

Supporting Information

Access to Densely Functionalized Chalcone Derivatives with a 2-Pyridone Subunit via Pd/Cu-Catalyzed Oxidative Furan–Yne Cyclization of N-(2-Furanylmethyl) Alkynamides under Air

Yongjie Yang^a, ChengCheng Fei^b, Kai Wang^c, Bo Liu^c, Dingxin Jiang ^{*b} and Biaolin Yin^{*a}

^aKey Laboratory of Functional Molecular Engineering of Guangdong Province, School of Chemistry and Chemical Engineering, South China University of Technology, Guangzhou, P. R. China, 510640.

^bKey Laboratory of Natural Pesticide and Chemical Biology, Ministry of Education, Laboratory of Insect Toxicology, South China Agricultural University, Guangzhou 510642, People's Republic of China.

^cGuangdong Provincial Academy of Chinese Medical Sciences, Guangzhou 510006, P.R. China.

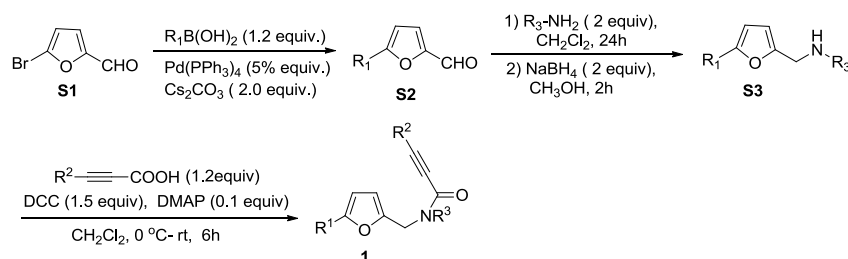
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1. General experimental details

All reactions were carried out in flame-dried sealed tubes with magnetic stirring. Unless otherwise noted, all experiments were performed under N₂ atmosphere. Solvents were treated with 4 Å molecular sieves or sodium and distilled prior to use. Purifications of reaction products were carried out by flash chromatography using Qingdao Haiyang Chemical Co. Ltd silica gel (200-300 mesh). Infrared spectra (IR) were recorded on a Bruker TENSOR 27 FTIR spectrophotometer and are reported as wavelength numbers (cm⁻¹). ¹H, ¹³C, ¹⁹F NMR spectra were recorded on a Bruker AVANCE 400 (400 MHz for ¹H; 100 MHz for ¹³C; 376 MHz for ¹⁹F), ¹H NMR and ¹³C NMR chemical shifts were determined relative to internal standard TMS at δ 0.0 and ¹⁹F NMR chemical shifts were determined relative to CFC1₃ as external standard. Chemical shifts (δ) are reported in ppm, and coupling constants (*J*) are in Hertz (Hz). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. Mass spectra (MS) were obtained using ESI, DART mass spectrometer. Melting points were determined using a hot stage apparatus. All reagents were used as received from commercial sources, unless specified otherwise, or prepared as described in the literature.

2. General Procedure for the Synthesis of the starting materials



Step 1: Procedure for the synthesis of **S2** from **S1** was identical to the literature.^[1-5]

Step 2: Procedure for the synthesis of **S3** from **S2**: A solution of **S2** (2 mmol, 1.0 equiv), amine (2.4 mmol, 1.2 equiv) was stirred in CH₂Cl₂ (10 mL) at room temperature for 24 h. Then the reaction mixture was concentrated in *vacuo* and the residue was dissolved in CH₃OH (10 mL). To the mixture was added NaBH₄ (4 mmol, 152 mg, 2.0 equiv) in portion at 0 °C. The reaction was warmed to room temperature. After stirring at the same temperature for 2 h, the solvent was removed after reduced pressure and the residue was purified by column chromatography on silica gel (petroleum ether /ethyl acetate = 2/1).

Step 3: Procedure for the synthesis of **1** from **S3**: To a mixture of **S3** (1.0 mmol) and propiolic acid (1.2 mmol, 1.2 equiv) in CH₂Cl₂ (10 mL) was added a solution of DMAP (0.1 mmol, 10% mol) and DCC (1.5 mmol, 1.5 equiv) in CH₂Cl₂ (5 mL) at 0°C. The reaction mixture was stirred for 6 hours at room temperature and filtered through a short plug of silica gel, which was rinsed with EtOAc. The filtrate was concentrated in *vacuo* and the residue was purified by column chromatography on silica gel (petroleum ether /ethyl acetate = 8/1).

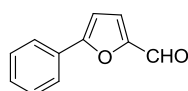
3. Reference

- [1] Opsenica, I. M.; Verbic, T. Z.; Tot, M.; Sciotti, R. J.; Pybus, B. S.; Djakovic, O. D.; Slavic, K.; Šolaja, B. A.; *Bioorg. Med. Chem.* **2015**, 23, 2176.
- [2] Krake, S. H.; Martinez, P. D. G.; McLaren, J.; Ryan, E.; Chen, G.; White, K.; Charman, S.A.; Campbell, S.; Willis, P.; Dias, L. C. *European Journal of Medicinal Chemistry* **2017**, 126, 929.
- [3] Feuerstein, M.; Doucet, H.; Santelli, M. *Tetrahedron Letters* 2001, 42, 5659.
- [4] Jung, M. E.; Ku, J. M.; Du, L. T.; Hu, H. L.; Gatti, R. A. *Bioorg. Med. Chem. Lett.* 2011, 21, 5842.
- [5] Feuerstein, M.; Doucet, H.; Santelli, M. *Journal of Organometallic Chemistry* 2003, 687, 327.

4. Characterization data for the starting materials

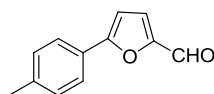
4.1 Characterization data for S2 and S3

5-Phenylfuran-2-carbaldehyde (S2-1a)



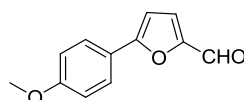
Yellow oil (500 mg, 97%); ^1H NMR (400 MHz, CDCl_3) δ 9.62 (s, 1H), 7.79 (d, $J = 7.4$ Hz, 2H), 7.46 – 7.33 (m, 3H), 7.29 (d, $J = 3.7$ Hz, 1H), 6.81 (d, $J = 3.7$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.2, 159.4, 152.1, 129.7, 129.0, 125.3, 107.7.

5-(*p*-Tolyl)furan-2-carbaldehyde (S2-1b)



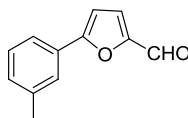
Yellow solid (515 mg, 93%); ^1H NMR (400 MHz, CDCl_3) δ 9.60 (s, 1H), 7.69 (d, $J = 8.0$ Hz, 2H), 7.28 (d, $J = 3.7$ Hz, 1H), 7.22 (d, $J = 7.9$ Hz, 2H), 6.76 (d, $J = 3.7$ Hz, 1H), 2.36 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.1, 159.8, 151.8, 140.0, 129.7, 126.3, 125.3, 107.1, 21.4.

5-(4-Methoxyphenyl)furan-2-carbaldehyde (S2-1c)



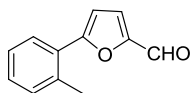
Yellow oil (580 mg, 96%); ^1H NMR (400 MHz, CDCl_3) δ 9.58 (s, 1H), 7.73 (d, $J = 8.6$ Hz, 2H), 7.28 (d, $J = 3.7$ Hz, 1H), 6.94 (d, $J = 8.6$ Hz, 2H), 6.69 (d, $J = 3.7$ Hz, 1H), 3.83 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 176.8, 160.9, 159.8, 151.6, 127.0, 121.8, 114.4, 106.3, 55.4.

5-(*m*-Tolyl)furan-2-carbaldehyde (S2-1d)



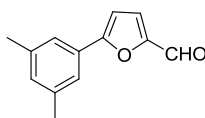
Yellow oil (532 mg, 96%); ^1H NMR (400 MHz, CDCl_3) δ 9.60 (s, 1H), 7.62 (s, 1H), 7.57 (d, $J = 7.8$ Hz, 1H), 7.28 (dd, $J = 5.5, 1.6$ Hz, 2H), 7.17 (d, $J = 7.6$ Hz, 1H), 6.79 (d, $J = 3.7$ Hz, 1H), 2.37 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.1, 159.7, 151.9, 138.7, 130.6, 128.8, 125.8, 122.5, 107.6, 21.4.

5-(*o*-Tolyl)furan-2-carbaldehyde (S2-1e)



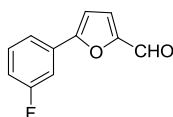
Yellow oil (486 mg, 87%); ^1H NMR (400 MHz, CDCl_3) δ 9.64 (s, 1H), 7.77 (d, $J = 7.6$ Hz, 1H), 7.31 (d, $J = 3.7$ Hz, 1H), 7.30 – 7.23 (m, 3H), 6.71 (d, $J = 3.7$ Hz, 1H), 2.52 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.4, 159.4, 151.8, 136.0, 131.5, 129.5, 128.5, 128.2, 126.3, 111.1, 21.8.

5-(3,5-Dimethylphenyl)furan-2-carbaldehyde (S2-1f)



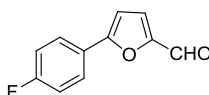
Yellow solid (575 mg, 96%); ^1H NMR (400 MHz, CDCl_3) δ 9.60 (s, 1H), 7.42 (s, 2H), 7.28 (d, $J = 3.7$ Hz, 1H), 7.00 (s, 1H), 6.77 (d, $J = 3.7$ Hz, 1H), 2.34 (s, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.1, 160.0, 151.9, 138.6, 131.6, 128.8, 123.2, 107.5, 21.2;

5-(3-Fluorophenyl)furan-2-carbaldehyde (S2-1g)



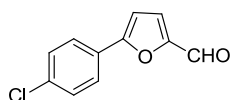
Yellow solid (480 mg, 84%); ^1H NMR (400 MHz, CDCl_3) δ 9.66 (s, 1H), 7.58 (d, $J = 7.8$ Hz, 1H), 7.49 (d, $J = 9.6$ Hz, 1H), 7.40 (dt, $J = 13.8, 7.0$ Hz, 1H), 7.32 (d, $J = 3.7$ Hz, 1H), 7.08 (td, $J = 8.4, 2.4$ Hz, 1H), 6.85 (d, $J = 3.7$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.4, 164.3, 161.8, 157.9 (d, $J = 3.0$ Hz), 152.2, 131.0 (d, $J = 8.4$ Hz), 130.7 (d, $J = 8.3$ Hz), 121.0 (d, $J = 3.0$ Hz), 116.7, 116.4, 112.3, 112.0, 108.6; ^{19}F NMR (376 MHz, CDCl_3) δ -111.9.

5-(4-Fluorophenyl)furan-2-carbaldehyde (S2-1h)



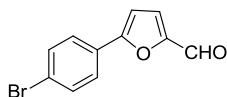
Yellow solid (455 mg, 80%); ^1H NMR (400 MHz, CDCl_3) δ 9.64 (s, 1H), 7.81 (dd, $J = 8.4, 5.5$ Hz, 2H), 7.31 (d, $J = 3.7$ Hz, 1H), 7.14 (t, $J = 8.6$ Hz, 2H), 6.78 (d, $J = 3.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.2, 164.8, 162.3, 158.5, 152.1, 127.3 (d, $J = 8.5$ Hz), 125.4 (d, $J = 3.3$ Hz), 116.3, 116.1, 107.40; ^{19}F NMR (376 MHz, CDCl_3) δ -110.1.

5-(4-Chlorophenyl)furan-2-carbaldehyde (S2-1i)



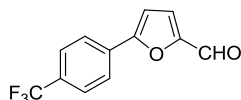
Yellow solid (430 mg, 70%); ^1H NMR (400 MHz, CDCl_3) δ 9.65 (s, 1H), 7.74 (d, $J = 8.3$ Hz, 2H), 7.41 (d, $J = 8.3$ Hz, 2H), 7.31 (d, $J = 3.6$ Hz, 1H), 6.82 (d, $J = 3.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.2, 158.2, 152.2, 135.7, 129.3, 127.5, 126.5, 108.0.

5-(4-Bromophenyl)furan-2-carbaldehyde (S2-1j)



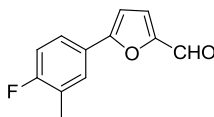
Yellow solid (505 mg, 68%); ^1H NMR (400 MHz, CDCl_3) δ 9.64 (s, 1H), 7.72 (d, $J = 8.5$ Hz, 2H), 7.39 (d, $J = 8.5$ Hz, 2H), 7.30 (d, $J = 3.7$ Hz, 1H), 6.81 (d, $J = 3.7$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.2, 158.2, 152.1, 135.6, 129.2, 127.5, 126.5, 108.0.

5-(4-(Trifluoromethyl)phenyl)furan-2-carbaldehyde (S2-1k)



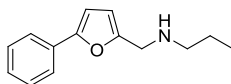
Yellow solid (400 mg, 55%); ^1H NMR (400 MHz, CDCl_3) δ 9.70 (s, 1H), 7.92 (d, $J = 8.0$ Hz, 2H), 7.70 (d, $J = 8.0$ Hz, 2H), 7.34 (d, $J = 3.6$ Hz, 1H), 6.95 (d, $J = 3.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.5, 157.4, 152.6, 132.2, 131.2 (d, $J = 32.5$ Hz), 125.99 (q, $J = 3.8$ Hz), 125.4, 123.1, 122.5, 109.3; ^{19}F NMR (376 MHz, CDCl_3) δ -62.7.

5-(4-Fluoro-3-methylphenyl)furan-2-carbaldehyde (S2-1l)



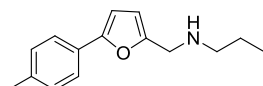
Yellow solid (490 mg, 80%); ^1H NMR (400 MHz, CDCl_3) δ 9.55 (s, 1H), 7.59 – 7.47 (m, 2H), 7.24 (d, $J = 3.6$ Hz, 1H), 6.97 (t, $J = 8.8$ Hz, 1H), 6.69 (d, $J = 3.6$ Hz, 1H), 2.23 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.0, 163.3, 160.8, 158.7, 151.7, 128.5 (d, $J = 5.6$ Hz), 125.7 (d, $J = 18.0$ Hz), 124.9 (d, $J = 3.7$ Hz), 124.6 (d, $J = 8.5$ Hz), 115.6 (d, $J = 23.2$ Hz), 107.3, 14.4 (d, $J = 3.2$ Hz); ^{19}F NMR (376 MHz, CDCl_3) δ -114.4.

***N*-((5-Phenylfuran-2-yl)methyl)propan-1-amine (S3-1a)**



Yellow oil (350 mg, 81%); ^1H NMR (400 MHz, CDCl_3) δ 7.68 (d, $J = 7.4$ Hz, 2H), 7.39 (t, $J = 7.7$ Hz, 2H), 7.30 – 7.22 (m, 1H), 6.60 (d, $J = 3.2$ Hz, 1H), 6.28 (d, $J = 3.2$ Hz, 1H), 3.86 (s, 2H), 2.66 (t, $J = 7.3$ Hz, 2H), 1.63 – 1.51 (m, 3H), 0.96 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.0, 153.1, 131.0, 128.6, 127.1, 123.6, 108.9, 105.6, 51.1, 46.4, 23.2, 11.8; IR (film) 3072, 1542, 1106, 912, 756, 688 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{14}\text{H}_{18}\text{NO}$ $[\text{M}+\text{H}]^+$: 216.1388; found: 216.1388.

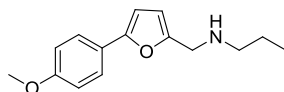
***N*-((5-(*p*-Tolyl)furan-2-yl)methyl)propan-1-amine (S3-1b)**



Yellow oil (380 mg, 83%); ^1H NMR (400 MHz, CDCl_3) δ 7.40 (d, $J = 8.0$ Hz, 2H), 6.99 (d, $J = 8.0$ Hz, 2H), 6.34 (d, $J = 3.0$ Hz, 1H), 6.06 (d, $J = 3.0$ Hz, 1H), 3.65 (s, 2H), 2.44 (d, $J = 7.3$ Hz, 2H), 2.17 (s, 3H), 1.42 – 1.30 (m, 3H), 0.77 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 153.0, 131.1,

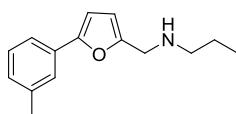
128.6, 127.0, 123.6, 108.3, 105.8, 50.7, 40.3, 29.1; IR (film) 3026, 1550, 1113, 958, 784 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{15}\text{H}_{20}\text{NO}$ $[\text{M}+\text{H}]^+$: 230.1545; found: 230.1540.

***N*-((5-(4-Methoxyphenyl)furan-2-yl)methyl)propan-1-amine (S3-1c)**



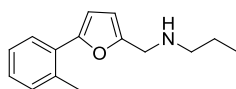
Yellow oil (420 mg, 86 %); ^1H NMR (400 MHz, CDCl_3) δ 7.43 (d, $J = 8.8$ Hz, 2H), 6.74 (d, $J = 8.8$ Hz, 2H), 6.28 (d, $J = 3.2$ Hz, 1H), 6.06 (d, $J = 3.2$ Hz, 1H), 3.66 (s, 2H), 3.61 (s, 3H), 2.46 (t, $J = 7.2$ Hz, 2H), 1.45 – 1.29 (m, 3H), 0.78 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 158.9, 153.3, 153.2, 125.0, 124.1, 114.1, 108.8, 104.0, 55.2, 51.1, 46.4, 23.2, 11.8; IR (film) 2955, 1551, 1178, 960, 832 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{15}\text{H}_{19}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 268.1313; found: 268.1307.

***N*-((5-(*m*-Tolyl)furan-2-yl)methyl)propan-1-amine (S3-1d)**



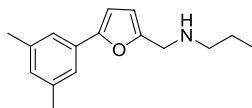
Yellow oil (385 mg, 84%); ^1H NMR (400 MHz, CDCl_3) δ 7.49 – 7.39 (m, 2H), 7.21 (t, $J = 7.6$ Hz, 1H), 7.00 (d, $J = 7.2$ Hz, 1H), 6.51 (d, $J = 3.2$ Hz, 1H), 6.20 (d, $J = 3.2$ Hz, 1H), 3.79 (s, 2H), 2.58 (t, $J = 7.4$ Hz, 2H), 2.33 (s, 3H), 1.56 – 1.42 (m, 2H), 0.90 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 153.8, 153.3, 138.2, 131.0, 128.6, 127.9, 124.2, 120.8, 108.9, 105.5, 51.1, 46.4, 23.2, 21.5, 11.8; IR (film) 3043, 1547, 1111, 960, 781 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{15}\text{H}_{20}\text{NO}$ $[\text{M}+\text{H}]^+$: 230.1545; found: 230.1545.

***N*-((5-(*o*-Tolyl)furan-2-yl)methyl)propan-1-amine (S3-1e)**



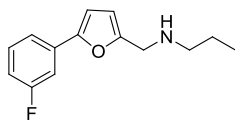
Yellow oil (350 mg, 76%); ^1H NMR (400 MHz, CDCl_3) δ 7.76 (d, $J = 7.6$ Hz, 1H), 7.32 – 7.16 (m, 3H), 6.50 (d, $J = 3.2$ Hz, 1H), 6.31 (d, $J = 3.2$ Hz, 1H), 3.87 (s, 2H), 2.67 (t, $J = 7.2$ Hz, 2H), 2.52 (s, 3H), 1.63 – 1.52 (m, 2H), 0.98 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 153.6, 152.6, 134.3, 131.2, 130.4, 127.2, 126.9, 126.0, 109.3, 108.6, 51.1, 46.4, 23.2, 22.0, 11.8; IR (film) 3062, 1541, 1118, 916, 760 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{15}\text{H}_{20}\text{NO}$ $[\text{M}+\text{H}]^+$: 230.1545; found: 230.1542.

***N*-((5-(3,5-Dimethylphenyl)furan-2-yl)methyl)propan-1-amine (S3-1f)**



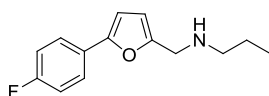
Yellow oil (395 mg, 81%); ^1H NMR (400 MHz, CDCl_3) δ 7.15 (s, 2H), 6.71 (s, 1H), 6.38 (d, $J = 3.2$ Hz, 1H), 6.07 (d, $J = 3.2$ Hz, 1H), 3.66 (s, 2H), 2.46 (t, $J = 7.2$ Hz, 2H), 2.17 (s, 6H), 1.42 – 1.33 (m, 2H), 0.78 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 153.5, 138.1, 130.9, 128.9, 121.5, 109.0, 105.4, 51.0, 46.4, 23.1, 21.4, 11.8; IR (film) 2958, 1543, 1110, 952, 786, 696 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{16}\text{H}_{22}\text{NO}$ $[\text{M}+\text{H}]^+$: 244.1701; found: 244.1699.

***N*-((5-(3-Fluorophenyl)furan-2-yl)methyl)propan-1-amine (S3-1g)**



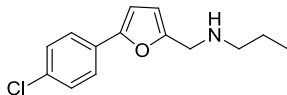
Yellow oil (366 mg, 79%); ^1H NMR (400 MHz, CDCl_3) δ 7.39 (d, $J = 7.6\text{ Hz}$, 1H), 7.36 – 7.24 (m, 2H), 6.93 – 6.86 (m, 1H), 6.57 (d, $J = 3.2\text{ Hz}$, 1H), 6.24 (d, $J = 3.6\text{ Hz}$, 1H), 3.81 (s, 2H), 2.61 (t, $J = 7.2\text{ Hz}$, 2H), 1.59 – 1.43 (m, 3H), 0.92 (t, $J = 7.4\text{ Hz}$, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 164.4, 161.9, 154.6, 151.9 (d, $J = 3.0\text{ Hz}$), 133.0 (d, $J = 8.6\text{ Hz}$), 130.2 (d, $J = 8.5\text{ Hz}$), 119.2 (d, $J = 2.8\text{ Hz}$), 113.9 (s), 113.6 (s), 110.5 (s), 110.3 (s), 108.9 (s), 106.7 (s), 51.1 (s), 46.3 (s), 23.1 (s), 11.7 (s); ^{19}F NMR (376 MHz, CDCl_3) δ -113.0; IR (film) 3072, 1547, 1151, 956, 784 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{14}\text{H}_{17}\text{FNO}$ $[\text{M}+\text{H}]^+$: 234.1294; found: 234.1293.

***N*-((5-(4-Fluorophenyl)furan-2-yl)methyl)propan-1-amine (S3-1h)**



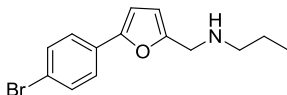
Yellow oil (358mg, 77%); ^1H NMR (400 MHz, CDCl_3) δ 7.63 – 7.55 (m, 2H), 7.03 (t, $J = 8.6\text{ Hz}$, 2H), 6.48 (d, $J = 3.2\text{ Hz}$, 1H), 6.23 (d, $J = 3.2\text{ Hz}$, 1H), 3.81 (s, 2H), 2.62 (t, $J = 7.2\text{ Hz}$, 2H), 1.59 – 1.47 (m, 3H), 0.93 (t, $J = 7.4\text{ Hz}$, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 163.2, 160.7, 154.0, 152.2, 127.4 (d, $J = 3.3\text{ Hz}$), 125.3 (d, $J = 8.0\text{ Hz}$), 115.7 (s), 115.4 (s), 108.9 (s), 105.3, 51.1, 46.3, 23.1, 11.7; ^{19}F NMR (376 MHz, CDCl_3) δ -114.6. IR (film) 3057, 1550, 1153, 919, 837 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{14}\text{H}_{17}\text{FNO}$ $[\text{M}+\text{H}]^+$: 234.1294; found: 234.1291.

***N*-((5-(4-Chlorophenyl)furan-2-yl)methyl)propan-1-amine (S3-1i)**



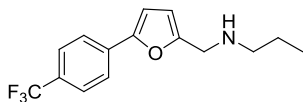
Yellow oil (330 mg, 66%); ^1H NMR (400 MHz, CDCl_3) δ 7.50 (d, $J = 8.0\text{ Hz}$, 2H), 7.26 (d, $J = 8.0\text{ Hz}$, 2H), 6.48 (s, 1H), 6.20 (s, 1H), 3.77 (s, 2H), 2.58 (t, $J = 7.2\text{ Hz}$, 2H), 1.55 – 1.42 (m, 2H), 0.90 (t, $J = 7.4\text{ Hz}$, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.4, 151.9, 132.6, 129.4, 128.7, 124.7, 108.9, 106.1, 51.1, 46.3, 23.1, 11.7; IR (film) 3114, 1542, 1100, 917, 828 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{14}\text{H}_{17}\text{ClNO}$ $[\text{M}+\text{H}]^+$: 250.0999; found: 250.0998.

***N*-((5-(4-Bromophenyl)furan-2-yl)methyl)propan-1-amine (S3-1j)**



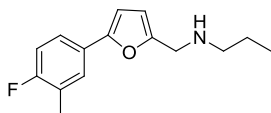
Yellow oil (398 mg, 68%); ^1H NMR (400 MHz, CDCl_3) δ 7.66 (d, $J = 7.2\text{ Hz}$, 1H), 7.52 – 7.45 (m, 2H), 7.41 – 7.21 (m, 1H), 6.56 (d, $J = 3.2\text{ Hz}$, 1H), 6.25 (d, $J = 3.2\text{ Hz}$, 1H), 3.82 (s, 2H), 2.62 (t, $J = 7.2\text{ Hz}$, 2H), 1.59 – 1.49 (m, 2H), 0.94 (t, $J = 7.4\text{ Hz}$, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.4, 151.9, 132.6, 129.5, 128.7, 124.7, 108.9, 106.1, 51.1, 46.3, 23.1, 11.7; IR (film) 2969, 1544, 1107, 921, 788 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{14}\text{H}_{17}\text{BrNO}$ $[\text{M}+\text{H}]^+$: 294.0494; found: 294.0486.

***N*-((5-(4-(Trifluoromethyl)phenyl)furan-2-yl)methyl)propan-1-amine (S3-1k)**



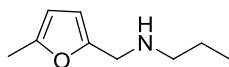
Yellow oil (307 mg, 54%); ^1H NMR (400 MHz, CDCl_3) δ 7.51 (d, $J = 8.4$ Hz, 2H), 7.40 (d, $J = 8.4$ Hz, 2H), 6.47 (d, $J = 3.2$ Hz, 1H), 6.10 (d, $J = 3.2$ Hz, 1H), 3.65 (s, 2H), 2.46 (t, $J = 7.2$ Hz, 2H), 1.42 – 1.32 (m, 3H), 0.77 (t, $J = 7.4$ Hz, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 155.3, 151.5, 134.0, 125.5 (d, $J = 3.8$ Hz), 123.4 (s), 109.0 (s), 107.7 (s), 51.1, 46.2, 23.0, 11.5. IR (film) 3125, 1552, 1121, 918, 840 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{15}\text{H}_{17}\text{F}_3\text{NO}$ $[\text{M}+\text{H}]^+$: 284.1262; found: 284.1261.

***N*-((5-(4-Fuoro-3-methylphenyl)furan-2-yl)methyl)propan-1-amine (S3-1l)**



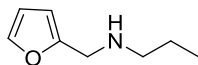
Yellow oil (360 mg, 75%); ^1H NMR (400 MHz, CDCl_3) δ 7.47 – 7.35 (m, 2H), 6.95 (t, $J = 9.0$ Hz, 1H), 6.44 (d, $J = 3.2$ Hz, 1H), 6.20 (d, $J = 3.2$ Hz, 1H), 3.79 (s, 2H), 2.60 (t, $J = 7.3$ Hz, 2H), 2.26 (s, 3H), 1.57 – 1.45 (m, 3H), 0.91 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 161.8, 159.4, 153.8, 152.5, 127.0 (d, $J = 3.6$ Hz), 126.7 (d, $J = 5.0$ Hz), 124.9 (d, $J = 17.8$ Hz), 122.7 (d, $J = 8.0$ Hz), 115.7, 115.05 (s), 108.9, 105.0 (d, $J = 1.2$ Hz), 51.1, 46.4, 23.1, 14.5 (d, $J = 2.5$ Hz), 11.7; ^{19}F NMR (376 MHz, CDCl_3) δ -119.0. IR (film) 2959, 1550, 1117, 955, 887 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{15}\text{H}_{19}\text{FNO}$ $[\text{M}+\text{H}]^+$: 248.1451; found: 248.1448.

***N*-((5-Mthylfuran-2-yl)methyl)propan-1-amine (S3-1m)**



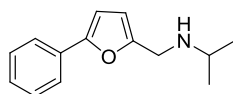
Yellow oil (265 mg, 87%); ^1H NMR (400 MHz, CDCl_3) δ 6.02 (d, $J = 1.6$ Hz, 1H), 5.86 (s, 1H), 3.70 (s, 2H), 2.57 (t, $J = 7.2$ Hz, 2H), 2.26 (s, 3H), 1.58 – 1.44 (m, 2H), 0.91 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 152.3, 151.2, 107.4, 105.8, 51.0, 46.3, 23.1, 13.5, 11.7; IR (film) 3103, 1453, 948, cm^{-1} ; HRMS (ESI) calcd for $\text{C}_9\text{H}_{16}\text{NO}$ $[\text{M}+\text{H}]^+$: 154.1232; found: 154.1230.

***N*-(Fran-2-ylmethyl)propan-1-amine (S3-1n)**



Yellow oil (240 mg, 86%); ^1H NMR (400 MHz, CDCl_3) δ 7.35 (s, 1H), 6.30 (s, 1H), 6.16 (d, $J = 2.8$ Hz, 1H), 3.78 (s, 2H), 2.58 (t, $J = 7.2$ Hz, 2H), 1.60 – 1.42 (m, 4H), 0.91 (t, $J = 7.4$ Hz, 4H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.2, 141.7, 110.1, 106.7, 51.1, 46.3, 23.1, 11.7; IR (film) 3115, 1460, 1178, 923, cm^{-1} ; HRMS (ESI) calcd for $\text{C}_8\text{H}_{14}\text{NO}$ $[\text{M}+\text{H}]^+$: 140.1075; found: 140.1073.

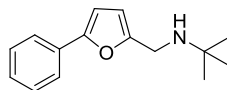
***N*-((5-Penylfuran-2-yl)methyl)propan-2-amine (S3-1aa)**



Yellow oil (270 mg, 82%); ^1H NMR (400 MHz, CDCl_3) δ 7.65 (d, $J = 7.6$ Hz, 2H), 7.36 (t, $J = 7.6$ Hz, 2H), 7.28 – 7.20 (m, 1H), 6.57 (d, $J = 3.2$ Hz, 1H), 6.33 (d, $J = 3.2$ Hz, 1H), 3.90 (s, 2H), 3.48 (s, 1H), 3.02 – 2.86 (m, 1H), 1.16 (d, $J = 6.0$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 153.5, 152.4, 130.8,

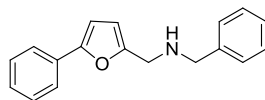
128.6, 127.2, 123.7, 109.9, 105.7, 47.8, 43.3, 22.2; IR (film) 3072, 1542, 1170, 912, 757 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{14}\text{H}_{18}\text{NO}$ $[\text{M}+\text{H}]^+$: 216.1388; found: 216.1386.

2-Methyl-*N*-((5-phenylfuran-2-yl)methyl)propan-2-amine (S3-1ab)



Yellow oil (258 mg, 78%); ^1H NMR (400 MHz, CDCl_3) δ 7.64 (d, $J = 7.8$ Hz, 2H), 7.34 (t, $J = 7.6$ Hz, 2H), 7.26 – 7.17 (m, 1H), 6.55 (d, $J = 2.8$ Hz, 1H), 6.24 (d, $J = 3.2$ Hz, 1H), 3.81 (s, 2H), 1.17 (s, 9H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 153.0, 131.1, 128.6, 127.0, 123.6, 108.3, 105.8, 50.7, 40.3, 29.1; IR (film) 3071, 1485, 1063, 961, 795 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{15}\text{H}_{20}\text{NO}$ $[\text{M}+\text{H}]^+$: 230.1545; found: 230.1541.

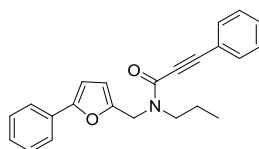
N-Benzyl-1-(5-phenylfuran-2-yl)methanamine (S3-1ac)



Yellow oil (433 mg, 82%); ^1H NMR (400 MHz, CDCl_3) δ 7.86 – 7.77 (m, 2H), 7.53 – 7.42 (m, 6H), 7.41 – 7.33 (m, 2H), 6.71 (d, $J = 3.2$ Hz, 1H), 6.39 (d, $J = 3.2$ Hz, 1H), 4.02 – 3.88 (br, 4H), 2.00 (s, 1H). ^{13}C NMR (100 MHz, CDCl_3) δ 153.9, 153.4, 140.1, 131.1, 128.8, 128.6, 128.5, 127.3, 127.2, 123.8, 109.4, 105.9, 52.9, 45.7; IR (film) 3029, 2827, 1546, 756, 693 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{18}\text{NO}$ $[\text{M}+\text{H}]^+$: 264.1388; found: 264.1388.

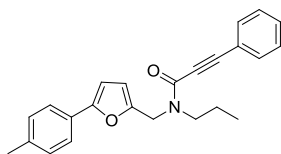
4.2 Characterization data for 1

3-Phenyl-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1a)



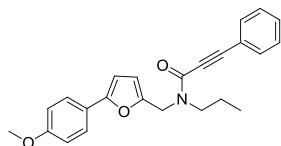
Yellow viscous oil (247 mg, 72%); ^1H NMR (400 MHz, CDCl_3) δ 7.56 (t, $J = 6.8$ Hz, 2H), 7.50 – 7.43 (m, 2H), 7.36 – 7.24 (m, 5H), 7.20 – 7.14 (m, 1H), 6.55 – 6.48 (m, 1H), 6.34 – 6.27 (m, 1H), 4.78 (s, 1H), 4.62 (s, 1H), 3.58 (t, $J = 7.6$ Hz, 1H), 3.38 (t, $J = 7.6$ Hz, 1H), 1.68 – 1.61 (m, 1H), 1.57 – 1.49 (m, 1H), 0.89 (t, $J = 7.2$ Hz, 1.5H), 0.84 (t, $J = 7.2$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 153.7, 153.6, 153.1, 152.7, 148.8, 131.4, 131.3, 129.6, 129.4, 129.0, 127.7, 127.5, 126.5, 126.4, 122.7, 119.6, 110.1, 109.5, 104.8, 104.7, 89.3, 89.1, 80.9, 80.7, 49.5, 45.5, 45.1, 39.8, 20.8, 19.5, 10.3, 10.2; IR (film) 2966, 2215, 1627, 1434, 969, 921, 796 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{22}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 344.1651; found: 344.1656.

3-Phenyl-*N*-propyl-*N*-((5-(*p*-tolyl)furan-2-yl)methyl)propiolamide (1b)



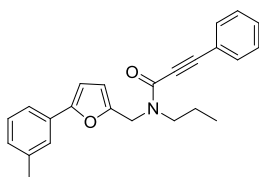
Yellow viscous oil (270 mg, 76%); ^1H NMR (400 MHz, CDCl_3) δ 7.59 – 7.49 (m, 4H), 7.43 – 7.30 (m, 3H), 7.19 – 7.12 (m, 2H), 6.55 – 6.51 (m, 1H), 6.39 – 6.34 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.65 (t, J = 7.6 Hz, 1H), 3.45 (t, J = 7.6 Hz, 1H), 2.34 (br, 3H), 1.74 – 1.67 (m, 1H), 1.64 – 1.56 (m, 1H), 0.96 (t, J = 7.4 Hz, 1.5H), 0.91 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 154.6, 154.3, 153.9, 149.4, 137.4, 137.3, 132.4, 130.0, 129.4, 128.6, 128.0, 127.8, 123.7, 120.7, 111.0, 110.5, 105.1, 105.0, 90.3, 90.0, 82.0, 81.8, 50.5, 46.6, 46.2, 40.9, 21.9, 21.3, 20.5, 11.3; IR (film) 2931, 2215, 1630, 1455, 1422, 967, 820, 757, 690 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 358.1807; found: 358.1815.

***N*-((5-(4-Methoxyphenyl)furan-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1c)**



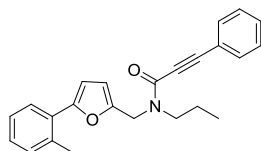
Yellow viscous oil (280 mg, 75%); ^1H NMR (400 MHz, CDCl_3) δ 7.60 – 7.51 (m, 4H), 7.44 – 7.32 (m, 3H), 6.94 – 6.86 (m, 2H), 6.48 – 6.43 (m, 1H), 6.38 – 6.33 (m, 1H), 4.84 (s, 1H), 4.68 (s, 1H), 3.85 – 3.79 (br, 3H), 3.65 (t, J = 7.2 Hz, 1H), 3.45 (t, J = 7.2 Hz, 1H), 1.75 – 1.68 (m, 1H), 1.65 – 1.57 (m, 1H), 0.97 (t, J = 7.2 Hz, 1.5H), 0.91 (t, J = 7.2 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 159.2, 159.1, 154.7, 154.6, 154.2, 153.8, 149.0, 132.4, 130.0, 128.6, 125.2, 123.8, 123.6, 120.7, 114.2, 111.1, 110.1, 104.2, 104.1, 90.3, 90.0, 82.0, 81.8, 55.3, 50.4, 46.5, 46.2, 40.8, 21.8, 20.5, 11.3; IR (film) 2965, 2215, 1629, 1497, 967, 833, 790, 758 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_3$ $[\text{M}+\text{H}]^+$: 374.1756; found: 374.1764.

3-Phenyl-*N*-propyl-*N*-((5-(*m*-tolyl)furan-2-yl)methyl)propiolamide (1d)



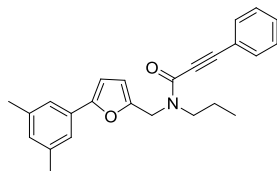
Yellow viscous oil (248 mg, 69%); ^1H NMR (400 MHz, CDCl_3) δ 7.59 – 7.50 (m, 2H), 7.48 – 7.31 (m, 5H), 7.28 – 7.20 (m, 1H), 7.06 (d, J = 7.6 Hz, 1H), 6.60 – 6.54 (m, 1H), 6.40 – 6.35 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.65 (t, J = 7.6 Hz, 1H), 3.45 (t, J = 7.6 Hz, 1H), 2.37 (s, 1.5H), 2.32 (s, 1.5H), 1.75 – 1.68 (m, 1H), 1.65 – 1.57 (m, 1H), 0.96 (t, J = 7.4 Hz, 1.5H), 0.91 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 154.3, 153.9, 149.7, 138.3, 132.5, 132.4, 130.6, 130.4, 130.0, 128.6, 128.4, 128.3, 124.4, 124.3, 120.9, 120.6, 111.1, 110.5, 105.8, 105.6, 90.3, 90.1, 82.0, 81.8, 50.5, 46.6, 46.2, 40.9, 21.9, 21.5, 21.4, 20.5, 11.3; IR (film) 2967, 2214, 1686, 1457, 968, 783, 691 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 358.1807; found: 358.1814.

3-Phenyl-*N*-propyl-*N*-((5-(*o*-tolyl)furan-2-yl)methyl)propiolamide (1e)



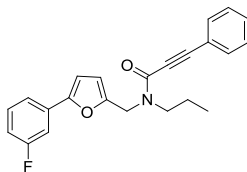
Yellow viscous oil (252 mg, 71%); ^1H NMR (400 MHz, CDCl_3) δ 7.65 (t, $J = 6.8$ Hz, 1H), 7.54 (t, $J = 7.8$ Hz, 2H), 7.44 – 7.31 (m, 3H), 7.26 – 7.16 (m, 3H), 6.48 (t, $J = 3.5$ Hz, 1H), 6.42 (t, $J = 3.5$ Hz, 1H), 4.87 (s, 1H), 4.71 (s, 1H), 3.66 (t, $J = 7.4$ Hz, 1H), 3.46 (t, $J = 7.4$ Hz, 1H), 2.61 – 2.37 (br, 3H), 1.76 – 1.68 (m, 1H), 1.64 – 1.57 (m, 1H), 0.97 (t, $J = 7.2$ Hz, 1.5H), 0.92 (t, $J = 7.2$ Hz, 1.5H); ^{13}C NMR (100MHz, CDCl_3) δ 154.7, 154.6, 153.8, 153.3, 149.4, 134.6, 134.5, 132.4, 131.2, 130.0, 129.8, 128.6, 128.5, 127.7, 127.5, 127.0, 126.0, 110.7, 110.3, 109.5, 109.2, 90.3, 90.1, 82.0, 81.8, 50.5, 46.5, 46.1, 40.8, 21.9, 20.5, 11.3; IR (film) 2932, 2215, 1630, 1459, 1422, 971, 759, 721 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_2$ $[\text{M} + \text{H}]^+$: 358.1807; found: 358.1818.

***N*-((5-(3,5-dimethylphenyl)furan-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1f)**



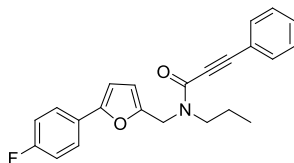
Yellow viscous oil (268 mg, 72%); ^1H NMR (400 MHz, CDCl_3) δ 7.60 – 7.50 (m, 2H), 7.43 – 7.31 (m, 3H), 7.28 – 7.24 (m, 2H), 6.91 – 6.86 (m, 1H), 6.57 – 6.53 (m, 1H), 6.39 – 6.34 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.65 (t, $J = 7.2$ Hz, 1H), 3.45 (t, $J = 7.2$ Hz, 1H), 2.33 (s, 3H), 2.28 (s, 3H), 1.75 – 1.67 (m, 1H), 1.65 – 1.56 (m, 1H), 0.96 (t, $J = 7.4$ Hz, 1.5H), 0.91 (t, $J = 7.4$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 154.4, 154.0, 149.5, 138.2, 132.5, 132.4, 130.5, 130.3, 130.0, 129.4, 129.2, 128.6, 121.6, 120.7, 111.1, 110.5, 105.7, 105.4, 90.3, 90.0, 82.0, 81.8, 50.5, 46.6, 46.2, 40.9, 21.9, 21.4, 21.3, 20.5, 11.3; IR (film) 2930, 2215, 1630, 1457, 969, 894, 790, 757, 691 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{25}\text{H}_{26}\text{NO}_2$ $[\text{M} + \text{H}]^+$: 372.1964; found: 372.1968.

***N*-((5-(3-Fluorophenyl)furan-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1g)**



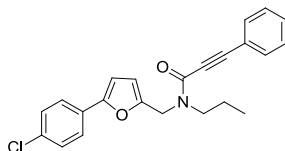
Yellow viscous oil (255 mg, 71%); ^1H NMR (400 MHz, CDCl_3) δ 7.58 – 7.51 (m, 2H), 7.43 – 7.28 (m, 6H), 6.93 (t, $J = 8.4$ Hz, 1H), 6.65 – 6.58 (m, 1H), 6.43 – 6.37 (m, 1H), 4.86 (s, 1H), 4.69 (s, 1H), 3.66 (t, $J = 7.4$ Hz, 1H), 3.46 (t, $J = 7.4$ Hz, 1H), 1.76 – 1.69 (m, 1H), 1.65 – 1.58 (m, 1H), 0.98 (t, $J = 7.2$ Hz, 1.5H), 0.92 (t, $J = 7.2$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 163.2 (d, $J = 243.5$ Hz), 163.1 (d, $J = 243.9$ Hz), 154.7, 154.6, 152.8 (d, $J = 3.1$ Hz), 152.4 (d, $J = 3.0$ Hz), 150.4, 132.4, 130.4 (d, $J = 3.7$ Hz), 130.3 (d, $J = 3.8$ Hz), 130.1, 128.6, 120.6 (d, $J = 3.6$ Hz), 119.3 (d, $J = 2.7$ Hz), 114.4, 114.2 (d, $J = 3.4$ Hz), 114.0, 111.1, 110.7 (d, $J = 4.4$ Hz), 110.6, 110.4 (d, $J = 4.3$ Hz), 107.0, 106.8, 90.4, 90.2, 81.9, 81.7, 50.6, 46.6, 46.1, 40.9, 21.9, 20.5, 11.3, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -112.7, -112.9; IR (film) 2932, 2215, 1630, 1453, 1422, 956, 870, 758 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{FNO}_2$ $[\text{M} + 1]^+$: 362.1556; found: 362.1565.

***N*-((5-(4-Fluorophenyl)furan-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1h)**



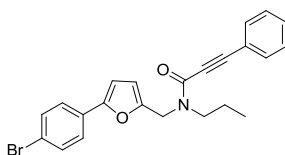
Yellow viscous oil (258 mg, 71%); ^1H NMR (400 MHz, CDCl_3) δ 7.64 – 7.51 (m, 4H), 7.44 – 7.31 (m, 3H), 7.09 – 7.00 (m, 2H), 6.54 – 6.50 (m, 1H), 6.40 – 6.36 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.65 (t, J = 7.4 Hz, 1H), 3.45 (t, J = 7.4 Hz, 1H), 1.75 – 1.68 (m, 1H), 1.65 – 1.57 (m, 1H), 0.97 (t, J = 7.4 Hz, 1.5H), 0.92 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 162.2 (d, J = 246.1 Hz), 162.2 (d, J = 245.5 Hz), 154.7, 154.6, 153.2, 152.8, 149.8, 132.4, 130.1, 128.6, 127.1 (d, J = 3.3 Hz), 126.9 (d, J = 3.3 Hz), 125.5 (d, J = 1.9 Hz), 125.4 (d, J = 1.8 Hz), 120.6, 115.8 (d, J = 3.7 Hz), 115.6 (d, J = 3.7 Hz), 111.1, 110.6, 105.5, 105.4, 90.3, 90.1, 81.9, 81.7, 50.5, 46.6, 46.1, 40.9, 21.9, 20.5, 11.3, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -113.9, -114.2; IR (film) 2933, 2215, 1629, 1457, 968, 810, 690 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{FNO}_2$ $[\text{M}+\text{H}]^+$: 362.1556; found: 362.1562.

***N*-((5-(4-Chlorophenyl)furan-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1i)**



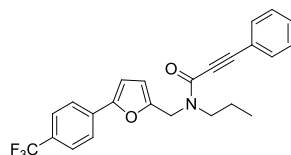
Yellow viscous oil (250 mg, 66%); ^1H NMR (400 MHz, CDCl_3) δ 7.59 – 7.51 (m, 4H), 7.44 – 7.28 (m, 5H), 6.61 – 6.55 (m, 1H), 6.41 – 6.36 (m, 1H), 4.85 (s, 1H), 4.68 (s, 1H), 3.65 (t, J = 7.2 Hz, 1H), 3.45 (t, J = 7.2 Hz, 1H), 1.75 – 1.68 (m, 1H), 1.65 – 1.57 (m, 1H), 0.97 (t, J = 7.4 Hz, 1.5H), 0.91 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 154.6, 153.0, 152.6, 150.2, 133.2, 133.0, 132.4, 130.1, 129.2, 129.0, 128.9, 128.6, 124.9, 120.6, 111.1, 110.6, 106.3, 106.2, 90.3, 90.2, 81.9, 81.7, 50.6, 46.6, 46.1, 40.9, 21.9, 20.5, 11.3, 11.2; IR (film) 2933, 2215, 1630, 1484, 1457, 968, 831, 758, 690 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{ClNO}_2$ $[\text{M}+\text{H}]^+$: 378.1261; found: 378.1267.

***N*-((5-(4-bromophenyl)furan-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1j)**



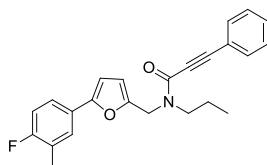
Yellow viscous oil (289 mg, 69%); ^1H NMR (400 MHz, CDCl_3) δ 7.59 – 7.44 (m, 6H), 7.42 – 7.31 (m, 3H), 6.59 (s, 1H), 6.38 (s, 1H), 4.85 (s, 1H), 4.68 (s, 1H), 3.65 (t, J = 7.2 Hz, 1H), 3.45 (t, J = 7.2 Hz, 1H), 1.75 – 1.68 (m, 1H), 1.65 – 1.56 (m, 1H), 0.97 (t, J = 7.4 Hz, 1.5H), 0.91 (t, J = 7.3 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 154.6, 153.0, 152.6, 150.3, 132.4, 131.8, 130.1, 129.6, 129.4, 128.6, 125.2, 121.3, 121.1, 120.6, 111.2, 110.7, 106.5, 106.3, 90.3, 90.2, 81.9, 81.7, 50.6, 46.6, 46.1, 40.9, 21.9, 20.5, 11.3, 11.2; IR (film) 2965, 2248, 2215, 1685, 1491, 968, 826, 757, 690 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 422.0756; found: 422.0763.

3-Phenyl-*N*-propyl-*N*-((5-(4-(trifluoromethyl)phenyl)furan-2-yl)methyl)propiolamide (1k)



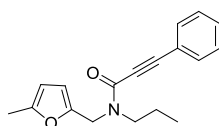
Yellow viscous oil (248 mg, 60%); ^1H NMR (400 MHz, CDCl_3) δ 7.72 (t, J = 7.6 Hz, 2H), 7.63 – 7.51 (m, 4H), 7.44 – 7.31 (m, 3H), 6.74 – 6.69 (m, 1H), 6.43 (s, 1H), 4.88 (s, 1H), 4.71 (s, 1H), 3.67 (t, J = 7.2 Hz, 1H), 3.47 (t, J = 7.2 Hz, 1H), 1.76 – 1.69 (m, 1H), 1.66 – 1.58 (m, 1H), 0.98 (t, J = 7.4 Hz, 1.5H), 0.92 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 154.6, 152.5, 152.1, 151.1, 132.4, 130.1, 128.6, 125.7, 123.7, 120.5, 111.2, 110.8, 107.9, 107.8, 90.4, 90.3, 81.9, 81.7, 50.7, 46.7, 46.1, 41.0, 21.9, 20.5, 11.3, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -62.5, -62.6; IR (film) 2935, 2216, 1623, 1422, 969, 919, 794, 758 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{21}\text{F}_3\text{NO}_2$ $[\text{M}+\text{H}]^+$: 412.1524; found: 412.1532.

***N*-((5-(4-Fluoro-3-methylphenyl)furan-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1l)**



Yellow viscous oil (261 mg, 70%); ^1H NMR (400 MHz, CDCl_3) δ 7.61 – 7.53 (m, 2H), 7.50 – 7.34 (m, 5H), 7.06 – 6.95 (m, 1H), 6.55 – 6.49 (m, 1H), 6.42 – 6.36 (m, 1H), 4.87 (s, 1H), 4.71 (s, 1H), 3.67 (t, J = 7.6 Hz, 1H), 3.47 (t, J = 7.6 Hz, 1H), 2.35 – 2.30 (br, 1.5H), 2.28 – 2.23 (br, 1.5H), 1.77 – 1.70 (m, 1H), 1.67 – 1.59 (m, 1H), 0.99 (t, J = 7.4 Hz, 1.5H), 0.94 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 160.8 (d, J = 244.6 Hz), 160.8 (d, J = 24.4 Hz), 154.7, 154.6, 153.5, 153.1, 149.6, 132.4, 130.1, 128.6, 126.9 (d, J = 4.6 Hz), 126.8 (d, J = 4.7 Hz), 126.7, 126.5, 125.3 (d, J = 4.4 Hz), 125.1 (d, J = 4.4 Hz), 122.9, 122.8, 120.6, 115.4 (d, J = 2.6 Hz), 115.2 (d, J = 2.5 Hz), 111.1, 110.6, 105.3, 105.1, 90.3, 90.1, 82.0, 81.8, 50.5, 46.5, 46.1, 40.8, 21.9, 20.5, 14.6, 14.6 (d, J = 3.4 Hz), 11.3, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -118.2, -118.2; IR (film) 2965, 2215, 2118, 1686, 1458, 968, 889, 790, 758 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{23}\text{FNO}_2$ $[\text{M}+\text{H}]^+$: 376.1713; found: 376.1721.

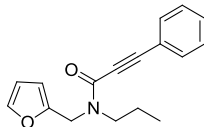
***N*-((5-Methylfuran-2-yl)methyl)-3-phenyl-*N*-propylpropiolamide (1m)**



Yellow viscous oil (220 mg, 78%); ^1H NMR (400 MHz, CDCl_3) δ 7.57 – 7.50 (m, 2H), 7.43 – 7.32 (m, 3H), 6.18 (d, J = 3.0 Hz, 1H), 5.93 – 5.88 (m, 1H), 4.74 (s, 1H), 4.58 (s, 1H), 3.59 (t, J = 7.4 Hz, 1H), 3.40 (t, J = 7.6 Hz, 1H), 2.26 (s, 3H), 1.67 (m, 1H), 1.55 (m, 1H), 0.95 (t, J = 7.4 Hz, 1.5H), 0.90 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.6, 154.5, 152.3, 152.0, 148.3, 148.2, 132.4, 132.3, 130.0, 128.5, 120.7, 120.6, 109.8, 109.4, 106.4, 90.1, 89.8, 82.0, 81.9, 50.2, 46.2, 46.0, 40.6, 21.7, 20.4,

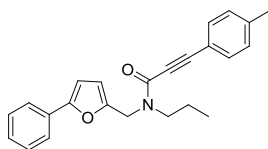
13.6, 11.3, 11.2; IR (film) 2965, 2214, 2118, 1631, 1448, 967, 892, 788 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{20}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 282.1494; found: 282.1501.

***N*-((Furan-2-ylmethyl)-3-phenyl)-*N*-propylpropiolamide (1n)**



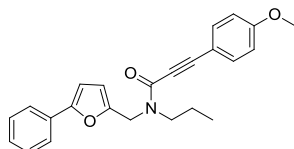
Yellow viscous oil (215 mg, 81%); ^1H NMR (400 MHz, CDCl_3) δ 7.57 – 7.50 (m, 2H), 7.44 – 7.33 (m, 4H), 6.39 – 6.27 (m, 2H), 4.81 (s, 1H), 4.64 (s, 1H), 3.60 (t, $J = 7.2$ Hz, 1H), 3.40 (t, $J = 7.2$ Hz, 1H), 1.70 – 1.63 (m, 1H), 1.60 – 1.52 (m, 1H), 0.95 (t, $J = 7.4$ Hz, 1.5H) 0.90 (t, $J = 7.4$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.6, 154.5, 150.4, 150.3, 142.6, 142.2, 132.4, 132.3, 130.0, 128.5, 120.6, 110.5, 108.9, 108.5, 90.2, 90.0, 81.9, 81.7, 50.4, 46.4, 45.9, 40.6, 21.8, 20.4, 11.3, 11.2; IR (film) 2934, 2215, 1629, 1458, 942, 813, 758 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{17}\text{H}_{18}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 268.1338; found: 268.1343.

***N*-((5-Phenylfuran-2-yl)methyl)-*N*-propyl-3-(*p*-tolyl)propiolamide (1o)**



Yellow viscous oil (260 mg, 73%); ^1H NMR (400 MHz, CDCl_3) δ 7.67 – 7.60 (m, 2H), 7.48 – 7.40 (m, 2H), 7.35 (q, $J = 7.7$ Hz, 2H), 7.27 – 7.21 (m, 1H), 7.18 – 7.11 (m, 2H), 6.62 – 6.56 (m, 1H), 6.41 – 6.35 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.65 (t, $J = 7.4$ Hz, 1H), 3.45 (t, $J = 7.4$ Hz, 1H), 2.35 (s, 3H), 1.74 – 1.67 (m, 1H), 1.64 – 1.56 (m, 1H), 0.96 (t, $J = 7.4$ Hz, 1.5H), 0.91 (t, $J = 7.4$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.9, 154.8, 154.0, 153.7, 149.9, 140.6, 132.4, 132.3, 130.7, 130.5, 129.3, 128.7, 127.5, 127.4, 123.7, 117.5, 111.0, 110.5, 105.9, 105.7, 90.7, 90.5, 81.6, 81.4, 50.5, 46.6, 46.2, 40.9, 21.9, 21.6, 20.5, 11.3; IR (film) 2965, 2213, 1629, 1544, 1453, 817, 761 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 358.1807; found: 358.1816.

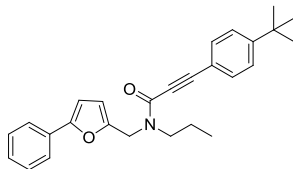
3-(4-Methoxyphenyl)-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1p)



Yellow viscous oil (285 mg, 76%); ^1H NMR (400 MHz, CDCl_3) δ 7.66 – 7.60 (m, 2H), 7.53 – 7.44 (m, 2H), 7.35 (q, $J = 7.7$ Hz, 2H), 7.25 – 7.20 (m, 1H), 6.90 – 6.83 (m, 2H), 6.59 (t, $J = 3.6$ Hz, 1H), 6.41 – 6.36 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.84 – 3.76 (br, 3H), 3.65 (t, $J = 7.6$ Hz, 1H), 3.45 (t, $J = 7.6$ Hz, 1H), 1.75 – 1.67 (m, 1H), 1.64 – 1.57 (m, 1H), 0.96 (t, $J = 7.4$ Hz, 1.5H), 0.91 (t, $J = 7.4$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 161.1, 155.0, 154.9, 154.0, 153.6, 150.0, 149.9, 134.2, 130.7, 130.5, 128.7, 127.5, 127.4, 123.7, 114.3, 112.5, 111.0, 110.4, 105.9, 105.7, 90.9, 90.6, 81.2, 81.1, 55.4,

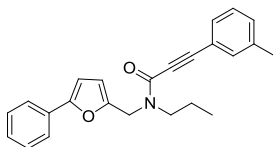
50.5, 46.5, 46.2, 40.8, 21.9, 20.5, 11.3; IR (film) 2965, 2210, 1626, 1457, 968, 834, 762 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_3$ $[\text{M}+\text{H}]^+$: 374.1756; found: 374.1766.

3-(4-(*Tert*-butyl)phenyl)-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1q)



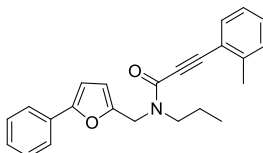
Yellow viscous oil (309 mg, 77%); ^1H NMR (400 MHz, CDCl_3) δ 7.64 (t, J = 6.8 Hz, 2H), 7.52 – 7.45 (m, 2H), 7.40 – 7.31 (m, 4H), 7.27 – 7.22 (m, 1H), 6.61 – 6.55 (m, 1H), 6.41 – 6.36 (m, 1H), 4.86 (s, 1H), 4.69 (s, 1H), 3.65 (t, J = 7.2 Hz, 1H), 3.46 (t, J = 7.2 Hz, 1H), 1.75 – 1.68 (m, 1H), 1.64 – 1.57 (m, 1H), 1.33 – 1.28 (br, 9H), 0.99 – 0.89 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.9, 154.8, 154.0, 153.6, 150.0, 149.9, 132.3, 130.7, 130.5, 128.7, 127.5, 127.4, 125.6, 123.7, 117.6, 111.0, 110.5, 105.9, 105.7, 90.7, 90.5, 81.5, 81.4, 50.5, 46.6, 40.9, 35.0, 31.1, 21.9, 20.5, 11.3, 11.2; IR (film) 2964, 2213, 1630, 1459, 968, 837, 794 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{27}\text{H}_{30}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 400.2277; found: 400.2285.

***N*-((5-Phenylfuran-2-yl)methyl)-*N*-propyl-3-(*m*-tolyl)propiolamide (1r)**



Yellow viscous oil (247 mg, 69%); ^1H NMR (400 MHz, CDCl_3) δ 7.67 – 7.59 (m, 2H), 7.40 – 7.31 (m, 4H), 7.26 – 7.19 (m, 3H), 6.62 – 6.56 (m, 1H), 6.41 – 6.36 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.65 (t, J = 7.2 Hz, 1H), 3.45 (t, J = 7.2 Hz, 1H), 2.33 (s, 1.5H), 2.30 (s, 1.5H), 1.75 – 1.67 (m, 1H), 1.64 – 1.59 (m, 1H), 0.97 (t, J = 7.4 Hz, 1.5H), 0.91 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.8, 154.7, 154.0, 153.7, 149.9, 138.4, 132.9, 132.8, 131.0, 130.7, 130.5, 129.6, 129.5, 128.7, 128.5, 127.6, 127.4, 123.7, 120.4, 111.1, 110.5, 105.9, 105.7, 90.6, 90.4, 81.7, 81.5, 50.5, 46.6, 46.2, 40.9, 21.9, 21.2, 20.5, 11.3; IR (film) 2967, 2209, 1685, 1454, 912, 884, 762, 693 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 358.1807; found: 358.1819.

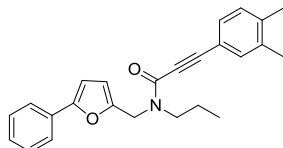
***N*-((5-Phenylfuran-2-yl)methyl)-*N*-propyl-3-(*o*-tolyl)propiolamide (1s)**



Yellow viscous oil (257 g, 72%); ^1H NMR (400 MHz, CDCl_3) δ 7.67 – 7.59 (m, 2H), 7.56 – 7.48 (m, 1H), 7.39 – 7.13 (m, 6H), 6.59 (d, J = 3.2 Hz, 1H), 6.42 – 6.35 (m, 1H), 4.88 (s, 1H), 4.70 (s, 1H), 3.67 (t, J = 7.6 Hz, 1H), 3.46 (t, J = 7.6 Hz, 1H), 2.47 (s, 1.5H), 2.45 (s, 1.5H), 1.76 – 1.69 (m, 1H), 1.65 – 1.57 (m, 1H), 0.99 – 0.89 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.8, 154.1, 153.7, 149.9, 149.8,

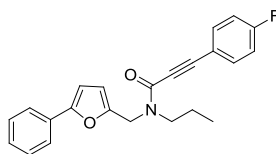
141.4, 141.3, 133.1, 133.0, 130.7, 130.5, 130.1, 129.7, 128.7, 127.6, 127.4, 125.8, 123.7, 120.5, 111.1, 110.4, 105.9, 105.7, 89.3, 89.2, 85.7, 85.6, 50.5, 46.5, 46.2, 40.9, 21.9, 20.7, 20.5, 11.3, 11.2; IR (film) 2932, 2210, 1629, 1486, 912, 795, 760 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{24}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 358.1807; found: 358.1817.

3-(3,4-Dimethylphenyl)-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1t)



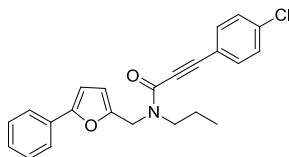
Yellow viscous oil (261 mg, 70%); ^1H NMR (400 MHz, CDCl_3) δ 7.67 – 7.60 (m, 2H), 7.40 – 7.20 (m, 5H), 7.14 – 7.06 (m, 1H), 6.62 – 6.55 (m, 1H), 6.41 – 6.35 (m, 1H), 4.85 (s, 1H), 4.69 (s, 1H), 3.65 (t, J = 7.4 Hz, 1H), 3.45 (t, J = 7.4 Hz, 1H), 2.28 – 2.19 (br, 6H), 1.74 – 1.67 (m, 1H), 1.64 – 1.56 (m, 1H), 0.99 – 0.88 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.9, 154.0, 153.6, 150.0, 149.9, 139.4, 137.0, 133.4, 133.3, 130.7, 130.5, 130.0, 129.9, 128.7, 127.5, 127.4, 123.7, 123.7, 117.8, 111.0, 110.5, 105.9, 105.7, 91.0, 90.8, 81.4, 81.2, 50.5, 46.6, 46.2, 40.8, 21.9, 20.5, 19.9, 19.6, 19.5, 11.3; IR (film) 2967, 2209, 1629, 1545, 1422, 968, 885, 820, 791, 761, 692 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{25}\text{H}_{26}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 372.1964; found: 372.1971.

3-(4-Fluorophenyl)-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1u)



Yellow viscous oil (254 mg, 70%); ^1H NMR (400 MHz, CDCl_3) δ 7.63 (t, J = 7.4 Hz, 2H), 7.57 – 7.49 (m, 2H), 7.36 (q, J = 7.6 Hz, 2H), 7.26 – 7.21 (m, 1H), 7.04 (dd, J = 15.7, 7.8 Hz, 2H), 6.62 – 6.56 (m, 1H), 6.41 – 6.36 (m, 1H), 4.84 (s, 1H), 4.69 (s, 1H), 3.64 (t, J = 7.4 Hz, 1H), 3.45 (t, J = 7.4 Hz, 1H), 1.75 – 1.68 (m, 1H), 1.64 – 1.57 (m, 1H), 0.97 (t, J = 7.4 Hz, 1.5H), 0.91 (t, J = 7.4 Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 163.6 (d, J = 252.4 Hz), 154.5 (d, J = 3.2 Hz), 154.1, 153.7, 149.7, 134.6, 134.5, 130.7, 130.4, 128.7, 127.6, 127.4, 123.7, 116.7 (d, J = 3.7 Hz), 116.1 (d, J = 1.5 Hz), 115.9 (d, J = 1.5 Hz), 111.1, 110.5, 105.9, 105.7, 89.3, 89.0, 81.8, 81.7, 50.5, 46.6, 46.2, 40.9, 21.8, 20.5, 11.3, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -107.6; IR (film) 2968, 2216, 1628, 1599, 1456, 839, 794, 761 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{FNO}_2$ $[\text{M}+\text{H}]^+$: 362.1556; found: 362.1564.

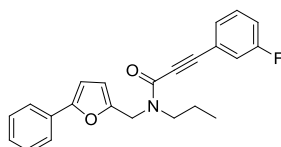
3-(4-Chlorophenyl)-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1v)



Yellow viscous oil (266 mg, 71%); ^1H NMR (400 MHz, CDCl_3) δ 7.63 (t, J = 7.8 Hz, 2H), 7.50 – 7.43 (m, 2H), 7.39 – 7.30 (m, 4H), 7.23 (d, J = 7.4 Hz, 1H), 6.59 (t, J = 3.5 Hz, 1H), 6.38 (dd, J = 8.9, 3.3

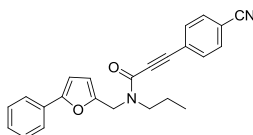
Hz, 1H), 4.83 (s, 1H), 4.69 (s, 1H), 3.64 (t, $J = 7.3$ Hz, 1H), 3.45 (t, $J = 7.3$ Hz, 1H), 1.74 – 1.68 (m, 1H), 1.64 – 1.56 (m, 1H), 0.96 (t, $J = 7.4$ Hz, 1.5H), 0.91 (t, $J = 7.4$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.4, 154.1, 153.7, 149.7, 136.4, 133.6, 133.5, 130.6, 130.4, 129.0, 128.7, 127.6, 127.4, 123.7, 119.1, 111.2, 110.6, 105.9, 105.7, 89.0, 88.8, 82.8, 82.6, 50.5, 46.6, 46.2, 40.9, 21.8, 20.5, 11.3; IR (film) 2968, 2216, 1629, 1545, 1423, 968, 830, 739 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{ClNO}_2$ $[\text{M}+\text{H}]^+$: 378.1261; found: 378.1270.

3-(3-Fluorophenyl)-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1w)



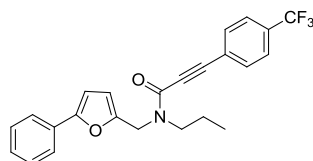
Yellow viscous oil (250 mg, 69%); ^1H NMR (400 MHz, CDCl_3) δ 7.63 (t, $J = 7.1$ Hz, 2H), 7.39 – 7.29 (m, 4H), 7.27 – 7.19 (m, 2H), 7.15 – 7.07 (m, 1H), 6.59 (t, $J = 3.4$ Hz, 1H), 6.39 (dd, $J = 8.2, 3.2$ Hz, 1H), 4.84 (s, 1H), 4.69 (s, 1H), 3.64 (t, $J = 7.2$ Hz, 1H), 3.45 (t, $J = 7.2$ Hz, 1H), 1.75 – 1.68 (m, 1H), 1.64 – 1.57 (m, 1H), 0.97 (t, $J = 7.4$ Hz, 1.5H), 0.91 (t, $J = 7.4$ Hz, 1.5H); ^{13}C NMR (100 MHz, CDCl_3) δ 162.3 (d, $J = 247.8$ Hz), 154.3 (d, $J = 4.5$ Hz), 154.2, 153.7, 149.6, 130.6, 130.4, 130.3, 128.7 (d, $J = 2.7$ Hz), 128.3 (d, $J = 3.2$ Hz), 127.6, 127.5, 123.7, 122.4 (d, $J = 9.3$ Hz), 119.2 (d, $J = 7.4$ Hz), 119.0 (d, $J = 7.5$ Hz), 117.6, 117.4, 111.2, 110.6, 105.9, 105.7, 88.7, 88.5, 82.5, 82.3, 50.5, 46.6, 46.2, 40.9, 21.8, 20.5, 11.3, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -111.9; IR (film) 2967, 2214, 1630, 1581, 1486, 969, 872, 762 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{FNO}_2$ $[\text{M}+\text{H}]^+$: 362.1556; found: 362.1566.

3-(4-Cyanophenyl)-*N*-((5-phenylfuran-2-yl)methyl)-*N*-propylpropiolamide (1x)



Yellow viscous oil (200 mg, 54%); ^1H NMR (400 MHz, CDCl_3) δ 7.68 – 7.57 (m, 6H), 7.35 (dd, $J = 15.1, 7.5$ Hz, 2H), 7.27 – 7.21 (m, 1H), 6.66 – 6.54 (m, 1H), 6.44 – 6.33 (m, 1H), 4.83 (s, 1H), 4.69 (s, 1H), 3.64 (t, $J = 7.2$ Hz, 1H), 3.46 (t, $J = 7.2$ Hz, 1H), 1.77 – 1.67 (m, 1H), 1.66 – 1.56 (m, 1H), 1.00 – 0.88 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.2, 153.9, 153.8, 149.4, 132.8, 132.7, 132.2, 130.6, 130.3, 128.7, 127.7, 127.5, 125.3, 123.7, 118.0, 113.4, 111.3, 110.7, 105.9, 105.8, 87.8, 87.6, 85.2, 85.0, 50.5, 46.7, 46.2, 40.9, 21.8, 20.5, 11.3; IR (film) 2962, 2228, 1633, 1545, 1453, 914, 841, 794, 762 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{20}\text{N}_2\text{O}_2$ $[\text{M}+\text{Na}]^+$: 391.1422; found: 391.1424.

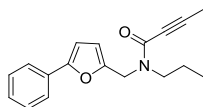
N-((5-phenylfuran-2-yl)methyl)-*N*-propyl-3-(4-(trifluoromethyl)phenyl)propiolamide (1y)



Yellow viscous oil (250 mg, 61%); ^1H NMR (400 MHz, CDCl_3) δ 7.67 – 7.55 (m, 6H), 7.38 – 7.30 (m, 2H), 7.23 (t, $J = 7.4$ Hz, 1H), 6.62 – 6.56 (br, 1H), 6.43 – 6.35 (br, 1H), 4.85 (s, 1H), 4.70 (s, 1H), 3.65

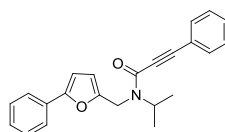
(t, $J = 7.4$ Hz, 1H), 3.47(t, $J = 7.4$ Hz, 1H), 1.77 – 1.56 (m, 2H), 1.00 – 0.89 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.2, 154.1, 153.7, 149.6, 132.6 (d, $J = 8.8$ Hz), 130.5(d, $J = 20.0$ Hz), 128.7, 127.7, 127.5, 125.4(dd, $J = 25.4, 23.3$ Hz), 123.7, 122.3, 111.3, 110.7, 105.9, 105.7, 88.3, 88.1, 83.8, 83.6, 50.5, 46.7, 46.2, 40.87 (s), 21.8, 20.5, 11.3, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -63.0. IR (film) 2968, 2219, 1632, 1423, 759, 689 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{20}\text{F}_3\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 434.1344; found: 434.1335.

***N*-((5-Phenylfuran-2-yl)methyl)-*N*-propylbut-2-ynamide (1z)**



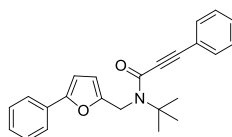
Yellow viscous oil (198 mg, 70%); ^1H NMR (400 MHz, CDCl_3) δ 7.66 – 7.59 (m, 2H), 7.40 – 7.33 (m, 2H), 7.28 – 7.21 (m, 1H), 6.61 – 6.55 (m, 1H), 6.36 – 6.30 (m, 1H), 4.77 (s, 1H), 4.63 (s, 1H), 3.55 (t, $J = 7.2$ Hz, 1H), 3.37 (t, $J = 7.2$ Hz, 1H), 2.03 (s, 1.5H), 2.00 (s, 1.5H), 1.68 – 1.61 (m, 1H), 1.58 – 1.51 (m, 1H), 0.94 – 0.85 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.8, 154.7, 154.0, 153.6, 149.9, 130.7, 130.5, 128.7, 128.7, 127.5, 127.3, 123.7, 110.9, 110.3, 105.8, 105.7, 89.1, 89.0, 73.6, 73.5, 50.2, 46.2, 46.0, 40.6, 21.7, 20.4, 11.3, 11.1, 4.1, 4.0; IR (film) 2932, 2240, 1629, 1423, 972, 796, 762 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{20}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 282.1494; found: 282.1492.

***N*-Isopropyl-3-phenyl-*N*-((5-phenylfuran-2-yl)methyl)propiolamide (1aa)**



Yellow viscous oil (235 mg, 69%); ^1H NMR (400 MHz, CDCl_3) δ 7.63 (d, $J = 7.5$ Hz, 2H), 7.57 – 7.49 (m, 2H), 7.41 – 7.28 (m, 5H), 7.25 – 7.20 (m, 1H), 6.58 (dd, $J = 6.6, 3.3$ Hz, 1H), 6.39 (dd, $J = 11.0, 3.3$ Hz, 1H), 4.82 (s, 1H), 4.80 – 4.70 (m, 1H), 4.61 (s, 1H), 1.34 (d, $J = 6.8$ Hz, 3H), 1.22 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.9, 154.5, 153.5, 152.7, 151.2, 150.9, 132.4, 130.9, 130.6, 129.0, 130.0, 128.7, 128.5, 127.4, 127.2, 123.6, 120.7, 120.6, 110.8, 110.0, 106.1, 105.9, 90.4, 89.9, 82.6, 81.7, 50.7, 46.1, 42.0, 36.9, 21.3, 20.1; IR (film) 2976, 2213, 1624, 1489, 924, 793 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{22}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 344.1651; found: 344.1649.

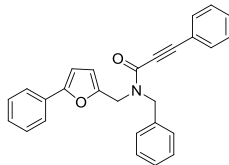
***N*-(Tert-butyl)-3-phenyl-*N*-((5-phenylfuran-2-yl)methyl)propiolamide (1ab)**



Yellow viscous oil (250 mg, 66%); ^1H NMR (400 MHz, CDCl_3) δ 7.98 (d, $J = 7.4$ Hz, 1H), 7.76 – 7.69 (m, 1H), 7.65 – 7.58 (m, 2H), 7.57 – 7.51 (m, 1H), 7.44 – 7.32 (m, 4H), 7.29 – 7.21 (m, 1H), 6.66 – 6.57 (m, 1H), 6.37 – 6.27 (m, 1H), 4.63 (s, 1H), 4.24 (s, 1H), 1.57 (s, 3H), 1.49 (s, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 194.8, 174.7, 168.5, 153.8, 152.2, 151.7, 136.6, 133.4, 130.6, 130.5, 128.8, 128.7,

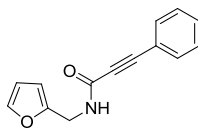
128.4, 127.6, 127.4, 125.9, 123.7, 123.6, 109.4, 109.2, 105.9, 105.8, 58.4, 48.3, 43.2, 42.7, 29.2, 28.7; IR (film) 2931, 2209, 1694, 1488, 921, 794, 760, 691 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{22}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 380.1626; found: 380.1625.

***N*-Benzyl-3-phenyl-*N*-((5-phenylfuran-2-yl)methyl)propiolamide (1ac)**



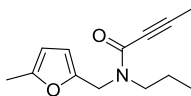
Yellow viscous oil (195 mg, 50%); ^1H NMR (400 MHz, CDCl_3) δ 7.69 – 7.61 (m, 3H), 7.54 (d, J = 7.2 Hz, 1H), 7.46 – 7.33 (m, 10H), 7.32 – 7.26 (m, 1H), 6.68 – 6.57 (m, 1H), 6.39 (t, J = 2.6 Hz, 1H), 4.96 (s, 1H), 4.81 (s, 1H), 4.76 (s, 1H), 4.66 (s, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.9, 154.7, 154.3, 153.9, 149.4, 149.3, 132.5, 132.5, 130.2, 128.9, 128.8, 128.7, 128.6, 128.5, 128.0, 127.8, 127.6, 127.5, 123.8, 120.5, 120.4, 111.4, 111.0, 105.8, 105.7, 91.1, 90.8, 81.7, 81.6, 52.2, 47.2, 44.8, 39.8; IR (film) 2932, 2215, 1630, 1419, 794, 759 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{27}\text{H}_{22}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 392.1651; found: 392.1647.

***N*-(Furan-2-ylmethyl)-3-phenylpropiolamide (1ad)**



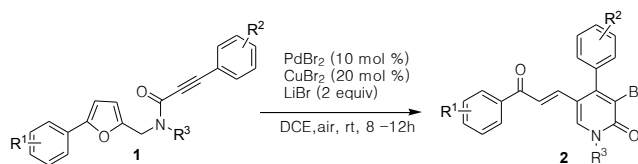
Yellow solid (700 mg, 65%); m.p. = 87–88 $^{\circ}\text{C}$; ^1H NMR (400 MHz, CDCl_3) δ 7.53 – 7.47 (m, 2H), 7.42 – 7.29 (m, 4H), 6.49 (br, 1H), 6.34 – 6.31 (m, 1H), 6.30 – 6.26 (m, 1H), 4.52 (d, J = 5.7 Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 153.2, 150.4, 142.4, 132.5, 130.1, 128.5, 120.13, 110.6, 108.0, 85.3, 82.8, 36.8; IR (KBr) 2936, 2220, 1635, 1524, 1458, 925, 884, 811, 757, 690 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{14}\text{H}_{12}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 226.0868; found: 226.0874.

***N*-((5-Methylfuran-2-yl)methyl)-*N*-propylbut-2-ynamide (1ak)**



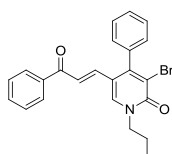
Yellow oil (158 mg, 72%); ^1H NMR (400 MHz, CDCl_3) δ 6.12 (s, 1H), 5.93 – 5.84 (m, 1H), 4.66 (s, 1H), 4.51 (s, 1H), 3.49 (t, J = 7.4 Hz, 1H), 3.31 (t, J = 7.4 Hz, 1H), 2.27 (s, 1.5H), 2.25 (s, 1.5H), 2.02 (s, 1.5H), 2.00 (s, 1.5H), 1.63 – 1.55 (m, 1H), 1.54 – 1.46 (m, 1H), 0.94 – 0.82 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.6, 154.5, 152.2, 151.8, 148.4, 109.5, 109.1, 106.2, 88.8, 88.6, 73.6, 73.5, 49.9, 45.8, 40.3, 21.5, 20.2, 13.5, 11.2, 11.0, 4.0, 3.9; IR (film) 2927, 2239, 1629, 1455, 977, 955, 789 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{13}\text{H}_{18}\text{NO}_2$ $[\text{M}+\text{H}]^+$: 220.1338; found: 220.1345.

5. General Procedure for the Synthesis of **2** and characterization data for **2**



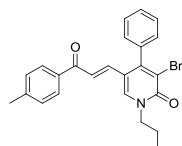
In a Schlenk tube with a magnetic bar under air atmosphere was added PdBr₂ (10 mol %, 10.7 mg), CuBr₂ (20 mol %, 17.9 mg) and LiBr (2 equiv, 69.4 mg) in 1,2-dichloroethane (DCE, 4 mL), and then the substrates **1** (0.4 mmol) were added. The mixture was stirred at room temperature until the starting materials was completely consumed (monitored by TLC). The corresponding reaction mixture was filtered through a pad of celite, washed with EtOAc and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using petroleum ether/ethyl acetate (4/1) as eluent to afford the desired product **2**.

(*E*)-3-Bromo-5-(3-oxo-3-phenylprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1*H*)-one (**2a**)



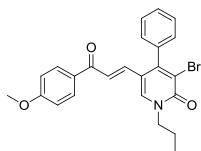
Yellow syrup (128 mg, 76%); ¹H NMR (400 MHz, CDCl₃) δ 7.66 (s, 1H), 7.59 (d, *J* = 7.5 Hz, 2H), 7.48 – 7.40 (m, 4H), 7.31 (t, *J* = 7.7 Hz, 2H), 7.21 – 7.11 (m, 3H), 6.54 (d, *J* = 15.8 Hz, 1H), 4.01 (t, *J* = 7.2 Hz, 2H), 1.88 – 1.79 (m, 2H), 0.97 (t, *J* = 7.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 188.6, 157.2, 151.2, 138.8, 136.7, 136.6, 136.6, 131.7, 128.0, 127.9, 127.4, 127.3, 127.0, 120.5, 117.8, 114.2, 52.4, 21.5, 10.1; IR (film) 2963, 1652, 1587, 1443, 979, 858, 764, 703 cm⁻¹; HRMS (ESI) calcd for C₂₃H₂₁BrNO₂ [M+H]⁺: 422.0756; found: 422.0770.

(*E*)-3-Bromo-5-(3-oxo-3-(*p*-tolyl)prop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1*H*)-one (**2b**)



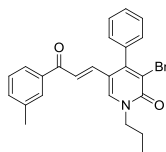
Yellow syrup (138 mg, 79%); ¹H NMR (400 MHz, CDCl₃) δ 7.72 (s, 1H), 7.58 (d, *J* = 8.1 Hz, 2H), 7.55 – 7.49 (m, 3H), 7.22 – 7.17 (m, 5H), 6.60 (d, *J* = 15.7 Hz, 1H), 4.08 (t, *J* = 7.2 Hz, 2H), 2.39 (s, 3H), 1.97 – 1.85 (m, 2H), 1.04 (t, *J* = 7.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 189.1, 158.2, 152.2, 143.7, 139.3, 137.7, 135.6, 135.2, 129.2, 129.0, 128.9, 128.5, 128.1, 121.6, 118.8, 115.3, 53.4, 22.5, 21.6, 11.2; IR (film) 2962, 1657, 1608, 1586, 1442, 980, 820, 763, 701 cm⁻¹; HRMS (ESI) calcd for C₂₄H₂₃BrNO₂ [M+H]⁺: 436.0912; found: 436.0921.

(*E*)-3-Bromo-5-(3-(4-methoxyphenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1*H*)-one (**2c**)



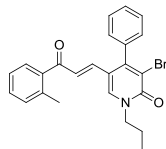
Yellow solid (142.5 mg, 79%); m.p. = 128–129.5 °C; ^1H NMR (400 MHz, CDCl_3) δ 7.71 (s, 1H), 7.67(d, J = 7.6 Hz, 2H), 7.56 – 7.46 (m, 3H), 7.25 – 7.17 (m, 3H), 6.86 (d, J = 7.9 Hz, 2H), 6.59 (d, J = 15.7 Hz, 1H), 4.07 (t, J = 7.3 Hz, 2H), 3.85 (s, 3H), 1.96 – 1.85 (m, 2H), 1.04 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 187.8, 163.4, 158.2, 152.2, 138.8, 137.7, 137.5, 130.7, 129.0, 128.8, 128.1, 121.5, 118.8, 115.4, 113.70, 55.5, 53.4, 22.5, 11.2; IR (KBr) 2930, 1653, 1601, 1441, 979, 833, 763, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{23}\text{BrNO}_3$ $[\text{M}+\text{H}]^+$: 452.0861; found: 452.0880.

(E)-3-Bromo-5-(3-oxo-3-(*m*-tolyl)prop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2d)



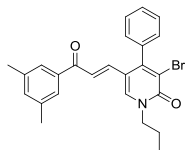
Yellow syrup (133 mg, 76%); ^1H NMR (400 MHz, CDCl_3) δ 7.64 (s, 1H), 7.50 – 7.36 (m, 5H), 7.22 – 7.12 (m, 5H), 6.48 (d, J = 15.8 Hz, 1H), 4.01 (t, J = 7.2 Hz, 2H), 2.30 (s, 3H), 1.90 – 1.79 (m, 2H), 0.98 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.7, 157.2, 151.1, 138.5, 137.3, 136.8, 136.7, 132.5, 128.0, 127.9, 127.9, 127.3, 127.1, 124.5, 120.8, 117.9, 114.2, 52.4, 21.5, 20.3, 10.1; IR (film) 2962, 1653, 1580, 1440, 980, 799, 763, 701 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{23}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 436.0912; found: 436.0926.

(E)-3-Bromo-5-(3-oxo-3-(*o*-tolyl)prop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2e)



Yellow solid (125 mg, 72%); m.p. = 125–126 °C; ^1H NMR (400 MHz, CDCl_3) δ 7.66 (s, 1H), 7.40 – 7.30 (m, 3H), 7.21 – 7.16 (m, 1H), 7.09 – 6.97 (m, 5H), 6.77 (d, J = 16.1 Hz, 1H), 6.36 (d, J = 16.1 Hz, 1H), 3.99 (t, J = 7.2 Hz, 2H), 2.20 (s, 3H), 1.87 – 1.76 (m, 2H), 0.95 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 195.6, 158.3, 152.4, 141.1, 138.3, 137.1, 136.9, 136.4, 131.2, 130.4, 128.8, 128.0, 127.9, 125.7, 125.2, 118.3, 115.0, 53.5, 22.5, 20.1, 11.1; IR (KBr) 2965, 1653, 1587, 1443, 984, 866, 765, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{23}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 436.0912; found: 436.0929.

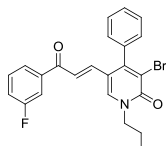
(E)-3-Bromo-5-(3-(3,5-dimethylphenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2f)



Yellow solid (138.2 mg, 77%); m.p. = 139–140 °C; ^1H NMR (400 MHz, CDCl_3) δ 7.71 (s, 1H), 7.59 – 7.47 (m, 3H), 7.26 – 7.17 (m, 5H), 7.14 (s, 1H), 6.51 (d, J = 15.8 Hz, 1H), 4.08 (t, J = 7.2 Hz, 2H), 2.32

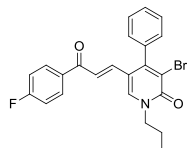
(s, 6H), 1.97 – 1.84 (m, 2H), 1.05 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.9, 158.2, 152.1, 139.2, 138.1, 137.9, 137.8, 134.4, 129.1, 128.9, 128.1, 126.1, 122.0, 119.0, 115.2, 53.4, 22.5, 21.2, 11.2; IR (KBr) 2926, 1653, 1603, 1582, 1442, 981, 841, 768, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{25}\text{H}_{25}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 450.1069; found: 450.1079.

(*E*)-3-Bromo-5-(3-(3-fluorophenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1*H*)-one (2g)



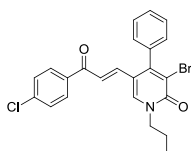
Yellow syrup (124.9 mg, 71%); ^1H NMR (400 MHz, CDCl_3) δ 7.74 (s, 1H), 7.60 – 7.50 (m, 3H), 7.44 – 7.30 (m, 3H), 7.28 – 7.17 (m, 4H), 6.49 (d, $J = 15.8$ Hz, 1H), 4.08 (t, $J = 7.3$ Hz, 2H), 1.97 – 1.86 (m, 2H), 1.05 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.3, 162.7 (d, $J = 247.9$ Hz), 158.2, 152.1, 140.4, 139.9 (d, $J = 6.4$ Hz), 138.1, 137.6, 130.1 (d, $J = 7.6$ Hz), 129.1, 129.0, 128.0, 124.0 (d, $J = 2.9$ Hz), 120.9, 119.7 (d, $J = 21.4$ Hz), 118.9, 115.2, 115.0 (d, $J = 5.2$ Hz), 53.5, 22.5, 11.1; ^{19}F NMR (376 MHz, CDCl_3) δ -111.9; IR (film) 2964, 1652, 1580, 1442, 981, 843, 790, 764, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{BrFNO}_2$ $[\text{M}+\text{H}]^+$: 440.0661; found: 440.0675.

(*E*)-3-Bromo-5-(3-(4-fluorophenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1*H*)-one (2h)



Yellow syrup (96.5 mg, 55%); ^1H NMR (400 MHz, CDCl_3) δ 7.76 (s, 1H), 7.73 – 7.66 (m, 2H), 7.58 – 7.49 (m, 3H), 7.30 – 7.21 (m, 3H), 7.06 (t, $J = 8.5$ Hz, 2H), 6.56 (d, $J = 15.7$ Hz, 1H), 4.09 (t, $J = 7.3$ Hz, 2H), 1.96 – 1.88 (m, 2H), 1.05 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.0, 165.5 (d, $J = 254.7$ Hz), 158.2, 152.1, 139.9, 137.8 (d, $J = 24.3$ Hz), 134.1 (d, $J = 2.9$ Hz), 131.0, 130.9, 129.1, 128.9, 128.1, 121.1, 118.8, 115.6 (d, $J = 21.8$ Hz), 115.1, 53.4, 22.5, 11.1; ^{19}F NMR (376 MHz, CDCl_3) δ -105.5; IR (film) 2964, 1652, 1599, 1580, 1441, 980, 836, 764, 701 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{BrFNO}_2$ $[\text{M}+\text{H}]^+$: 440.0661; found: 440.0678.

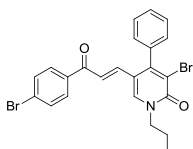
(*E*)-3-Bromo-5-(3-(4-chlorophenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1*H*)-one (2i)



Yellow solid (87.1 mg, 48%); m.p. = 126.5–127.5 $^{\circ}\text{C}$; ^1H NMR (400 MHz, CDCl_3) δ 7.74 (s, 1H), 7.58 (d, $J = 8.4$ Hz, 2H), 7.56 – 7.49 (m, 3H), 7.35 (d, $J = 8.3$ Hz, 2H), 7.26 – 7.18 (m, 3H), 6.51 (d, $J = 15.7$ Hz, 1H), 4.08 (t, $J = 7.3$ Hz, 2H), 1.95 – 1.87 (m, 2H), 1.04 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.3, 158.2, 152.1, 140.2, 139.2, 138.1, 137.7, 136.1, 129.7, 129.1, 128.9, 128.8, 128.0,

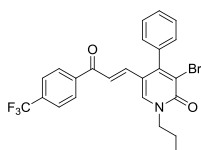
120.9, 118.9, 115.0, 53.4, 22.5, 11.1; ^{19}F NMR (376 MHz, CDCl_3) δ -105.5; IR (KBr) 2964, 1652, 1592, 1441, 980, 829, 765, 701 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{BrClNO}_2$ $[\text{M}+\text{H}]^+$: 456.0366; found: 456.0381.

(E)-3-Bromo-5-(3-(4-bromophenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2j)



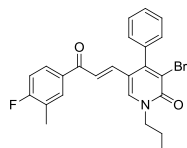
Yellow syrup (113.5 mg, 57%); ^1H NMR (400 MHz, CDCl_3) δ 7.74 (s, 1H), 7.56 – 7.47 (m, 7H), 7.27 (s, 1H), 7.24 – 7.21 (m, 2H), 6.4 (d, J = 15.6 Hz, 1H), 4.08 (t, J = 7.2 Hz, 2H), 1.95 – 1.87 (m, 2H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.4, 158.2, 152.1, 140.3, 138.1, 137.7, 136.5, 131.8, 129.8, 129.1, 128.9, 128.0, 127.9, 120.8, 118.9, 115.0, 53.5, 22.5, 11.2; IR (film) 2964, 1653, 1589, 1441, 980, 826, 764, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{Br}_2\text{NO}_2$ $[\text{M}+\text{H}]^+$: 499.9861; found: 499.9881.

(E)-3-Bromo-5-(3-oxo-3-(4-(trifluoromethyl)phenyl)prop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2k)



Yellow syrup (97.8 mg, 50%); ^1H NMR (400 MHz, CDCl_3) δ 7.79 (s, 1H), 7.73 (d, J = 8.2 Hz, 2H), 7.64 (d, J = 8.2 Hz, 2H), 7.60 – 7.52 (m, 3H), 7.29 – 7.23 (m, 3H), 6.53 (d, J = 15.8 Hz, 1H), 4.10 (t, J = 7.4 Hz, 2H), 1.96 – 1.89 (m, 2H), 1.06 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.7, 158.2, 152.1, 141.04, 140.6, 138.4, 137.6, 133.9 (q, J = 32.8 Hz), 129.1, 129.0, 128.6, 128.0, 125.5 (q, J = 3.7 Hz), 120.9, 118.9, 114.8, 53.5, 22.5, 11.1; ^{19}F NMR (376 MHz, CDCl_3) δ -63.1; IR (film) 2964, 1652, 1588, 1440, 980, 836, 762, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{20}\text{BrF}_3\text{NO}_2$ $[\text{M}+\text{H}]^+$: 490.0630; found: 490.0645.

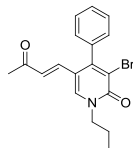
(E)-3-Bromo-5-(3-(4-fluoro-3-methylphenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2l)



Yellow syrup (108.6 mg, 60%); ^1H NMR (400 MHz, CDCl_3) δ 7.73 (s, 1H), 7.58 – 7.46 (m, 5H), 7.2 – 7.19 (m, 3H), 6.98 (t, J = 8.9 Hz, 1H), 6.50 (d, J = 15.7 Hz, 1H), 4.08 (t, J = 7.2, 2H), 2.28 (s, 3H), 1.95 – 1.87 (m, 2H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.2, 164.2 (d, J = 253.5 Hz), 158.2, 152.1, 139.6, 138.2, 137.8, 133.8 (d, J = 3.3 Hz), 132.1 (d, J = 6.5 Hz), 129.1, 128.9, 128.3, 128.2 (d, J = 9.3 Hz), 125.3 (d, J = 17.8 Hz), 121.3, 118.9, 115.3, 115.1 (d, J = 6.4 Hz), 53.4, 22.5, 14.5

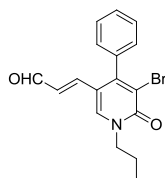
(d, $J = 2.6$ Hz), 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -109.6; IR (film) 2964, 1653, 1590, 1441, 981, 827, 763, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{22}\text{BrFNO}_2$ $[\text{M}+\text{H}]^+$: 454.0818; found: 454.0835.

(E)-3-Bromo-5-(3-oxobut-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2m)



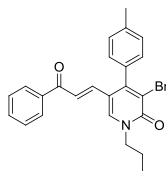
Yellow syrup (86 mg, 60%); ^1H NMR (400 MHz, CDCl_3) δ 7.72 (s, 1H), 7.54 – 7.44 (m, 3H), 7.21 – 7.17 (m, 2H), 6.86 (d, $J = 16.3$ Hz, 1H), 6.13 (d, $J = 16.3$ Hz, 1H), 4.07 (t, $J = 7.2$ Hz, 2H), 2.05 (s, 3H), 1.92 – 1.86 (m, 2H), 1.03 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 197.5, 158.3, 152.3, 138.6, 137.0, 135.7, 129.0, 128.8, 128.1, 126.1, 118.2, 114.6, 53.5, 27.0, 22.5, 11.1; IR (film) 2964, 1651, 1613, 1443, 977, 872, 833, 766, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{19}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 360.0599; found: 360.0609.

(E)-3-(5-Bromo-6-oxo-4-phenyl-1-propyl-1,6-dihydropyridin-3-yl)acrylaldehyde (2n)



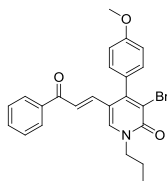
Yellow syrup (93.7 mg, 68%); ^1H NMR (400 MHz, CDCl_3) δ 9.31 (d, $J = 7.6$ Hz, 1H), 7.81 (s, 1H), 7.56 – 7.45 (m, 3H), 7.23 – 7.14 (m, 2H), 6.84 (d, $J = 16.0$ Hz, 1H), 6.19 (dd, $J = 16.0, 7.6$ Hz, 1H), 4.09 (t, $J = 7.4$ Hz, 2H), 1.94 – 1.87 (m, 2H), 1.04 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 192.9, 158.3, 152.2, 147.5, 136.7, 136.4, 129.1, 129.0, 128.1, 127.0, 118.4, 114.2, 53.7, 22.5, 11.1; IR (film) 2963, 1651, 1614, 1559, 973, 840, 765, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{17}\text{H}_{17}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 346.0443; found: 346.0454.

(E)-3-Bromo-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propyl-4-(p-tolyl)pyridin-2(1H)-one (2o)



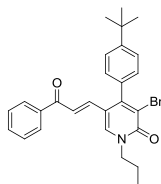
Yellow syrup (121.8 mg, 70%); ^1H NMR (400 MHz, CDCl_3) δ 7.75 (s, 1H), 7.70 (d, $J = 8.0$ Hz, 2H), 7.53 (t, $J = 7.1$ Hz, 1H), 7.44 – 7.32 (m, 4H), 7.28 (s, 1H), 7.13 (d, $J = 7.8$ Hz, 2H), 6.62 (d, $J = 15.8$ Hz, 1H), 4.09 (t, $J = 7.4$ Hz, 2H), 2.48 (s, 3H), 1.96 – 1.88 (m, 2H), 1.06 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.6, 158.2, 152.4, 139.9, 138.9, 137.8, 137.6, 134.7, 132.7, 129.7, 128.5, 128.4, 128.0, 128.0, 121.3, 118.8, 115.4, 53.4, 22.5, 21.4, 11.2; IR (film) 2964, 1653, 1587, 1446, 981, 858, 810, 781, 694 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{23}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 436.0912; found: 436.0921.

(E)-3-Bromo-4-(4-methoxyphenyl)-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2p)



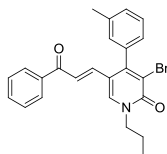
Yellow syrup (118.8 mg, 66%); ^1H NMR (400 MHz, CDCl_3) δ 7.72 (d, J = 6.6 Hz, 3H), 7.52 (t, J = 7.3 Hz, 1H), 7.40 (t, J = 7.6 Hz, 2H), 7.26 (t, J = 7.9 Hz, 1H), 7.15 (d, J = 8.5 Hz, 2H), 7.04 (d, J = 8.5 Hz, 2H), 6.67 (d, J = 15.7 Hz, 1H), 4.07 (t, J = 7.4 Hz, 2H), 3.88 (s, 3H), 1.96 – 1.85 (m, 2H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.2, 160.0, 158.3, 152.2, 140.1, 137.8, 137.2, 132.8, 129.7, 129.6, 128.5, 128.4, 121.3, 119.0, 115.6, 114.4, 55.5, 53.4, 22.5, 11.2; IR (film) 2962, 1651, 1446, 980, 835, 749, 711 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{23}\text{BrNO}_3$ $[\text{M}+\text{H}]^+$: 452.0861; found: 452.0879.

(E)-3-Bromo-4-(4-(tert-butyl)phenyl)-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2q)



Yellow solid (143 mg, 75%); m.p. = 154–155 $^{\circ}\text{C}$; ^1H NMR (400 MHz, CDCl_3) δ 7.73 (s, 1H), 7.64 (d, J = 7.6 Hz, 2H), 7.56 – 7.46 (m, 3H), 7.36 (t, J = 7.7 Hz, 2H), 7.28 (d, J = 11.2 Hz, 1H), 7.16 (d, J = 8.2 Hz, 2H), 6.52 (d, J = 15.8 Hz, 1H), 4.07 (t, J = 7.2 Hz, 2H), 1.95 – 1.85 (m, 2H), 1.39 (s, 9H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.7, 158.2, 152.3, 152.0, 140.1, 138.4, 137.8, 134.7, 132.7, 128.4, 128.3, 127.7, 125.9, 121.3, 119.1, 115.3, 53.4, 34.8, 31.4, 22.5, 11.2; IR (KBr) 2963, 1652, 1587, 1445, 981, 859, 781, 711 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{27}\text{H}_{29}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 478.1382; found: 478.1402.

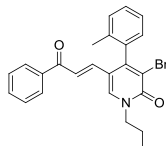
(E)-3-Bromo-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propyl-4-(m-tolyl)pyridin-2(1H)-one (2r)



Yellow syrup (109.4 mg, 63%); ^1H NMR (400 MHz, CDCl_3) δ 7.73 (s, 1H), 7.67 (d, J = 8.4 Hz, 2H), 7.51 (t, J = 7.0 Hz, 1H), 7.44 – 7.36 (m, 3H), 7.30 (d, J = 7.6 Hz, 1H), 7.22 (d, J = 15.8 Hz, 1H), 7.02 (d, J = 8.7 Hz, 2H), 6.62 (d, J = 15.8 Hz, 1H), 4.08 (t, J = 7.4 Hz, 2H), 2.42 (s, 3H), 1.94 – 1.87 (m, 2H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.8, 158.2, 152.5, 139.9, 138.8, 137.8, 137.6, 137.5, 132.7, 129.6, 129.0, 128.4, 128.3, 121.5, 118.7, 115.3, 53.4, 22.5, 21.5, 11.2; IR (film)

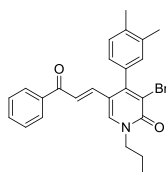
2964, 1652, 1587, 1446, 981, 841, 782, 706 cm⁻¹; HRMS (ESI) calcd for C₂₄H₂₃BrNO₂ [M+H]⁺: 436.0912; found: 436.0928.

(E)-3-Bromo-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propyl-4-(o-tolyl)pyridin-2(1H)-one (2s)



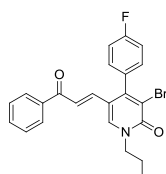
Yellow syrup (109.1 mg, 63%); ¹H NMR (400 MHz, CDCl₃) δ 7.73 (s, 1H), 7.60 (d, *J* = 7.9 Hz, 2H), 7.50 (t, *J* = 7.3 Hz, 1H), 7.46 – 7.34 (m, 5H), 7.21 (d, *J* = 15.8 Hz, 1H), 7.08 (d, *J* = 7.0 Hz, 1H), 6.45 (d, *J* = 15.8 Hz, 1H), 4.19 – 3.99 (m, 2H), 2.11 (s, 3H), 1.96 – 1.88 (m, 2H), 1.04 (t, *J* = 7.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 189.6, 158.2, 152.1, 139.3, 138.9, 137.7, 137.5, 134.7, 132.8, 130.7, 129.1, 128.4, 128.3, 127.5, 126.8, 120.9, 119.1, 114.9, 53.41, 22.44, 19.3, 11.1; IR (film) 2928, 1653, 1588, 1447, 980, 856, 764, 709cm⁻¹; HRMS (ESI) calcd for C₂₄H₂₃BrNO₂ [M+H]⁺: 436.0912; found: 436.0922.

(E)-3-Bromo-4-(3,4-dimethylphenyl)-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2t)



Yellow syrup (126.2 mg, 70%); ¹H NMR (400 MHz, CDCl₃) δ 7.73 (s, 1H), 7.67 (d, *J* = 7.9 Hz, 2H), 7.51 (t, *J* = 7.5 Hz, 1H), 7.38 (t, *J* = 7.6 Hz, 2H), 7.30 – 7.21 (m, 2H), 6.98 (s, 1H), 6.94 (d, *J* = 7.6 Hz, 1H), 6.59 (d, *J* = 15.8 Hz, 1H), 4.07 (t, *J* = 7.4 Hz, 2H), 2.36 (s, 3H), 2.32 (s, 3H), 1.94 – 1.86 (m, 2H), 1.03 (t, *J* = 7.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 189.6, 158.2, 152.5, 140.0, 137.8, 137.6, 137.4, 135.1, 132.7, 130.2, 128.9, 128.4, 128.3, 125.4, 121.3, 118.7, 115.4, 53.4, 22.5, 19.9, 19.7, 11.1; IR (film) 2965, 1652, 1587, 1446, 983, 853, 781, 706 cm⁻¹; HRMS (ESI) calcd for C₂₅H₂₅BrNO₂ [M+H]⁺: 450.1069; found: 450.1087.

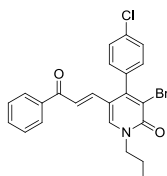
(E)-3-Bromo-4-(4-fluorophenyl)-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2u)



Yellow syrup (134 mg, 76%); ¹H NMR (400 MHz, CDCl₃) δ 7.76 (s, 1H), 7.72 (d, *J* = 7.6 Hz, 2H), 7.53 (t, *J* = 7.2 Hz, 1H), 7.41 (t, *J* = 7.7 Hz, 2H), 7.28 – 7.17 (m, 5H), 6.71 (d, *J* = 15.7 Hz, 1H), 4.08 (t, *J* = 7.2 Hz, 2H), 1.96 – 1.86 (m, 2H), 1.04 (t, *J* = 7.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 189.5, 162.9 (d, *J* = 249.4 Hz), 158.2, 151.3, 139.6, 137.7, 137.2, 133.4 (d, *J* = 3.6 Hz), 132.9, 130.2 (d, *J* =

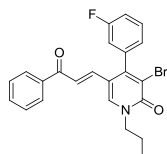
8.3 Hz), 128.6, 128.3, 121.5, 119.0, 116.2 (d, $J = 21.9$ Hz), 115.2, 53.5, 22.5, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -111.8; IR (film) 2965, 1651, 1588, 1446, 980, 852, 781, 694 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{BrFNO}_2$ $[\text{M}+\text{H}]^+$: 440.0661; found: 440.0677.

(E)-3-Bromo-4-(4-chlorophenyl)-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2v)



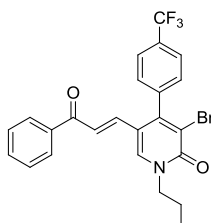
Yellow syrup (135.7 mg, 75%); ^1H NMR (400 MHz, CDCl_3) δ 7.75 (s, 1H), 7.70 (d, $J = 7.6$ Hz, 2H), 7.56 – 7.49 (m, 3H), 7.42 (t, $J = 7.6$ Hz, 2H), 7.23 – 7.15 (m, 3H), 6.65 (d, $J = 15.7$ Hz, 1H), 4.07 (t, $J = 7.4$ Hz, 2H), 1.95 – 1.85 (m, 2H), 1.04 (t, $J = 7.5$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.4, 158.1, 151.1, 139.4, 137.6, 137.5, 135.9, 135.2, 132.9, 130.9, 129.7, 129.4, 128.6, 128.3, 121.6, 118.8, 115.0, 53.5, 22.5, 11.1; IR (film) 2964, 1651, 1588, 1446, 980, 857, 781, 762, 709 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{BrClNO}_2$ $[\text{M}+\text{H}]^+$: 456.0366; found: 456.0386.

(E)-3-Bromo-4-(3-fluorophenyl)-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2w)



Yellow syrup; (132.3 mg, 75%); ^1H NMR (400 MHz, CDCl_3) δ 7.77 (s, 1H), 7.74 – 7.69 (m, 2H), 7.56 – 7.47 (m, 2H), 7.41 (t, $J = 7.7$ Hz, 2H), 7.23 – 7.15 (m, 2H), 7.05 – 6.93 (m, 2H), 6.72 (d, $J = 15.8$ Hz, 1H), 4.08 (t, $J = 7.2$ Hz, 2H), 1.94 – 1.87 (m, 2H), 1.05 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.6, 162.9 (d, $J = 248.6$ Hz), 158.1, 150.9 (d, $J = 1.7$ Hz), 139.3 (d, $J = 4.7$ Hz), 137.7, 137.2, 132.9, 130.9 (d, $J = 8.4$ Hz), 128.5, 128.3, 123.9 (d, $J = 3.1$ Hz), 121.7, 118.7, 116.0 (d, $J = 20.9$ Hz), 115.5 (d, $J = 22.6$ Hz), 114.9, 53.5, 22.5, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -111.1; IR (film) 2928, 1651, 1586, 1455, 848, 782, 706 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{BrFNO}_2$ $[\text{M}+\text{H}]^+$: 440.0661; found: 440.0672.

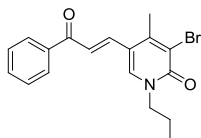
(E)-3-bromo-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propyl-4-(4-(trifluoromethyl)phenyl)pyridin-2(1H)-one (2y)



Yellow syrup (86 mg, 44%); ^1H NMR (400 MHz, CDCl_3) δ 7.85 – 7.79 (m, 3H), 7.62 (d, $J = 7.2$ Hz, 2H), 7.52 (t, $J = 7.4$ Hz, 1H), 7.42 – 7.35 (m, 4H), 7.19 (d, $J = 15.8$ Hz, 1H), 6.56 (d, $J = 15.8$ Hz, 1H),

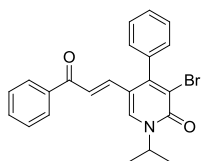
4.10 (t, $J = 7.2$ Hz, 2H), 1.95 – 1.86 (m, 2H), 1.04 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.3, 158.0, 150.6, 141.2, 139.1, 138.3, 137.5, 133.0, 131.3, 131.0, 128.8, 128.6, 128.2, 126.15 (d, $J = 3.7$ Hz), 125.2, 122.5, 121.6, 118.7, 114.6, 53.6, 22.5, 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -62.7; IR (film) 2983, 1654, 1590, 1445, 849, 769, 690 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{20}\text{BrF}_3\text{NO}_2$ $[\text{M}+\text{H}]^+$: 490.0630; found: 490.0617.

(E)-3-Bromo-4-methyl-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2z)



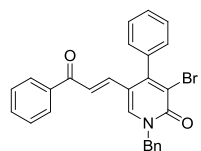
Yellow syrup (66 mg, 46%); ^1H NMR (400 MHz, CDCl_3) δ 7.99 (d, $J = 7.4$ Hz, 2H), 7.79 (d, $J = 15.4$ Hz, 1H), 7.66 – 7.58 (m, 1H), 7.54 – 7.49 (m, 2H), 7.26 (s, 1H), 7.20 (d, $J = 15.4$ Hz, 1H), 4.01 (t, $J = 7.2$ Hz, 2H), 2.51 (s, 3H), 1.90 – 1.80 (m, 2H), 1.00 (t, $J = 7.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.5, 158.05, 148.6, 139.33, 137.9, 134.7, 133.1, 128.7, 128.4, 121.8, 119.0, 115.72, 53.2, 22.5, 21.0, 11.1; IR (film) 2962, 1652, 1457, 976, 857, 780, 700 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{19}\text{BrNO}_2$ $[\text{M}+\text{H}]^+$: 360.0599; found: 360.0612.

(E)-3-Bromo-1-isopropyl-5-(3-oxo-3-phenylprop-1-en-1-yl)-4-phenylpyridin-2(1H)-one (2aa)



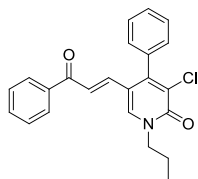
Yellow syrup (85.6 mg, 51%); ^1H NMR (400 MHz, CDCl_3) δ 7.77 (s, 1H), 7.70 – 7.63 (m, 2H), 7.58 – 7.50 (m, 3H), 7.40 (t, $J = 7.7$ Hz, 2H), 7.31 – 7.24 (m, 4H), 6.53 (d, $J = 15.8$ Hz, 1H), 5.39 (dt, $J = 13.6$, 6.8 Hz, 1H), 1.52 (d, $J = 6.8$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.8, 158.0, 151.4, 140.1, 137.8, 137.7, 133.8, 132.7, 129.1, 128.8, 128.4, 128.4, 128.0, 121.5, 118.7, 115.6, 49.4, 22.0; IR (film) 2930, 1650, 1587, 1444, 980, 922, 762, 734, 702 cm^{-1} ; HRMS (ESI) calcd for: $\text{C}_{23}\text{H}_{20}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 444.0575; found: 444.0573.

(E)-1-Benzyl-3-bromo-5-(3-oxo-3-phenylprop-1-en-1-yl)-4-phenylpyridin-2(1H)-one (2ac)



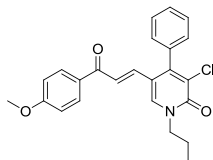
Yellow solid (139.1 mg, 74%); m.p. = 156–157 $^{\circ}\text{C}$; ^1H NMR (400 MHz, CDCl_3) δ 7.78 (s, 1H), 7.62 (d, $J = 7.7$ Hz, 2H), 7.55 – 7.46 (m, 4H), 7.46 – 7.33 (m, 7H), 7.23 – 7.13 (m, 3H), 6.52 (d, $J = 15.8$ Hz, 1H), 5.29 (s, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.7, 158.4, 152.3, 139.6, 137.6, 137.6, 137.3, 135.1, 132.8, 129.2, 129.1, 128.9, 128.8, 128.5, 128.3, 128.0, 121.8, 118.8, 115.7, 54.1; IR (KBr) 2926, 1654, 1589, 1443, 976, 860, 764, 701 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{27}\text{H}_{20}\text{BrNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 492.0575; found: 492.0573.

(E)-3-Chloro-5-(3-oxo-3-phenylprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2ae)



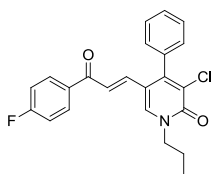
Yellow syrup (106 mg, 70%); ^1H NMR (400 MHz, CDCl_3) δ 7.72 (s, 1H), 7.70 – 7.64 (m, 2H), 7.56 – 7.47 (m, 4H), 7.38 (t, J = 7.6 Hz, 2H), 7.27 – 7.21 (m, 3H), 6.64 (d, J = 12.6 Hz, 1H), 4.07 (t, J = 7.4 Hz, 2H), 1.97 – 1.82 (m, 2H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.6, 158.1, 149.2, 139.7, 137.7, 136.8, 135.4, 132.8, 129.0, 129.0, 128.5, 128.3, 128.3, 125.9, 121.5, 114.9, 53.1, 22.5, 11.2; IR (film) 2965, 1656, 1588, 1446, 983, 909, 771, 700 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{ClNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 400.1080; found: 400.1077.

(E)-3-Chloro-5-(3-(4-methoxyphenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2af)



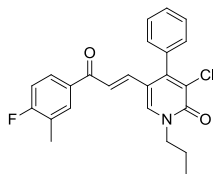
Yellow syrup (125.5 mg, 77%); ^1H NMR (400 MHz, CDCl_3) δ 7.74 – 7.65 (m, 3H), 7.56 – 7.47 (m, 3H), 7.29 – 7.19 (m, 3H), 6.86 (d, J = 8.9 Hz, 2H), 6.65 (d, J = 15.7 Hz, 1H), 4.10 – 4.02 (t, J = 7.4 Hz, 2H), 3.84 (s, 3H), 1.96 – 1.82 (m, 2H), 1.03 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 187.8, 163.4, 158.1, 149.2, 138.7, 136.8, 135.5, 130.7, 130.6, 129.0, 128.9, 128.3, 125.8, 121.4, 115.0, 113.7, 55.5, 53.1, 22.5, 11.2; IR (film) 2928, 1653, 1597, 1435, 875, 835, 762, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{22}\text{ClNO}_3\text{Na}$ $[\text{M}+\text{Na}]^+$: 430.1186; found: 430.1185.

(E)-3-Chloro-5-(3-(4-fluorophenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2ag)



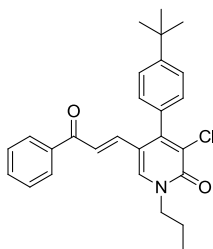
Yellow syrup (109 mg, 69%); ^1H NMR (400 MHz, CDCl_3) δ 7.76 (s, 1H), 7.74 – 7.66 (m, 2H), 7.57 – 7.48 (m, 3H), 7.30 – 7.22 (m, 3H), 7.05 (t, J = 8.6 Hz, 2H), 6.61 (d, J = 15.7 Hz, 1H), 4.10 – 4.05 (m, 2H), 1.96 – 1.85 (m, 2H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 187.9, 165.5 (d, J = 254.7 Hz), 158.1, 149.2, 139.9, 137.2, 135.5, 134.1 (d, J = 2.9 Hz), 130.9 (d, J = 9.3 Hz), 129.1, 129.0, 128.3, 125.9, 121.0, 115.6 (d, J = 21.8 Hz), 114.7, 53.1, 22.5, 11.1; ^{19}F NMR (376 MHz, CDCl_3) δ -105.4; IR (film) 2967, 1656, 1597, 1379, 982, 879, 838, 761, 703 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{19}\text{ClFNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 418.0986; found: 418.0984.

(E)-3-Chloro-5-(3-(4-fluoro-3-methylphenyl)-3-oxoprop-1-en-1-yl)-4-phenyl-1-propylpyridin-2(1H)-one (2ah)



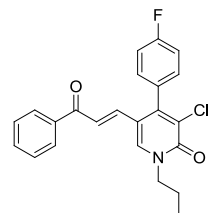
Yellow syrup (121.3 mg, 74%); ^1H NMR (400 MHz, CDCl_3) δ 7.73 (s, 1H), 7.59 – 7.45 (m, 5H), 7.30 – 7.20 (m, 3H), 6.98 (t, J = 9.0 Hz, 1H), 6.55 (d, J = 15.7 Hz, 1H), 4.07 (t, J = 7.4 Hz, 2H), 2.27 (d, J = 1.4 Hz, 3H), 1.96 – 1.85 (m, 2H), 1.04 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 188.1, 164.2 (d, J = 253.5 Hz), 158.0, 149.1, 139.5, 137.4, 135.6, 133.8 (d, J = 3.3 Hz), 132.1 (d, J = 6.5 Hz), 129.1, 129.0, 128.3, 128.2 (d, J = 9.5 Hz), 126.0, 125.3 (d, J = 17.8 Hz), 121.2, 115.2 (d, J = 22.9 Hz), 114.7, 53.1, 22.5, 14.5 (d, J = 3.0 Hz), 11.2; ^{19}F NMR (376 MHz, CDCl_3) δ -109.5; IR (film) 2964, 1655, 1586, 1499, 983, 900, 820, 751, 702 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{21}\text{ClFNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 432.1143; found: 432.1140.

(E)-4-(4-(Tert-butyl)phenyl)-3-chloro-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2ai)



Yellow syrup (141.8 mg, 82%); ^1H NMR (400 MHz, CDCl_3) δ 7.72 (s, 1H), 7.69 – 7.62 (m, 2H), 7.56 – 7.47 (m, 3H), 7.39 – 7.27 (m, 3H), 7.19 (d, J = 8.3 Hz, 2H), 6.57 (d, J = 15.8 Hz, 1H), 4.10 – 4.02 (m, 2H), 1.95 – 1.84 (m, 2H), 1.39 (s, 9H), 1.03 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.7, 158.1, 152.0, 149.2, 140.1, 137.8, 137.6, 132.7, 132.5, 128.5, 128.3, 128.0, 126.0, 125.9, 121.3, 114.9, 53.0, 34.8, 31.4, 22.5, 11.2; IR (film) 2961, 1654, 1589, 1448, 978, 846, 753, 697 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{27}\text{H}_{28}\text{ClNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 456.1706; found: 456.1703.

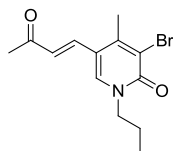
(E)-3-Chloro-4-(4-fluorophenyl)-5-(3-oxo-3-phenylprop-1-en-1-yl)-1-propylpyridin-2(1H)-one (2aj)



Yellow syrup (124.6 mg, 79%); ^1H NMR (400 MHz, CDCl_3) δ 7.79 (s, 1H), 7.74 (d, J = 7.3 Hz, 2H), 7.53 (t, J = 7.4 Hz, 1H), 7.41 (t, J = 7.7 Hz, 2H), 7.27 – 7.18 (m, 5H), 6.78 (d, J = 15.7 Hz, 1H), 4.07 (t, J = 7.2 Hz, 2H), 1.95 – 1.84 (m, 2H), 1.03 (t, J = 7.4 Hz, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 189.5, 162.9 (d, J = 249.4 Hz), 158.0, 148.3, 139.5, 137.6, 136.5, 132.9, 131.1 (d, J = 3.6 Hz), 130.5 (d, J =

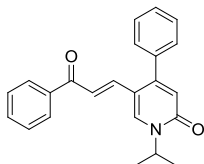
8.3 Hz), 128.6, 128.3, 126.0, 121.4, 116.2 (d, $J = 21.9$ Hz), 114.8, 53.2, 22.5, 11.1; ^{19}F NMR (376 MHz, CDCl_3) δ -111.8; IR (film) 2929, 1655, 1593, 1447, 878, 775, 701 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{19}\text{ClFNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 418.0986; found: 418.0984.

(E)-3-Bromo-4-methyl-5-(3-oxobut-1-en-1-yl)-1-propylpyridin-2(1H)-one (2ak)



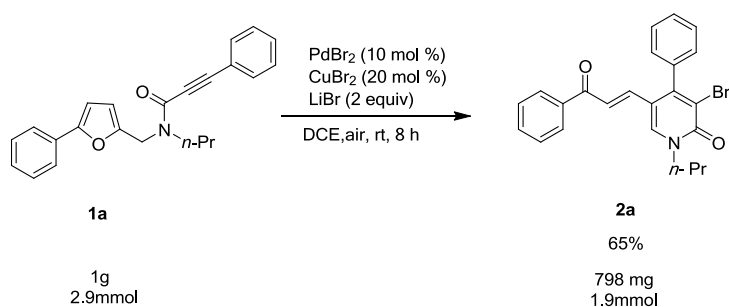
White solid (85.5 mg, 72%); m.p. = 136.5–137.5 $^{\circ}\text{C}$; ^1H NMR (400 MHz, CDCl_3) δ 7.54 (s, 1H), 7.49 (d, $J = 15.6$ Hz, 2H), 6.41 (d, $J = 15.9$ Hz, 1H), 3.98 (t, $J = 7.3$ Hz, 2H), 2.47 (s, 3H), 2.35 (s, 3H), 1.86 – 1.78 (m, 2H), 0.97 (t, $J = 7.3$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 197.1, 158.0, 148.2, 137.5, 134.6, 126.7, 118.9, 115.0, 53.1, 27.9, 22.4, 20.8, 11.0; IR (KBr) 2961, 1649, 1611, 1433, 972, 872, 761 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{13}\text{H}_{16}\text{BrNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 320.0262; found: 320.0262.

(E)-1-isopropyl-5-(3-oxo-3-phenylprop-1-en-1-yl)-4-phenylpyridin-2(1H)-one (3aa)

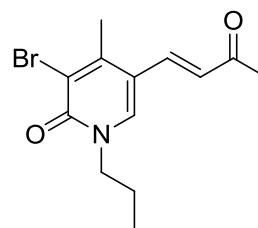
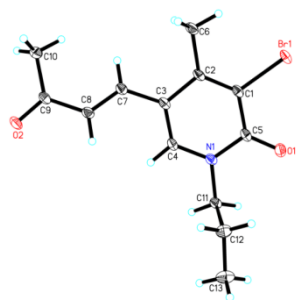


Yellow syrup (42.5 mg, 31%); ^1H NMR (400 MHz, CDCl_3) δ 7.80 (s, 1H), 7.76 (d, $J = 7.4$ Hz, 2H), 7.55 – 7.49 (m, 2H), 7.49 – 7.44 (m, 3H), 7.41 (t, $J = 7.6$ Hz, 2H), 7.36 – 7.31 (m, 2H), 6.83 (d, $J = 15.6$ Hz, 1H), 6.55 (s, 1H), 5.32 (dt, $J = 13.6, 6.8$ Hz, 1H), 1.47 (d, $J = 6.8$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 189.9, 161.3, 152.2, 140.6, 138.0, 137.3, 134.9, 132.7, 129.0, 128.8, 128.5, 128.3, 121.0, 120.5, 114.8, 47.1, 22.1; IR (film) 3062, 1661, 1450, 968, 775, 700 cm^{-1} ; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{21}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 366.1470; found: 366.1467.

6. Gram-scale reaction



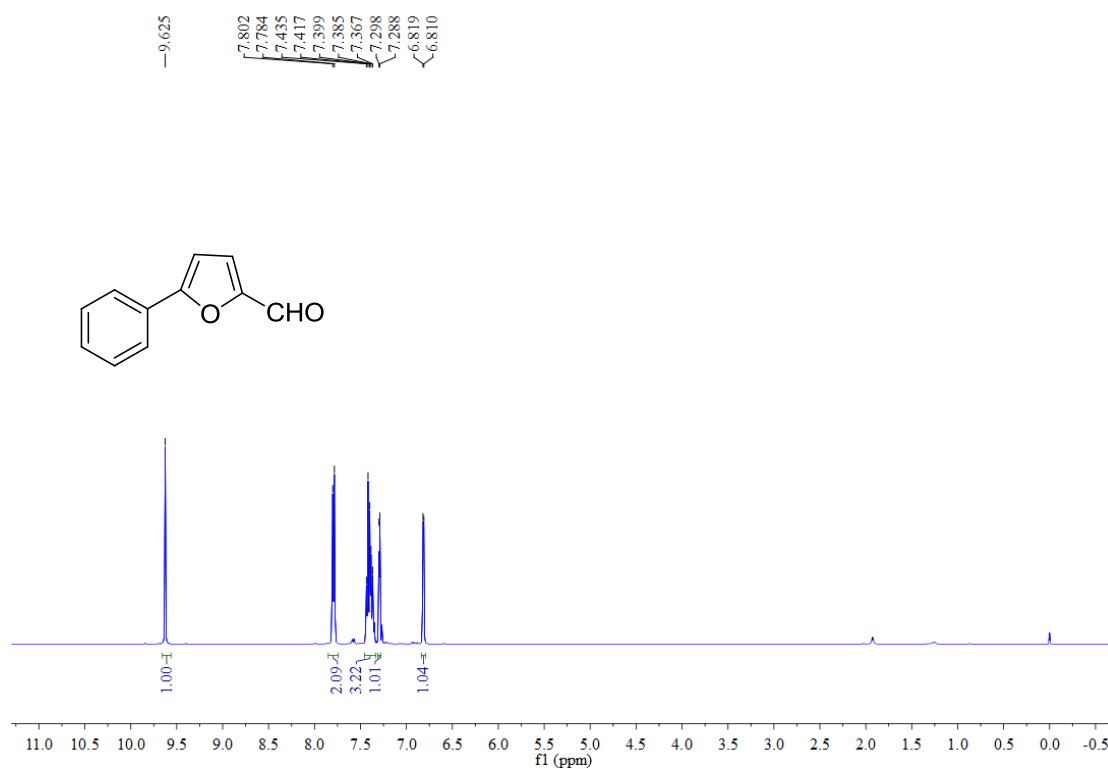
7. X-Ray diffraction analysis



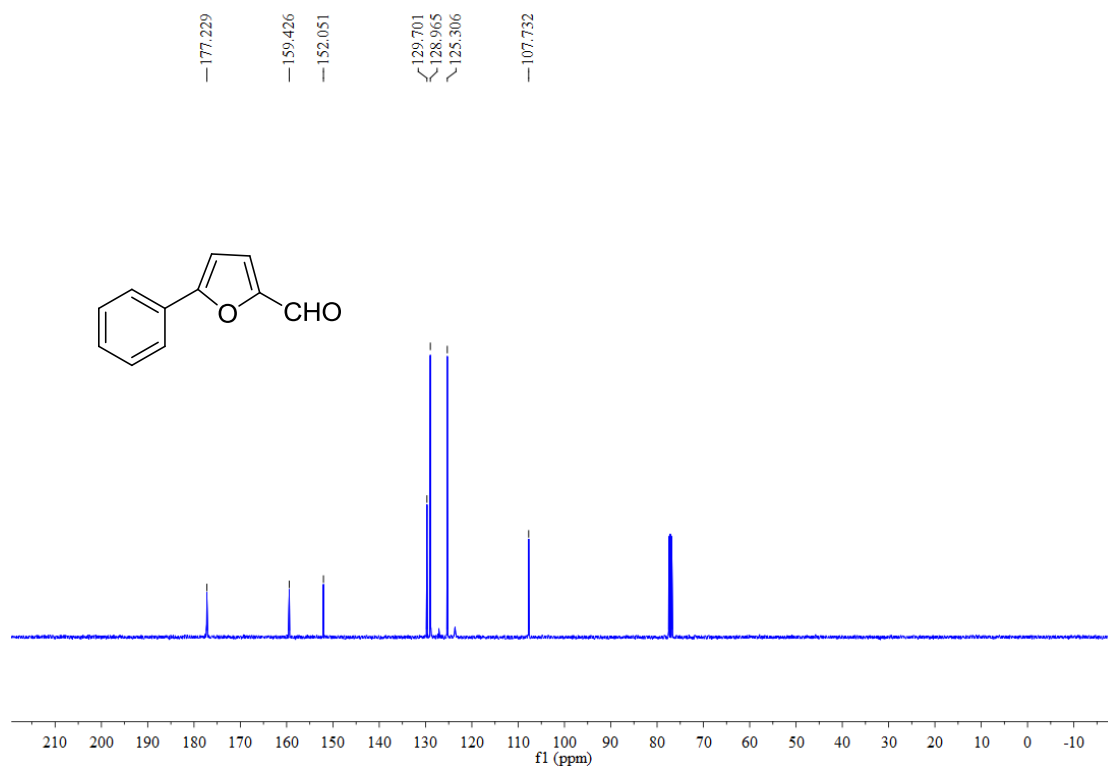
Identification code	2ak			
Empirical formula	C ₁₃ H ₁₆ BrNO ₂			
Formula weight	298.18			
Temperature/K	149.99(10)			
Crystal system	triclinic			
Space group	P-1			
Unit cell dimensions				
	a/Å	5.37560(10)	α /°	103.198(2)
	b/Å	14.4048(3)	β /°	97.005(2)
	c/Å	17.4028(4)	γ /°	97.624(2)
Volume/Å ³	1284.10(5)			
Z	4			
ρ _{calc} g/cm ³	1.542			
μ /mm ⁻¹	4.286			
F(000)	608.0			
Crystal size/mm ³	0.18 × 0.14 × 0.12			
Radiation	CuKα (λ = 1.54184)			
2θ range for data collection/°	6.392 to 148.2			
Index ranges	-6 ≤ h ≤ 6, -16 ≤ k ≤ 17, -20 ≤ l ≤ 21			
Reflections collected	11866			
Independent reflections	5016 [Rint = 0.0435, Rsigma = 0.0387]			
Data/restraints/parameters	5016/0/313			
Goodness-of-fit on F ²	1.066			
Final R indexes [I ≥ 2σ (I)]	R1 = 0.0430, wR2 = 0.1180			
Final R indexes [all data]	R1 = 0.0448, wR2 = 0.1194			
Largest diff. peak/hole / e Å ⁻³	0.56/-1.31			

8. Copies of NMR spectra of substrates and products

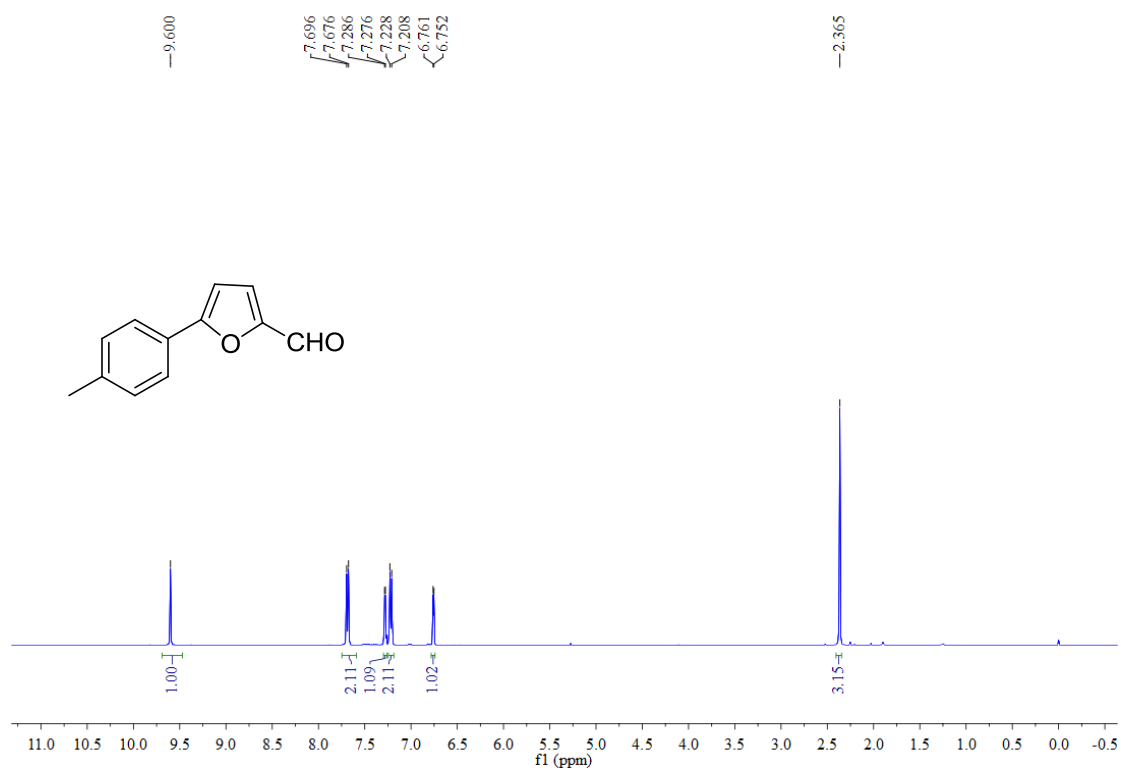
¹H NMR spectrum (400 MHz, CDCl₃) of **S2-1a**



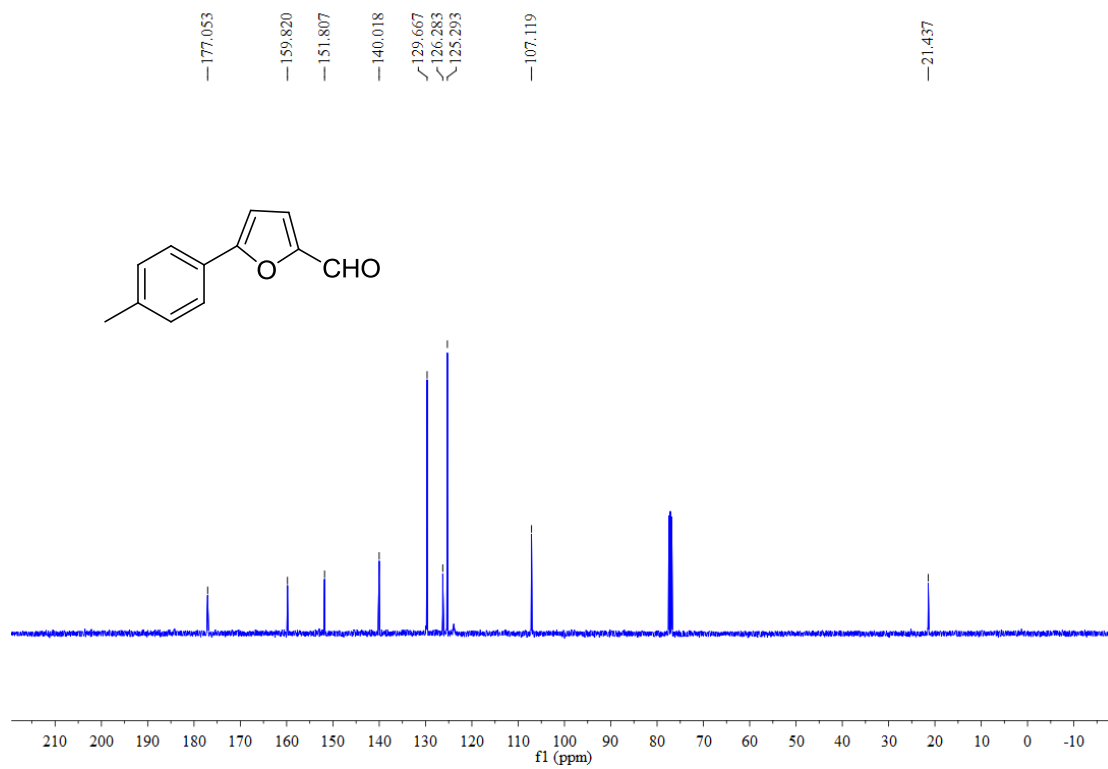
¹³C NMR spectrum (100 MHz, CDCl₃) of **S2-1a**



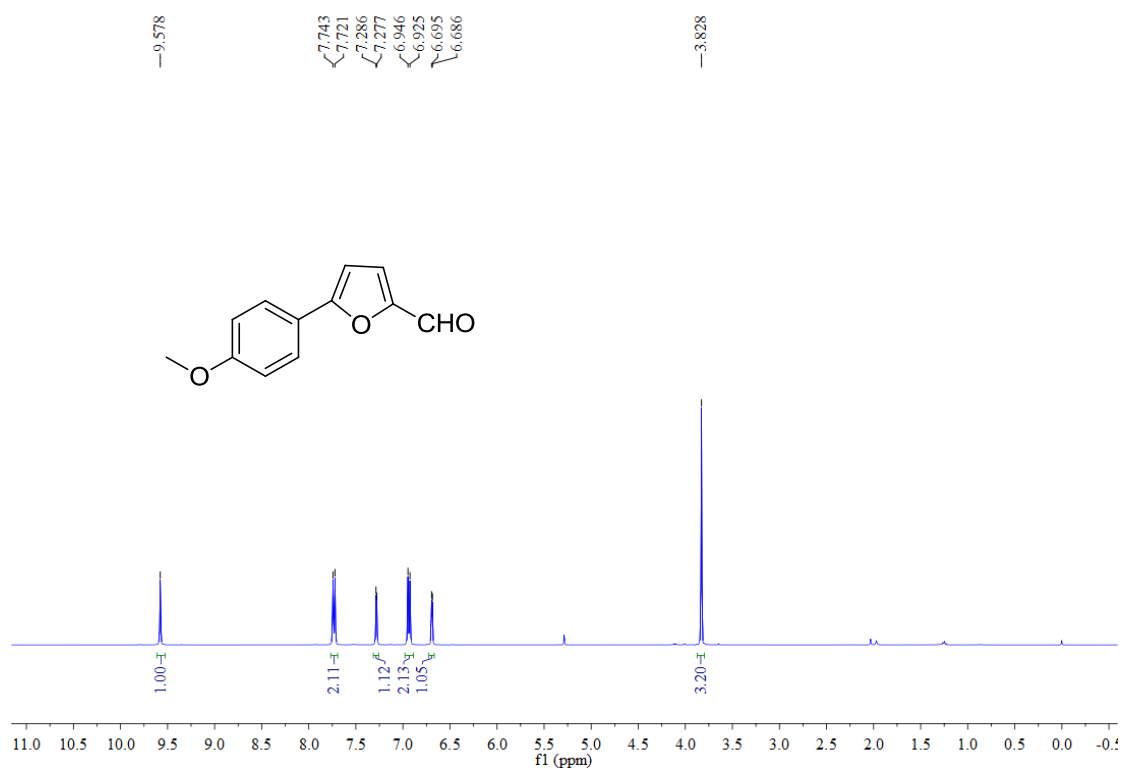
¹H NMR spectrum (400 MHz, CDCl₃) of **S2-1b**



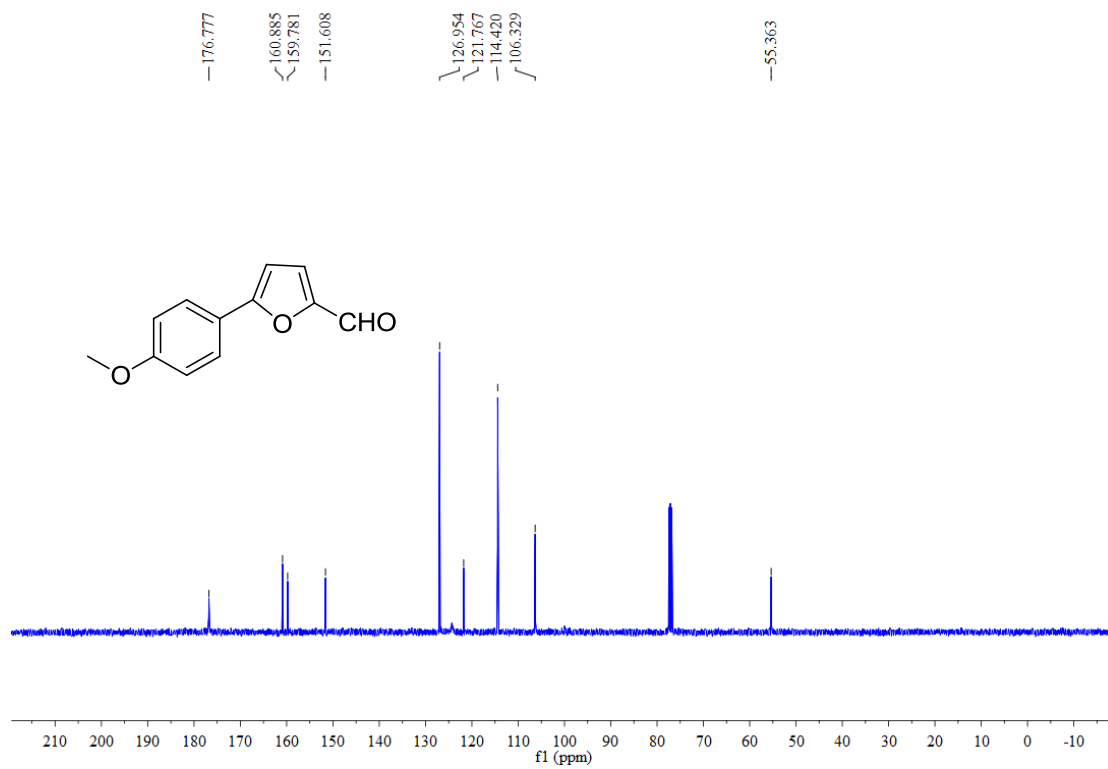
¹³C NMR spectrum (100 MHz, CDCl₃) of **S2-1b**



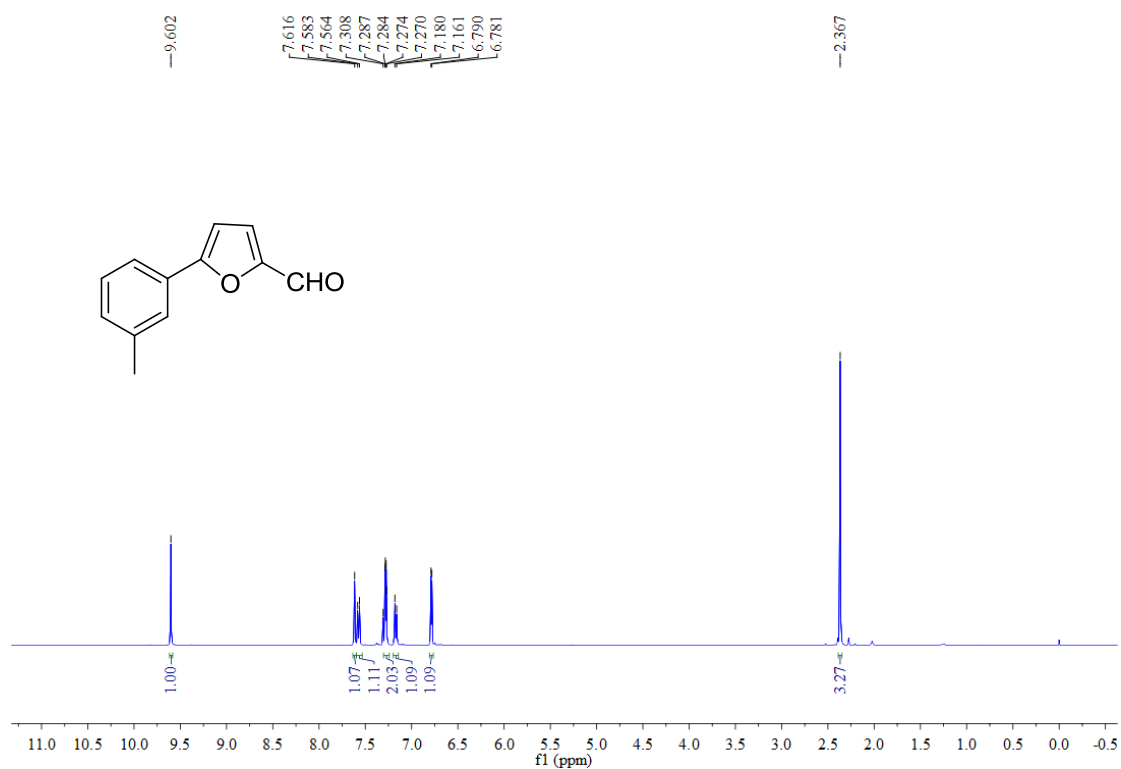
^1H NMR spectrum (400 MHz, CDCl_3) of **S2-1c**



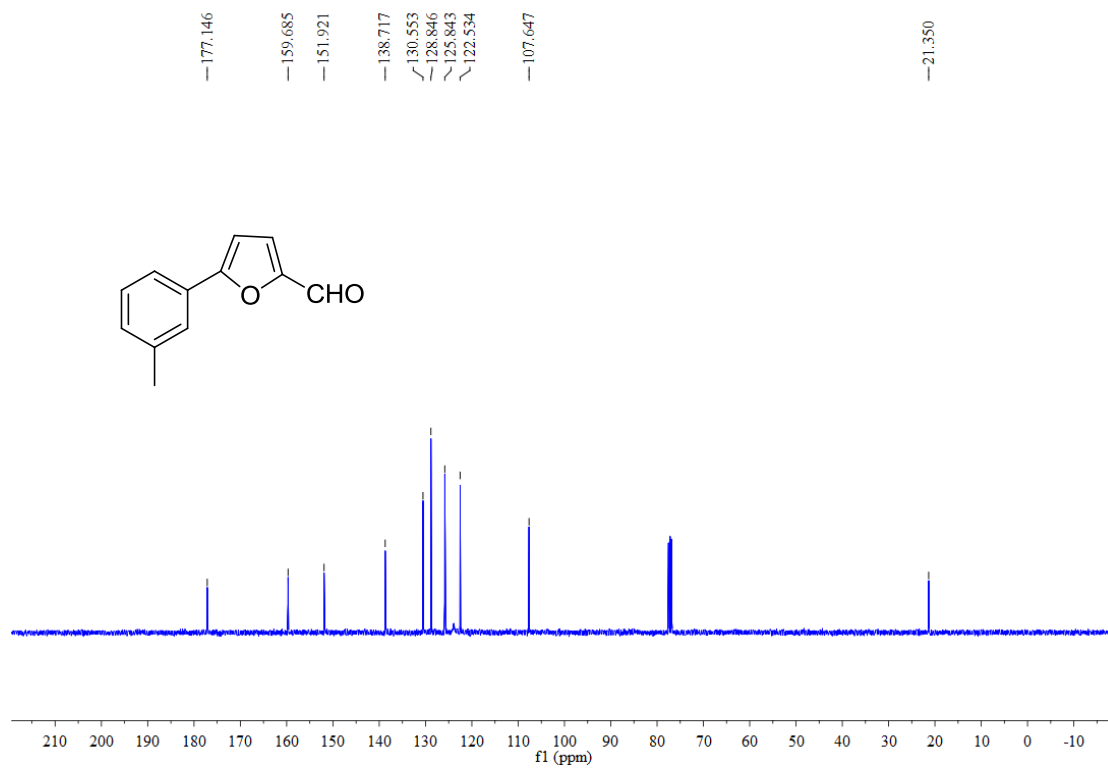
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S2-1c**



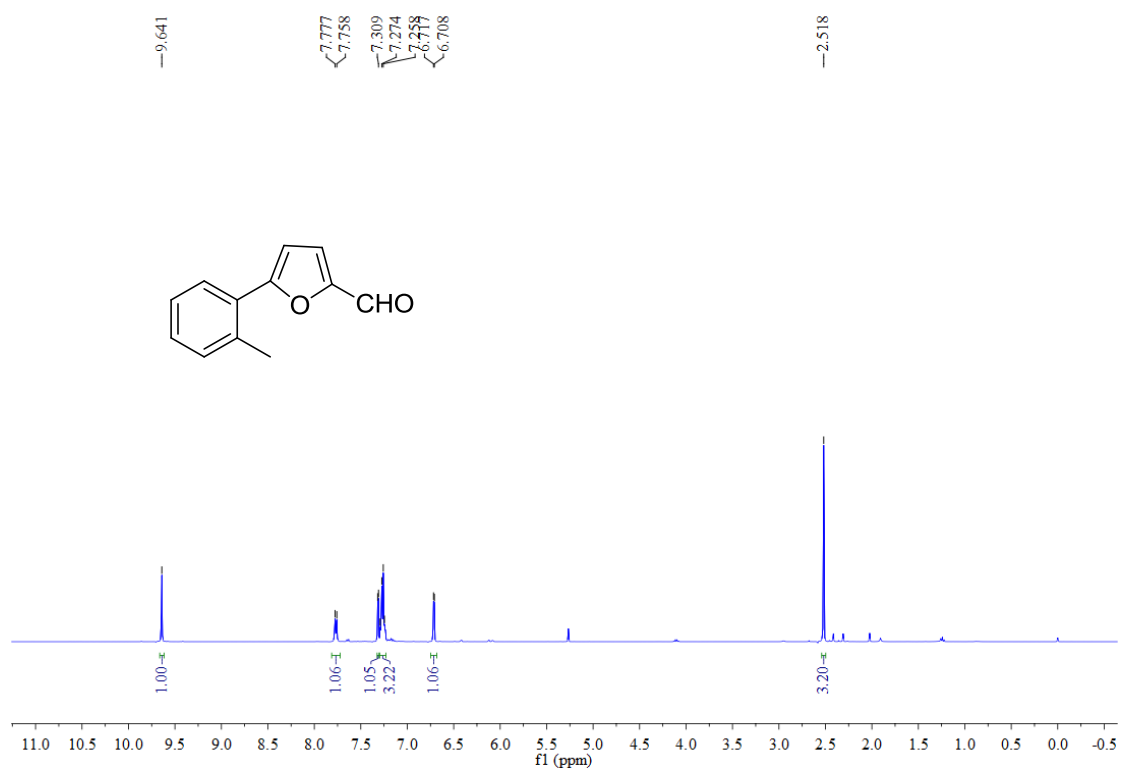
¹H NMR spectrum (400 MHz, CDCl₃) of **S2-1d**



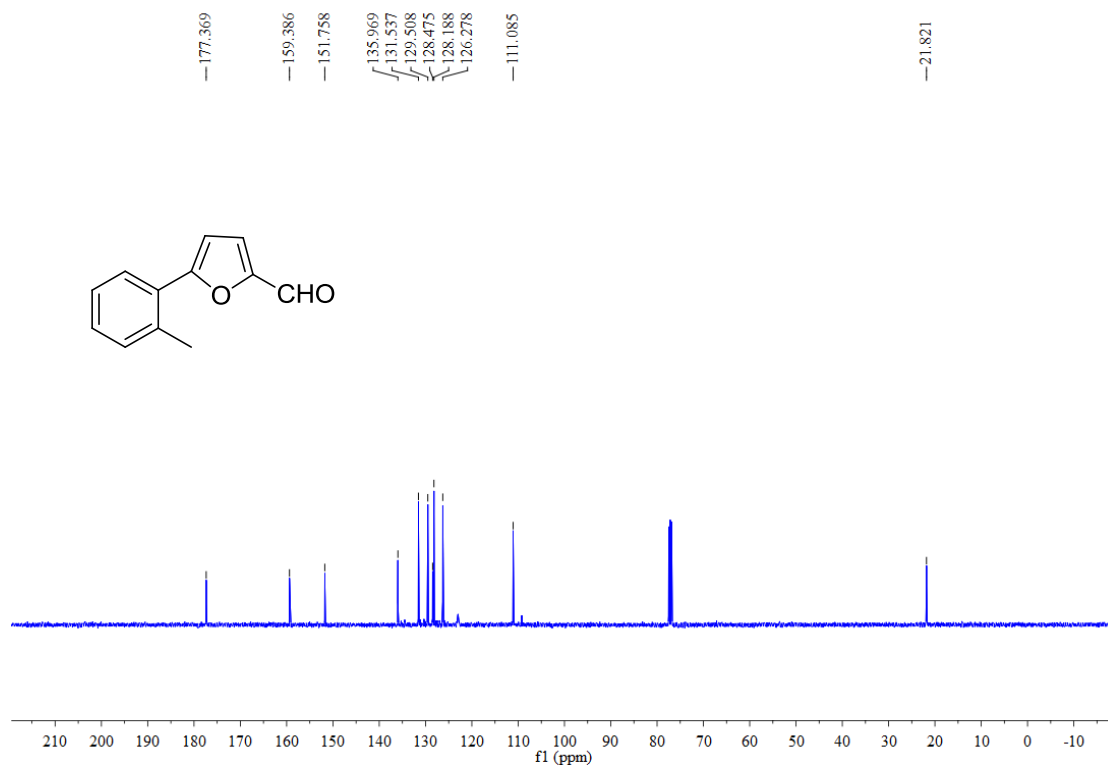
¹³C NMR spectrum (100 MHz, CDCl₃) of **S2-1d**



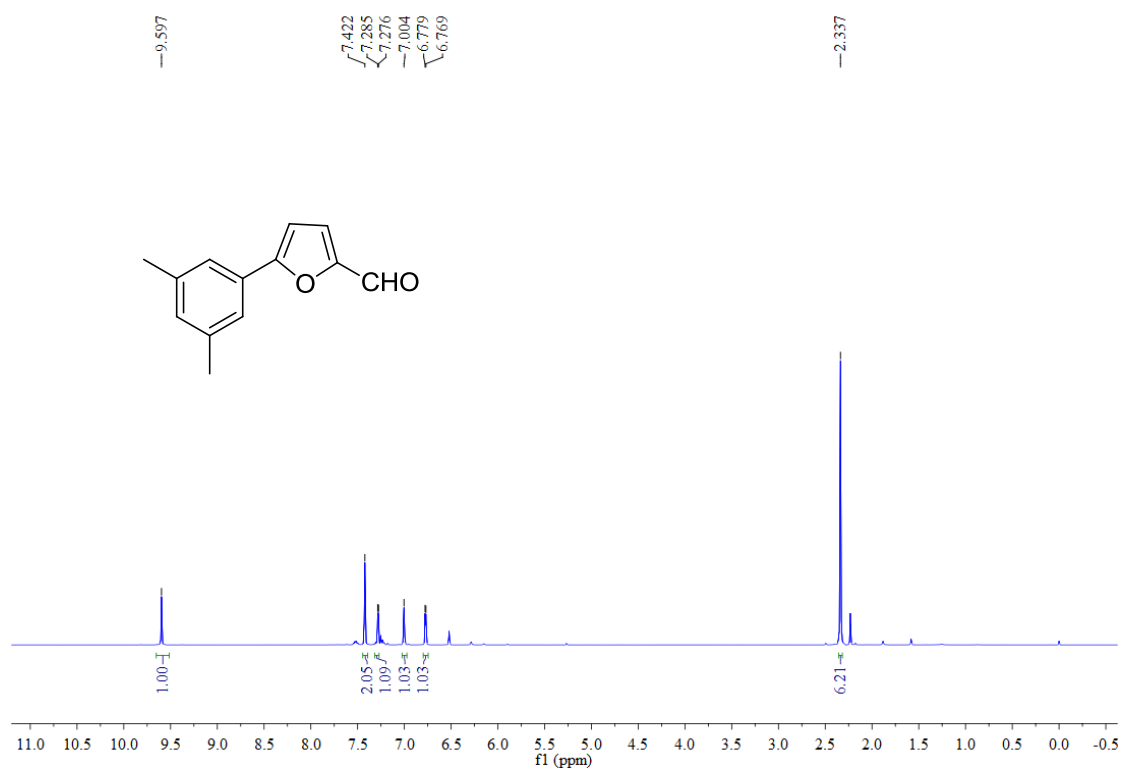
^1H NMR spectrum (400 MHz, CDCl_3) of **S2-1e**



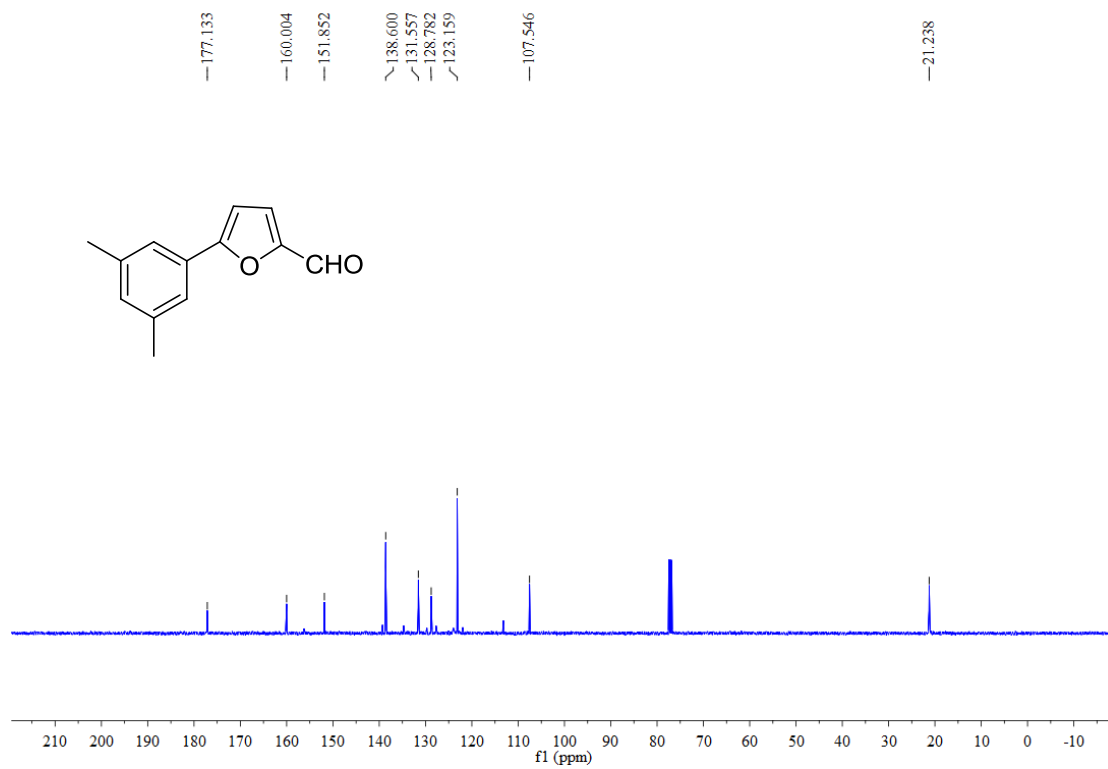
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S2-1e**



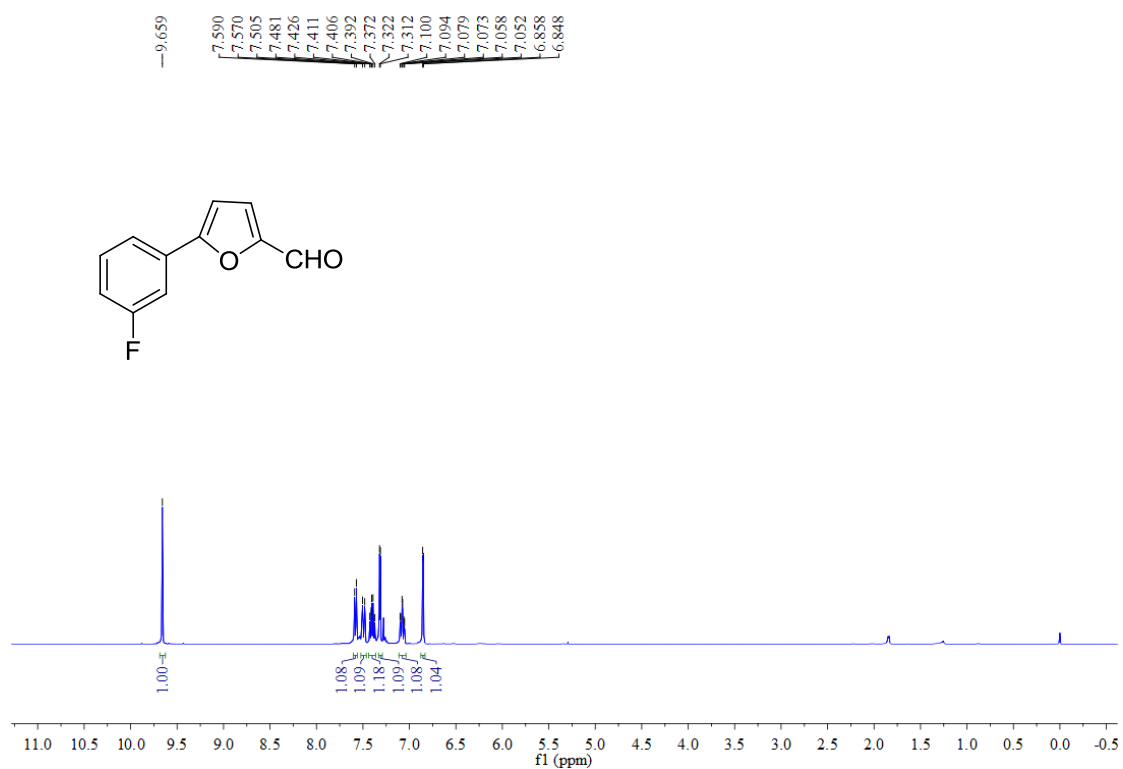
^1H NMR spectrum (400 MHz, CDCl_3) of **S2-1f**



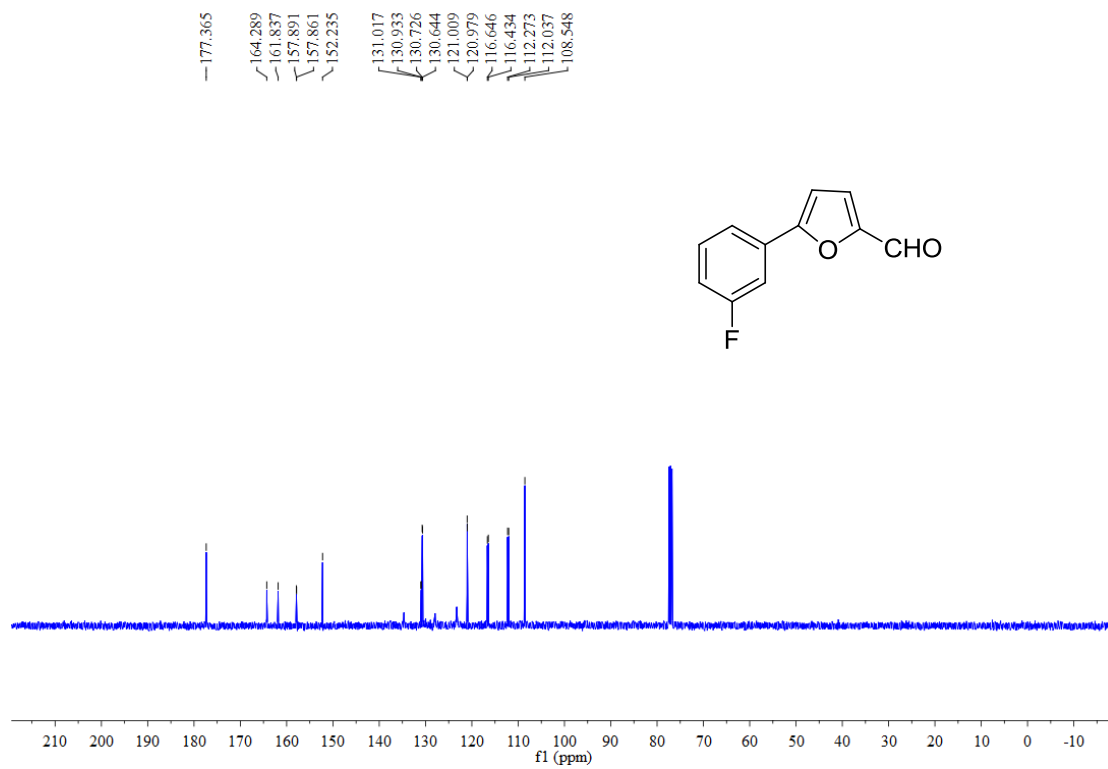
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S2-1f**



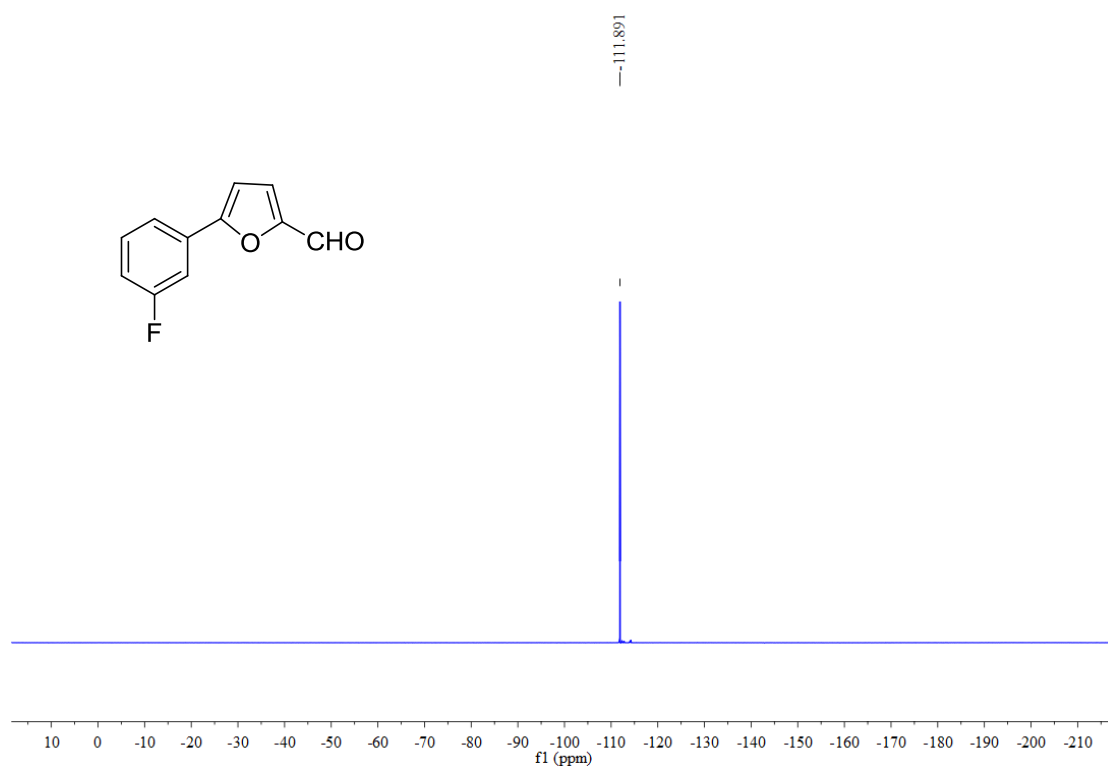
^1H NMR spectrum (400 MHz, CDCl_3) of **S2-1g**



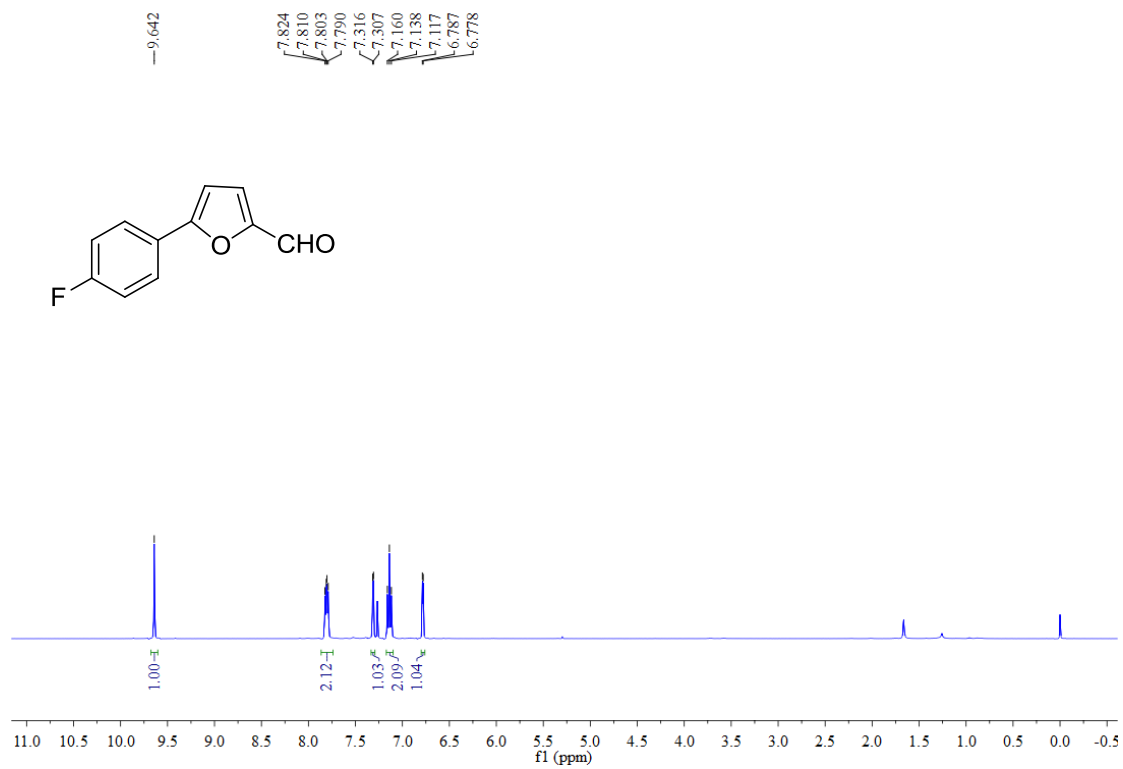
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S2-1g**



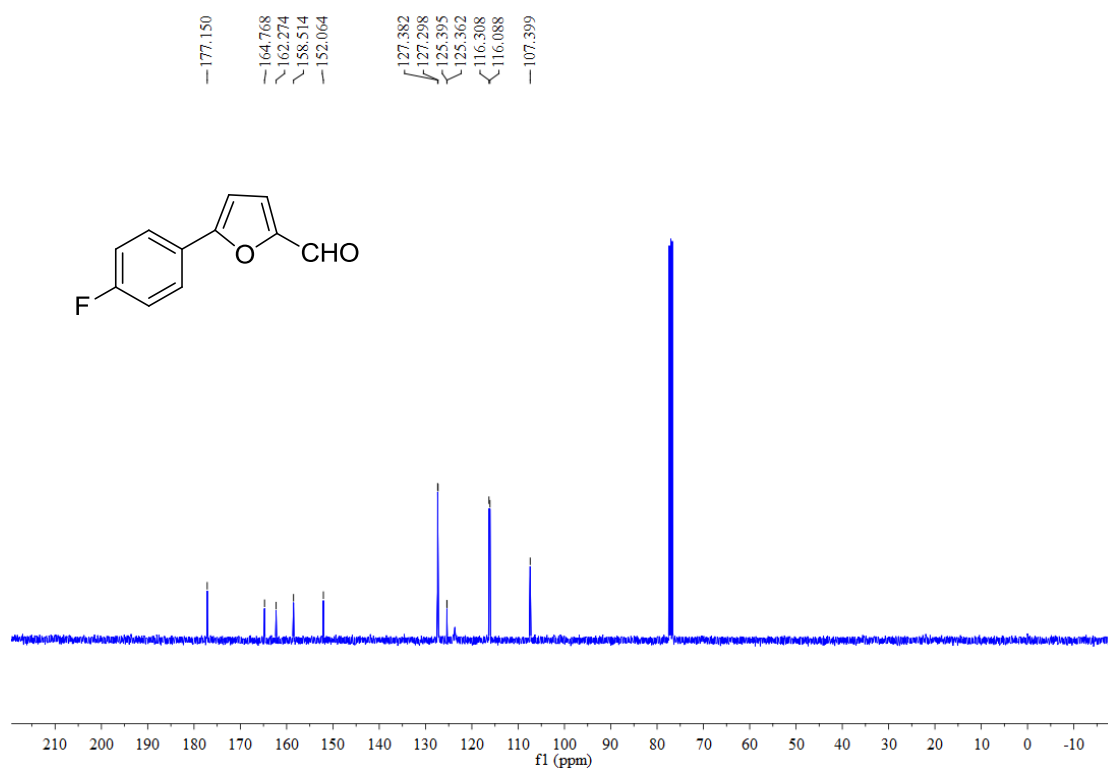
^{19}F NMR spectrum (376 MHz, CDCl_3) of S2-1g



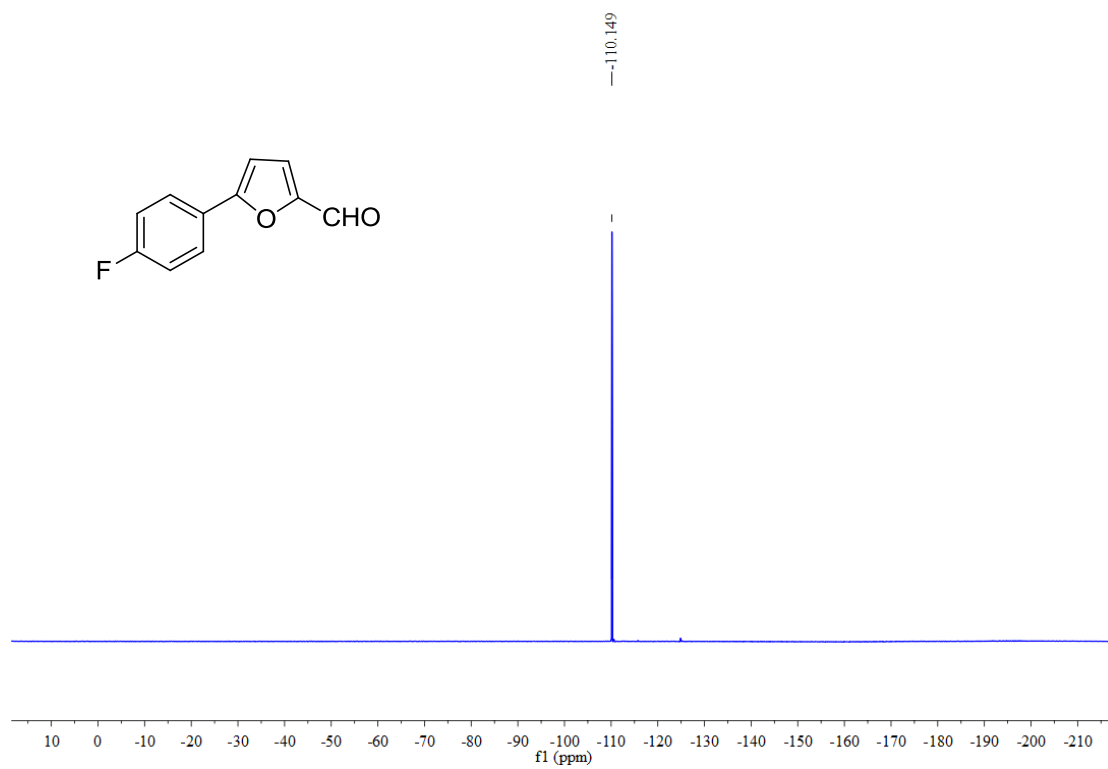
^1H NMR spectrum (400 MHz, CDCl_3) of S2-1h



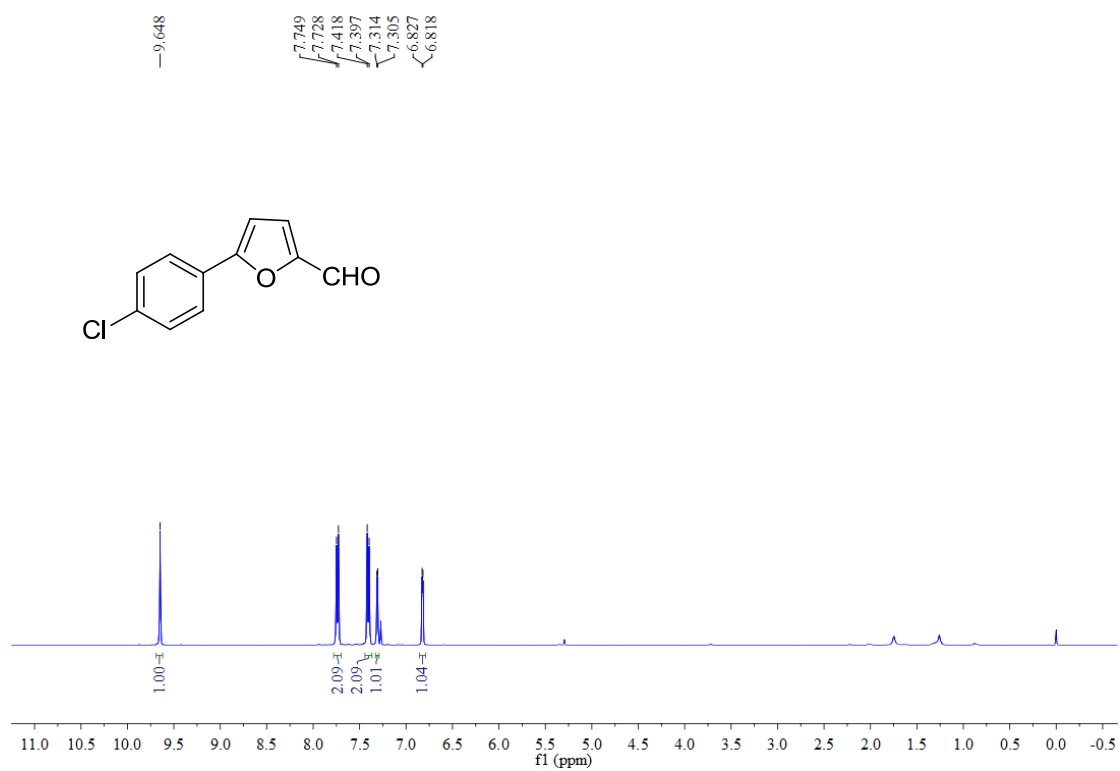
¹³C NMR spectrum (100 MHz, CDCl₃) of **S2-1h**



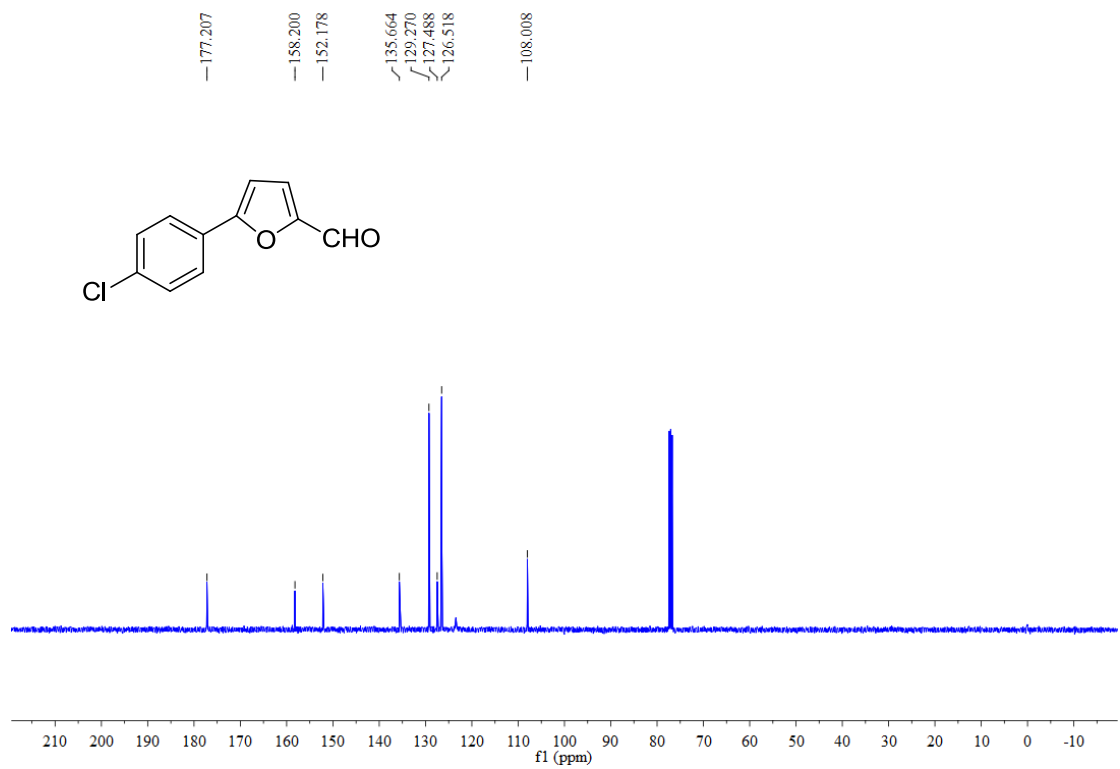
¹⁹F NMR spectrum (376 MHz, CDCl₃) of **S2-1h**



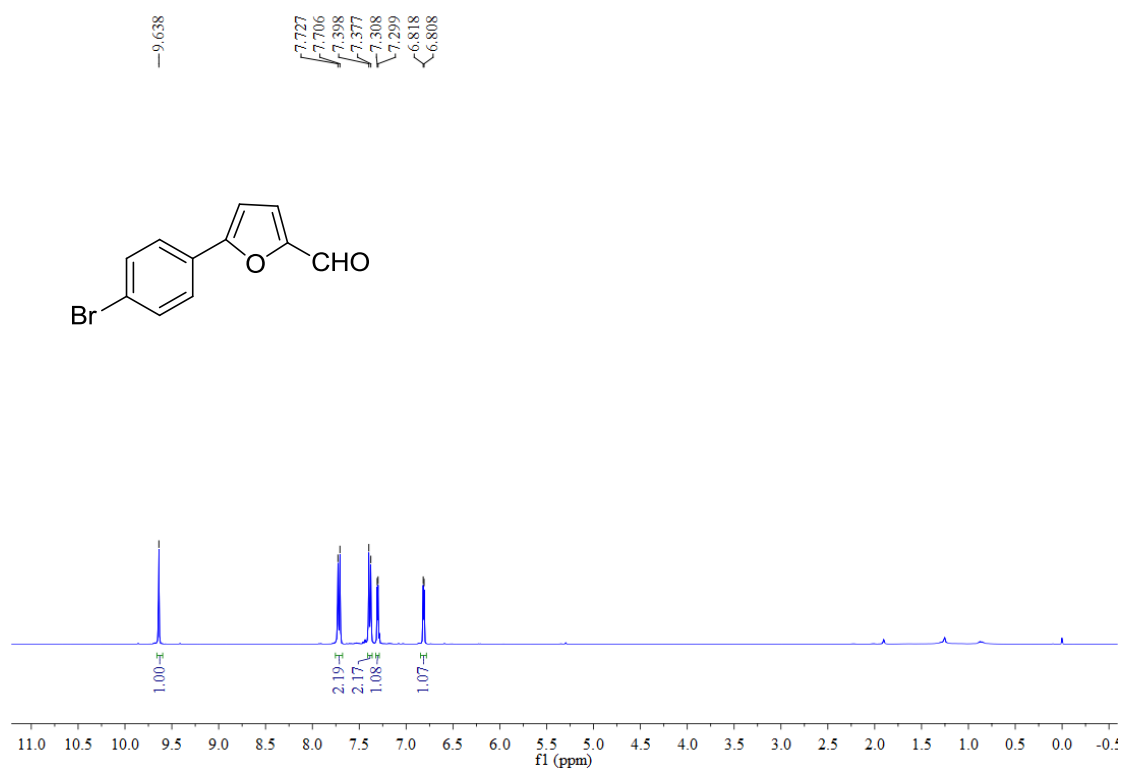
^1H NMR spectrum (400 MHz, CDCl_3) of **S2-1i**



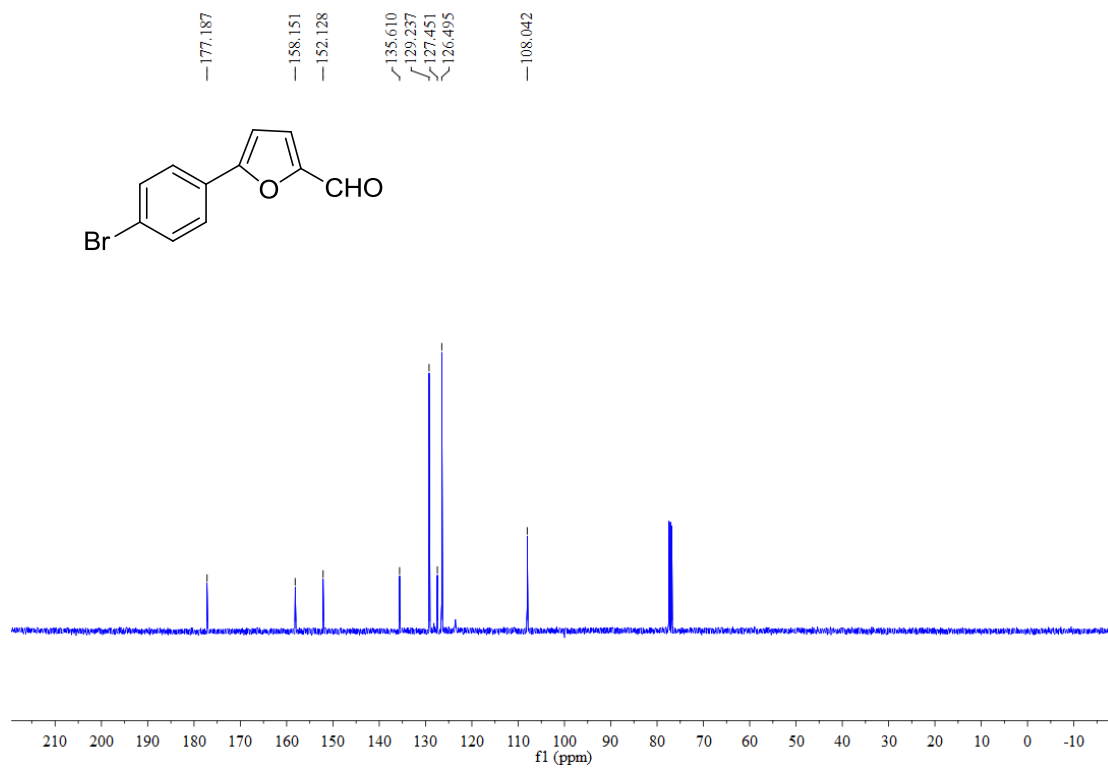
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S2-1i**



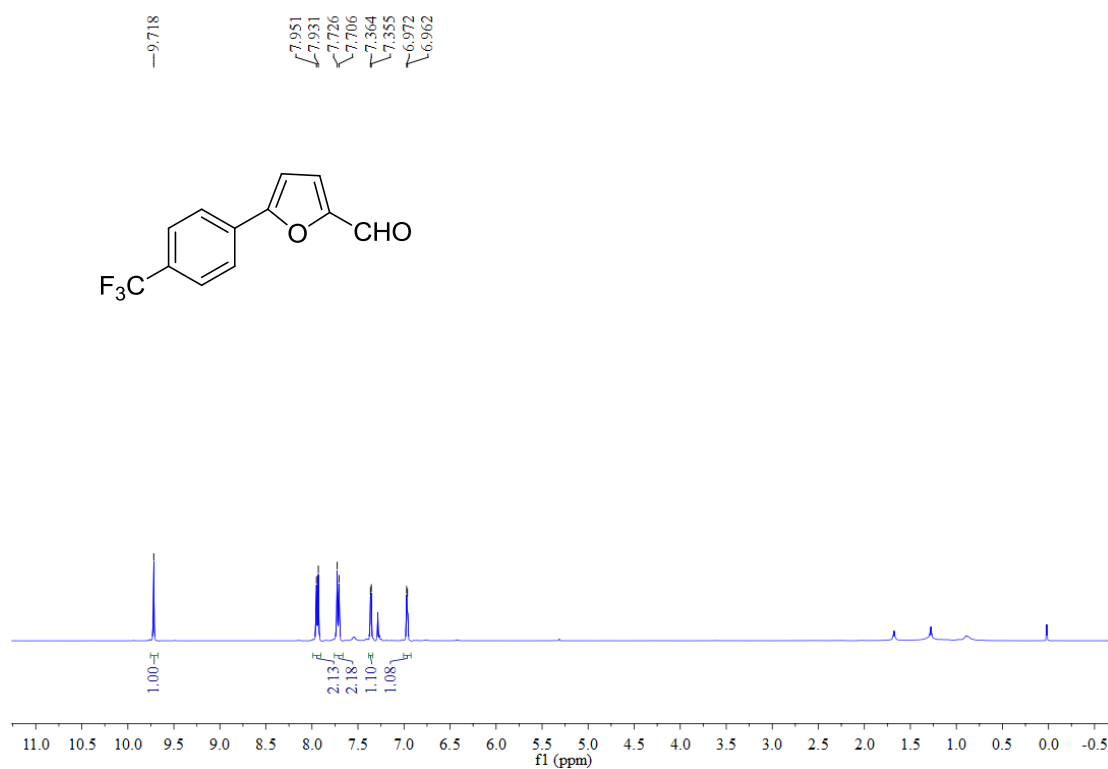
¹H NMR spectrum (400 MHz, CDCl₃) of **S2-1j**



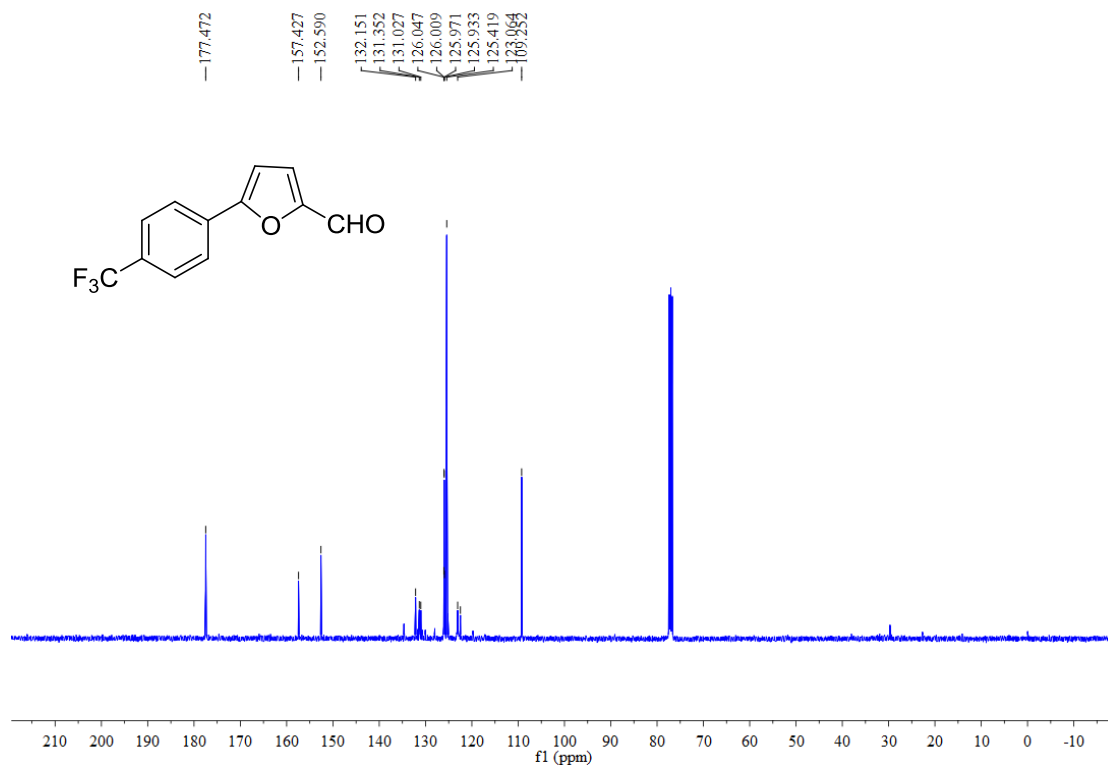
¹³C NMR spectrum (100 MHz, CDCl₃) of **S2-1j**



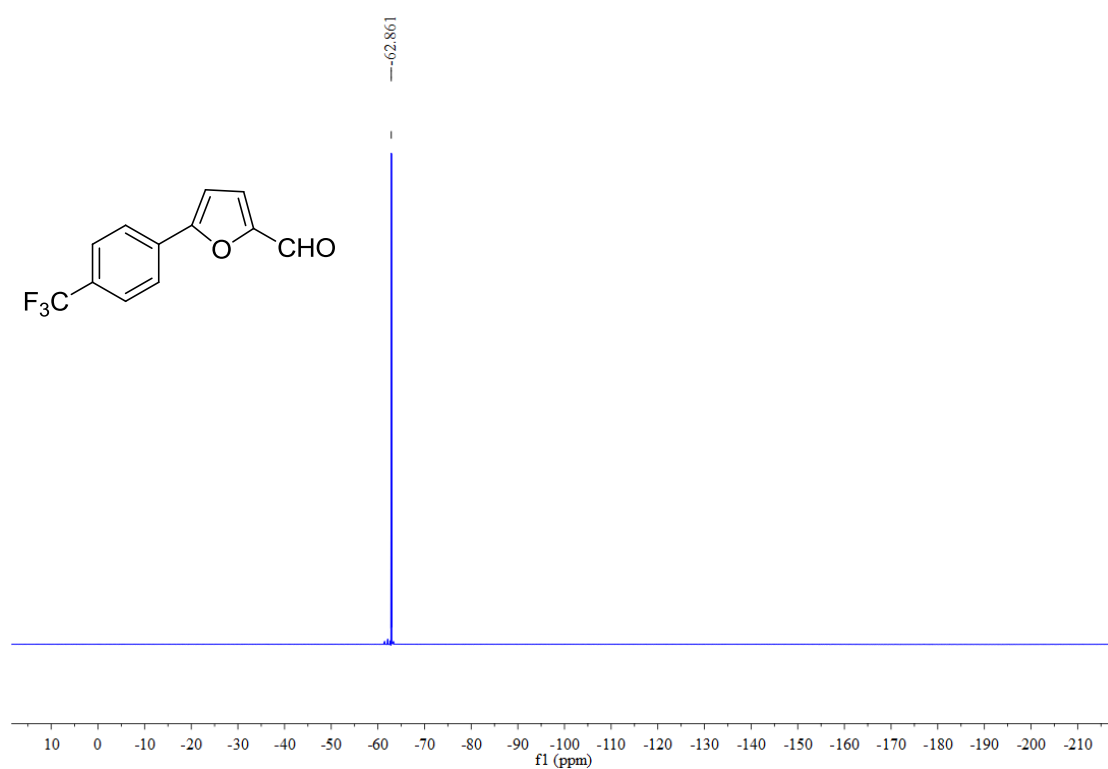
¹H NMR spectrum (400 MHz, CDCl₃) of **S2-1k**



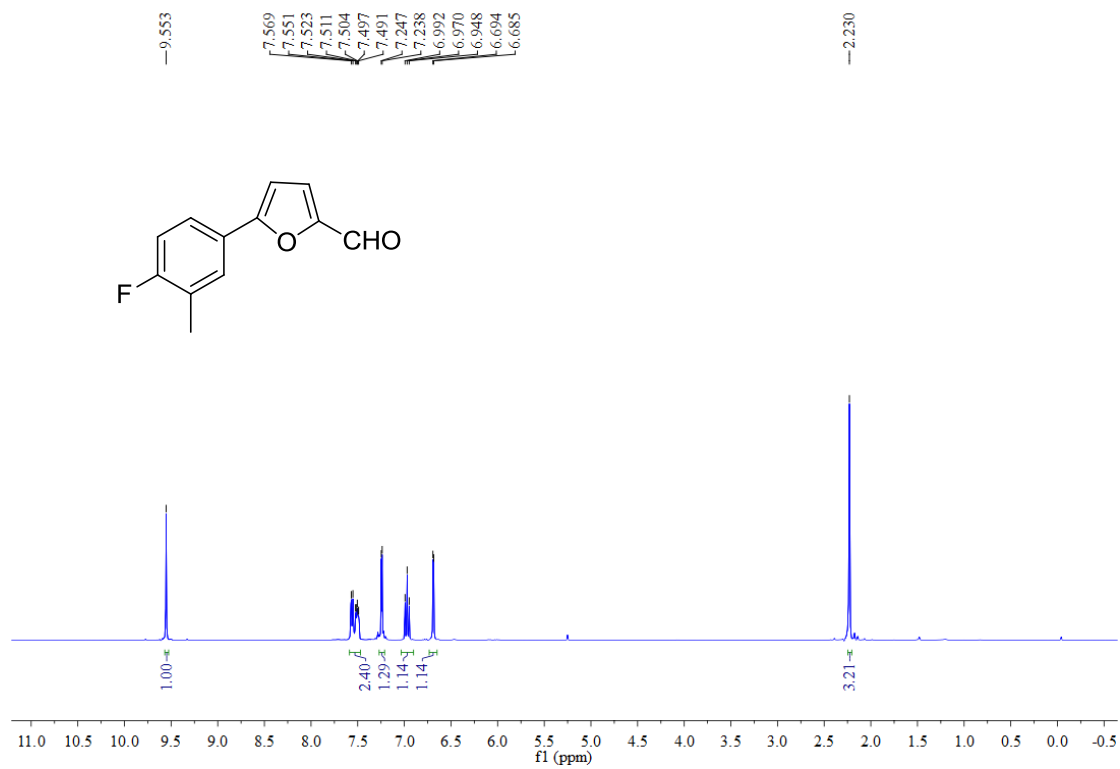
¹³C NMR spectrum (100 MHz, CDCl₃) of **S2-1k**



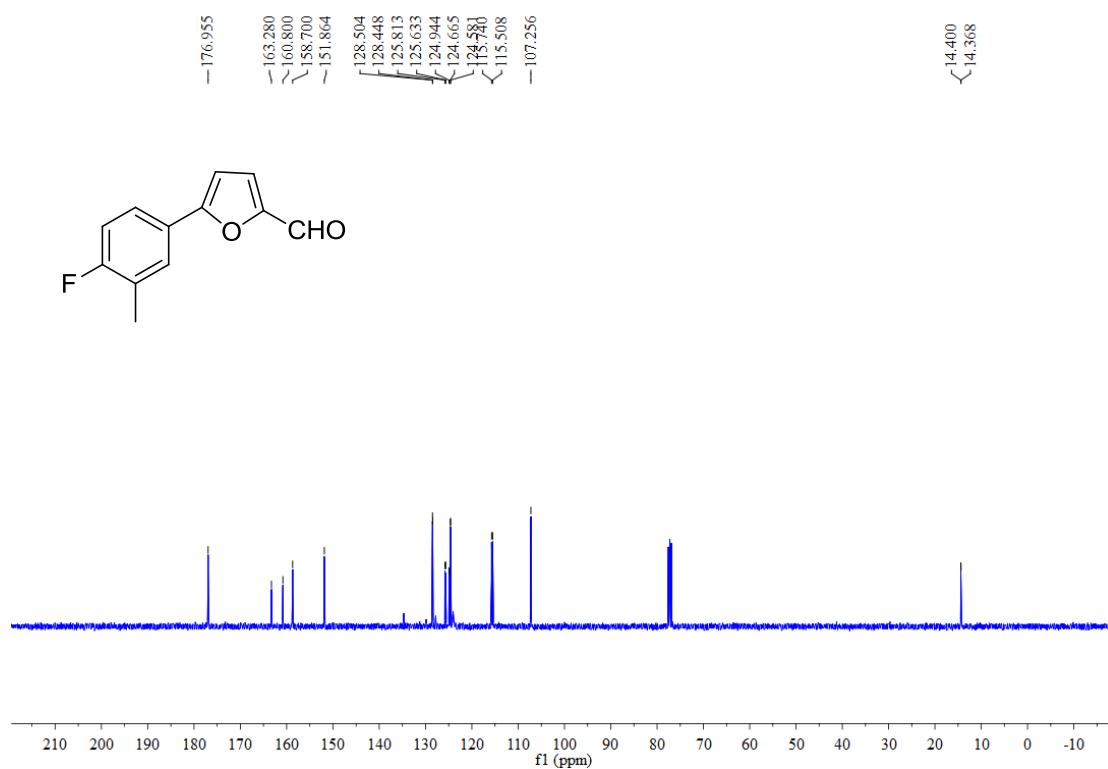
^{19}F NMR spectrum (376 MHz, CDCl_3) of **S2-1k**



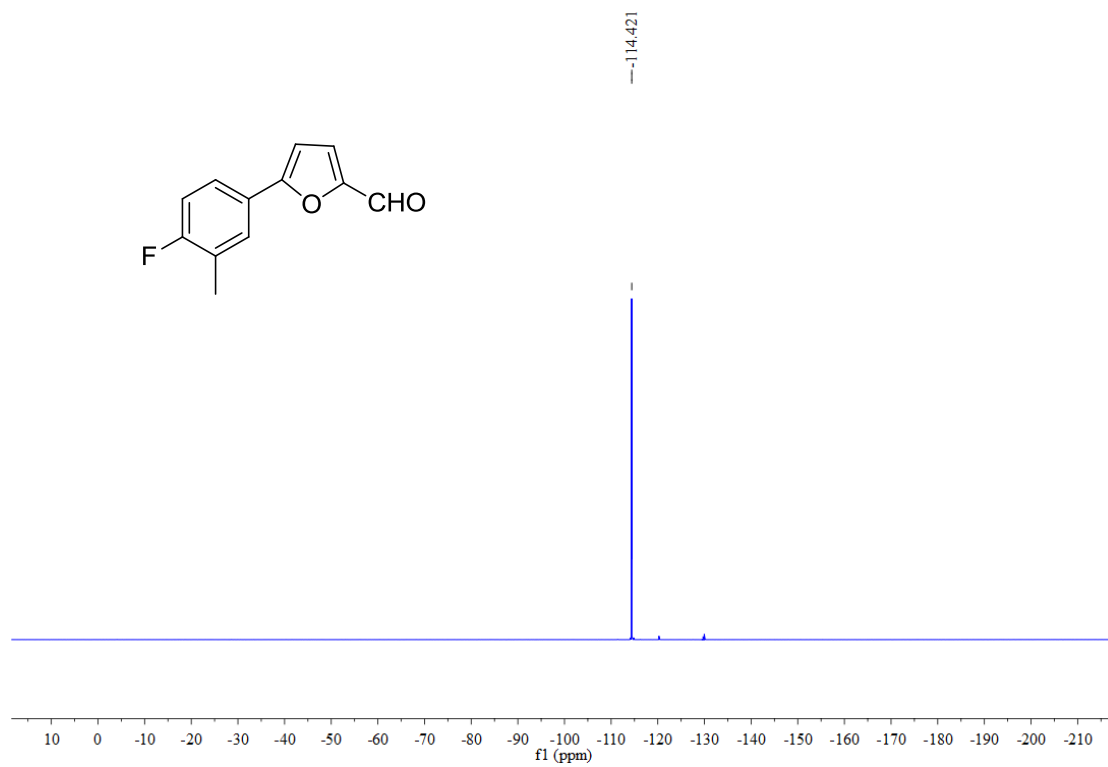
^1H NMR spectrum (400 MHz, CDCl_3) of **S2-1l**



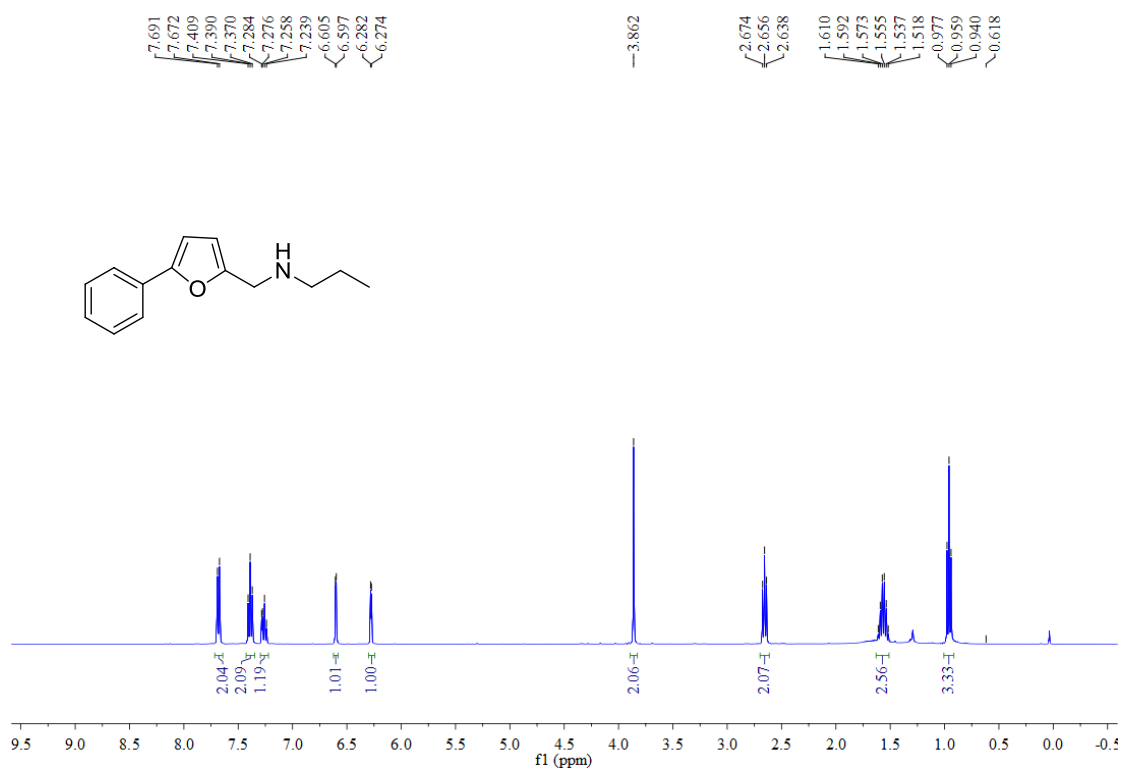
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S2-11**



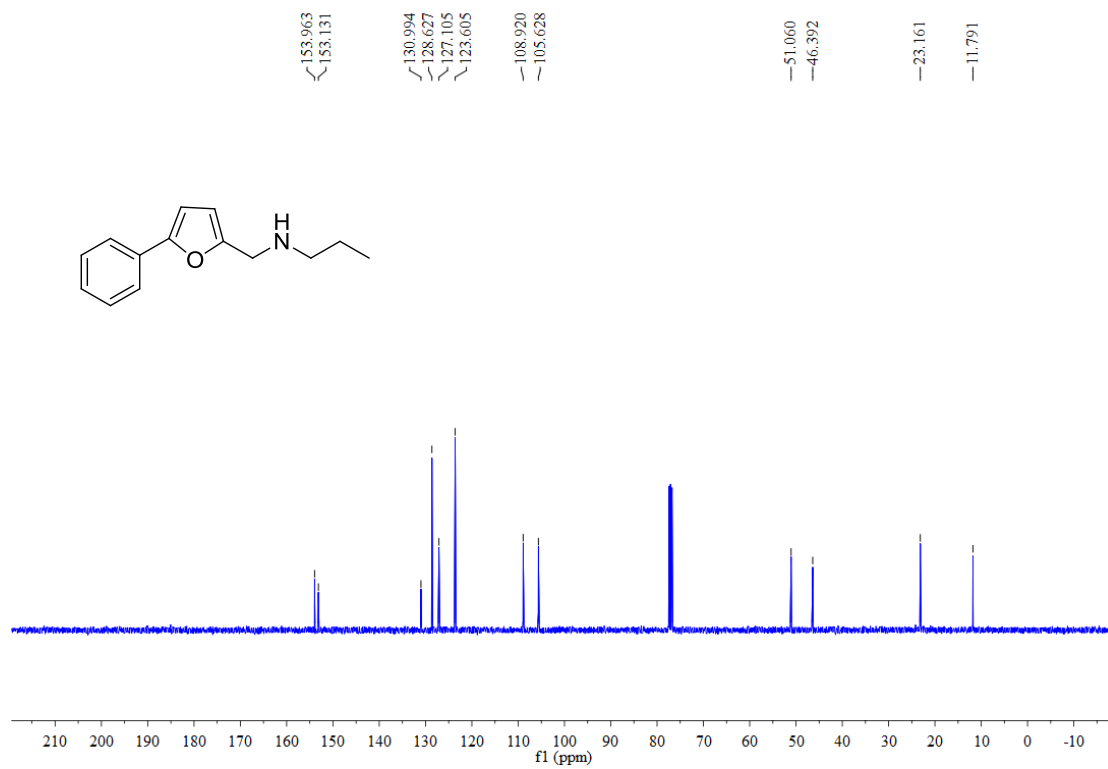
^{19}F NMR spectrum (376 MHz, CDCl_3) of **S2-11**



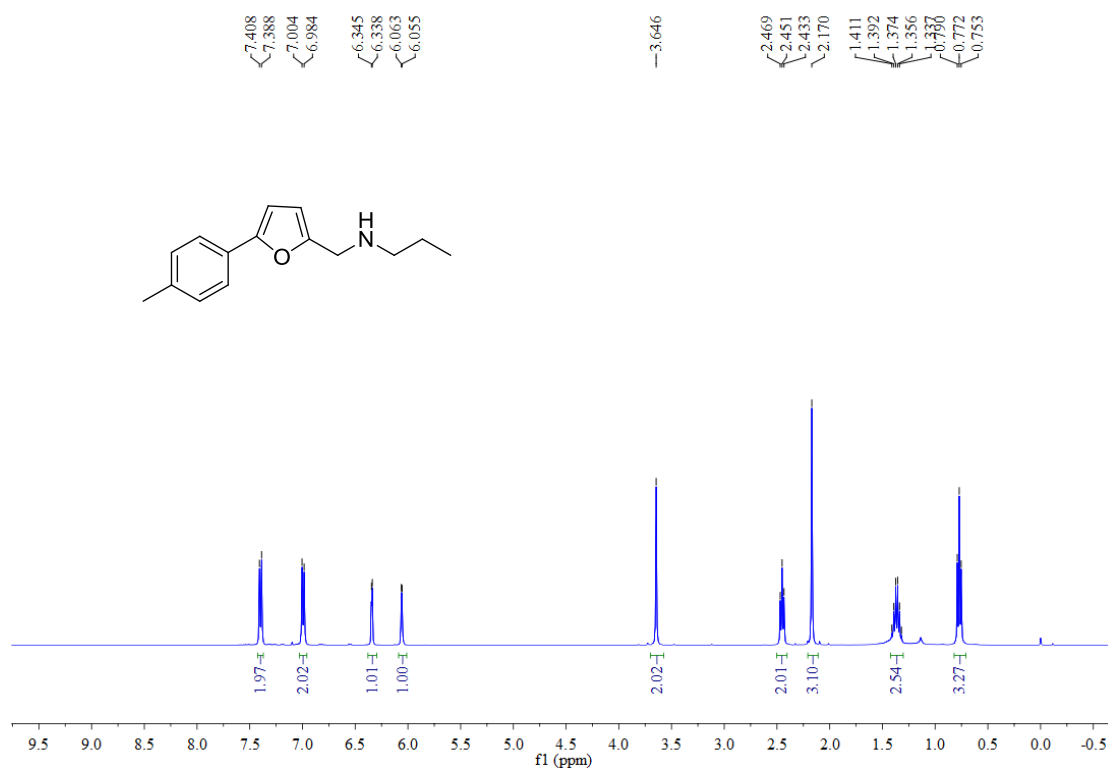
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1a**



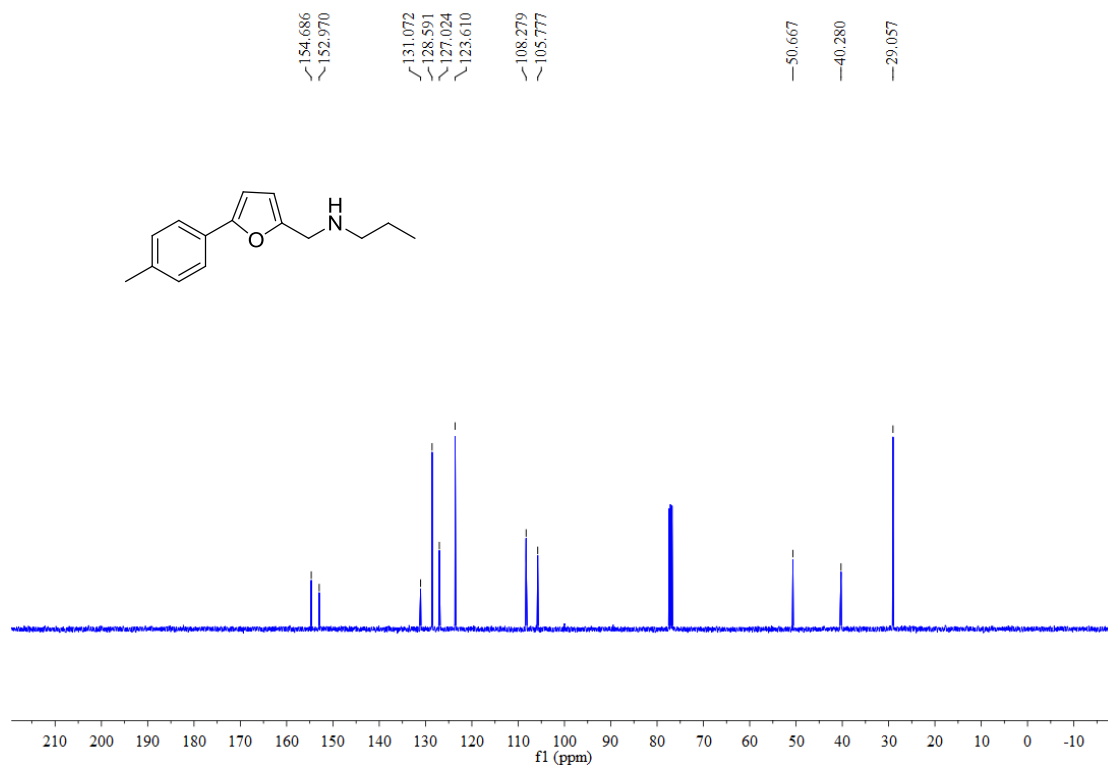
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1a**



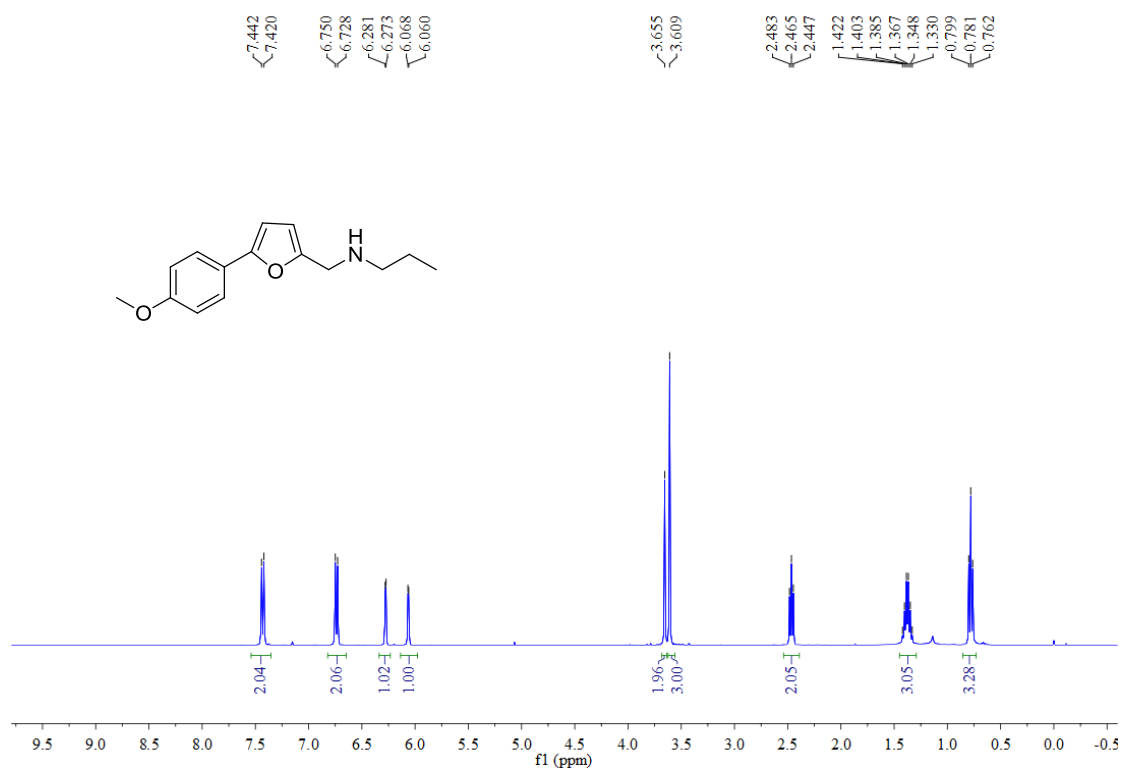
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1b**



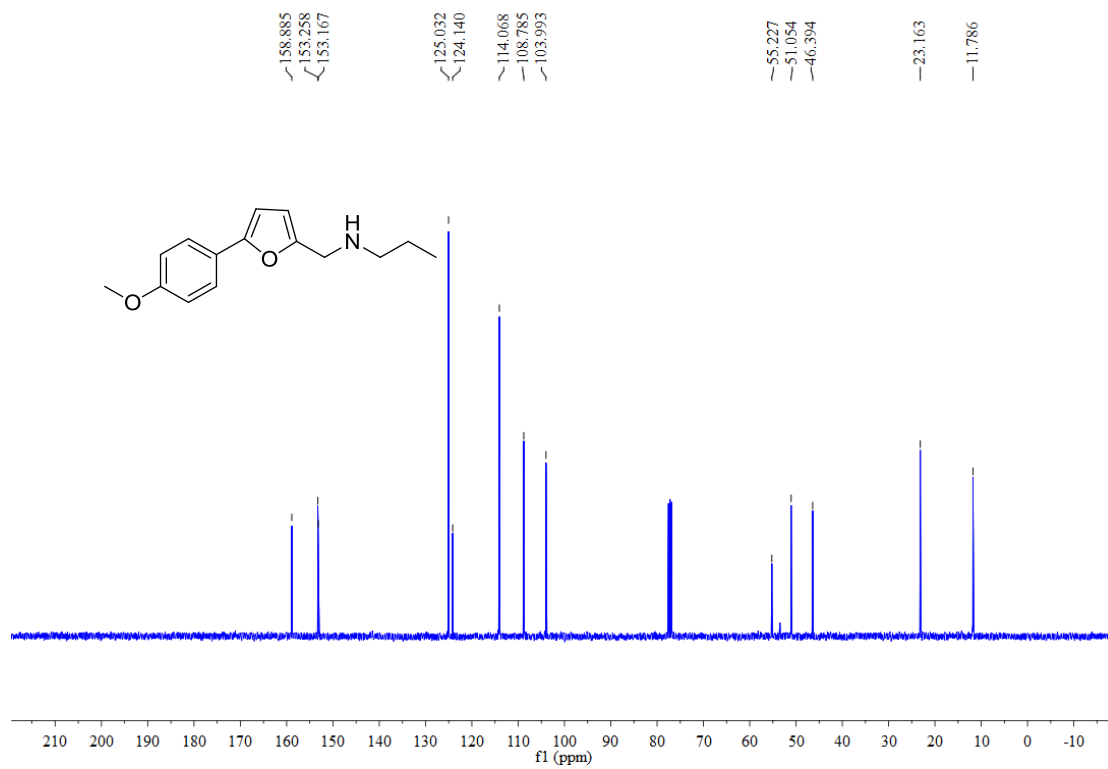
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1b**



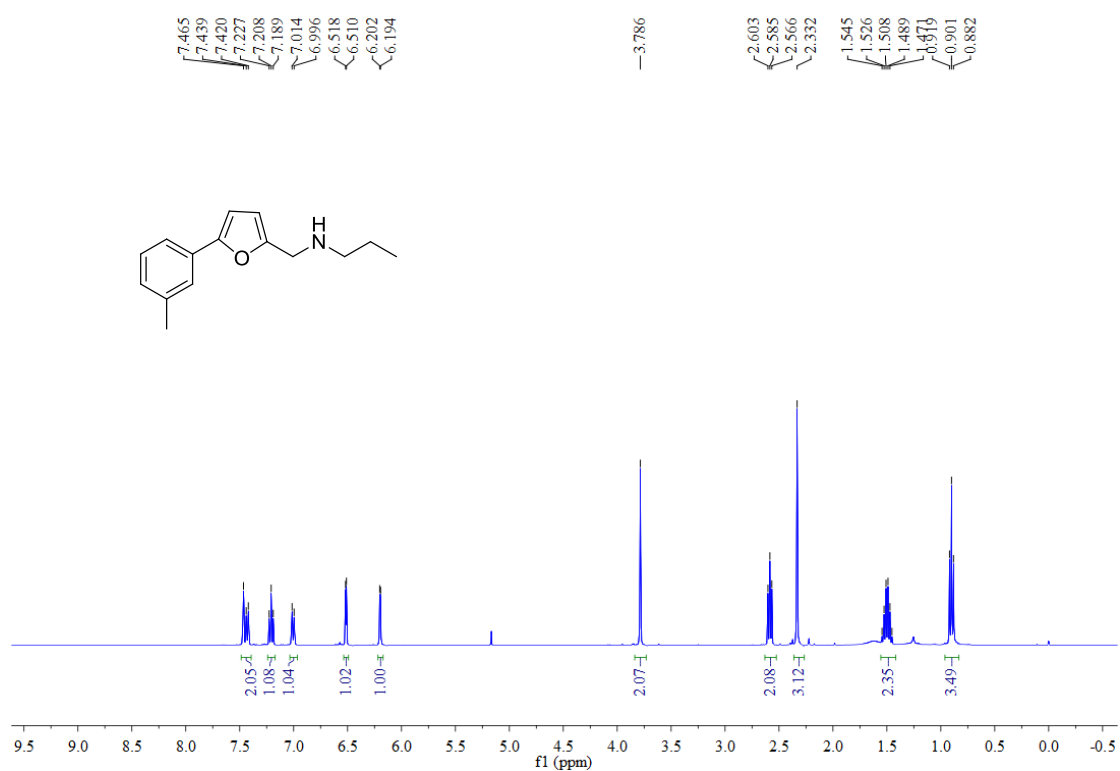
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1c**



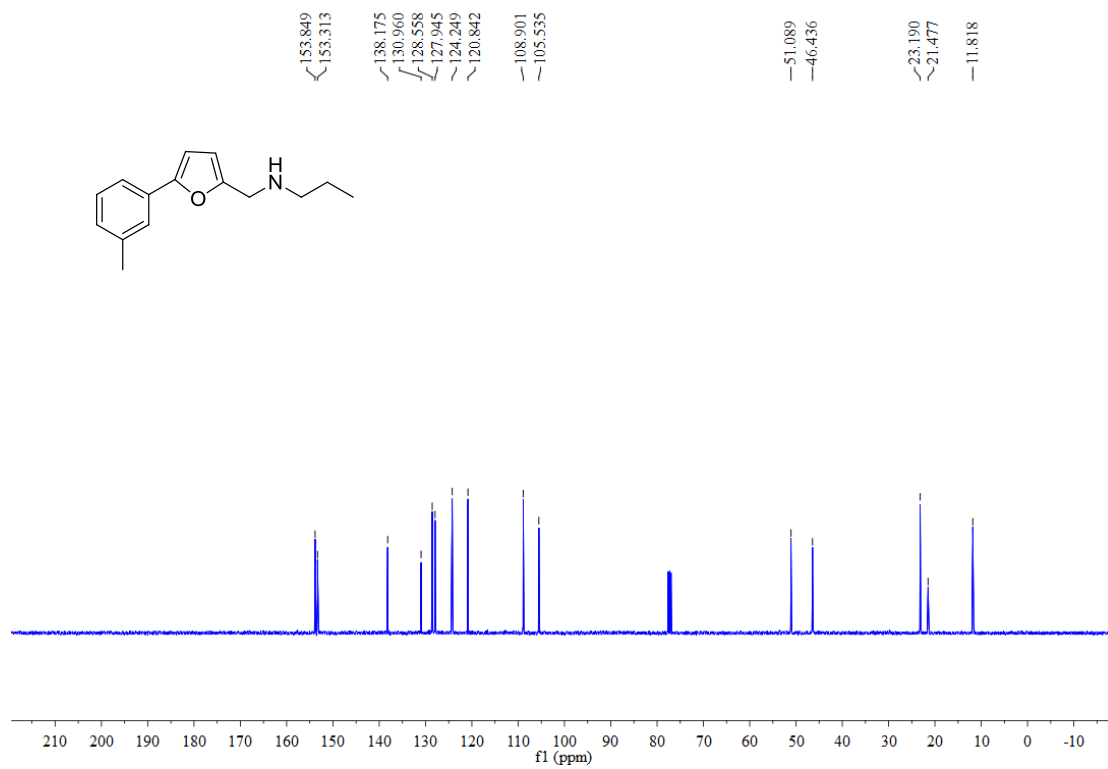
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1c**



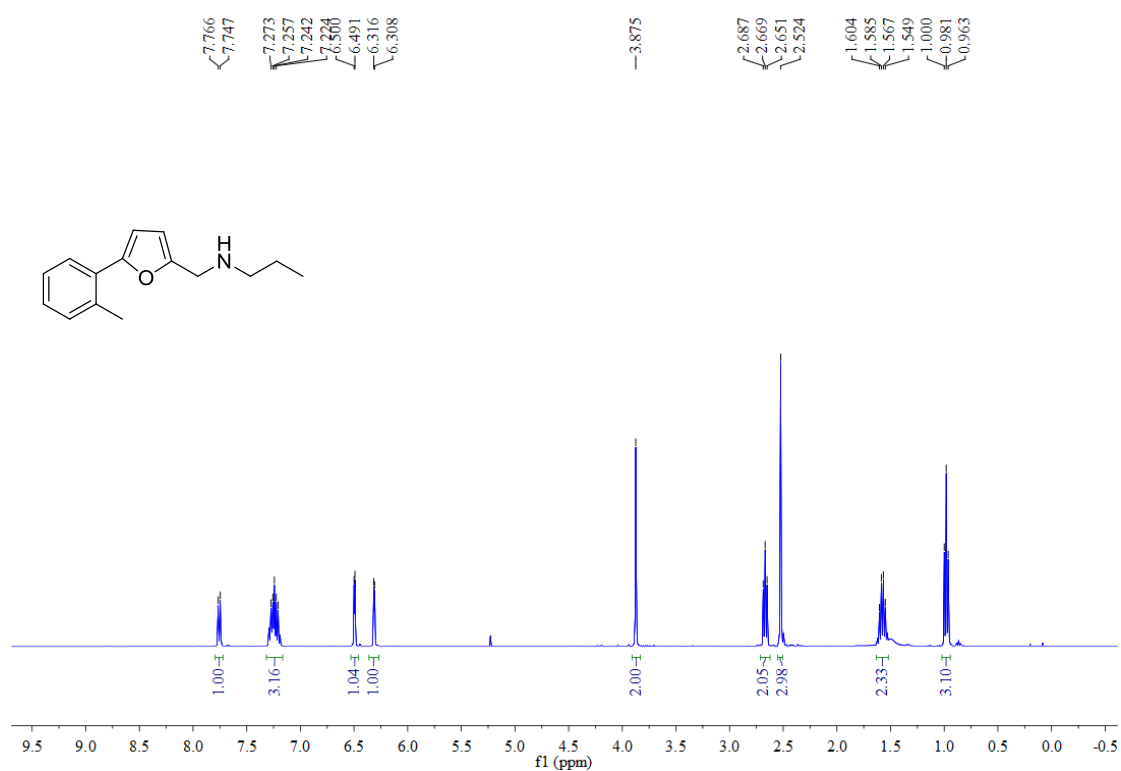
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1d**



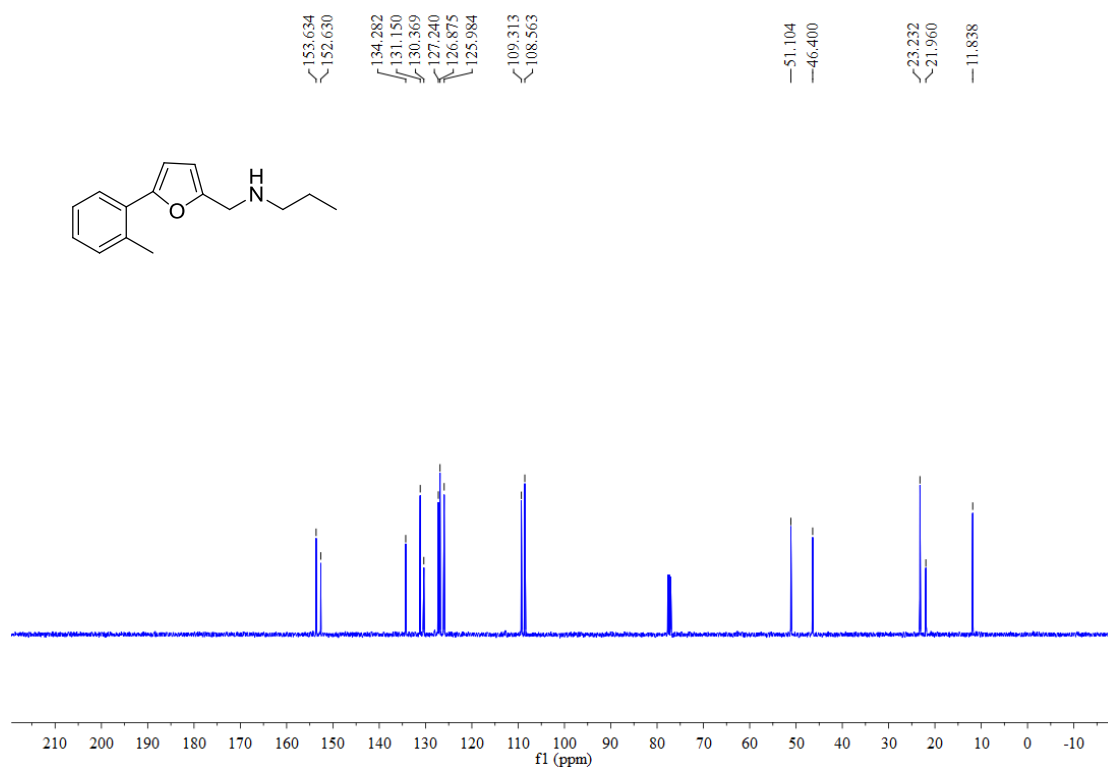
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1d**



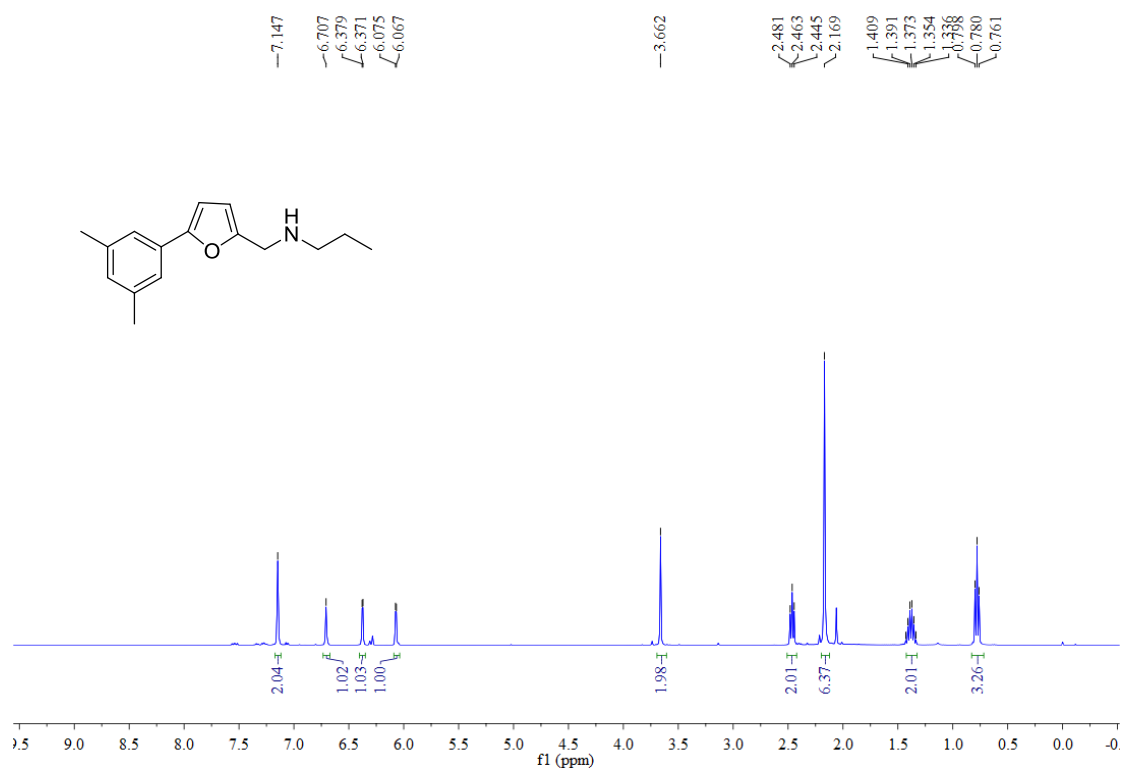
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1e**



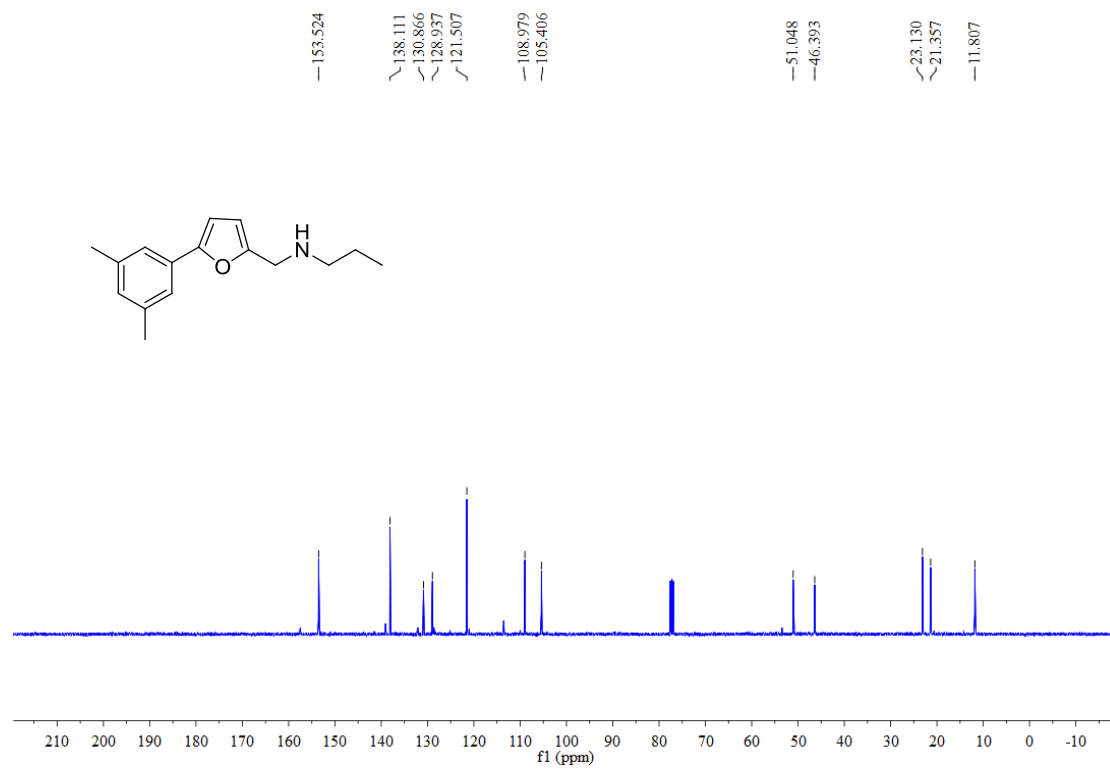
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1e**



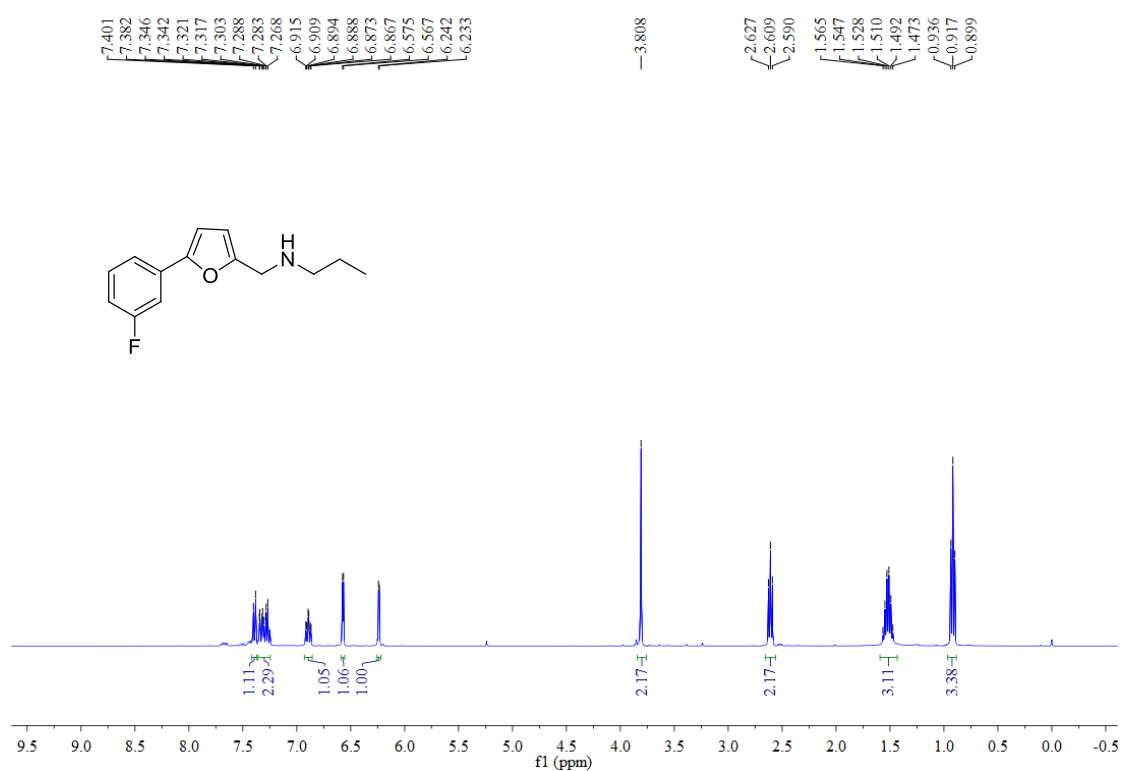
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1f**



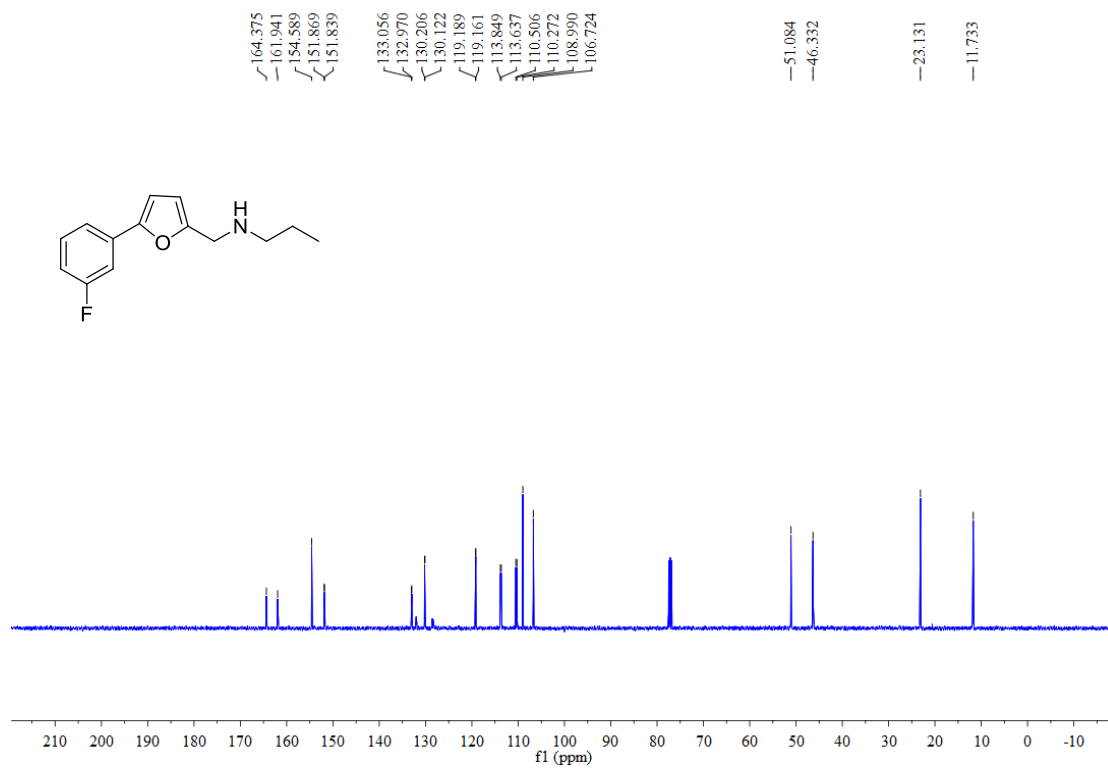
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1f**



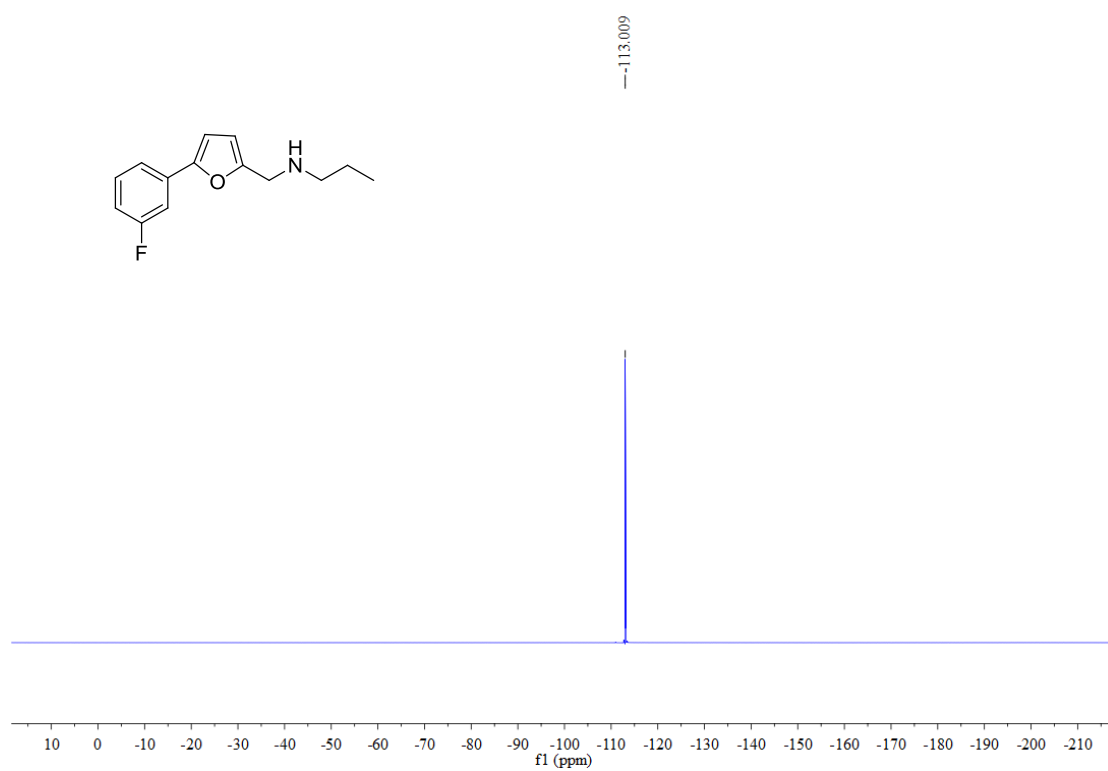
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1g**



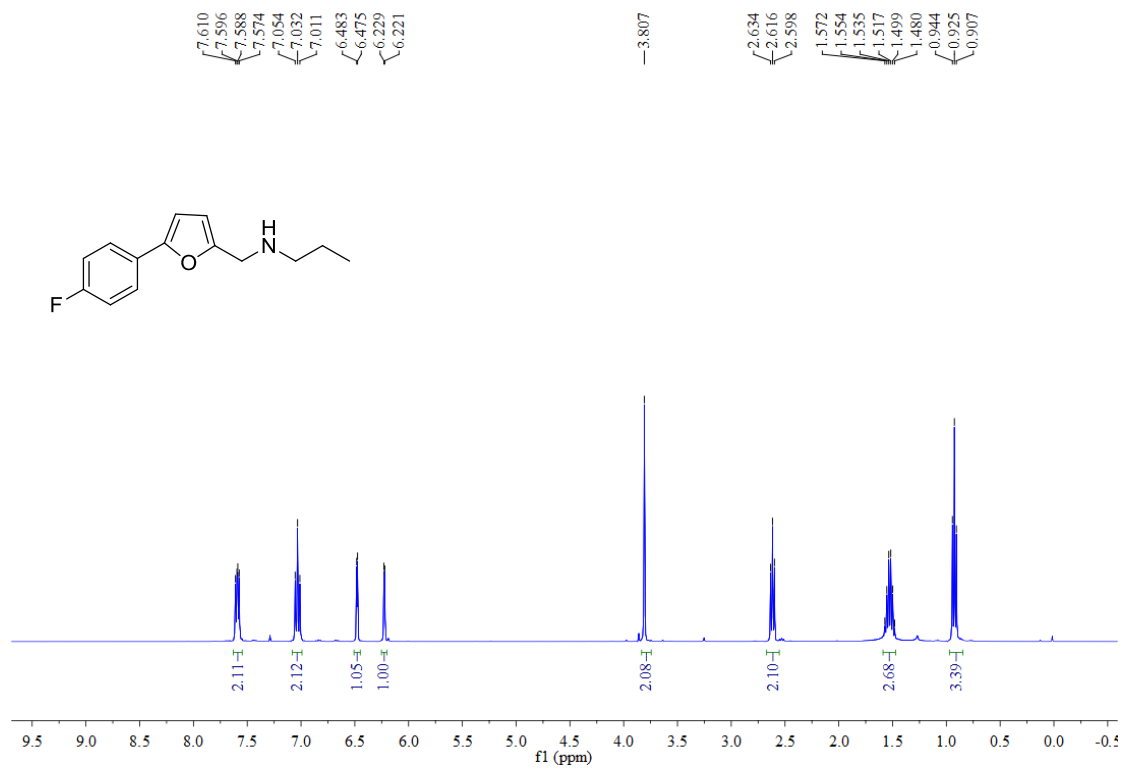
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1g**



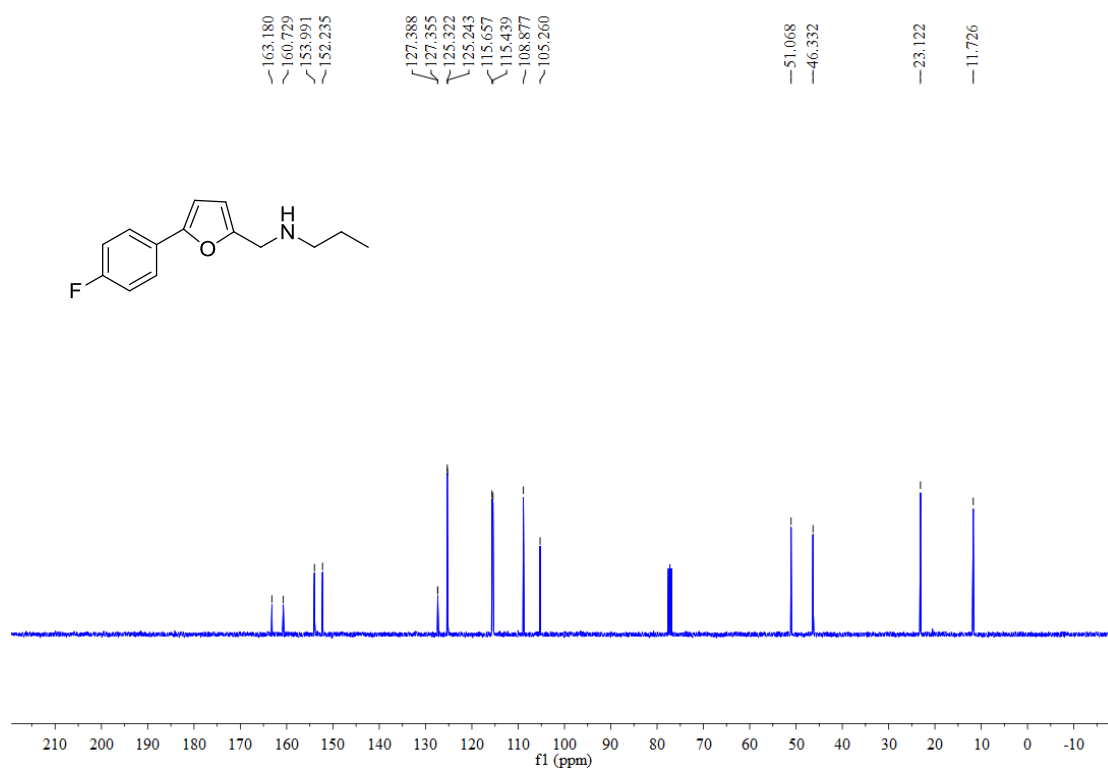
^{19}F NMR spectrum (376 MHz, CDCl_3) of **S3-1g**



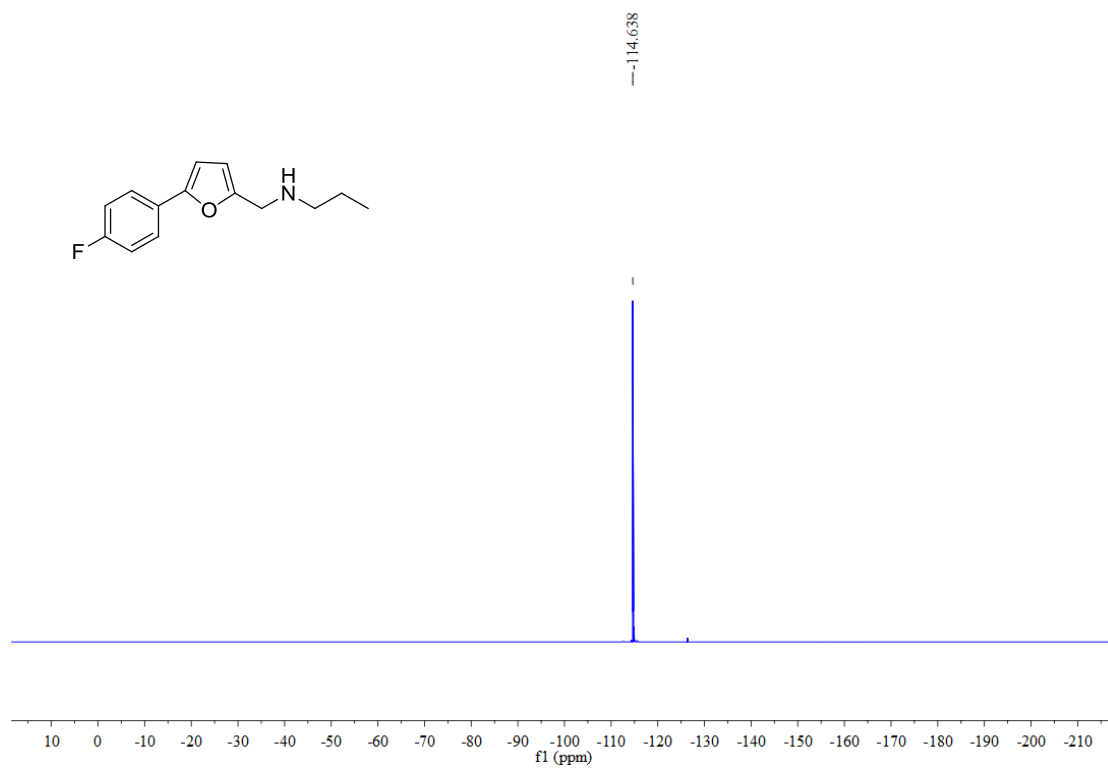
^1H NMR spectrum (400 MHz, CDCl_3) of **S3-1h**



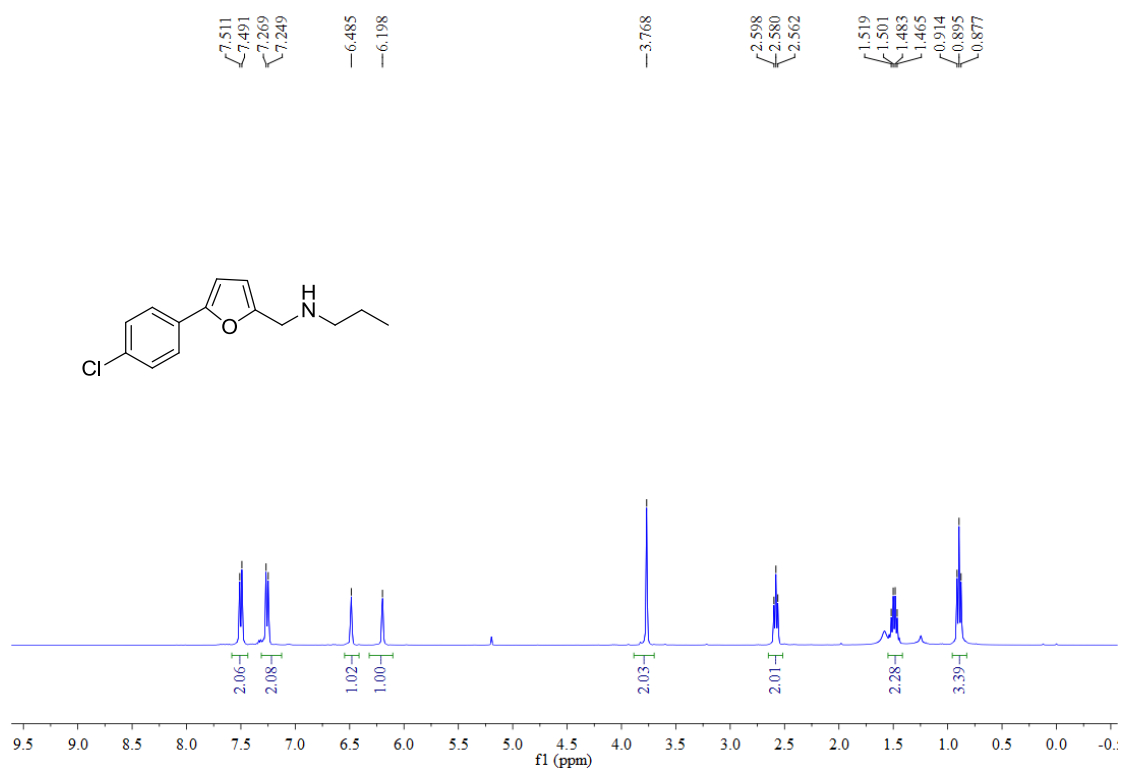
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1h**



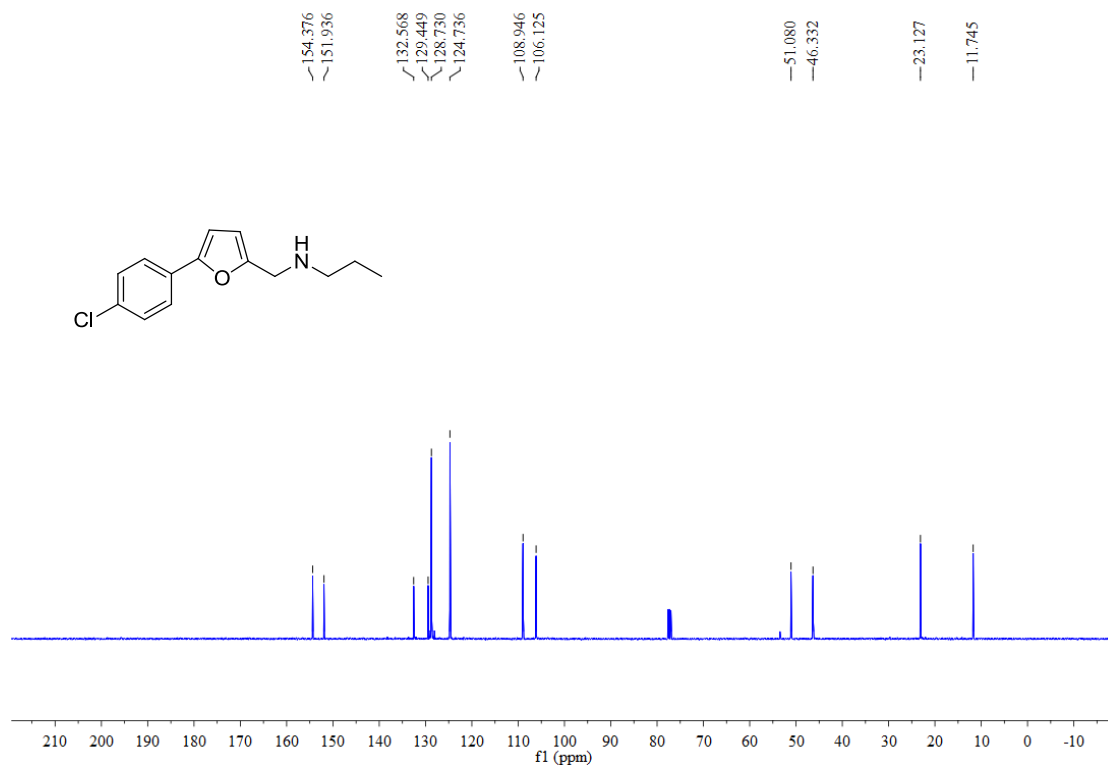
¹⁹F NMR spectrum (376 MHz, CDCl₃) of **S3-1h**



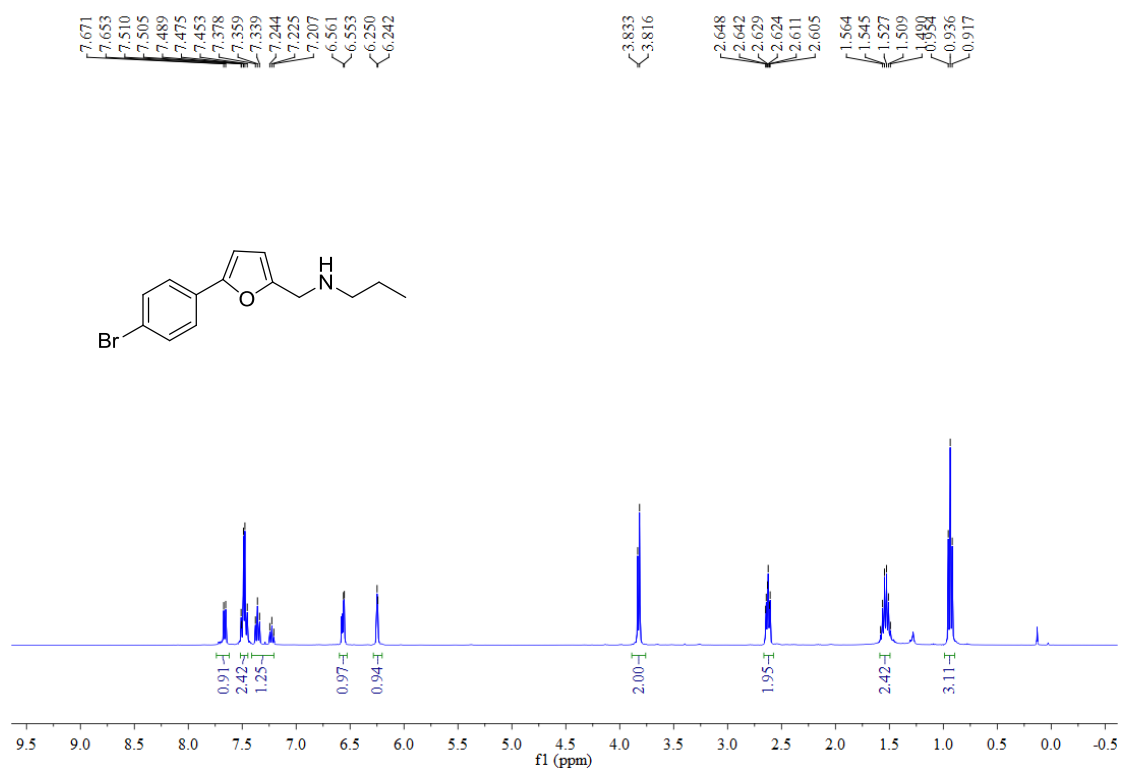
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1i**



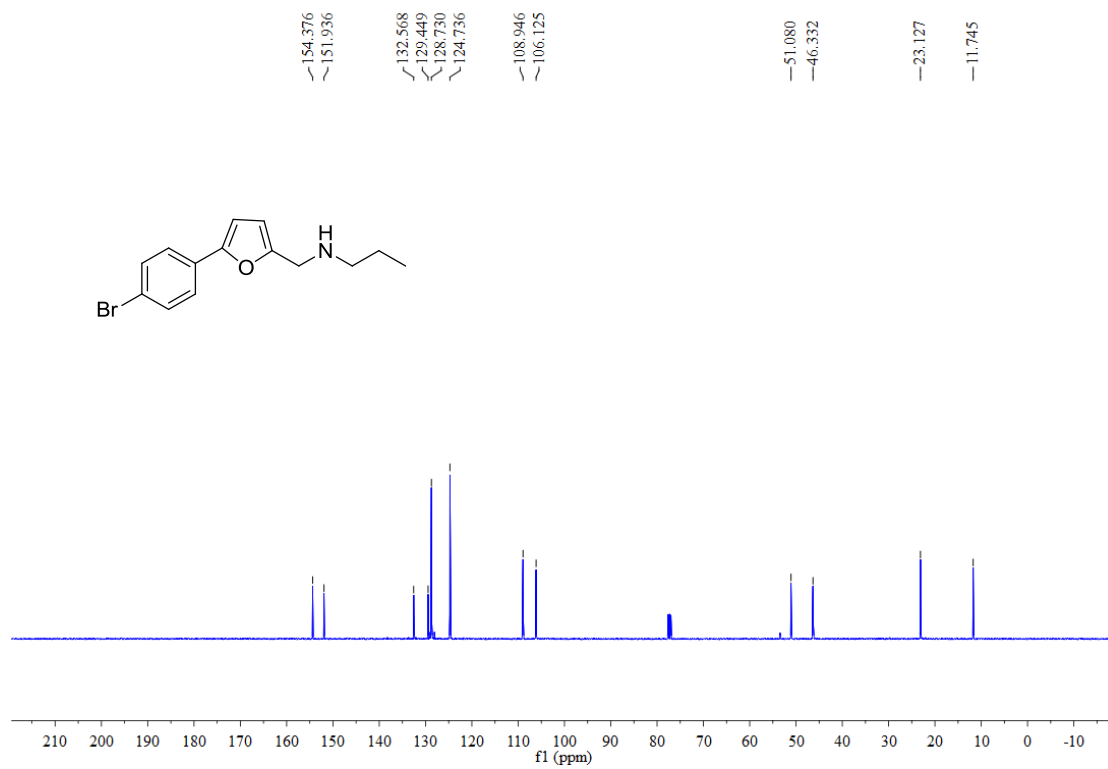
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1i**



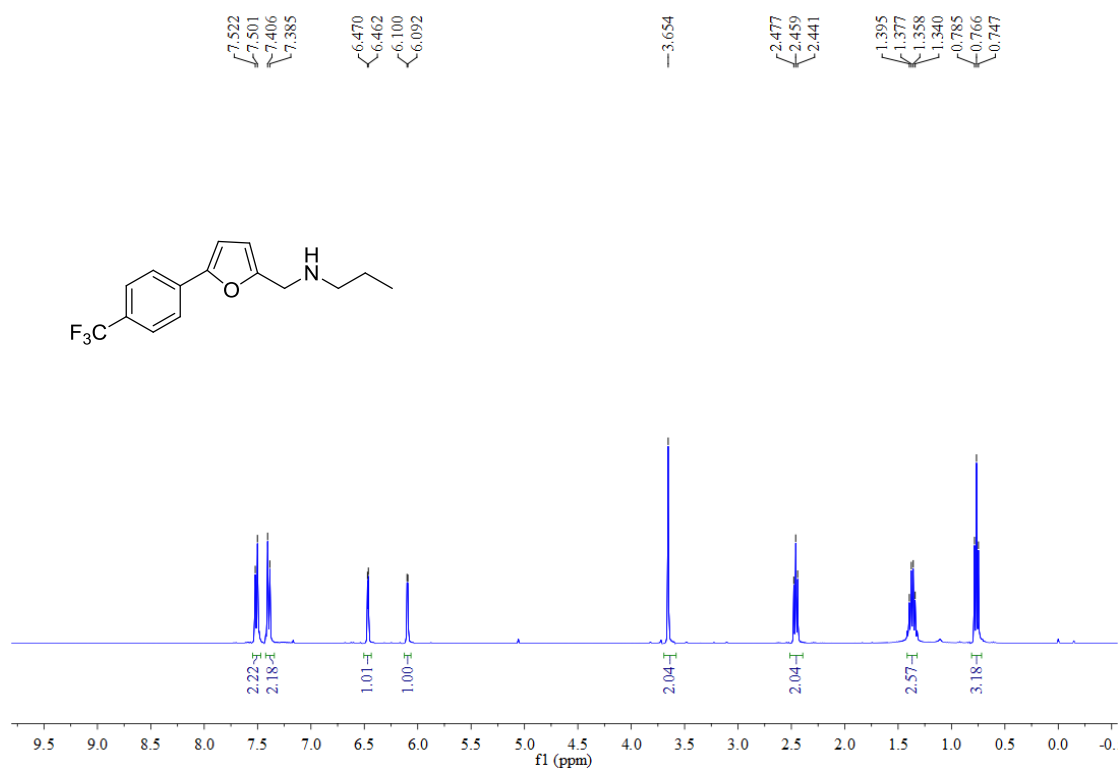
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1j**



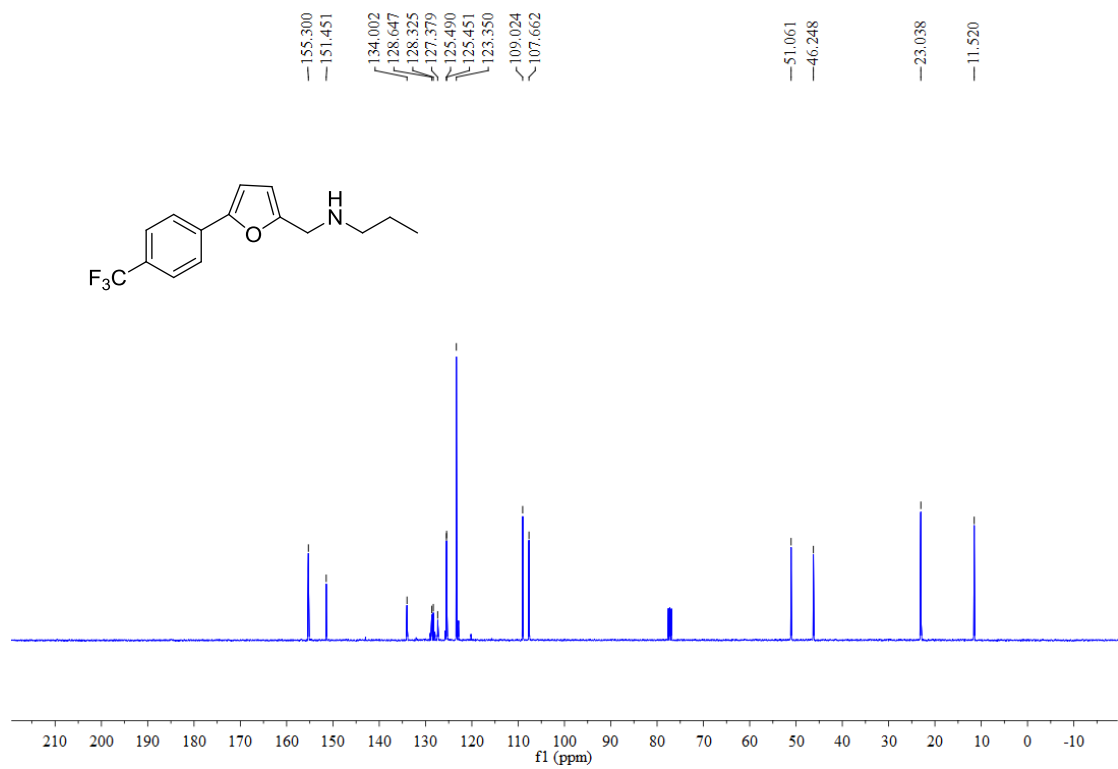
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1j**



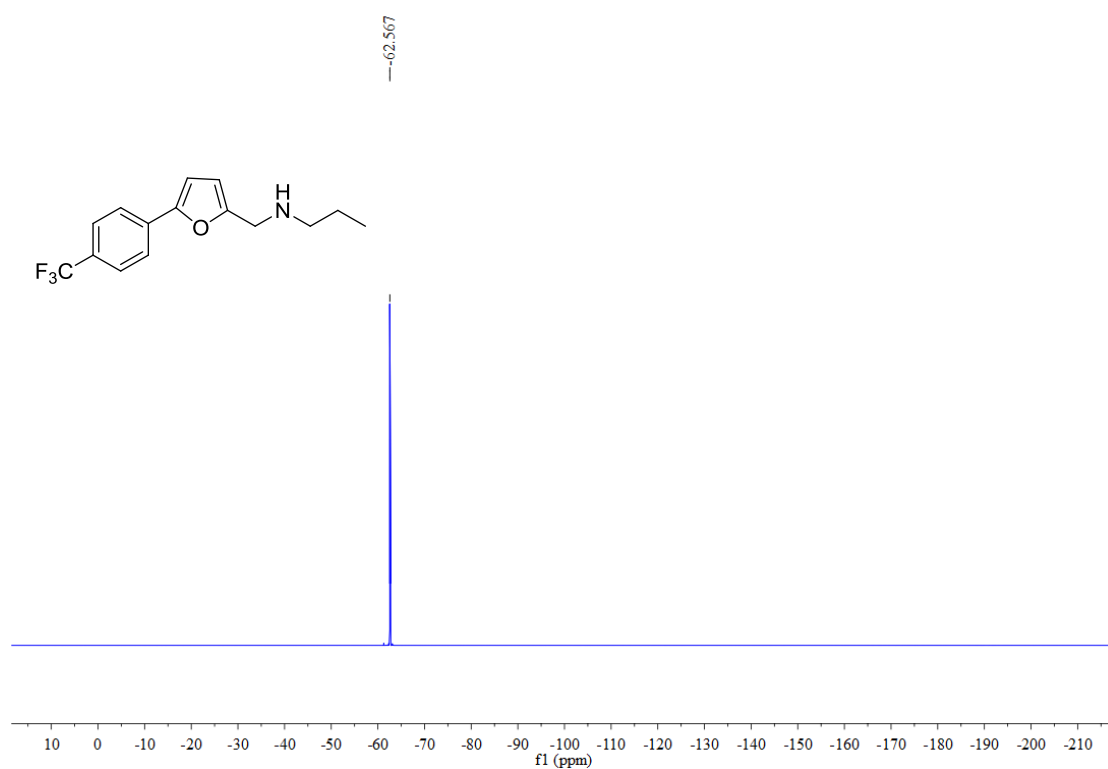
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1k**



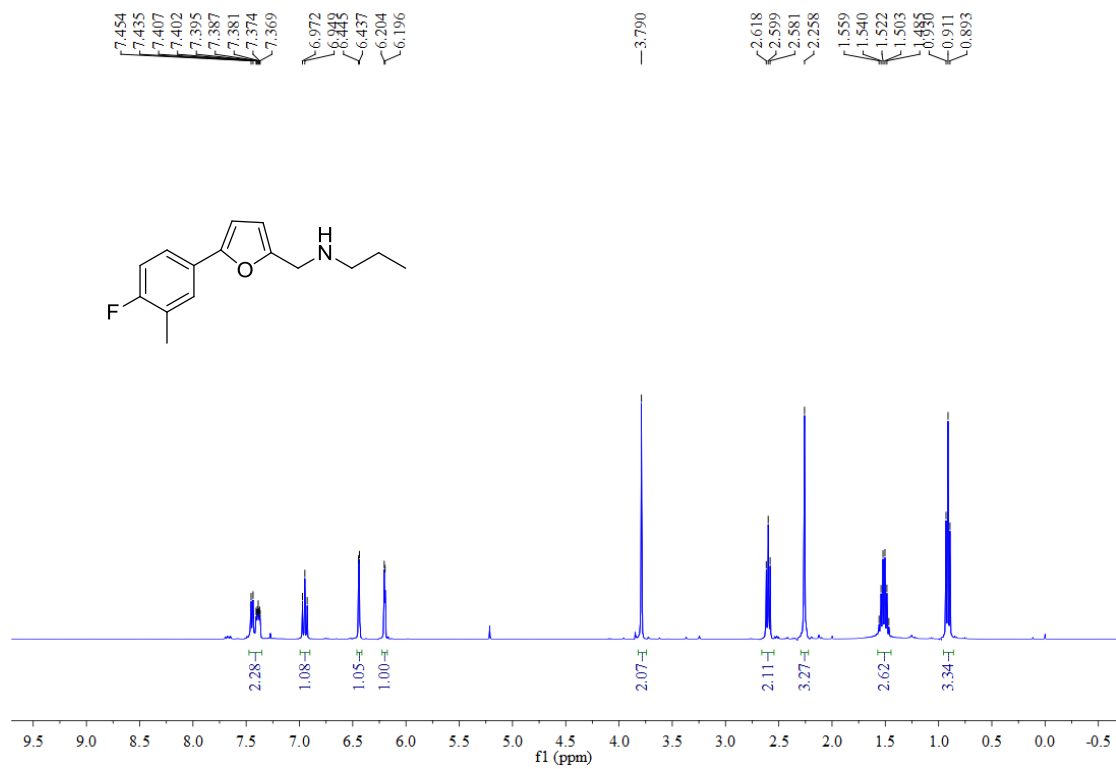
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1k**



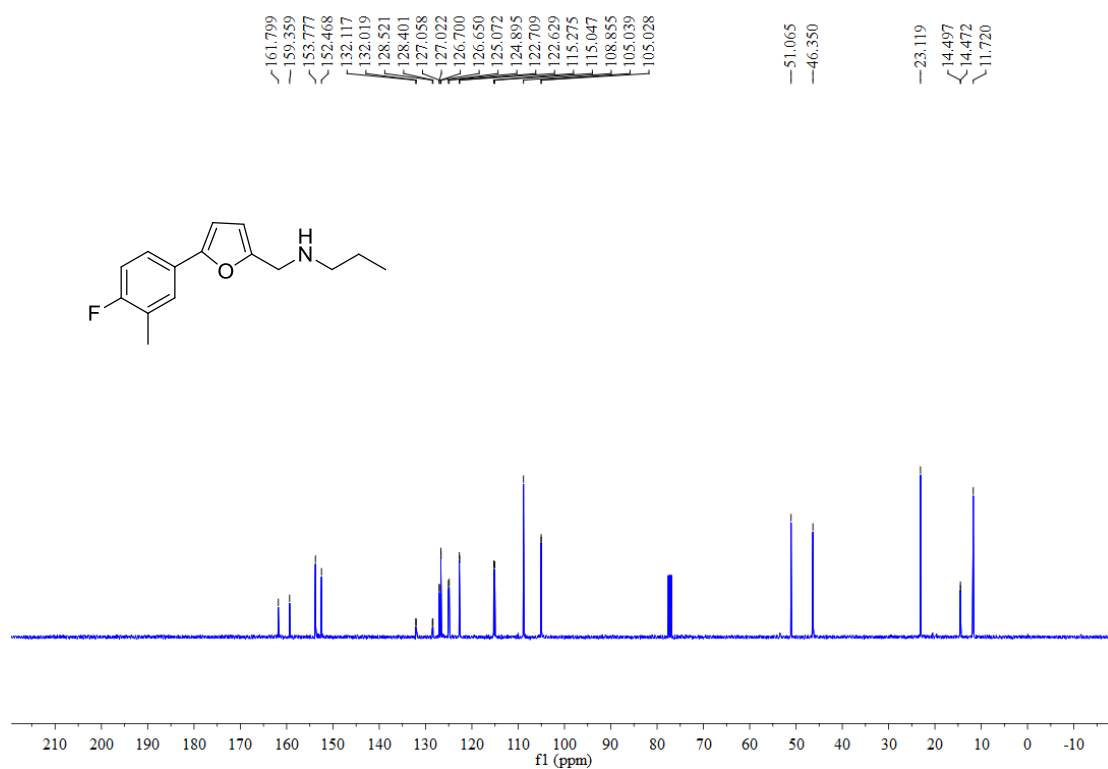
^{19}F NMR spectrum (376 MHz, CDCl_3) of **S3-1k**



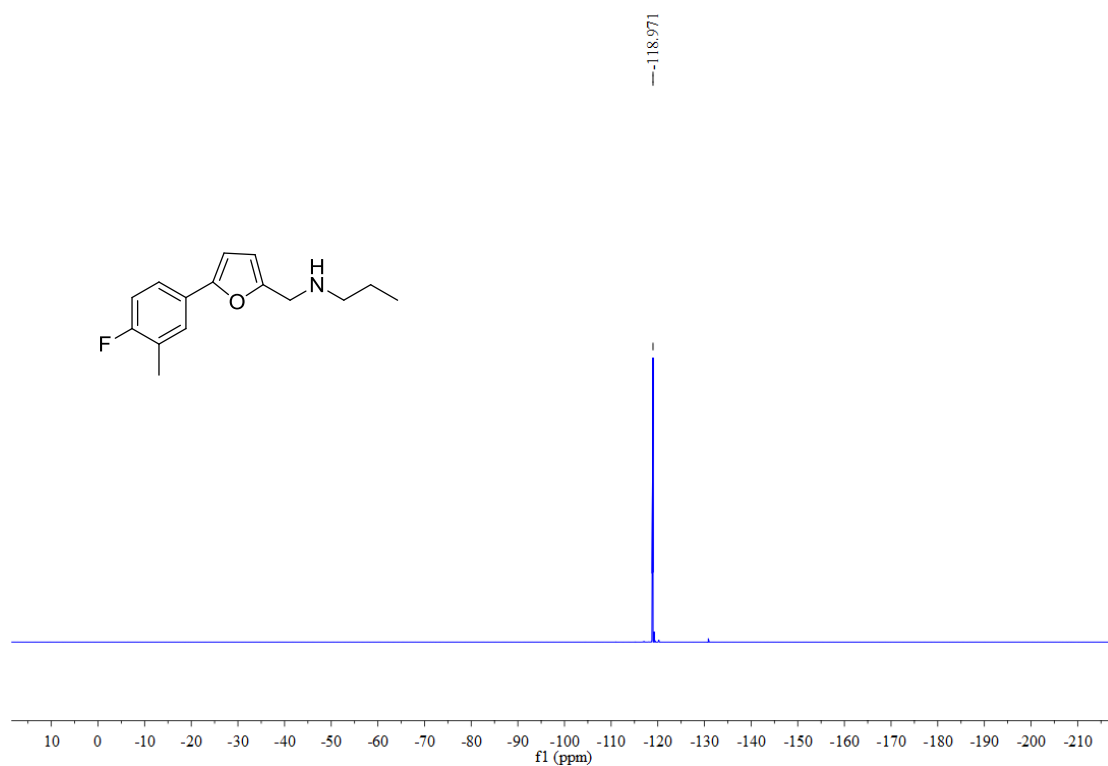
^1H NMR spectrum (400 MHz, CDCl_3) of **S3-1l**



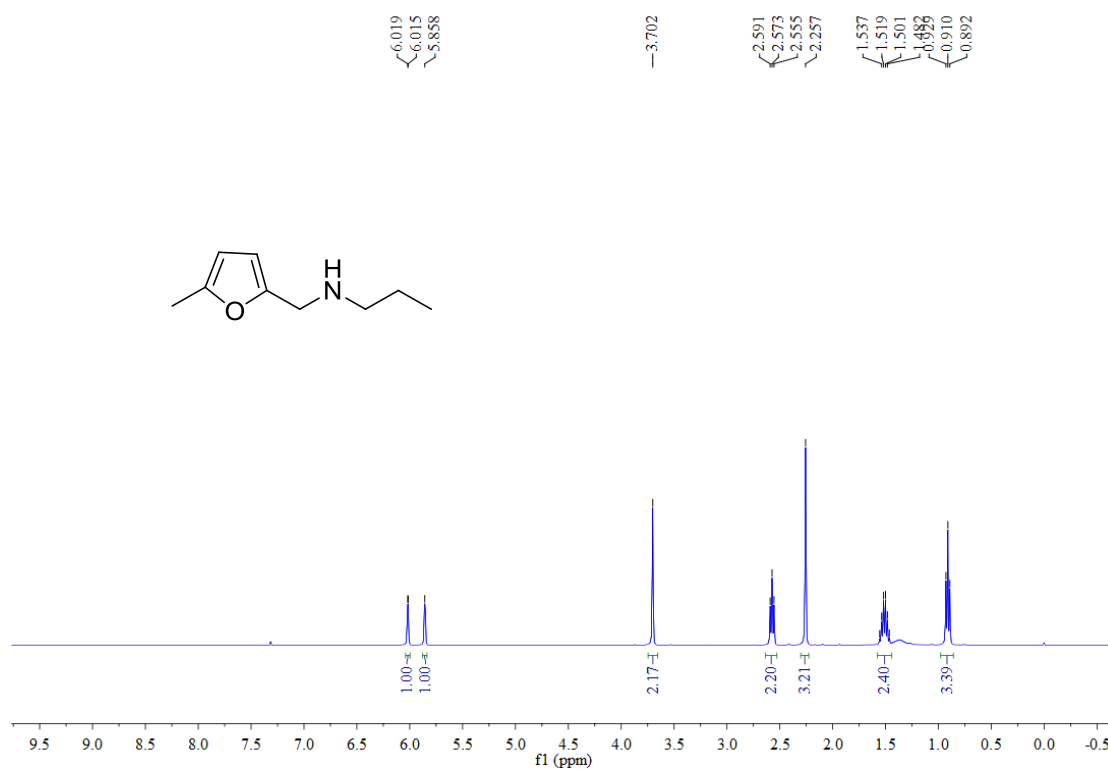
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S3-11**



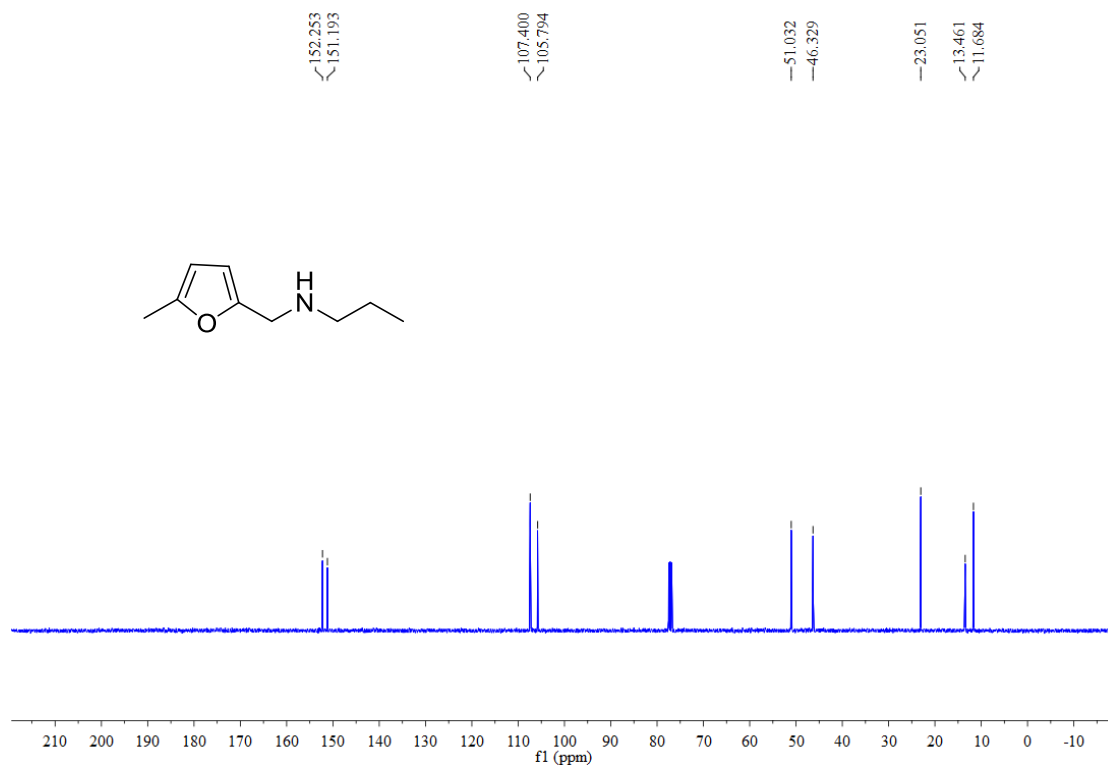
^{19}F NMR spectrum (376 MHz, CDCl_3) of **S3-11**



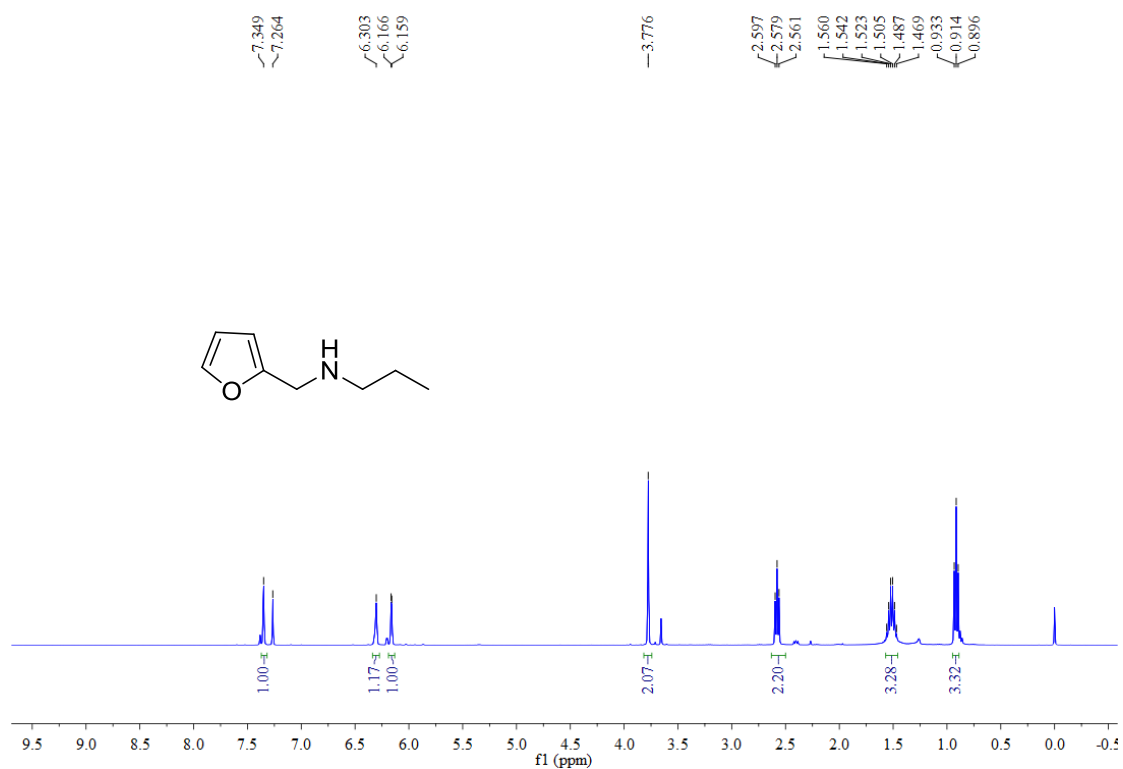
^1H NMR spectrum (400 MHz, CDCl_3) of **S3-1m**



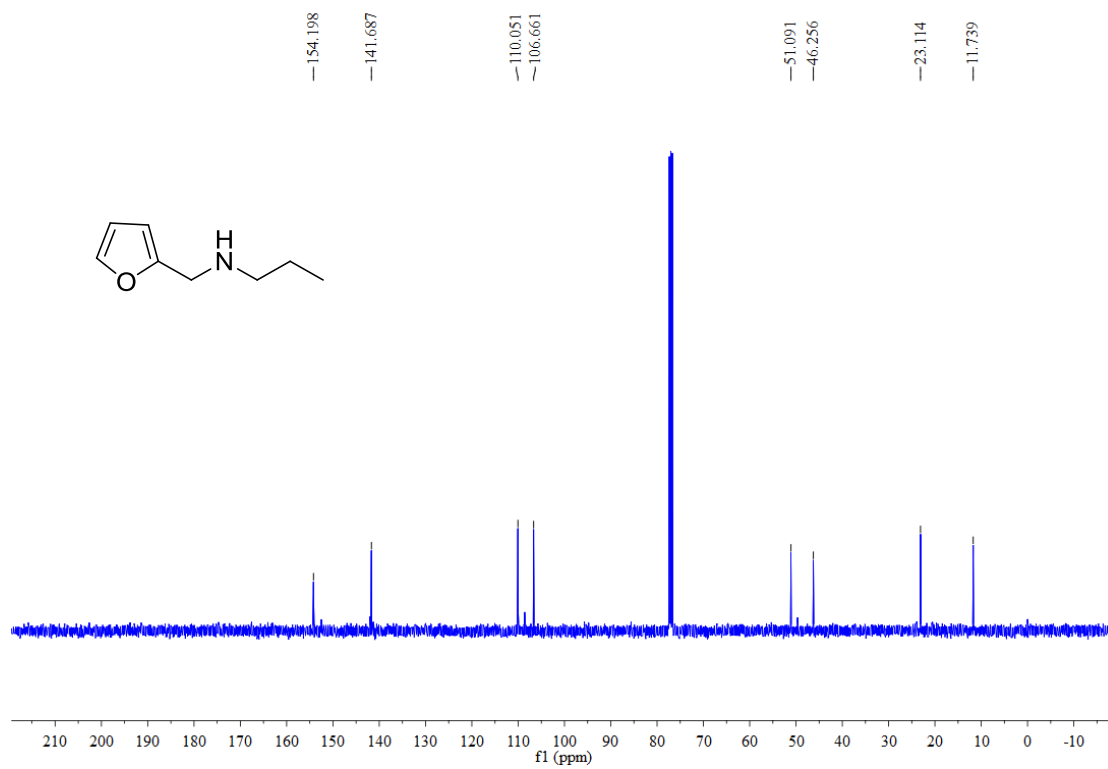
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S3-1m**



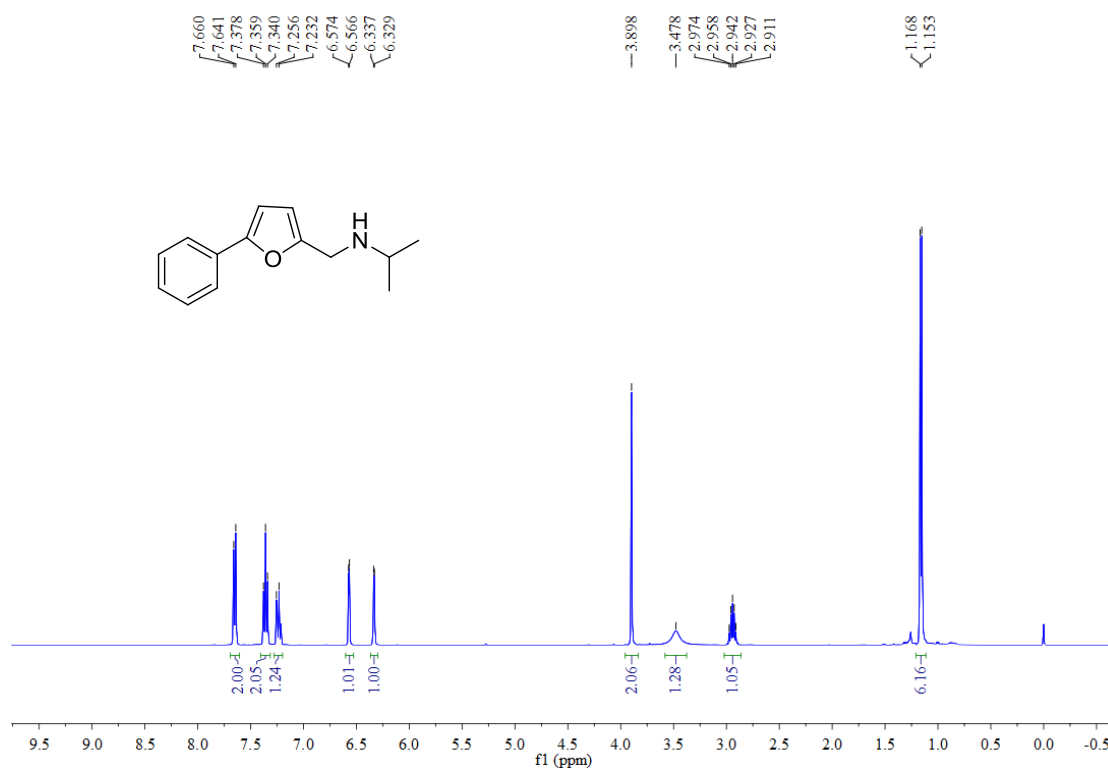
^1H NMR spectrum (400 MHz, CDCl_3) of **S3-1n**



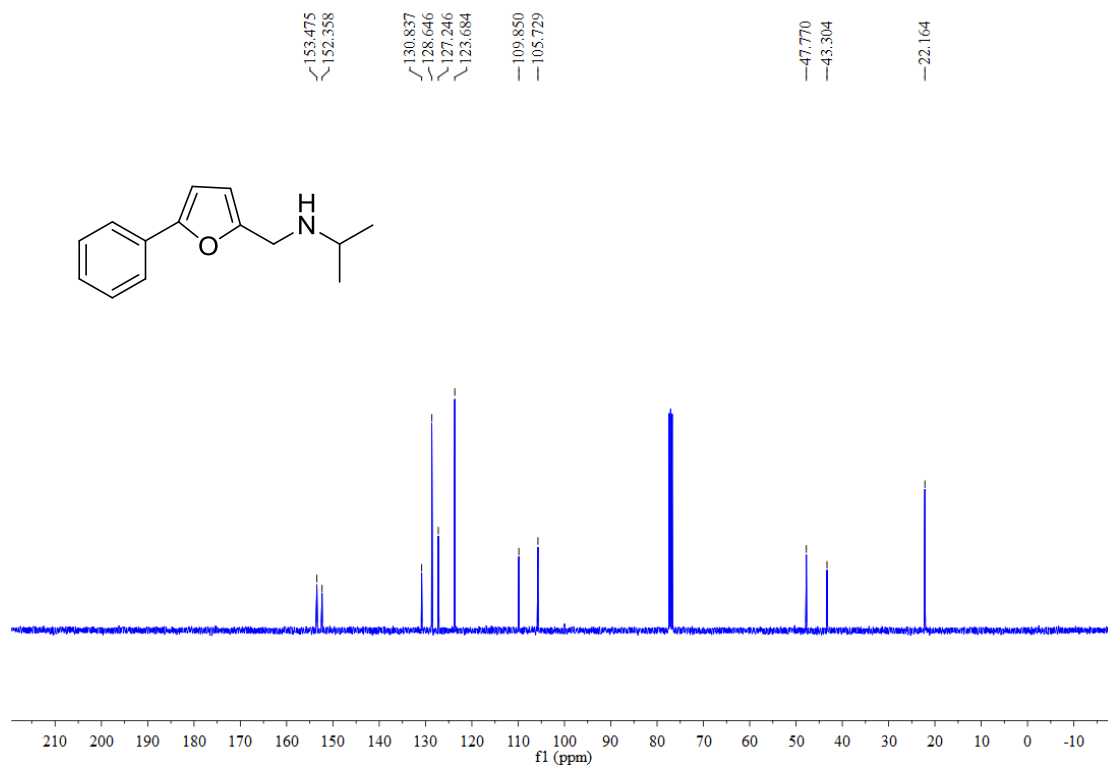
^{13}C NMR spectrum (100 MHz, CDCl_3) of **S3-1n**



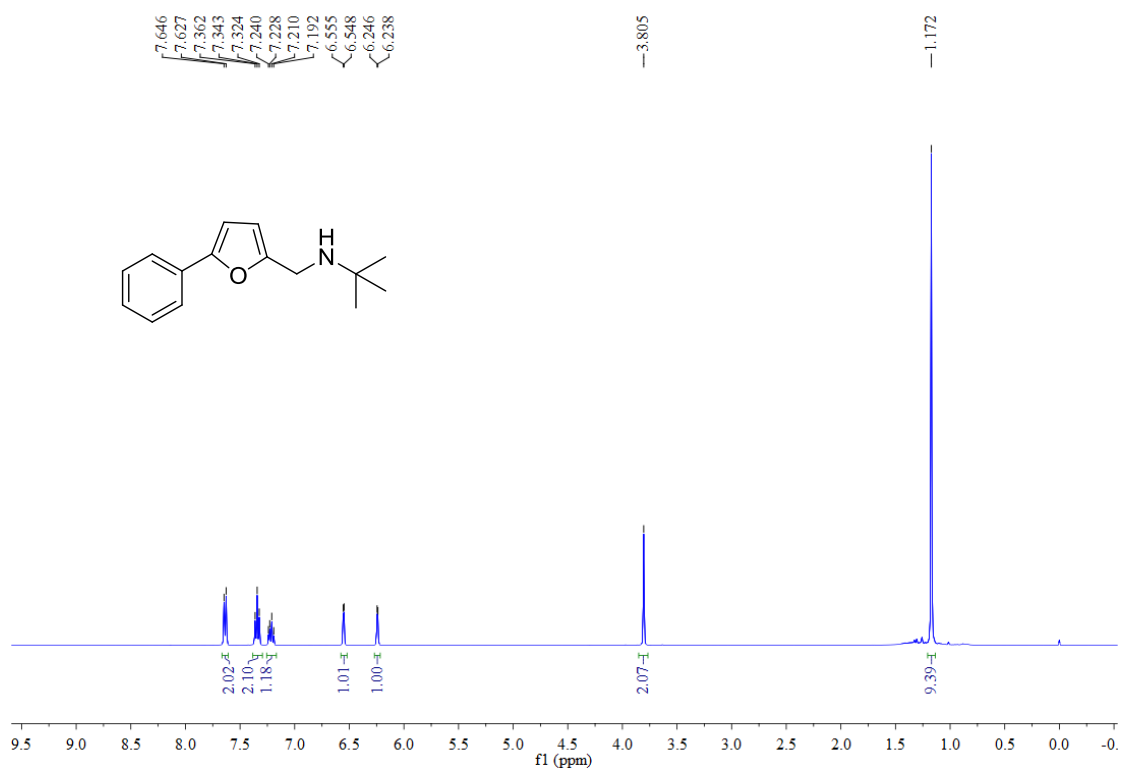
¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1aa**



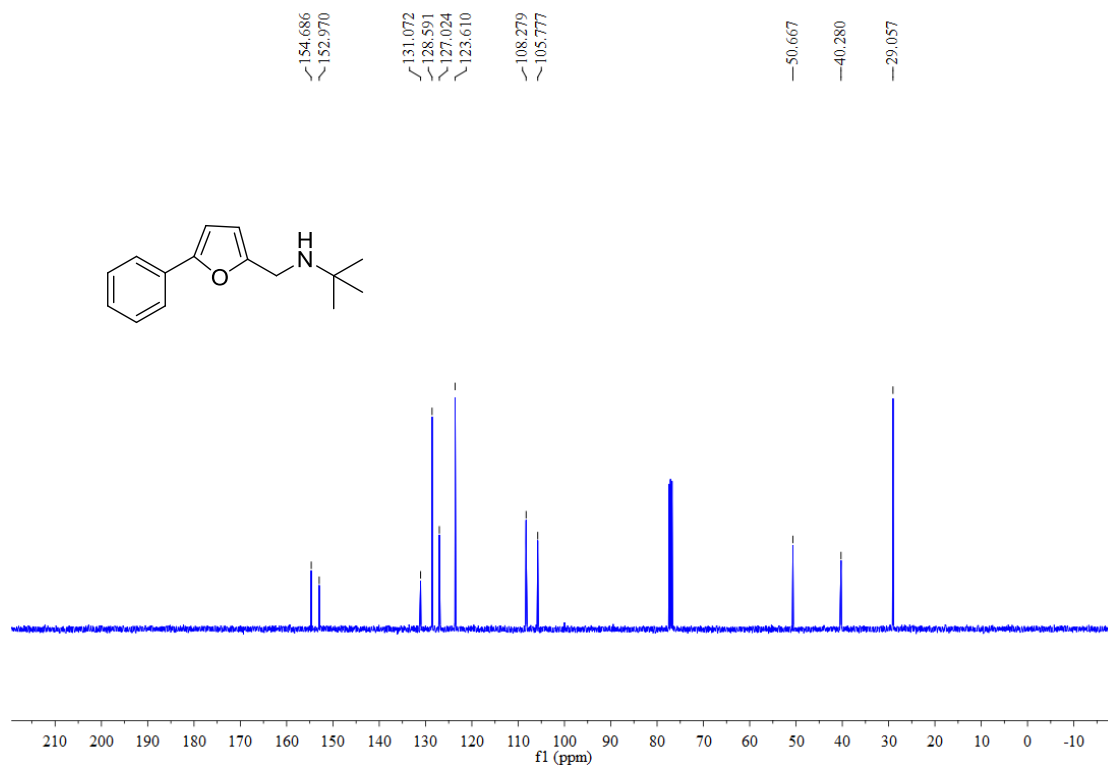
¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1aa**



¹H NMR spectrum (400 MHz, CDCl₃) of **S3-1ab**



¹³C NMR spectrum (100 MHz, CDCl₃) of **S3-1ab**



Chemical structure: c1ccc(cc1)C2=CC=C(C=C2)OC2=CC=C(C=C2)NC2=CC=CC=C2

¹H NMR spectrum (CDCl₃) data:

Chemical Shift (ppm)	Integration
7.823, 7.820, 7.802, 7.513, 7.509, 7.495, 7.477, 7.460, 7.440, 7.402, 7.394, 7.386, 7.382, 7.379, 7.361	2.02, 6.00, 2.03
6.716, 6.708, 6.390, 6.382	1.01, 1.00
3.955, 3.951	4.03
2.003	0.96

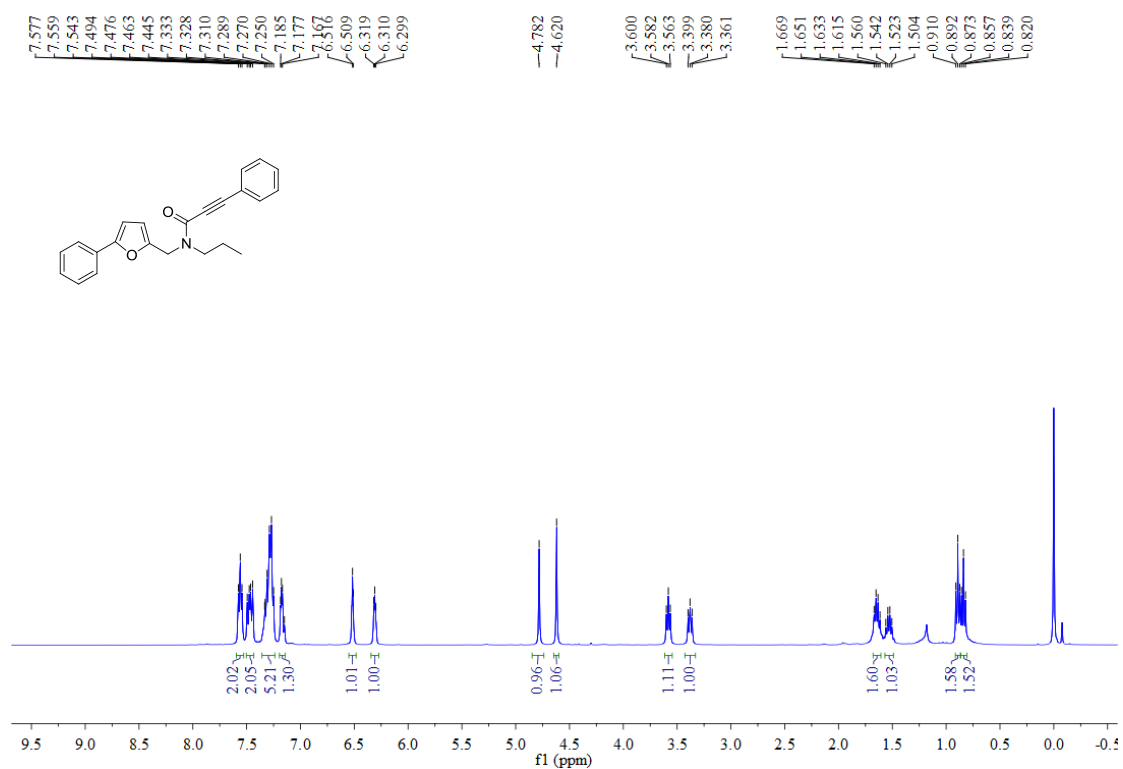
Chemical structure of N-(benzyl(phenyl)methyl)-2-phenyloxazole-5-carboxamide (10b) is shown above its ¹³C NMR spectrum. The spectrum displays peaks corresponding to the structure, with the following chemical shifts (ppm) labeled above the peaks:

Chemical Shift (ppm)
153.867
153.355
140.100
128.817
128.593
128.456
127.301
127.206
126.764
105.854
52.937
45.668

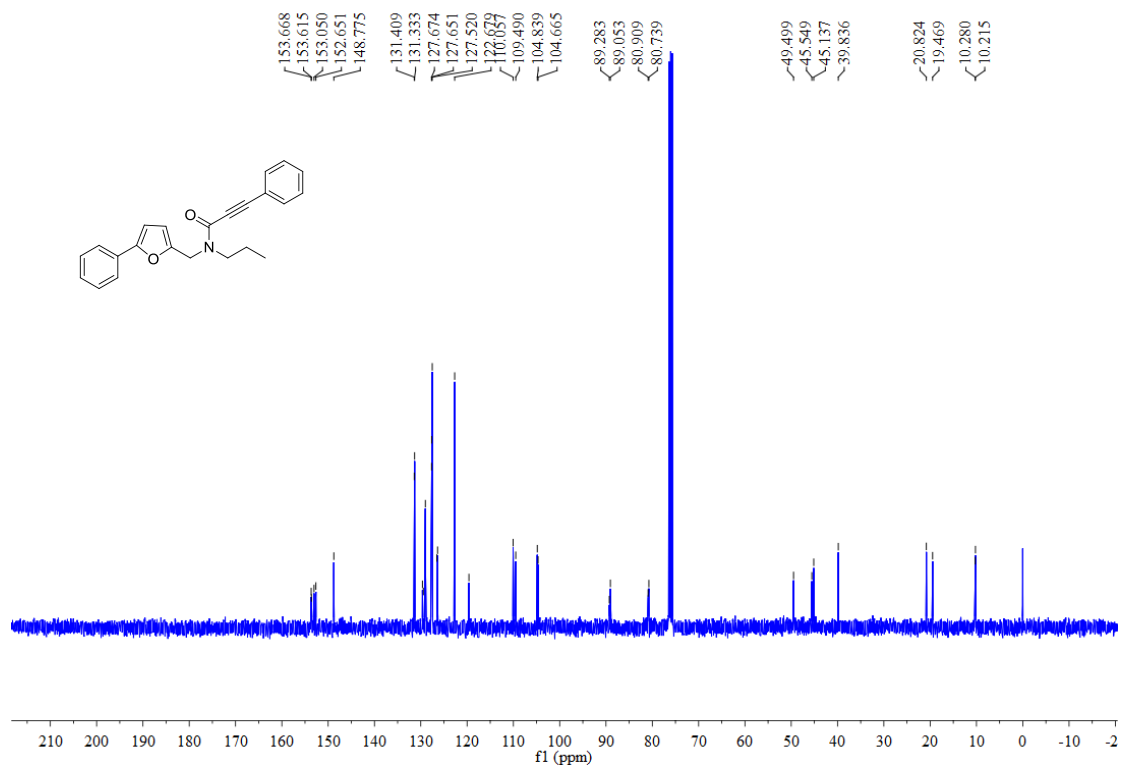


The spectrum is recorded in CDCl₃, as indicated by the solvent triplet at 77.0 ppm. The x-axis is labeled f1 (ppm) and ranges from -10 to 210.

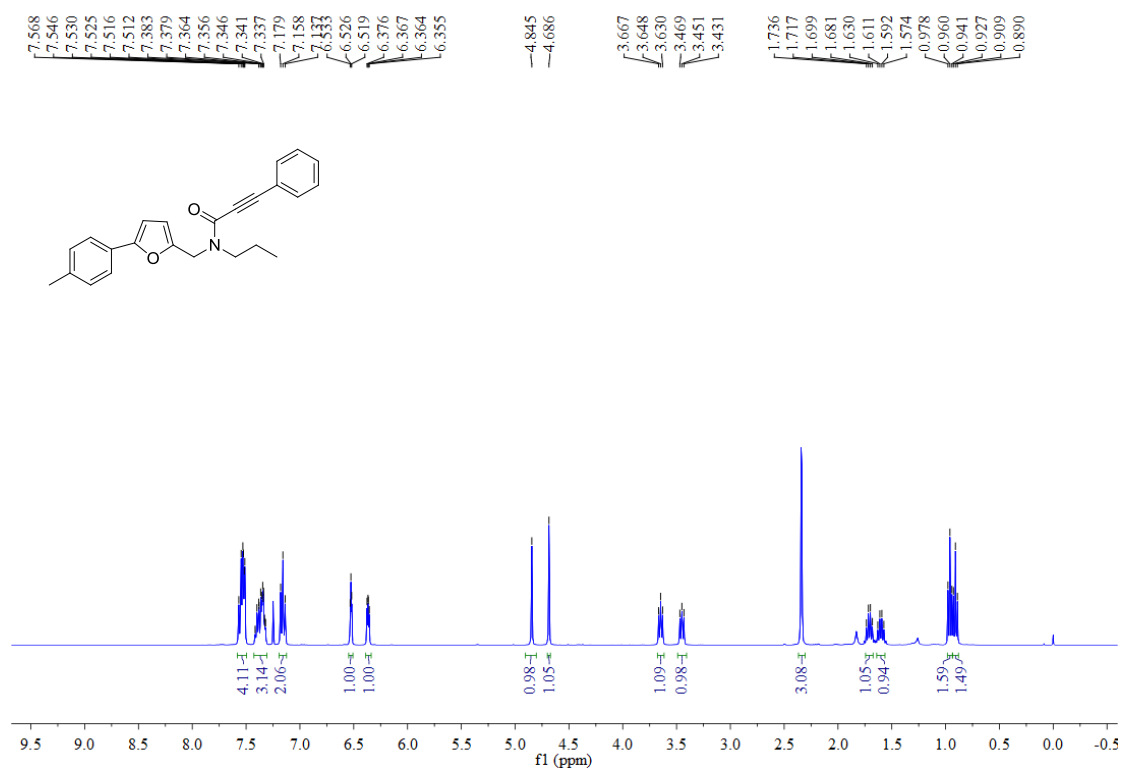
¹H NMR spectrum (400 MHz, CDCl₃) of **1a**



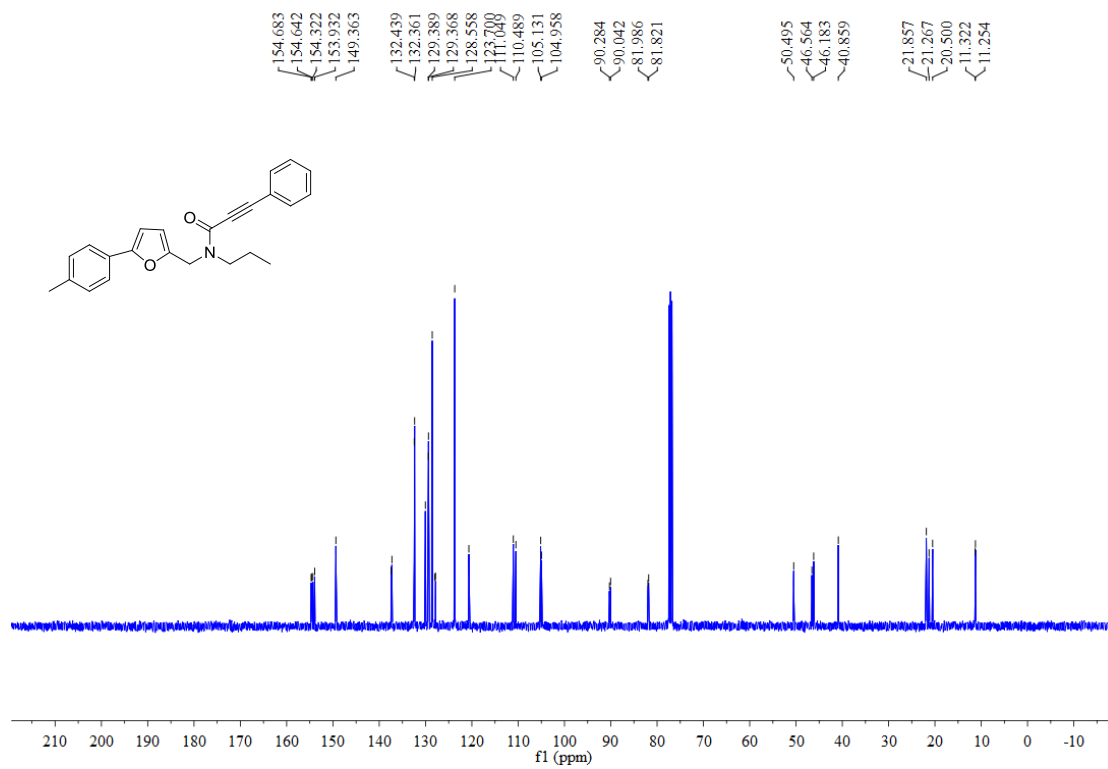
¹³C NMR spectrum (100 MHz, CDCl₃) of **1a**



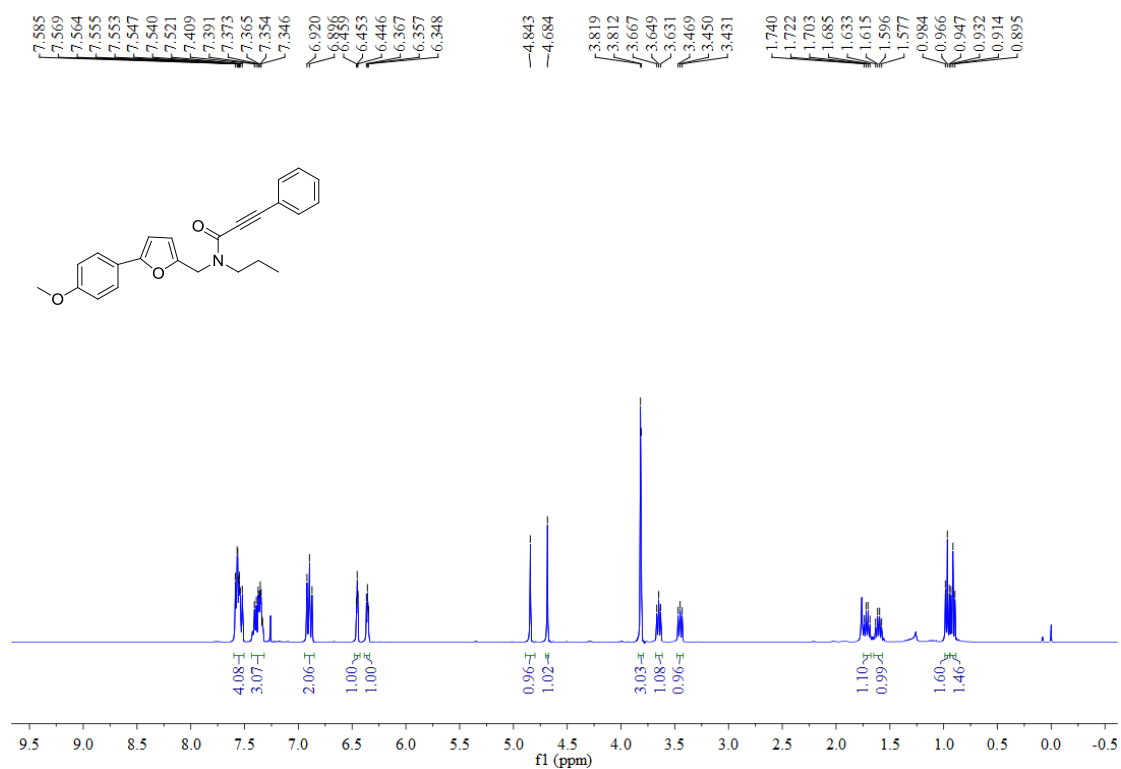
¹H NMR spectrum (400 MHz, CDCl₃) of **1b**



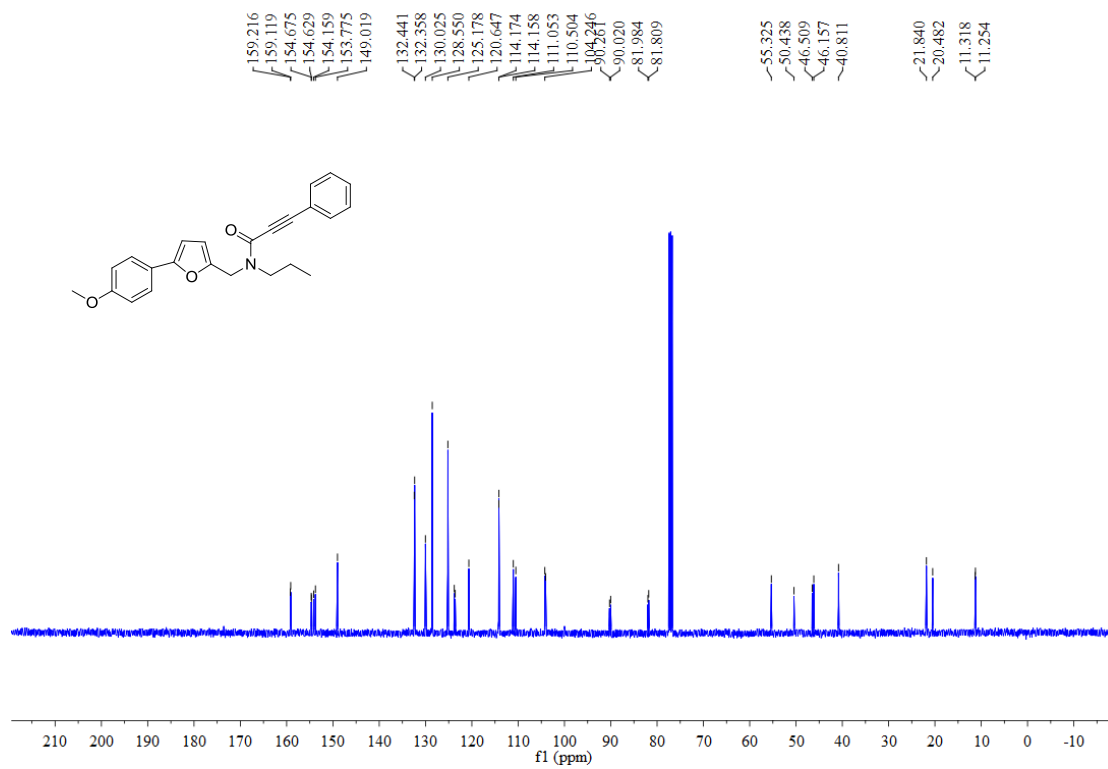
¹³C NMR spectrum (100 MHz, CDCl₃) of **1b**



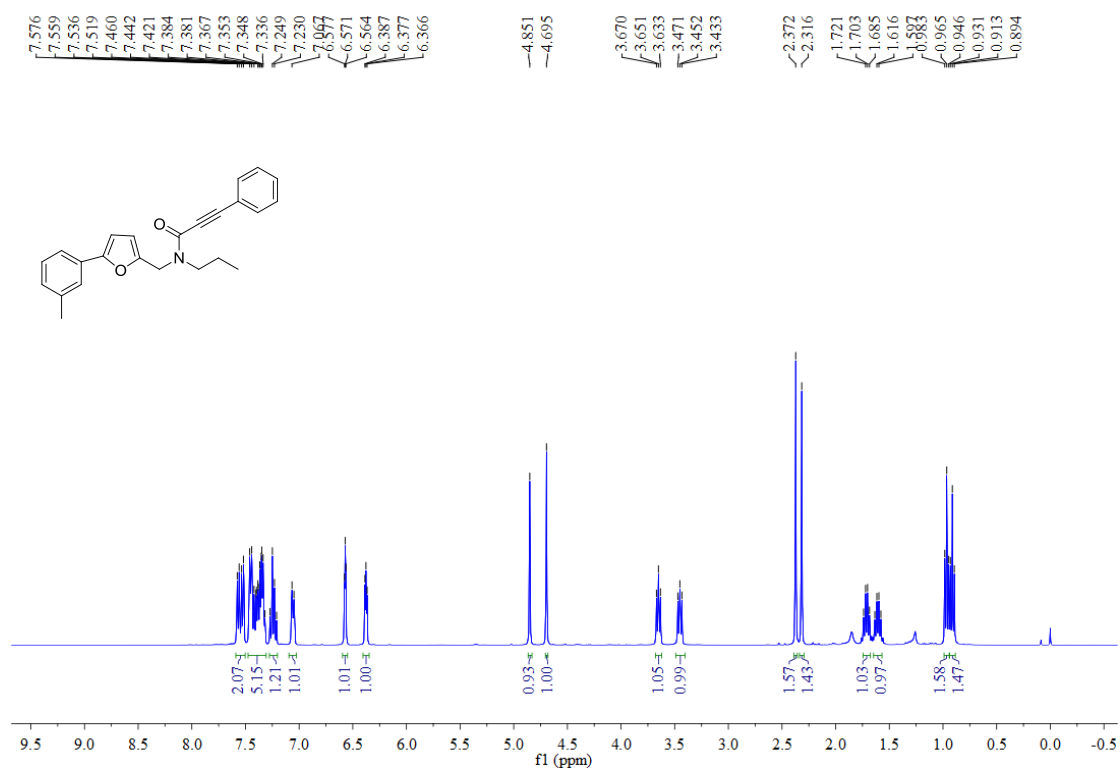
¹H NMR spectrum (400 MHz, CDCl₃) of **1c**



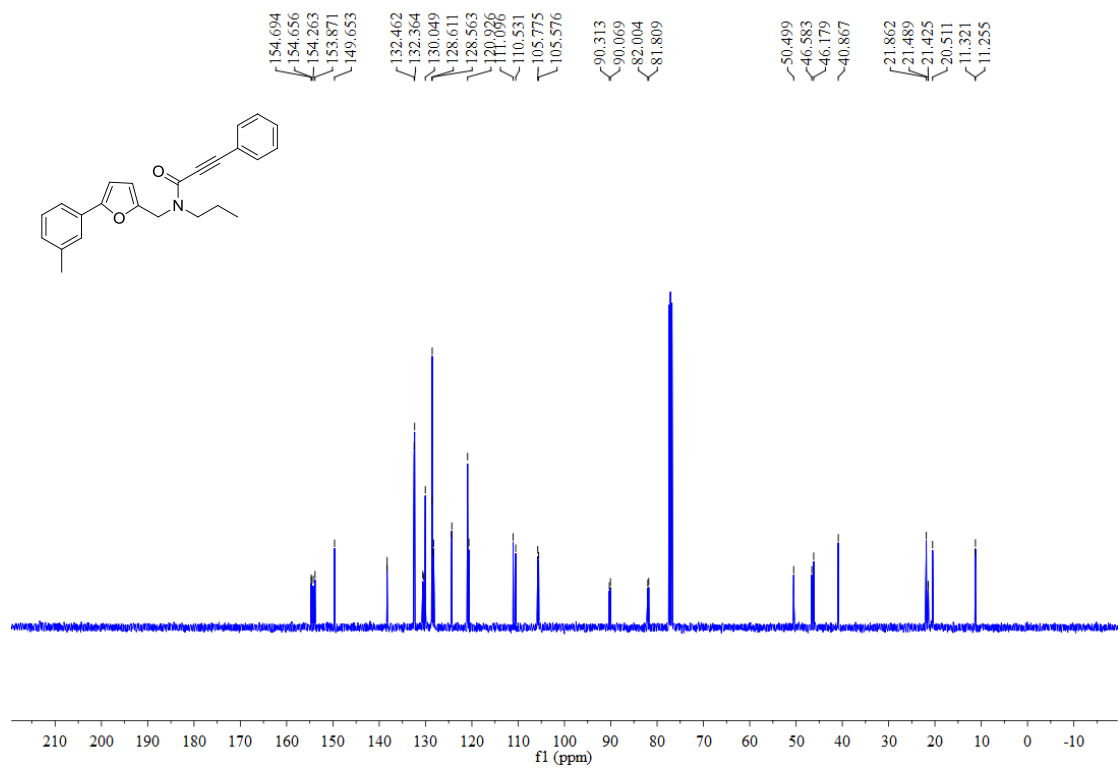
¹³C NMR spectrum (100 MHz, CDCl₃) of **1c**



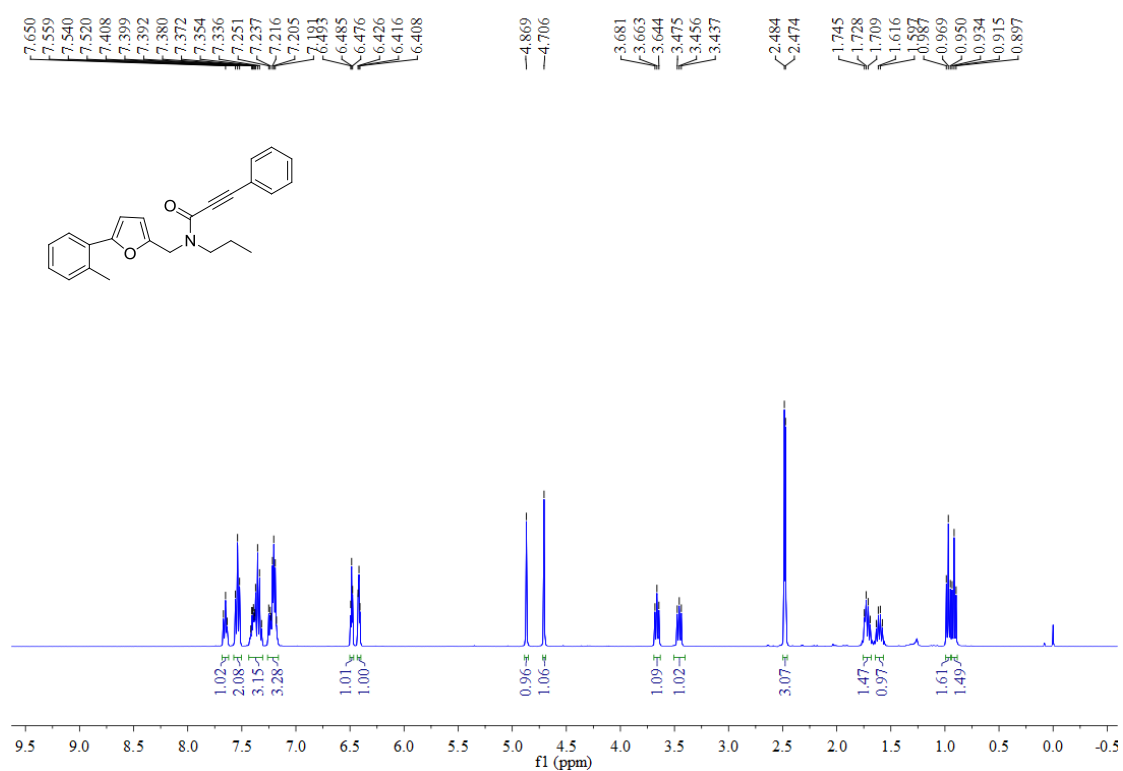
¹H NMR spectrum (400 MHz, CDCl₃) of **1d**



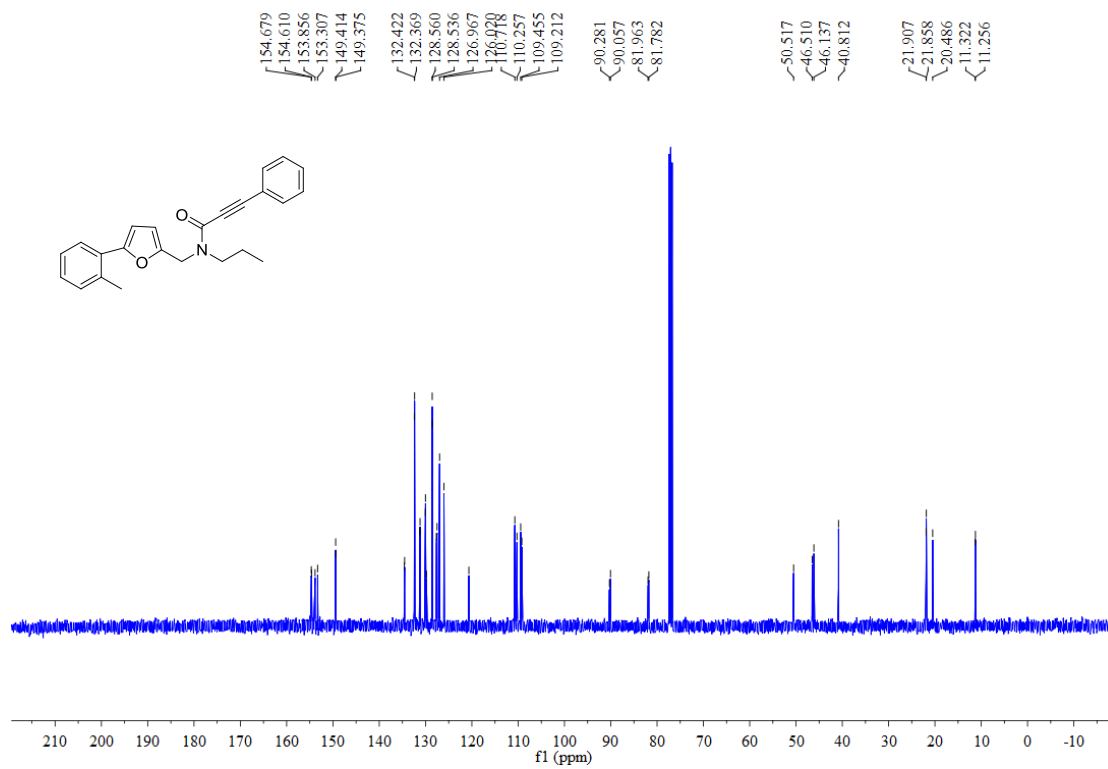
¹³C NMR spectrum (100 MHz, CDCl₃) of **1d**



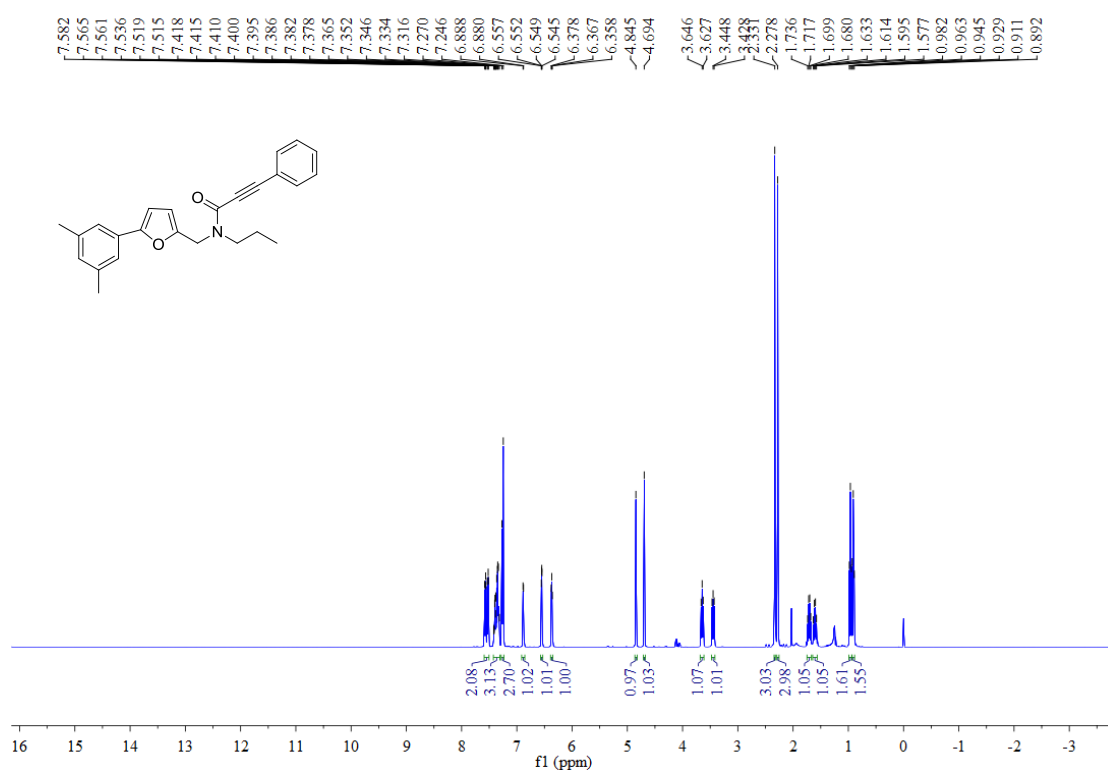
¹H NMR spectrum (400 MHz, CDCl₃) of **1e**



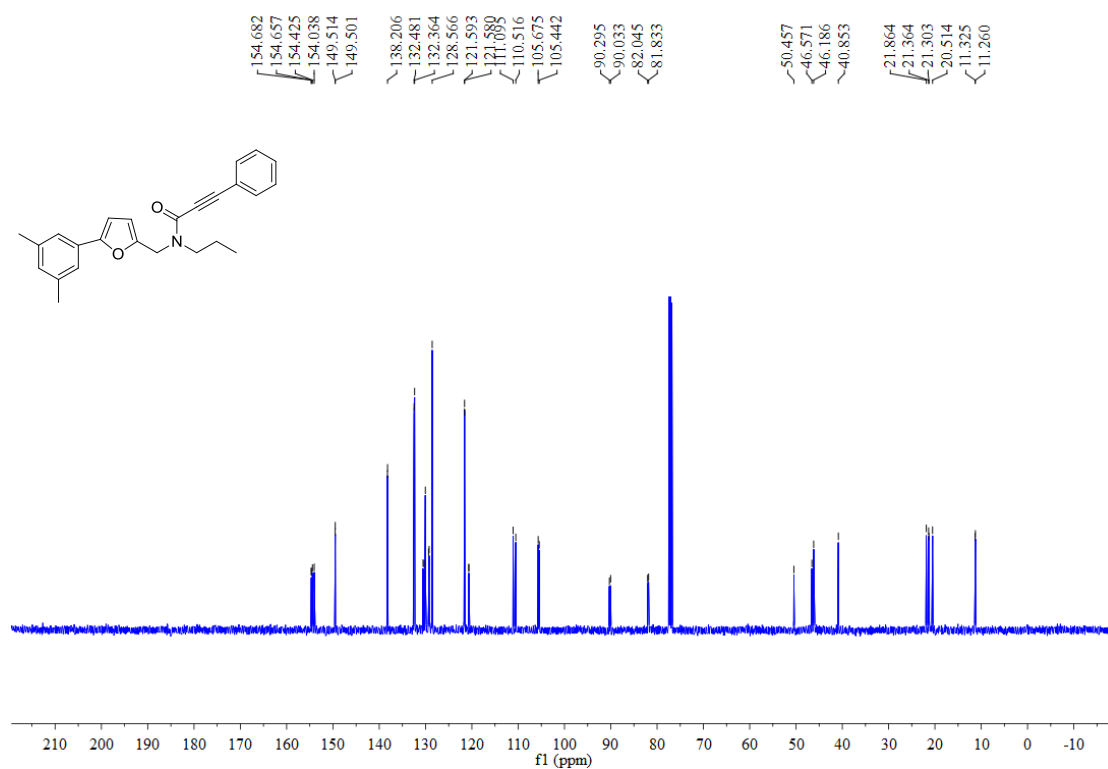
¹³C NMR spectrum (100 MHz, CDCl₃) of **1e**



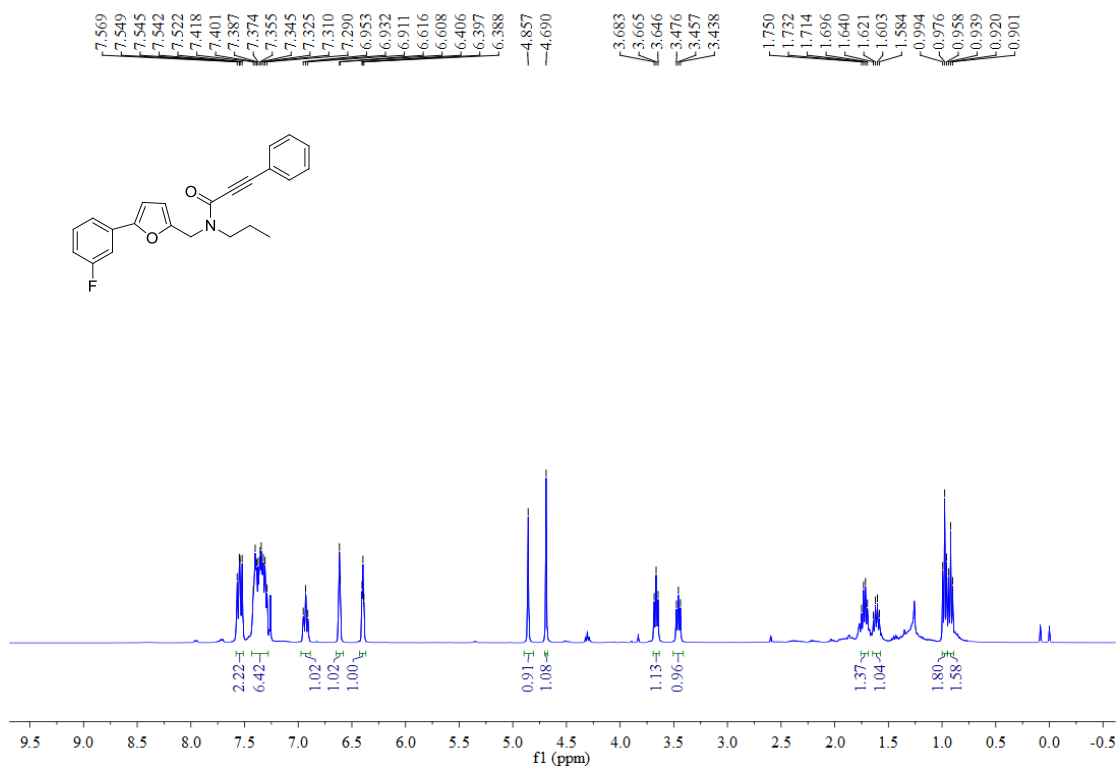
¹H NMR spectrum (400 MHz, CDCl₃) of **1f**



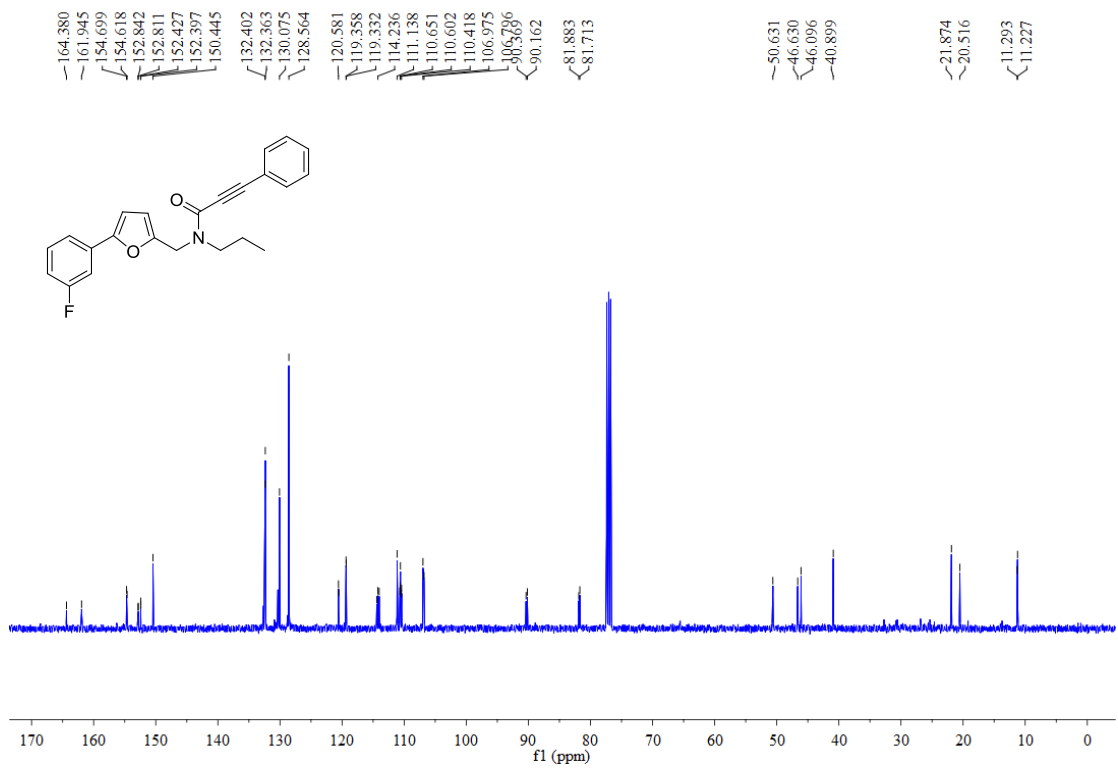
¹³C NMR spectrum (100 MHz, CDCl₃) of **1f**



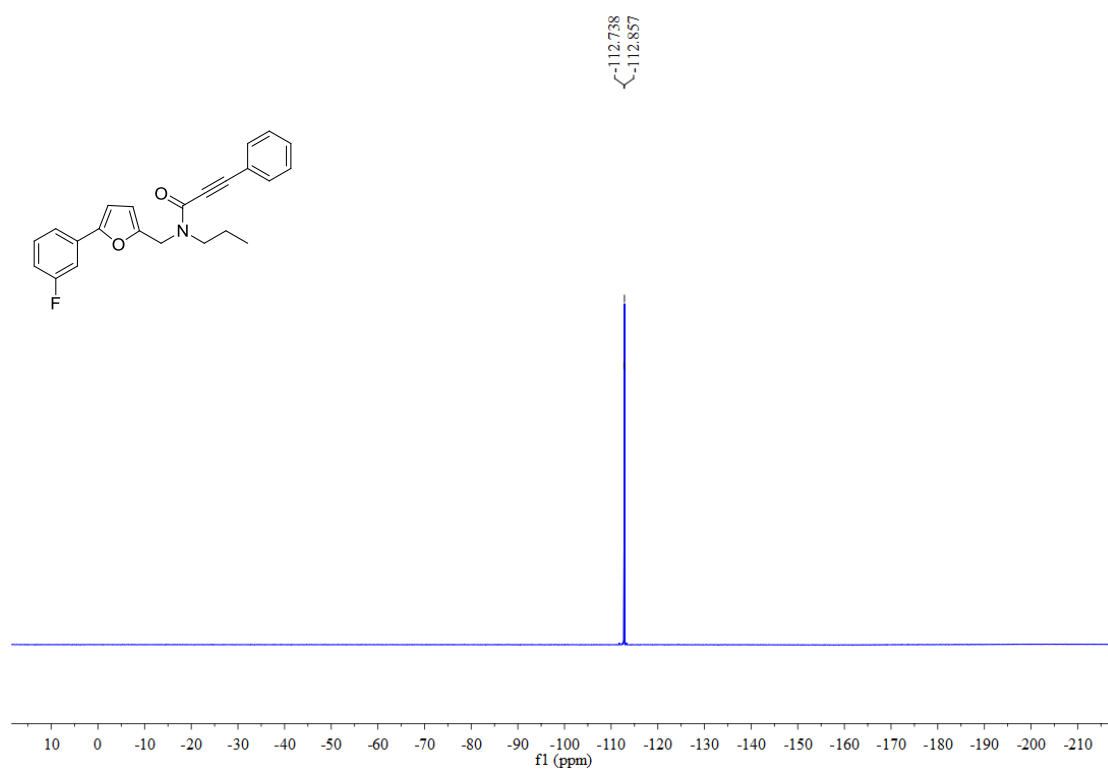
¹H NMR spectrum (400 MHz, CDCl₃) of **1g**



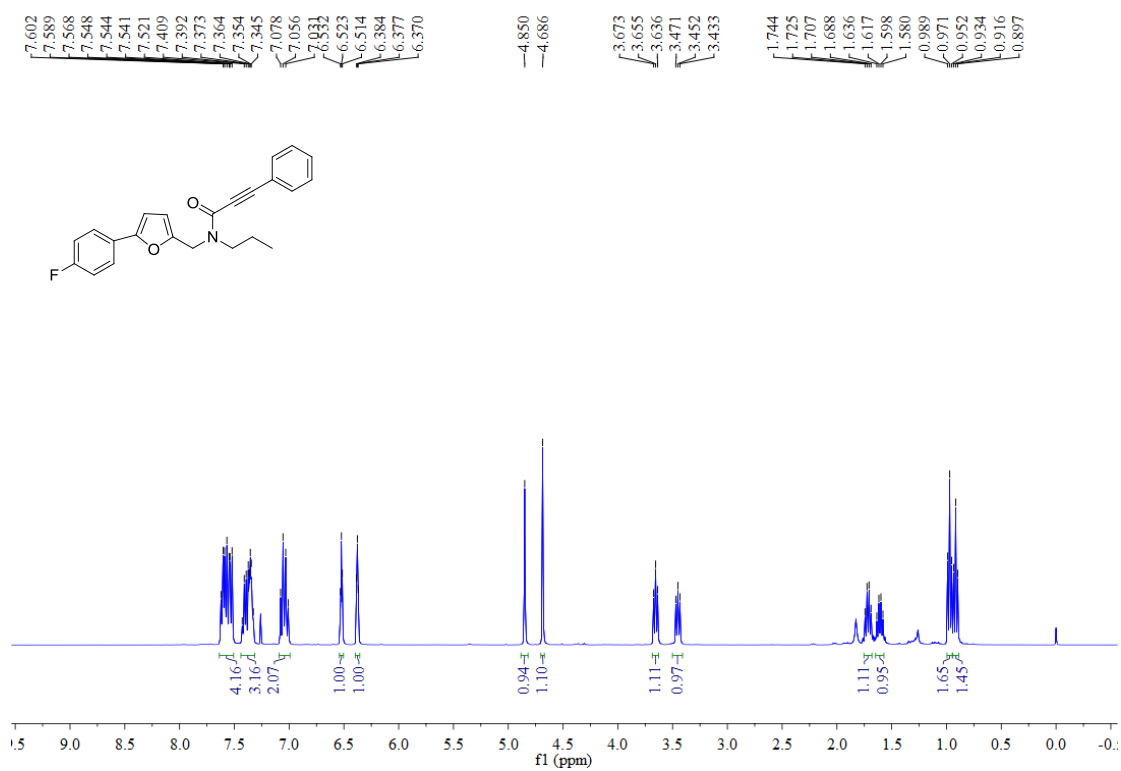
¹³C NMR spectrum (100 MHz, CDCl₃) of **1g**



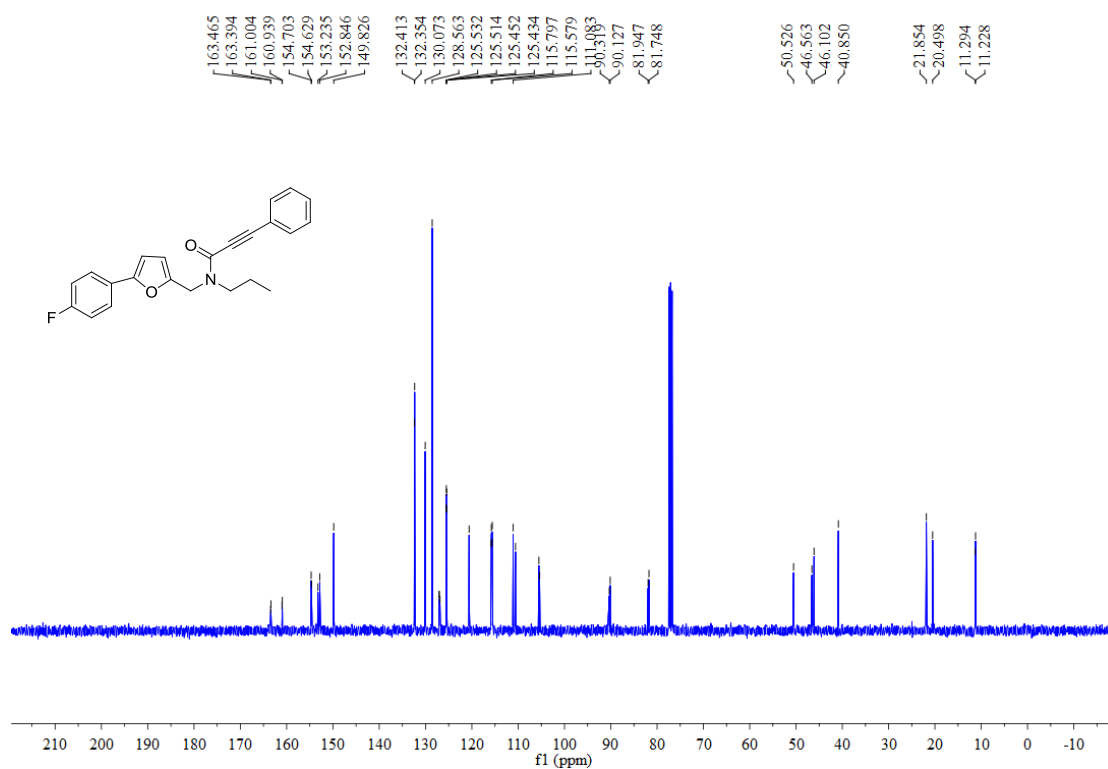
^{13}F NMR spectrum (376 MHz, CDCl_3) of **1g**



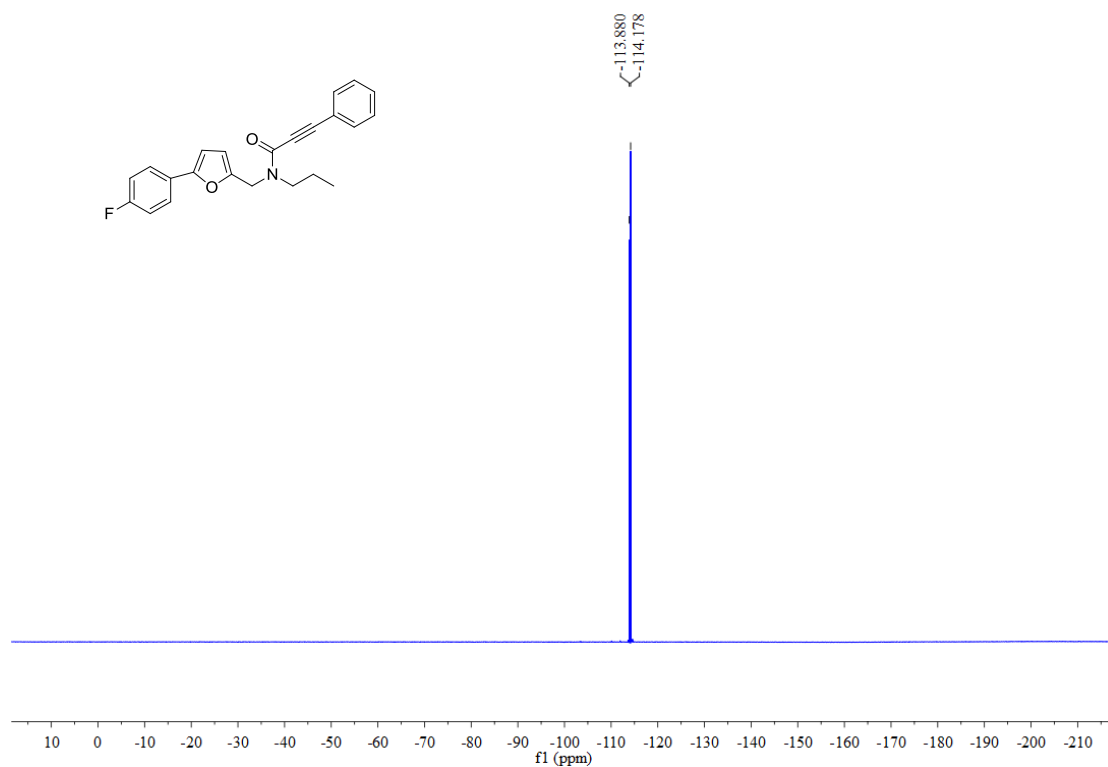
^1H NMR spectrum (400 MHz, CDCl_3) of **1h**



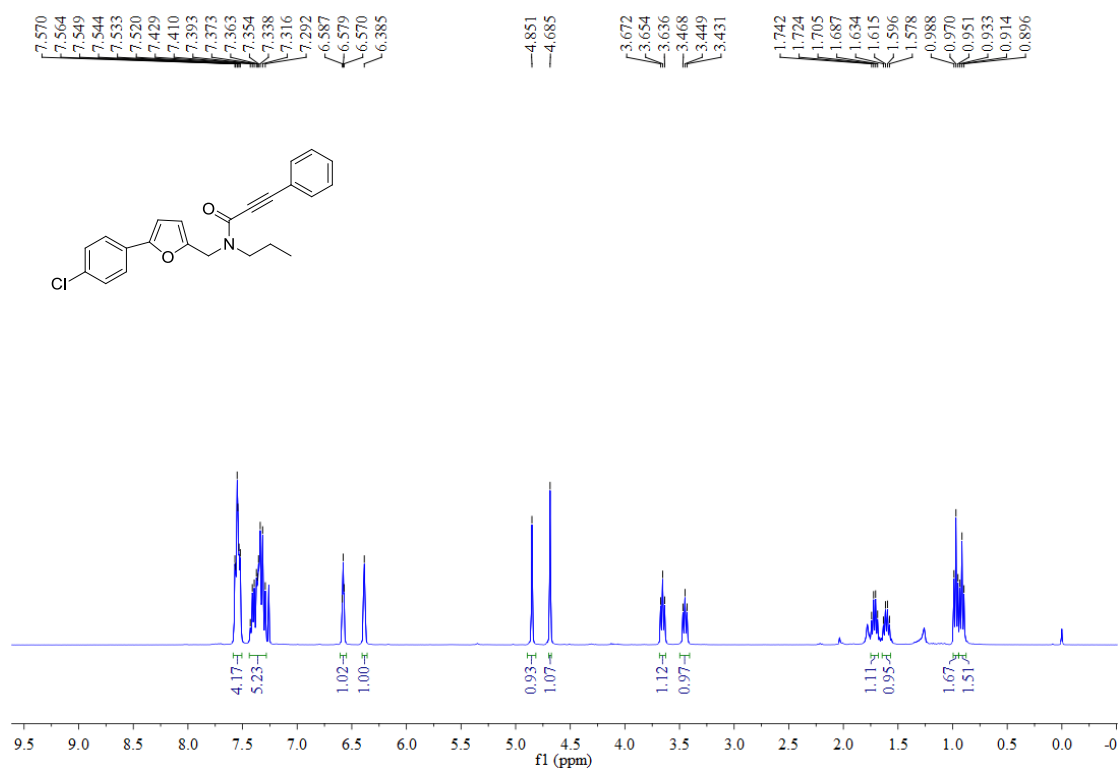
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1h**



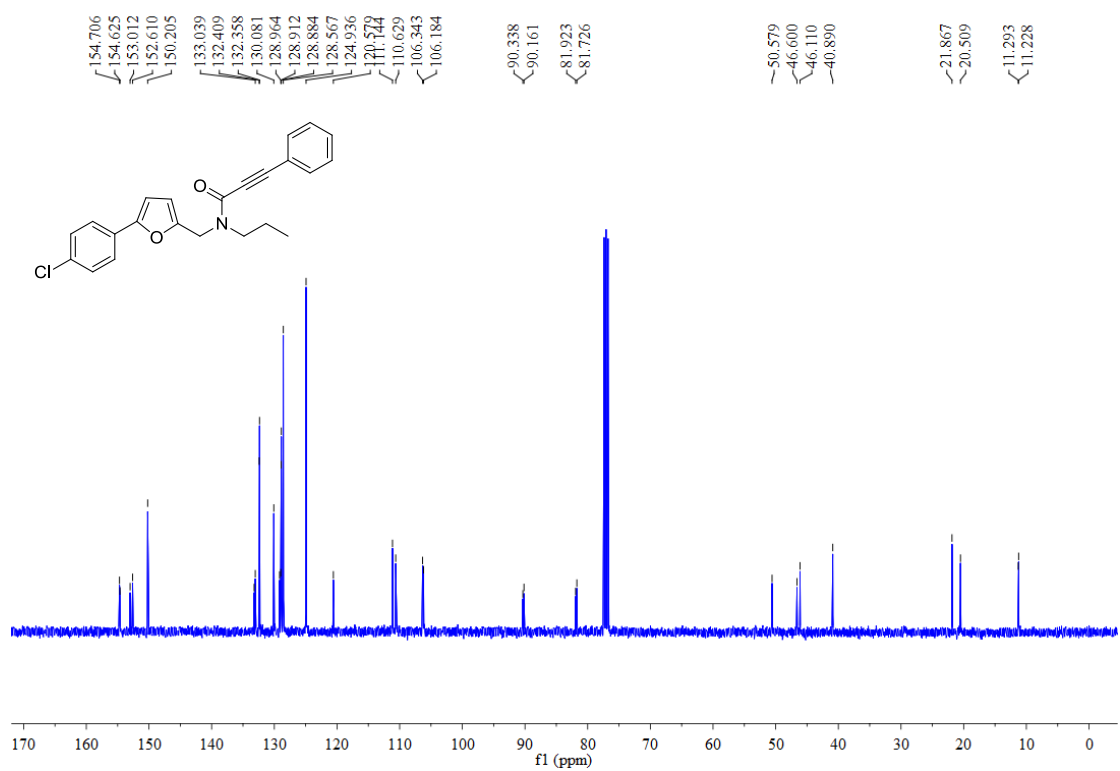
^{19}F NMR spectrum (376 MHz, CDCl_3) of **1h**



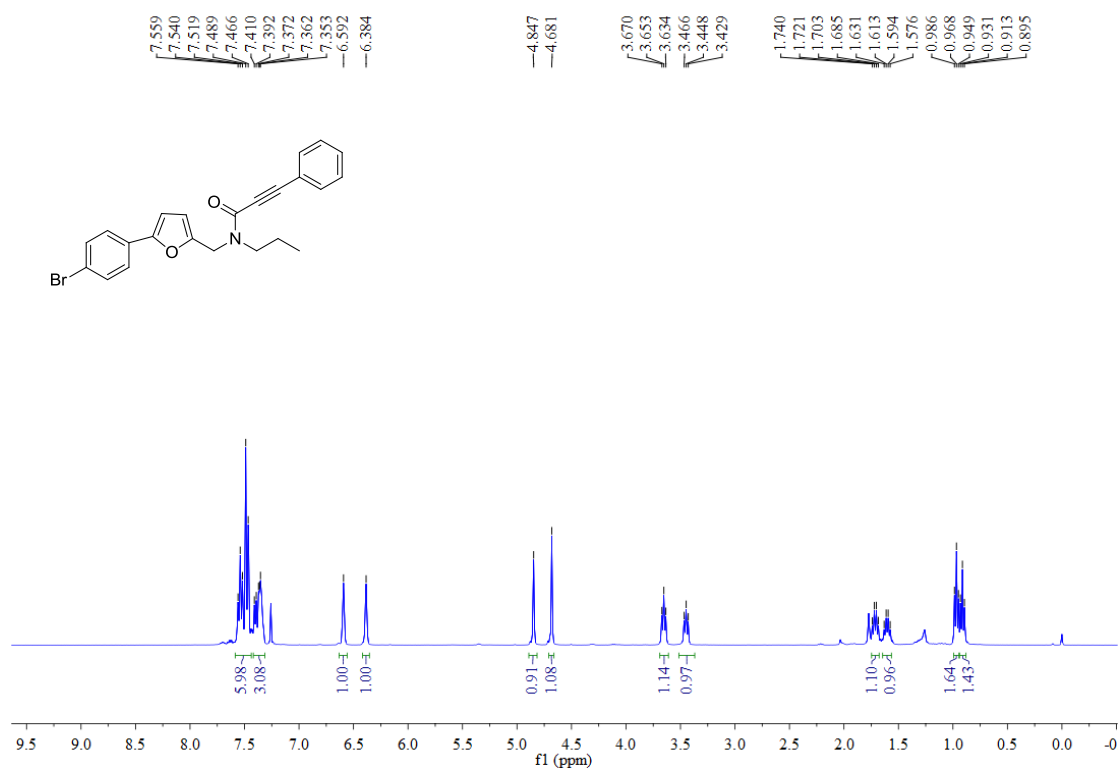
¹H NMR spectrum (400 MHz, CDCl₃) of **1i**



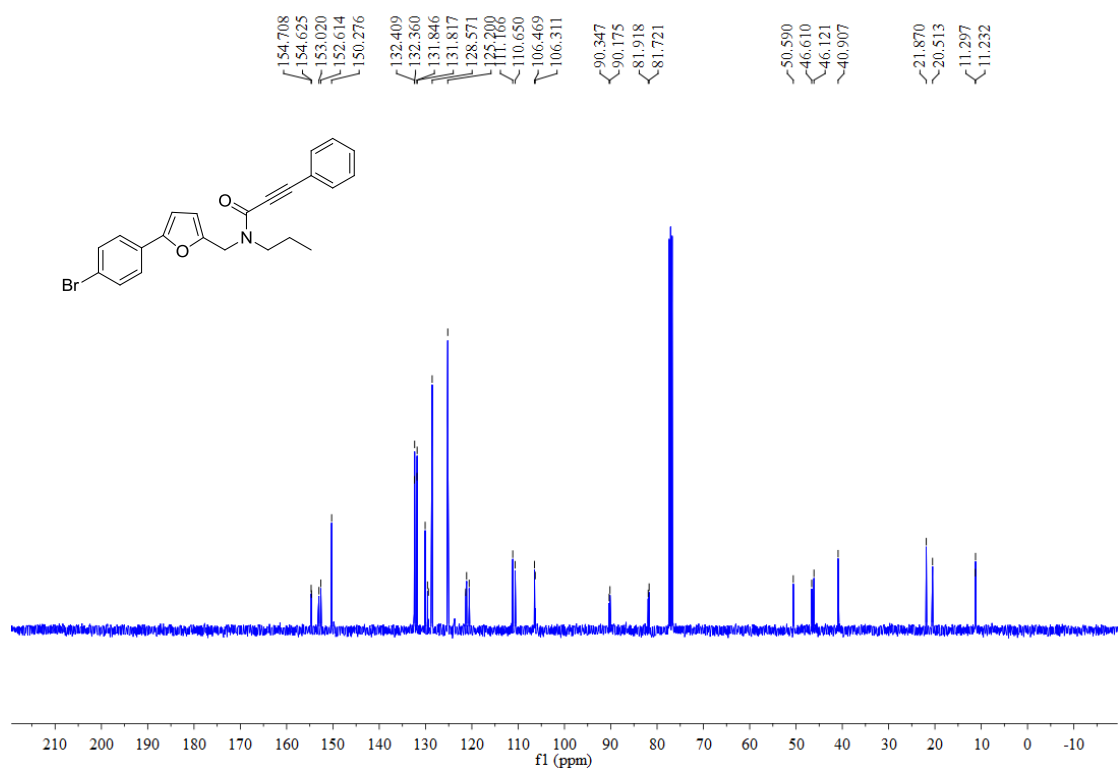
¹³C NMR spectrum (100 MHz, CDCl₃) of **1i**



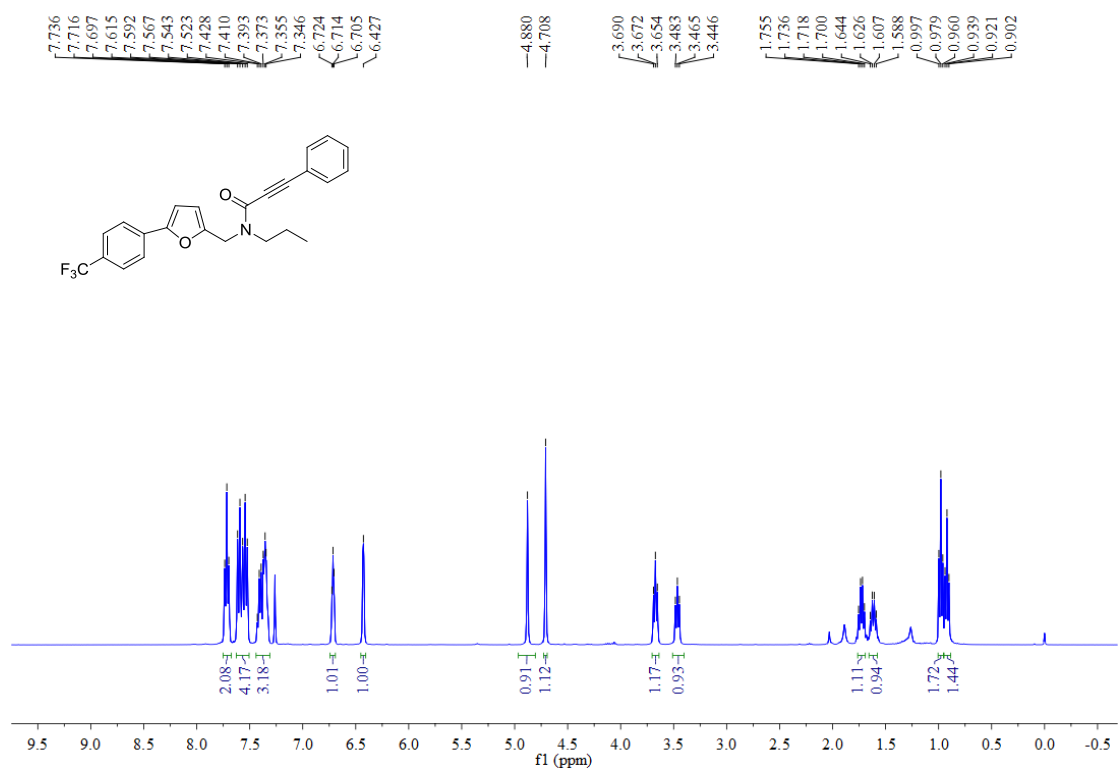
¹H NMR spectrum (400 MHz, CDCl₃) of **1j**



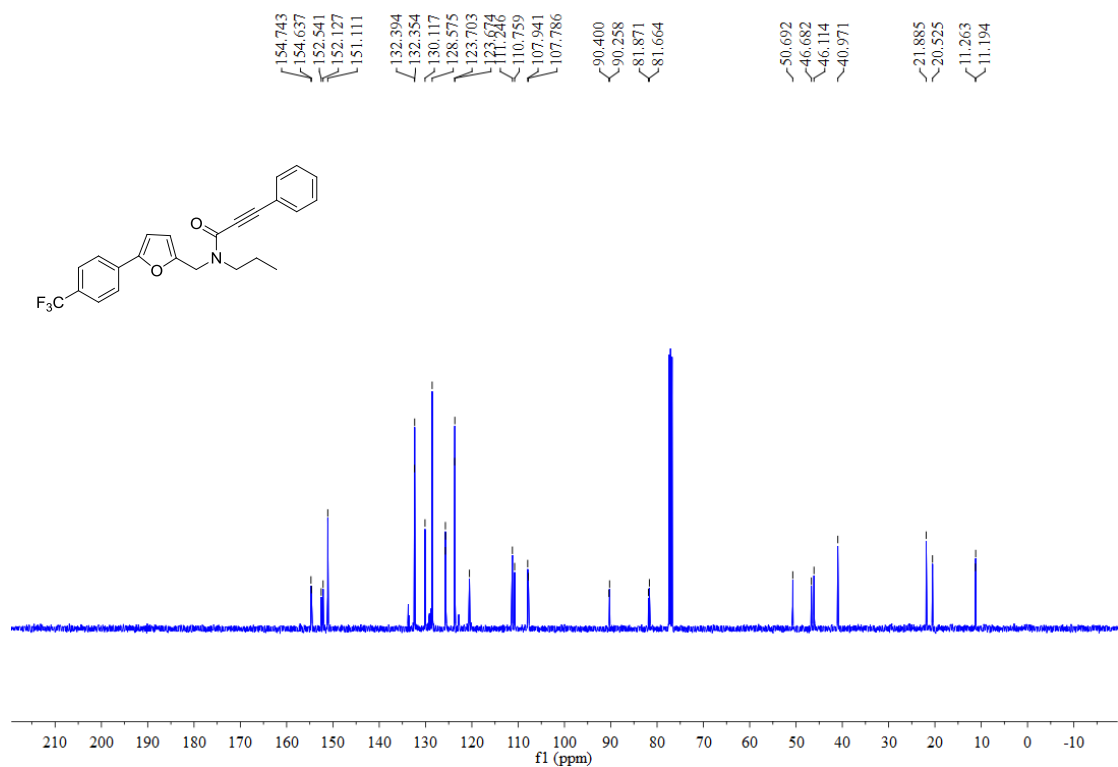
¹³C NMR spectrum (100 MHz, CDCl₃) of **1j**



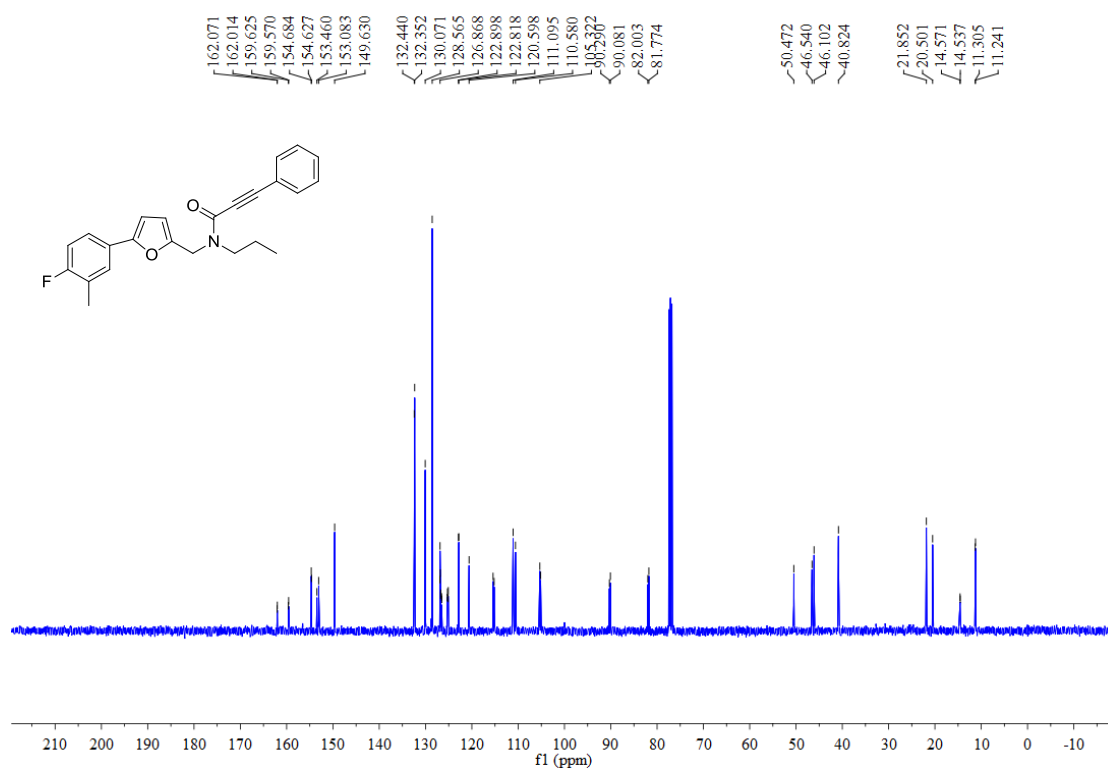
¹H NMR spectrum (400 MHz, CDCl₃) of **1k**



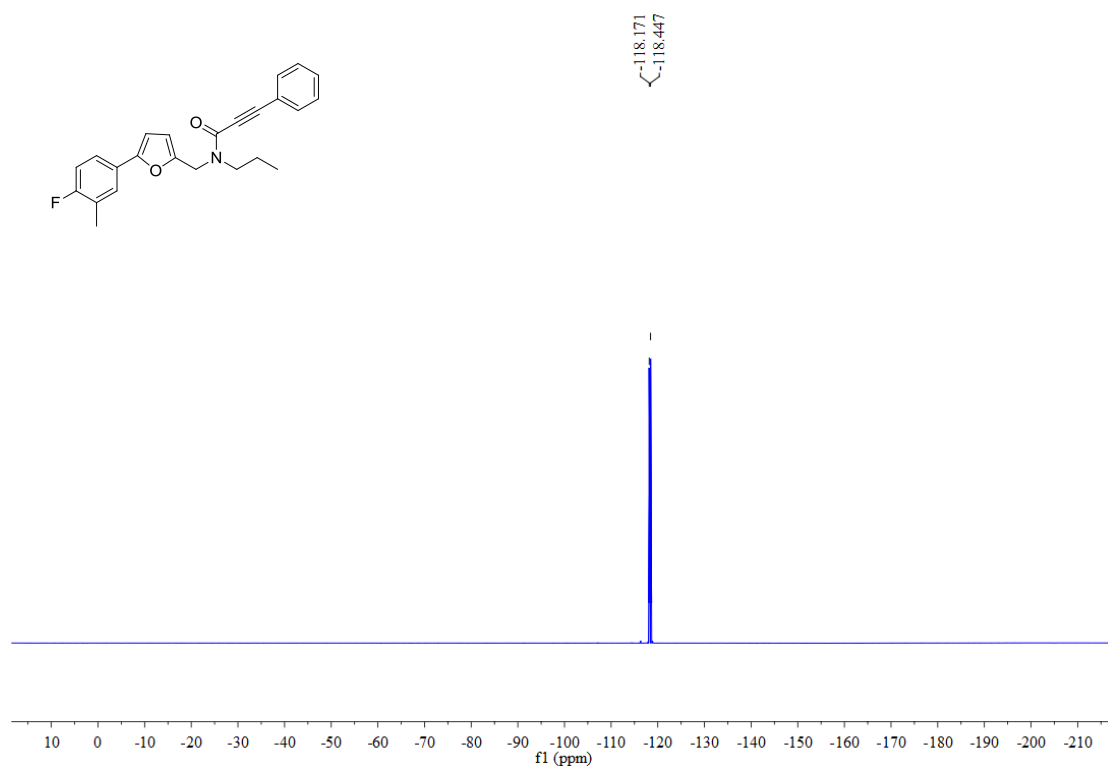
¹³C NMR spectrum (100 MHz, CDCl₃) of **1k**



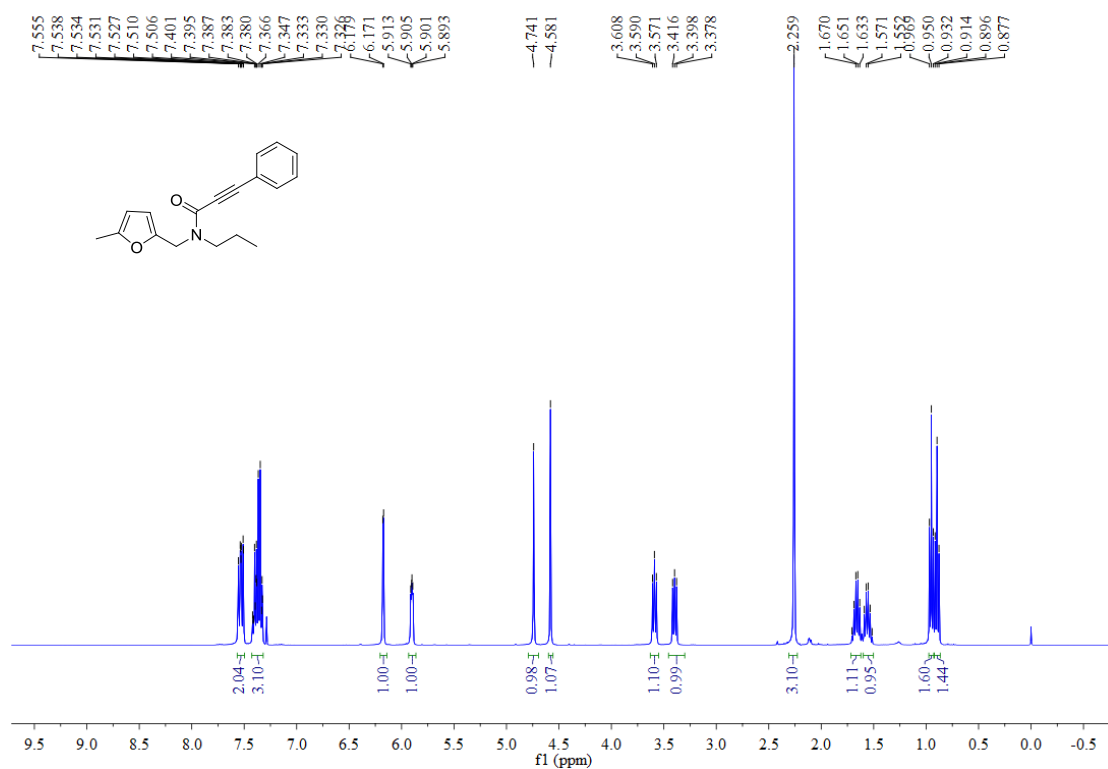
^{13}C NMR spectrum (100 MHz, CDCl_3) of **11**



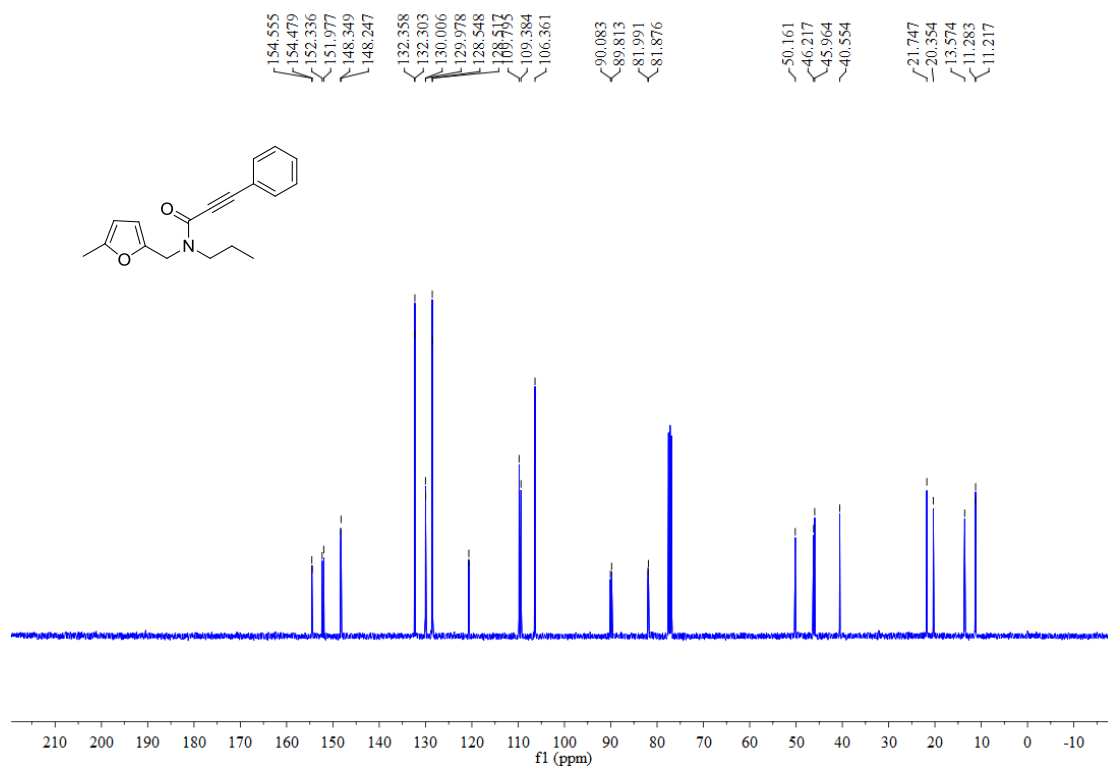
^{19}F NMR spectrum (376 MHz, CDCl_3) of **11**



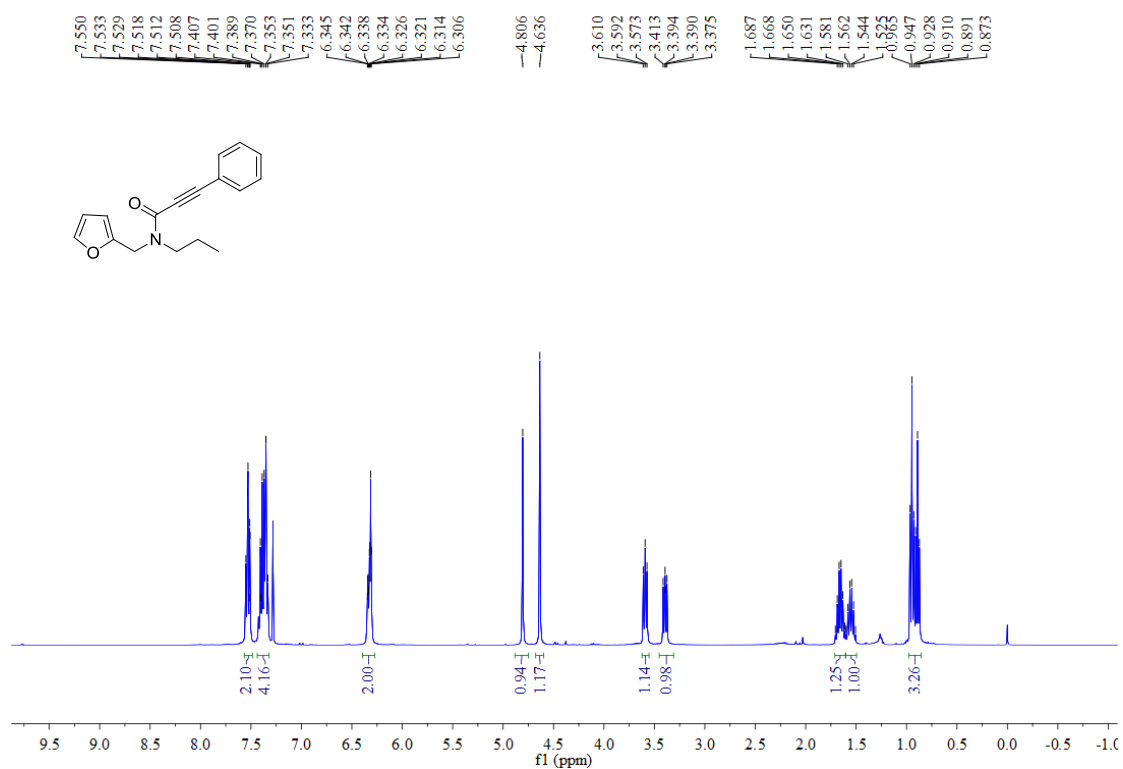
¹H NMR spectrum (400 MHz, CDCl₃) of **1m**



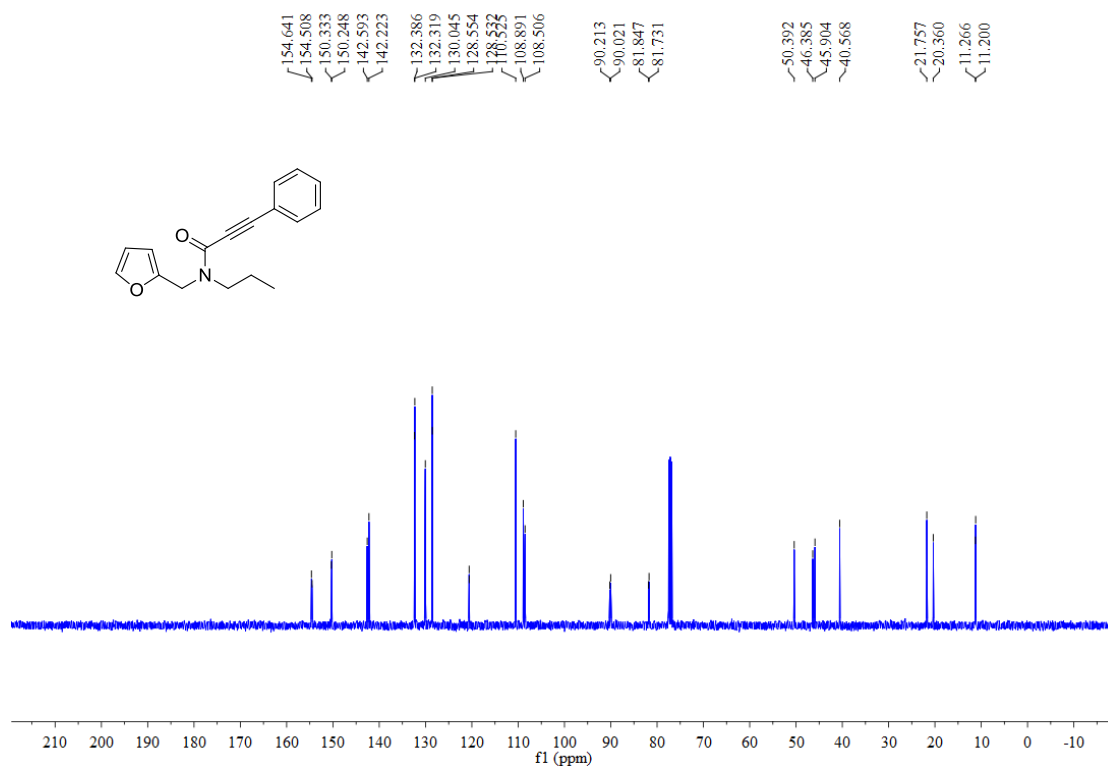
¹³C NMR spectrum (100 MHz, CDCl₃) of **1m**



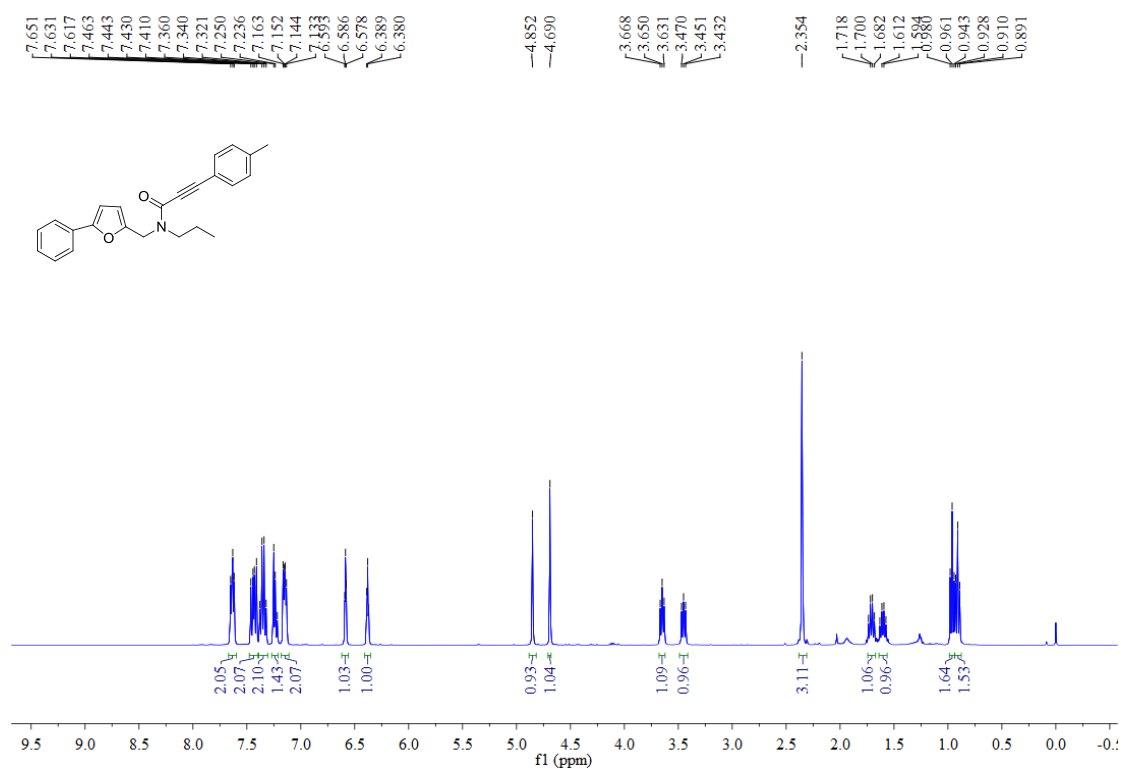
¹H NMR spectrum (400 MHz, CDCl₃) of **1n**



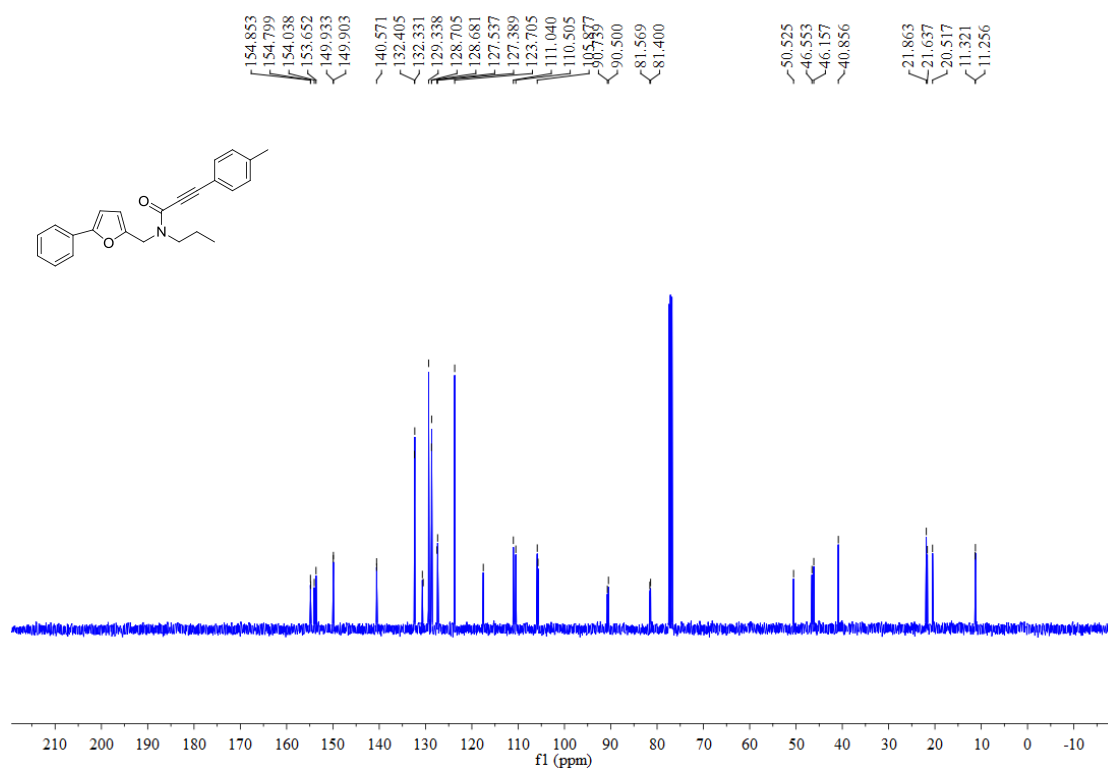
¹³C NMR spectrum (100 MHz, CDCl₃) of **1n**



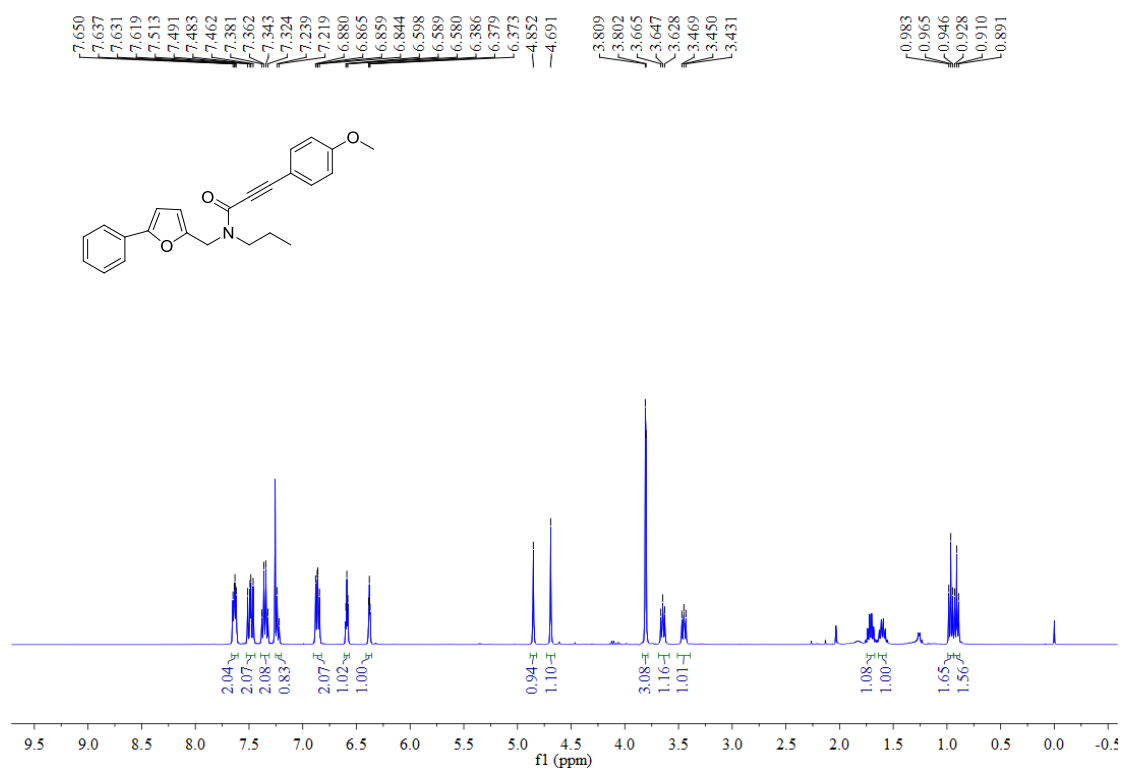
¹H NMR spectrum (400 MHz, CDCl₃) of **1o**



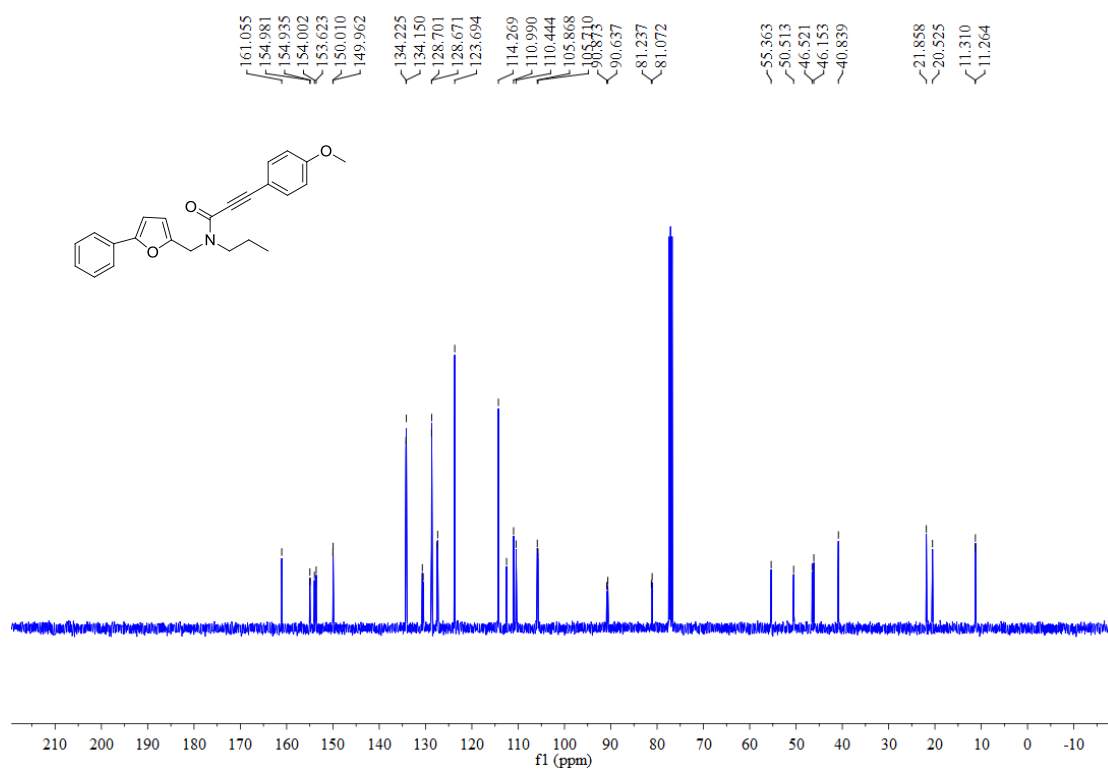
¹³C NMR spectrum (100 MHz, CDCl₃) of **1o**



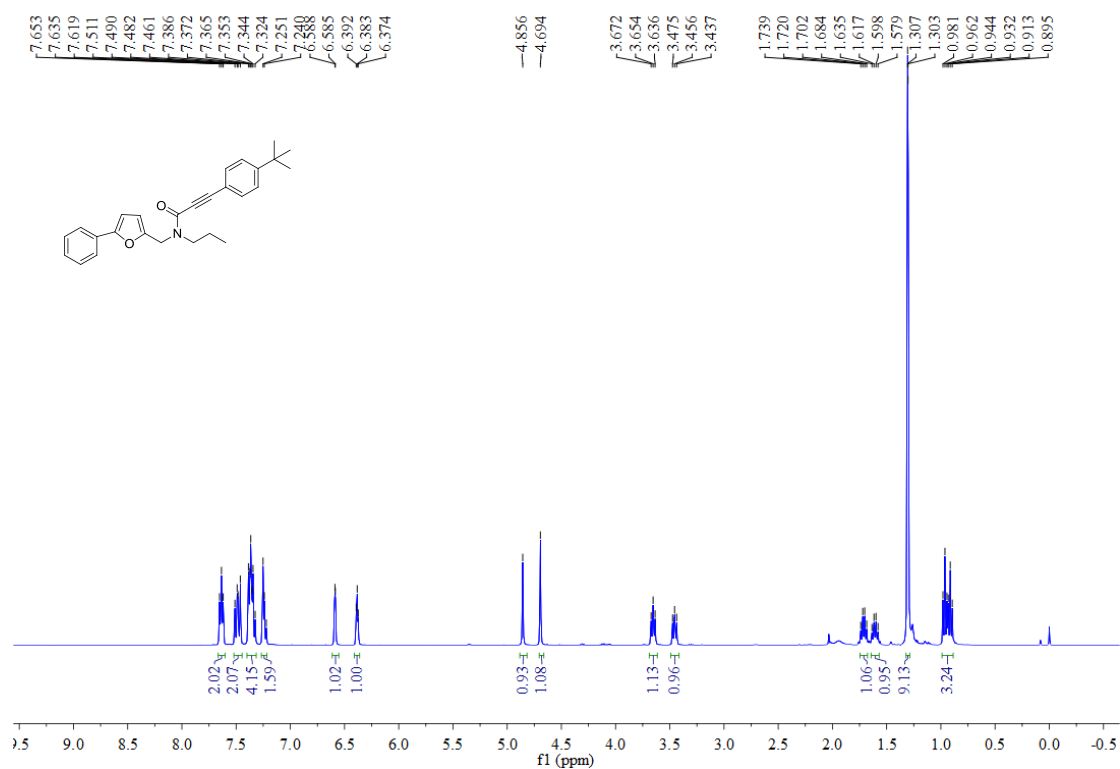
¹H NMR spectrum (400 MHz, CDCl₃) of **1p**



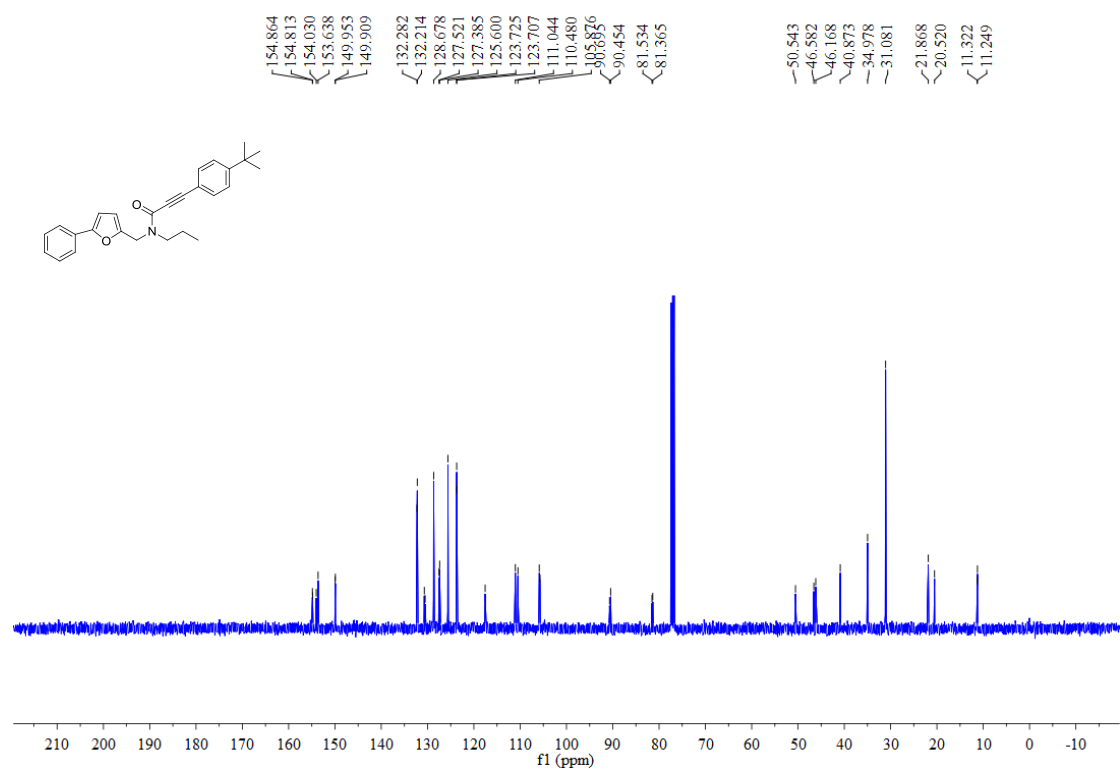
¹³C NMR spectrum (100 MHz, CDCl₃) of **1p**



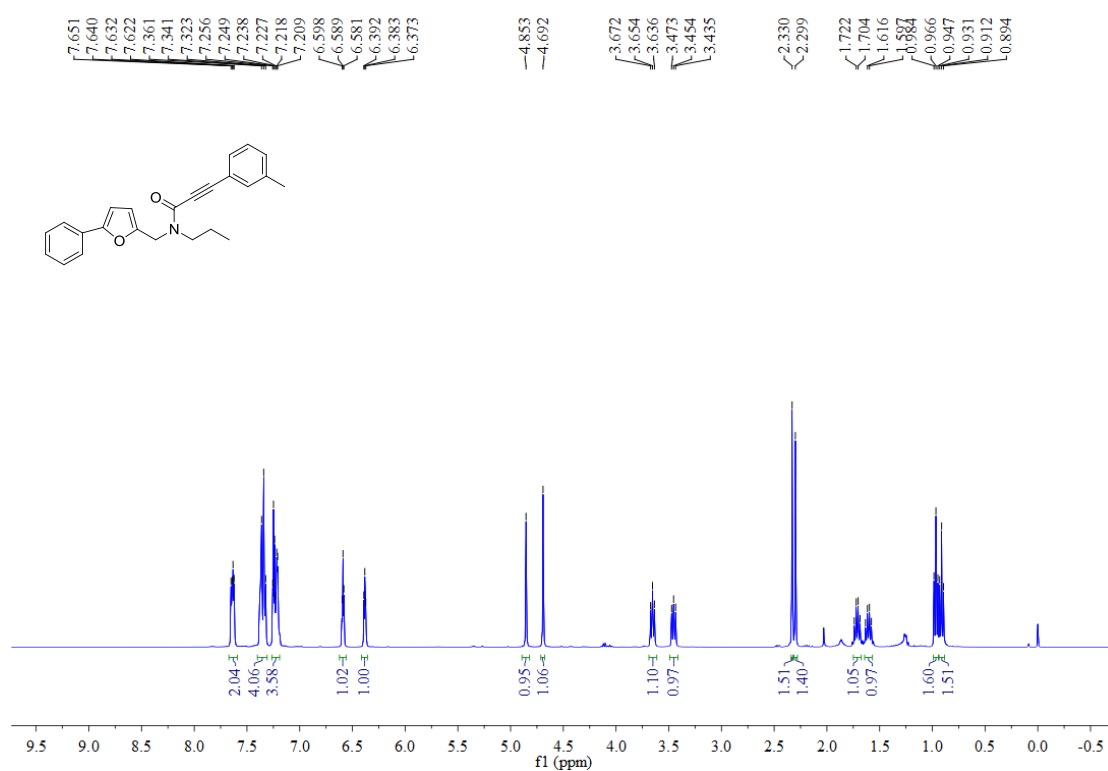
¹H NMR spectrum (400 MHz, CDCl₃) of **1q**



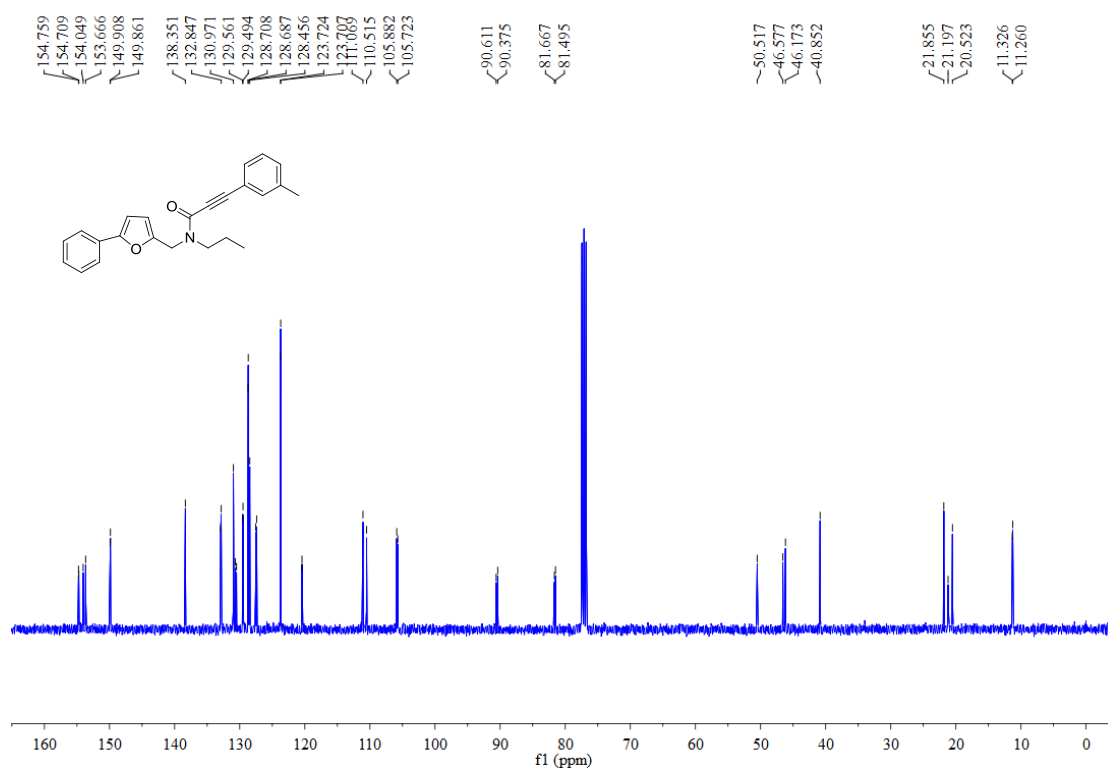
¹³C NMR spectrum (100 MHz, CDCl₃) of **1q**



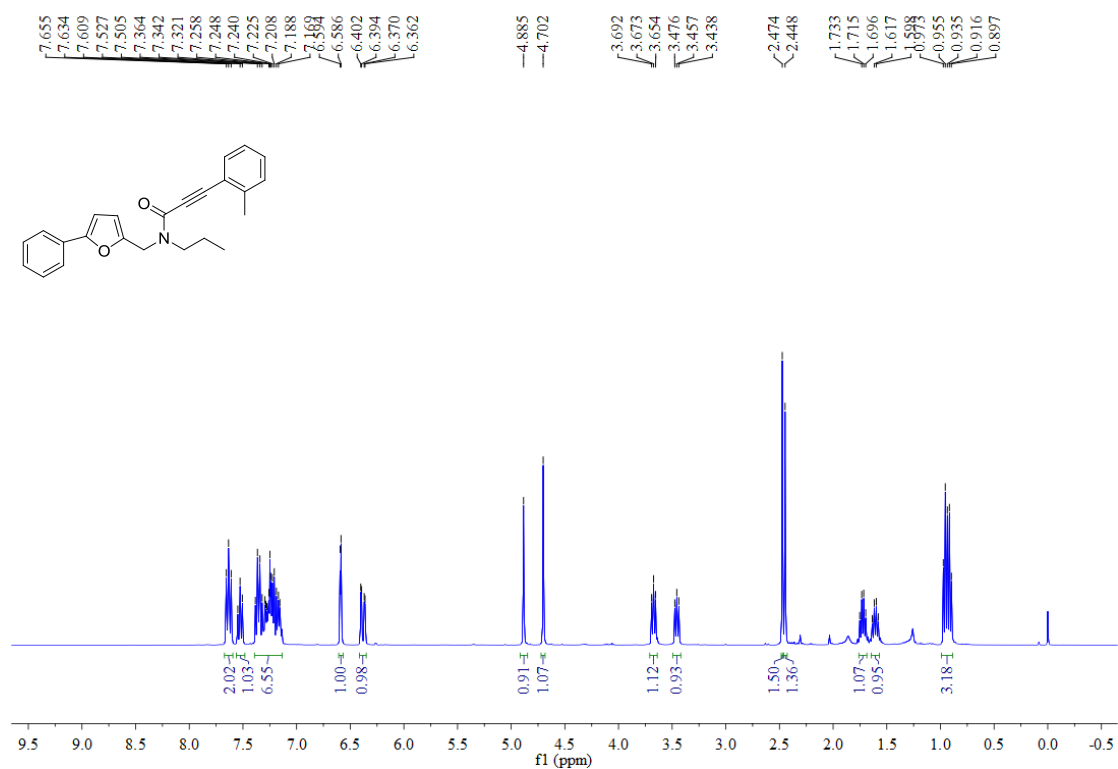
¹H NMR spectrum (400 MHz, CDCl₃) of **1r**



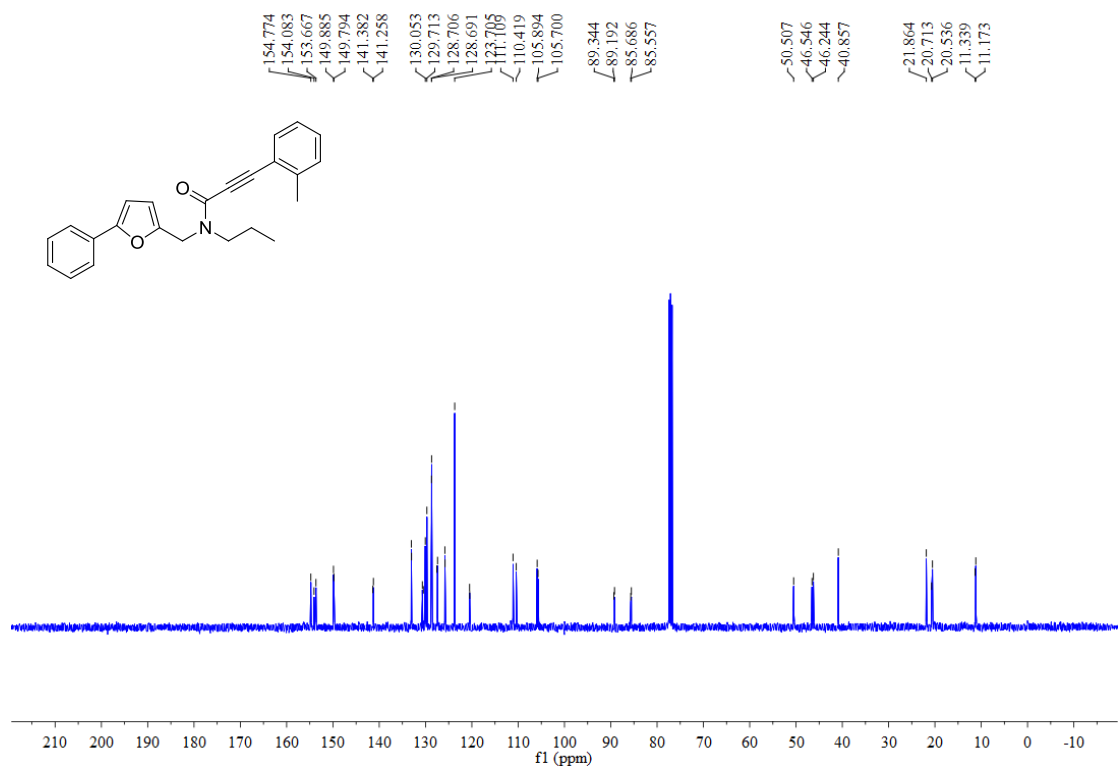
¹³C NMR spectrum (100 MHz, CDCl₃) of **1r**



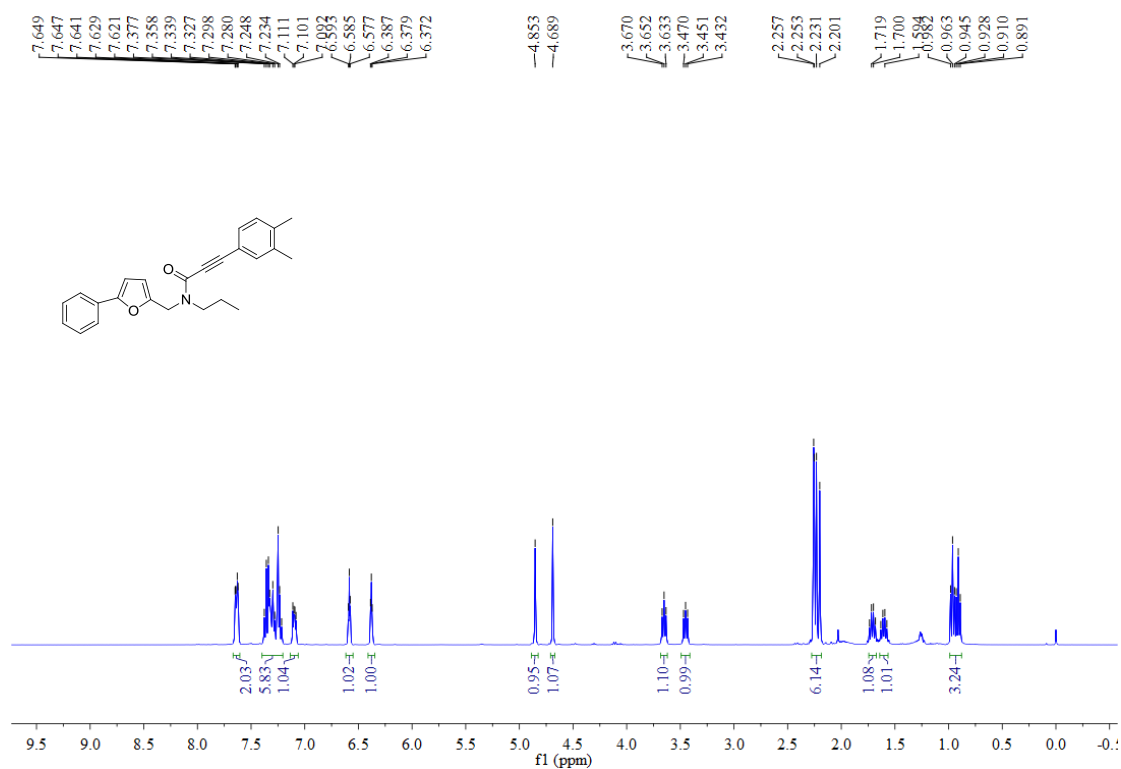
¹H NMR spectrum (400 MHz, CDCl₃) of **1s**



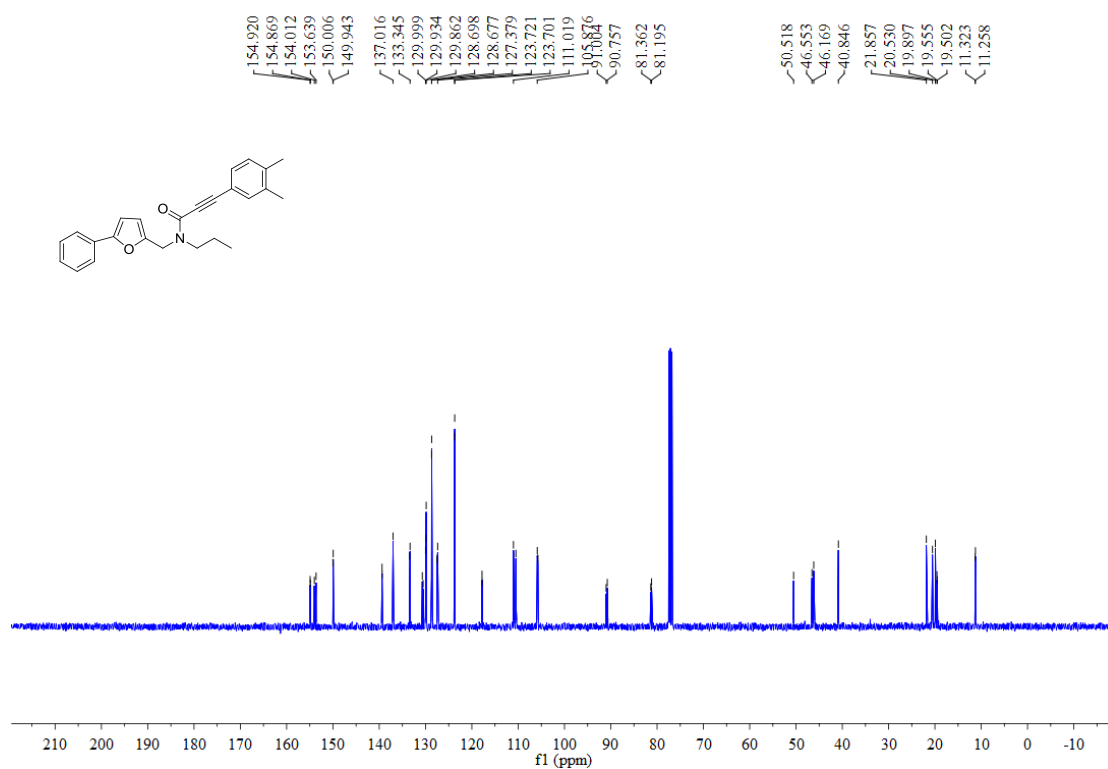
¹³C NMR spectrum (100 MHz, CDCl₃) of **1s**



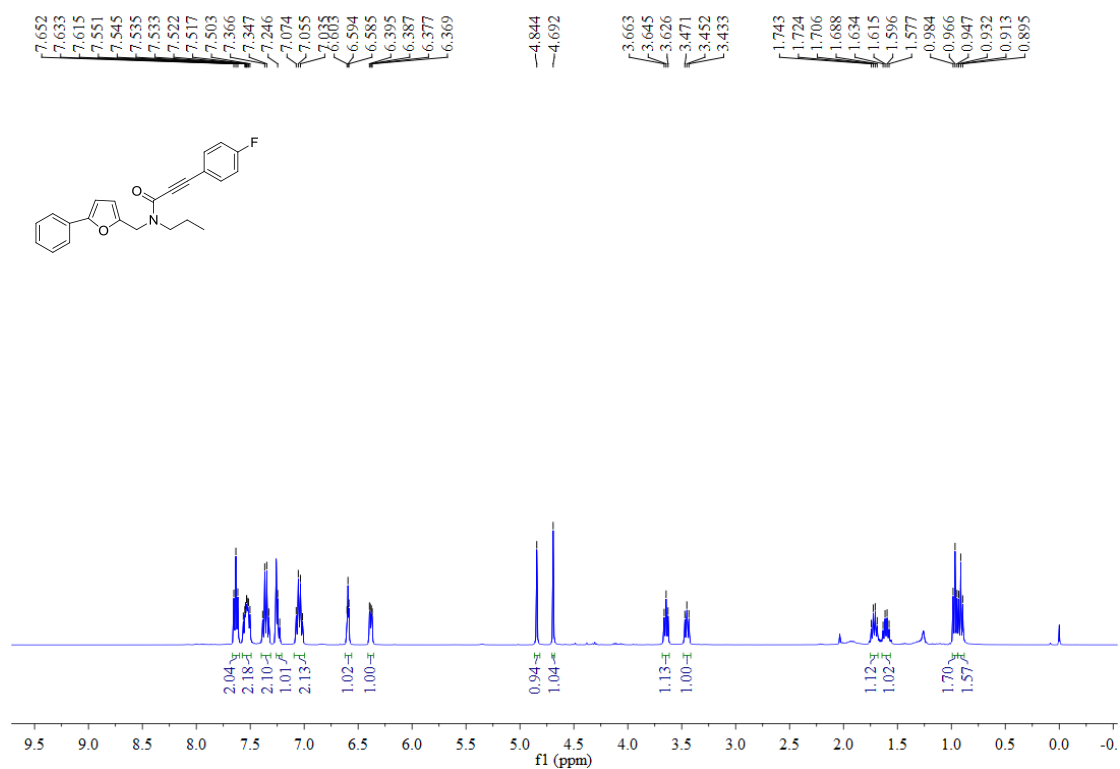
¹H NMR spectrum (400 MHz, CDCl₃) of **1t**



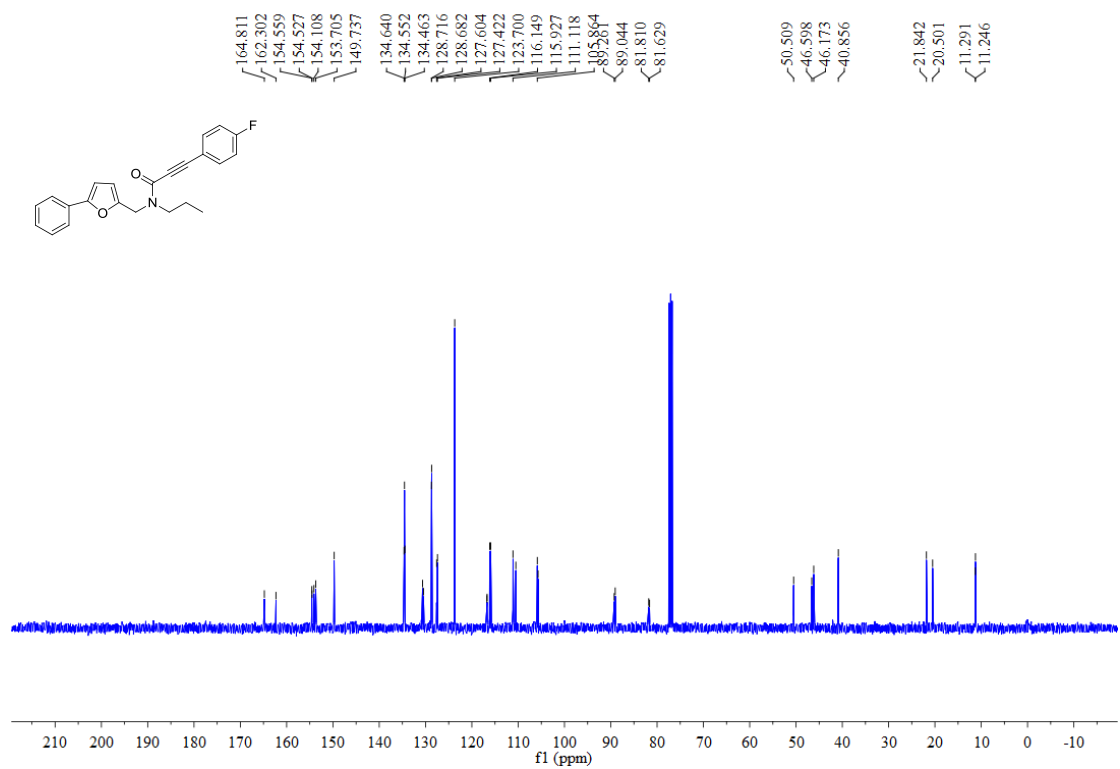
¹³C NMR spectrum (100 MHz, CDCl₃) of **1t**



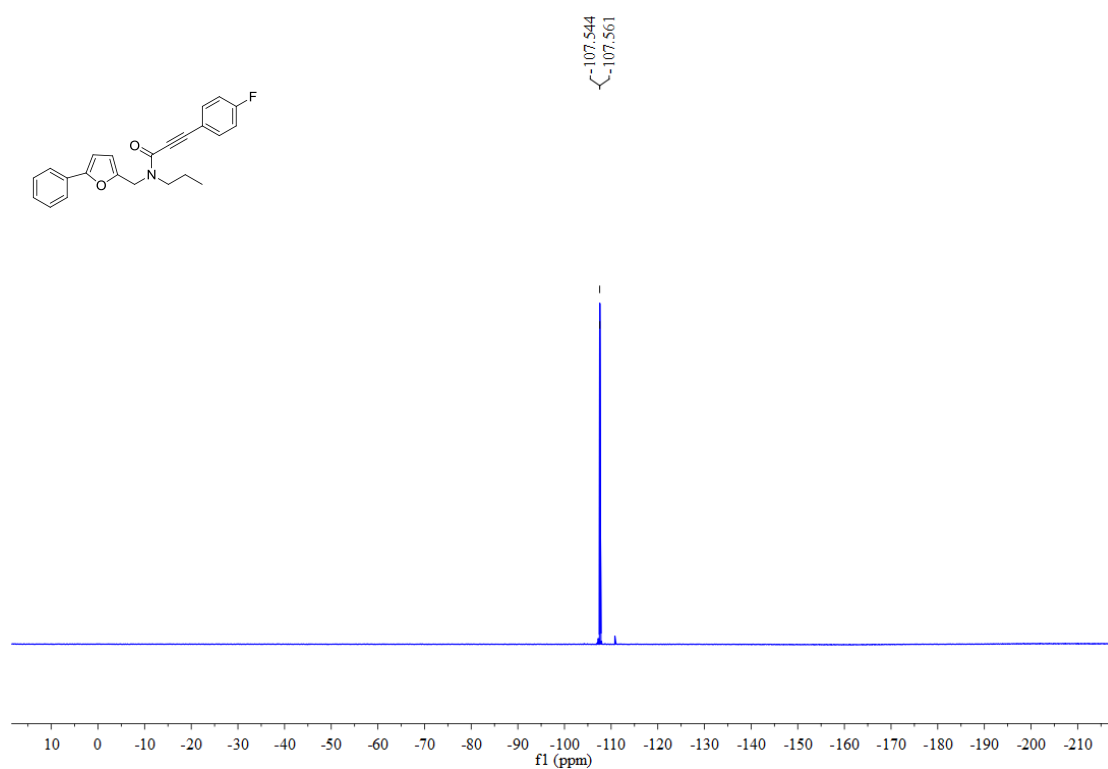
¹H NMR spectrum (400 MHz, CDCl₃) of **1u**



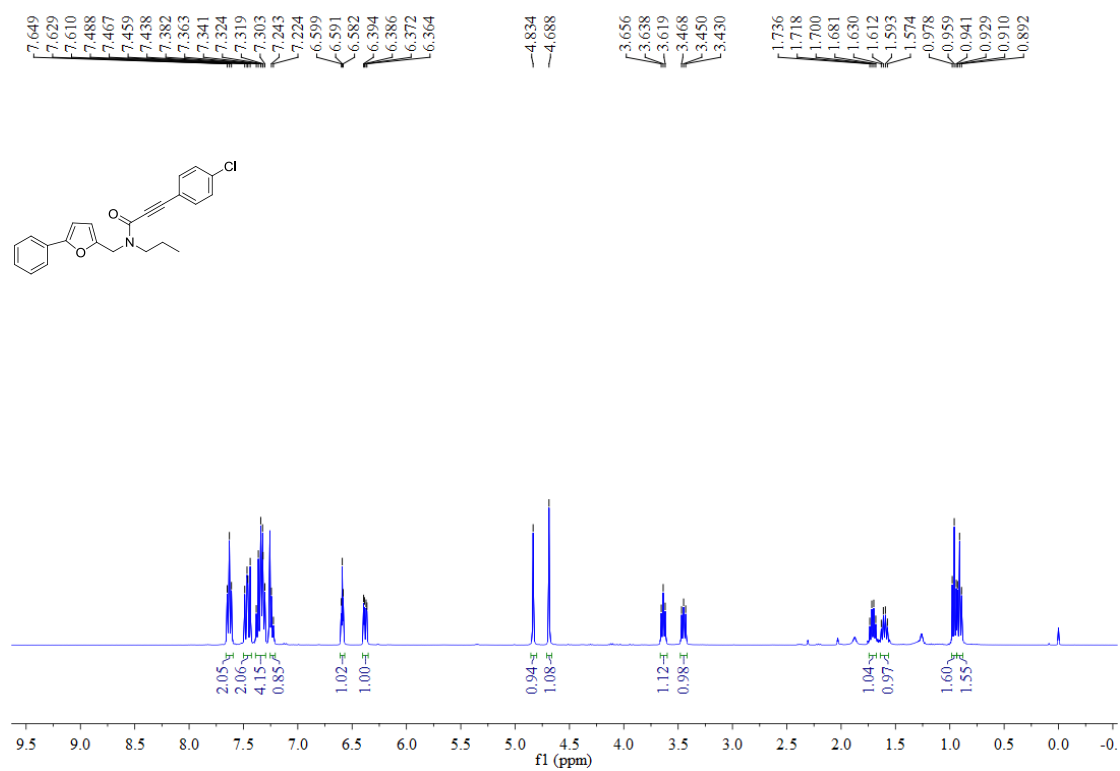
¹³C NMR spectrum (100 MHz, CDCl₃) of **1u**



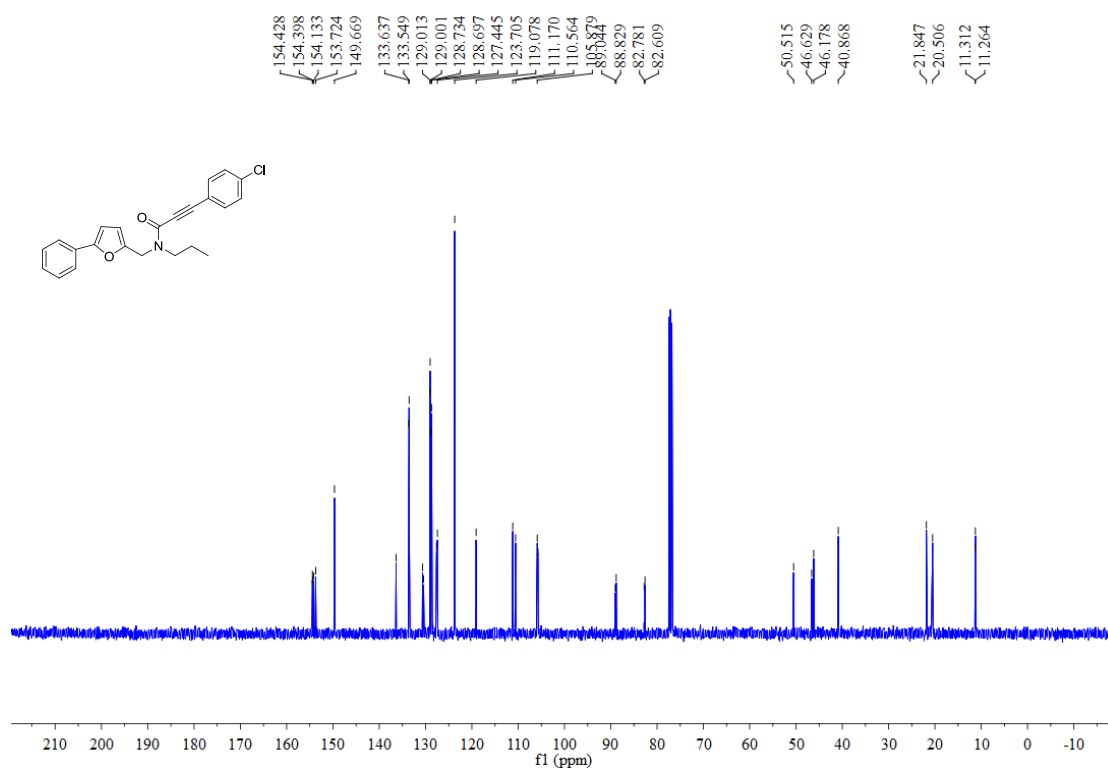
^{19}F NMR spectrum (376MHz, CDCl_3) of **1u**



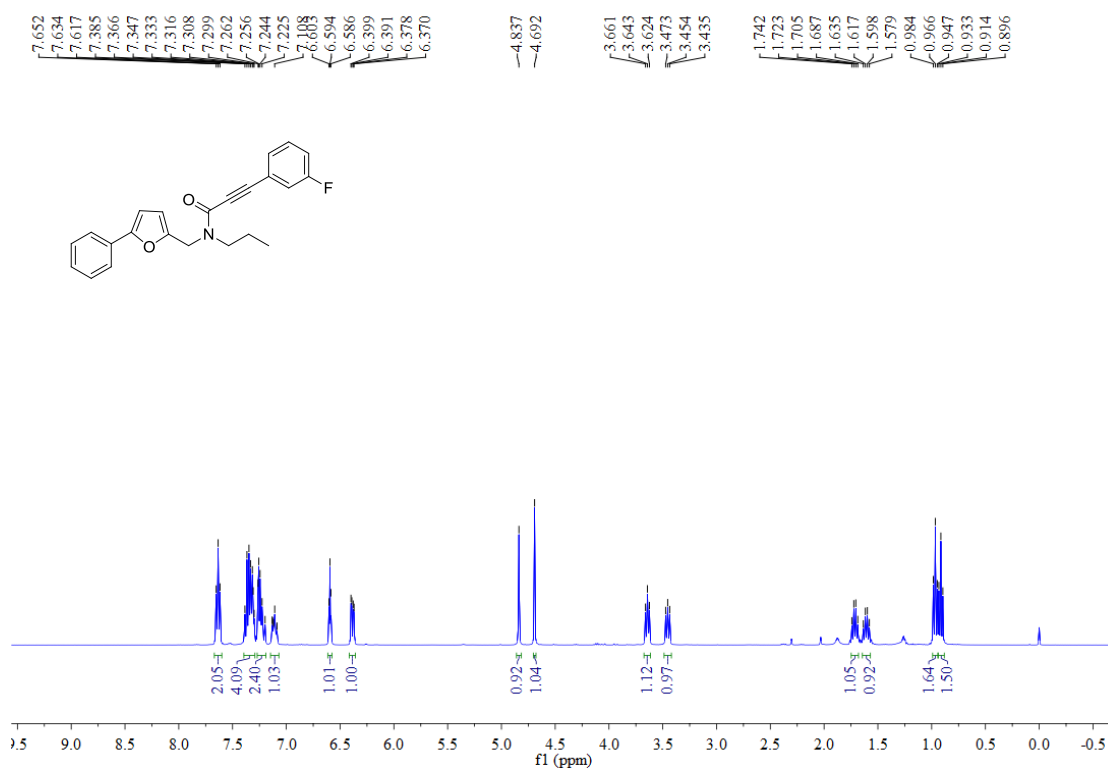
^1H NMR spectrum (400 MHz, CDCl_3) of **1v**



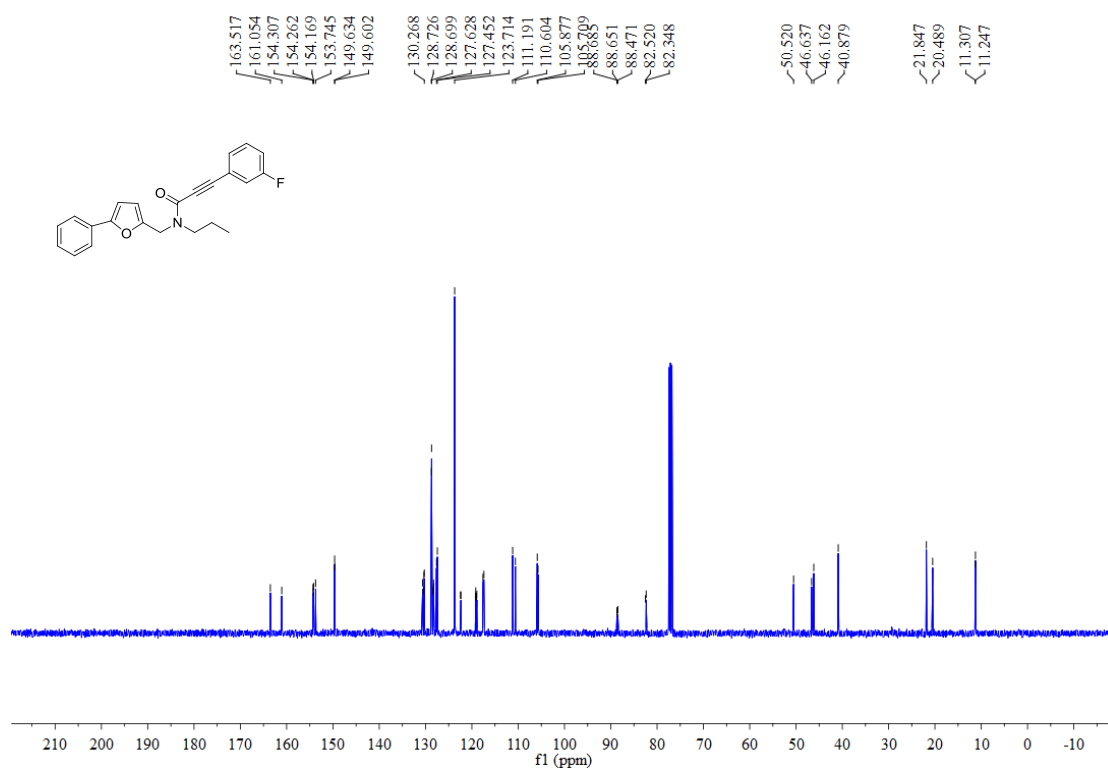
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1v**



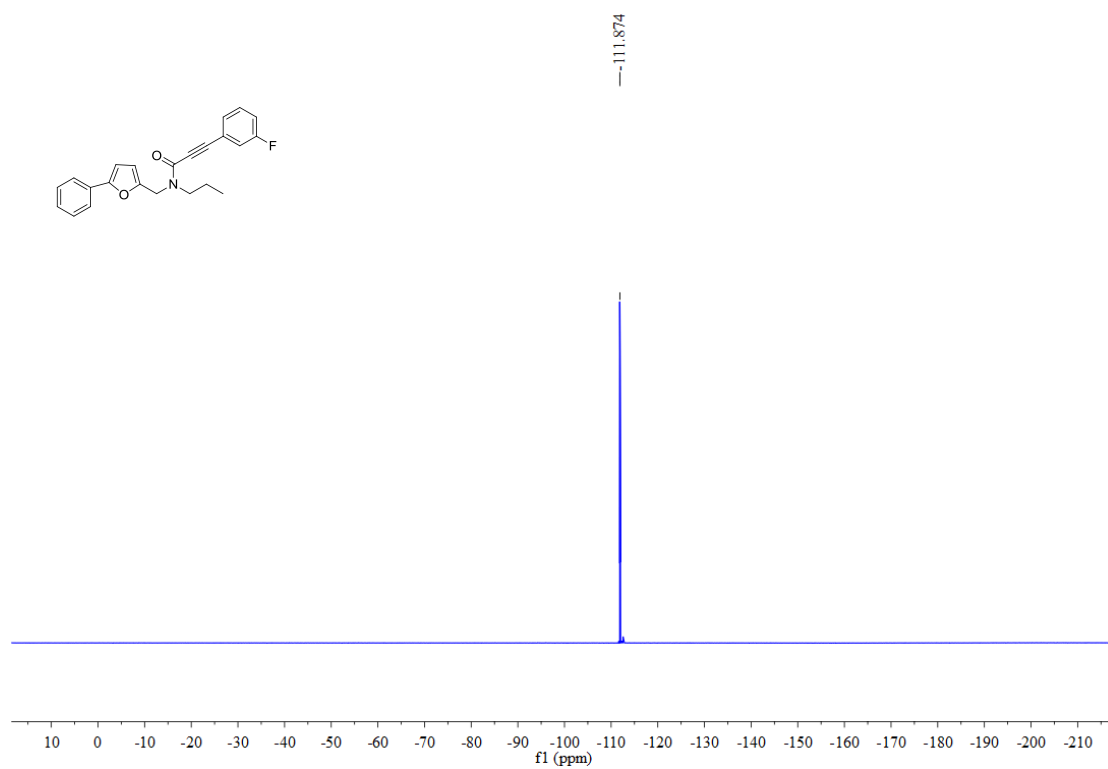
^1H NMR spectrum (400 MHz, CDCl_3) of **1w**



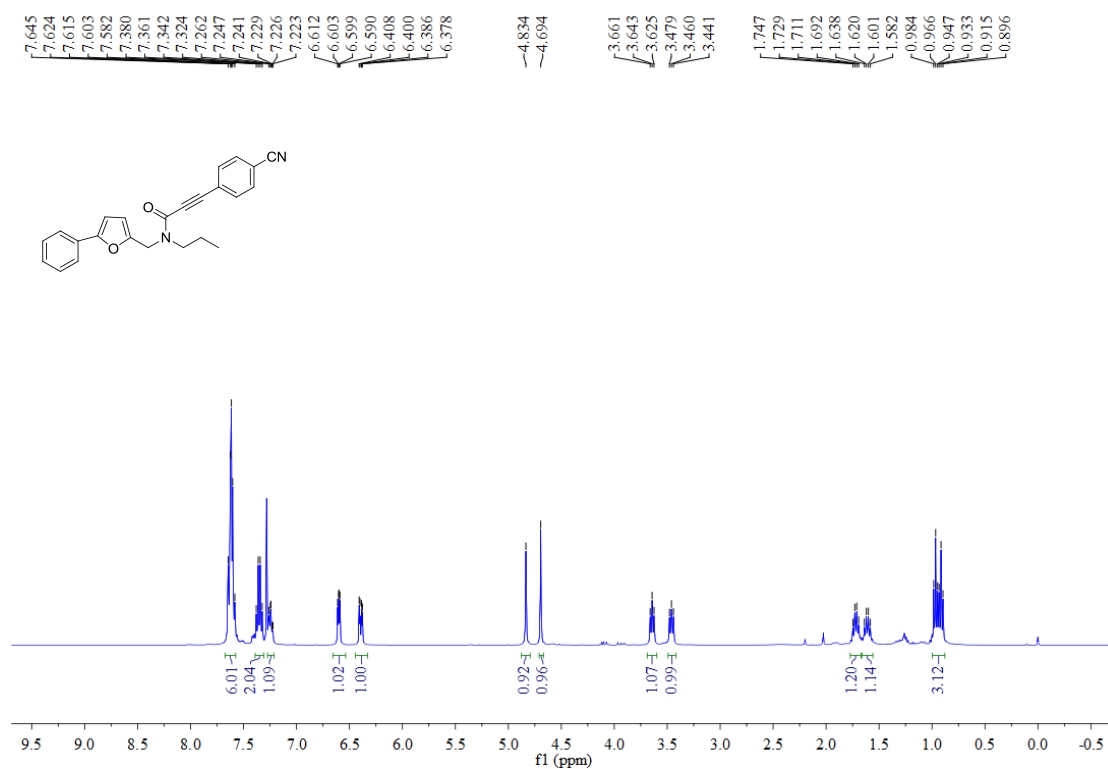
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1w**



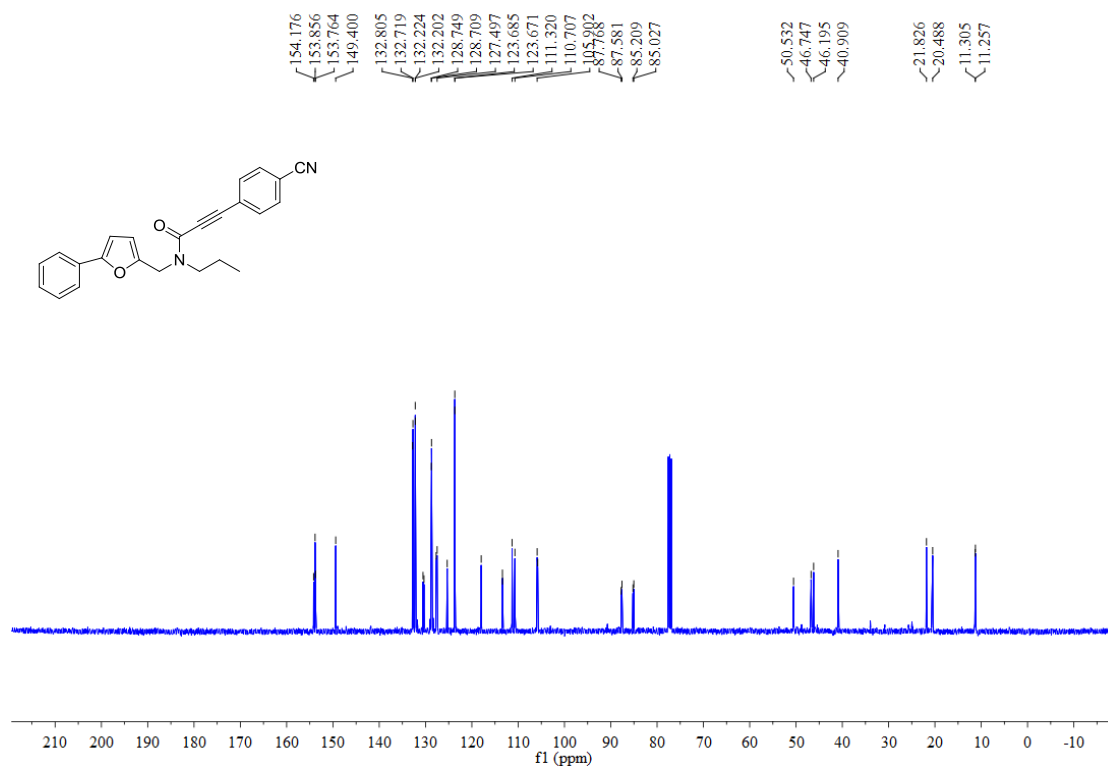
^{19}F NMR spectrum (376 MHz, CDCl_3) of **1w**



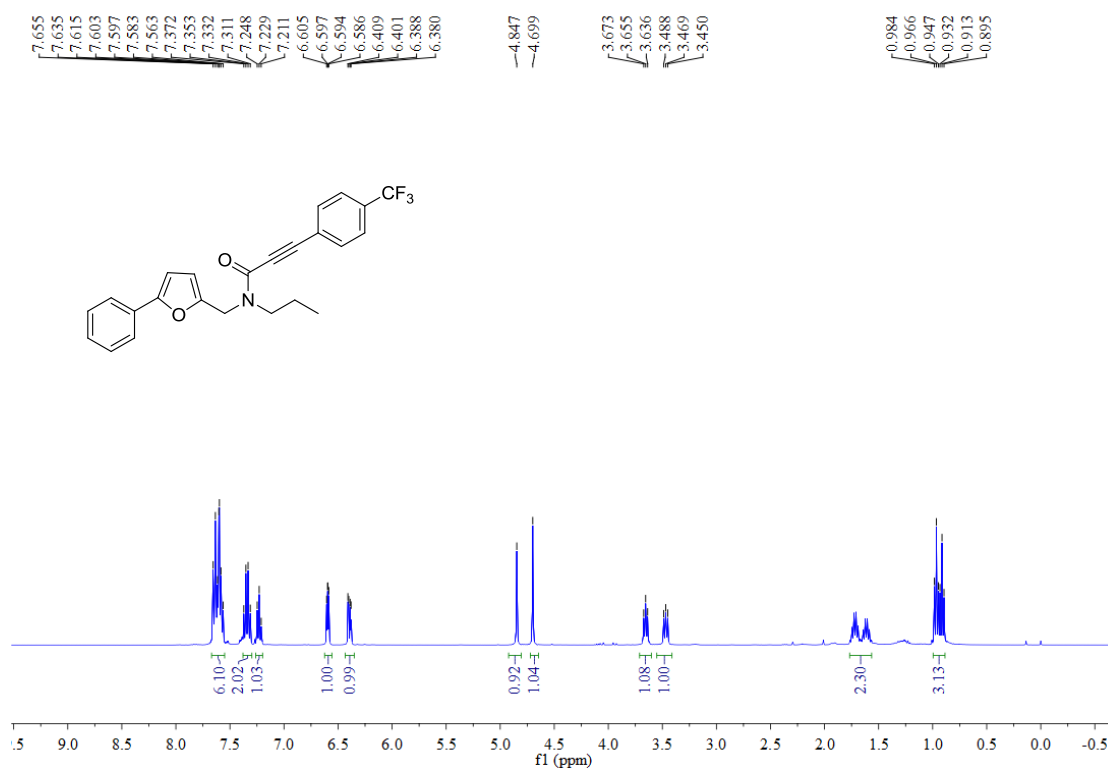
¹H NMR spectrum (400 MHz, CDCl₃) of **1x**



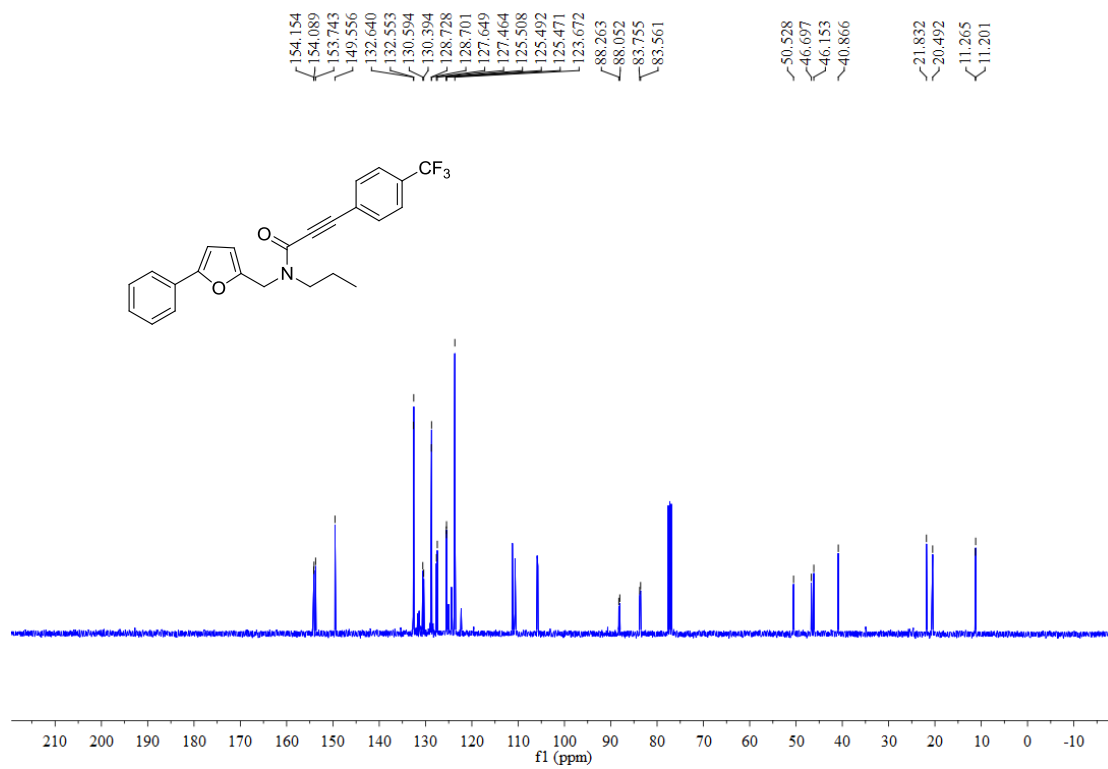
¹³C NMR spectrum (100 MHz, CDCl₃) of **1x**



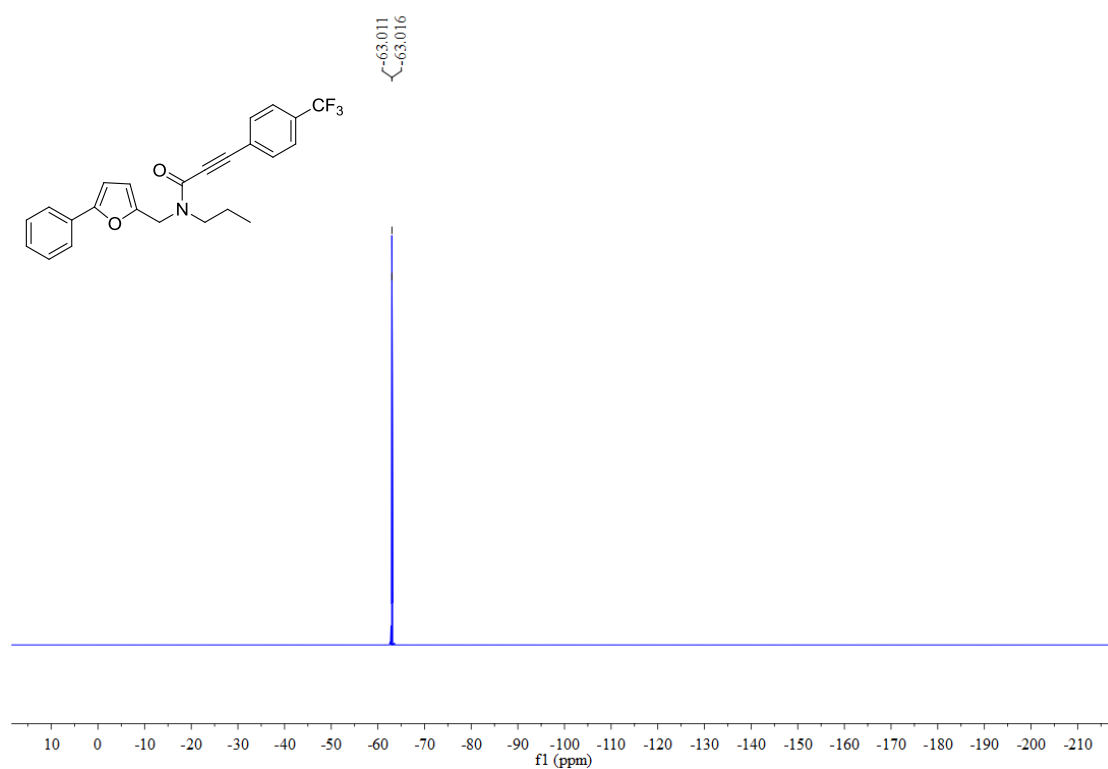
¹H NMR spectrum (400 MHz, CDCl₃) of **1y**



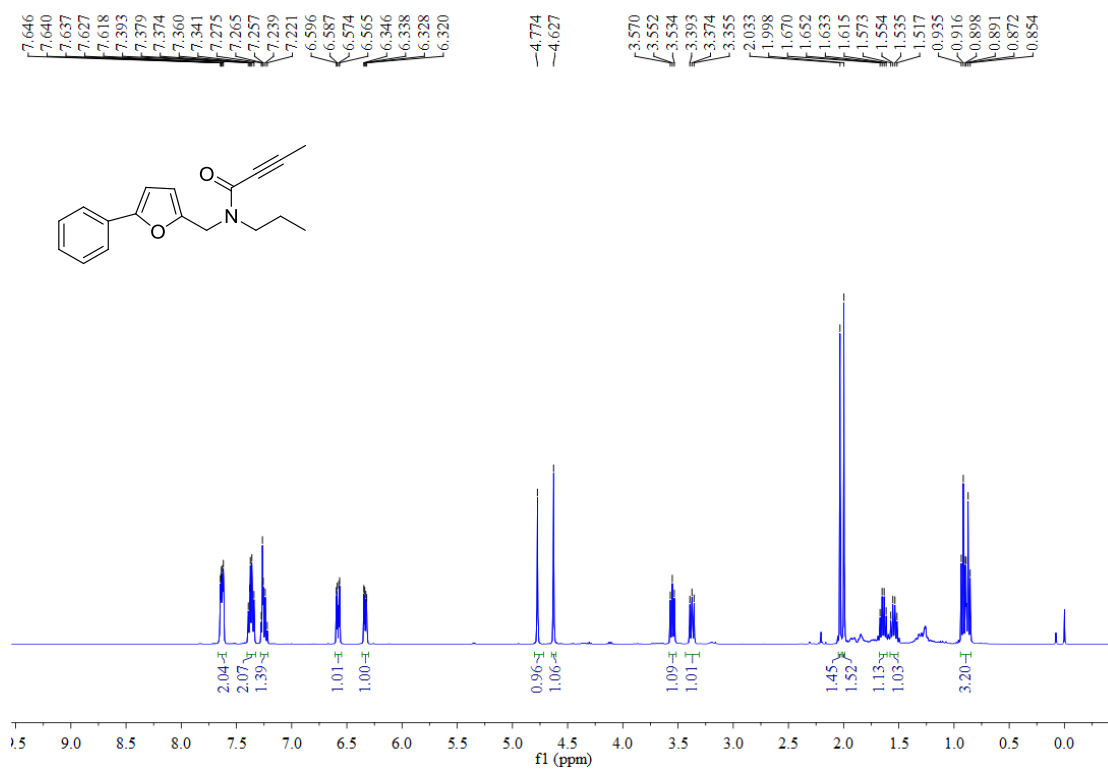
¹³C NMR spectrum (100 MHz, CDCl₃) of **1y**



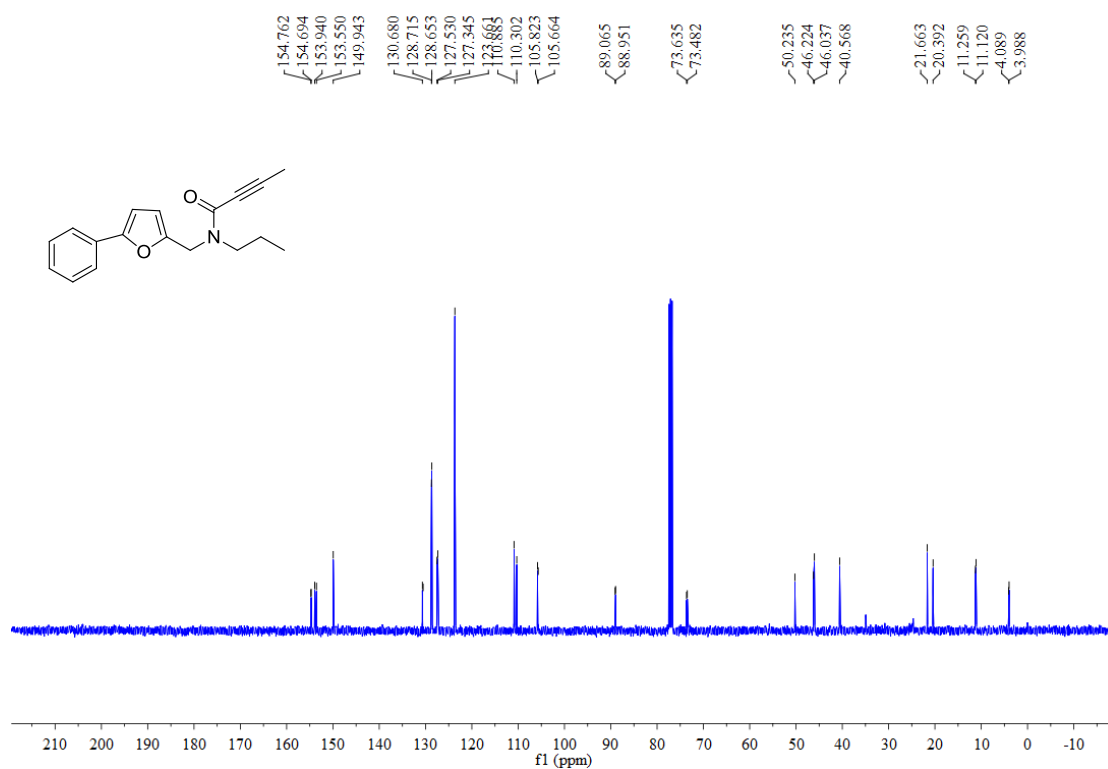
¹⁹F NMR spectrum (376 MHz, CDCl₃) of **1y**



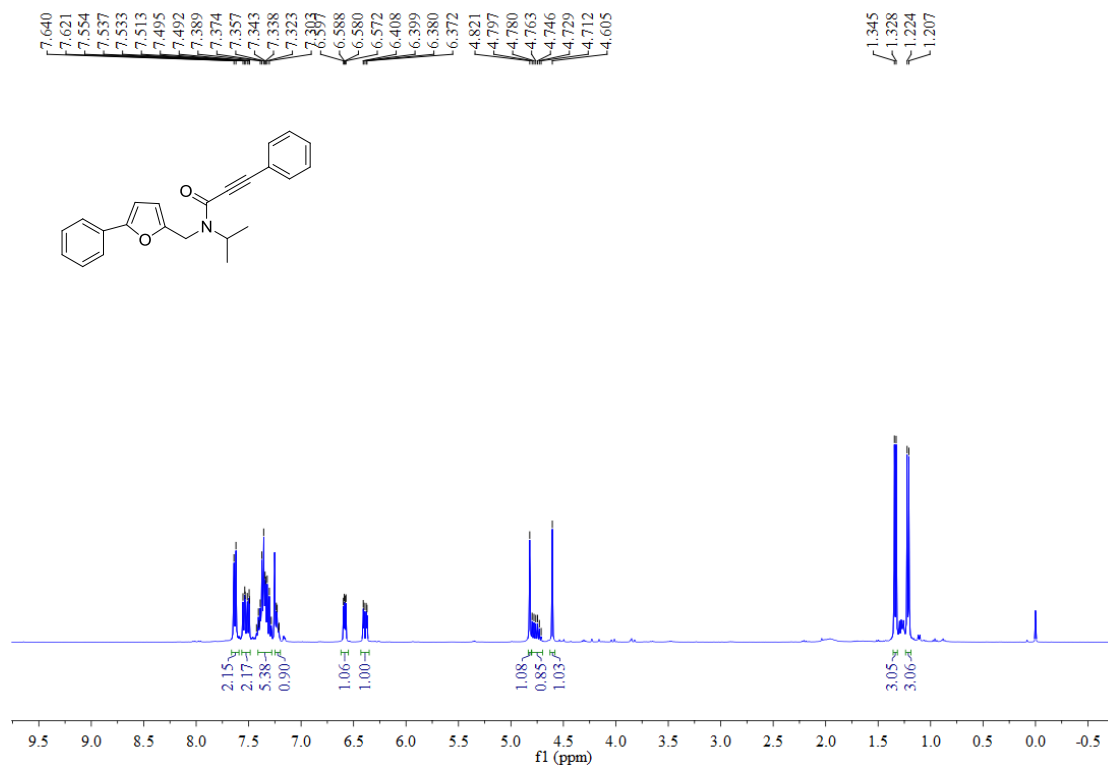
¹H NMR spectrum (400 MHz, CDCl₃) of **1z**



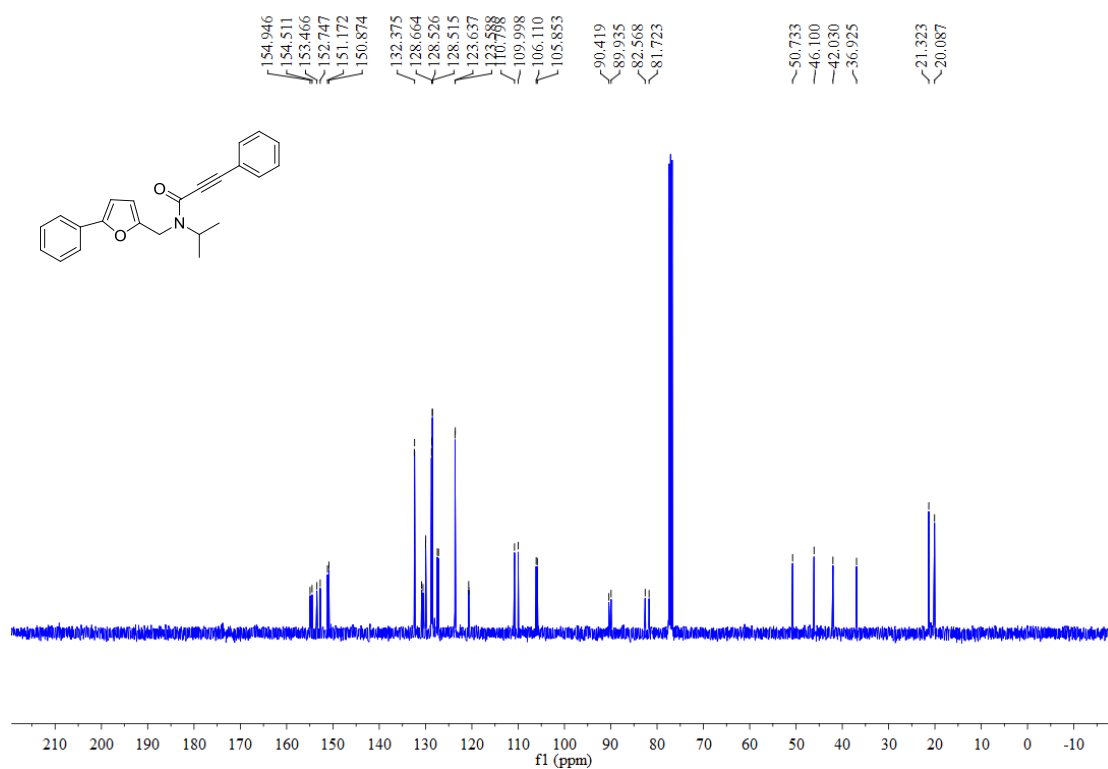
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1z**



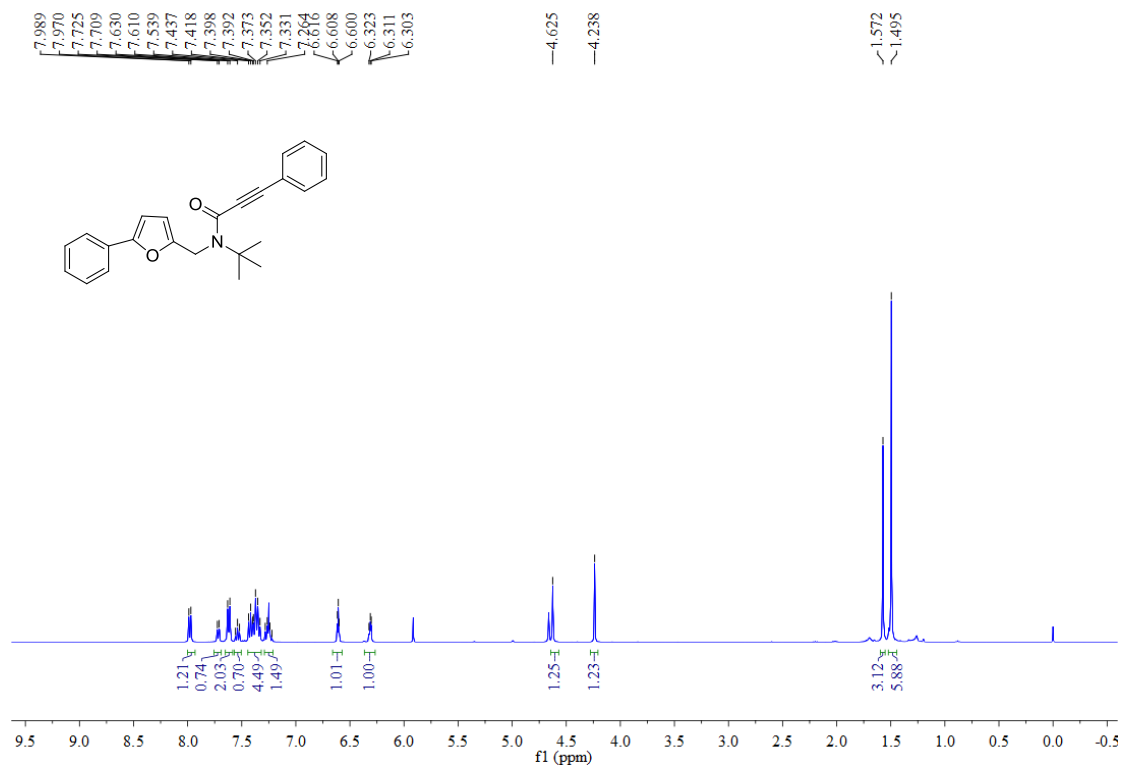
^1H NMR spectrum (400 MHz, CDCl_3) of **1aa**



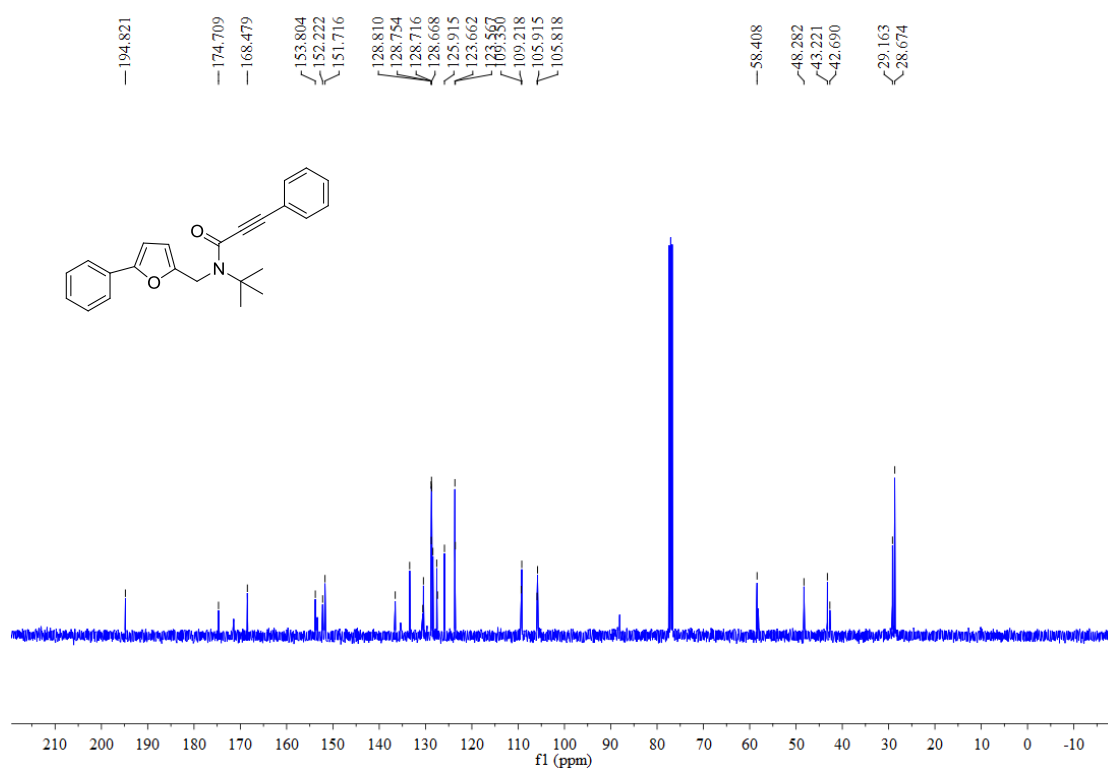
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1aa**



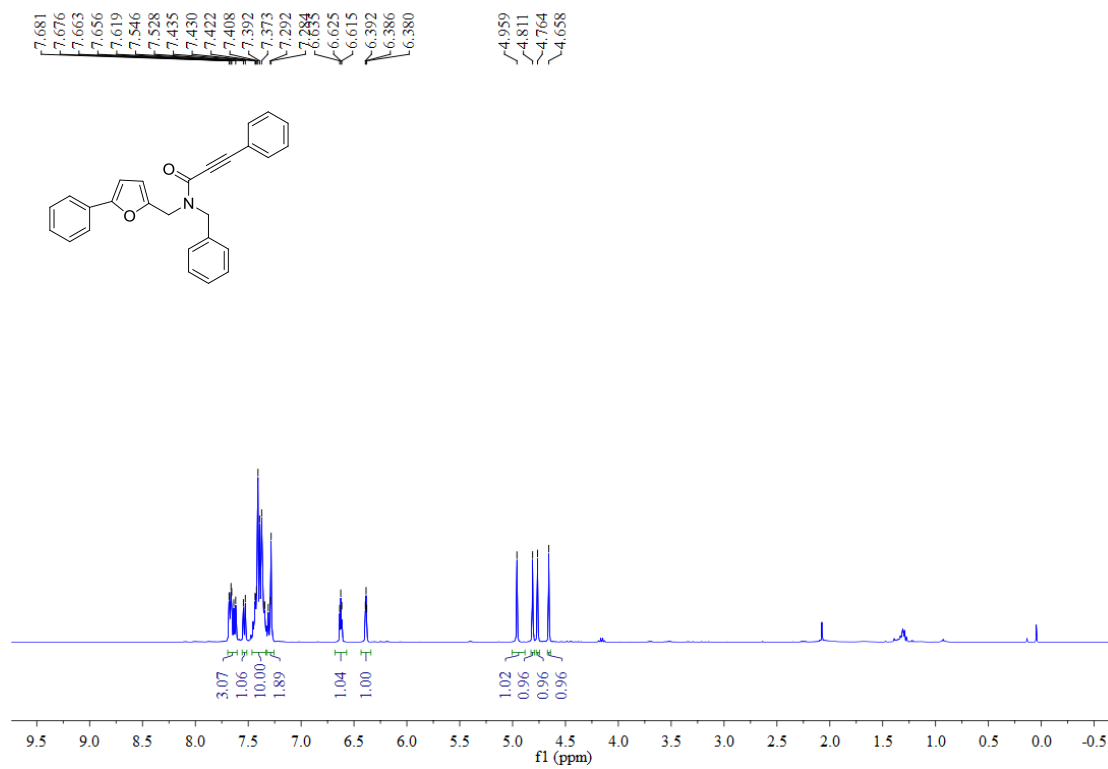
^1H NMR spectrum (400 MHz, CDCl_3) of **1ab**



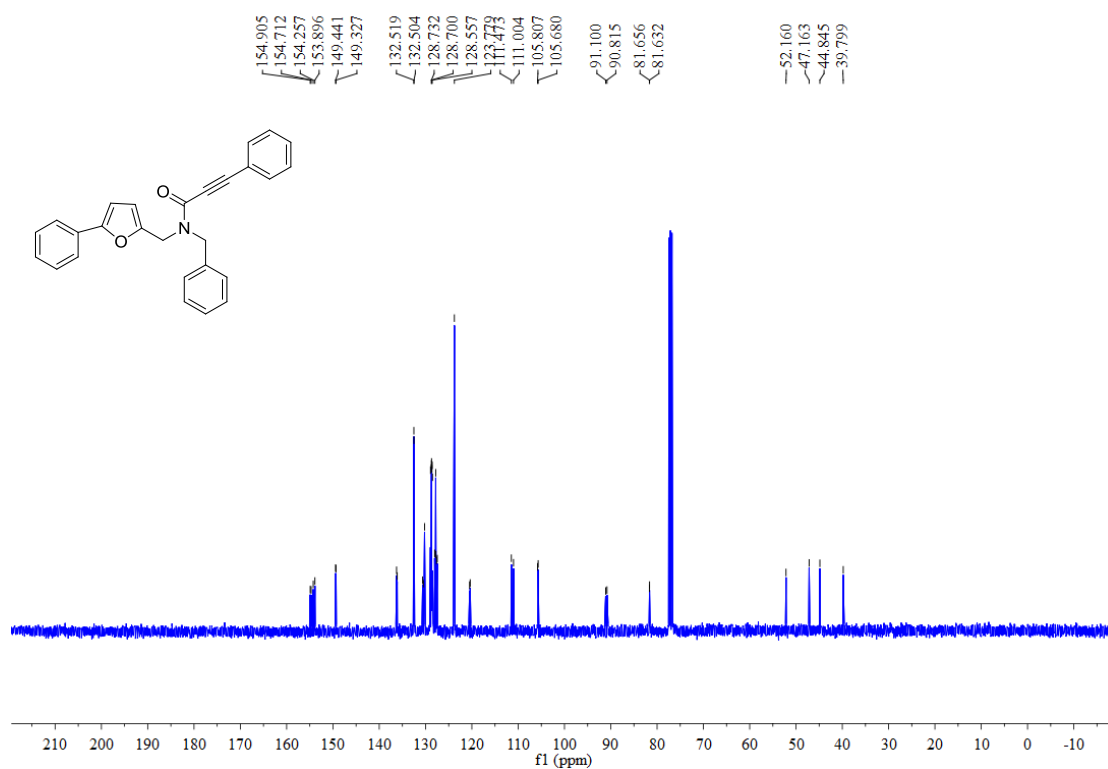
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1ab**



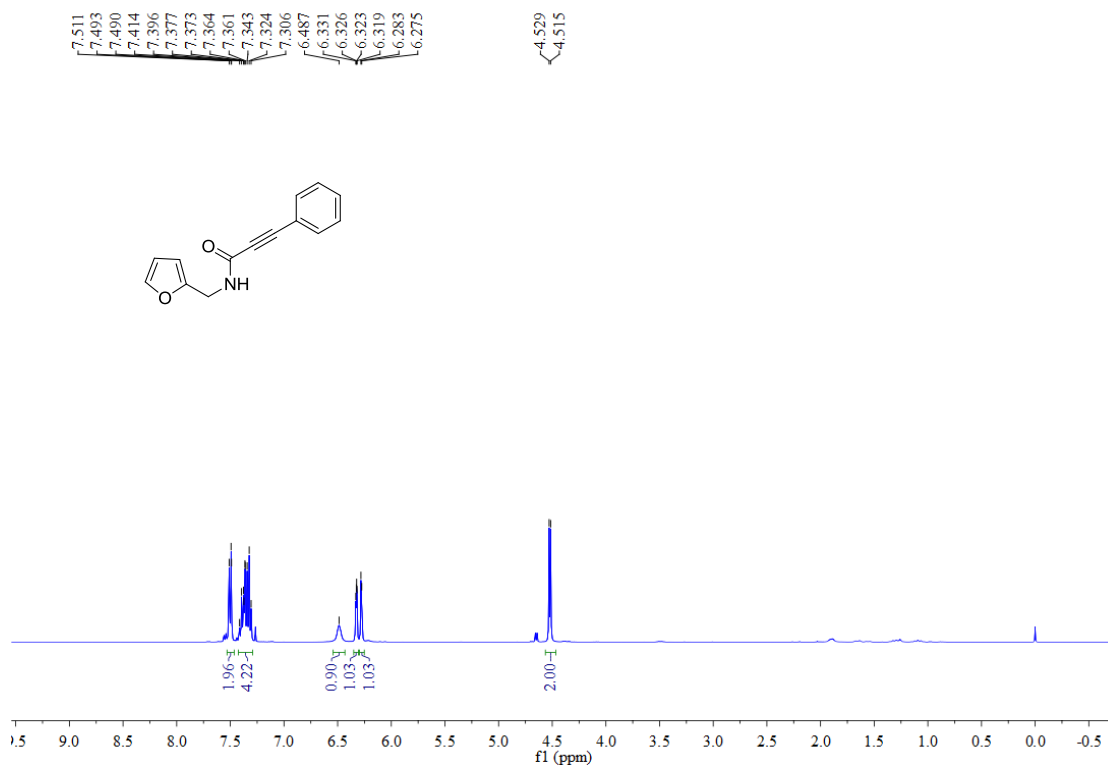
^1H NMR spectrum (400 MHz, CDCl_3) of **1ac**



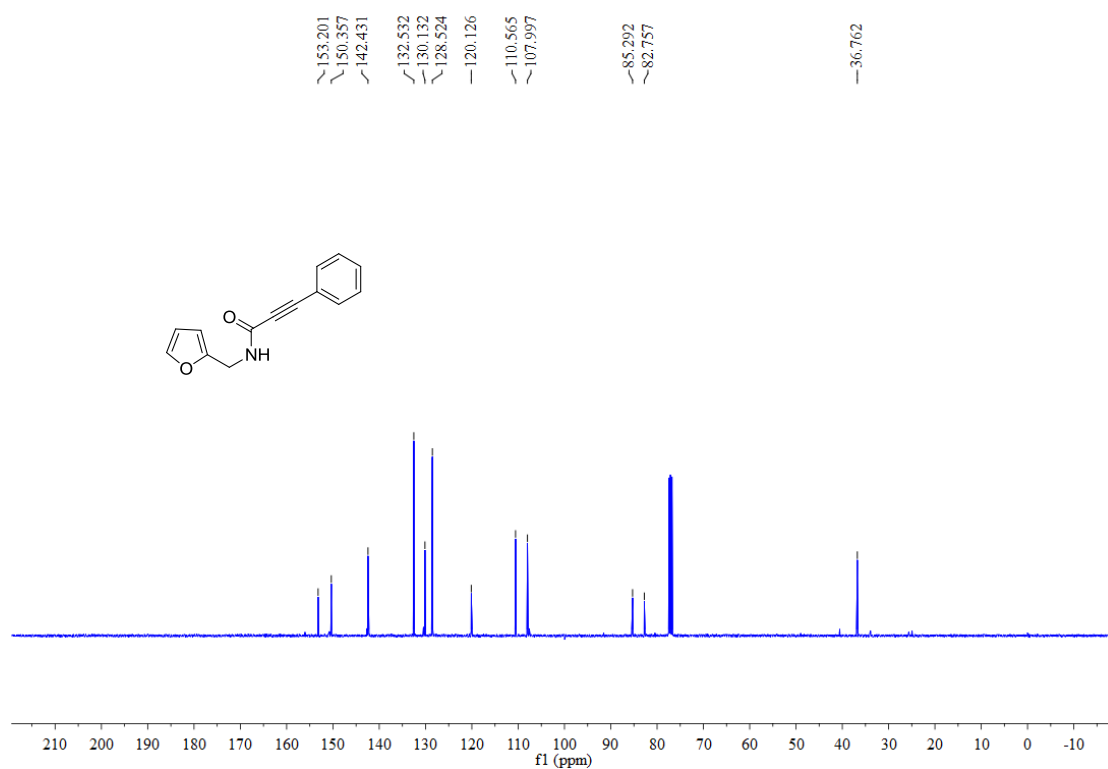
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1ac**



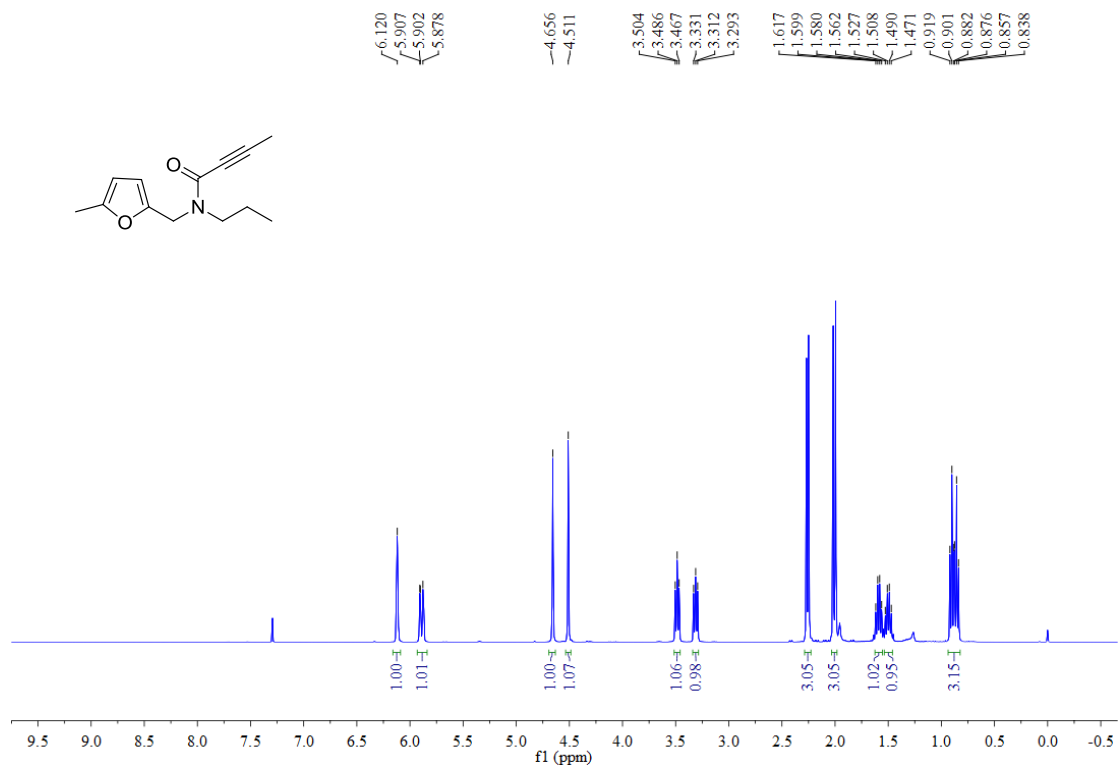
^1H NMR spectrum (400 MHz, CDCl_3) of **1ad**



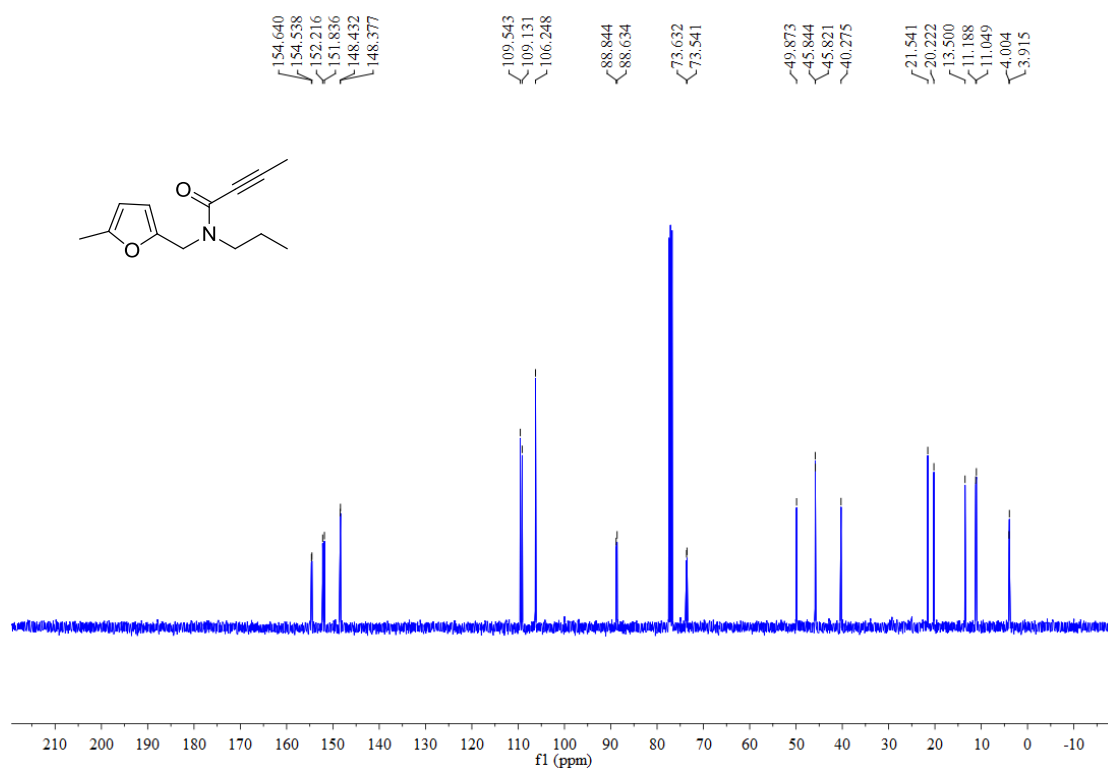
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1aj**



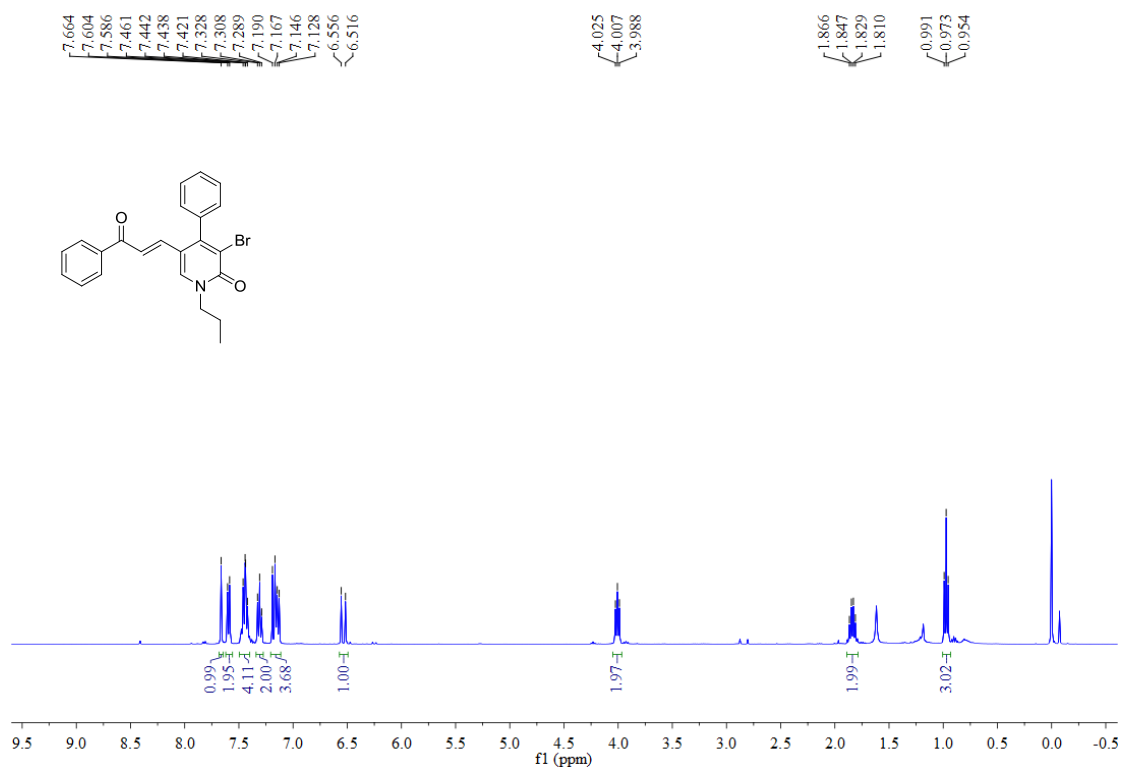
^1H NMR spectrum (400 MHz, CDCl_3) of **1ak**



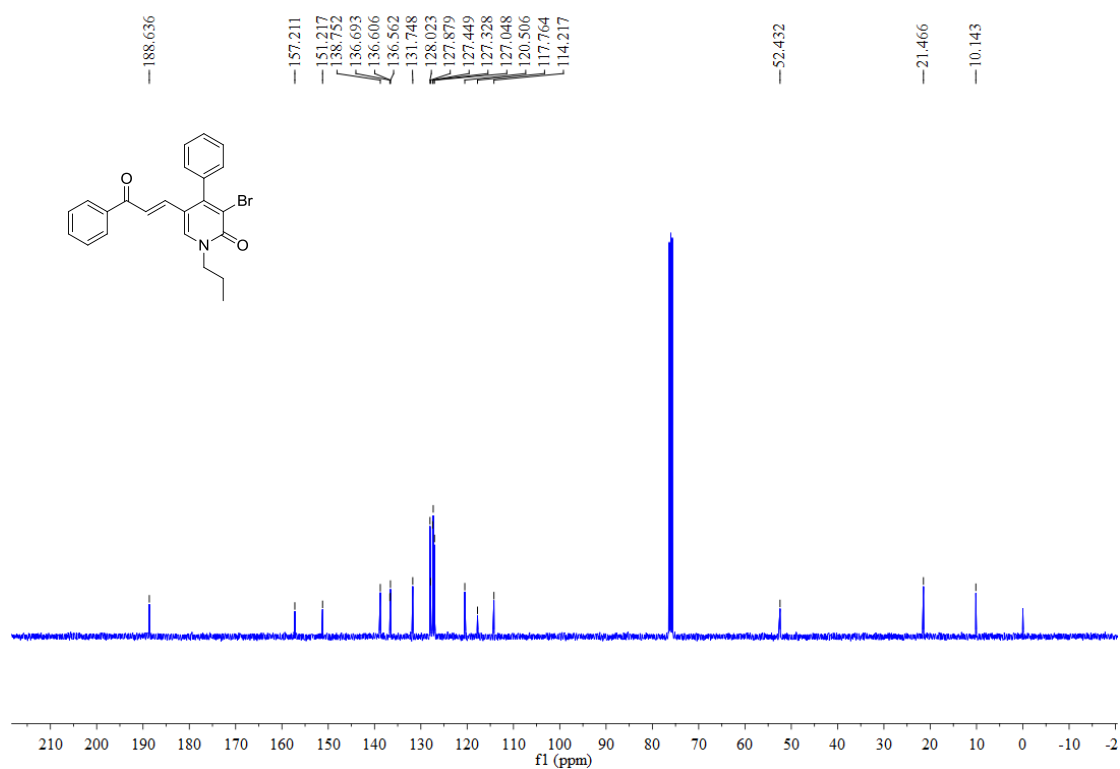
^{13}C NMR spectrum (100 MHz, CDCl_3) of **1ak**



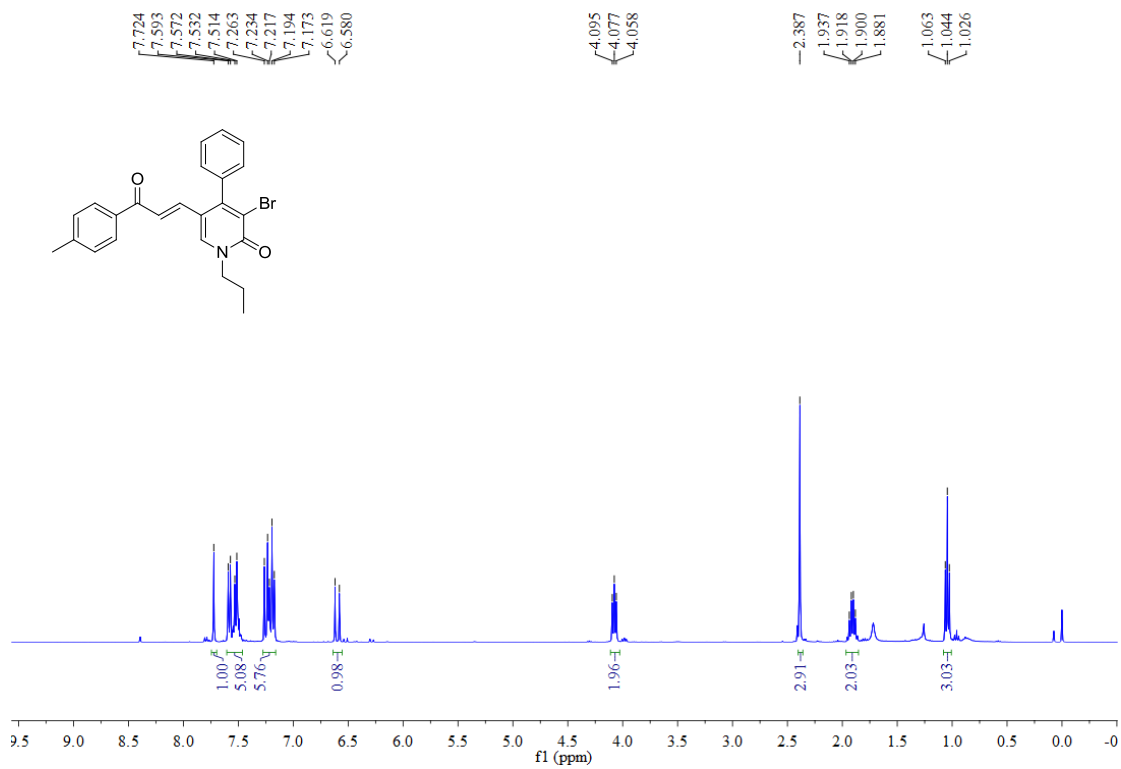
^1H NMR spectrum (400 MHz, CDCl_3) of **2a**



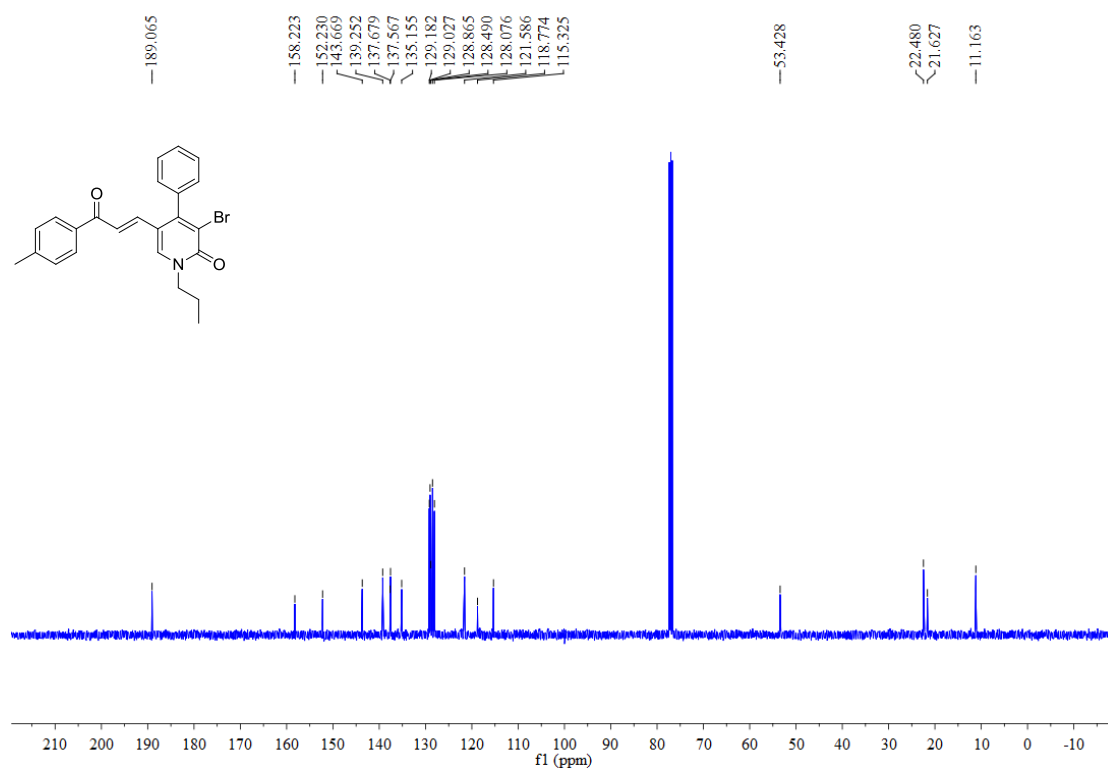
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2a**



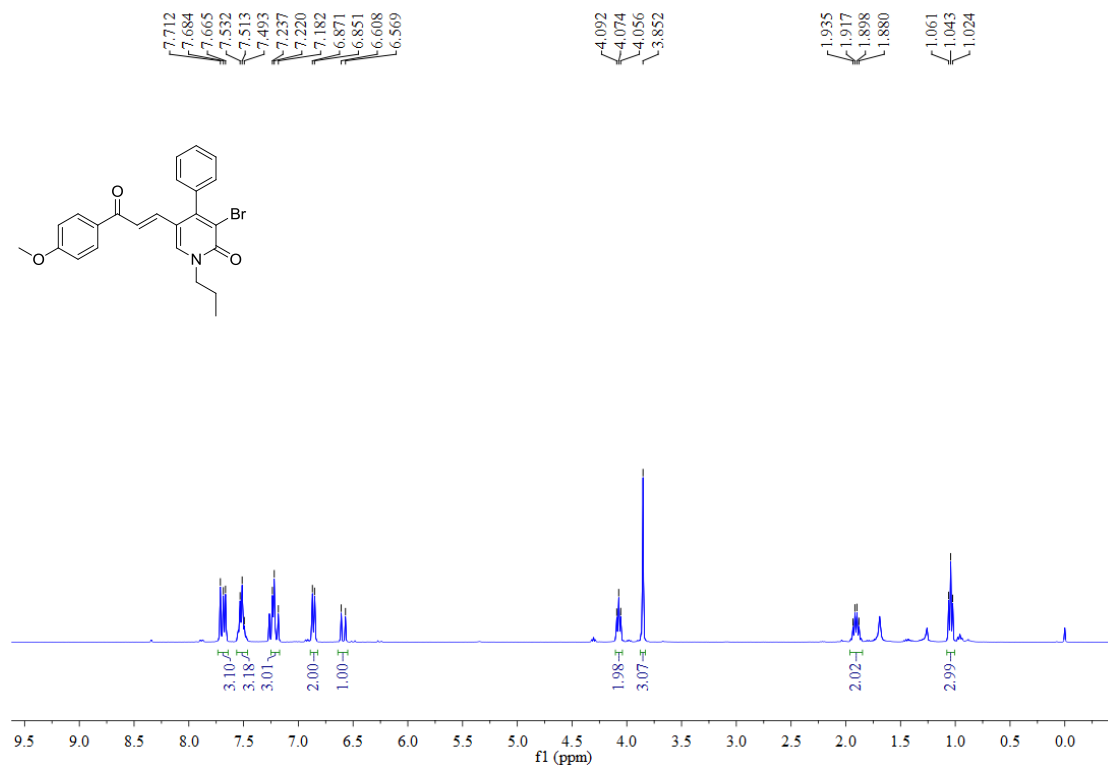
^1H NMR spectrum (400 MHz, CDCl_3) of **2b**



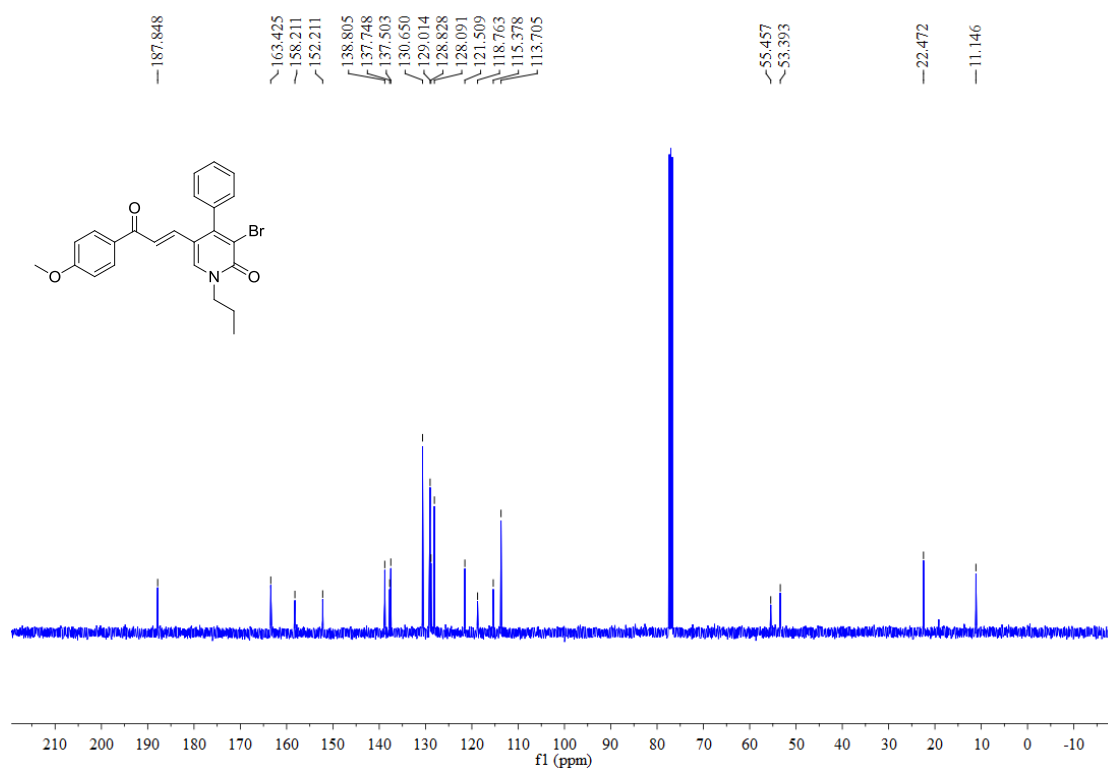
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2b**



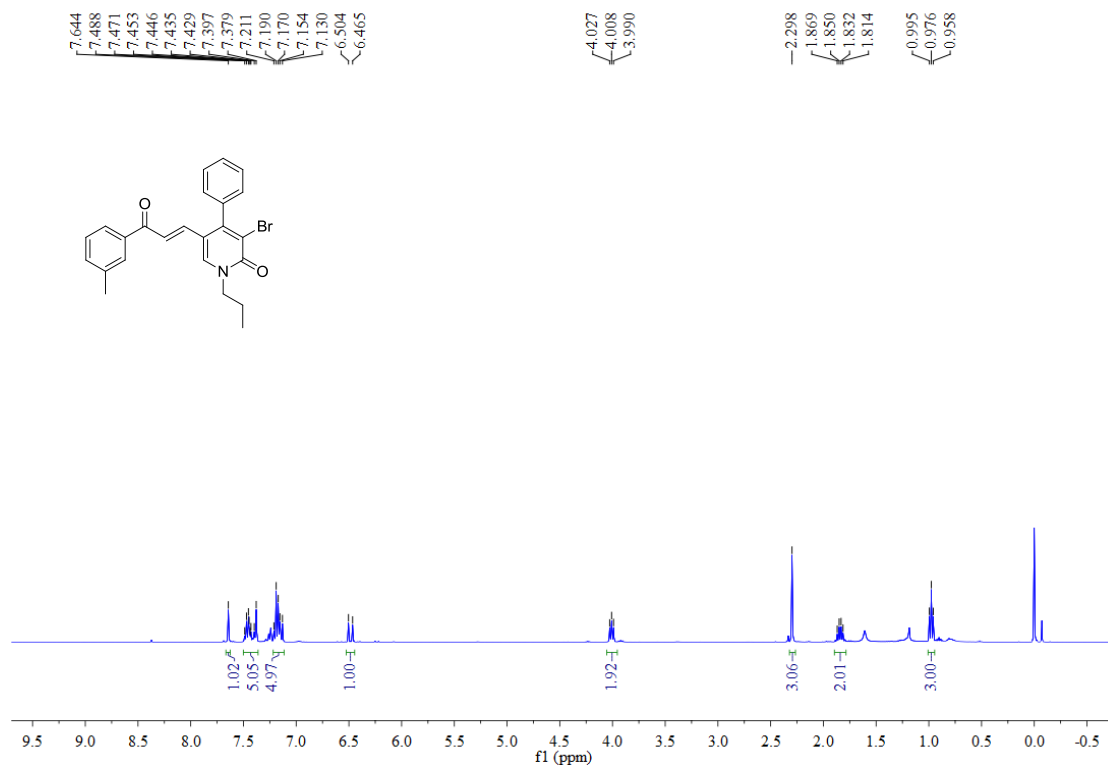
^1H NMR spectrum (400 MHz, CDCl_3) of **2c**



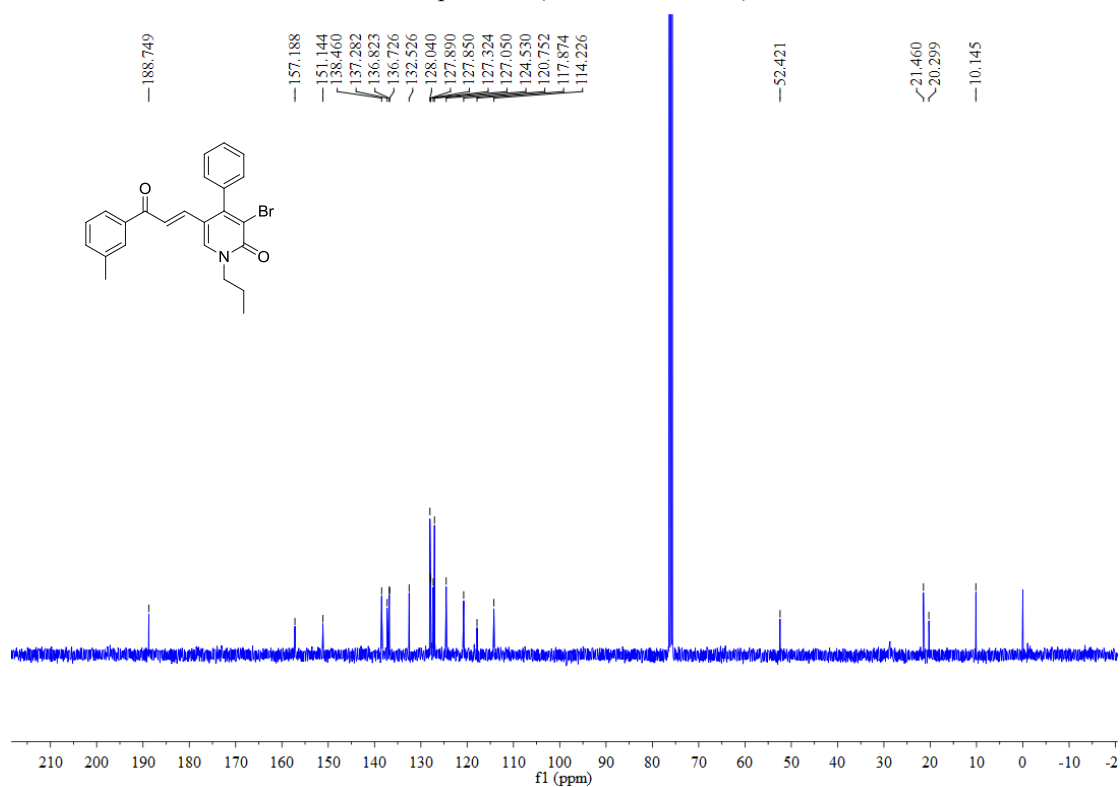
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2c**



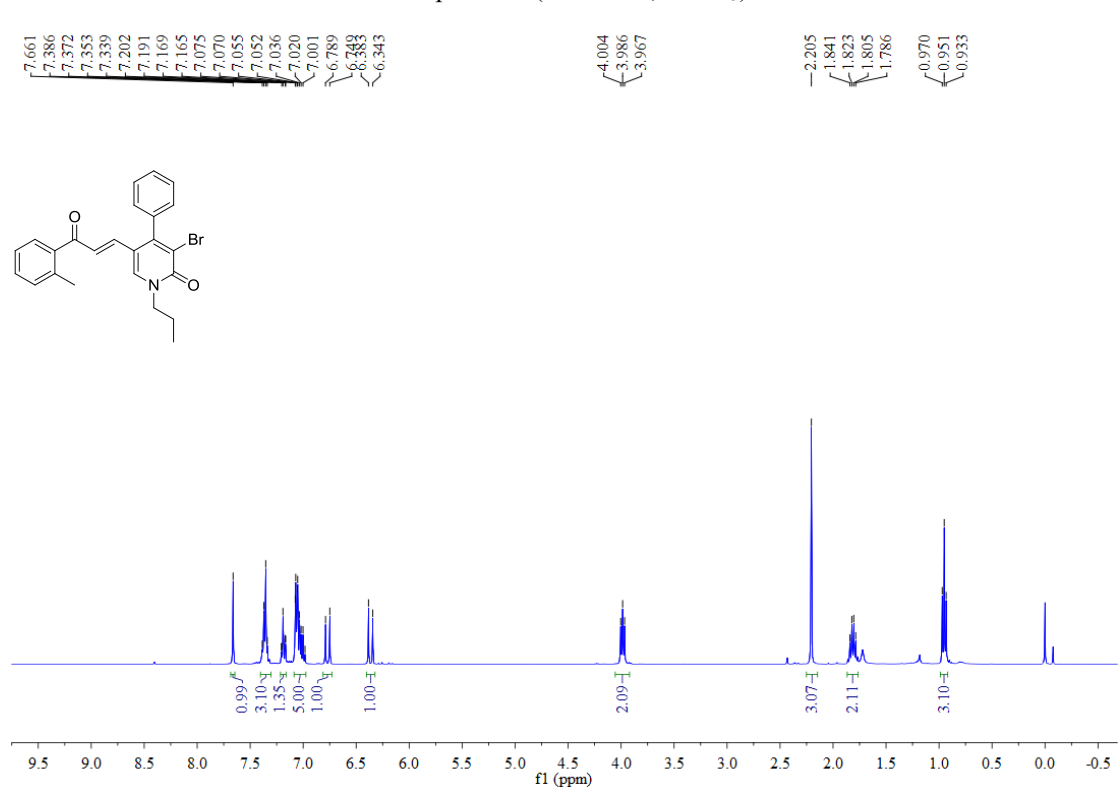
^1H NMR spectrum (400 MHz, CDCl_3) of **2d**



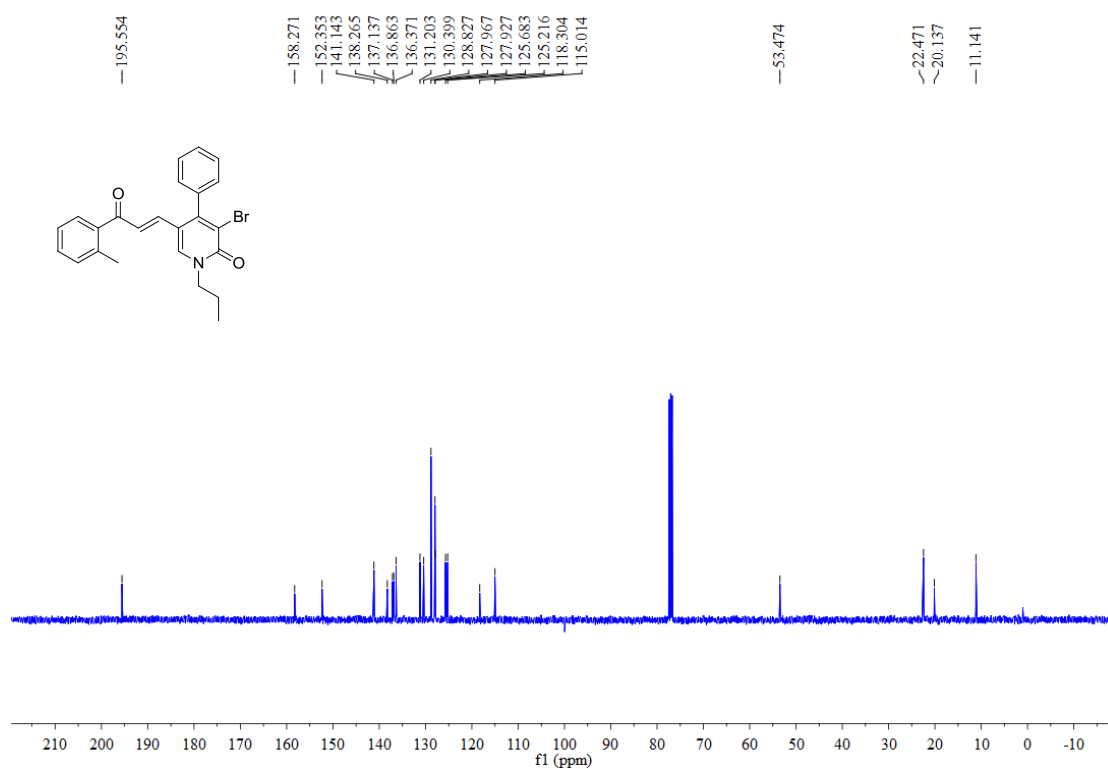
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2d**



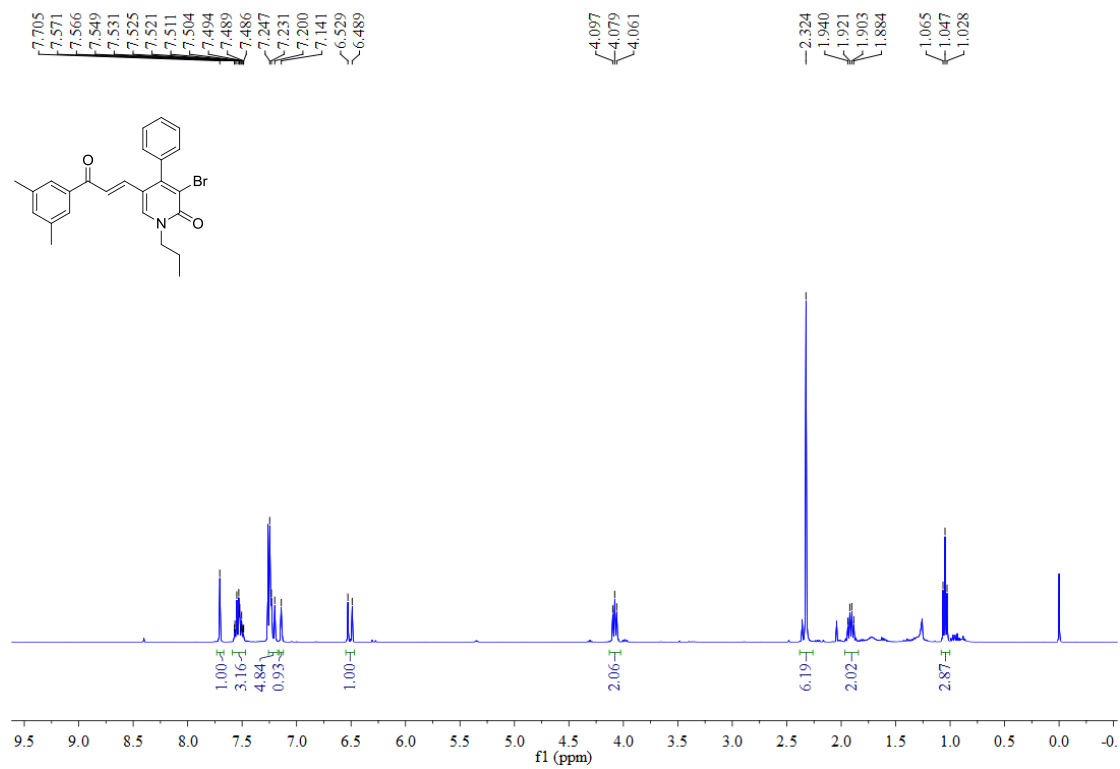
^1H NMR spectrum (400 MHz, CDCl_3) of **2e**



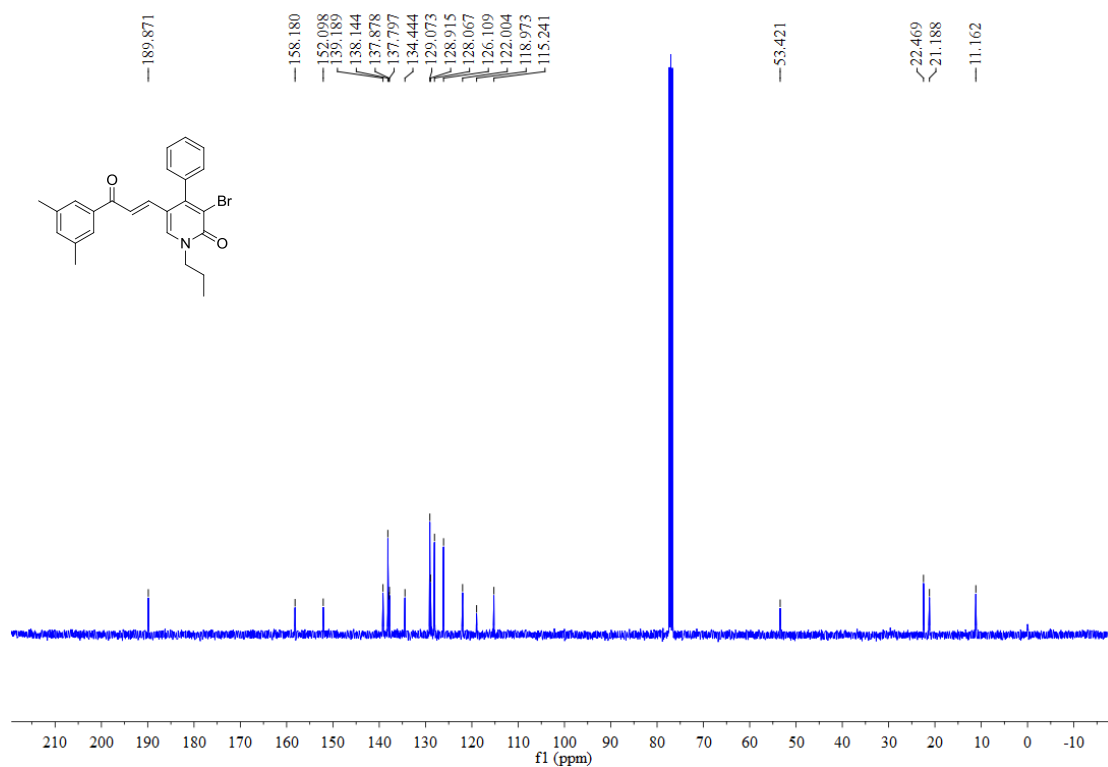
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2e**



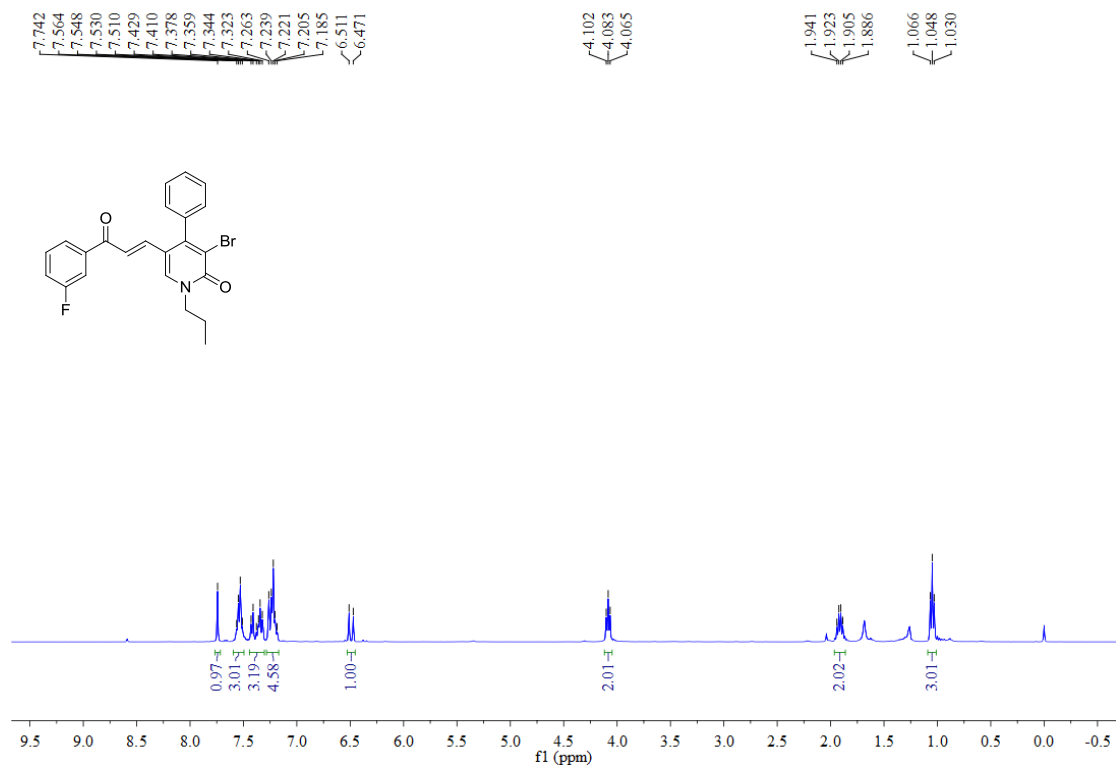
^1H NMR spectrum (400 MHz, CDCl_3) of **2f**



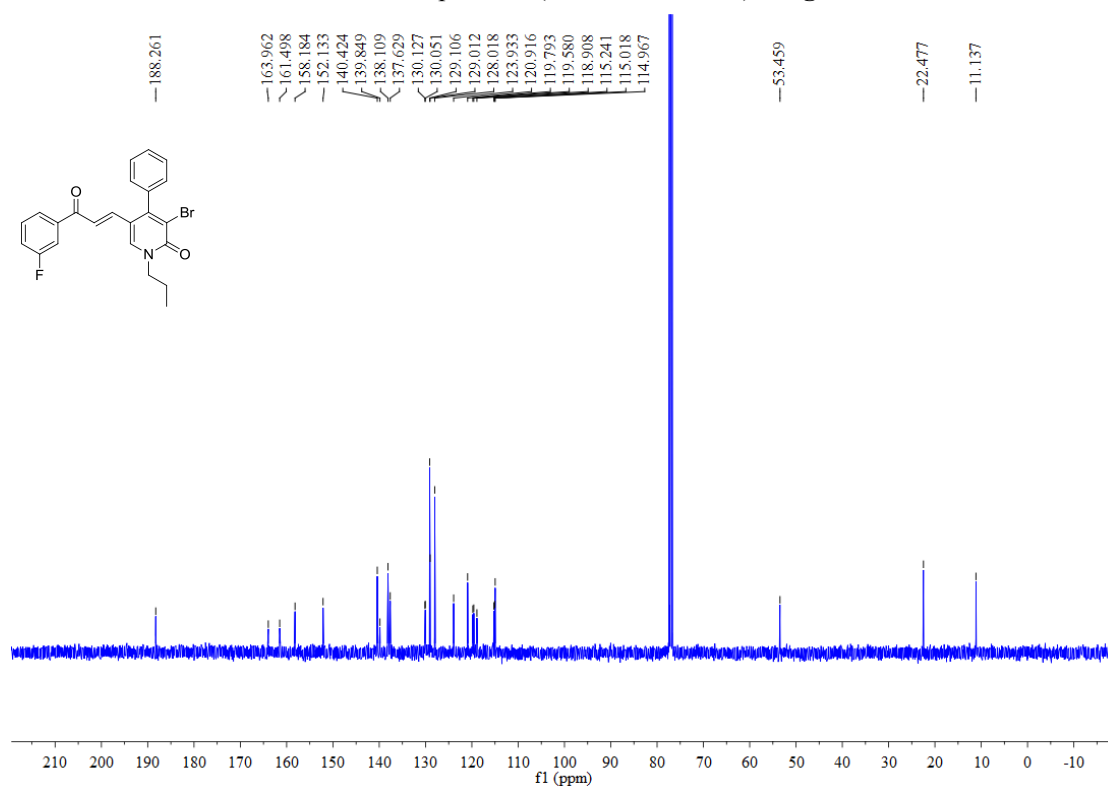
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2f**



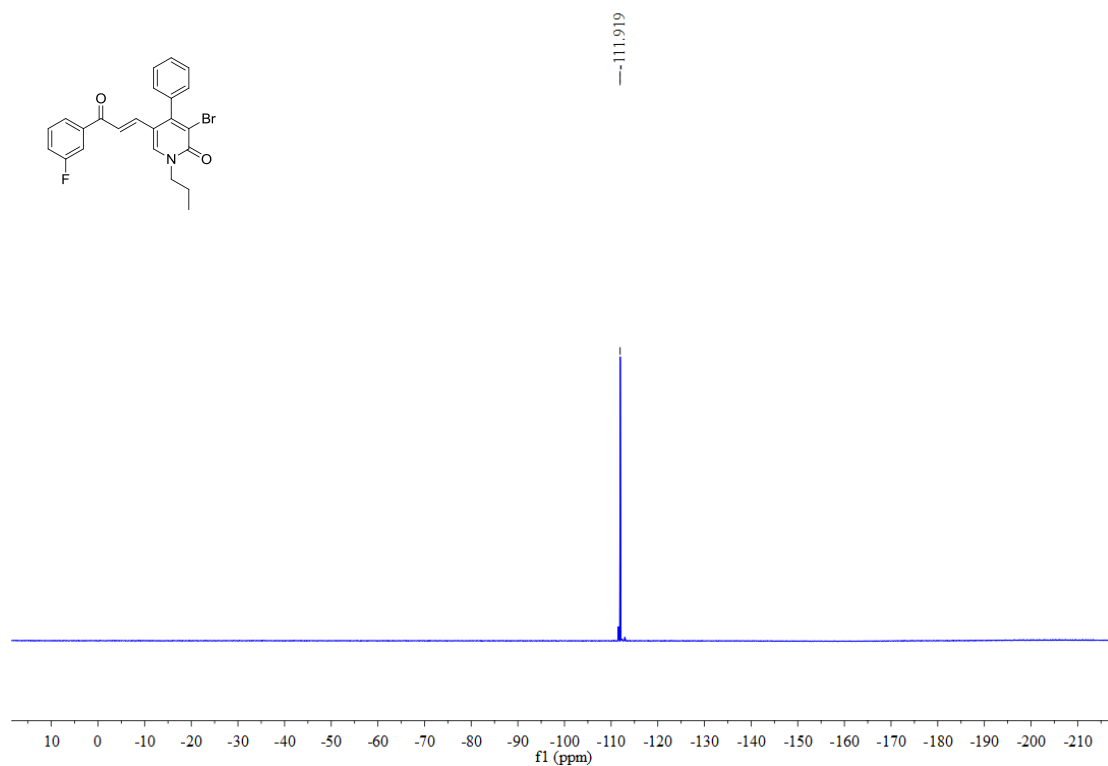
^1H NMR spectrum (400 MHz, CDCl_3) of **2g**



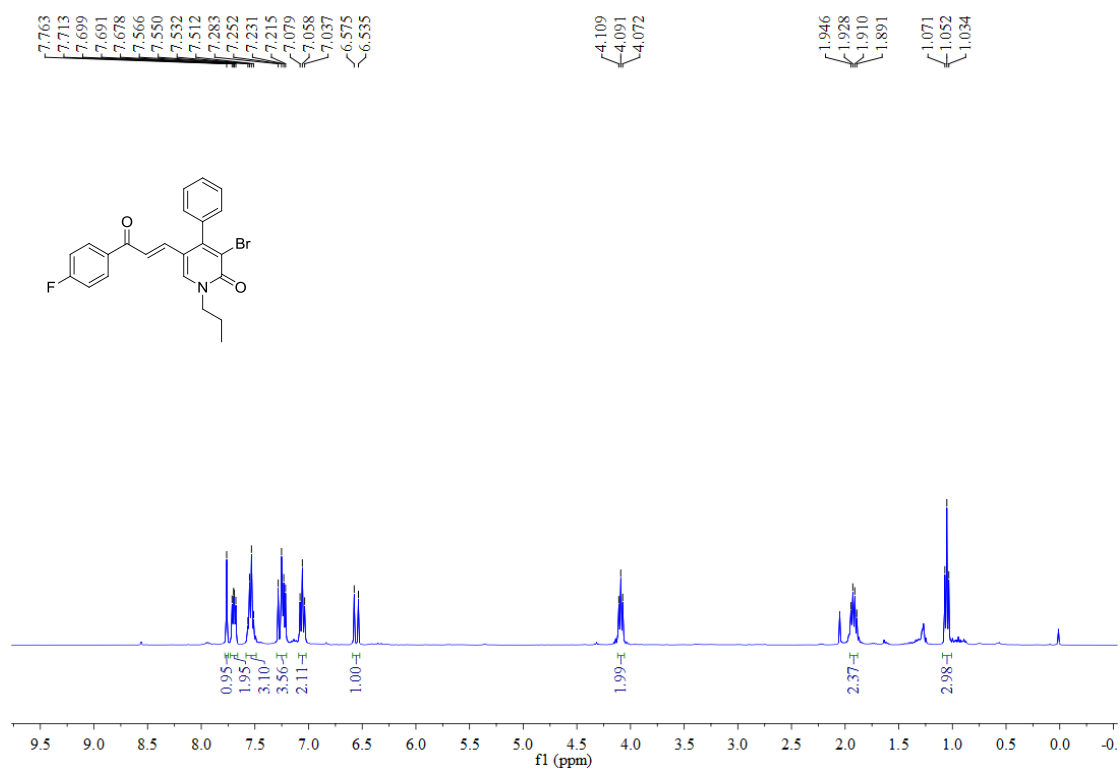
¹³C NMR spectrum (100 MHz, CDCl₃) of **2g**



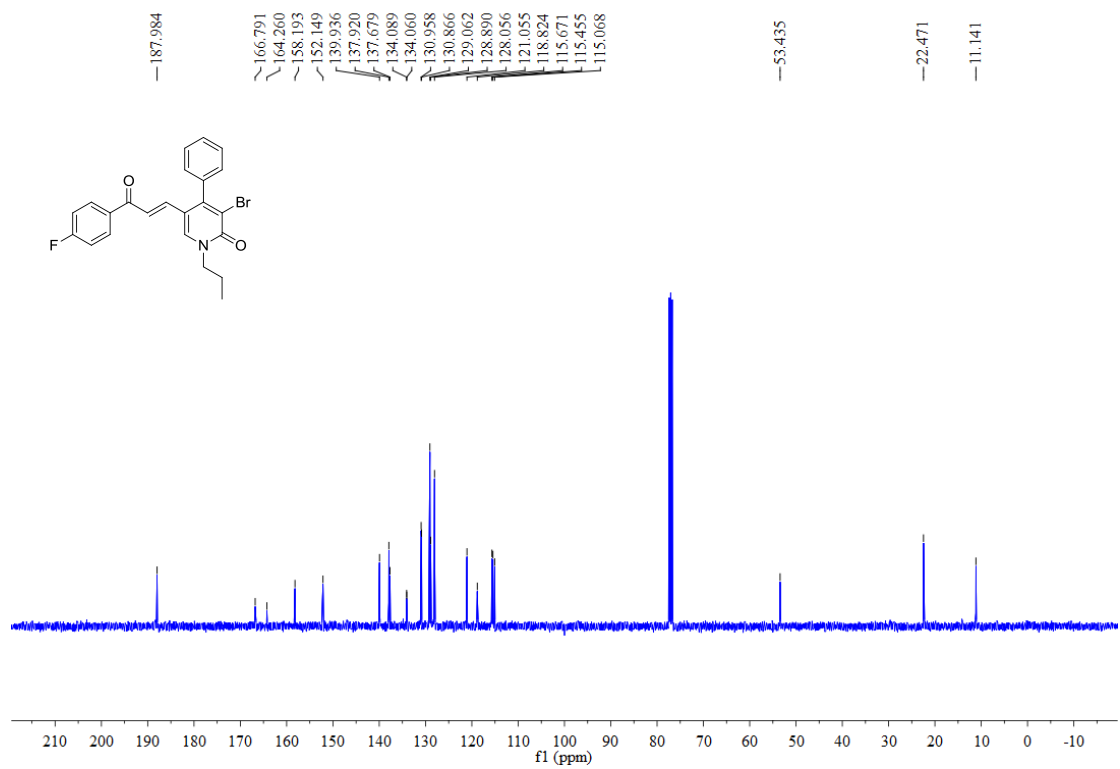
¹⁹F NMR spectrum (376 MHz, CDCl₃) of **2g**



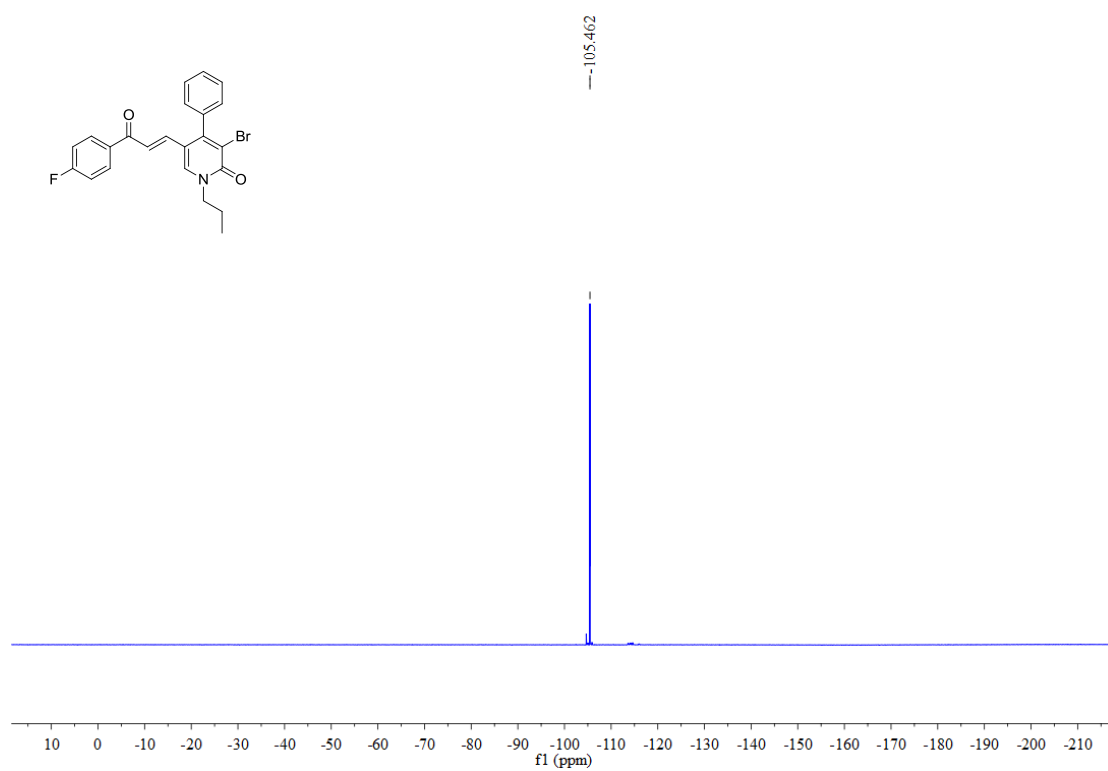
¹H NMR spectrum (400 MHz, CDCl₃) of **2h**



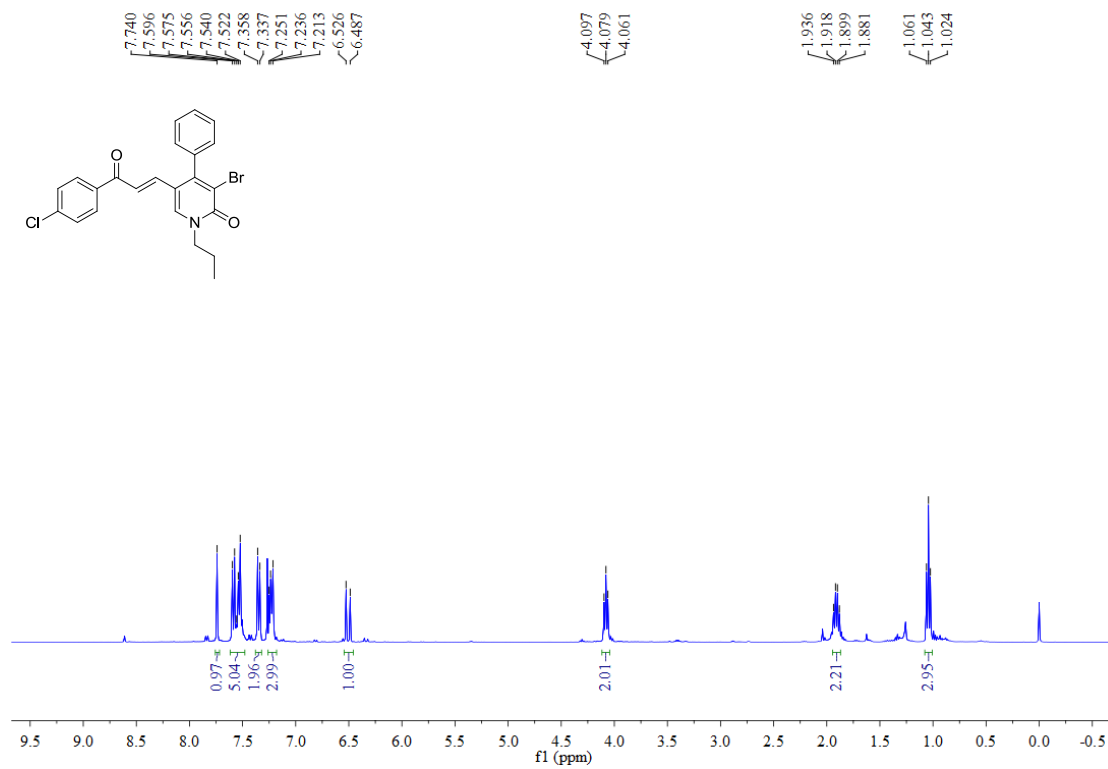
¹³C NMR spectrum (100 MHz, CDCl₃) of **2h**



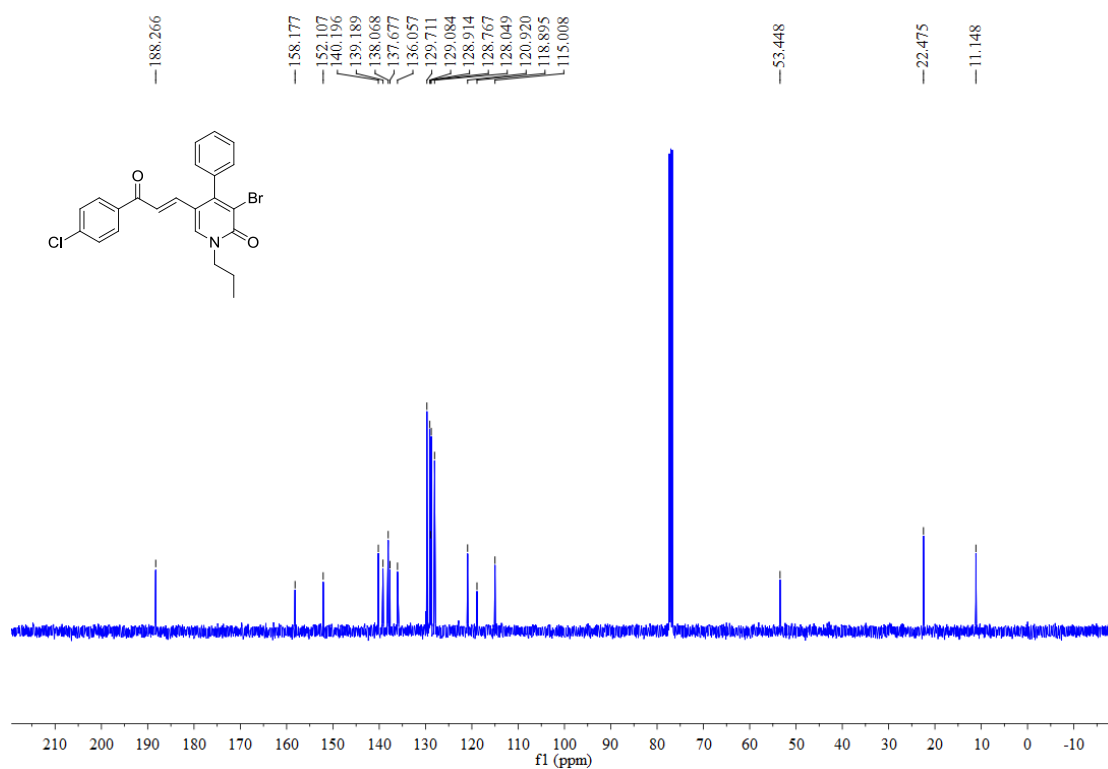
^{19}F NMR spectrum (376 MHz, CDCl_3) of **2h**



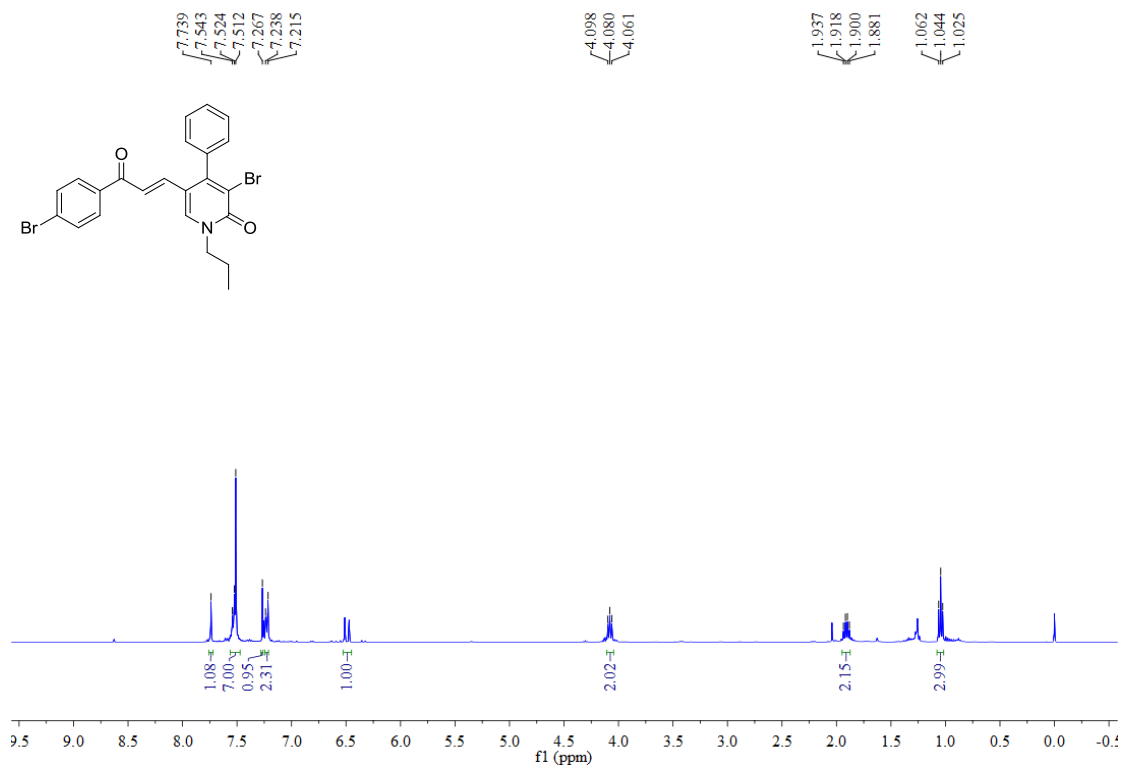
^1H NMR spectrum (400 MHz, CDCl_3) of **2i**



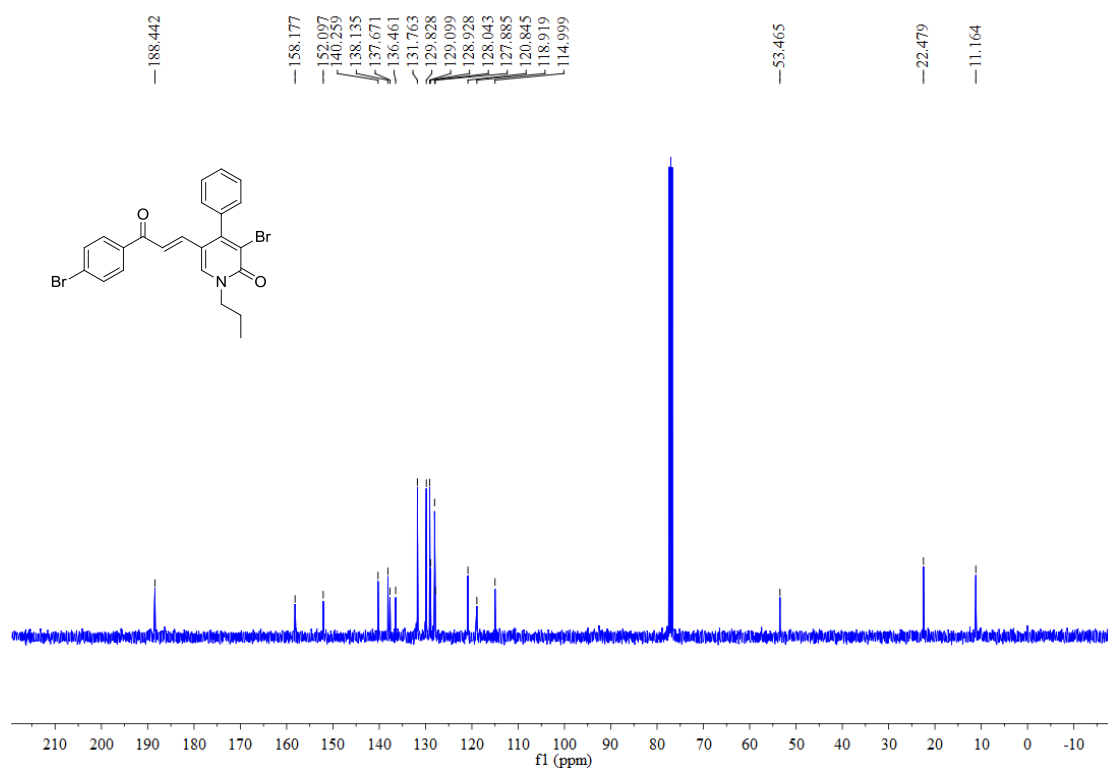
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2i**



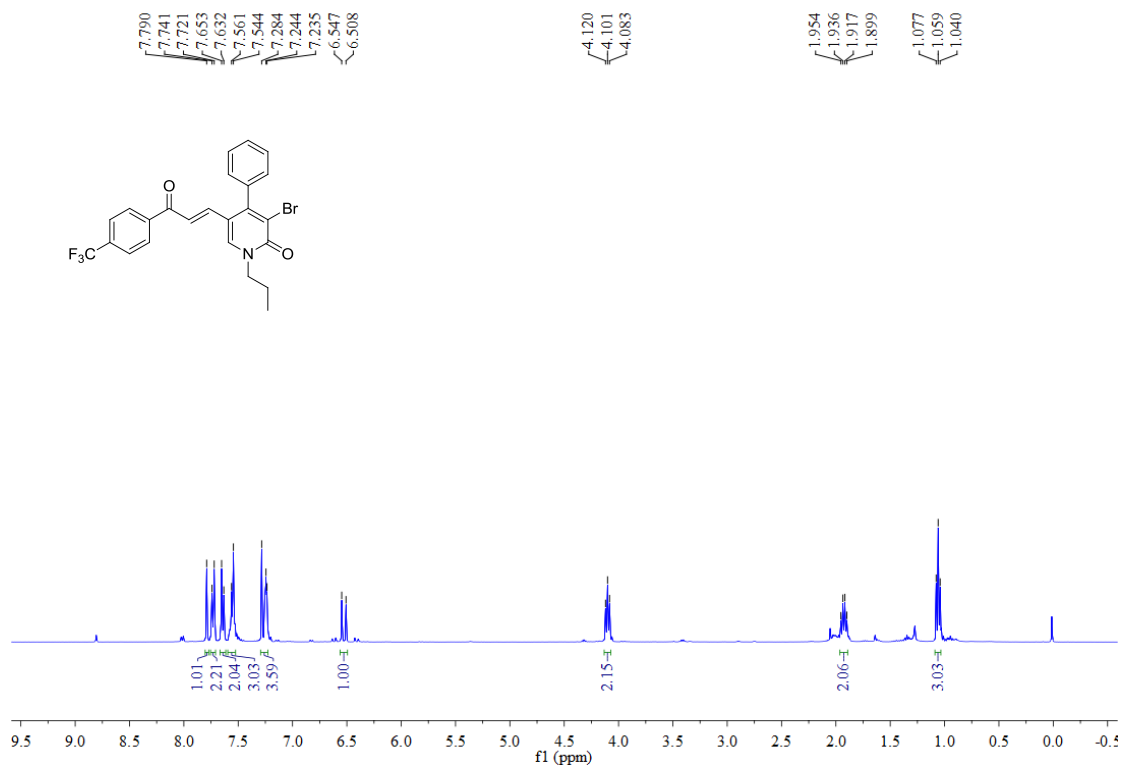
^1H NMR spectrum (400 MHz, CDCl_3) of **2j**



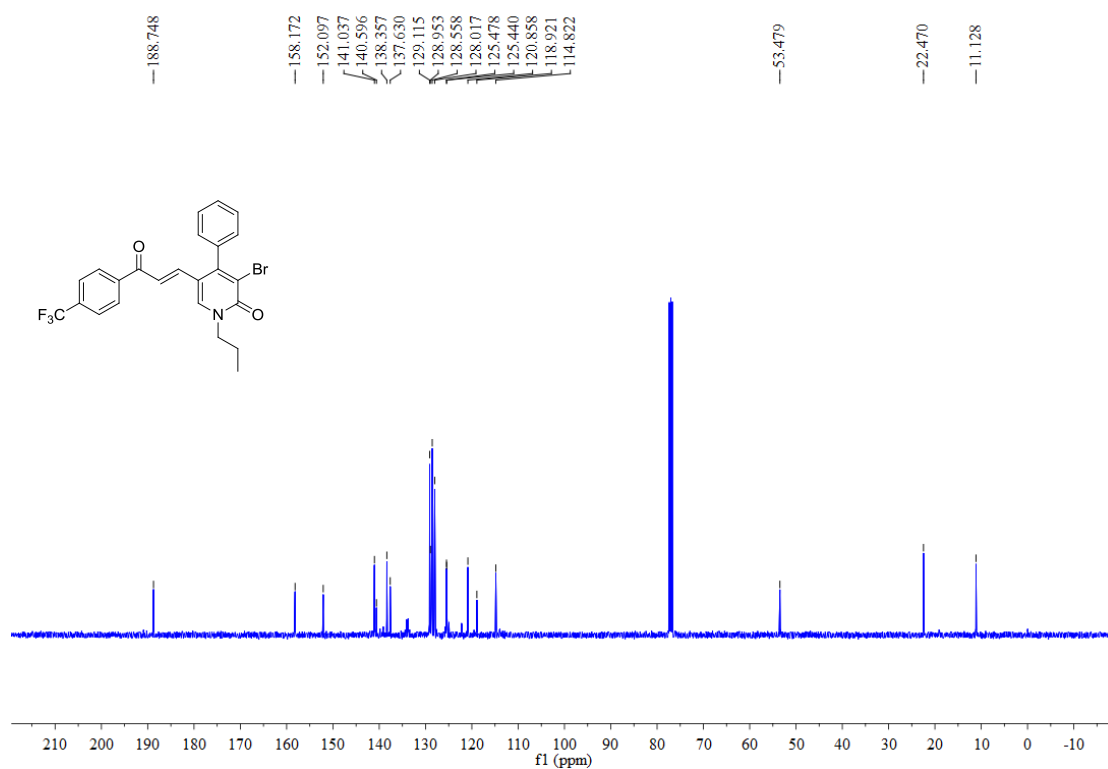
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2j**



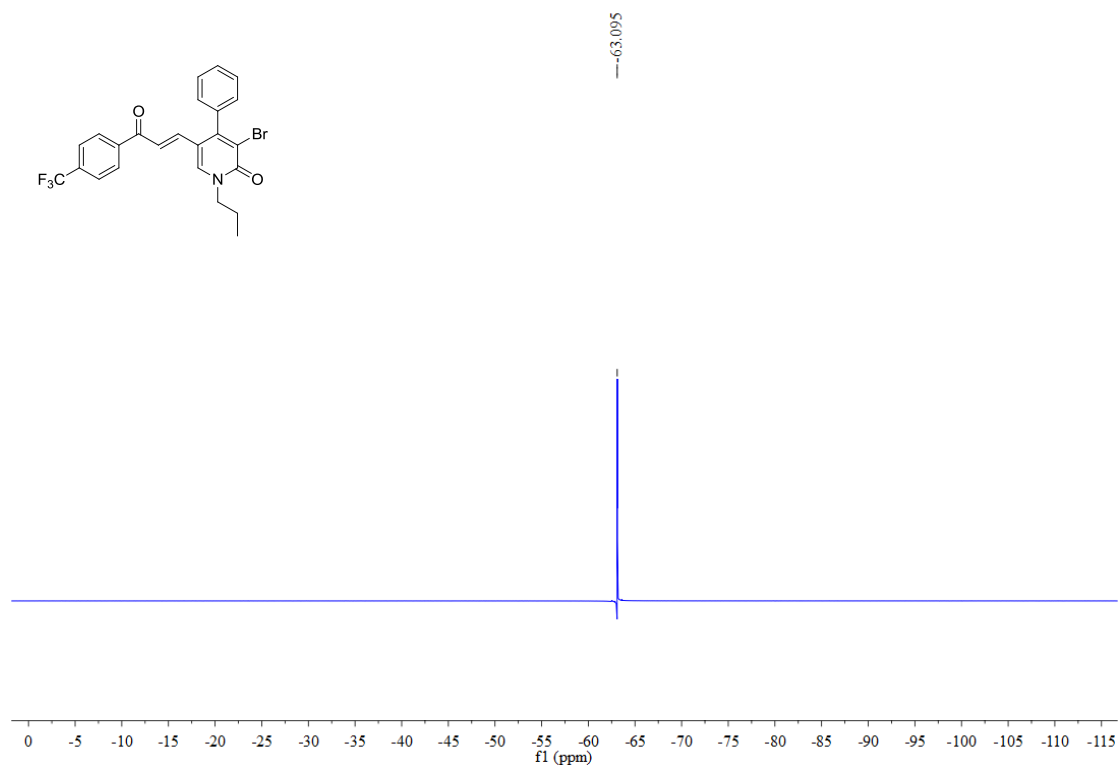
^1H NMR spectrum (400 MHz, CDCl_3) of **2k**



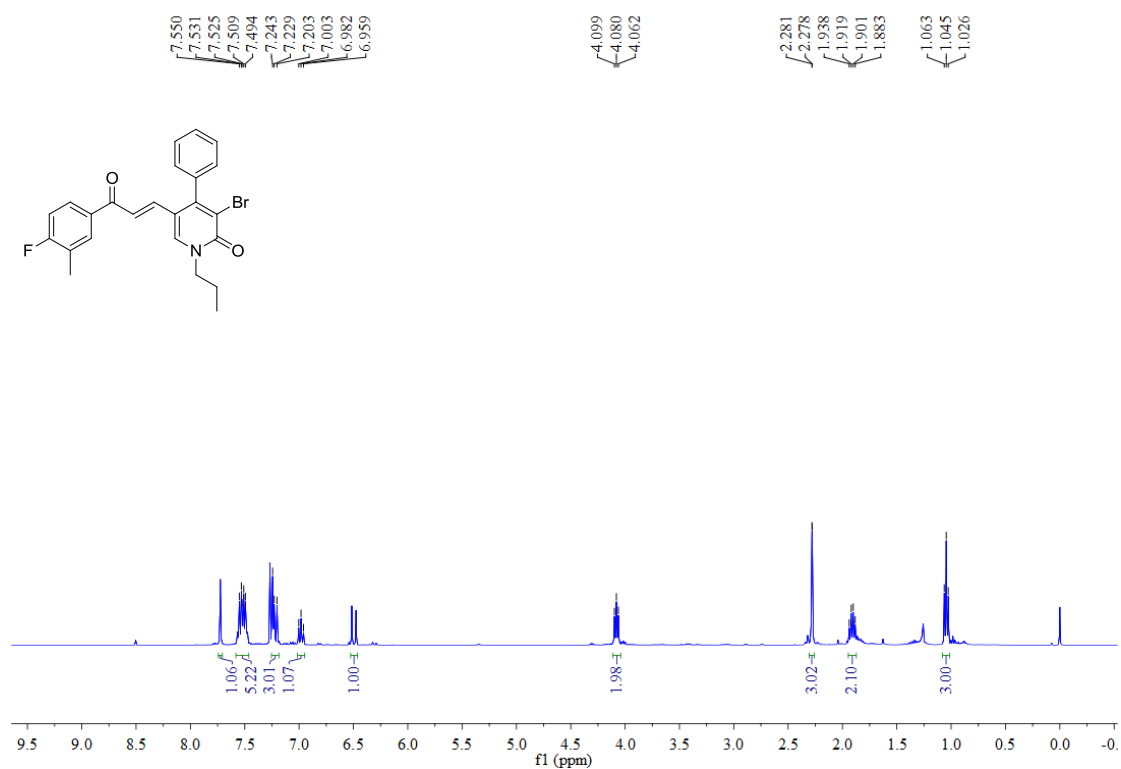
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2k**



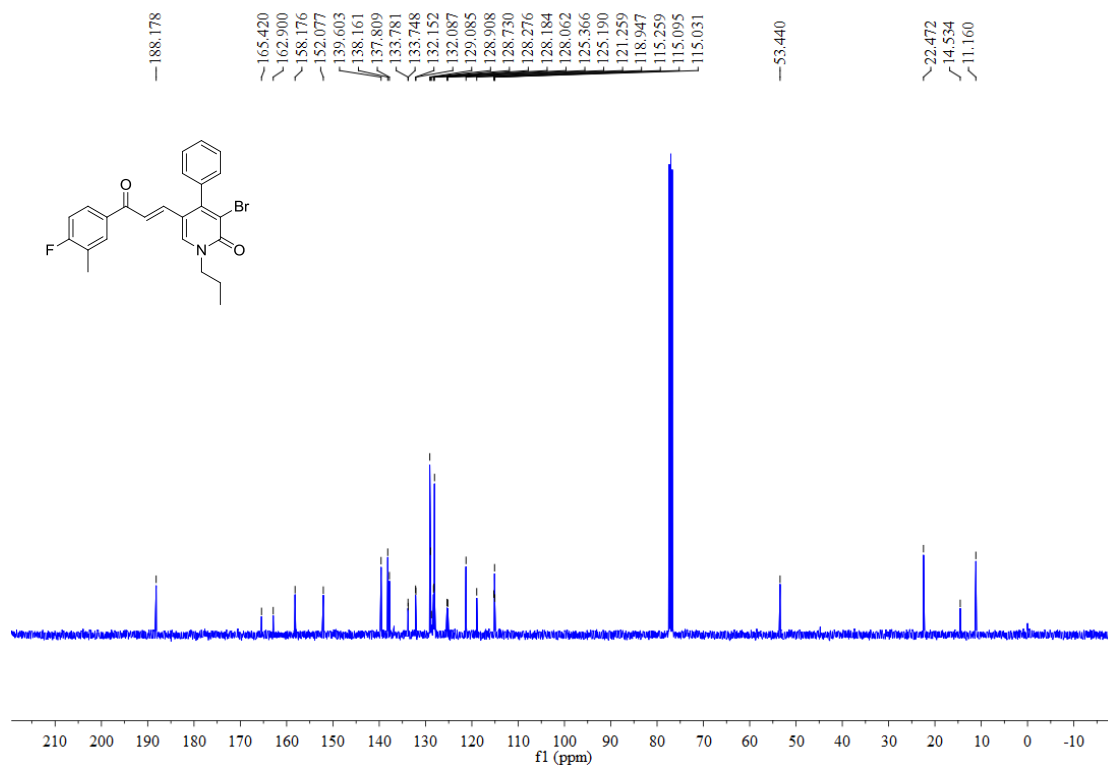
^{19}F NMR spectrum (376 MHz, CDCl_3) of **2k**



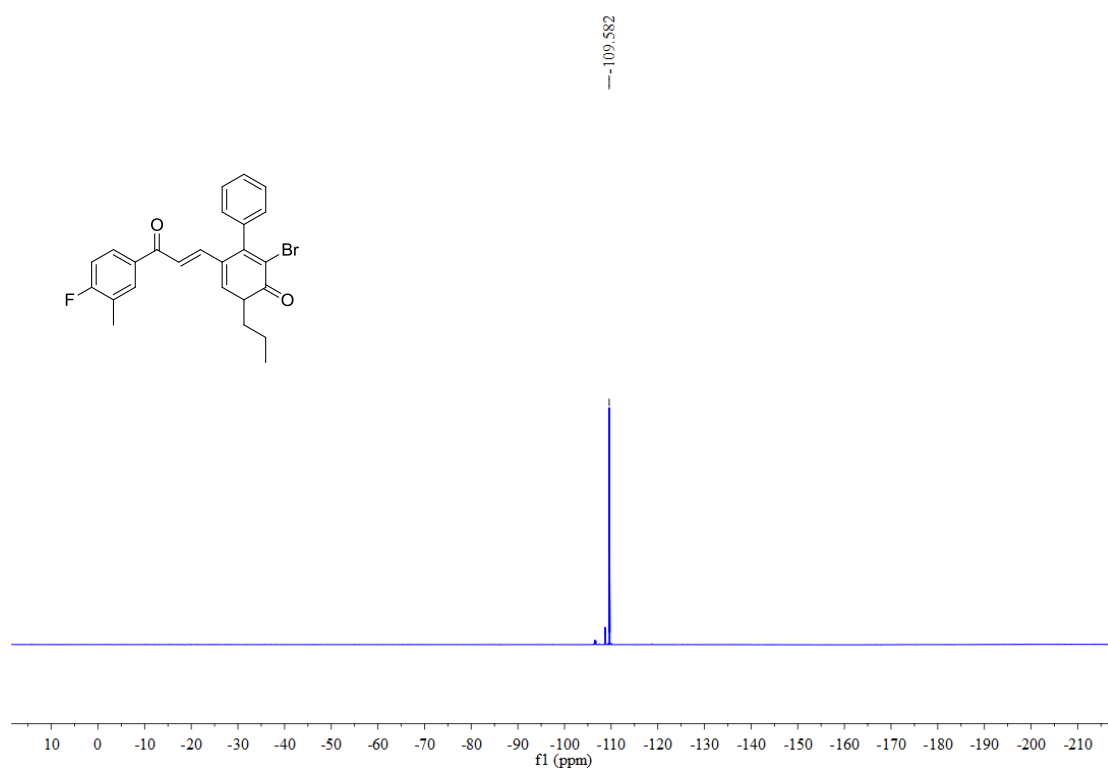
¹H NMR spectrum (400 MHz, CDCl₃) of **2I**



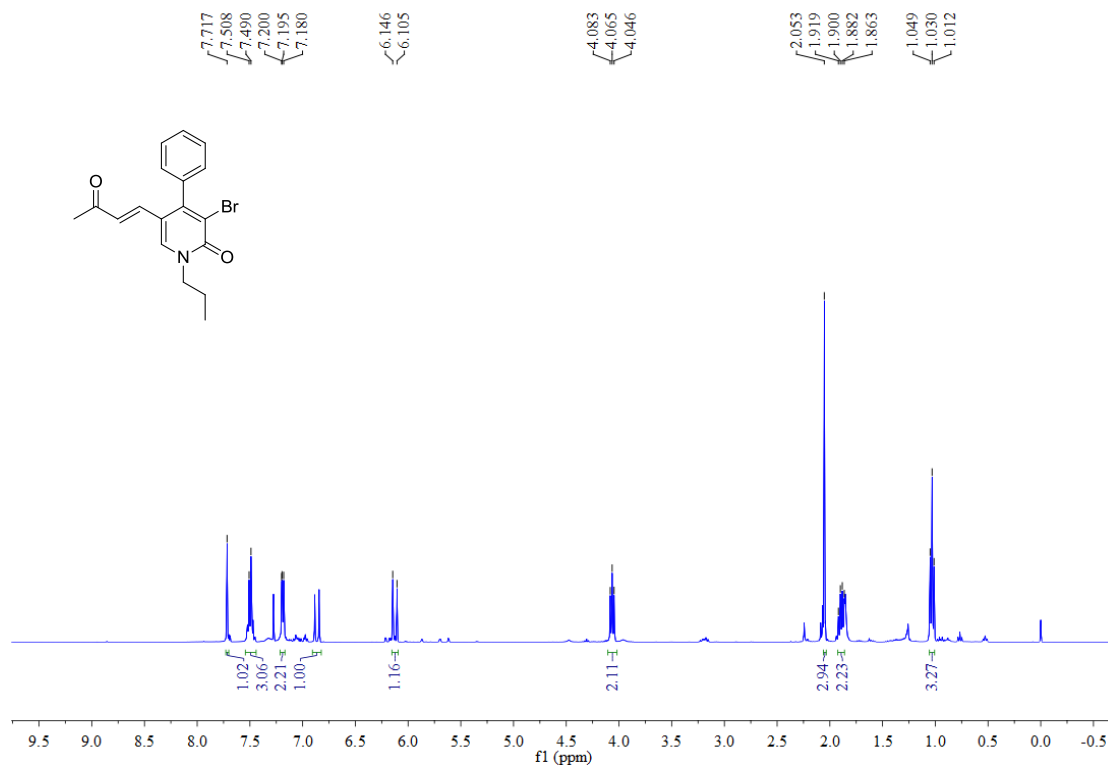
¹³C NMR spectrum (100 MHz, CDCl₃) of **2I**



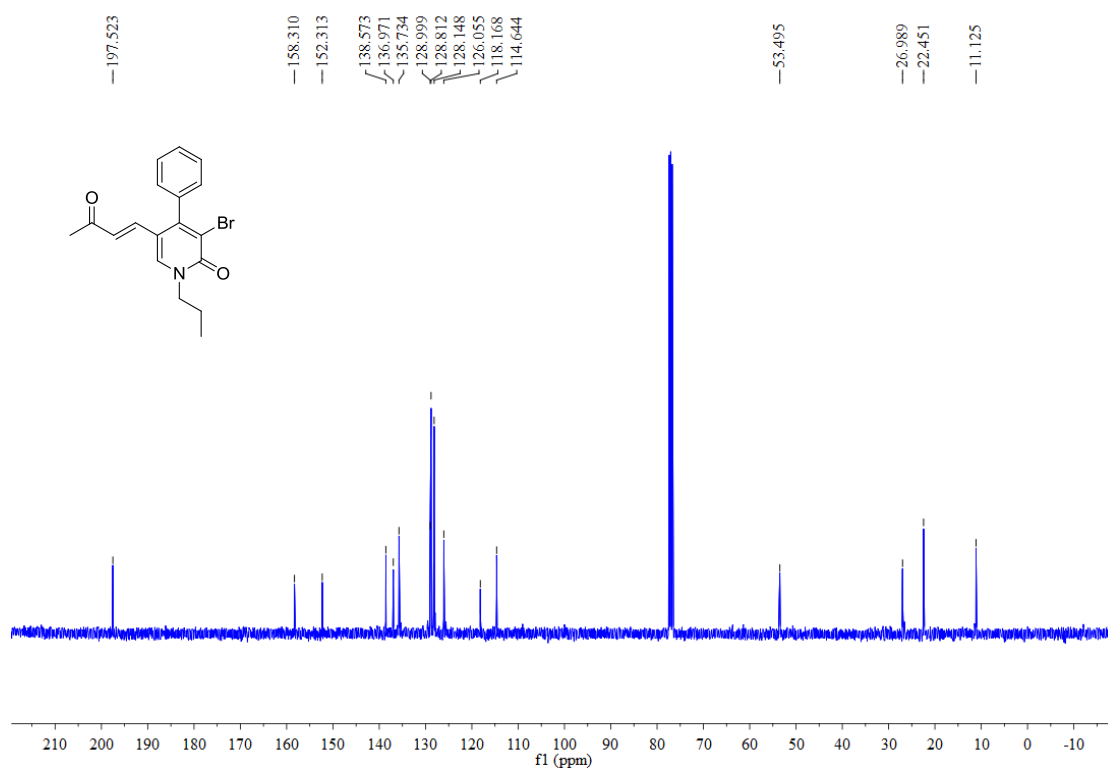
^{19}F NMR spectrum (376 MHz, CDCl_3) of **2l**



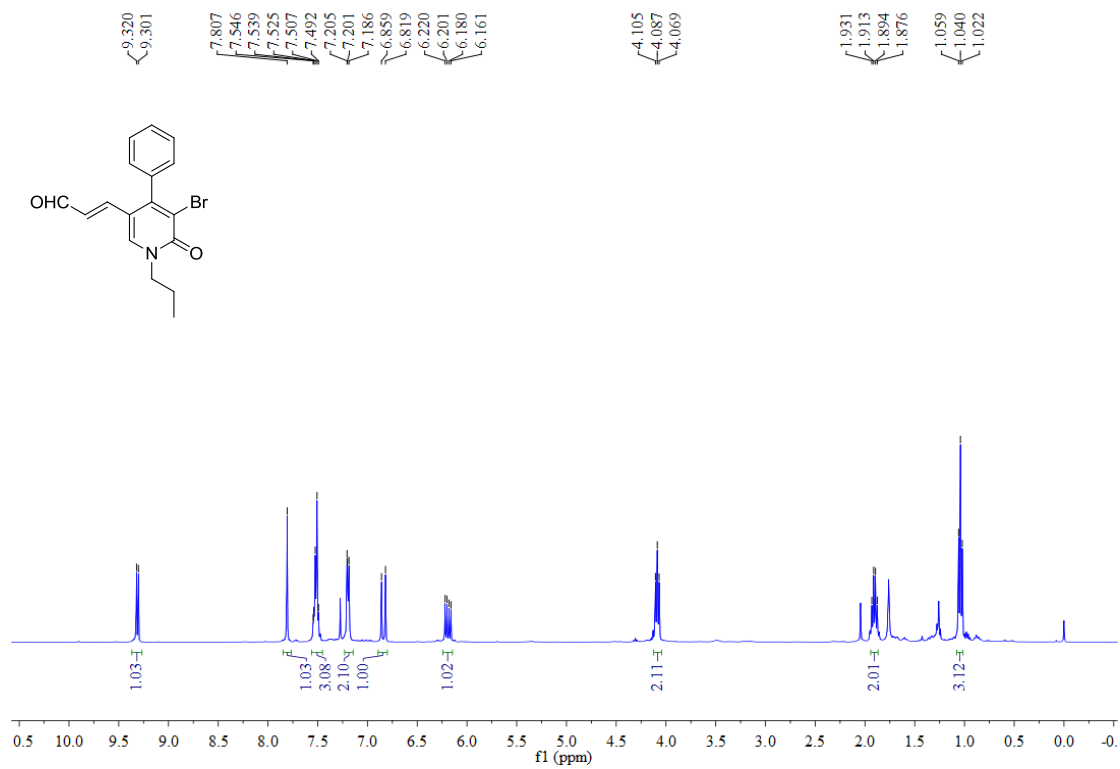
^1H NMR spectrum (400 MHz, CDCl_3) of **2m**



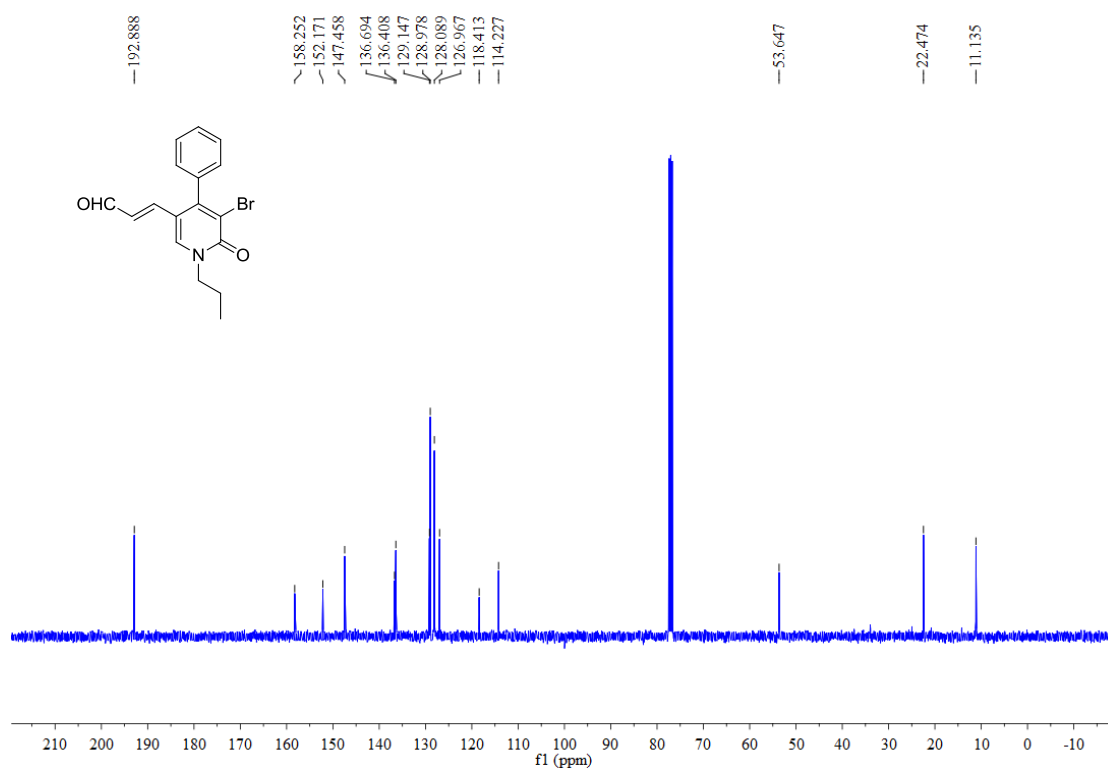
¹³C NMR spectrum (100 MHz, CDCl₃) of **2m**



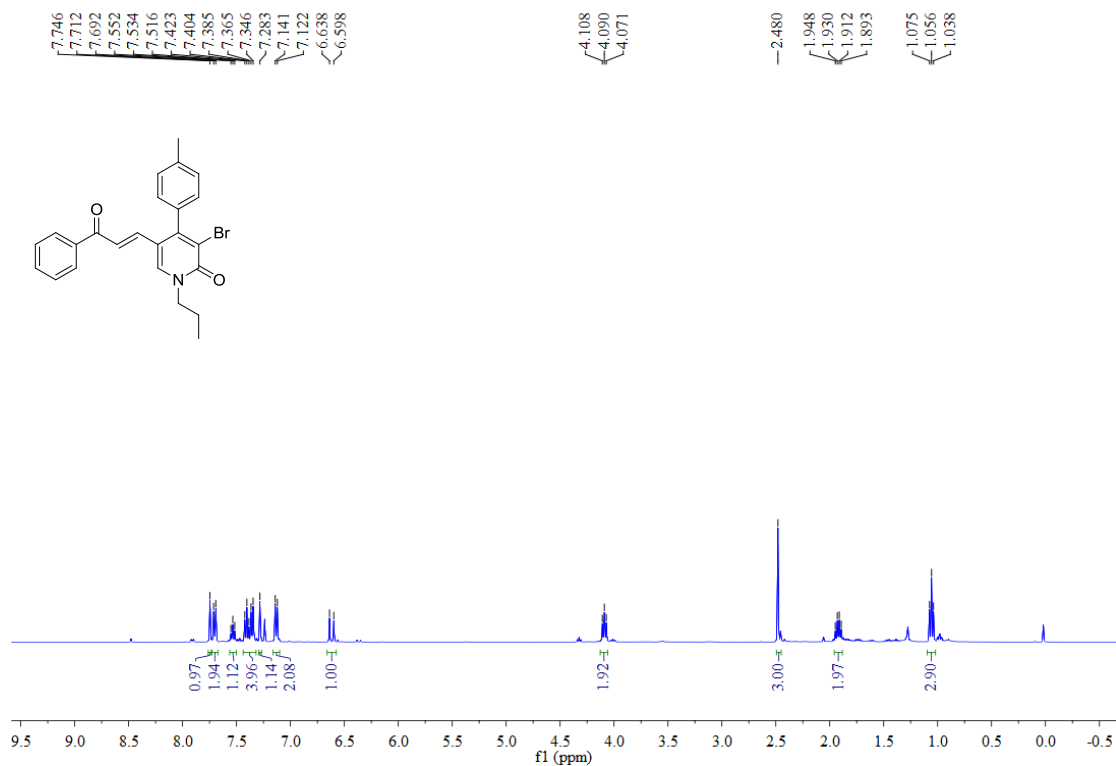
¹H NMR spectrum (400 MHz, CDCl₃) of **2n**



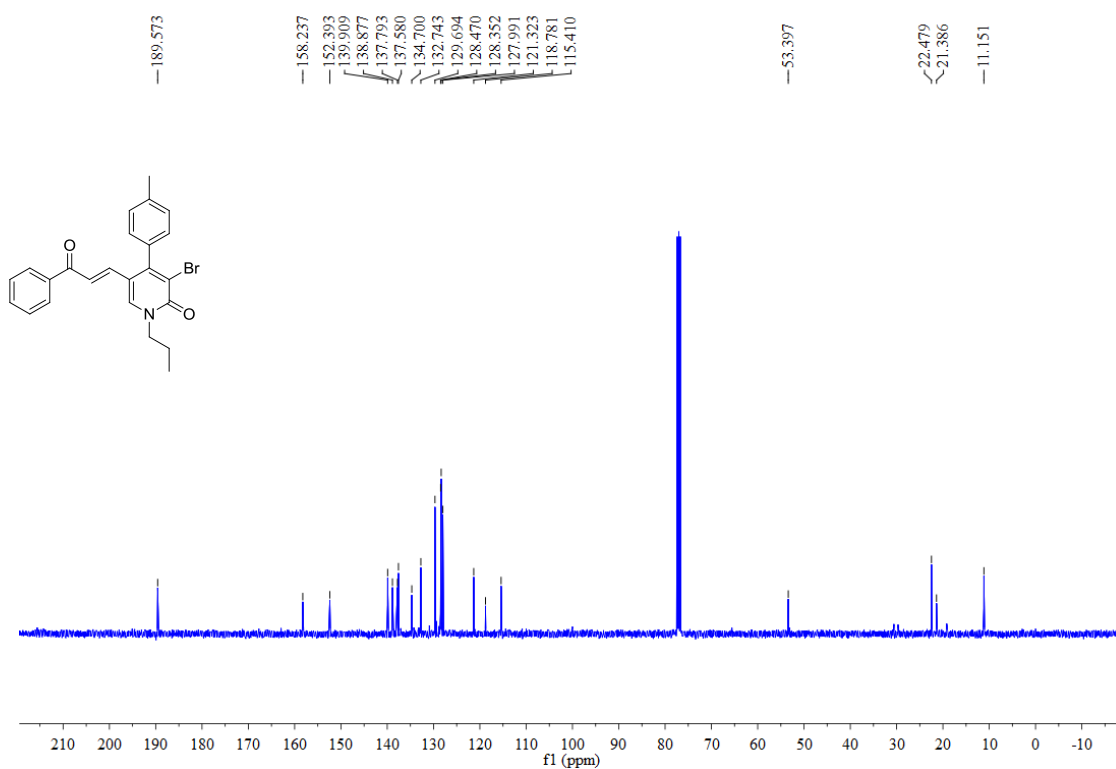
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2n**



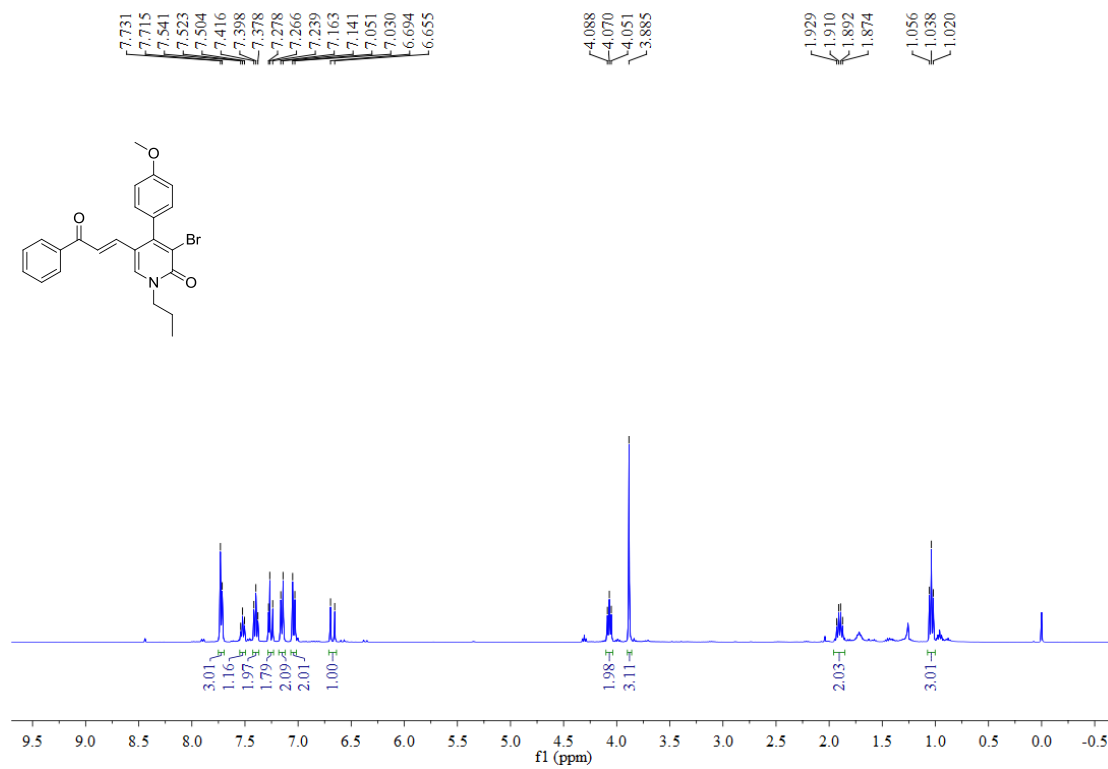
^1H NMR spectrum (400 MHz, CDCl_3) of **2o**



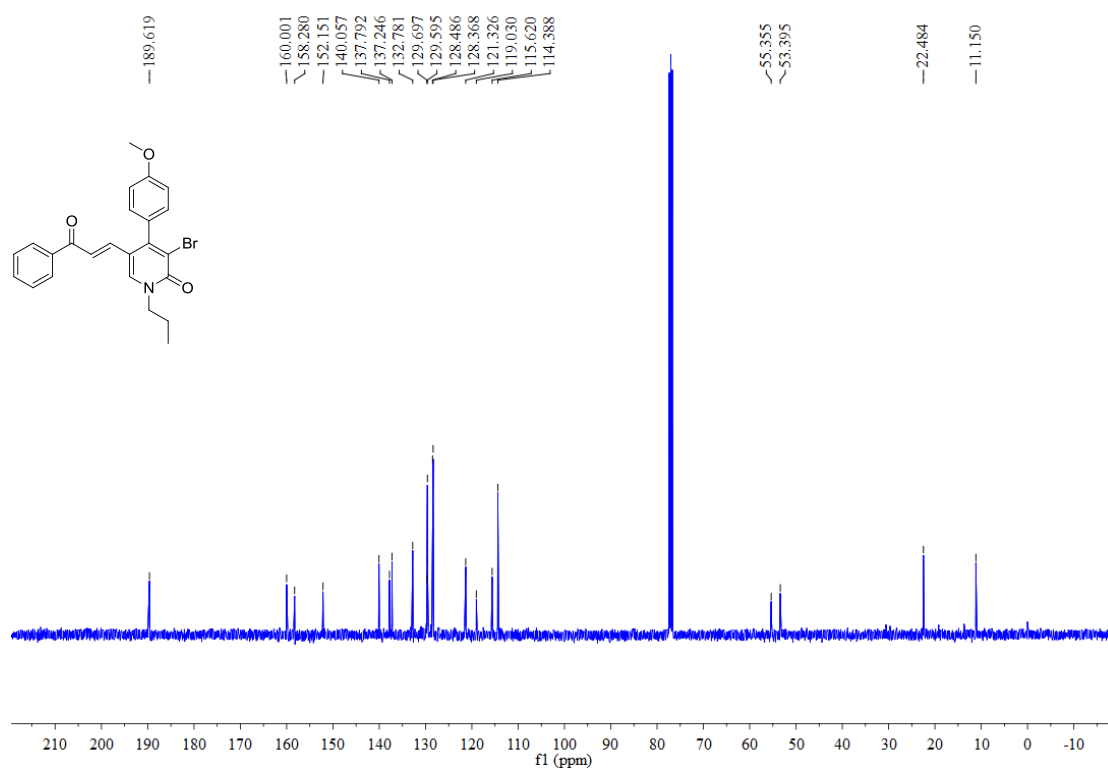
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2o**



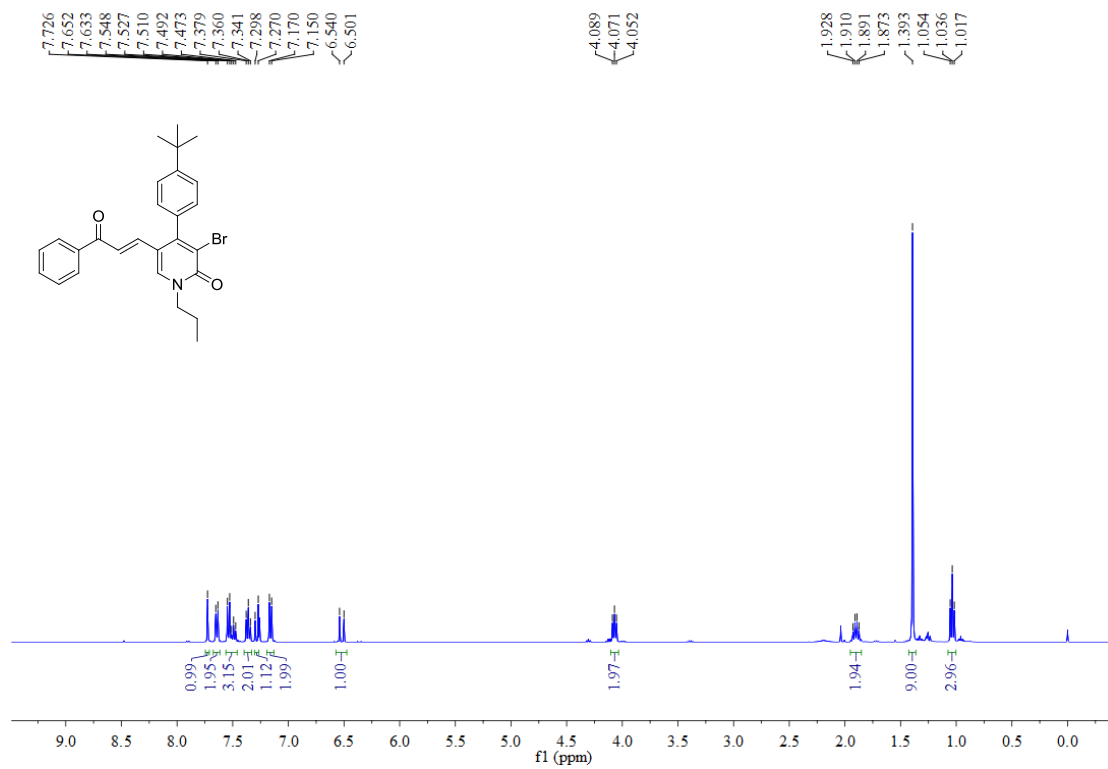
^1H NMR spectrum (400 MHz, CDCl_3) of **2p**



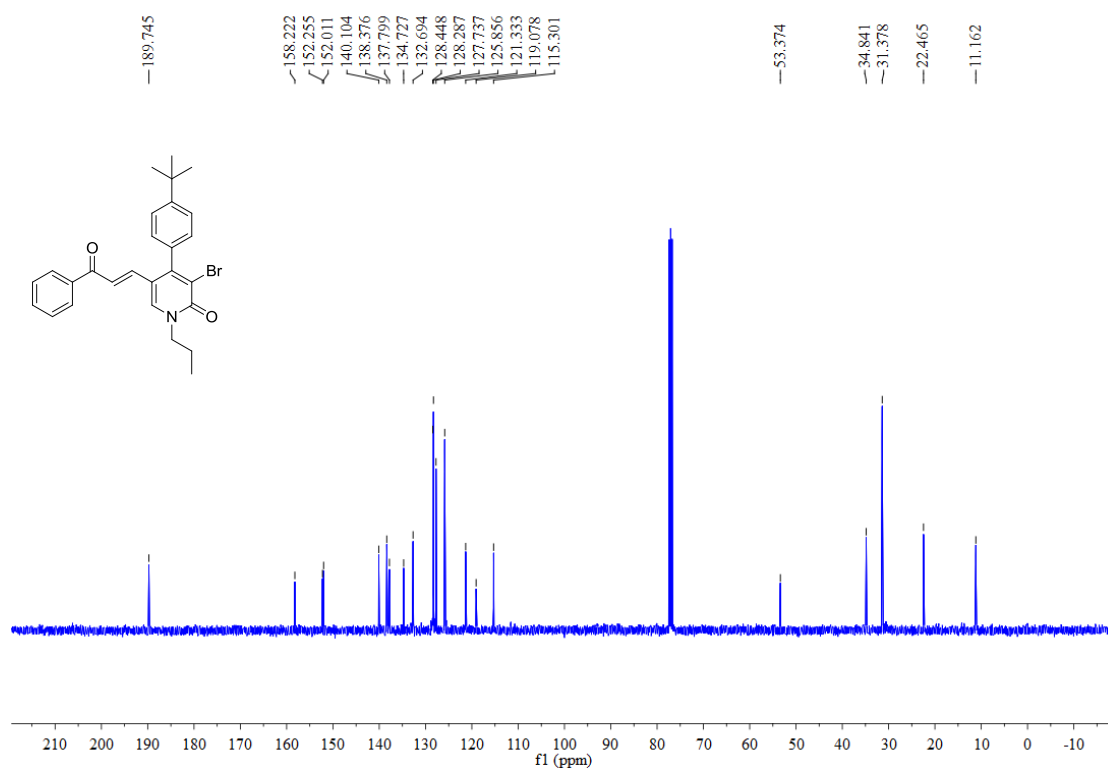
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2p**



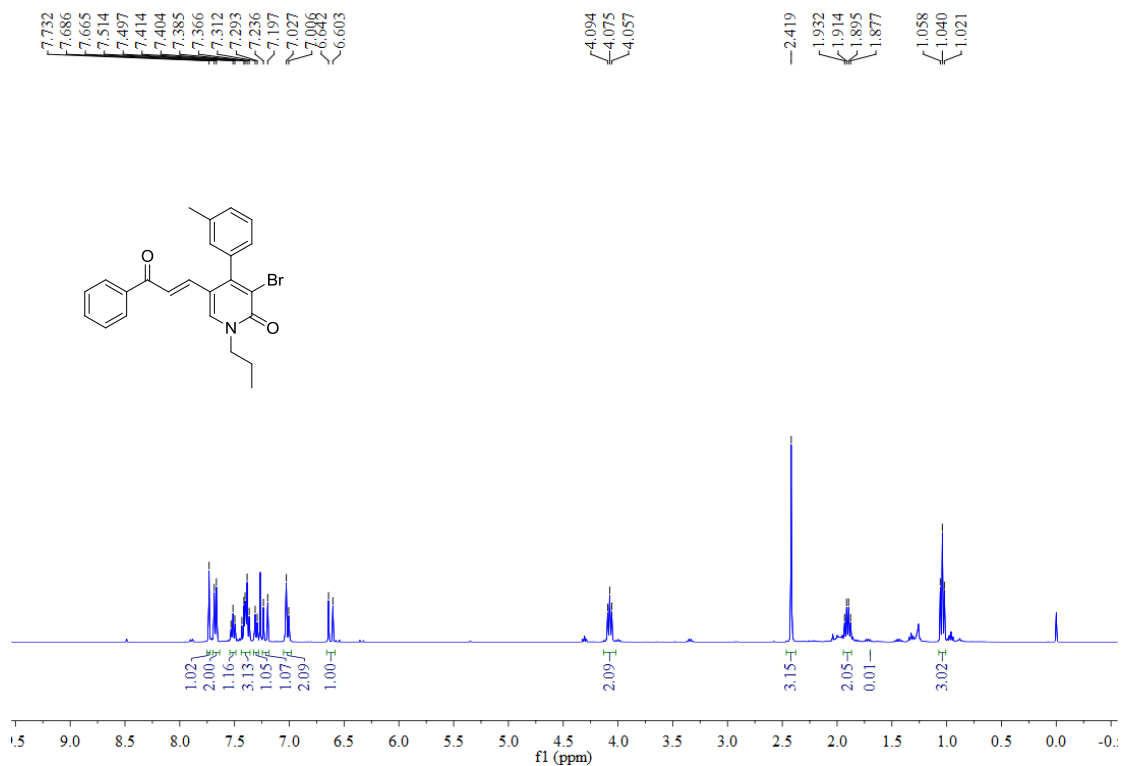
^1H NMR spectrum (400 MHz, CDCl_3) of **2q**



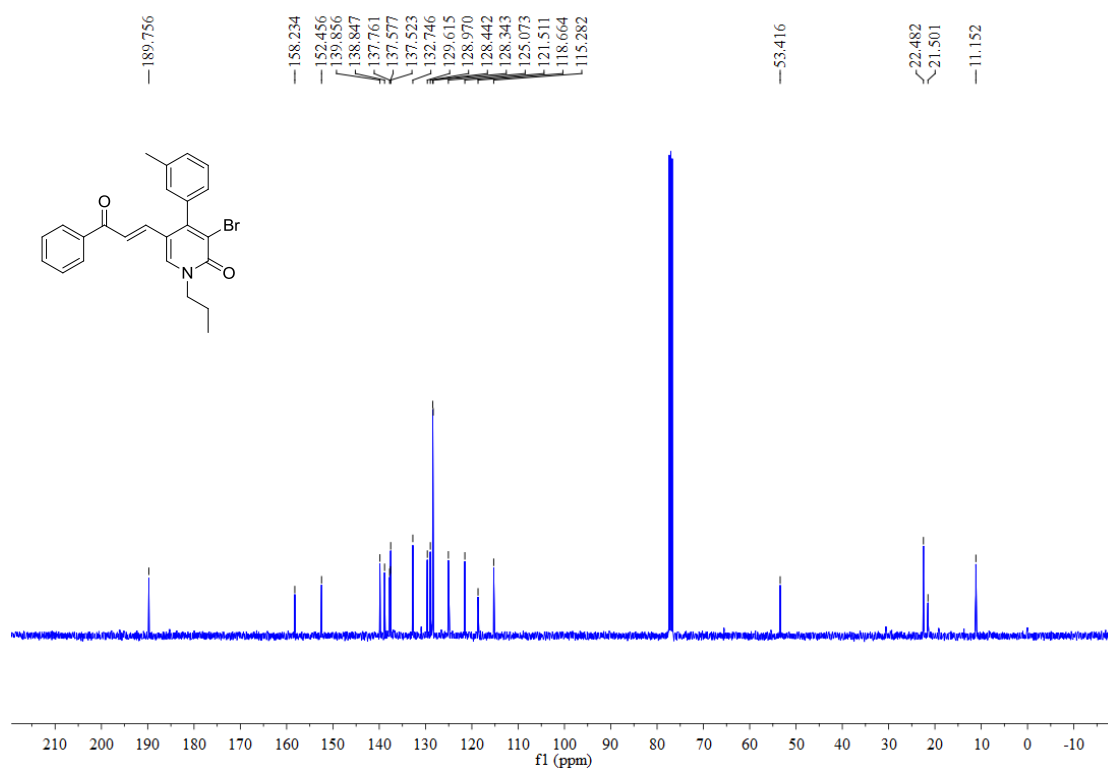
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2q**



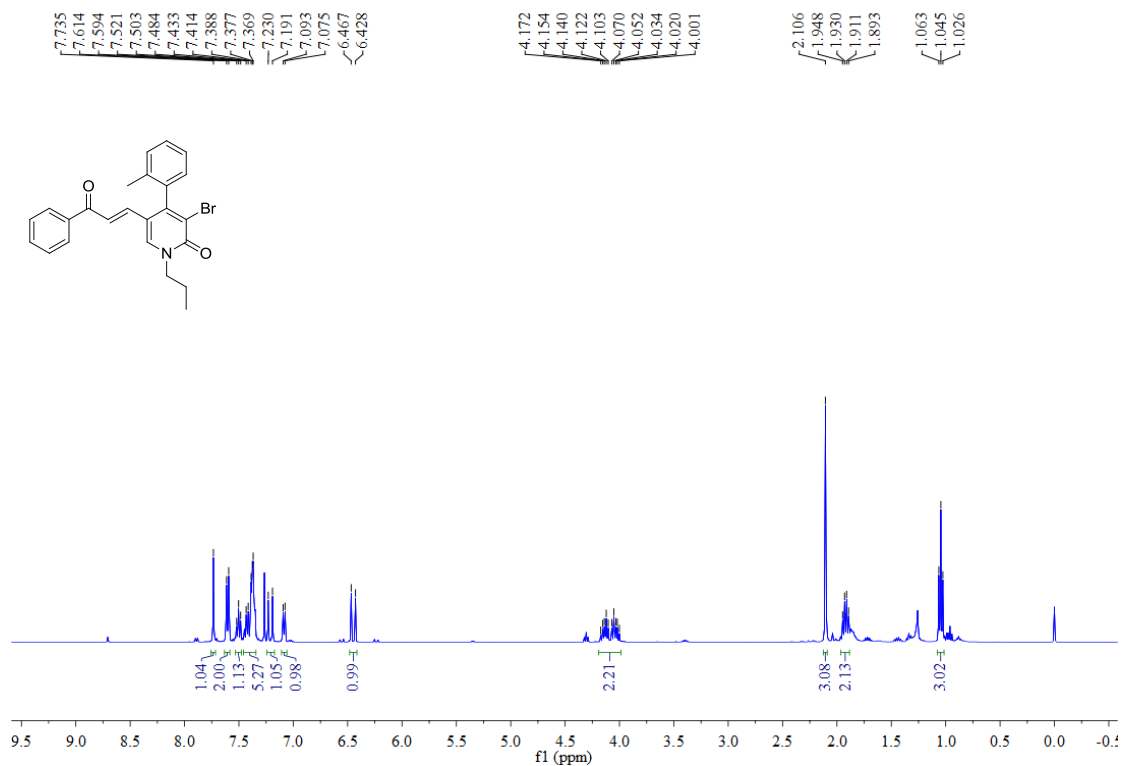
^1H NMR spectrum (400 MHz, CDCl_3) of **2r**



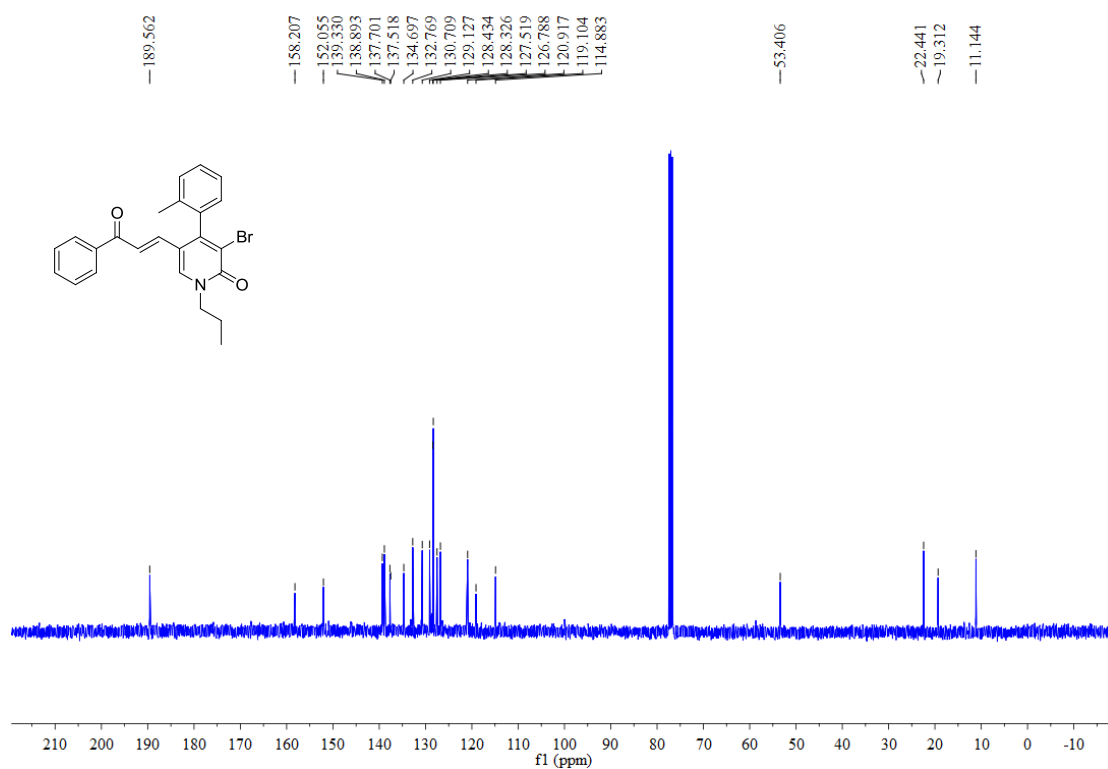
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2r**



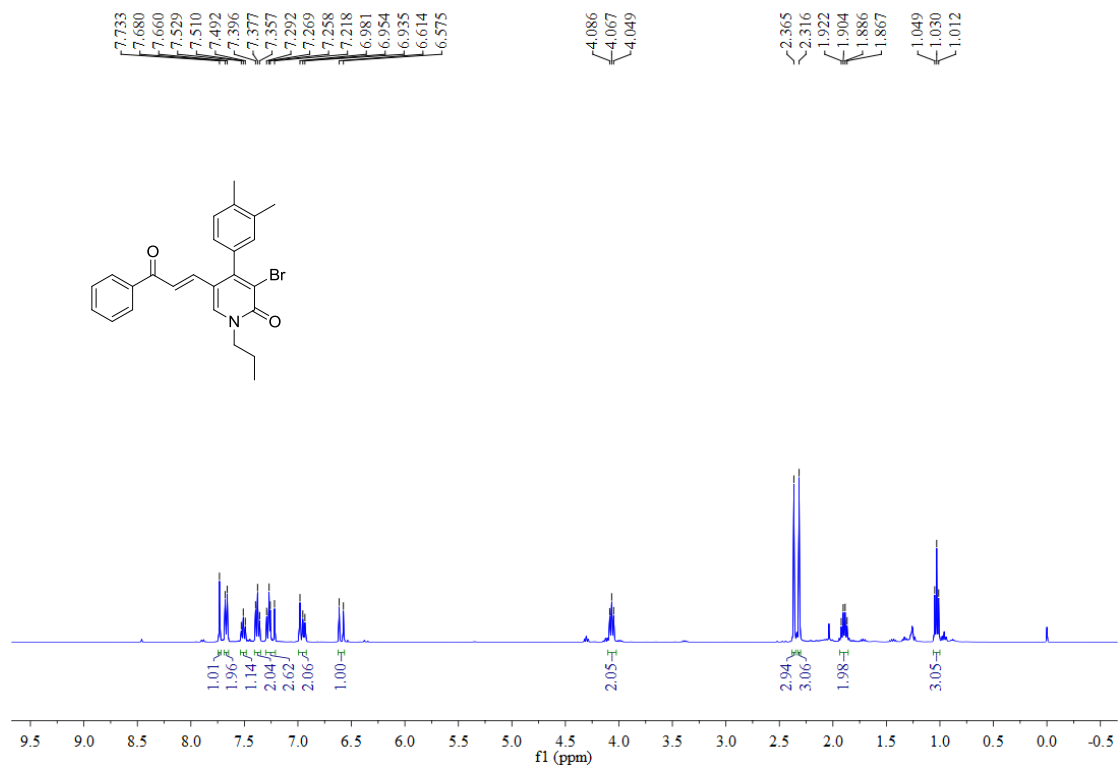
^1H NMR spectrum (400 MHz, CDCl_3) of **2s**



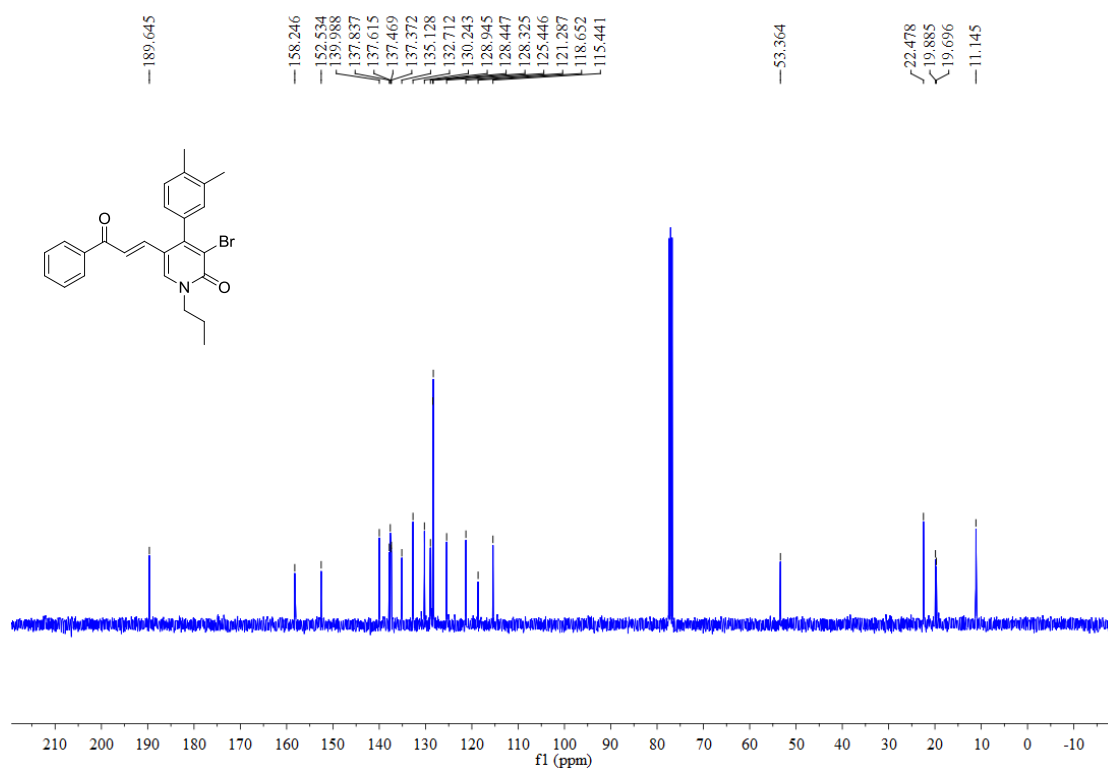
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2s**



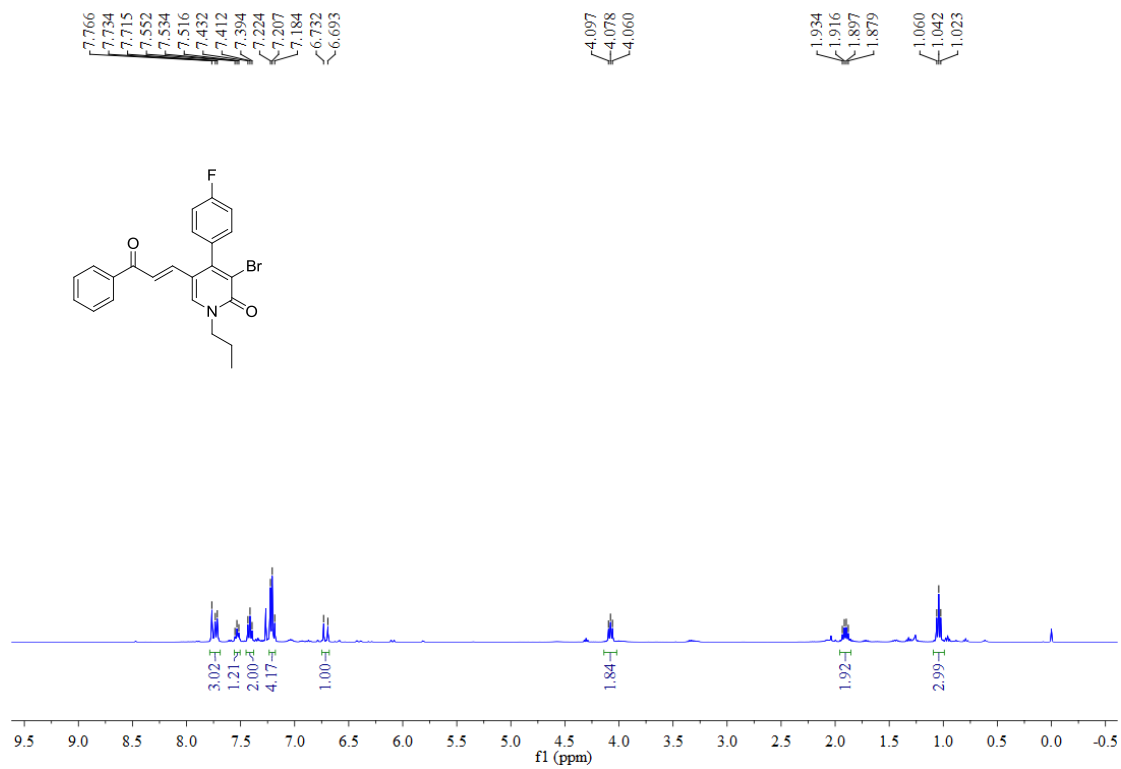
^1H NMR spectrum (400 MHz, CDCl_3) of **2t**



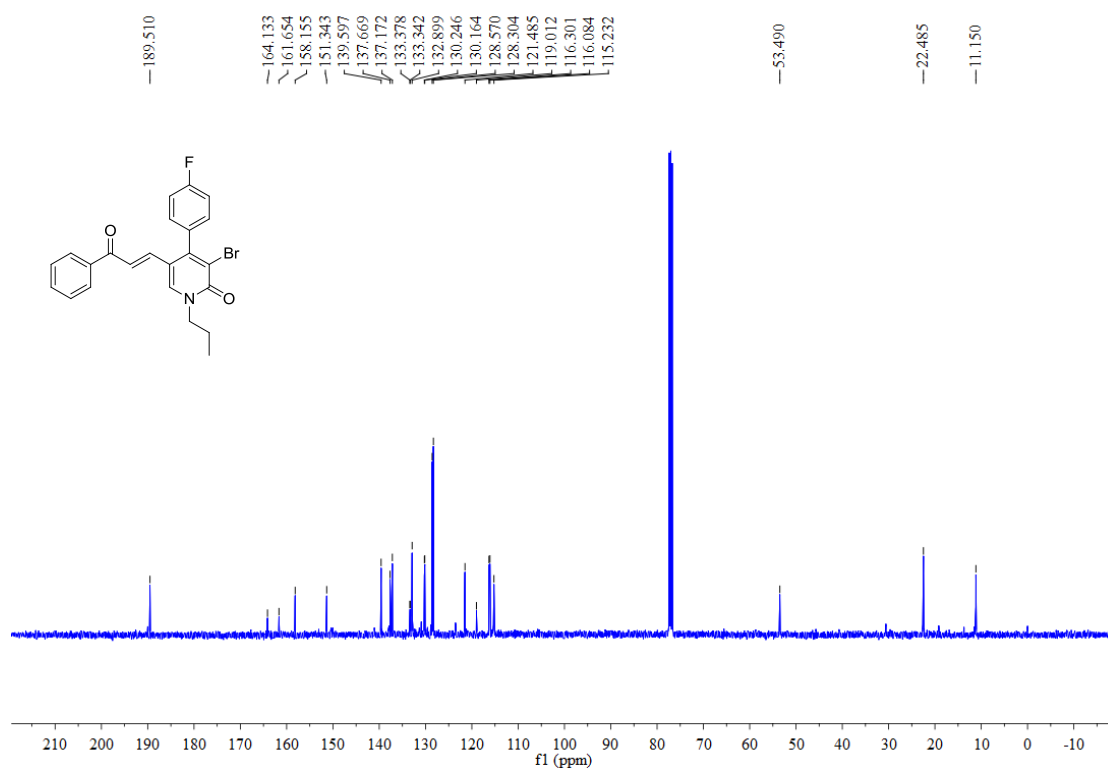
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2t**



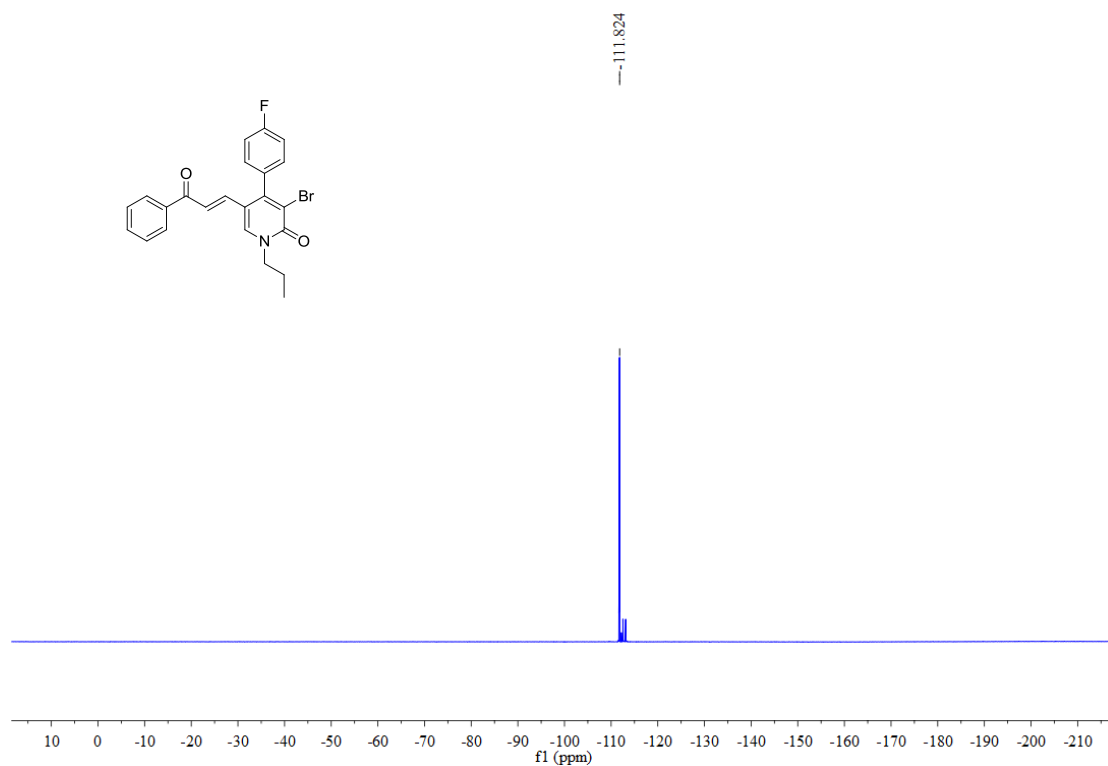
^1H NMR spectrum (400 MHz, CDCl_3) of **2u**



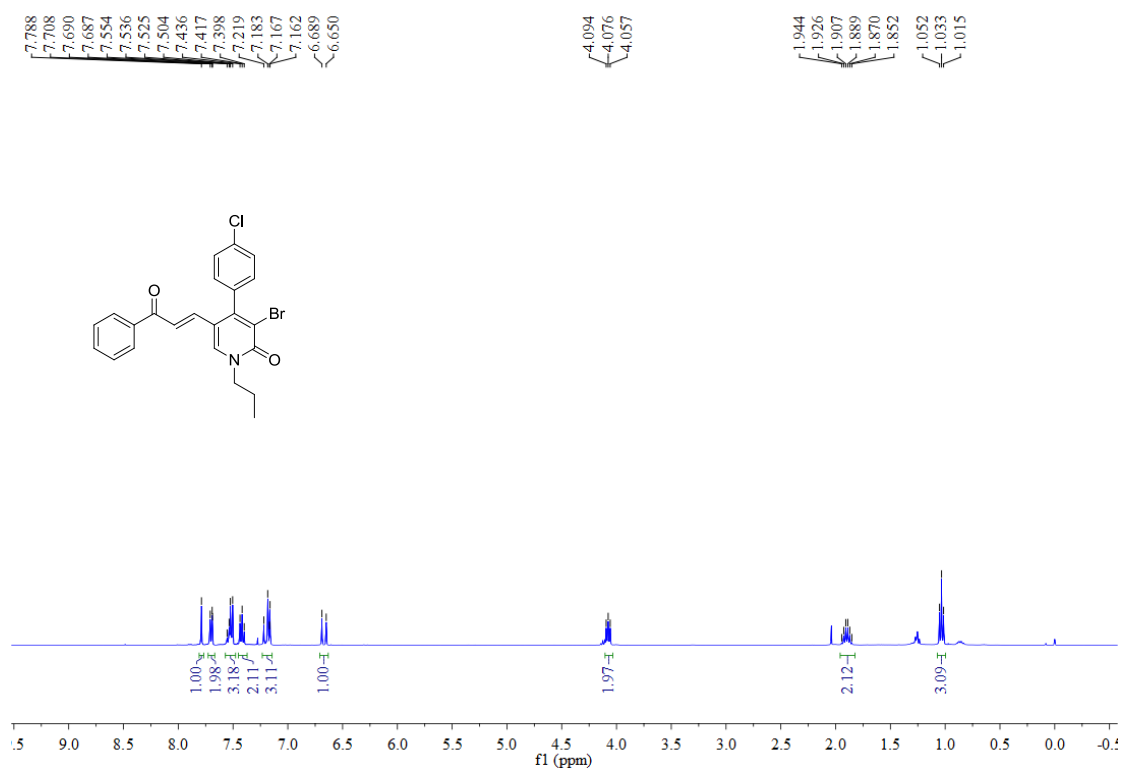
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2u**



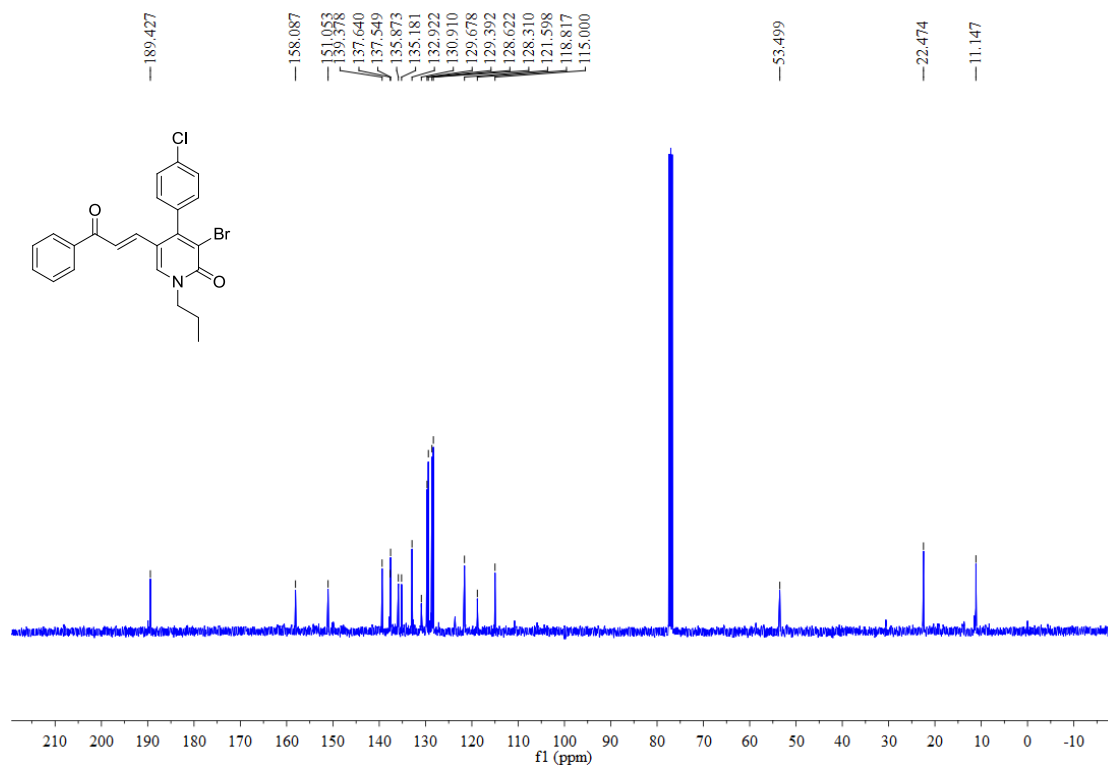
^{19}F NMR spectrum (100 MHz, CDCl_3) of **2u**



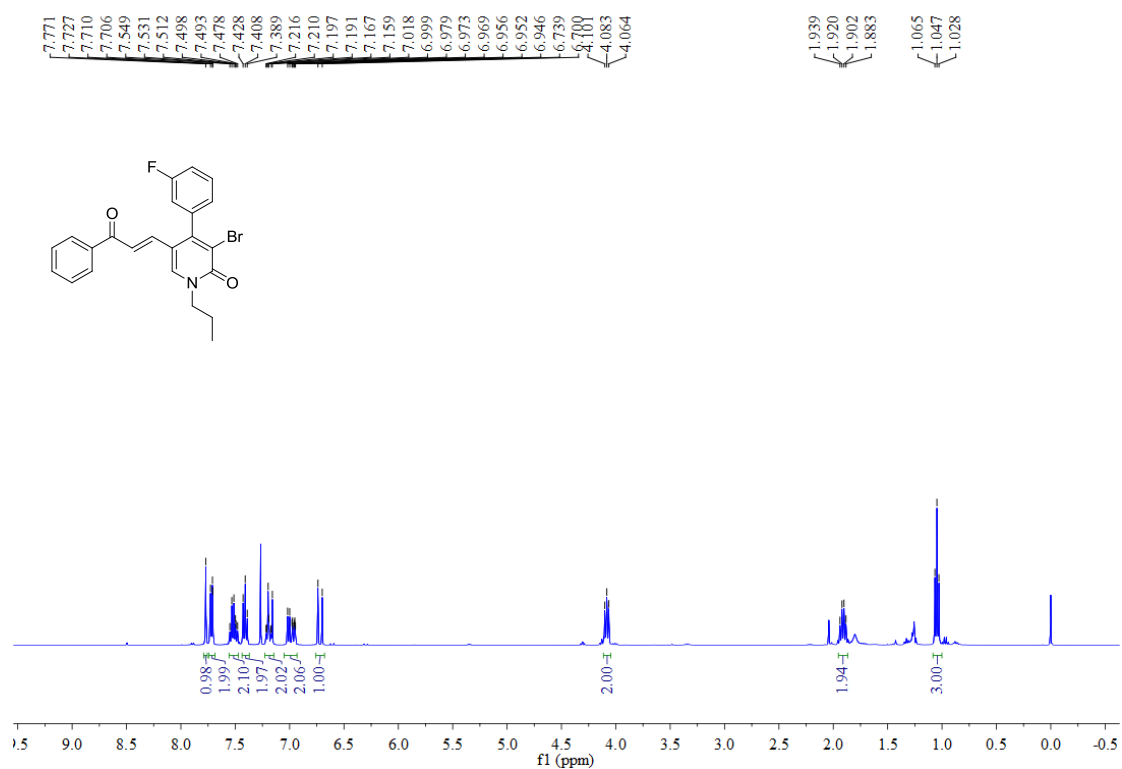
¹H NMR spectrum (400 MHz, CDCl₃) of **2v**



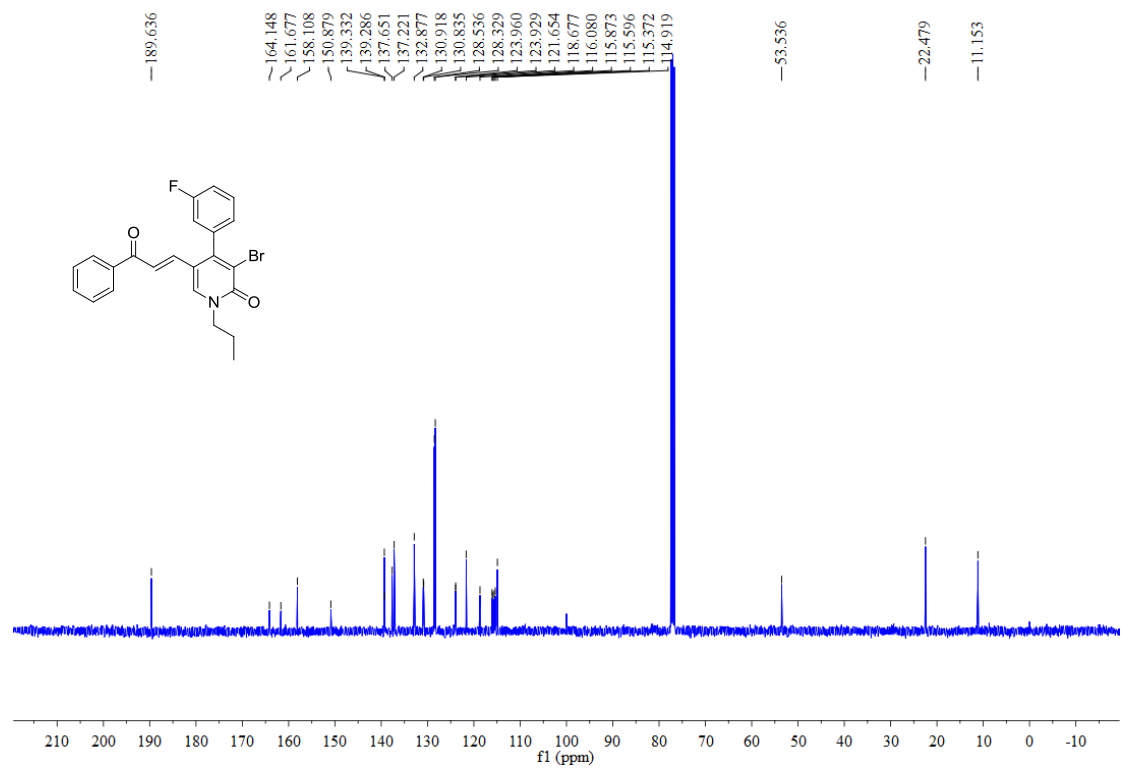
¹³C NMR spectrum (100 MHz, CDCl₃) of **2v**



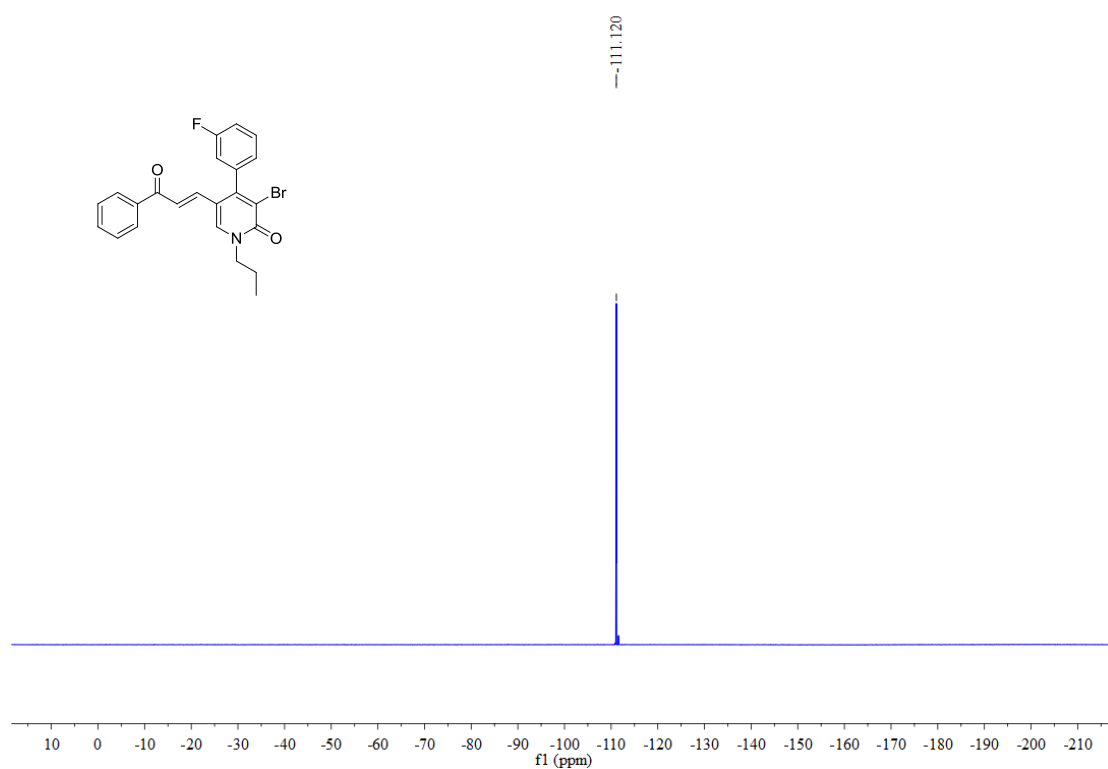
¹H NMR spectrum (400 MHz, CDCl₃) of **2w**



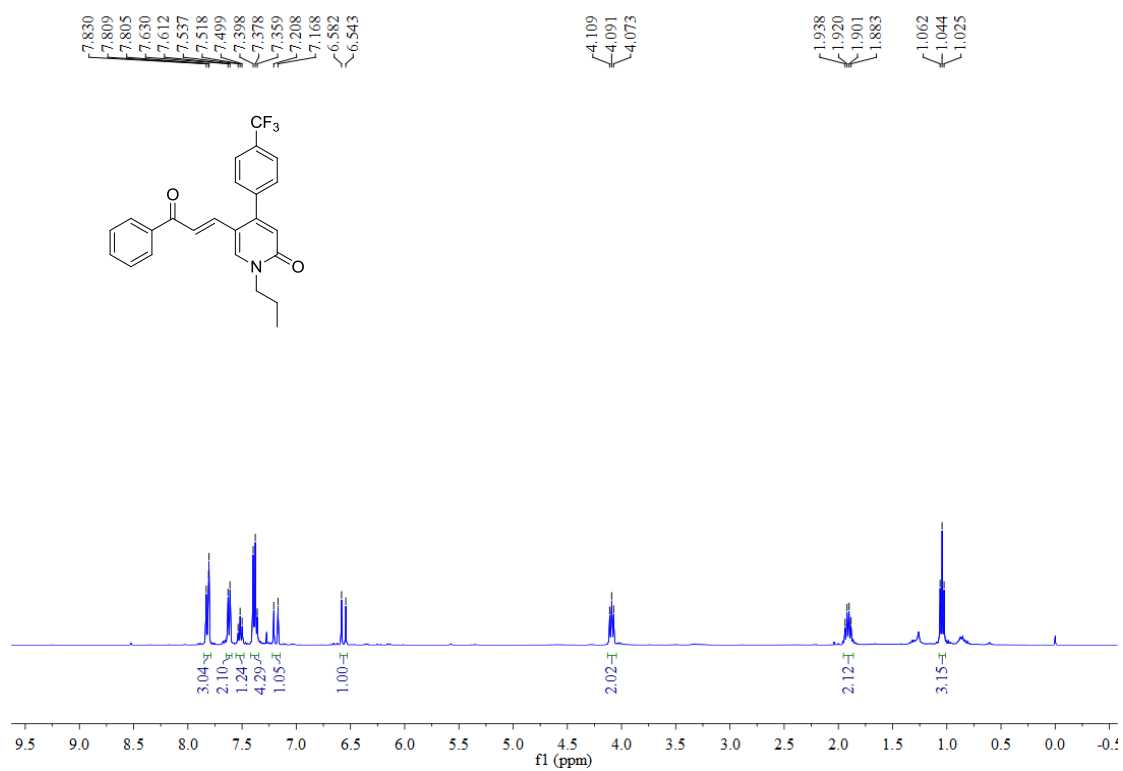
¹³C NMR spectrum (100 MHz, CDCl₃) of **2w**



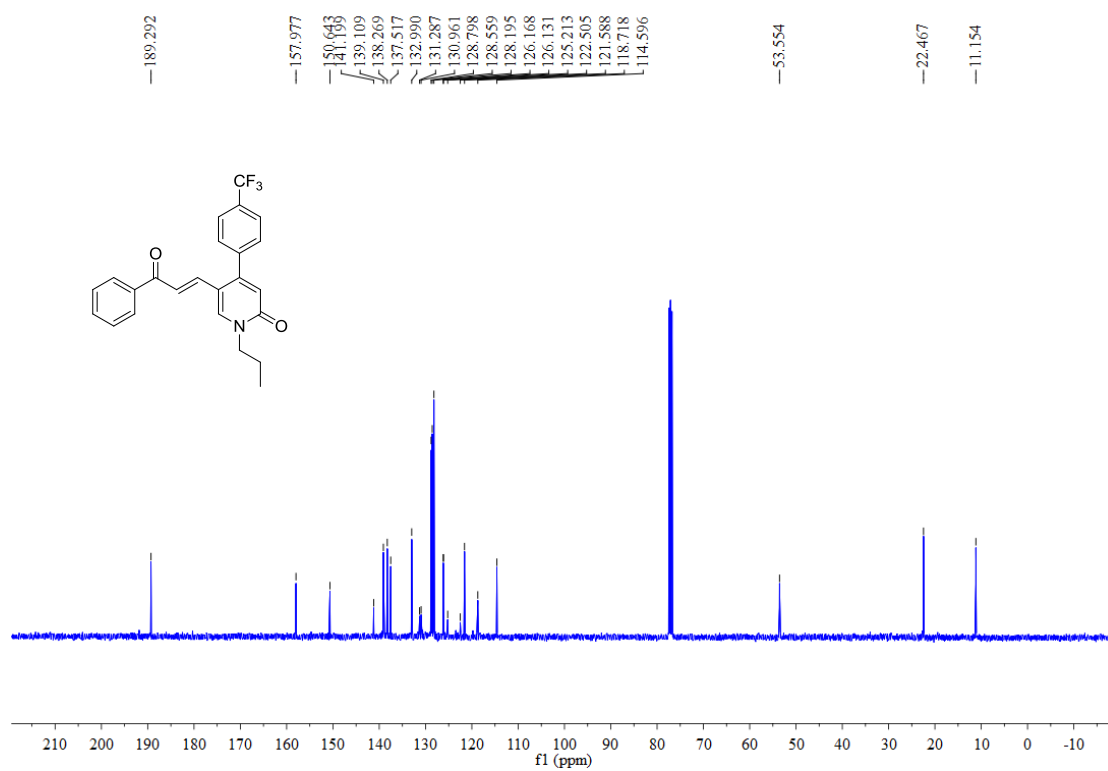
^{19}F NMR spectrum (376 MHz, CDCl_3) of **2w**



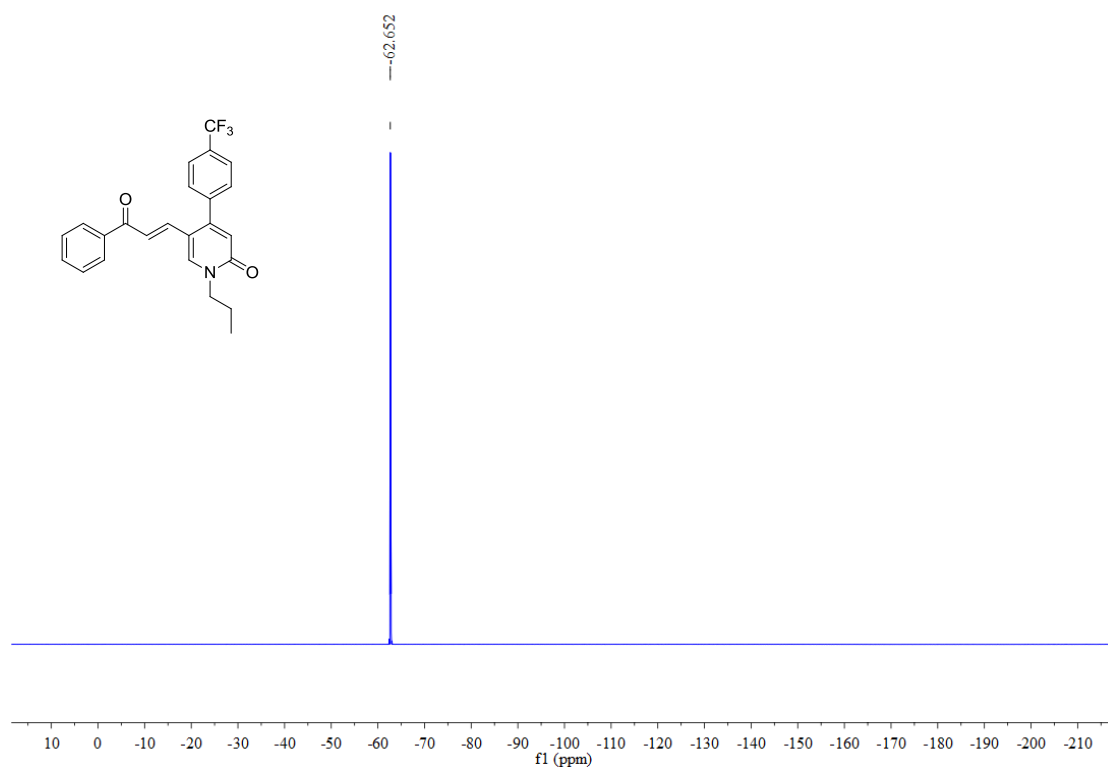
^1H NMR spectrum (400 MHz, CDCl_3) of **2y**



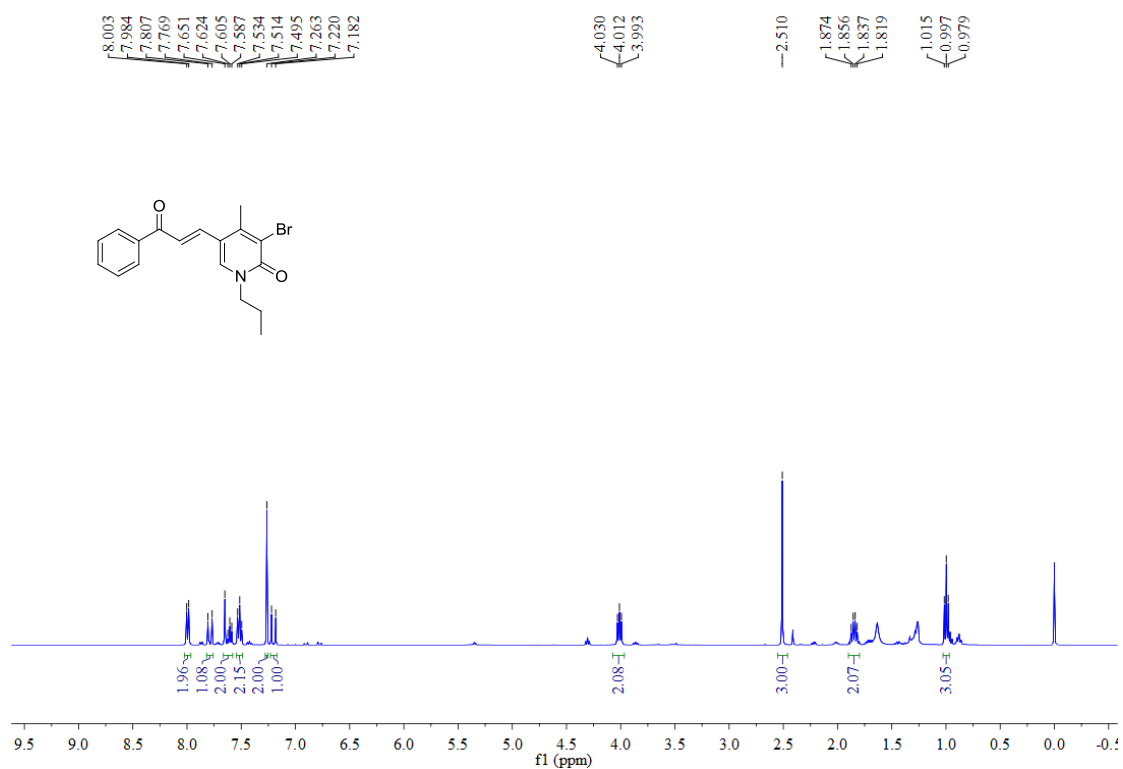
^{13}C NMR spectrum (100 MHz, CDCl_3) of **2y**



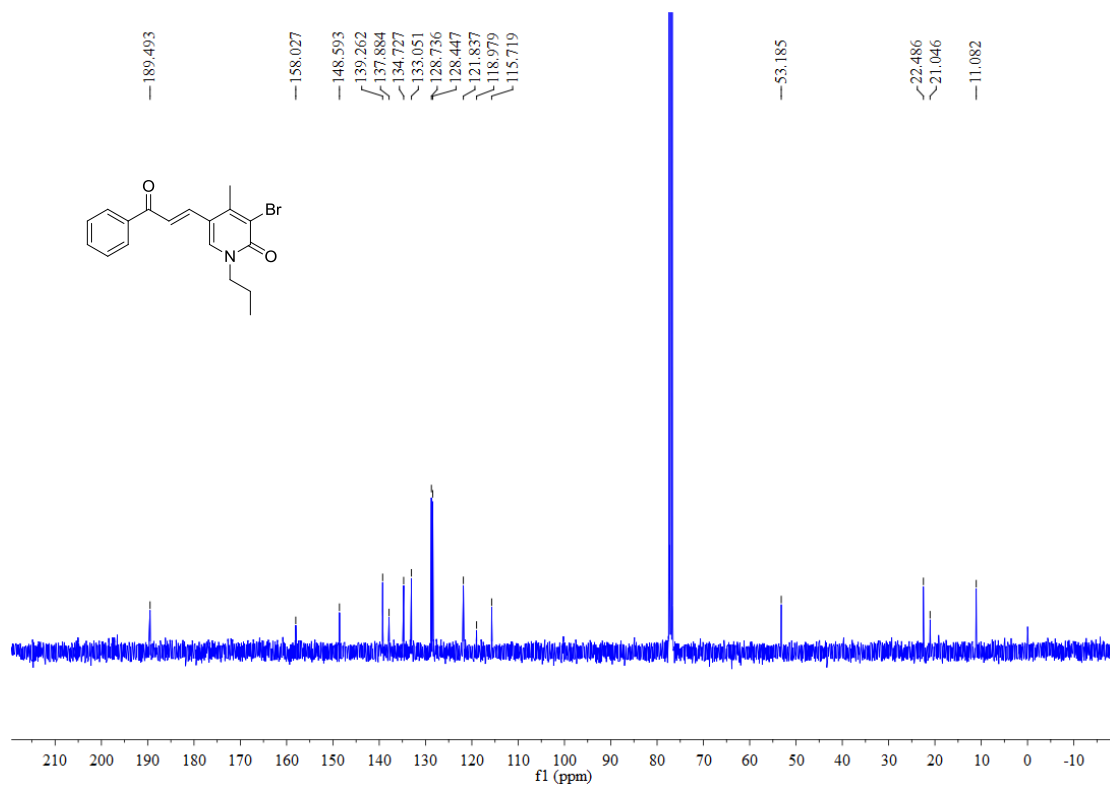
^{19}F NMR spectrum (376 MHz, CDCl_3) of **2y**



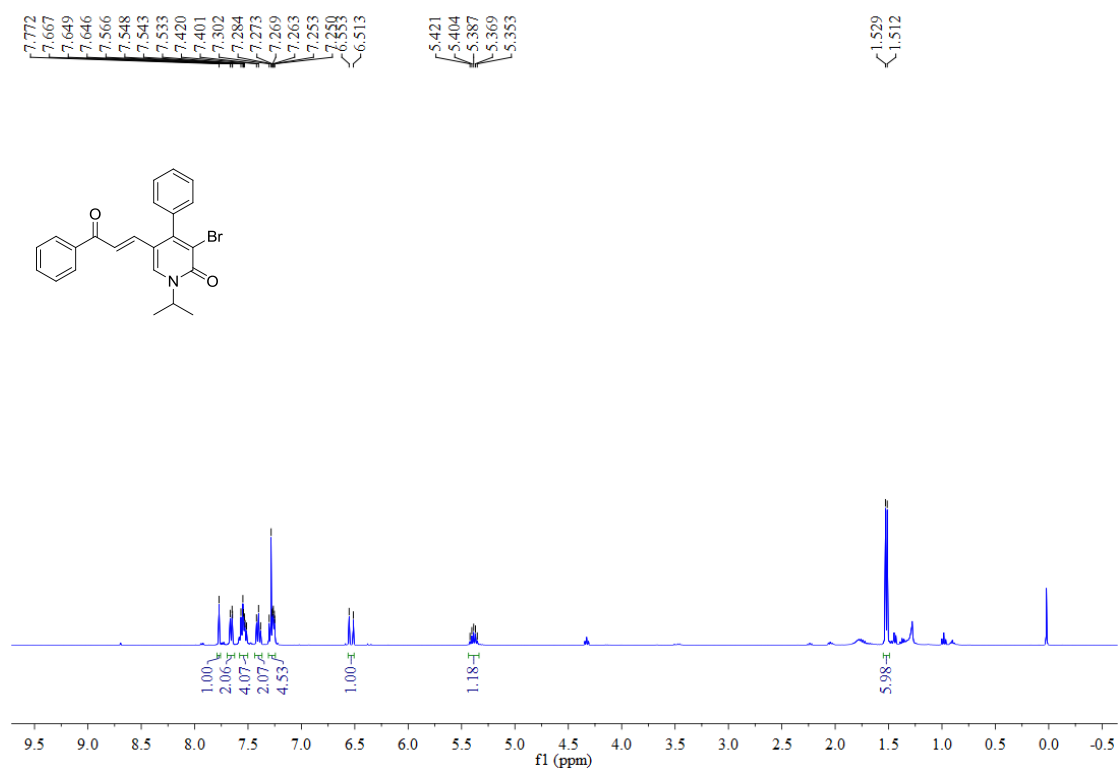
¹H NMR spectrum (400 MHz, CDCl₃) of **2z**



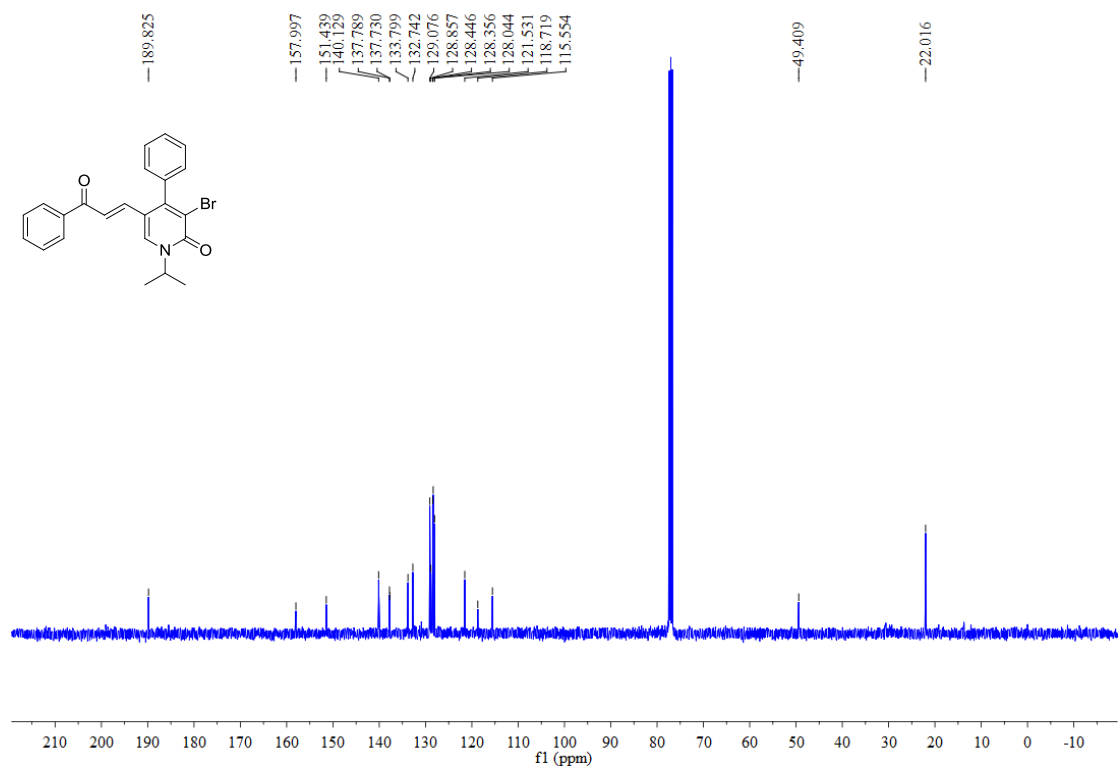
¹³C NMR spectrum (100 MHz, CDCl₃) of **2z**



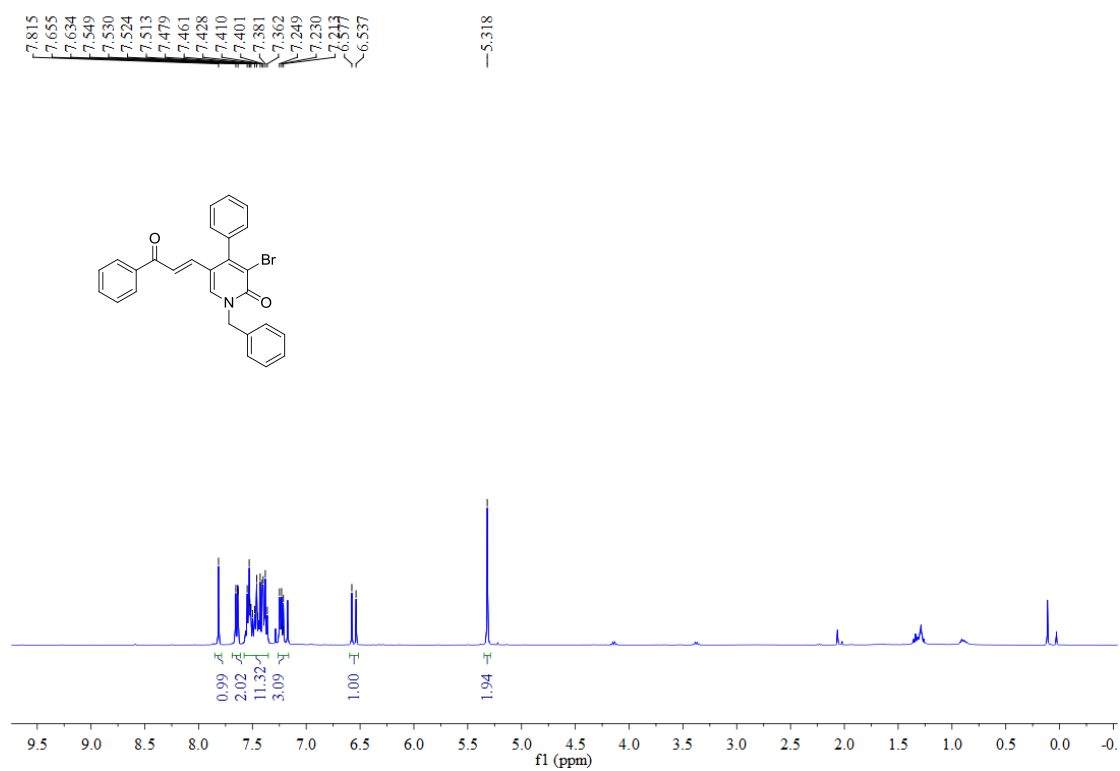
¹H NMR spectrum (400 MHz, CDCl₃) of **2aa**



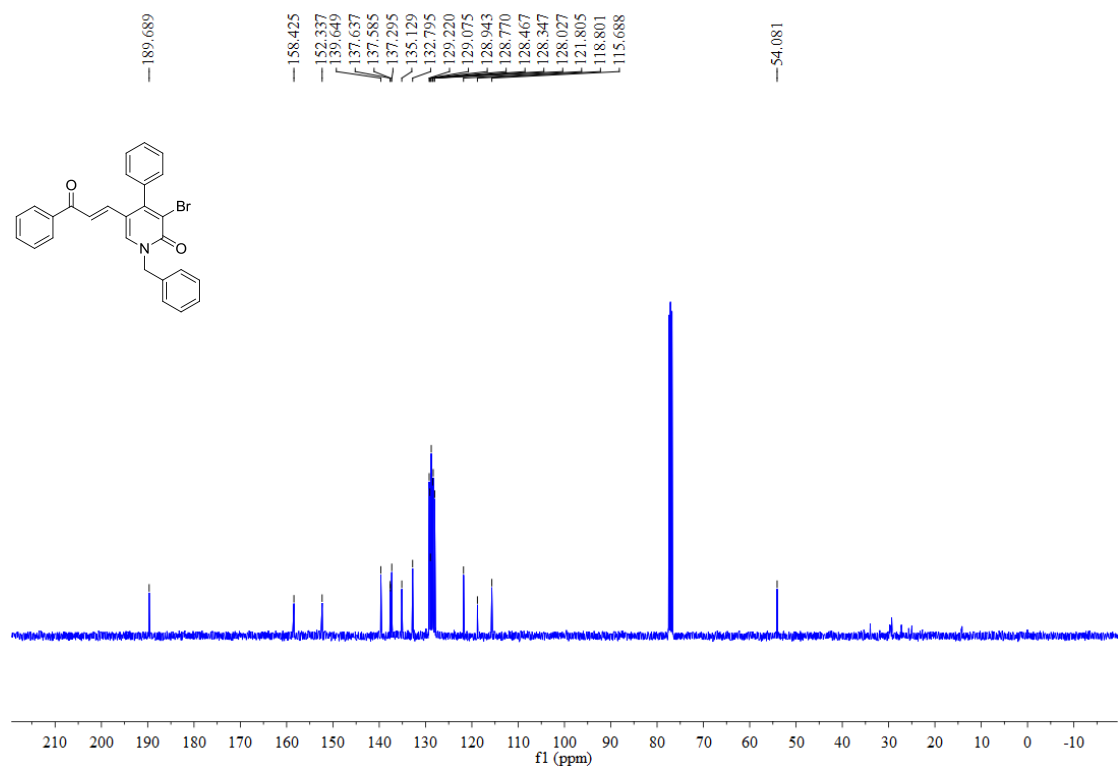
¹³C NMR spectrum (100 MHz, CDCl₃) of **2aa**



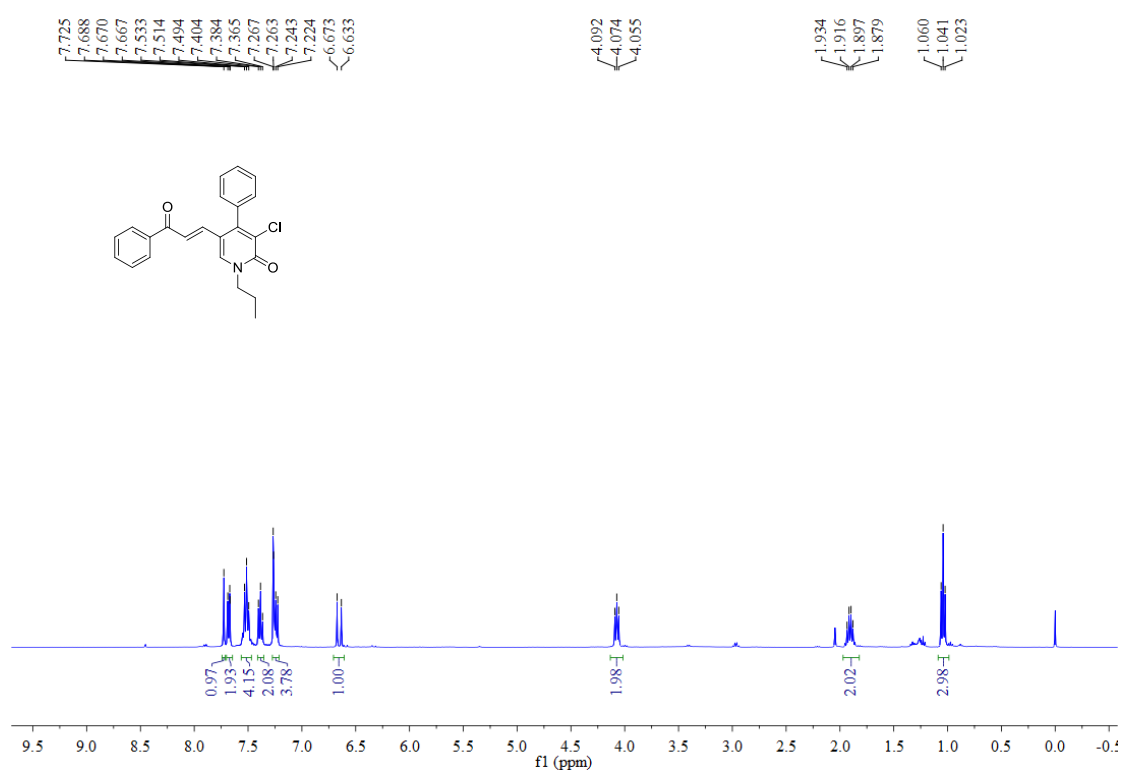
¹H NMR spectrum (400 MHz, CDCl₃) of **2ac**



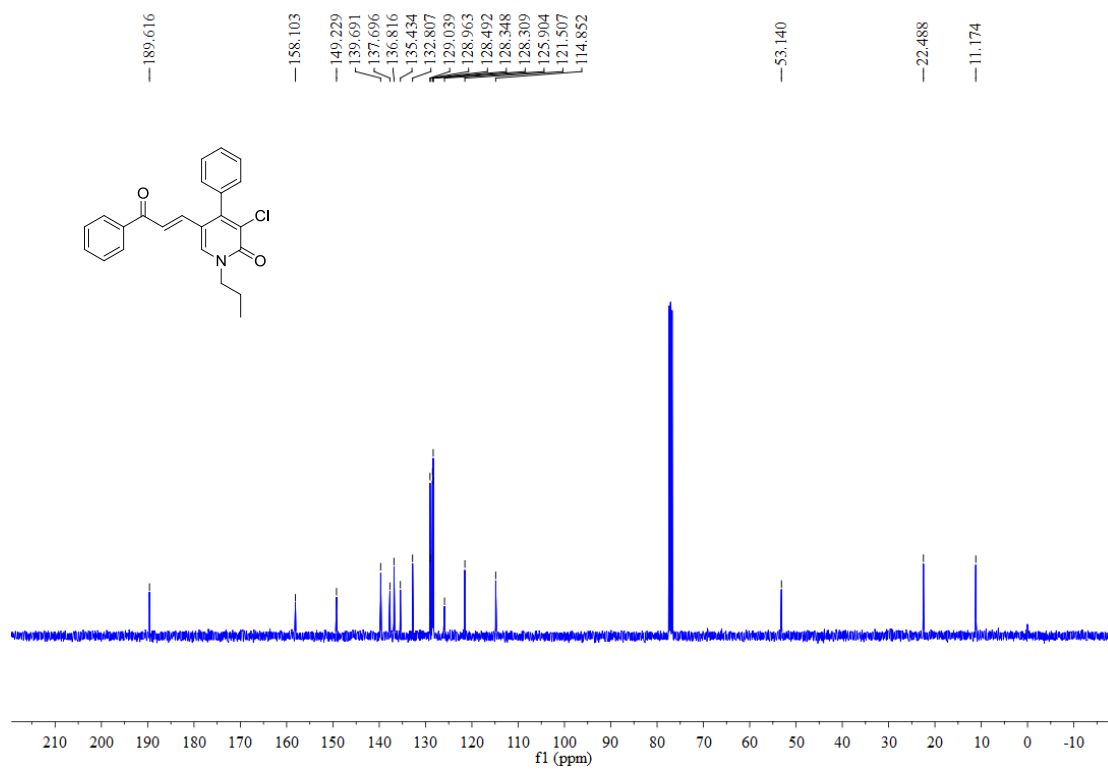
¹³C NMR spectrum (100 MHz, CDCl₃) of **2ac**



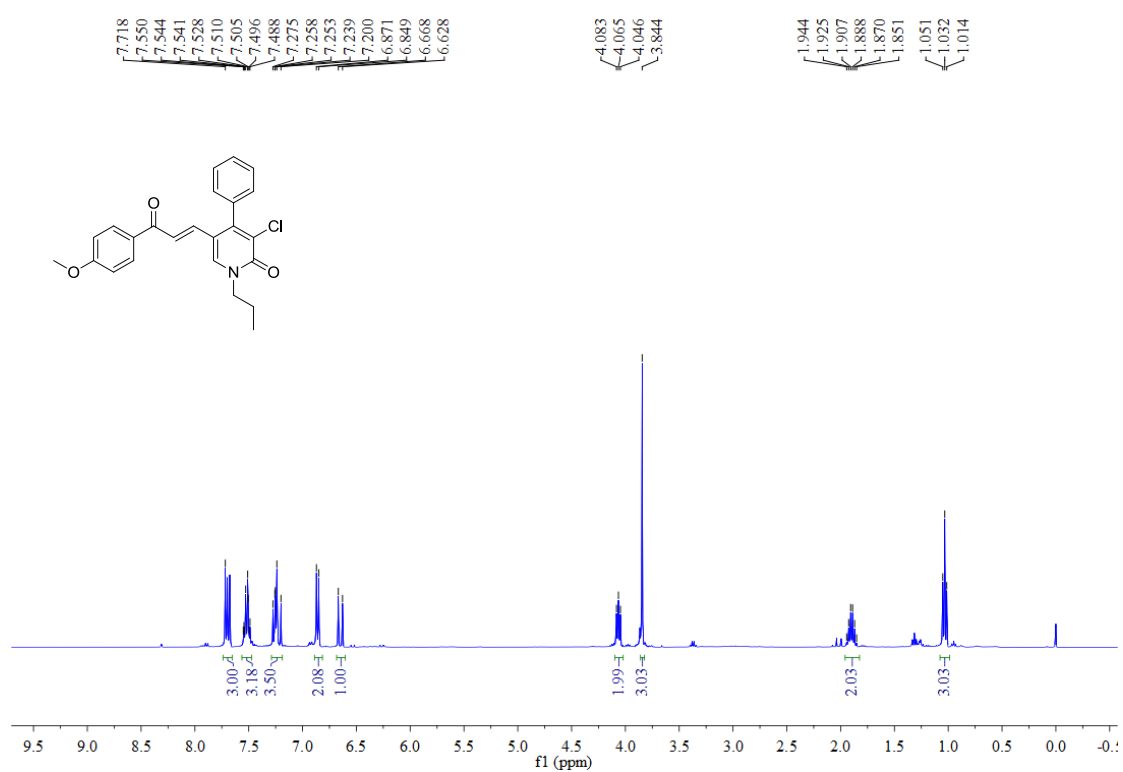
¹H NMR spectrum (400 MHz, CDCl₃) of **2ae**



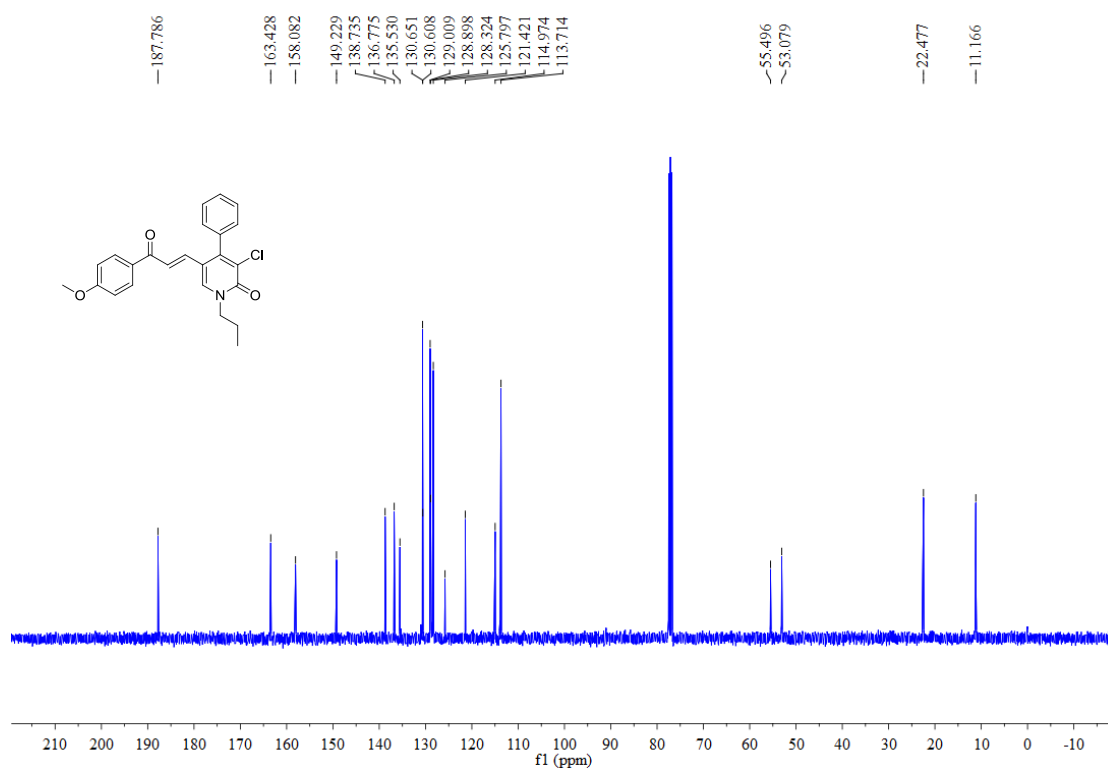
¹³C NMR spectrum (100 MHz, CDCl₃) of **2ae**



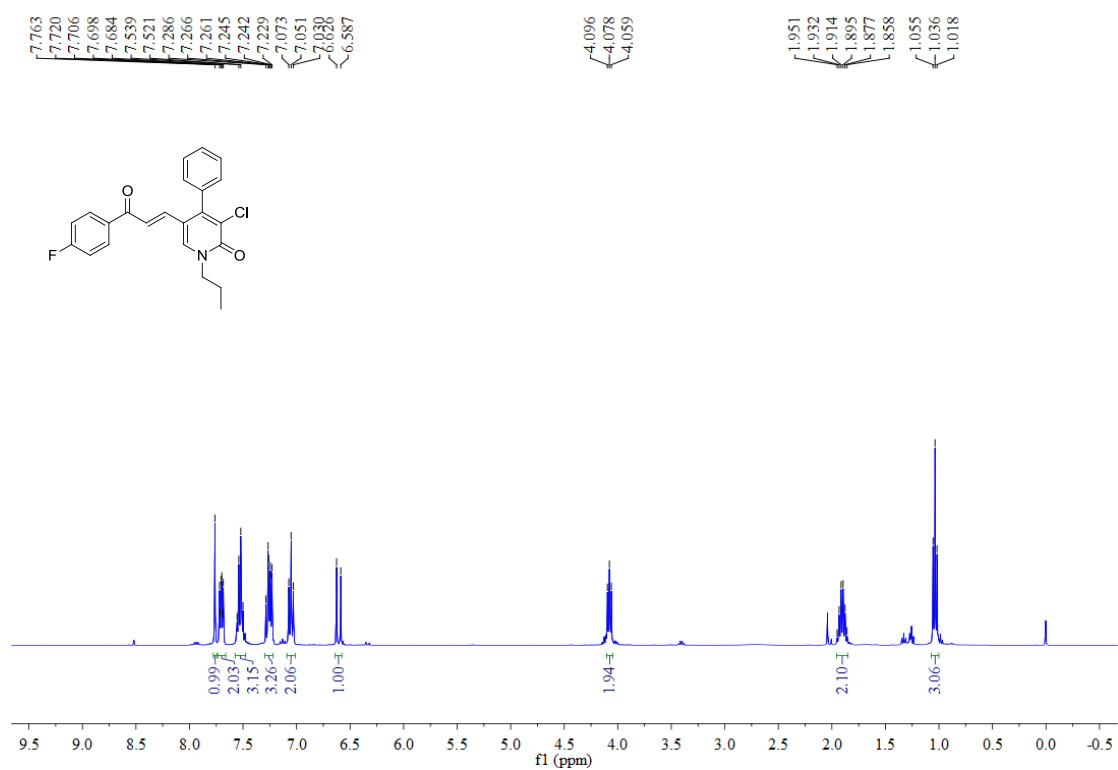
¹H NMR spectrum (400 MHz, CDCl₃) of **2af**



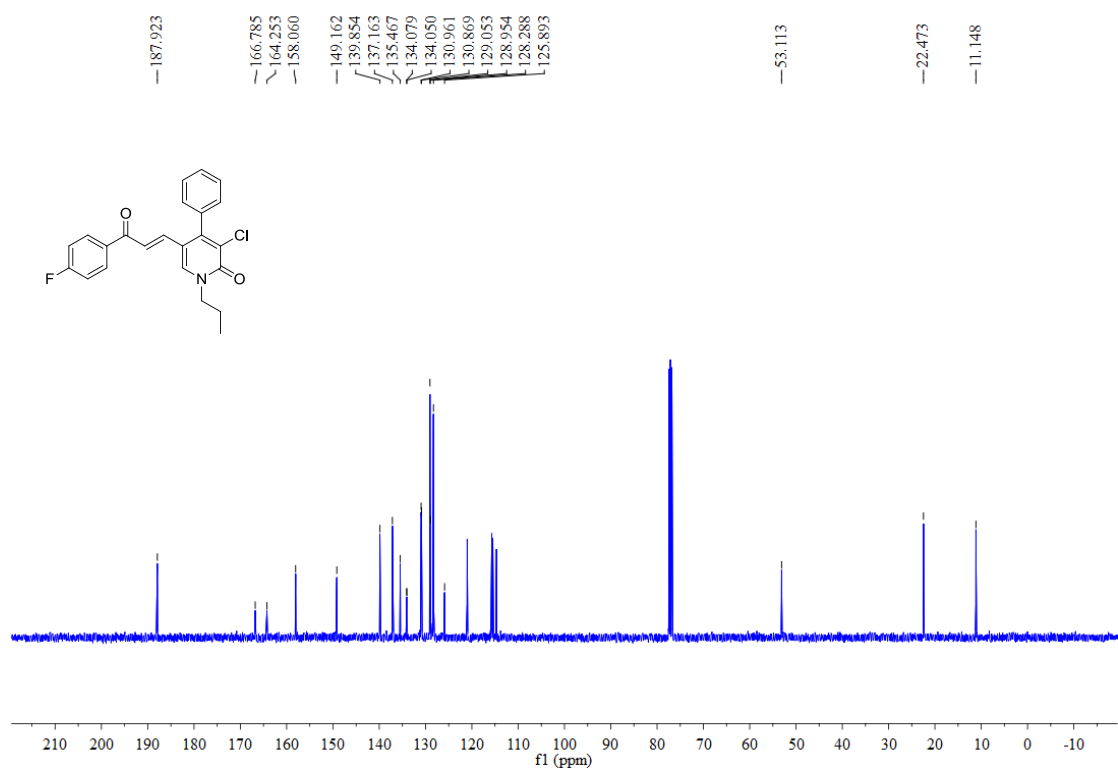
¹³C NMR spectrum (100 MHz, CDCl₃) of **2af**



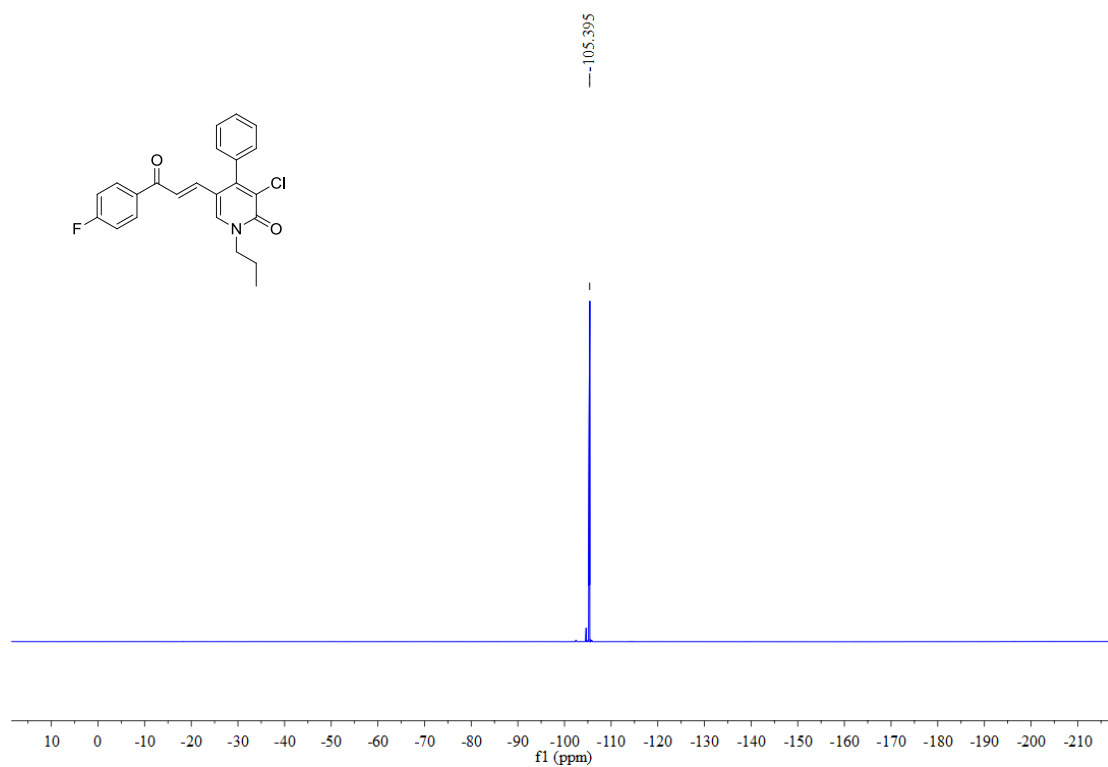
¹H NMR spectrum (400 MHz, CDCl₃) of **2ag**



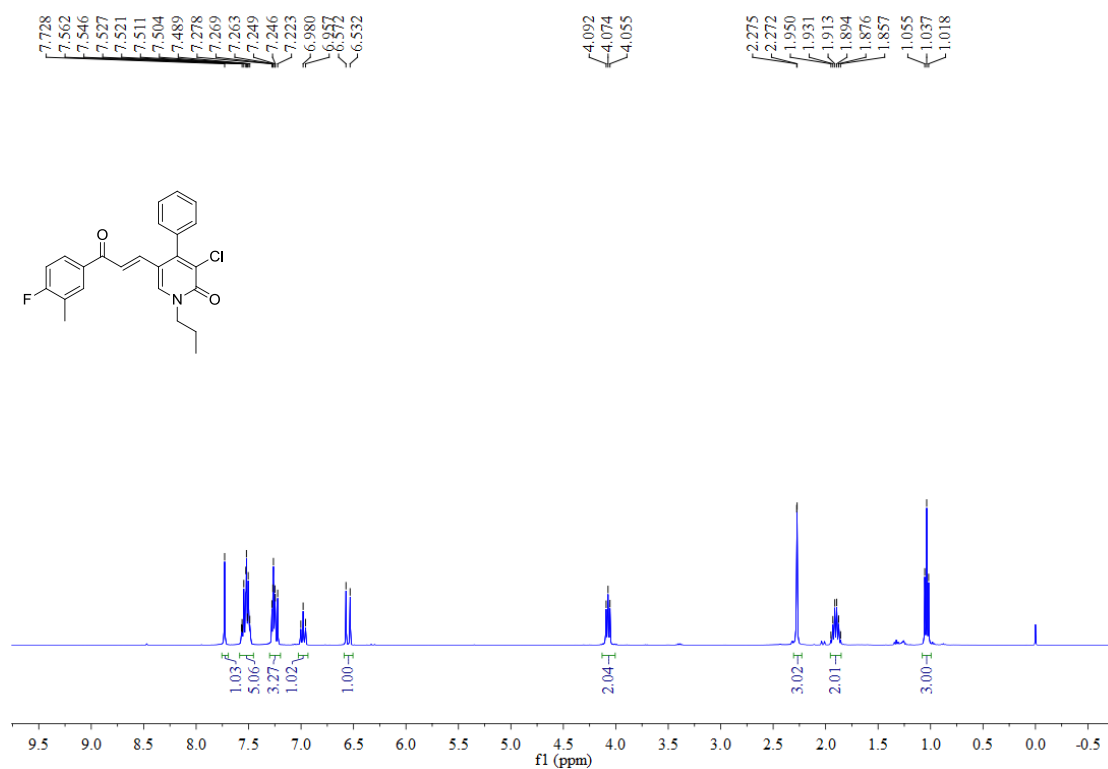
¹³C NMR spectrum (100 MHz, CDCl₃) of **2ag**



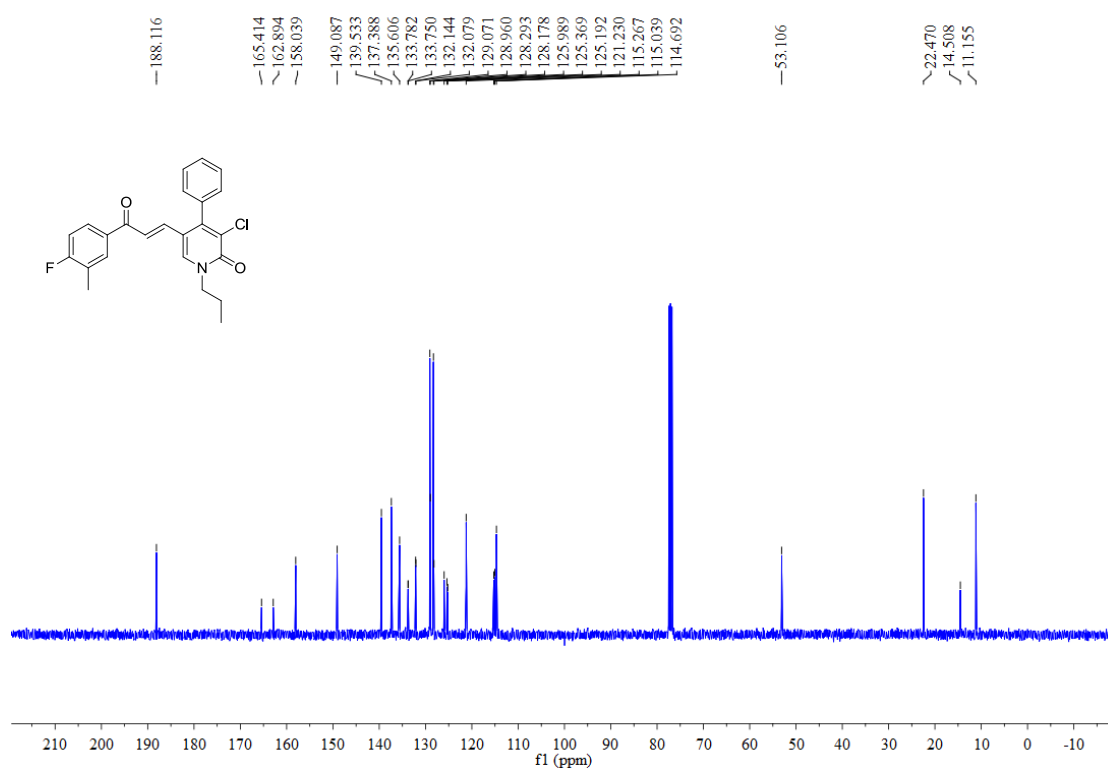
^{19}F NMR spectrum (376 MHz, CDCl_3) of **2ag**



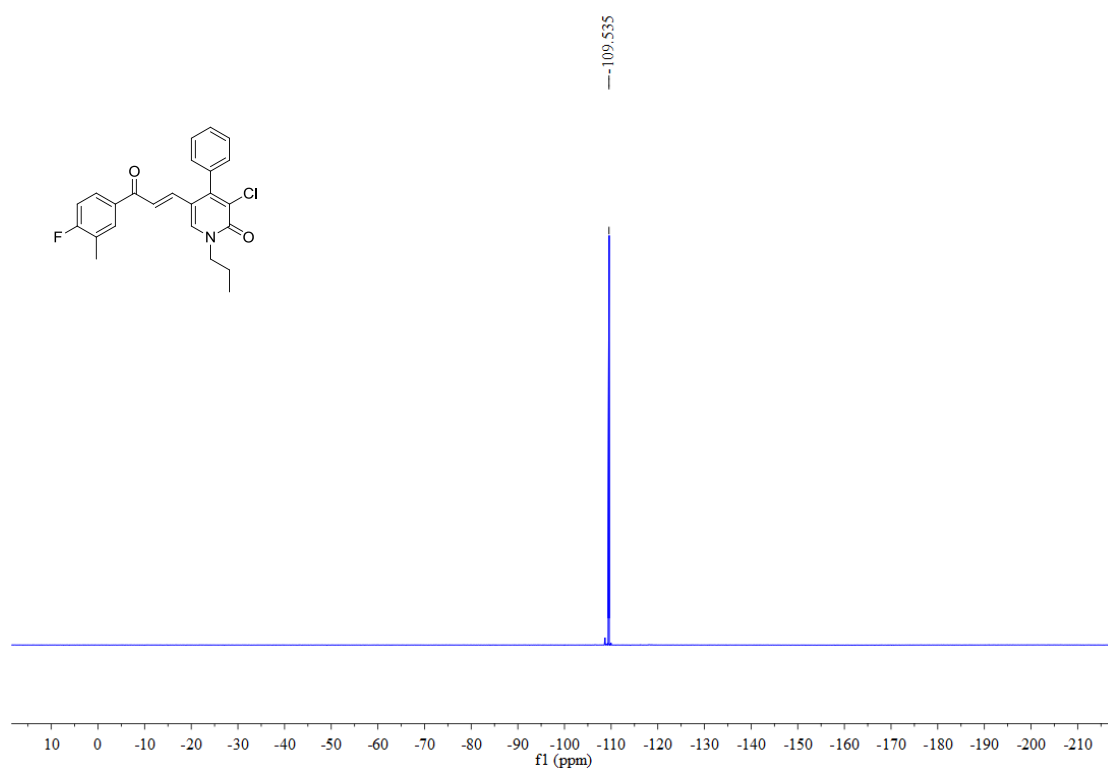
^1H NMR spectrum (400 MHz, CDCl_3) of **2ah**



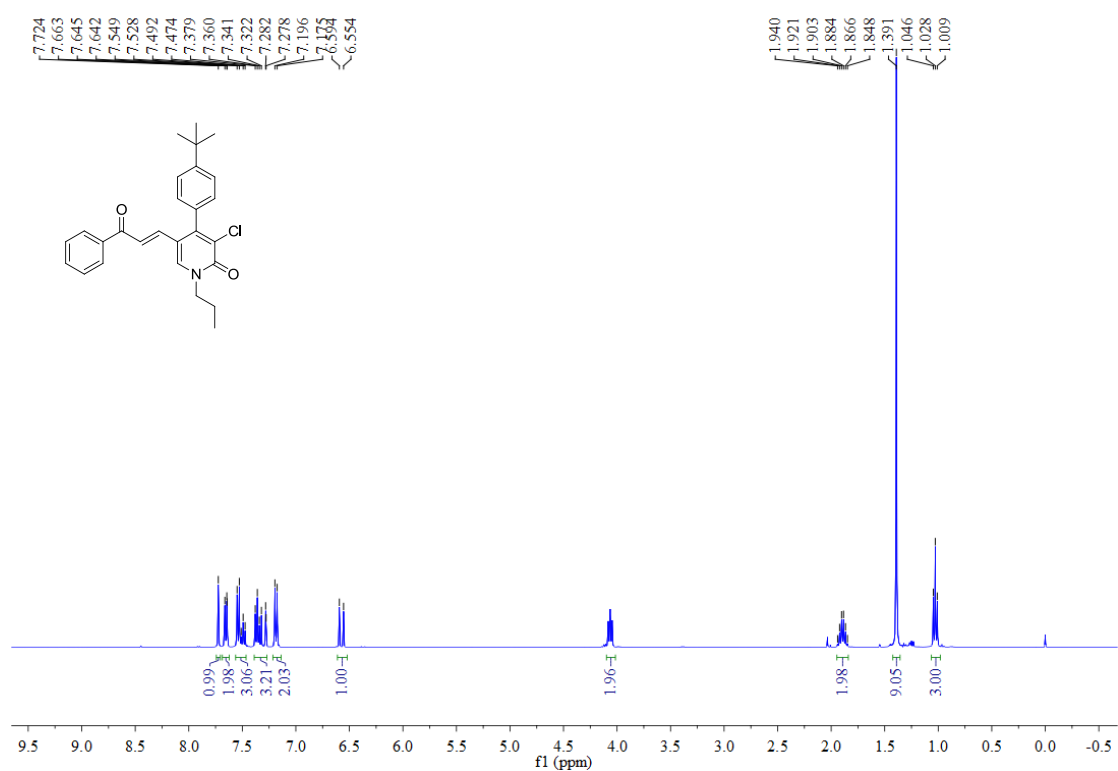
¹³C NMR spectrum (100 MHz, CDCl₃) of **2ah**



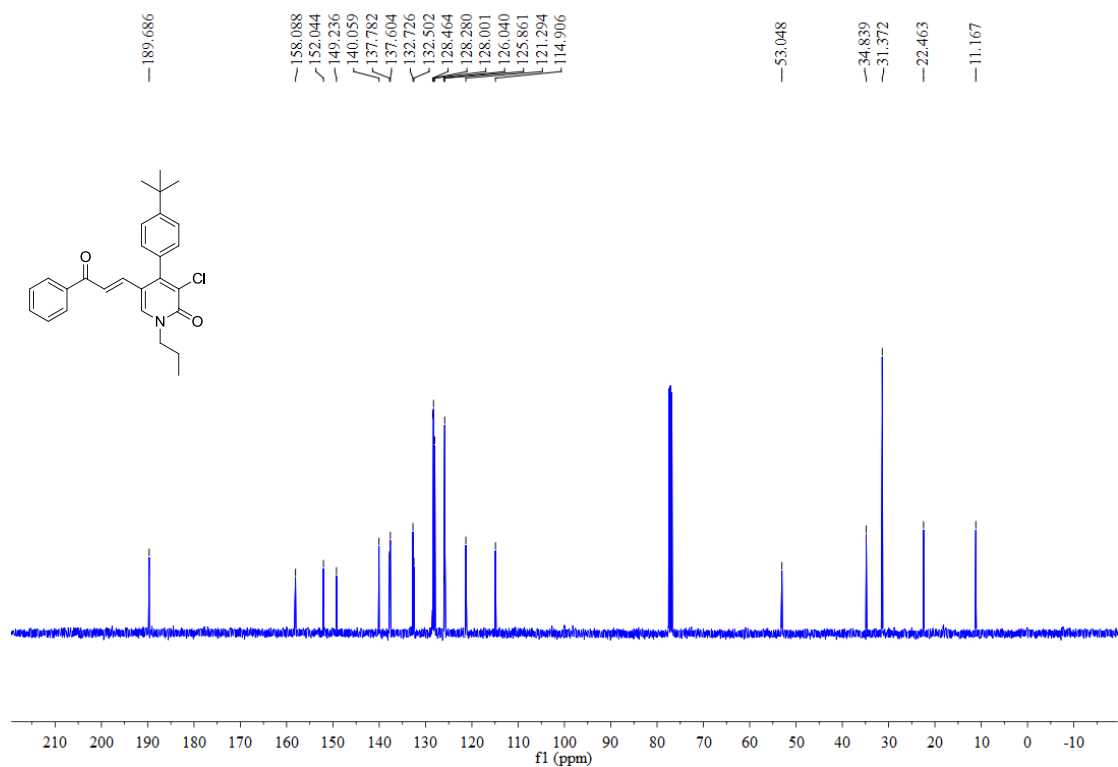
¹⁹F NMR spectrum (100 MHz, CDCl₃) of **2ah**



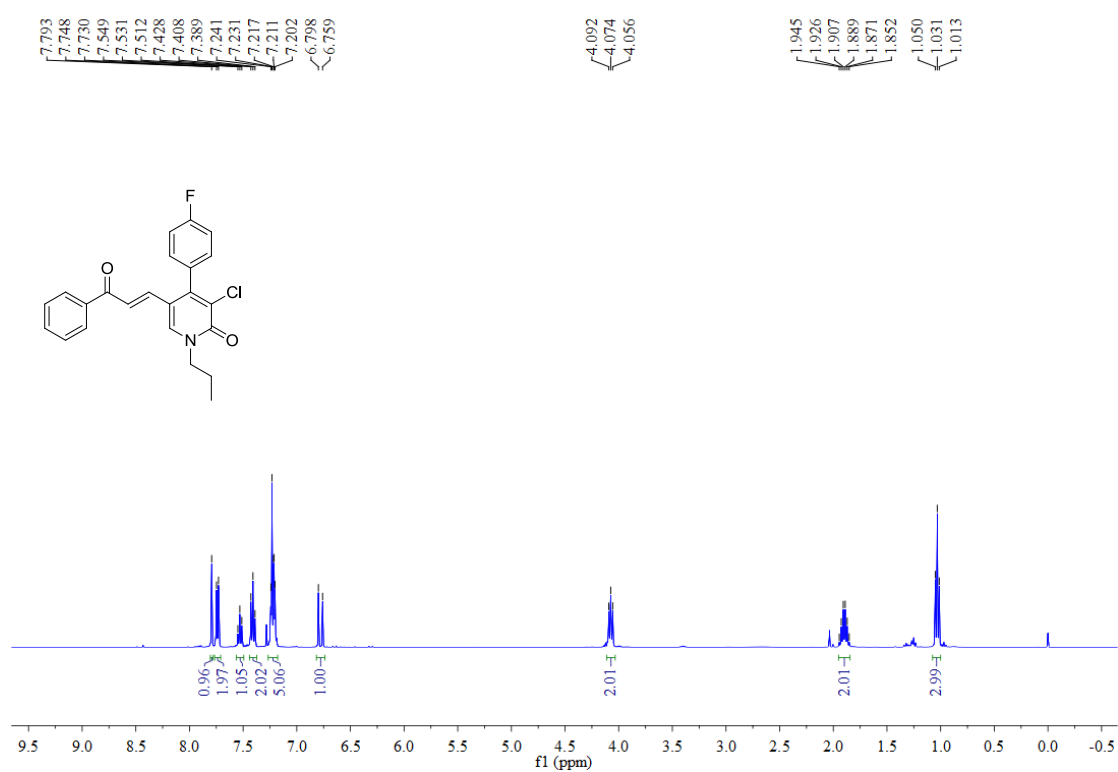
¹H NMR spectrum (400 MHz, CDCl₃) of **2ai**



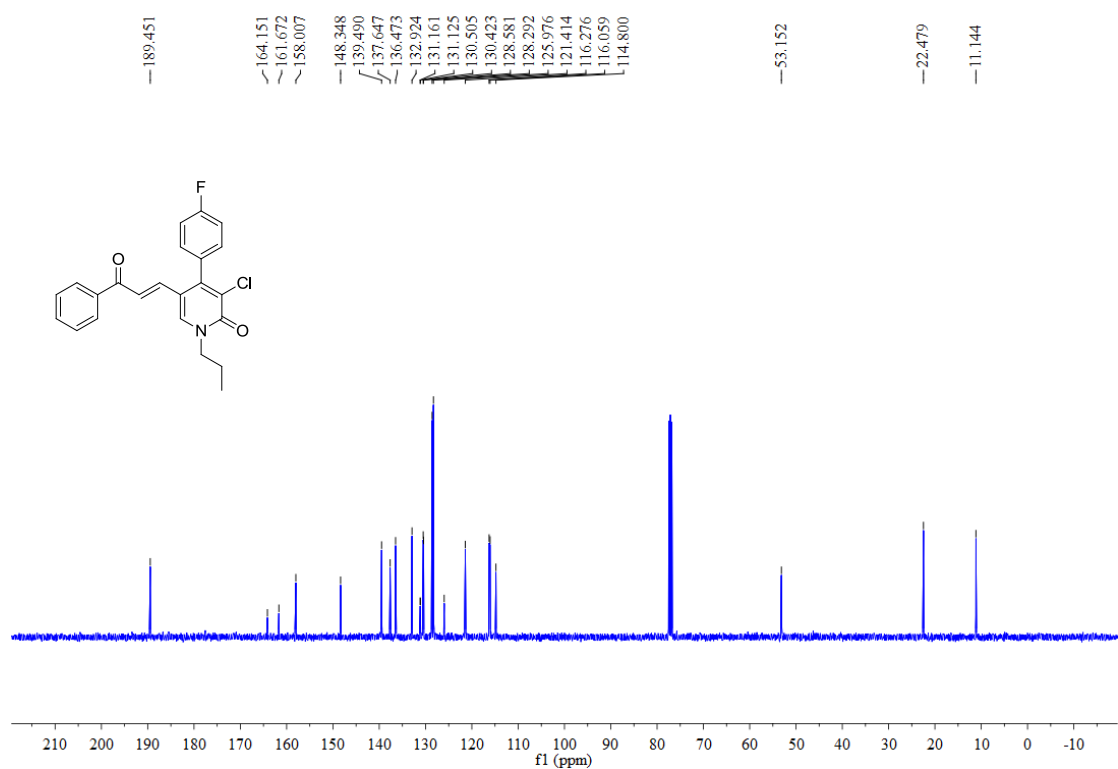
¹³C NMR spectrum (100 MHz, CDCl₃) of **2ai**



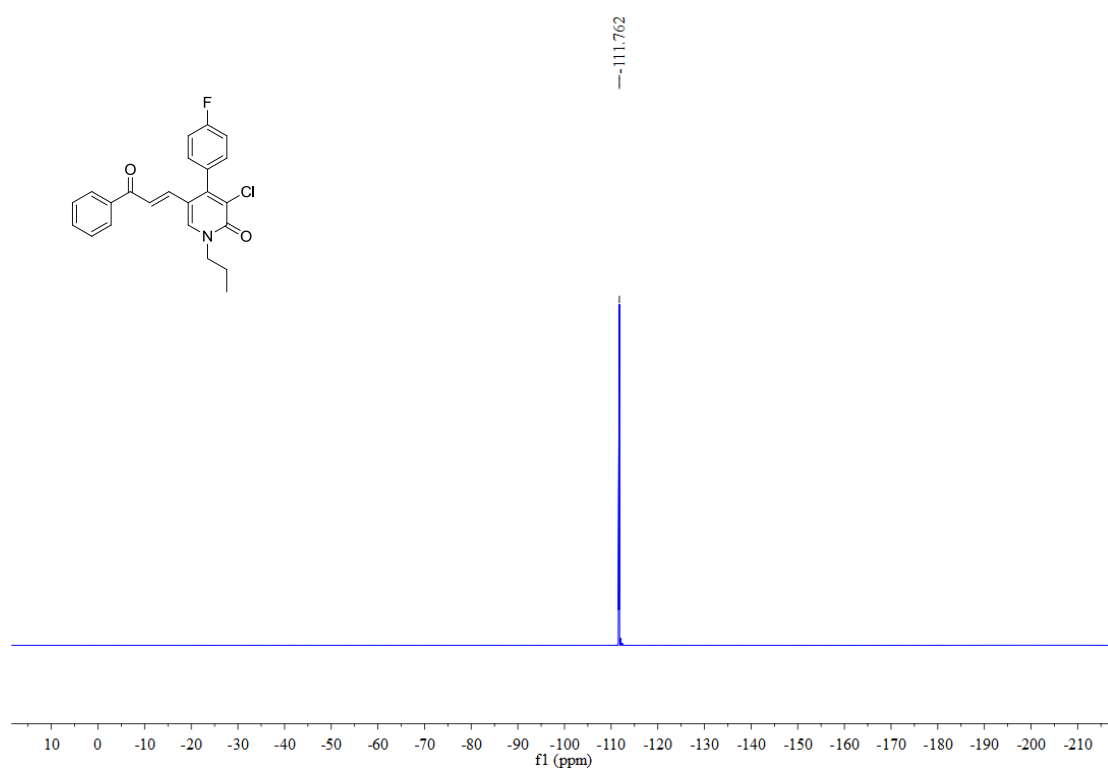
¹H NMR spectrum (400 MHz, CDCl₃) of **2aj**



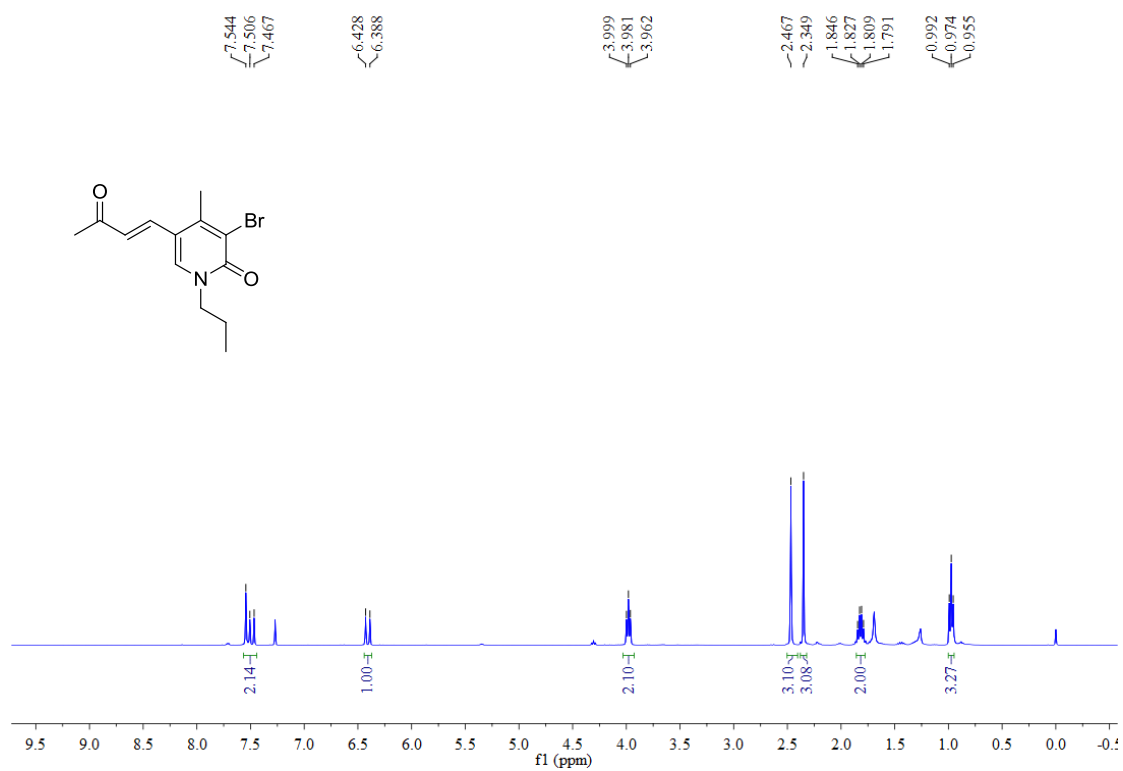
¹³C NMR spectrum (100 MHz, CDCl₃) of **2aj**



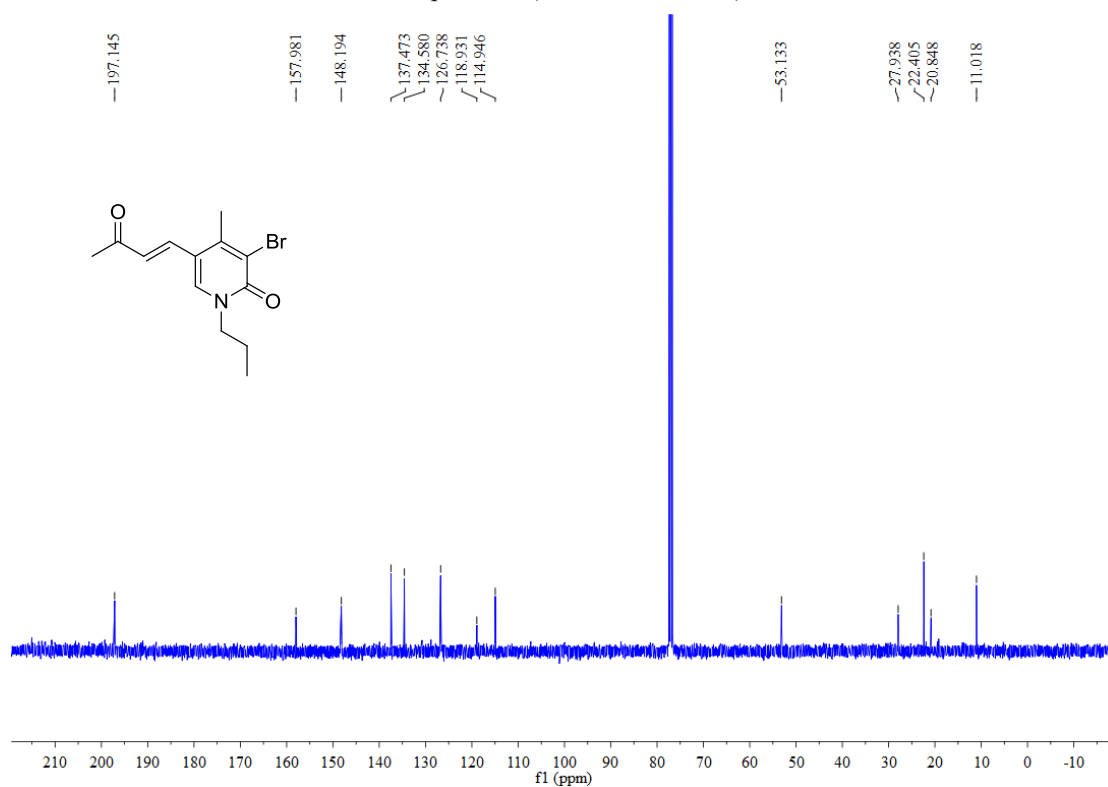
^{19}F NMR spectrum (376 MHz, CDCl_3) of **2aj**



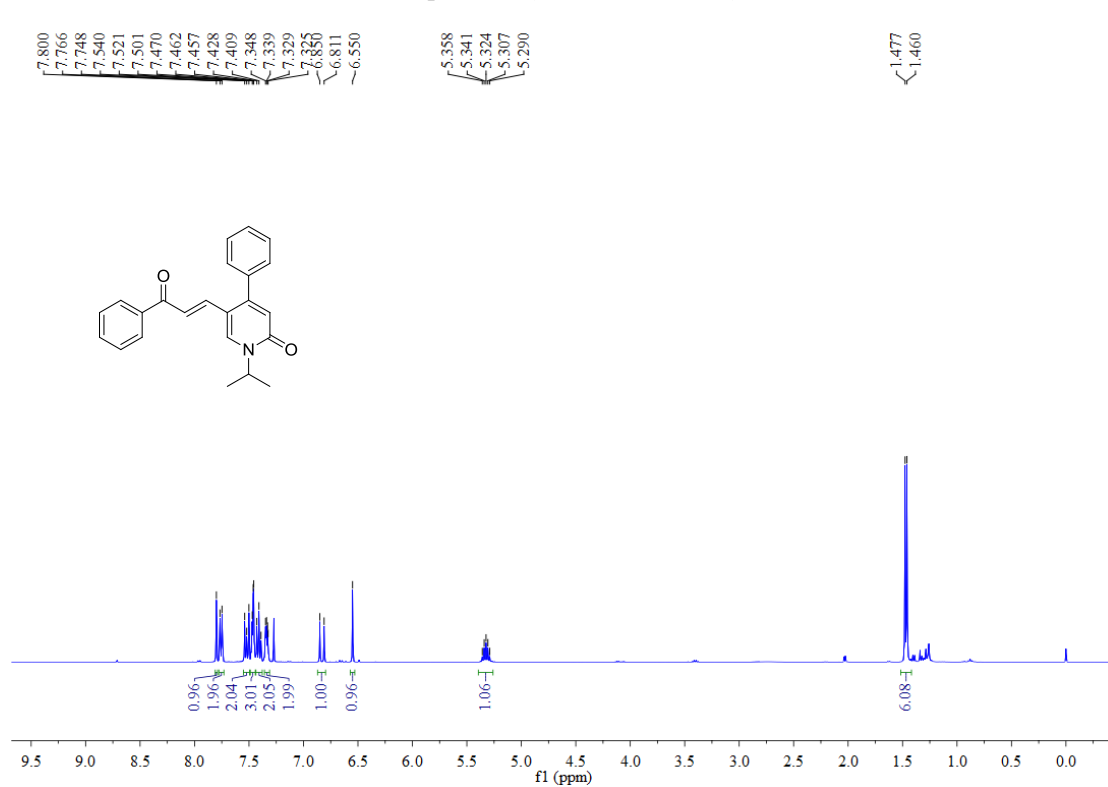
^1H NMR spectrum (400 MHz, CDCl_3) of **2ak**



^{13}C NMR spectrum (100 MHz, CDCl_3) of **2ak**



^1H NMR spectrum (400 MHz, CDCl_3) of **3aa**



^{13}C NMR spectrum (100 MHz, CDCl_3) of **3aa**

