Supporting Information

(PART I.)

Synthesis and HPLC-ECD Study of Cytostatic Condensed O,N-Heterocycles Obtained from 3-Aminoflavanones

Ádám Szappanos [1], Attila Mándi [1], Katalin Gulácsi [1,†], Erika Lisztes [2], Balázs István Tóth [2], Tamás Bíró [3], Anita Kónya-Ábrahám [1], Attila Kiss-Szikszai [1], Attila Bényei [4], Sándor Antus [1], Tibor Kurtán [1,*]

[1] Department of Organic Chemistry, University of Debrecen, P. O. Box 400, 4002 Debrecen, Hungary Fax: +36-52-512-744 E-mail: kurtan.tibor@science.unideb.hu.

[2] Department of Physiology, University of Debrecen, Debrecen, Hungary

[3] Department of Immunology, University of Debrecen, Debrecen, Hungary

[4] Department og Physical Chemistry, University of Debrecen, Debrecen, Hungary

[†] deceased

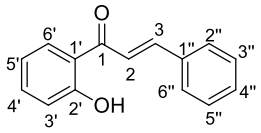
* Correspondence: E-mail: kurtan.tibor@science.unideb.hu.; Fax: +36-52-512-744

Table of Contents

1 Experimental Section of known compounds

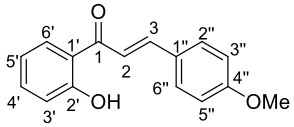
1.1 General Procedure for the Synthesis of chalcone analogues (15a-g)

2-hidroxyacetophenone **13** (24.24 mmol) was dissolved in ethanol (165 mL) under stirring. To this was added NaOH (72.72 mmol in 5 mL water) and stirred for 5 min. To this reaction mixture, the aromatic aldehyde (29.09 mmol) was then added and stirring continued at room temperature for 24 h. Reaction was monitored by TLC. After completion of reaction, the mixture was poured over crushed ice and neutralized with 10 % HCl solution. The separated solid was filtered and washed well with water. Crude product was dried and recrystallized from ethanol to obtain the desired product in pure form.



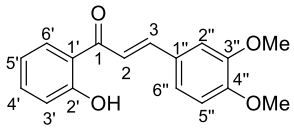
(E)-1-(2-Hydroxyphenyl)-3-phenylprop-2-en-1-one (15a) [1]

Yellow crystals. Yield: 92%. m.p. 87-88 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 6.93 (m, 1H, 5'-H), 7.02 (dd, *J* = 8.4 Hz, 1H, 2.0 Hz, 3'-H), 7.38 (m, 3H, 2"-H, 4"-H, 6"-H), 7.48 (m, 1H, 4'-H), 7.60 (m, 3H, 3-H, 3"-H, 5"-H), 7.89 (dd, *J* = 8.4, 1.2 Hz, 1H, 6'-H), 7.90 (d, *J* = 15.4 Hz, 1H, 2-H), 12.90 (s, 1H, OH); ^{13}C-NMR (101 MHz, $CDCl_3$) δ: 118.6 (C-3'), 118.8 (C-3), 120.0 (C-1'), 120.1 (C-5'), 128.6 (C-1"), 129.0 (C-6'), 129.6 (C-3", C-5"), 130.9 (C-4"), 134.5 (C-2", C-6"), 136.3 (C-4'), 145.4 (C-2), 163.5 (C-2'), 193.7 (C-1)



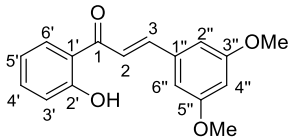
(E)-1-(2-Hydroxyphenyl)-3-(4-methoxyphenyl)prop-2-en-1-one (15b) [2]

Yellow crystals. Yield: 65%. m.p. 90-92 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 3.85 (s, 3H, 4'-OCH_3), 6.89 (m, 3H, 5'-H, 3"-H, 5"-H), 7.00 (dd, *J* = 8.4, 0.8 Hz, 3'-H), 7.47 (m, 1H, 4'-H), 7.53 (d, *J* = 15.7 Hz, 1H, 3-H), 7.61 (d, 2H, 2"-H, 6"-H), 7.88 (d, *J* = 15.7 Hz, 1H, 2-H), 7.90 (dd, *J* = 8.4, 2.0 Hz, 1H, 6'-H), 12.91 (s, 1H, OH); ^{13}C-NMR (101 MHz, $CDCl_3$) δ: 55.4 (C-OCH_3), 114.5 (C-3", C-5"), 117.6 (C-3'), 118.6 (C-3), 118.7 (C-1'), 120.1 (C-5'), 127.4 (C-1"), 129.5 (C-2", C-6"), 130.5 (C-6'), 136.1 (C-4'), 145.4 (C-2), 162.0 (C-4"), 163.5 (C-2'), 193.7 (C-1)



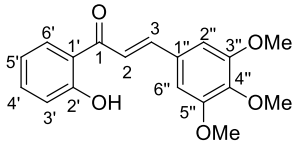
(E)-1-(2-Hydroxyphenyl)-3-(3,4-dimethoxyphenyl)prop-2-en-1-one (15c) [3]

Yellow crystals. Yield: 79%. m.p. 120-122 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 3.94 (s, 3H, 3'-OCH_3), 3.96 (s, 3H, 4'-OCH_3), 6.90 (m, 2H, 5"-H, 5'-H), 7.01 (dd, *J* = 8.4, 0.8 Hz, 1H, 6"-H), 7.17 (d, *J* = 1.6 Hz, 1H, 2"-H), 7.25 (dd, J = 8.4, 2.0 Hz, 1H, 3'-H), 7.45 (m, 1H, 4'-H), 7.50 (d, J = 15.2 Hz, 1H, 3-H), 7.86 (d, J = 15,6 Hz, 1H, 2-H), 7.92 (dd, J = 8.4, 1.2 Hz, 1H, 6'-H), 12.95 (s, 1H, OH); ^{13}C-NMR (101 MHz, $CDCl_3$) δ: 56.1 (2xC-OCH_3), 110.4 (C-5"), 111.2 (C-2"), 117.8 (C-3'), 118.6 (C-6"), 118.8 (C-3), 120.2 (C-1'), 123.7 (C-5'), 127.7 (C-1"), 129.6 (C-6'), 136.2 (C-4'), 145.7 (C-2), 149.4 (C-3"), 151.9 (C-4"), 163.6 (C-2'), 193.6 (C-1)



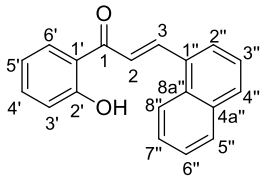
(E)-1-(2-Hydroxyphenyl)-3-(3,5-dimethoxyphenyl)prop-2-en-1-one (15d) [4]

Yellow crystals. Yield: 85%. m.p. 125-127 ℃; ^{1}H-NMR (360 MHz, $CDCl_3$) δ: 3.83 (s, 6H, 2xOCH_3), 6.53 (t, *J* = 3.6 Hz, 4”-H), 6.77 (d, 2H, 2”-H, 6”-H), 6.91 (m, 1H, 5’-H), 7.01 (d, *J* = 7.2 Hz, 1H, 3’-H), 7.47 (m, 1H, 4’-H), 7.56 (d, *J* = 14.4 Hz, 1H, 3-H), 7.79 (d, *J* = 14.4 Hz, 1H, 2-H), 7.88 (dd, *J* = 7.2, 3.6 Hz, 1H, 6’-H), 12.80 (s, 1H, OH); ^{13}C NMR (90 MHz, $CDCl_3$) δ: 55.3 (2xC-OCH_3), 102.9 (C-4”), 106.4 (C-2”, C-6”), 118.5 (C-3’), 118.7 (C-3), 119.8 (C-1’), 120.4 (C-5’), 129.5 (C-6’), 136.2 (C-1”), 145.3 (C-2), 160.9 (C-3”, C-5”), 163.4 (C-2’), 193.5 (C-1)



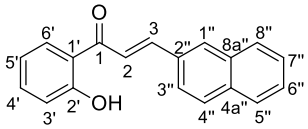
(E)-1-(2-Hydroxyphenyl)-3-(3,4,5-trimethoxyphenyl)prop-2-en-1-one (15e) [5]

Yellow crystals. Yield: 82%. m.p. 156-158 ℃; ^{1}H NMR (360 MHz, $CDCl_3$) δ: 3.92 (s, 3H, 4”-OCH_3), 3.93 (s, 6H, 2xOCH_3), 6.88 (s, 2H, 2”-H, 6”-H), 6.92 (m, 1H, 5’-H), 7.01 (dd, *J* = 10.8, 3.6 Hz, 1H, 3’-H), 7.47 (m, 1H, 4’-H), 7.51 (d, *J* = 18.0 Hz, 1H, 3-H), 7.81 (d, *J* = 18.0 Hz, 1H, 2-H), 7.92 (dd, *J* = 7.2, 3.6 Hz, 1H, 6’-H), 12.87 (s, 1H, OH); ^{13}C-NMR (90 MHz, $CDCl_3$) δ: 56.1 (2xC-OCH_3), 60.9 (C-OCH_3), 105.8 (C-2”, C-6”), 118.4 (C-3’), 118.7 (C-3), 119.0 (C-5’), 119.8 (C-1’), 129.5 (C-6’), 129.9 (C-1”, C-4”), 136.2 (C-6’), 145.5 (C-2), 153.3 (C-3”, C-5”), 163.4 (C-2’), 193.3 (C-1)



(E)-1-(2-Hydroxyphenyl)-3-(1-naphthyl)prop-2-en-1-one (15f) [6]

Yellow crystals Yield: 98 %. m.p. 107-109 ºC, ^{1}H NMR (360 MHz, $CDCl_3$) δ: 6.95 (t, *J* = 7.9 Hz, 1 H, 5’-H), 7.04 (d, *J* = 8.3 Hz, 1 H, 3’-H), 7.55 (m, 4 H, 4’-H, 3”-H, 6”-H, 7”-H), 7.72 (d, *J* = 15.5 Hz, 1 H, 2-H), 7.93 (m, 4 H, 2”-H, 4”-H, 5”-H, 8”-H), 8.26 (d, *J* = 8.3 Hz, 1 H, 6’-H), 8.76 (d, *J* = 15.1 Hz, 1 H, 3-H), 12.87 (s, 1 H, OH). ^{13}C NMR (90 MHz, $CDCl_3$) δ: 118.8 (C-3’), 119.0 (C-5’), 120.1 (C-1’), 122.8 (C-2), 123.5 (C-8”), 125.4 (C-2”), 125.5 (C-3”), 126.5 (C-6”), 127,2 (C-7”), 128.9 (C-6’), 129,8 (C-4”), 131.3 (C-5”), 131.9 (C-8a”), 132.1 (C-4a”), 133.8 (C-1”), 136.6 (C-4’), 142.4 (C-3), 163.8 (C-2’), 193.6 (C-1).

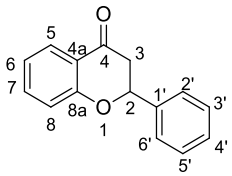


(E)-1-(2-Hydroxyphenyl)-3-(2-naphthyl)prop-2-en-1-one (15g) [6]

Yellow crystals. Yield: 96 %. m.p. 150-152 ºC, ^{1}H NMR (360 MHz, $CDCl_3$) δ: 6.95 (t, *J* = 7.2 Hz, 1 H, 5’-H), 7.02 (d, *J* = 8.3 Hz, 1 H, 3’-H), 7.52 (m, 3 H, H-3”, 6”-H, 7”-H), 7.75 (m, 2 H, 3-H, 4’-H), 7.84 (m, 3 H, 4”-H, 5”-H, 8”-H), 7.93 (d, *J* = 8,3 Hz, 1 H, 6’-H), 8.03 (m, 2 H, 2-H, 1”-H), 12.88 (s, 1 H, OH). ^{13}C NMR (90 MHz, $CDCl_3$) δ: 118.1 (C-3’), 118.4 (C-2), 119.6 (C-1’), 119.6 (C-5’), 123.1 (C-3”), 126.4 (C-6”), 127.1 (C-7”), 127.3 (C-5”), 128.2 (C-1”), 128.3 (C-8”), 129.2 (C-4”), 130.6 (C-6’), 131.6 (C-2”), 132.8 (C-4a”), 134.0 (C-8a”), 135.9 (C-4’), 145.0 (C-3), 163.1 (C-2’), 193.1 (C-1).

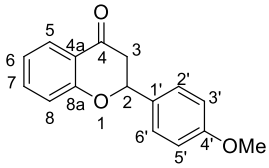
1.2 General Procedure for the Synthesis of 4-Chromanone Derivatives (6a-g)

To a stirred solution of chalcone derivatives **15a-g** (22.30 mmol) in ethanol (300 mL) was added sodium acetate solution (25 g in 65 mL water). The reaction mixture was refluxed for 5 h. After cooling to room temperature, a part of the solvent was removed under reduced pressure, and then extracted with ethyl acetate more times. The combined organic layers were washed with water, dried over $MgSO_4$, filtered and solvent was evaporated under reduced pressure. The residue was triturated with cold diethyl ether. The precipitate was filtered and dried on air.



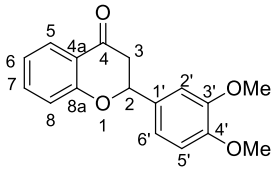
(±)-2-Phenylchroman-4-one (6a) [7]

White crystals. Yield: 70%. m.p. 75-77 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 2.88 (dd, *J* = 16.9, 2.9 Hz, 1H, 3-H_a), 3.08 (dd, *J* = 16.9, 13.3 Hz, 1H, 3-H_b), 5.47 (dd, *J* = 13.3, 2.9 Hz, 1H, 2-H), 7.01 (m, 2H, 6-H, 8-H), 7.33 (m, 6H, 7-H, 2'-H, 3'-H, 4'-H, 5'-H, 6'-H), 7.93 (dd, *J* = 8.0, 1.8 Hz, 1H, 5-H); ^{13}C NMR (101 MHz, $CDCl_3$) δ: 44.6 (C-3), 79.6 (C-2), 118.1 (C-8), 120.9 (C-4a), 121.6 (C-6), 126.1 (C-5), 127.0 (C-2', C-6'), 128.7 (C-4'), 128.8 (C-3', C-5'), 136.2 (C-7), 138.7 (C-1'), 161.5 (C-8a), 191.9 (C-4)



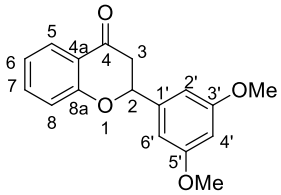
(±)-2-(4-Methoxyphenylphenyl)chromanone (6b) [8]

Pale yellow crystals. Yield: 75%. m.p. 86-88 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 2,85 (dd, *J* = 16.8, 2.8 Hz, 1H, 3-H_a), 3,10 (dd, *J* = 13.3, 2.8 Hz, 1H, 3-H_b), 3.83 (s, 3H, OCH_3), 5.43 (dd, *J* = 13.3, 2.8 Hz, 1H, 2-H), 6.96 (m, 2H, 3'-H, 5'-H), 7.03 (m, 2H, 6-H, 8-H), 7.41 (m, 2H, 2'-H, 6'-H), 7.48 (m, 1H, 7-H), 7.92 (dd, *J* = 8.4, 1.6 Hz, 5'-H); ^{13}C NMR (101 MHz, $CDCl_3$) δ: 44.4 (C-3), 55.3 (C-OCH_3), 79.3 (C-2), 114.2 (C-3', C-5'), 118.1 (C-8), 120.9 (C-4a), 121.4 (C-6), 127.0 (C-5), 127.7 (C-2', C-6'), 130.7 (C-7), 136.1 (C-1'), 159.9 (C-8a), 161.6 (C-4'), 192.2 (C-4)



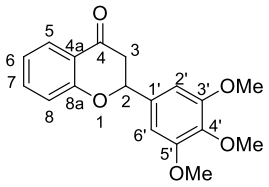
(±)-2-(3,4-Dimethoxyphenylphenyl)chromanone (6c) [9]

Pale yellow crystals. Yield: 54%. m.p. 120-122 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 2.83 (dd, *J* = 16.8, 2.8 Hz, 1H, 3-H_a), 3.06 (dd, *J* = 17.2, 13.6 Hz, 1H, 3-H_b), 3.89 (d, 2H, 2xOCH_3), 5.39 (dd, *J* = 13.2, 2.8 Hz, 1H, 2-H), 6.89 (d, *J* = 8.4 Hz, 1H, 5'-H), 6.99 (m, 4H, 6-H, 8-H, 2'-H, 6'-H), 7.47 (m, 1H, 7-H), 7.90 (dd, *J* = 8.4, 2.0 Hz, 1H, 5-H); ^{13}C NMR (101 MHz, $CDCl_3$) δ: 44.5 (C-3), 55.9 (2xOCH_3), 79.5 (C-2), 109.4 (C-5'), 111.1 (C-2'), 118.1 (C-8), 118.8 (C-6'), 120.9 (C-4a), 121.6 (C-6), 127.0 (C-5), 131.2 (C-1'), 136.1 (C-7), 149.2 (C-4'), 149.4 (C-3'), 161.5 (C-8a), 192.0 (C-4)



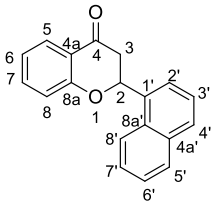
(±)-2-(3,5-Dimethoxyphenylphenyl)chromanone (6d) [10]

Pale yellow crystals. Yield: 59%. m.p. 87-88 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 2.82 (dd, *J* = 16.0, 4.0 Hz, 1H, 3-H_a), 2.99 (dd, *J* = 16.0, 12.0 Hz, 1H, 3-H_b), 3.79 (s, 6H, 2xOCH_3), 5.35 (dd, *J* = 16.0, 4.0 Hz, 1H, 2-H), 6.44 (t, *J* = 4.0 Hz, 1H, 4'-H), 6.61 (d, 2H, 2'-H, 6'-H), 7.00 (m, 2H, 5-H, 7-H), 7.46 (m, 1H, 6-H), 7.89 (dd, *J* = 8.0, 0.8 Hz, 1H, 8-H); ^{13}C NMR (101 MHz, $CDCl_3$) δ: 44.5 (C-3), 55.2 (C-2xOCH_3), 79.3 (C-2), 100.2 (C-4'), 104.0 (C-2', C-6'), 118.0 (C-8), 120.7 (C-4a), 121.4 (C-6), 126.8 (C-5), 136.0 (C-7), 140.9 (C-1'), 160.9 (C-3', C-5'), 161.2 (C-8a), 191.6 (C-4)



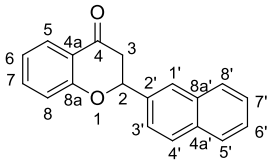
(±)-2-(3,4,5-Trimethoxyphenylphenyl)chromanone (6e) [10]

Pale yellow crystals. Yield: 65%. m.p. 124-126 ℃; ^{1}H NMR (360 MHz, $CDCl_3$) δ: 2.86 (dd, *J* = 14.4, 3.6 Hz, 1H, 3-H_a), 3.06 (dd, *J* = 18.0, 14.4 Hz, 1H, 3-H_b), 3.87 (m, 9H, 3xOCH_3), 5.39 (dd, *J* = 14.4, 3.6 Hz, 1H, 2-H), 6.71 (s, 2H, 2'-H, 6'-H), 7.07 (m, 2H, 2'-H, 6'-H), 7.50 (m, 1H, 6-H), 7.93 (dd, *J* = 7.2, 0.8 Hz, 1H, 8-H); ^{13}C NMR (90 MHz, $CDCl_3$) δ: 44.8 (C-3), 56.2 (C-2xOCH_3), 60.8 (C-OCH_3), 79.8 (C-2), 103.3 (C-2', C-6'), 110.0 (C-4'), 118.1 (C-8), 120.9 (C-4a), 121.7 (C-6), 127.1 (C-5), 134.3 (C-3', C-5'), 136.2 (C-7), 153.6 (C-1'), 161.4 (C-8a), 191.9 (C-4)



(±)-2-(1-Naphthyl)chromanone (6f) [6]

Yield: 54%. m.p. 99-101 ℃; ^{1}H NMR (360 MHz, $CDCl_3$) δ: 3.05 (dd, *J* = 16.9, 2.8 Hz, 1 H, 3-H_a), 3.24 (m, 1 H, 3-H_b), 6.19 (dd, *J* = 13.3, 2.8 Hz, 1 H, 2-H), 7.08 (m, 2 H, 6-H, 8-H), 7.53 (m, 4 H, 7-H, 2'-H, 3'-H, 7'-H), 7.75 (d, *J* = 6.8 Hz, 1 H, 4'-H), 7.89 (m, 2 H, 5'-H, 6'-H), 8.00 (m, 2 H, 5-H, 8'-H). ^{13}C NMR (90 MHz, $CDCl_3$) δ: 43.9 (C-3), 76.8 (C-2), 118.2 (C-8), 121.1 (C-4a), 121.7 (C-6), 122.7 (C-8'), 123.8 (C-3'), 125.9 (C-7'), 126.6 (C-2), 127.1 (C-5), 129.0 (C-4'), 129.3 (C-5'), 130.1 (C-8a'), 133.8 (C-4a'), 134.1 (C-1), 136.2 (C-7), 161.7 (C-8a), 192.2 (C-4).

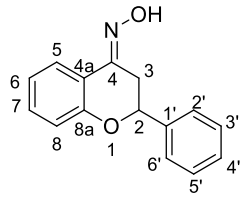


(±)-2-(2-Naphthyl)chromanone (6g) [6]

White crystals. Yield: 65%. m.p. 108-110 ℃; ^{1}H NMR (360 MHz, $CDCl_3$) δ: 2.90 (dd, *J* = 16.5, 2.5 Hz, 1H, 3-H_a), 3.09 (m, 1H, 3-H_b), 5.56 (dd, *J* = 13.3, 2.2 Hz, 1H, 2-H), 7.05 (m, 2H, 6-H, 8-H), 7.50 (m, 4H, 7-H, 6'-H, 7'-H, 8'-H), 7.88 (m, 5H, 5-H, 1'-H, 3'-H, 4'-H, 5'-H). ^{13}C NMR (90 MHz, $CDCl_3$) δ: 44.5 (C-3), 79.6 (C-2), 118.1 (C-8), 120.9 (C-4a), 121.6 (C-6), 123.6 (C-3'), 125.3 (C-1'), 126.5 (C-4', C-6'), 127.0 (C-7'), 127.7 (C-5), 128.1 (C-5'), 128.7 (C-8a'), 133.0 (C-4a'), 136.0 (C-2'), 136.1 (C-7), 161.4 (C-8a), 191.8 (C-4).

1.3 General Procedure for the Synthesis of oxime analogues (16a-g)

Flavanone derivative **6a-g** (15.61 mmol) and Hydroxylamine hydrochloride salt (23.41 mmol) were suspended in a mixture of Ethanol: Water 5:2 (40 mL). Then NaOH (5.20 mmol) was added at 0 ℃. Under reflux Hydroxylamine hydrochloride salt (15.61 mmol) and NaOH (5.20 mmol) were put to the reaction after every 45 minutes until the starting materiel was completely disappeared. After cooling the reaction to room temperature, the pH was adJusted about 5 with concentrated HCl solution which provided a white suspension. Filtration and washing with water afforded the pure product.



(*E*)-2-phenylchroman-4-one oxime (16a) [11]

White crystals. Yield: 97%. m.p 160-162 ℃; 1H-NMR (400 MHz, CDCl3, 25°C) δ: 2.74 (dd, *J* = 17.2, 12.8 Hz, 1 H, 3-Ha), 3.57 (dd, *J* = 17.2, 2.8 Hz, 1 H, 3-Hb), 5.09 (dd, *J* = 12.4, 2.4 Hz, 1 H, 2-H), 6.96 (m, 2 H, 6-H, 8-H), 7.27 (m, 1 H, 7-H), 7.36 (m, 6 H, 2'-H, 3'-H, 4'-H, 5'-H, 6'-H), 7.83 (d, *J* = 6.8 Hz, 1 H, 5-H), 8.89 (bs, 1 H, OH); 13C-NMR (101 MHz, CDCl3, 25 ℃) δ: 30.6 (C-3), 77.2 (C-2), 118.1 (C-4a), 118.2 (C-8), 121.8 (C-6), 124.0 (C-5), 126.3 (C-2', C-6'), 128.6 (C-4'), 128.8 (C-3', C-5'), 131.5 (C-7), 139.9 (C-1'), 150.4 (C-4), 156.9 (C-8a); HRMS (ESI) calcd. for C15H13NO2 [M+H]+ 240.102; found 239.09

(*E*)-2-(4-methoxyphenyl)chroman-4-one oxime (16b)

White crystals, Yield: 93%.: m.p. 171-173 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 2.75 (dd, *J* = 17.2, 12.4 Hz, 1 H, 3-Ha), 3.52 (dd, *J* = 17.2, 2.8 Hz, 1 H, 3-Hb), 3.83 (s, 3 H, 4'-OCH_3), 5.04 (dd, *J* = 12.4, 2.8 Hz, 1 H, 2-H), 6.93 (m, 4 H, 6-H, 8-H, 3'-H, 5'-H), 7.27 (m, 1 H, 7-H), 7.40 (d, 2 H, 2'-H, 6'-H), 7.82 (dd, *J* = 8.0, 1.6 Hz, 1 H, 5-H), 8.64 (bs, 1 H, OH); ^{13}C-NMR (101 MHz, $CDCl_3$) δ: 30.6 (C-3), 55.8 (C-OCH_3), 77.3 (C-2), 114.5 (C-3', C-5'), 118.4 (C-4a), 118.5 (C-8), 122.0 (C-6), 124.3 (C-5), 128.1 (C-2', C-6'), 131.8 (C-7), 132.3 (C-1'), 150.9 (C-4), 157.2 (C-8a), 160.2 (C-4'); HRMS (ESI) calcd. for $C_{16}H_{15}NO_3$ $[M+H]^+$ 270.113; found 270.111

(*E*)-2-(3,4-dimethoxyphenyl)chroman-4-one oxime (16c)

White crystals. Yield: 85%. m.p. 151-153 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 2.78 (dd, *J* = 17.2, 12.4 Hz, 1 H, 3-Ha), 3.54 (dd, *J* = 17.2, 3.2 Hz, 1 H, 3-Hb), 3.89 (d, 6 H, 2xOCH_3), 5.03 (dd, *J* = 12.4, 3.2 Hz, 1 H, 2-H), 6.87 (d, *J* = 8.0 Hz, 1 H, 5'-H), 6.95 (m, 4 H, 6-H, 8-H, 2'-H, 6'-H), 7.27 (m, 1 H, 7-H), 7.82 (dd, *J* = 8.0, 1.6 Hz, 1 H, 5-H), 9.32 (bs, 1 H, OH); ^{13}C-NMR (101 MHz, $CDCl_3$) δ: 30.4 (C-3), 56.0 (2xC-OCH_3), 77.1 (C-2), 109.5 (C-5'), 111.2 (C-2'), 118.0 (C-4a), 118.2 (C-8), 118.9 (C-6'), 121.7 (C-6), 123.9 (C-5), 131.4 (C-7), 132.3 (C-1'), 149.2 (C-4'), 150.4 (C-4, C-3'), 156.8 (C-8a); HRMS (ESI) calcd. for $C_{17}H_{17}NaNO_4$ $[M+Na]^+$ 322.105; found 322.105

(*E*)-2-(3,5-dimethoxyphenyl)chroman-4-one oxime (16d)

White crystals. Yield: 88%. m.p. 130-132 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 2.73 (dd, *J* = 17.2, 12.4 Hz, 1 H, 3-Ha), 3.55 (dd, *J* = 17.2, 2.8 Hz, 1 H, 3-Hb), 3.81 (s, 6 H, 2xOCH_3), 5.02 (dd, *J* = 12.4, 2.8 Hz, 1 H, 2-H), 6.45 (t, *J* = 2.0 Hz, 1 H, 4'-H), 6.64 (d, 2 H, 2'-H, 6'-H), 6.97 (m, 2 H, 6-H, 8-H), 7.27 (m, 1 H, 7-H), 7.82 (dd, *J* = 8.0, 1.6 Hz, 1 H, 5-H), 8.97 (bs, 1 H, OH); ^{13}C-NMR (101 MHz, $CDCl_3$) δ = 30.6 (C-3), 55.5 (2xC-OCH_3), 77.2 (C-2), 100.4 (C-4'), 104.3 (C-2', C-6'), 118.1 (C-4a), 118.2 (C-8), 121.8 (C-6), 124.0 (C-5), 131.5 (C-7), 142.2 (C-1'), 150.3 (C-4), 156.7 (C-8a), 161.2 (C-3', C-5'); HRMS (ESI) calcd. for $C_{17}H_{17}NaNO_4$ $[M+Na]^+$ 322.105; found 322.105

(*E*)-2-(3,4,5-trimethoxyphenyl)chroman-4-one oxime (16e)

White crystals. Yield: 95%. m.p. 165-167 ℃; ^{1}H-NMR (360 MHz, $CDCl_3$) δ: 2.76 (dd, *J* = 17.3, 12.6 Hz, 1 H, 3-Ha), 3.56 (dd, *J* = 17.3, 2.5 Hz, 1 H, 3-Hb), 3.87 (d, 9 H, 3xOCH_3), 5.02 (dd, *J* = 12.6, 2.5 Hz, 1 H, 2-H), 6.72 (s, 2 H, 2'-H, 6'-H), 7.00 (m, 2 H, 6-H, 8-H), 7.28 (t, *J* = 8.0 Hz, 1 H, 7-H), 7.83 (d, *J* = 7.9 Hz, 1 H, 5-H), 9.32 (bs, 1 H, OH); ^{13}C-NMR (91 MHz, $CDCl_3$) δ: 30.7 (C-3), 56.2 (2xC-OCH_3), 61.0 (C-OCH_3), 77.4 (C-2), 103.4 (C-2', C-6'), 118.0 (C-4a), 118.2 (C-8), 121.8 (C-6), 123.9 (C-5), 131.5 (C-7), 135.4 (C-1'), 138.0 (C-4'), 150.1 (C-4), 153.5 (C-3', C-5'), 156.6 (C-8a); HRMS (ESI) calcd. for $C_{18}H_{19}NO_5$ $[M+H]^+$ 330.134; found 330.134

(*E*)-2-(naphthalen-1-yl)chroman-4-one oxime (16f)

White crystals. 81%. m.p. 219-221 ℃; ^{1}H-NMR (400 MHz, DMSO-d6) δ: 2.85 (dd, *J* = 17.2, 12.0 Hz, 1 H, 3-Ha), 3.51 (dd, *J* = 17.2, 3.2 Hz, 1 H, 3-Hb), 5.93 (dd, *J* = 11.6 , 2.8 Hz, 1 H, 2-H), 6.97 (m, 2 H, 6-H, 8-H), 7.29 (m, 1 H, 7-H), 7.55 (m, 3 H, 2'-H, 3'-H, 7'-H), 7.74 (d, *J* = 7.2 Hz, 1 H, 5-H), 7.89 (d, *J* = 6.8 Hz, 1 H, 6'-H), 7.94 (m, 2 H, 4'-H, 5'-H), 8.18 (d, *J* = 7.2 Hz, 1 H, 8'-H), 11.4 (s, 1 H, OH); ^{13}C-NMR (101 MHz, DMSO-d6) δ: 29.2 (C-3), 73.6 (C-2), 117.7 (C-8), 119.2 (C-4a), 121.5 (C-6), 123.4 (C-8'), 123.5 (C-5), 123.9 (C-2'), 125.4 (C-3'), 125.8 (C-7'), 126.5 (C-6'), 128.7 (C-4', C-5'), 130.1 (C-8a'), 130.5

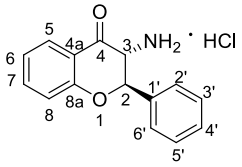
(C-7), 133.4 (C-4a'), 135.4 (C-1'), 147.4 (C-4), 155.9 (C-8a); HRMS (ESI) calcd. for $C_{19}H_{15}NO_2$ $[M+H]^+$ 290.118; found 290.117

(*E*)-2-(naphthalen-2-yl)chroman-4-one oxime (16g)

White crystals. Yield: 98%. m.p. 203-205 ℃; ^{1}H-NMR (400 MHz, DMSO-d6) δ: 2.80 (dd, *J* = 17.2, 12.0 Hz, 1 H, 3-Ha), 3.44 (dd, *J* = 17.2, 3.2 Hz, 1 H, 3-Hb), 5.34 (dd, *J* = 12.0, 3.2 Hz, 1 H, 2-H), 6.99 (m, 2 H, 6-H, 8-H), 7.71 (m, 1 H, 7-H), 7.29 (m, 2 H, 3'-H, 7'-H), 7.66 (dd, *J* = 8.4, 1.6 Hz, 1 H, 5-H), 7.85 (dd, *J* = 8.0, 1.6 Hz, 1 H, 6'-H), 7.93 (m, 3 H, 4'-H, 5'-H, 8'-H), 8.03 (s, 1 H, 1'-H), 11.38 (s, 1 H, OH); ^{13}C-NMR (101 MHz, DMSO-d6) δ: 29.8 (C-3), 76.4 (C-2), 117.7 (C-8), 119.0 (C-4a), 121.5 (C-6), 123.4 (C-5), 124.4 (C-1'), 125.2 (C-8'), 126.4 (C-3', C-7'), 127.6 (C-6'), 128.0 (C-5'), 128.2 (C-4'), 130.6 (C-7), 132.7 (C-8a'), 132.7 (C-4a'), 137.5 (C-2'), 147.3 (C-4), 155.7 (C-4); HRMS (ESI) calcd. for $C_{19}H_{15}NO_2$ $[M+H]^+$ 290.118; found 290.118

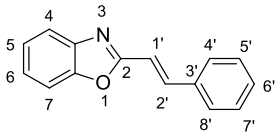
1.4 General Procedure for Neber rearrangement (*rac-cis*-1a-g, *rac-trans*-1a-g, 17a-g)

Tosyl oxime derivative **5a-g** (8.895 mmol) was dissolved in anhydrous Toluene (50 mL) under inert atmosphere and then 10.9 mL NaOEt (940 mg in 50 mL EtOH) was dropped to the solution. Stirring for 1 day at room temperature afforded an orange suspension. The suspension was filtered through cellite and washed with EtOH. Concentration of the filtrate under vacuum provided the crude product as an orange oil. Then it was solved in CH2Cl2 and 3 N HCl solution (3 mL) was added to it. After 2 hours stirring at room temperature resulted in an orange suspension. Filtration and washing with Acetone provided the cis relative configurational product as white powder. Then the filtrate was thoroughly concentrated under reduced pressure and trituration with Acetone afforded the trans relative configurational product as off-white powder. The residue filtrate was purified after concentration by column chromatography using an eluent of Toluene : Ethyl Acetate (4:1). The benzoxazole derivate was obtained by this procedure.



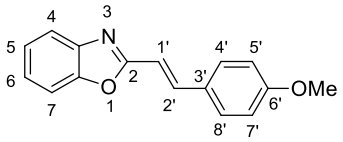
(±)-(2*R,3*R**)-3-amino-2-phenyl-2,3-dihydro-4H-chroman-4-one hydrochloride (*rac-trans*-1a) [12]**

off-White solid. Yield: 30%. m.p. 197-199 ℃; 1H-NMR (400 MHz, DMSO-d6, 25°C) δ: 5.01 (d, *J* = 12.4 Hz, 1 H, 3-H), 5.77 (d, *J* = 12.4 Hz, 1 H, 2-H), 7.13 (d, *J* = 8 Hz, 1 H, 8-H), 7.20 (m, 1 H, 6-H), 7.50 (m, 3 H, 3'-H, 4'-H, 5'-H), 7.68 (m, 3 H, 7-H, 2'-H, 6'-H), 7.87 (dd, *J* = 8.0, 1.6 Hz, 1 H, 5-H), 8.72 (bs, 3 H, NH_3); ^{13}C-NMR (101 MHz, DMSO-d6, 25°C) δ: 55.7 (C-3), 80.2 (C-2), 118.0 (C-8), 118.5 (C-4a), 122.5 (C-6), 126.9 (C-5), 128.6 (C-2', C-6'), 128.8 (C-3', C-5'), 129.9 (C-4'), 134.3 (C-1'), 137.6 (C-7), 160.8 (C-8a), 187.6 (C-4); HRMS (ESI) calcd. for $C_{15}H_{13}NO_2$ $[M+H]^+$ 240.102; found 240.101



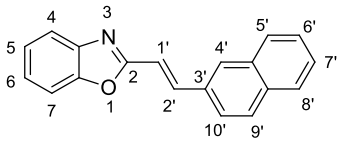
2-(*E*)-2-phenylethenyl-1,3-benzoxazole (17a) [13]

Pale yellow crystals. Yield: 15%. m.p. 62-64 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 7.05 (d, *J* = 16.4 Hz, 1 H, 2'-H), 7.30 (m, 2 H, 4-H, 7-H), 7.36 (m, 3 H, 5'-H, 6'-H, 7'-H), 7.50 (m, 1 H, 5-H), 7.57 (d, 2 H, 4'-H, 8'-H), 7.69 (m, 1 H, 6-H), 7.76 (d, *J* = 16.4 Hz, 1 H, 1'-H); ^{13}C-NMR (101 MHz, $CDCl_3$) δ: 110.4 (C-2'), 114.0 (C-5), 119.9 (C-6), 124.6 (C-4), 125.3 (C-7), 127.6 (C-5', C-7'), 129.0 (C-4', C-8'), 129.9 (C-6'), 135.2 (C-3'), 139.6 (C-1'), 142.2 (C-3a), 150.5 (C-7a), 162.9 (C-2); HRMS (ESI) calcd. for $C_{15}H_{11}NO$ $[M+H]^+$ 222.092; found 222.089



2-[(*E*)-2-(4-methoxyphenyl)ethenyl]-1,3-benzoxazole (17b) [14]

White chrystals. Yield: 20%. m.p. 128-130 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$, 25°C) δ: 3.79 (s, 3 H, OCH_3), 6.88 (m, 3 H, β-H, 3'-H, 5'-H), 7.27 (m, 2 H, 4-H, 7-H), 7.46 (m, 3 H, 5-H, 2'-H, 6'-H), 7.67 (m, 2 H, α-H, 6-H); ^{13}C-NMR (101 MHz, $CDCl_3$, 25°C) δ: 55.4 (C-OCH_3), 110.2 (C-5), 111.5 (C-β), 114.4 (C-3', C-5'), 119.7 (C-6), 124.4 (C-4), 124.9 (C-7), 127.9 (C-1'), 129.1 (C-2', C-6'), 139.1 (C-β), 142.3 (C-3a), 150.4 (C-7a), 161.0 (C-4'), 163.2 (C-2); HRMS (ESI) calcd. for $C_{16}H_{13}NO_2$ $[M+H]^+$ 252.102; found



2-[(*E*)-2-naphthlaen-2-ylethenyl]-1,3-benzoxazole (17g) [13]

White crystals. 11%. m.p. 129-131 ℃; ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 7.11 (d, J = 16.4 Hz, 1 H, 2'-H), 7.28 (m, 2 H, 4-H, 7-H), 7.45 (m, 3 H, 5-H, 4'-H, 8'-H), 7.68 (m, 2 H, 6-H, 7'-H), 7.77 (m, 3 H, 5'-H, 6'-H, 9'-H), 7.90 (m, 2 H, 10'-H, 1'-H); ^{1}H-NMR (400 MHz, $CDCl_3$) δ: 110.4 (C-5), 114.1 (C-2'), 120.0 (C-6), 123.2 (C-10'), 124.6 (C-4), 125.3 (C-7), 126.8 (C-9'), 127.1 (C-4'), 127.9 (C-8'), 128.5 (C-7'), 128.8 (C-6'), 129.2 (C-5'), 132.7 (C-5a'), 133.5 (C-9a'), 134.0 (C-3'), 139.5 (C-1'), 142.3 (C-3a), 150.5 (C-7a), 162.9 (C-2); HRMS (ESI) calcd. for $C_{19}H_{13}NO$ $[M+H]^+$ 272.107; found 272.107

1.5 References of known compounds

[1] Krohn, K.; Ahmed, I.; John, M. Enantioselective Synthesis of Flavan-3-ols Using a Mitsunobu Cyclization. *Synthesis* **2009**, 10.1055/s-0028-1083361, 779-786, doi:10.1055/s-0028-1083361.

[2] Jagadeesh, M.; Lavanya, M.; Babu, B.H.; Hong, K.; Ma, R.; Kim, J.; Kim, T.K. Synthesis and detailed spectroscopic characterization of various hydroxy-functionalized fluorescent chalcones: A combined experimental and theoretical study. *Spectroc. Acta Pt. A-Molec. Biomolec. Spectr*. **2015**, 150, 557-564, doi:10.1016/j.saa.2015.05.085.

[3] Li, X.; Chen, G.L.; Zhang, X.J.; Zhang, Q.; Zheng, S.L.; Wang, G.D.; Chen, Q.H. A new class of flavonol-based anti-prostate cancer agents: Design, synthesis, and evaluation in cell models. *Bioorg. Med. Chem. Lett*. **2016**, 26, 4241-4245, doi:10.1016/j.bmcl.2016.07.050.

[4] Britton, R.G.; Horner-Glister, E.; Pomenya, O.A.; Smith, E.E.; Denton, R.; Jenkins, P.R.; Steward, W.P.; Brown, K.; Gescher, A.; Sale, S. Synthesis and biological evaluation of novel flavonols as potential anti-prostate cancer agents. *Eur. J. Med. Chem*. **2012**, 54, 952-958, doi:10.1016/j.ejmech.2012.06.031.

[5] Dias, T.A.; Duarte, C.L.; Lima, C.F.; Proenca, M.F.; Pereira-Wilson, C. Superior anticancer activity of halogenated chalcones and flavonols over the natural flavonol quercetin. Eur. J. Med. Chem. **2013**, 65, 500-510, doi:10.1016/j.ejmech.2013.04.064.

[6] Muller, B.M.; Litberg, T.J.; Yocum, R.A.; Pniewski, C.A.; Adler, M.J. Extended Aromatic and Heteroaromatic Ring Systems in the Chalcone-Flavanone Molecular Switch Scaffold. *J. Org. Chem*. **2016**, 81, 5775-5781, doi:10.1021/acs.joc.6b00986.

[7] Safavi, M.; Esmati, N.; Ardestani, S.K.; Emami, S.; Ajdari, S.; Davoodi, J.; Shafiee, A.; Foroumadi, A. Halogenated flavanones as potential apoptosis-inducing agents: Synthesis and biological activity evaluation. *Eur. J. Med. Chem*. **2012**, 58, 573-580, doi:10.1016/j.ejmech.2012.10.043.

[8] Chimenti, F.; Fioravanti, R.; Bolasco, A.; Chimenti, P.; Secci, D.; Rossi, F.; Yanez, M.; Orallo, F.; Ortuso, F.; Alcaro, S., et al. A new series of flavones, thioflavones, and flavanones as selective monoamine oxidase-B inhibitors. *Bioorg. Med. Chem.* **2010**, 18, 1273-1279, doi:10.1016/j.bmc.2009.12.029.

[9] Cabrera, M.; Simoens, M.; Falchi, G.; Lavaggi, M.L.; Piro, O.E.; Castellano, E.E.; Vidal, A.; Azqueta, A.; Monge, A.; de Cerain, A.L., et al. Synthetic chalcones, flavanones, and flavones as antitumoral agents: Biological evaluation and structure-activity relationships. *Bioorg. Med. Chem*. **2007**, 15, 3356-3367, doi:10.1016/j.bmc.2007.03.031.

[10] Kondhare, D.D.; Gyananath, G.; Tamboli, Y.; Kumbhar, S.S.; Choudhari, P.B.; Bhatia, M.S.; Zubaidha, P.K. An efficient synthesis of flavanones and their docking studies with aldose reductase. *Med. Chem. Res*. **2017**, 26, 987-998, doi:10.1007/s00044-017-1813-1.

[11] Zhu, Z.Z.; Tang, X.D.; Cen, J.H.; Li, J.X.; Wu, W.Q.; Jiang, H.F. Copper-catalyzed synthesis of thiazol-2-yl ethers from oxime acetates and xanthates under redox-neutral conditions. *Chem. Commun*. **2018**, 54, 3767-3770, doi:10.1039/c8cc00445e.

[12] O'Brien, C.; Philbin, E.M.; Ushioda, S.; Wheeler, T.S. The synthesis of 3-aminoflavanones. *Tetrahedron* **1963**, *19*, 373-377, doi:10.1016/S0040-4020(01)99183-5

[13] Lee, W.C.; Wang, T.H.; Ong, T.G. Ligand promoted Pd-catalyzed dehydrogenative alkenylation of hetereoarenes. *Chem. Commun*. **2014**, 50, 3671-3673, doi:10.1039/c3cc48750d.

[14] Neumann, K.T.; Lindhardt, A.T.; Bang-Andersen, B.; Skrydstrup, T. Access to 2-(Het)aryl and 2-Styryl Benzoxazoles via Palladium-Catalyzed Aminocarbonylation of Aryl and Vinyl Bromides. *Organic Letters* **2015**, 17, 2094-2097, doi:10.1021/acs.orglett.5b00642.

2 1D- and 2D-NMR spectra

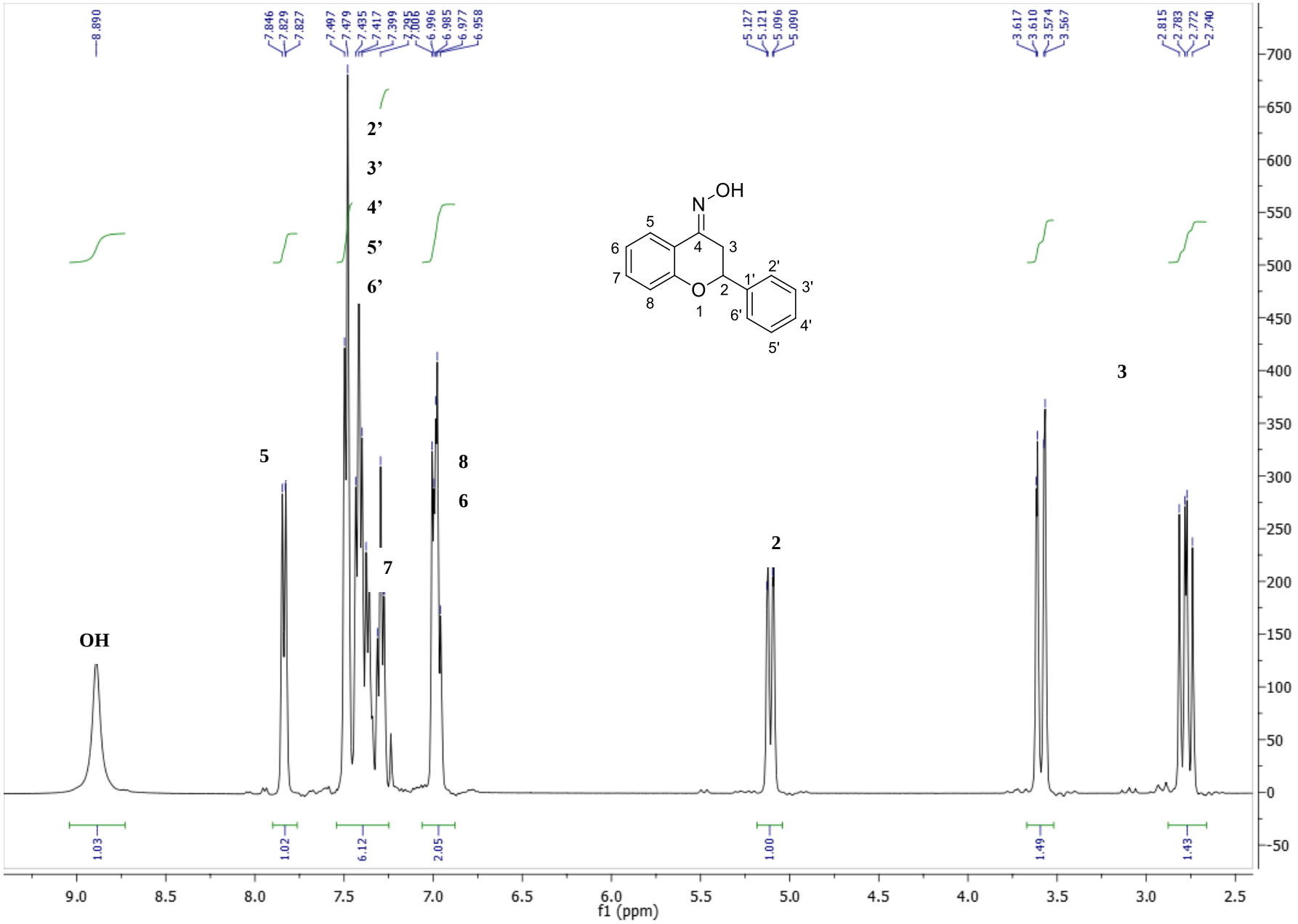


Figure S1. ^{1}H-NMR spectrum of **16a** in $CDCl_3$

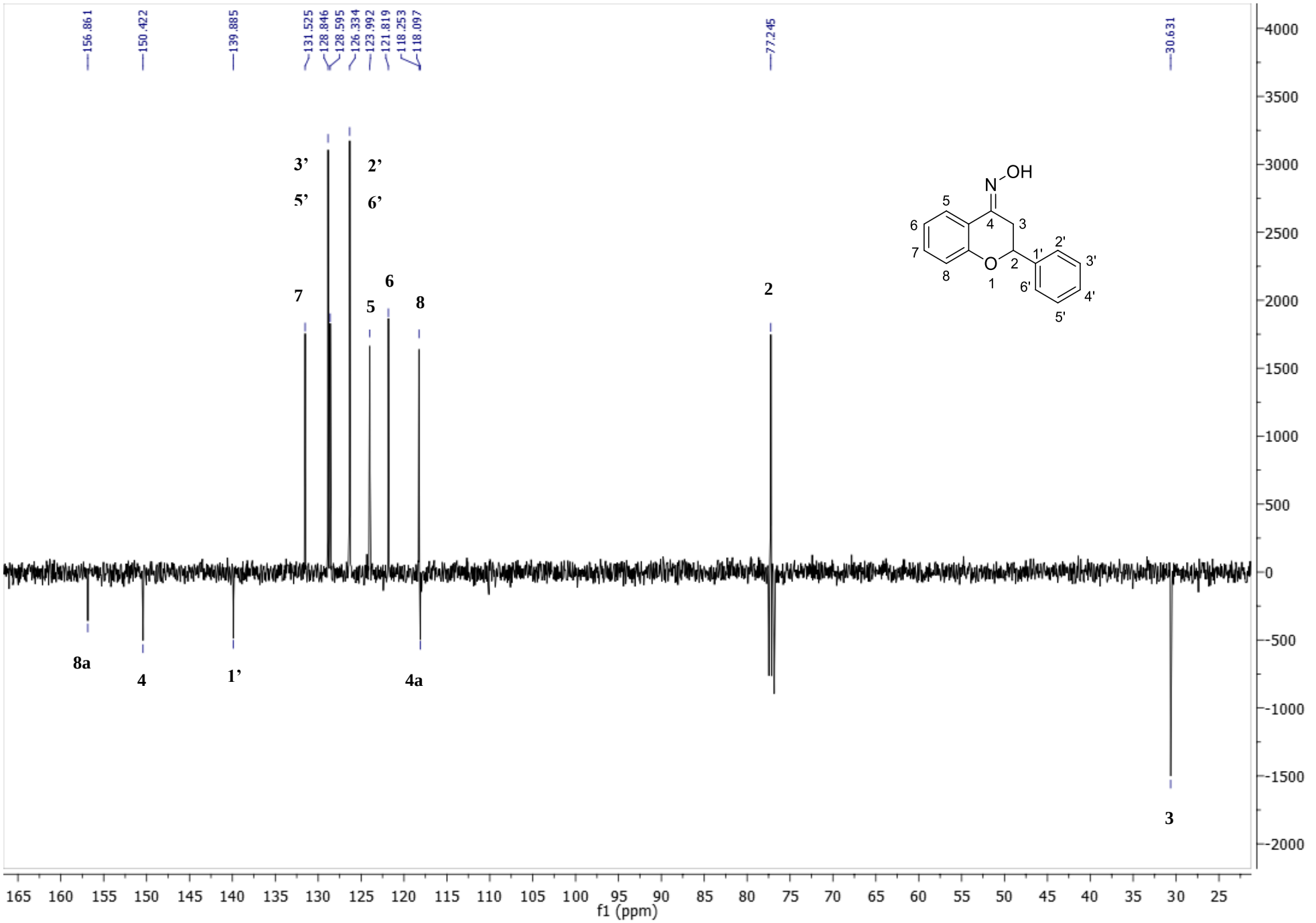


Figure S2. ^{13}C-NMR spectrum of **16a** in $CDCl_3$

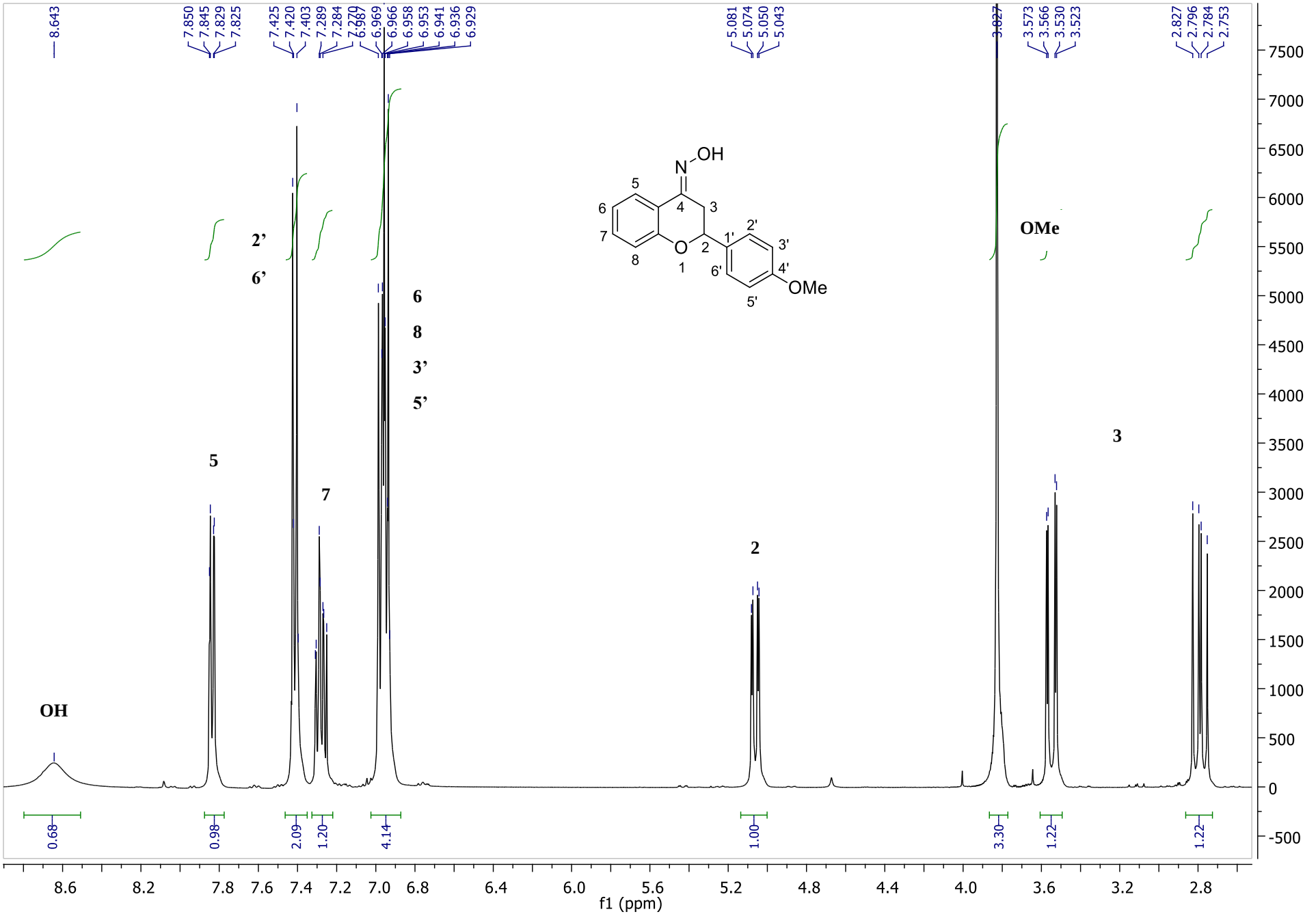


Figure S3. ^{1}H-NMR spectrum of **16b** in $CDCl_3$

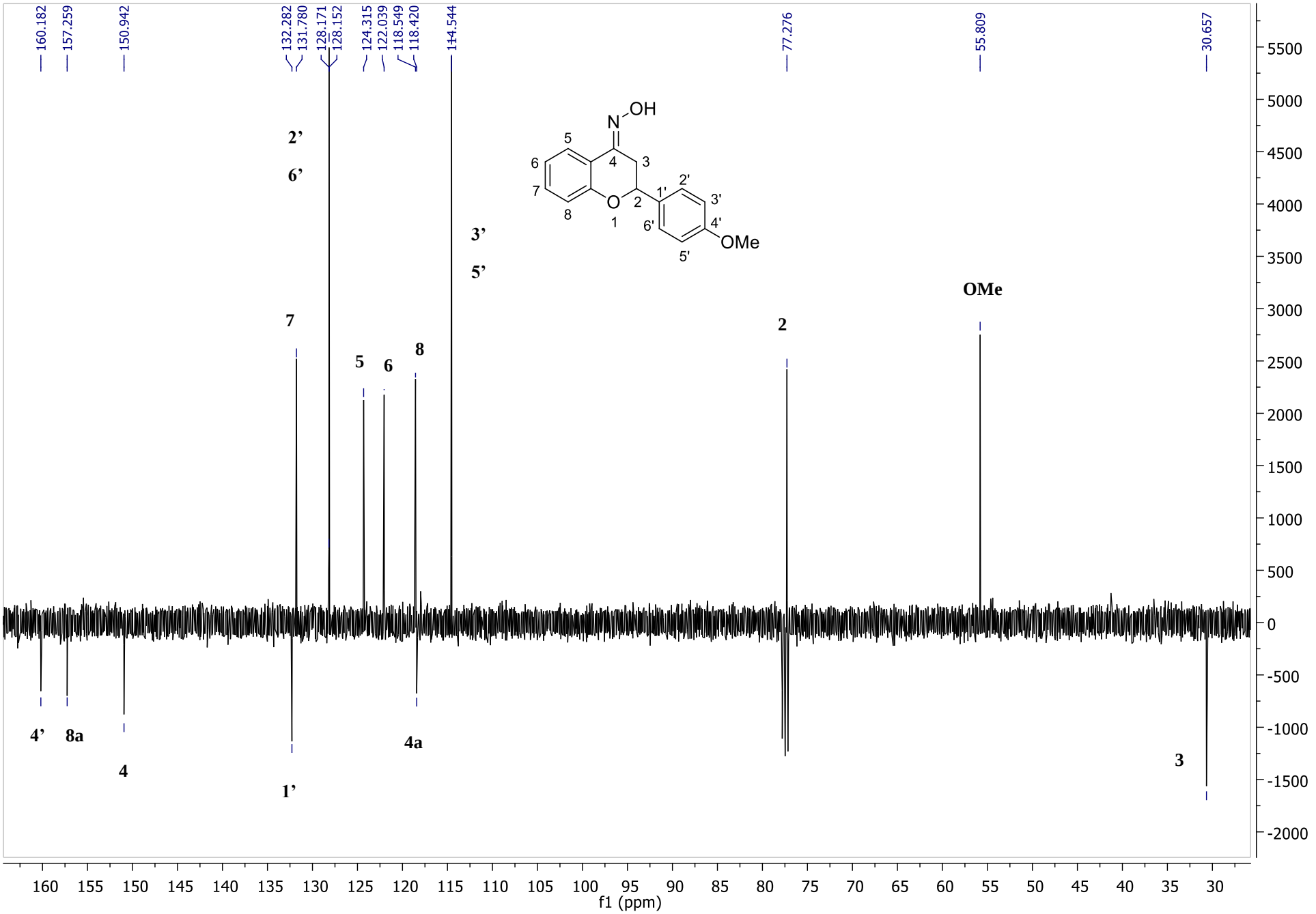


Figure S4. ^{13}C-NMR spectrum of **16b** in $CDCl_3$

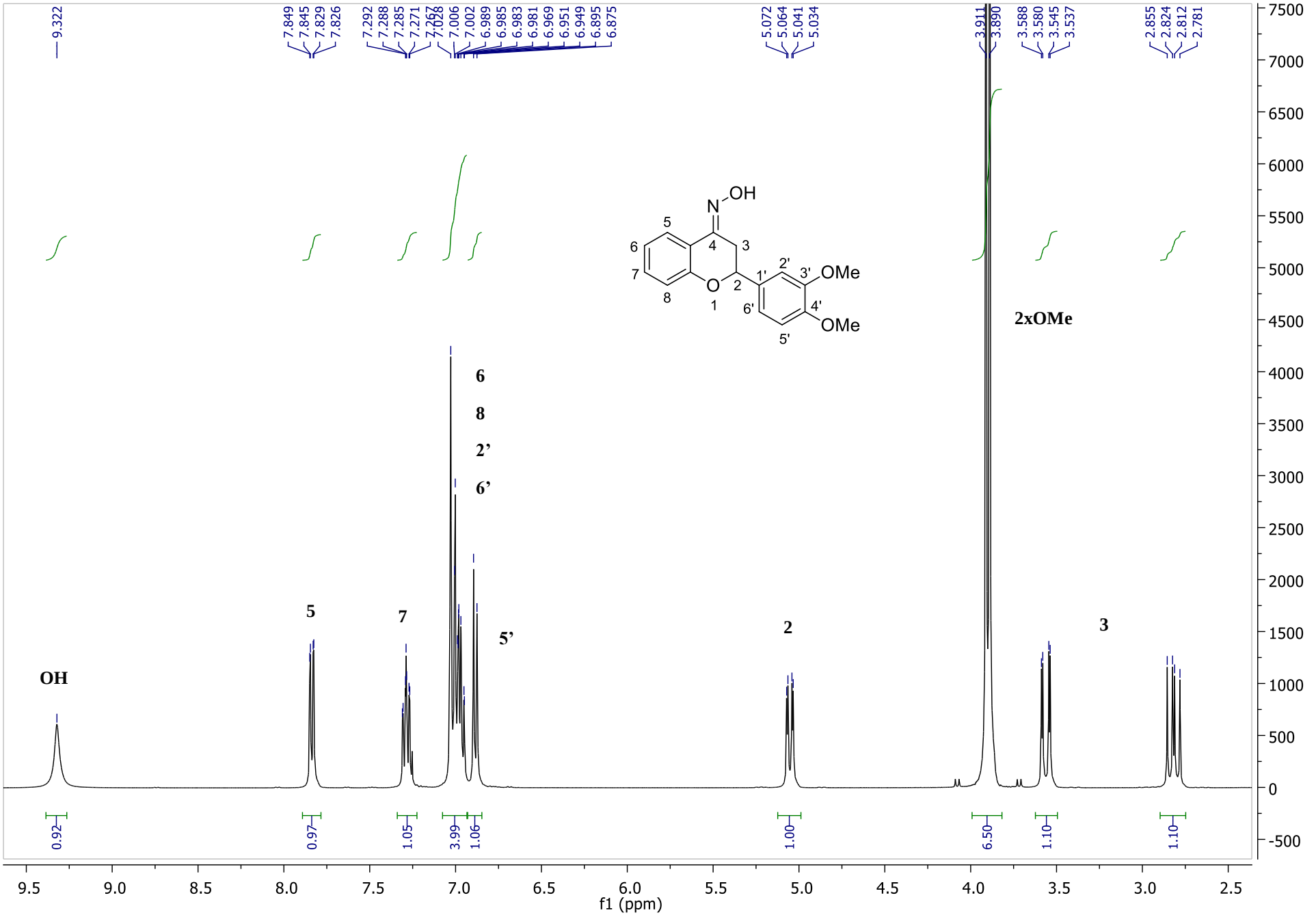


Figure S5. ^{1}H-NMR spectrum of **16c** in $CDCl_3$

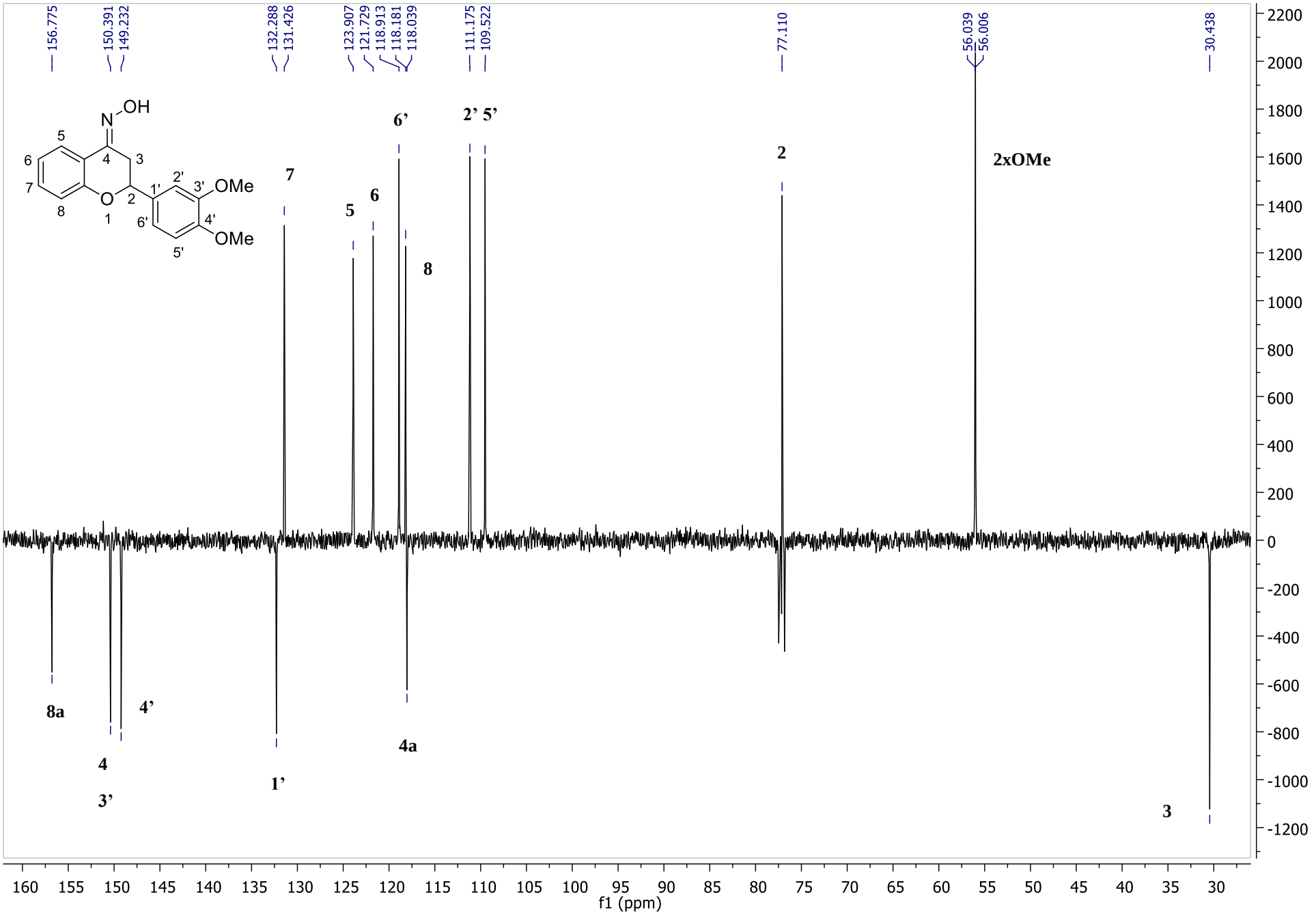


Figure S6. ^{13}C-NMR spectrum of **16c** in $CDCl_3$

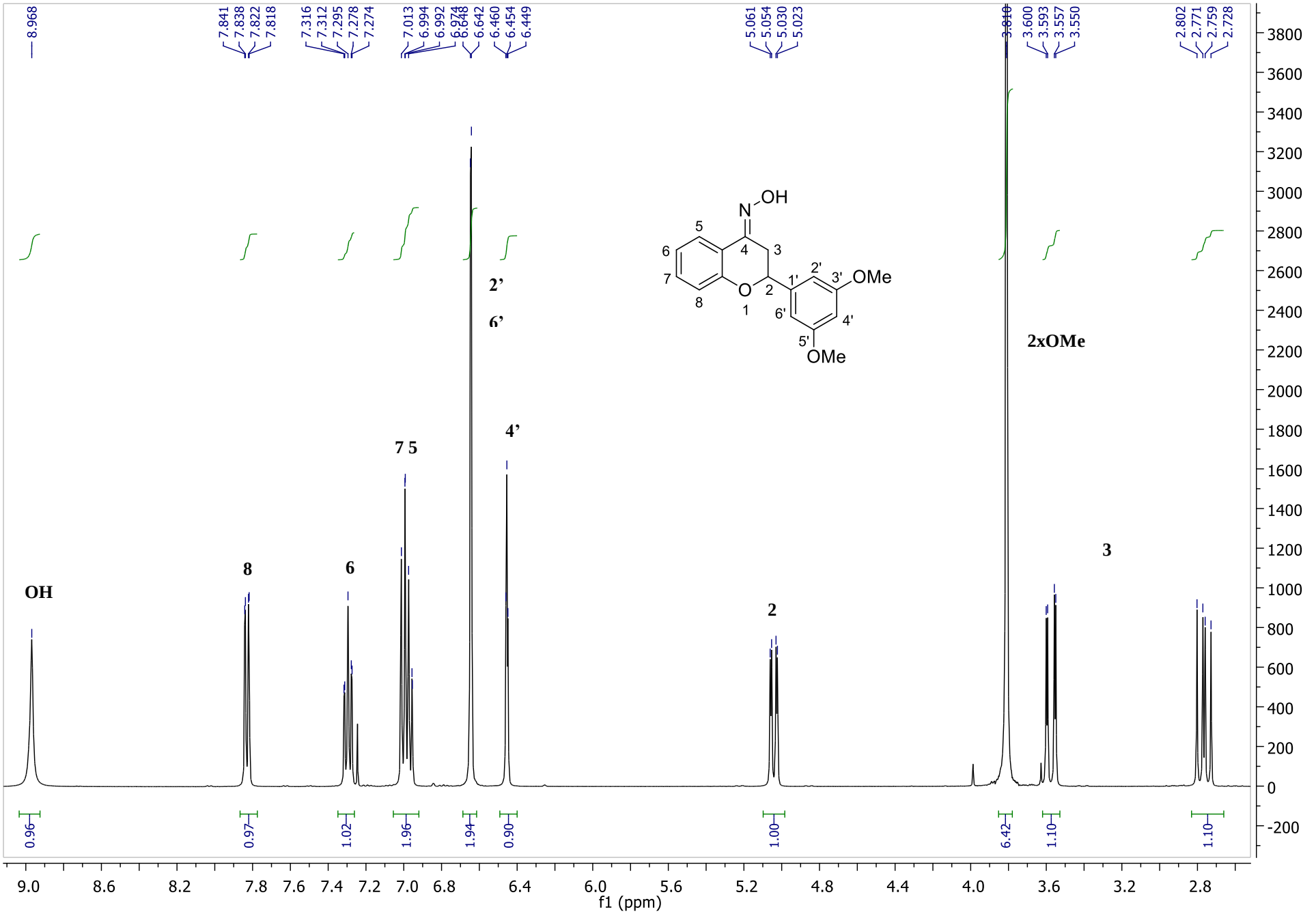


Figure 7. ^{1}H-NMR spectrum of **16d** in $CDCl_3$

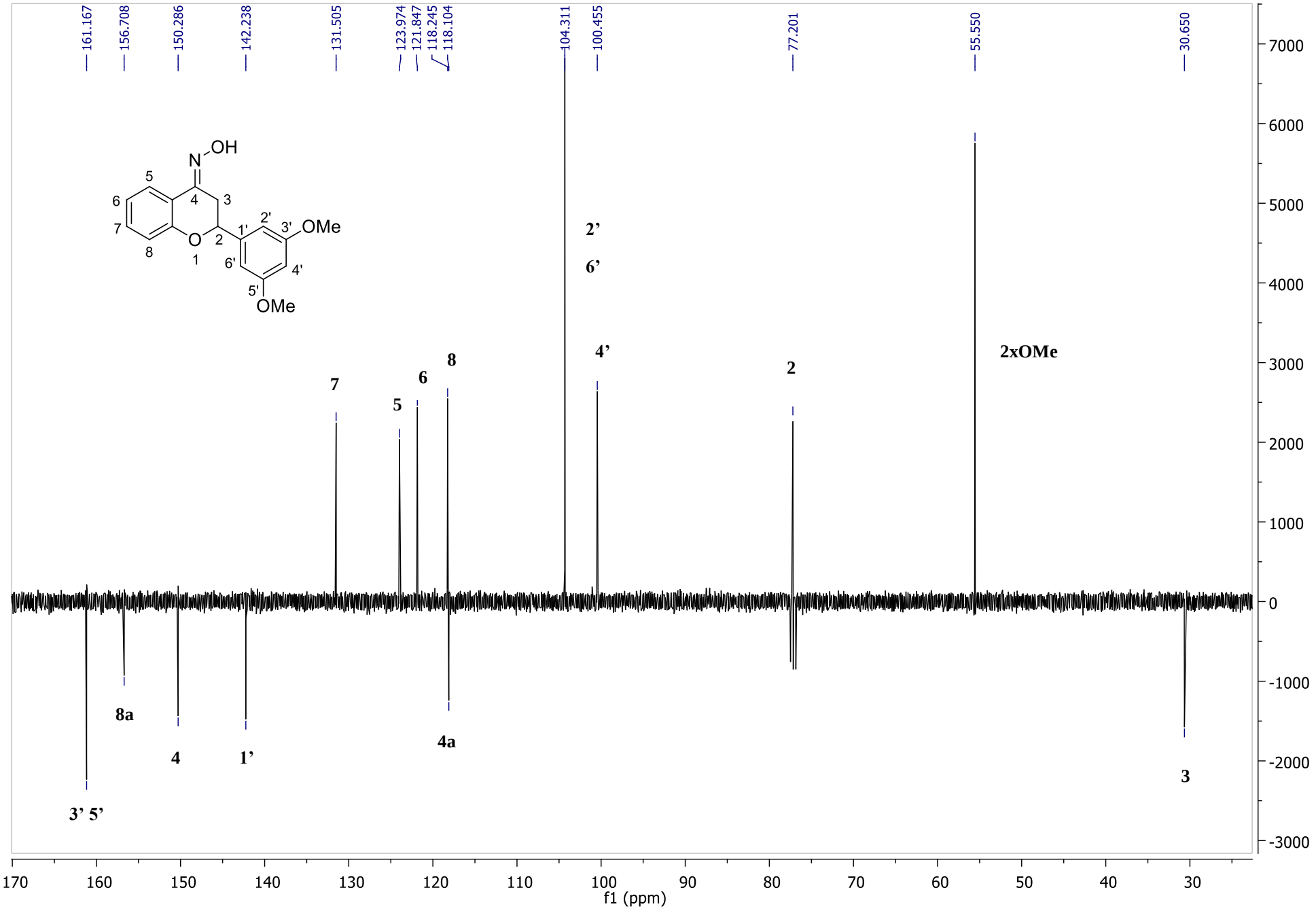


Figure S8. ^{13}C-NMR spectrum of **16d** in $CDCl_3$

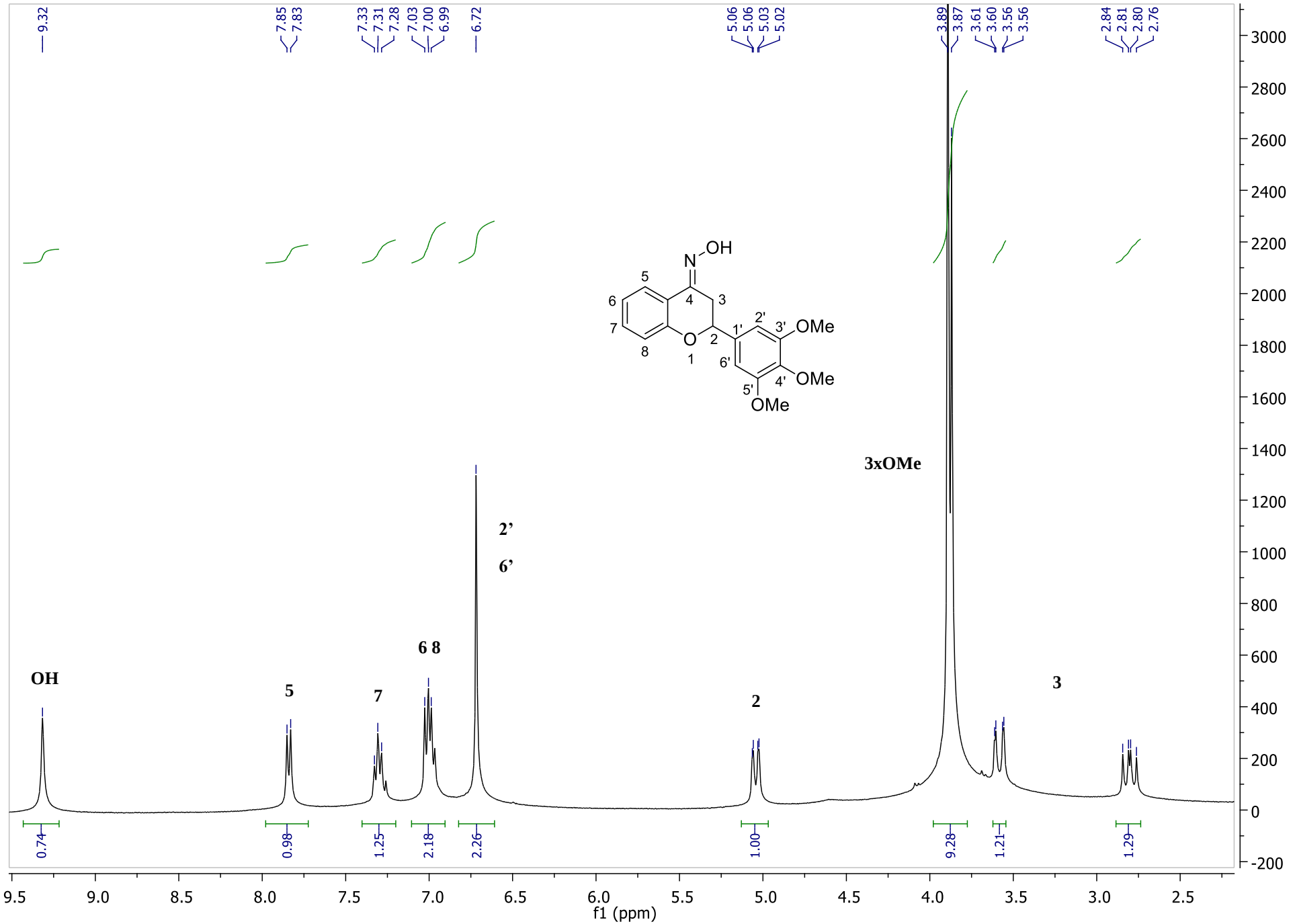


Figure S9. ^{1}H-NMR spectrum of **16e** in $CDCl_3$

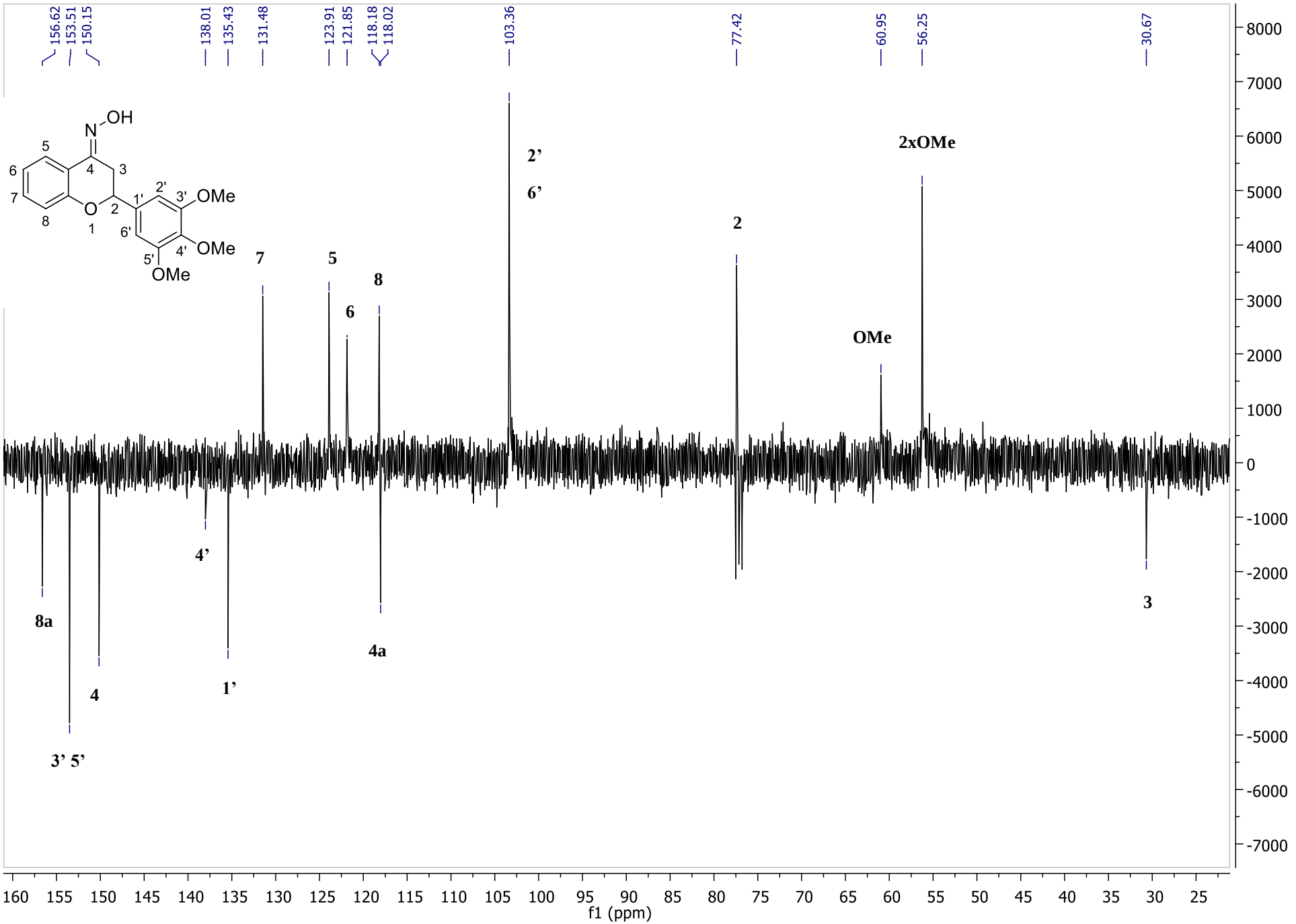


Figure S10. ^{13}C-NMR spectrum of **16e** in $CDCl_3$

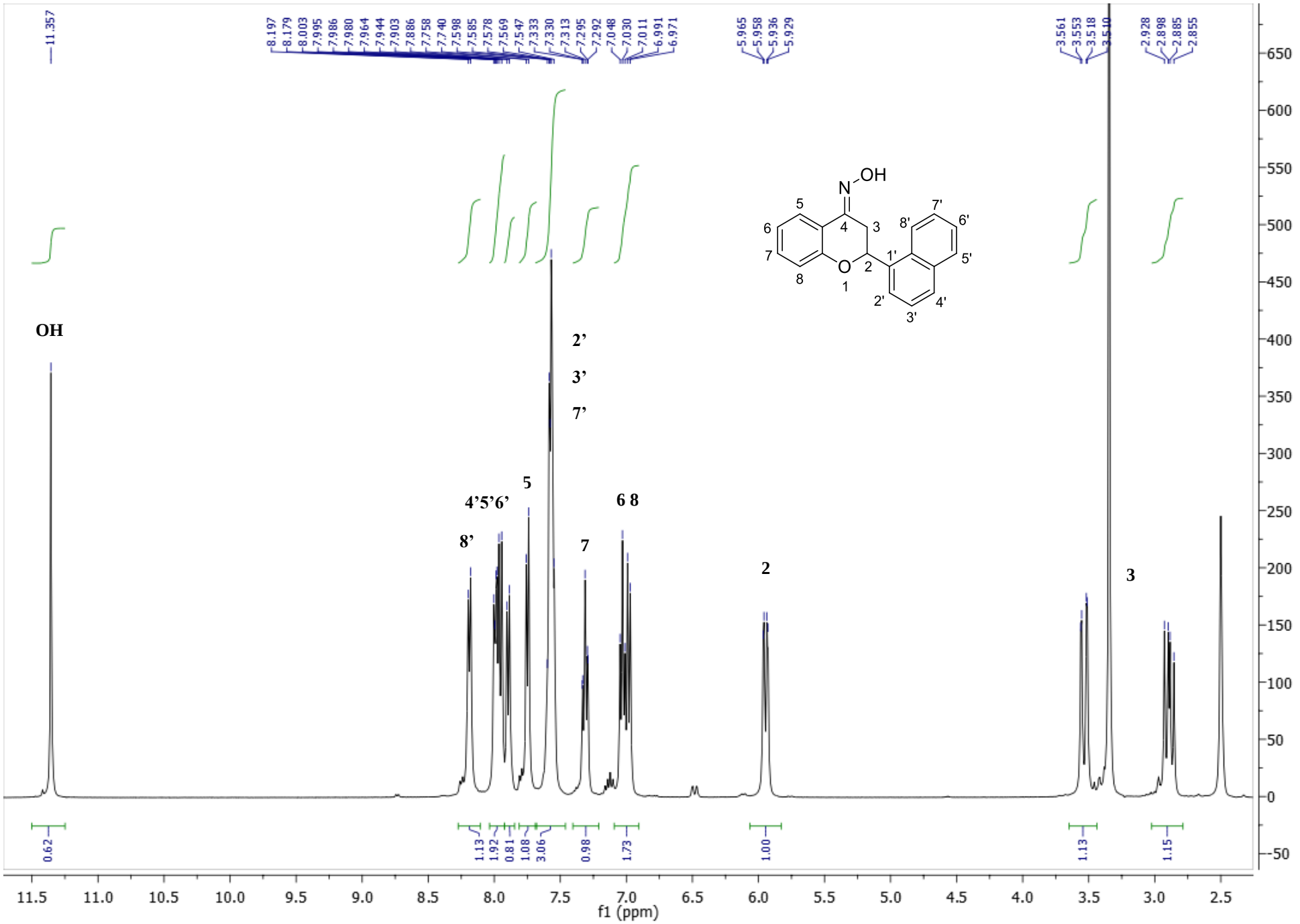


Figure S11. ^{1}H-NMR spectrum of **16f** in DMSO-d_6

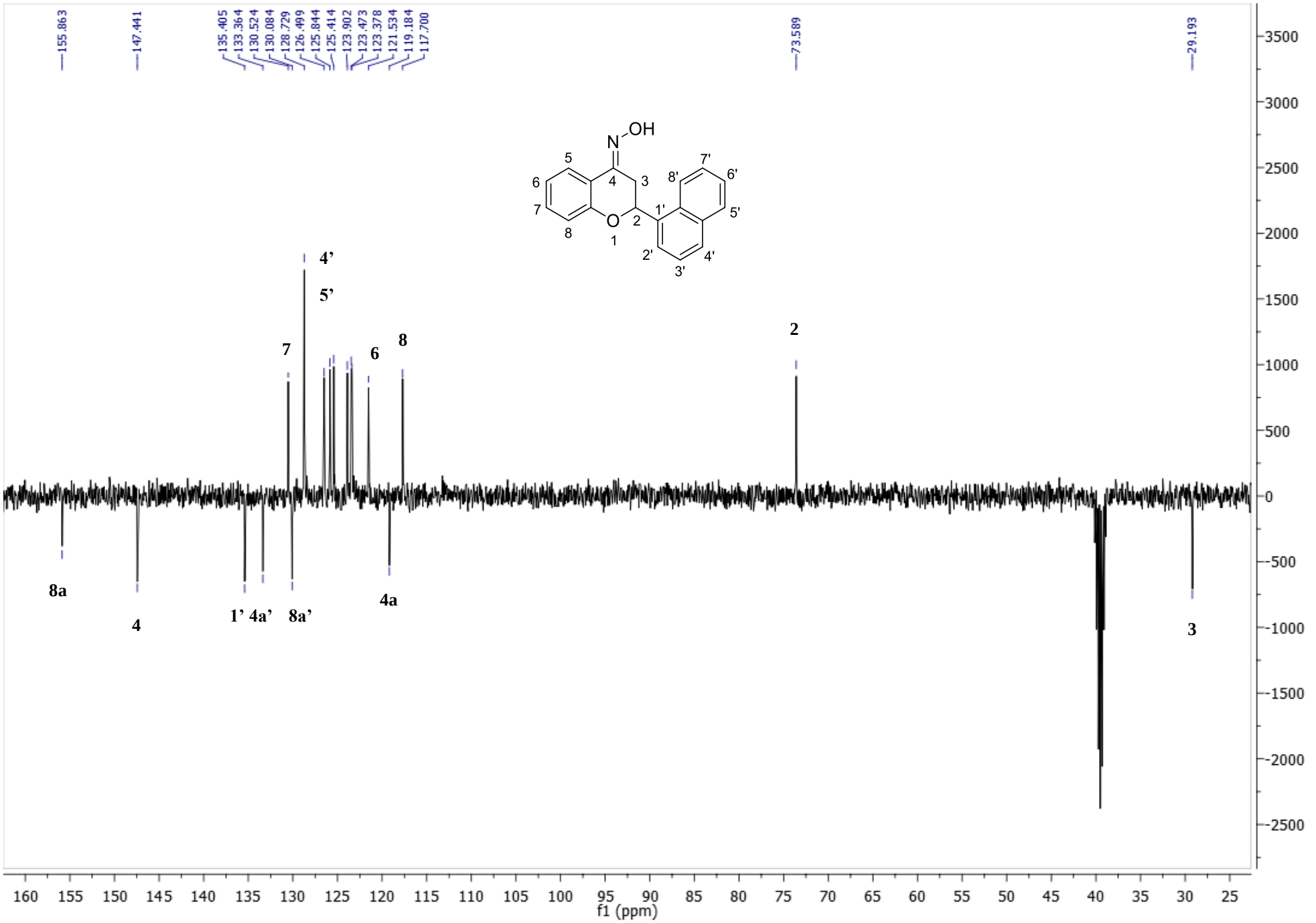


Figure S12. ^{13}C-NMR spectrum of **16f** in DMSO-d_6

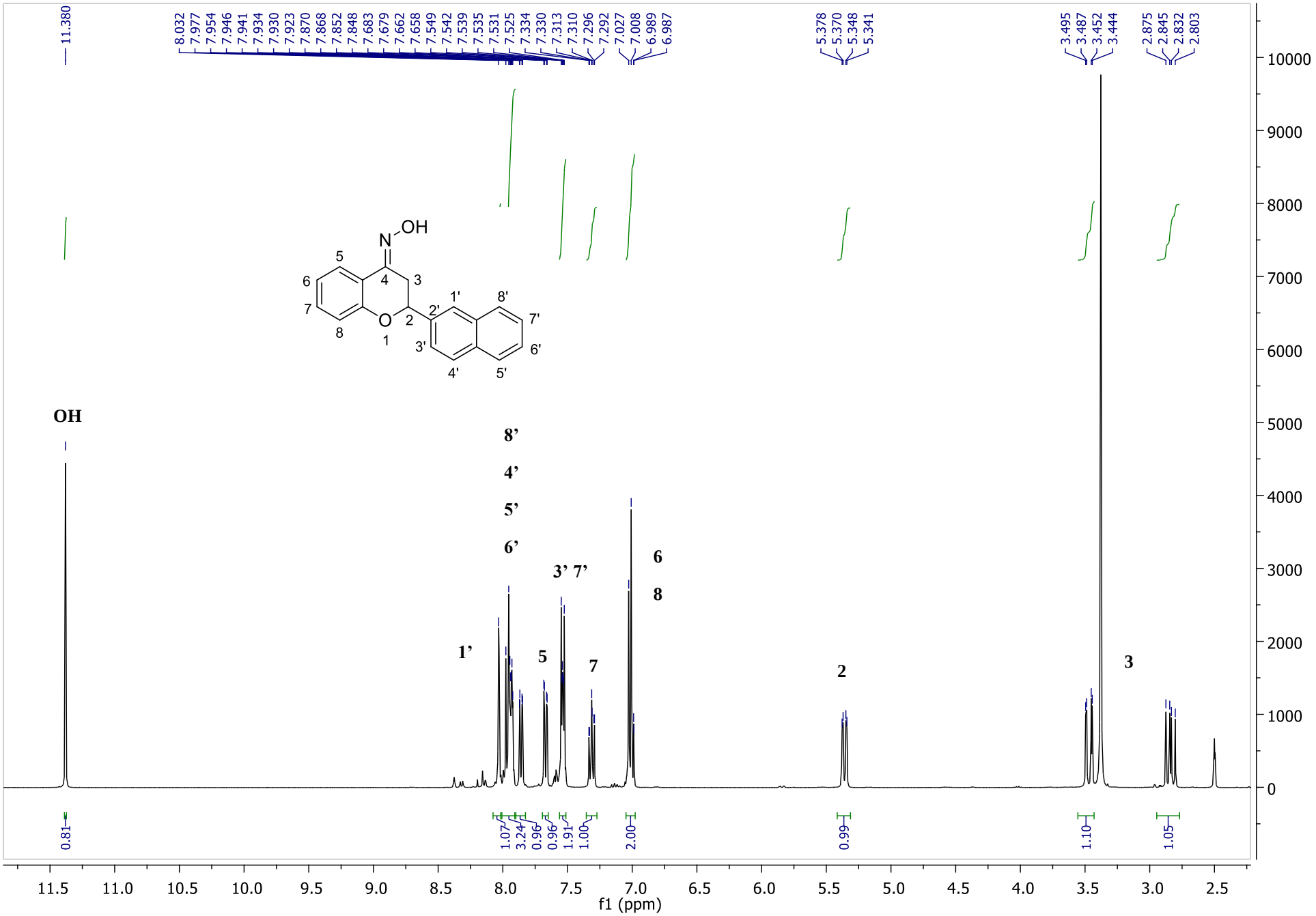


Figure S13. ^{1}H-NMR spectrum of **16g** in DMSO-d_6

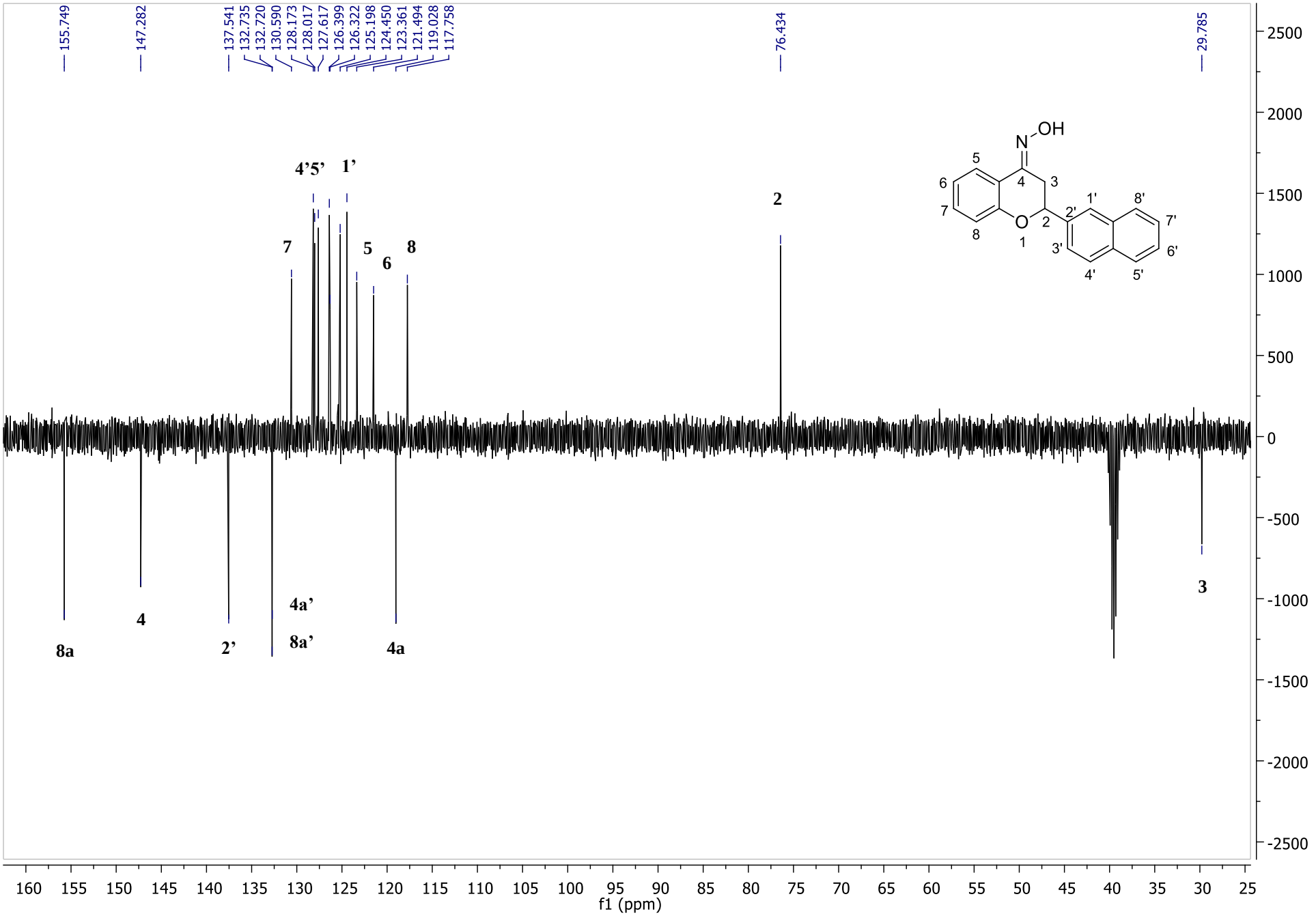


Figure S14. ^{13}C-NMR spectrum of **16g** in DMSO-d_6

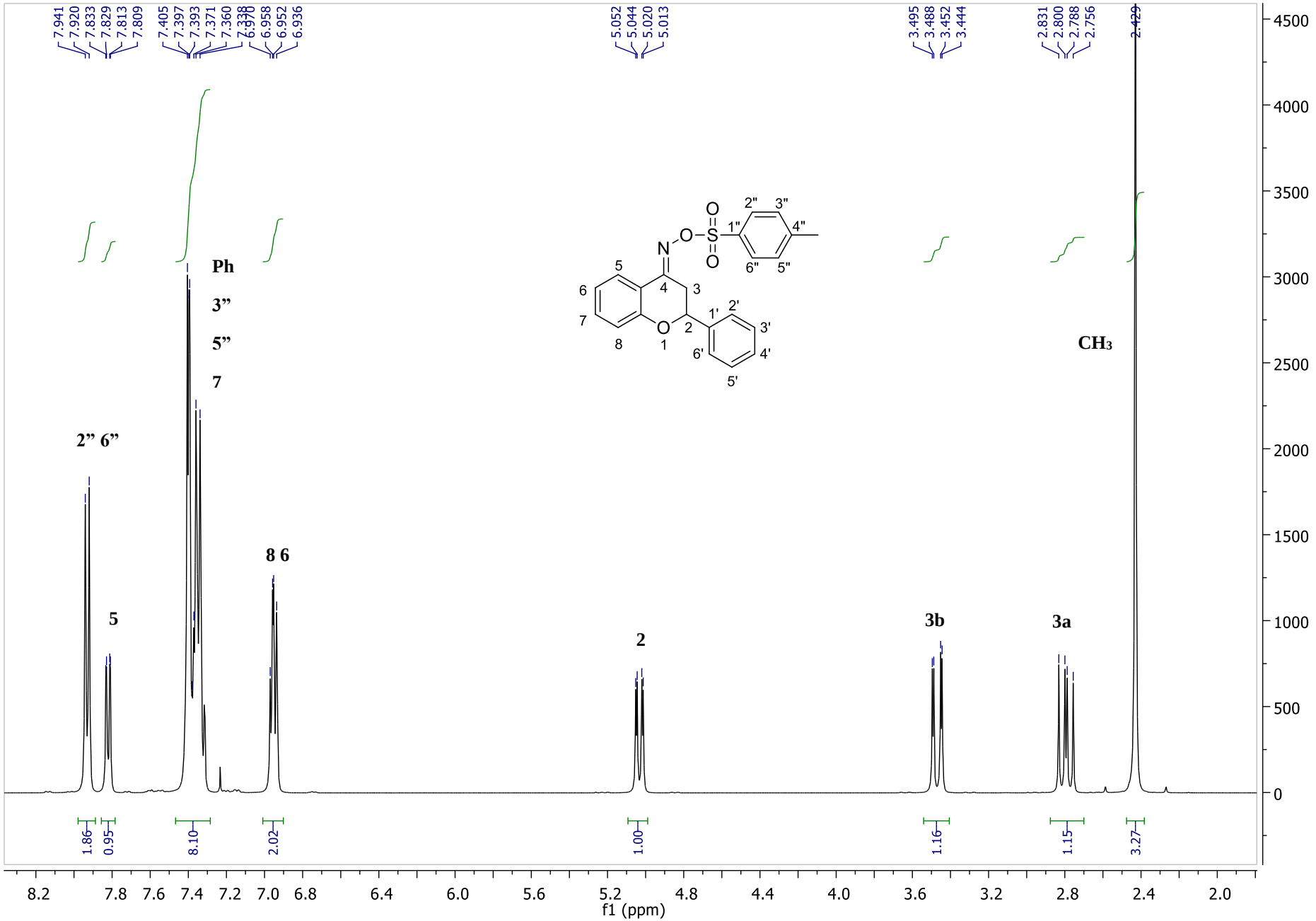


Figure S15. ^{1}H-NMR spectrum of **5a** in $CDCl_3$

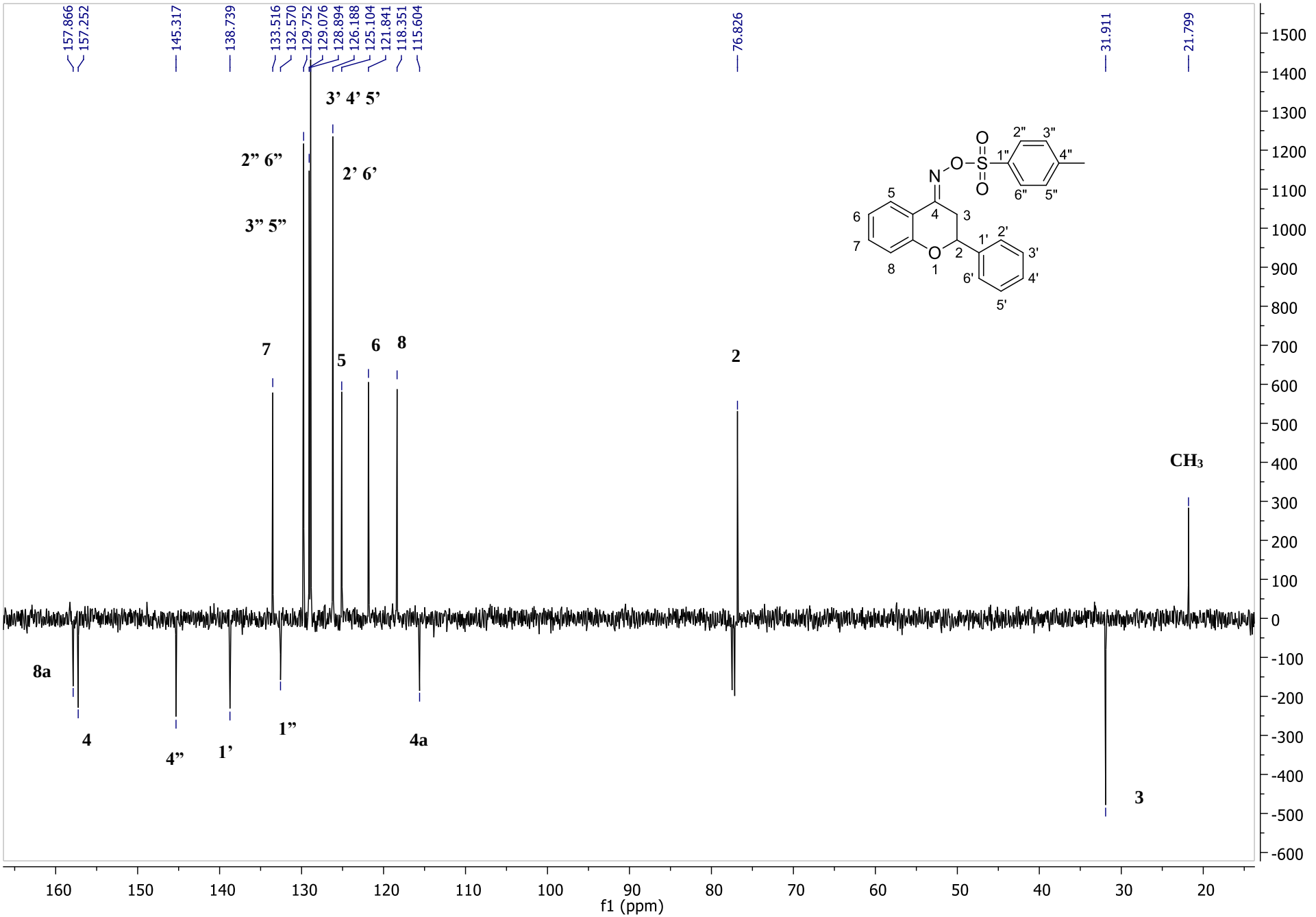


Figure S16. ^{13}C-NMR spectrum of **5a** in $CDCl_3$

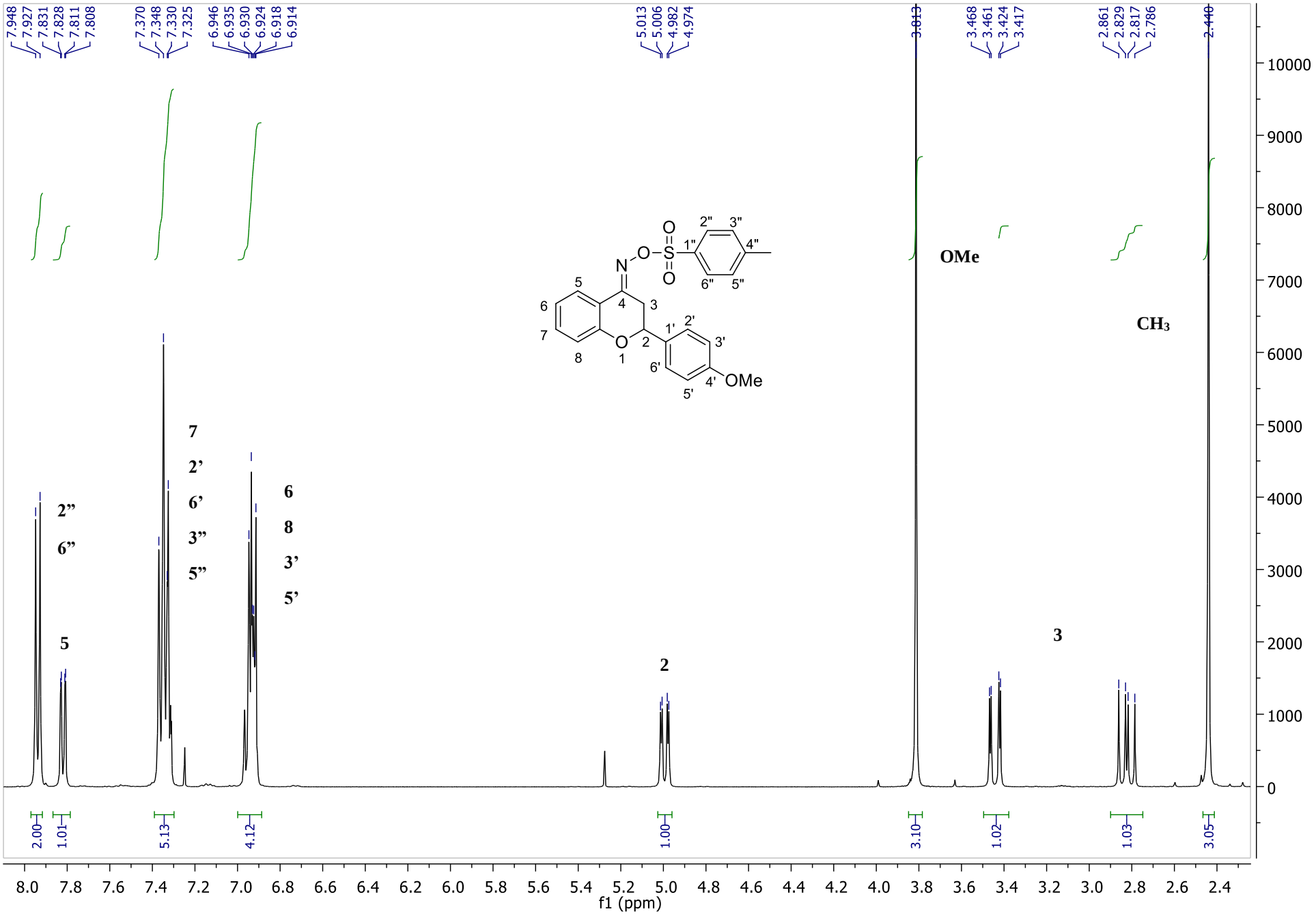


Figure S17. ^{1}H-NMR spectrum of **5b** in $CDCl_3$

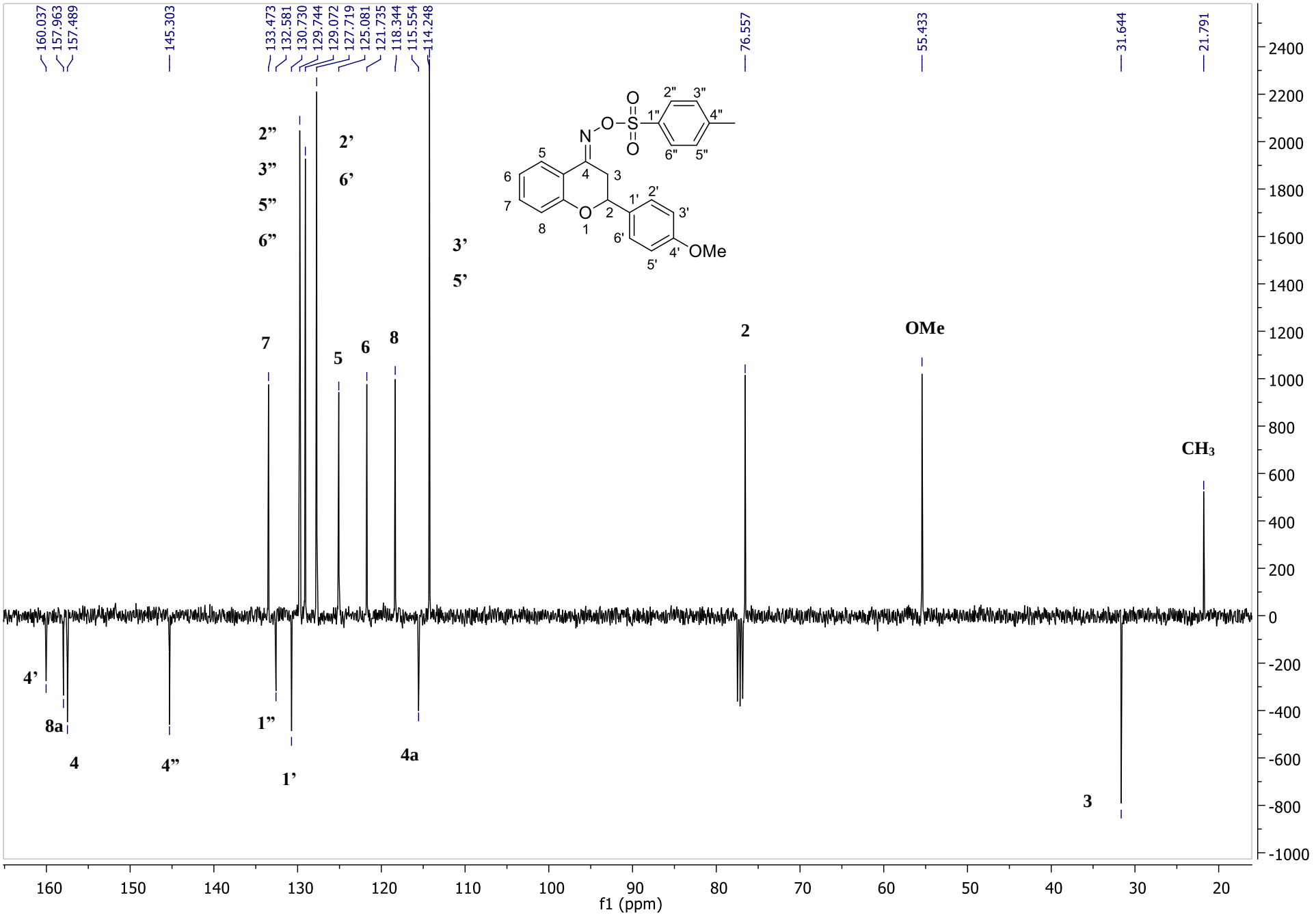


Figure 18. ^{13}C-NMR spectrum of **5b** in $CDCl_3$

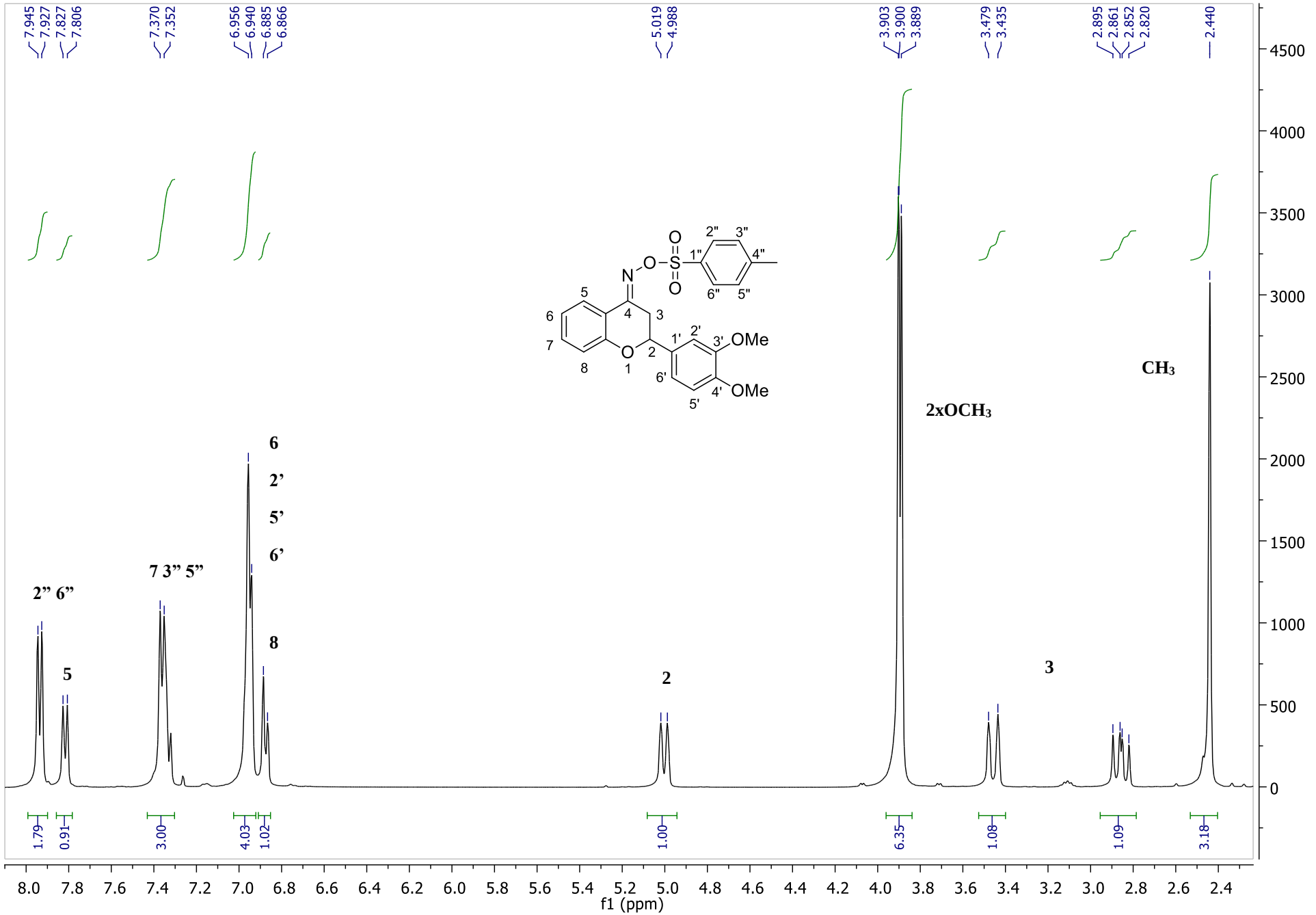


Figure S19. ^{1}H-NMR spectrum of **5c** in $CDCl_3$

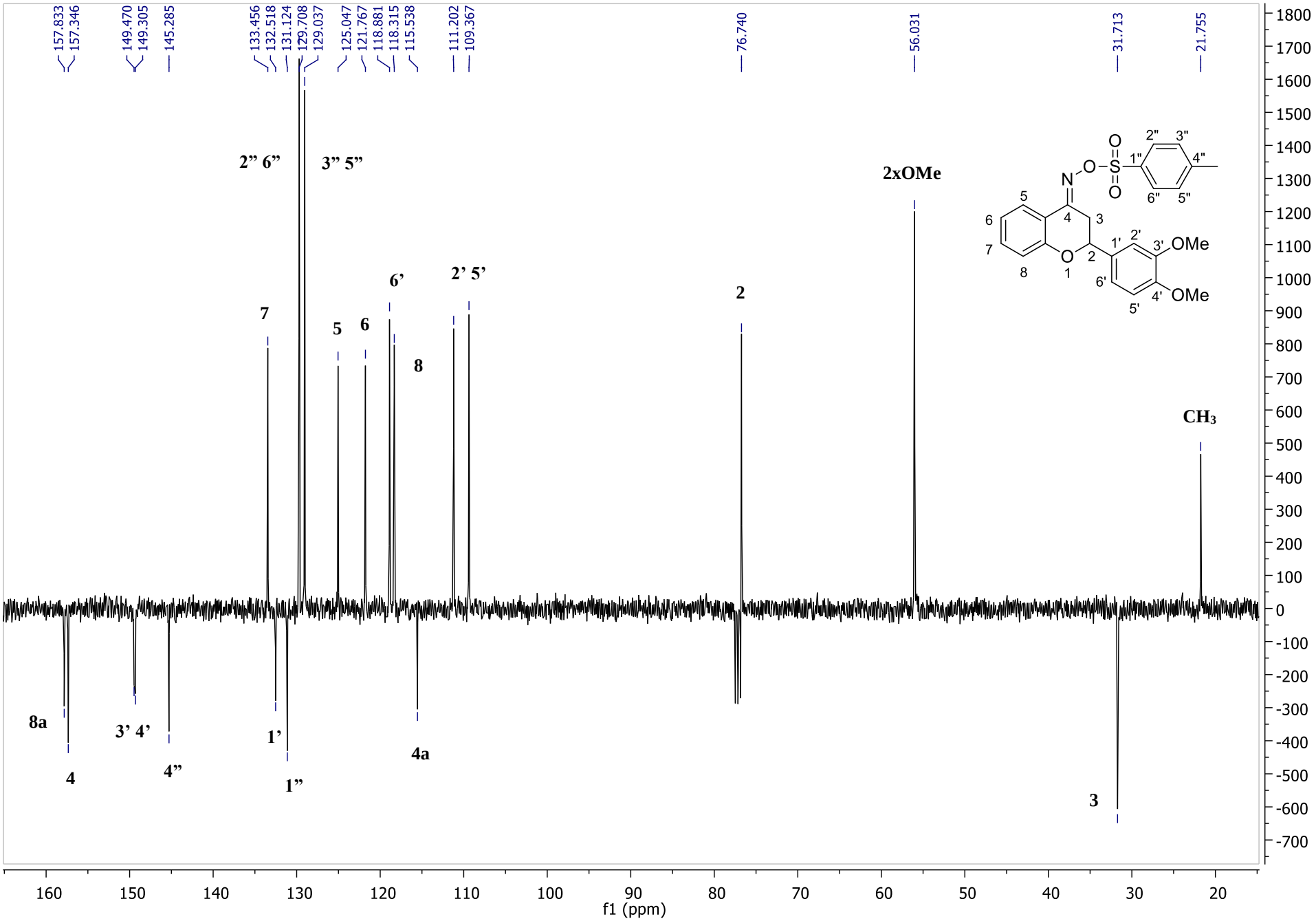


Figure 20. ^{13}C-NMR spectrum of **5c** in $CDCl_3$

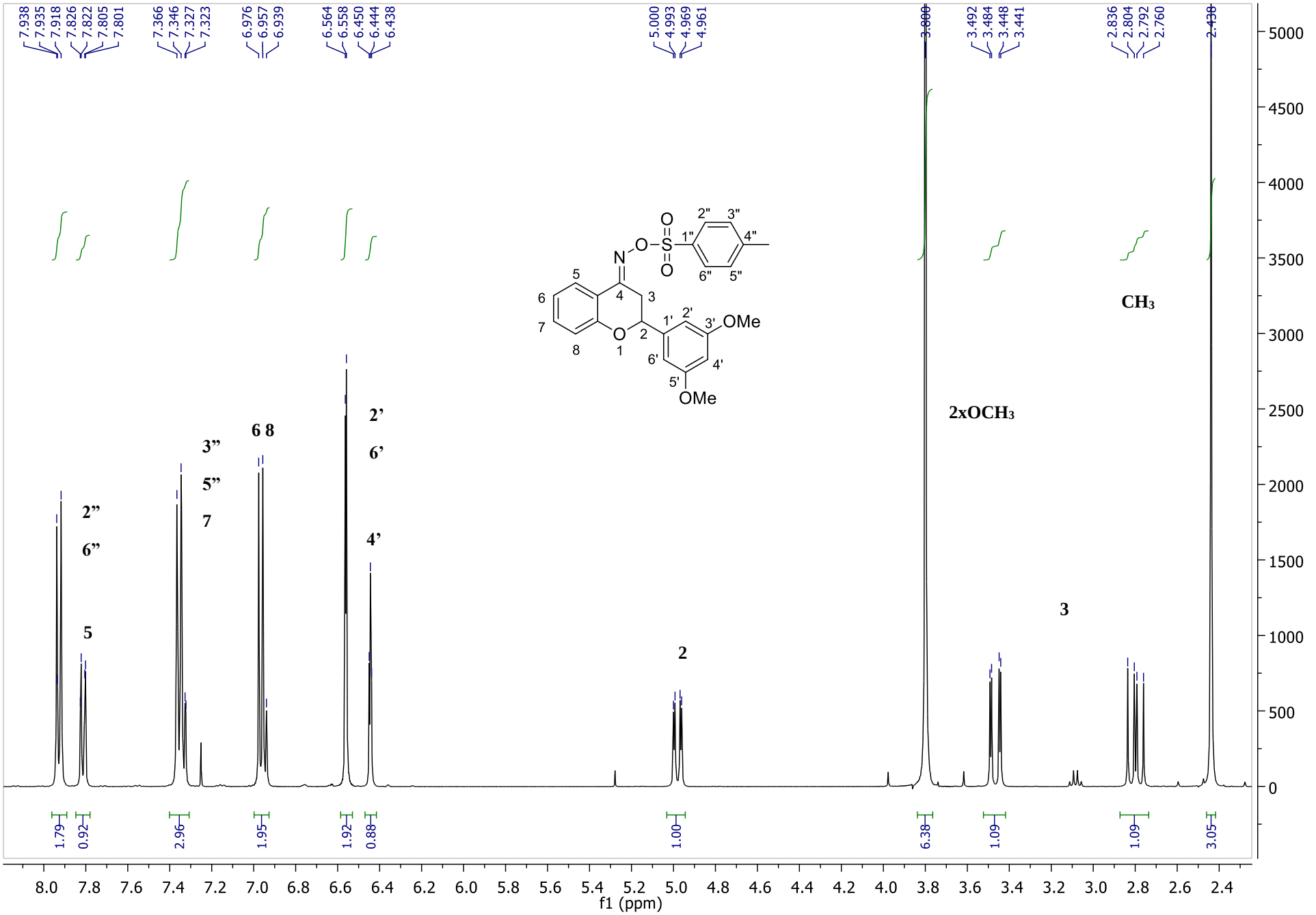


Figure 21. ^{1}H-NMR spectrum of **5d** in $CDCl_3$

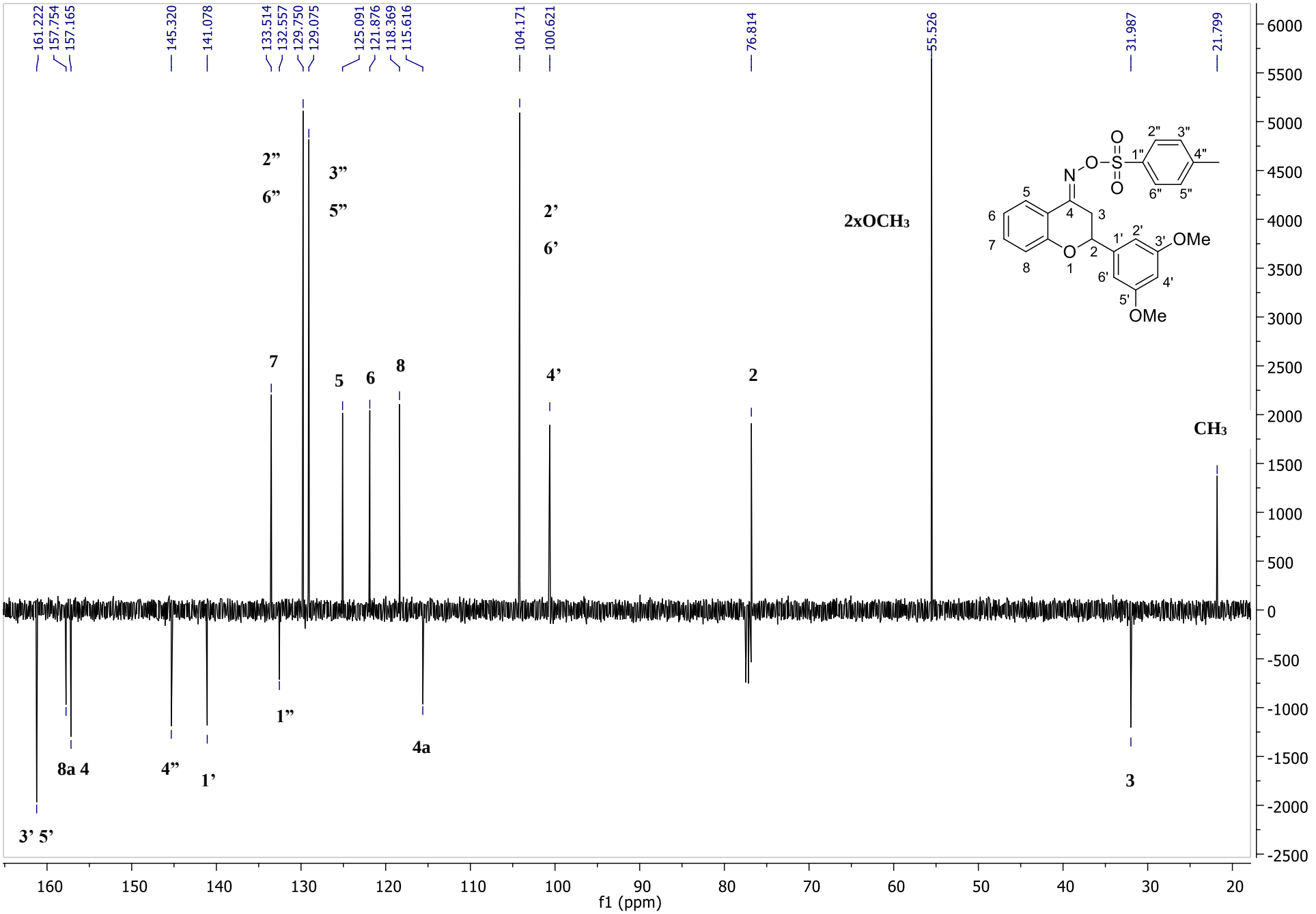


Figure S22. ^{13}C-NMR spectrum of **5d** in $CDCl_3$

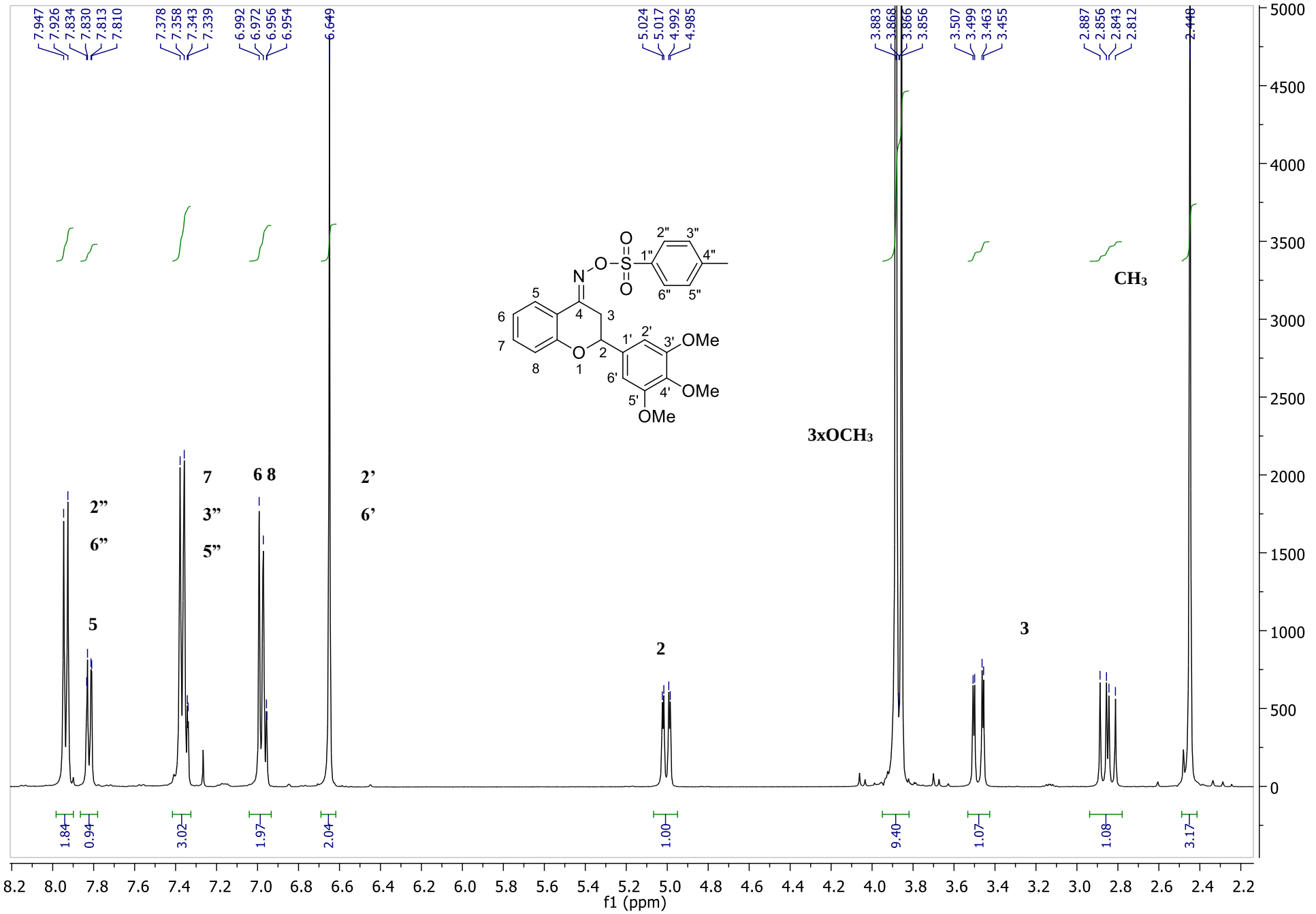


Figure S23. ^{1}H-NMR spectrum of **5e** in $CDCl_3$

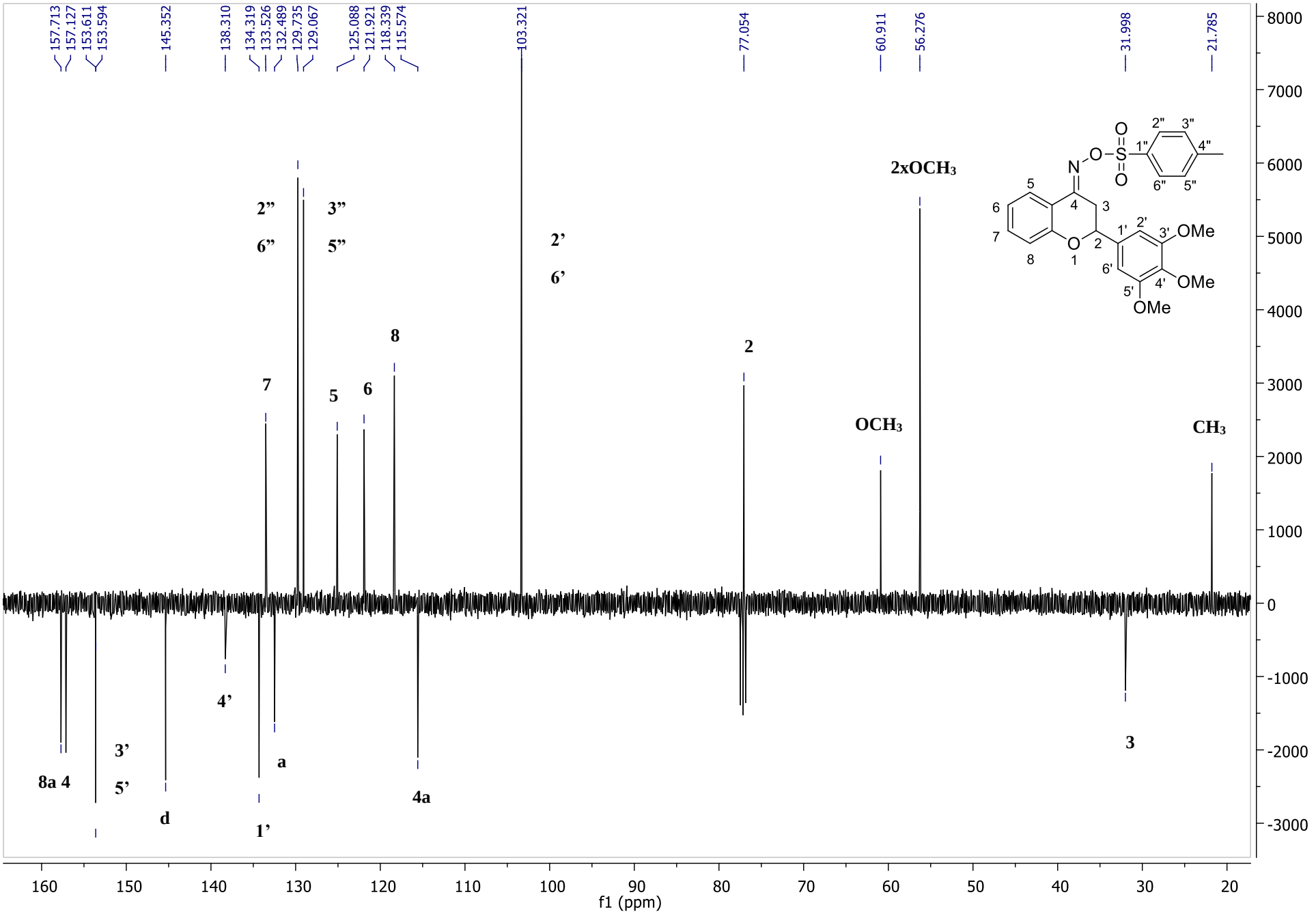


Figure S24. ^{13}C-NMR spectrum of **5e** in $CDCl_3$

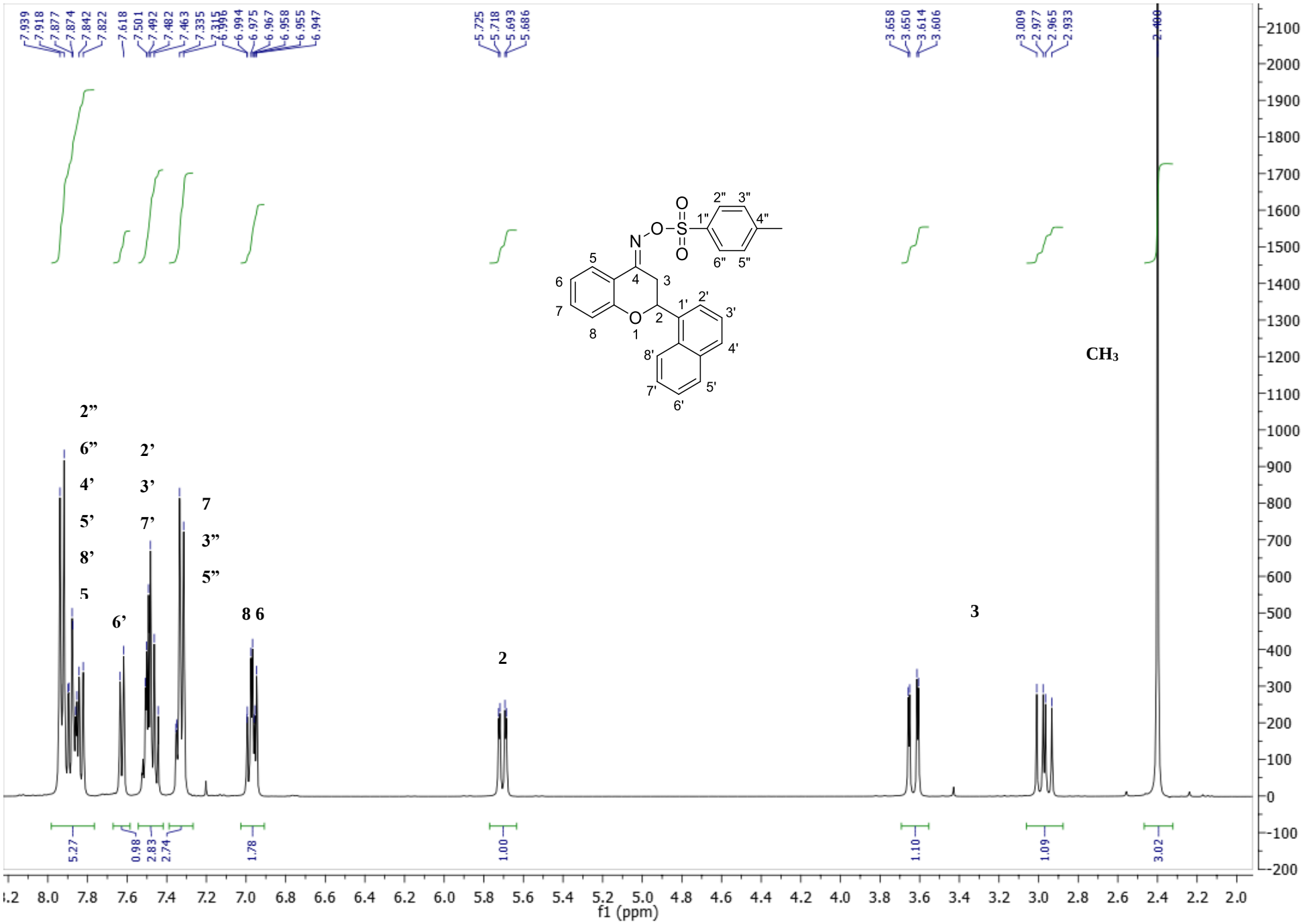


Figure S25. ^{1}H-NMR spectrum of **5f** in $CDCl_3$

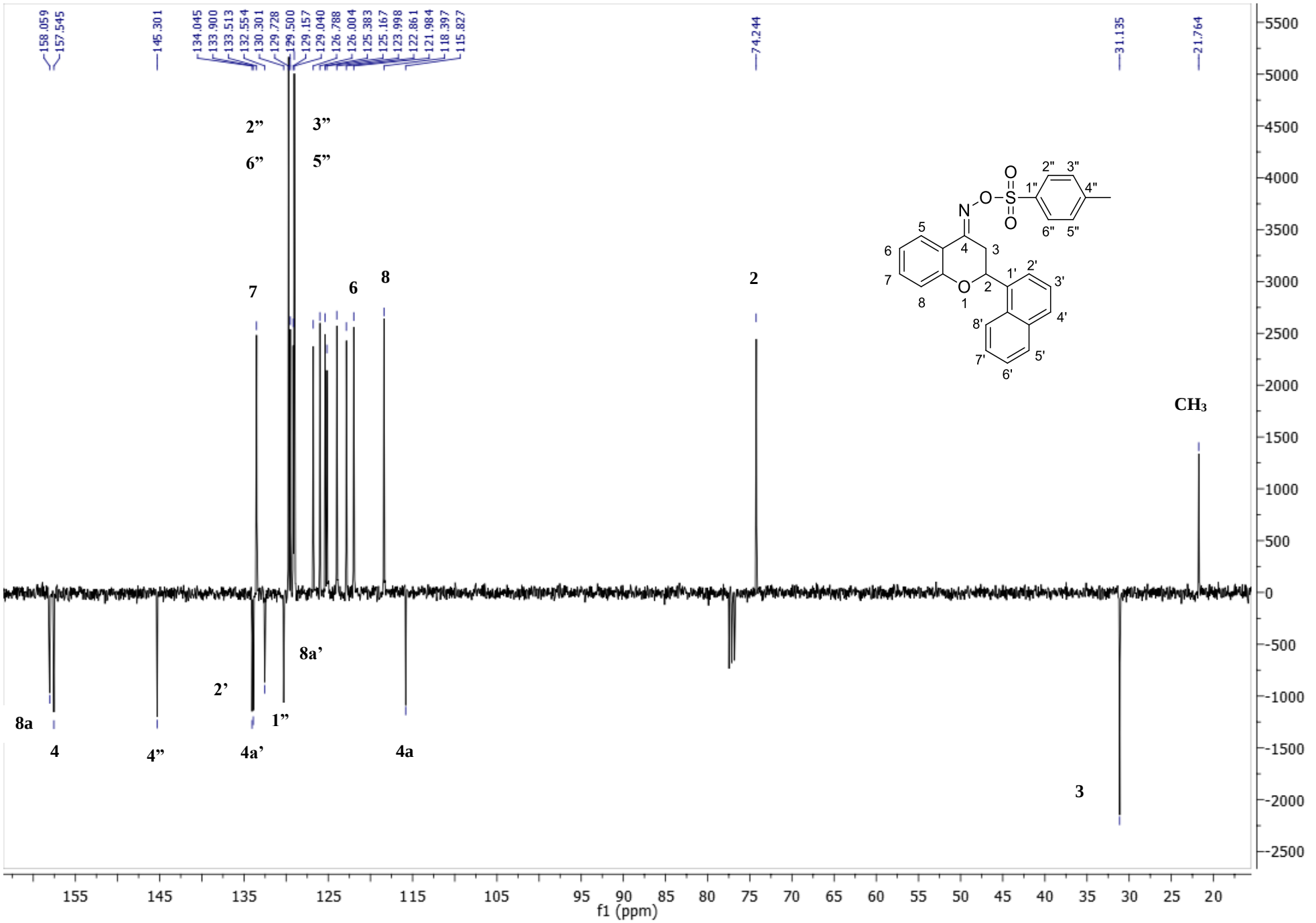


Figure S26. ^{13}C-NMR spectrum of **5f** in $CDCl_3$

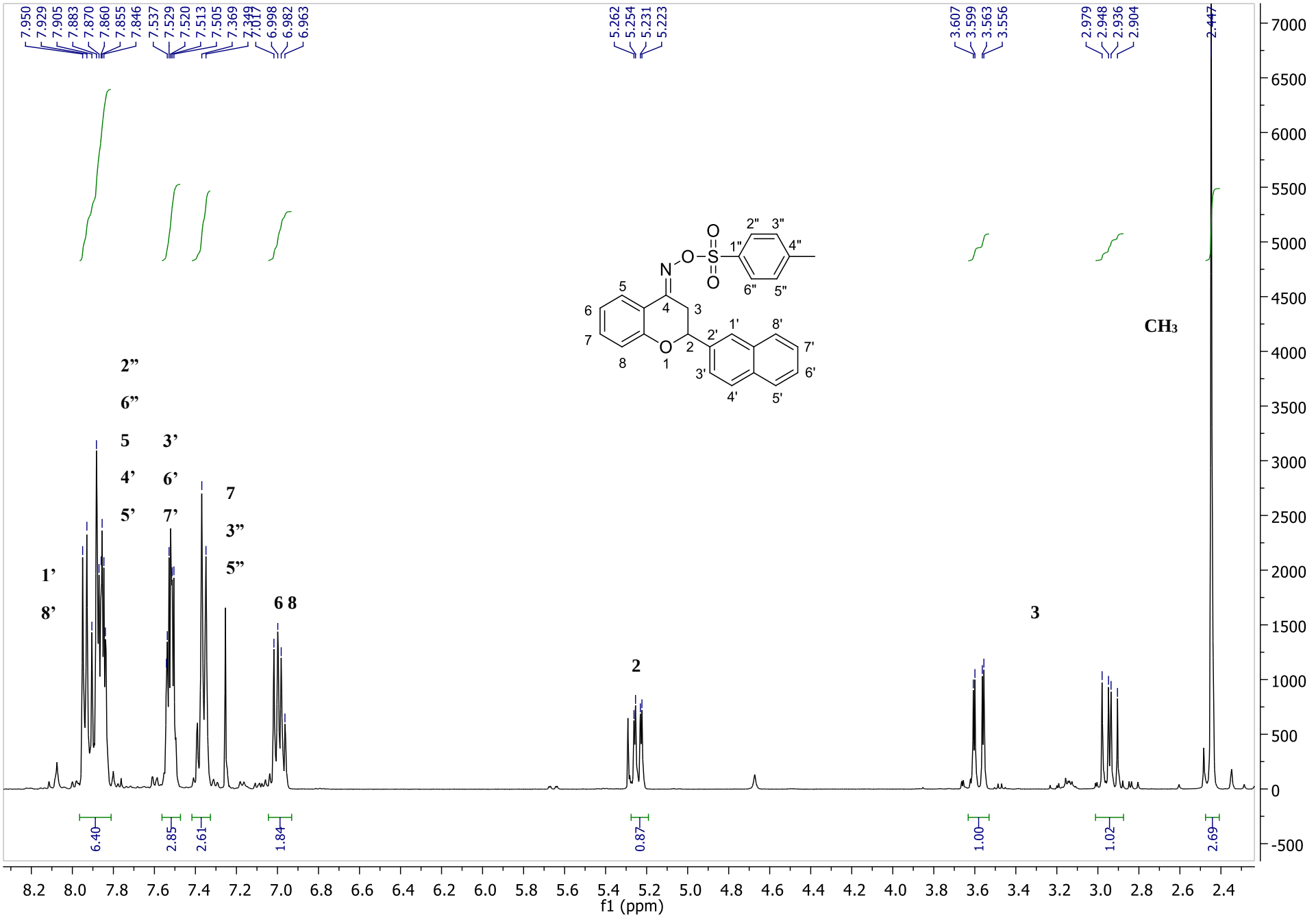


Figure S27. ^{1}H-NMR spectrum of **5g** in $CDCl_3$

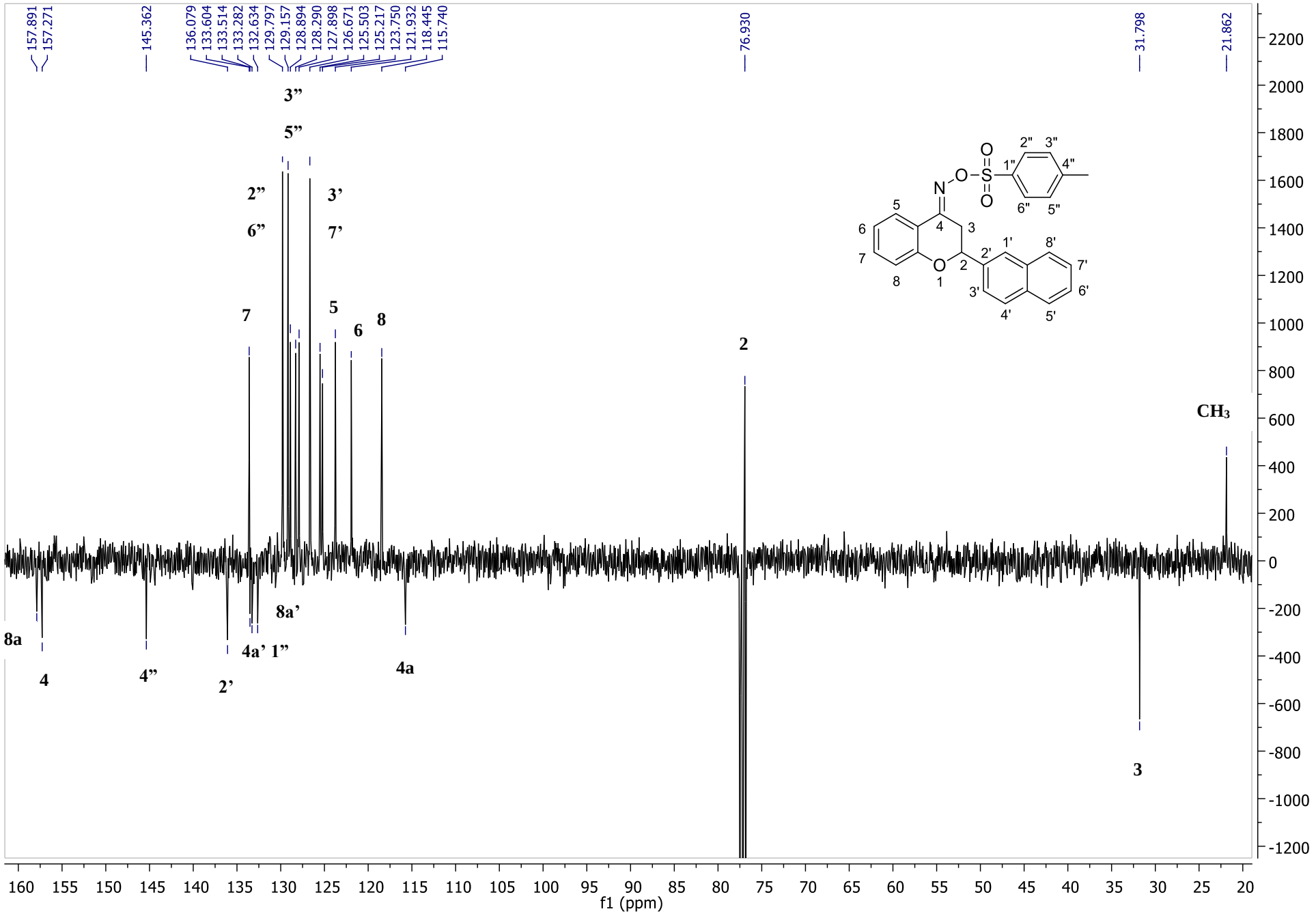


Figure S28. ^{13}C-NMR spectrum of **5g** in $CDCl_3$

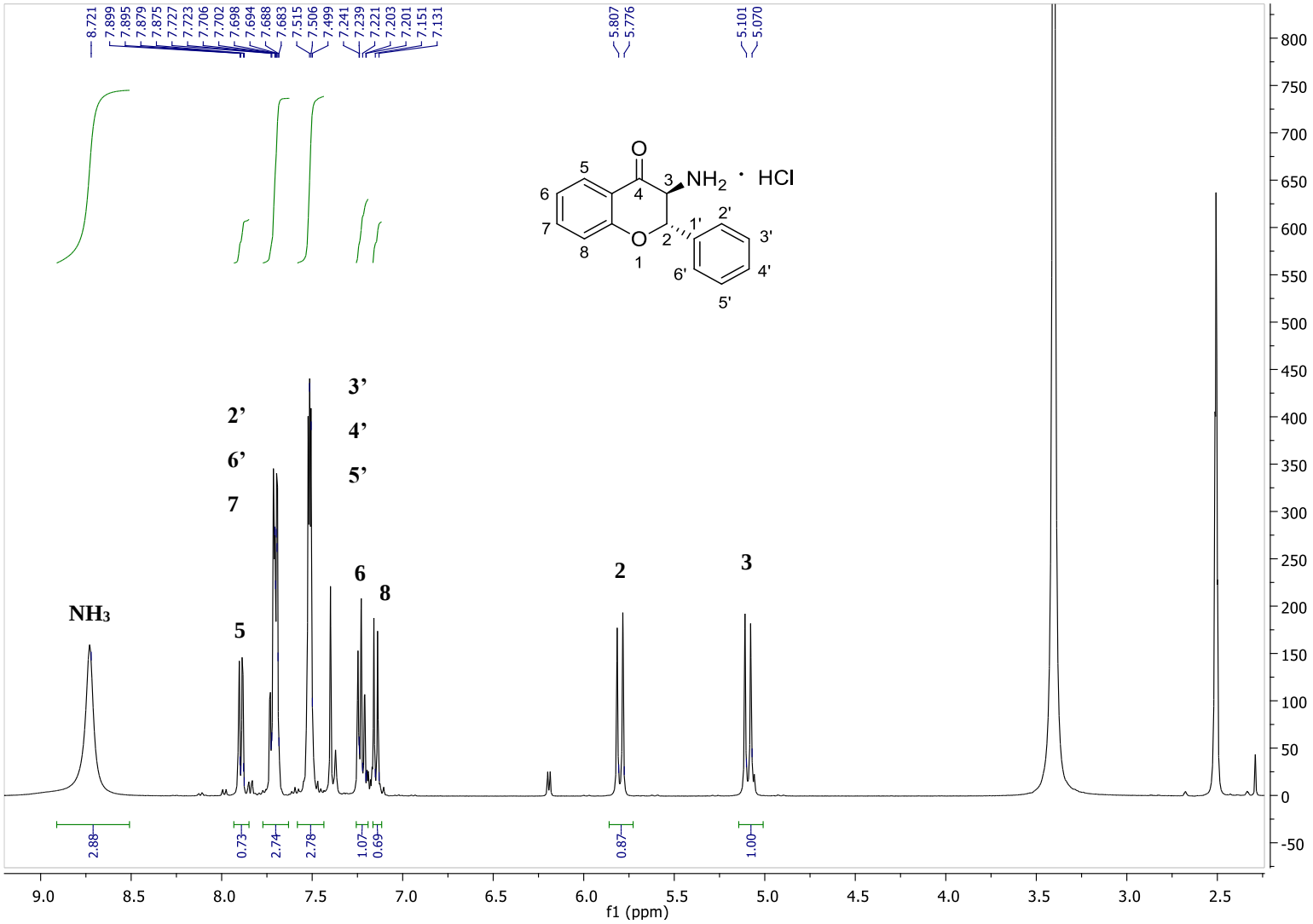


Figure S29. ^{1}H-NMR spectrum of *rac-trans*-**1a** in DMSO-d_6

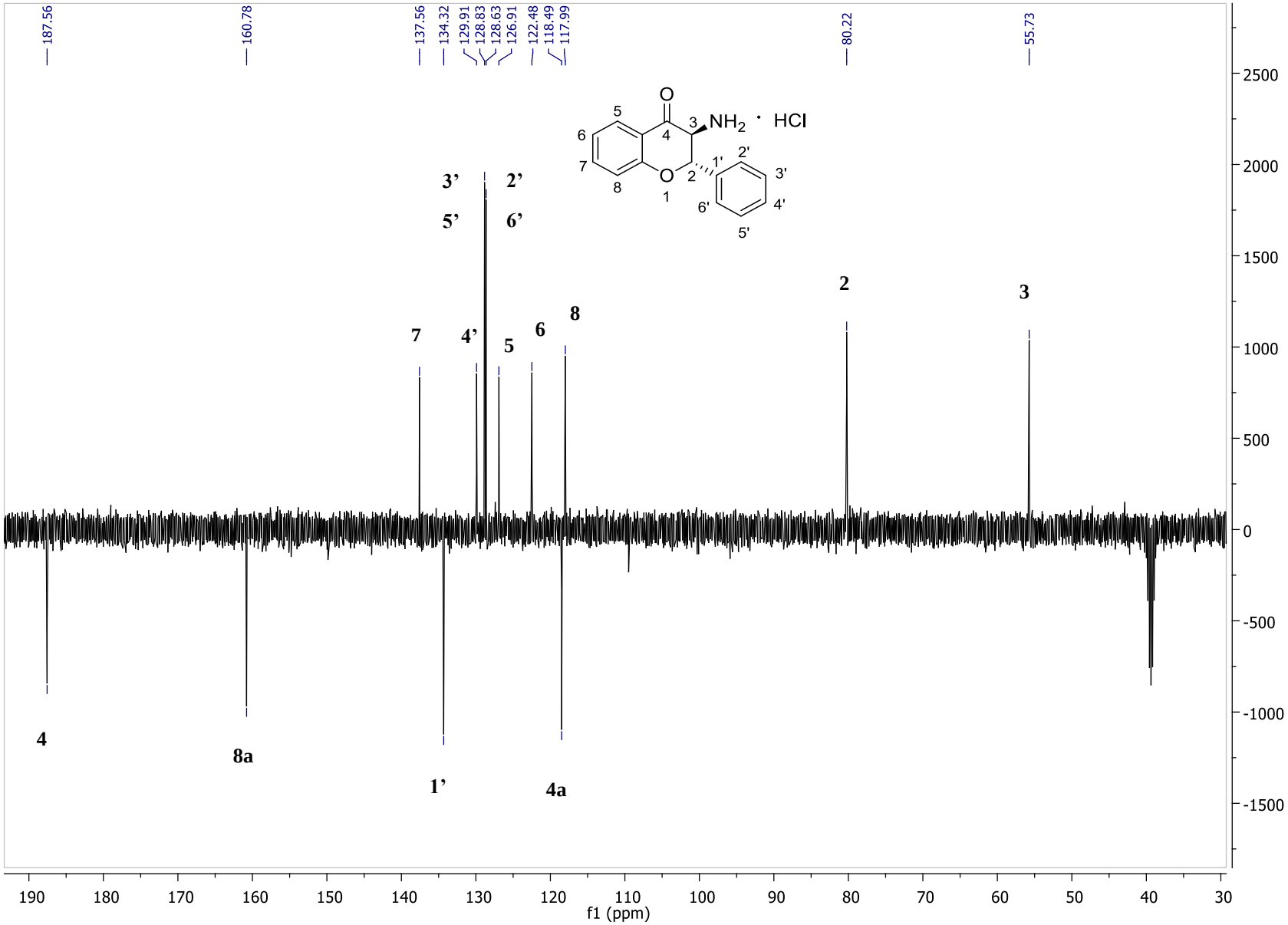


Figure S30. ^{13}C-NMR spectrum of *rac-trans*-**1a** in DMSO-d_6

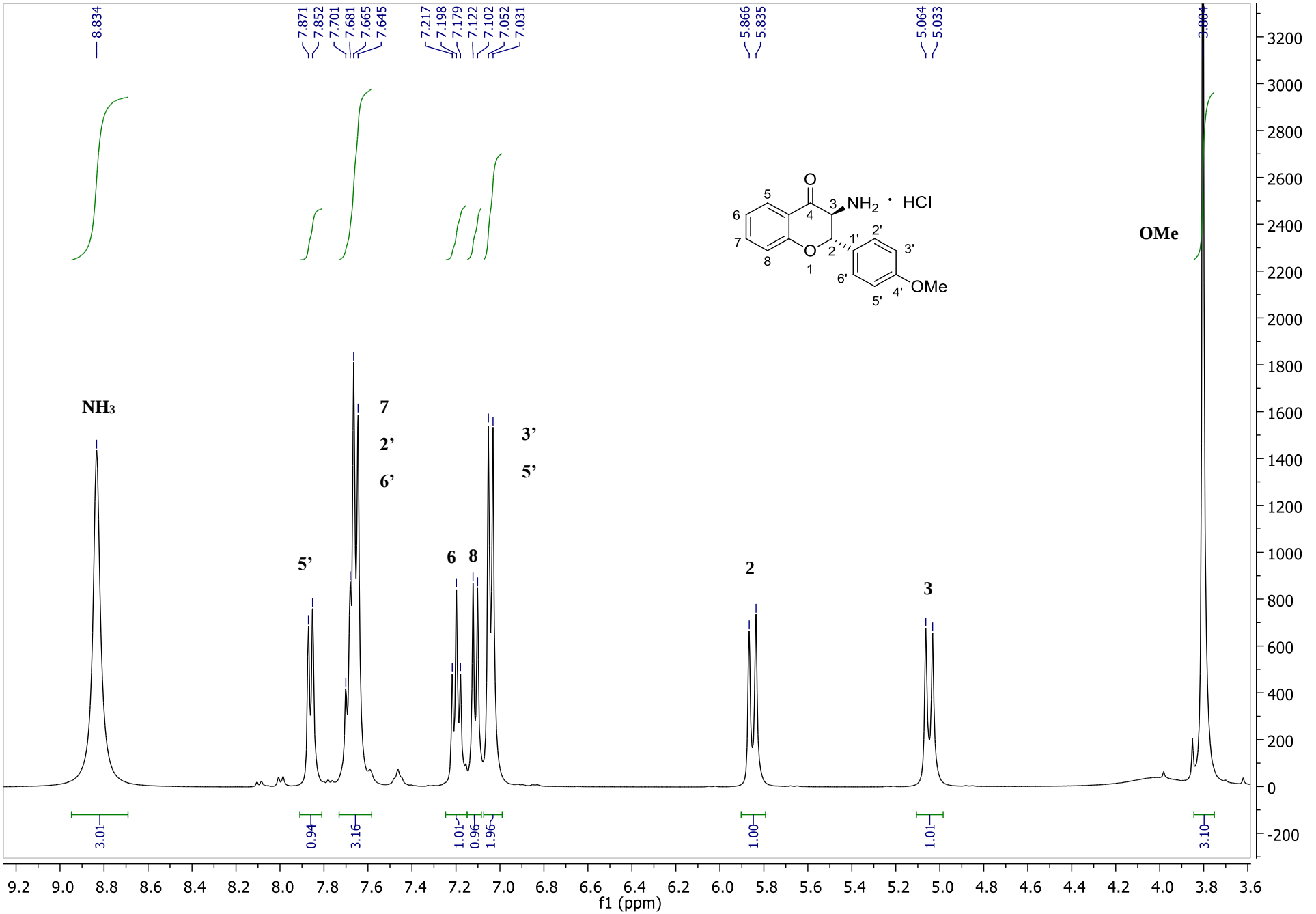


Figure S31. ^{1}H-NMR spectrum of *rac-trans*-**1b** in DMSO-d_6

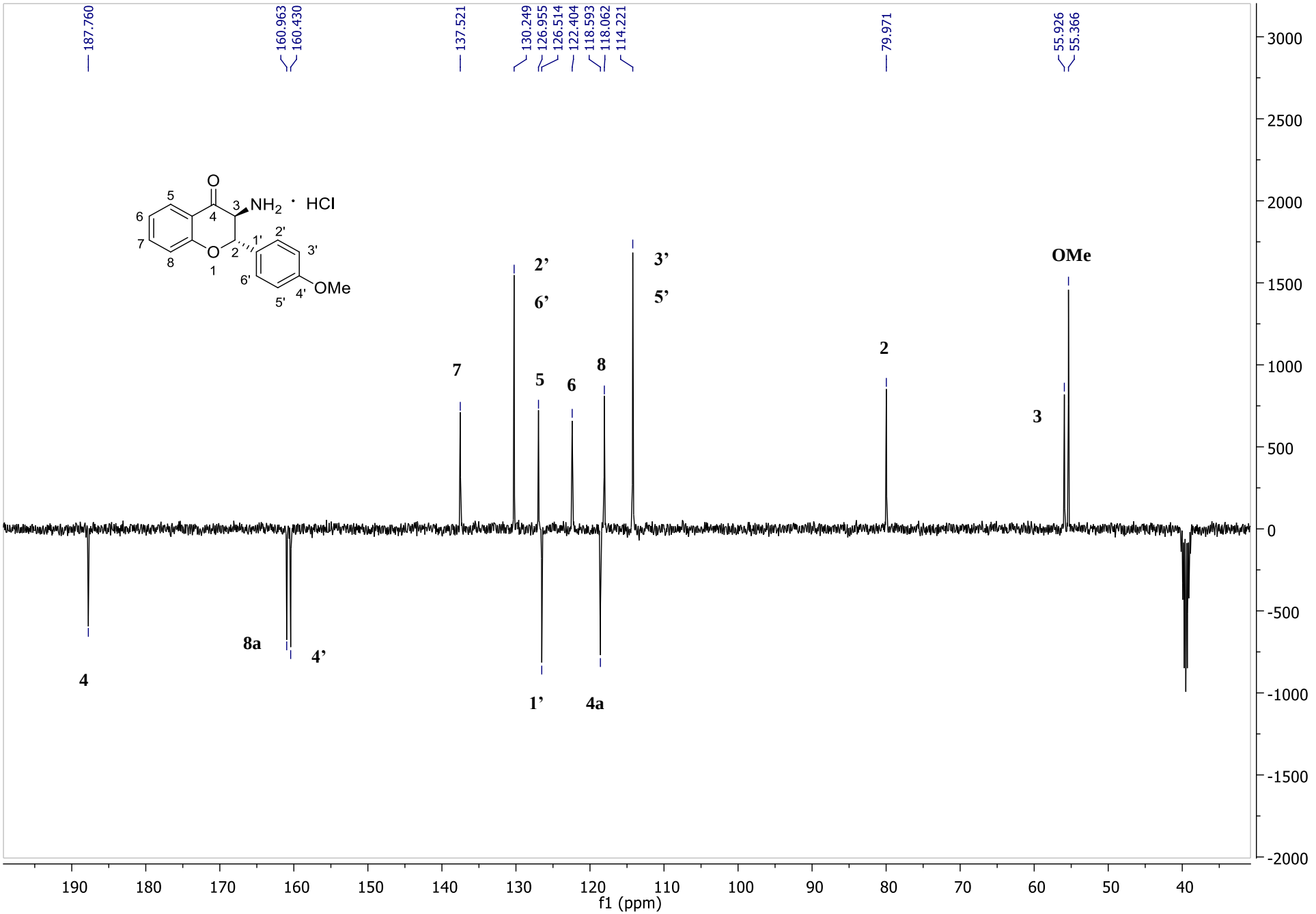


Figure S32. ^{13}C-NMR spectrum of *rac-trans*-**1b** in DMSO-d_6

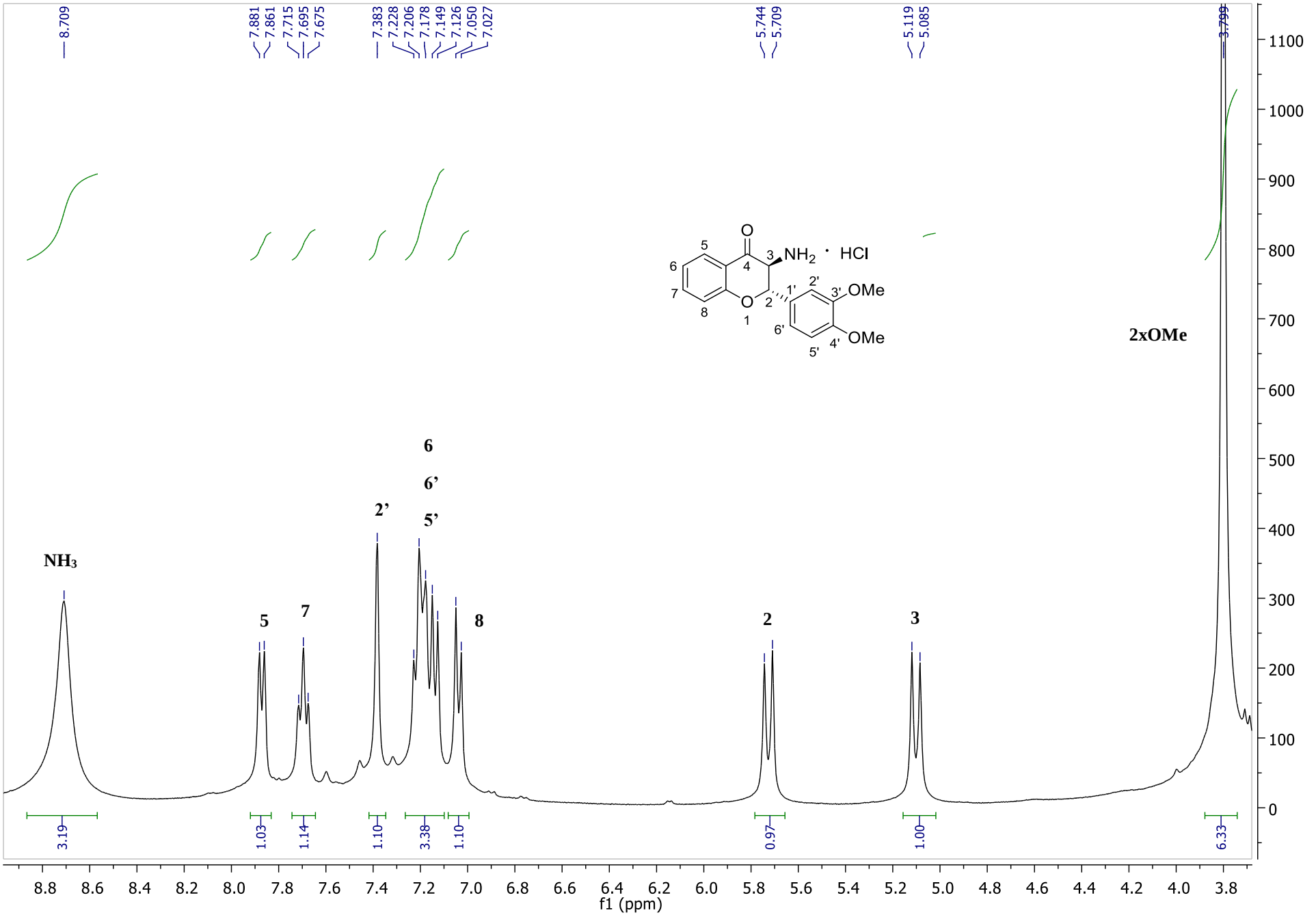


Figure S33. ^{1}H-NMR spectrum of *rac-trans*-**1c** in DMSO-d_6

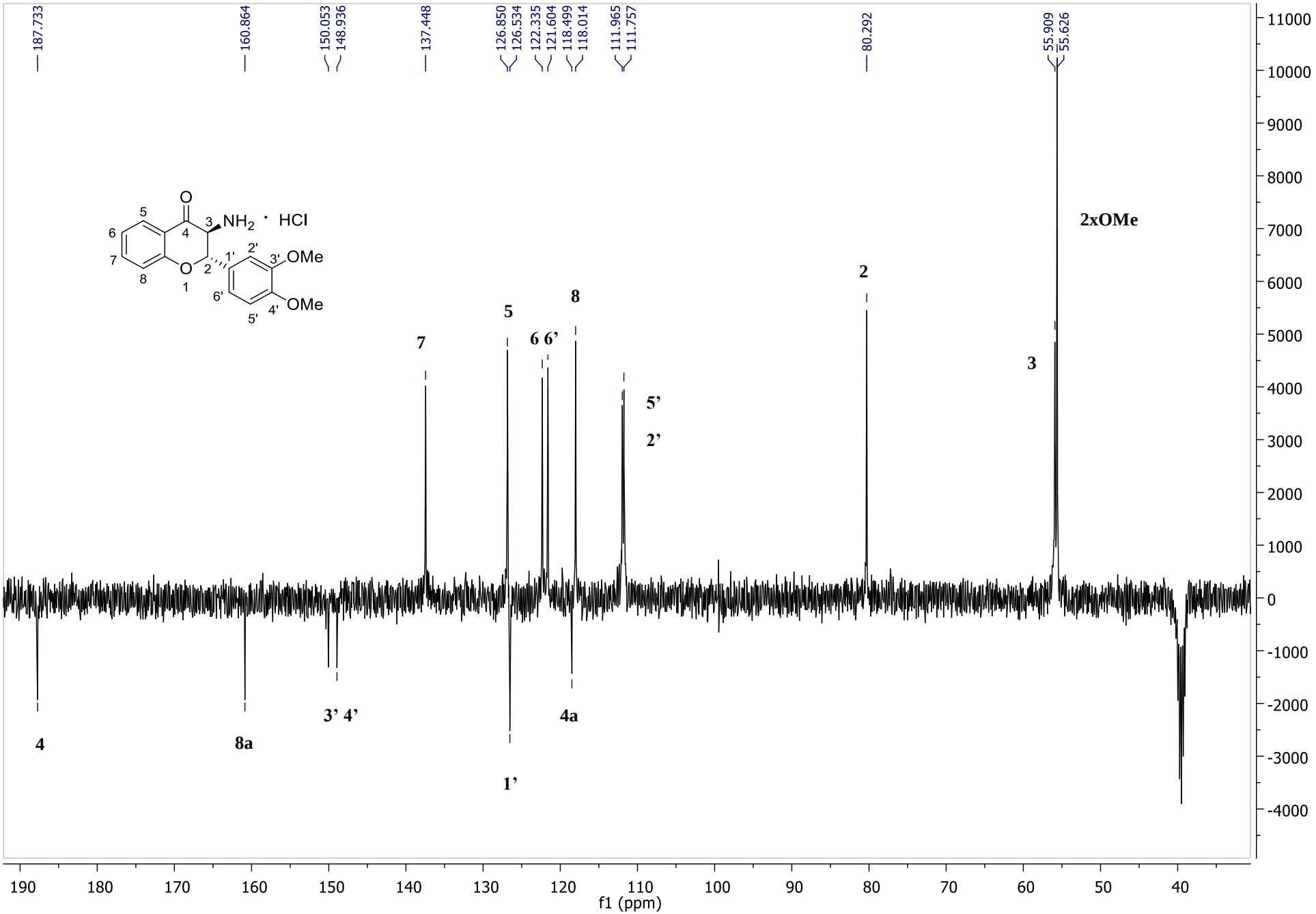


Figure S34. ^{13}C-NMR spectrum of *rac-trans*-**1c** in DMSO-d_6

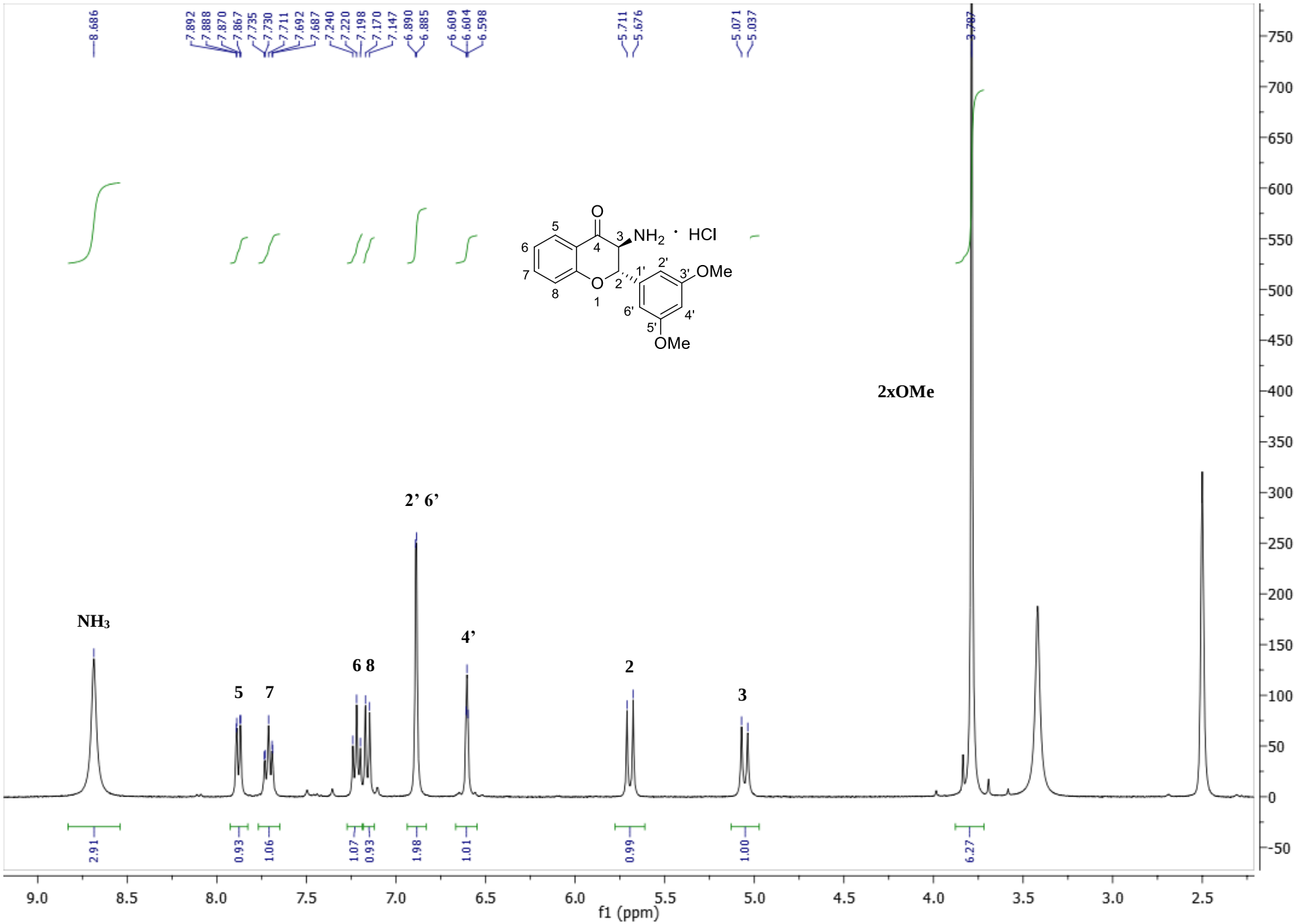


Figure S35. ^{1}H-NMR spectrum of *rac-trans*-**1d** in DMSO-d_6

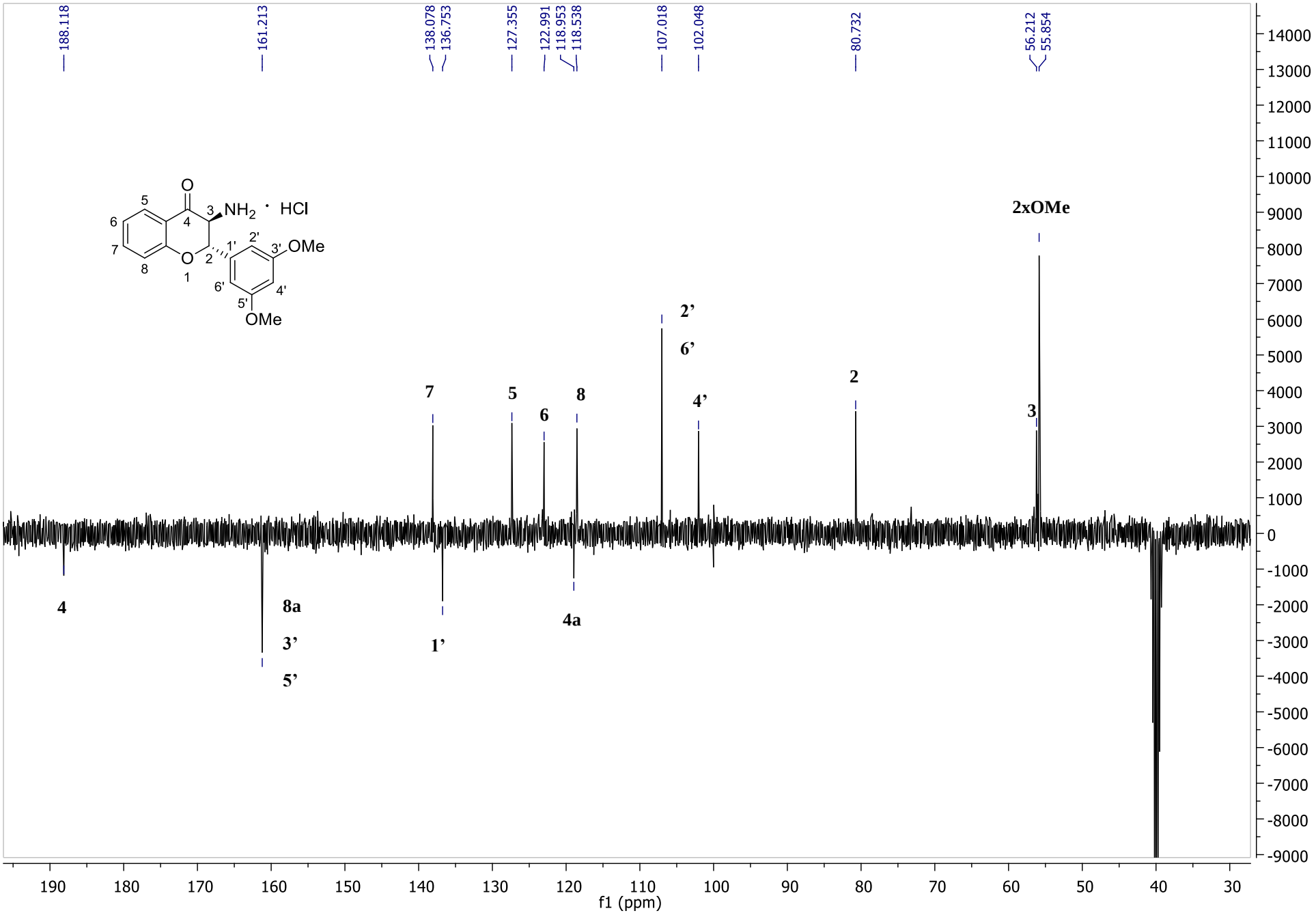


Figure S36. ^{13}C-NMR spectrum of *rac-trans*-**1d** in DMSO-d_6

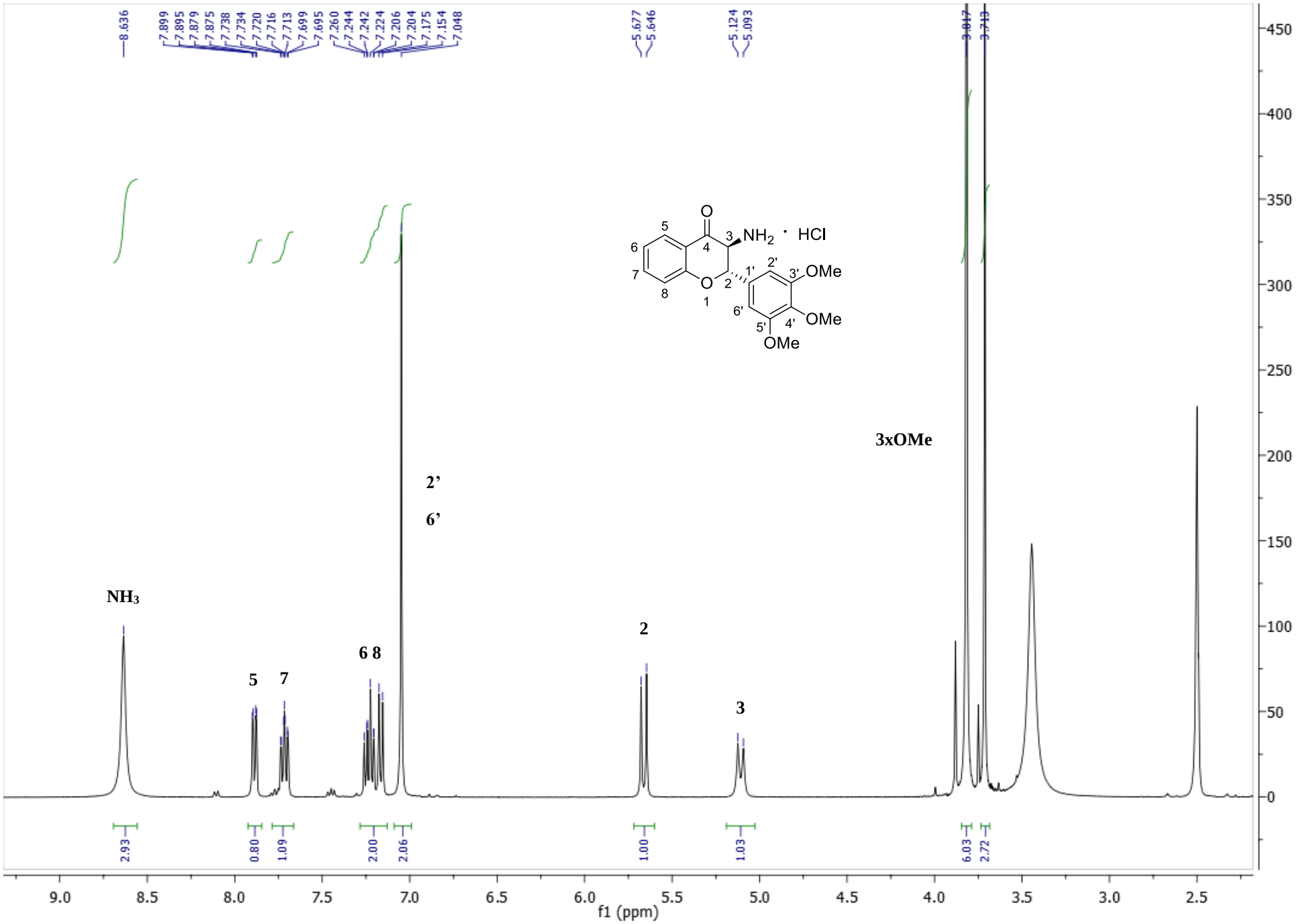


Figure S37. ^{1}H-NMR spectrum of *rac-trans*-**1e** in DMSO-d_6

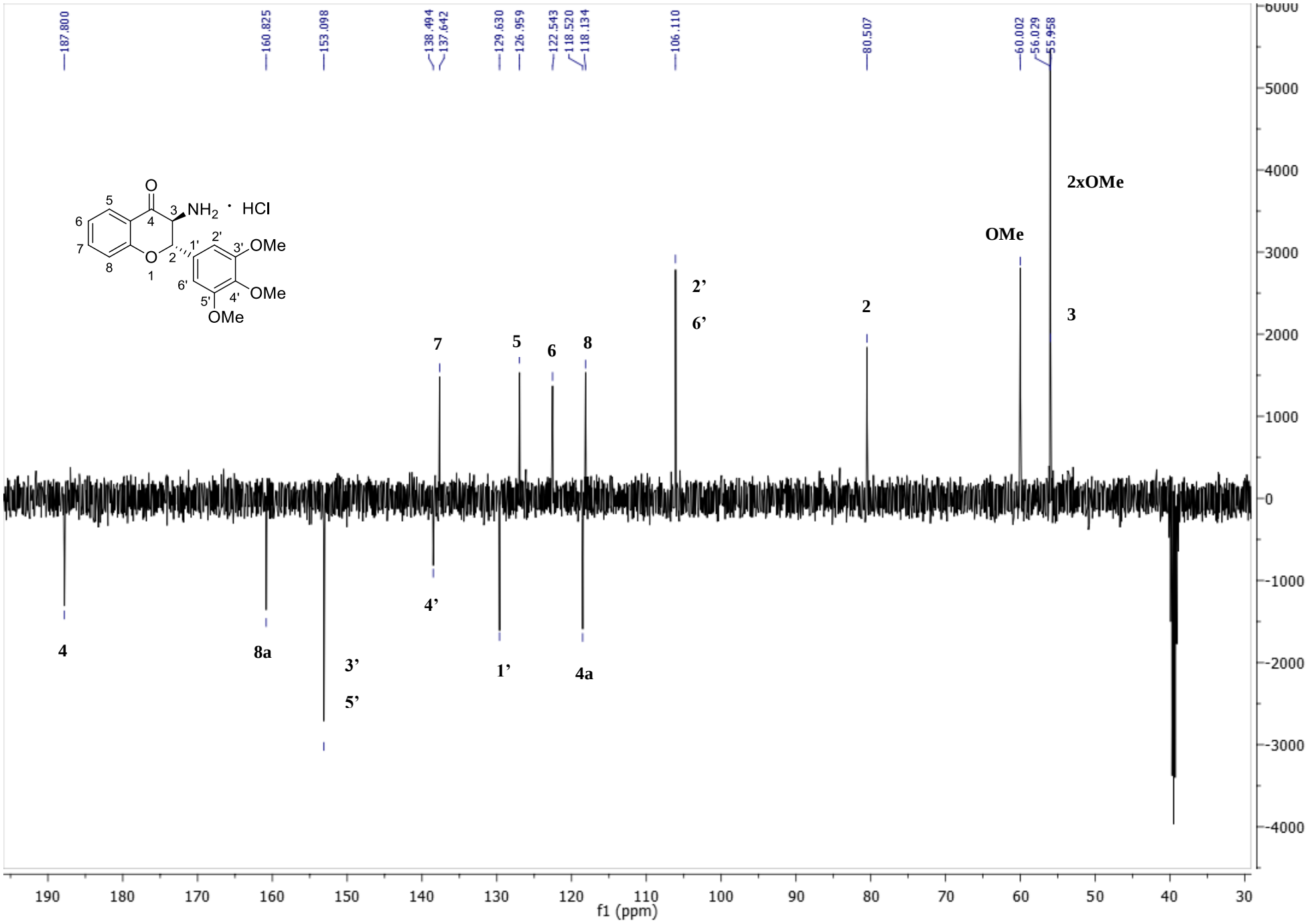


Figure S38. ^{13}C-NMR spectrum of *rac-trans*-**1e** in DMSO-d_6

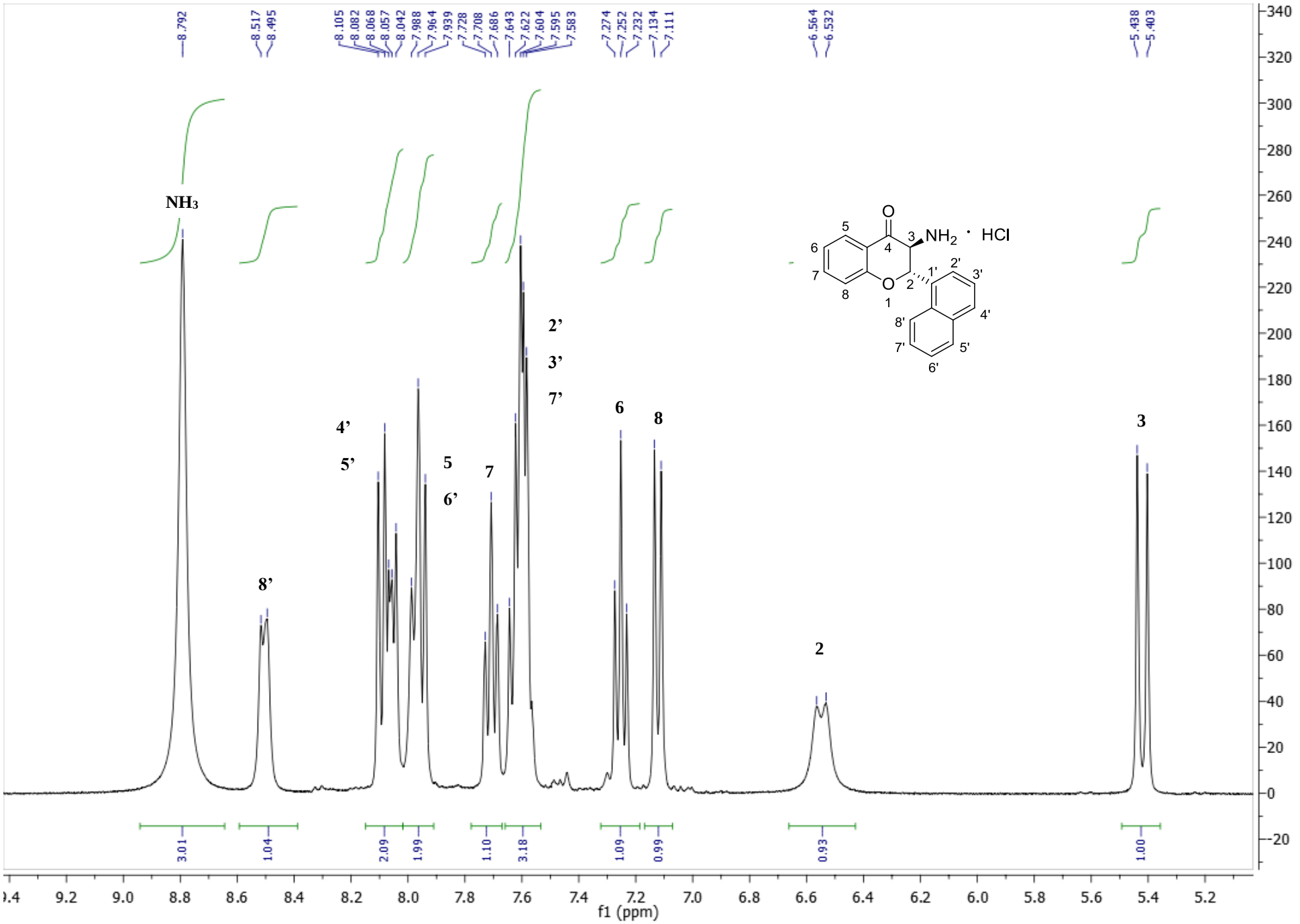


Figure S39. ^{1}H-NMR spectrum of *rac-trans*-**1f** in DMSO-d_6

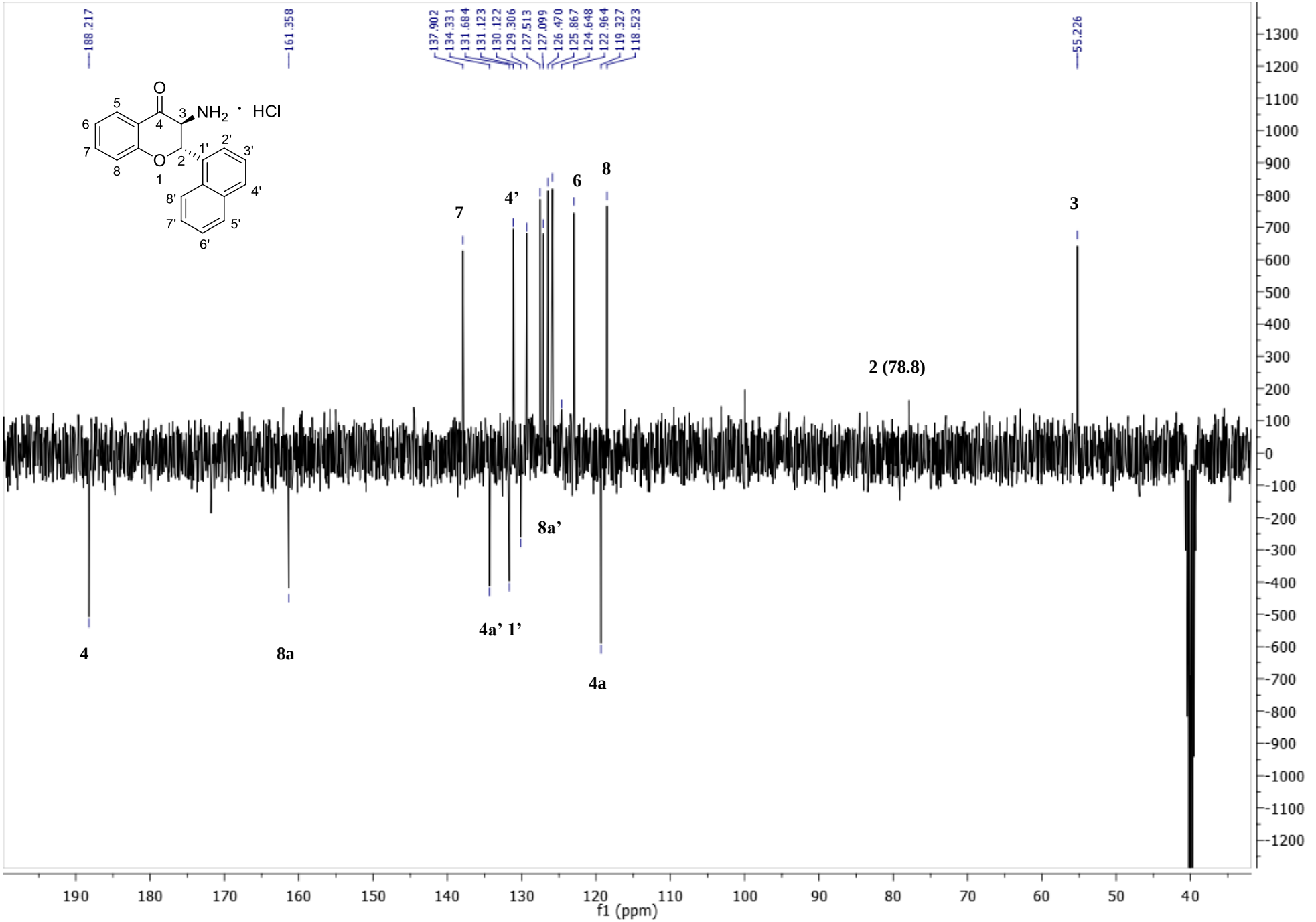


Figure S40. ^{13}C-NMR spectrum of *rac-trans*-**1f** in DMSO-d_6

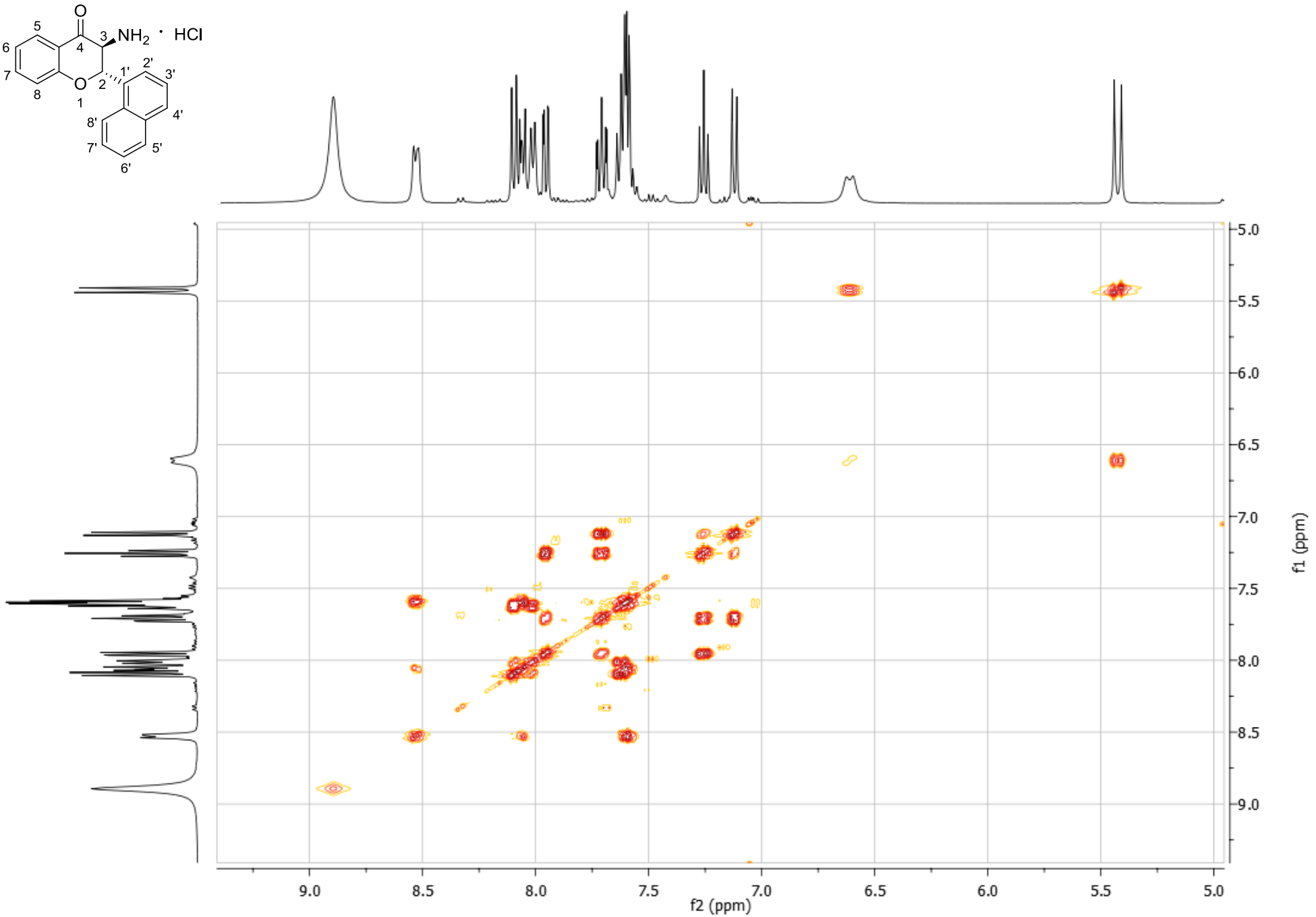


Figure S41. COSY-spectrum of *rac-trans*-**1f** in DMSO-d_6

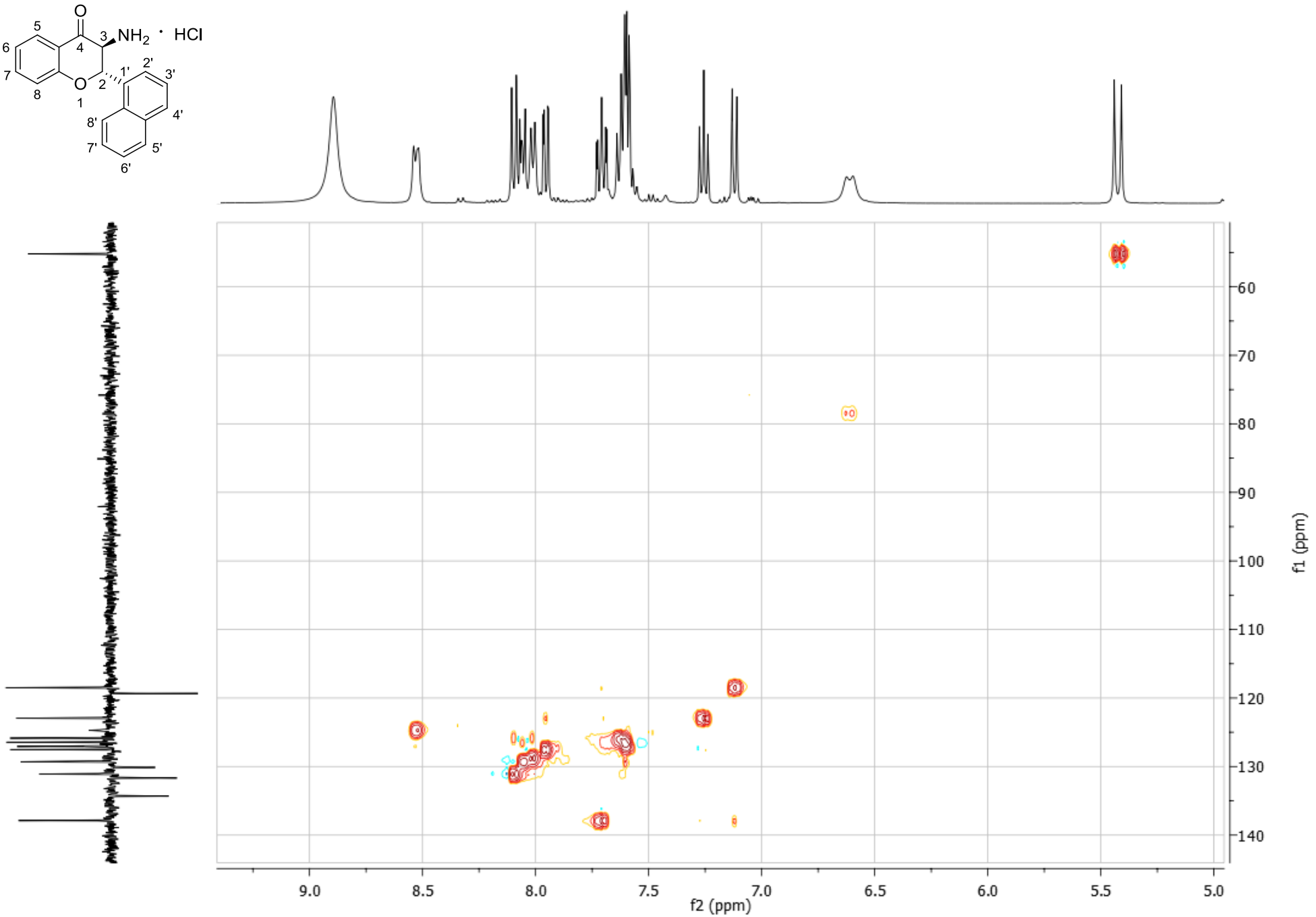


Figure S42. HSQC-spectrum of *rac-trans*-**1f** in DMSO-d_6

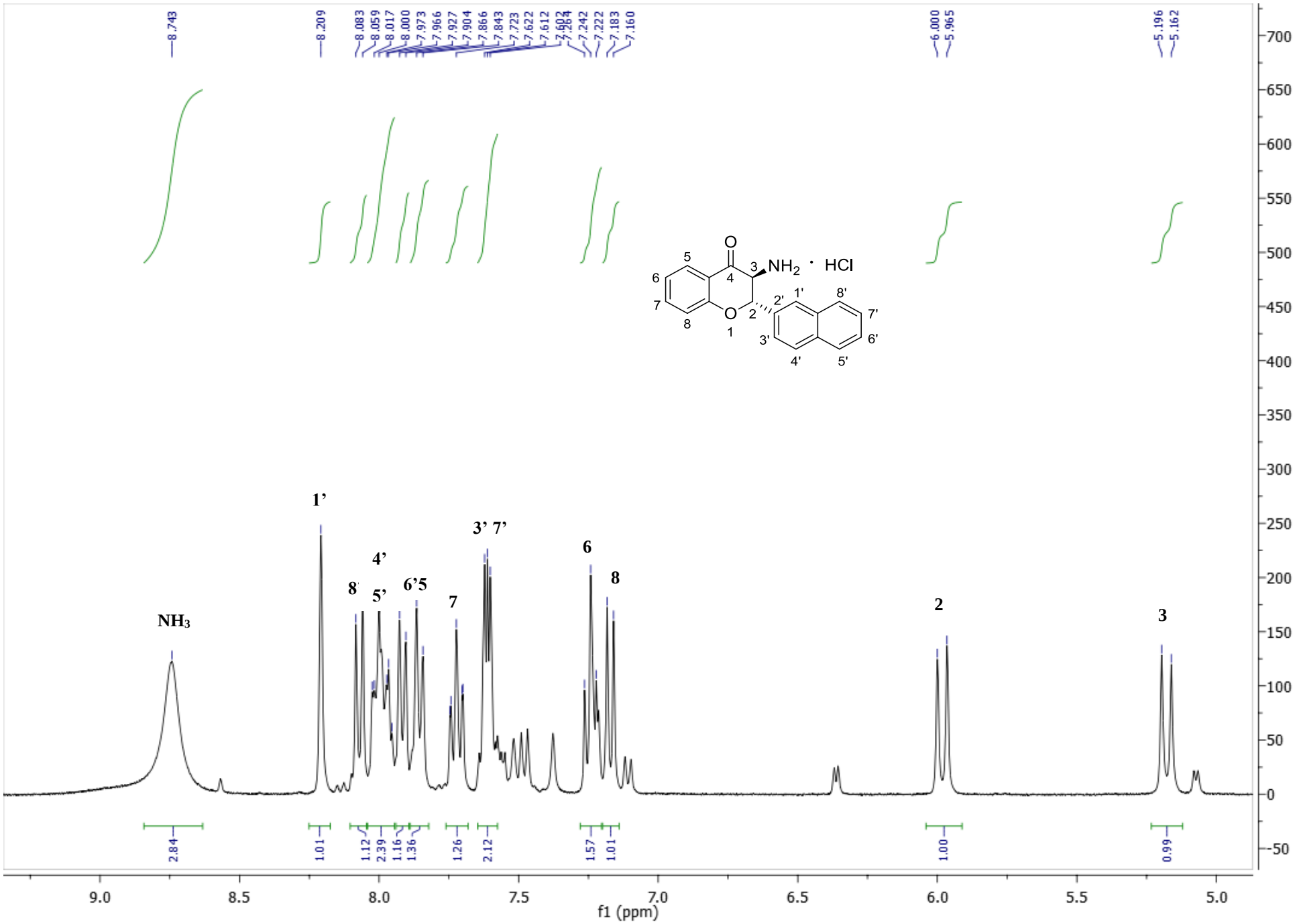


Figure S43. ^{1}H-NMR spectrum of *rac-trans*-**1g** in DMSO-d_6

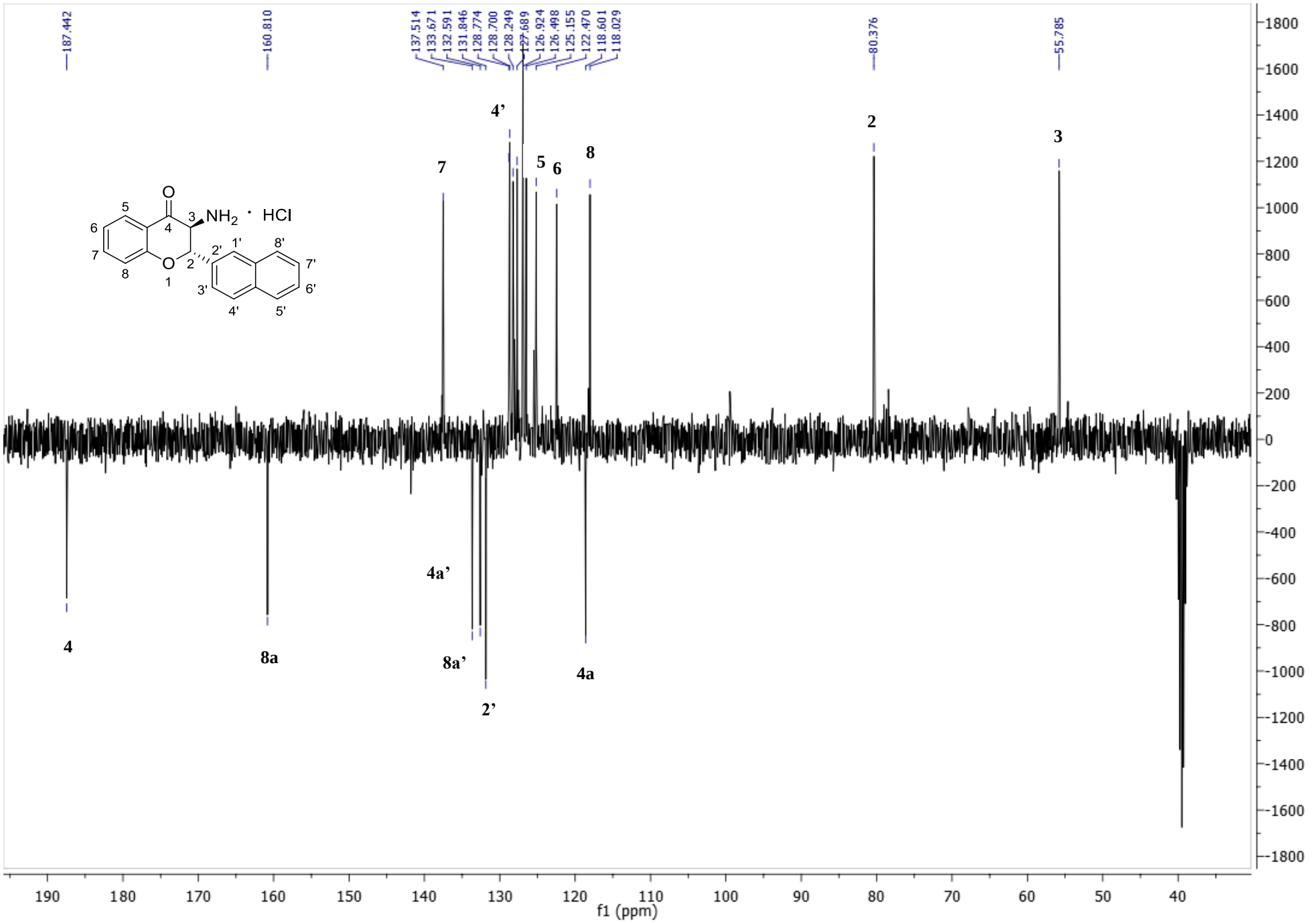


Figure S44. ^{13}C-NMR spectrum of *rac-trans*-**1g** in DMSO-d_6

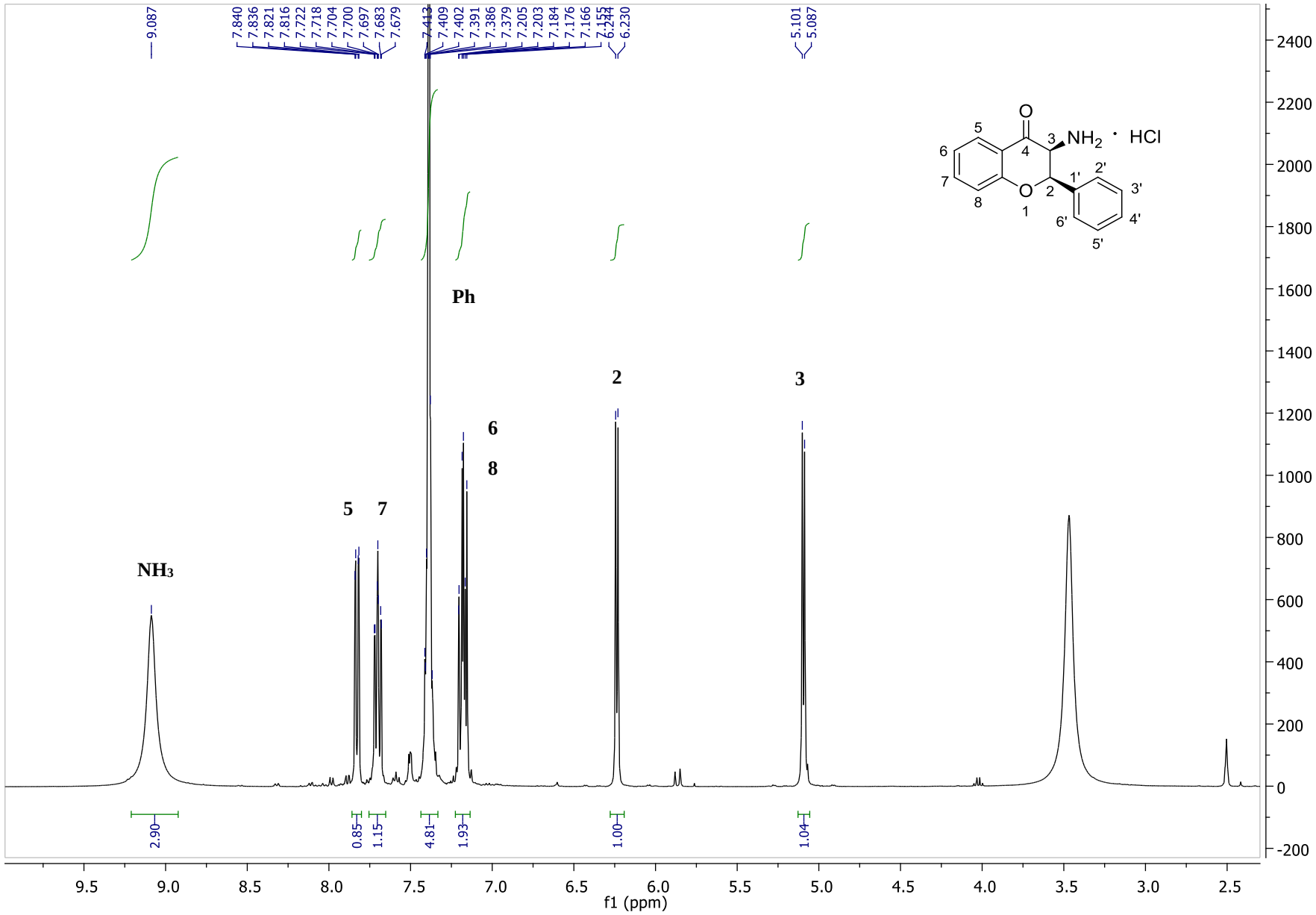


Figure S45. ^{1}H-NMR spectrum of *rac-cis*-**1a** in DMSO-d_6

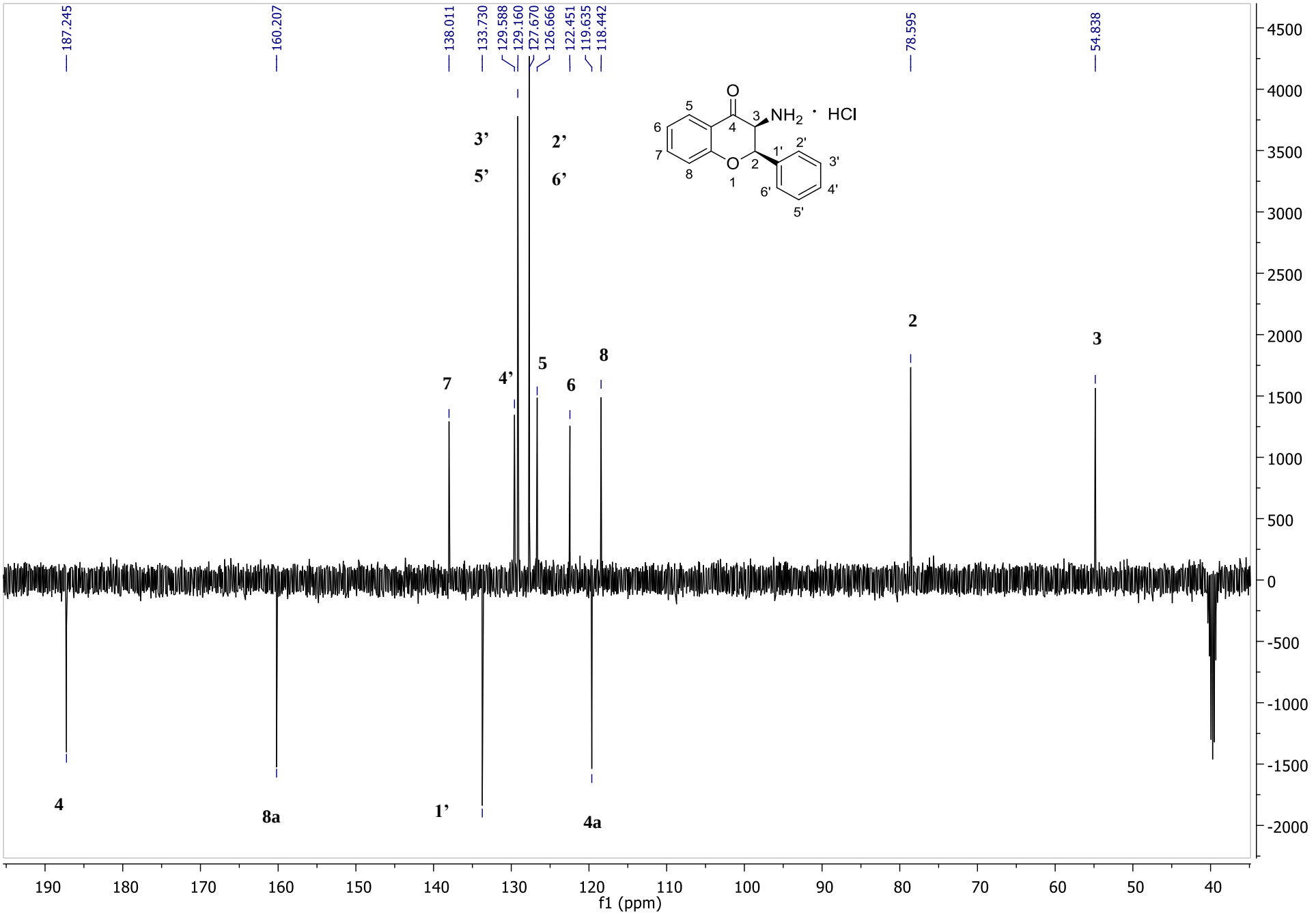


Figure S46. ^{13}C-NMR spectrum of *rac-cis*-**1a** in DMSO-d_6

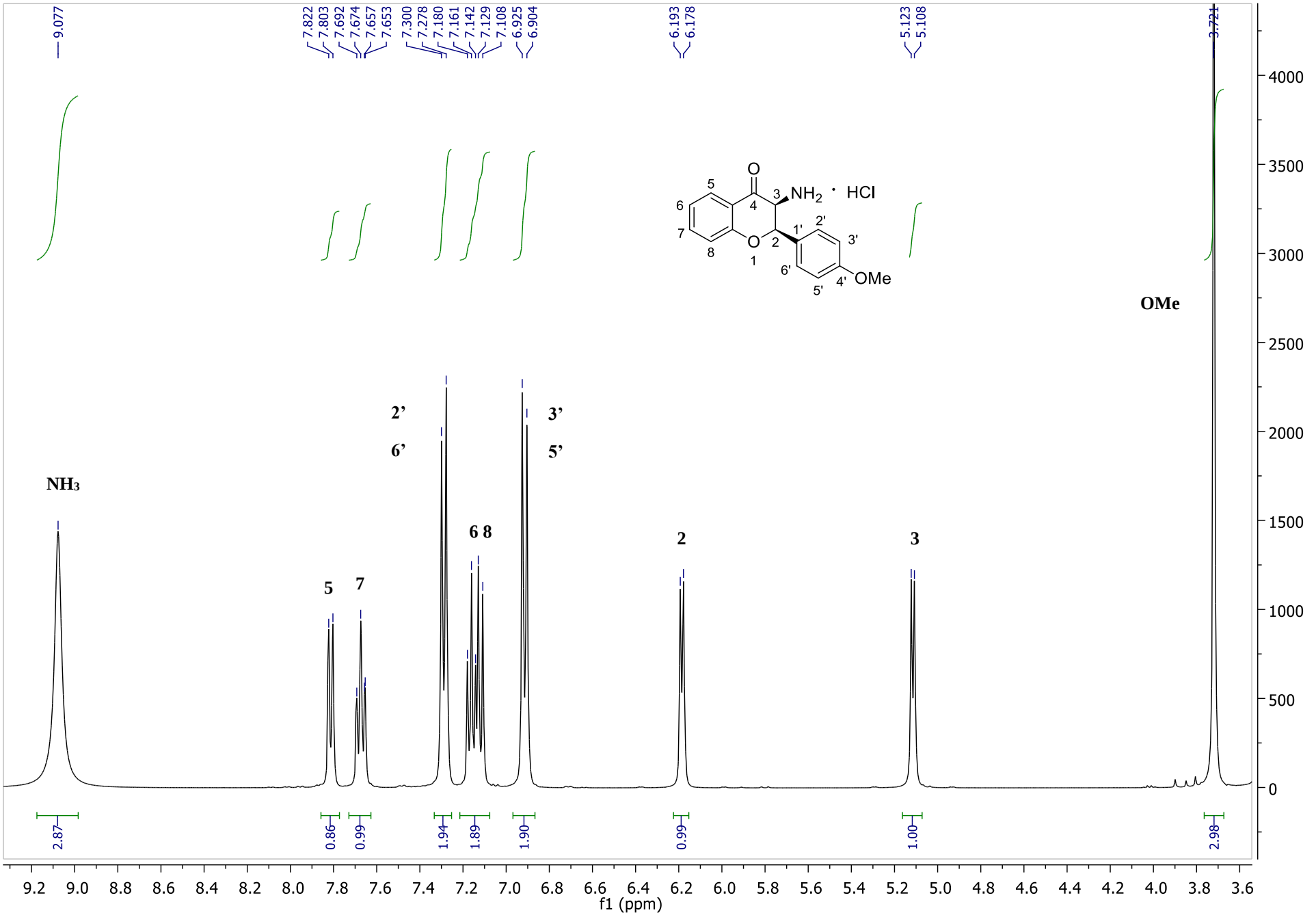


Figure S47. ^{1}H-NMR spectrum of *rac-cis*-**1b** in DMSO-d_6

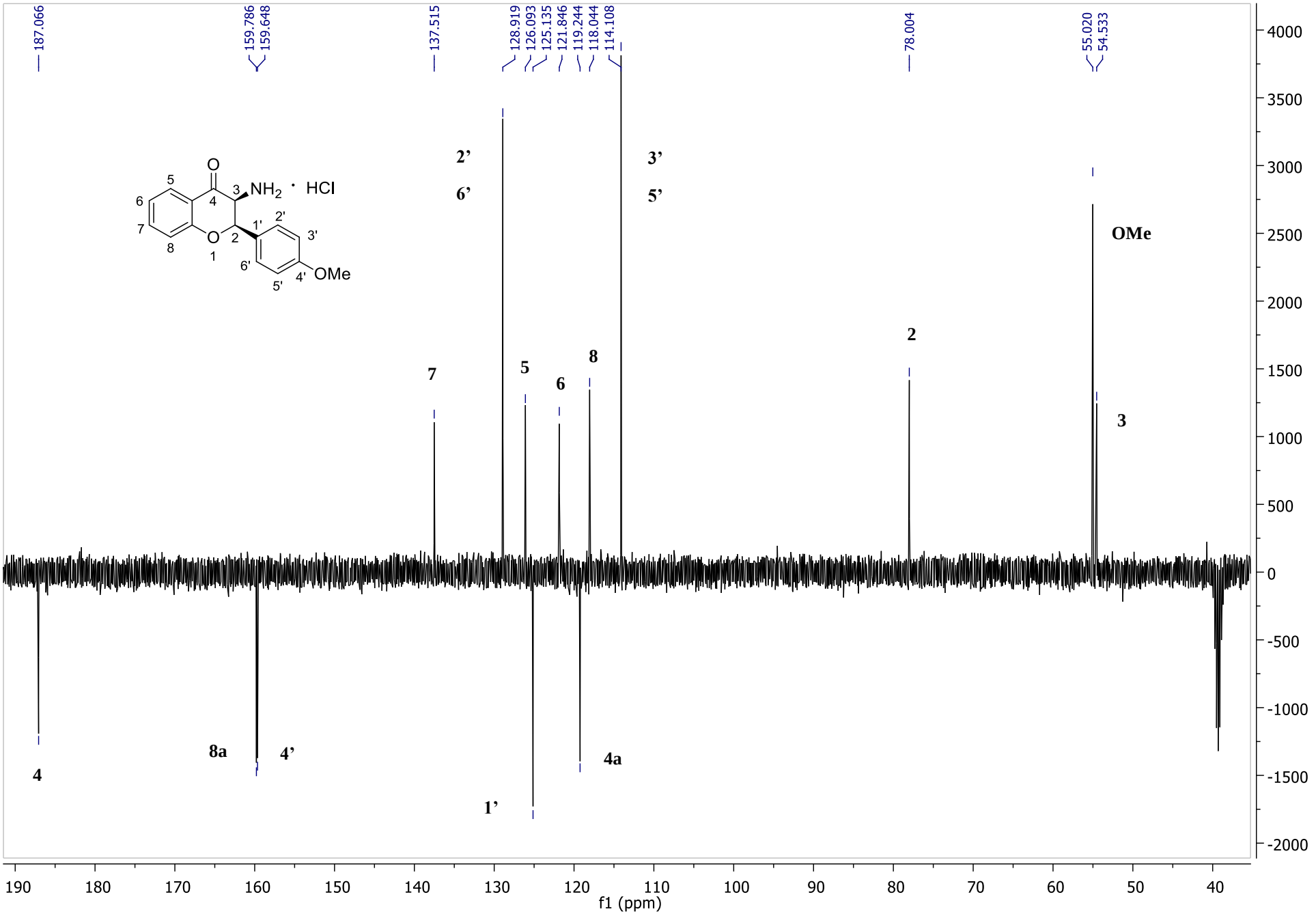


Figure S48. ^{13}C-NMR spectrum of *rac-cis*-**1b** in DMSO-d_6

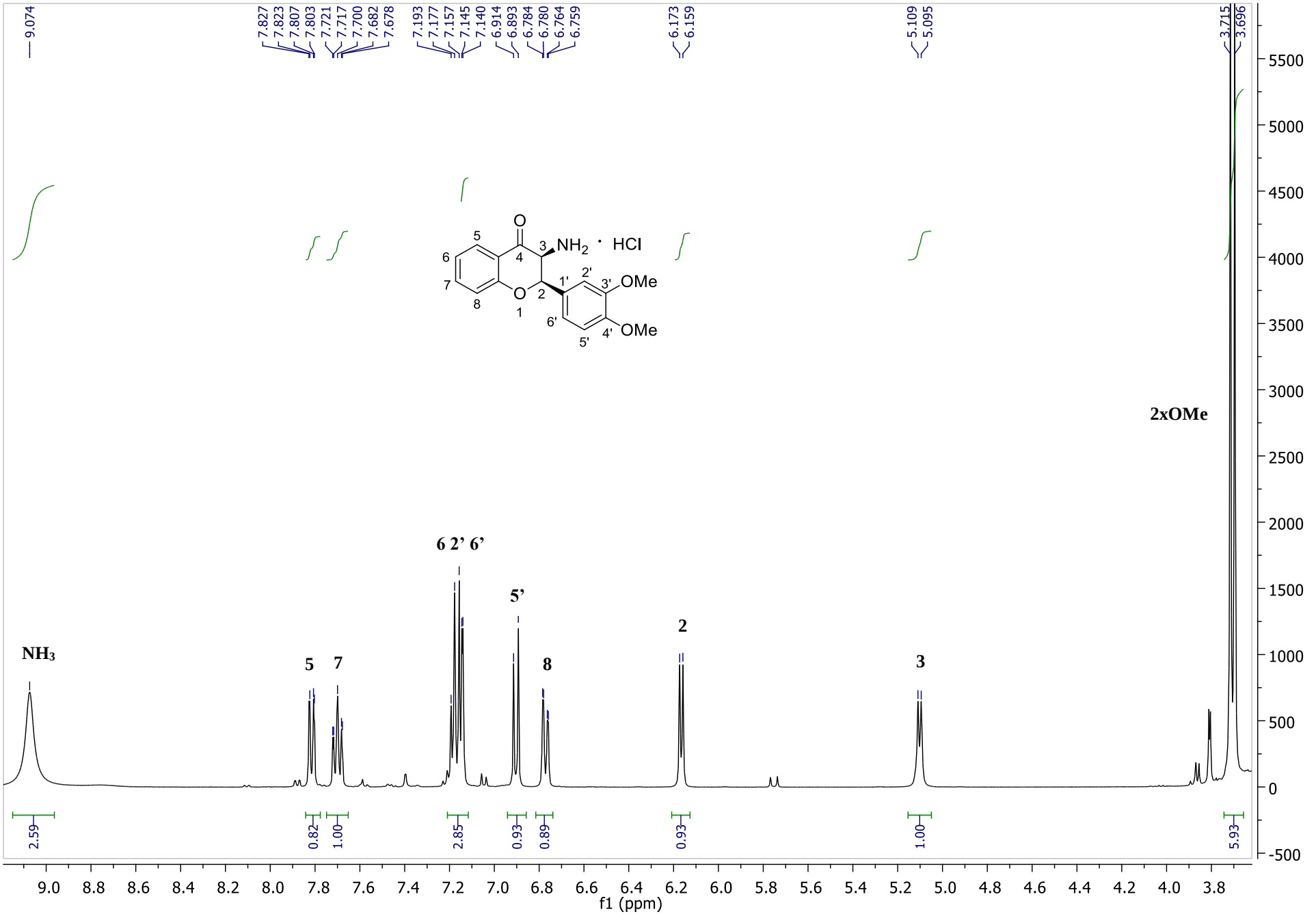


Figure S49. ^{1}H-NMR spectrum of *rac-cis*-**1c** in DMSO-d_6

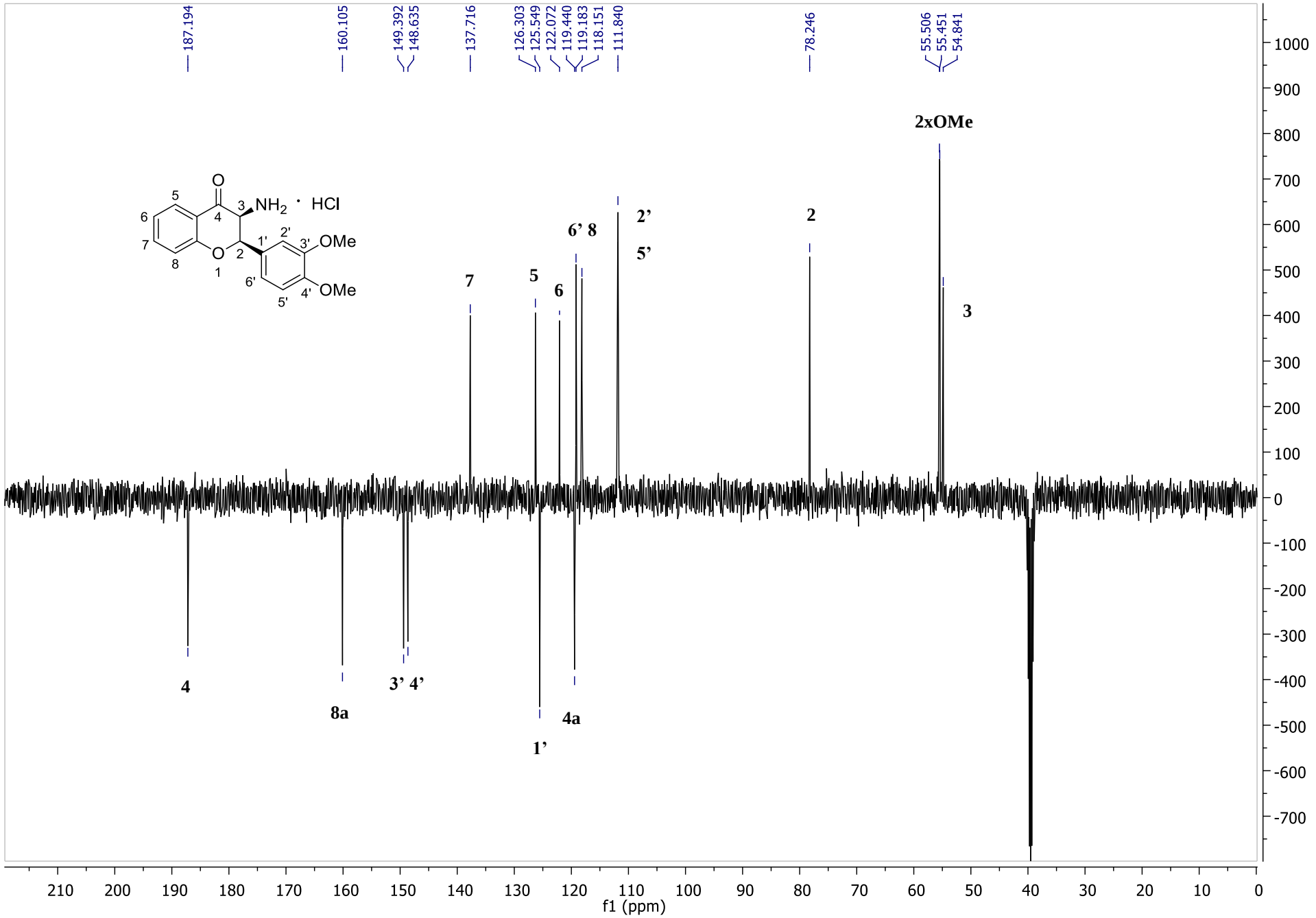


Figure S50. ^{13}C-NMR spectrum of *rac-cis*-**1c** in DMSO-d_6

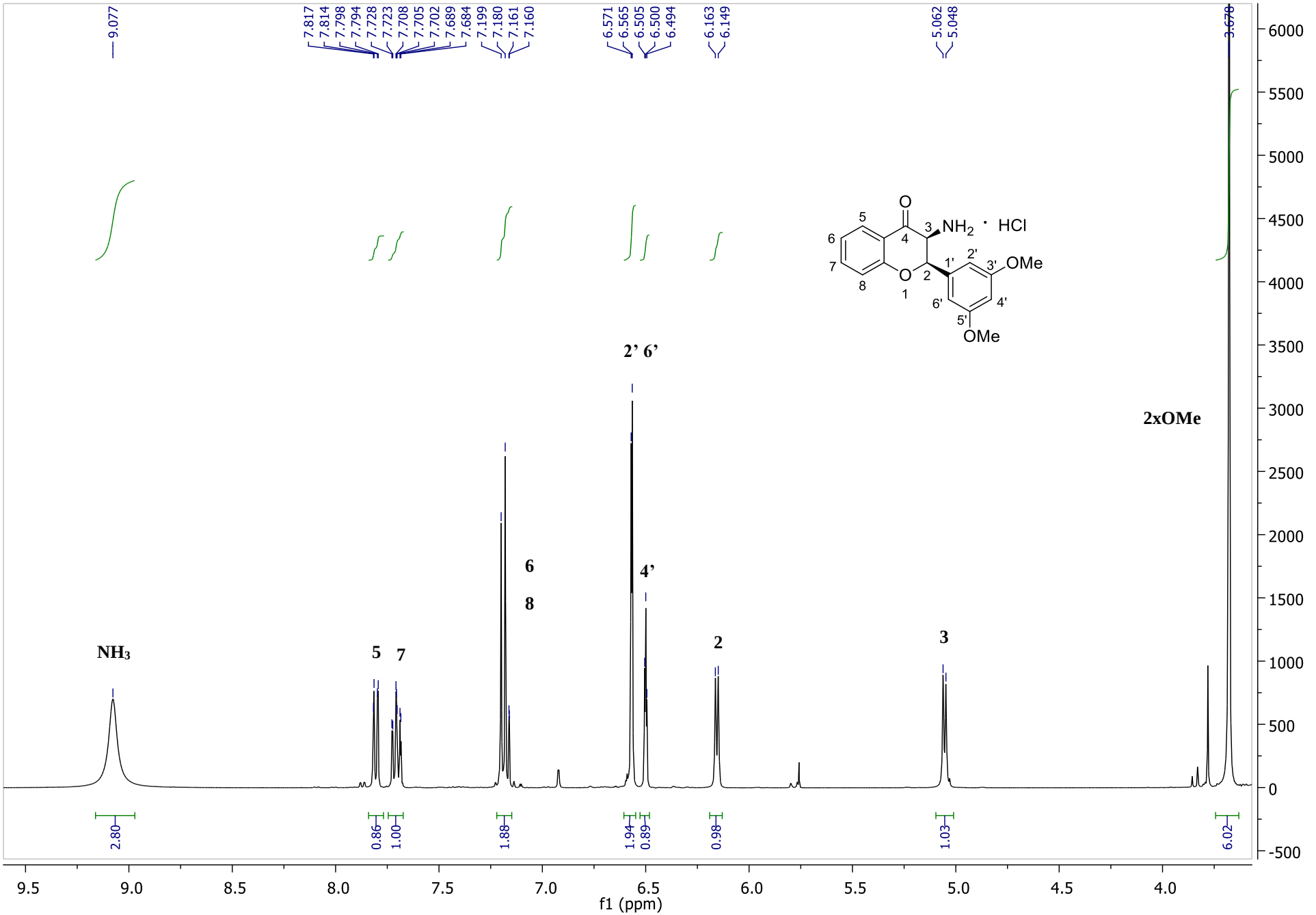


Figure S51. ^{1}H-NMR spectrum of *rac-cis*-**1d** in DMSO-d_6

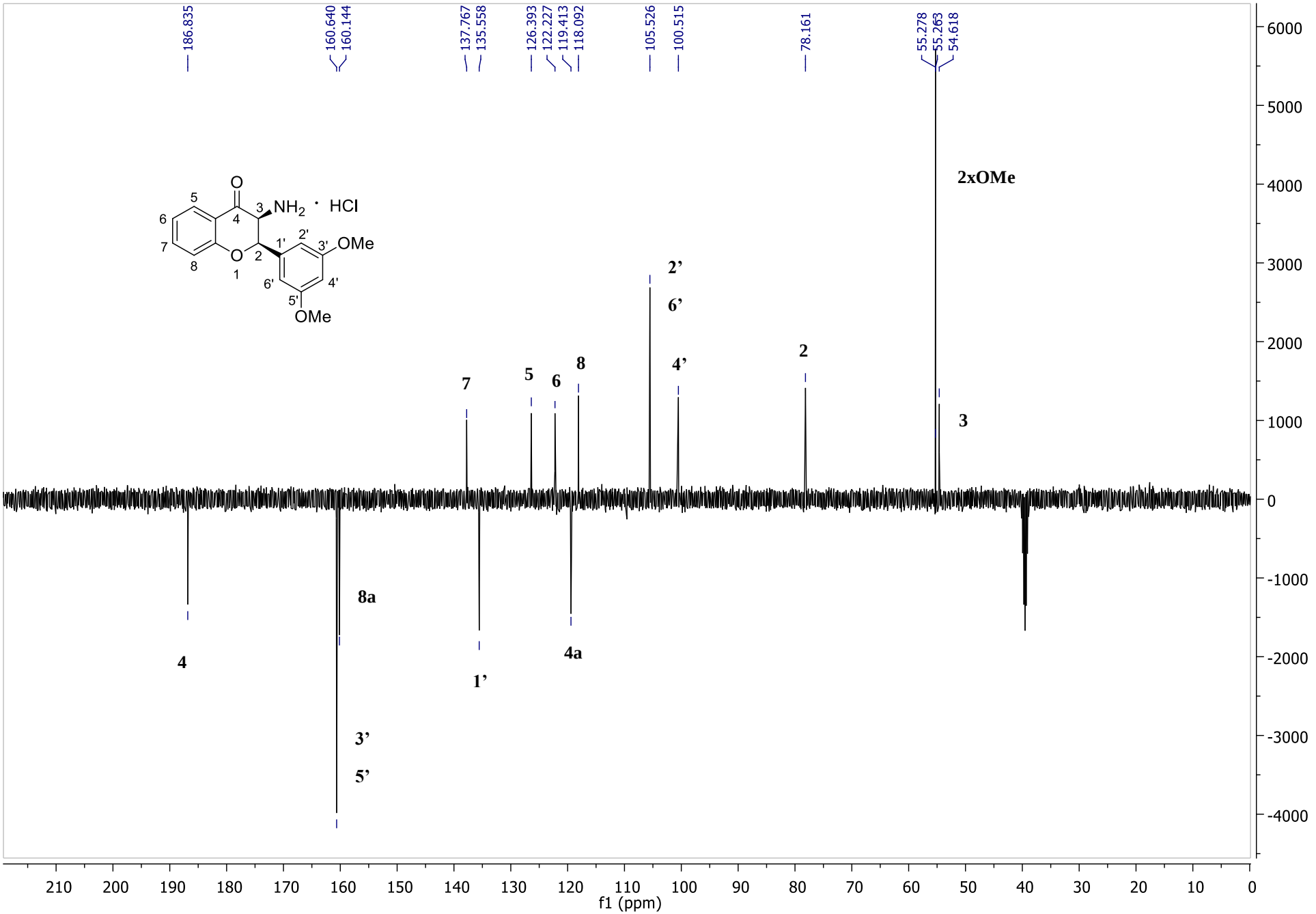


Figure S52. ^{13}C-NMR spectrum of *rac-cis*-**1d** in DMSO-d_6

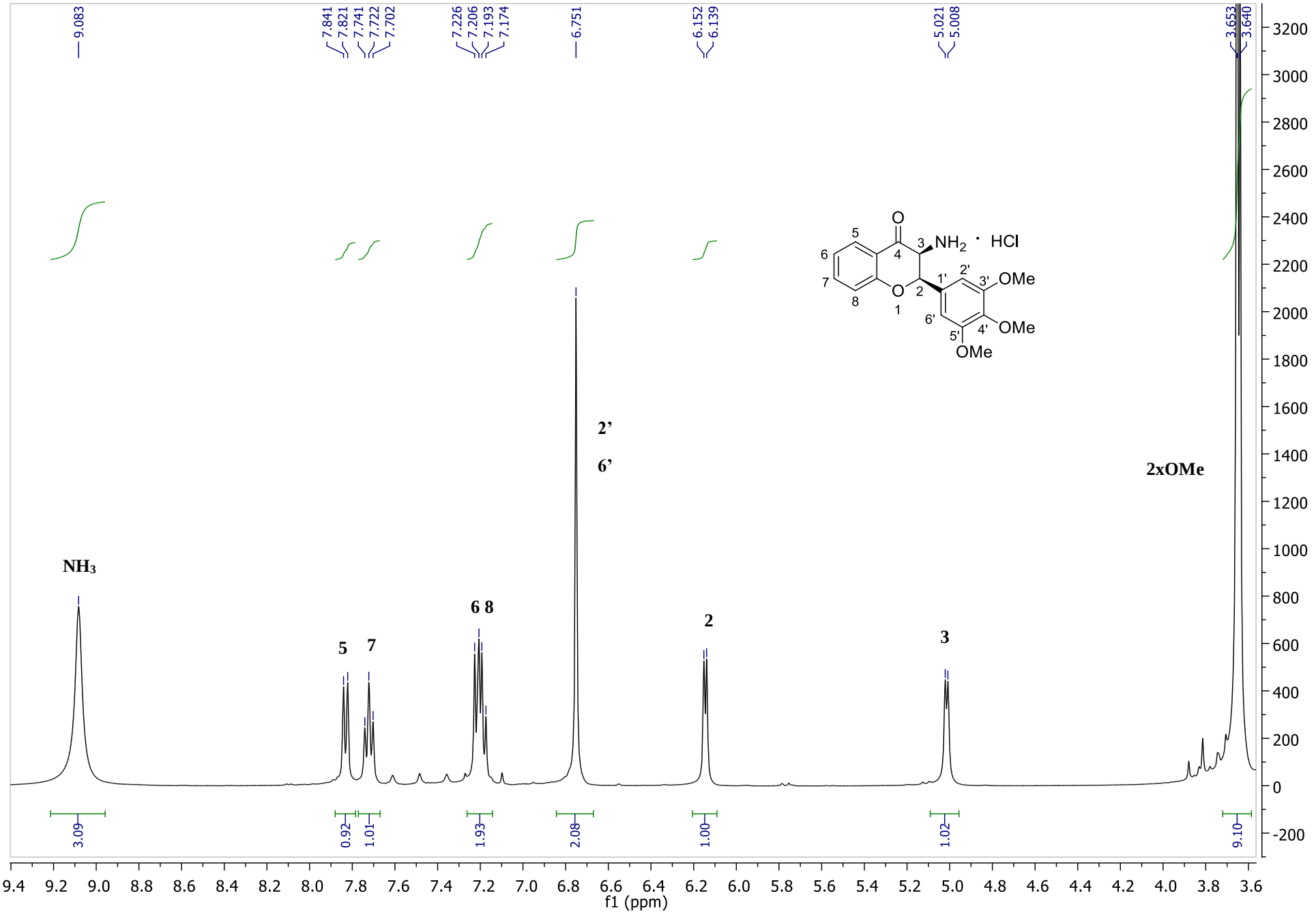


Figure S53. ^{1}H-NMR spectrum of *rac-cis*-**1e** in DMSO-d_6

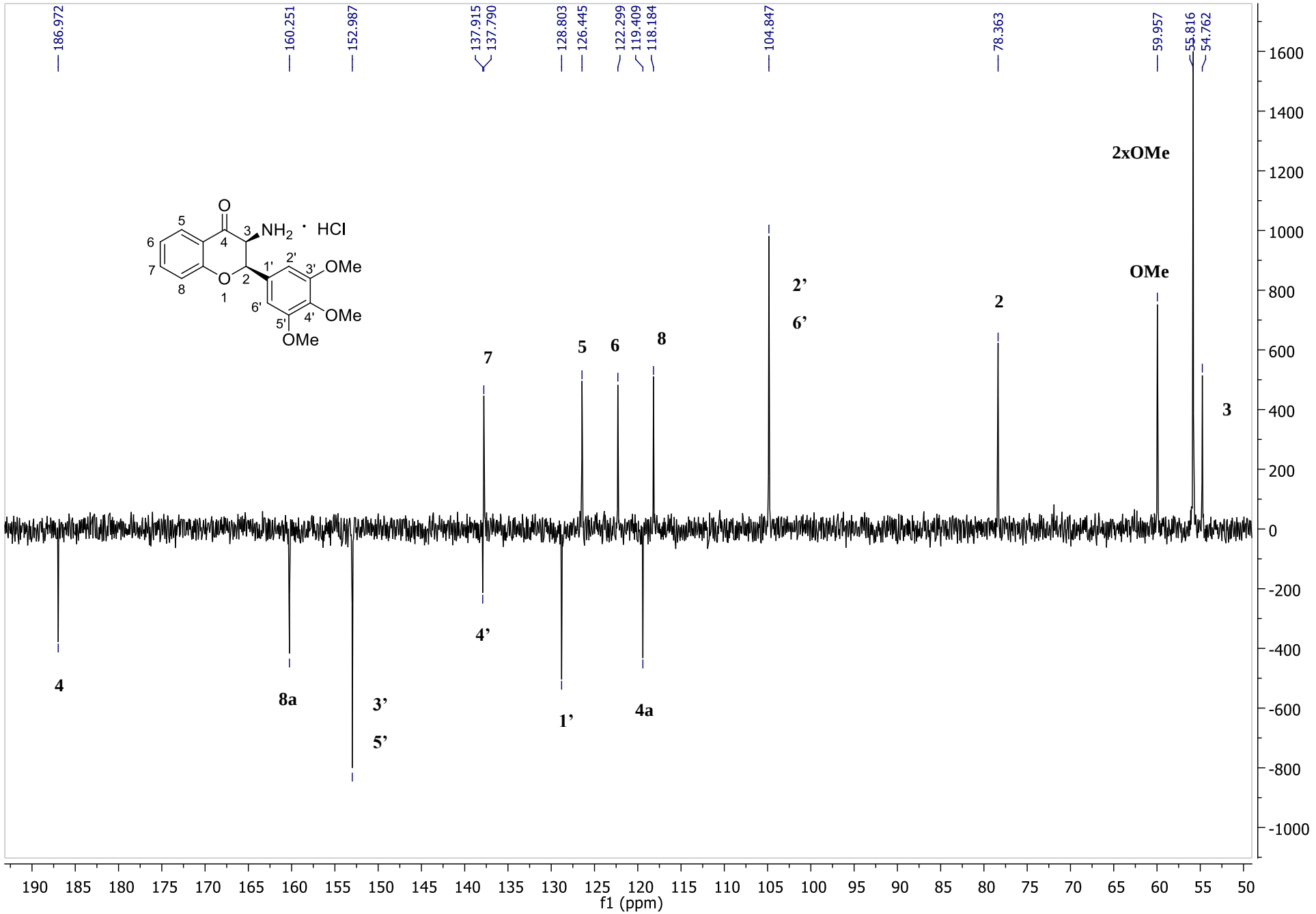


Figure S54. ^{13}C-NMR spectrum of *rac-cis*-**1e** in DMSO-d_6

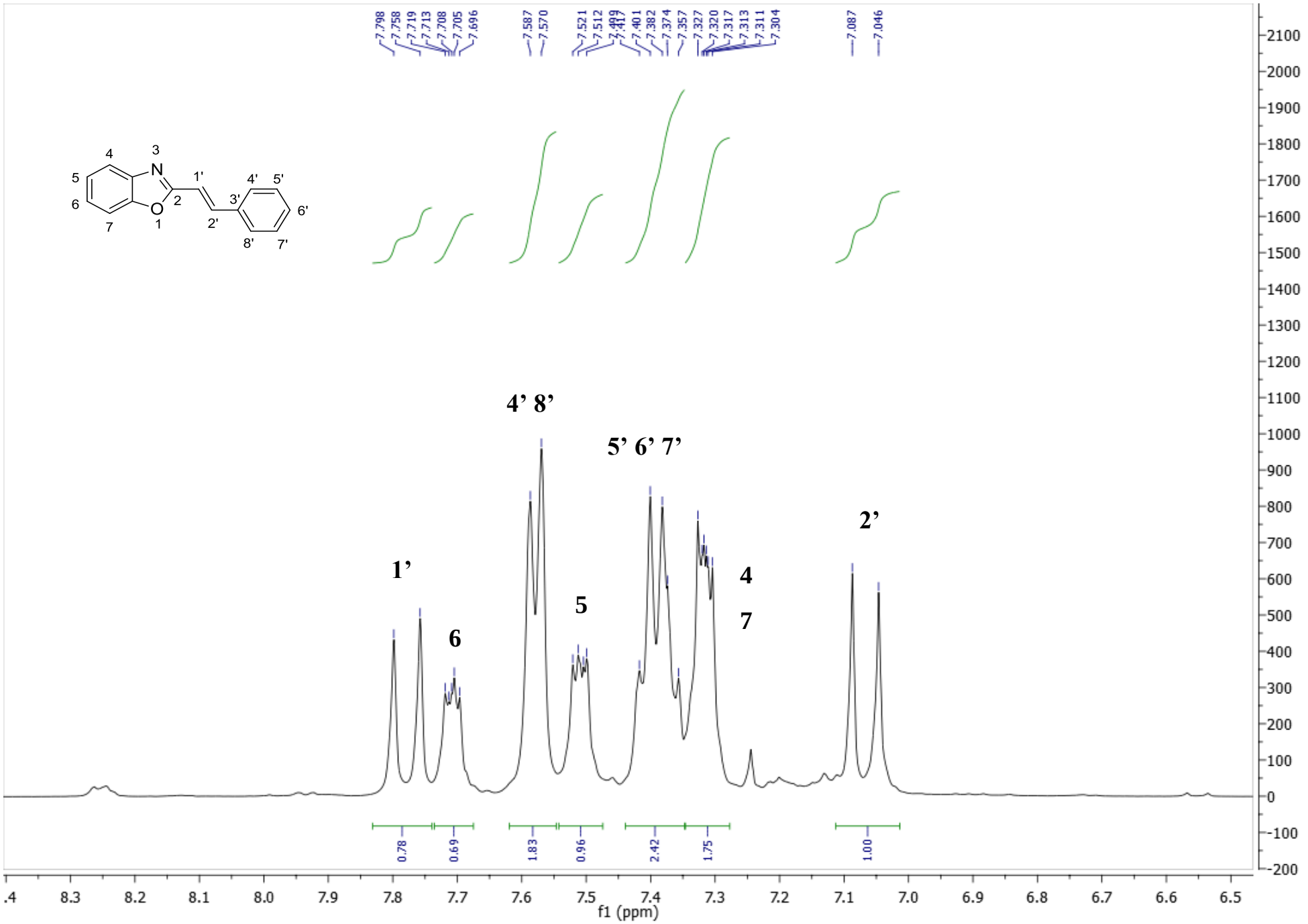


Figure S55. ^{1}H-NMR spectrum of **17a** in $CDCl_3$

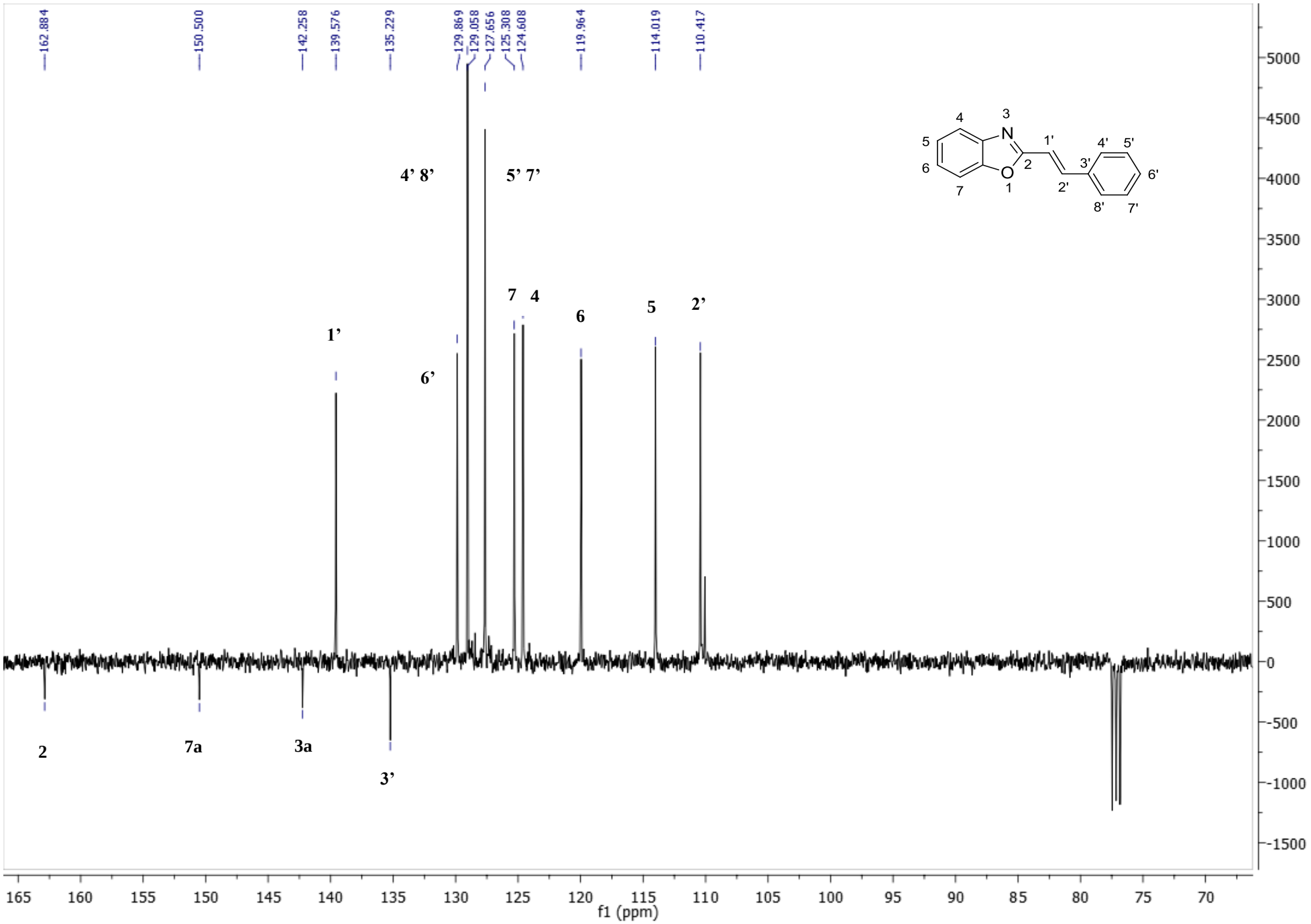


Figure S56. ^{13}C-NMR spectrum of **17a** in $CDCl_3$

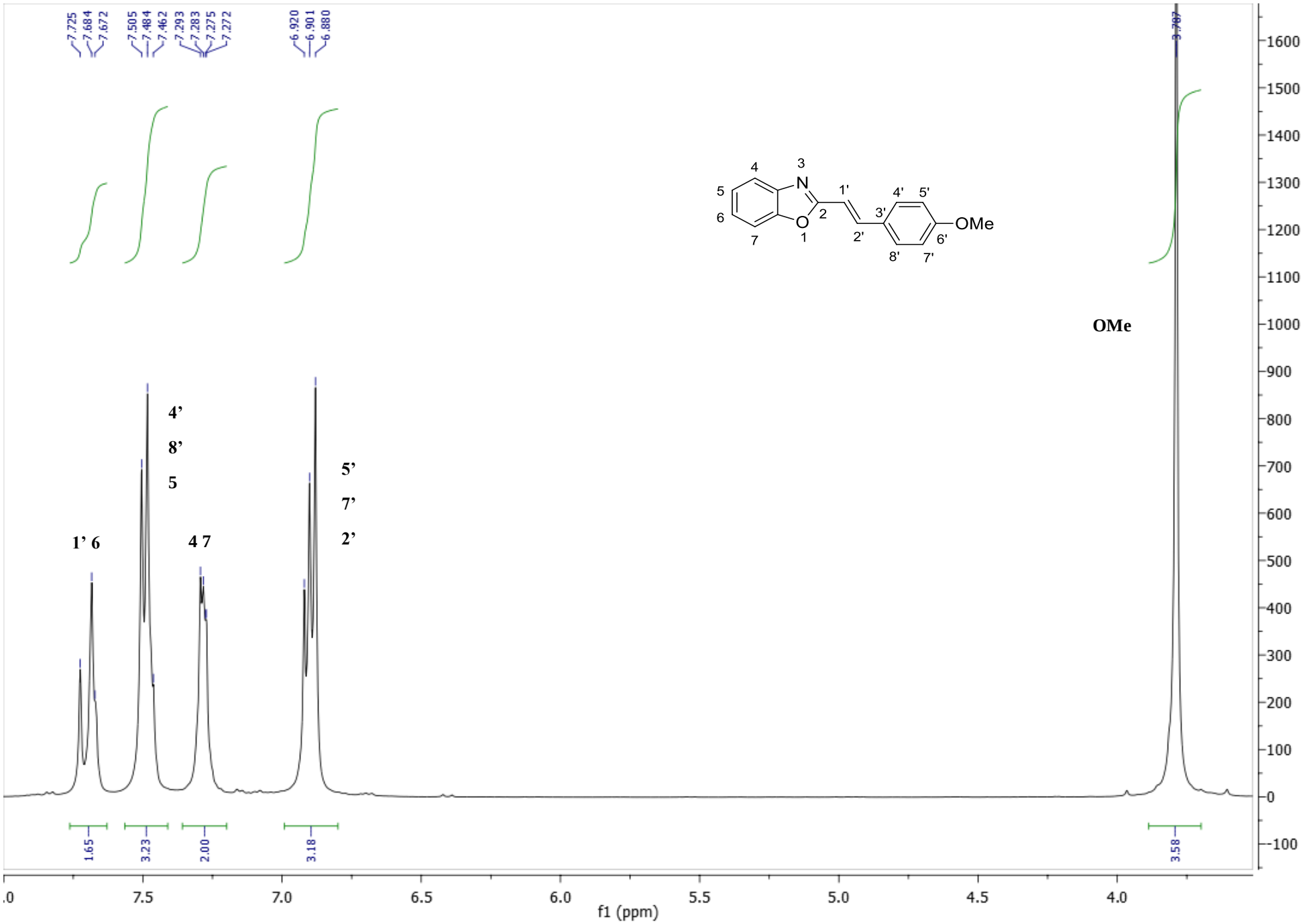


Figure S57. ^{1}H-NMR spectrum of **17b** in $CDCl_3$

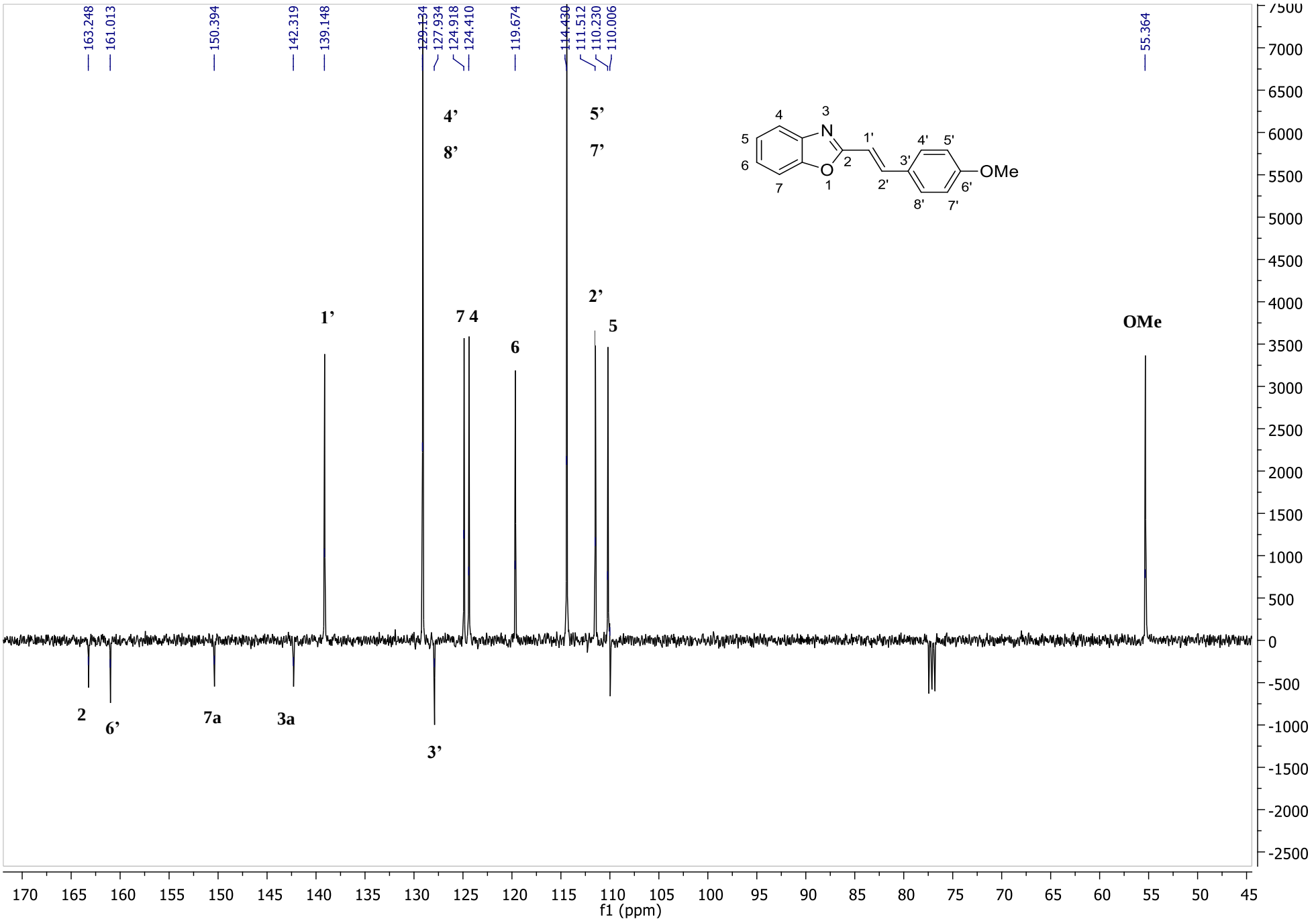


Figure S58. ^{13}C-NMR spectrum of **17b** in $CDCl_3$

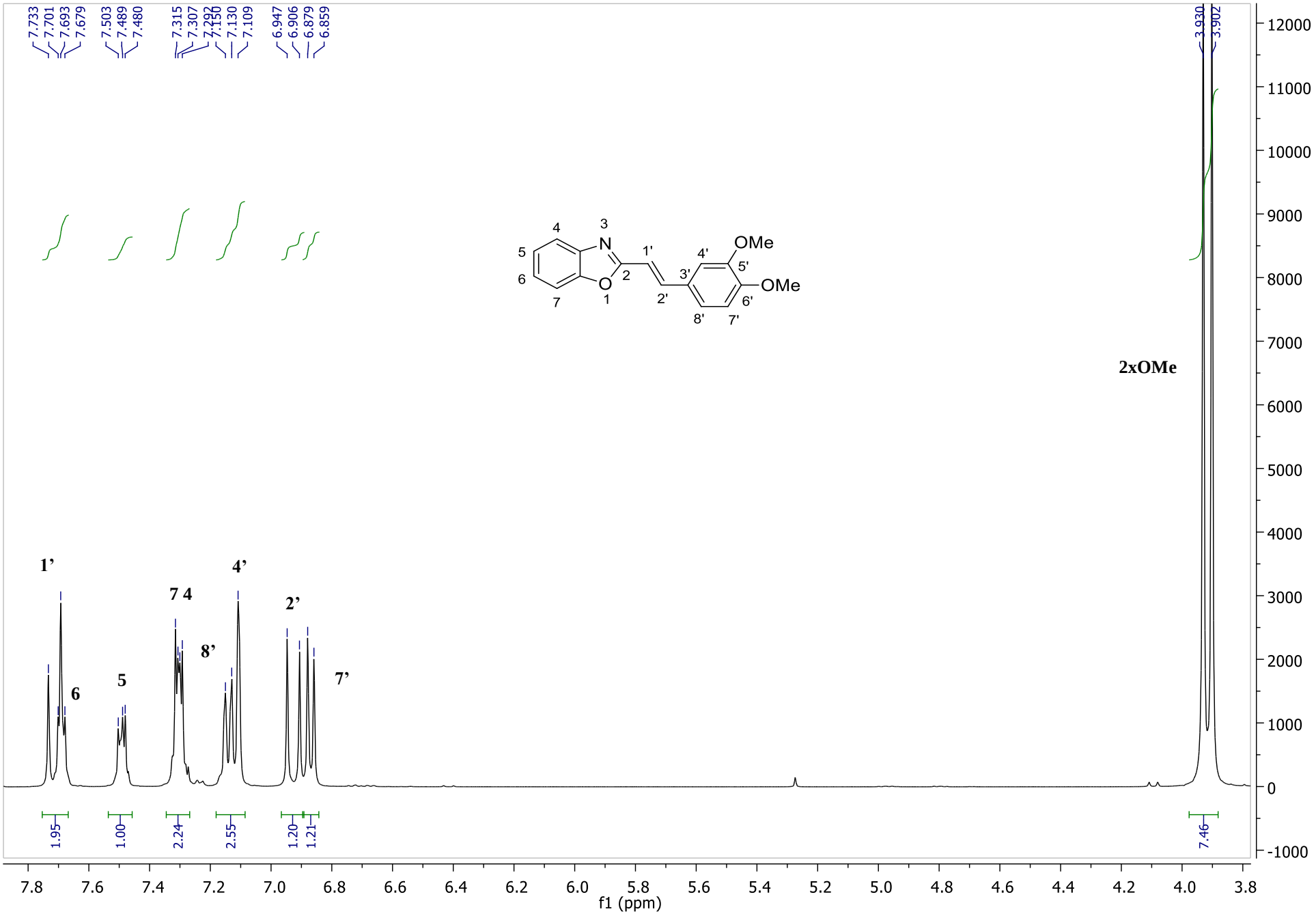


Figure S59. ^{1}H-NMR spectrum of **17c** in $CDCl_3$

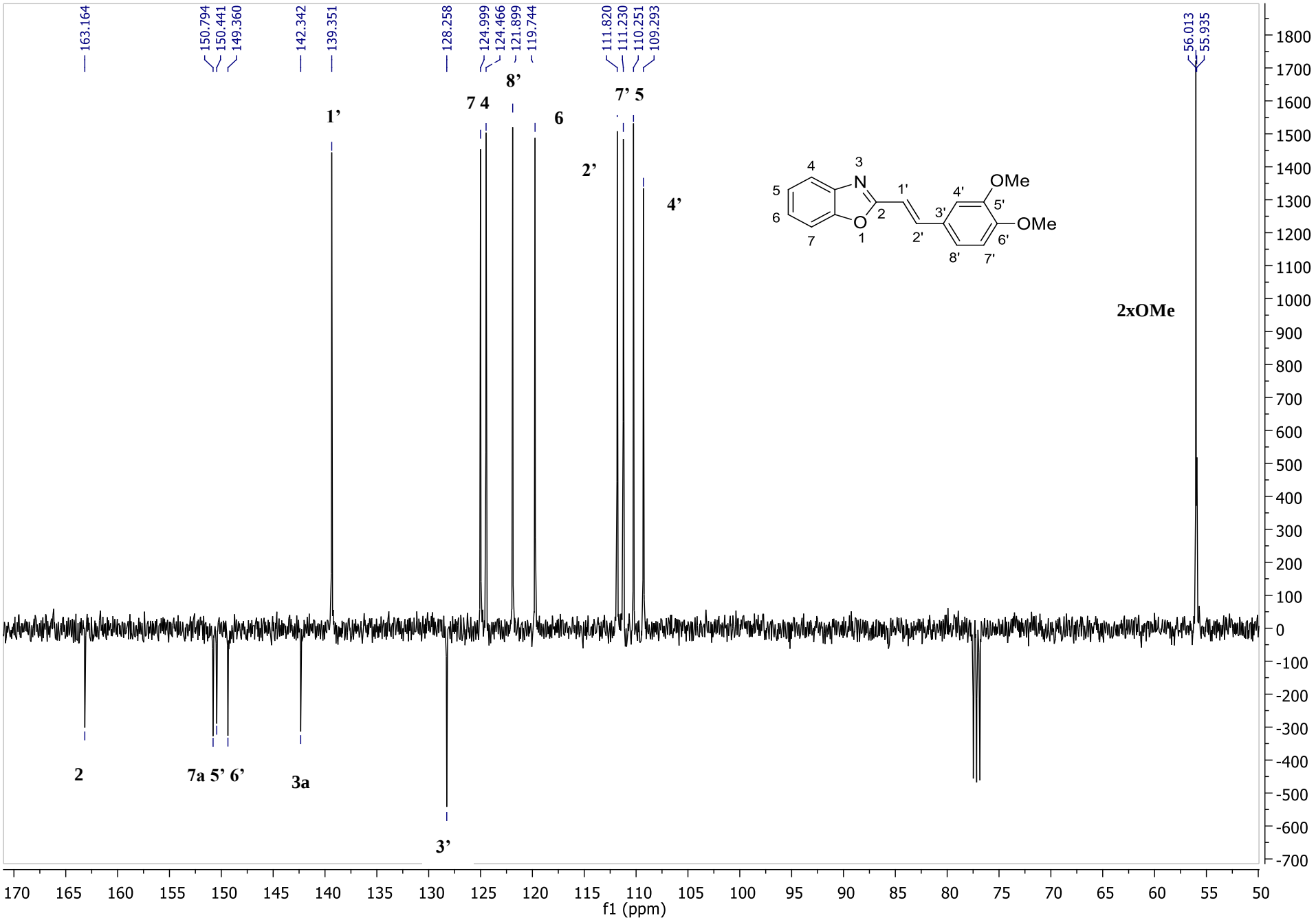


Figure S60. ^{13}C-NMR spectrum of **17c** in $CDCl_3$

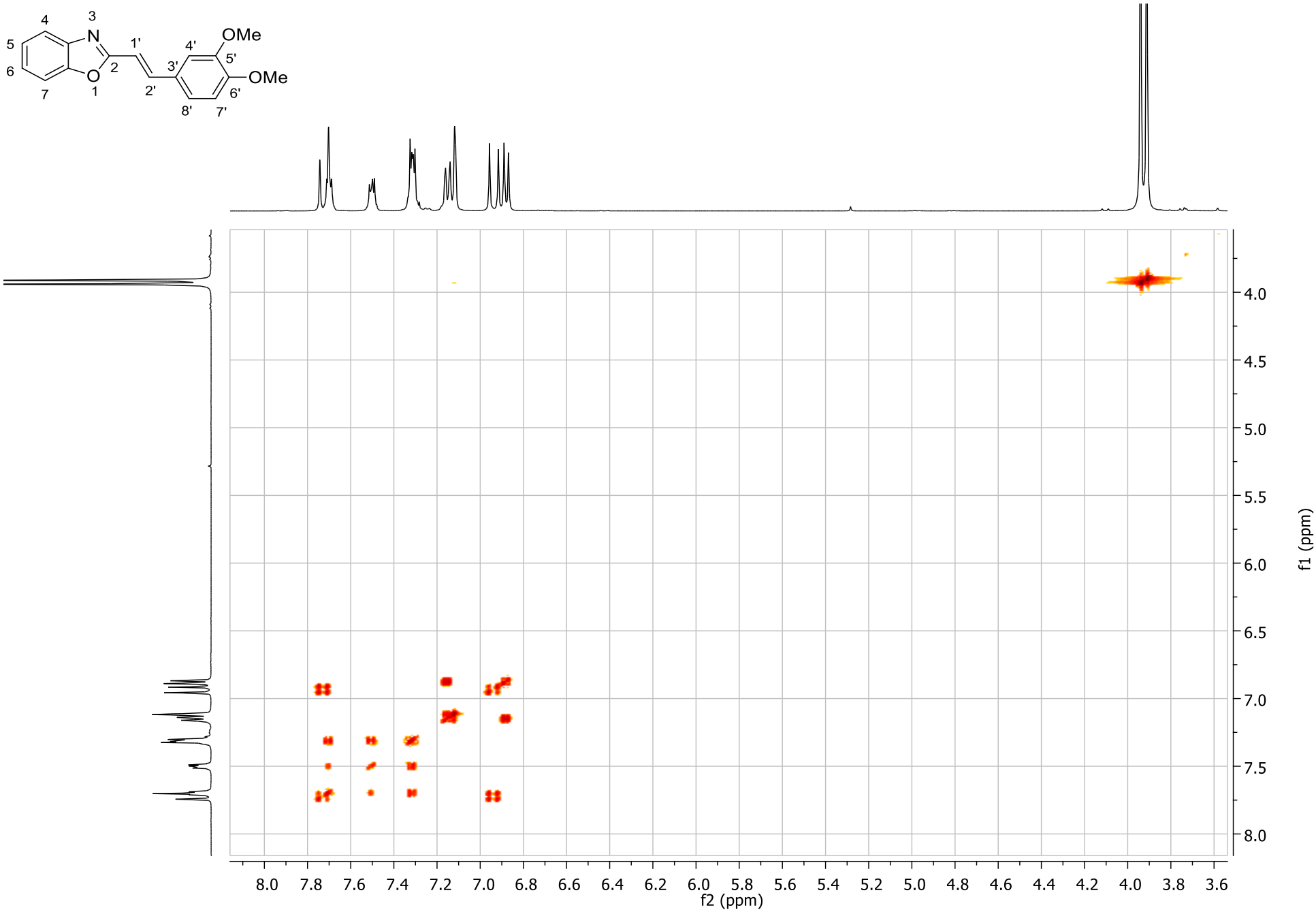


Figure S61. COSY-spectrum of **17c** in $CDCl_3$

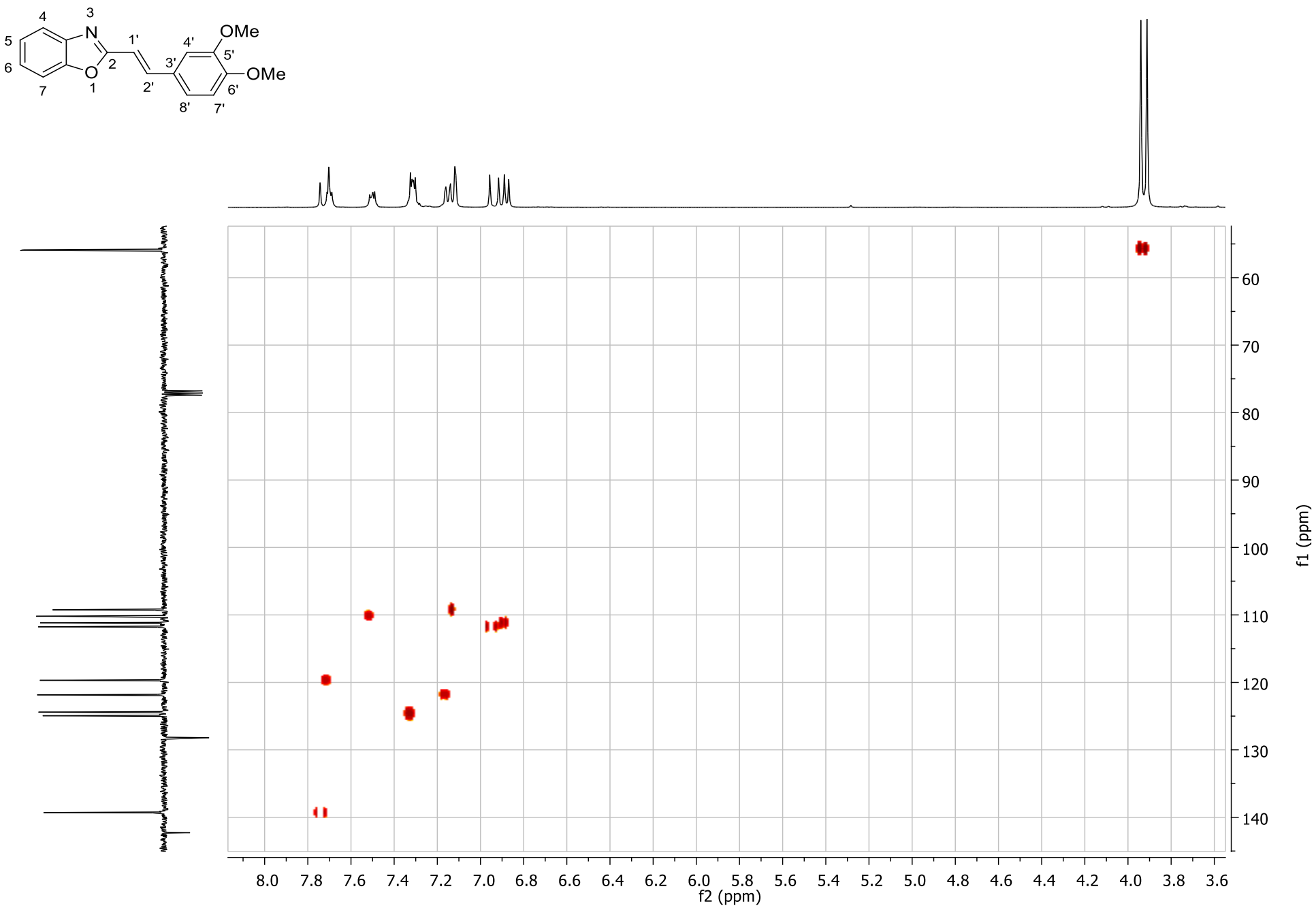


Figure S62. HSQC-spectrum of **17c** in $CDCl_3$

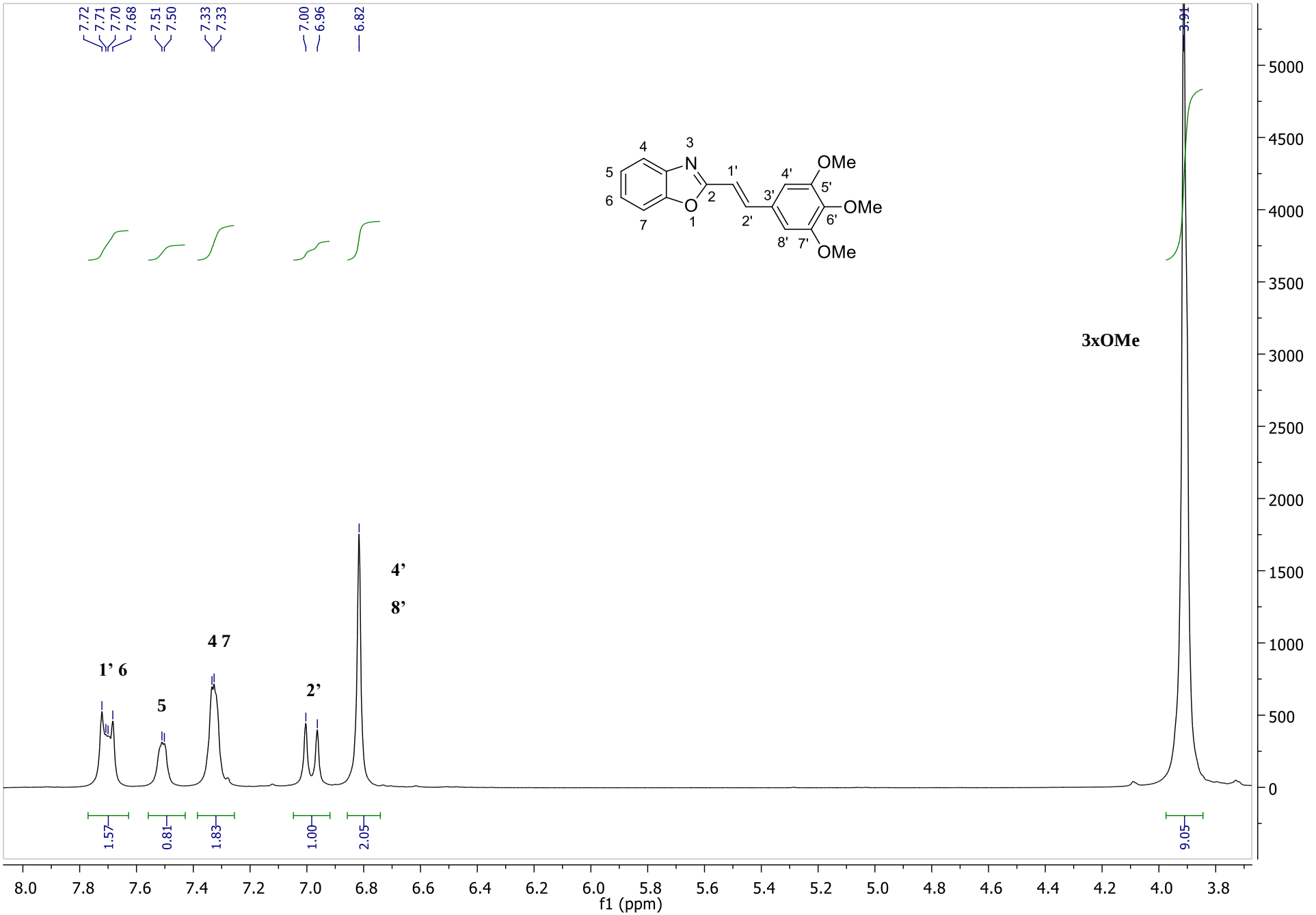


Figure S63. ^{1}H-NMR spectrum of **17e** in $CDCl_3$

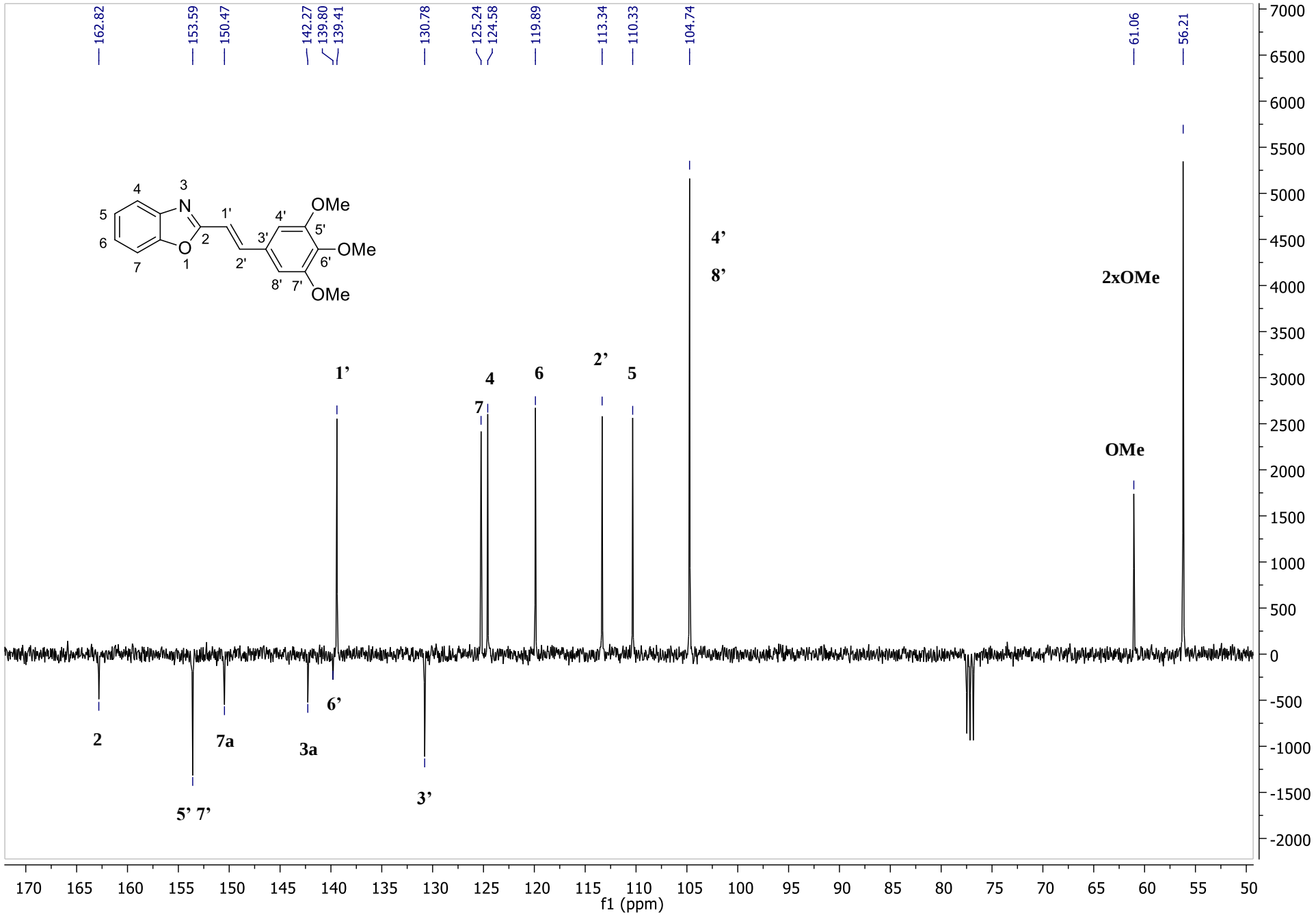


Figure S64. ^{13}C-NMR spectrum of **17e** in $CDCl_3$

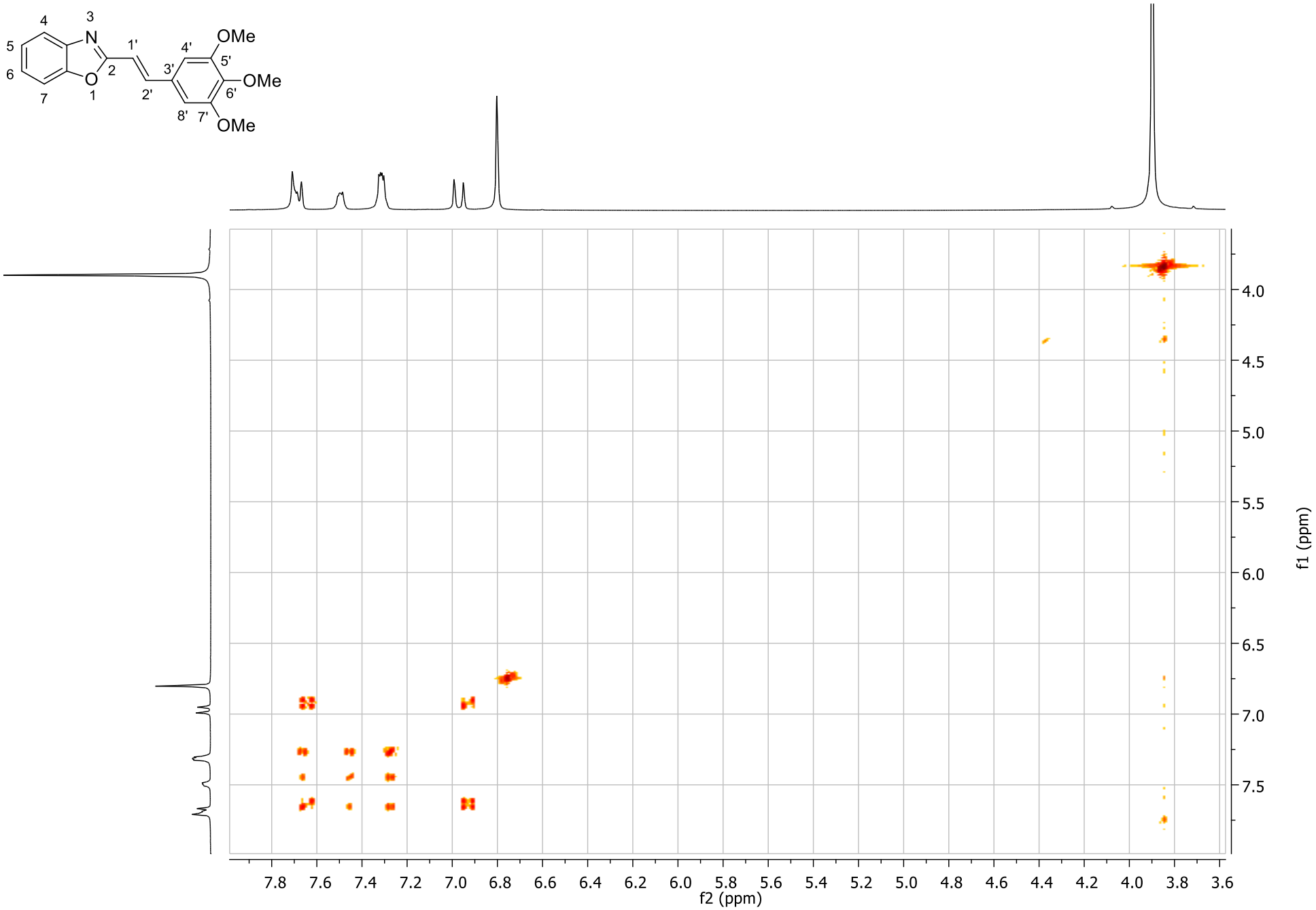


Figure S65. COSY-spectrum of **17e** in $CDCl_3$

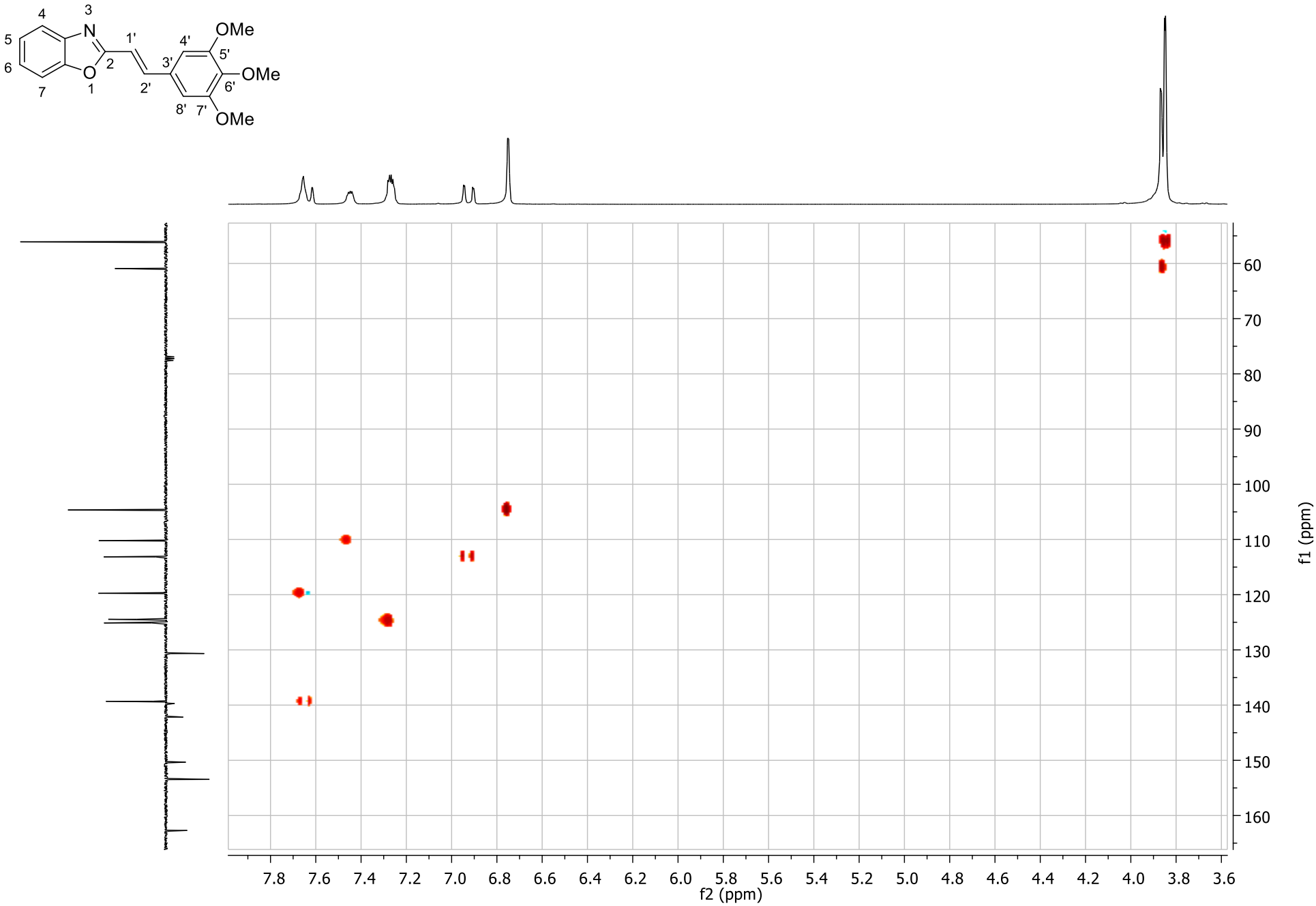


Figure S66. HSQC-spectrum of **17e** in $CDCl_3$

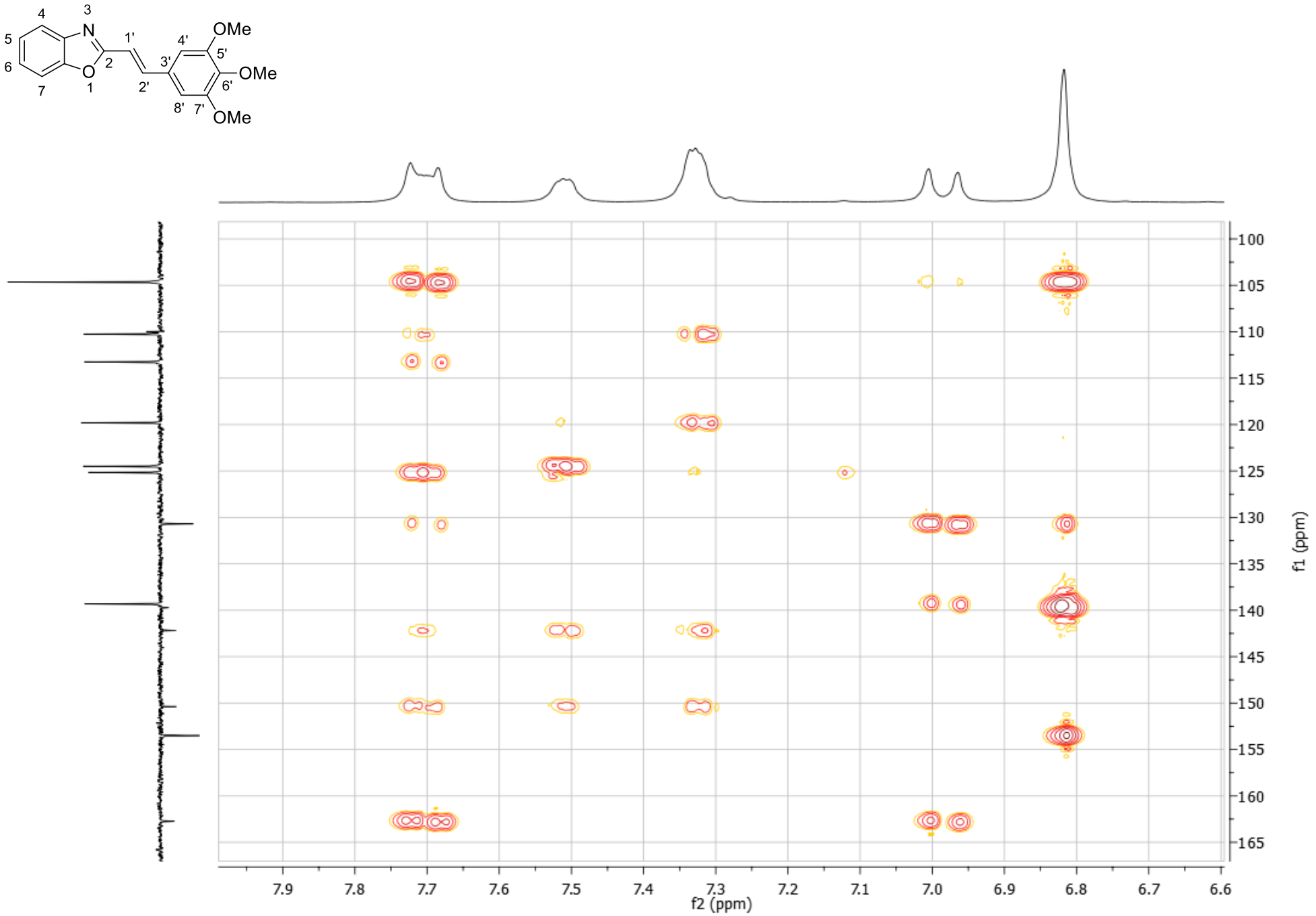


Figure S67. HMBC-spectrum of **17e** in $CDCl_3$

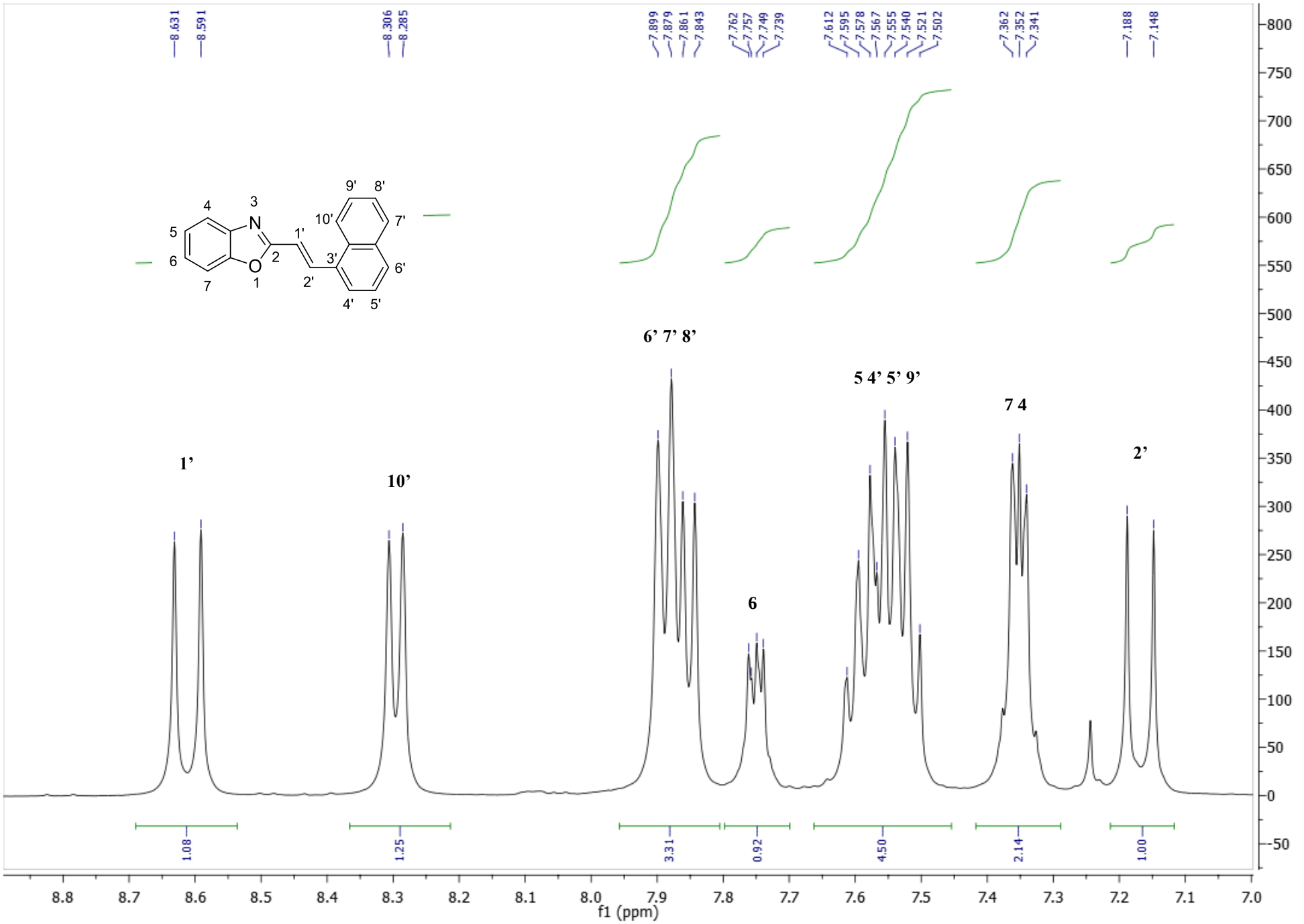


Figure S68. ^{1}H-NMR spectrum of **17f** in $CDCl_3$

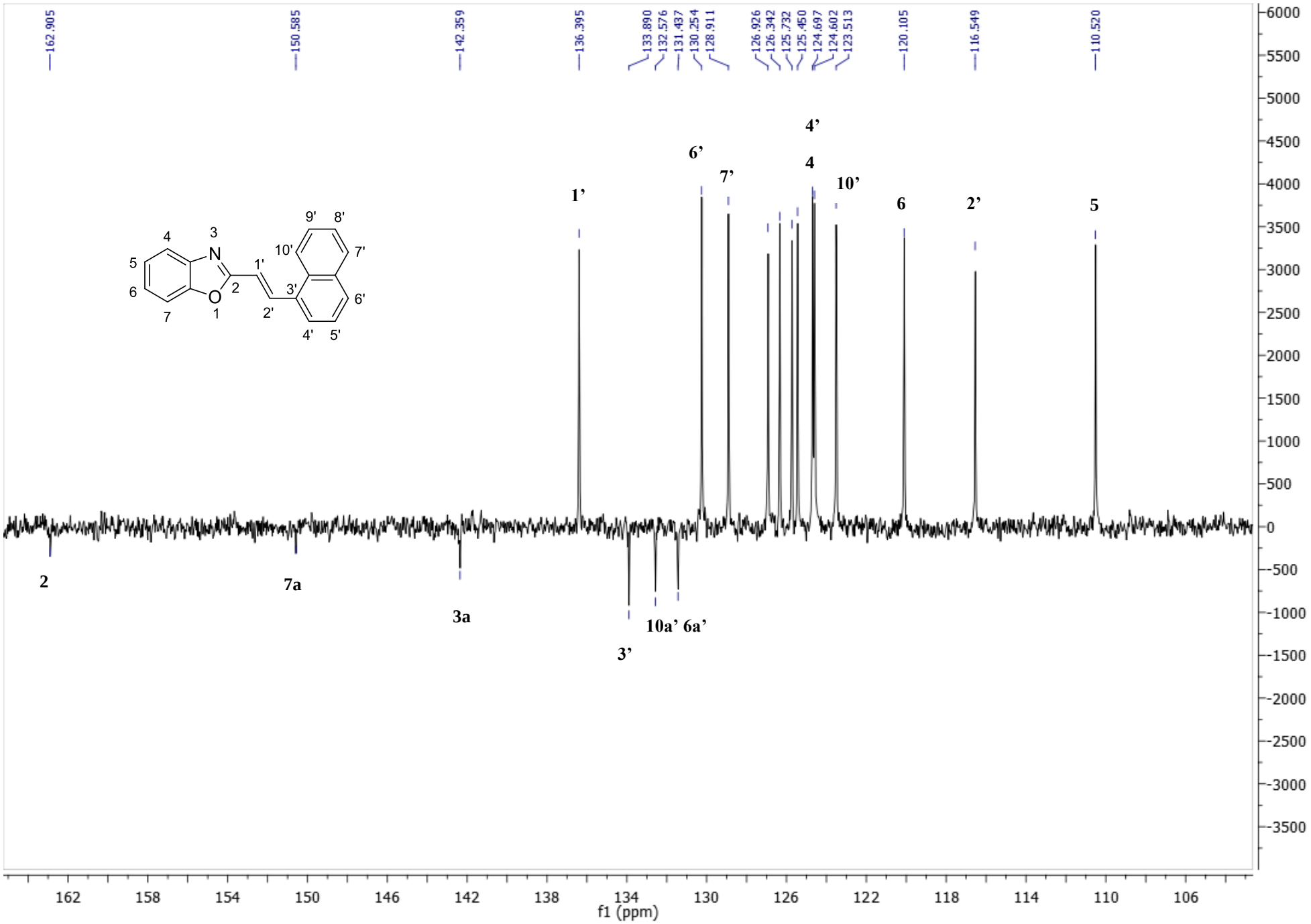


Figure S69. ^{13}C-NMR spectrum of **17f** in $CDCl_3$

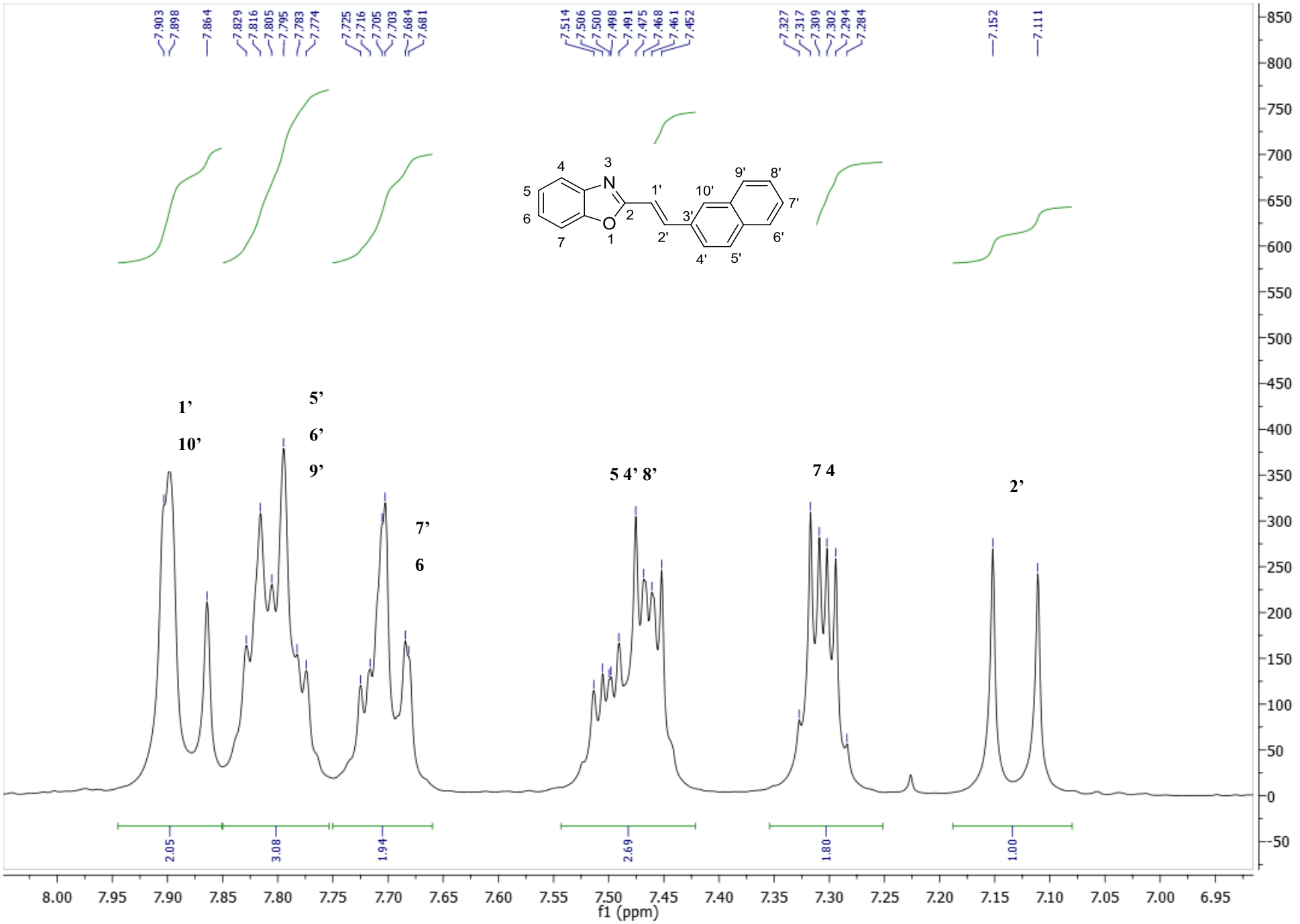


Figure S70. ^{1}H-NMR spectrum of **17g** in $CDCl_3$

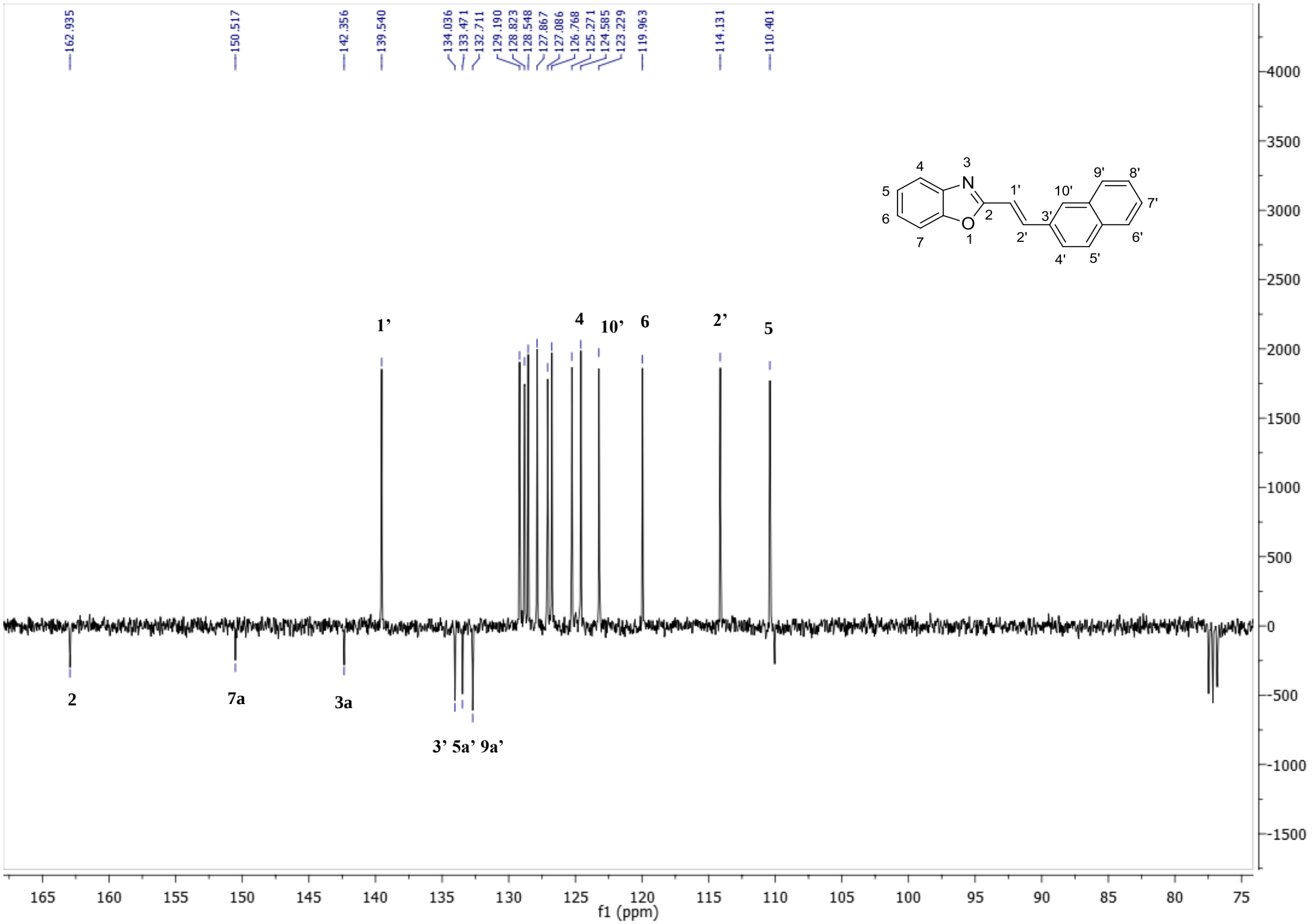


Figure S71. ^{13}C-NMR spectrum of **17g** in $CDCl_3$

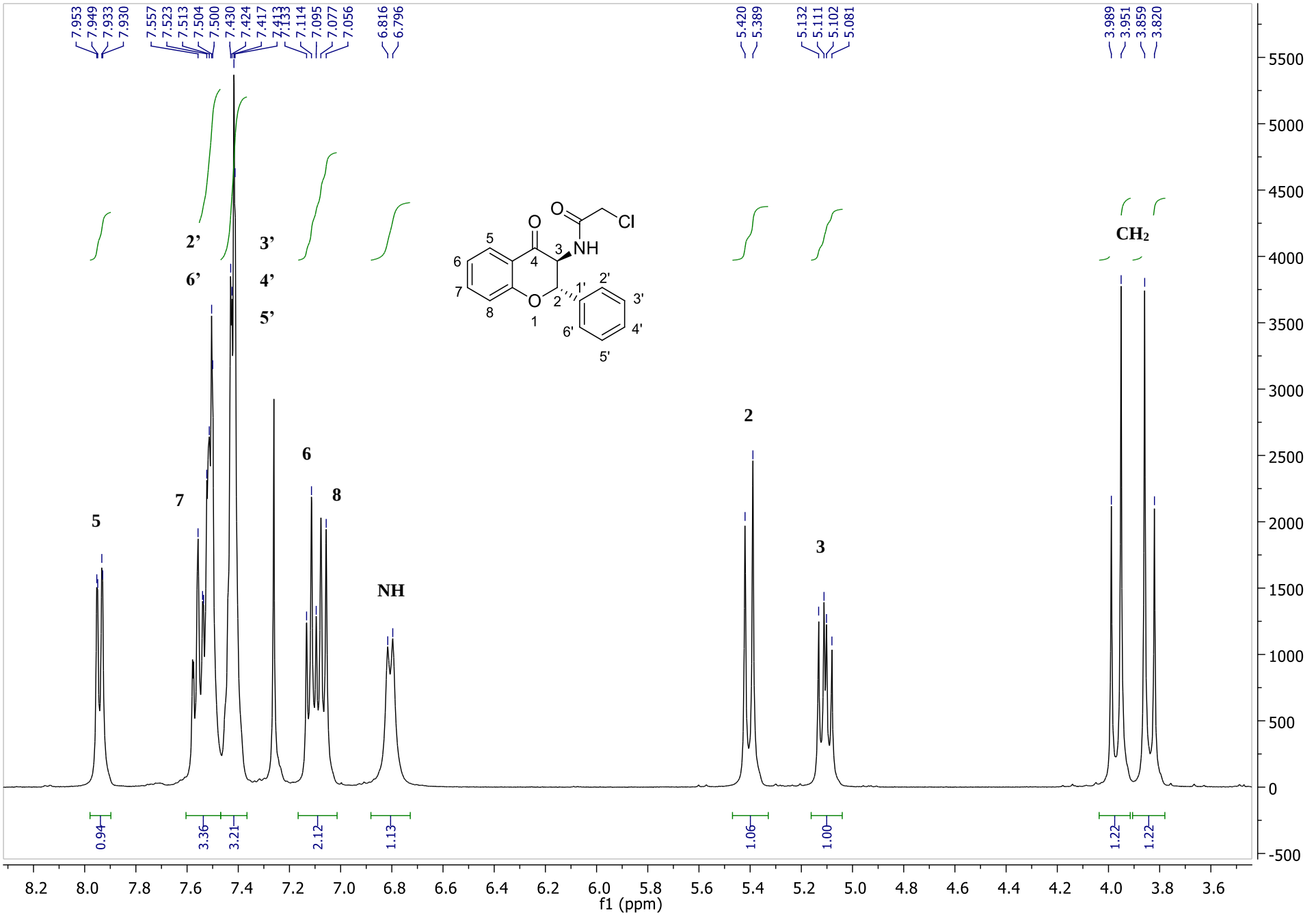


Figure S72. ^{1}H-NMR spectrum of *rac-trans*-**18a** in $CDCl_3$

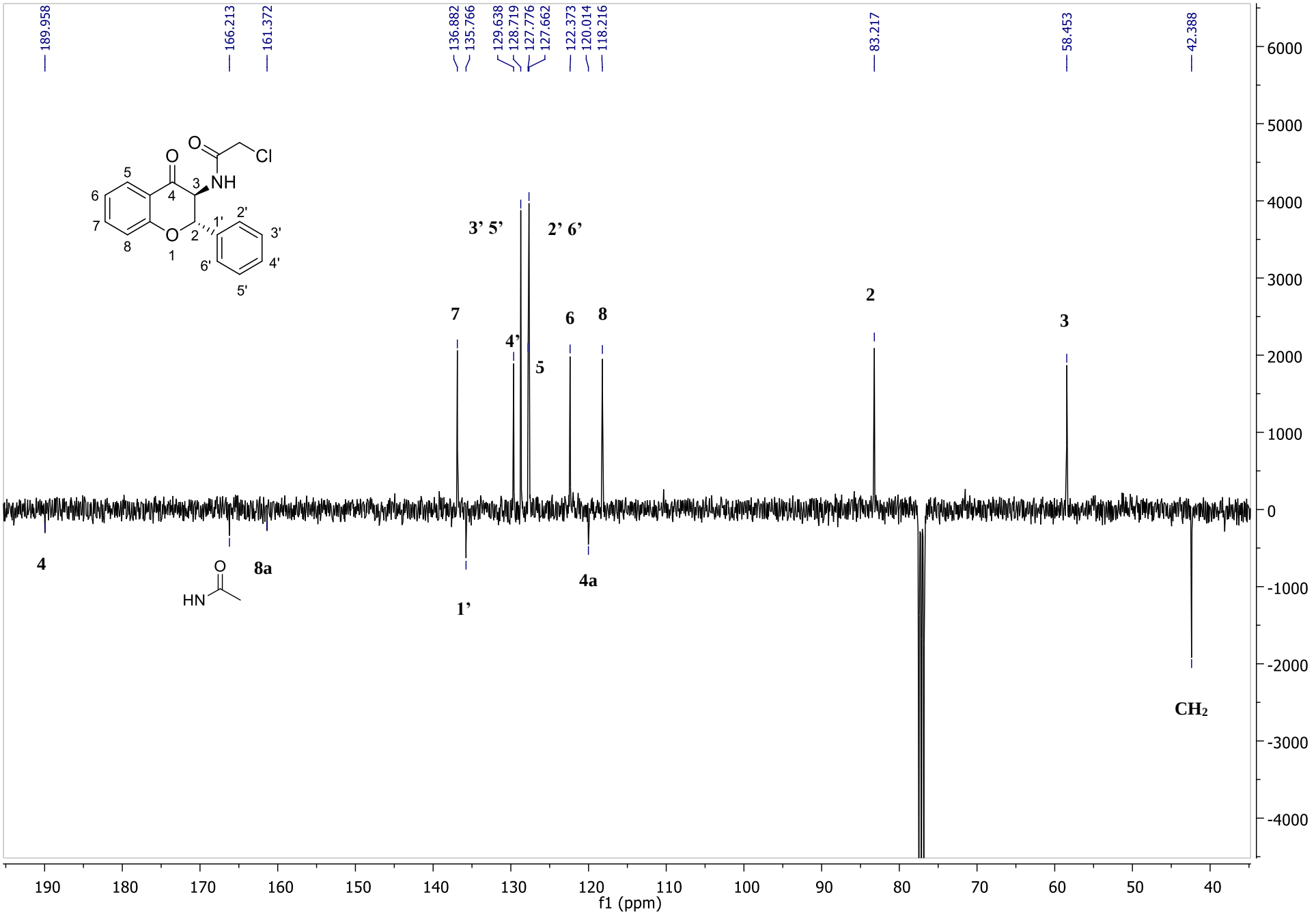


Figure S73. ^{13}C-NMR spectrum of *rac-trans*-**18a** in $CDCl_3$

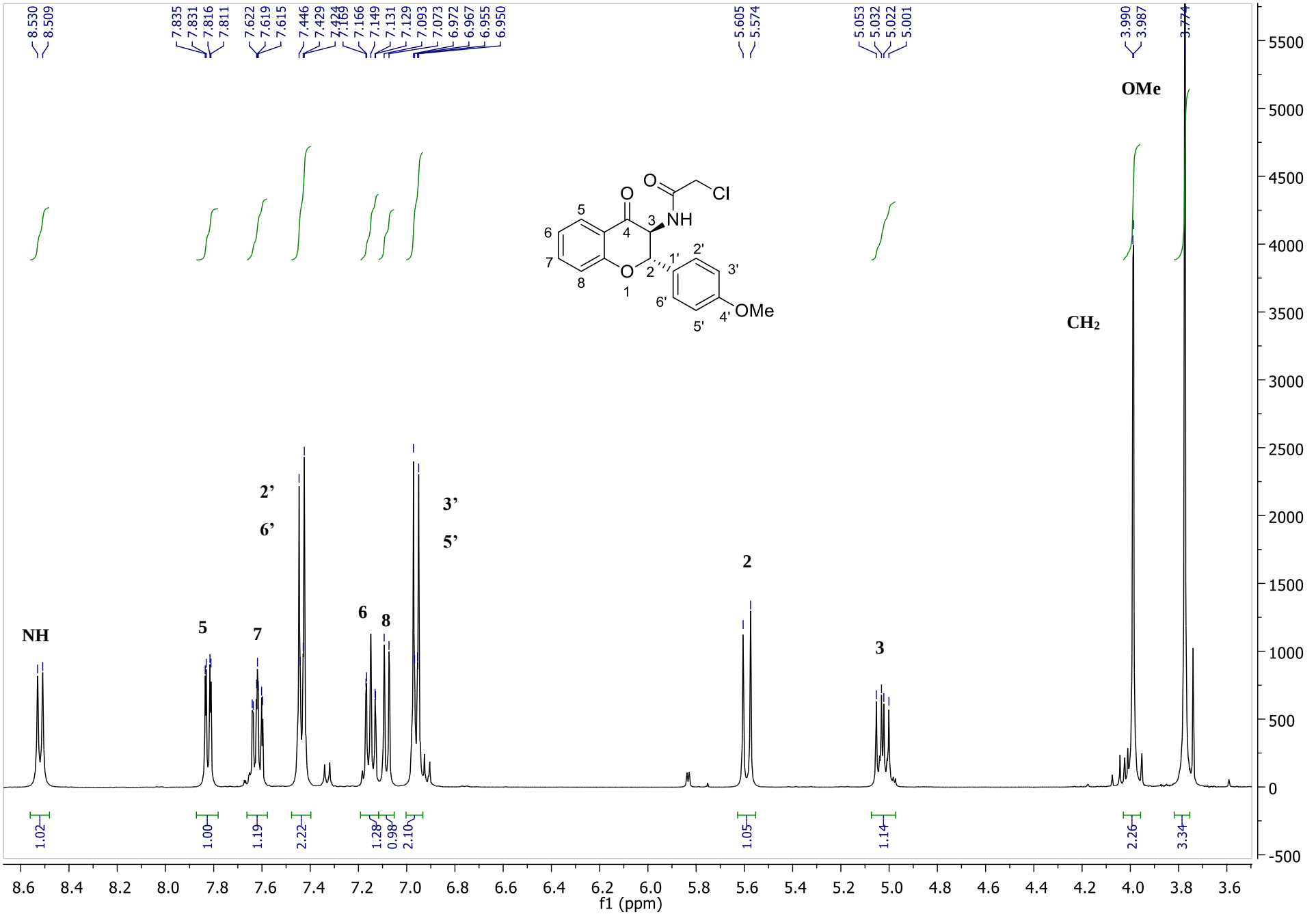


Figure S74. ^{1}H-NMR spectrum of *rac-trans*-**18b** in DMSO-d_6

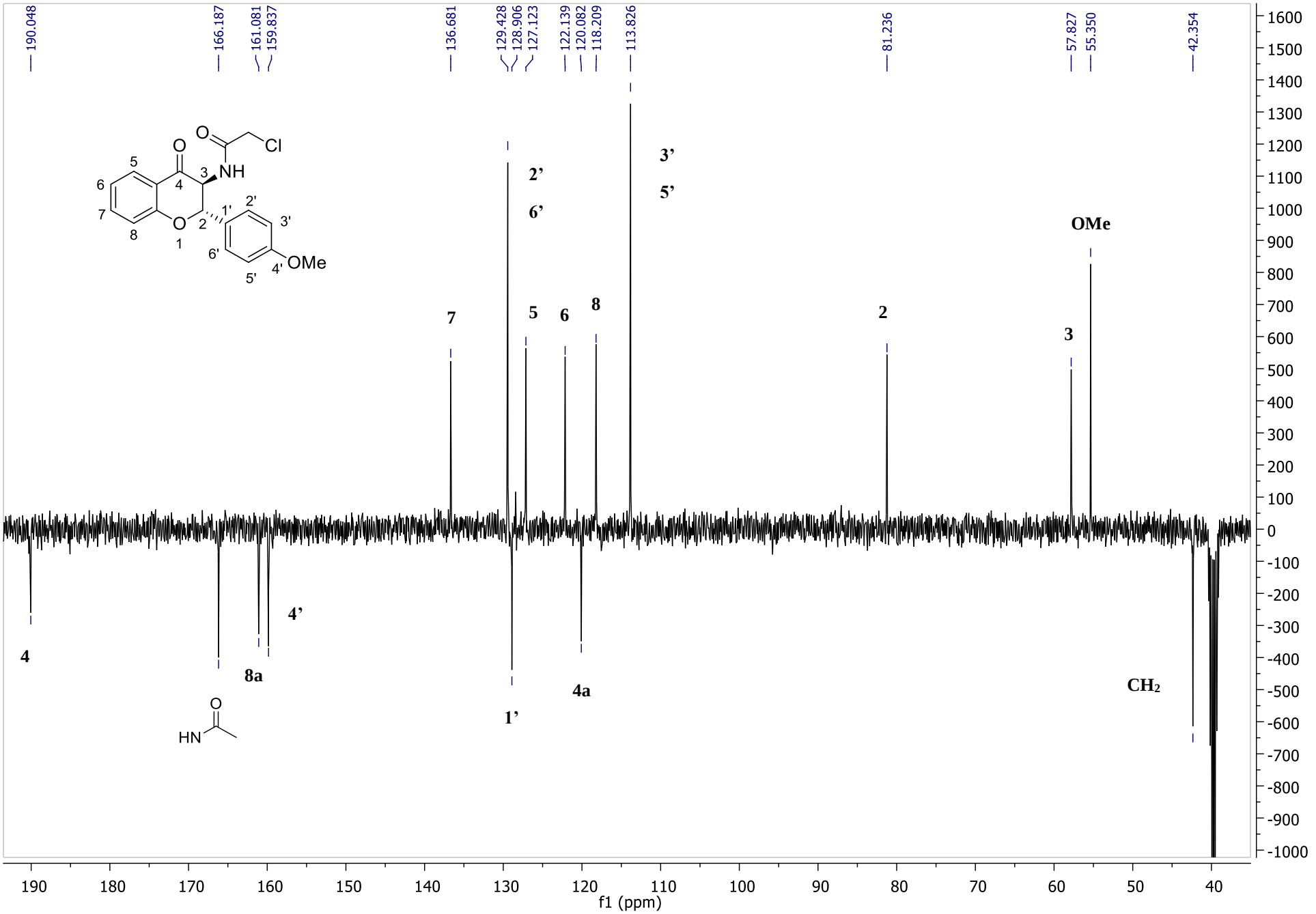


Figure S75. ^{13}C-NMR spectrum of *rac-trans*-**18b** in DMSO-d_6

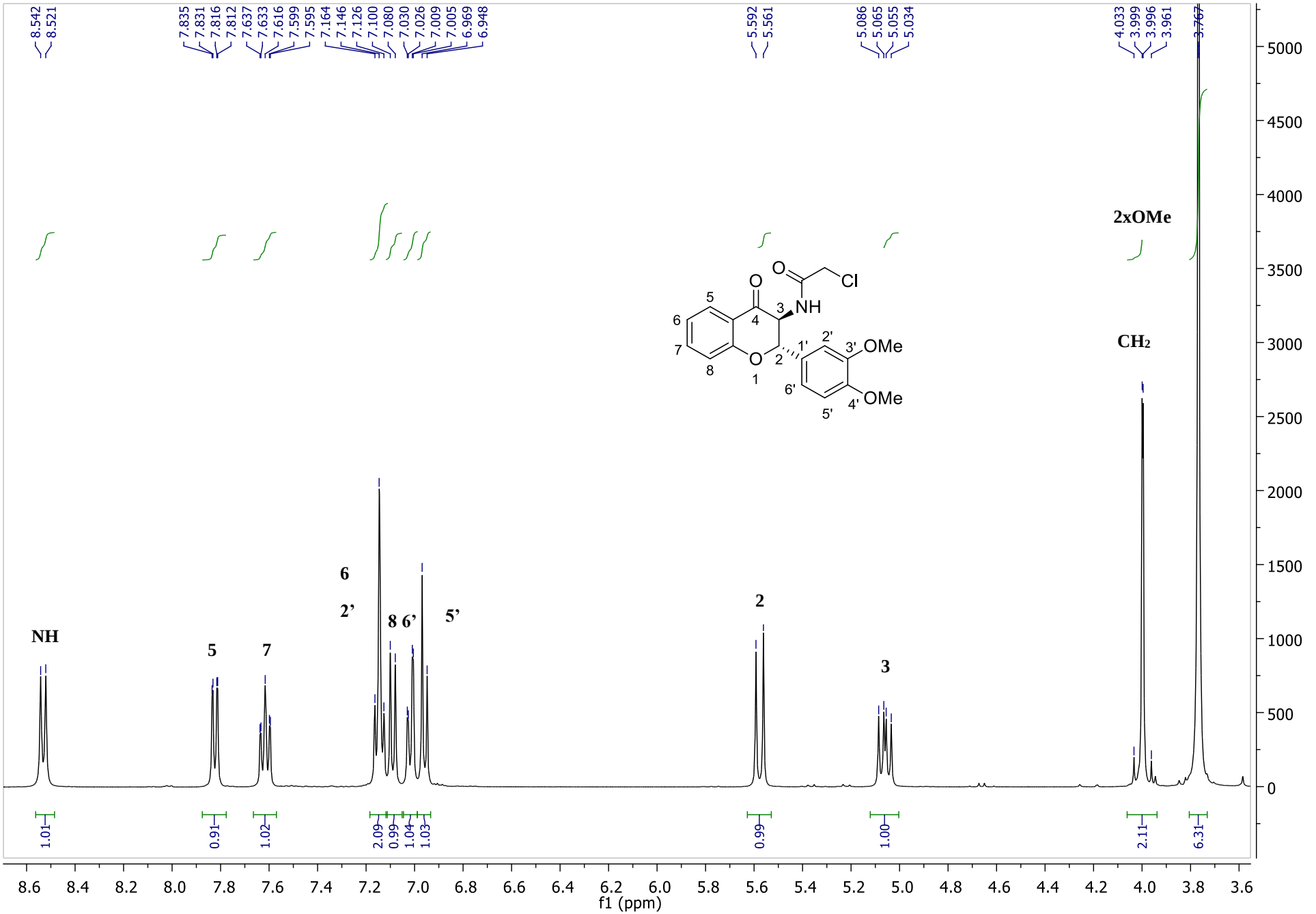


Figure S76. ^{1}H-NMR spectrum of *rac-trans*-**18c** in DMSO-d_6

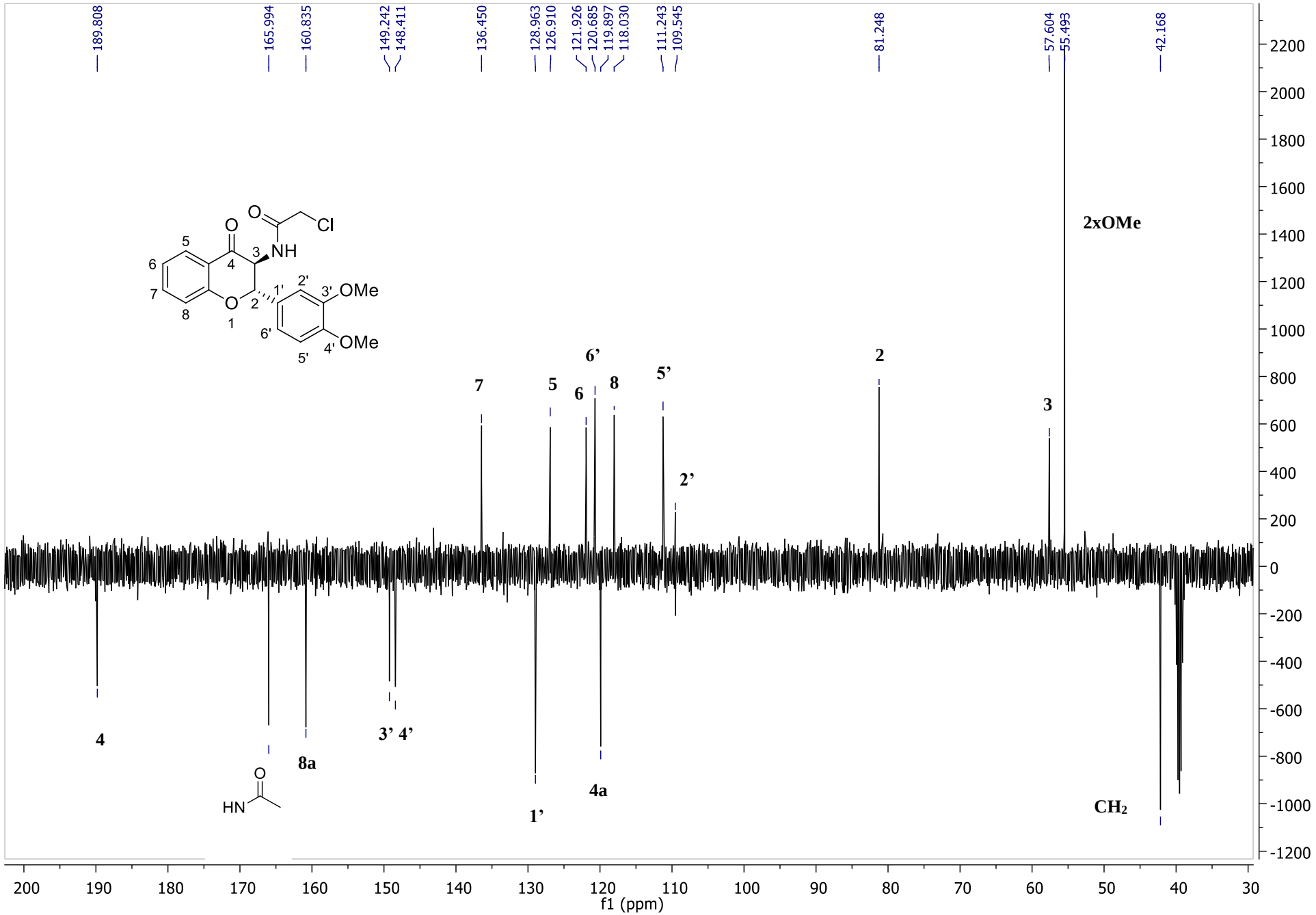


Figure S77. ^{13}C-NMR spectrum of *rac-trans*-**18c** in DMSO-d_6

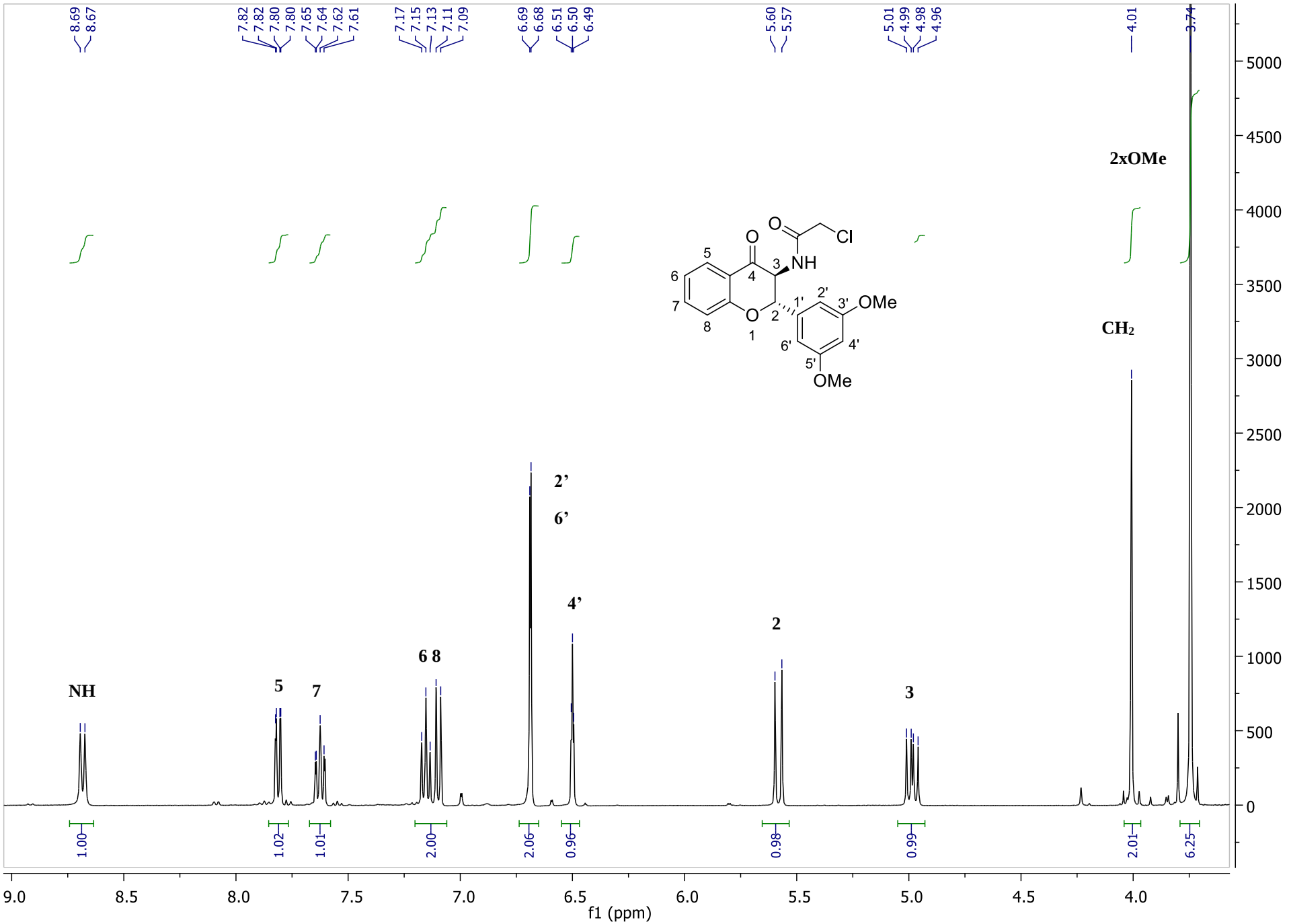


Figure S78. ^{1}H-NMR spectrum of *rac-trans*-**18d** in DMSO-d_6

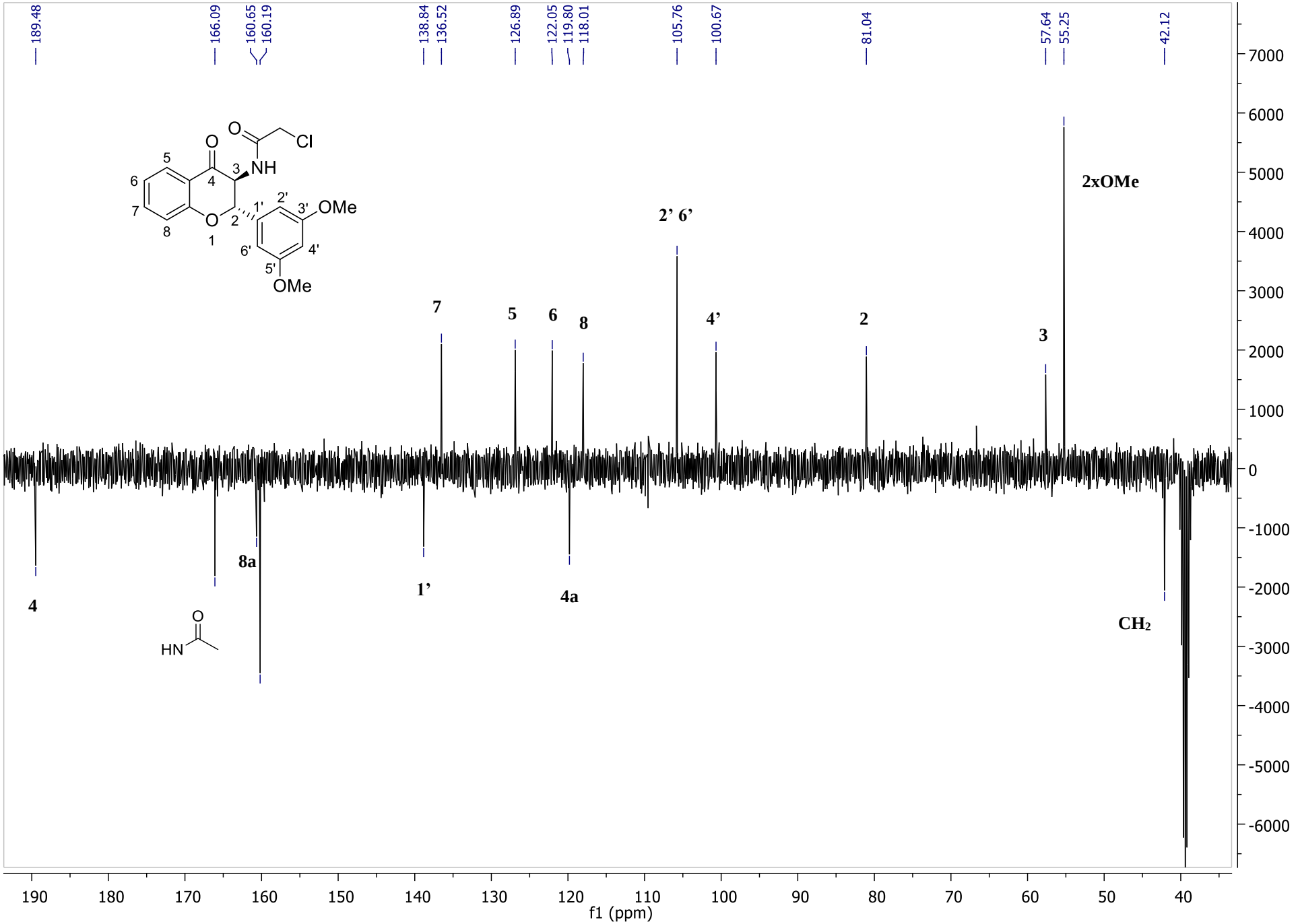


Figure S79. ^{13}C-NMR spectrum of *rac-trans*-**18d** in DMSO-d_6

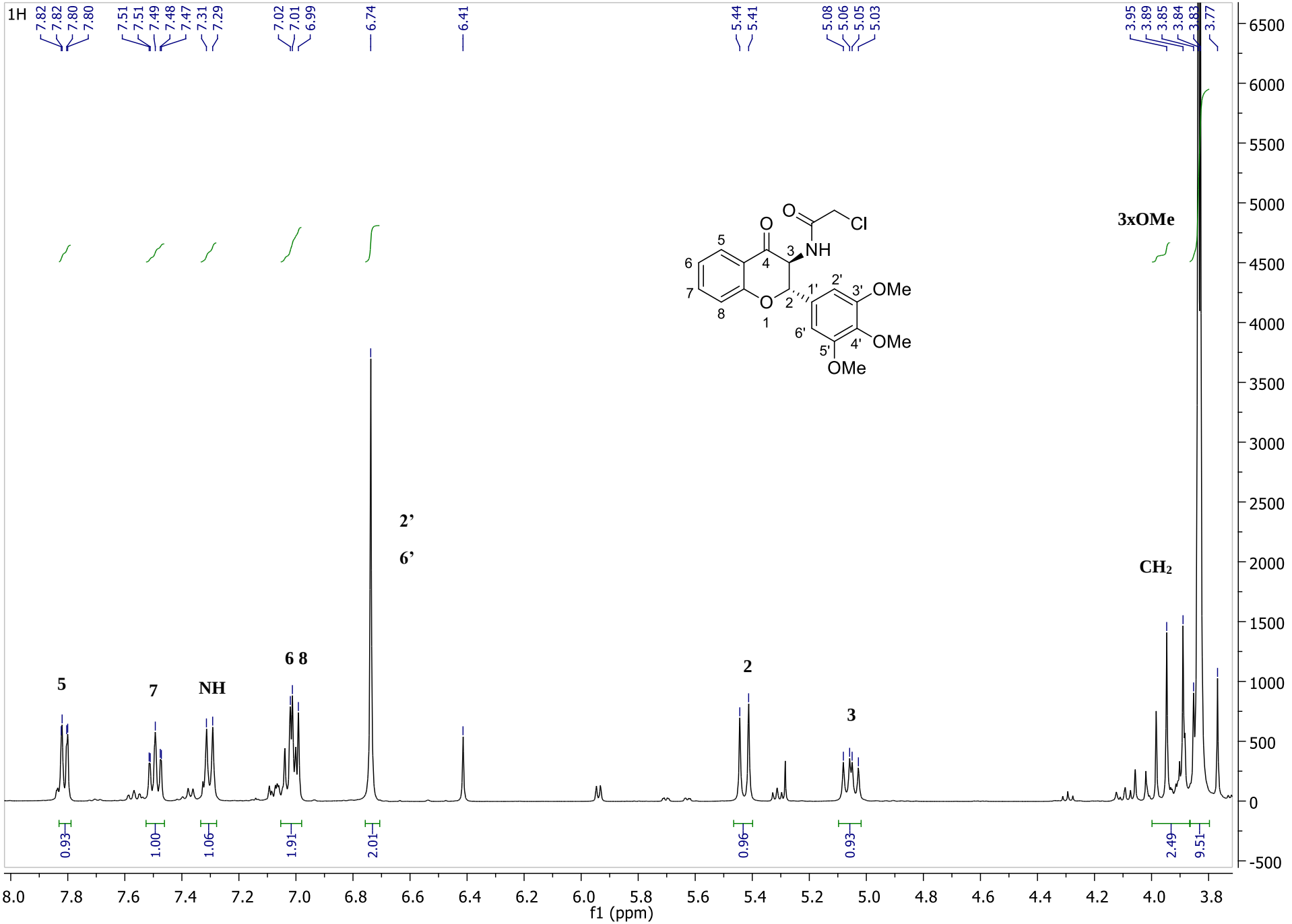


Figure S80. ^{1}H-NMR spectrum of *rac-trans*-**18e** in $CDCl_3$

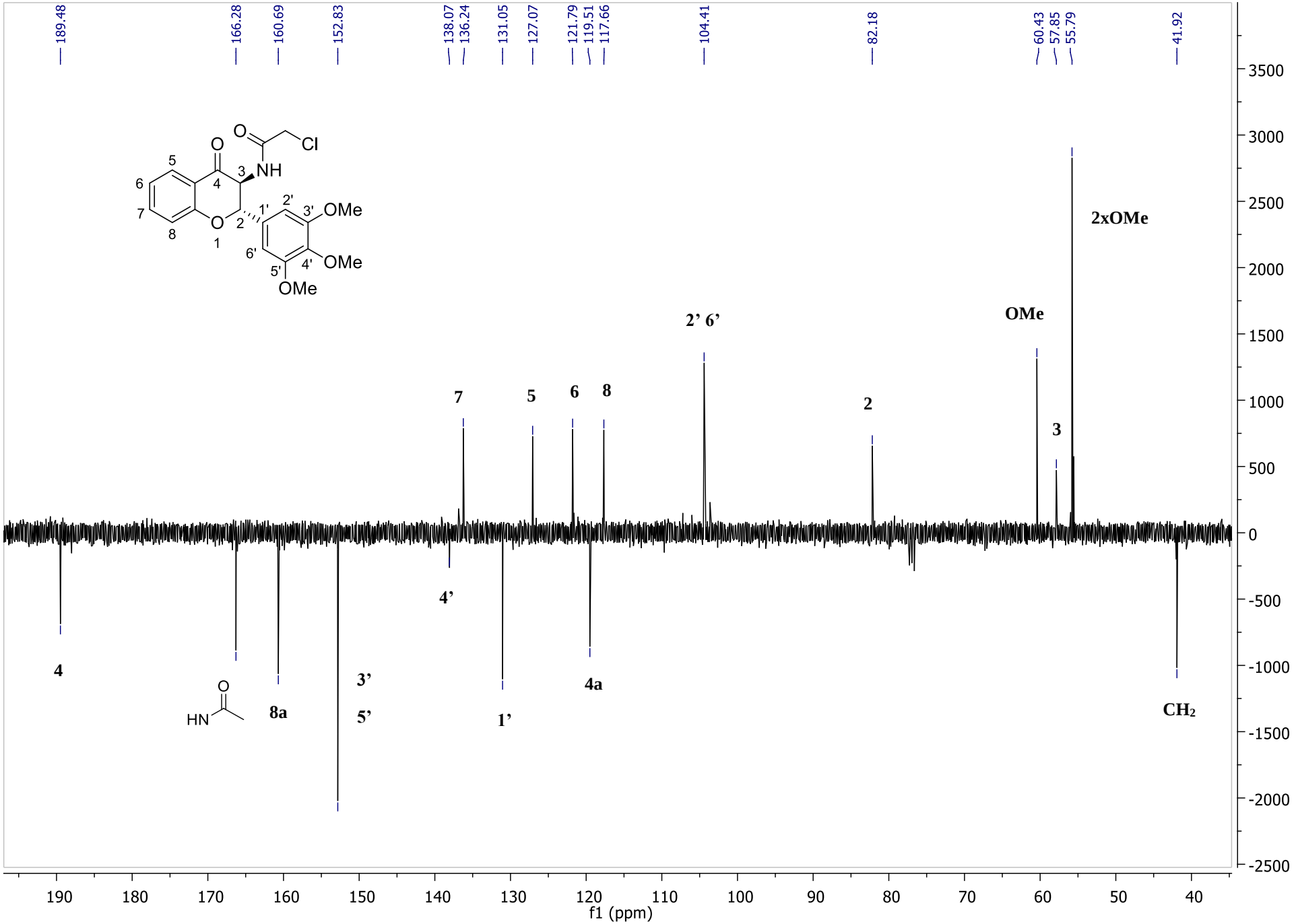


Figure S81. ^{13}C-NMR spectrum of *rac-trans*-**18e** in $CDCl_3$

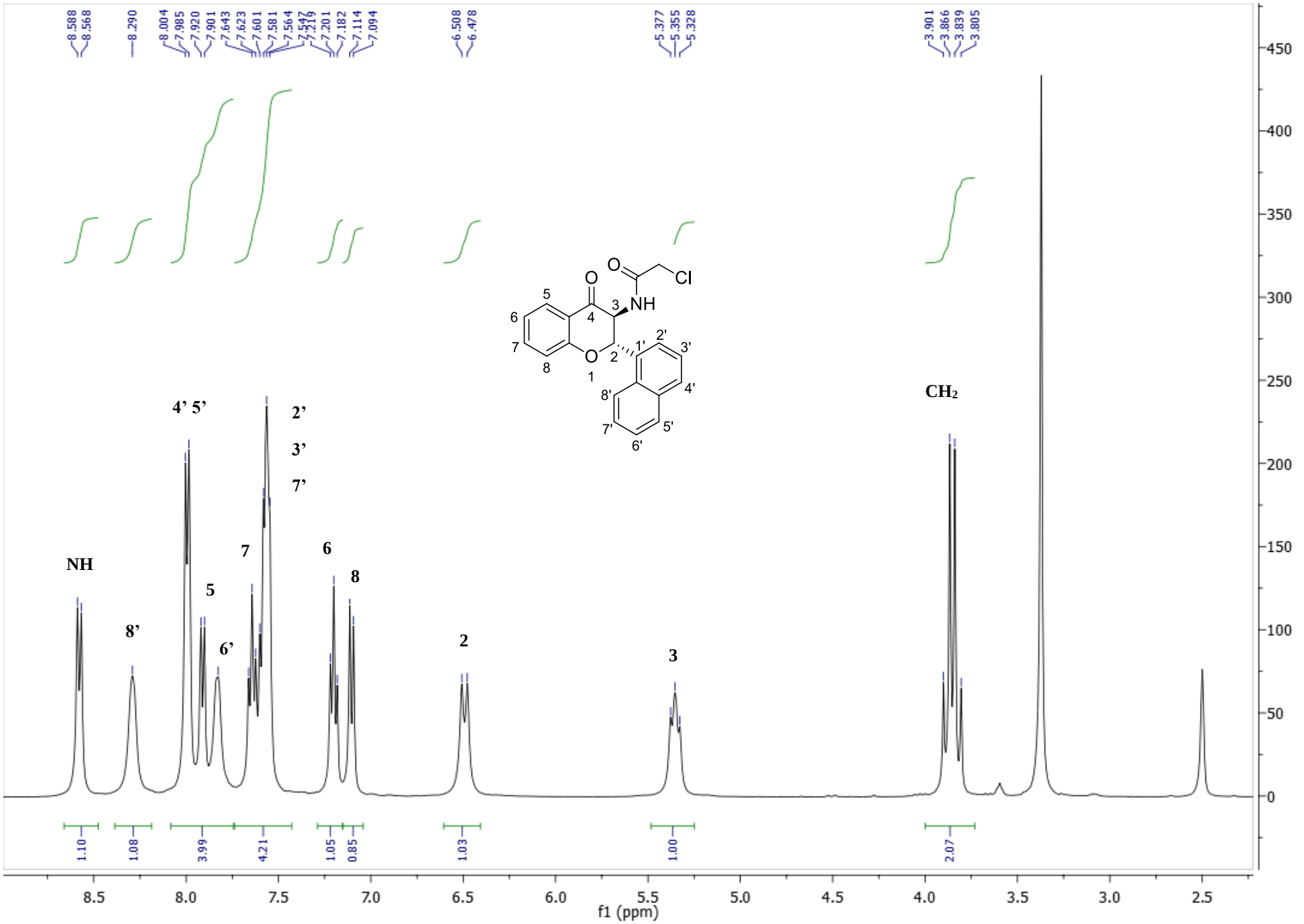


Figure S82. ^{1}H-NMR spectrum of *rac-trans*-**18f** in DMSO-d_6

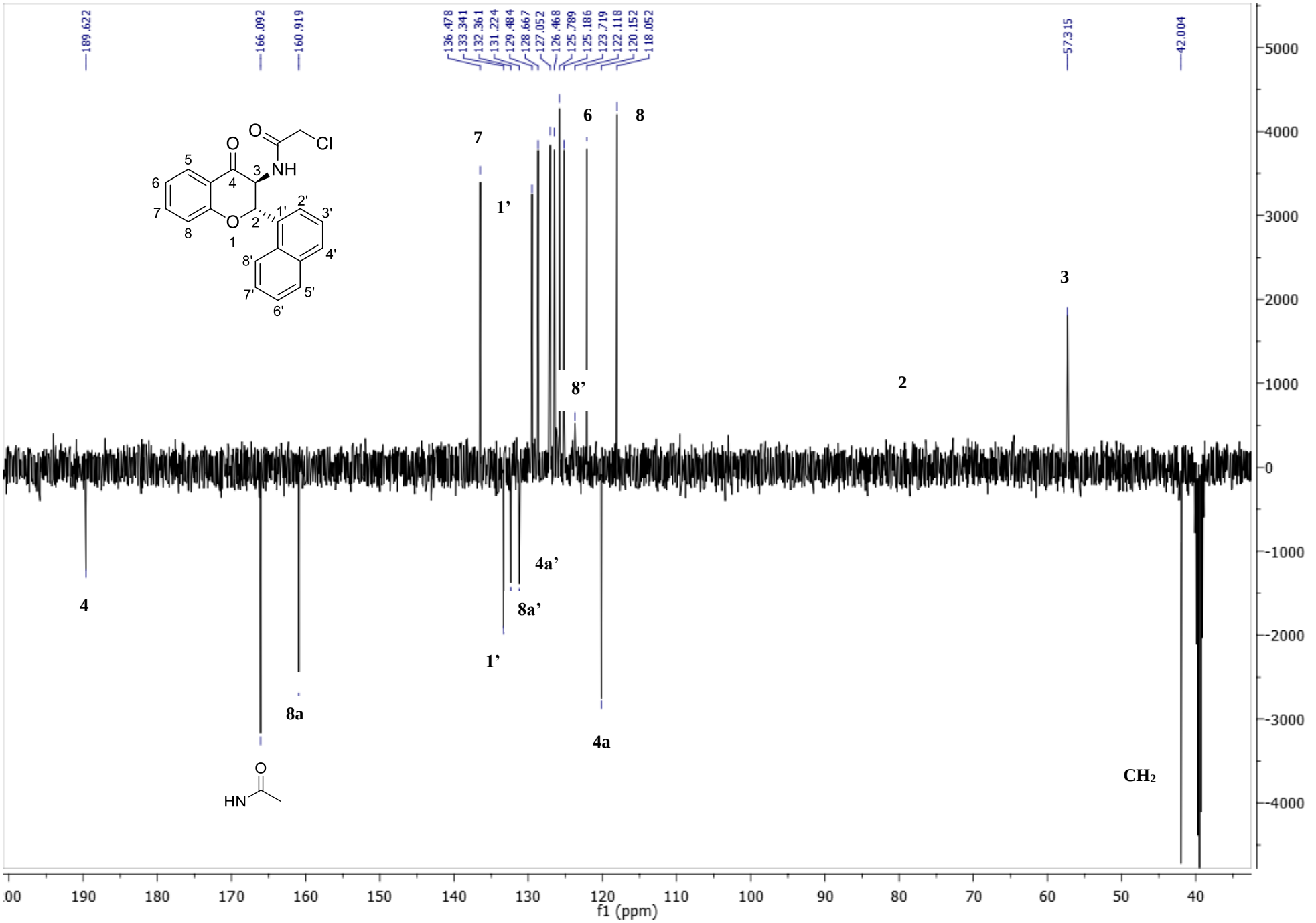


Figure S83. ^{13}C-NMR spectrum of *rac-trans*-**18f** in $CDCl_3$

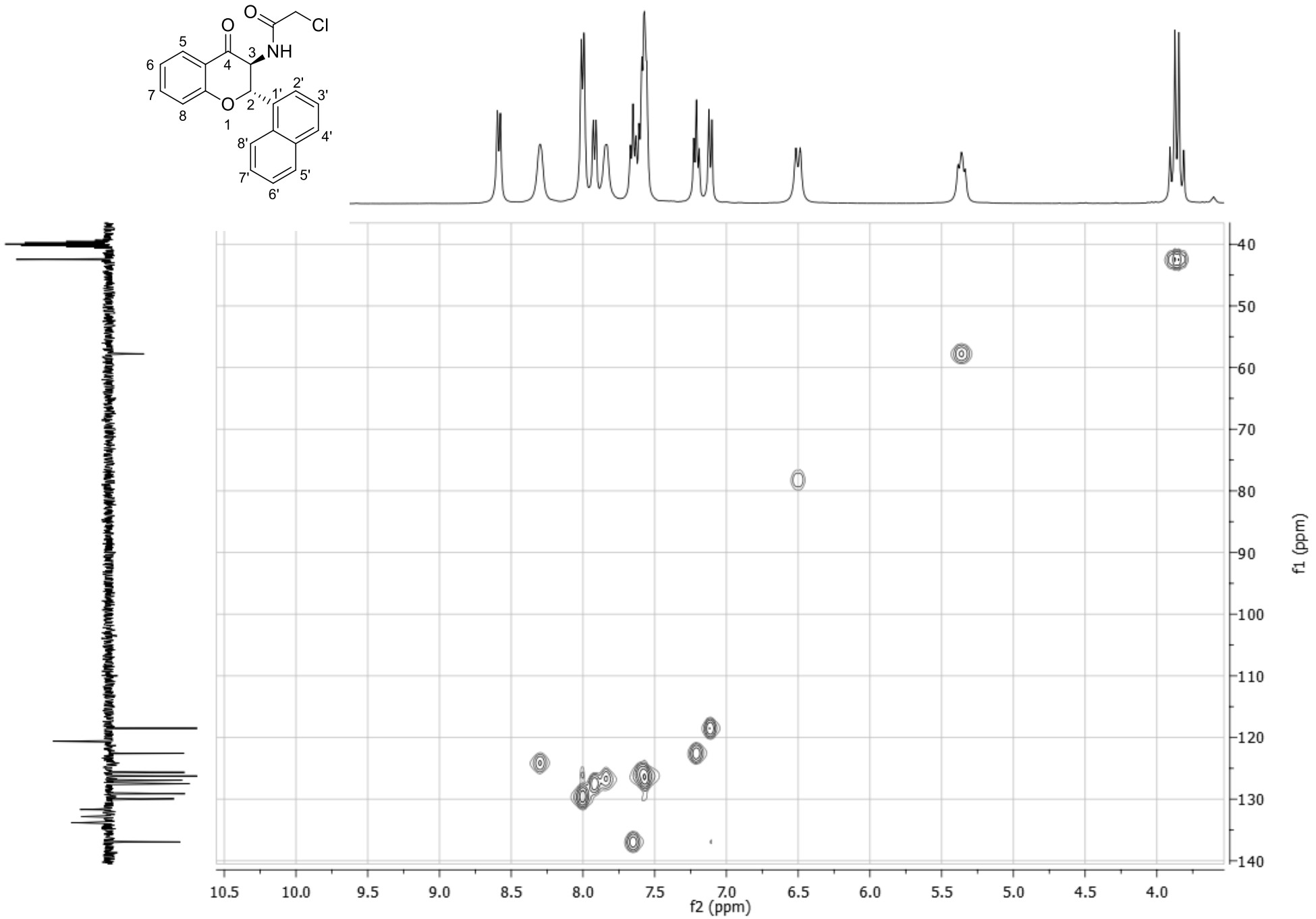


Figure S84. HSQC-spectrum of *rac*-*trans*-**18f** in DMSO-d_6

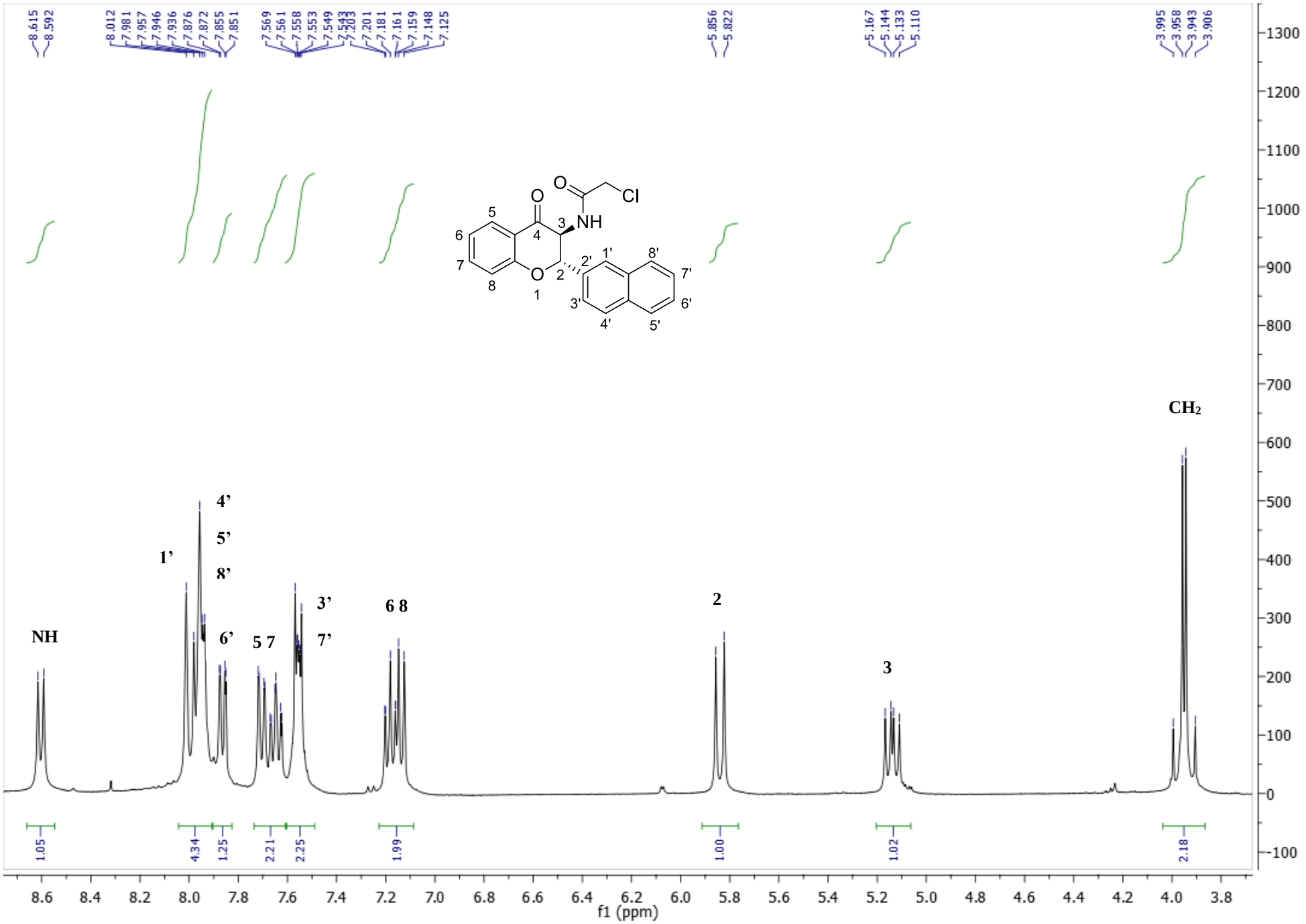


Figure S85. ^{1}H-NMR spectrum of *rac-trans*-**18g** in DMSO-d_6

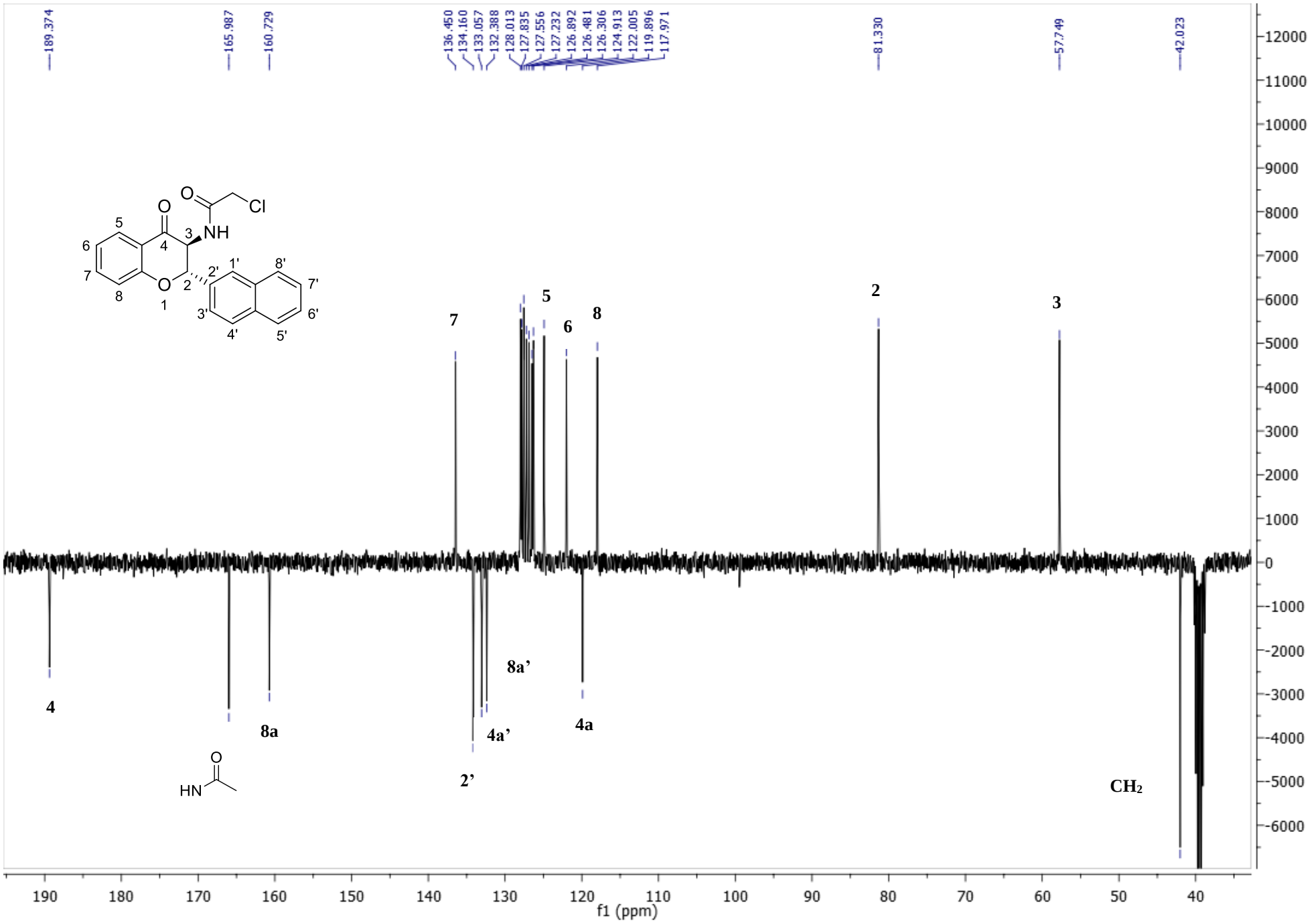


Figure S86. ^{13}C-NMR spectrum of *rac-trans*-**18g** in $CDCl_3$

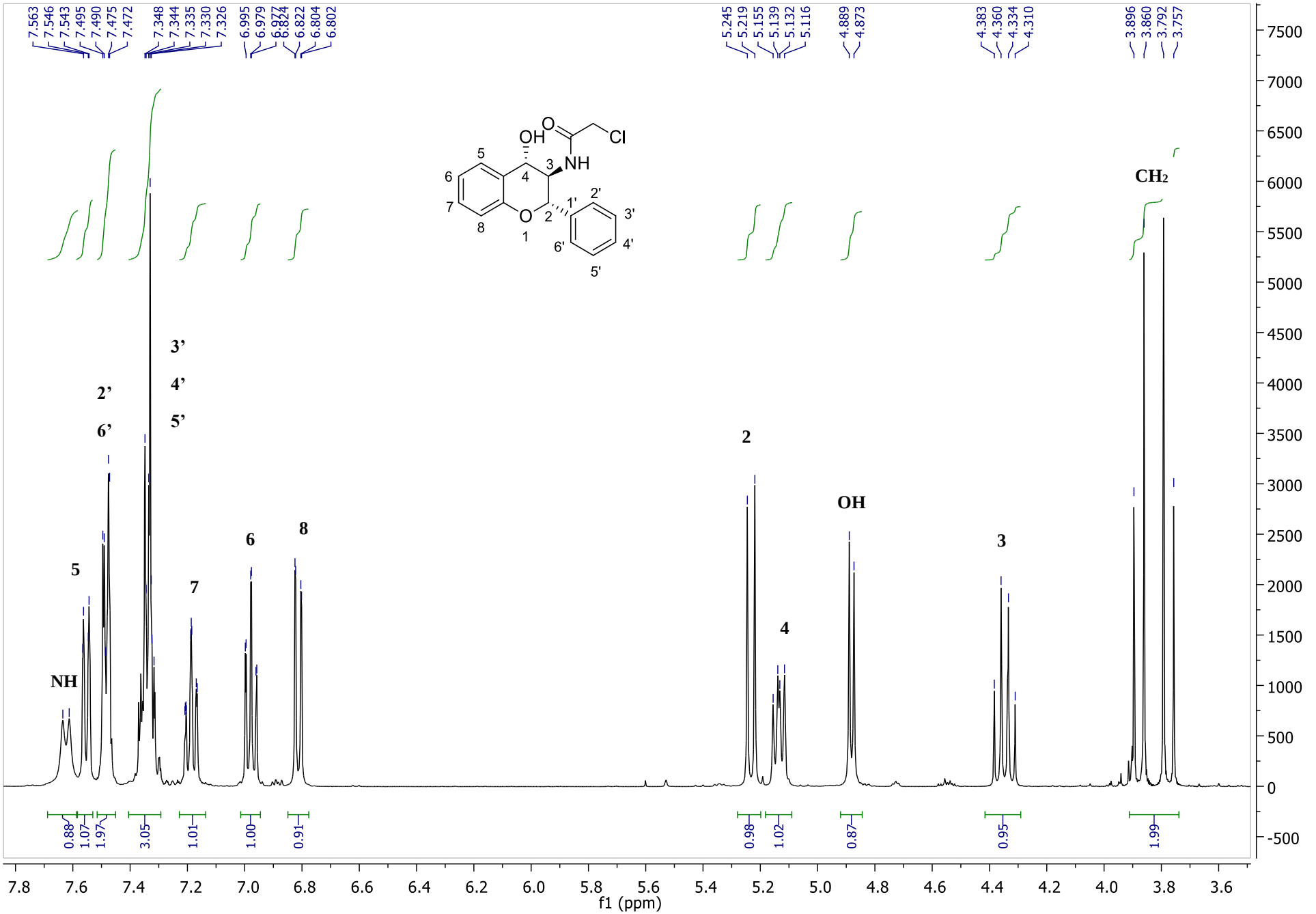


Figure S87. ^{1}H-NMR spectrum of *rac*-**19a** in Acetone-d_6

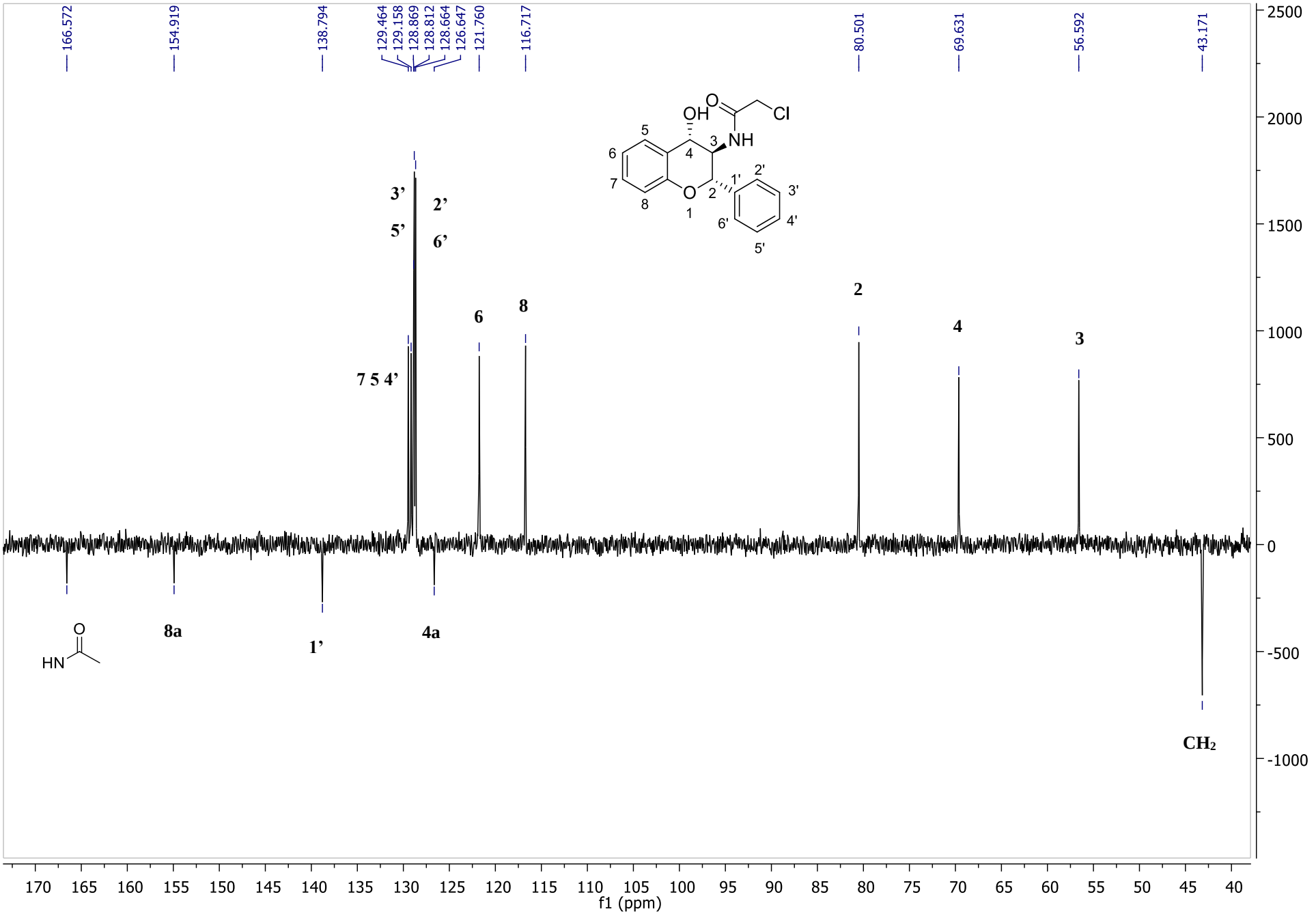


Figure S88. ^{13}C-NMR spectrum of *rac*-**19a** in Acetone-d_6

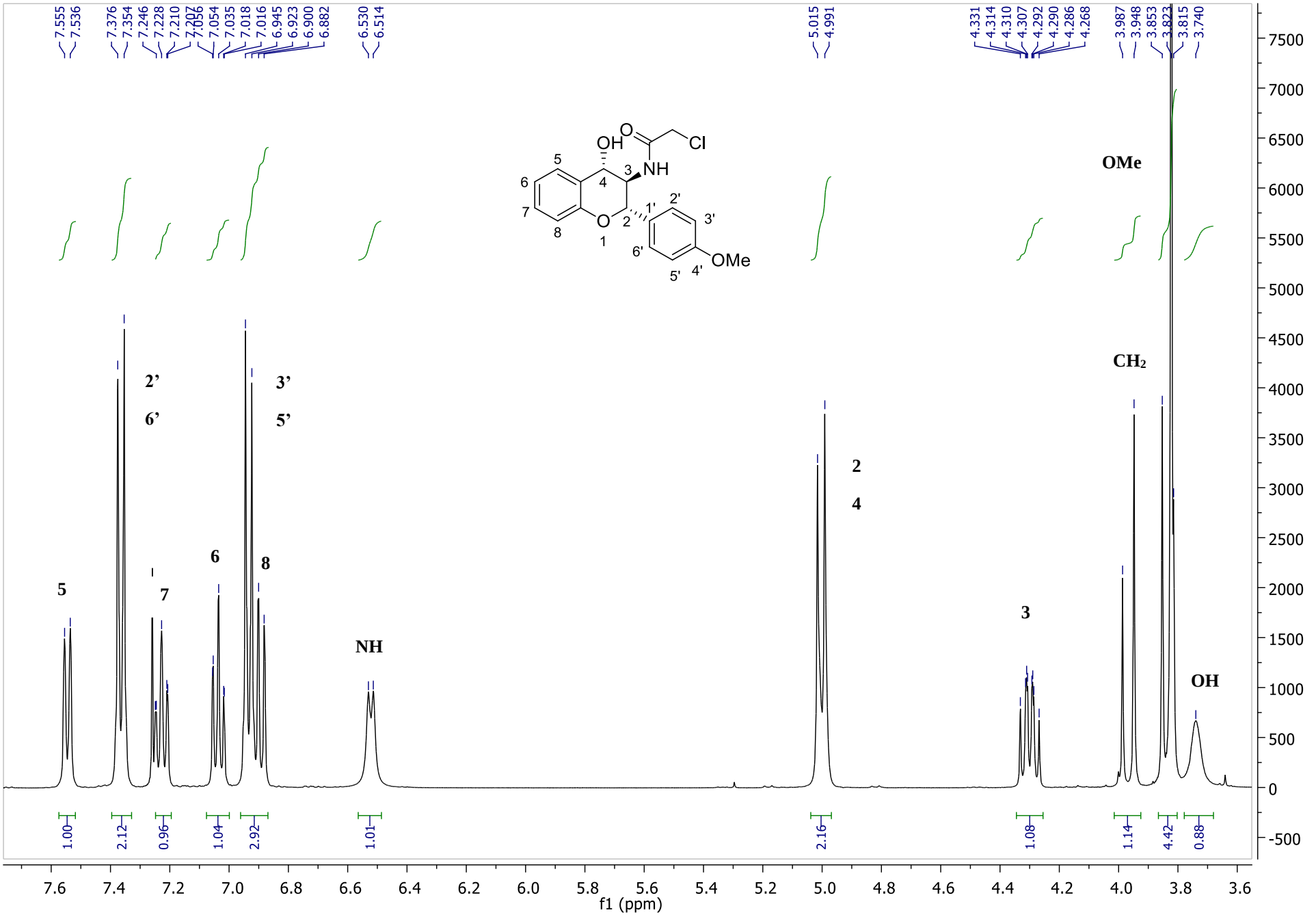


Figure S89. ^{1}H-NMR spectrum of *rac*-**19b** in $CDCl_3$

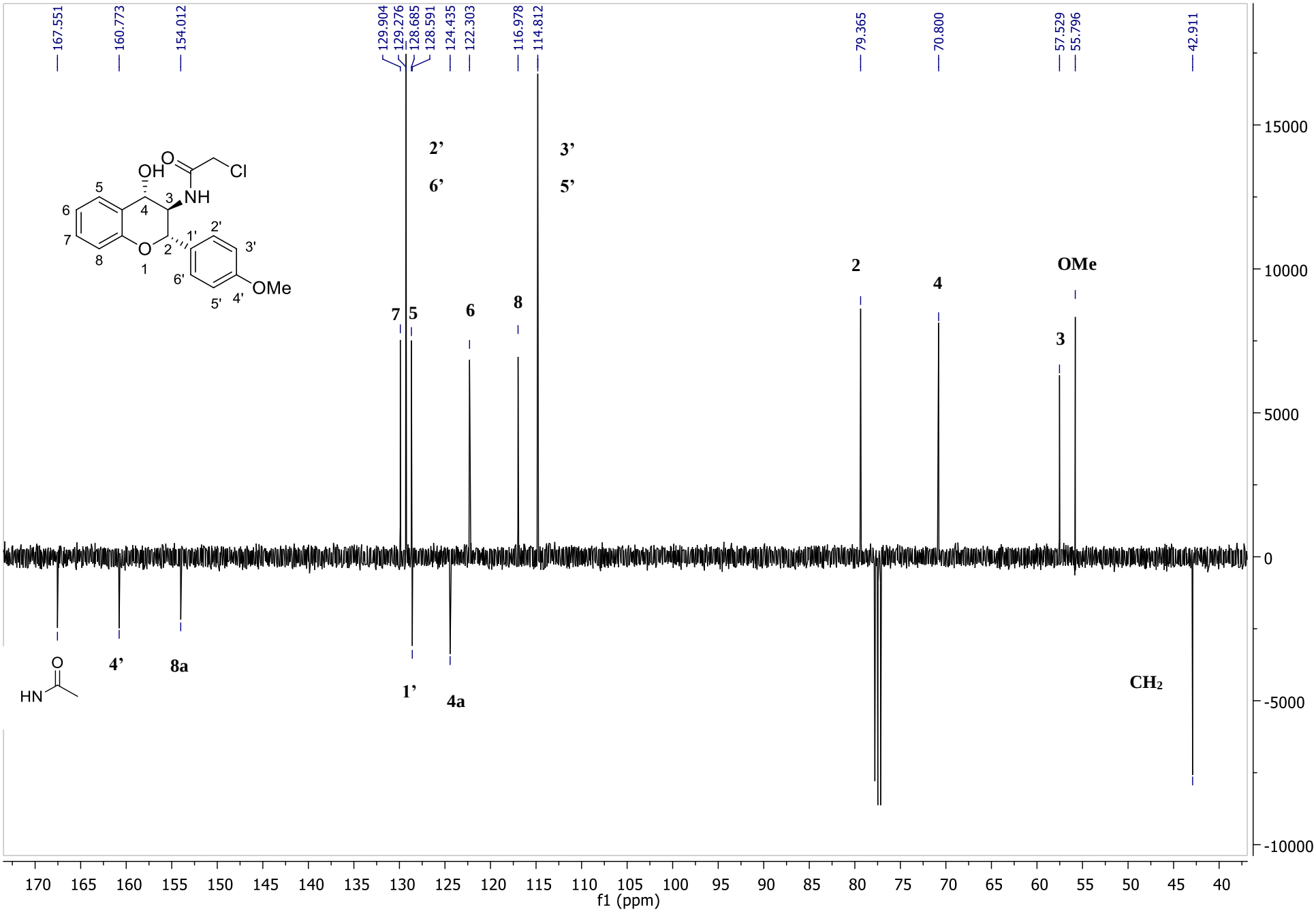


Figure S90. ^{13}C-NMR spectrum of *rac*-**19b** in $CDCl_3$

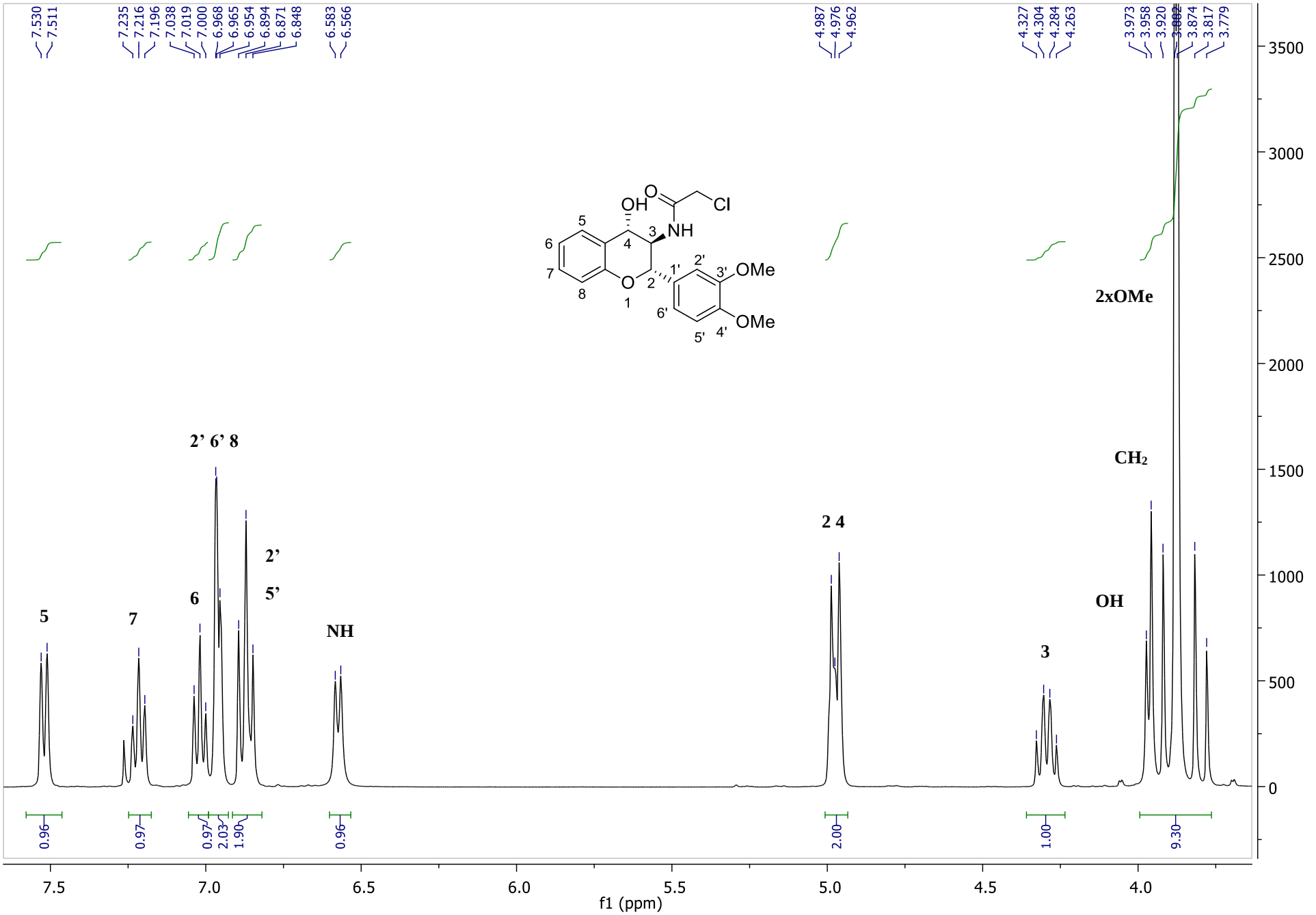


Figure S91. ^{1}H-NMR spectrum of *rac*-**19c** in $CDCl_3$

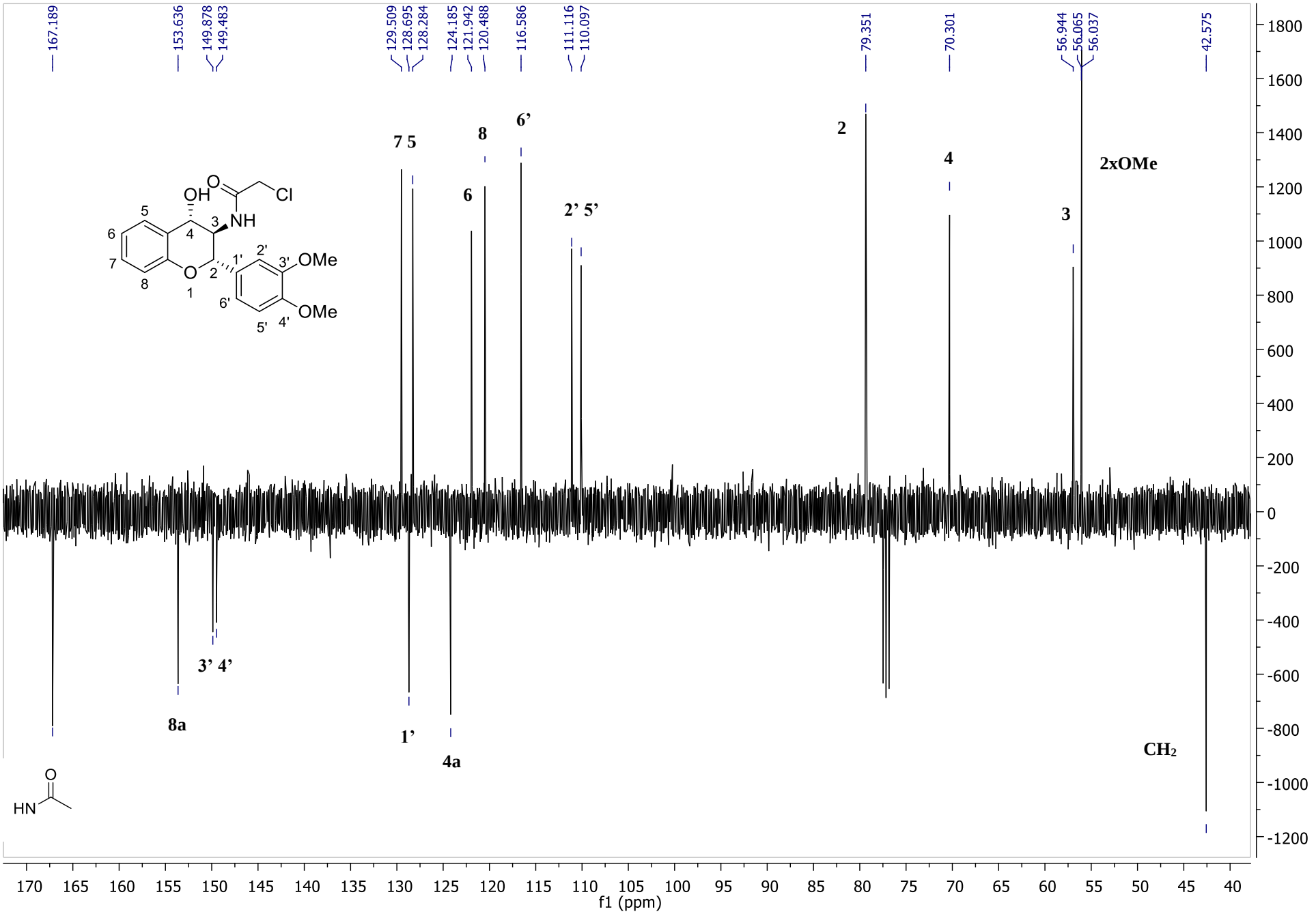


Figure S92. ^{13}C-NMR spectrum of *rac*-**19c** in $CDCl_3$

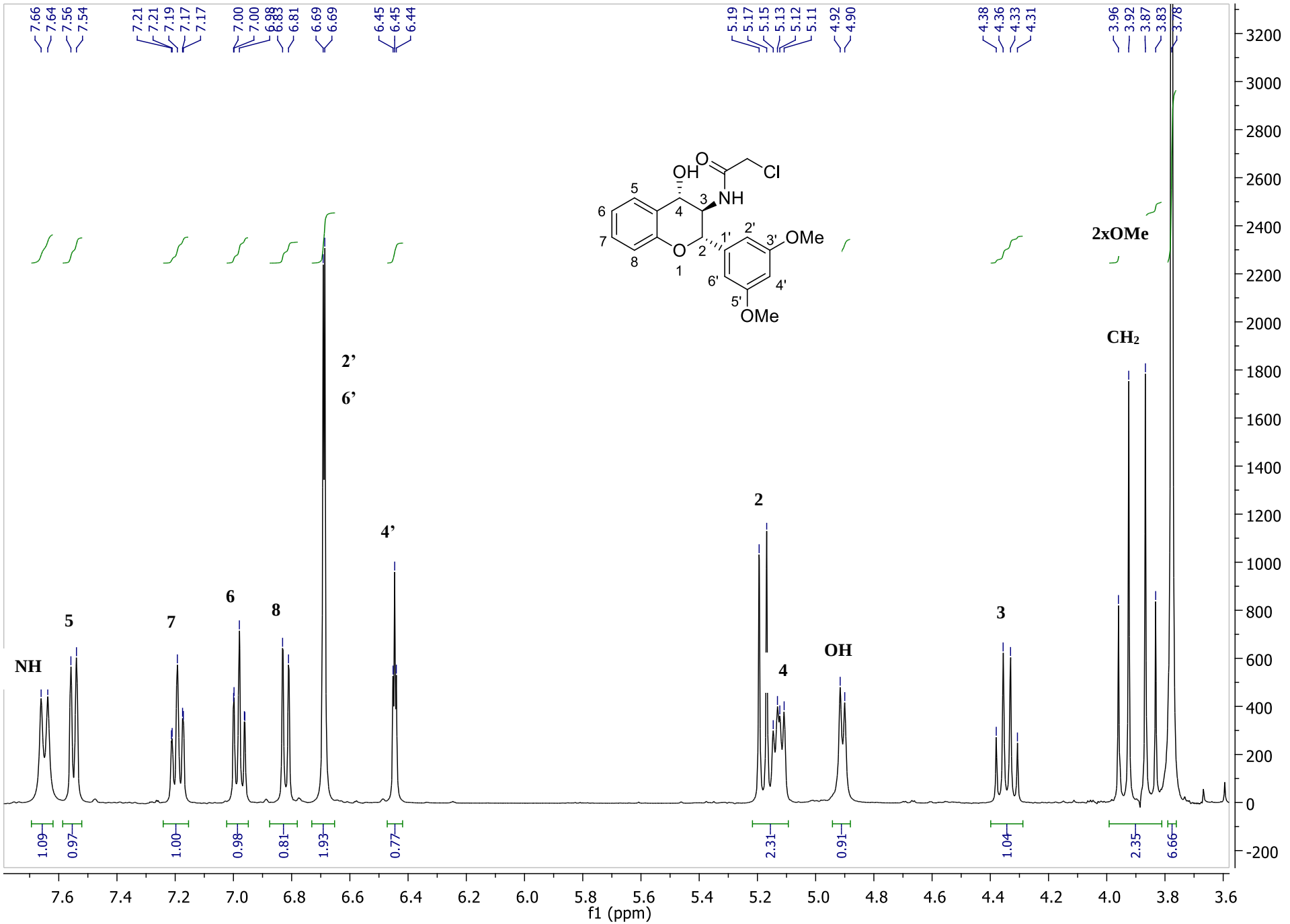


Figure S93. ^{1}H-NMR spectrum of *rac*-**19d** in Acetone-d_6

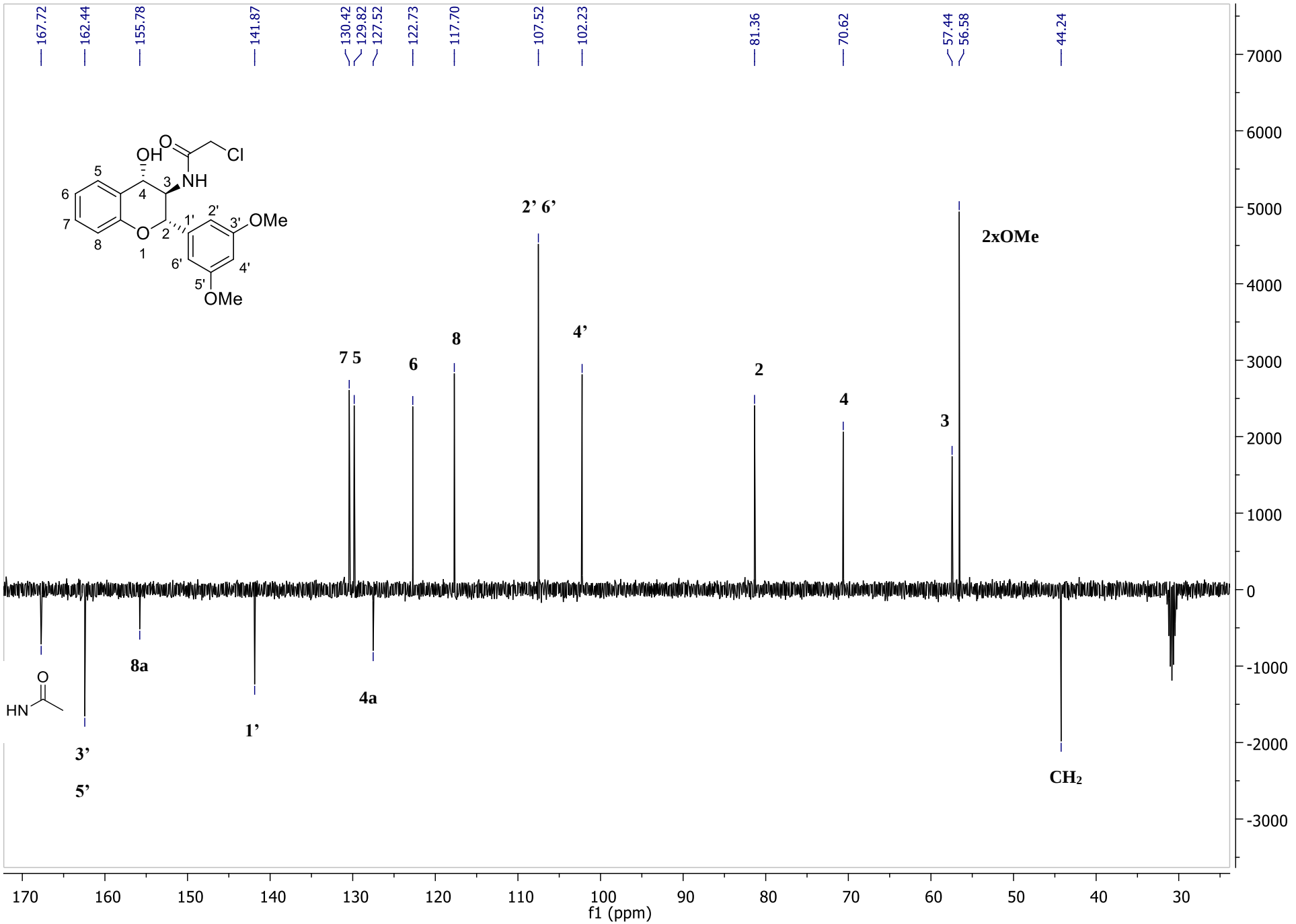


Figure S94. ^{13}C-NMR spectrum of *rac*-**19d** in Acetone-d_6

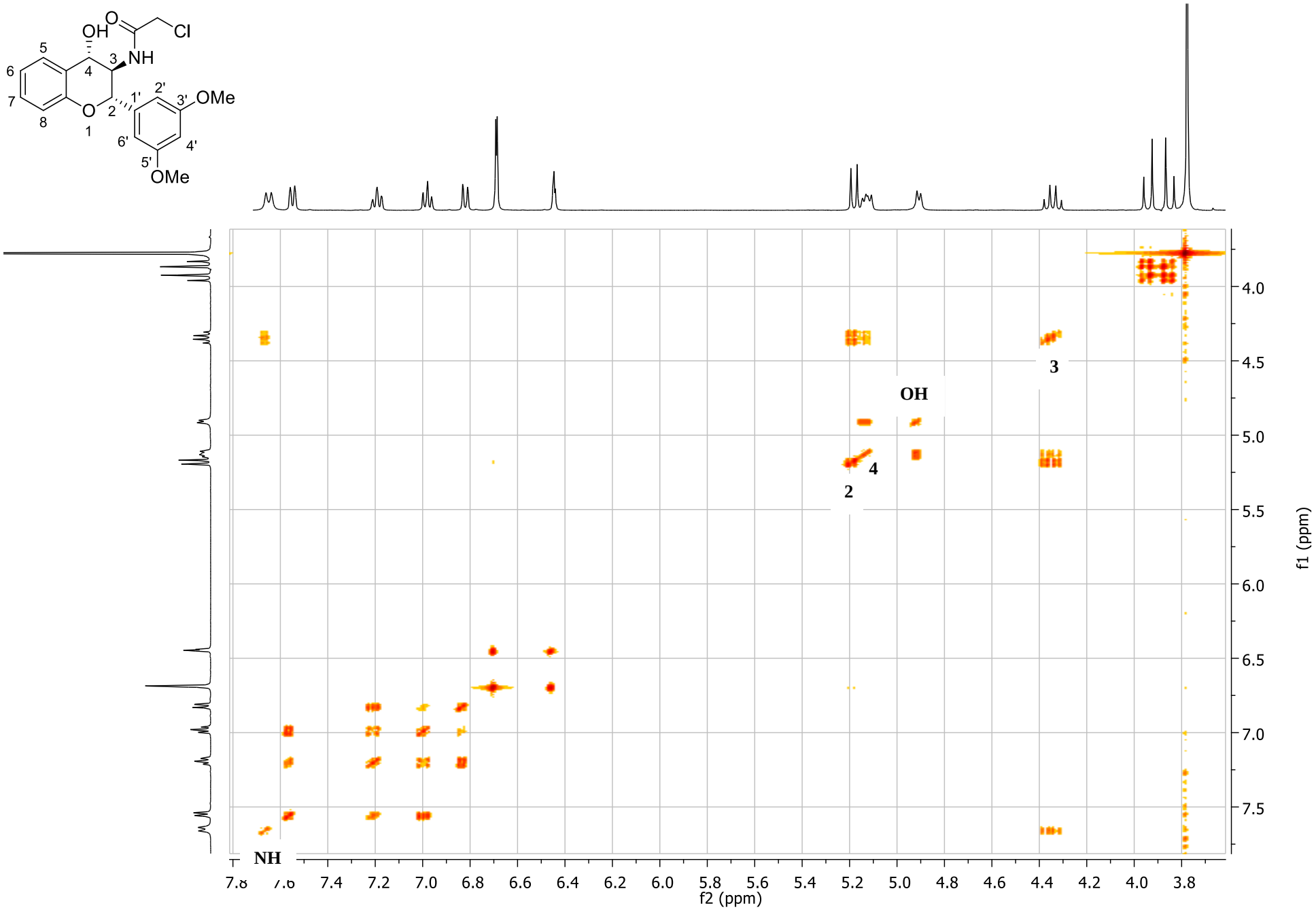


Figure S95. COSY-spectrum of *rac*-**19d** in Acetone-d_6

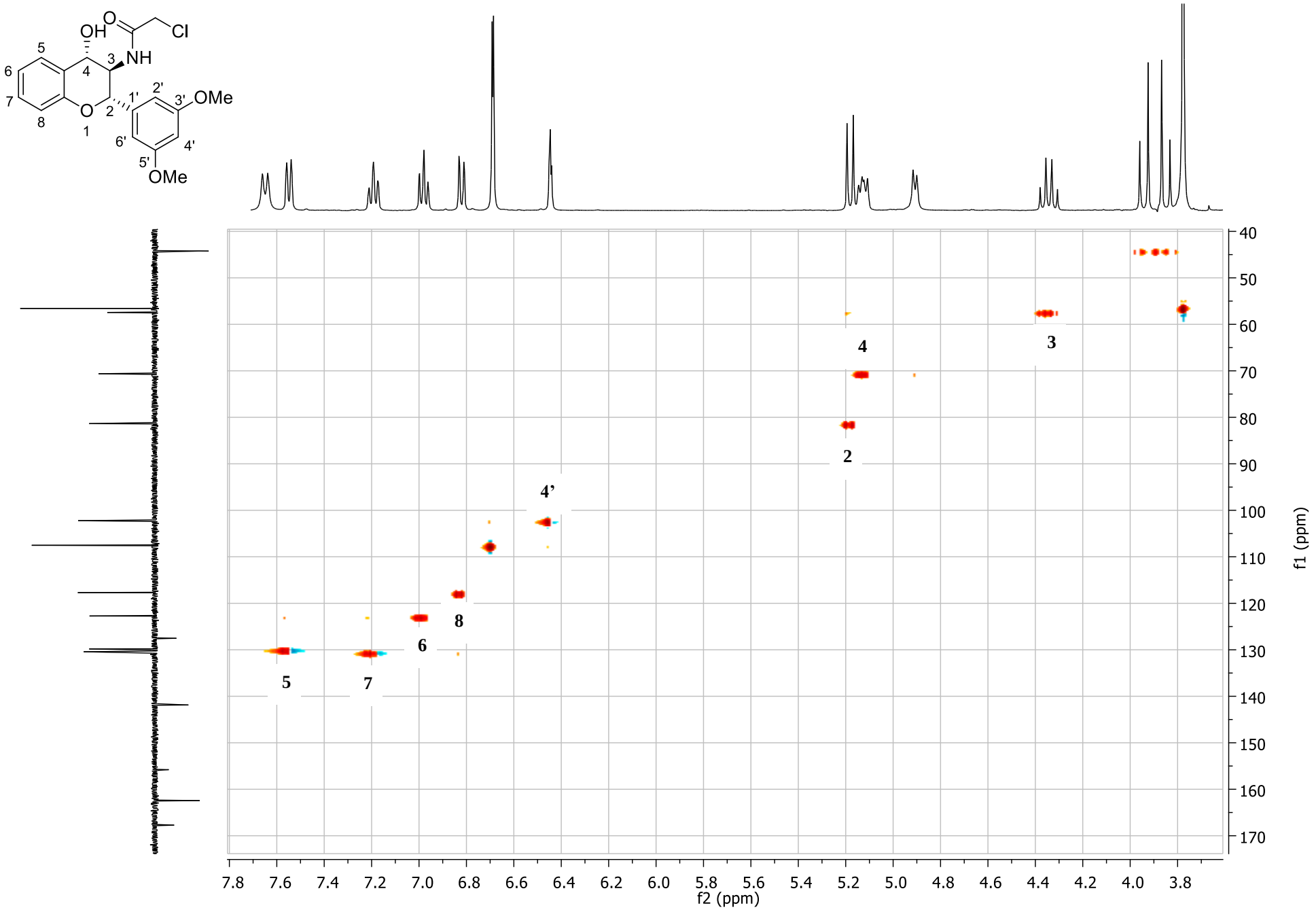


Figure S96. HSQC-spectrum of *rac*-**19d** in Acetone-d_6

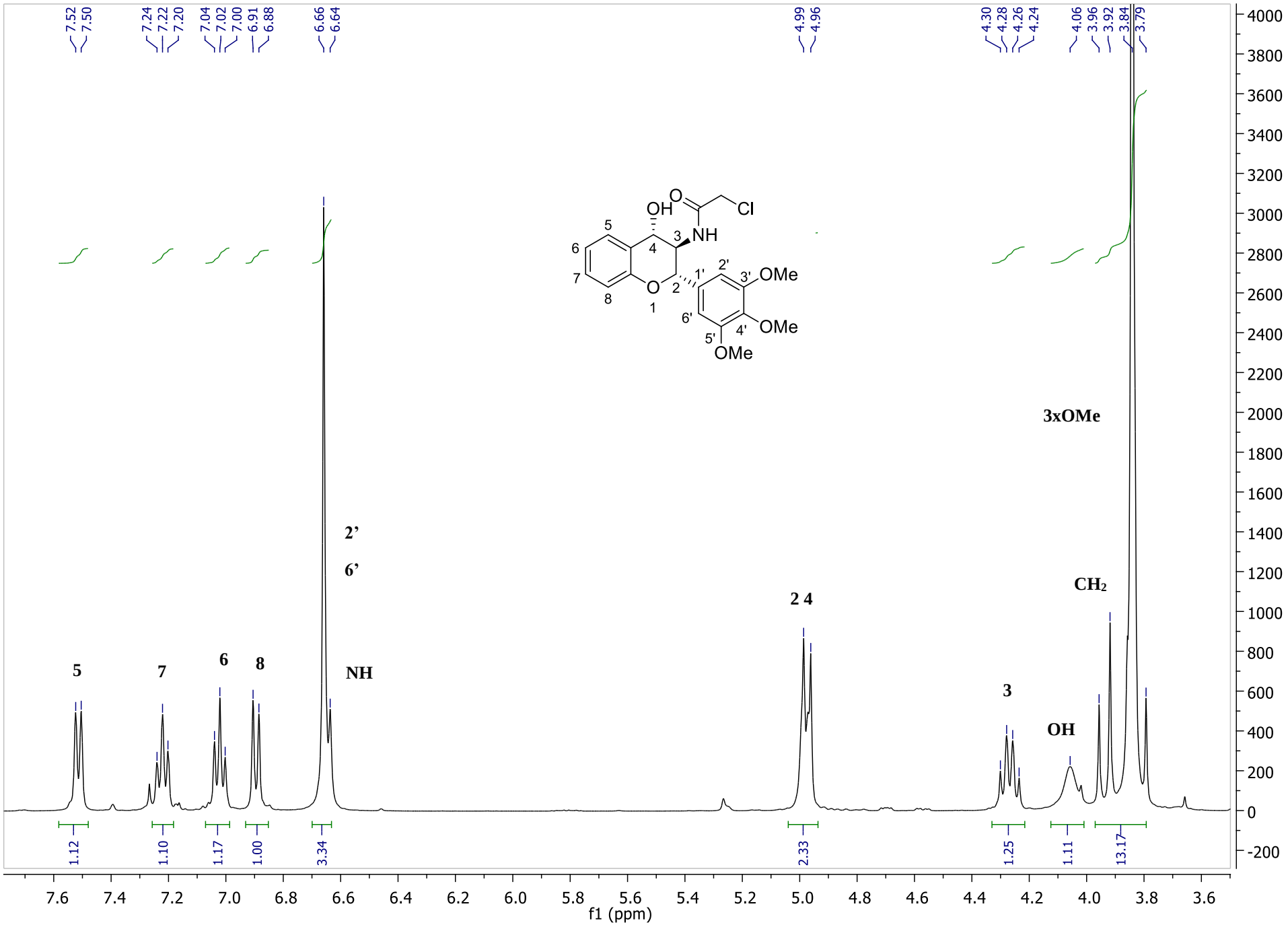


Figure S97. ^{1}H-NMR spectrum of *rac*-**19e** in $CDCl_3$

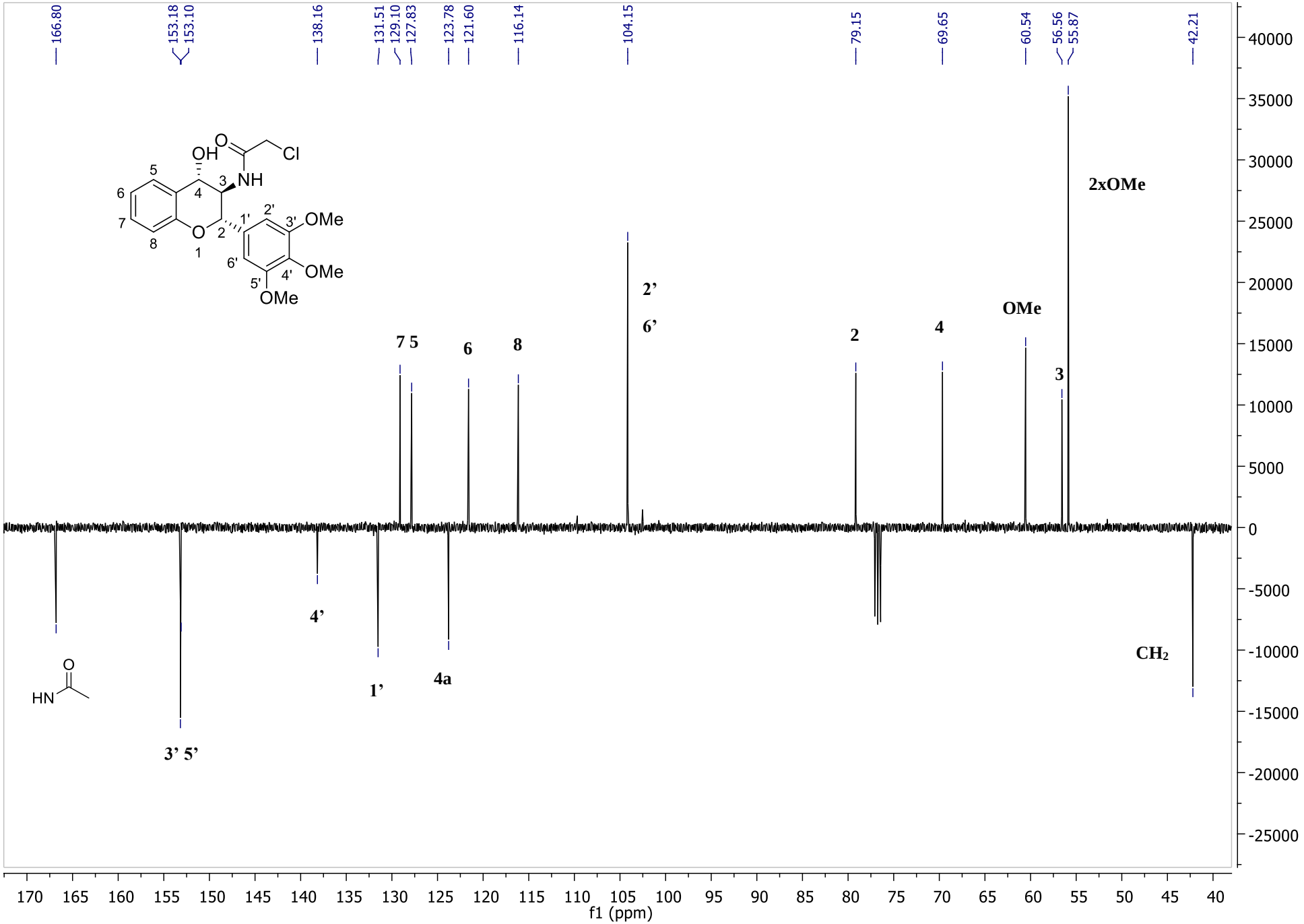


Figure S98. ^{13}C-NMR spectrum of *rac*-**19e** in $CDCl_3$

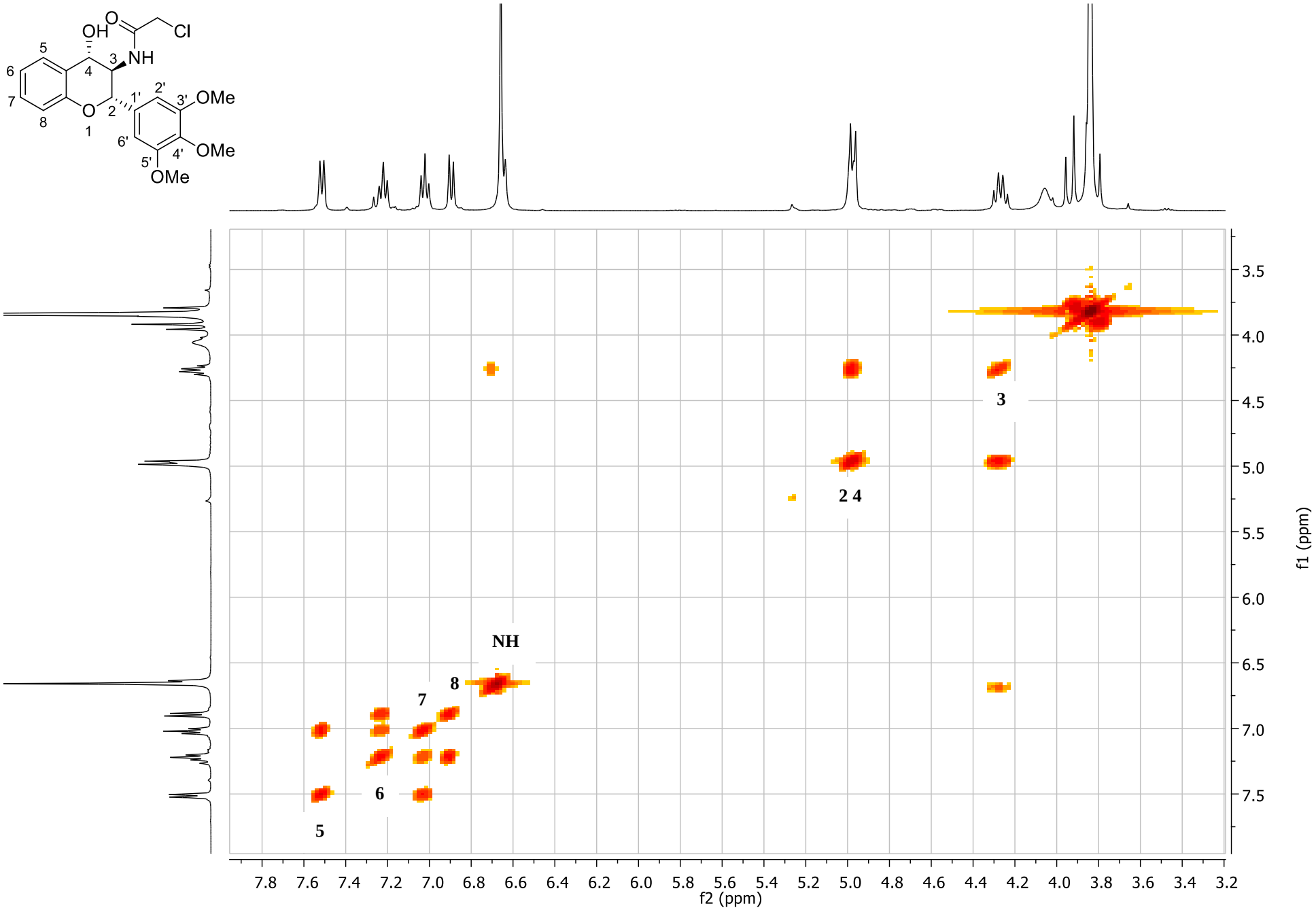


Figure S99. COSY-spectrum of *rac*-**19e** in $CDCl_3$

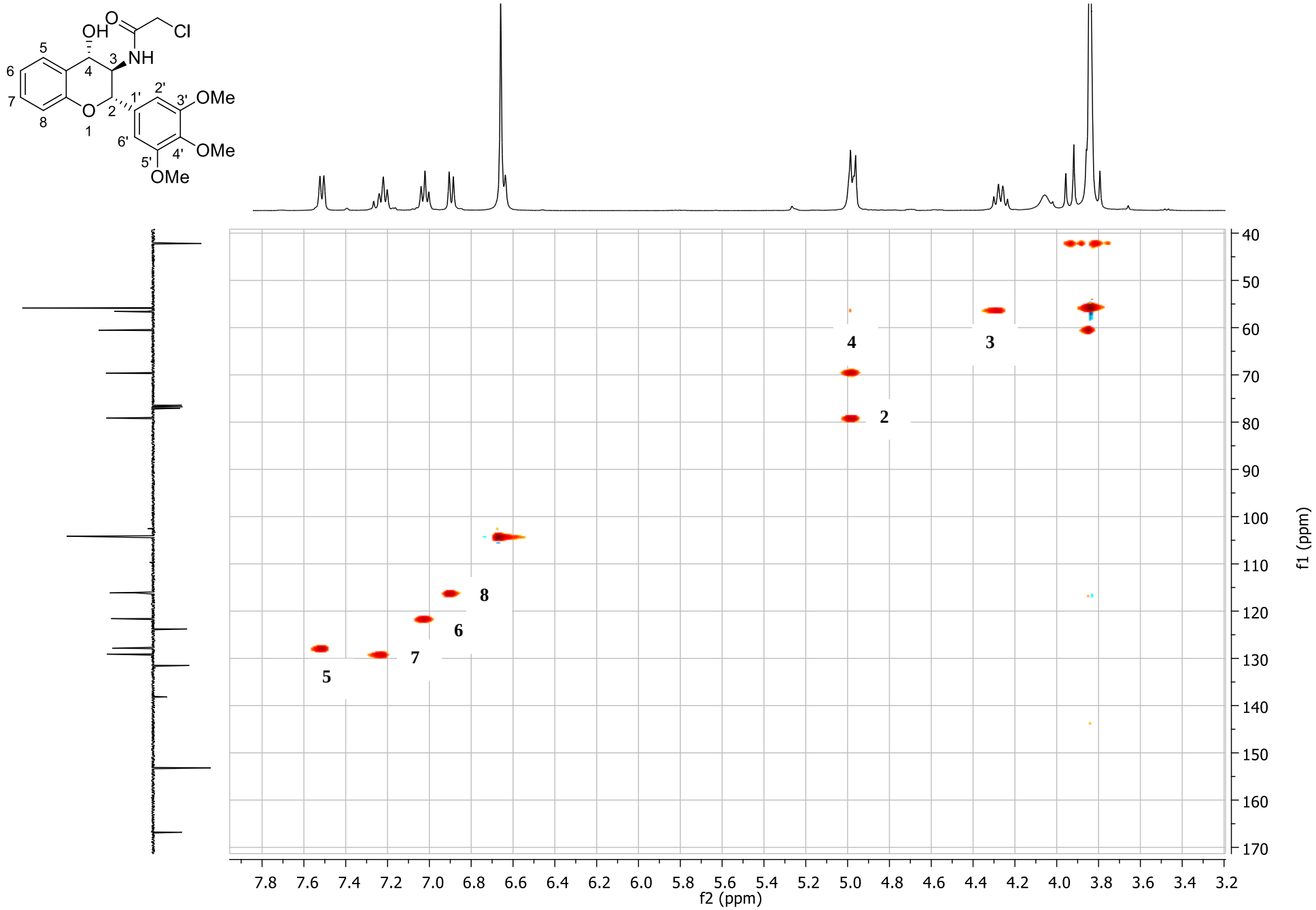


Figure S100. COSY-spectrum of *rac*-**19e** in $CDCl_3$

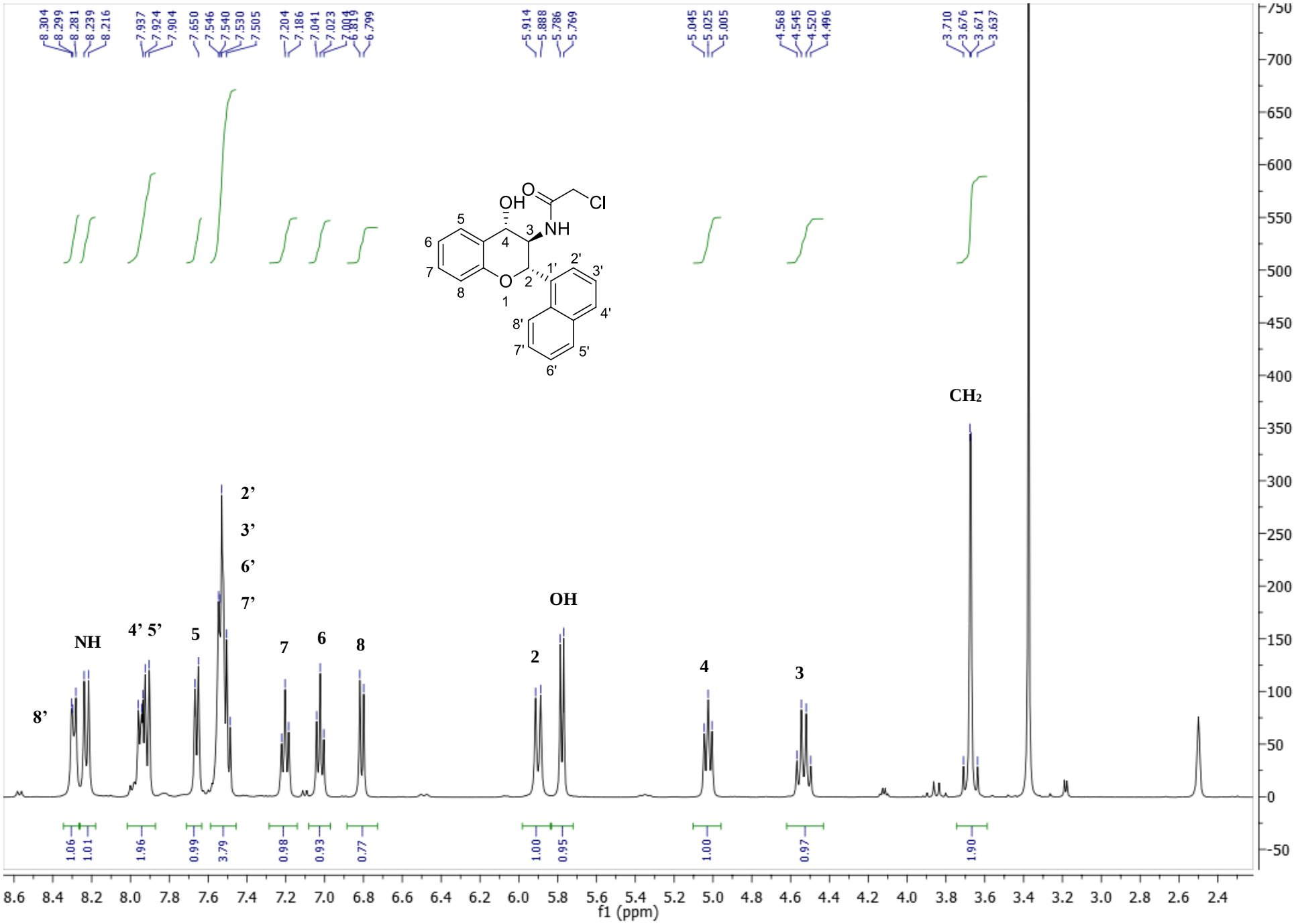


Figure S101. ^{1}H-NMR spectrum of *rac*-**19f** in DMSO-d_6

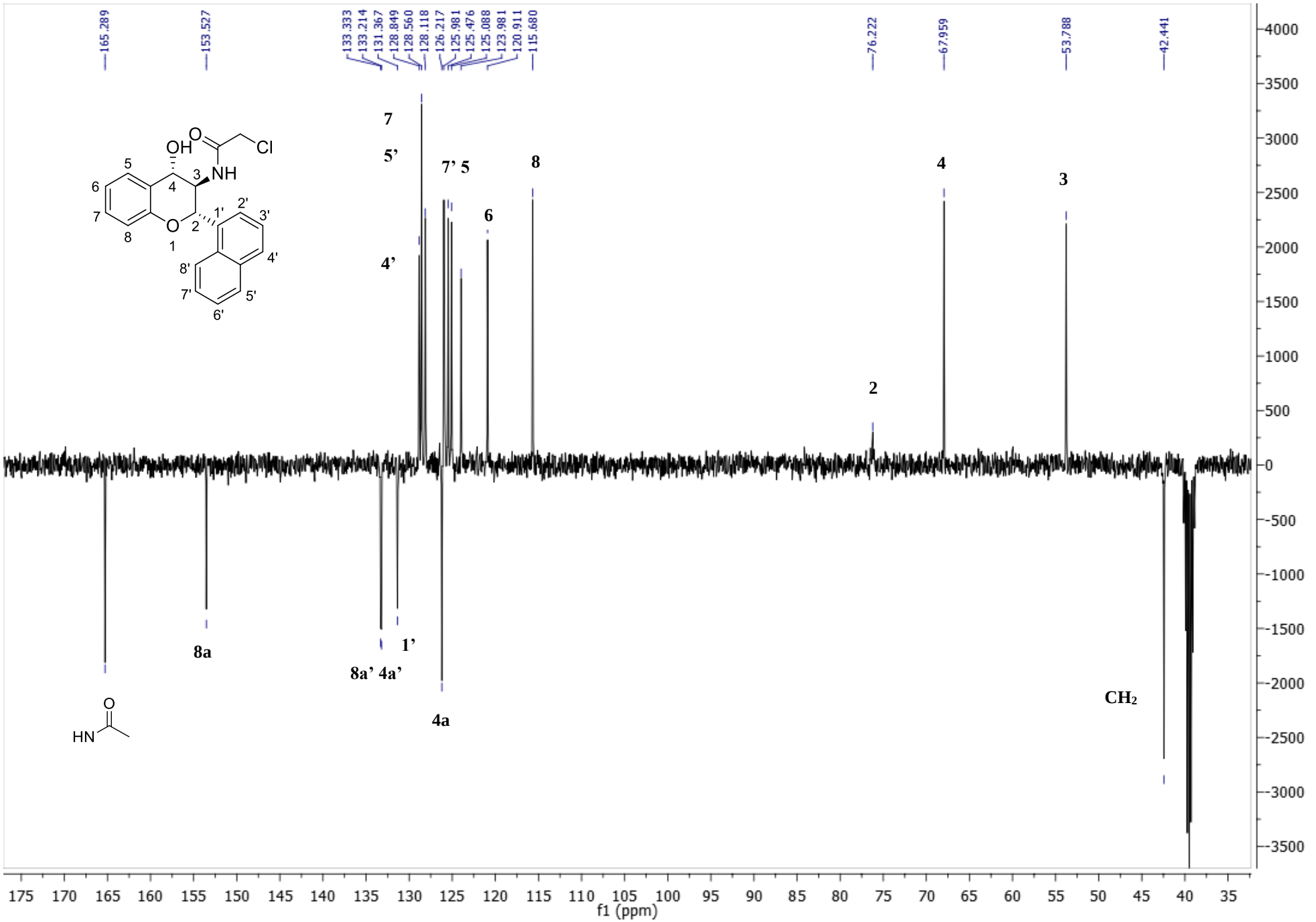


Figure S102. ^{13}C-NMR spectrum of *rac*-**19f** in DMSO-d_6

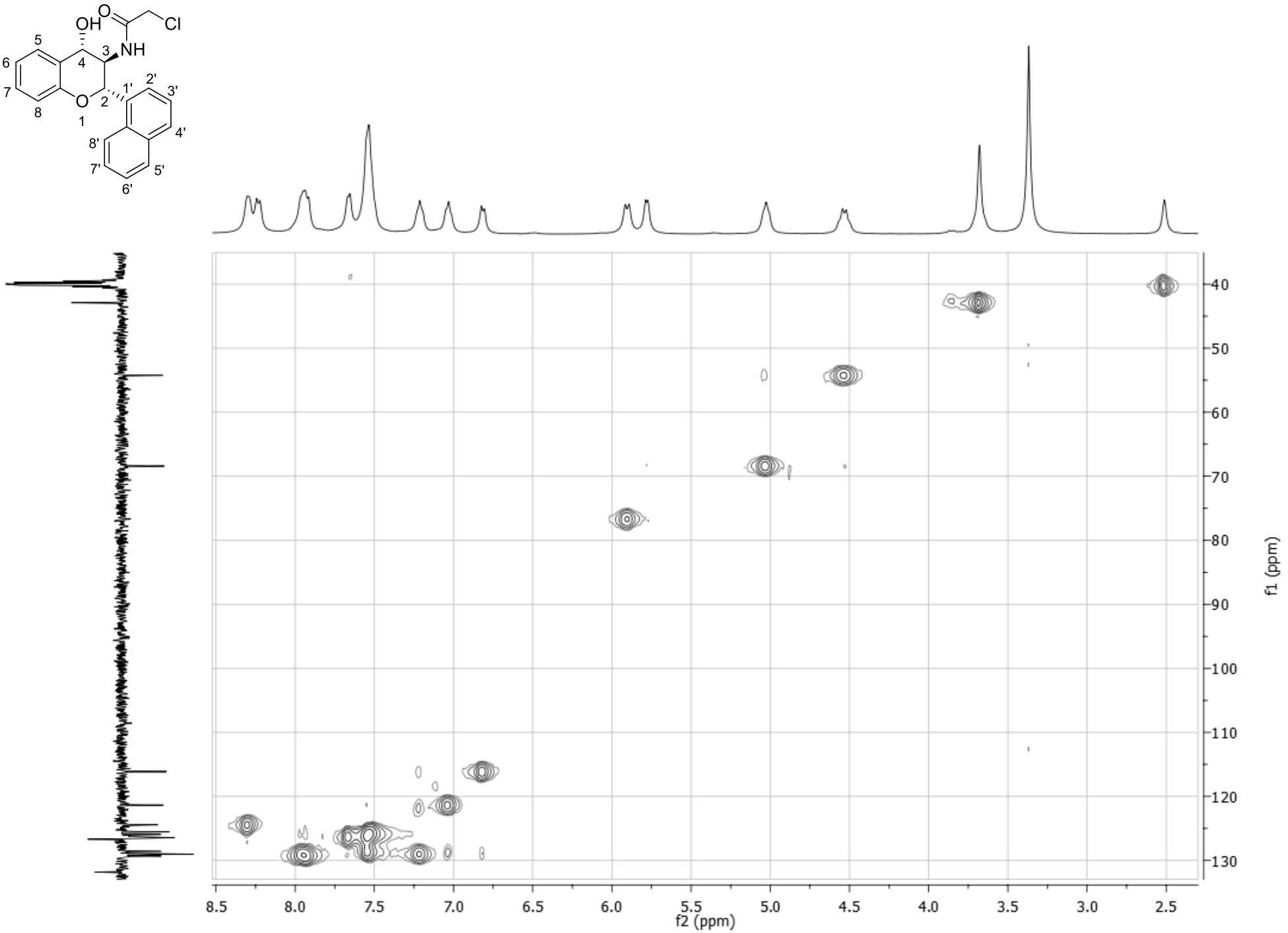


Figure S103. HSQC spectrum of *rac*-**19f** in DMSO-d_6

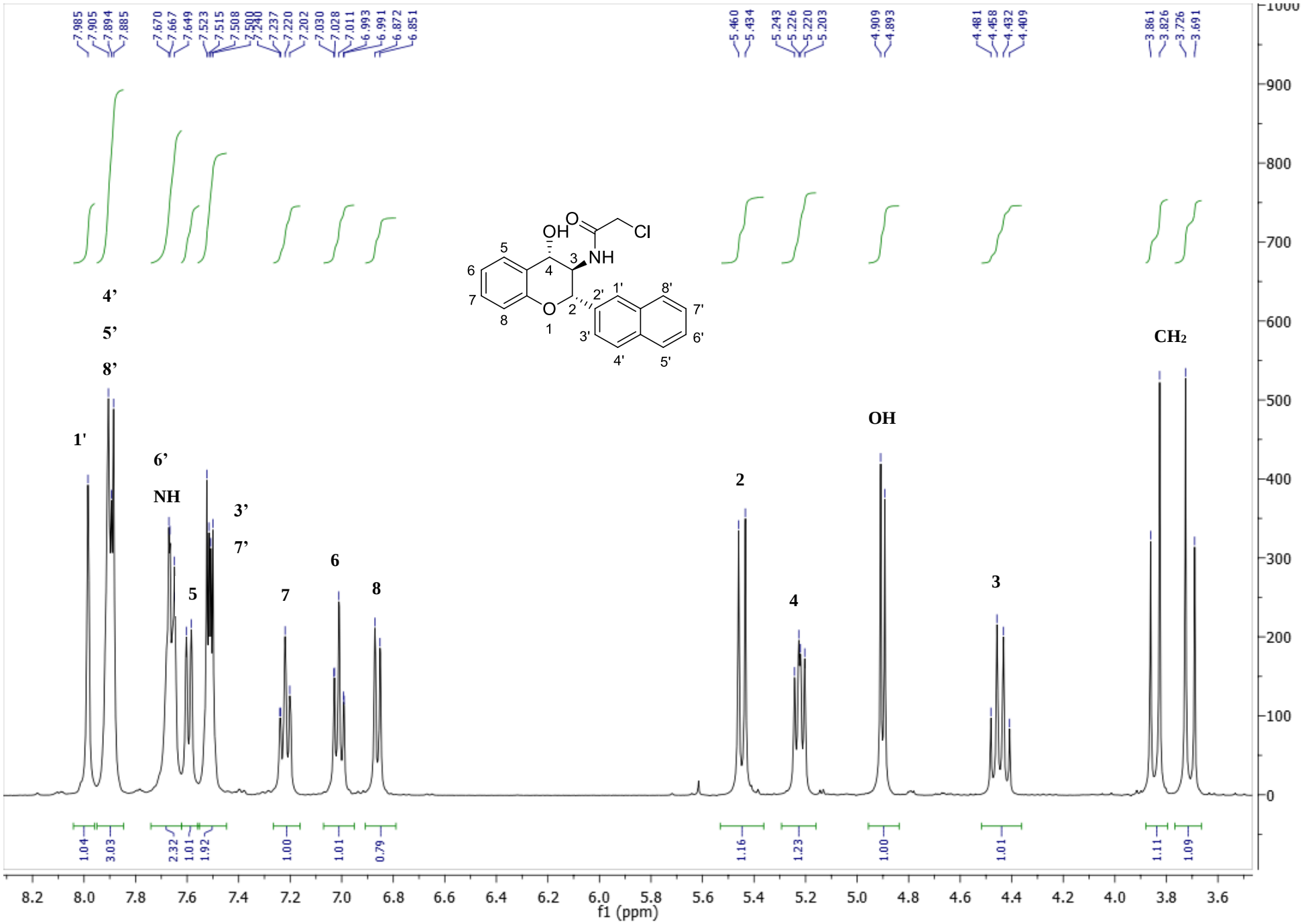


Figure S104. ^{1}H-NMR spectrum of *rac*-**19g** in Acetone-d_6

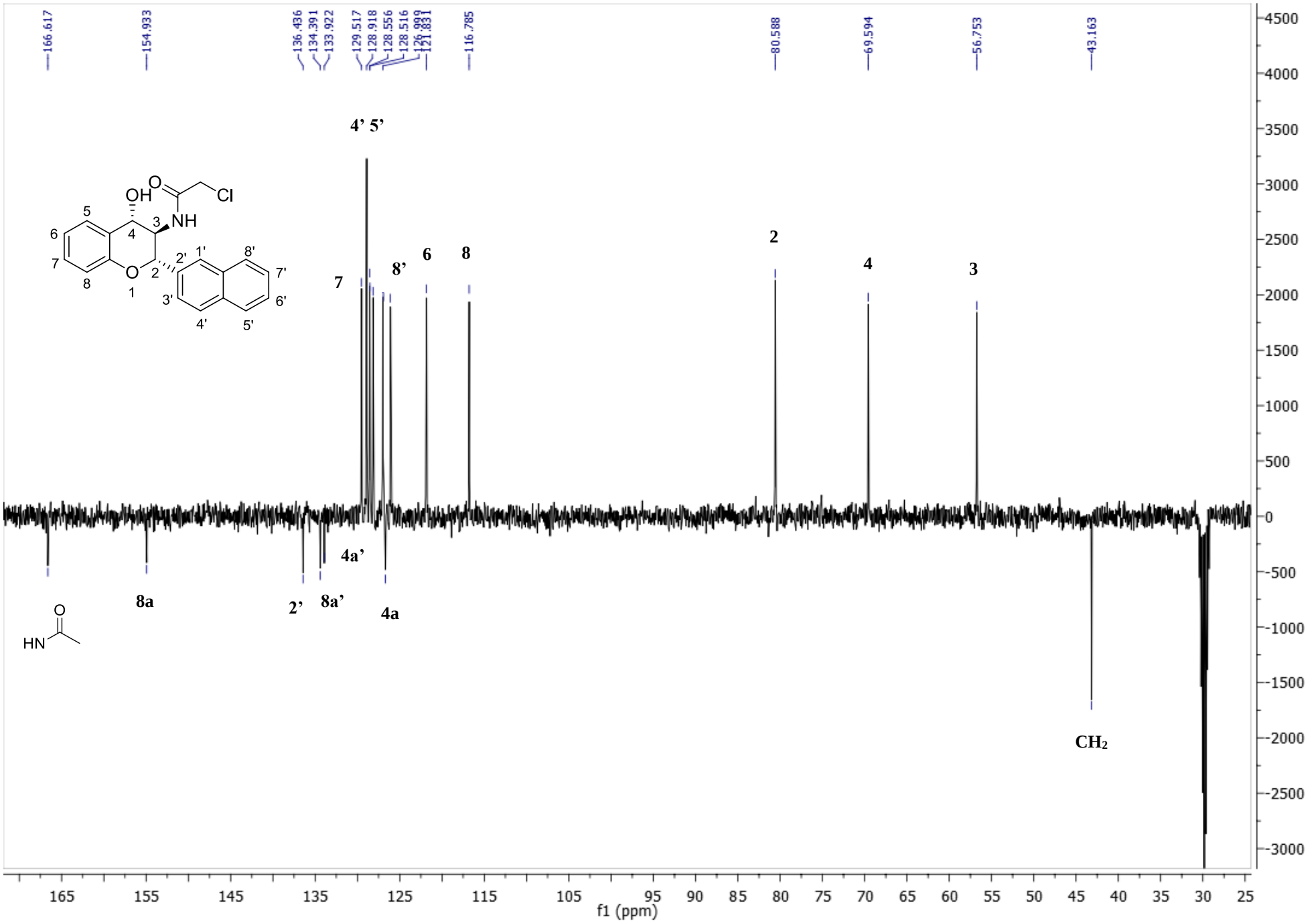


Figure S105. ^{13}C-NMR spectrum of *rac*-**19g** in Acetone-d_6

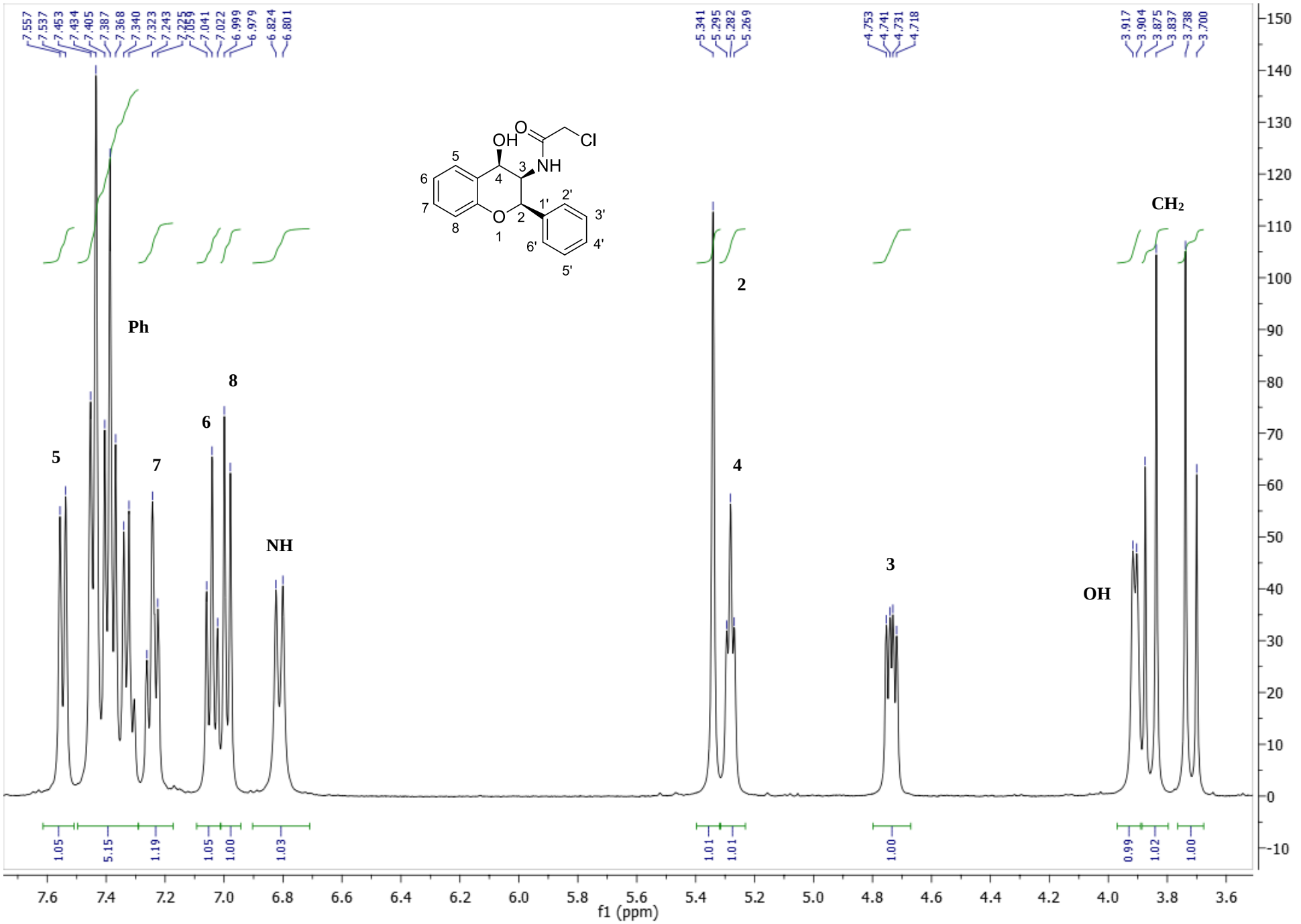


Figure S106. ^{1}H-NMR spectrum of *rac*-**22a** in $CDCl_3$

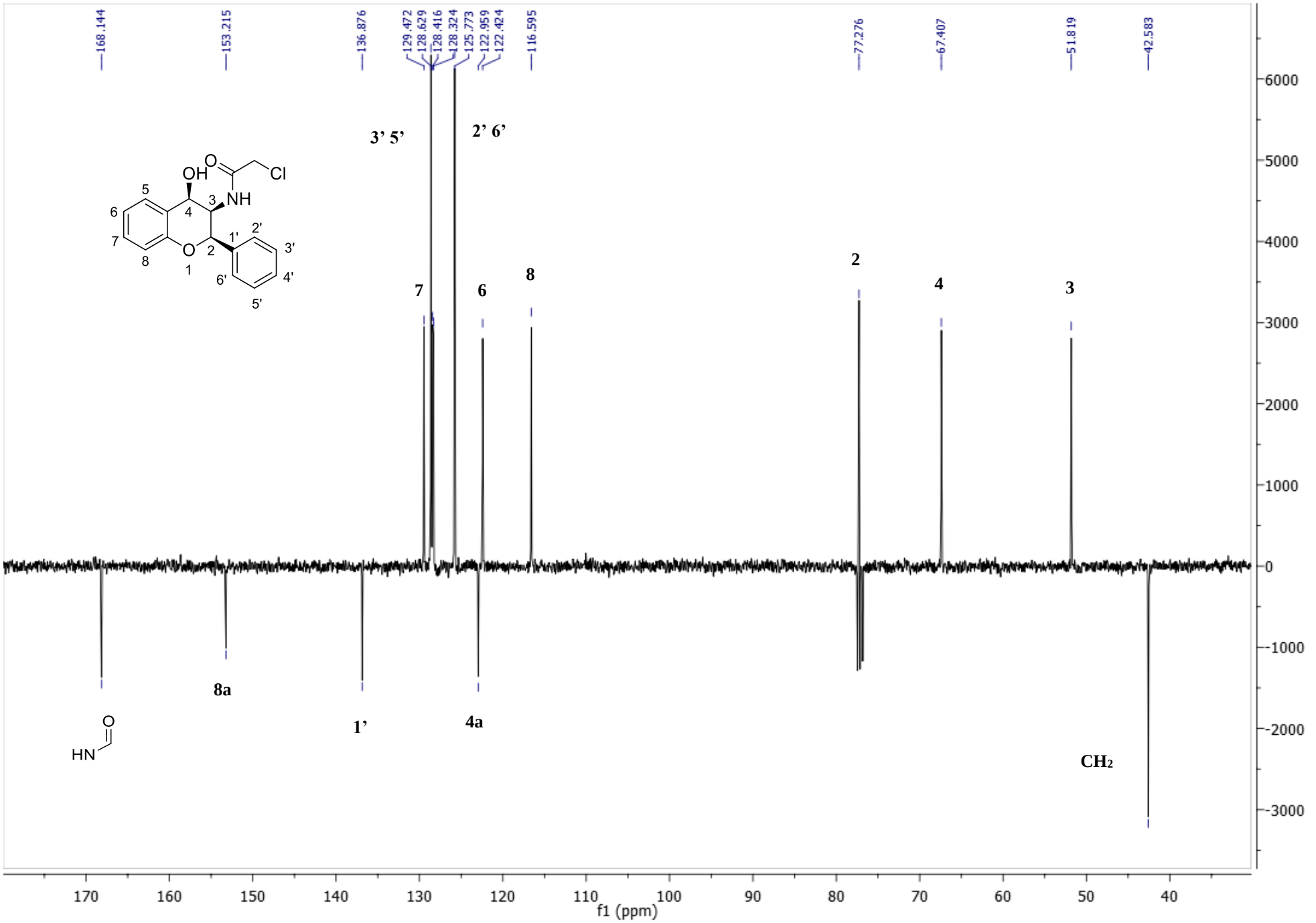


Figure S107. ^{13}C-NMR spectrum of *rac*-**22a** in $CDCl_3$

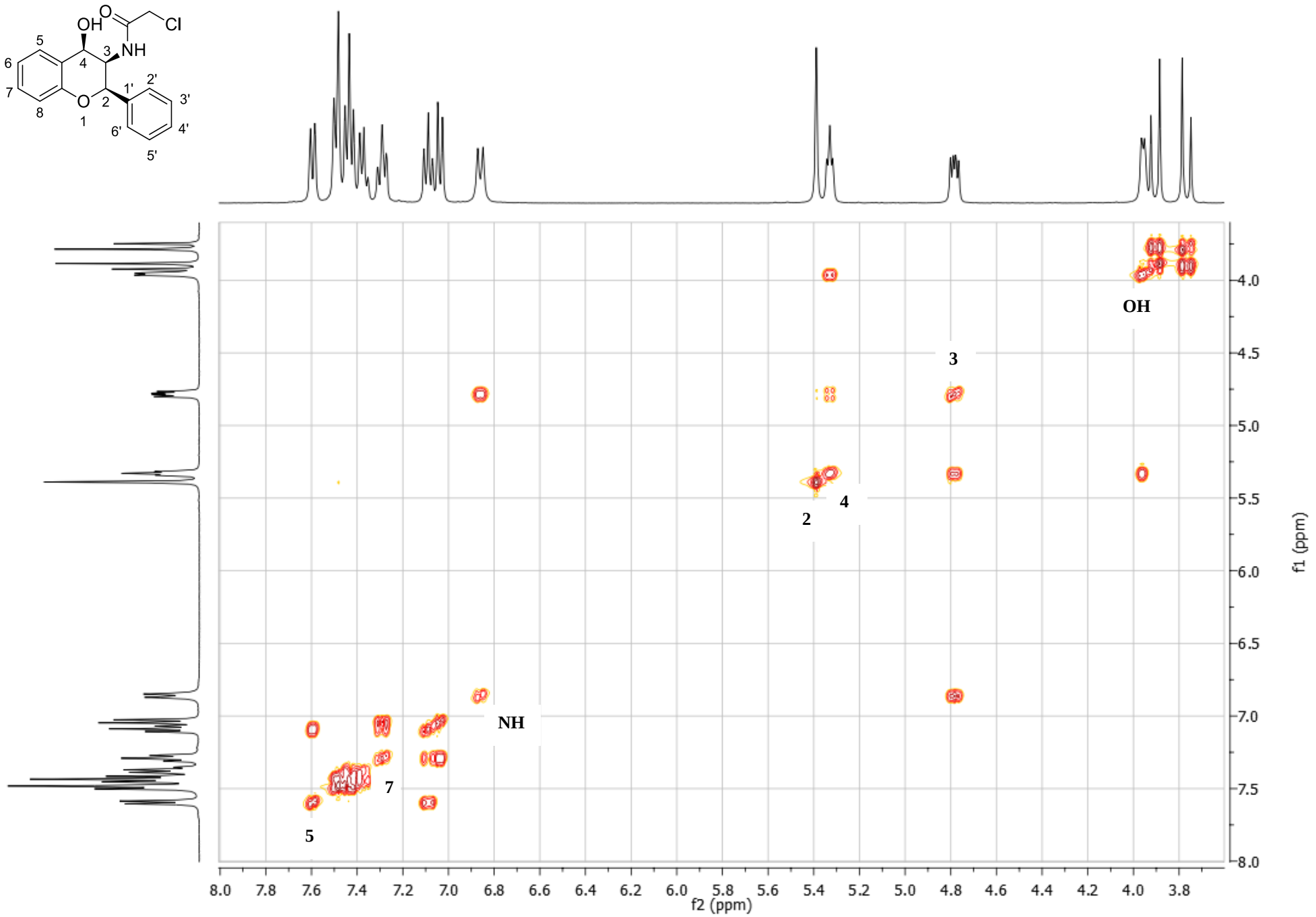


Figure S108. COSY spectrum of *rac*-**22a** in $CDCl_3$

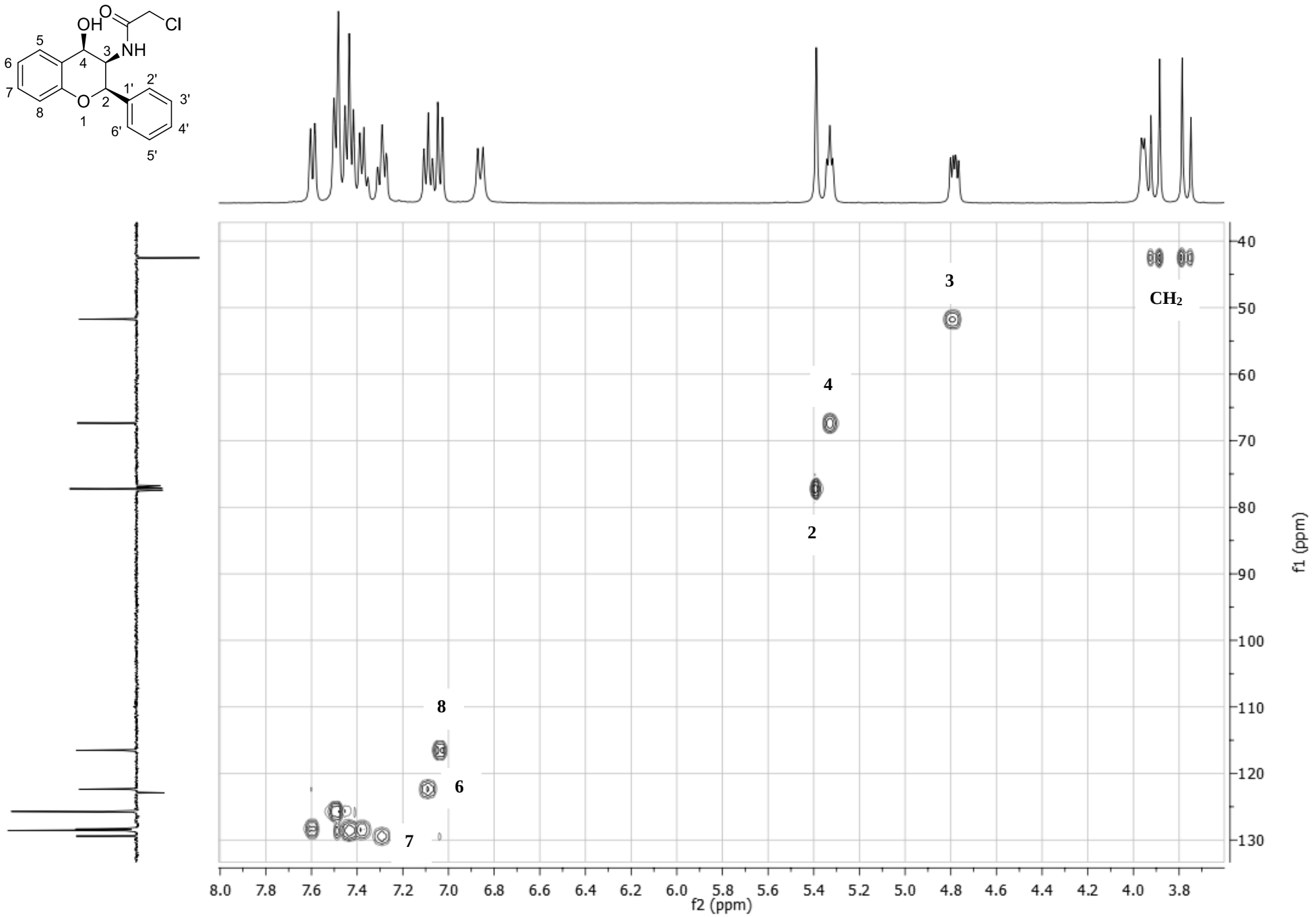


Figure S109. HSQC spectrum of *rac*-**22a** in $CDCl_3$

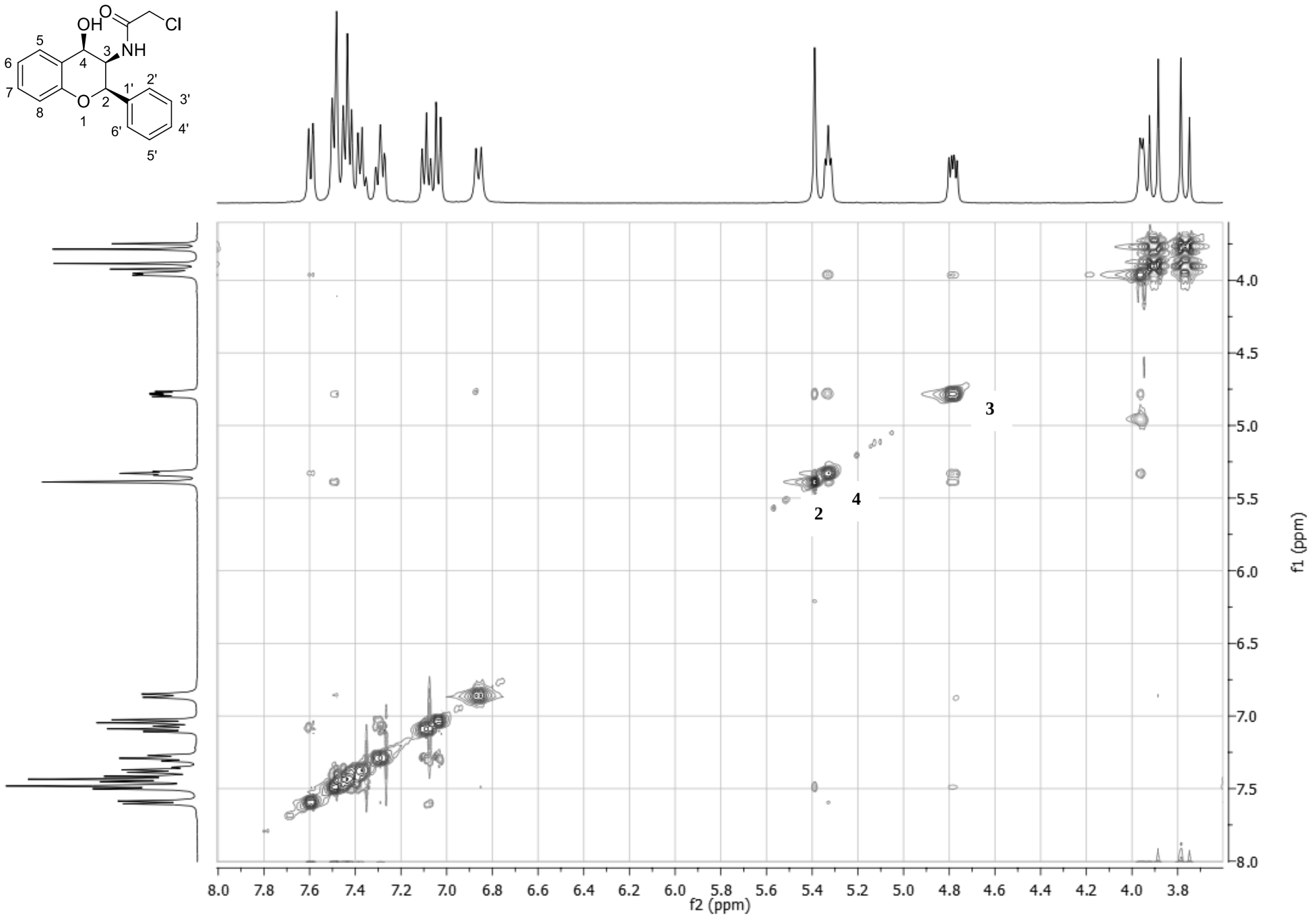


Figure S110. NOESY spectrum of *rac*-**22a** in $CDCl_3$

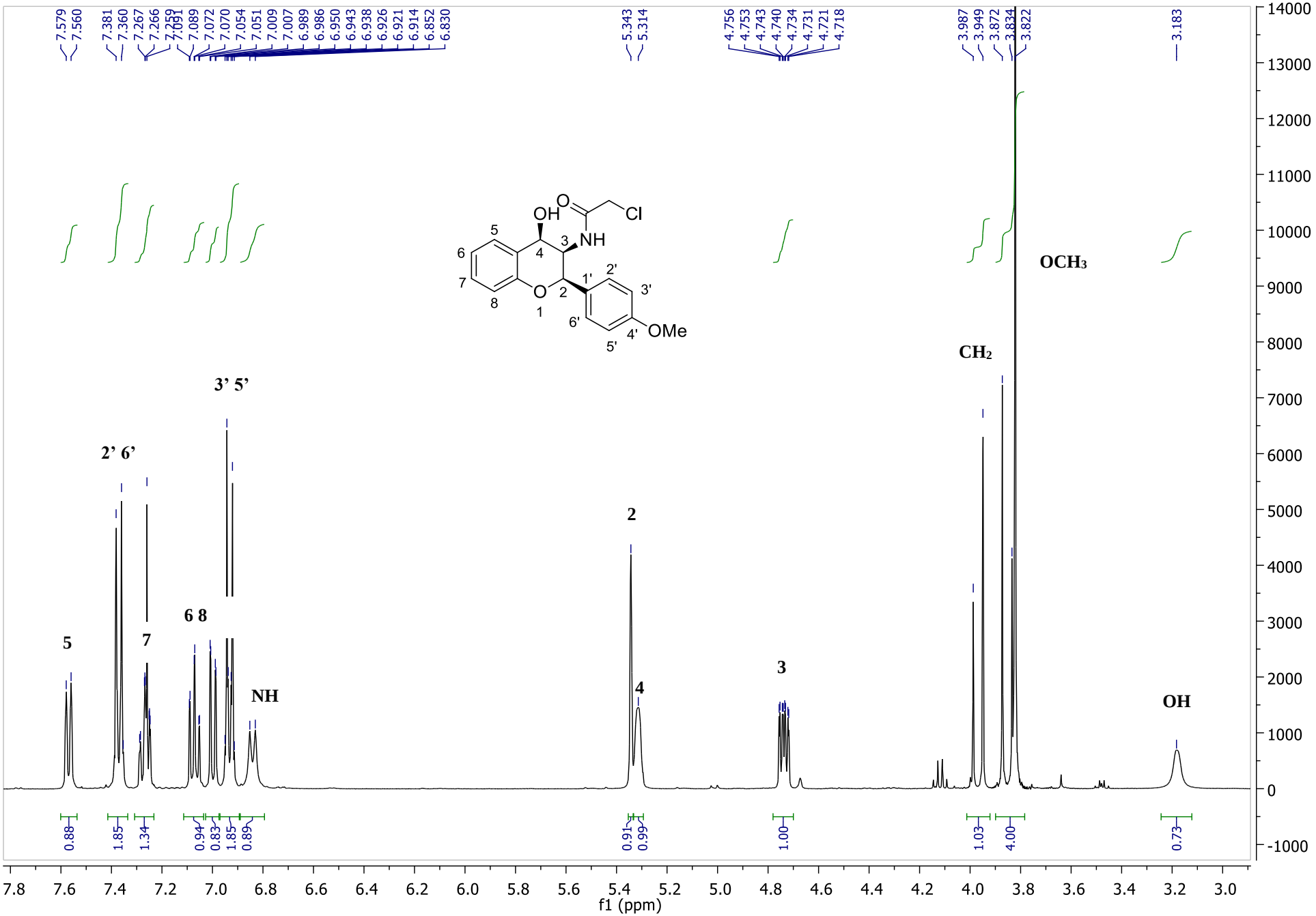


Figure S111. ^{1}H-NMR spectrum of *rac*-**22b** in $CDCl_3$

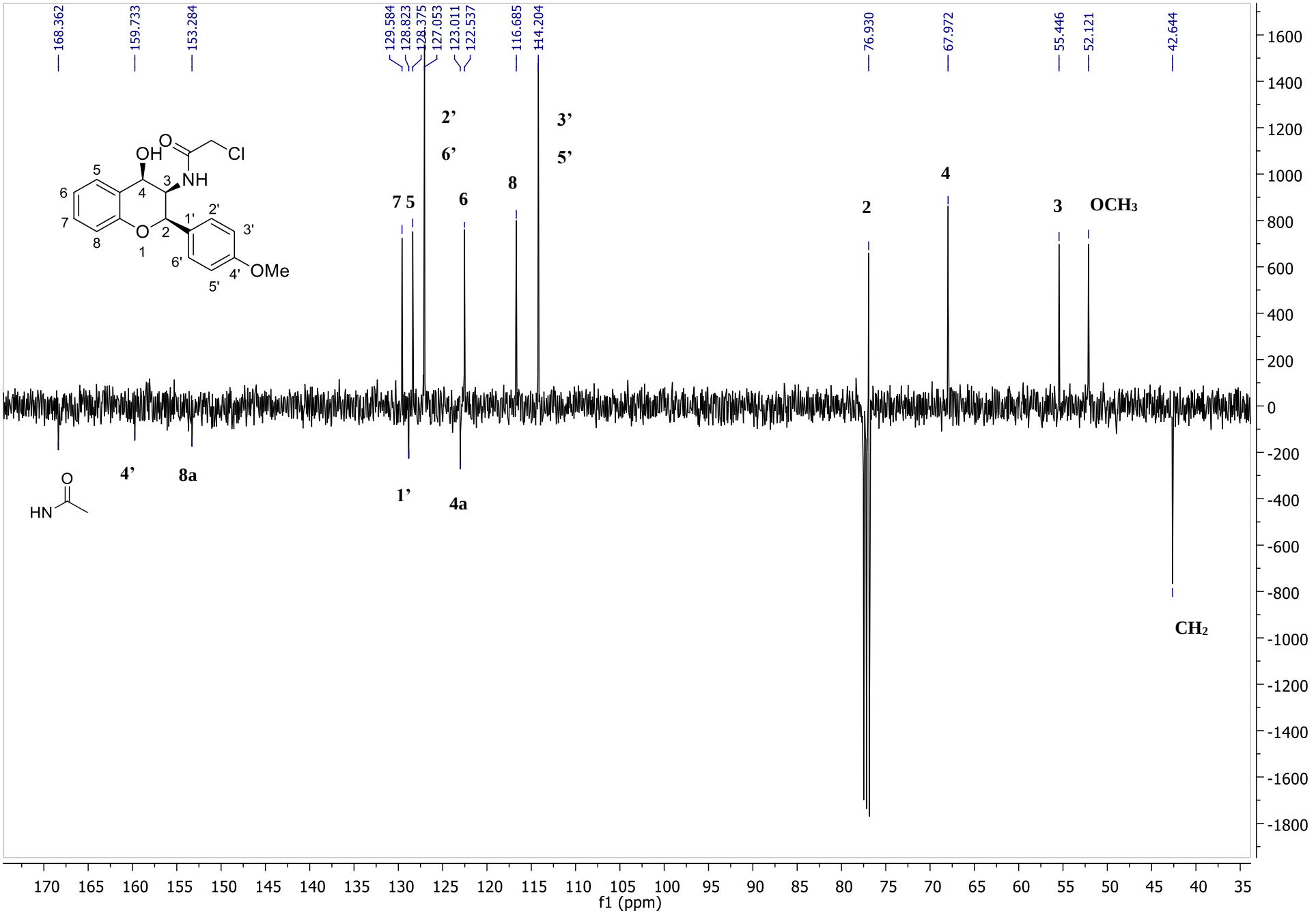


Figure S112. ^{13}C-NMR spectrum of *rac*-**22b** in $CDCl_3$

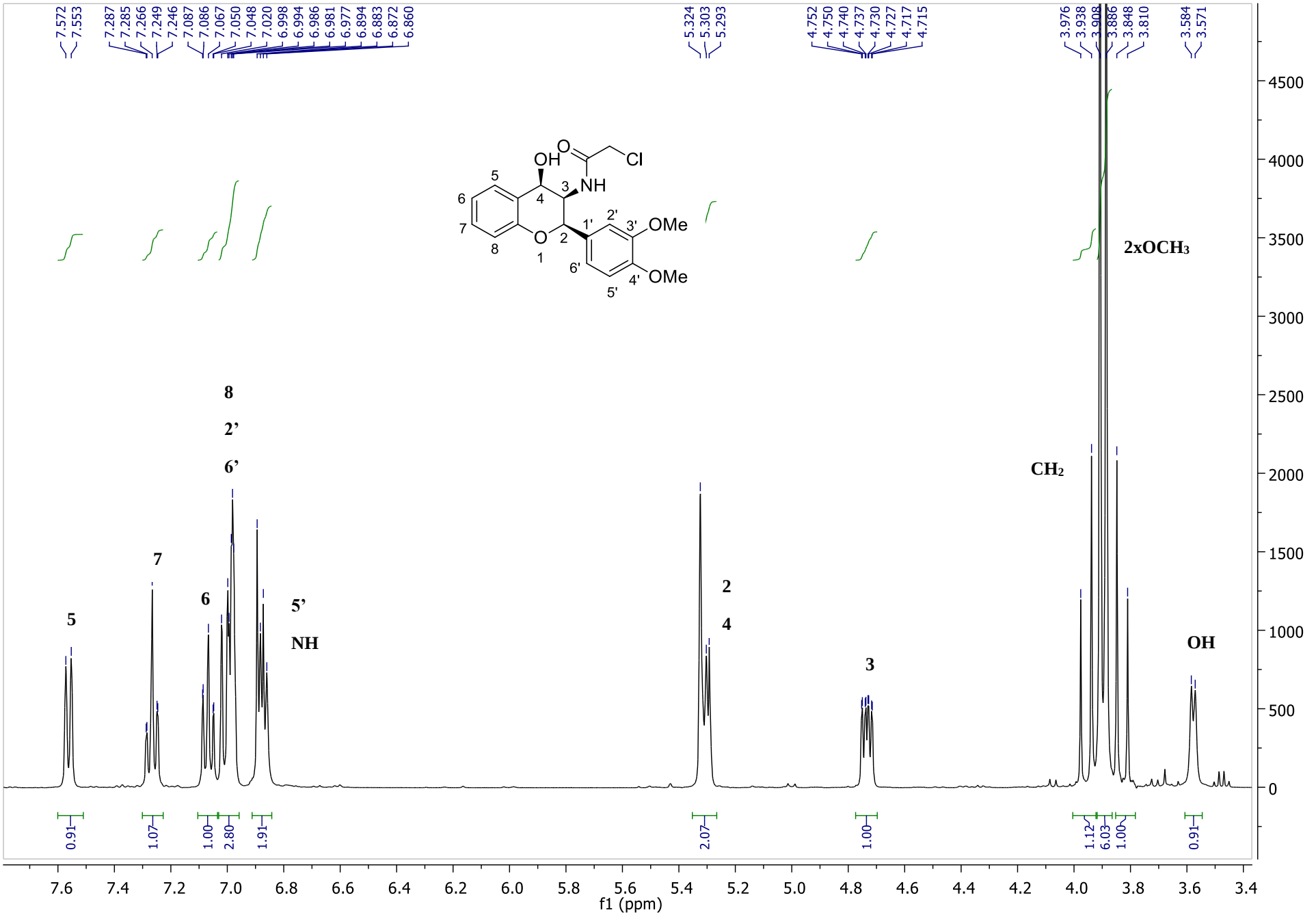


Figure S113. ^{1}H-NMR spectrum of *rac*-**22c** in $CDCl_3$

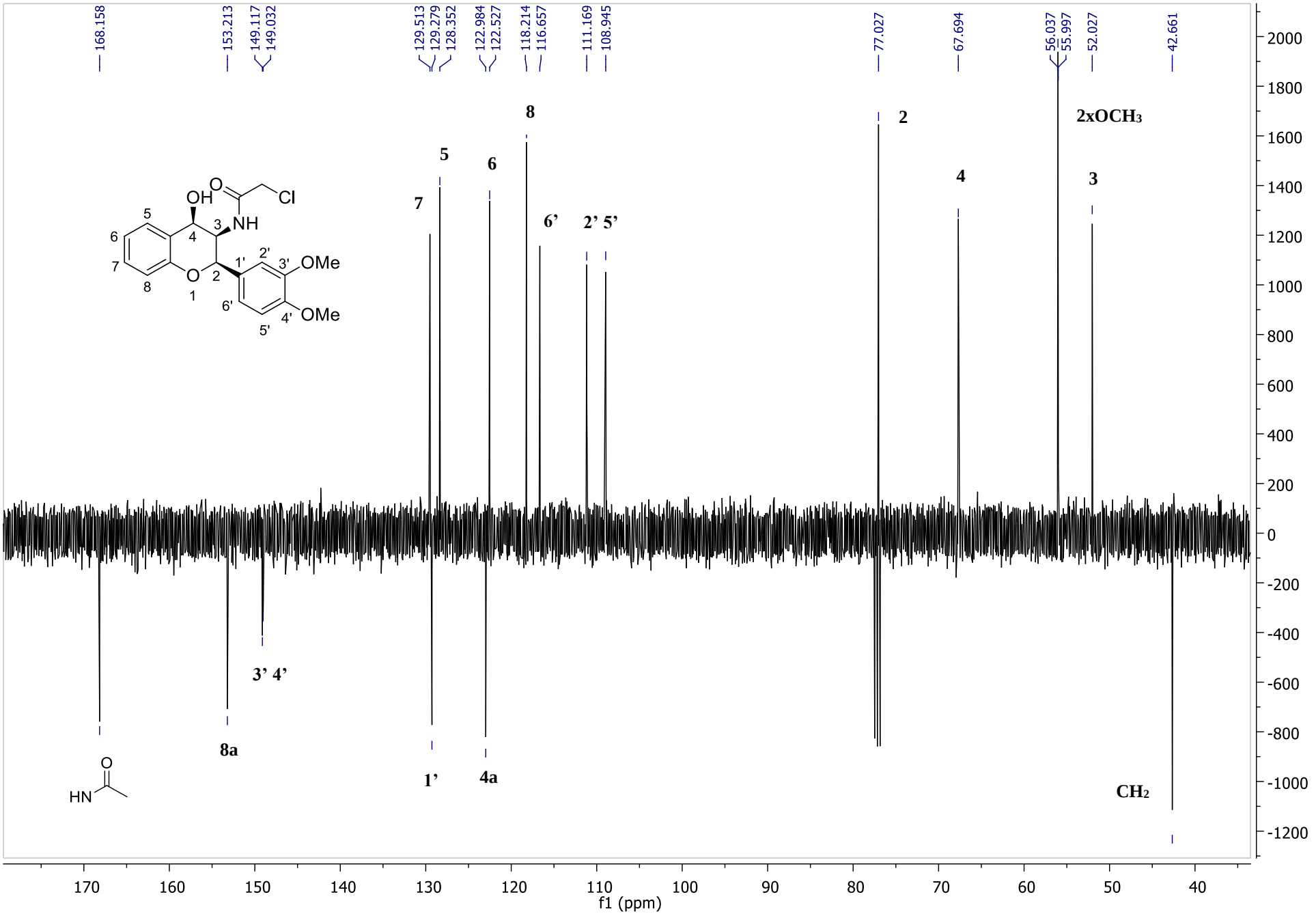


Figure S114. ^{13}C-NMR spectrum of *rac*-**22c** in $CDCl_3$

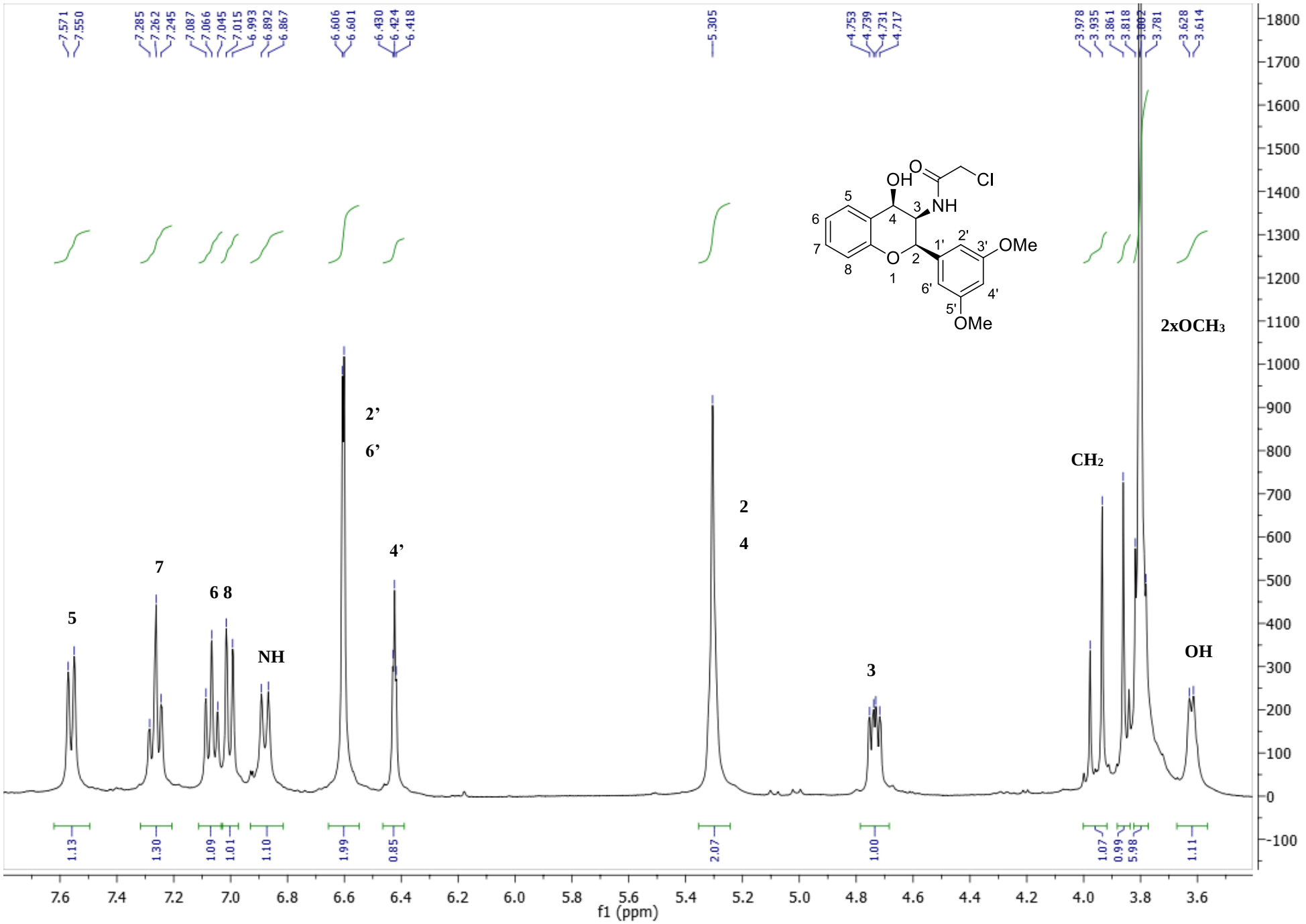


Figure S115. ^{1}H-NMR spectrum of *rac*-**22d** in $CDCl_3$

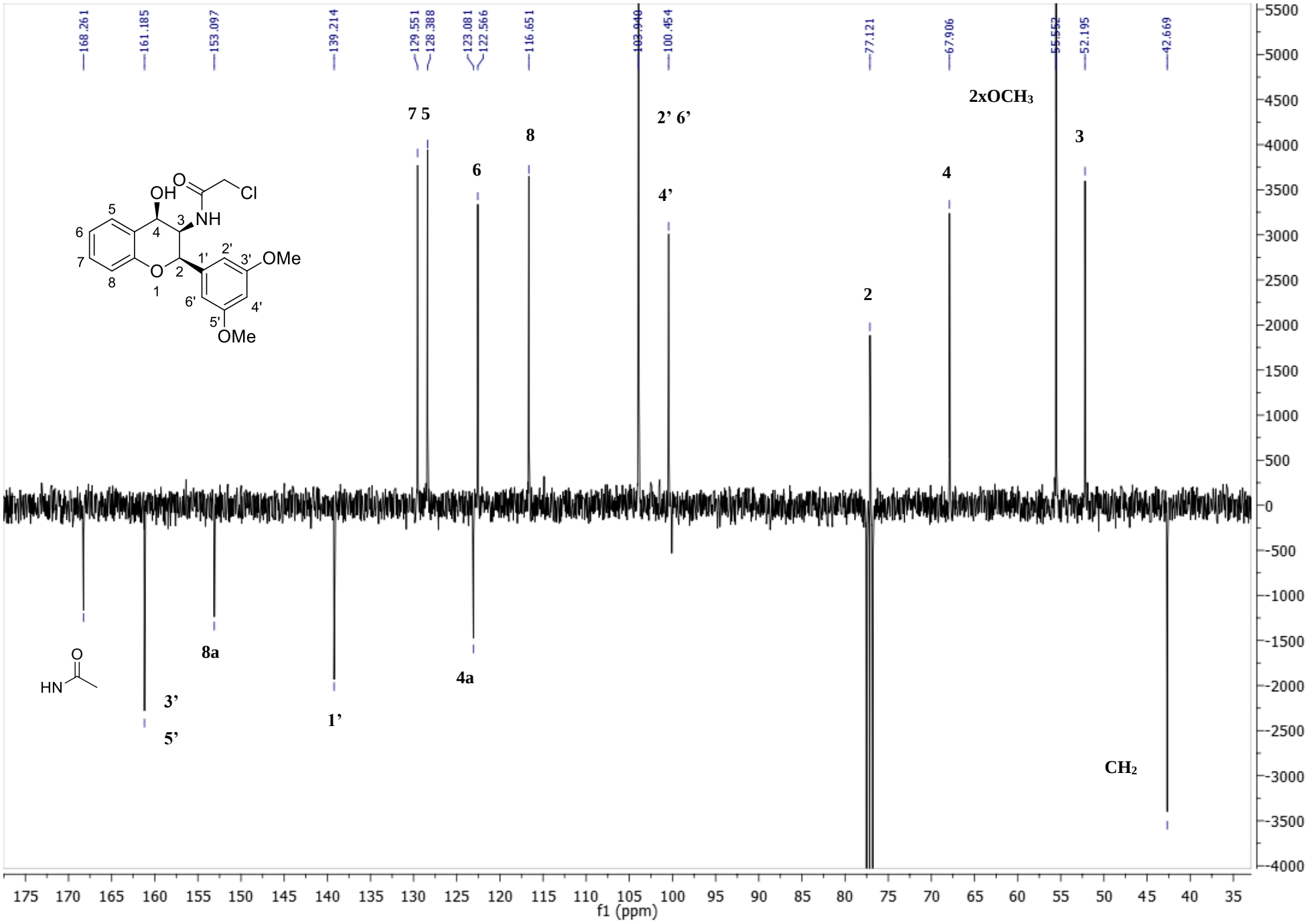


Figure S116. ^{13}C-NMR spectrum of *rac*-**22d** in $CDCl_3$

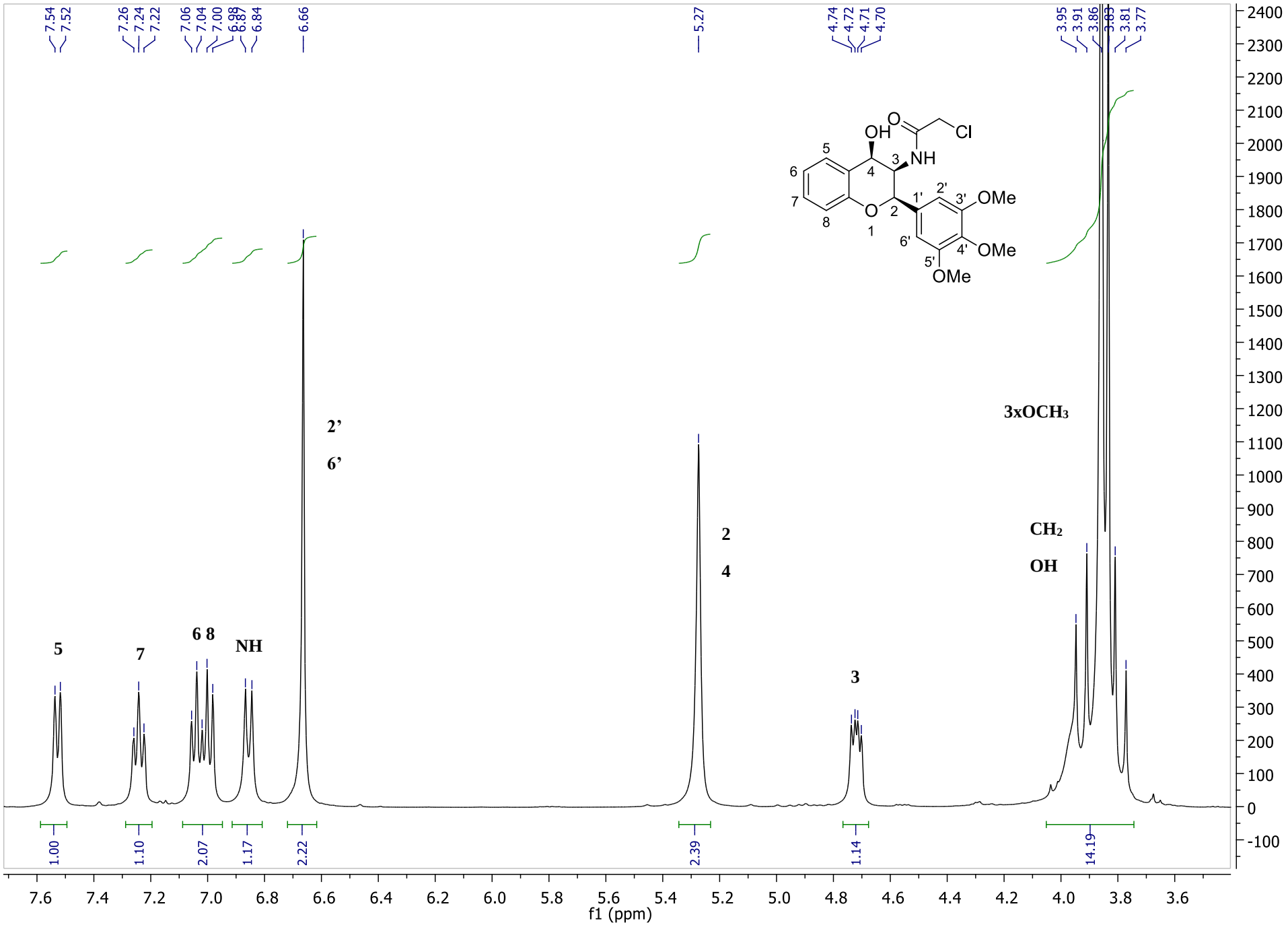


Figure S117. ^{1}H-NMR spectrum of *rac*-**22e** in $CDCl_3$

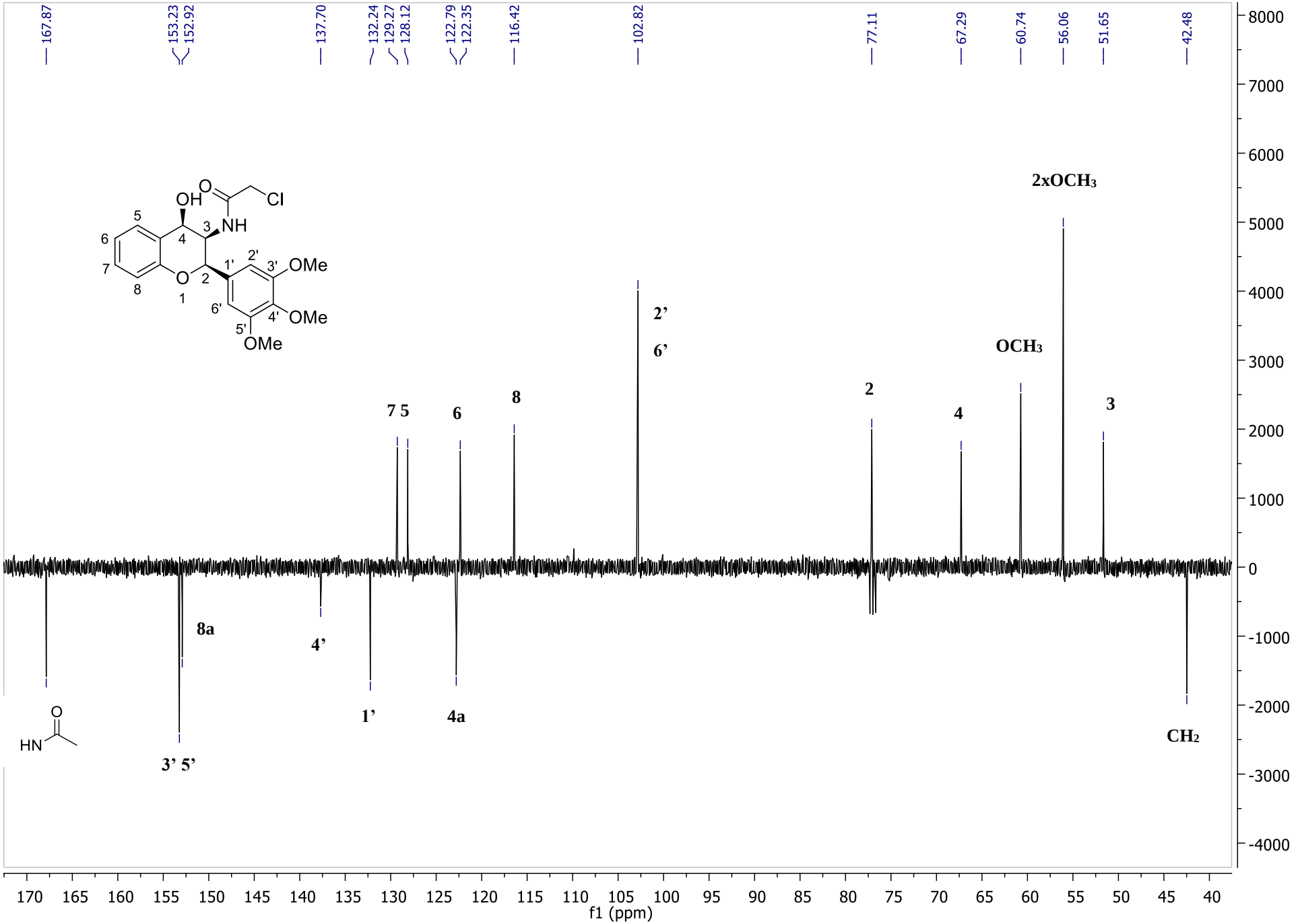


Figure S118. ^{13}C-NMR spectrum of *rac*-**22e** in $CDCl_3$

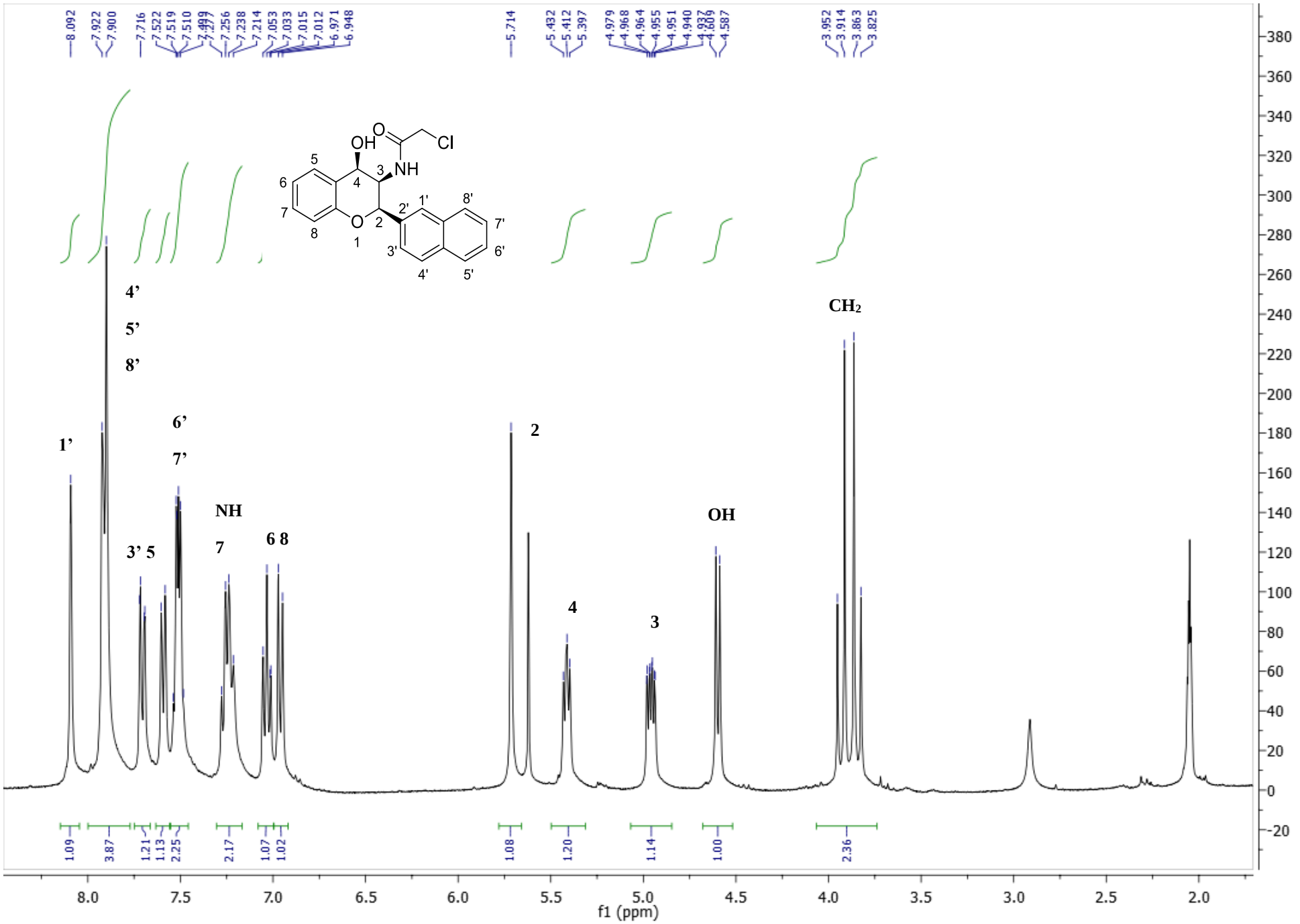


Figure S119. ^{1}H-NMR spectrum of *rac*-**22g** in Acetone-d_6

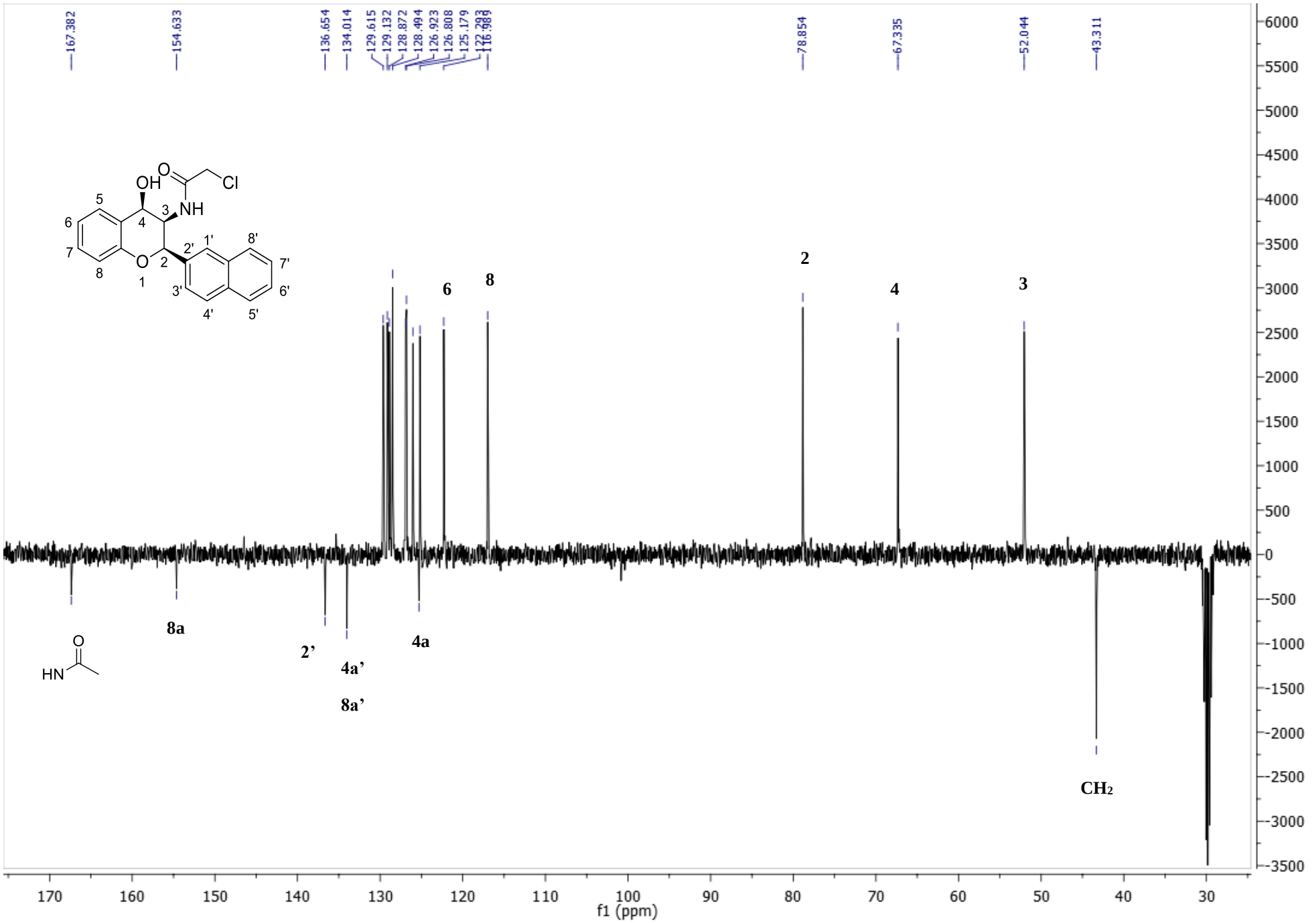


Figure S120. ^{13}C-NMR spectrum of *rac*-**22g** in Acetone-d_6

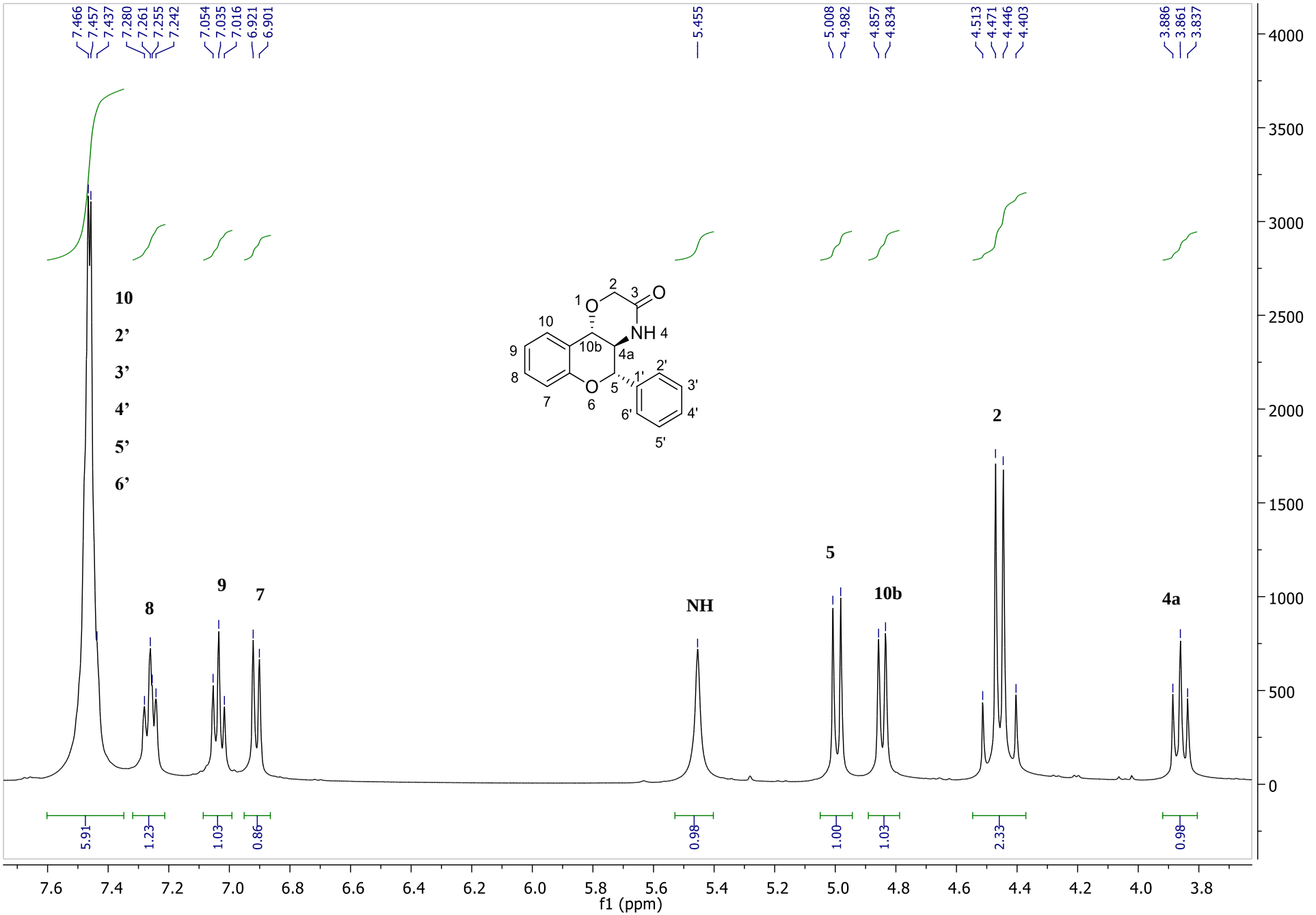


Figure S121. ^{1}H-NMR spectrum of *rac*-**20a** in $CDCl_3$

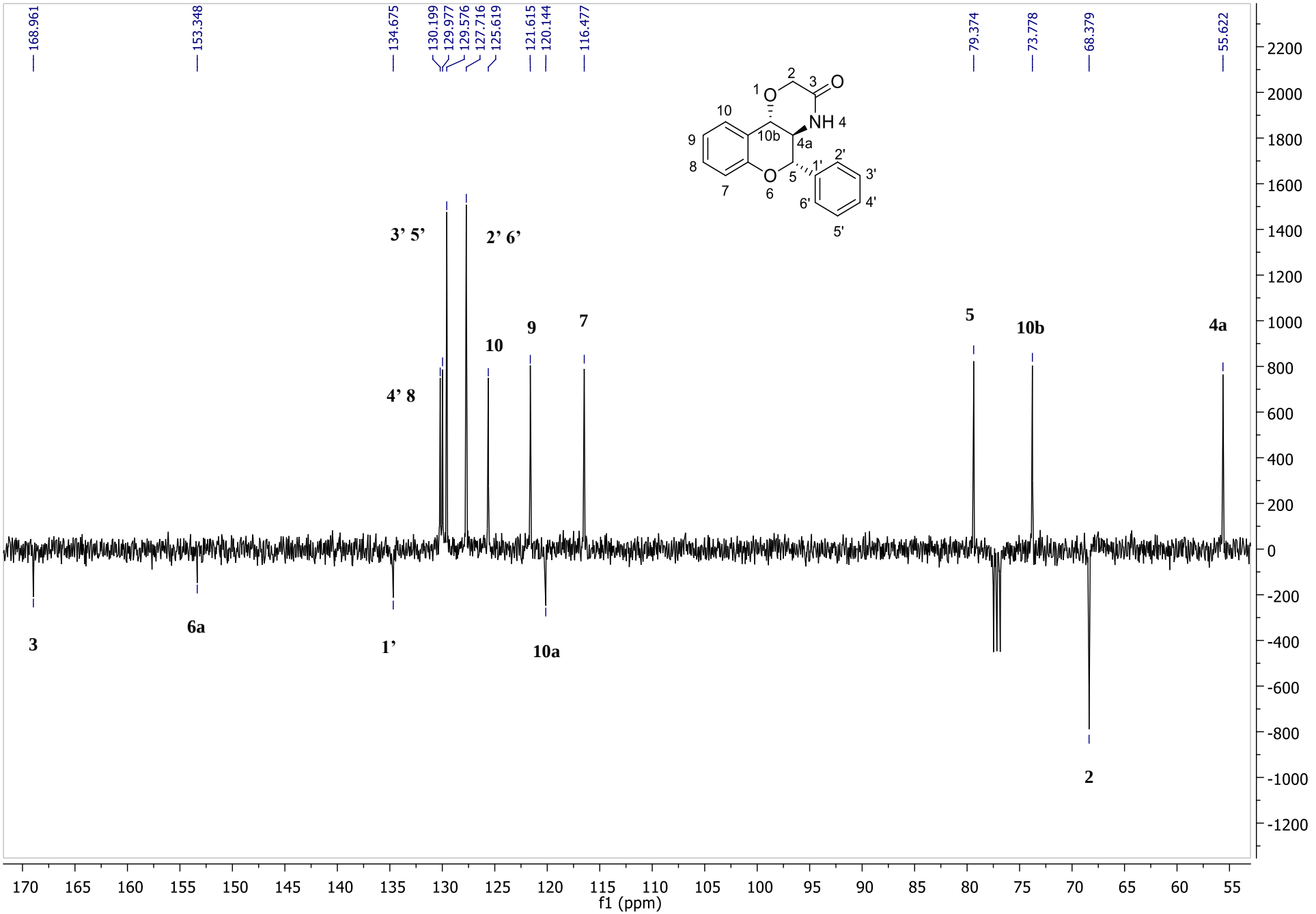


Figure S122. ^{13}C-NMR spectrum of *rac*-**20a** in $CDCl_3$

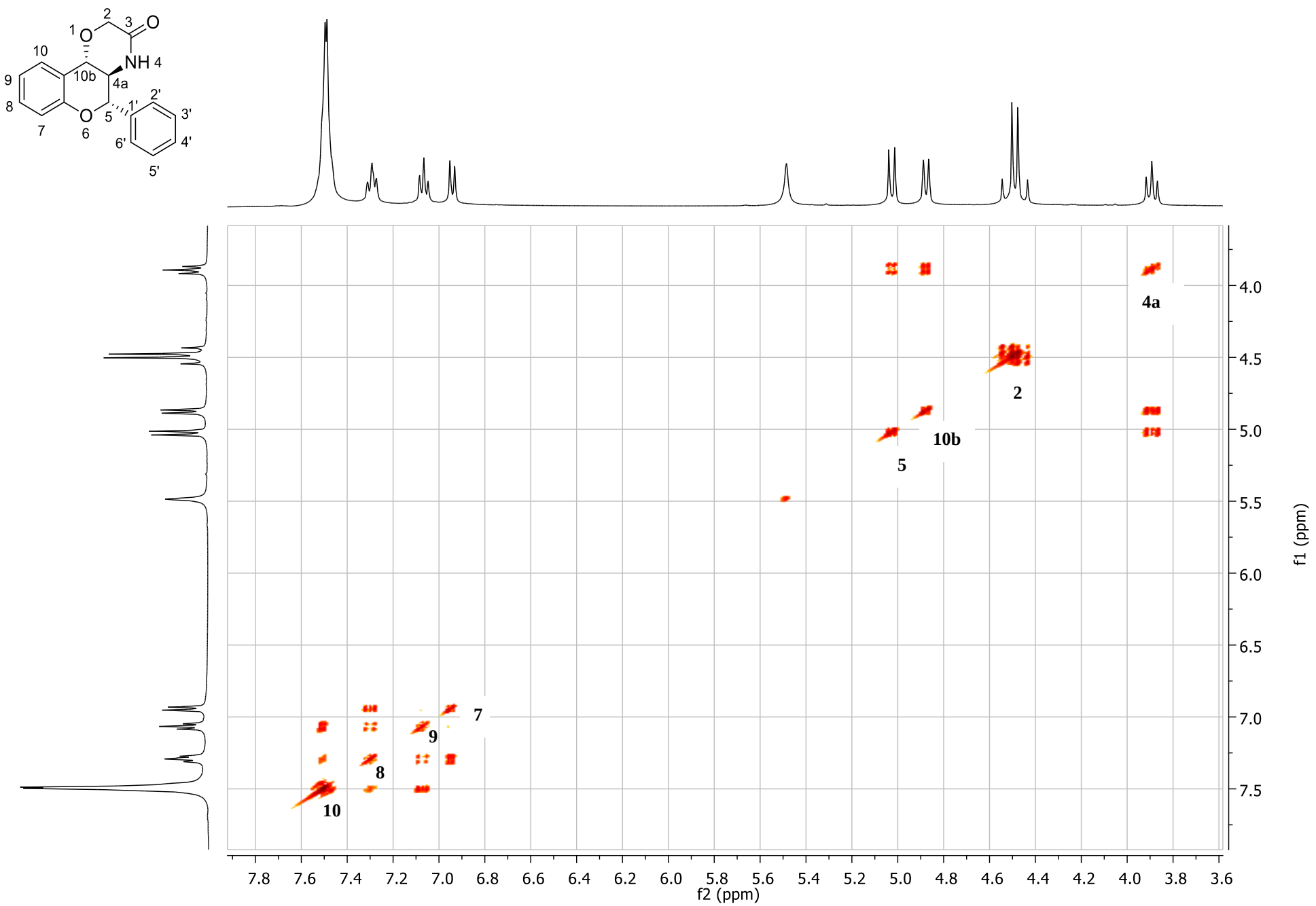


Figure S123. COSY spectrum of *rac*-**20a** in $CDCl_3$

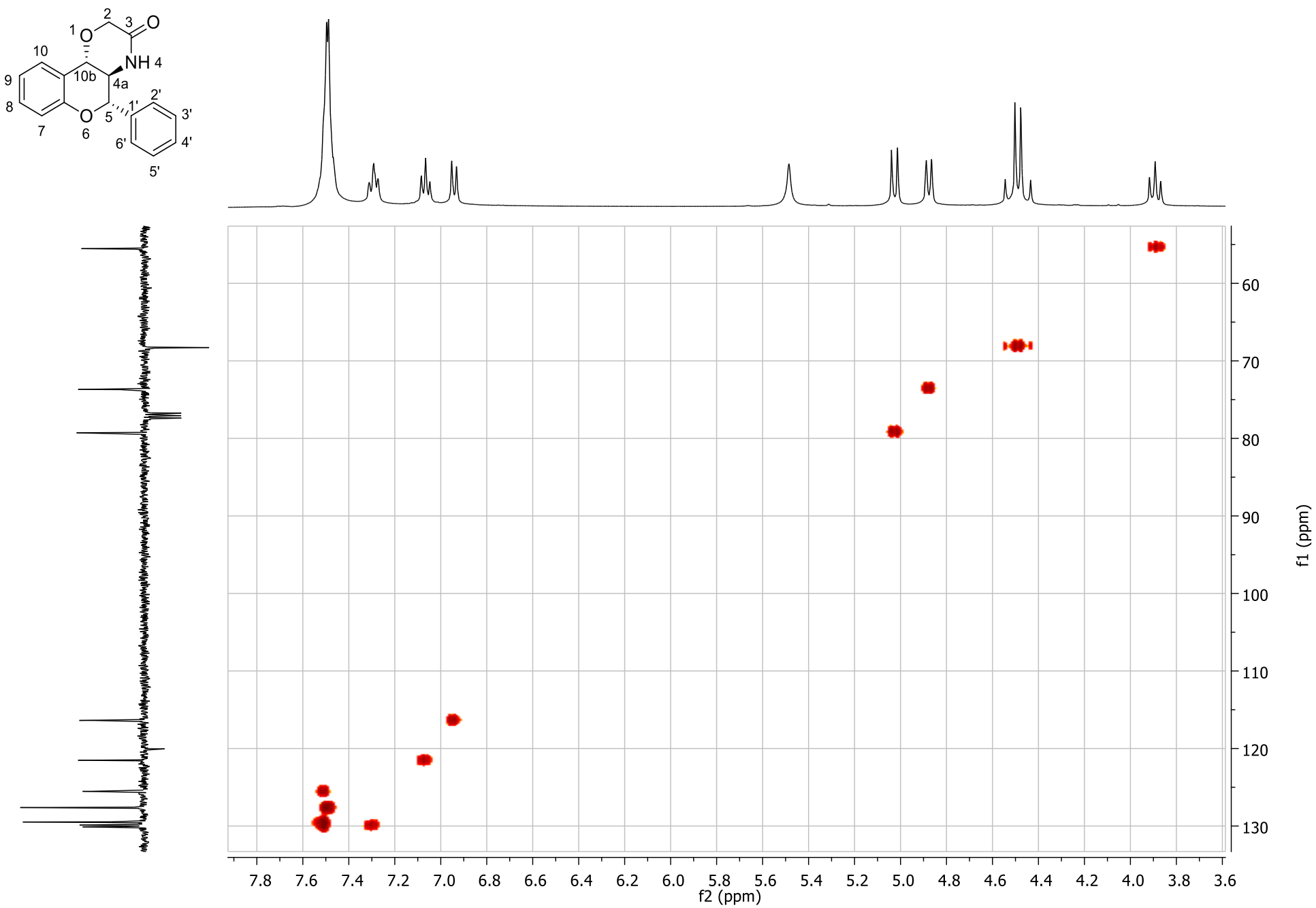


Figure S124. HSQC spectrum of *rac*-**20a** in $CDCl_3$

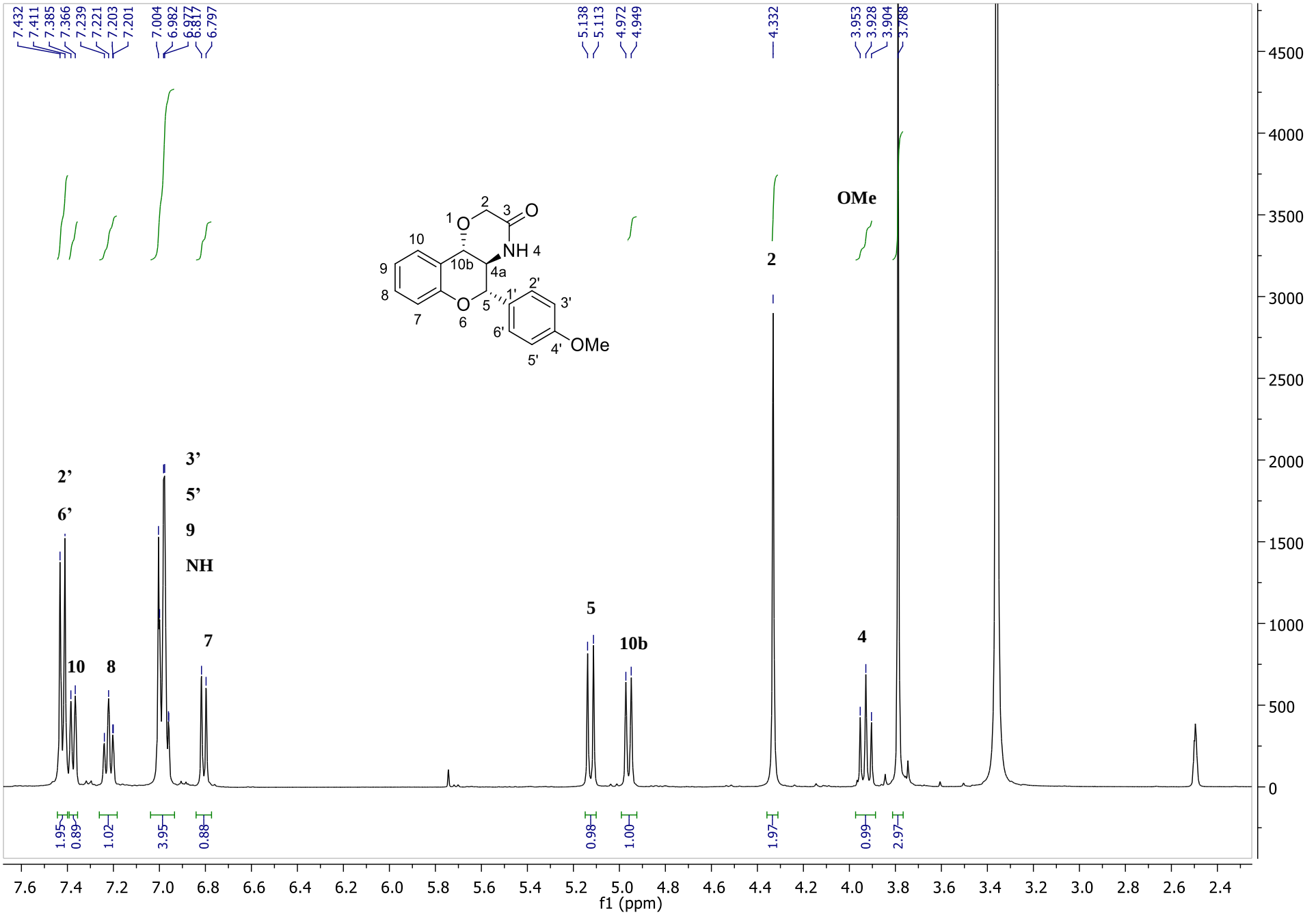


Figure S125. ^{1}H-NMR spectrum of *rac*-**20b** in DMSO-d_6

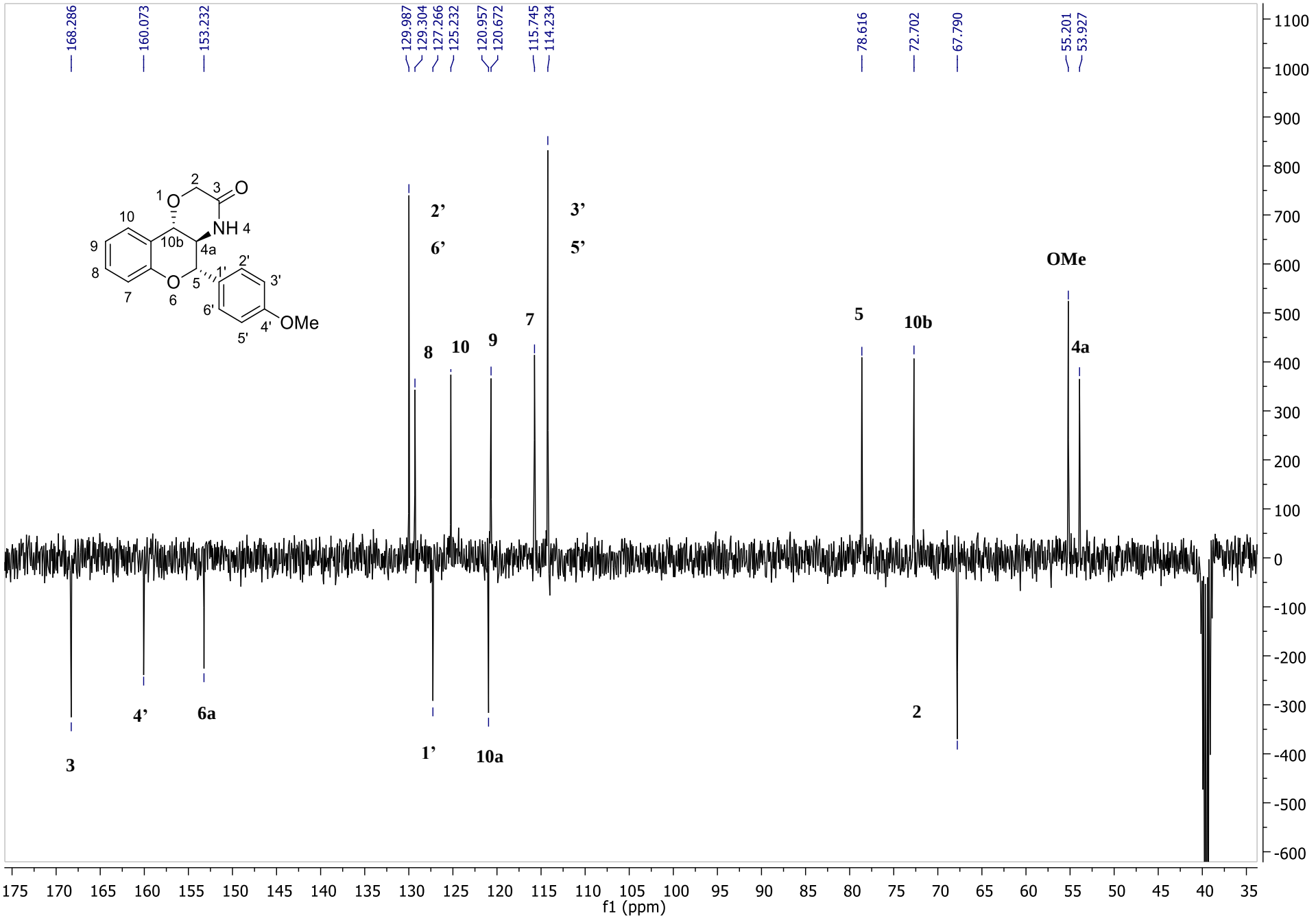


Figure S126. ^{13}C-NMR spectrum of *rac*-**20b** in DMSO-d_6

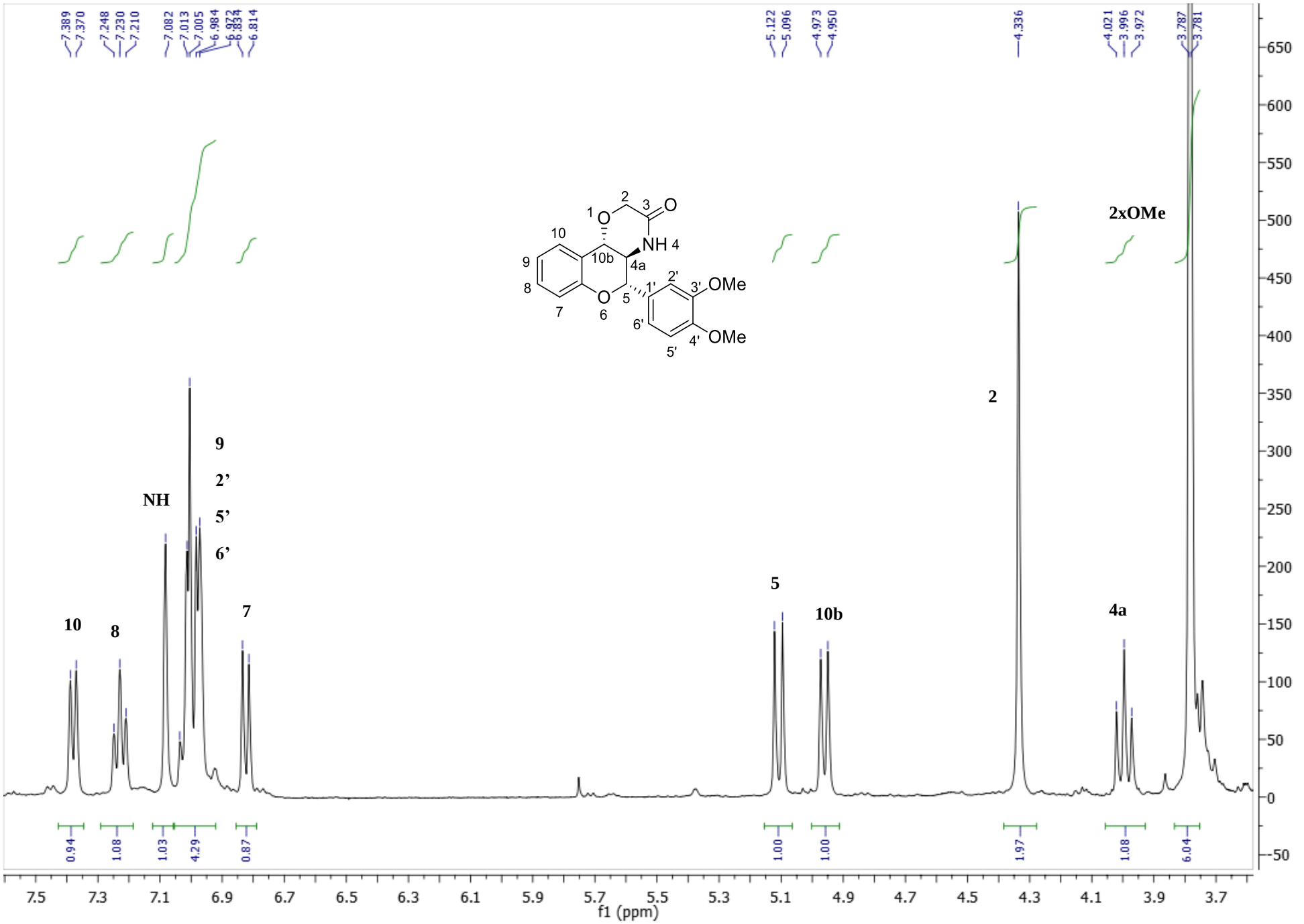


Figure S127. ^{1}H-NMR spectrum of *rac*-**20c** in DMSO-d_6

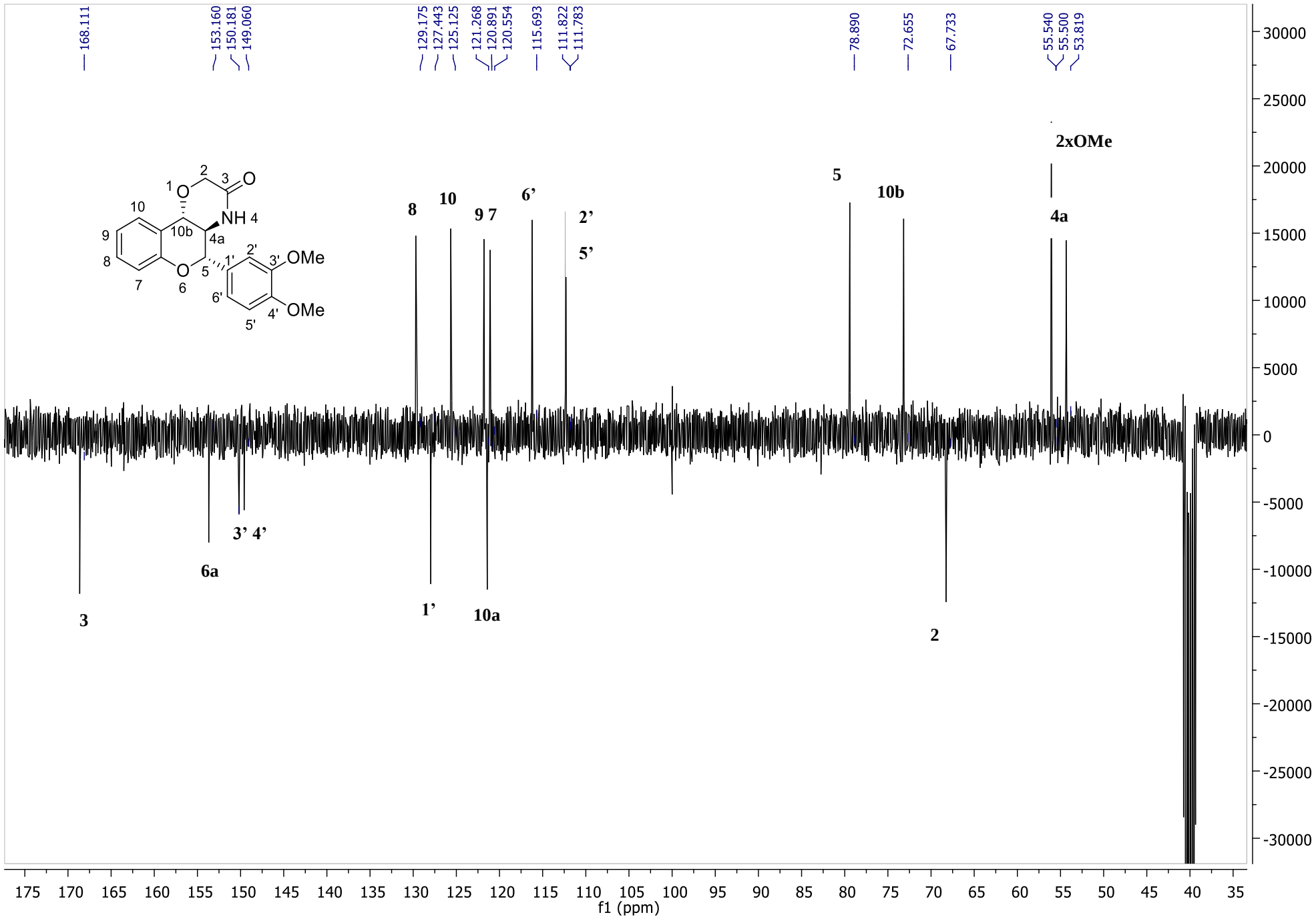


Figure S128. ^{13}C-NMR spectrum of *rac*-**20c** in DMSO-d_6

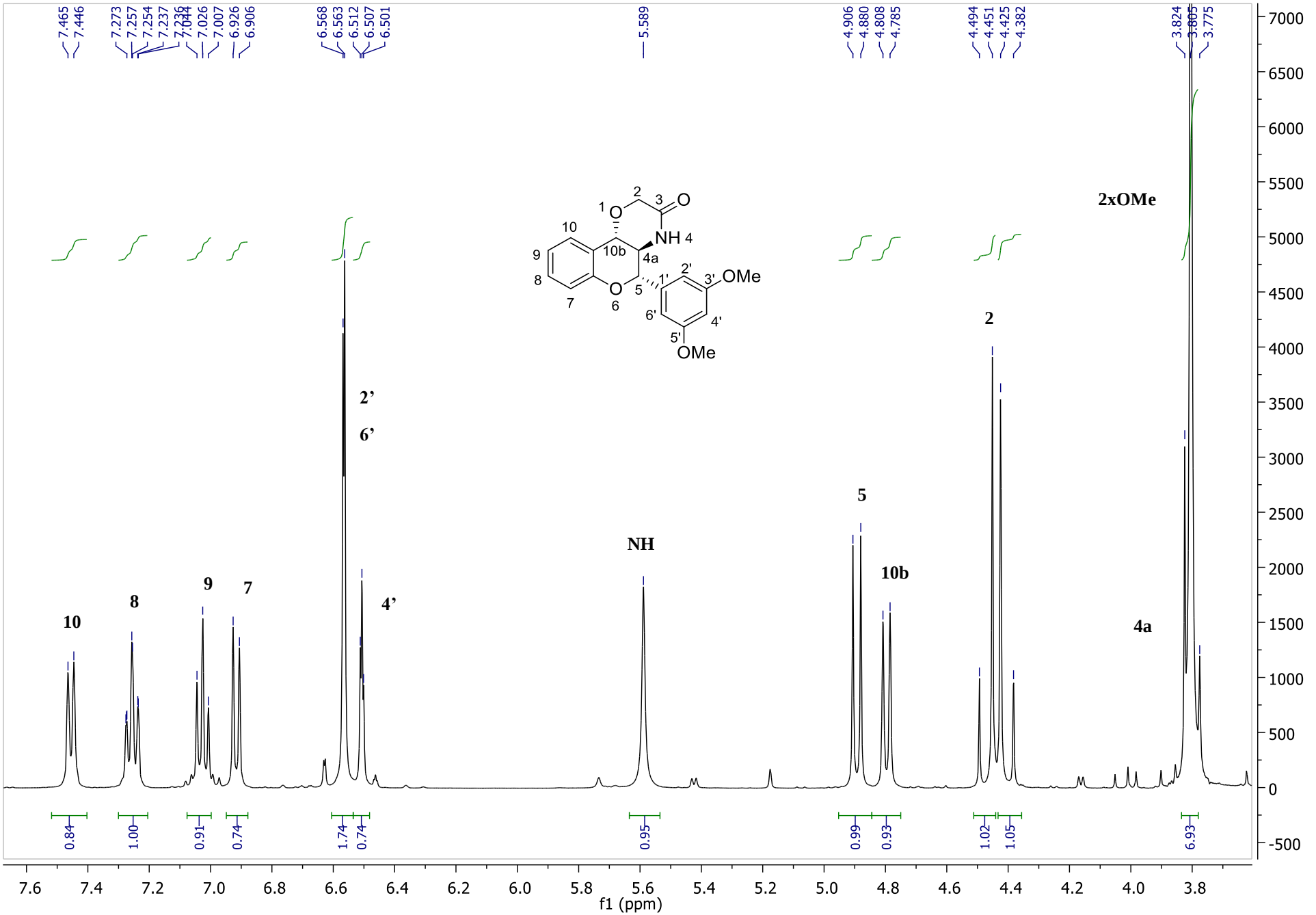


Figure S129. ^{1}H-NMR spectrum of *rac*-**20d** in $CDCl_3$

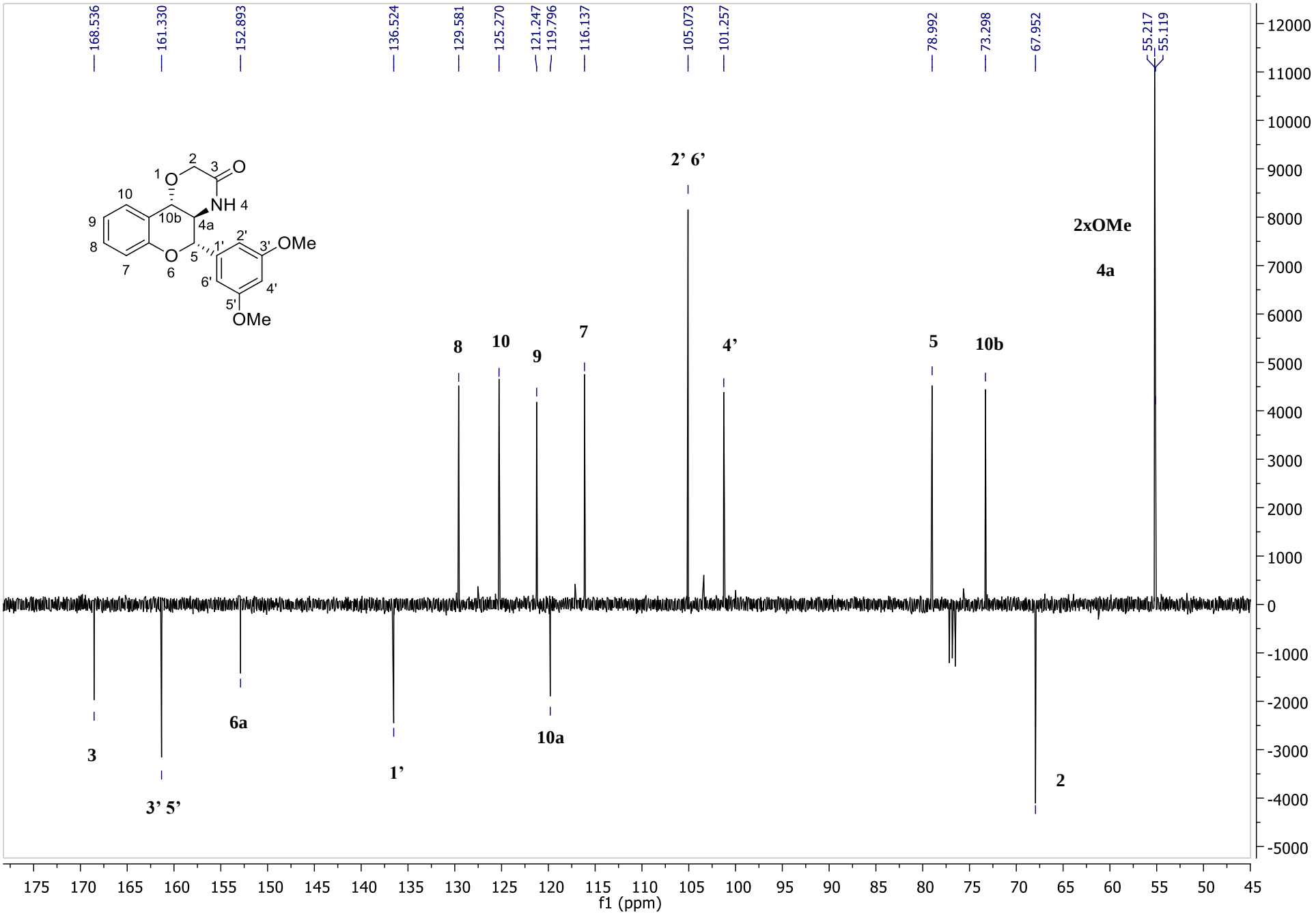


Figure S130. ^{13}C-NMR spectrum of *rac*-**20d** in $CDCl_3$

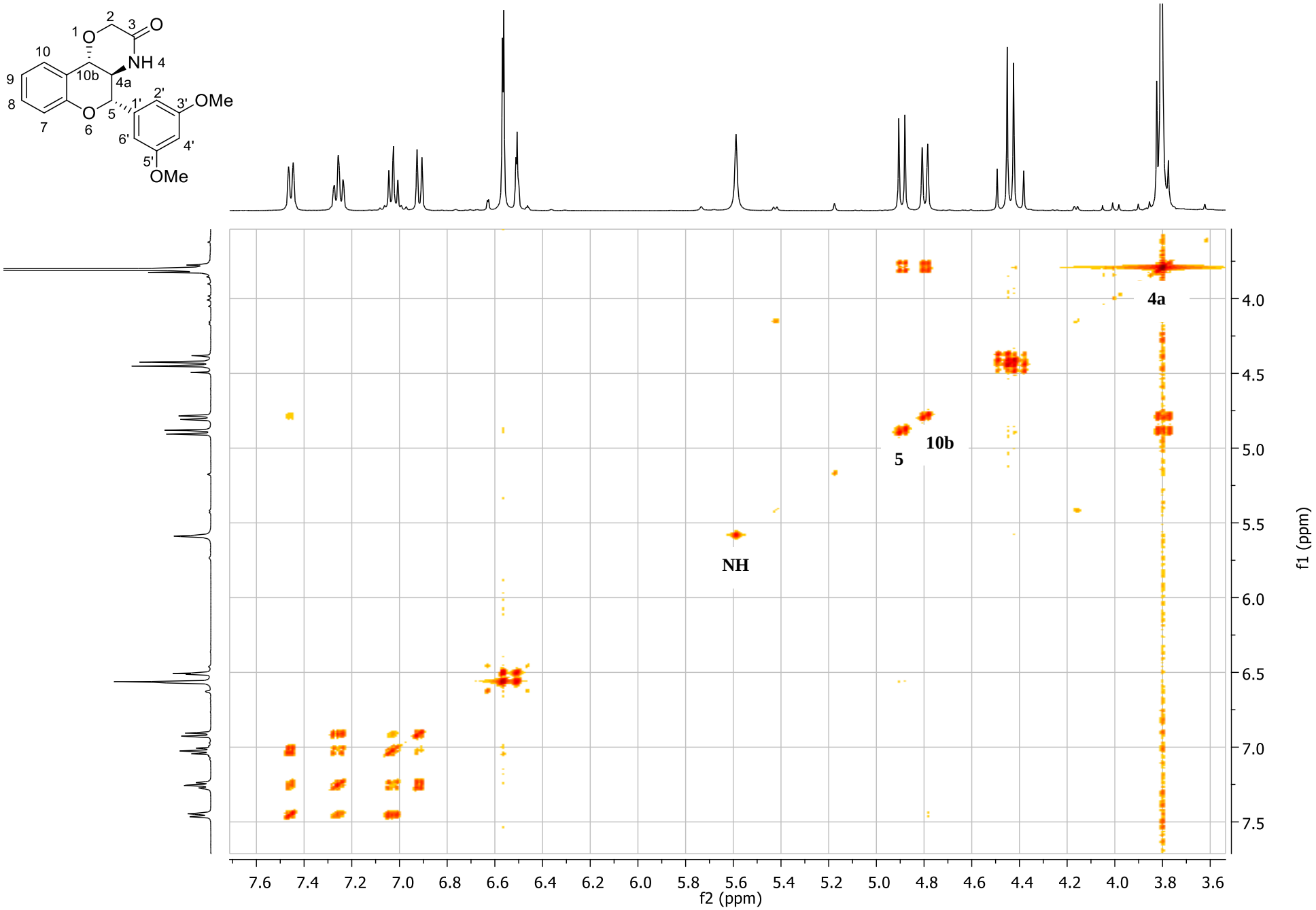


Figure S131. COSY-spectrum of *rac*-**20d** in $CDCl_3$

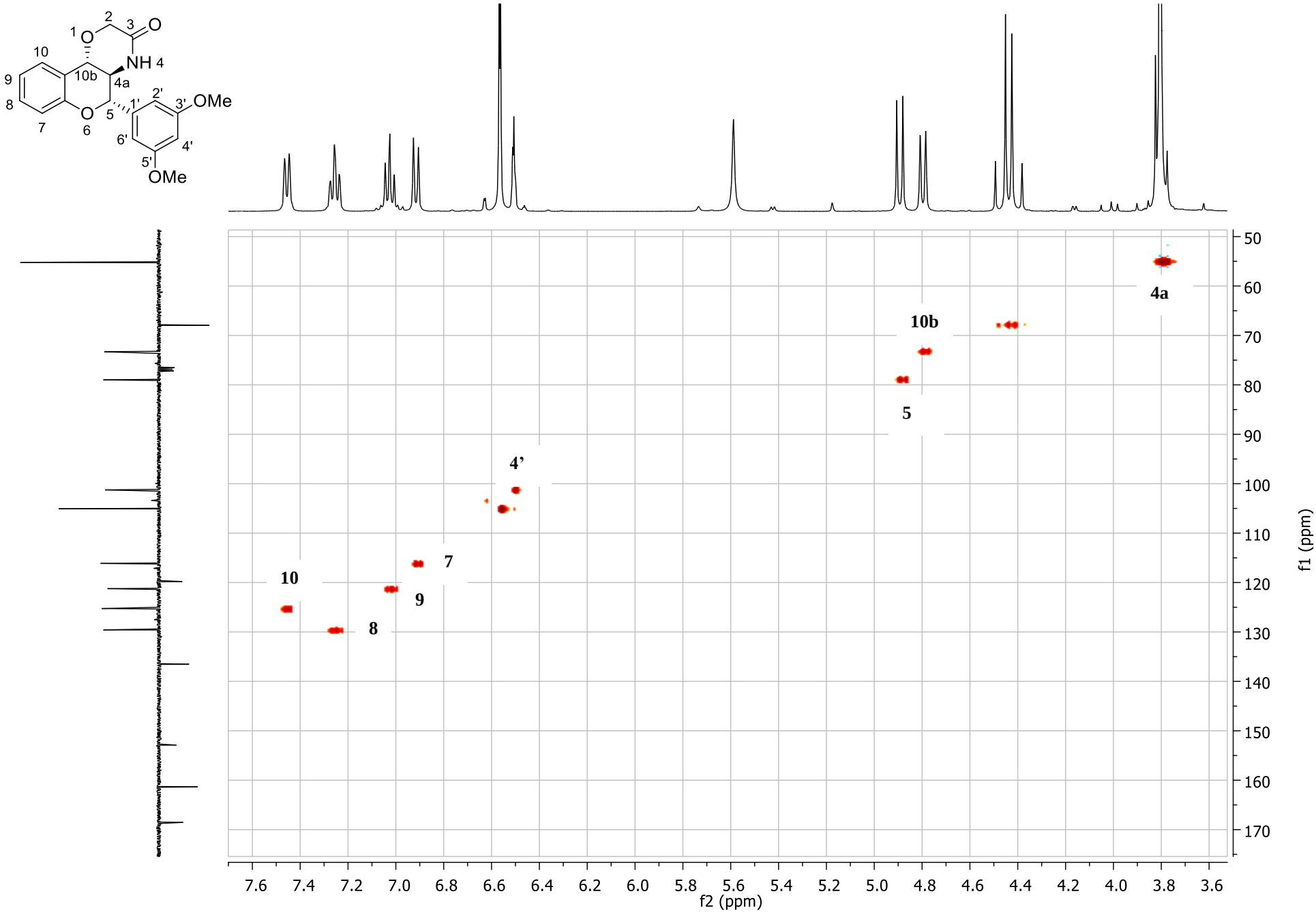


Figure S132. COSY-spectrum of *rac*-**20d** in $CDCl_3$

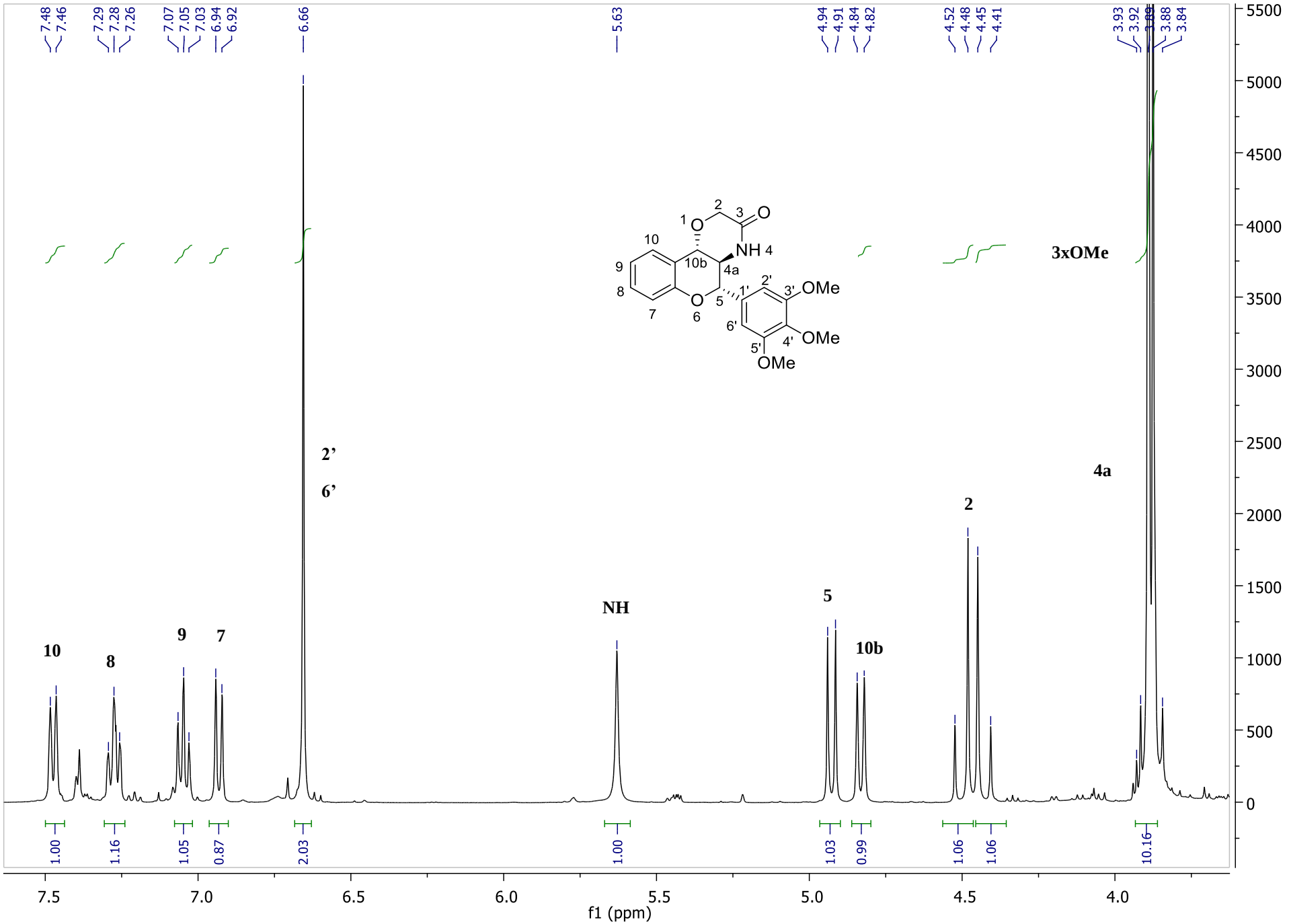


Figure S133. ^{1}H-NMR spectrum of *rac*-**20e** in $CDCl_3$

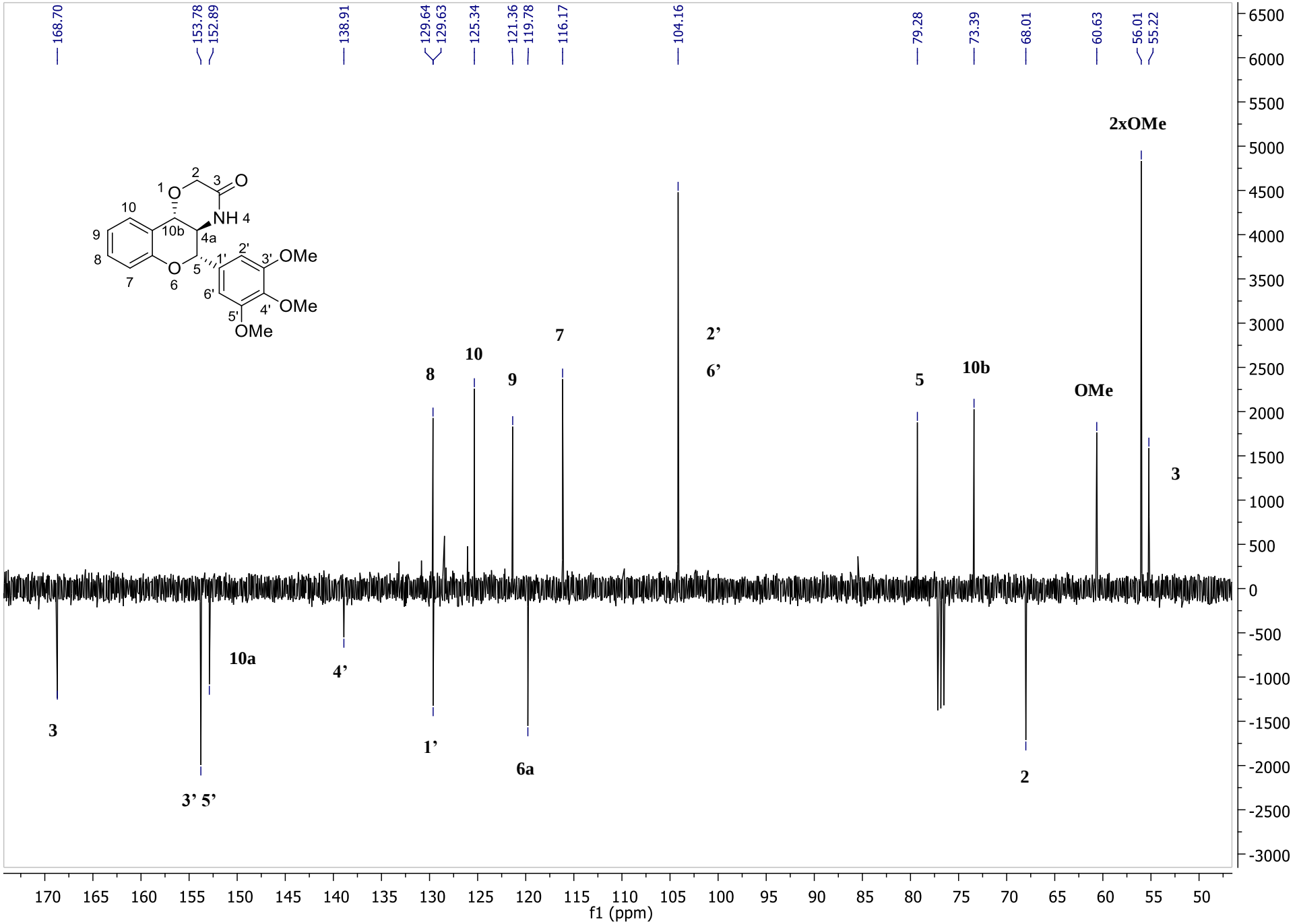


Figure S134. ^{13}C-NMR spectrum of *rac*-**20e** in $CDCl_3$

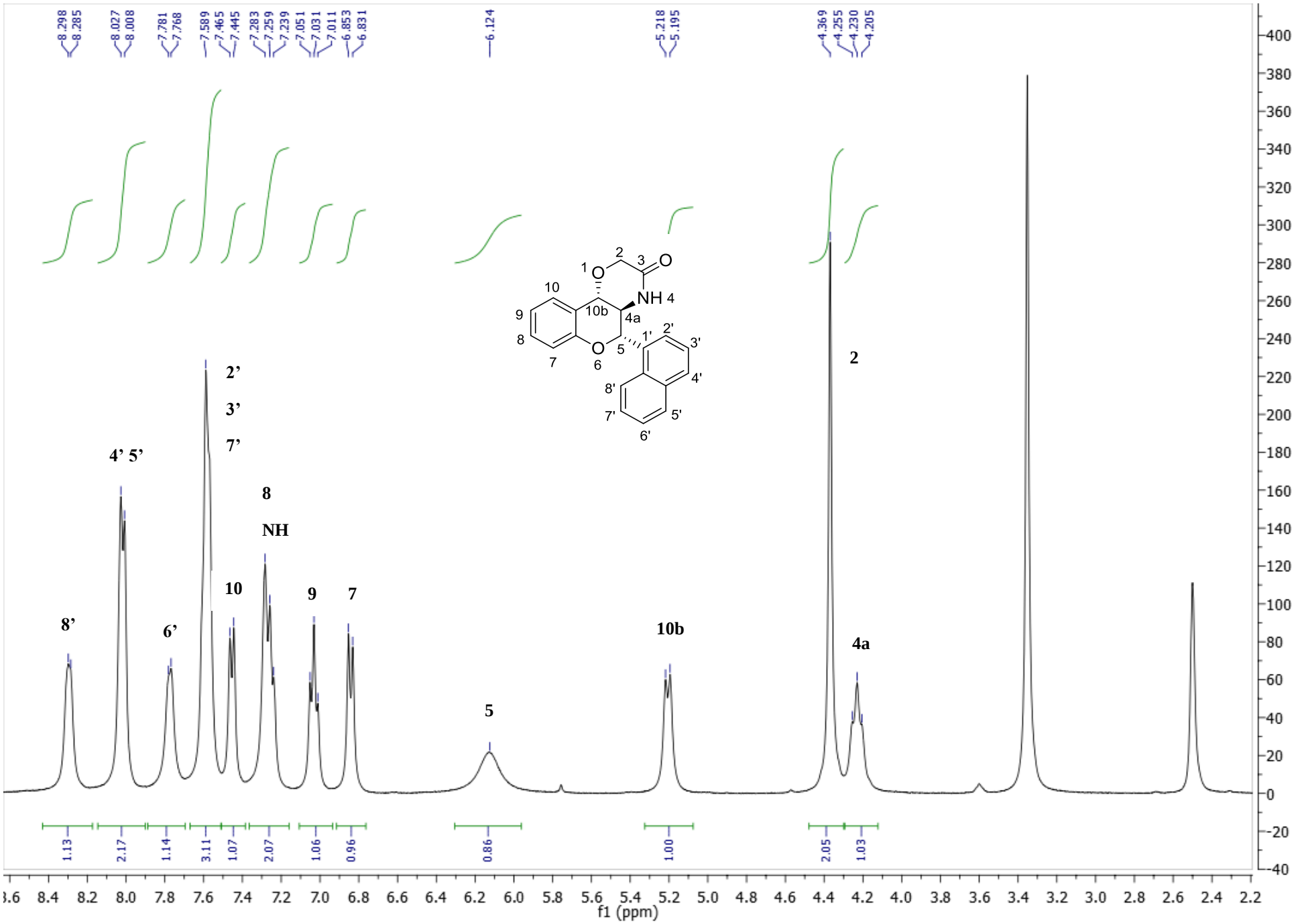


Figure S135. ^{1}H-NMR spectrum of *rac*-**20f** in DMSO-d_6

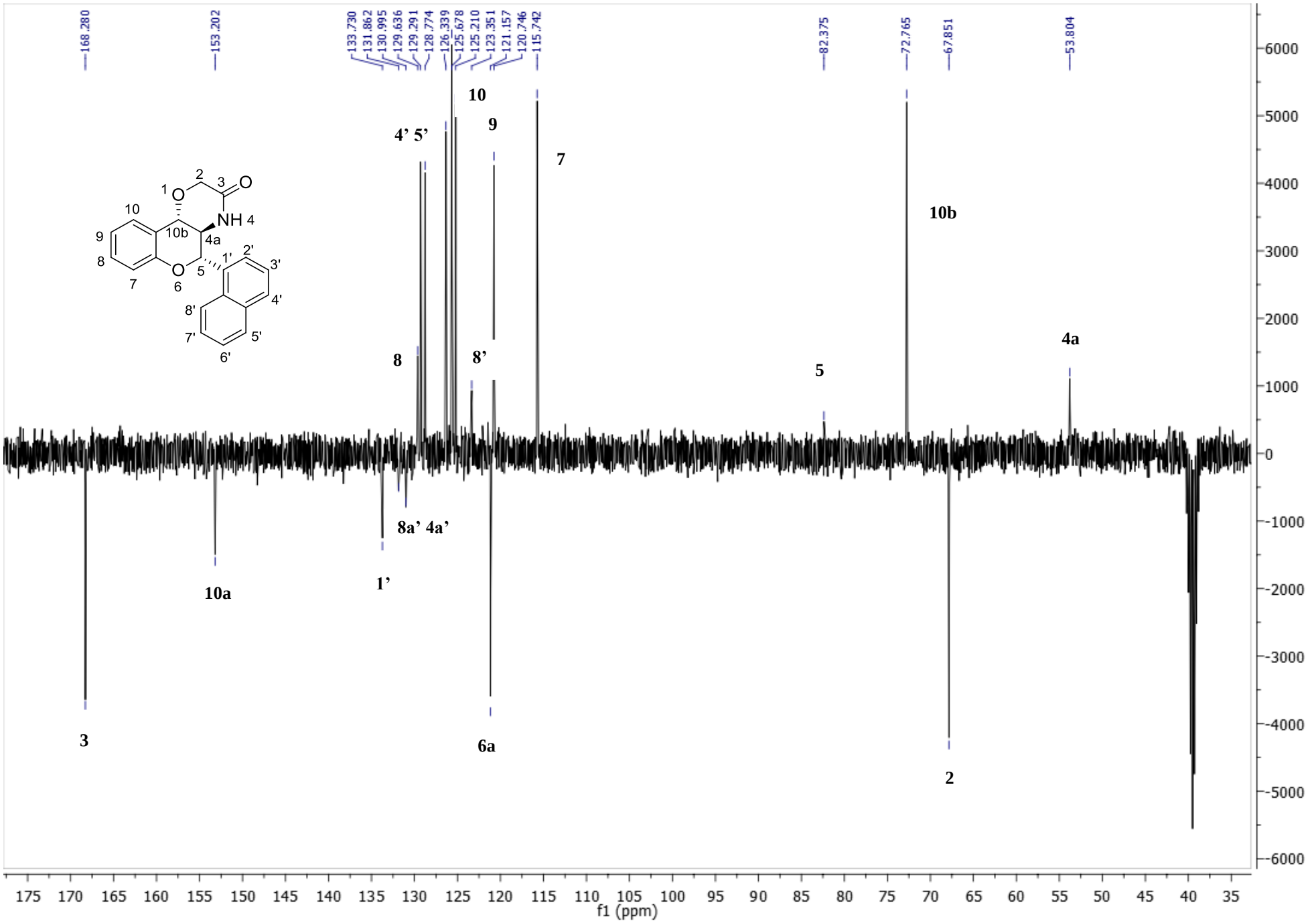


Figure S136. ^{13}C-NMR spectrum of *rac*-**20f** in DMSO-d_6

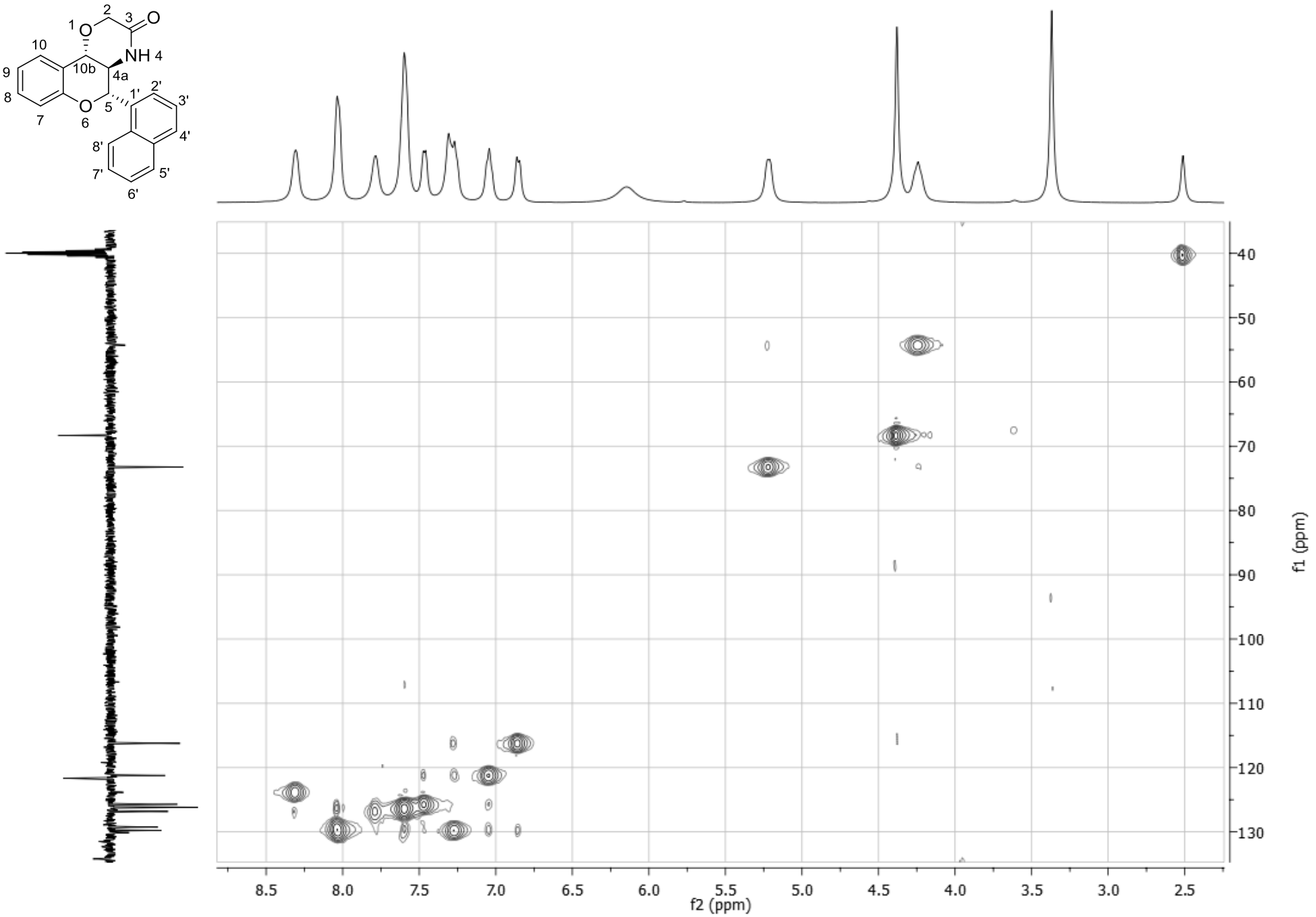


Figure S137. HSQC spectrum of *rac*-**20f** in DMSO-d_6

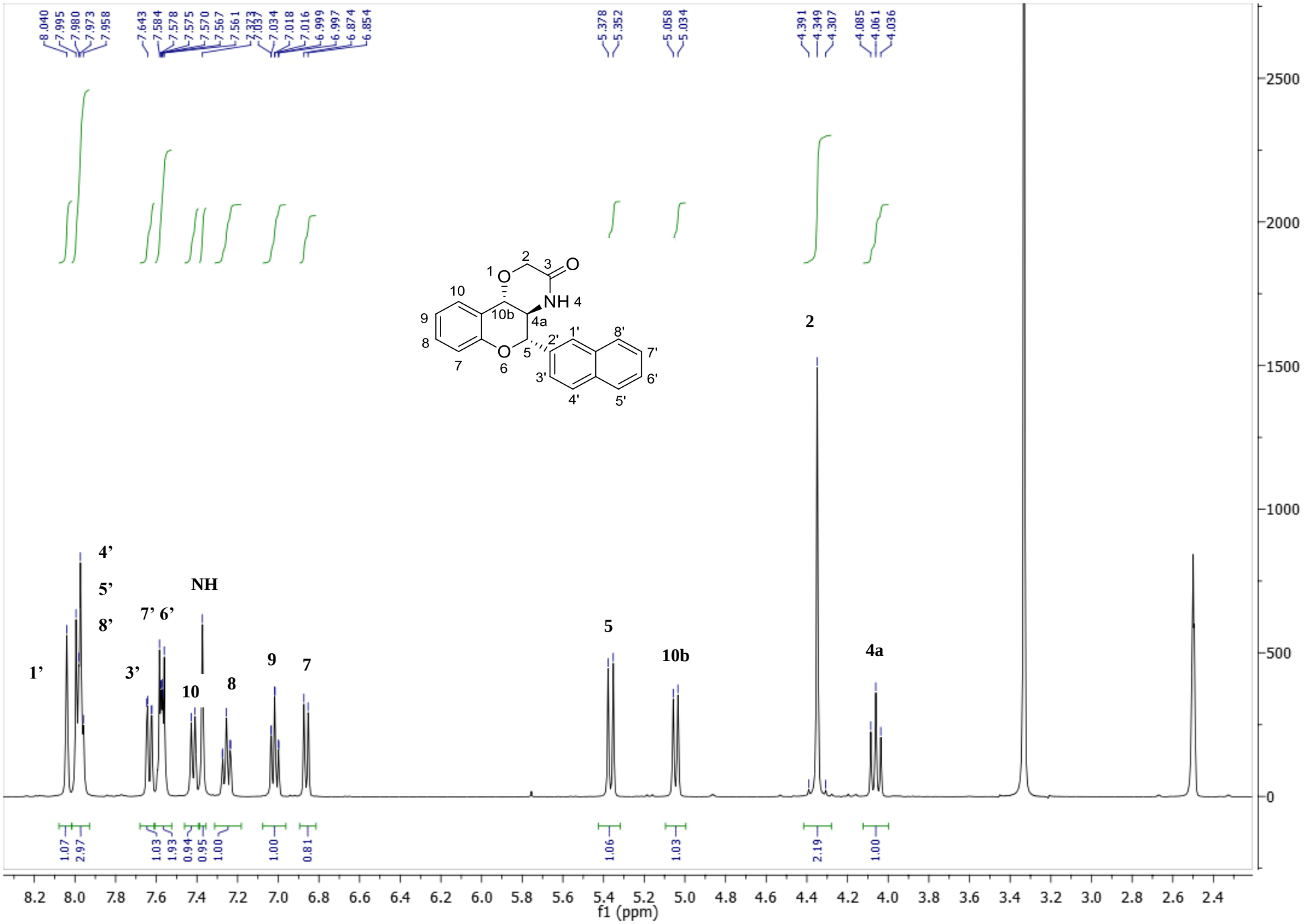


Figure S138. ^{1}H-NMR spectrum of *rac*-**20g** in DMSO-d_6

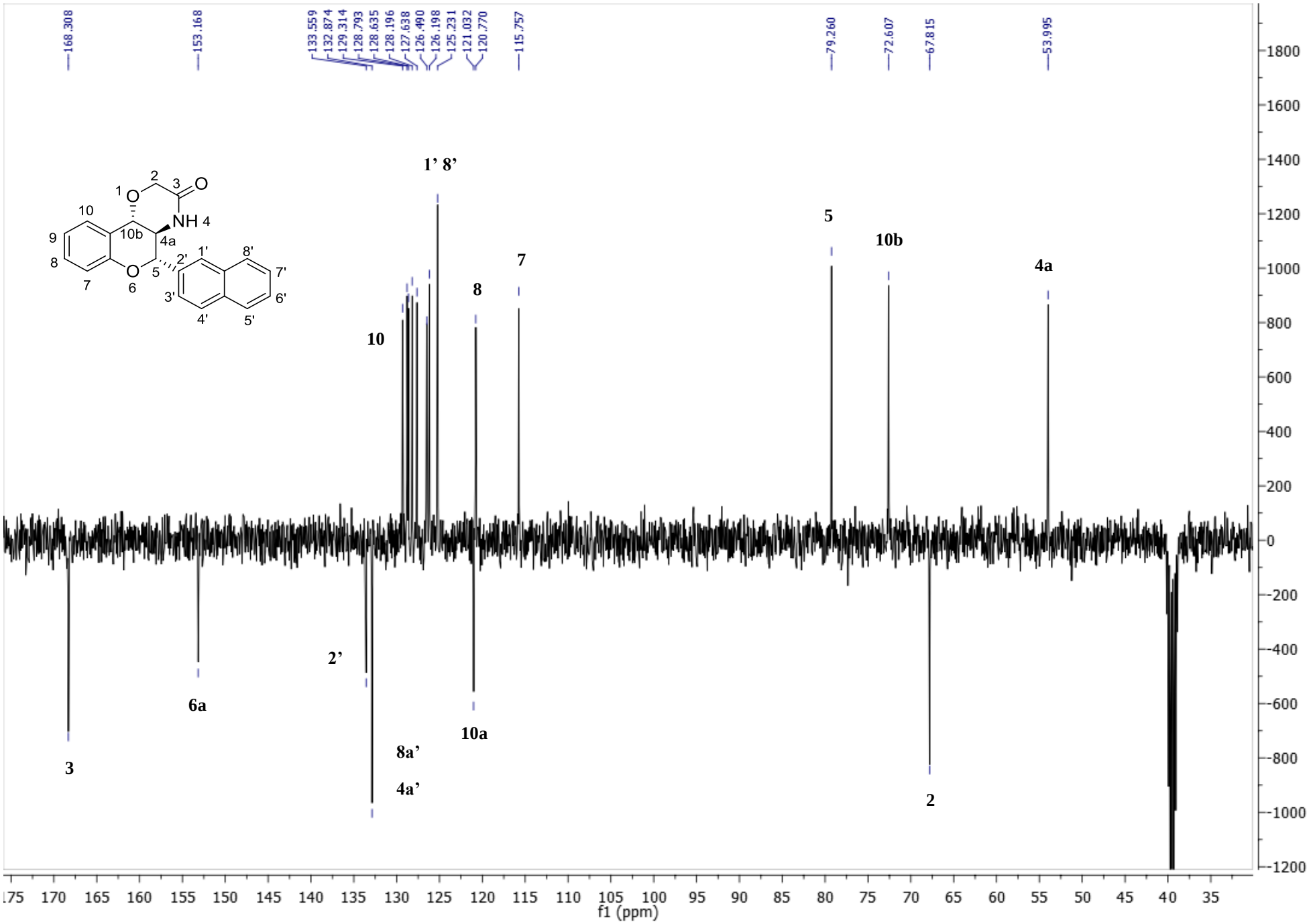


Figure S139. ^{13}C-NMR spectrum of *rac*-**20g** in DMSO-d_6

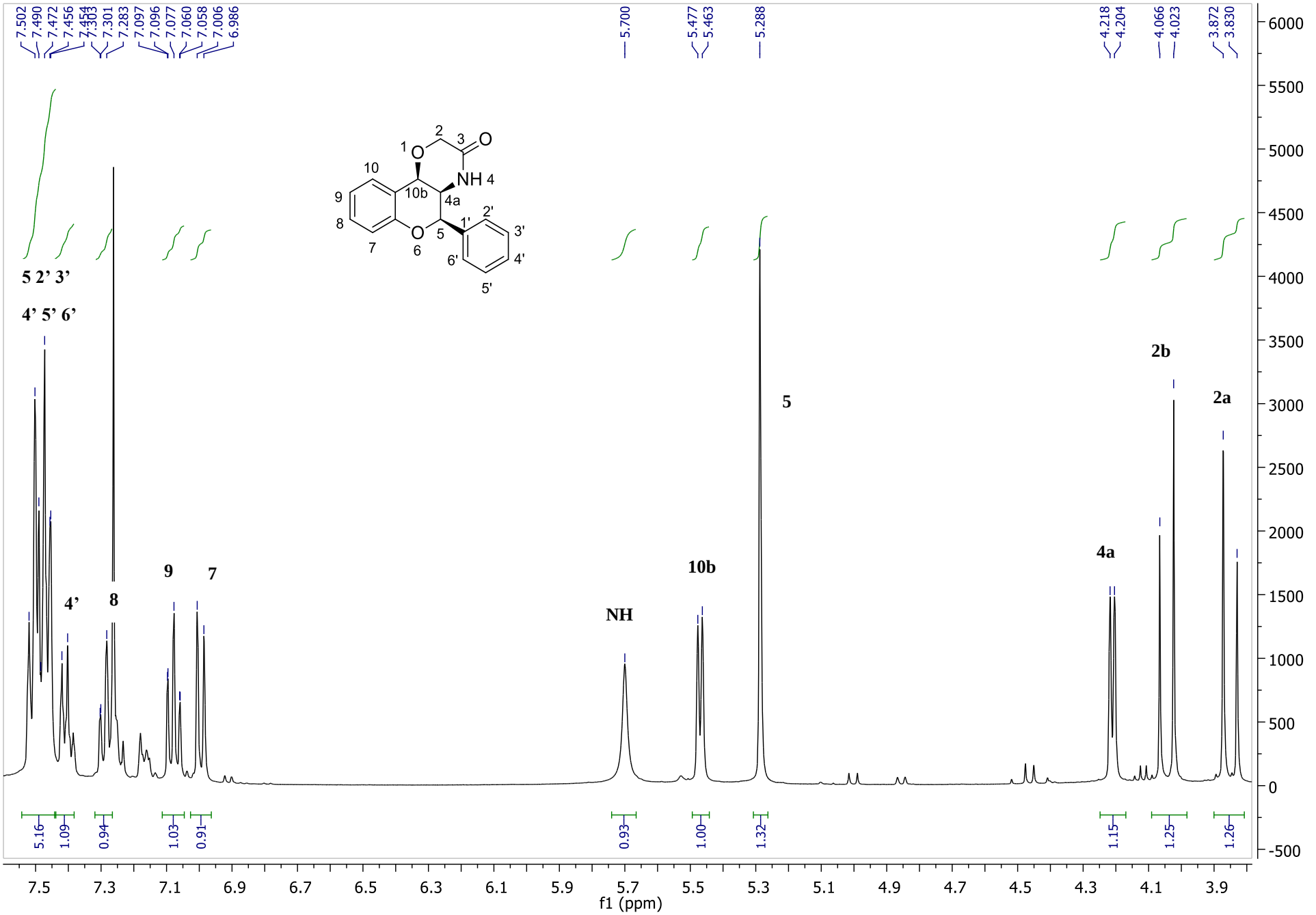


Figure S140. ^{1}H-NMR spectrum of *rac*-**23a** in $CDCl_3$

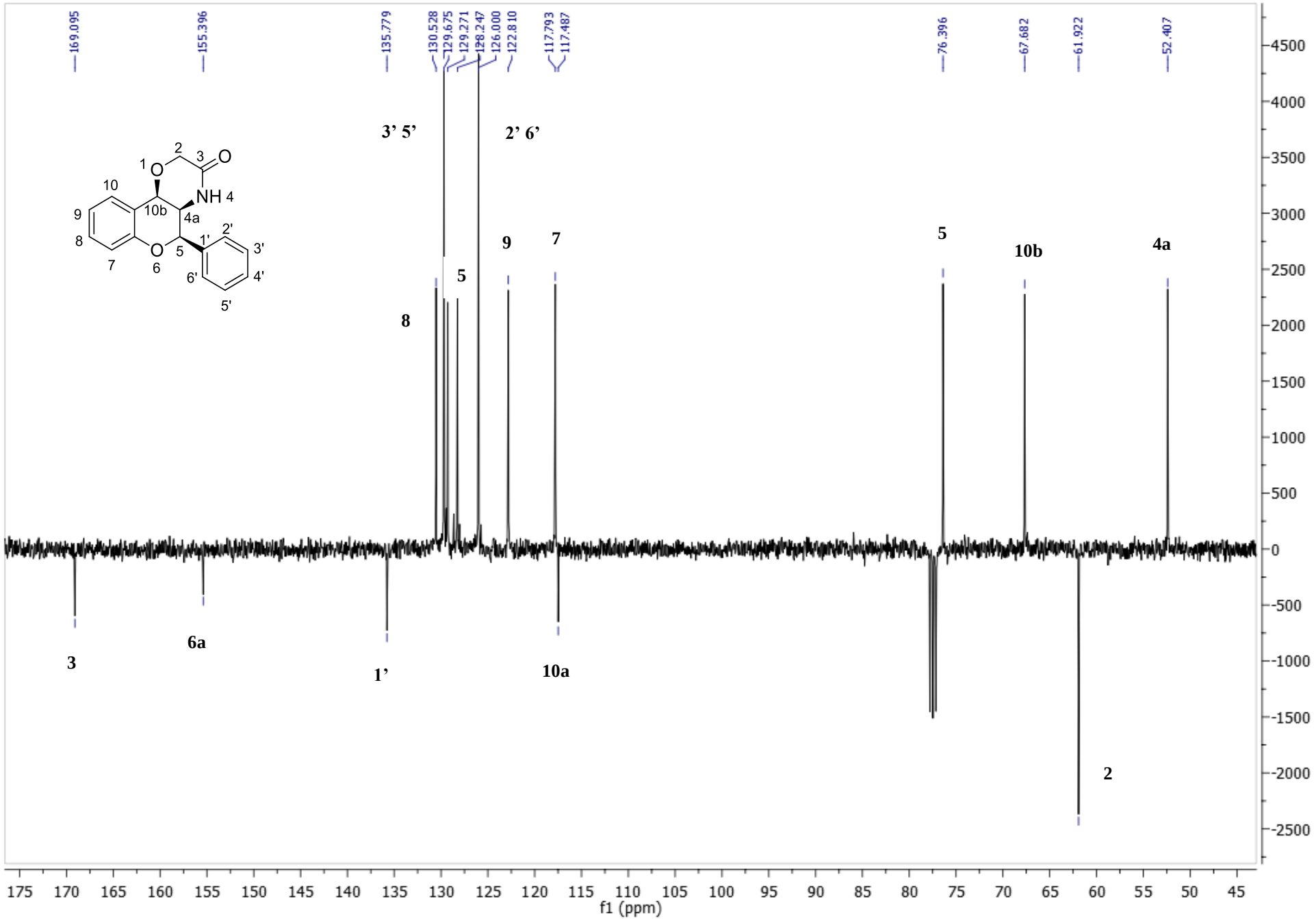


Figure S141. ^{13}C-NMR spectrum of *rac*-**23a** in $CDCl_3$

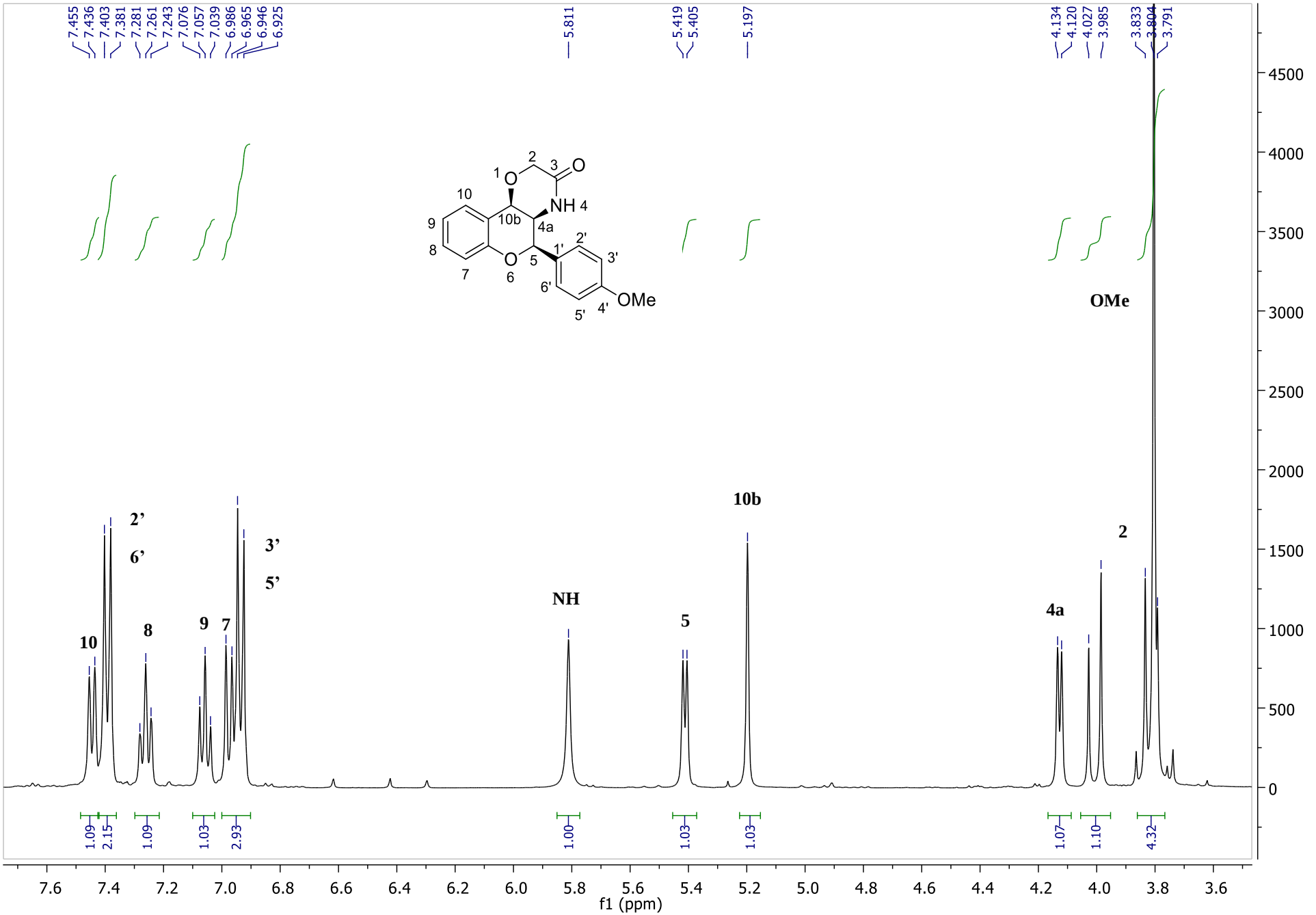


Figure S142. ^{1}H-NMR spectrum of *rac*-**23b** in $CDCl_3$

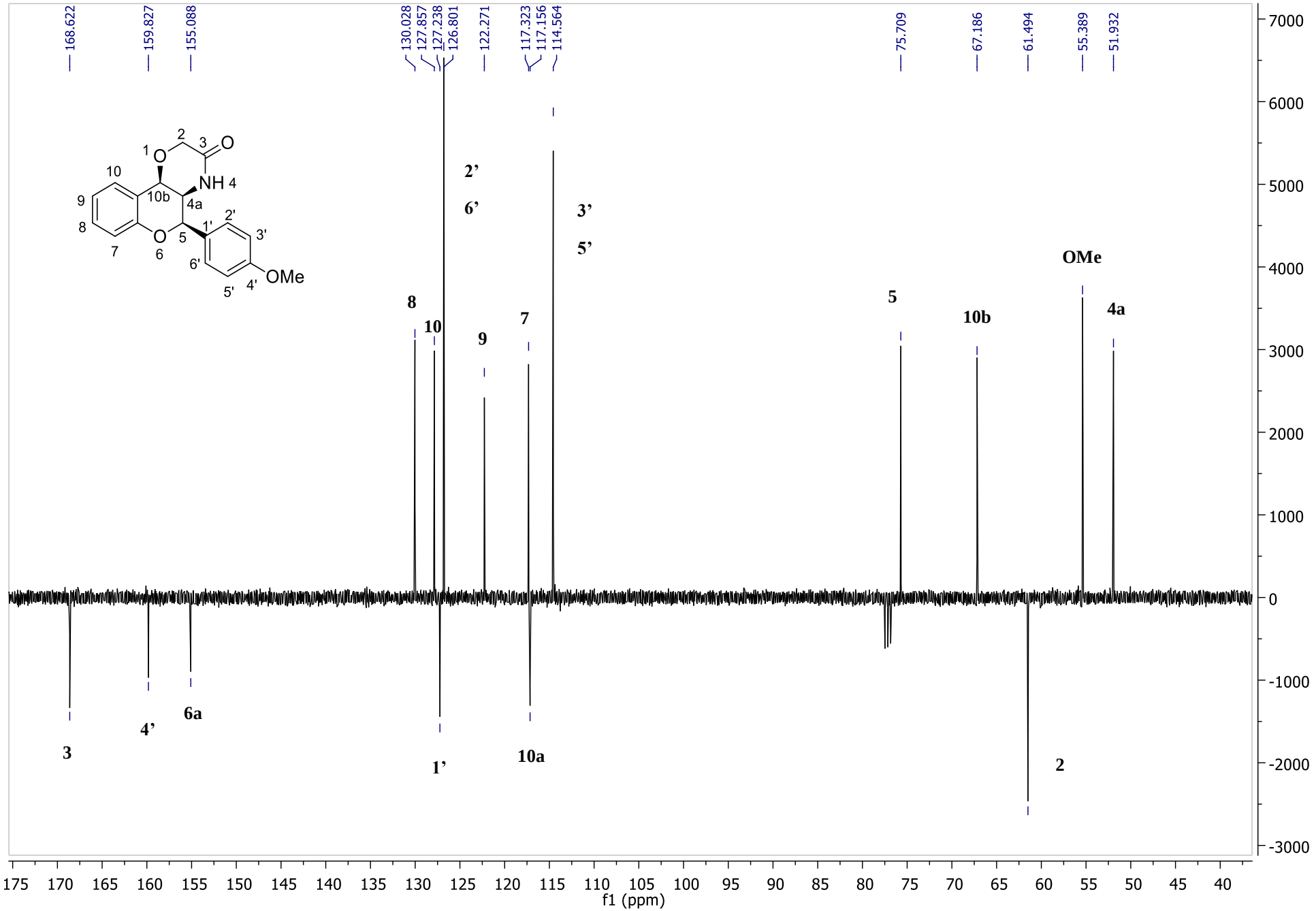


Figure S143. ^{13}C-NMR spectrum of *rac*-**23b** in $CDCl_3$

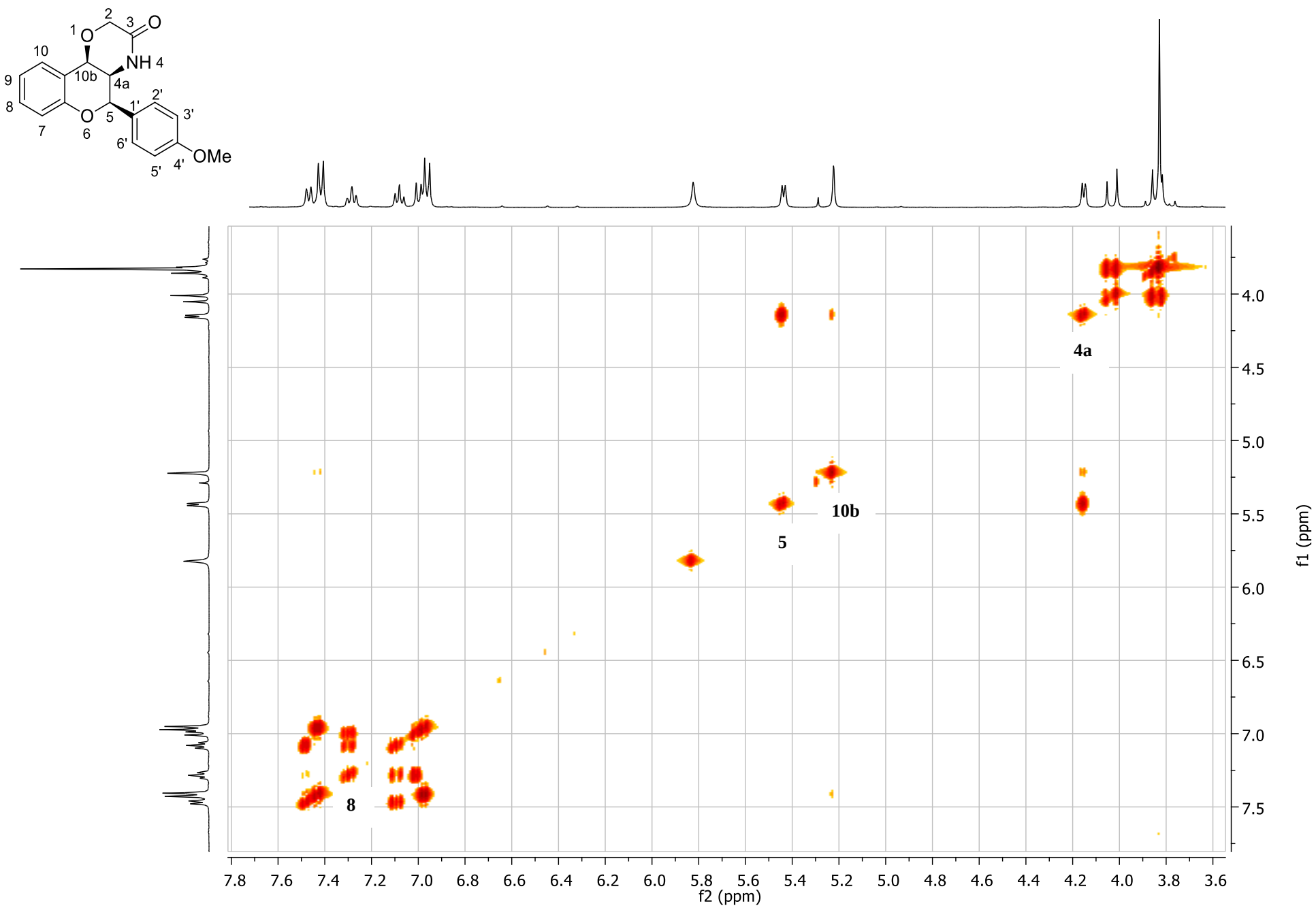


Figure S144. COSY spectrum of *rac*-**23b** in $CDCl_3$

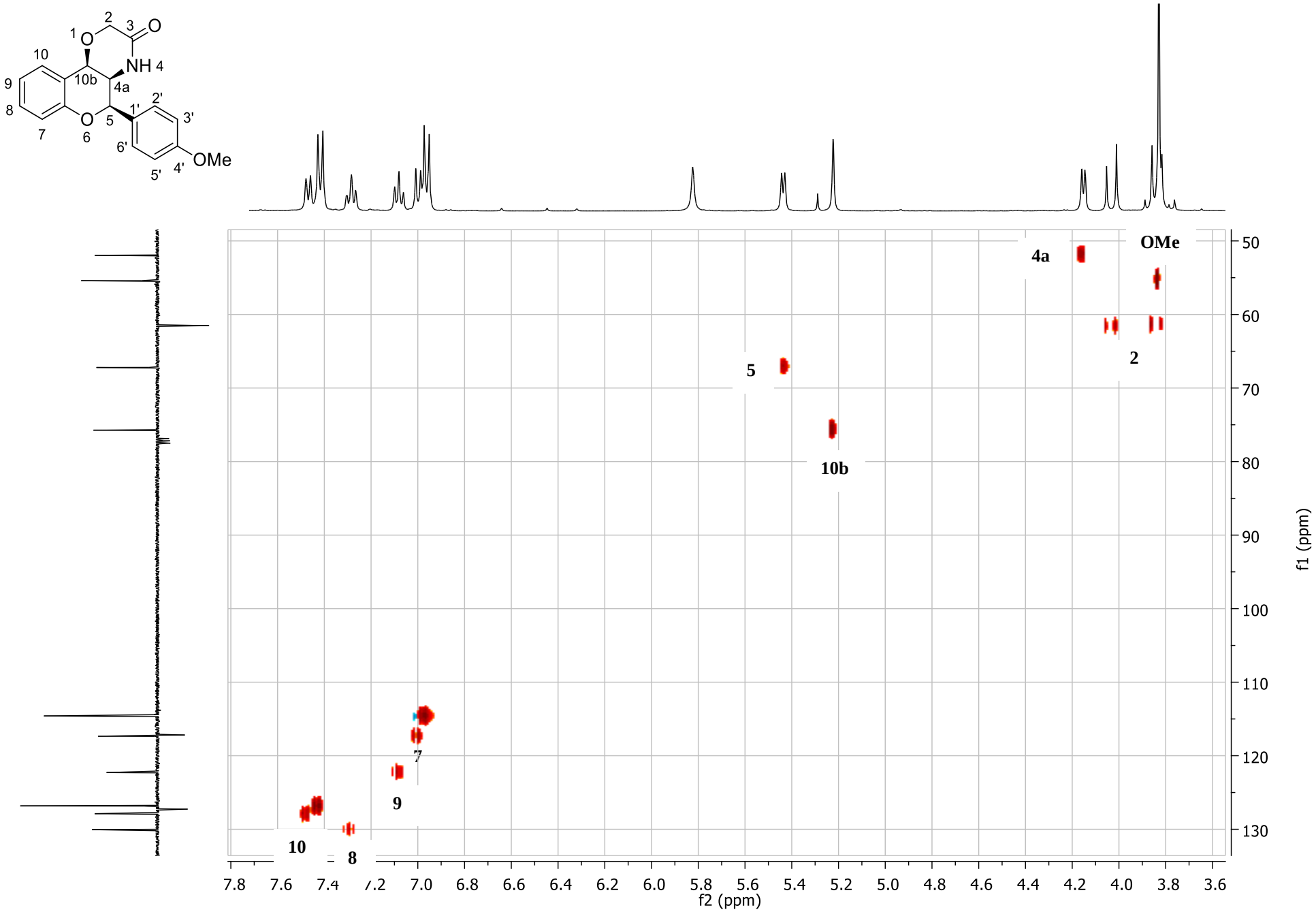


Figure S145. HSQC spectrum of *rac*-**23b** in $CDCl_3$

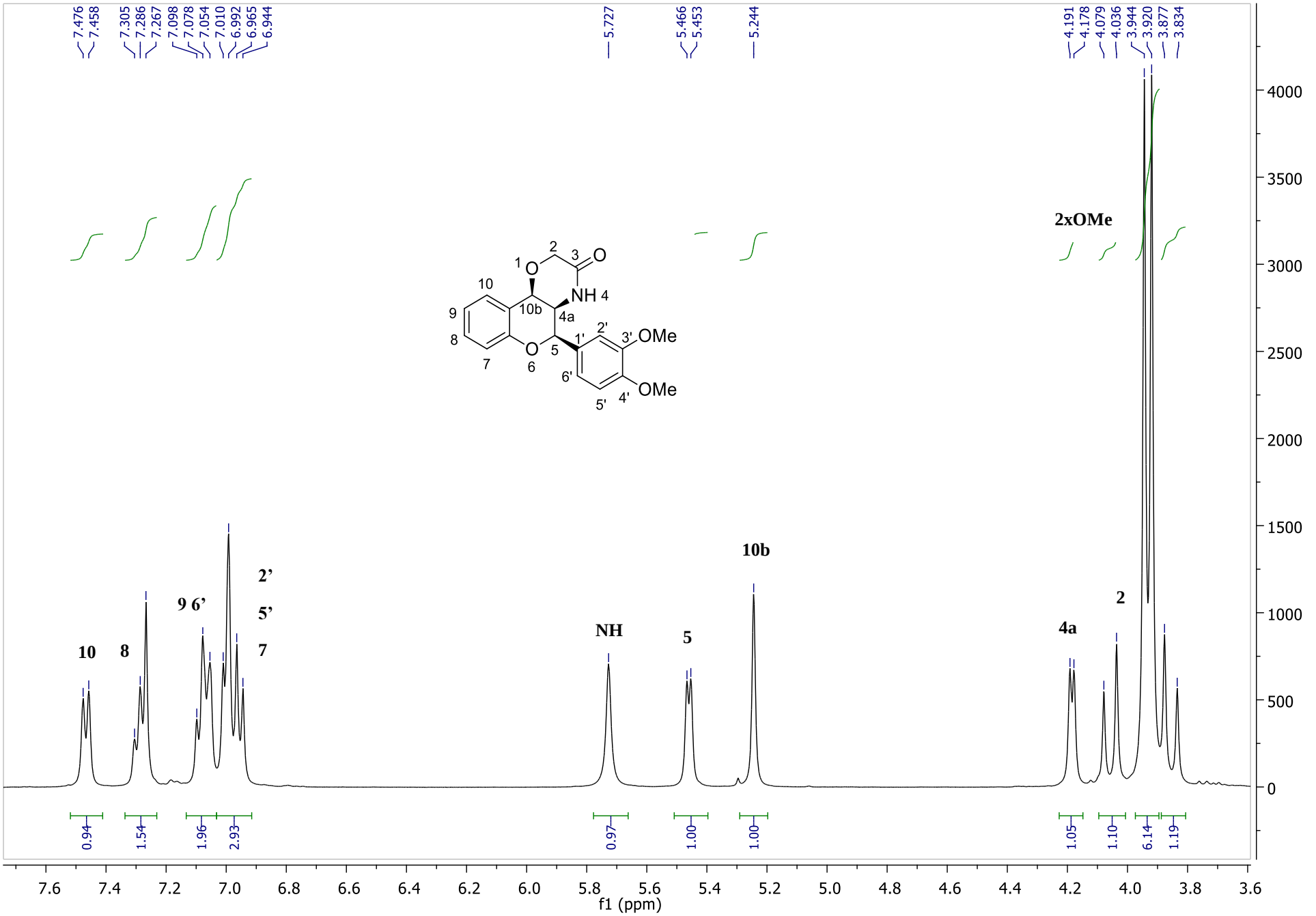


Figure S146. ^{1}H-NMR spectrum of *rac*-**23c** in $CDCl_3$

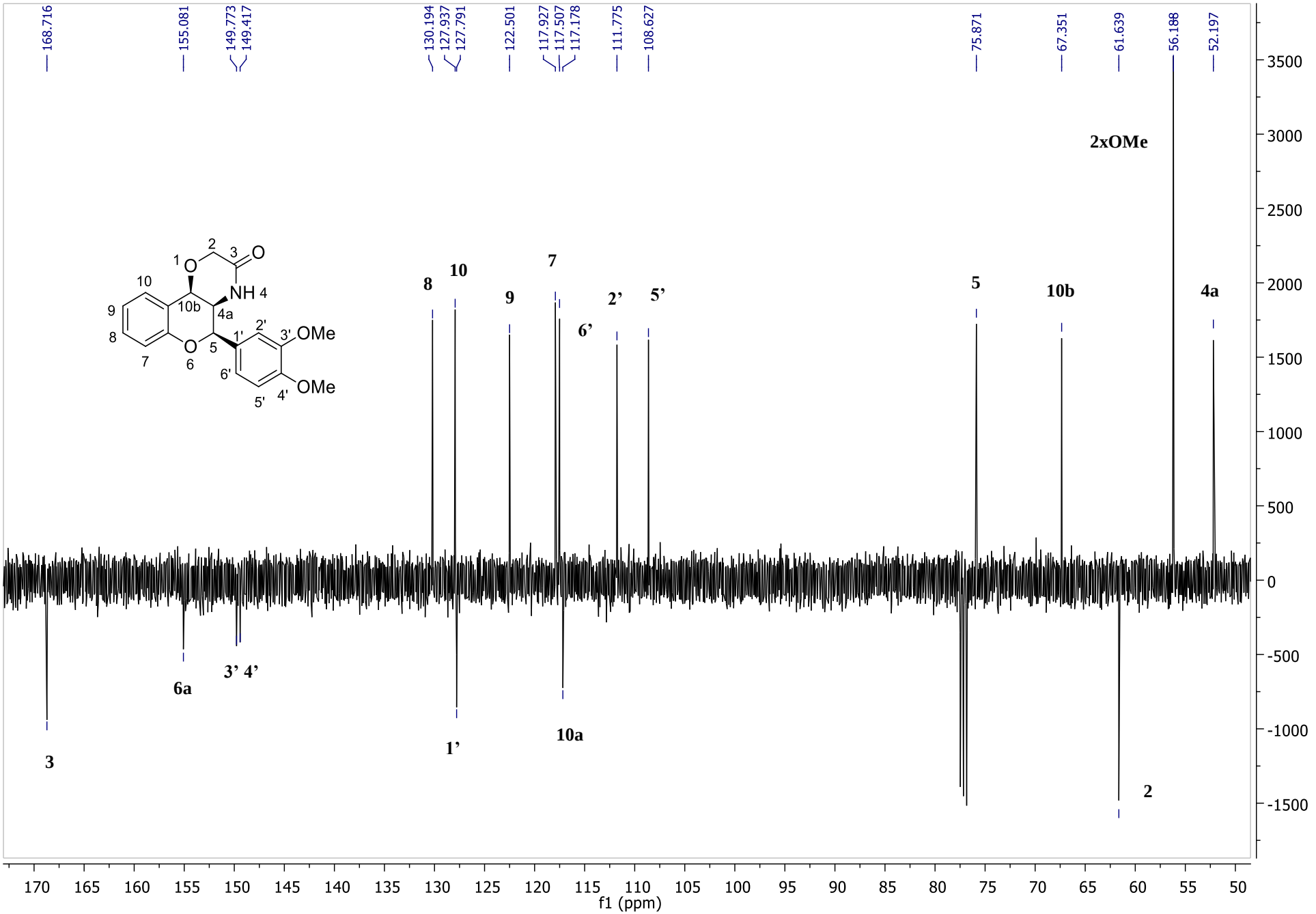


Figure S147. ^{13}C-NMR spectrum of *rac*-**23c** in $CDCl_3$

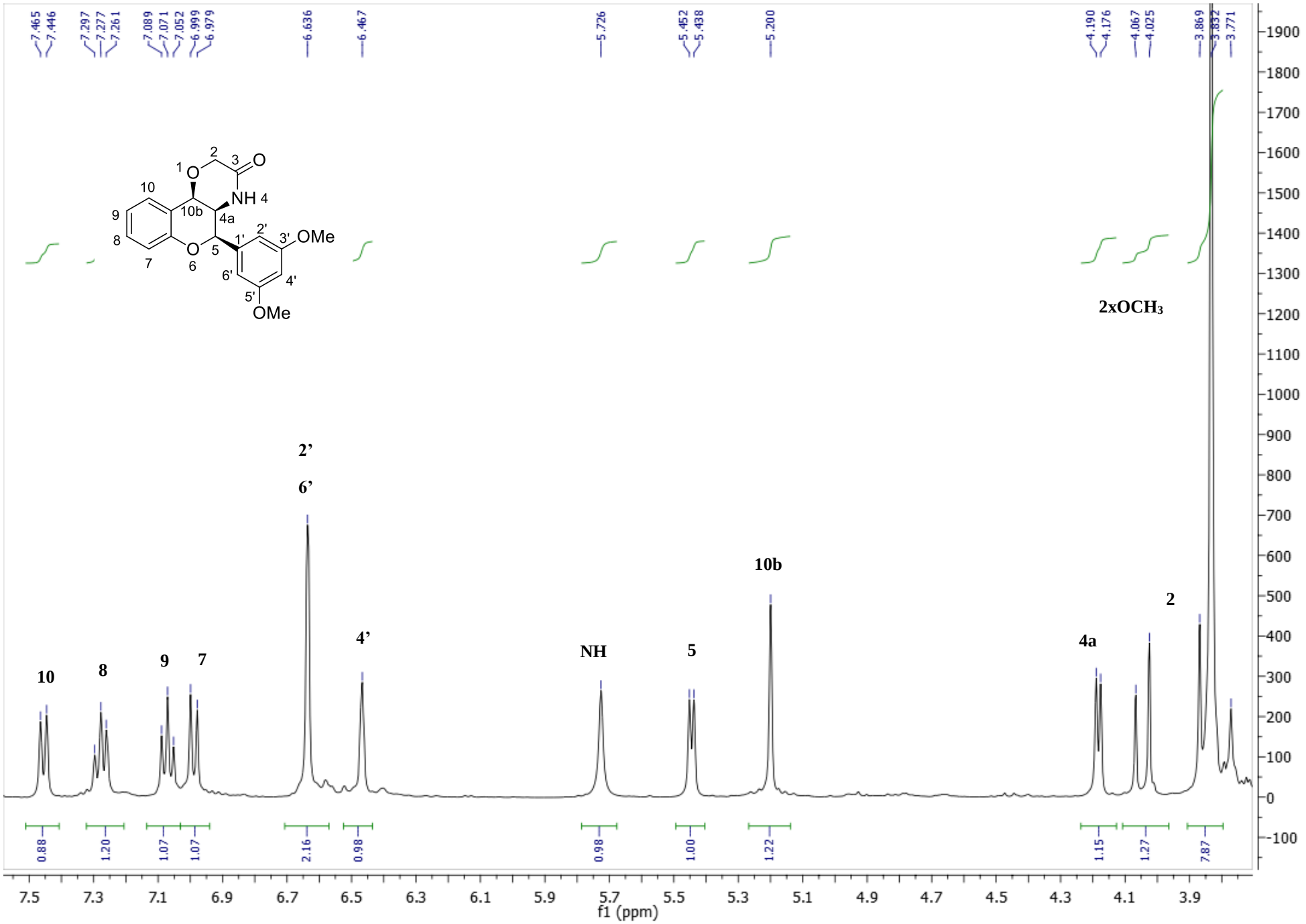


Figure S148. ^{1}H-NMR spectrum of *rac*-**23d** in $CDCl_3$

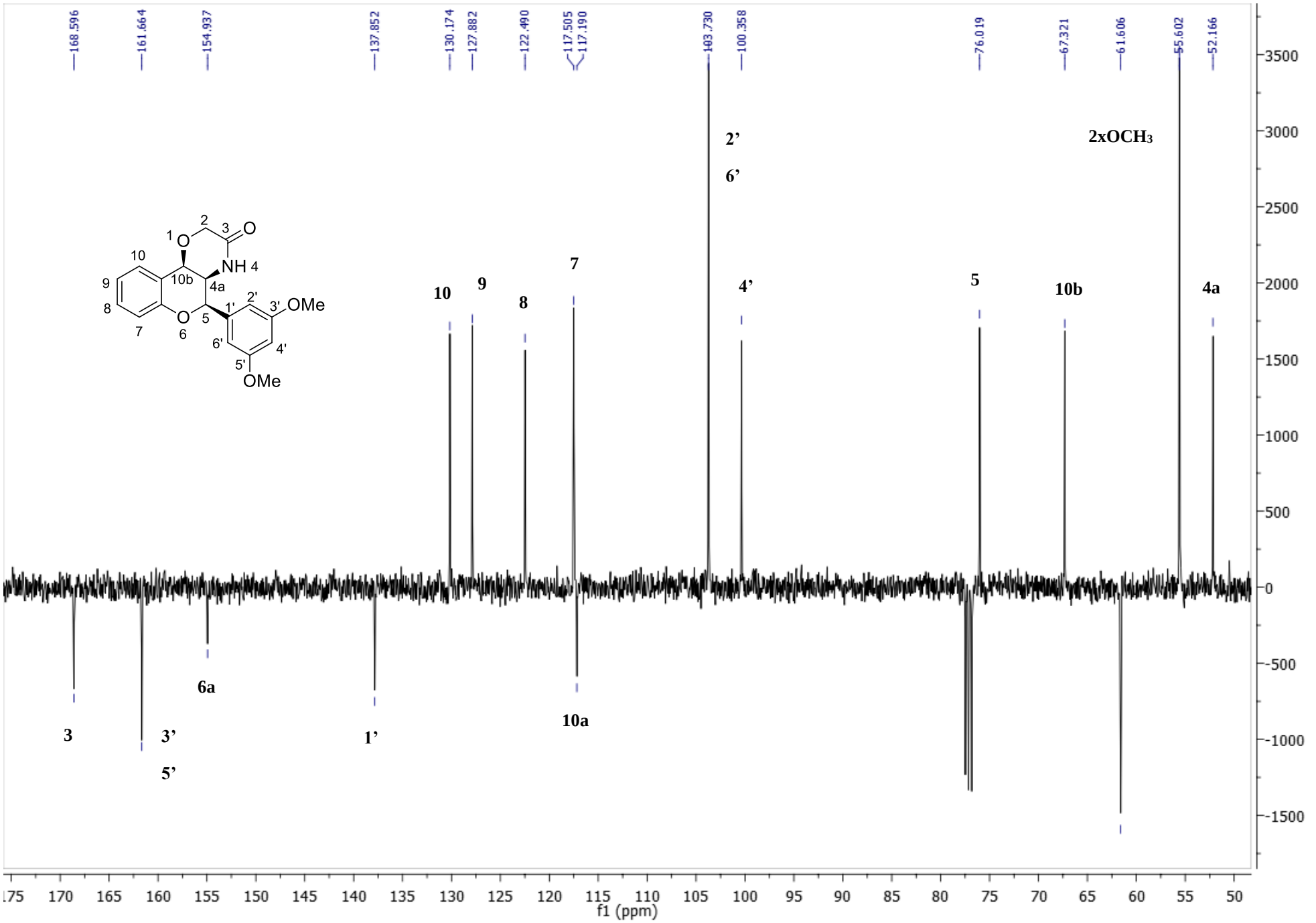


Figure S149. ^{13}C-NMR spectrum of *rac*-**23d** in $CDCl_3$

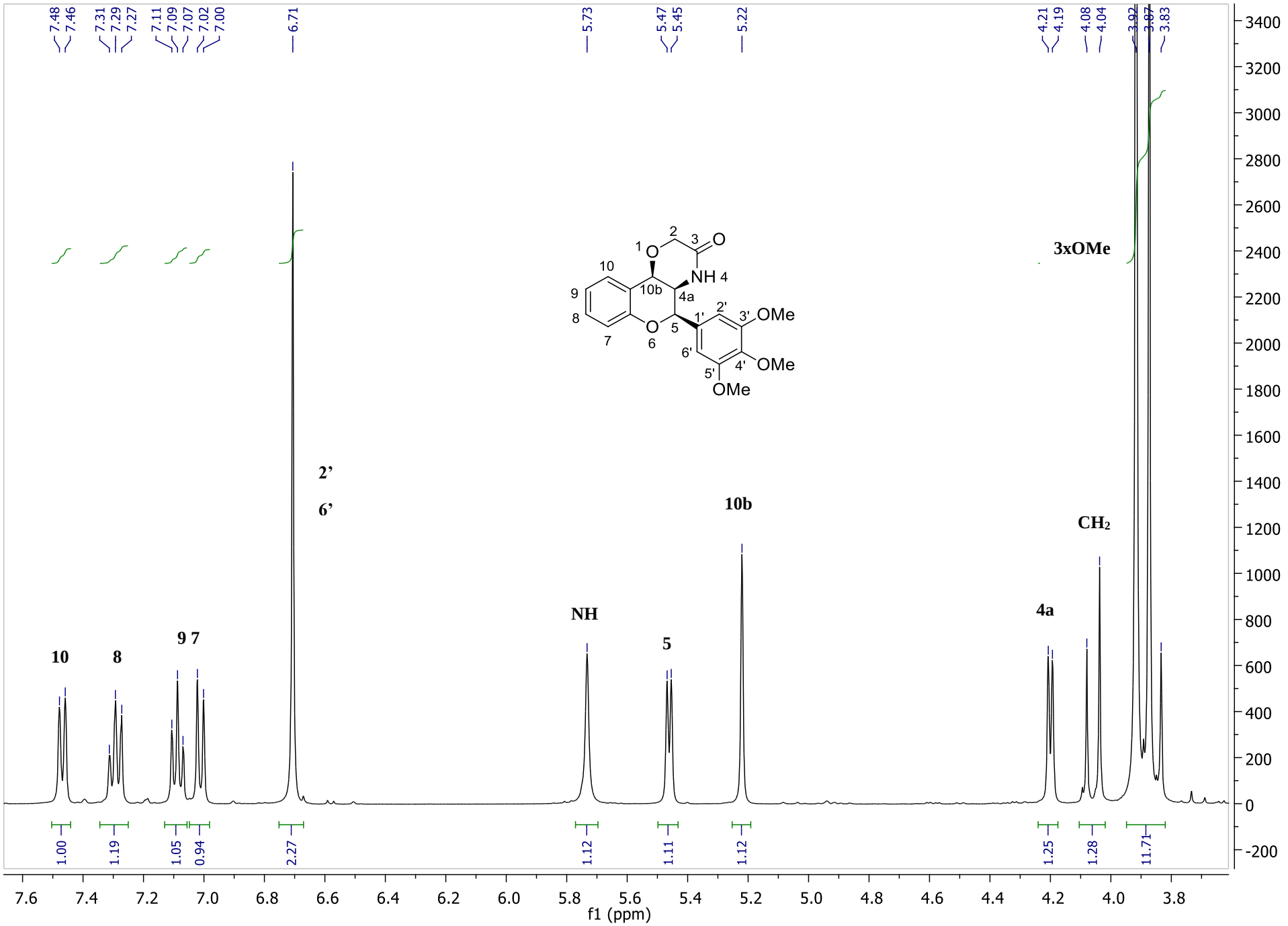


Figure S150. ^{1}H-NMR spectrum of *rac*-**23e** in $CDCl_3$

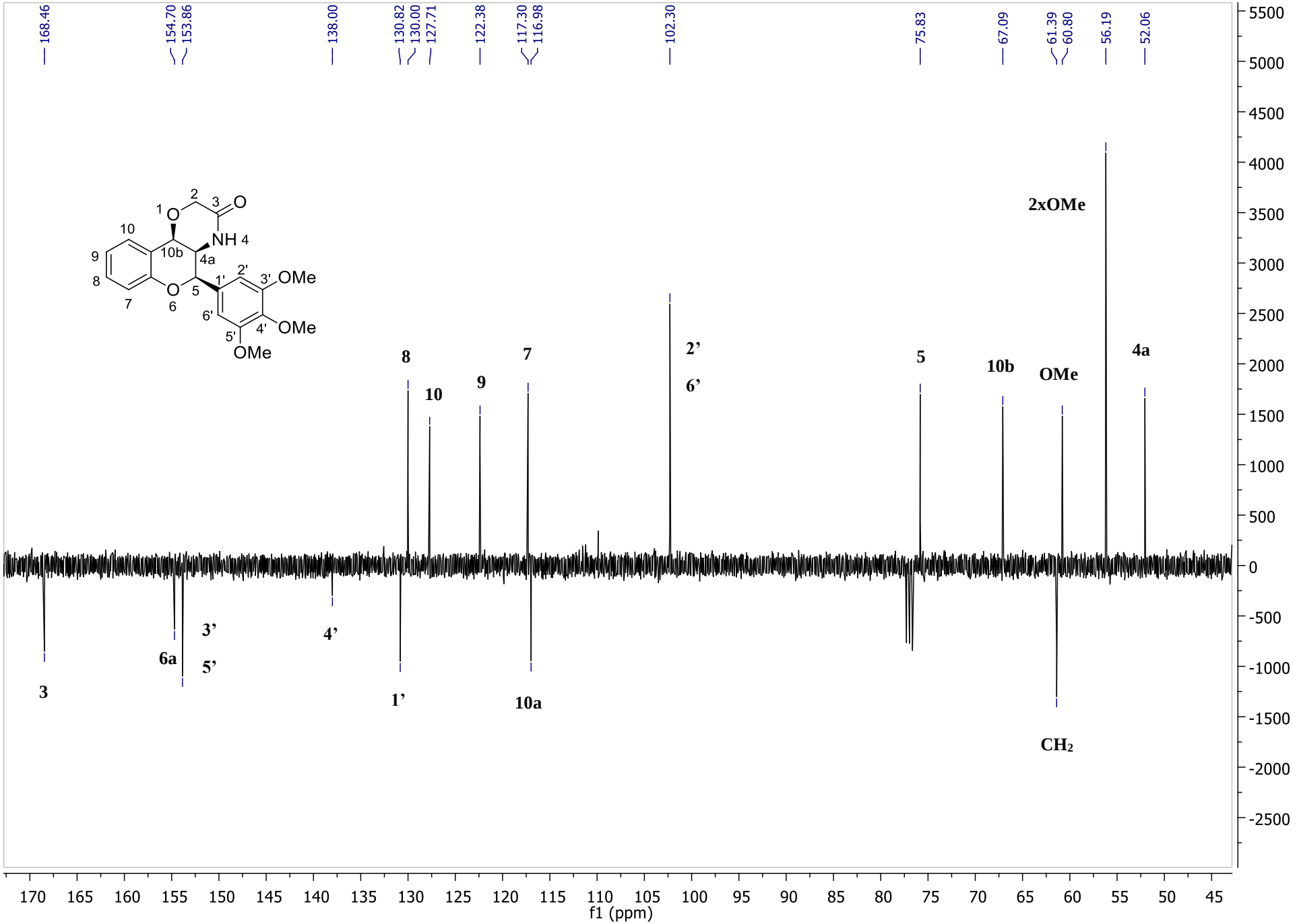


Figure S151. ^{13}C-NMR spectrum of *rac*-**23e** in $CDCl_3$

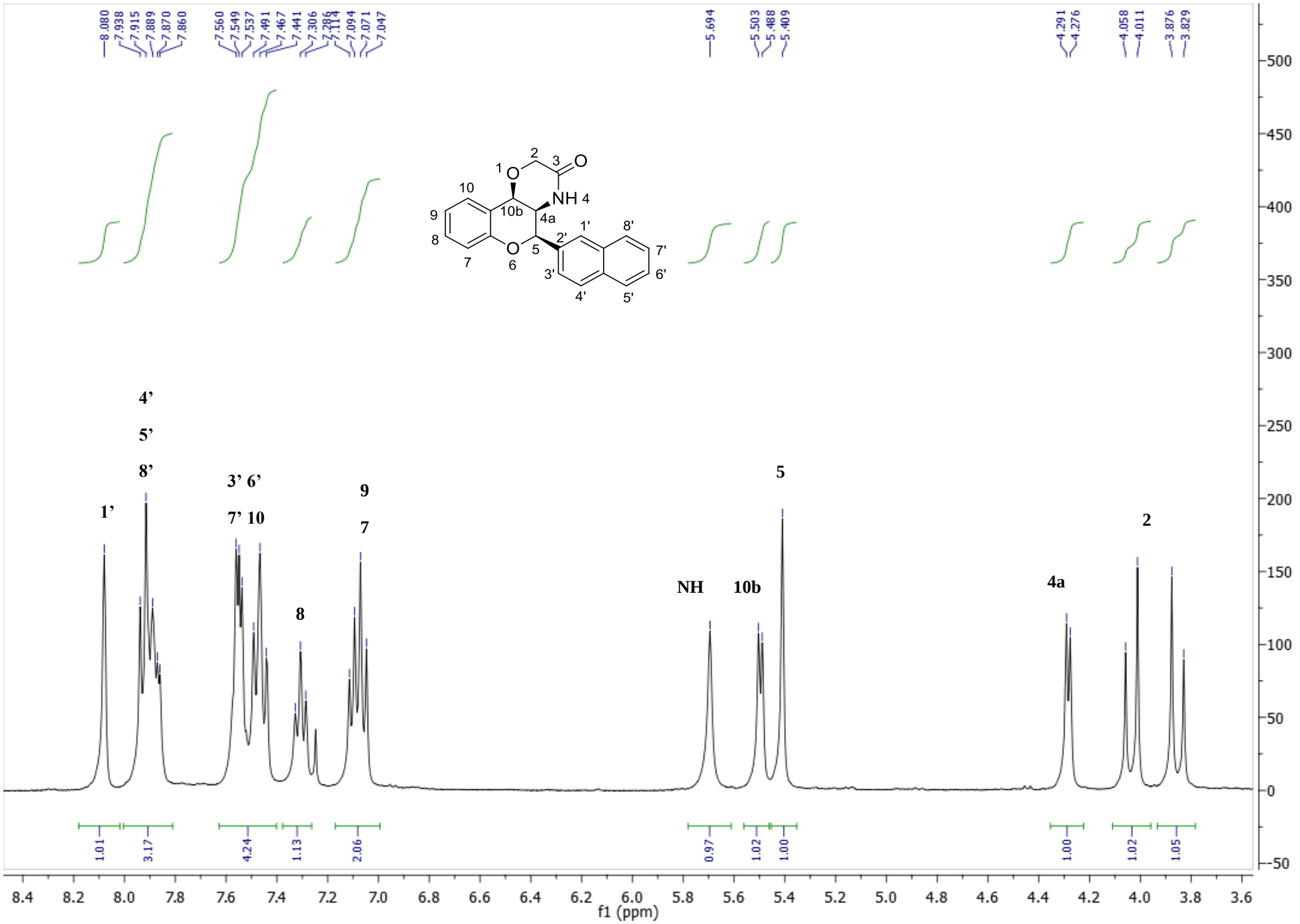


Figure S152. ^{1}H-NMR spectrum of *rac*-**23g** in $CDCl_3$

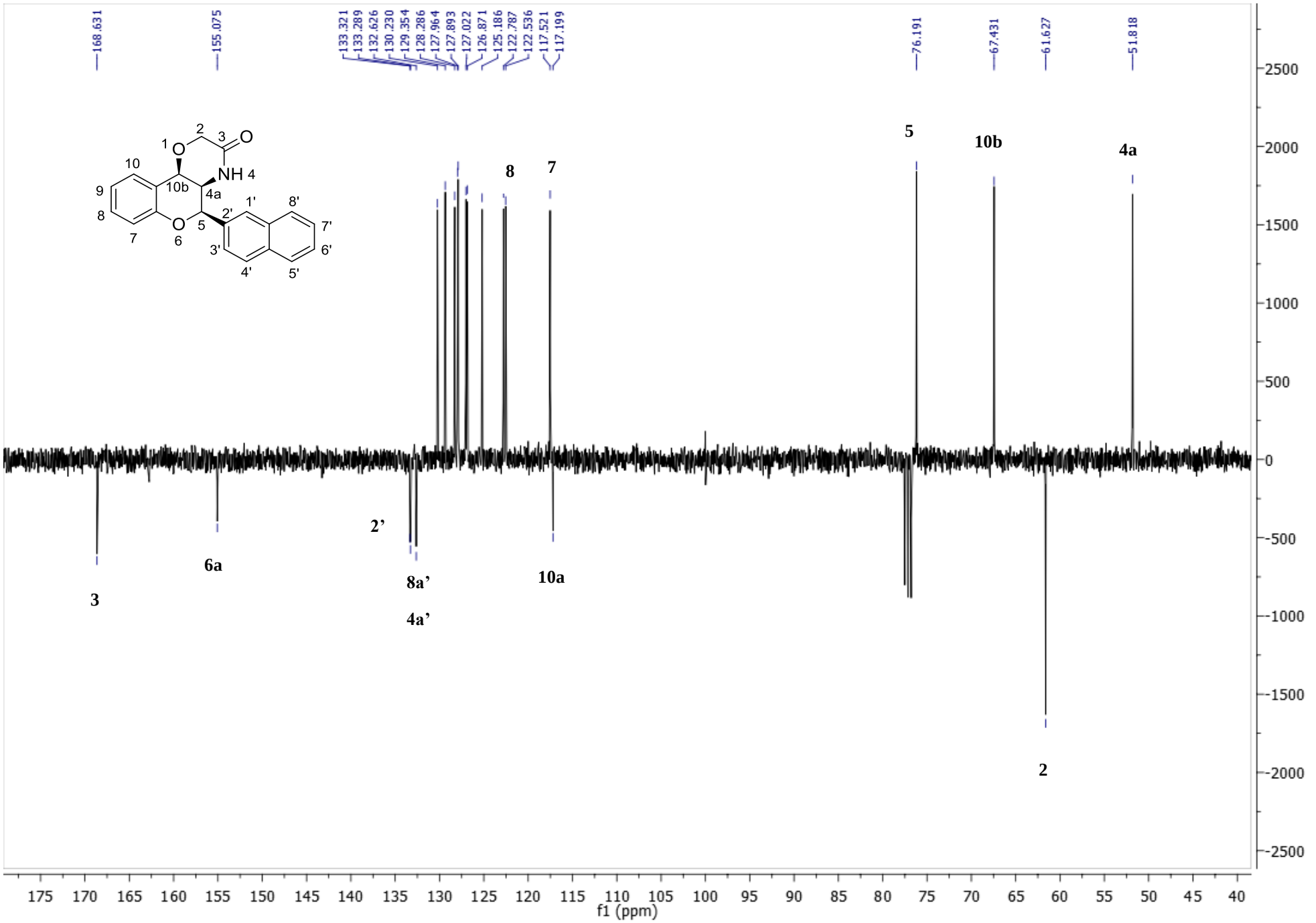


Figure S153. ^{13}C-NMR spectrum of *rac*-**23g** in $CDCl_3$

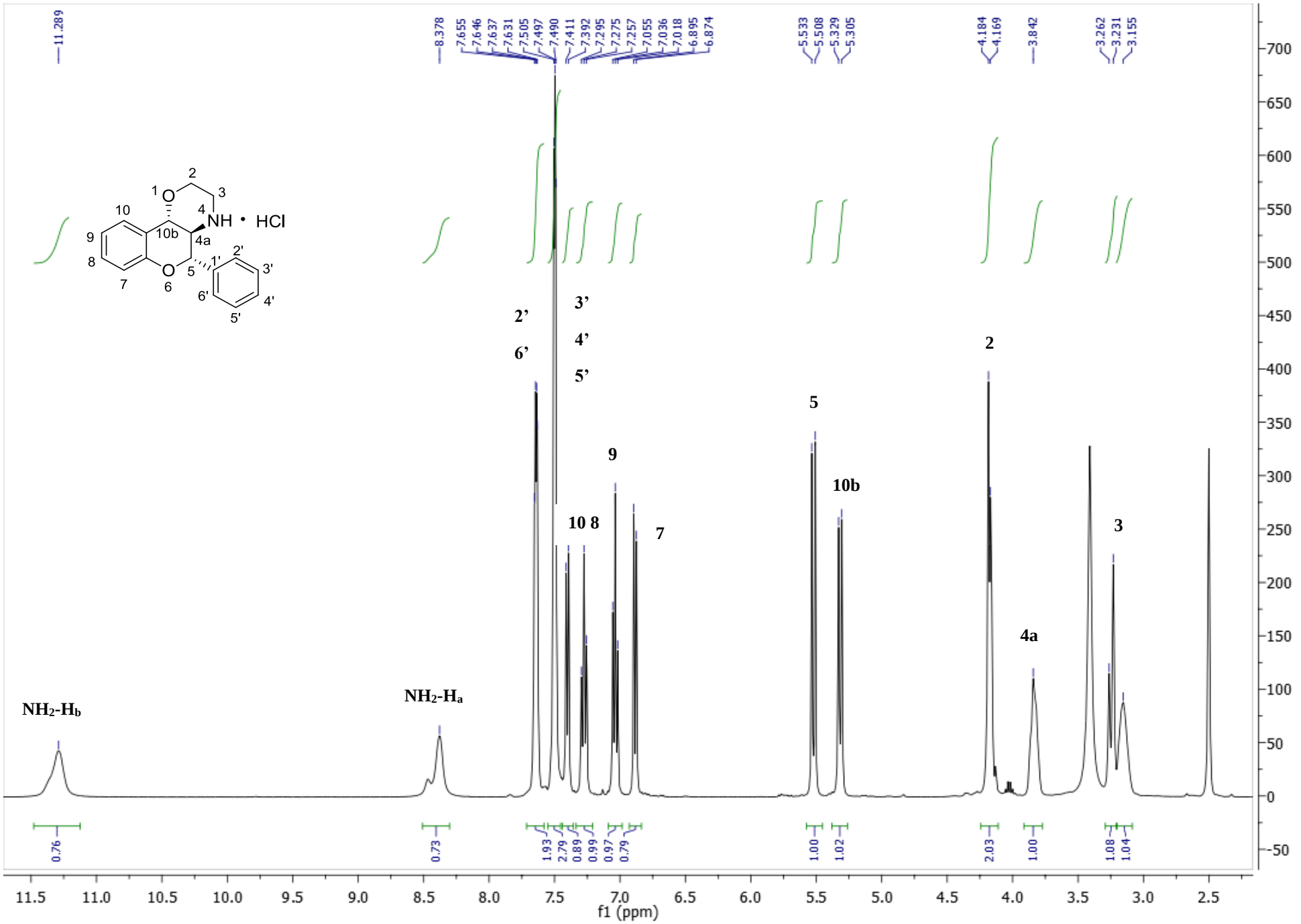


Figure S154. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2a** in DMSO-d_6

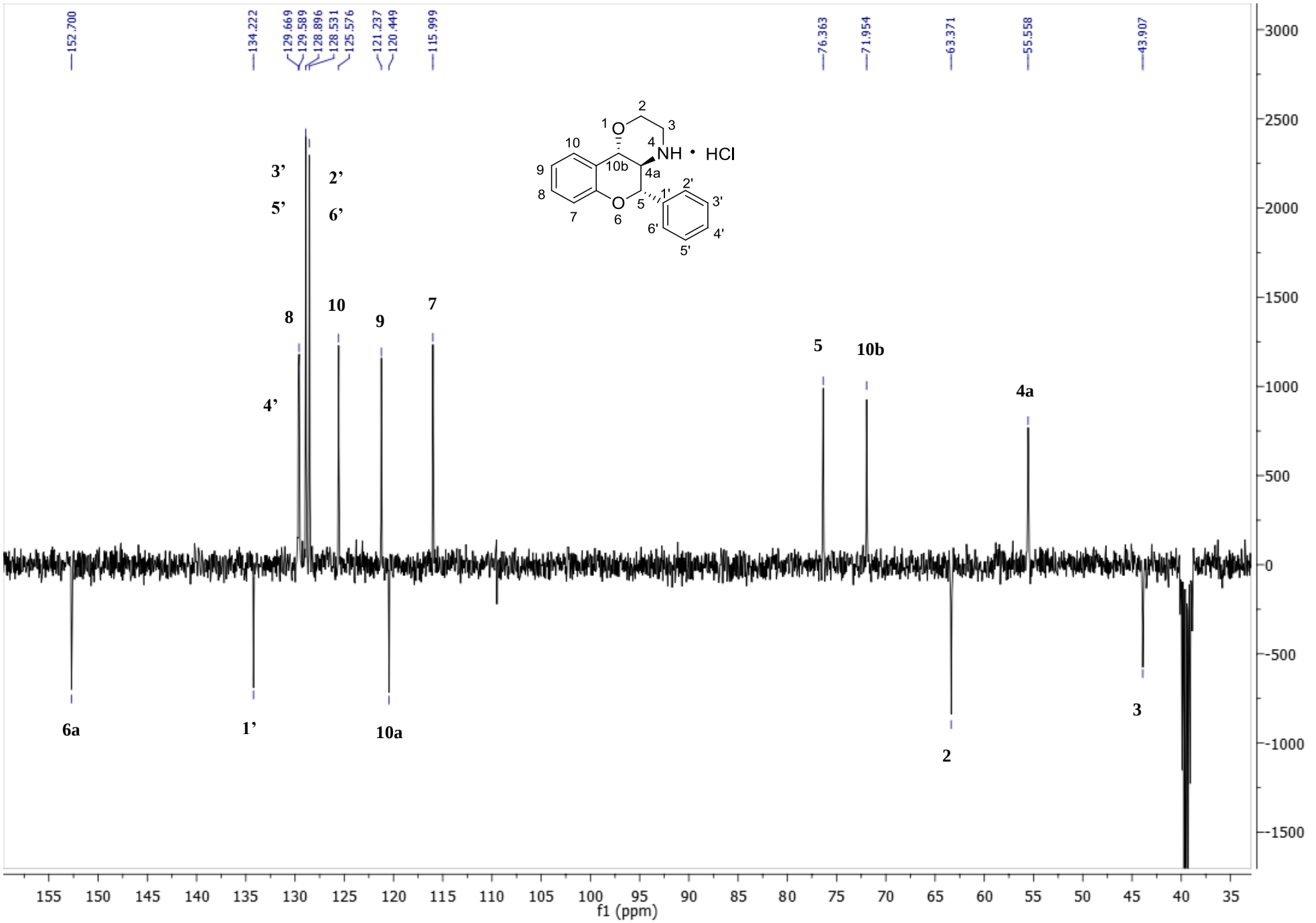


Figure S155. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2a** in DMSO-d_6

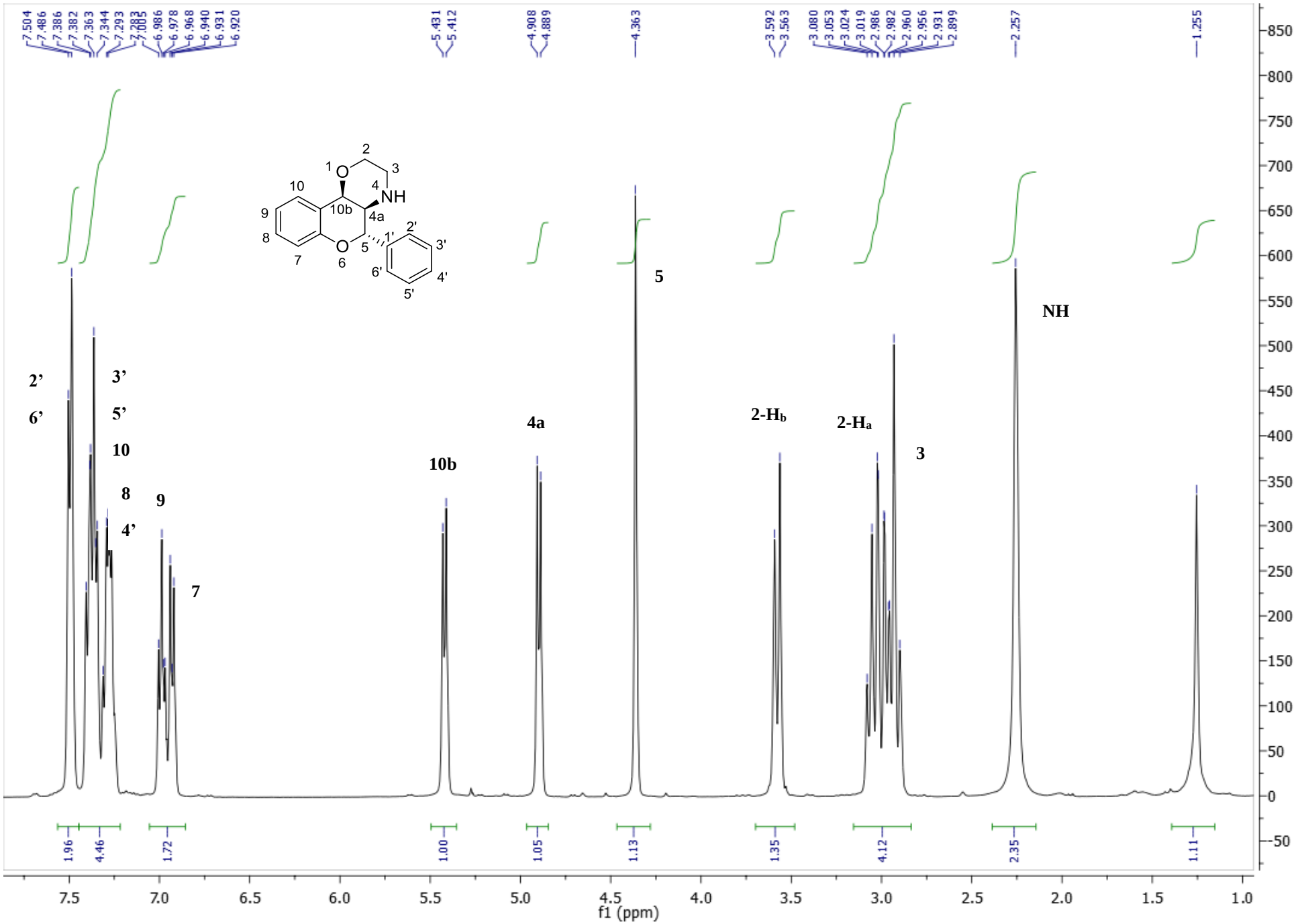


Figure S156. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2a** in $CDCl_3$

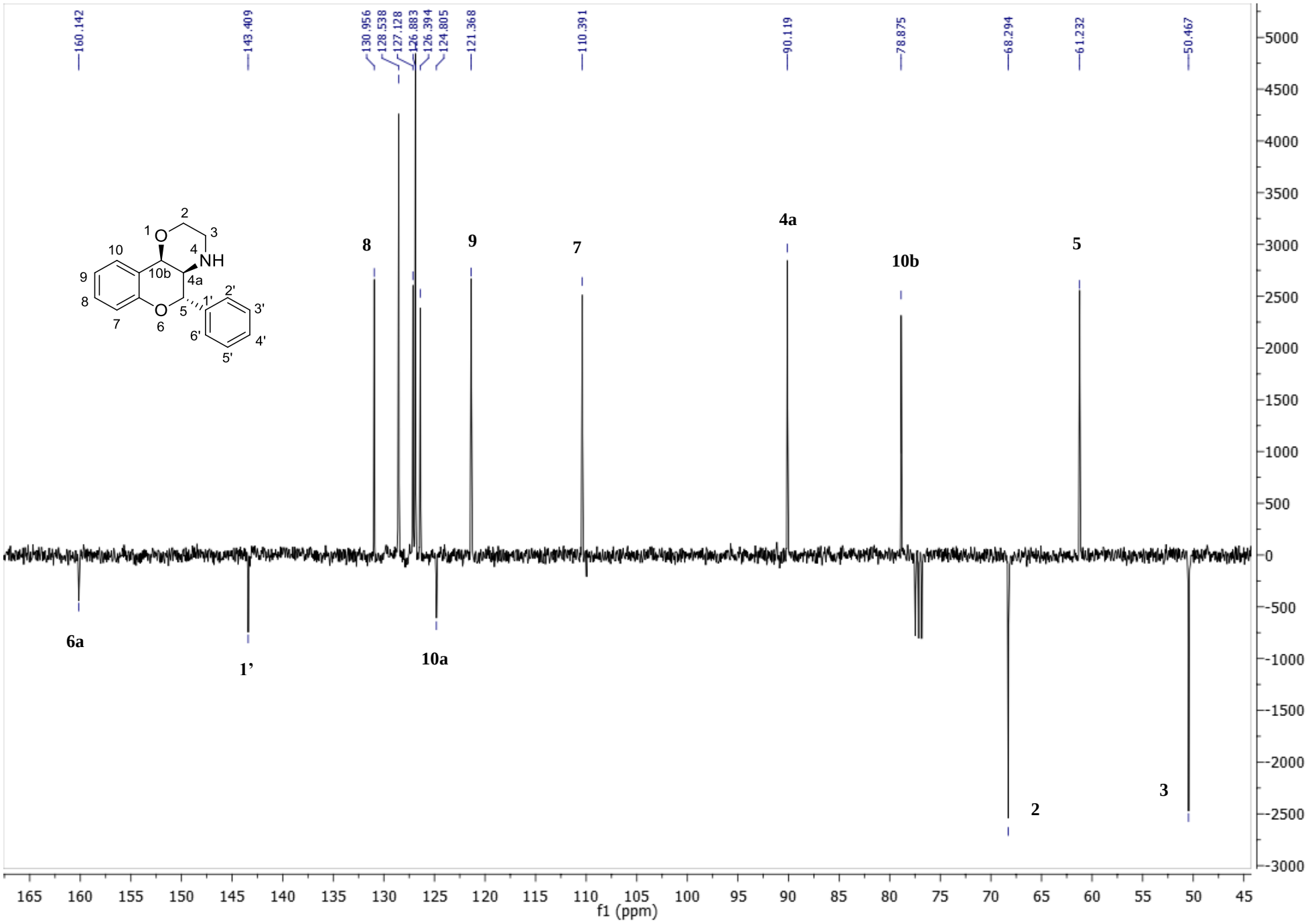


Figure S157. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2a** in $CDCl_3$

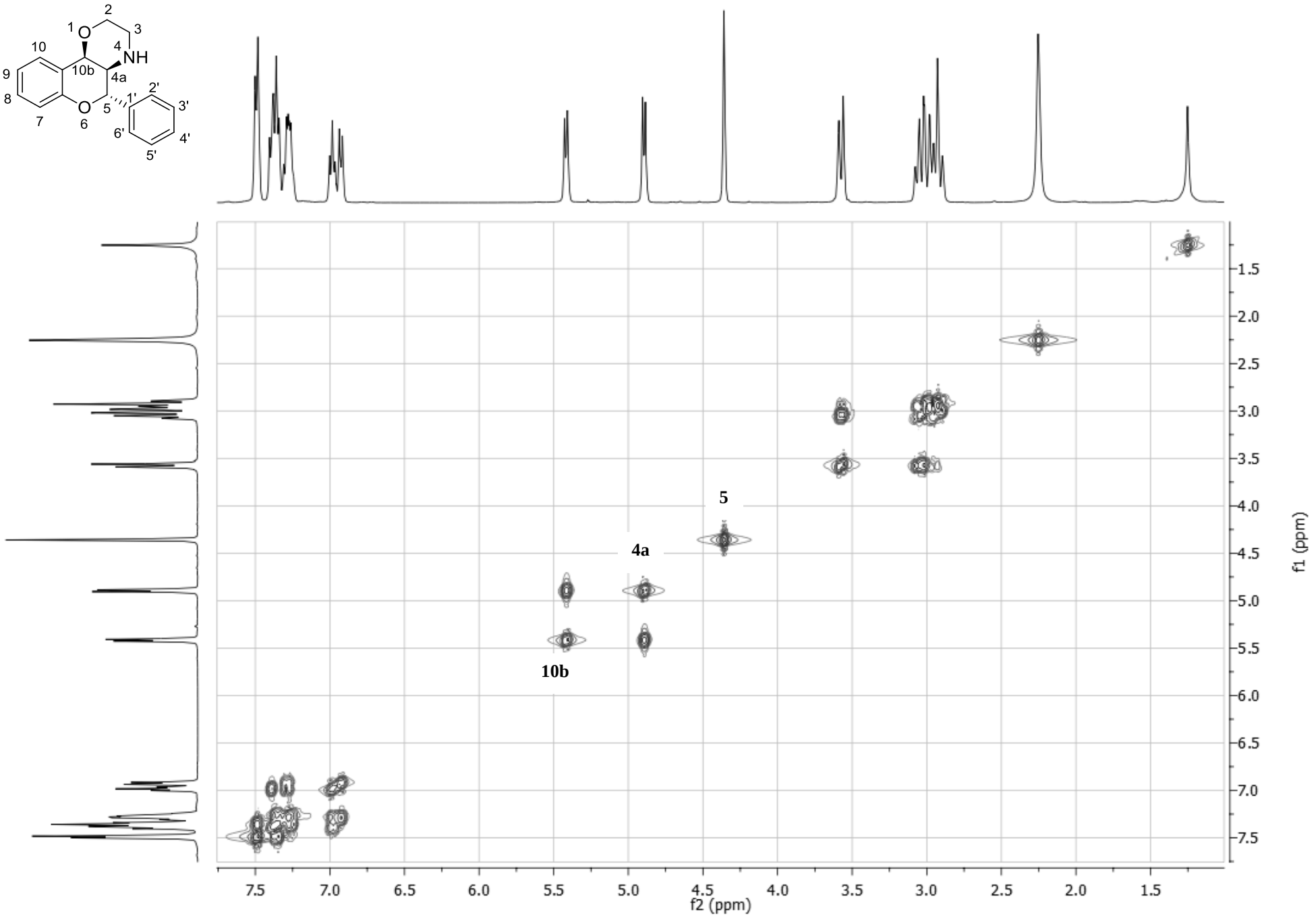


Figure S158. COSY spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2a** in $CDCl_3$

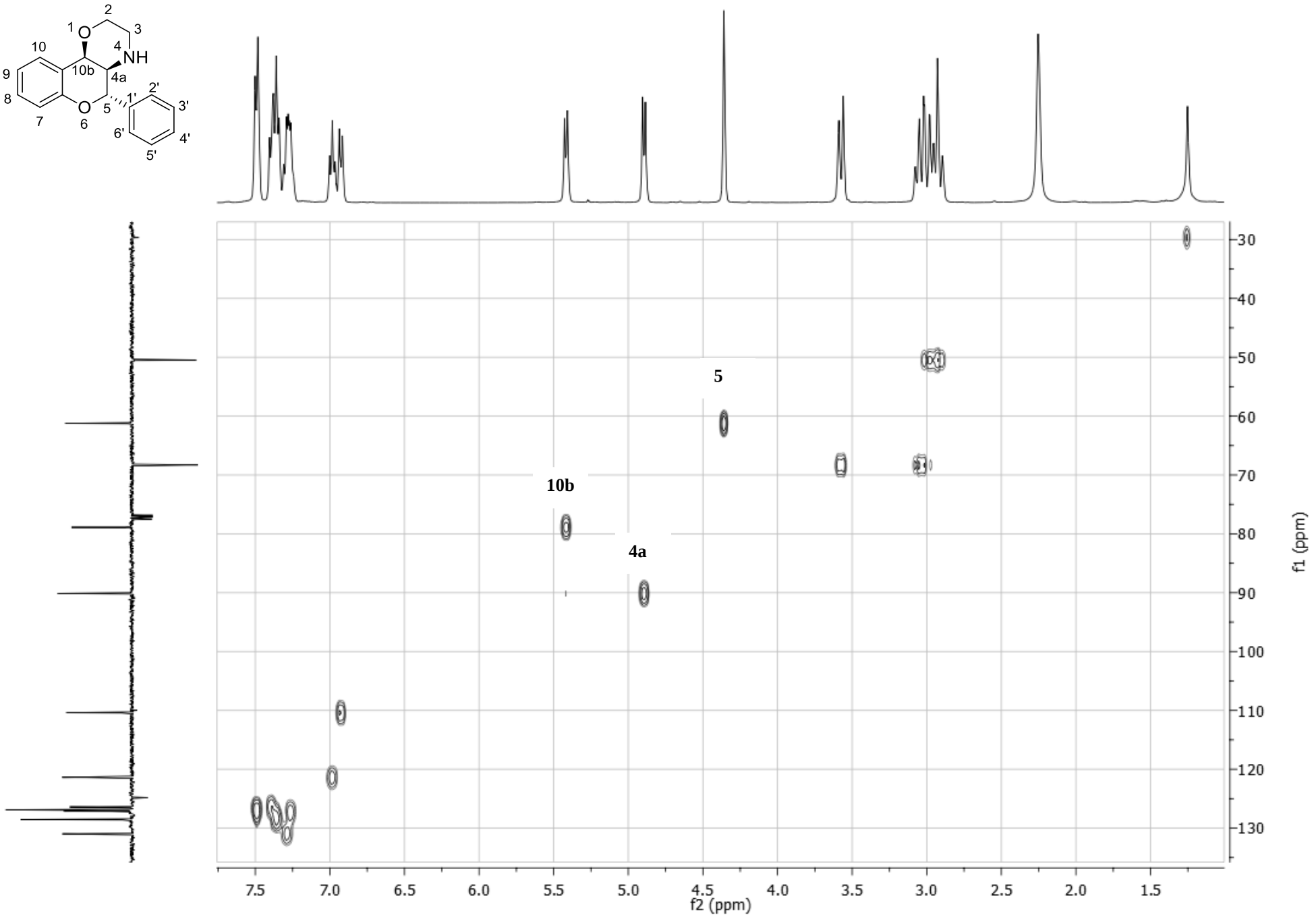


Figure S159. HSQC spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2a** in $CDCl_3$

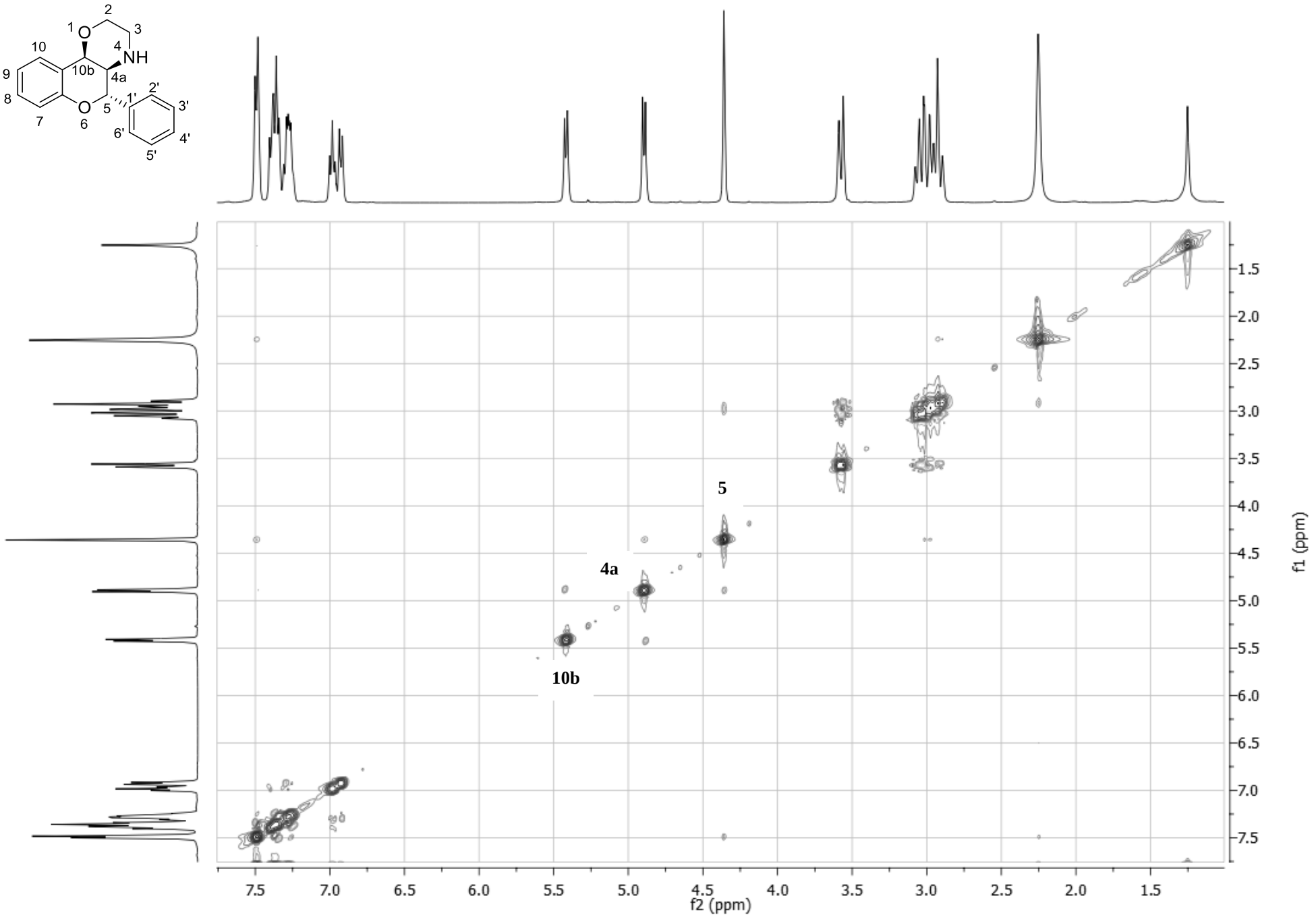


Figure S160. NOESY spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2a** in $CDCl_3$

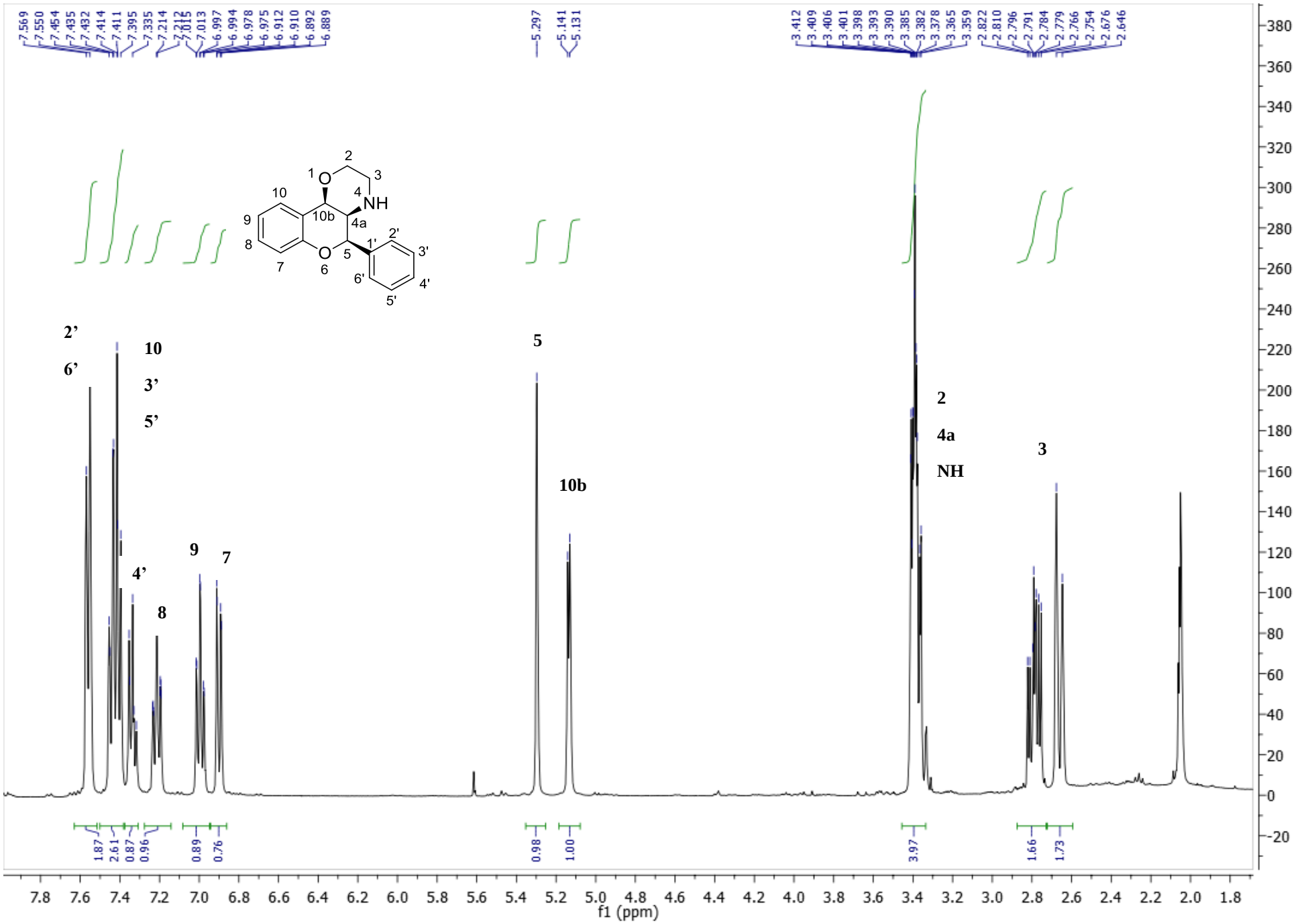


Figure S161. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2a** in Acetone-d_6

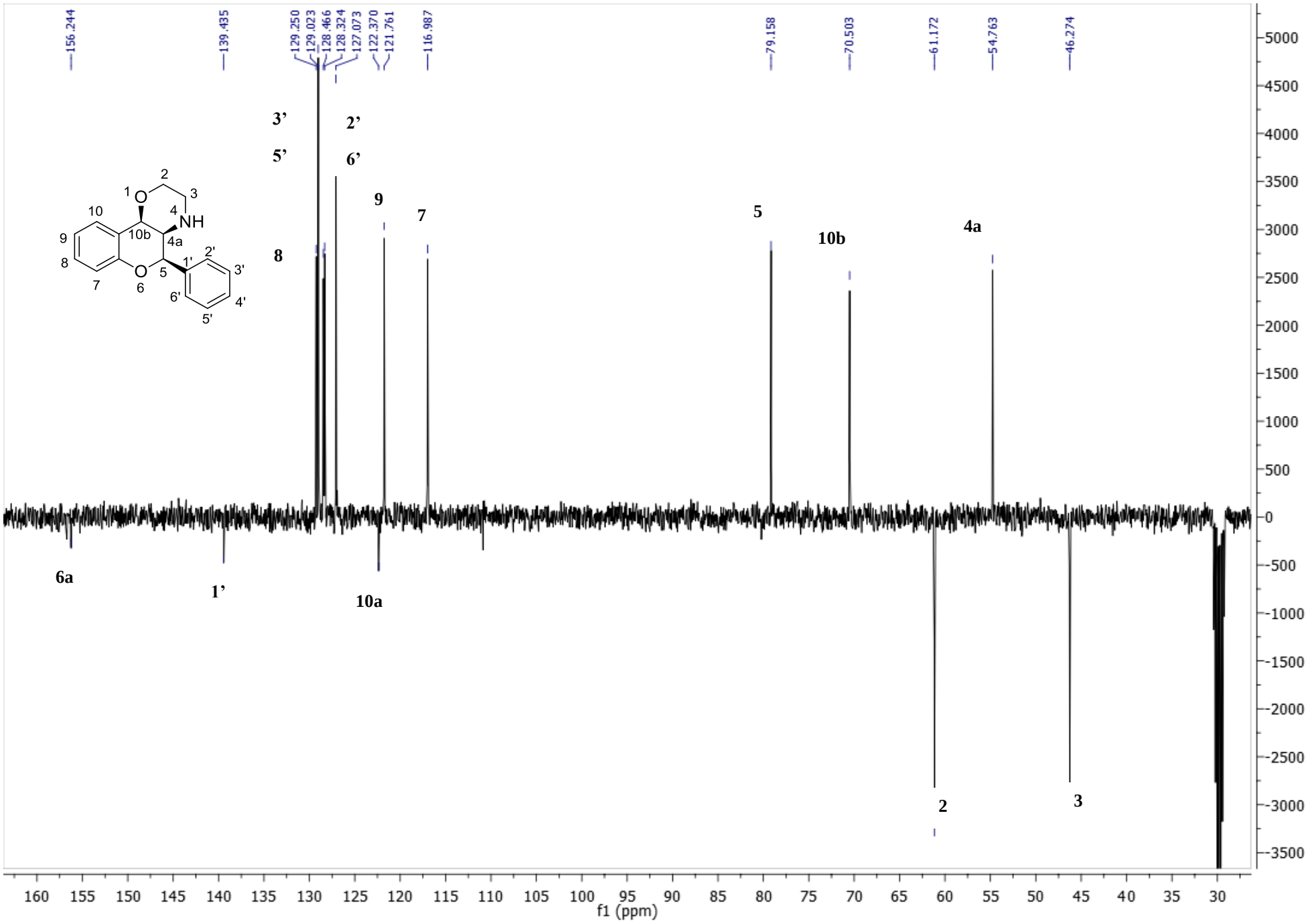


Figure S162. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2a** in Acetone-d_6

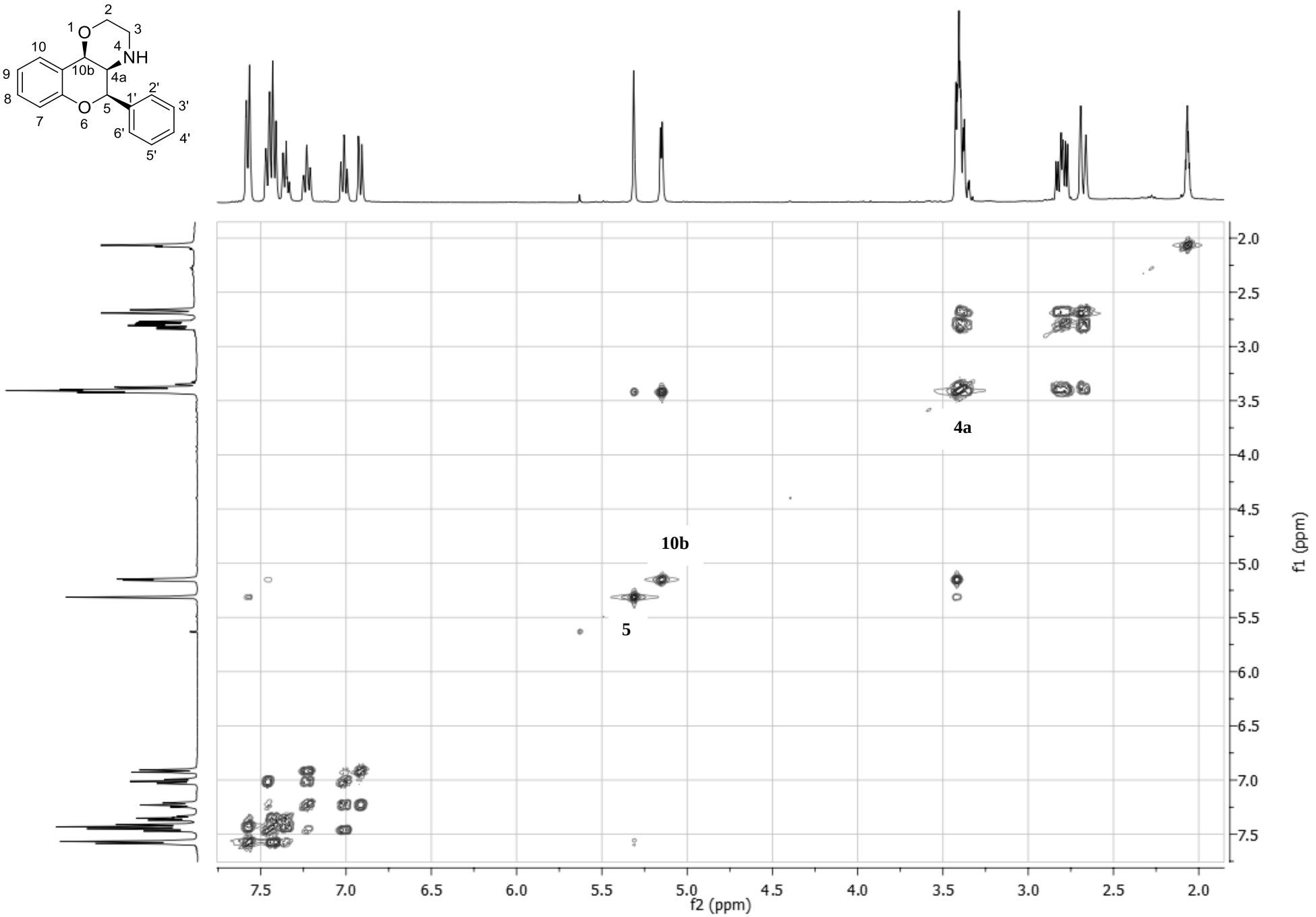


Figure S163. COSY spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2a** in Acetone-d_6

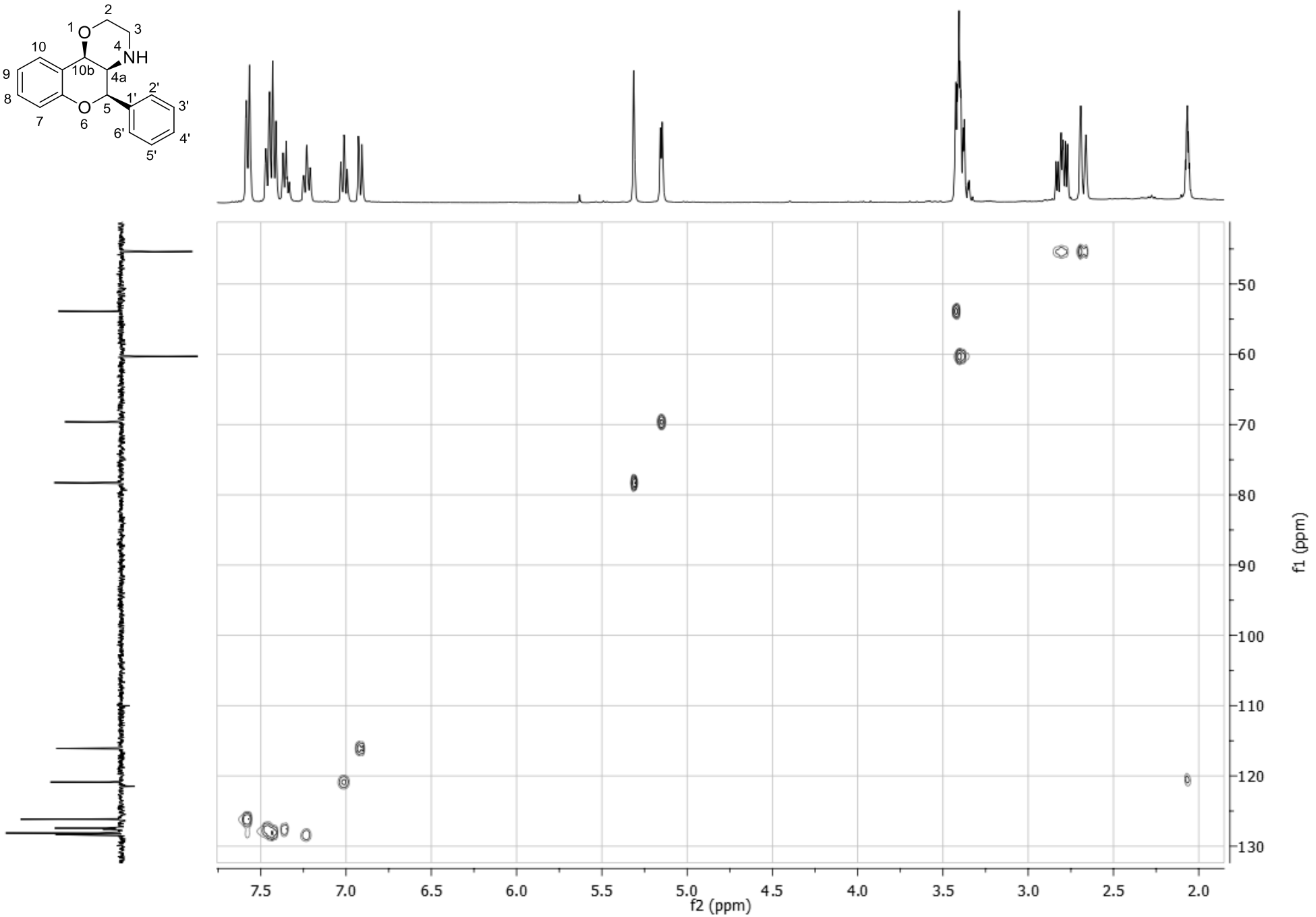


Figure S164. HSQC spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2a** in Acetone-d_6

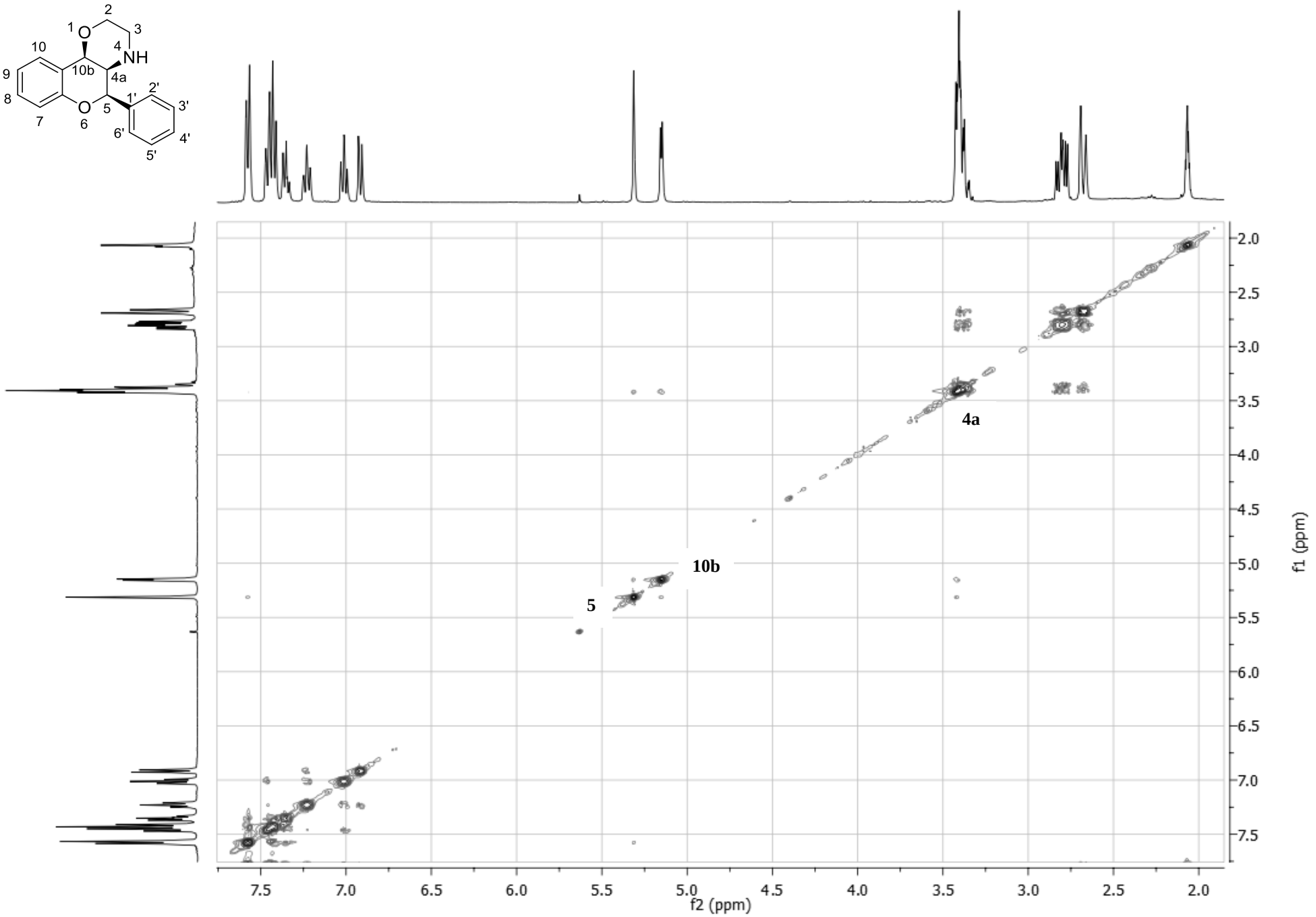


Figure 165. NOESY spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2a** in Acetone-d_6

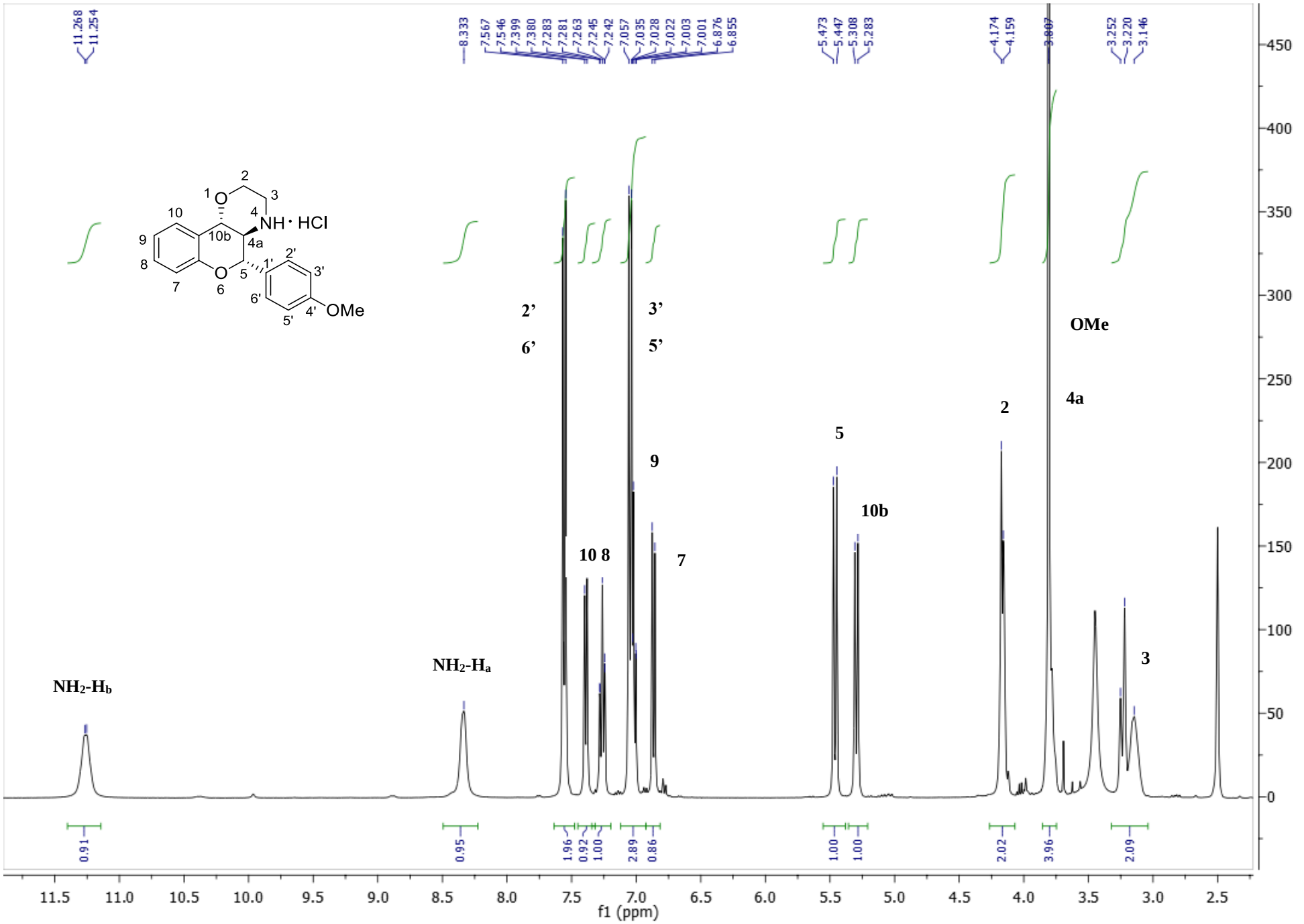


Figure S166. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2b** in DMSO-d_6

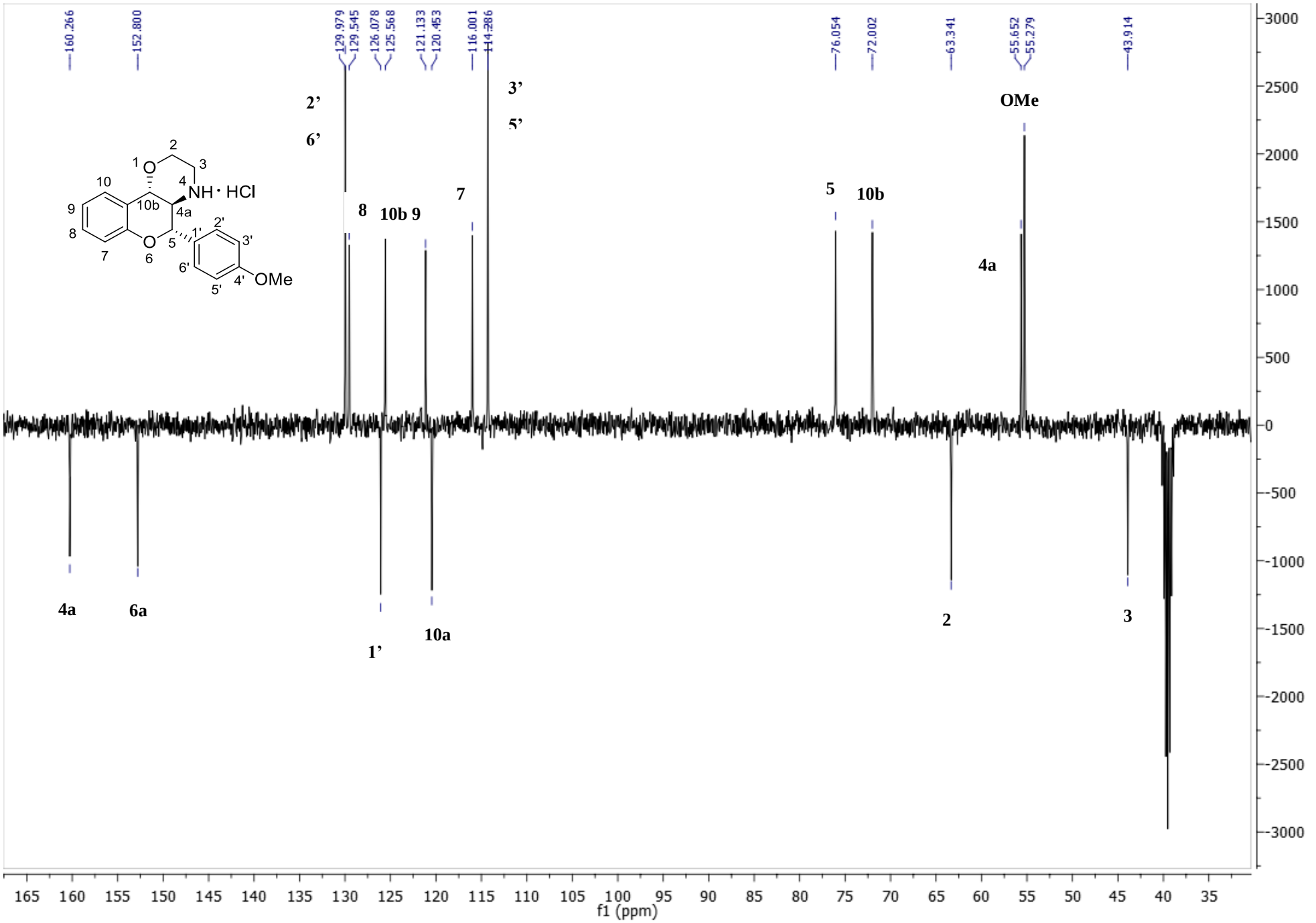


Figure S167. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2b** in DMSO-d_6

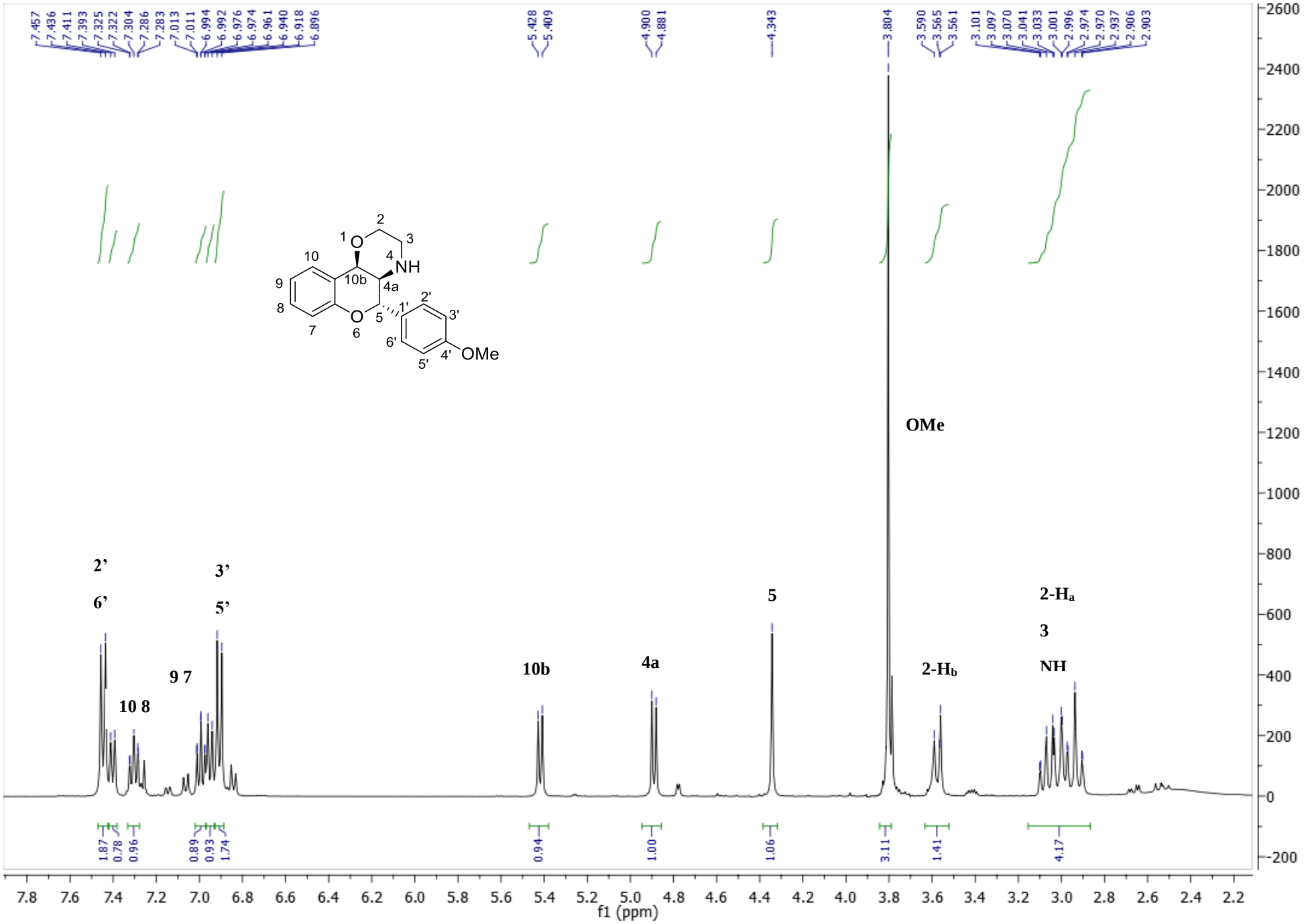


Figure S168. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2b** in $CDCl_3$

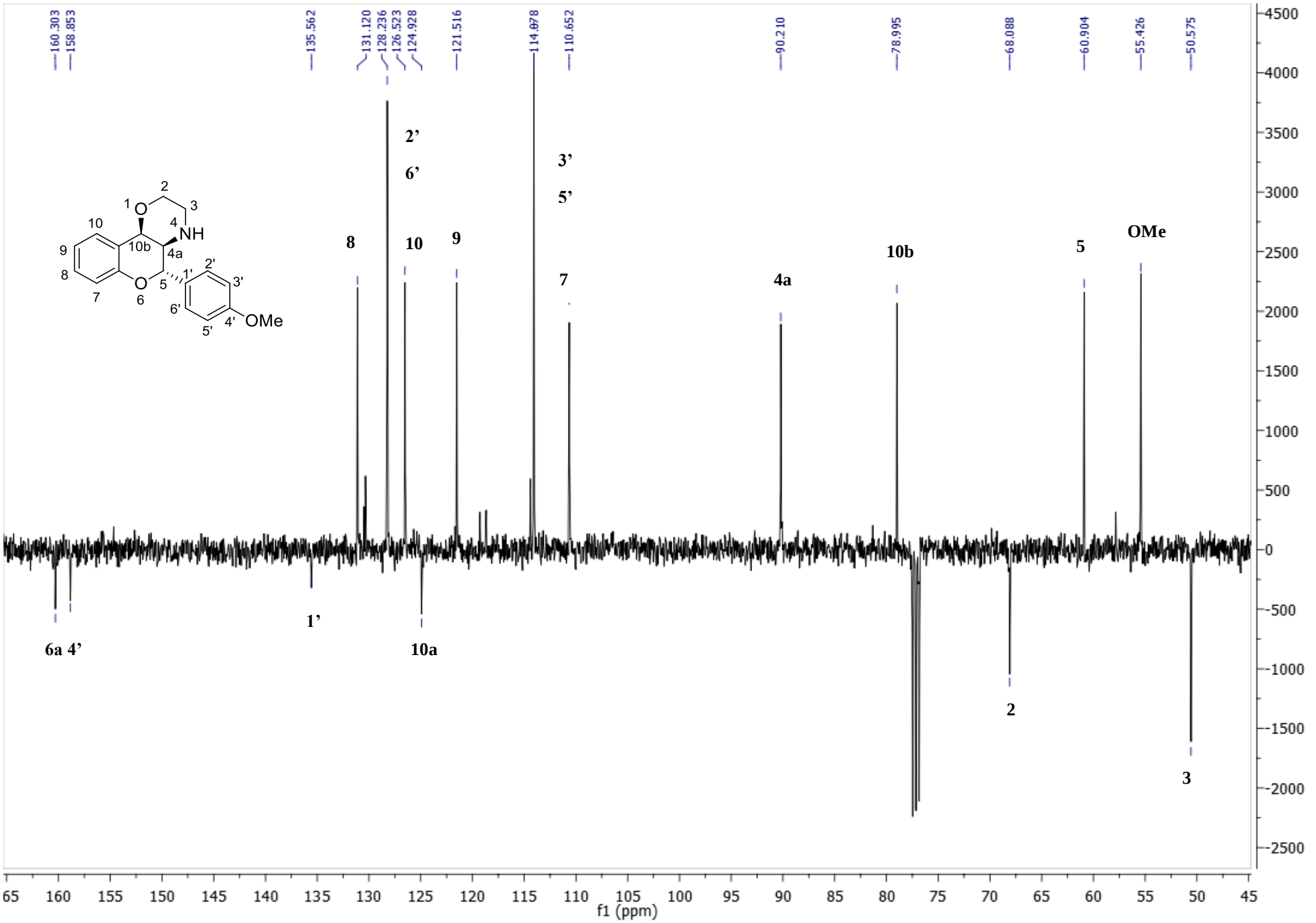


Figure S169. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2b** in $CDCl_3$

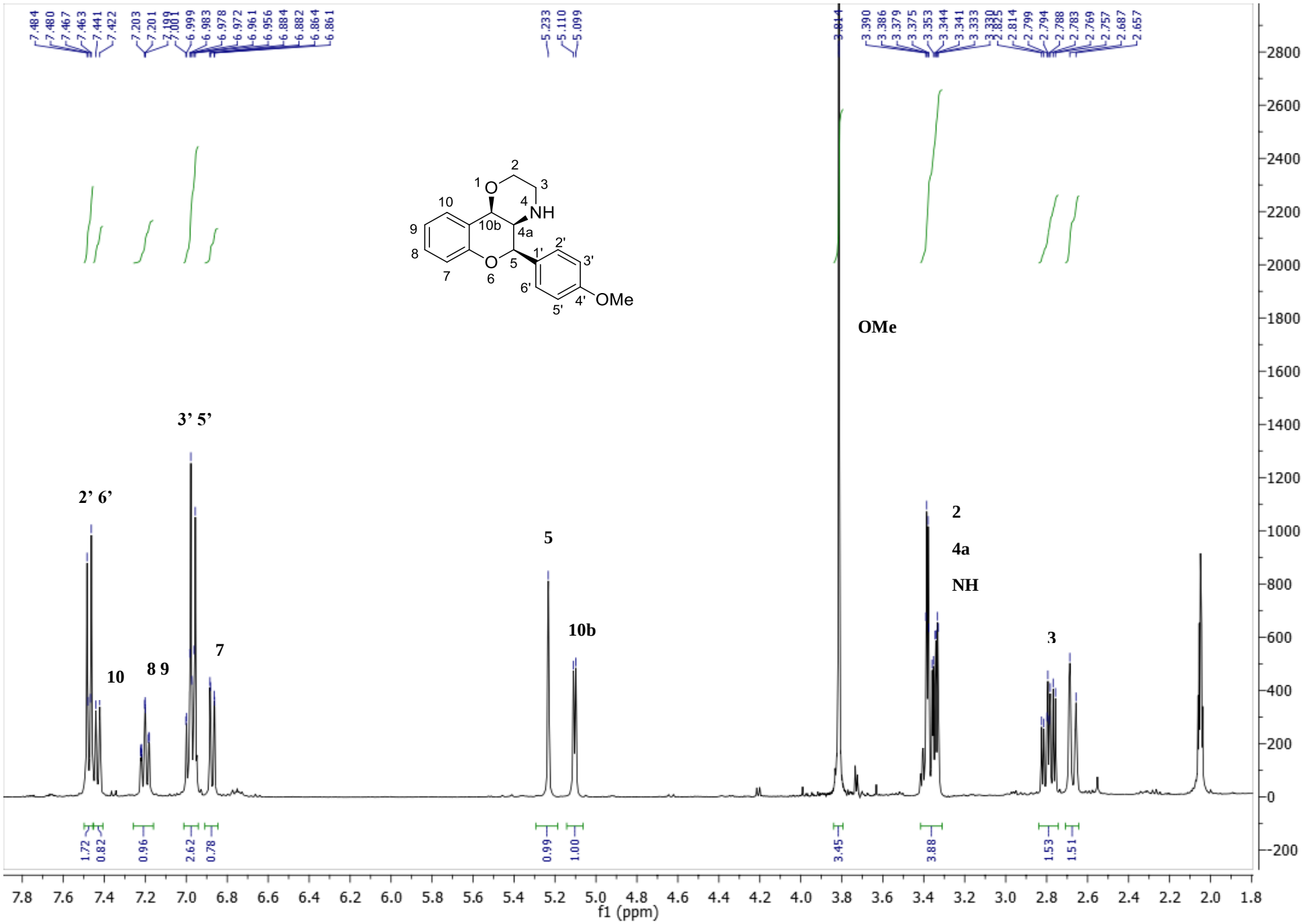


Figure S170. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2b** in Acetone-d_6

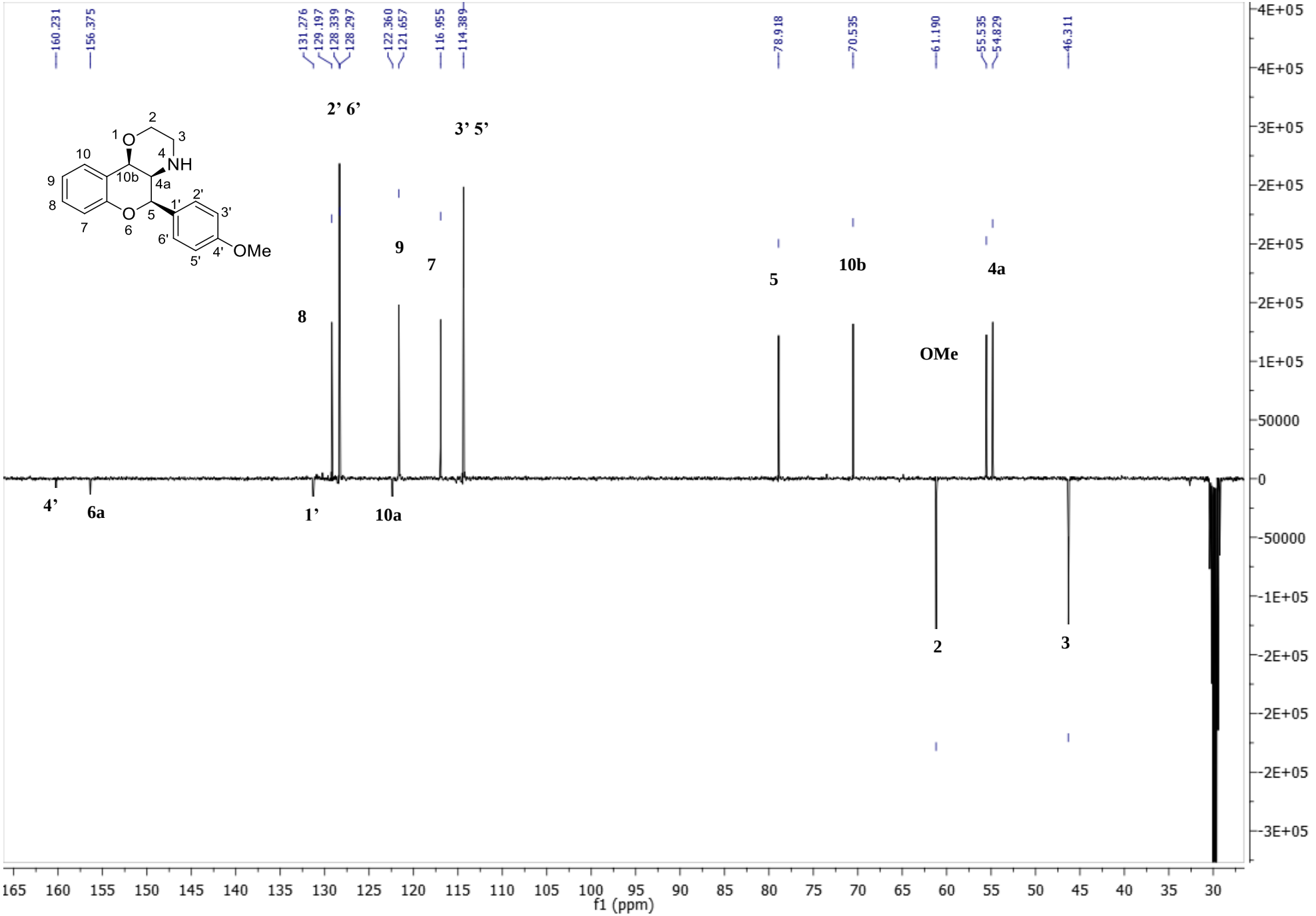


Figure S171. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2b** in Acetone-d$_6$

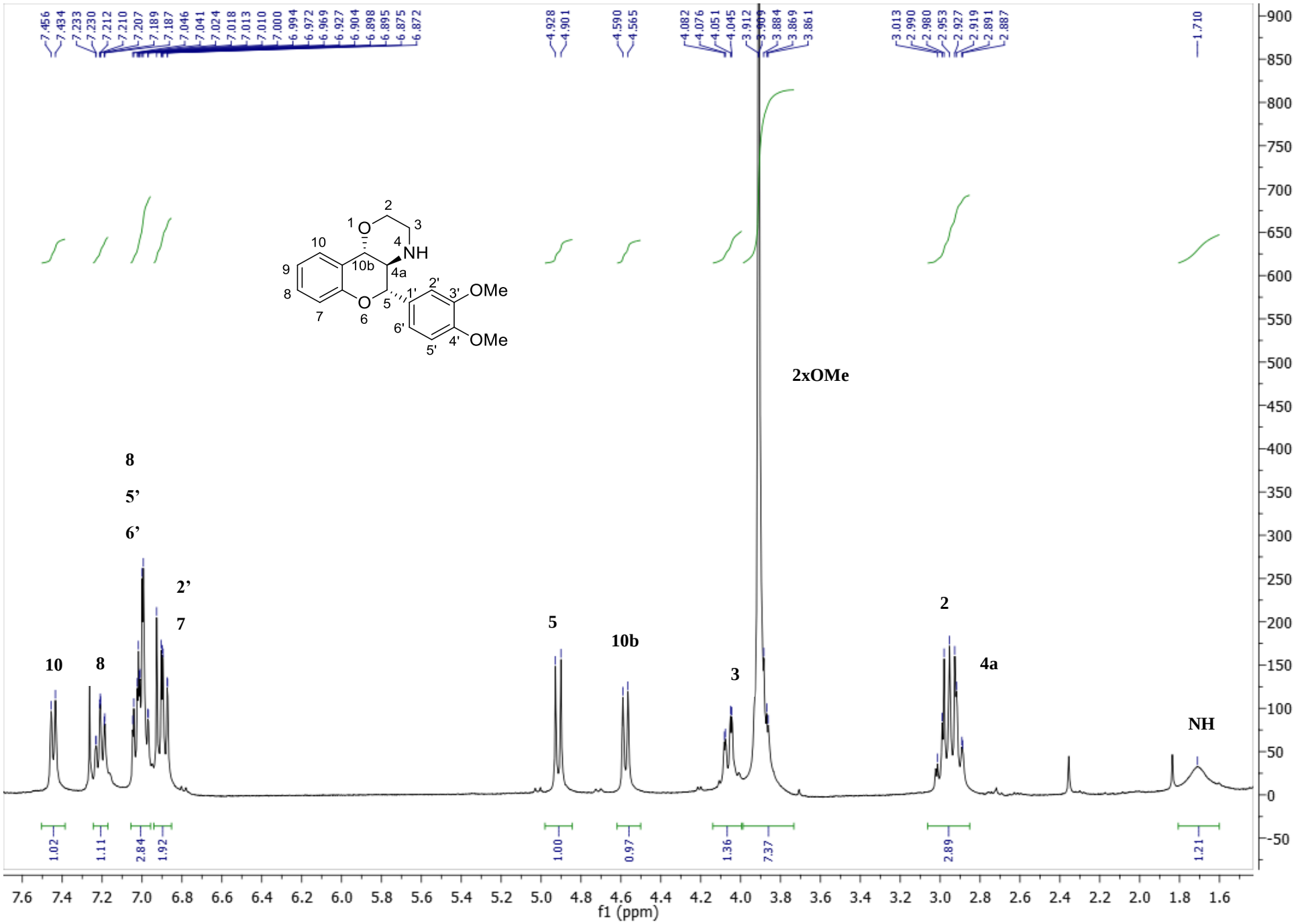


Figure S172. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2c** in $CDCl_3$

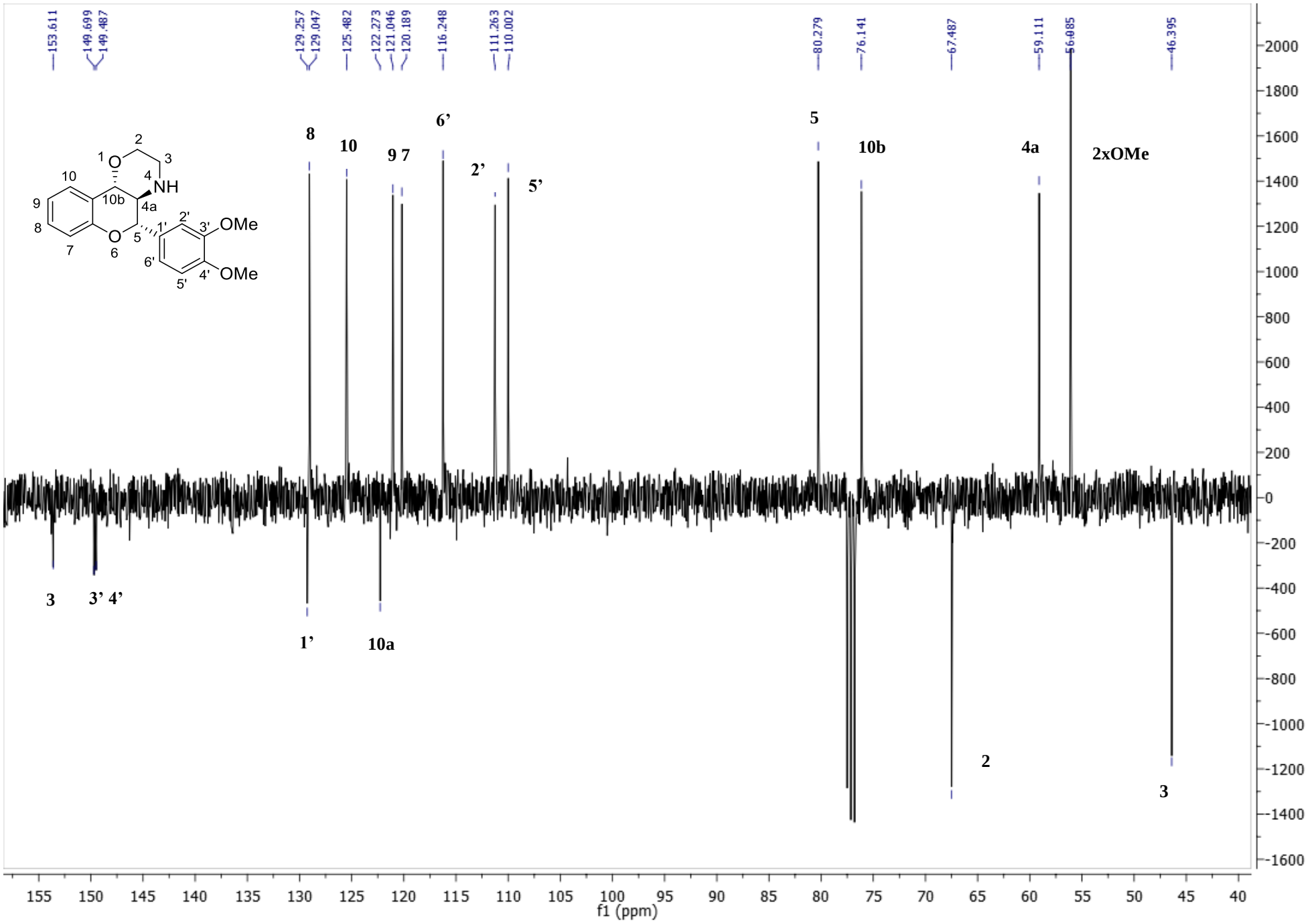


Figure S173. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2c** in $CDCl_3$

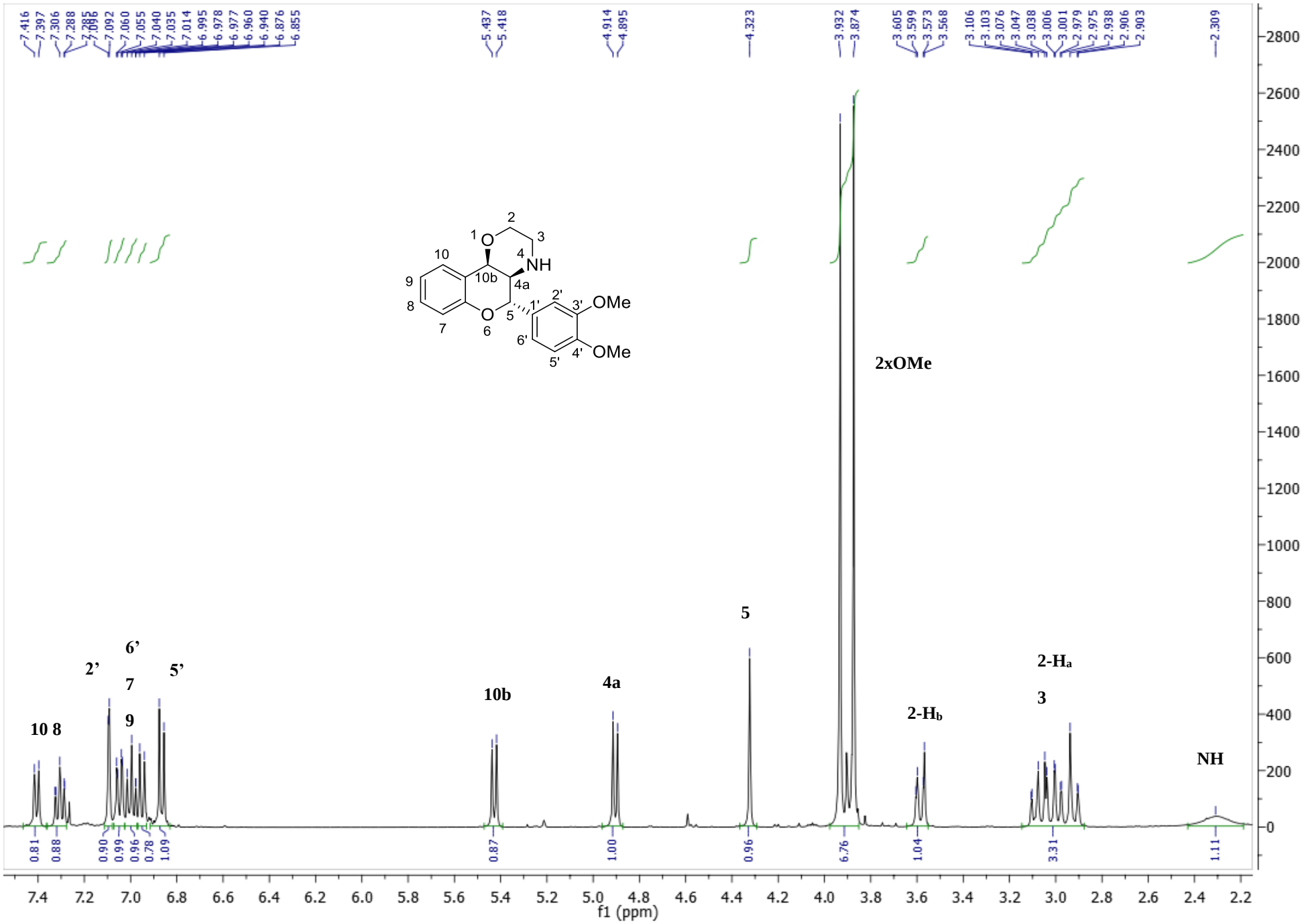


Figure S174. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2c** in $CDCl_3$

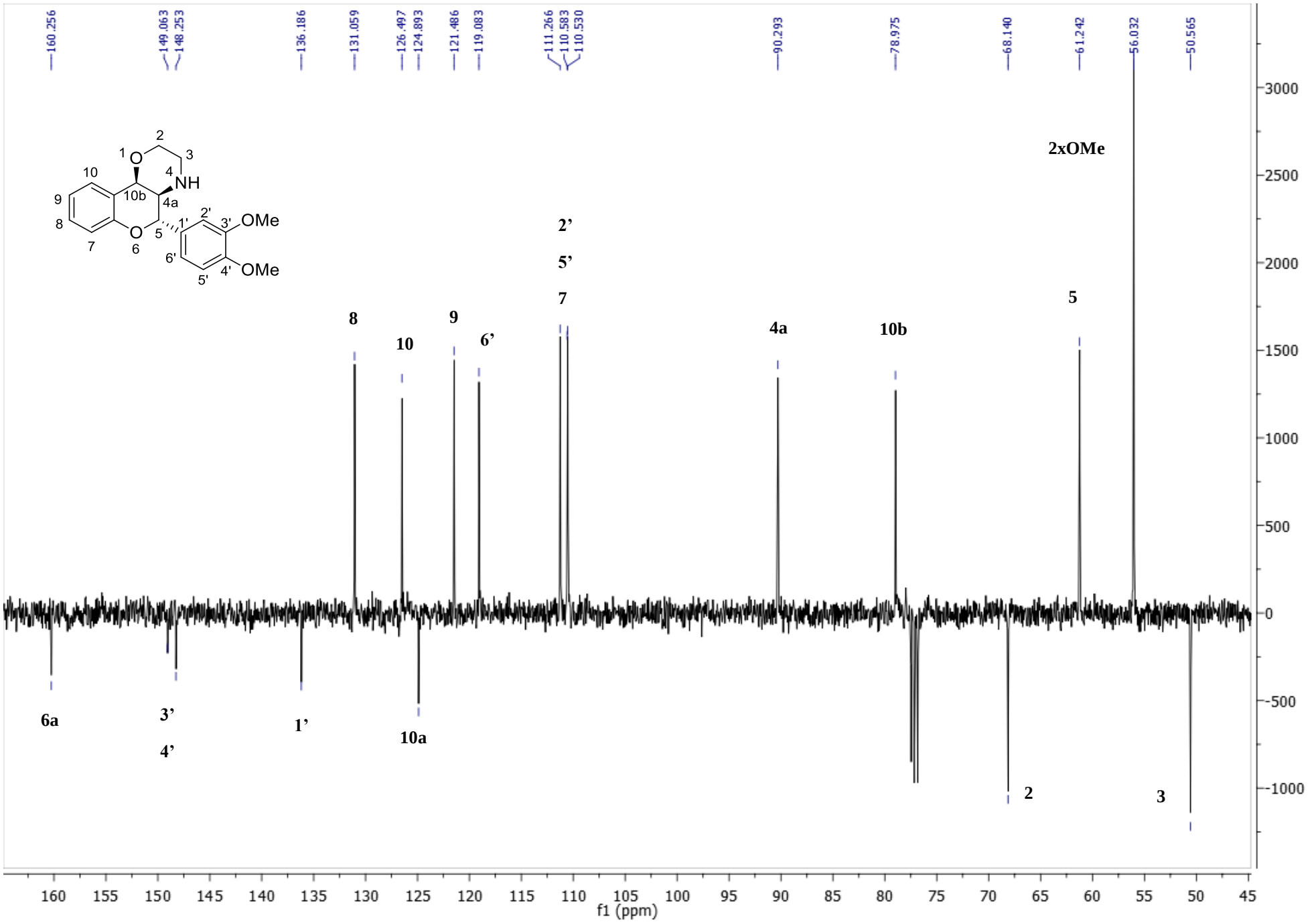


Figure S175. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2c** in $CDCl_3$

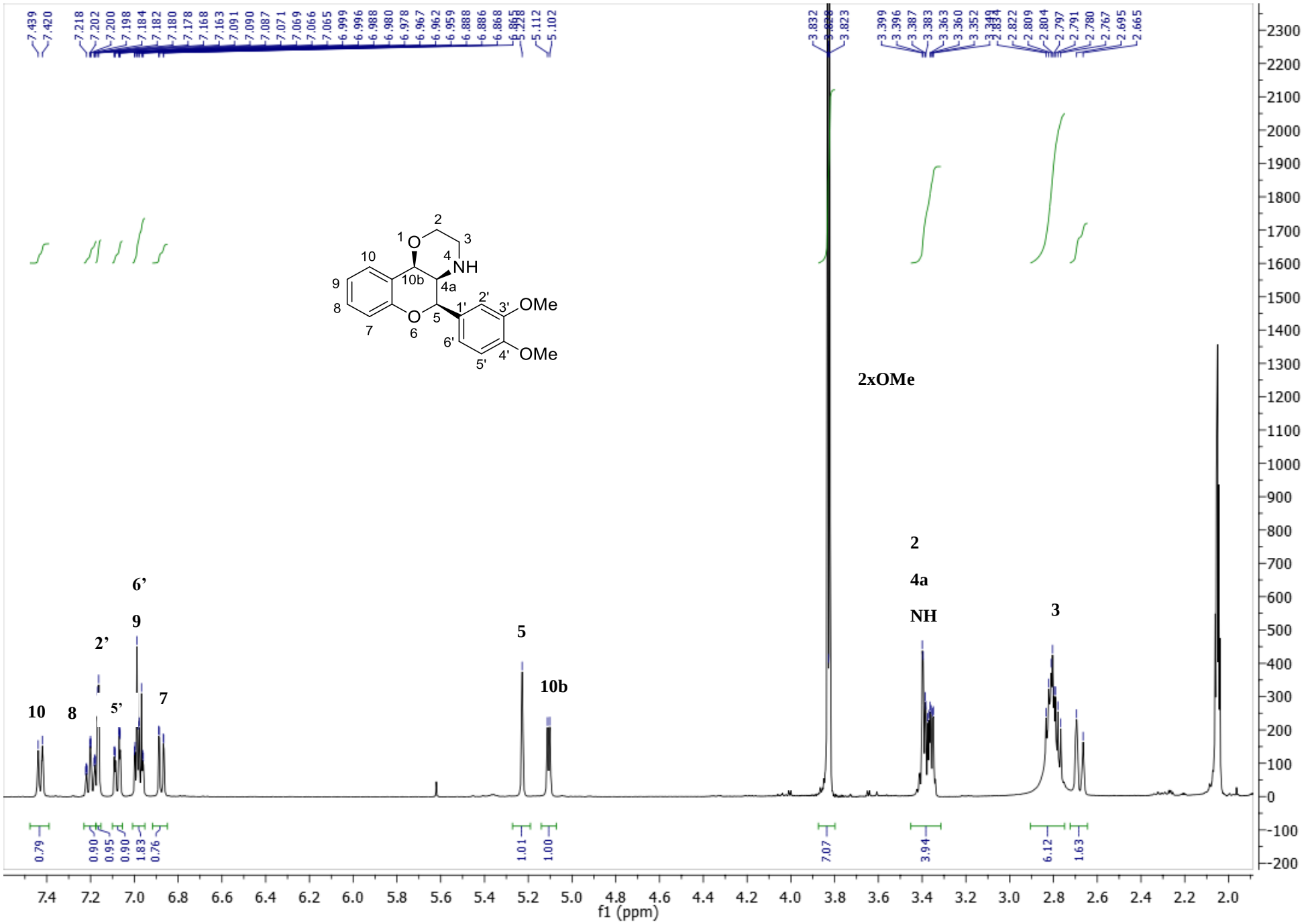


Figure S176. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2c** in Acetone-d_6

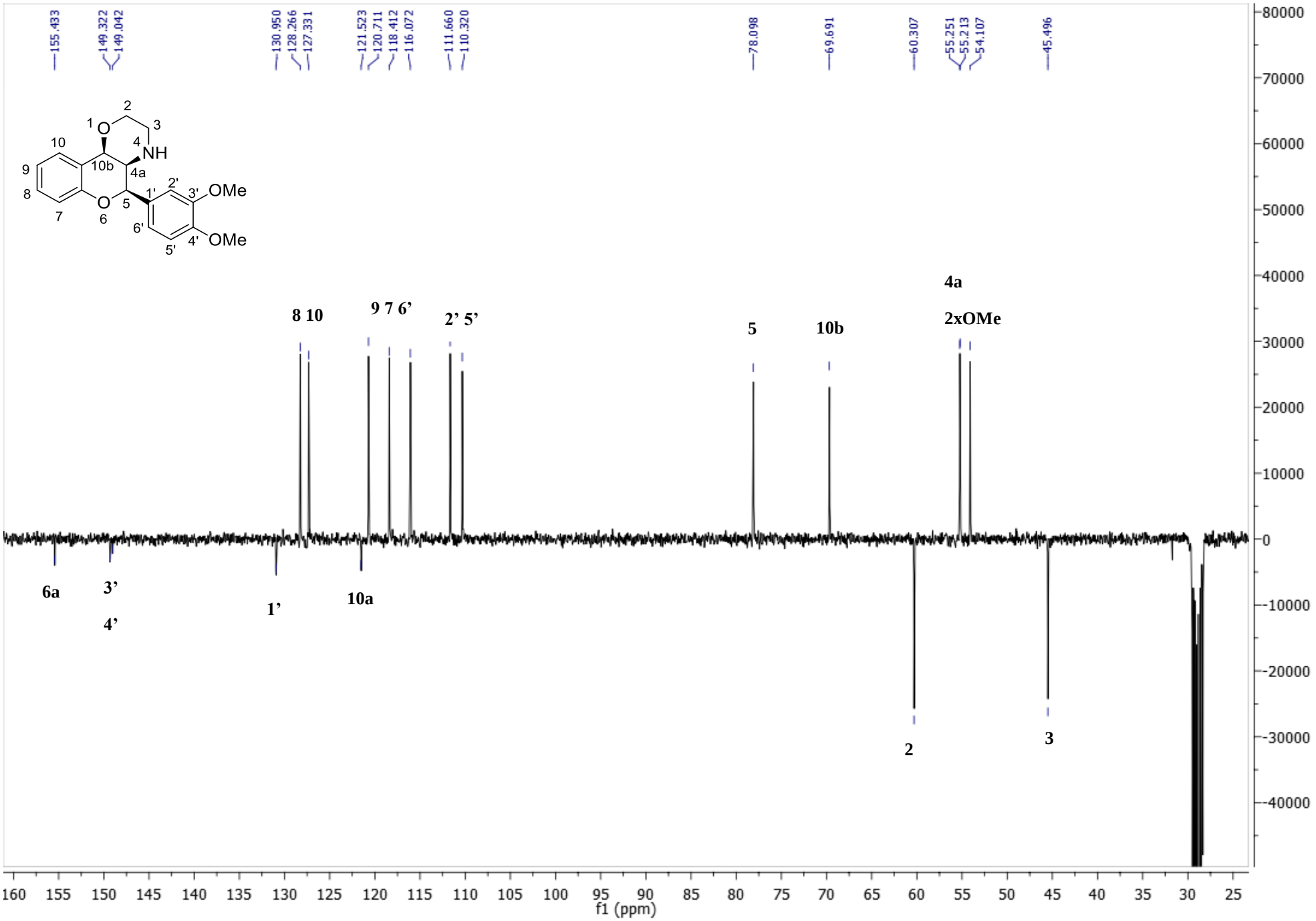


Figure S177. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2c** in Acetone-d_6

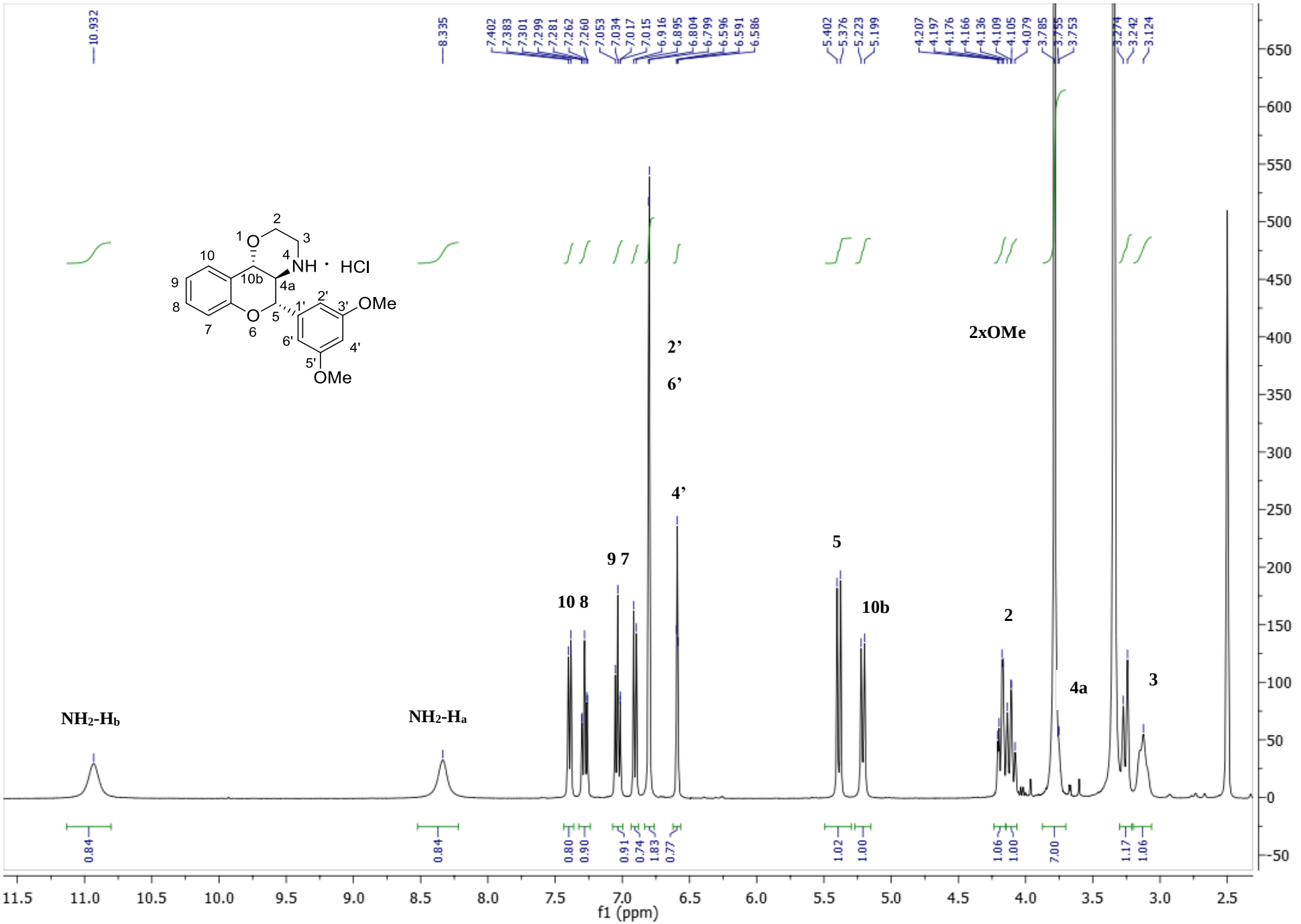


Figure S178. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2d** in DMSO-d$_6$

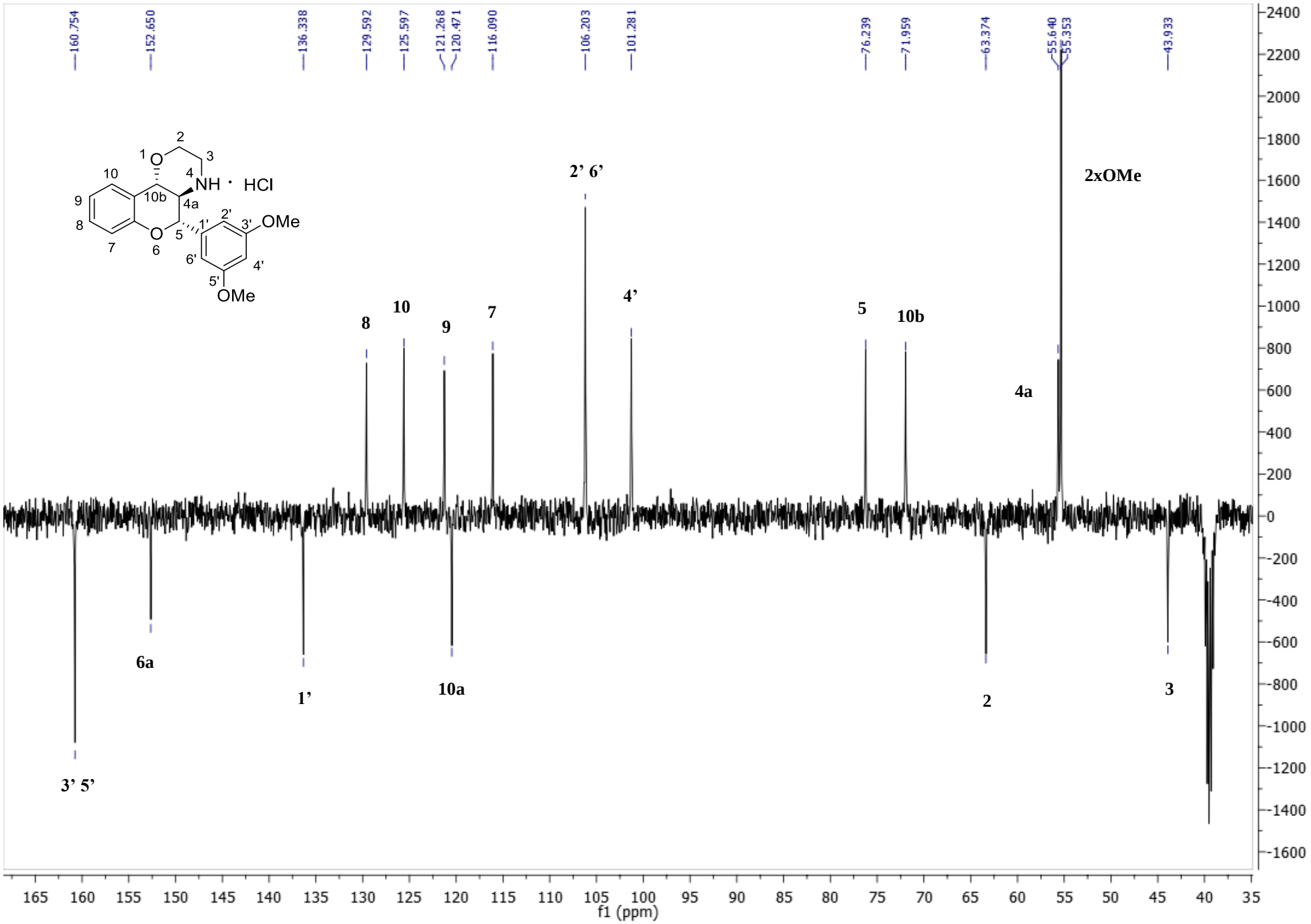


Figure S179. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2d** in DMSO-d$_6$

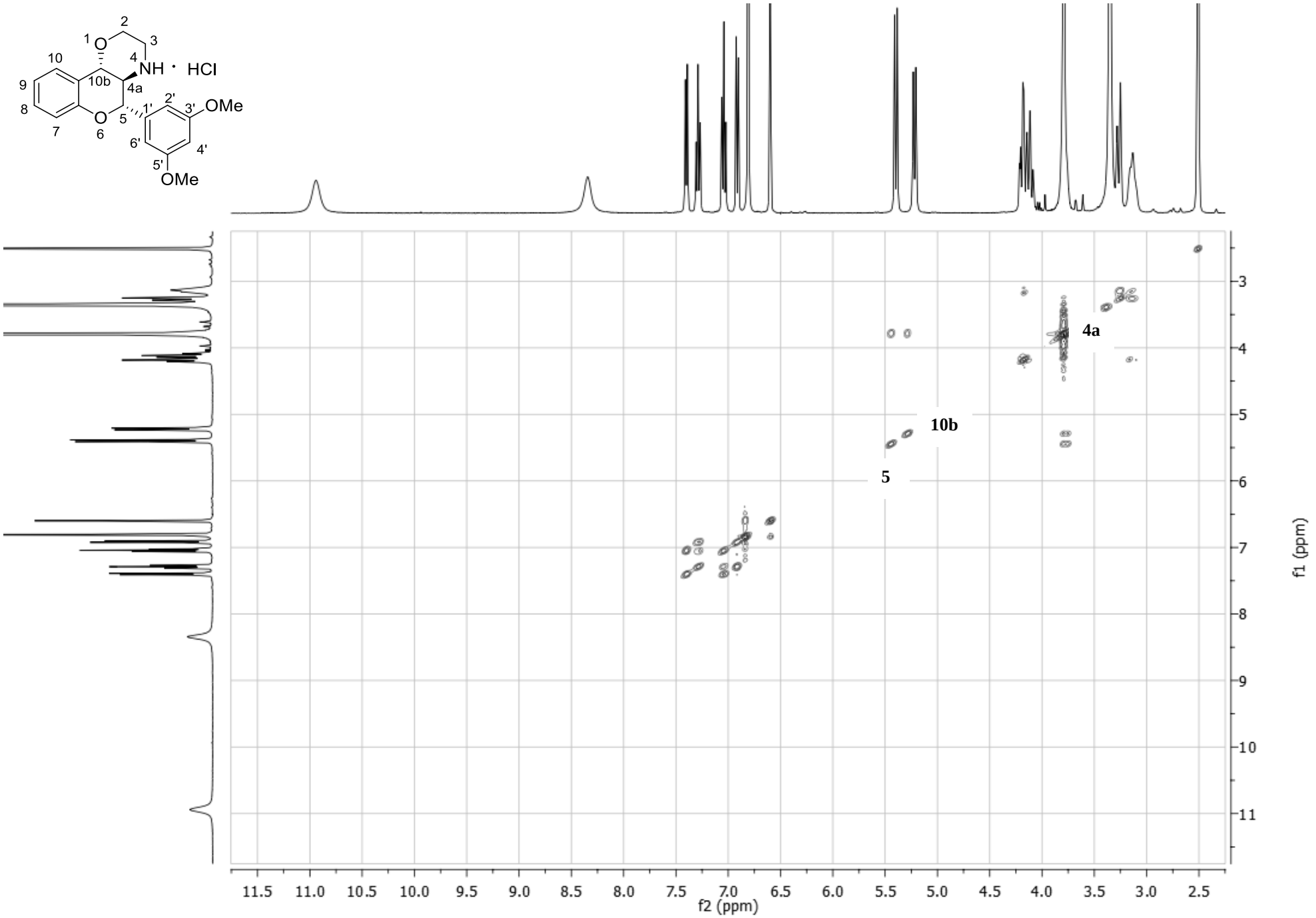


Figure S180. COSY spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2d** in DMSO-d_6

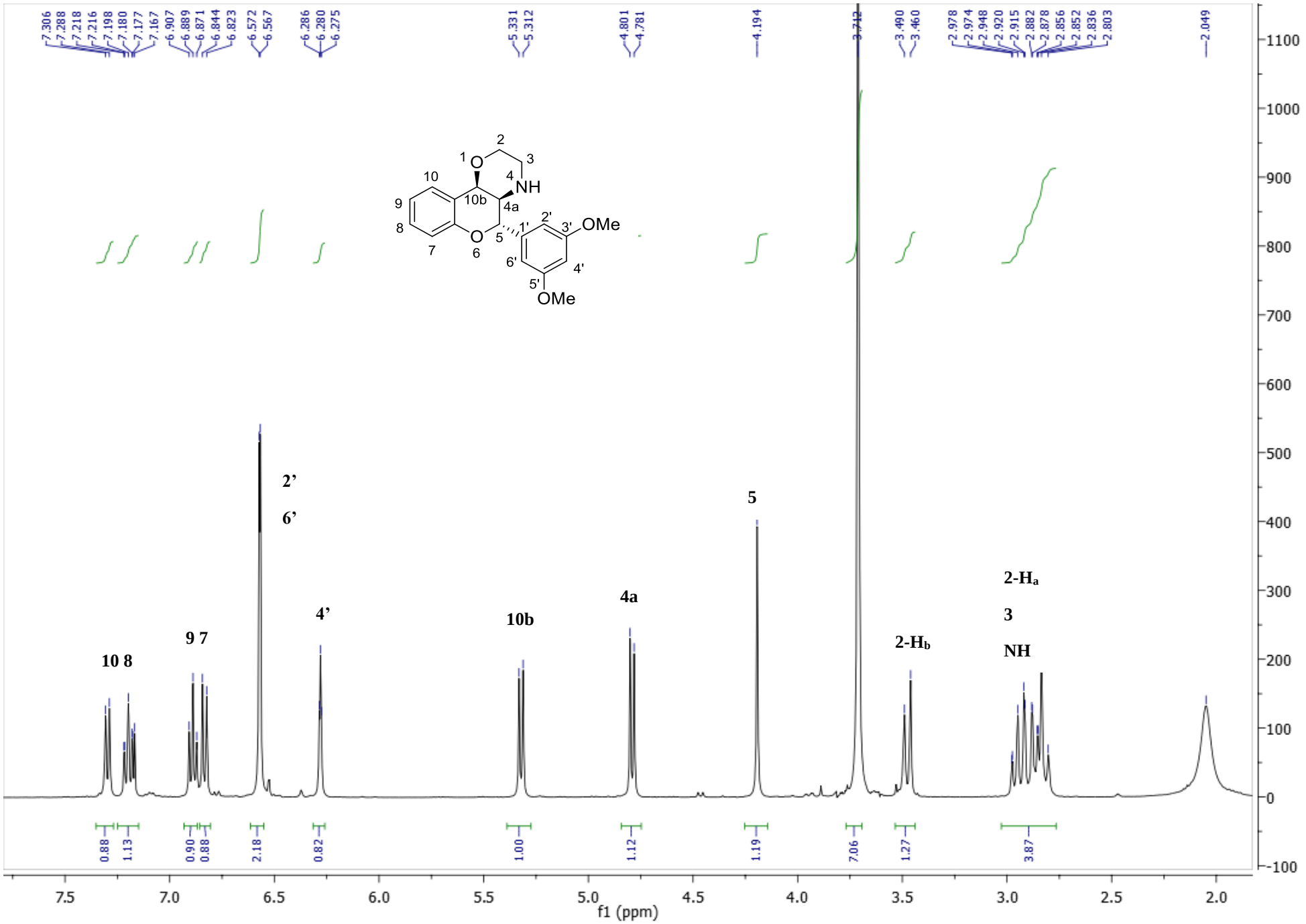


Figure S181. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2d** in $CDCl_3$

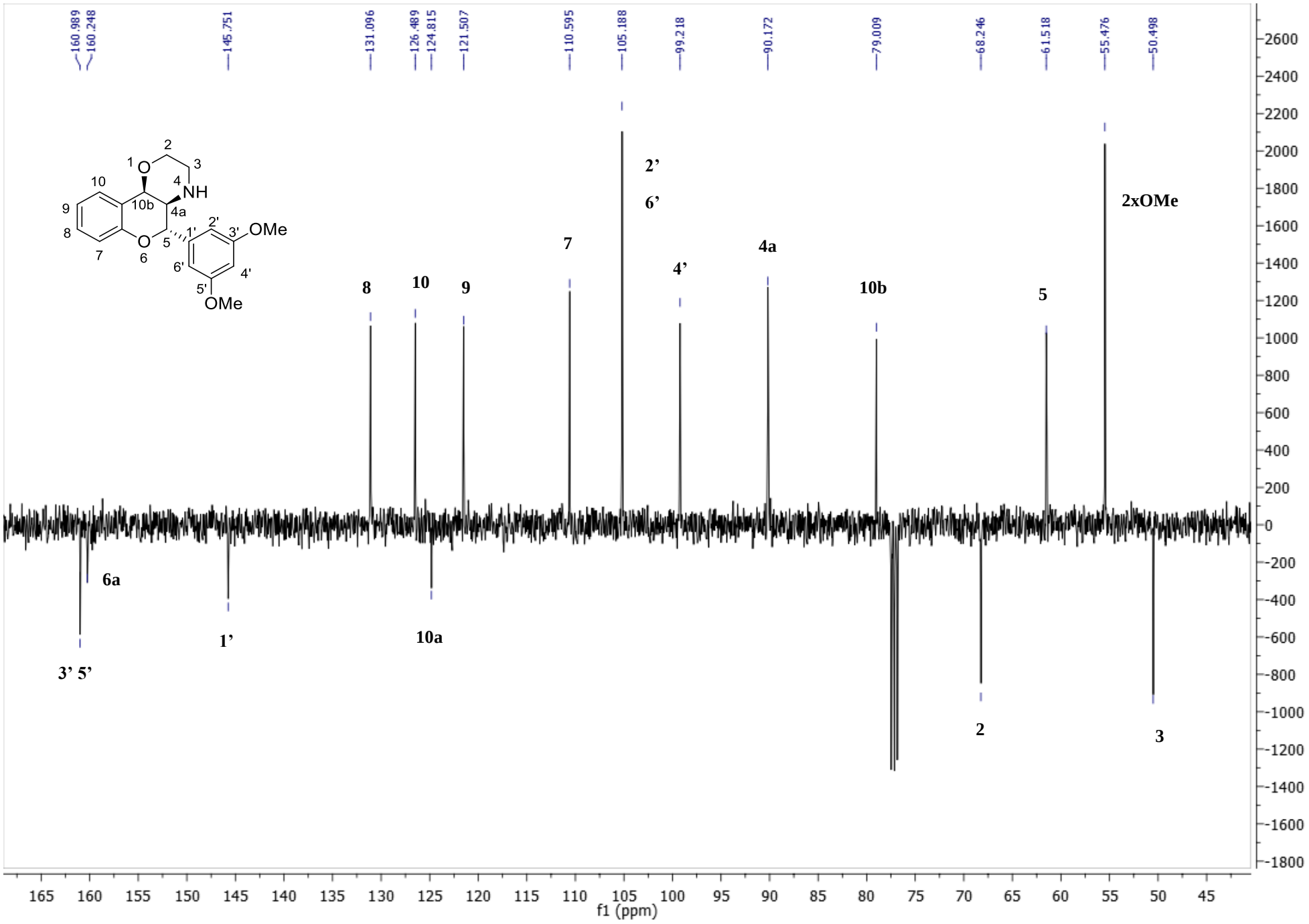


Figure S182. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2d** in $CDCl_3$

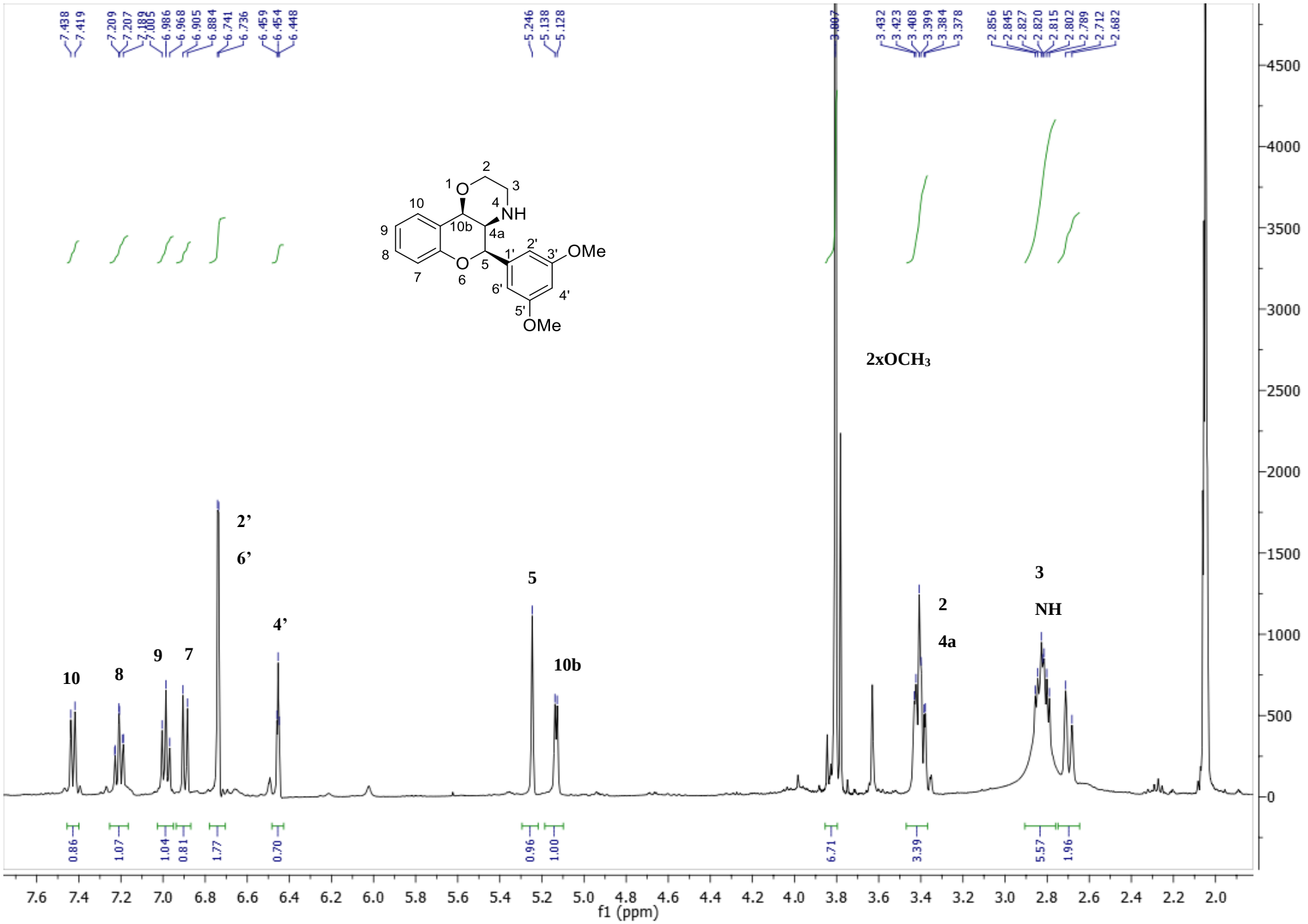


Figure S183. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2d** in Acetone-d_6

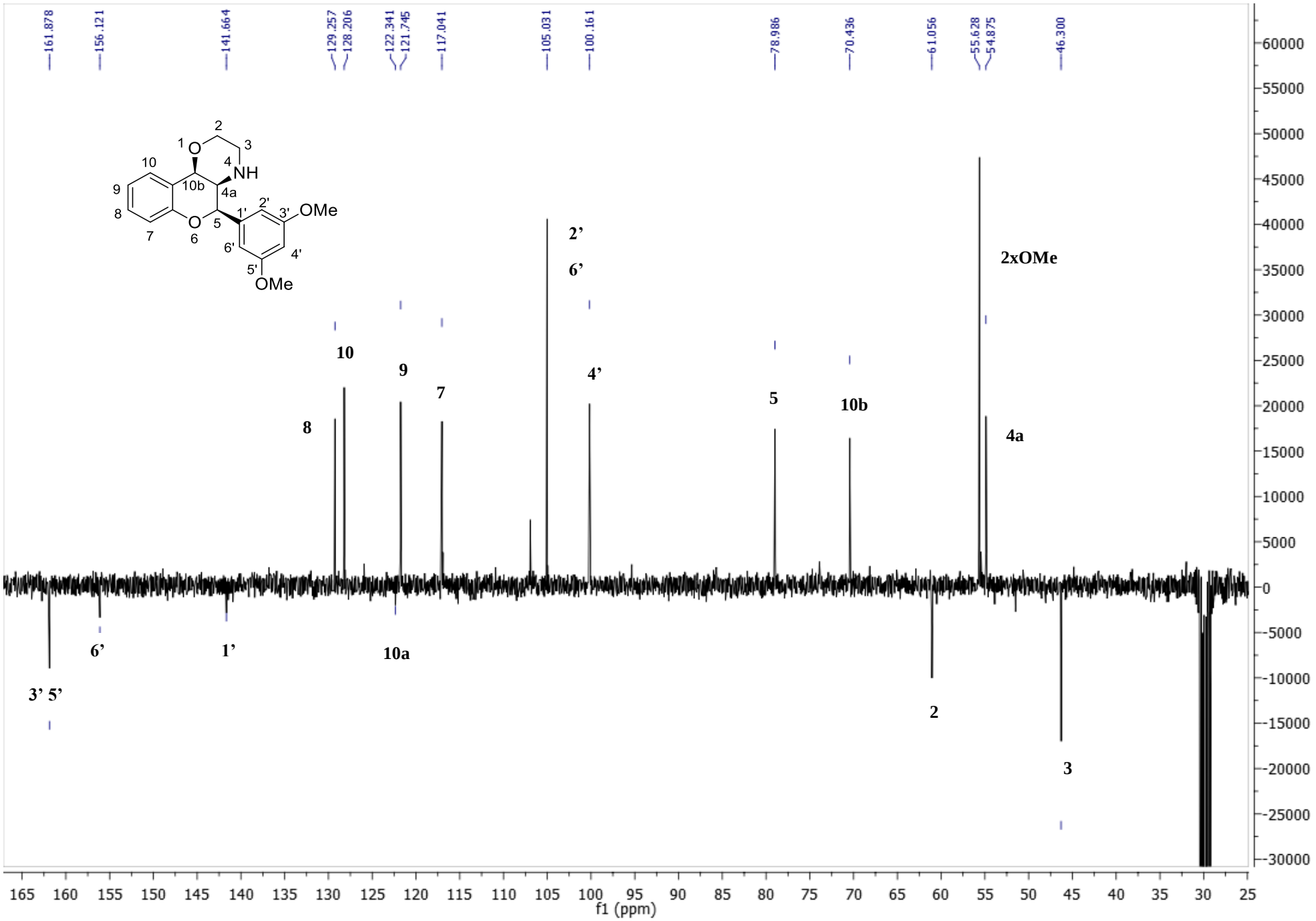


Figure S184. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2d** in Acetone-d_6

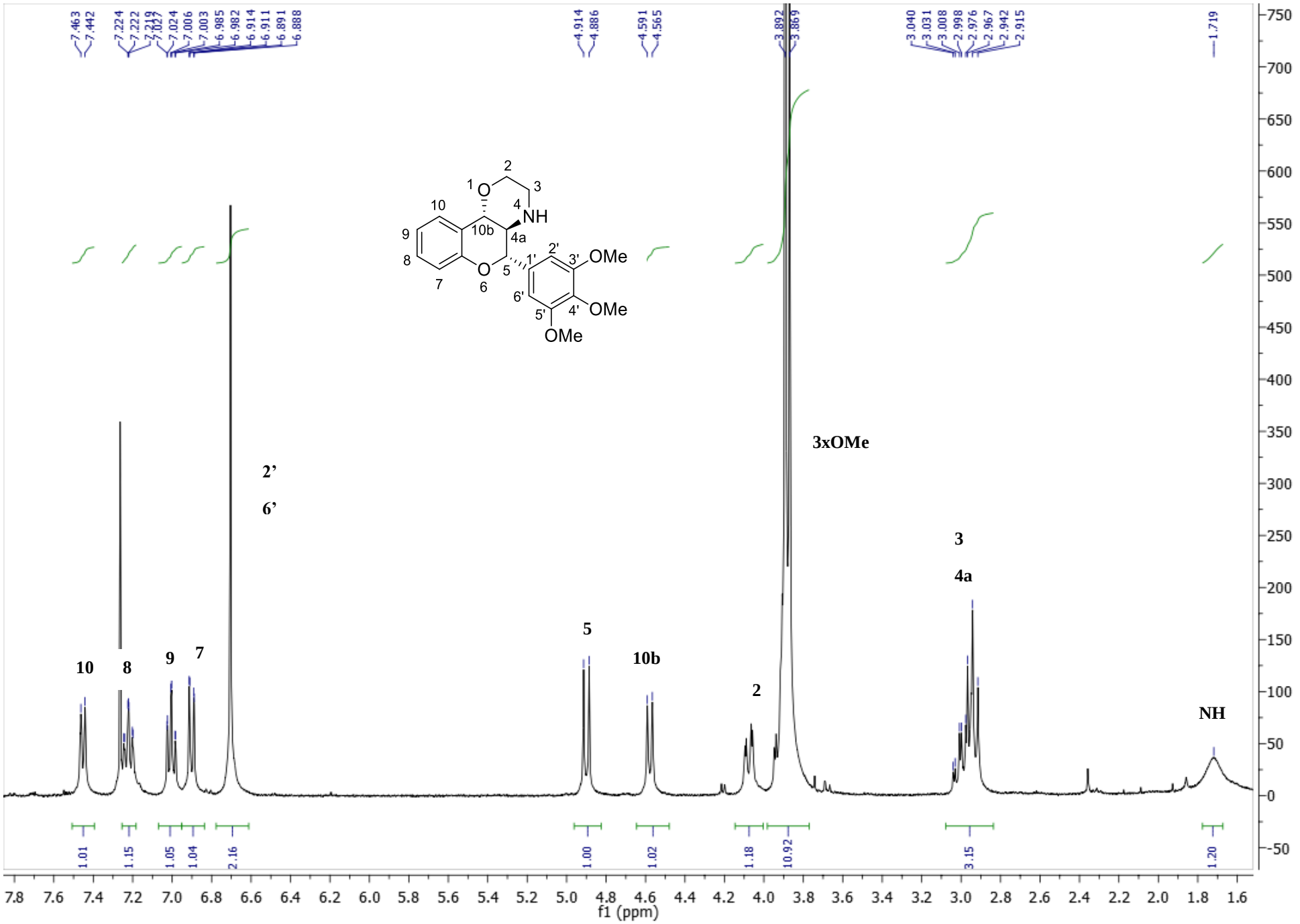


Figure S185. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2e** in $CDCl_3$

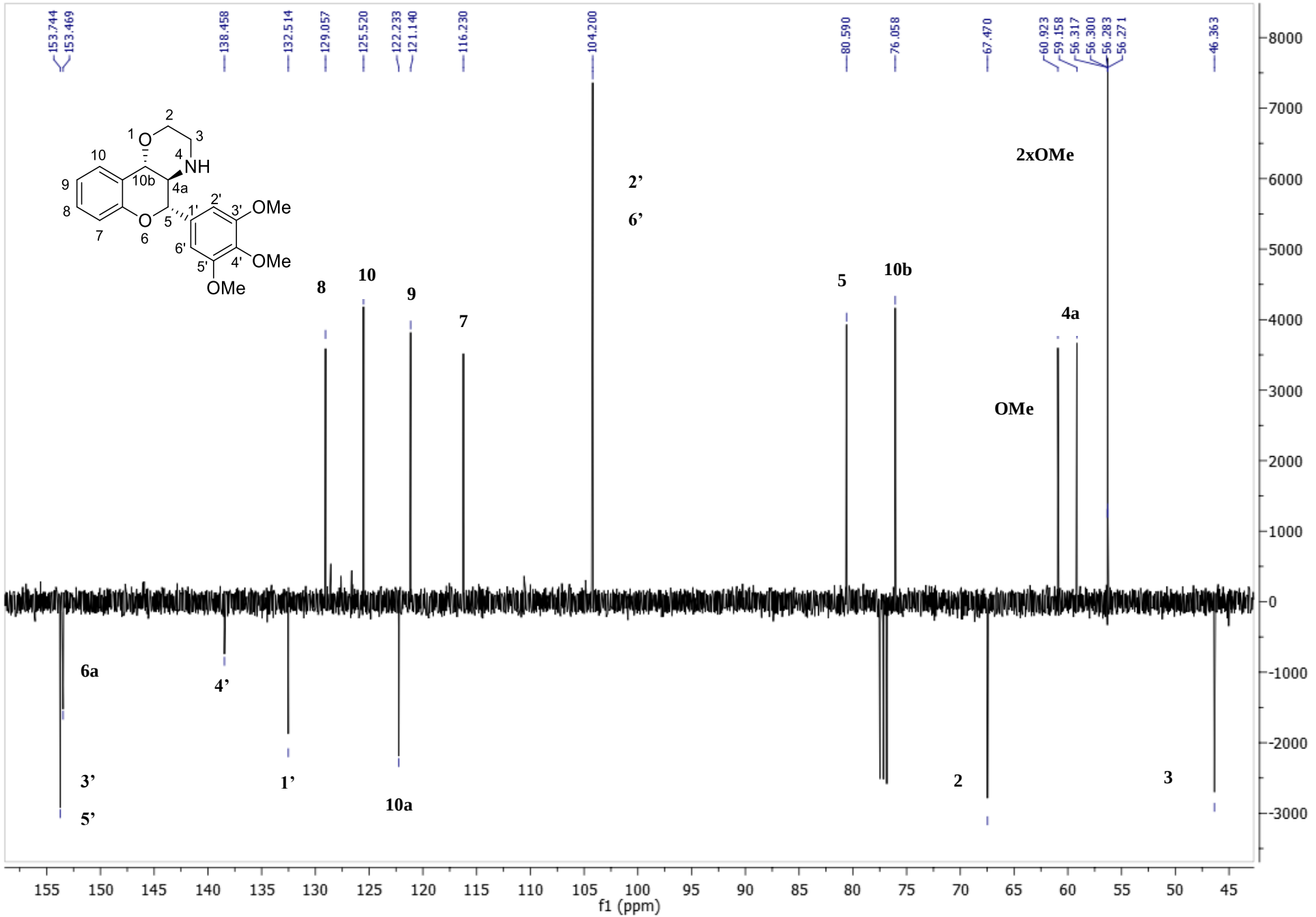


Figure S186. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2e** in $CDCl_3$

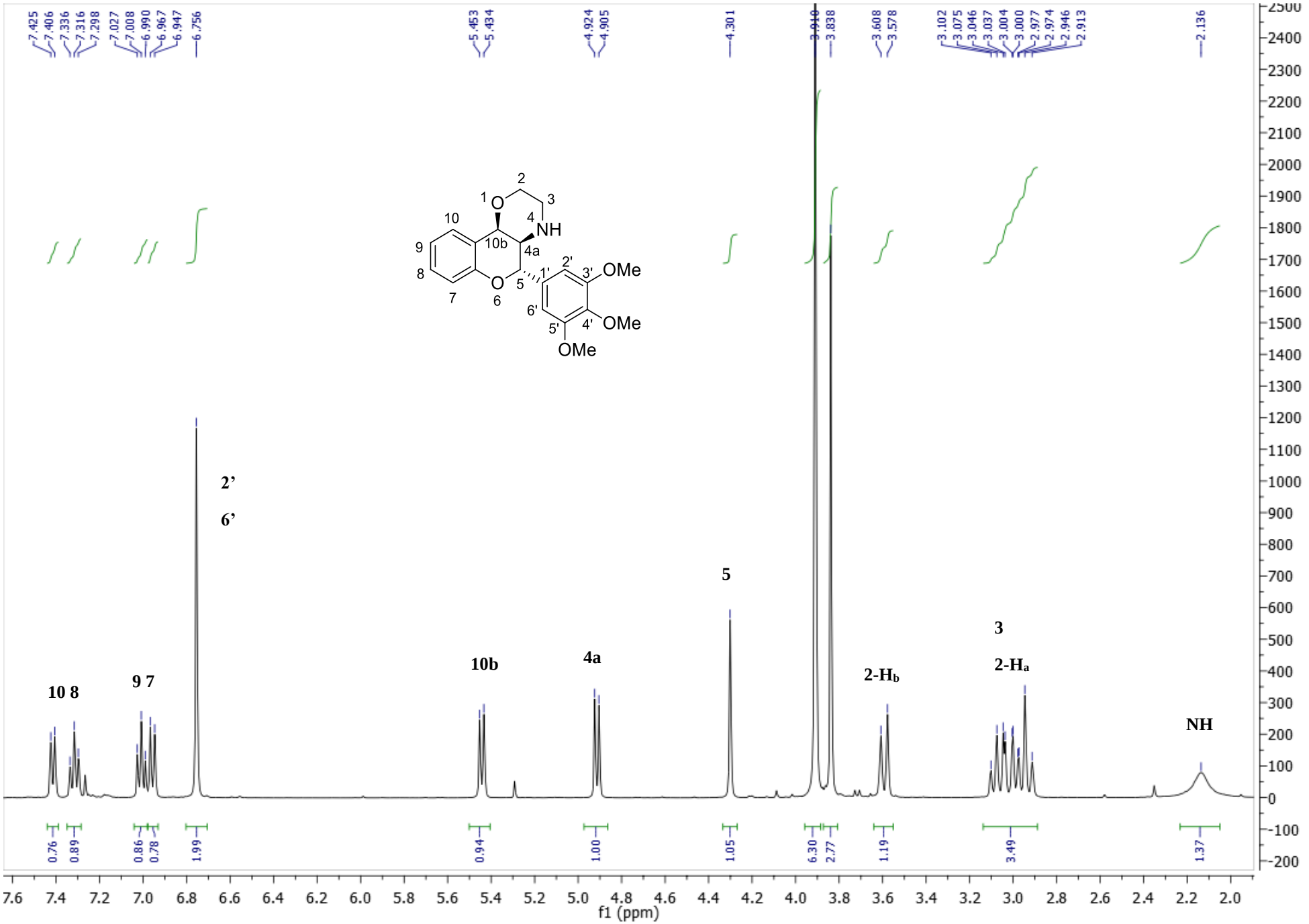


Figure S187. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2e** in $CDCl_3$

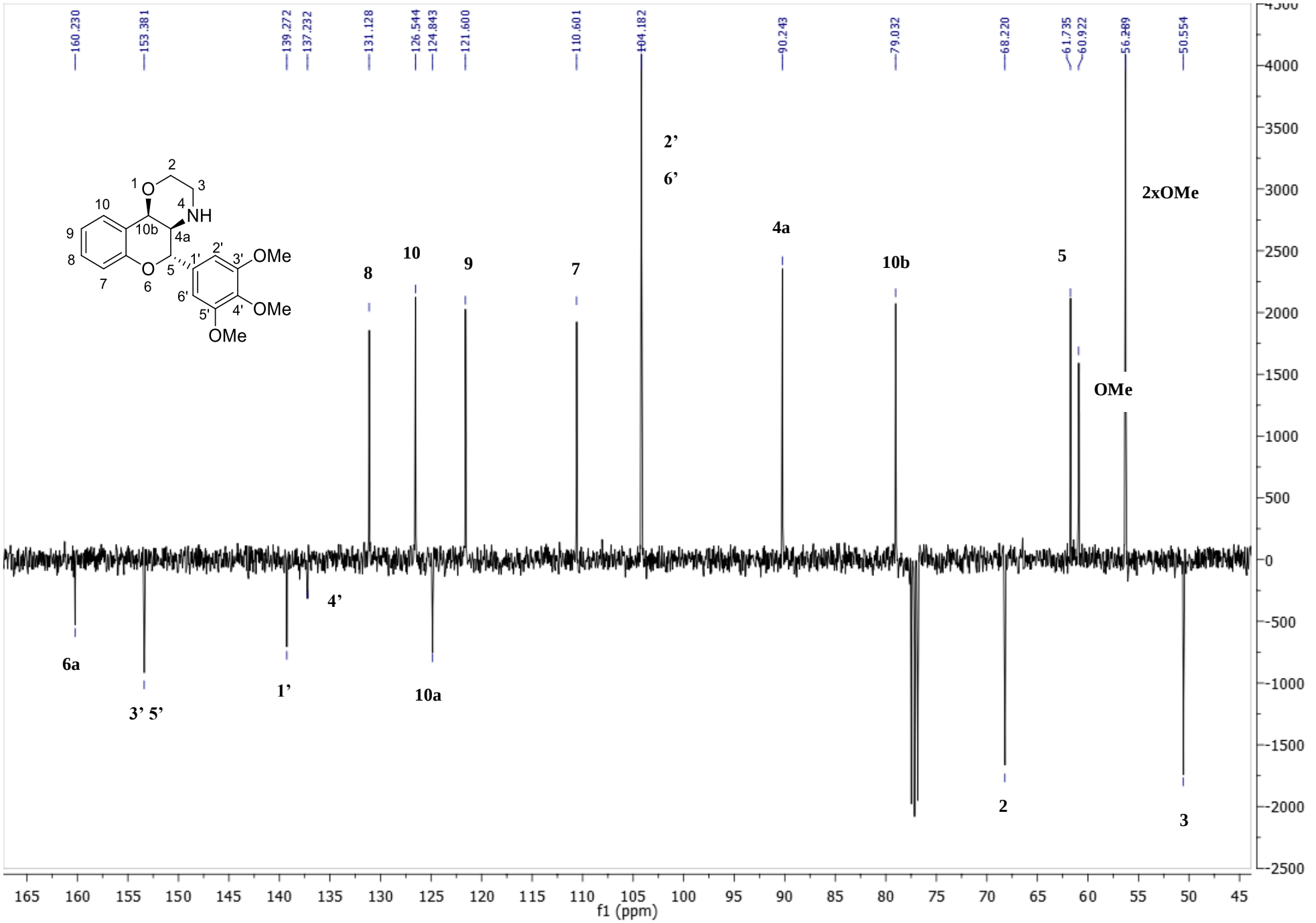


Figure S188. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2e** in $CDCl_3$

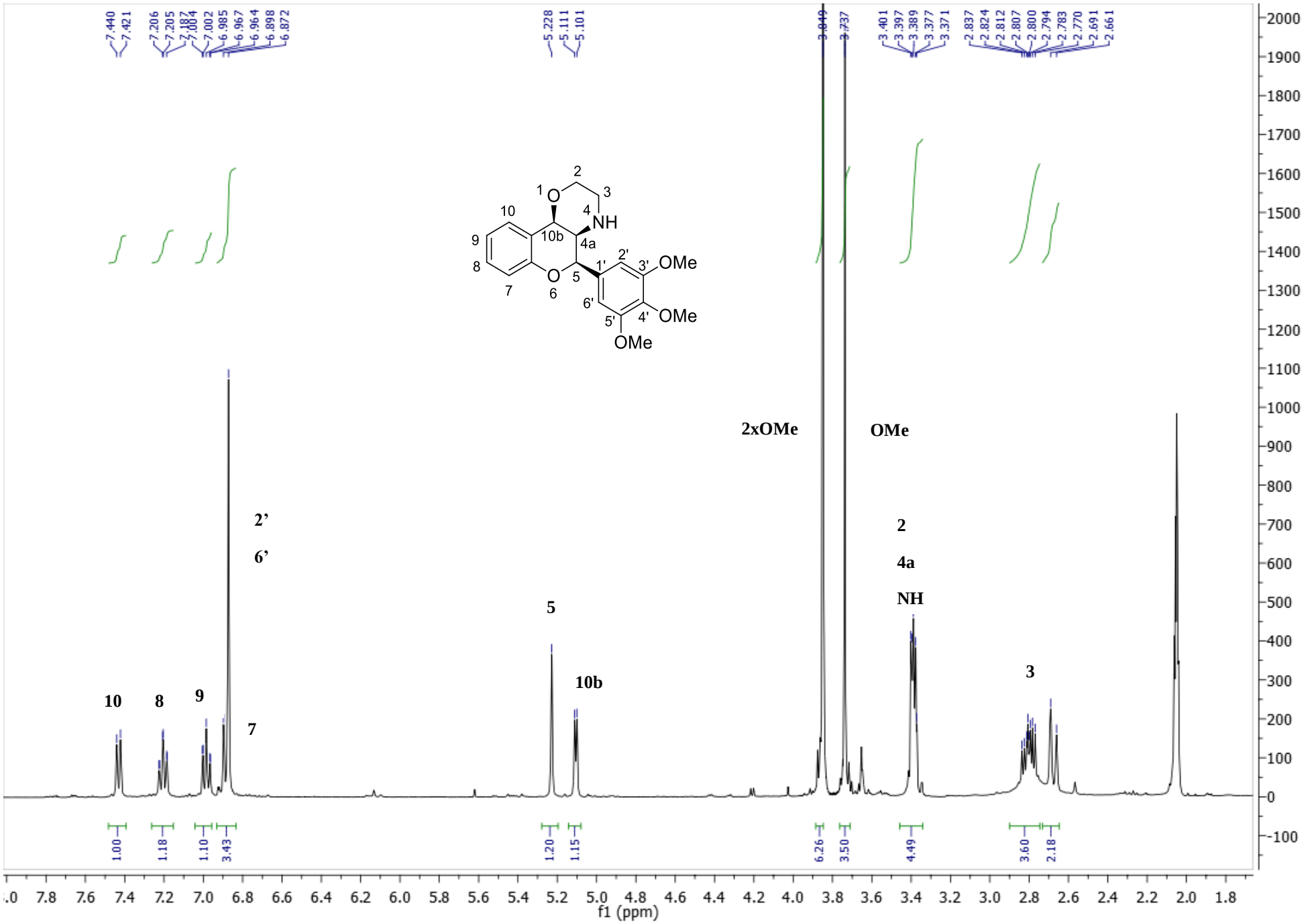


Figure S189. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2e** in Acetone-d_6

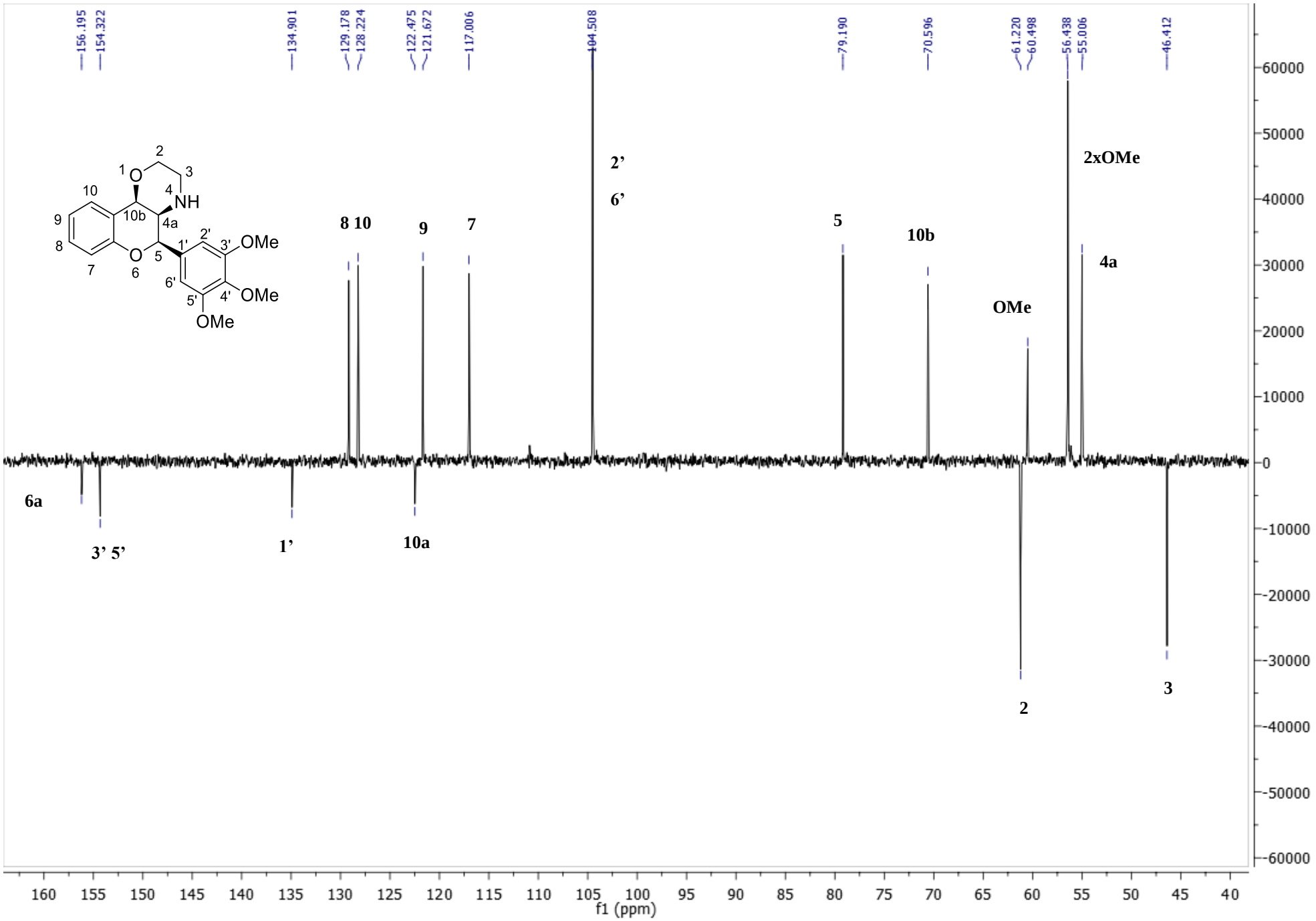


Figure S190. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2e** in Acetone-d_6

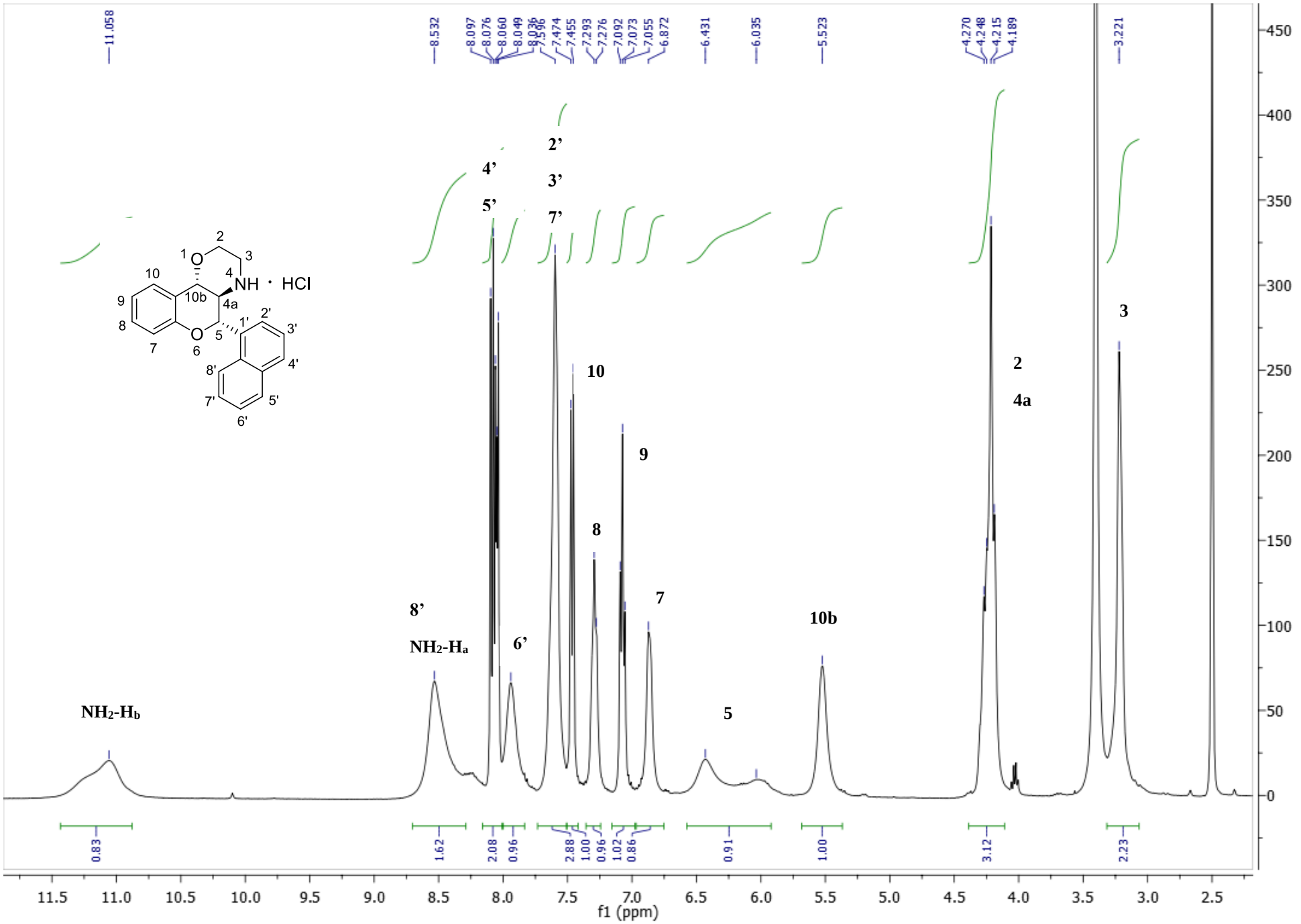


Figure S191. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2f** in DMSO-d$_6$

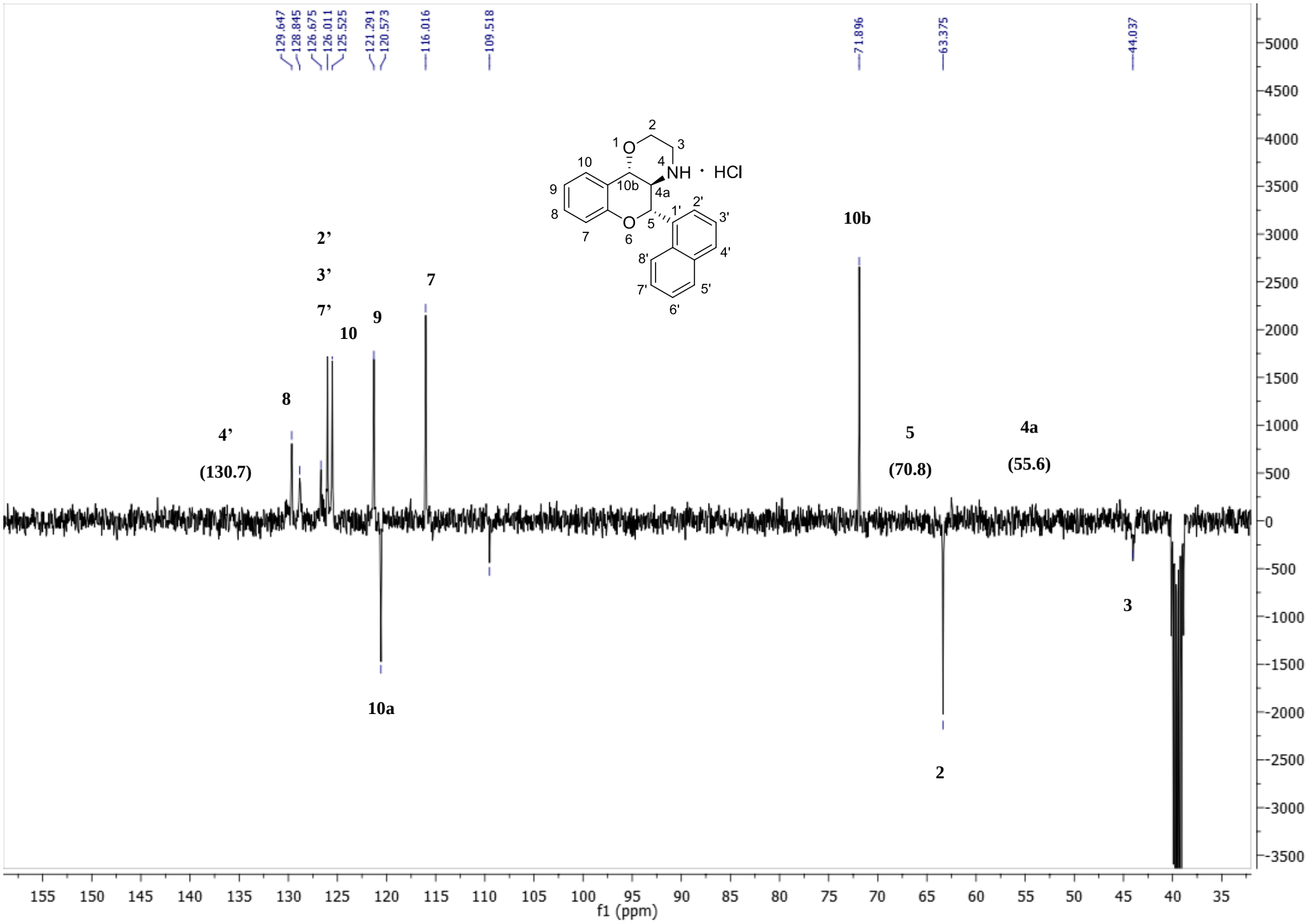


Figure S192. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2f** in DMSO-d_6

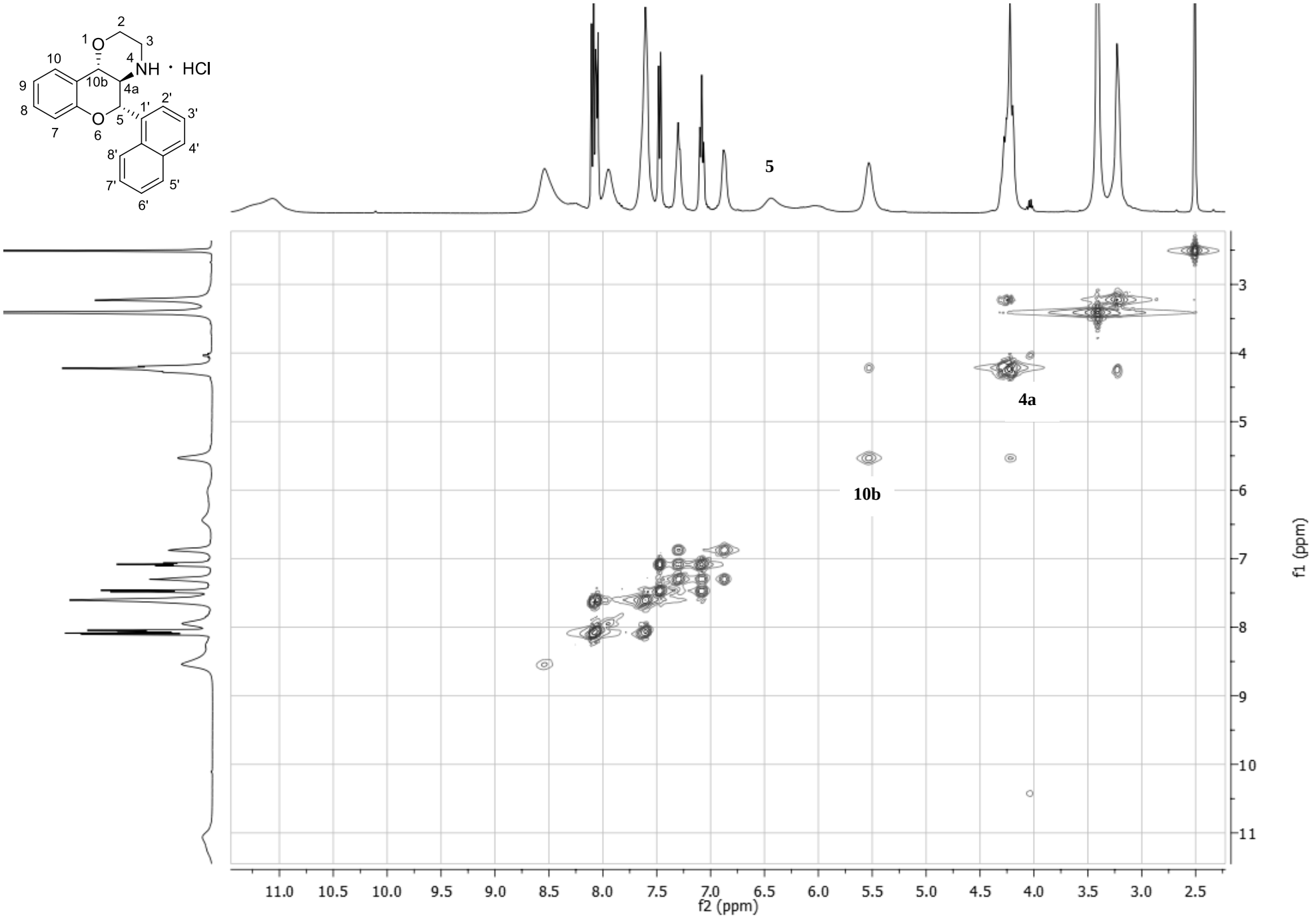


Figure S193. COSY spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2f** in DMSO-d_6

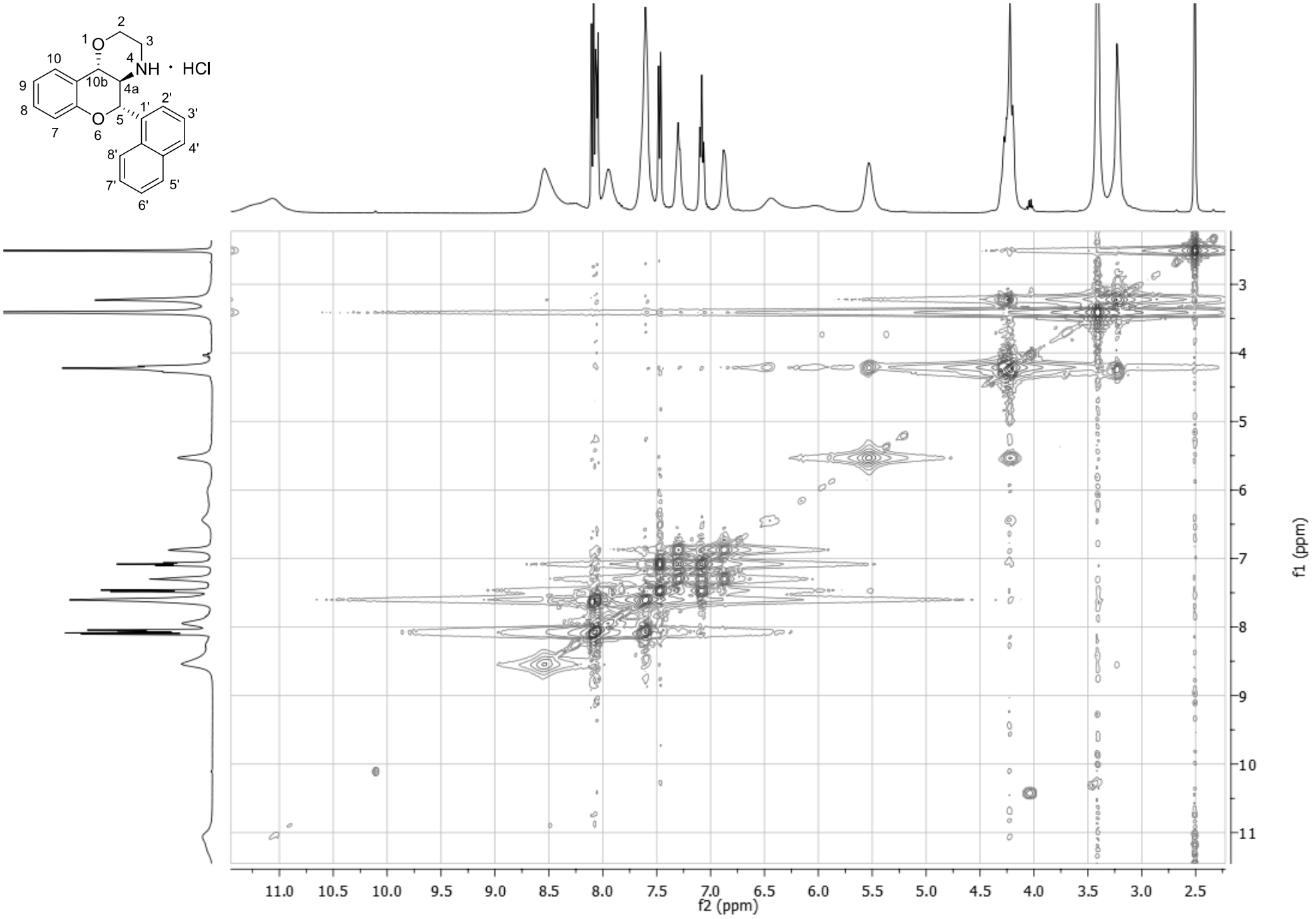


Figure S194. COSY spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2f** in DMSO-d_6 (maximized)

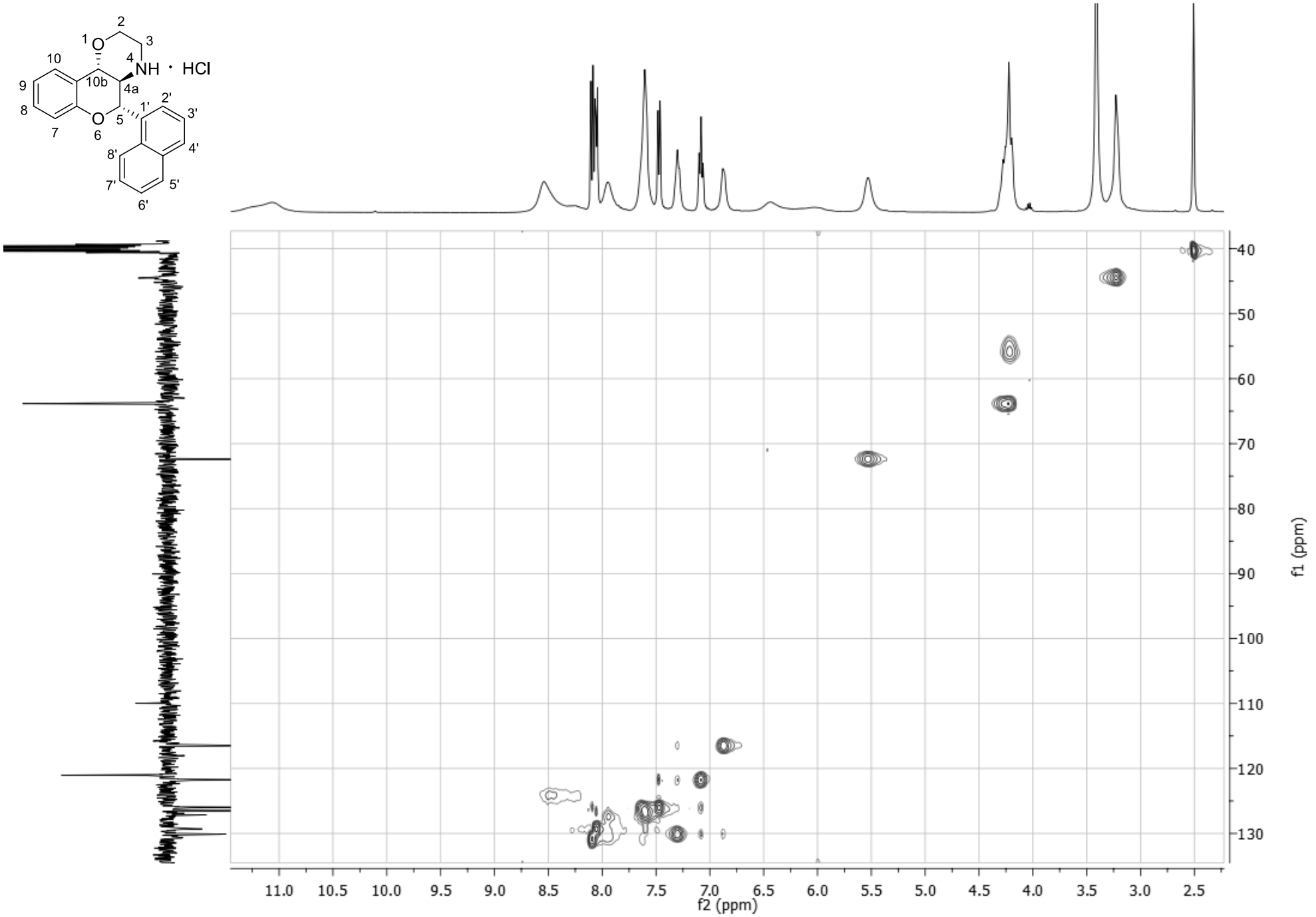


Figure S195. HSQC spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2f** in DMSO-d_6

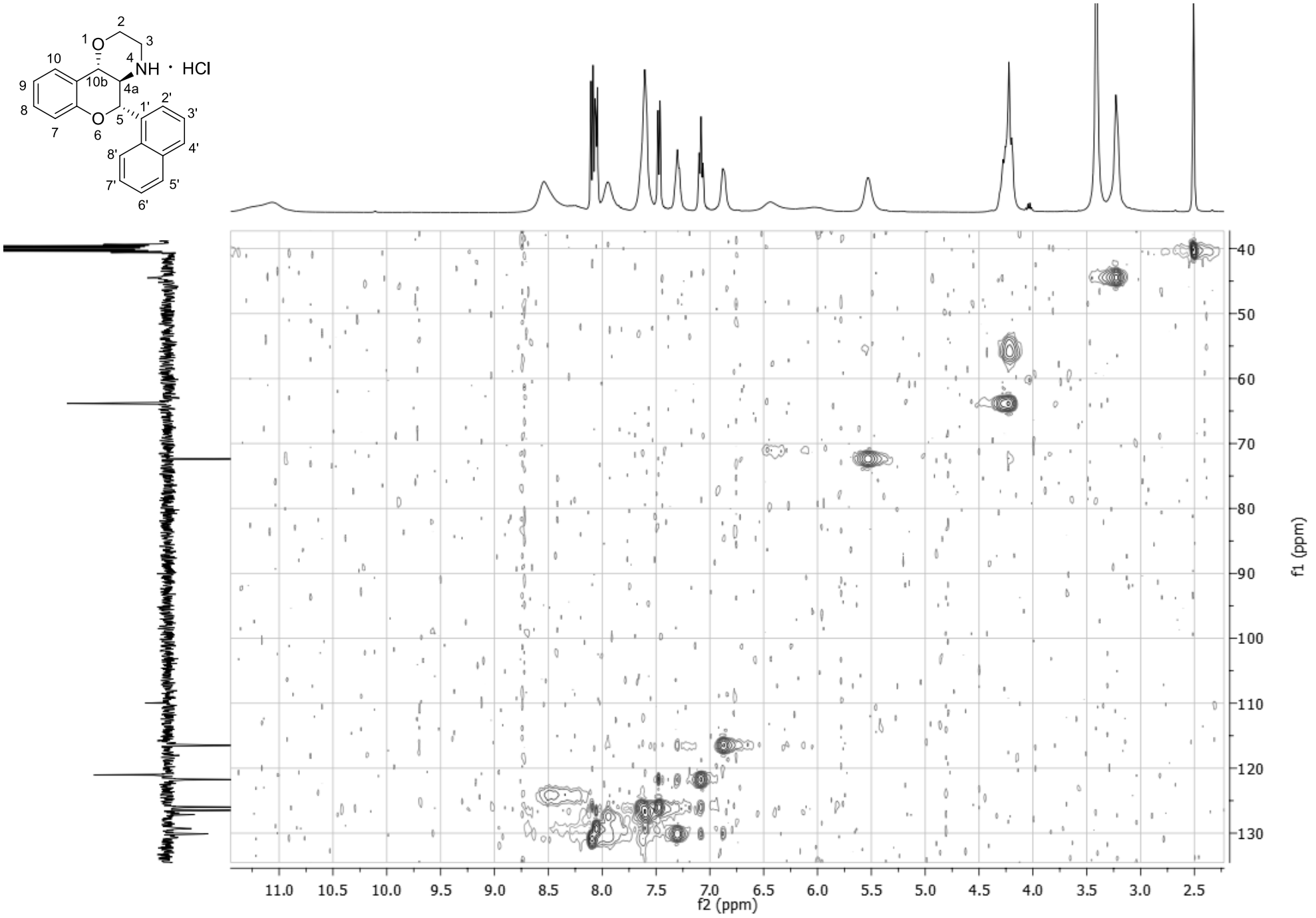


Figure S196. HSQC spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2f** in DMSO-d_6 (maximized)

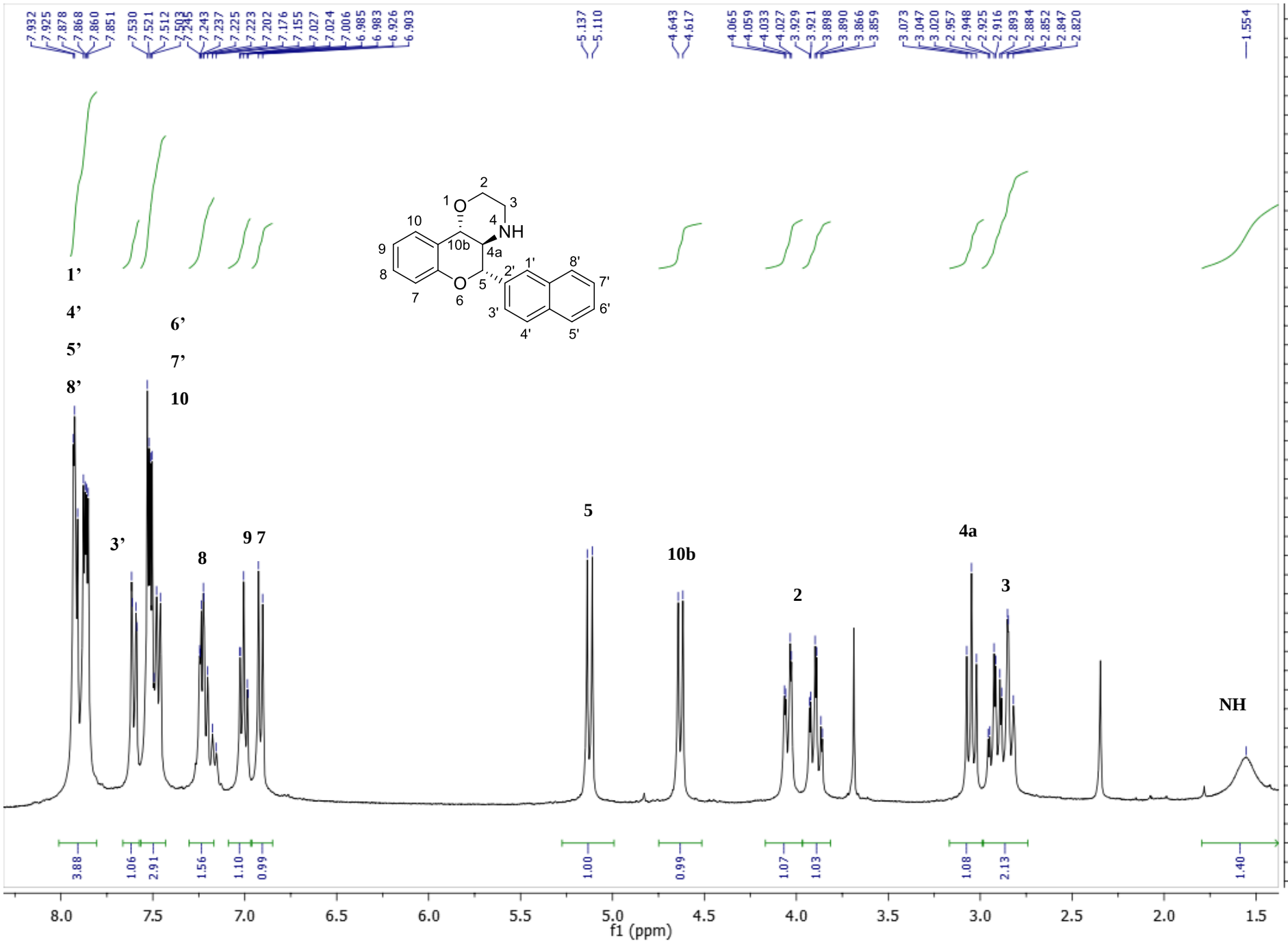


Figure S197. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2g** in $CDCl_3$

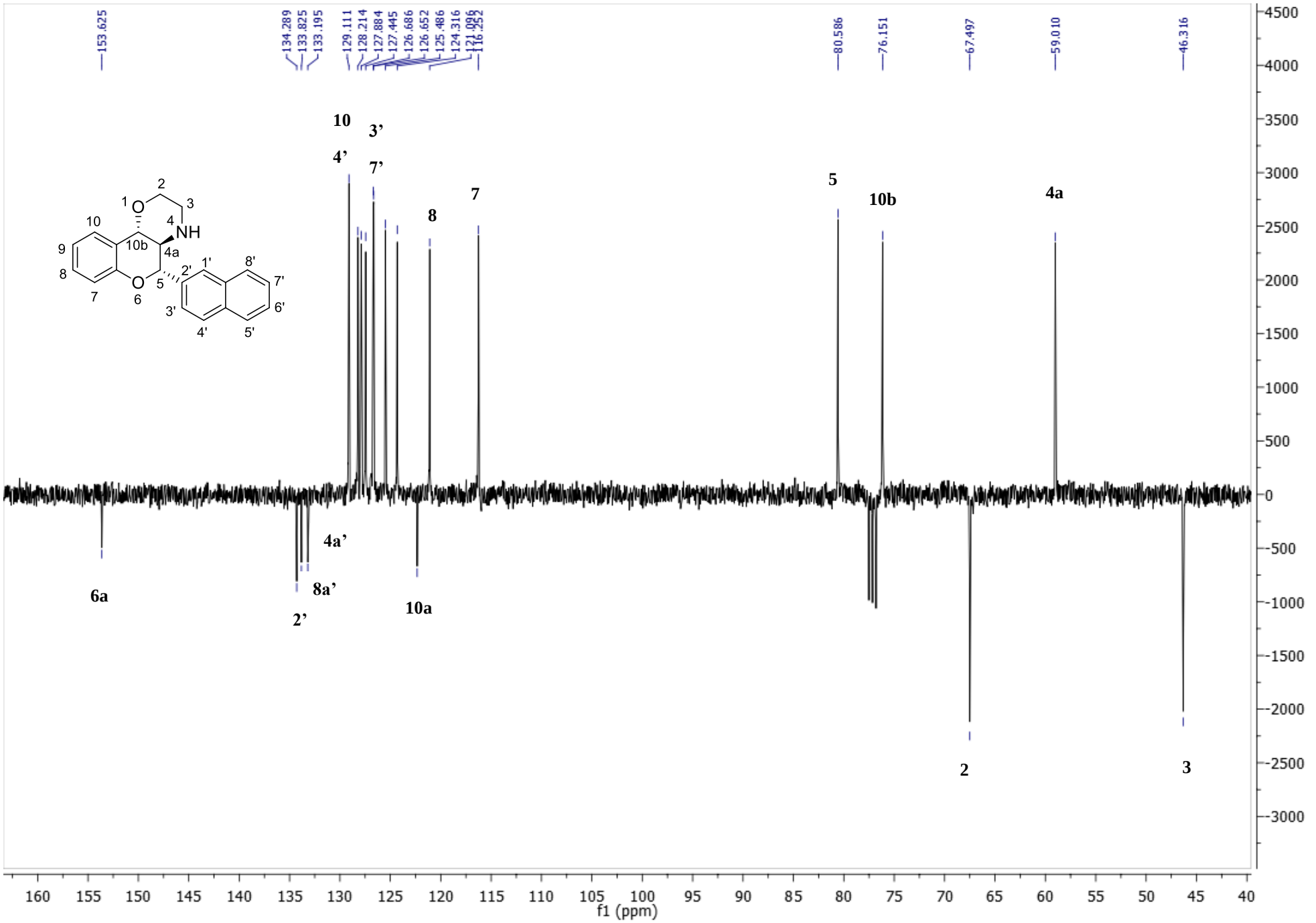


Figure S198. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*S**)-**2g** in $CDCl_3$

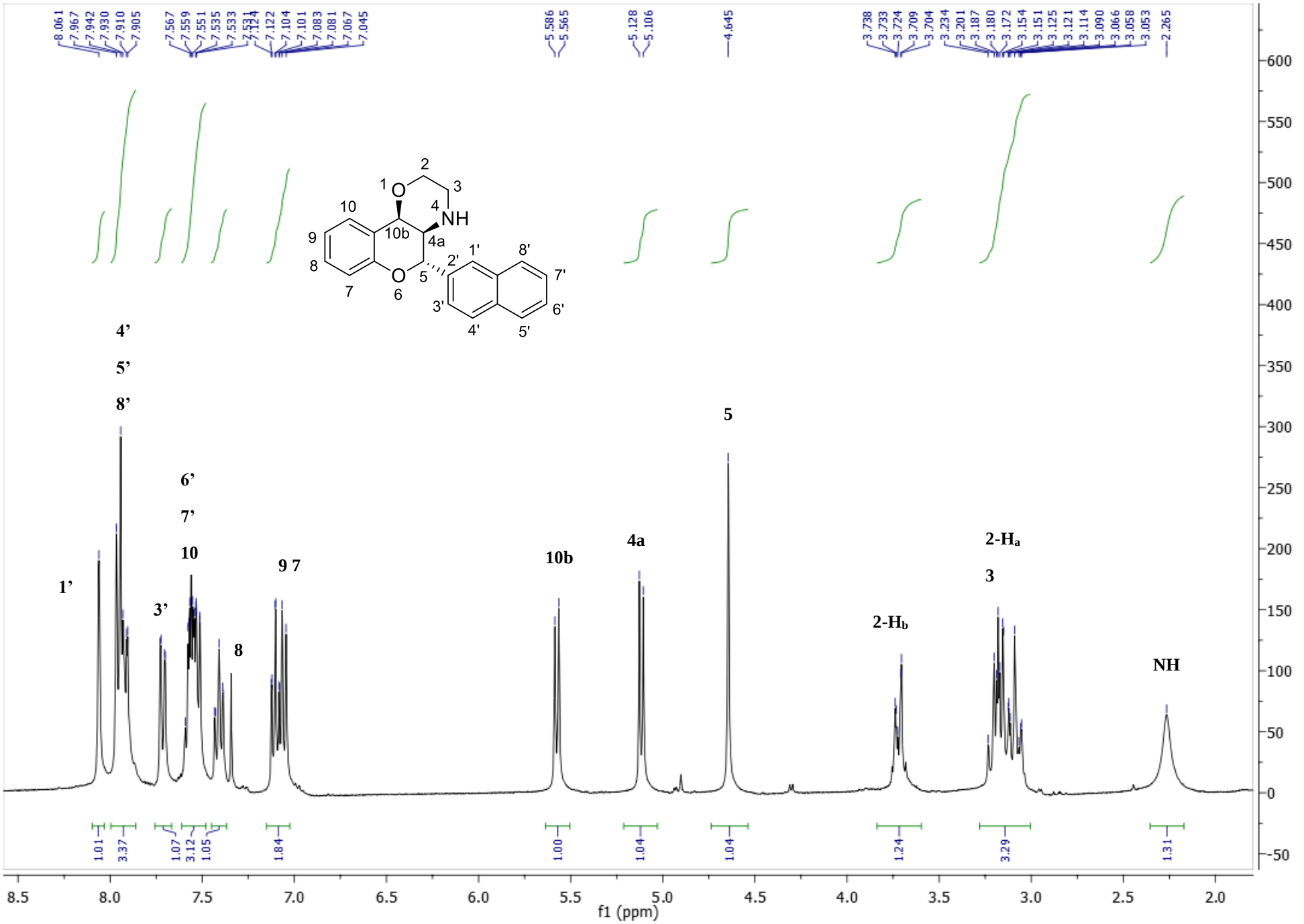


Figure S199. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2g** in $CDCl_3$

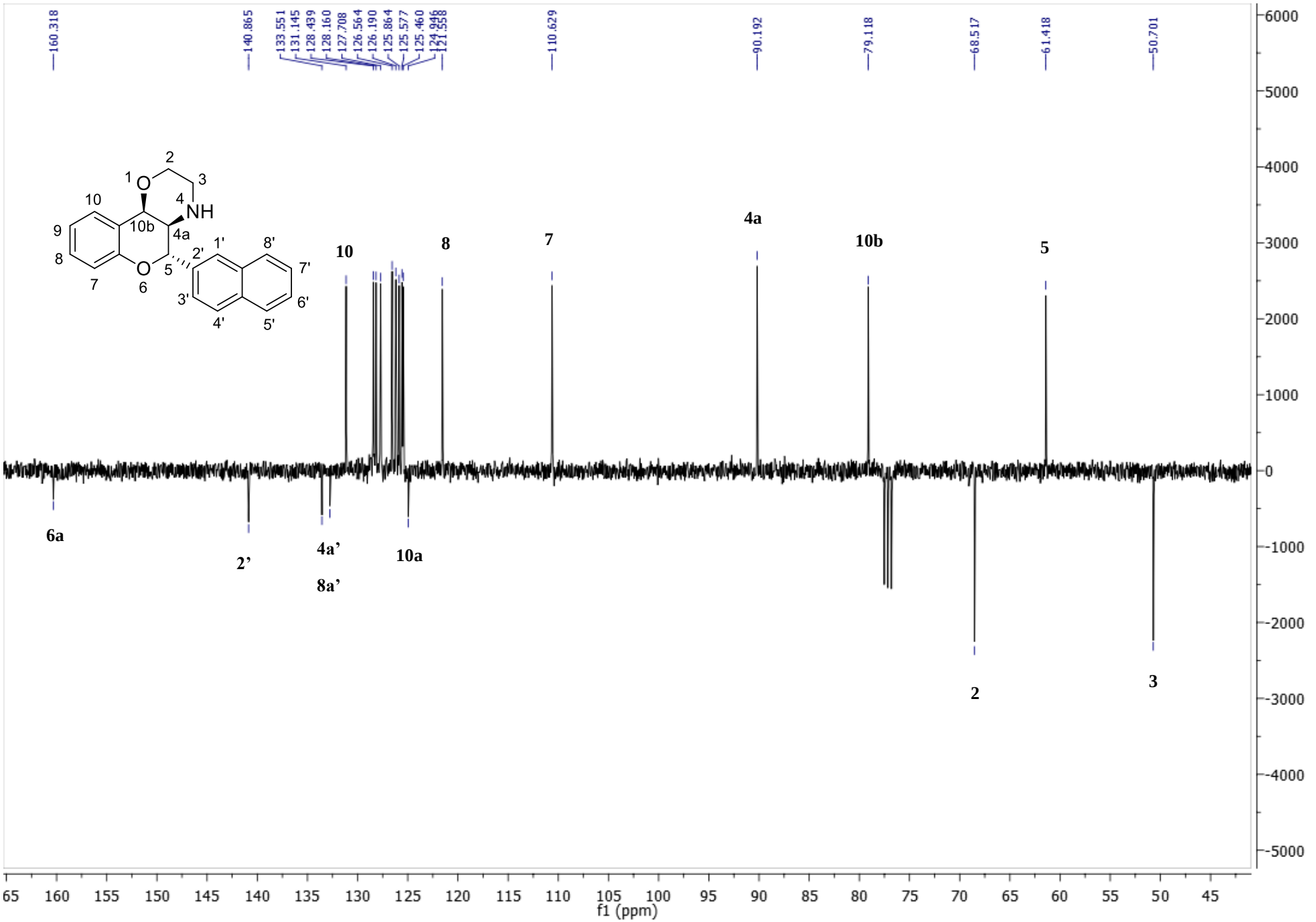


Figure S200. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*S**,10a*R**)-**2g** in $CDCl_3$

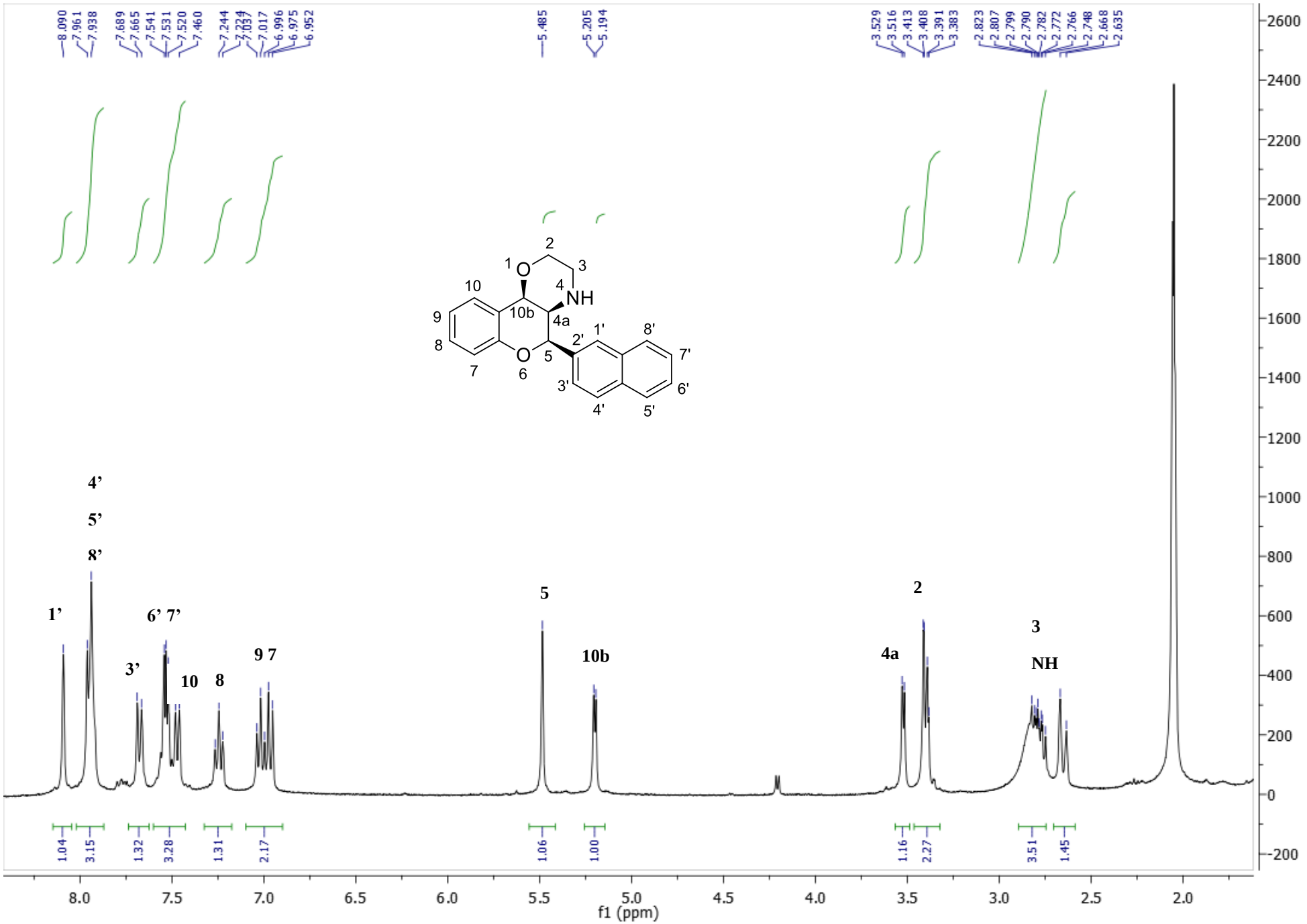


Figure S201. ^{1}H-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2g** in Acetone-d_6

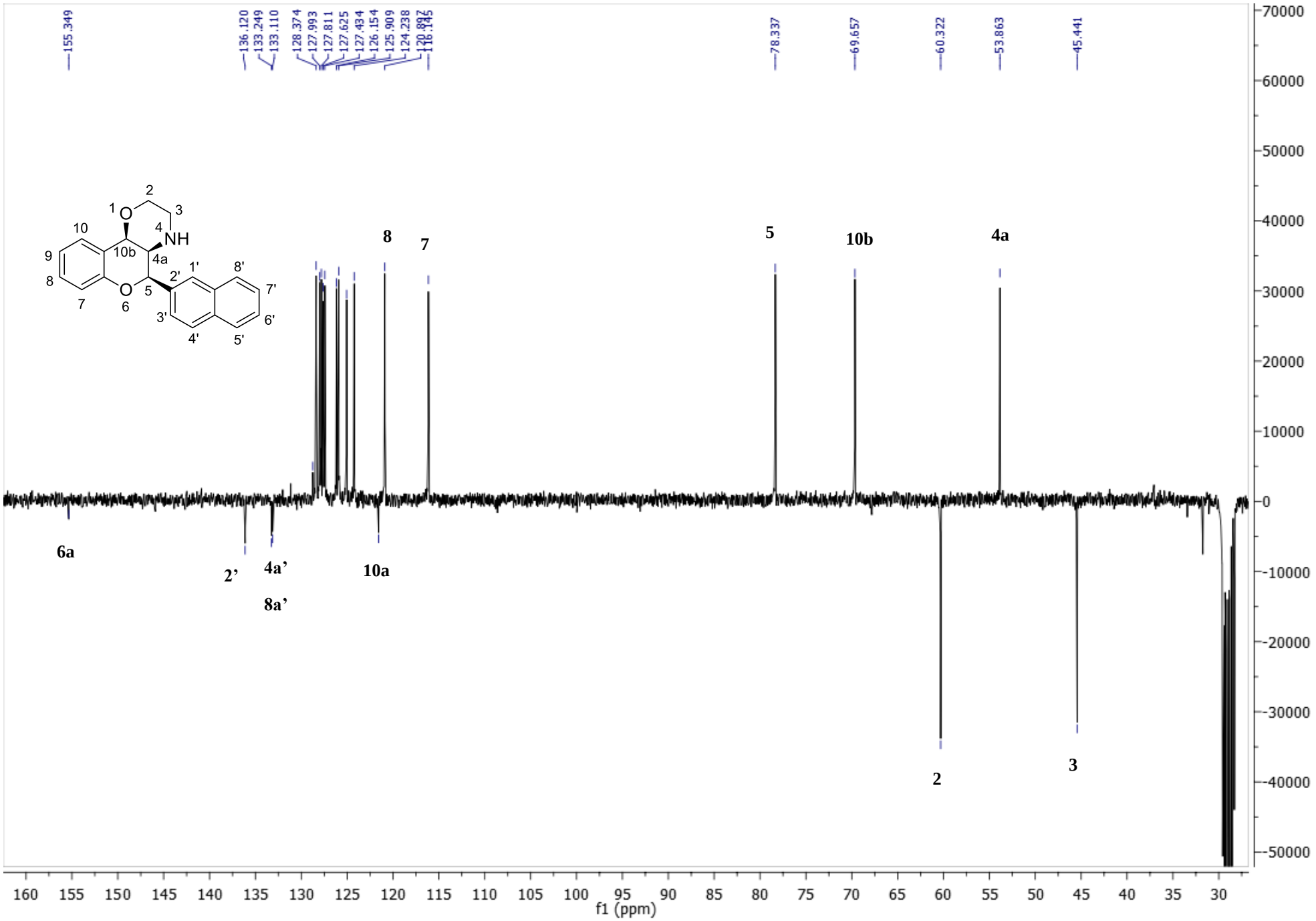


Figure S202. ^{13}C-NMR spectrum of *rac*-(4a*R**,5*R**,10a*R**)-**2g** in Acetone-d_6

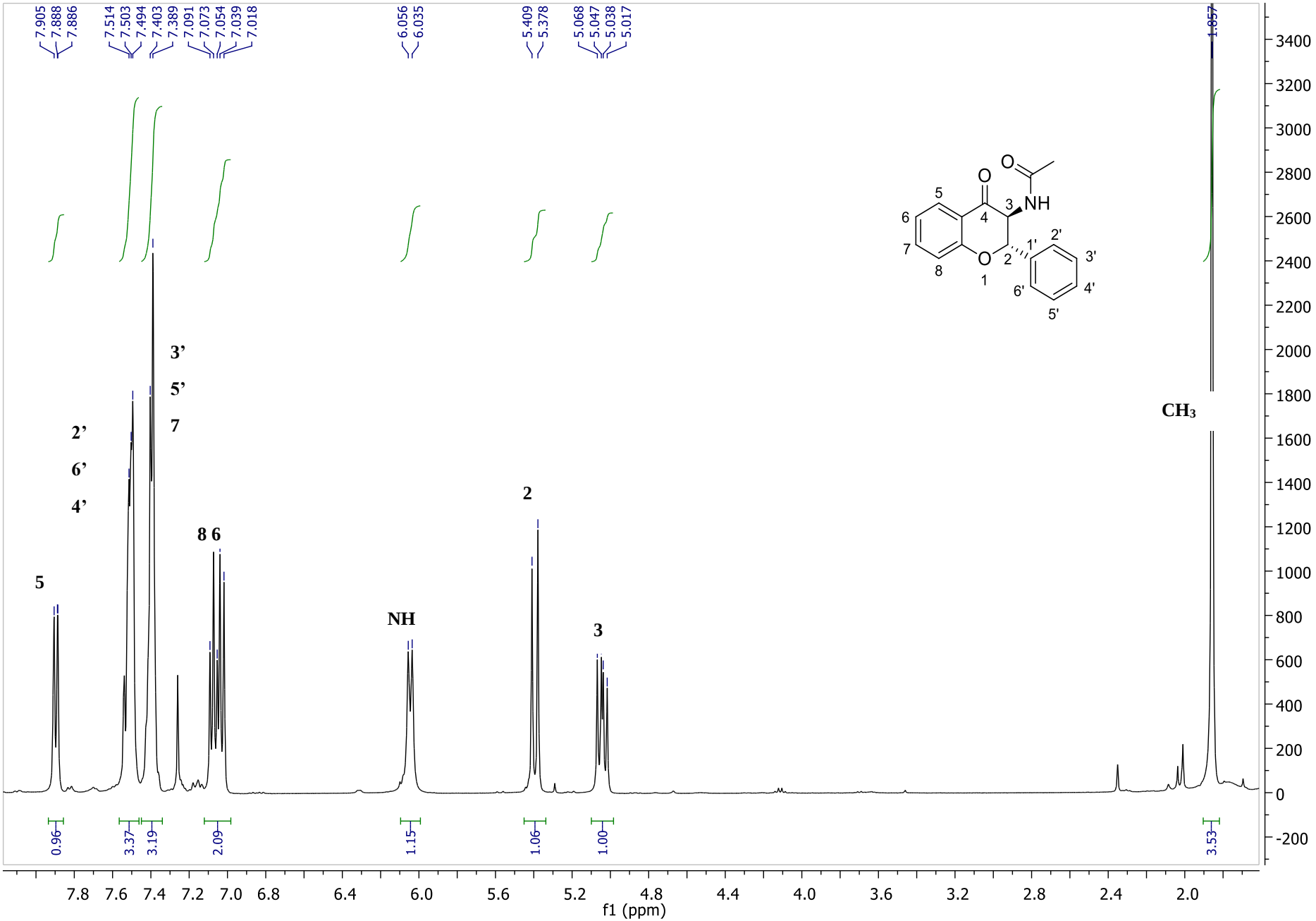


Figure S203. ^{1}H-NMR spectrum of *rac-trans*-**24a** in $CDCl_3$

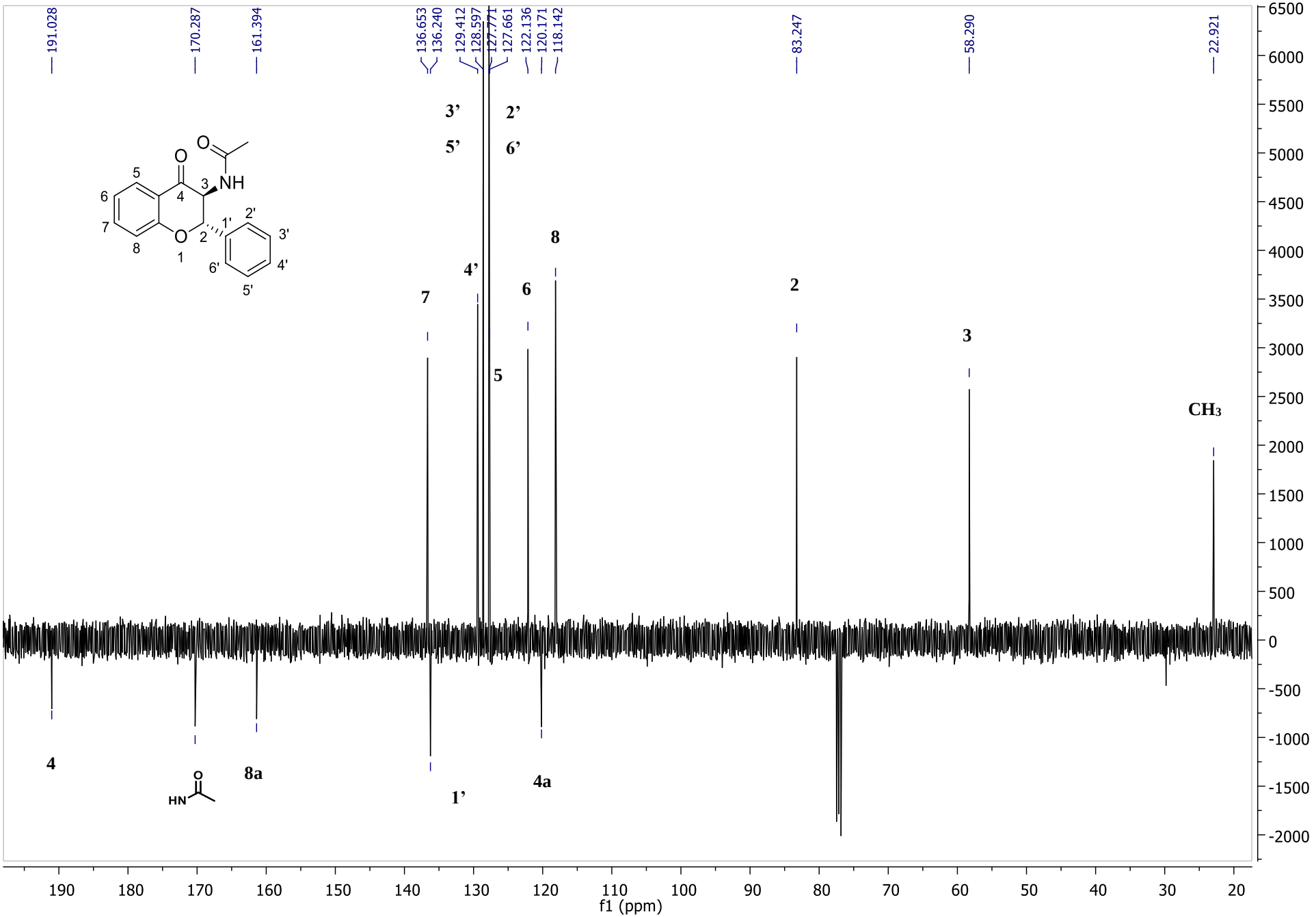


Figure S204. ^{13}C-NMR spectrum of *rac-trans*-**24a** in $CDCl_3$

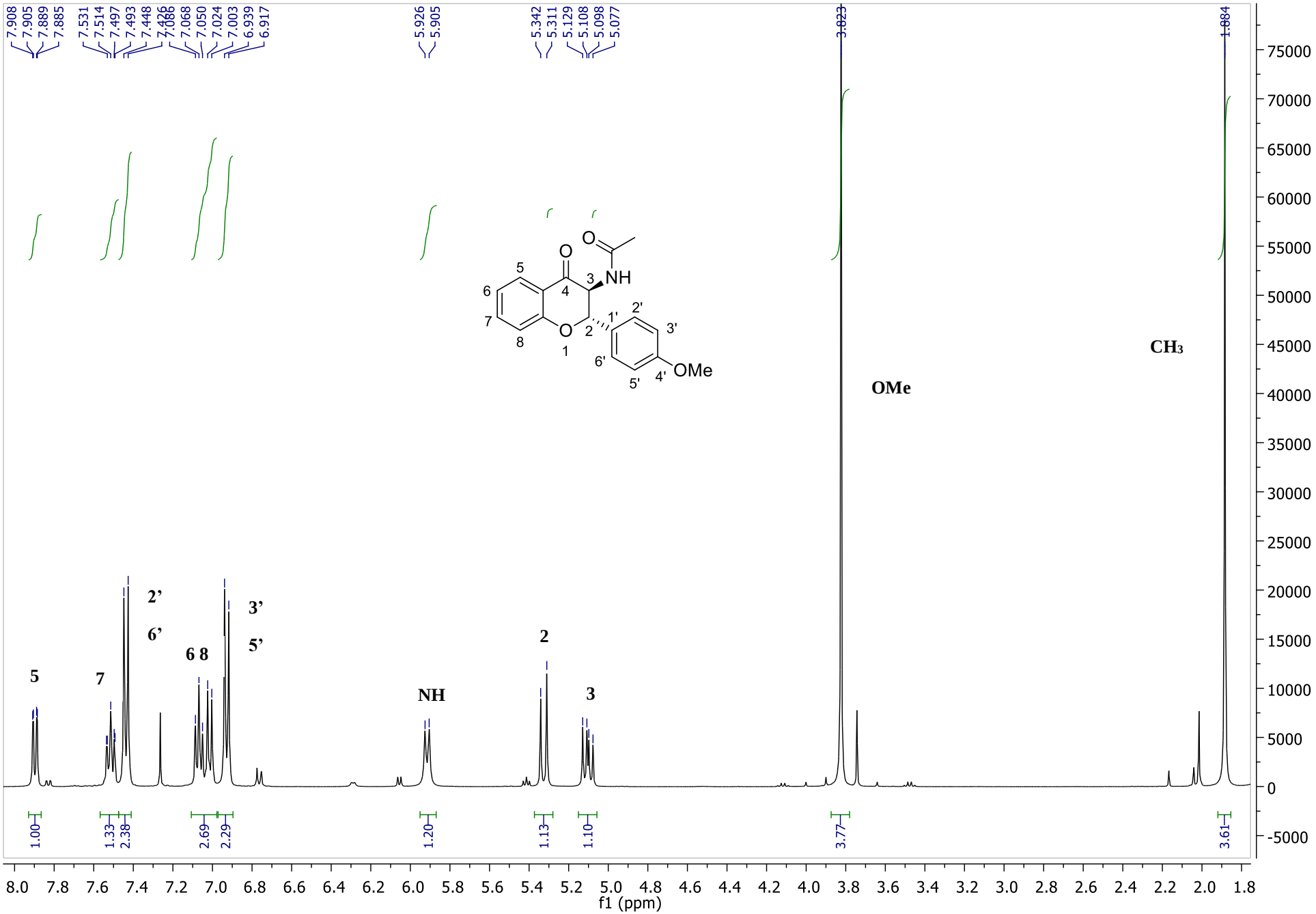


Figure S205. ^{1}H-NMR spectrum of *rac*-*trans*-**24b** in $CDCl_3$

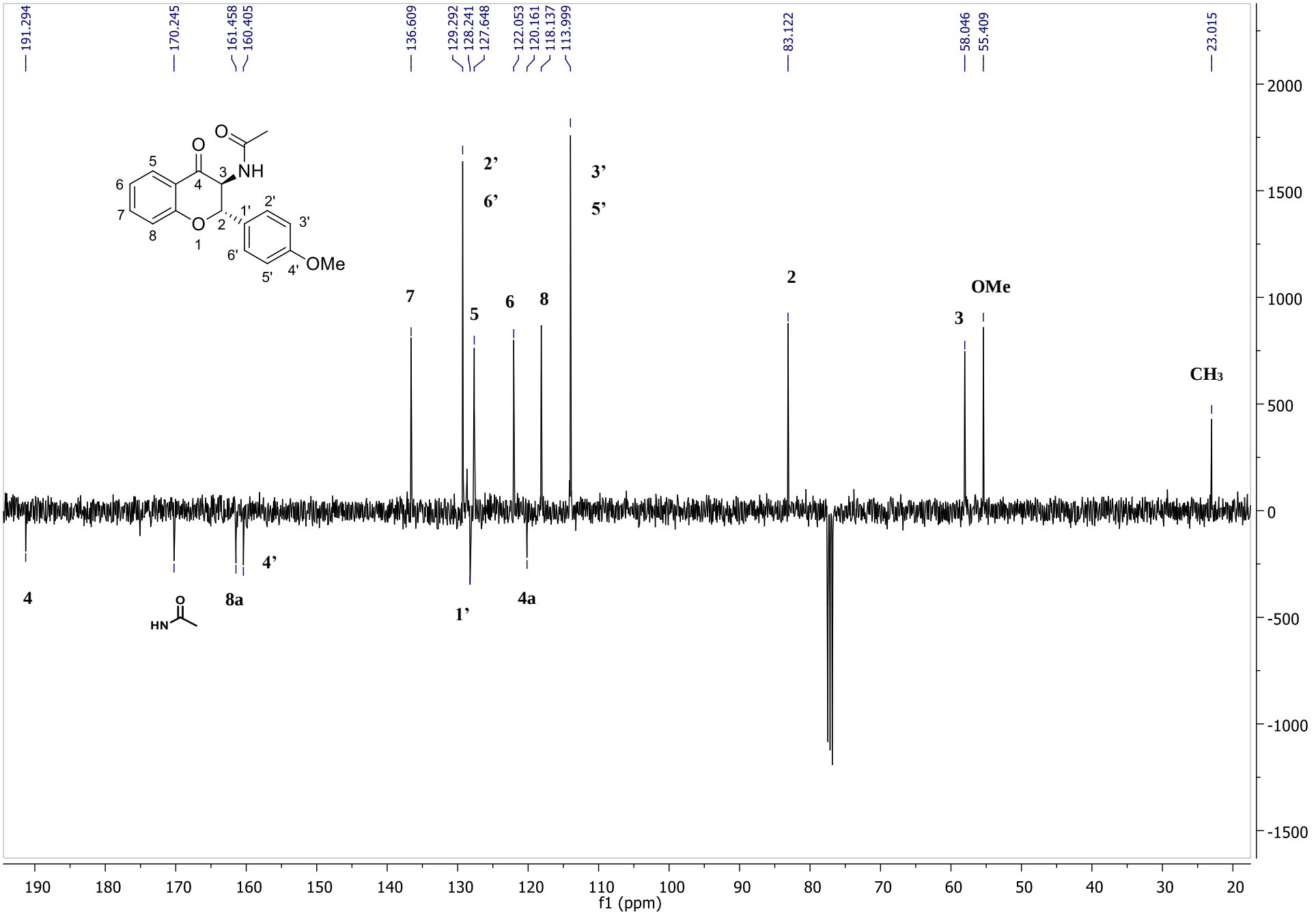


Figure S206. ^{13}C-NMR spectrum of *rac-trans*-**24b** in $CDCl_3$

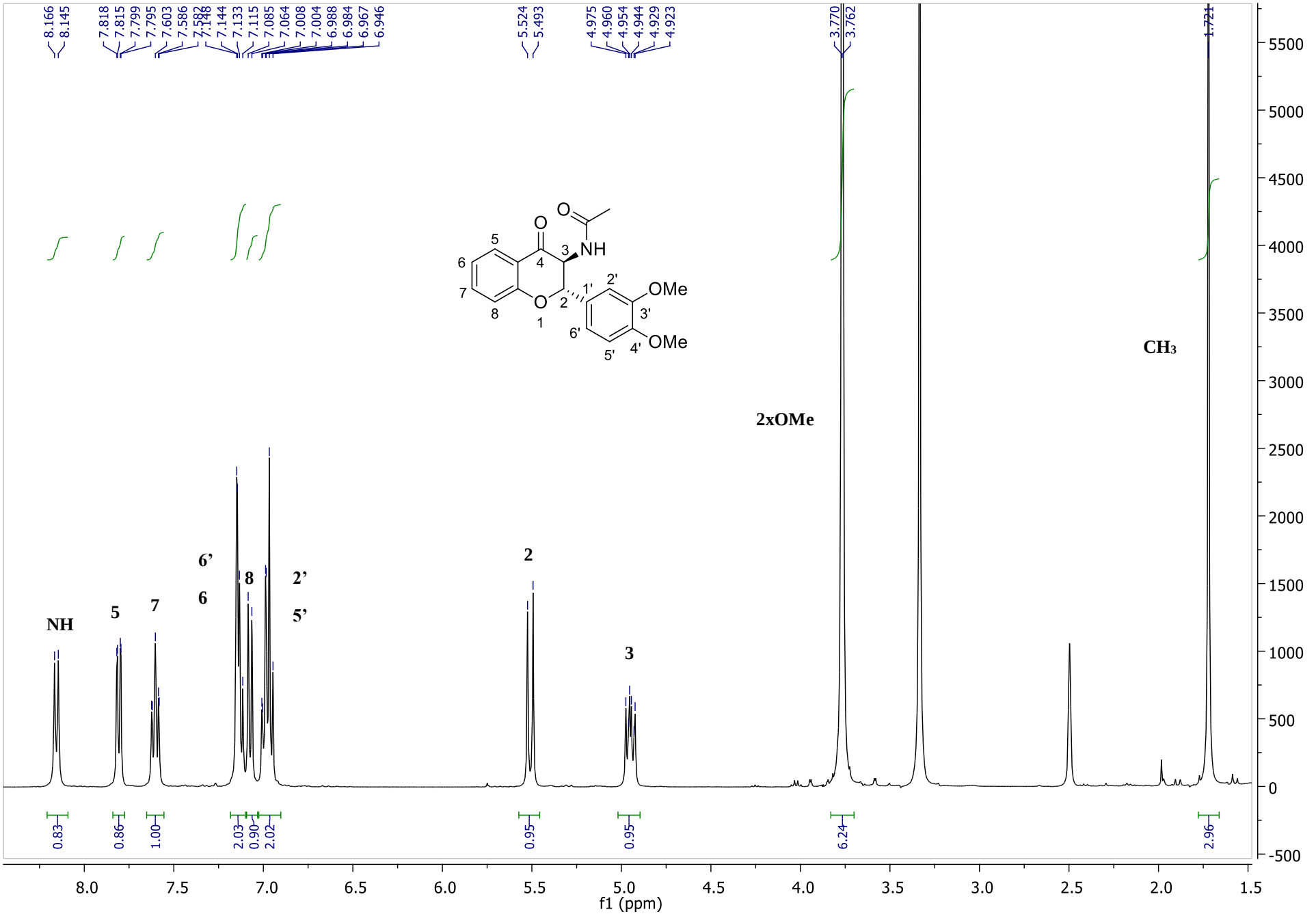


Figure S207. ^{1}H-NMR spectrum of *rac-trans*-**24c** in DMSO-d_6

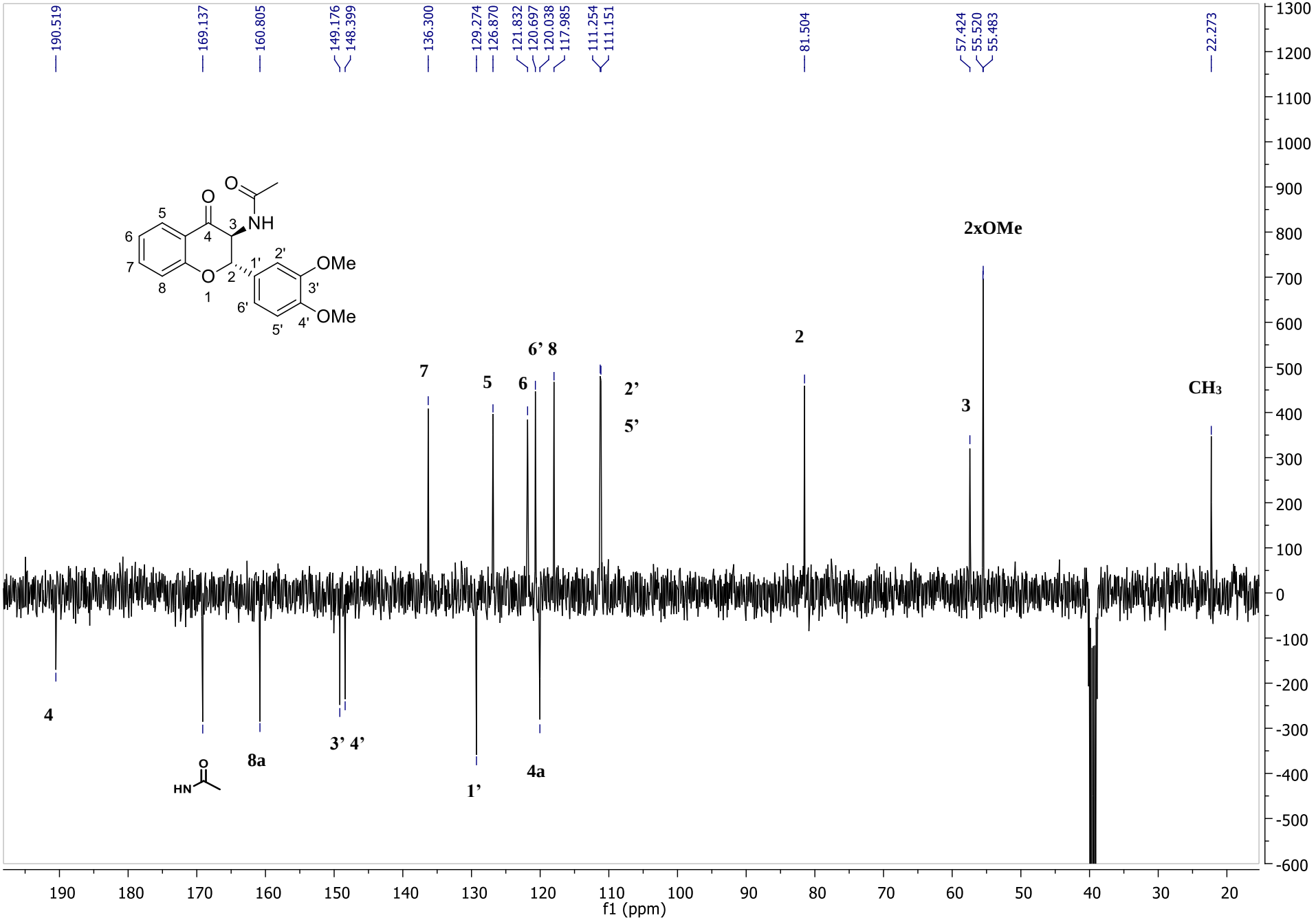


Figure S208. ^{13}C-NMR spectrum of *rac-trans*-**24c** in DMSO-d_6

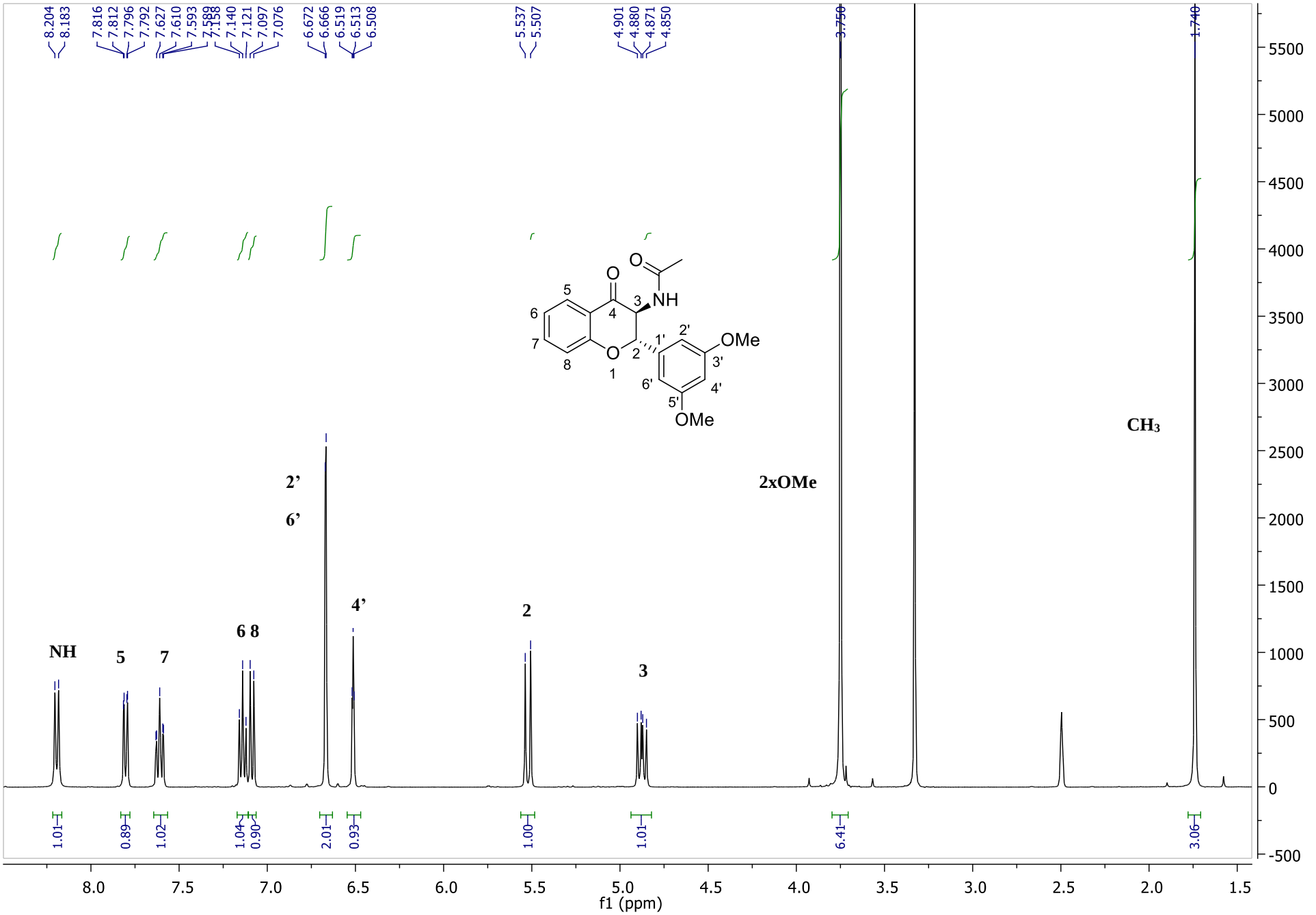


Figure S209. ^{1}H-NMR spectrum of *rac-trans*-**24d** in DMSO-d_6

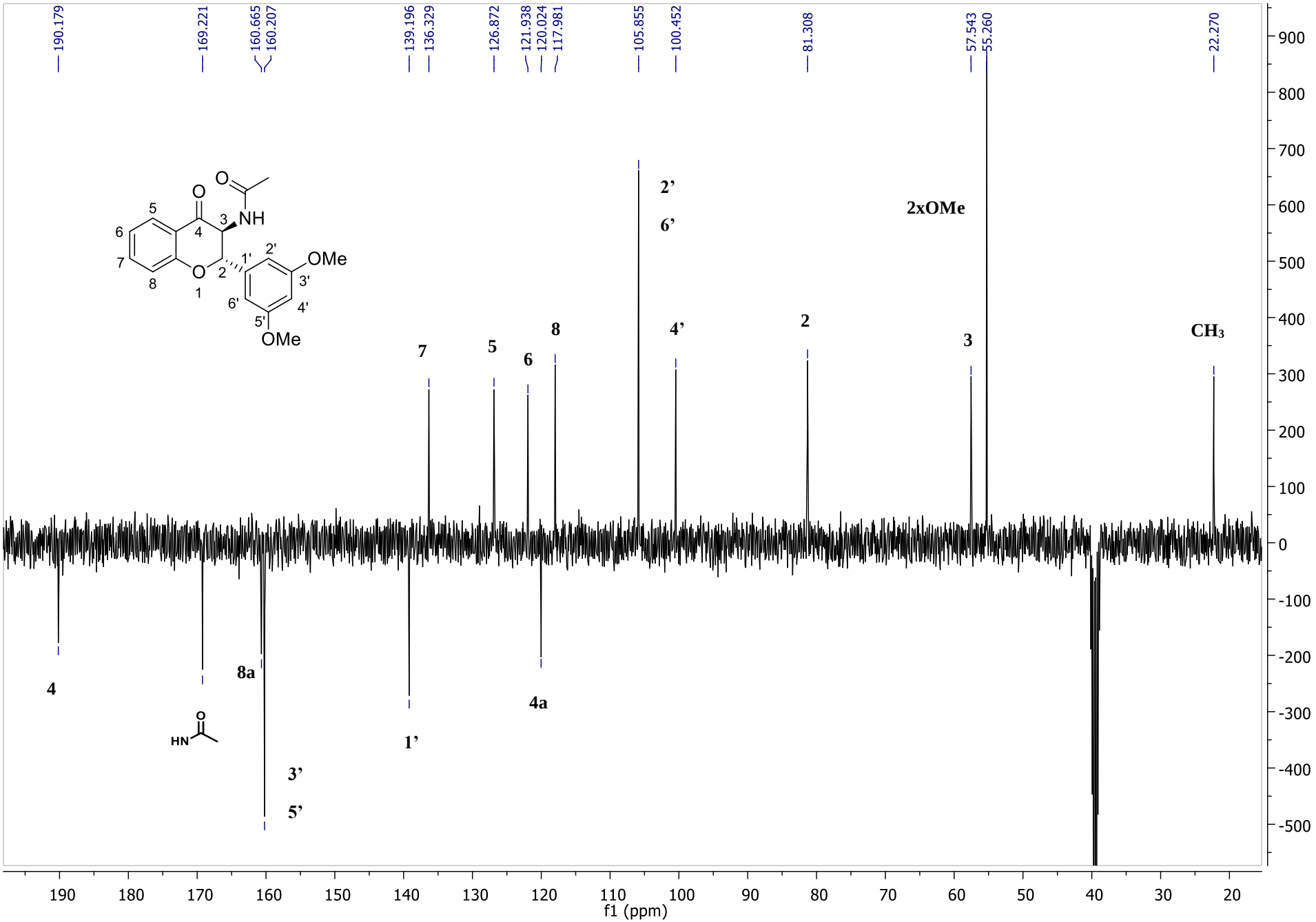


Figure S210. ^{13}C-NMR spectrum of *rac-trans*-**24d** in DMSO-d$_6$

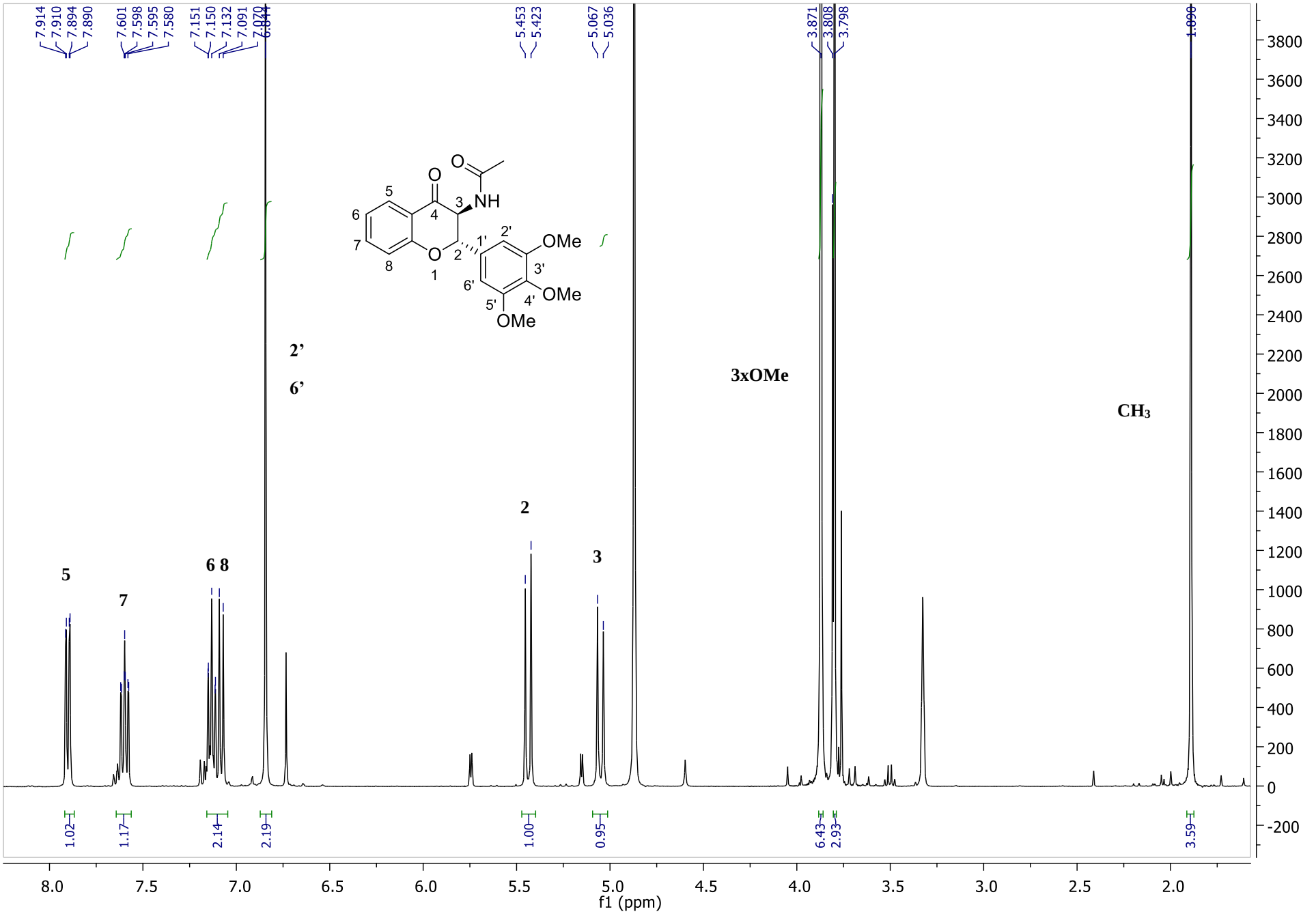


Figure S211. ^{1}H-NMR spectrum of *rac-trans*-**24e** in CD_3OD

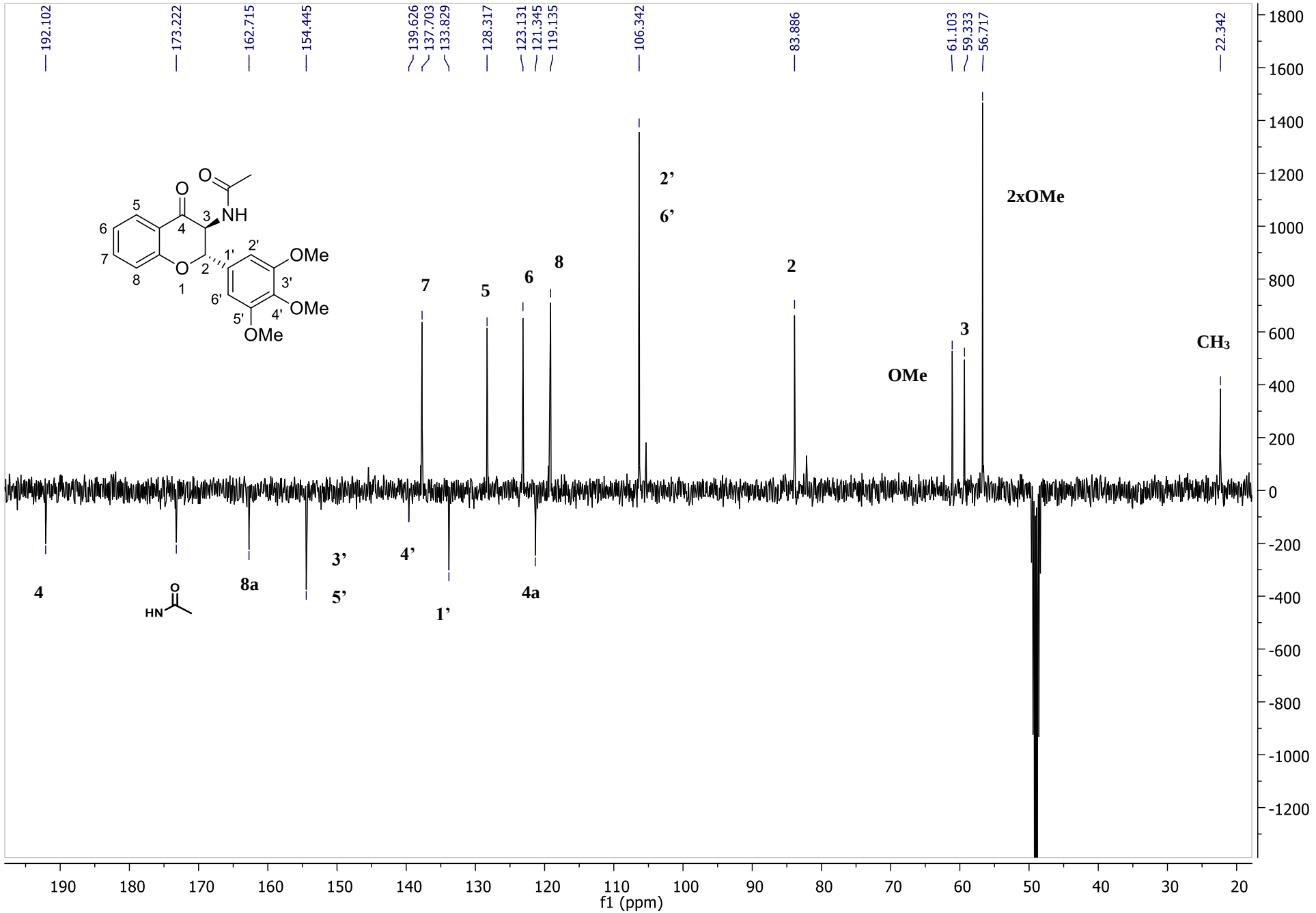


Figure S212. ^{13}C-NMR spectrum of *rac-trans*-**24e** in CD_3OD

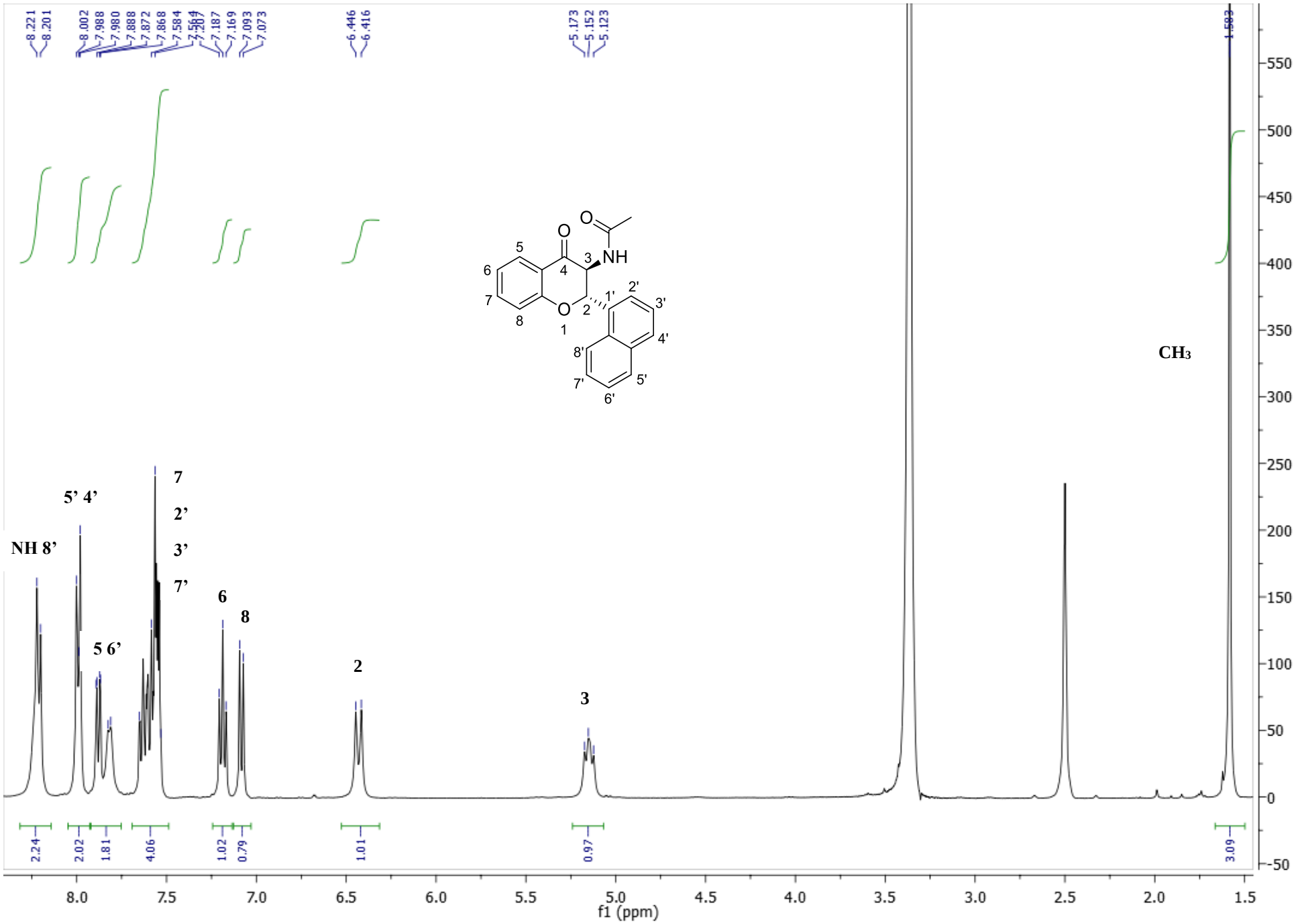


Figure S213. ^{1}H-NMR spectrum of *rac-trans*-**24f** in DMSO-d_6

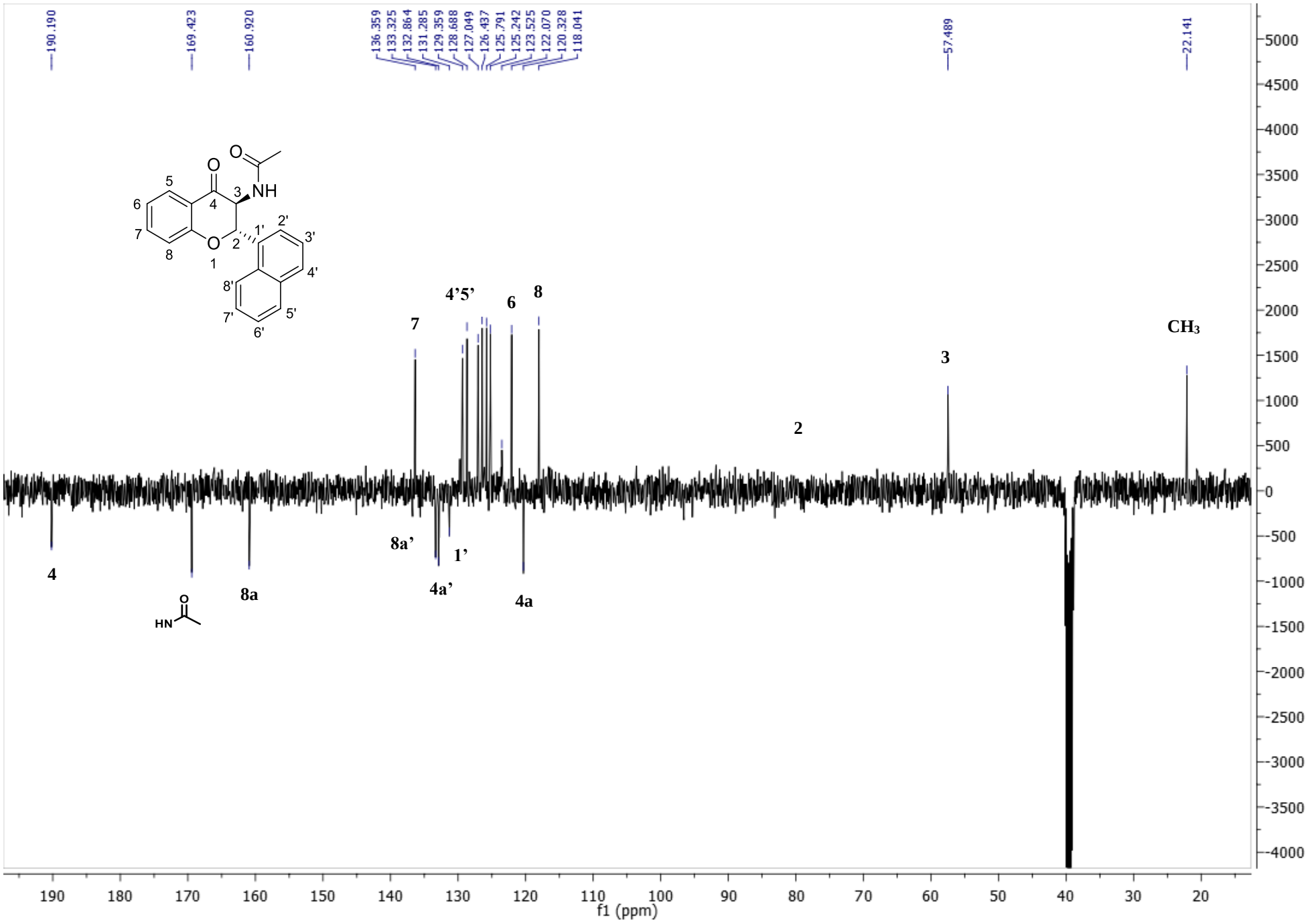


Figure S214. ^{13}C-NMR spectrum of *rac-trans*-**24f** in DMSO-d_6

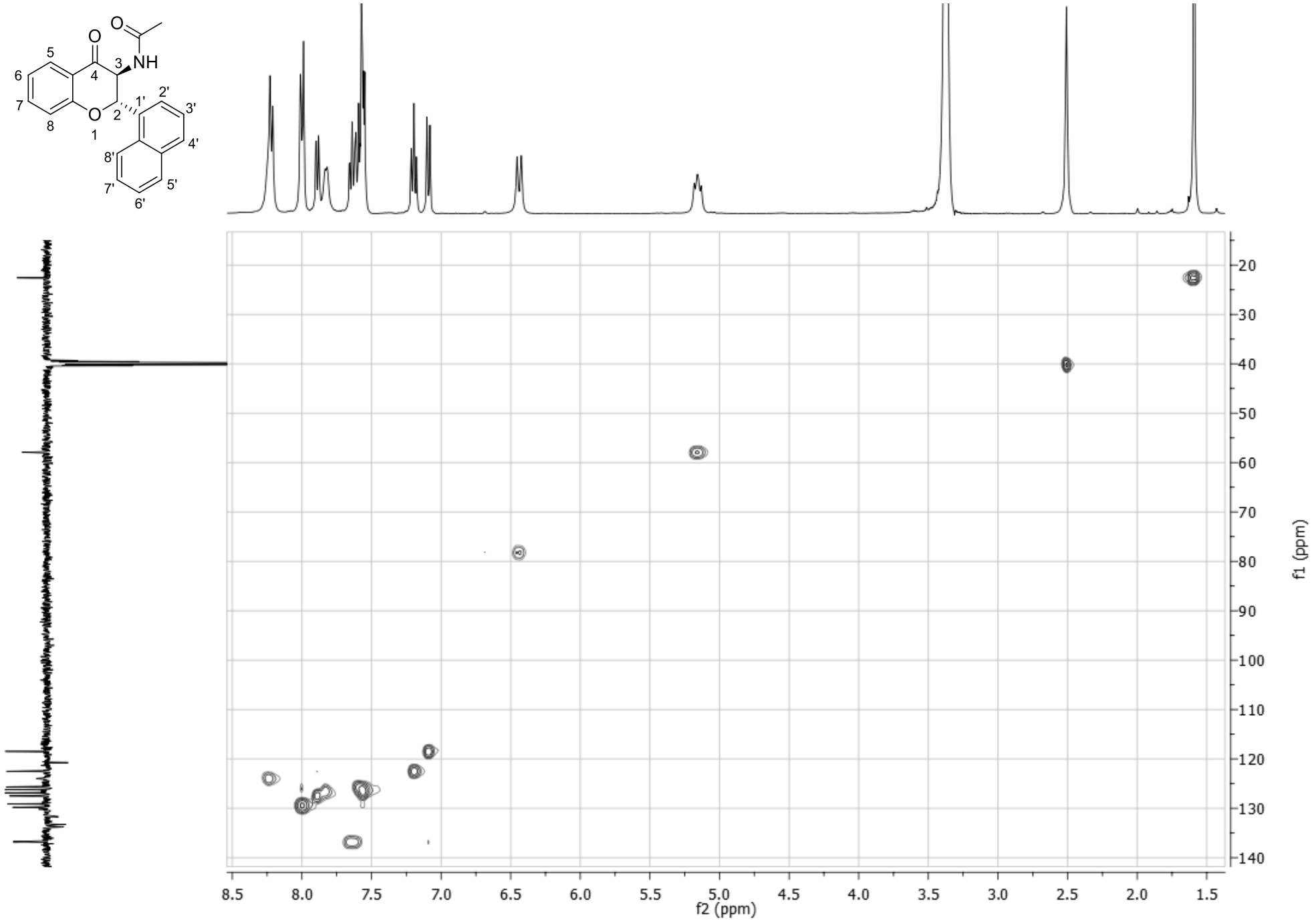


Figure S215. HSQC spectrum of *rac-trans*-**24f** in DMSO-d_6

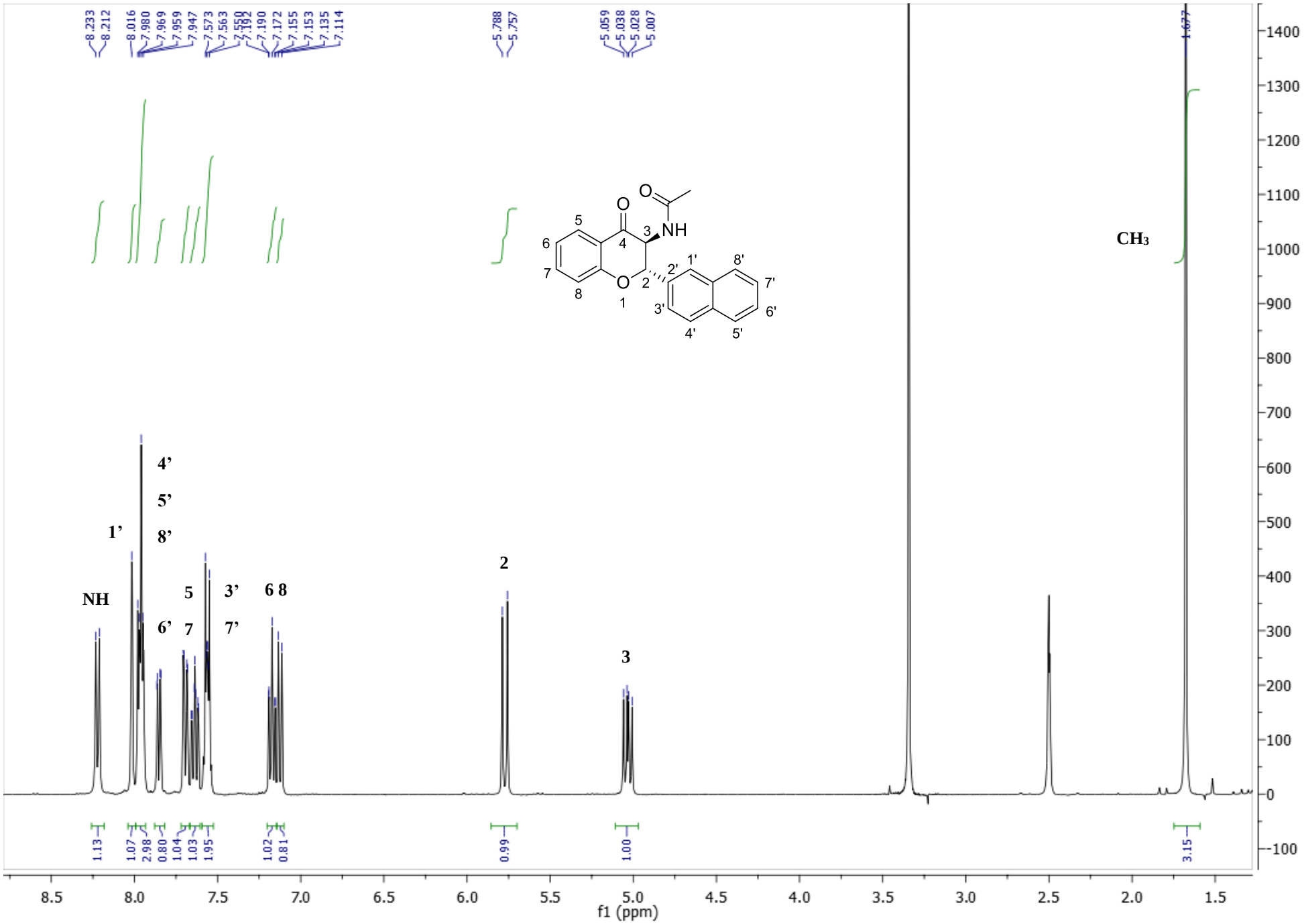


Figure S216. ^{1}H-NMR spectrum of *rac-trans*-**24g** in DMSO-d_6

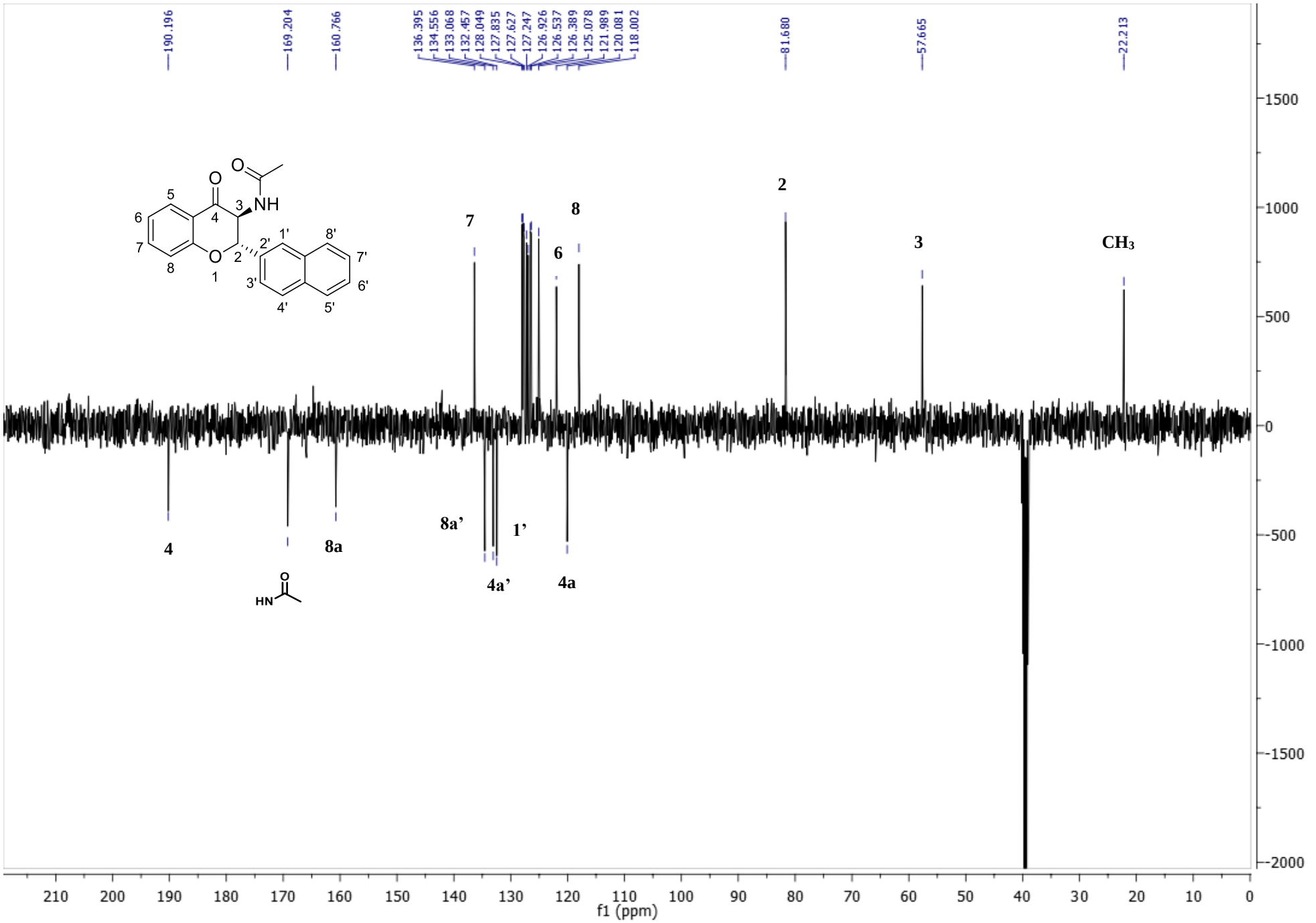


Figure S217. ^{13}C-NMR spectrum of *rac-trans*-**24g** in DMSO-d_6

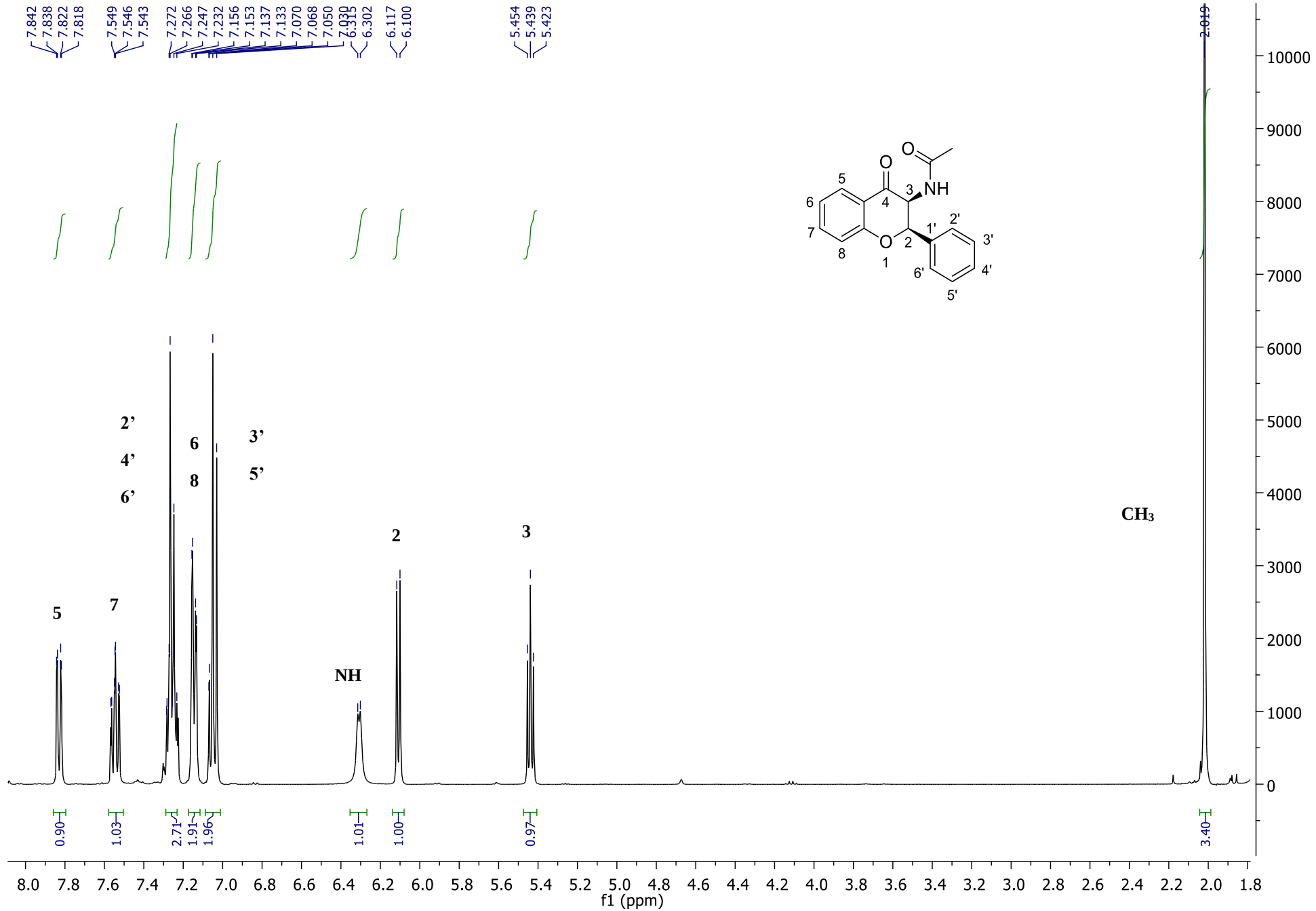


Figure S218. ^{1}H-NMR spectrum of *rac-cis*-**24a** in $CDCl_3$

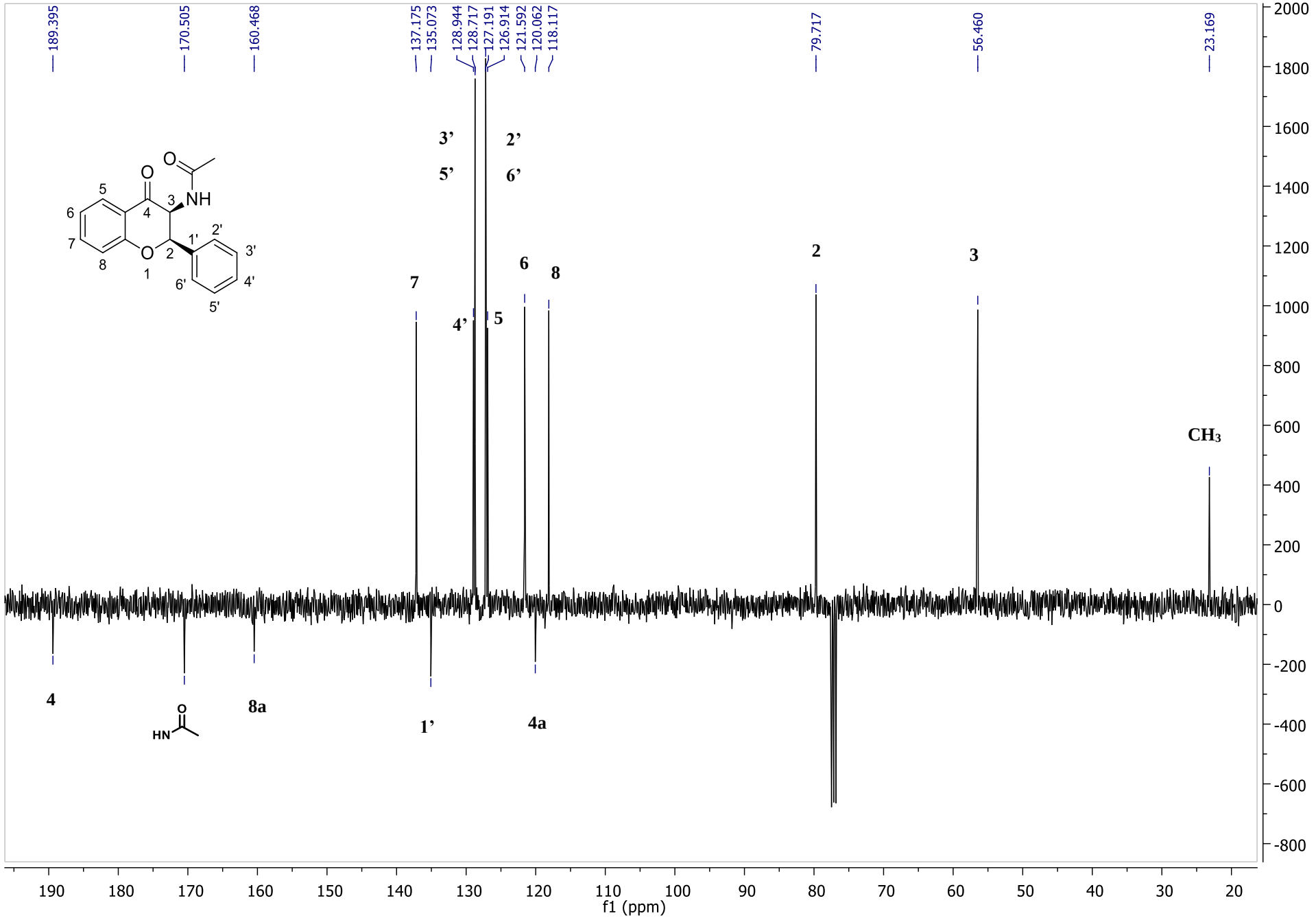


Figure S219. ^{13}C-NMR spectrum of *rac-cis*-**24a** in $CDCl_3$

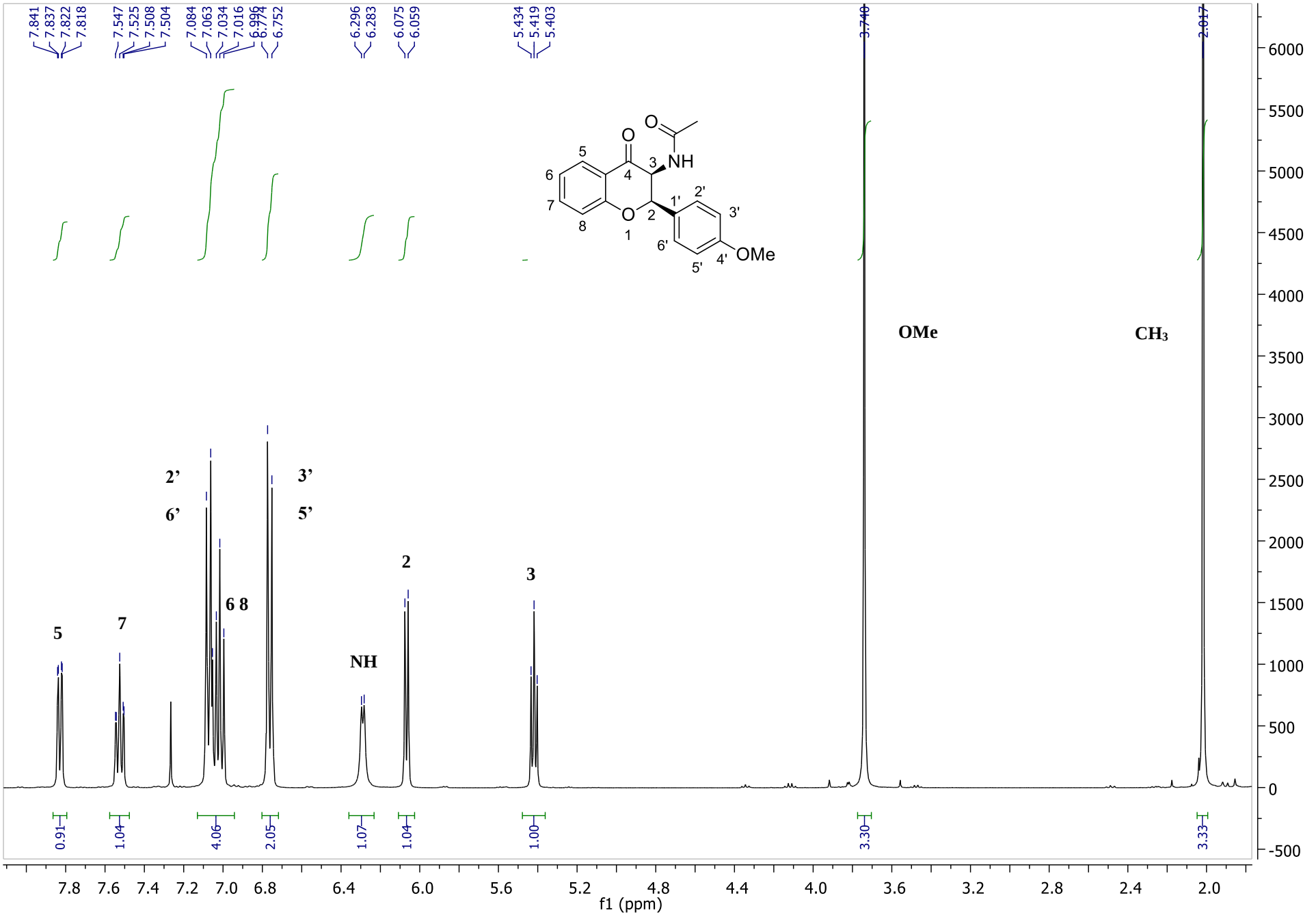


Figure S220. ^{1}H-NMR spectrum of *rac-cis*-**24b** in $CDCl_3$

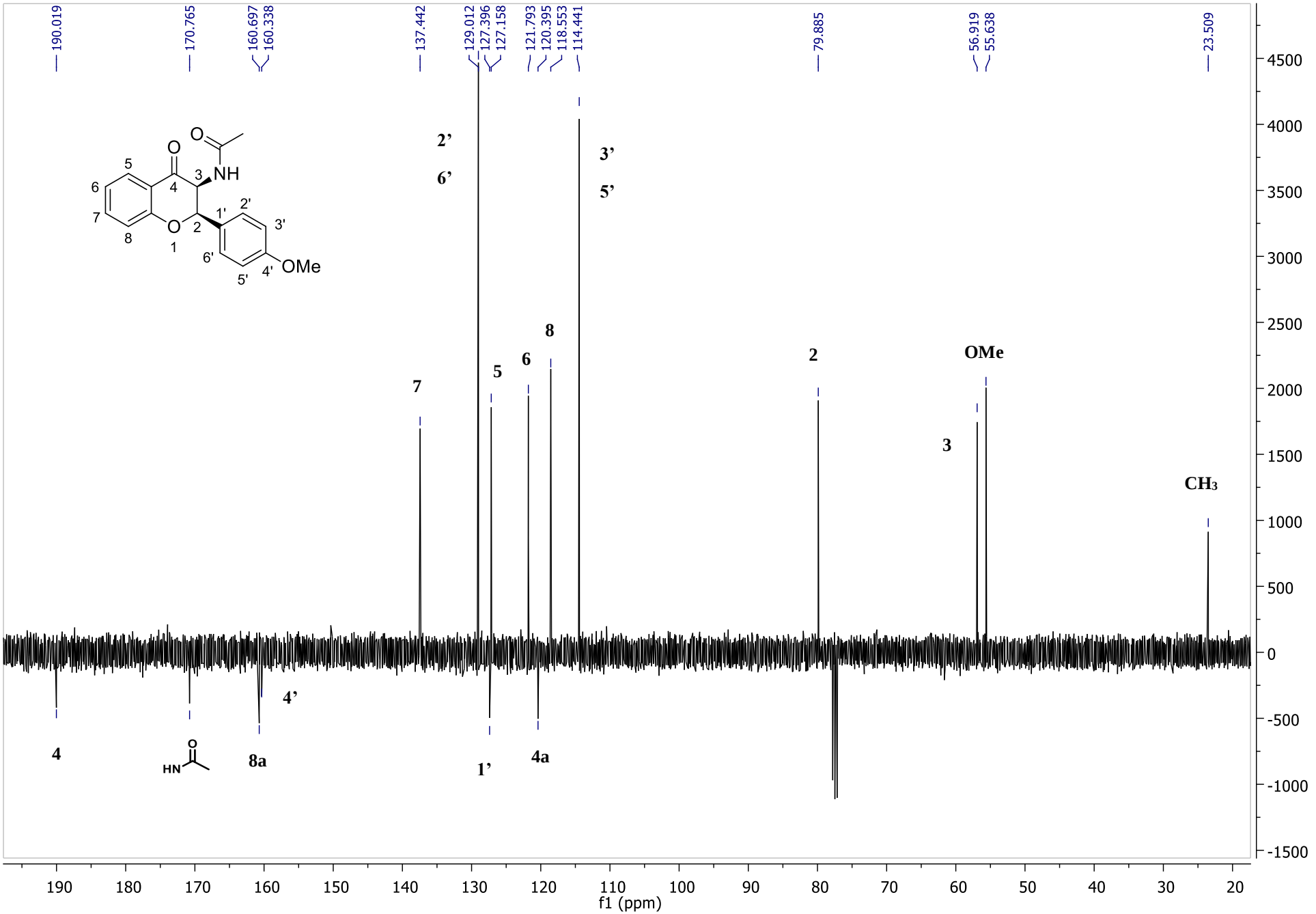


Figure S221. ^{13}C-NMR spectrum of *rac-cis*-**24b** in $CDCl_3$

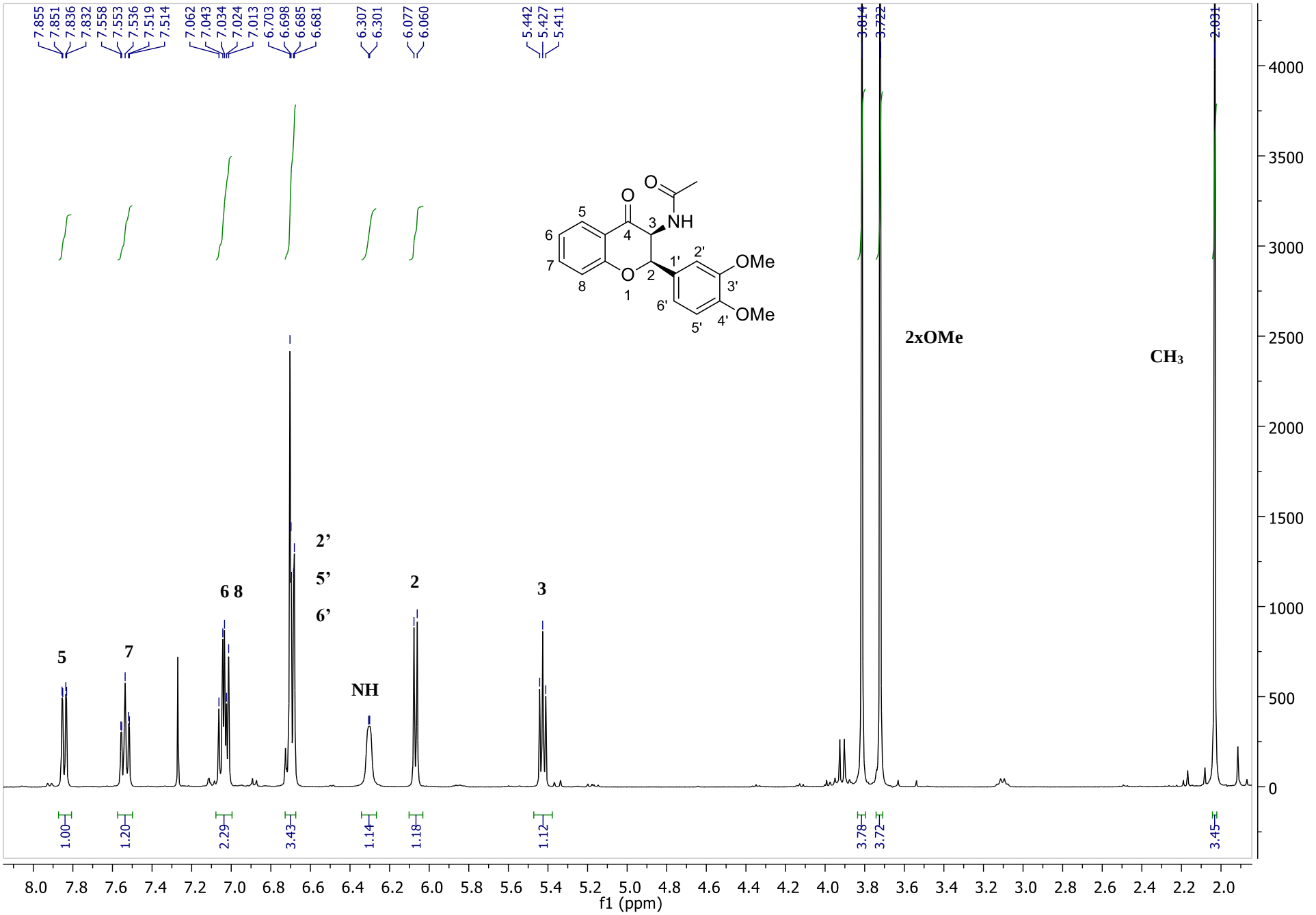


Figure S222. ^{1}H-NMR spectrum of *rac-cis*-**24c** in $CDCl_3$

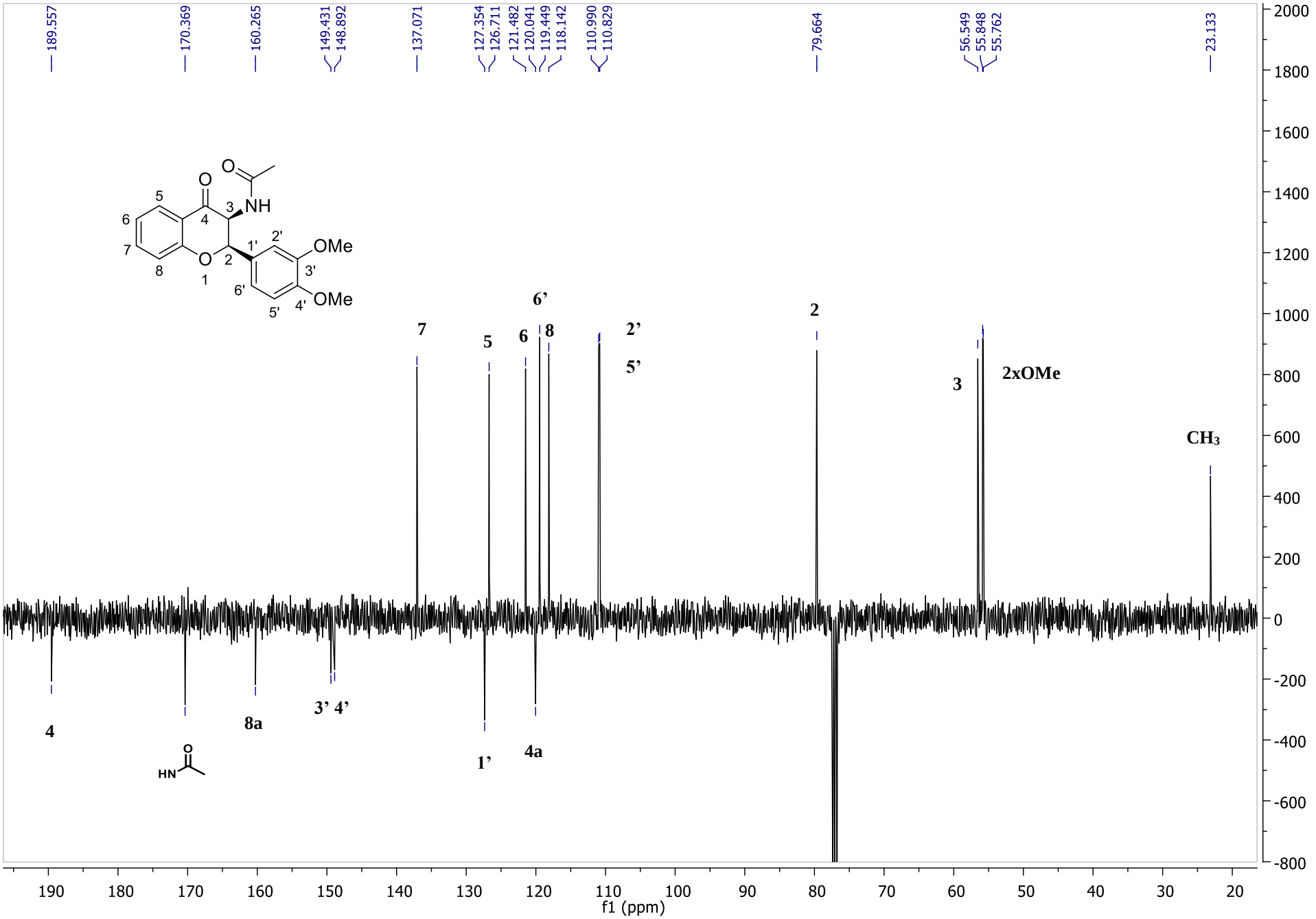


Figure S223. ^{13}C-NMR spectrum of *rac-cis*-**24c** in $CDCl_3$

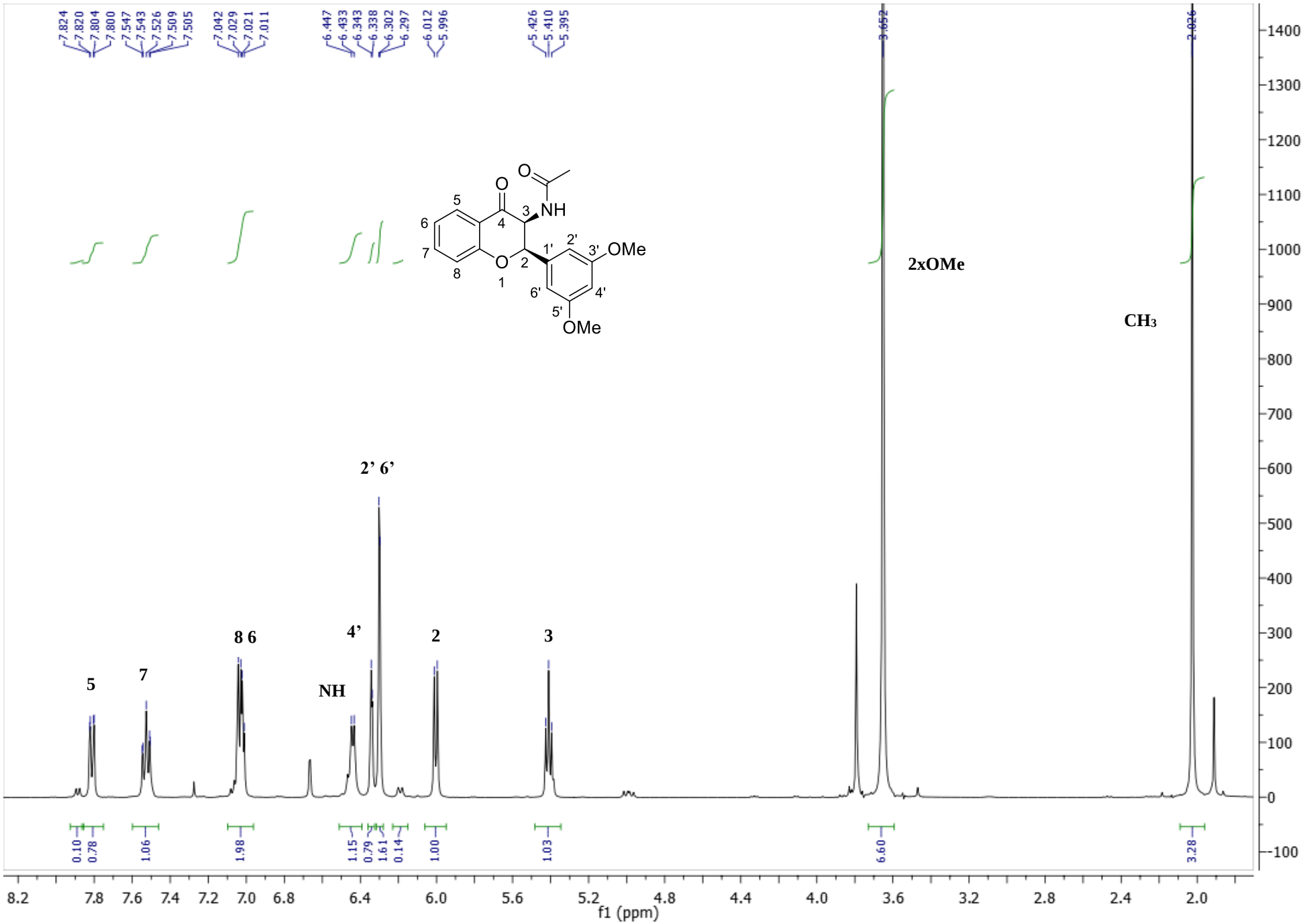


Figure S224. ^{1}H-NMR spectrum of *rac*-*cis*-**24d** in $CDCl_3$

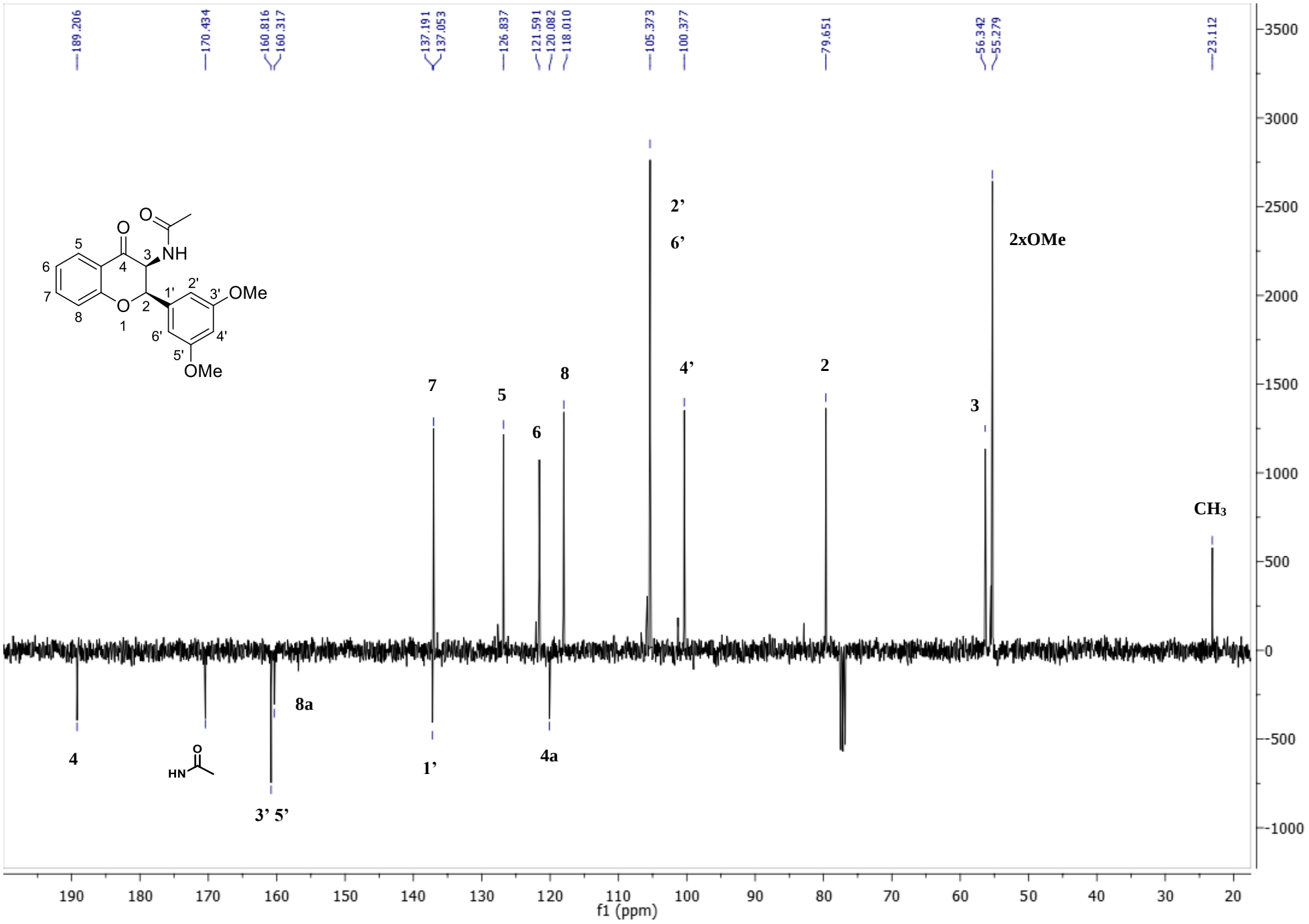


Figure S225. ^{13}C-NMR spectrum of *rac-cis*-**24d** in $CDCl_3$

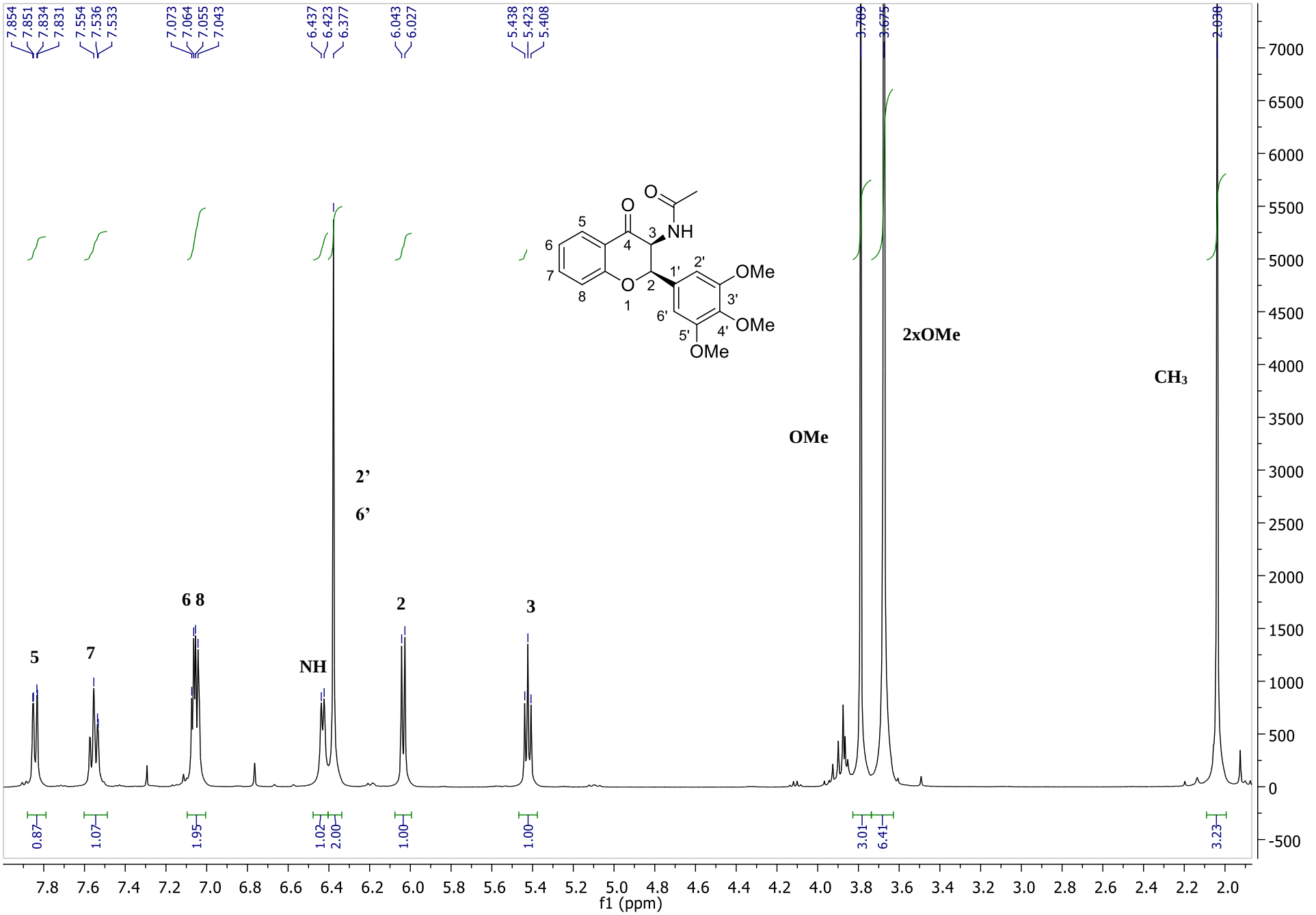


Figure S226. ^{1}H-NMR spectrum of *rac-cis*-**24e** in $CDCl_3$

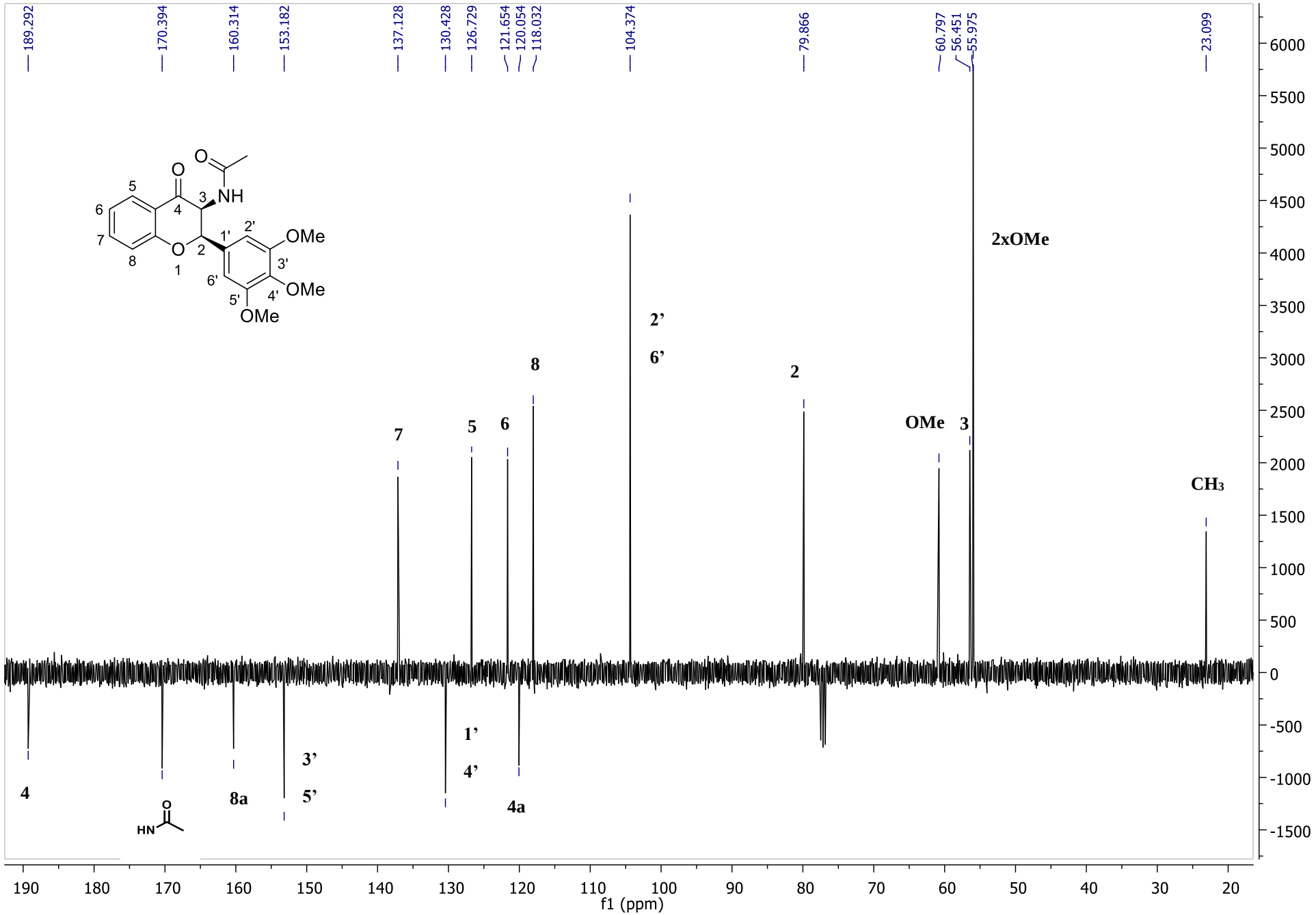


Figure S227. ^{13}C-NMR spectrum of *rac-cis*-**24e** in $CDCl_3$

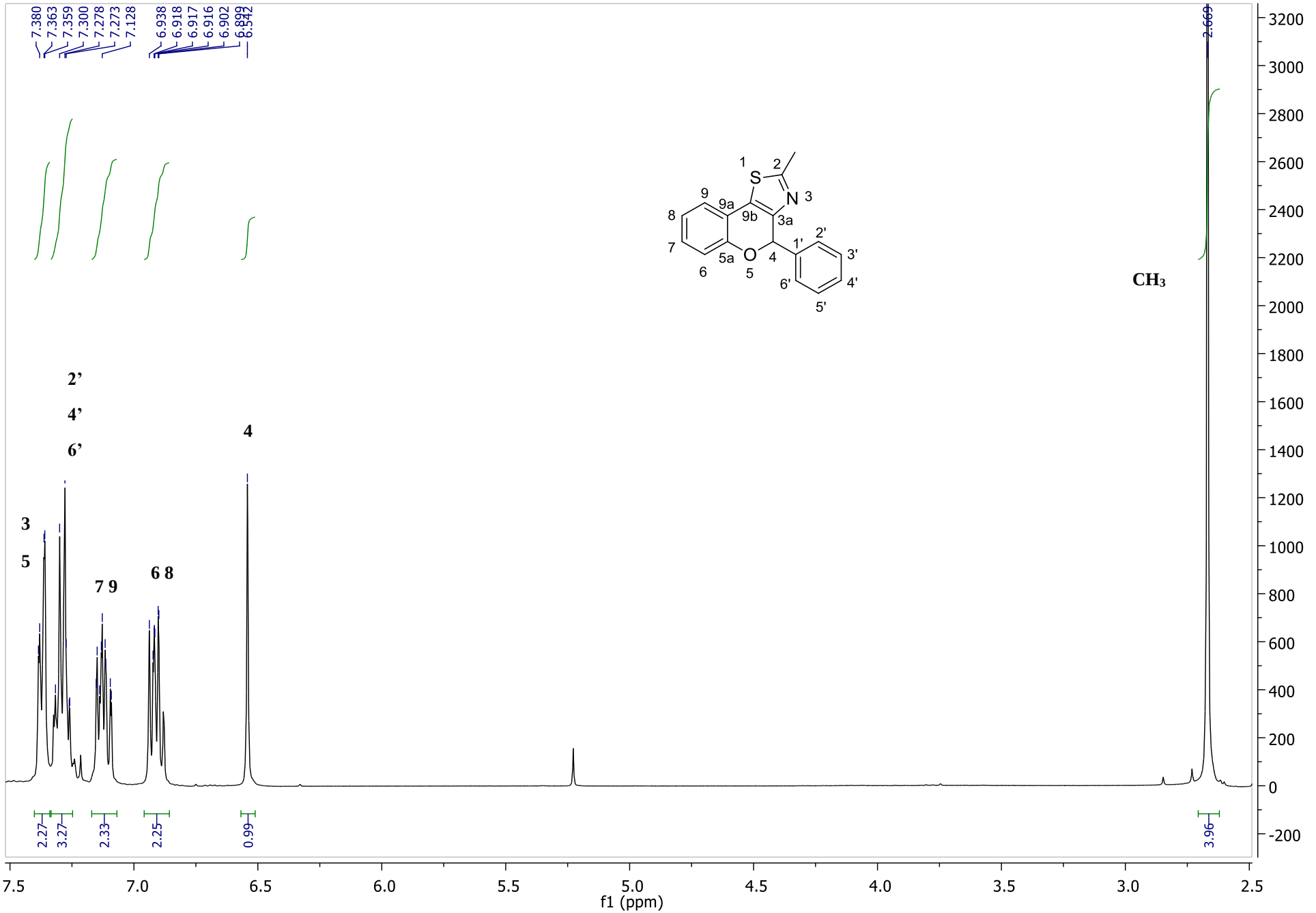


Figure S228. ^{1}H-NMR spectrum of *rac*-**3a** in $CDCl_3$

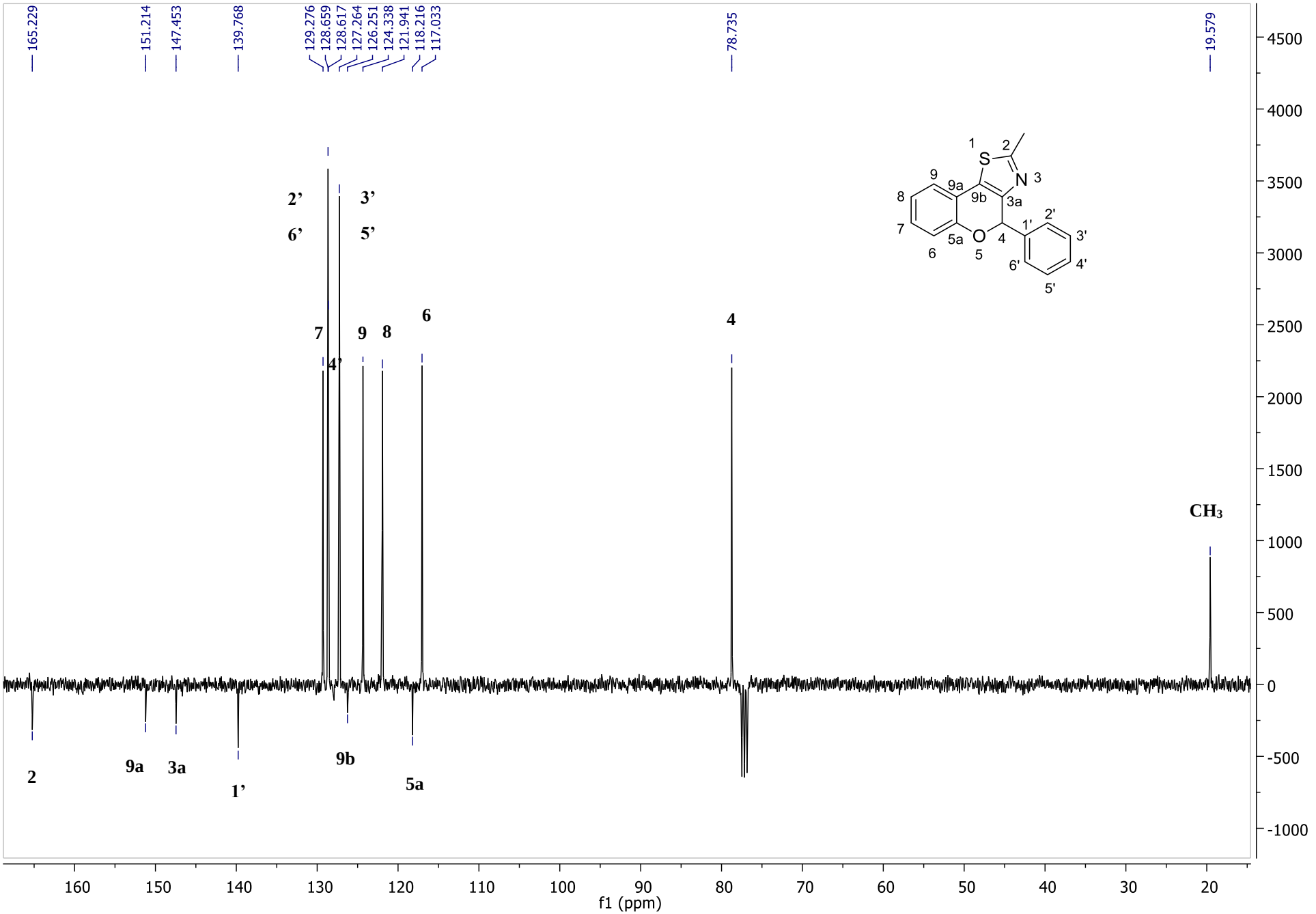


Figure S229. ^{13}C-NMR spectrum of *rac*-**3a** in $CDCl_3$

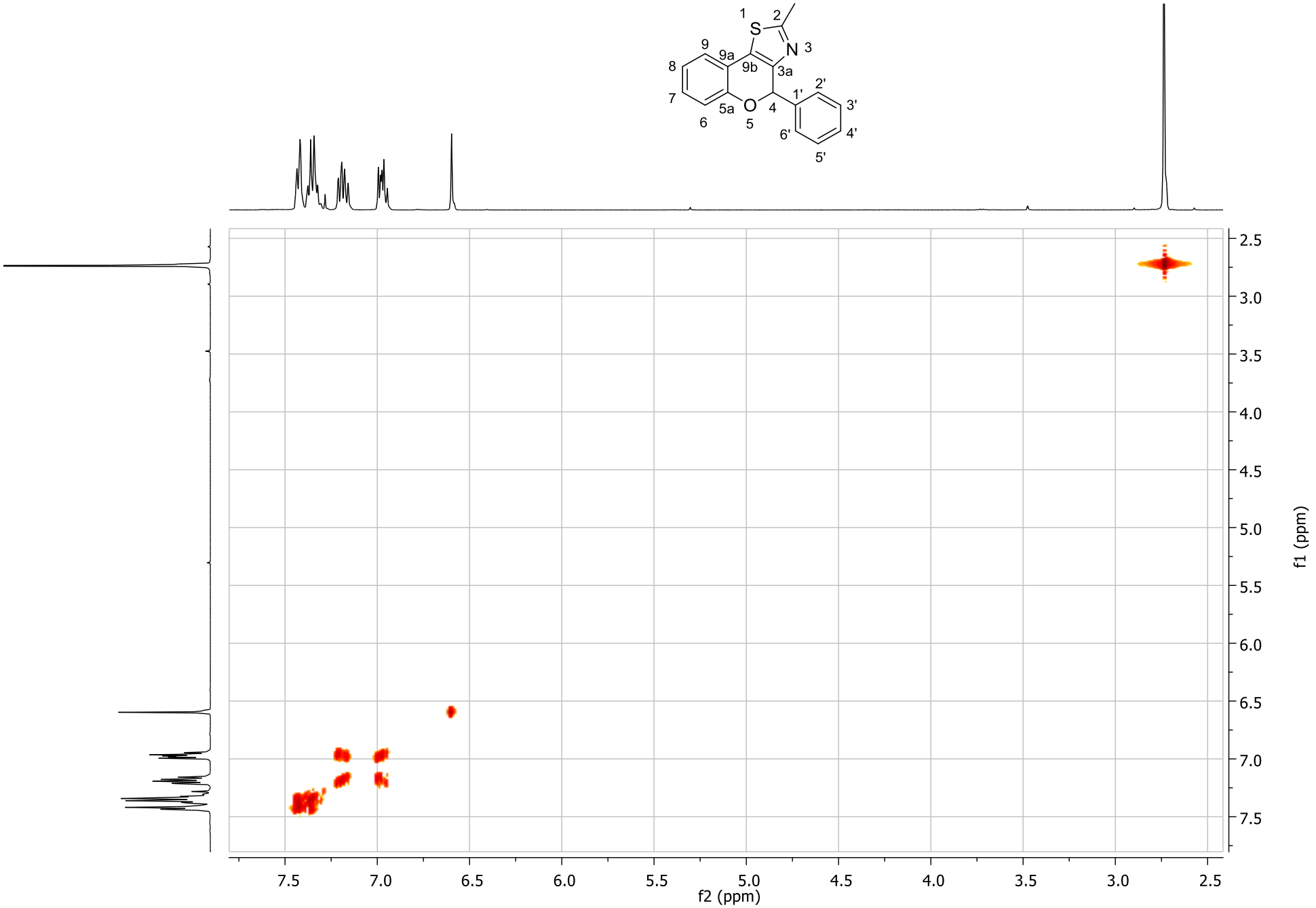


Figure S230. COSY spectrum of *rac*-**3a** in $CDCl_3$

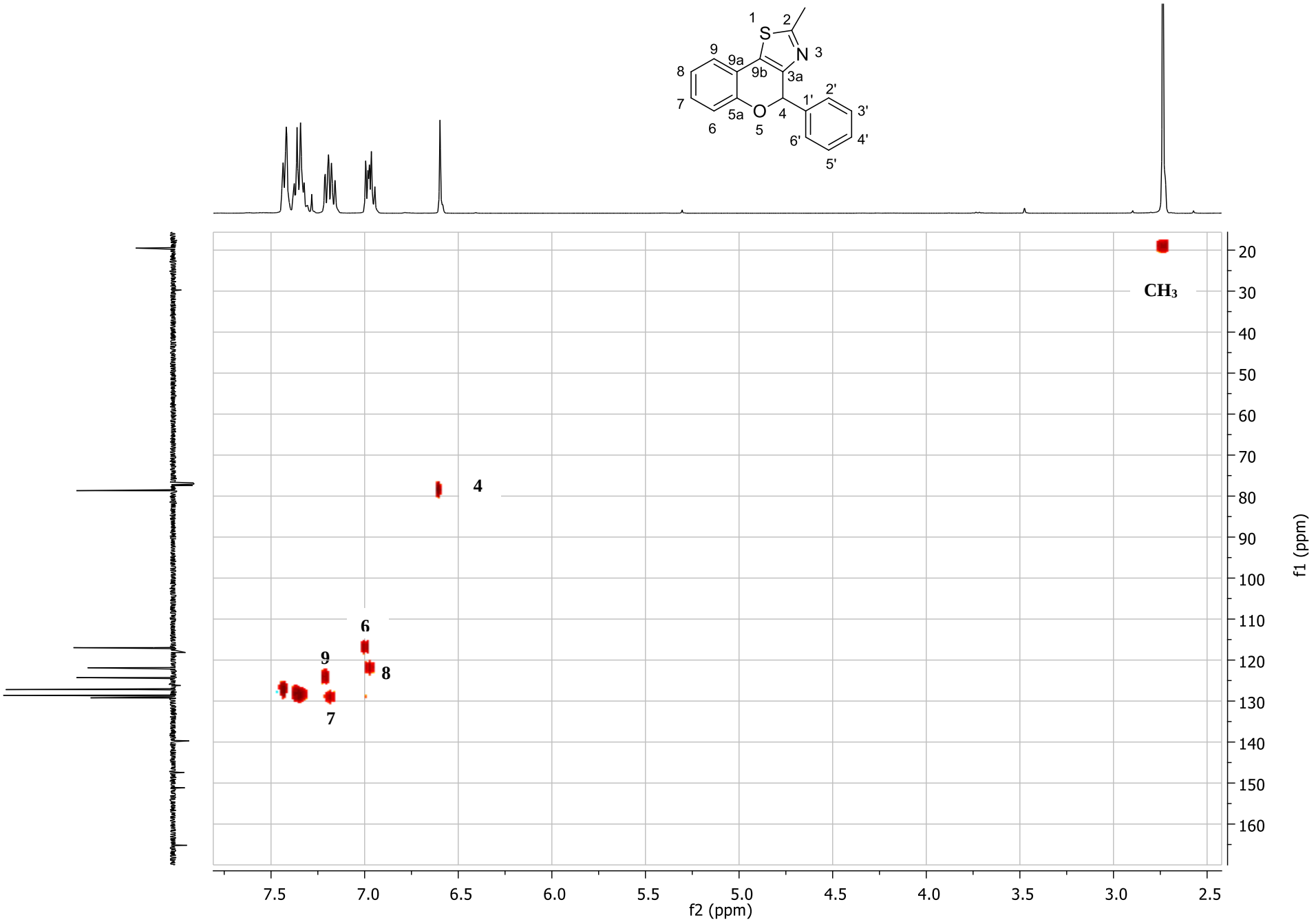


Figure S231. HSQC spectrum of *rac*-**3a** in $CDCl_3$

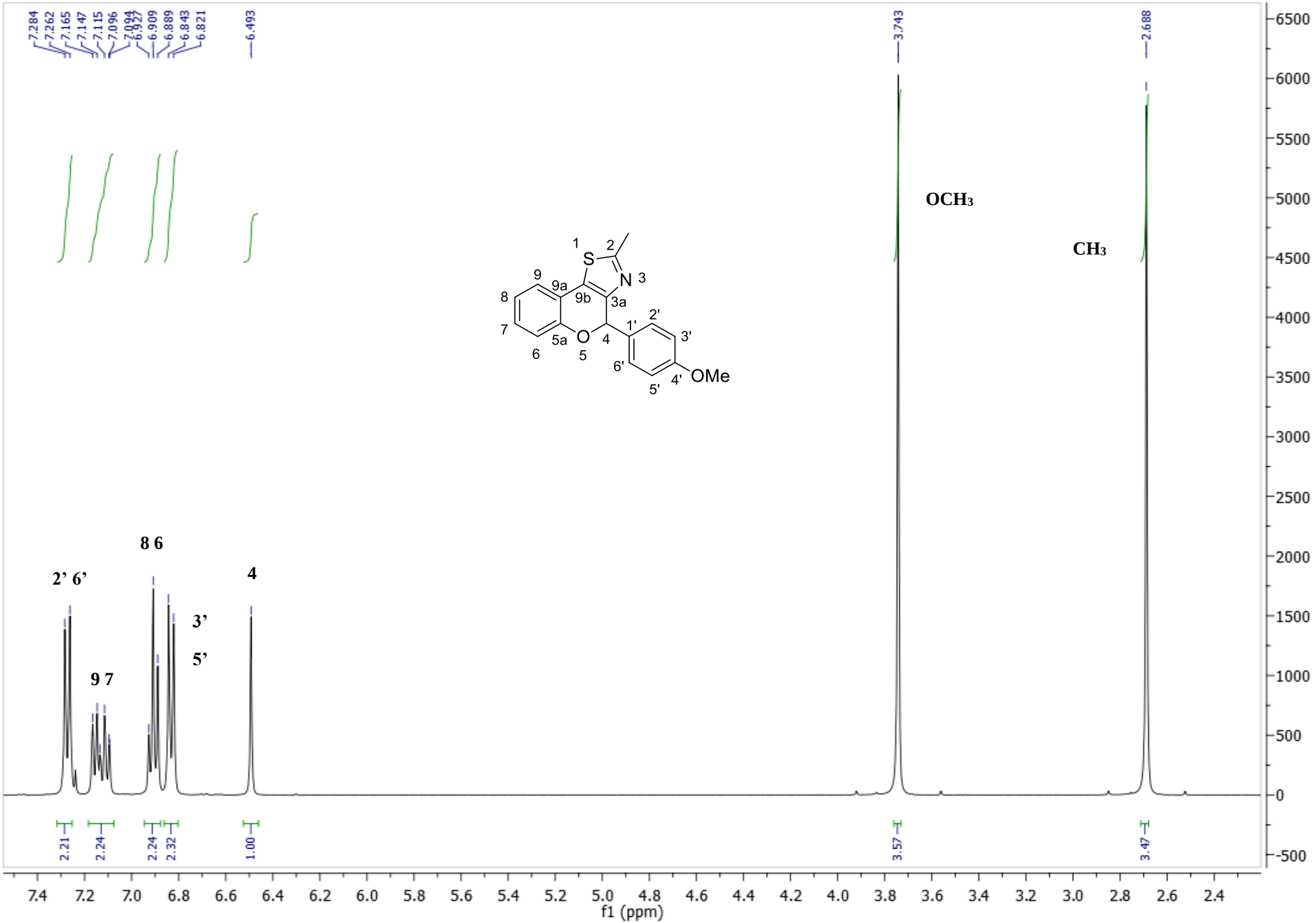


Figure S232. ^{1}H-NMR spectrum of *rac*-**3b** in $CDCl_3$

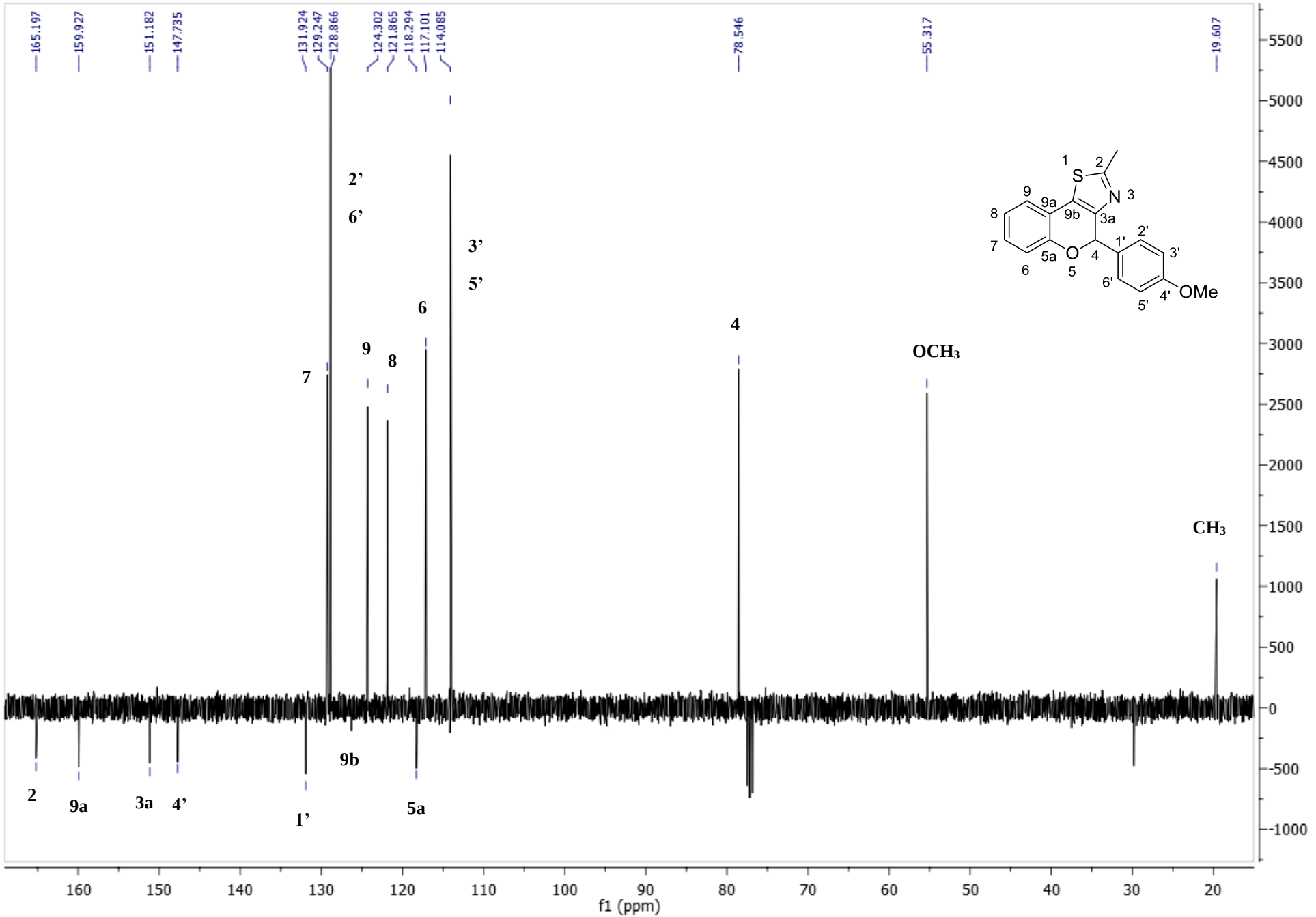


Figure S233. ^{13}C-NMR spectrum of *rac*-**3b** in $CDCl_3$

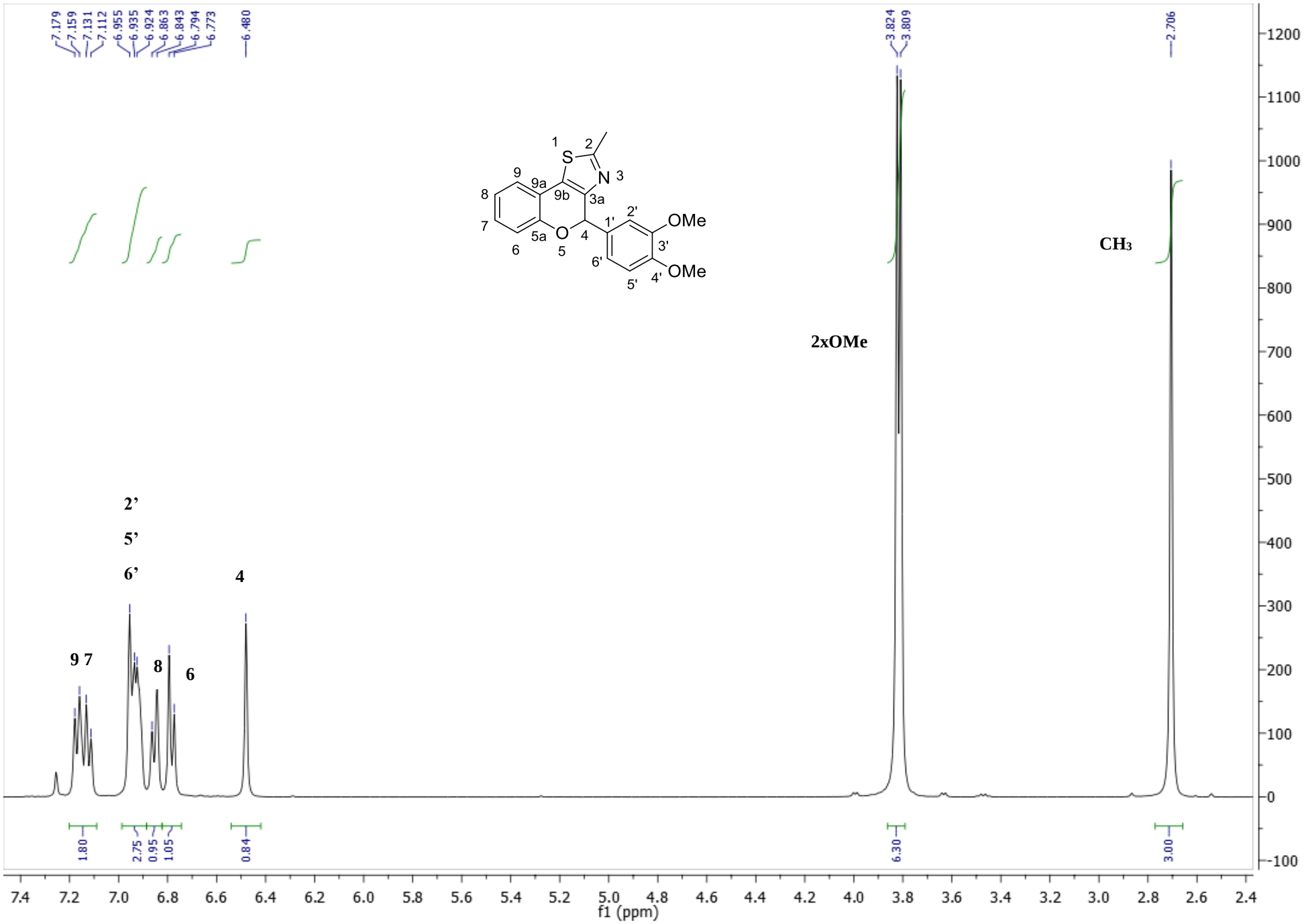


Figure S234. ^{1}H-NMR spectrum of *rac*-**3c** in $CDCl_3$

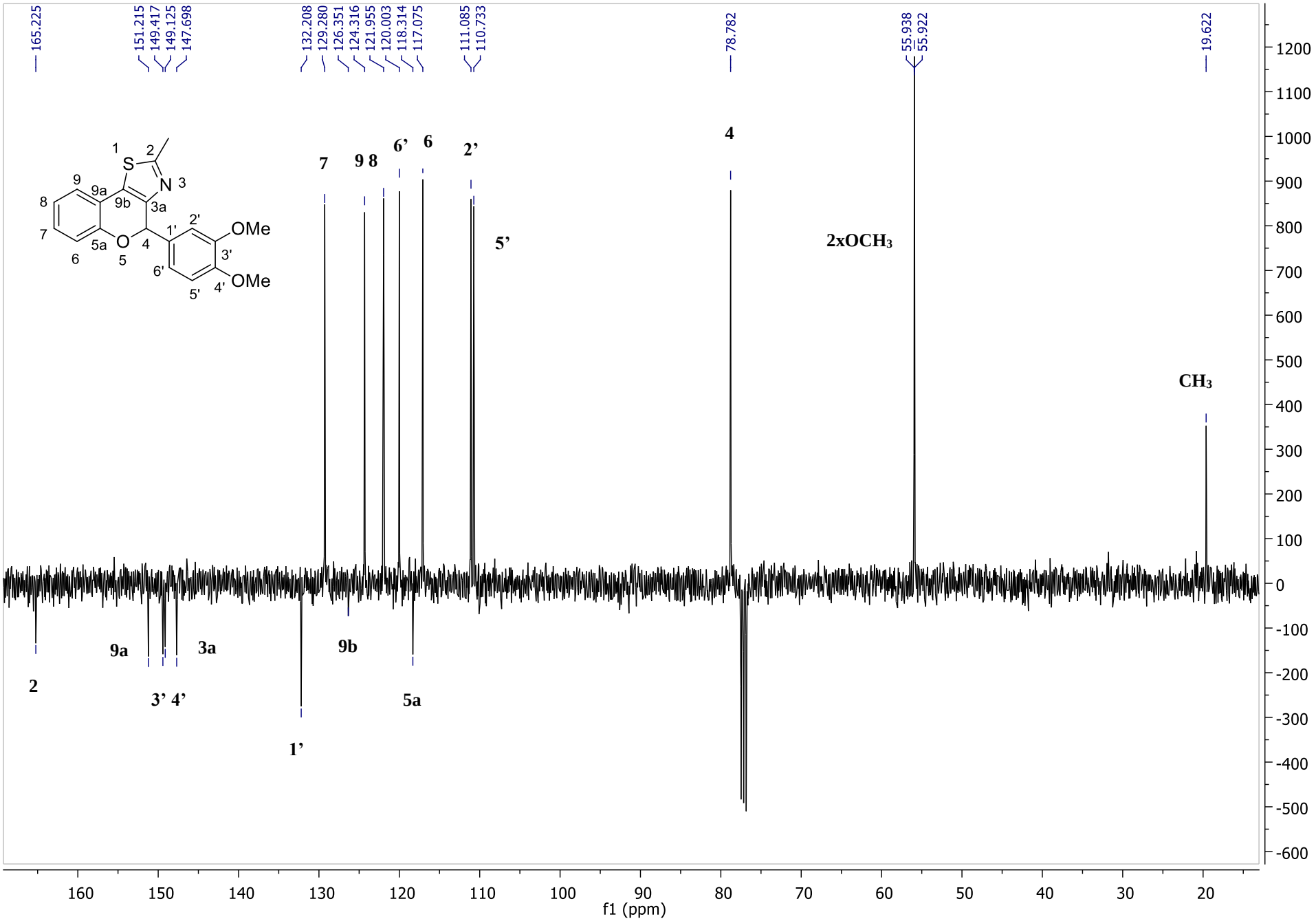


Figure S235. ^{13}C-NMR spectrum of *rac*-**3c** in $CDCl_3$

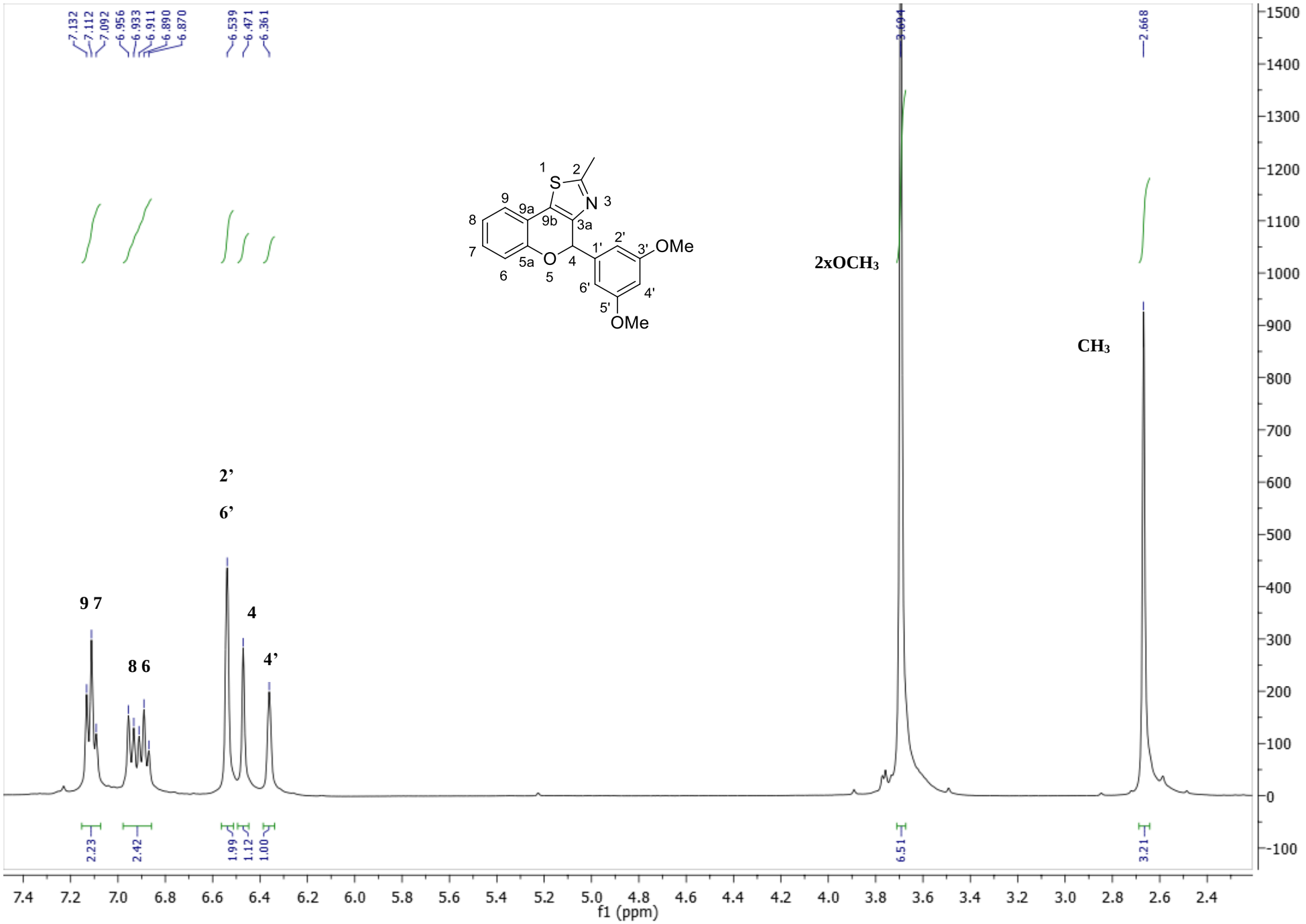


Figure S236. ^{1}H-NMR spectrum of *rac*-**3d** in $CDCl_3$

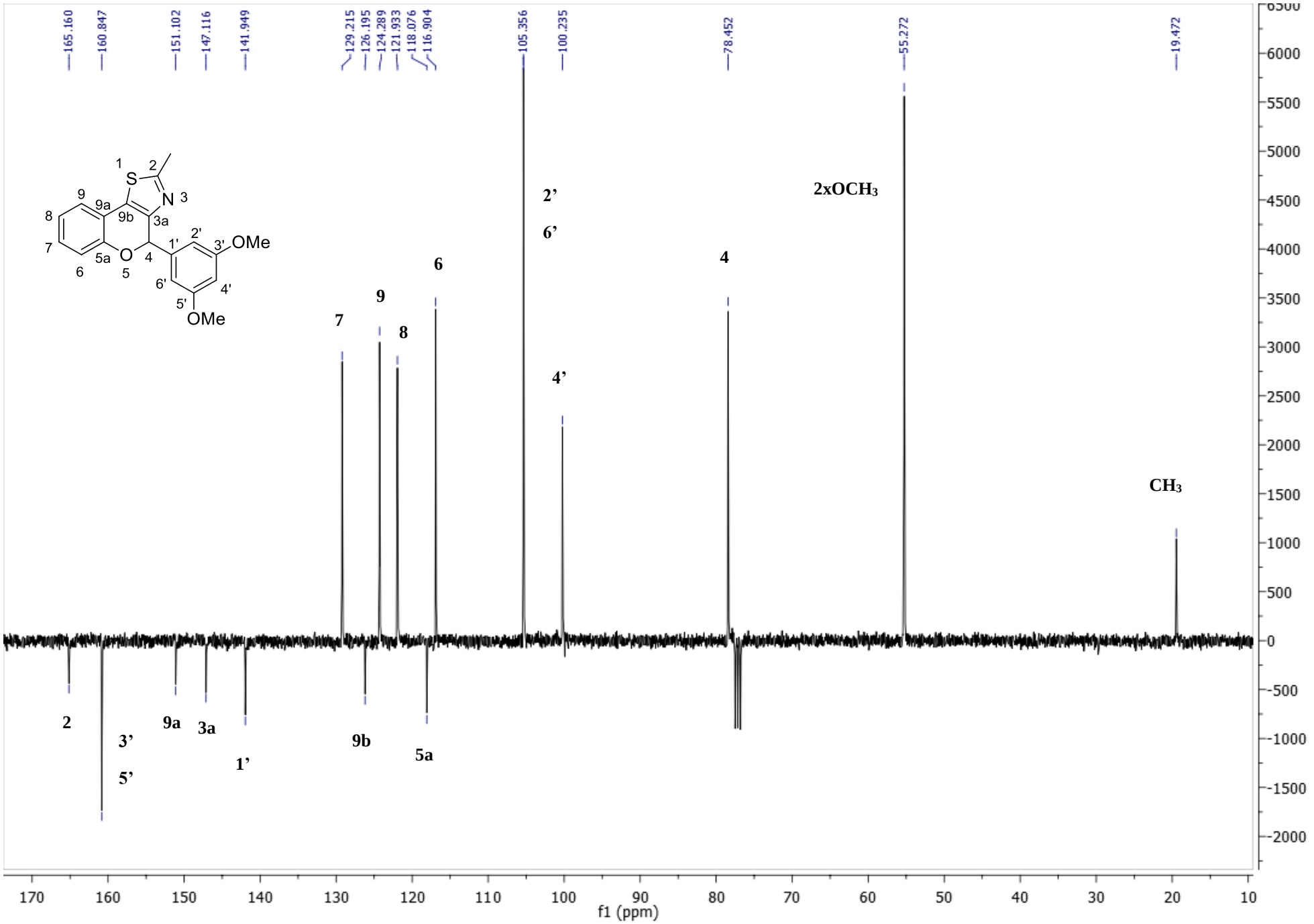


Figure S237. ^{13}C-NMR spectrum of *rac*-**3d** in $CDCl_3$

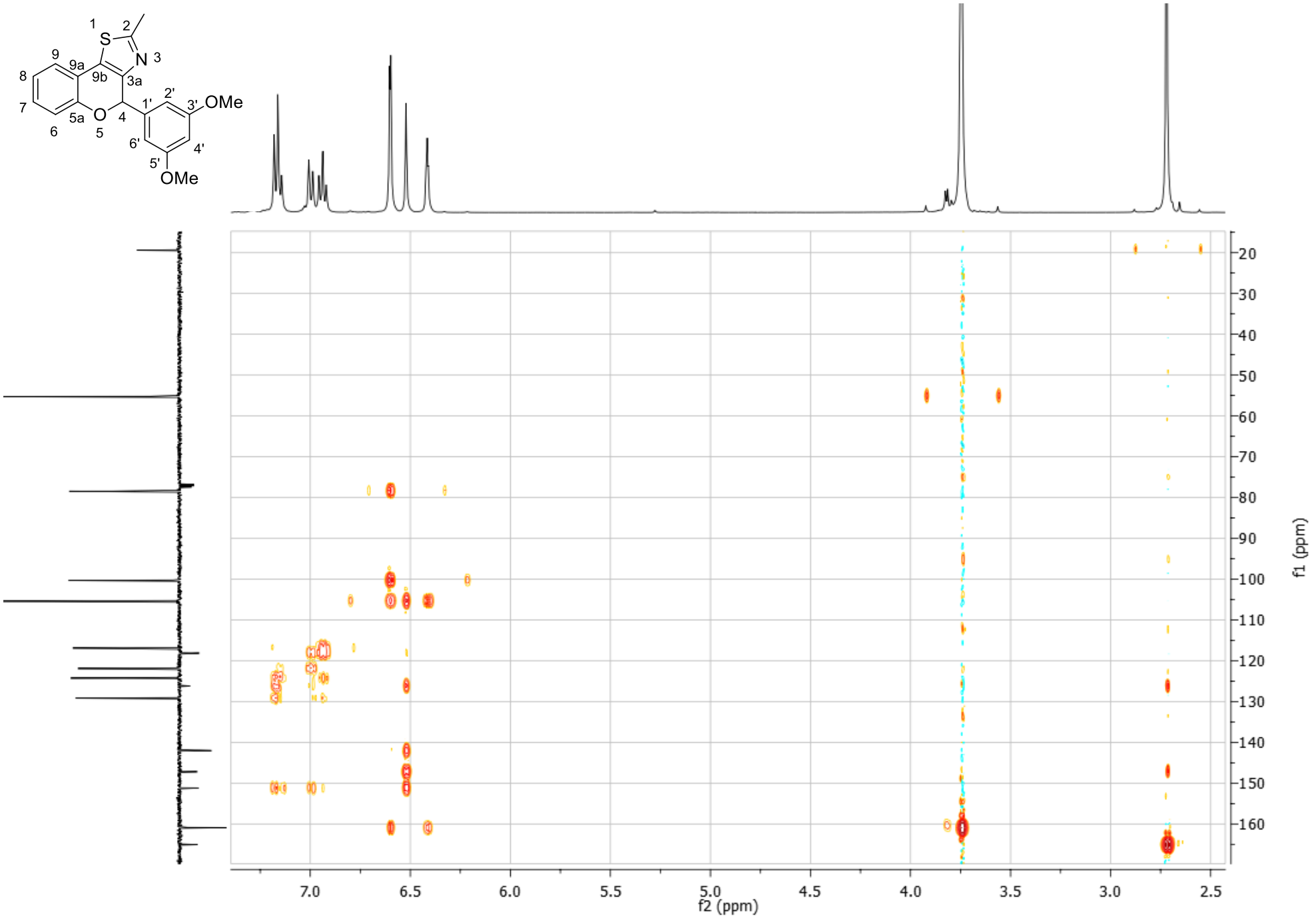


Figure S238. HMBC-spectrum of *rac*-**3d** in $CDCl_3$

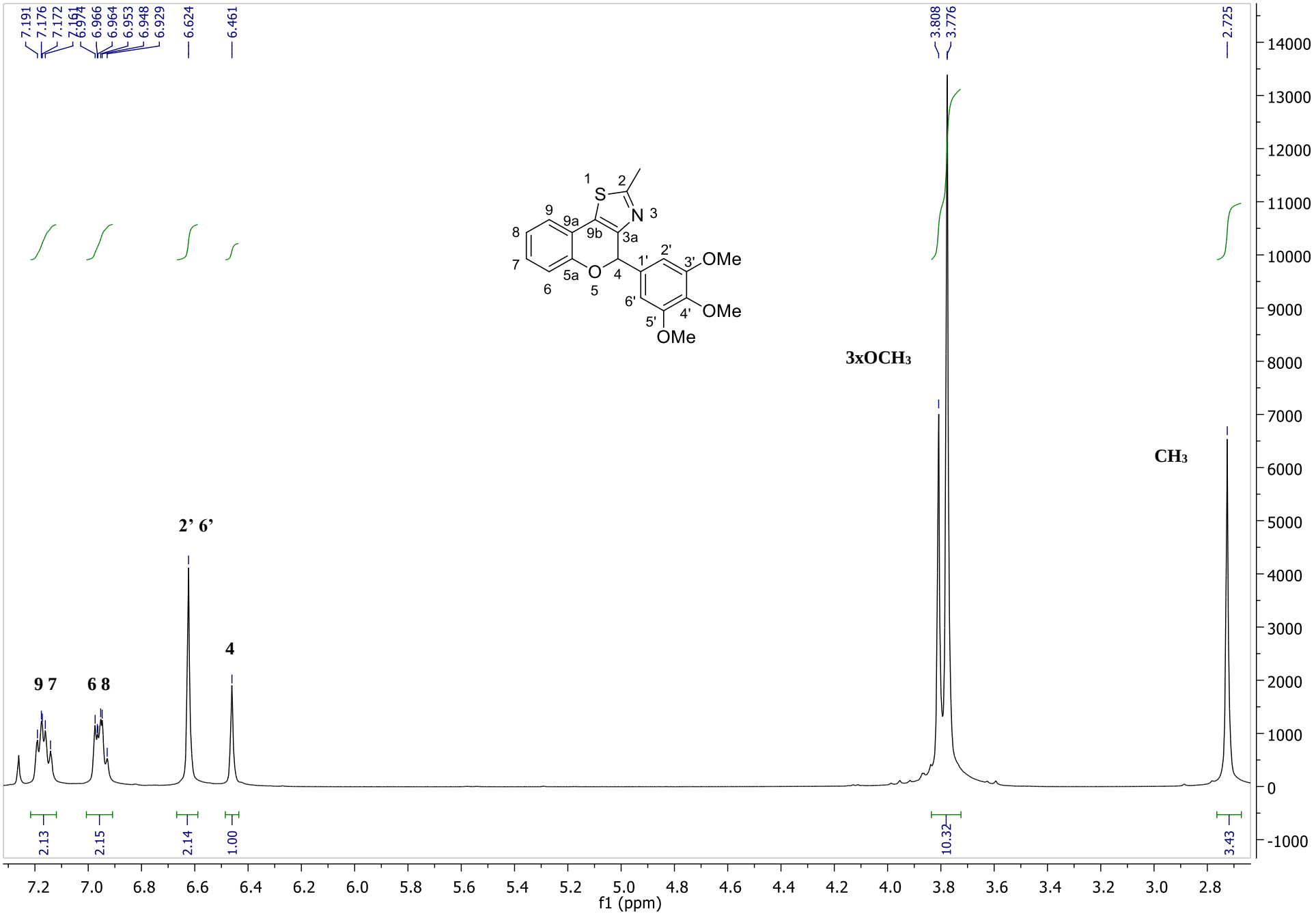


Figure S239. ^{1}H-NMR spectrum of *rac*-**3e** in $CDCl_3$

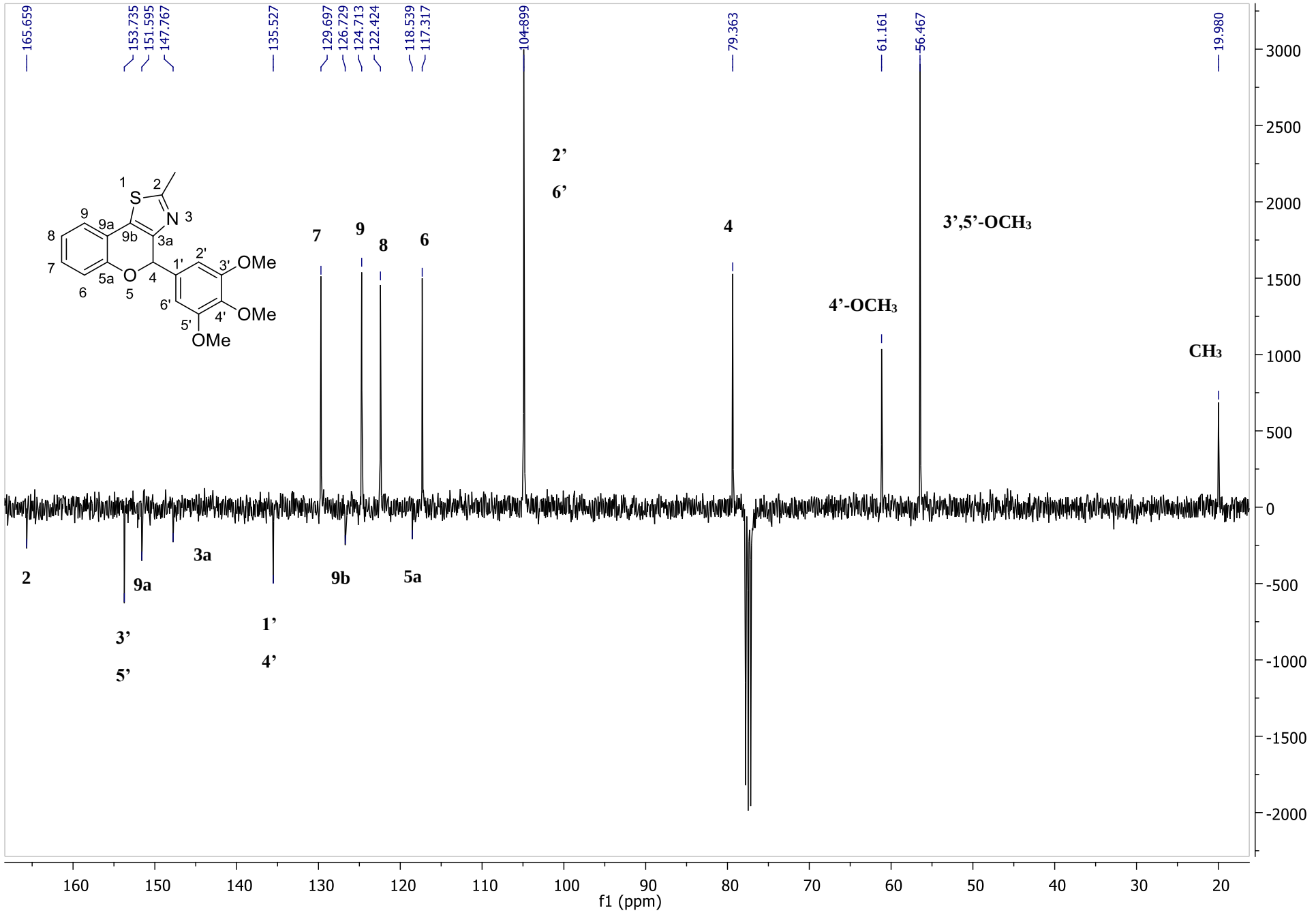


Figure S240. ^{13}C-NMR spectrum of *rac*-**3e** in $CDCl_3$

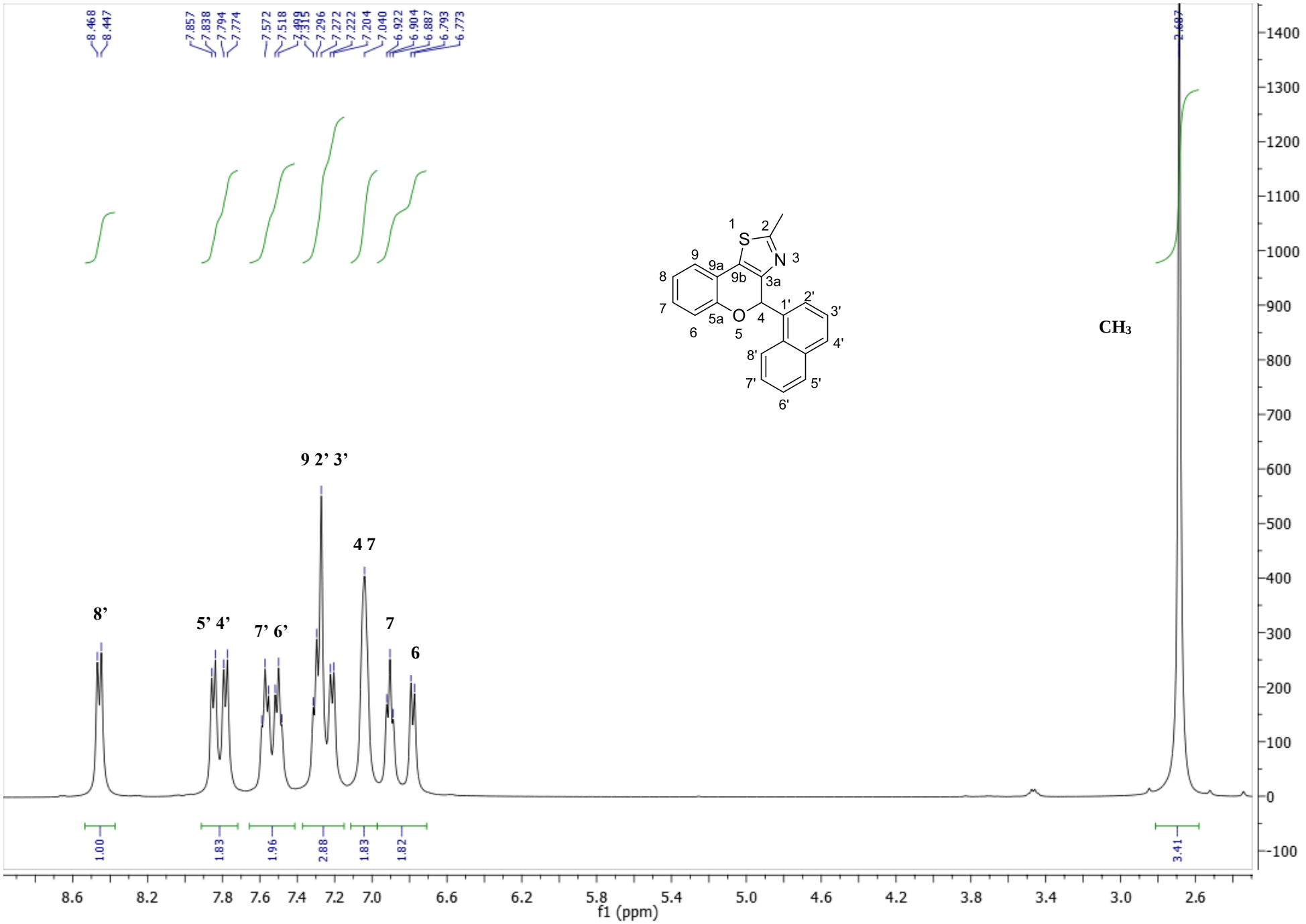


Figure 241. ^{1}H-NMR spectrum of *rac*-**3f** in $CDCl_3$

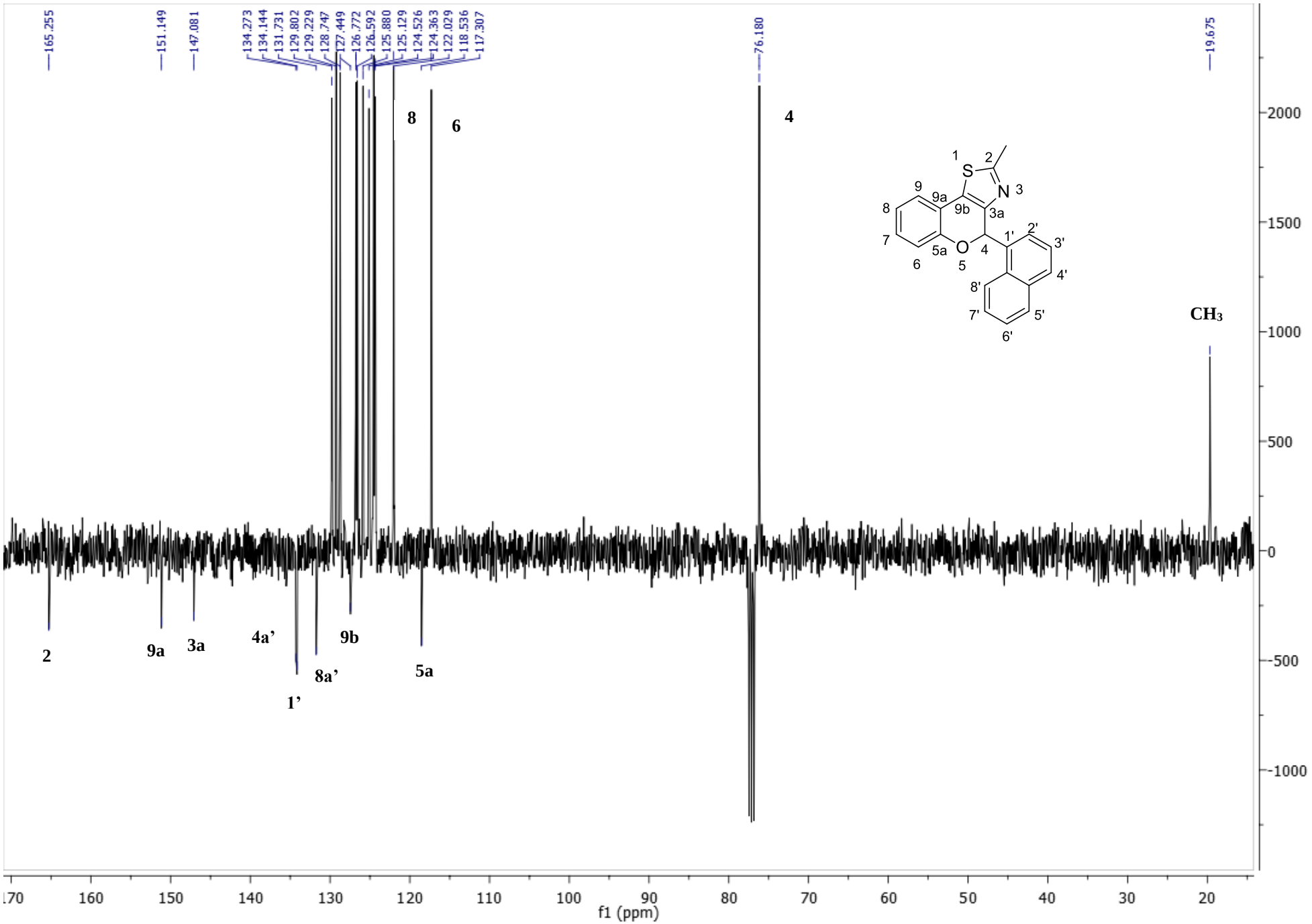


Figure S242. ^{13}C-NMR spectrum of *rac*-**3f** in $CDCl_3$

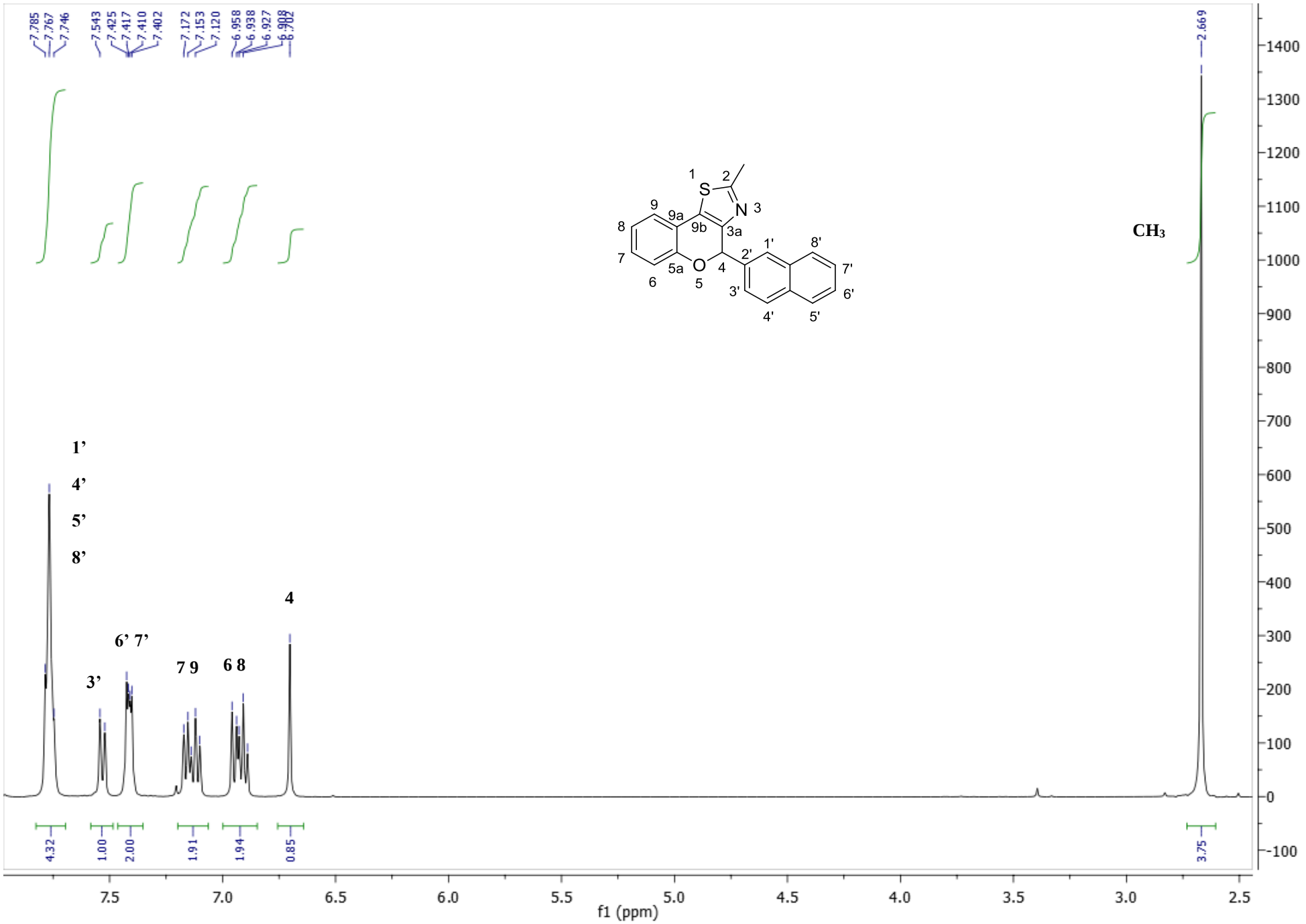


Figure S243. ^{1}H-NMR spectrum of *rac*-**3g** in $CDCl_3$

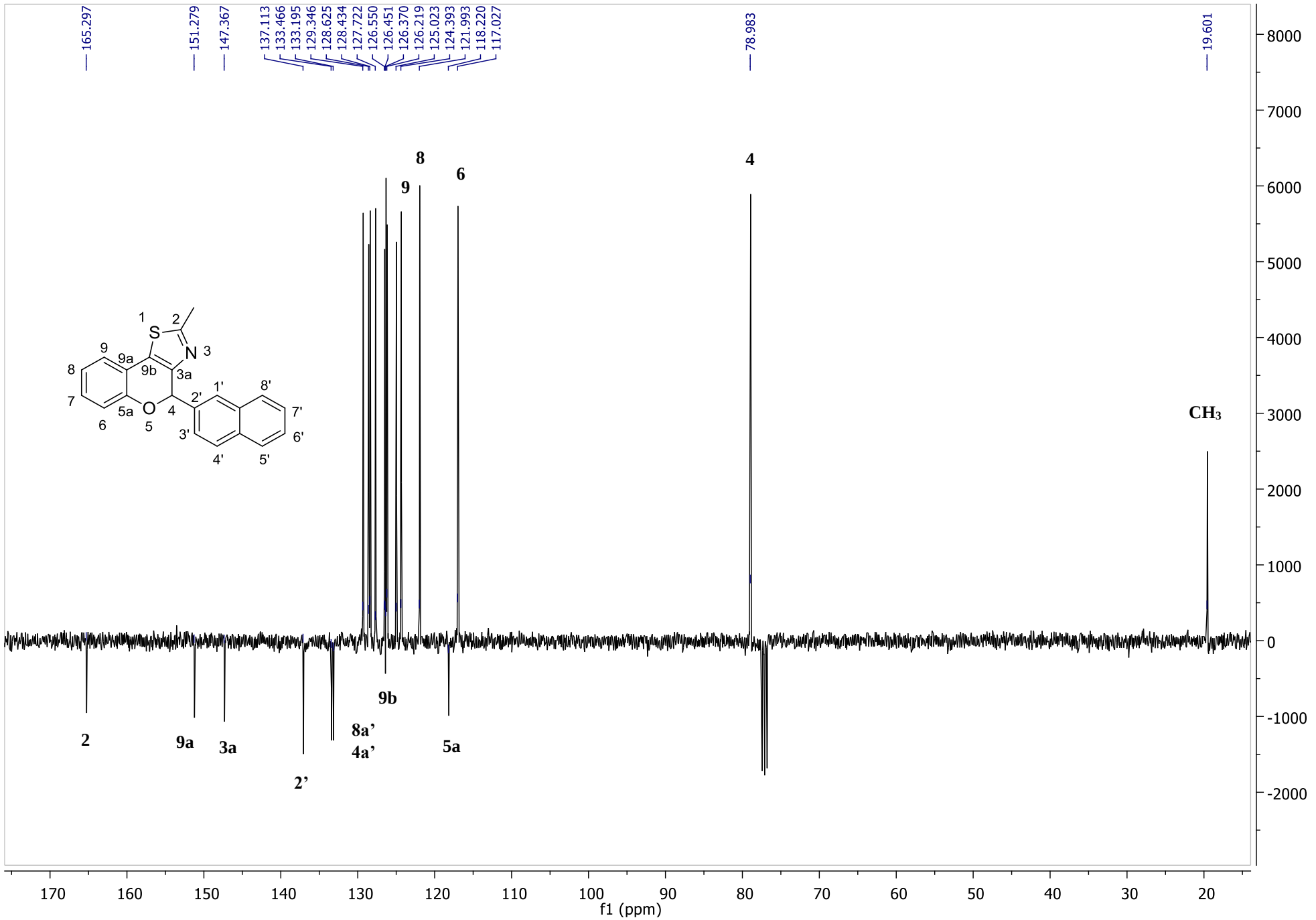


Figure S244. ^{13}C-NMR spectrum of *rac*-**3g** in $CDCl_3$

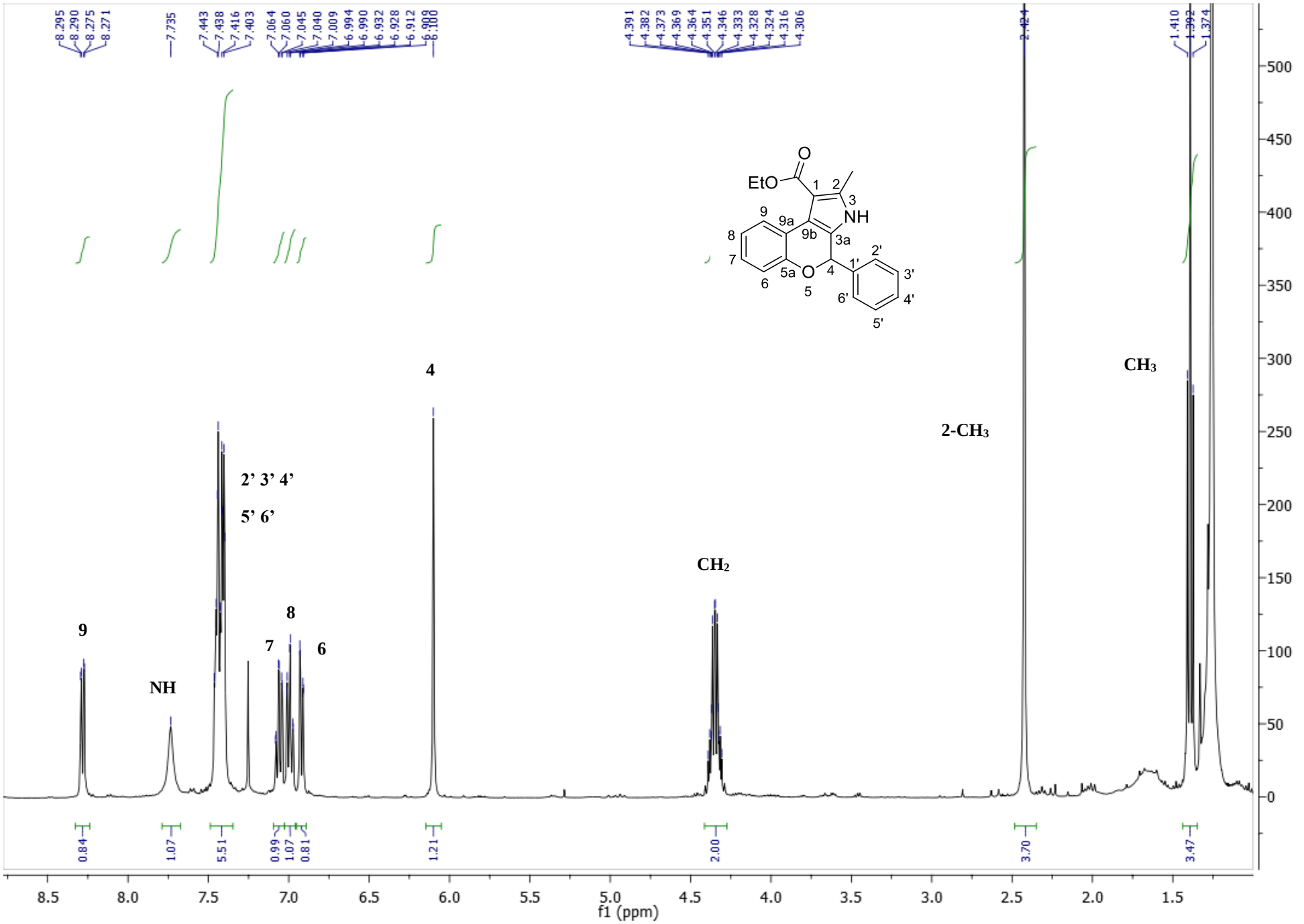


Figure S245. ^{1}H-NMR spectrum of *rac*-**4a** in $CDCl_3$

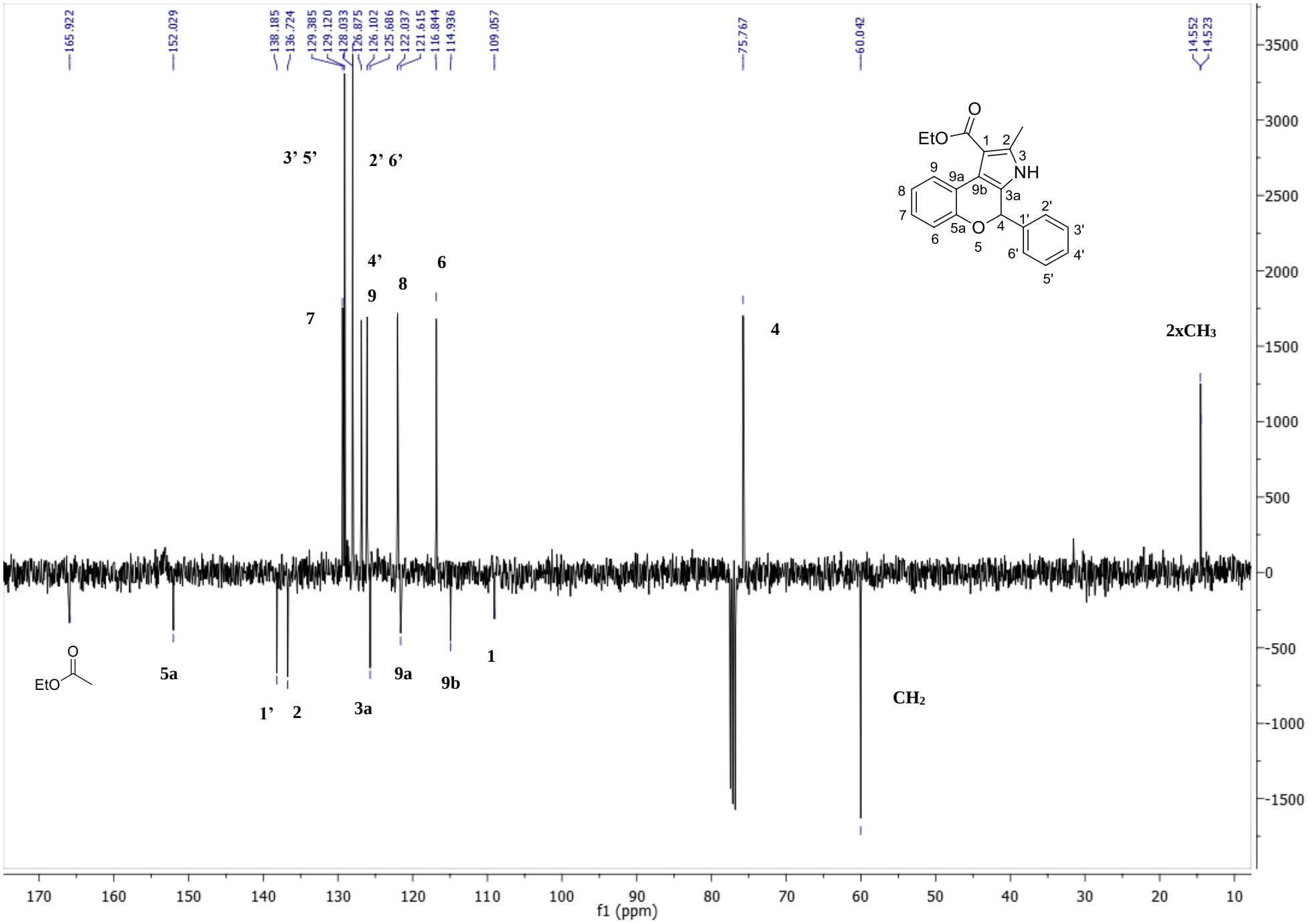


Figure S246. ^{13}C-NMR spectrum of *rac*-**4a** in $CDCl_3$

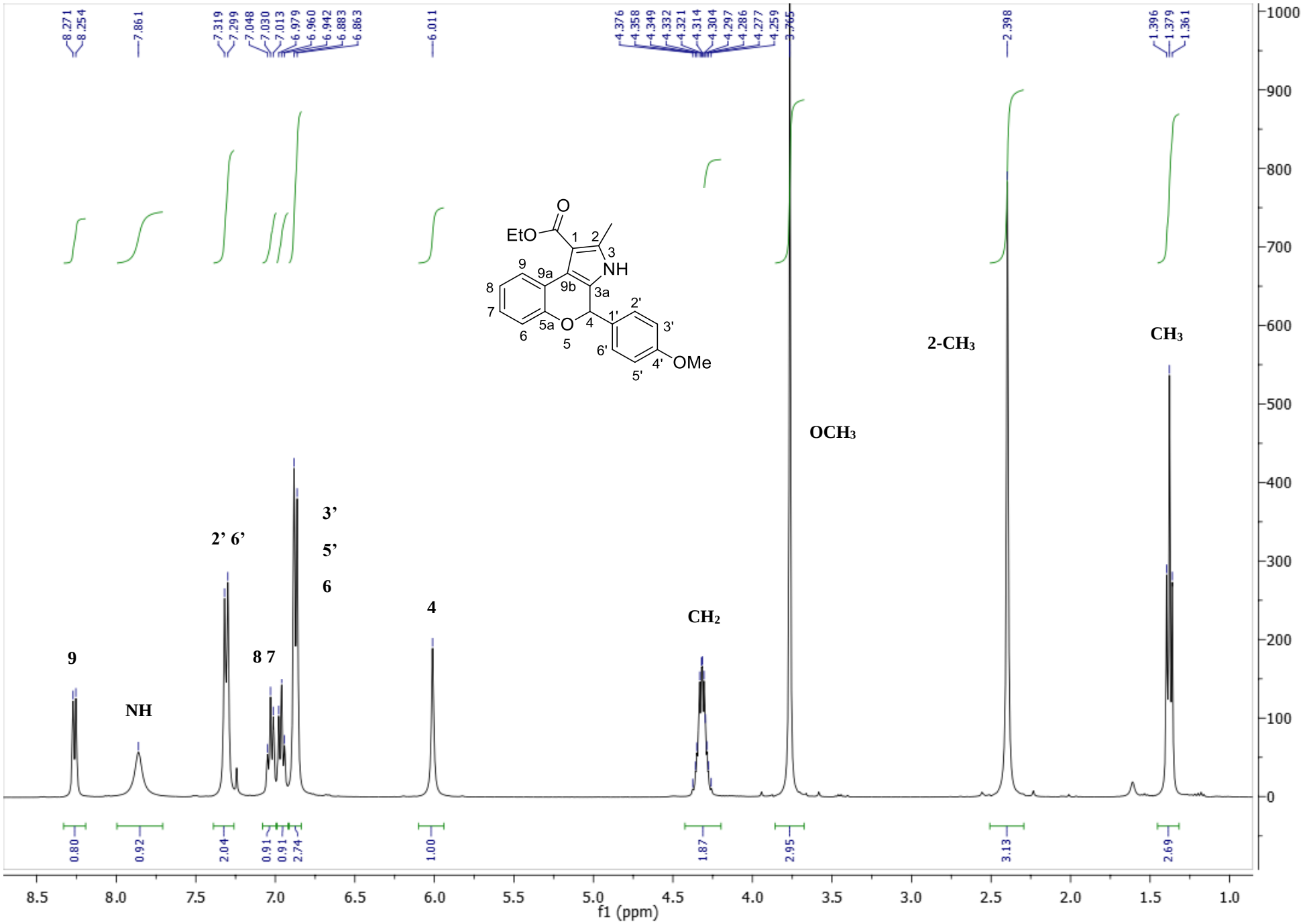


Figure S247. ^{1}H-NMR spectrum of *rac*-**4b** in $CDCl_3$

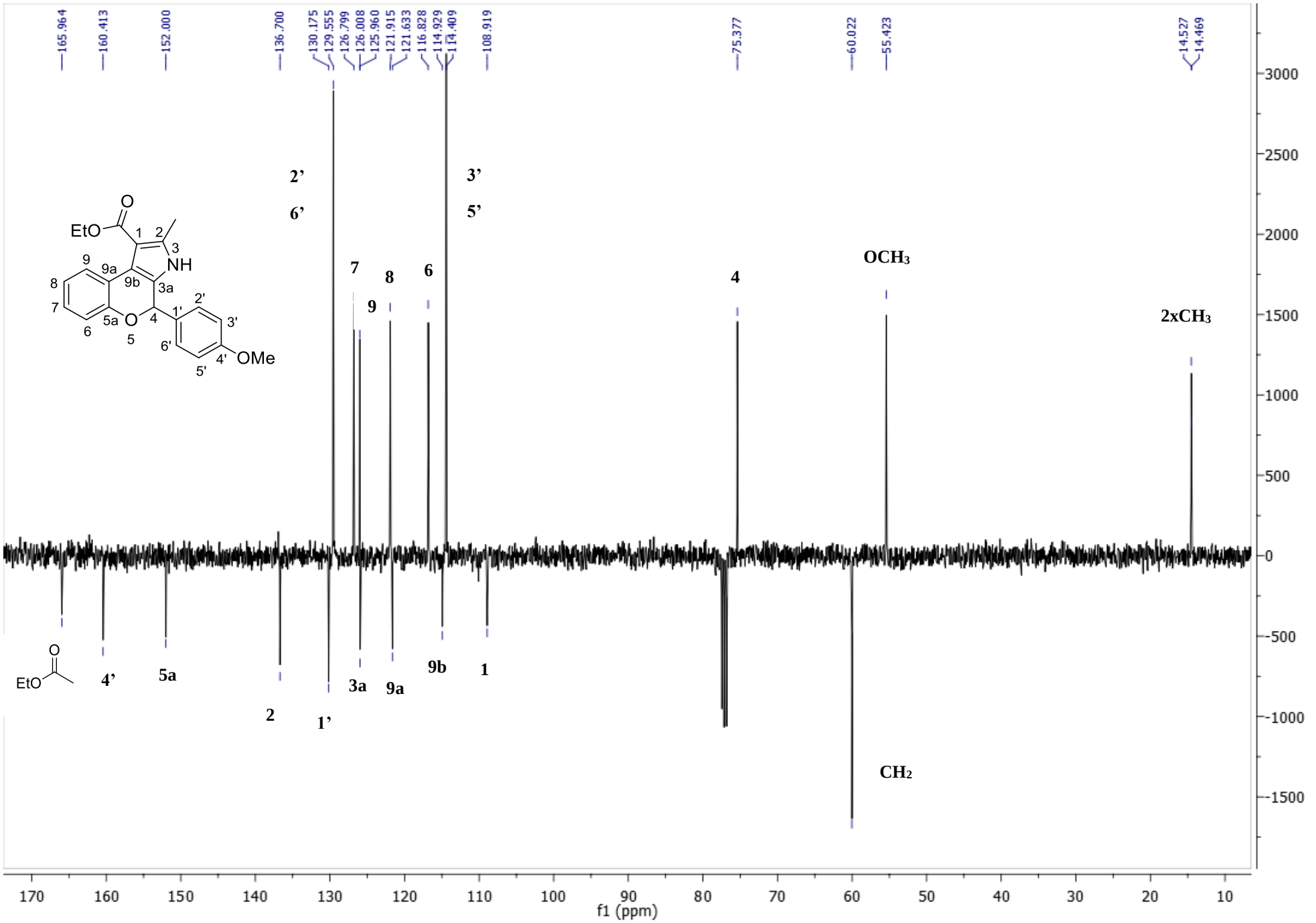


Figure S248. ^{13}C-NMR spectrum of *rac*-**4b** in $CDCl_3$

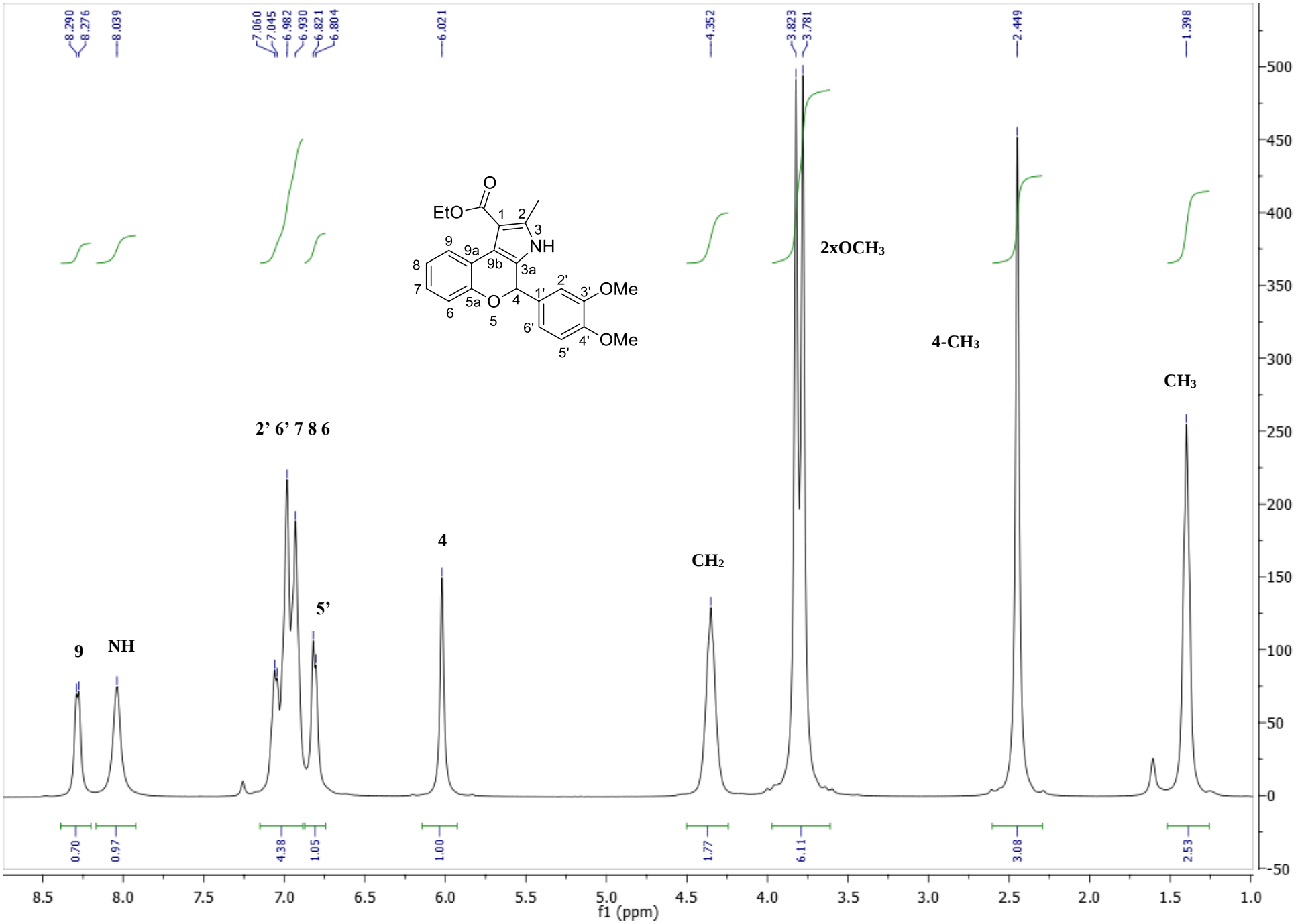


Figure S249. ^{1}H-NMR spectrum of *rac*-**4c** in $CDCl_3$

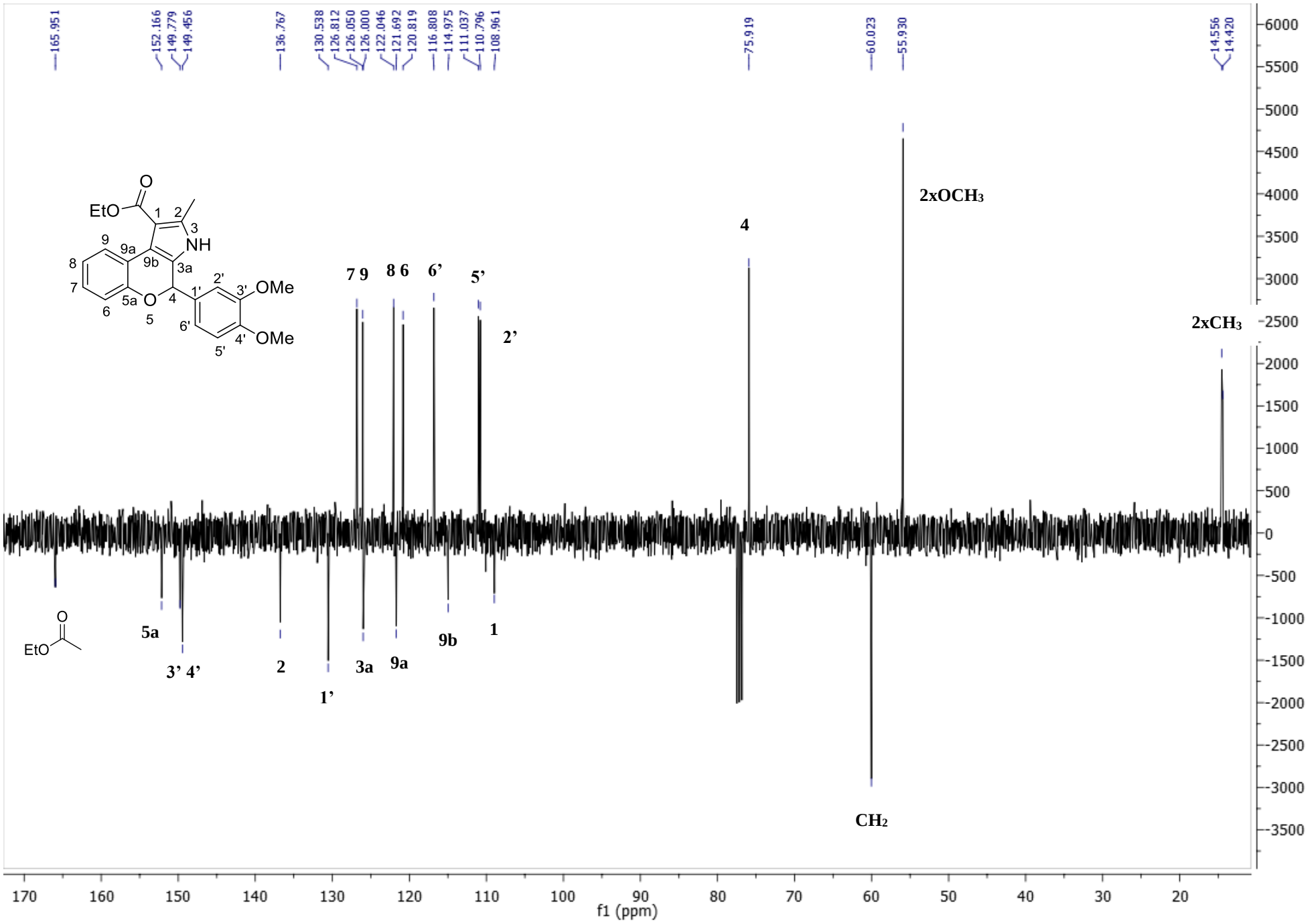


Figure S250. ^{13}C-NMR spectrum of *rac*-**4c** in $CDCl_3$

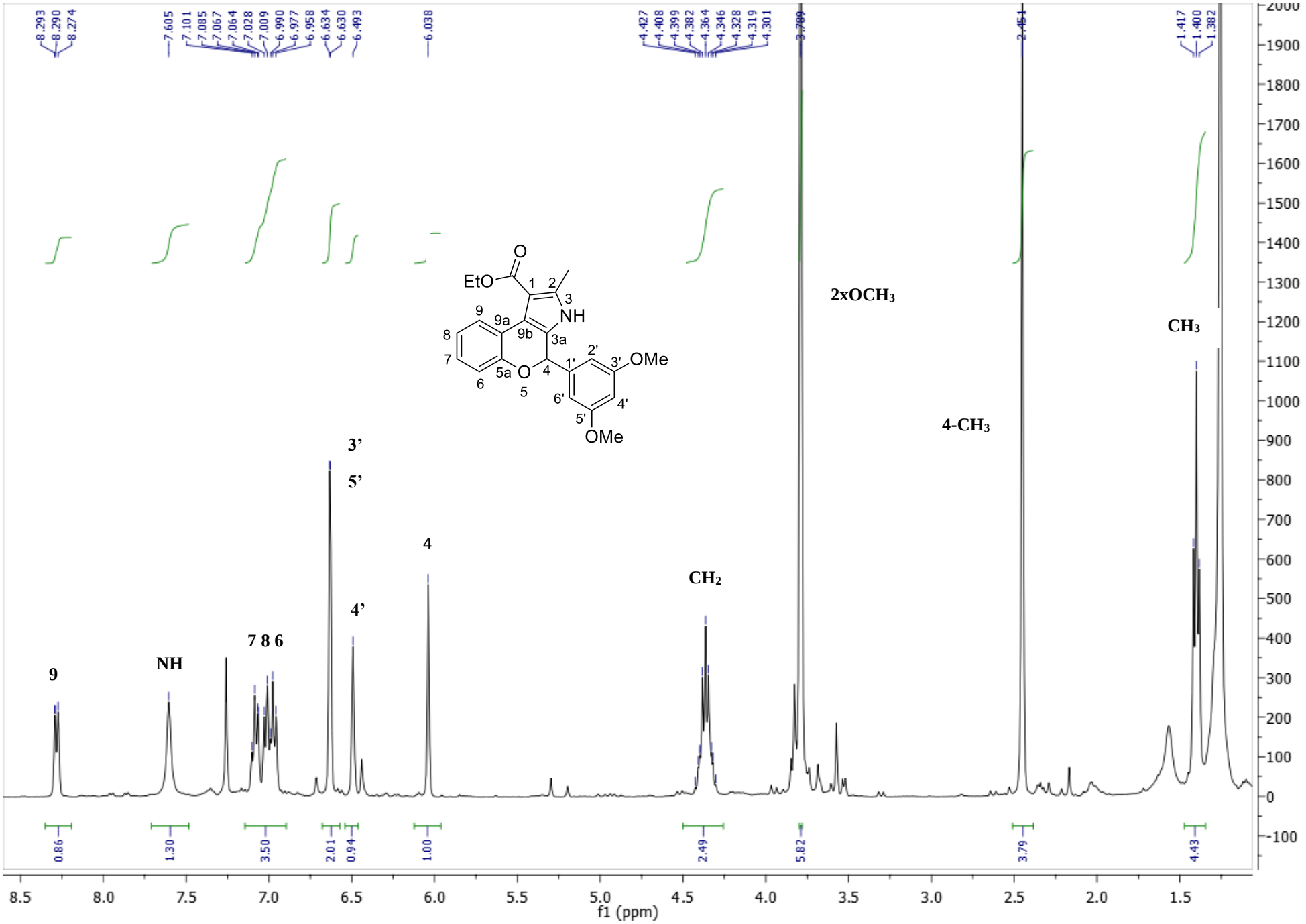


Figure S251. ^{1}H-NMR spectrum of *rac*-**4d** in $CDCl_3$

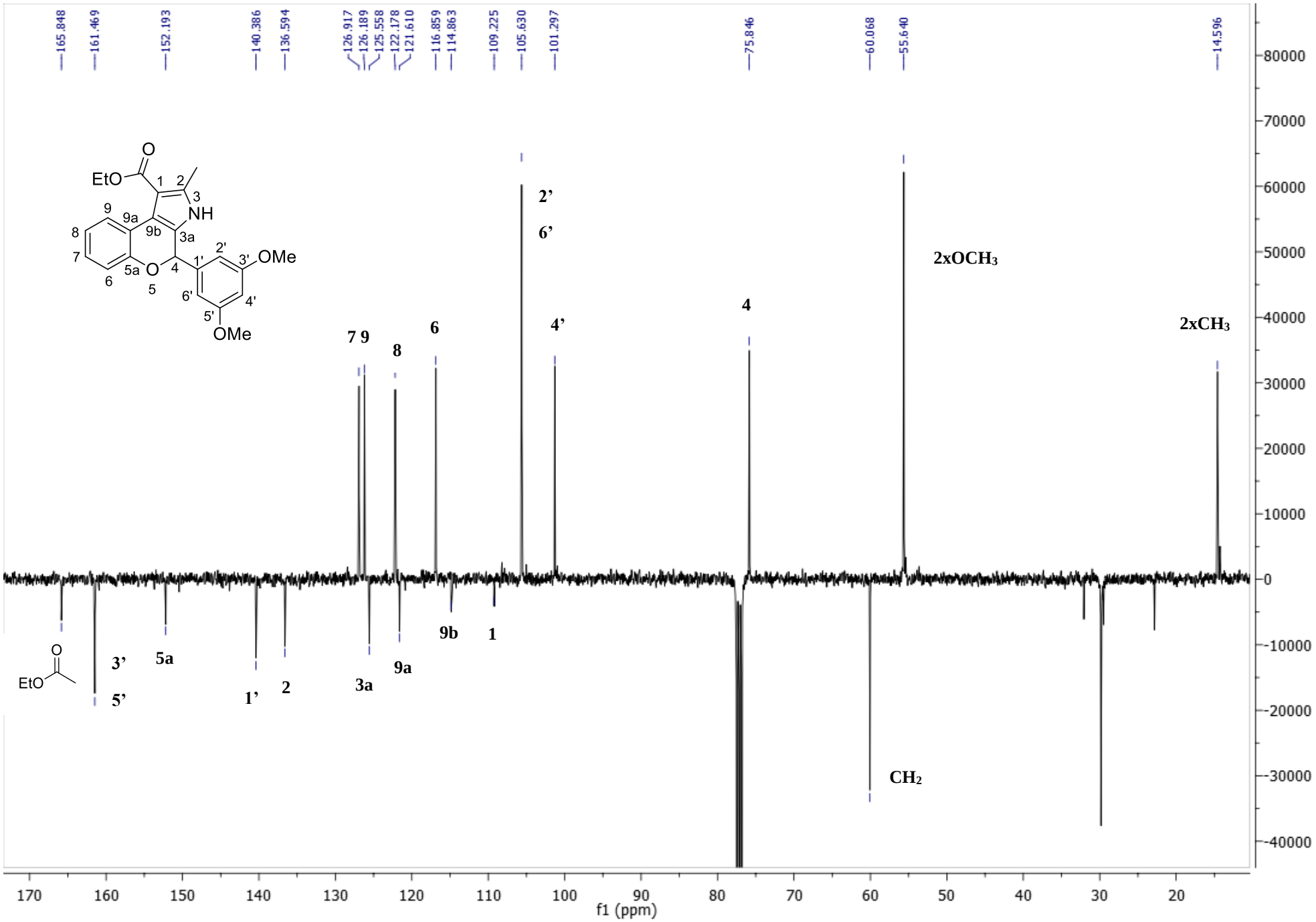


Figure S252. ^{13}C-NMR spectrum of *rac*-**4d** in $CDCl_3$

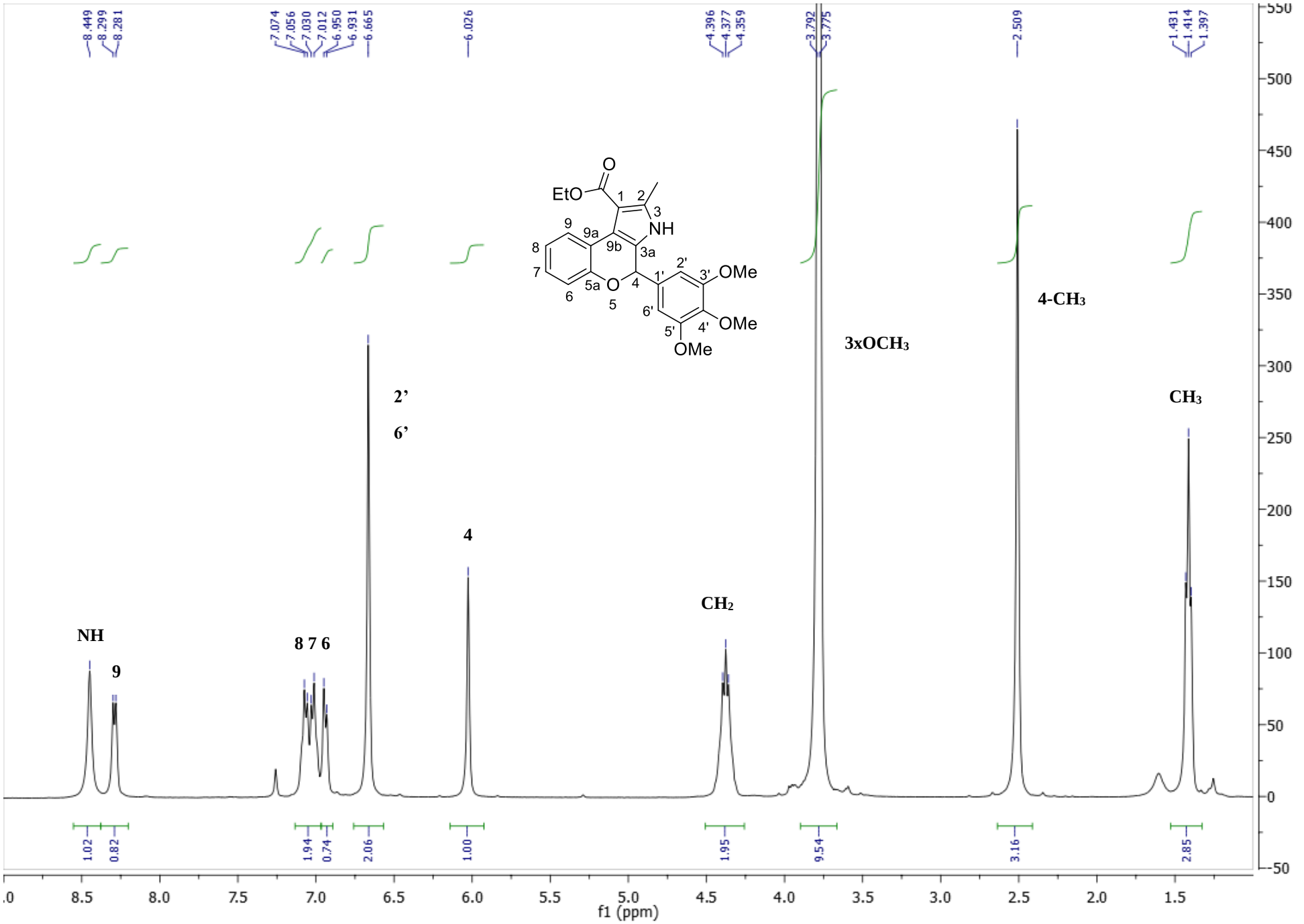


Figure S253. ^{1}H-NMR spectrum of *rac*-**4e** in $CDCl_3$

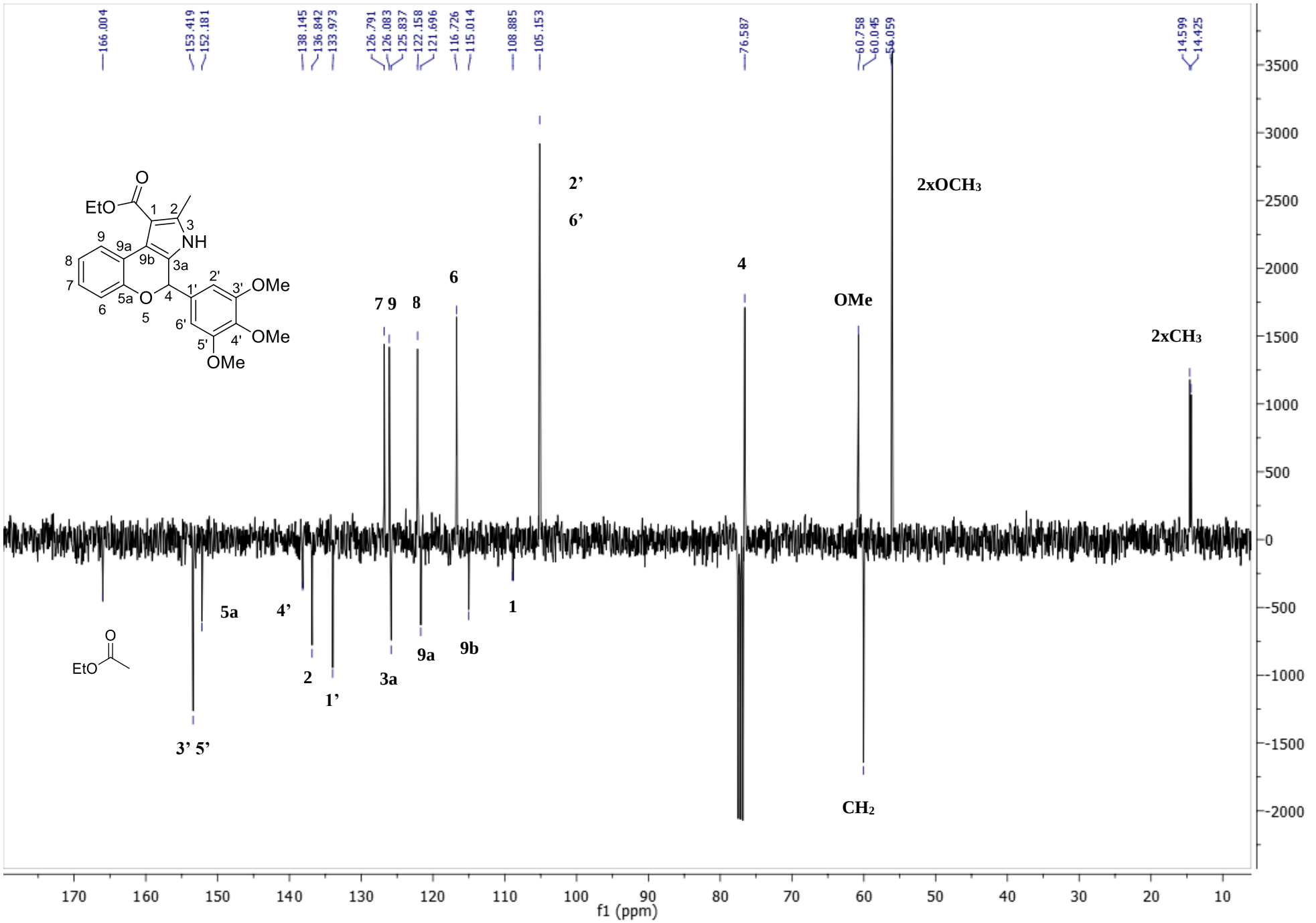


Figure S254. ^{13}C-NMR spectrum of *rac*-**4e** in $CDCl_3$

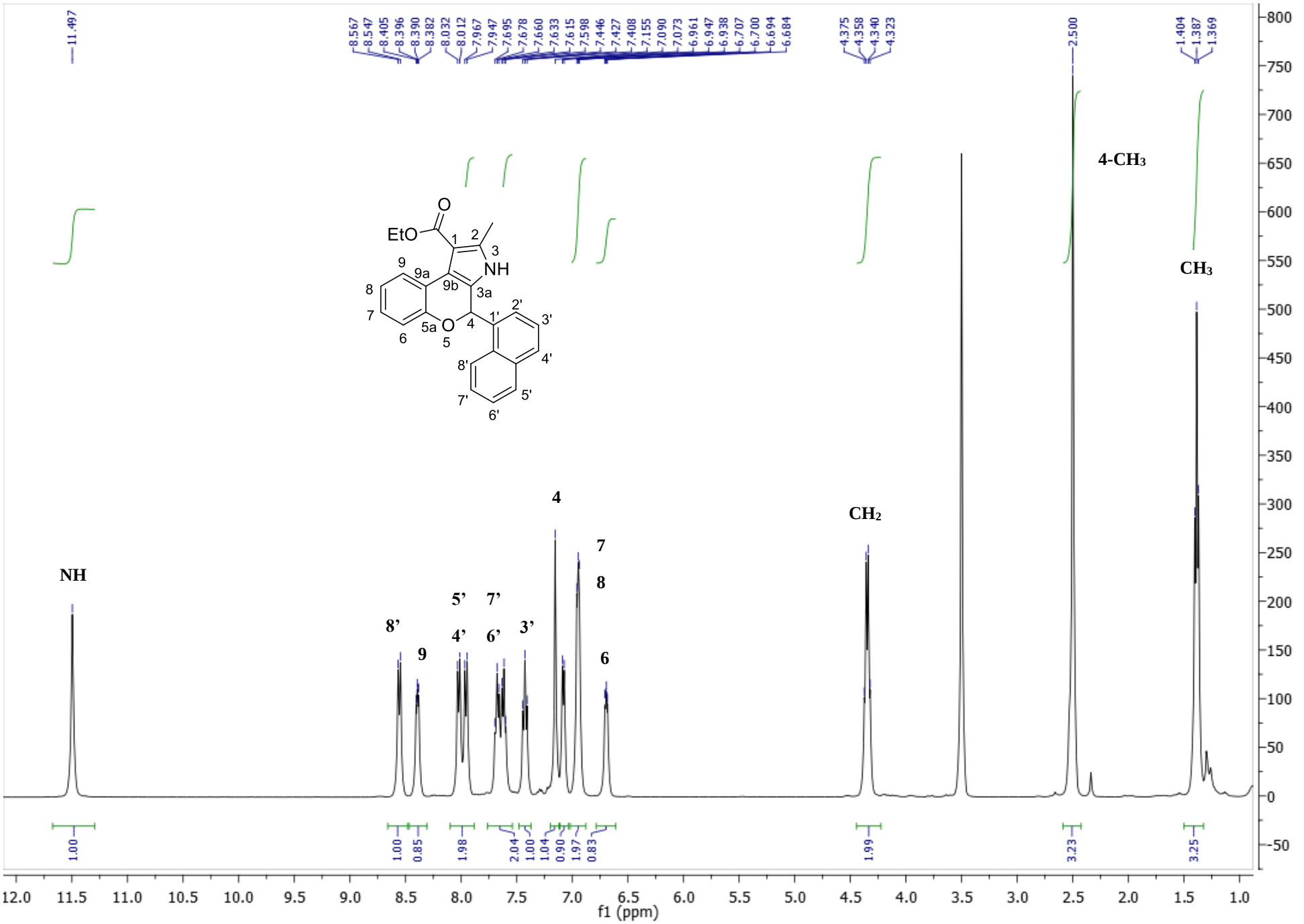


Figure S255. ^{1}H-NMR spectrum of *rac*-**4f** in DMSO-d_6

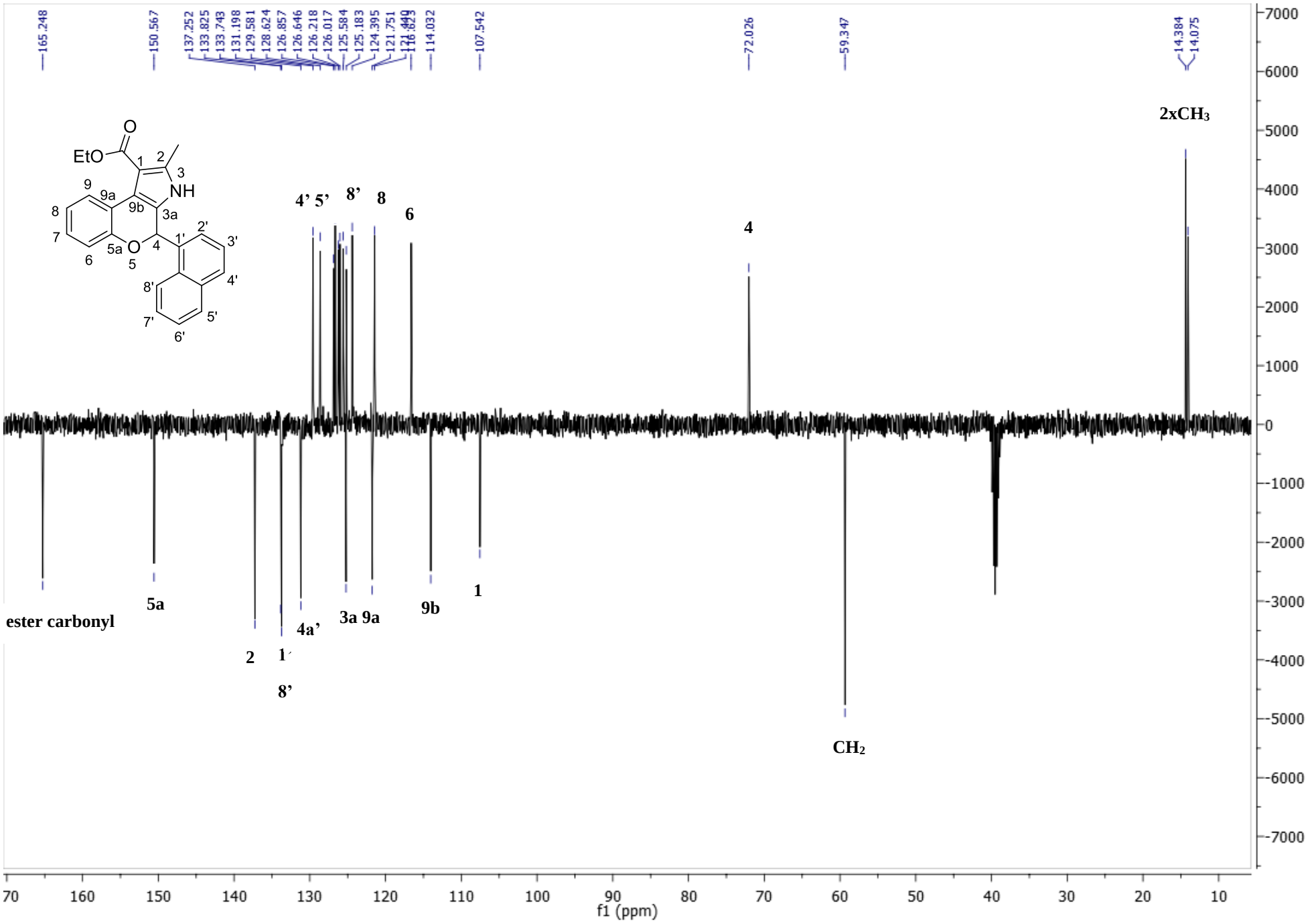


Figure S256. ^{13}C-NMR spectrum of *rac*-**4f** in DMSO-d_6

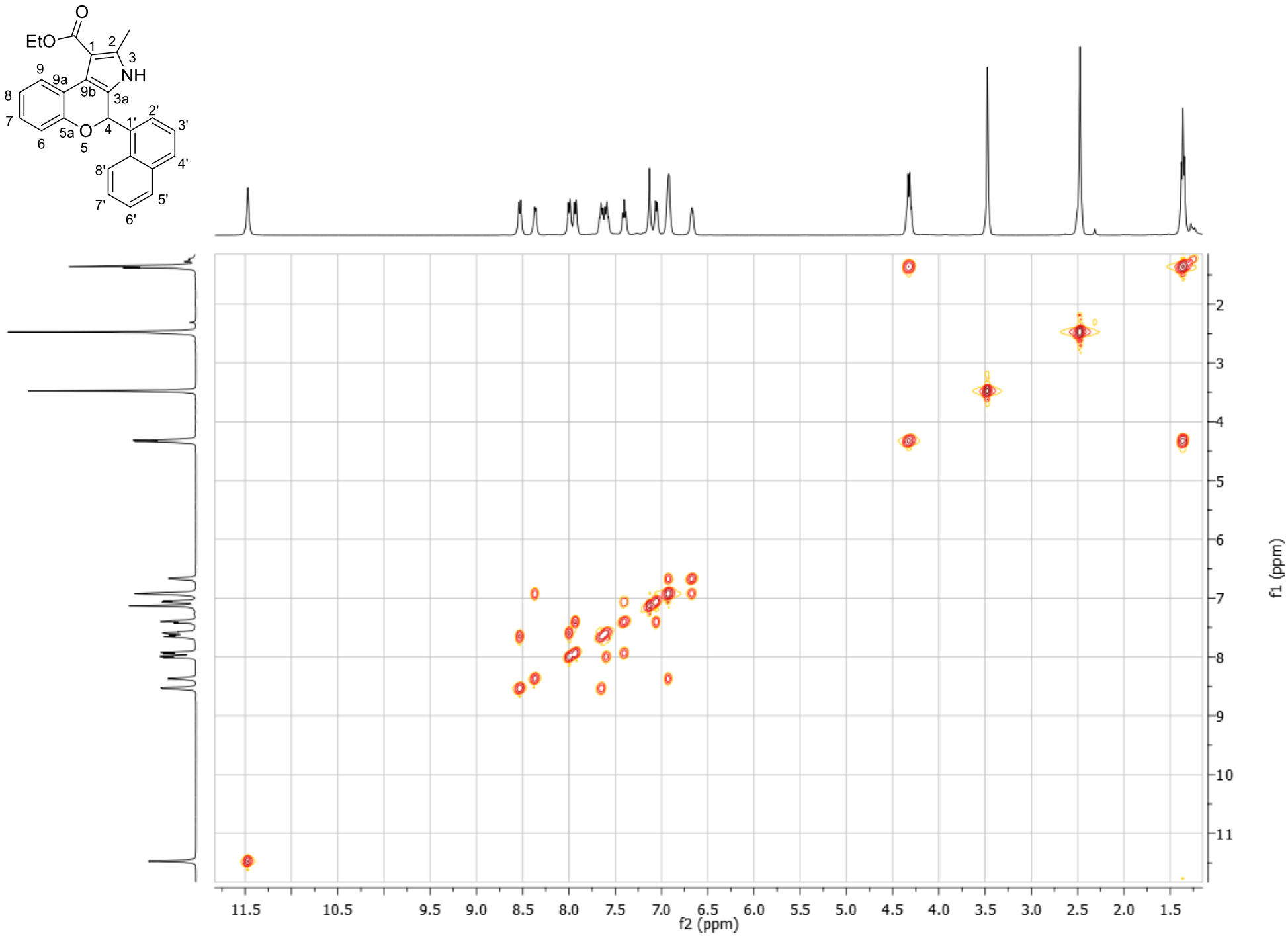


Figure S257. COSY-spectrum of *rac*-**4f** in DMSO-d_6

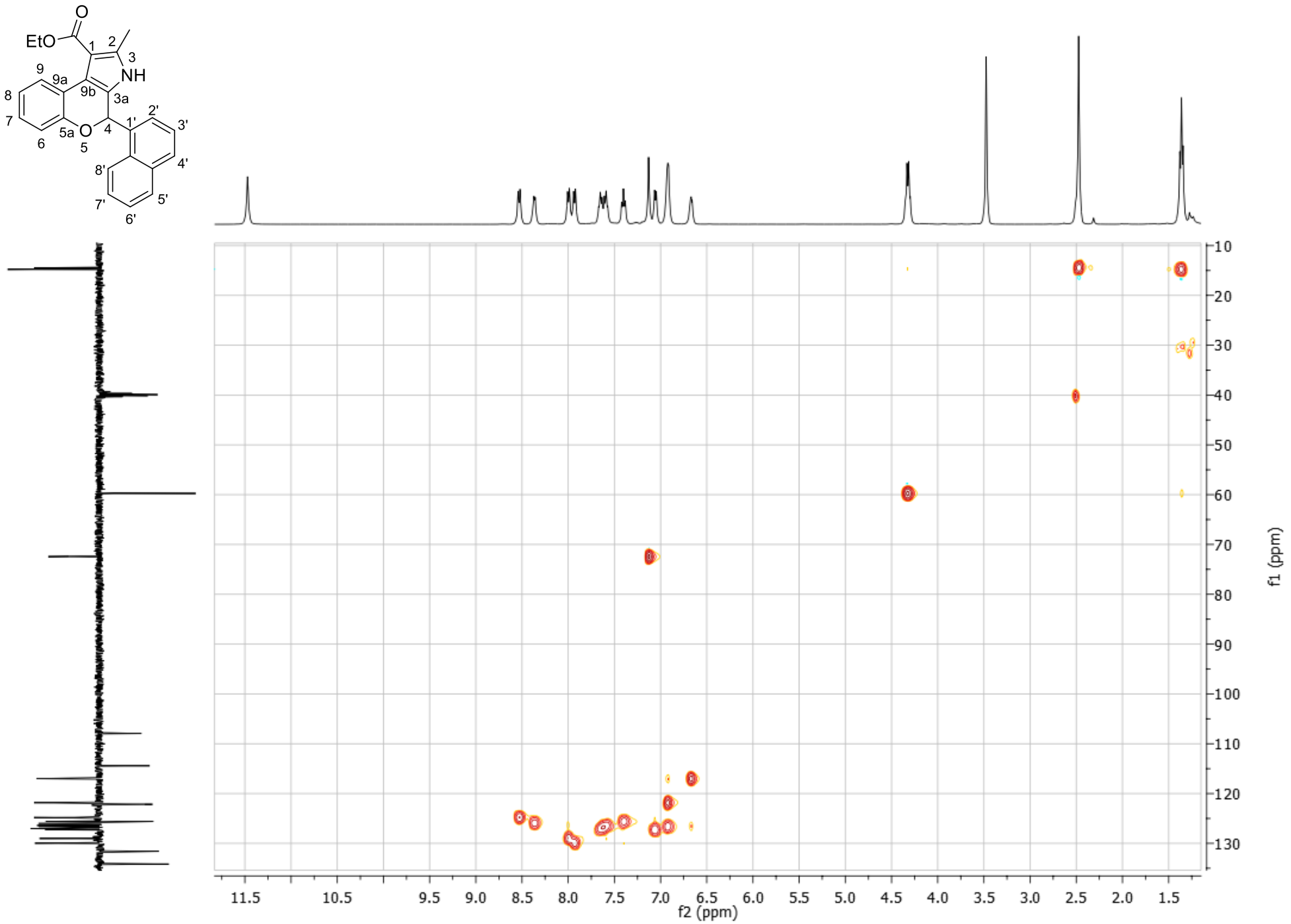


Figure S258. HSQC-spectrum of *rac*-**4f** in DMSO-d_6

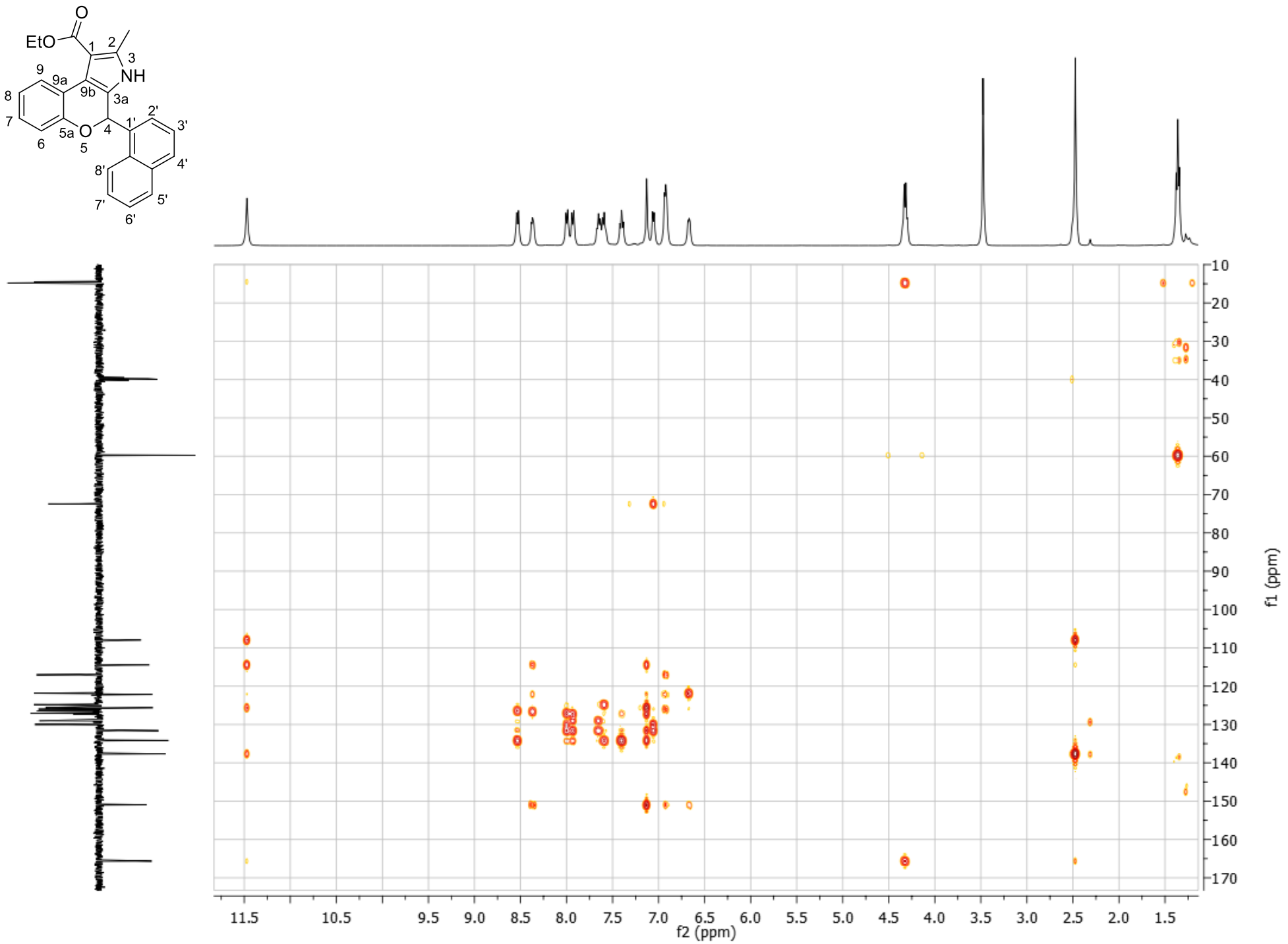


Figure S259. HMBC-spectrum of *rac*-**4f** in DMSO-d_6

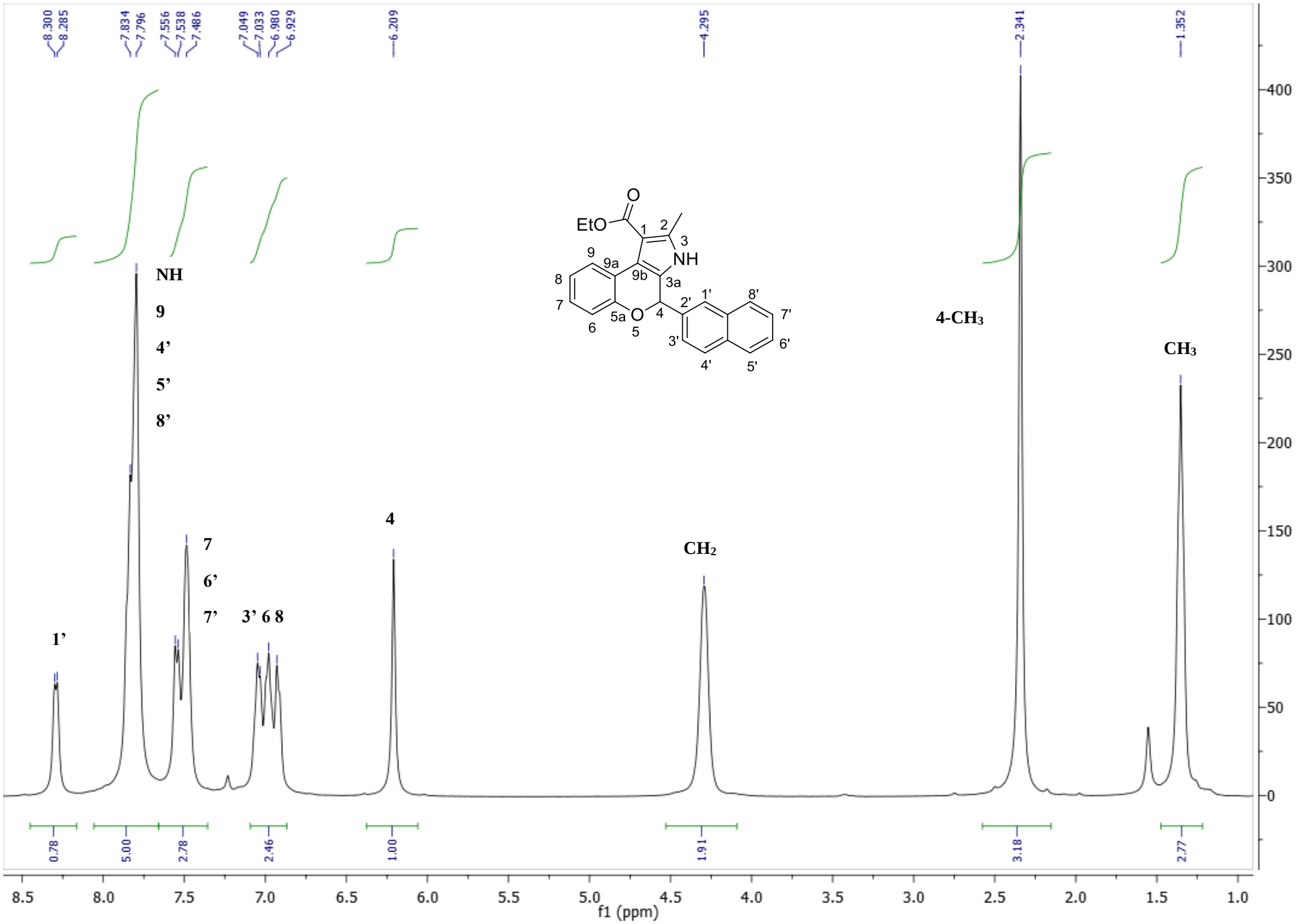


Figure S260. ^{1}H-NMR spectrum of *rac*-**4g** in $CDCl_3$

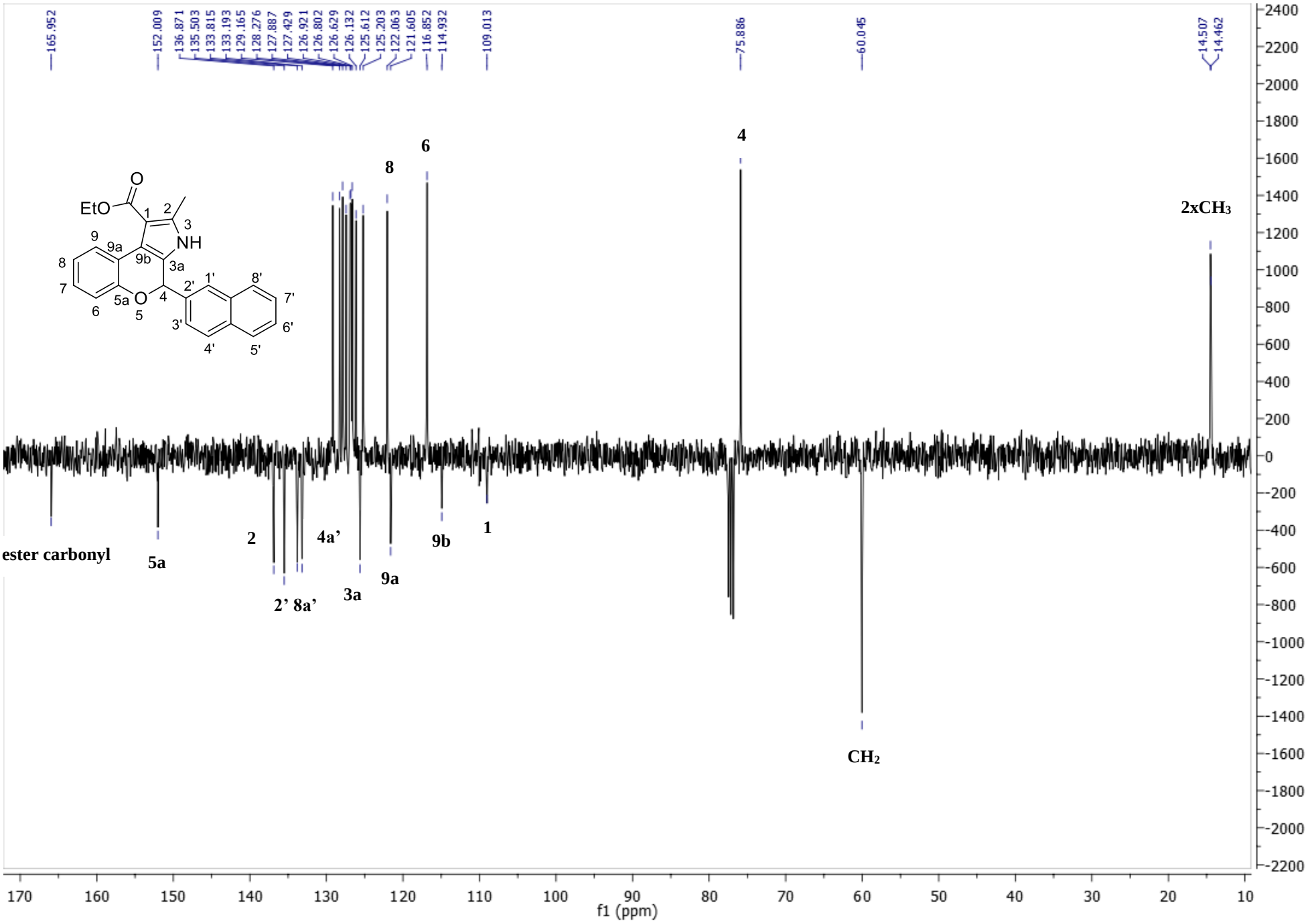


Figure S261. ^{13}C-NMR spectrum of *rac*-**4g** in $CDCl_3$

Table S1. Yields in the preparation of thiazole-condensed derivatives *rac*-**3a-g** from *rac-cis*- and *trans*-**1a-g**

Entry	Substrate	R^1	R^2	R^3	Yield 1[b] (%)	Yield 2[c] (%)
1	*rac-cis*-**24a** or *rac-trans*-**24a**	H	H	H	*rac*-**3a** (76)	*rac*-**3a** (82)
2	*rac-cis*-**24b** or *rac-trans*-**24b**	H	OMe	H	*rac*-**3b** (44)	*rac*-**3b** (52)
3	*rac-cis*-**24c** or *rac-trans*-**24c**	OMe	OMe	H	*rac*-**3c** (34)	*rac*-**3c** (66)
4	*rac-cis*-**24d** or *rac-trans*-**24d**	OMe	H	OMe	*rac*-**3d** (52)	*rac*-**3d** (70)
5	*rac-cis*-**24e** or *rac-trans*-**24e**	OMe	OMe	OMe	*rac*-**3e** (66)	*rac*-**3e** (84)
6	*rac-trans*-**24f**	1-naphthyl			-	*rac*-**3f** (60)
7	*rac-trans*-**24g**	2-naphthyl			-	*rac*-**3g** (55)

[a] Reaction condition: *rac-cis*-**24a-**e, **g** or *rac-trans*-**24a-g** (0.355 mmol), Lawesson reagent (0.355 mmol) in 5 mL toluene, 4h, 70°C

[b] Isolated yields of product prepared from *rac-cis*-**24a-e**, **g**

[c] Isolated yields of product prepared from *rac-trans*-**24a-g**