Supporting Information

For

Radical Trifluoromethylation of Vinyl Azides via Organic Photoredox Catalysis for the Synthesis of α–Trifluoromethylated Ketones

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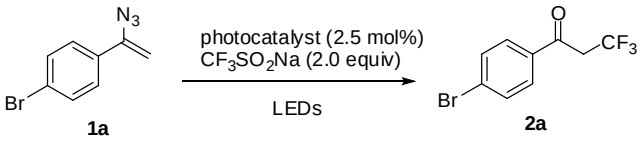
1. General remarks

^{1}H NMR spectra were recorded on 400 or 600 MHz (100 or 150 MHz for ^{13}C NMR, 376 or 564 MHz for ^{19}F NMR) agilent NMR spectrometer with $CDCl_3$ as the solvent and tetramethylsilane (TMS) as the internal standard. Chemical shifts were reported in parts per million (ppm, δ scale) downfield from TMS at 0.00 ppm and referenced to the $CDCl_3$ at 7.26 ppm (for ^{1}H NMR) or 77.16 ppm (for ^{13}C NMR). HRMS was recorded on a GCT Premier^{TM} (CI) Mass Spectrometer. Infrared (FT-IR) spectra were recorded on a Varian 1000 FT-IR, ν_{max} in cm^{-1}. Melting points were measured using SGW, X-4B and values are uncorrected. All commercially available reagents and solvents were used as received unless otherwise specified. The substrates were readily prepared from phenylethylenes or alkynes (*Org. Lett.* **2016***, 18,* 3642; *Angew. Chem., Int. Ed.* **2014**. *53,* 4390; *Org. Lett.* **2014***, 16,* 3668).

2. Screening of solvents



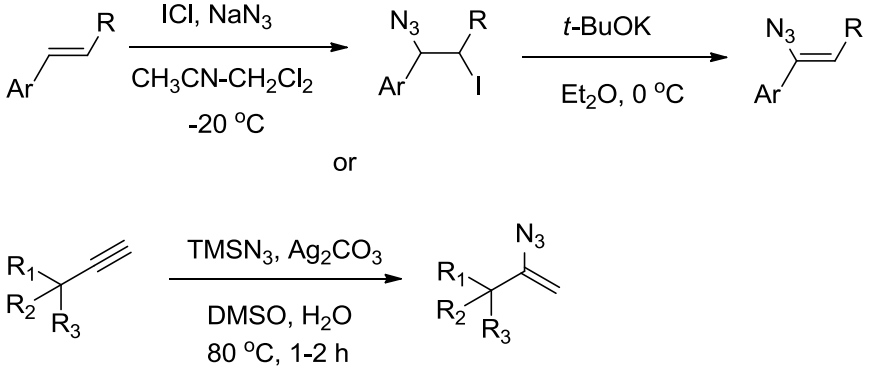
1a **2a**

entry[a]	LEDs	catalyst	solvent	yield (%)[b]
1	White	Mes-Acr$^+$	CH_3CN	61
2	White	Mes-Acr$^+$	DMF	44
3	White	Mes-Acr$^+$	DMSO	21
4	White	Mes-Acr$^+$	DCE	20
5	White	Mes-Acr$^+$	ethyl acetate	48
6	White	Mes-Acr$^+$	acetone	63
7	**White**	**Mes-Acr$^+$**	**1,4-dioxane**	**65**
8	White	Mes-Acr$^+$	CH_3OH	20
9	White	Mes-Acr$^+$	HFIP	<5
10	White	Mes-Acr$^+$	THF	65
11	White	Mes-Acr$^+$	$PhCH_3$	25
12	White	Mes-Acr$^+$	PhCl	37

[a]**1a** (0.20 mmol), catalyst (2.5 mol%), CF_3SO_2Na (0.40 mmol), solvent (2 mL), Argon balloon, 5 W LEDs, 36-60 h. [b]Isolated yield.

3. Synthesis of vinyl azides

Synthetic Scheme:



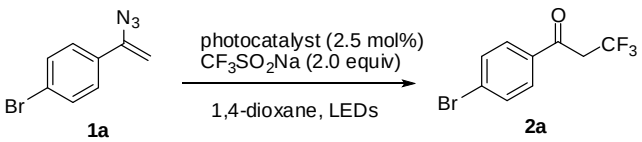
Typical synthetic procedures:

1: To a suspension of NaN_3 (3.9 g, 60 mmol) in acetonitrile (18 mL) was added dropwise a solution of iodine monochloride (5.8 g, 36 mmol) in CH_2Cl_2 (30 mL) at −20 °C, and the mixture was stirred at the same temperature. After 30 min, a solution of 4-vinylbiphenyl (4.3 g, 24 mmol) in CH_2Cl_2 (30 mL) was added slowly, and the mixture was stirred for 1 h. The reaction was quenched with saturated aqueous $Na_2S_2O_3$, and the organic materials were extracted two times with Et_2O. The combined extracts were washed with brine and dried over $MgSO_4$. After evaporation of solvents, the resulting crude materials were used immediately for the next step without any further purification.

To a solution of the obtained compounds above in Et_2O (60 mL) was added *t*-BuOK (3.2 g, 28.8 mmol) at 0 °C, and the mixture was stirred for 1.5 h at the same temperature. The reaction mixture was filtered through celite and the solvent was removed *in vacuo*. The resulting crude materials were purified by flash column chromatography (silica gel; hexane) to give 4-(1-azidovinyl)biphenyl（**1a**） (4.5 g, 84% yield) as a white solid.

2: To a solution of (prop-2-ynyloxy) benzene (660 mg, 5 mmol), $TMSN_3$ (1.15 g, 10 mmol) and H_2O (0.18 mL, 10 mmol) in DMSO (8 mL) at 80 °C, Ag_2CO_3 (138 mg, 0.5 mmol) was added. The mixture was then stirred for 1-2 h until substrate (prop-2-ynyloxy) benzene consumed as indicated by TLC. The resulting mixture was concentrated and taken up by dichloromethane (3 × 30 mL). The organic layer was washed with brine (3 × 40 mL), dried over $MgSO_4$ and concentrated. The resulting crude materials were purified by flash column chromatography (silica gel; hexane) to give (2-azidoallyloxy)benzene（**1s**）(717 mg, 82% yield) as a yellow oil.

4. Typical experimental procedure

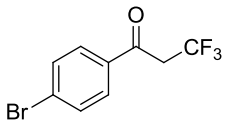


To a suspension of CF_3SO_2Na (62.4 mg, 0.4 mmol) and *N*-Methyl-9-mesityl acridinium perchlorate (2 mg, 0.005 mmol) in 1,4-dioxane (2 mL) was added vinyl azide **1a** (44.2 mg, 0.2 mmol) at rt. The resulting mixture was stirred upon 5W blue LEDs irradiation under argon balloon. After the reaction was finished, the solvent was removed under reduced pressure and the residue was purified by flash column chromatography on silica gel to give **2a** as a white solid (38.3 mg, 72% yield).

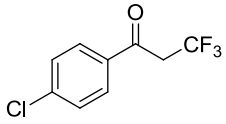
5. References for known products

Entry	Reference	Compound
1	Maji, A.; Hazra, A. *Org. Lett.*, **2014** , *16*, 4524.	**2a, 2c, 2d, 2e, 2k, 2q**
2	Deb, A.; Manna, S. *Angew. Chem. Int. Ed.,* **2013**, *37*, 9747.	**2b, 2l, 2n, 2p**
3	Zhang, C.-P.; Wang, Z.-L. *Chem.Commun.*, **2011**, *47*, 6632.	**2f**
4	Novak, P.; Lishchynskyi, A. *J. Am. Chem. Soc*., **2012**, *134,* 16167.	**2m, 2j**
5	Li, L.; Chen, Q.-Y. *J. Org. Chem.*, **2014**, *79*, 5145.	**2o**
6	He, Z.-B.; Zhang, R. *Chem. Sci.*, **2013**, *4*, 3478.	**2r**
7	Lerch, M.-M.; Morandi, B. *Angew. Chem. Int. Ed.,* **2014***, 33*, 8654.	**2s**
8	Miura, K.; Taniguchi, M. *Tetrahedron*, **1990**, *31*, 6391.	**2v**
9	Sun, X.-Y. ; Yu, S.-Y. *Chem. Commun.*, **2016**, *52*, 10898.	**7**

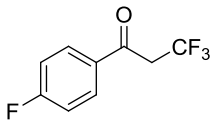
6. Characterization of the products



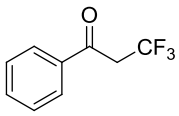
1-(4-Bromophenyl)-3,3,3-trifluoropropan-1-one (2a): White solid; m.p. 65-67 ℃; 72% (38.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 8.2 Hz, 2H), 7.65 (d, *J* = 8.2 Hz, 2H), 3.76 (q, *J* = 9.9 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 188.9, 134.6, 132.5, 129.9, 129.8, 123.9 (q, *J* = 277.1 Hz), 42.3 (q, *J* = 28.5 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.04 (t, *J* = 9.9 Hz, 3F).



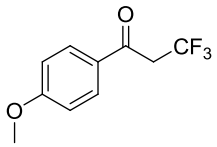
1-(4-Chlorophenyl)-3,3,3-trifluoropropan-1-one (2b): Light yellow oil; 66% (29.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 8.4 Hz, 2H), 7.49 (d, *J* = 8.4 Hz, 2H), 3.77 (q, *J* = 9.9 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 188.7, 141.05, 134.3, 129.9, 129.5, 124.0 (q, *J* = 277.0 Hz), 42.3 (q, *J* = 28.5 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.03 (t, *J* = 9.9 Hz, 3F).



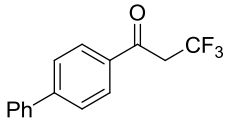
3,3,3-Trifluoro-1-(4-fluorophenyl)propan-1-one (2c): Colorless oil; 67% (27.6 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 – 7.91 (m, 2H), 7.23 – 7.13 (m, 2H), 3.77 (q, *J* = 9.9 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 188.3, 166.5 (d, *J* = 257.1 Hz), 132.4, 131.3 (d, *J* = 9.6 Hz), 124.0 (q, *J* = 277.0 Hz), 116.4 (d, *J* = 22.1 Hz), 42.3 (q, *J* = 28.4 Hz); ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.00 (t, *J* = 9.9 Hz, 3F), -100.26 – -109.04 (m, 1F).



3,3,3-Trifluoro-1-phenylpropan-1-one (2d): Colorless oil; 59% (22.2 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 7.7 Hz, 2H), 7.64 (t, *J* = 7.3 Hz, 1H), 7.51 (t, *J* = 7.6 Hz, 2H), 3.80 (q, *J* = 10.0 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 189.8, 136.0, 134.3, 129.1, 128.5, 124.1 (q, *J* = 276.9 Hz), 42.2 (q, *J* = 28.2 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -58.13 (t, *J* = 10.0 Hz, 3F).

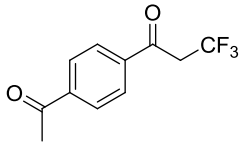


3,3,3-Trifluoro-1-(4-methoxyphenyl)propan-1-one (2e): White solid; m.p. 47-49 ℃; 64% (27.9 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 8.7 Hz, 2H), 6.97 (d, *J* = 8.7 Hz, 2H), 3.89 (s, 3H), 3.74 (q, *J* = 10.1 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 188.1, 164.3, 130.8, 128.9, 124.1 (q, *J* = 277.0 Hz), 114.1, 55.6, 41.8 (q, *J* = 28.0 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -61.99 (t, *J* = 10.1 Hz, 3F).

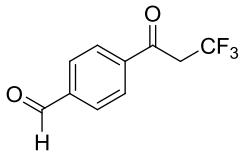


1-(Biphenyl-4-yl)-3,3,3-trifluoropropan-1-one (2f): White solid; m.p. 126-128 ℃; 46% (24.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.1 Hz, 2H), 7.73 (d, *J* = 8.1 Hz, 2H), 7.64 (d, *J* = 7.4 Hz, 2H), 7.49 (t, *J* = 7.3 Hz, 2H), 7.46 – 7.40 (m, 1H),

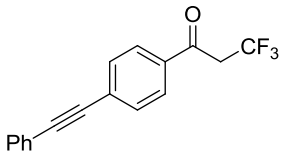
3.83 (q, *J* = 10.0 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 189.4, 147.1, 139.6, 134.6, 129.2, 129.1, 128.7, 127.7, 127.5, 124.2 (q, *J* = 277.3 Hz), 42.3 (q, *J* = 28.2 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -61.97 (t, *J* = 10.1 Hz, 3F).



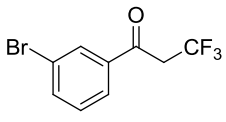
1-(4-Acetylphenyl)-3,3,3-trifluoropropan-1-one (2g): White solid; m.p. 113-115 ℃; 69% (31.7 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 8.3 Hz, 2H), 8.02 (d, *J* = 8.3 Hz, 2H), 3.83 (q, *J* = 9.8 Hz, 2H), 2.66 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 197.3, 189.4, 141.1, 138.9, 128.9, 128.8, 123.9 (q, *J* = 277.0 Hz), 42.7 (q, *J* = 28.6 Hz), 27.1; ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.06 (t, *J* = 9.9 Hz, 3F); FT-IR (thin film, KBr): ν (cm^{-1}) 2921, 1680, 1272, 1018, 643; HRMS(CI) calcd $C_{11}H_{10}F_3O_2$ $[M + H]^+$: 231.0633, found: 231.0632.



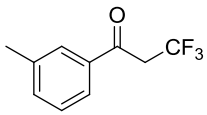
4-(3,3,3-Trifluoropropanoyl)benzaldehyde (2h): White solid; m.p. 89-91 ℃; 77% (33.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.12 (s, 1H), 8.09 (d, *J* = 8.1 Hz, 2H), 8.02 (d, *J* = 8.1 Hz, 2H), 3.85 (q, *J* = 9.8 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 191.4, 189.4, 139.9, 139.8, 130.1, 129.0, 123.9 (q, *J* = 277.1 Hz), 42.7 (q, *J* = 28.6 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.06 (t, *J* = 9.8 Hz, 3F); FT-IR (thin film, KBr): ν (cm^{-1}) 2949, 2850, 1688, 1370, 800; HRMS(CI) calcd $C_{10}H_8F_3O_2$ $[M + H]^+$: 217.0476, found: 217.0479.



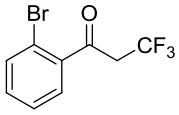
3,3,3-Trifluoro-1-(4-(phenylethynyl)phenyl)propan-1-one (2i): White solid; m.p. 140 -142 ℃; 54% (31.1 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (d, *J* = 8.1 Hz, 2H), 7.65 (d, *J* = 8.1 Hz, 2H), 7.61 – 7.52 (m, 2H), 7.43 – 7.33 (m, 3H), 3.80 (q, *J* = 9.9 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 189.0, 134.9, 132.1, 131.9, 129.6, 129.2, 128.6, 128.5, 124.1 (q, *J* = 277.1 Hz), 122.5, 93.9, 88.4, 42.3 (q, *J* = 28.4 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.01 (t, *J* = 9.9 Hz, 3F); FT-IR (thin film, KBr): ν (cm^{-1}) 2921, 2217, 1687, 1123, 848; HRMS(CI) calcd $C_{17}H_{12}F_3O$ $[M + H]^+$: 289.0840, found: 289.0846.



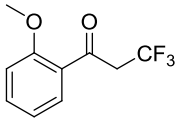
1-(3-Bromophenyl)-3,3,3-trifluoropropan-1-one (2j): Colorless oil; 67% (35.5 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (s, 1H), 7.85 (d, *J* = 7.8 Hz, 1H), 7.76 (d, *J* = 7.8 Hz, 1H), 7.40 (t, *J* = 7.9 Hz, 1H), 3.78 (q, *J* = 9.8 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 188.5, 137.6, 137.2, 131.5, 130.6, 127.0, 123.9 (q, *J* = 277.1 Hz), 123.5, 42.4 (q, *J* = 28.6 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.06 (t, *J* = 9.8 Hz, 3F).



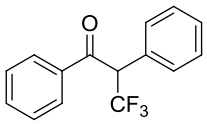
3,3,3-Trifluoro-1-m-tolylpropan-1-one (2k): Colorless oil; 65% (26.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.72 (d, *J* = 7.9 Hz, 1H), 7.45 (d, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 1H), 3.78 (q, *J* = 10.0 Hz, 2H), 2.43 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 190.0, 139.0, 136.0, 135.1, 129.0, 128.9, 125.7, 124.2 (q, *J* = 277.0 Hz), 42.3 (q, *J* = 28.1 Hz), 21.5; ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.08 (t, *J* = 10.1 Hz, 3F).



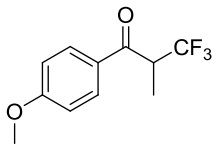
1-(2-Bromophenyl)-3,3,3-trifluoropropan-1-one (2l): Colorless oil; 68% (36.2 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 7.8 Hz, 1H), 7.51 – 7.32 (m, 3H), 3.84 (q, *J* = 10.0 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 193.4, 140.1, 134.1, 132.8, 129.3, 127.9, 123.6 (q, *J* = 277.6 Hz), 119.0, 45.9 (q, *J* = 28.4 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.17 (t, *J* = 10.0 Hz, 3F).



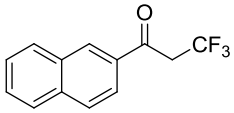
3,3,3-Trifluoro-1-(2-methoxyphenyl)propan-1-one (2m): Colorless oil; 67% (29.2 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.81 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.57 – 7.49 (m, 1H), 7.08 – 7.01 (m, 1H), 6.99 (d, *J* = 8.4 Hz, 1H), 3.94 (s, 3H), 3.88 (q, *J* = 10.3 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 191.1, 159.1, 135.1, 131.0, 126.6, 124.4 (q, *J* = 276.9 Hz), 121.1, 111.8, 55.7, 47.0 (q, *J* = 27.4 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.60 (t, *J* = 10.3 Hz, 3F).



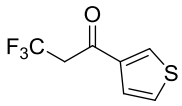
3,3,3-Trifluoro-1,2-diphenylpropan-1-one (2n): Colorless oil; 65% (34.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.7 Hz, 2H), 7.53 (t, *J* = 7.3 Hz, 1H), 7.49 – 7.32 (m, 7H), 5.29 (q, *J* = 8.2 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 191.2, 135.5, 133.9, 130.0, 129.8, 129.4, 129.3, 129.0, 128.9, 124.4 (q, *J* = 280.3 Hz), 56.7(q, *J* = 26.6 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -66.55 (d, *J* = 8.2 Hz, 3F).



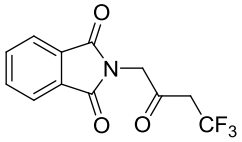
3,3,3-Trifluoro-1-(4-methoxyphenyl)-2-methylpropan-1-one (2o): Colorless oil; 59% (22.2 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 8.7 Hz, 2H), 6.97 (d, *J* = 8.7 Hz,2H), 4.32 – 4.06 (m, 1H), 3.89 (s, 3H), 1.46 (d, *J* = 7.1 Hz, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 192.9, 164.4, 131.2, 128.8, 125.6 (q, *J* = 280.2 Hz), 114.2, 55.72, 44.0 (q, *J* = 26.3 Hz), 11.9; ^{19}F NMR (564 MHz, $CDCl_3$) δ -65.76 (d, *J* = 8.2 Hz, 3F).



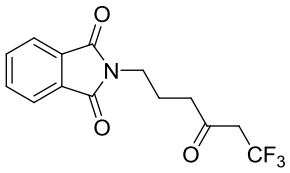
3,3,3-Trifluoro-1-(naphthalen-2-yl)propan-1-one (2p): White solid; m.p. 87 -89 ℃; 70% (33.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (s, 1H), 8.00 (t, *J* = 9.4 Hz, 2H), 7.96 – 7.87 (m, 2H), 7.66 (t, *J* = 7.3 Hz, 1H), 7.60 (t, *J* = 7.4 Hz, 1H), 3.94 (q, *J* = 10.0 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 189.8, 136.1, 133.4, 132.5, 130.7, 129.9, 129.4, 129.1, 128.0, 127.4, 124.2 (q, *J* = 277.7 Hz), 123.6, 42.4 (q, *J* = 28.2 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -61.92 (t, *J* = 9.9 Hz, 3F).



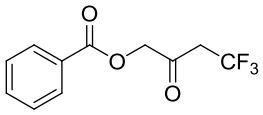
3,3,3-Trifluoro-1-(thiophen-3-yl)propan-1-one (2q): light yellow oil; 62% (24.1 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (s, 1H), 7.56 (d, *J* = 5.0 Hz, 1H), 7.43 – 7.33 (m, 1H), 3.69 (q, *J* = 10.1 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 183.7, 141.4, 133.7, 127.3, 127.0, 123.9 (q, *J* = 277.0 Hz), 43.6 (q, *J* = 28.3 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.00 (t, *J* = 10.1 Hz, 3F).



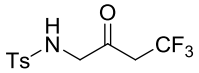
2-(4,4,4-Trifluoro-2-oxobutyl)isoindoline-1,3-dione (2r): White solid; m.p. 160-162 ℃; 69% (37.4 mg); ^{1}H NMR (600 MHz,$CDCl_3$) δ 7.88 (dd, *J* = 5.4, 3.1 Hz, 2H), 7.75 (dd, *J* = 5.5, 3.0 Hz, 2H), 4.59 (s, 2H), 3.40 (q, *J* = 10.2 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 192.3, 167.4, 134.5, 132.0, 123.9, 123.4 (q, *J* = 277.1 Hz), 46.9, 44.4 (q, *J* = 29.6 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.01 (t, *J* = 10.2 Hz, 3F).



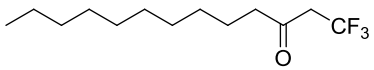
2-(6,6,6-Trifluoro-4-oxohexyl)isoindoline-1,3-dione (2s): White solid; m.p. 100-102 ℃; 67% (40.1 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.83 (dd, *J* = 5.3, 3.0 Hz, 2H), 7.72 (dd, *J* = 5.4, 3.0 Hz, 2H), 3.71 (t, *J* = 6.5 Hz, 2H), 3.25 (q, *J* = 10.5 Hz, 2H), 2.59 (t, *J* = 6.9 Hz, 2H), 1.99 (p, *J* = 6.7 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 199.0, 168.6, 134.2, 132.1, 123.7 (q, *J* = 276.9 Hz), 123.4, 46.4 (q, *J* = 28.3 Hz), 40.4, 36.9, 22.3; ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.50 (t, *J* = 10.4 Hz, 3F).



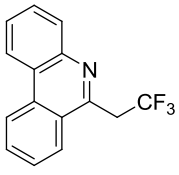
4,4,4-Trifluoro-2-oxobutyl benzoate (2t): White solid; m.p. 98-100 ℃; 71% (34.9 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 – 8.00 (m, 2H), 7.74 – 7.54 (m,1H), 7.54 – 7.42 (m, 2H), 4.96 (s, 2H), 3.38 (q, *J* = 10.2 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$, overlapping peaks) δ 194.0, 165.8, 133.9, 130.1, 128.8, 123.5 (q, *J* = 277.1 Hz), 68.4 (q, *J* = 2.4 Hz), 43.5 (q, *J* = 29.3 Hz); ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.00 (t, *J* = 10.3 Hz, 3F); FT-IR (thin film, KBr): ν (cm^{-1}) 2924, 1742, 1413, 1159, 686; HRMS(CI) calcd $C_{11}H_{10}F_3O_3$ $[M + H]^+$: 247.0582, found: 247.0589.



4-Methyl-*N*-(4,4,4-trifluoro-2-oxobutyl)benzenesulfonamide (2u): White solid; m.p. 157-159 ℃; 63% (37.2 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 7.9 Hz, 2H), 7.32 (d, *J* = 7.8 Hz, 2H), 5.24 (brs, 1H), 3.94 (d, *J* = 4.9 Hz, 2H), 3.24 (q, *J* = 10.1 Hz, 2H), 2.43 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 194.3, 144.4, 135.9, 130.1, 127.3, 123.1 (q, *J* = 276.9 Hz), 52.3, 44.2 (q, *J* = 29.7 Hz), 21.7; ^{19}F NMR (564 MHz, $CDCl_3$) δ -58.87 – -65.52 (m, 3F); FT-IR (thin film, KBr): ν (cm^{-1}) 3285, 1736, 1307, 1037, 677; HRMS(CI) calcd $C_{11}H_{13}F_3NO_3S$ $[M + H]^+$: 296.0568, found: 296.0574.



1,1,1-Trifluorotridecan-3-one (2v): White solid; m.p. 44-46 ℃; 66% (33.3 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.20 (q, *J* = 10.5 Hz, 2H), 2.51 (t, *J* = 7.3 Hz, 2H), 1.65 – 1.52 (m, 2H), 1.30 – 1.22 (m, 14H), 0.87 (t, *J* = 6.5 Hz,3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 200.4, 123.8 (q, *J* = 276.9 Hz), 46.3 (q, *J* = 28.1 Hz), 43.7, 32.0, 29.7, 29.6, 29.5, 29.4, 29.1, 23.3, 22.8, 14.2; ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.47 (t, *J* = 10.5 Hz, 3F).

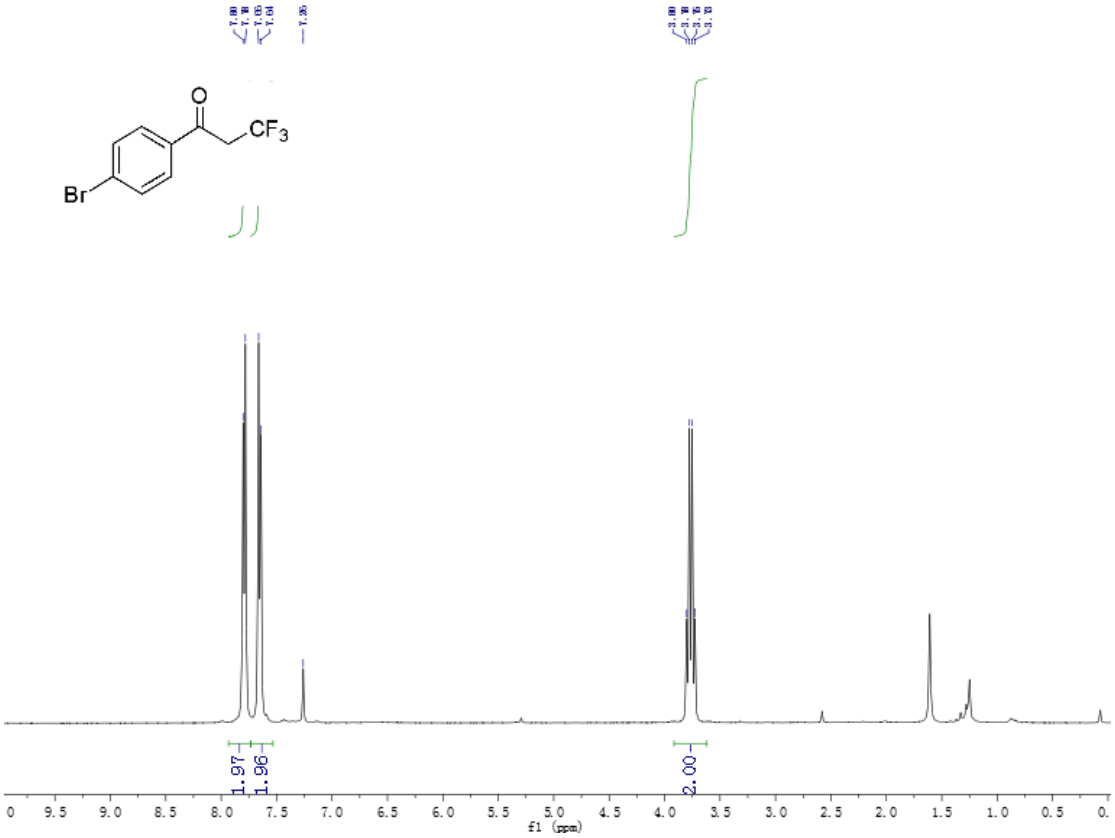


6-(2,2,2-Trifluoroethyl)phenanthridine (7): Yellow solid; m.p. 99-101℃; 74% (38.6 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.69 (d, *J* = 8.3 Hz, 1H), 8.59 (d, *J* = 8.0 Hz, 1H),

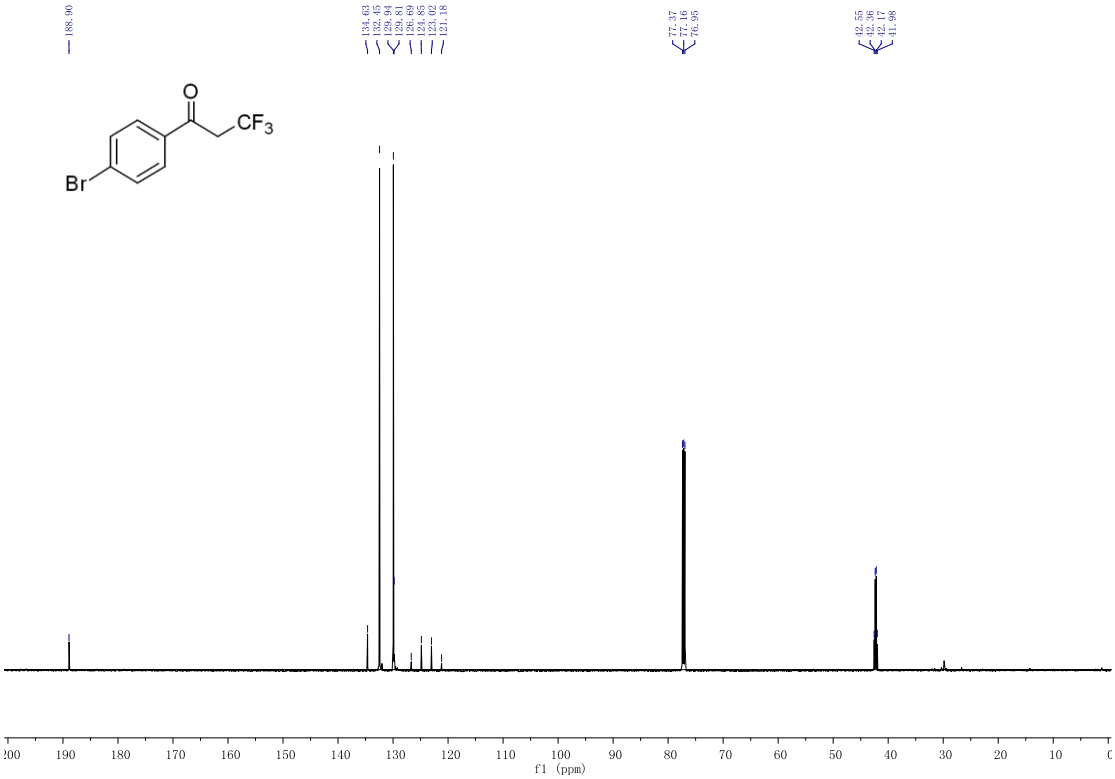
8.21 (t, *J* = 9.0 Hz, 2H), 7.89 (t, *J* = 7.6 Hz, 1H), 7.84 – 7.62 (m, 3H), 4.22 (q, *J* = 10.3 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 151.3, 143.6, 133.4, 131.0, 130.3, 129.1, 127.8, 127.7, 126.4, 125.8 (q, *J* = 278.1 Hz), 125.7, 124.2, 122.7, 122.1, 40.7 (q, *J* = 29.2 Hz); ^{19}F NMR (564 MHz, $CDCl_3$) δ -62.54 (t, *J* = 10.4 Hz, 3F).

NMR Spectra for the products

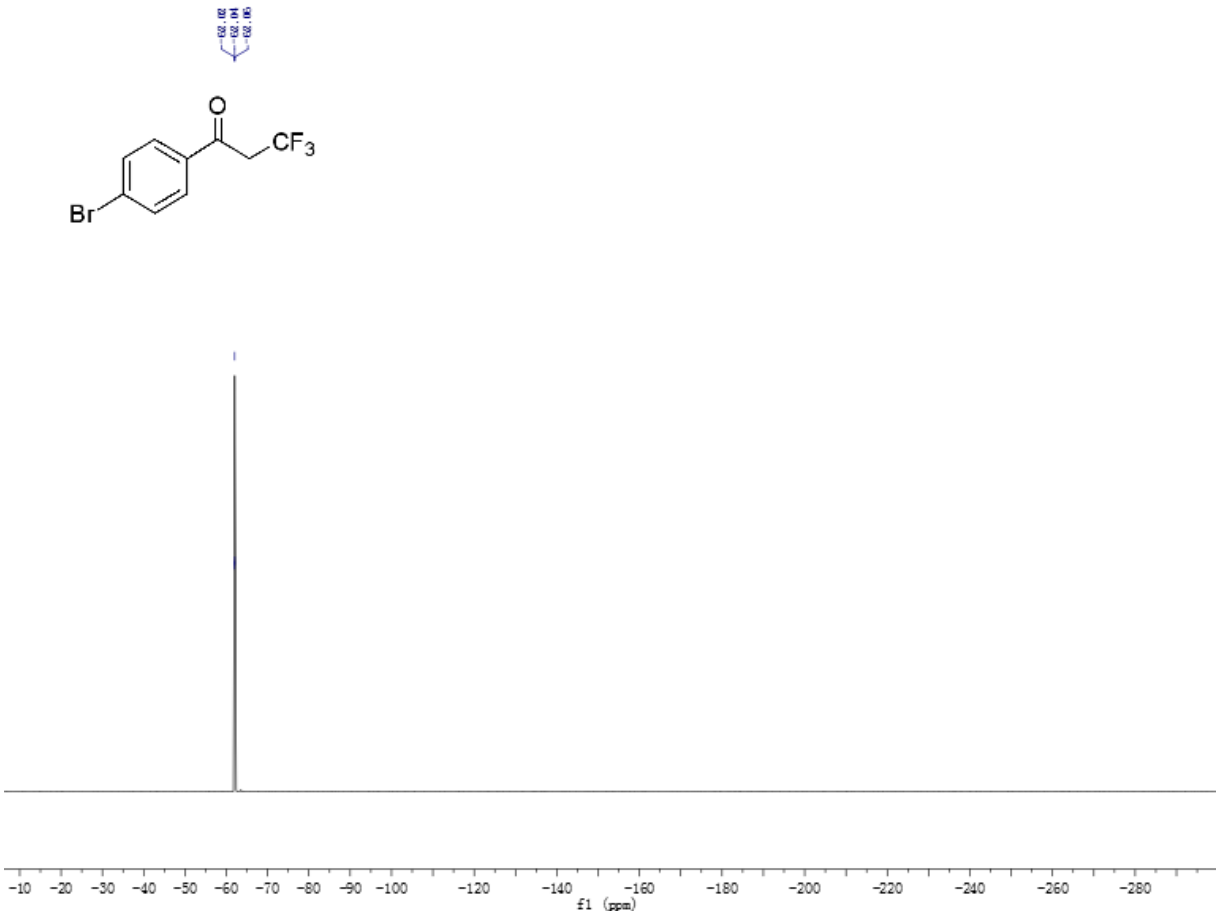
^{1}H NMR of **2a**



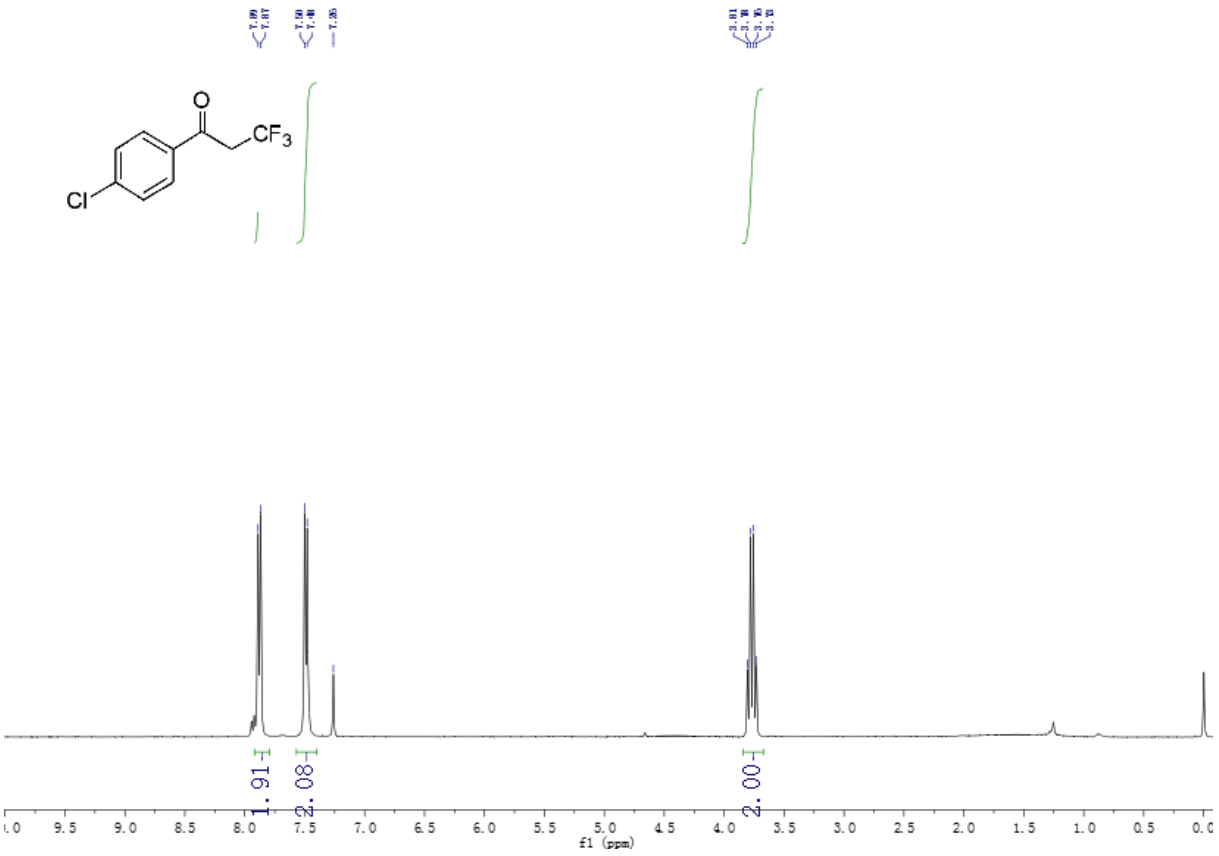
^{13}C NMR of **2a**



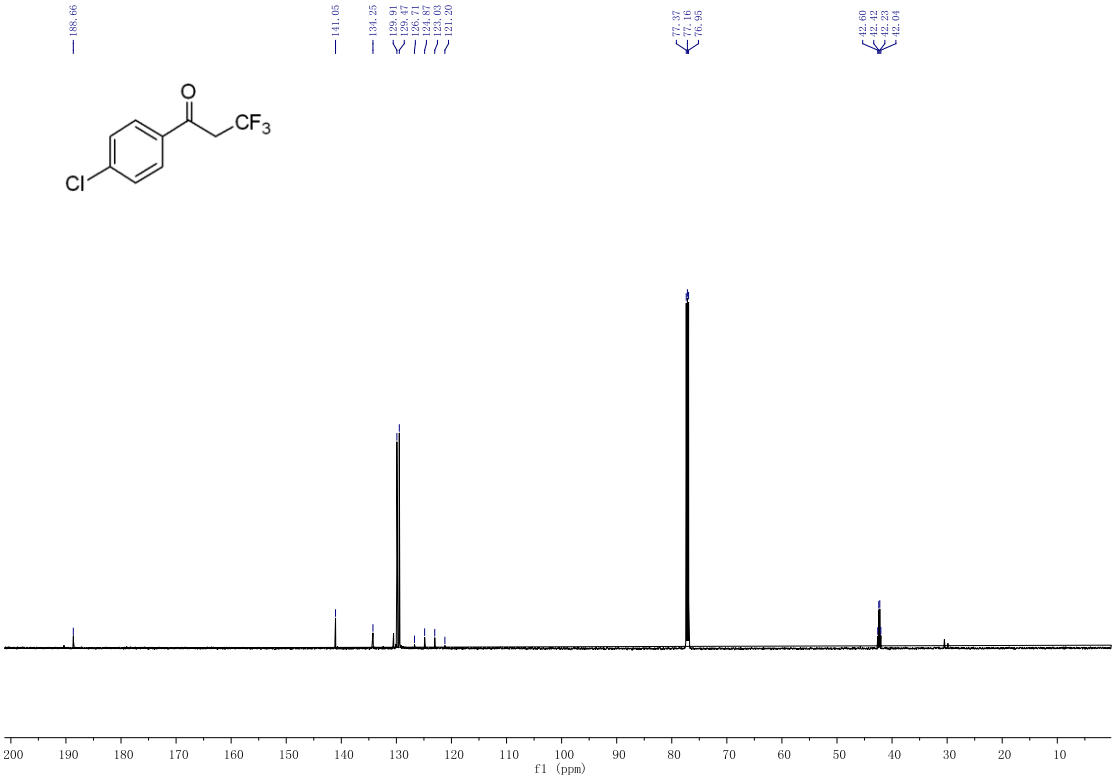
^{19}F NMR of **2a**



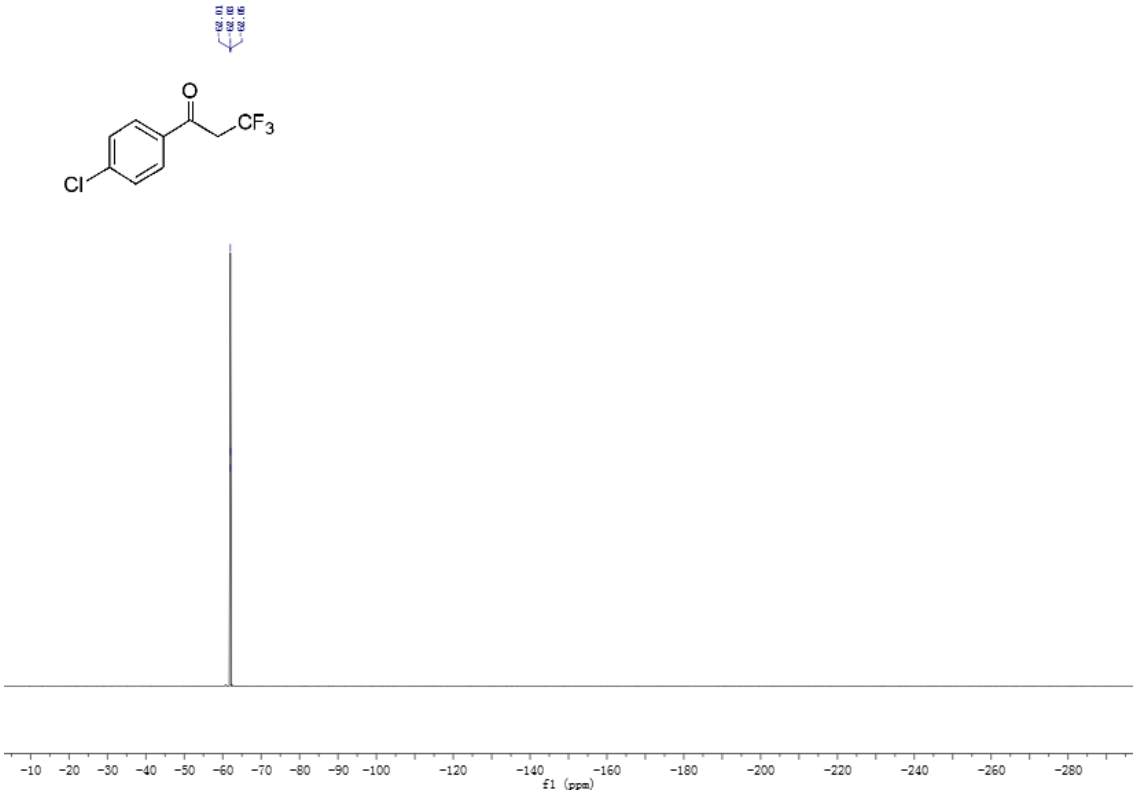
^{1}H NMR of **2b**



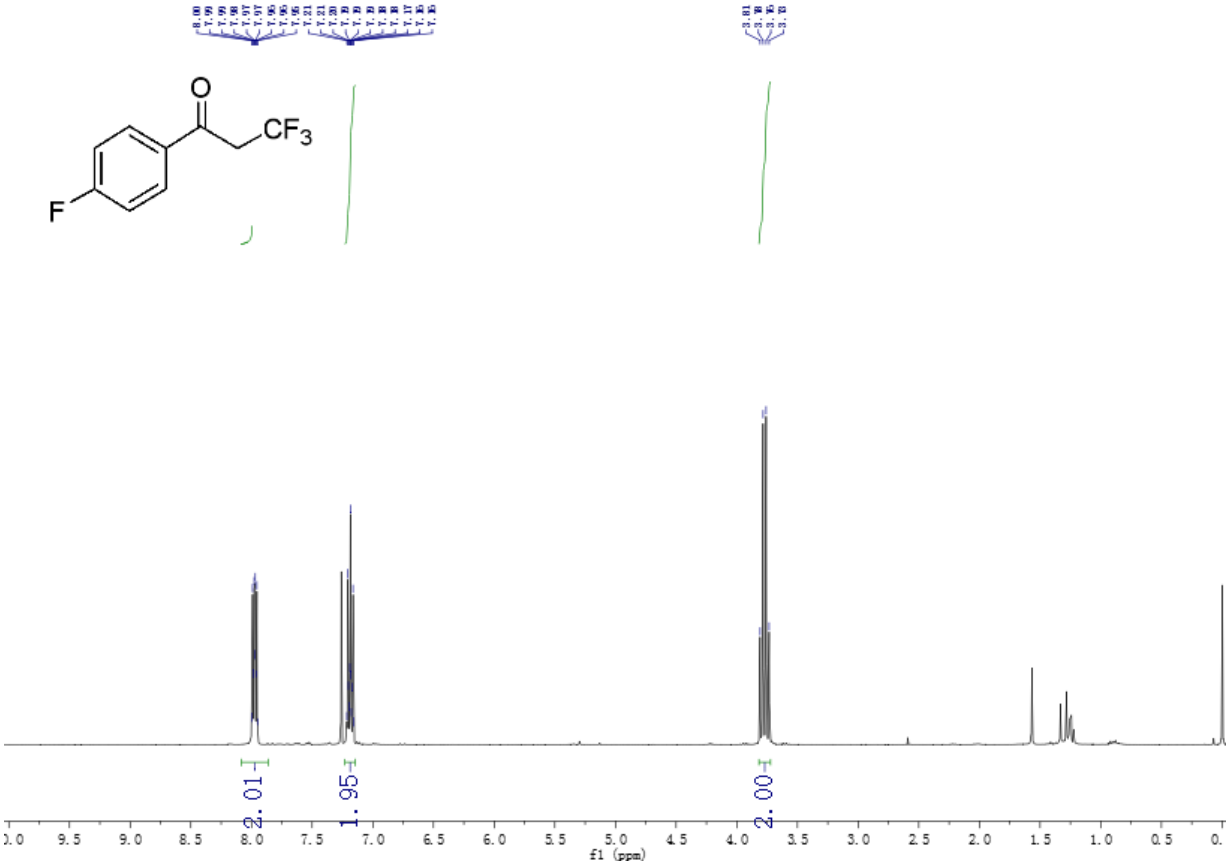
^{13}C NMR of **2b**



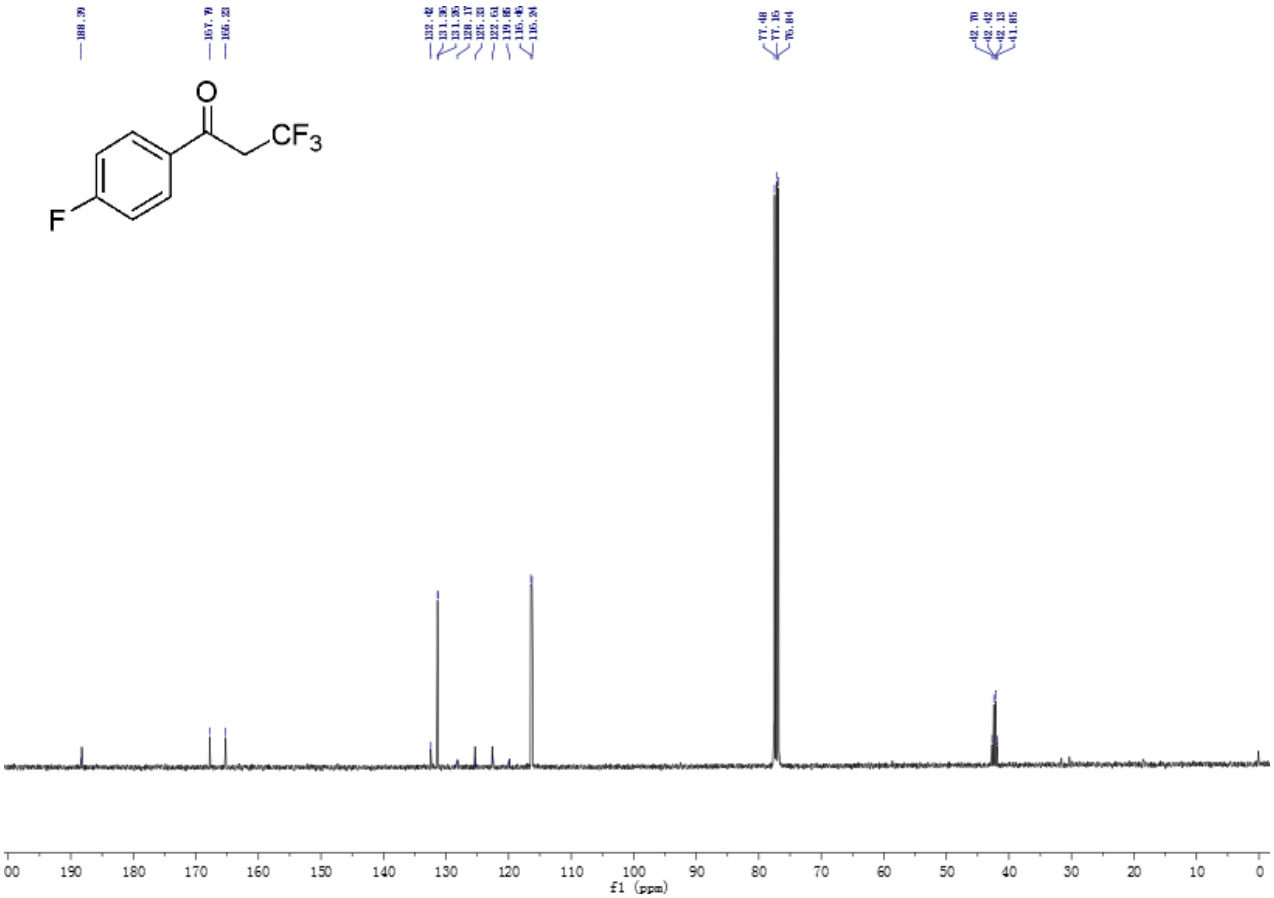
^{19}F NMR of **2b**



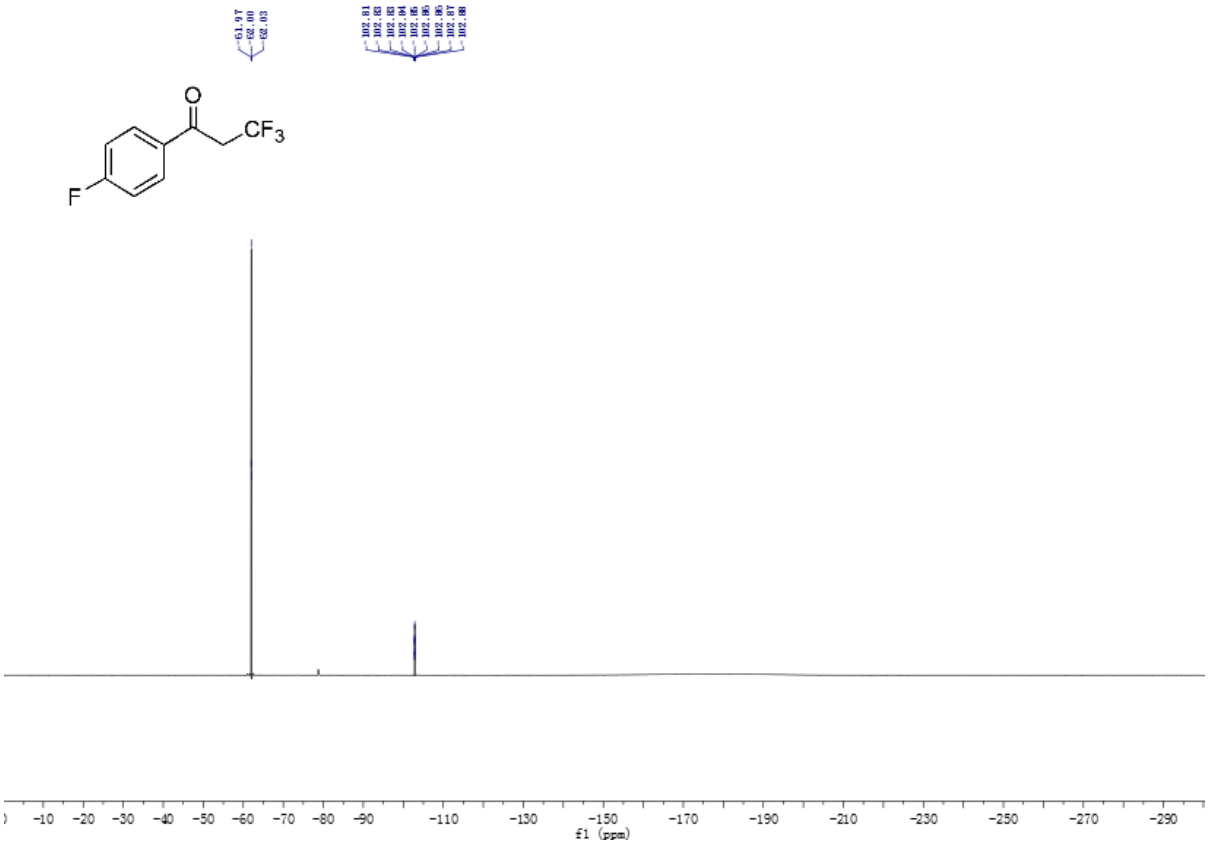
^{1}H NMR of **2c**



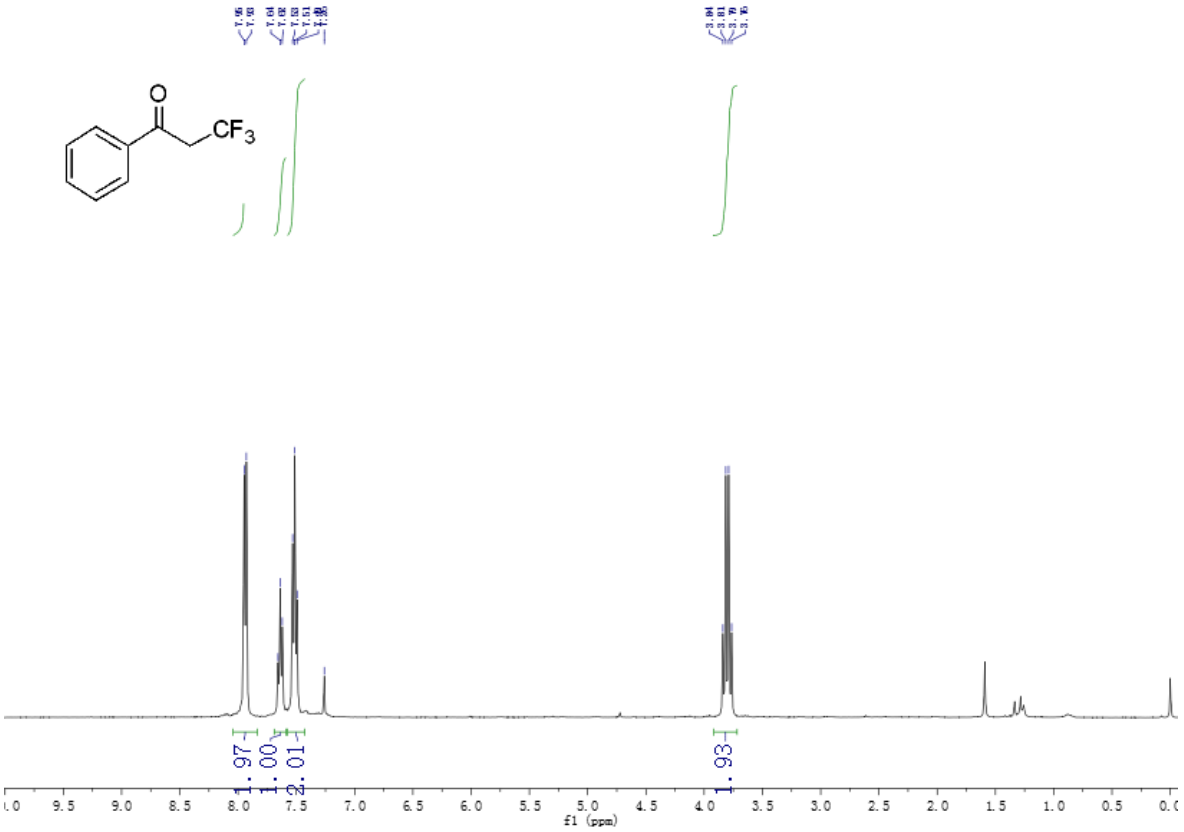
^{13}C NMR of **2c**



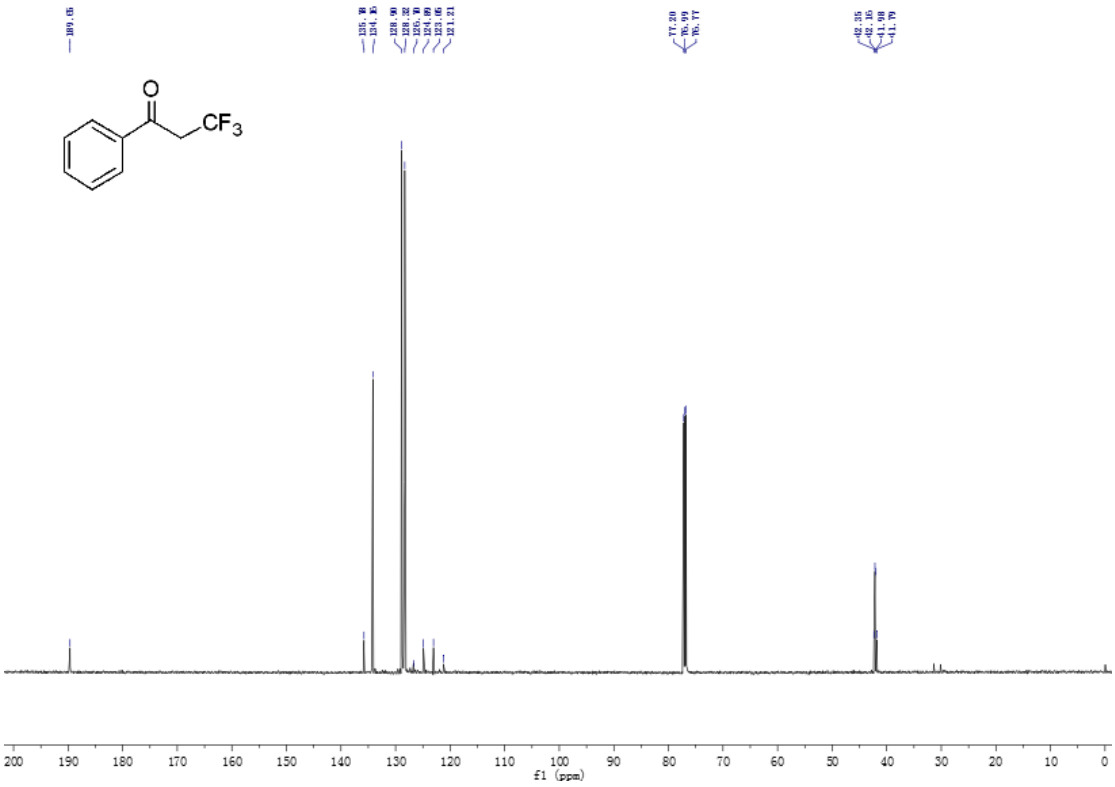
^{19}F NMR of **2c**



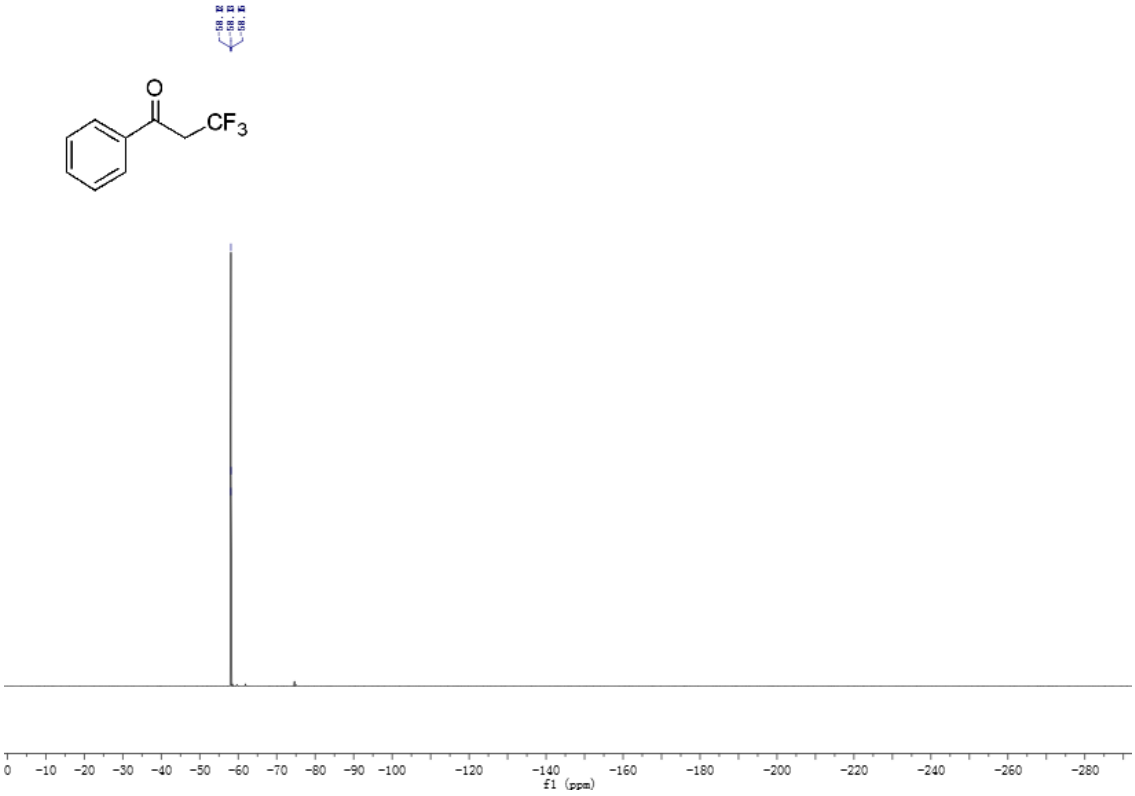
^{1}H NMR of **2d**



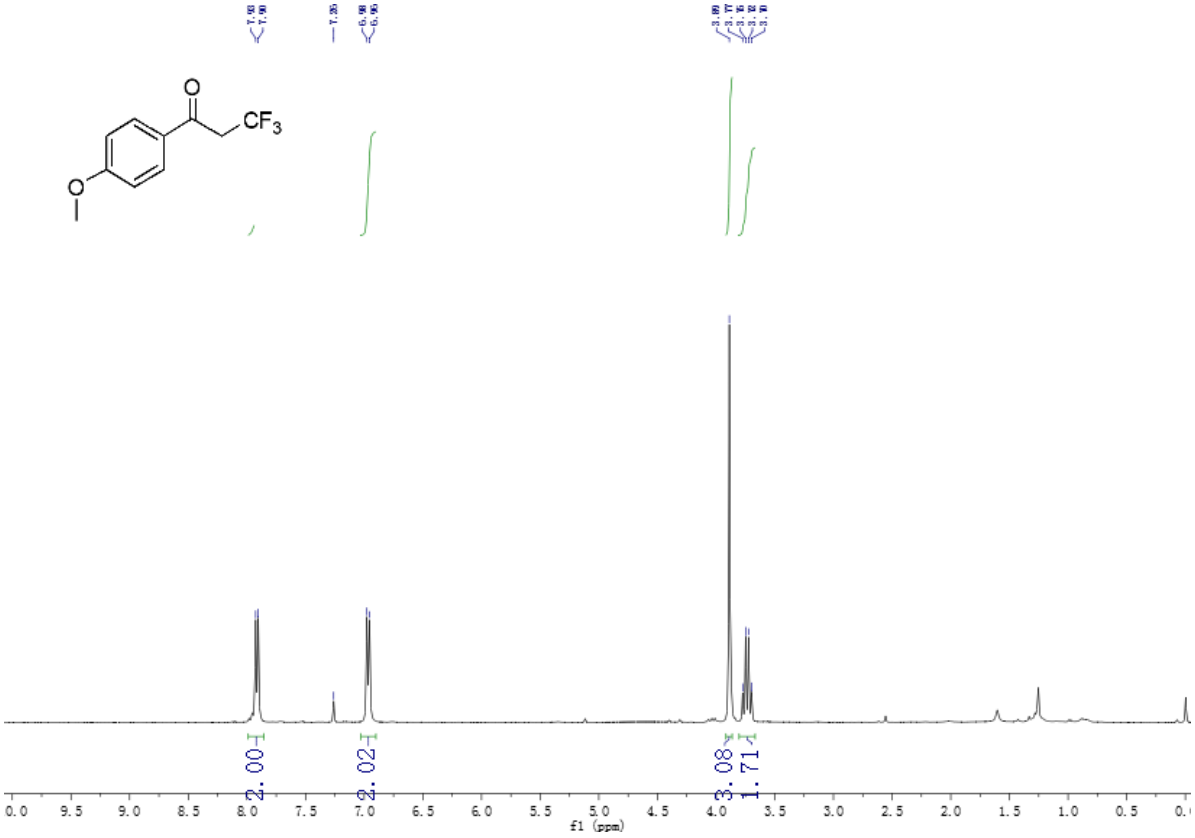
^{13}C NMR of **2d**



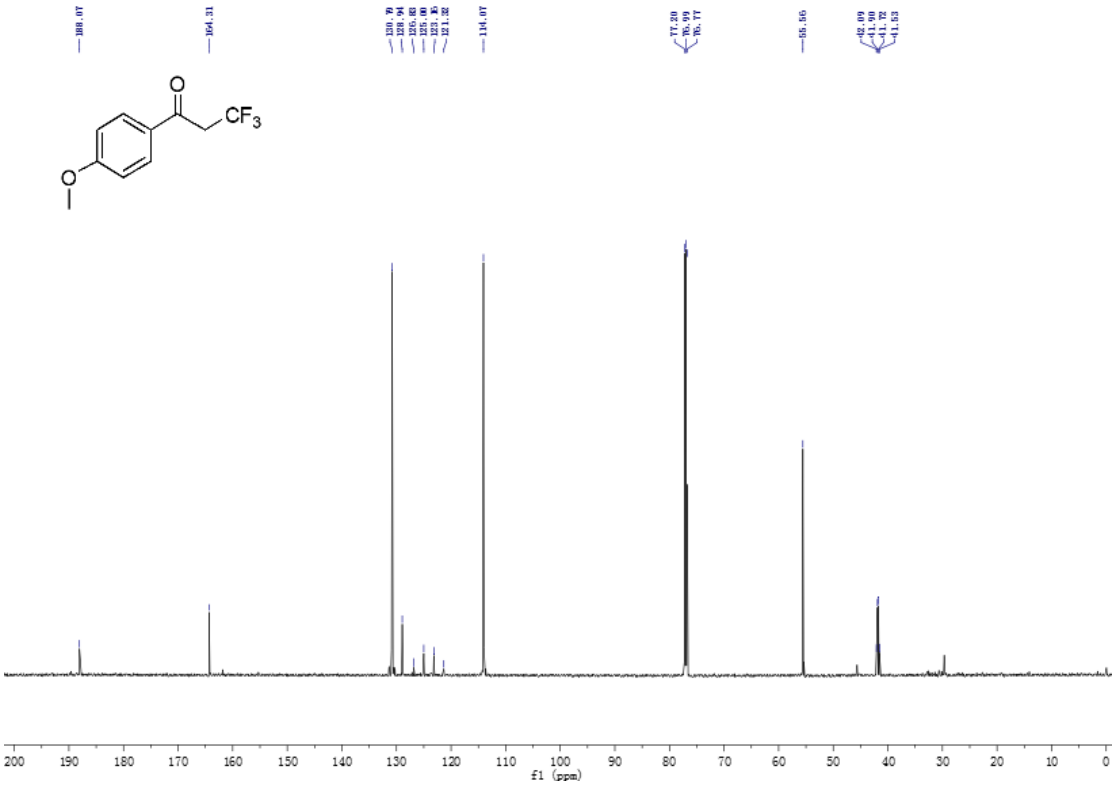
^{19}F NMR of **2d**



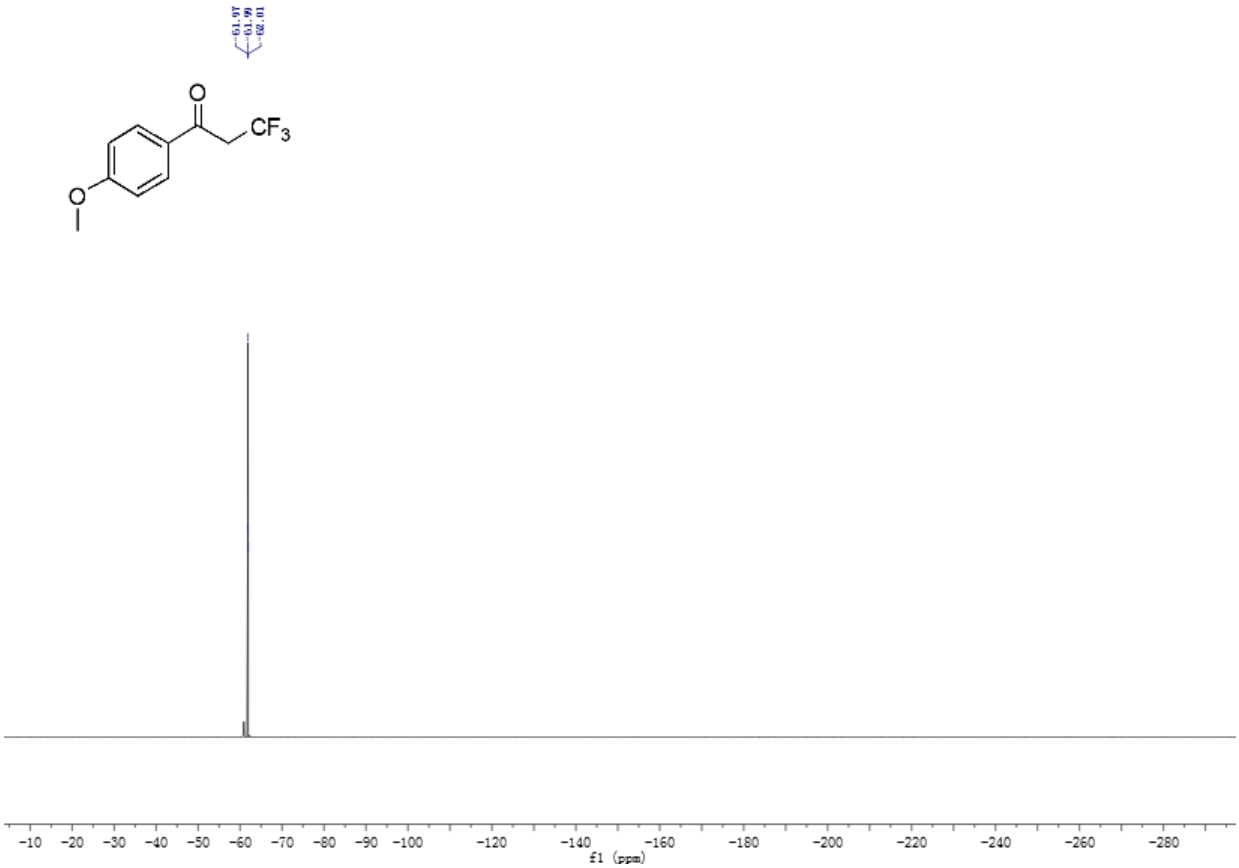
^{1}H NMR of **2e**



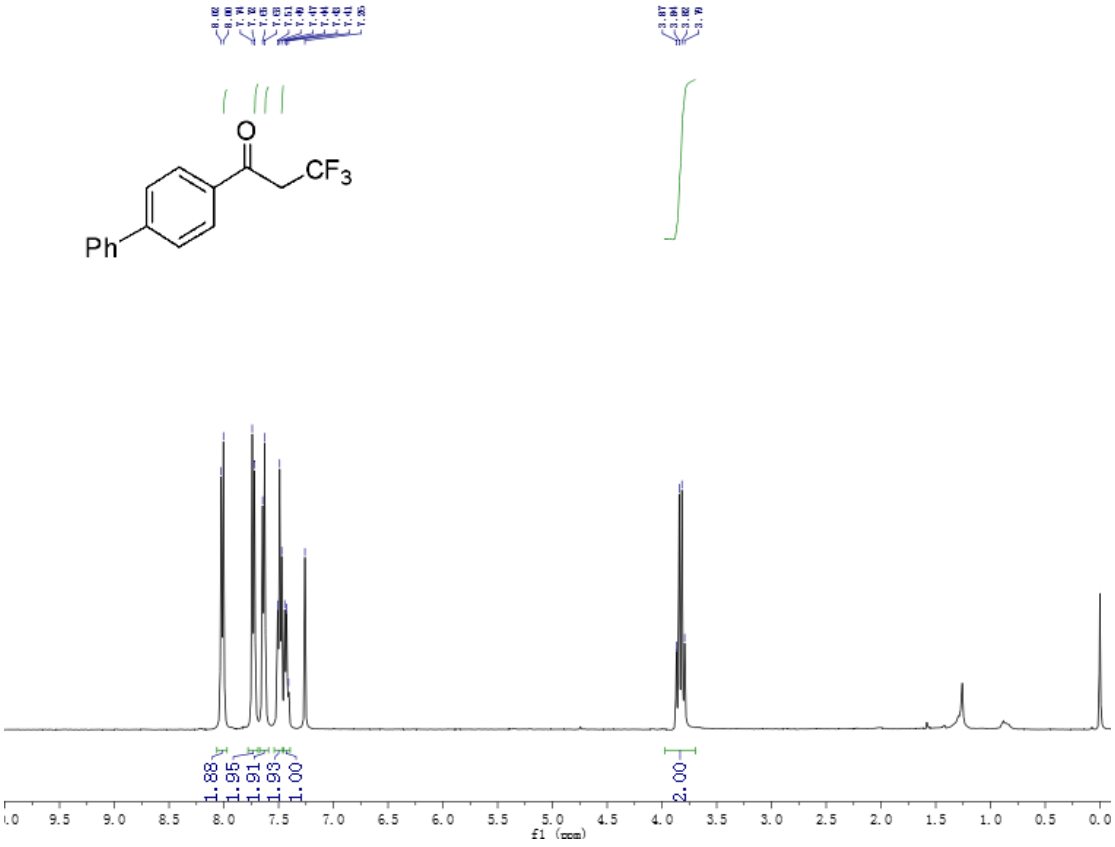
^{13}C NMR of **2e**



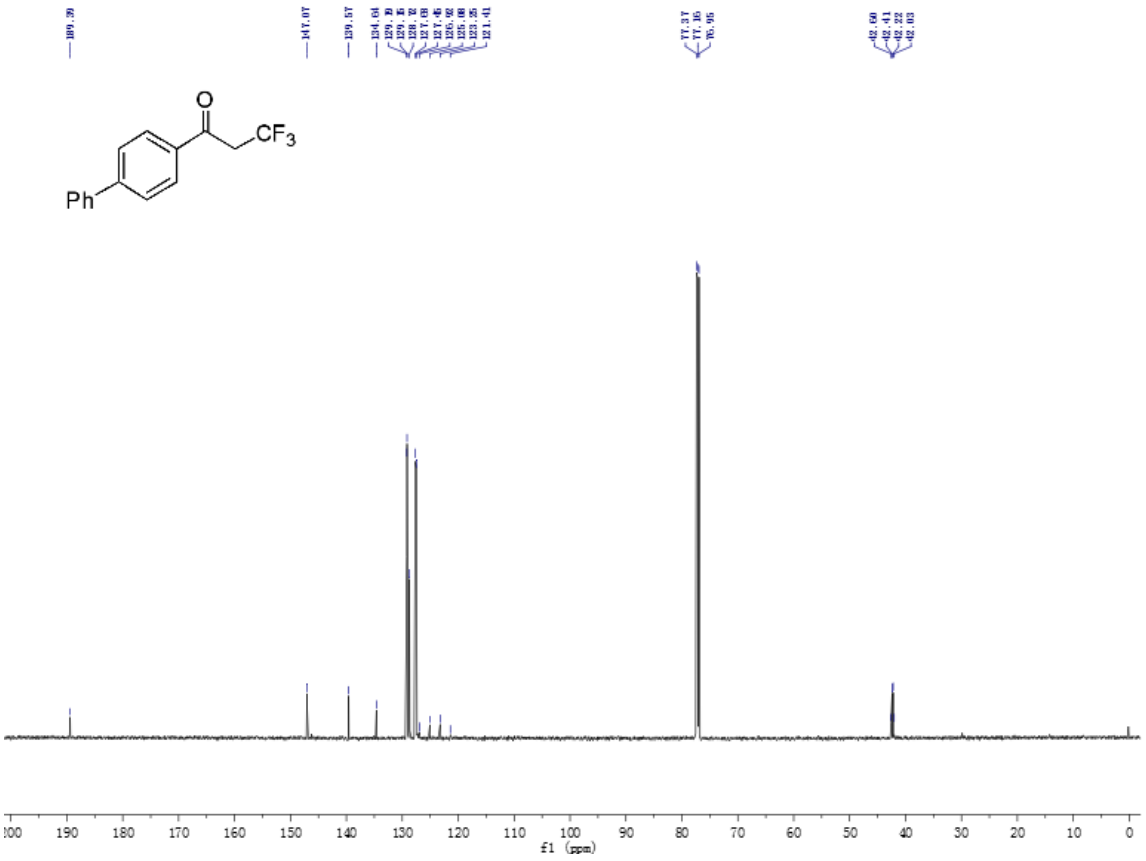
^{19}F NMR of **2e**



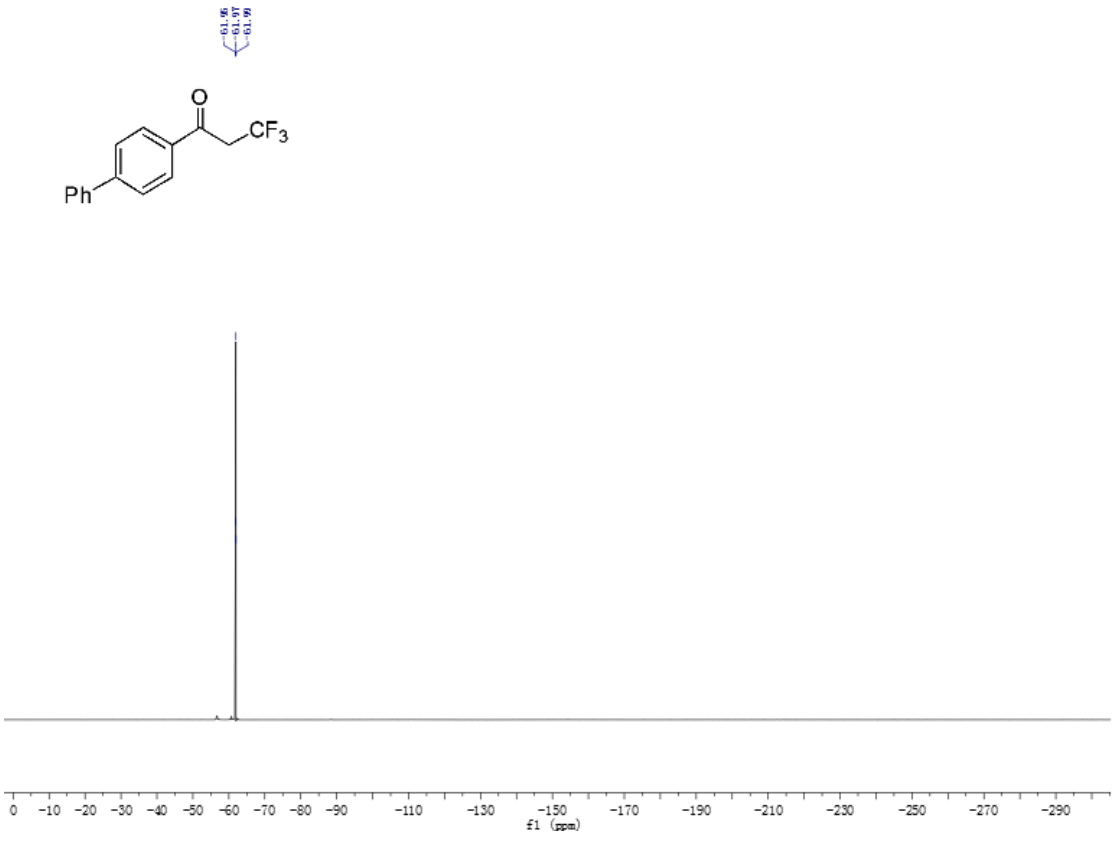
^{1}H NMR of **2f**



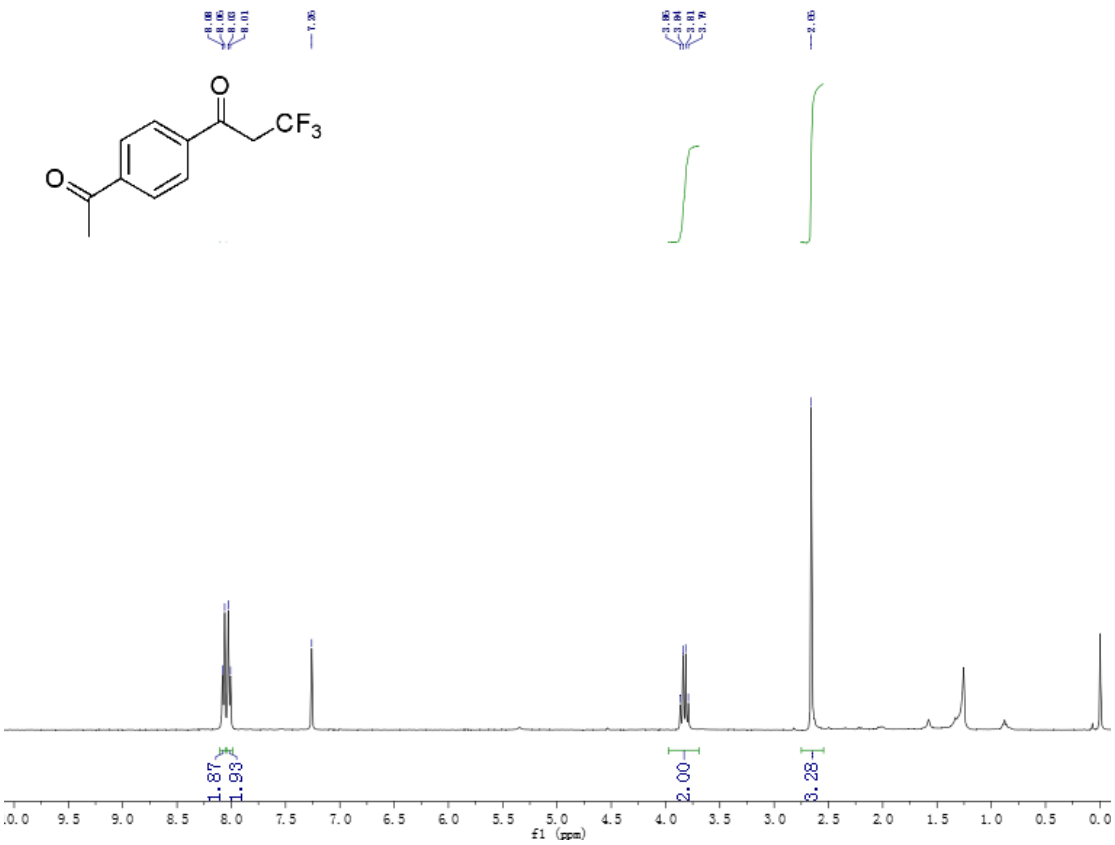
^{13}C NMR of **2f**



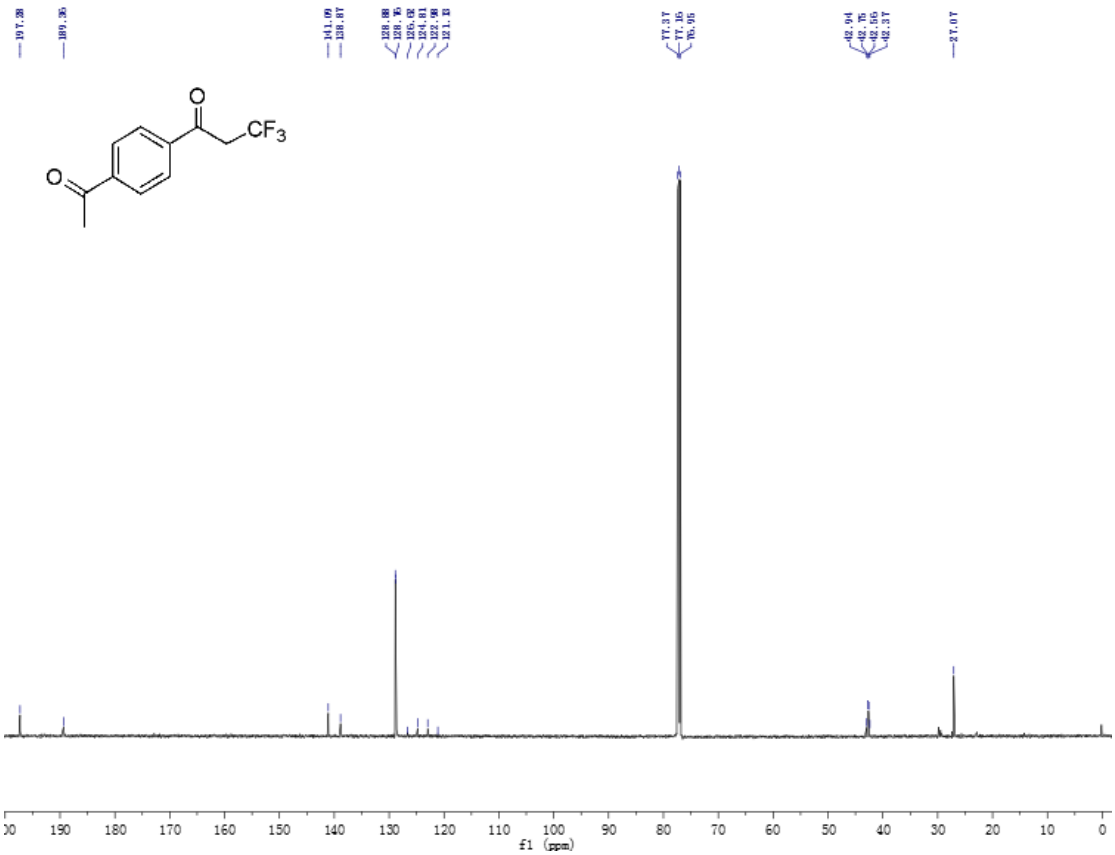
^{19}F NMR of **2f**



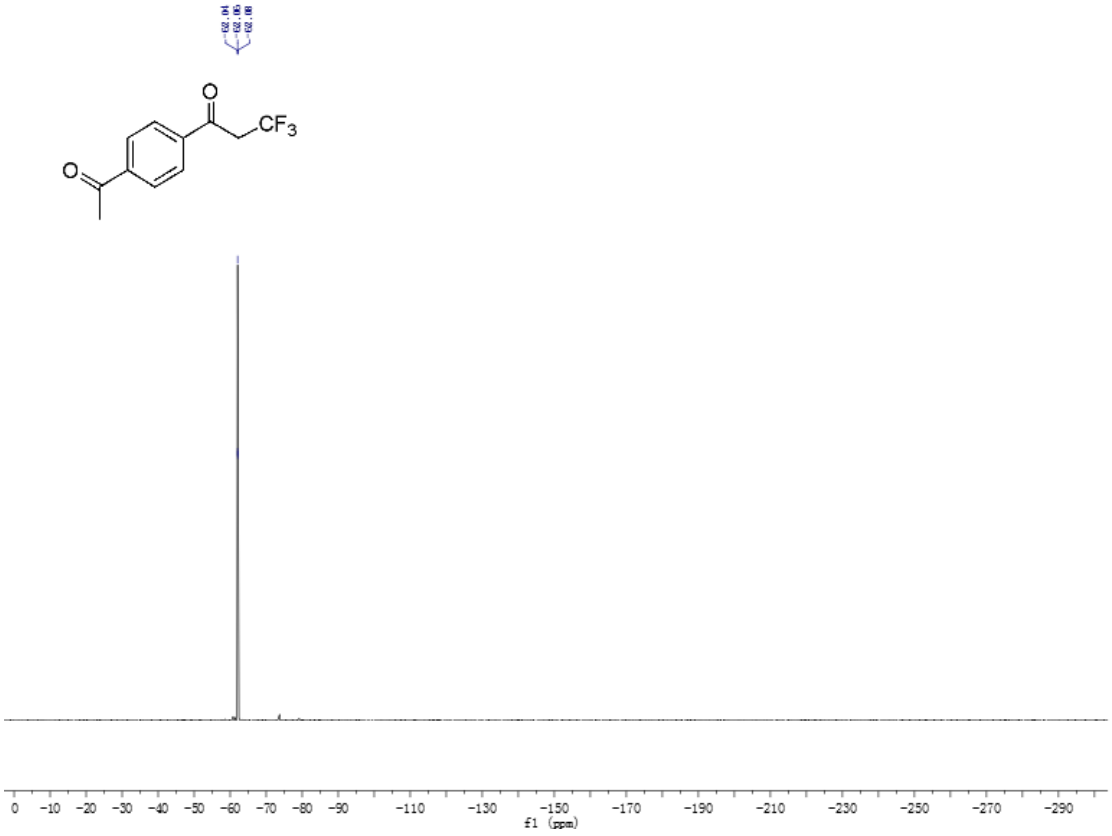
^{1}H NMR of **2g**



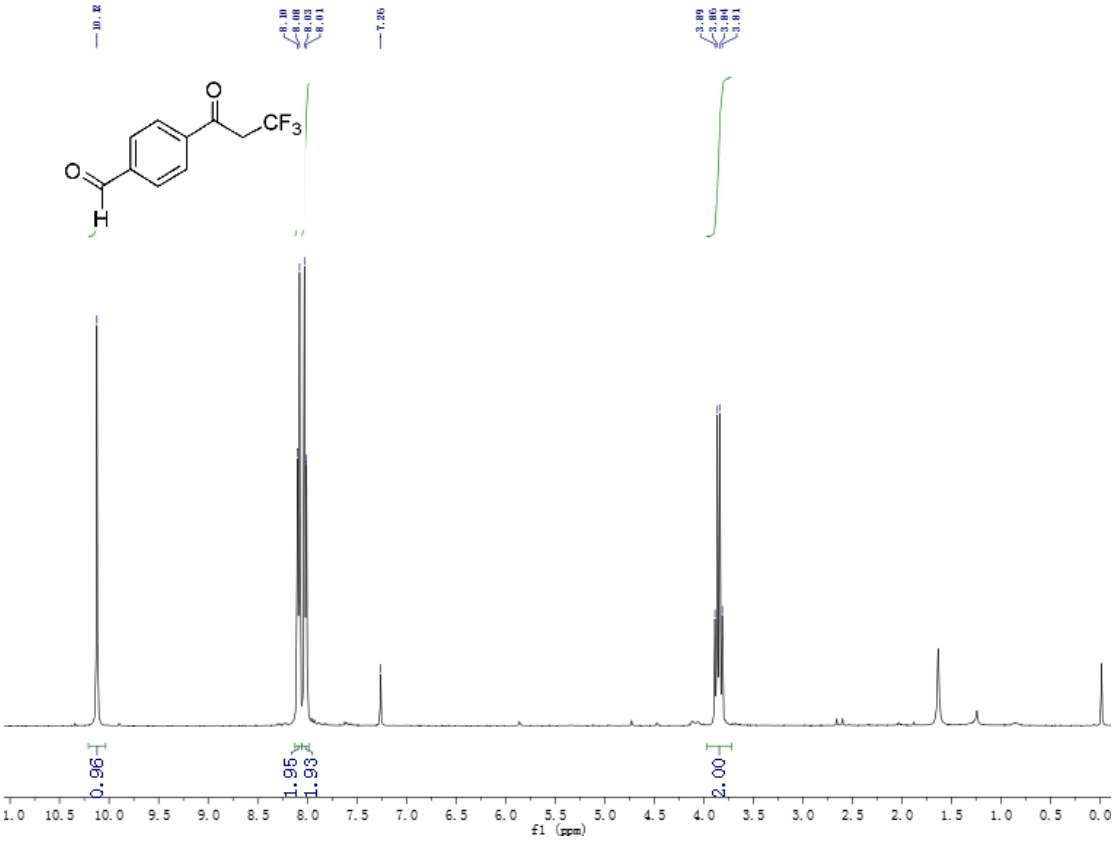
^{13}C NMR of **2g**



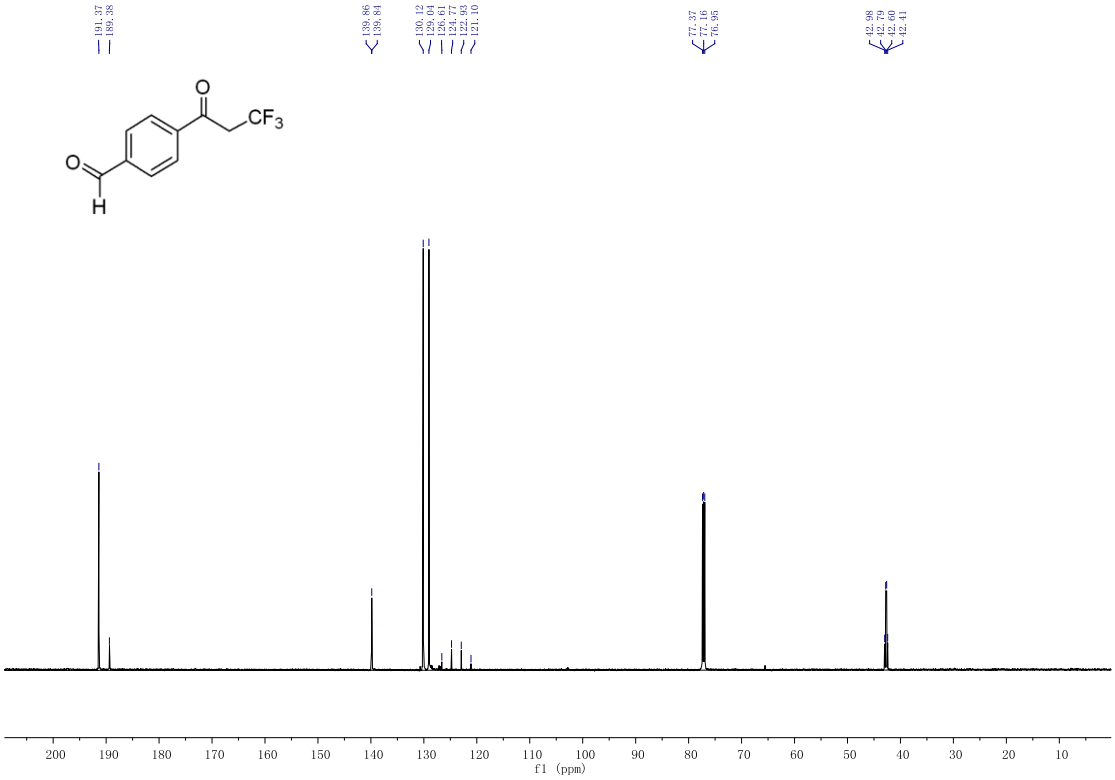
^{19}F NMR of **2g**



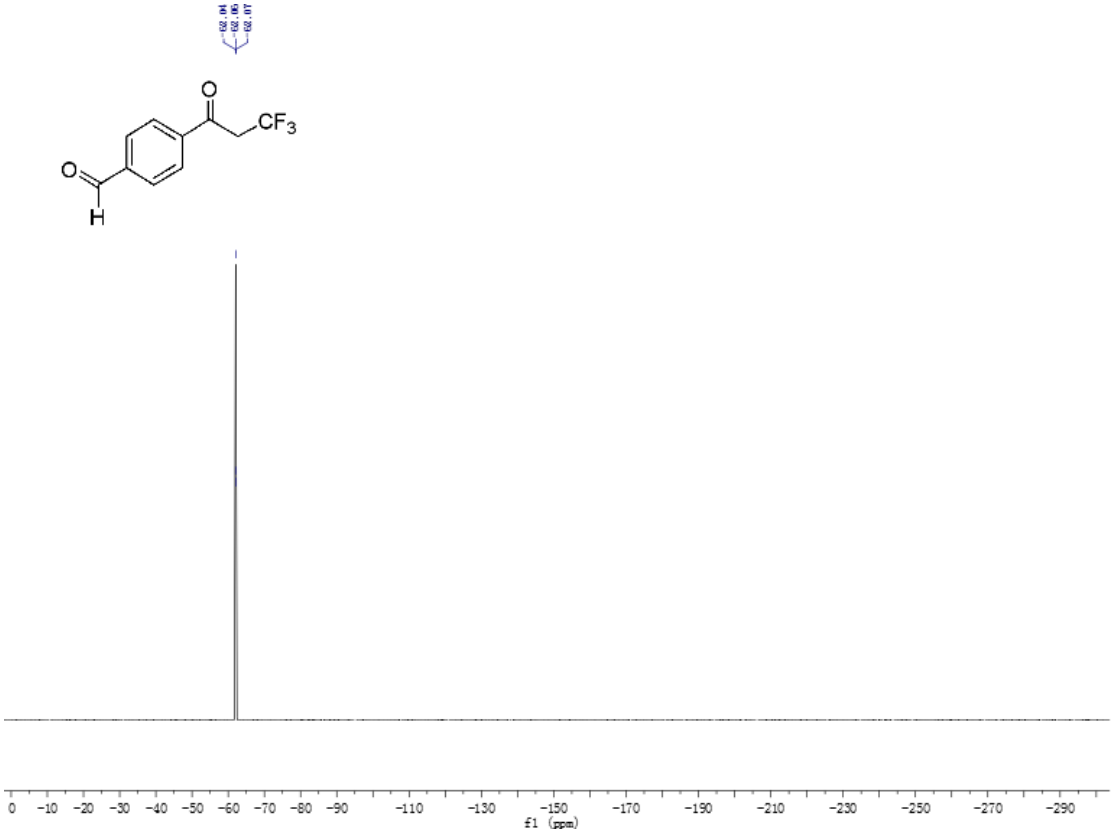
^{1}H NMR of **2h**



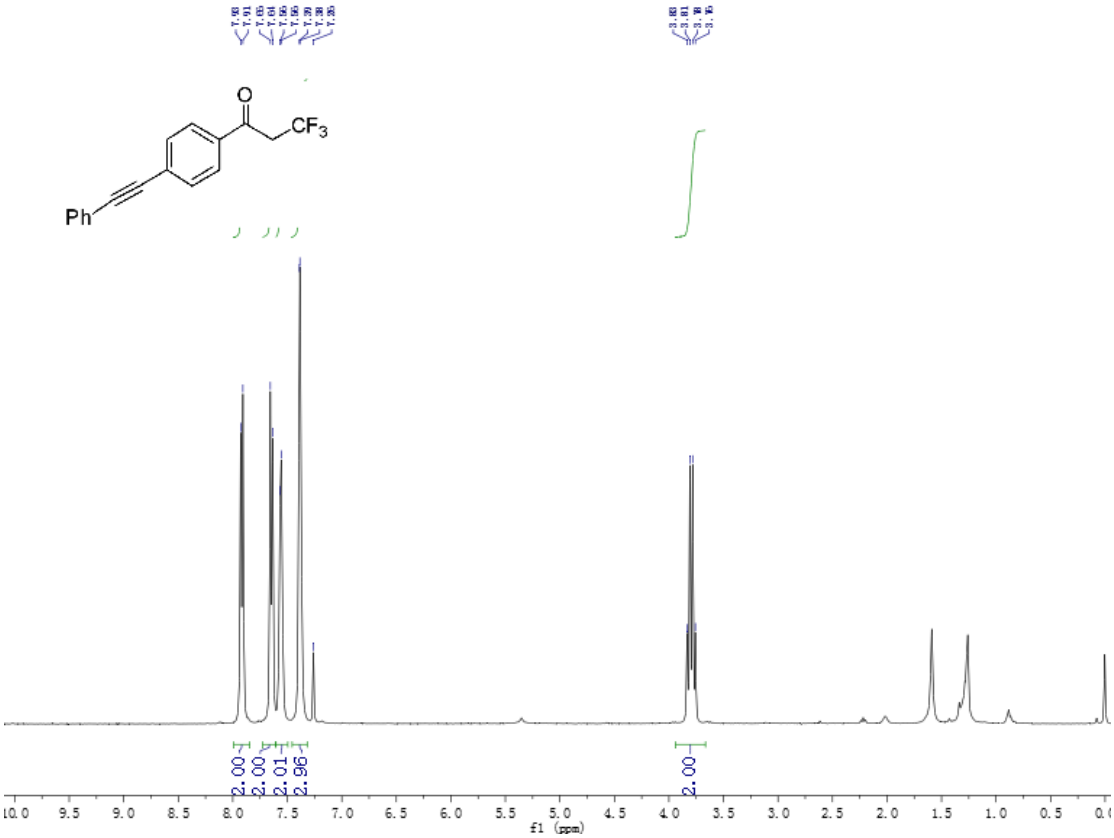
^{13}C NMR of **2h**



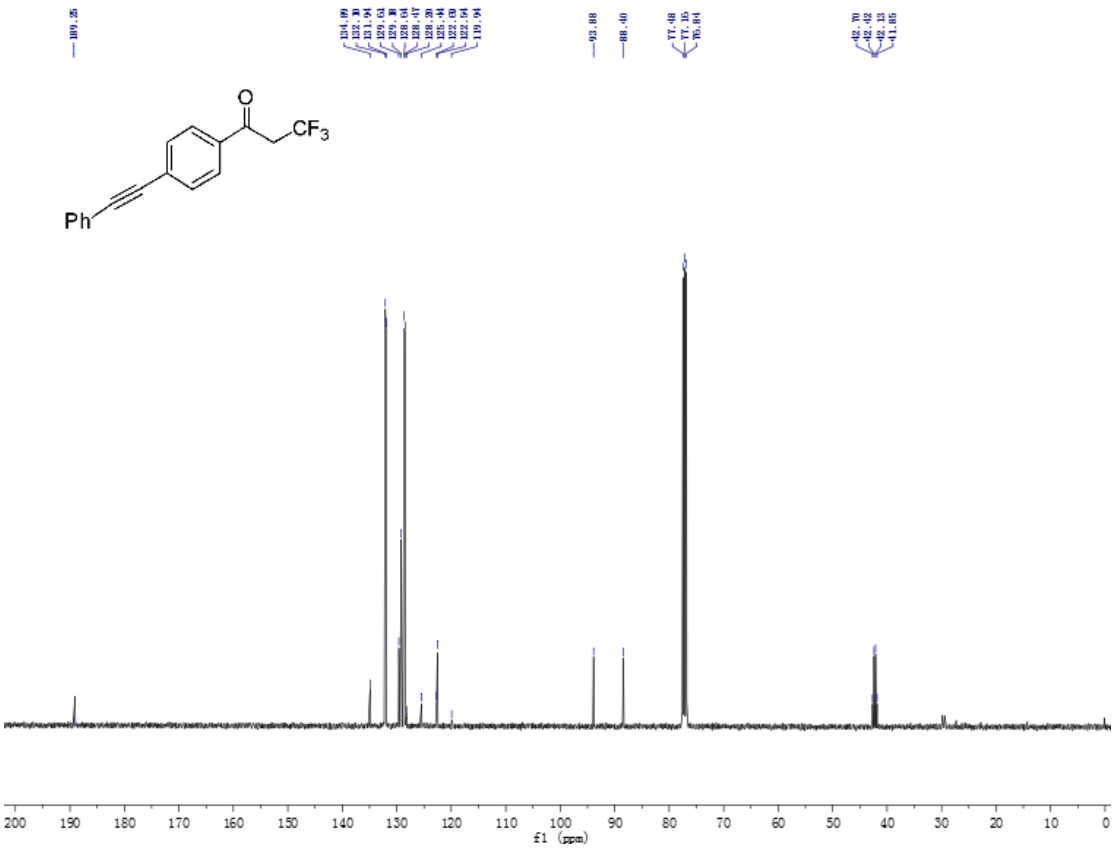
^{19}F NMR of **2h**



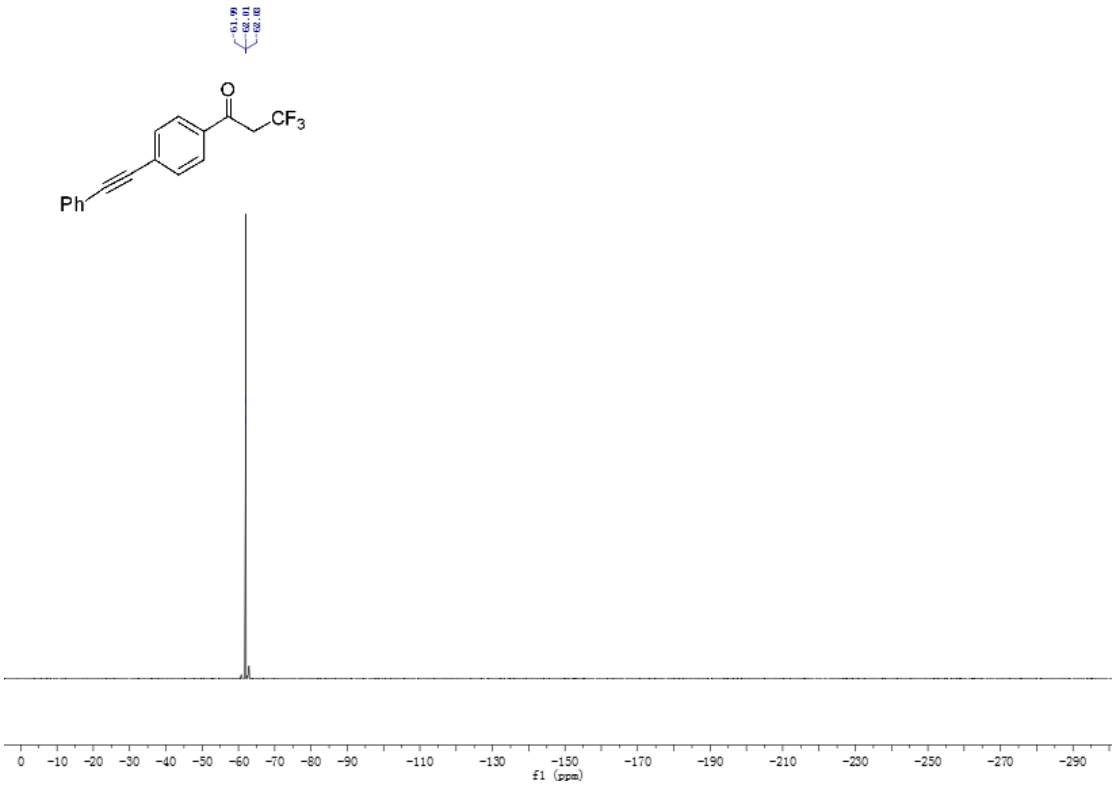
^{1}H NMR of **2i**



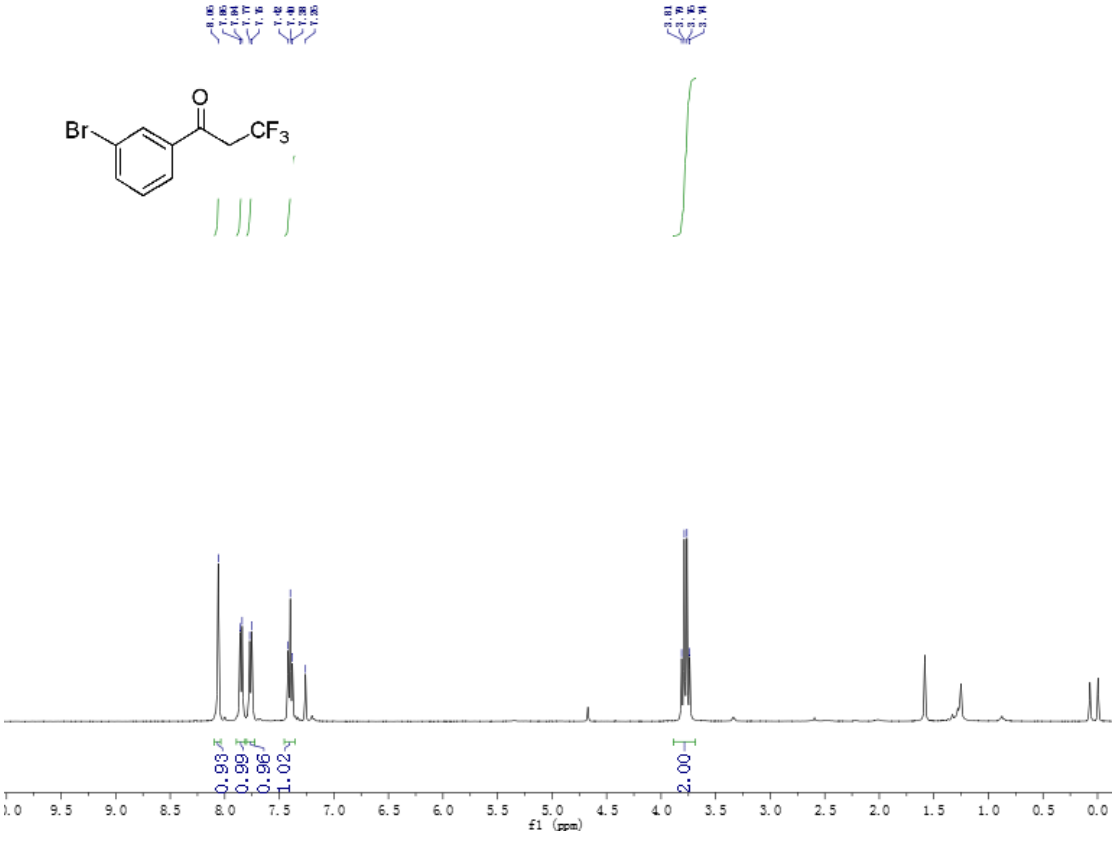
^{13}C NMR of **2i**



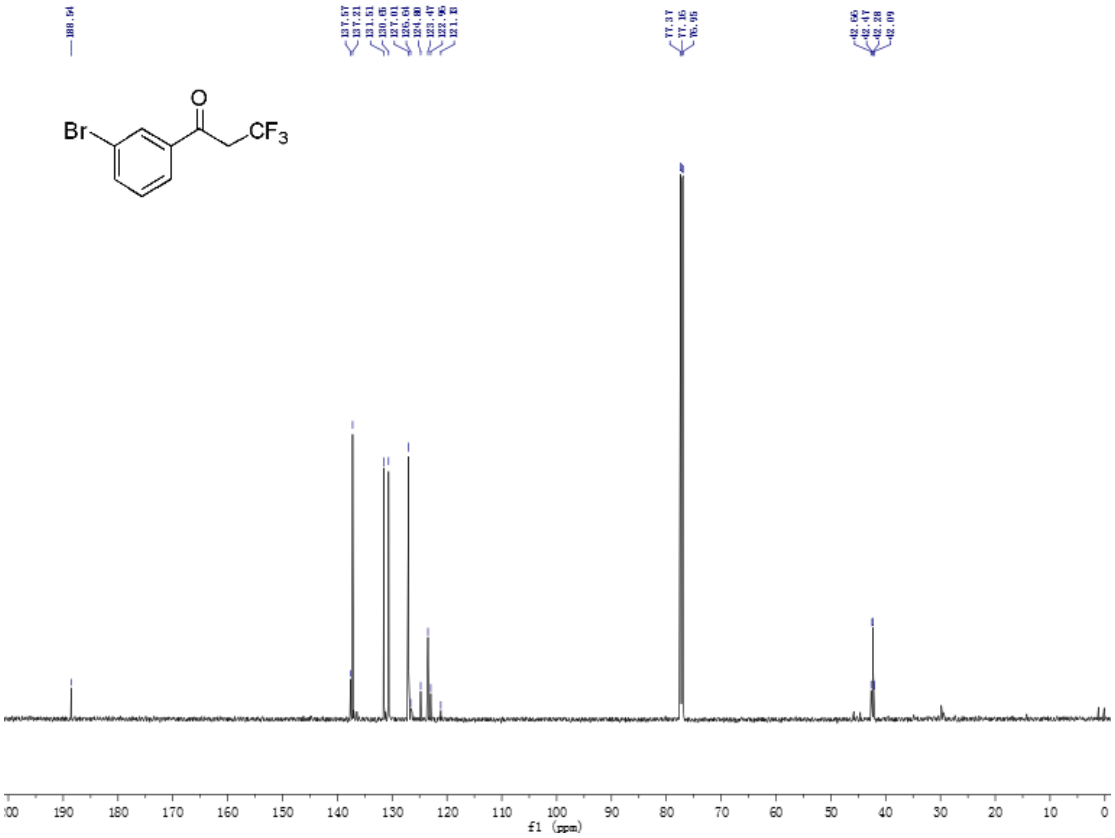
^{19}F NMR of **2i**



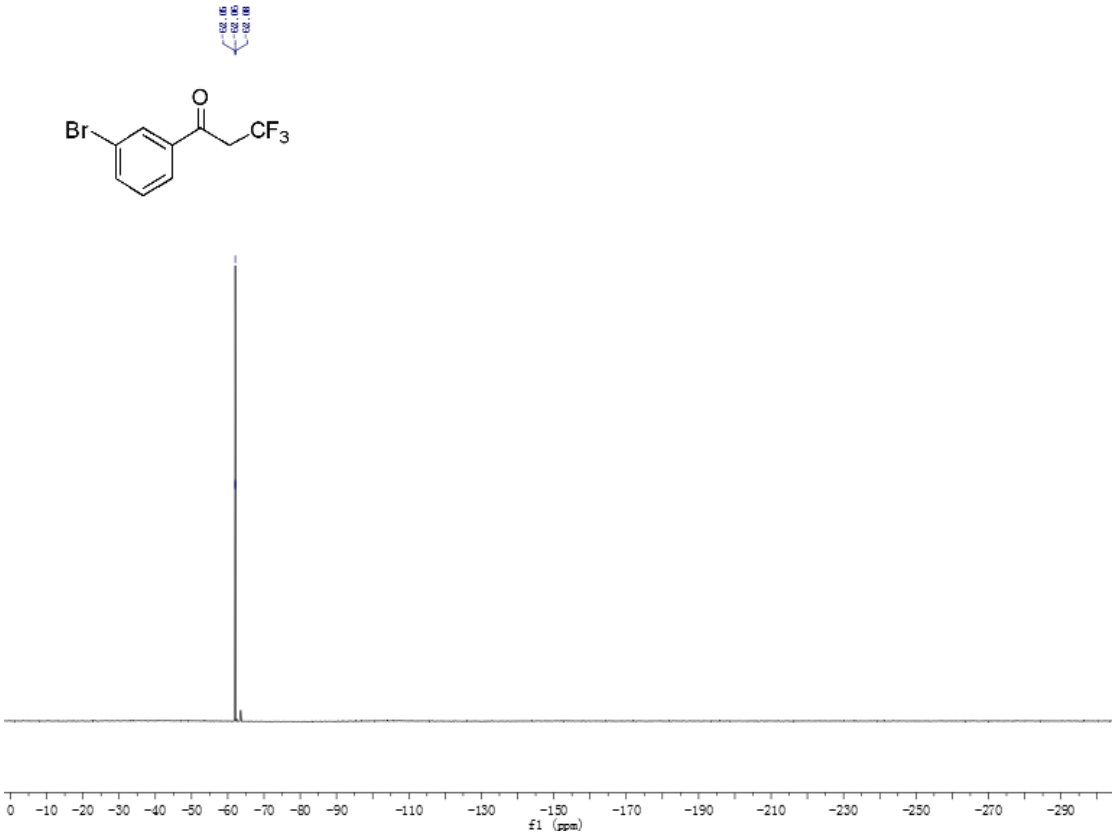
^{1}H NMR of **2j**



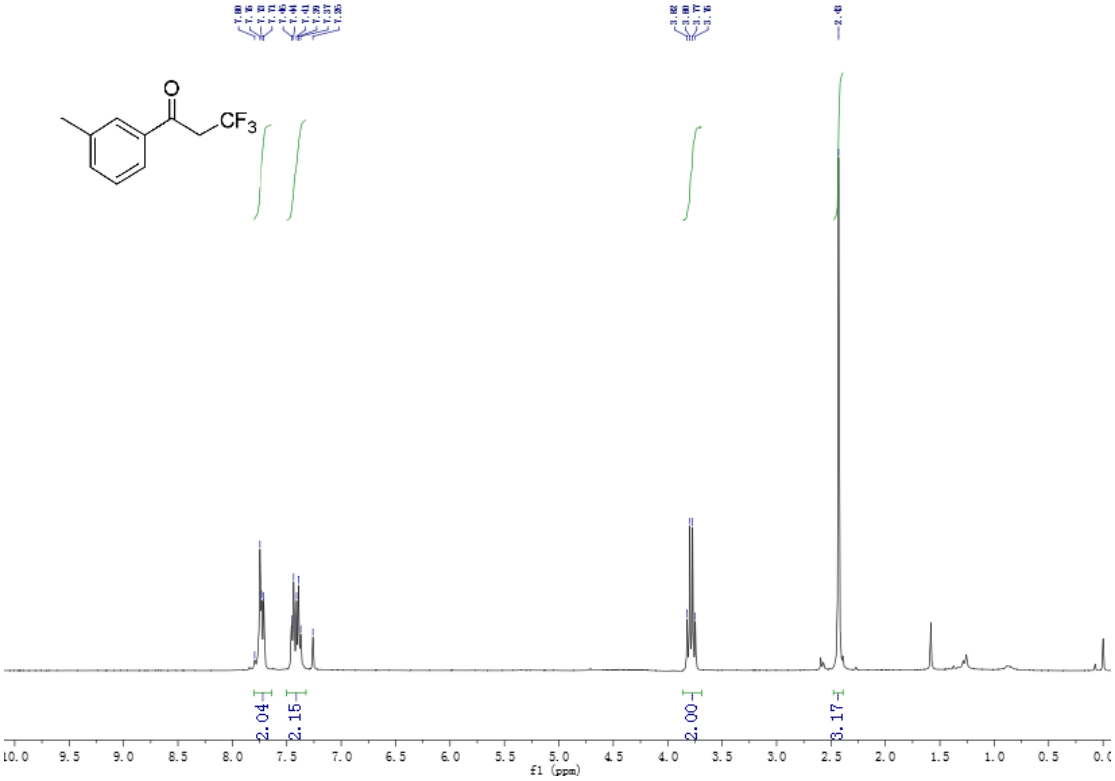
^{13}C NMR of **2j**



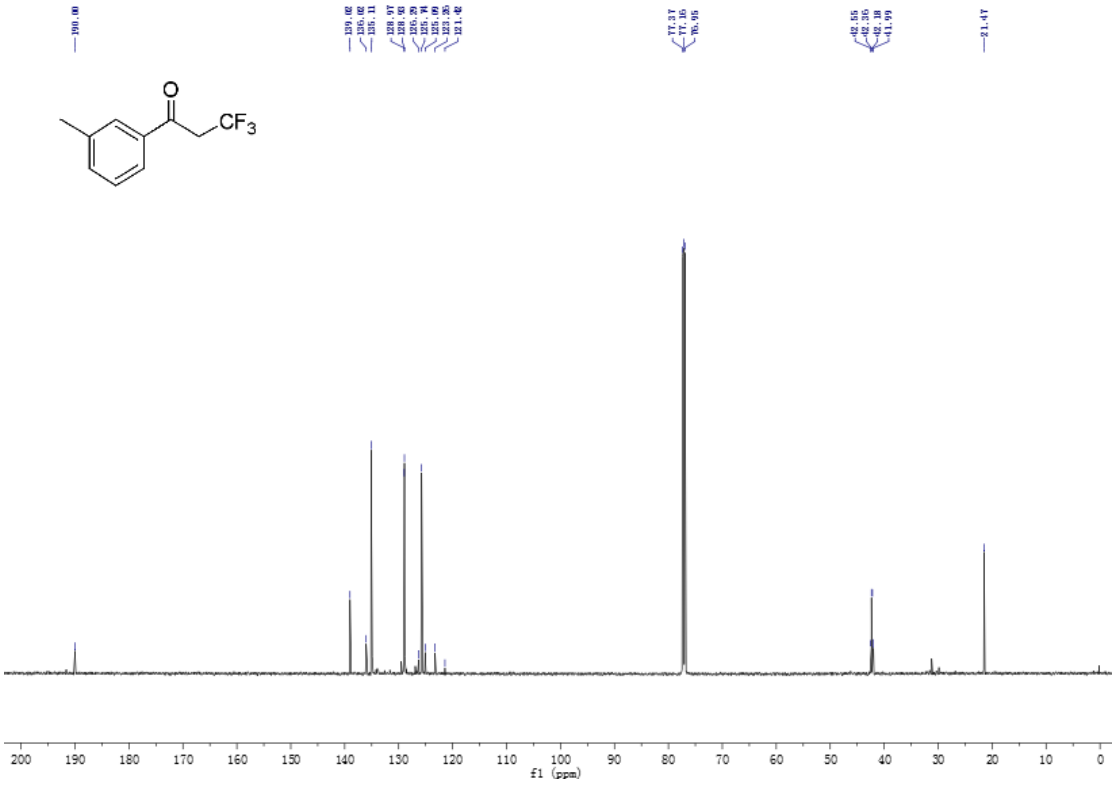
^{19}F NMR of **2j**



^{1}H NMR of **2k**



^{13}C NMR of **2k**



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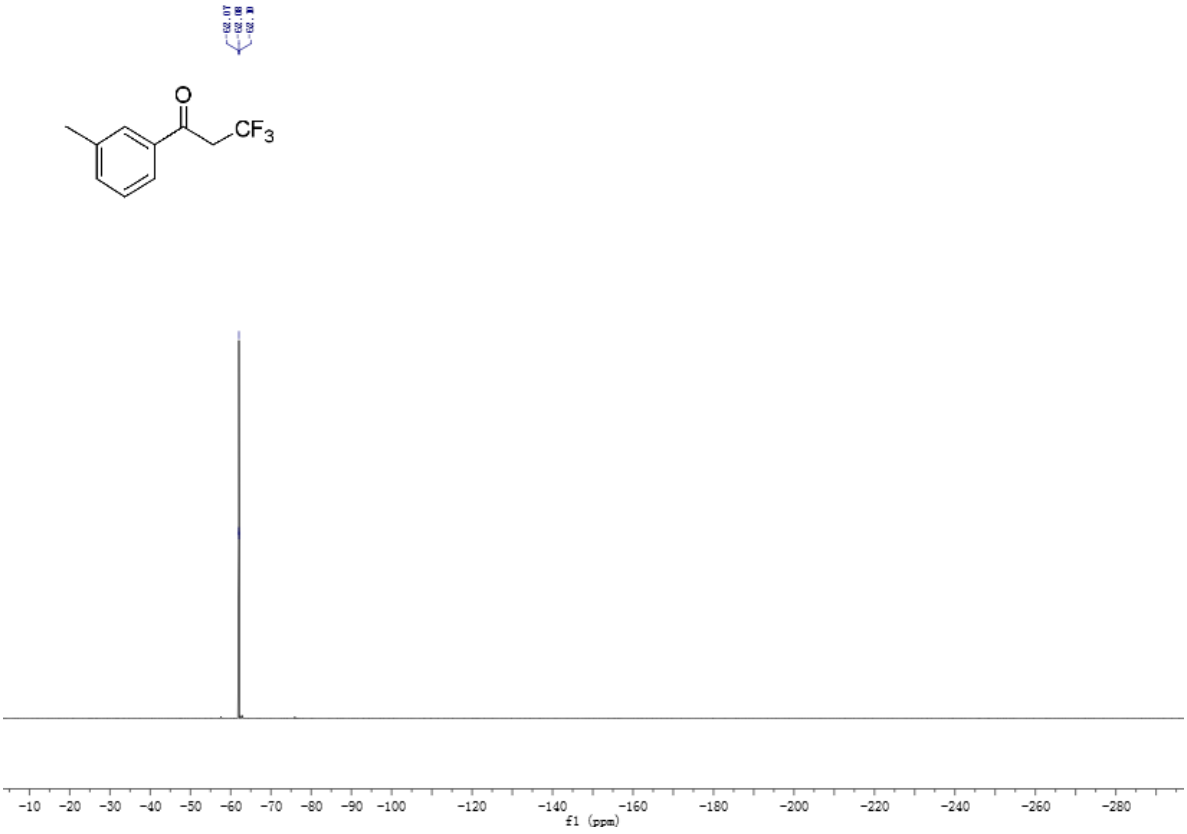
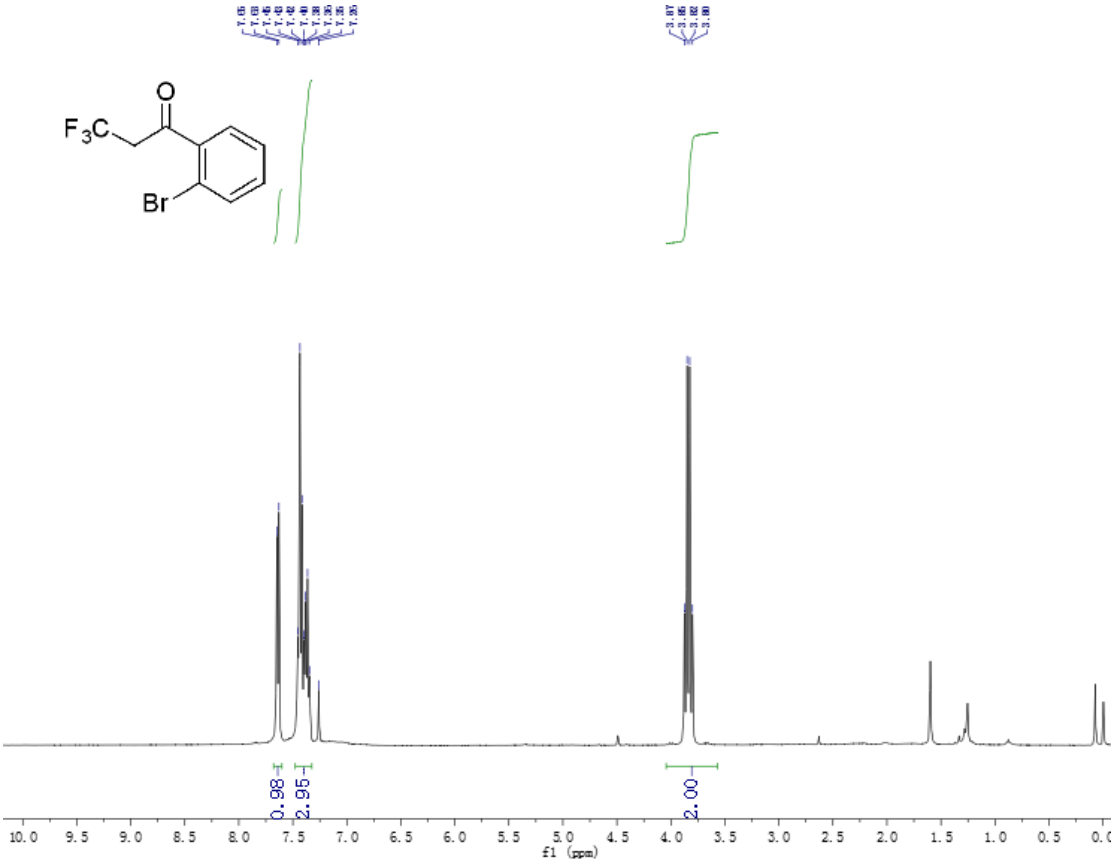
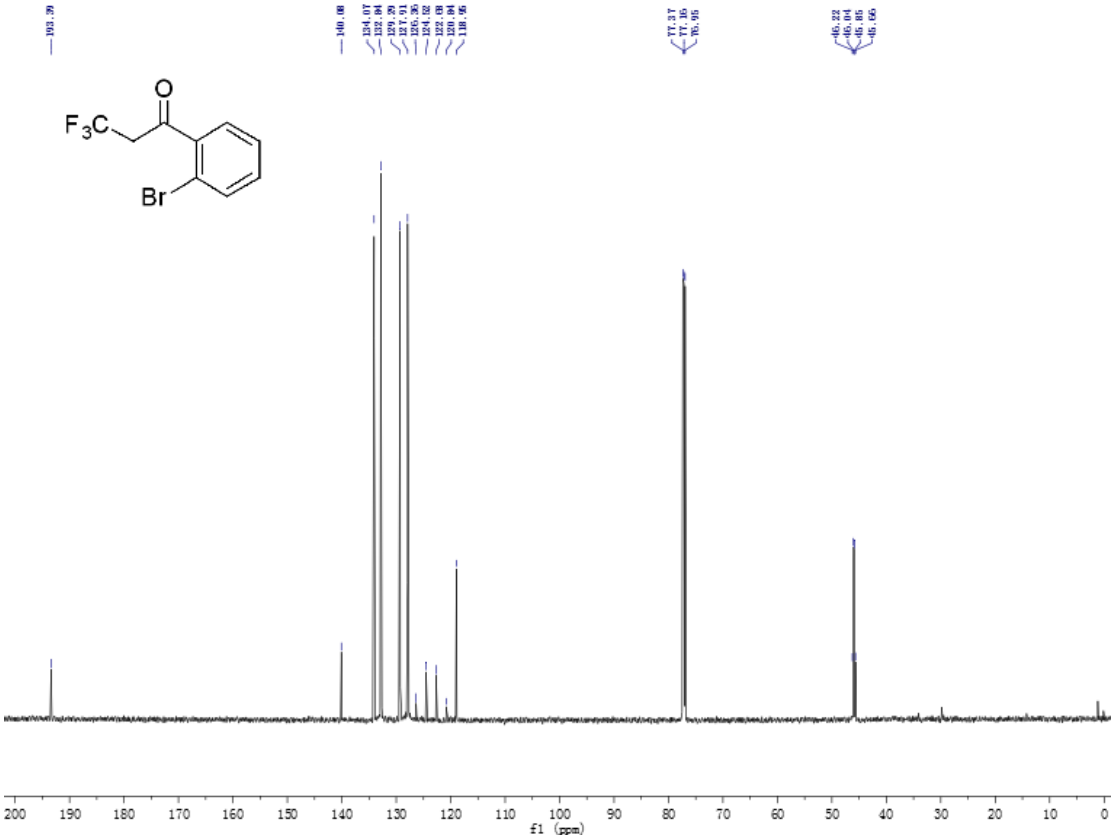


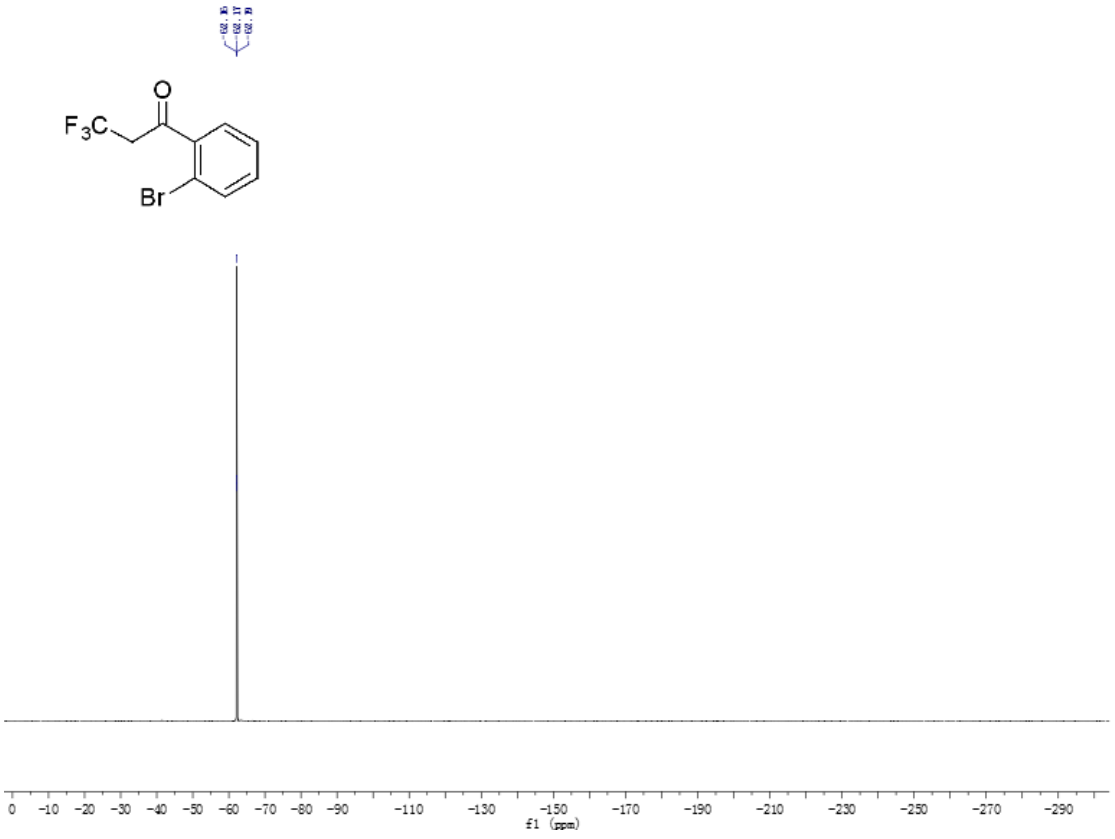
^{1}H NMR of **2l**



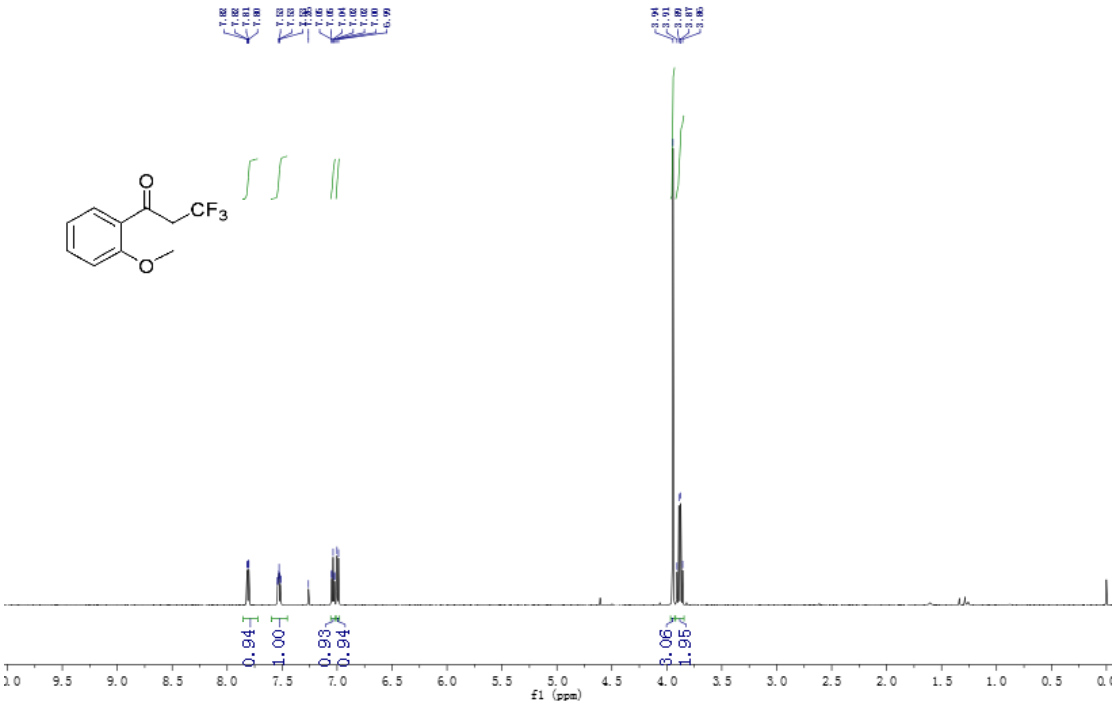
^{13}C NMR of **2l**



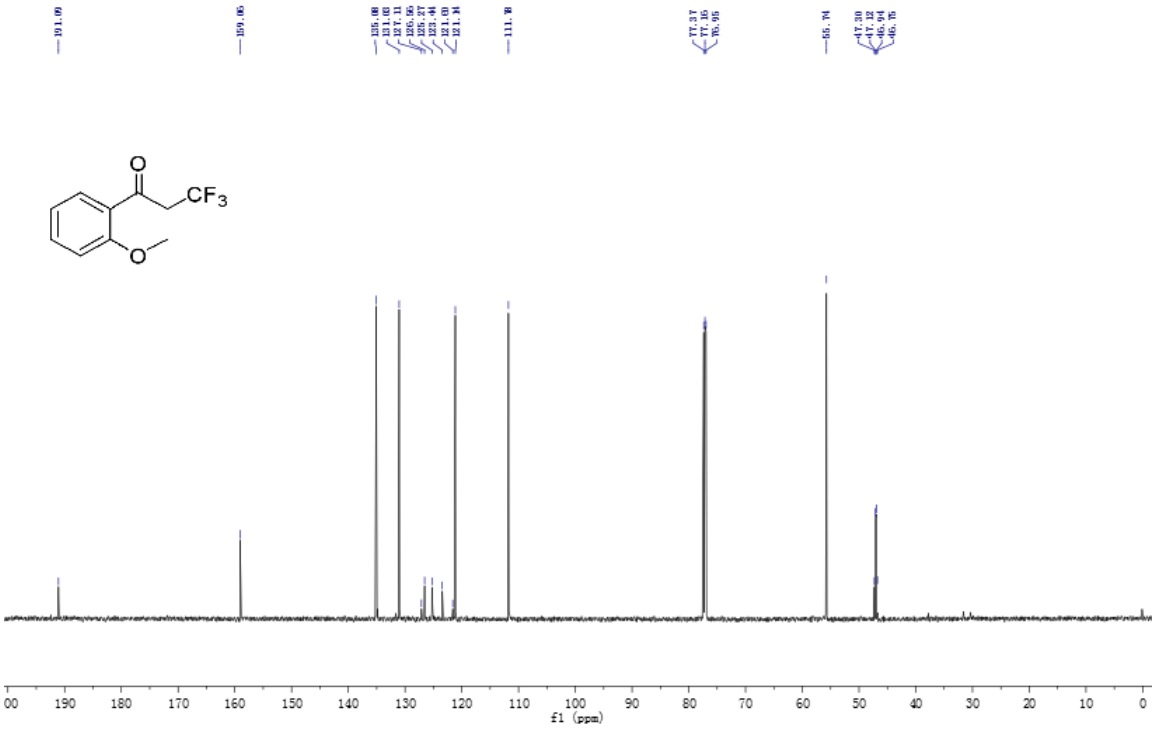
^{19}F NMR of **2l**



^{1}H NMR of **2m**



^{13}C NMR of **2m**



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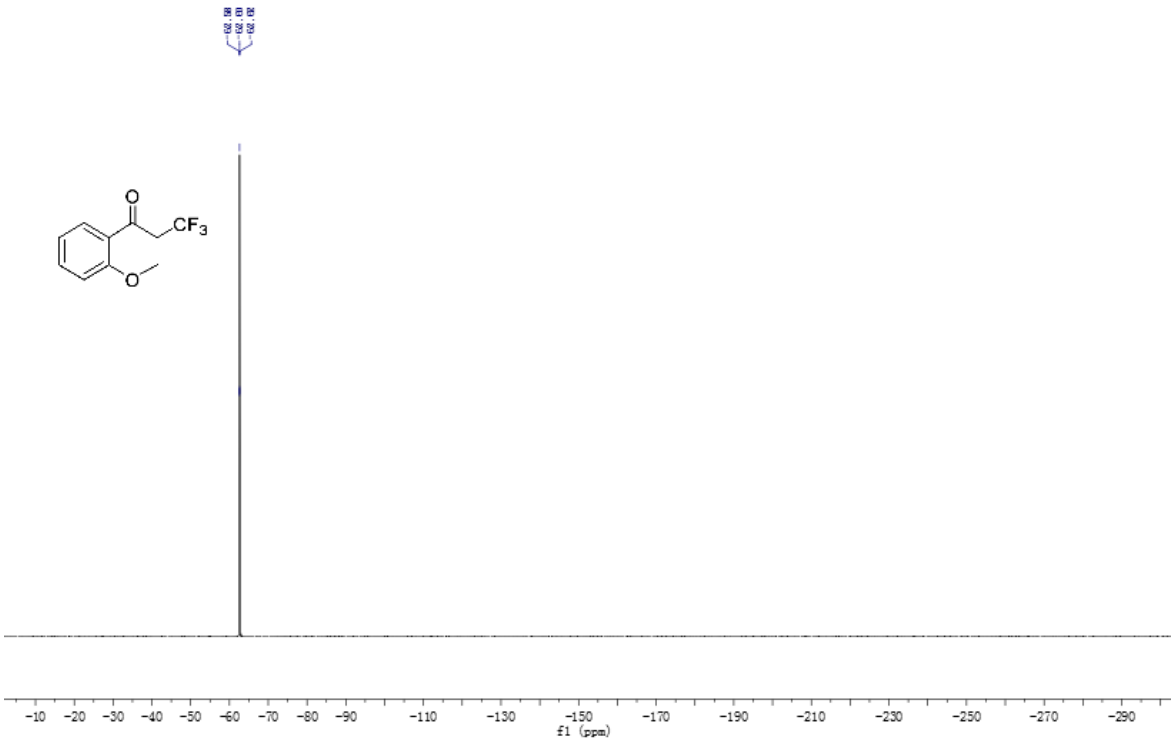
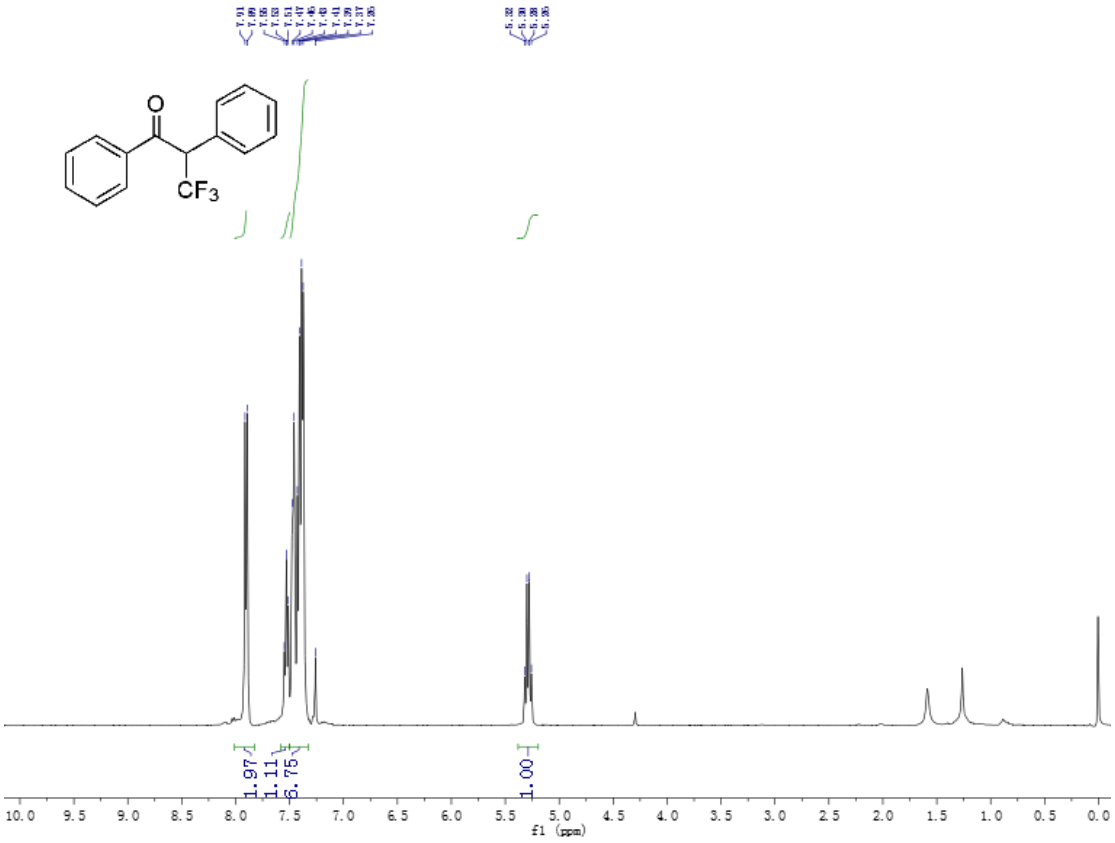
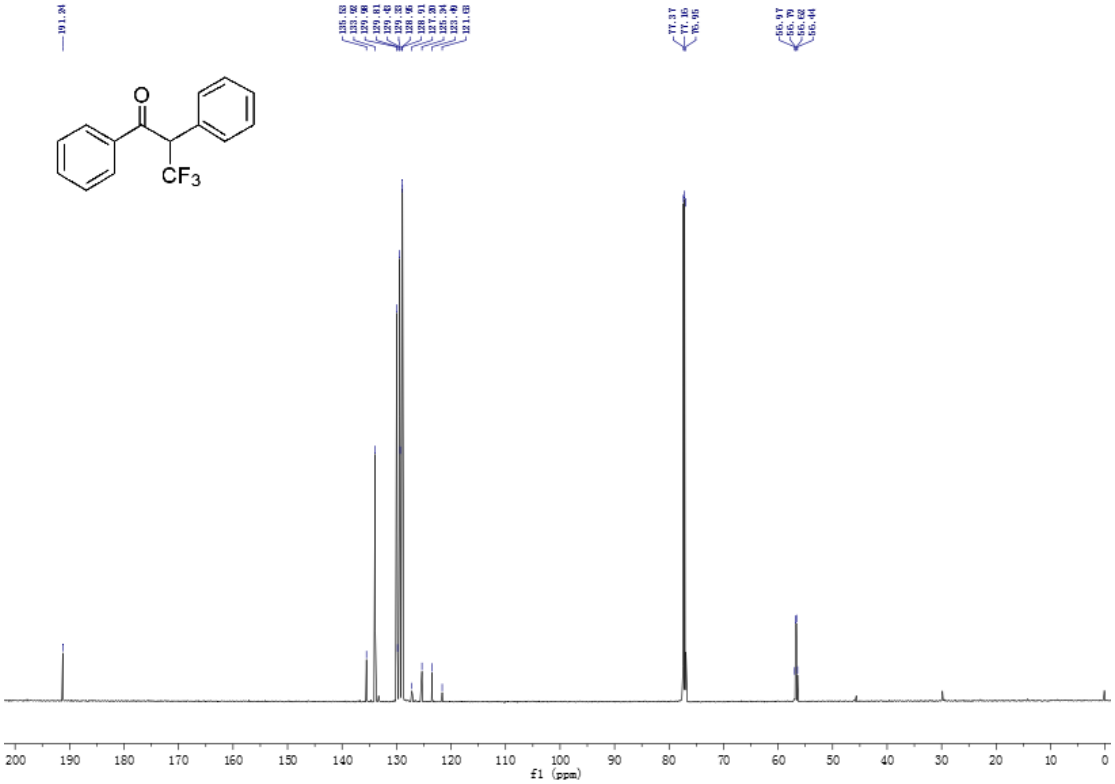


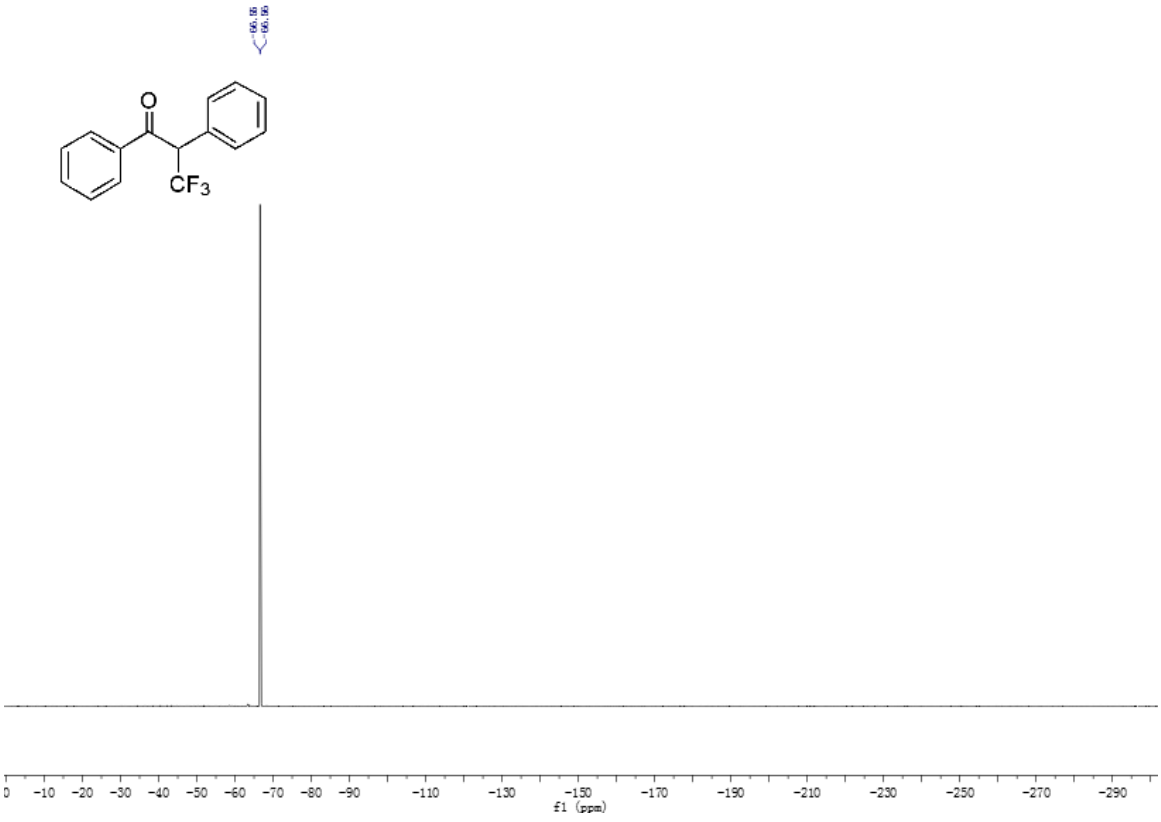
^{1}H NMR of **2n**



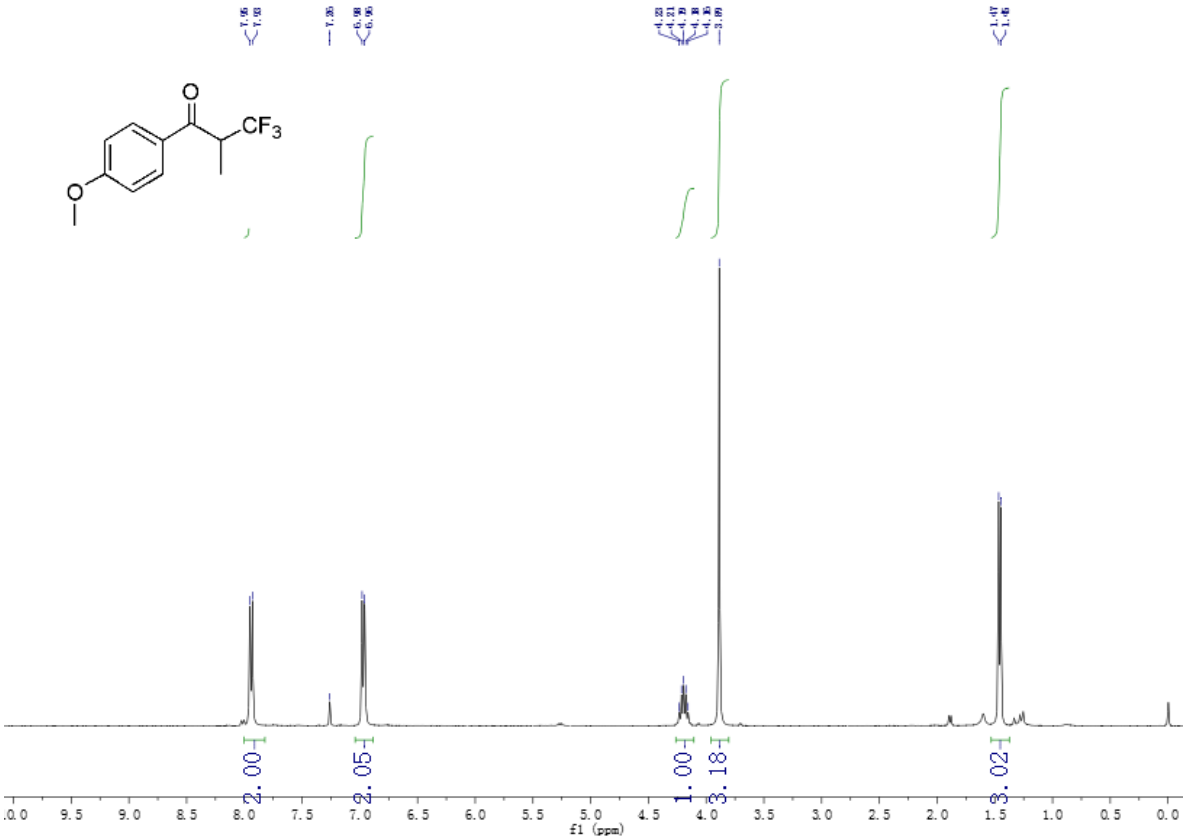
^{13}C NMR of **2n**



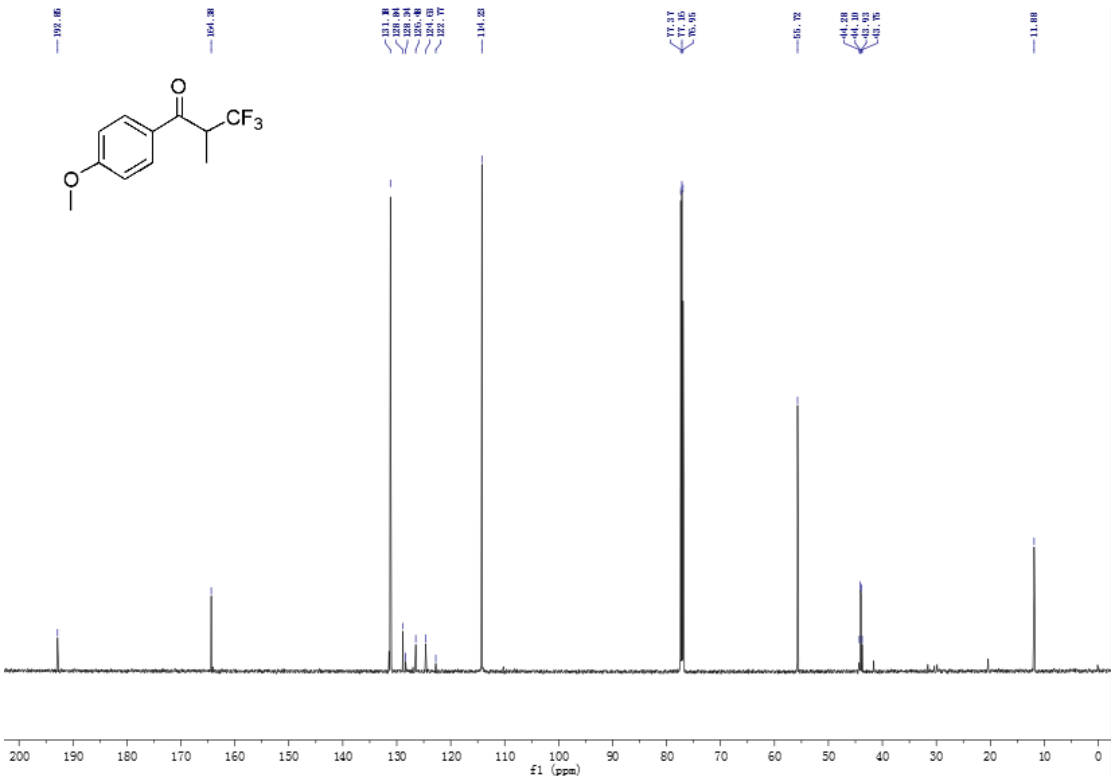
^{19}F NMR of **2n**



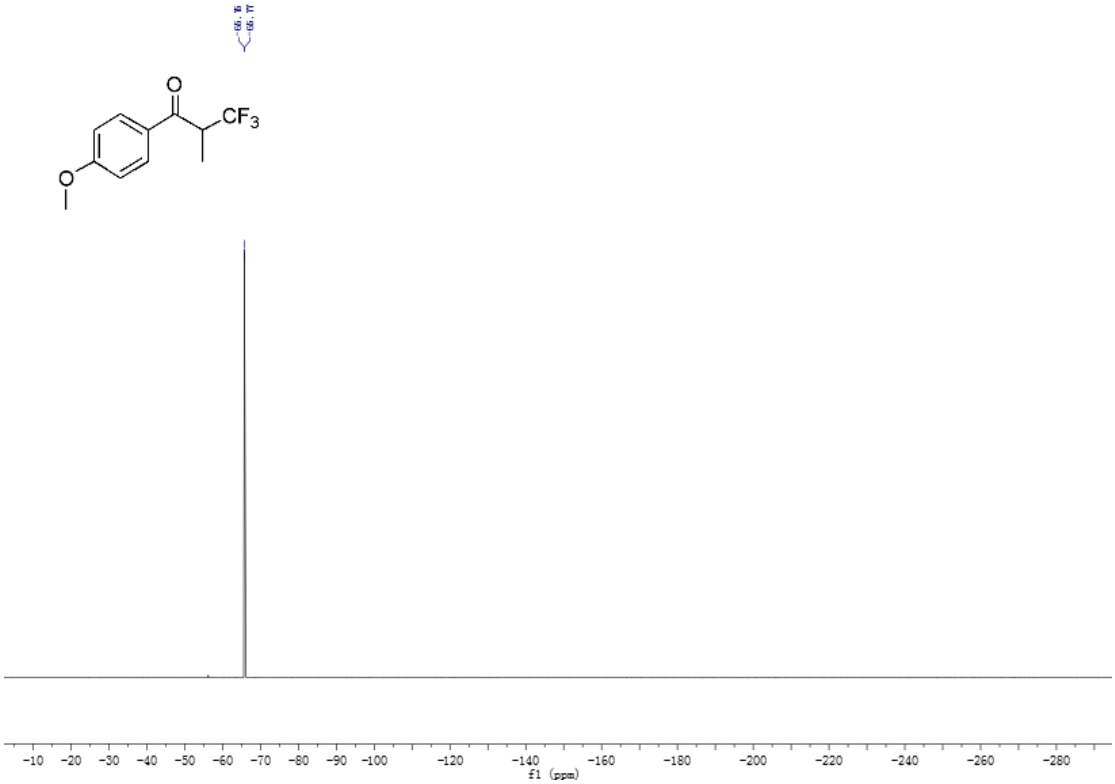
^{1}H NMR of **2o**



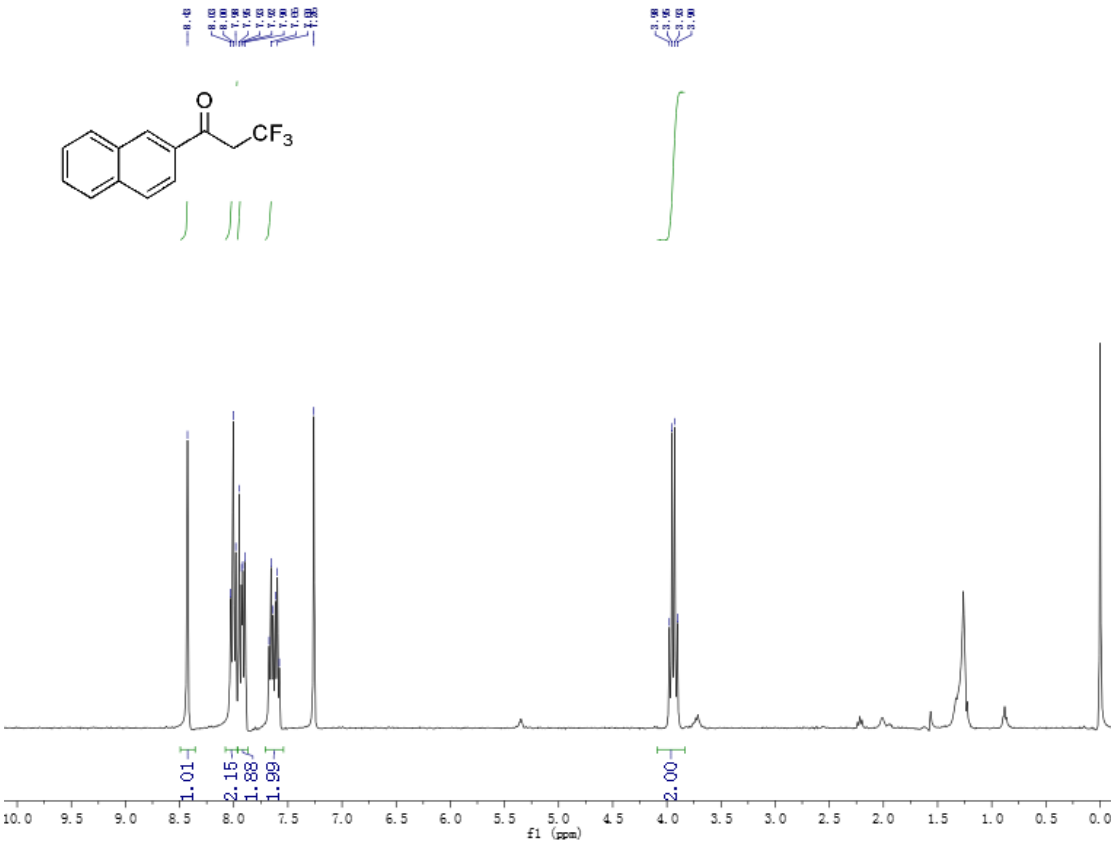
^{13}C NMR of **2o**



^{19}F NMR of **2o**



^{1}H NMR of **2p**



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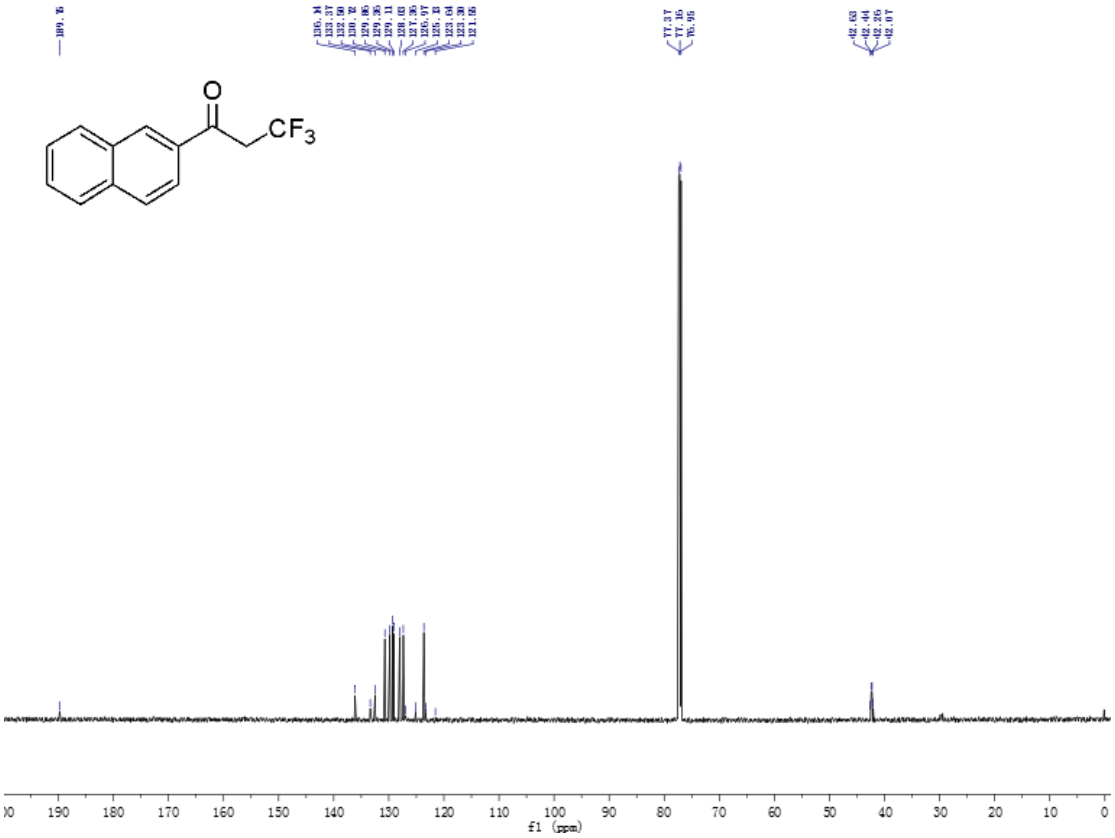

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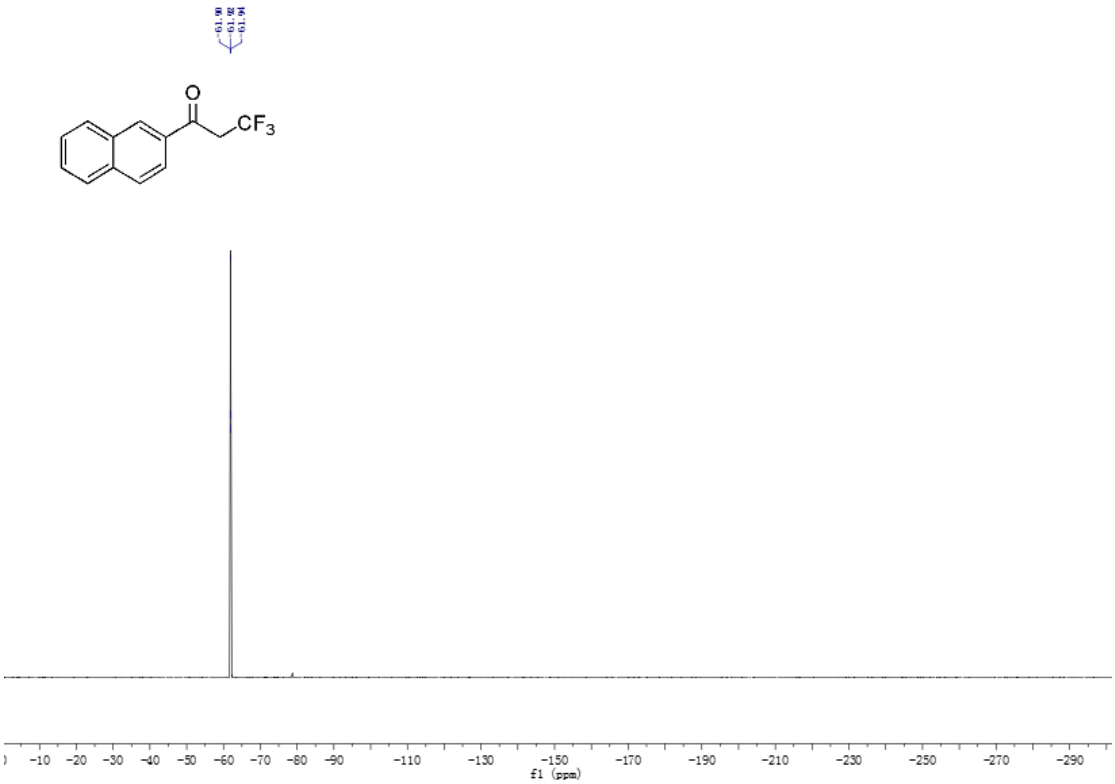

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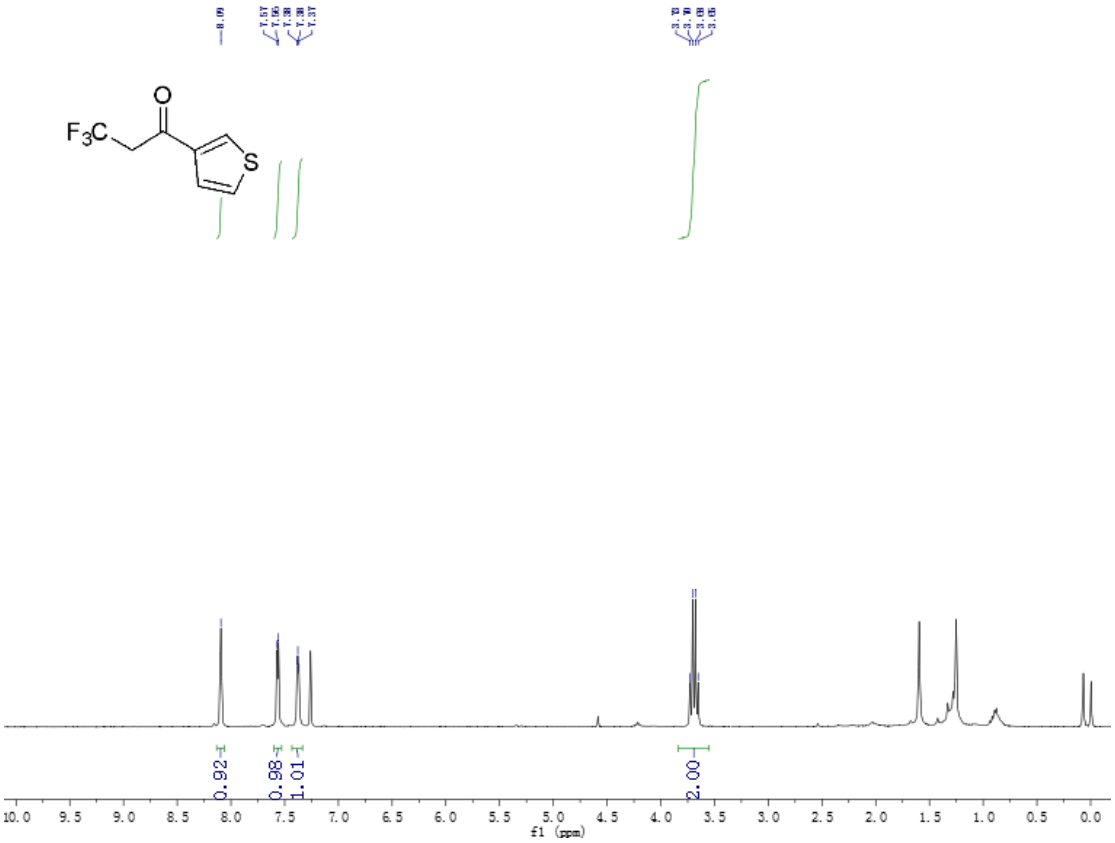

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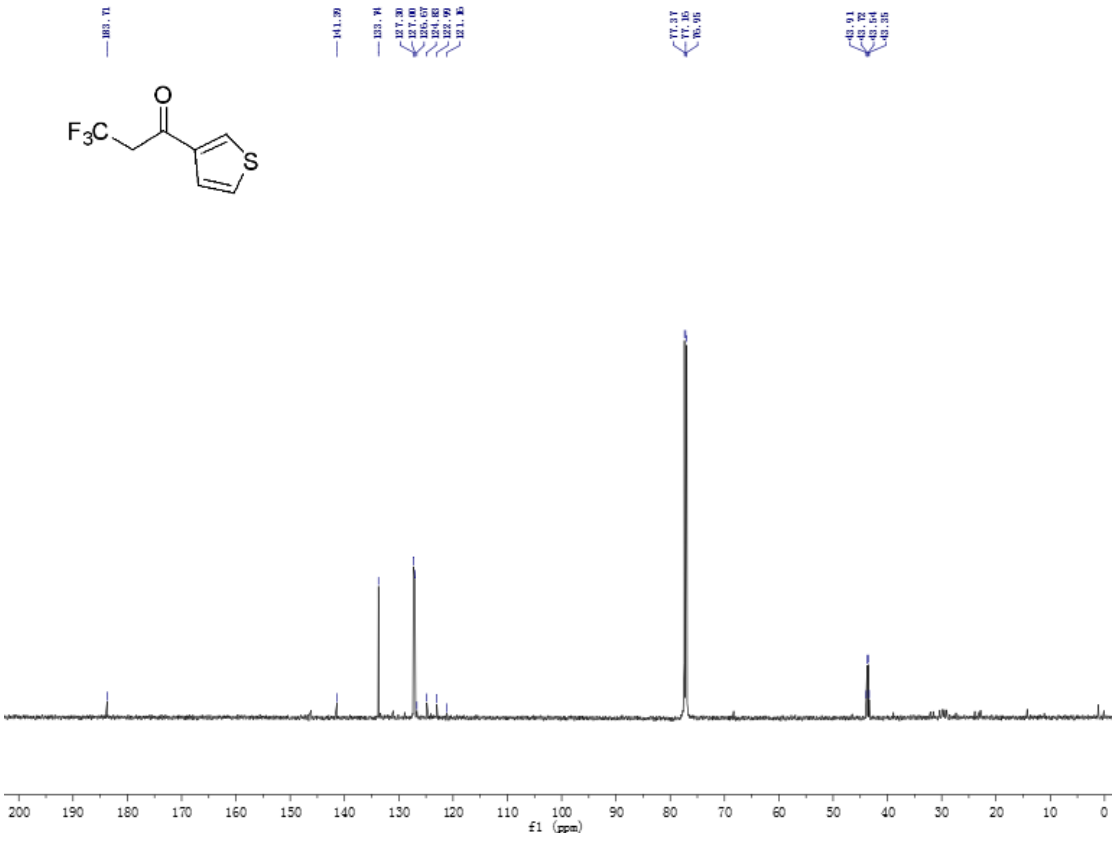
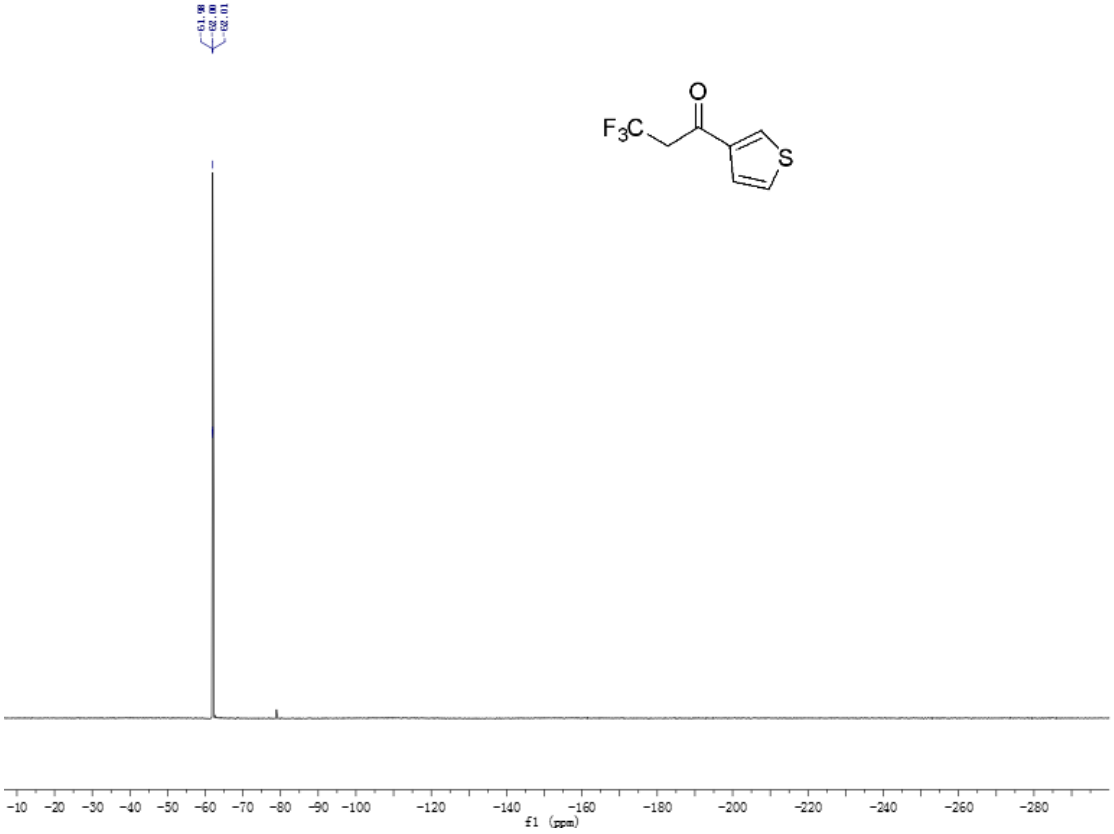


^{19}F NMR of **2q**



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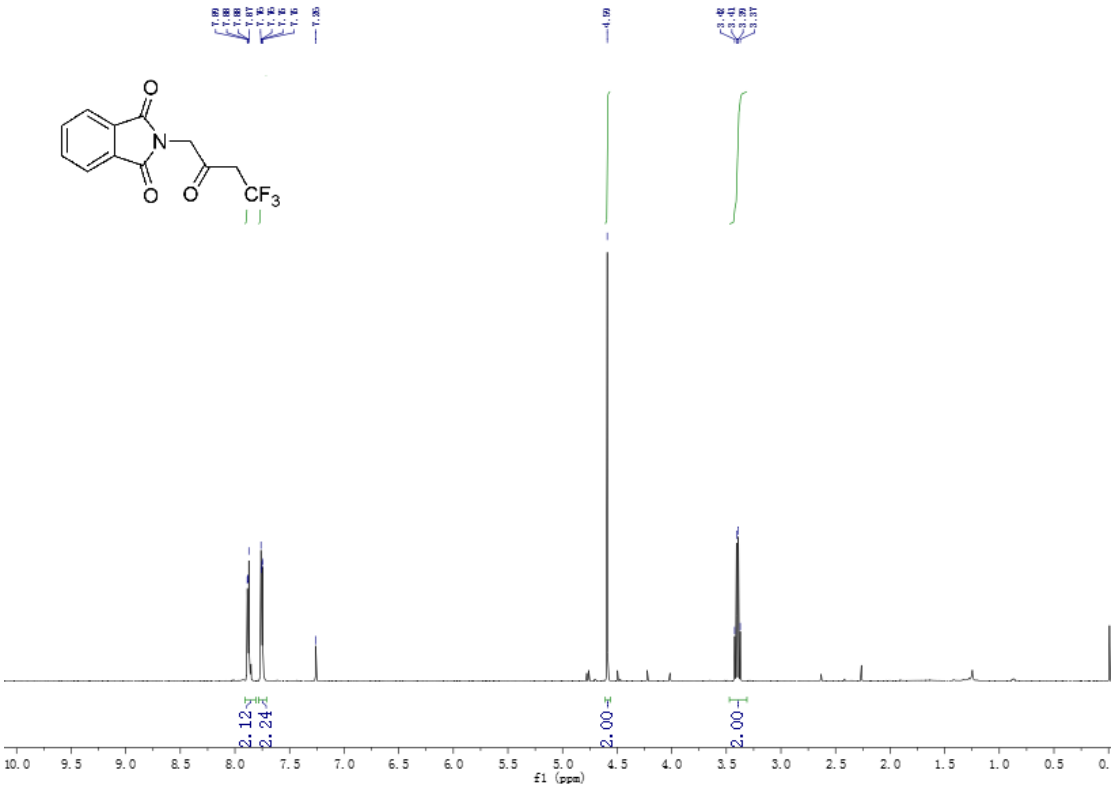

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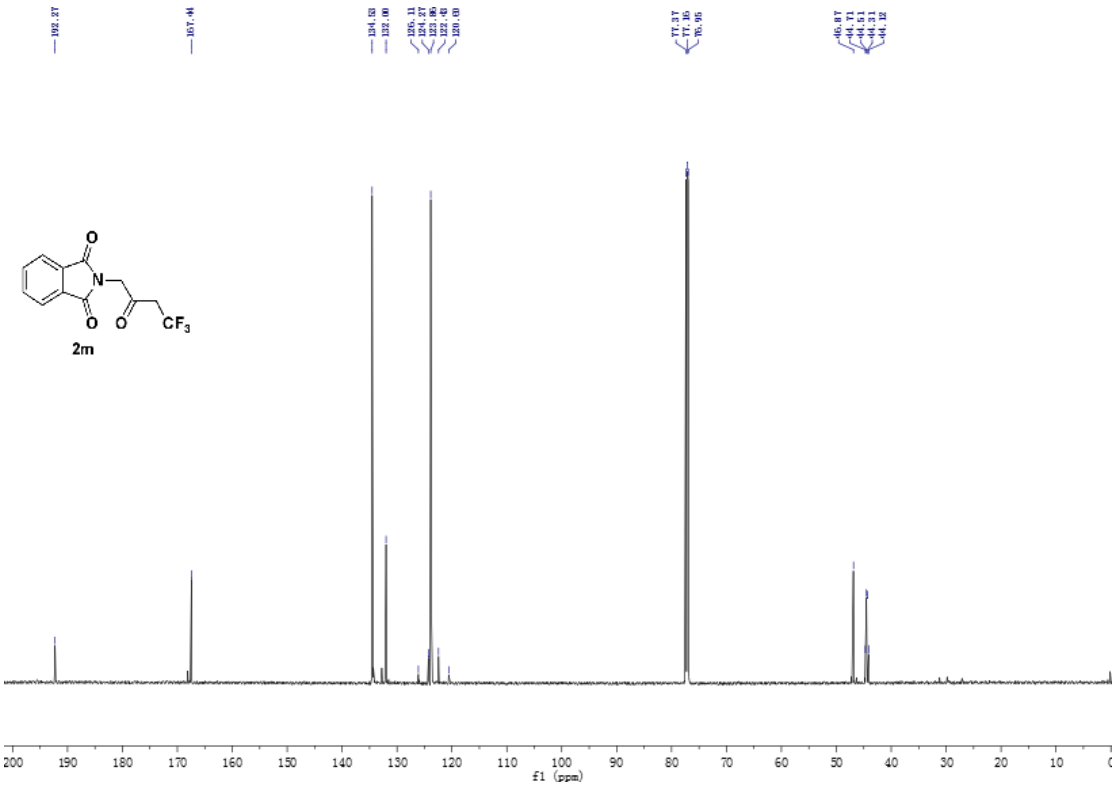

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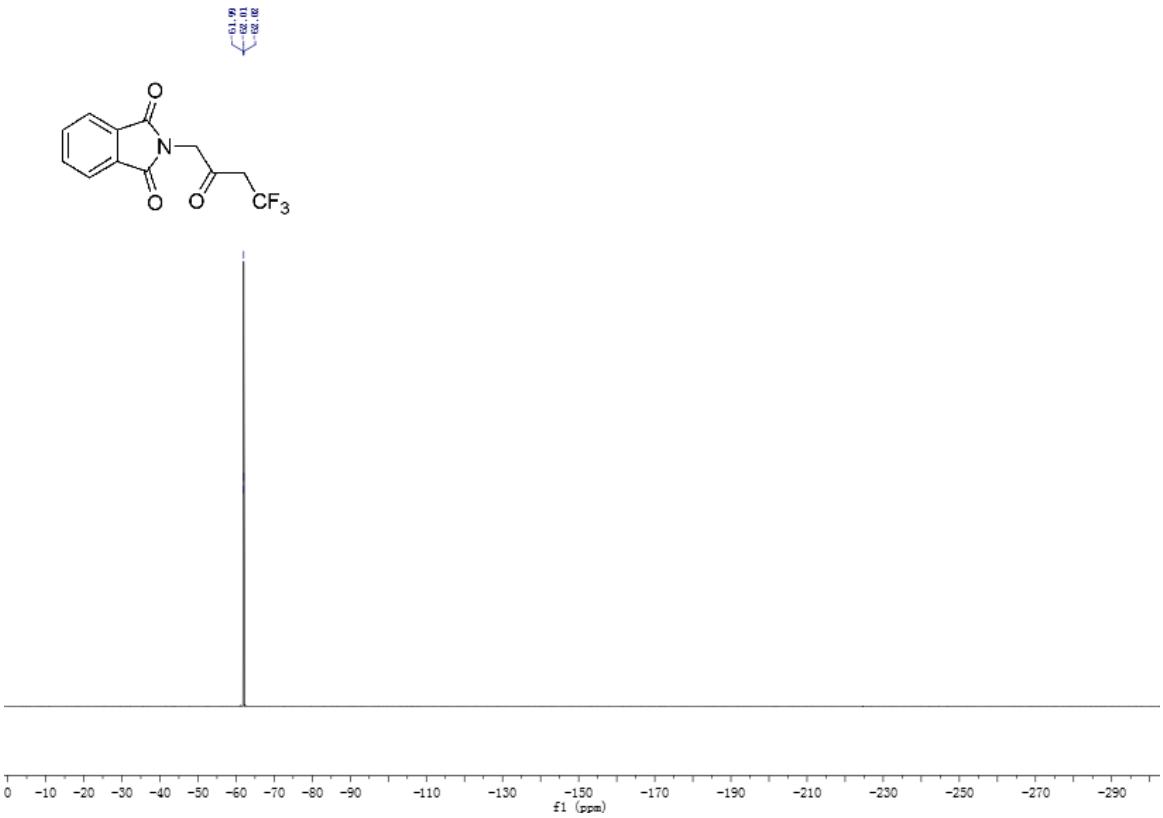

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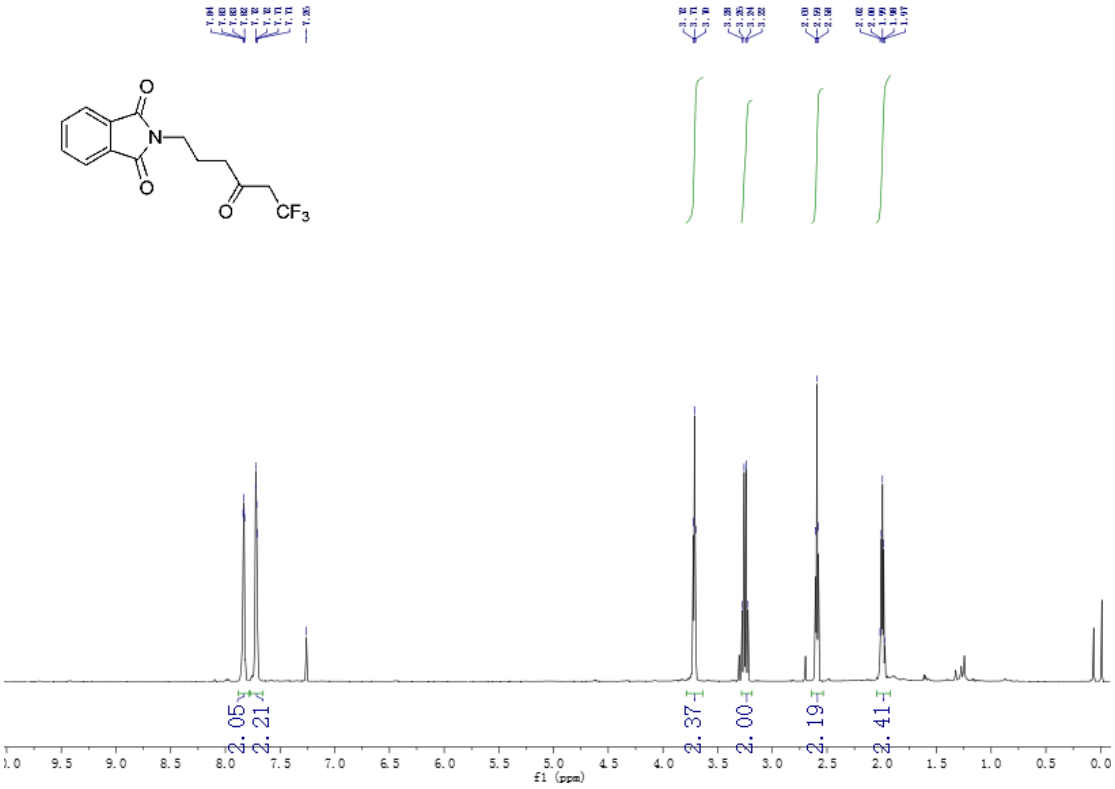

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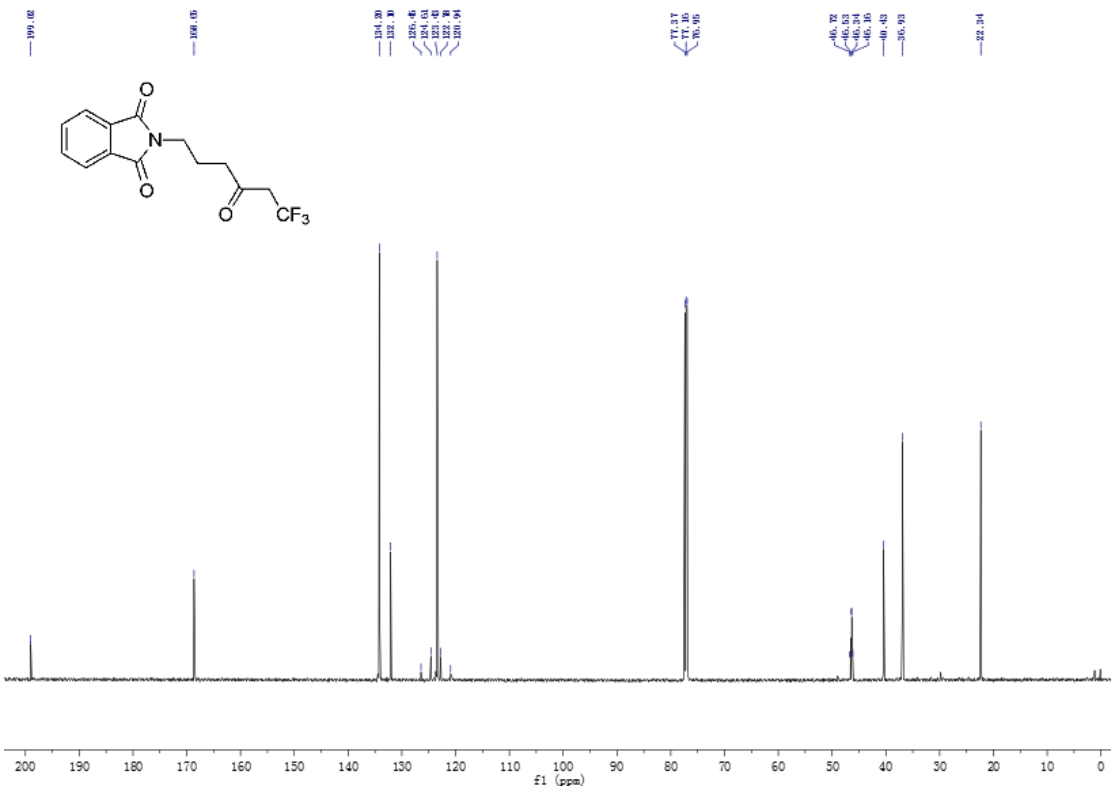

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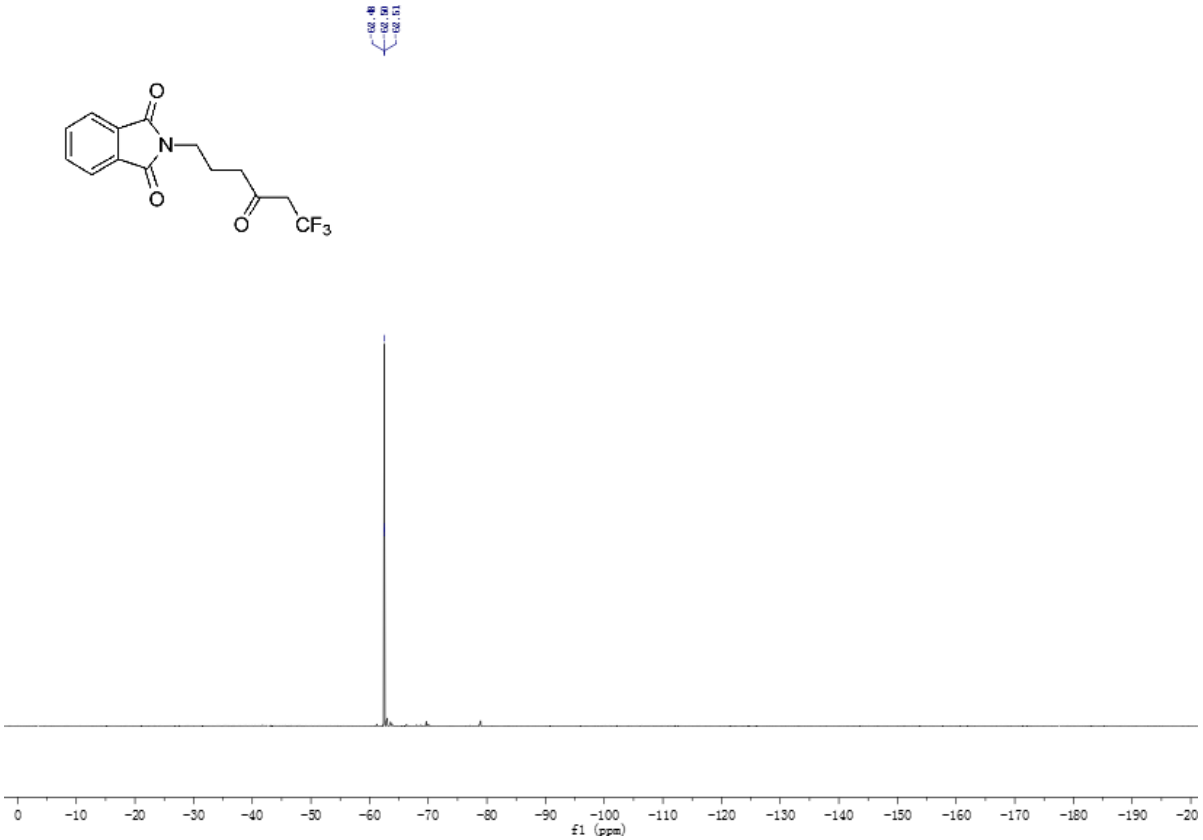

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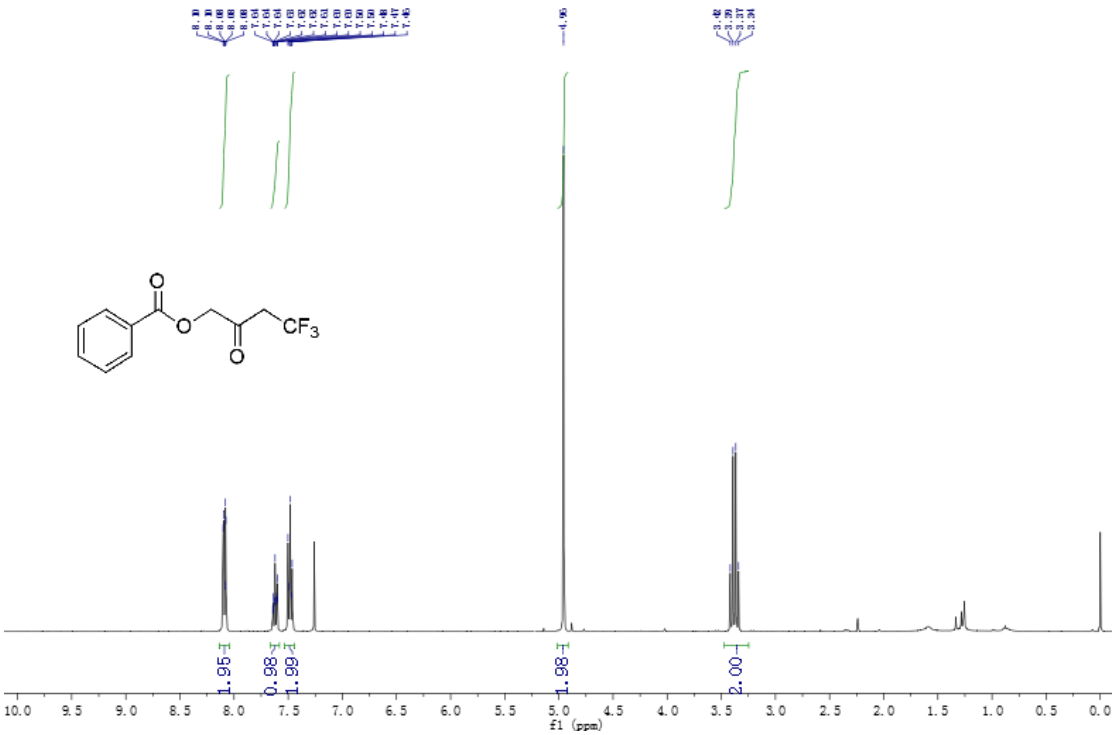

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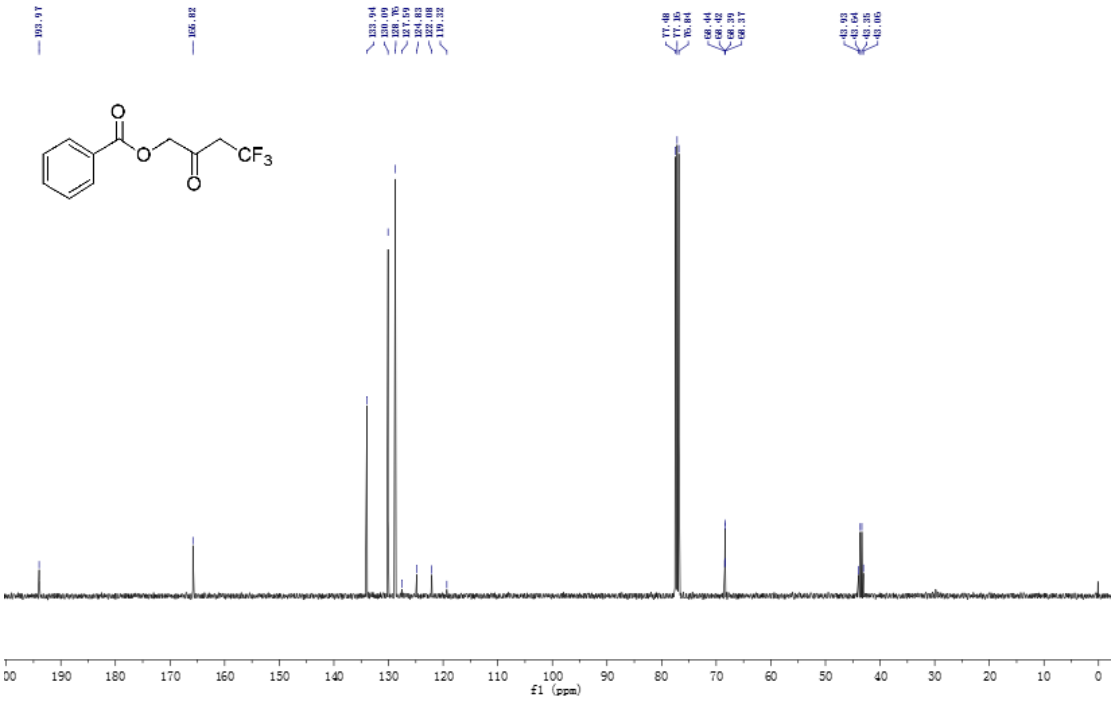

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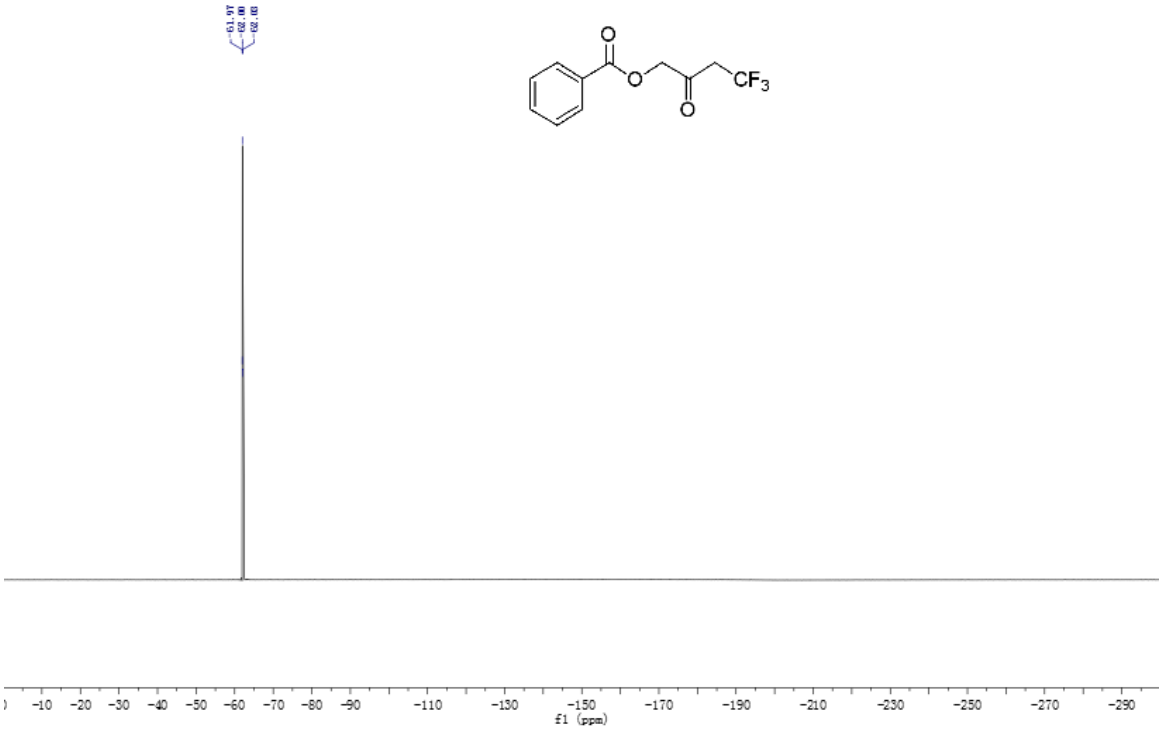

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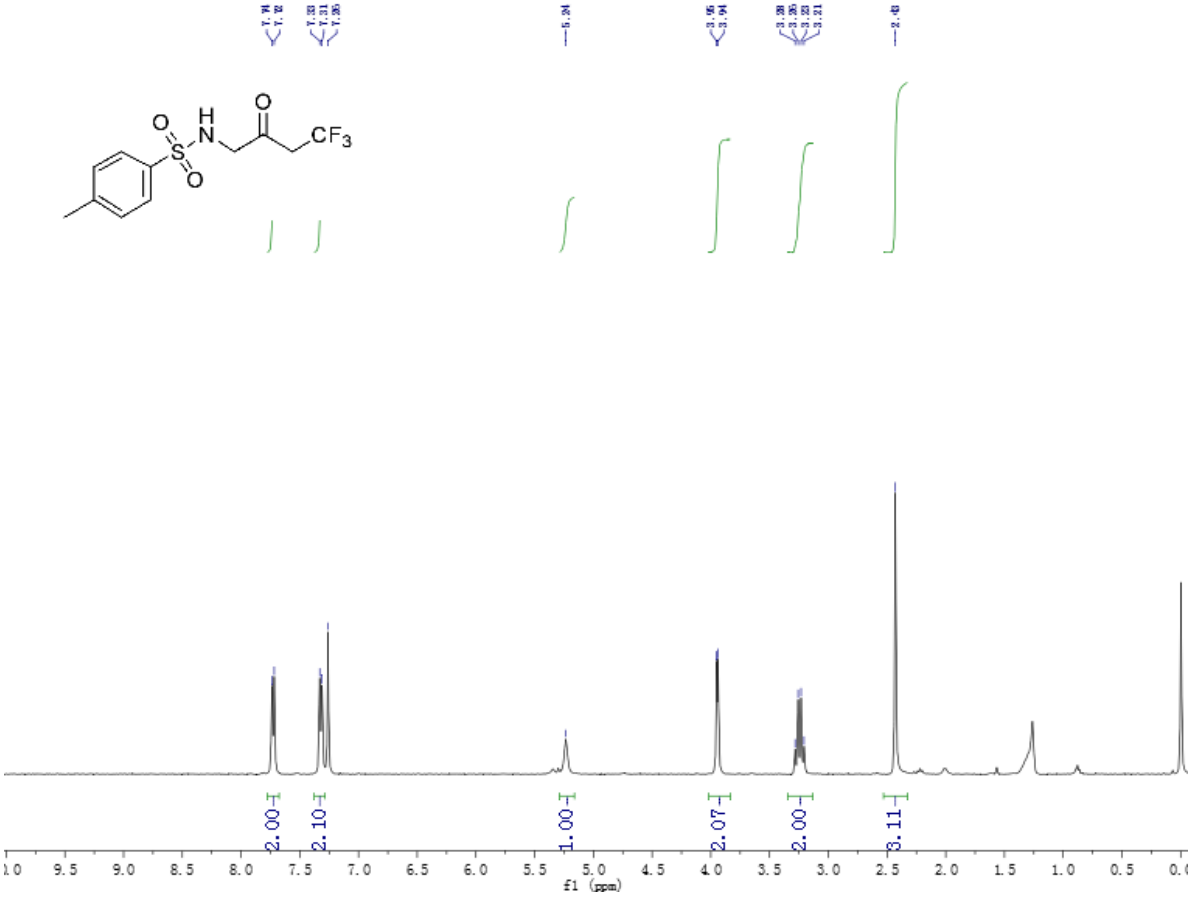
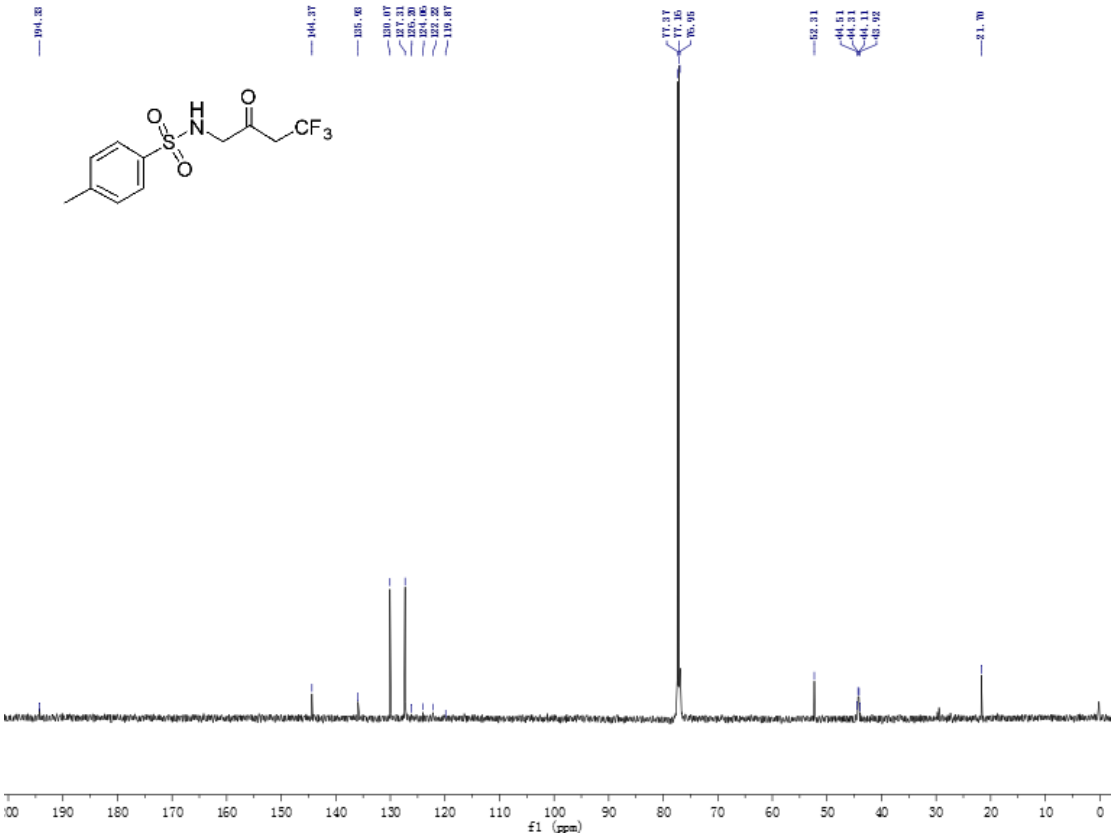


^{13}C NMR of **2u**



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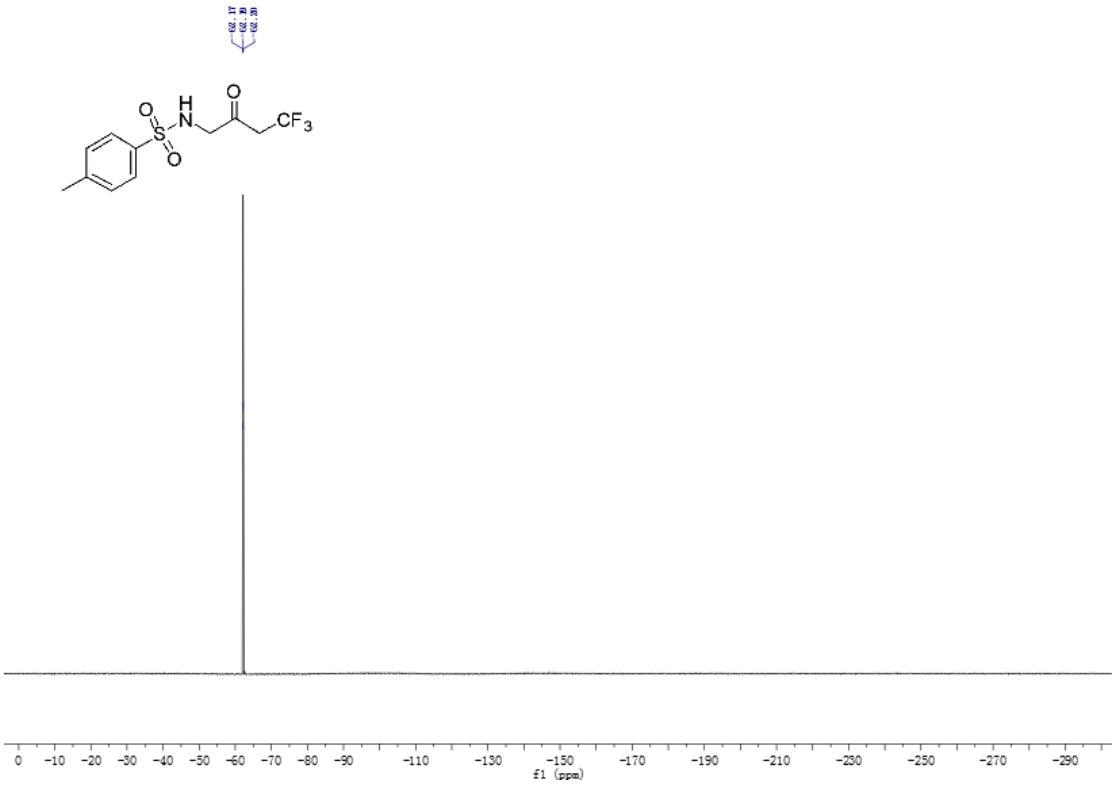

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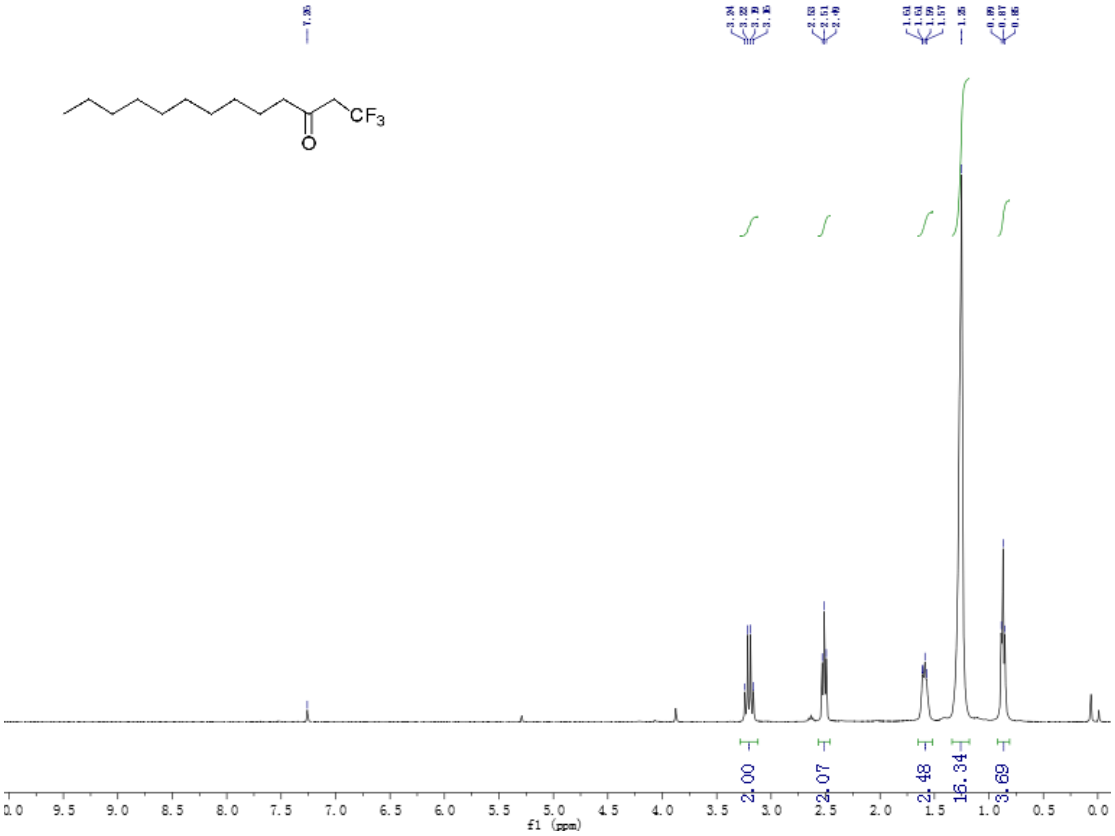

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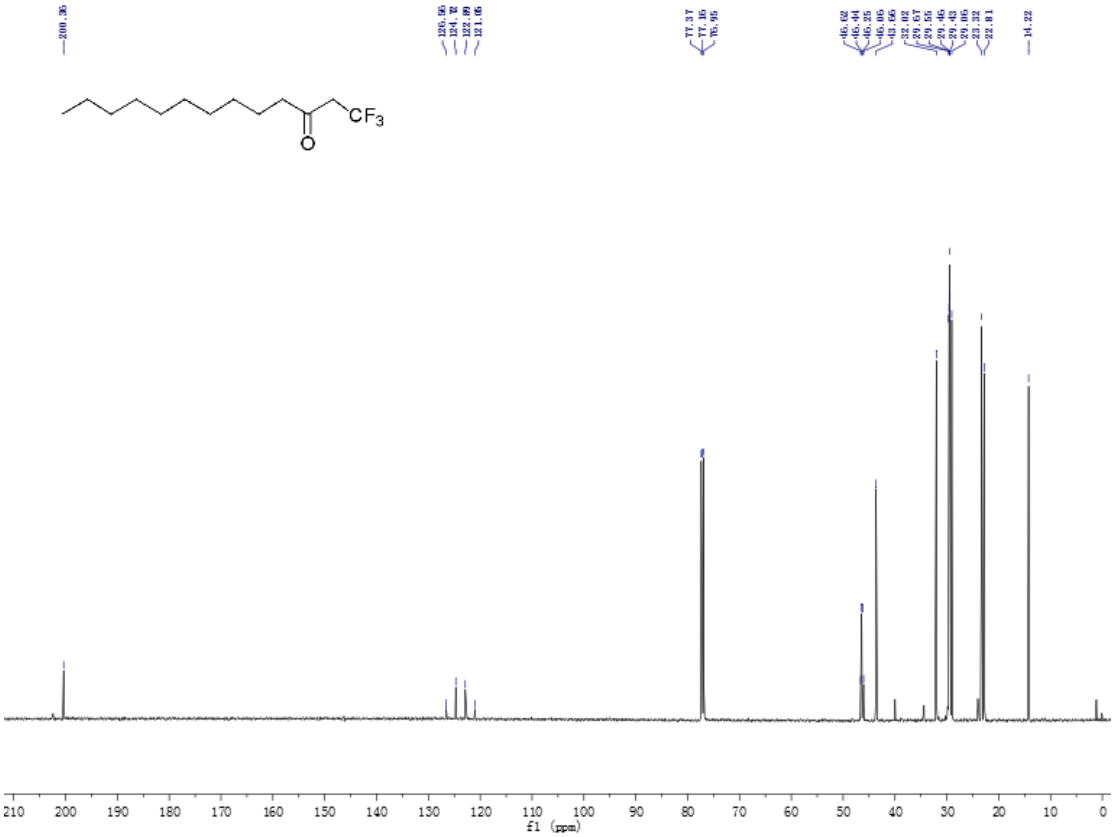

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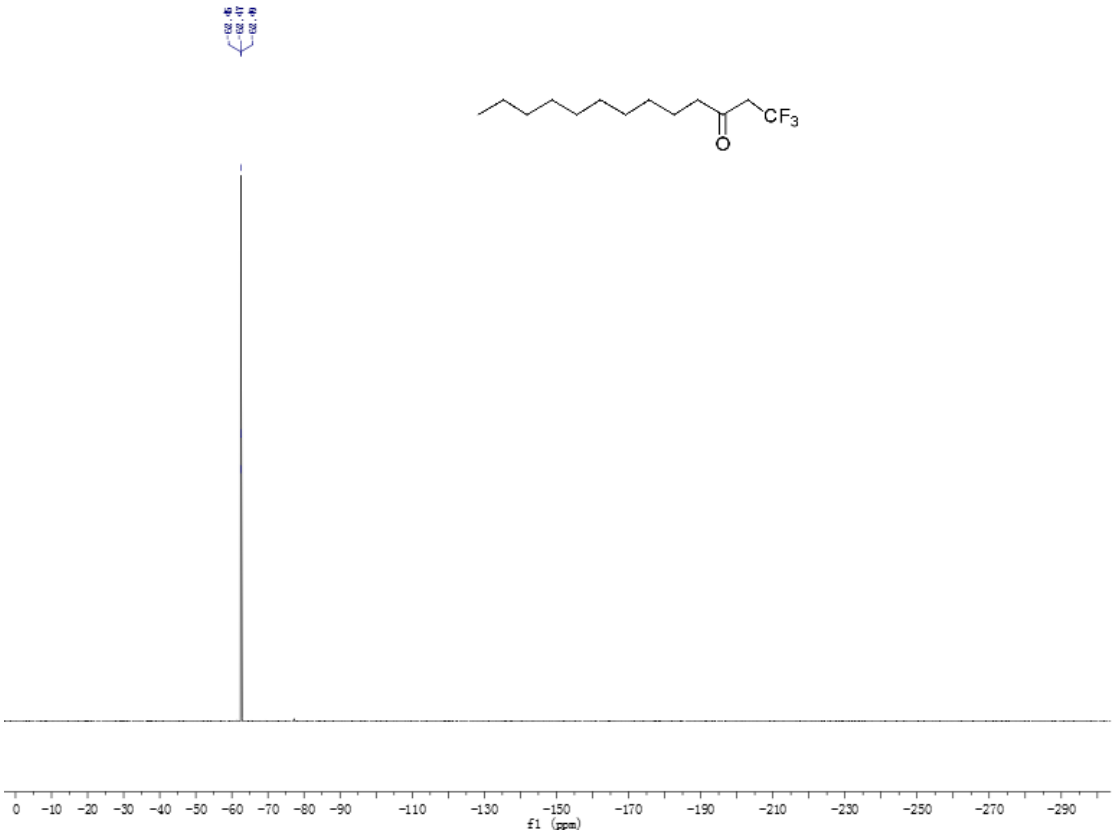

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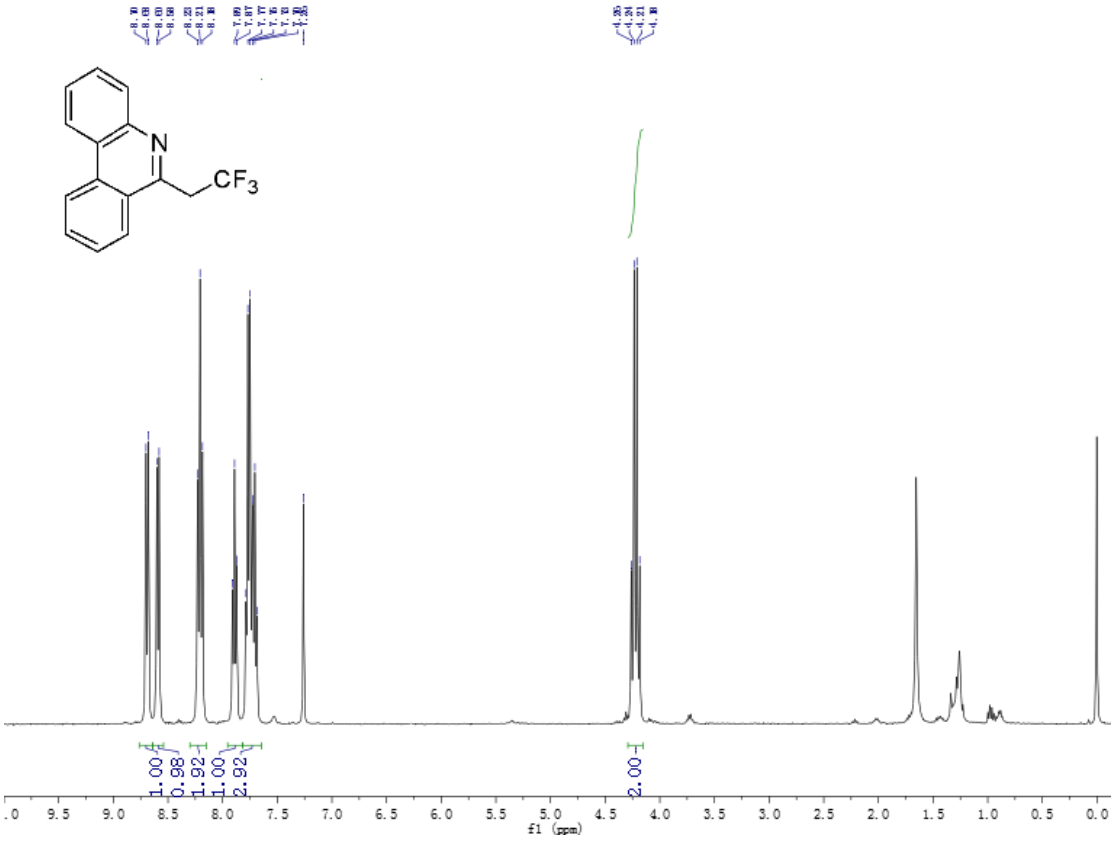

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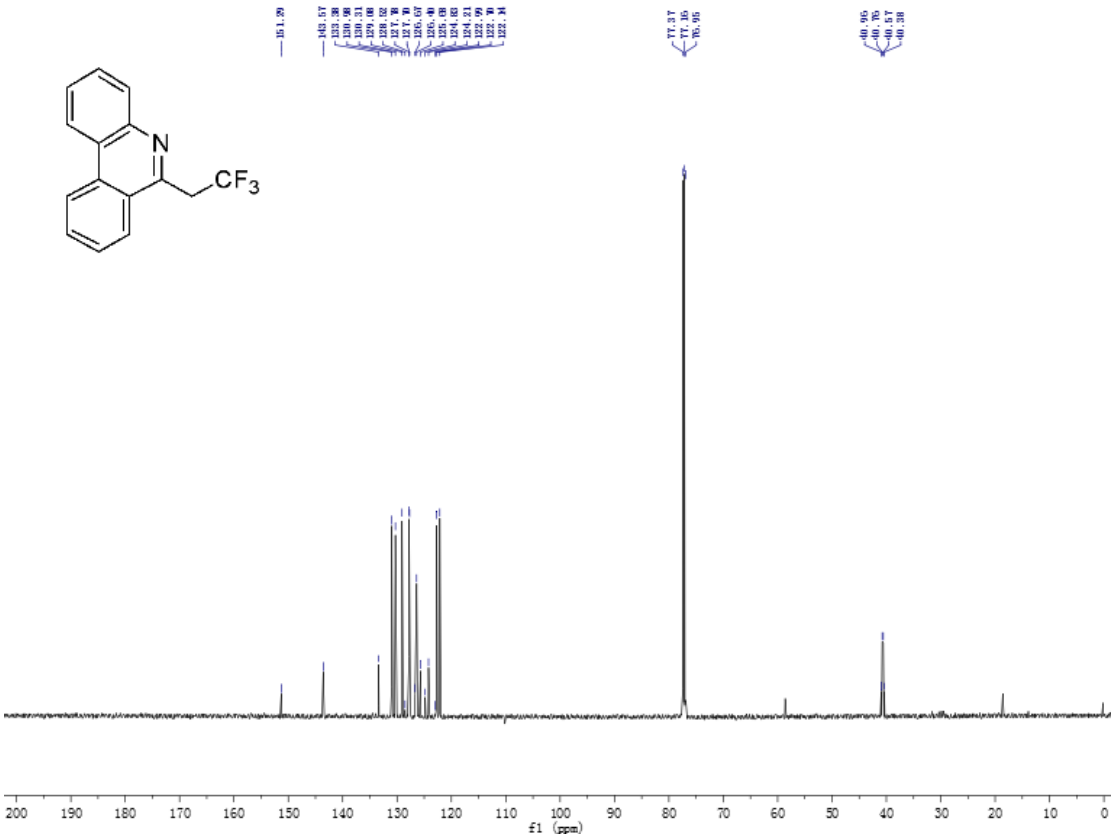
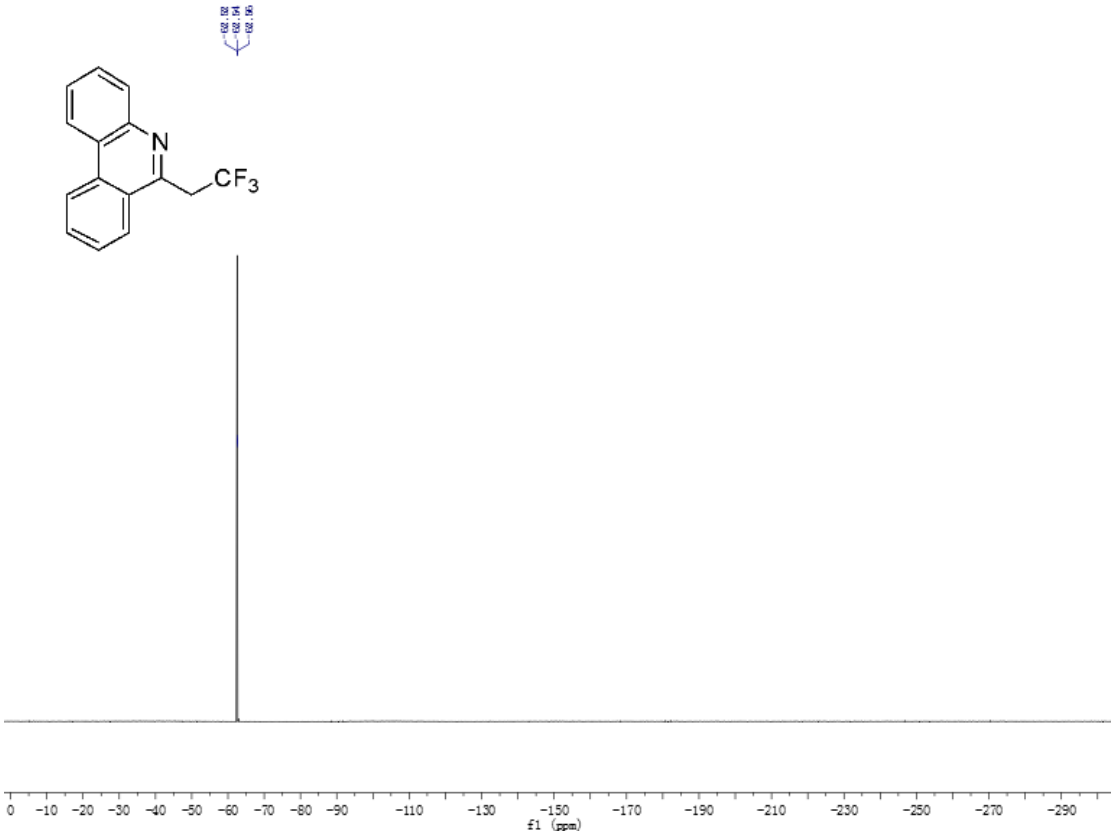


^{19}F NMR of **7**


N
CF3
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -110 -130 -150 -170 -190 -210 -230 -250 -270 -290
f1 (ppm)