Supporting Information for

Enantioselective Synthesis of Medium-sized-ring Lactones via Iridium-catalyzed *Z*-Retentive Asymmetric Allylic Substitution Reaction

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1. General Methods.

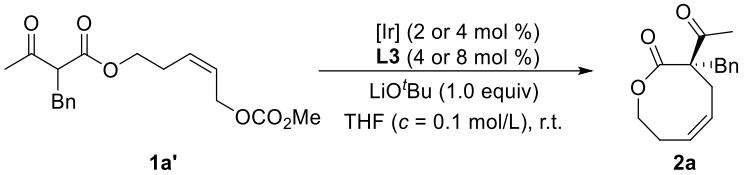
Unless stated otherwise, all reactions were carried out in flame-dried glassware under a dry argon atmosphere. All solvents were purified and dried according to standard methods prior to use.

^{1}H NMR spectra were recorded on a Varian (400 MHz) or Agilent instrument (400 MHz) and internally referenced to tetramethylsilane signal or residual solvent signals. ^{13}C NMR spectra were recorded on a Varian (100 MHz) or Agilent instrument (100 MHz) and internally referenced to residual solvent signals. Data for ^{1}H NMR are recorded as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet or unresolved, brs = broad singlet, coupling constant (s) in Hz, integration). Data for ^{13}C NMR are reported in terms of chemical shift (δ, ppm).

2. Experimental details and characterization data

2.1 Optimization of the reaction conditions

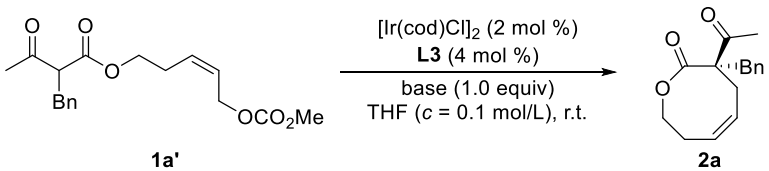
Table S1 Investigation of the Ir/L ratios and Ir sources



entry[a]	[Ir]	Ir/L	conv. (%)[b]	yield (%)[c]	ee (%)[d]
1	$[Ir(cod)Cl]_2$	1:1	> 95	41	91
2	$[Ir(cod)Cl]_2$	1:2	87	47	32
3	$[Ir(cod)Cl]_2$	2:1	86	22	84
4	$[Ir(coe)_2Cl]_2$	1:1	89	43	76
5	$[Ir(dbcot)Cl]_2$	1:1	69	(< 10)	/
6	$[Ir(dncot)Cl]_2$	1:1	45	(< 10)	/

[a] Reaction conditions: **1a′** (0.2 mmol), Ir (0.004 or 0.08 mmol), **L3** (0.008 or 0.016 mmol), and LiO^{t}Bu (0.2 mmol) in THF (2.0 mL) at room temperature. [b] Determined by ^{1}H NMR using CH_2Br_2 (0.2 mmol) as internal standard. [c] Isolated yield. [d] Determined by HPLC analysis.

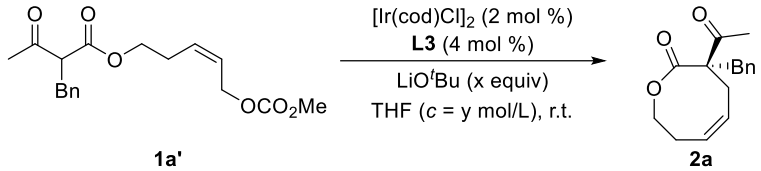
Table S2 Investigation of the bases



entry[a]	base	conv. (%)[b]	yield (%)[c]	ee (%)[d]
1	DABCO	89	11	12
2	Cs_2CO_3	85	33	57
3	LiO^{t}Bu	> 95	41	91
4	NaO^{t}Bu	92	38	56
5	KO^{t}Bu	87	25	69
6	NaH	92	46	86

[a] Reaction conditions: **1a′** (0.2 mmol), $[Ir(cod)Cl]_2$ (0.004 mmol), **L3** (0.008 mmol), and base (0.2 mmol) in THF (2.0 mL) at room temperature. [b] Determined by ^{1}H NMR using CH_2Br_2 (0.2 mmol) as internal standard. [c] Isolated yield. [d] Determined by HPLC analysis.

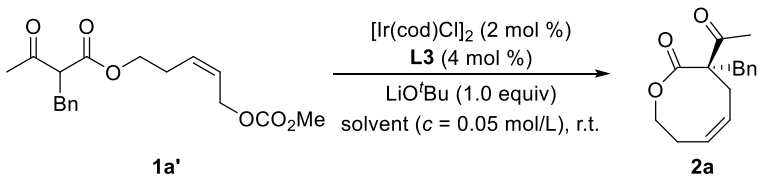
Table S3 Investigation of the substrate concentration and the equivalent of base



entry[a]	x	y	conv. (%)[b]	yield (%)[c]	ee (%)[d]
1	1.0	0.1	> 95	41	91
2	1.0	0.067	> 95	47	96
3	1.0	0.05	> 95	51	97
4	1.0	0.04	> 95	46	96
5	1.0	0.033	> 95	49	96
6	1.0	0.025	> 95	33	90
7	1.0	0.001	> 95	31	94
8	2.0	0.05	89	17	12
9	3.0	0.05	> 95	< 5	/

[a] Reaction conditions: **1a′** (0.2 mmol), $[Ir(cod)Cl]_2$ (0.004 mmol), **L3** (0.008 mmol), and LiO^tBu (x equiv) in THF (*c* = y mol/L) at room temperature. [b] Determined by ^1H NMR using CH_2Br_2 (0.2 mmol) as internal standard. [c] Isolated yield. [d] Determined by HPLC analysis.

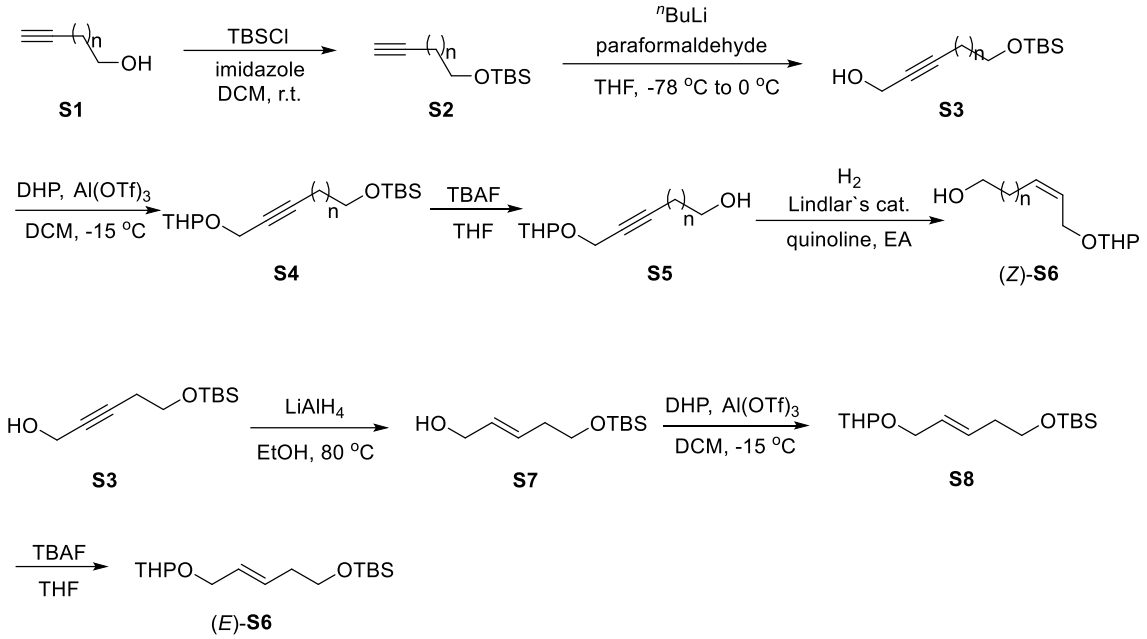
Table S4 Investigation of the solvents



entry[a]	solvent	conv. (%)[b]	yield (%)[c]	ee (%)[d]
1	THF	> 95	51	97
2	dioxane	> 95	13	94
3	DCM	> 95	45	85
4	Et_2O	> 95	38	91
5	toluene	> 95	50	94
6	CH_3CN	> 95	38	94

[a] Reaction conditions: **1a′** (0.2 mmol), $[Ir(cod)Cl]_2$ (0.004 mmol), **L3** (0.008 mmol), and LiO^tBu (0.2 mmol) in solvent (4.0 mL) at room temperature. [b] Determined by ^1H NMR using CH_2Br_2 (0.2 mmol) as internal standard. [c] Isolated yield. [d] Determined by HPLC analysis.

2.2 General procedure for the synthesis of substrates



Imidazole (1.5 equiv) and TBSCl (1.5 equiv) were added to a solution of **S1** (1.0 equiv) in DCM (0.2 M) at 0 °C. Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was quenched by saturated NH_4Cl aqueous solution. The mixture was extracted with DCM. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo to afford crude product **S2**.

^{n}BuLi (1.2 equiv, 2.5 mol/L in THF) was added to a solution of **S2** (1.0 equiv) in THF (0.5 M) under argon atmosphere at -78 °C. The reaction mixture was stirred at -78 °C for 30 min, then $(CH_2O)_n$ (3.0 equiv) was added. Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was quenched by saturated $NaHCO_3$ aqueous solution. The mixture was extracted with EtOAc. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo to afford crude product **S3**.

DHP (1.5 equiv) and $Al(OTf)_3$ (0.1 equiv) were added to a solution of **S3** (1.0 equiv) in DCM (0.2 M) at -15 °C. Then the reaction mixture was stirred at -15 °C. After the reaction was complete (monitored by TLC), the crude reaction mixture was quenched by saturated $NaHCO_3$ aqueous solution. The mixture was extracted with

DCM. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo to afford crude product **S4**.

TBAF (1.0 equiv, 1.0 mol/L in THF) was added to a solution of **S4** (1.0 equiv) in THF (0.2 M) at 0 ºC. Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was extracted with EtOAc. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo to afford crude product **S5**.

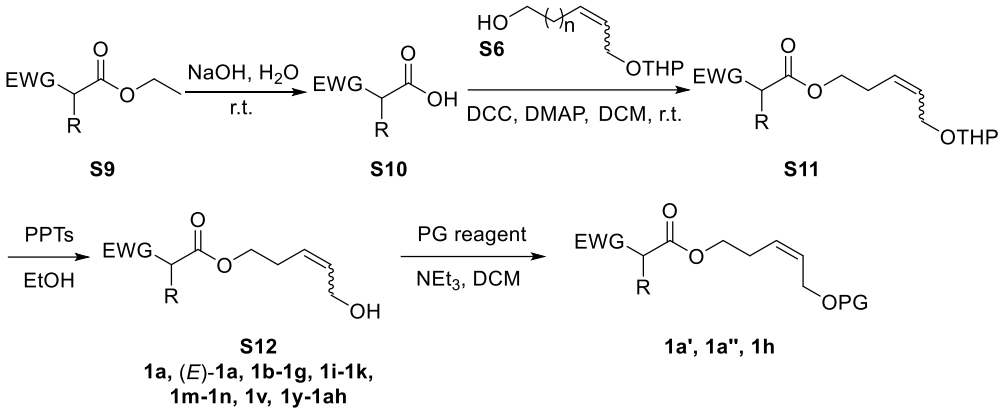
Lindlar's catalyst (10% wt, 5% Pd/$CaSO_4$) and quinoline (0.1 equiv) were added to a solution of **S5** (1.0 equiv) in EtOAc (0.2 M). Then the reaction system was filled with H_2 and stirred at room temperature. After the reaction was complete (monitored by NMR crude spectrum), the crude reaction mixture was filtered through a pad of celite. After the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 2:1) to afford the desired intermediate (*Z*)-**S6**.

$LiAlH_4$ (1.1 equiv) and EtOH (2.0 equiv) was added to a solution of **S3** (1.0 equiv) in THF (0.2 M) at 0 ºC. Then the reaction mixture was heated at 80 ℃. After the reaction was complete (monitored by TLC), the crude reaction mixture was extracted with EtOAc. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. After the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 20:1) to afford the desired intermediate **S7**.

DHP (1.5 equiv) and $Al(OTf)_3$ (0.1 equiv) were added to a solution of **S7** (1.0 equiv) in DCM (0.2 M) at -15 ºC. Then the reaction mixture was stirred at -15 ºC. After the reaction was complete (monitored by TLC), the crude reaction mixture was quenched by saturated $NaHCO_3$ aqueous solution. The mixture was extracted with DCM. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo to afford crude product **S8**.

TBAF (1.0 equiv, 1.0 mol/L in THF) was added to a solution of **S8** (1.0 equiv) in

THF (0.2 M) at 0 °C. Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was extracted with EtOAc. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo to afford crude product (*E*)-**S6**.



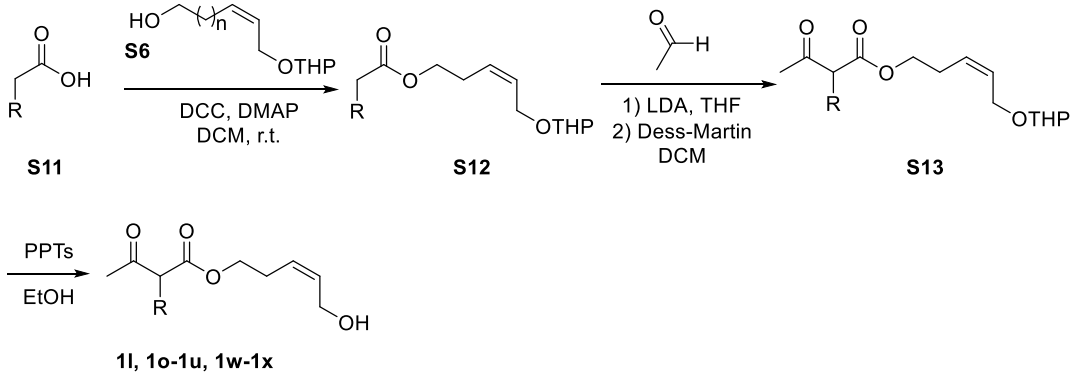
S9 was added to NaOH aqueous solution (2.5 mol/L). Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), concentrated hydrochloric acid (12 N) was added to adjust the solution pH = 1.0. The mixture was extracted with DCM. The organic layer was dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo to afford crude product **S10**.

DCC (1.3 equiv) and DMAP (0.13 equiv) were added to a solution of **S6** (1.0 equiv) and **S10** (3.0 equiv) in DCM (0.5 M). Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was filtered through a pad of celite. After the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 30:1) to afford the desired compound **S11**.

PPTs (0.5 equiv) was added to a solution of **S11** (1.0 equiv) in EtOH (0.5 M). Then the reaction mixture was stirred at 55 °C. After the reaction was complete (monitored by TLC), the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 5:1) to afford the desired compound **S12/1a**, (*E*)-**1a**, **1b-1g**, **1i-1k**, **1m-1n**, **1v**, **1y-1ah**.

PG reagent (1.2-1.5 equiv) was added to a solution of **S12** (1.0 equiv) and NEt_3 (2.0 equiv) in DCM (0.5 M) at room temperature. After the reaction was complete

(monitored by TLC), the crude reaction mixture was quenched by water and extracted with DCM. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. After the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 30:1) to afford the desired product **1a′**, **1a″**, **1h**.

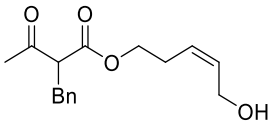


DCC (1.3 equiv) and DMAP (0.13 equiv) were added to a solution of **S6** (1.0 equiv) and **S11** (3.0 equiv) in DCM (0.5 M). Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was filtered through a pad of celite. After the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 30:1) to afford the desired compound **S12**.

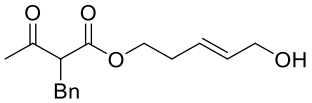
LDA (1.2 equiv, 2.0 mol/L in THF/n-heptane/ethylbenzene) was added to a solution of **S12** (1.0 equiv) in THF (0.5 M) under argon atmosphere at -78 °C. The reaction mixture was stirred at -78 °C for 30 min, then CH_3CHO (1.2 equiv) was added. Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was quenched by saturated NH_4Cl aqueous solution. The mixture was extracted with EtOAc. The organic layer was washed with brine, dried over anhydrous Na_2SO_4 and filtered. Then, the filtrate was concentrated in vacuo. Dess-Martin (1.2 equiv) was added to a solution of the residue (1.0 equiv) in DCM (0.5 M). Then the reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was filtered through a pad of celite. After the solvent was concentrated under reduced

pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 30:1) to afford the desired compound **S13**.

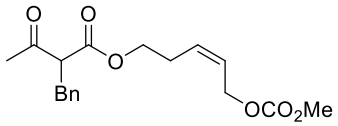
PPTs (0.5 equiv) was added to a solution of **S13** (1.0 equiv) in EtOH (0.5 M). Then the reaction mixture was stirred at 55 ºC. After the reaction was complete (monitored by TLC), the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 5:1) to afford the desired compound **1l**, **1o-1u**, **1w-1x**.



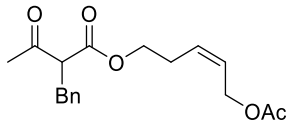
1a: colorless oil, 916.0 mg, 80% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.16 (m, 5H), 5.72-5.66 (m, 1H), 5.42-5.36 (m, 1H), 4.15-4.05 (m, 4H), 3.80 (t, *J* = 7.6 Hz, 1H), 3.15 (d, *J* = 7.6 Hz, 2H), 2.41-2.30 (m, 2H), 2.24 (brs, 1H), 2.17 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.8, 168.7, 137.6, 131.6, 128.4, 128.3, 126.5, 126.4, 64.2, 60.8, 58.0, 33.7, 29.6, 26.5. IR (film): v_{max} (cm^{-1}) = 3663, 3412, 2970, 2902, 1736, 1711, 1604, 1496, 1410, 1381, 1358, 1244, 1216, 1146, 1043, 748, 699, 609, 566, 536, 508. HRMS (ESI): Exact mass calcd. for $C_{16}H_{20}O_4Na$ ($[M+Na]^+$): 299.12538. Found: 299.12571.



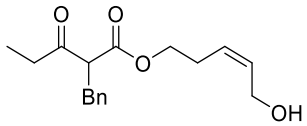
(*E*)-**1a**: colorless oil, 330.2 mg, 81% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30-7.11 (m, 5H), 5.65 (dt, J = 15.6, 5.6 Hz, 1H), 5.58-5.49 (m, 1H), 4.23-4.02 (m, 4H), 3.81 (t, *J* = 7.6 Hz, 1H), 3.15 (d, *J* = 7.6 Hz, 2H), 2.37-2.28 (m, 2H), 2.17 (s, 3H), 2.14 (brs, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.1, 169.0, 138.0, 132.3, 128.8, 128.6, 127.1, 126.8, 64.4, 63.2, 61.1, 34.0, 31.5, 30.0. IR (film): v_{max} (cm^{-1}) = 3412, 3029, 3003, 2927, 2862, 1735, 1712, 1643, 1604, 1496, 1454, 1425, 1385, 1358, 1328, 1213, 1146, 1086, 1059, 1003, 969, 894, 749, 700, 610, 566, 536, 509. HRMS (ESI): Exact mass calcd. for $C_{16}H_{20}O_4Na$ ($[M+Na]^+$): 299.12538. Found: 299.12567.



1a′: colorless oil, 1.56 g, 72% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27-7.23 (m, 2H), 7.20-7.15 (m, 3H), 5.67-5.61 (m, 1H), 5.56-5.50 (m, 1H), 4.63-4.56 (m, 2H), 4.14-4.05 (m, 2H), 3.81 (t, *J* = 7.6 Hz, 1H), 3.73 (s, 3H), 3.18-3.09 (m, 2H), 2.45-2.32 (m, 2H), 2.16 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.2, 169.1, 155.7, 138.1, 130.3, 128.8, 128.6, 126.7, 125.9, 64.2, 63.3, 61.1, 54.8, 34.0, 29.7, 27.0. IR (film): v_{max} (cm^{-1}) = 3029, 2958, 2927, 2854, 1741, 1714, 1496, 1442, 1360, 1326, 1258, 1145, 1083, 1061, 1029, 947, 906, 792, 733, 700, 566, 536, 509. HRMS (ESI): Exact mass calcd. for $C_{18}H_{22}O_6Na$ ($[M+Na]^+$): 357.13086. Found: 357.13018.

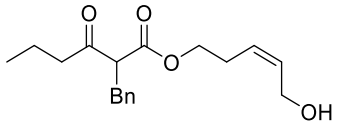


1a″: colorless oil, 2.16 g, 84% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (m, 5H), 5.66-5.60 (m, 1H), 5.55-5.47 (m, 1H), 4.58 (d, *J* = 6.8 Hz, 2H), 4.11 (t, *J* = 6.8 Hz, 2H), 3.79 (t, *J* = 7.6 Hz, 1H), 3.15 (dd, *J* = 7.6, 1.6 Hz, 2H), 2.40 (m, 2H), 2.18 (s, 3H), 2.05 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.3, 170.8, 169.0, 138.0, 129.4, 128.7, 128.6, 126.7, 126.5, 64.3, 61.1, 60.0, 34.0, 29.7, 26.9, 20.9. IR (film): v_{max} (cm^{-1}) = 3029, 2960, 2322, 1734, 1714, 1646, 1605, 1496, 1453, 1439, 1372, 1360, 1328, 1227, 1145, 1026, 960, 843, 736, 700, 607, 566, 508. HRMS (ESI): Exact mass calcd. for $C_{18}H_{22}O_5Na$ ($[M+Na]^+$): 341.13594. Found: 341.13566.

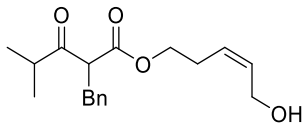


1b: colorless oil, 405.0 mg, 79% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.14 (m, 5H), 5.73-5.67 (m, 1H), 5.42-5.36 (m, 1H), 4.19-4.04 (m, 4H), 3.81 (t, *J* = 7.6 Hz, 1H), 3.15 (d, *J* = 7.6 Hz, 2H), 2.61-2.51 (m, 1H), 2.44-2.26 (m, 3H), 2.21 (brs, 1H), 0.97 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.9, 169.0, 138.0, 131.8, 128.7, 128.6, 126.7, 64.4, 60.1, 60.0, 58.3, 36.5, 34.2, 26.8, 7.4. IR (film): v_{max} (cm^{-1}) = 3398, 3026, 2975, 2939, 1737, 1711, 1604, 1496, 1455, 1408, 1380, 1349, 1327, 1267,

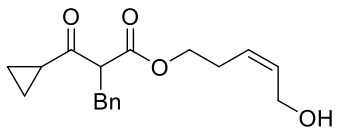
1201, 1162, 1107, 1030, 1004, 748, 699, 565, 506. HRMS (ESI): Exact mass calcd. for $C_{17}H_{22}O_4Na$ ([M+Na]$^+$): 313.14103. Found: 313.14140.



1c: colorless oil, 581.3 mg, 83% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.24 (m, 5H), 5.73-5.67 (m, 1H), 5.42-5.36 (m, 1H), 4.19-4.04 (m, 4H), 3.80 (t, *J* = 7.6 Hz, 1H), 3.14 (d, *J* = 7.6 Hz, 2H), 2.55-2.25 (m, 5H), 1.56-1.47 (m, 2H), 0.82 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.3, 169.0, 138.0, 131.8, 128.8, 128.5, 126.7, 64.4, 60.4, 58.2, 44.9, 34.1, 26.8, 16.7, 13.4. IR (film): v_{max} (cm^{-1}) = 3396, 3026, 2963, 2934, 2876, 1737, 1710, 1604, 1496, 1454, 1379, 1262, 1199, 1162, 1120, 1030, 1003, 749, 699, 565, 507. HRMS (ESI): Exact mass calcd. for $C_{18}H_{24}O_4Na$ ([M+Na]$^+$): 327.15668. Found: 327.15658.

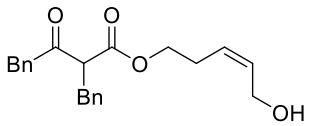


1d: colorless oil, 497.7 mg, 97% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.14 (m, 5H), 5.74-5.68 (m, 1H), 5.43-5.37 (m, 1H), 4.23-4.02 (m, 4H), 3.96 (t, *J* = 7.6 Hz, 1H), 3.14 (d, *J* = 7.6 Hz, 2H), 2.57 (hept, *J* = 6.8 Hz, 1H), 2.45-2.29 (m, 3H), 1.04 (d, *J* = 6.8 Hz, 3H), 0.85 (d, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 209.1, 168.9, 138.2, 131.8, 128.9, 128.5, 126.7, 126.6, 64.4, 58.5, 58.3, 41.6, 34.5, 26.8, 17.7, 17.4. IR (film): v_{max} (cm^{-1}) = 3397, 3026, 2970, 2934, 2874, 1738, 1709, 1604, 1495, 1456, 1383, 1249, 1201, 1156, 1113, 1098, 1080, 1030, 1005, 976, 751, 700, 562, 521. HRMS (ESI): Exact mass calcd. for $C_{18}H_{24}O_4Na$ ([M+Na]$^+$): 327.15668. Found: 327.15681.

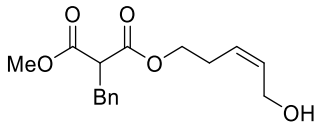


1e: colorless oil, 133.0 mg, 83% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.17 (m, 5H), 5.72-5.66 (m, 1H), 5.43-5.37 (m, 1H), 4.17-4.04 (m, 4H), 3.93 (t, *J* = 7.6 Hz, 1H), 3.19 (d, *J* = 7.6 Hz, 2H), 2.42-2.29 (m, 2H), 2.19 (brs, 1H), 2.01 (dt, *J* = 8.0 Hz, 4.4 Hz, 1H), 1.08-0.98 (m, 2H), 0.96-0.84 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.2, 169.1,

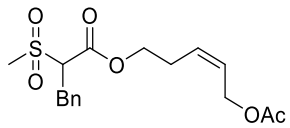
138.1, 131.7, 128.8, 128.5, 126.8, 126.6, 64.4, 61.3, 58.2, 34.1, 26.8, 20.5, 12.1, 11.9. IR (film): v_{max} (cm^{-1}) = 3395, 3023, 2957, 2927, 2860, 1734, 1697, 1604, 1495, 1453, 1382, 1318, 1260, 1200, 1160, 1109, 1070, 1030, 1003, 981, 868, 817, 749, 699, 560, 516. HRMS (ESI): Exact mass calcd. for $C_{18}H_{22}O_4Na$ ($[M+Na]^+$): 325.14103. Found: 325.14121.



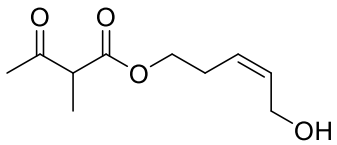
1f: colorless oil, 302.5 mg, 60% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.16 (m, 6H), 7.07-7.06 (m, 2H), 7.03-7.01 (m, 2H), 5.71-5.65 (m, 1H), 5.40-5.34 (m, 1H), 4.16-4.00 (m, 4H), 3.91 (t, *J* = 7.6 Hz, 1H), 3.71 (d, *J* = 16.0 Hz, 1H), 3.64 (d, *J* = 16.0 Hz, 1H), 3.17-3.07 (m, 2H), 2.40-2.24 (m, 2H), 2.12 (brs, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.7, 168.8, 137.8, 132.8, 131.9, 129.6, 128.8, 128.7, 128.6, 127.2, 126.8, 126.7, 64.6, 59.1, 58.3, 50.2, 34.2, 26.8. IR (film): v_{max} (cm^{-1}) = 3372, 3028, 2958, 2898, 1738, 1711, 1603, 1495, 1453, 1384, 1330, 1264, 1212, 1162, 1093, 1030, 1001, 735, 698, 531, 499. HRMS (ESI): Exact mass calcd. for $C_{22}H_{24}O_4Na$ ($[M+Na]^+$): 375.15668. Found: 375.15657.



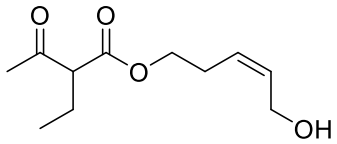
1g: colorless oil, 297.0 mg, 75% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.18 (m, 5H), 5.73-5.67 (m, 1H), 5.43-5.37 (m, 1H), 4.17-4.05 (m, 4H), 3.68-3.65 (m, 4H), 3.21 (d, *J* = 8.0 Hz, 2H), 2.43-2.29 (m, 2H), 2.13 (brs, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.5, 168.7, 137.7, 131.8, 128.8, 128.6, 127.0, 126.9, 64.5, 58.3, 53.8, 52.7, 34.7, 26.8. IR (film): v_{max} (cm^{-1}) = 3410, 2958, 2902, 1728, 1604, 1496, 1452, 1437, 1383, 1340, 1273, 1228, 1148, 1028, 909, 750, 736, 699, 597, 562, 520. HRMS (ESI): Exact mass calcd. for $C_{16}H_{20}O_5Na$ ($[M+Na]^+$): 315.12029. Found: 315.12029.



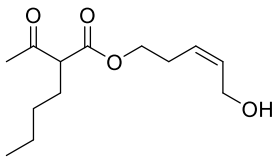
1h: colorless oil, 312.8 mg, 80% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34-7.25 (m, 3H), 7.21-7.19 (m, 2H), 5.60-5.54 (m, 1H), 5.43-5.36 (m, 1H), 4.53 (d, *J* = 6.8 Hz, 2H), 4.12 (t, *J* = 6.8 Hz, 2H), 4.05 (dd, *J* = 11.6, 3.6 Hz, 1H), 3.47 (dd, *J* = 13.6, 3.6 Hz, 1H), 3.32-3.26 (m, 1H), 3.06 (s, 3H), 2.40-2.26 (m, 2H), 2.05 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.8, 166.1, 135.3, 128.9, 128.8, 127.5, 126.6, 71.0, 65.3, 60.0, 38.8, 32.9, 26.6, 20.9. IR (film): v_{max} (cm^{-1}) = 3030, 2957, 2933, 1729, 1586, 1496, 1455, 1413, 1374, 1311, 1228, 1165, 1135, 1116, 1080, 1027, 956, 882, 752, 700, 607, 573, 502, 478. HRMS (ESI): Exact mass calcd. for $C_{17}H_{22}O_6NaS$ ($[M+Na]^+$): 377.10293. Found: 377.10272.



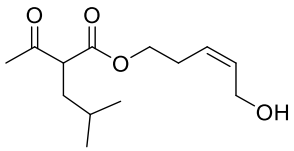
1i: colorless oil, 293.2 mg, 80% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.45 (m, 1H), 4.23-4.09 (m, 4H), 3.54 (q, *J* = 7.2 Hz, 1H), 2.59 (brs, 1H), 2.49-2.40 (m, 2H), 2.25 (s, 3H), 1.34 (d, *J* = 7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.2, 170.3, 131.8, 126.6, 64.3, 58.1, 53.4, 28.5, 26.8, 12.7. IR (film): v_{max} (cm^{-1}) = 3402, 2943, 1735, 1710, 1455, 1423, 1380, 1359, 1328, 1239, 1199, 1154, 1098, 1077, 1034, 1007, 986, 706, 603, 531. HRMS (ESI): Exact mass calcd. for $C_{10}H_{16}O_4Na$ ($[M+Na]^+$): 223.09408. Found: 223.09421.



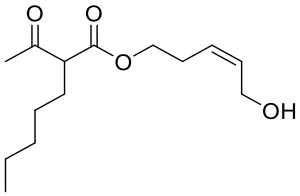
1j: colorless oil, 350 mg, 85% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.44 (m, 1H), 4.22-4.11 (m, 4H), 3.37 (t, *J* = 7.6 Hz, 1H), 2.56 (brs, 1H), 2.49-2.38 (m, 2H), 2.23 (s, 3H), 1.94-1.82 (m, 2H), 0.93 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.8, 169.6, 131.9, 126.6, 64.3, 61.2, 58.1, 29.0, 26.8, 21.5, 11.8. IR (film): v_{max} (cm^{-1}) = 3399, 2968, 2937, 2879, 1735, 1709, 1461, 1424, 1383, 1359, 1251, 1192, 1151, 1114, 1087, 1032, 1008, 985, 804, 733, 598, 538. HRMS (ESI): Exact mass calcd. for $C_{11}H_{18}O_4Na$ ($[M+Na]^+$): 237.11031. Found: 237.10973.



1k: colorless oil, 371.0 mg, 88% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.44 (m, 1H), 4.23-4.11 (m, 4H), 3.42 (t, *J* = 7.6 Hz, 1H), 2.49-2.39 (m, 2H), 2.36 (brs, 1H), 2.23 (s, 3H), 1.91-1.77 (m, 2H), 1.38-1.23 (m, 4H), 0.90 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.9, 169.7, 131.9, 126.7, 64.3, 59.7, 58.2, 29.5, 28.9, 27.9, 26.9, 22.4, 13.7. IR (film): v_{max} (cm^{-1}) = 3433, 2958, 2930, 2872, 1736, 1710, 1464, 1422, 1381, 1358, 1242, 1220, 1181, 1151, 1112, 1034, 1009, 988, 731, 545. HRMS (ESI): Exact mass calcd. for $C_{13}H_{22}O_4Na$ ($[M+Na]^+$): 265.14103. Found: 265.14146.

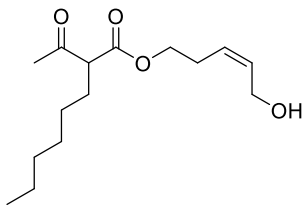


1l: colorless oil, 400.1 mg, 73% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.44 (m, 1H), 4.22-4.08 (m, 4H), 3.53 (dd, *J* = 8.0, 6.8 Hz, 1H), 2.61 (brs, 1H), 2.50-2.38 (m, 2H), 2.23 (s, 3H), 1.83-1.76 (m, 1H), 1.71-1.64 (m, 1H), 1.57-1.47 (m, 1H), 0.91 (dd, *J* = 6.4, 2.4 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.0, 169.9, 132.0, 126.7, 64.4, 58.2, 58.1, 36.9, 28.9, 26.9, 26.2, 22.5, 22.1. IR (film): v_{max} (cm^{-1}) = 3433, 2959, 2903, 1737, 1710, 1642, 1467, 1386, 1360, 1323, 1237, 1185, 1151, 1119, 1041, 987, 704, 604, 548, 507. HRMS (ESI): Exact mass calcd. for $C_{13}H_{22}O_4Na$ ($[M+Na]^+$): 265.14103. Found: 265.14105.

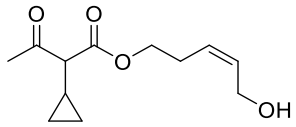


1m: colorless oil, 372 mg, 74% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.45 (m, 1H), 4.23-4.11 (m, 4H), 3.42 (t, *J* = 7.6 Hz, 1H), 2.49-2.39 (m, 2H), 2.22 (s, 3H), 1.93 (brs, 1H), 1.88-1.81 (m, 2H), 1.34-1.22 (m, 6H), 0.88 (t, *J* = 6.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.8, 169.7, 131.8, 126.8, 64.2, 59.8, 58.3, 31.4, 28.9, 28.1, 27.0, 26.9, 22.3, 13.9. IR (film): v_{max} (cm^{-1}) = 3434, 2957, 2928, 2861, 1737,

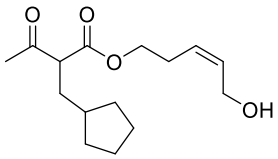
1710, 1464, 1422, 1381, 1358, 1262, 1237, 1211, 1152, 1115, 1033, 915, 731, 647, 603, 545. HRMS (ESI): Exact mass calcd. for $C_{14}H_{24}O_4Na$ ([M+Na]$^+$): 279.15668. Found: 279.15708.



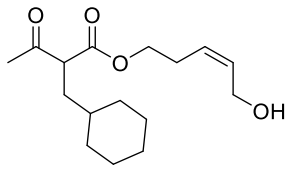
1n: colorless oil, 313 mg, 87% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.44 (m, 1H), 4.22-4.10 (m, 4H), 3.42 (t, *J* = 7.6 Hz, 1H), 2.49-2.39 (m, 2H), 2.27 (brs, 1H), 2.23 (s, 3H), 1.91-1.80 (m, 2H), 1.37-1.19 (m, 8H), 0.88 (t, *J* = 6.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.9, 169.7, 131.9, 126.7, 64.3, 59.8, 59.7, 58.2, 31.4, 28.9, 28.2, 27.3, 26.9, 22.5, 14.0. IR (film): v_{max} (cm^{-1}) = 3433, 2957, 2925, 2858, 1737, 1711, 1463, 1380, 1358, 1228, 1203, 1152, 1116, 1034, 987, 726, 602, 545. HRMS (ESI): Exact mass calcd. for $C_{15}H_{26}O_4Na$ ([M+Na]$^+$): 293.17233. Found: 293.17202.



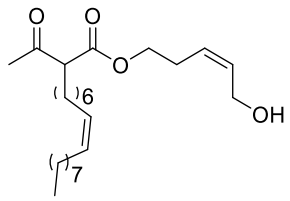
1o: colorless oil, 350 mg, 53% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.78-5.72 (m, 1H), 5.53-5.46 (m, 1H), 4.25-4.13 (m, 4H), 2.63 (d, *J* = 10.4 Hz, 1H), 2.48-2.42 (m, 2H), 2.30 (s, 3H), 1.99 (brs, 1H), 1.35-1.26 (m, 1H), 0.73-0.65 (m, 2H), 0.36-0.24 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.9, 169.6, 131.8, 126.5, 64.5, 64.3, 58.0, 28.7, 26.8, 10.1, 4.2, 4.1. IR (film): v_{max} (cm^{-1}) = 3399, 3010, 2960, 2924, 1733, 1708, 1461, 1425, 1386, 1358, 1295, 1255, 1205, 1140, 1028, 1005, 871, 827, 730, 582, 526. HRMS (ESI): Exact mass calcd. for $C_{12}H_{18}O_4Na$ ([M+Na]$^+$): 249.10973. Found: 249.10991.



1p: colorless oil, 465 mg, 77% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.515.45 (m, 1H), 4.22-4.09 (m, 4H), 3.48 (t, *J* = 7.2 Hz, 1H), 2.49-2.38 (m, 2H), 2.23 (s, 3H), 2.02 (brs, 1H), 1.95-1.88 (m, 1H), 1.85-1.80 (m, 1H), 1.78-1.68 (m, 3H), 1.66-1.58 (m, 2H), 1.56-1.45 (m, 2H), 1.14-1.05 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.8, 169.8, 131.9, 126.9, 64.3, 59.3, 58.3, 38.0, 34.3, 32.5, 32.4, 28.9, 26.9, 25.0. IR (film): v_{max} (cm^{-1}) = 3663, 3432, 2952, 2869, 1737, 1710, 1451, 1409, 1382, 1358, 1232, 1189, 1140, 1044, 734, 702, 615, 540, 498. HRMS (ESI): Exact mass calcd. for $C_{15}H_{24}O_4Na$ ([M+Na]$^+$): 291.15668. Found: 291.15689.

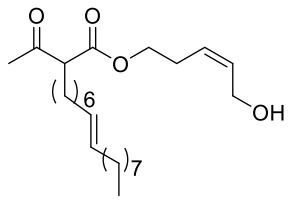


1q: colorless oil, 449 mg, 58% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.44 (m, 1H), 4.23-4.09 (m, 4H), 3.55 (t, *J* = 7.2 Hz, 1H), 2.49-2.39 (m, 3H), 2.22 (s, 3H), 1.82-1.75 (m, 1H), 1.72-1.63 (m, 6H), 1.21-1.11 (m, 4H), 0.95-0.84 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.0, 169.9, 131.8, 126.8, 64.3, 58.3, 57.4, 35.6, 35.5, 33.1, 32.8, 28.8, 26.9, 26.9, 26.02, 25.99. IR (film): v_{max} (cm^{-1}) = 3663, 3432, 2922, 2852, 1737, 1710, 1641, 1449, 1408, 1382, 1358, 1307, 1238, 1190, 1150, 1043, 892, 843, 734, 703, 615, 546, 499, 437. HRMS (ESI): Exact mass calcd. for $C_{16}H_{26}O_4Na$ ([M+Na]$^+$): 305.17233. Found: 305.17240.

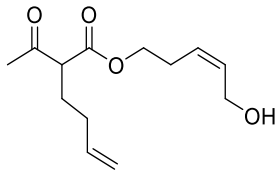


1r: colorless oil, 473 mg, 59% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.44 (m, 1H), 5.38-5.29 (m, 2H), 4.24-4.08 (m, 4H), 3.42 (t, *J* = 7.2 Hz, 1H), 2.49-2.39 (m, 2H), 2.28 (brs, 1H), 2.22 (s, 3H), 2.01-1.98 (m, 4H), 1.87-1.80 (m, 2H), 1.38-1.19 (m, 20H), 0.88 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.9, 169.8, 132.0, 130.1, 129.6, 126.8, 64.3, 59.8, 58.3, 31.9, 29.8, 29.7, 29.6, 29.4, 29.3, 29.0, 28.2, 27.4, 27.3, 27.2, 27.0, 22.7, 14.2. IR (film): v_{max} (cm^{-1}) = 3663, 3412, 2956, 2923, 2854, 1739, 1712, 1462, 1407, 1380, 1358, 1238, 1148, 1045, 895, 869, 734, 603,

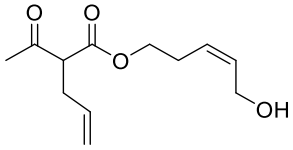
545. HRMS (ESI): Exact mass calcd. for $C_{25}H_{44}O_4Na$ ([M+Na]$^+$): 431.31318. Found: 431.31292.



1s: colorless oil, 382 mg, 66% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.78-5.72 (m, 1H), 5.51-5.45 (m, 1H), 5.43-5.34 (m, 2H), 4.23-4.10 (m, 4H), 3.42 (t, J = 7.2 Hz, 1H), 2.49-2.39 (m, 2H), 2.22 (s, 3H), 2.03-1.91 (m, 4H), 1.91-1.72 (m, 3H), 1.40-1.20 (m, 20H), 0.88 (t, J = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.0, 169.8, 132.0, 130.6, 130.2, 127.1, 64.4, 59.9, 58.5, 32.7, 32.6, 32.0, 29.7, 29.6, 29.4, 29.3, 29.1, 28.9, 28.3, 27.5, 27.0, 22.8, 14.2. IR (film): v_{max} (cm^{-1}) = 3663, 3435, 2957, 2923, 2854, 1740, 1712, 1463, 1408, 1380, 1358, 1238, 1149, 1044, 967, 908, 734, 544. HRMS (ESI): Exact mass calcd. for $C_{25}H_{44}O_4Na$ ([M+Na]$^+$): 431.31318. Found: 431.31276.

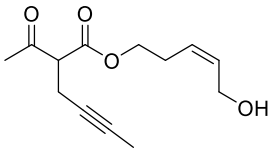


1t: colorless oil, 278 mg, 70% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.78-5.70 (m, 2H), 5.51-5.45 (m, 1H), 5.05-5.01 (m, 2H), 4.23-4.09 (m, 4H), 3.48 (t, J = 7.2 Hz, 1H), 2.49-2.40 (m, 2H), 2.29 (brs, 1H), 2.24 (s, 3H), 2.07-2.01 (m, 2H), 2.00-1.90 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.7, 169.6, 137.0, 132.0, 126.9, 116.2, 64.5, 58.8, 58.4, 31.4, 29.4, 27.2, 27.0. IR (film): v_{max} (cm^{-1}) = 3411, 2971, 2903, 1736, 1710, 1641, 1414, 1382, 1359, 1225, 1179, 1150, 1115, 1040, 996, 915, 733, 592, 552. HRMS (ESI): Exact mass calcd. for $C_{13}H_{20}O_4Na$ ([M+Na]$^+$): 263.12538. Found: 263.12568.

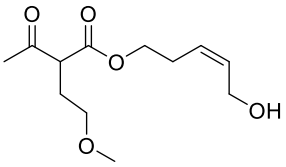


1u: colorless oil, 510 mg, 75% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.79-5.69 (m, 2H), 5.51-5.44 (m, 1H), 5.12-5.05 (m, 2H), 4.22-4.09 (m, 4H), 3.56 (t, J = 7.6 Hz, 1H), 2.65-2.53 (m, 2H), 2.46-2.38 (m, 3H), 2.24 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ

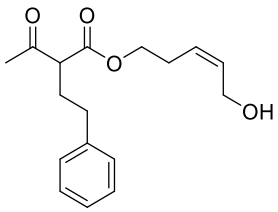
203.1, 169.2, 134.1, 132.0, 126.7, 117.6, 64.5, 59.1, 58.2, 32.2, 29.4, 26.9. IR (film): v_{max} (cm^{-1}) = 3400, 2971, 2903, 1736, 1711, 1642, 1415, 1383, 1359, 1336, 1229, 1185, 1150, 1116, 1041, 992, 920, 732, 650, 590, 537. HRMS (ESI): Exact mass calcd. for $C_{12}H_{18}O_4Na$ ([M+Na]$^+$): 249.10973. Found: 249.11012.



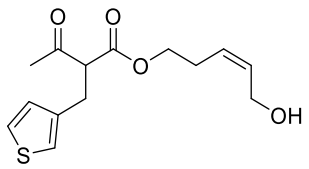
1v: colorless oil, 323 mg, 75% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.52-5.45 (m, 1H), 4.25-4.08 (m, 4H), 3.66 (t, *J* = 7.6 Hz, 1H), 2.66-2.64 (m, 2H), 2.51-2.38 (m, 2H), 2.34 (brs, 1H), 2.30 (s, 3H), 1.74 (t, *J* = 2.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.2, 168.3, 131.9, 126.7, 77.9, 74.8, 64.6, 58.6, 58.2, 29.6, 26.8, 17.9, 3.4. IR (film): v_{max} (cm^{-1}) = 3402, 3019, 2958, 2922, 2860, 1738, 1713, 1426, 1383, 1358, 1337, 1266, 1224, 1174, 1144, 1072, 1030, 1003, 734, 702, 648, 591, 532, 512. HRMS (ESI): Exact mass calcd. for $C_{13}H_{18}O_4Na$ ([M+Na]$^+$): 261.10973. Found: 261.10993.



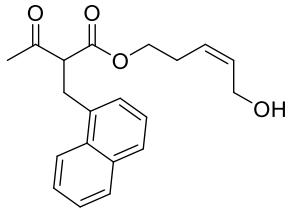
1w: colorless oil, 351 mg, 67% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.70 (m, 1H), 5.51-5.44 (m, 1H), 4.22-4.12 (m, 4H), 3.66 (t, *J* = 7.2 Hz, 1H), 3.39 (t, *J* = 5.6 Hz, 2H), 3.29 (s, 3H), 2.65 (brs, 1H), 2.51-2.39 (m, 2H), 2.26 (m, 3H), 2.18-2.06 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.6, 169.5, 132.0, 126.7, 69.9, 64.4, 58.5, 58.2, 56.3, 29.5, 28.0, 26.9. IR (film): v_{max} (cm^{-1}) = 3434, 2970, 2901, 1737, 1711, 1384, 1359, 1247, 1197, 1151, 1116, 1079, 1039, 985, 869, 733, 601, 543, 500. HRMS (ESI): Exact mass calcd. for $C_{12}H_{20}O_5Na$ ([M+Na]$^+$): 267.12029. Found: 267.12017.



1x: colorless oil, 546 mg, 59% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30-7.27 (m, 2H), 7.22-7.15 (m, 3H), 5.76-5.70 (m, 1H), 5.50-5.44 (m, 1H), 4.26-4.06 (m, 4H), 3.44 (t, *J* = 6.8 Hz, 1H), 2.67-2.55 (m, 2H), 2.48-2.38 (m, 2H), 2.28 (brs, 1H), 2.22-2.11 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.6, 169.6, 140.6, 132.0, 128.62, 128.57, 126.9, 126.4, 64.5, 58.9, 58.4, 33.4, 29.7, 29.3, 27.0. IR (film): v_{max} (cm^{-1}) = 3412, 2968, 2903, 1736, 1710, 1603, 1496, 1453, 1411, 1382, 1358, 1331, 1239, 1144, 1032, 911, 735, 700, 583, 565, 493. HRMS (ESI): Exact mass calcd. for $C_{17}H_{22}O_4Na$ ($[M+Na]^+$): 313.14103. Found: 313.14116.

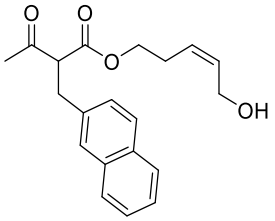


1y: colorless oil, 270 mg, 93% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (dd, *J* = 5.2, 3.2 Hz, 1H), 6.99-6.98 (m, 1H), 6.91 (dd, *J* = 5.2, 1.2 Hz, 1H), 5.74-5.68 (m, 1H), 5.45-5.39 (m, 1H), 4.19-4.08 (m, 4H), 3.79 (t, *J* = 7.6 Hz, 1H), 3.18 (d, *J* = 7.6 Hz, 2H), 2.45-2.33 (m, 2H), 2.21 (brs, 1H), 2.19 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.0, 168.9, 138.0, 131.9, 128.0, 126.7, 125.9, 121.9, 64.5, 60.5, 58.3, 29.7, 28.5, 26.8. IR (film): v_{max} (cm^{-1}) = 3396, 2960, 2922, 1735, 1711, 1415, 1384, 1358, 1336, 1242, 1206, 1145, 1076, 1029, 1003, 859, 834, 776, 687, 636, 605, 552, 493. HRMS (ESI): Exact mass calcd. for $C_{14}H_{18}O_4NaS$ ($[M+Na]^+$): 305.08180. Found: 305.08181.

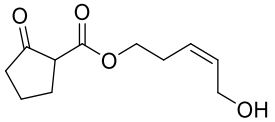


1z: colorless oil, 567 mg, 35% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.72 (d, *J* = 8.0 Hz, 1H), 7.55-7.46 (m, 2H), 7.37-7.29 (m, 2H), 5.67-5.61 (m, 1H), 5.35-5.29 (m, 1H), 4.14-4.02 (m, 4H), 3.98 (t, *J* = 7.2 Hz, 1H), 3.68-3.57 (m, 2H), 2.35-2.21 (m, 2H), 2.19-2.09 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.2, 169.3, 134.0, 133.9, 131.9, 131.5, 129.1, 127.7, 127.3, 126.8, 126.4, 125.8, 125.6, 123.2, 64.6, 60.0, 58.3, 31.2, 30.1, 26.9. IR (film): v_{max} (cm^{-1}) = 3400,

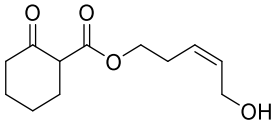
2968, 2902, 1735, 1711, 1597, 1511, 1453, 1395, 1358, 1333, 1245, 1222, 1206, 1145, 1040, 910, 866, 795, 776, 733, 702, 612, 582, 552, 491, 436. HRMS (ESI): Exact mass calcd. for $C_{20}H_{22}O_4Na$ ([M+Na]$^+$): 349.14103. Found: 349.14099.



1aa: colorless oil, 629 mg, 81% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80-7.75 (m, 3H), 7.61 (s, 1H), 7.47-7.41 (m, 2H), 7.32-7.26 (m, 1H), 5.64-5.58 (m, 1H), 5.36-5.30 (m, 1H), 4.15-4.01 (m, 4H), 3.90 (t, J = 8.0 Hz, 1H), 3.31 (d, J = 8.0 Hz, 2H), 2.38-2.24 (m, 2H), 2.18 (s, 3H), 1.97 (brs, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.9, 169.0, 135.4, 133.4, 132.3, 131.8, 128.3, 127.6, 127.5, 127.3, 127.0, 126.7, 126.2, 125.7, 64.5, 61.1, 58.2, 34.2, 29.9, 26.8. IR (film): v_{max} (cm^{-1}) = 3412, 2969, 2902, 1734, 1711, 1634, 1601, 1508, 1420, 1373, 1358, 1334, 1242, 1205, 1145, 1042, 895, 858, 817, 735, 702, 623, 476. HRMS (ESI): Exact mass calcd. for $C_{20}H_{22}O_4Na$ ([M+Na]$^+$): 349.14103. Found: 349.14070.

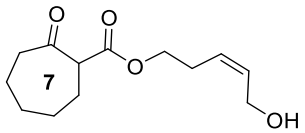


1ab: colorless oil, 359 mg, 88% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.80-5.74 (m, 1H), 5.54-5.48 (m, 1H), 4.26-4.11 (m, 4H), 3.16 (t, J = 9.2 Hz, 1H), 2.53-2.39 (m, 2H), 2.37-2.24 (m, 4H), 2.18-2.09 (m, 1H), 1.98 (brs, 1H), 1.93-1.82 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 212.9, 169.3, 131.8, 126.7, 64.3, 58.0, 54.7, 38.0, 27.2, 26.9, 20.8. IR (film): v_{max} (cm^{-1}) = 3434, 2963, 2885, 1751, 1720, 1454, 1403, 1384, 1337, 1297, 1249, 1184, 1110, 1032, 994, 918, 834, 730, 602, 496. HRMS (ESI): Exact mass calcd. for $C_{11}H_{16}O_4Na$ ([M+Na]$^+$): 235.09408. Found: 235.09470.

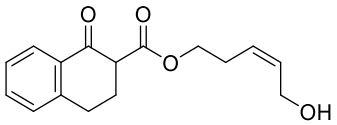


1ac: colorless oil, 302 mg, 81% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 12.2 (brs,

0.5H), 5.78-5.71 (m, 1H), 5.58-5.47 (m, 1H), 4.27-4.10 (m, 4H), 3.40-3.36 (m, 0.5H), 2.52-2.33 (m, 3H), 2.28-2.25 (m, 1H), 2.22-2.19 (m, 1H), 2.16-1.94 (m, 2H), 1.89-1.80 (m, 1H), 1.72-1.57 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.7, 172.6, 172.4, 169.9, 131.7, 131.5, 127.3, 127.2, 97.6, 64.2, 63.3, 58.4, 58.3, 57.2, 41.6, 29.9, 29.1, 27.1, 27.04, 27.02, 23.3, 22.38, 22.36, 21.9. IR (film): v_{max} (cm^{-1}) = 3370, 2937, 2861, 1739, 1710, 1649, 1614, 1450, 1422, 1400, 1357, 1296, 1258, 1213, 1173, 1081, 1057, 1030, 980, 830, 815, 732, 650, 516, 451. HRMS (ESI): Exact mass calcd. for $C_{12}H_{18}O_4Na$ ($[M+Na]^+$): 249.10973. Found: 249.10963.

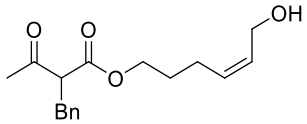


1ad: colorless oil, 328 mg, 95% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.77-5.71 (m, 1H), 5.51-5.45 (m, 1H), 4.23-4.09 (m, 4H), 3.54 (dd, *J* = 10.4, 3.6 Hz, 1H), 2.65-2.55 (m, 2H), 2.49-2.32 (m, 3H), 2.14-2.04 (m, 1H), 1.97-1.79 (m, 4H), 1.61-1.59 (m, 1H), 1.49-1.42 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 209.5, 170.4, 131.7, 127.1, 64.1, 58.9, 58.2, 43.1, 29.6, 27.9, 27.4, 26.9, 24.3. IR (film): v_{max} (cm^{-1}) = 3399, 2928, 2857, 1734, 1699, 1637, 1453, 1385, 1355, 1309, 1239, 1214, 1185, 1126, 1036, 994, 939, 863, 832, 730, 512. HRMS (ESI): Exact mass calcd. for $C_{13}H_{20}O_4Na$ ($[M+Na]^+$): 263.12538. Found: 263.12510.

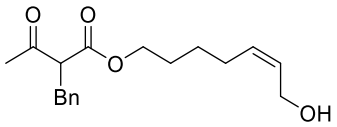


1ae: colorless oil, 430 mg, 98% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 12.40 (brs, 0.5H), 8.02 (d, *J* = 7.6 Hz, 0.4H), 7.79 (d, *J* = 7.2 Hz, 0.5H), 7.49 (t, *J* = 7.6 Hz, 0.5H), 7.33-7.23 (m, 2H), 7.16 (d, *J* = 7.2 Hz, 0.5H), 5.79-5.72 (m, 1H), 5.61-5.45 (m, 1H), 4.27-4.17 (m, 4H), 3.61 (dd, *J* = 10.4, 4.8 Hz, 0.5H), 3.10-2.94 (m, 1H), 2.80 (t, *J* = 7.6 Hz, 1H), 2.57-2.31 (m, 4H), 1.92 (brs, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 193.5, 172.6, 170.0, 165.3, 143.8, 139.4, 134.1, 131.7, 131.5, 131.5, 130.6, 129.9, 128.8, 127.7, 127.4, 127.3, 127.2, 126.9, 126.5, 124.3, 96.8, 64.3, 63.6, 58.4, 58.3, 54.4, 27.7, 27.5, 27.1, 27.0, 26.3, 20.4. IR (film): v_{max} (cm^{-1}) = 3370, 2957, 2900, 1735, 1681, 1642, 1616,

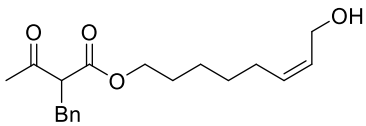
1598, 1568, 1453, 1431, 1395, 1354, 1323, 1296, 1263, 1210, 1168, 1156, 1136, 1112, 1084, 1028, 990, 818, 768, 730, 702, 565, 485, 423. HRMS (ESI): Exact mass calcd. for $C_{16}H_{18}O_4Na$ ([M+Na]$^+$): 297.10973. Found: 297.10915.



1af: colorless oil, 680 mg, 65% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.16 (m, 5H), 5.66-5.60 (m, 1H), 5.46-5.39 (m, 1H), 4.13-4.07 (m, 4H), 3.81 (t, J = 7.6 Hz, 1H), 3.15 (d, J = 7.6 Hz, 2H), 2.18 (s, 3H), 2.13 (brs, 1H), 2.07-2.02 (m, 2H), 1.68-1.61 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.8, 169.2, 138.0, 130.7, 129.9, 128.7, 128.6, 126.7, 64.7, 61.2, 58.2, 34.0, 29.7, 28.2, 23.6. IR (film): v_{max} (cm^{-1}) = 3398, 2958, 2924, 1735, 1711, 1604, 1496, 1453, 1358, 1326, 1245, 1213, 1146, 1080, 1027, 748, 699, 610, 566, 537, 508. HRMS (ESI): Exact mass calcd. for $C_{17}H_{22}O_4Na$ ([M+Na]$^+$): 313.14103. Found: 313.14135.



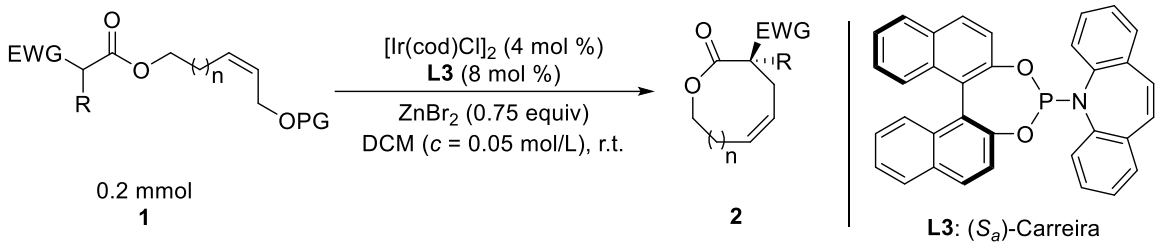
1ag: colorless oil, 352 mg, 58% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.16 (m, 5H), 5.65-5.58 (m, 1H), 5.49-5.43 (m, 1H), 4.16 (d, J = 6.8 Hz, 2H), 4.08 (t, J = 6.8 Hz, 2H), 3.79 (t, J = 7.6 Hz, 1H), 3.15 (d, J = 7.6 Hz, 2H), 2.18 (s, 3H), 2.08-1.93 (m, 3H), 1.60-1.53 (m, 2H), 1.36-1.29 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.7, 169.2, 138.0, 131.8, 129.2, 128.7, 128.6, 126.7, 65.2, 61.2, 58.4, 34.0, 29.7, 27.9, 26.8, 25.6. IR (film): v_{max} (cm^{-1}) = 3412, 2928, 2862, 1735, 1712, 1604, 1496, 1453, 1358, 1327, 1245, 1213, 1146, 1008, 748, 699, 610, 566, 536, 508. HRMS (ESI): Exact mass calcd. for $C_{18}H_{24}O_4Na$ ([M+Na]$^+$): 327.15668. Found: 327.15637.



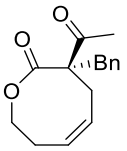
1ah: colorless oil, 696 mg, 64% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.14 (m, 5H), 5.64-5.57 (m, 1H), 5.51-5.45 (m, 1H), 4.18-4.16 (m, 2H), 4.07 (t, J = 6.8 Hz, 2H), 3.79 (t, J = 7.6 Hz, 1H), 3.15 (d, J = 7.6 Hz, 2H), 2.18 (s, 3H), 2.07-2.02 (m, 2H),

1.99 (brs, 1H), 1.59-1.52 (m, 2H), 1.38-1.31 (m, 2H), 1.29-1.21 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.7, 169.2, 138.0, 132.2, 128.9, 128.7, 128.5, 126.7, 65.5, 61.2, 58.4, 34.0, 29.7, 29.0, 28.2, 27.1, 25.2. IR (film): v_{max} (cm^{-1}) = 3412, 2929, 2859, 1736, 1712, 1643, 1604, 1496, 1454, 1358, 1327, 1245, 1213, 1146, 1015, 748, 699, 610, 566, 536, 508. HRMS (ESI): Exact mass calcd. for $C_{19}H_{26}O_4Na$ ($[M+Na]^+$): 341.17233. Found: 341.17249.

2.3 General procedure for enantioselective synthesis of medium-sized-ring lactones via iridium-catalyzed *Z*-retentive asymmetric allylic substitution reaction

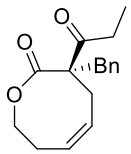


A flame-dried seal tube was cooled to room temperature and filled with argon. To this tube were added $[Ir(cod)Cl]_2$ (5.4 mg, 0.008 mmol, 4 mol %), **L3** (8.1 mg, 0.016 mmol, 8 mol %) and DCM (1.0 mL). The reaction mixture was stirred at room temperature for 15 min. After that, **1** (0.2 mmol) and $ZnBr_2$ (33.8 mg, 0.15 mmol, 0.75 equiv) and DCM (3.0 mL) were added. The reaction mixture was stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was filtered through a pad of celite. The mixture was concentrated in vacuo. Then the residue was purified by silica gel column chromatography (PE/EtOAc = 10:1) to afford the desired product **2**. The analytical data of the products are summarized below.

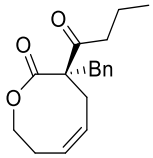


2a: colorless oil, 37.1 mg, 72% yield. $[\alpha]_D^{20}$ = +21.3 (*c* = 0.5, chloroform, 96% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 8.11 min, t (minor) = 8.86 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.21 (m, 3H), 7.13-7.09 (m,, 2H), 5.89-5.79 (m, 2H),

4.52 (t, J = 10.0 Hz, 1H), 4.09-4.06 (m, 1H), 3.38 (AB, J_{AB} =14.0 Hz, 1H), 3.04 (BA, J_{BA} = 14.4 Hz, 1H), 2.88 (dd, J = 12.8, 8.8 Hz, 1H), 2.57-2.49 (m, 1H), 2.29 (dd, J = 12.4, 6.4 Hz, 1H), 2.21-2.17 (m, 1H), 2.10 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.0, 175.8, 135.8, 130.2, 130.0, 129.8, 128.5, 127.1, 70.3, 67.4, 38.1, 31.7, 28.6, 28.3. IR (film): v_{max} (cm^{-1}) = 2959, 1750, 1710, 1495, 1452, 1356, 1251, 1212, 1170, 1065, 987, 914, 869, 802, 782, 720, 701, 644, 607, 574, 516, 491. HRMS (ESI): Exact mass calcd. for $C_{16}H_{18}O_3Na$ ([M+Na]$^+$): 281.11482. Found: 281.11513.

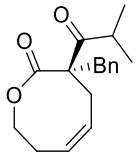


2b: colorless oil, 42.3 mg, 75% yield. $[\alpha]_D^{20}$ = +29.1 (c = 0.5, chloroform, 99% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 7.93 min, t (minor) = 9.42 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.20 (m, 3H), 7.11-7.06 (m, 2H), 5.90-5.80 (m, 2H), 4.59-4.51 (m, 1H), 4.08-3.98 (m, 1H), 3.37 (AB, J_{AB} =14.0 Hz, 1H), 3.01 (BA, J_{BA} = 14.0 Hz, 1H), 2.92 (dd, J = 12.8, 8.8 Hz, 1H), 2.60-2.51 (m, 1H), 2.38-2.27 (m, 3H), 2.18-2.12 (m, 1H), 0.97 (t, J = 7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.8, 176.0, 136.0, 130.2, 130.0, 129.9, 128.4, 127.0, 70.0, 67.3, 38.3, 33.8, 31.8, 28.6, 7.5. IR (film): v_{max} (cm^{-1}) = 3026, 2959, 2937, 1751, 1711, 1604, 1495, 1452, 1412, 1377, 1356, 1324, 1298, 1250, 1211, 1168, 1117, 1076, 1048, 1025, 983, 868, 811, 749, 719, 701, 621, 572, 506, 496. HRMS (ESI): Exact mass calcd. for $C_{17}H_{20}O_3Na$ ([M+Na]$^+$): 295.13047. Found: 295.13060.

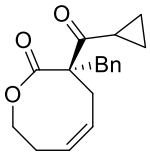


2c: colorless oil, 47.6 mg, 77% yield. $[\alpha]_D^{20}$ = +30.6 (c = 0.5, chloroform, 98% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 6.61 min, t (minor) = 7.50 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27-7.20 (m, 3H), 7.10 (d, J = 6.8 Hz, 2H), 5.89-5.78 (m, 2H), 4.55 (t, J = 10.8 Hz, 1H), 4.05-4.02 (m, 1H), 3.36 (AB, J_{AB} =14.0 Hz, 1H), 3.02

(BA, J_{BA} = 14.4 Hz, 1H), 2.92 (dd, J = 12.8, 8.8 Hz, 1H), 2.61-2.52 (m, 1H), 2.40-2.24 (m, 3H), 2.16-2.11 (m, 1H), 1.61-1.45 (m, 2H), 0.84 (t, J = 7.6 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.1, 176.0, 136.0, 130.3, 130.0, 129.9, 128.4, 127.0, 70.0, 67.3, 42.4, 38.1, 31.7, 28.6, 16.8, 13.6. IR (film): v_{max} (cm^{-1}) = 3026, 2961, 2933, 2875, 1751, 1710, 1604, 1495, 1453, 1407, 1359, 1324, 1297, 1249, 1210, 1167, 1129, 1090, 1053, 1025, 992, 918, 869, 805, 751, 719, 701, 621, 575, 508, 495. HRMS (ESI): Exact mass calcd. for $C_{18}H_{22}O_3Na$ ([M+Na]$^+$): 309.14612. Found: 309.14552.

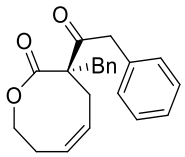


2d: colorless oil, 43.7 mg, 74% yield. $[\alpha]_D^{20}$ = +26.7 (c = 0.5, chloroform, 98% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (minor) = 5.79 min, t (major) = 6.14 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.19 (m, 3H), 7.13 (d, J = 6.8 Hz, 2H), 5.87-5.80 (m, 1H), 5.74-5.66 (m, 1H), 4.57 (td, J = 11.6, 1.6 Hz, 1H), 4.05 (dt, J = 10.8, 3.6 Hz, 1H), 3.34 (AB, J_{AB} =14.4 Hz, 1H), 3.16 (BA, J_{BA} = 14.8 Hz, 1H), 3.03-2.94 (m, 1H), 2.89 (hept, J = 6.8 Hz, 1H), 2.65-2.56 (m, 1H), 2.24 (dd, J = 12.8, 6.8 Hz, 1H), 2.14-2.07 (m, 1H), 1.04 (t, J = 6.4 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 211.4, 176.1, 136.3, 130.4, 130.1, 129.8, 128.4, 126.9, 70.1, 67.6, 38.2, 37.3, 31.6, 28.7, 20.3, 19.8. IR (film): v_{max} (cm^{-1}) = 3026, 2969, 2933, 2875, 1749, 1708, 1604, 1496, 1454, 1382, 1357, 1324, 1298, 1250, 1213, 1166, 1125, 1094, 1059, 1025, 990, 950, 868, 806, 752, 720, 700, 667, 614, 580, 533, 498. HRMS (ESI): Exact mass calcd. for $C_{18}H_{22}O_3Na$ ([M+Na]$^+$): 309.14612. Found: 309.14560.

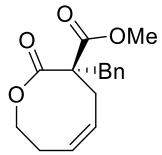


2e: white solid, 37.2 mg, 65% yield, m.p. = 97-99 ºC. $[\alpha]_D^{20}$ = +56.4 (c = 0.5, chloroform, 98% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 7.08 min, t (minor) = 8.20 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.19 (m, 3H), 7.16-7.11 (m,

2H), 5.90-5.82 (m, 2H), 4.55 (t, J = 10.4 Hz, 1H), 4.10-4.06 (m, 1H), 3.52 (AB, J_{AB} =14.4 Hz, 1H), 3.11 (BA, J_{BA} = 14.4 Hz, 1H), 2.92 (dd, J = 12.8, 8.0 Hz, 1H), 2.62-2.53 (m, 1H), 2.27-2.11 (m, 2H), 1.99-1.93 (m, 1H), 1.12-1.07 (m, 2H), 0.96-0.92 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.4, 176.2, 136.0, 130.50, 130.0, 129.9, 128.3, 126.9, 70.7, 67.6, 37.6, 30.7, 28.7, 19.4, 13.3, 12.5. IR (film): v_{max} (cm^{-1}) = 3016, 2957, 2922, 2854, 1745, 1694, 1603, 1496, 1451, 1382, 1360, 1323, 1288, 1252, 1213, 1196, 1169, 1131, 1104, 1070, 1025, 991, 955, 922, 870, 803, 755, 720, 700, 676, 612, 580, 534, 496. HRMS (ESI): Exact mass calcd. for $C_{18}H_{20}O_3Na$ ([M+Na]$^+$): 307.13047. Found: 307.13087.

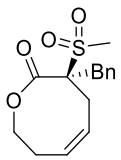


2f: colorless oil, 53.7 mg, 80% yield. $[\alpha]_D^{20}$ = +71.0 (c = 0.5, chloroform, 98% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 90 / 10, 1.0 mL/min, λ = 214 nm, t (minor) = 7.10 min, t (major) = 15.38 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30-7.21 (m, 6H), 7.13-7.10 (m, 2H), 7.04 (d, J = 7.2 Hz, 2H), 5.91-5.79 (m, 2H), 4.58 (t, J = 10.4 Hz, 1H), 4.12-4.07 (m, 1H), 3.73 (AB, J_{AB} =17.2 Hz, 1H), 3.58 (BA, J_{BA} = 17.2 Hz, 1H), 3.47 (AB, J_{AB} =14.4 Hz, 1H), 3.08 (BA, J_{BA} = 14.0 Hz, 1H), 2.96 (dd, J = 12.8, 8.8 Hz, 1H), 2.60-2.51 (m, 1H), 2.36 (dd, J = 12.8, 6.4 Hz, 1H), 2.21-2.15 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.3, 175.9, 135.9, 133.3, 130.19, 130.18, 130.1, 129.9, 128.6, 128.3, 127.1, 126.9, 70.3, 67.5, 47.2, 38.3, 32.4, 28.7. IR (film): v_{max} (cm^{-1}) = 3028, 2959, 2924, 2852, 1750, 1713, 1603, 1495, 1452, 1408, 1357, 1325, 1251, 1212, 1163, 1099, 1059, 1027, 992, 868, 802, 719, 699, 621, 508, 492. HRMS (ESI): Exact mass calcd. for $C_{22}H_{22}O_3Na$ ([M+Na]$^+$): 357.14612. Found: 357.14661.

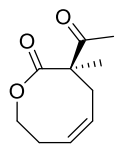


2g: white solid, 21.9 mg, 40% yield, m.p. = 80-83 ºC. $[\alpha]_D^{20}$ = +15.0 (c = 0.5,

chloroform, 98% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 99 / 1, 1.0 mL/min, λ = 214 nm, t (major) = 18.99 min, t (minor) = 21.44 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30-7.22 (m, 3H), 7.11 (d, J = 7.2 Hz, 2H), 5.94-5.84 (m, 2H), 4.53 (t, J = 10.0 Hz, 1H), 4.13-4.05 (m, 1H), 3.70 (s, 3H), 3.43 (AB, J_{AB} =14.0 Hz, 1H), 2.99 (BA, J_{BA} = 14.0 Hz, 1H), 2.96-2.90 (m, 1H), 2.62-2.52 (m, 1H), 2.35-2.30 (m, 1H), 2.21-2.15 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.7, 170.7, 136.2, 130.6, 130.0, 129.9, 128.5, 127.1, 67.4, 64.4, 52.3, 38.1, 31.6, 28.8. IR (film): v_{max} (cm^{-1}) = 3003, 2917, 2850, 1733, 1449, 1437, 1358, 1284, 1258, 1229, 1196, 1164, 1090, 1059, 1026, 947, 920, 873, 795, 754, 721, 703, 614, 581, 537, 497. HRMS (ESI): Exact mass calcd. for $C_{16}H_{18}O_4Na$ ([M+Na]$^+$): 297.10973. Found: 297.10925.

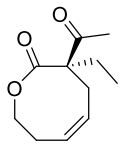


2h: colorless oil, 18.7 mg, 32% yield. $[\alpha]_D^{20}$ = +56.7 (c = 0.5, chloroform, 94% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 70 / 30, 1.0 mL/min, λ = 214 nm, t (major) = 11.56 min, t (minor) = 19.41 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.35 (m, 2H), 7.33-7.27 (m, 3H), 5.99-5.89 (m, 2H), 4.76 (td, J = 10.4, 1.6 Hz, 1H), 4.26 (dt, J = 10.4, 4.0 Hz, 1H), 3.71 (AB, J_{AB} =14.4 Hz, 1H), 3.33 (BA, J_{BA} = 14.4 Hz, 1H), 3.06-2.99 (m, 1H), 2.93-2.87 (m, 1H), 2.70-2.61 (m, 1H), 2.36 (s, 3H), 2.30-2.23 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 134.9, 130.4, 130.2, 129.9, 128.9, 127.9, 80.6, 69.0, 41.8, 40.2, 33.7, 28.8. IR (film): v_{max} (cm^{-1}) = 3032, 2928, 2851, 1747, 1604, 1495, 1457, 1445, 1361, 1301, 1252, 1215, 1168, 1135, 1097, 1081, 1054, 1023, 1004, 953, 798, 759, 725, 700, 667, 615, 595, 523, 504, 477. HRMS (ESI): Exact mass calcd. for $C_{15}H_{18}O_4NaS$ ([M+Na]$^+$): 317.08180. Found: 317.08177.

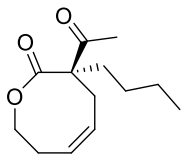


2i: colorless oil, 31.0 mg, 76% yield. $[\alpha]_D^{20}$ = +81.9 (c = 0.5, chloroform, 97% ee).

The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 7.00 min, t (minor) = 10.05 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.83-5.74 (m, 2H), 4.43 (td, *J* = 10.8, 1.6 Hz, 1H), 4.00 (dt, *J* = 10.8, 3.6 Hz, 1H), 3.04-2.94 (m, 1H), 2.55-2.48 (m, 1H), 2.15 (s, 3H), 2.13-2.08 (m, 2H), 1.32 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.3, 176.3, 130.3, 129.9, 67.5, 65.4, 34.1, 28.7, 26.4, 18.4. IR (film): v_{max} (cm^{-1}) = 3023, 2962, 2938, 1752, 1710, 1460, 1446, 1377, 1357, 1300, 1282, 1250, 1213, 1170, 1091, 993, 972, 920, 874, 776, 720, 615, 581, 494, 465. HRMS (EI): Exact mass calcd. for $C_{10}H_{14}O_3$ ($[M]^+$): 182.0937. Found: 182.0932.

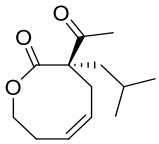


2j: colorless oil, 31.3 mg, 76% yield. $[\alpha]_D^{20}$ = +49.5 (*c* = 0.5, chloroform, 98% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.90 min, t (minor) = 8.06 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.82-5.71 (m, 2H), 4.43 (td, *J* = 10.4, 1.6 Hz, 1H), 4.06 (dt, *J* = 10.8, 4.0 Hz, 1H), 2.91 (dd, *J* = 12.8, 8.8 Hz, 1H), 2.54-2.45 (m, 1H), 2.29-2.22 (m, 1H), 2.17-2.11 (m, 4H), 2.08-1.99 (m, 1H), 1.87-1.77 (m, 1H), 0.83 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.9, 176.2, 130.5, 129.7, 69.7, 67.3, 30.6, 28.6, 27.1, 24.4, 8.6. IR (film): v_{max} (cm^{-1}) = 2966, 2940, 1750, 1710, 1461, 1387, 1357, 1326, 1289, 1248, 1217, 1197, 1167, 1091, 1007, 982, 788, 770, 720, 630, 607, 578, 535, 497. HRMS (EI): Exact mass calcd. for $C_{11}H_{16}O_3$ ($[M]^+$): 196.1094. Found: 196.1089.

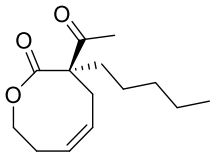


2k: colorless oil, 32.6 mg, 81% yield. $[\alpha]_D^{20}$ = +32.7 (*c* = 0.5, chloroform, 97% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.22 min, t (minor) = 5.80 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.83-5.72 (m, 2H), 4.42 (td, *J* = 10.0, 1.6 Hz, 1H), 4.06 (dt, *J* = 10.4, 4.0 Hz, 1H), 2.92 (dd, *J* = 12.8, 8.8 Hz, 1H), 2.52-2.45 (m, 1H), 2.30-2.23 (m,

1H), 2.16-2.12 (m, 4H), 2.00-1.92 (m, 1H), 1.81-1.73 (m, 1H), 1.37-1.27 (m, 2H), 1.26-1.16 (m, 1H), 1.08-0.97 (m, 1H), 0.89 (t, J = 7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.1, 176.2, 130.5, 129.6, 69.4, 67.4, 31.3, 31.2, 28.6, 27.1, 26.3, 23.1, 13.8. IR (film): v_{max} (cm^{-1}) = 2957, 2934, 2869, 1749, 1710, 1461, 1356, 1251, 1214, 1165, 1106, 1050, 1007, 986, 721, 607, 498. HRMS (ESI): Exact mass calcd. for $C_{13}H_{20}O_3Na$ ($[M+Na]^+$): 247.13047. Found: 247.13058.

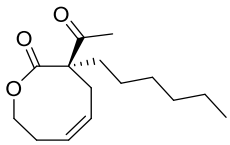


2l: colorless oil, 29.6 mg, 66% yield. $[\alpha]_D^{20}$ = 40.4 (c = 0.5, chloroform, 96% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.06 min, t (minor) = 6.02 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.83-5.73 (m, 2H), 4.39 (t, J = 10.0 Hz, 1H), 4.14-4.05 (m, 1H), 2.96 (dd, J = 12.8, 8.4 Hz, 1H), 2.53-2.42 (m, 1H), 2.35 (dd, J = 13.2, 6.0 Hz, 1H), 2.21-2.13 (m, 4H), 1.93 (dd, J = 14.8, 6.8 Hz, 1H), 1.82 (dd, J = 15.2, 5.2 Hz, 1H), 1.67-1.57 (m, 1H), 0.94 (d, J = 6.8 Hz, 3H), 0.84 (d, J = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.8, 176.3, 130.7, 129.6, 69.5, 67.3, 40.4, 31.8, 28.6, 27.6, 24.7, 24.6, 23.5. IR (film): v_{max} (cm^{-1}) = 2958, 2871, 1750, 1710, 1461, 1357, 1253, 1215, 1163, 1111, 1054, 1021, 986, 869, 798, 781, 759, 721, 650, 607, 579, 495. HRMS (ESI): Exact mass calcd. for $C_{13}H_{20}O_3Na$ ($[M+Na]^+$): 247.13047. Found: 247.13004.

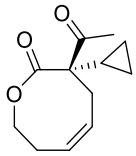


2m: colorless oil, 31.9 mg, 80% yield. $[\alpha]_D^{20}$ = +28.6 (c = 0.5, chloroform, 97% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (minor) = 9.75 min, t (major) = 10.25 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.83-5.72 (m, 2H), 4.42 (td, J = 10.4, 1.6 Hz, 1H), 4.10-4.03 (m, 1H), 2.93 (dd, J = 12.4, 8.8 Hz, 1H), 2.53-2.45 (m, 1H), 2.30-2.23 (m, 1H), 2.17-2.13 (m, 4H), 1.99-1.92 (m, 1H), 1.80-1.73 (m, 1H), 1.32-1.20 (m, 5H), 1.08-1.01 (m, 1H), 0.86 (t, J = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.1, 176.2, 130.5,

129.6, 69.4, 67.4, 32.1, 31.6, 31.2, 28.6, 27.1, 23.8, 22.3, 13.9. IR (film): v_{max} (cm^{-1}) = 2956, 2931, 2861, 1750, 1711, 1461, 1356, 1250, 1212, 1165, 1109, 1059, 1022, 989, 781, 721, 607, 498. HRMS (ESI): Exact mass calcd. for $C_{14}H_{22}O_3Na$ ($[M+Na]^+$): 261.14612. Found: 261.14594.

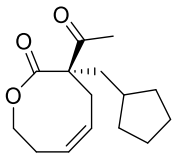


2n: colorless oil, 36.7 mg, 73% yield. $[\alpha]_D^{20}$ = +25.2 (*c* = 0.5, chloroform, 95% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.04 min, t (minor) = 5.45 min. ^1H NMR (400 MHz, $CDCl_3$) δ 5.83-5.72 (m, 2H), 4.47-4.37 (m, 1H), 4.11-4.02 (m, 1H), 2.92 (dd, *J* = 12.8, 8.8 Hz, 1H), 2.53-2.45 (m, 1H), 2.30-2.23 (m, 1H), 2.17-2.12 (m, 4H), 1.99-1.92 (m, 1H), 1.80-1.72 (m, 1H), 1.32-1.17 (m, 7H), 1.07-0.98 (m, 1H), 0.85 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.1, 176.2, 130.5, 129.6, 69.4, 67.3, 31.6, 31.4, 31.1, 29.6, 28.6, 27.1, 24.1, 22.5, 14.0. IR (film): v_{max} (cm^{-1}) = 2955, 2927, 2857, 1750, 1711, 1461, 1356, 1250, 1211, 1164, 1110, 1065, 1004, 721, 606, 497. HRMS (ESI): Exact mass calcd. for $C_{15}H_{24}O_3Na$ ($[M+Na]^+$): 275.16177. Found: 275.16118.

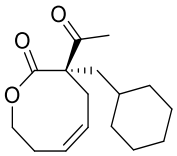


2o: colorless oil, 28.6 mg, 69% yield. $[\alpha]_D^{20}$ = 0.8 (*c* = 0.5, chloroform, 97% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.81 min, t (minor) = 7.25 min. ^1H NMR (400 MHz, $CDCl_3$) δ 5.84-5.74 (m, 2H), 4.47 (t, *J* = 10.0 Hz, 1H), 4.11-4.02 (m, 1H), 2.86-2.77 (m, 1H), 2.50-2.41 (m, 1H), 2.23-2.16 (m, 4H), 2.09-2.00 (m, 1H), 1.29-1.22 (m, 1H), 0.69-0.62 (m, 1H), 0.59-0.50 (m, 2H), 0.42-0.35 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 203.7, 175.7, 131.2, 129.4, 68.3, 67.7, 31.1, 28.6, 27.7, 13.0, 3.3, 1.5. IR (film): v_{max} (cm^{-1}) = 3023, 2959, 2853, 1753, 1710, 1462, 1443, 1355, 1298, 1250, 1199, 1166, 1133, 1087, 1066, 1026, 989, 890, 827, 791, 759, 716, 623, 609, 576, 545,

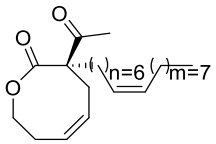
507. HRMS (EI): Exact mass calcd. for $C_{12}H_{16}O_3$ ($[M]^+$): 208.1094. Found: 208.1094.



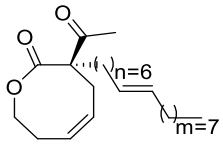
2p: colorless oil, 27.1 mg, 54% yield. $[\alpha]_D^{20}$ = 24.9 (*c* = 0.5, chloroform, 88% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.56 min, t (minor) = 6.38 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.82-5.73 (m, 2H), 4.40 (t, *J* = 10.0 Hz, 1H), 4.12-4.03 (m, 1H), 2.99-2.91 (m, 1H), 2.52-2.42 (m, 1H), 2.38-2.34 (m, 1H), 2.19-2.15 (m, 4H), 2.15-2.07 (m, 1H), 1.92 (dd, *J* = 14.8, 6.0 Hz, 1H), 1.84-1.77 (m, 1H), 1.73-1.55 (m, 4H), 1.50-1.39 (m, 2H), 1.16-1.06 (m, 1H), 1.05-0.96 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.8, 176.4, 130.9, 129.7, 69.8, 67.5, 37.7, 36.5, 34.5, 34.0, 31.7, 28.7, 27.6, 25.0, 24.9. IR (film): v_{max} (cm^{-1}) = 3022, 2953, 2867, 1749, 1710, 1451, 1356, 1251, 1215, 1164, 1103, 1057, 1005, 988, 947, 866, 801, 779, 722, 608, 578, 535, 495. HRMS (ESI): Exact mass calcd. for $C_{15}H_{22}O_3Na$ ($[M+Na]^+$): 273.14612. Found: 273.14637.



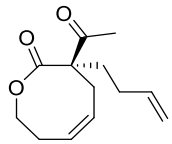
2q: colorless oil, 32.4 mg, 61% yield. $[\alpha]_D^{20}$ = 18.6 (*c* = 0.5, chloroform, 87% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.47 min, t (minor) = 6.56 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.82-5.72 (m, 2H), 4.45-4.33 (m, 1H), 4.19-3.94 (m, 1H), 3.00-2.89 (m, 1H), 2.53-2.40 (m, 1H), 2.38-2.27 (m, 1H), 2.25-2.09 (m, 4H), 1.89 (dd, *J* = 14.8, 6.4 Hz, 1H), 1.81-7.71 (m, 1H), 1.66-1.54 (m, 5H), 1.22-1.07 (m, 4H), 1.03-0.97 (m, 1H), 0.93-0.84 (m, 1H). IR (film): v_{max} (cm^{-1}) = 3021, 2922, 2850, 1750, 1710, 1448, 1356, 1249, 1213, 1161, 1137, 1052, 1021, 986, 939, 779, 721, 644, 608, 579, 535, 502, 451. HRMS (ESI): Exact mass calcd. for $C_{16}H_{24}O_3Na$ ($[M+Na]^+$): 287.16177. Found: 287.16163.



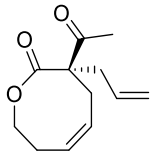
2r: colorless oil, 49.1 mg, 63% yield. $[\alpha]_D^{20}$ = 14.7 (*c* = 0.5, chloroform, 96% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 99 / 1, 1.0 mL/min, λ = 214 nm, t (major) = 6.36 min, t (minor) = 7.51 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.83-5.73 (m, 2H), 5.37-5.28 (m, 2H), 4.43 (t, *J* = 10.0 Hz, 1H), 4.08-4.05 (m, 1H), 2.93 (dd, *J* = 13.2, 8.8 Hz, 1H), 2.53-2.45 (m, 1H), 2.26 (dd, *J* = 13.2, 6.8 Hz, 1H), 2.20-2.12 (m, 4H), 2.00-1.92 (m, 5H), 1.81-1.71 (m, 1H), 1.36-1.20 (m, 19H), 1.09-0.99 (m, 1H), 0.87 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.0, 176.2, 130.6, 130.1, 129.7, 129.6, 69.4, 67.4, 31.9, 31.6, 31.2, 29.9, 29.8, 29.7, 29.6, 29.4, 29.3, 29.0, 28.7, 27.3, 27.2, 27.1, 24.2, 22.7, 14.2. IR (film): v_{max} (cm^{-1}) = 2923, 2853, 1752, 1713, 1461, 1356, 1251, 1215, 1166, 1094, 1052, 1007, 989, 721, 607, 497. HRMS (ESI): Exact mass calcd. for $C_{25}H_{42}O_3Na$ ($[M+Na]^+$): 413.30262. Found: 413.30298.



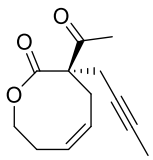
2s: colorless oil, 51.5 mg, 66% yield. $[\alpha]_D^{20}$ = 12.5 (*c* = 0.5, chloroform, 95% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), CO_2 / EtOH = 98 / 2, 1.0 mL/min, λ = 210 nm, t (minor) = 9.96 min, t (major) = 10.57 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.83-5.72 (m, 2H), 5.41-5.30 (m, 2H), 4.47-4.38 (m, 1H), 4.09-4.04 (m, 1H), 2.92 (dd, *J* = 12.8, 8.4 Hz, 1H), 2.53-2.45 (m, 1H), 2.26 (dd, *J* = 12.8, 6.8 Hz, 1H), 2.20-2.10 (m, 4H), 1.99-1.89 (m, 5H), 1.80-1.73 (m, 1H), 1.36-1.17 (m, 19H), 1.08-0.98 (m, 1H), 0.86 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.0, 176.2, 130.6, 130.1, 129.7, 69.4, 67.4, 32.6, 32.5, 31.9, 31.7, 31.3, 29.9, 29.7, 29.53, 29.51, 29.3, 29.2, 28.8, 28.7, 27.2, 24.2, 22.7, 14.1. IR (film): v_{max} (cm^{-1}) = 2922, 2853, 1752, 1713, 1461, 1356, 1251, 1215, 1166, 1096, 967, 721, 645, 607, 578, 535, 497. HRMS (ESI): Exact mass calcd. for $C_{25}H_{42}O_3Na$ ($[M+Na]^+$): 413.30262. Found: 413.30253.



2t: colorless oil, 30.9 mg, 67% yield. $[\alpha]_D^{20}$ = 30.3 (*c* = 0.5, chloroform, 96% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 5.86 min, t (minor) = 6.55 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.84-5.74 (m, 3H), 5.03 (d, *J* = 17.2 Hz, 1H), 4.97 (d, *J* = 10.0 Hz, 1H), 4.44 (t, *J* = 10.0 Hz, 1H), 4.10-4.05 (m, 1H), 2.94 (dd, *J* = 13.2, 8.8 Hz, 1H), 2.54-2.46 (m, 1H), 2.29 (dd, *J* = 12.8, 6.8 Hz, 1H), 2.20-2.12 (m, 4H), 2.09-1.97 (m, 2H), 1.92-1.81 (m, 2H). IR (film): v_{max} (cm^{-1}) = 3022, 2957, 2853, 1749, 1710, 1641, 1454, 1357, 1251, 1214, 1165, 1105, 1076, 990, 914, 864, 785, 722, 657, 607, 578, 536, 499. HRMS (EI): Exact mass calcd. for $C_{13}H_{18}O_3$ ($[M]^+$): 222.1250. Found: 222.1244.

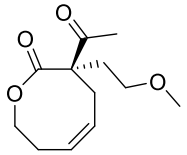


2u: colorless oil, 28.8 mg, 62% yield. $[\alpha]_D^{20}$ = 69.7 (*c* = 0.5, chloroform, 95% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 7.06 min, t (minor) = 7.67 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.85-5.74 (m, 2H), 5.69-5.58 (m, 1H), 5.15-5.09 (m, 2H), 4.47 (t, *J* = 10.0 Hz, 1H), 4.05 (dt, *J* = 10.8, 3.6 Hz, 1H), 2.94 (dd, *J* = 12.8, 8.8 Hz, 1H), 2.74 (dd, *J* = 14.4, 6.4 Hz, 1H), 2.55-2.47 (m, 2H), 2.27 (dd, *J* = 13.2, 6.8 Hz, 1H), 2.16-2.09 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.2, 175.7, 132.2, 130.3, 129.9, 119.2, 69.2, 67.6, 36.2, 31.3, 28.7, 27.5. IR (film): v_{max} (cm^{-1}) = 3021, 2960, 2919, 1749, 1710, 1641, 1460, 1445, 1357, 1323, 1280, 1252, 1215, 1167, 1101, 1077, 988, 922, 863, 786, 723, 680, 608, 585, 534, 495. HRMS (EI): Exact mass calcd. for $C_{12}H_{16}O_3$ ($[M]^+$): 208.1094. Found: 208.1090.

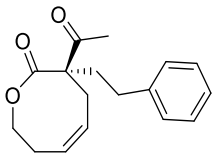


2v: colorless oil, 40.5 mg, 67% yield. $[\alpha]_D^{20}$ = 21.4 (*c* = 0.5, chloroform, 95% ee).

The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 6.57 min, t (minor) = 7.58 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.84-5.74 (m, 2H), 4.45 (t, *J* = 10.8 Hz, 1H), 4.03-4.01 (m, 1H), 3.06 (dd, *J* = 12.4, 8.4 Hz, 1H), 2.83 (d, *J* = 17.2 Hz, 1H), 2.62-2.53 (m, 2H), 2.40 (dd, *J* = 13.2, 6.4 Hz, 1H), 2.20 (s, 3H), 2.12-2.10 (m, 1H), 1.72 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.9, 174.9, 130.22, 130.19, 79.4, 73.2, 68.6, 68.0, 30.8, 28.8, 27.0, 22.1, 3.5. IR (film): v_{max} (cm^{-1}) = 3021, 2962, 2921, 2855, 1750, 1715, 1445, 1357, 1322, 1281, 1252, 1214, 1164, 1117, 1101, 1068, 1036, 1006, 984, 943, 912, 868, 818, 789, 720, 646, 606, 590, 533, 514, 493. HRMS (ESI): Exact mass calcd. for $C_{13}H_{16}O_3Na$ ($[M+Na]^+$): 243.09917. Found: 243.09873.

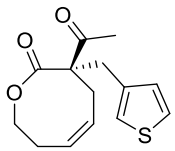


2w: colorless oil, 27.6 mg, 61% yield. $[\alpha]_D^{20}$ = +78.4 (*c* = 0.5, chloroform, 97% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 90 / 10, 1.0 mL/min, λ = 214 nm, t (major) = 9.35 min, t (minor) = 11.98 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.84-5.72 (m, 2H), 4.45 (t, *J* = 10.4 Hz, 1H), 4.17-4.04 (m, 1H), 3.46-3.41 (m, 1H), 3.36-3.30 (m, 1H), 3.20 (s, 3H), 2.99 (dd, *J* = 12.8, 9.2 Hz, 1H), 2.57-2.48 (m, 1H), 2.37-2.27 (m, 2H), 2.18-2.10 (m, 4H), 1.99 (dt, *J* = 14.8, 5.2 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.7, 176.0, 130.3, 130.0, 68.3, 67.8, 67.4, 58.6, 32.2, 32.0, 28.7, 27.4. IR (film): v_{max} (cm^{-1}) = 2959, 2929, 2875, 1749, 1710, 1460, 1449, 1356, 1252, 1216, 1164, 1116, 1098, 1040, 1004, 944, 774, 721, 633, 607, 582, 535, 493. HRMS (ESI): Exact mass calcd. for $C_{12}H_{18}O_4Na$ ($[M+Na]^+$): 249.10973. Found: 249.10921.

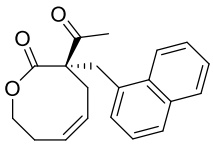


2x: colorless oil, 39.6 mg, 73% yield. $[\alpha]_D^{20}$ = -8.5 (*c* = 0.5, chloroform, 94% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (minor) = 7.29 min, t (major) = 8.56 min. ^{1}H

NMR (400 MHz, $CDCl_3$) δ 7.31-7.27 (m, 2H), 7.22-7.17 (m, 3H), 5.87-5.76 (m, 2H), 4.47 (t, *J* = 10.0 Hz, 1H), 4.11-4.09 (m, 1H), 3.02 (dd, *J* = 12.8, 8.8 Hz, 1H), 2.61-2.07 (m, 10H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.0, 175.9, 141.0, 130.2, 130.0, 128.5, 128.2, 126.2, 69.3, 67.5, 33.7, 31.7, 30.7, 28.6, 27.3. IR (film): v_{max} (cm^{-1}) = 3025, 2957, 2924, 2853, 1748, 1710, 1603, 1496, 1455, 1357, 1250, 1212, 1159, 1105, 1089, 1028, 1004, 987, 780, 751, 722, 699, 607, 507, 492, 469. HRMS (ESI): Exact mass calcd. for $C_{17}H_{20}O_3Na$ ($[M+Na]^+$): 295.13047. Found: 295.13052.

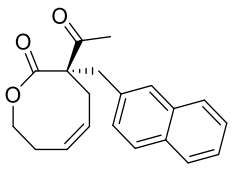


2y: colorless oil, 48.7 mg, 82% yield. $[\alpha]_D^{20}$ = 16.5 (*c* = 0.5, chloroform, 95% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 8.36 min, t (minor) = 8.91 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.23 (dd, *J* = 4.8, 2.8 Hz, 1H), 7.00-6.98 (m, 1H), 6.87 (dd, *J* = 4.8, 1.2 Hz, 1H), 5.88-5.74 (m, 2H), 4.51 (td, *J* = 10.4, 1.6 Hz, 1H), 4.11-4.02 (m, 1H), 3.36 (AB, J_{AB} = 14.8 Hz, 1H), 3.08 (BA, J_{BA} = 14.8 Hz, 1H), 2.93 (dd, *J* = 13.2, 9.6 Hz, 1H), 2.57-2.49 (m, 1H), 2.30 (dd, *J* = 13.2, 7.2 Hz, 1H), 2.21-2.14 (m, 1H), 2.08 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.2, 175.7, 135.9, 130.2, 130.0, 129.0, 125.7, 123.4, 69.9, 67.4, 32.7, 32.2, 28.6, 28.1. IR (film): v_{max} (cm^{-1}) = 2960, 2921, 2851, 1748, 1709, 1447, 1414, 1356, 1323, 1255, 1212, 1170, 1154, 1097, 1066, 1030, 1007, 989, 910, 865, 833, 794, 722, 690, 653, 610, 568, 534, 495. HRMS (ESI): Exact mass calcd. for $C_{14}H_{16}O_3NaS$ ($[M+Na]^+$): 287.07124. Found: 287.07116.

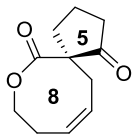


2z: white solid, 46.1 mg, 75% yield, m.p. = 135-137 ºC. $[\alpha]_D^{20}$ = 38.8 (*c* = 0.5, chloroform, 91% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (minor) = 14.50 min, t (major) = 15.66 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 8.0 Hz, 1H), 7.85 (d, *J* = 7.6 Hz, 1H), 7.76 (d, *J* = 7.2 Hz, 1H), 7.54-7.46 (m, 2H), 7.42-7.37 (m, 2H), 5.89-

5.78 (m, 2H), 4.55 (t, J = 9.2 Hz, 1H), 4.16-4.06 (m, 1H), 3.81 (AB, J_{AB} = 15.2 Hz, 1H), 3.67 (BA, J_{BA} = 15.2 Hz, 1H), 2.94 (dd, J = 12.8, 8.8 Hz, 1H), 2.47-2.39 (m, 2H), 2.30-2.19 (m, 1H), 1.91 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.1, 175.9, 133.9, 132.6, 132.4, 130.5, 130.1, 128.9, 128.1, 127.9, 126.2, 125.8, 125.3, 123.7, 70.4, 67.2, 33.6, 32.5, 28.6. IR (film): v_{max} (cm^{-1}) = 3019, 2971, 2949, 2909, 1749, 1706, 1593, 1509, 1460, 1440, 1393, 1358, 1324, 1286, 1251, 1214, 1182, 1158, 1119, 1083, 1046, 1005, 989, 938, 911, 879, 866, 805, 790, 776, 741, 722, 666, 611, 587, 547, 531, 510, 486, 435. HRMS (ESI): Exact mass calcd. for $C_{20}H_{20}O_3Na$ ($[M+Na]^+$): 331.13047. Found: 331.13041.

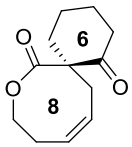


2aa: colorless oil, 47.9 mg, 78% yield. $[\alpha]_D^{20}$ = 6.8 (c = 0.5, chloroform, 95% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (minor) = 13.68 min, t (major) = 14.46 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79-7.73 (m, 3H), 7.58 (s, 1H), 7.47-7.41 (m, 2H), 7.23 (d, J = 8.8 Hz, 1H), 5.91-5.83 (m, 2H), 4.54 (t, J = 10.0 Hz, 1H), 4.12-4.02 (m, 1H), 3.54 (AB, J_{AB} = 14.0 Hz, 1H), 3.20 (BA, J_{BA} = 14.0 Hz, 1H), 2.97-2.83 (m, 1H), 2.55-2.49 (m, 1H), 2.36-2.33 (m, 1H), 2.20-2.17 (m, 1H), 2.10 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.2, 175.8, 133.5, 133.3, 132.4, 130.3, 130.1, 128.7, 128.1, 127.9, 127.64, 127.59, 126.1, 125.8, 70.4, 67.4, 38.3, 31.9, 28.6, 28.5. IR (film): v_{max} (cm^{-1}) = 3054, 3020, 2959, 2926, 2852, 1749, 1710, 1632, 1600, 1508, 1447, 1356, 1323, 1251, 1212, 1166, 1098, 1066, 1033, 1005, 987, 962, 914, 894, 860, 819, 787, 728, 666, 621, 607, 535, 478. HRMS (ESI): Exact mass calcd. for $C_{20}H_{20}O_3Na$ ($[M+Na]^+$): 331.13047. Found: 331.13026.

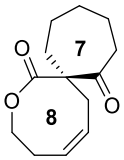


2ab: colorless oil, 22.9 mg, 59% yield. $[\alpha]_D^{20}$ = 27.1 (c = 0.5, chloroform, 5% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes /

IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (minor) = 14.21 min, t (major) = 16.40 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.86-5.72 (m, 2H), 4.46 (td, *J* = 10.8, 1.6 Hz, 1H), 4.17 (dt, *J* = 10.8, 4.0 Hz, 1H), 3.22-3.14 (m, 1H), 2.72-2.61 (m, 2H), 2.42-2.34 (m, 1H), 2.29-2.20 (m, 1H), 2.15-2.09 (m, 1H), 2.01 (dd, *J* = 12.4, 7.2 Hz, 1H), 1.96-1.89 (m, 2H), 1.76 (dt, *J* = 12.8, 8.0 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 212.3, 173.3, 130.1, 129.8, 68.9, 66.2, 37.8, 34.8, 31.7, 28.8, 19.3. IR (film): v_{max} (cm^{-1}) = 3021, 2961, 2925, 2893, 1727, 1634, 1460, 1405, 1358, 1321, 1296, 1277, 1249, 1218, 1166, 1143, 1105, 1038, 988, 955, 919, 902, 867, 825, 774, 719, 623, 598, 533, 488. HRMS (ESI): Exact mass calcd. for $C_{11}H_{14}O_3Na$ ($[M+Na]^+$): 217.08352. Found: 217.08333.

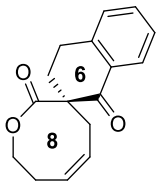


2ac: colorless oil, 36.6 mg, 72% yield. $[\alpha]_D^{20}$ = 42.8 (*c* = 0.5, chloroform, 60% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 90 / 10, 1.0 mL/min, λ = 214 nm, t (minor) = 7.17 min, t (major) = 8.05 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.91-5.84 (m, 1H), 5.78-5.71 (m, 1H), 4.32-4.16 (m, 2H), 2.86-2.73 (m, 1H), 2.62-2.50 (m, 2H), 2.41 (dt, *J* = 13.6, 3.6 Hz, 1H), 2.40-2.32 (m, 1H), 2.30-2.24 (m, 1H), 2.23-2.14 (m, 1H), 2.08-2.00 (m, 1H), 1.79-1.72 (m, 2H), 1.68-1.57 (m, 1H), 1.56-1.48 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.4, 175.8, 131.2, 128.8, 67.6, 67.1, 41.5, 36.4, 34.0, 28.6, 28.0, 23.1. IR (film): v_{max} (cm^{-1}) = 2935, 2861, 1736, 1712, 1448, 1359, 1317, 1252, 1210, 1179, 1124, 1090, 1076, 1051, 1031, 1005, 982, 950, 917, 850, 767, 744, 720, 682, 614, 583, 542, 515, 497, 468. HRMS (ESI): Exact mass calcd. for $C_{12}H_{16}O_3Na$ ($[M+Na]^+$): 231.09917. Found: 231.09959.

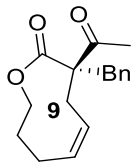


2ad: white solid, 37.6 mg, 79% yield, m.p. = 51-52 °C. $[\alpha]_D^{20}$ = 36.6 (*c* = 0.5, chloroform, 57% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 90 / 10, 1.0 mL/min, λ = 214 nm, t (major) = 5.88 min, t (minor) = 8.97 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.86-5.74 (m, 2H), 4.34 (t, *J* = 10.0

Hz, 1H), 4.14-4.11 (m, 1H), 3.04 (dd, J = 12.0, 8.4 Hz, 1H), 2.70-2.64 (m, 1H), 2.47-2.41 (m, 2H), 2.26-2.11 (m, 3H), 1.83-1.66 (m, 3H), 1.62-1.53 (m, 3H), 1.41-1.34 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 208.1, 175.6, 130.9, 129.3, 69.2, 67.1, 41.8, 34.2, 31.7, 29.3, 28.5, 25.2, 24.9. IR (film): v_{max} (cm^{-1}) = 2941, 2924, 2853, 1741, 1708, 1452, 1354, 1321, 1288, 1250, 1213, 1177, 1160, 1112, 1091, 1070, 1043, 1014, 995, 946, 918, 862, 841, 794, 752, 720, 615, 533, 496. HRMS (ESI): Exact mass calcd. for $C_{13}H_{18}O_3Na$ ([M+Na]$^+$): 245.11482. Found: 245.11484.

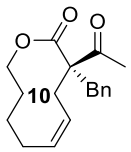


2ae: colorless oil, 45.2 mg, 88% yield. $[\alpha]_D^{20}$ = 6.3 (c = 0.5, chloroform, 13% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 90 / 10, 1.0 mL/min, λ = 214 nm, t (major) = 12.36 min, t (minor) = 14.70 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, J = 8.0 Hz, 1H), 7.45 (t, J = 7.6 Hz, 1H), 7.29 (t, J = 7.2 Hz, 1H), 7.19 (d, J = 7.6 Hz, 1H), 6.11-6.04 (m, 1H), 5.89-5.82 (m, 1H), 4.34-4.24 (m, 2H), 3.33-3.21 (m, 1H), 3.16-3.05 (m, 1H), 2.96-2.91 (m, 1H), 2.65-2.62 (m, 1H), 2.40-2.32 (m, 3H), 2.10 (td, J = 13.2, 4.8 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 194.7, 174.9, 143.1, 133.5, 132.2, 131.3, 129.2, 128.7, 127.8, 126.7, 67.9, 63.9, 34.6, 31.2, 28.8, 26.8. IR (film): v_{max} (cm^{-1}) = 3026, 2956, 2926, 2850, 1737, 1686, 1600, 1483, 1453, 1356, 1325, 1272, 1251, 1233, 1151, 1118, 1074, 984, 940, 922, 895, 815, 789, 774, 729, 685, 639, 591, 539, 511, 479. HRMS (ESI): Exact mass calcd. for $C_{16}H_{16}O_3Na$ ([M+Na]$^+$): 279.09917. Found: 279.09896.

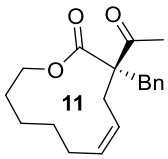


2af: colorless oil, 48.6 mg, 84% yield. $[\alpha]_D^{20}$ = 74.8 (c = 0.5, chloroform, 95% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 99 / 1, 1.0 mL/min, λ = 214 nm, t (major) = 15.66 min, t (minor) = 16.70 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28-7.20 (m, 3H), 7.11-7.10 (m, 2H), 5.70-5.63 (m, 1H),

5.58-5.50 (m, 1H), 4.68-4.62 (m, 1H), 4.06-3.88 (m, 1H), 3.37 (AB, J_{AB} = 14.4 Hz, 1H), 3.03 (BA, J_{BA} = 14.4 Hz, 1H), 2.85 (t, J = 11.2 Hz, 1H), 2.28-2.22 (m, 2H), 2.09-2.00 (m, 4H), 1.91-1.84 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.5, 172.7, 135.9, 134.8, 129.9, 128.5, 127.1, 124.1, 64.8, 63.4, 38.4, 30.5, 28.3, 26.3, 21.7. IR (film): v_{max} (cm^{-1}) = 3012, 2929, 2864, 1744, 1709, 1604, 1496, 1455, 1355, 1279, 1264, 1229, 1209, 1177, 1118, 1067, 994, 885, 820, 726, 701, 647, 559, 524, 492, 450. HRMS (ESI): Exact mass calcd. for $C_{17}H_{20}O_3Na$ ($[M+Na]^+$): 295.13047. Found: 295.13002.



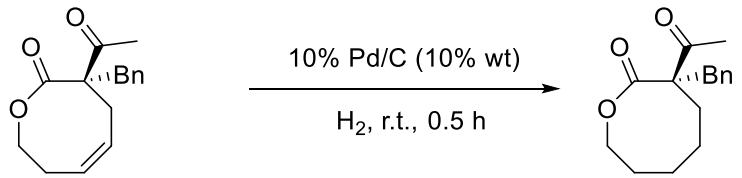
2ag: colorless oil, 39.9 mg, 66% yield. $[\alpha]_D^{20}$ = 44.1 (c = 0.5, chloroform, 89% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 99 / 1, 1.0 mL/min, λ = 214 nm, t (minor) = 12.25 min, t (major) = 17.00 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26-7.22 (m, 3H), 7.10-7.08 (m, 2H), 5.75-5.32 (m, 2H), 4.88-4.76 (m, 1H), 3.79-3.65 (m, 1H), 3.39 (AB, J_{AB} = 14.4 Hz, 1H), 3.11 (BA, J_{BA} = 14.4 Hz, 1H), 3.01-2.88 (m, 1H), 2.82-2.62 (m, 1H), 2.19-1.83 (m, 5H), 1.74-1.64 (m, 2H), 1.52-1.38 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.4, 171.4, 136.0, 134.4, 130.0, 128.5, 127.1, 123.7, 67.7, 64.9, 37.4, 27.6, 27.4, 26.9, 26.1, 24.7. IR (film): v_{max} (cm^{-1}) = 2955, 2918, 2852, 1739, 1708, 1604, 1495, 1453, 1355, 1292, 1263, 1229, 1197, 1177, 1130, 1070, 1023, 943, 848, 809, 736, 719, 700, 646, 607, 567, 547, 519, 501, 463. HRMS (ESI): Exact mass calcd. for $C_{18}H_{22}O_3Na$ ($[M+Na]^+$): 309.14612. Found: 309.14620.



2ah: colorless oil, 40.9 mg, 66% yield. $[\alpha]_D^{20}$ = 41.5 (c = 0.5, chloroform, 96% ee). The enantiomeric ratio was determined by Daicel Chiralpak IC-3 (15 cm), Hexanes / IPA = 99 / 1, 1.0 mL/min, λ = 214 nm, t (minor) = 10.18 min, t (major) = 12.32 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26-7.21 (m, 3H), 7.16-7.02 (m, 2H), 5.73-5.48 (m, 1H), 5.46-5.31 (m, 1H), 4.96-4.40 (m, 1H), 3.97-3.55 (m, 1H), 3.36 (AB, J_{AB} = 14.0 Hz, 1H),

3.20 (BA, J_{BA} = 14.4 Hz, 1H), 3.01-2.62 (m, 1H), 2.52-2.20 (m, 2H), 2.10 (s, 3H), 2.04-1.85 (m, 1H), 1.80-1.63 (m, 1H), 1.60-1.45 (m, 2H), 1.44-1.33 (m, 2H), 1.32-1.17 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.8, 171.9, 136.0, 134.7, 130.0, 128.5, 127.1, 123.9, 65.6, 65.3, 37.3, 29.2, 28.1, 27.9, 26.8, 24.3, 22.3. IR (film): v_{max} (cm^{-1}) = 3028, 3010, 2928, 2854, 1739, 1708, 1604, 1496, 1451, 1354, 1299, 1272, 1204, 1172, 1131, 1064, 1001, 959, 855, 751, 738, 701, 647, 573, 522, 502. HRMS (ESI): Exact mass calcd. for $C_{19}H_{24}O_3Na$ ($[M+Na]^+$): 323.16177. Found: 323.16179.

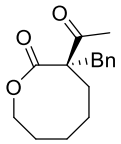
2.4 Transformation of products



2a
0.2 mmol, 96% ee

3
> 99% yield, 95% ee

Pd/C (5.2 mg, 10% wt) was added to a solution of **2a** (51.7 mg, 0.2 mmol) in MeOH (2.0 mL) under argon atmosphere. Then the reaction system was filled with H_2 and stirred at room temperature. After the reaction was complete (monitored by TLC), the crude reaction mixture was filtered through a pad of celite. After the solvent was concentrated under reduced pressure, the crude product was purified by silica gel column chromatography (PE/EtOAc = 10:1) to afford the desired product **3**. The analytical data of the products are summarized below.

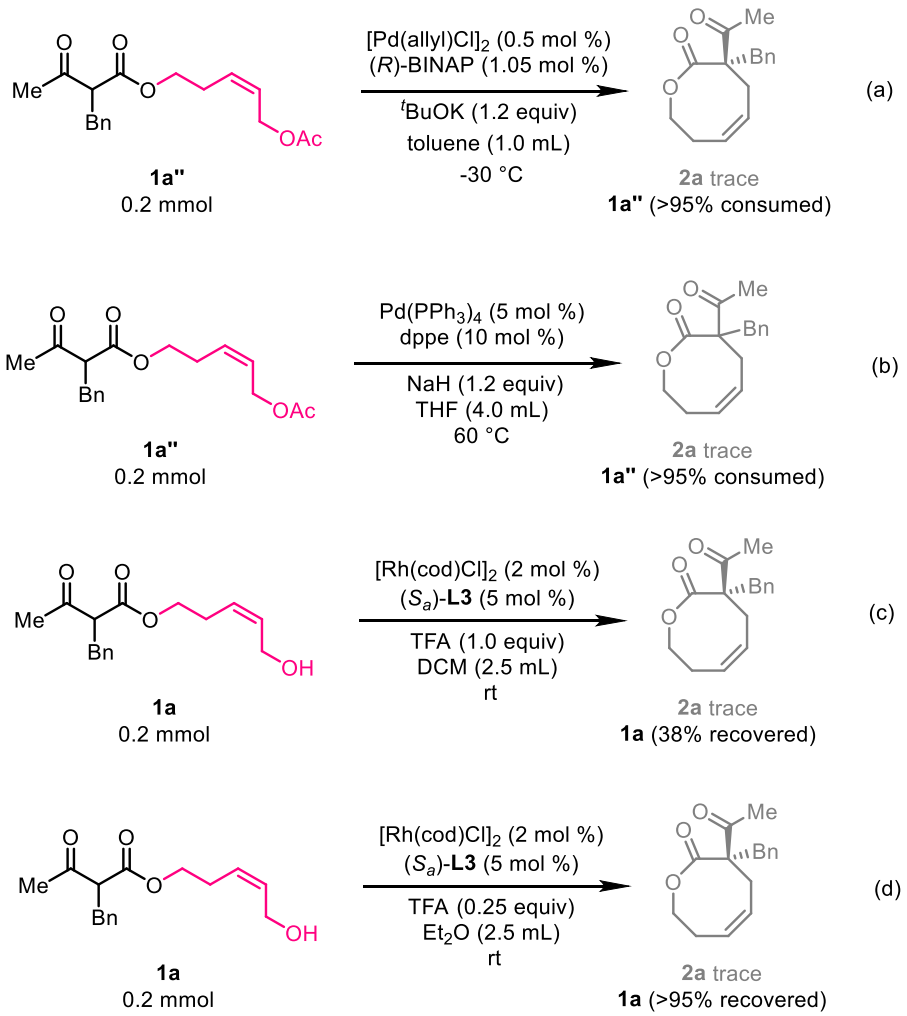


3: colorless oil, 54.0 mg, > 99% yield. $[\alpha]_D^{20}$ = 18.3 (*c* = 0.5, chloroform, 95% ee). The enantiomeric ratio was determined by Daicel Chiralpak IG (25 cm), Hexanes / IPA = 95 / 5, 1.0 mL/min, λ = 214 nm, t (major) = 6.70 min, t (minor) = 7.23 min. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27-7.18 (m, 3H), 7.10-7.07 (m, 2H), 4.87-4.81 (m, 1H), 4.08-4.05 (m, 1H), 3.38 (AB, J_{AB} = 14.0 Hz, 1H), 2.98 (BA, J_{BA} = 14.0 Hz, 1H), 2.30 (dd, *J* = 14.0, 7.6 Hz, 1H), 2.03 (s, 3H), 1.82-1.76 (m, 2H), 1.74-1.50 (m, 4H), 1.39-1.31 (m,

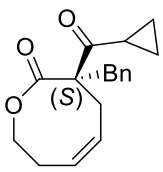
1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.3, 176.2, 135.9, 130.0, 128.3, 126.9, 67.6, 64.5, 40.0, 39.3, 31.8, 28.8, 25.9, 25.0. IR (film): ν_{max} (cm^{-1}) = 3030, 2928, 2857, 1742, 1707, 1604, 1496, 1452, 1373, 1354, 1268, 1227, 1203, 1184, 1155, 1089, 1001, 982, 806, 758, 741, 700, 646, 603, 576, 507, 449. HRMS (ESI): Exact mass calcd. for $C_{16}H_{20}O_3Na$ ($[M+Na]^+$): 283.13047. Found: 283.12998.

2.5 Control experiments

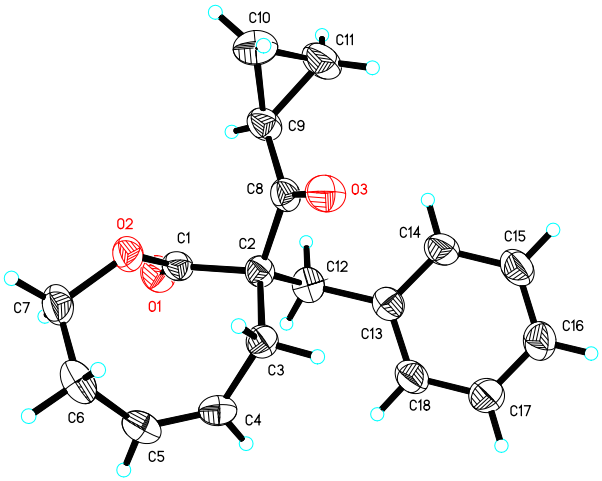
The synthesis of medium-sized-ring lactones via *Z*-retentive asymmetric allylic substitution reactions has been investigated with Pd- or Rh-catalysis by using *Z*-allylic alcohol **1a** or acetate **1a″** as the substrates. Under the conditions reported by Ito[1] (eq a), Trost[2] (eq b) (Pd) or by our group[3] (eqs c and d) (Rh), the desired product or products via branched-selective intramolecular reaction or intermolecular reaction was not formed.



3. X-Ray crystal data of 2e.



2f



A single crystal of **2e** was obtained through slow evaporation from its solution in DCM. The structure and absolute configuration of **2e** were then determined by X-ray crystallographic analysis. (CCDC No: 2007144)

Crystal data and structure refinement for cu_d8v19971_0m.

Identification code	cu_d8v19971_0m	
Empirical formula	C18 H20 O3	
Formula weight	284.34	
Temperature	293(2) K	
Wavelength	1.54178 Å	
Crystal system	Orthorhombic	
Space group	P 21 21 21	
Unit cell dimensions	a = 9.9053(3) Å	α= 90°.
	b = 12.0849(4) Å	β= 90°.
	c = 12.9982(4) Å	γ = 90°.
Volume	1555.94(8) $Å^3$	
Z	4	
Density (calculated)	1.214 Mg/m^3	
Absorption coefficient	0.654 mm^{-1}	
F(000)	608	
Crystal size	0.200 x 0.160 x 0.130 mm^3	
Theta range for data collection	6.812 to 66.980°.	
Index ranges	-11<=h<=11, -12<=k<=14, -15<=l<=14	

Reflections collected	13538
Independent reflections	2756 [R(int) = 0.0415]
Completeness to theta = 67.679°	97.7 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.7533 and 0.5356
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	2756 / 0 / 191
Goodness-of-fit on F^2	1.071
Final R indices [I>2sigma(I)]	R1 = 0.0348, wR2 = 0.0908
R indices (all data)	R1 = 0.0361, wR2 = 0.0927
Absolute structure parameter	0.05(7)
Extinction coefficient	0.326(12)
Largest diff. peak and hole	0.133 and -0.139 e.$Å^{-3}$

4. References

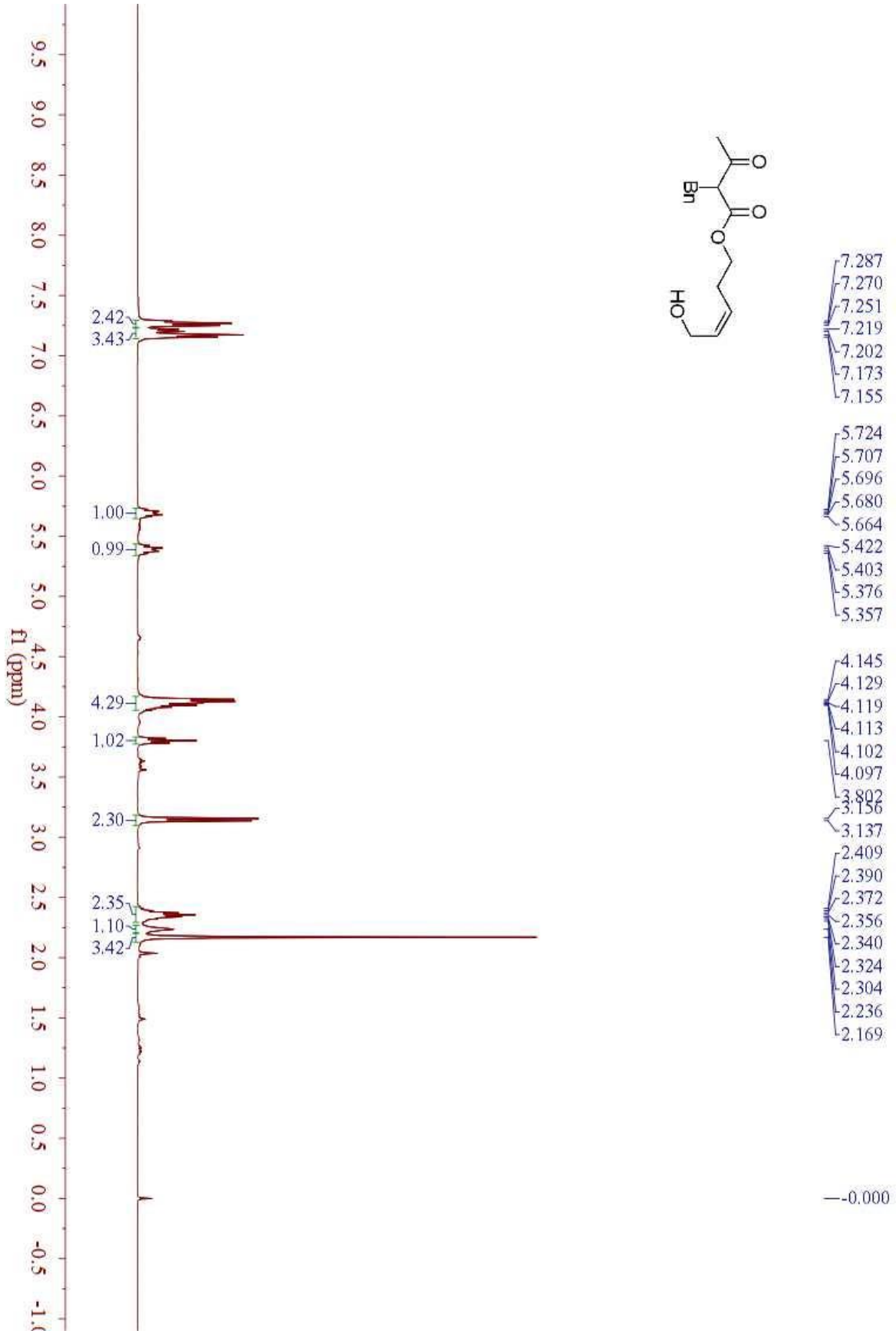
[1] Kuwano, R.; Ito, Y. *J. Am. Chem. Soc.* **1999**, *121*, 3236.

[2] Trost, B. M.; Verhoeven, T. R. *J. Am. Chem. Soc.* **1979**, *101*, 1595.

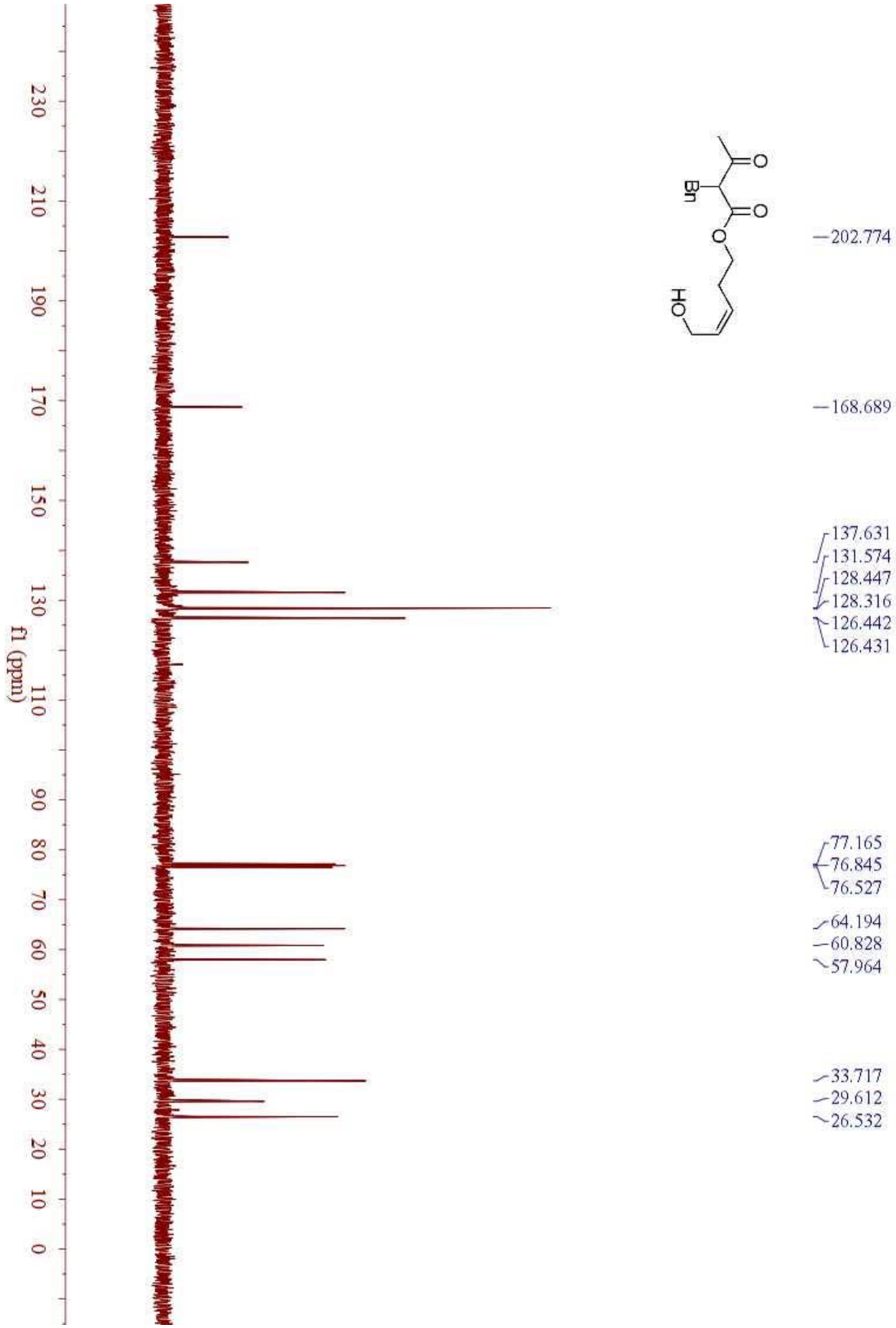
[3] Tang, S.-B.; Zhang, X.; Tu, H.-F.; You, S.-L. *J. Am. Chem. Soc.* **2018**, *140*, 7737.

5. Copies of NMR spectra and HPLC chromatograms

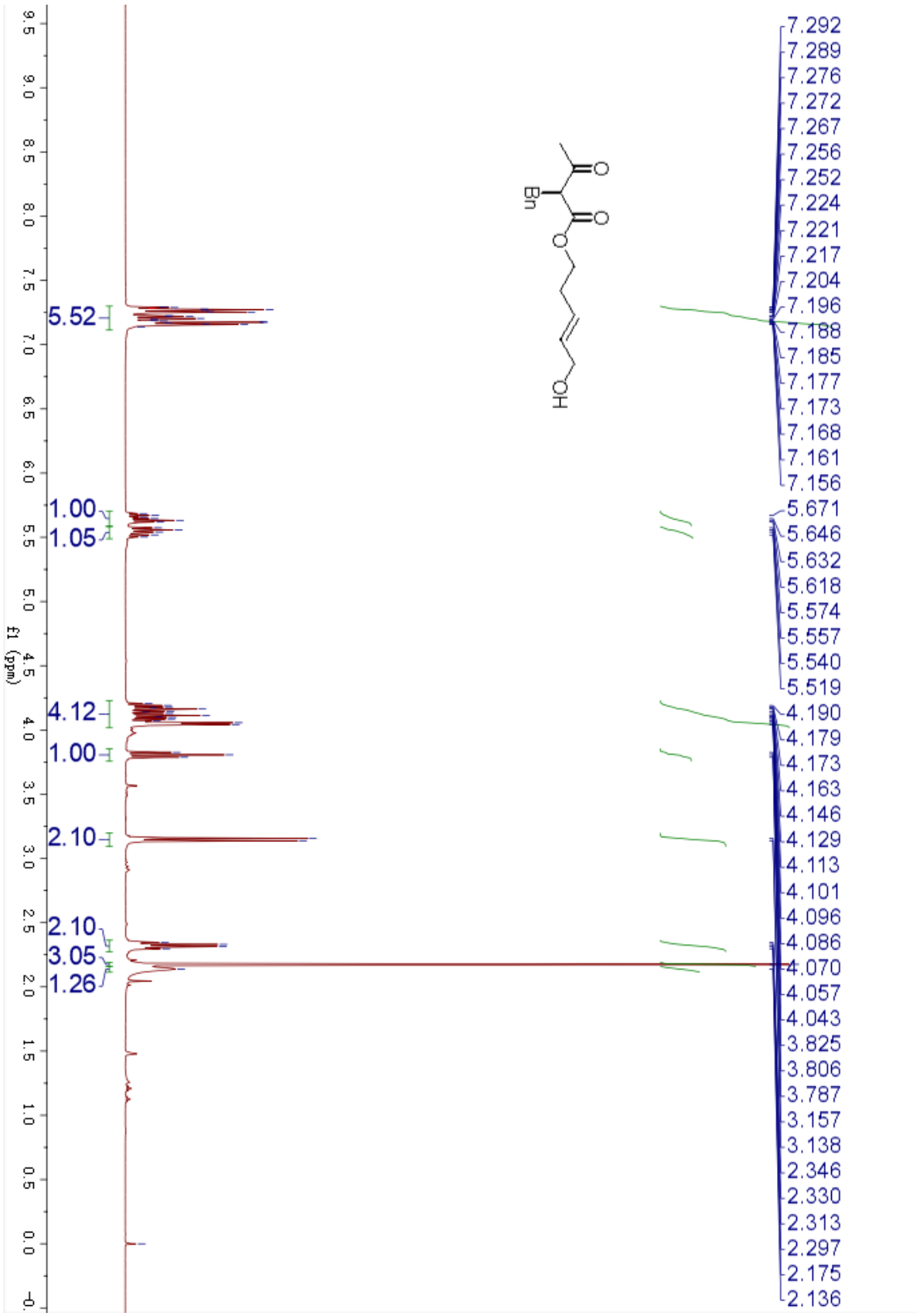
1a ^{1}H NMR (400 MHz, $CDCl_3$)



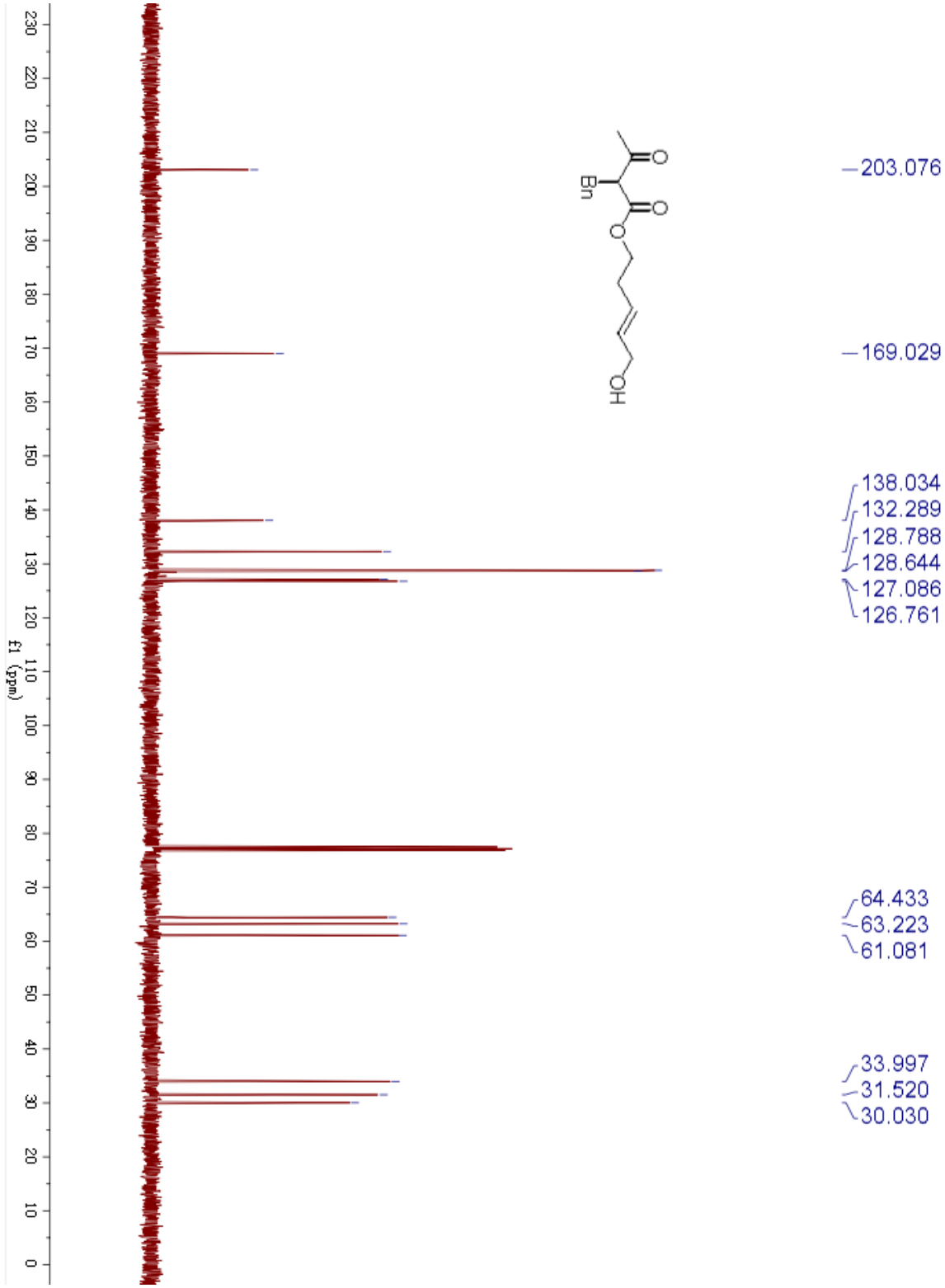
1a ^{13}C NMR (100 MHz, $CDCl_3$)



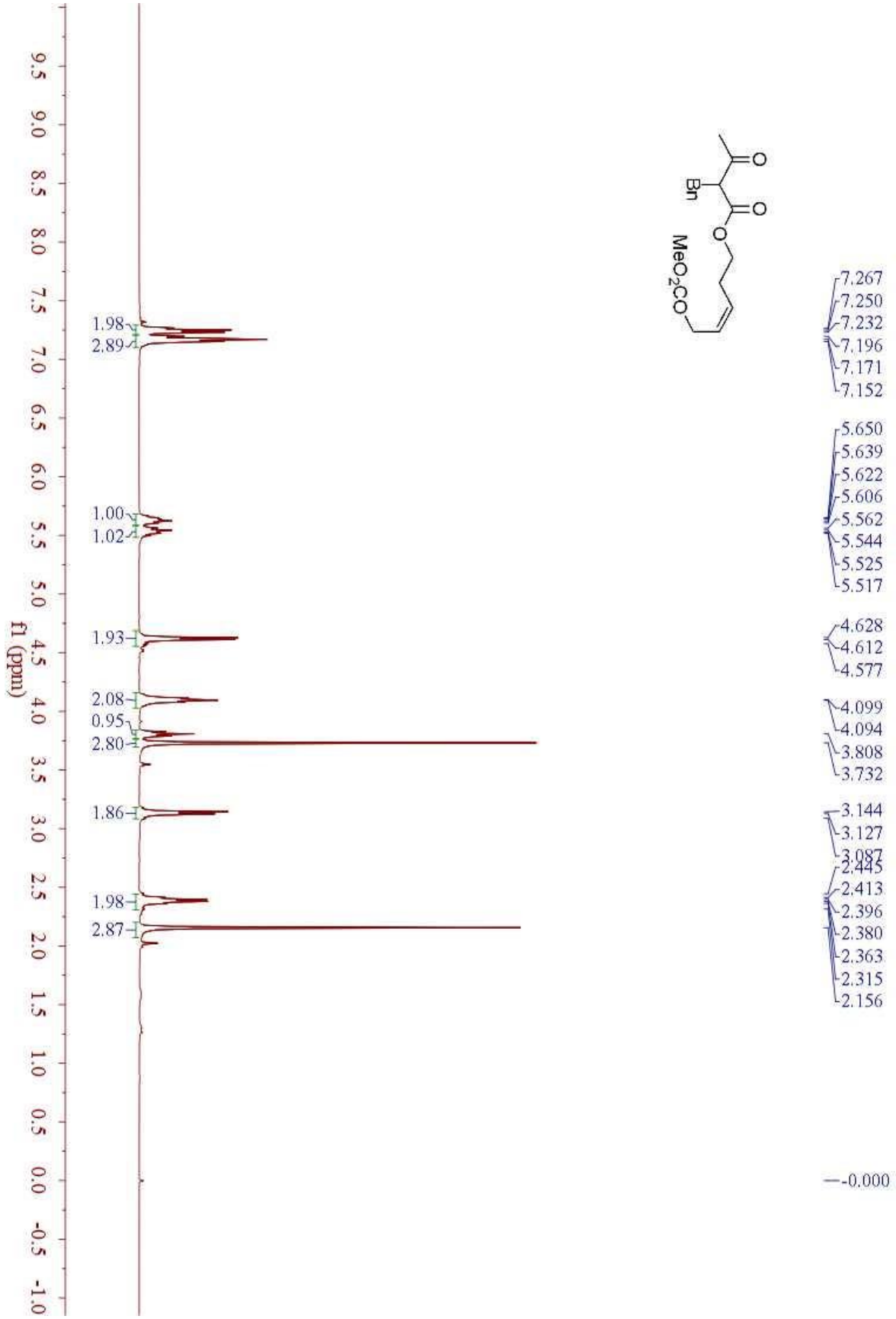
(*E*)-**1a** ^{1}H NMR (400 MHz, $CDCl_3$)



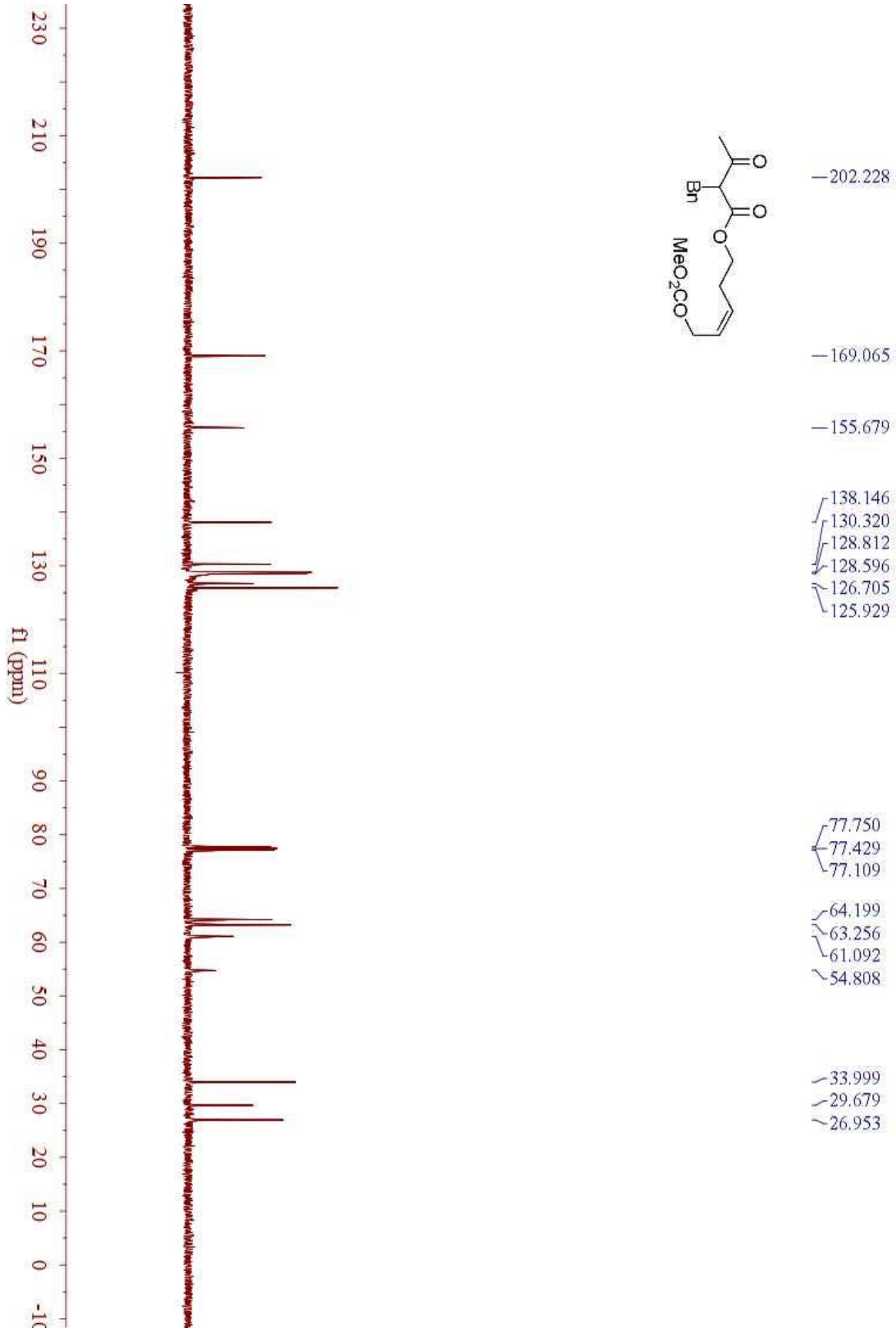
(*E*)-**1a** ^{13}C NMR (100 MHz, $CDCl_3$)



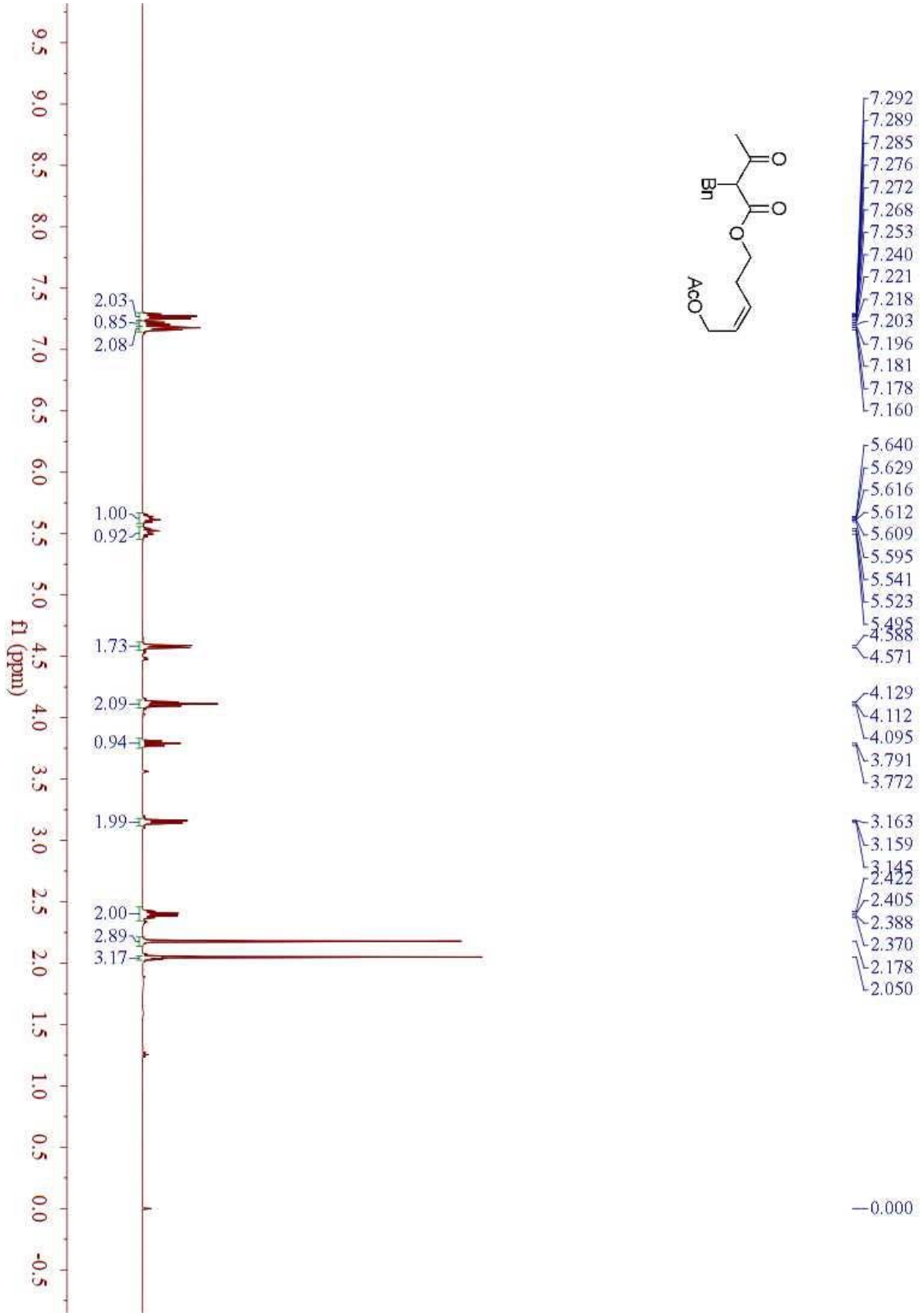
1a′ ^{1}H NMR (400 MHz, $CDCl_3$)



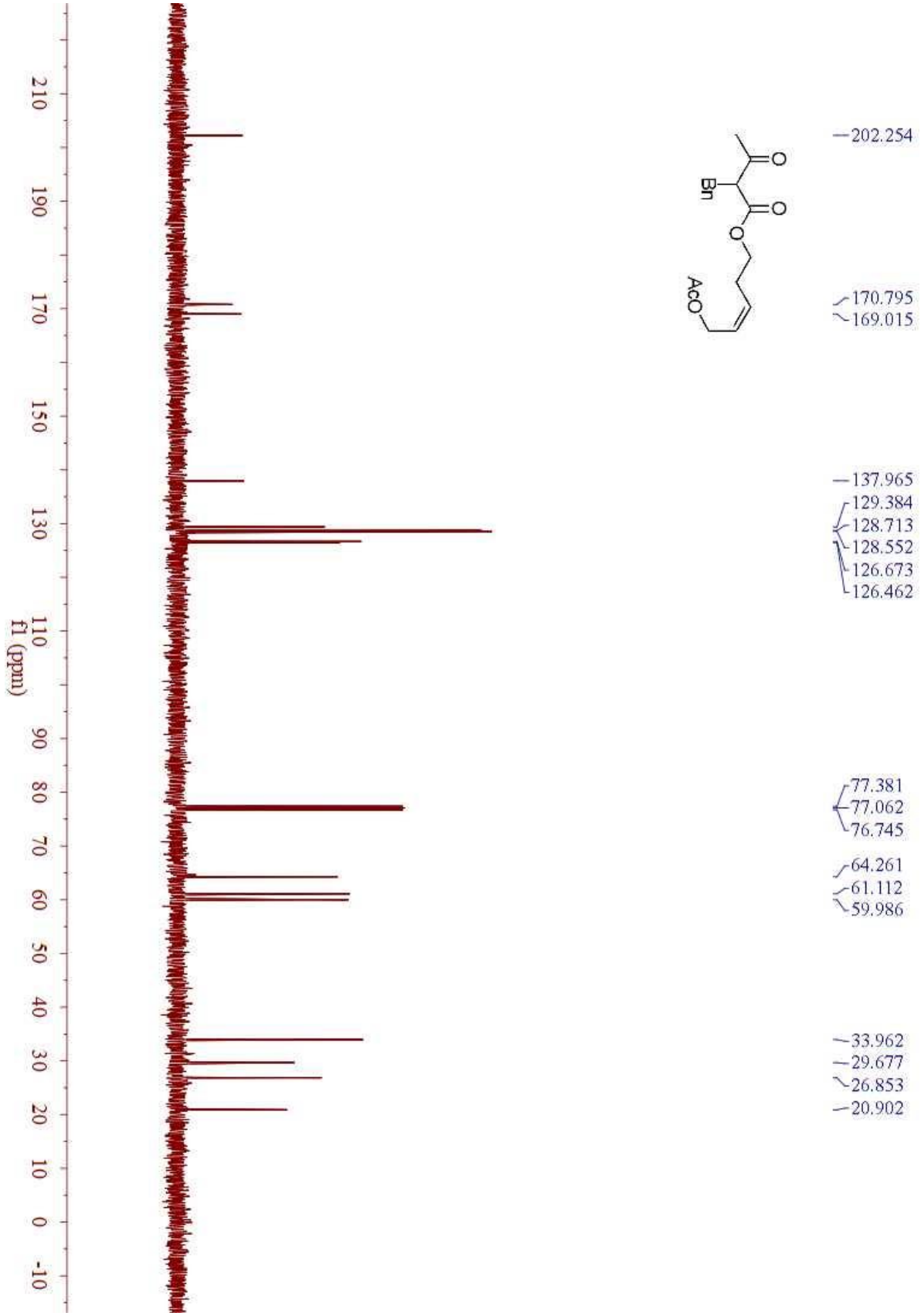
1a′ ^{13}C NMR (100 MHz, $CDCl_3$)



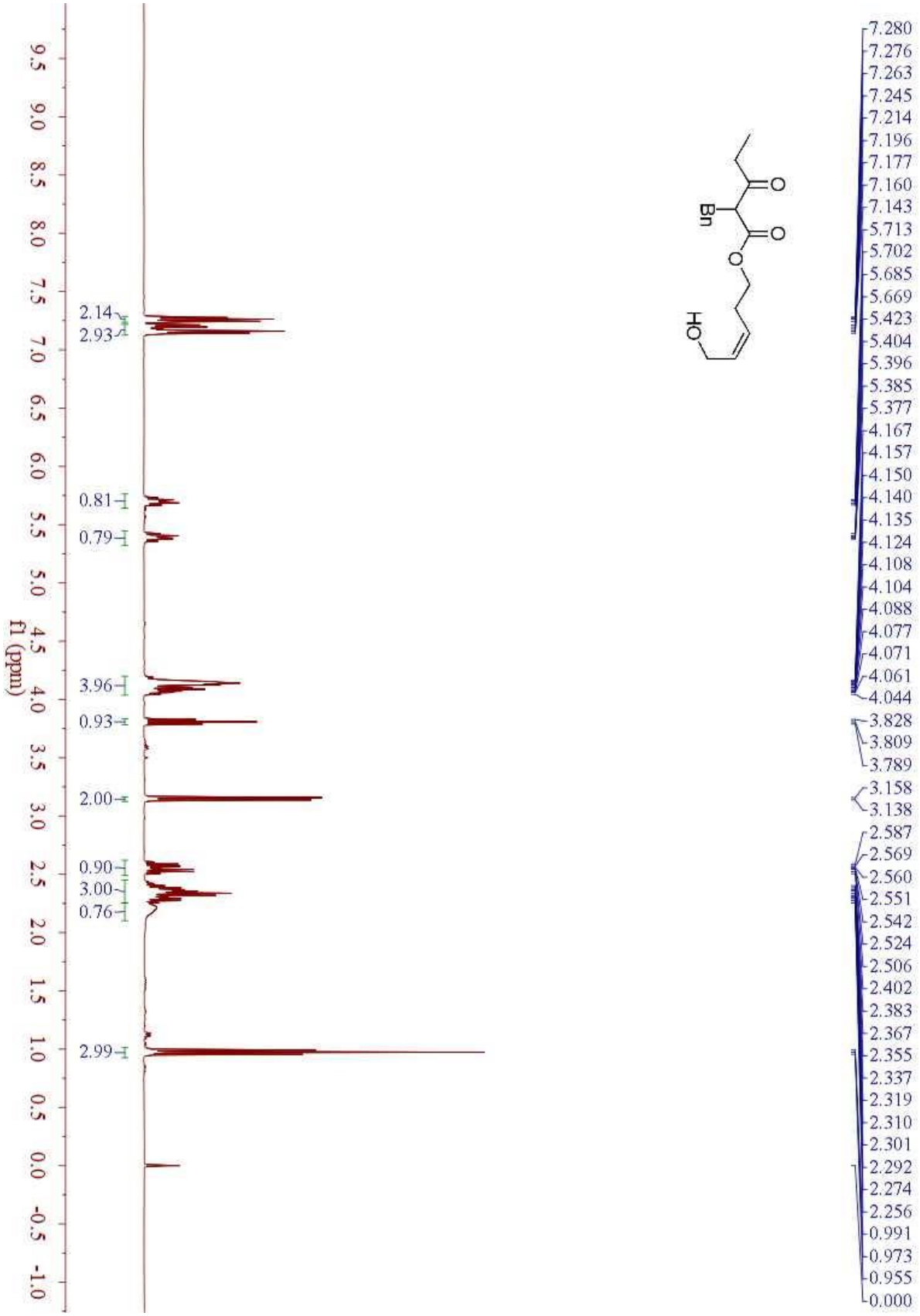
1a″ ^{1}H NMR (400 MHz, $CDCl_3$)



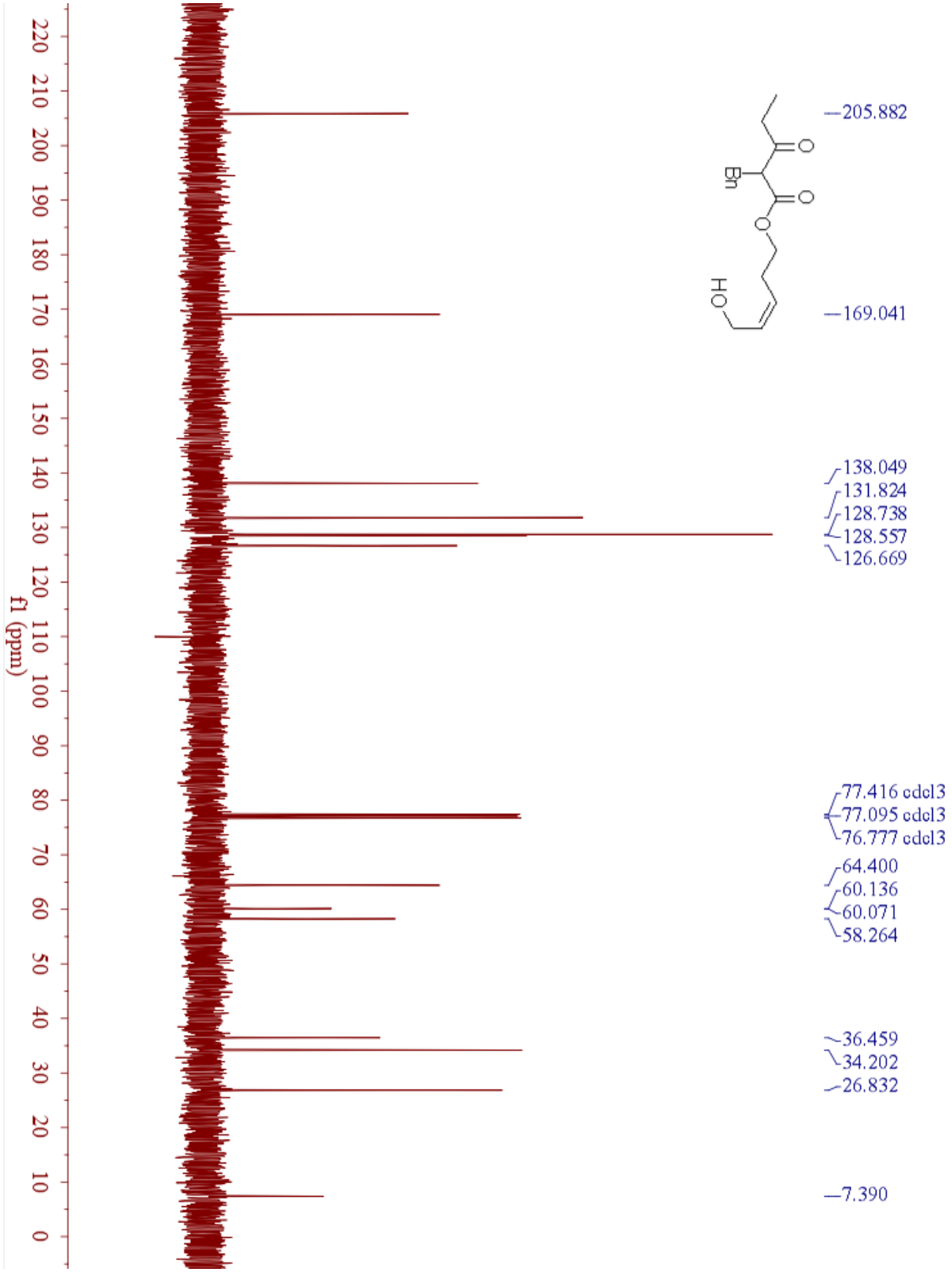
1a″ ^{13}C NMR (100 MHz, $CDCl_3$)



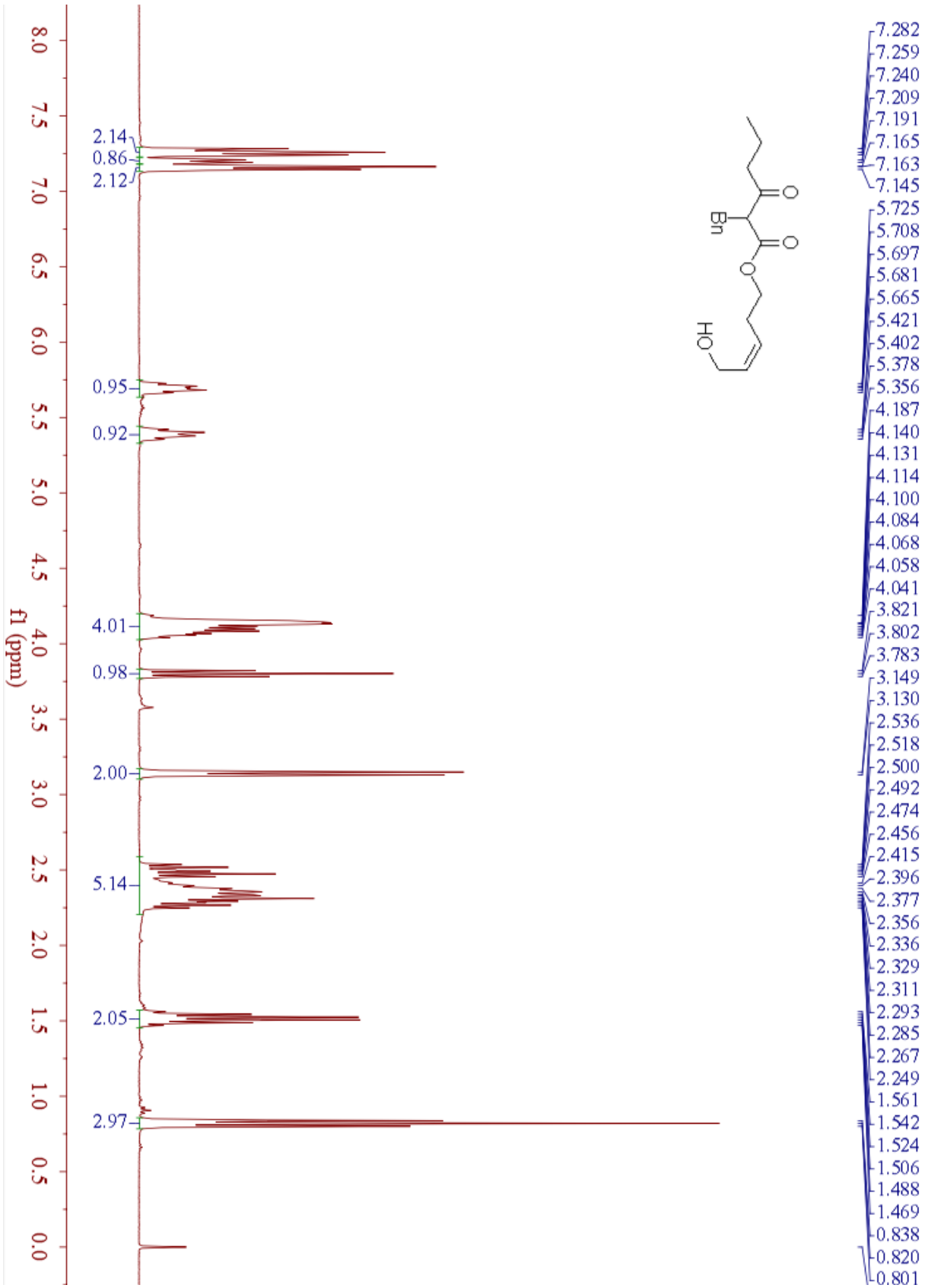
1b ^{1}H NMR (400 MHz, $CDCl_3$)



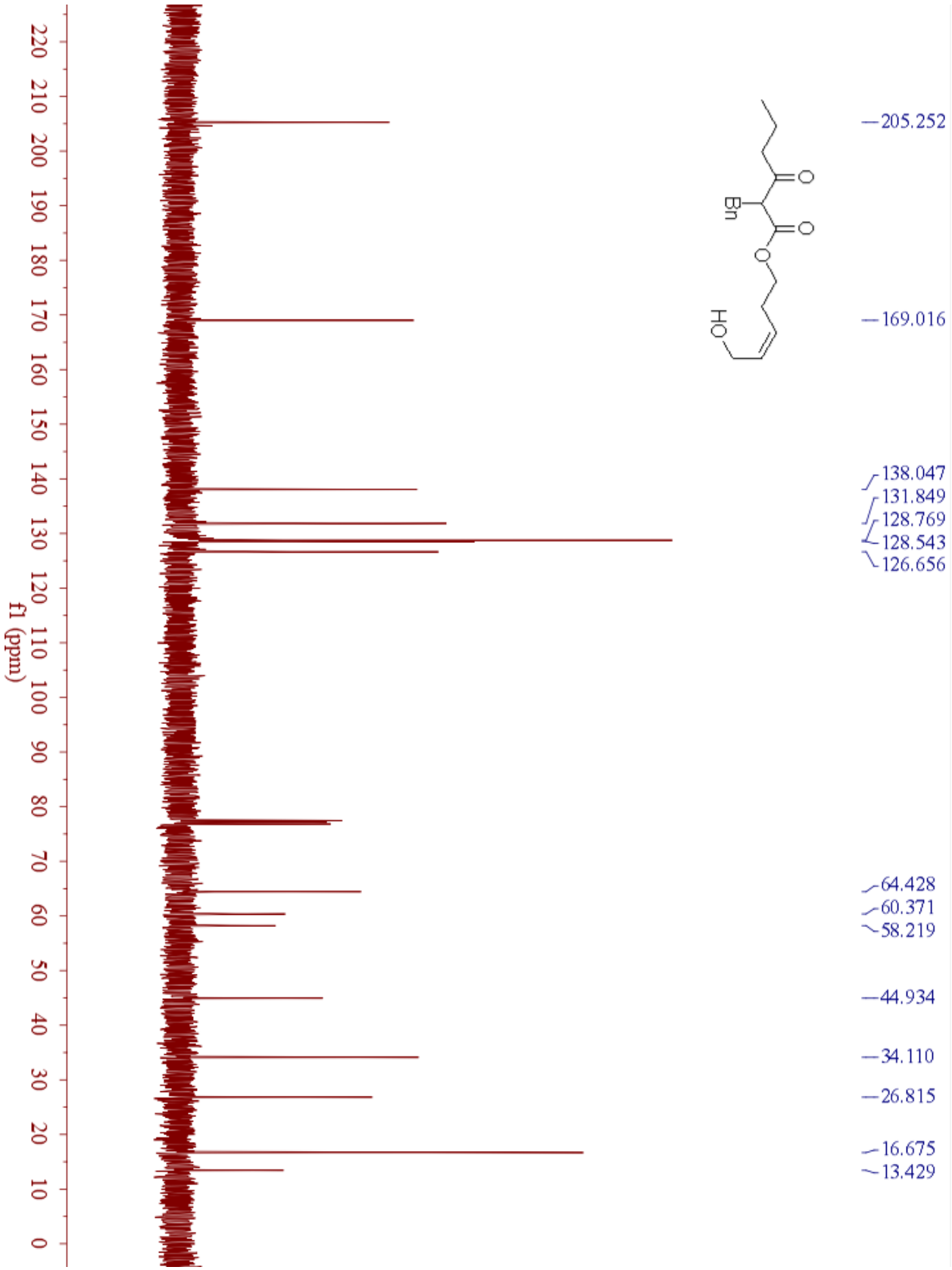
1b ^{13}C NMR (100 MHz, $CDCl_3$)



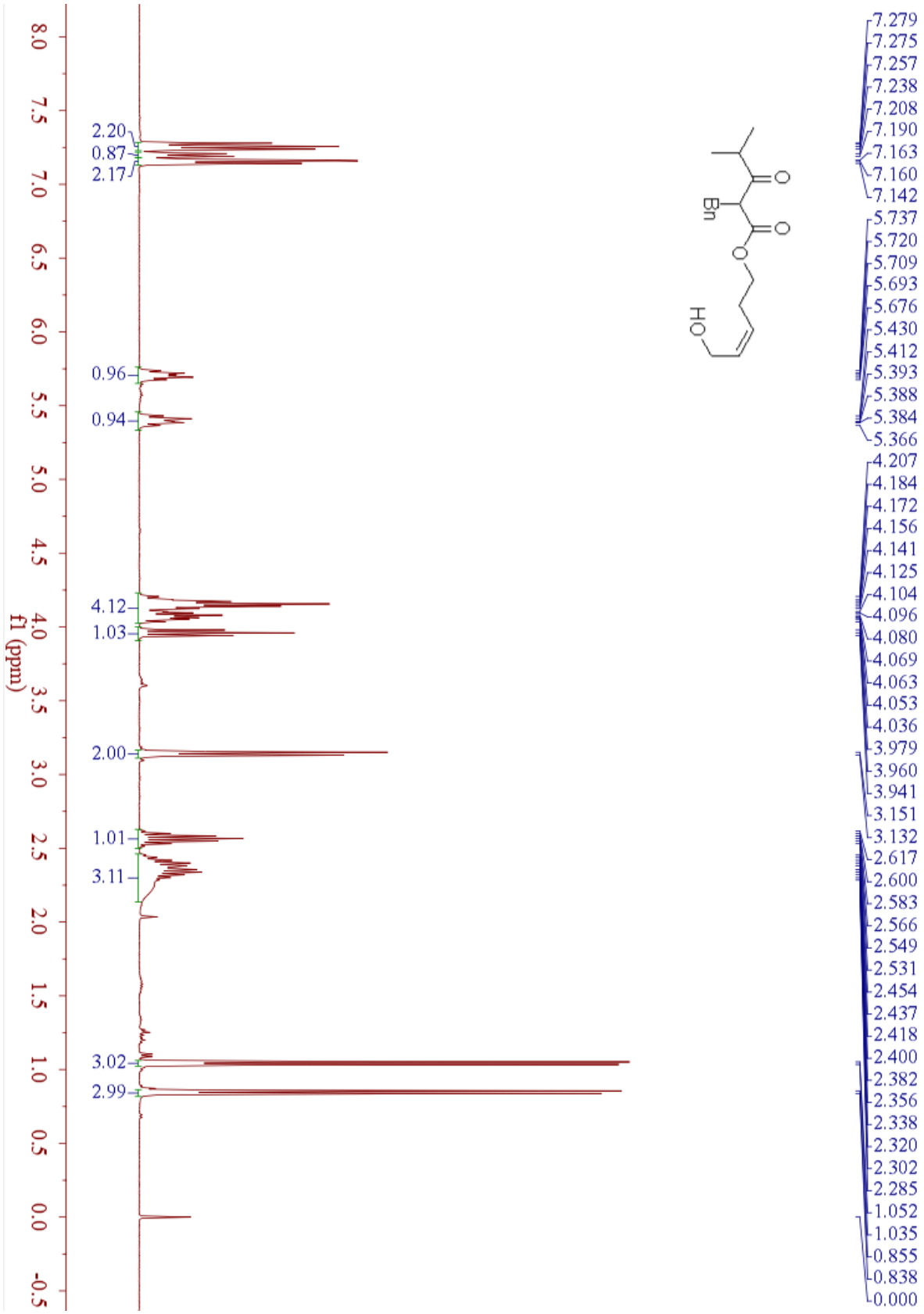
1c ^{1}H NMR (400 MHz, $CDCl_3$)



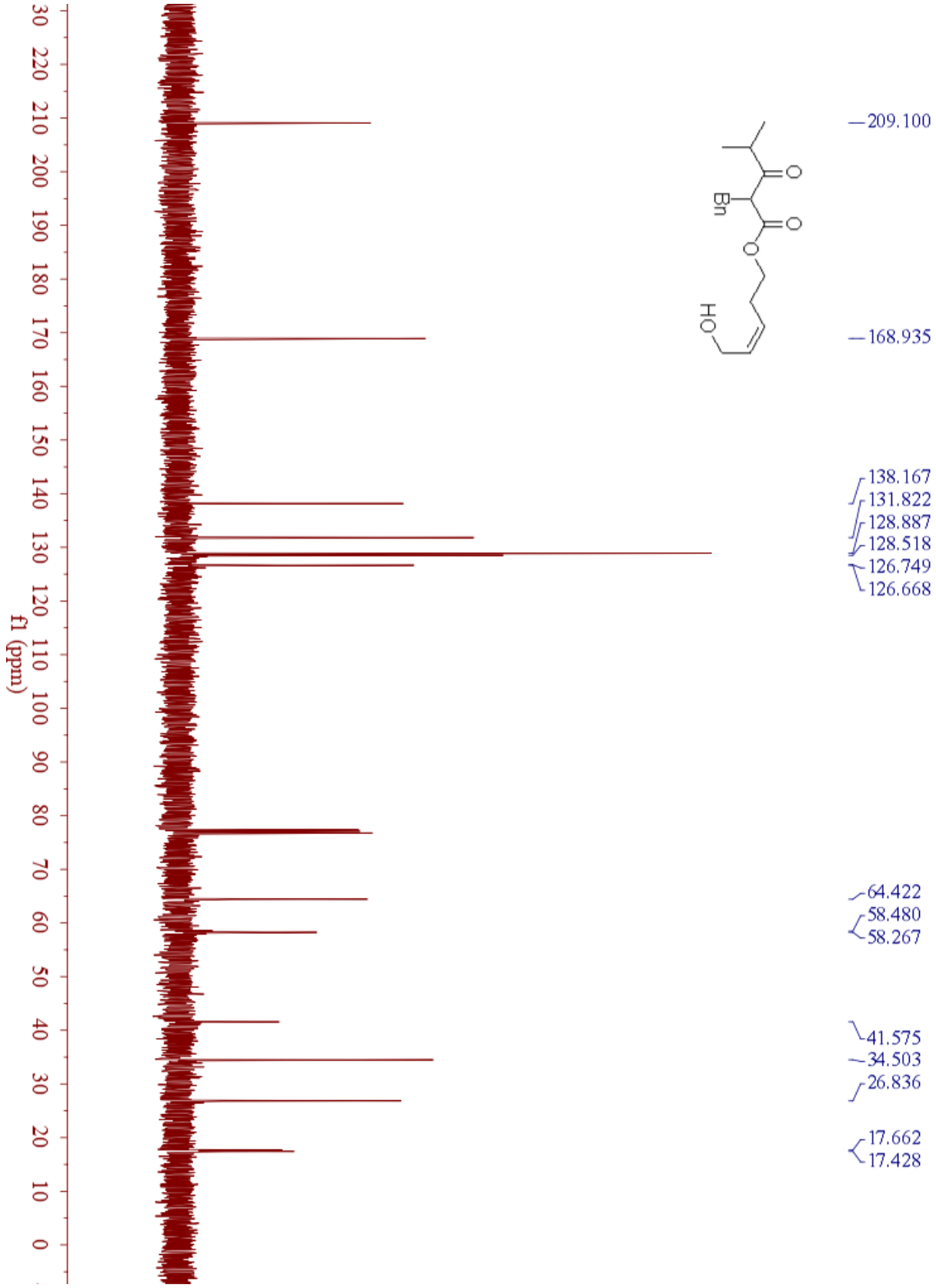
1c ^{13}C NMR (100 MHz, $CDCl_3$)



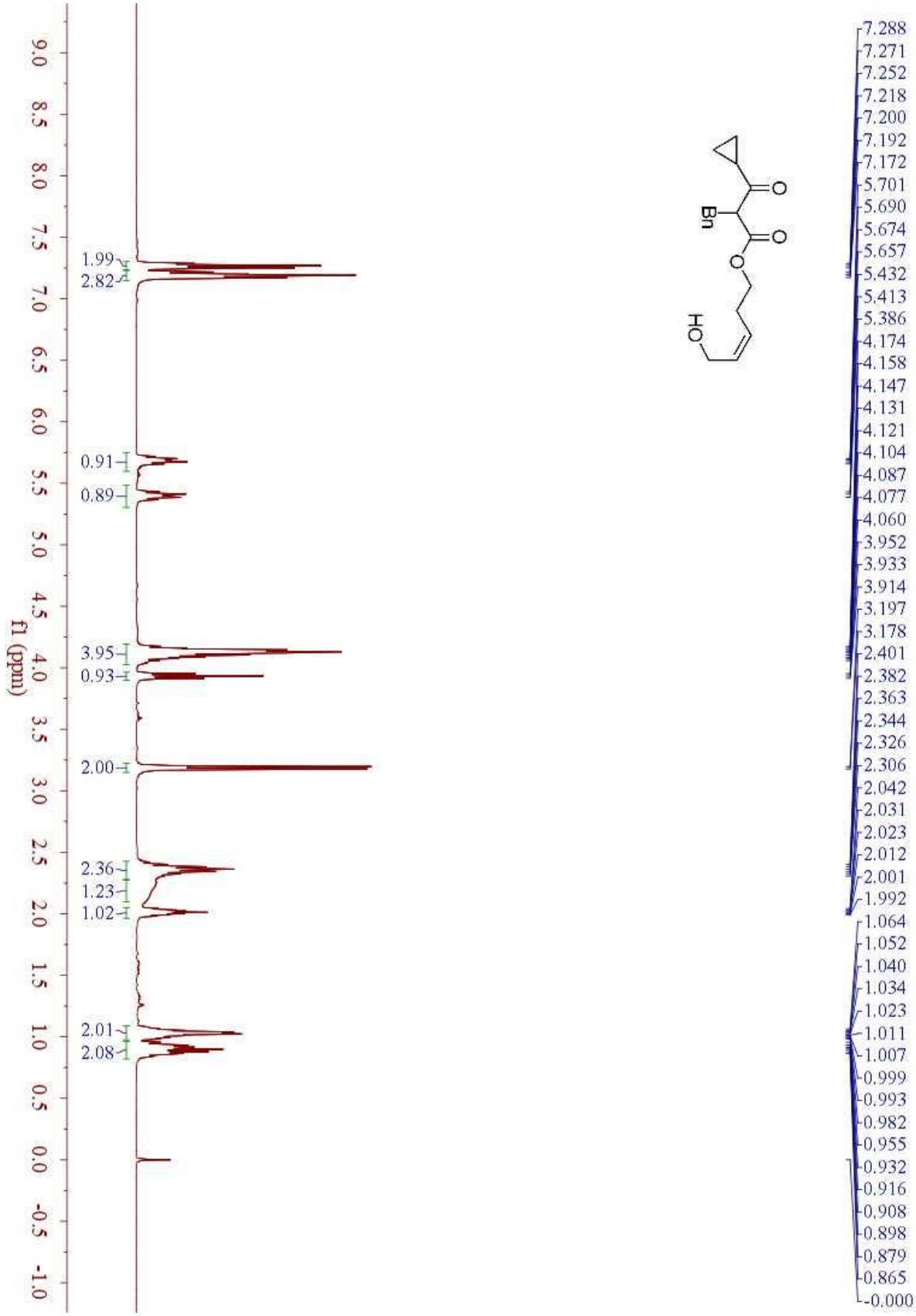
1d ^{1}H NMR (400 MHz, $CDCl_3$)



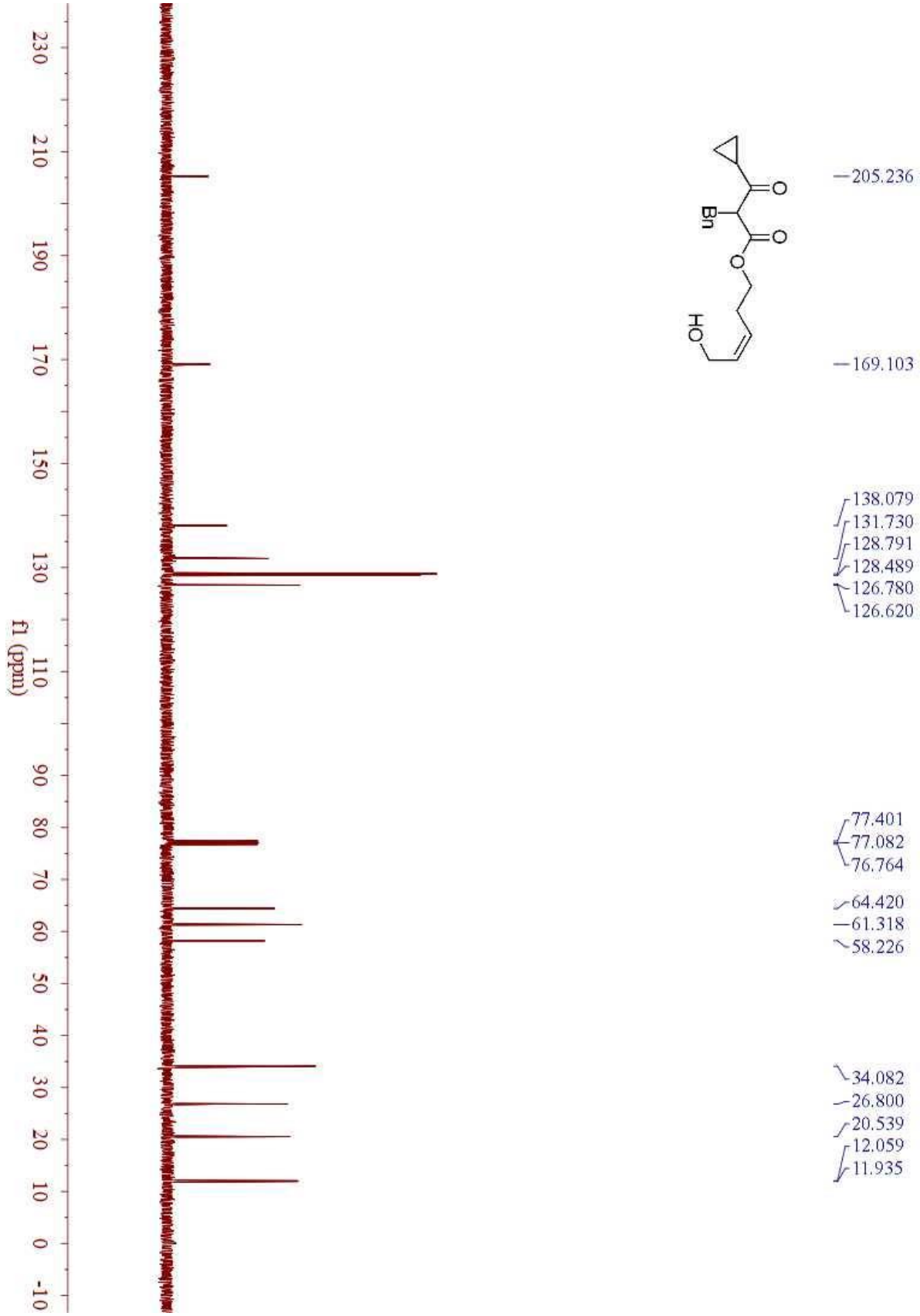
1d ^{13}C NMR (100 MHz, $CDCl_3$)



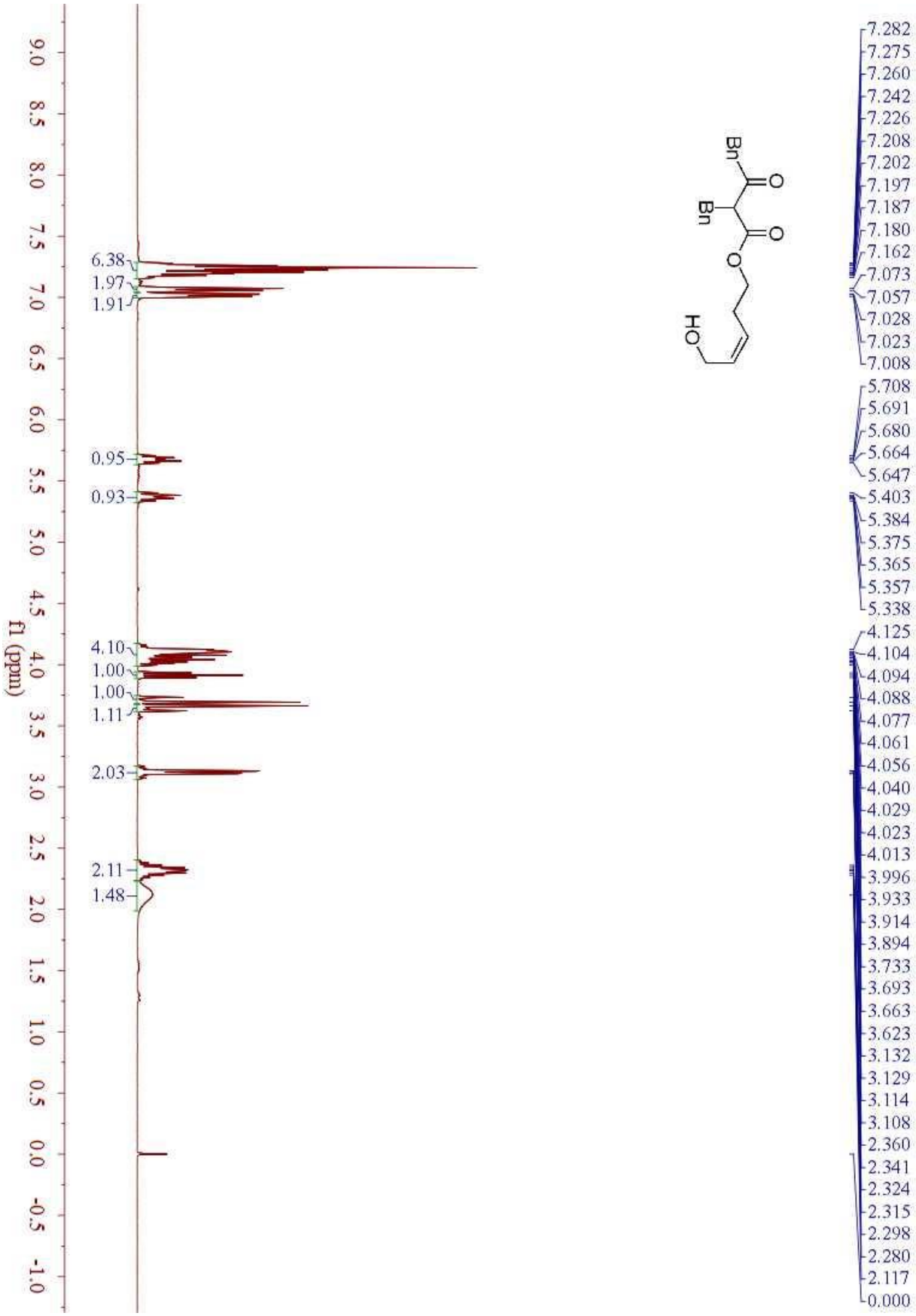
1e ^{1}H NMR (400 MHz, $CDCl_3$)



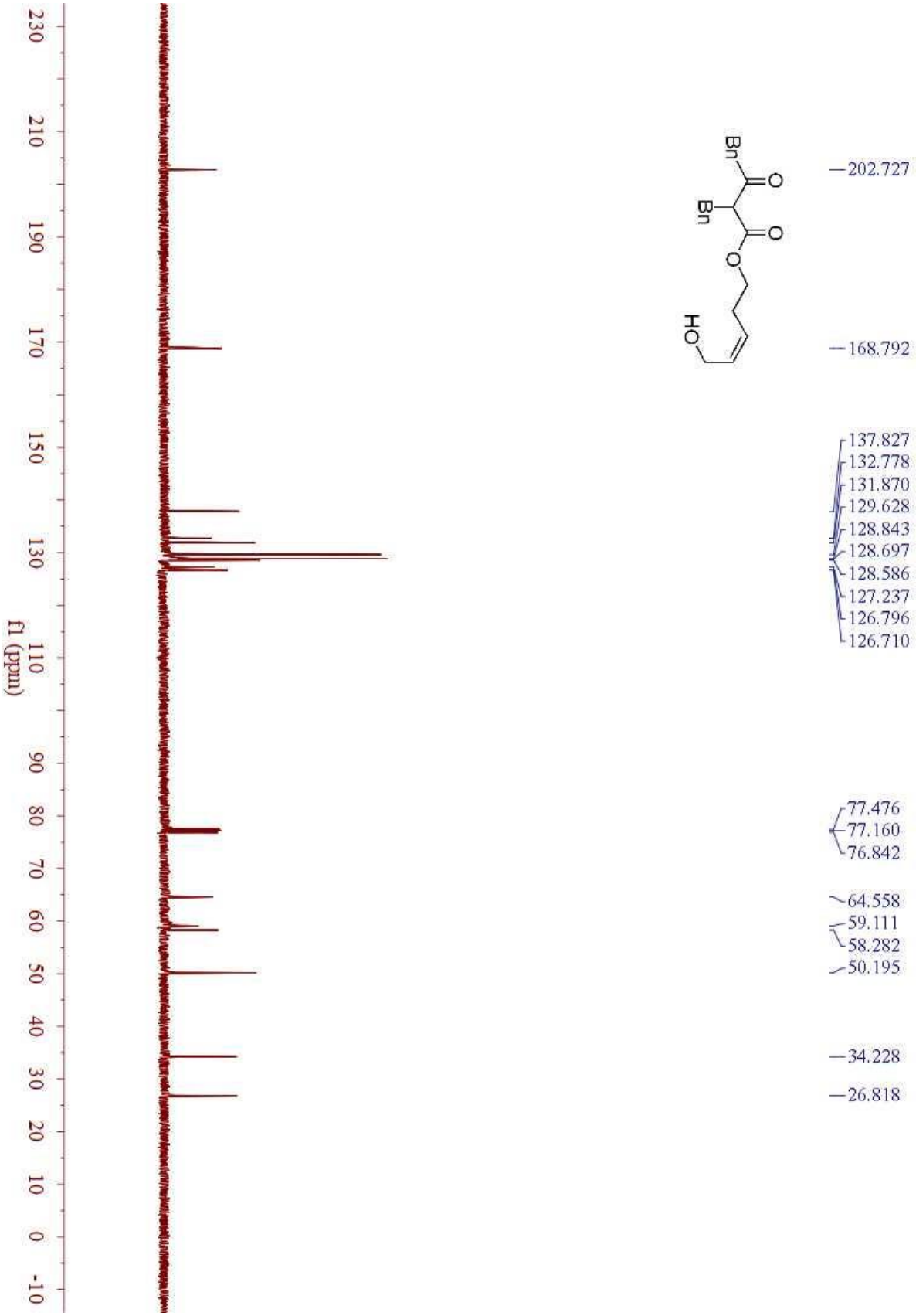
1e ^{13}C NMR (100 MHz, $CDCl_3$)



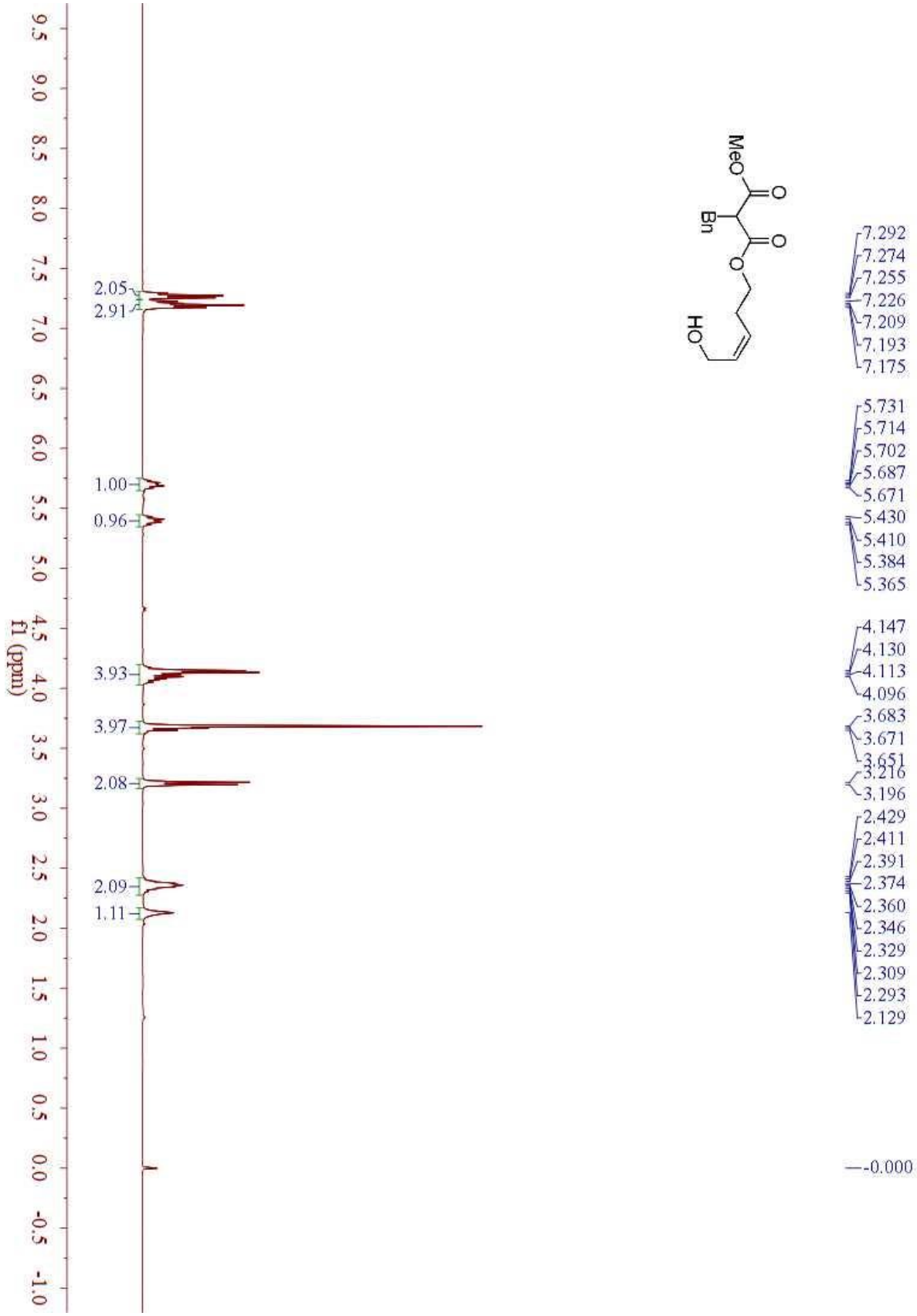
1f ^{1}H NMR (400 MHz, $CDCl_3$)



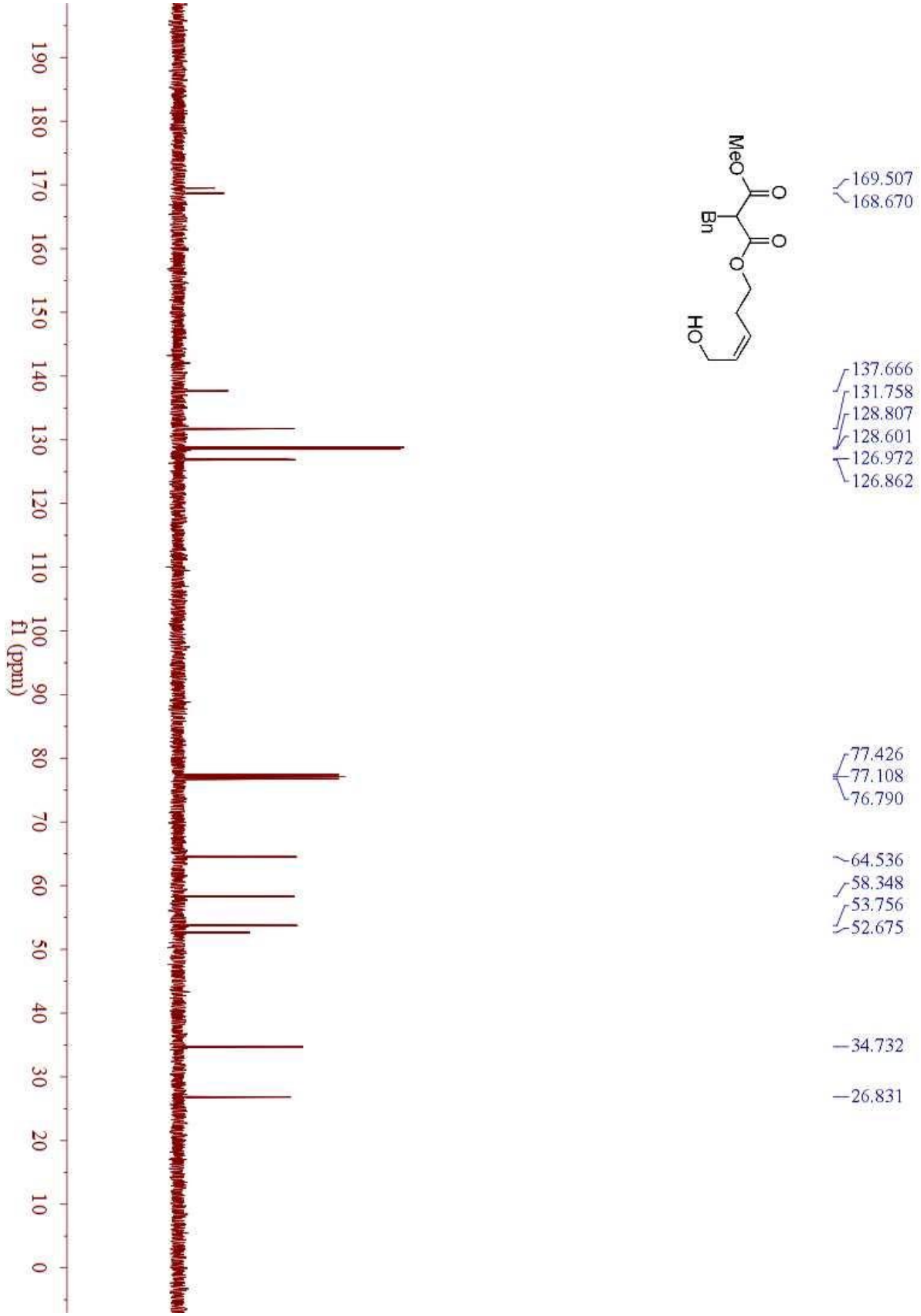
1f ^{13}C NMR (100 MHz, $CDCl_3$)



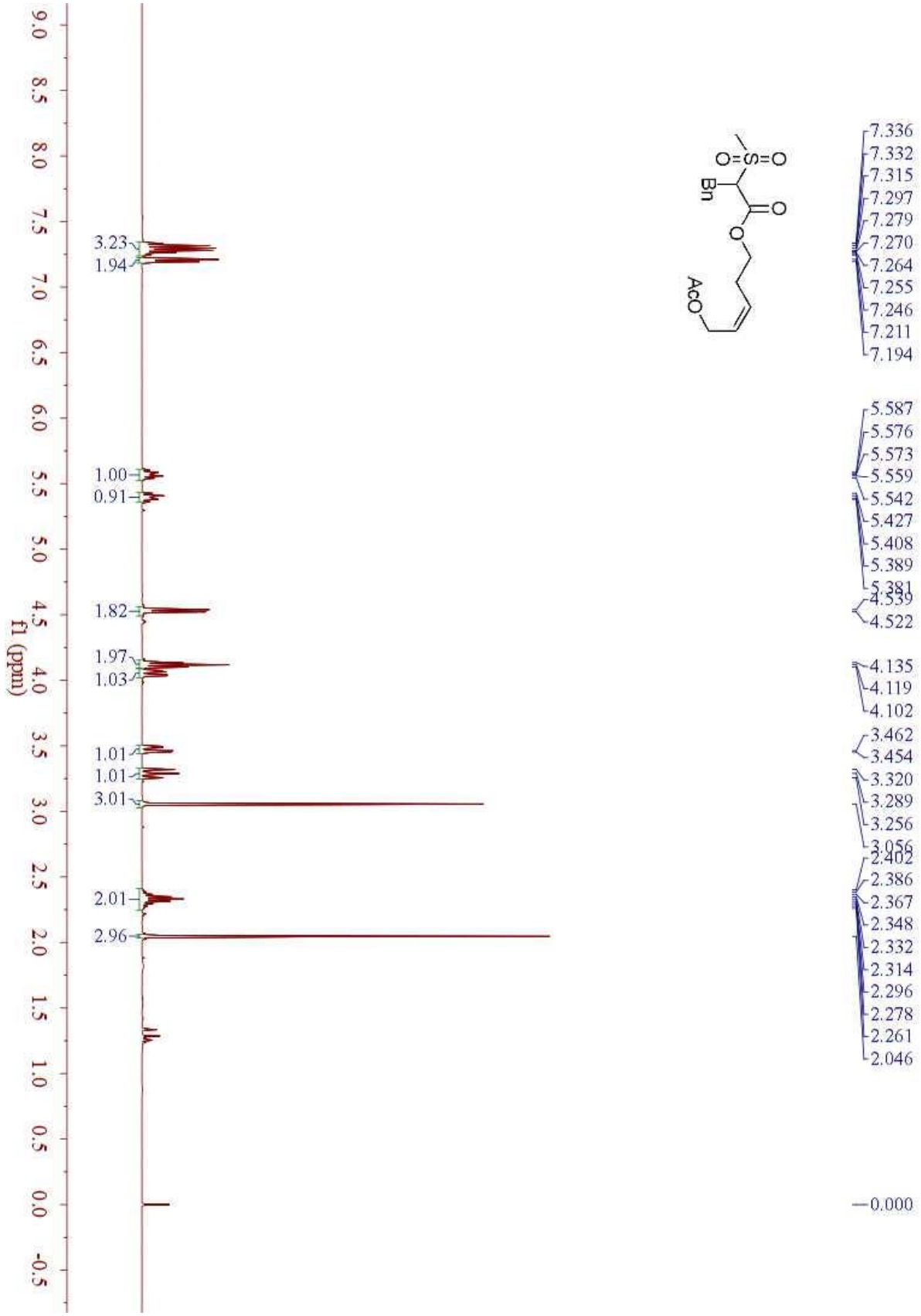
1g ^{1}H NMR (400 MHz, $CDCl_3$)



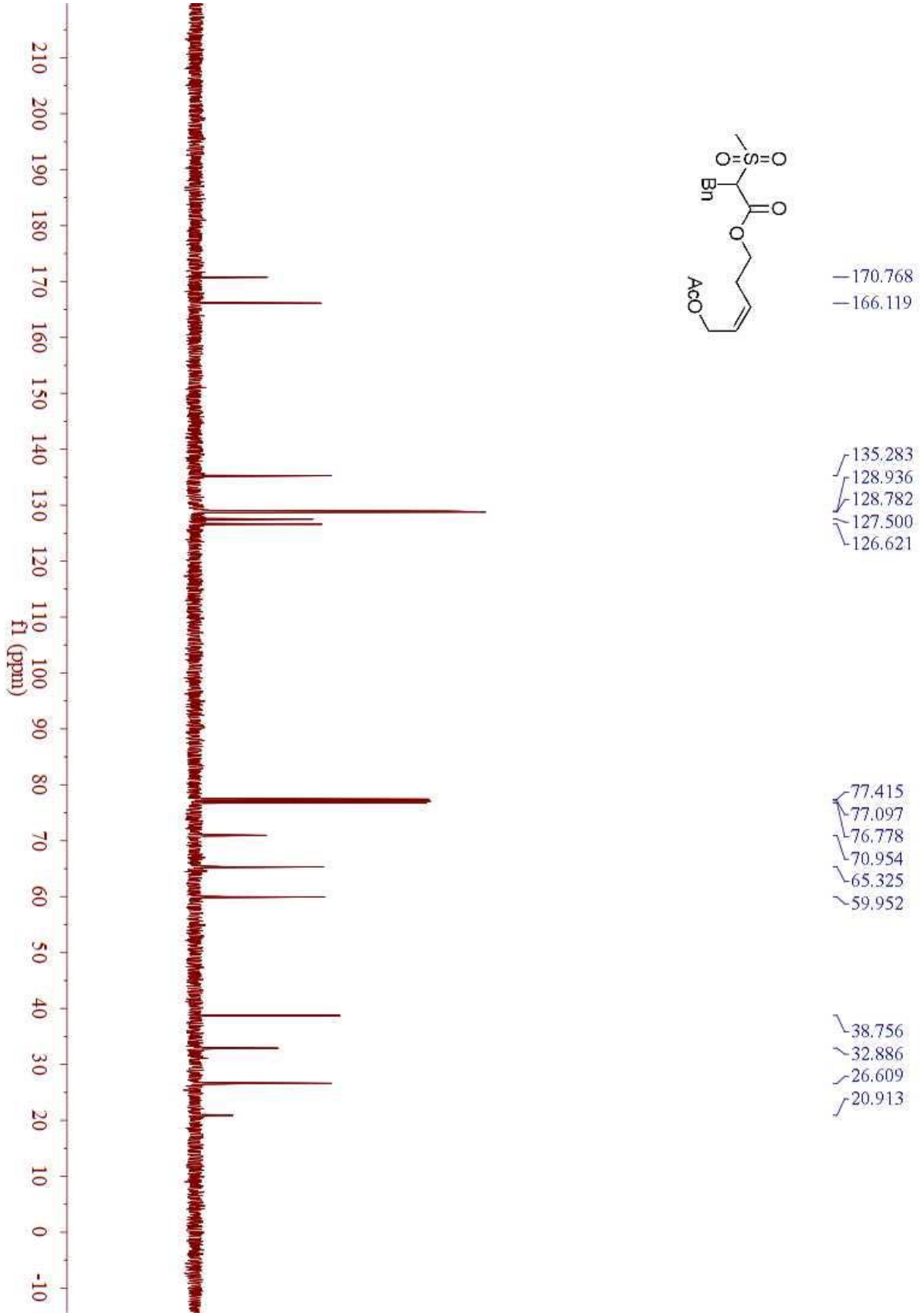
1g ^{13}C NMR (100 MHz, $CDCl_3$)



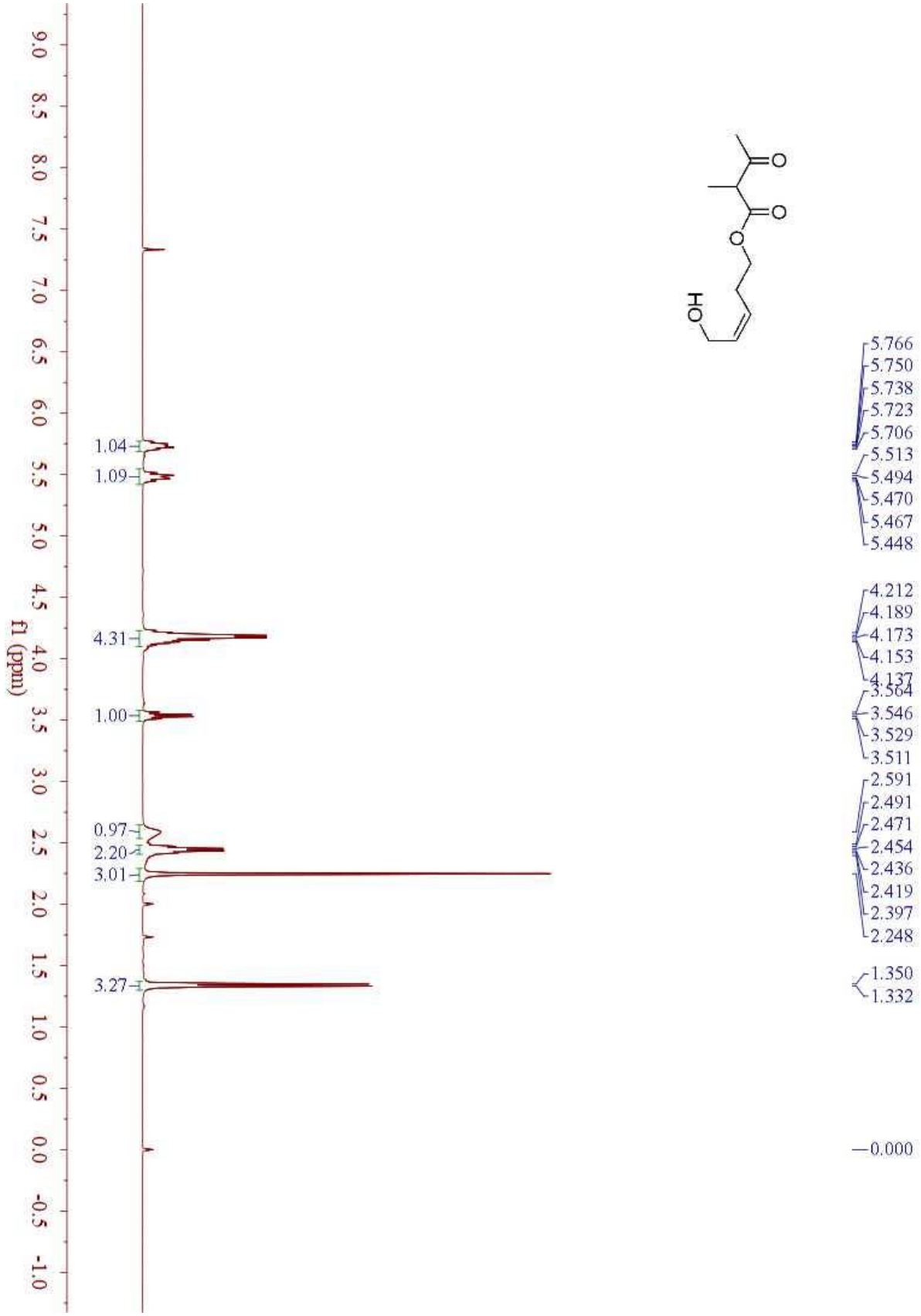
1h ^{1}H NMR (400 MHz, $CDCl_3$)



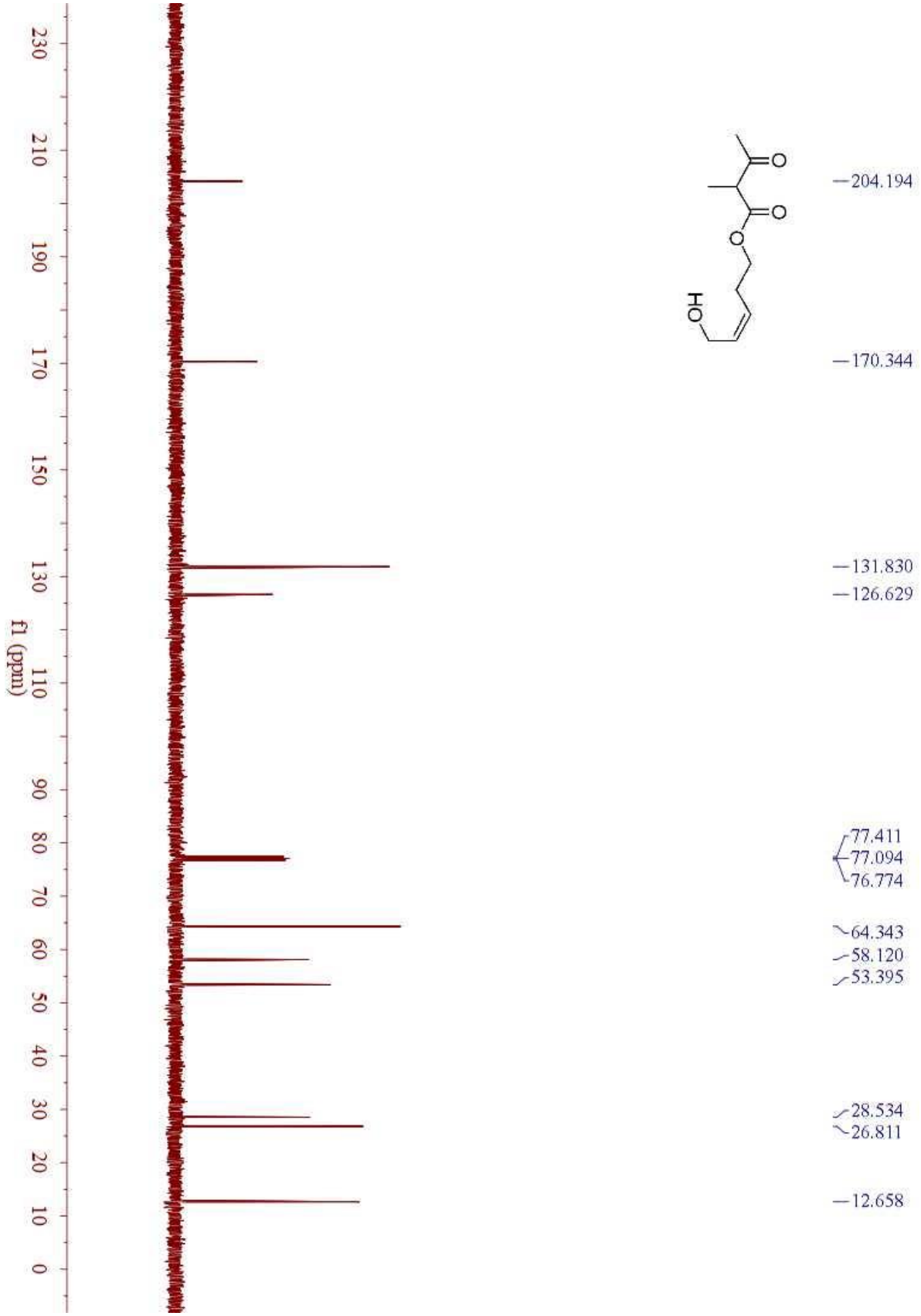
1h ^{13}C NMR (100 MHz, $CDCl_3$)



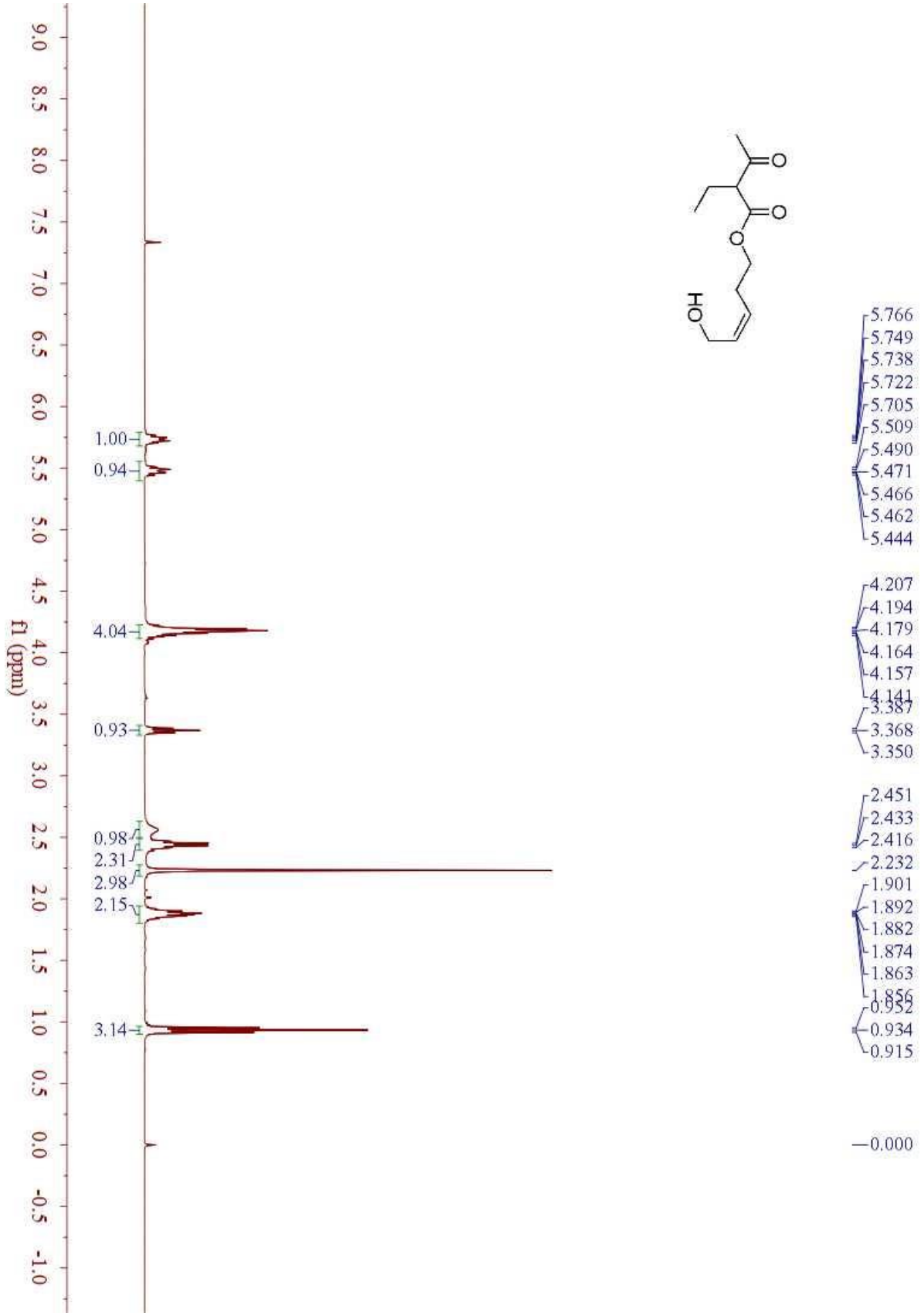
1i ^{1}H NMR (400 MHz, $CDCl_3$)



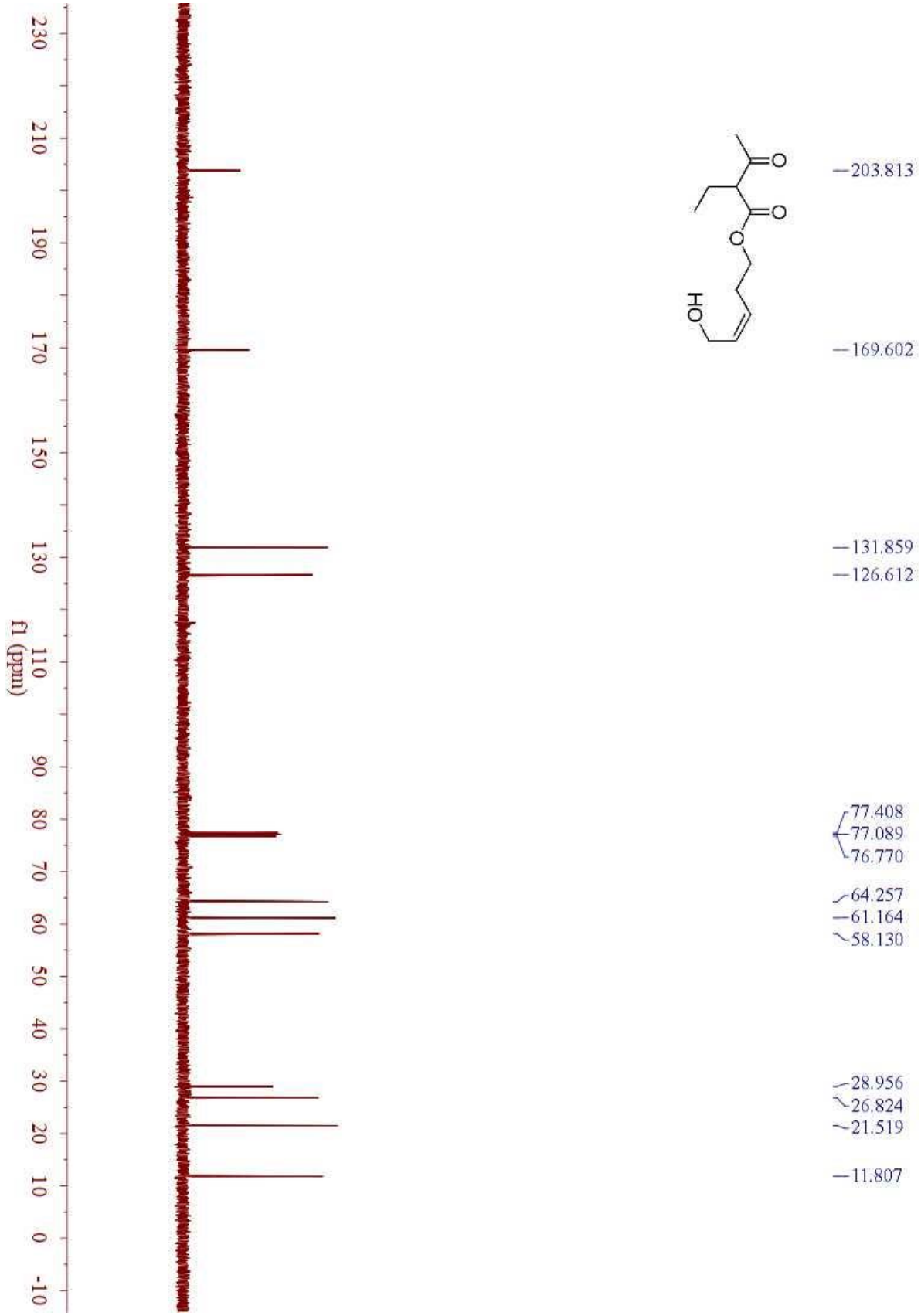
1i ^{13}C NMR (100 MHz, $CDCl_3$)



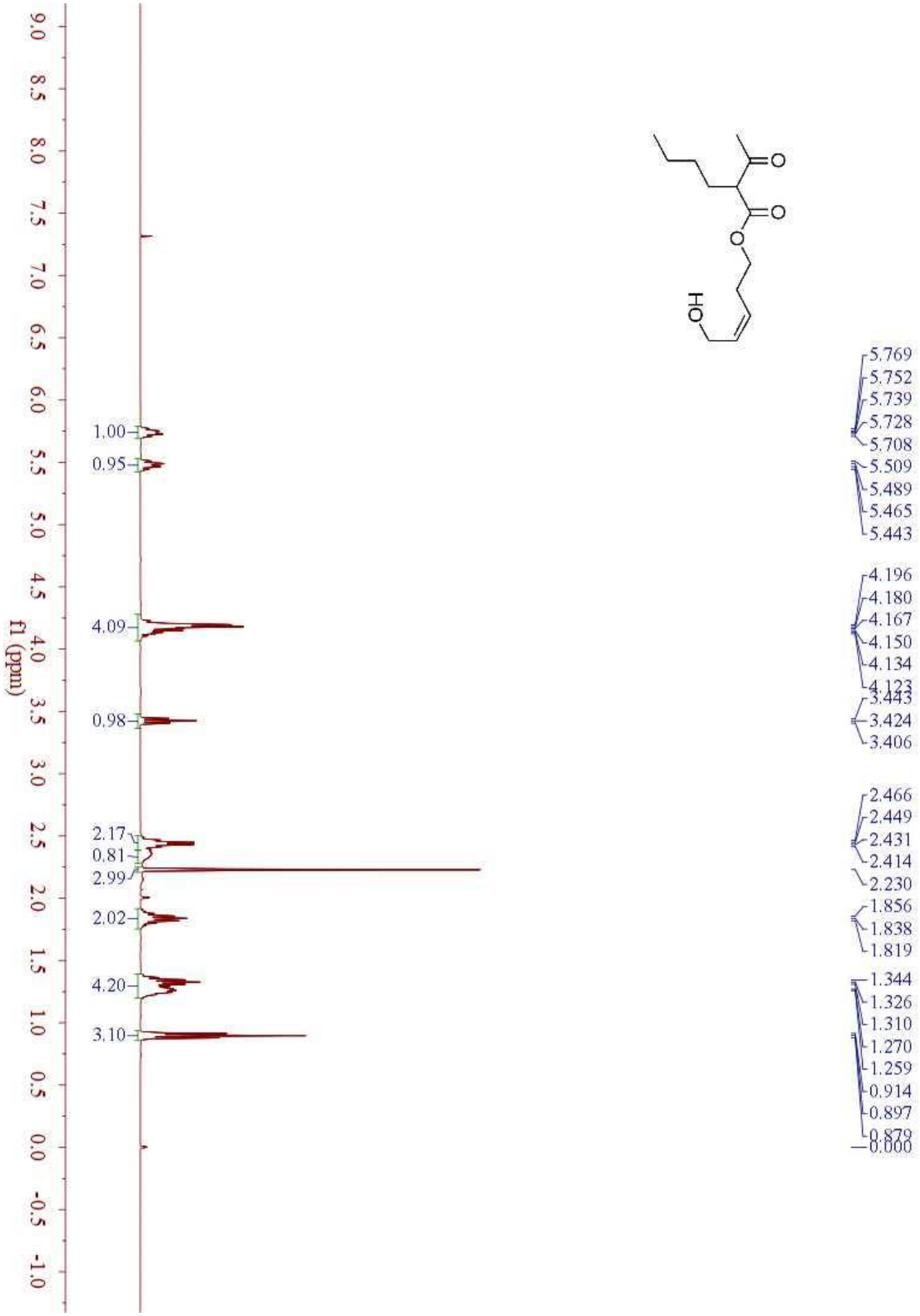
1j ^{1}H NMR (400 MHz, $CDCl_3$)



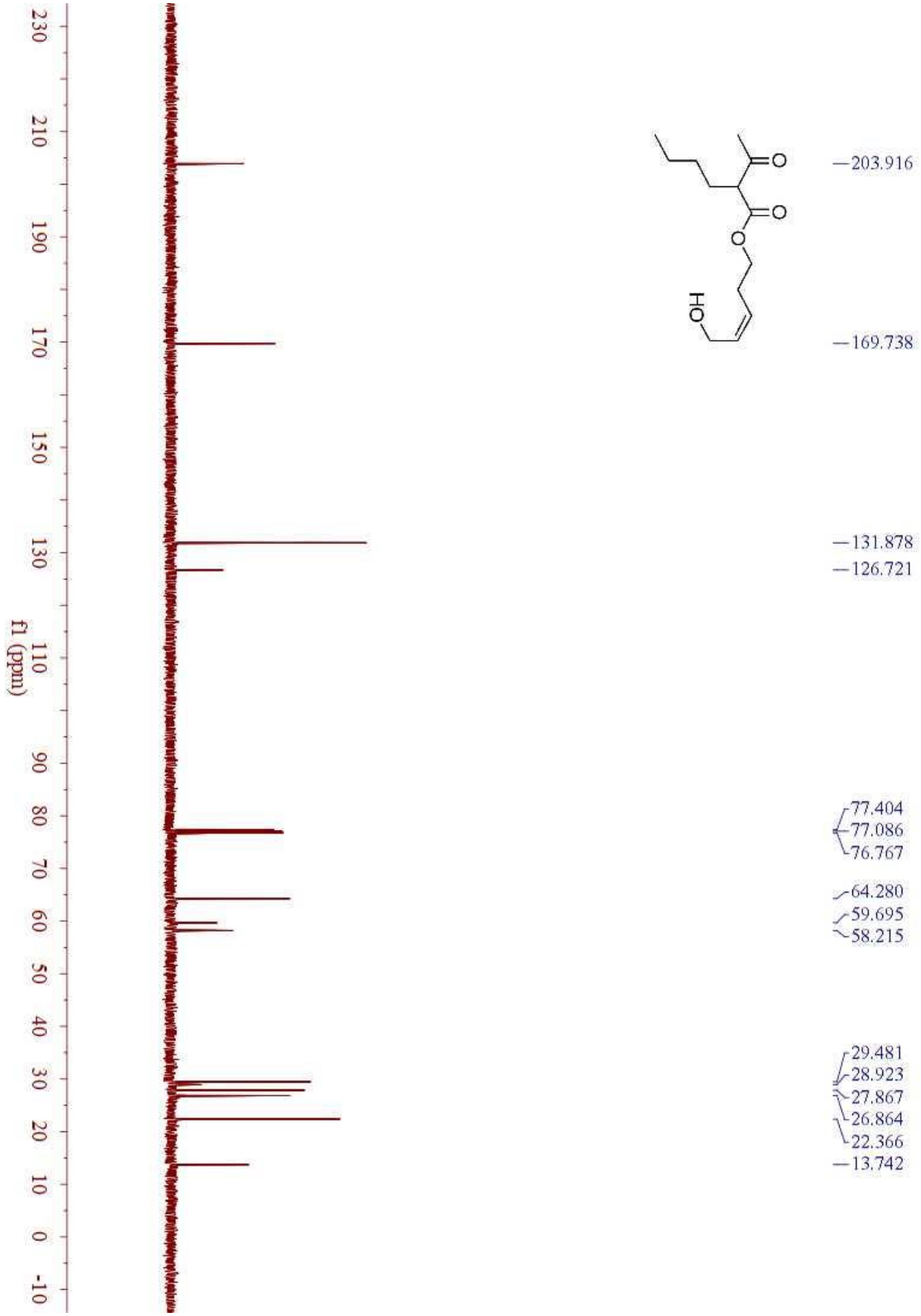
1j ^{13}C NMR (100 MHz, $CDCl_3$)



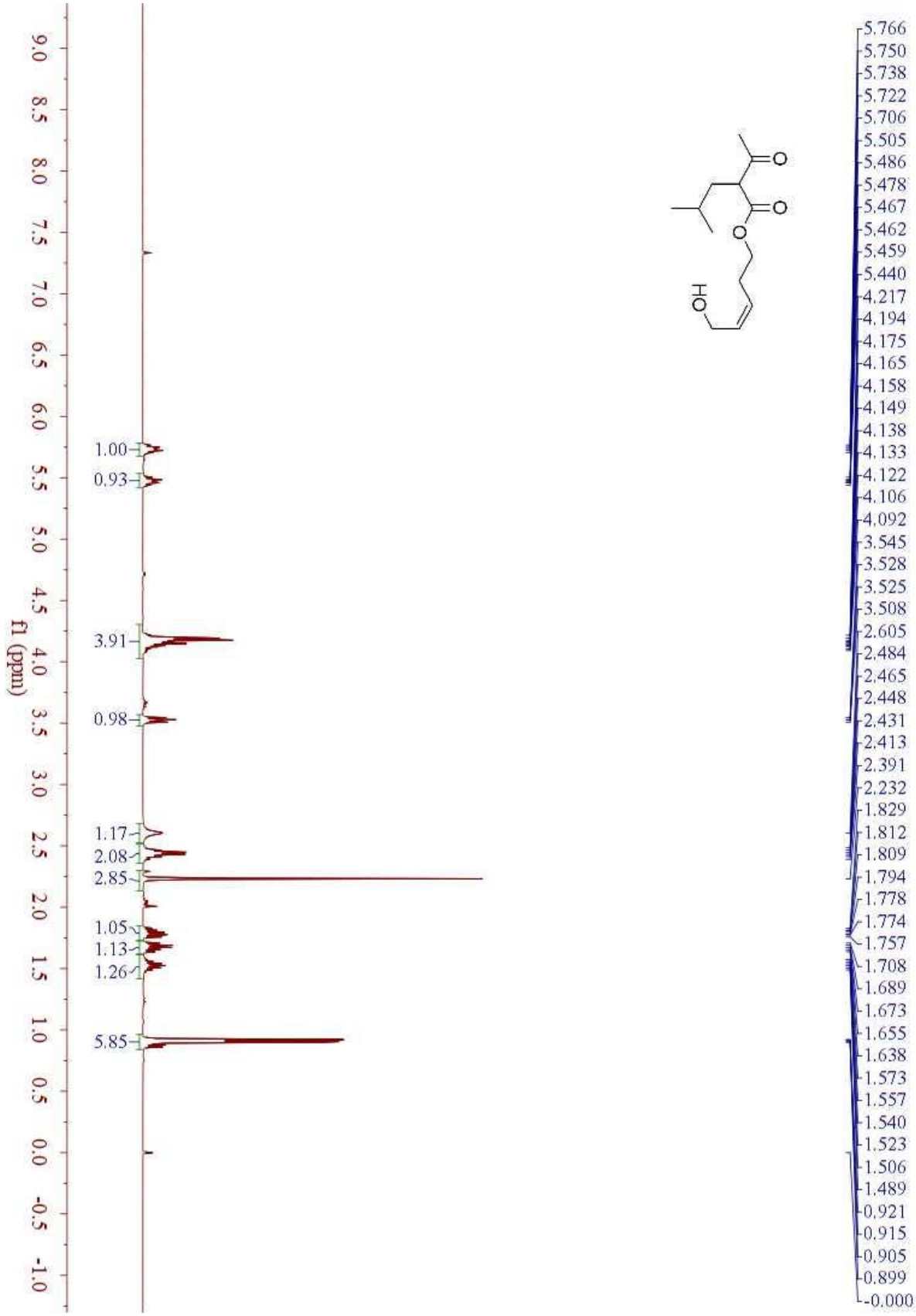
1k ^{1}H NMR (400 MHz, $CDCl_3$)



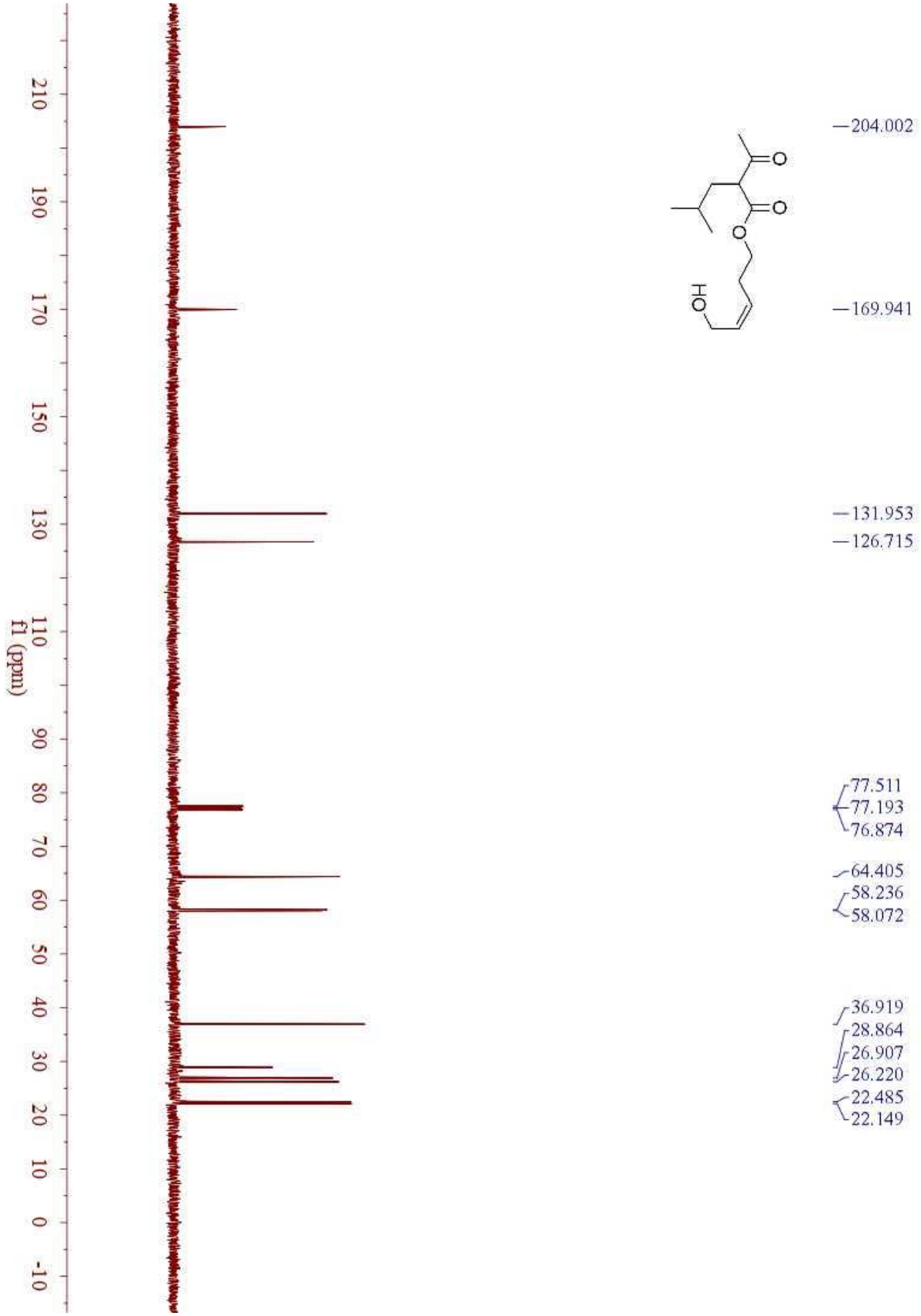
1k ^{13}C NMR (100 MHz, $CDCl_3$)



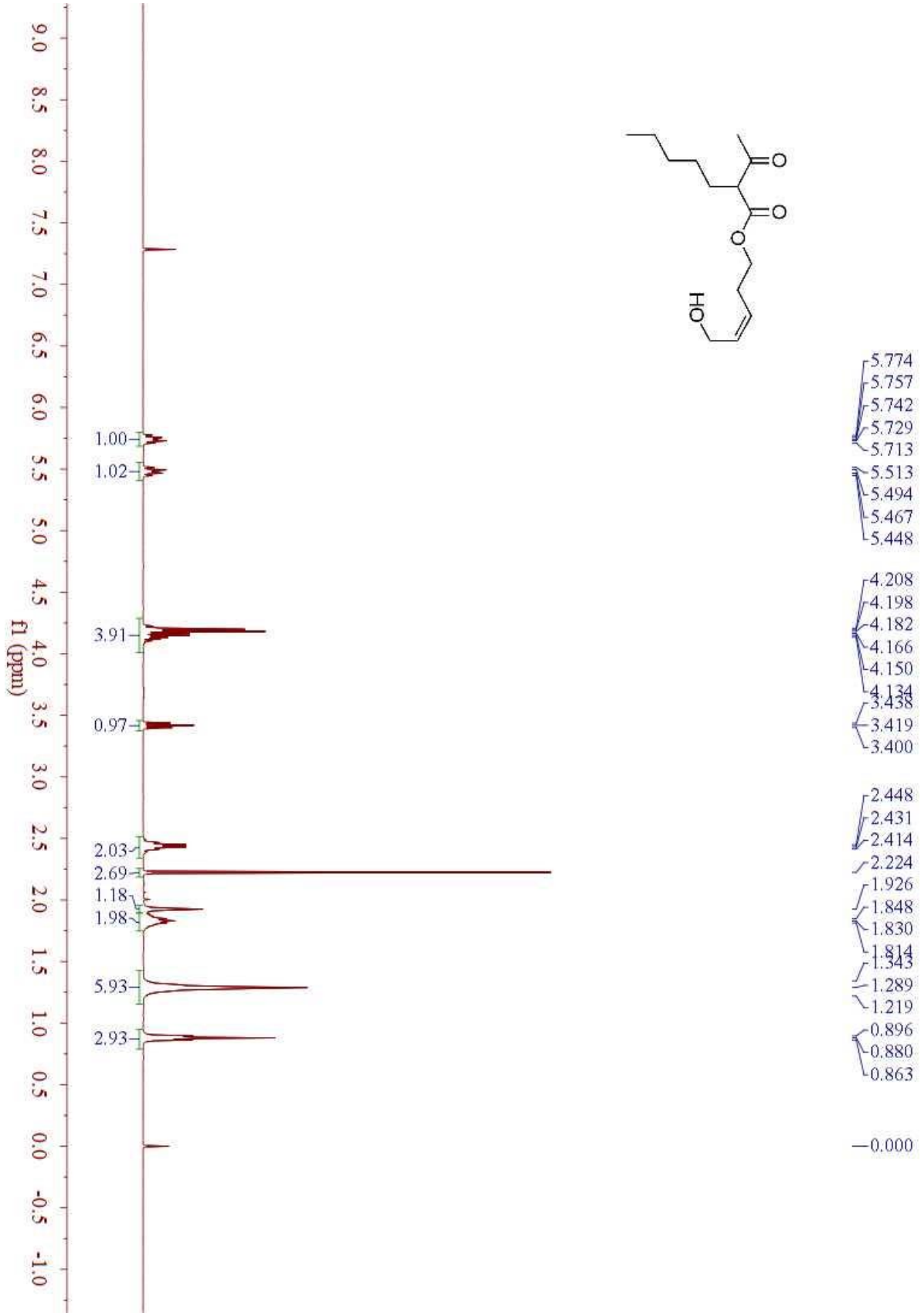
1l ^{1}H NMR (400 MHz, $CDCl_3$)



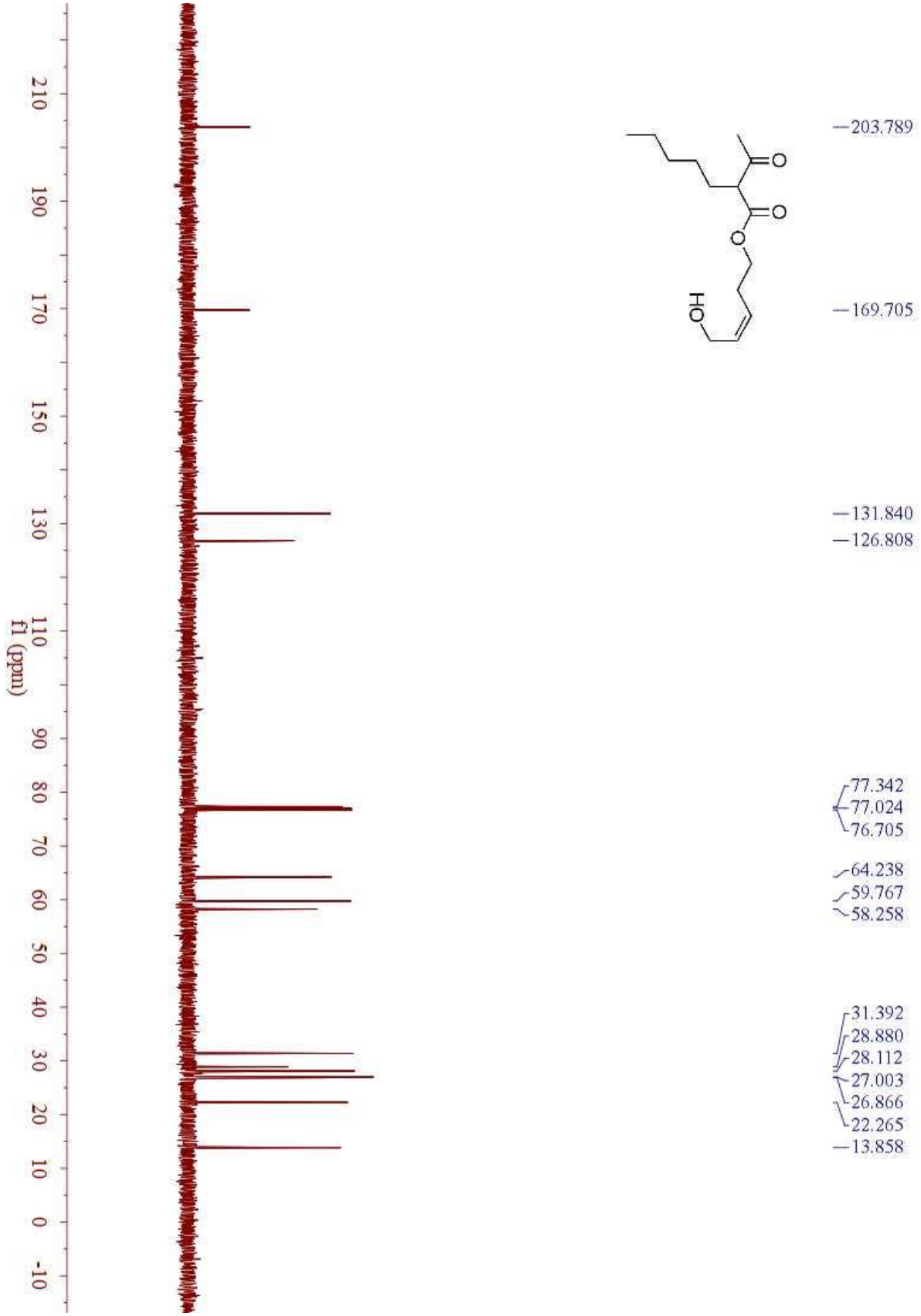
1l ^{13}C NMR (100 MHz, $CDCl_3$)



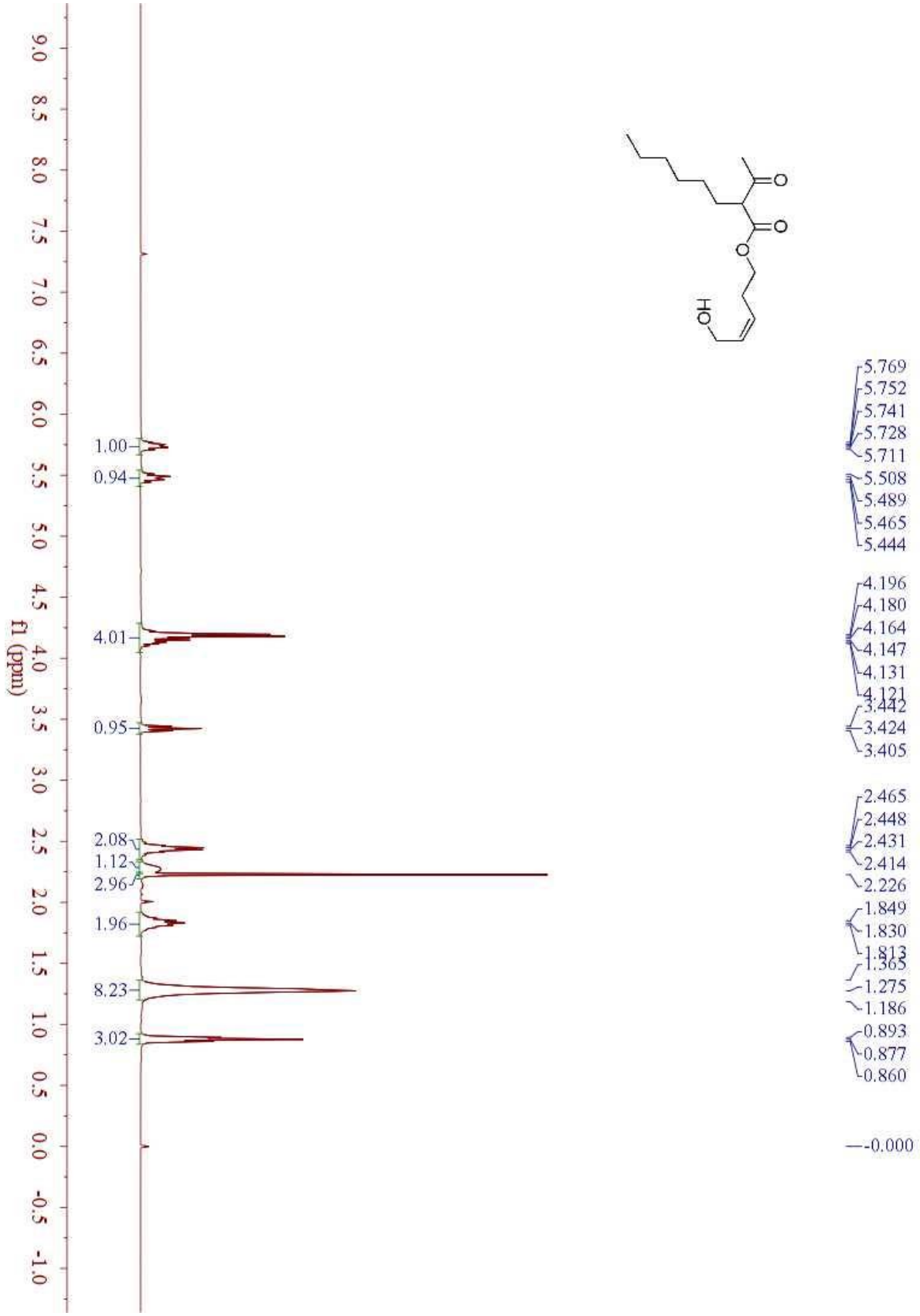
1m ^{1}H NMR (400 MHz, $CDCl_3$)



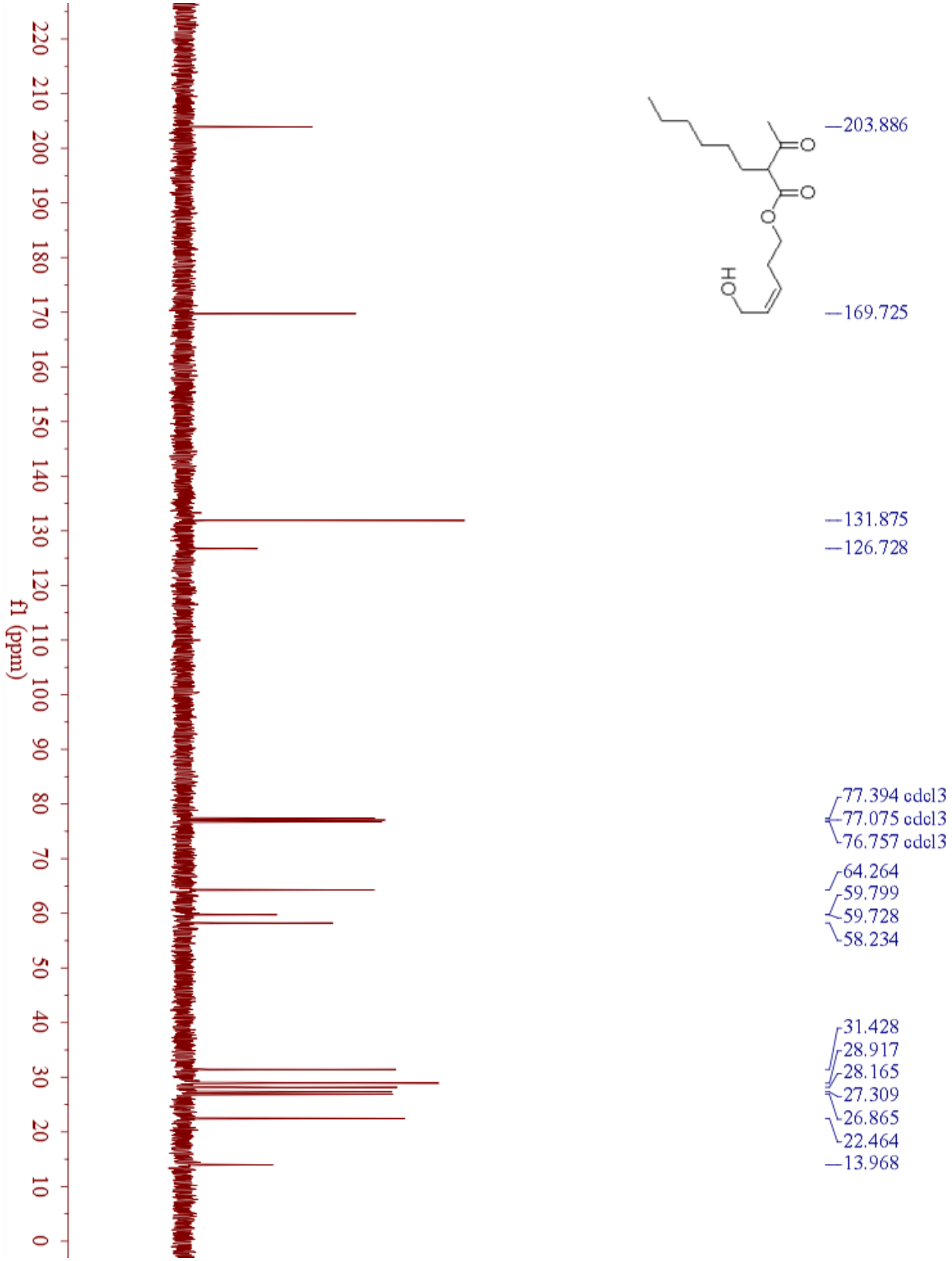
1m ^{13}C NMR (100 MHz, $CDCl_3$)



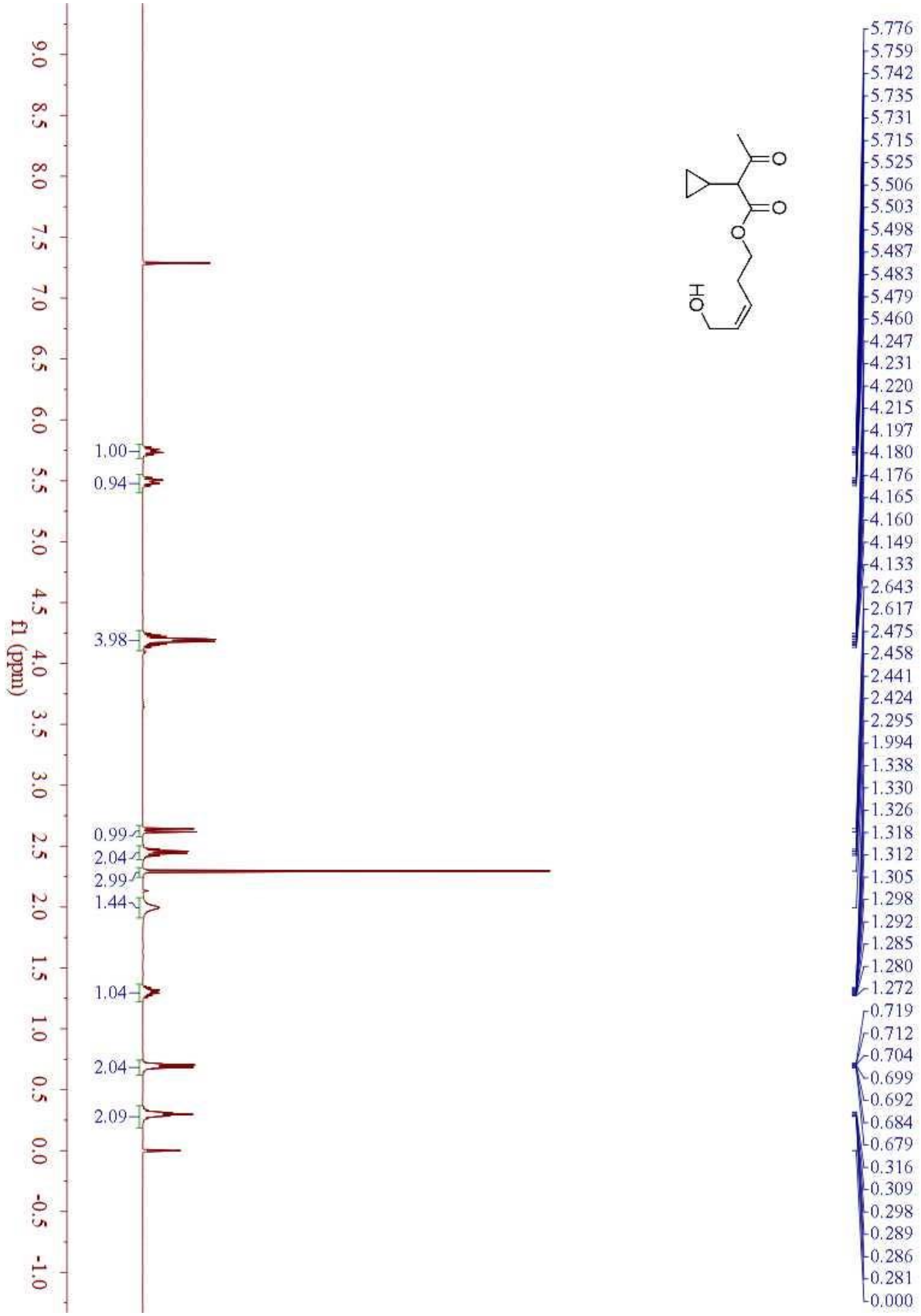
1n ^{1}H NMR (400 MHz, $CDCl_3$)



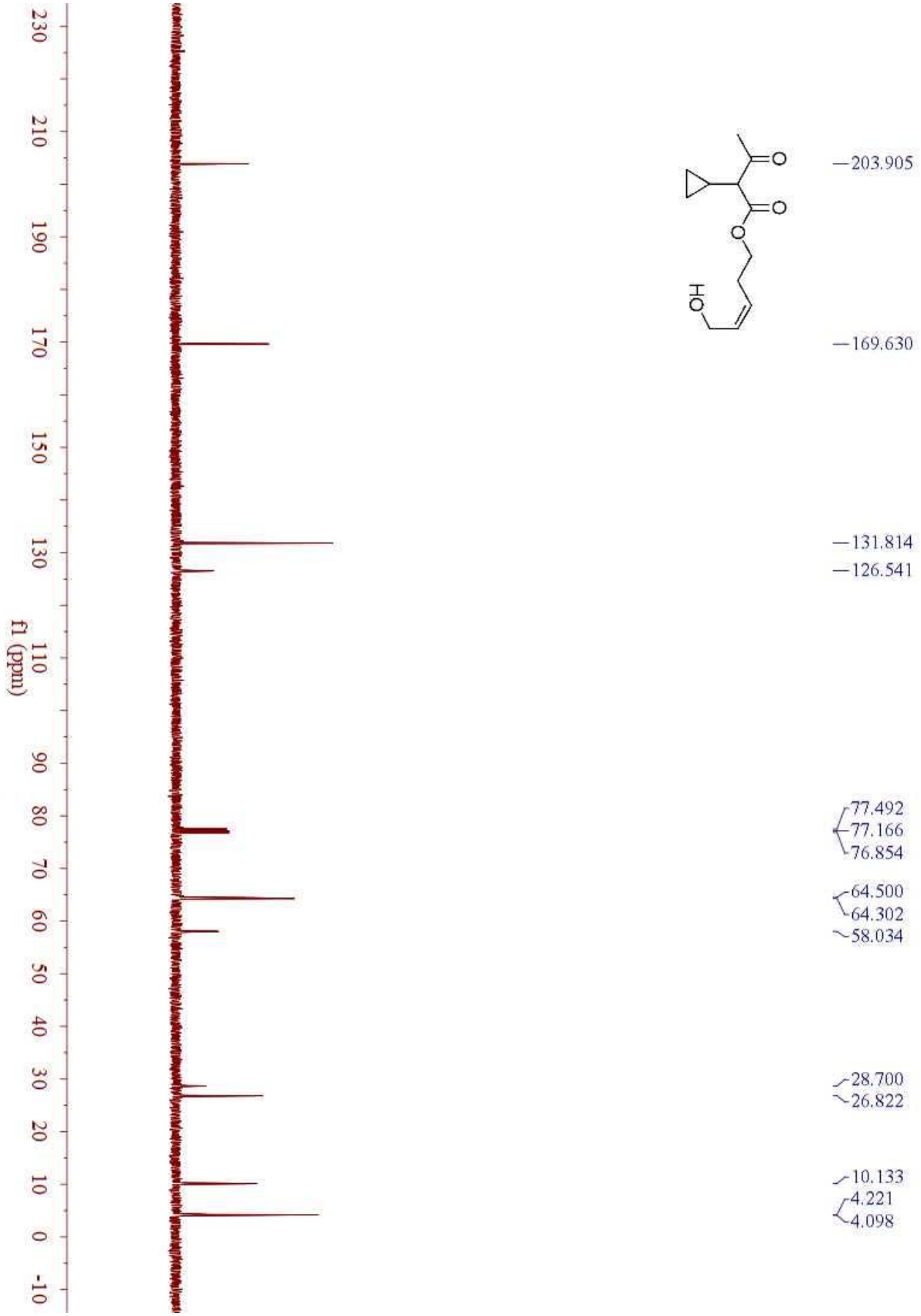
1n ^{13}C NMR (100 MHz, $CDCl_3$)



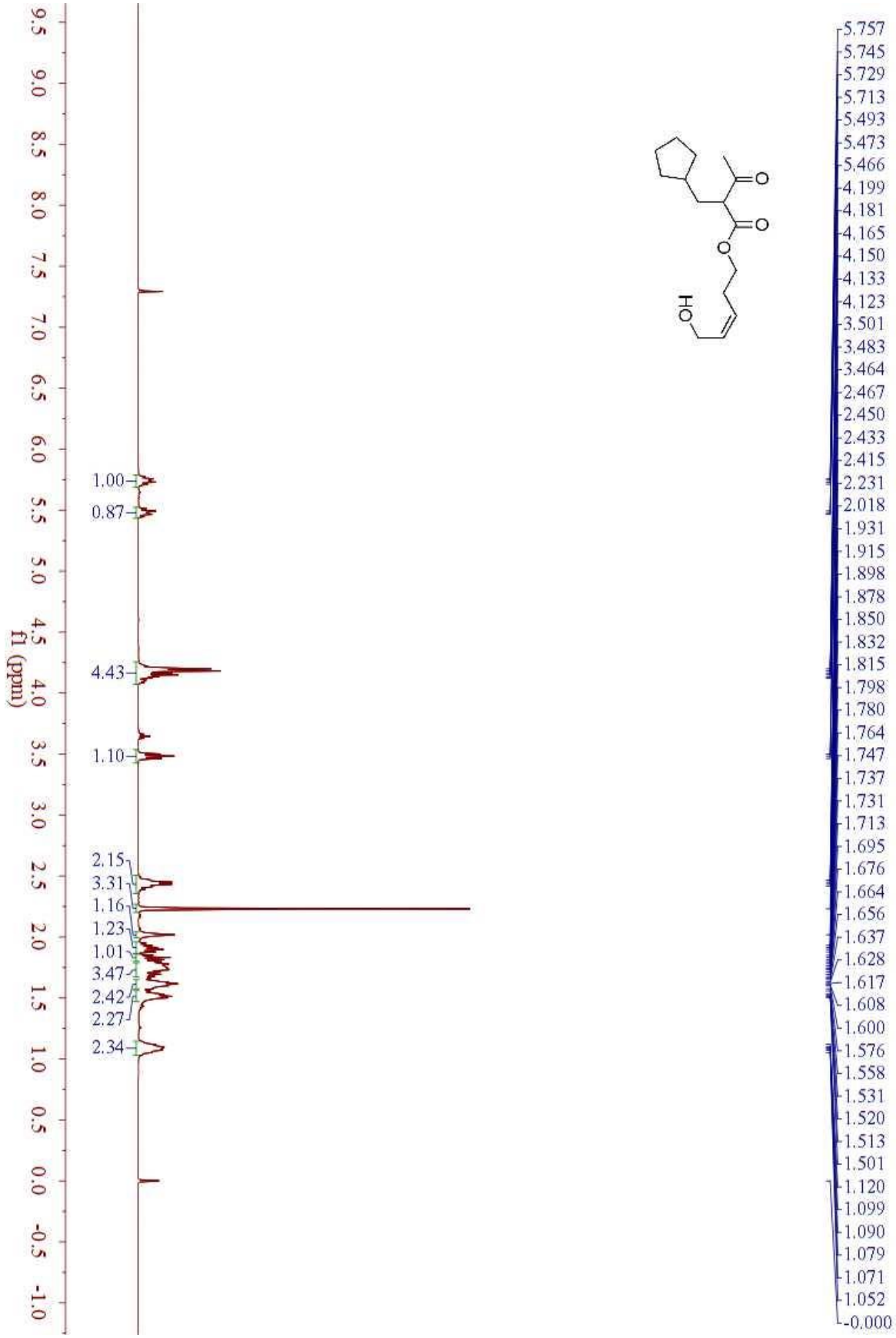
1o ^{1}H NMR (400 MHz, $CDCl_3$)



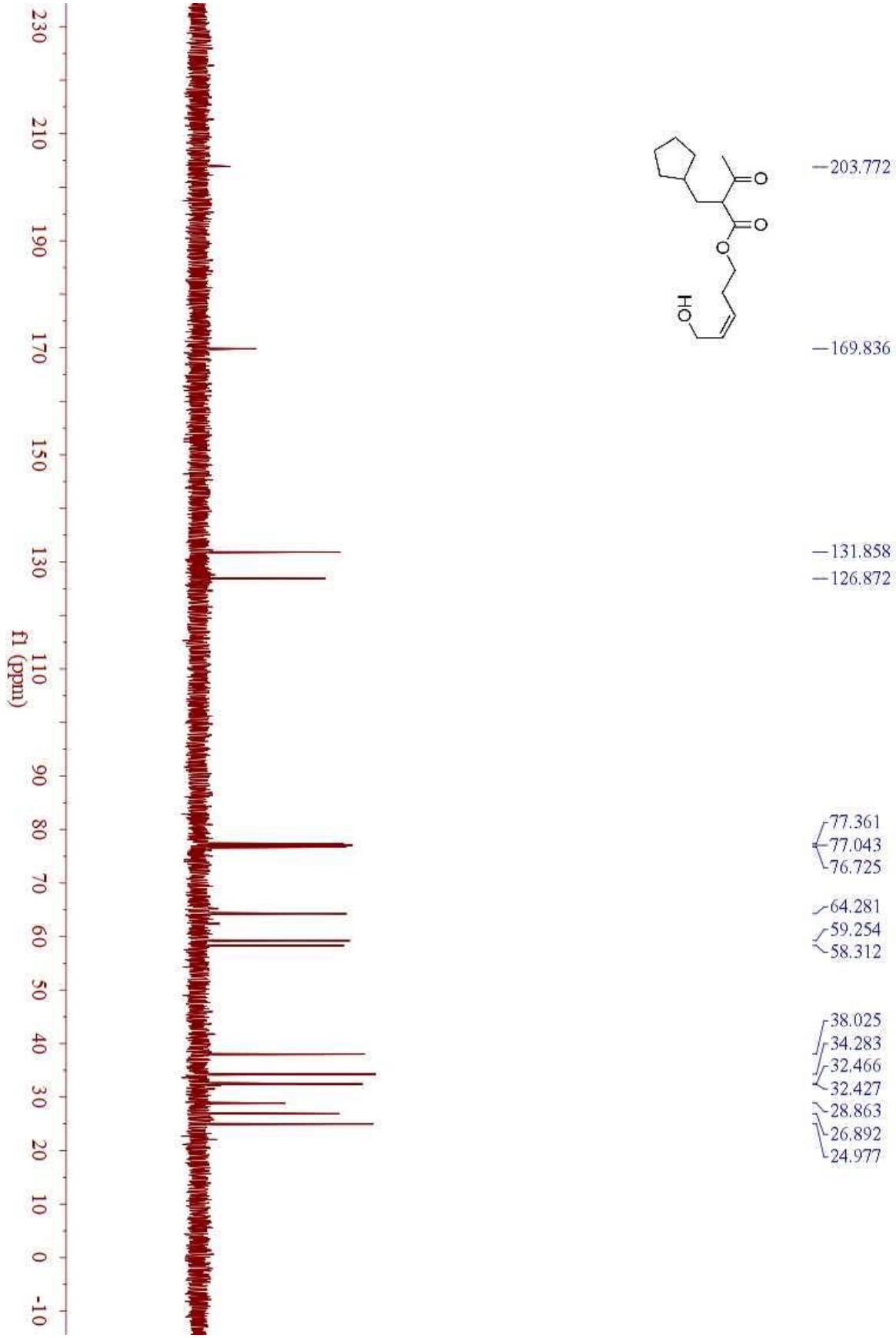
1o ^{13}C NMR (100 MHz, $CDCl_3$)



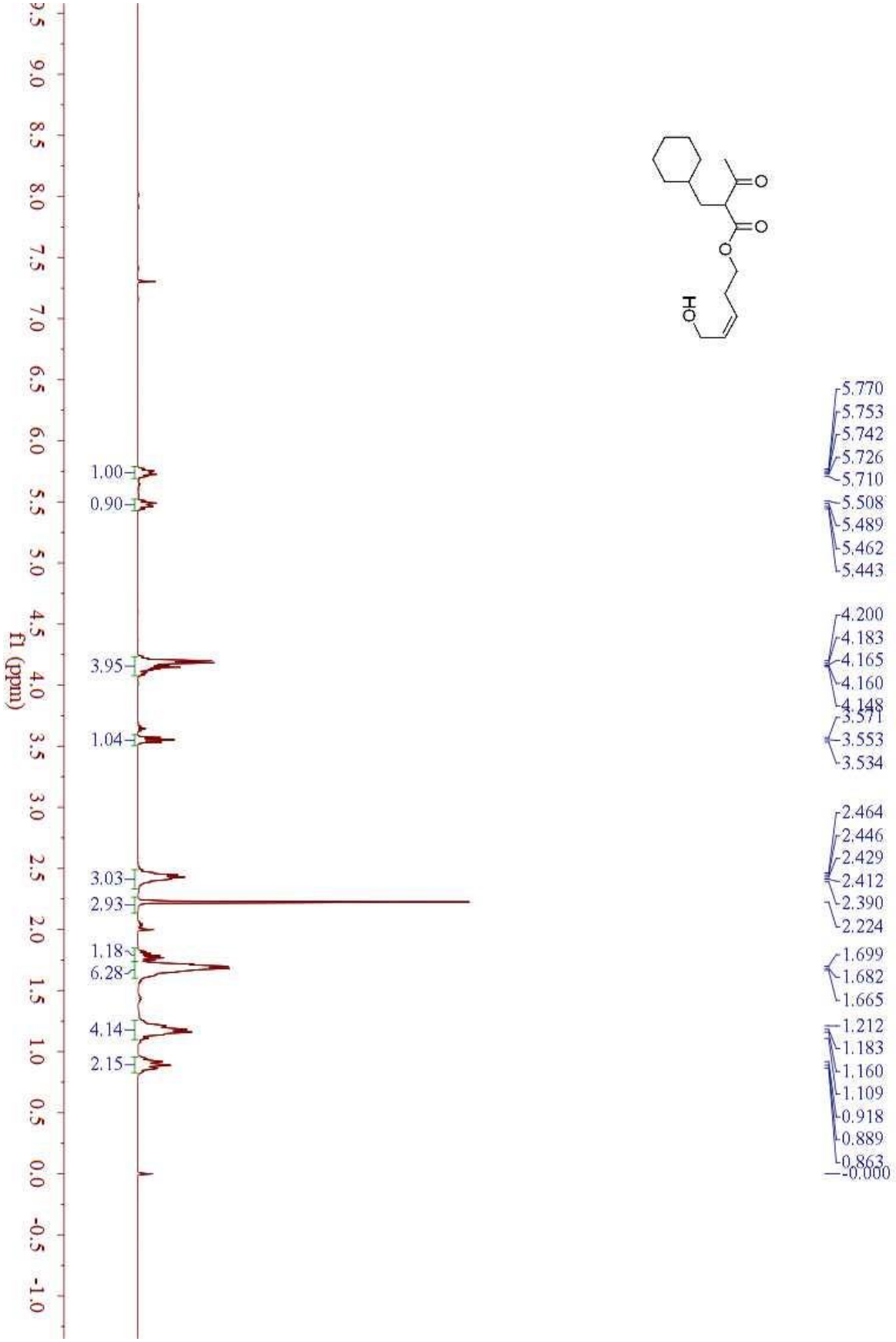
1p ^{1}H NMR (400 MHz, $CDCl_3$)



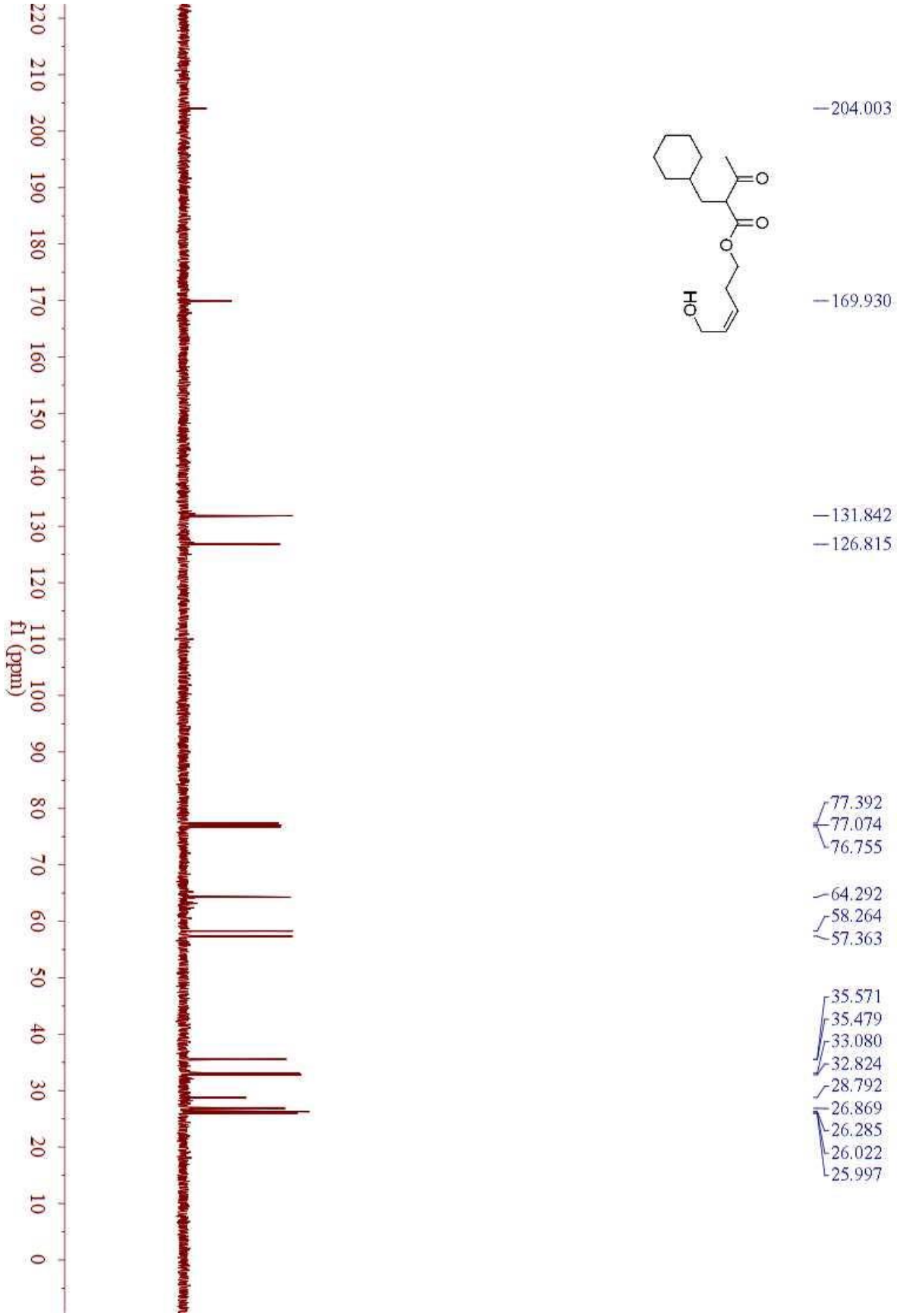
1p ^{13}C NMR (100 MHz, $CDCl_3$)



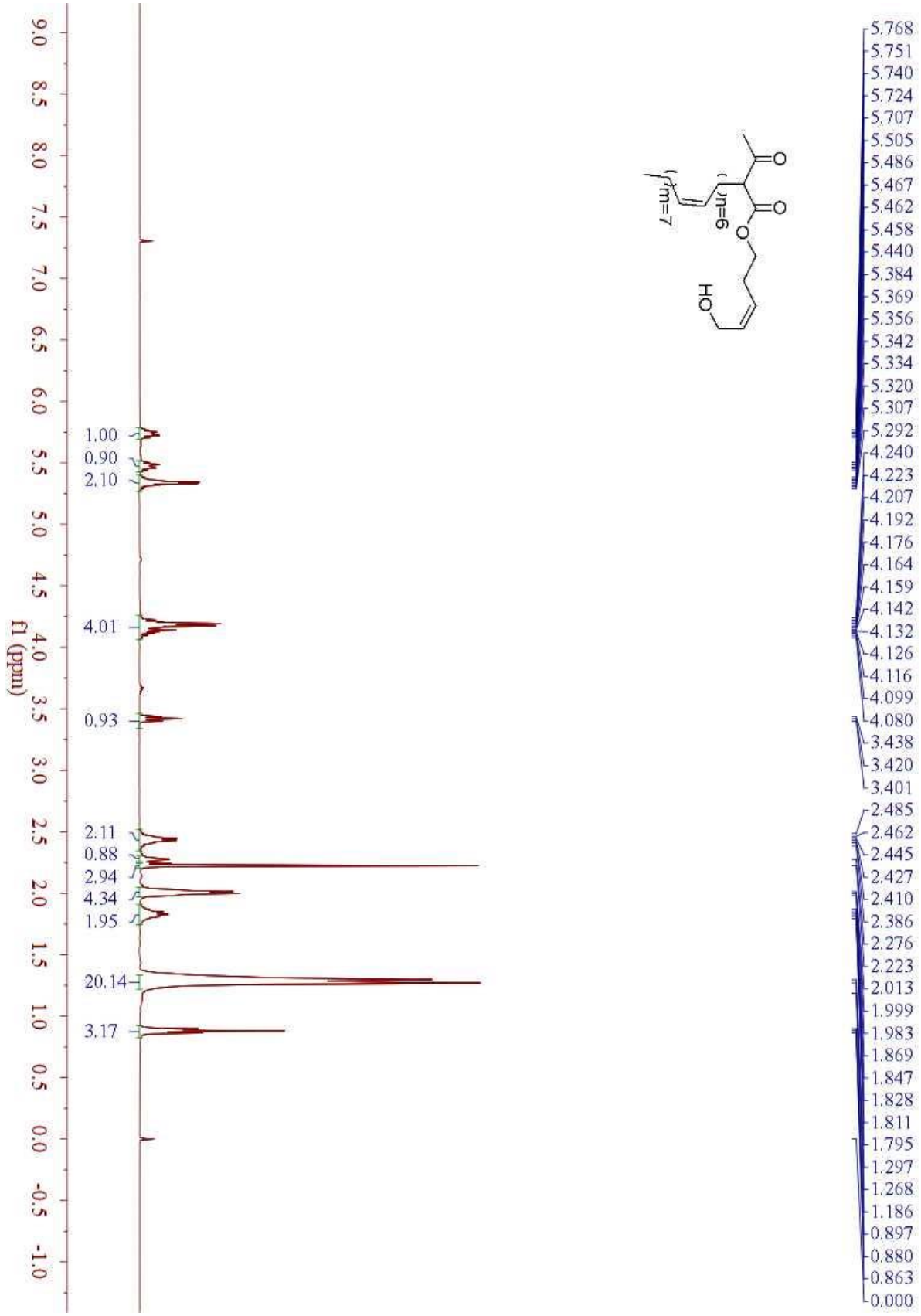
1q ^{1}H NMR (400 MHz, $CDCl_3$)



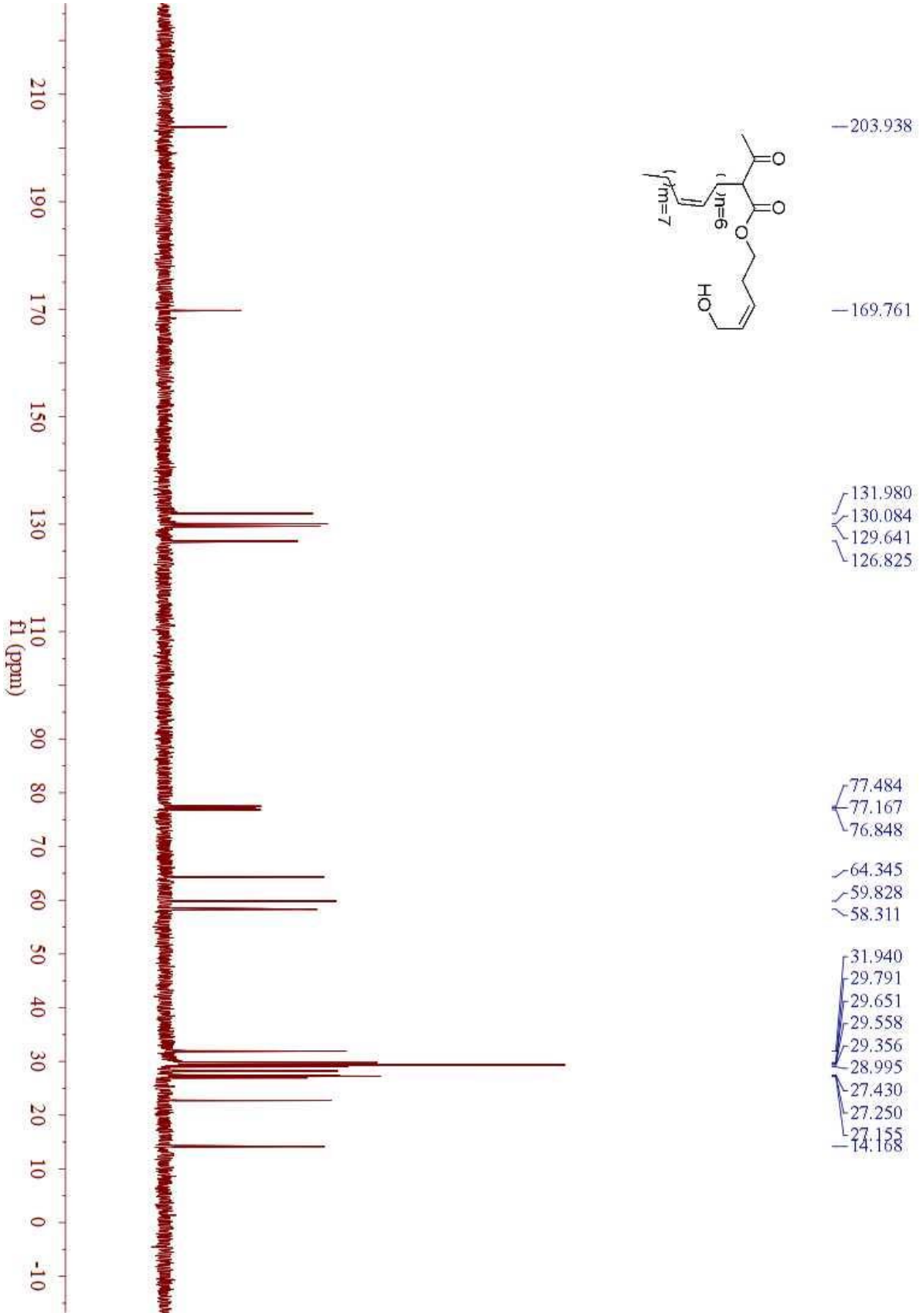
1q ^{13}C NMR (100 MHz, $CDCl_3$)



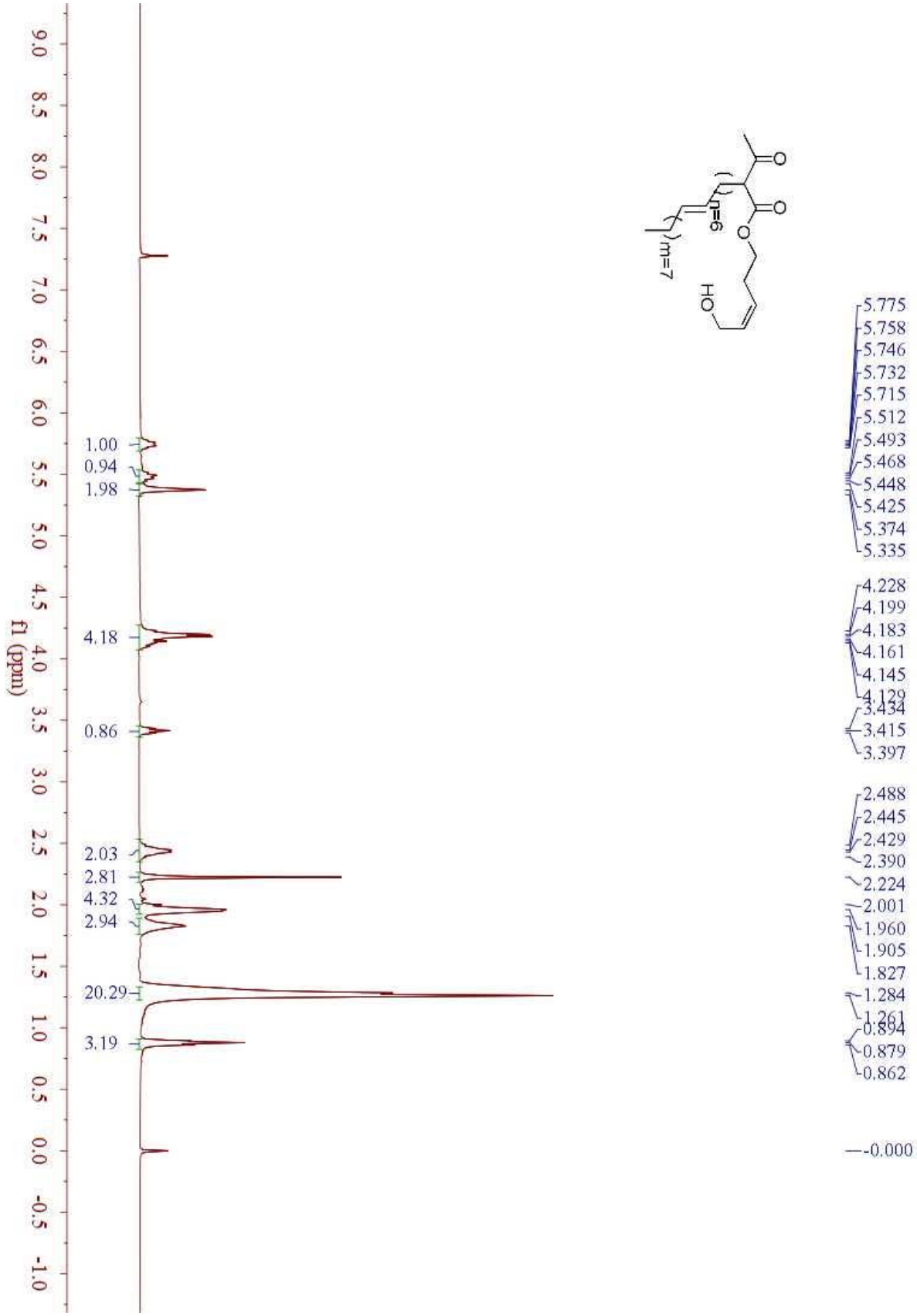
1r ^{1}H NMR (400 MHz, $CDCl_3$)



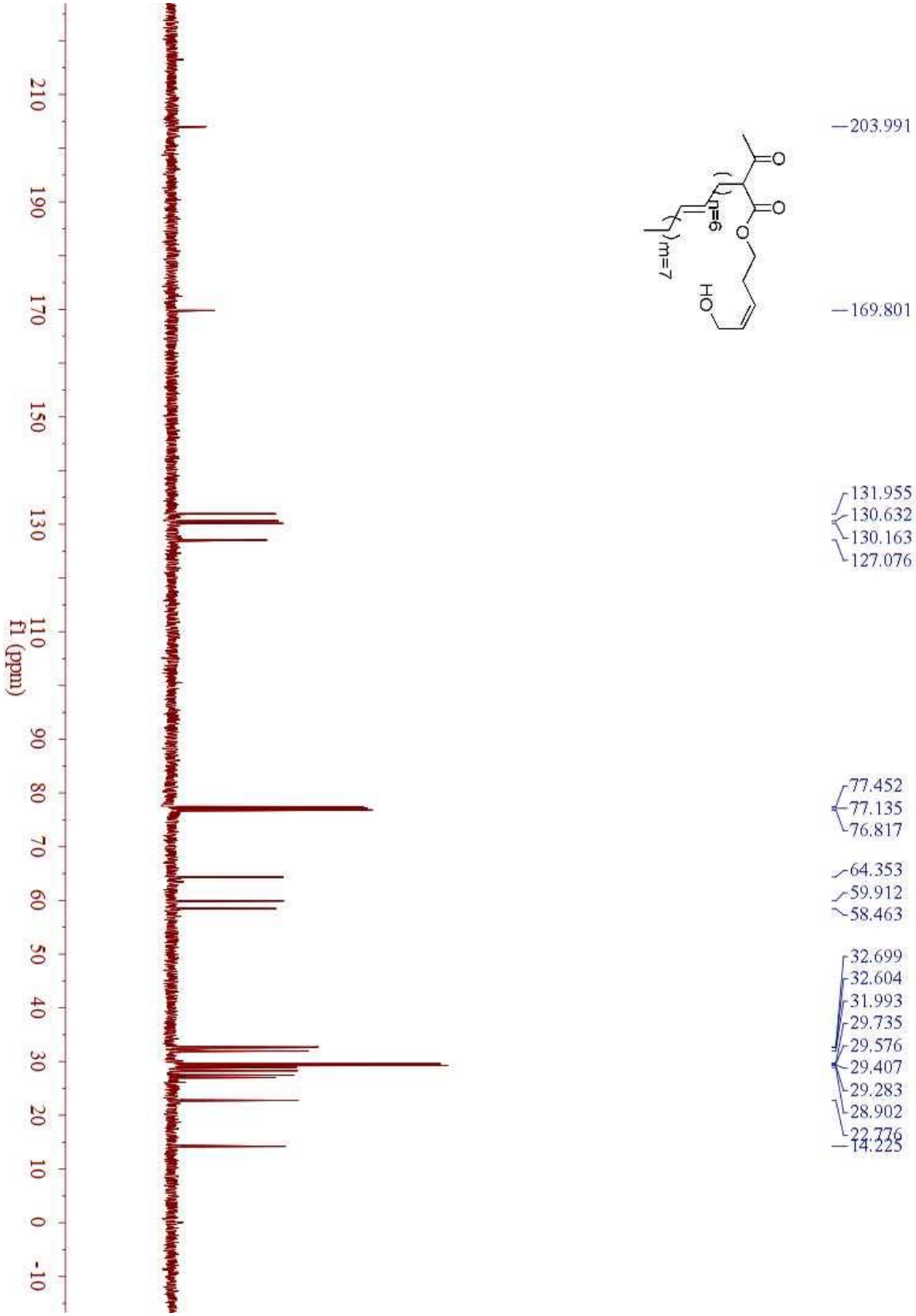
1r ^{13}C NMR (100 MHz, $CDCl_3$)



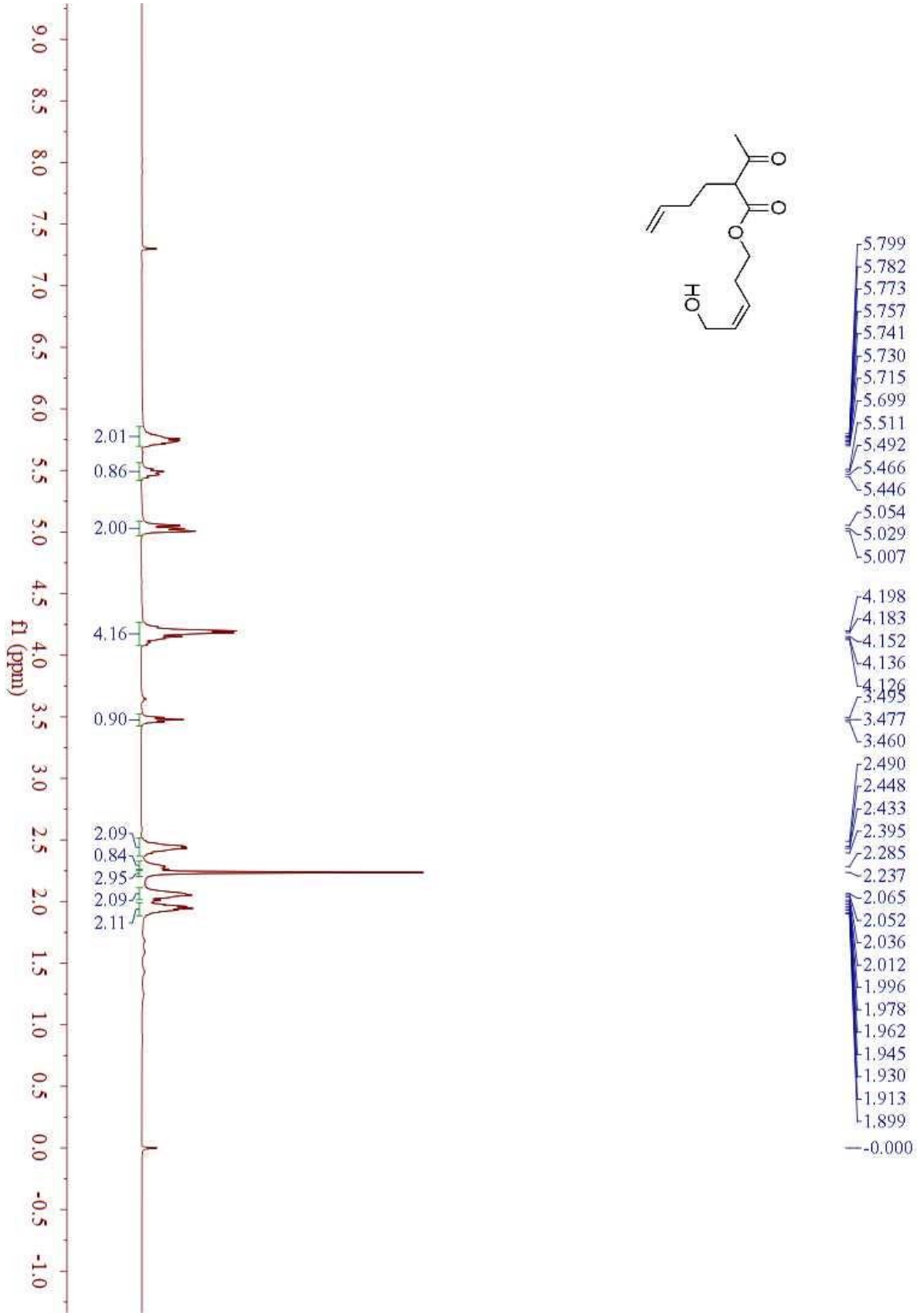
1s ^{1}H NMR (400 MHz, $CDCl_3$)



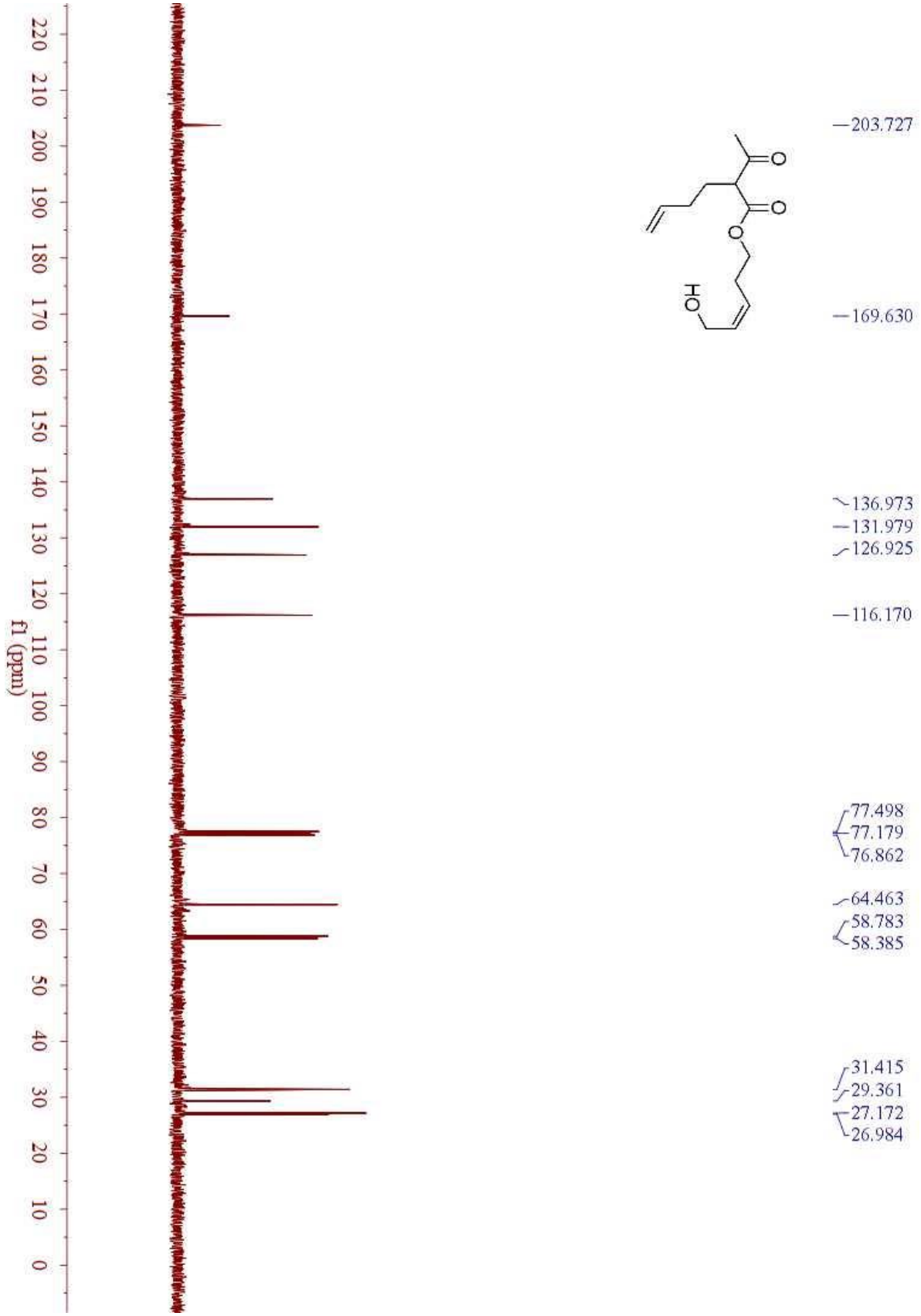
1s ^{13}C NMR (100 MHz, $CDCl_3$)



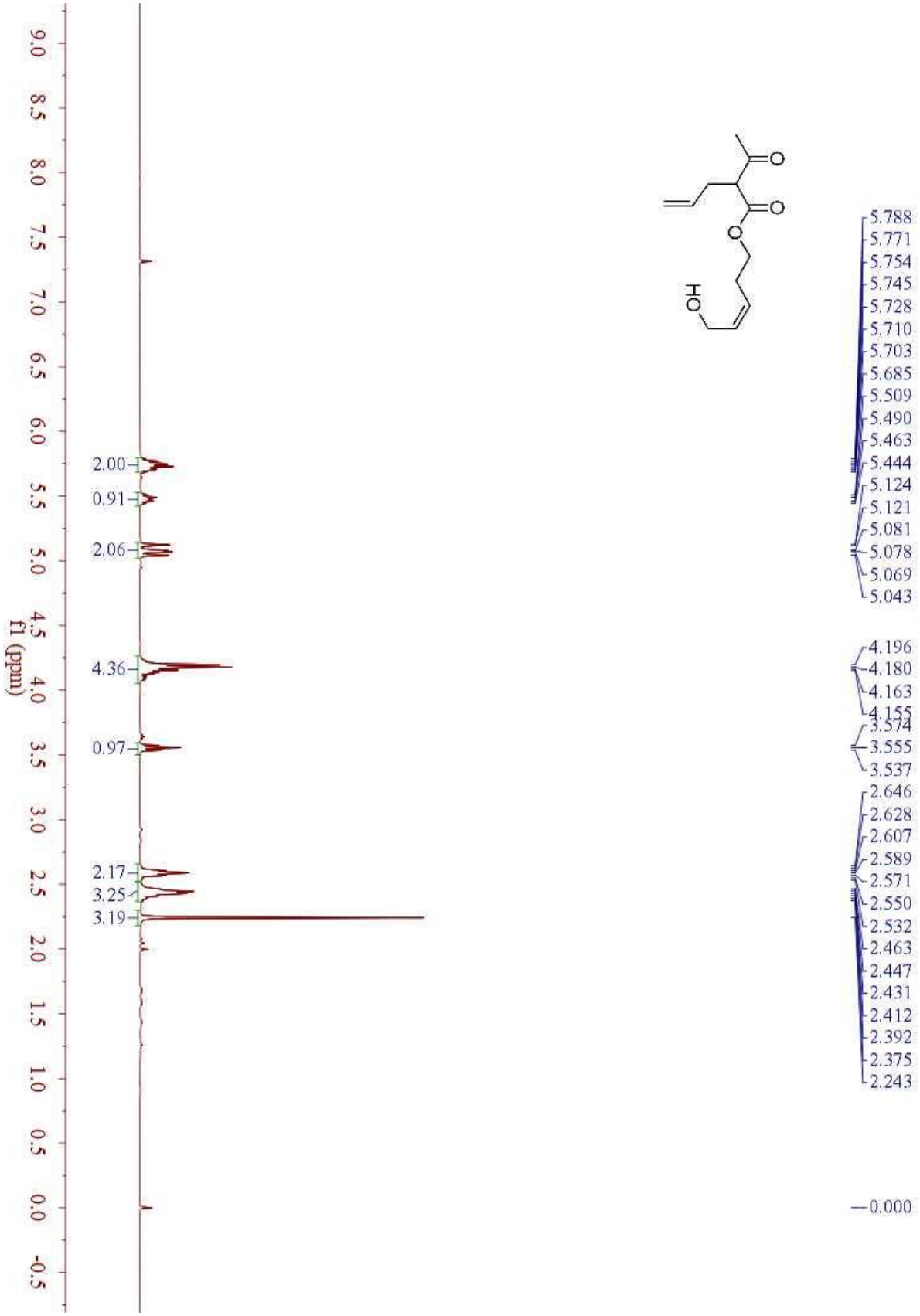
1t ^{1}H NMR (400 MHz, $CDCl_3$)



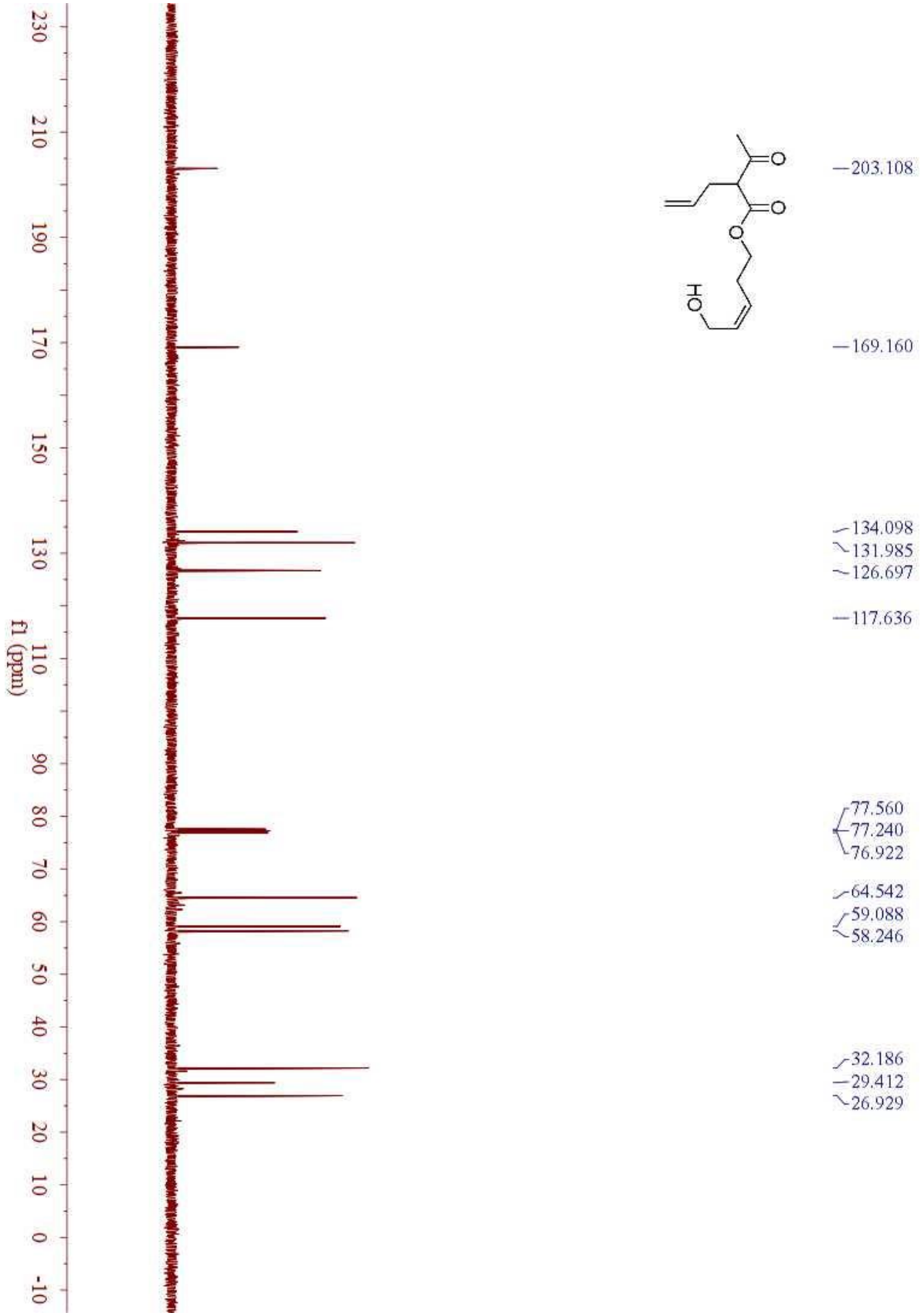
1t ^{13}C NMR (100 MHz, $CDCl_3$)



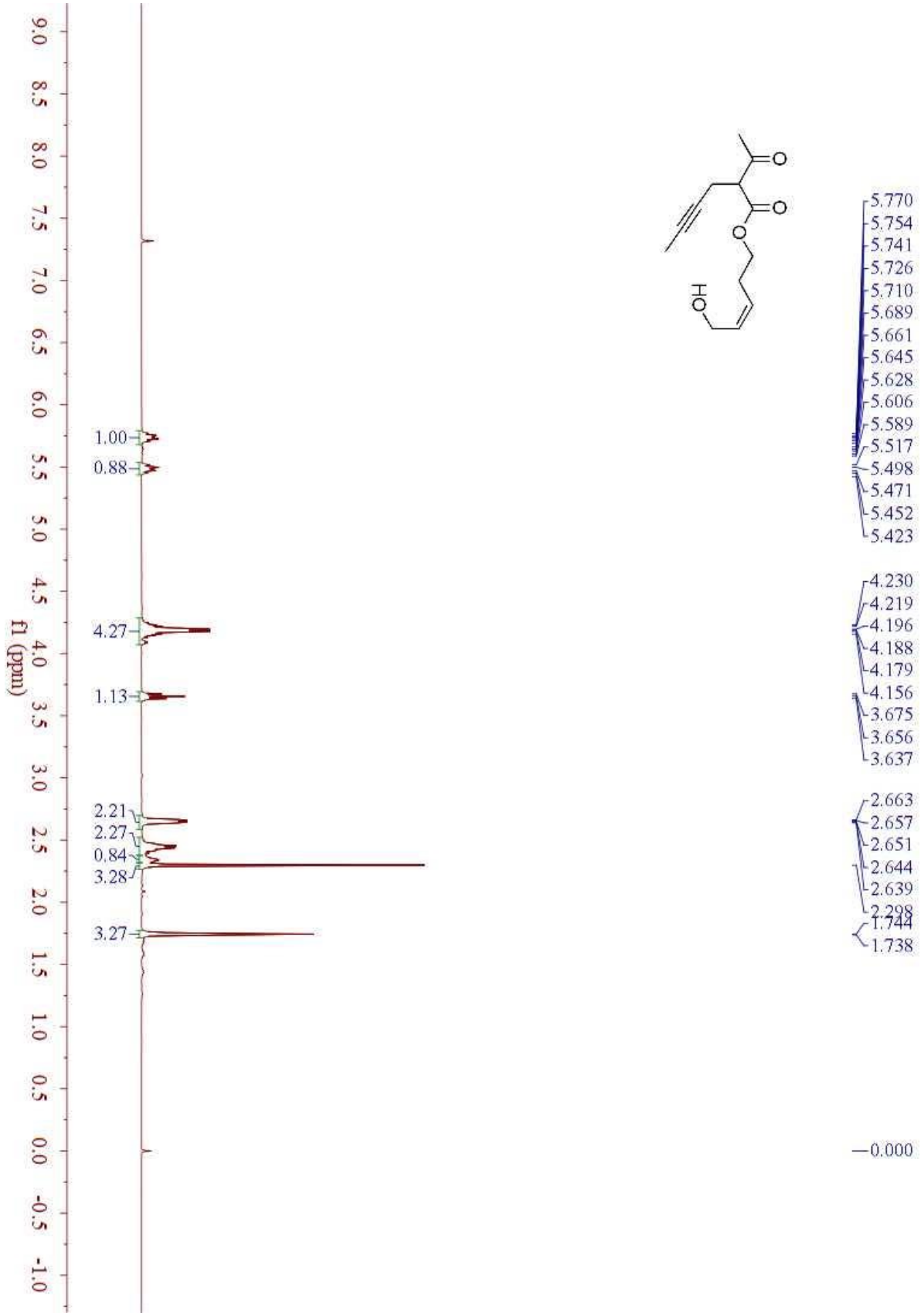
1u ^{1}H NMR (400 MHz, $CDCl_3$)



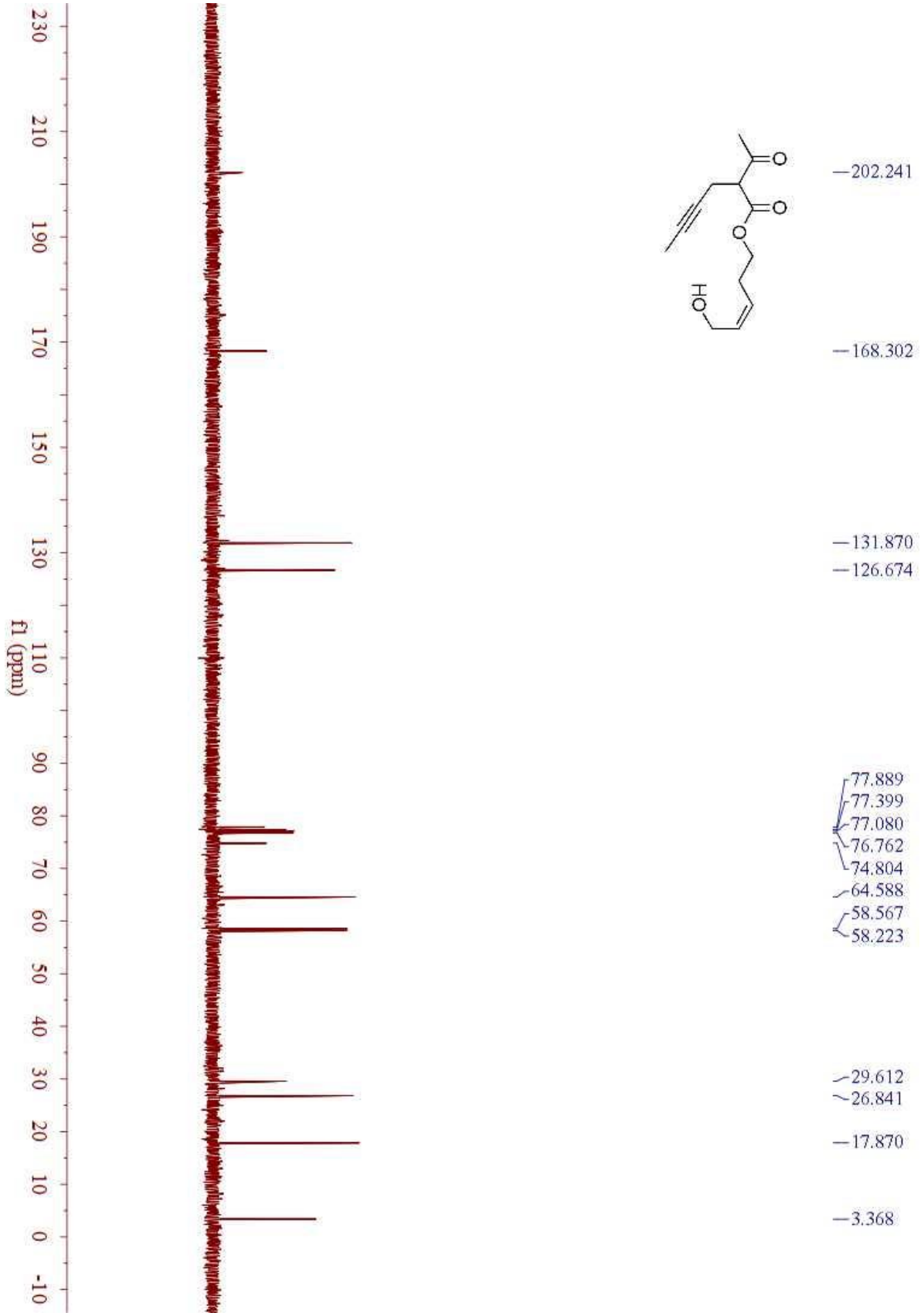
1u ^{13}C NMR (100 MHz, $CDCl_3$)



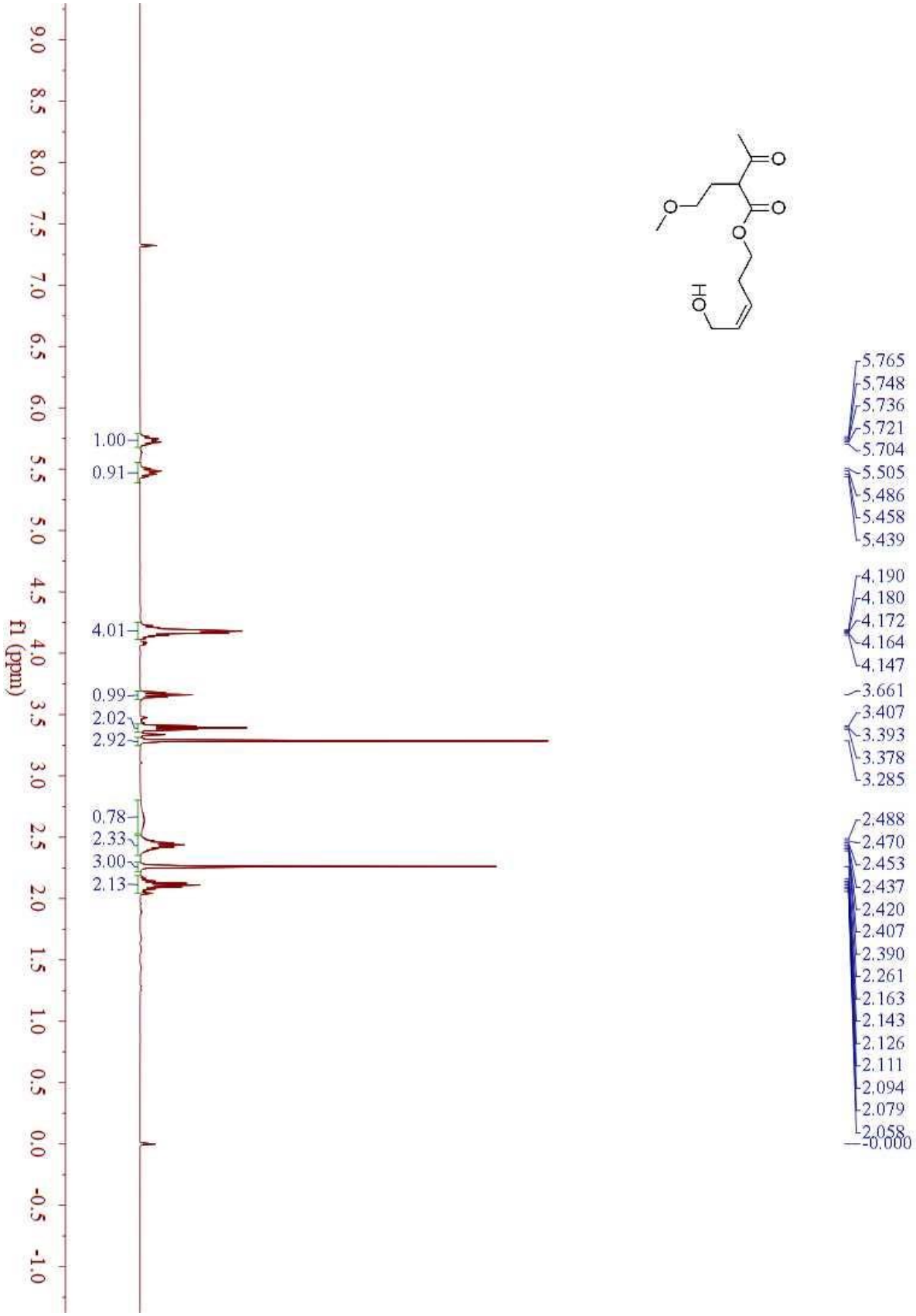
1v ^{1}H NMR (400 MHz, $CDCl_3$)



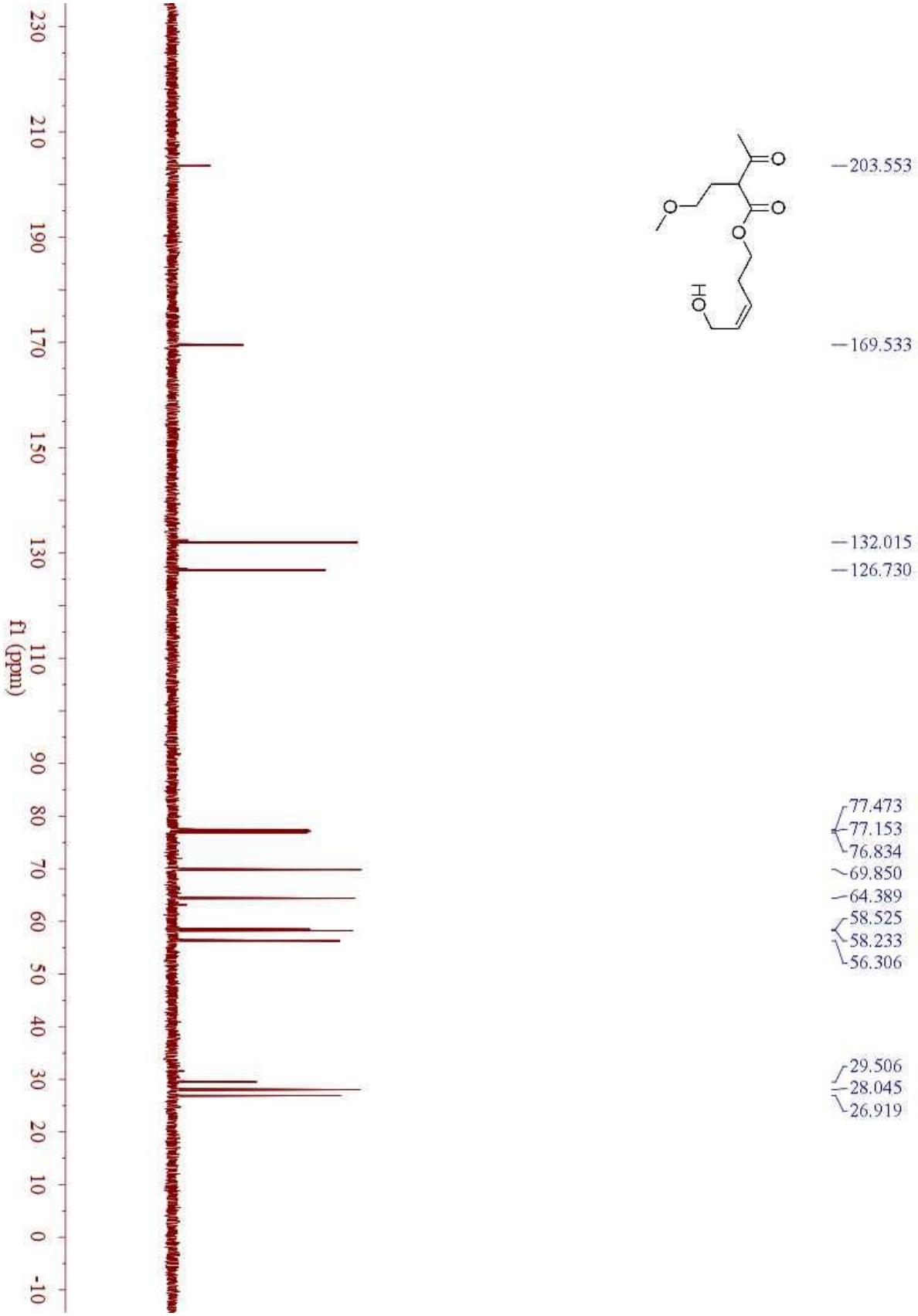
1v ^{13}C NMR (100 MHz, $CDCl_3$)



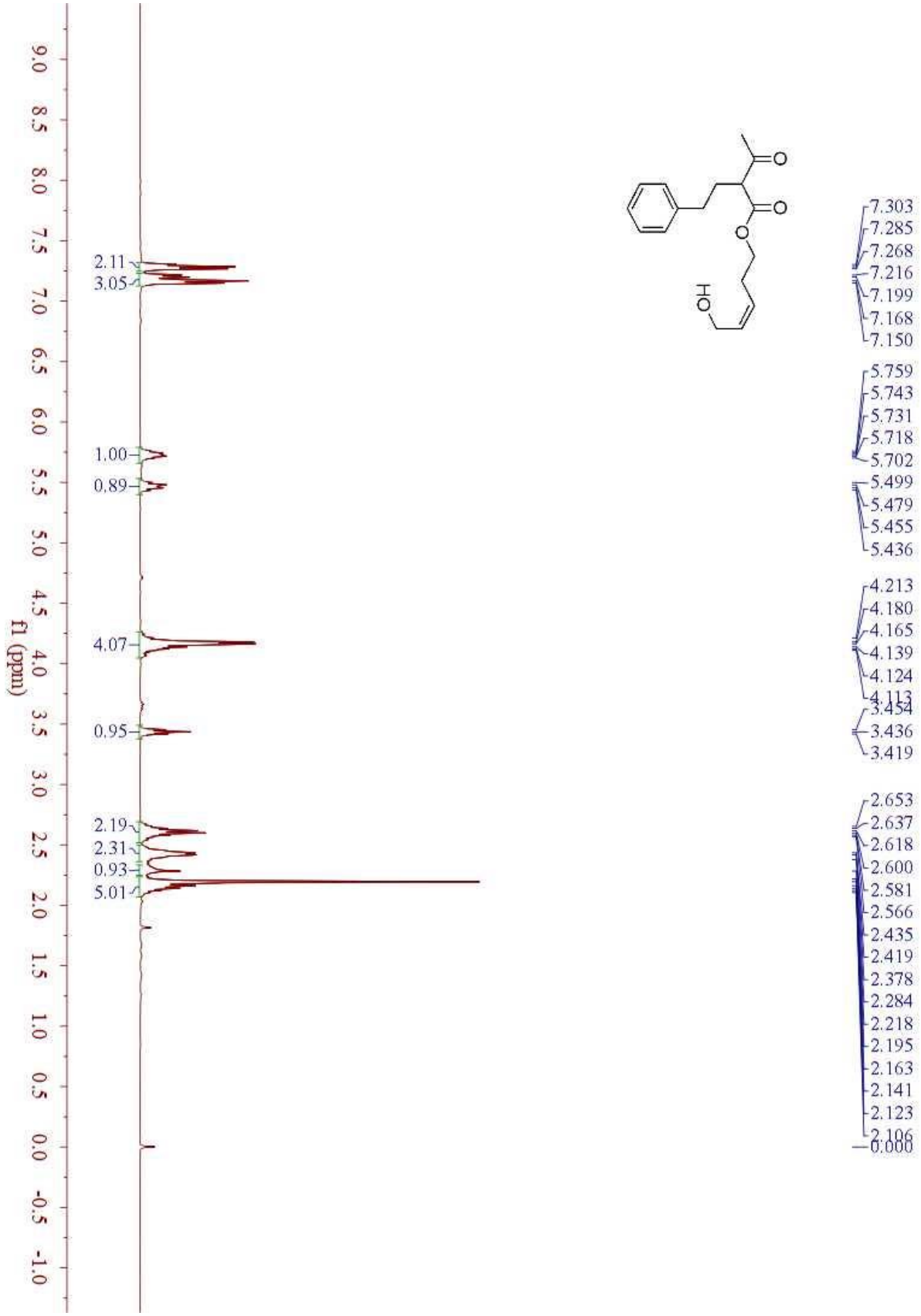
1w ^{1}H NMR (400 MHz, $CDCl_3$)



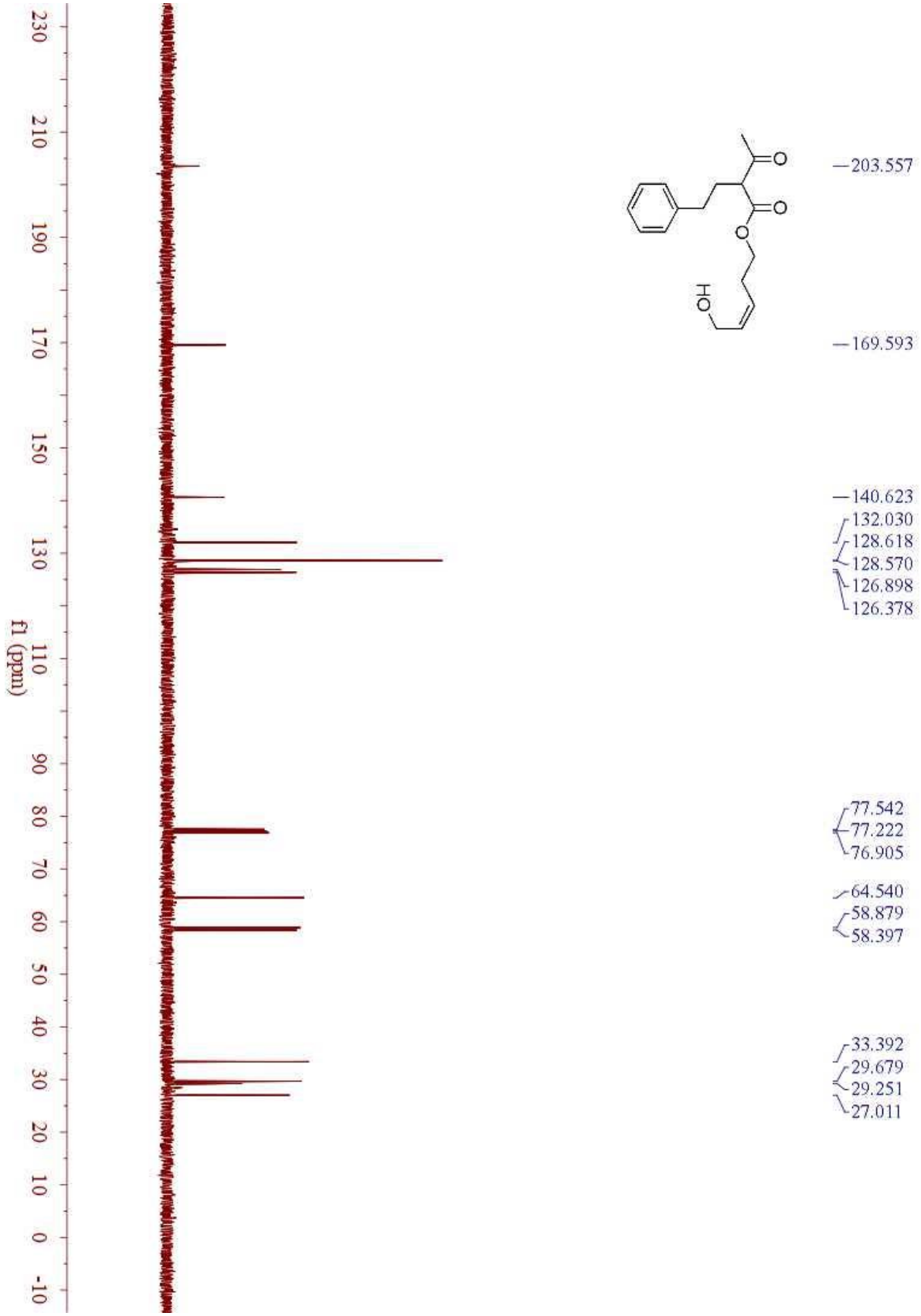
1w ^{13}C NMR (100 MHz, $CDCl_3$)



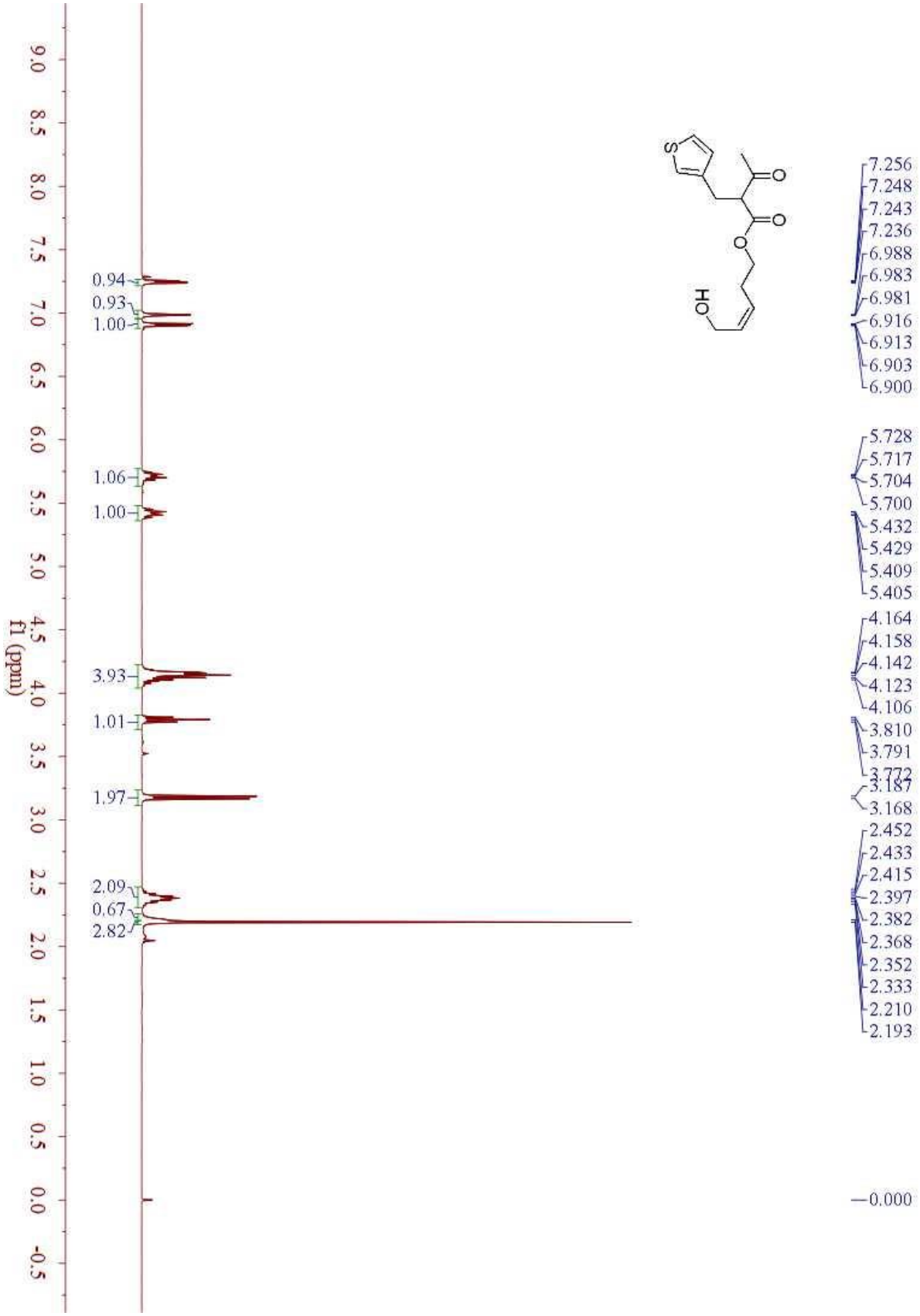
1x ^{1}H NMR (400 MHz, $CDCl_3$)



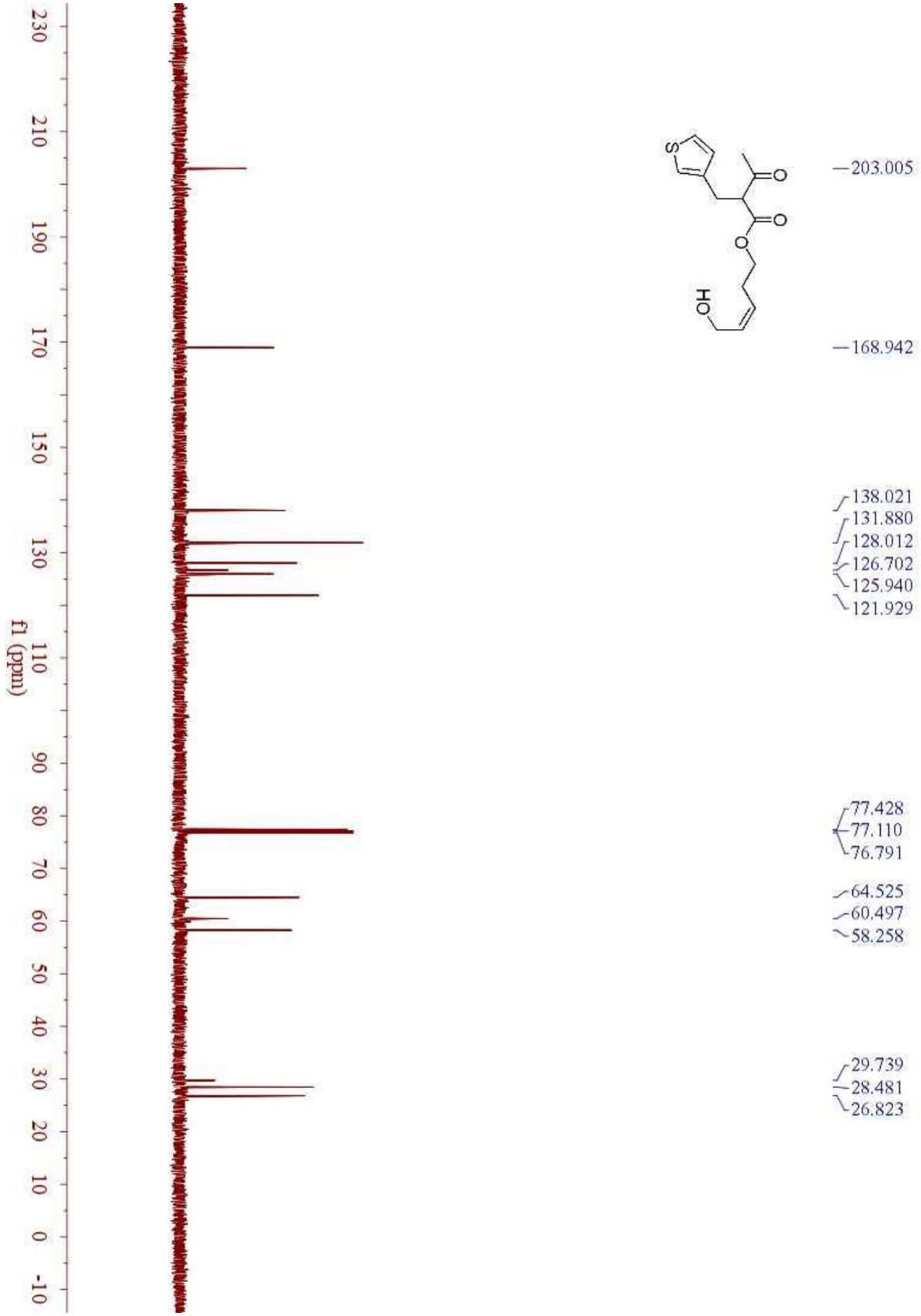
1x ^{13}C NMR (100 MHz, $CDCl_3$)



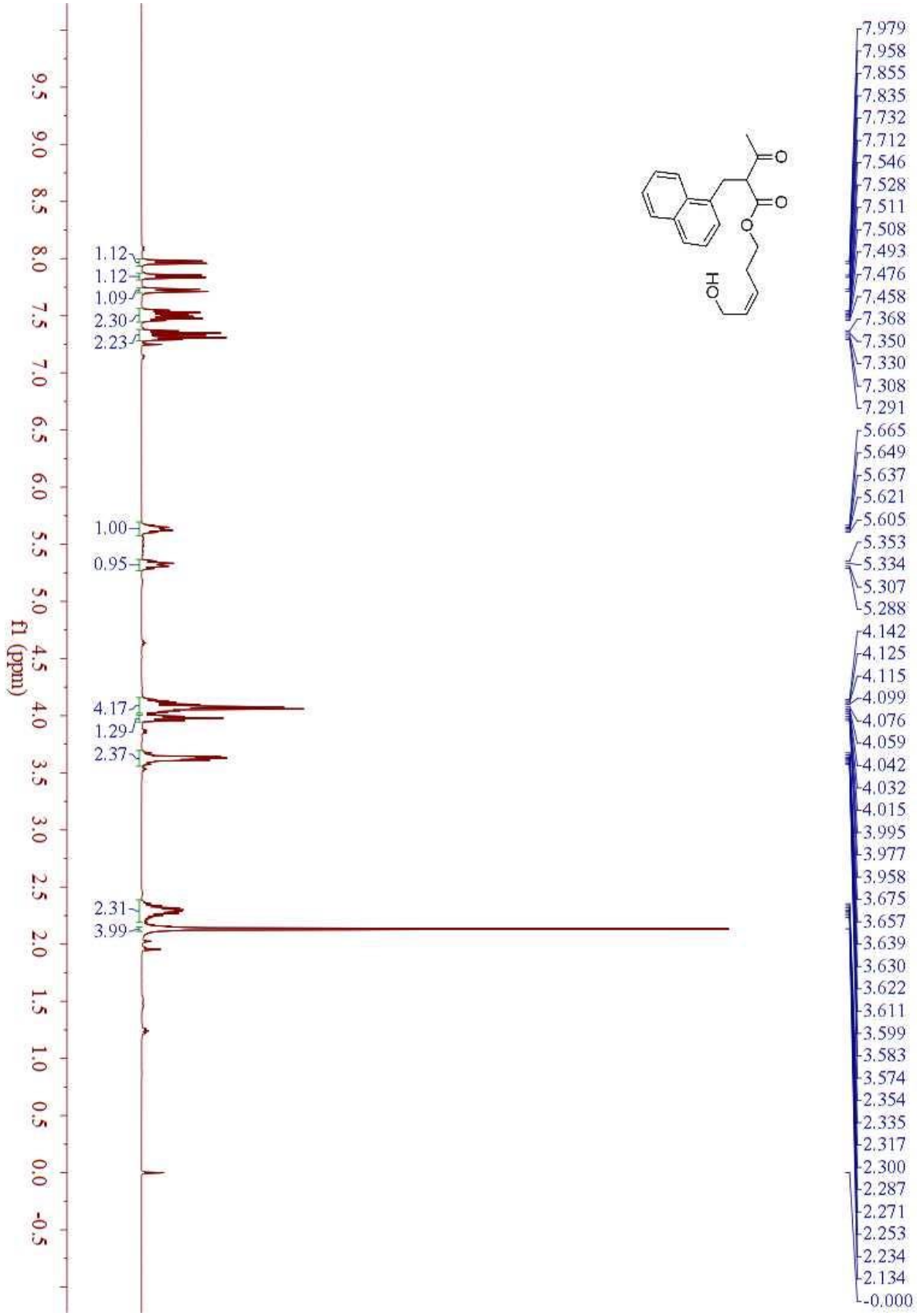
1y ^{1}H NMR (400 MHz, $CDCl_3$)



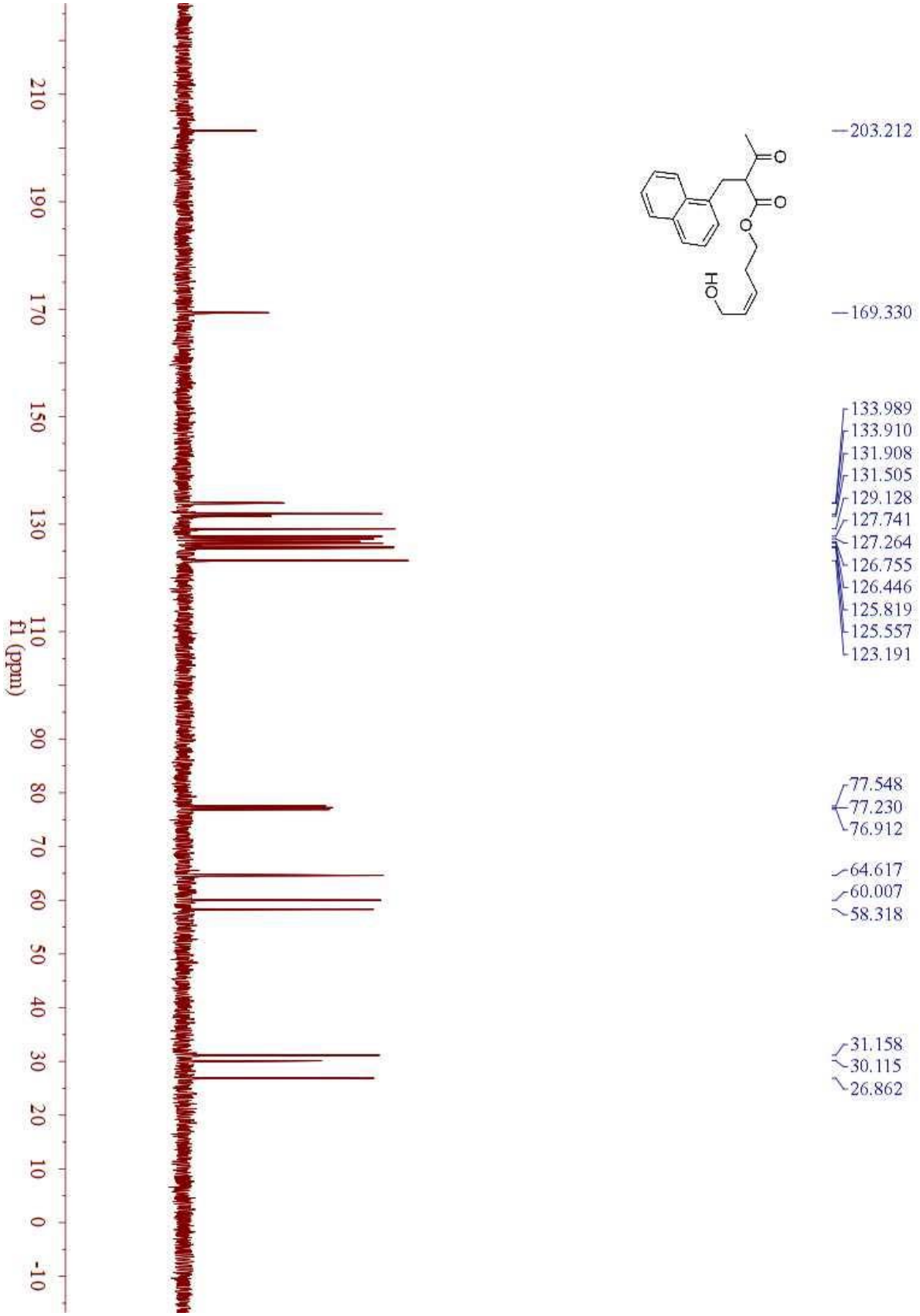
1y ^{13}C NMR (100 MHz, $CDCl_3$)



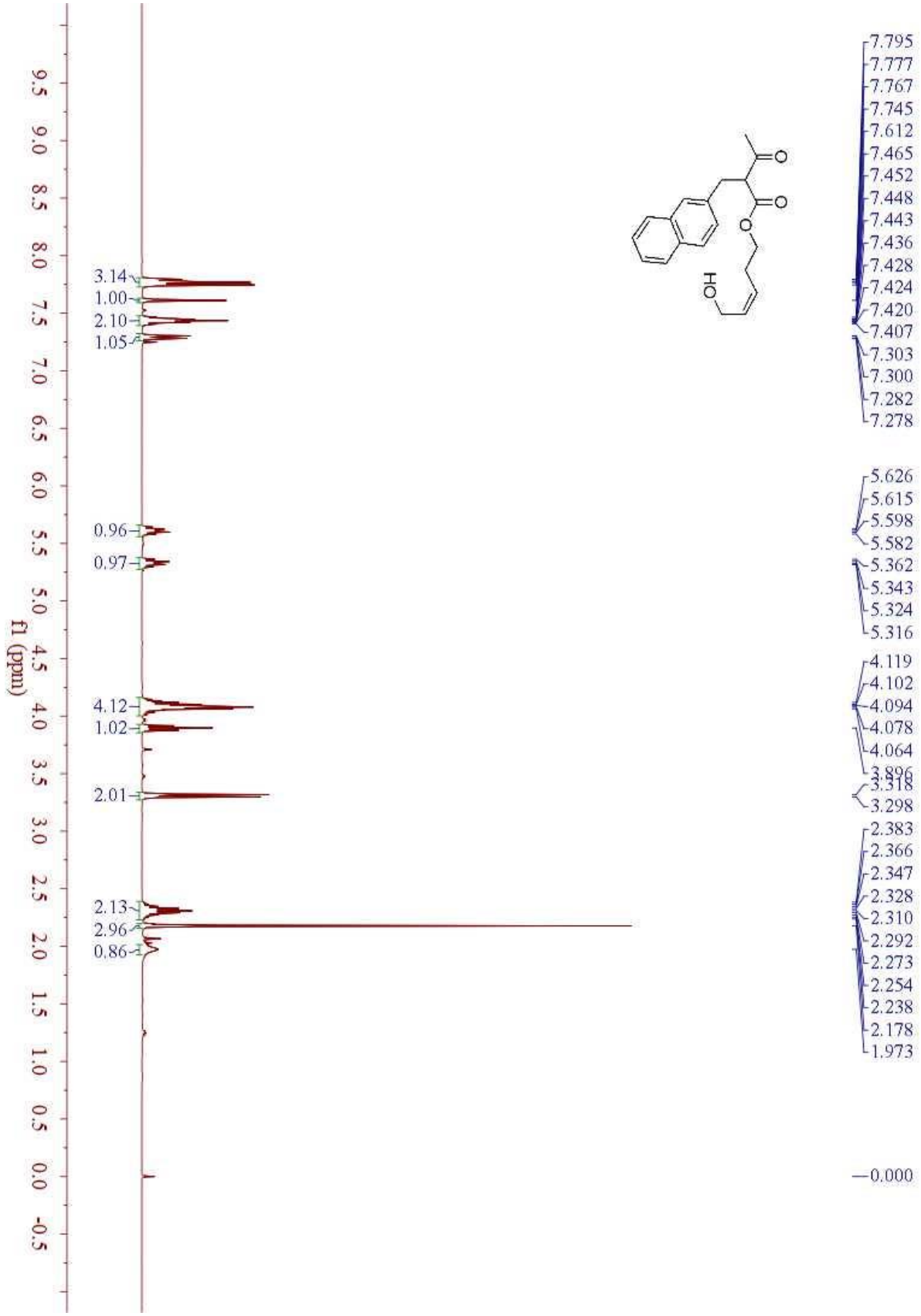
1z ^{1}H NMR (400 MHz, $CDCl_3$)



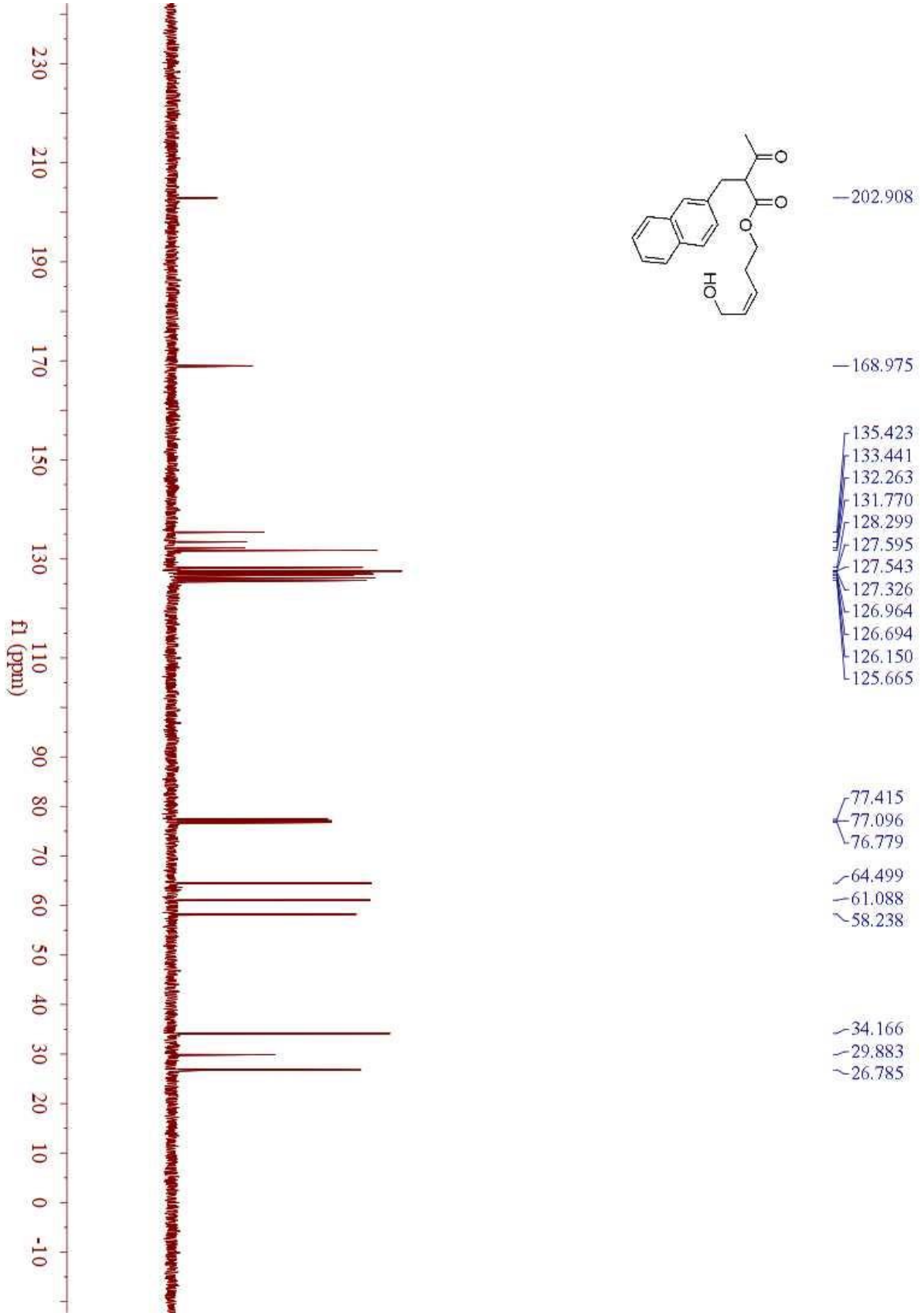
1z ^{13}C NMR (100 MHz, $CDCl_3$)



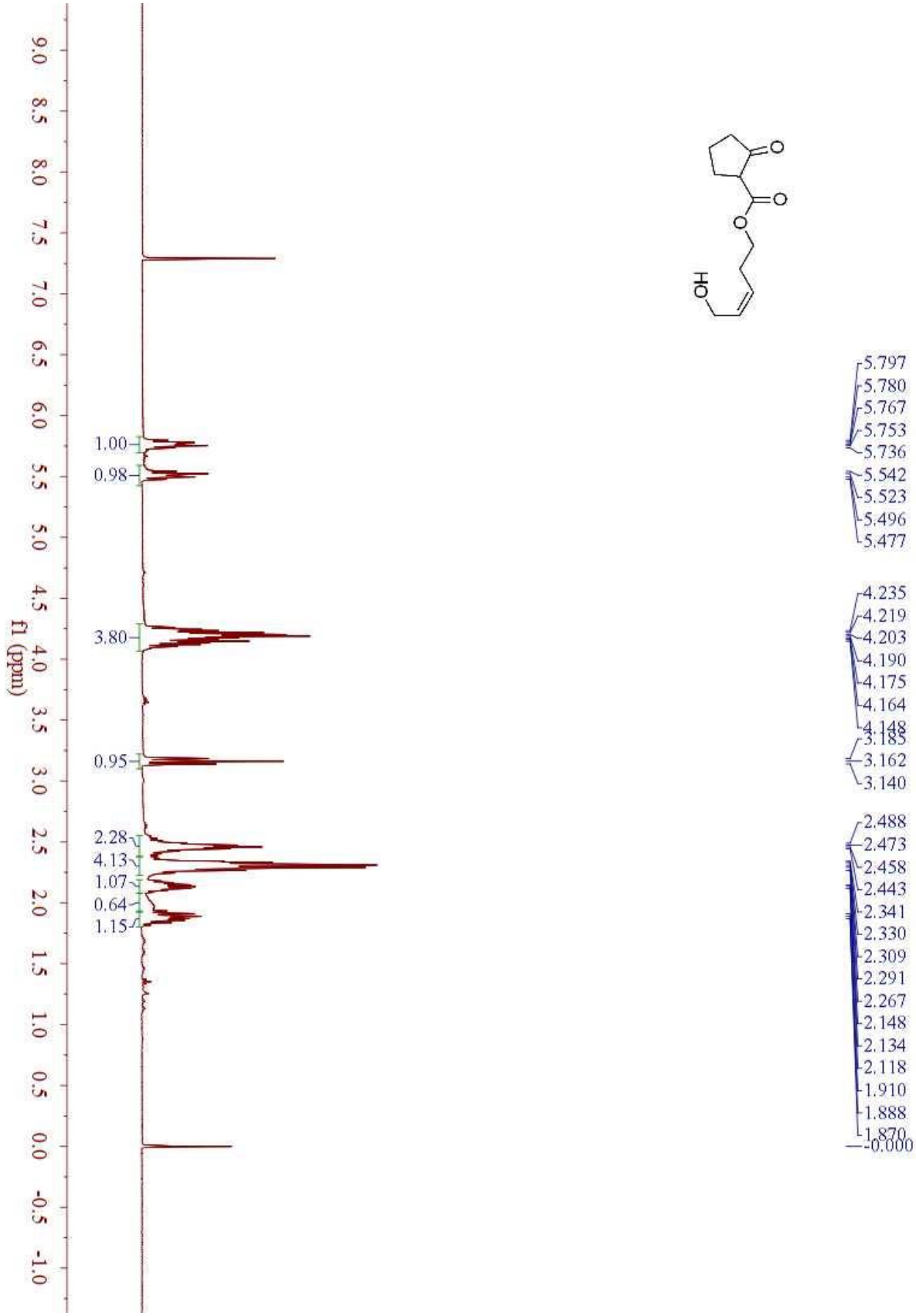
1aa ^{1}H NMR (400 MHz, $CDCl_3$)



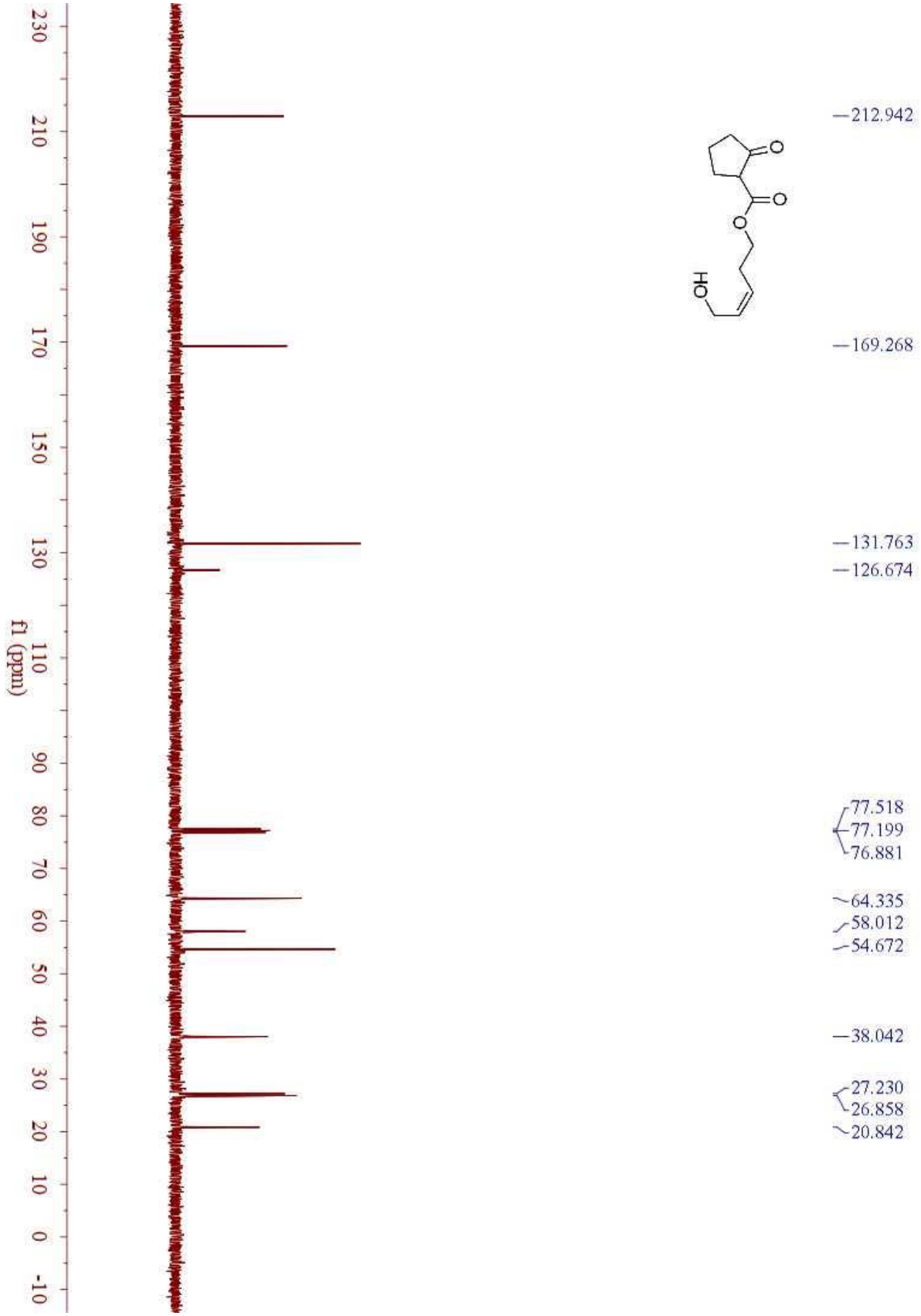
1aa ^{13}C NMR (100 MHz, $CDCl_3$)



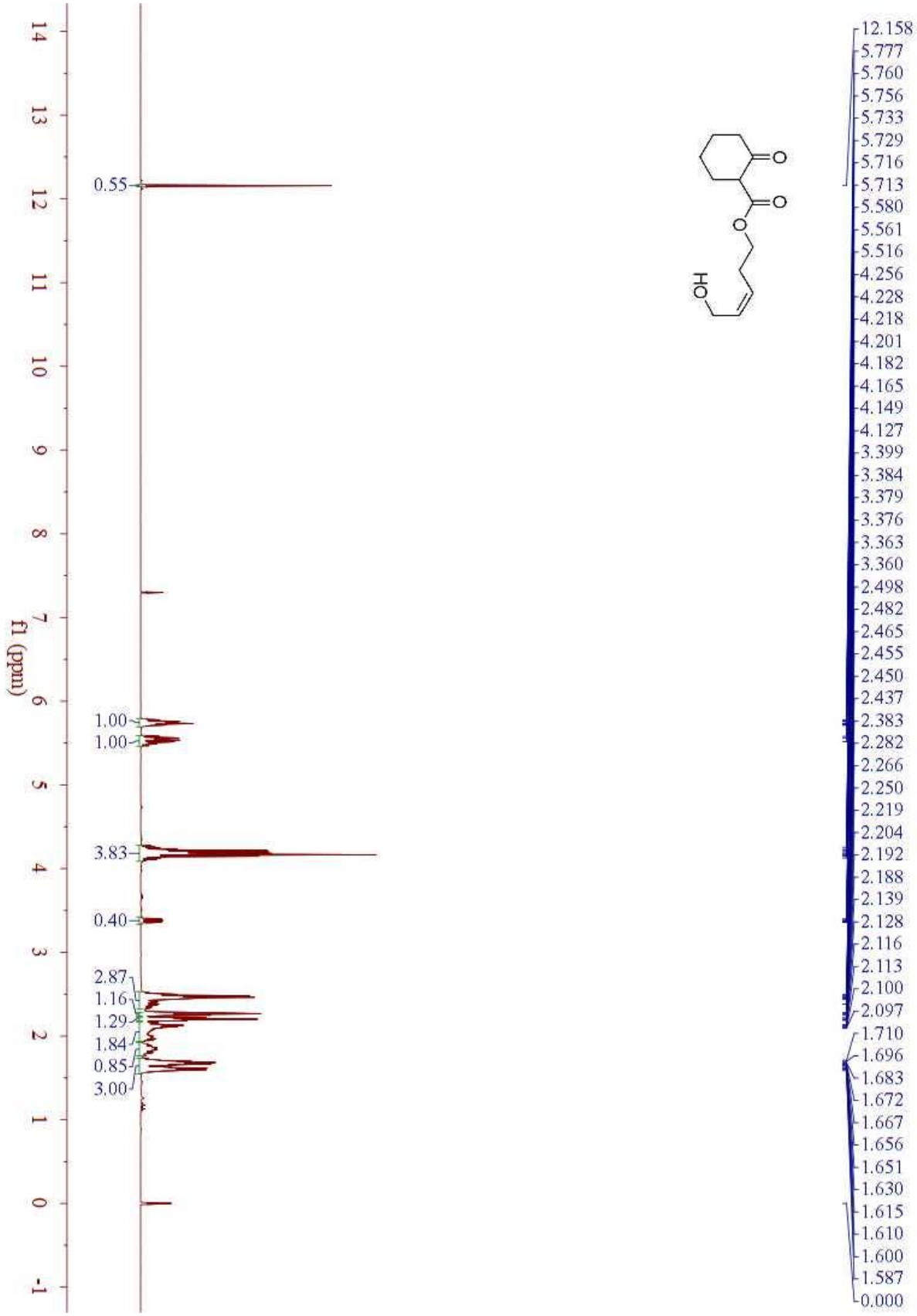
1ab ^{1}H NMR (400 MHz, $CDCl_3$)



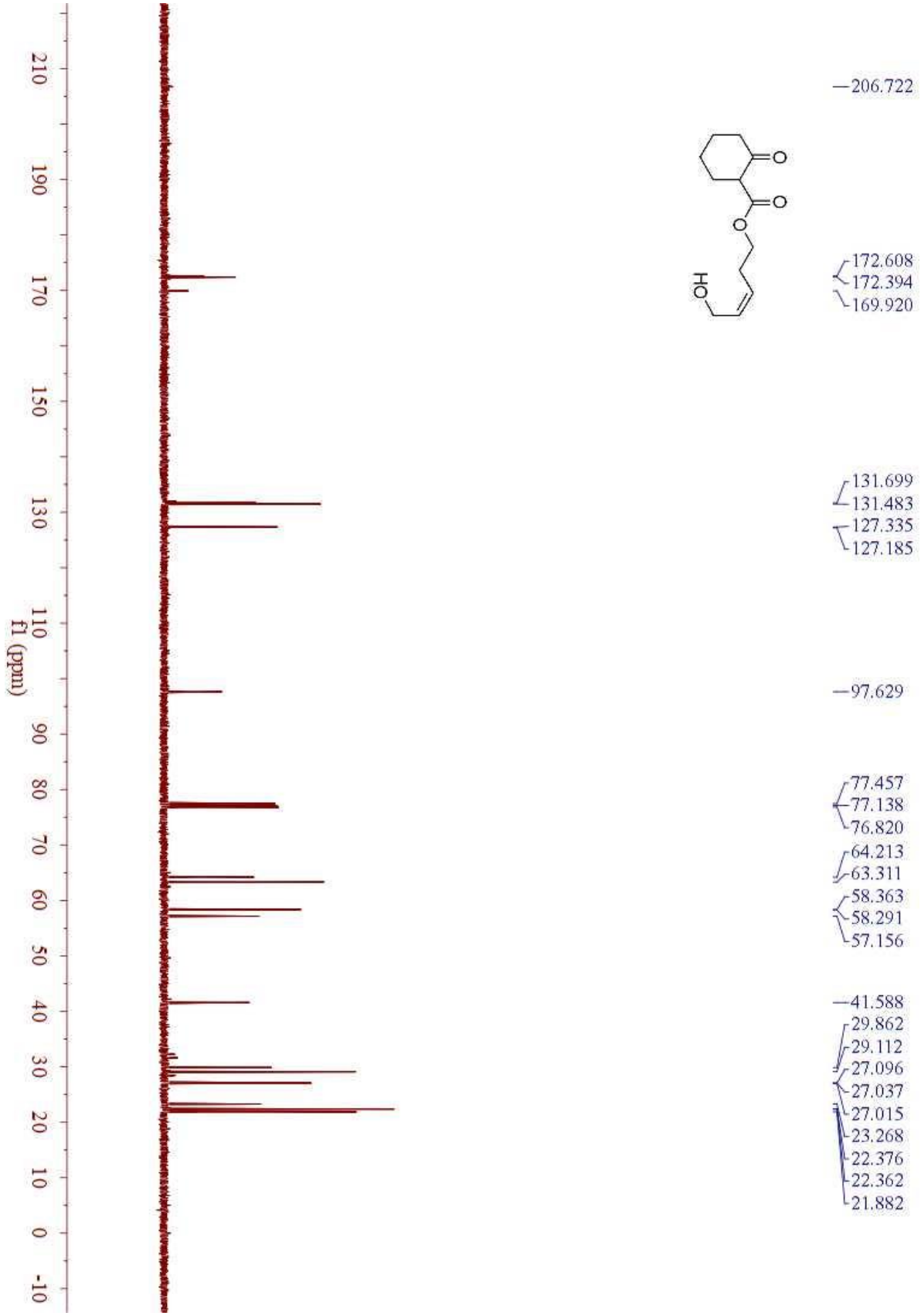
1ab ^{13}C NMR (100 MHz, $CDCl_3$)



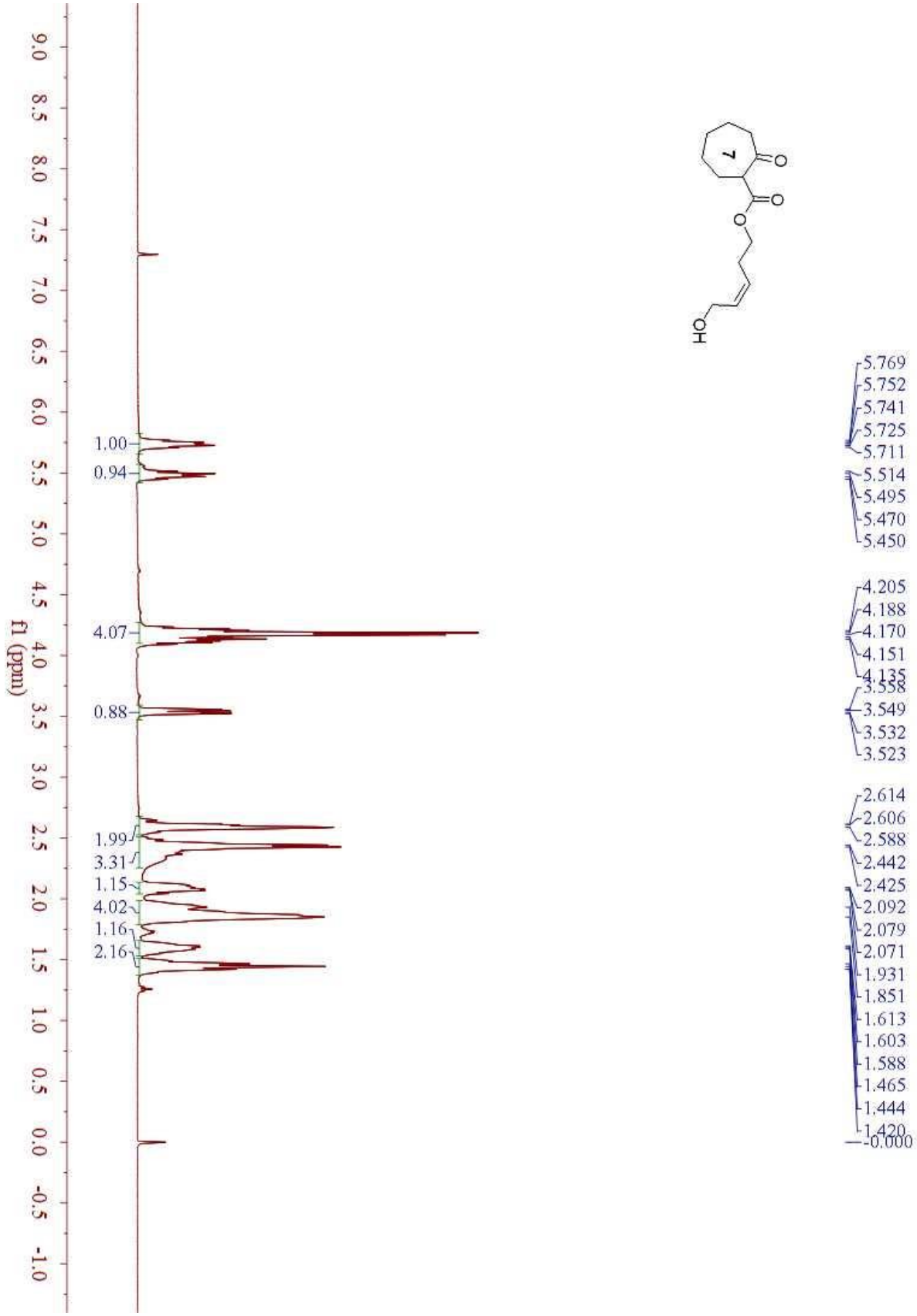
1ac ^{1}H NMR (400 MHz, $CDCl_3$)



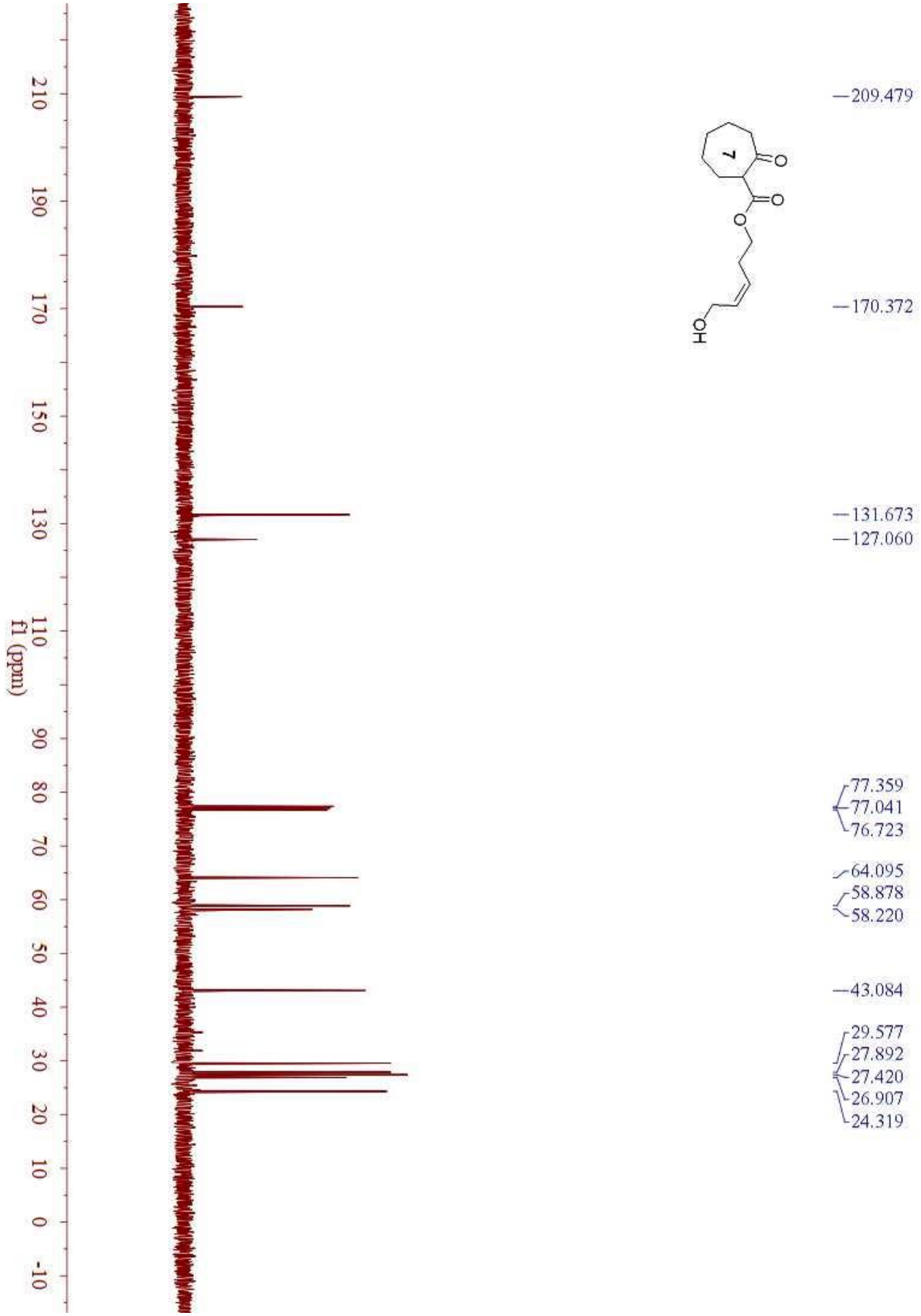
1ac ^{13}C NMR (100 MHz, $CDCl_3$)



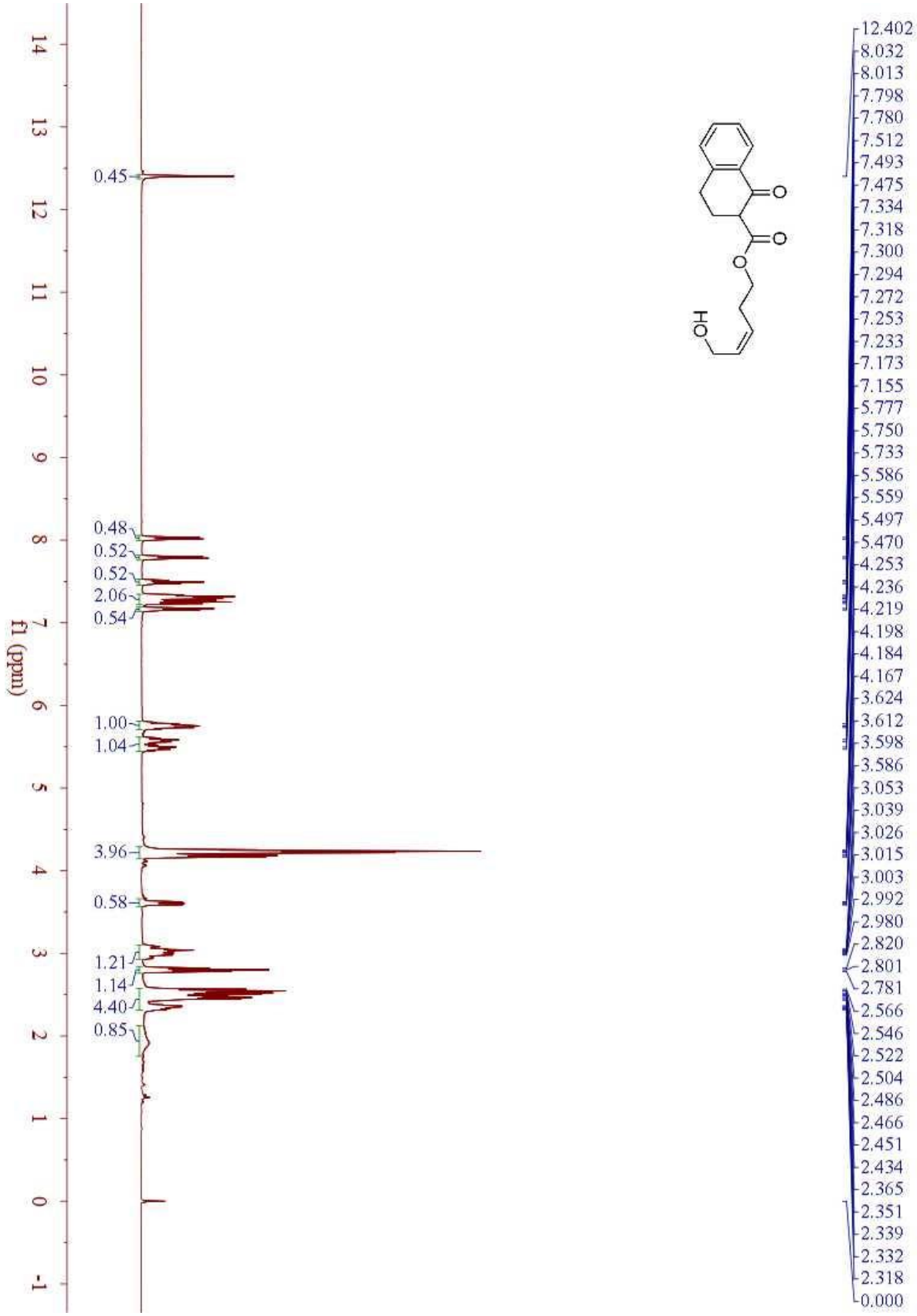
1ad ^{1}H NMR (400 MHz, $CDCl_3$)



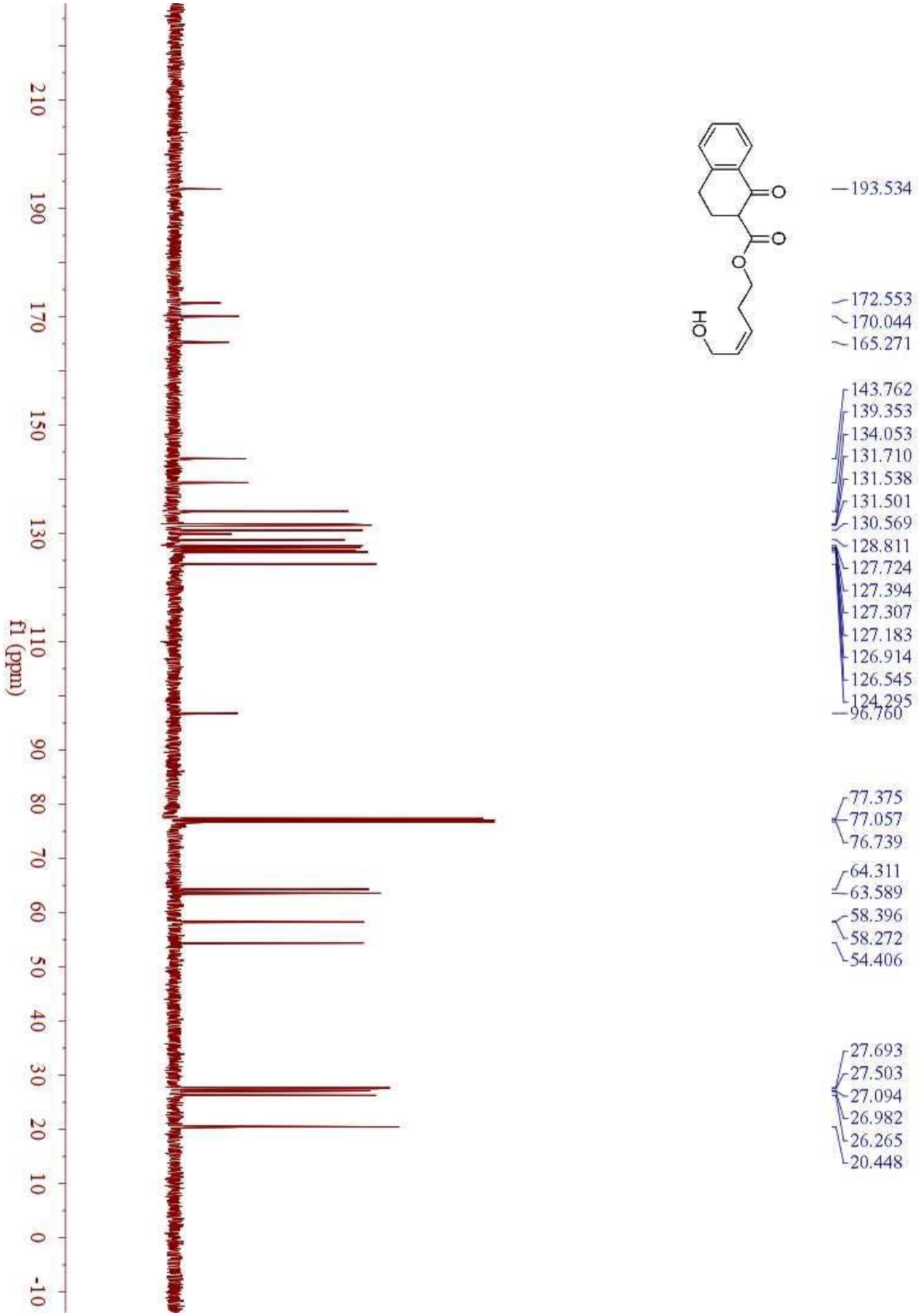
1ad ^{13}C NMR (100 MHz, $CDCl_3$)



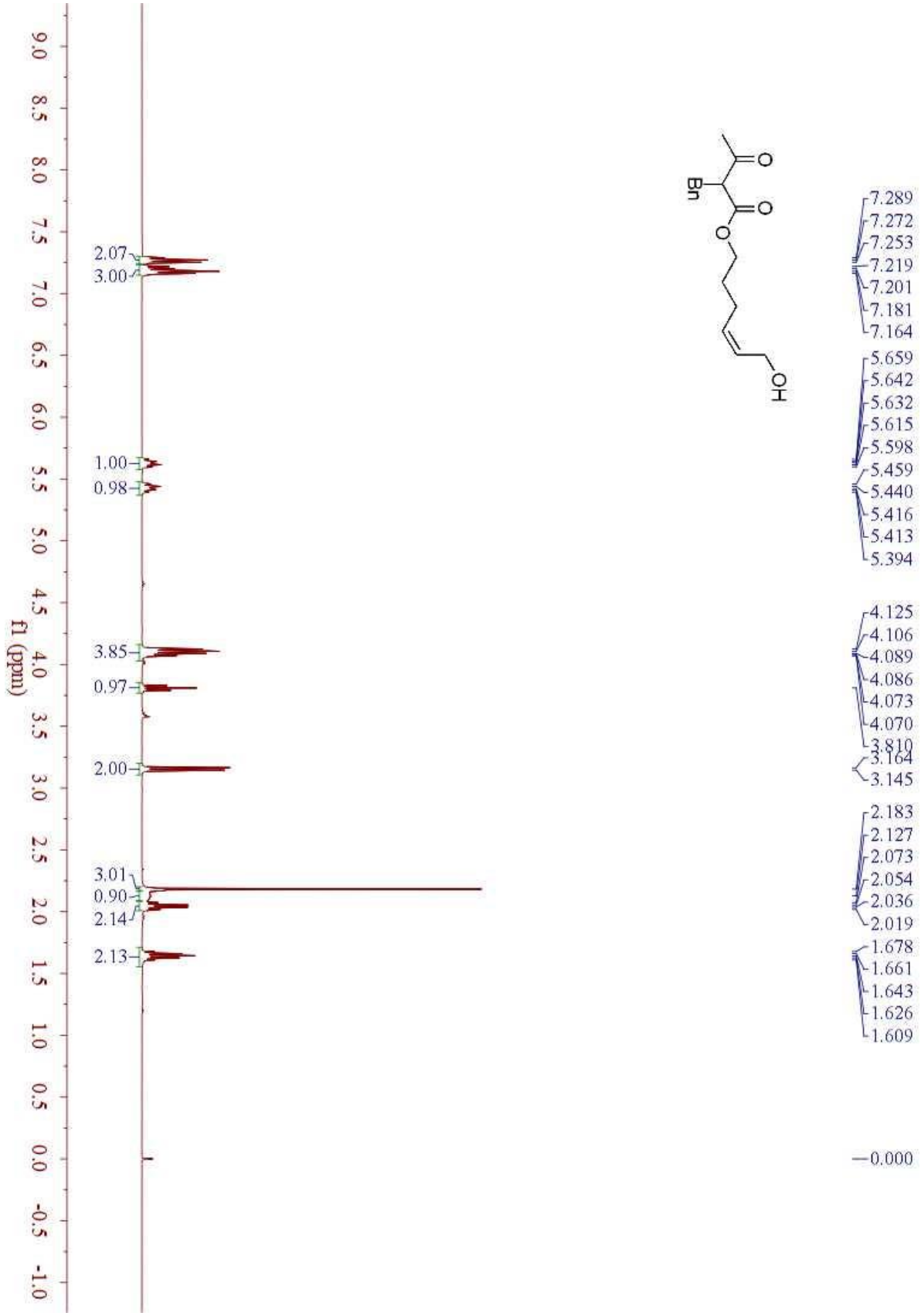
1ae ^{1}H NMR (400 MHz, $CDCl_3$)



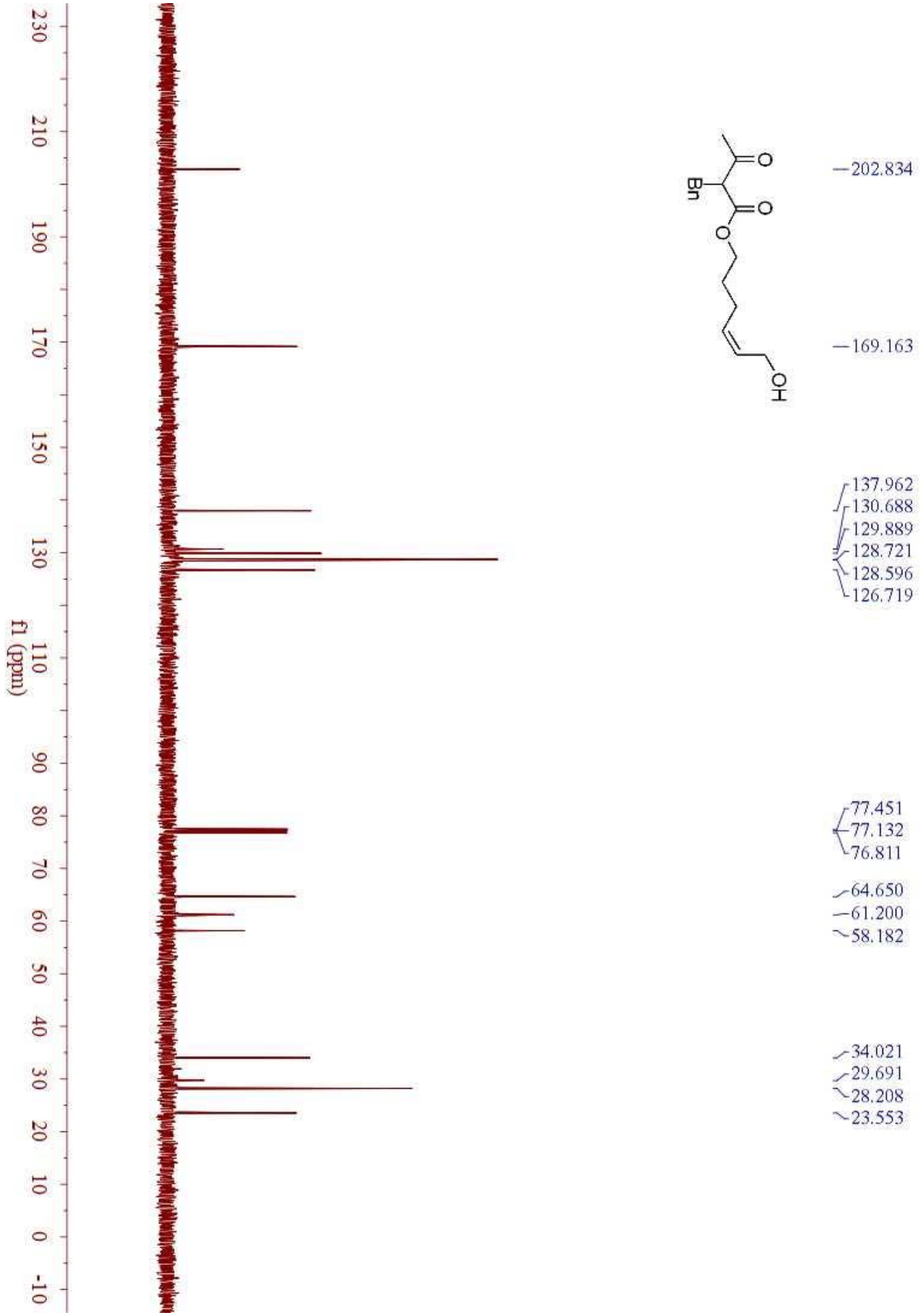
1ae ^{13}C NMR (100 MHz, $CDCl_3$)



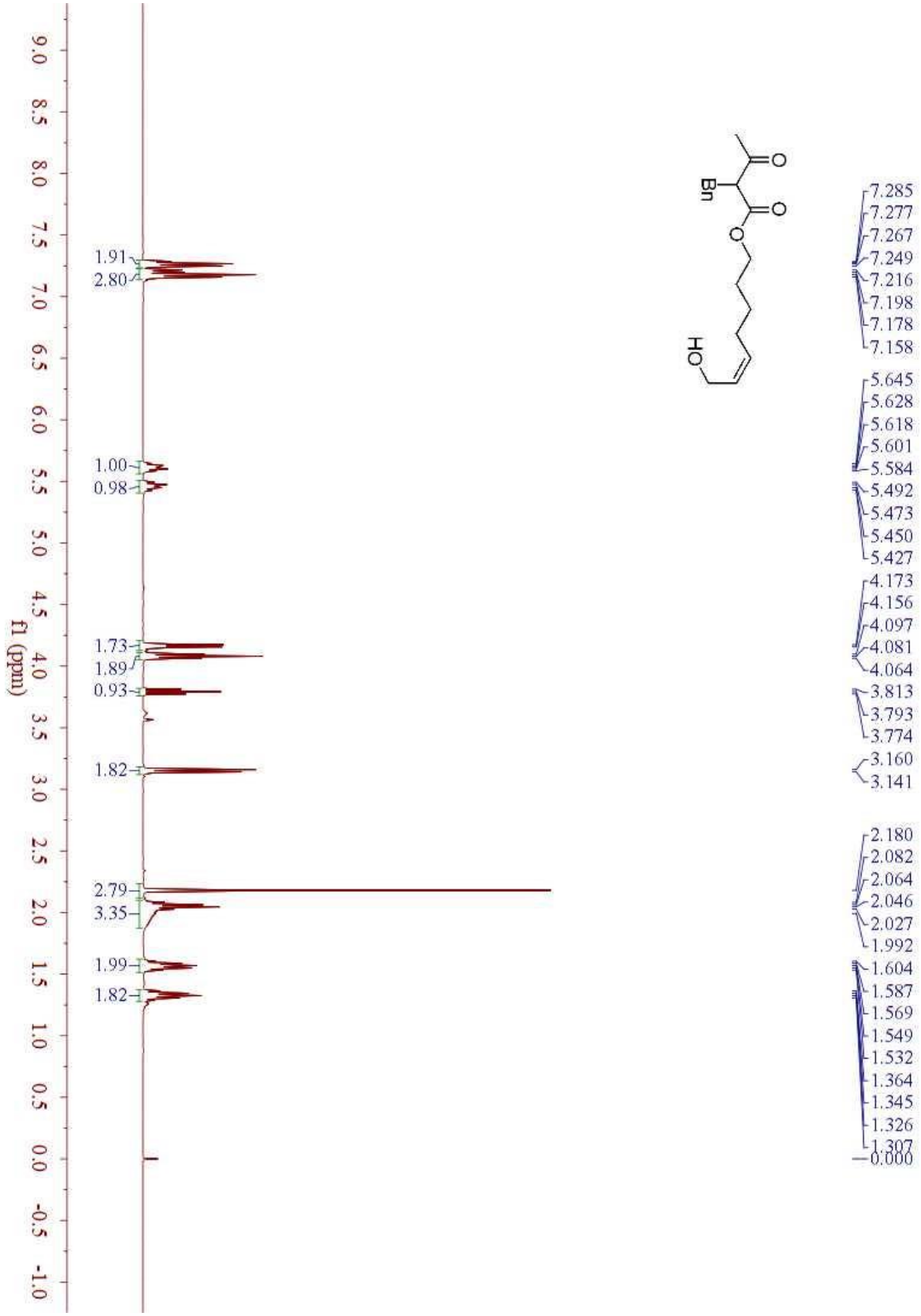
1af ^{1}H NMR (400 MHz, $CDCl_3$)



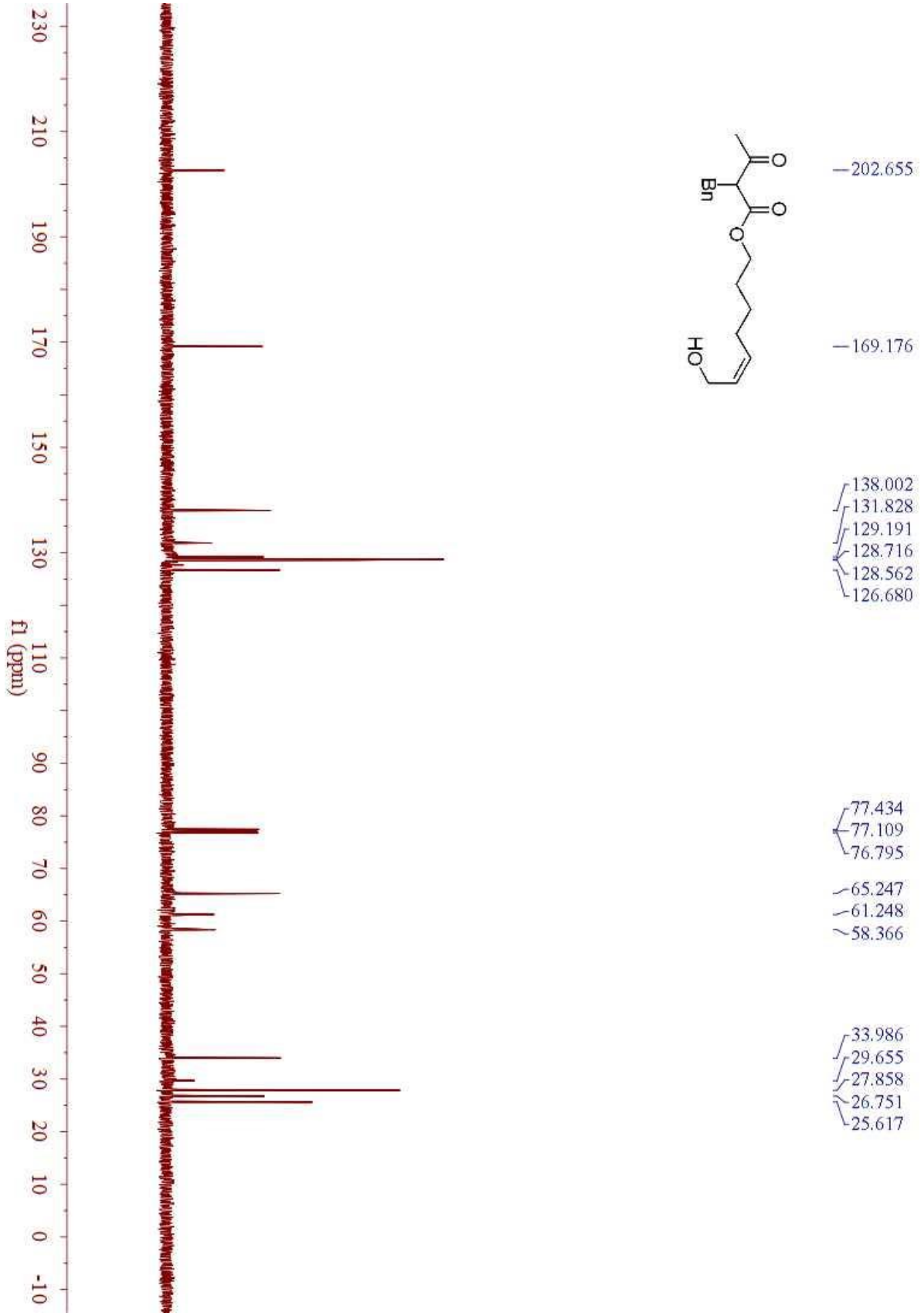
1af ^{13}C NMR (100 MHz, $CDCl_3$)



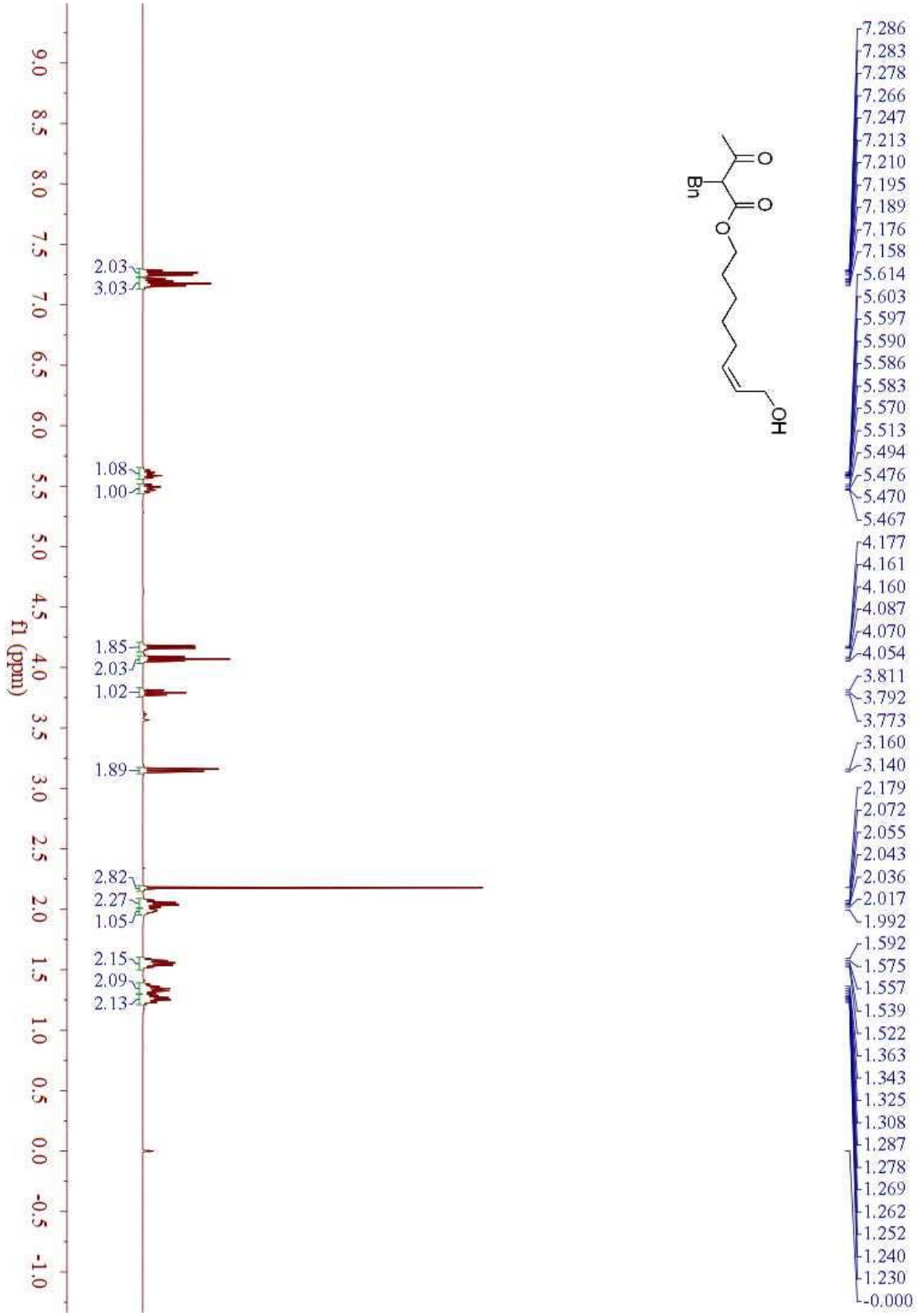
1ag ^{1}H NMR (400 MHz, $CDCl_3$)



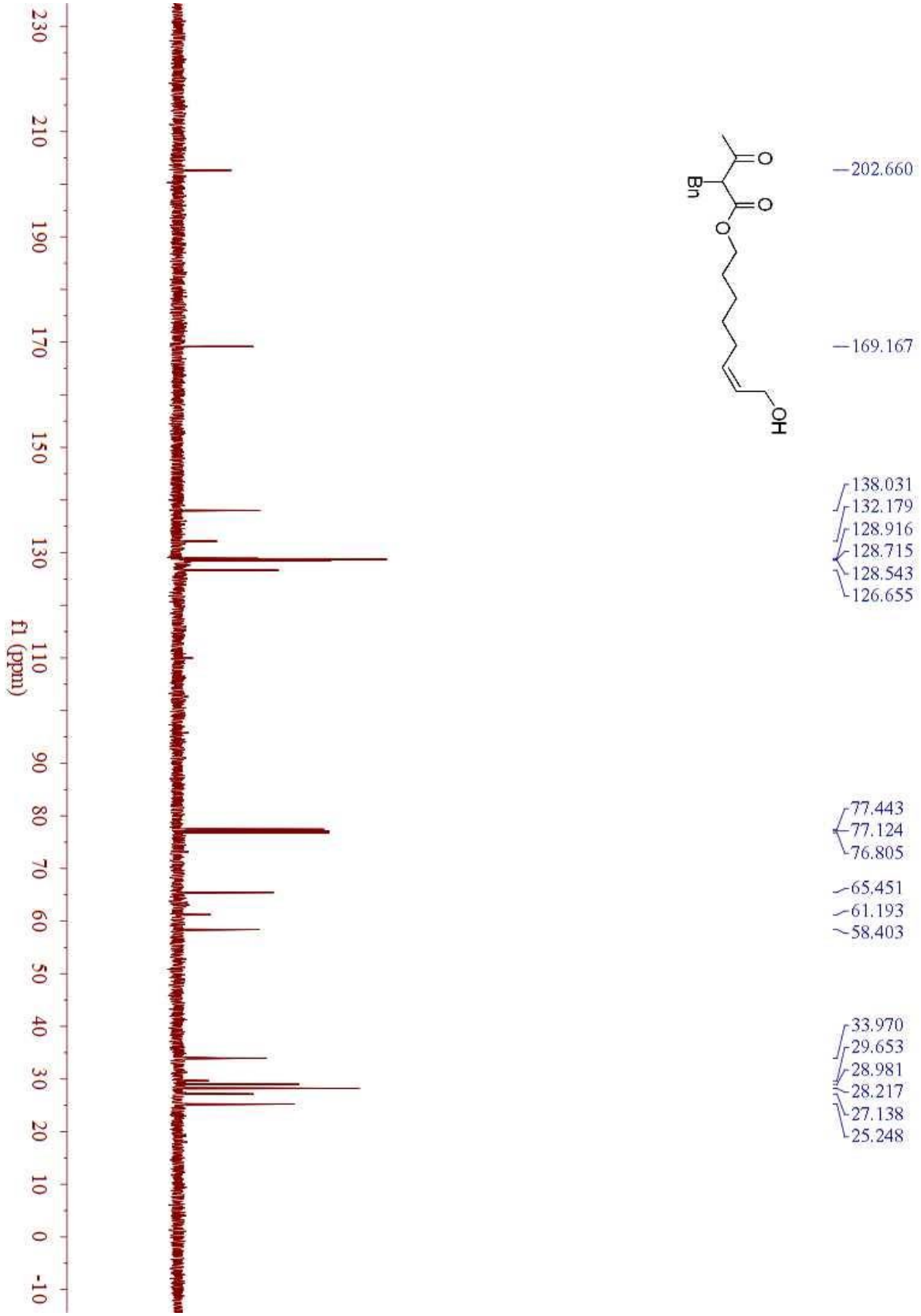
1ag ^{13}C NMR (100 MHz, $CDCl_3$)



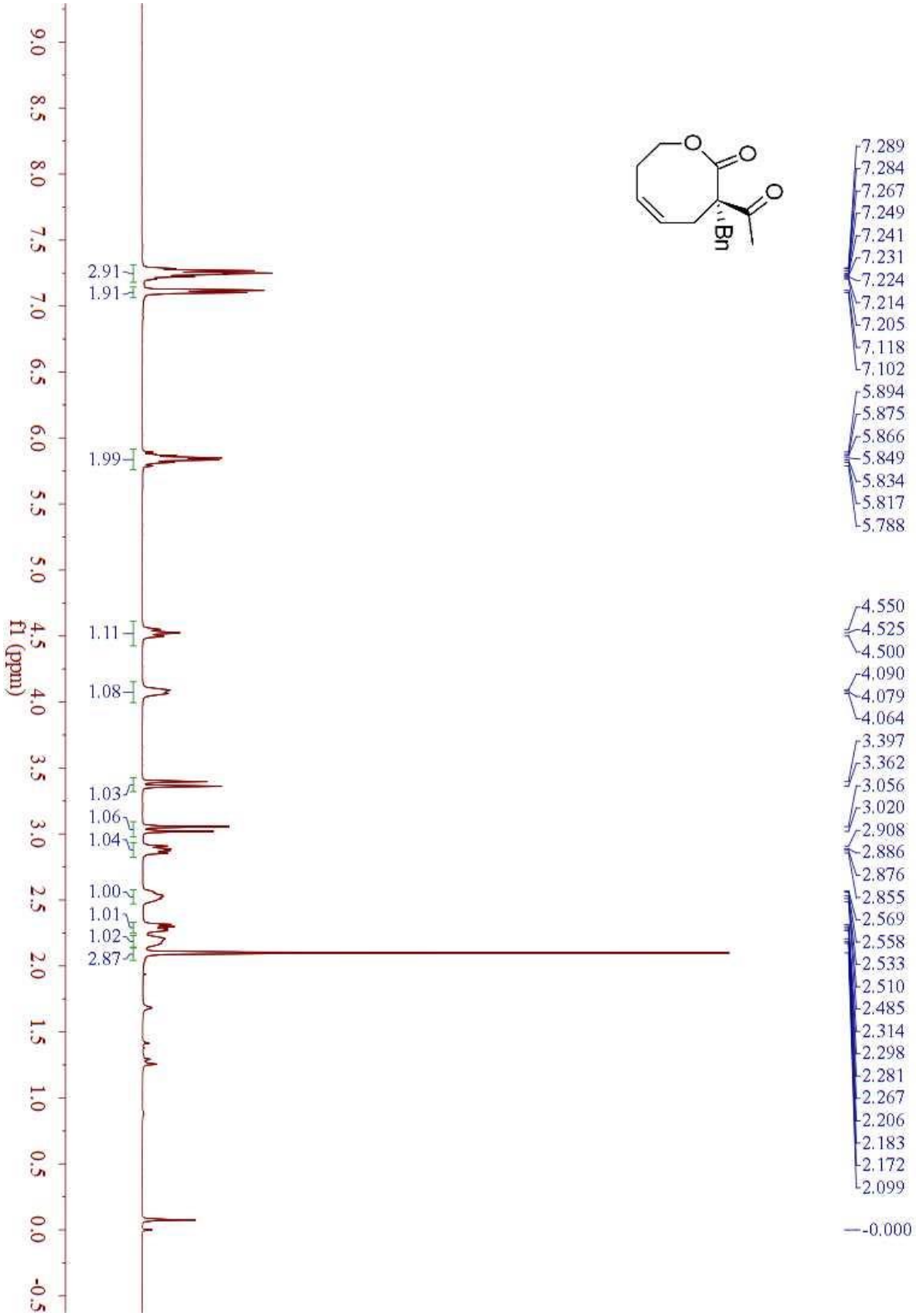
1ah ^{1}H NMR (400 MHz, $CDCl_3$)



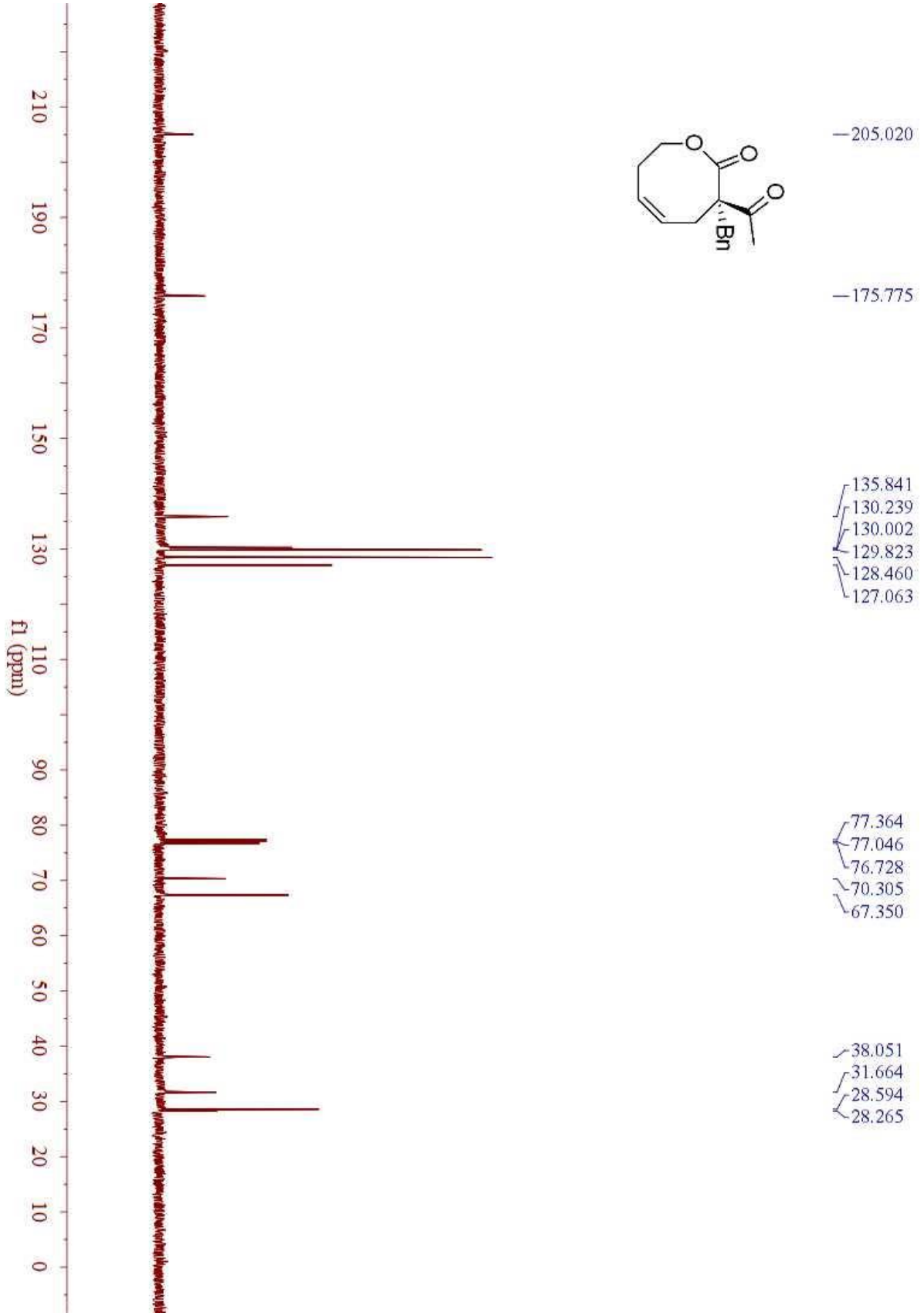
1ah ^{13}C NMR (100 MHz, $CDCl_3$)



2a ^{1}H NMR (400 MHz, $CDCl_3$)



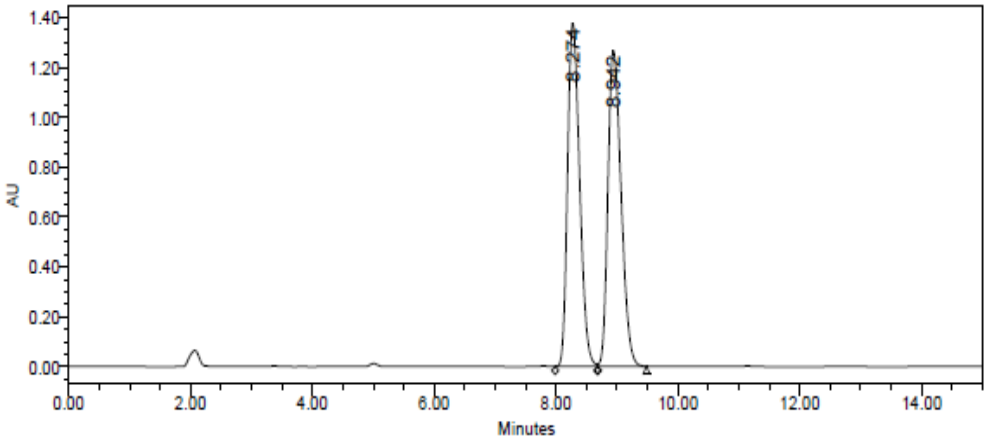
2a ^{13}C NMR (100 MHz, $CDCl_3$)



2a HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-69-1.4mmolrac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgg
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	dl1870rac
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	10/8/2019 9:39:05 AM CST		
Date Processed:	4/15/2020 11:49:24 AM CST		



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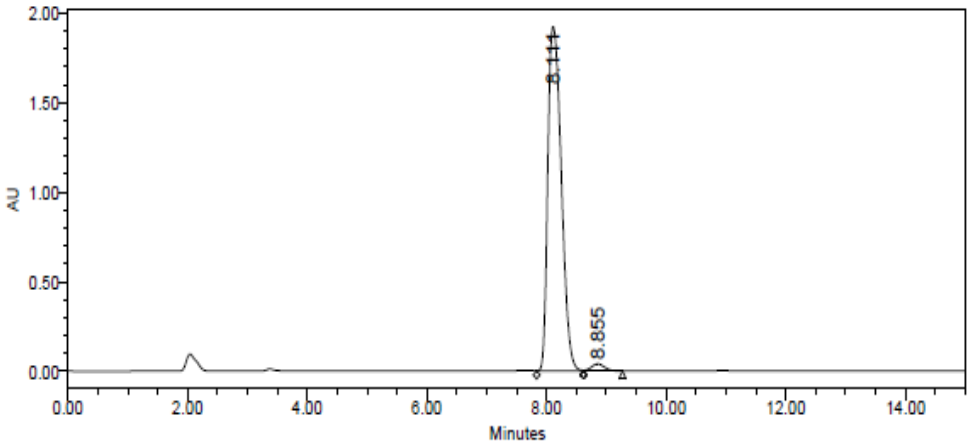
2	8.942	19001280	50.13	1271236

2a HPLC: chiral sample

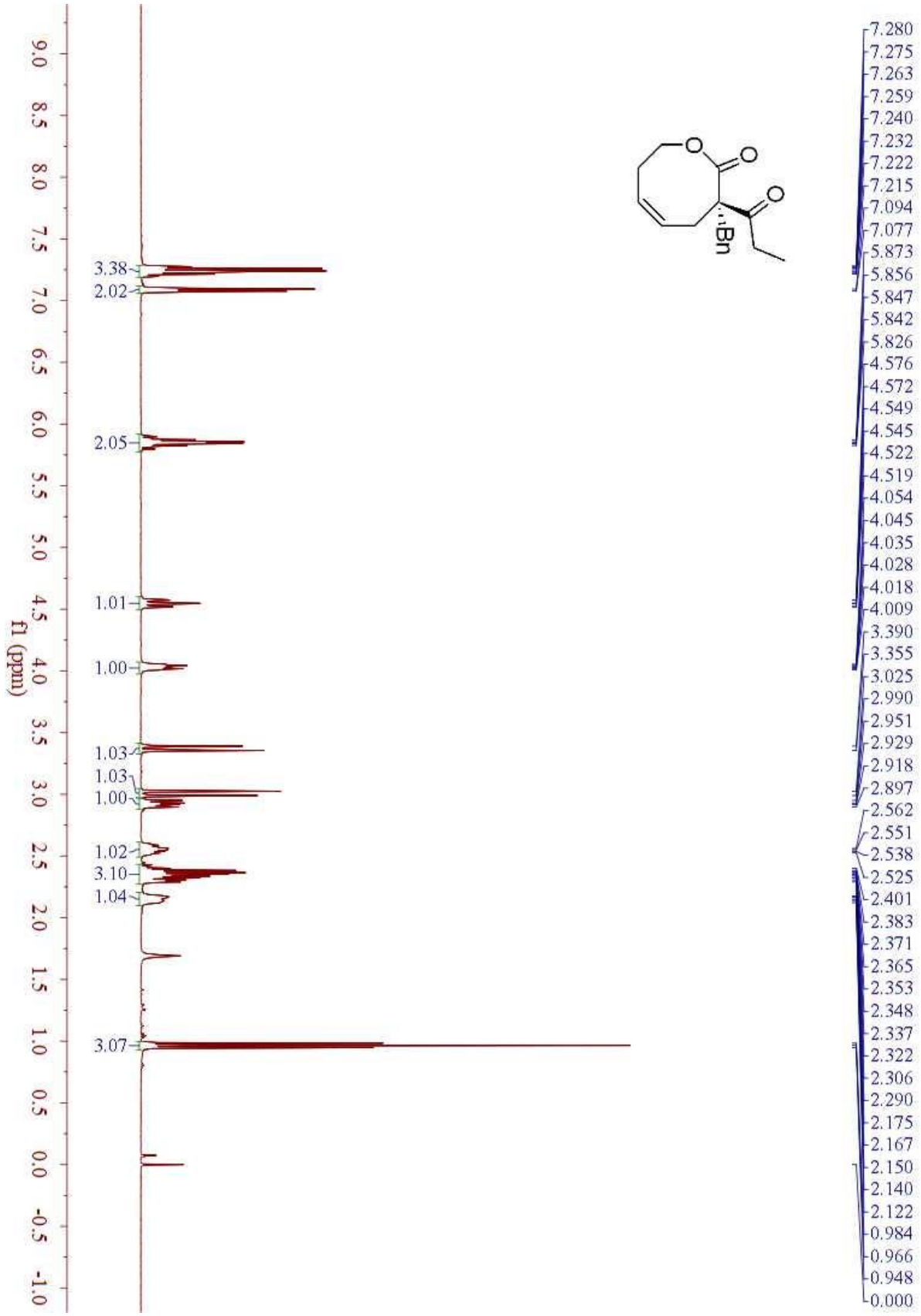
SAMPLE INFORMATION

Sample Name:	dl-18-70-0.2mmolchiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgg
Vial:	1:A,4	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	dfrfr
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	10/8/2019 10:09:54 AM CST		
Date Processed:	4/15/2020 12:00:27 PM CST		

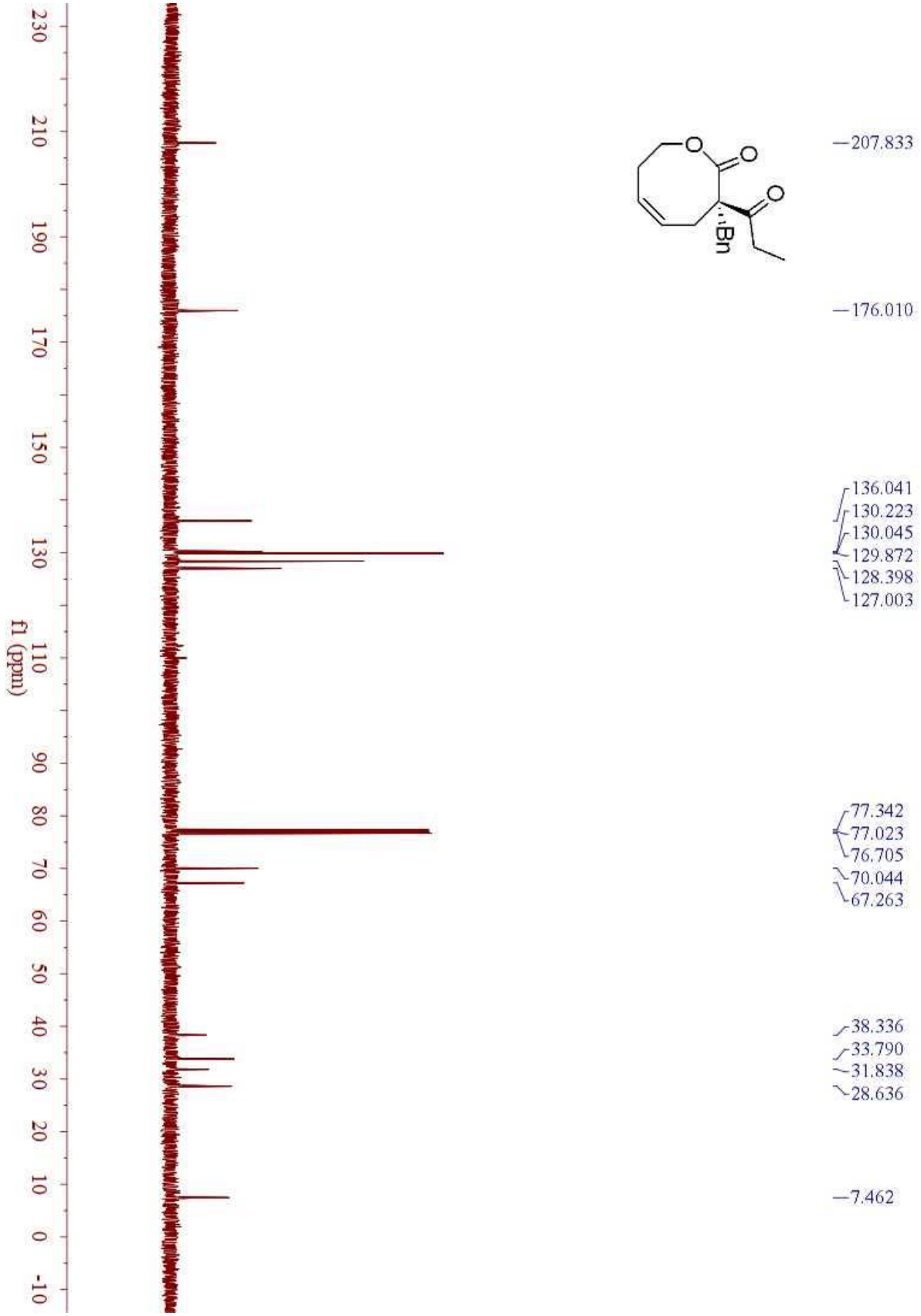


	RT	Area	% Area	Height
1	8.111	30102511	98.07	1924387
2	8.855	593889	1.93	39846

2b ^{1}H NMR (400 MHz, $CDCl_3$)



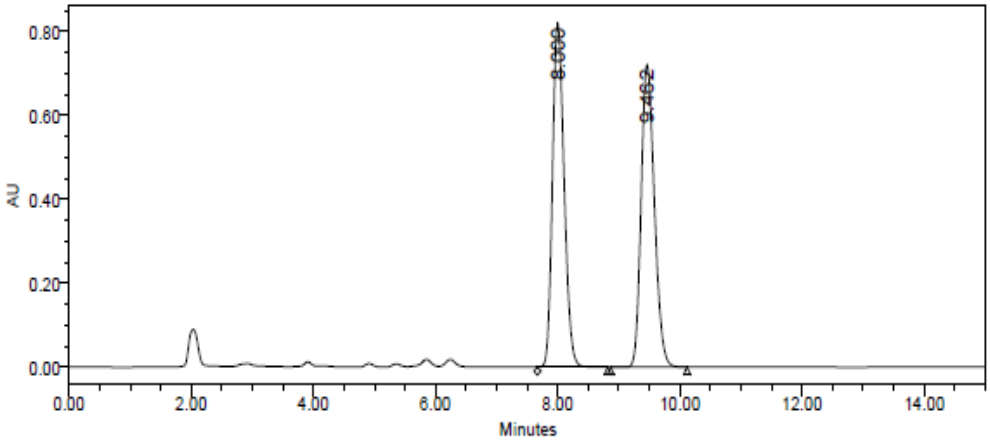
2b ^{13}C NMR (100 MHz, $CDCl_3$)



2b HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-71-Et-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	hfgyhgg
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/25/2019 11:43:06 PM CST		
Date Processed:	4/15/2020 12:11:57 PM CST		

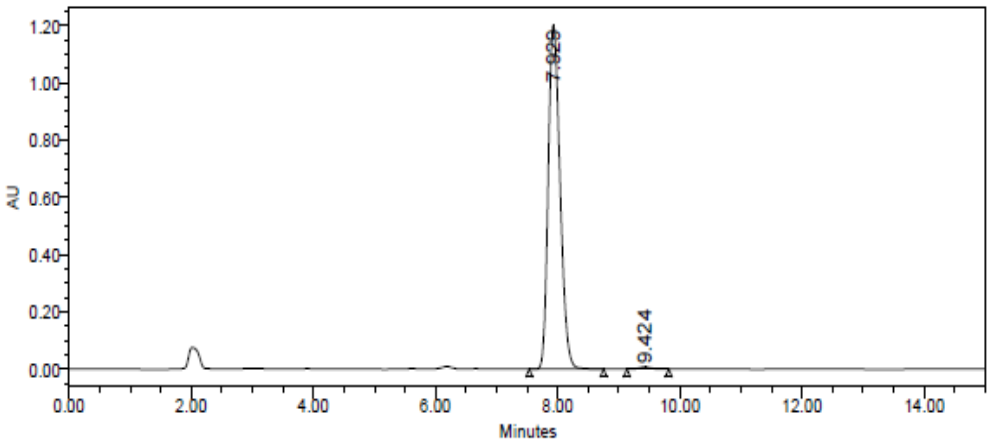


	RT	Area	% Area	Height
1	8.000	10877420	49.98	820658
2	9.462	10886218	50.02	721849

2b HPLC: chiral sample

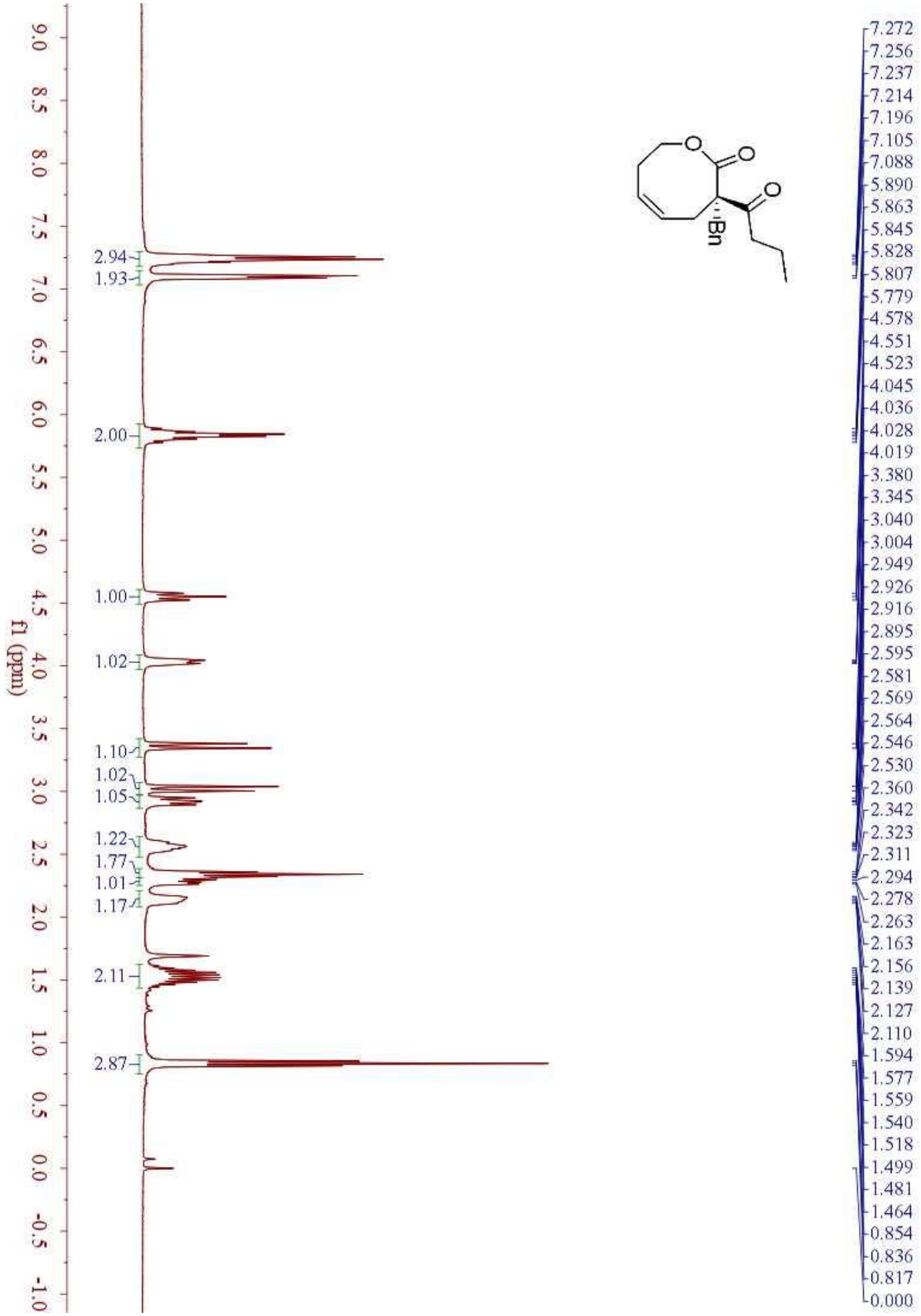
SAMPLE INFORMATION

Sample Name:	dl-17-71-Et-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	ghfgf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/25/2019 11:58:32 PM CST		
Date Processed:	4/15/2020 12:13:00 PM CST		

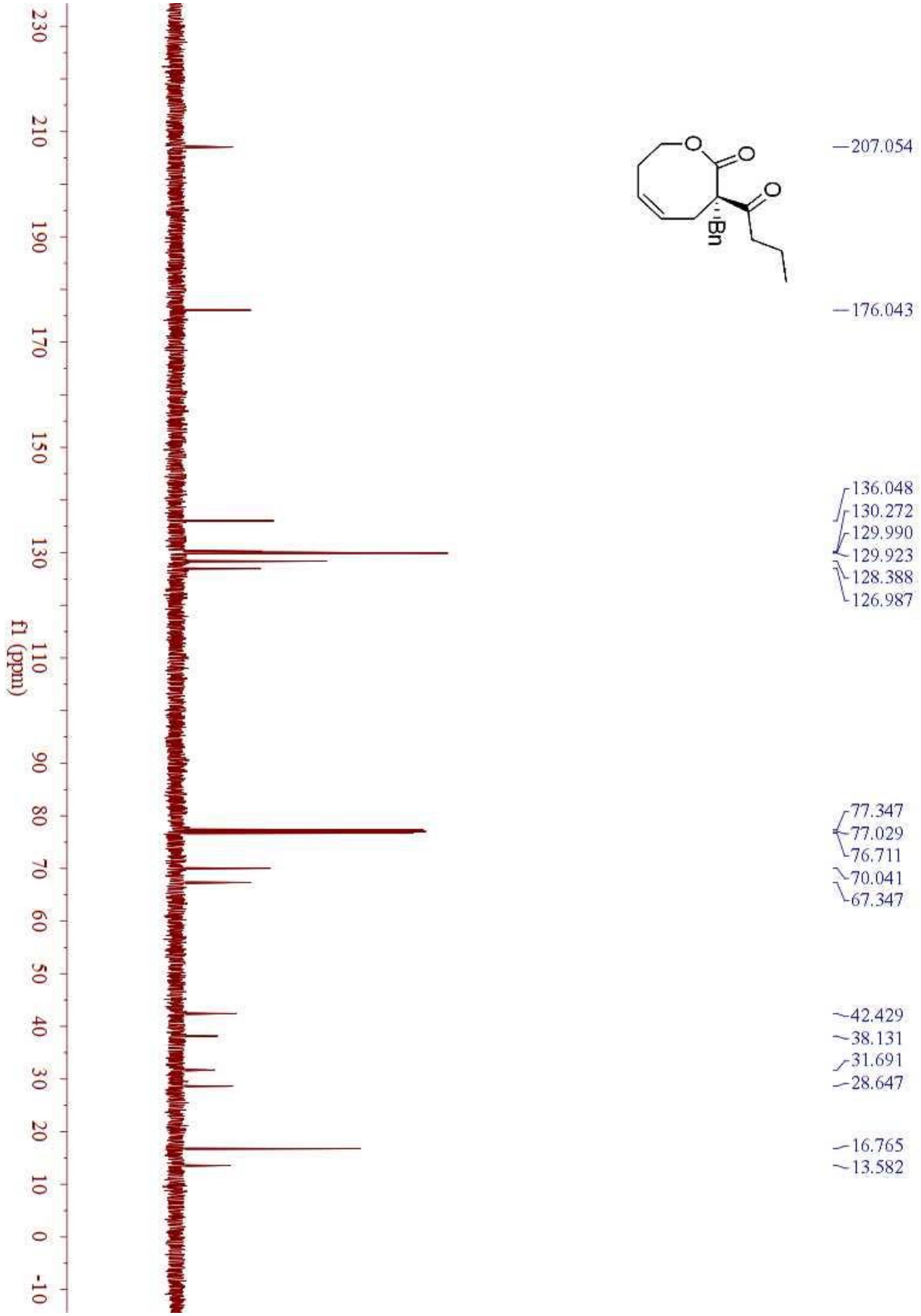


	RT	Area	% Area	Height
1	7.929	16188216	99.33	1204469
2	9.424	108729	0.67	7505

2c ^{1}H NMR (400 MHz, $CDCl_3$)



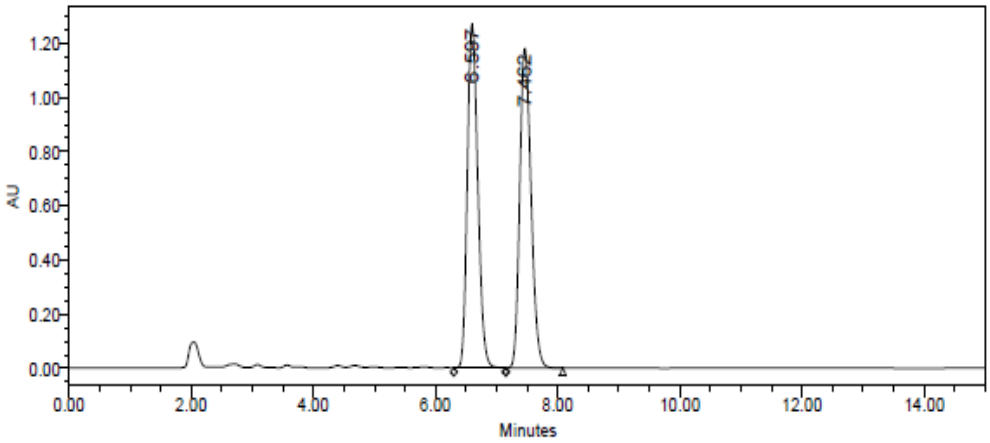
2c ^{13}C NMR (100 MHz, $CDCl_3$)



2c HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-72-pro-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:A,4	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	hjgjgj
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 12:13:55 AM CST		
Date Processed:	4/15/2020 12:13:51 PM CST		

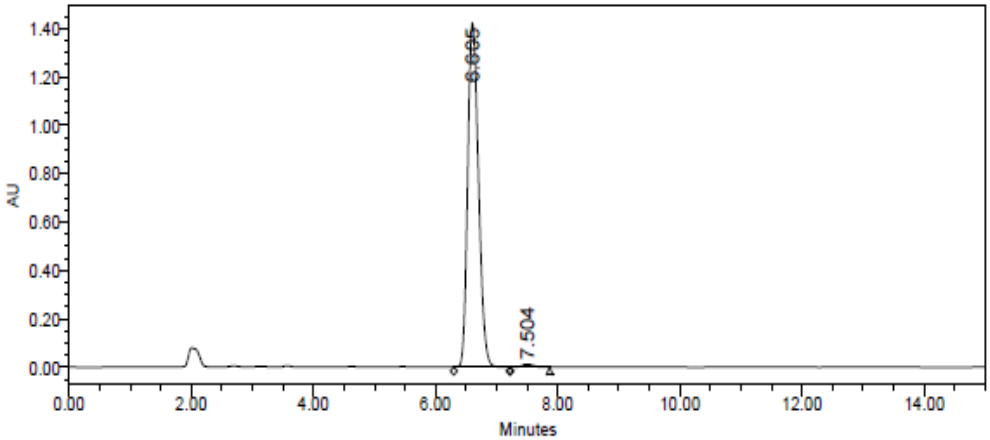


	RT	Area	% Area	Height
1	6.597	15134065	49.92	1271397
2	7.462	15182889	50.08	1181895

2c HPLC: chiral sample

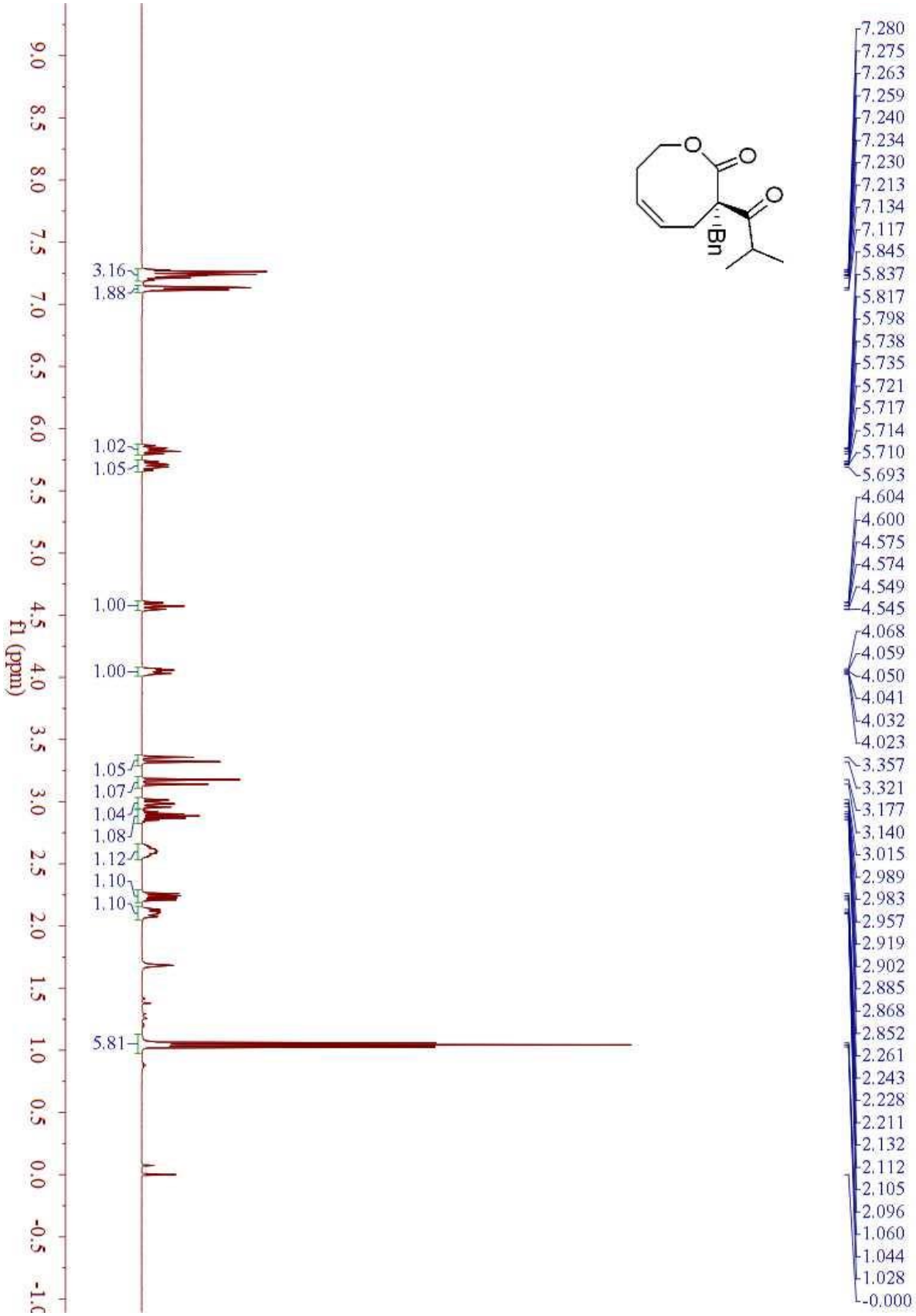
SAMPLE INFORMATION

Sample Name:	dl-17-72-pro-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:A,5	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	fgrfdrf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 12:29:22 AM CST		
Date Processed:	4/15/2020 12:14:44 PM CST		

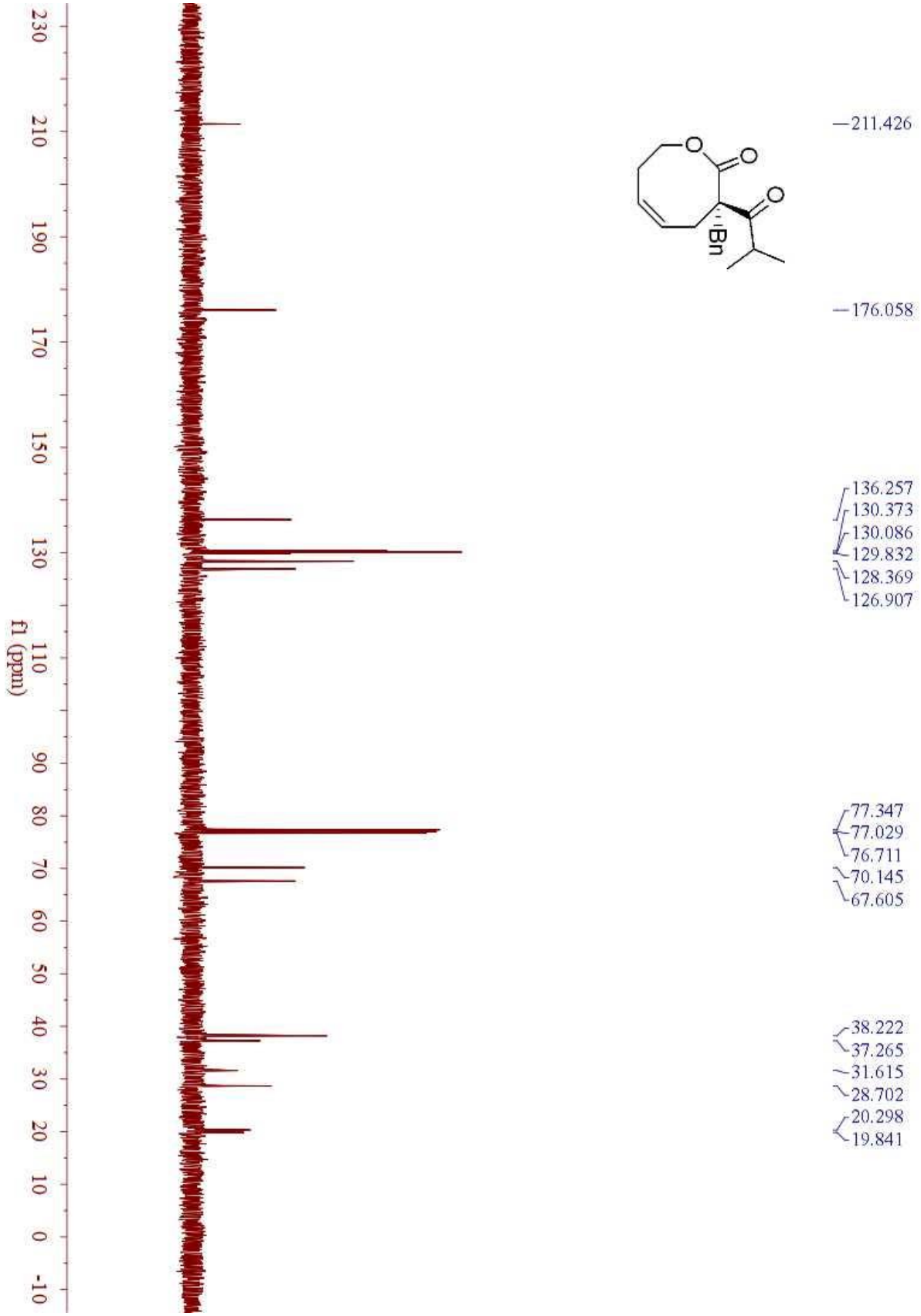


	RT	Area	% Area	Height
1	6.605	17392039	99.10	1424699
2	7.504	157424	0.90	12249

2d ^{1}H NMR (400 MHz, $CDCl_3$)



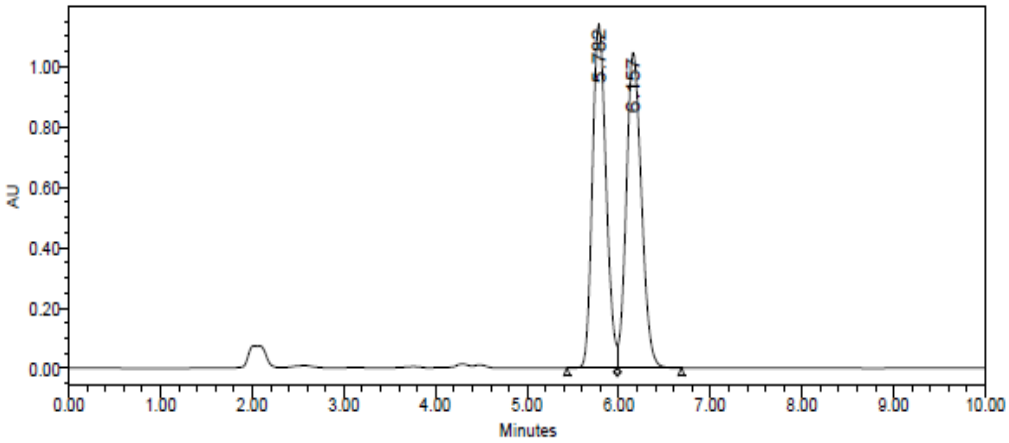
2d ^{13}C NMR (100 MHz, $CDCl_3$)



2d HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-73-isopro-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:A,6	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	fgfxdgfgf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 12:44:48 AM CST		
Date Processed:	4/15/2020 12:16:01 PM CST		

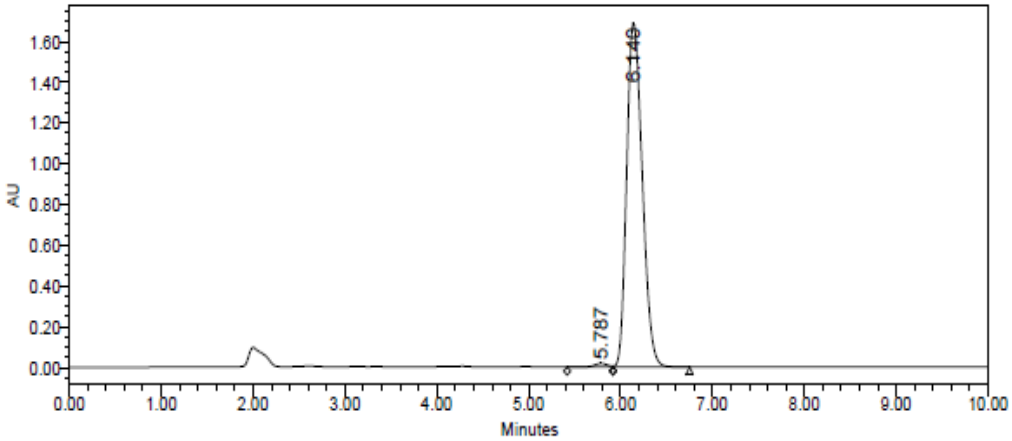


	RT	Area	% Area	Height
1	5.782	11785737	49.54	1140771
2	6.157	12003599	50.46	1048610

2d HPLC: chiral sample

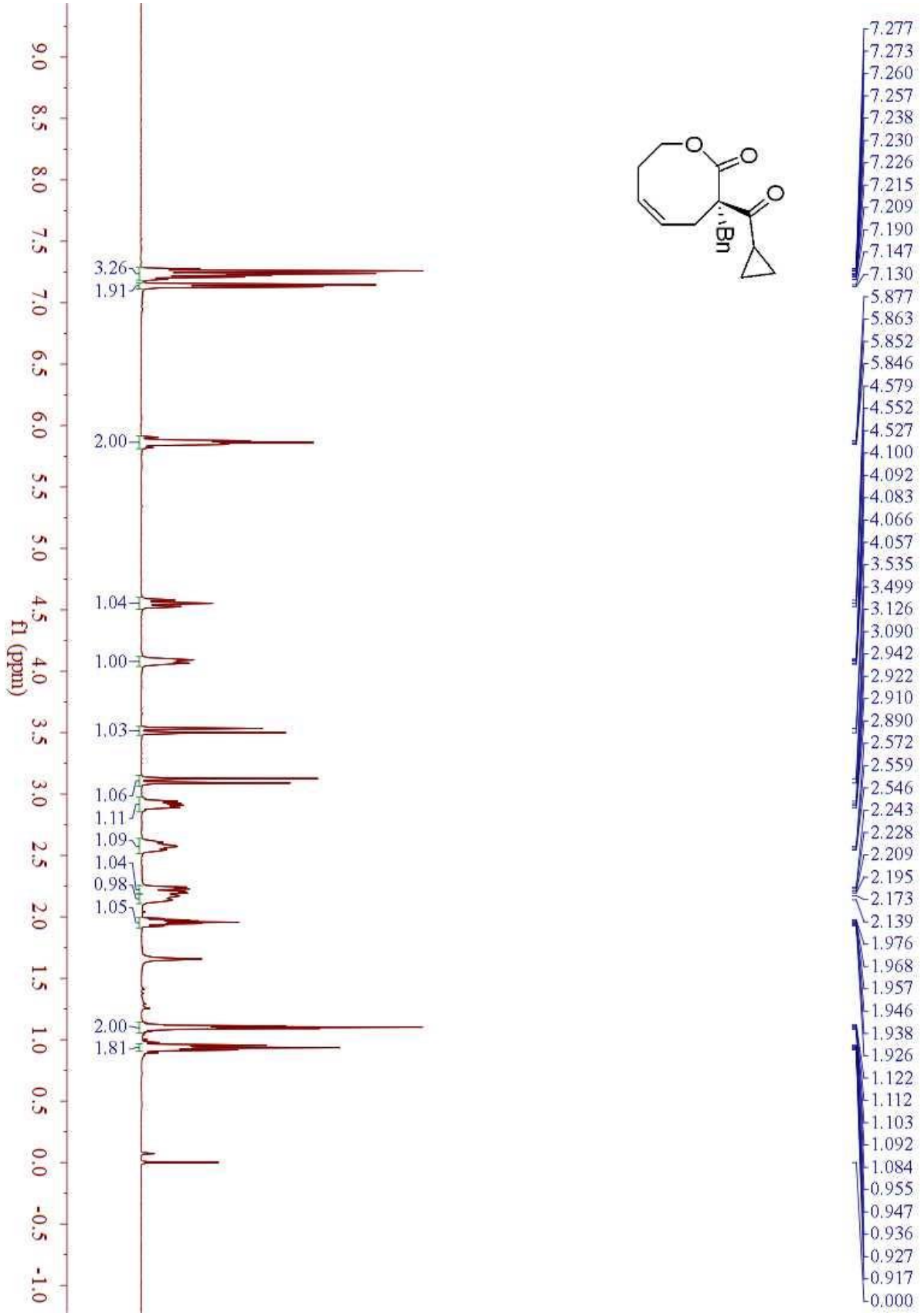
SAMPLE INFORMATION

Sample Name:	dl-17-73-isopro-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:A,7	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	hggh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 12:55:12 AM CST		
Date Processed:	4/15/2020 12:16:52 PM CST		

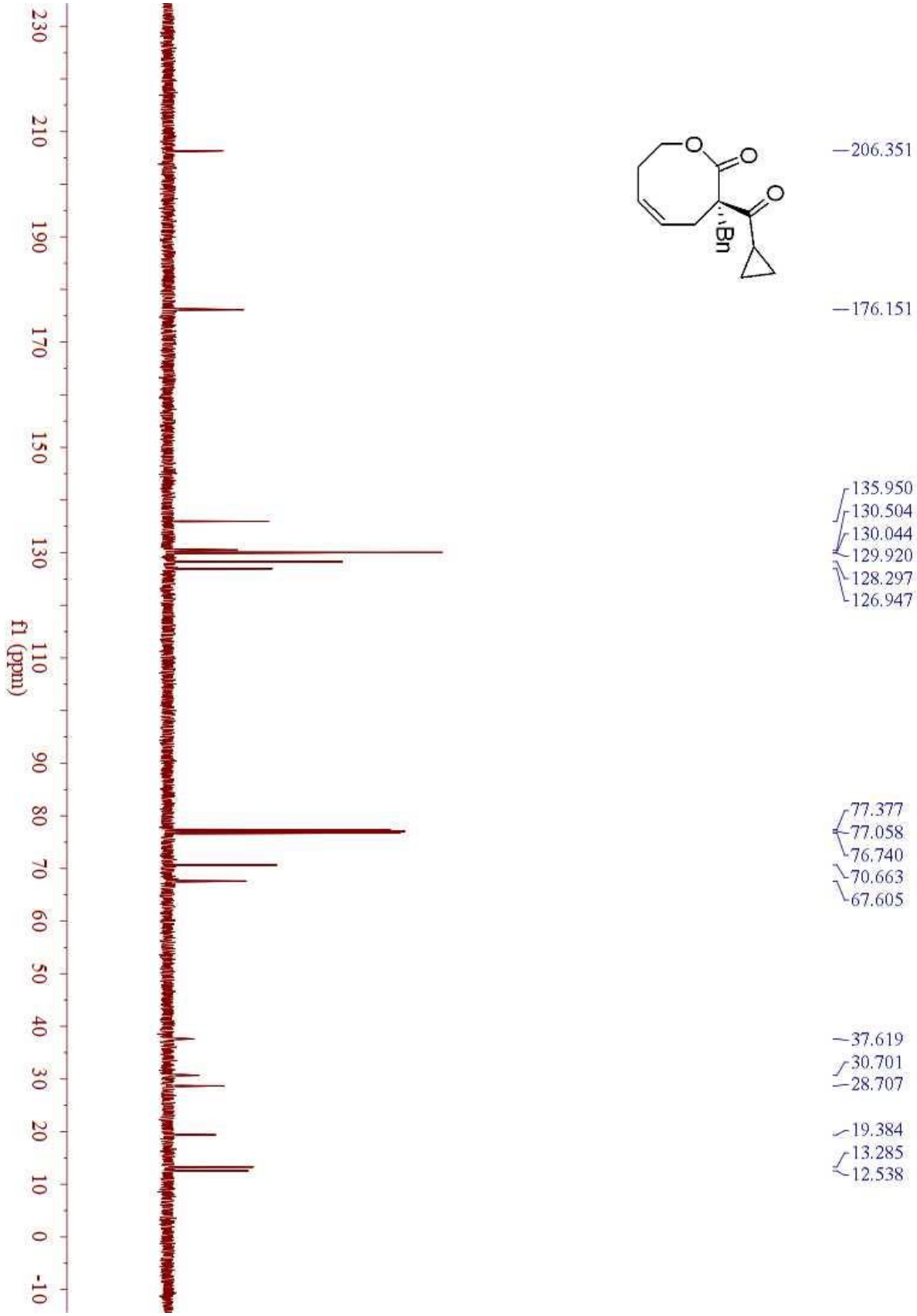


	RT	Area	% Area	Height
1	5.787	180949	0.90	17742
2	6.140	19903578	99.10	1696335

2e ^{1}H NMR (400 MHz, $CDCl_3$)



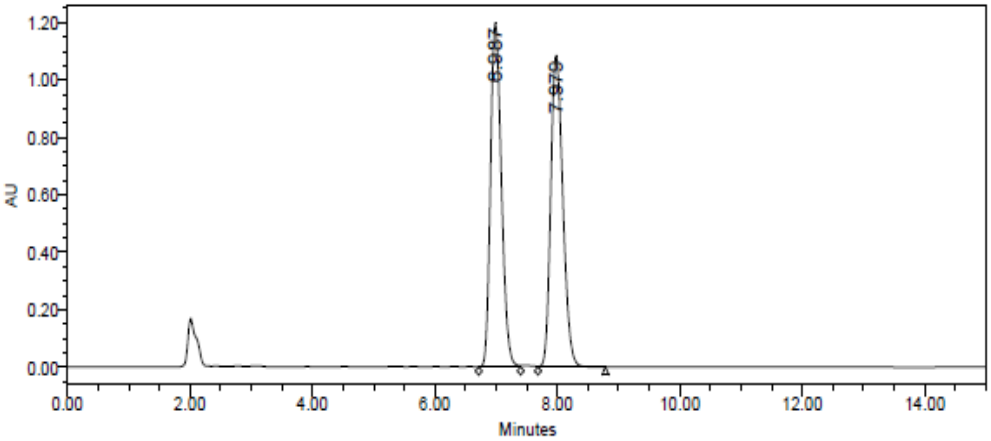
2e ^{13}C NMR (100 MHz, $CDCl_3$)



2e HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-75-cyclopro-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:A,8	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	dfsdrfde
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 1:05:37 AM CST		
Date Processed:	4/15/2020 12:17:47 PM CST		

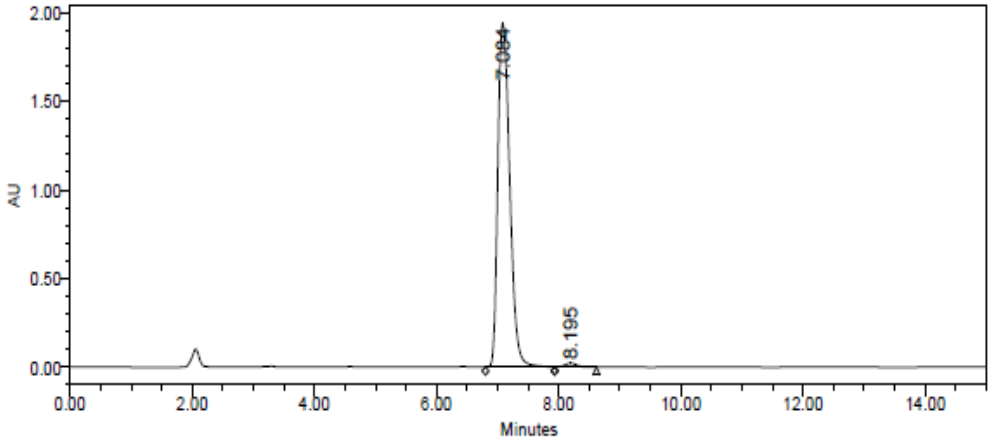


	RT	Area	% Area	Height
1	6.987	14808995	49.82	1199409
2	7.979	14917962	50.18	1085521

2e HPLC: chiral sample

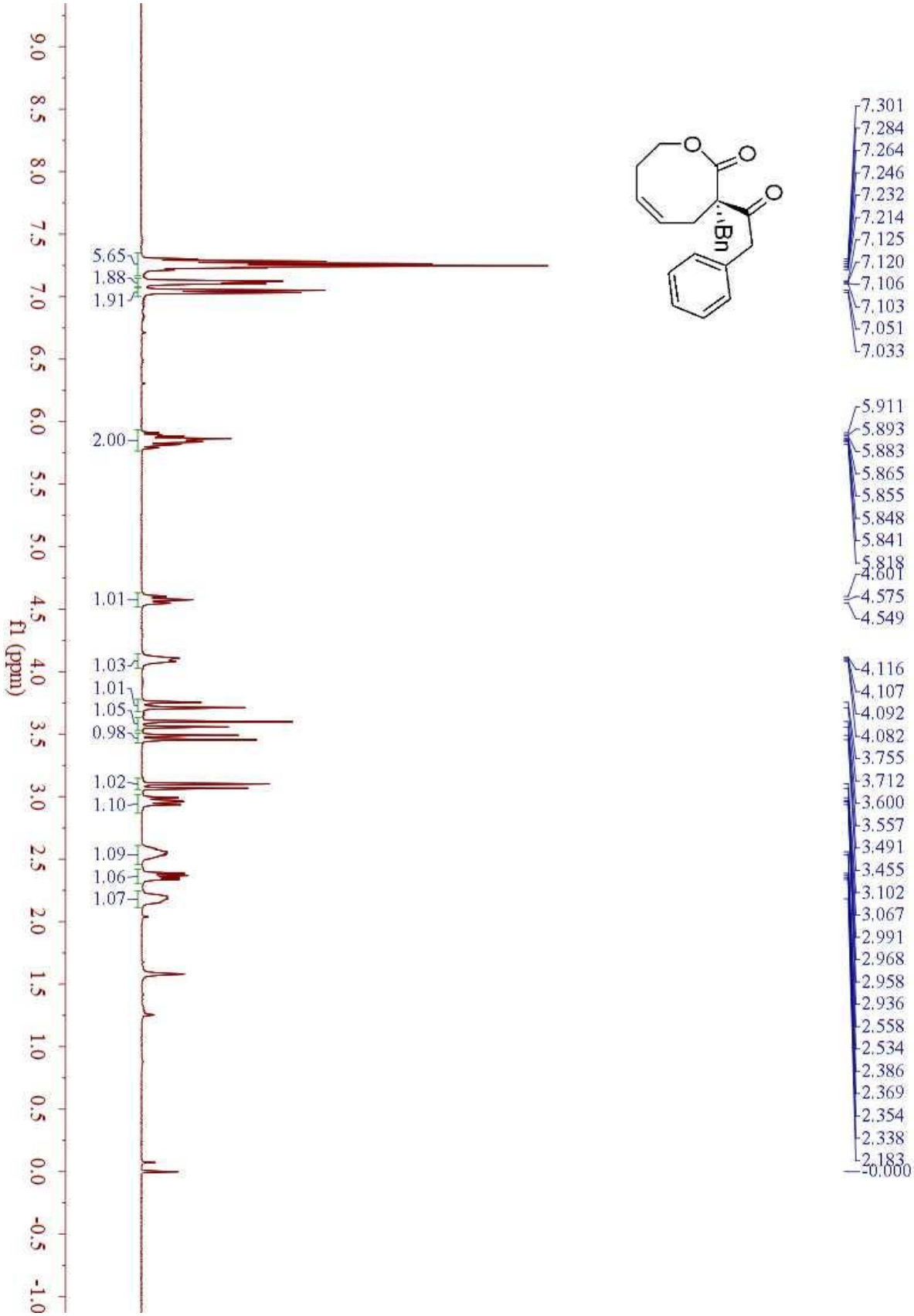
SAMPLE INFORMATION

Sample Name:	dl-17-75cyclopro-chiralic95/5214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gyhfh
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	uihuh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/24/2019 10:00:45 AM CST		
Date Processed:	4/15/2020 12:18:54 PM CST		

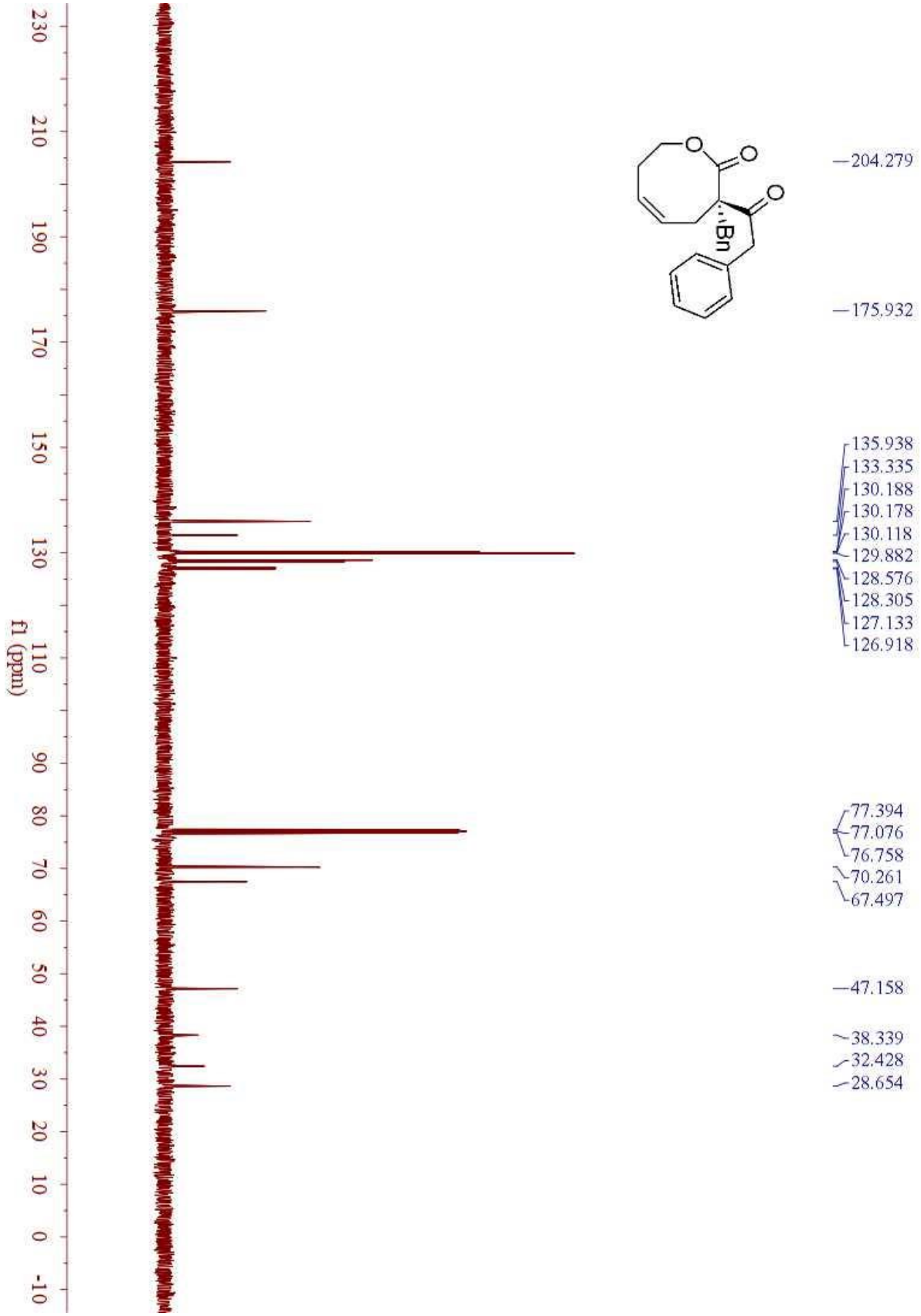


	RT	Area	% Area	Height
1	7.084	26357256	98.88	1944707
2	8.195	299108	1.12	21801

2f ^{1}H NMR (400 MHz, $CDCl_3$)



2f ^{13}C NMR (100 MHz, $CDCl_3$)

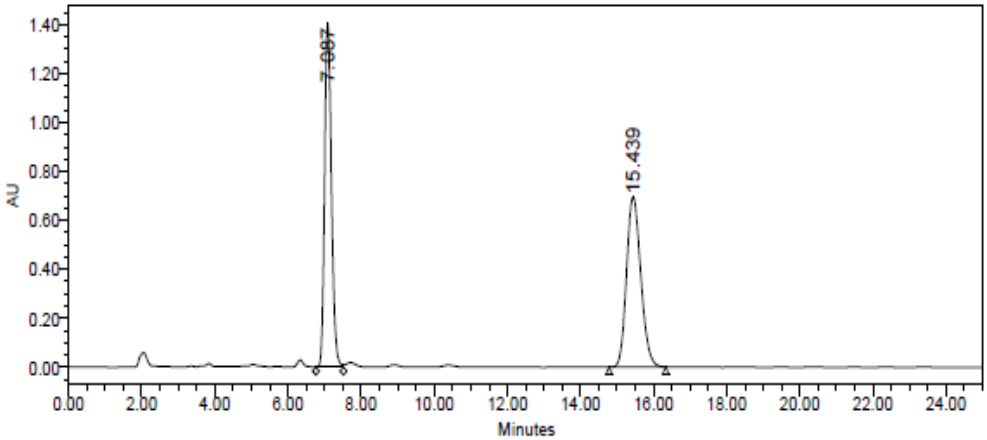


2f HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-100-1-rac-ic9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgf
Vial:	1:A,2	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	fcdvc
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 9/8/2019 5:38:56 PM CST
Date Processed: 4/15/2020 12:27:22 PM CST

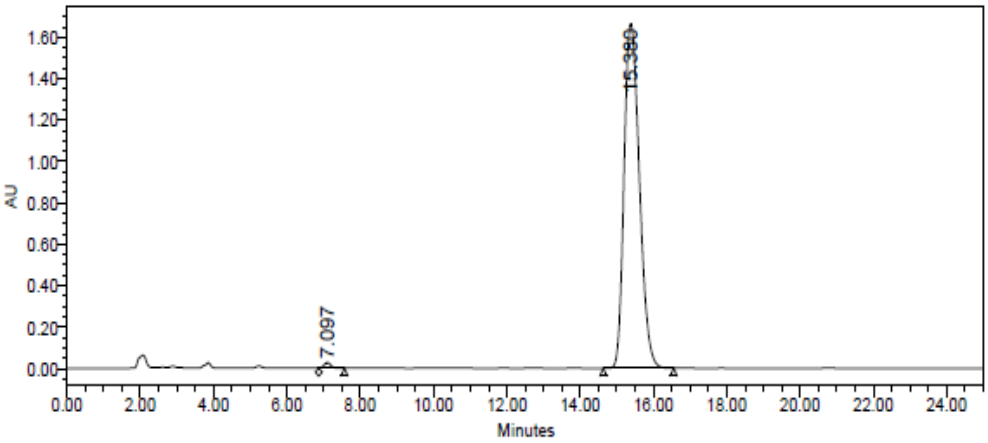


	RT	Area	% Area	Height
1	7.087	18256946	49.25	1407671
2	15.439	18811519	50.75	695905

2f HPLC: chiral sample

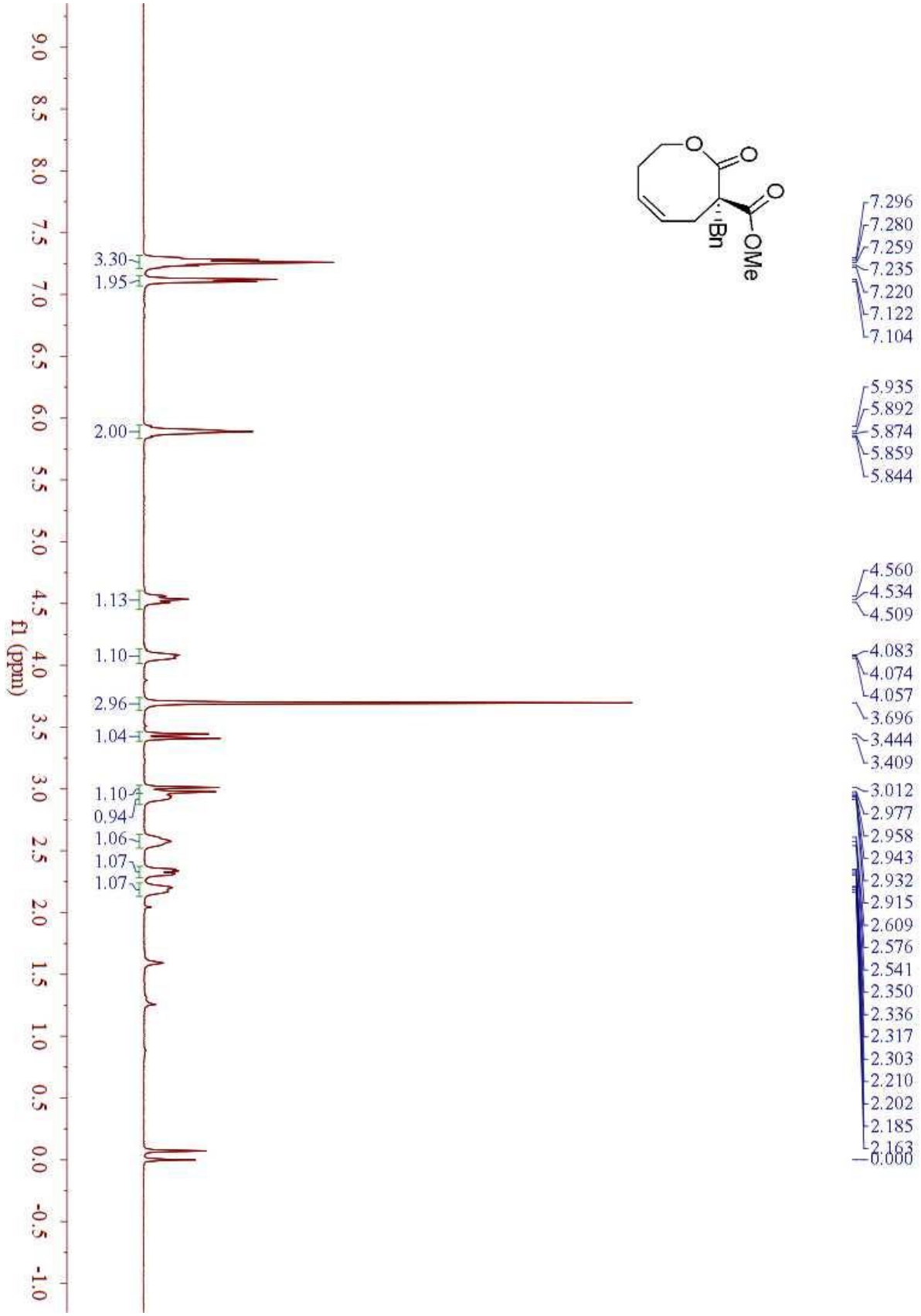
SAMPLE INFORMATION

Sample Name:	dl-17-100-2-chiral-ic9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgf
Vial:	1:A,3	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	xcxzc
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 6:04:20 PM CST		
Date Processed:	4/15/2020 12:28:23 PM CST		

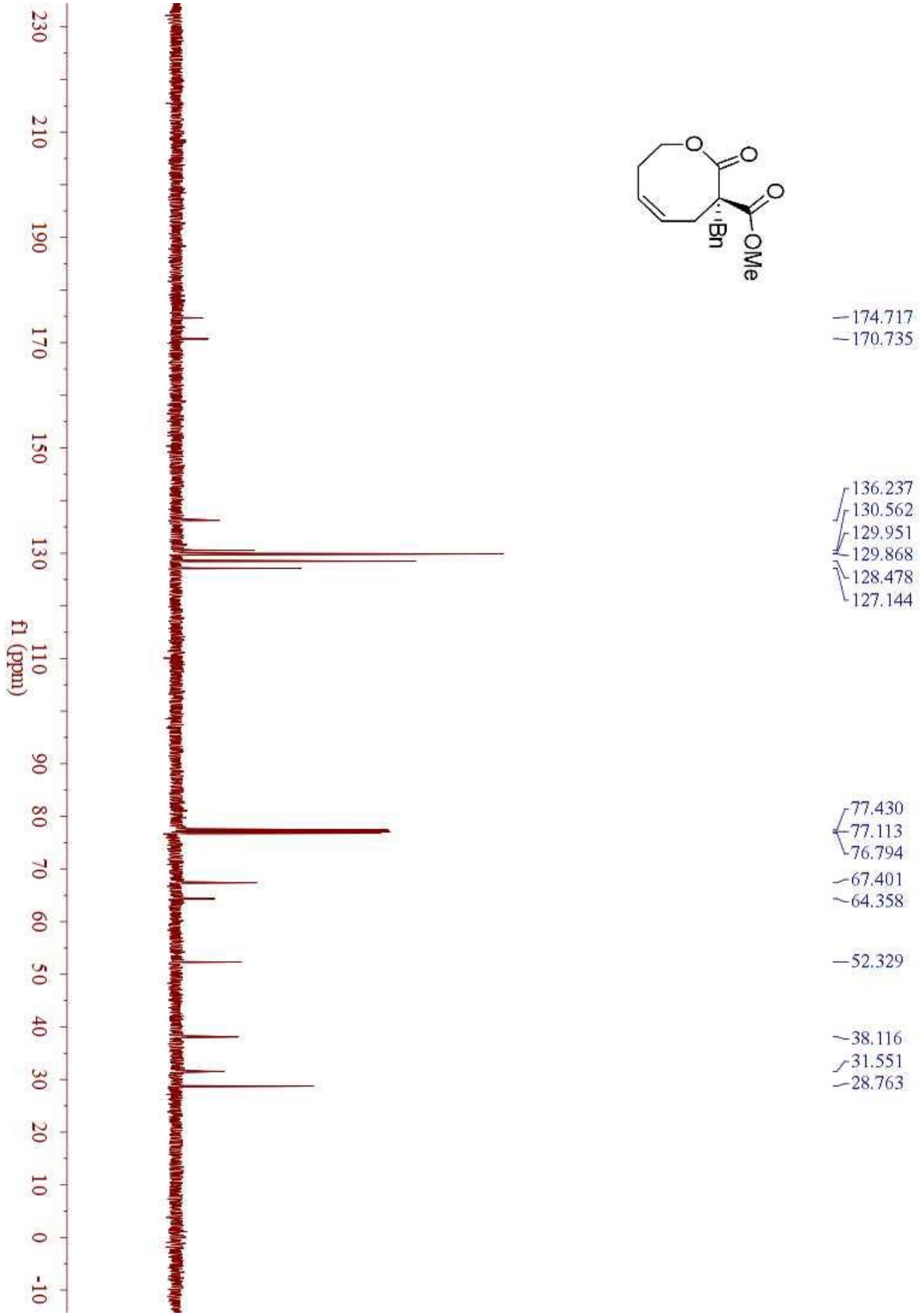


	RT	Area	% Area	Height
1	7.097	354746	0.73	27281
2	15.380	48340066	99.27	1665086

2g ^{1}H NMR (400 MHz, $CDCl_3$)



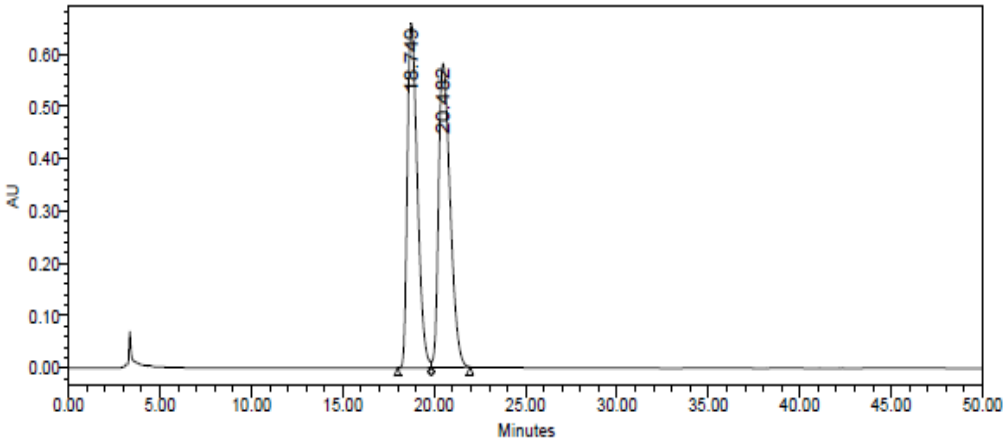
2g ^{13}C NMR (100 MHz, $CDCl_3$)



2g HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-79-1-rac-ig9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fffd
Vial:	1:A,2	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	tdrtrt
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	50.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/15/2019 7:08:18 PM CST		
Date Processed:	4/15/2020 12:09:32 PM CST		

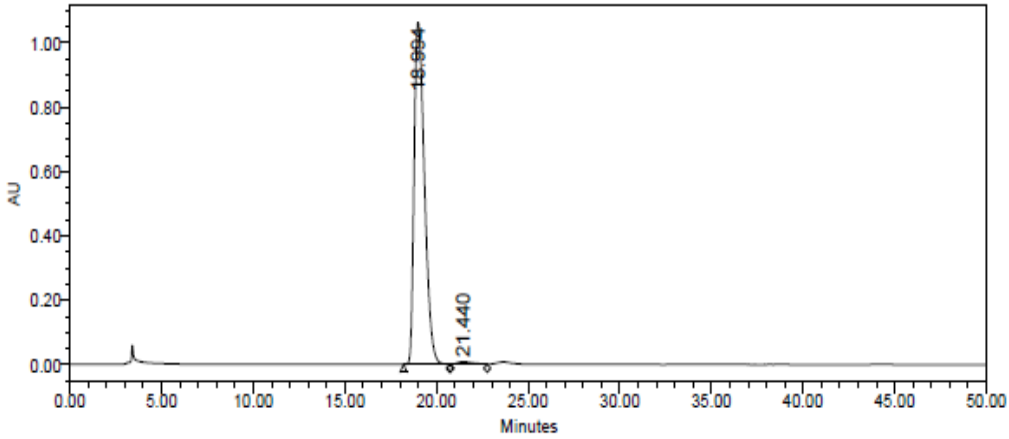


	RT	Area	% Area	Height
1	18.749	24986988	49.45	658844
2	20.482	25546722	50.55	581096

2g HPLC: chiral sample

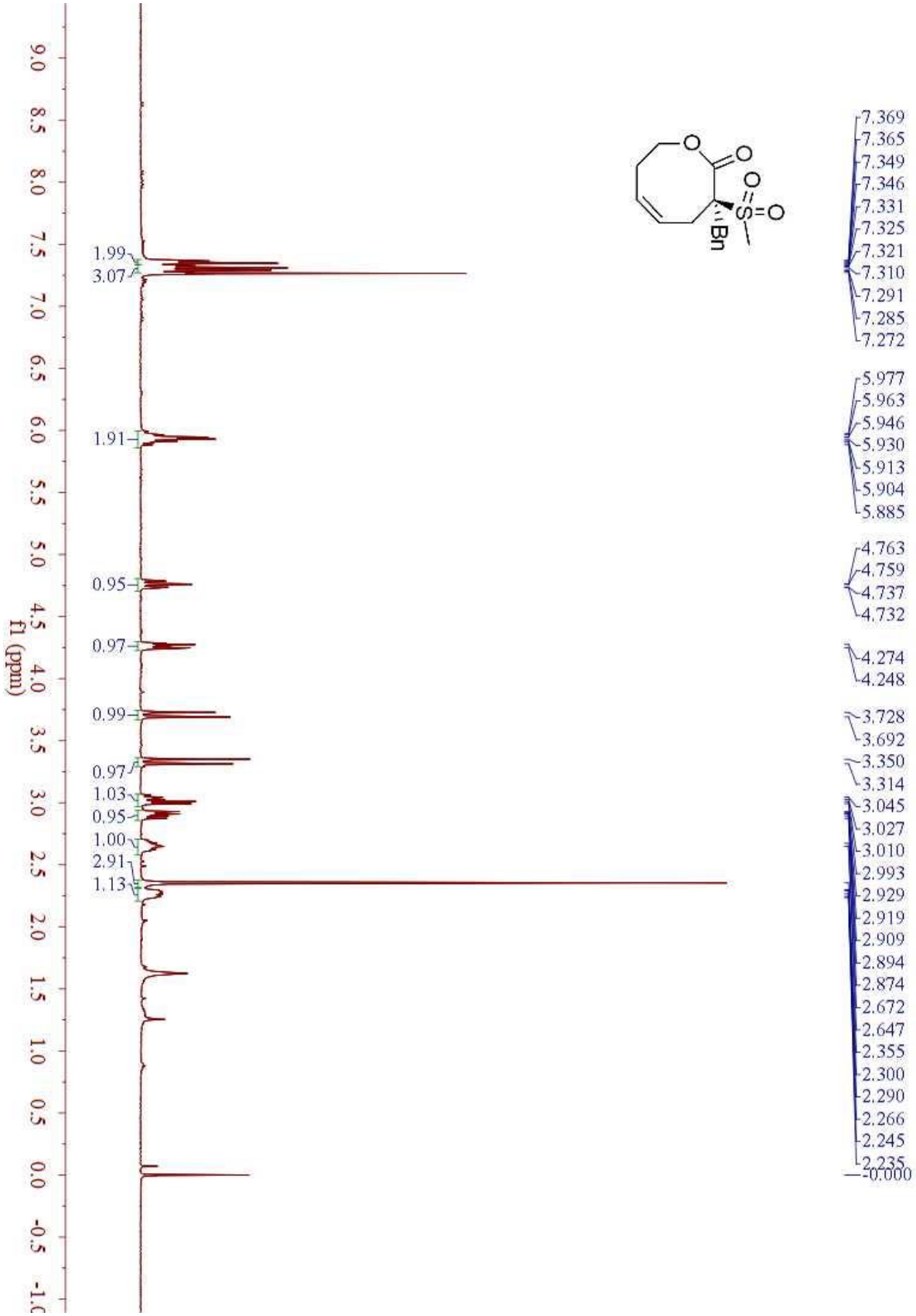
SAMPLE INFORMATION

Sample Name:	dl-19-79-2-chiral-ig9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fffd
Vial:	1:A,3	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	hgfff
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	50.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/15/2019 7:58:44 PM CST		
Date Processed:	4/15/2020 12:10:34 PM CST		

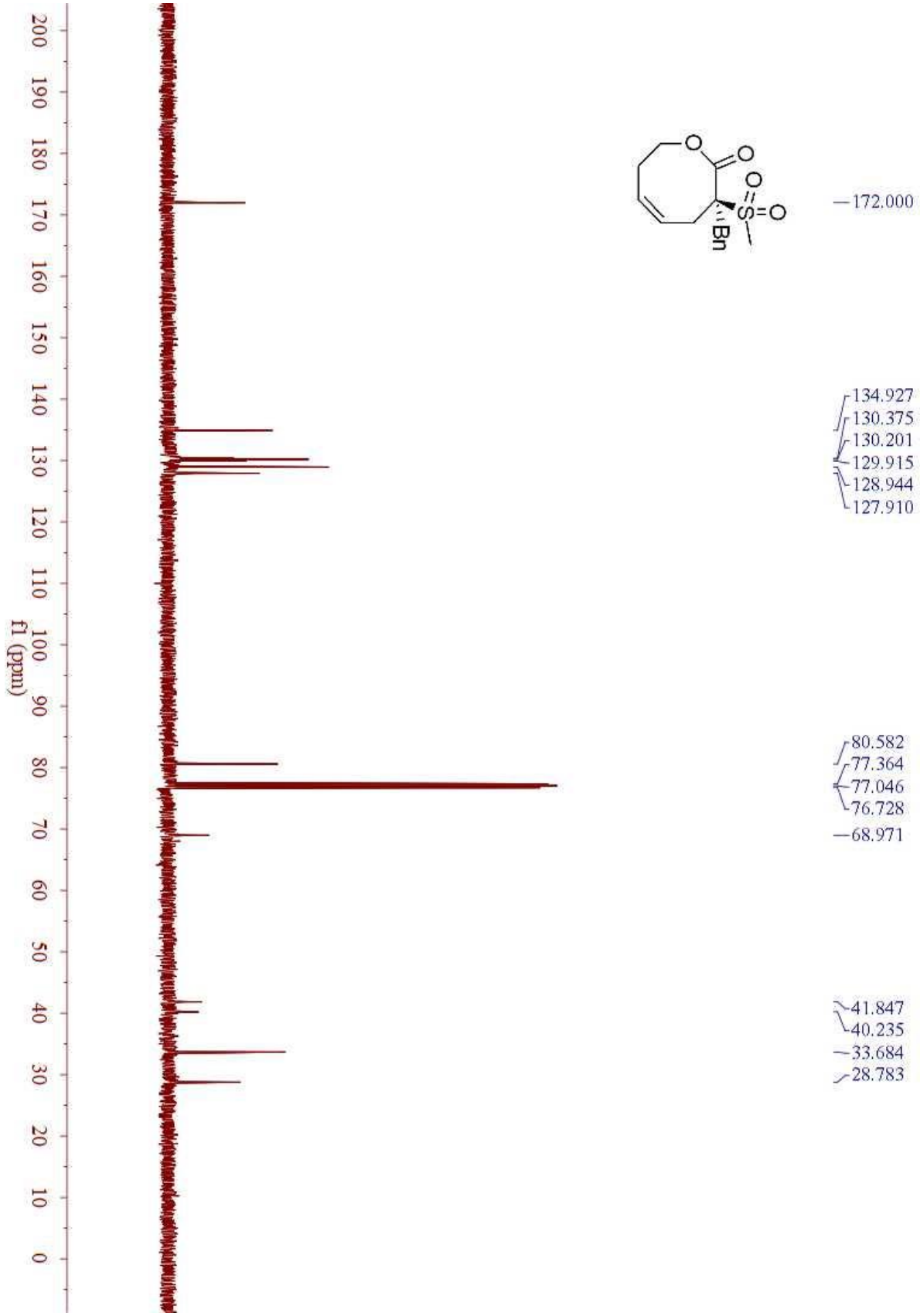


	RT	Area	% Area	Height
1	18.994	41521968	98.83	1063132
2	21.440	493380	1.17	8500

2h ^{1}H NMR (400 MHz, $CDCl_3$)



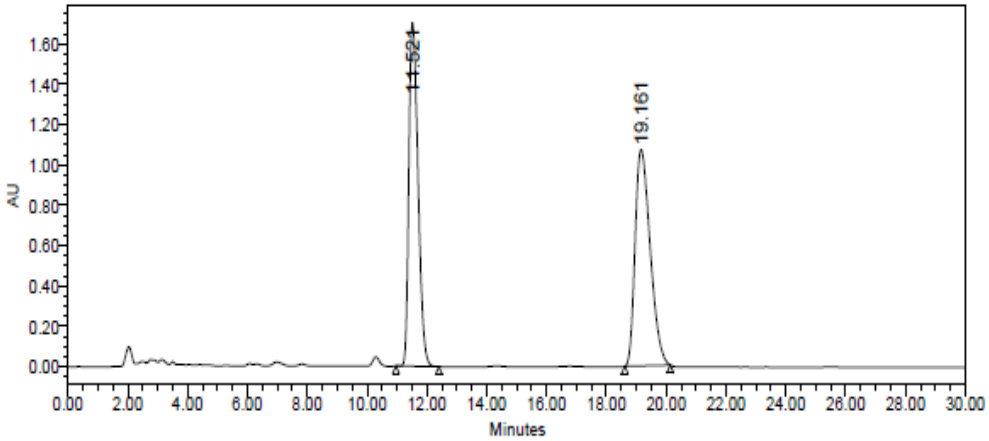
2h ^{13}C NMR (100 MHz, $CDCl_3$)



2h HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-62-rac-ic7030214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	jjmml
Vial:	1:A,2	Acq. Method Set:	dl7030214
Injection #:	1	Processing Method	ghghgyrty
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	30.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 9:27:15 PM CST		
Date Processed:	4/15/2020 12:07:54 PM CST		

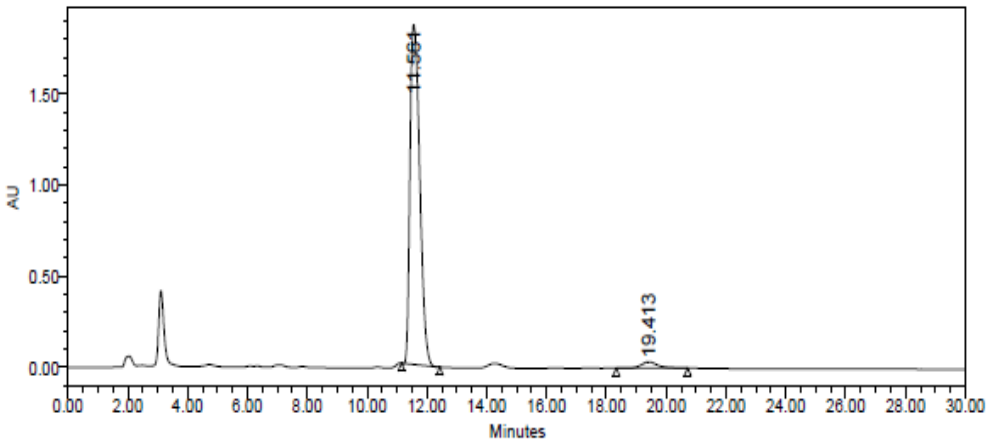


	RT	Area	% Area	Height
1	11.521	36125996	49.05	1702162
2	19.161	37524948	50.95	1072247

2h HPLC: chiral sample

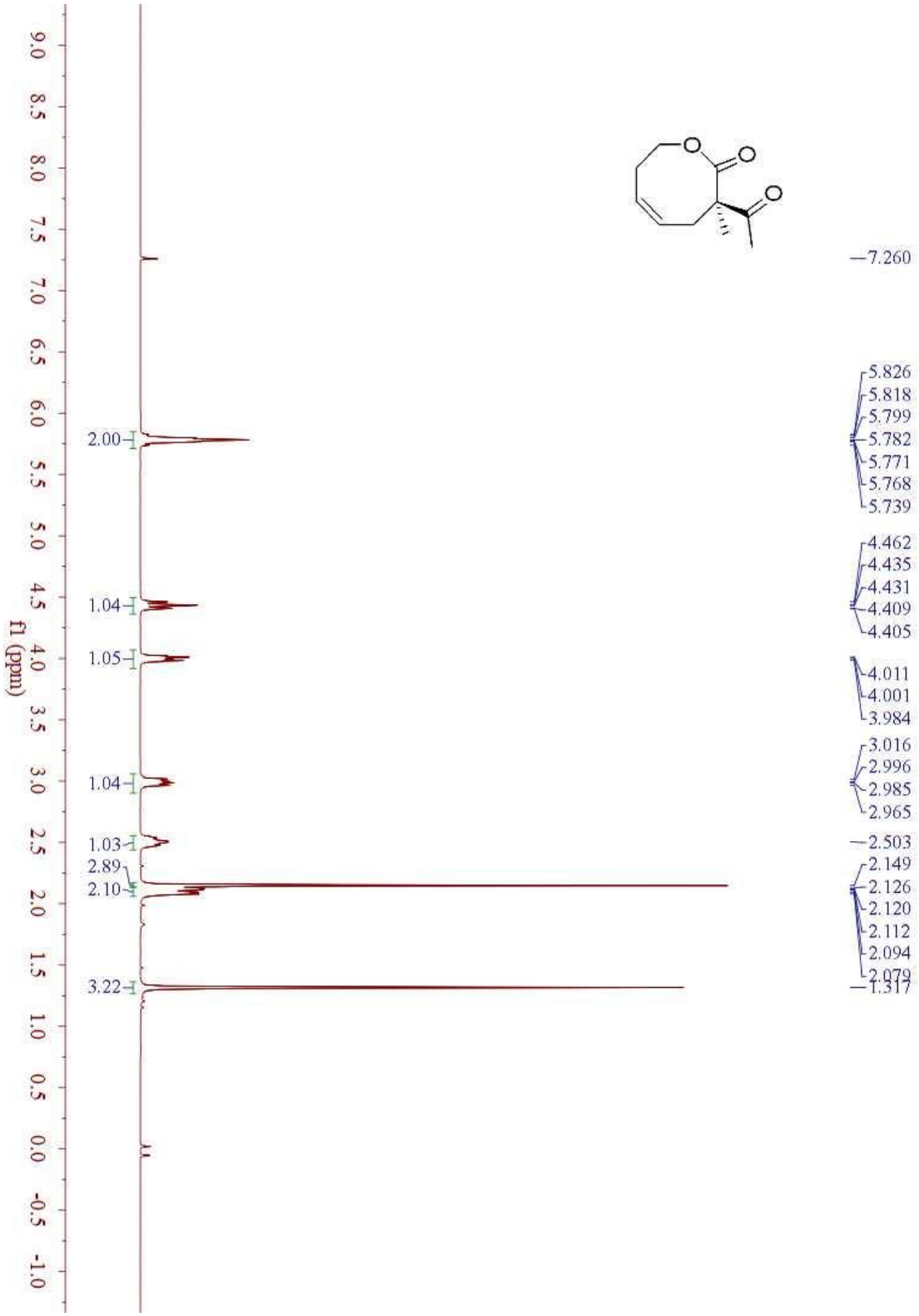
SAMPLE INFORMATION

Sample Name:	dl-17-86-chiral-ic7030214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghg
Vial:	1:A,5	Acq. Method Set:	dl7030214
Injection #:	1	Processing Method	fgf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	30.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 8:36:28 PM CST		
Date Processed:	4/15/2020 12:05:53 PM CST		

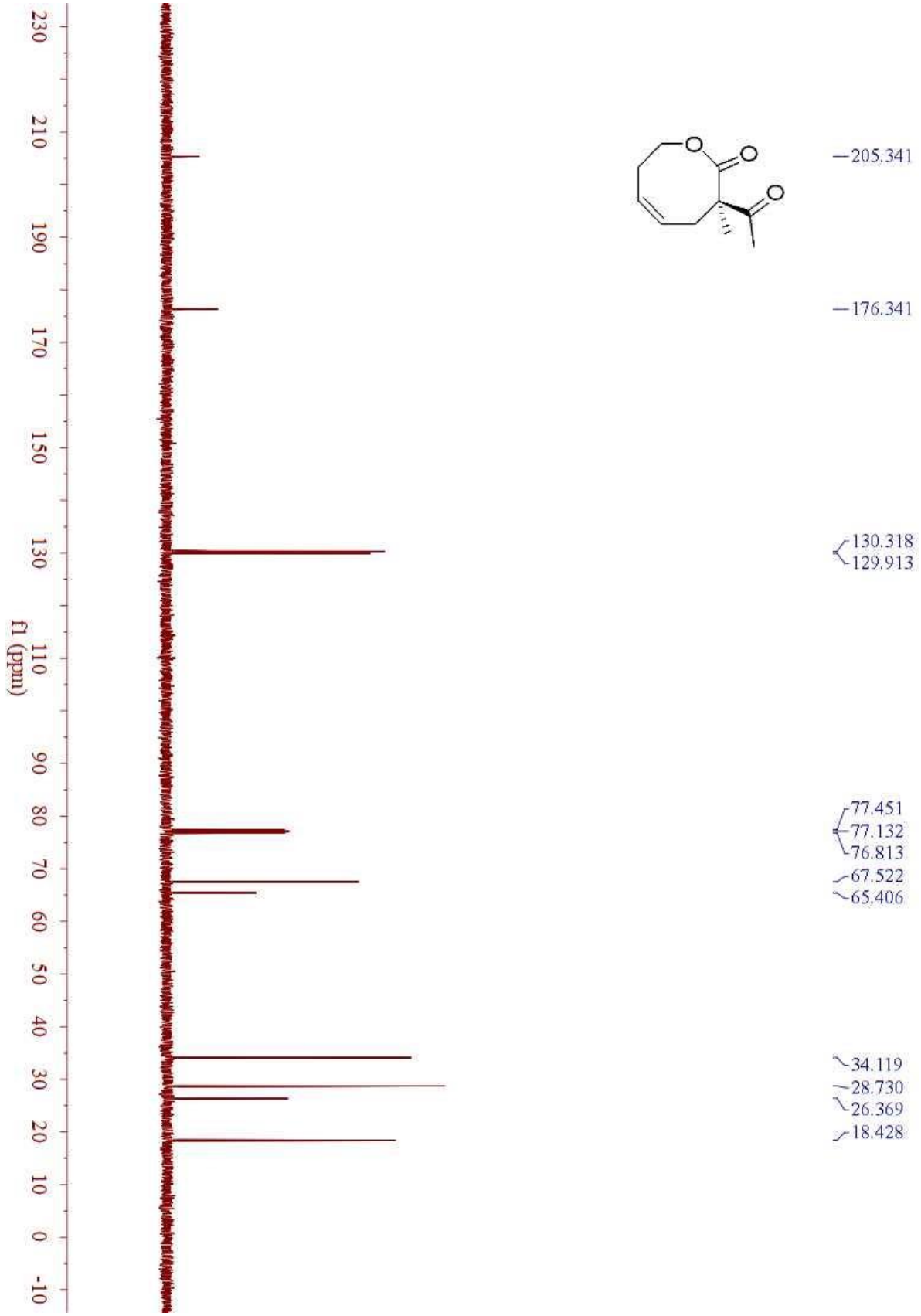


	RT	Area	% Area	Height
1	11.561	42110649	97.01	1865279
2	19.413	1297284	2.99	33958

2i ^{1}H NMR (400 MHz, $CDCl_3$)



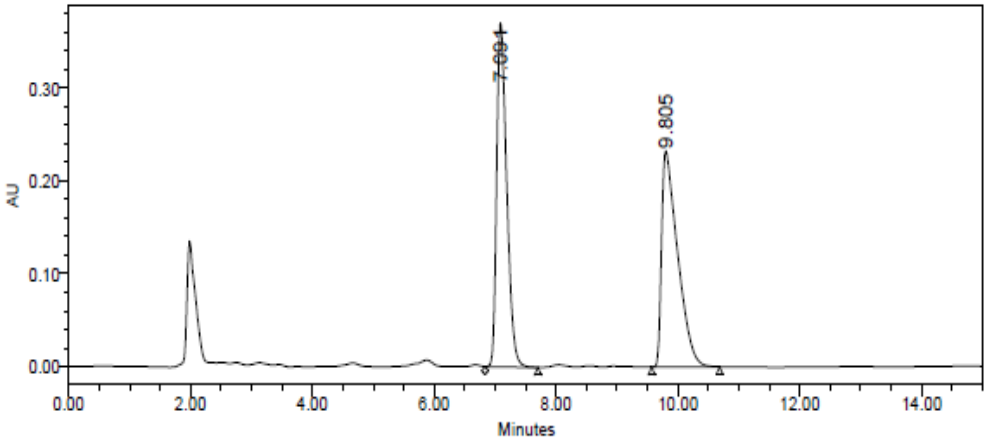
2i ^{13}C NMR (100 MHz, $CDCl_3$)



2i HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-87-2Me-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghfghgf
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	ghgh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 4:05:52 PM CST		
Date Processed:	4/15/2020 12:32:31 PM CST		

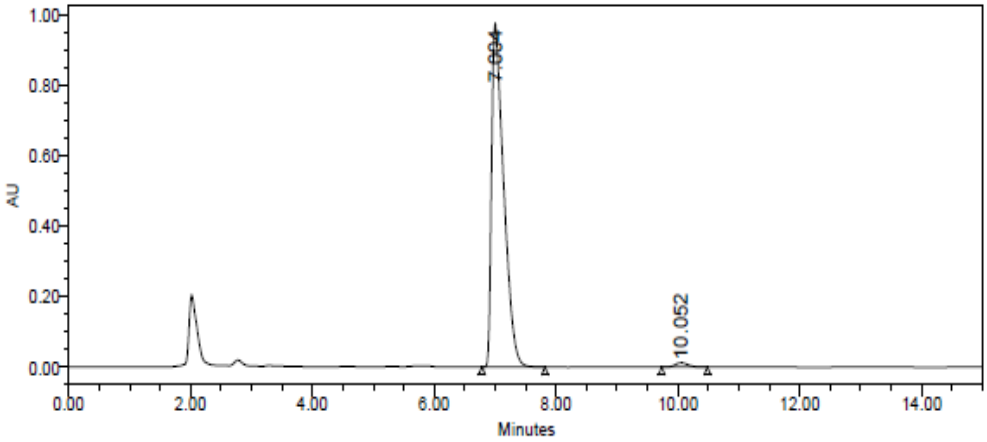


	RT	Area	% Area	Height
1	7.091	4250459	49.99	372605
2	9.805	4252921	50.01	233390

2i HPLC: chiral sample

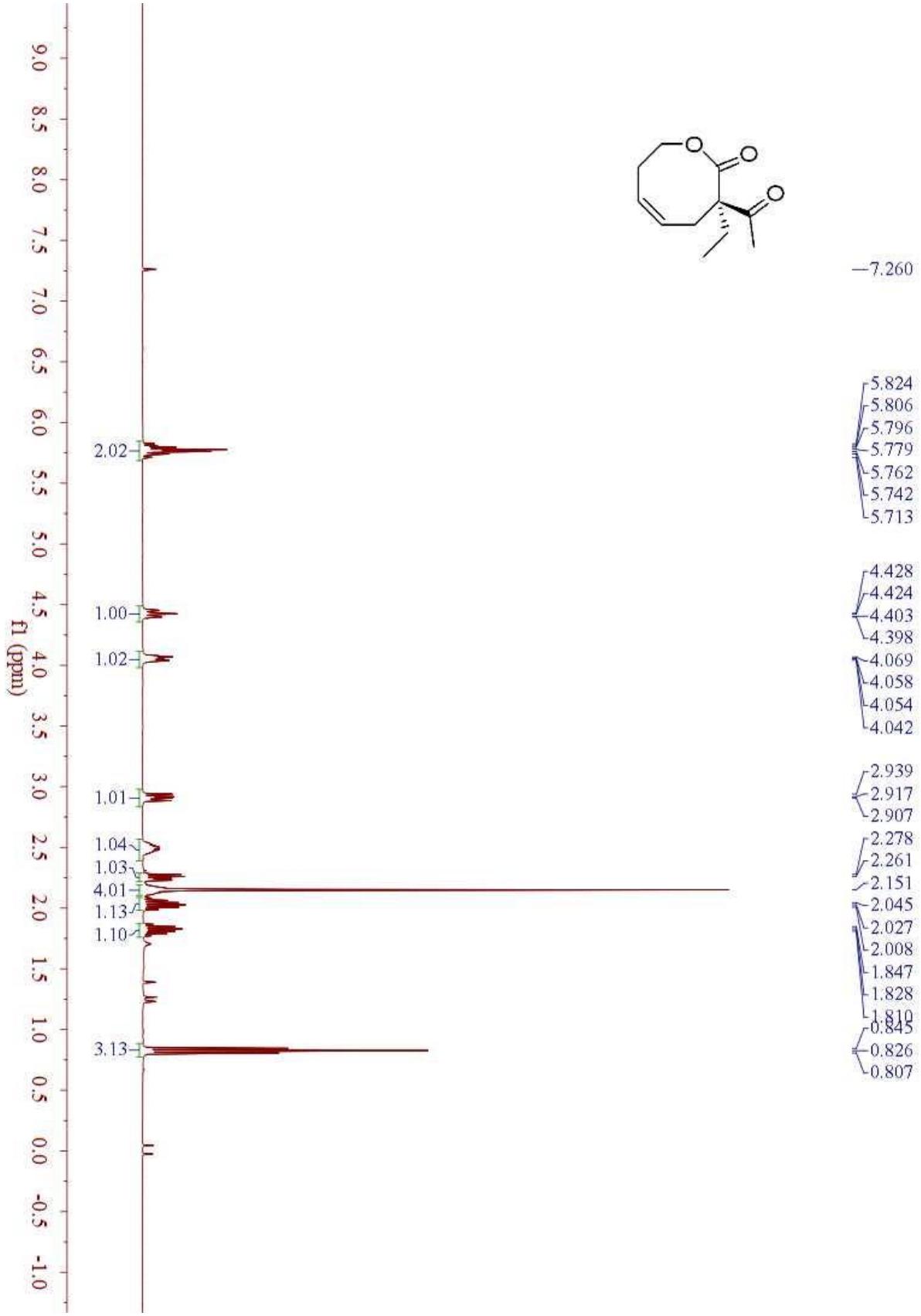
SAMPLE INFORMATION

Sample Name:	dl-17-87-2Me-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghfghgf
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	cvbvcb
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 4:21:16 PM CST		
Date Processed:	4/15/2020 12:34:10 PM CST		

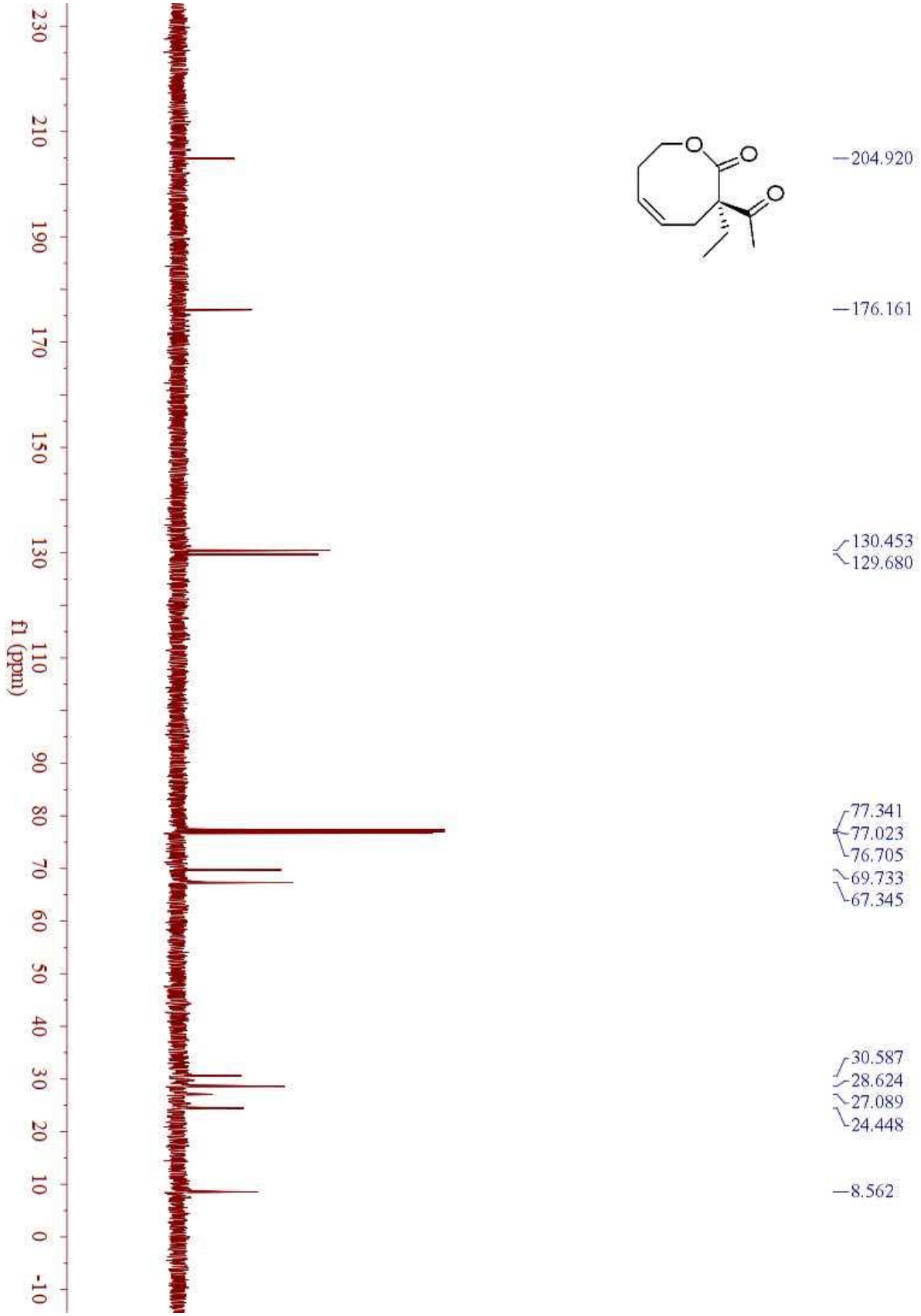


	RT	Area	% Area	Height
1	7.004	13475375	98.69	979874
2	10.052	179413	1.31	12233

2j ^{1}H NMR (400 MHz, $CDCl_3$)



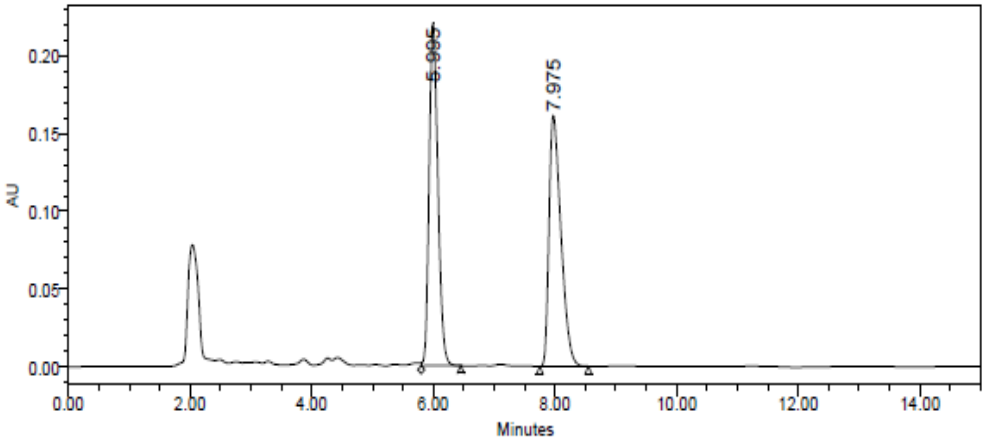
2j ^{13}C NMR (100 MHz, $CDCl_3$)



2j HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-83-2-2Et-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fddd
Vial:	1:B,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	xvcxv
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 1:47:15 AM CST		
Date Processed:	4/15/2020 12:35:02 PM CST		

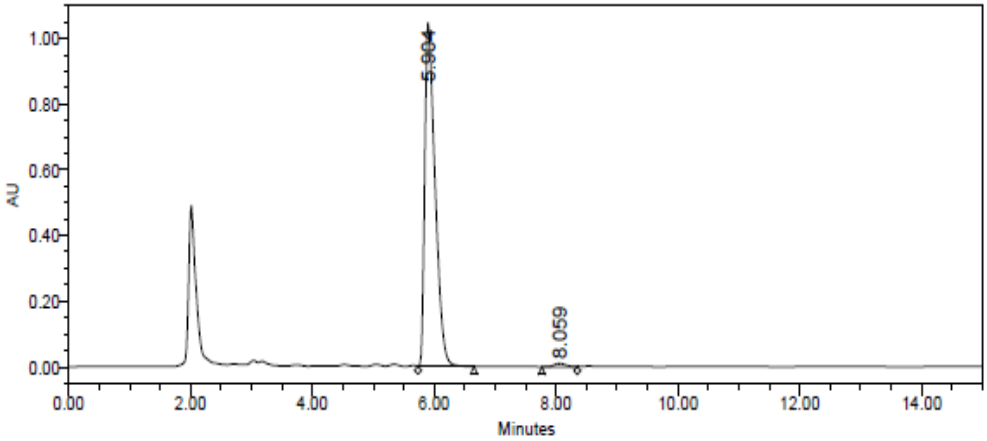


	RT	Area	% Area	Height
1	5.995	2202043	50.08	220430
2	7.975	2195048	49.92	161891

2j HPLC: chiral sample

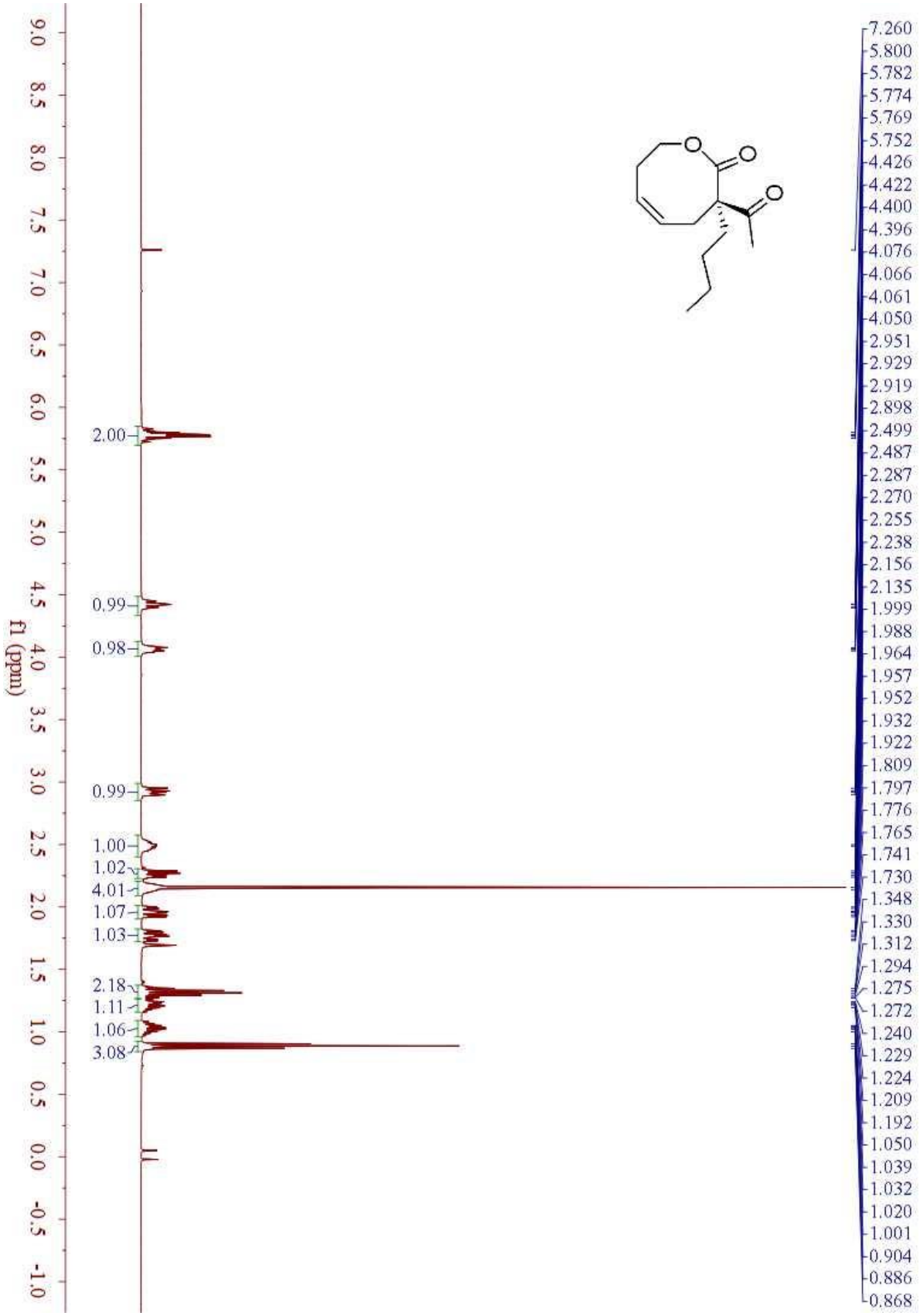
SAMPLE INFORMATION

Sample Name:	dl-17-88-2Et-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghfghgf
Vial:	1:A,5	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	sds
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	8/26/2019 4:57:31 PM CST		
Date Processed:	4/15/2020 12:36:02 PM CST		

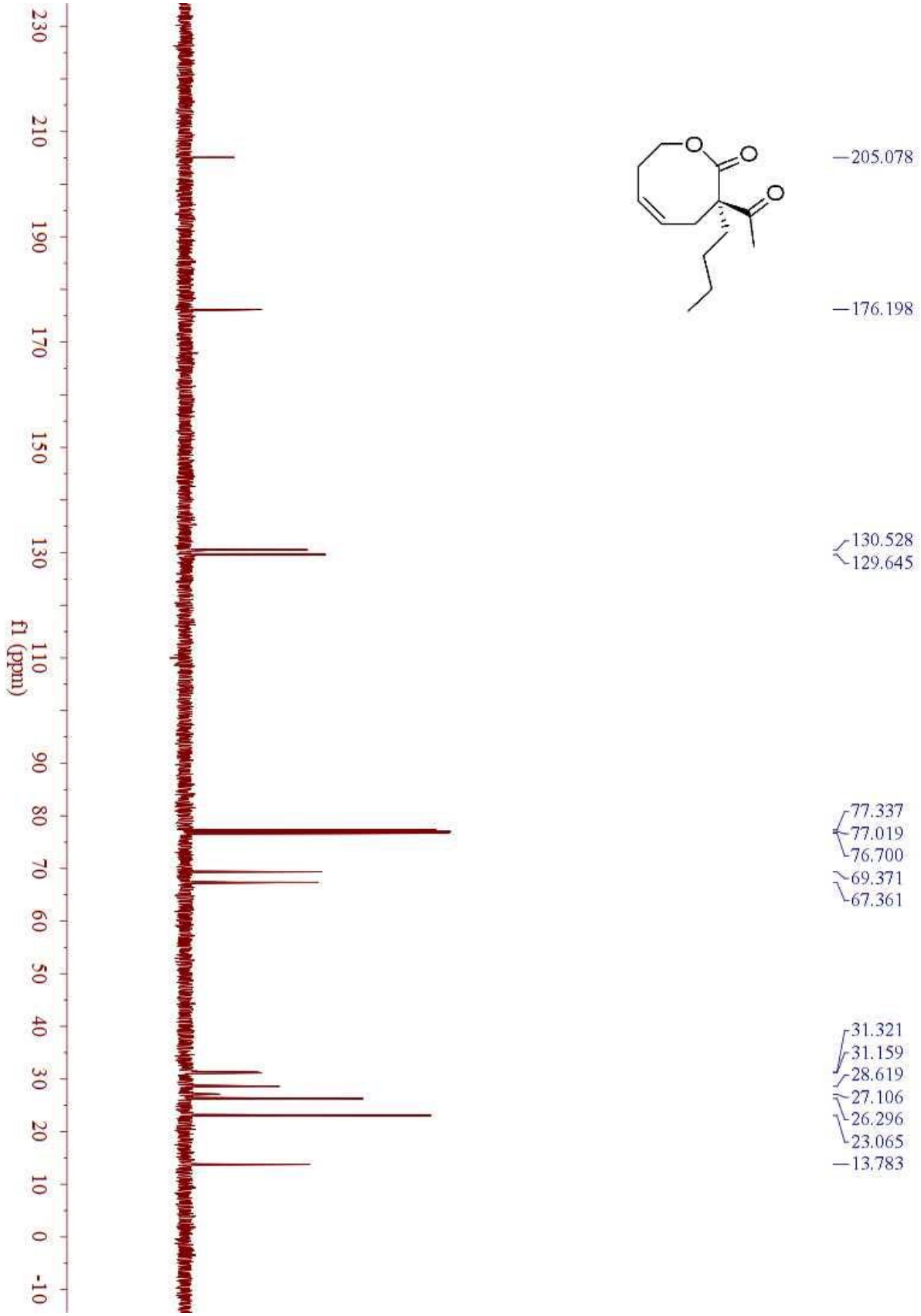


	RT	Area	% Area	Height
1	5.904	12310535	98.92	1048773
2	8.059	133936	1.08	10380

2k ^{1}H NMR (400 MHz, $CDCl_3$)



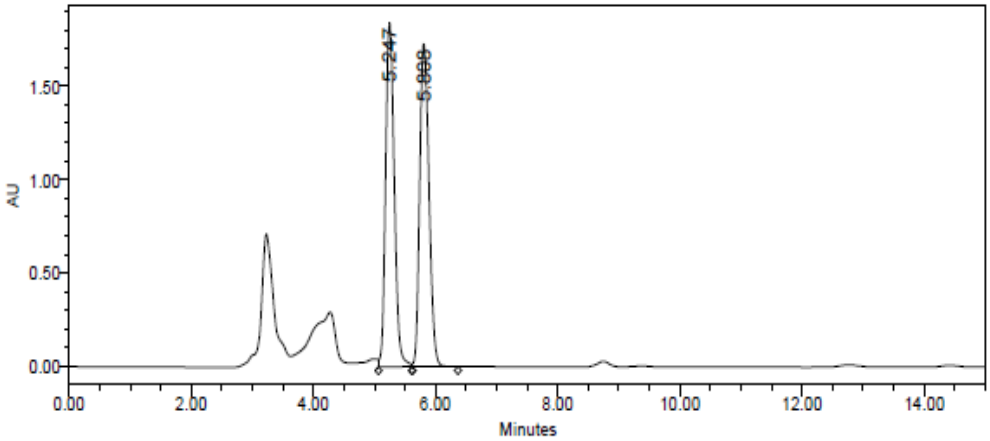
2k ^{13}C NMR (100 MHz, $CDCl_3$)



2k HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-21-1-rac-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghf
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	kj
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/14/2019 2:44:50 PM CST		
Date Processed:	4/15/2020 12:37:21 PM CST		

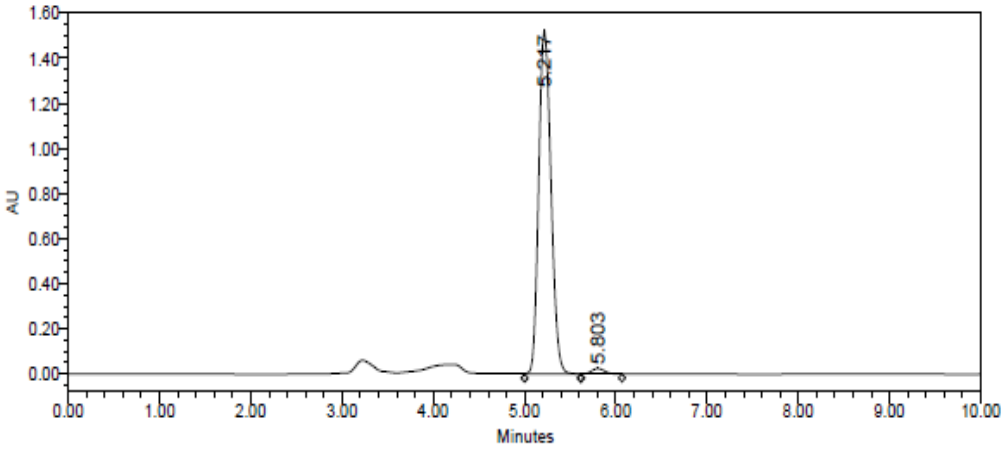


	RT	Area	% Area	Height
1	5.247	18190894	49.98	1839269
2	5.808	18203289	50.02	1736051

2k HPLC: chiral sample

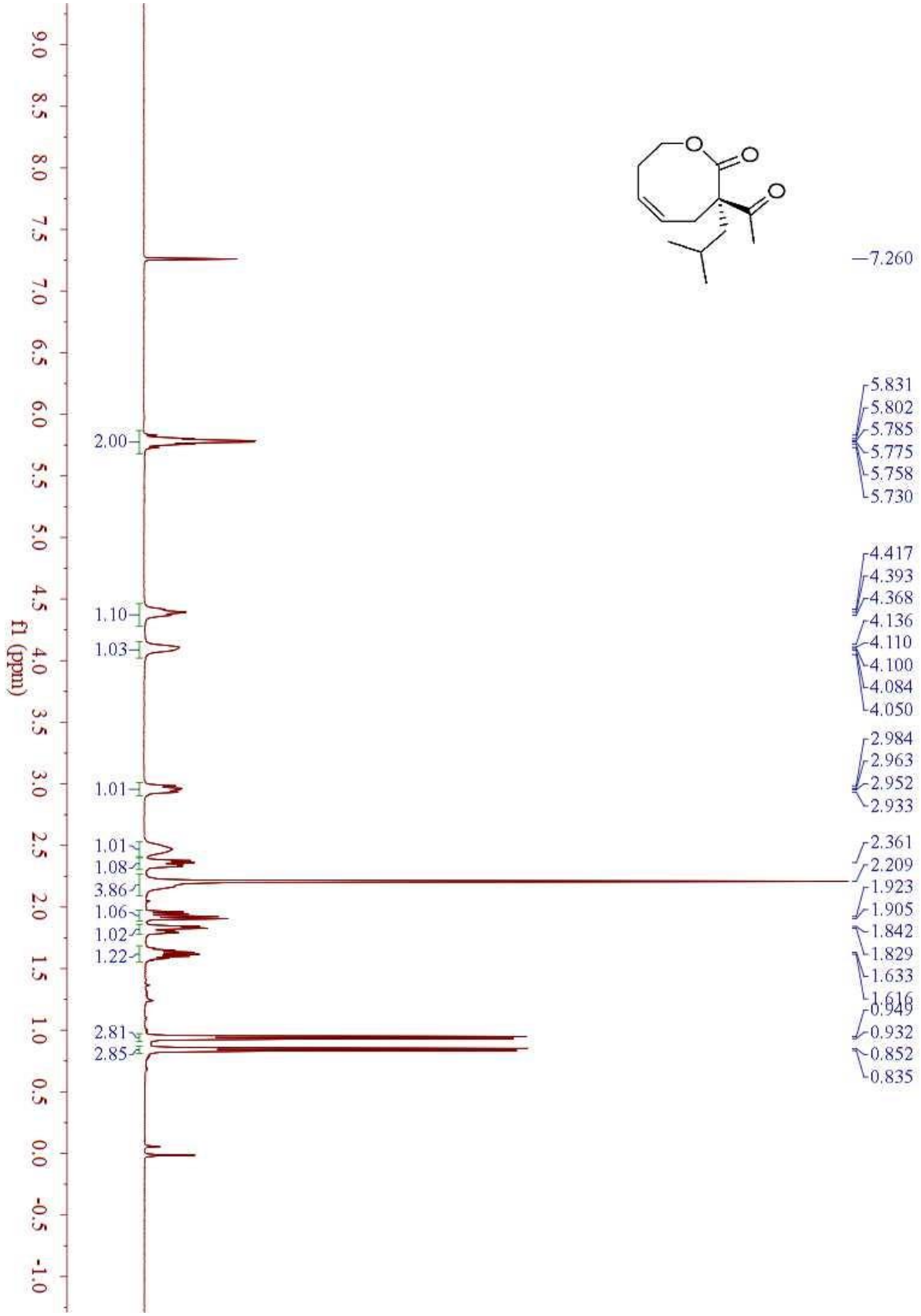
SAMPLE INFORMATION

Sample Name:	dl-18-21-2-chiral-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	jhuj
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	vd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/14/2019 4:52:50 PM CST		
Date Processed:	4/15/2020 12:38:42 PM CST		

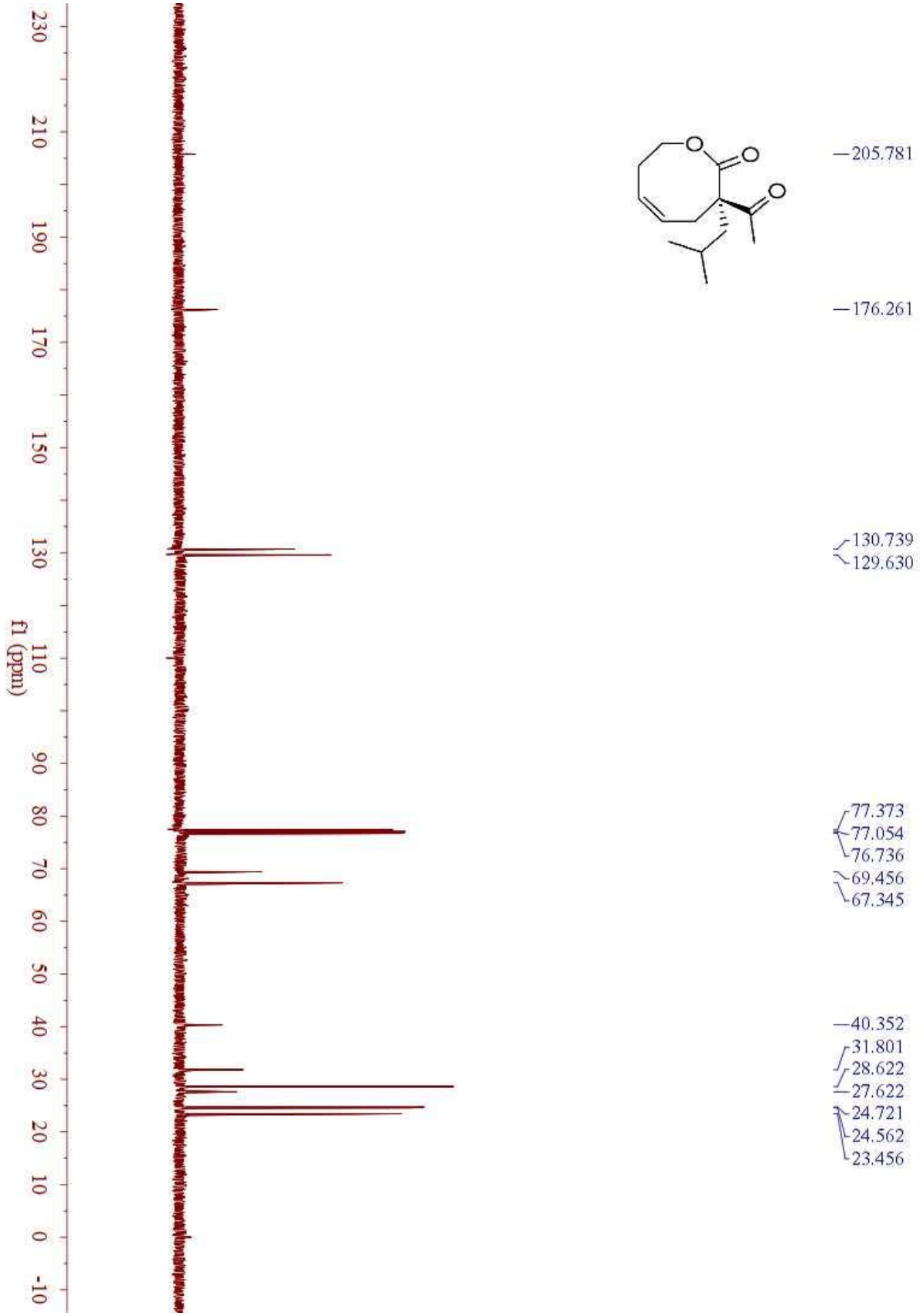


	RT	Area	% Area	Height
1	5.217	14280764	98.27	1524607
2	5.803	250714	1.73	25006

2l ^{1}H NMR (400 MHz, $CDCl_3$)



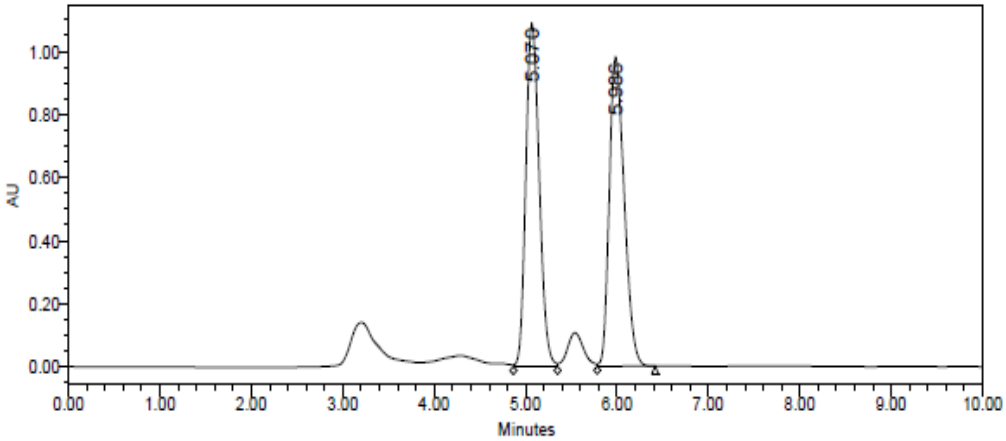
2l ^{13}C NMR (100 MHz, $CDCl_3$)



2l HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-75-1-rac-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hyfyhf
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	dfdf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/13/2019 8:32:47 AM CST		
Date Processed:	4/15/2020 12:58:36 PM CST		

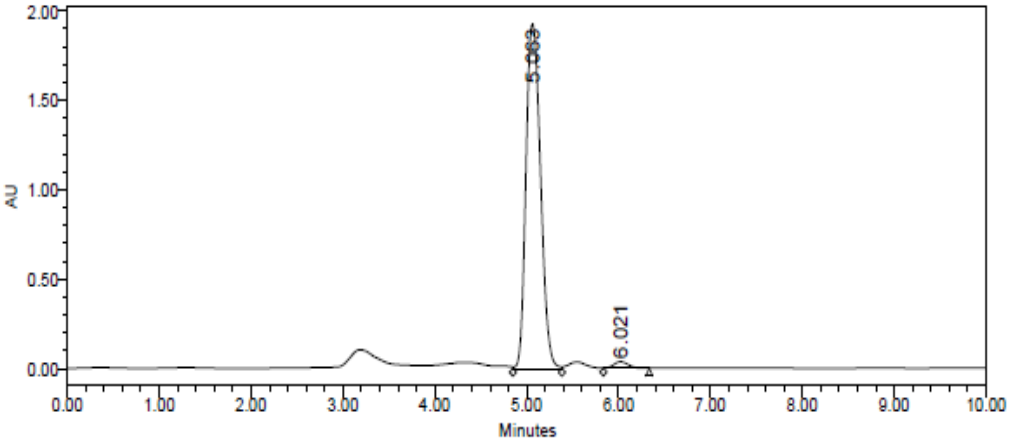


	RT	Area	% Area	Height
1	5.070	11110906	50.02	1090481
2	5.986	11101850	49.98	982008

2l HPLC: chiral sample

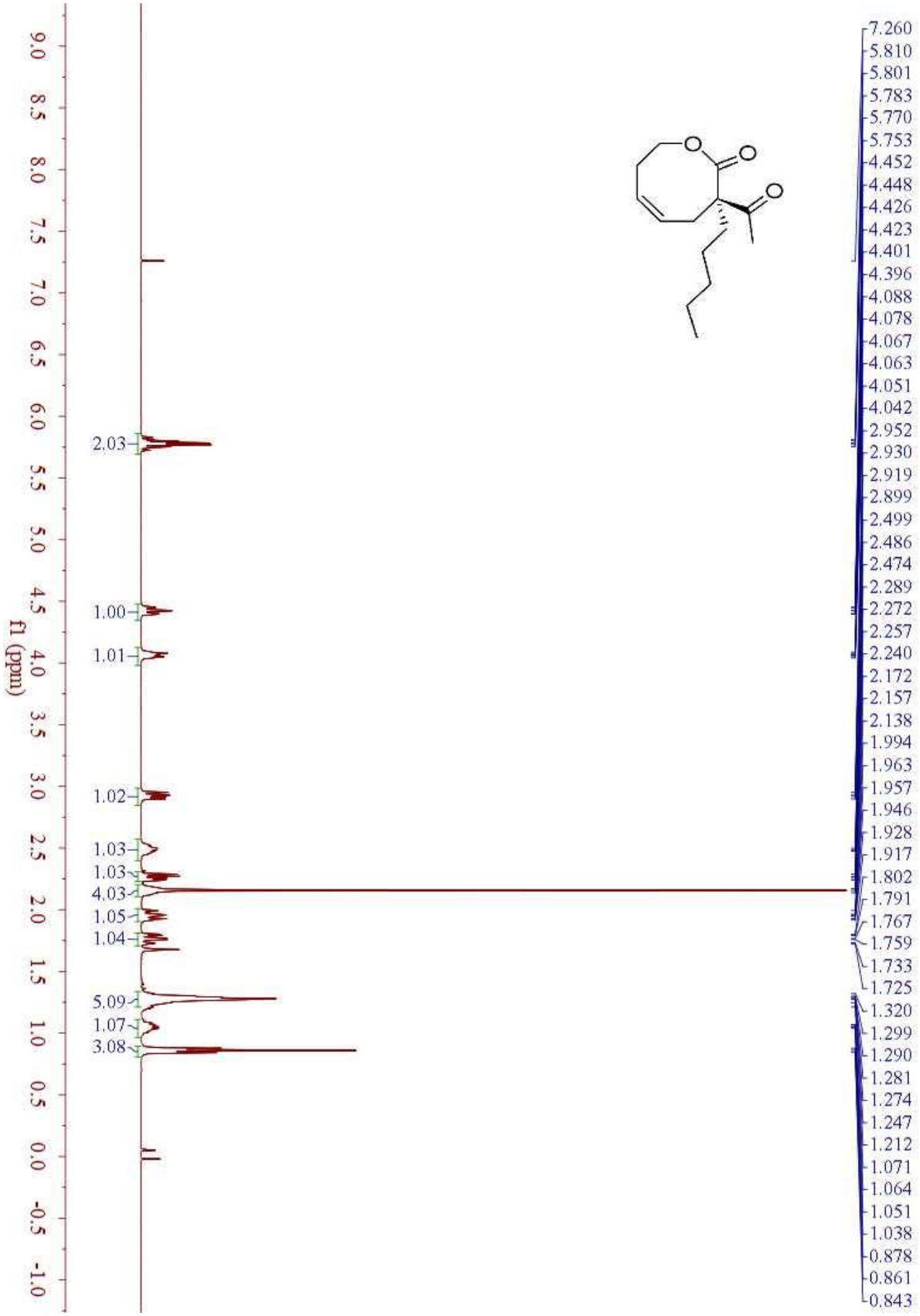
SAMPLE INFORMATION

Sample Name:	dl-19-75-2-chiral-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hyfyhf
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	fgddg
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/13/2019 8:43:11 AM CST		
Date Processed:	4/15/2020 12:59:52 PM CST		

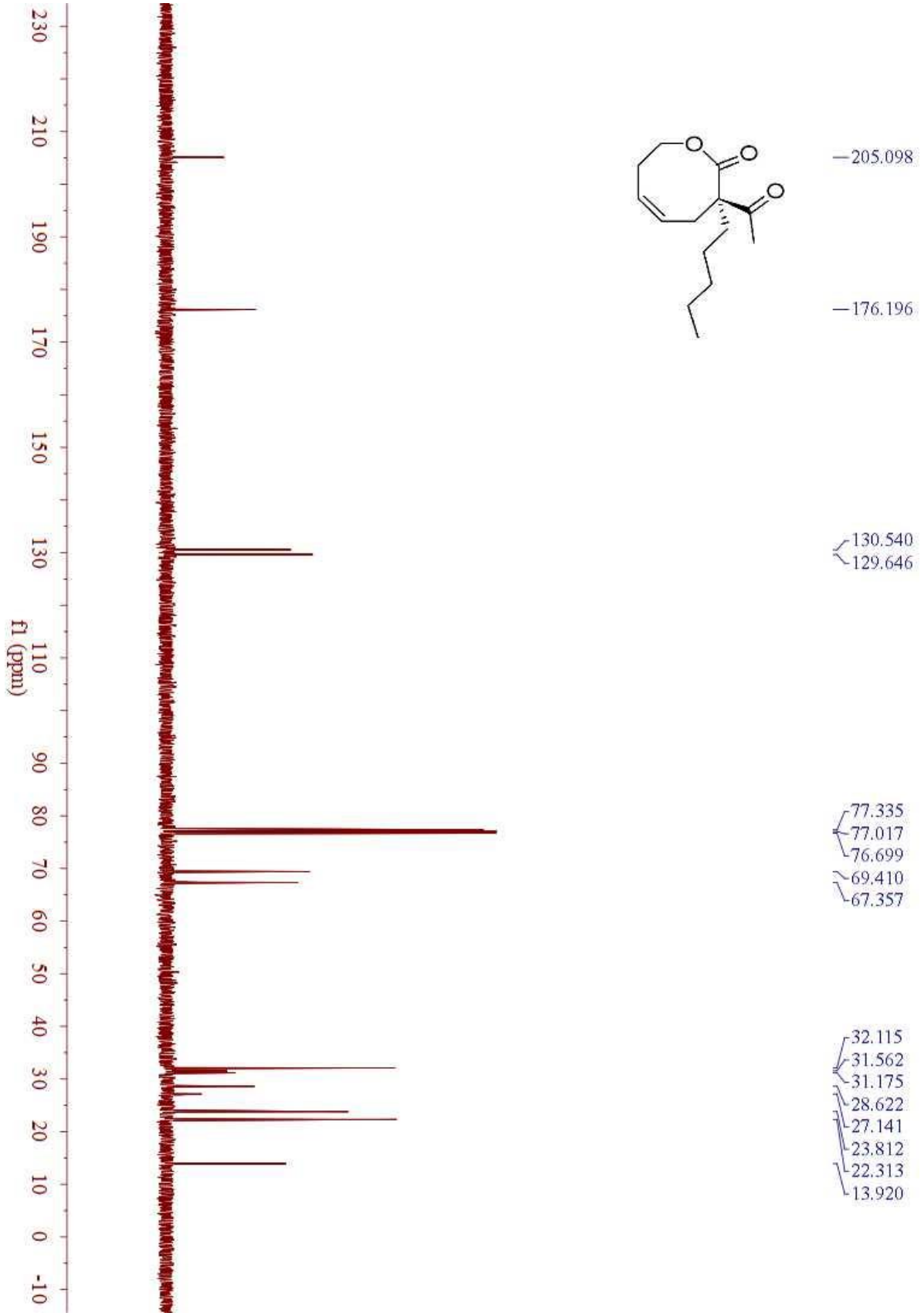


	RT	Area	% Area	Height
1	5.063	21145504	98.15	1930596
2	6.021	399404	1.85	37102

2m ^{1}H NMR (400 MHz, $CDCl_3$)



2m ^{13}C NMR (100 MHz, $CDCl_3$)

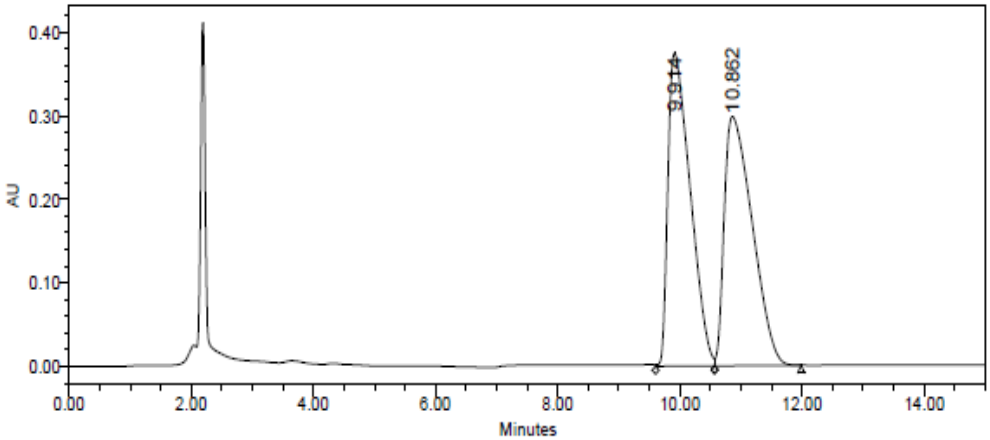


2m HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-22-1-rac-9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gfgf
Vial:	1:A,2	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	ssfd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 9/12/2019 10:30:49 PM CST
Date Processed: 4/15/2020 12:39:58 PM CST

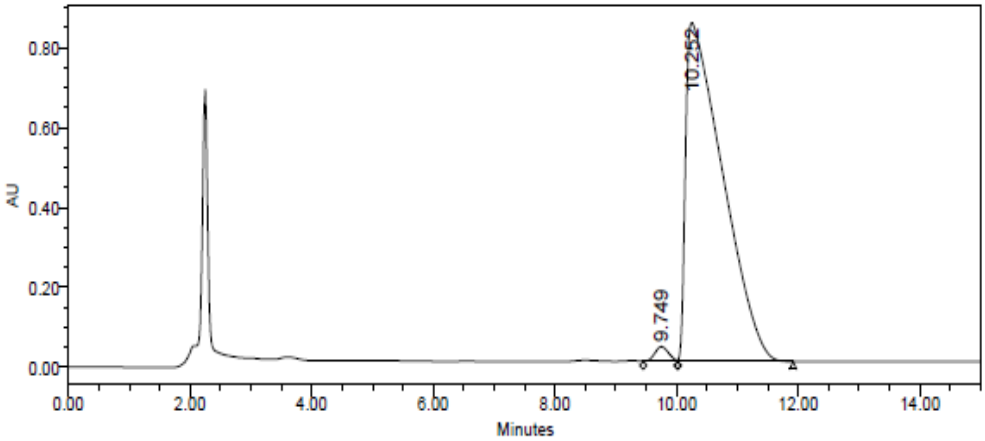


	RT	Area	% Area	Height
1	9.914	9476529	49.88	375133
2	10.862	9523638	50.12	298593

2m HPLC: chiral sample

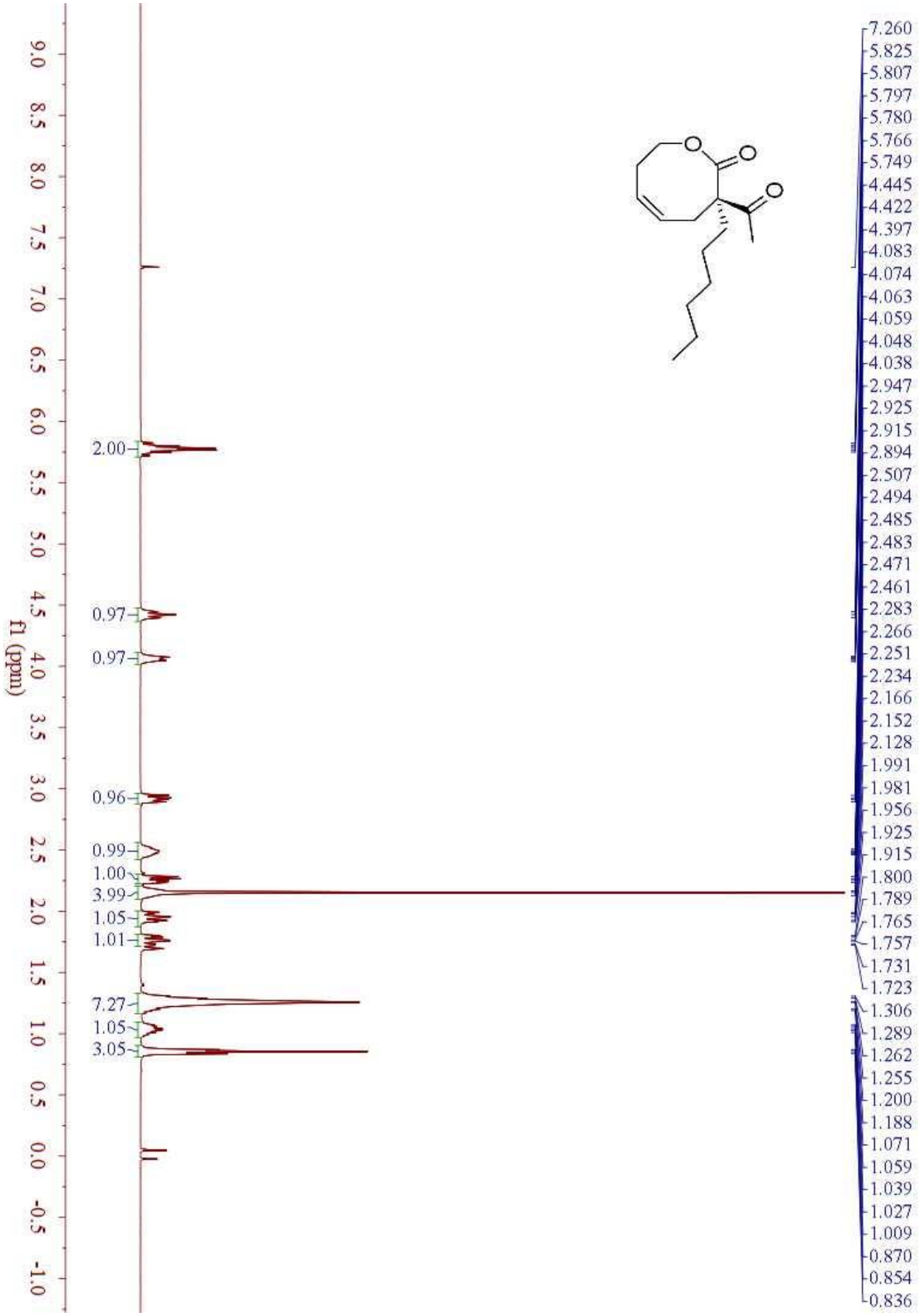
SAMPLE INFORMATION

Sample Name:	dl-18-22-2-chiral-9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hj
Vial:	1:A,2	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	fdf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/12/2019 9:54:09 PM CST		
Date Processed:	4/15/2020 12:40:41 PM CST		

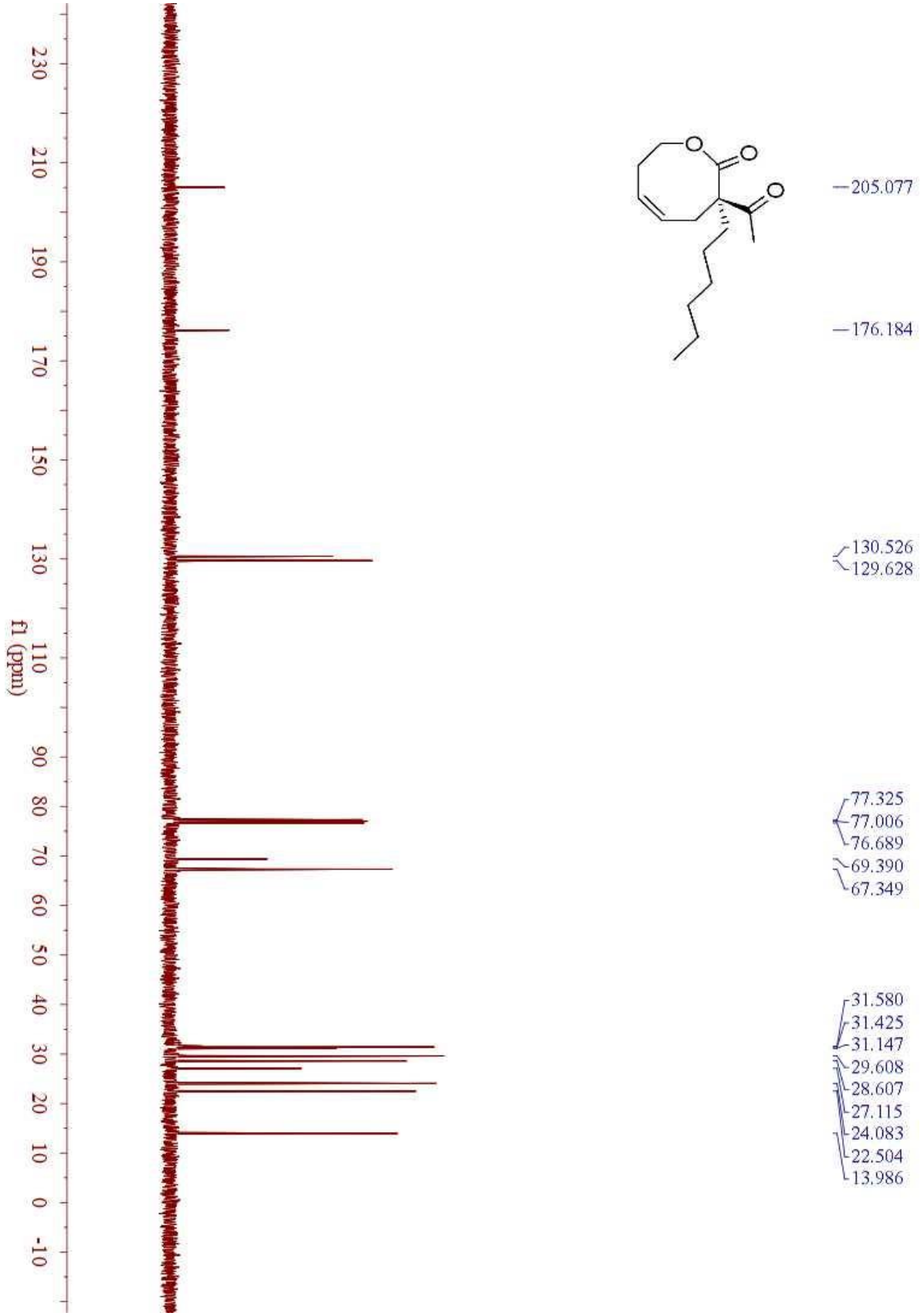


	RT	Area	% Area	Height
1	9.749	592767	1.63	37442
2	10.252	35831355	98.37	848163

2n ^{1}H NMR (400 MHz, $CDCl_3$)



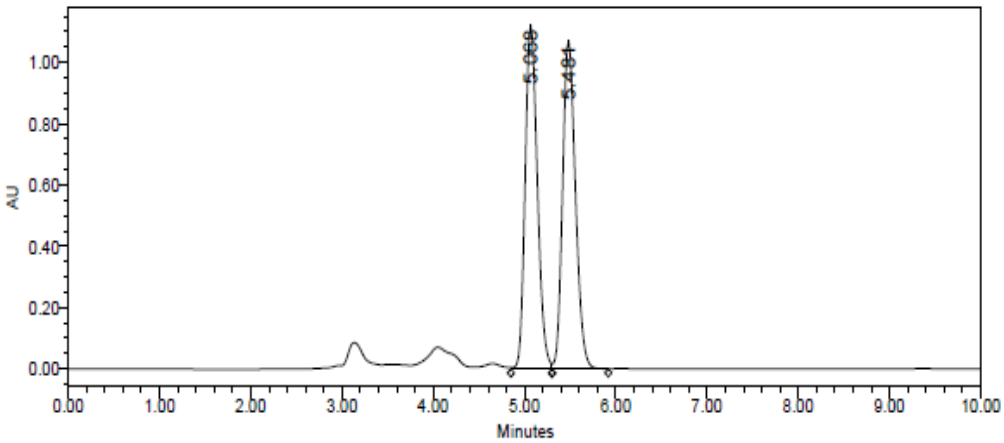
2n ^{13}C NMR (100 MHz, $CDCl_3$)



2n HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-57-1-rac-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hghg
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	klk
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	10/4/2019 11:24:06 AM CST		
Date Processed:	4/15/2020 12:51:43 PM CST		

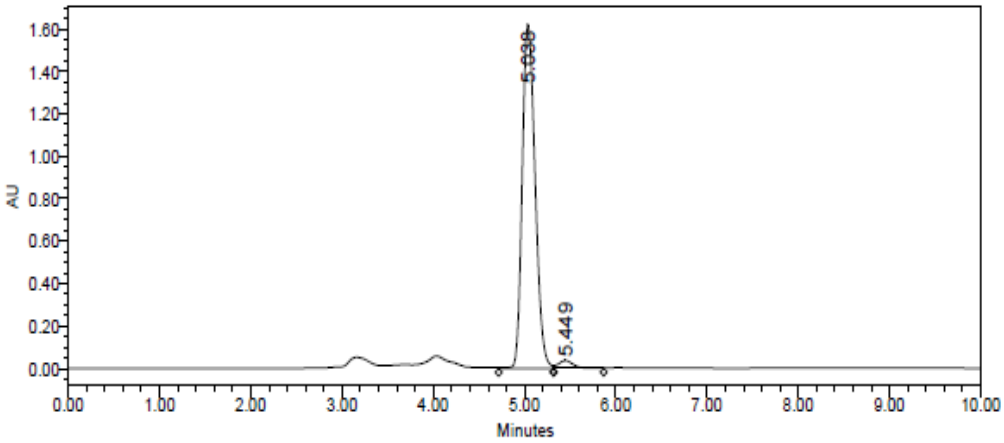


	RT	Area	% Area	Height
1	5.068	10416295	49.76	1122187
2	5.481	10517143	50.24	1071387

2n HPLC: chiral sample

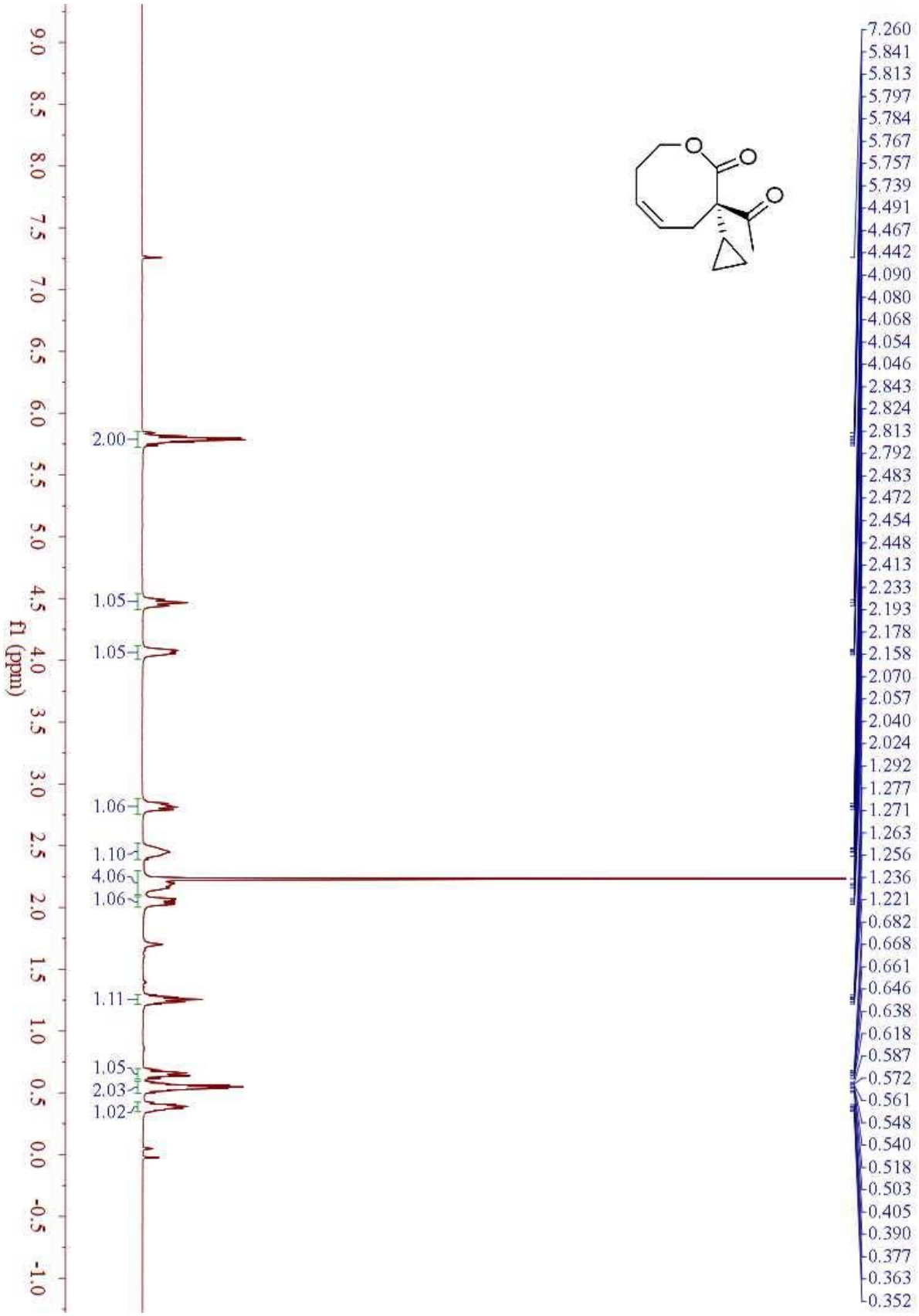
SAMPLE INFORMATION

Sample Name:	dl-18-57-2-chiral-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hghg
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	xfxd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	10/4/2019 11:34:31 AM CST		
Date Processed:	4/15/2020 12:52:30 PM CST		

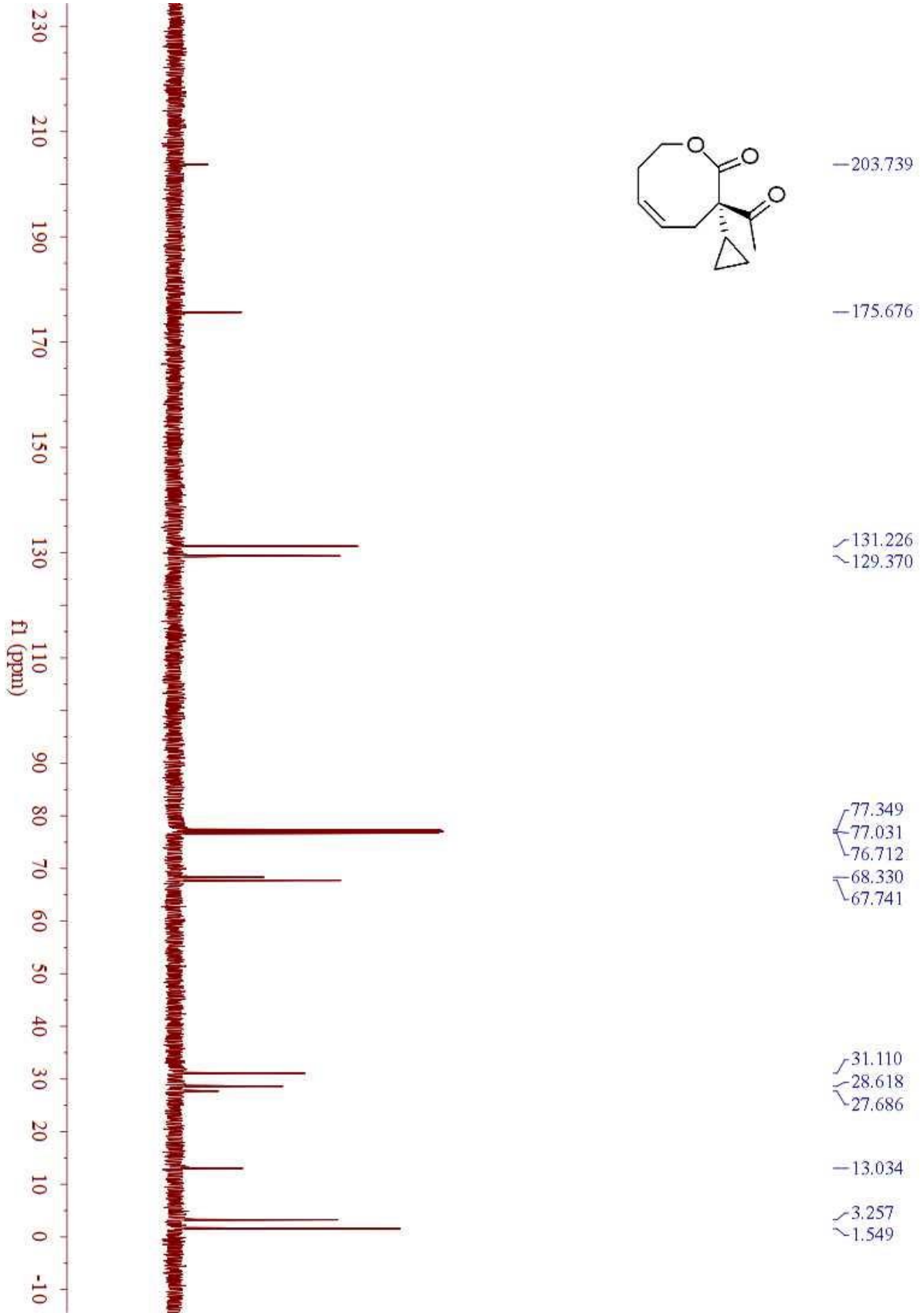


	RT	Area	% Area	Height
1	5.038	15882716	97.46	1625866
2	5.449	414691	2.54	36583

2o ^{1}H NMR (400 MHz, $CDCl_3$)



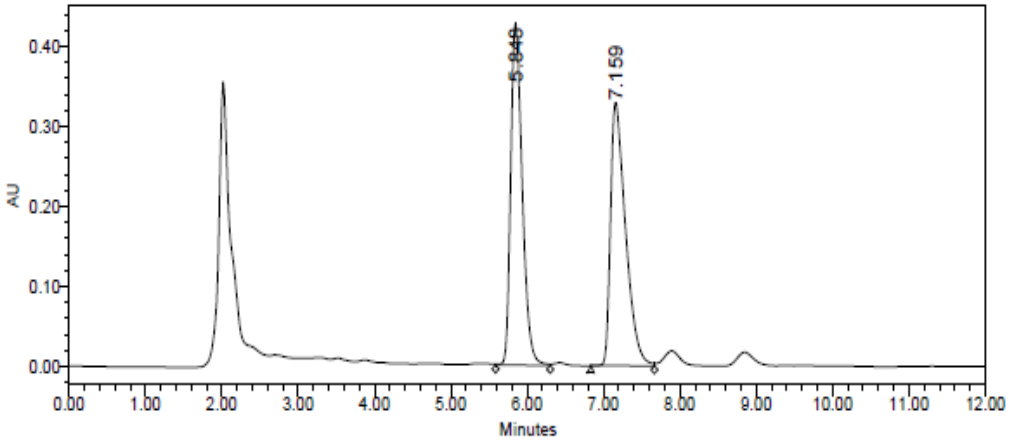
2o ^{13}C NMR (100 MHz, $CDCl_3$)



2o HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-83-3-rac-9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	GFG
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	fgfgf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 9:38:09 AM CST		
Date Processed:	4/15/2020 12:55:53 PM CST		

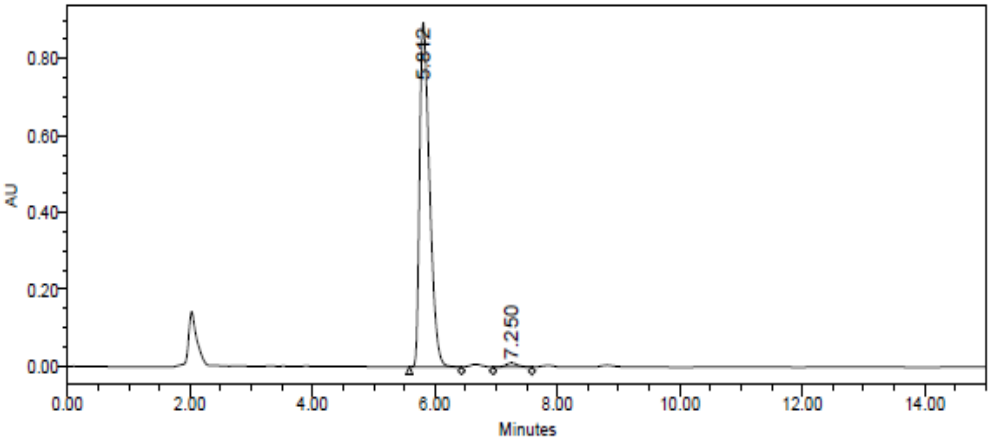


	RT	Area	% Area	Height
1	5.848	4486761	49.98	428183
2	7.159	4489666	50.02	330987

2o HPLC: chiral sample

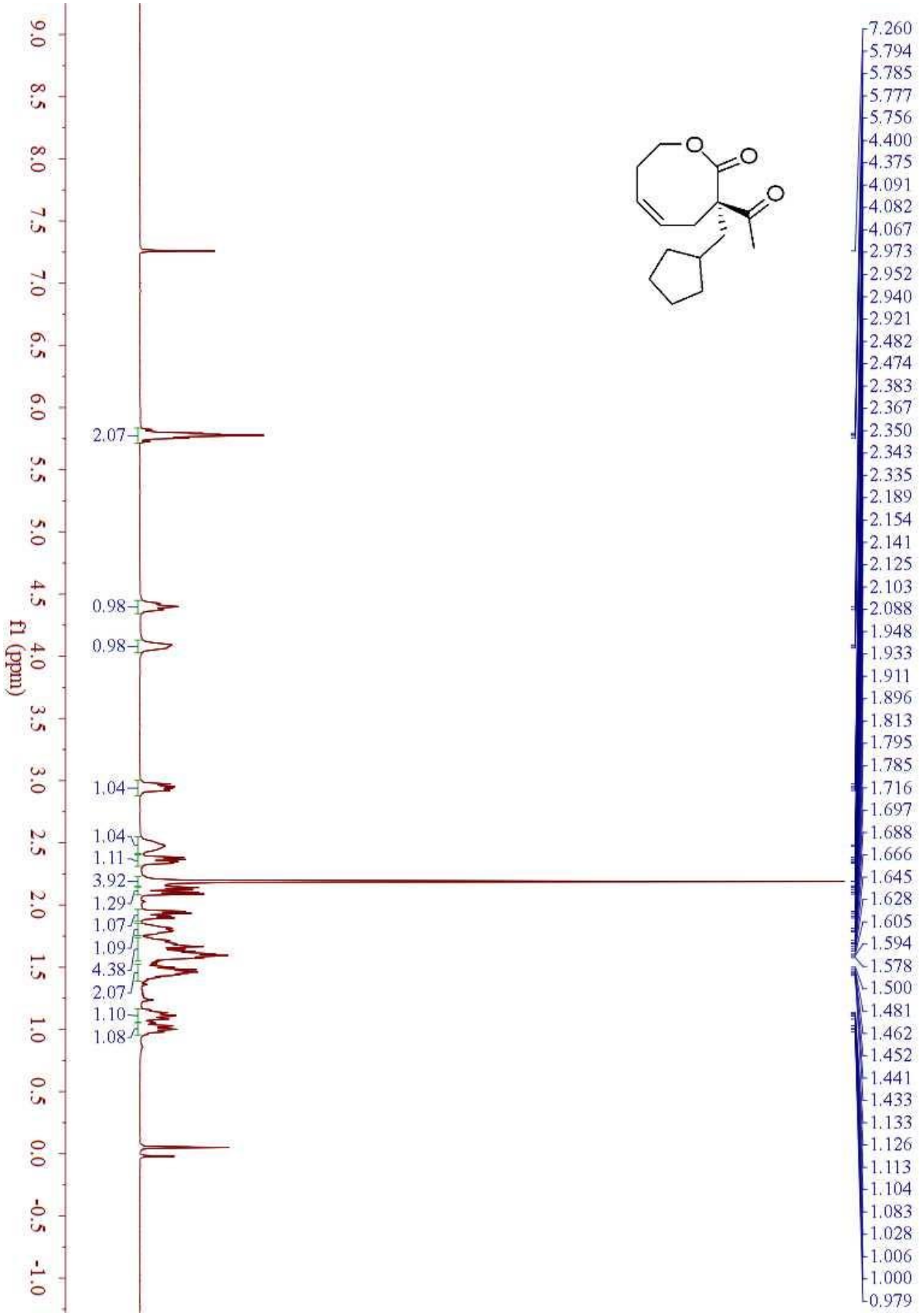
SAMPLE INFORMATION

Sample Name:	dl-17-98-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gfdcg
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	fdsfd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/7/2019 11:48:17 PM CST		
Date Processed:	4/15/2020 12:56:58 PM CST		

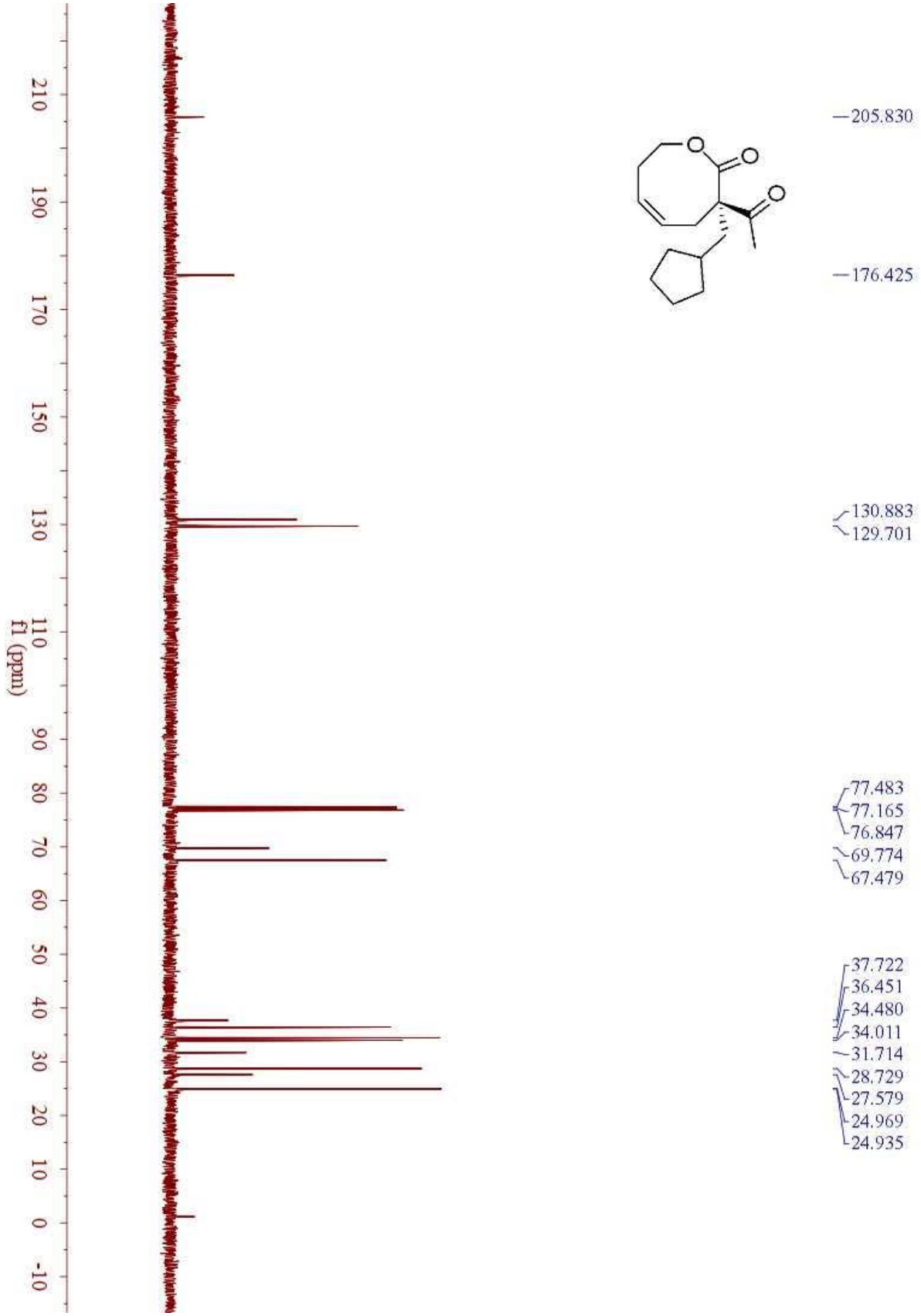


	RT	Area	% Area	Height
1	5.812	10049292	98.67	896017
2	7.250	135636	1.33	10382

2p ^{1}H NMR (400 MHz, $CDCl_3$)



2p ^{13}C NMR (100 MHz, $CDCl_3$)

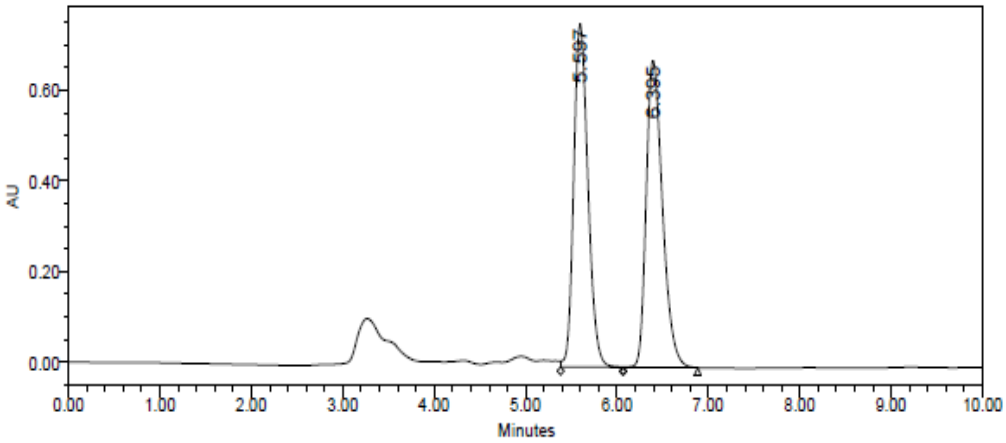


2p HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-37-1-rac-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	jhjkk
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	ggh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 1/6/2020 9:29:36 AM CST
Date Processed: 4/15/2020 1:00:51 PM CST

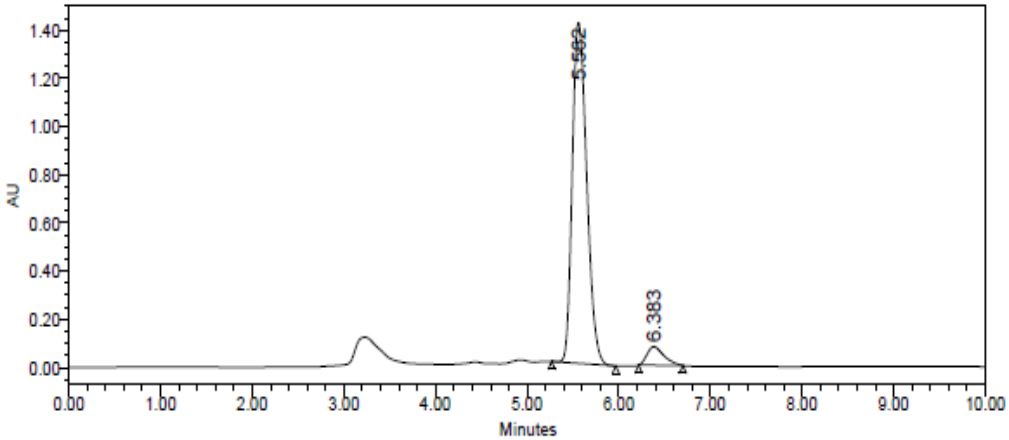


	RT	Area	% Area	Height
1	5.597	8185540	49.43	757289
2	6.395	8375544	50.57	677197

2p HPLC: chiral sample

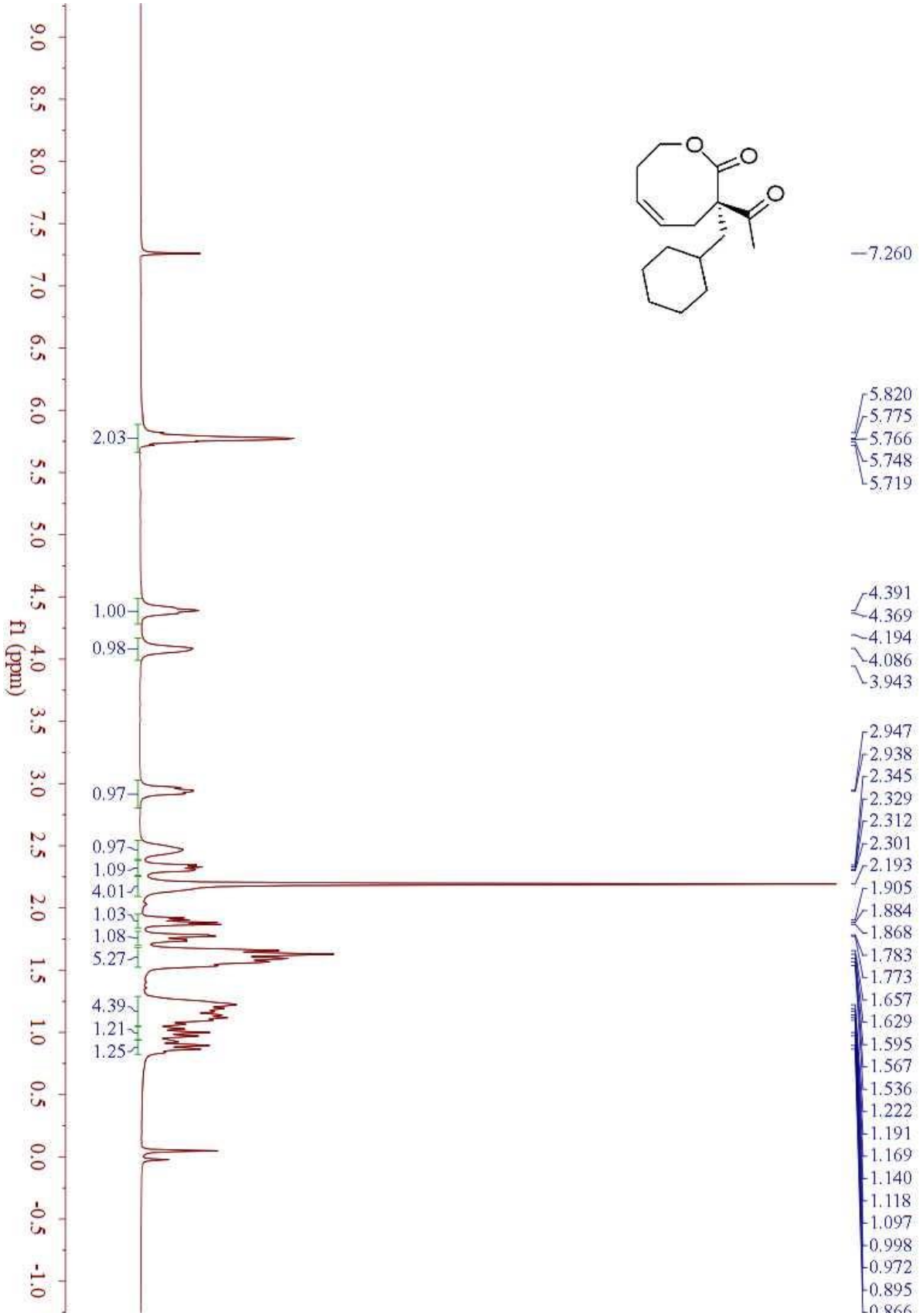
SAMPLE INFORMATION

Sample Name:	dl-19-37-2-chiral-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	jhjkk
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	dfdfd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	1/6/2020 9:40:00 AM CST		
Date Processed:	4/15/2020 1:03:48 PM CST		

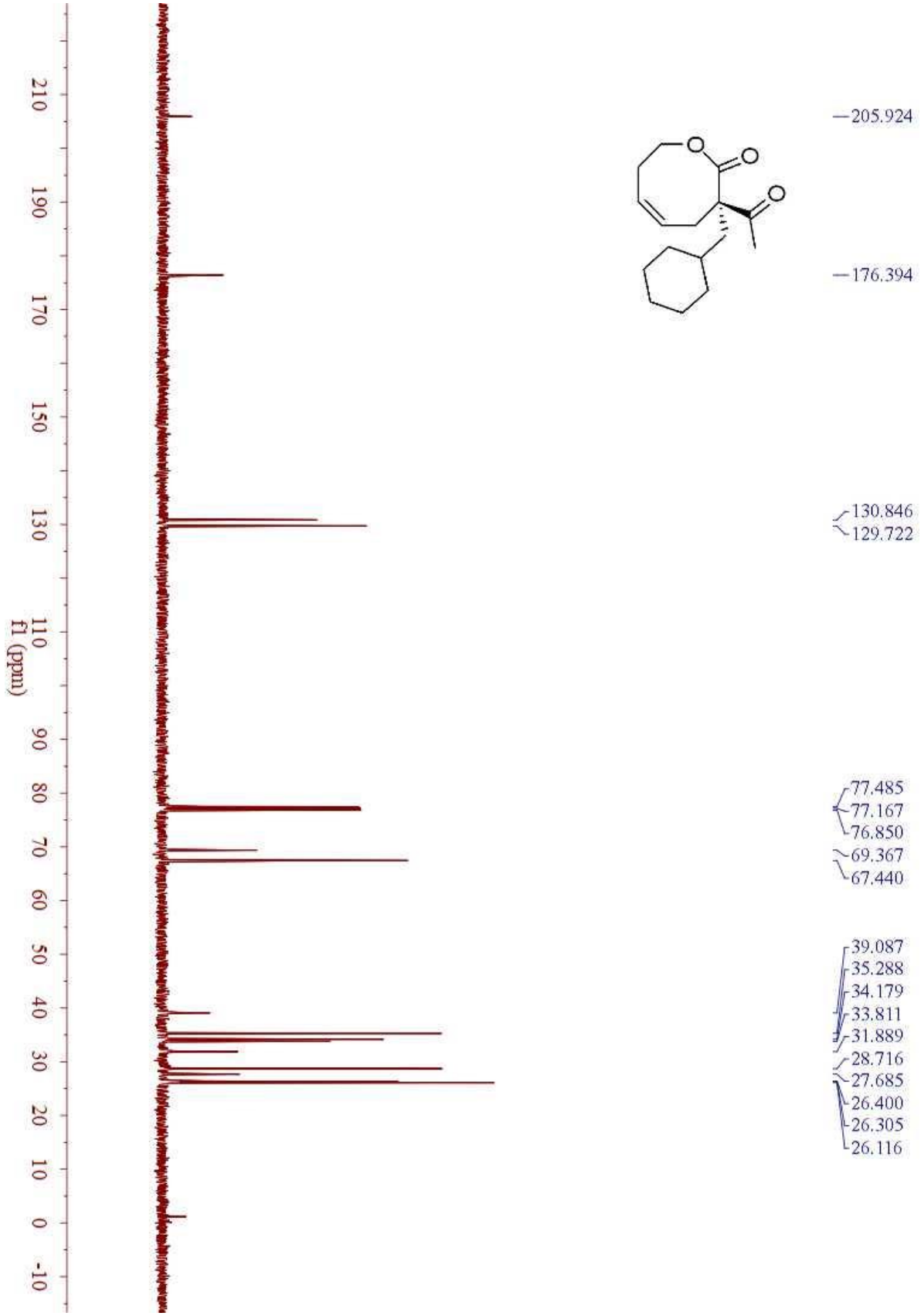


	RT	Area	% Area	Height
1	5.562	15470408	94.04	1416240
2	6.383	980232	5.96	76669

2q ^{1}H NMR (400 MHz, $CDCl_3$)



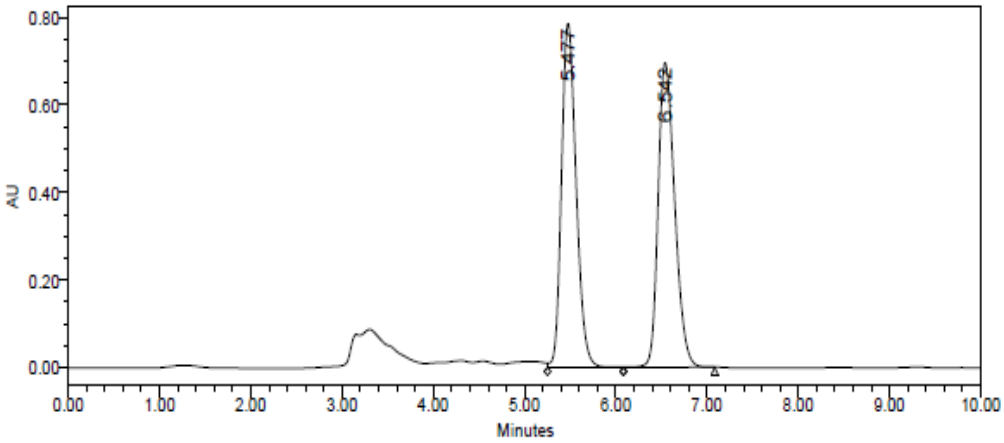
2q ^{13}C NMR (100 MHz, $CDCl_3$)



2q HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-38-1-rac-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	jhjkk
Vial:	1:A,4	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	fhygf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	1/6/2020 9:50:25 AM CST		
Date Processed:	4/15/2020 1:05:42 PM CST		

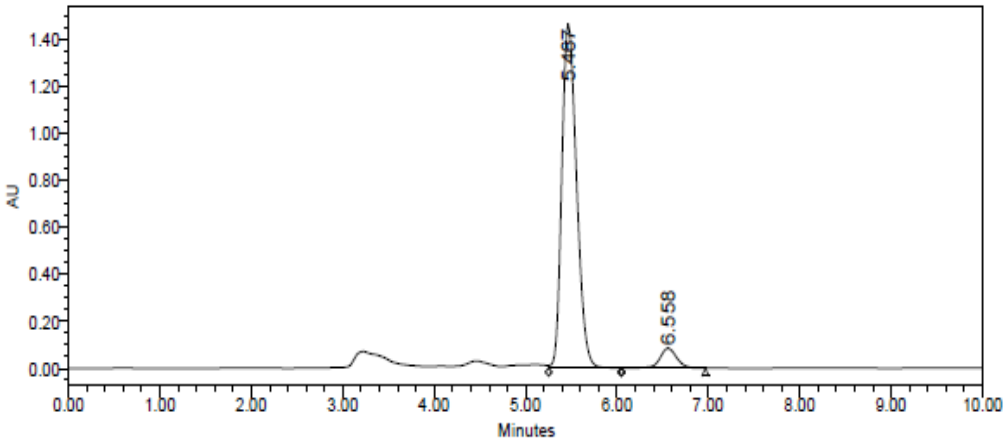


	RT	Area	% Area	Height
1	5.477	8759484	49.94	786577
2	6.542	8780422	50.06	697336

2q HPLC: chiral sample

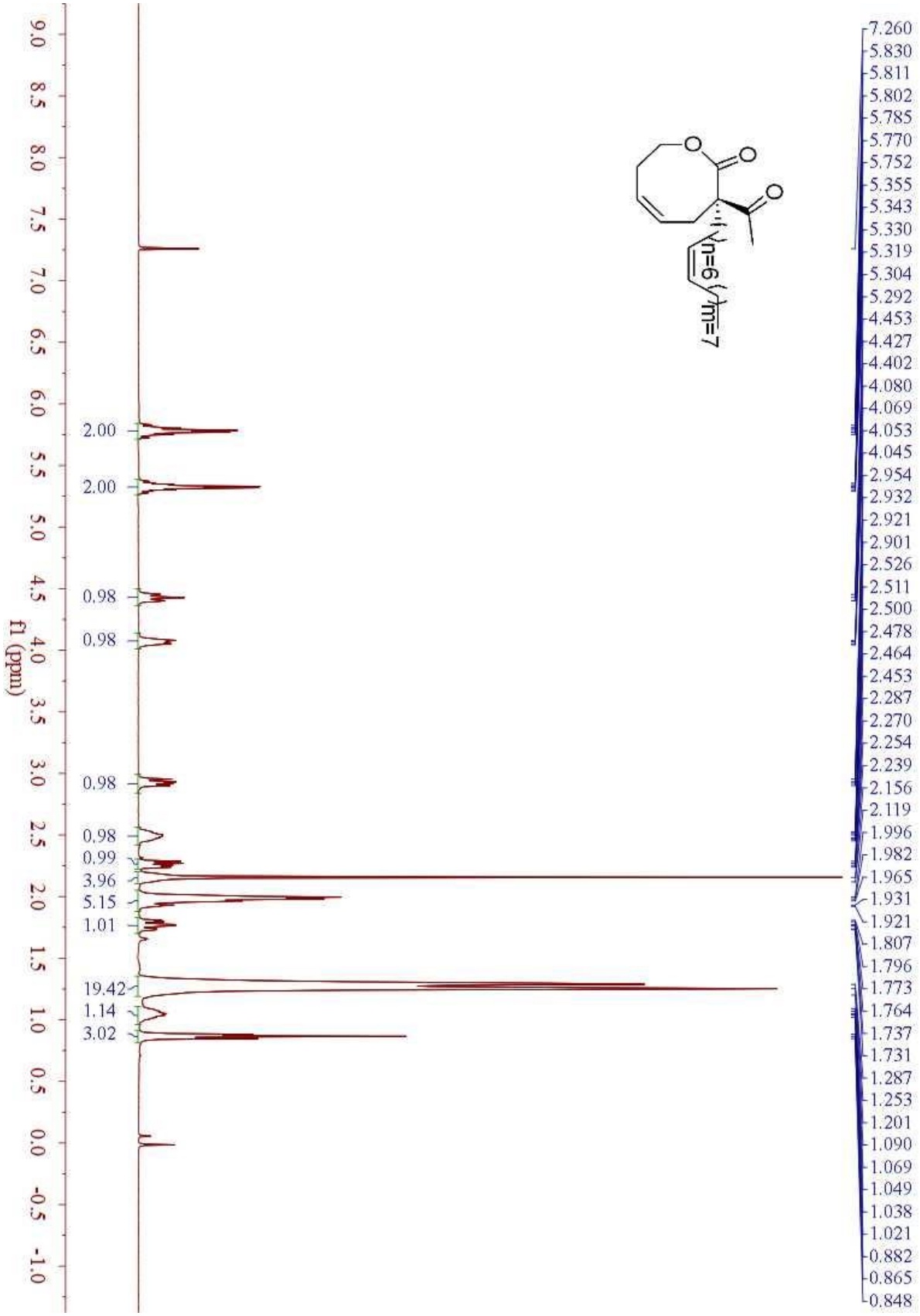
SAMPLE INFORMATION

Sample Name:	dl-19-38-2-chiral-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	jhjkk
Vial:	1:A,5	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	dfdfdfdxvgxvc
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	10.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	1/6/2020 10:00:49 AM CST		
Date Processed:	4/15/2020 1:06:28 PM CST		

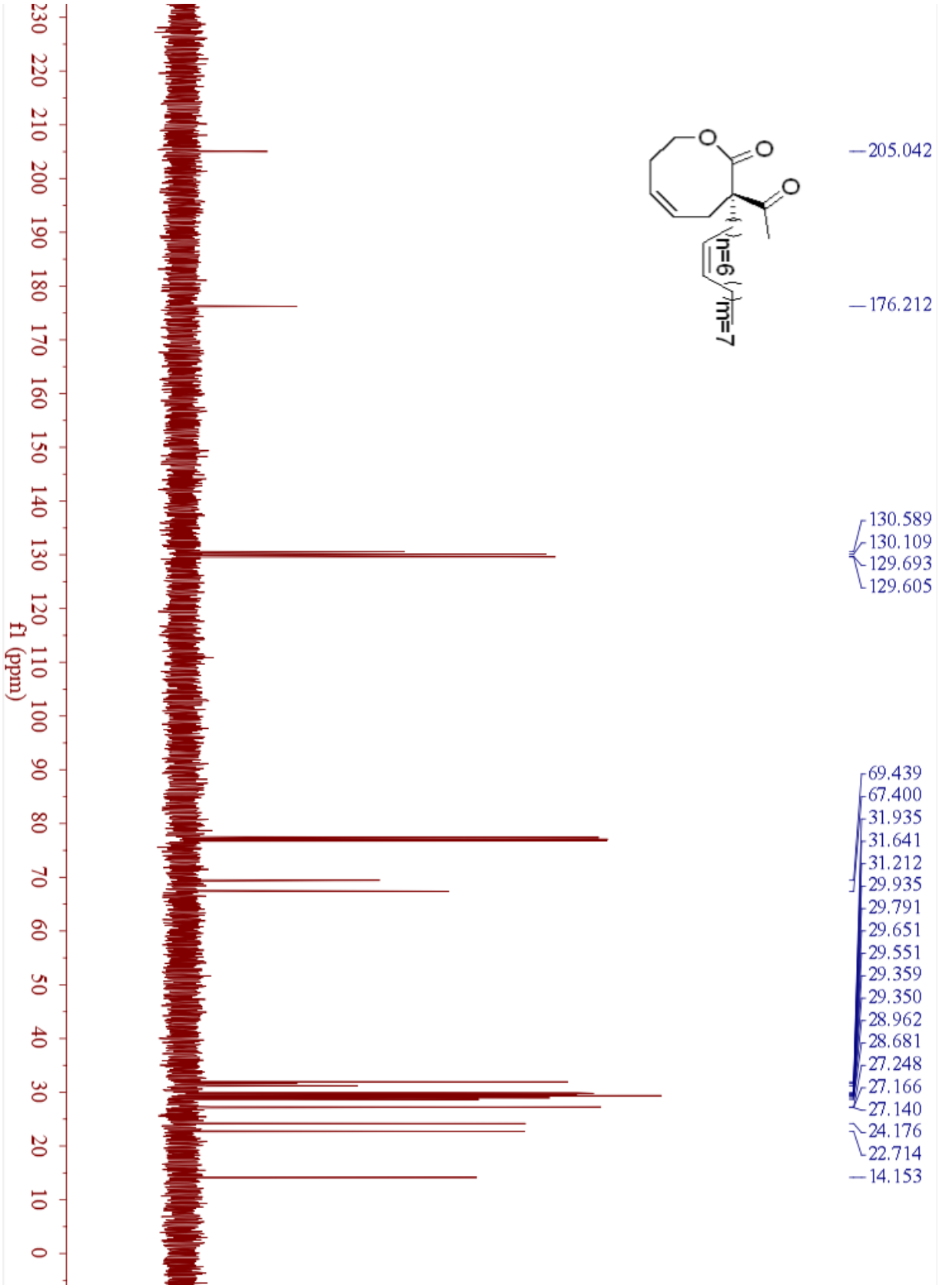


	RT	Area	% Area	Height
1	5.467	16444377	93.73	1463938
2	6.558	1099202	6.27	84362

2r ^{1}H NMR (400 MHz, $CDCl_3$)



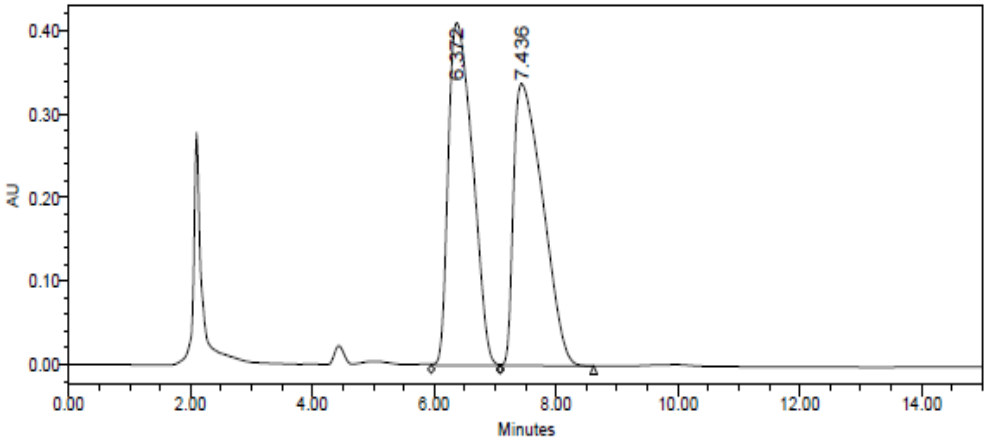
2r ^{13}C NMR (100 MHz, $CDCl_3$)



2r HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-76-1-rac-ic9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	jkjkk
Vial:	1:A,3	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	dfdsff
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/11/2019 10:05:42 PM CST		
Date Processed:	4/15/2020 1:07:39 PM CST		



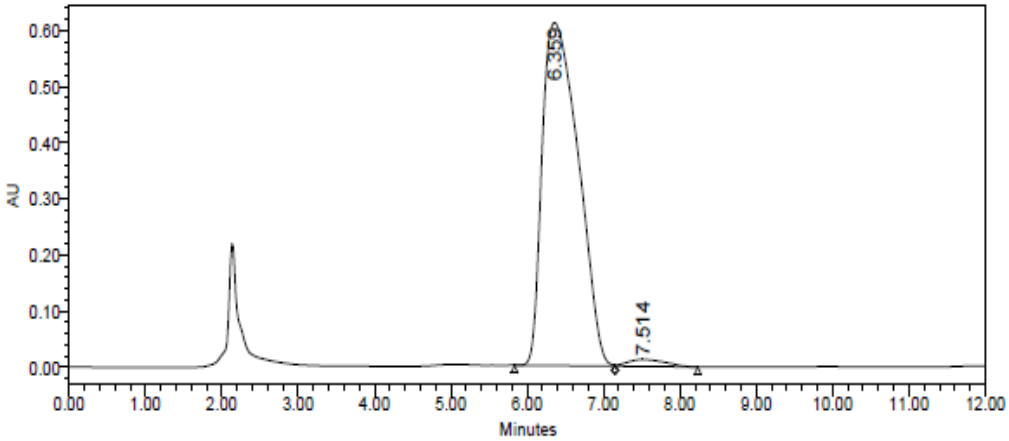
	RT	Area	% Area	Height
1	6.372	11360860	50.21	410353
2	7.436	11266545	49.79	337631

2r HPLC: chiral sample

SAMPLE INFORMATION

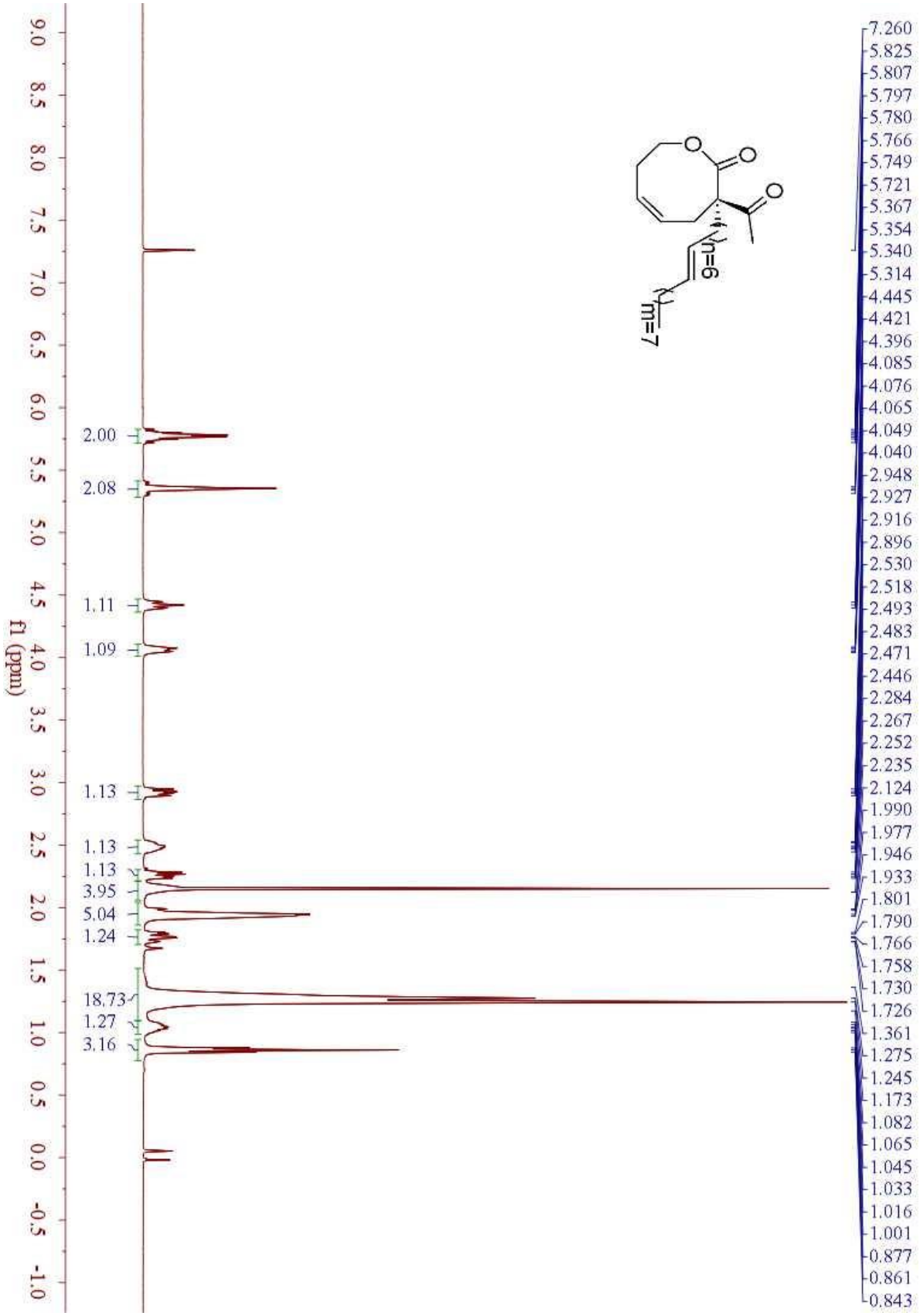
Sample Name:	dl-19-76-2-chiral-ic9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghjg
Vial:	1:A,3	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	cvcvc
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 12/11/2019 10:48:26 PM CST
Date Processed: 4/15/2020 1:08:21 PM CST

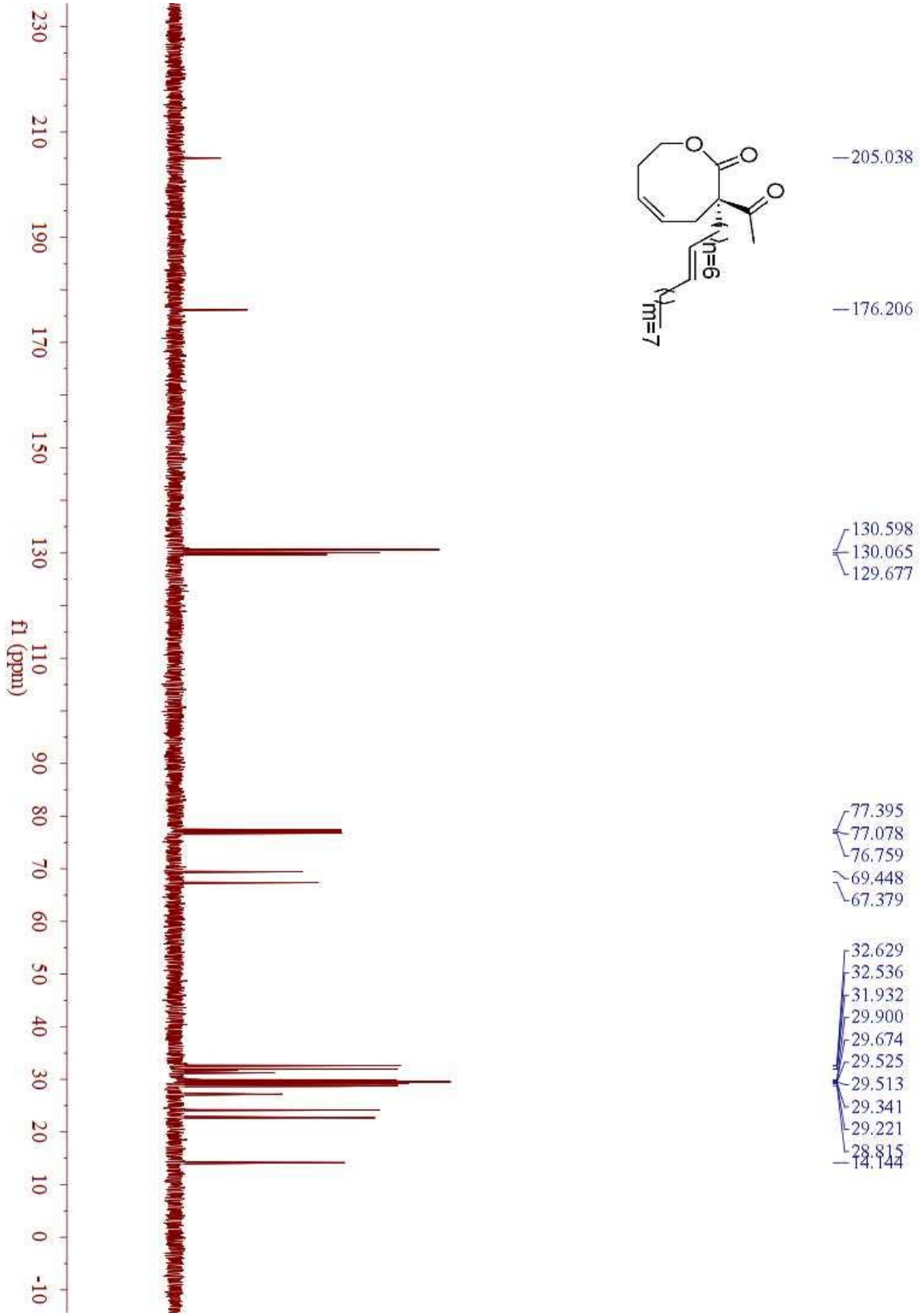


	RT	Area	% Area	Height
1	6.359	20079331	97.96	611045
2	7.514	418880	2.04	12242

2s ^{1}H NMR (400 MHz, $CDCl_3$)



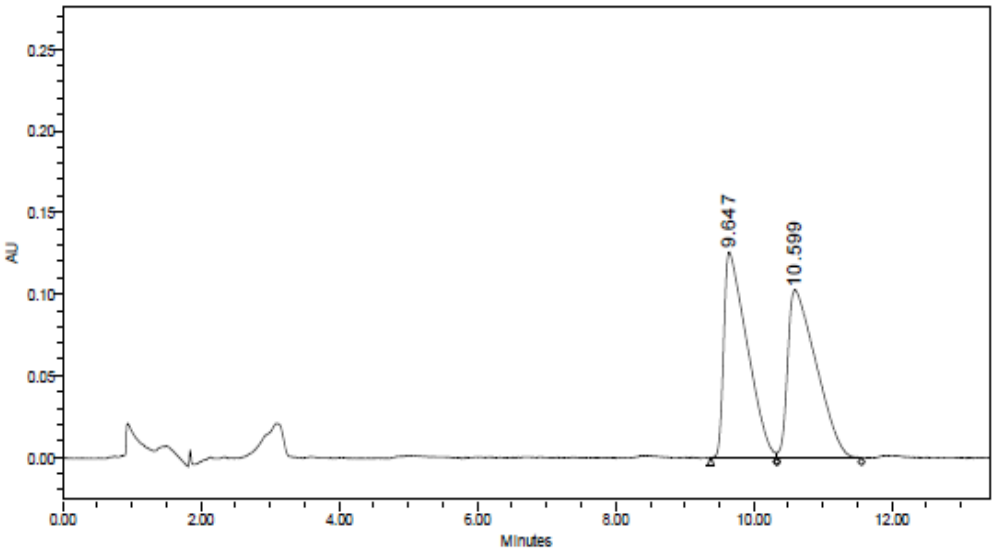
2s ^{13}C NMR (100 MHz, $CDCl_3$)



2s HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-20-3-1-rac-ic-98-2etoh	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	2:E,3	Acq. Method Set:	upc_pda_2019m
Injection #:	2	Processing Method	TEST
Injection Volume:	3.00 ul	Channel Name:	210.0nm
Run Time:	40.0 Minutes	Proc. Chnl. Descr.:	PDA Spectrum PDA 210.0 nm
Date Acquired:	1/7/2020 2:34:52 PM CST		
Date Processed:	1/8/2020 2:08:20 PM CST		

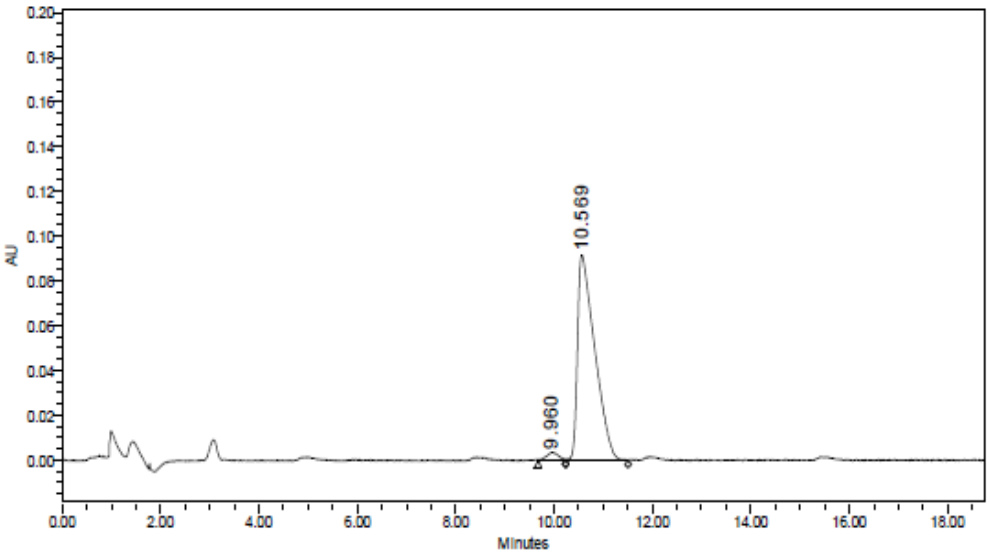


	RT	Peak Type	Height	Width (sec)	Area	% Area
1	9.647	Unknown	126143	57.112	2962139	50.12
2	10.599	Unknown	102787	73.516	2947398	49.88

2s HPLC: chiral sample

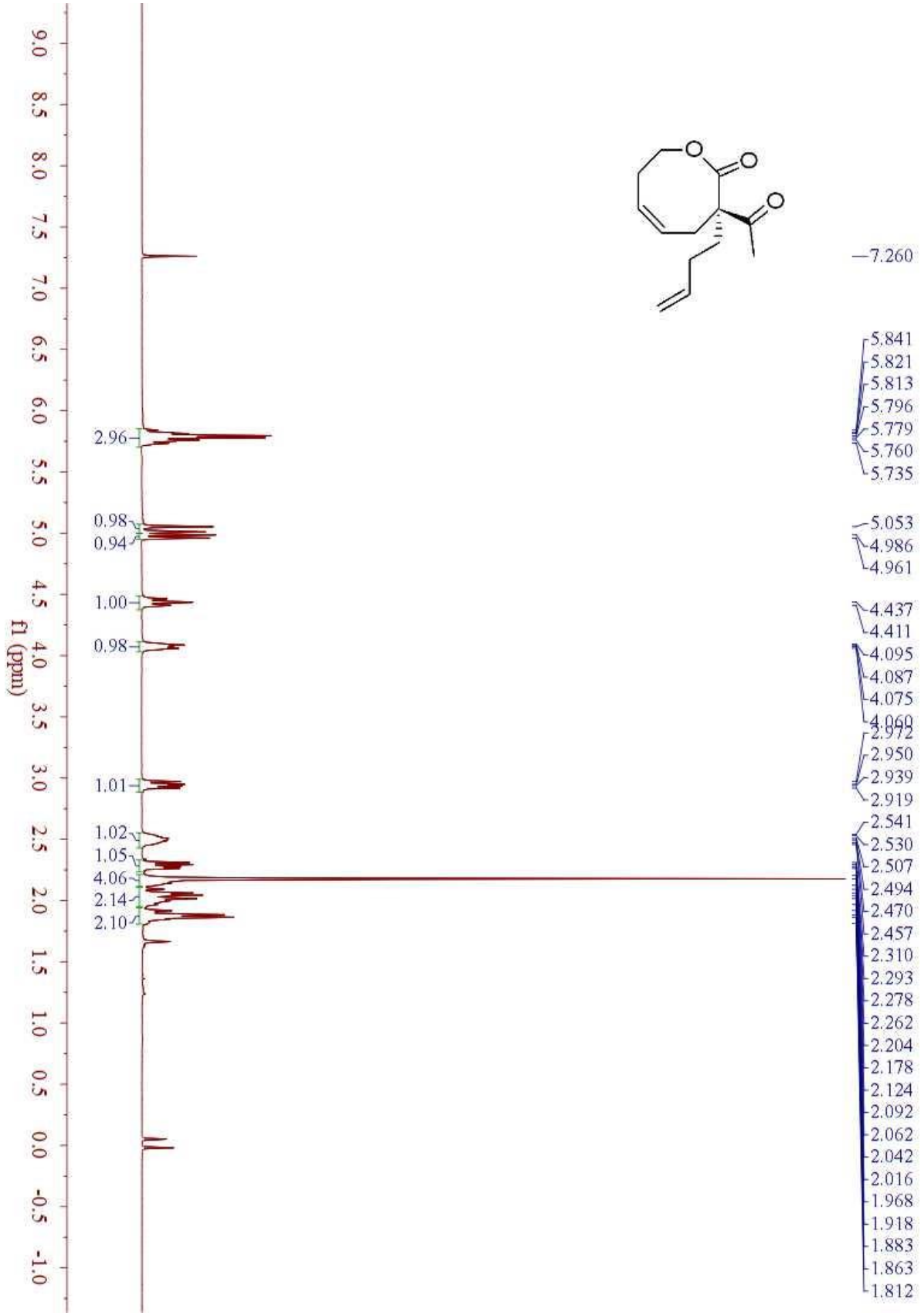
SAMPLE INFORMATION

Sample Name:	dl-20-3-2-chiral	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	2:E,4	Acq. Method Set:	upc_pda_2019m
Injection #:	1	Processing Method	TEST
Injection Volume:	1.50 ul	Channel Name:	210.0nm
Run Time:	40.0 Minutes	Proc. Chnl. Descr.:	PDA Spectrum PDA 210.0 nm
Date Acquired:	1/7/2020 2:49:40 PM CST		
Date Processed:	1/8/2020 2:07:59 PM CST		

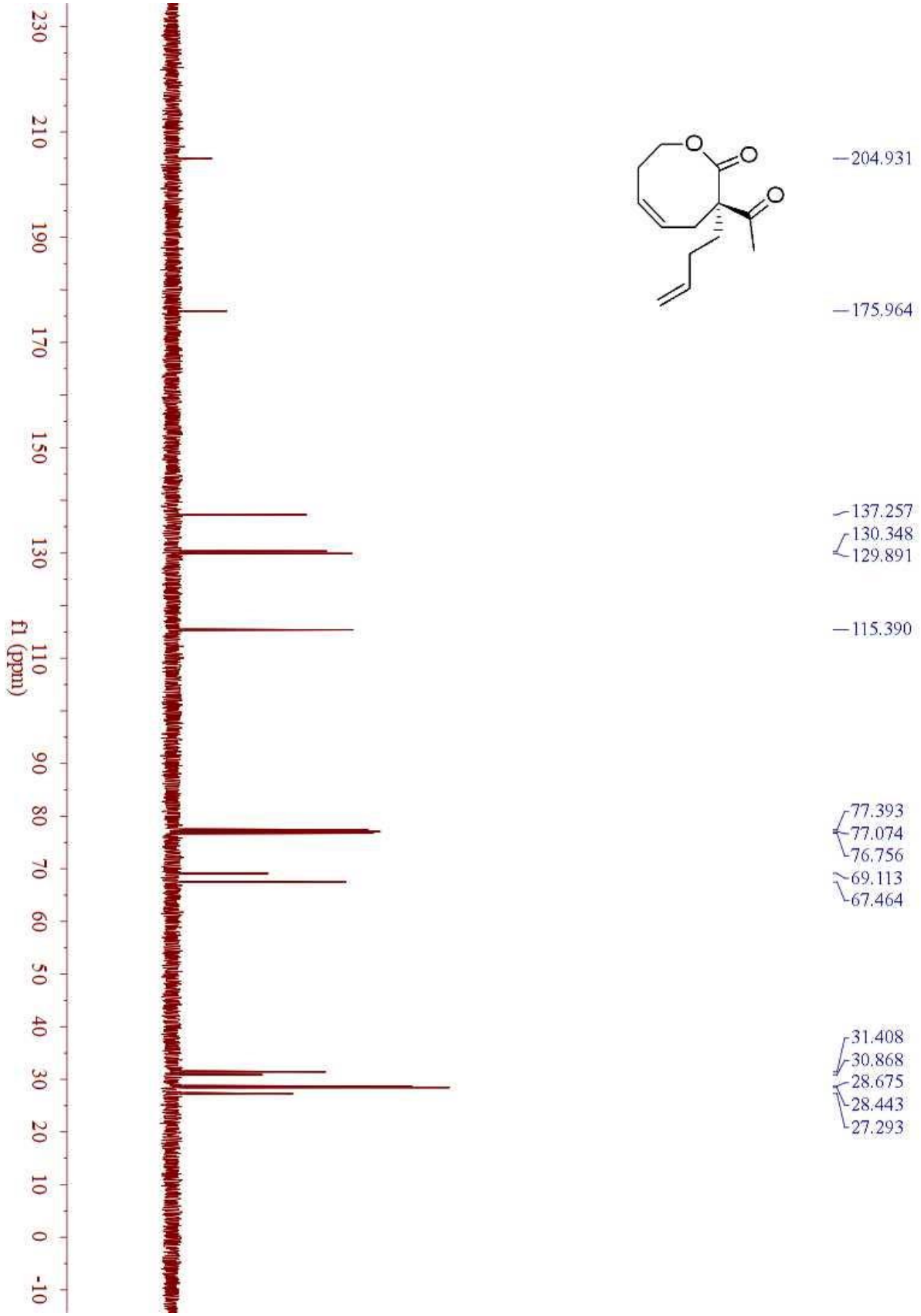


	RT	Peak Type	Height	Width (sec)	Area	% Area
1	9.960	Unknown	3624	33.307	60696	2.63
2	10.569	Unknown	91934	76.216	2248453	97.37

2t ^{1}H NMR (400 MHz, $CDCl_3$)



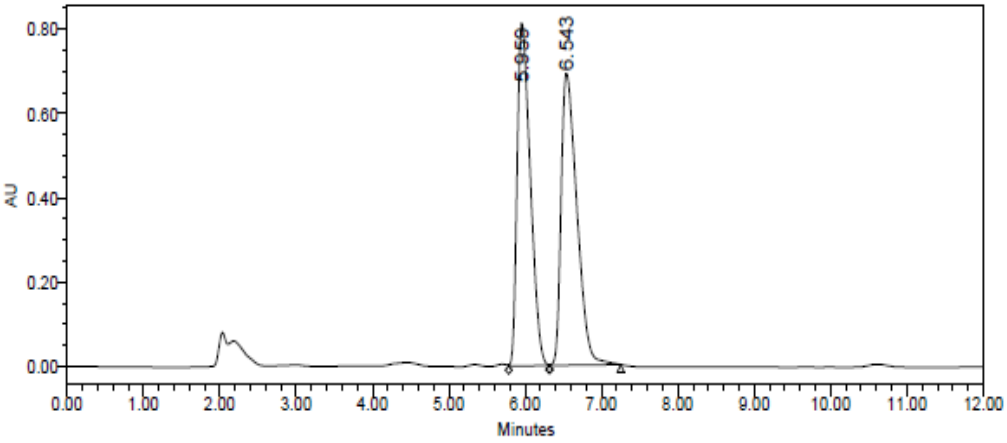
2t ^{13}C NMR (100 MHz, $CDCl_3$)



2t HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-20-2-1-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gjj
Vial:	1:A,6	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	vcxvdf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/27/2019 10:16:30 AM CST		
Date Processed:	4/15/2020 1:35:44 PM CST		



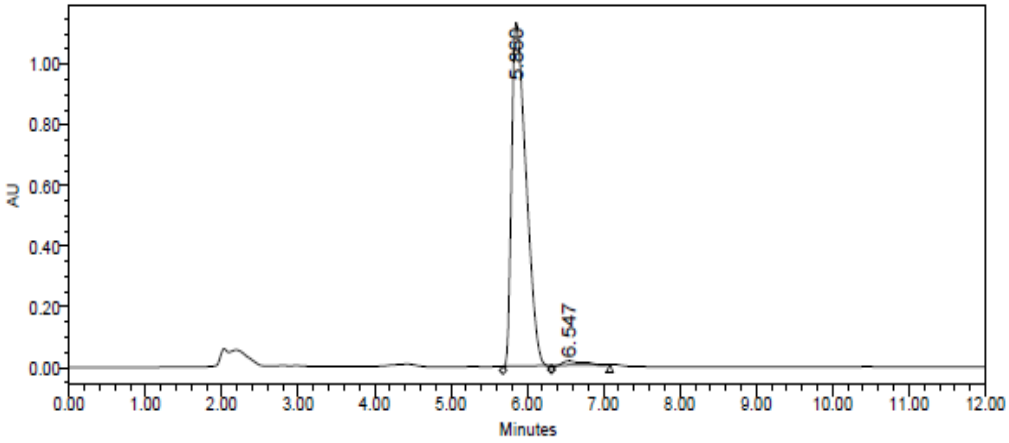
	RT	Area	% Area	Height
1	5.959	9695437	49.37	819777
2	6.543	9942854	50.63	697279

2t HPLC: chiral sample

SAMPLE INFORMATION

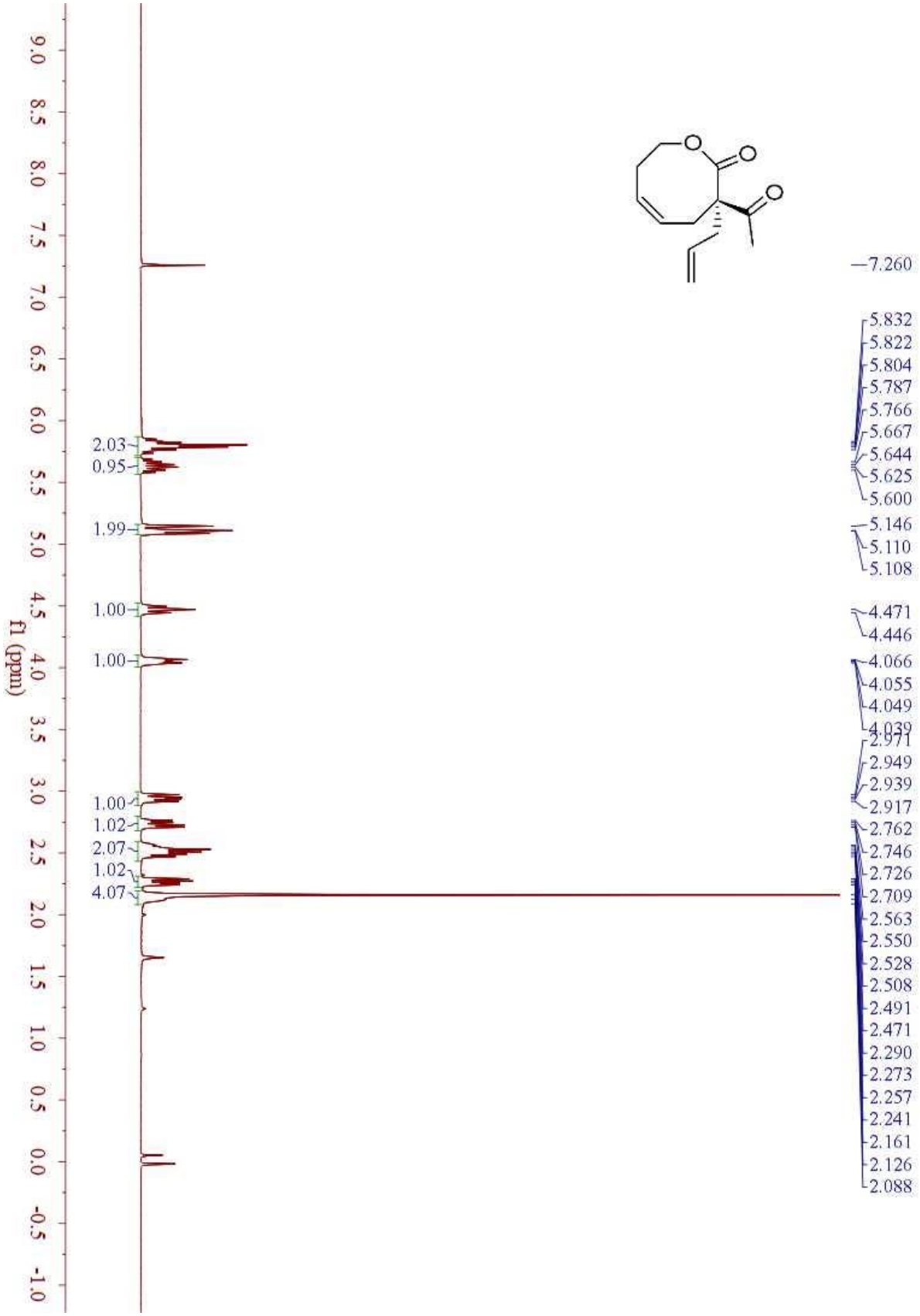
Sample Name:	dl-20-2-2-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gjj
Vial:	1:A,7	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	cfdsf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 12/27/2019 10:28:56 AM CST
Date Processed: 4/15/2020 1:37:02 PM CST

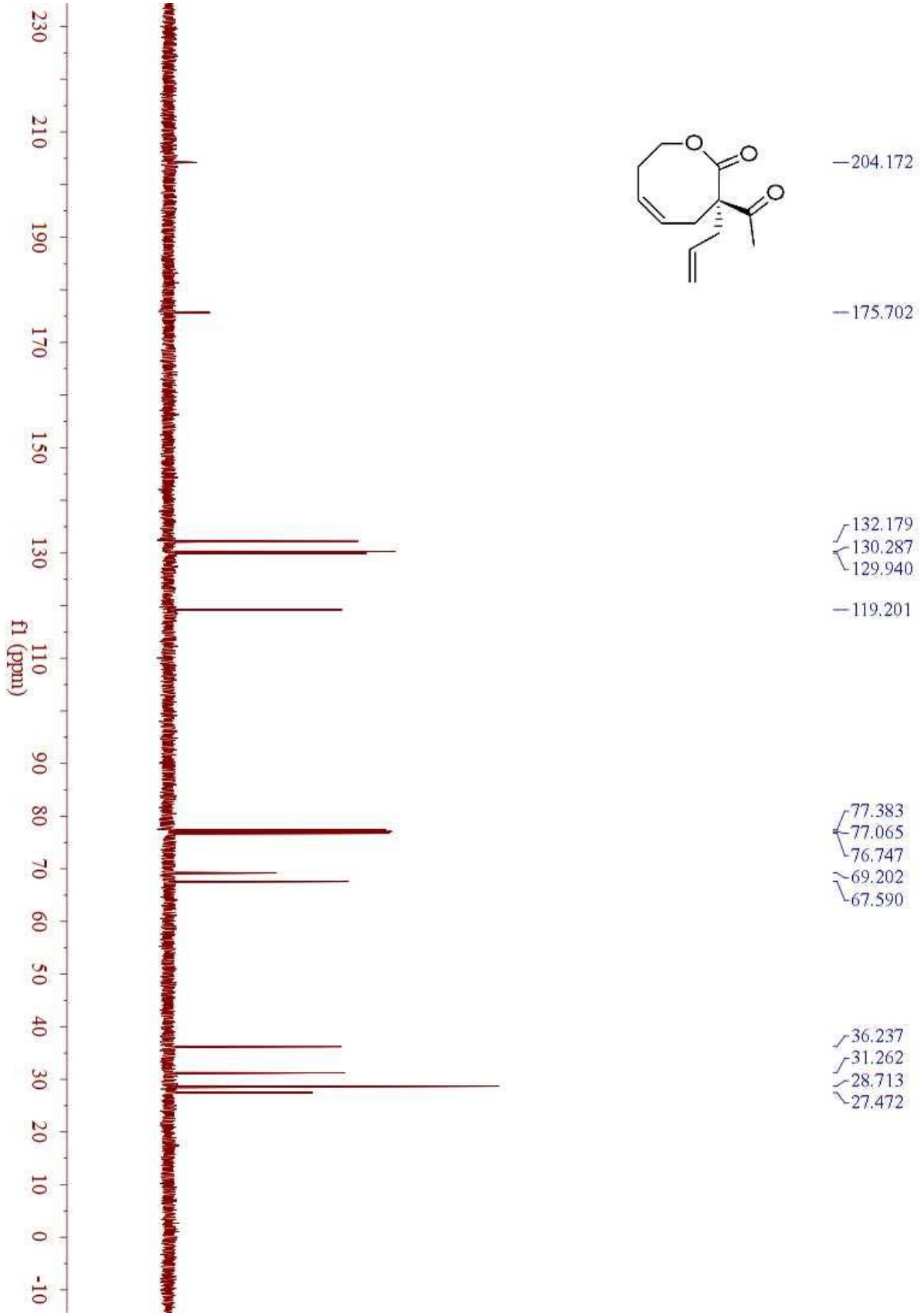


	RT	Area	% Area	Height
1	5.860	14829010	98.16	1143736
2	6.547	278557	1.84	14277

2u ^{1}H NMR (400 MHz, $CDCl_3$)



2u ^{13}C NMR (100 MHz, $CDCl_3$)

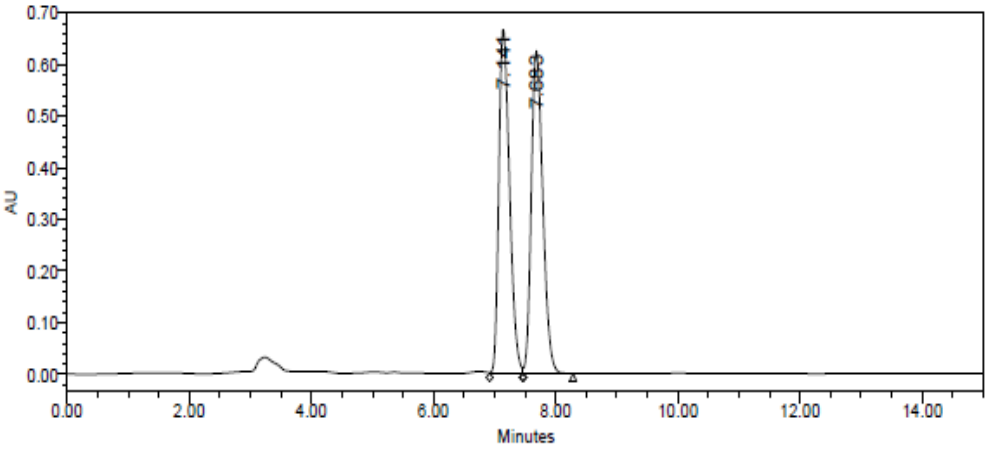


2u HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-20-1-1-rac-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hkj
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	bnvbnhgh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 12/27/2019 11:52:11 AM CST
Date Processed: 4/15/2020 1:34:13 PM CST

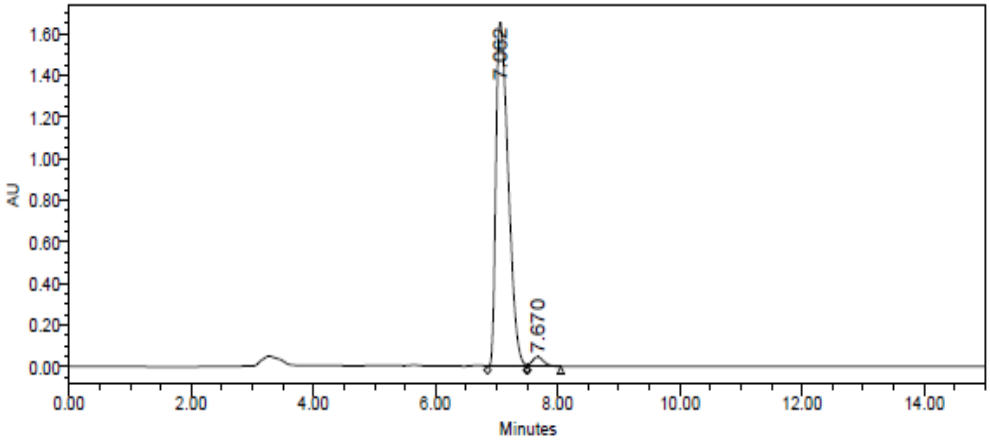


	RT	Area	% Area	Height
1	7.141	8110167	49.78	668654
2	7.683	8182812	50.22	624961

2u HPLC: chiral sample

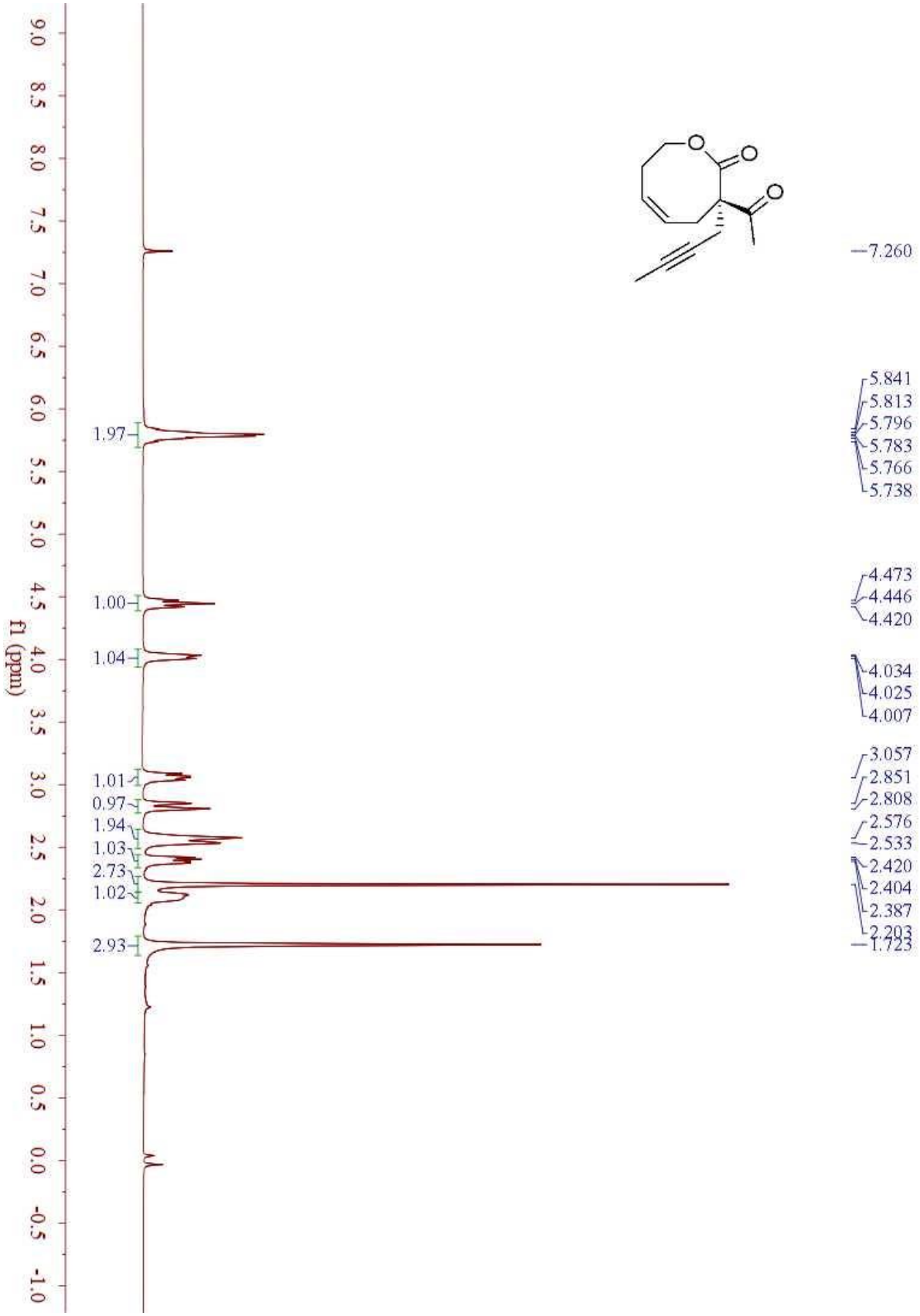
SAMPLE INFORMATION

Sample Name:	dl-20-1-2-chiral-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hkj
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	xvcxvd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/27/2019 12:07:35 PM CST		
Date Processed:	4/15/2020 1:34:56 PM CST		

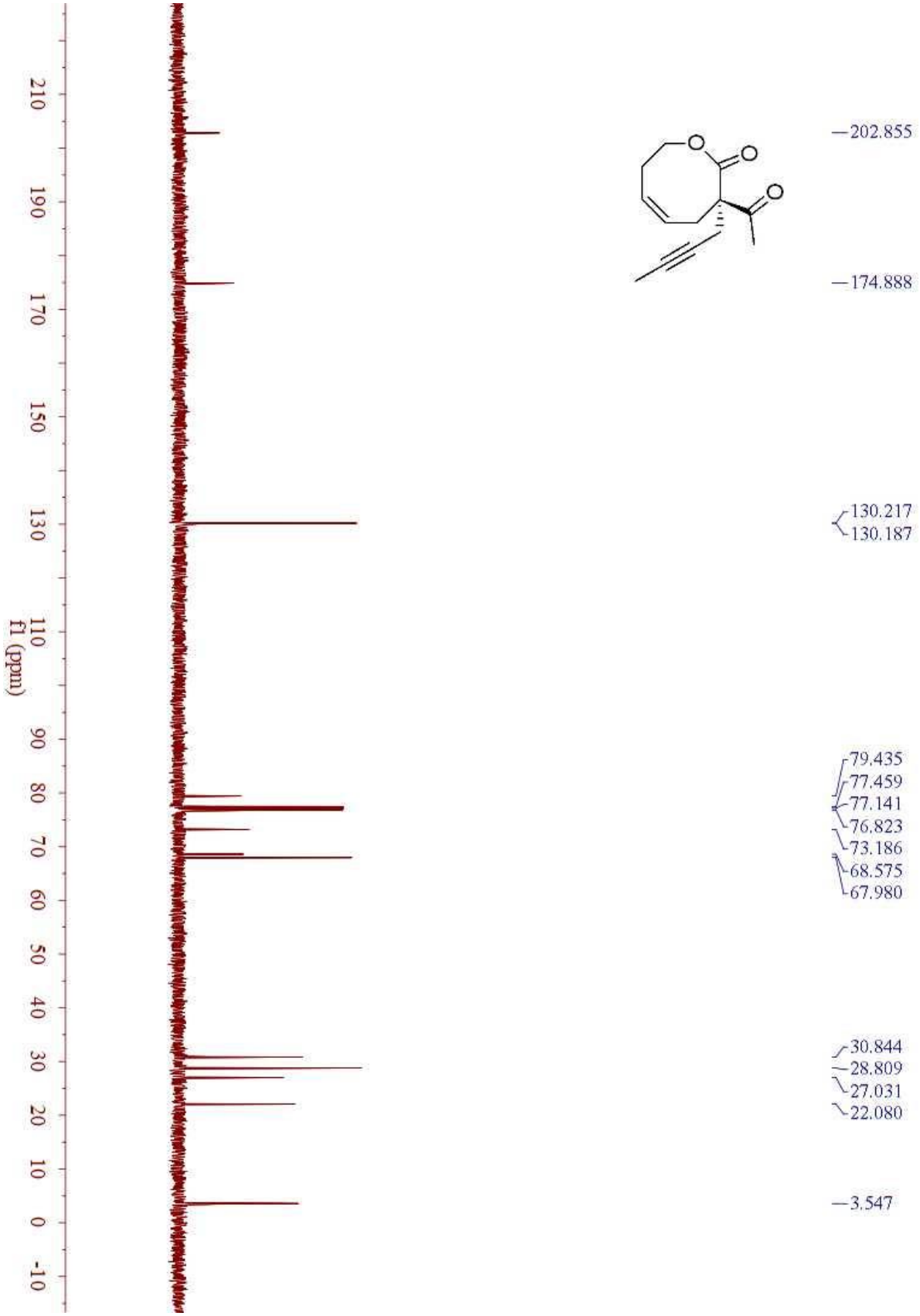


	RT	Area	% Area	Height
1	7.062	23148144	97.54	1654269
2	7.670	584107	2.46	45444

2v ^{1}H NMR (400 MHz, $CDCl_3$)



2v ^{13}C NMR (100 MHz, $CDCl_3$)

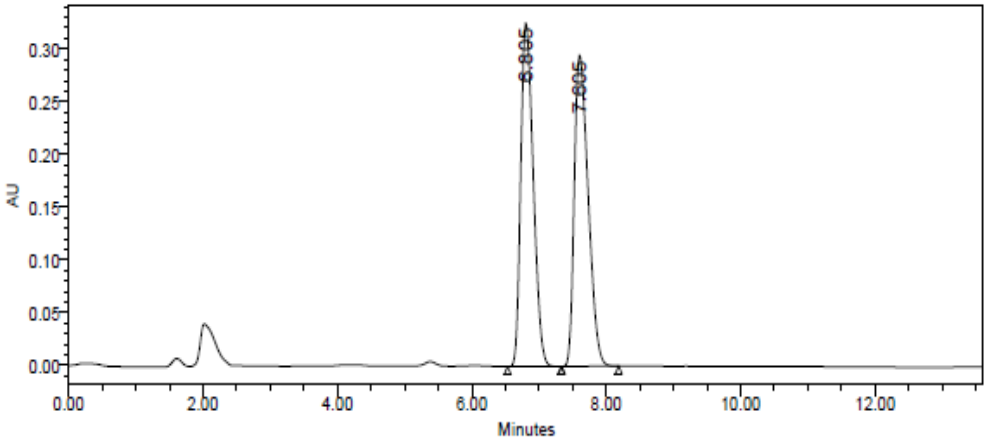


2v HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-20-18-1-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gfg
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	kiujkij
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	20.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 4/15/2020 2:40:58 PM CST
Date Processed: 4/15/2020 5:11:42 PM CST

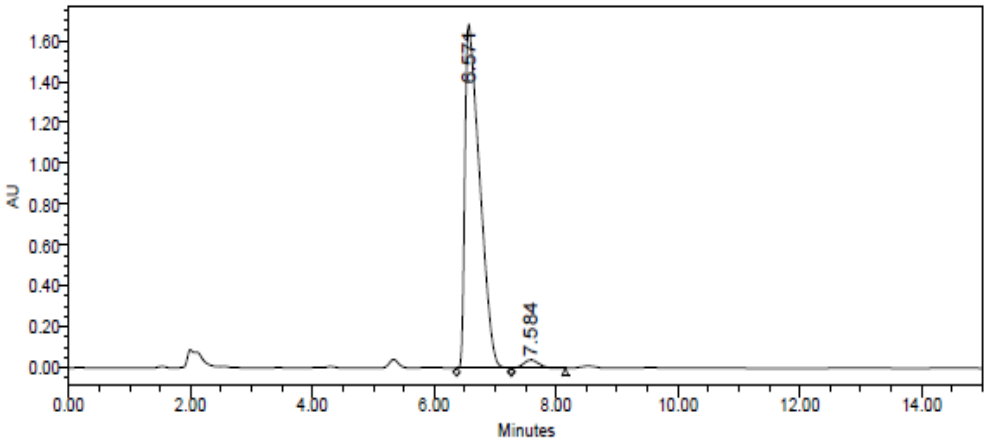


	RT	Area	% Area	Height
1	6.805	4212064	49.91	326513
2	7.605	4227320	50.09	295702

2v HPLC: chiral sample

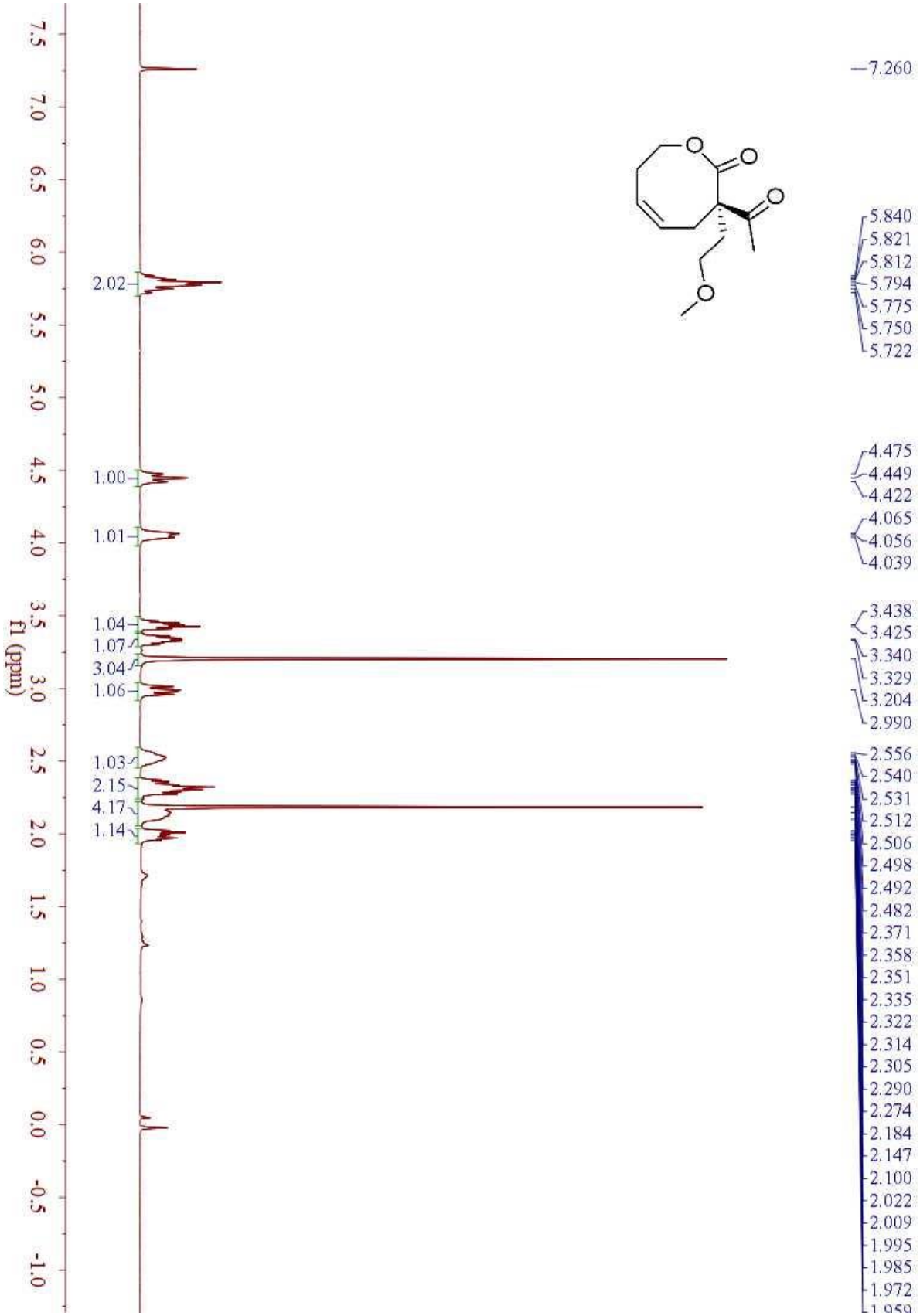
SAMPLE INFORMATION

Sample Name:	dl-20-18-2-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gfg
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	hgthh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	4/15/2020 3:04:42 PM CST		
Date Processed:	4/15/2020 5:12:57 PM CST		

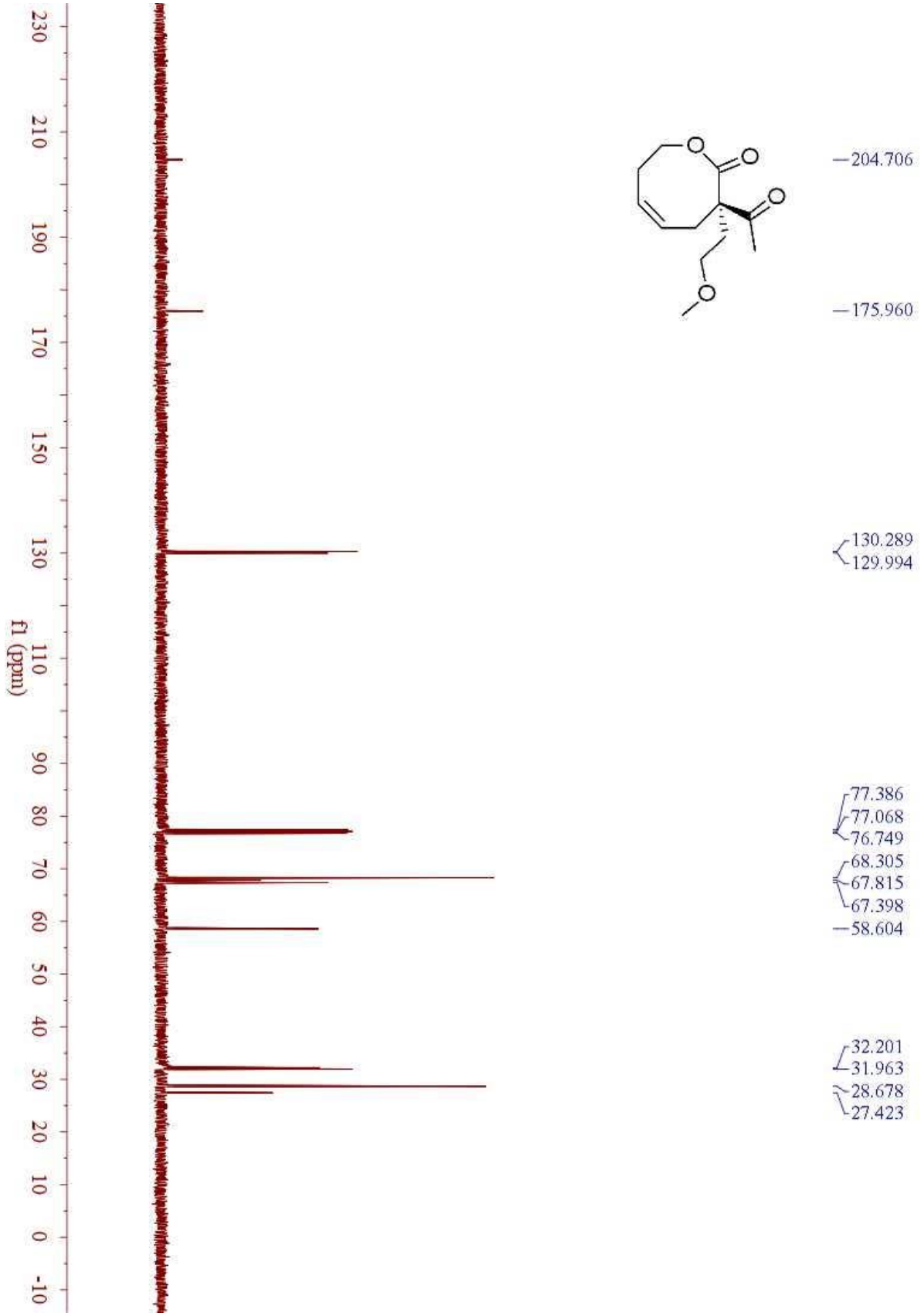


	RT	Area	% Area	Height
1	6.571	28198241	97.62	1686716
2	7.584	687674	2.38	39241

2w ^{1}H NMR (400 MHz, $CDCl_3$)



2w ^{13}C NMR (100 MHz, $CDCl_3$)

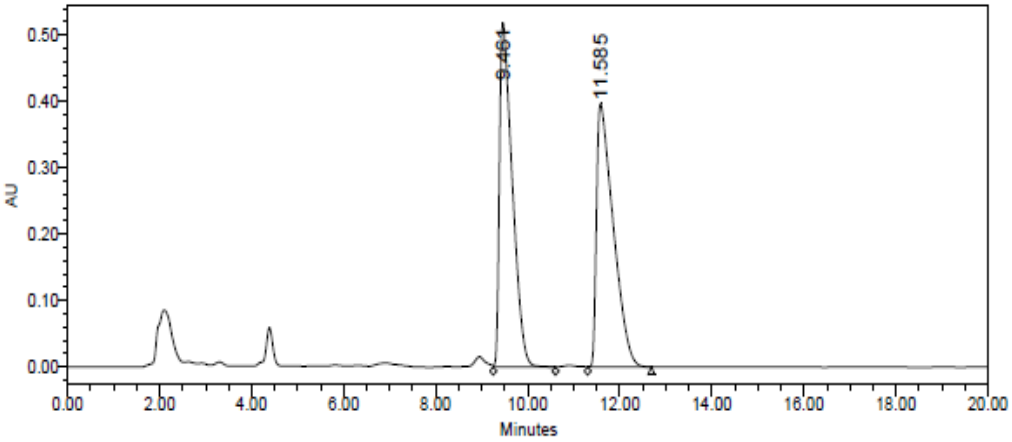


2w HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-20-8-1-rac-ic9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgdfg
Vial:	1:A,2	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	xcfdd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	20.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 12/31/2019 9:50:42 AM CST
Date Processed: 4/15/2020 1:38:16 PM CST



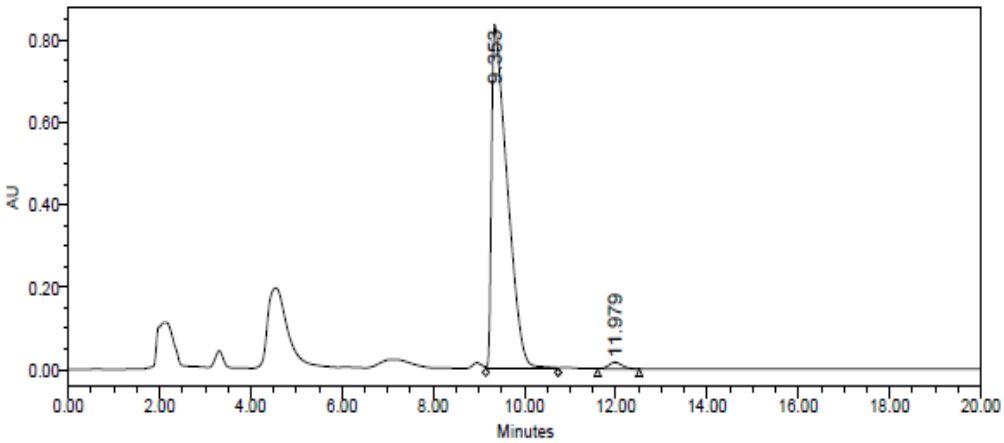
	RT	Area	% Area	Height
1	9.461	10057767	50.09	522593
2	11.585	10020023	49.91	396960

2w HPLC: chiral sample

SAMPLE INFORMATION

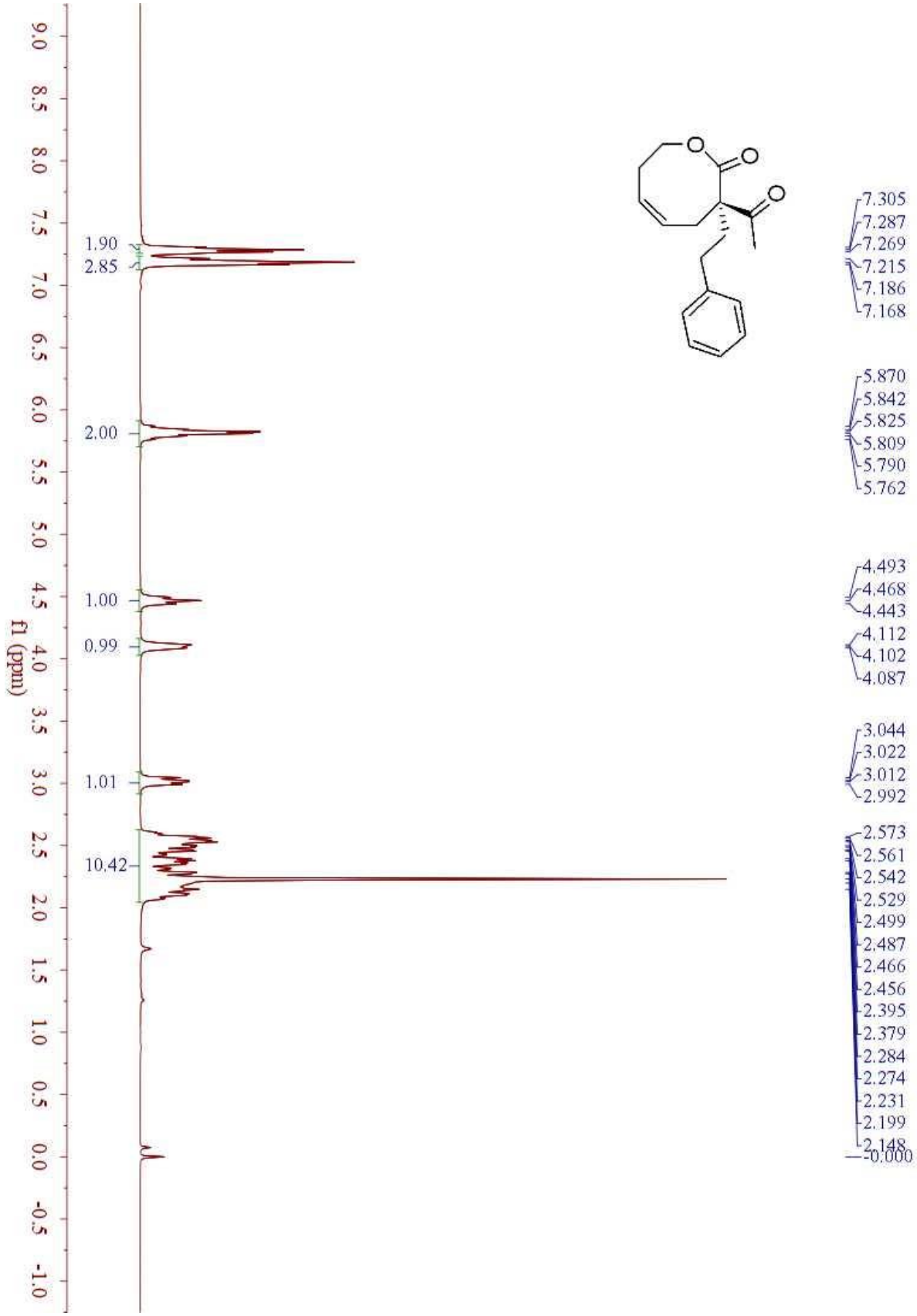
Sample Name:	dl-20-8-2-chiral-ic9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgdfg
Vial:	1:A,3	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	ghgggk
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	20.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 12/31/2019 10:11:07 AM CST
Date Processed: 4/15/2020 1:39:09 PM CST

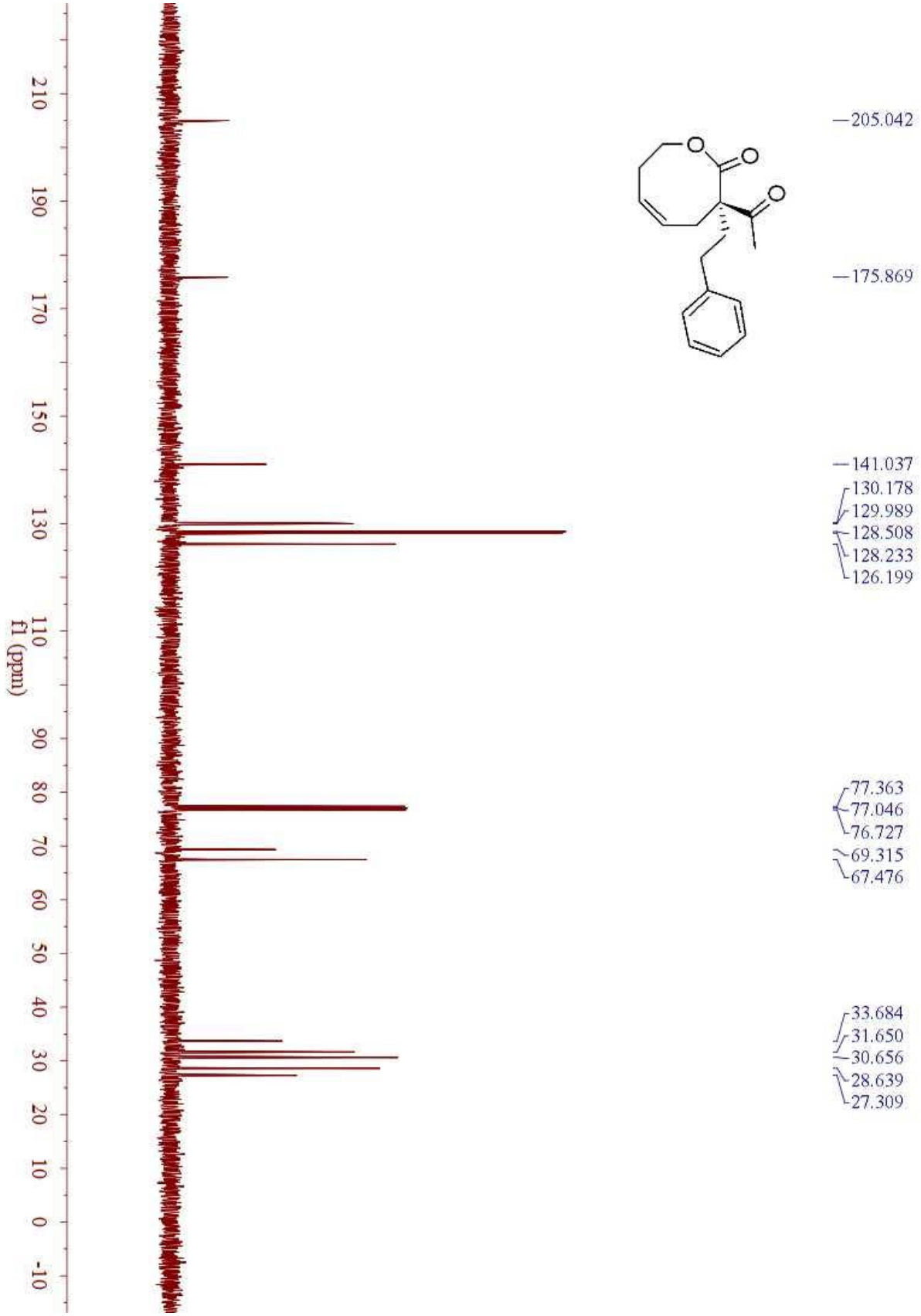


	RT	Area	% Area	Height
1	9.353	19896474	98.47	836192
2	11.979	309611	1.53	15726

2x ^{1}H NMR (400 MHz, $CDCl_3$)



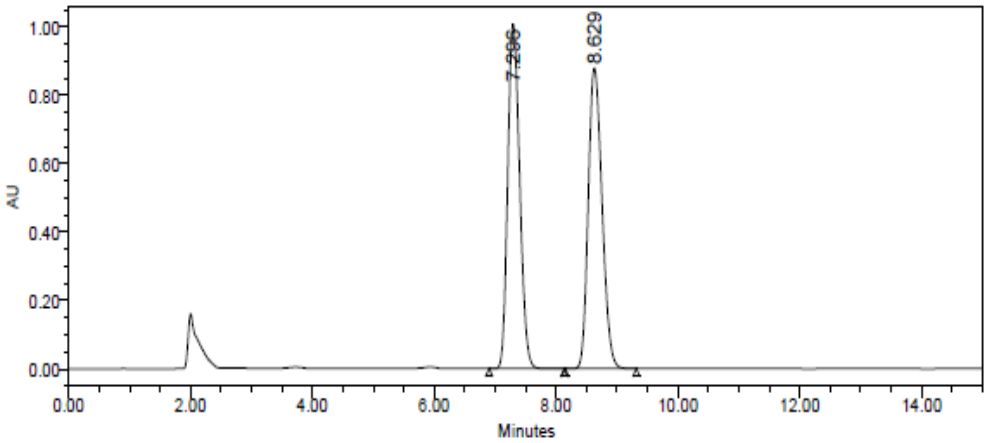
2x ^{13}C NMR (100 MHz, $CDCl_3$)



2x HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-93-1-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghjh
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	szcc
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/20/2019 6:58:02 PM CST		
Date Processed:	4/15/2020 12:53:43 PM CST		

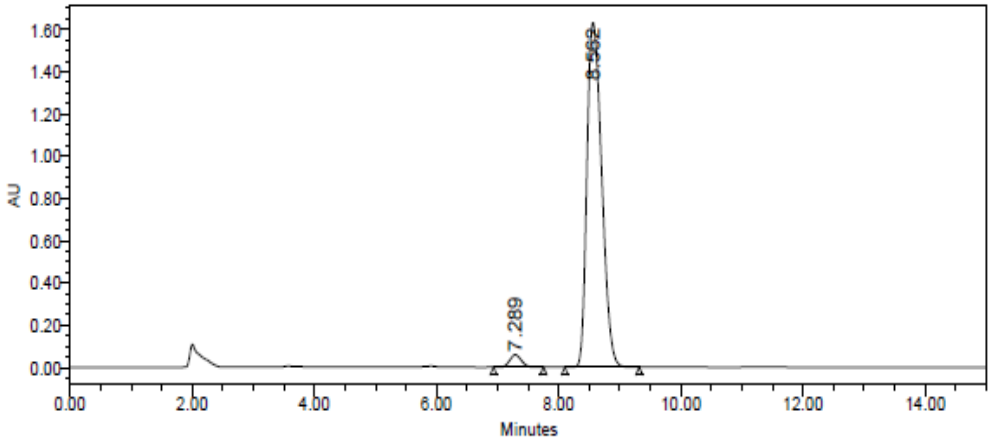


	RT	Area	% Area	Height
1	7.296	13720178	49.79	1009117
2	8.629	13837721	50.21	880505

2x HPLC: chiral sample

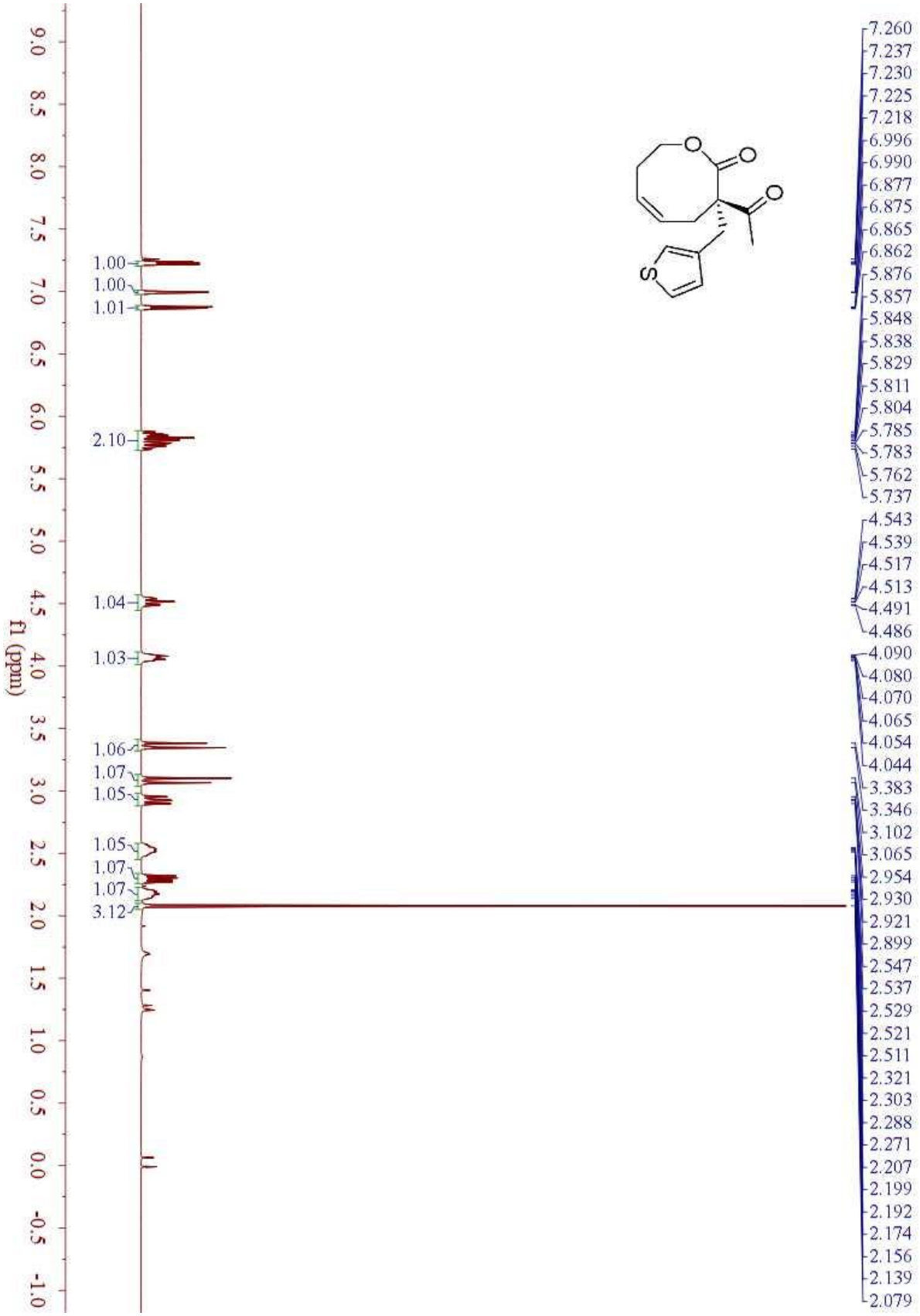
SAMPLE INFORMATION

Sample Name:	dl-19-93-2-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghjh
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	ffgfgf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/20/2019 7:13:28 PM CST		
Date Processed:	4/15/2020 12:54:31 PM CST		

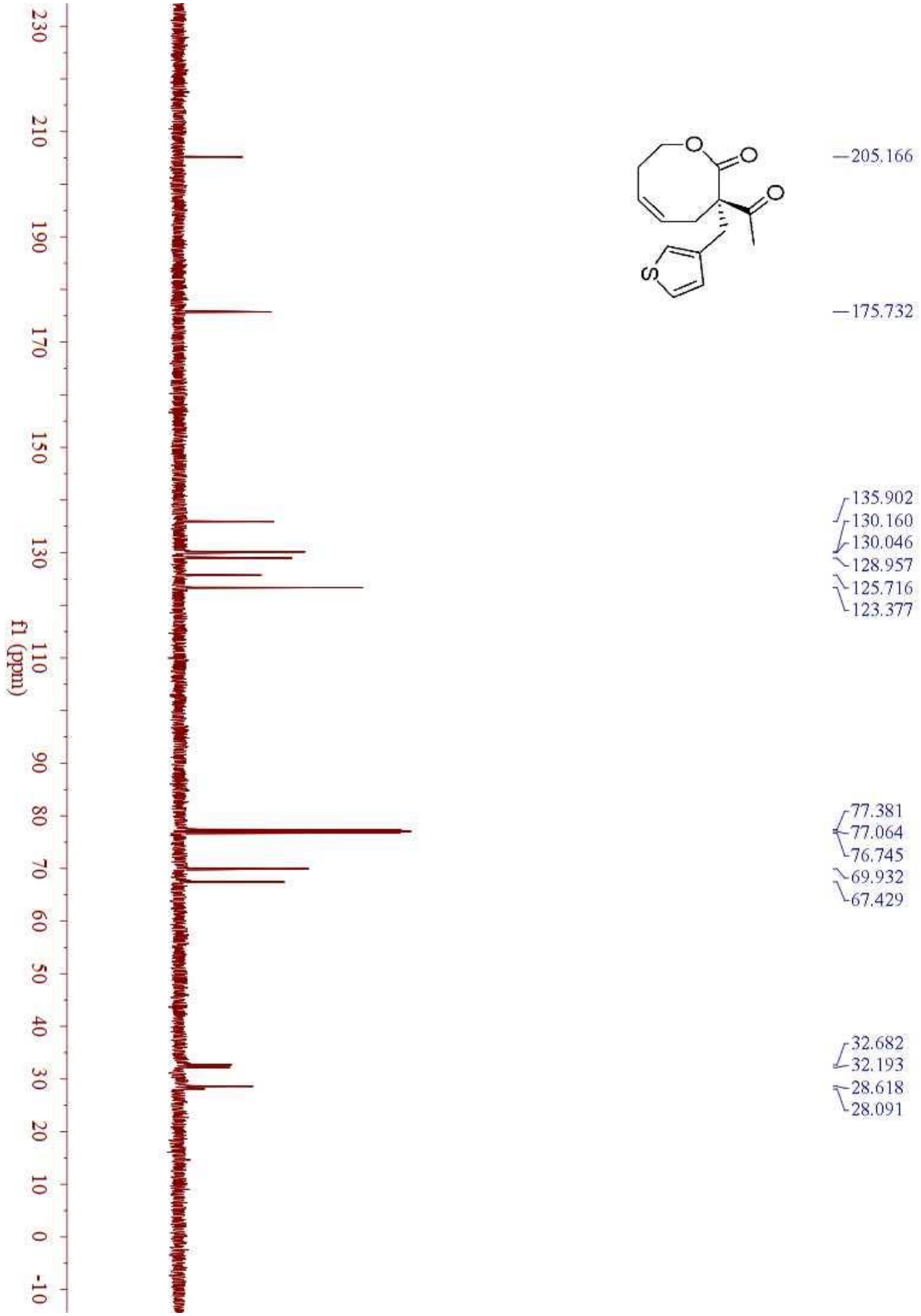


	RT	Area	% Area	Height
1	7.289	786003	2.78	59413
2	8.562	27456360	97.22	1632129

2y ^{1}H NMR (400 MHz, $CDCl_3$)



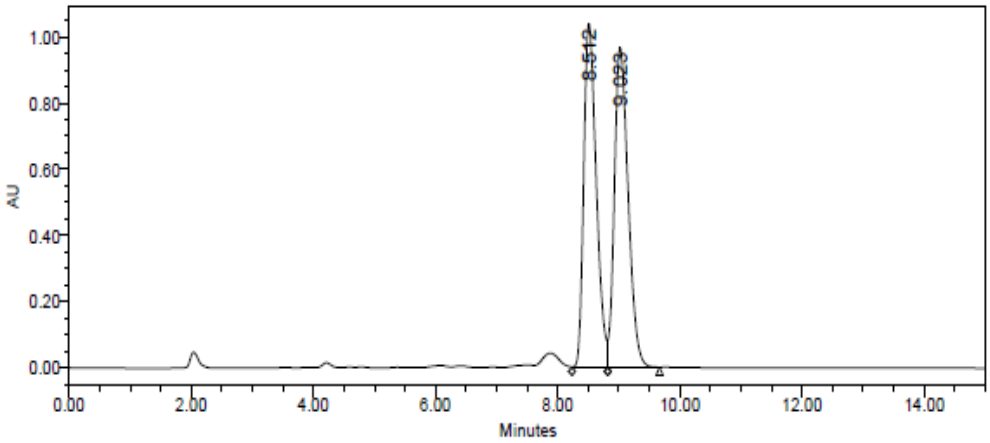
2y ^{13}C NMR (100 MHz, $CDCl_3$)



2y HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-8-1-rac-9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	dvxcv
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	zxcx ccx
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 10:49:19 AM CST		
Date Processed:	4/15/2020 1:09:32 PM CST		

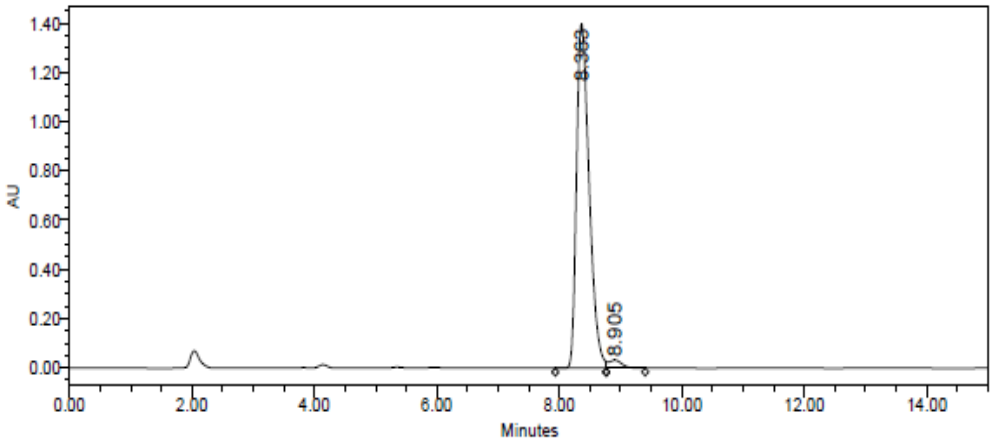


	RT	Area	% Area	Height
1	8.512	14796372	49.49	1040394
2	9.023	15103470	50.51	969198

2y HPLC: chiral sample

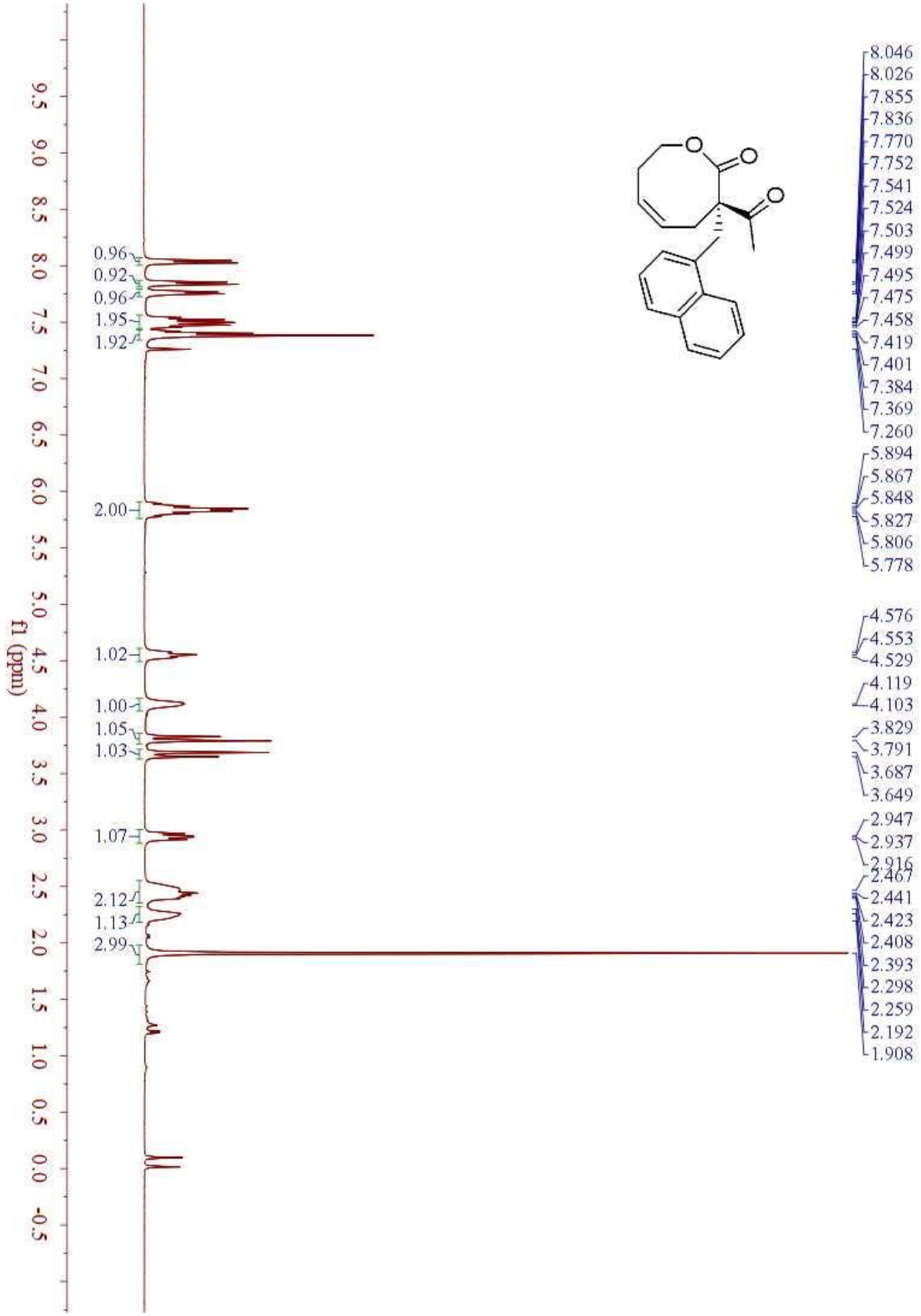
SAMPLE INFORMATION

Sample Name:	dl-18-8-2-chiral-9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghnghnv
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	cxxvcee
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 11:56:23 AM CST		
Date Processed:	4/15/2020 1:10:36 PM CST		

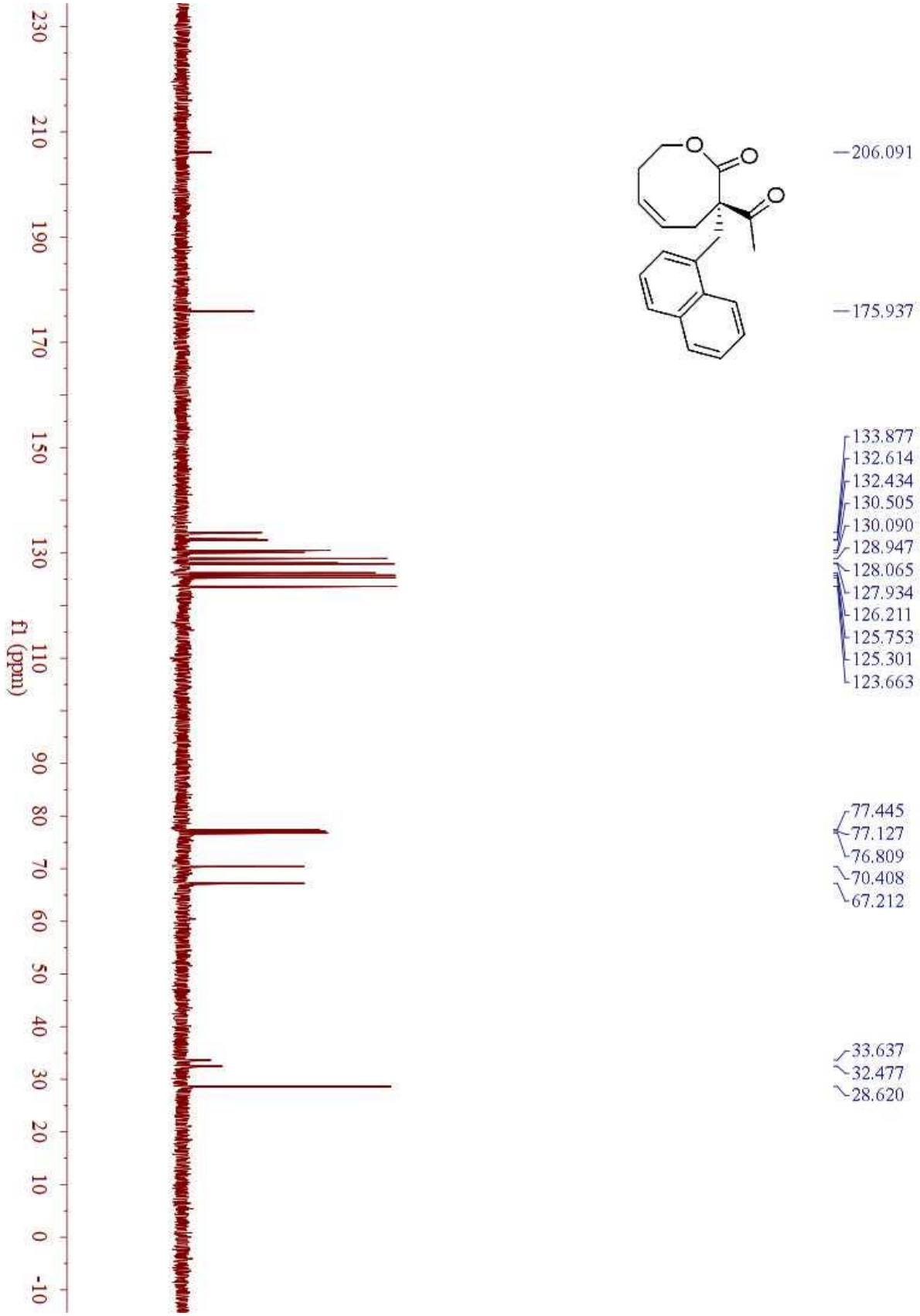


	RT	Area	% Area	Height
1	8.363	20006717	97.54	1398641
2	8.905	505421	2.46	32405

2z ^{1}H NMR (400 MHz, $CDCl_3$)



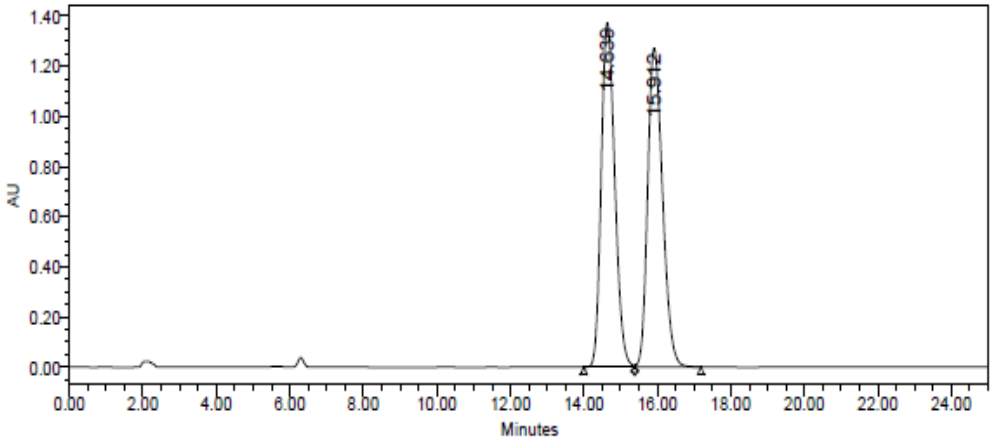
2z ^{13}C NMR (100 MHz, $CDCl_3$)



2z HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-74-1-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgfg
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	cvxvcgfdgtr
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/11/2019 7:59:18 PM CST		
Date Processed:	4/15/2020 1:11:54 PM CST		

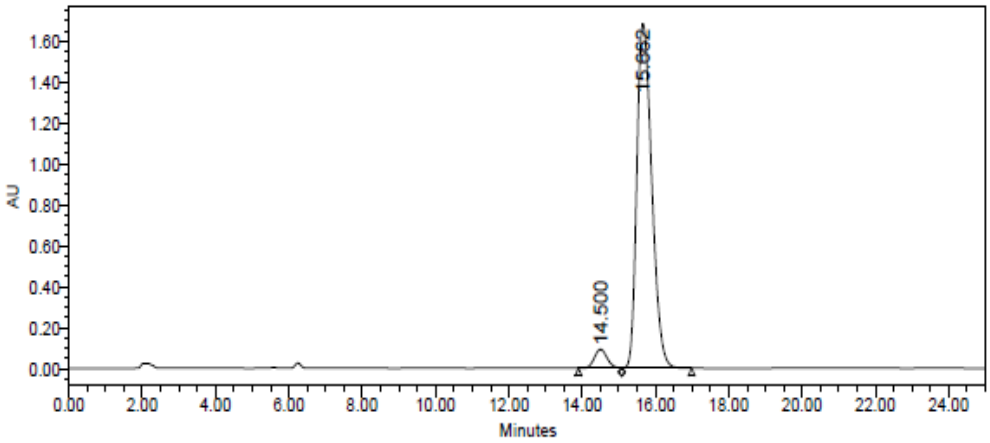


	RT	Area	% Area	Height
1	14.639	35244575	49.69	1372965
2	15.912	35690683	50.31	1271292

2z HPLC: chiral sample

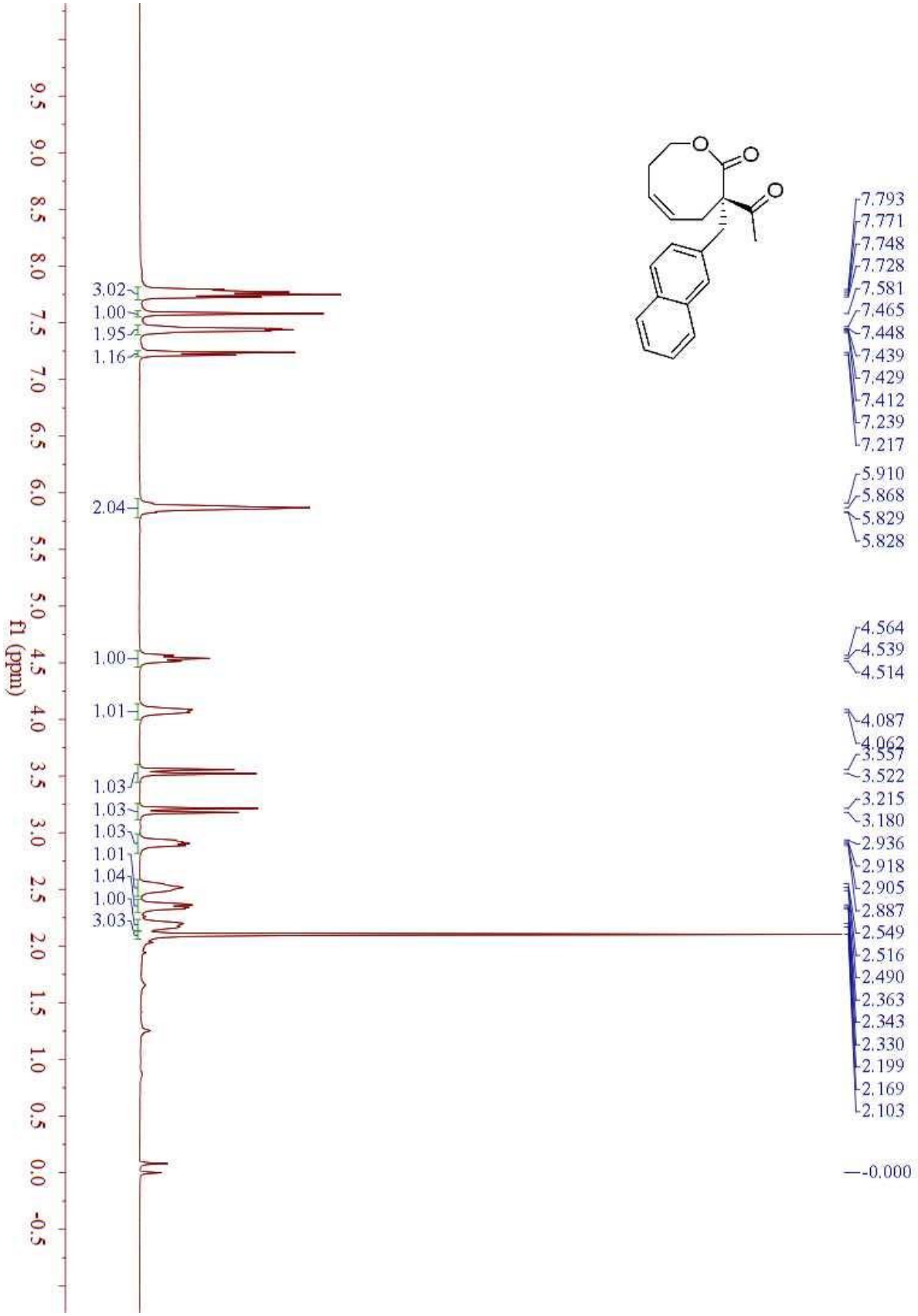
SAMPLE INFORMATION

Sample Name:	dl-19-74-2-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fgfg
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	hiujghgh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	12/11/2019 8:24:43 PM CST		
Date Processed:	4/15/2020 1:12:35 PM CST		

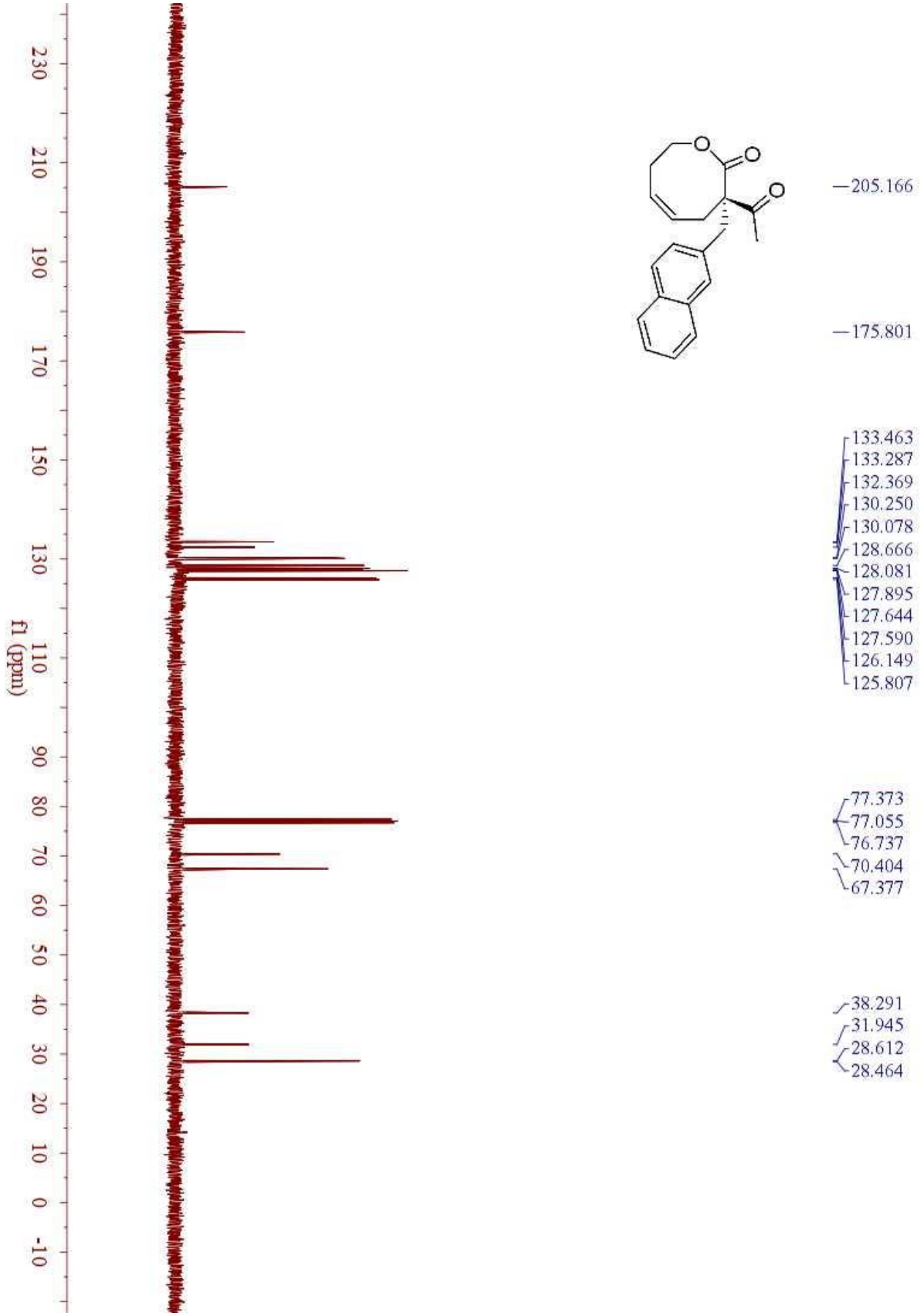


	RT	Area	% Area	Height
1	14.500	2249245	4.51	92704
2	15.662	47668056	95.49	1685774

2aa ^{1}H NMR (400 MHz, $CDCl_3$)



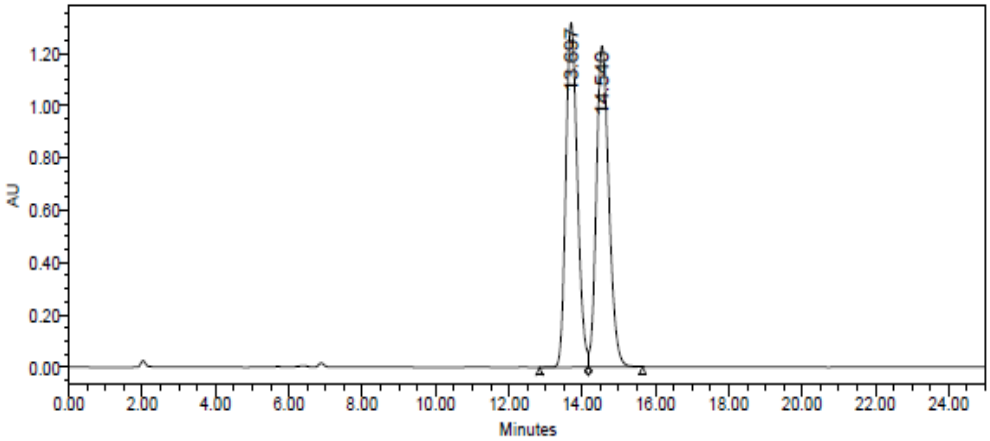
2aa ^{13}C NMR (100 MHz, $CDCl_3$)



2aa HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-19-22-1-rac-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghf
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	zcxcxdsf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	11/11/2019 5:17:51 PM CST		
Date Processed:	4/15/2020 1:14:13 PM CST		

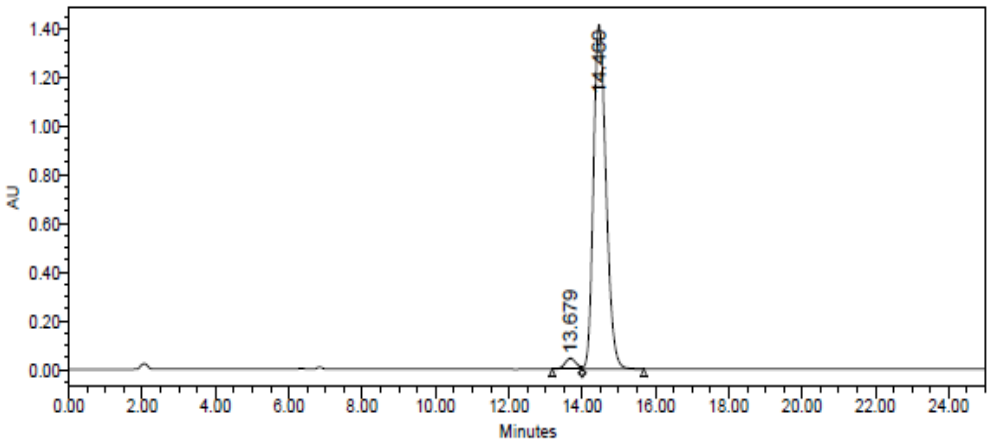


	RT	Area	% Area	Height
1	13.697	28780412	49.75	1316537
2	14.540	29070432	50.25	1227296

2aa HPLC: chiral sample

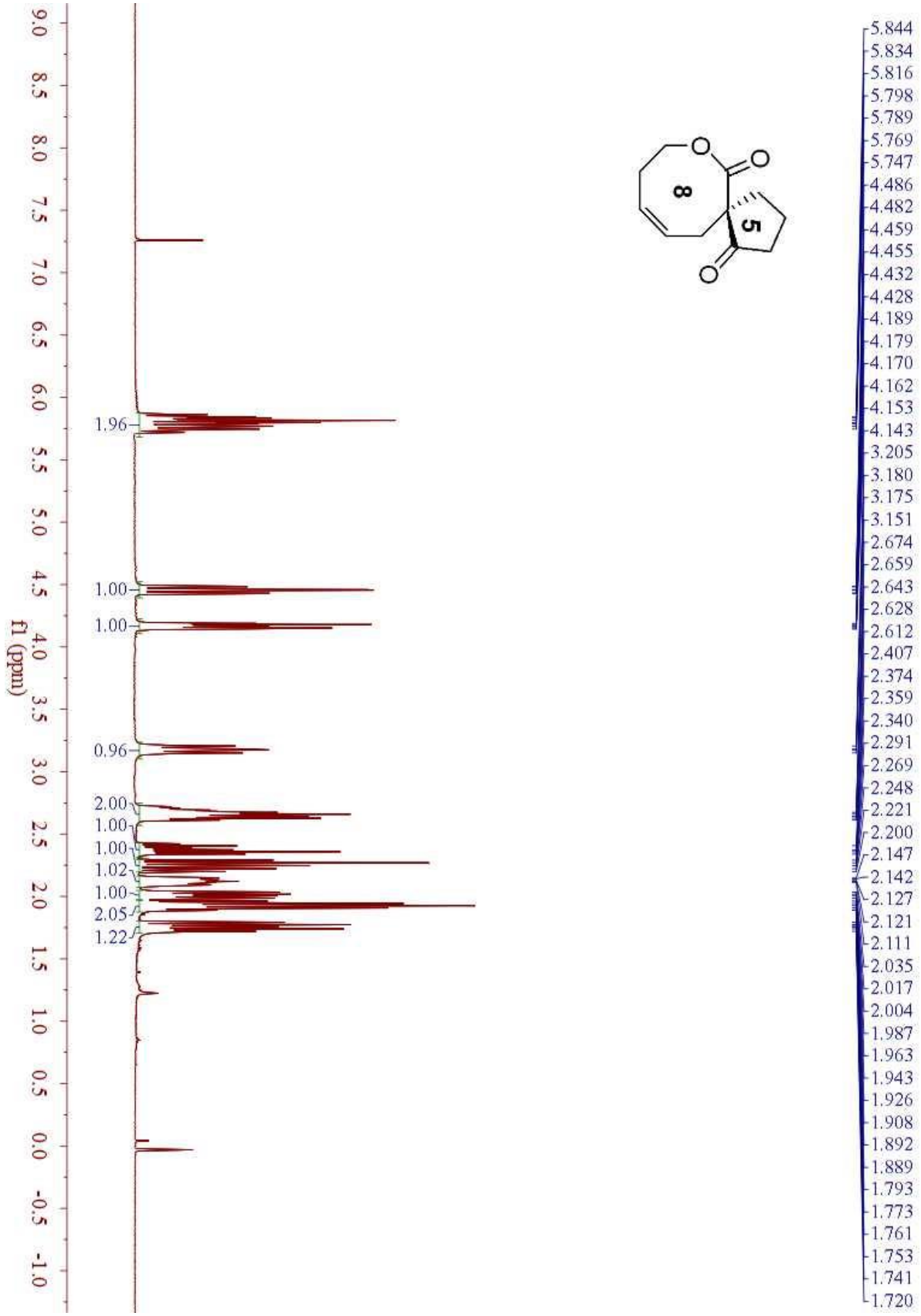
SAMPLE INFORMATION

Sample Name:	dl-19-22-2-chiral-ic9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	gfgfg
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	zxzcxfsd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	11/11/2019 7:37:07 PM CST		
Date Processed:	4/15/2020 1:14:59 PM CST		

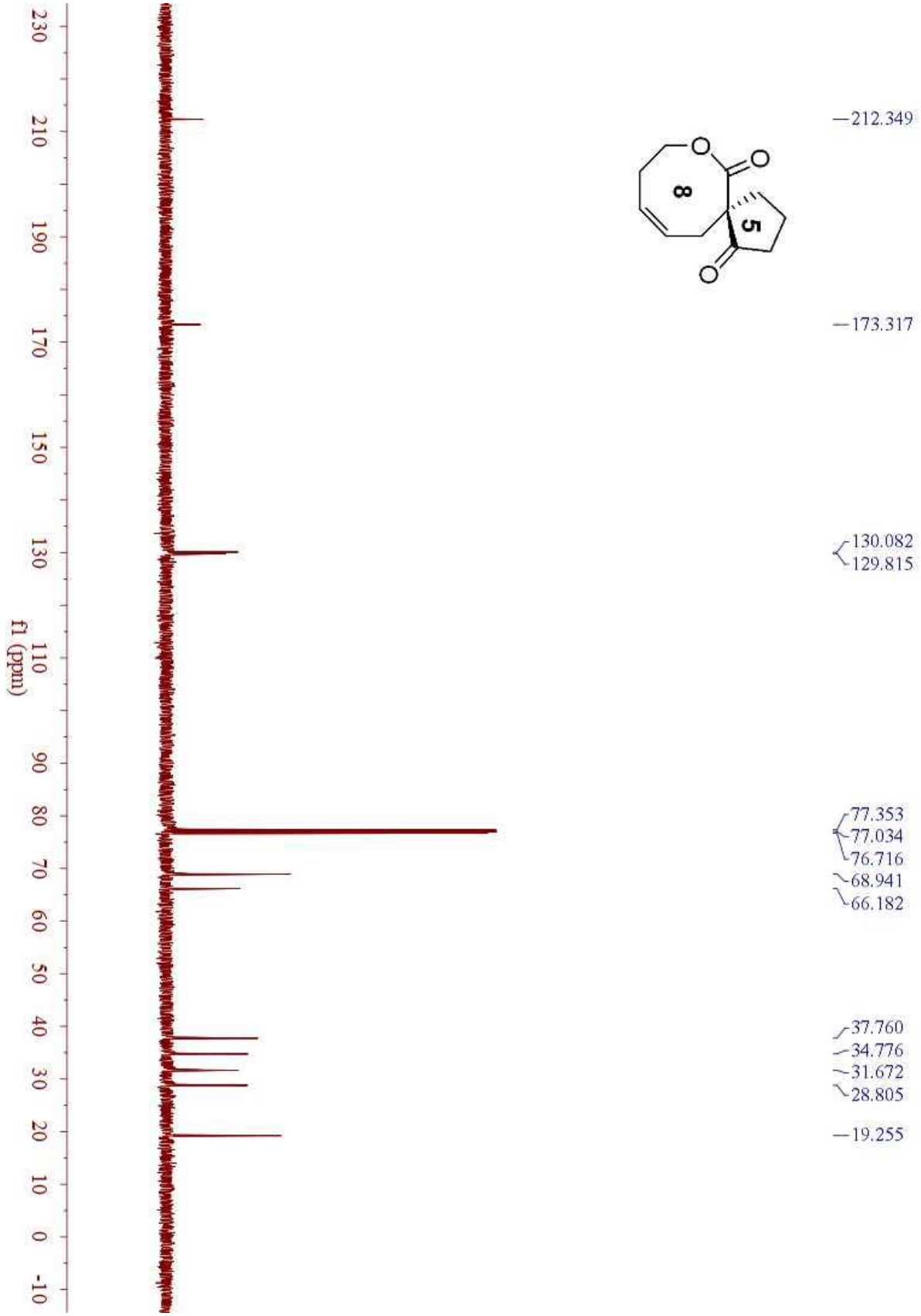


	RT	Area	% Area	Height
1	13.679	919694	2.65	43887
2	14.460	33725715	97.35	1414874

2ab ^{1}H NMR (400 MHz, $CDCl_3$)



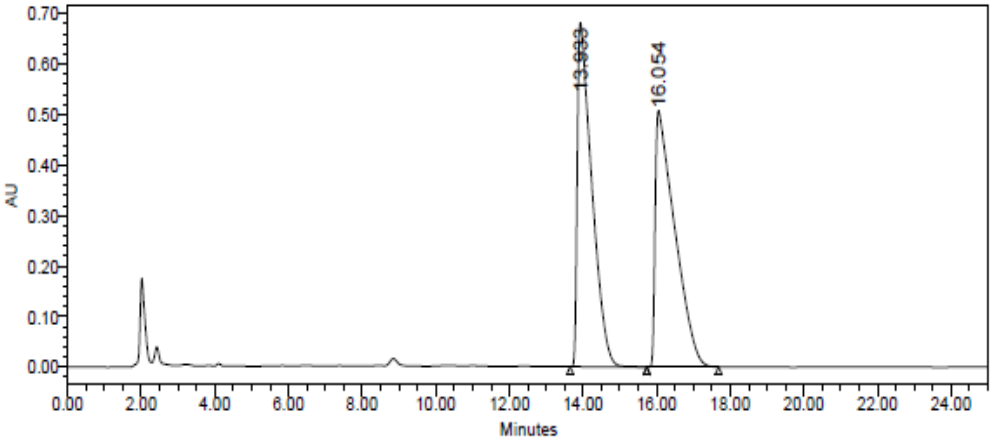
2ab ^{13}C NMR (100 MHz, $CDCl_3$)



2ab HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-17-99-1-rac-9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	dfdf
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	zxdasd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 1:03:35 PM CST		
Date Processed:	4/15/2020 1:16:19 PM CST		

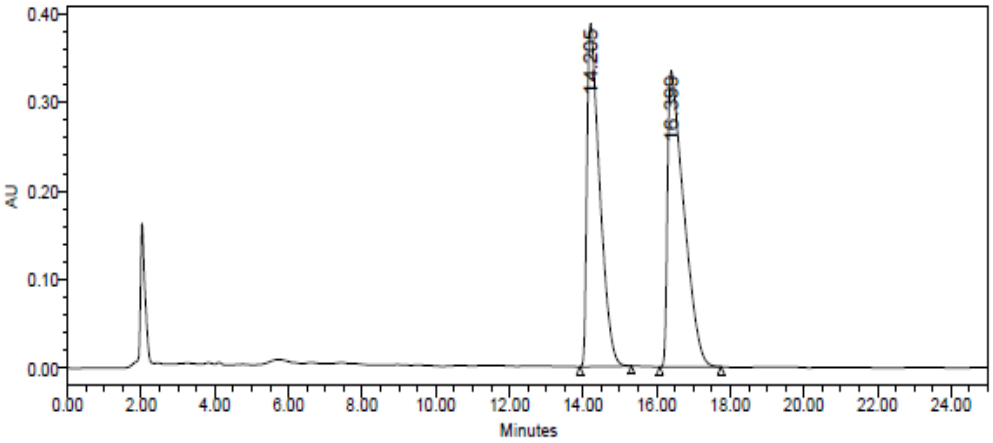


	RT	Area	% Area	Height
1	13.933	18686883	49.88	681617
2	16.054	18774056	50.12	507572

2ab HPLC: chiral sample

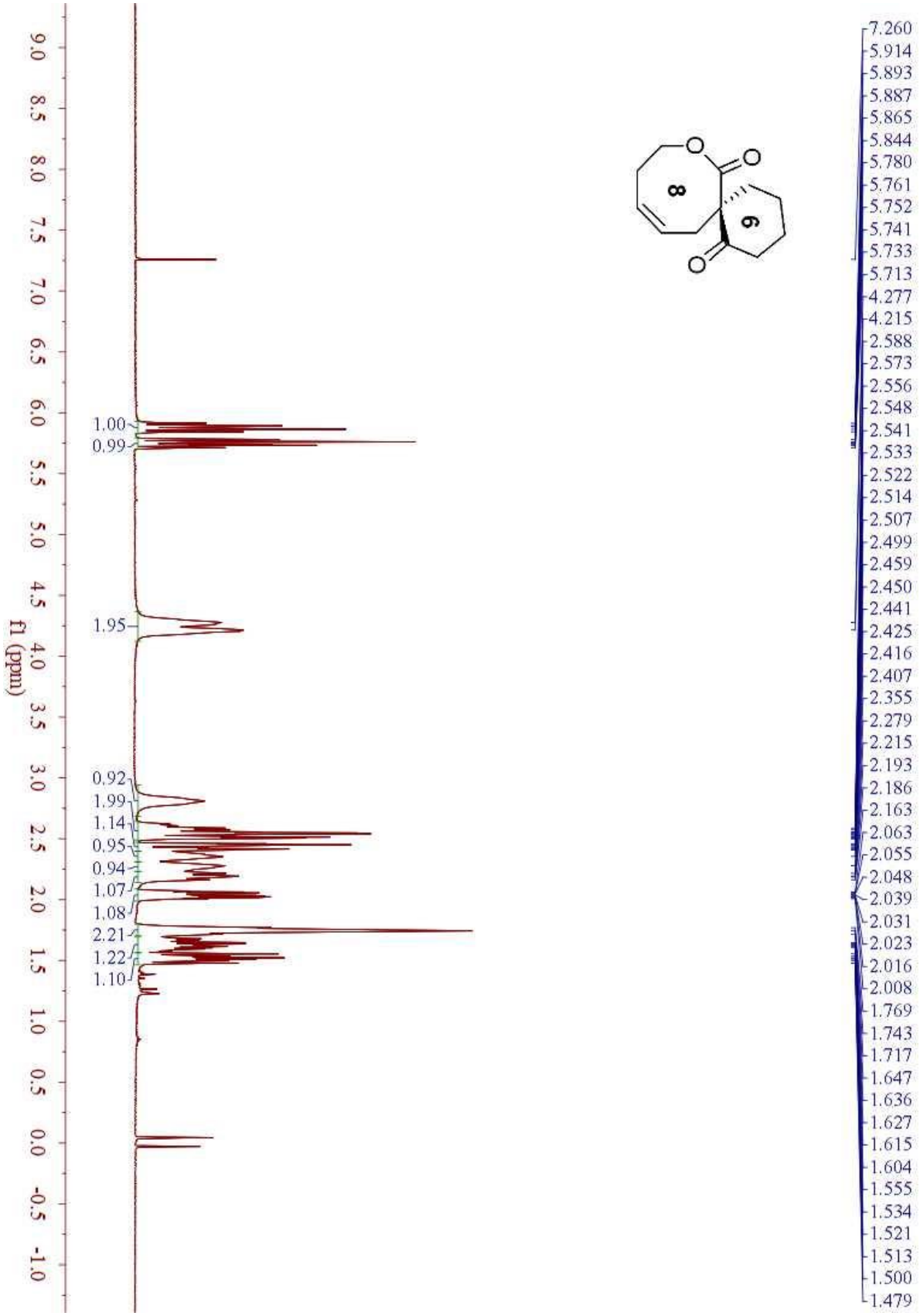
SAMPLE INFORMATION

Sample Name:	dl-17-99-2-chiral-9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	dfdf
Vial:	1:A,3	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	xcdsfd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/8/2019 1:29:00 PM CST		
Date Processed:	4/15/2020 1:17:05 PM CST		

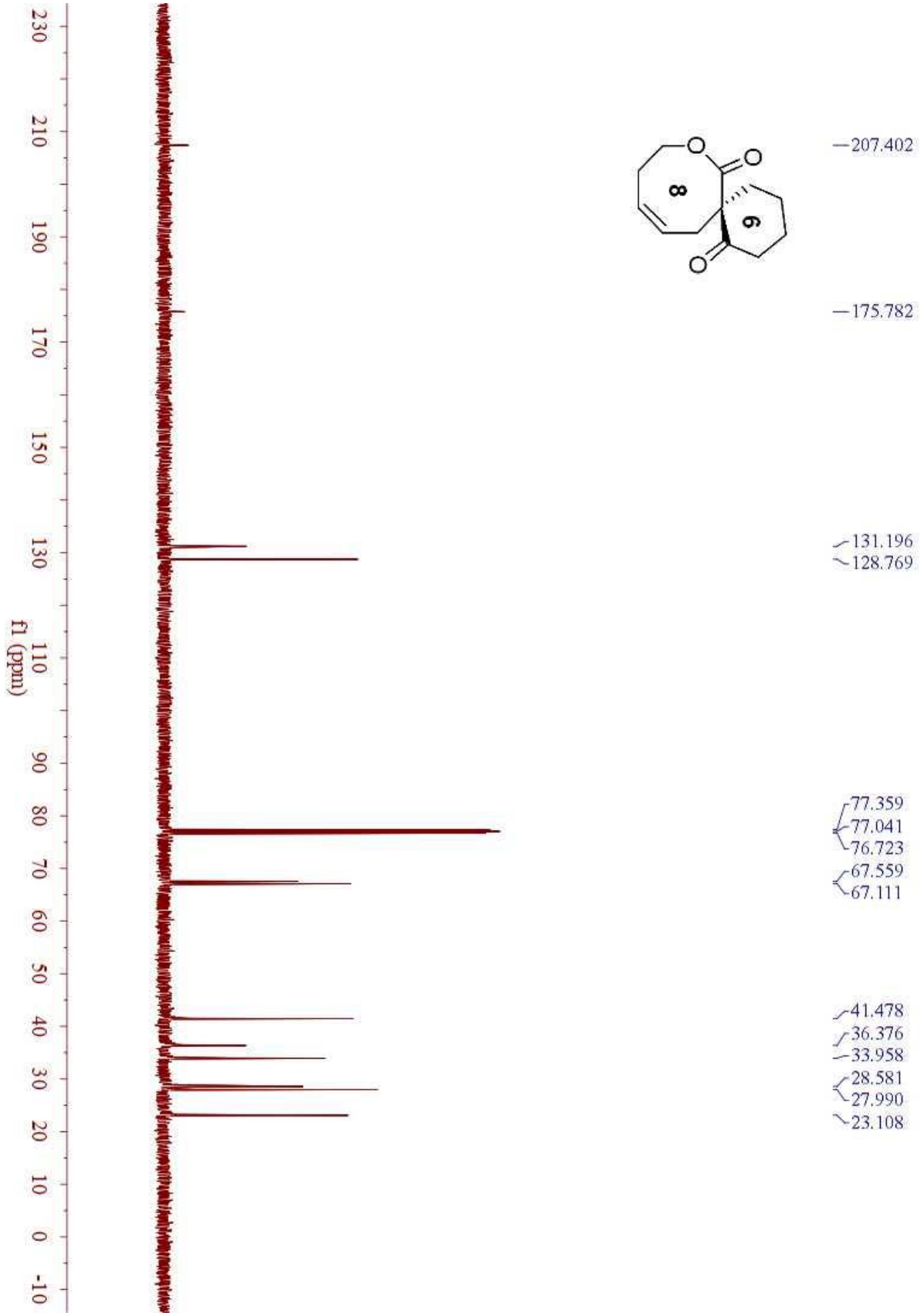


	RT	Area	% Area	Height
1	14.205	9271175	47.52	387186
2	16.399	10239309	52.48	333621

2ac ^{1}H NMR (400 MHz, $CDCl_3$)



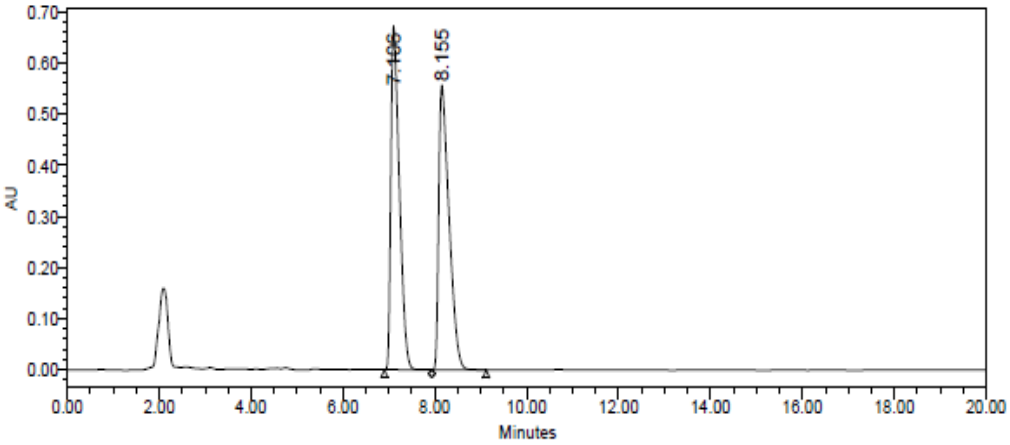
2ac ^{13}C NMR (100 MHz, $CDCl_3$)



2ac HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-20-1-rac-9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ghghjkk
Vial:	1:A,3	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	cvcgfgf
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	20.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/12/2019 4:05:23 PM CST		
Date Processed:	4/15/2020 1:17:57 PM CST		

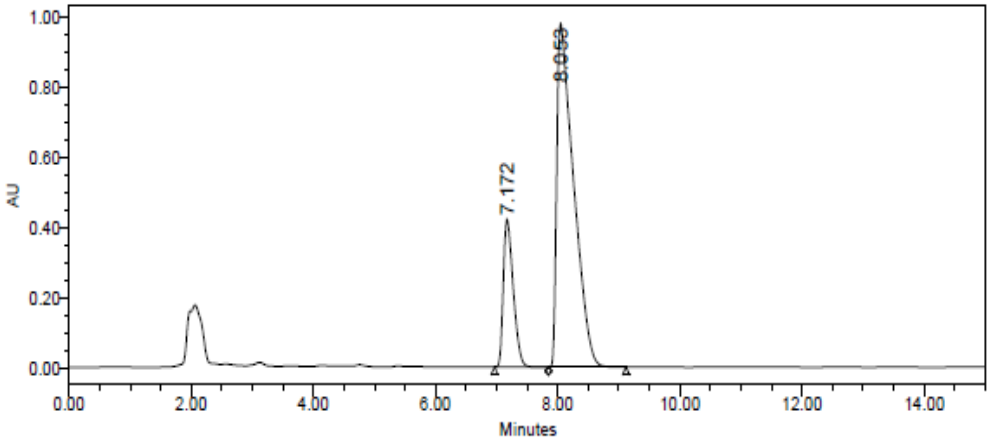


	RT	Area	% Area	Height
1	7.106	8631907	49.81	673695
2	8.155	8696733	50.19	557630

2ac HPLC: chiral sample

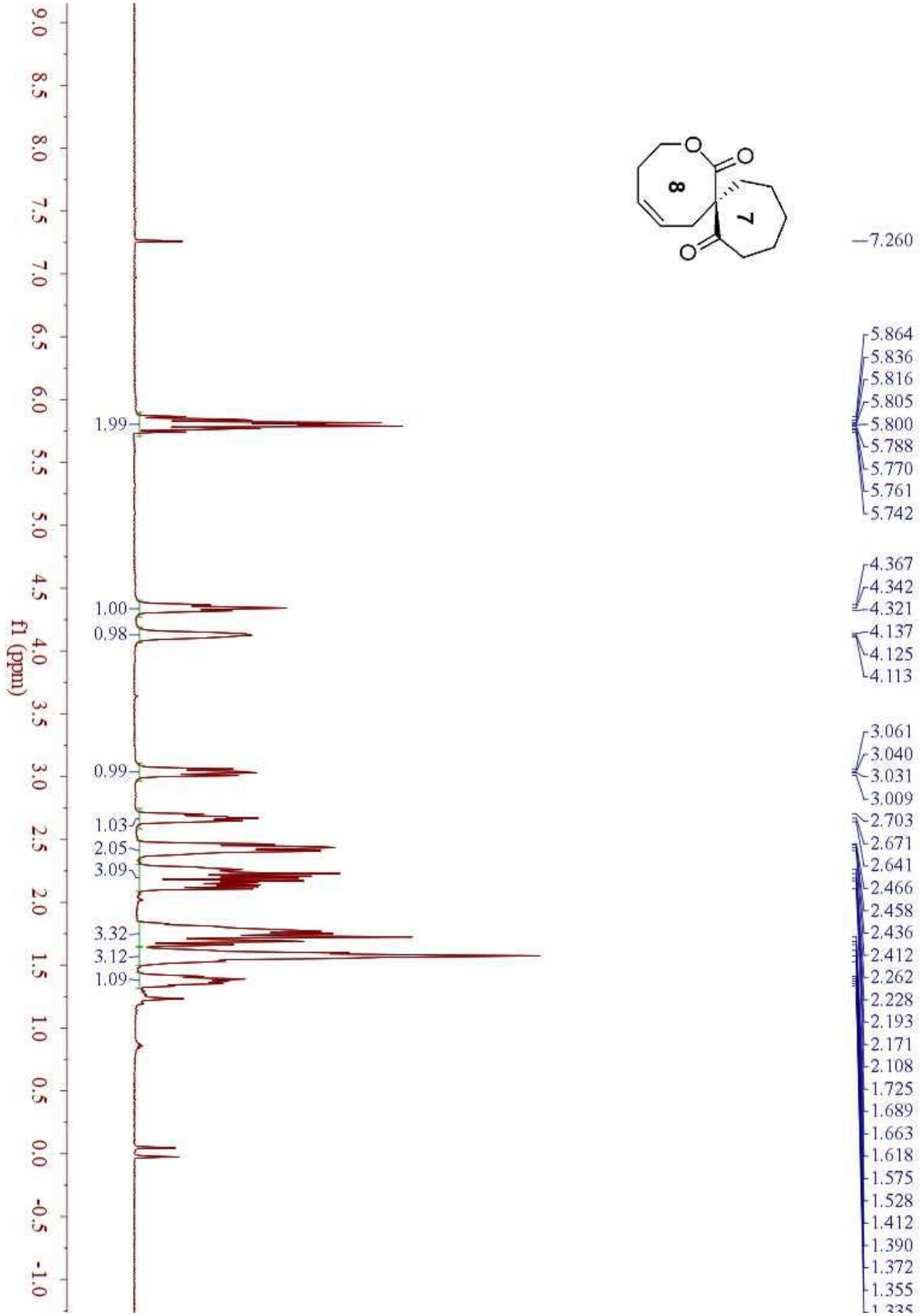
SAMPLE INFORMATION

Sample Name:	dl-18-20-2-chiral-9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	fghh
Vial:	1:A,2	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	cxzcx
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/12/2019 7:21:06 PM CST		
Date Processed:	4/15/2020 1:19:43 PM CST		

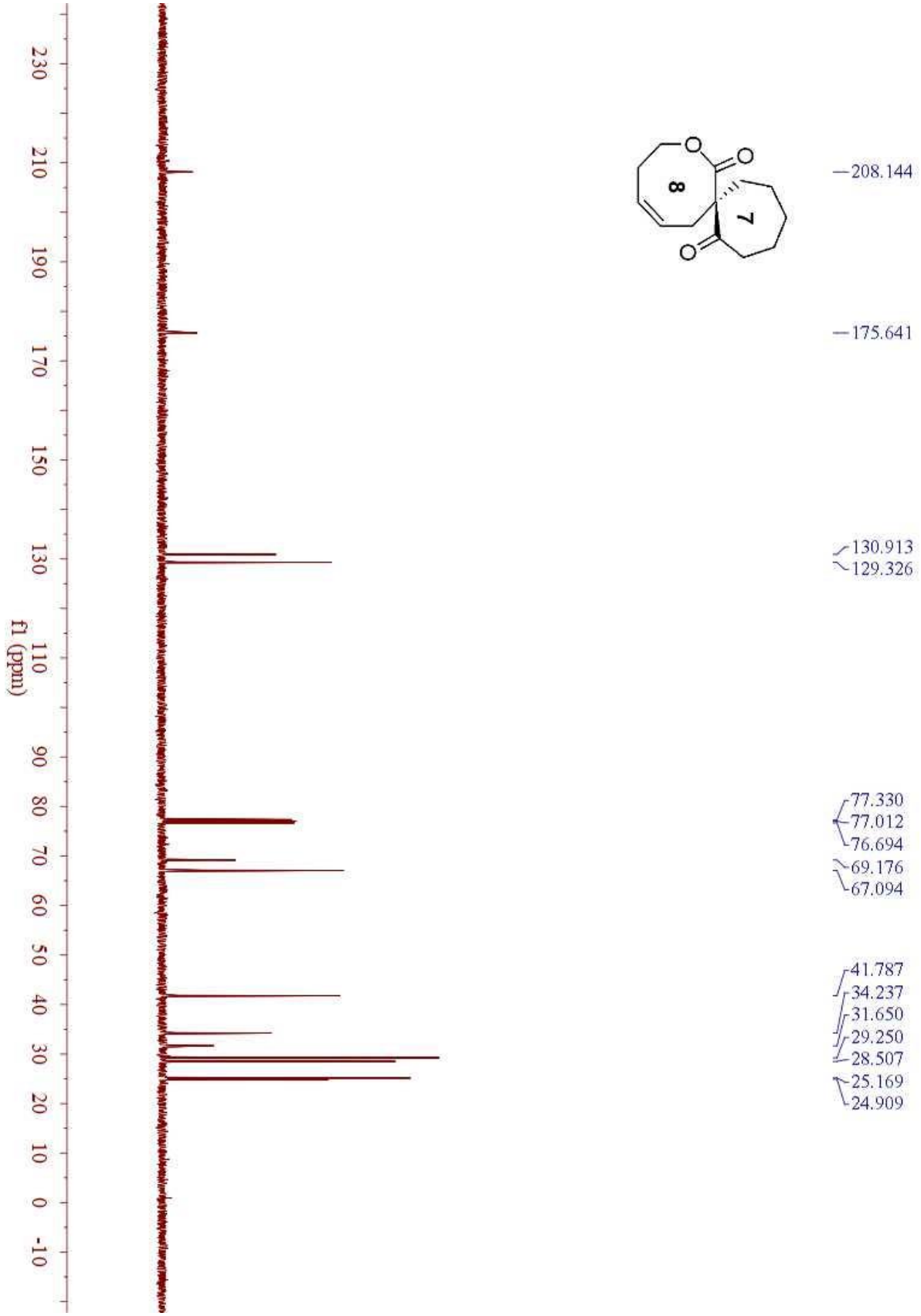


	RT	Area	% Area	Height
1	7.172	4755862	20.22	423897
2	8.053	18758943	79.78	983823

2ad ^{1}H NMR (400 MHz, $CDCl_3$)



2ad ^{13}C NMR (100 MHz, $CDCl_3$)

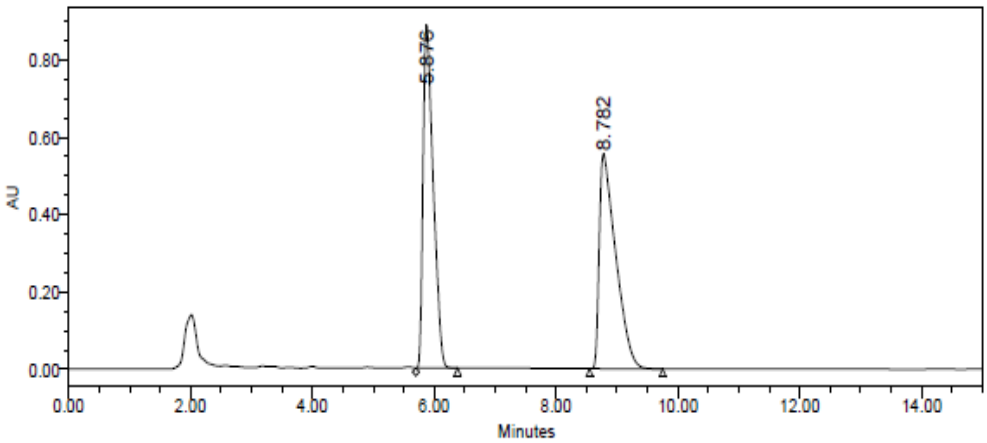


2ad HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-50-1-rac-ic9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hgh
Vial:	1:A,2	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	zxzsd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 9/24/2019 11:00:25 PM CST
Date Processed: 4/15/2020 1:21:02 PM CST

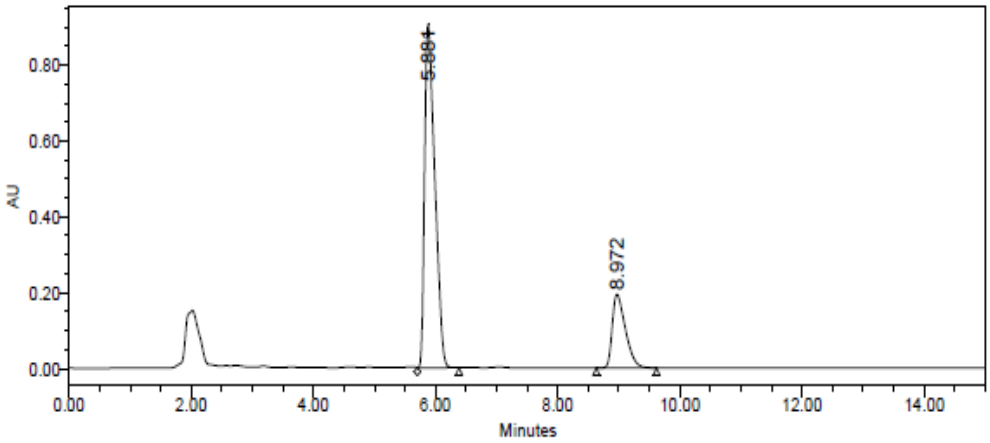


	RT	Area	% Area	Height
1	5.876	10239252	49.59	896056
2	8.782	10409116	50.41	555362

2ad HPLC: chiral sample

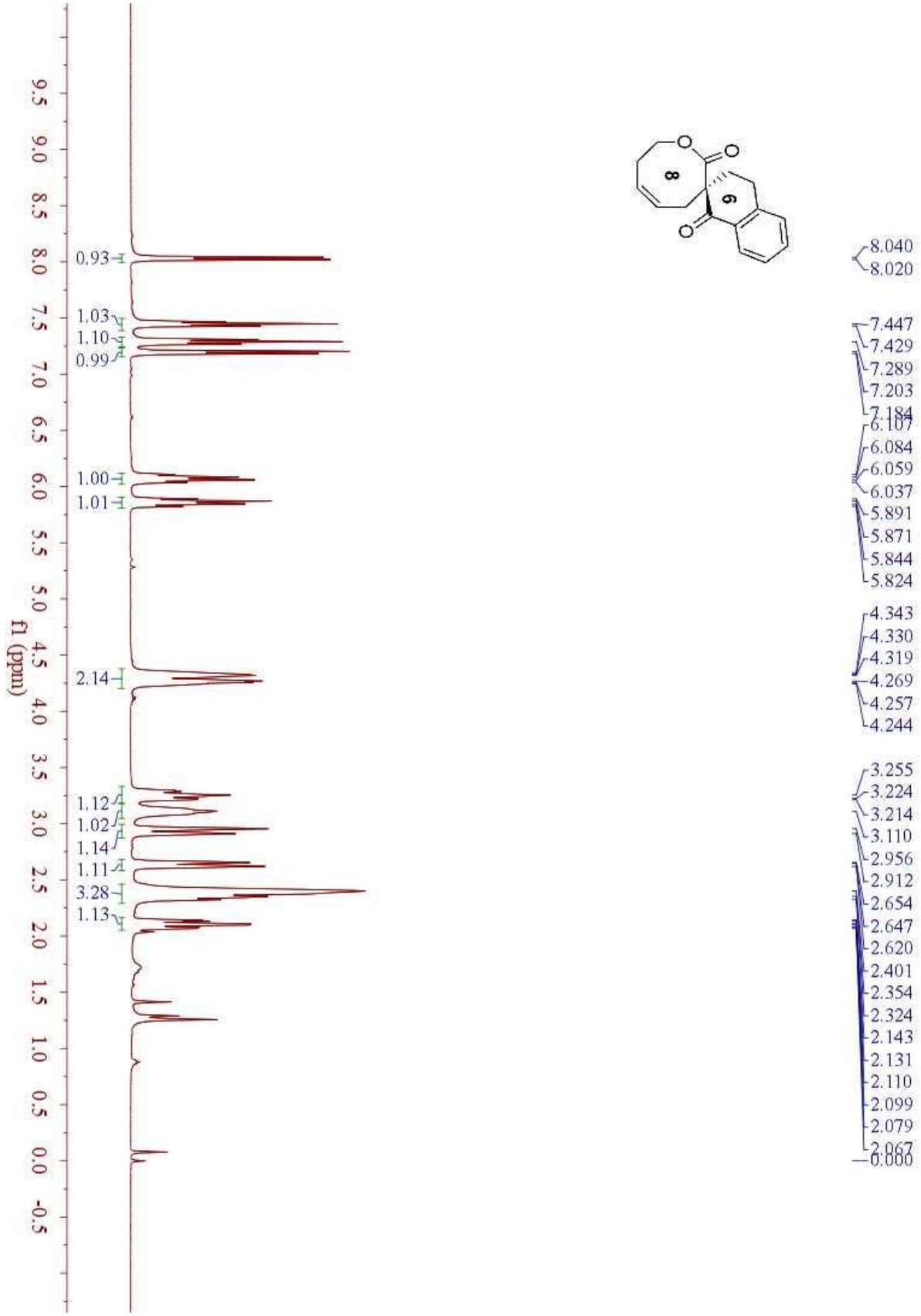
SAMPLE INFORMATION

Sample Name:	dl-18-50-2-chiral-ic-9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hgh
Vial:	1:A,3	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	cxfgffd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	15.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/24/2019 11:15:50 PM CST		
Date Processed:	4/15/2020 1:21:41 PM CST		

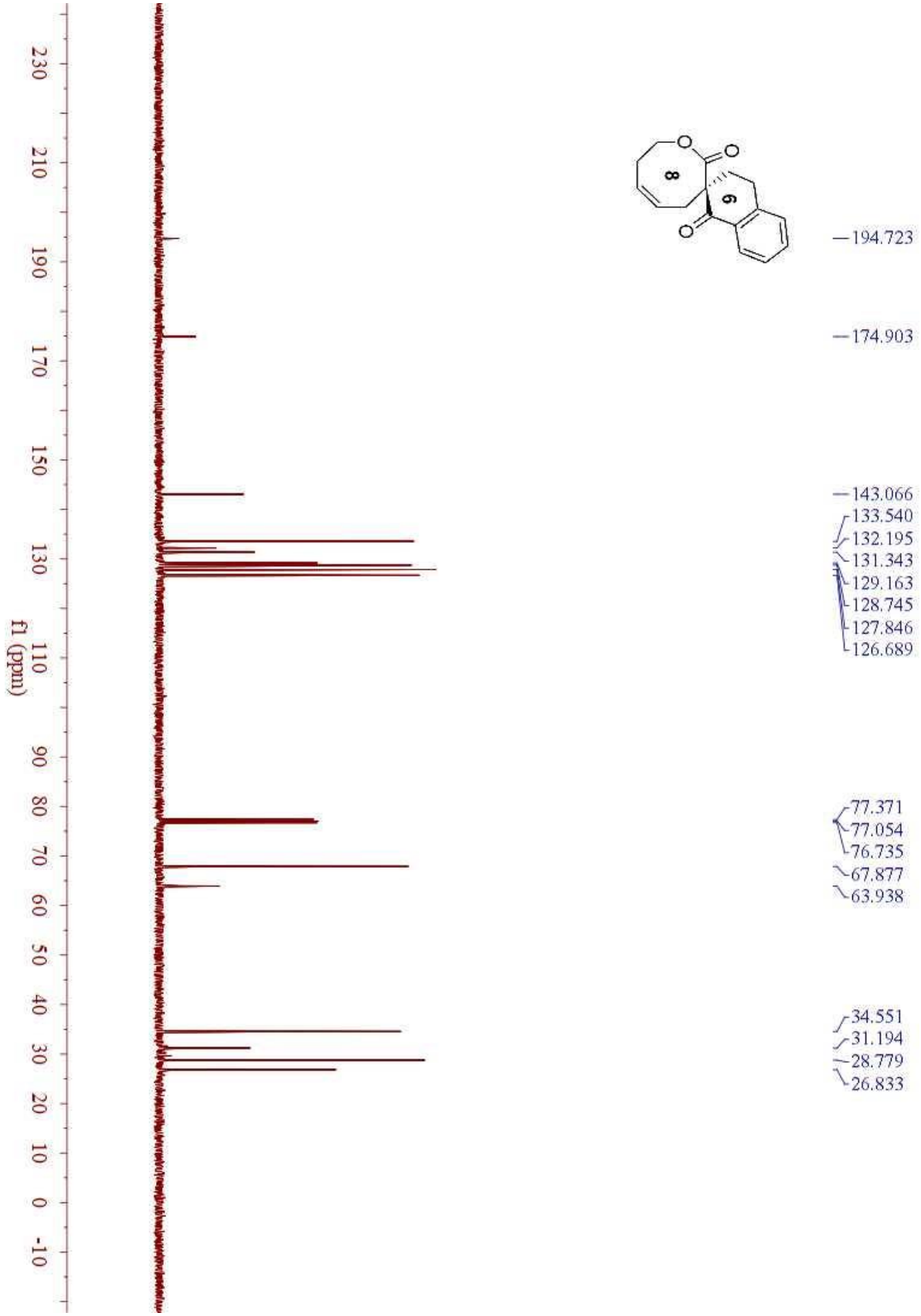


	RT	Area	% Area	Height
1	5.881	10467841	78.41	907314
2	8.972	2882472	21.59	194753

2ae ^{1}H NMR (400 MHz, $CDCl_3$)



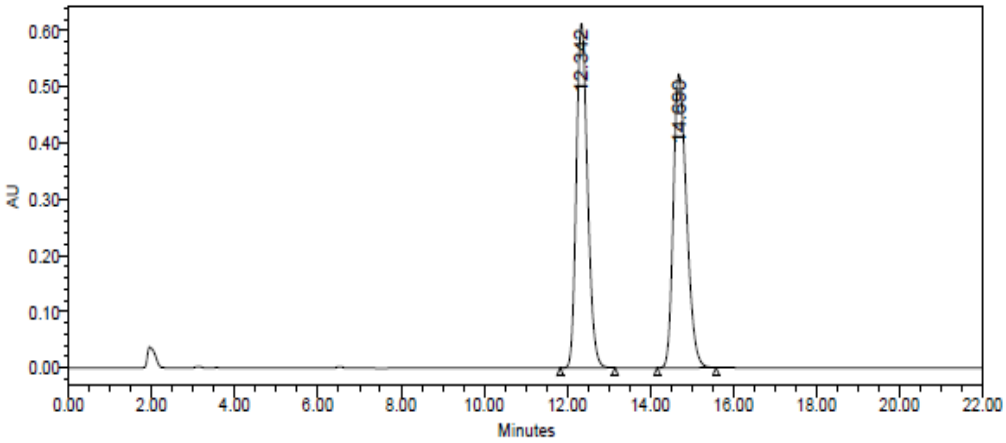
2ae ^{13}C NMR (100 MHz, $CDCl_3$)



2ae HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-103-1-rac-ic9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hjkhjk
Vial:	1:A,2	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	cvdrfgdg
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	22.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	10/26/2019 3:07:10 PM CST		
Date Processed:	4/15/2020 1:23:23 PM CST		



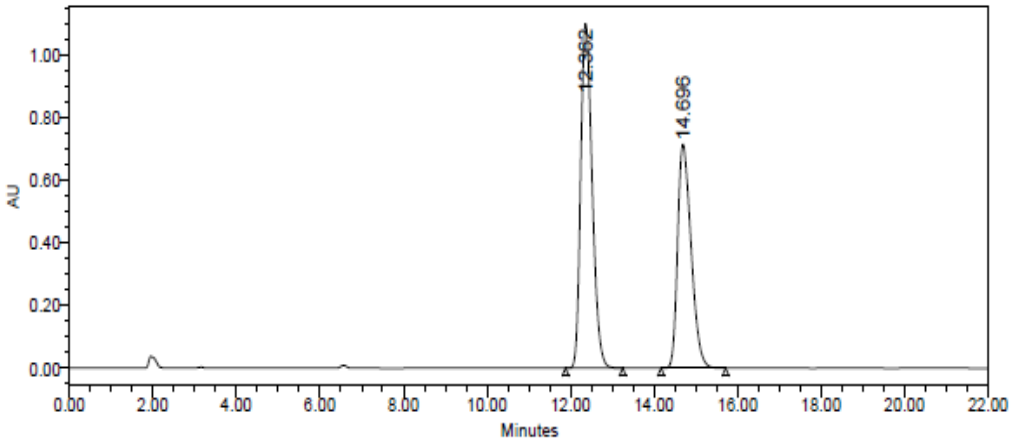
	RT	Area	% Area	Height
1	12.342	11453560	49.85	613013
2	14.690	11520917	50.15	522313

2ae HPLC: chiral sample

SAMPLE INFORMATION

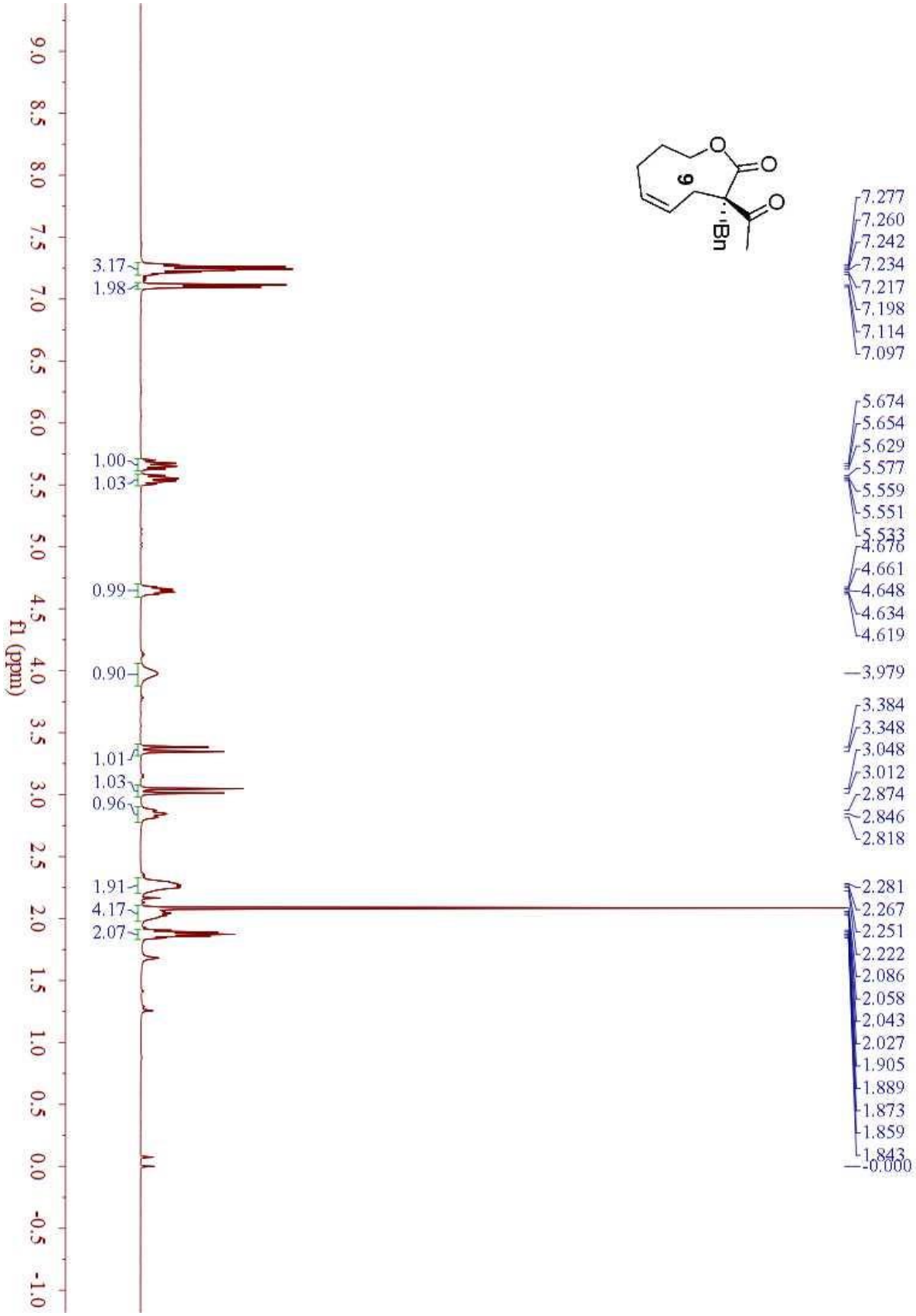
Sample Name:	dl-18-103-2-chiral-ic9010214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hjkhjk
Vial:	1:A,3	Acq. Method Set:	dl9010214
Injection #:	1	Processing Method	cxvbn
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	22.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm

Date Acquired: 10/26/2019 3:29:34 PM CST
Date Processed: 4/15/2020 1:24:02 PM CST

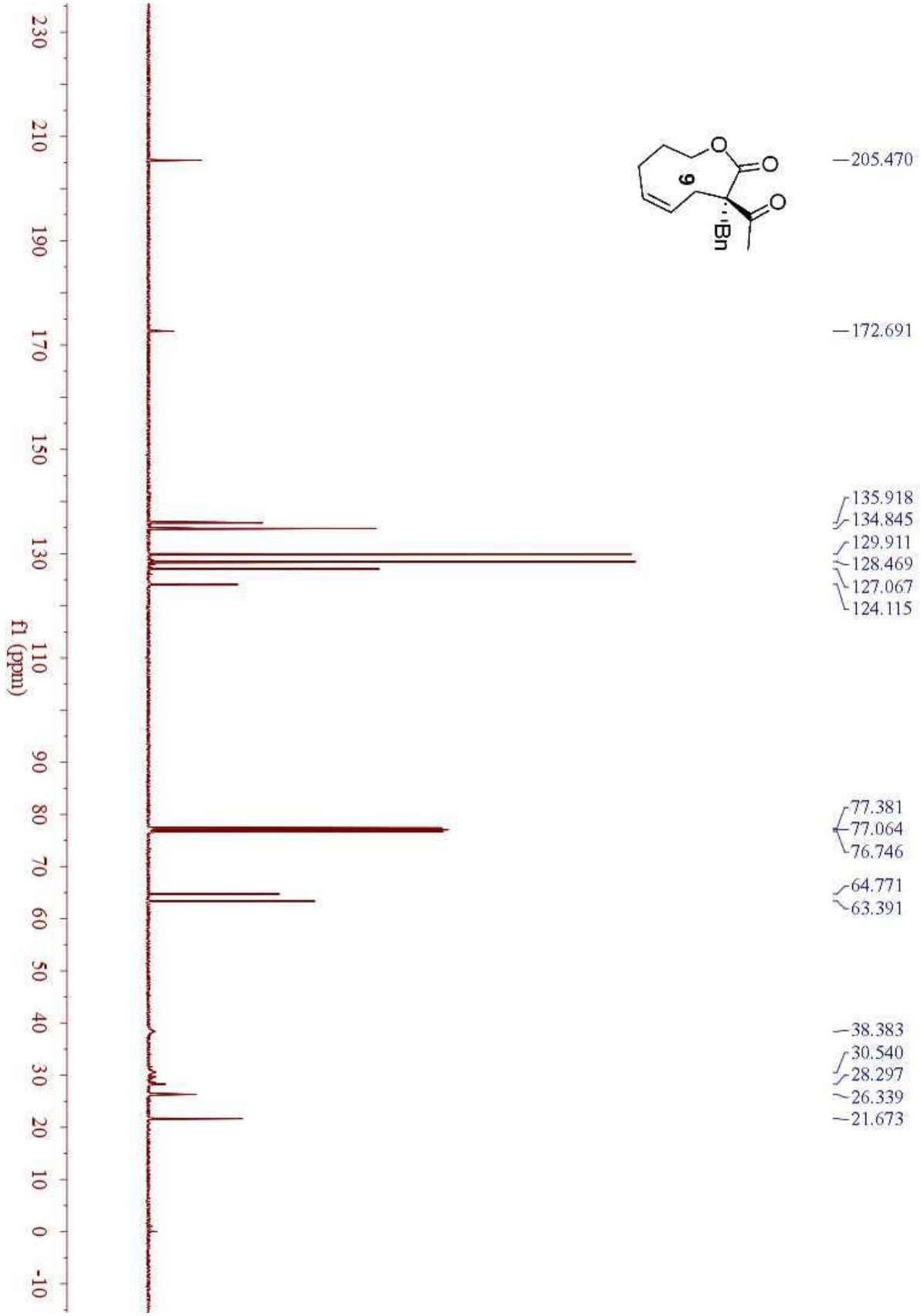


	RT	Area	% Area	Height
1	12.362	20958949	56.70	1098421
2	14.696	16005721	43.30	713542

2af ^{1}H NMR (400 MHz, $CDCl_3$)



2af ^{13}C NMR (100 MHz, $CDCl_3$)

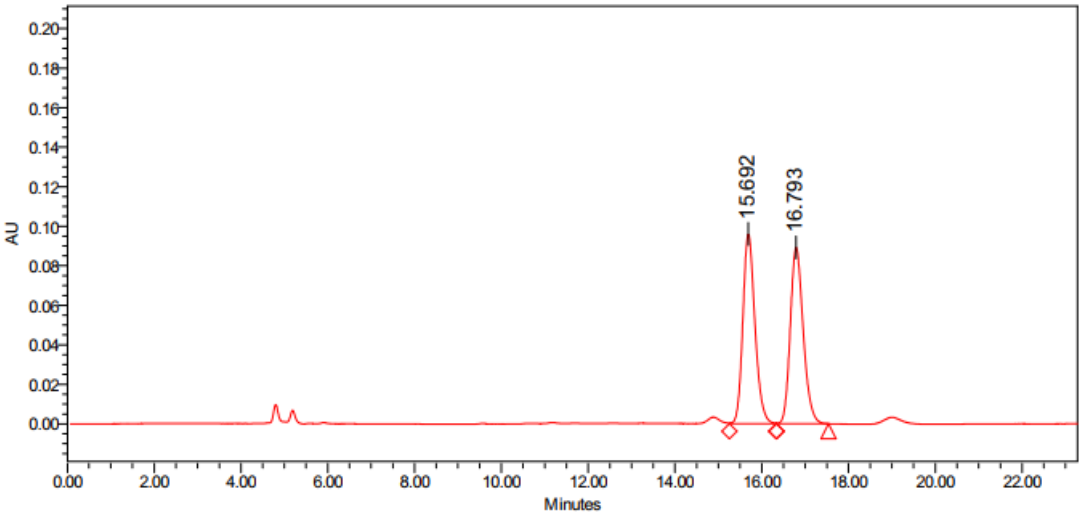


2af HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	DL-17-63-RAC-IC-97-3	Acquired By:	System
Sample Type:	Unknown	Sample Set Name	
Vial:	25	Acq. Method Set:	2695PDA
Injection #:	3	Processing Method	Default
Injection Volume:	3.00 ul	Channel Name:	2998 Ch3 214nm@1.2nm
Run Time:	35.0 Minutes	Proc. Chnl. Descr.:	2998 Ch3 214nm@1.2nm
Date Acquired:	2020/12/9 9:38:40 CST		
Date Processed:	2020/12/9 10:02:26 CST		

Auto-Scaled Chromatogram



Peak Results

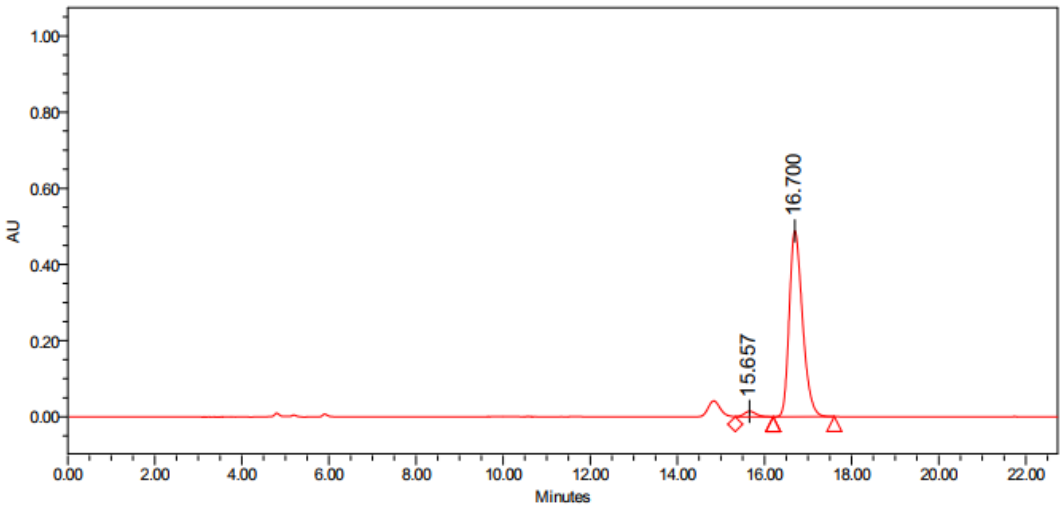
	SampleName	Vial	RT	Retention Time (min)	Width (sec)	Height	Area	% Area
1	DL-17-63-RAC-IC-97-3	25	15.692	15.692	65.400	95986	1863912	50.13
2	DL-17-63-RAC-IC-97-3	25	16.793	16.793	71.600	89095	1854056	49.87

2af HPLC: chiral sample

SAMPLE INFORMATION

Sample Name:	DL-18-10-CHIRAL	Acquired By:	System
Sample Type:	Unknown	Sample Set Name	
Vial:	26	Acq. Method Set:	2695PDA
Injection #:	1	Processing Method	Default
Injection Volume:	3.00 ul	Channel Name:	2998 Ch3 214nm@1.2nm
Run Time:	35.0 Minutes	Proc. Chnl. Descr.:	2998 Ch3 214nm@1.2nm
Date Acquired:	2020/12/9 10:02:47 CST		
Date Processed:	2020/12/9 10:36:21 CST		

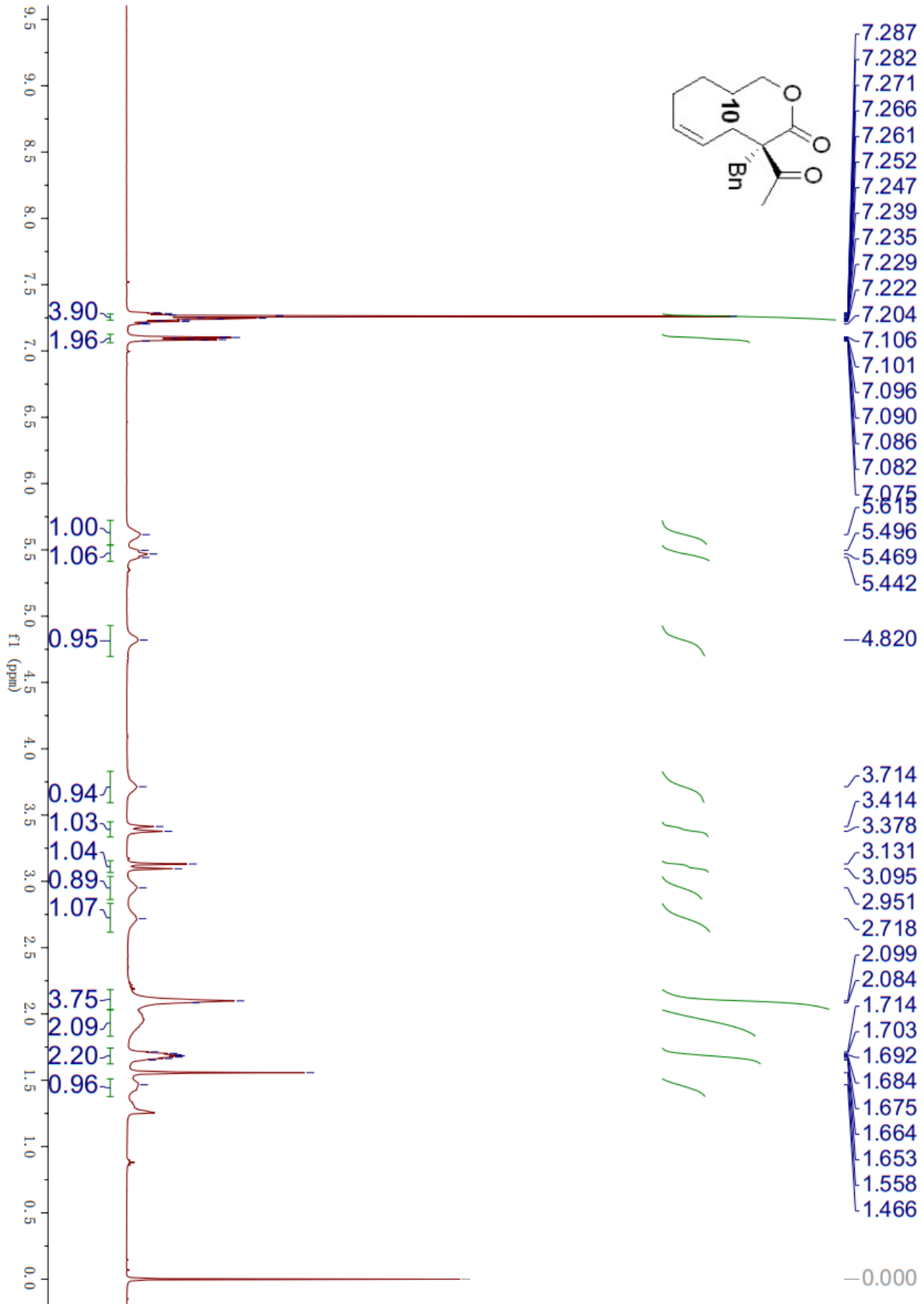
Auto-Scaled Chromatogram



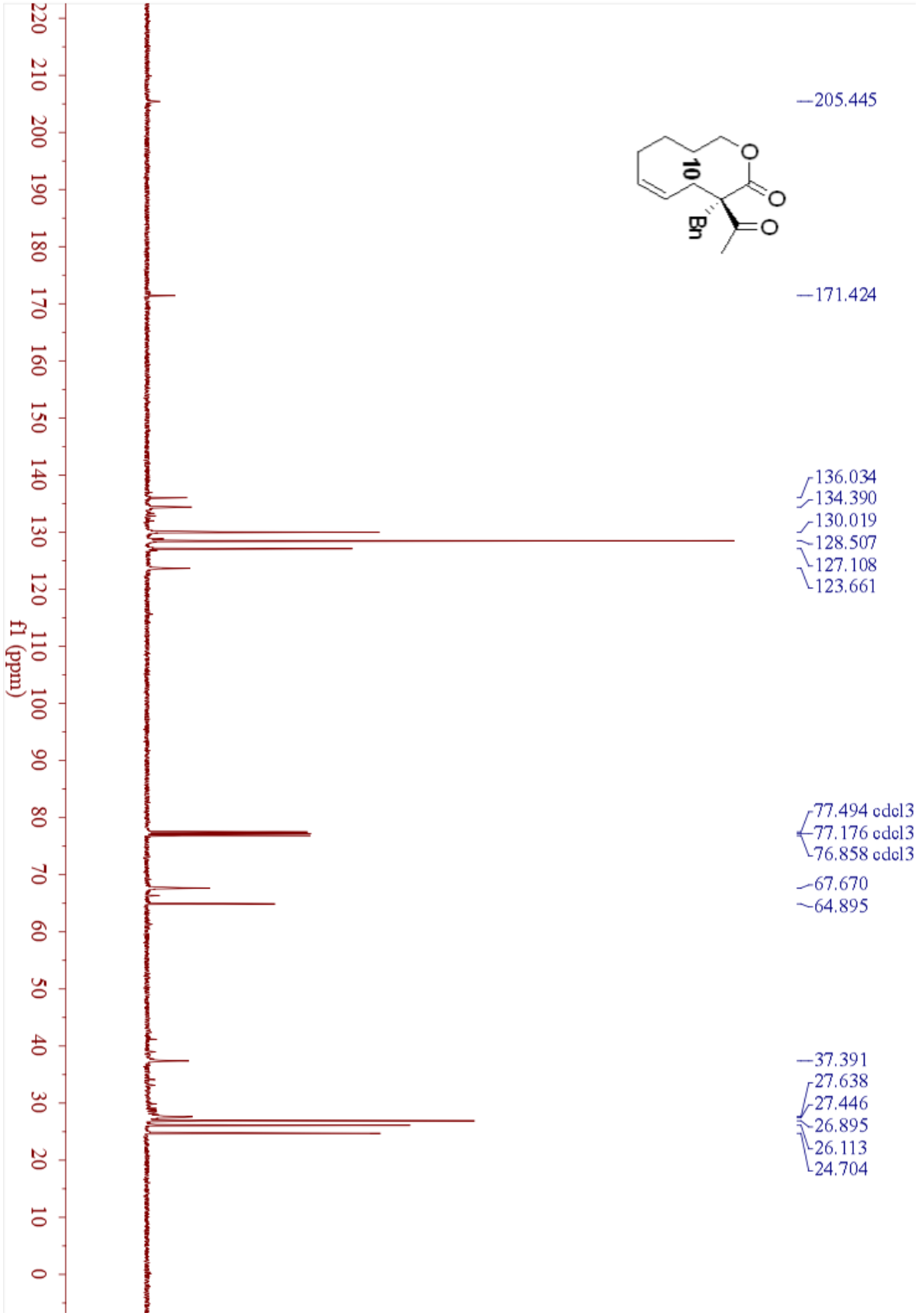
Peak Results

	SampleName	Vial	RT	Retention Time (min)	Width (sec)	Height	Area	% Area
1	DL-18-10-CHIRAL	26	15.657	15.657	52.100	14583	280505	2.64
2	DL-18-10-CHIRAL	26	16.700	16.700	84.100	488146	10335044	97.36

2ag ^{1}H NMR (400 MHz, $CDCl_3$)



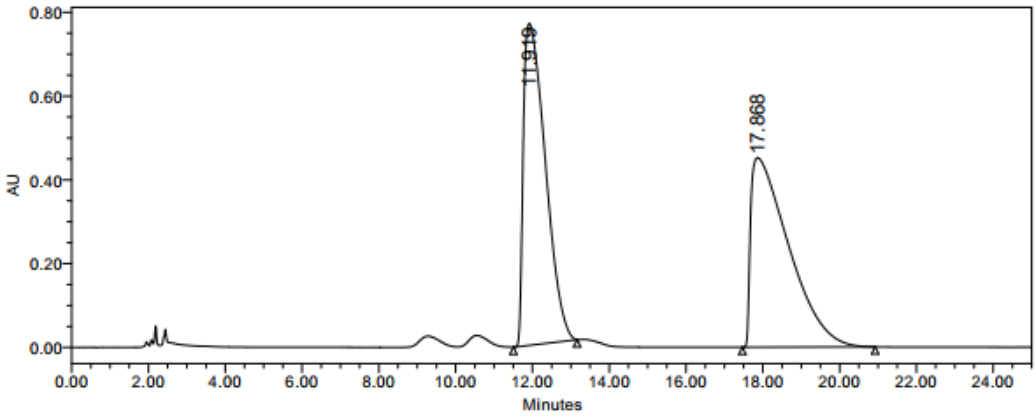
2ag ^{13}C NMR (100 MHz, $CDCl_3$)



2ag HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	SH-DL-1R-IC3-9901214-1-40	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	01
Vial:	20	Acq. Method Set:	waters40_P3
Injection #:	1	Processing Method:	test
Injection Volume:	10.00 ul	Channel Name:	2998 Ch1 214nm@1.2nm
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	2998 Ch1 214nm@1.2nm
Date Acquired:	11/12/2020 2:36:52 AM CST		
Date Processed:	11/12/2020 10:34:25 PM CST		



Channel: 2998 Ch1 214nm@1.2nm; Processed Channel: 2998 Ch1 214nm@1.2nm; Result Id: 1404; Processing Method: test

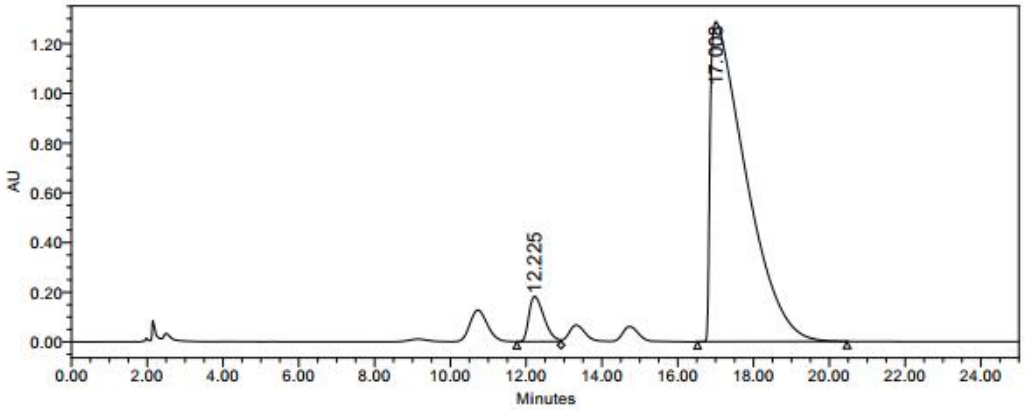
Processed Channel Descr.: 2998 Ch1 214nm@1.2nm

	Processed Channel Descr.	RT	Area	% Area	Height
1	2998 Ch1 214nm@1.2nm	11.919	30520449	49.52	768070
2	2998 Ch1 214nm@1.2nm	17.868	31111103	50.48	452050

2ag HPLC: chiral sample

SAMPLE INFORMATION

Sample Name:	SH-DL-1C-IC3-9901214-1	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	1
Vial:	20	Acq. Method Set:	SH_9901214_1_P3
Injection #:	1	Processing Method	test
Injection Volume:	10.00 ul	Channel Name:	2998 Ch1 214nm@1.2nm
Run Time:	25.0 Minutes	Proc. Chnl. Descr.:	2998 Ch1 214nm@1.2nm
Date Acquired:	11/11/2020 8:15:47 PM CST		
Date Processed:	11/12/2020 10:50:58 PM CST		

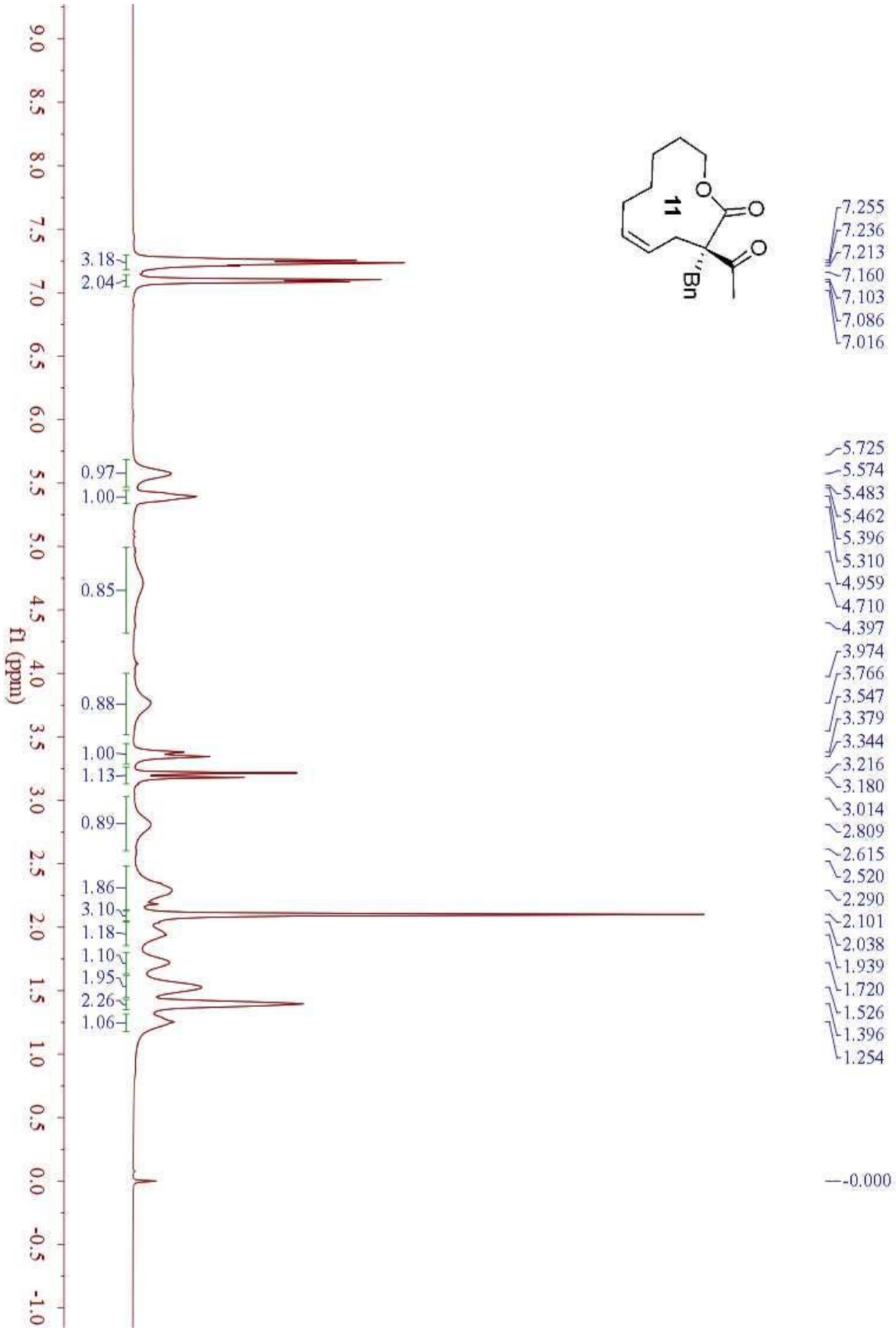


Channel: 2998 Ch1 214nm@1.2nm; Processed Channel: 2998 Ch1 214nm@1.2nm; Result Id: 1416; Processing Method: test

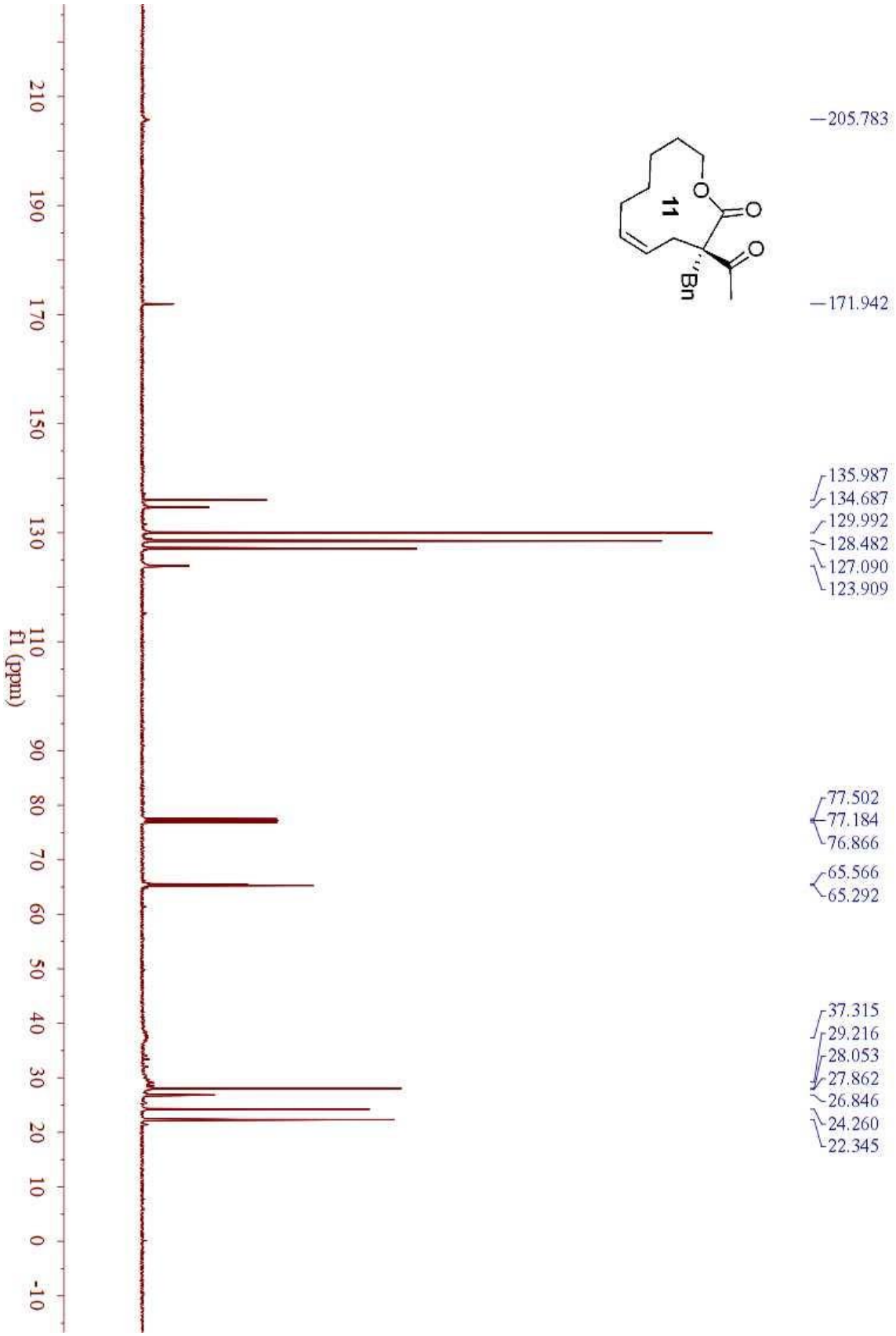
Processed Channel Descr.: 2998 Ch1 214nm@1.2nm

	Processed Channel Descr.	RT	Area	% Area	Height
1	2998 Ch1 214nm@1.2nm	12.225	5016141	5.65	181436
2	2998 Ch1 214nm@1.2nm	17.008	83807110	94.35	1285987

2ah ^{1}H NMR (400 MHz, $CDCl_3$)



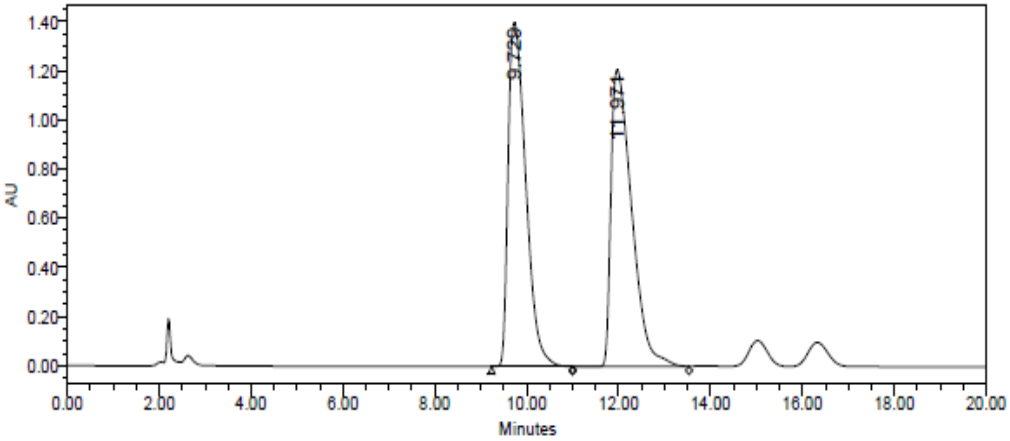
2ah ^{13}C NMR (100 MHz, $CDCl_3$)



2ah HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-33-1-rac-ic9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hklkk
Vial:	1:A,2	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	bvbgfh
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	20.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/19/2019 12:33:51 PM CST		
Date Processed:	4/15/2020 2:15:07 PM CST		

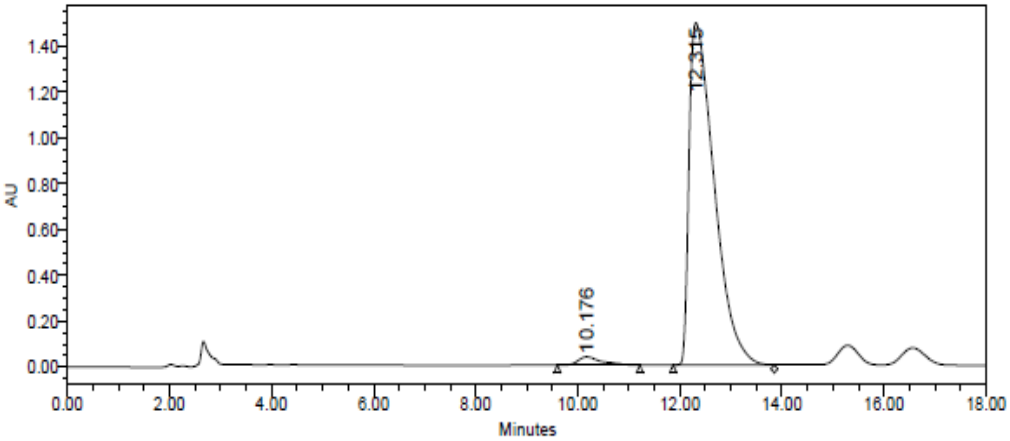


	RT	Area	% Area	Height
1	9.729	37304868	49.68	1399838
2	11.971	37786391	50.32	1207518

2ah HPLC: chiral sample

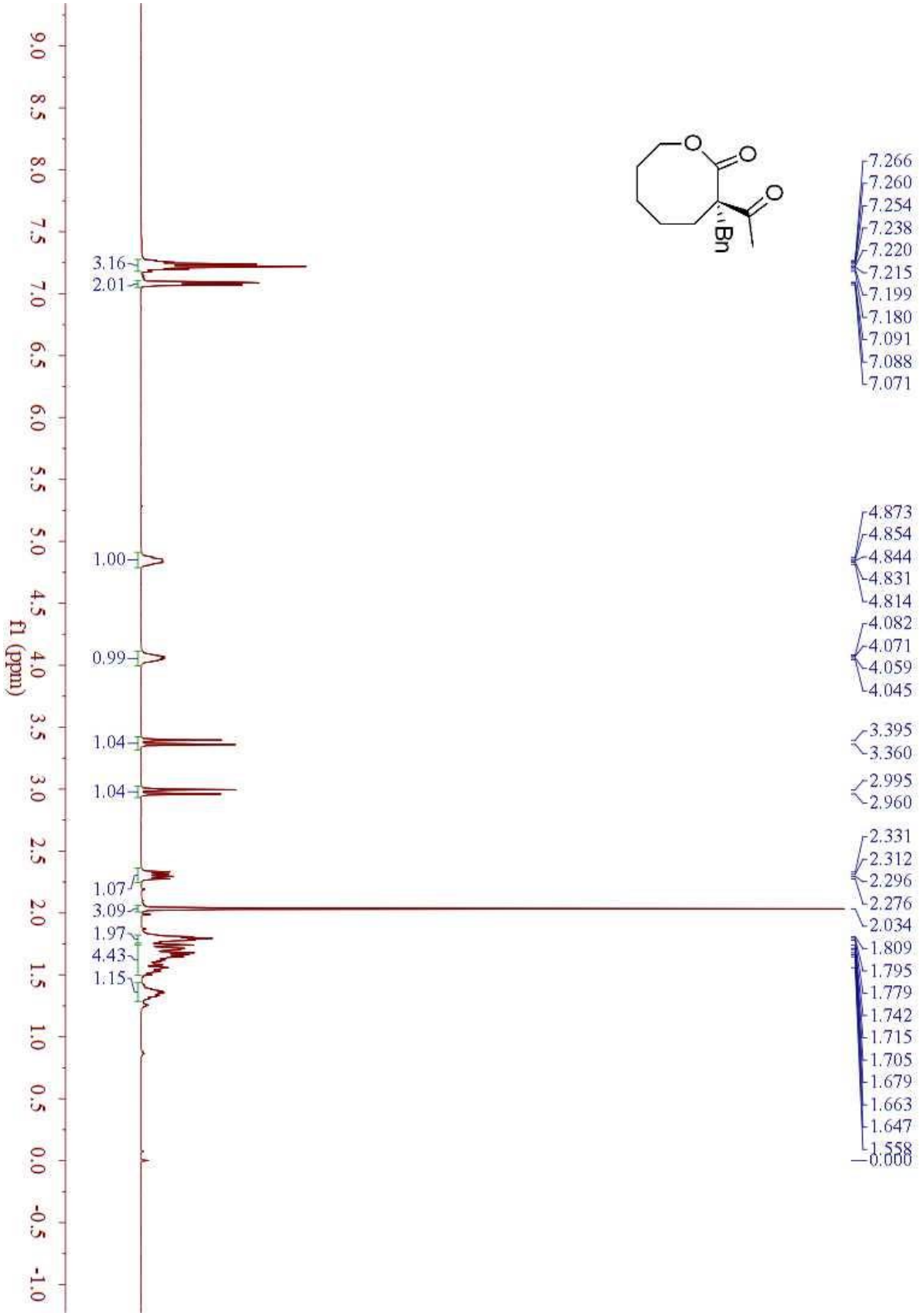
SAMPLE INFORMATION

Sample Name:	dl-18-33-2-chiral-ic9901214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hklkk
Vial:	1:A,2	Acq. Method Set:	dl9901214
Injection #:	1	Processing Method	trett
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	18.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	9/19/2019 11:56:41 AM CST		
Date Processed:	4/15/2020 2:16:35 PM CST		

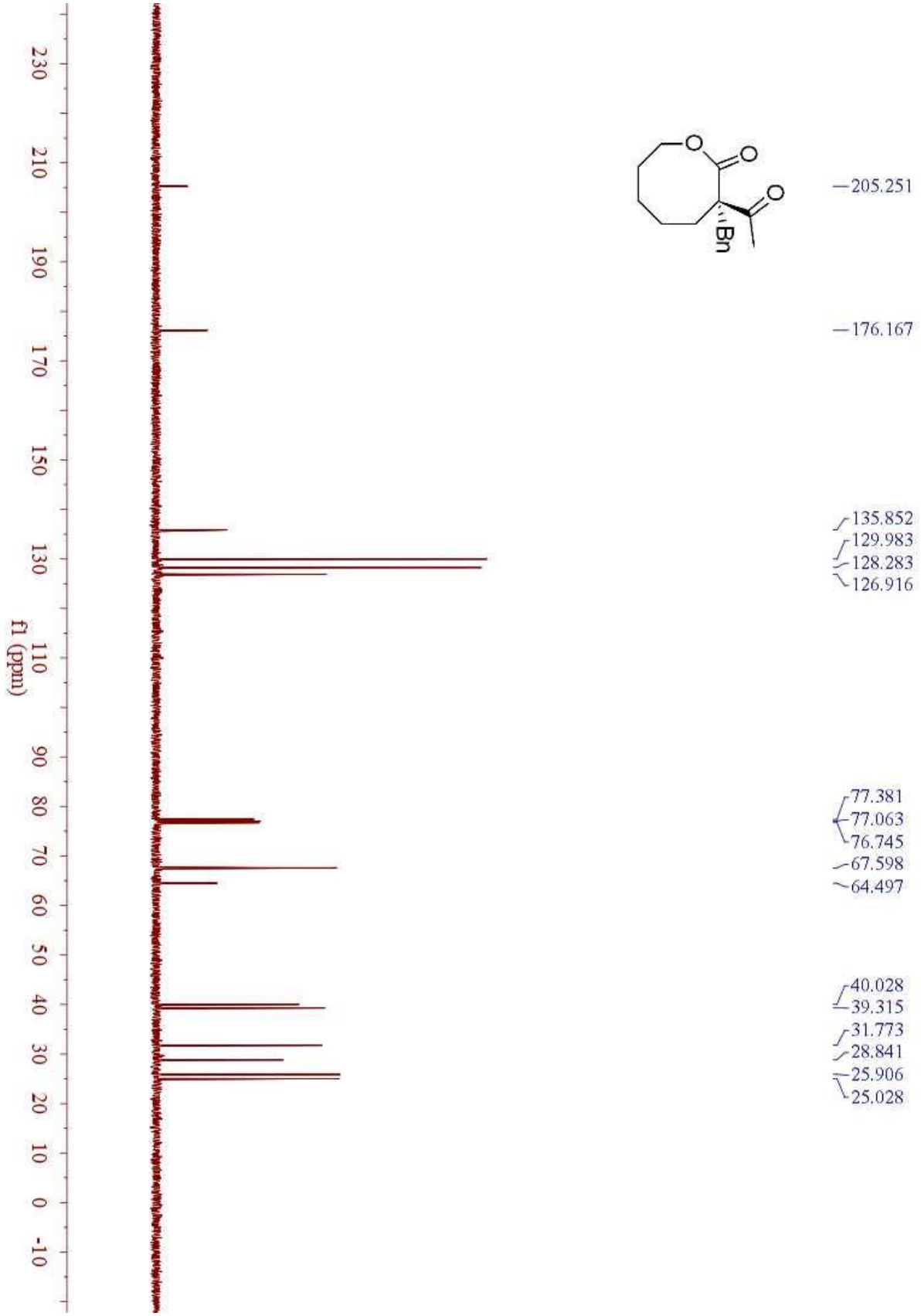


	RT	Area	% Area	Height
1	10.176	1132027	2.17	35841
2	12.315	51057110	97.83	1494552

3 ^{1}H NMR (400 MHz, $CDCl_3$)



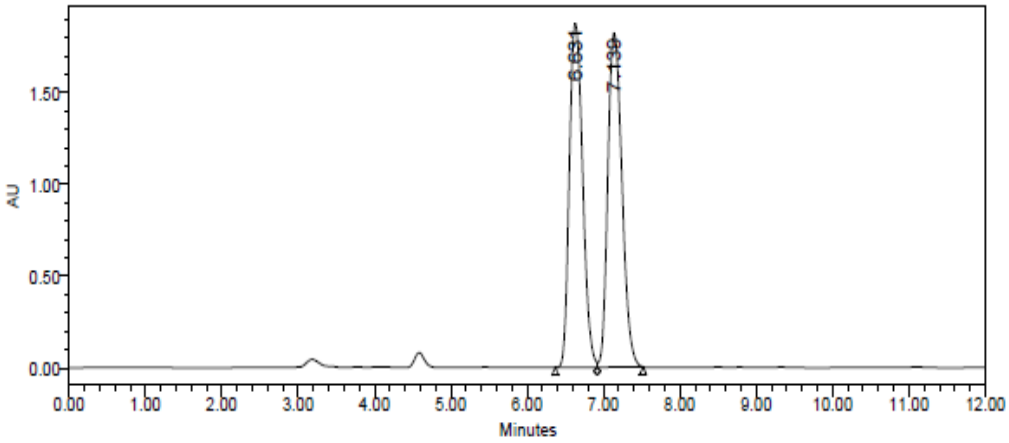
3 ^{13}C NMR (100 MHz, $CDCl_3$)



3 HPLC: racemic sample

SAMPLE INFORMATION

Sample Name:	dl-18-76-1-rac-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	dfgfd
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	vcxfsdfd
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	10/14/2019 12:16:38 PM CST		
Date Processed:	4/15/2020 1:32:04 PM CST		

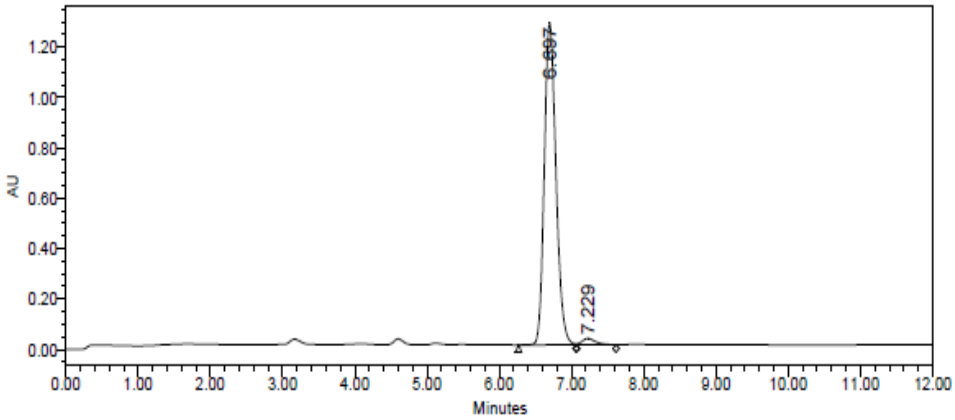


	RT	Area	% Area	Height
1	6.631	22671800	49.17	1876145
2	7.139	23433922	50.83	1825677

3 HPLC: chiral sample

SAMPLE INFORMATION

Sample Name:	dl-18-76-2-chiral-ig9505214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	hhjk
Vial:	1:A,2	Acq. Method Set:	dl9505214
Injection #:	1	Processing Method	wcvfg
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	10/14/2019 2:06:00 PM CST		
Date Processed:	4/15/2020 1:33:17 PM CST		



	RT	Area	% Area	Height
1	6.697	14353897	97.66	1280256
2	7.229	344116	2.34	25912