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# Electronic Supporting Information

# Catalytic enantioselective synthesis of α-nitro epoxides via aminolytic kinetic resolution

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## Table of contents

## General Methods

All reactions requiring dry or inert conditions were conducted in flame dried glassware under a positive pressure of nitrogen. THF and DCM were freshly distilled prior to use respectively over $LiAlH_4$ and calcium hydride and stored under nitrogen, all other solvents were dried over molecular sieves. Molecular sieves (Aldrich Molecular Sieves, 3 Å, 1.6 mm pellets) were activated under vacuum at 200°C overnight. Reactions were monitored by thin layer chromatography (TLC) on Merck silica gel plates (0.25 mm) and visualised by UV light or by phosphomolybdic acid/ethanol spray test. Flash chromatography was performed on Merck silica gel (60, particle size: 0.040–0.063 mm). $^{1}H$ NMR and $^{13}C$ NMR spectra were recorded on Bruker Avance-400 spectrometer, Bruker Avance-300 spectrometer and Bruker Avance-250 spectrometer at room temperature in $CDCl_3$ as solvent. Chemical shifts for protons are reported using residual $CHCl_3$ as internal reference ($\delta$ = 7.26 ppm). Carbon spectra were referenced to the shift of the $^{13}C$ signal of $CDCl_3$ ($\delta$ = 77.0 ppm). Optical rotation of compounds was performed on a Jasco Dip-1000 digital polarimeter using the Na lamp (582 nm). FTIR spectra were recorded as thin films on KBr plates using Bruker Tensor 27 spectrometer and absorption maxima are reported in wavenumber ($cm^{-1}$). ESI-MS was performed using a Bio-Q triple quadrupole mass spectrometer (Micromass, Manchester, UK) equipped with an electrospray ion source. Elemental analyses were carried out by using Flash EA 1112 (Thermo Electron Corporation) analyzer. Melting points were measured with a Stuart Model SMP 30 melting point apparatus. Petrol ether (PE) refers to light petroleum ether (boiling point 40-60°C). Anhydrous toluene, dry methanol and all starting materials (unless otherwise noted) were purchased from Aldrich and used as received.

Catalysts **I**, **III** were purchased from Aldrich and compound **IV** from Strem Chemicals and used as received. Catalysts **II**,[1] **V**,[2] **VI**,[2] **VII**[2] and **VIII**[3] were prepared according to the literature. Enantiomeric excesses of α-nitroepoxides **1a**, **1e-m** and compound **4a** were determined by HPLC (Waters-Breeze 2487, UV dual λ absorbance detector and 1525 Binary HPLC Pump) using Daicel chiral columns.

## Experimental Procedures and Compounds Characterization Data

### General procedure for the epoxidation of nitroalkenes

The (*E*)-α,β- disubstituted nitroalkenes were synthesized according to the literature.[4]

α-Nitroepoxides were prepared according to published procedures.[5] To a stirred ice-bath cold suspension of (*E*)-α,β-disubstituted nitroalkene (6 mmol) in methanol (12 mL) and hydrogen peroxide 50% aqueous solution (450 μL, 7.8 mmol), aqueous NaOH 2M (1.5 mL, 3 mmol) was added rapidly (ca. 5 minutes) with stirring. The reaction was stirred at 0ºC for 1 h (5 h for compound **1h)**. Then, water was added (30 mL), extracted with diethyl ether (3 x 30 mL) and the combined ethereal extracts were washed with brine (40 mL), dried with $Na_2SO_4$ and concentrated under vacuum. The residue was purified by flash chromatography (PE/ diethyl ether 100:5) to give compounds **1a**, **1e-m** (13-72% yields).

### General procedure for the aminolytic kinetic resolution (AKR) of racemic α-nitro epoxides

A sample vial was charged with nitroepoxide **1** (0.20 mmol) and catalyst **VI** (22.5 mg, 0.04 mmol) in anhydrous toluene (2 mL). Aniline (55 μL, 0.60 mmol) was added and the reaction stirred at room temperature for 84-115 h, monitored by TLC (eluent PE/ diethyl ether 95:5 or 90:10 and PE/ ethyl acetate 90:10 only for compounds **1,3g** and **1,3k**). The enantioenriched α-nitroepoxides **1a**, **1e-m** and products **3a-3e-m** were isolated by flash chromatography (eluting from PE/ diethyl ether 100:2 to 100:5 and to 80:20 only for compound **3m**. In particular, aniline and α-amino ketone **3m** have the same polarity. To remove aniline from the mixture of the two products, recovered after silica gel chromatography, the mixture was diluted with $Et_2O$ and washed with water. As a general note, α-amino ketone **3** showed to be relatively unstable compounds and they have to be stored under nitrogen at low temperature.

### General procedure for the kinetic resolution of 1a-(±) with thiol 5

A sample vial was charged with nitroepoxide **1a-(±)** (17.9 mg, 0.10 mmol), $K_2CO_3$ (2.8 mg, 0.02 mmol) and catalyst **VI** (8.5 mg, 0.015 mmol) in anhydrous toluene (1 mL). Then, 2-naphthalenethiol (19.2 mg, 0.12 mmol) was added and the reaction stirred at room temperature for 70 h, monitored by TLC (eluent PE/ diethyl ether 95:5). The enantioenriched α-nitroepoxide **1a** (4.5 mg, 25% yield) and product **6 (**21.3 mg, 73% yield) were isolated by flash chromatography (eluting from PE/ diethyl ether 100:1 to 80:20).

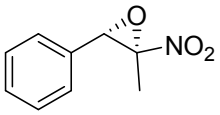
**General procedure for the kinetic resolution of 1a-(±) with diamine 7**

A sample vial was charged with nitroepoxide **1a-(±)** (26.9 mg, 0.15 mmol) and catalyst **VI** (12.7 mg, 0.022 mmol) in anhydrous toluene (1.5 mL). Then *o*-phenylenediamine (19.5 mg, 0.18 mmol) was added and the reaction was stirred at room temperature for 47 h, monitored by TLC (eluent PE/ diethyl ether 95:5). The enantioenriched α-nitroepoxide **1a** (8.6 mg, 32% yield) and product **8 (**18.5 mg, 56% yield) were isolated by flash chromatography (eluting from PE/ diethyl ether 100:2 to 90:10).

**General procedure for one-pot stereoselective ring-opening/reduction sequence to amino alcohol 4a**

To a solution of nitroepoxide **1a-(±)** (22.6 mg, 0.126 mmol) in dry $CHCl_3$ (315 μL), pyrrolidine (21 μL, 0.252 mmol) was added at 0°C. The resulting mixture was stirred for 6 hours at 0 °C (TLC eluent PE/ diethyl ether 95:5). After completion, dry MeOH (105 μL) was added at 0 °C, followed by dry $CeCl_3$ (31.1 mg, 0.126 mmol, finely ground $CeCl_3 \bullet 7H_2O$ dried at 100°C under vacuum overnight). The reaction mixture was stirred for 10 min at the same temperature and then $NaBH_4$ (4.8 mg, 0.126 mmol) was added. After stirring at 0 °C for 2.5 h, a second portion of $NaBH_4$ (4.8 mg, 0.126 mmol) and $CeCl_3$ (31.1 mg, 0.126 mmol) was added, and stirring continued for additional 3 h. After complete conversion of the ketone to the alcohol (TLC eluent ethyl acetate/ MeOH 10 mL : 1 mL with 6 drops of $NH_4OH$, stained with permanganate) the reaction was quenched by diluting with brine (20 mL) and extracting with ethyl acetate (3x20 mL). The combined organic layers were washed with brine, dried over anhydrous $Na_2SO_4$ and concentrated under reduced pressure. Purification by flash chromatography eluting with $CH_2Cl_2$ and then with diethyl ether afforded *anti*-1,2-amino alcohol **4a** in 78% yield (20.2 mg). Absolute configuration of (1*R*,2*S*)-1-phenyl-1-(pyrrolidin-1-yl)propan-2-ol **4a** was determined by comparison of optical rotation with the literature.[6] The absolute configuration of α-nitroepoxide **1a** was assigned to be (2*R*,3*S*) and the absolute configuration of α-nitroepoxides **1** was assigned to be (2*R*,3*S*) by analogy.

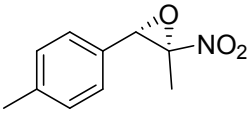
**(*2R*, *3S*)-2-Methyl-2-nitro-3-phenyloxirane (1a)**



Data for this compound were consistent with those reported in the literature.[5c]

Yellow oil, 10 mg, 28 % yield. $[\alpha]_D^{17}$ = -36.7 (*c* 0.48, $CHCl_3$), *ee* 72%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 3066, 3035, 2947, 1558, 1451, 1357, 1159, 1107, 901, 770, 754, 703, 602. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.46-7.40 (m, 3H), 7.32-7.29 (m, 2H), 4.54 (s, 1H), 1.80 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 130.9, 129.4, 128.7, 126.4, 88.9, 62.6, 12.4. HPLC analysis with Chiralpak AS-H column, 95:5 *n*-hexane:2-propanol, 1 mL/min, 254 nm; minor enantiomer $t_R$ = 6.1 min, major enantiomer $t_R$ = 6.8 min.

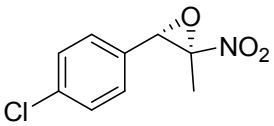
**(*2R*, *3S*)-2-Methyl-2-nitro-3-p-tolyloxirane (1e)**



Data for this compound were consistent with those reported in the literature.[5c]

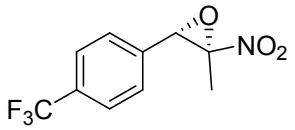
Yellow oil, 6.6 mg, 17% yield. $[\alpha]_D^{24}$ = -33.5 (*c* 0.50, $CHCl_3$), *ee* 84%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 3028, 2925, 1559, 1452, 1346, 1159, 1106, 903, 848, 817, 772. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.25-7.16 (m, 4H), 4.50 (s, 1H), 2.38 (s, 3H), 1.80 (d, 3H, *J*= 1.3 Hz). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 139.5, 129.4, 127.9, 126.3, 89.0, 62.8, 21.3, 12.4. **MS** (ESI *m/z*) 216.5 [$MNa^+$, 12%]. HPLC analysis with Chiralpak IE-3 column, 98:2 *n*-hexane:2-propanol, 0.7 mL/min, 220 nm; minor enantiomer $t_R$ = 16.2 min, major enantiomer $t_R$ = 14.2 min.

**(*2R*, *3S*)-3-(4-Chlorophenyl)-2-methyl-2-nitrooxirane (1f)**



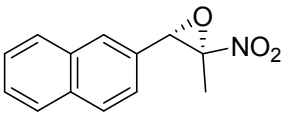
White solid, 12.4 mg, 29% yield. **Mp** 55.9-57.9 °C. $[\alpha]_D^{22}$ = -53.8 (*c* 0.65, $CHCl_3$), *ee* 86%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 1561, 1495, 1436, 1352, 1159, 1091, 1015, 900, 763. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.41 (d, 2H, *J*= 8.2 Hz), 7.25 (d, 2H, *J*= 8.2 Hz), 4.52 (s, 1H), 1.79 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 135.6, 129.4, 129.1, 127.8, 88.6, 62.0, 12.4. Elemental analysis calcd (%) for $C_9H_8ClNO_3$: C, 50.60; H, 3.77; N, 6.56; found C, 50.89; H, 3.97; N, 6.60. HPLC analysis with Chiralpak AS-H column, 90:10 *n*-hexane:2-propanol, 1 mL/min, 220 nm; minor enantiomer $t_R$ = 6.9 min, major enantiomer $t_R$ = 7.5 min.

**(*2R*, *3S*)-2-Methyl-2-nitro-3-(4-(trifluoromethyl)phenyl)oxirane (1g)**



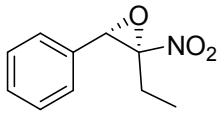

Yellow solid, 18 mg, 36% yield. **Mp** 58.2-62.6 °C. **[α]$_D^{23}$** = -30.9 (*c* 0.53, $CHCl_3$), *ee* 77%. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 1561, 1325, 1167, 1127, 1067, 1019, 857, 832. **$^1$H NMR** ($CDCl_3$, 250 MHz): $\delta$ 7.69 (d, 2H, *J*= 8.1 Hz), 7.45 (d, 2H, *J*= 8.1 Hz), 4.61 (s, 1H), 1.78 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 134.9, 131.7 (q, $^2J_{(C\text{-}C\text{-}F)}$= 32.8 Hz), 126.9, 125.9, 125.8, 123.6 (q, $^1J_{(C\text{-}F)}$= 271.0 Hz), 88.5, 61.8, 12.4. **MS** (ESI *m/z*) 285.6 [MK$^+$, 20%]. Elemental analysis calcd (%) for $C_{10}H_8F_3NO_3$: C, 48.59; H, 3.26; N, 5.67; found C, 48.94; H, 3.48; N, 5.40. HPLC analysis with Chiralpak IE-3 column, 98:2 *n*-hexane:2-propanol, 0.7 mL/min, 220 nm; minor enantiomer $t_R$ = 18.4 min, major enantiomer $t_R$ = 13.2 min.

**(*2R*, *3S*)-2-Methyl-3-(naphthalen-2-yl)-2-nitrooxirane (1h)**




Pale yellow solid, 11.9 mg, 26% yield. **Mp** 63.8-65.7 °C. **[α]$_D^{20}$** = -72.2 (*c* 0.67, $CHCl_3$), *ee* 95%. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3057, 2925, 1559, 1343, 1105, 893, 861, 821, 756. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.92-7.85 (m, 3H), 7.79 (s, 1H), 7.58-7.53 (m, 2H), 7.39 (dd, 1H, $J_1$= 8.4 Hz, $J_2$= 1.5 Hz), 4.71 (s, 1H), 1.83 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 133.6, 132.8, 128.8, 128.3, 128.0, 127.9, 126.9, 126.1, 123.2, 80.0, 62.9, 12.5. **MS** (ESI *m/z*) 230.0 [MH$^+$, 6%], 248.6 [M+$H_3O^+$, 38%]. Elemental analysis calcd (%) for $C_{13}H_{11}NO_3$: C, 68.11; H, 4.84; N, 6.11; found C, 68.44; H, 5.10; N, 6.24. HPLC analysis with Chiralpak IE-3 column, 98:2 *n*-hexane:2-propanol, 0.7 mL/min, 254 nm; minor enantiomer $t_R$ = 24.7 min, major enantiomer $t_R$ = 20.3 min.

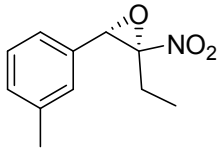
**(*2R*, *3S*)-2-Ethyl-2-nitro-3-phenyloxirane (1i)**




Yellow oil, 8 mg, 21% yield. **[α]$_D^{22}$** = -25.1 (*c* 0.67, $CHCl_3$), *ee* 92%. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 2918, 1557, 1458, 1435, 1351, 938, 813, 768. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.44-7.38 (m, 3H), 7.33-7.29 (m, 2H), 4.52 (s, 1H), 2.55-2.41 (m, 1H), 1.69 (dq, 1H, $J_1$= 15.1 Hz, $J_2$= 7.3 Hz), 1.07 (t, 3H, $J_1$= 7.4 Hz). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 131.1, 129.4, 128.7, 126.3, 92.5, 63.2, 19.5, 7.6. **MS** (ESI *m/z*) 193.8 [MH$^+$, 7%], 216.5 [MNa$^+$, 15%]. Elemental analysis calcd (%) for $C_{10}H_{11}NO_3$: C, 62.17; H, 5.74; N, 7.25; found C, 62.46; H, 5.50; N, 7.48. HPLC analysis with Chiralpak IE-3

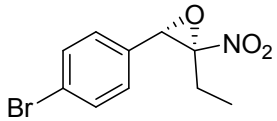
column, 98:2 *n*-hexane:2-propanol, 0.7 mL/min, 220 nm; minor enantiomer $t_R$ = 13.7 min, major enantiomer $t_R$ = 11.9 min.

**(*2R*, *3S*)-2-Ethyl-2-nitro-3-m-tolyloxirane (1j)**



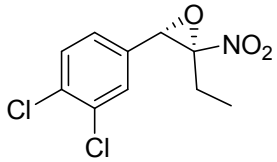
Yellow oil, 12.8 mg, 31% yield. **[α]$_D^{23}$** = -30.6 (*c* 0.57, $CHCl_3$), *ee* 92%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 2984, 2945, 1559, 1462, 1435, 1351, 1152, 1083, 969, 815, 790. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.30 (t, 1H, *J*= 7.5 Hz), 7.23-7.18 (m, 1H), 7.12-7.07 (m, 2H), 4.47 (s, 1H), 2.48 (dq, 1H, $J_1$= 15.1 Hz, $J_2$= 7.4 Hz), 2.38 (s, 3H), 1.69 (dq, 1H, $J_1$= 15.1 Hz, $J_2$= 7.4 Hz), 1.08 (t, 3H, *J*= 7.4 Hz). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 138.6, 131.0, 130.1, 128.6, 126.9, 123.3, 92.6, 63.3, 21.4, 19.5, 7.6. **MS** (ESI *m/z*) 207.9 [$MH^+$, 8%], 230.5 [$MNa^+$, 10%]. Elemental analysis calcd (%) for $C_{11}H_{13}NO_3$: C, 63.76; H, 6.32; N, 6.76; found C, 64.07; H, 6.53; N, 6.63. HPLC analysis with Chiralpak IE-3 column, 98:2 *n*-hexane:2-propanol, 0.7 mL/min, 254 nm; minor enantiomer $t_R$ = 13.4 min, major enantiomer $t_R$ = 11.6 min.

**(*2R*, *3S*)-3-(4-Bromophenyl)-2-ethyl-2-nitrooxirane (1k)**



White solid, 18.2 mg, 33% yield. **Mp** 59.6-60.3 °C. **[α]$_D^{21}$** = -29.0 (*c* 0.53, $CHCl_3$), *ee* 90%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 2984, 1557, 1489, 1463, 1434, 1346, 1071, 1011, 936, 808. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.56 (d, 2H, *J*= 8.4 Hz), 7.19 (d, 2H, *J*= 8.4 Hz), 4.48 (s, 1H), 2.46 (dq, 1H, $J_1$= 15.1 Hz, $J_2$= 7.4 Hz), 1.66 (dq, 1H, $J_1$= 15.1 Hz, $J_2$= 7.4 Hz), 1.07 (t, 3H, *J*= 7.4 Hz). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 132.0, 130.1, 127.9, 123.7, 92.2, 62.6, 19.5, 7.6. **MS** (ESI *m/z*) 225.8 [$M^+$-$NO_2$, 5%], 261.7 [$M^+$-$NO_2$+$2H_2O$, 20%]. Elemental analysis calcd (%) for $C_{10}H_{10}BrNO_3$: C, 44.14; H, 3.70; N, 5.15; found C, 43.87; H, 3.88; N, 5.37. HPLC analysis with Chiralpak IE-3 column, 98:2 *n*-hexane:2-propanol, 0.7 mL/min, 220 nm; minor enantiomer $t_R$ = 17.4 min, major enantiomer $t_R$ = 14.6 min.

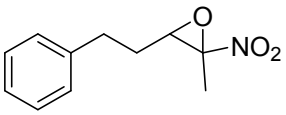
**(*2R*, *3S*)-3-(3,4-Dichlorophenyl)-2-ethyl-2-nitrooxirane (1l)**



Yellow oil, 18.1 mg, 35% yield. **[α]$_D^{25}$** = -18.3 (*c* 0.76, $CHCl_3$), *ee* 61%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 2984, 2944, 1561, 1474, 1435, 1350, 1133, 1033, 944, 811. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.51 (d, 1H, *J*= 8.3 Hz), 7.40 (d, 1H, *J*= 1.9 Hz), 7.16 (dd, 1H, $J_1$= 8.3 Hz, $J_2$= 1.9 Hz), 4.48 (s, 1H), 2.46

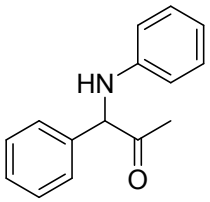
(dq, 1H, $J_1$= 15.1 Hz, $J_2$= 7.4 Hz), 1.65 (dq, 1H, $J_1$= 15.1 Hz, $J_2$= 7.4 Hz), 1.09 (t, 3H, $J$= 7.4 Hz). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 133.8, 133.3, 131.3, 130.9, 128.2, 125.6, 92.0, 61.8, 19.5, 7.6. **MS** (ESI *m/z*) 251.6 [$M^+$-$NO_2$+2$H_2O$, 100%]. Elemental analysis calcd (%) for $C_{10}H_9Cl_2NO_3$: C, 45.83; H, 3.46; N, 5.34; found C, 46.16; H, 3.24; N, 5.55. HPLC analysis with Chiralpak IE-3 column, 98:2 *n*-hexane:2-propanol, 0.7 mL/min, 254 nm; minor enantiomer $t_R$ = 17.3 min, major enantiomer $t_R$ = 13.5 min.

**2-Methyl-2-nitro-3-phenethyloxirane (1m)**




Yellow oil, 14.5 mg, 35% yield. **$[\alpha]_D^{25}$** = -4.6 (*c* 0.88, $CHCl_3$), *ee* 16%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 3027, 2924, 1557, 1496, 1455, 1388, 1357, 1112, 1083, 751, 699. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.35-7.24 (m, 3H), 7.21-7.16 (m, 2H), 3.48 (t, 1H, $J$= 6.3 Hz), 2.95-2.87 (m, 1H), 2.83-2.74 (m, 1H), 2.06-1.95 (m, 1H), 1.93-1.83 (m, 1H), 1.74 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 139.6, 128.8, 128.3, 126.7, 62.4, 31.9, 29.8, 13.5. Elemental analysis calcd (%) for $C_{11}H_{13}NO_3$: C, 63.76; H, 6.32; N, 6.76; found C, 64.11; H, 6.58; N, 6.65. HPLC analysis with Chiralpak AS-H column, 99:1 *n*-hexane:2-propanol, 0.8 mL/min, 220 nm; minor enantiomer $t_R$ = 12.7 min, major enantiomer $t_R$ = 11.5 min.

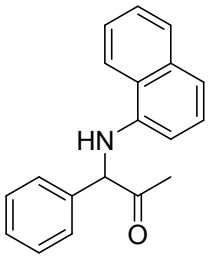
**1-Phenyl-1-(phenylamino)propan-2-one (3a)**




Data for this compound were consistent with those reported in the literature.[7]

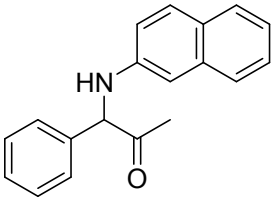
Wax, 29.3 mg, 65% yield. **$[\alpha]_D^{27}$** = +27.9 (*c* 0.50, $CHCl_3$), *ee* 16%. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 3393, 2863, 1714, 1600, 1505, 1312, 1230, 1165, 745, 692. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.55-7.32 (m, 5H), 7.13-7.06 (m, 2H), 6.73-6.66 (m, 1H), 6.63-6.57 (m, 2H), 5.01 (brd, 1H), 2.14 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 203.8, 145.4, 137.6, 129.7, 129.2, 129.1, 128.8, 127.8, 118.0, 113.7, 68.4, 26.7. **MS** (ESI *m/z*) 248.5 [$MNa^+$, 10%]. HPLC analysis with Chiralpak IE-3 column, 95:5 *n*-hexane:2-propanol, 0.7 mL/min, 254 nm; minor enantiomer $t_R$ = 18.8 min, major enantiomer $t_R$ = 15.6 min.

**1-(naphthalen-1-ylamino)-1-phenylpropan-2-one (3b)**



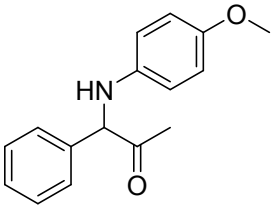

Red solid, 12.4 mg, 30% yield. **Mp** 81 °C (Decomp.). **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3415, 3064, 1715, 1625, 1582, 1526, 1476, 1165, 769, 701. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 8.09 (d, 1H, *J*= 8.2 Hz), 7.76 (d, 1H, *J*= 8.0 Hz), 7.58-7.44 (m, 3H), 7.41-7.29 (m, 3H), 7.20-7.13 (m, 2H), 6.36-6.30 (m, 2H), 5.15 (d, 1H, *J*= 2.7 Hz), 2.20 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 204.0, 140.9, 137.8, 134.3, 129.3, 128.6, 128.5, 127.8, 126.3, 125.8, 124.9, 123.4, 120.2, 117.6, 105.3, 68.2, 26.6. **MS** (ESI *m/z*) 276.7 [MH$^+$, 28%], 298.6 [MNa$^+$, 100%]. Elemental analysis calcd (%) for $C_{19}H_{17}NO$: C, 82.88; H, 6.22; N, 5.09; found C, 83.25; H, 6.47; N, 4.94.

**1-(naphthalen-2-ylamino)-1-phenylpropan-2-one (3c)**




Red solid, 12.8 mg, 31% yield. **Mp** 83 °C (Decomp.). **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3398, 3057, 1714, 1629, 1519, 1482, 1358, 1190, 827, 748, 701. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.64-7.58 (m, 2H), 7.54-7.45 (m, 3H), 7.42-7.37 (m, 2H), 7.34-7.28 (m, 1H), 7.18-7.13 (m, 1H), 6.96 (dd, 1H, $J_1$= 8.8 Hz, $J_2$= 2.5 Hz), 6.63-6.60 (m, 2H), 5.61 (brs, 1H), 5.13 (d, 1H, *J*= 4.3 Hz), 2.18 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 203.9, 143.5, 137.8, 134.8, 129.3, 129.0, 128.5, 127.8, 127.6, 126.2, 125.9, 122.1, 118.1, 105.4, 68.1, 26.7. **MS** (ESI *m/z*) 276.7 [MH$^+$, 26%], 298.6 [MNa$^+$, 100%]. Elemental analysis calcd (%) for $C_{19}H_{17}NO$: C, 82.88; H, 6.22; N, 5.09; found C, 83.22; H, 6.50; N, 4.84.

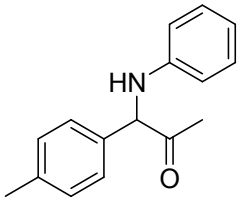
**1-(4-methoxyphenylamino)-1-phenylpropan-2-one (3d)**




Ochre wax, 14.6 mg, 38% yield. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3404, 1719, 1654, 1513, 1239, 1178, 1035, 820, 762, 701. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.48-7.30 (m, 5H), 6.69 (d, 2H, *J*= 8.8 Hz), 6.50 (d, 2H, *J*= 8.8 Hz), 5.15 (brs, 1H), 4.93 (s, 1H), 3.68 (s, 3H), 2.12 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 204.4, 152.1, 140.3, 138.3, 129.2, 128.3, 127.8, 114.8, 114.5, 69.1, 55.7, 26.7. **MS** (ESI

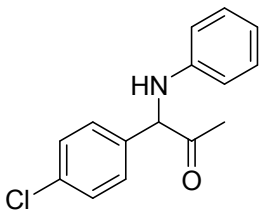
*m/z*) 255.7 [$MH^+$, 13%], 278.0 [$MNa^+$, 16%]. Elemental analysis calcd (%) for $C_{16}H_{17}NO_2$: C, 75.27; H, 6.71; N, 5.49; found C, 75.58; H, 7.00; N, 5.72.

**1-(phenylamino)-1-p-tolylpropan-2-one (3e)**



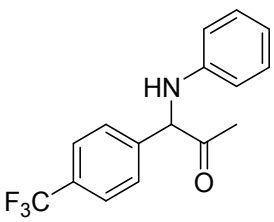

Red wax, 37.8 mg, 79% yield. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 3422, 2921, 1707, 1668, 1601, 1496, 1444, 1314, 1159, 1113, 1030, 901, 823, 744. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.32 (d, 2H, *J*= 7.7 Hz), 7.17 (d, 2H, *J*= 7.7 Hz), 7.13-7.06 (m, 2H), 6.72-6.66 (m, 1H), 6.64-6.58 (m, 2H), 4.99 (brs, 1H), 2.33 (s, 3H), 2.13 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 204.2, 145.8, 138.2, 134.8, 130.4, 129.9, 129.5, 129.1, 127.6, 117.6, 113.3, 67.8, 26.6, 21.1. **MS** (ESI *m/z*) 240.8 [$MH^+$, 10%], 262.8 [$MNa^+$, 14%]. Elemental analysis calcd (%) for $C_{16}H_{17}NO$: C, 80.30; H, 7.16; N, 5.85; found C, 79.98; H, 7.41; N, 6.06.

**1-(4-chlorophenyl)-1-(phenylamino)propan-2-one (3f)**



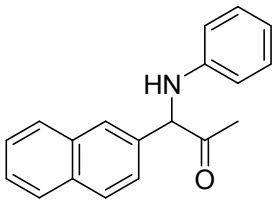

Red wax, 34.9 mg, 67% yield. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 3449, 1715, 1670, 1601, 1542, 1500, 1489, 1441, 1315, 1162, 1091, 836, 752, 693. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.46-7.33 (m, 4H), 7.14-7.07 (m, 2H), 6.70-6.66 (m, 1H), 6.55-6.50 (m, 2H), 4.98 (brs, 1H), 2.14 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 203.2, 145.5, 136.6, 131.7, 129.4, 129.2, 129.1, 117.9, 113.3, 67.4, 26.6. **MS** (ESI *m/z*) 260.5 [$MH^+$, 37%], 282.5 [$MNa^+$, 10%]. Elemental analysis calcd (%) for $C_{15}H_{14}ClNO$: C, 69.36; H, 5.43; N, 5.39; found C, 69.70; H, 5.60; N, 5.21.

**1-(phenylamino)-1-(4-(trifluoromethyl)phenyl)propan-2-one (3g)**



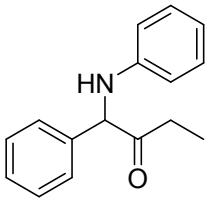
Yellow wax, 28.1 mg, 48% yield. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3392, 3052, 2926, 1721, 1603, 1505, 1417, 1325, 1279, 1166, 1125, 1066, 1017, 845, 751, 692. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.67-7.58 (m, 4H), 7.12-7.07(m, 2H), 6.70-6.66 (m, 1H), 6.53-6.48 (m, 2H), 5.47 (brs, 1H), 5.06 (brs, 1H), 2.16 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 202.7, 145.5, 142.3, 130.7 (q, $^2J_{(C\text{-}C\text{-}F)}$ = 32.3 Hz), 129.3, 128.2, 126.2 (q, $^3J_{(C\text{-}C\text{-}C\text{-}F)}$ = 3.6 Hz), 123.9 (q, $^1J_{(C\text{-}F)}$ = 270.5 Hz), 118.1, 113.3., 67.8, 26.8. **MS** (ESI *m/z*) 293.6 [MH$^+$, 17%], 316.7 [MNa$^+$, 21%]. Elemental analysis calcd (%) for $C_{16}H_{14}F_3NO$: C, 65.52; H, 4.81; N, 4.78; found C,65.79; H, 4.97; N, 4.63.

**1-(naphthalen-2-yl)-1-(phenylamino)propan-2-one (3h)**



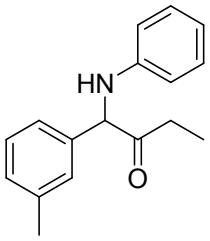

Red wax, 39.6 mg, 72% yield. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3056, 1711, 1667, 1598, 1544, 1496, 1444, 1313, 1232, 1155, 1028, 821, 753, 693. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.99 (s, 1H), 7.93-7.80 (m, 2H), 7.58-7.35 (m, 5H), 7.17-7.05 (m, 2H), 6.70-6.58 (m, 2H), 5.17 (s, 1H), 2.16 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 203.9, 145.9, 135.5, 133.4, 133.2, 129.2, 129.1, 128.3, 127.8, 127.7, 127.3, 126.5, 126.3, 124.9, 117.7, 113.3, 68.3, 26.8. **MS** (ESI *m/z*) 276.6 [MH$^+$, 39%], 298.6 [MNa$^+$, 77%]. Elemental analysis calcd (%) for $C_{19}H_{17}NO$: C, 82.88; H, 6.22; N, 5.09; found C, 82.58; H, 6.38; N, 5.37.

**1-phenyl-1-(phenylamino)butan-2-one (3i)**



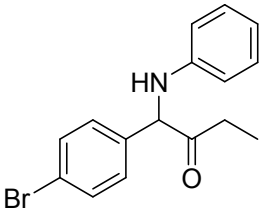

Ochre solid, 28.2 mg, 59% yield. **Mp** 84.2-86.7 °C. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3395, 2923, 1716, 1603, 1504, 1454, 1428, 1317, 1260, 1111, 1034, 749. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.47-7.42 (m, 2H), 7.39-7.34 (m, 3H), 7.30 (d, 1H, *J*= 7.2 Hz), 7.12-7.05 (m, 2H), 6.65 (t, 1H, *J*= 7.3 Hz), 6.57-6.53 (m, 2H), 5.50 (brs, 1H), 5.00 (s, 1H), 2.53-2.40 (m, 2H), 0.99 (t, 3H, *J*= 7.3 Hz). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 206.9, 146.0, 138.3, 129.14, 129.12, 128.3, 127.8, 117.6, 113.3., 67.4, 32.5, 7.86. **MS** (ESI *m/z*) 240.7 [MH$^+$, 18%], 262.6 [MNa$^+$, 43%]. Elemental analysis calcd (%) for $C_{16}H_{17}NO$: C, 80.30; H, 7.16; N, 5.85; found C, 80.57; H, 7.41; N, 6.12.

**1-(phenylamino)-1-m-tolylbutan-2-one (3j)**



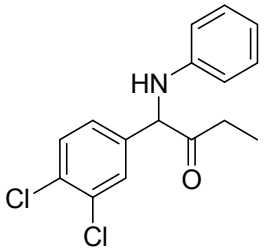

Orange wax, 33.4 mg, 66% yield. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3386, 1716, 1603, 1505, 1428, 1321, 1111, 1035, 749, 692. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.31-7.23 (m, 3H), 7.16-7.08 (m, 3H), 6.68 (t, 1H, *J*= 7.3 Hz), 6.61-6.56 (m, 2H), 5.48 (brs, 1H), 4.98 (s, 1H), 2.48 (q, 2H, *J*= 7.3 Hz), 2.36 (s, 3H), 1.01 (t, 3H, *J*= 7.3 Hz). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 207.1, 146.2, 138.9, 138.3, 129.13, 129.09, 128.95, 128.21, 125.0, 117.5, 113.3, 67.4, 32.4, 21.4, 7.9. **MS** (ESI *m/z*) 276.5 [$MNa^+$, 100%]. Elemental analysis calcd (%) for $C_{17}H_{19}NO$: C, 80.60; H, 7.56; N, 5.53; found C, 80.28; H, 7.81; N, 5.80.

**1-(4-Bromophenyl)-1-(phenylamino)butan-2-one (3k)**




Red wax, 40.7 mg, 64% yield. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3066, 1719, 1602, 1505, 1428, 1404, 1316, 1140, 1111, 1071, 1010, 833, 750, 692. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.50 (d, 2H, *J*= 8.3 Hz), 7.34 (d, 2H, *J*= 8.3 Hz), 7.13-7.05 (m, 2H), 6.67 (t, 1H, *J*= 7.2 Hz), 6.54-6.49 (m, 2H), 4.96 (s, 1H), 2.50-2.40 (m, 2H), 1.00 (t, 3H, *J*= 7.3 Hz). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 206.1, 145.6, 137.4, 132.3, 129.3, 129.1, 122.2, 117.8, 113.3, 66.7, 32.4, 7.8. **MS** (ESI *m/z*) 318.5 [$MH^+$, 45%]. Elemental analysis calcd (%) for $C_{16}H_{16}BrNO$: C, 60.39; H, 5.07; N, 4.40; found C, 60.13; H, 5.28; N, 4.63.

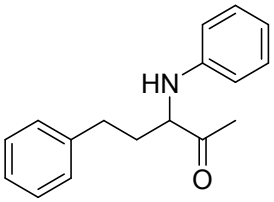
**1-(3,4-Dichlorophenyl)-1-(phenylamino)butan-2-one (3l)**




Red wax, 29 mg, 47% yield. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3390, 1720, 1604, 1505, 1467, 1429, 1394, 1318, 1135, 1031, 752, 740, 692. **$^1$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.56 (s, 1H), 7.48-7.42 (m, 1H), 7.35-7.28 (m, 1H), 7.16-7.07 (m, 2H), 6.70 (t, 1H, *J*= 7.3 Hz), 6.55-6.48 (m, 2H), 5.55 (brs, 1H),

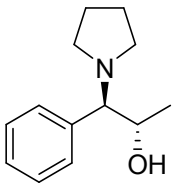
4.95 (s, 1H), 2.53-2.41 (m, 2H), 1.02 (t, 3H, *J*= 7.3 Hz). **$^{13}$C NMR** ($CDCl_3$, 75 MHz): $\delta$ 205.5, 145.4, 138.9, 133.4, 132.5, 131.1, 129.5, 129.2, 127.0, 118.1, 113.3, 66.4, 32.6, 7.7. **MS** (ESI *m/z*) 307.7 [$MH^+$, 19%], 331.4 [$MNa^+$, 12%]. Elemental analysis calcd (%) for $C_{16}H_{15}Cl_2NO$: C, 62.35; H, 4.91; N, 4.54; found C, 62.57; H, 5.07; N, 4.37.

**5-Phenyl-3-(phenylamino)pentan-2-one (3m)**




Yellow oil, 14.2 mg, 28% yield. Aniline and α-amino ketone **3m** have the same polarity. To remove aniline from the mixture of the two products, recovered after silica gel chromatography, the mixture was diluted with $Et_2O$ and washed with water. **FTIR** $\nu_{max}$ (KBr)/$cm^{-1}$ 3441, 2918, 2850, 1705, 1635, 1602, 1506, 1454, 1260, 1093, 799, 748, 693. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.33-7.15 (m, 7H), 6.77-6.72 (m, 1H), 6.59-6.52 (m, 2H), 4.32 (brs, 1H), 4.07-4.02 (m, 1H), 2.94-2.84 (m, 1H), 2.80-2.65 (m, 2H), 2.19 (s, 3H), 2.03-1.93 (m, 1H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 210.0, 146.8, 140.8, 129.4, 128.5, 128.4, 126.2, 118.1, 113.2, 62.8, 33.4, 31.5, 26.4. Elemental analysis calcd (%) for $C_{17}H_{19}NO$: C, 80.60; H, 7.56; N, 5.53; found C, 82.32; H, 7.72; N, 5.70.

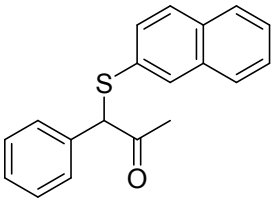
**(1*R*,2*S*)-1-phenyl-1-(pyrrolidin-1-yl)propan-2-ol (4a)**




Data for this compound were consistent with those reported in the literature.[6]

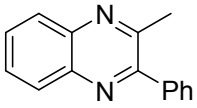
White solid, 20.2 mg, 78% yield. **$[\alpha]_D^{24}$** = -53.0 (*c* 0.82, $CH_2Cl_2$), *ee* 67%. **$^1$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 7.32-7.27 (m, 5H), 4.27-4.21 (m, 1H), 2.99 (d, 1H, *J*= 3.3 Hz), 2.69-2.60 (m, 2H), 2.47-2.40 (m, 2H), 1.79-1.74 (m, 4H), 0.83 (d, 3H, *J*= 6.4 Hz). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 138.4, 129.4, 127.8, 127.4, 75.7, 66.9, 52.8, 23.3, 19.1. HPLC analysis with Chiralcel OD-H column, 99:1 *n*-hexane: ethanol, 1 mL/min, 220 nm; minor enantiomer $t_R$ = 7.5 min, major enantiomer $t_R$ = 8.4 min, *ee* 67 %.

**1-(Naphthalen-2-ylthio)-1-phenylpropan-2-one (6)**




Pink solid, 21.3 mg, 73% yield. **Mp** 70.8-74.3 °C. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 2923, 1712, 1585, 1493, 1454, 1355, 1067, 815, 744, 699, 569. **$^{1}$H NMR** ($CDCl_3$, 300 MHz): $\delta$ 7.81-7.68 (m, 4H), 7.48-7.44 (m, 2H), 7.41-7.31 (m, 6H), 5.10 (s, 1H), 2.21 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 203.1, 135.4, 133.5, 132.5, 131.3, 131.0, 129.3, 128.9, 128.6, 128.5, 128.3, 127.6, 127.5, 126.5, 126.4, 64.4, 27.3. **MS** (ESI *m/z*) 293.4 [$MH^+$, 14%]. Elemental analysis calcd (%) for $C_{19}H_{16}OS$: C, 78.05; H, 5.52; S, 10.97; found C, 78.27; H, 5.34; S, 11.12.

**2-methyl-3-phenylquinoxaline (8)**




Data for this compound were consistent with those reported in the literature.[8]

White wax, 18.5 mg, 56% yield. **FTIR** $\nu_{max}$ (KBr)/cm$^{-1}$ 3060, 2924, 1562, 1483, 1445, 1396, 1374, 1343, 1191, 1132, 1006, 996, 766, 699. **$^{1}$H NMR** ($CDCl_3$, 400 MHz): $\delta$ 8.13-8.10 (m, 1H), 8.07-8.05 (m, 1H), 7.76-7.68 (m, 2H), 7.68-7.63 (m, 2H), 7.56-7.47 (m, 3H), 2.77 (s, 3H). **$^{13}$C NMR** ($CDCl_3$, 100 MHz): $\delta$ 154.9, 152.5, 141.1, 140.9, 138.9, 129.7, 129.21, 129.17, 129.0, 128.9, 128.5, 128.2, 24.3.

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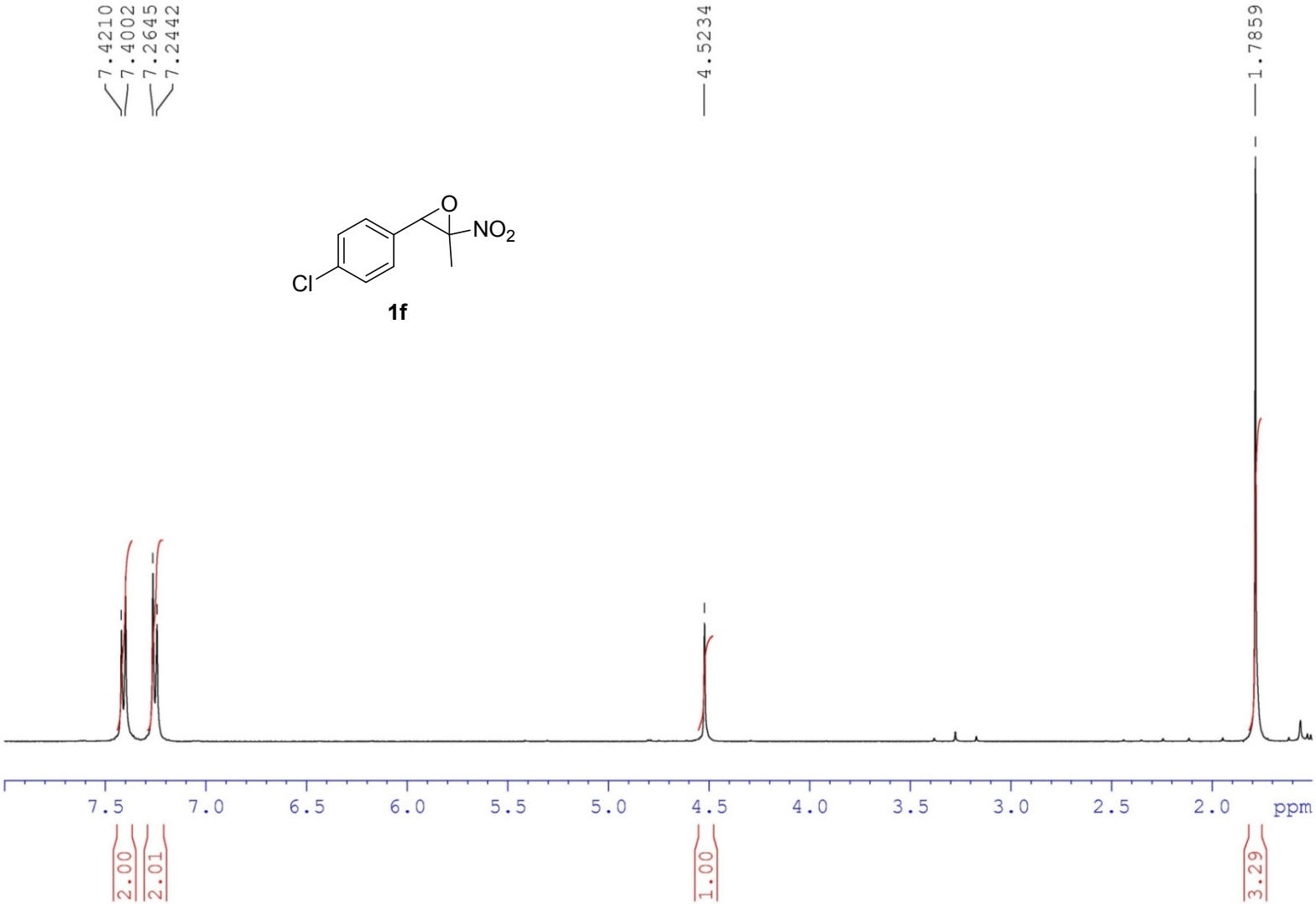
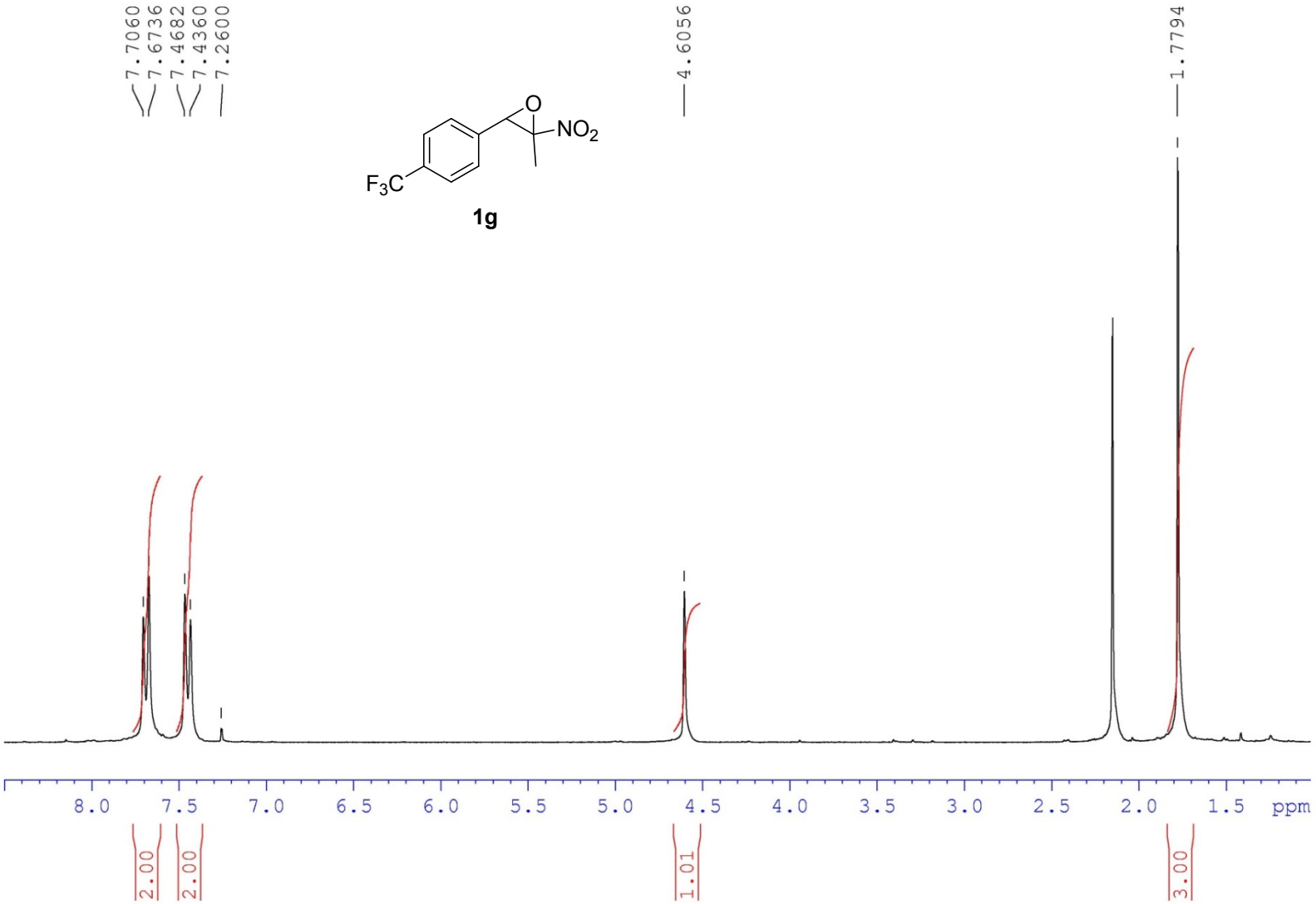
**NMR Spectra**

$^{1}H$ NMR in $CDCl_3$ (400 MHz)

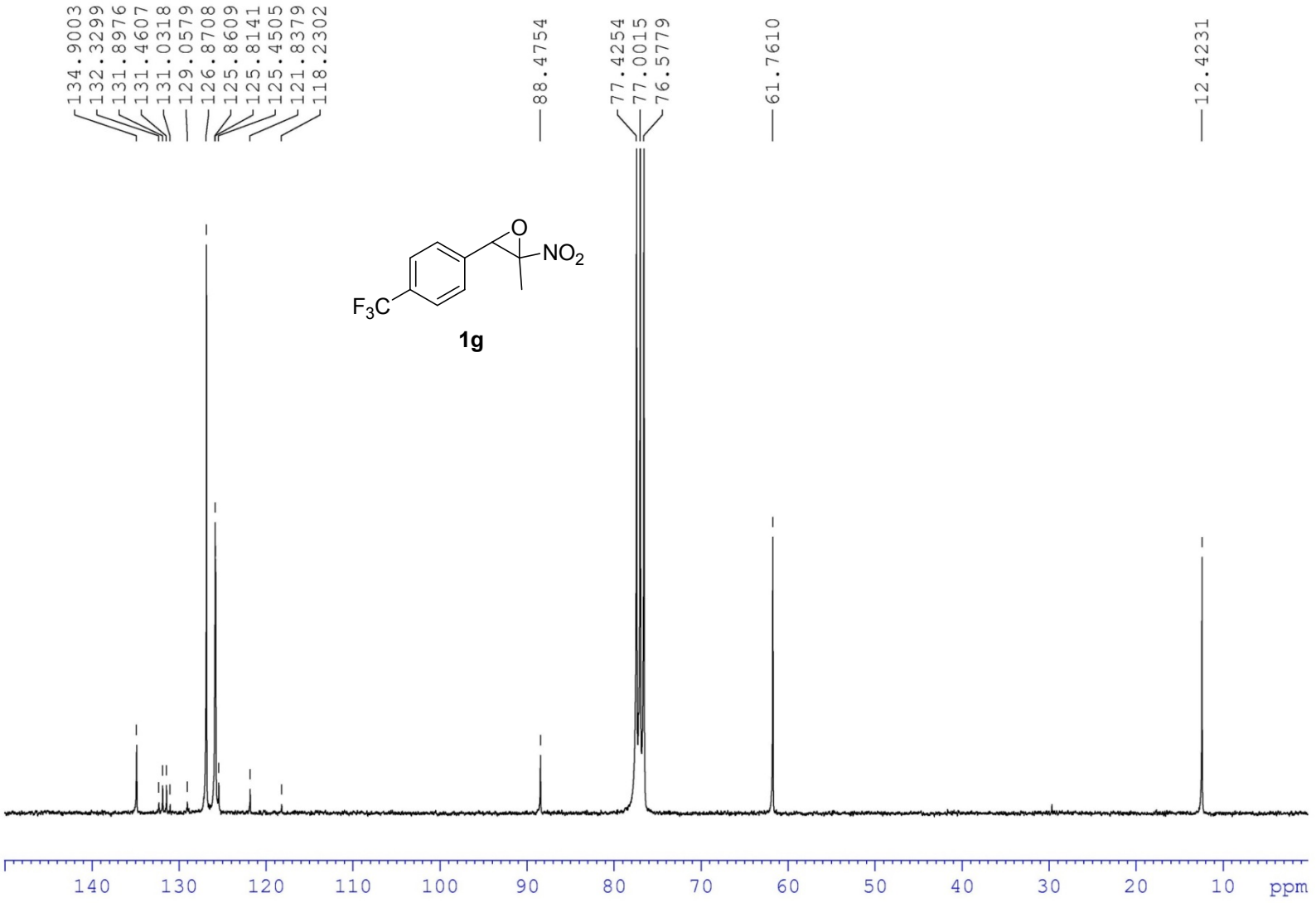


$^{13}C$ NMR in $CDCl_3$ (100 MHz)

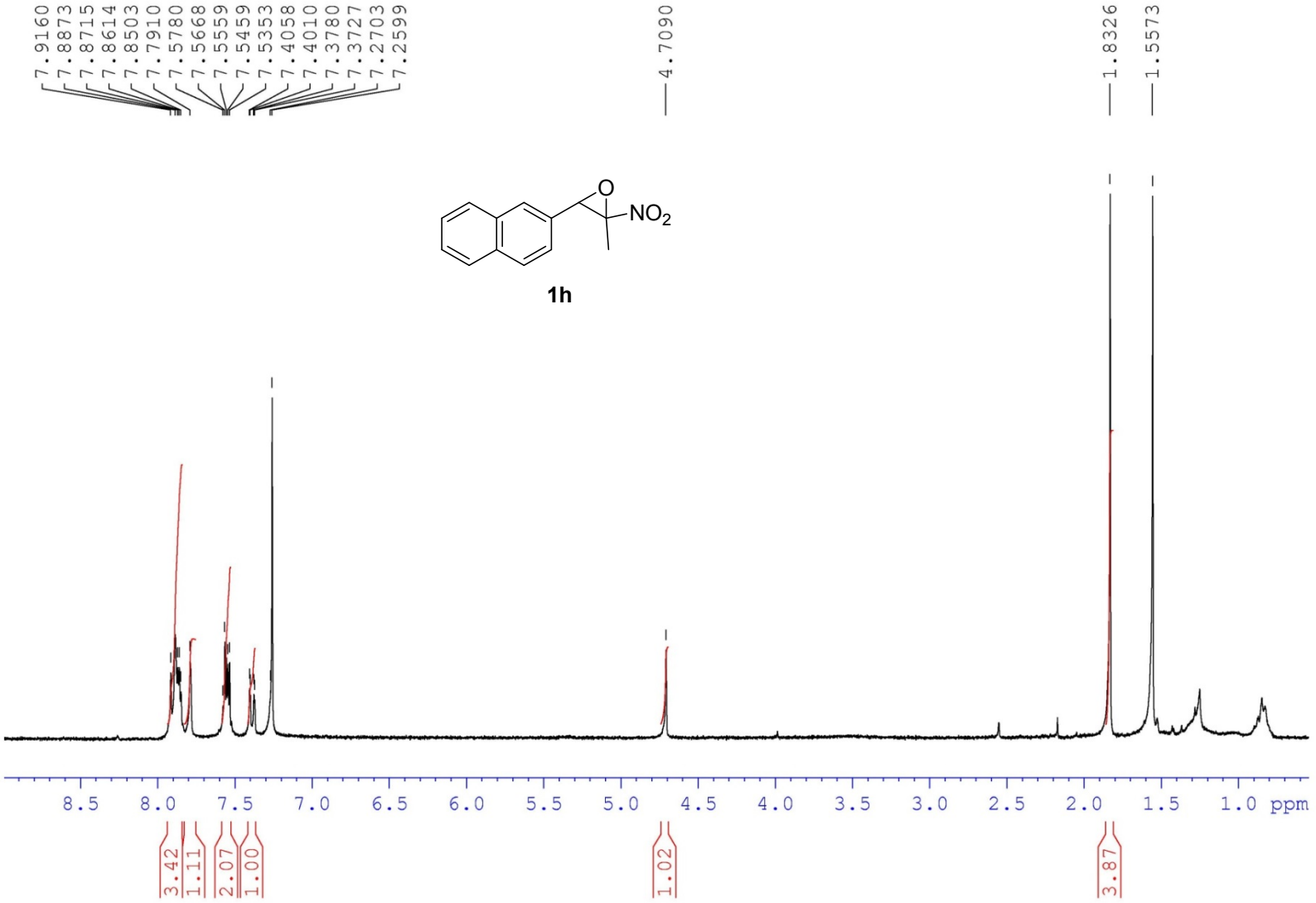
$^{1}$H NMR in $CDCl_3$ (250 MHz)



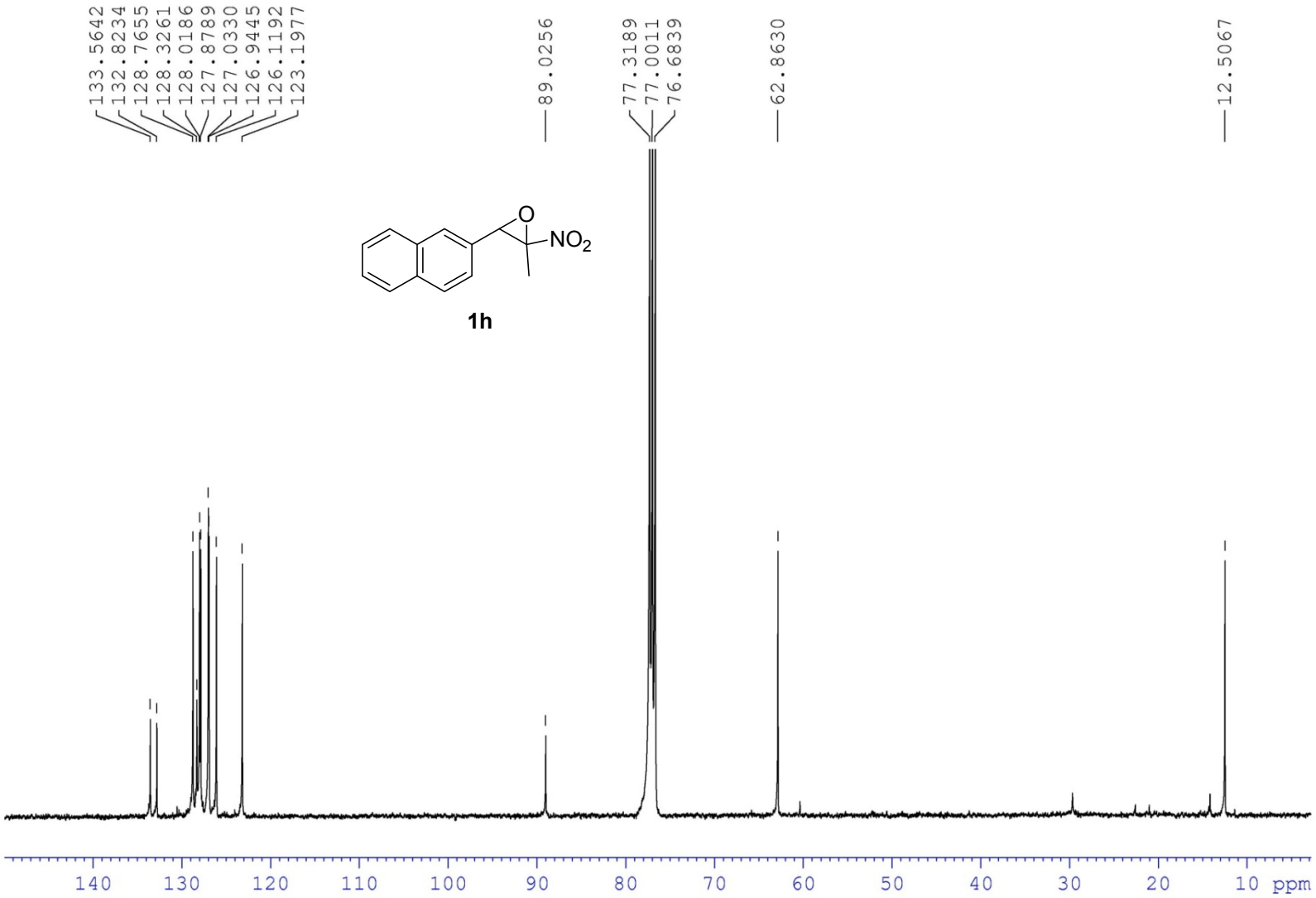
$^{13}C$ NMR in $CDCl_3$ (75 MHz)



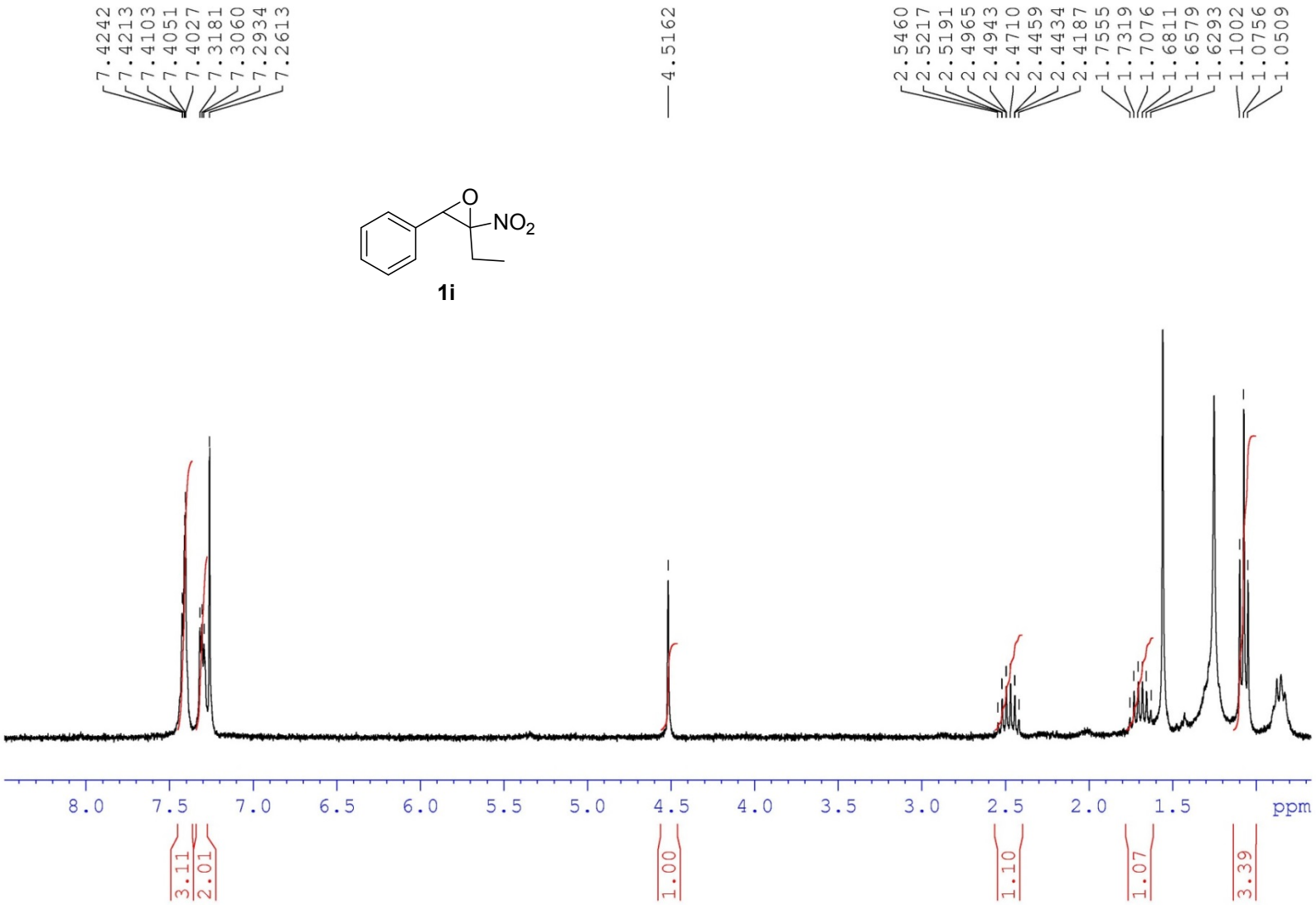
$^{1}$H NMR in $CDCl_3$ (300 MHz)



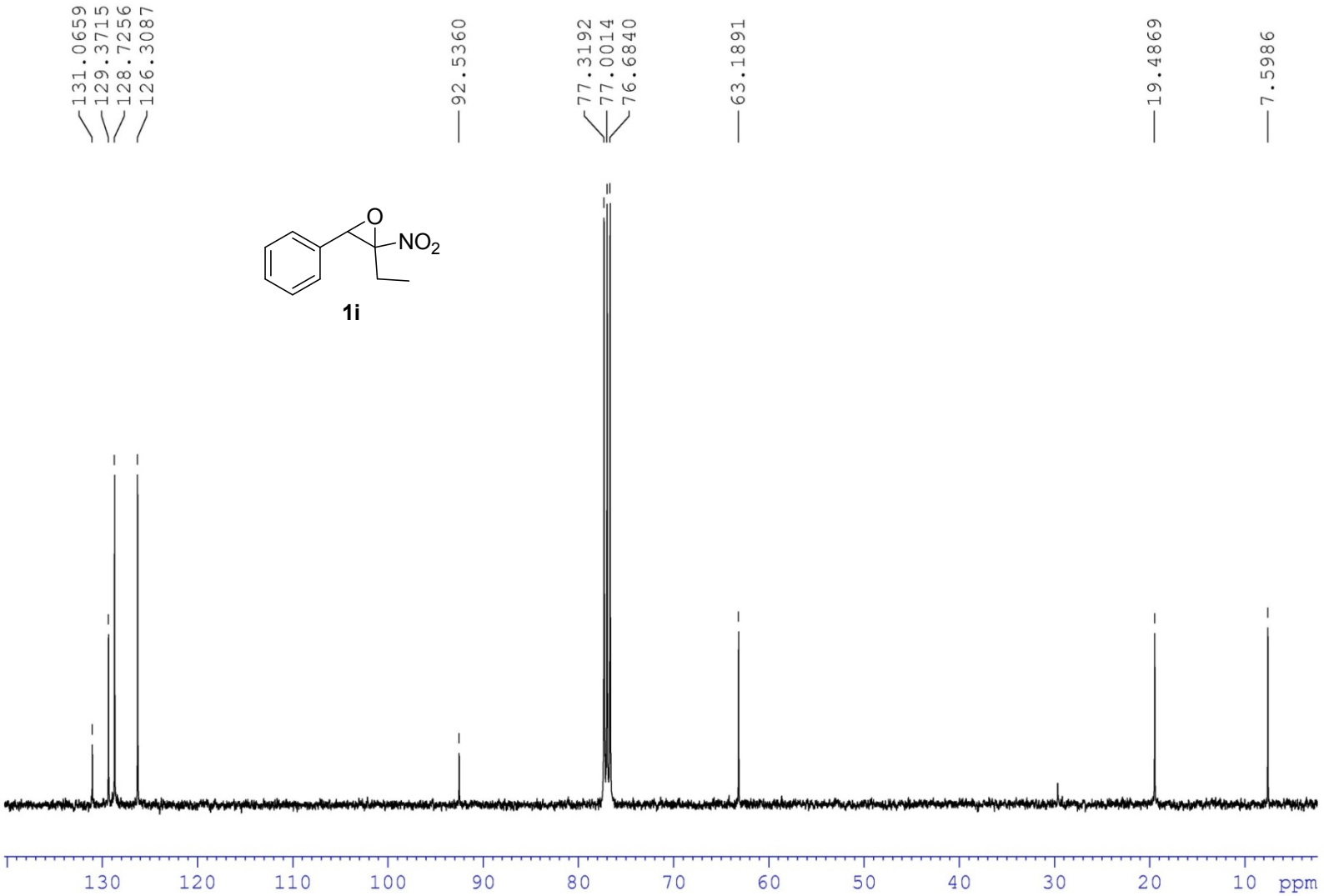
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



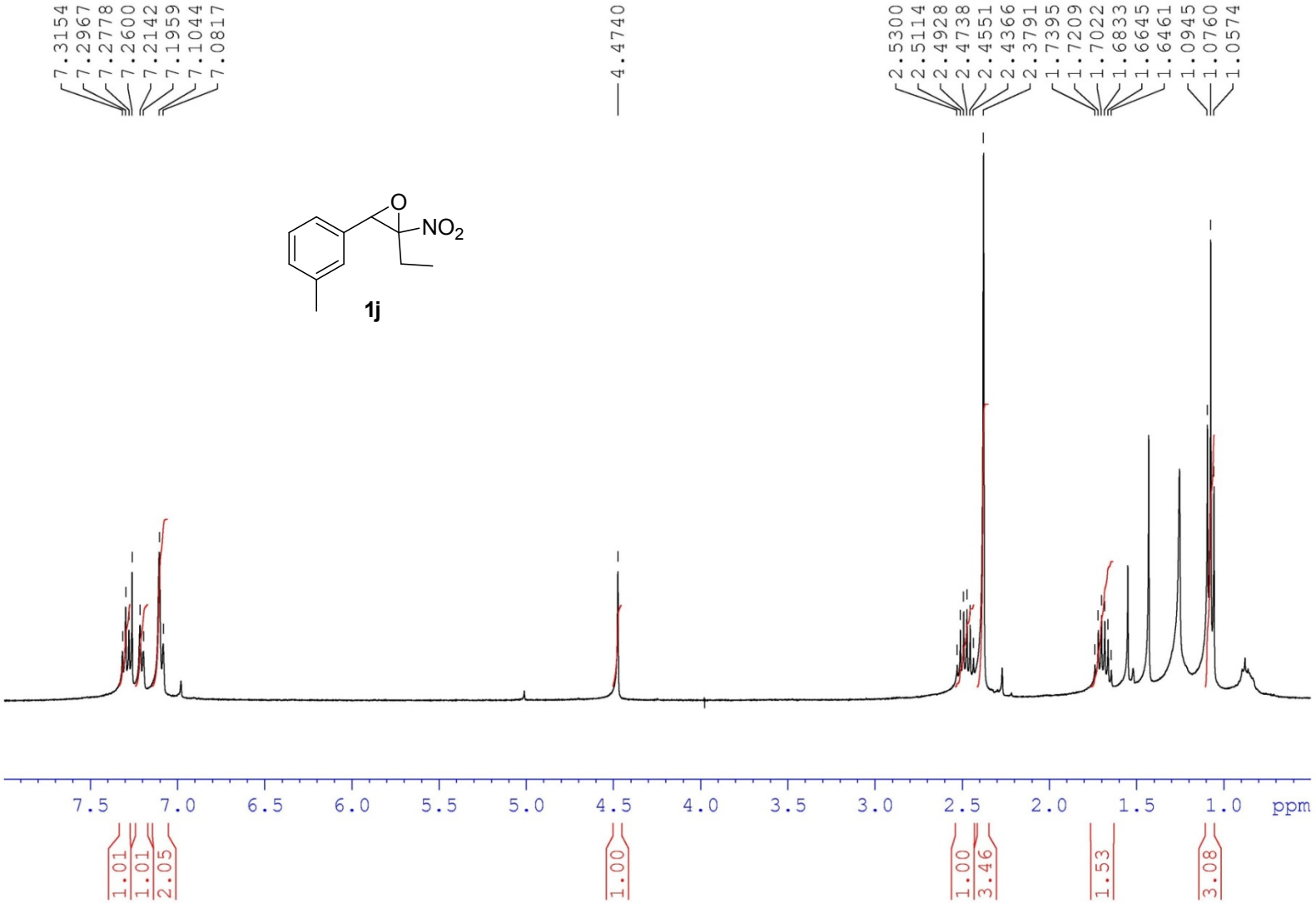
$^{1}H$ NMR in $CDCl_3$ (300 MHz)



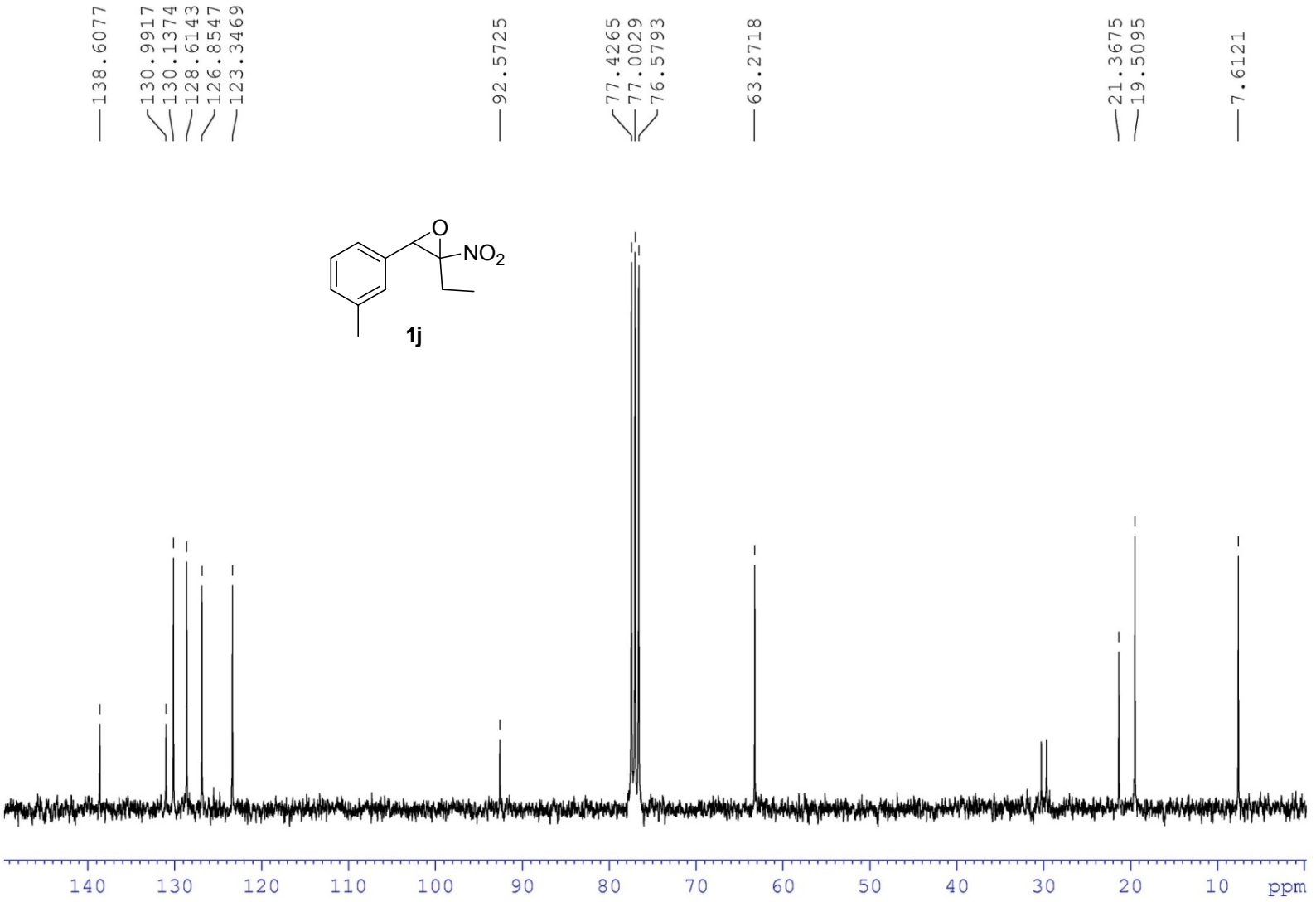
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



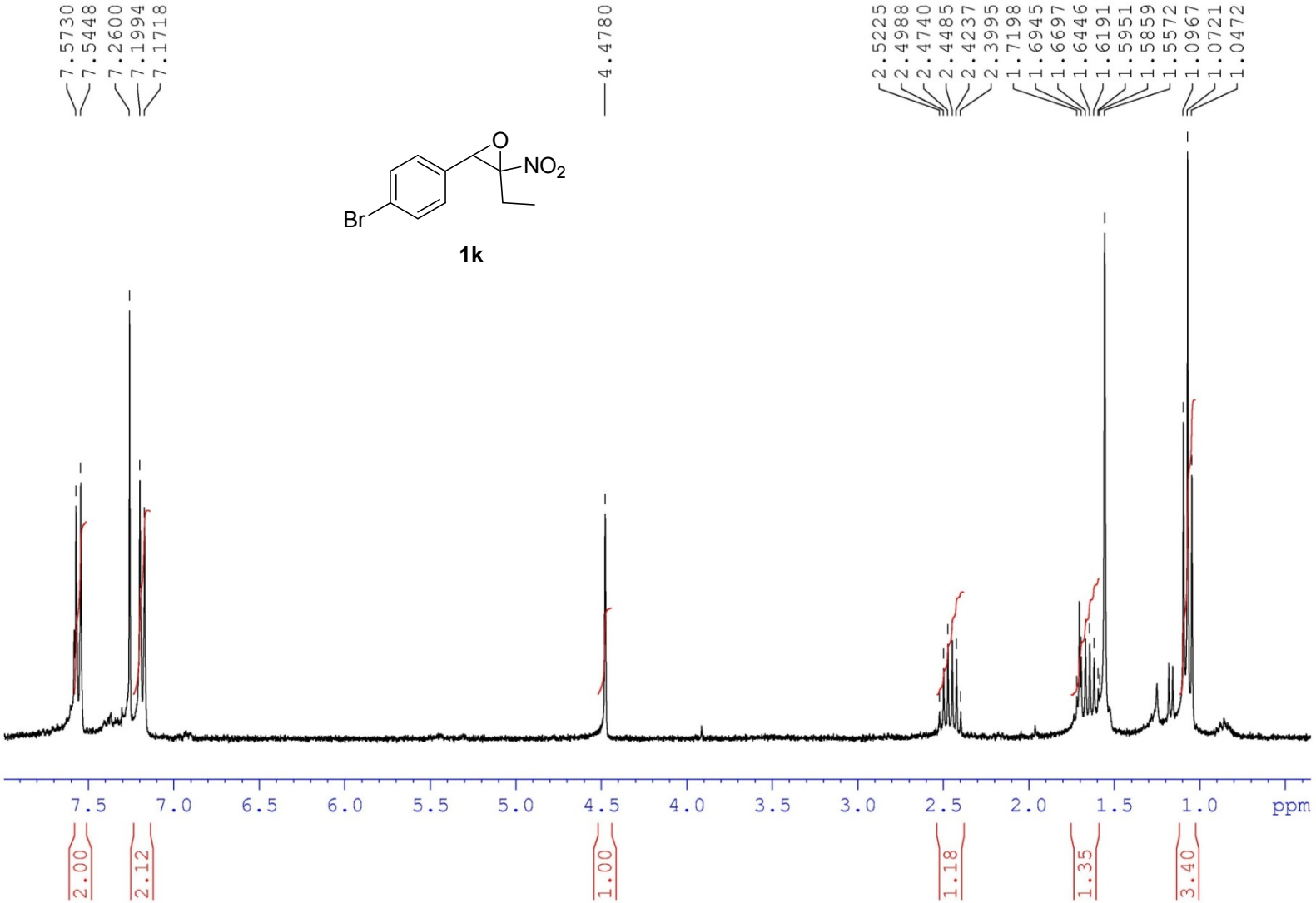
$^{1}$H NMR in $CDCl_3$ (400 MHz)



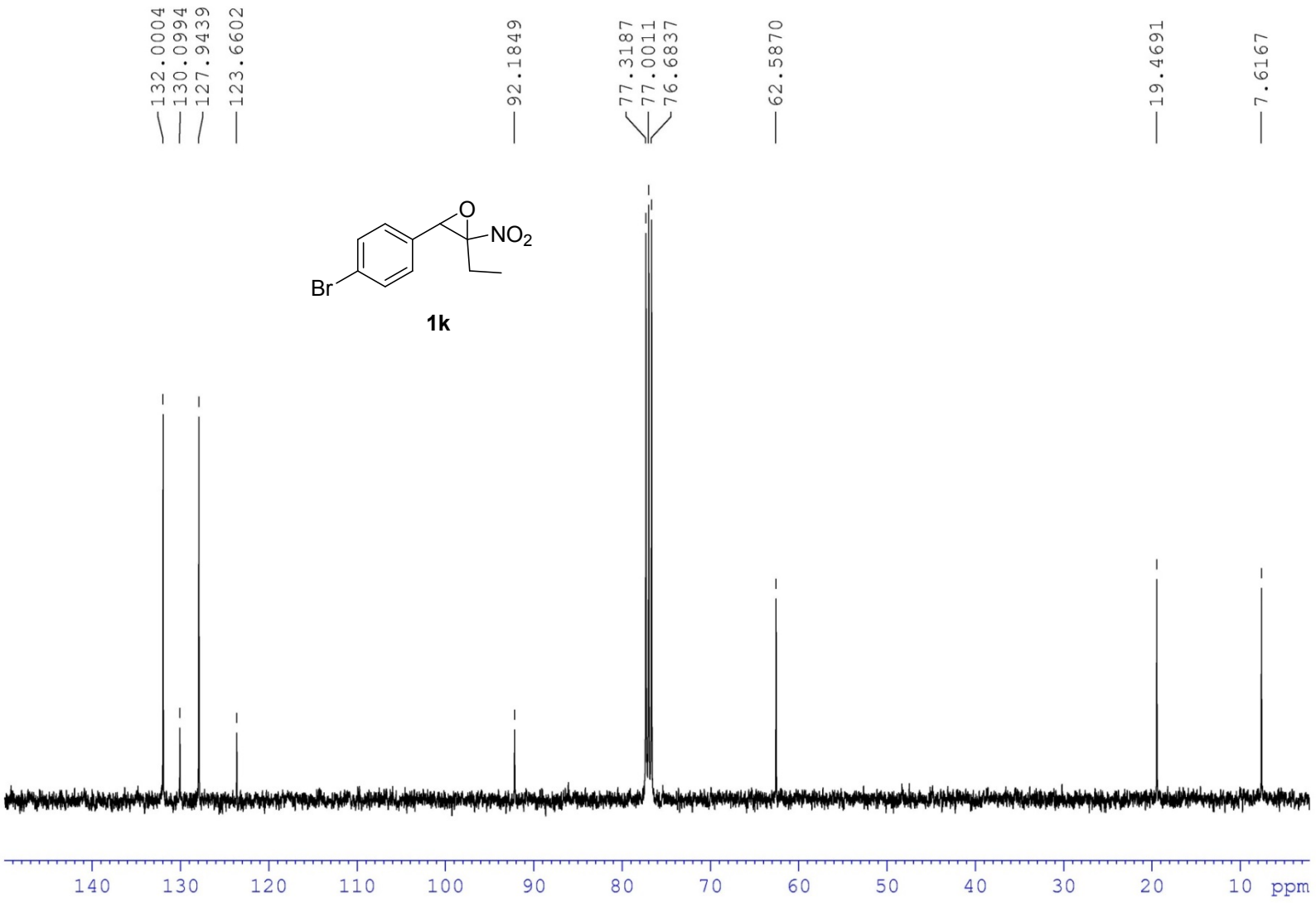
$^{13}C$ NMR in $CDCl_3$ (75 MHz)



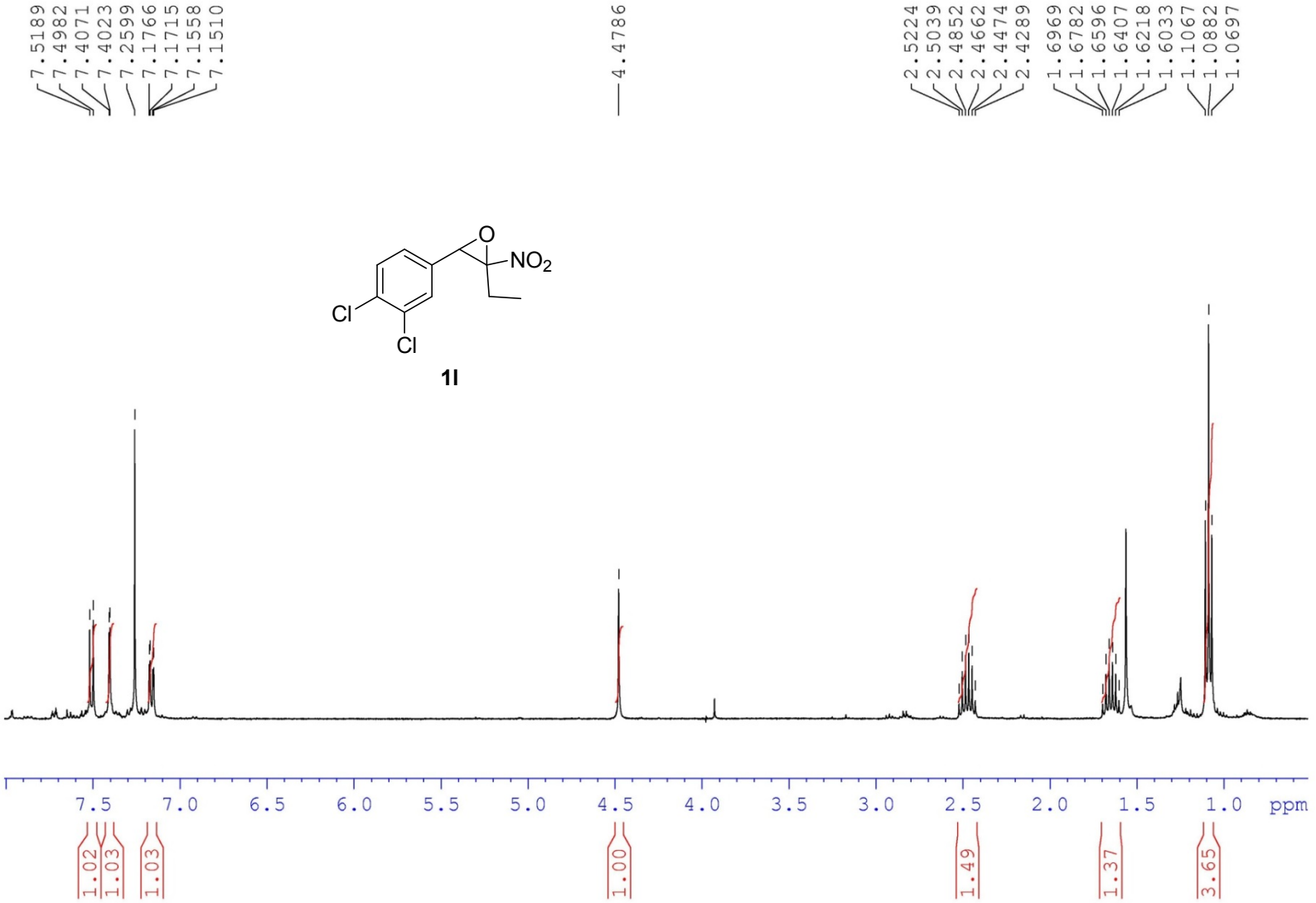
$^{1}$H NMR in $CDCl_3$ (300 MHz)



$^{13}C$ NMR in $CDCl_3$ (100 MHz)

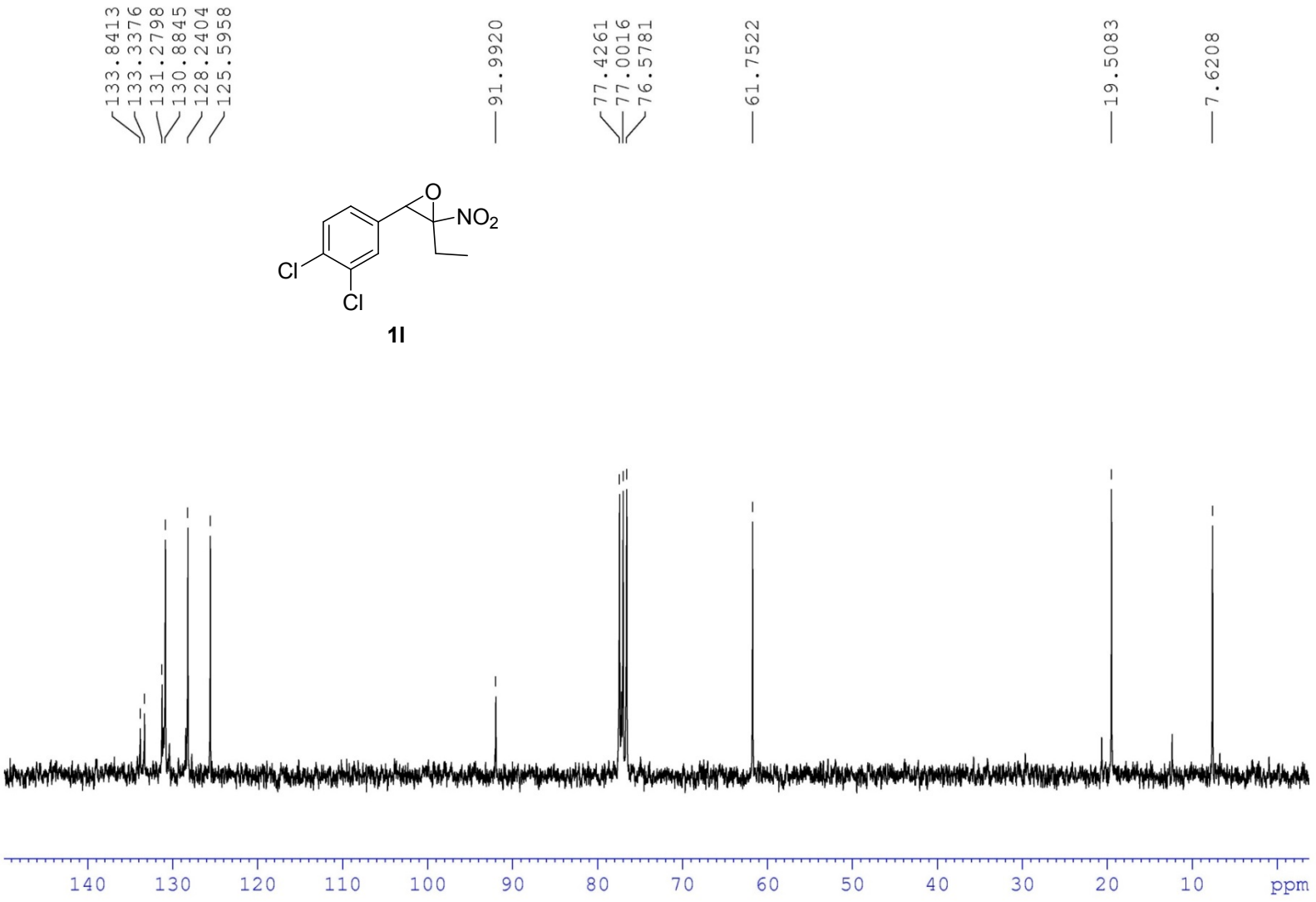


$^{1}$H NMR in $CDCl_3$ (400 MHz)



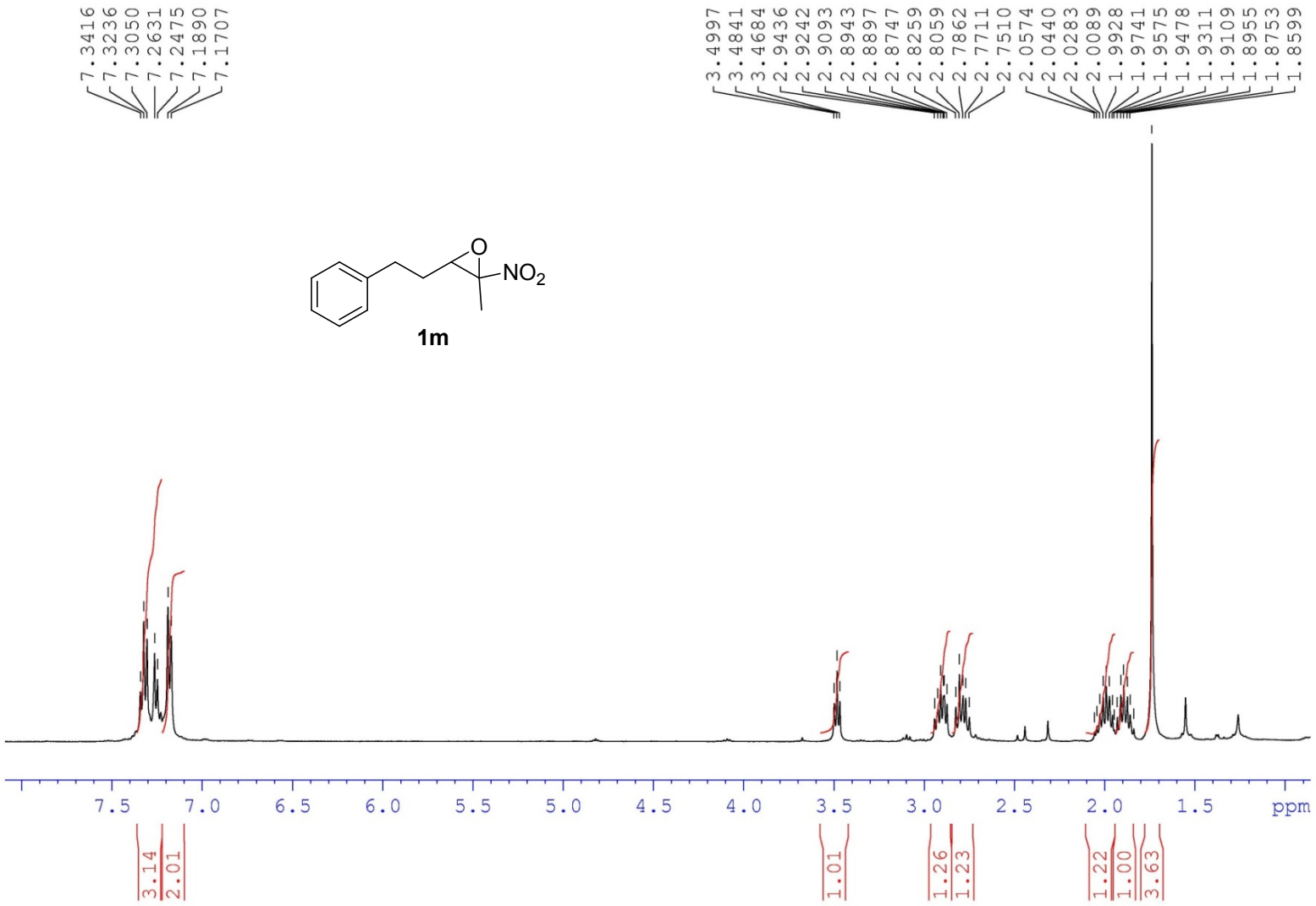

**1l**

$^{13}C$ NMR in $CDCl_3$ (75 MHz)

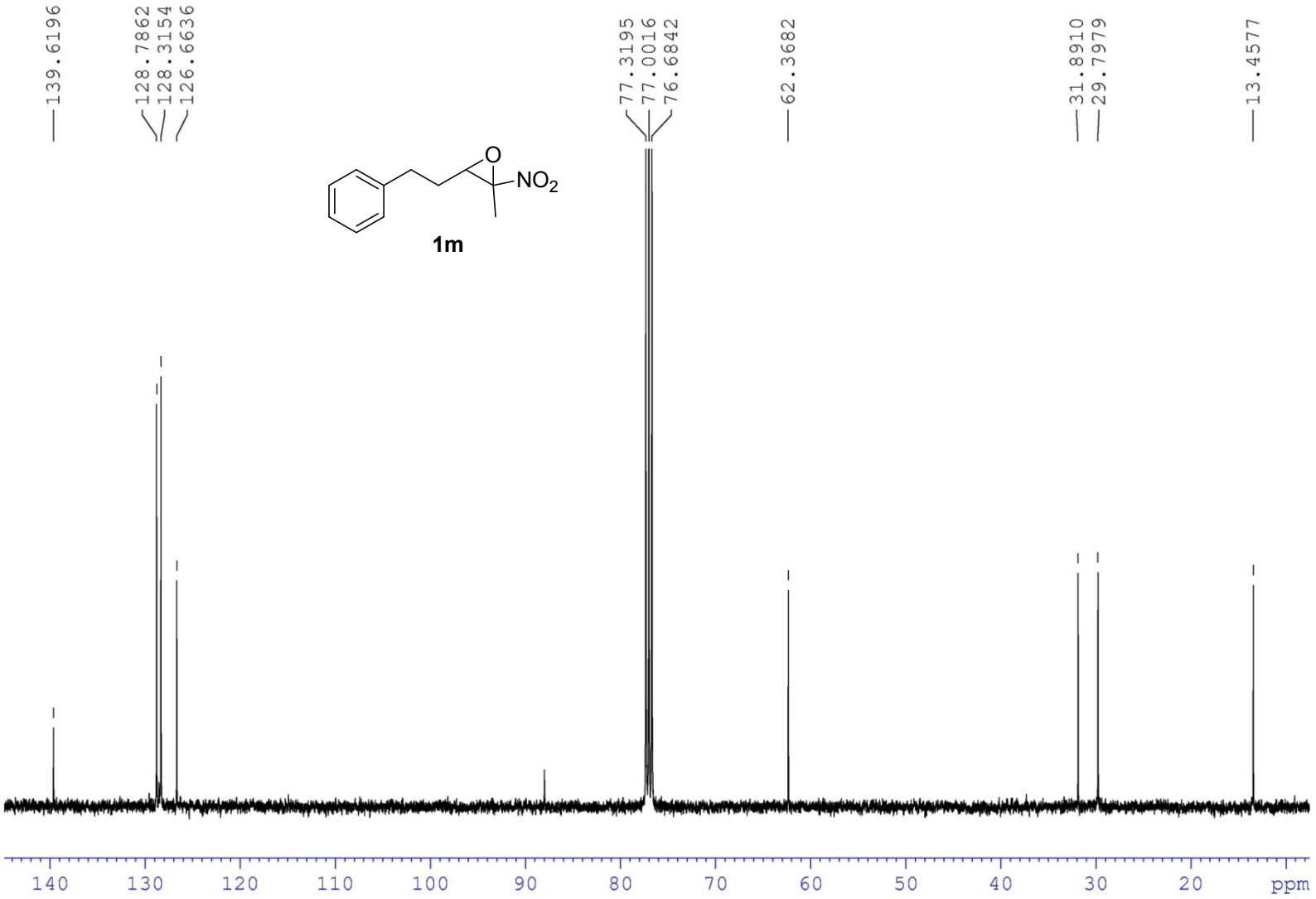



**1l**

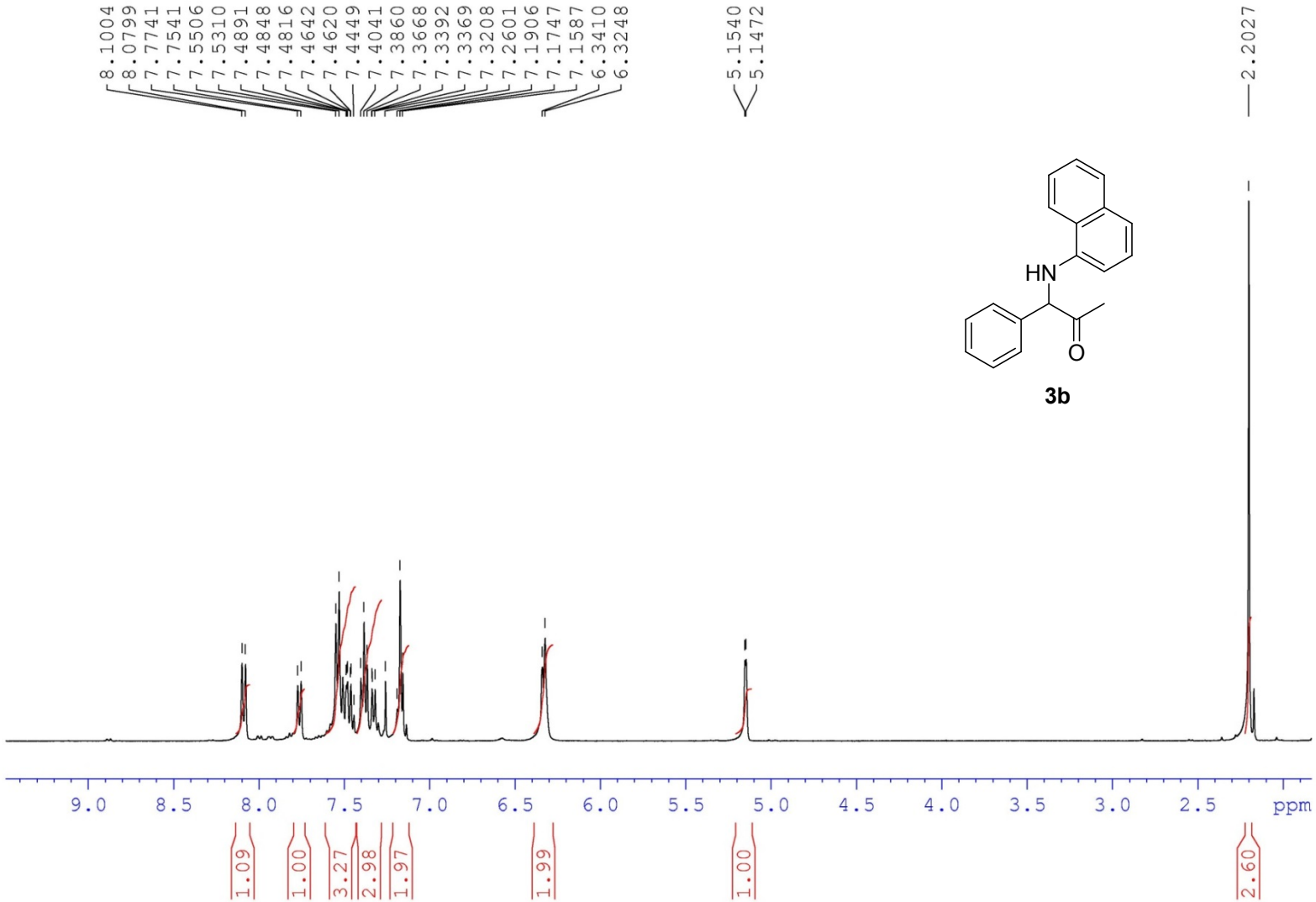
$^{1}$H NMR in $CDCl_3$ (400 MHz)



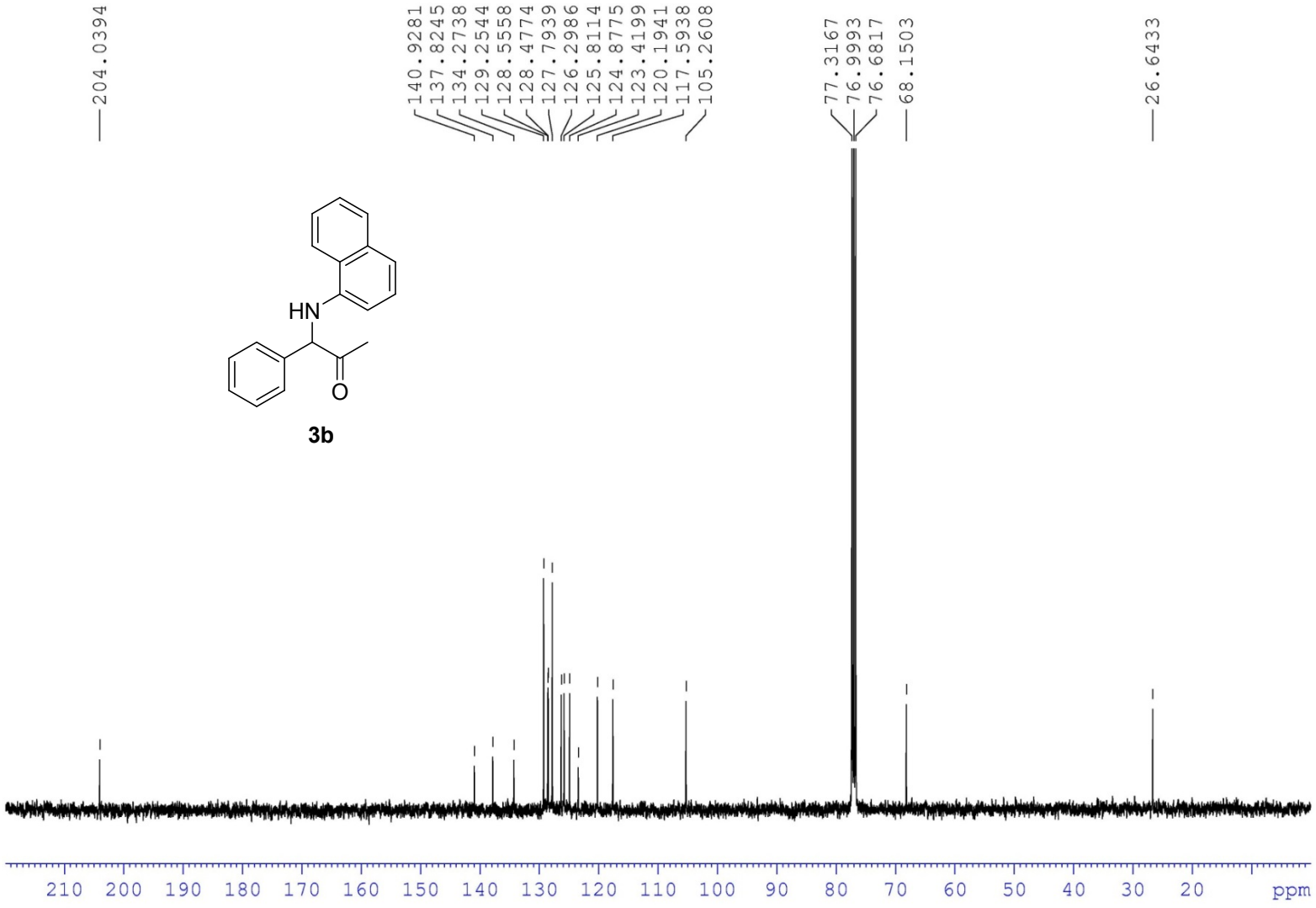
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



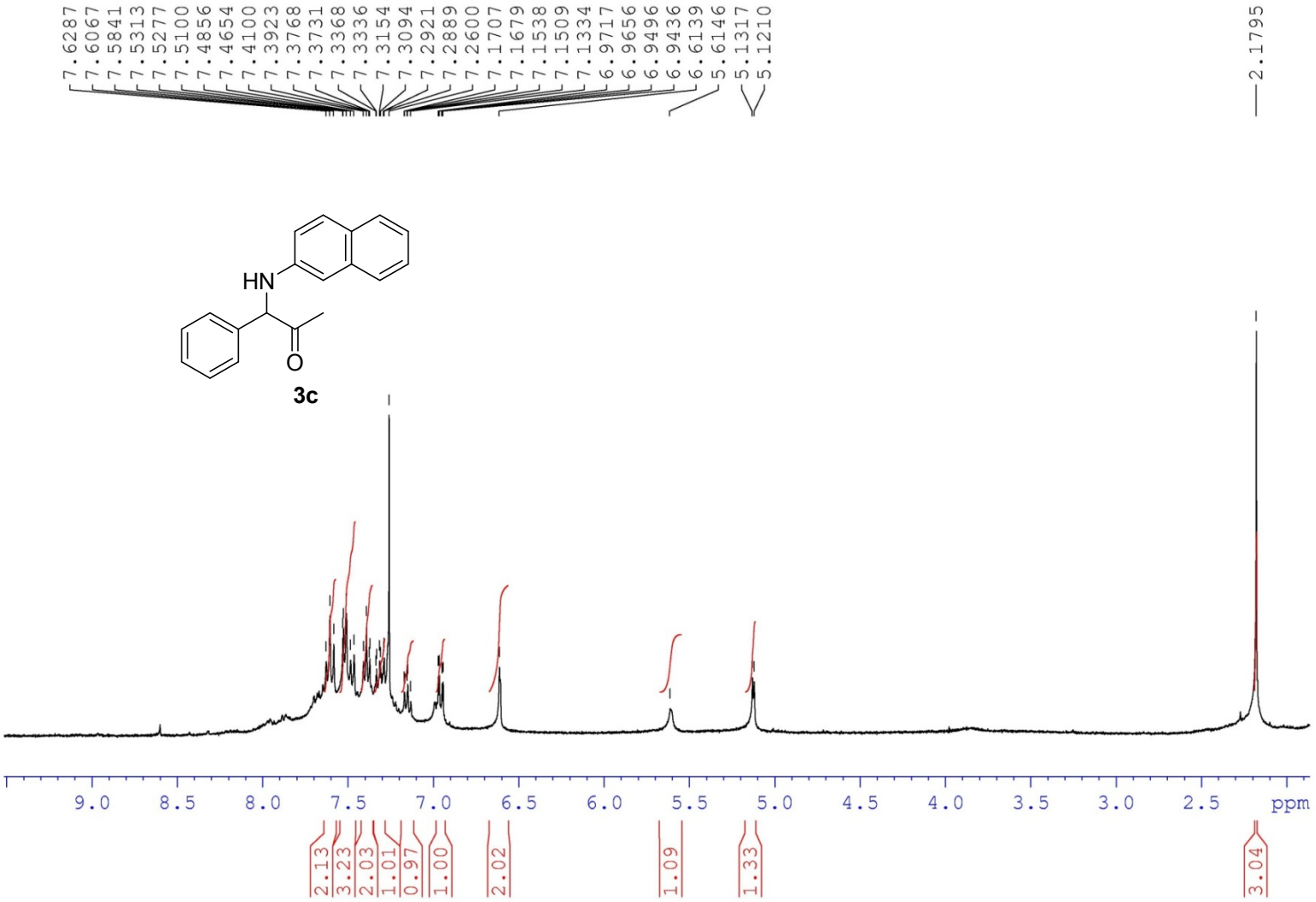
$^{1}H$ NMR in $CDCl_3$ (400 MHz)



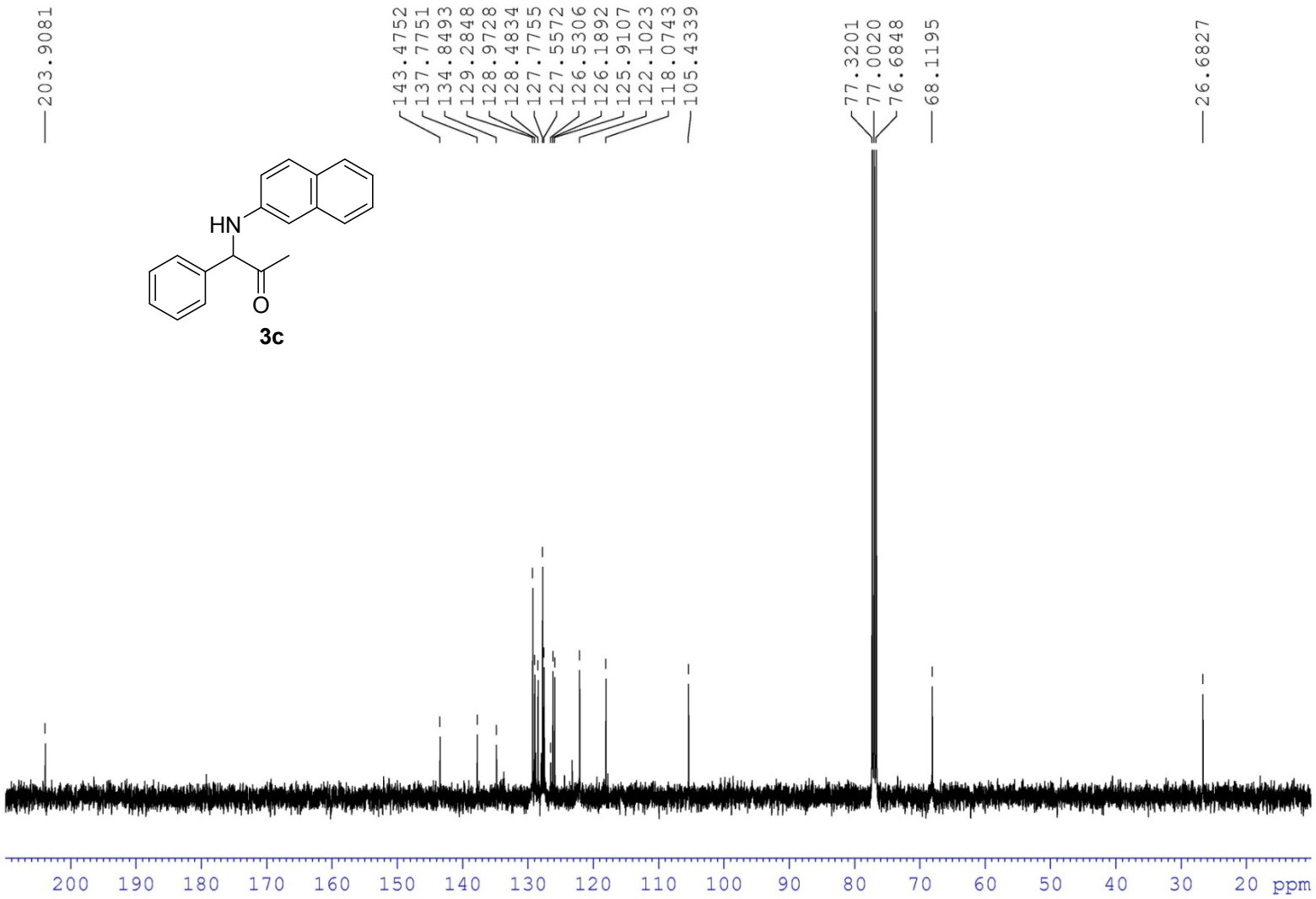
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



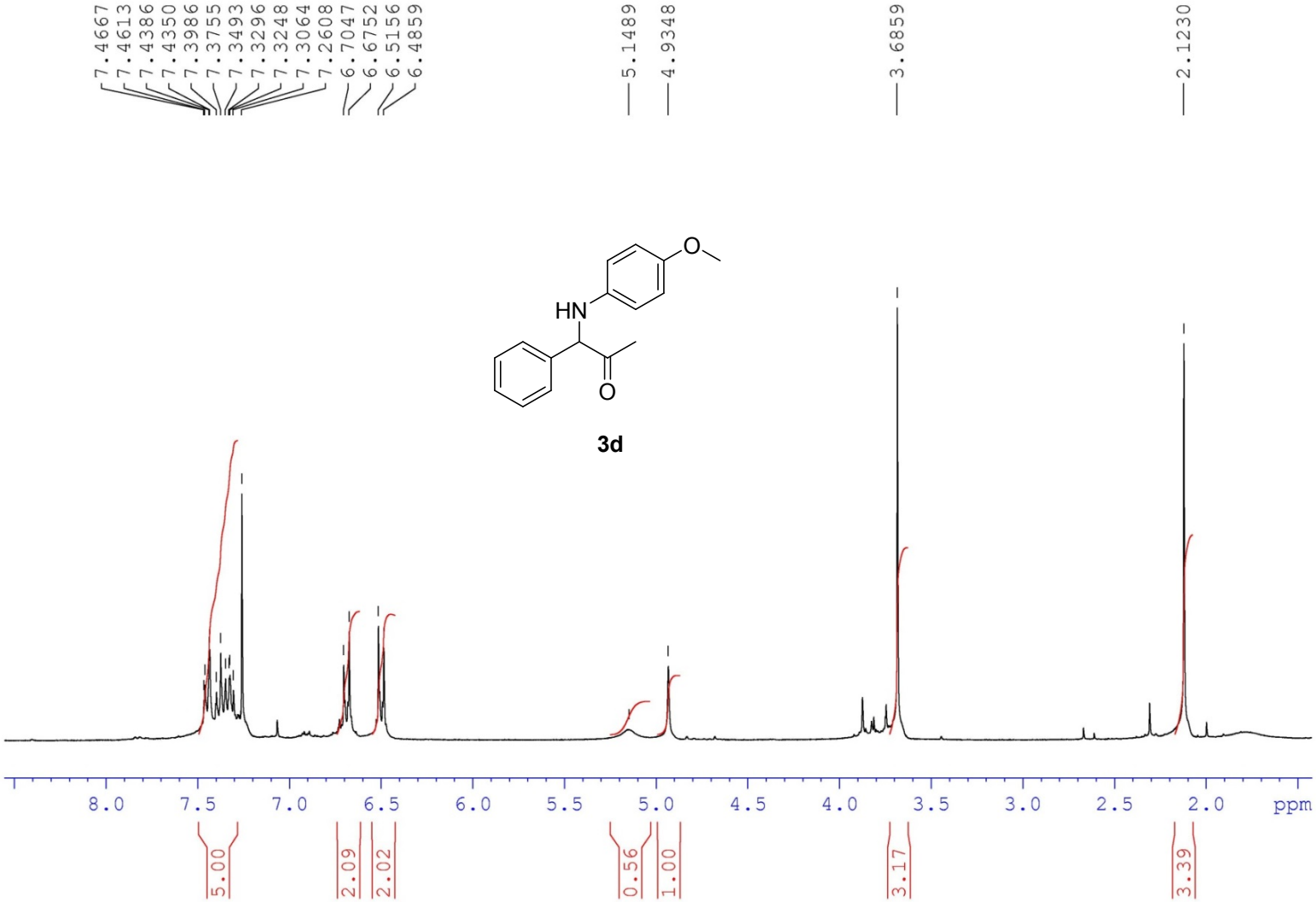
$^{1}$H NMR in $CDCl_3$ (400 MHz)



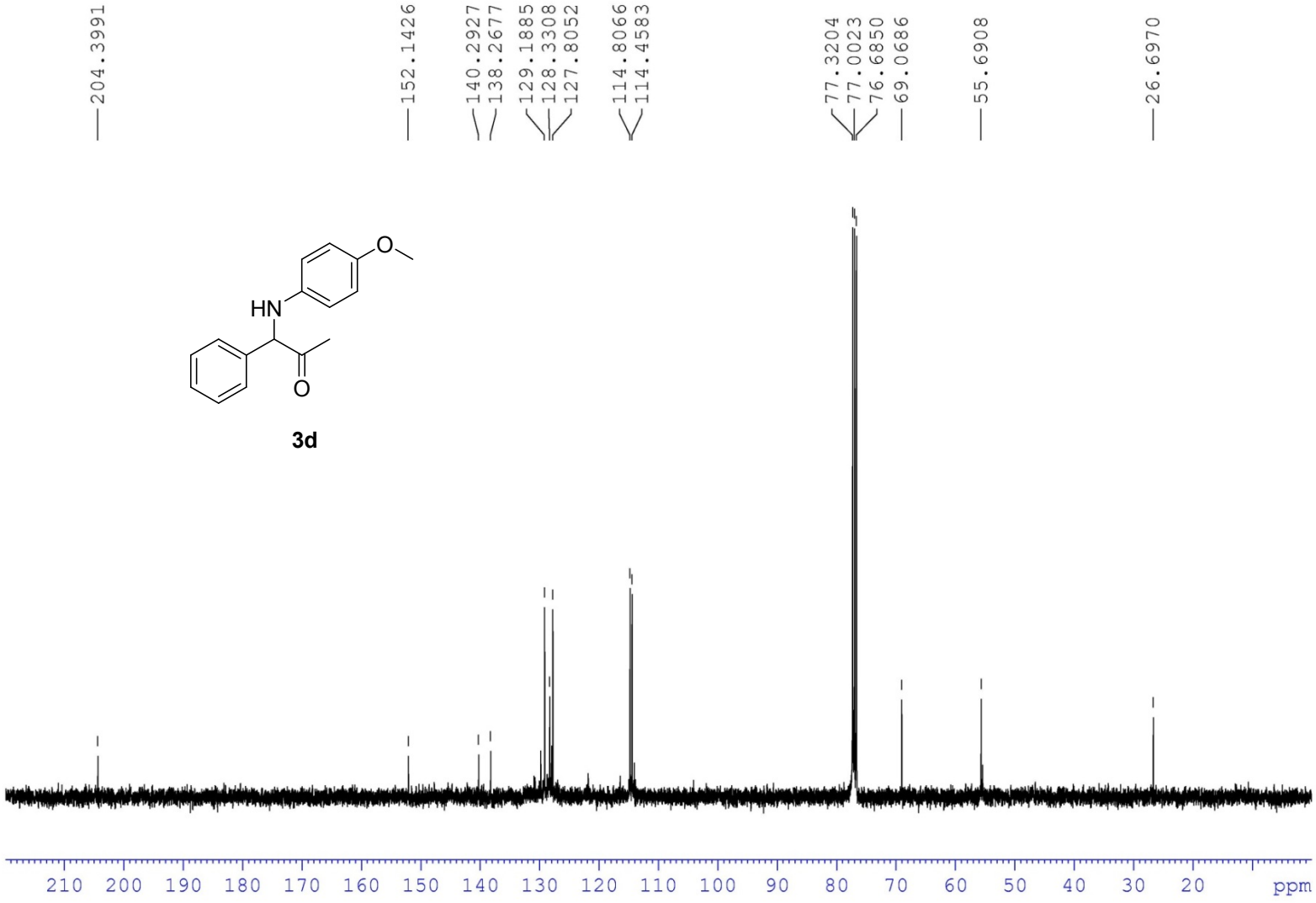
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



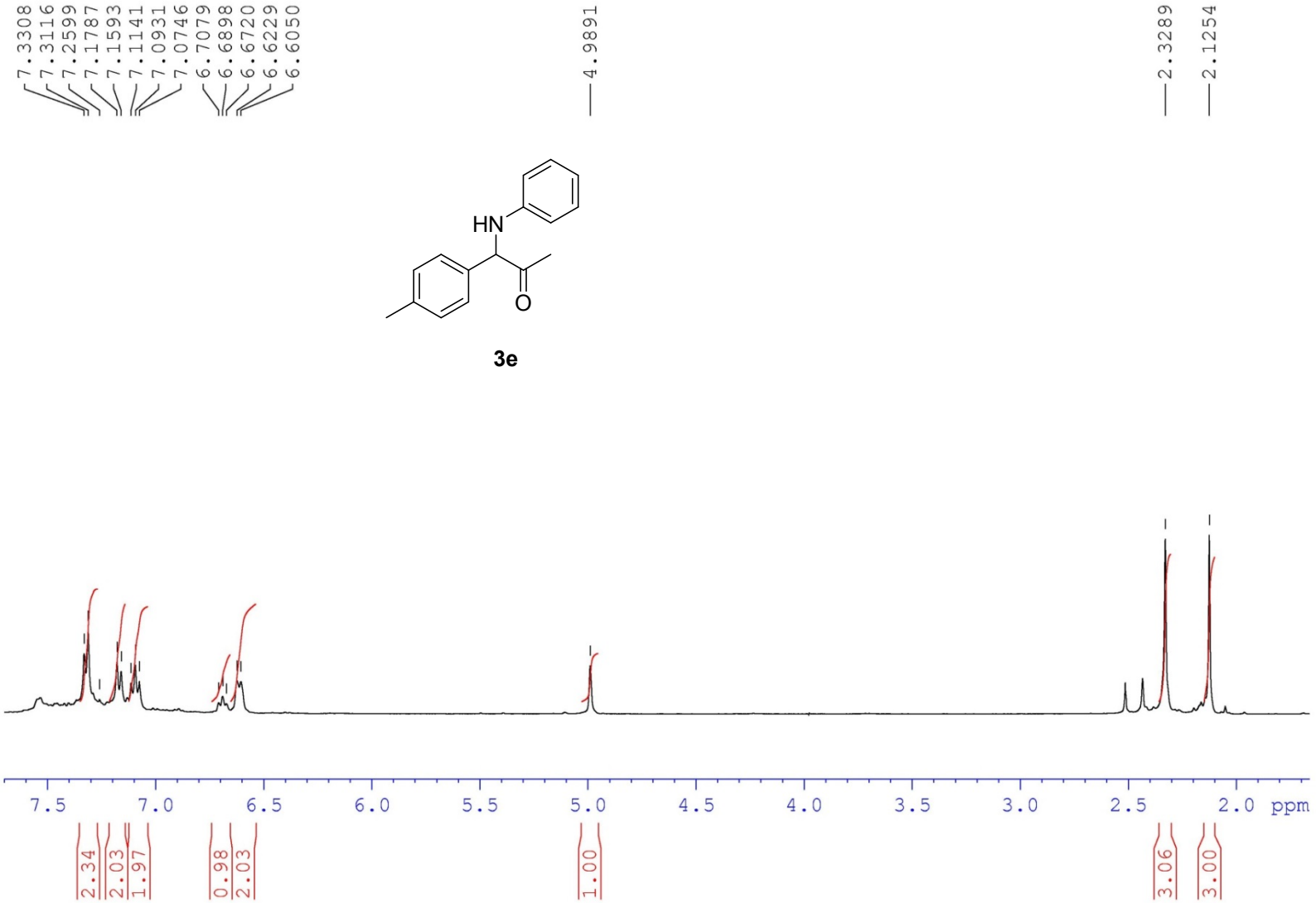
$^{1}$H NMR in $CDCl_3$ (300 MHz)



$^{13}C$ NMR in $CDCl_3$ (100 MHz)

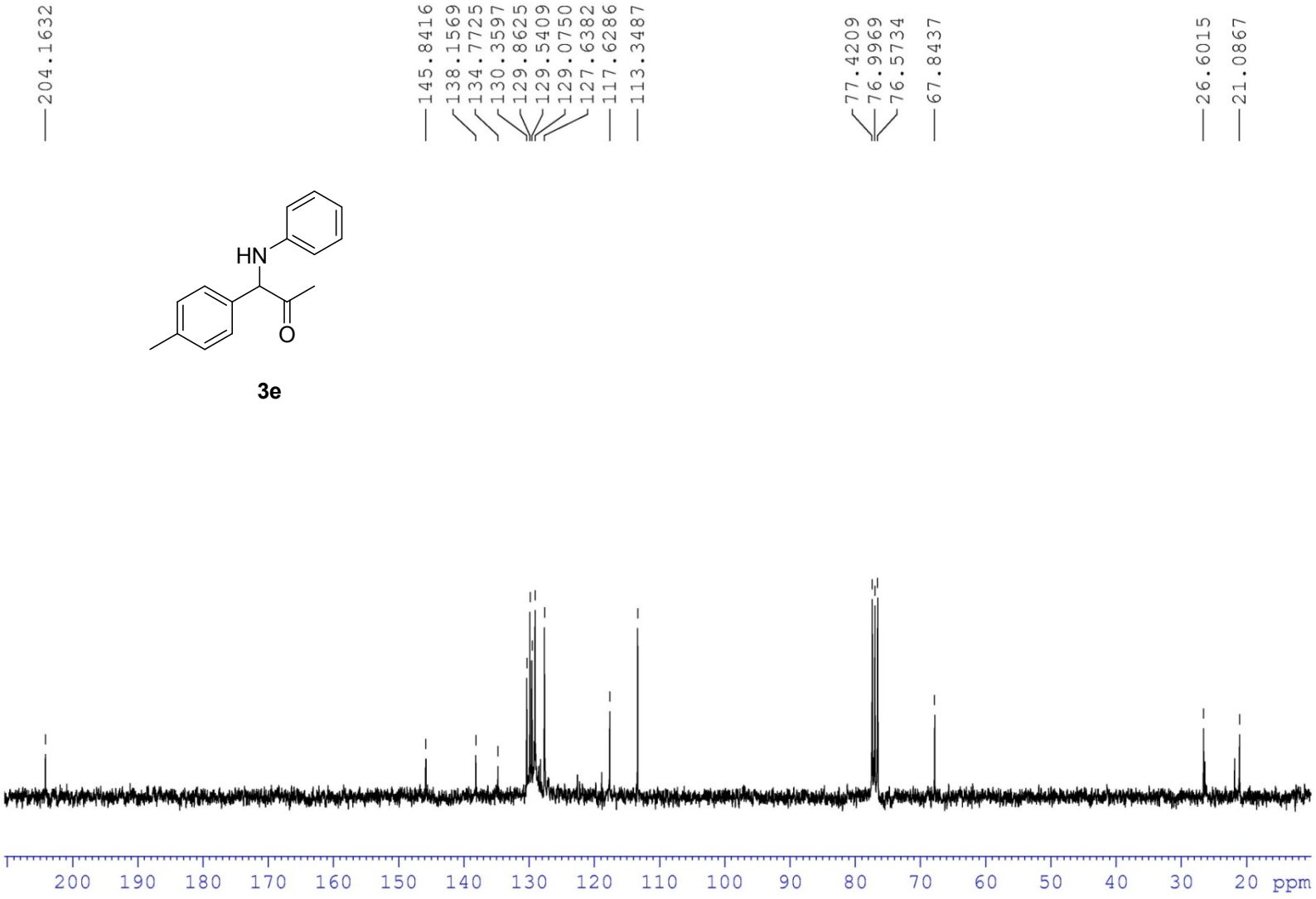


$^{1}$H NMR in $CDCl_3$ (400 MHz)



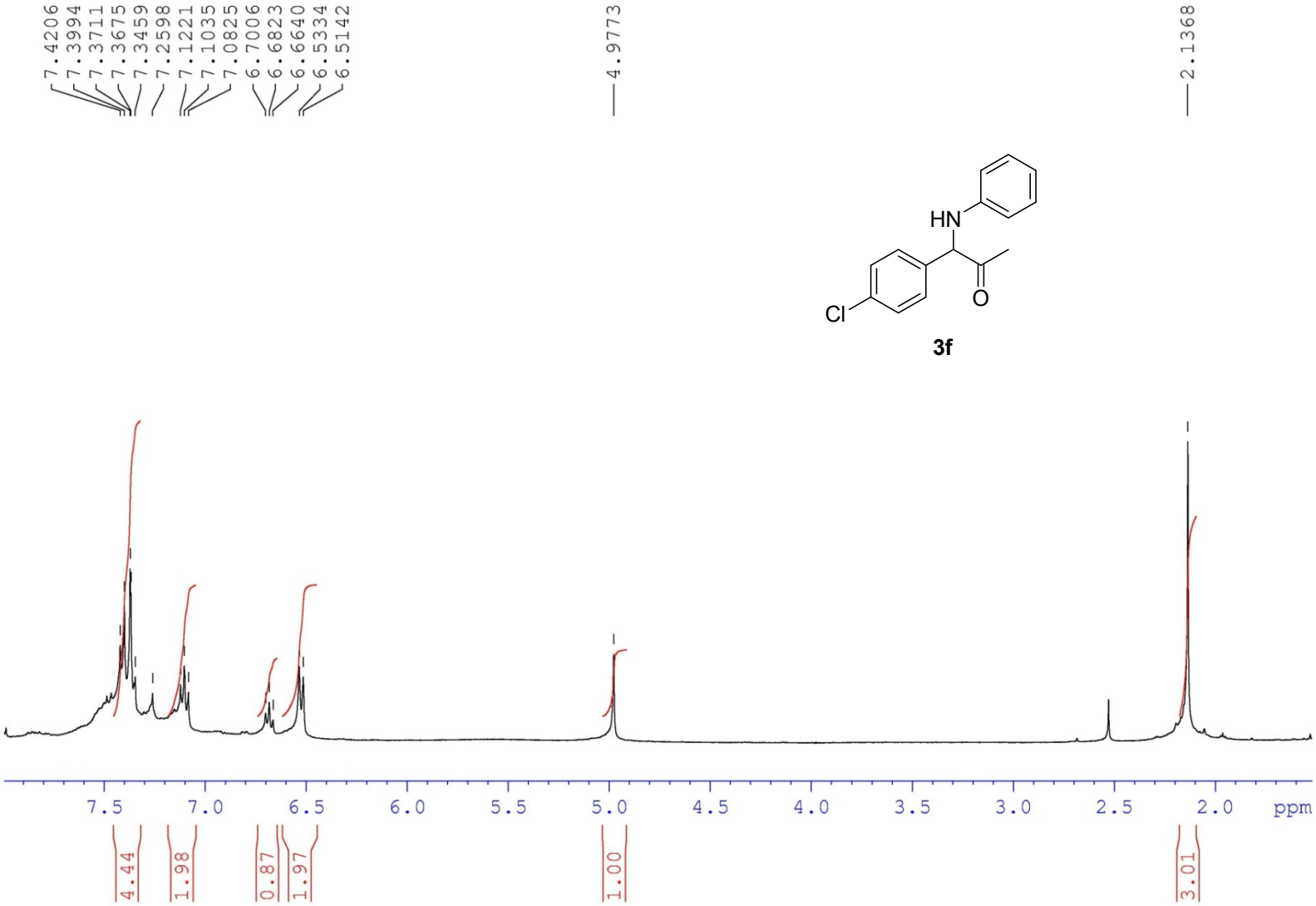

**3e**

$^{13}C$ NMR in $CDCl_3$ (75 MHz)

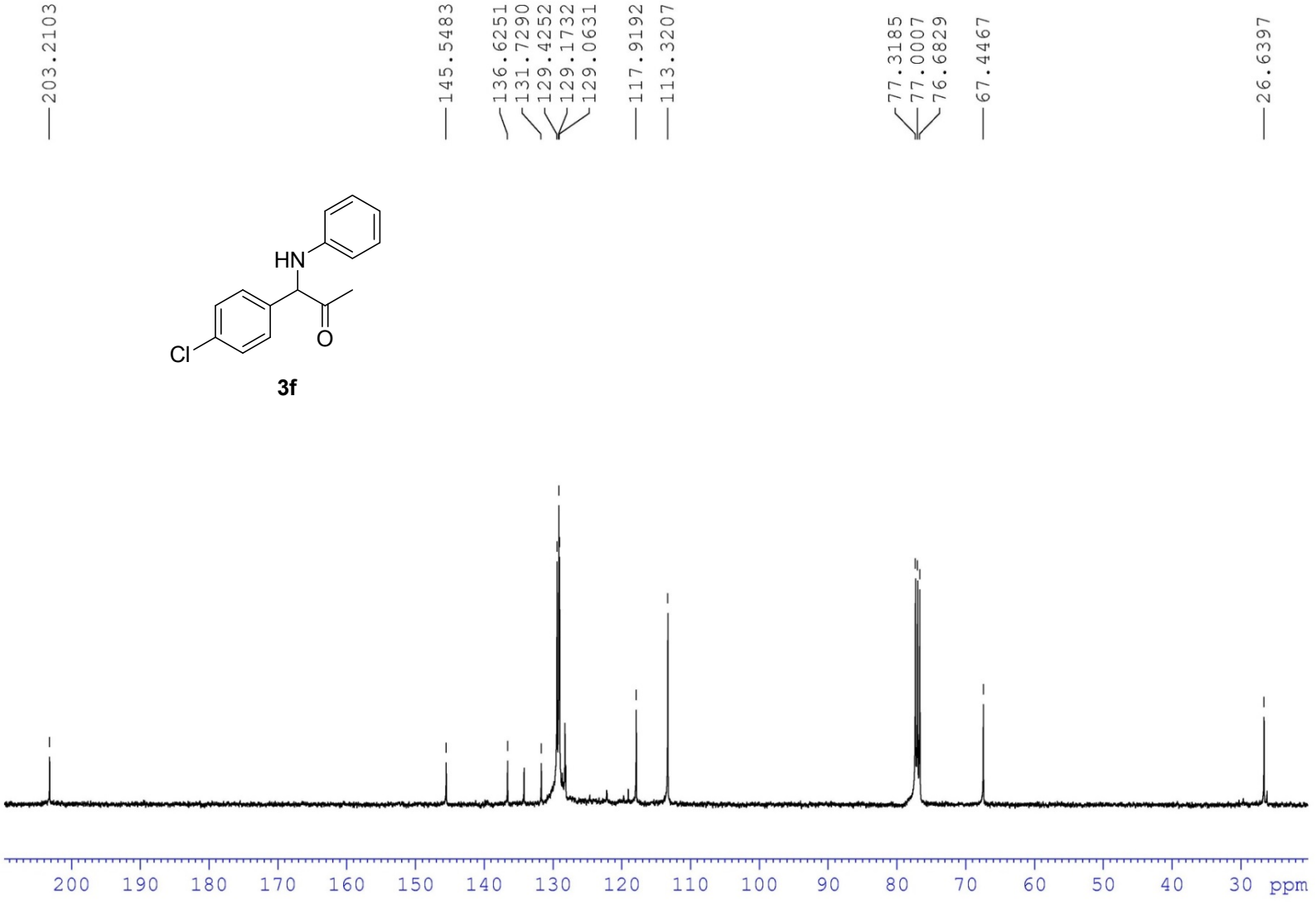



**3e**

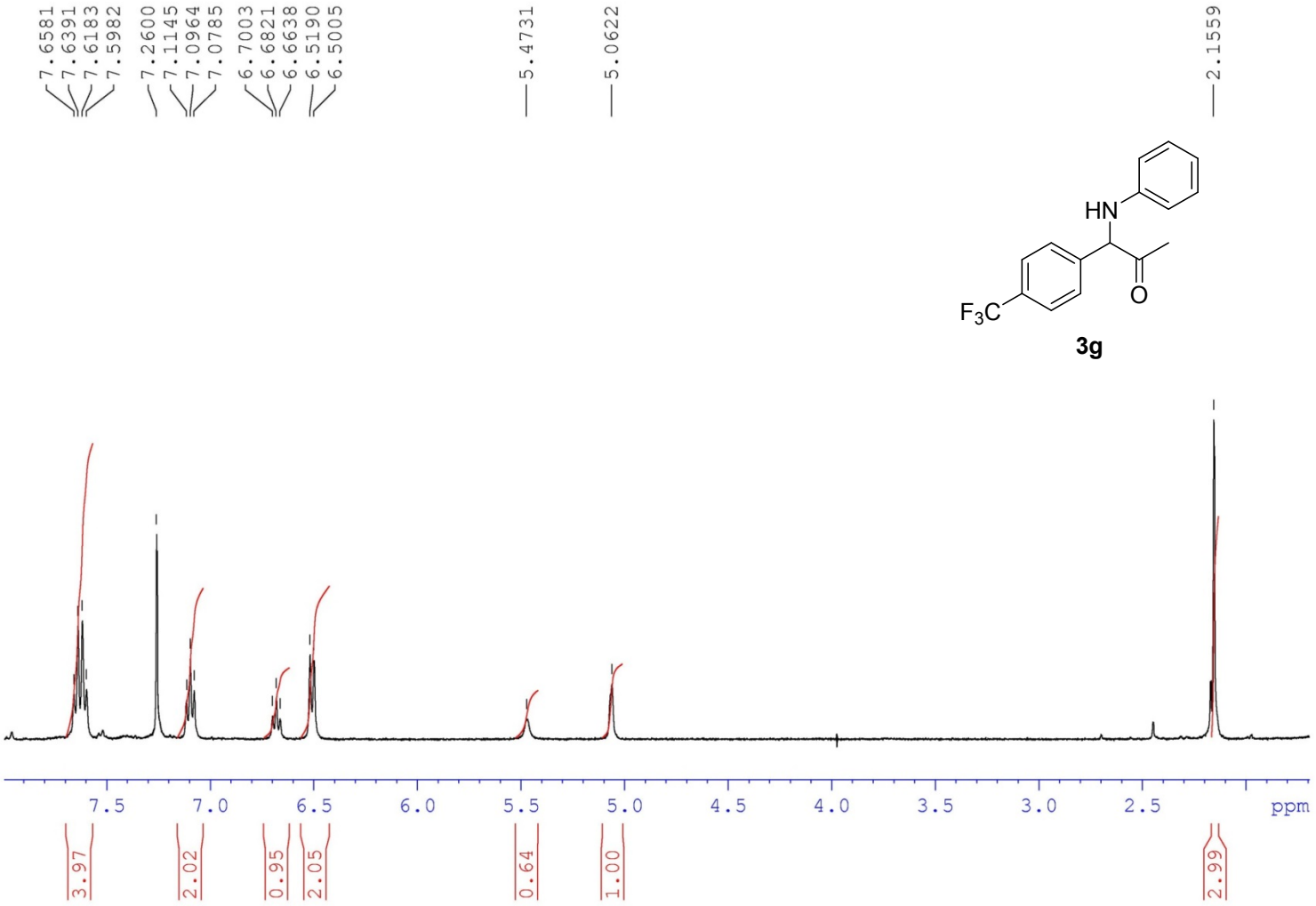
$^{1}H$ NMR in $CDCl_3$ (400 MHz)



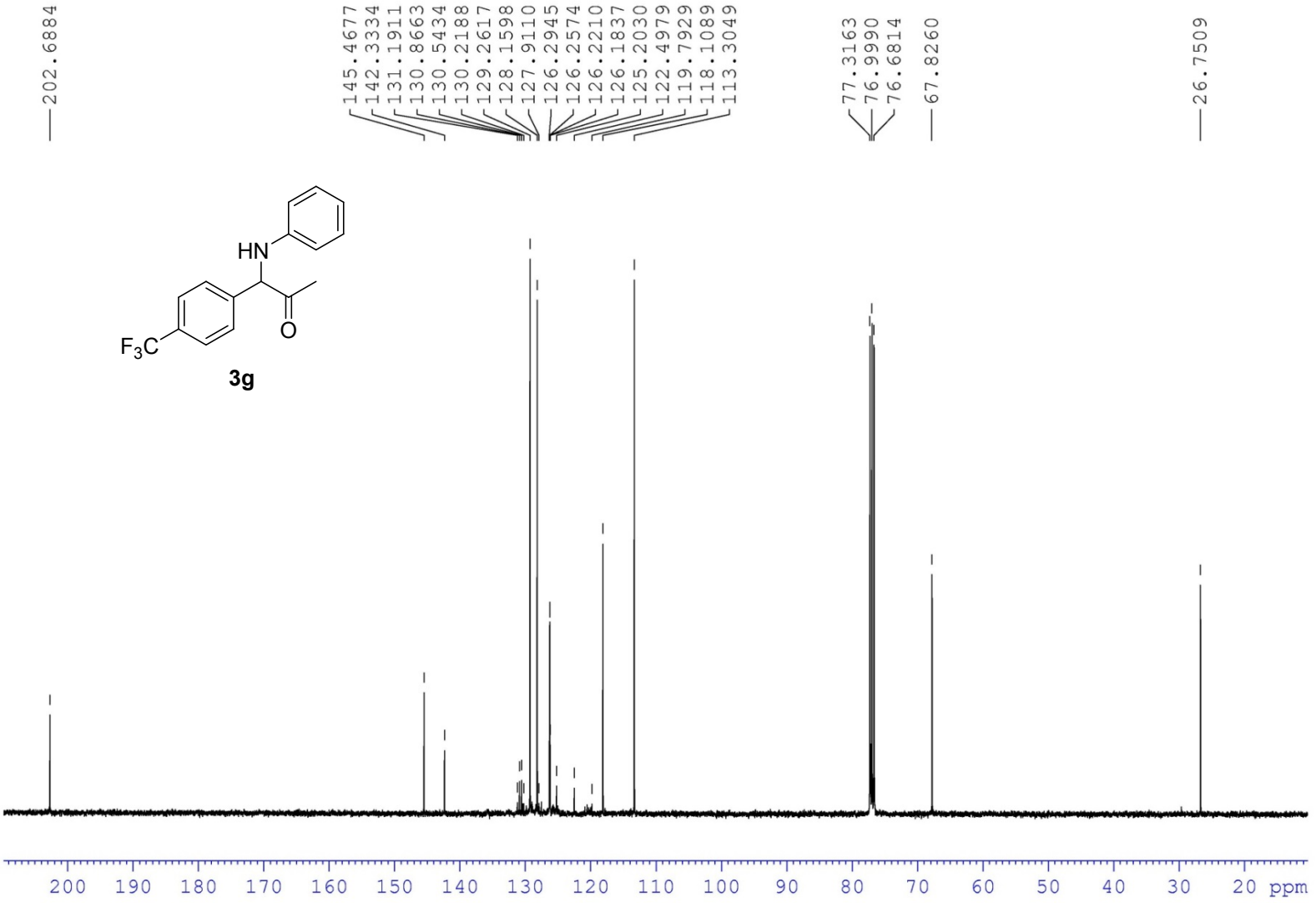
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



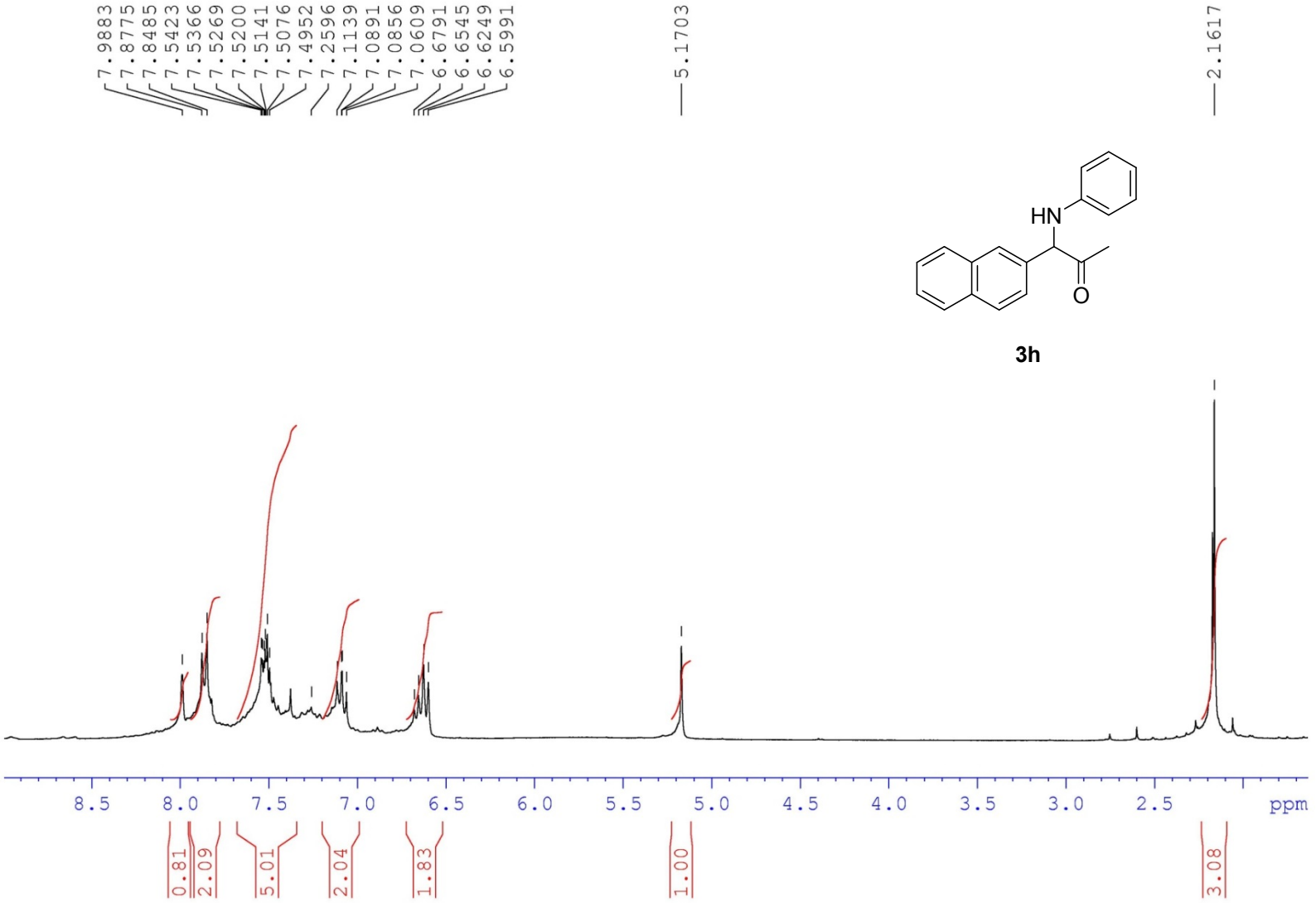
$^{1}$H NMR in $CDCl_3$ (400 MHz)



$^{13}C$ NMR in $CDCl_3$ (100 MHz)

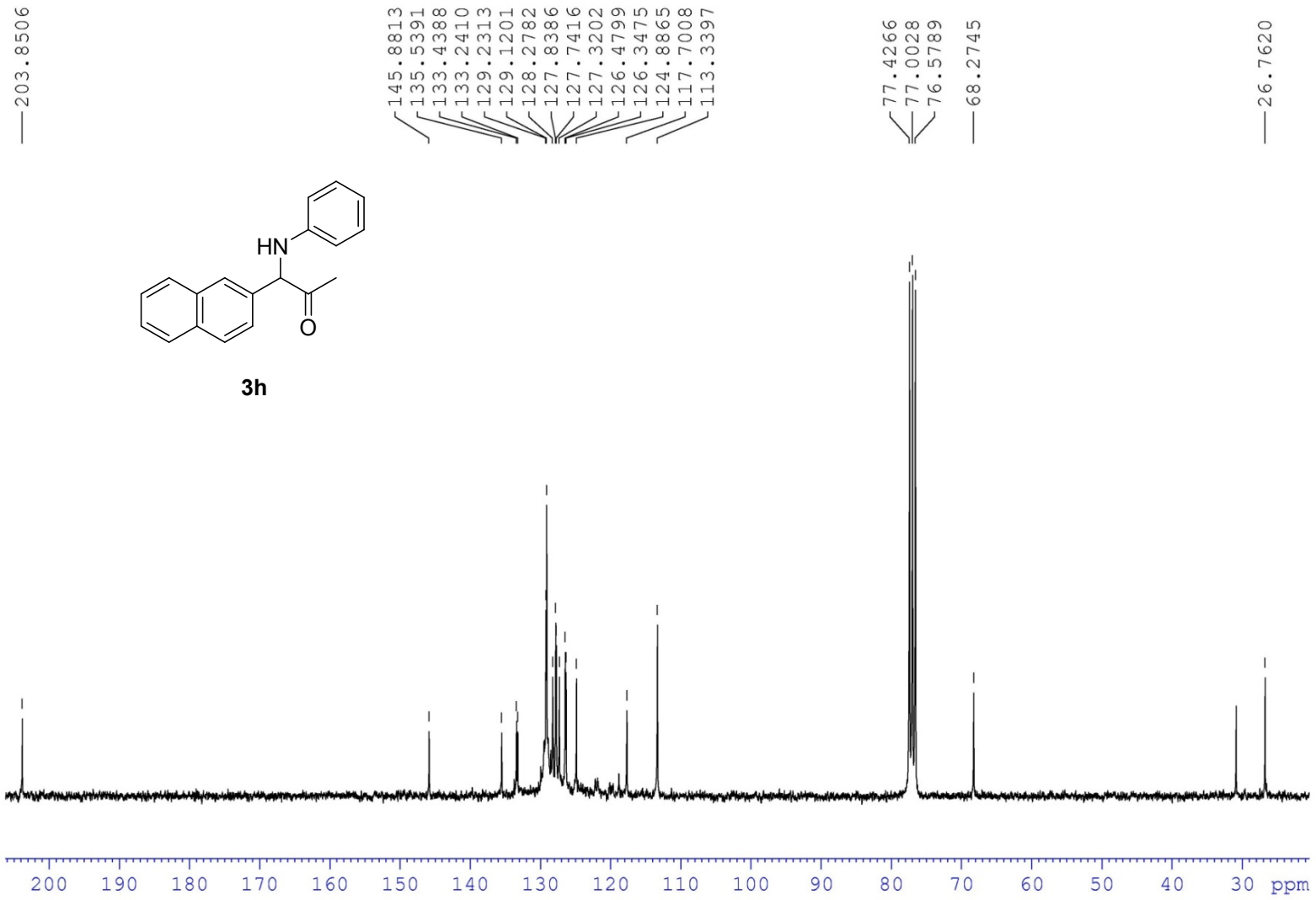


$^{1}$H NMR in $CDCl_3$ (300 MHz)

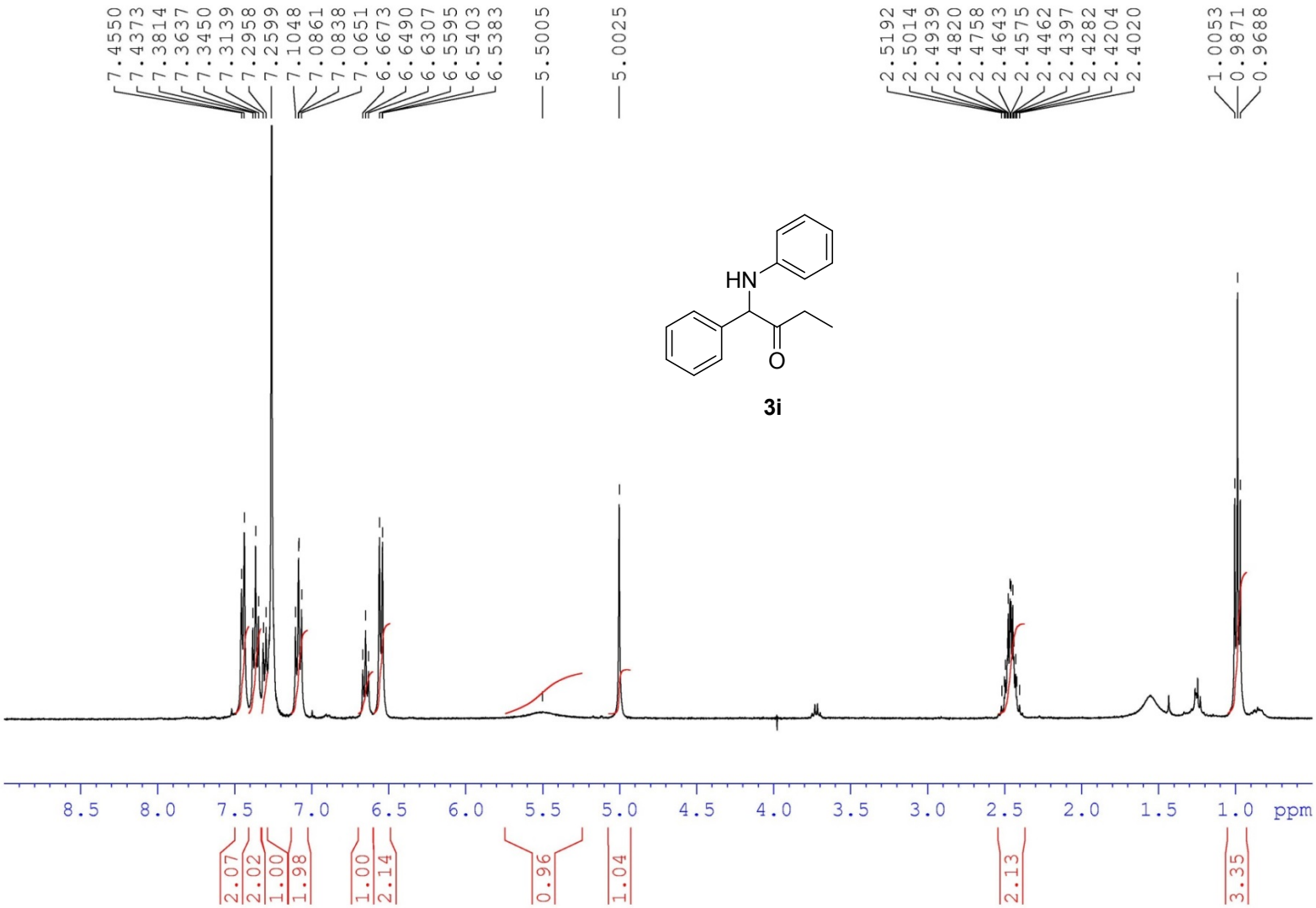



**3h**

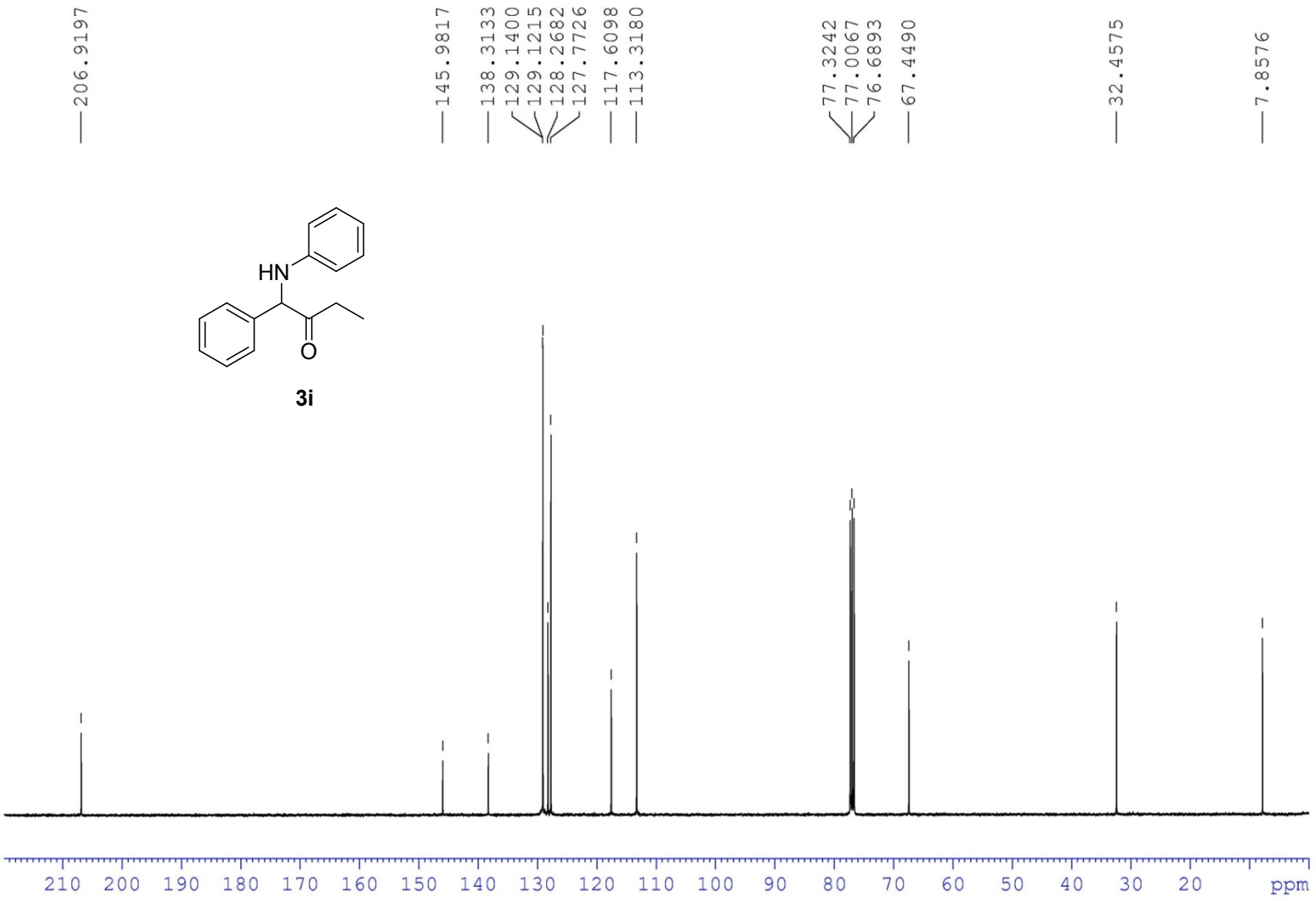
$^{13}C$ NMR in $CDCl_3$ (75 MHz)



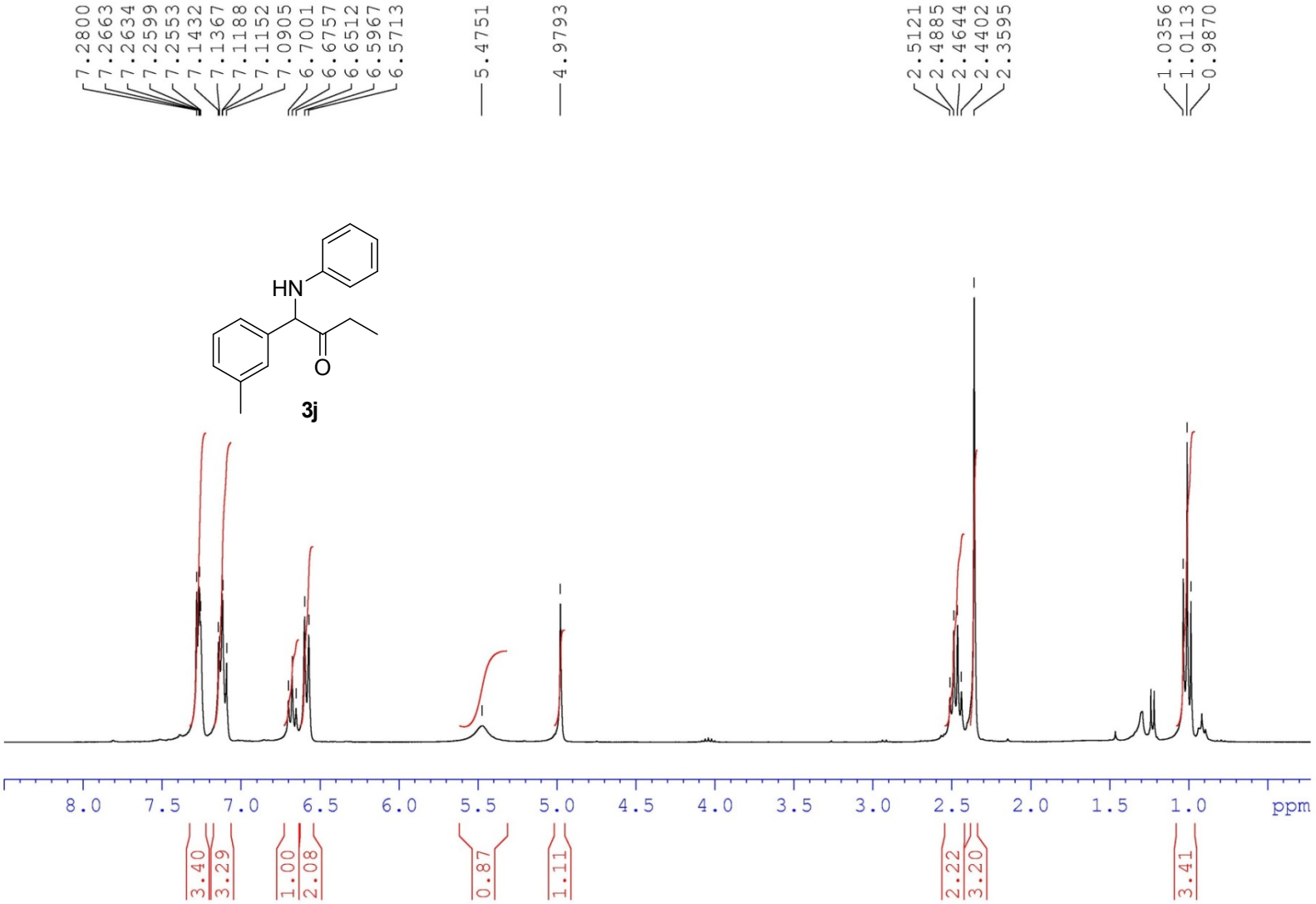
$^{1}H$ NMR in $CDCl_3$ (400 MHz)



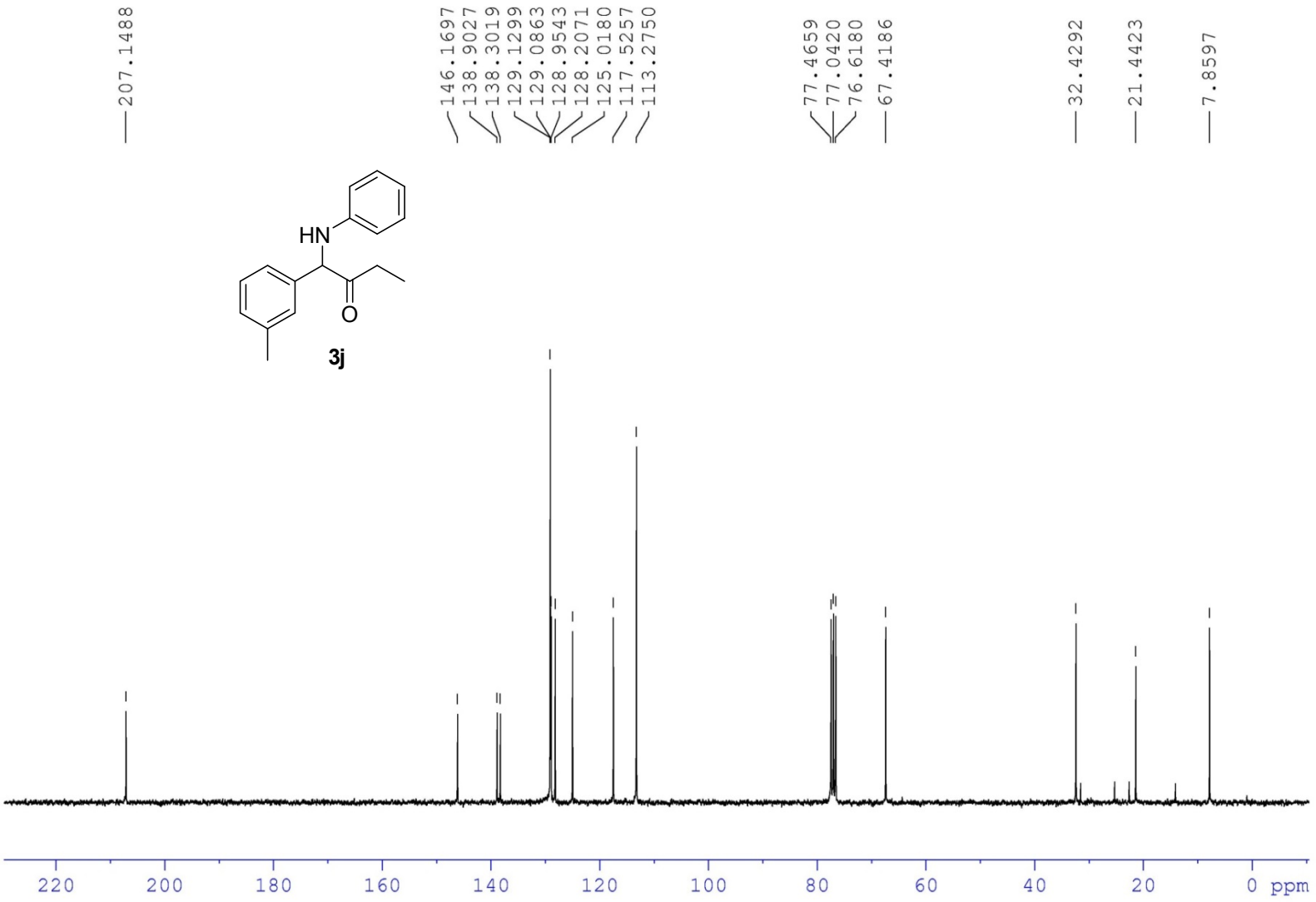
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



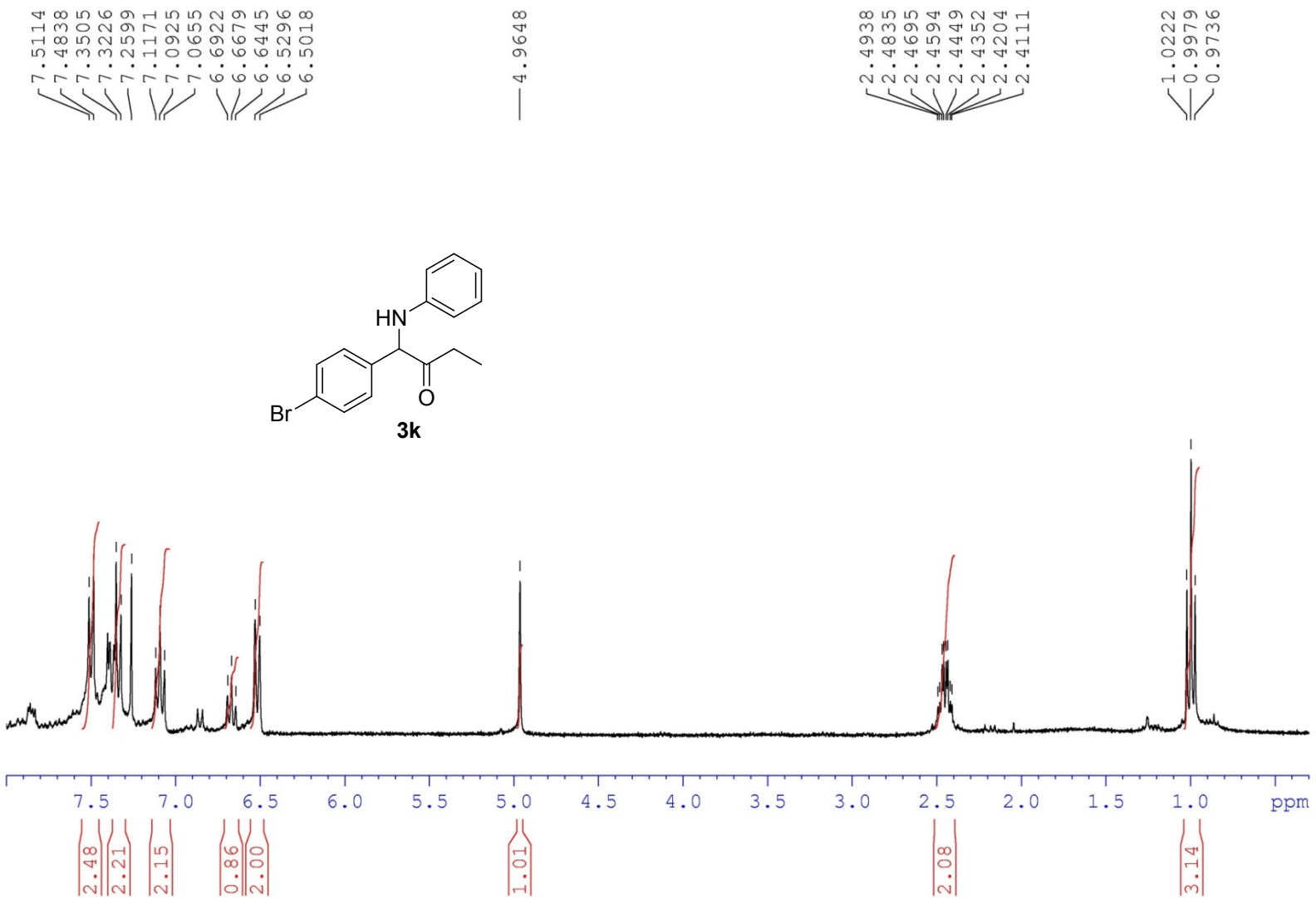
$^{1}H$ NMR in $CDCl_3$ (300 MHz)



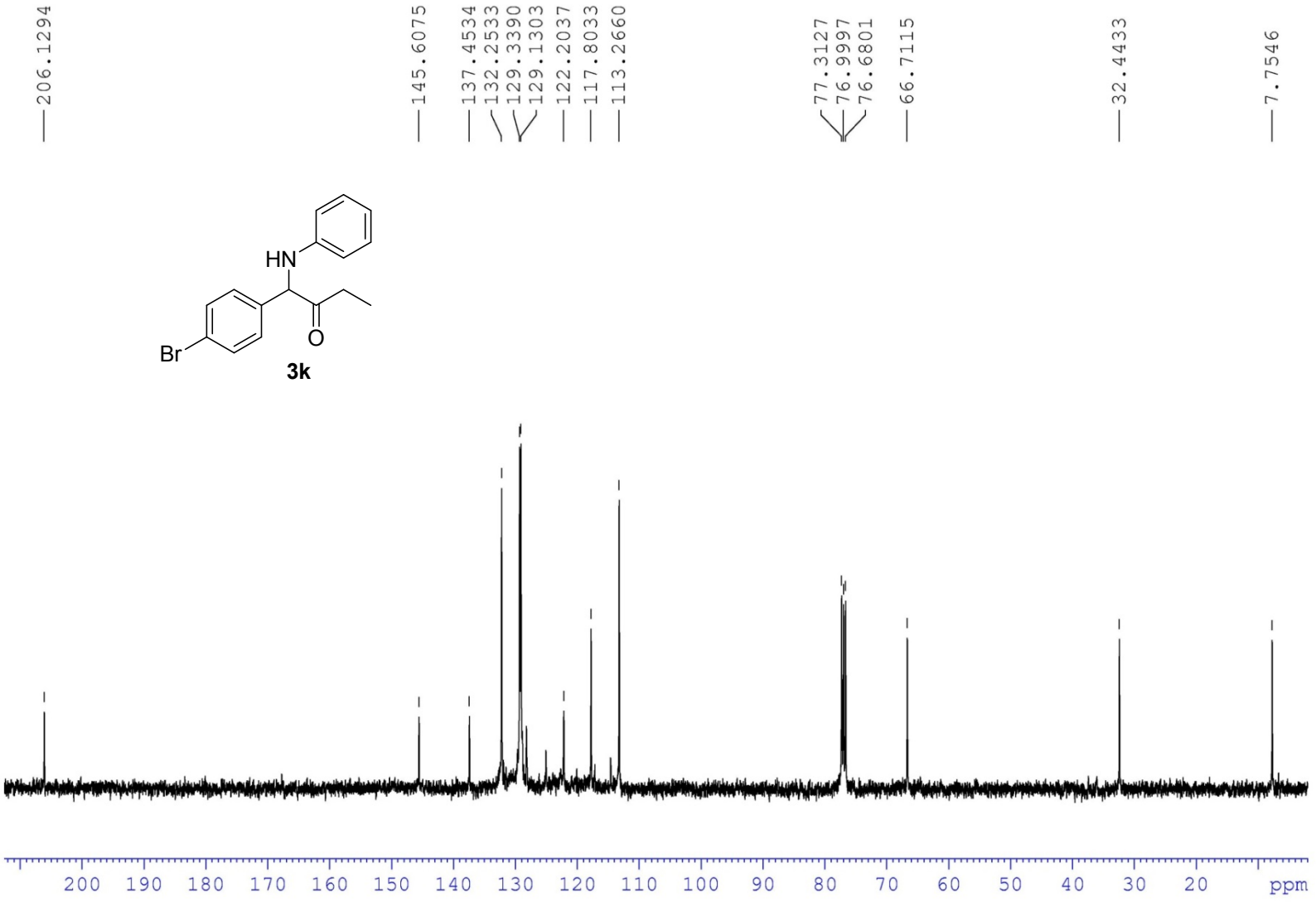
$^{13}C$ NMR in $CDCl_3$ (75 MHz)



$^{1}H$ NMR in $CDCl_3$ (300 MHz)



$^{13}C$ NMR in $CDCl_3$ (100 MHz)



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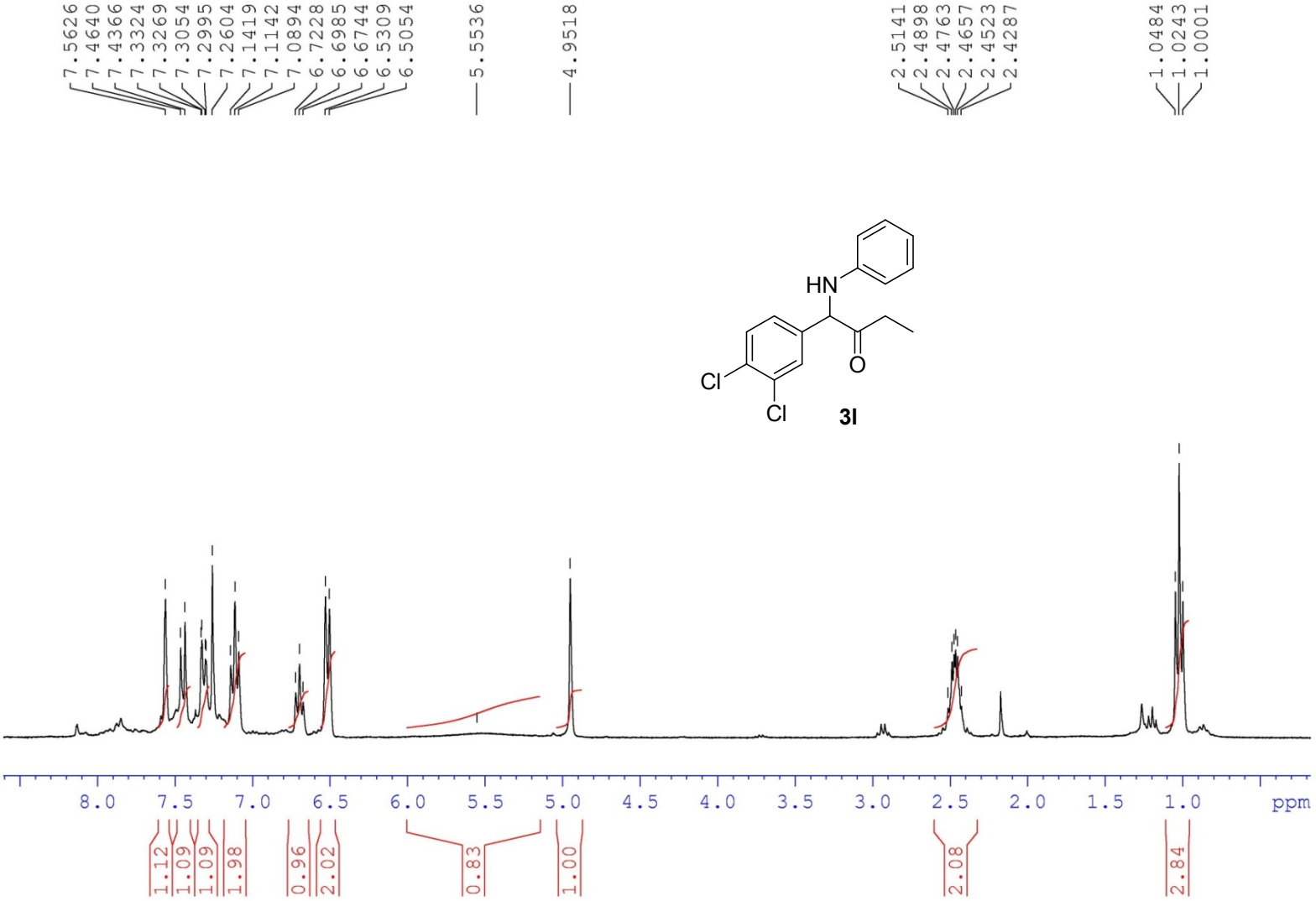

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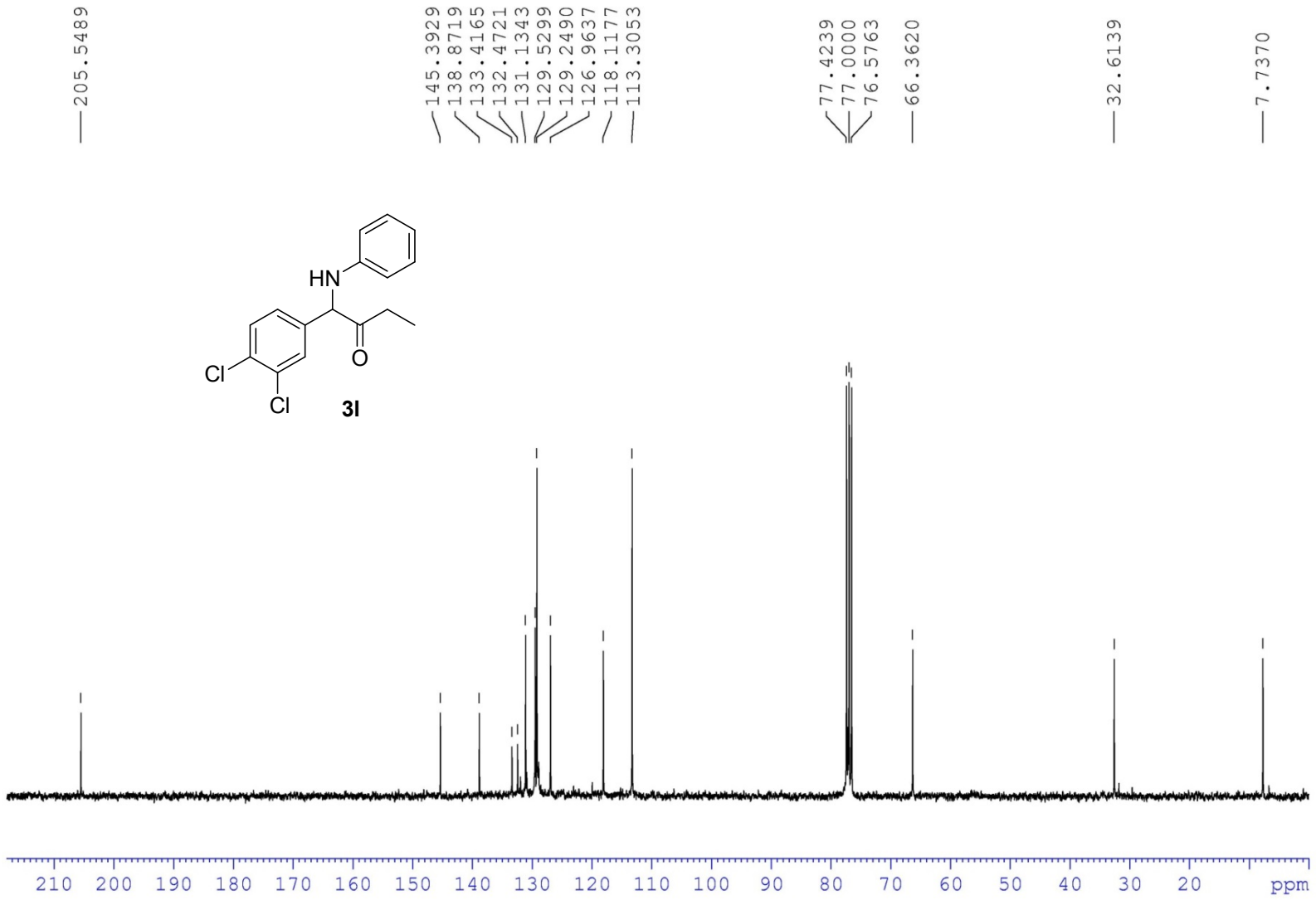
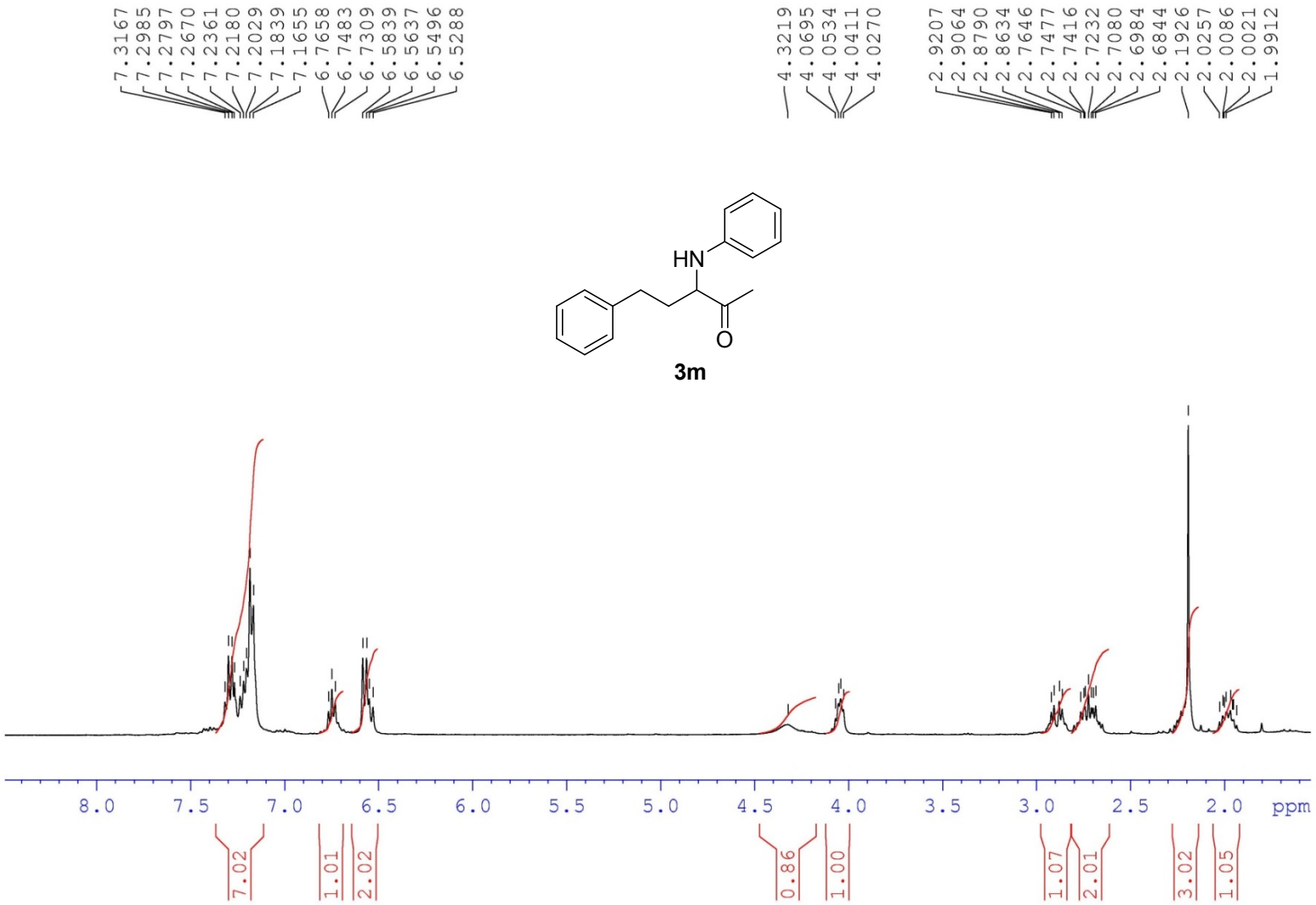
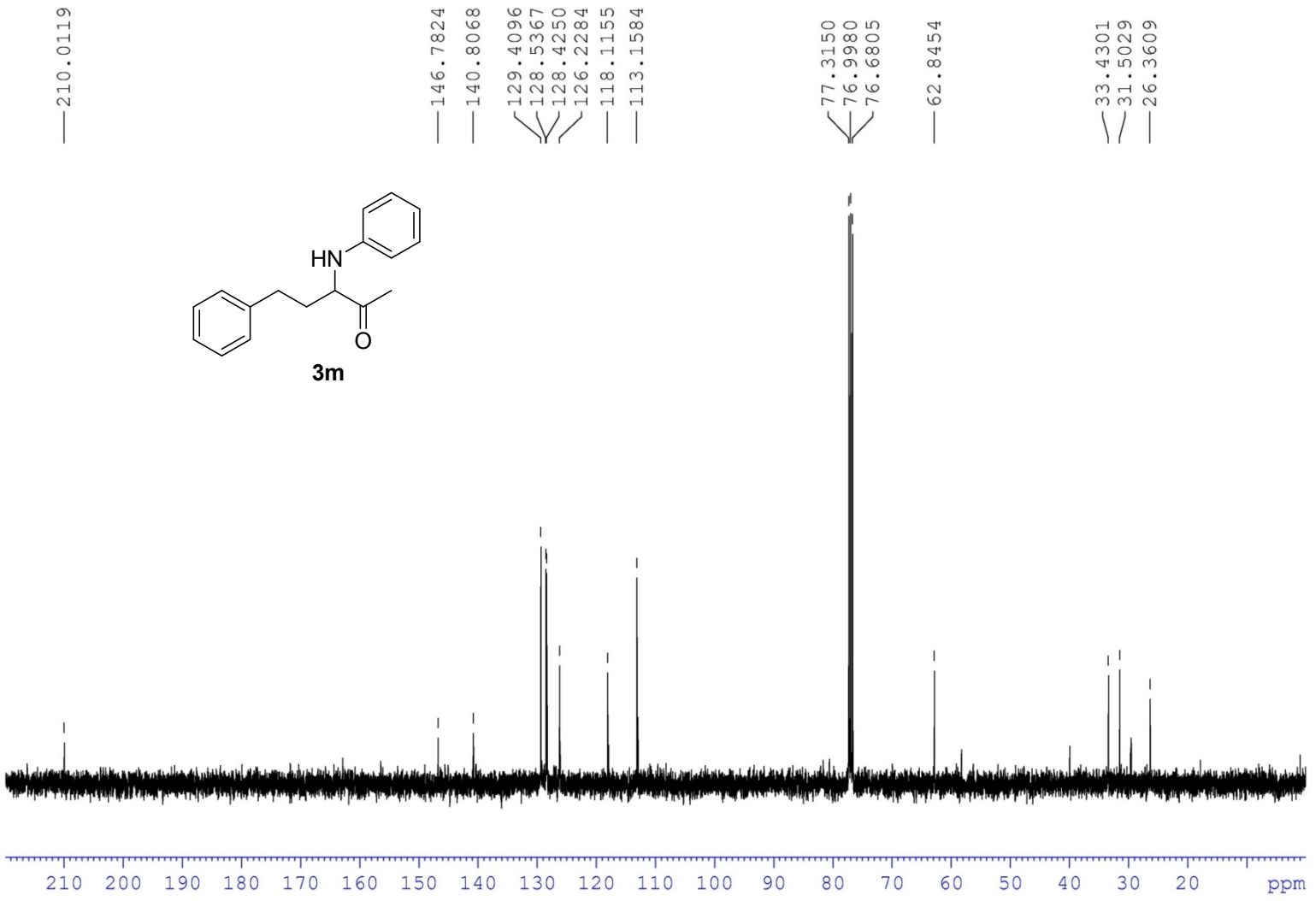


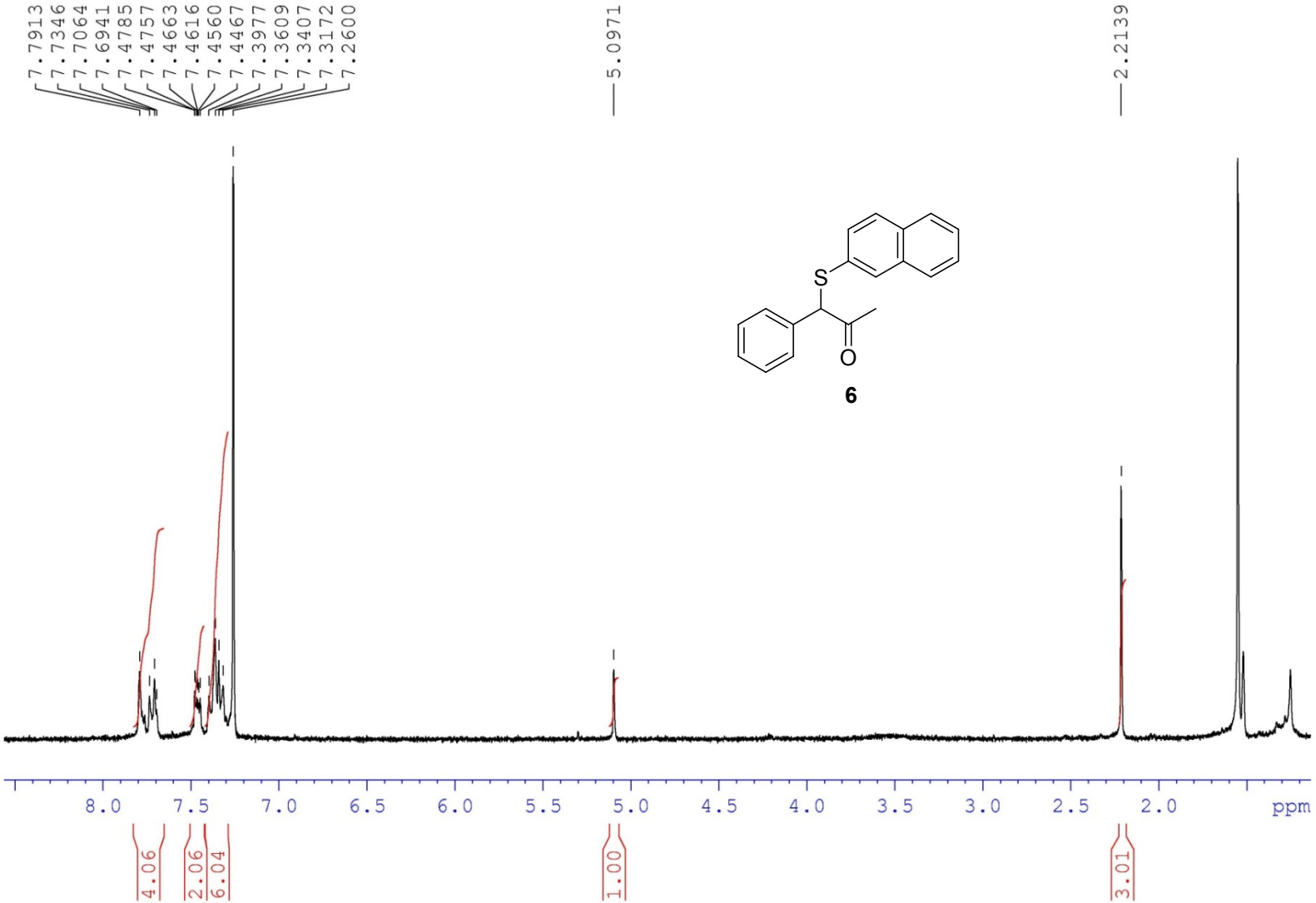
$^{1}$H NMR in $CDCl_3$ (400 MHz)



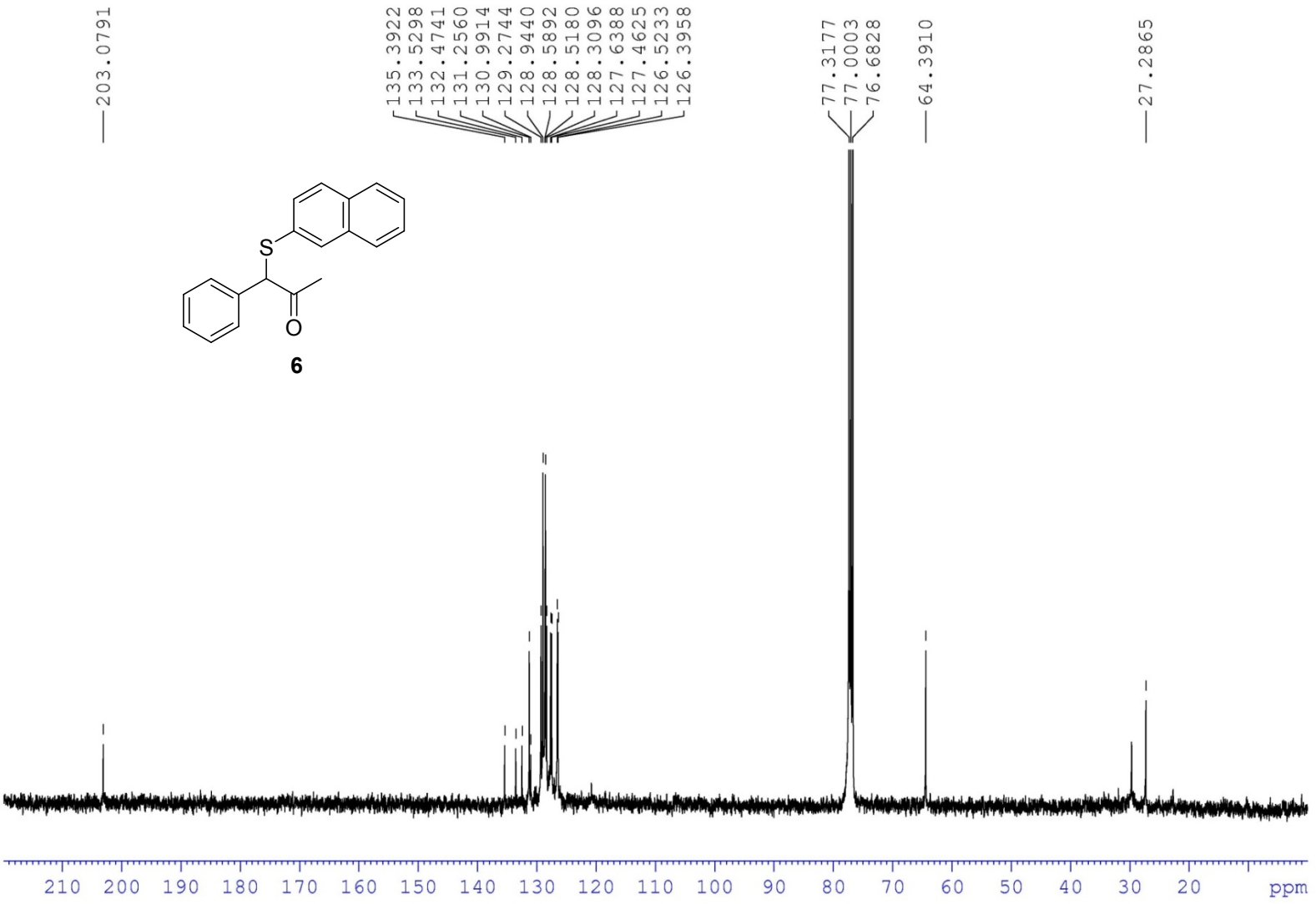
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



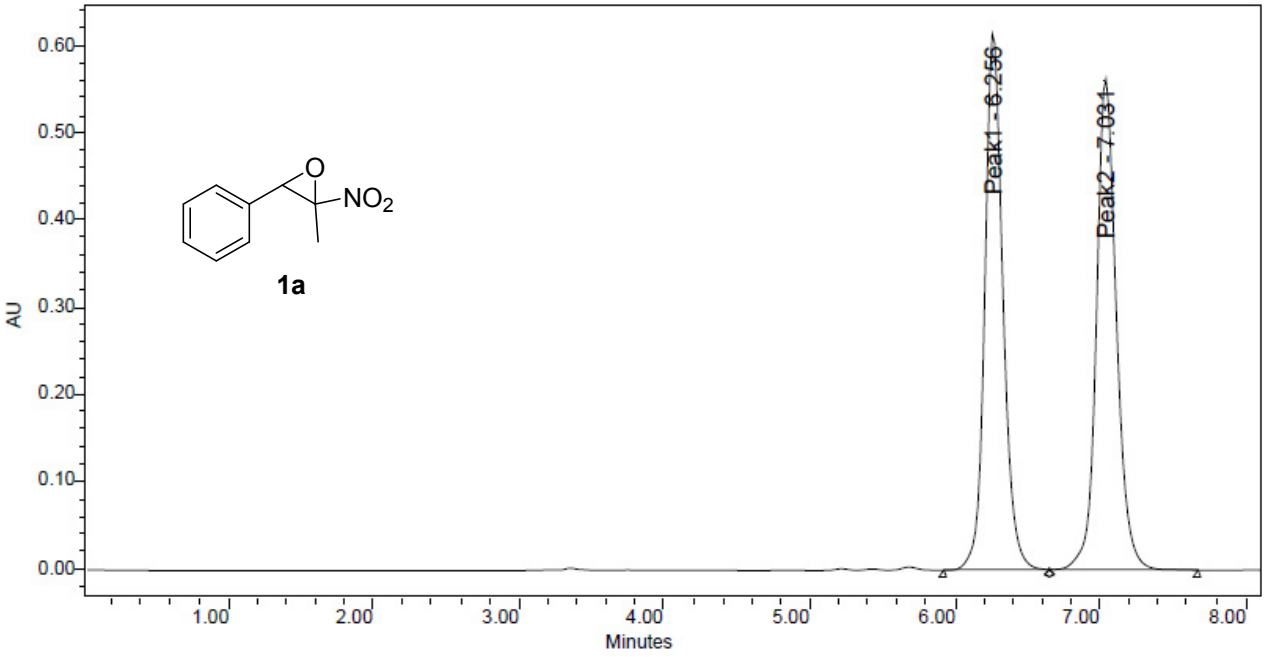
$^{1}H$ NMR in $CDCl_3$ (300 MHz)



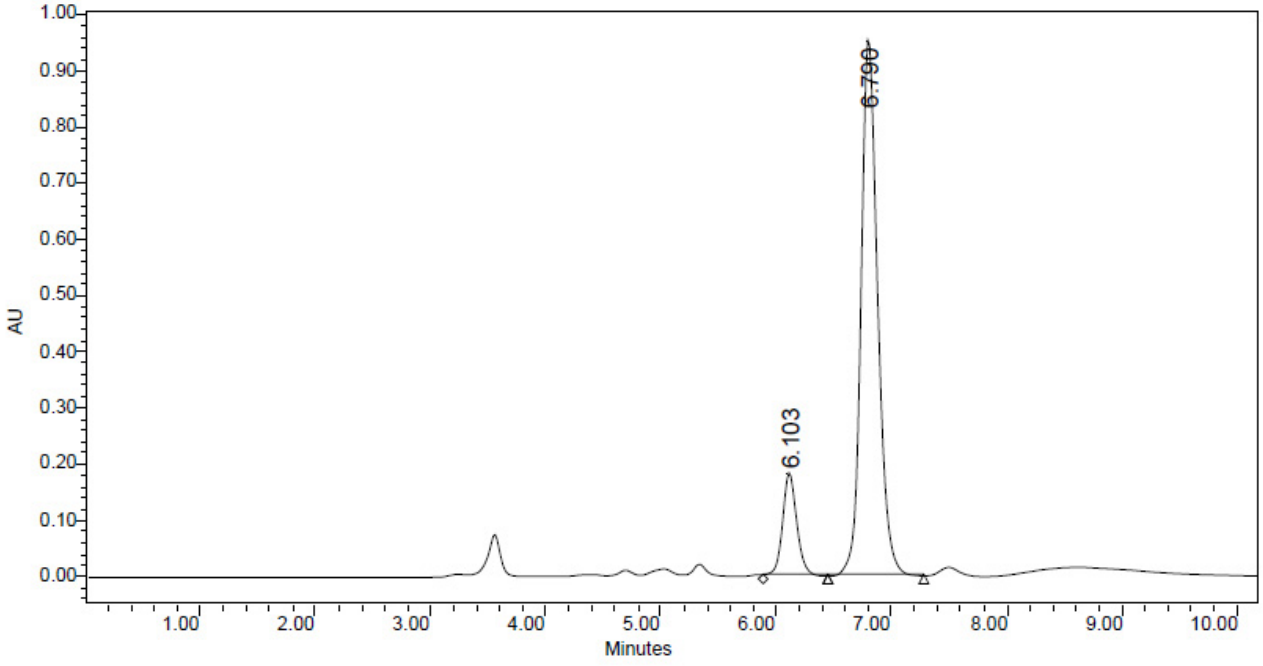
$^{13}C$ NMR in $CDCl_3$ (100 MHz)



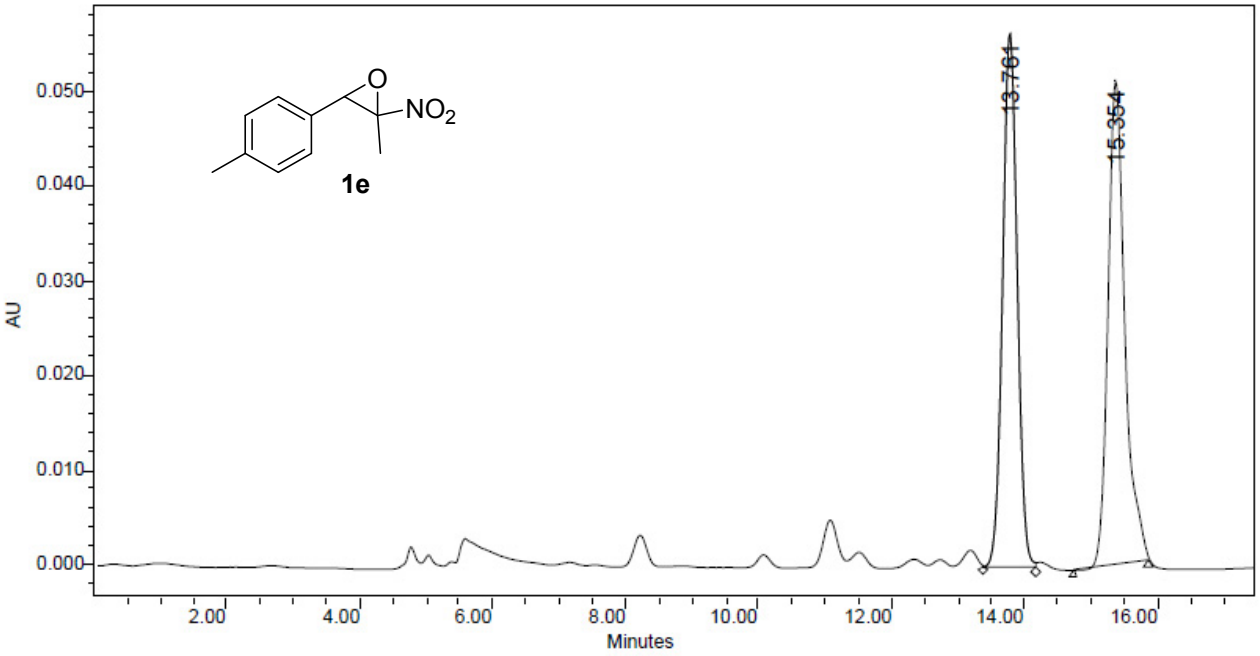
## HPLC Chromatograms



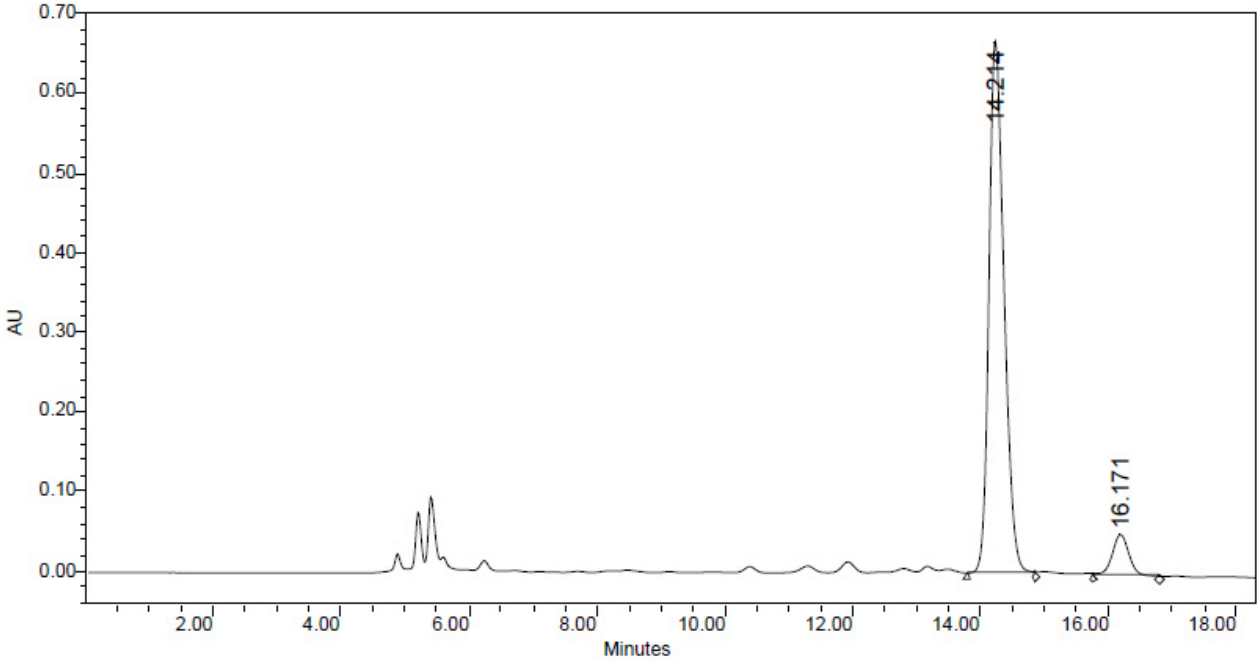

| | Peak Name | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|---|
| 1 | Peak1 | 6.256 | 5361797 | 49.72 | 616764 | 52.31 |
| 2 | Peak2 | 7.031 | 5422280 | 50.28 | 562333 | 47.69 |



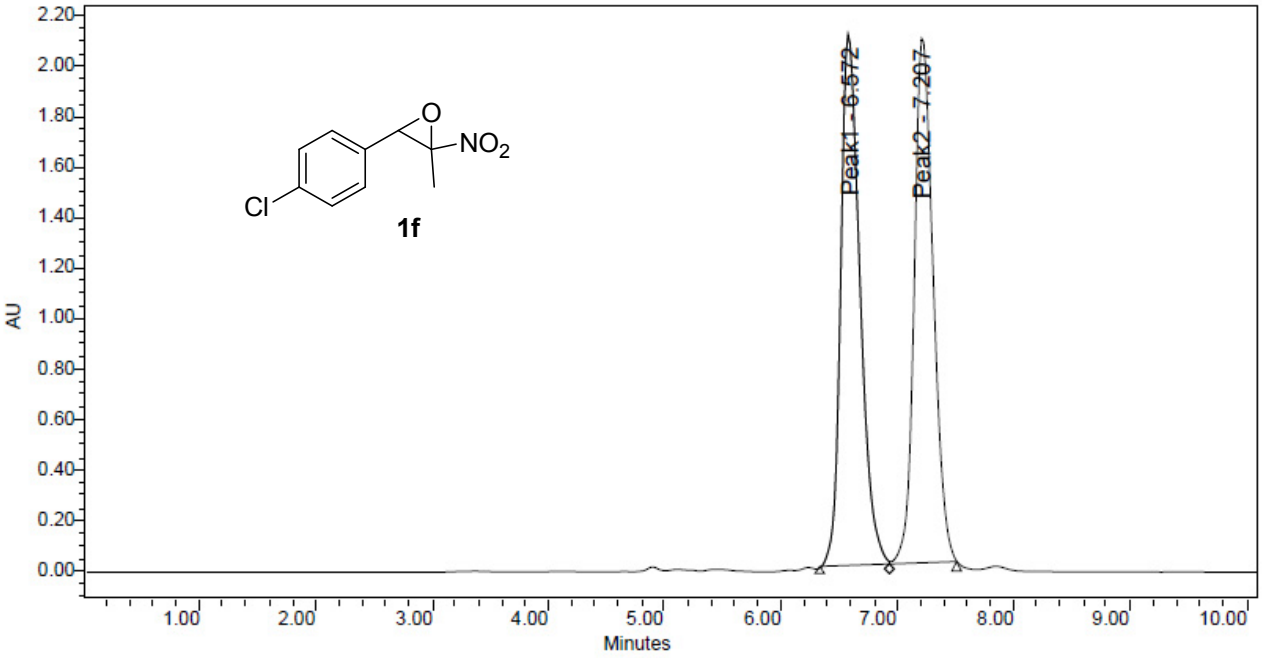

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 6.103 | 1594105 | 14.22 | 183756 | 16.07 |
| 2 | 6.790 | 9615424 | 85.78 | 959503 | 83.93 |



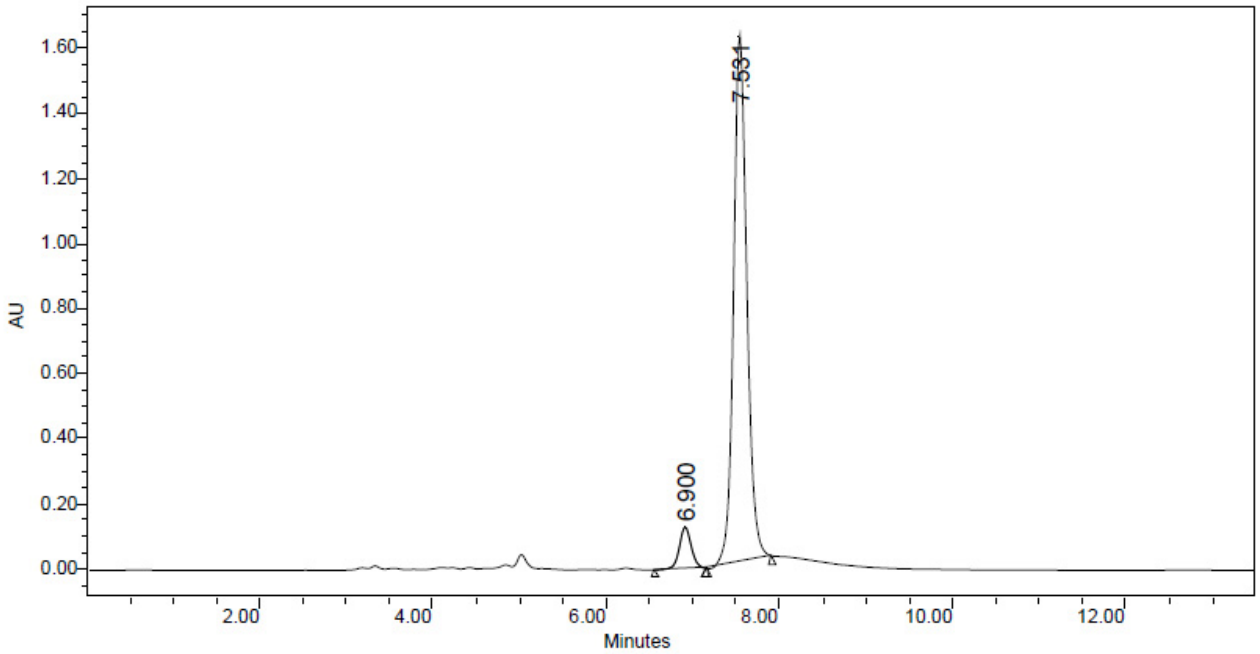

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 13.761 | 864135 | 49.01 | 56472 | 52.53 |
| 2 | 15.354 | 899101 | 50.99 | 51032 | 47.47 |



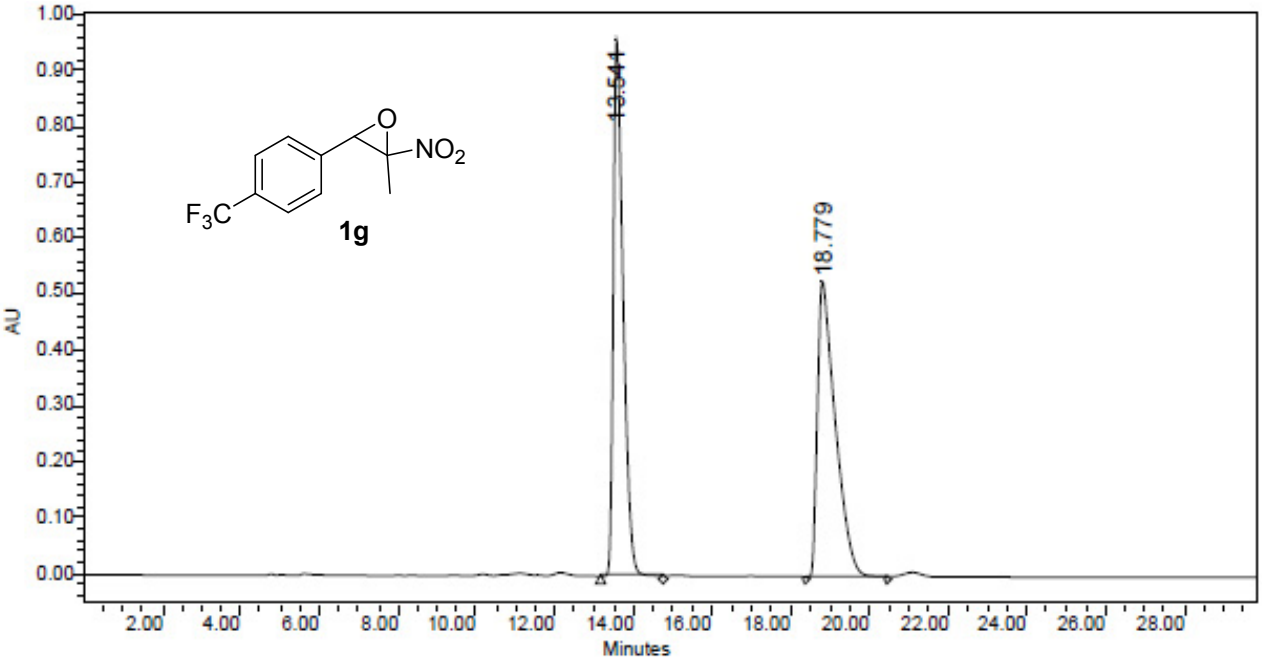

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 14.214 | 10970925 | 92.06 | 667355 | 92.80 |
| 2 | 16.171 | 945669 | 7.94 | 51757 | 7.20 |



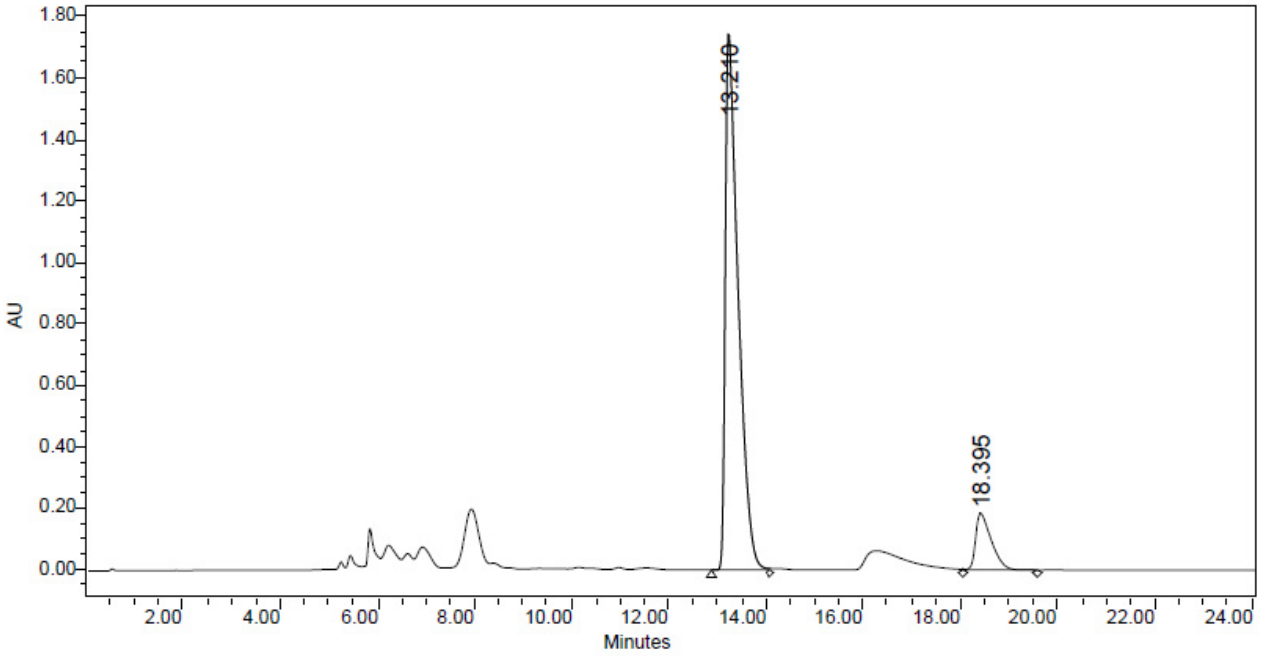

| | Peak Name | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|---|
| 1 | Peak1 | 6.572 | 24387382 | 50.58 | 2110891 | 50.21 |
| 2 | Peak2 | 7.207 | 23826568 | 49.42 | 2092925 | 49.79 |



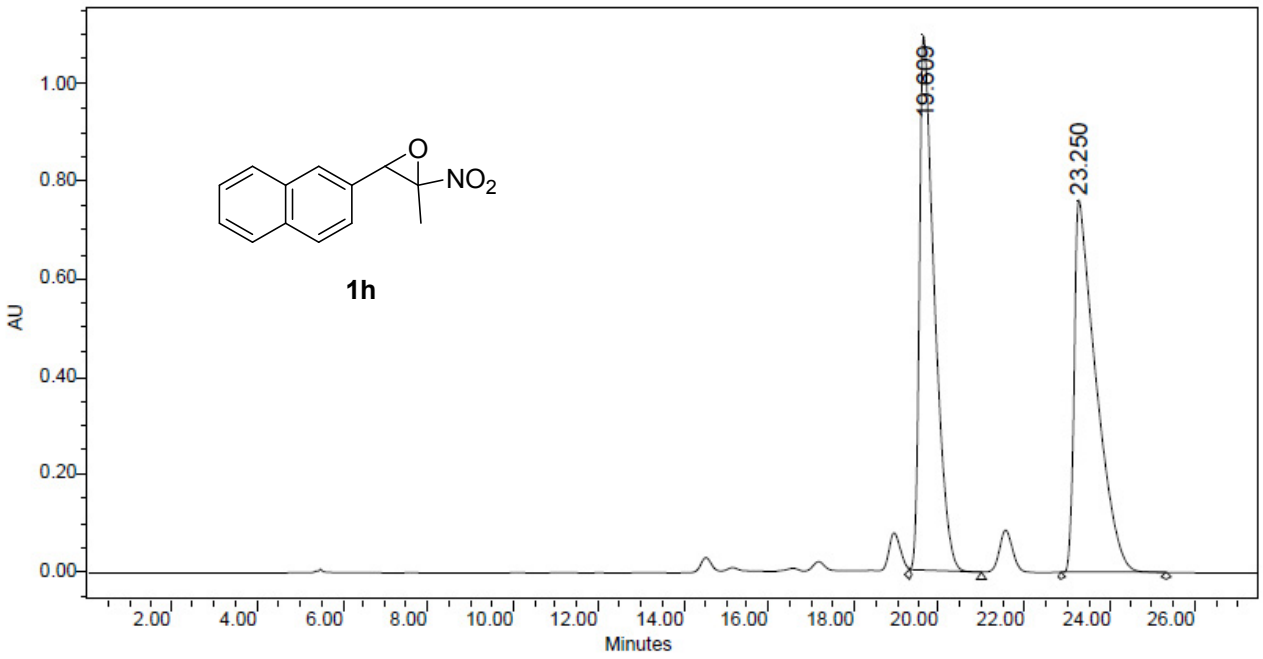

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 6.900 | 1262277 | 6.81 | 129544 | 7.41 |
| 2 | 7.531 | 17268101 | 93.19 | 1619217 | 92.59 |




| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 13.541 | 16667643 | 50.01 | 962702 | 64.58 |
| 2 | 18.779 | 16663753 | 49.99 | 528055 | 35.42 |




| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 13.210 | 32134640 | 88.53 | 1756444 | 90.47 |
| 2 | 18.395 | 4163943 | 11.47 | 185022 | 9.53 |

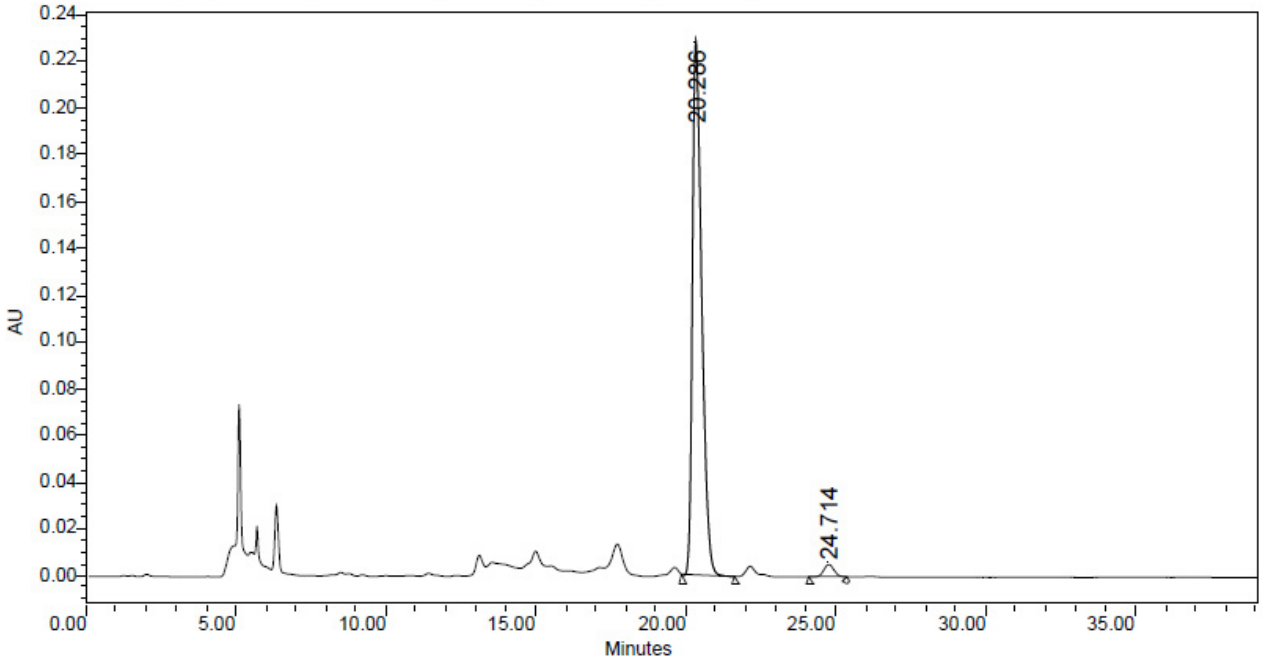




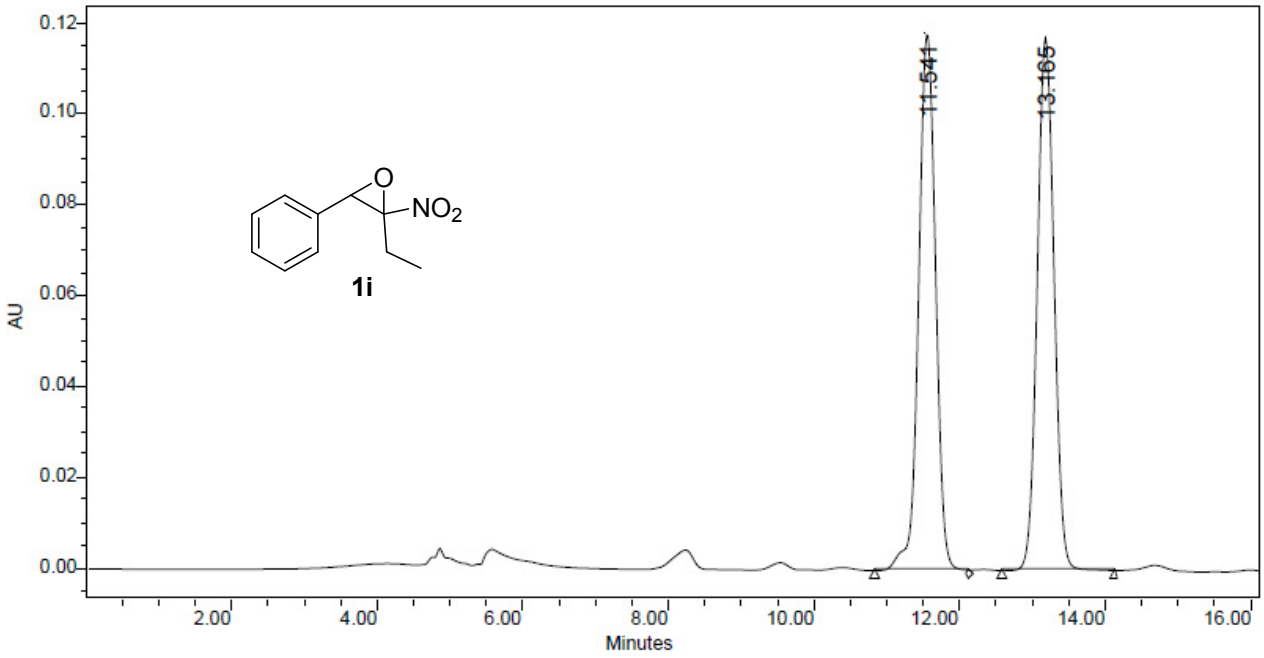


**1h**

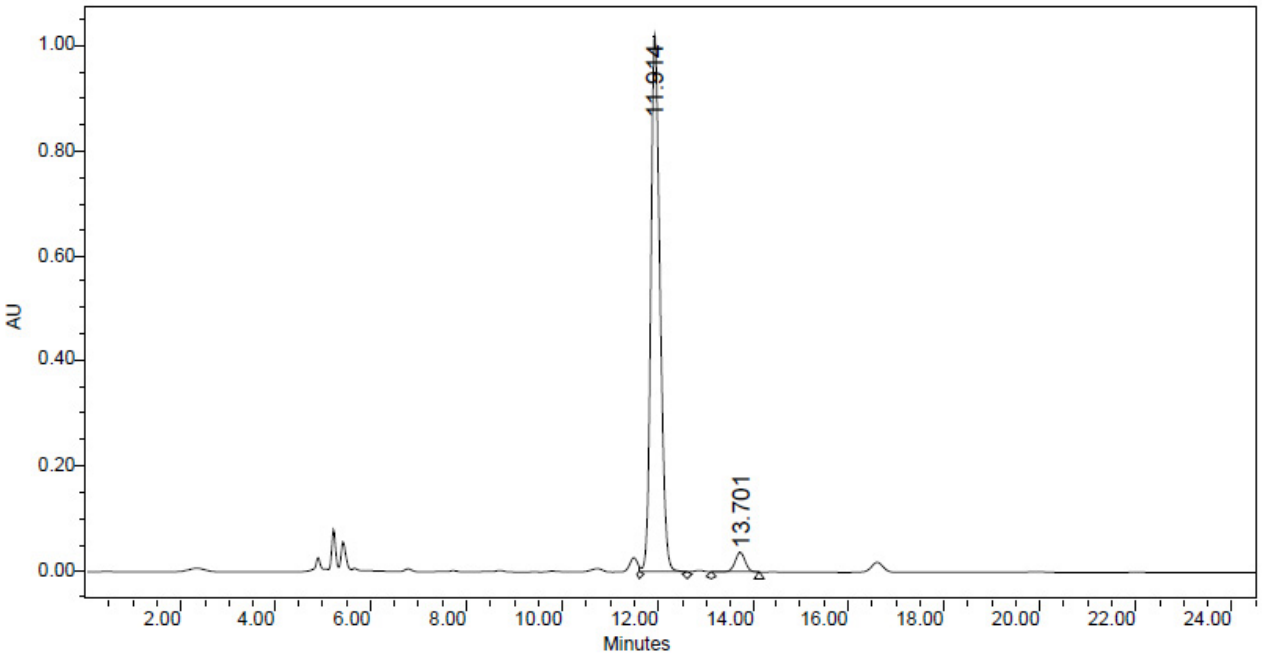
| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 19.609 | 26936455 | 49.84 | 1099274 | 59.03 |
| 2 | 23.250 | 27112984 | 50.16 | 762846 | 40.97 |



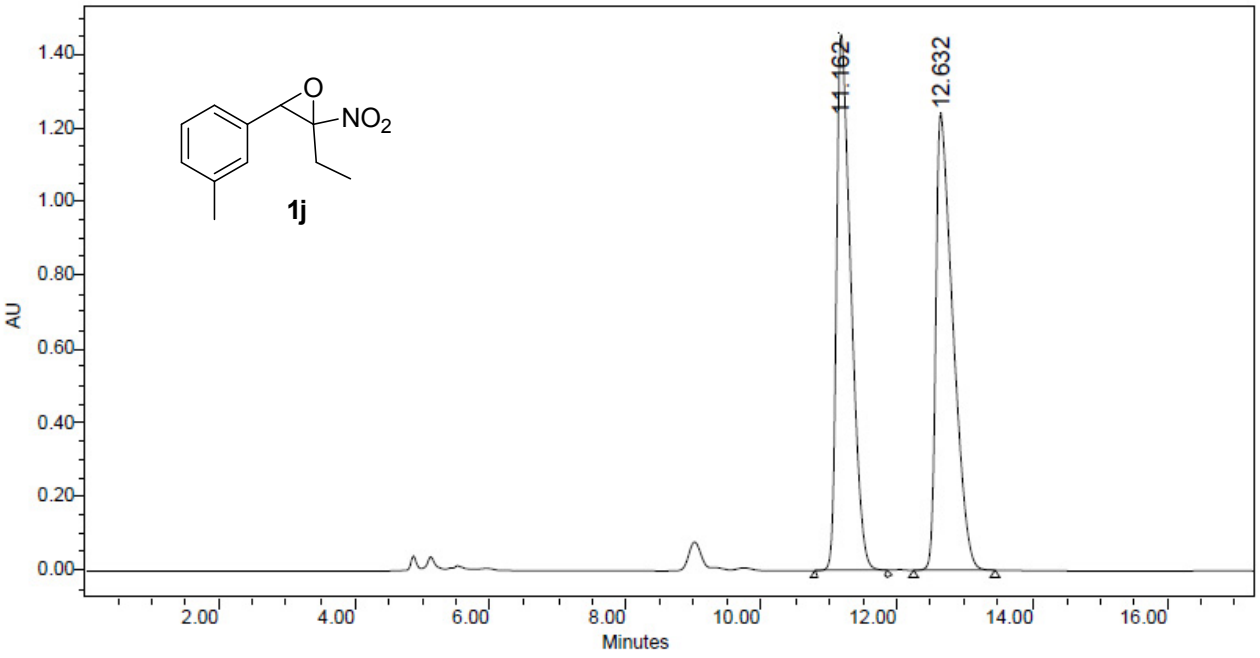

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 20.286 | 4915967 | 97.43 | 228886 | 97.69 |
| 2 | 24.714 | 129924 | 2.57 | 5403 | 2.31 |



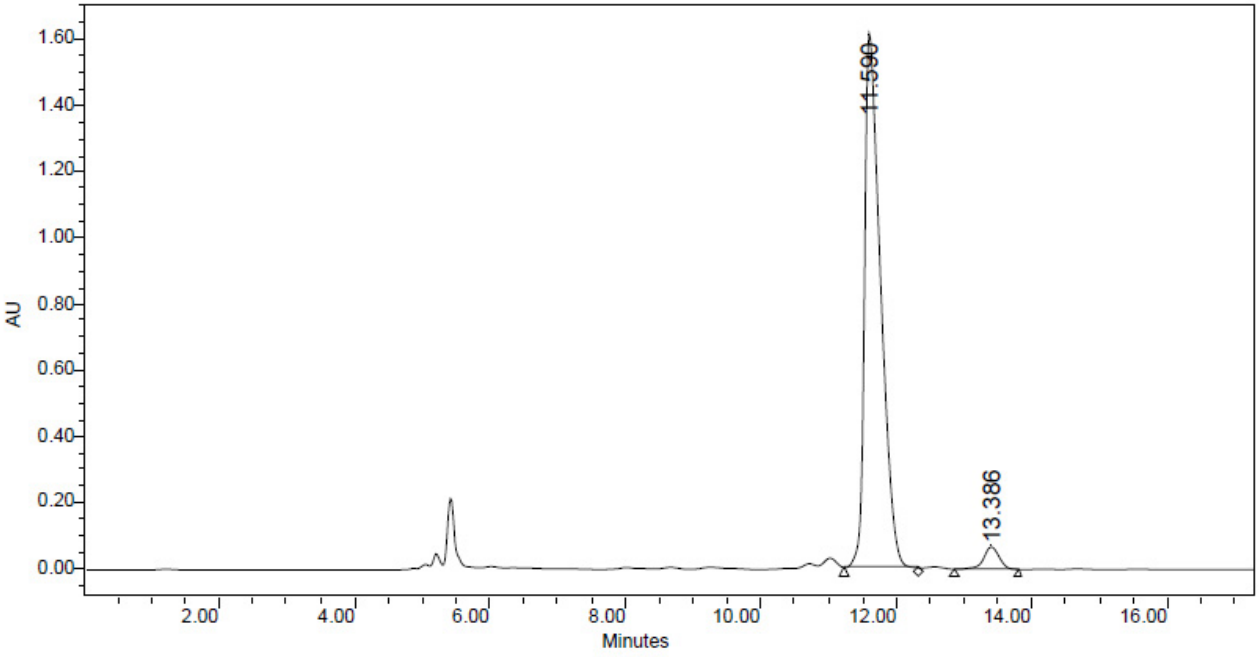

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 11.541 | 1923611 | 50.50 | 118170 | 50.21 |
| 2 | 13.165 | 1885766 | 49.50 | 117159 | 49.79 |



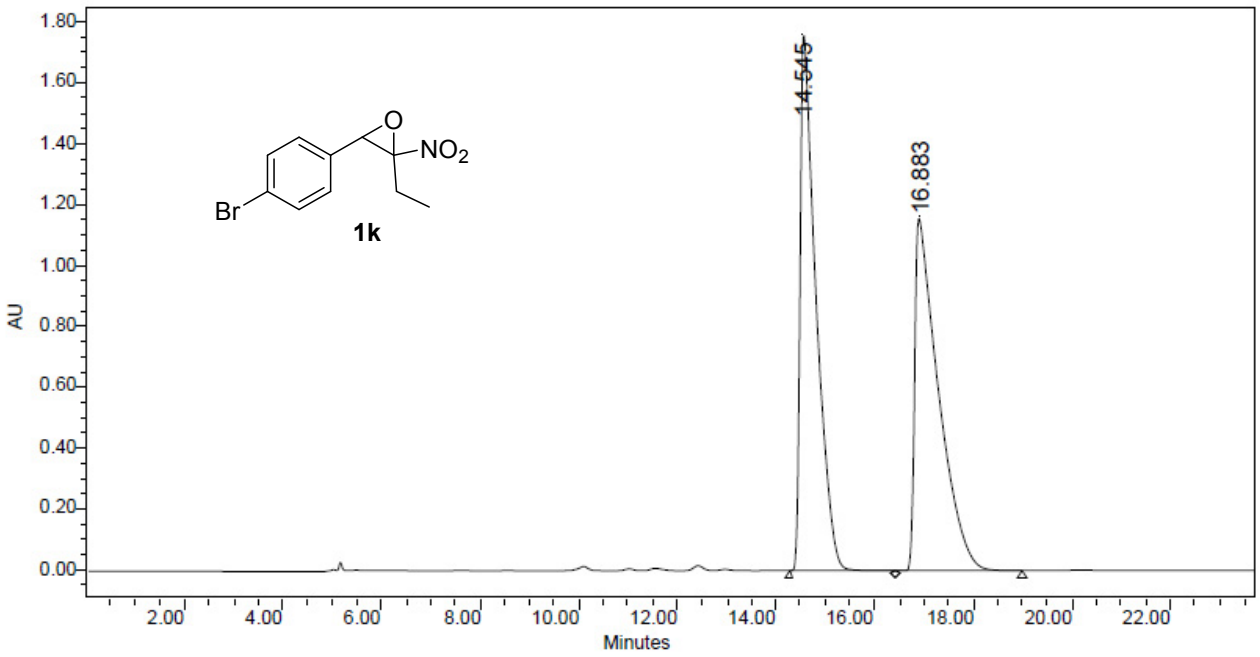

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 11.914 | 13675053 | 96.06 | 1023689 | 96.47 |
| 2 | 13.701 | 560750 | 3.94 | 37491 | 3.53 |



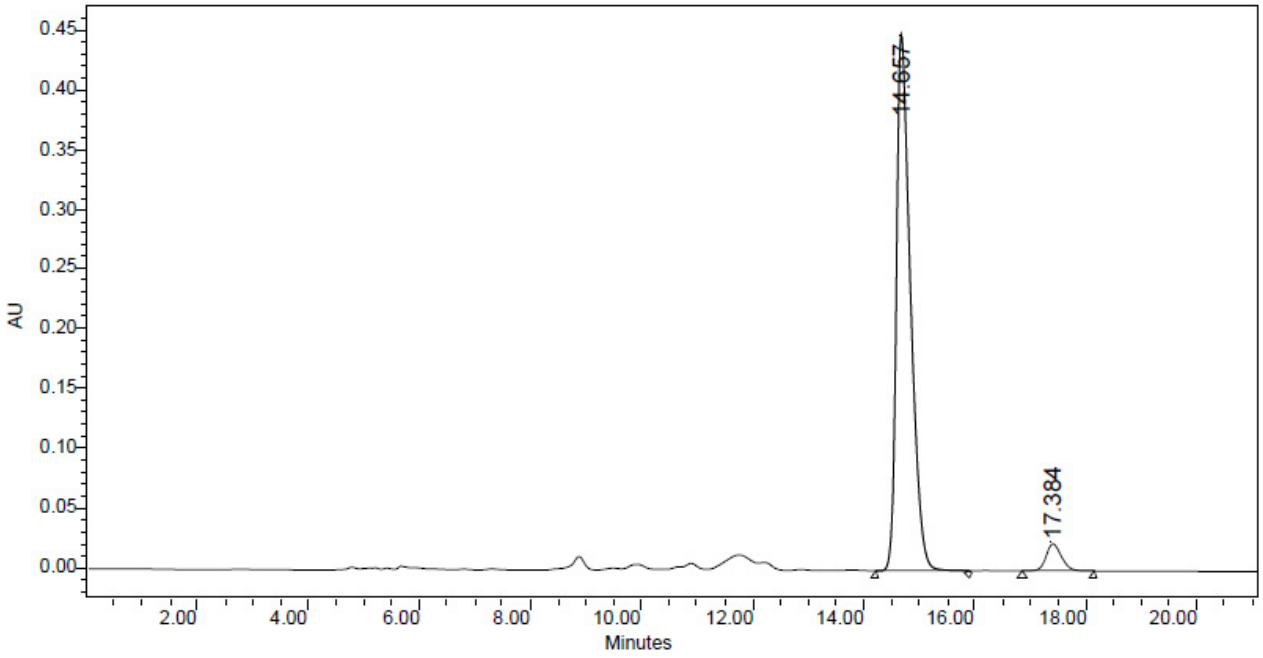

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 11.162 | 21624916 | 49.80 | 1457832 | 54.04 |
| 2 | 12.632 | 21802428 | 50.20 | 1239960 | 45.96 |



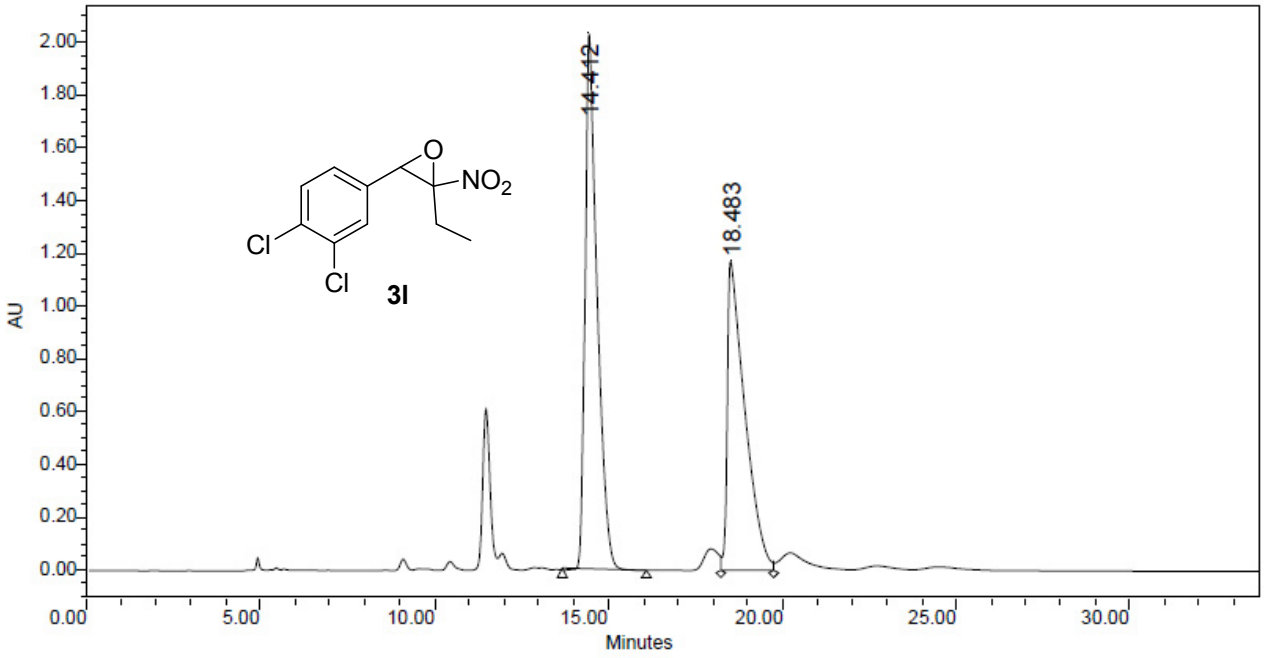

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 11.590 | 26703128 | 96.06 | 1621520 | 95.97 |
| 2 | 13.386 | 1096052 | 3.94 | 68014 | 4.03 |



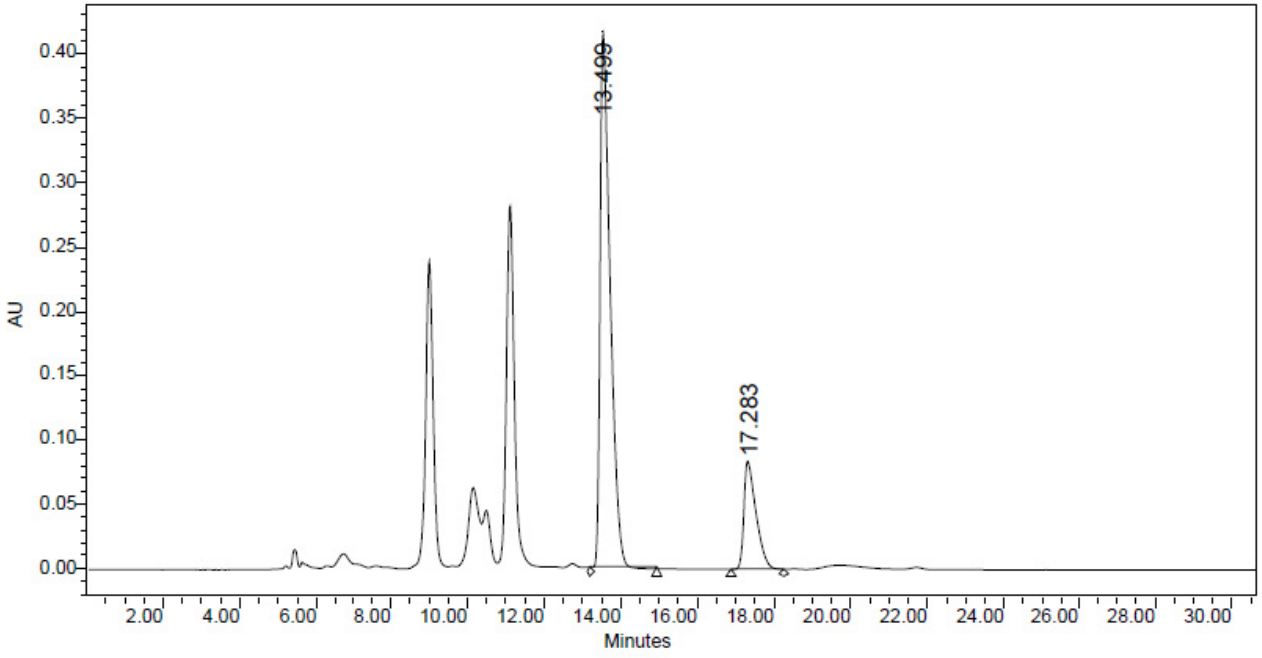

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 14.545 | 39250385 | 50.50 | 1766722 | 60.46 |
| 2 | 16.883 | 38466589 | 49.50 | 1155372 | 39.54 |



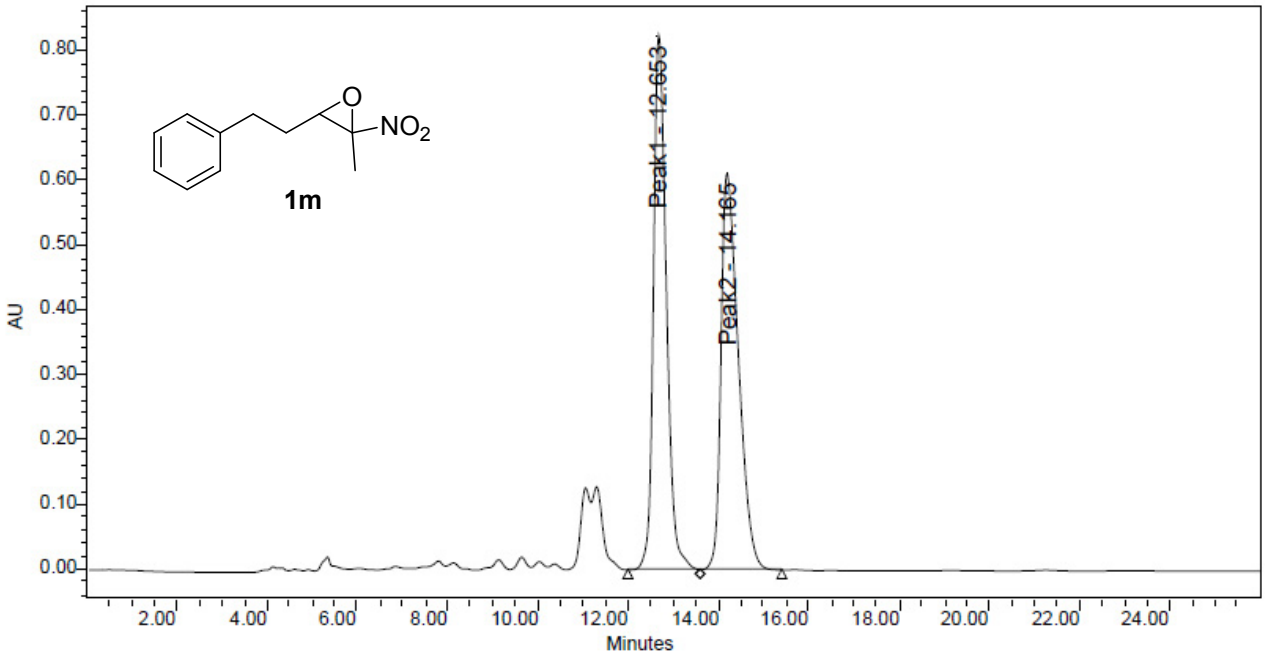

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 14.657 | 7879406 | 94.74 | 449920 | 95.20 |
| 2 | 17.384 | 437210 | 5.26 | 22678 | 4.80 |



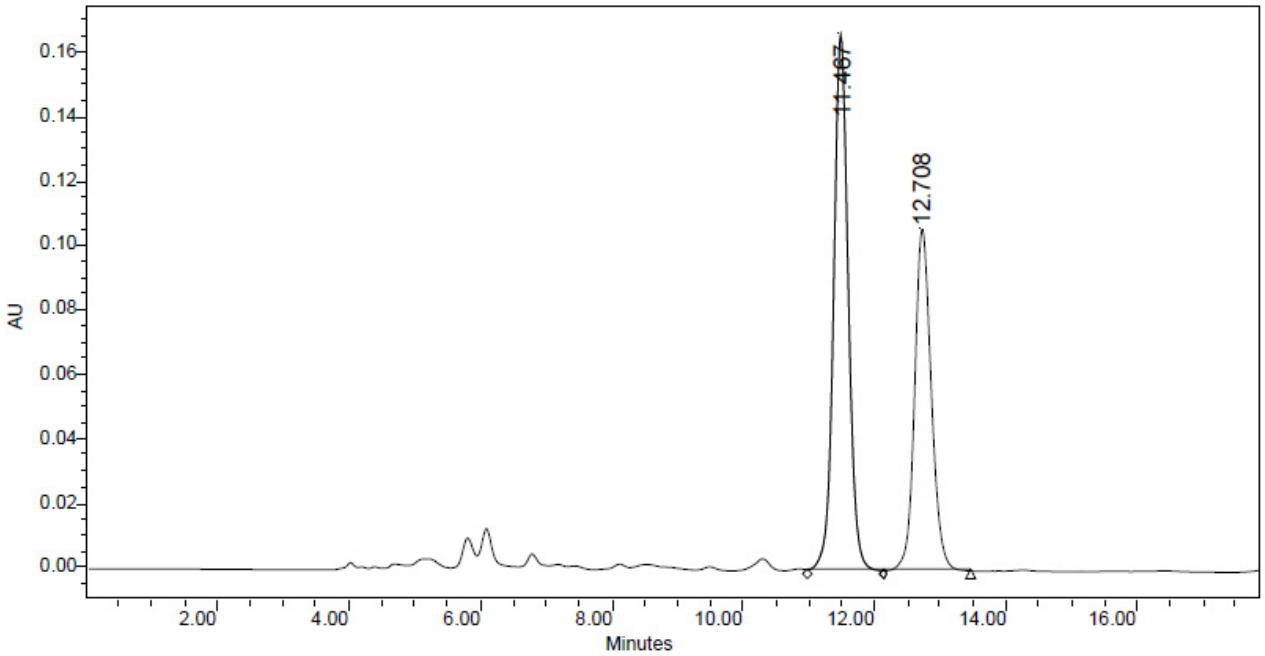

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 14.412 | 48990714 | 54.39 | 2036442 | 63.44 |
| 2 | 18.483 | 41082265 | 45.61 | 1173808 | 36.56 |



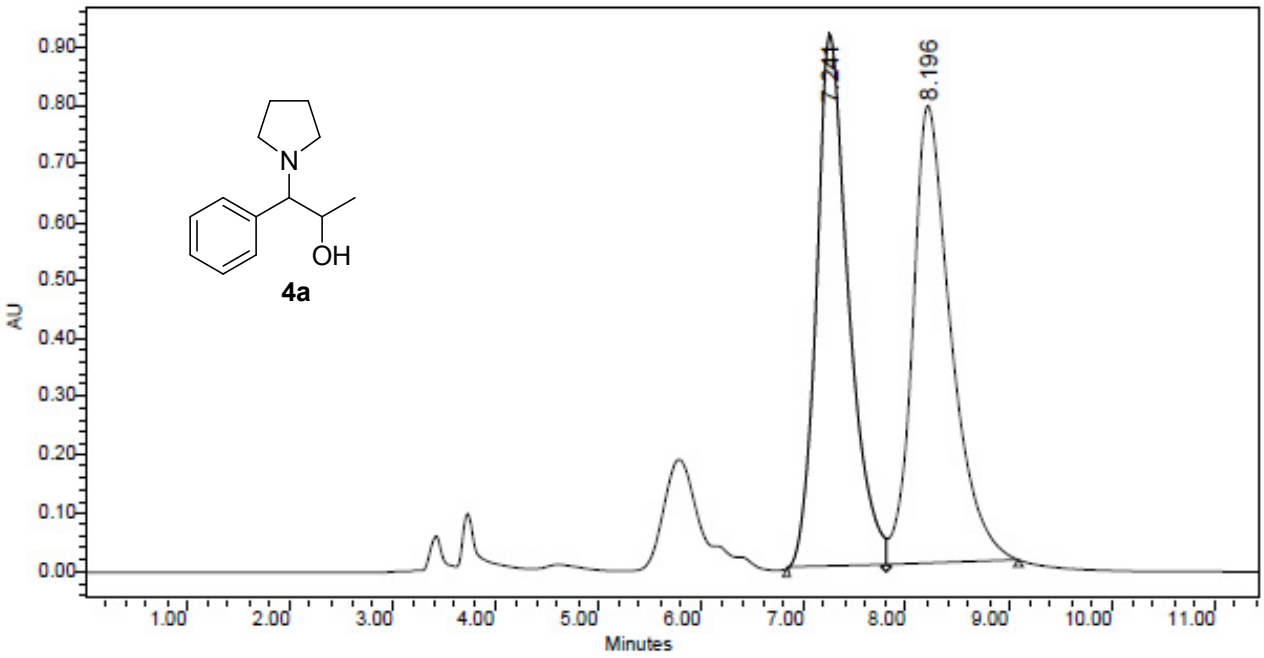

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 13.499 | 7654713 | 80.51 | 415746 | 83.16 |
| 2 | 17.283 | 1853334 | 19.49 | 84187 | 16.84 |



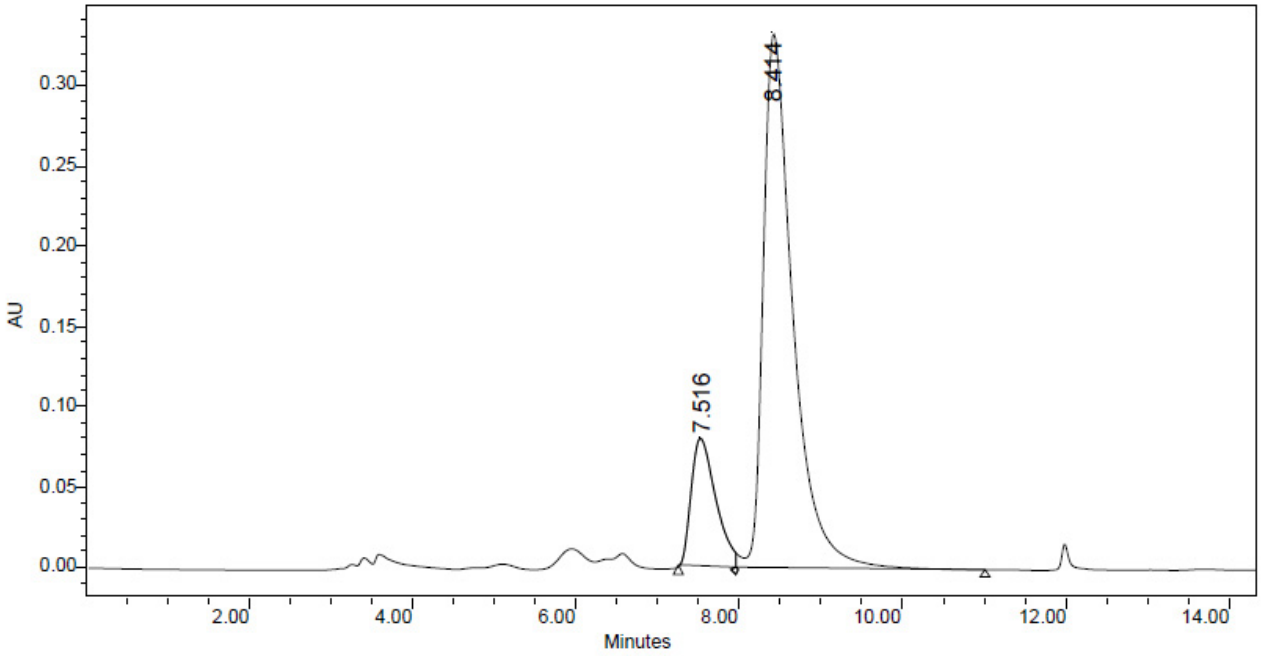

| | Peak Name | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|---|
| 1 | Peak1 | 12.653 | 16423500 | 50.02 | 826511 | 57.44 |
| 2 | Peak2 | 14.165 | 16412094 | 49.98 | 612332 | 42.56 |



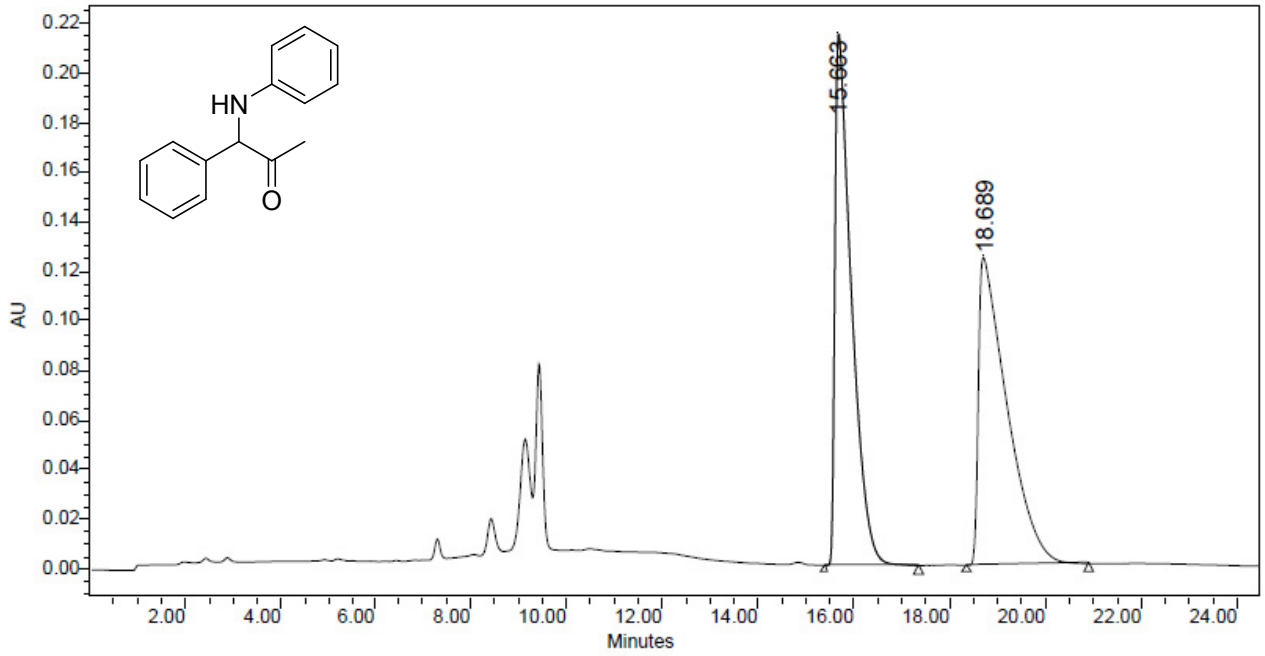

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 11.467 | 2574653 | 57.82 | 166210 | 61.02 |
| 2 | 12.708 | 1877866 | 42.18 | 106186 | 38.98 |



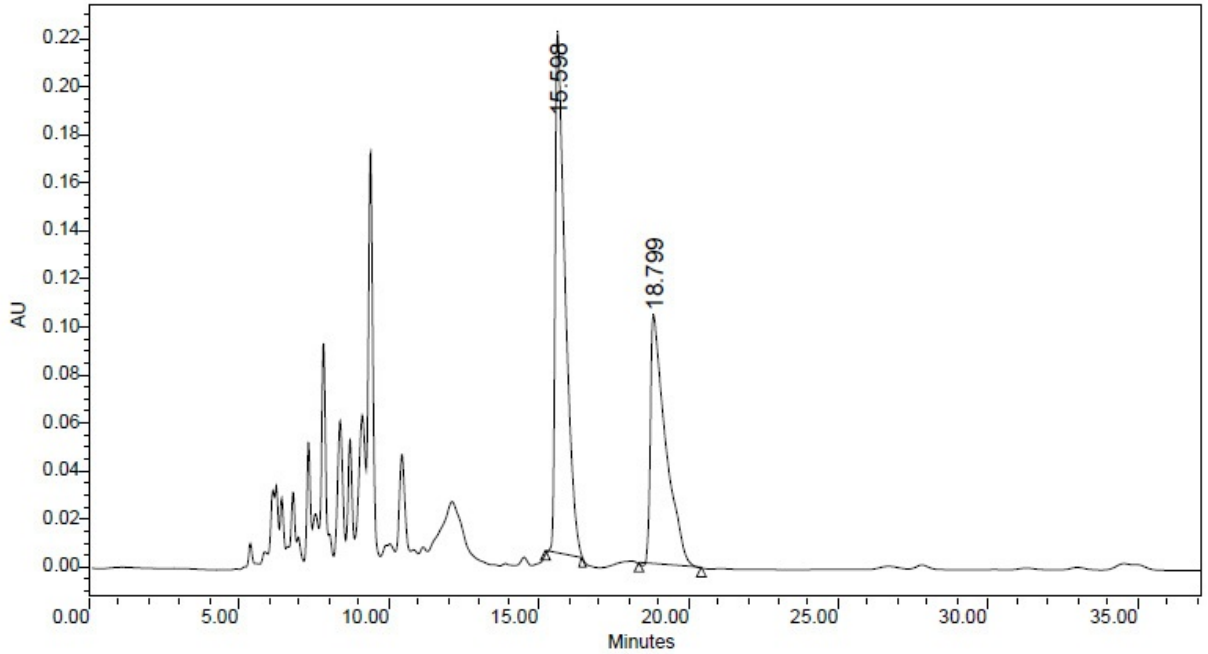

| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 7.241 | 19928016 | 49.44 | 914490 | 53.79 |
| 2 | 8.196 | 20381865 | 50.56 | 785762 | 46.21 |




| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 7.516 | 1676367 | 16.59 | 80018 | 19.41 |
| 2 | 8.414 | 8429950 | 83.41 | 332326 | 80.59 |




| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 15.663 | 5135581 | 49.95 | 214295 | 63.32 |
| 2 | 18.689 | 5144843 | 50.05 | 124154 | 36.68 |




| | RT (min) | Area (μV*sec) | % Area | Height (μV) | % Height |
|---|---|---|---|---|---|
| 1 | 15.598 | 5075409 | 57.82 | 216692 | 67.56 |
| 2 | 18.799 | 3702638 | 42.18 | 104049 | 32.44 |