

Supporting Information

for

Three Component Synthesis of β -Aminoxy Amides

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1. General Information

Reactions were monitored by thin layer chromatography (TLC) using silicycle pre-coated silica gel plates. Column chromatography was performed over silica gel (200–300mesh).

Melting points were measured with X–4 micro melting point apparatus.

HRMS were performed on Agilent Technologies 6546-LC/Q-TOF mass spectrometer (ESI-TOF) (Pharmaceutical Informatics Institute, Zhejiang University).

^1H NMR spectra and ^{13}C NMR spectra were recorded on a Bruker AV-600 spectrometer (College of Life Sciences, Zhejiang University), a Bruker AV-500 spectrometer (Pharmaceutical Informatics Institute, Zhejiang University) or a WNMR-I-400 spectrometer (Department of Chemistry, Zhejiang University) in chloroform-*d* (CDCl_3 , contain internal TMS). Chemical shifts of ^1H NMR spectra were reported in ppm with the internal TMS signal at 0 ppm as a standard, and chemical shifts of ^{13}C NMR spectra were reported in ppm with the chloroform signal at 77.16 ppm as a standard.¹ The data is being reported as (s = singlet, d = doublet, t = triplet, q = quartet, quint = quintet, hept = heptet, dd = double doublet, dt = double of triplet, m = multiplet or unresolved, br = broad singlet, coupling constant(s) in Hz, integration).

Solvents, such as ethyl acetate (EA), petroleum ether (PE) were obtained commercially and used without further purification unless otherwise noted. Methanol (MeOH) purified by distillation after treating with magnesium rod; toluene (PhMe), 1,4-dioxane (dioxane) and tetrahydrofuran (THF) were purified by distillation after treating with sodium; dichloromethane (CH_2Cl_2), acetonitrile (MeCN), 1,2-dichloroethane (DCE) were purified by distillation after treating with CaH_2 .

2. Starting Materials

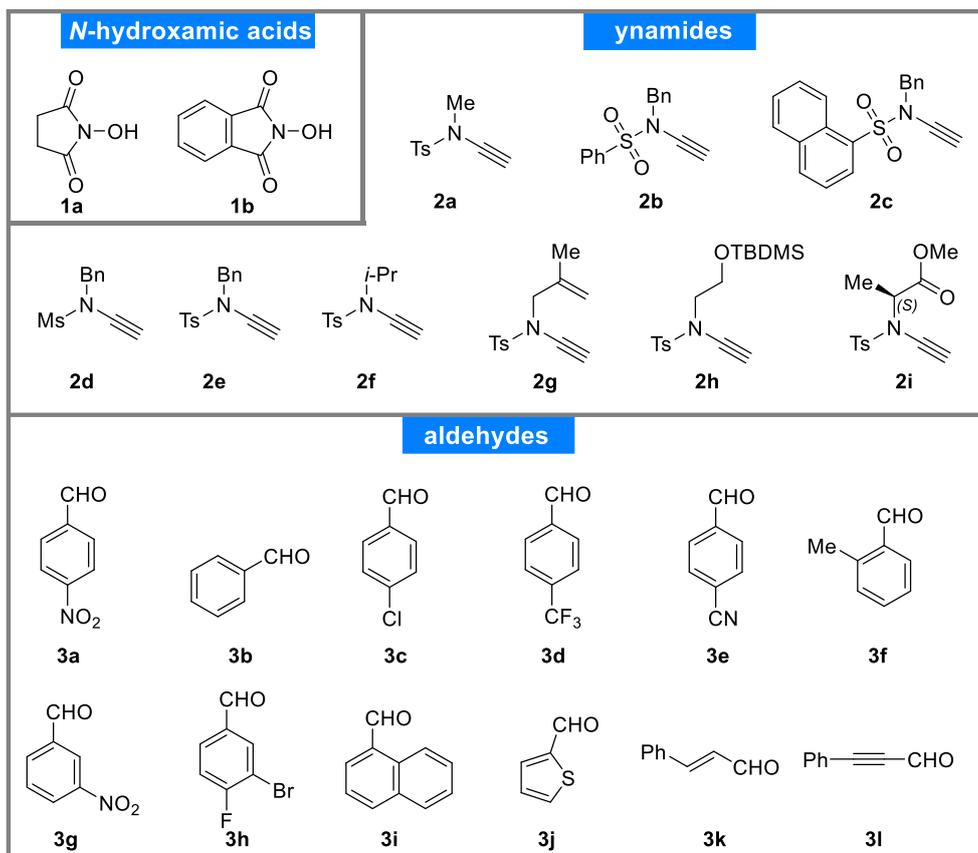


Figure S1. Starting materials

All starting materials are listed as Figure S1. *N*-hydroxamic acids **1a** and **2a** were commercially available; Ynamides were prepared according to the reported methods (Figure S2). Ynamides **2a-2h** were synthesized via the **method A**,² and ynamide **2i** was obtained by the **method B**.³ Aldehydes **3a-3k** were commercially available, and **3l** was synthesized according to the reported procedure.⁴

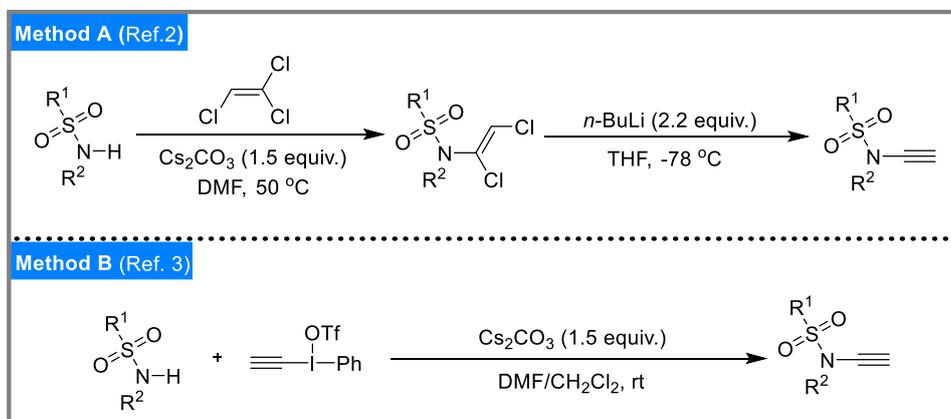
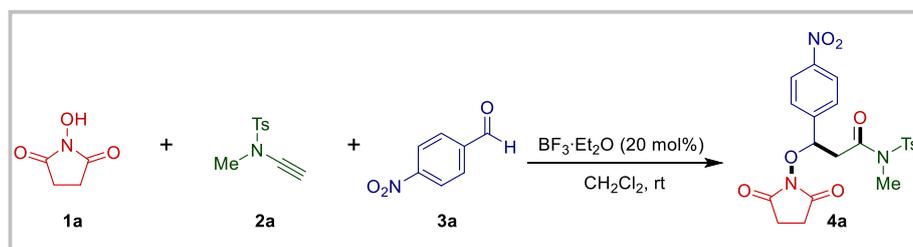


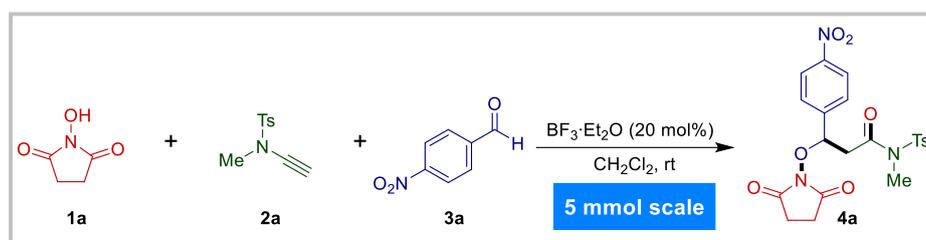
Figure S2. Synthesis of ynamides

3. Typical Procedure for The Synthesis of 4a



An oven-dried Schlenk tube equipped with a magnetic stirrer bar was charged with *N*-hydroxysuccinimide **1a** (23 mg, 0.2 mmol), ynamide **2a** (42 mg, 0.2 mmol) and *p*-nitrobenzaldehyde **3a** (31 mg, 0.2 mmol), and then purged with argon three times. Anhydrous CH₂Cl₂ (2 mL) was added as solvent and the mixture was stirred for 3 h until **1a** and **2a** were completely consumed. BF₃·Et₂O (5 μL, 20 mol%) was added and the reaction was stirred for another 5 mins. TLC analysis showed that the completion of the reaction. The reaction mixture was concentrated to obtain the residue, which was purified by silica gel column chromatography eluting with PE/EA = 3/1 to give the desired product 3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-3-(4-nitrophenyl)-*N*-tosylpropanamide **4a** (58 mg, 61% yield) as a white solid.

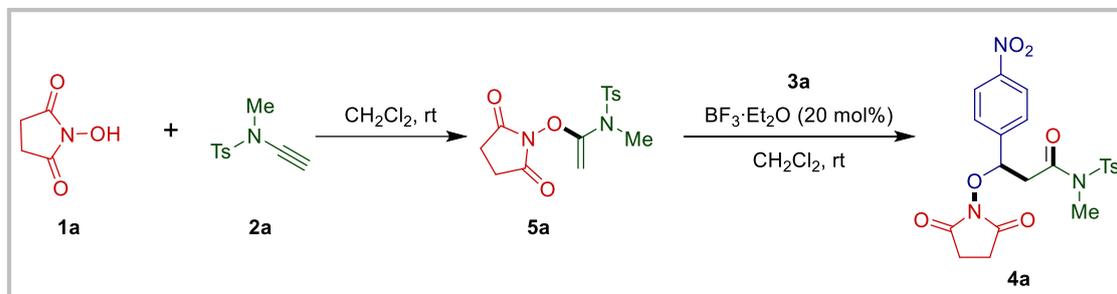
4. Gram-Scale Reaction



An oven-dried flask tube equipped with a magnetic stirrer bar was charged with *N*-hydroxysuccinimide **1a** (576 mg, 5 mmol), ynamide **2a** (1.05 g, 5 mmol) and *p*-nitrobenzaldehyde **3a** (775 mg, 5 mmol), and then purged with argon three times. Anhydrous CH₂Cl₂ (50 mL) was added as solvent and the mixture was stirred for 3 h until **1a** and **2a** were completely consumed. BF₃·Et₂O (120 μL, 20 mol%) was added and the reaction was stirred until TLC analysis showed the completion of the reaction. The reaction mixture was concentrated to obtain the residue, which was purified by silica gel column chromatography eluting with PE/EA = 3/1 to give the desired product

3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-3-(4-nitrophenyl)-*N*-tosylpropanamide **4a** (1.35 g, 57% yield) as a white solid.

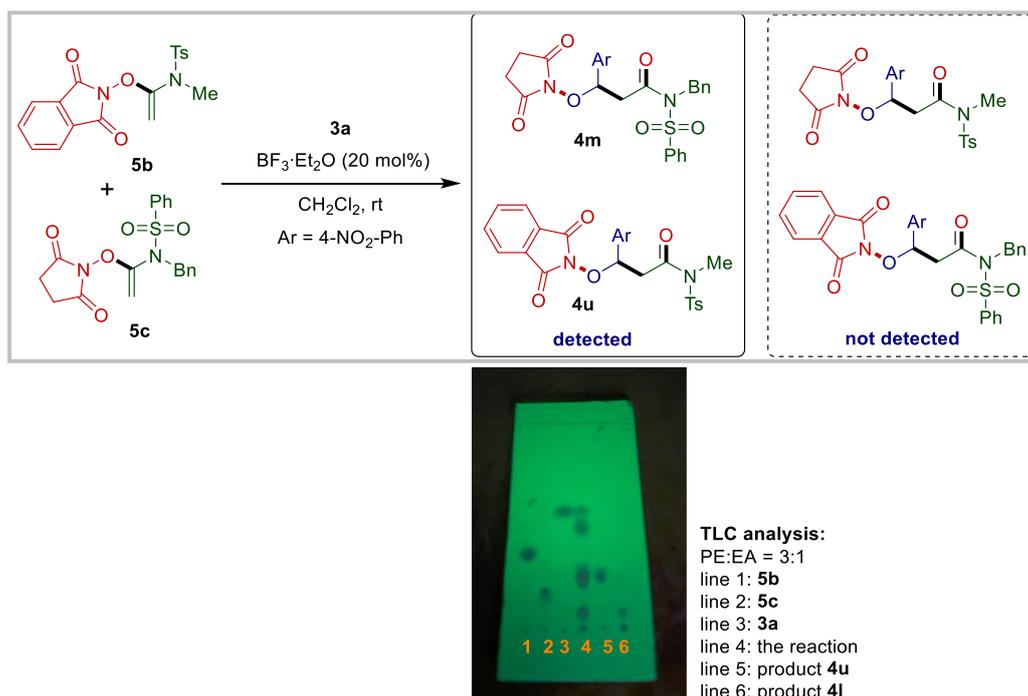
5. Step-wise Reaction



An oven-dried Schlenk tube equipped with a magnetic stirrer bar was charged with *N*-hydroxysuccinimide **1a** (23 mg, 0.2 mmol) and ynamide **2a** (42 mg, 0.2 mmol), and then purged with argon three times. Anhydrous CH₂Cl₂ (2 mL) was added as solvent and the mixture was stirred for 3 h until **1a** and **2a** were completely consumed. The mixture was concentrated to obtain the residue, which was further purified by silica gel column chromatography eluting with PE/EA = 5/1 to give **5a** (64 mg, 98% yield).

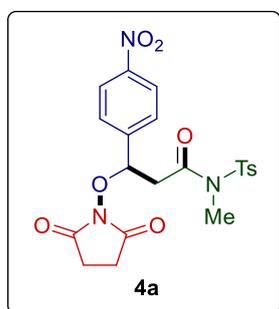
An oven-dried Schlenk tube equipped with a magnetic stirrer bar was charged with **5a** (64 mg, 0.2 mmol) and *p*-nitrobenzaldehyde **3a** (31 mg, 0.2 mmol), and then purged with argon three times. Anhydrous CH₂Cl₂ (2 mL) was added as solvent. BF₃·Et₂O (5 μL, 20 mol%) was added and the reaction was stirred for another 5 mins. TLC analysis showed that the completion of the reaction. The reaction mixture was concentrated to obtain the residue, which was purified by silica gel column chromatography eluting with PE/EA = 3/1 to give the desired product 3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-3-(4-nitrophenyl)-*N*-tosylpropanamide **4a** (59 mg, 63% yield) as a white solid.

6. Crossover reaction



An oven-dried Schlenk tube equipped with a magnetic stirrer bar was charged with **5b** (38 mg, 0.1 mmol), **5c** (39 mg, 0.1 mmol) and *p*-nitrobenzaldehyde **3a** (31 mg, 0.2 mmol), and then purged with argon three times. Anhydrous CH_2Cl_2 (2 mL) was added as solvent. $\text{BF}_3 \cdot \text{Et}_2\text{O}$ (5 μL , 20 mol%) was added and the reaction was stirred for another 10 mins. TLC analysis showed the formation of **4m** and **4u**. The crossover products were not detected (See the TLC analysis). **4m** and **4u** were isolated in 61% and 66% yields, respectively.

7. Characterization of Products



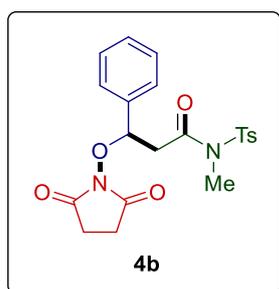
3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-3-(4-nitrophenyl)-*N*-tosylpropanamide

4a: White solid (58 mg, 61% yield), m. p. 162.4-164.2 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.17 (d, *J* = 7.8 Hz, 2H), 7.77 (d, *J* = 7.2 Hz, 2H), 7.63 (d, *J* = 7.8 Hz, 2H), 7.36 (d, *J* = 7.2 Hz, 2H), 5.87 (t, *J* = 6.0 Hz, 1H), 3.69 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 3.31 (dd, *J*₁ = 17.4 Hz, *J*₂ = 4.8 Hz, 1H), 3.21 (s, 3H), 2.58 (s, 4H), 2.46 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.0, 169.1, 148.3, 145.4, 144.0, 135.6, 130.1, 128.7, 127.6, 123.7, 82.3, 42.7, 33.0, 25.3, 21.7.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₁H₂₂N₃O₈S, 476.1128; found, 476.1130.



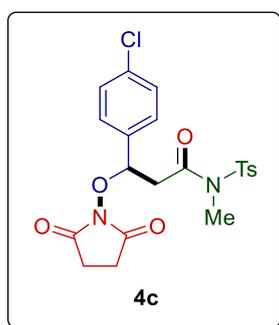
3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-3-phenyl-*N*-tosylpropanamide

4b: White solid (52 mg, 61% yield), m. p. 162.3-164.1 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.81 – 7.76 (m, 2H), 7.45 – 7.38 (m, 2H), 7.36 – 7.30 (m, 5H), 5.84 (dd, *J*₁ = 7.2 Hz, *J*₂ = 5.4 Hz, 1H), 3.68 (dd, *J*₁ = 18.0 Hz, *J*₂ = 7.2 Hz, 1H), 3.27 (dd, *J*₁ = 17.4 Hz, *J*₂ = 4.8 Hz, 1H), 3.23 (s, 3H), 2.49 (s, 4H), 2.44 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.4, 169.9, 145.2, 136.6, 135.9, 130.0, 129.4, 128.6, 128.0, 127.8, 83.2, 42.4, 33.1, 25.3, 21.7.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₁H₂₃N₂O₆S, 431.1277; found, 431.1273.



3-(4-chlorophenyl)-3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-*N*-tosylpropanamide

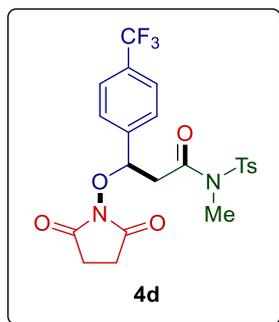
4c: White solid (53 mg, 57% yield), m. p. 177.0-178.5 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.78 – 7.73 (m, 2H), 7.38 – 7.32 (m, 4H), 7.30 – 7.27

(m, 2H), 5.79 (t, $J = 6.0$ Hz, 1H), 3.64 (dd, $J_1 = 17.4$ Hz, $J_2 = 6.6$ Hz, 1H), 3.27 (dd, $J_1 = 17.4$ Hz, $J_2 = 6.0$ Hz, 1H), 3.22 (s, 3H), 2.52 (s, 4H), 2.45 (s, 3H).

^{13}C NMR (150 MHz, CDCl_3) δ 171.3, 169.6, 145.3, 135.9, 135.4, 135.3, 130.1, 129.4, 128.9, 127.7, 82.6, 42.4, 33.1, 25.4, 21.8.

HRMS (ESI-TOF) m/z : $(\text{M}+\text{H})^+$ calcd. For $\text{C}_{21}\text{H}_{22}\text{ClN}_2\text{O}_6\text{S}$, 465.0887; found, 465.0892.



3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-*N*-tosyl-3-(4-(trifluoromethyl)phenyl)propenamide

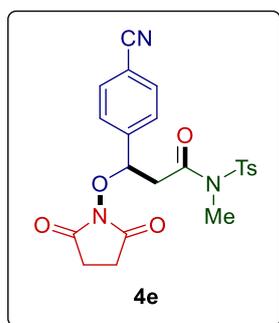
4d: White solid (51 mg, 51% yield), m. p. 115.7-117.6 °C.

^1H NMR (600 MHz, CDCl_3) δ 7.79 – 7.73 (m, 2H), 7.61 – 7.53 (m, 4H), 7.34 (d, $J = 7.8$ Hz, 2H), 5.86 (dd, $J_1 = 6.6$ Hz, $J_2 = 6.0$ Hz 1H), 3.67 (dd, $J_1 = 17.4$ Hz, $J_2 = 7.2$ Hz, 1H), 3.28 (dd, $J_1 = 18.0$ Hz, $J_2 = 5.4$ Hz, 1H), 3.22 (s, 3H), 2.55 (s, 4H), 2.45 (s, 3H).

^{13}C NMR (150 MHz, CDCl_3) δ 171.3, 169.5, 145.4, 140.9, 135.8, 131.4 (q, $J = 33.0$ Hz), 130.1, 128.2, 127.7, 125.6 (q, $J = 3.0$ Hz), 124.0 (q, $J = 270.0$ Hz), 82.7, 42.8, 33.2, 25.4, 21.8.

^{19}F NMR (565 MHz, CDCl_3) δ -62.76.

HRMS (ESI-TOF) m/z : $(\text{M}+\text{H})^+$ calcd. For $\text{C}_{22}\text{H}_{22}\text{F}_3\text{N}_2\text{O}_6\text{S}$, 499.1151; found, 499.1145.



3-(4-cyanophenyl)-3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-*N*-

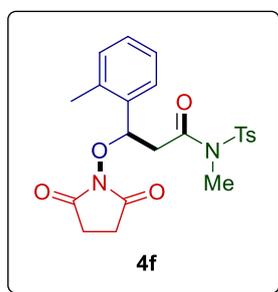
tosylpropanamide

4e: White solid (52 mg, 57% yield), m. p. 122.6-124.2 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.78 – 7.72 (m, 2H), 7.64 – 7.59 (m, 2H), 7.58 – 7.54 (m, 2H), 7.35 (d, *J* = 8.4 Hz, 2H), 5.81 (t, *J* = 6.0 Hz, 1H), 3.65 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 3.27 (dd, *J*₁ = 17.4 Hz, *J*₂ = 5.4 Hz, 1H), 3.20 (s, 3H), 2.55 (s, 4H), 2.45 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.1, 169.2, 145.4, 142.0, 135.6, 132.3, 130.0, 128.5, 127.6, 118.3, 113.0, 82.5, 42.5, 33.0, 25.3, 21.7.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₂H₂₂N₃O₆S, 456.1229; found, 456.1230.



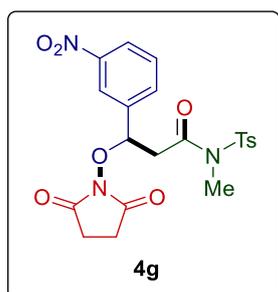
3-((2,5-dioxopyrrolidin-1-yl)oxy)-N-methyl-3-(*o*-tolyl)-N-tosylpropanamide

4f: White solid (56 mg, 63% yield), m. p. 144.0-146.0 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.80 (d, *J* = 7.8 Hz, 2H), 7.41 (dd, *J*₁ = 7.8 Hz, *J*₂ = 1.2 Hz, 1H), 7.34 (d, *J* = 8.4 Hz, 2H), 7.21 (td, *J*₁ = 7.2 Hz, *J*₂ = 1.8 Hz, 1H), 7.17 (td, *J*₁ = 7.8 Hz, *J*₂ = 1.8 Hz, 1H), 7.13 (dd, *J*₁ = 7.8 Hz, *J*₂ = 1.8 Hz, 1H), 6.11 (dd, *J*₁ = 7.2 Hz, *J*₂ = 4.2 Hz, 1H), 3.69 (dd, *J*₁ = 17.4 Hz, *J*₂ = 7.2 Hz, 1H), 3.25 (s, 3H), 3.15 (dd, *J*₁ = 18.0 Hz, *J*₂ = 4.2 Hz, 1H), 2.55 – 2.45 (m, 4H), 2.44 (s, 3H), 2.41 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.6, 170.2, 145.1, 136.7, 135.9, 135.1, 130.7, 129.9, 129.0, 127.8, 127.1, 126.2, 79.6, 42.4, 33.1, 25.3, 21.7, 19.2.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₂H₂₅N₂O₆S, 445.1433; found, 445.1433.



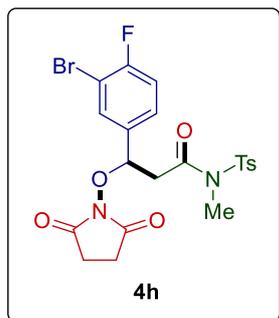
3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-3-(3-nitrophenyl)-*N*-tosylpropanamide

4g: White solid (51 mg, 54% yield), m. p. 159.6-160.4 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.27 (t, *J* = 1.8 Hz, 1H), 8.18 (dd, *J*₁ = 8.4 Hz, *J*₂ = 1.8 Hz, 1H), 7.82 (dt, *J*₁ = 7.8 Hz, *J*₂ = 1.2 Hz, 1H), 7.80 – 7.75 (m, 2H), 7.53 (t, *J* = 7.8 Hz, 1H), 7.36 (d, *J* = 7.8 Hz, 2H), 5.83 (t, *J* = 6.0 Hz, 1H), 3.71 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 3.32 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 3.23 (s, 3H), 2.58 (s, 4H), 2.45 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.1, 169.2, 148.2, 145.4, 139.1, 135.6, 134.0, 130.1, 129.6, 127.6, 124.1, 122.7, 82.3, 42.5, 33.0, 25.3, 21.7.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₁H₂₂N₃O₈S, 476.1128; found, 476.1126.



3-(3-bromo-4-fluorophenyl)-3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-methyl-*N*-tosylpropanamide

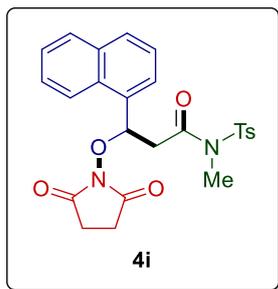
4h: White solid (58 mg, 55% yield), m. p. 143.7-144.9 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.77 (d, *J* = 7.8 Hz, 2H), 7.62 (dd, *J*₁ = 6.6 Hz, *J*₂ = 2.4 Hz, 1H), 7.42 – 7.32 (m, 3H), 7.07 (t, *J* = 8.4 Hz, 1H), 5.74 (t, *J* = 6.0 Hz, 1H), 3.63 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 3.28 – 3.21 (m, 4H), 2.56 (s, 4H), 2.45 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.3, 169.4, 159.5 (d, *J* = 247.5 Hz), 145.4, 135.8, 134.4 (d, *J* = 4.5 Hz), 133.2, 130.1, 128.8 (d, *J* = 7.5 Hz), 127.7, 116.7 (d, *J* = 22.5 Hz), 109.2 (d, *J* = 22.5 Hz), 82.0, 42.6, 33.1, 25.4, 21.8.

¹⁹F NMR (565 MHz, CDCl₃) δ -105.90.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₁H₂₁BrFN₂O₆S, 527.0288; found, 527.0291.



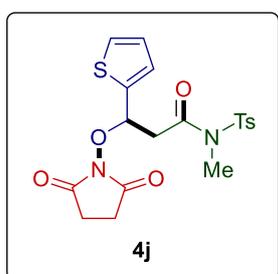
3-((2,5-dioxopyrrolidin-1-yl)oxy)-N-methyl-3-(naphthalen-1-yl)-N-tosylpropanamide

4i: Yellow solid (47 mg, 49% yield), m. p. 145.2-146.1 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.23 (d, *J* = 8.4 Hz, 1H), 7.87 – 7.81 (m, 2H), 7.82 – 7.77 (m, 2H), 7.69 (dd, *J*₁ = 7.2 Hz, *J*₂ = 1.2 Hz, 1H), 7.54 (ddd, *J*₁ = 8.4 Hz, *J*₂ = 6.6 Hz, *J*₃ = 1.2 Hz, 1H), 7.49 (ddd, *J*₁ = 7.8 Hz, *J*₂ = 6.6 Hz, *J*₃ = 1.2 Hz, 1H), 7.45 (dd, *J*₁ = 8.4 Hz, *J*₂ = 7.2 Hz, 1H), 7.32 (d, *J* = 7.8 Hz, 2H), 6.67 (dd, *J*₁ = 7.2 Hz, *J*₂ = 3.6 Hz, 1H), 3.87 (dd, *J*₁ = 18.0 Hz, *J*₂ = 7.8 Hz, 1H), 3.29 – 3.24 (m, 4H), 2.55 – 2.45 (m, 4H), 2.44 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.7, 170.4, 145.2, 136.0, 133.8, 133.0, 130.8, 129.9, 129.8, 129.0, 128.0, 126.9, 126.0, 125.5, 125.3, 123.4, 79.7, 42.8, 33.2, 25.4, 21.8.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₅H₂₅N₂O₆S, 481.1433; found, 481.1434.



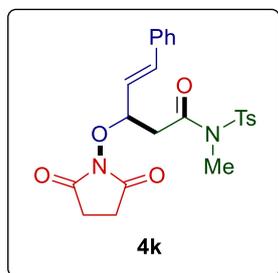
3-((2,5-dioxopyrrolidin-1-yl)oxy)-N-methyl-3-(thiophen-2-yl)-N-tosylpropanamide

4j: White solid (33 mg, 38% yield), m. p. 144.6-145.7 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.81 (d, *J* = 7.8 Hz, 2H), 7.39 – 7.32 (m, 3H), 7.14 (d, *J* = 3.6 Hz, 1H), 6.98 – 6.94 (m, 1H), 6.05 (t, *J* = 6.0 Hz, 1H), 3.77 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 3.45 (dd, *J*₁ = 17.4 Hz, *J*₂ = 4.8 Hz, 1H), 3.25 (s, 3H), 2.55 (s, 4H), 2.45 (s, 3H).

^{13}C NMR (150 MHz, CDCl_3) δ 171.3, 169.4, 145.3, 138.9, 135.9, 130.1, 128.3, 127.8, 127.5, 127.0, 78.3, 42.7, 33.2, 25.4, 21.8.

HRMS (ESI-TOF) m/z : $(\text{M}+\text{H})^+$ calcd. For $\text{C}_{19}\text{H}_{21}\text{N}_2\text{O}_6\text{S}_2$, 437.0841; found, 437.0844.



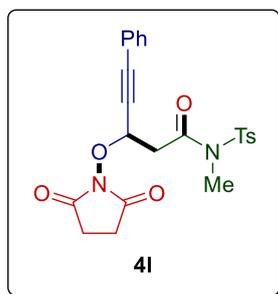
(E)-3-((2,5-dioxopyrrolidin-1-yl)oxy)-N-methyl-5-phenyl-N-tosylpent-4-enamide

4k: White solid (30 mg, 33% yield), m. p. 122.0-123.3 °C.

^1H NMR (600 MHz, CDCl_3) δ 7.79 (d, $J = 7.8$ Hz, 2H), 7.37 – 7.26 (m, 7H), 6.64 (d, $J = 15.6$ Hz, 1H), 6.13 (dd, $J_1 = 15.6$ Hz, $J_2 = 9.0$ Hz, 1H), 5.37 (dt, $J_1 = 9.0$ Hz, $J_2 = 6.0$ Hz, 1H), 3.48 (dd, $J_1 = 17.4$ Hz, $J_2 = 6.0$ Hz, 1H), 3.27 – 3.20 (m, 4H), 2.58 (s, 4H), 2.43 (s, 3H).

^{13}C NMR (150 MHz, CDCl_3) δ 171.6, 169.4, 145.2, 136.9, 136.0, 135.6, 130.1, 128.81, 128.77, 127.7, 127.1, 124.7, 83.4, 41.2, 33.2, 25.4, 21.8.

HRMS (ESI-TOF) m/z : $(\text{M}+\text{H})^+$ calcd. For $\text{C}_{23}\text{H}_{25}\text{N}_2\text{O}_6\text{S}$, 457.1433; found, 457.1430.



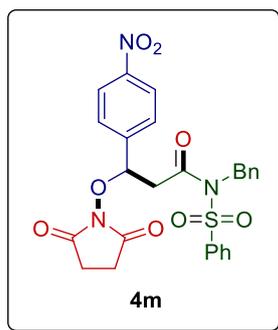
3-((2,5-dioxopyrrolidin-1-yl)oxy)-N-methyl-5-phenyl-N-tosylpent-4-ynamide

4l: Yellow solid (36 mg, 40% yield), m. p. 56.0-58.0 °C.

^1H NMR (600 MHz, CDCl_3) δ 7.85 – 7.80 (m, 2H), 7.42 – 7.37 (m, 2H), 7.38 – 7.27 (m, 5H), 5.75 (dd, $J_1 = 7.2$ Hz, $J_2 = 5.4$ Hz, 1H), 3.65 (dd, $J_1 = 18.0$ Hz, $J_2 = 7.2$ Hz, 1H), 3.43 (dd, $J_1 = 18.0$ Hz, $J_2 = 5.4$ Hz, 1H), 3.28 (s, 3H), 2.67 (s, 4H), 2.42 (s, 3H).

^{13}C NMR (150 MHz, CDCl_3) δ 171.3, 168.9, 145.3, 135.8, 132.0, 130.2, 129.3, 128.5, 127.8, 121.6, 89.1, 83.6, 72.8, 42.3, 33.2, 25.5, 21.8.

HRMS (ESI-TOF) m/z : (M+H)⁺ calcd. For C₂₃H₂₃N₂O₆S, 455.1277; found, 455.1277.



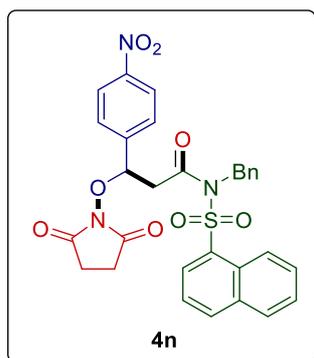
***N*-benzyl-3-((2,5-dioxopyrrolidin-1-yl)oxy)-3-(4-nitrophenyl)-*N*-(phenylsulfonyl)propenamide**

4m: Yellow solid (61 mg, 57% yield), m. p. 45.9-47.4 °C.

¹H NMR (500 MHz, CDCl₃) δ 8.11 – 8.04 (m, 2H), 7.80 – 7.73 (m, 2H), 7.68 – 7.61 (m, 1H), 7.54 – 7.47 (m, 2H), 7.48 – 7.41 (m, 2H), 7.29 – 7.23 (m, 3H), 7.24 – 7.16 (m, 2H), 5.78 (t, $J_1 = 6.5$ Hz, 1H), 5.08 (d, $J = 16.0$ Hz, 1H), 4.92 (d, $J = 16.0$ Hz, 1H), 3.57 (dd, $J_1 = 17.0$ Hz, $J_2 = 6.0$ Hz, 1H), 3.23 (dd, $J_1 = 17.5$ Hz, $J_2 = 6.5$ Hz, 1H), 2.57 – 2.43 (m, 4H).

¹³C NMR (125 MHz, CDCl₃) δ 171.0, 169.3, 148.3, 143.7, 139.2, 136.0, 134.2, 129.4, 128.8, 128.03, 127.99, 127.8, 123.7, 82.4, 49.8, 42.5, 25.3.

HRMS (ESI-TOF) m/z : (M+H)⁺ calcd. For C₂₆H₂₄N₃O₈S, 538.1284; found, 538.1280.



***N*-benzyl-3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-(naphthalen-1-ylsulfonyl)-3-(4-nitrophenyl)propenamide**

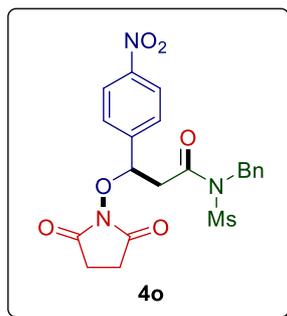
4n: White solid (59 mg, 50% yield), m. p. 81.6-83.8 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.21 (s, 1H), 7.97 – 7.81 (m, 5H), 7.71 (t, $J = 7.2$ Hz, 1H), 7.64 (t, $J = 7.8$ Hz, 2H), 7.39 – 7.17 (m, 7H), 5.74 (t, $J = 6.0$ Hz, 1H), 5.17 (d, $J =$

15.6 Hz, 1H), 4.98 (d, $J = 15.6$ Hz, 1H), 3.58 (dd, $J_1 = 17.4$ Hz, $J_2 = 5.4$ Hz, 1H), 3.28 (dd, $J_1 = 17.4$ Hz, $J_2 = 6.6$ Hz, 1H), 2.52 – 2.36 (m, 4H).

^{13}C NMR (150 MHz, CDCl_3) δ 171.0, 169.2, 148.1, 143.6, 136.1, 135.9, 135.3, 131.9, 130.01, 129.99, 129.7, 129.6, 128.8, 128.6, 128.2, 128.13, 128.09, 128.0, 123.5, 122.2, 82.5, 49.6, 42.5, 25.3.

HRMS (ESI-TOF) m/z : (M+H) $^+$ calcd. For $\text{C}_{30}\text{H}_{26}\text{N}_3\text{O}_8\text{S}$, 588.1441; found, 588.1440.



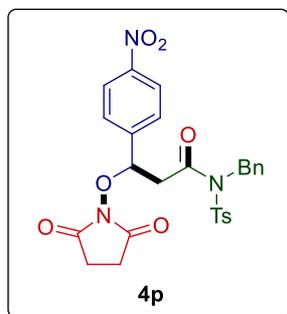
***N*-benzyl-3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-(methylsulfonyl)-3-(4-nitrophenyl)propanamide**

4o: Yellow solid (35 mg, 37% yield), m. p. 54.6-55.1 °C.

^1H NMR (400 MHz, CDCl_3) δ 8.24 – 8.15 (m, 2H), 7.67 – 7.58 (m, 2H), 7.38 – 7.25 (m, 5H), 5.89 (dd, $J_1 = 7.6$ Hz, $J_2 = 4.4$ Hz, 1H), 5.02 (d, $J = 16.0$ Hz, 1H), 4.95 (d, $J = 16.0$ Hz, 1H), 3.66 (dd, $J_1 = 17.6$ Hz, $J_2 = 7.6$ Hz, 1H), 3.20 (s, 3H), 3.12 (dd, $J_1 = 17.6$ Hz, $J_2 = 4.8$ Hz, 1H), 2.65 – 2.58 (m, 4H).

^{13}C NMR (100 MHz, CDCl_3) δ 171.2, 170.2, 148.4, 143.8, 135.8, 129.1, 128.7, 128.3, 127.7, 123.9, 82.7, 49.4, 43.04, 42.99, 25.4.

HRMS (ESI-TOF) m/z : (M+H) $^+$ calcd. For $\text{C}_{21}\text{H}_{22}\text{N}_3\text{O}_8\text{S}$, 476.1128; found, 476.1133.



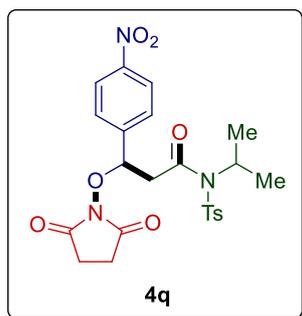
***N*-benzyl-3-((2,5-dioxopyrrolidin-1-yl)oxy)-3-(4-nitrophenyl)-*N*-tosylpropanamide**

4p: White solid (50 mg, 45% yield), m. p. 68.0-69.4 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.10 – 8.05 (m, 2H), 7.65 – 7.60 (m, 2H), 7.48 – 7.43 (m, 2H), 7.31 – 7.24 (m, 5H), 7.24 – 7.17 (m, 2H), 5.79 (t, *J* = 6.6 Hz, 1H), 5.06 (d, *J* = 16.2 Hz, 1H), 4.90 (d, *J* = 15.6 Hz, 1H), 3.56 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 3.24 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 2.58 – 2.46 (m, 4H), 2.45 (s, 3H).

¹³C NMR (100 MHz, CDCl₃) δ 171.1, 169.2, 148.2, 145.5, 143.6, 136.1, 136.0, 130.0, 128.8, 128.7, 128.0, 127.8, 123.6, 82.4, 49.6, 42.4, 25.3, 21.7.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₇H₂₆N₃O₈S, 552.1441; found, 552.1437.



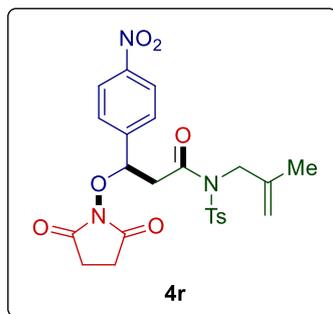
3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-isopropyl-3-(4-nitrophenyl)-*N*-tosylpropanamide

4q: Yellow solid (54 mg, 54% yield), m. p. 109.2-111.0 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.16 (d, *J* = 8.4 Hz, 2H), 7.78 (d, *J* = 7.8 Hz, 2H), 7.61 (d, *J* = 8.4 Hz, 2H), 7.37 (d, *J* = 7.8 Hz, 2H), 5.87 (t, *J* = 6.0 Hz, 1H), 4.30 (hept, *J* = 6.6 Hz, 1H), 3.70 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 3.36 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 2.60 (s, 4H), 2.47 (s, 3H), 1.31 (d, *J* = 7.2 Hz, 3H), 1.28 (d, *J* = 6.6 Hz, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.1, 169.3, 148.3, 145.3, 144.2, 136.7, 130.2, 128.9, 127.6, 123.7, 82.6, 53.6, 44.2, 25.4, 21.8, 20.4.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₃H₂₆N₃O₈S, 504.1441; found, 504.1445.



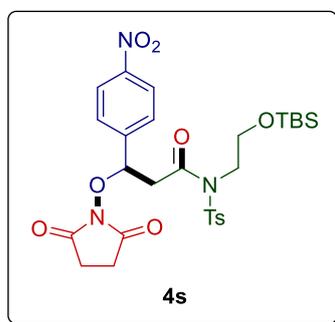
3-((2,5-dioxopyrrolidin-1-yl)oxy)-*N*-(2-methylallyl)-3-(4-nitrophenyl)-*N*-tosylpropanamide

4r: White solid (46 mg, 45% yield), m. p. 146.6-147.9 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.13 (d, *J* = 8.4 Hz, 2H), 7.80 (d, *J* = 7.8 Hz, 2H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.32 (d, *J* = 7.8 Hz, 2H), 5.82 (t, *J* = 5.4 Hz, 1H), 4.87 (s, 1H), 4.66 (s, 1H), 4.44 (d, *J* = 17.4 Hz, 1H), 4.27 (d, *J* = 17.4 Hz, 1H), 3.51 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 3.13 (dd, *J*₁ = 17.4 Hz, *J*₂ = 5.4 Hz, 1H), 2.61 – 2.48 (m, 4H), 2.45 (s, 3H), 1.70 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 171.2, 169.2, 148.3, 145.4, 143.8, 139.8, 136.1, 129.7, 128.7, 128.6, 123.7, 112.1, 82.1, 51.5, 41.9, 25.4, 21.8, 20.2.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₄H₂₆N₃O₈S, 516.1441; found, 516.1440.



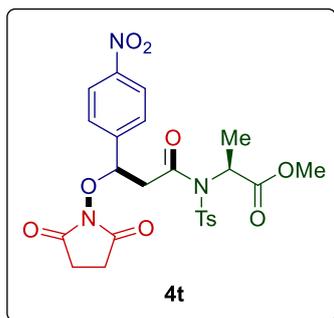
***N*-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-3-((2,5-dioxopyrrolidin-1-yl)oxy)-3-(4-nitrophenyl)-*N*-tosylpropanamide**

4s: White solid (74 mg, 60% yield), m. p. 138.6-140.0 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.17 – 8.12 (m, 2H), 7.84 – 7.78 (m, 2H), 7.60 – 7.55 (m, 2H), 7.32 (d, *J* = 7.8 Hz, 2H), 5.83 (dd, *J*₁ = 6.6 Hz, *J*₂ = 5.4 Hz, 1H), 3.96 (dt, *J*₁ = 15.0 Hz, *J*₂ = 5.4 Hz, 1H), 3.87 (dt, *J*₁ = 15.0 Hz, *J*₂ = 6.6 Hz, 1H), 3.83 – 3.73 (m, 2H), 3.59 (dd, *J*₁ = 18.0 Hz, *J*₂ = 6.6 Hz, 1H), 3.24 (dd, *J*₁ = 18.0 Hz, *J*₂ = 5.4 Hz, 1H), 2.58 – 2.49 (m, 4H), 2.45 (s, 3H), 0.77 (s, 9H), -0.01 – -0.05 (m, 6H).

¹³C NMR (100 MHz, CDCl₃) δ 171.2, 169.8, 148.3, 145.2, 144.0, 136.5, 129.8, 128.7, 128.2, 123.8, 81.9, 61.7, 48.4, 42.6, 25.8, 25.4, 21.8, 18.3, -5.4.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₈H₃₈N₃O₉SSi, 620.2098; found, 620.2095.



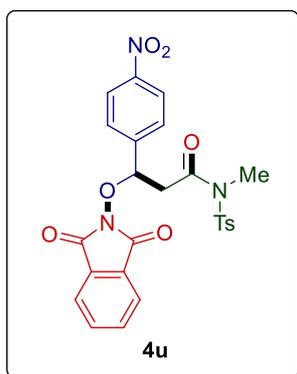
methyl *N*-(3-((2,5-dioxopyrrolidin-1-yl)oxy)-3-(4-nitrophenyl)propanoyl)-*N*-tosyl-*L*-alaninate

4t: White solid (22 mg, 20% yield), m. p. 83.6-84.9 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.20 – 8.14 and 8.14 – 8.06 (m, 2H), 7.90 – 7.86 and 7.85 – 7.80 (m, 2H), 7.65 – 7.57 and 7.50 – 7.44 (m, 2H), [7.41 (d, *J* = 7.8 Hz) and 7.40 – 7.36 (m)] (2H), [5.82 (dd, *J*₁ = 7.2 Hz, *J*₂ = 6.0 Hz) and 5.76 (dd, *J*₁ = 7.8 Hz, *J*₂ = 5.4 Hz)] (1H), 4.88 – 4.81 (m, 1H), [3.73 (dd, *J*₁ = 18.0 Hz, *J*₂ = 5.4 Hz) and 3.59 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz)] (1H), 3.65 and 3.45 (s, 3H), [3.41 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz) and 3.28 (dd, *J*₁ = 17.4 Hz, *J*₂ = 7.8 Hz)] (1H), 2.63 – 2.56 (m, 4H), 2.49 (s, 3H), 1.54 and 1.44 (d, *J* = 7.2 Hz, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 170.9, 170.8, 169.8, 169.7, 168.3, 148.2, 145.8, 143.7, 136.0, 130.2, 130.1, 129.0, 128.9, 127.9, 127.8, 123.6, 123.4, 82.4, 82.1, 56.1, 56.0, 52.6, 52.4, 42.4, 42.2, 25.3, 25.3, 21.8, 21.7, 16.04, 15.97.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₄H₂₆N₃O₁₀S, 548.1339; found, 548.1342.



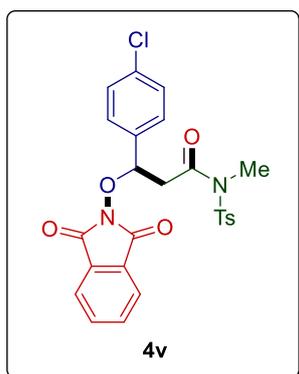
3-((1,3-dioxoisoindolin-2-yl)oxy)-*N*-methyl-3-(4-nitrophenyl)-*N*-tosylpropanamide

4u: White solid (68 mg, 65% yield), m. p. 133.2-135.1 °C.

¹H NMR (600 MHz, CDCl₃) δ 8.19 – 8.13 (m, 2H), 7.78 – 7.72 (m, 4H), 7.75 – 7.69 (m, 2H), 7.70 – 7.65 (m, 2H), 7.35 (d, *J* = 8.4 Hz, 2H), 5.90 (t, *J* = 6.6 Hz, 1H), 3.74 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 3.52 (dd, *J*₁ = 17.4 Hz, *J*₂ = 7.2 Hz, 1H), 3.21 (s, 3H), 2.46 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 169.0, 163.5, 148.4, 145.5, 144.4, 135.8, 134.8, 130.3, 129.2, 128.7, 127.5, 123.8, 123.7, 84.2, 42.6, 33.2, 21.8.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₅H₂₂N₃O₈S, 524.1128; found, 524.1127.



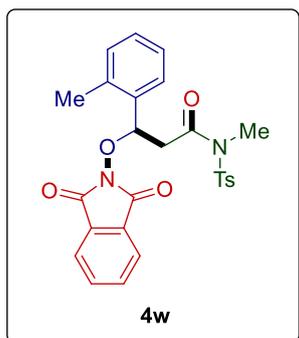
3-(4-chlorophenyl)-3-((1,3-dioxoisindolin-2-yl)oxy)-*N*-methyl-*N*-tosylpropanamide

4v: White solid (57 mg, 56% yield), m. p. 126.3-127.6 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.77 – 7.69 (m, 6H), 7.42 – 7.38 (m, 2H), 7.36 – 7.32 (m, 2H), 7.29 – 7.25 (m, 2H), 5.82 (t, *J* = 6.6 Hz, 1H), 3.69 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 3.48 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 3.21 (s, 3H), 2.45 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 169.3, 163.6, 145.3, 135.9, 135.6, 135.3, 134.6, 130.2, 129.6, 128.8, 127.6, 127.5, 127.2, 123.6, 84.4, 42.3, 33.2, 21.8.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₅H₂₂ClN₂O₆S, 513.0887; found, 513.0889.



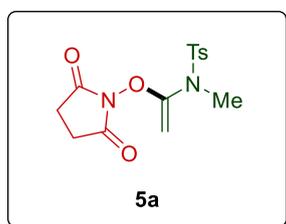
3-((1,3-dioxoisindolin-2-yl)oxy)-*N*-methyl-3-(*o*-tolyl)-*N*-tosylpropanamide

4w: White solid (45 mg, 46% yield), m. p. 115.0-116.5 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.80 – 7.75 (m, 2H), 7.76 – 7.70 (m, 2H), 7.72 – 7.67 (m, 2H), 7.45 (dd, *J*₁ = 7.8 Hz, *J*₂ = 1.2 Hz, 1H), 7.33 (d, *J* = 7.8 Hz, 2H), 7.23 – 7.14 (m, 2H), 7.12 (dd, *J*₁ = 7.8 Hz, *J*₂ = 1.8 Hz, 1H), 6.16 (t, *J* = 6.6 Hz, 1H), 3.73 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.6 Hz, 1H), 3.48 (dd, *J*₁ = 17.4 Hz, *J*₂ = 6.0 Hz, 1H), 3.21 (s, 3H), 2.45 (s, 3H), 2.43 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 169.8, 163.7, 145.0, 137.4, 135.9, 135.1, 134.4, 130.6, 130.0, 129.0, 128.8, 127.5, 127.3, 126.1, 123.4, 81.4, 42.0, 33.0, 21.7, 19.2.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₂₆H₂₅N₂O₆S, 493.1433; found, 493.1430.



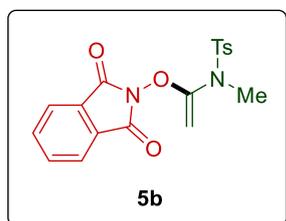
N-(1-((2,5-dioxopyrrolidin-1-yl)oxy)vinyl)-*N*,4-dimethylbenzenesulfonamide

5a: White solid (64 mg, 98% yield), m. p. 132.9-133.7 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.84 – 7.79 (m, 2H), 7.32 (d, *J* = 8.4 Hz, 2H), 4.61 (d, *J* = 3.6 Hz, 1H), 4.54 (d, *J* = 3.6 Hz, 1H), 3.15 (s, 3H), 2.76 (s, 4H), 2.43 (s, 3H).

¹³C NMR (150 MHz, CDCl₃) δ 169.7, 152.5, 144.3, 134.8, 129.8, 128.2, 92.0, 36.6, 25.7, 21.7.

HRMS (ESI-TOF) *m/z*: (M+H)⁺ calcd. For C₁₄H₁₇N₂O₅S, 325.0858; found, 325.0855.



N-(1-((1,3-dioxoisindolin-2-yl)oxy)vinyl)-*N*,4-dimethylbenzenesulfonamide

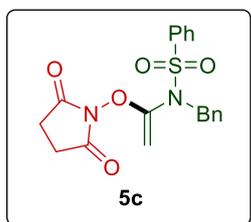
5b: White solid, m. p. 118.6-119.5 °C.

¹H NMR (600 MHz, CDCl₃) δ 7.89 – 7.83 (m, 4H), 7.81 – 7.77 (m, 2H), 7.30 (d, *J* = 7.8 Hz, 2H), 4.72 (d, *J* = 4.2 Hz, 1H), 4.67 (d, *J* = 3.6 Hz, 1H), 3.23 (s, 3H), 2.39 (s,

3H).

^{13}C NMR (150 MHz, CDCl_3) δ 162.2, 153.5, 144.2, 135.0, 129.7, 128.9, 128.3, 124.0, 90.6, 36.3, 21.7.

HRMS (ESI-TOF) m/z : $(\text{M}+\text{H})^+$ calcd. For $\text{C}_{18}\text{H}_{17}\text{N}_2\text{O}_5\text{S}$, 373.0858; found, 373.0855.



***N*-benzyl-*N*-(1-((2,5-dioxopyrrolidin-1-yl)oxy)vinyl)benzenesulfonamide**

5c: White solid, m. p. 121.7-122.9 °C.

^1H NMR (600 MHz, CDCl_3) δ 7.93 – 7.88 (m, 2H), 7.61 – 7.54 (m, 1H), 7.48 (t, J = 7.8 Hz, 2H), 7.41 – 7.35 (m, 2H), 7.33 – 7.26 (m, 3H), 4.73 (s, 2H), 4.62 (d, J = 3.0 Hz, 1H), 4.38 (d, J = 3.6 Hz, 1H), 2.71 (s, 4H).

^{13}C NMR (150 MHz, CDCl_3) δ 169.7, 149.8, 139.4, 135.5, 133.2, 129.4, 129.1, 128.5, 128.2, 128.1, 95.8, 52.1, 25.7.

HRMS (ESI-TOF) m/z : $(\text{M}+\text{H})^+$ calcd. For $\text{C}_{18}\text{H}_{17}\text{N}_2\text{O}_5\text{S}$, 387.1015; found, 387.1015.

8. X-Ray Crystallographic Data

Compound **4b** was crystallized from petroleum ether / dichloromethane. Intensity data for **4b** was collected on Bruker D8 Venture Ims3.0. The details of crystal data collection and refinement of **4b** is summarized in Table S1.

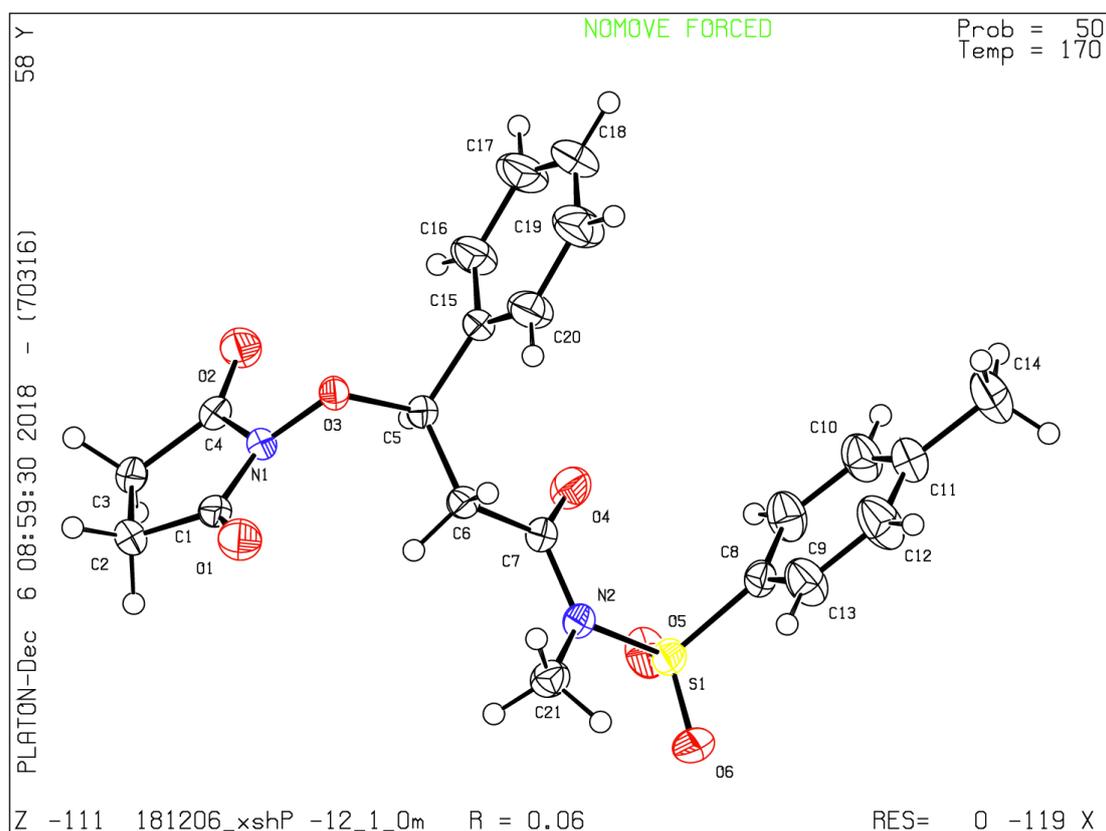
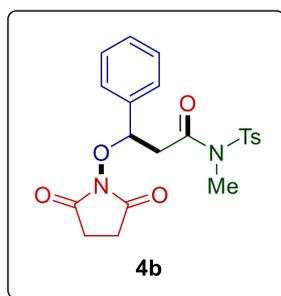


Figure S3. X-ray crystallographic structure **4b** (ORTEP view with 50% thermal ellipsoid contour probability)

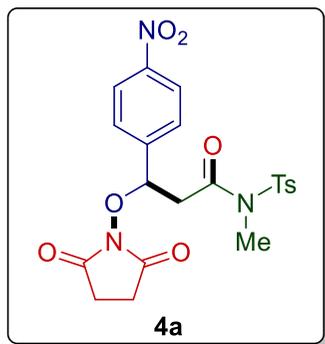
Table S1. Crystal data and structure refinements for **4b**.

CCDC code	1883882
Empirical formula	C ₂₁ H ₂₂ N ₂ O ₆ S
Formula weight	430.46
Temperature/K	170
Crystal system	triclinic
Space group	P-1
a / Å	8.9610(3)
b / Å	10.1919(3)
c / Å	11.3979(3)
α /°	89.228(1)
β /°	84.590(1)
γ /°	89.609(1)
Volume/Å ³	1036.22(5)
Z	2
ρ calc g / cm ³	1.380
μ / mm ⁻¹	0.197
F(000)	452.0
Crystal size / mm ³	0.362 × 0.299 × 0.226
Radiation	MoK α (λ = 0.71073)
2 θ range for data collection / °	2.28 to 35.4
Index ranges	-15 ≤ h ≤ 13, -18 ≤ k ≤ 18, -20 ≤ l ≤ 20
Reflections collected	33755
Independent reflections	12284 [R _{int} = 0.1011, R _{sigma} = 0.0572]
Data / restraints / parameters	12284/0/273
Goodness-of-fit on F ²	1.035
Final R indexes [I ≥ 2 σ (I)]	R ₁ = 0.0572, wR ₂ = 0.0587
Final R indexes [all data]	R ₁ = 0.1011, wR ₂ = 0.0794
Largest diff. peak / hole / e Å ⁻³	0.581/-0.406

9. References

1. Gottlieb, H. E.; Kotlyar, V.; Nudelman, A. *J. Org. Chem.* **1997**, *62*, 7512.
2. Mansfield, S. J.; Campbell, C. D.; Jones, M. W.; Anderson, E. A. *Chem. Commun.* **2015**, *51*, 3316.
3. Witulski, B.; Gossmann, M. *Chem. Commun.* **1999**, 1879.
4. Paioti, P.; Abboud, K.; Aponick, A. *J. Am. Chem. Soc.* **2016** *138*, 2150.

10.Copies of NMR Spectra

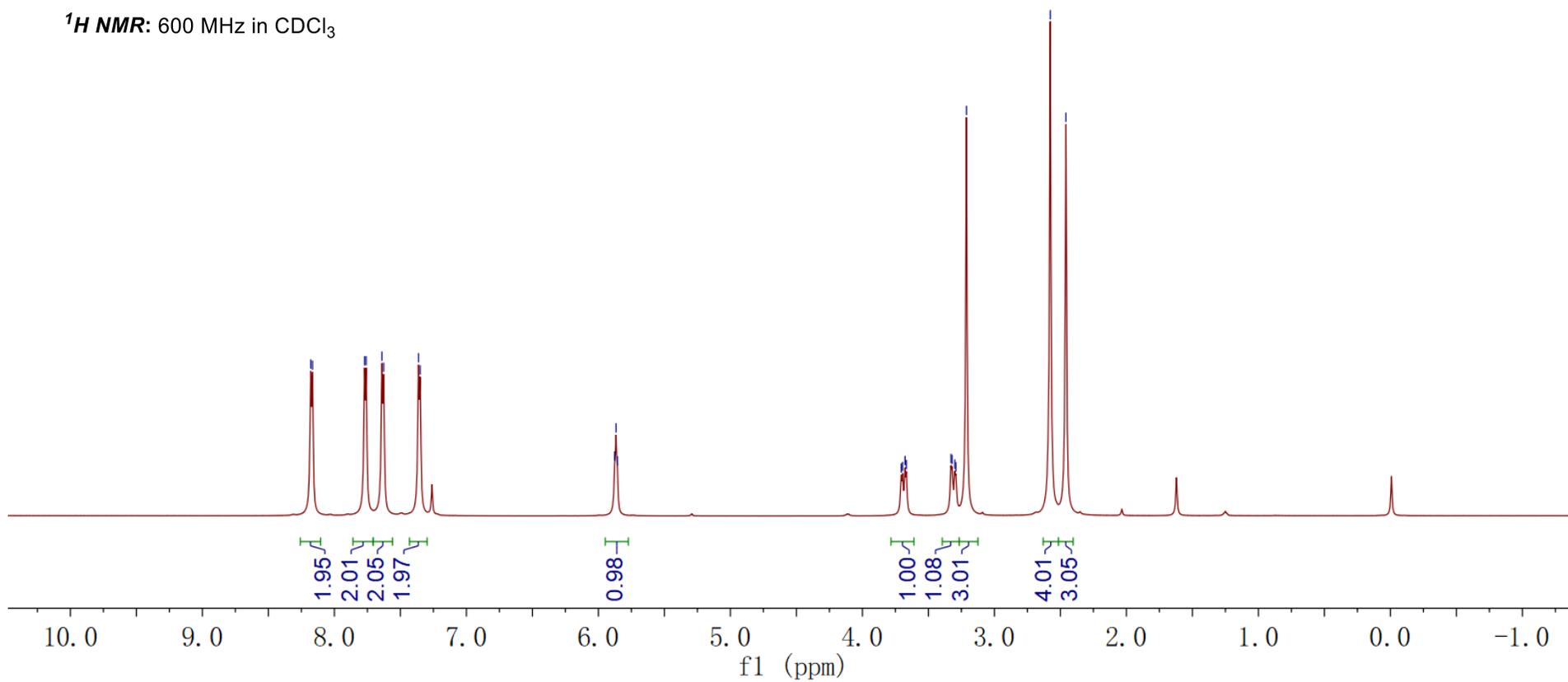


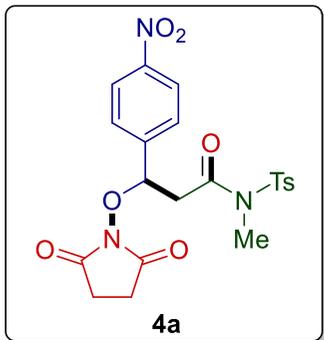
$^1\text{H NMR}$: 600 MHz in CDCl_3

8.179
8.166
7.771
7.759
7.640
7.627
7.362
7.350

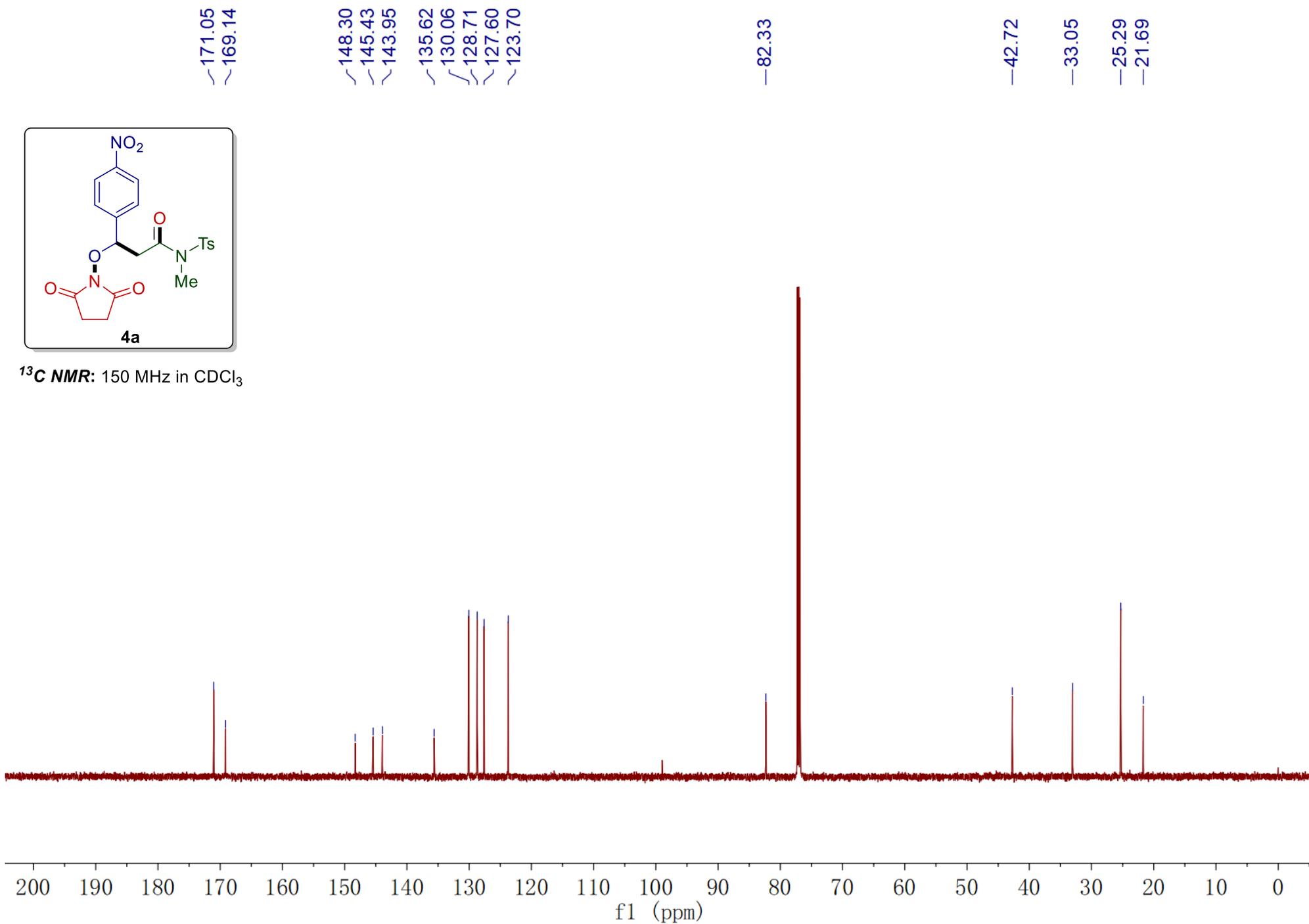
5.877
5.866
5.856

3.706
3.696
3.677
3.667
3.329
3.321
3.300
3.292
3.212
2.577
2.458



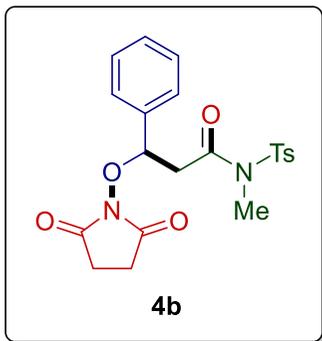


¹³C NMR: 150 MHz in CDCl₃

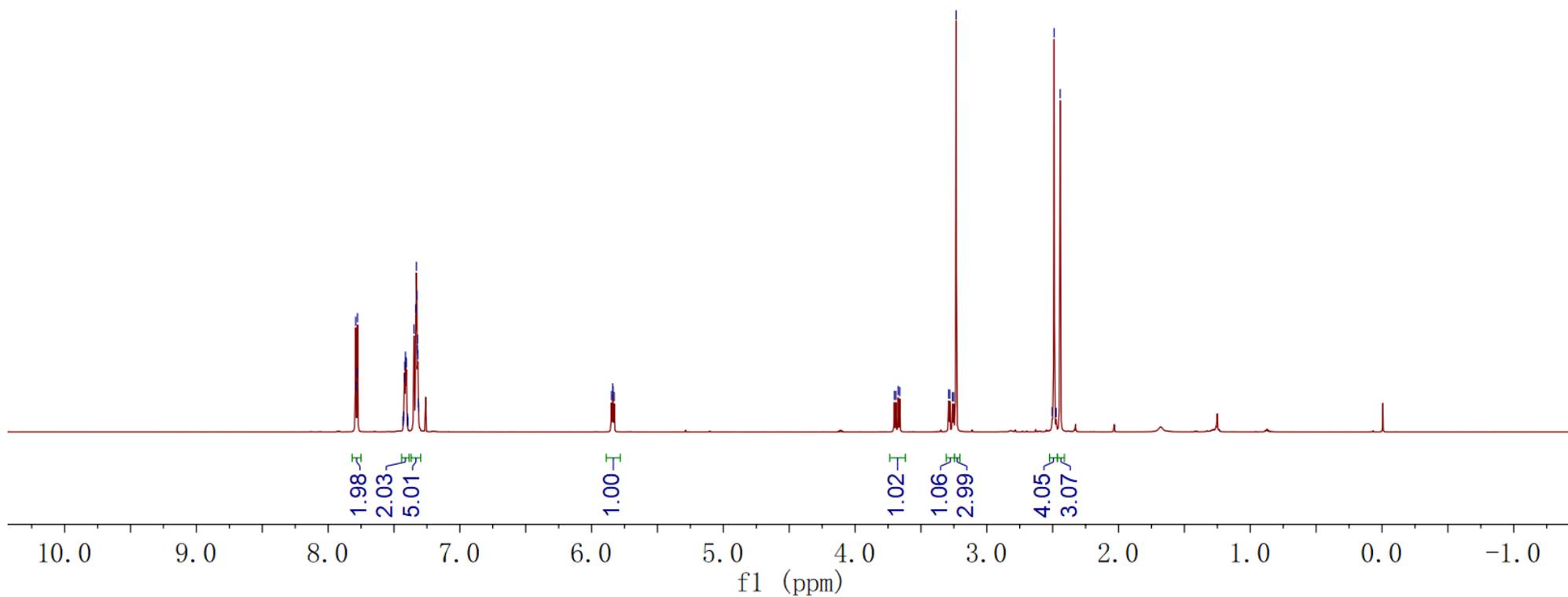


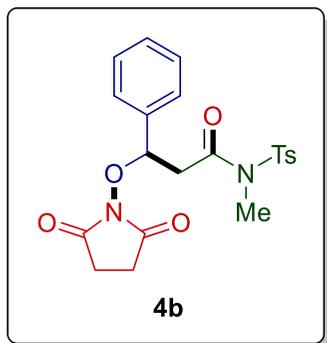
7.791
7.788
7.780
7.777
7.432
7.428
7.422
7.418
7.413
7.411
7.406
7.397
7.349
7.335
7.330
7.326
7.322
7.320
7.319
7.315
5.849
5.840
5.837
5.828

3.702
3.690
3.672
3.660
3.289
3.281
3.260
3.252
3.232
2.504
2.489
2.473
2.443

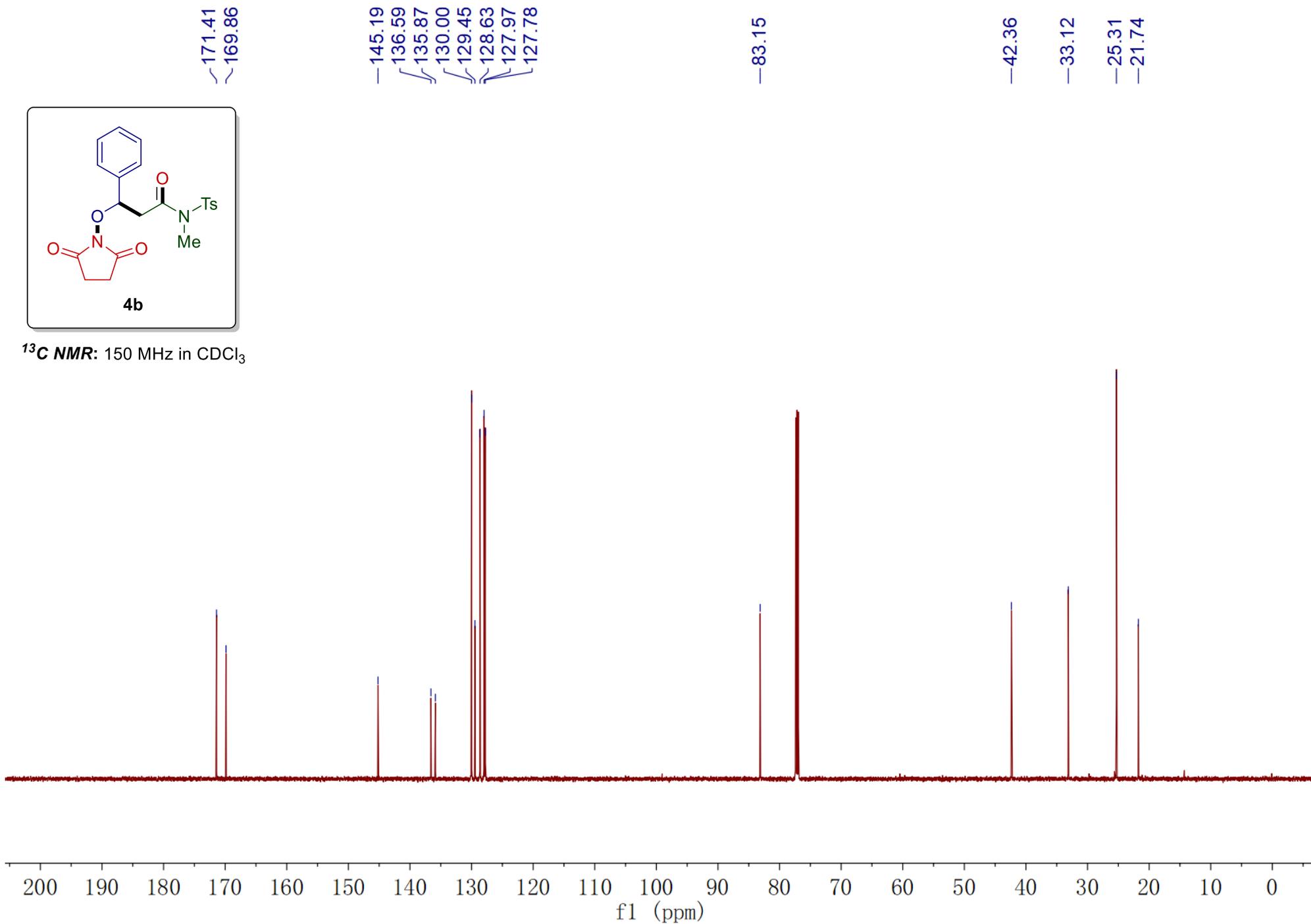


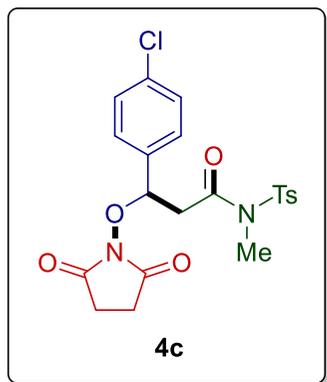
¹H NMR: 600 MHz in CDCl₃



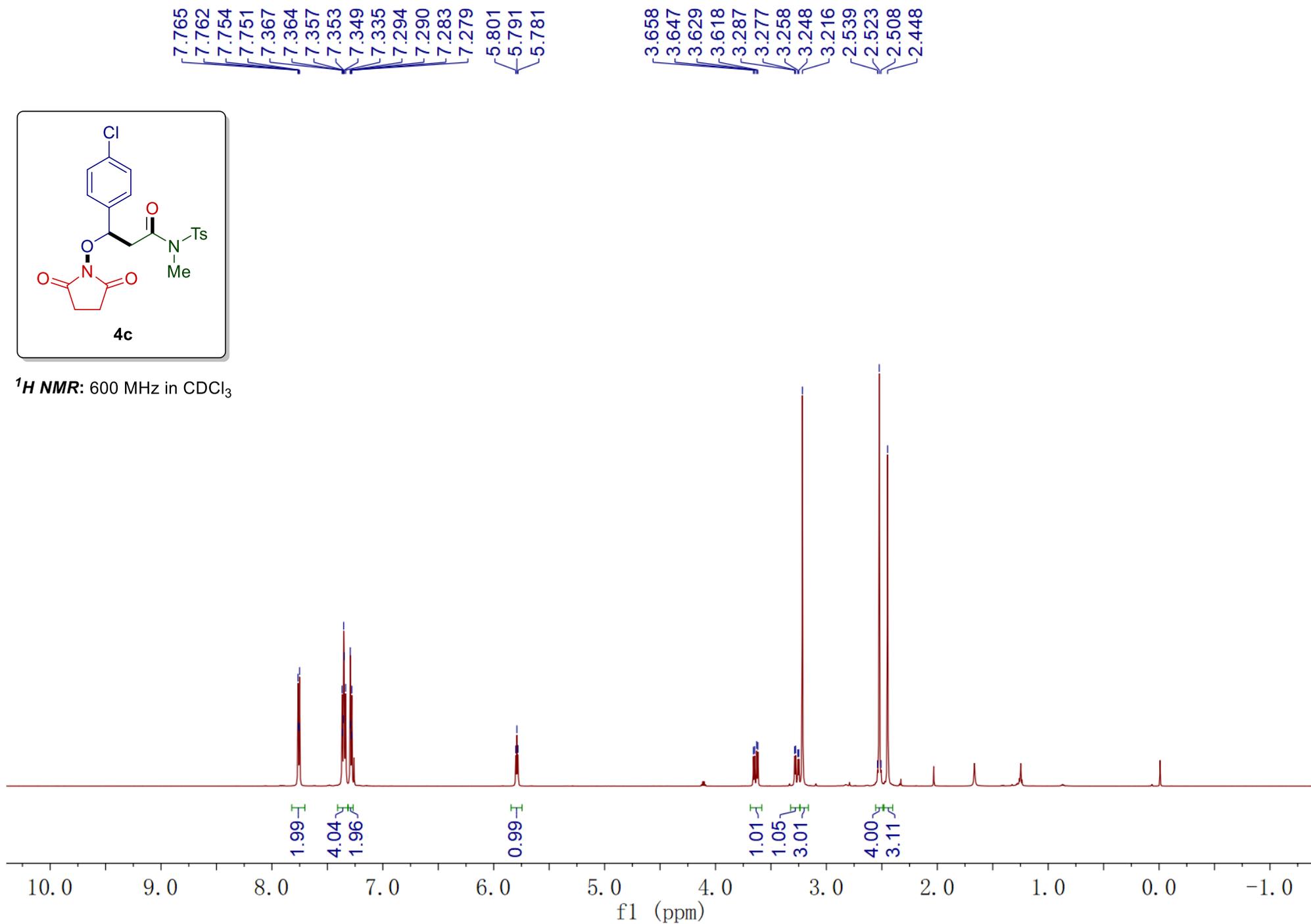


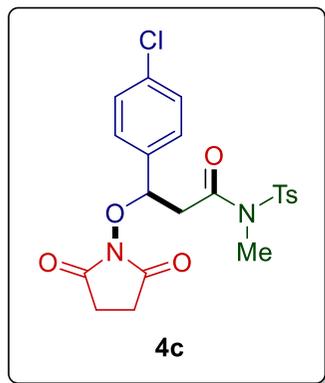
¹³C NMR: 150 MHz in CDCl₃



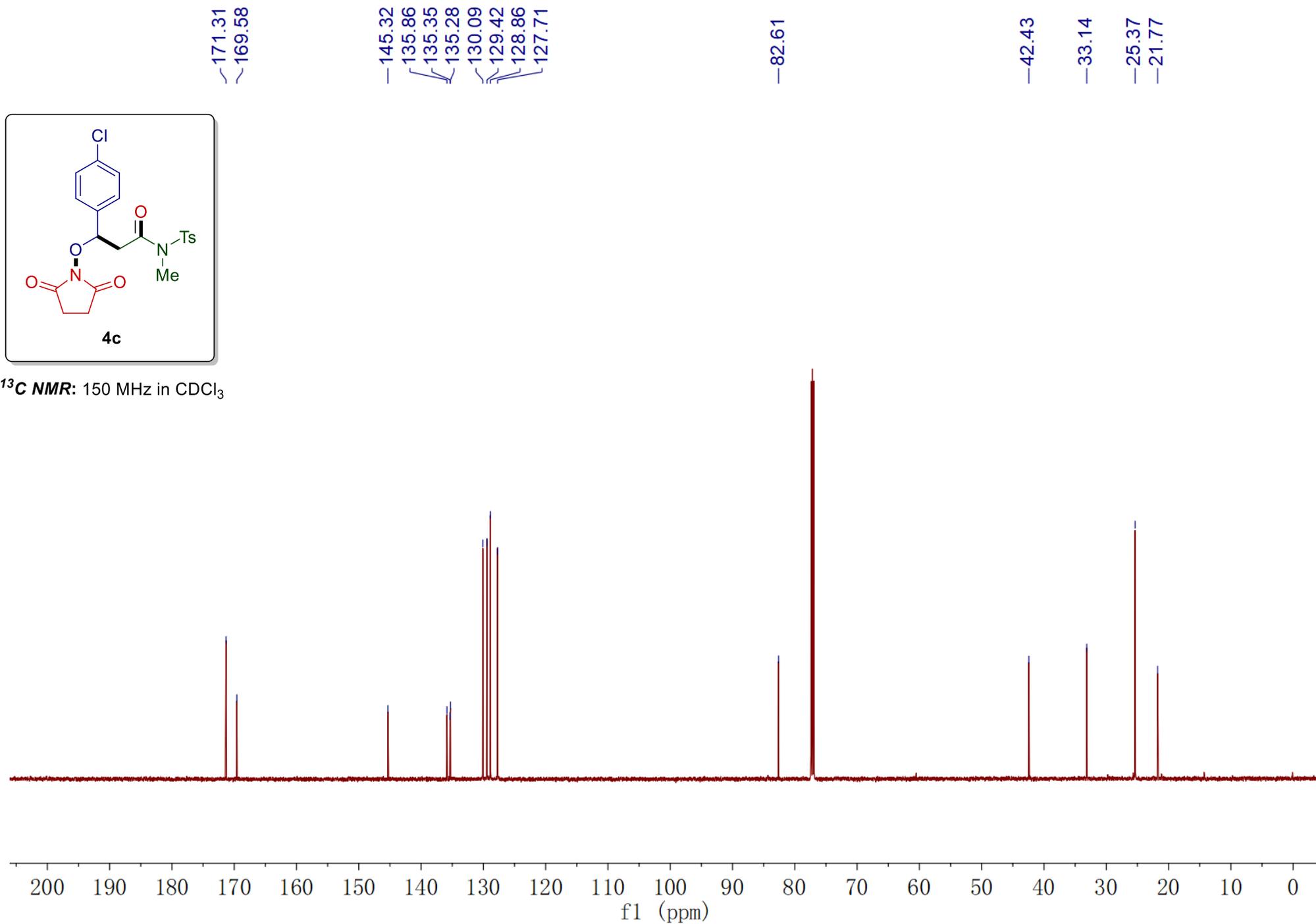


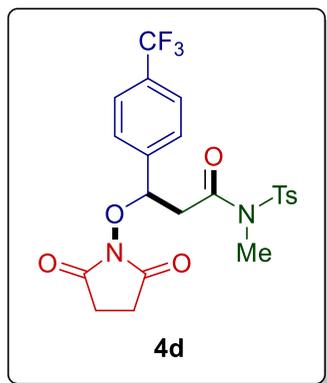
¹H NMR: 600 MHz in CDCl₃





¹³C NMR: 150 MHz in CDCl₃

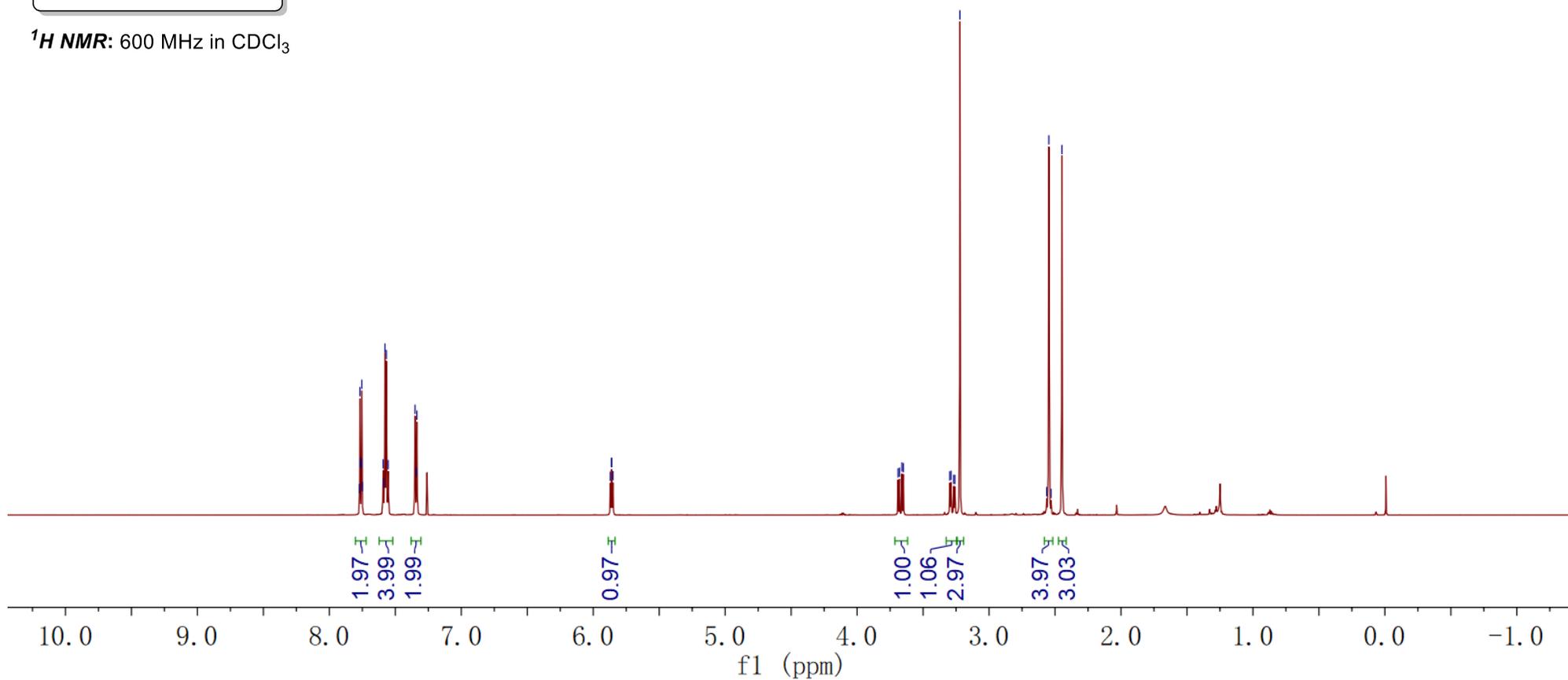


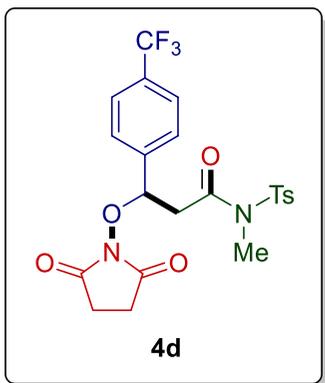


¹H NMR: 600 MHz in CDCl₃

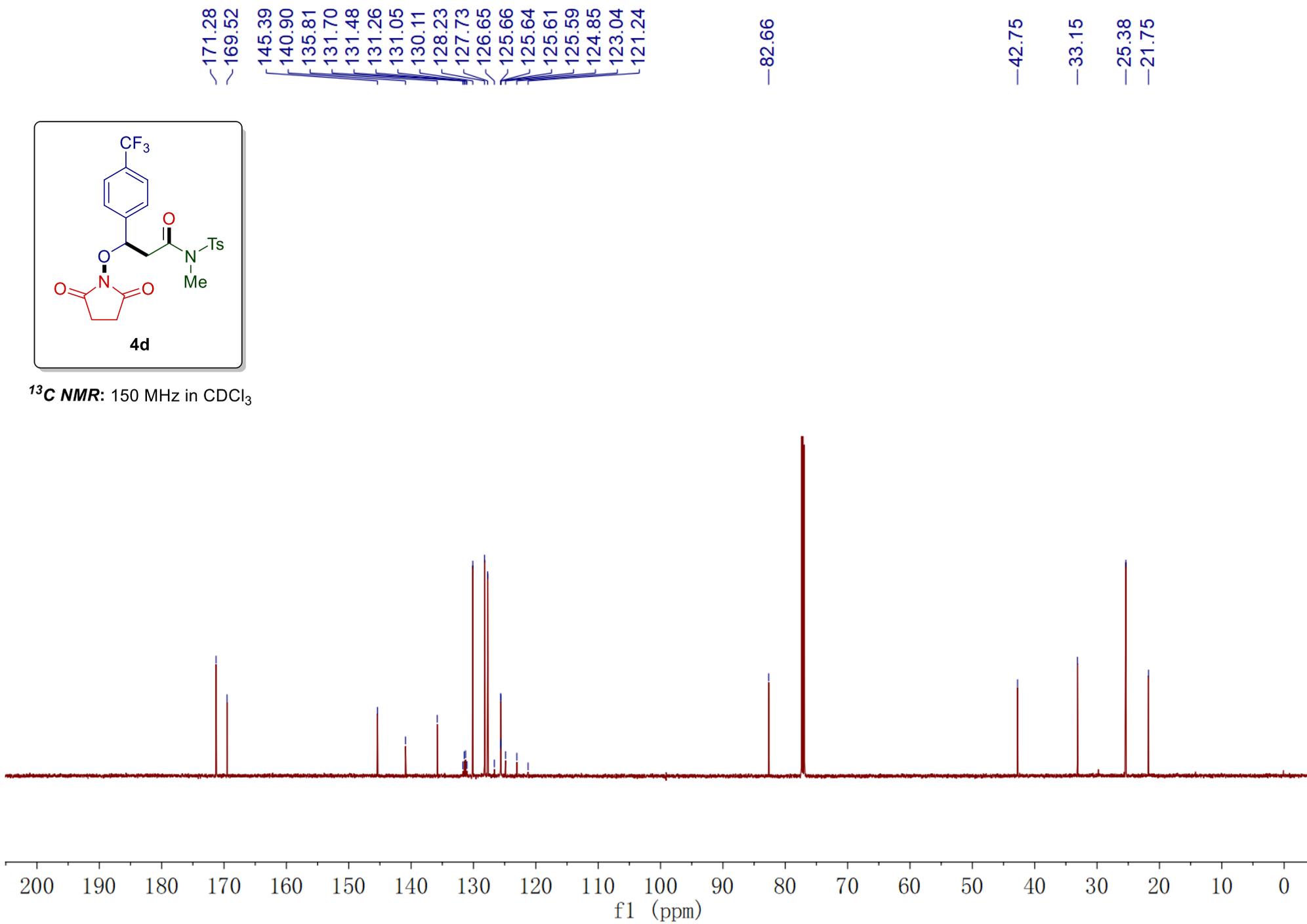
7.772
7.768
7.765
7.757
7.754
7.750
7.593
7.590
7.578
7.568
7.554
7.350
7.340
7.337
5.871
5.861
5.860
5.850

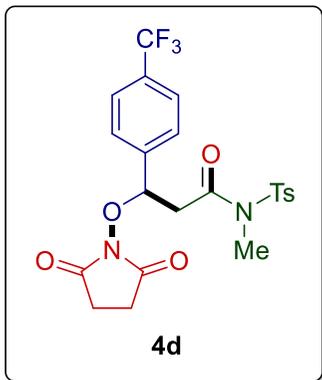
3.690
3.678
3.661
3.649
3.298
3.289
3.268
3.259
3.221
2.563
2.547
2.530
2.448



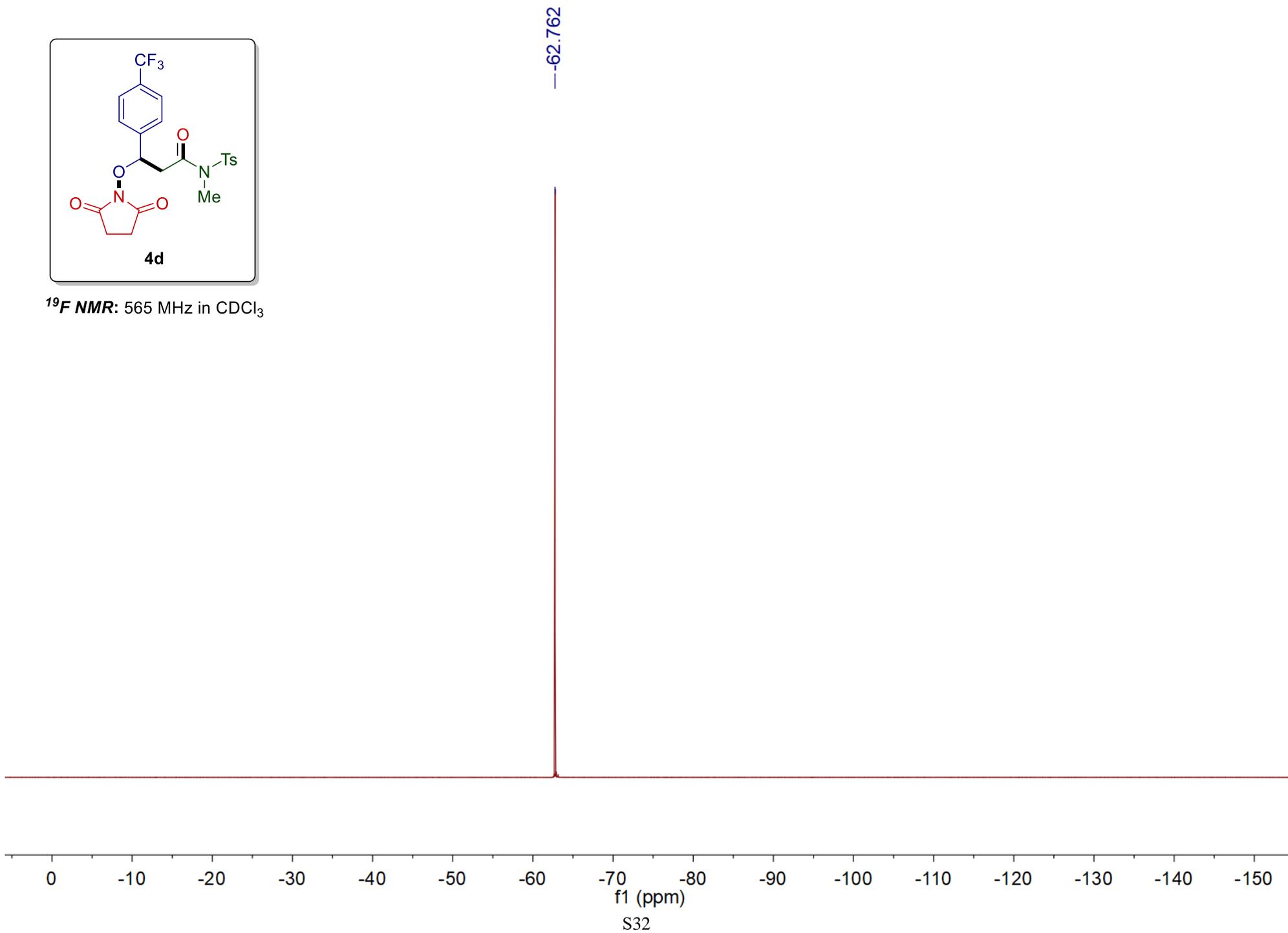


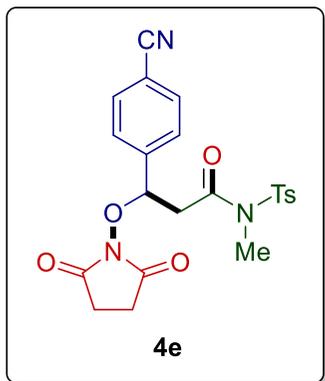
¹³C NMR: 150 MHz in CDCl₃



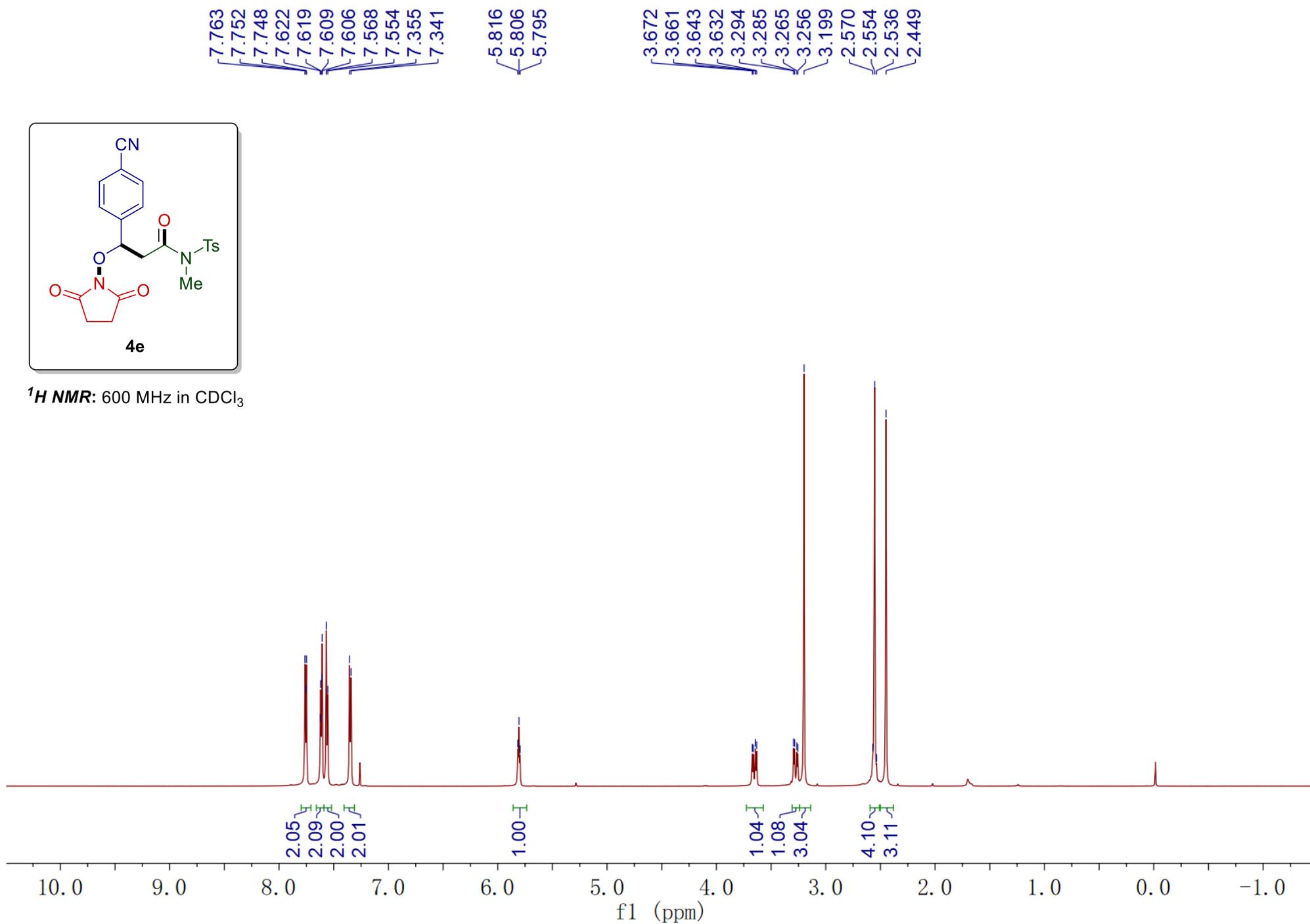


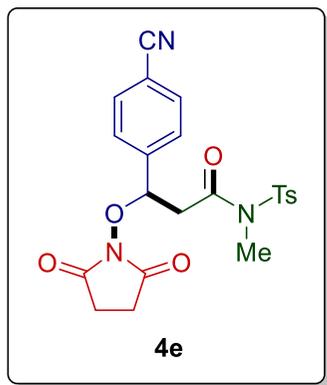
¹⁹F NMR: 565 MHz in CDCl₃





$^1\text{H NMR}$: 600 MHz in CDCl_3





¹³C NMR: 150 MHz in CDCl₃

171.14
169.22

145.38
142.04
135.60
132.33
130.04
128.48
127.62

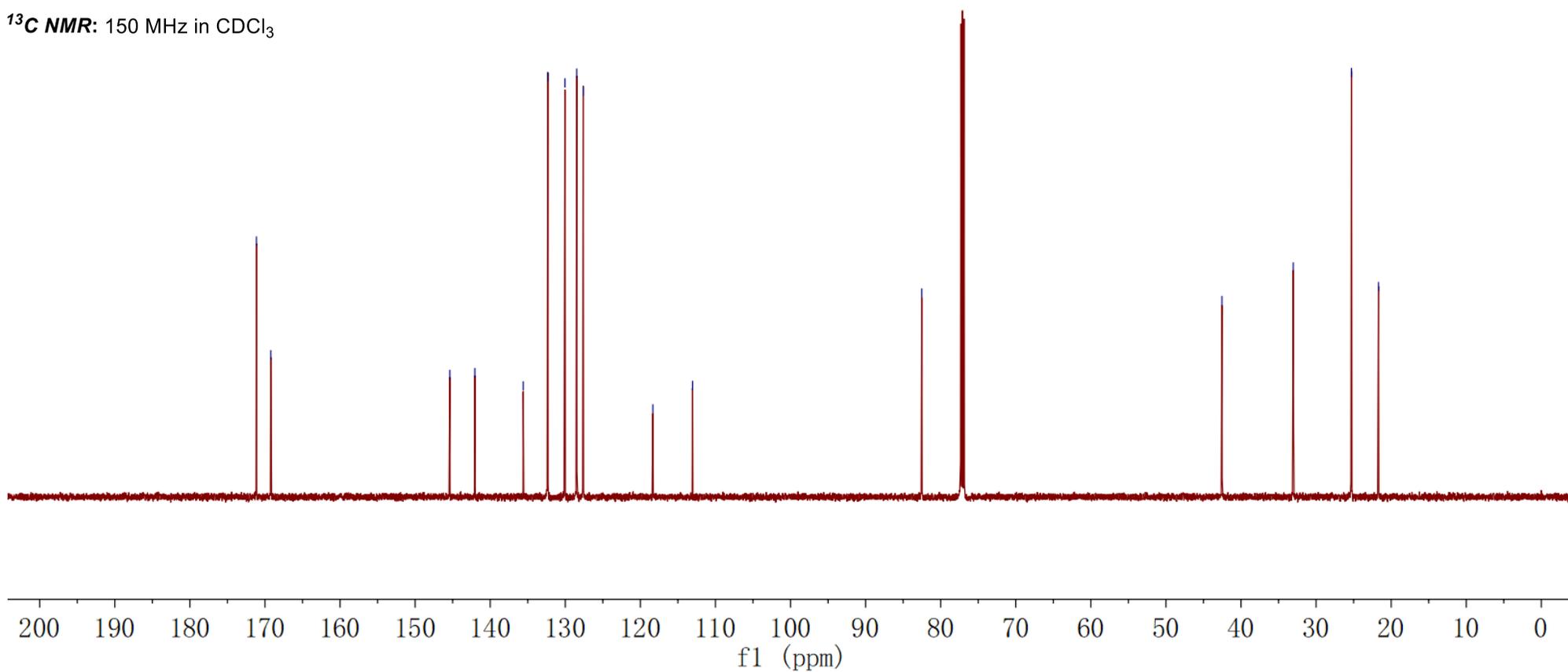
118.33
113.04

82.52

42.54

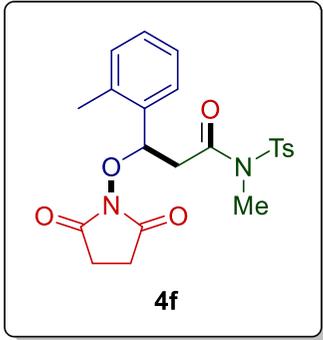
33.04

25.29
21.69

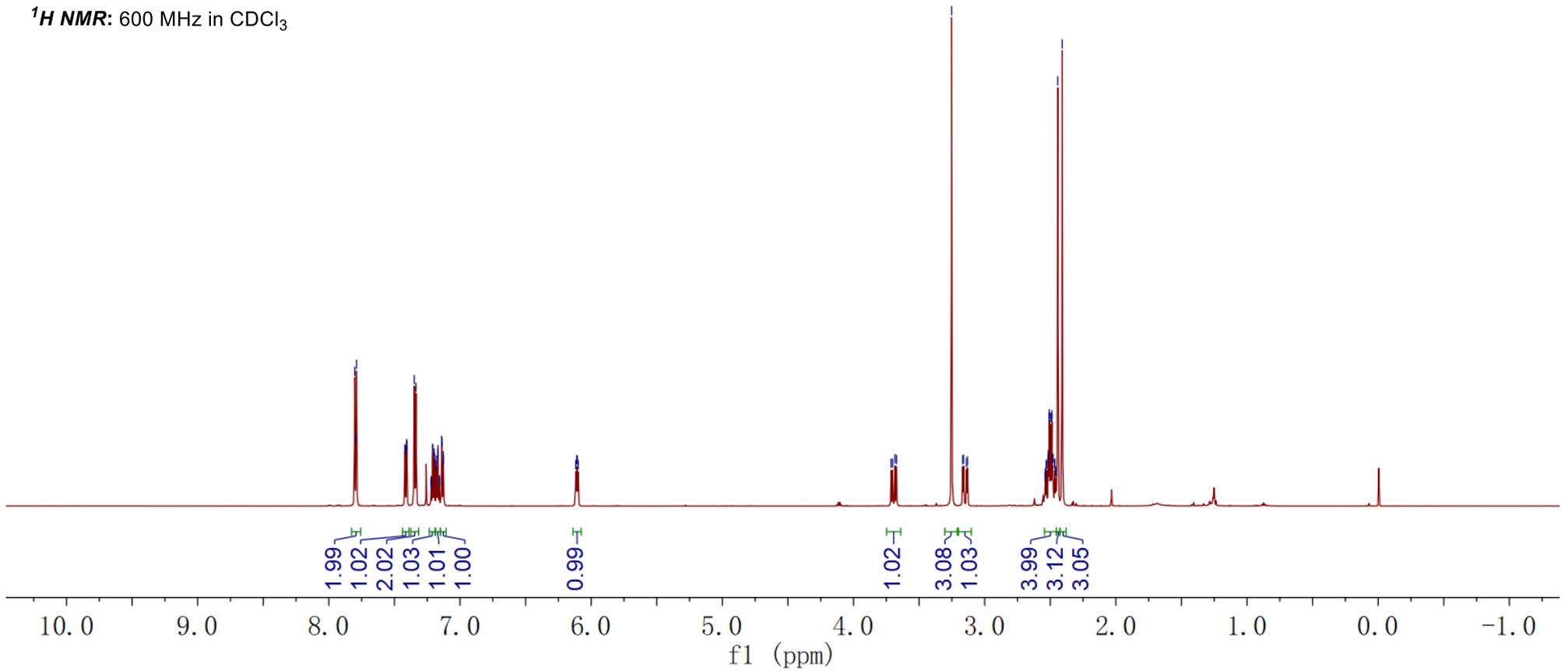


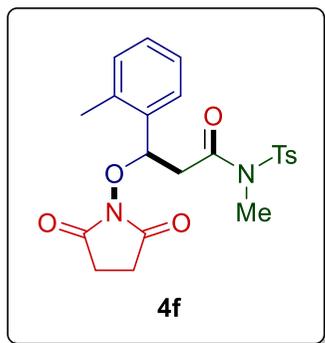
7.802
7.792
7.789
7.420
7.417
7.407
7.405
7.349
7.335
7.209
7.207
7.197
7.194
7.170
7.168
7.141
7.138
7.128
6.128
6.111
6.106
6.099

3.714
3.701
3.684
3.672
3.252
3.168
3.161
3.138
3.131
2.540
2.538
2.531
2.529
2.517
2.515
2.509
2.507
2.498
2.489
2.487
2.481
2.479
2.467
2.466
2.458
2.456
2.443
2.409

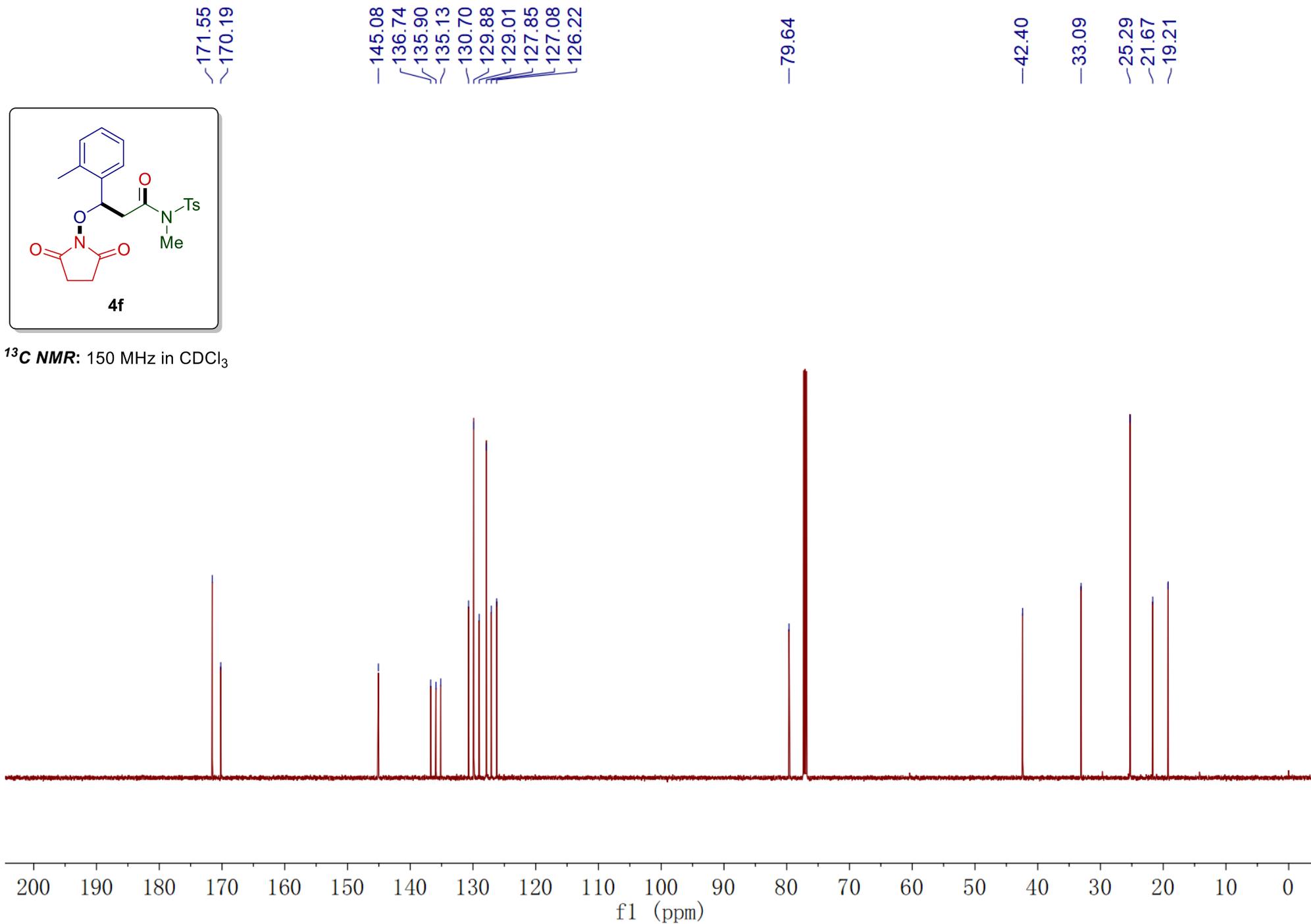


¹H NMR: 600 MHz in CDCl₃



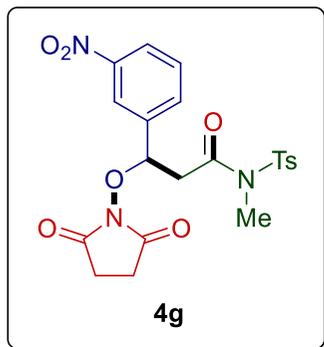


¹³C NMR: 150 MHz in CDCl₃

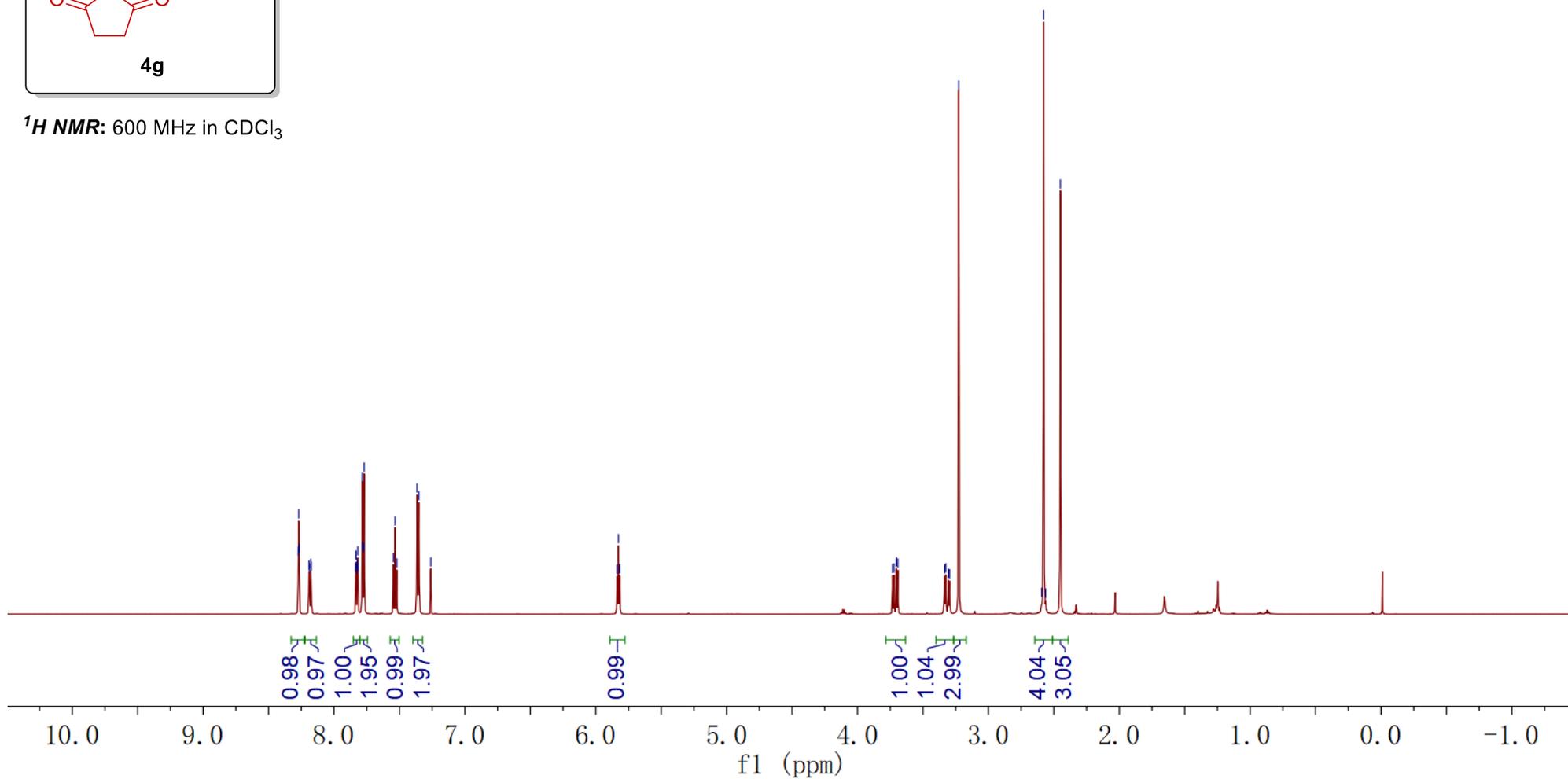


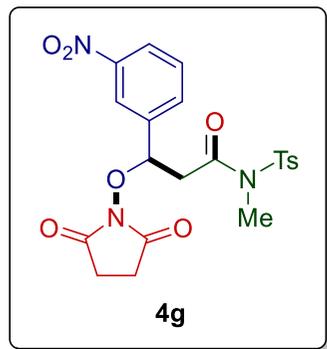
8.273
8.269
8.266
8.191
8.177
8.174
7.834
7.831
7.821
7.818
7.816
7.784
7.781
7.773
7.770
7.546
7.533
7.520
7.365
7.352
7.299
5.827
5.817

3.732
3.721
3.703
3.692
3.335
3.325
3.305
3.296
3.226
2.593
2.578
2.563
2.450



¹H NMR: 600 MHz in CDCl₃





171.11
169.21

148.15
145.44
139.12
135.60
133.96
130.06
129.65
127.61
124.11
122.72

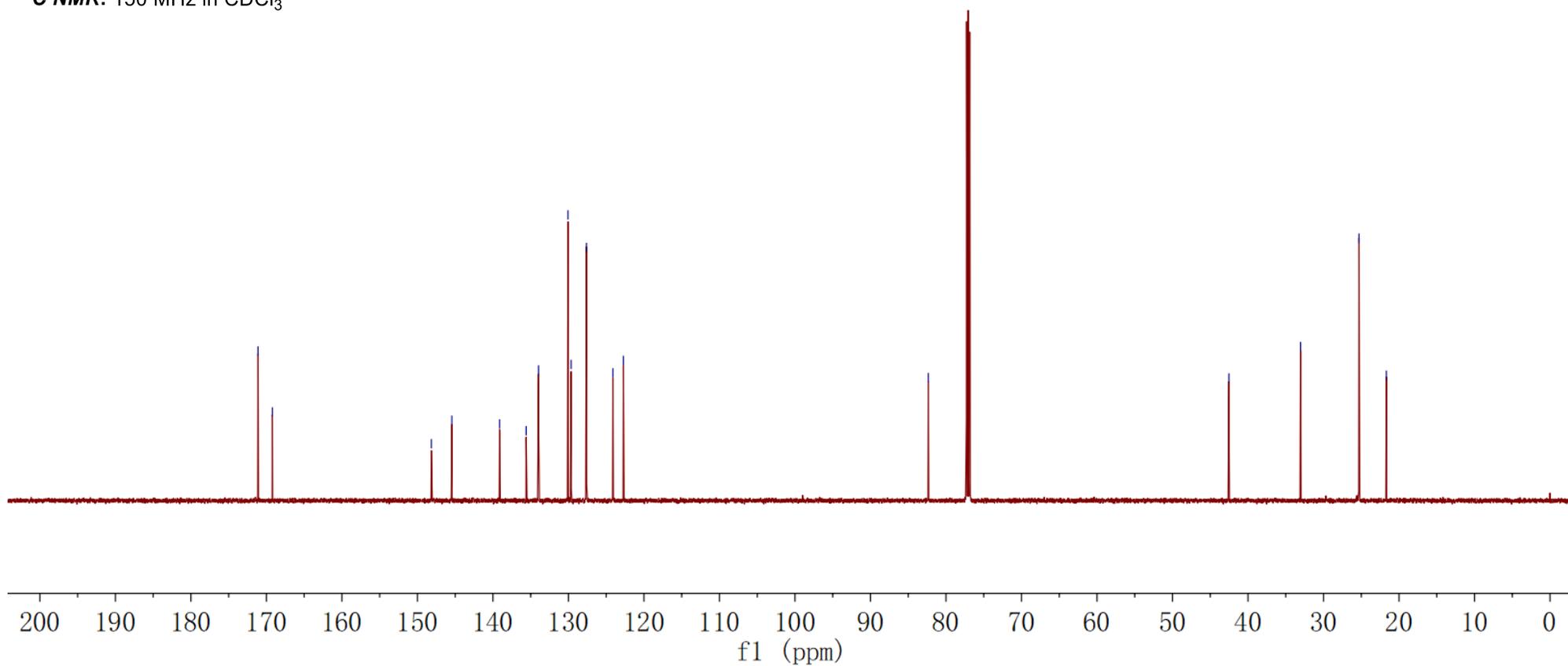
82.34

42.53

33.04

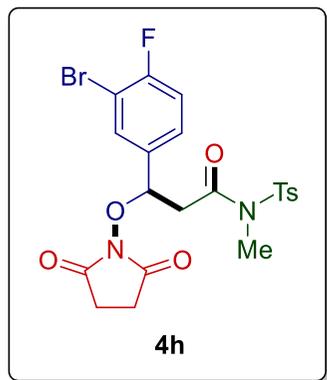
25.30
21.68

¹³C NMR: 150 MHz in CDCl₃

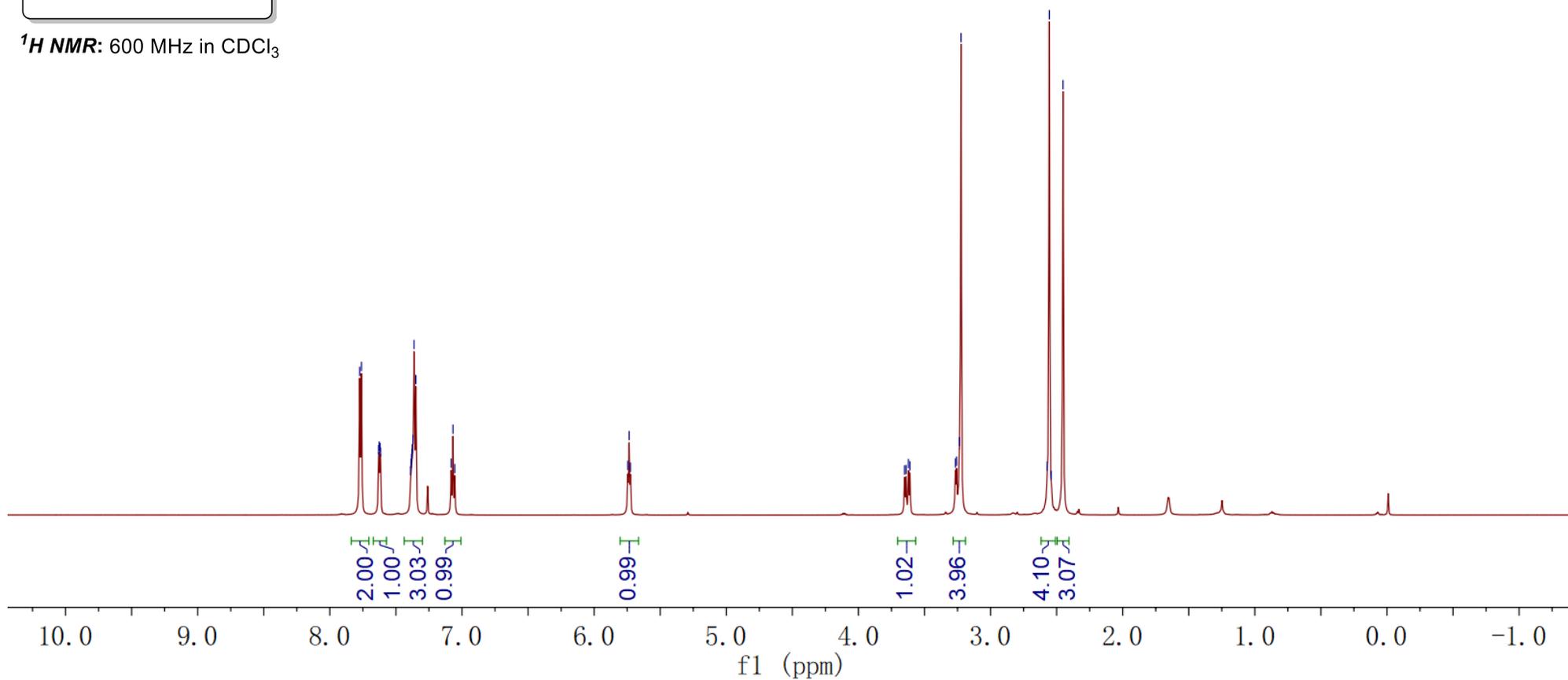


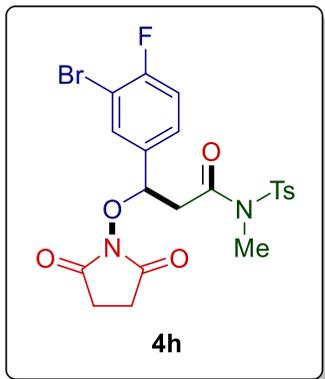
7.774
7.761
7.630
7.627
7.620
7.616
7.389
7.386
7.382
7.378
7.376
7.371
7.363
7.349
7.082
7.068
7.054
5.745
5.735
5.725

3.651
3.640
3.622
3.610
3.266
3.257
3.236
3.223
2.571
2.555
2.540
2.452

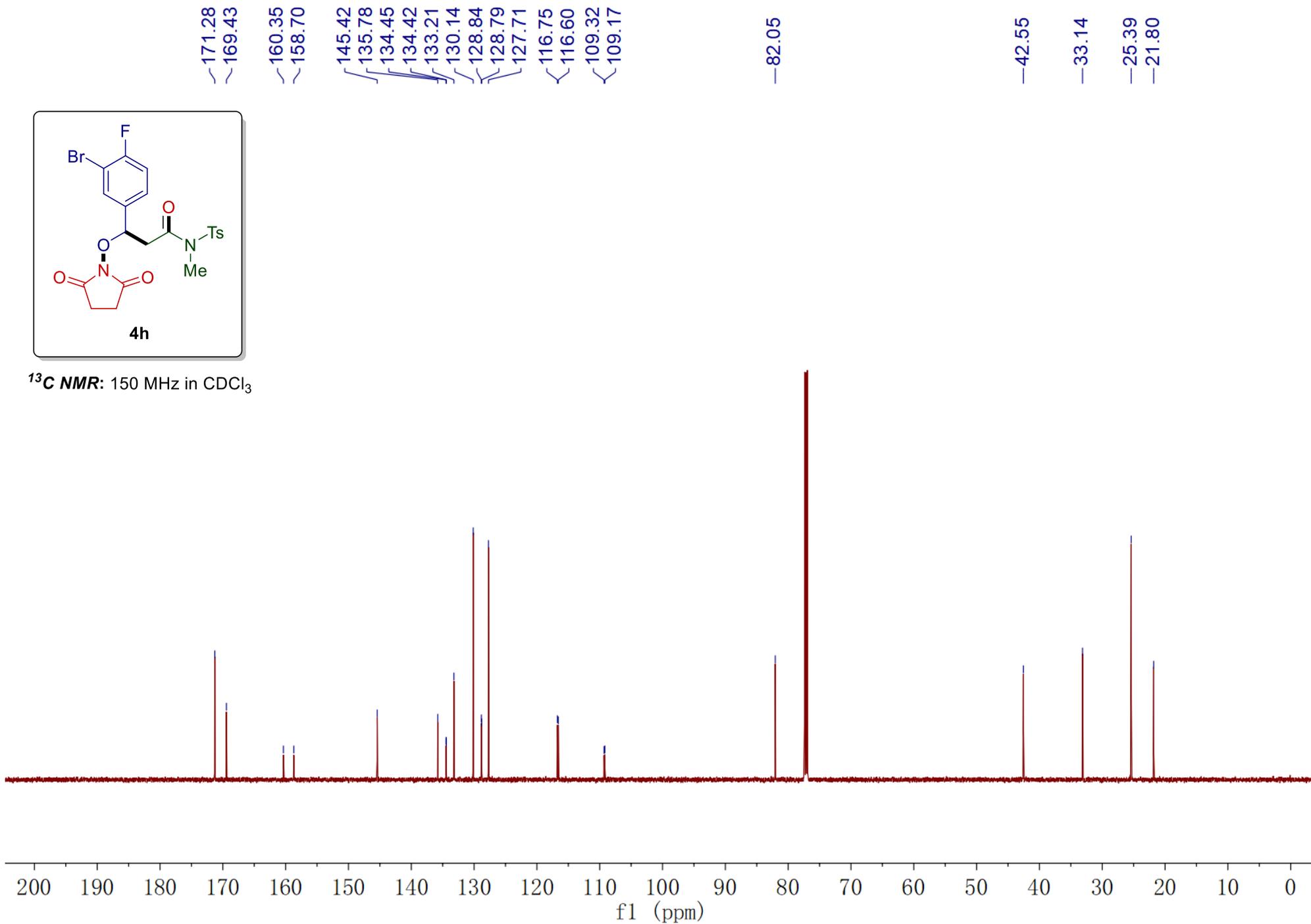


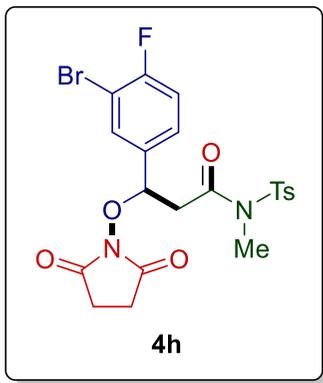
¹H NMR: 600 MHz in CDCl₃





¹³C NMR: 150 MHz in CDCl₃





¹⁹F NMR: 565 MHz in CDCl₃

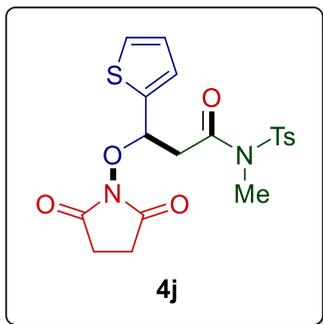
---105.902



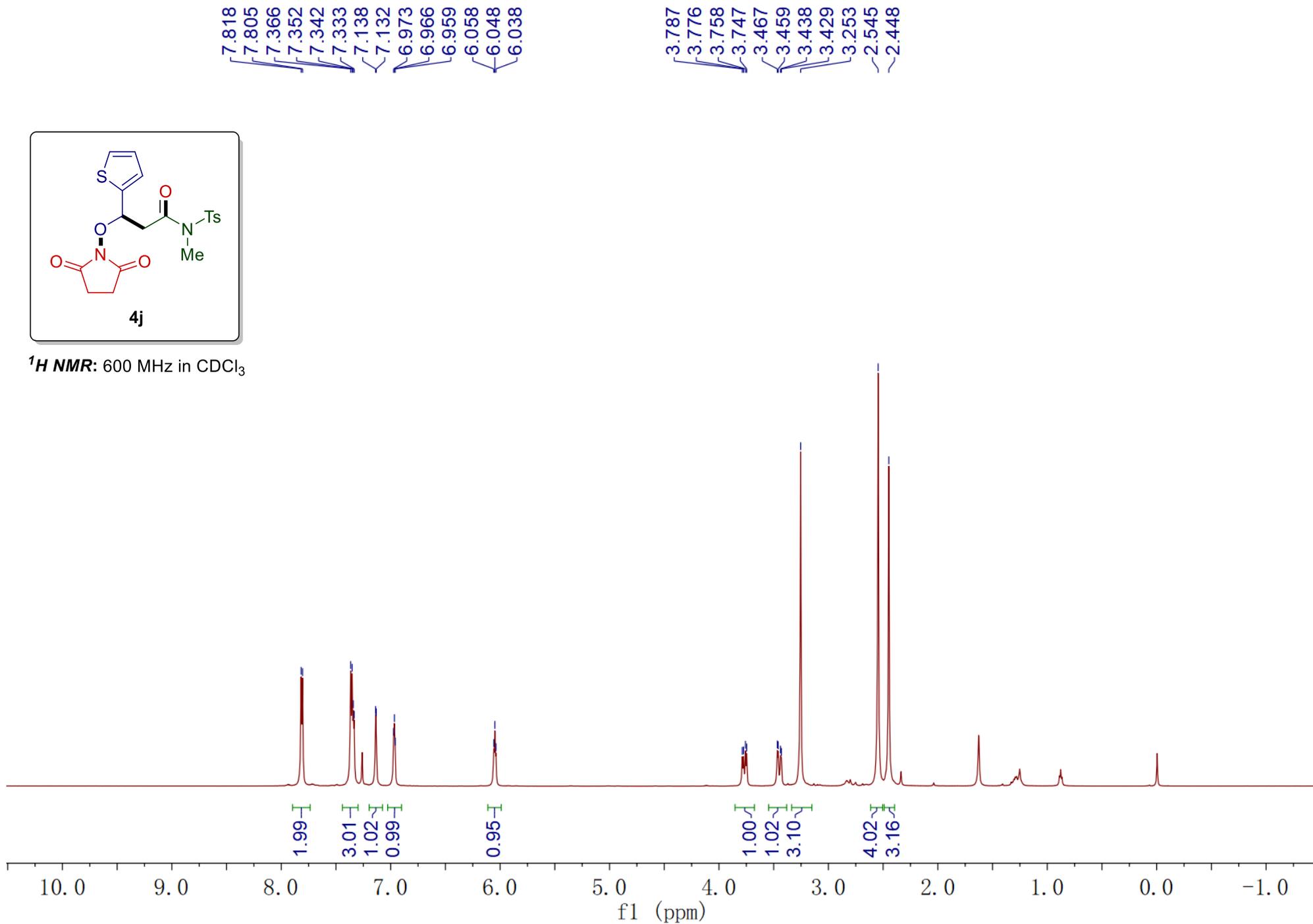
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150

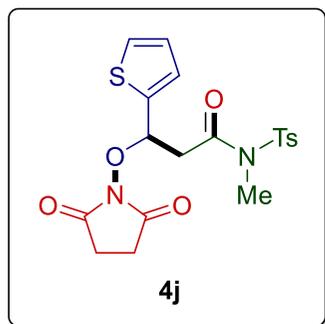
f1 (ppm)

S41



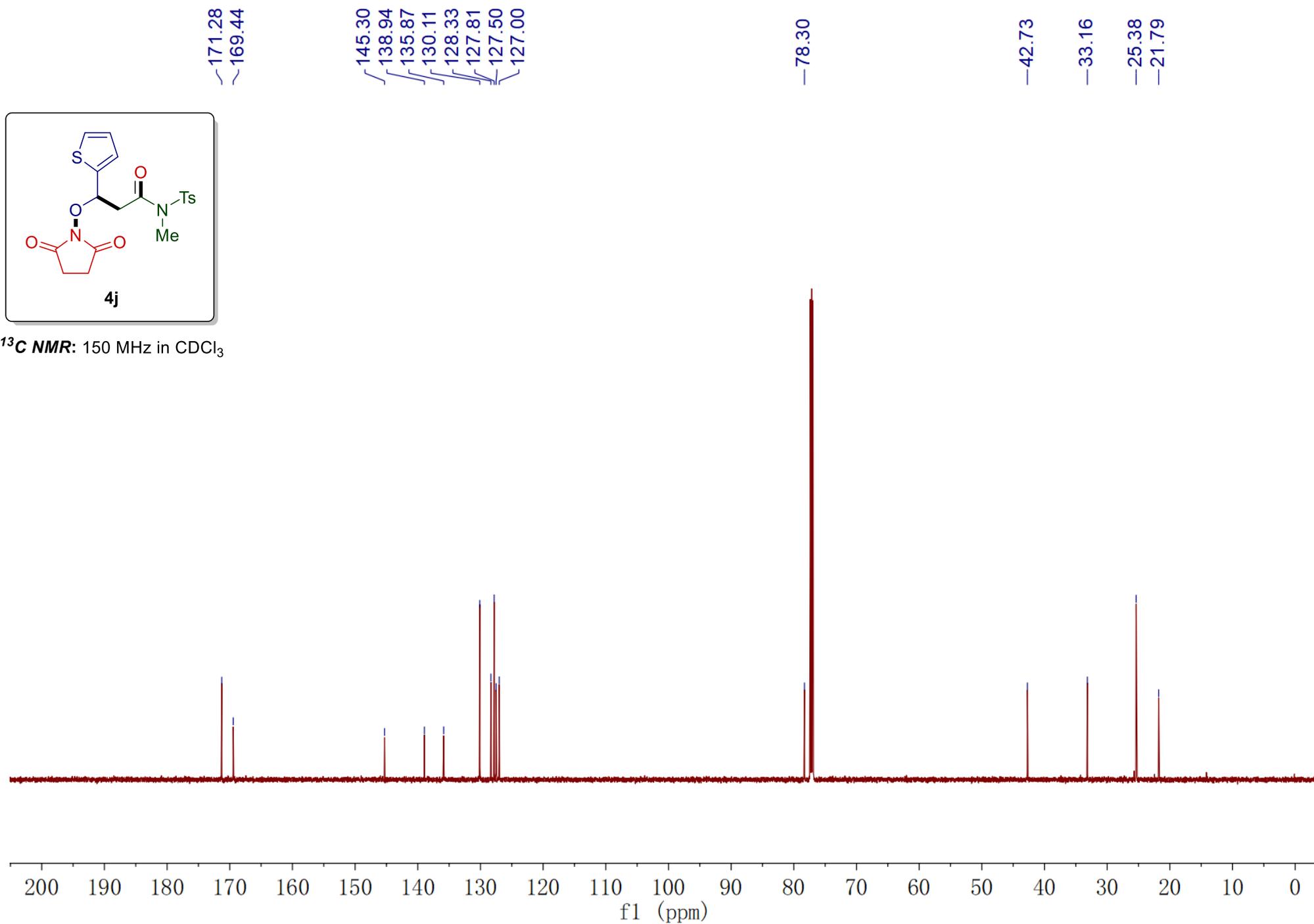
¹H NMR: 600 MHz in CDCl₃

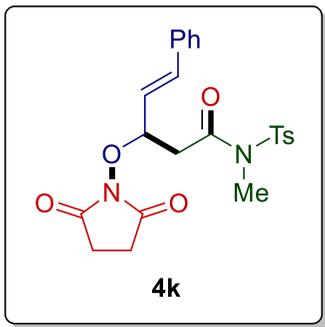




4j

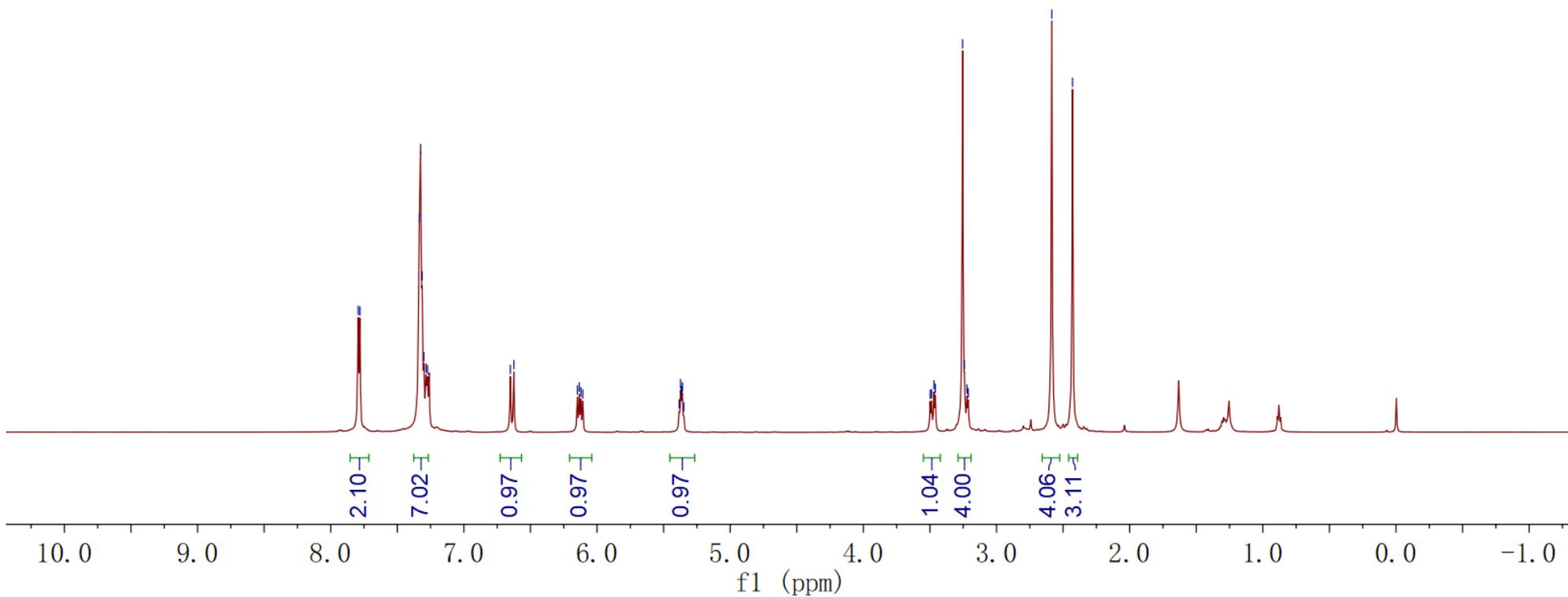
^{13}C NMR: 150 MHz in CDCl_3

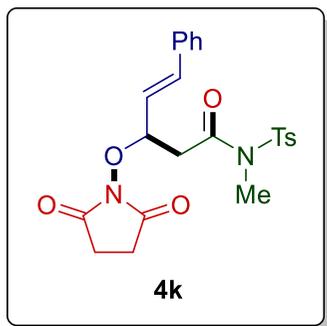




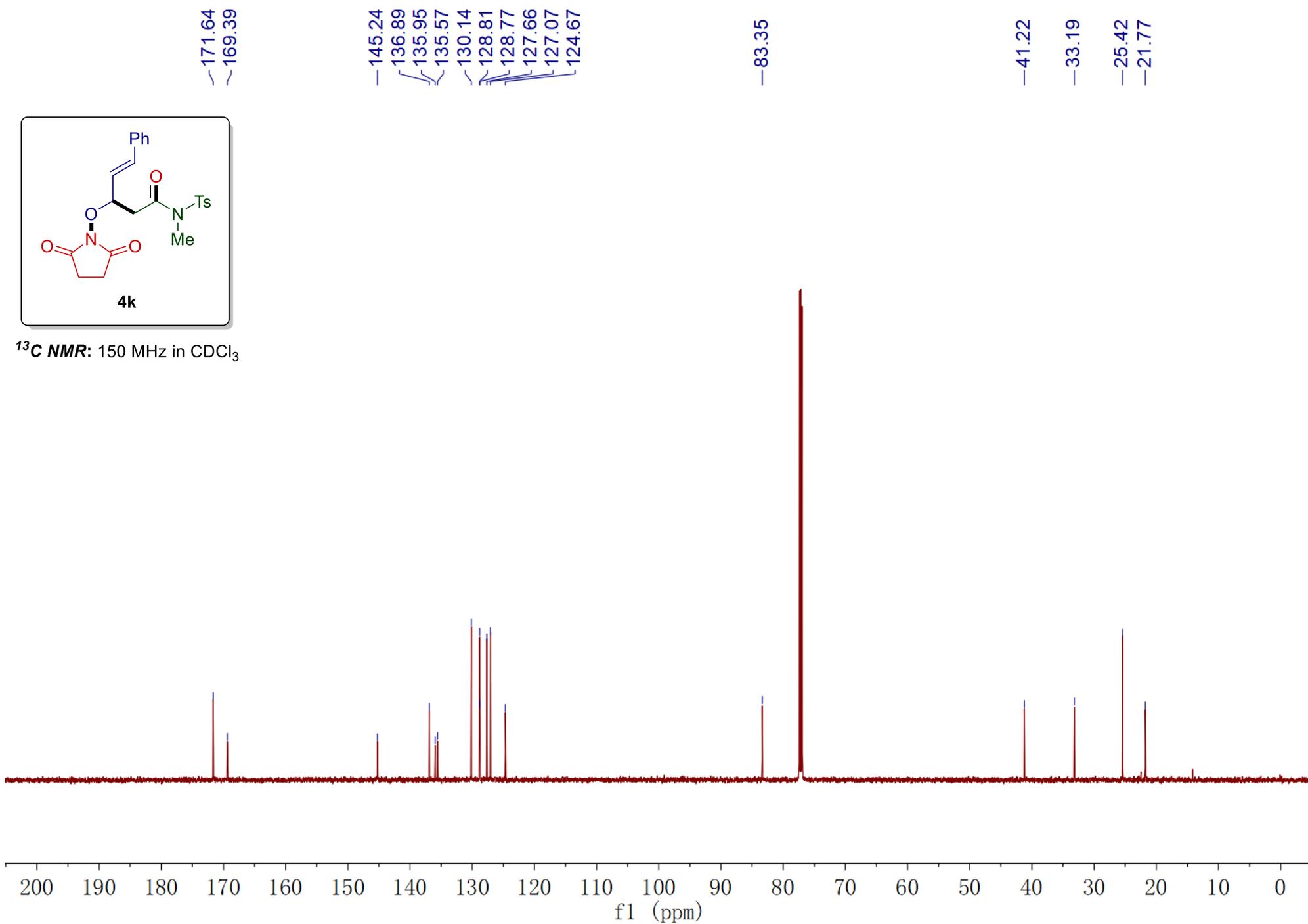
¹H NMR: 600 MHz in CDCl₃

7.794
7.781
7.335
7.325
7.313
7.301
7.284
7.273
6.651
6.625
6.148
6.133
6.121
6.107
5.383
5.373
5.368
5.363
5.358
5.348
3.498
3.488
3.470
3.459
3.255
3.241
3.222
3.212
-2.585
-2.429

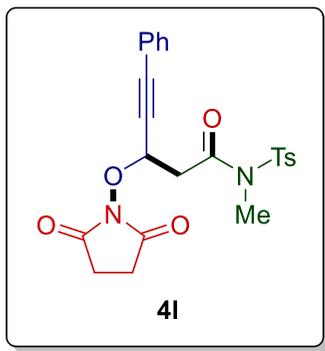




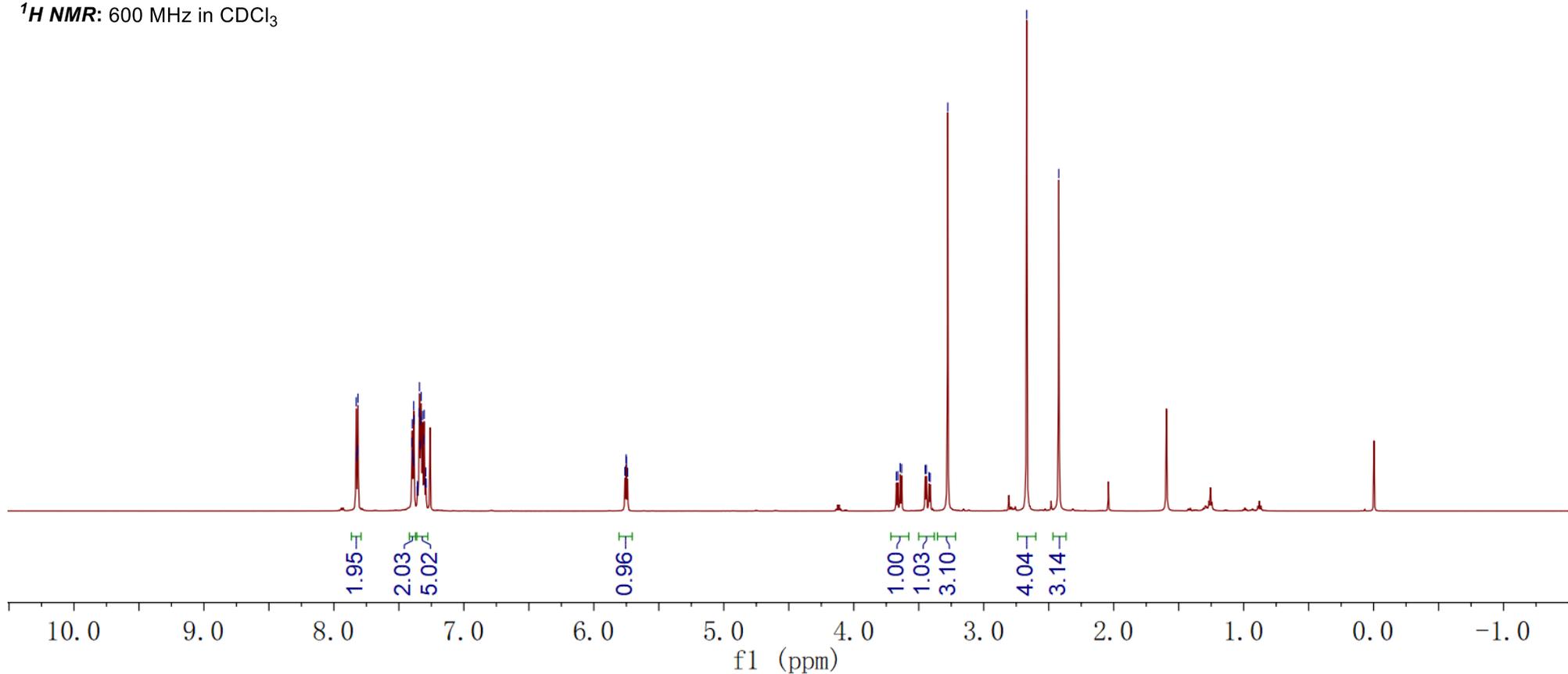
¹³C NMR: 150 MHz in CDCl₃

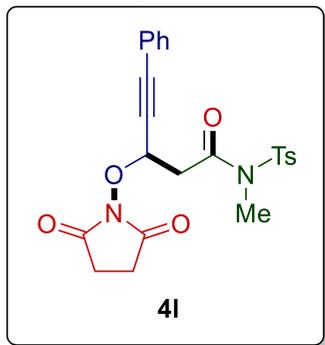


7.829
7.825
7.818
7.815
7.399
7.397
7.394
7.390
7.386
7.383
7.359
7.357
7.354
7.345
7.342
7.335
7.332
7.328
7.318
7.308
7.305
7.296
7.293
7.291
5.761
5.752
5.749
5.740
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3.412
3.277
-2.669
-2.422

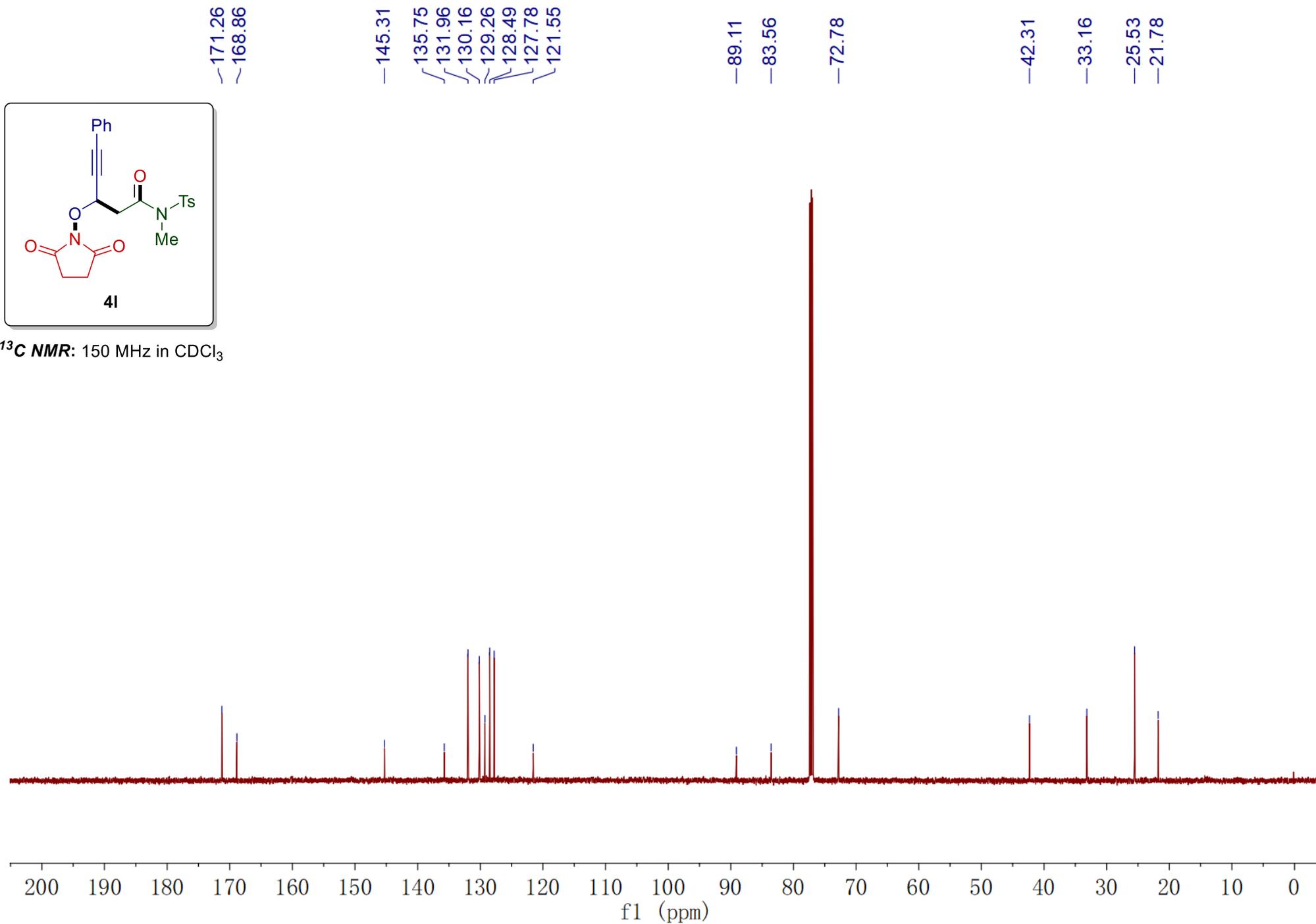


¹H NMR: 600 MHz in CDCl₃

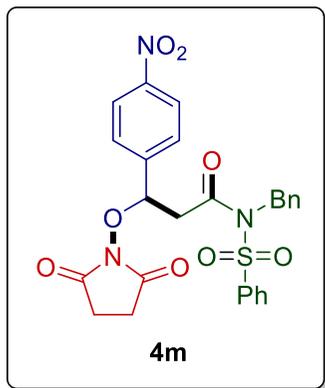




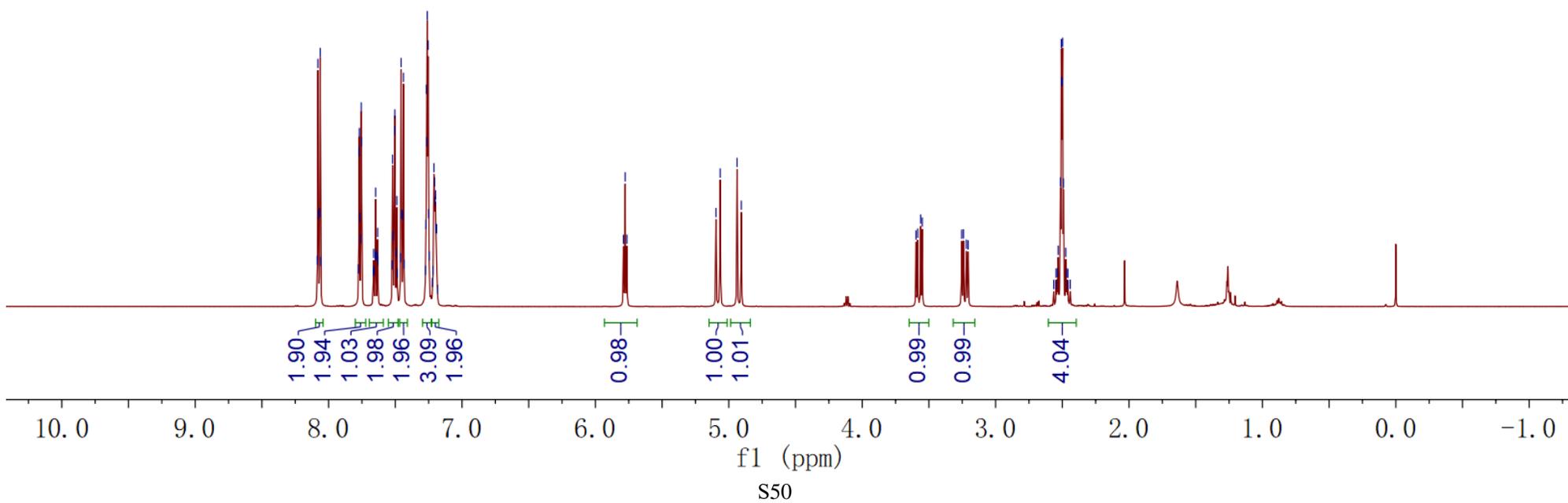
^{13}C NMR: 150 MHz in CDCl_3

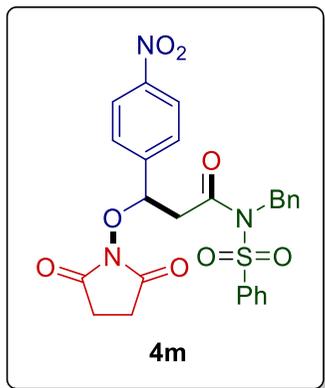


8.080
8.076
8.067
8.062
7.772
7.769
7.767
7.759
7.755
7.752
7.662
7.647
7.644
7.632
7.520
7.517
7.506
7.503
7.492
7.489
7.456
7.452
7.443
7.439
7.270
7.267
7.264
7.261
7.254
7.250
7.210
7.205
7.202
7.198
7.195
7.191
5.790
5.777
5.764
5.096
5.064
4.938
4.906
3.596
3.584
3.562
3.550
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2.501
2.498
2.491
2.474

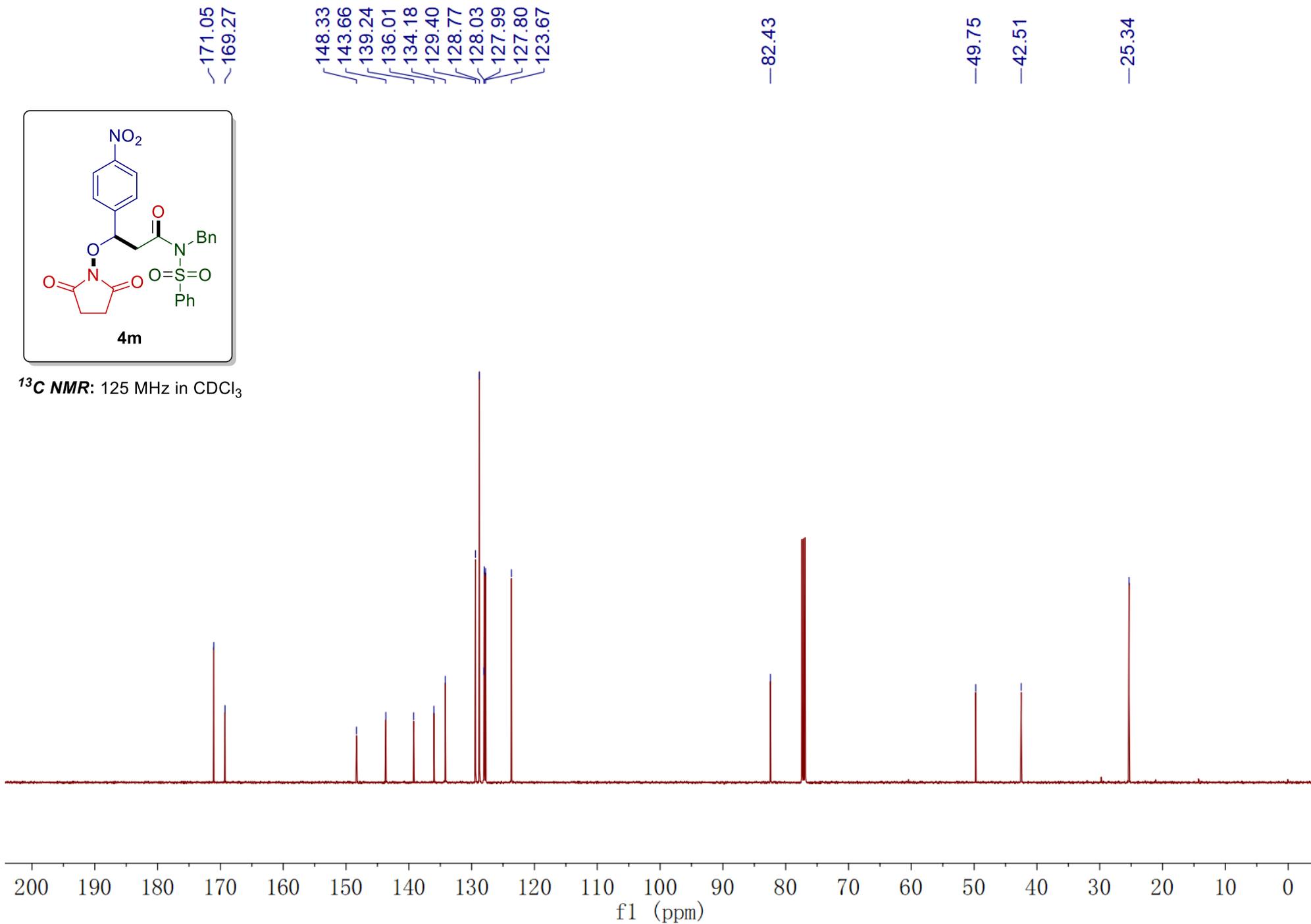


¹H NMR: 500 MHz in CDCl₃

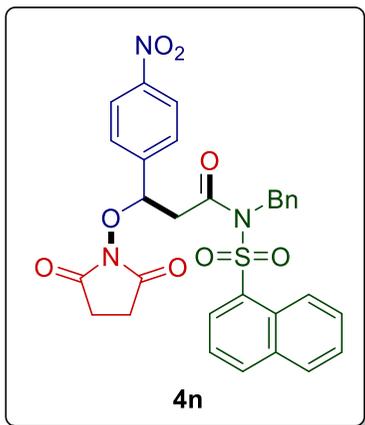




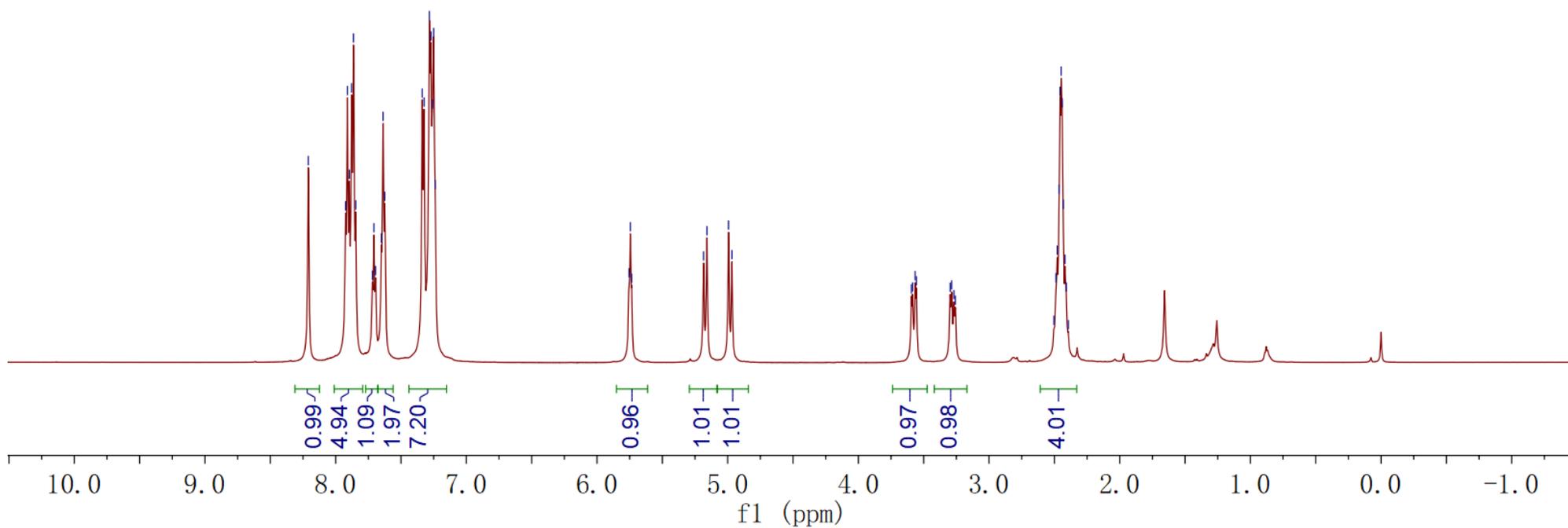
¹³C NMR: 125 MHz in CDCl₃

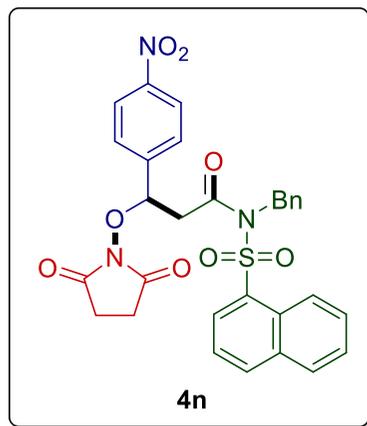


8.209
7.923
7.910
7.895
7.878
7.864
7.846
7.719
7.707
7.695
7.650
7.637
7.624
7.337
7.323
7.283
7.271
7.260
7.250
7.238
5.755
5.745
5.735
5.184
5.158
4.993
4.967
3.594
3.585
3.565
3.556
3.297
3.286
3.269
3.257
2.504
2.488
2.478
2.464
2.457
2.448
2.440
2.433
2.419
2.409
2.393

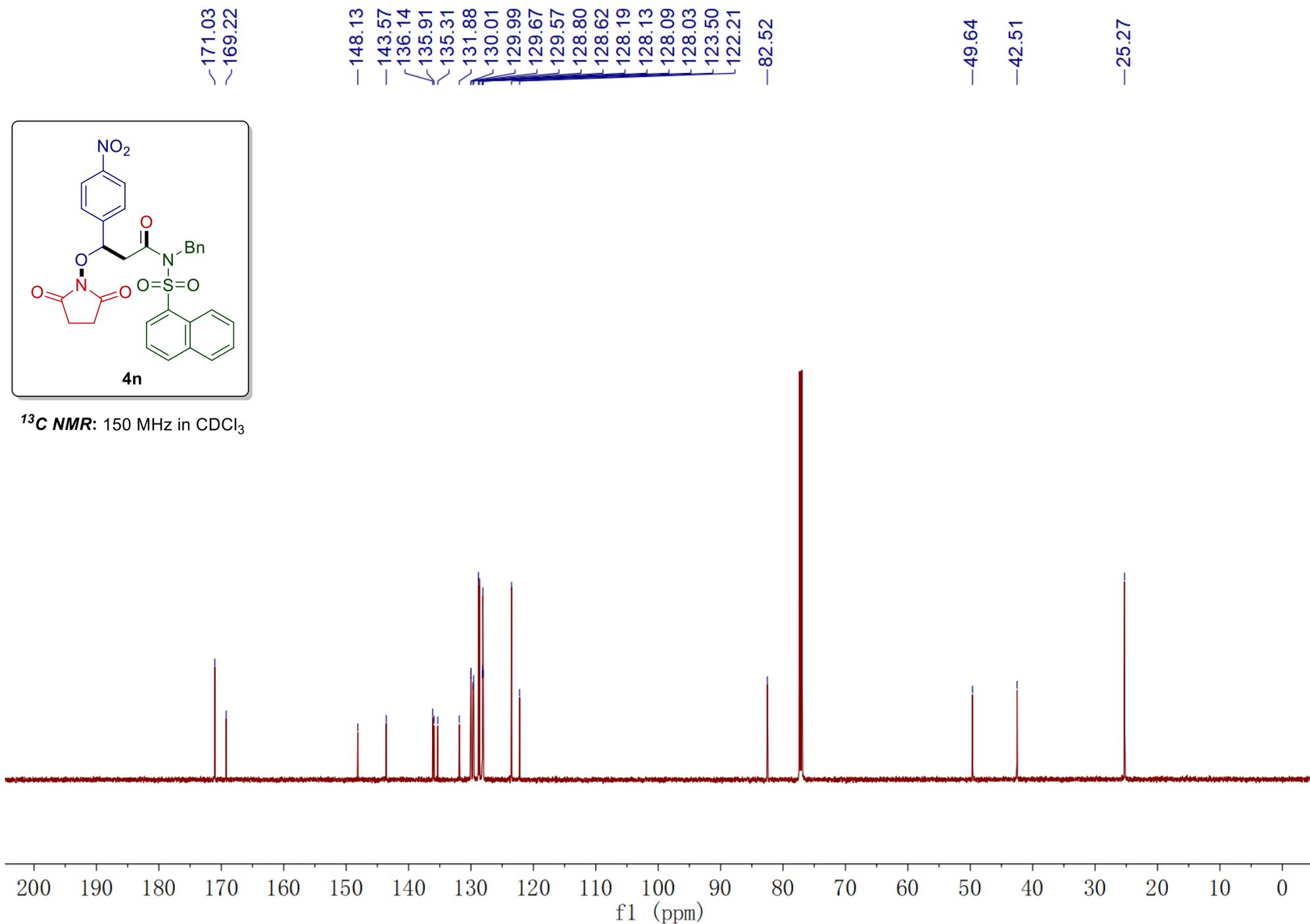


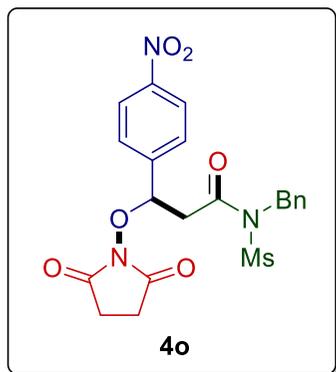
¹H NMR: 600 MHz in CDCl₃



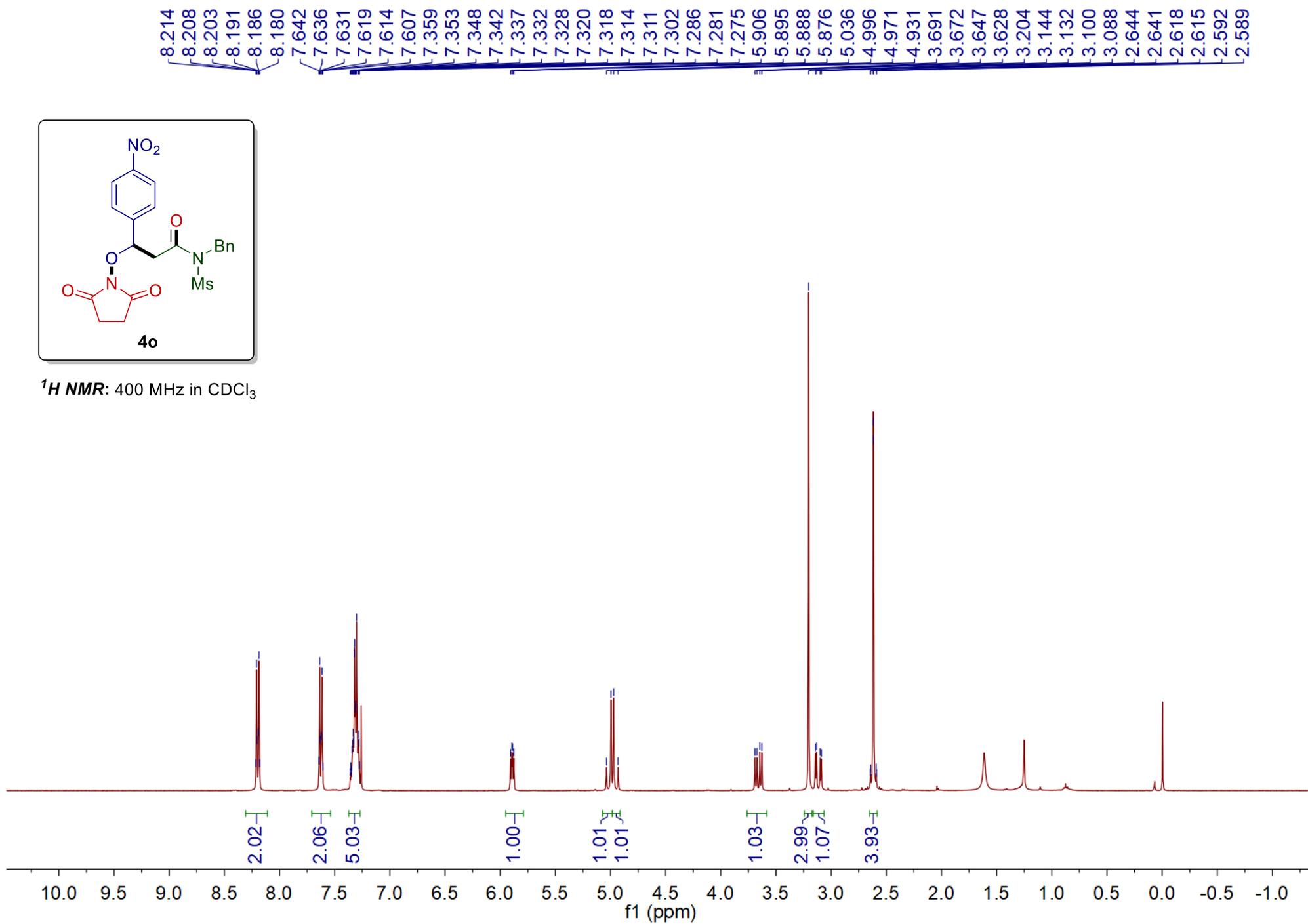


¹³C NMR: 150 MHz in CDCl₃

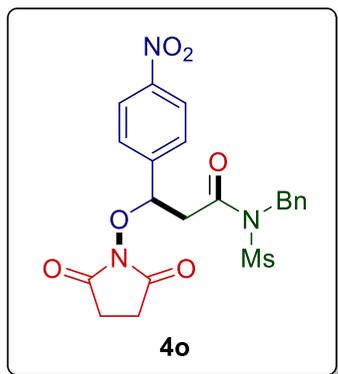




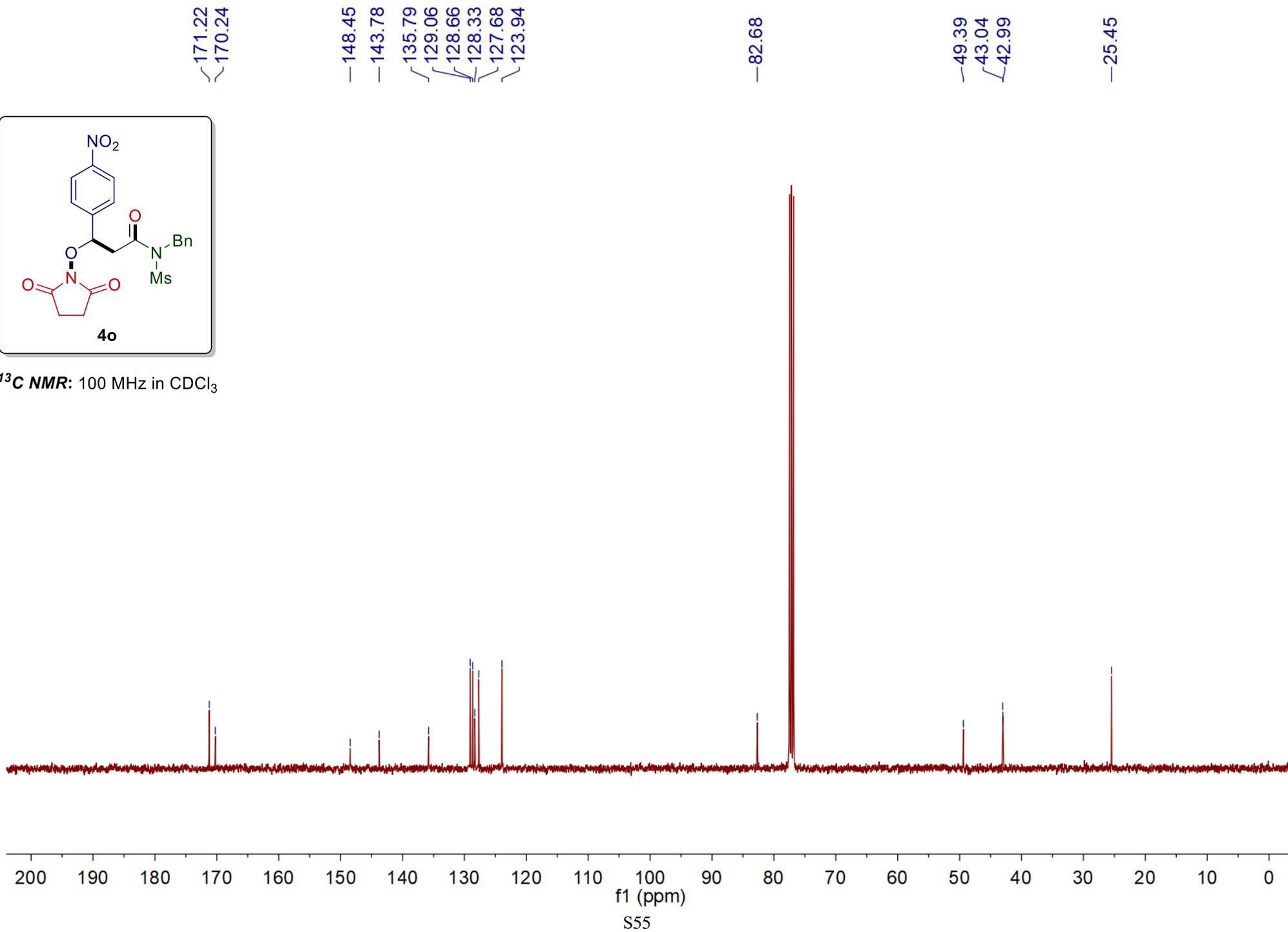
¹H NMR: 400 MHz in CDCl₃



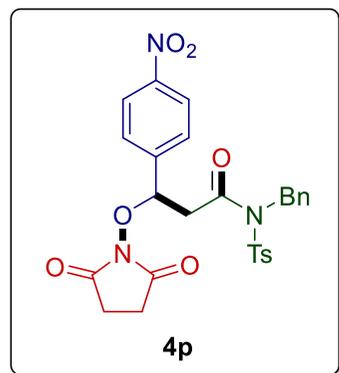
8.214
8.208
8.203
8.191
8.186
8.180
7.642
7.636
7.631
7.619
7.614
7.607
7.359
7.353
7.348
7.342
7.337
7.332
7.328
7.320
7.318
7.314
7.311
7.302
7.286
7.281
7.275
5.906
5.895
5.888
5.876
5.036
4.996
4.971
4.931
3.691
3.672
3.647
3.628
3.204
3.144
3.132
3.100
3.088
2.644
2.641
2.618
2.615
2.592
2.589



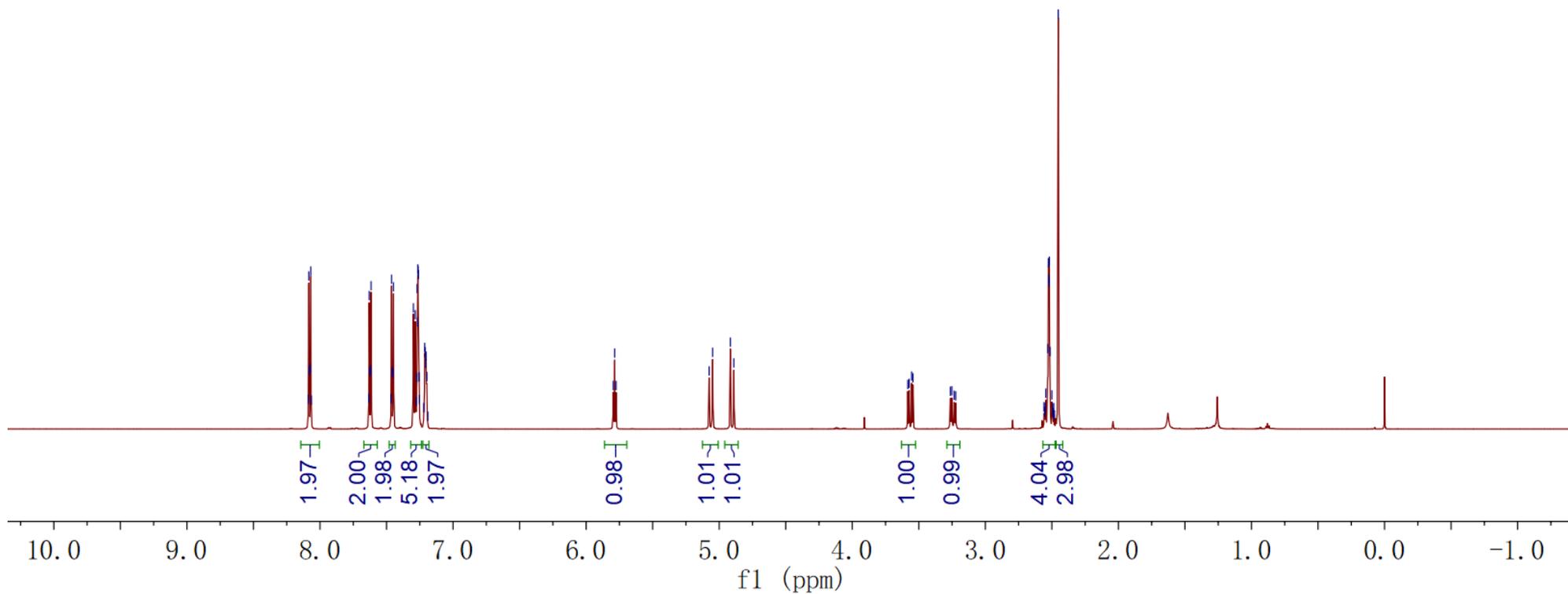
^{13}C NMR: 100 MHz in CDCl_3

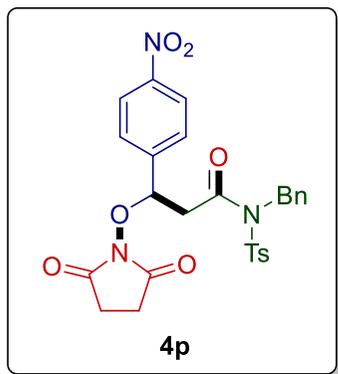


8.088
8.084
8.081
8.073
8.069
8.065
7.634
7.630
7.627
7.619
7.616
7.467
7.462
7.459
7.451
7.448
7.298
7.285
7.277
7.273
7.270
7.267
7.265
7.263
7.259
7.256
7.253
7.213
7.209
7.206
7.203
7.197
5.796
5.786
5.775
5.076
5.049
4.916
4.890
3.583
3.573
3.554
3.544
3.263
3.251
3.234
3.223
2.559
2.551
2.545
2.531
2.526
2.524
2.521
2.519
2.514
2.500
2.486
2.452



¹H NMR: 600 MHz in CDCl₃





171.06
169.16

148.22
145.48
143.62
136.11
136.05
129.95
128.76
128.70
127.96
127.79
123.62

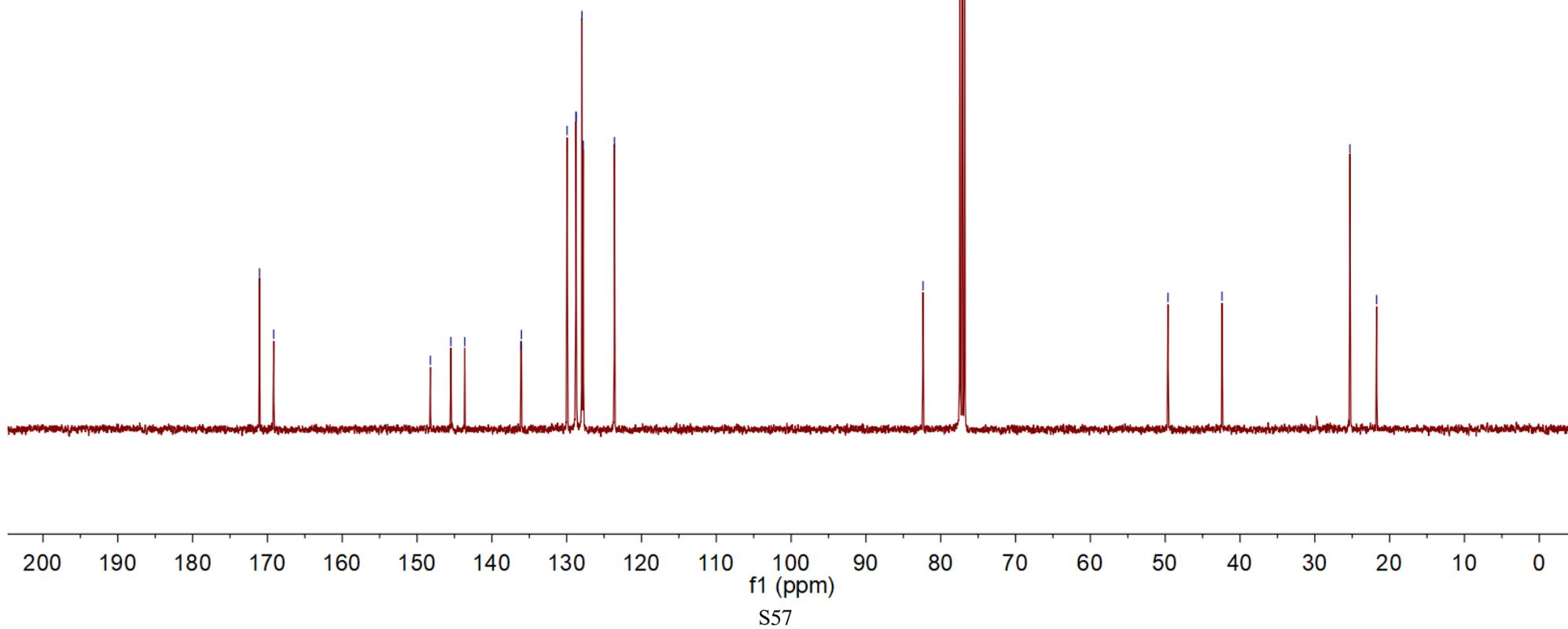
82.37

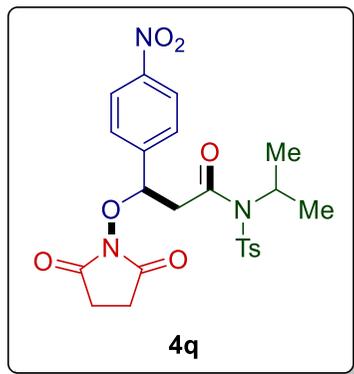
49.63

42.41

25.30
21.74

¹³C NMR: 100 MHz in CDCl₃



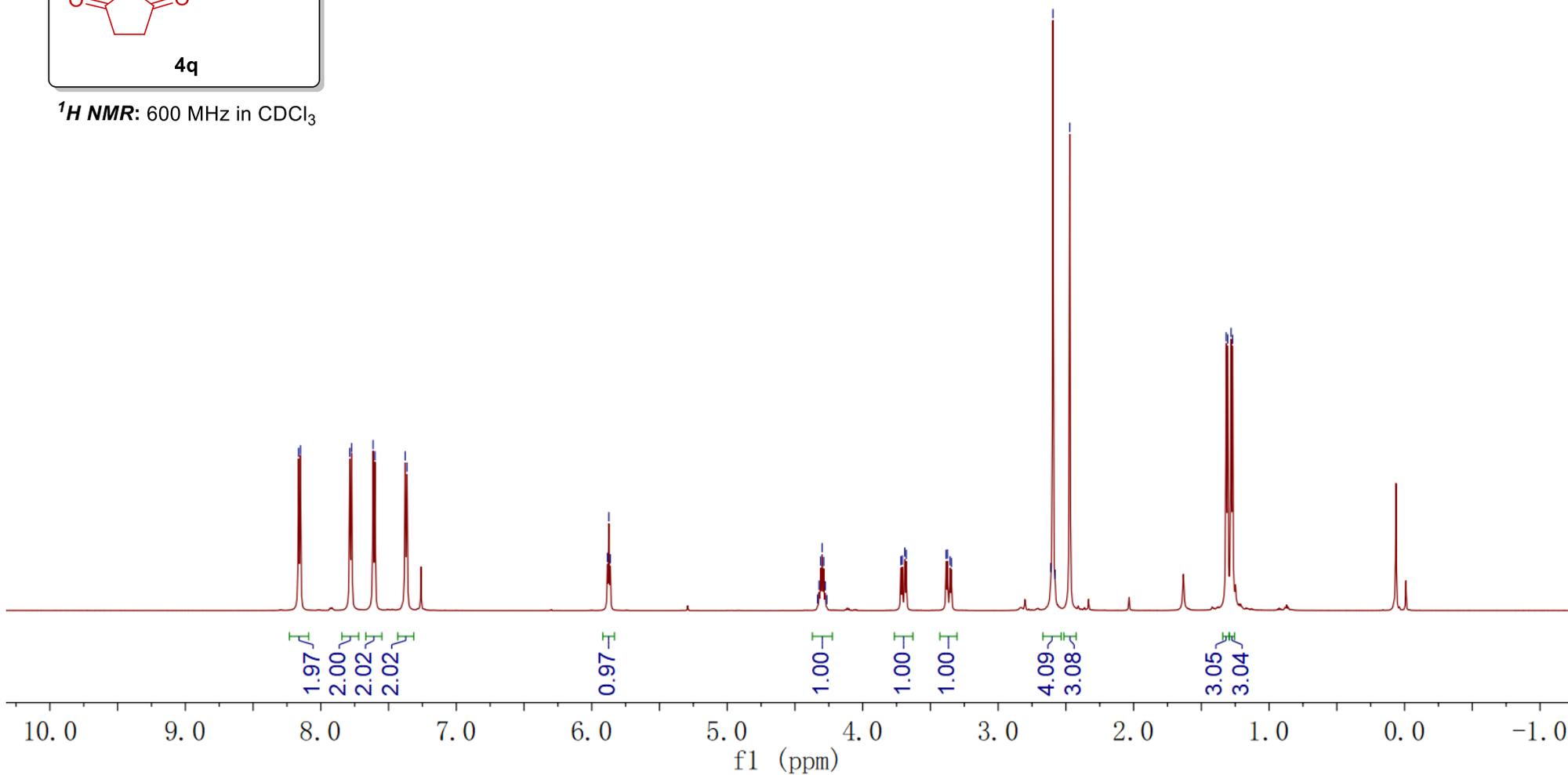


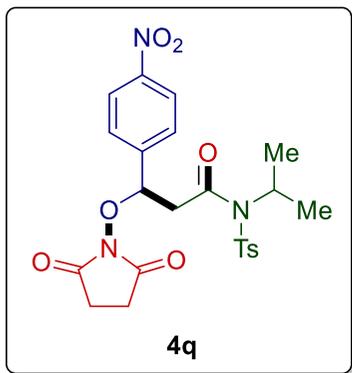
¹H NMR: 600 MHz in CDCl₃

8.164
8.150
7.786
7.773
7.614
7.600
7.377
7.364

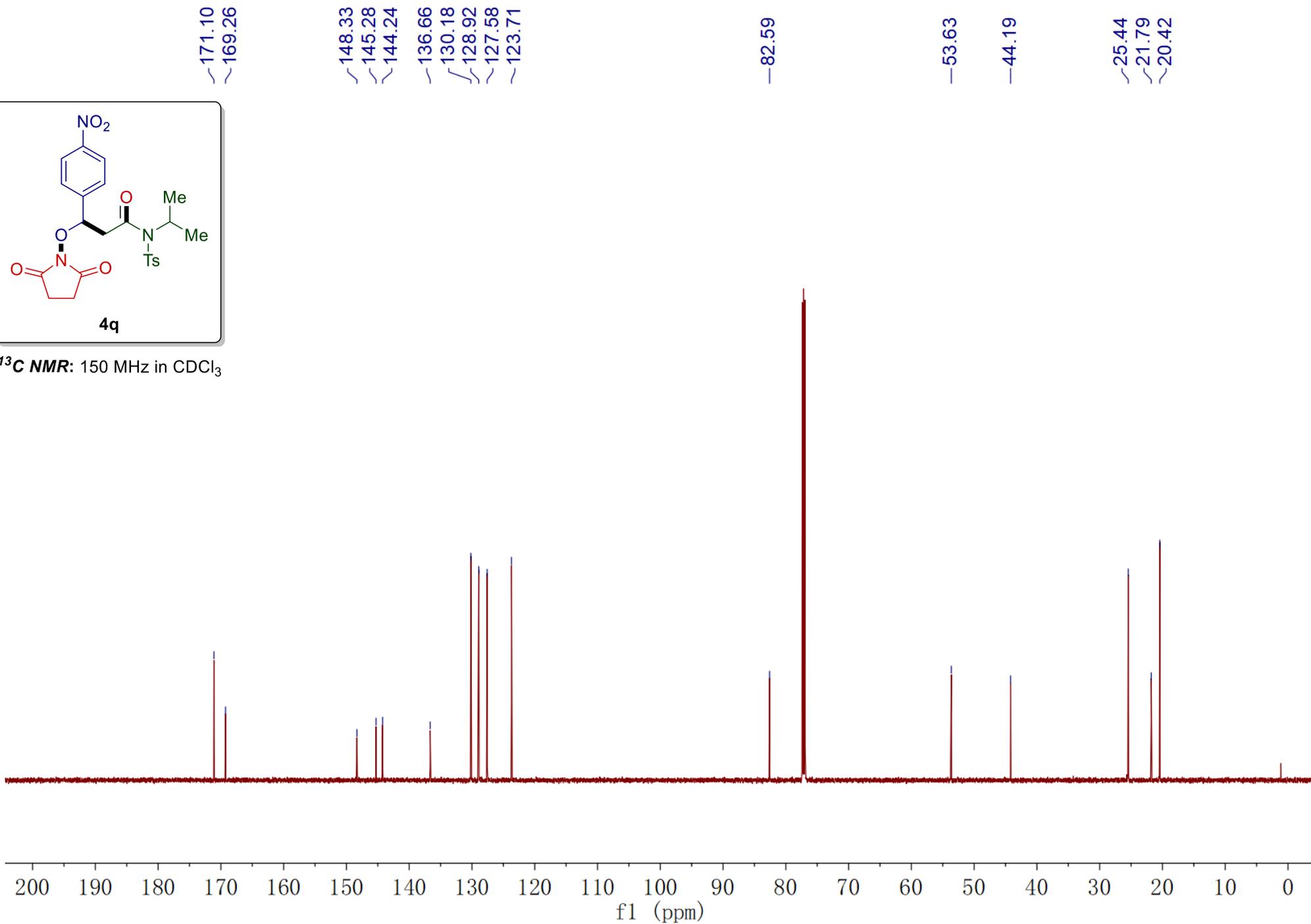
5.884
5.874
5.863

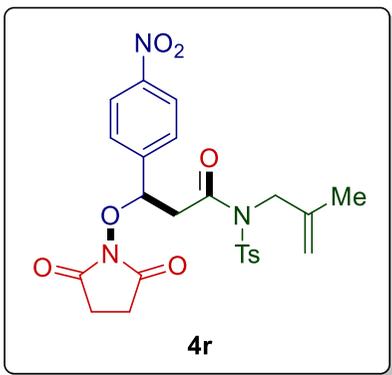
4.333
4.322
4.310
4.299
4.288
4.276
4.265
3.718
3.707
3.689
3.678
3.384
3.374
3.355
3.345
2.612
2.596
2.579
2.471
1.317
1.305
1.281
1.270





¹³C NMR: 150 MHz in CDCl₃

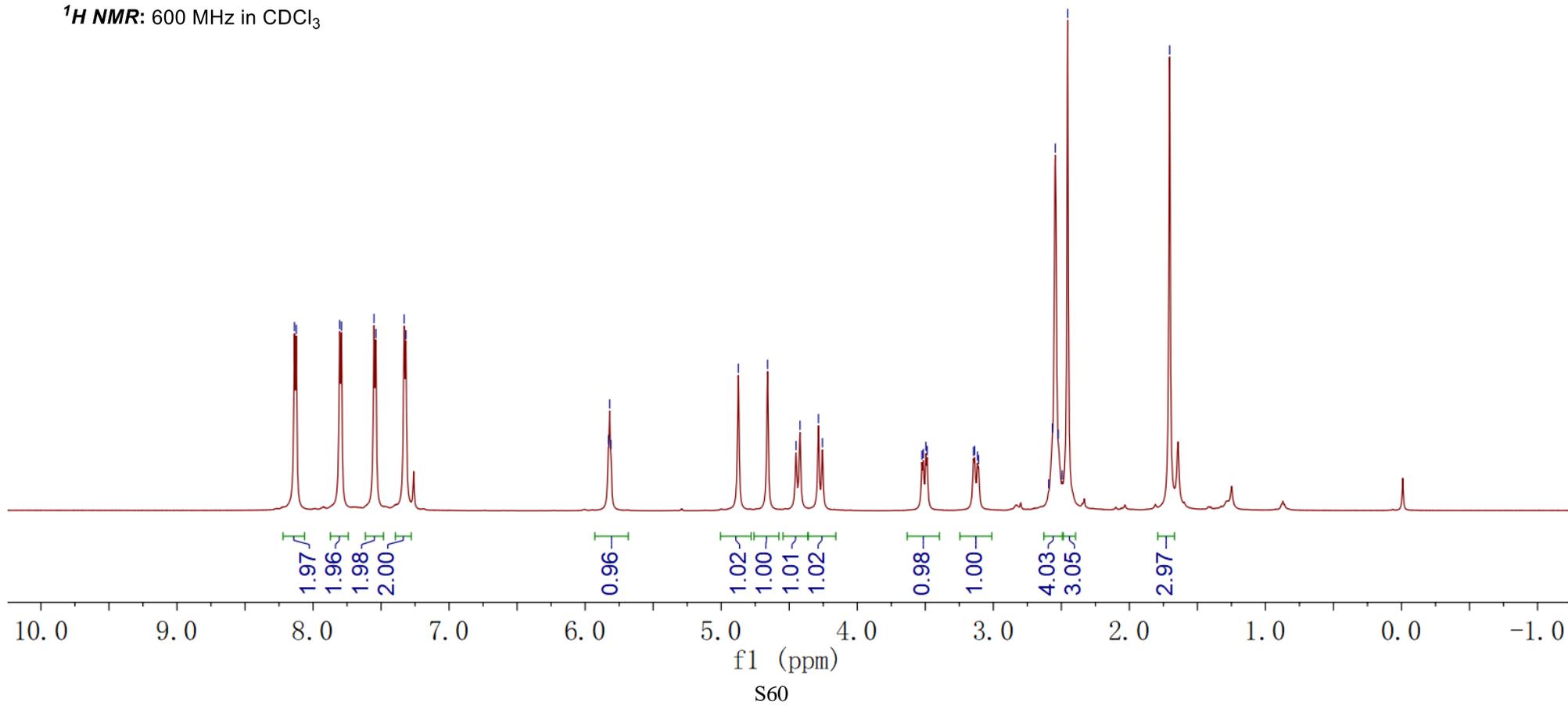


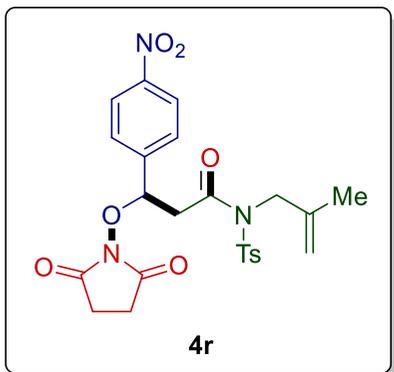


¹H NMR: 600 MHz in CDCl₃

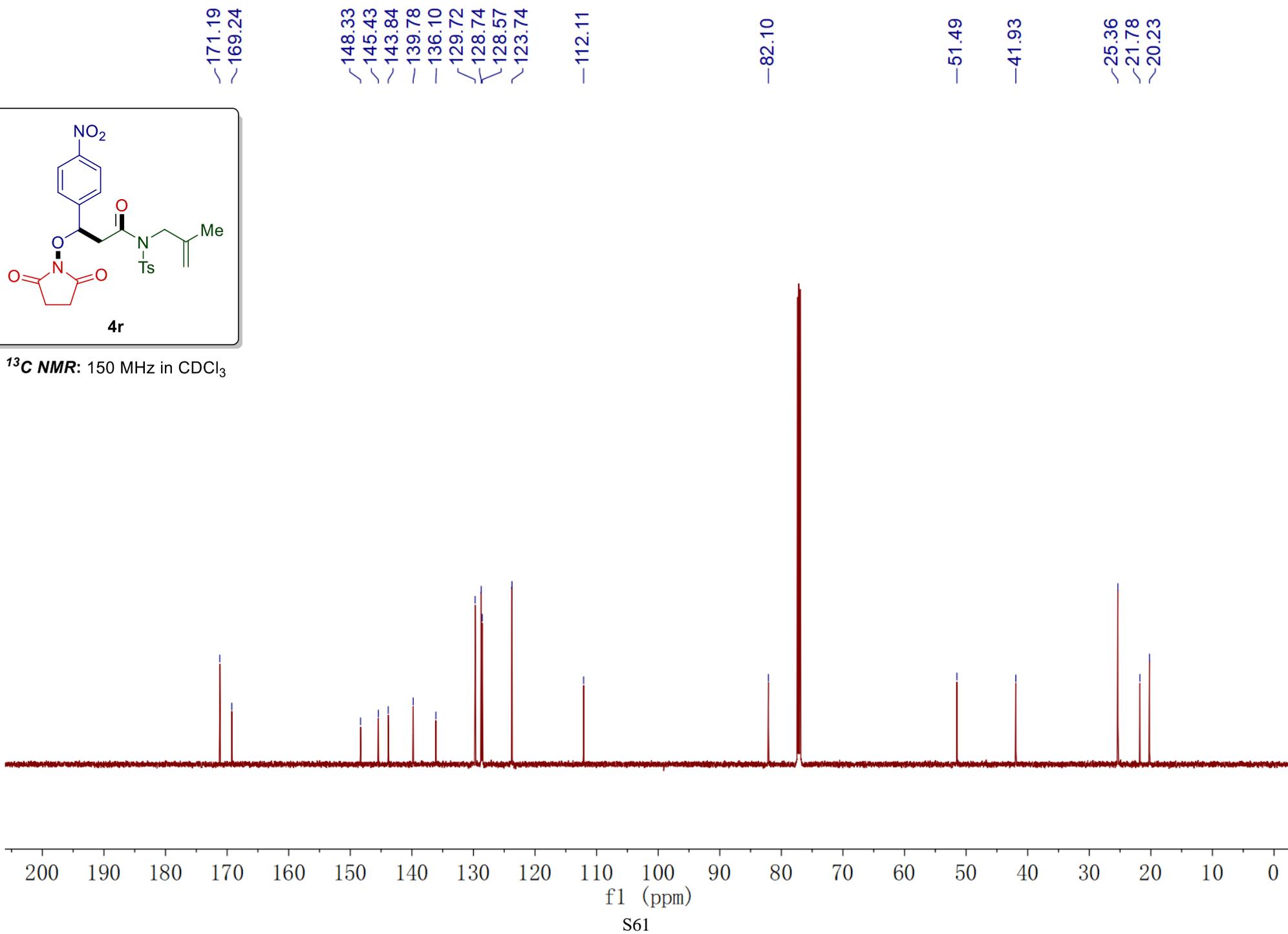
8.137
8.123
7.804
7.791
7.552
7.538
7.330
7.317

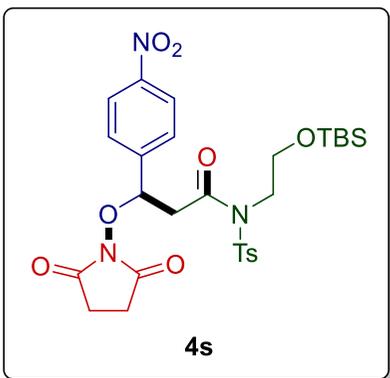
5.829
5.820
5.811
4.874
4.659
4.450
4.421
4.285
4.256
3.525
3.515
3.496
3.486
3.145
3.137
3.117
3.108
2.593
2.566
2.545
2.523
2.493
2.454
1.704



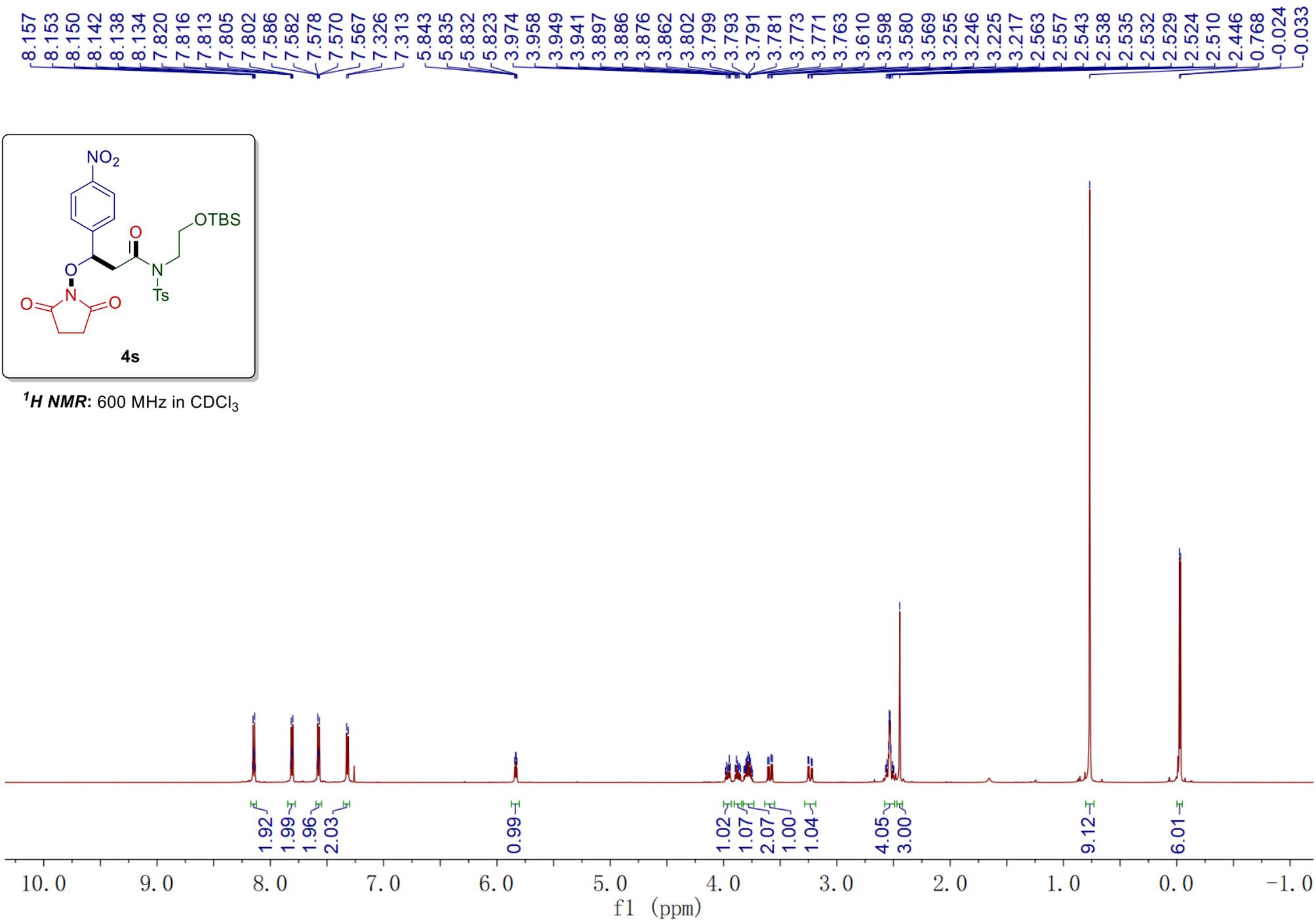


¹³C NMR: 150 MHz in CDCl₃

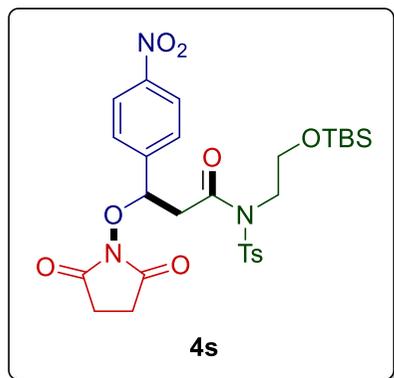




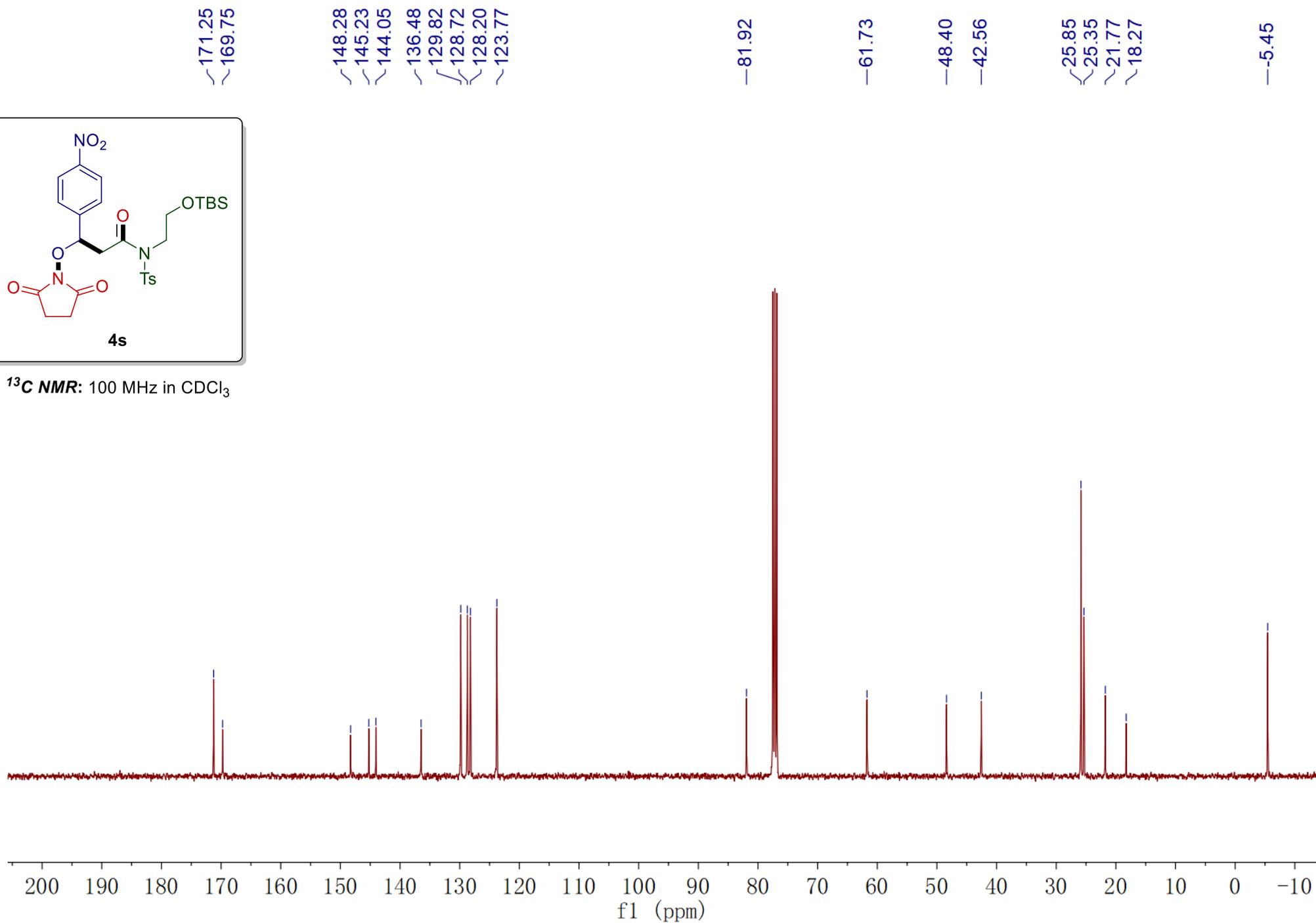
¹H NMR: 600 MHz in CDCl₃



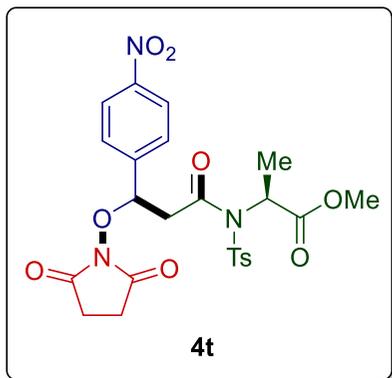
8.157
8.153
8.150
8.142
8.138
8.134
7.820
7.816
7.813
7.805
7.802
7.586
7.582
7.578
7.570
7.567
7.326
7.313
5.843
5.835
5.832
5.823
3.974
3.958
3.949
3.941
3.897
3.886
3.876
3.862
3.802
3.799
3.793
3.791
3.781
3.773
3.771
3.763
3.610
3.598
3.580
3.569
3.255
3.246
3.225
3.217
2.563
2.557
2.543
2.538
2.535
2.532
2.529
2.524
2.510
2.446
0.768
-0.024
-0.033



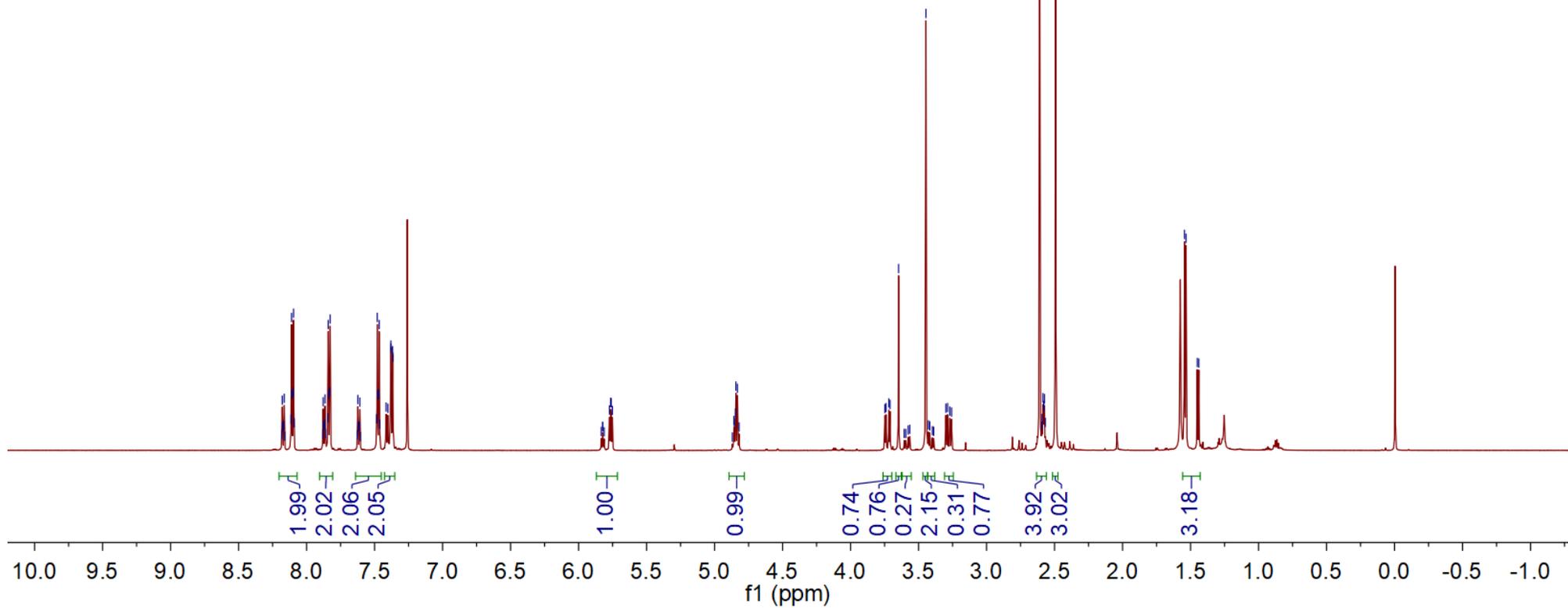
¹³C NMR: 100 MHz in CDCl₃

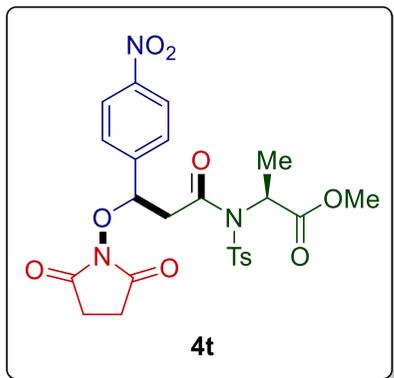


8.179
8.164
8.115
8.110
8.107
8.099
8.096
8.092
7.878
7.864
7.845
7.841
7.838
7.830
7.827
7.623
7.608
7.485
7.481
7.477
7.469
7.466
7.415
7.402
7.382
7.380
7.368
7.366
5.773
5.764
5.760
5.752
4.858
4.855
4.846
4.843
4.832
3.748
3.739
3.719
3.710
3.647
3.446
3.299
3.286
3.270
3.257
2.610
2.591
2.585
2.581
2.579
2.574
2.568
2.493
1.545
1.533
1.451
1.439

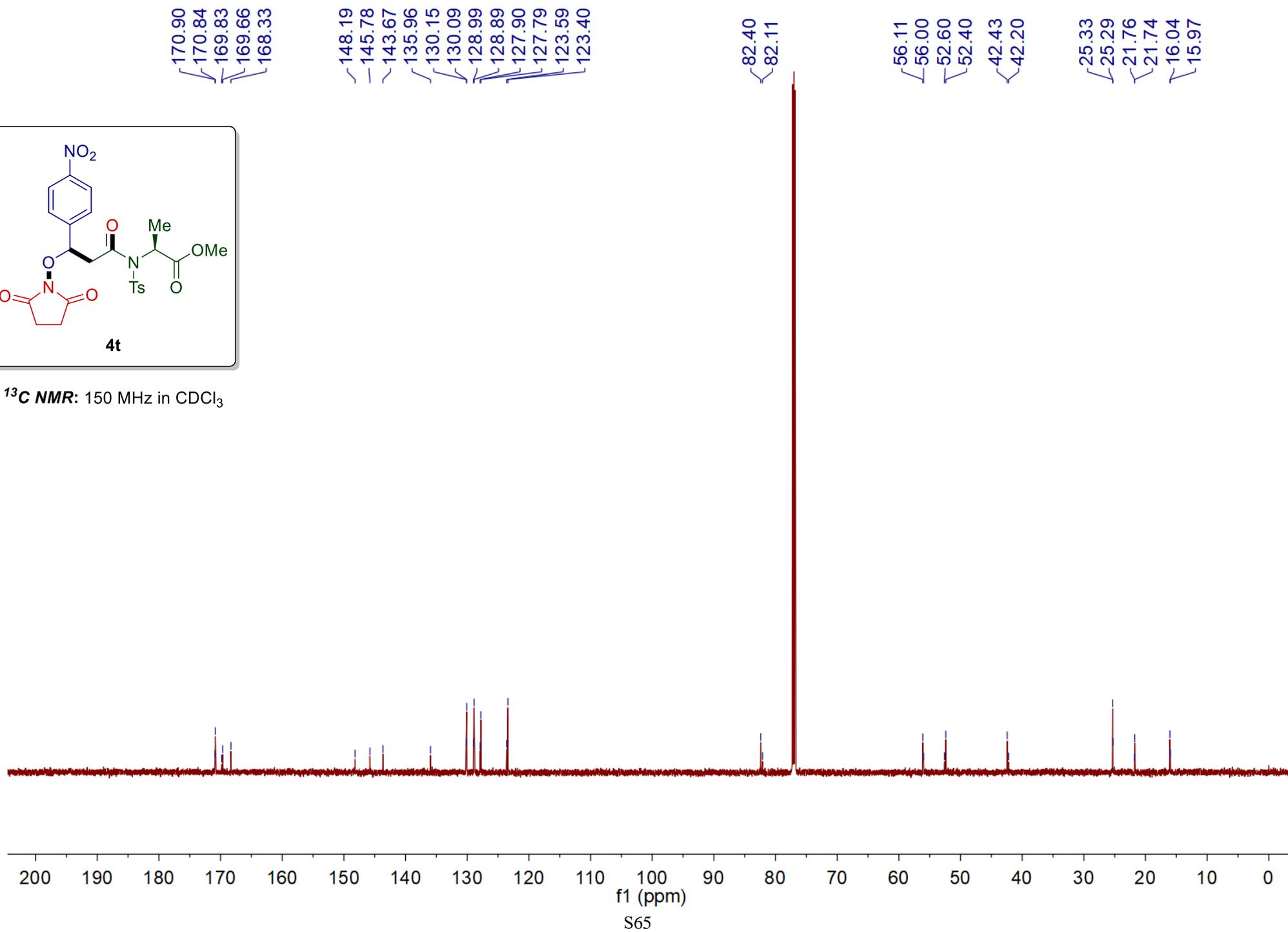


¹H NMR: 600 MHz in CDCl₃



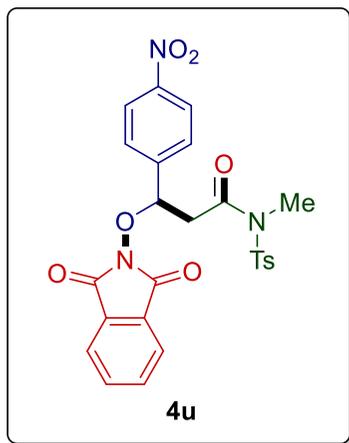


¹³C NMR: 150 MHz in CDCl₃

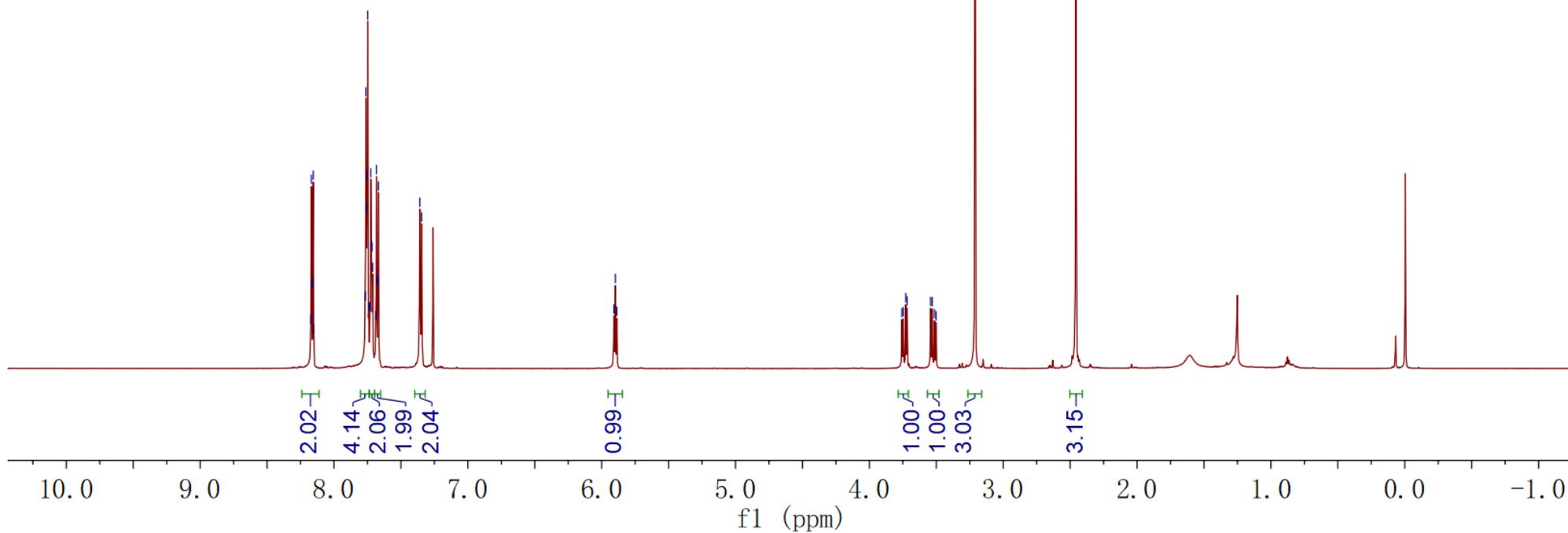


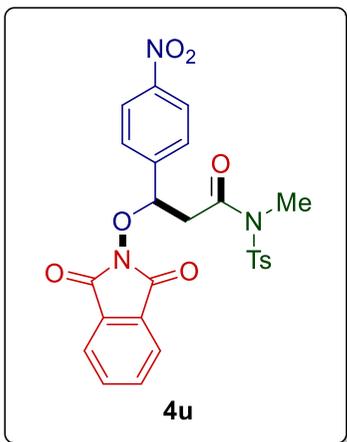
8.169
8.166
8.158
8.155
7.767
7.762
7.757
7.752
7.748
7.740
7.732
7.725
7.720
7.716
7.711
7.683
7.680
7.672
7.668
7.359
3.905
5.898
5.887

3.757
3.747
3.728
3.718
3.543
3.531
3.514
3.502
3.210
-2.457

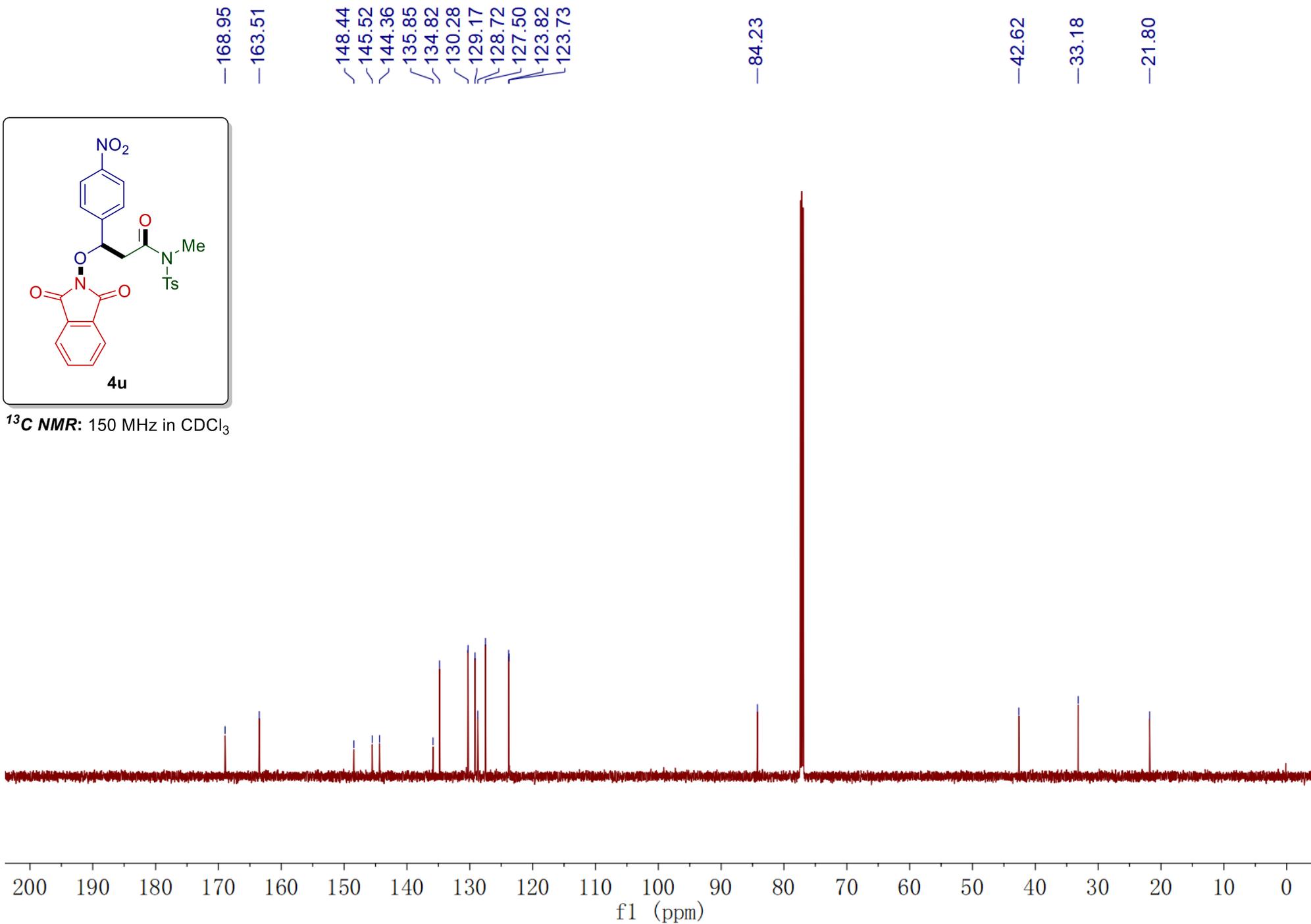


¹H NMR: 600 MHz in CDCl₃



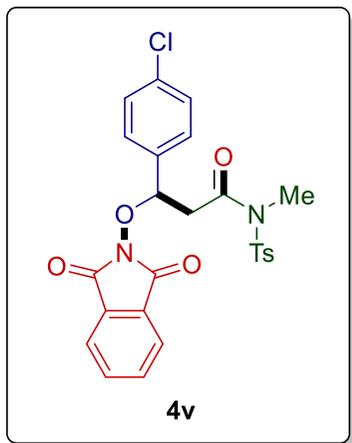


¹³C NMR: 150 MHz in CDCl₃

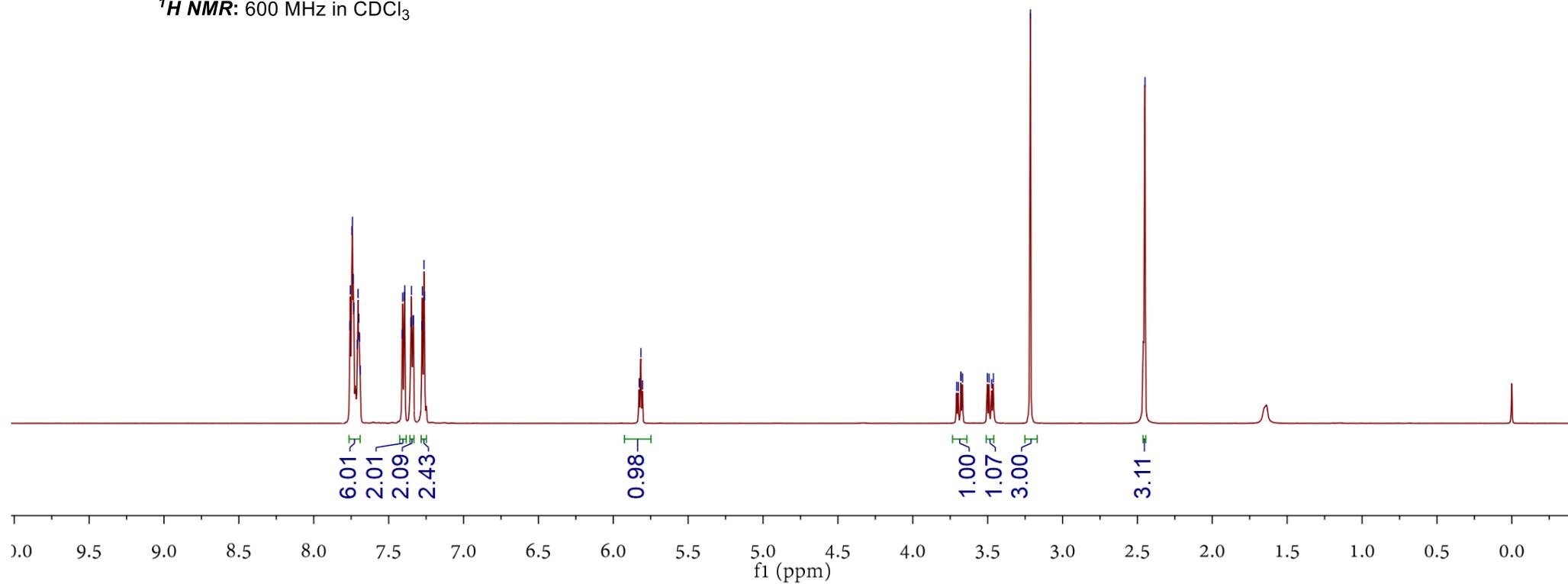


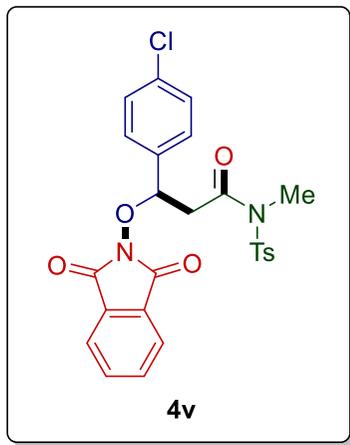
7.759
7.756
7.745
7.741
7.736
7.731
7.709
7.704
7.699
7.695
7.410
7.406
7.395
7.392
7.352
7.348
7.337
7.334
7.279
7.275
7.264
7.269
5.827
5.816
5.805

3.706
3.696
3.678
3.678
3.667
3.502
3.490
3.473
3.462
3.214
-2.449

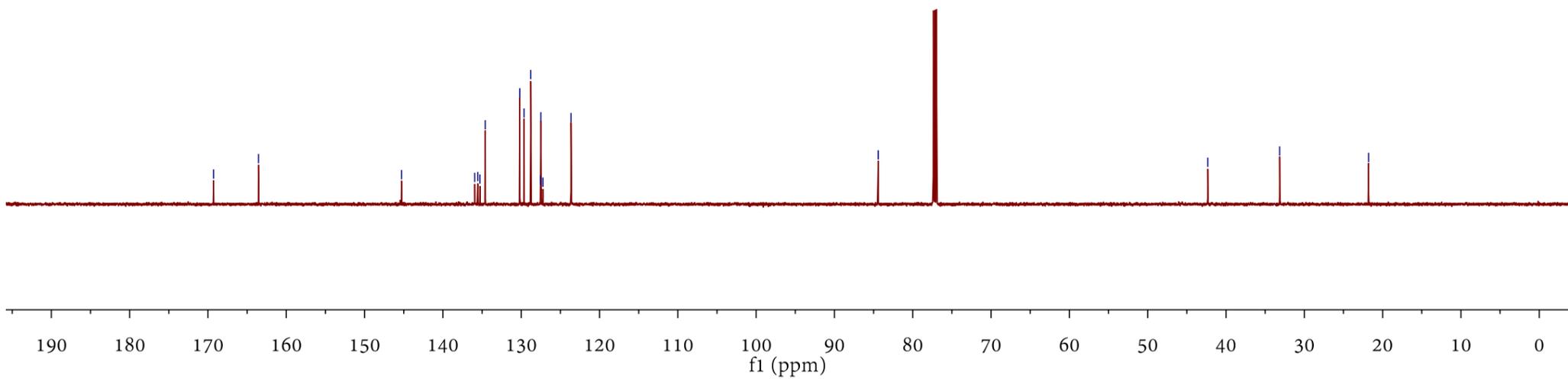


¹H NMR: 600 MHz in CDCl₃

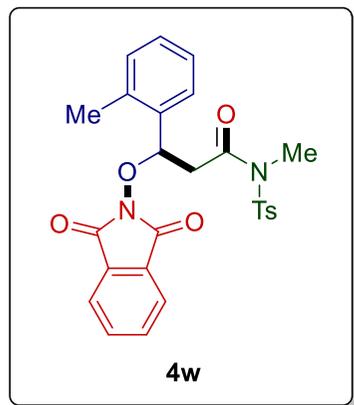




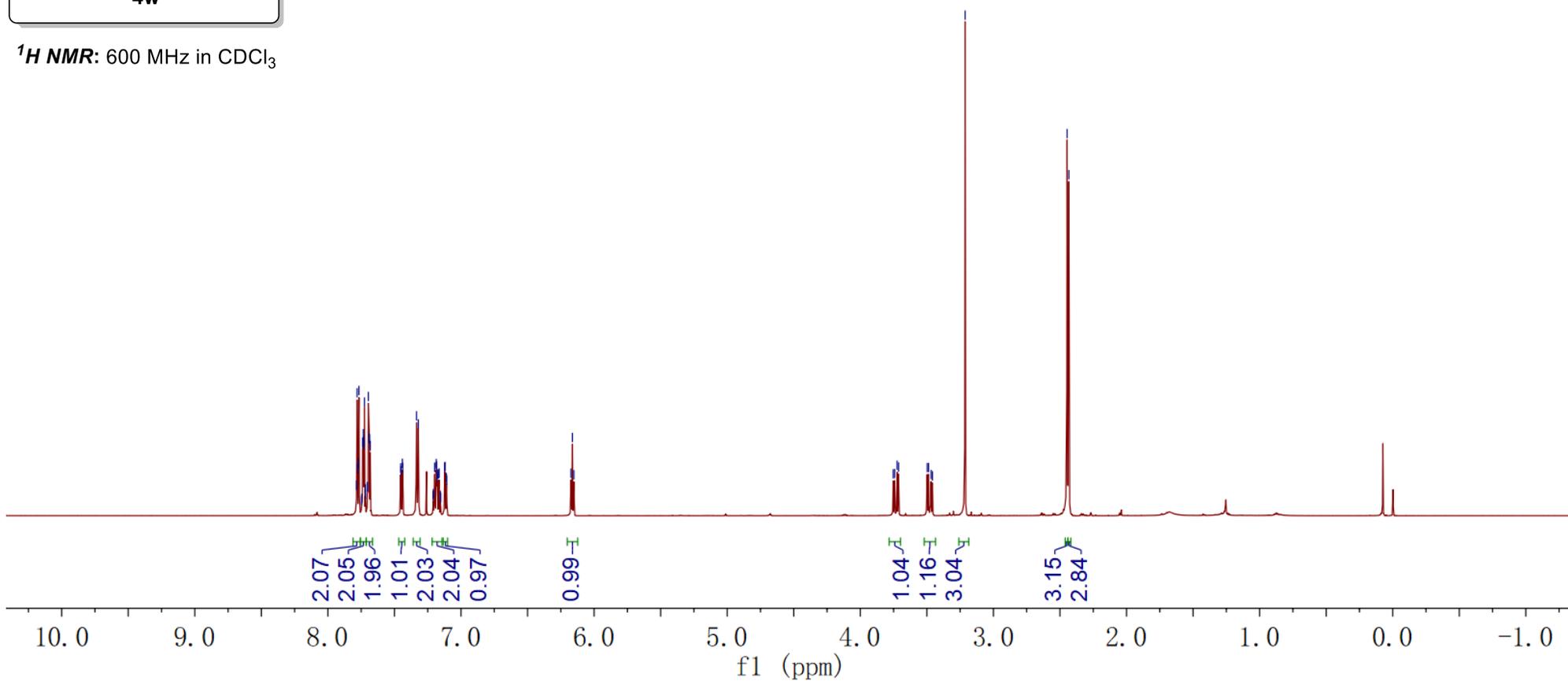
¹³C NMR: 150 MHz in CDCl₃

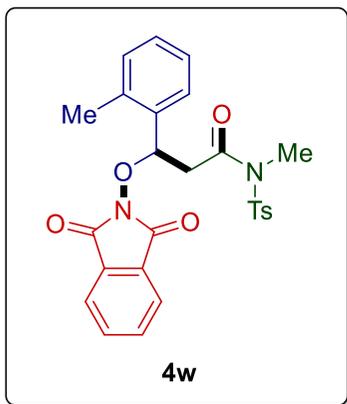


7.785
7.781
7.778
7.770
7.767
7.748
7.745
7.739
7.734
7.731
7.730
7.725
7.718
7.717
7.704
7.702
7.696
7.691
7.687
7.682
7.453
7.451
7.440
7.438
7.334
7.321
7.210
7.207
7.198
7.195
7.186
7.183
7.180
7.177
7.168
7.165
7.155
7.152
7.123
7.120
7.110
7.108
6.174
6.163
6.152
3.753
3.742
3.724
3.713
3.497
3.487
3.468
3.458
3.212
2.446
2.433

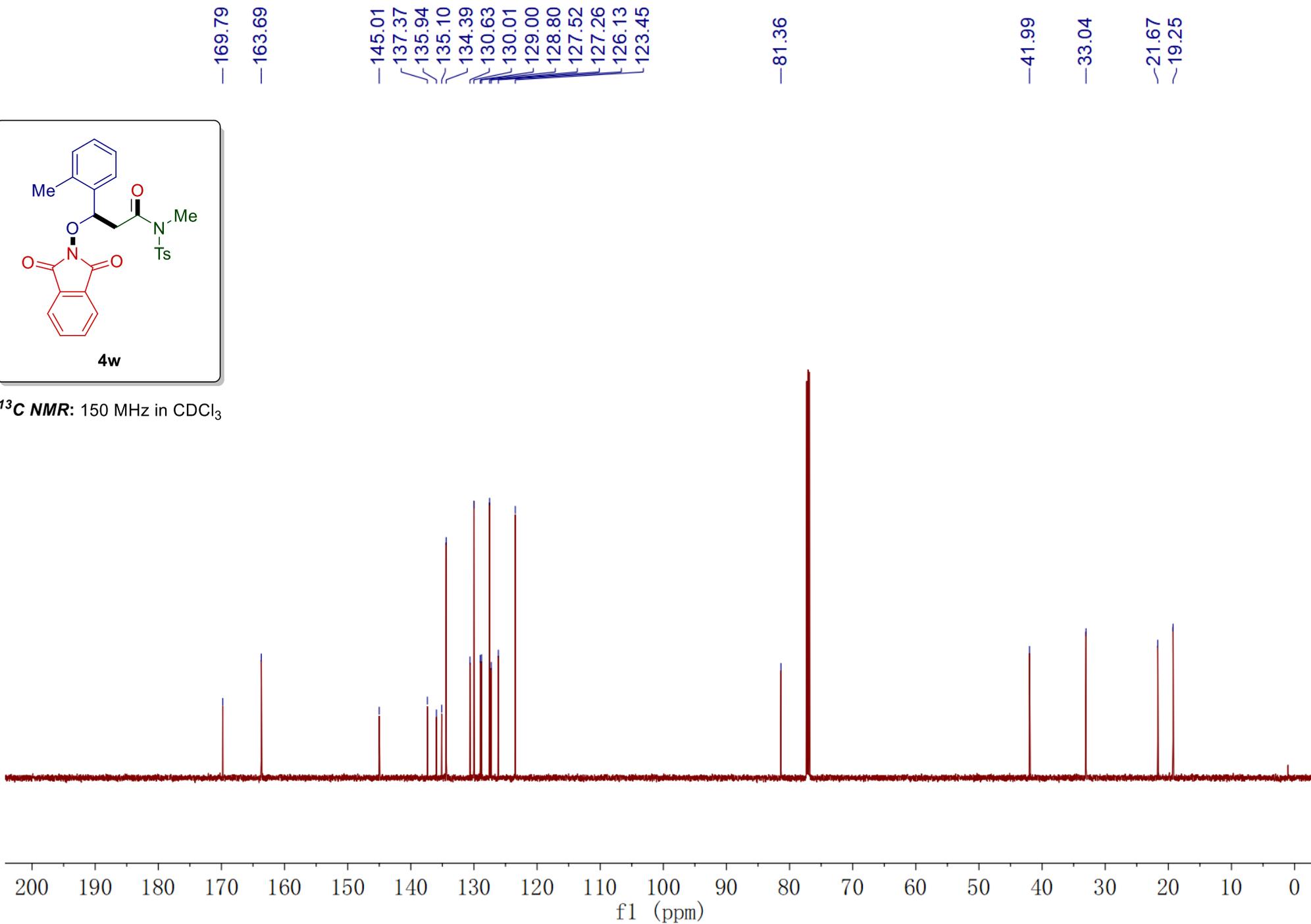


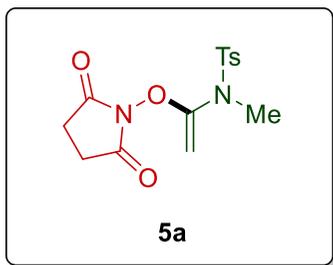
¹H NMR: 600 MHz in CDCl₃





¹³C NMR: 150 MHz in CDCl₃



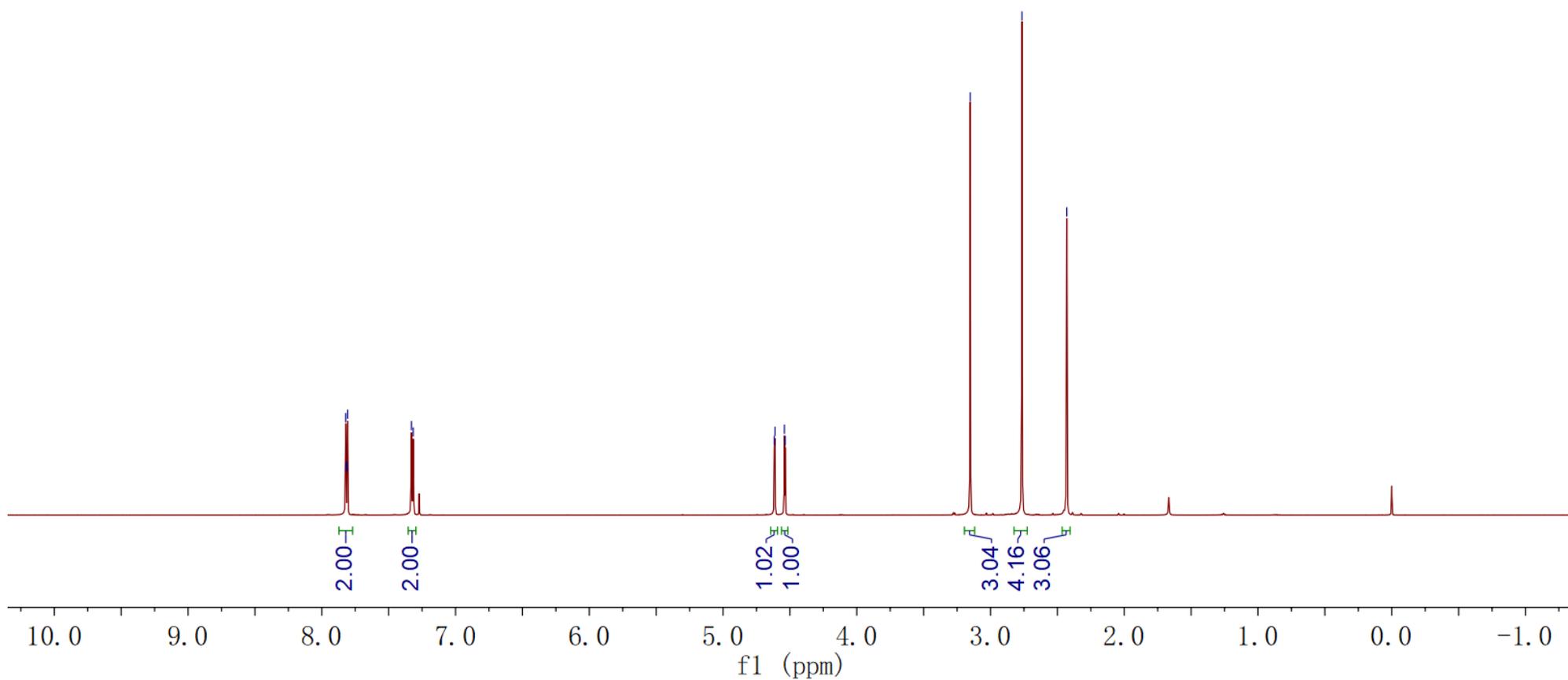


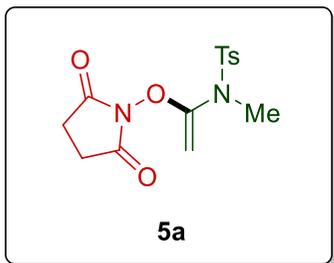
¹H NMR: 600 MHz in CDCl₃

7.821
7.818
7.810
7.807
7.330
7.316

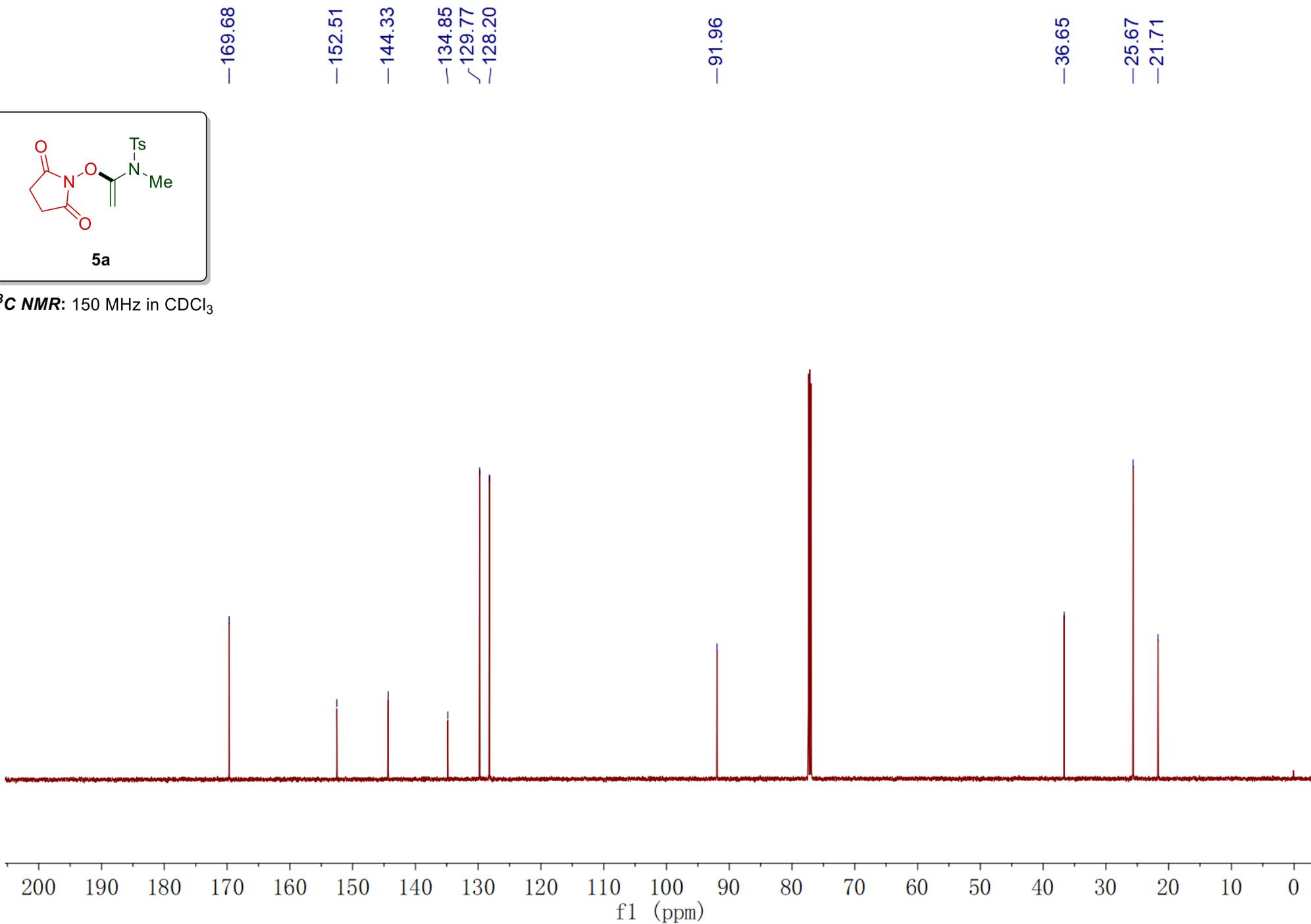
4.617
4.611
4.541
4.535

3.151
2.765
2.429





^{13}C NMR: 150 MHz in CDCl_3

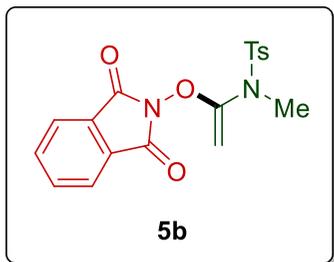


7.877
7.866
7.864
7.861
7.857
7.852
7.845
7.805
7.798
7.793
7.789
7.784
7.774
7.302
7.289
7.264

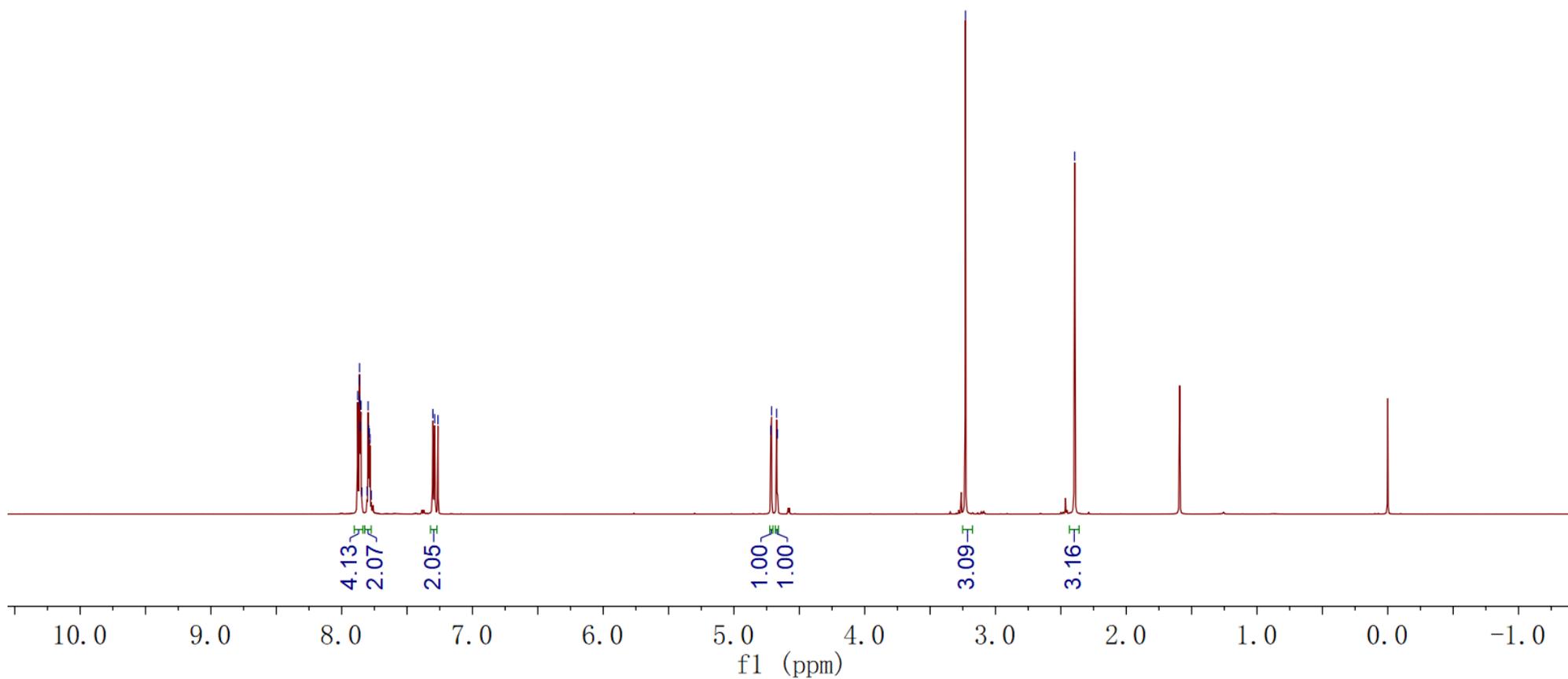
4.719
4.712
4.674
4.668

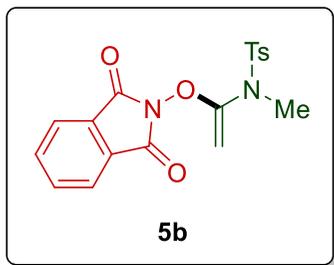
3.230

2.395

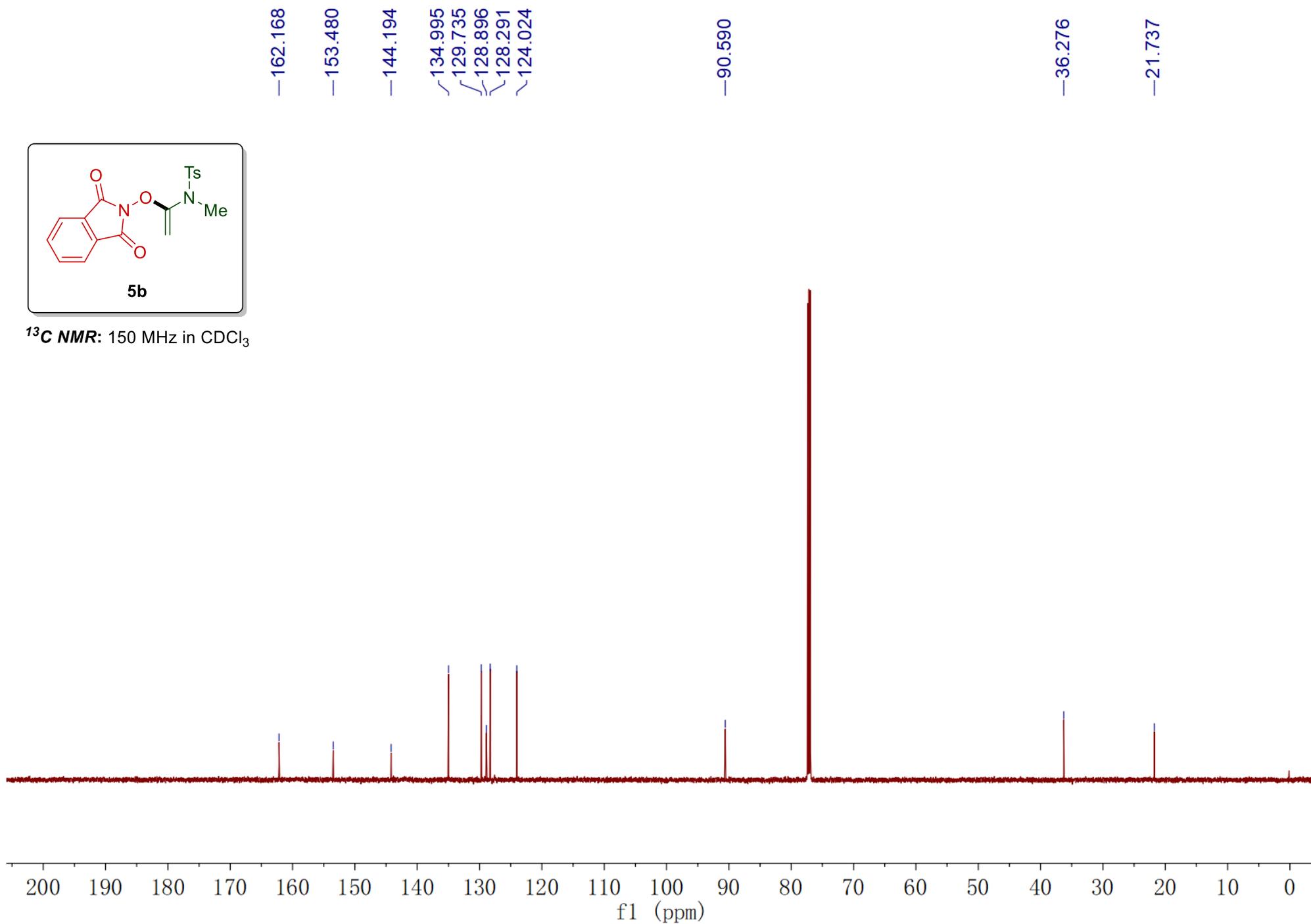


¹H NMR: 600 MHz in CDCl₃

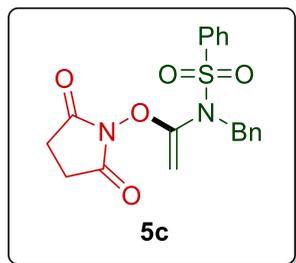




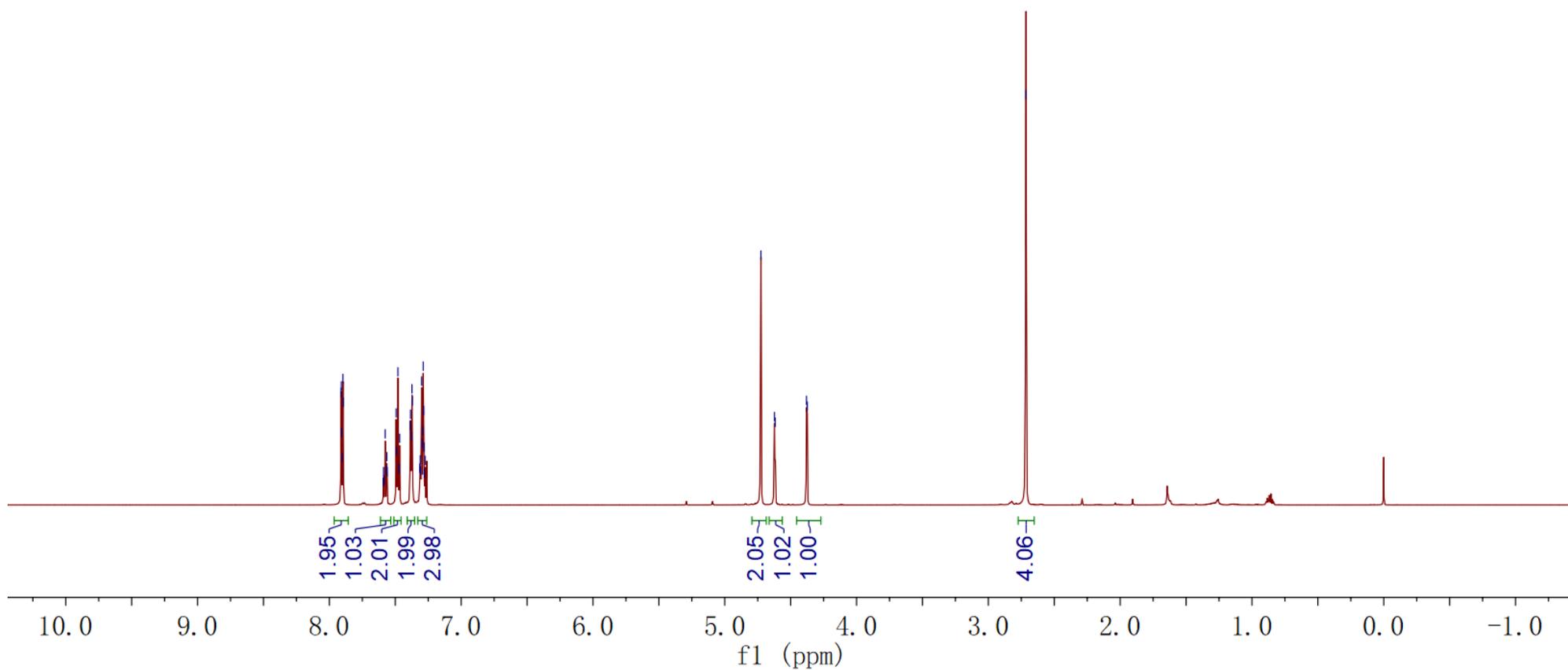
¹³C NMR: 150 MHz in CDCl₃

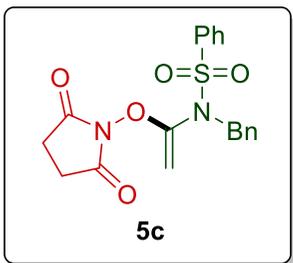


7.911
7.909
7.907
7.901
7.897
7.895
7.589
7.587
7.576
7.566
7.564
7.562
7.493
7.491
7.480
7.470
7.467
7.387
7.383
7.376
7.373
7.371
7.314
7.310
7.307
7.300
7.297
7.291
7.288
7.285
7.282
7.279
7.274
4.726
4.623
4.618
4.380
4.374



¹H NMR: 600 MHz in CDCl₃





^{13}C NMR: 150 MHz in CDCl_3

