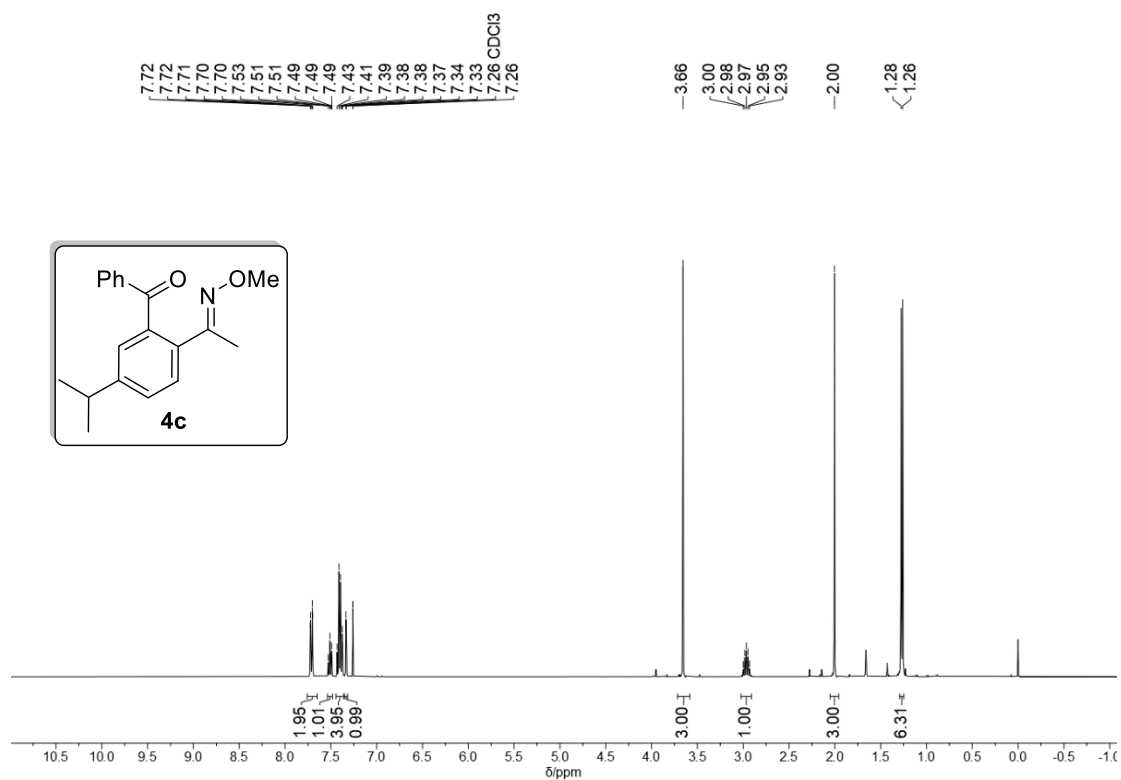
<sup>1</sup>H NMR of compound **4b**



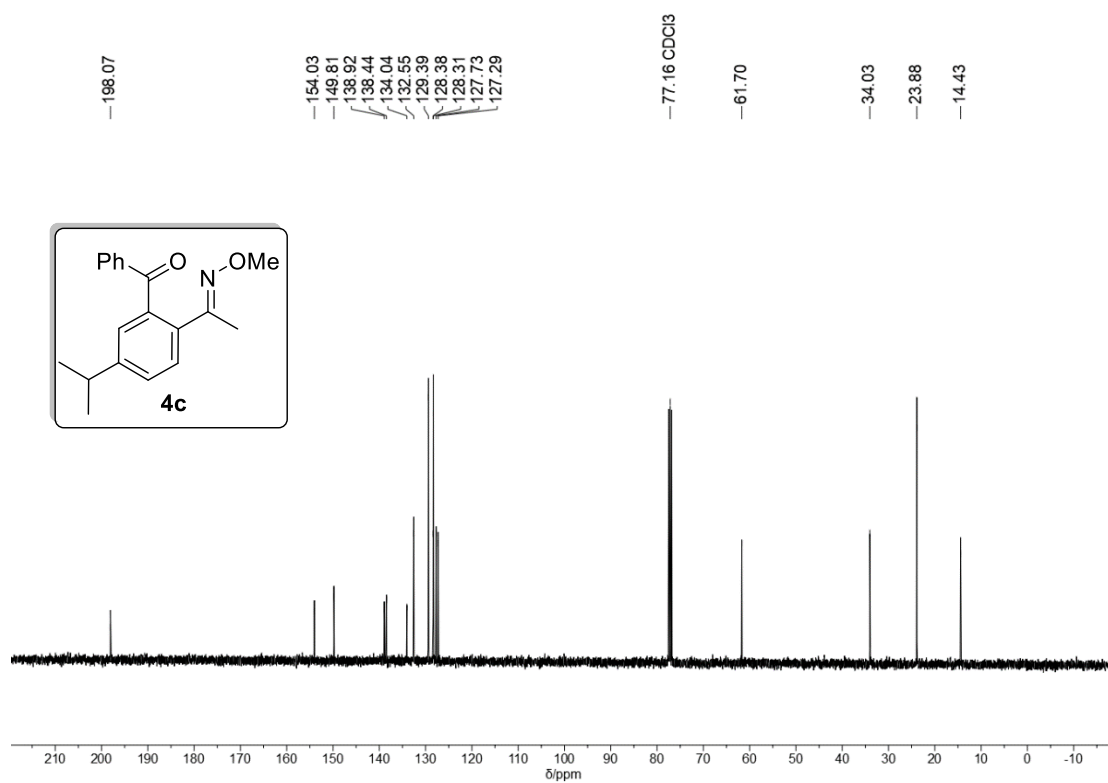
<sup>13</sup>C NMR of compound **4b**



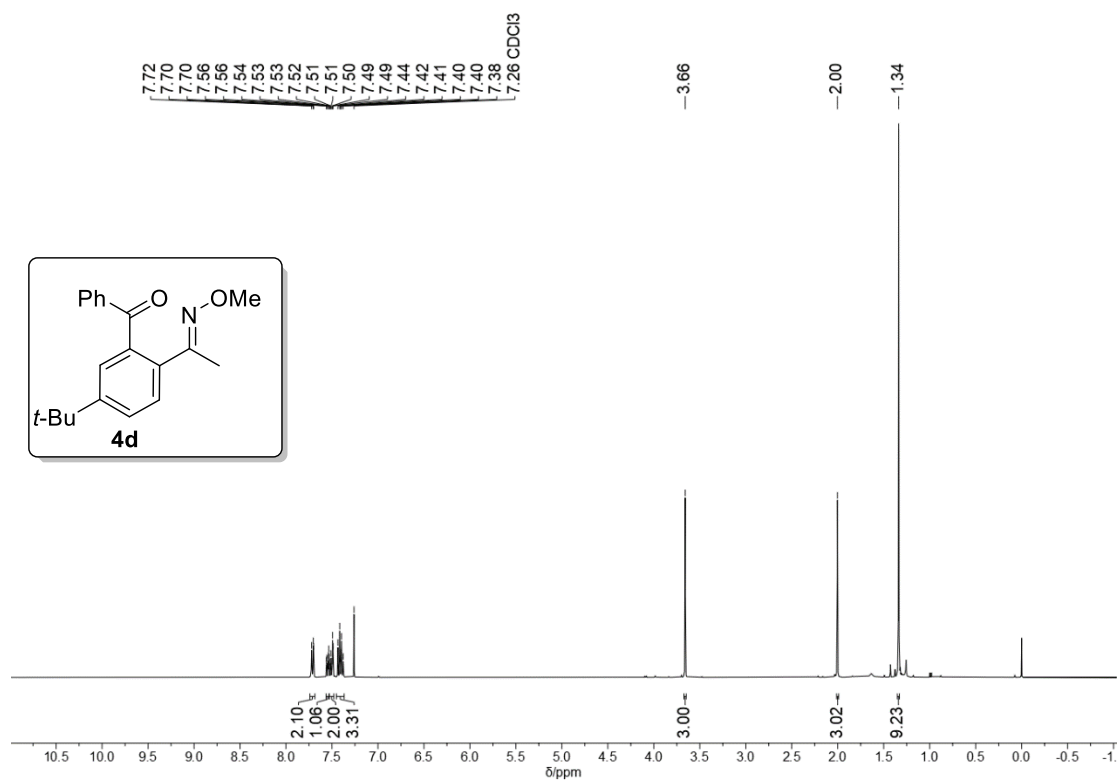
<sup>1</sup>H NMR of compound **4c**



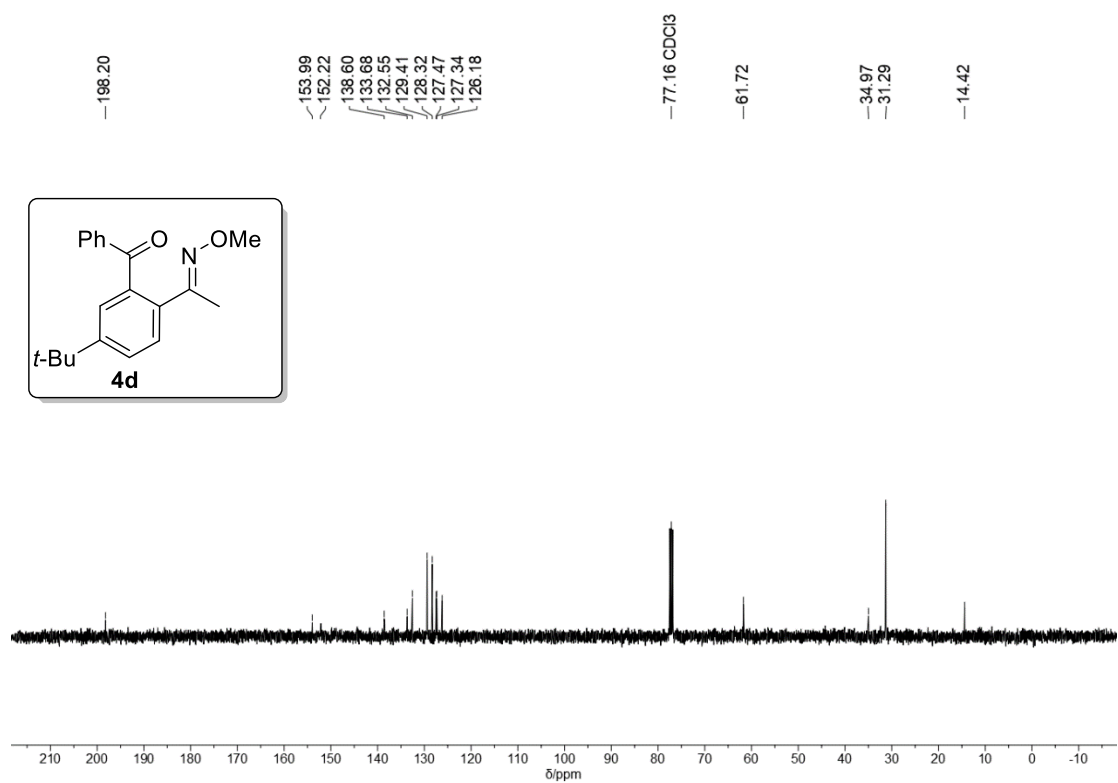
<sup>13</sup>C NMR of compound **4c**



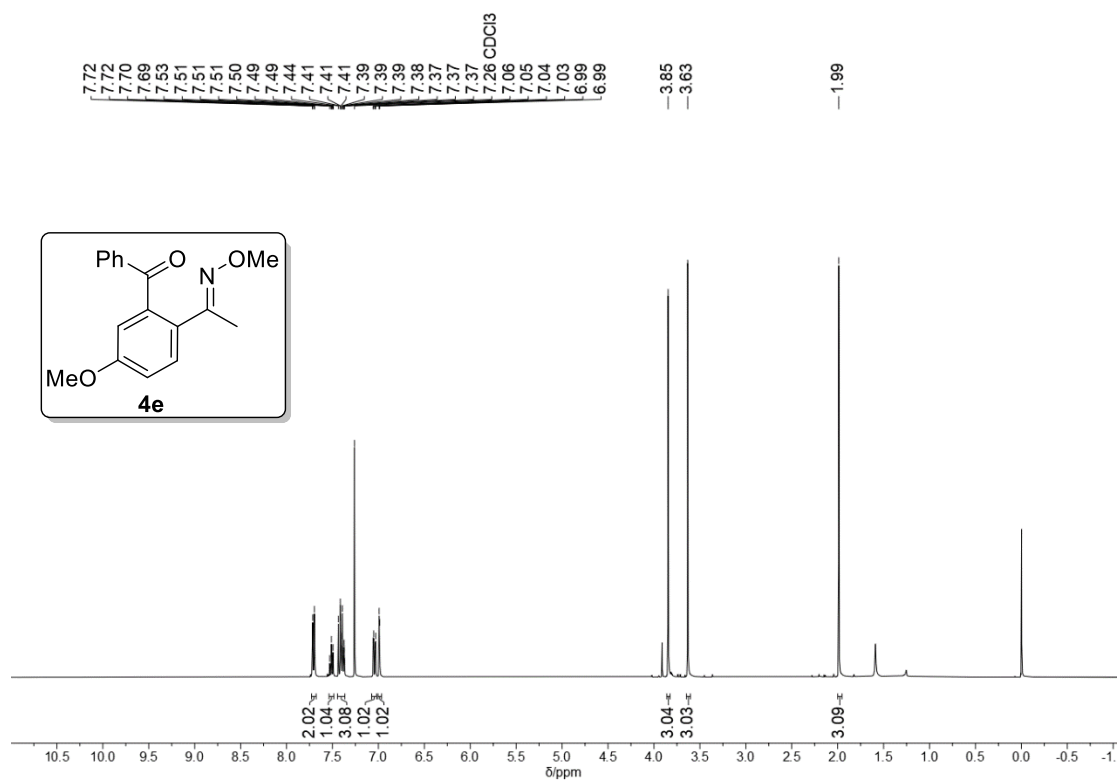
<sup>1</sup>H NMR of compound **4d**



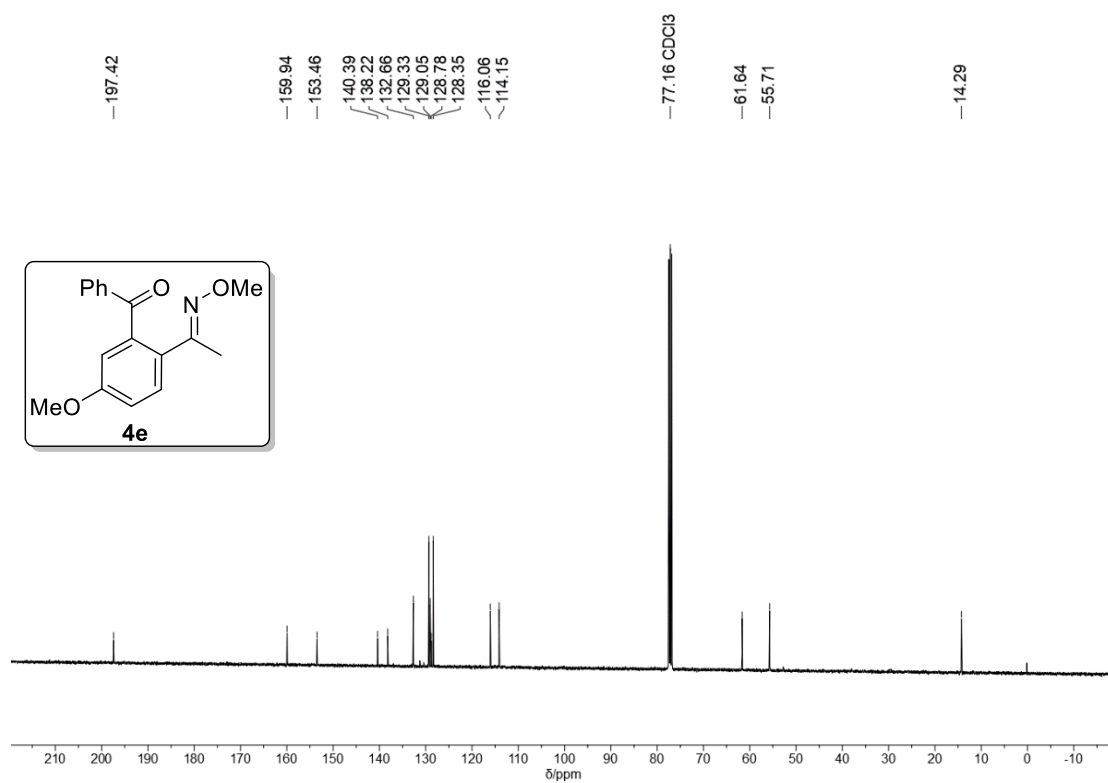
<sup>13</sup>C NMR of compound **4d**



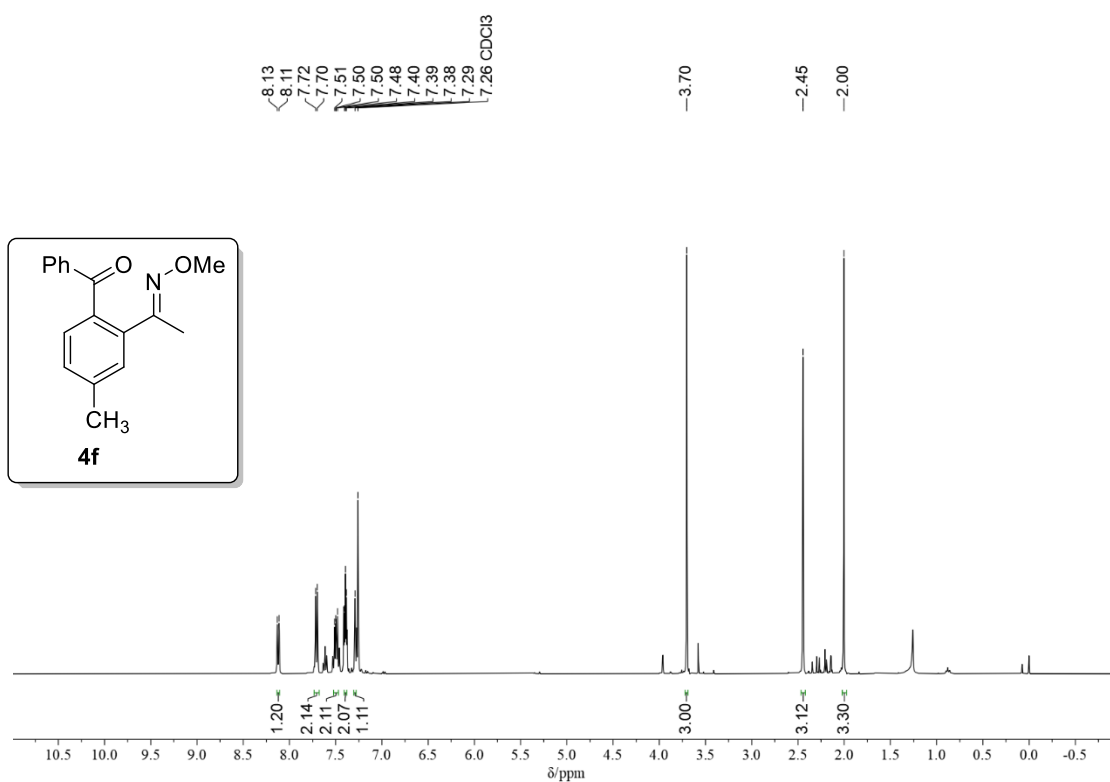
<sup>1</sup>H NMR of compound **4e**



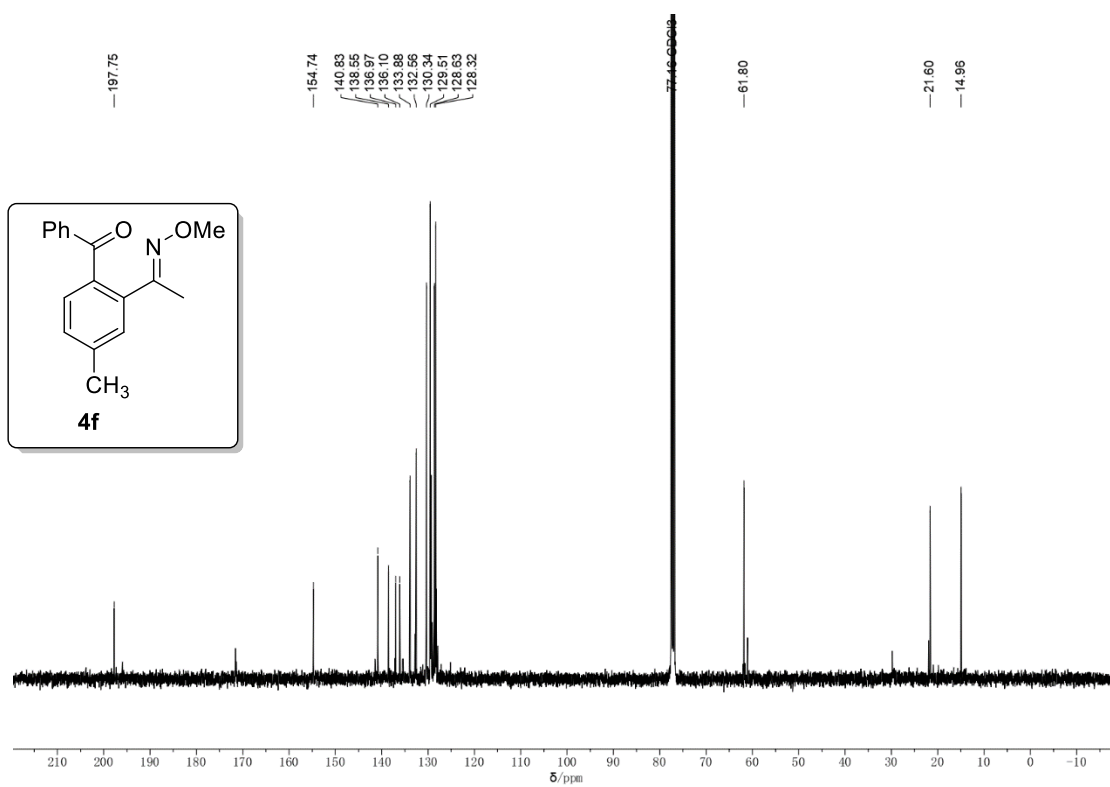
<sup>13</sup>C NMR of compound **4e**



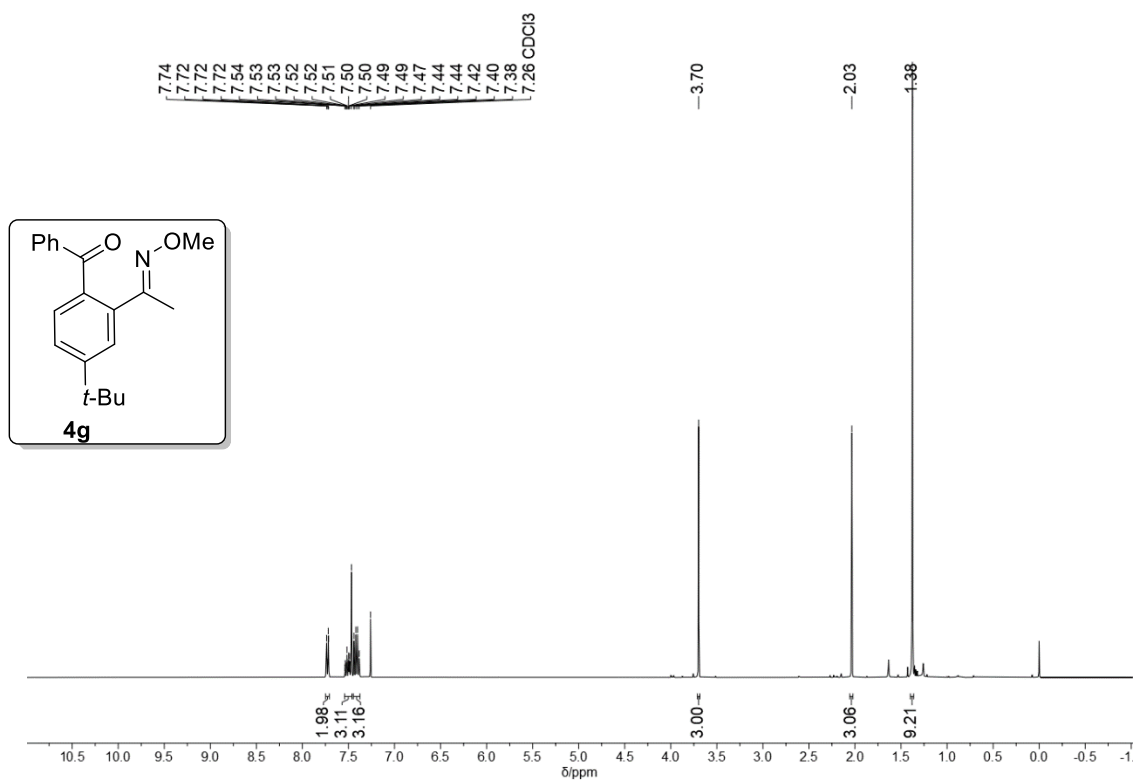
<sup>1</sup>H NMR of compound **4f**



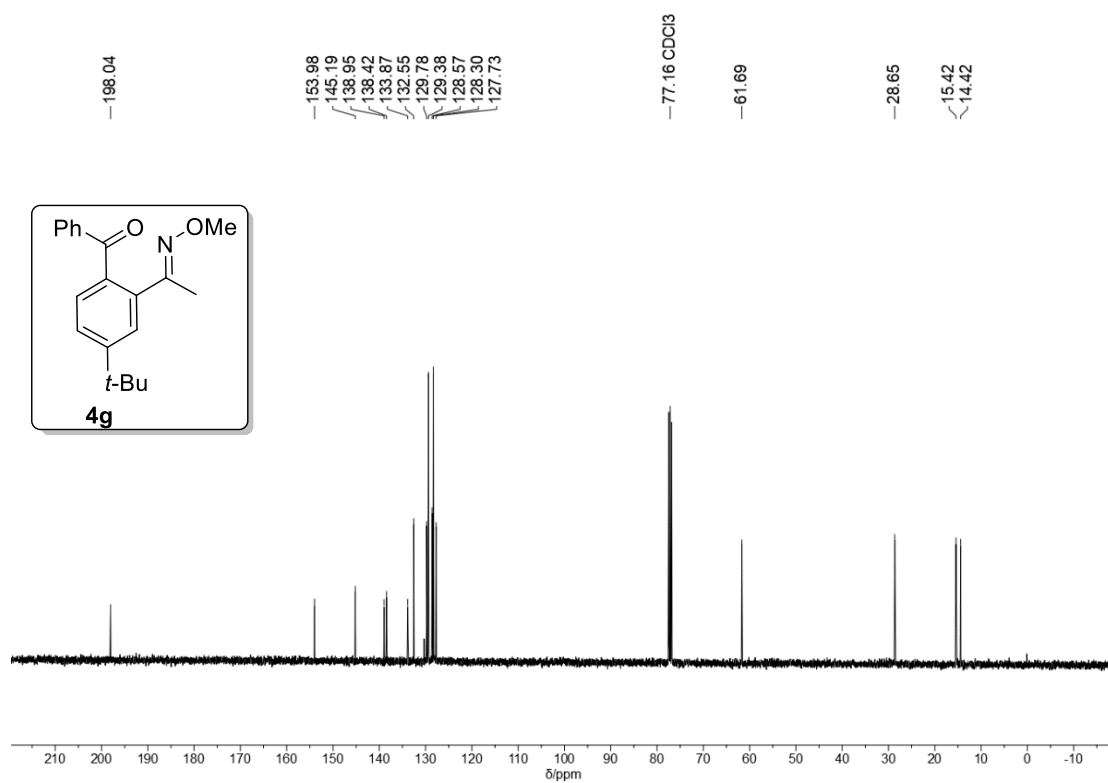
<sup>13</sup>C NMR of compound **4f**



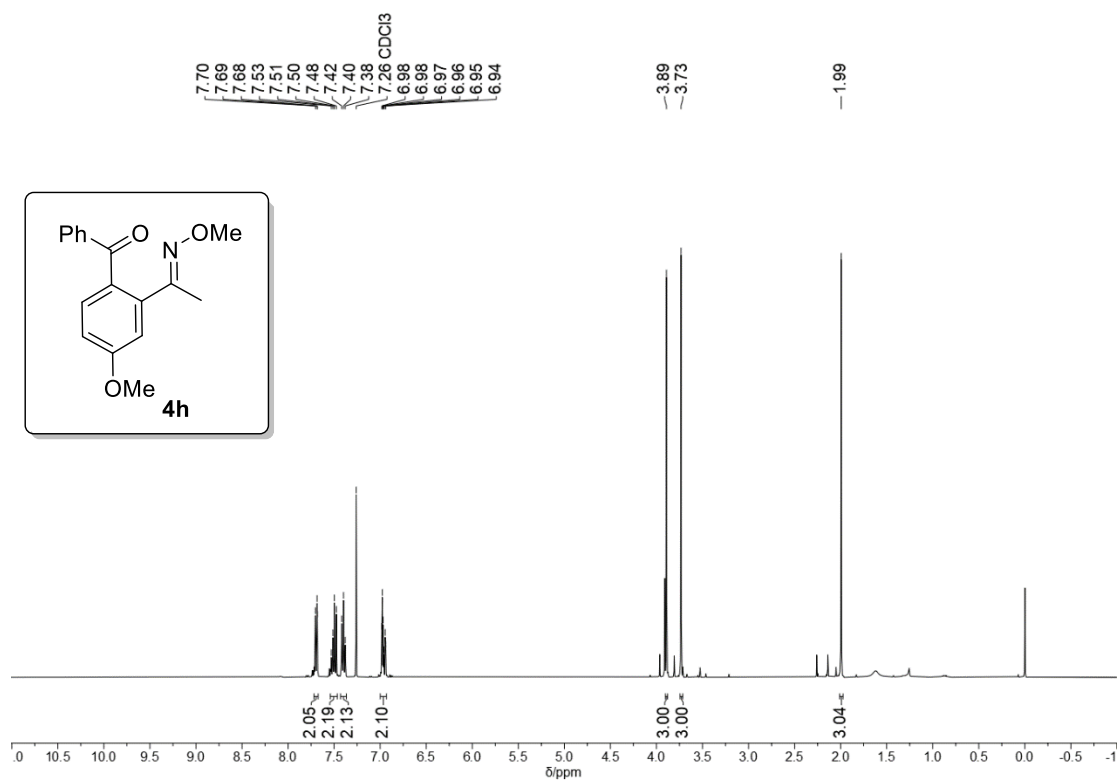
<sup>1</sup>H NMR of compound **4g**



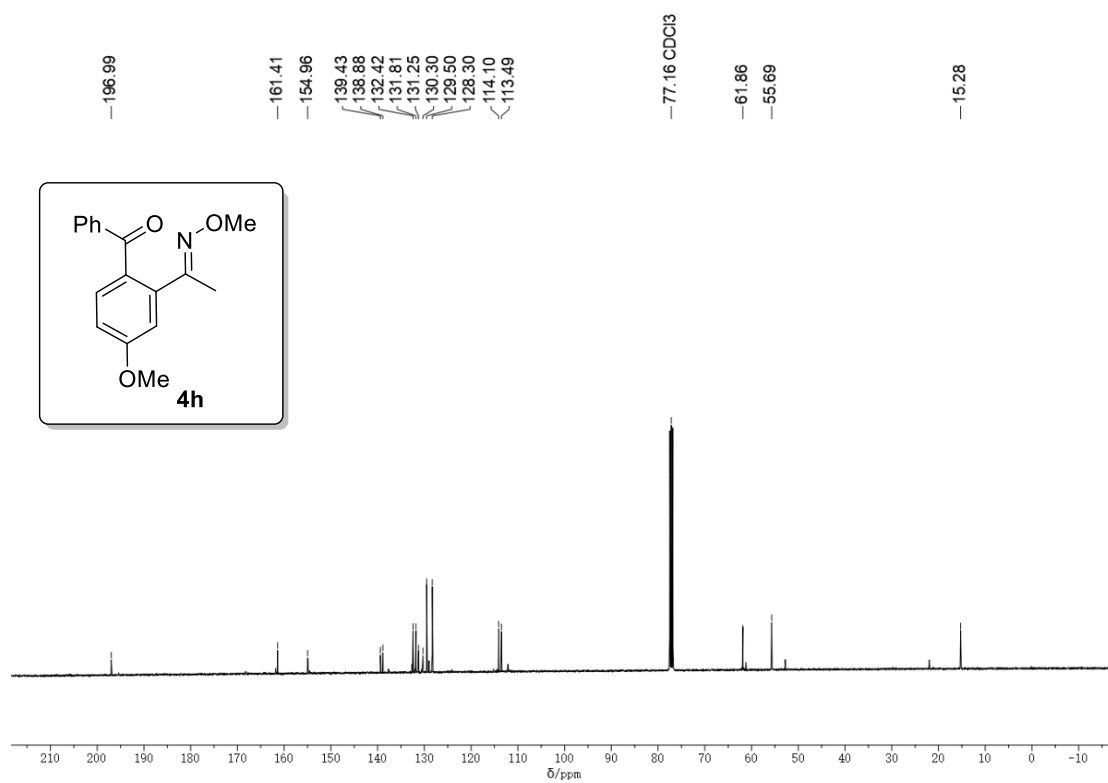
<sup>13</sup>C NMR of compound **4g**



<sup>1</sup>H NMR of compound **4h**

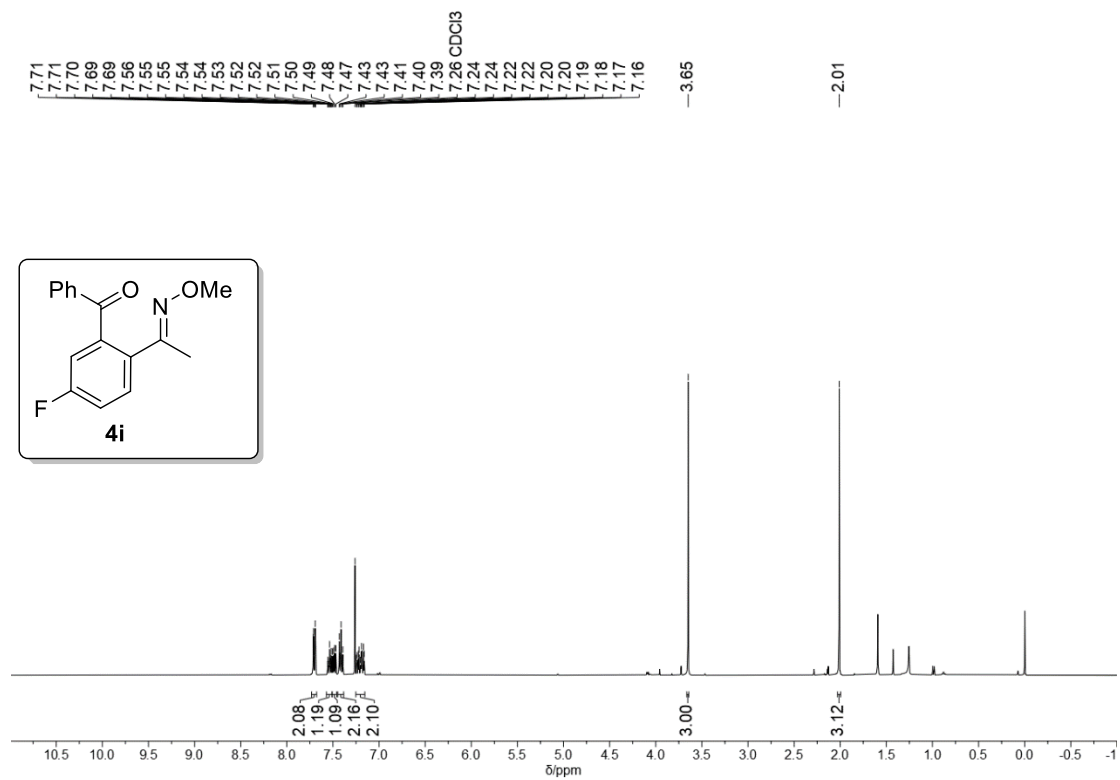


<sup>13</sup>C NMR of compound **4h**

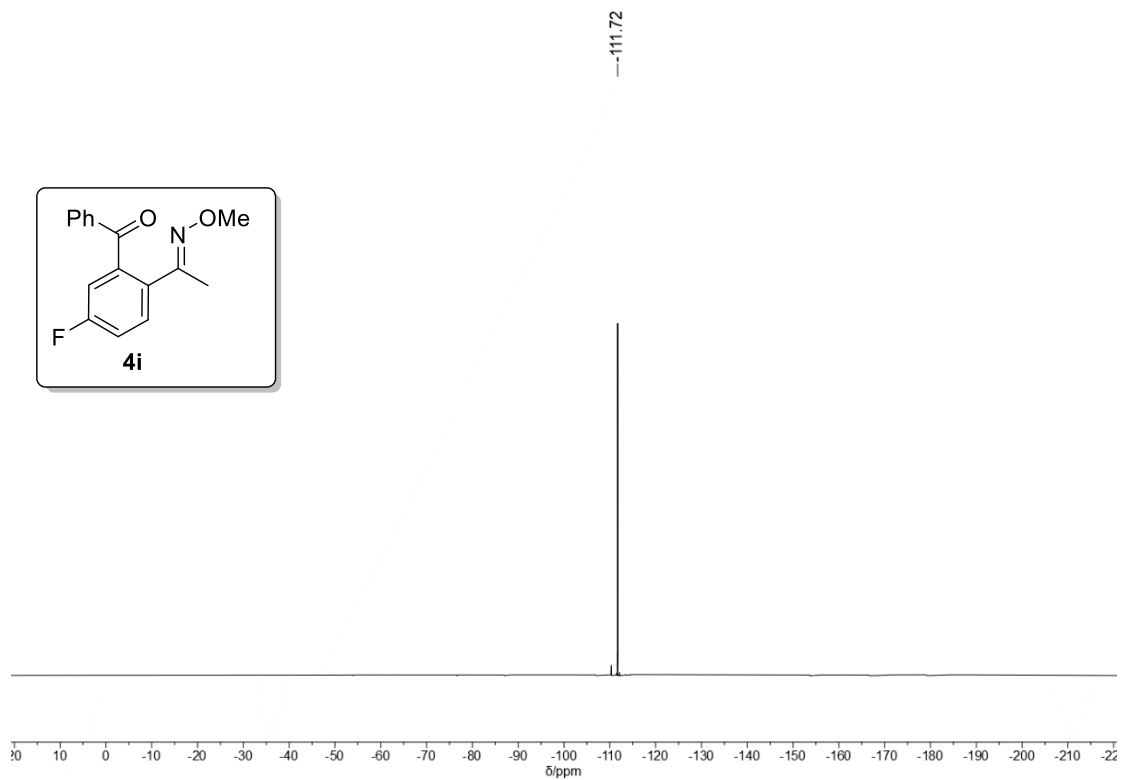




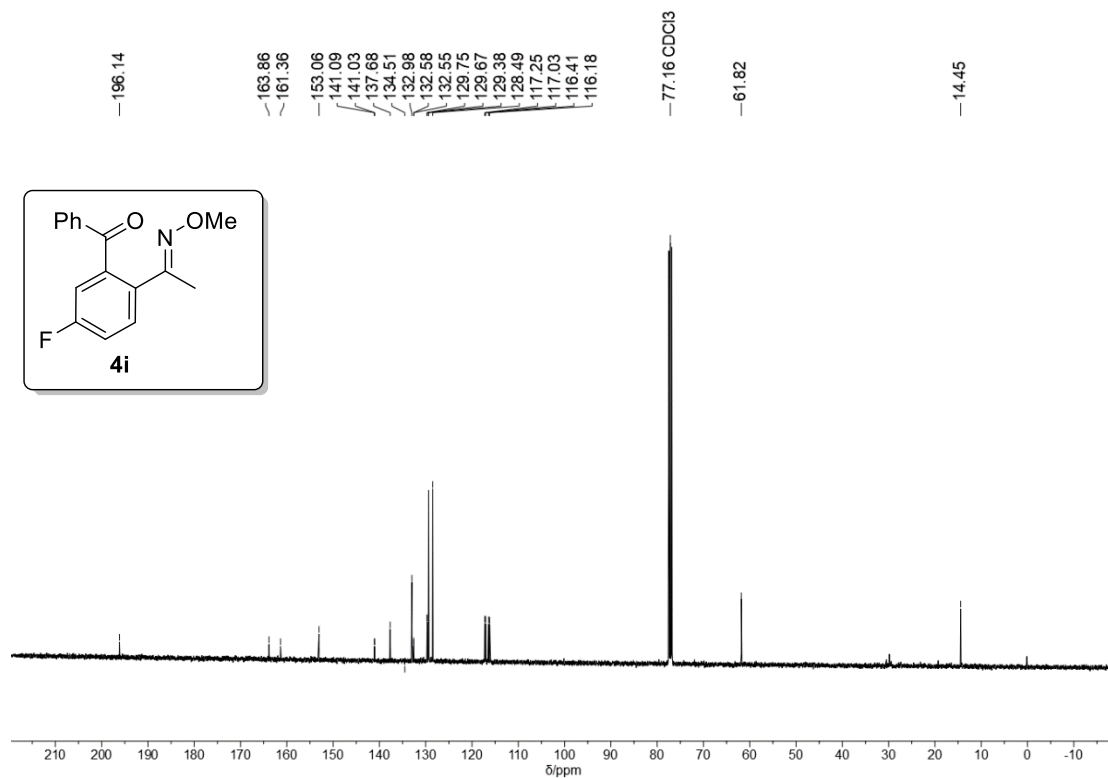
<sup>1</sup>H NMR of compound **4i**



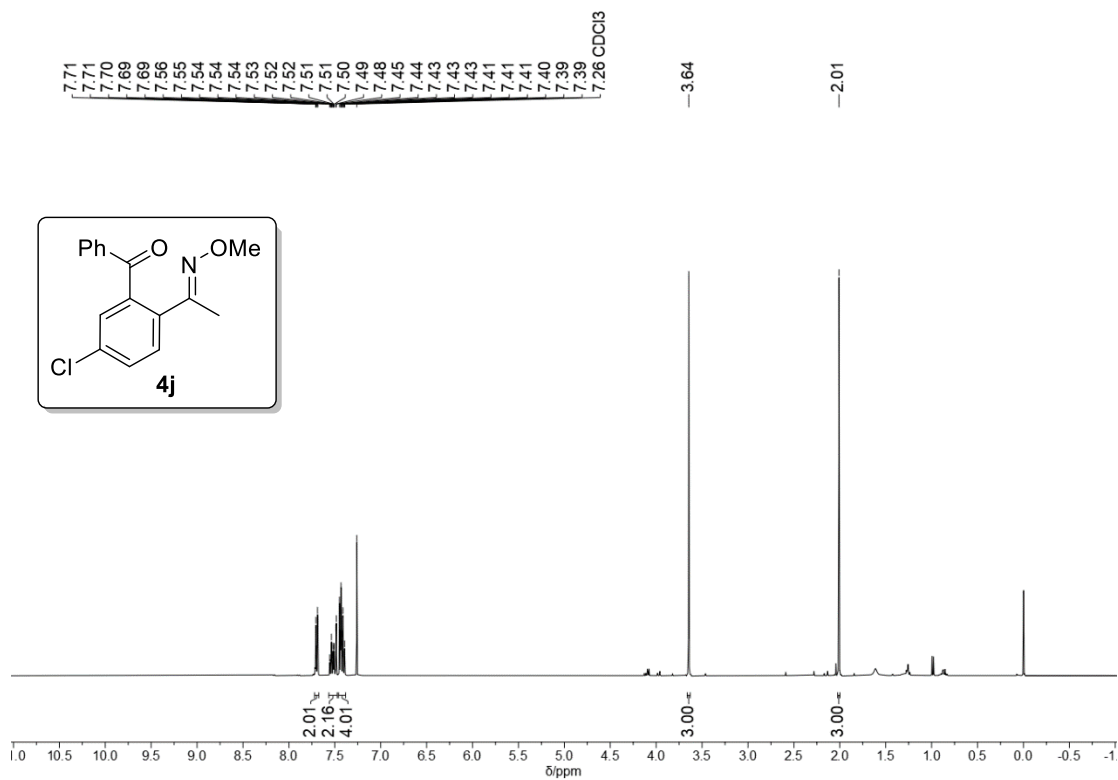
<sup>19</sup>F NMR of compound **4i**



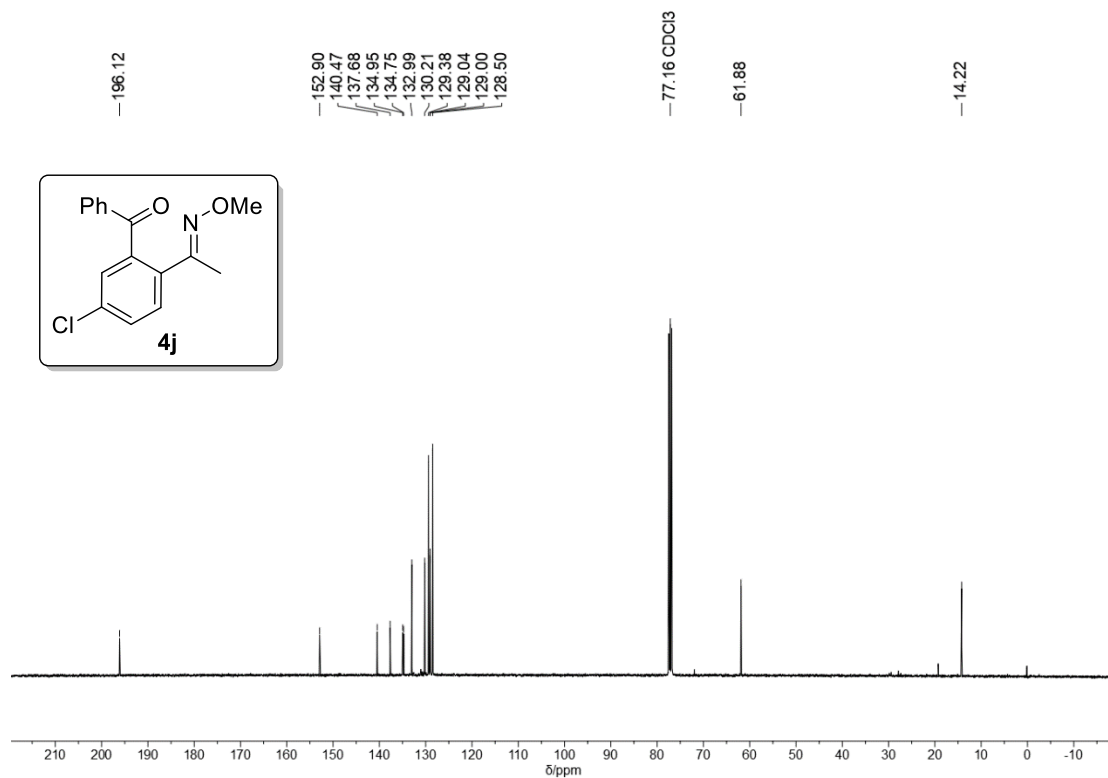
$^{13}\text{C}$  NMR of compound **4i**



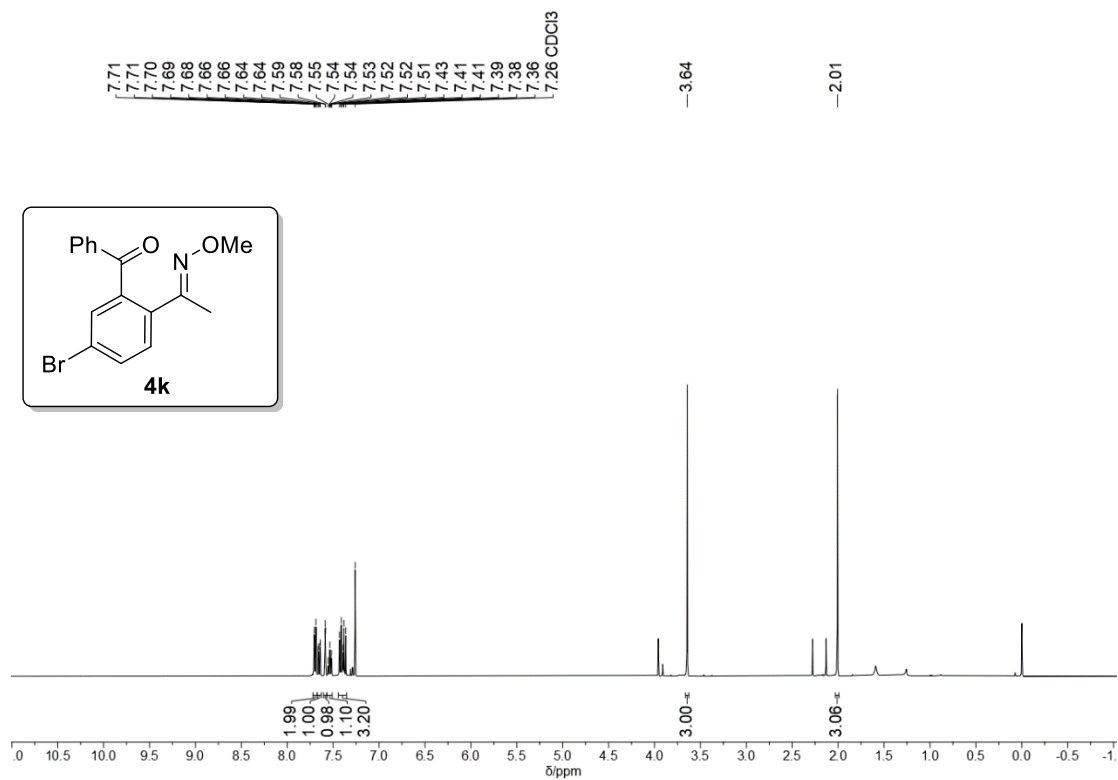
$^1\text{H}$  NMR of compound **4j**



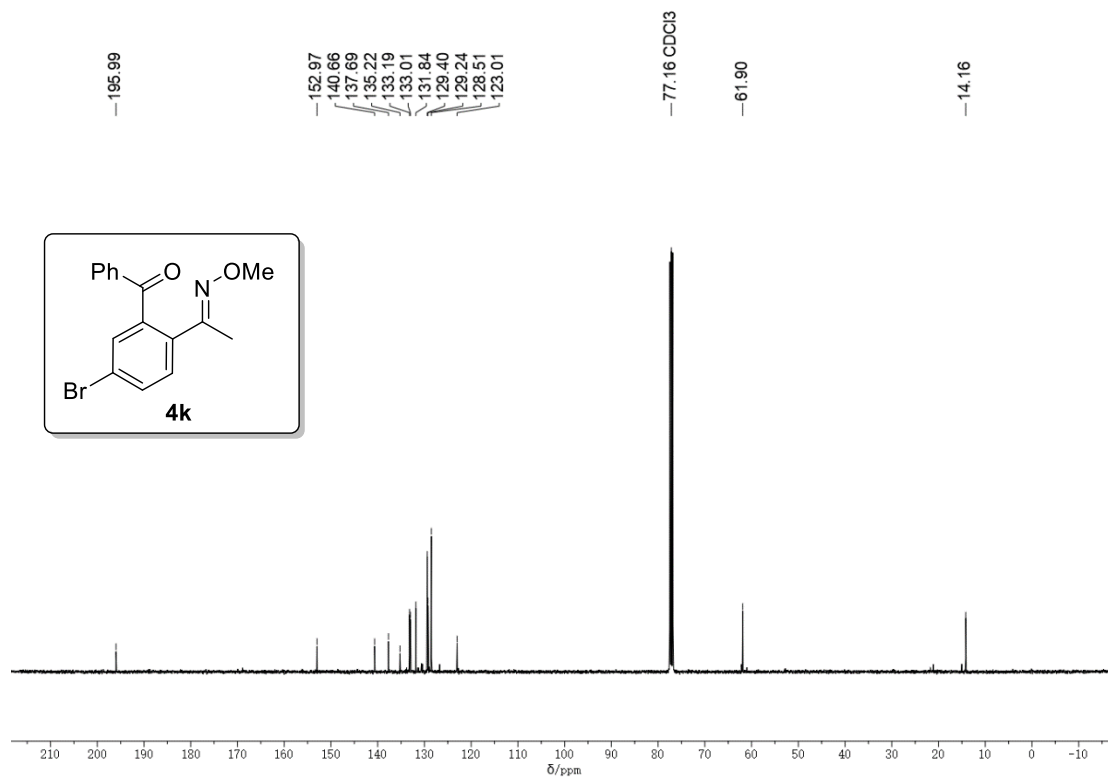
<sup>13</sup>C NMR of compound **4j**



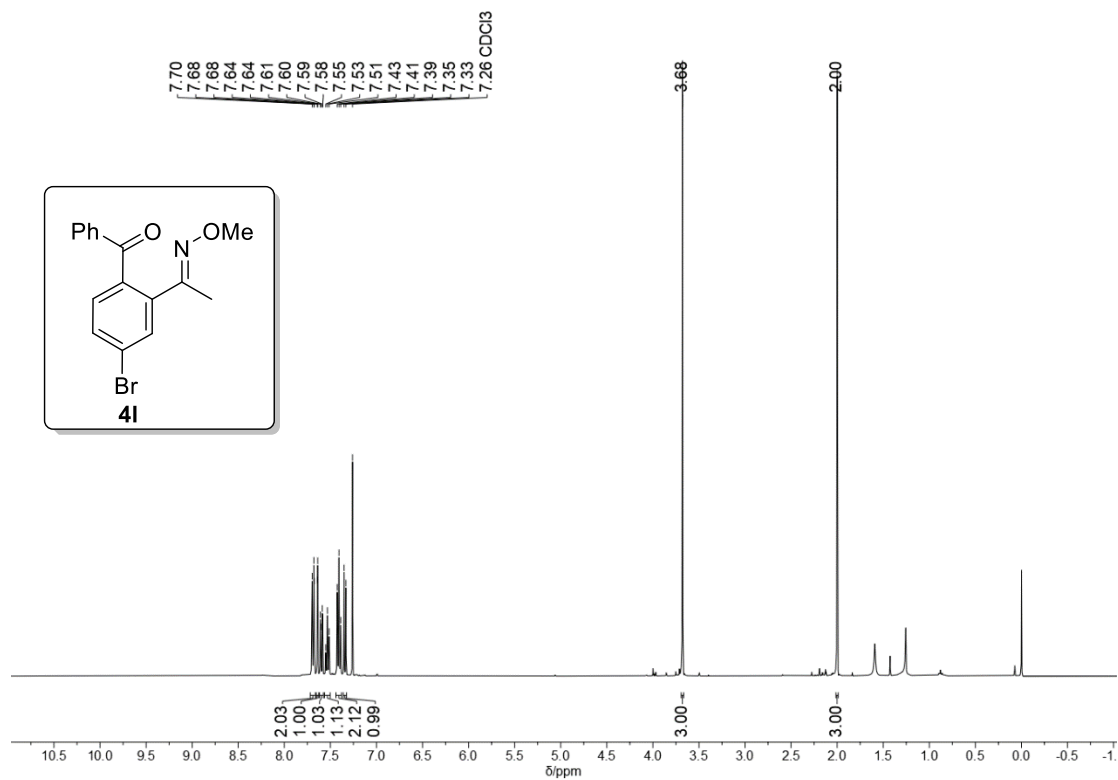
<sup>1</sup>H NMR of compound **4k**



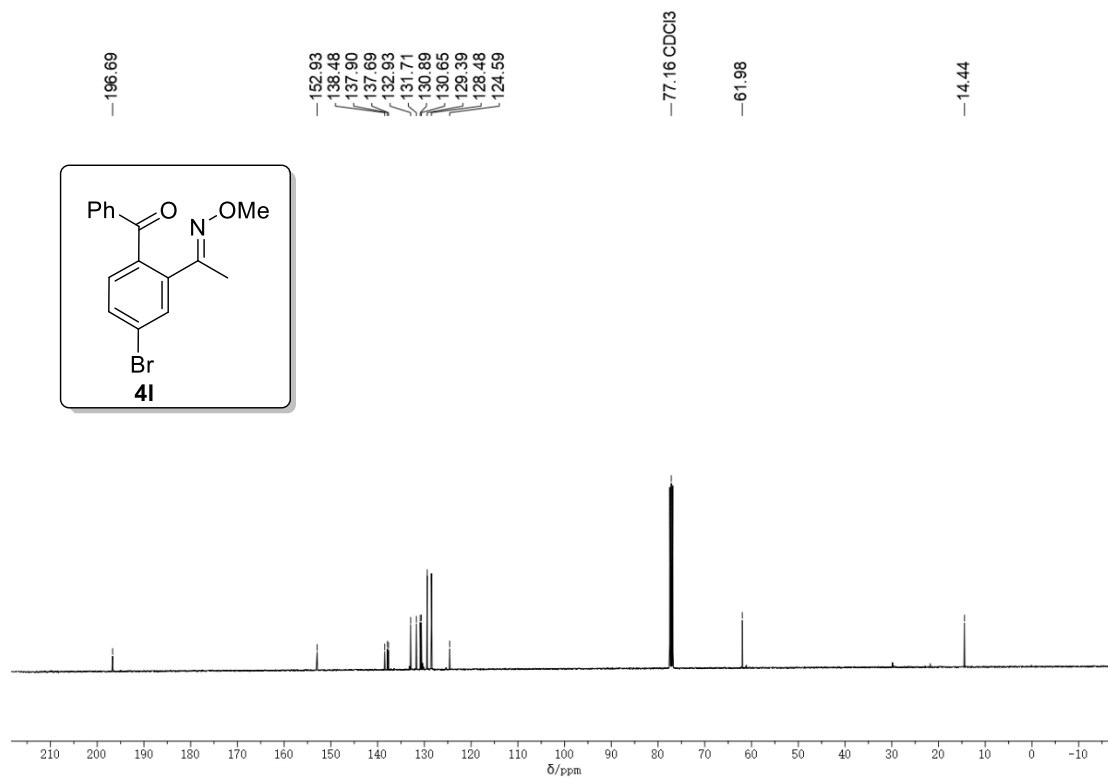
$^{13}\text{C}$  NMR of compound **4k**



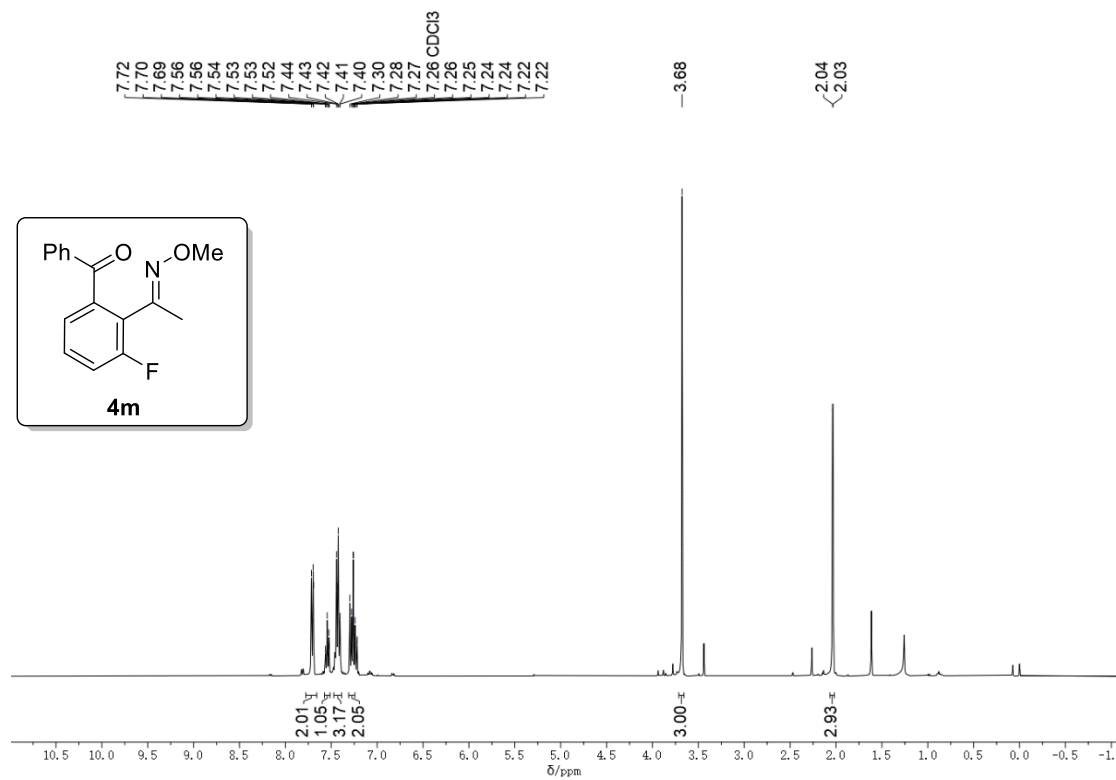
$^1\text{H}$  NMR of compound **4l**



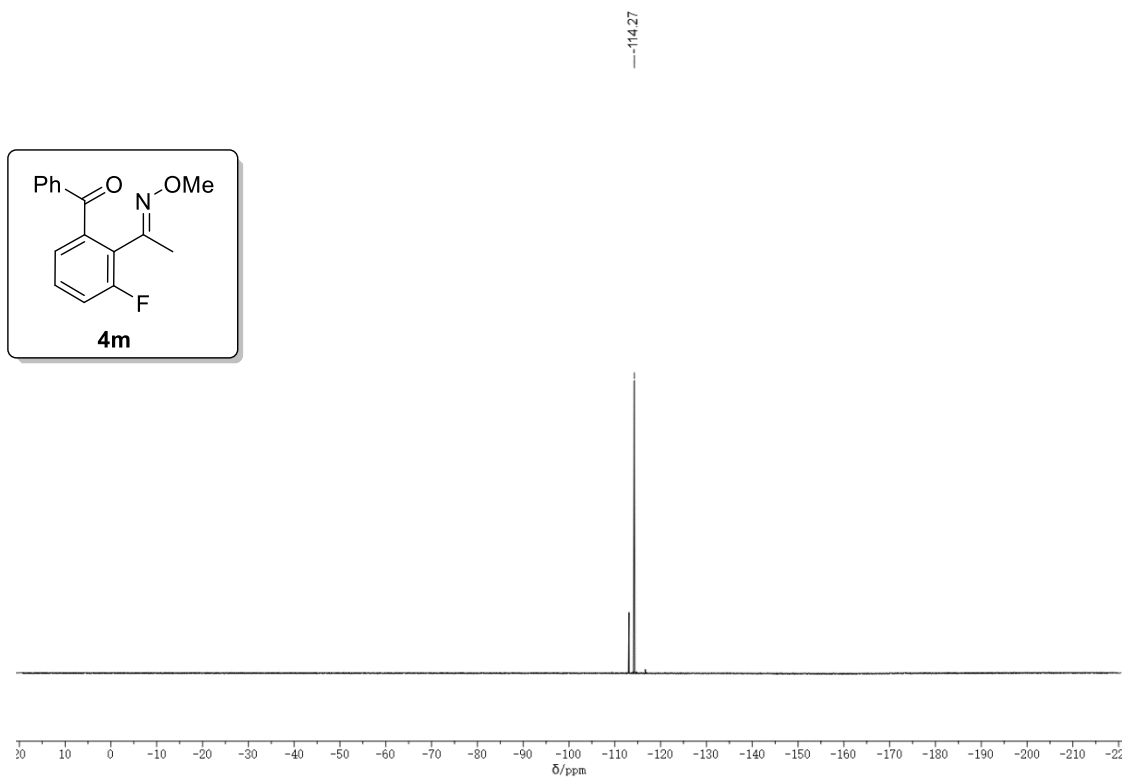
<sup>13</sup>C NMR of compound **4l**



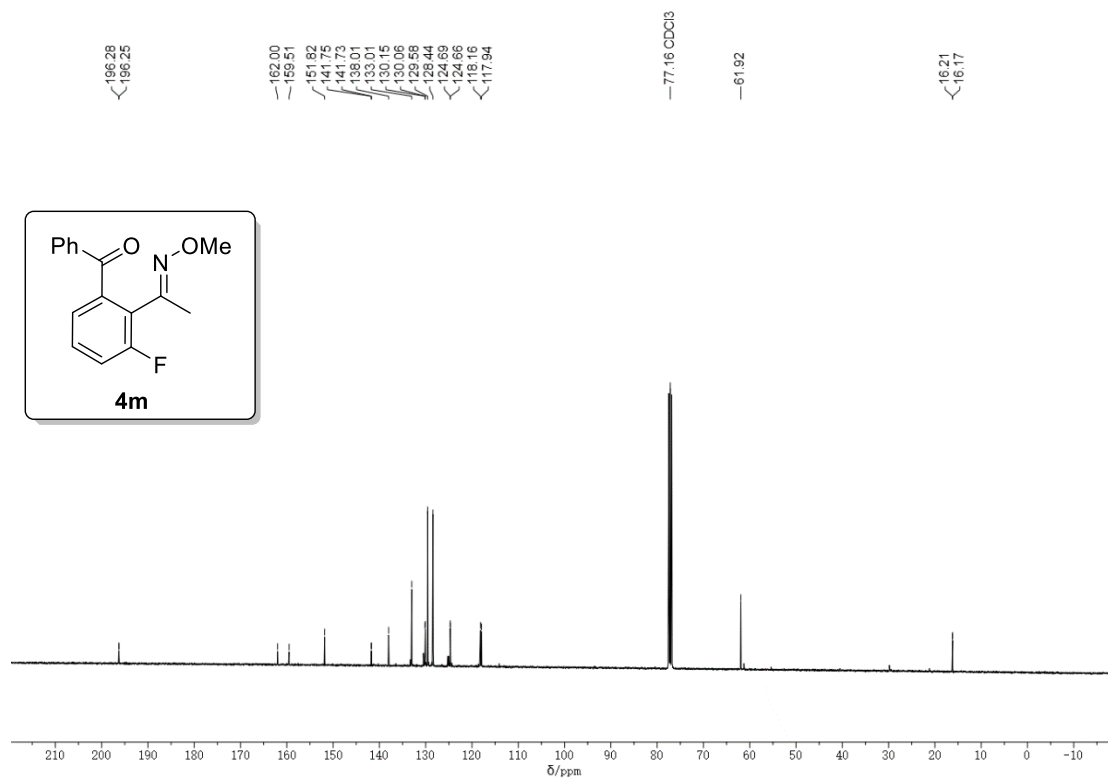
<sup>1</sup>H NMR of compound **4m**



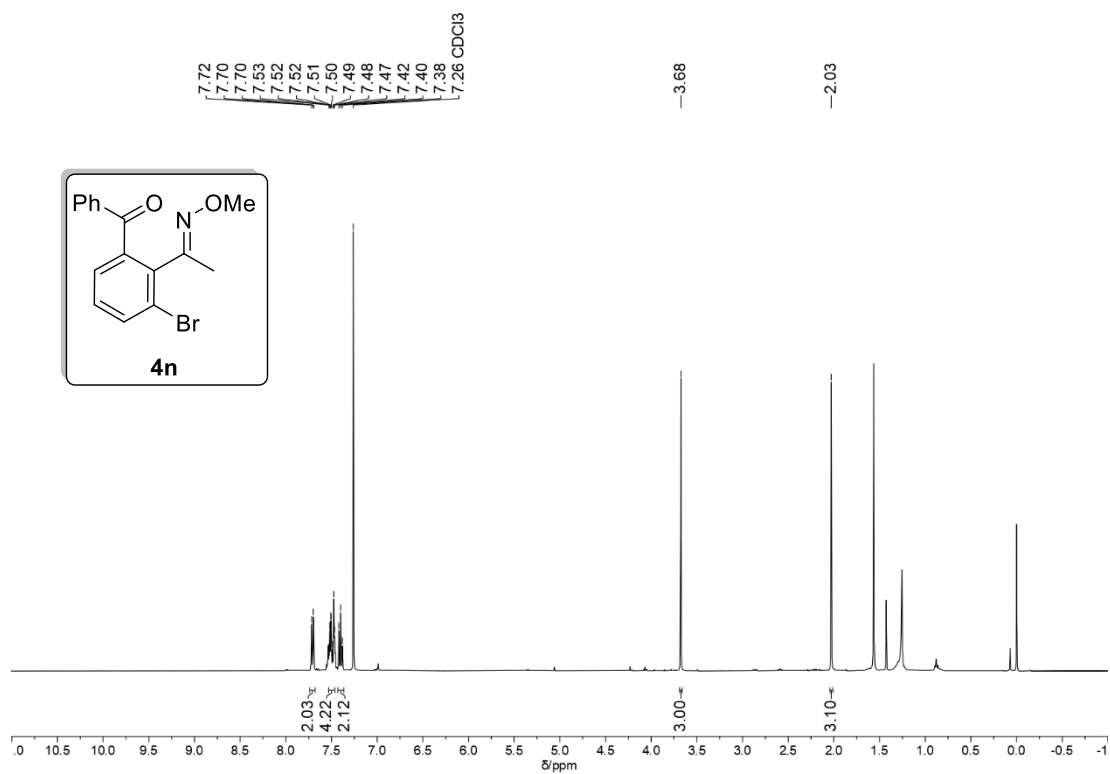
$^{19}\text{F}$  NMR of compound **4m**



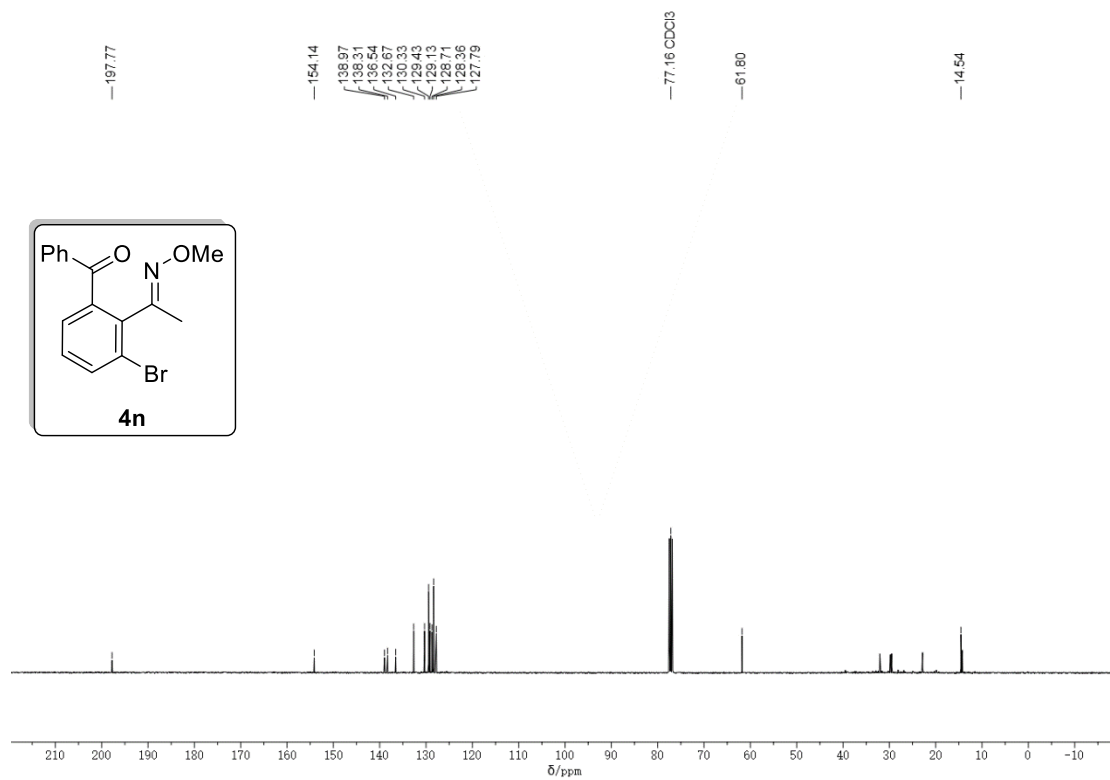
$^{13}\text{C}$  NMR of compound **4m**



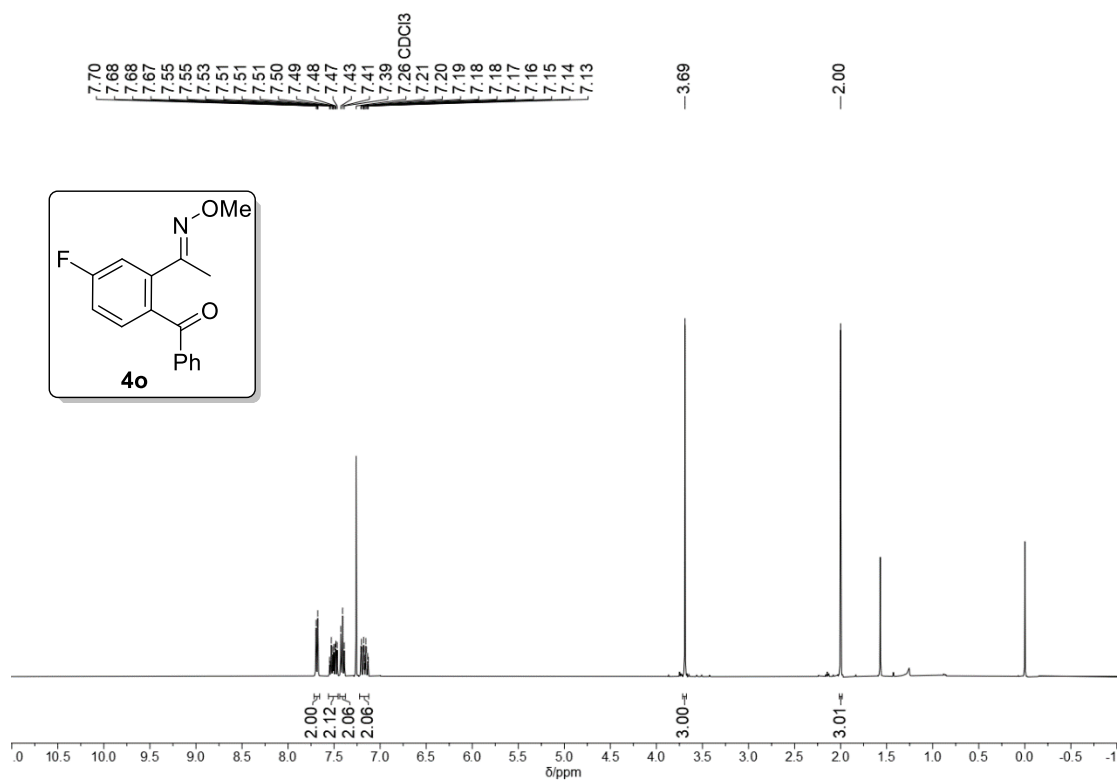
<sup>1</sup>H NMR of compound **4n**



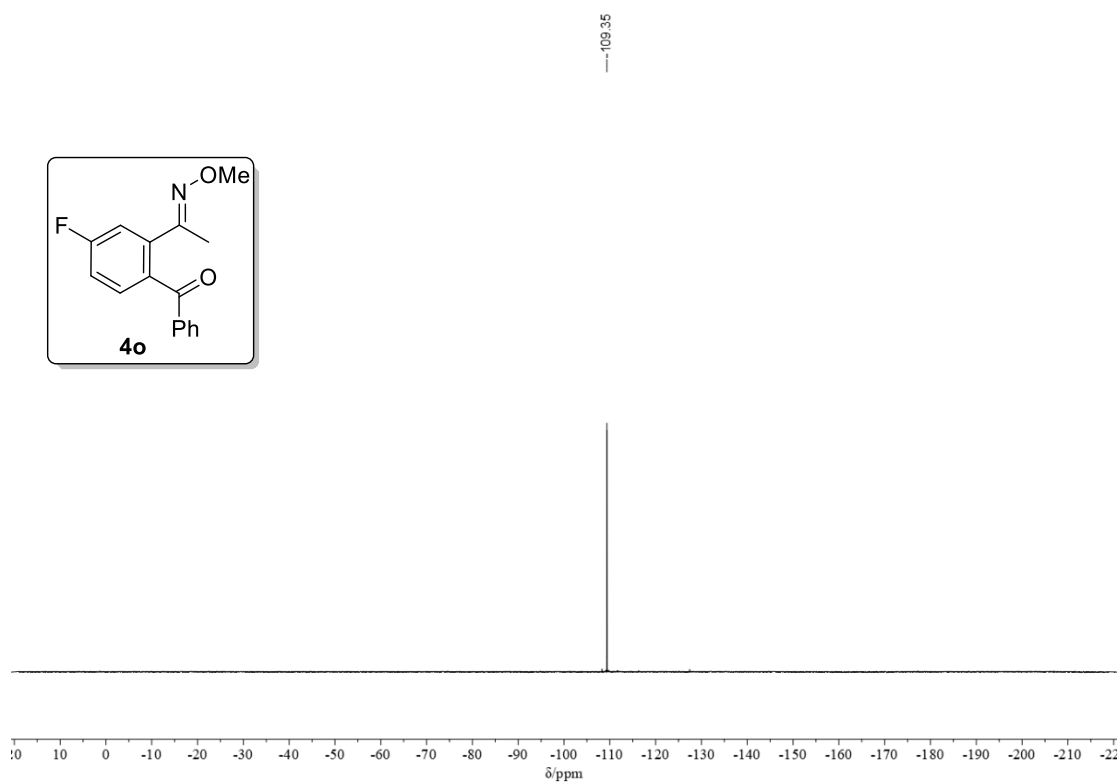
<sup>13</sup>C NMR of compound **4n**



<sup>1</sup>H NMR of compound **4o**

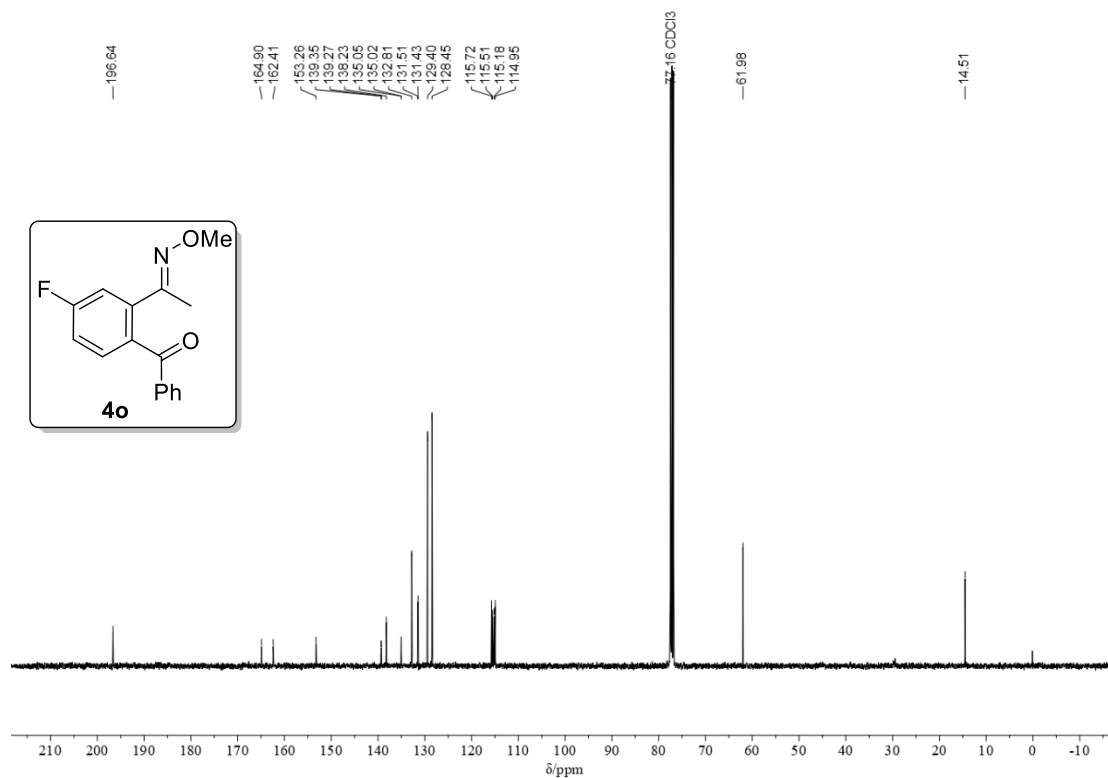


<sup>19</sup>F NMR of compound **4o**

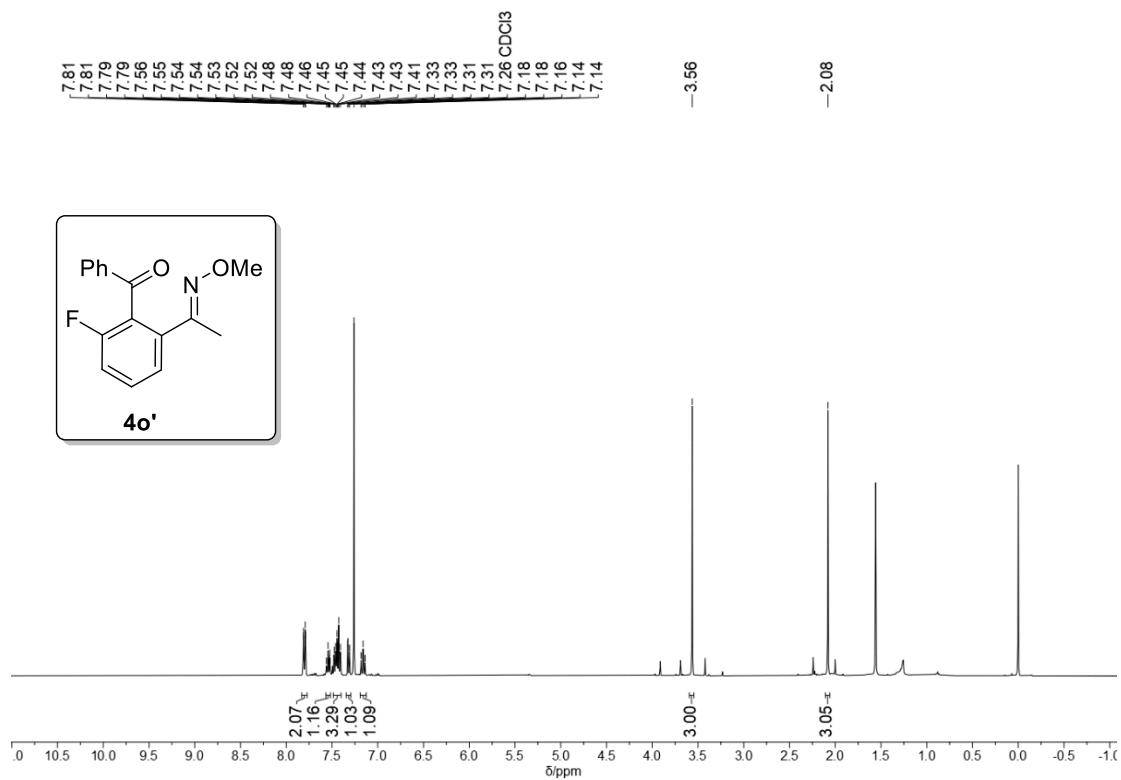




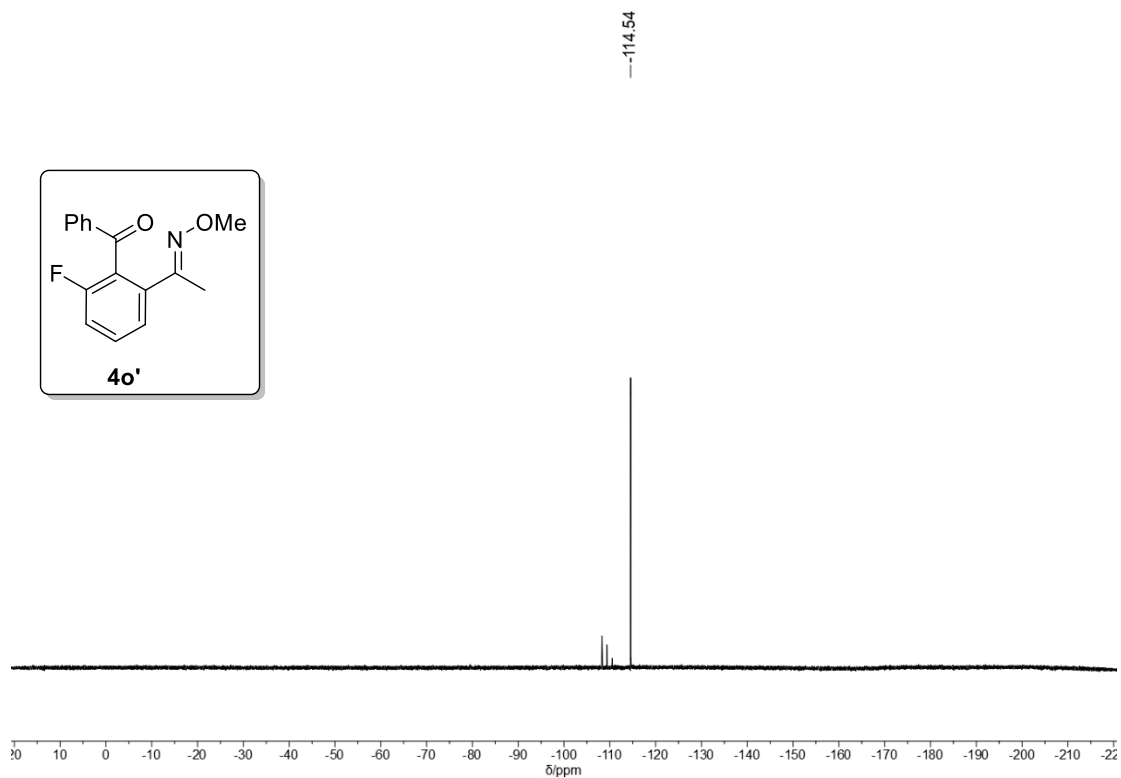
$^{13}\text{C}$  NMR of compound **4o**



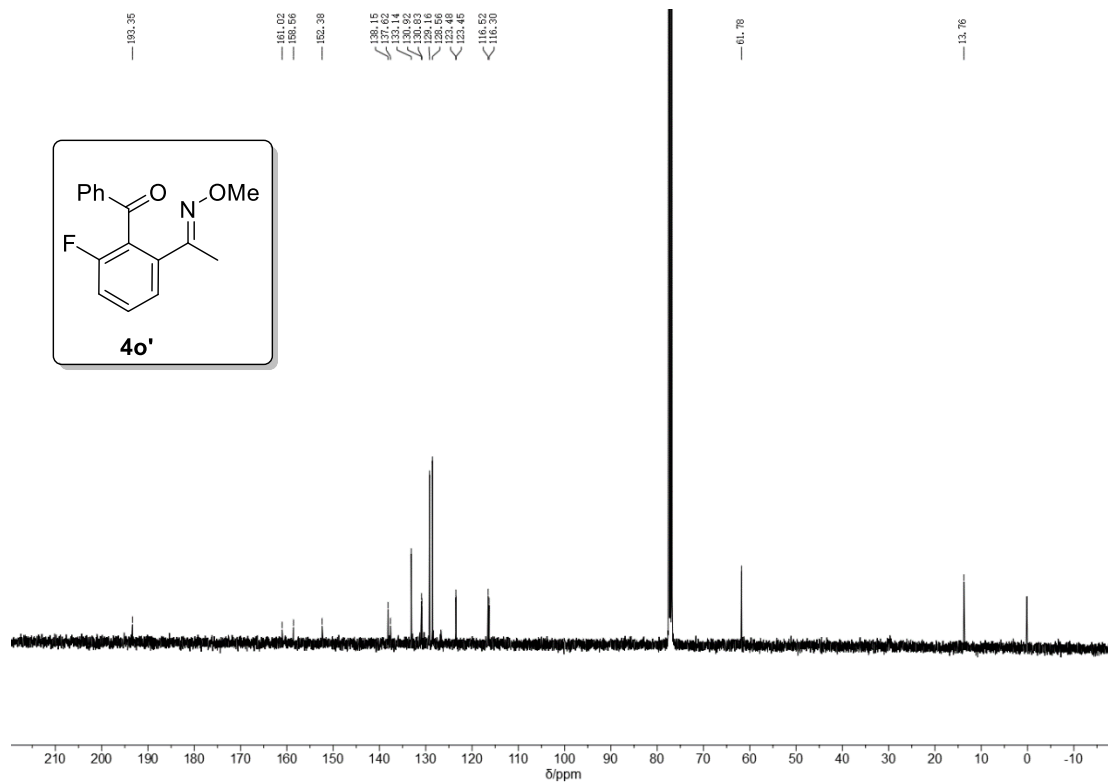
$^1\text{H}$  NMR of compound **4o'**



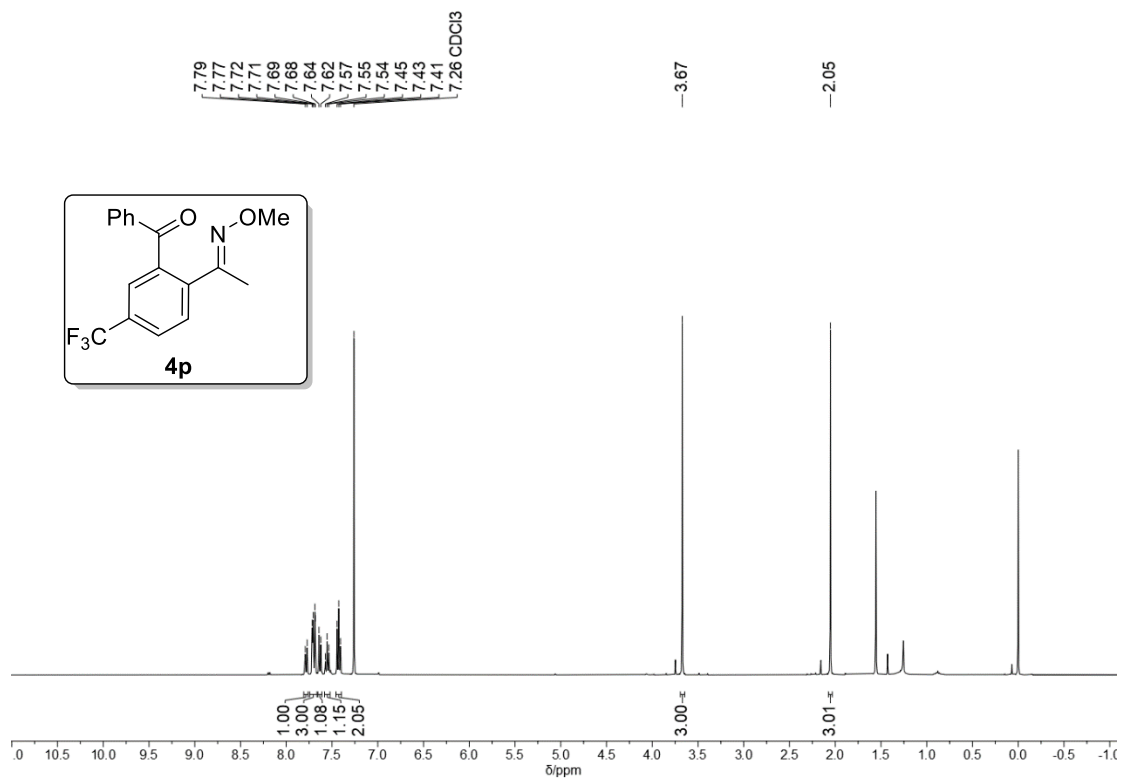
$^{19}\text{F}$  NMR of compound **4o'**



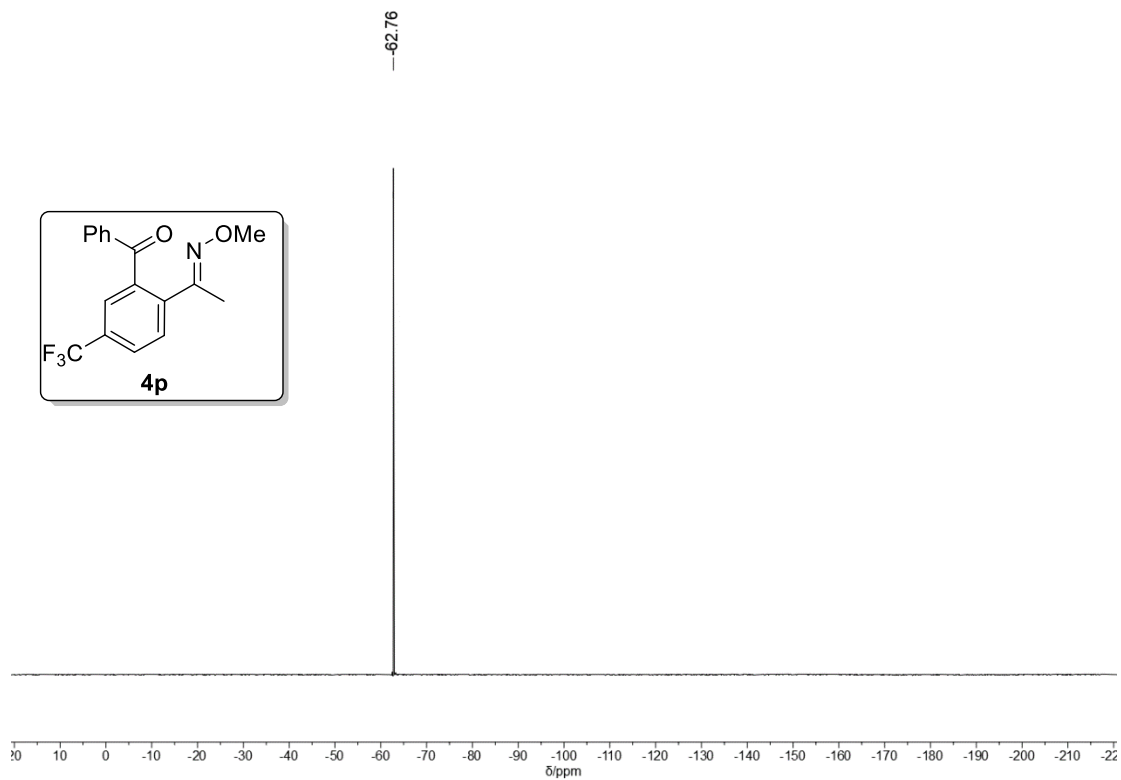
$^{13}\text{C}$  NMR of compound **4o'**



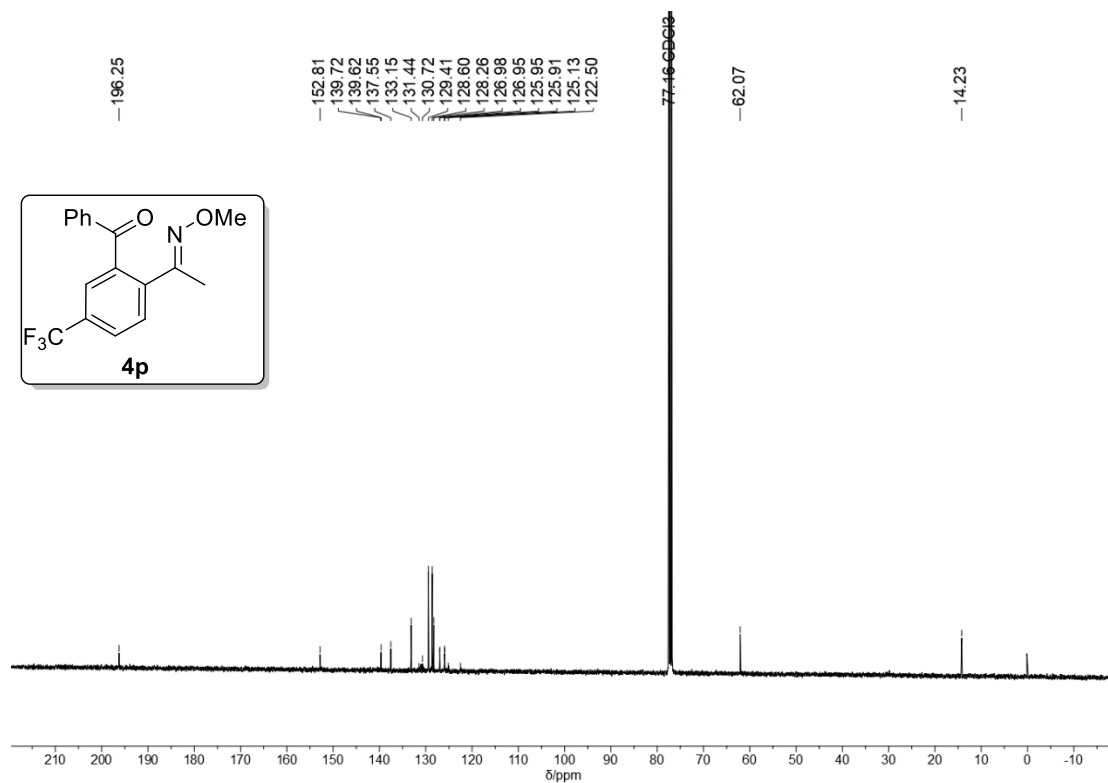
<sup>1</sup>H NMR of compound **4p**



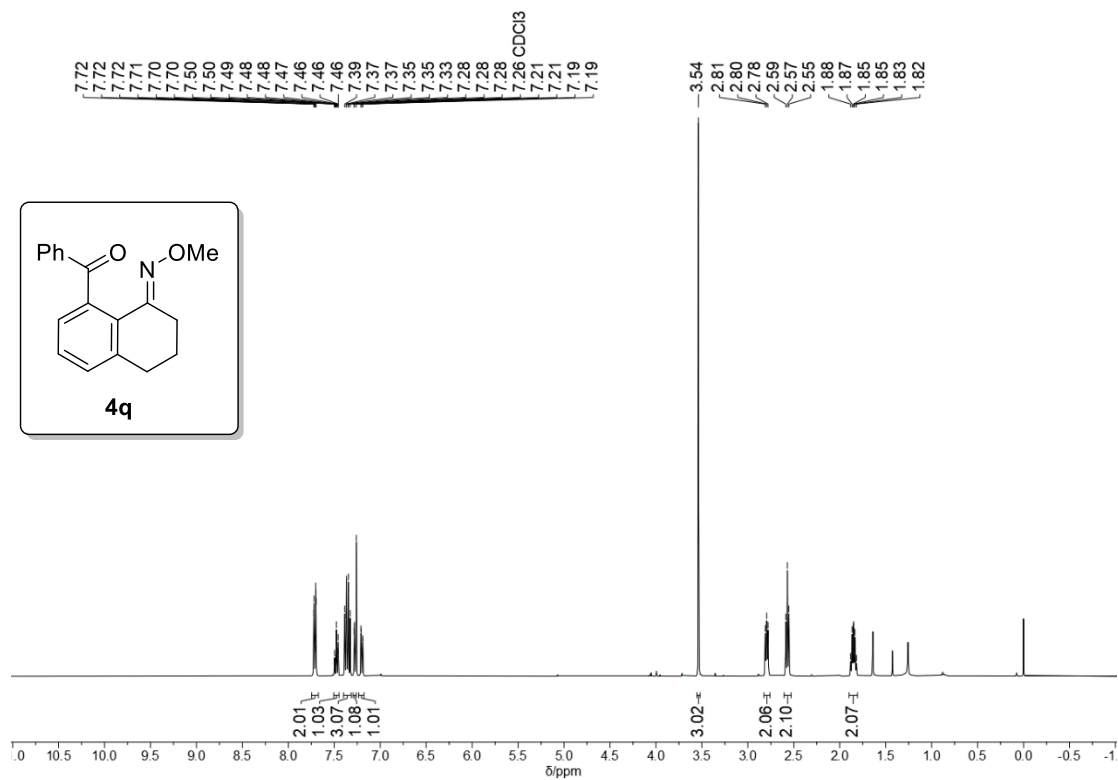
<sup>19</sup>F NMR of compound **4p**



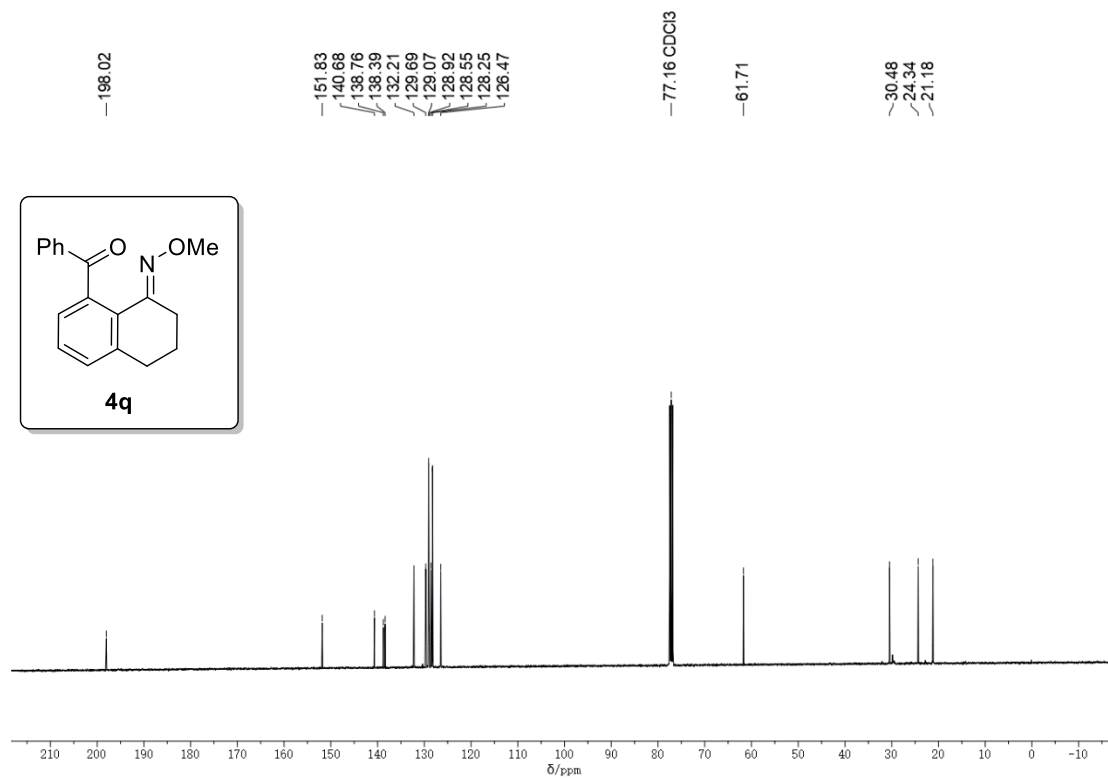
$^{13}\text{C}$  NMR of compound **4p**



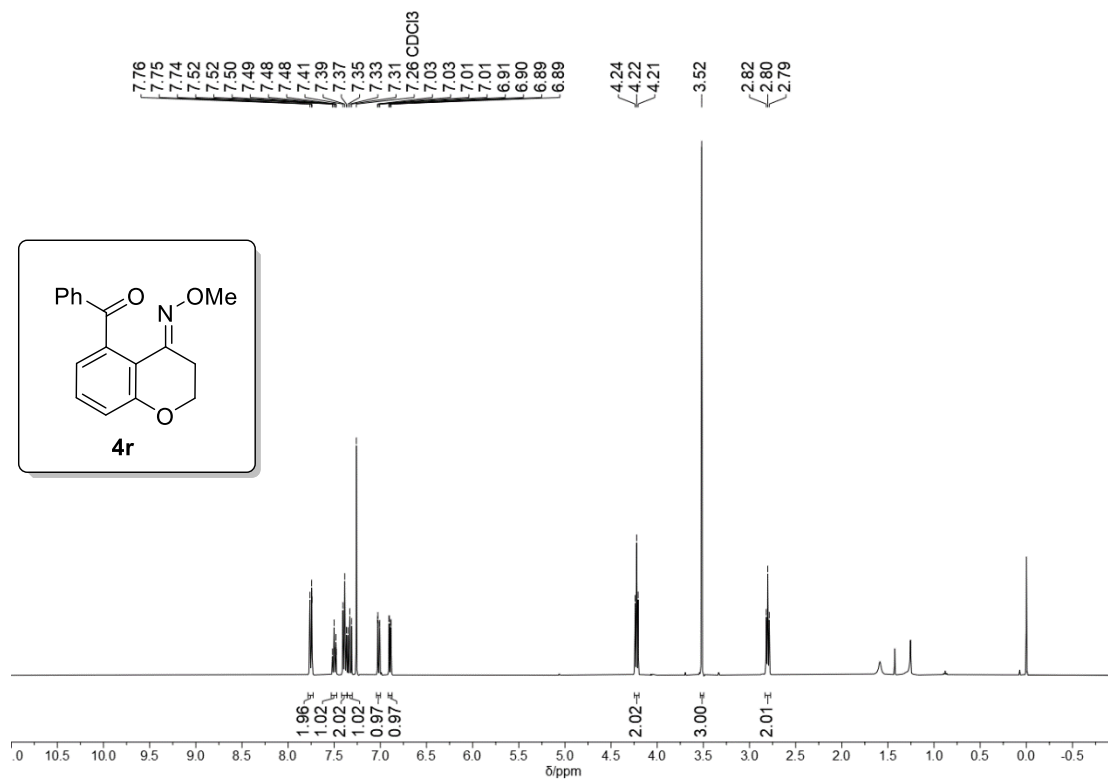
$^1\text{H}$  NMR of compound **4q**



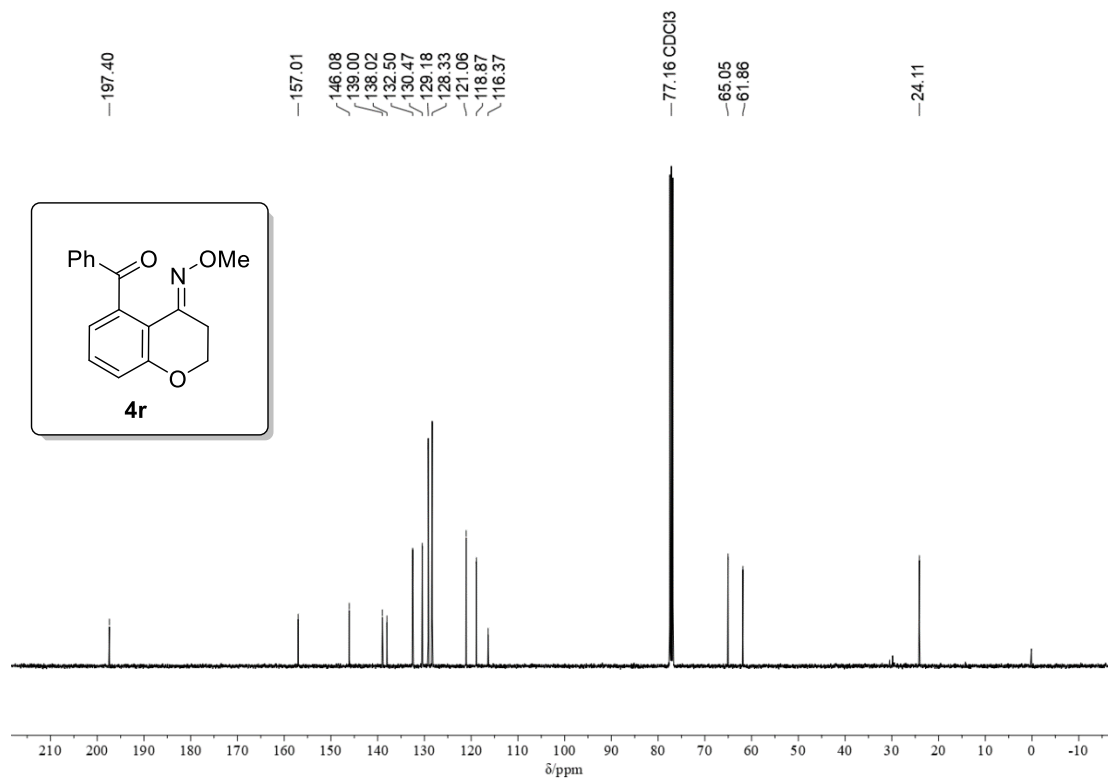
<sup>13</sup>C NMR of compound **4q**



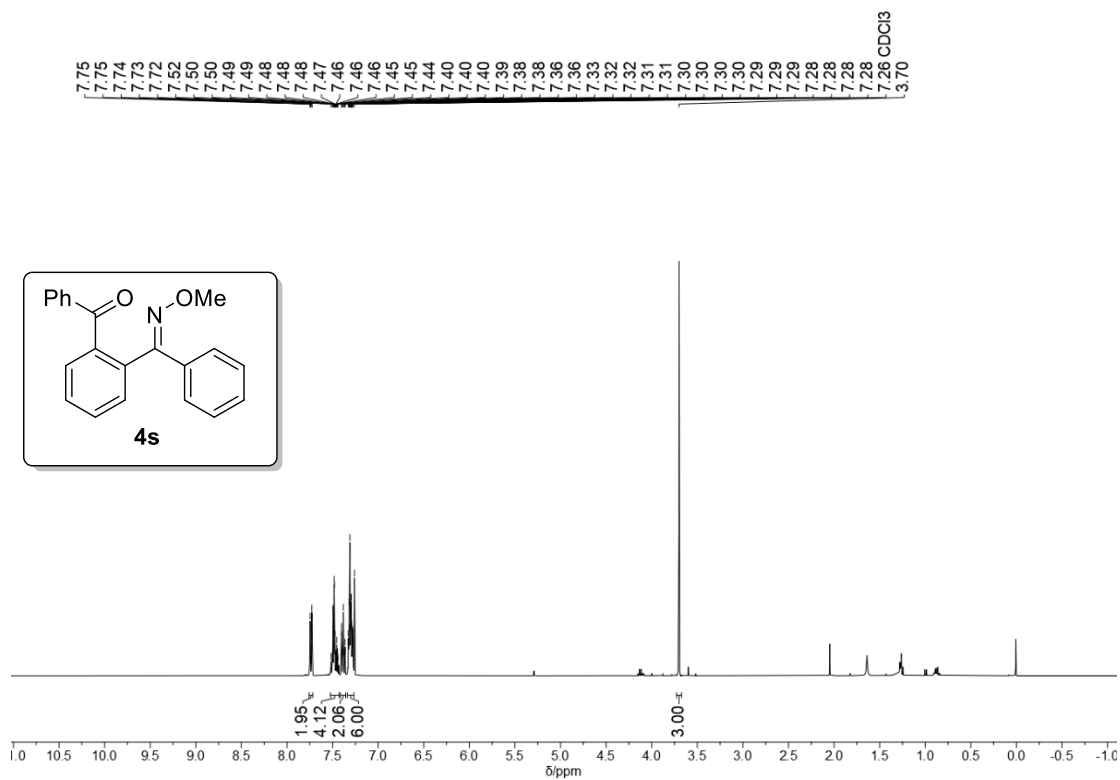
<sup>1</sup>H NMR of compound **4r**



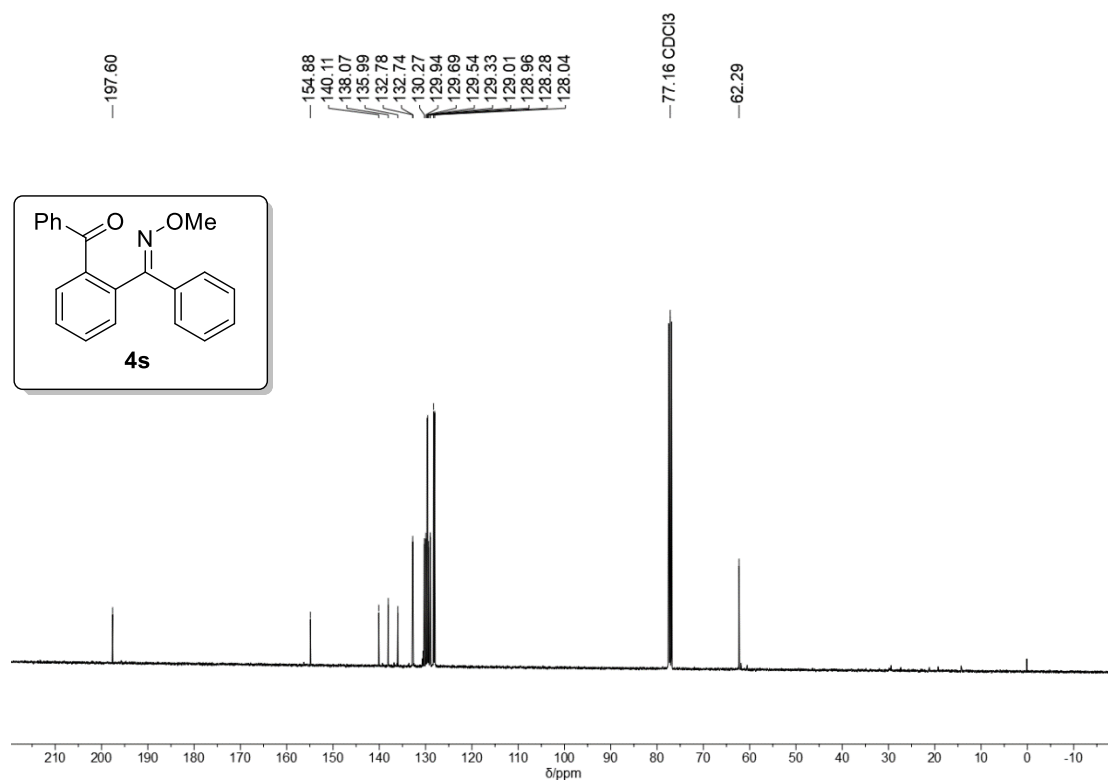
$^{13}\text{C}$  NMR of compound **4r**



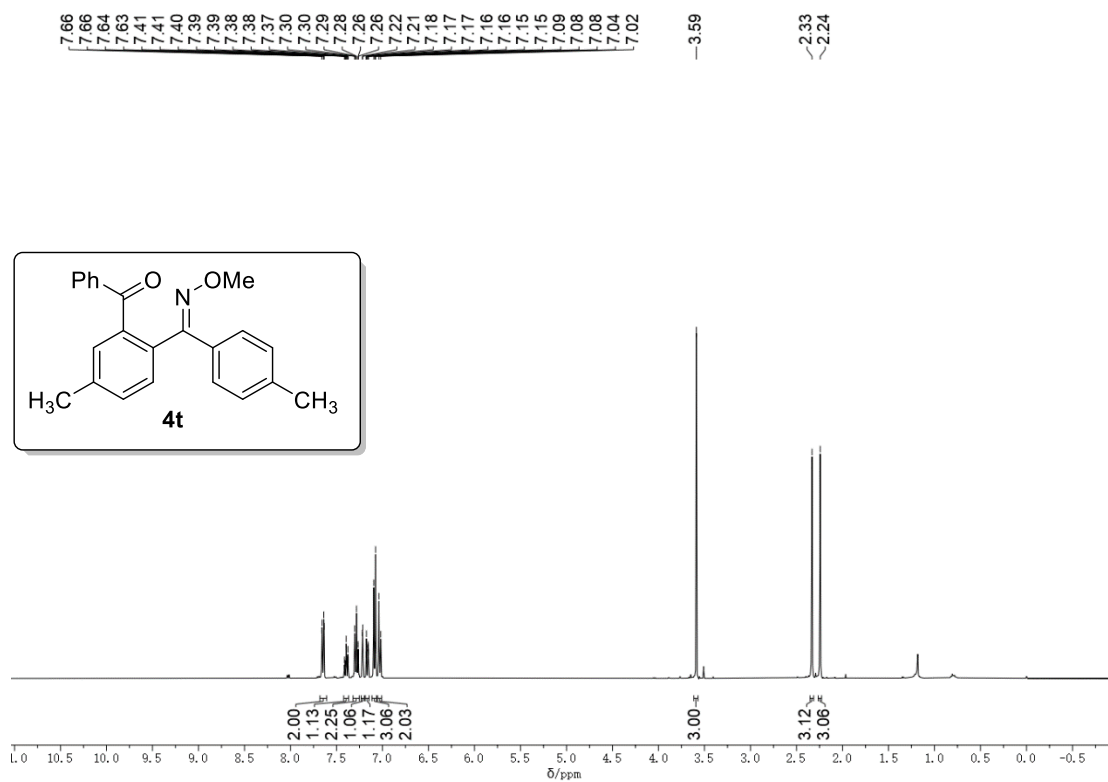
$^1\text{H}$  NMR of compound **4s**



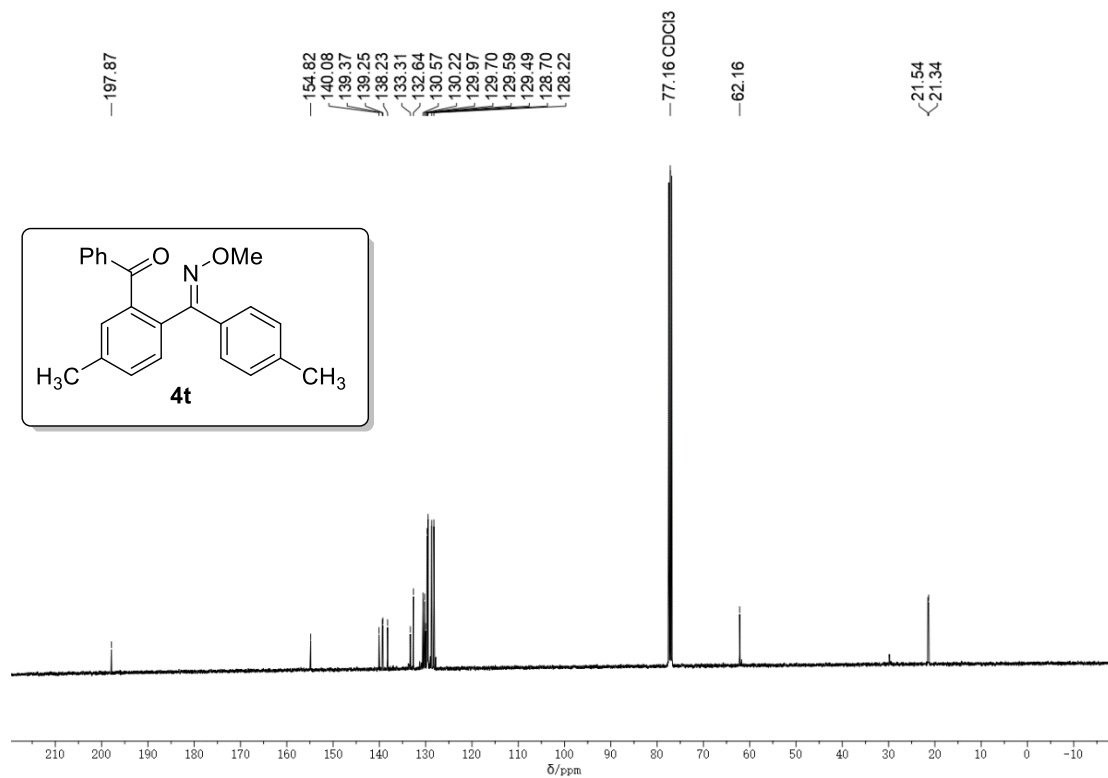
<sup>13</sup>C NMR of compound **4s**



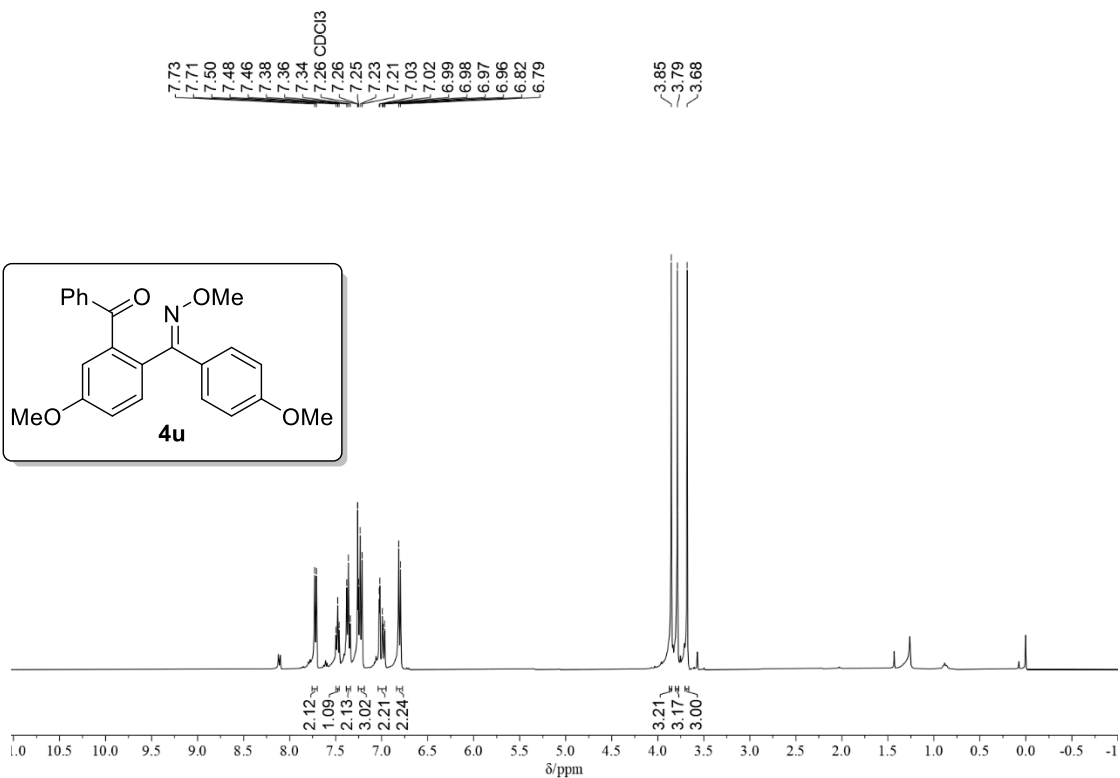
<sup>1</sup>H NMR of compound **4t**



$^{13}\text{C}$  NMR of compound **4t**

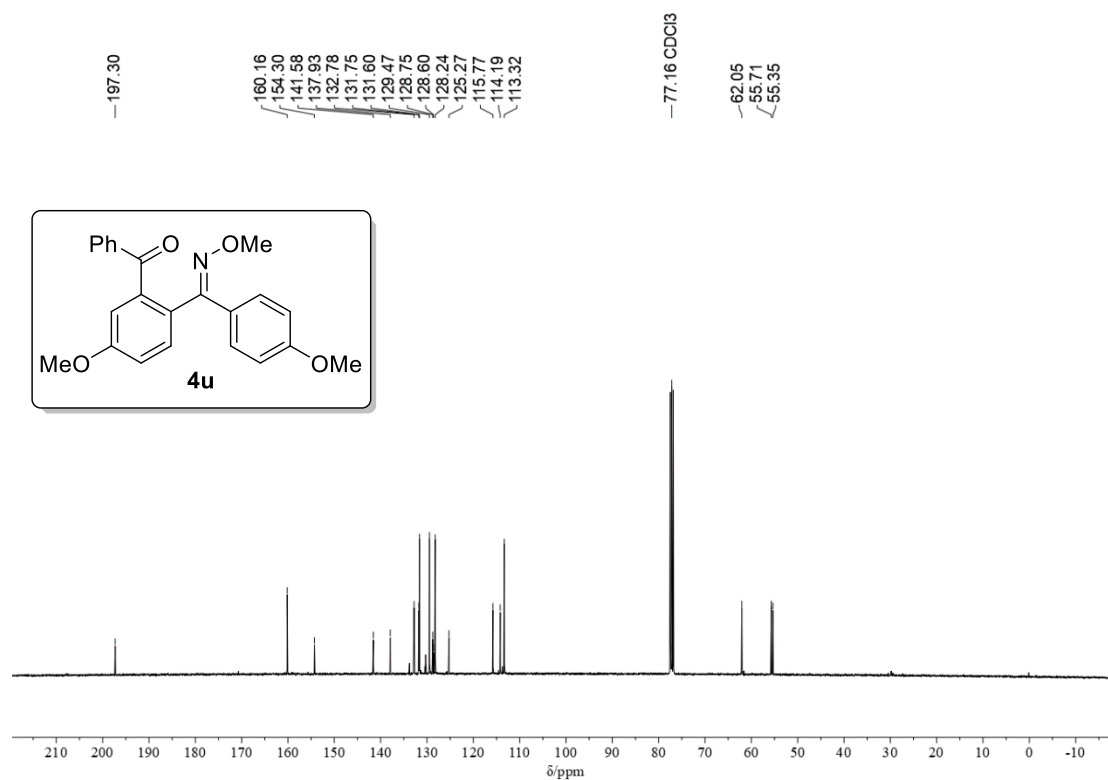


$^1\text{H}$  NMR of compound **4u**

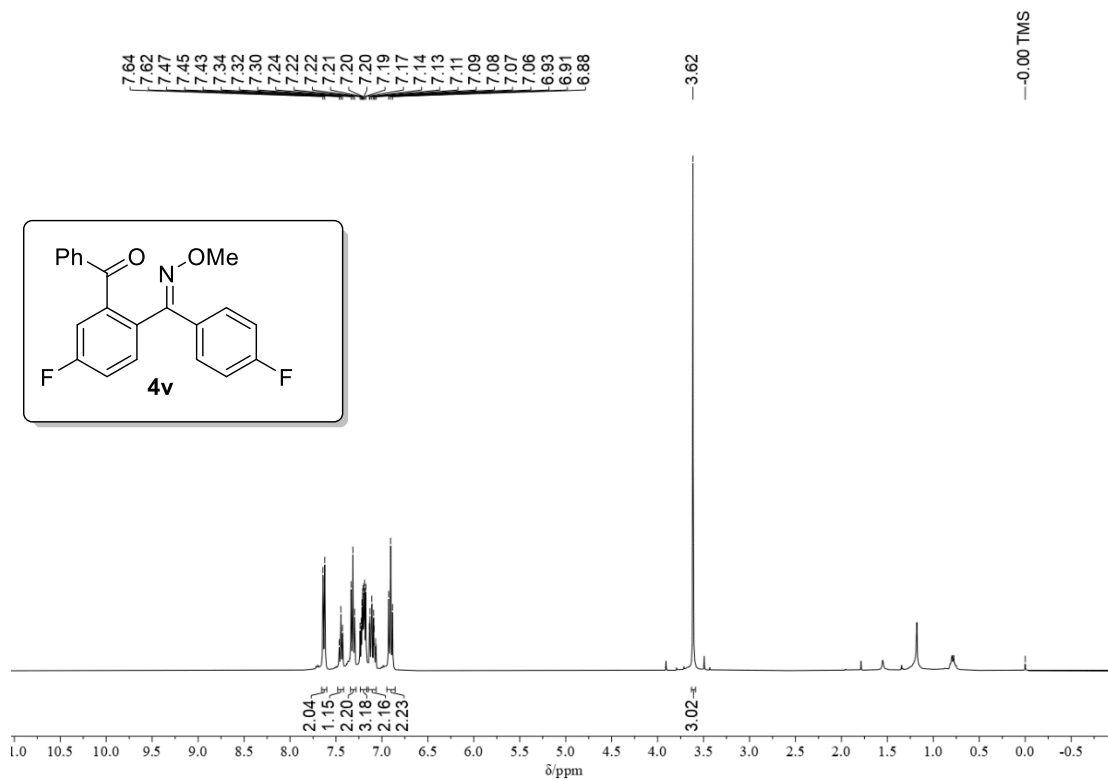




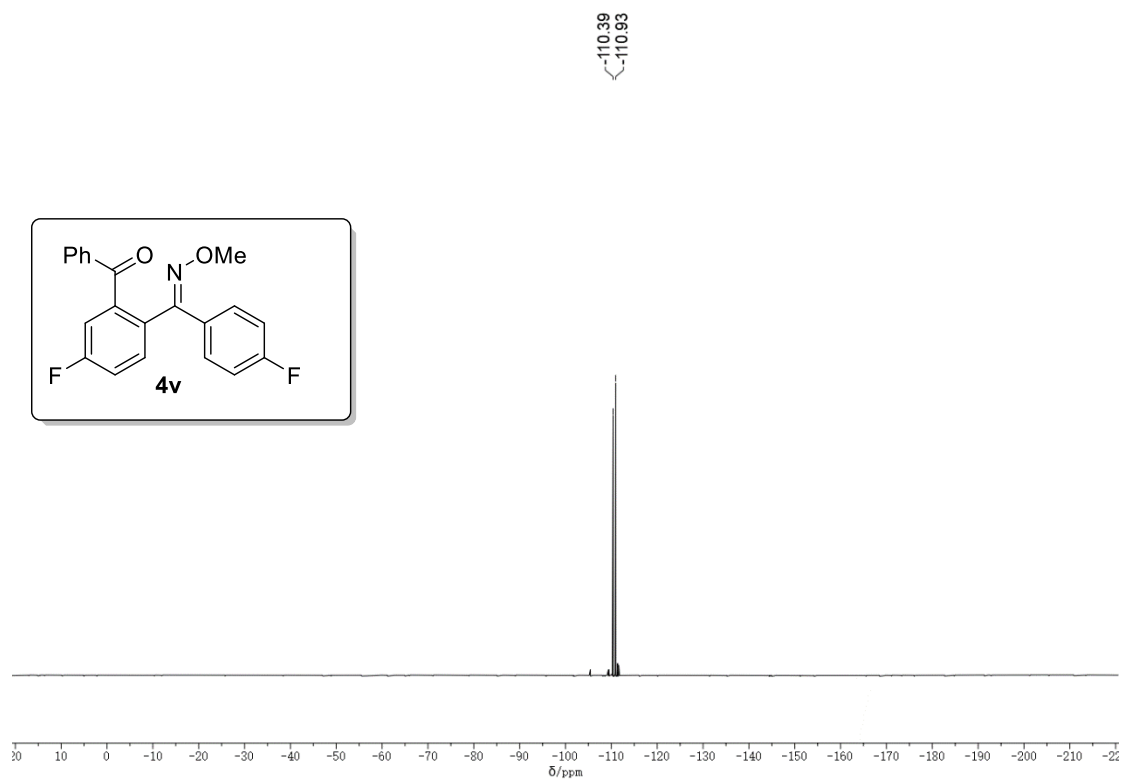
<sup>13</sup>C NMR of compound **4u**



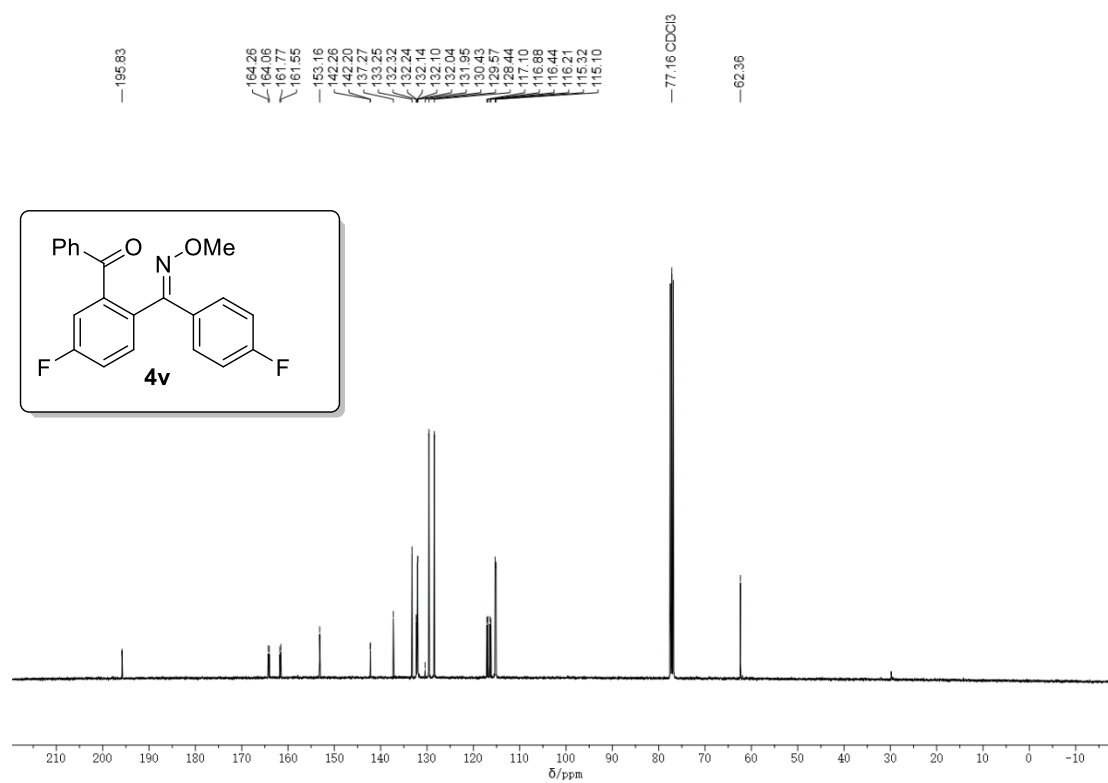
<sup>1</sup>H NMR of compound **4v**



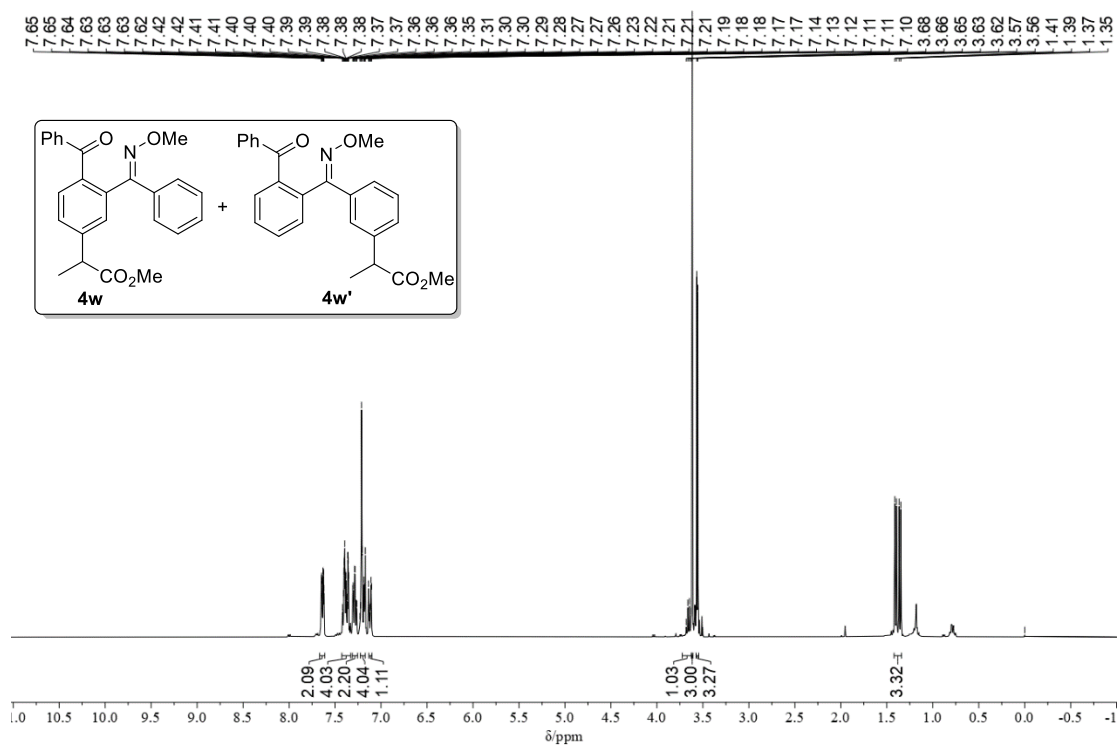
$^{19}\text{F}$  NMR of compound **4v**



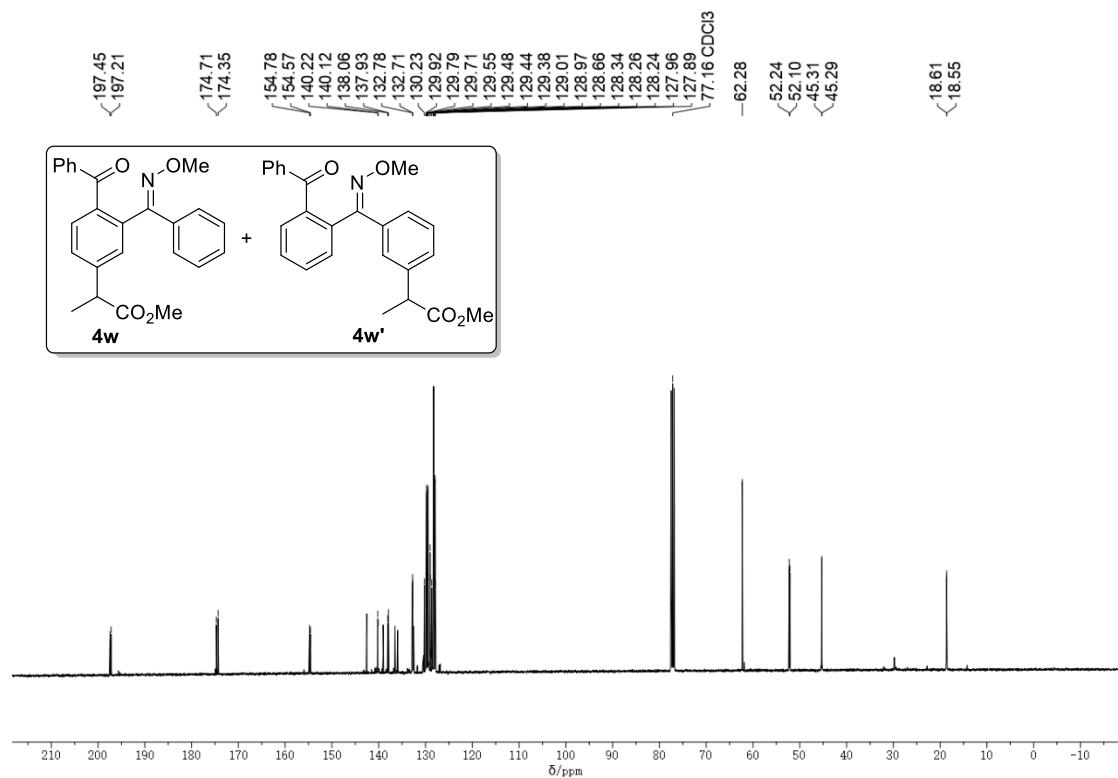
$^{13}\text{C}$  NMR of compound **4v**



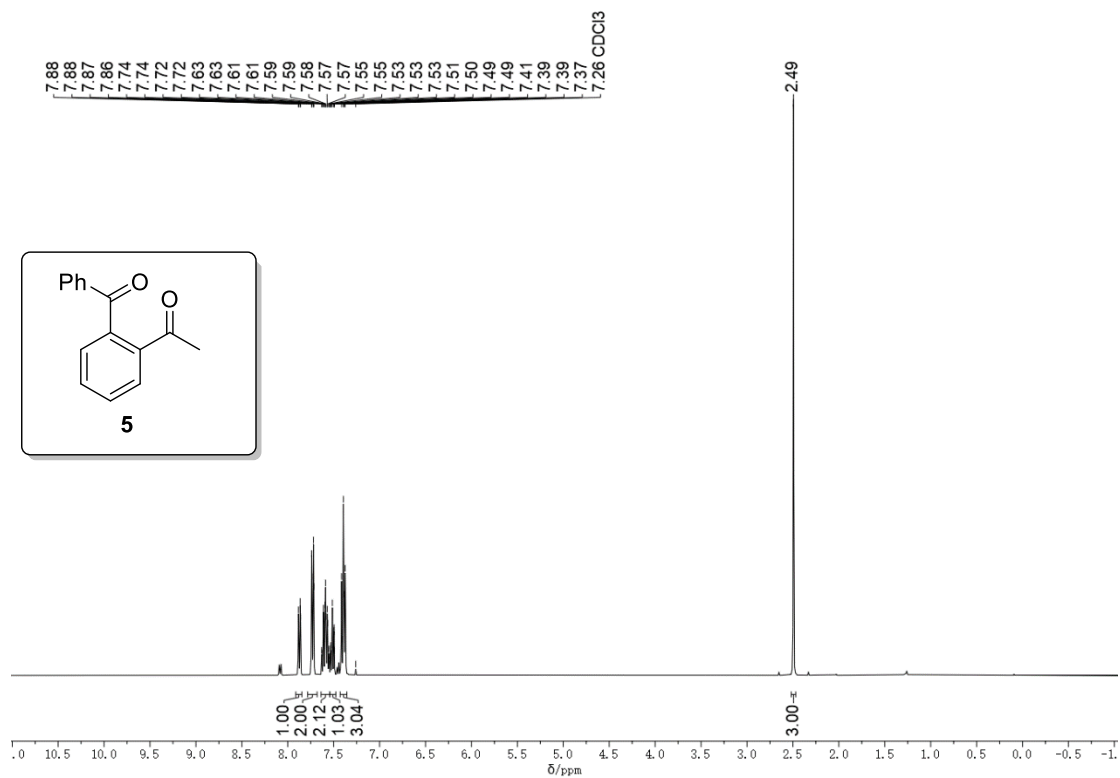
<sup>1</sup>H NMR of compound (4w+4w')



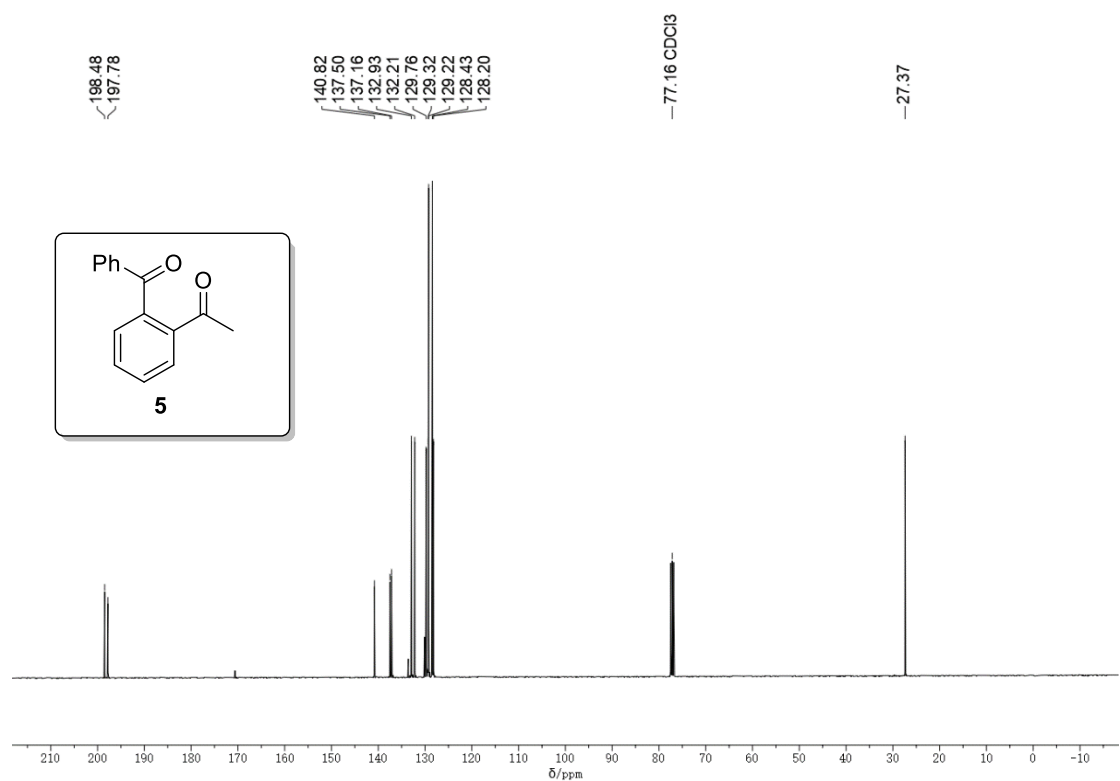
<sup>13</sup>C NMR of compound (4w+4w')



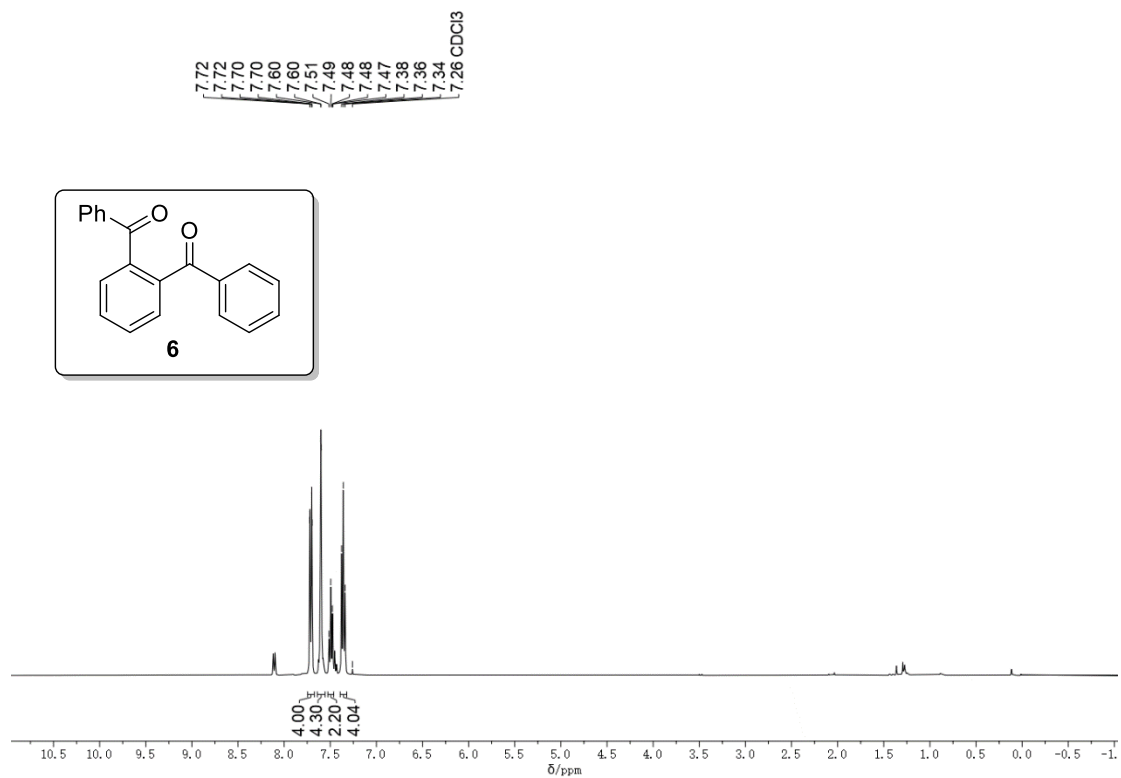
$^1\text{H}$  NMR of compound **5**



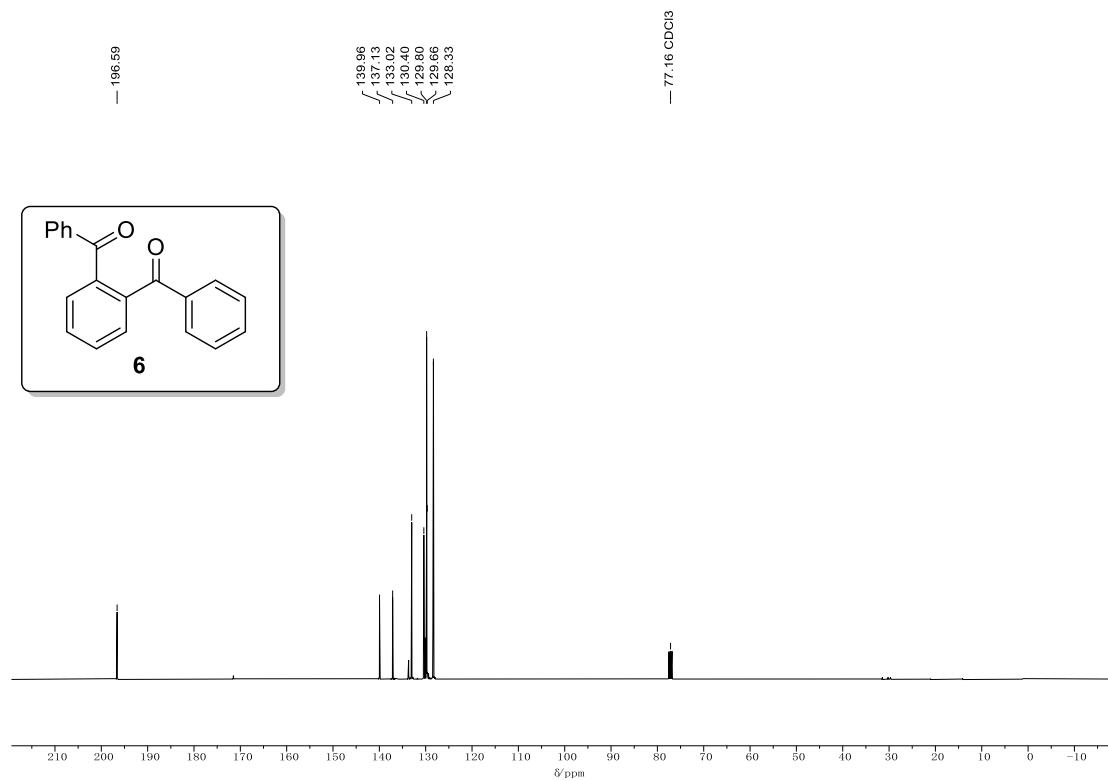
$^{13}\text{C}$  NMR of compound **5**



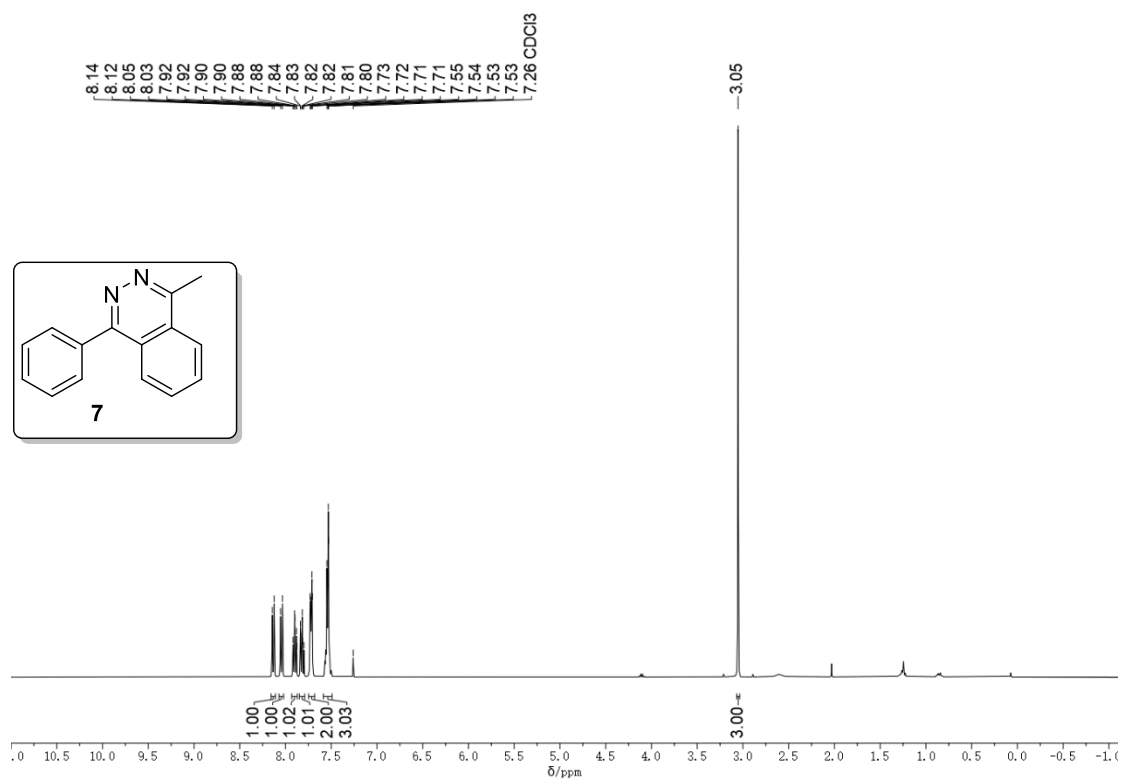
<sup>1</sup>H NMR of compound **6**



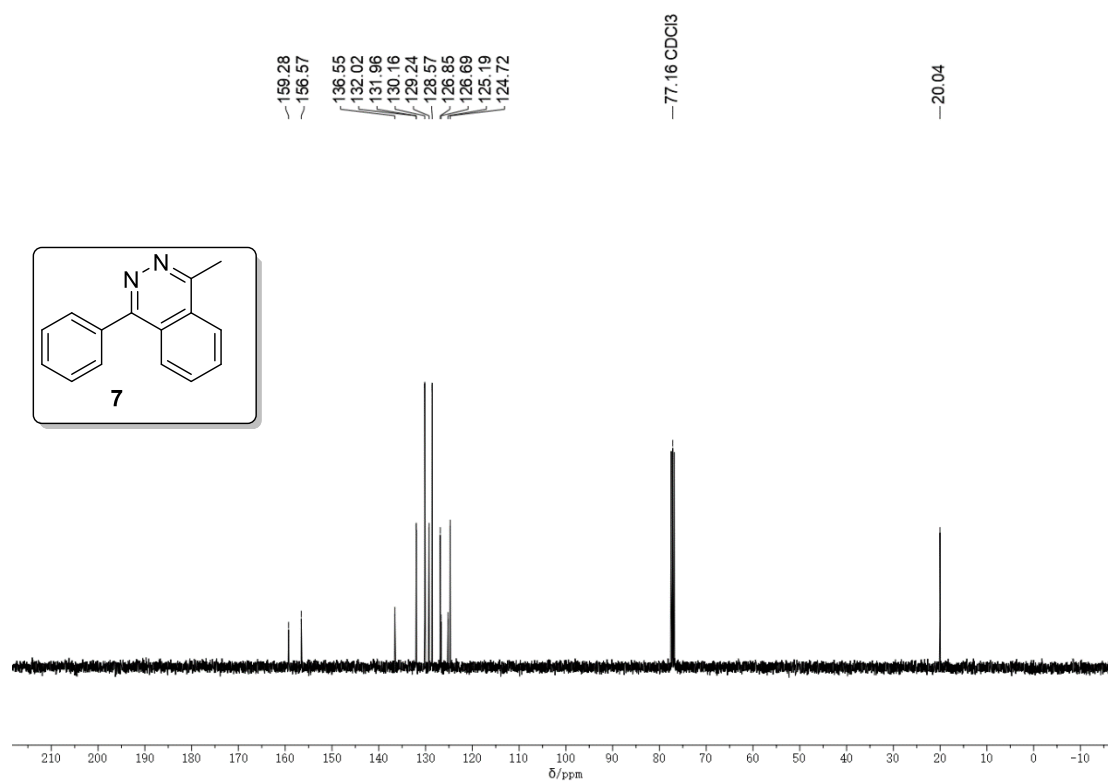
<sup>13</sup>C NMR of compound **6**



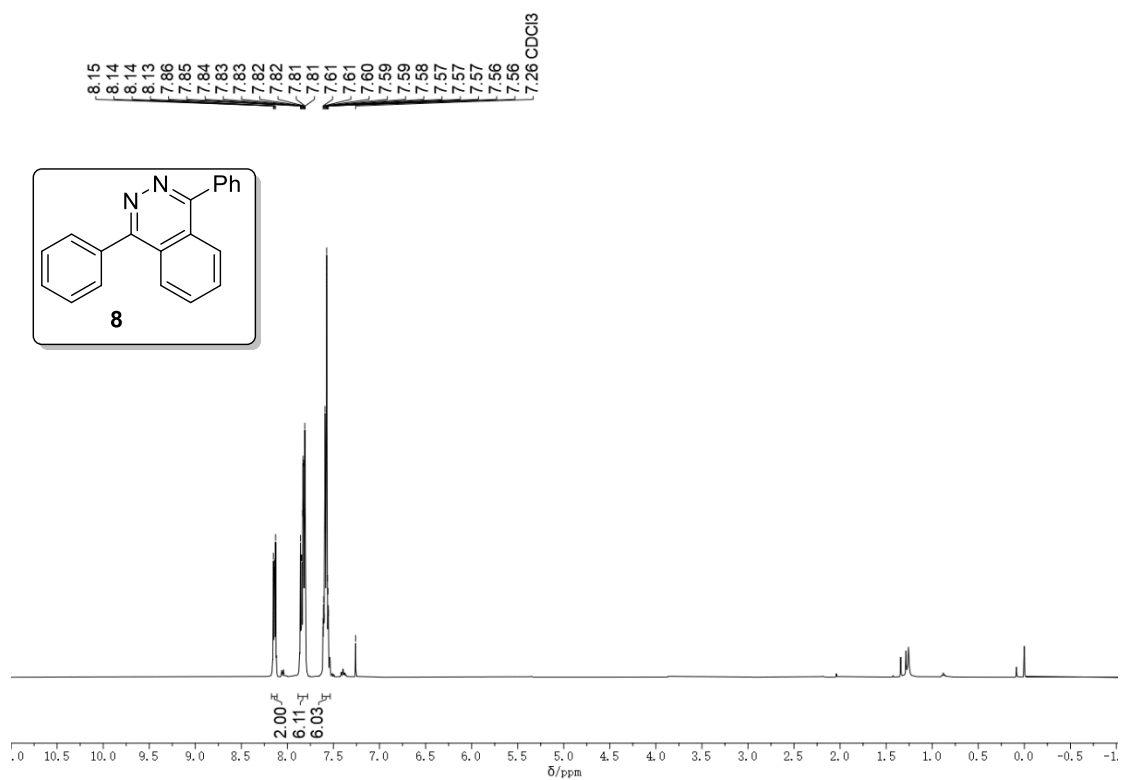
<sup>1</sup>H NMR of compound 7



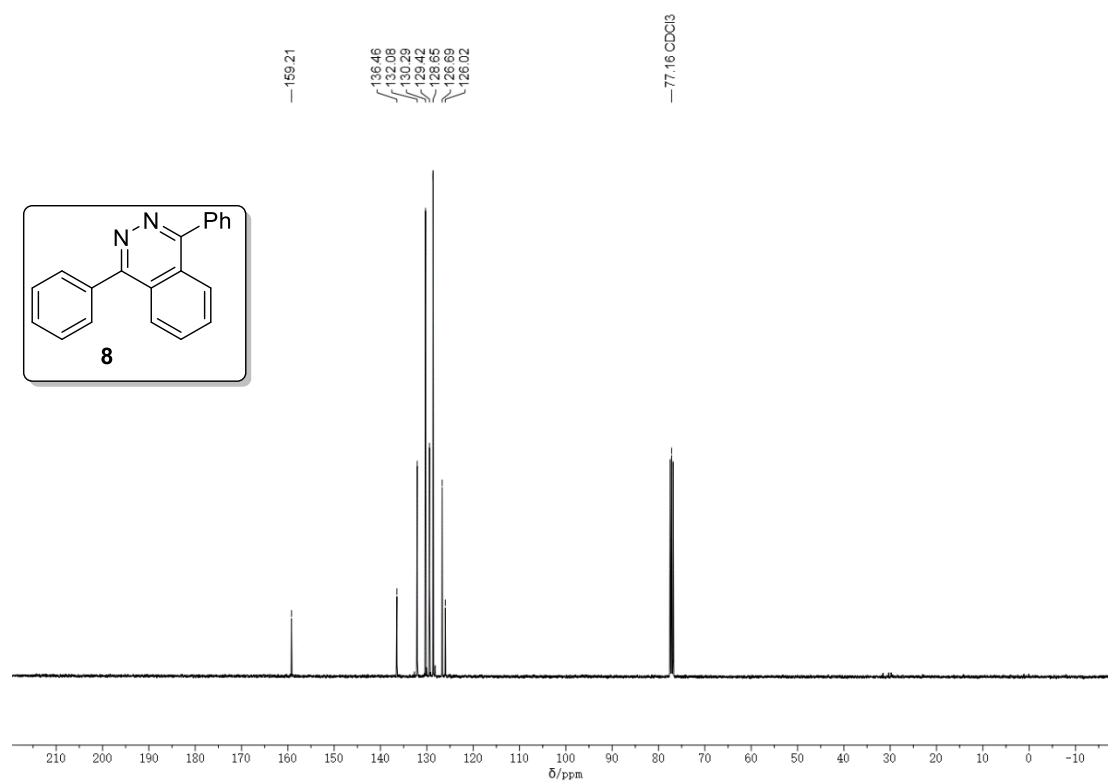
<sup>13</sup>C NMR of compound 7



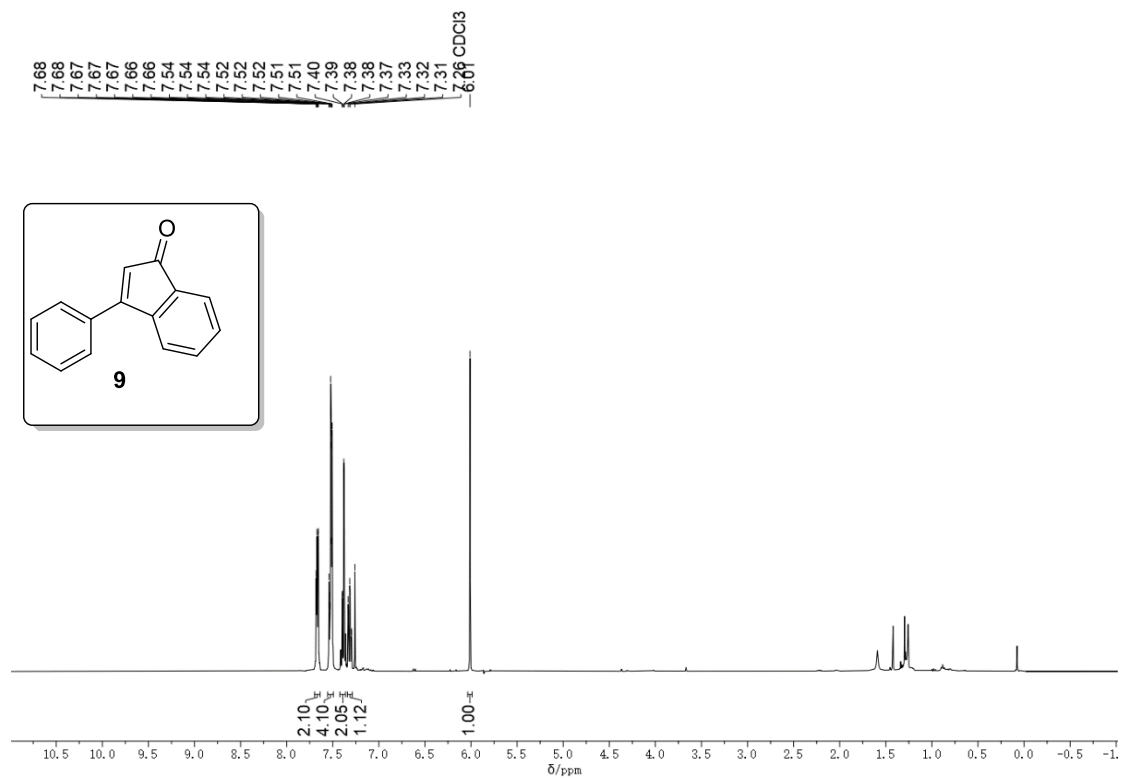
<sup>1</sup>H NMR of compound **8**



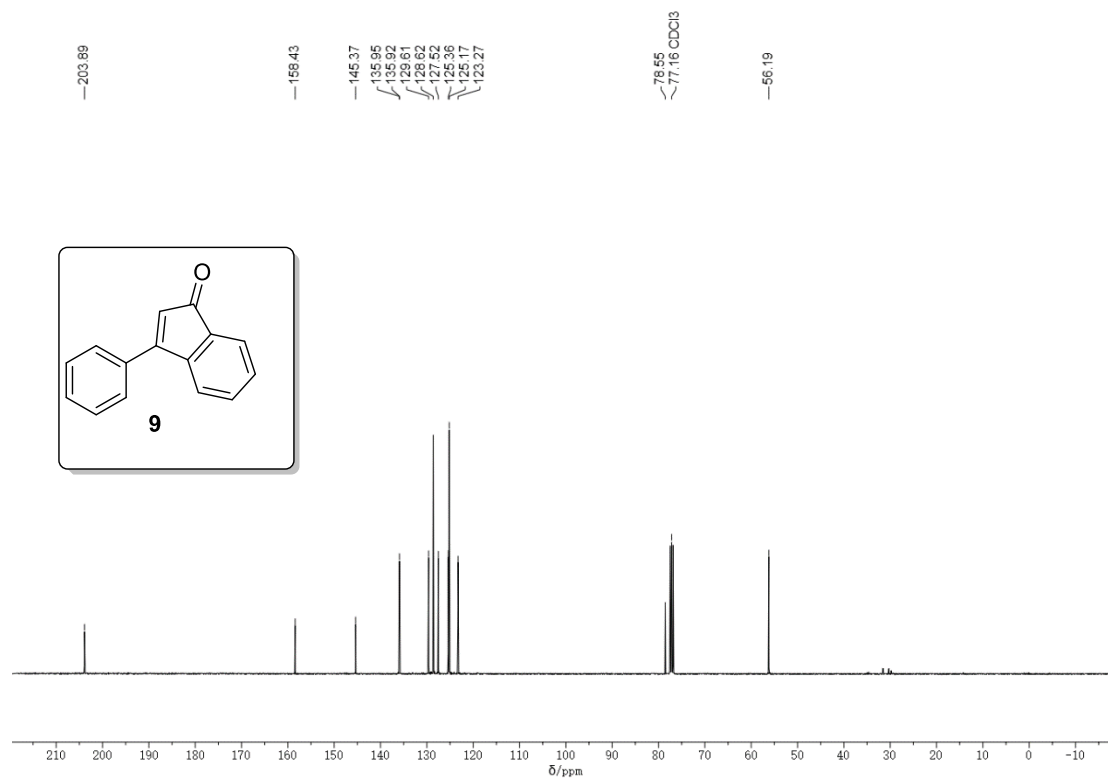
<sup>13</sup>C NMR of compound **8**



<sup>1</sup>H NMR of compound **9**

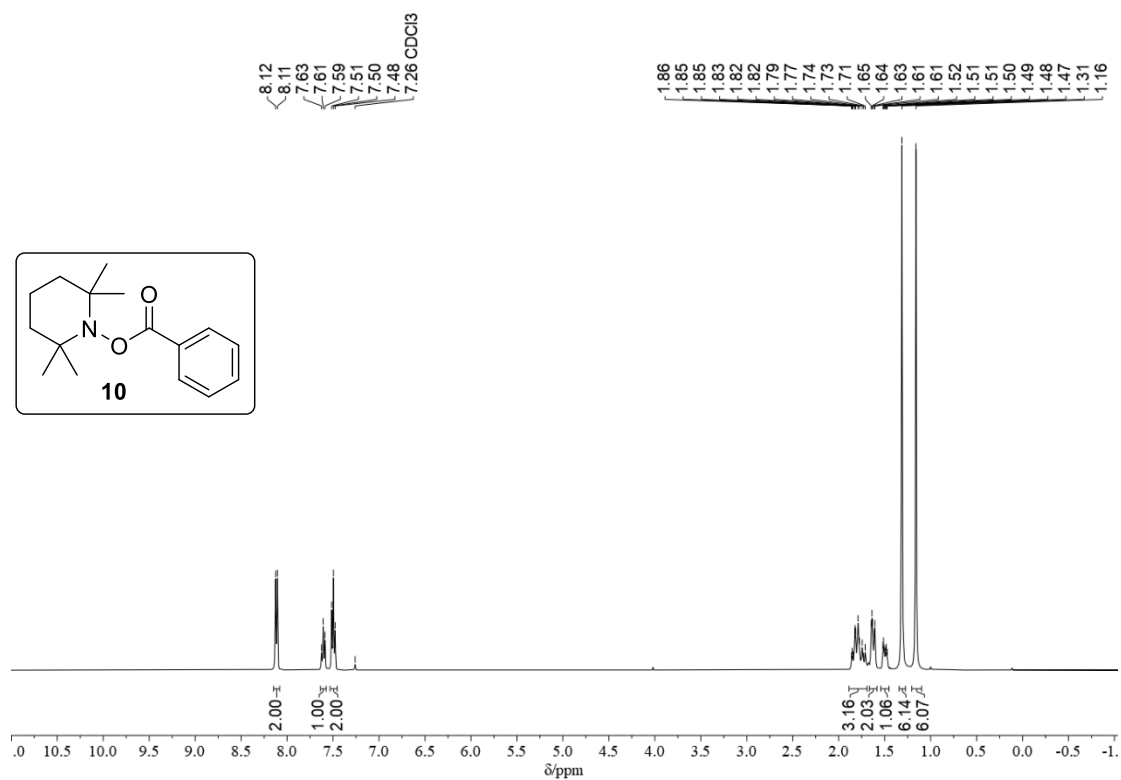


<sup>13</sup>C NMR of compound **9**





<sup>1</sup>H NMR of compound **10**



<sup>13</sup>C NMR of compound **10**

