

Supporting Information

AgNTf₂ Catalyzed Cycloaddition of *N*-Acyliminium ions with Alkynes for the Synthesis of 3,4-Dihydro-1,3-oxazin-2-one Skeleton

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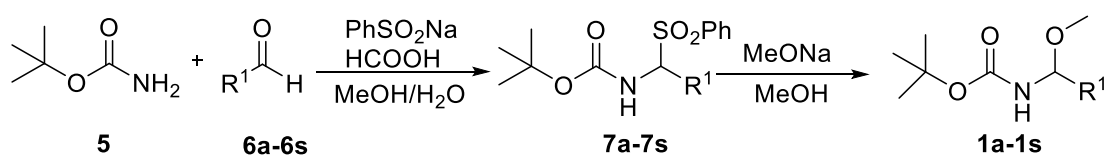
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I. The synthetic details data for the substrates 1a-1s.



General Procedure for the Synthesis of 1a-1s. First, a mixture of an aldehyde **6a-6s** (20 mmol), *tert*-butyl carbamate **5** (10 mmol), sodium benzenesulfinate (25 mmol) and formic acid (20 mmol) in methanol/water 1/2 (30 mL) under nitrogen was stirred at room temperature for 24 h. After cooling at 0°C, the resulting solid was separated by filtration, solubilized in dichloromethane (30 mL) and the organic layer was dried (MgSO₄). After concentration in vacuo, sulfones **7a-7s** was obtained without further purification.

Next, **7a-7s** (10 mmol), was added to a solution of sodium methoxide (30 mmol) in methanol (60 mL), and the mixture was stirred at room temperature for 2 hours. After dilution with water, the resulting mixture was extracted with dichloromethane and dried over anhydrous Na₂SO₄. After the solvents were evaporated, The crude product was purified by flash chromatography on silica gel with PE/EtOAc to obtain **1a-1s**.

Among the following compounds, **1a**, **1b**, **1d**, **1e**, **1f**, **1g**, **1k**, **1o**, **1p** are known compounds, so this paper only tests their ¹H NMR spectra, and their ¹H NMR spectra data are consistent with the literature.²³

***tert*-Butyl (methoxy(phenyl)methyl)carbamate (1a).** White solid (2.73 g, 64%, PE:EA = 9:1, R_f = 0.25); mp 67-68 °C; ¹H NMR (400 MHz, CDCl₃) δ 7.44-7.40 (m, 2H), 7.38-7.29 (m, 3H), 5.82 (d, *J* = 10.0 Hz, 1H), 5.15 (d, *J* = 7.2 Hz, 1H), 3.44 (s, 3H), 1.48 (s, 9H) ppm.

***tert*-Butyl (methoxy(*p*-tolyl)methyl)carbamate (1b).** White solid (3.29 g, 77%, PE:EA = 9:1, R_f = 0.25); mp 134-135 °C; ¹H NMR (400 MHz, CDCl₃) δ 7.33-7.26 (m, 2H), 7.20-7.12 (m, 2H), 5.78 (d, *J* = 9.2 Hz, 1H), 5.13 (d, *J* = 7.6 Hz, 1H), 3.43 (s, 3H), 2.34 (s, 3H), 1.47 (s, 9H) ppm.

***tert*-Butyl ((4-(*tert*-butyl)phenyl)(methoxy)methyl)carbamate (1c).** White solid (4.03 g, 81%, PE:EA = 9:1, R_f = 0.25); IR (film): ν_{max} 2963, 2904, 1716, 1512, 1363, 1169, 1080, 892 cm⁻¹; mp 83-84 °C; ¹H NMR (400 MHz, CDCl₃) δ 7.40-7.33 (m, 4H), 5.79 (d, *J* = 9.6 Hz, 1H), 5.10 (d, *J* = 7.6 Hz, 1H), 3.44 (s, 3H), 1.47 (s, 9H), 1.31 (s, 9H) ppm; ¹³C{¹H} NMR (100 MHz, CDCl₃) δ 155.4, 151.6, 136.6, 125.7, 125.6, 83.5, 80.1, 55.6,

34.7, 31.4, 28.4 ppm; HRMS (ESI) m/z : $[M + Na]^+$ Calcd for $C_{17}H_{27}NO_3Na^+$, 316.1883, found 316.1885.

***tert*-Butyl (methoxy(4-methoxyphenyl)methyl)carbamate (1d)**. White solid (3.04 g, 67%, PE:EA = 9:1, R_f = 0.25); mp 135-136 °C; 1H NMR (400 MHz, $CDCl_3$) δ 7.36-7.34 (m, 2H), 6.91-6.89 (m, 2H), 5.78 (d, J = 9.6 Hz, 1H), 5.16 (d, J = 8.0 Hz, 1H), 3.81 (s, 3H), 3.44 (s, 3H), 1.49 (s, 9H) ppm.

***tert*-Butyl ((4-bromophenyl)(methoxy)methyl)carbamate (1e)**. White solid (3.05 g, 57%, PE:EA = 9:1, R_f = 0.25); mp 89-90 °C; 1H NMR (400 MHz, $CDCl_3$) δ 7.50-7.45 (m, 2H), 7.32-7.28 (m, 2H), 5.79 (d, J = 9.6 Hz, 1H), 5.10 (d, J = 8.4 Hz, 1H), 3.42 (s, 3H), 1.48 (s, 9H) ppm.

***tert*-Butyl (methoxy(4-(trifluoromethyl)phenyl)methyl)carbamate (1f)**. White solid (2.64 g, 51%, PE:EA = 9:1, R_f = 0.25); mp 161-162 °C; 1H NMR (400 MHz, $CDCl_3$) δ 7.65-7.59 (m, 2H), 7.58-7.52 (m, 2H), 5.89 (d, J = 10.0 Hz, 1H), 5.09 (d, J = 7.6 Hz, 1H), 3.48 (s, 3H), 1.49 (s, 9H) ppm.

***tert*-Butyl ((4-cyanophenyl)(methoxy)methyl)carbamate (1g)**. White solid (2.41 g, 54%, PE:EA = 9:1, R_f = 0.25); mp 111-112 °C; 1H NMR (400 MHz, $CDCl_3$) δ 7.68-7.62 (m, 2H), 7.58-7.53 (m, 2H), 5.87 (d, J = 9.6 Hz, 1H), 5.18-4.94 (d, J = 8.8 Hz, 1H), 3.48 (s, 3H), 1.49 (s, 9H) ppm.

***tert*-Butyl (methoxy(*m*-tolyl)methyl)carbamate (1h)**. Colorless oil (2.99 g, 70%, PE:EA = 9:1, R_f = 0.25); IR (film): ν_{max} 2978, 2930, 1713, 1514, 1367, 1248, 1165, 965 cm^{-1} ; 1H NMR (400 MHz, $CDCl_3$) δ 7.28-7.16 (m, 3H), 7.16-7.09 (m, 1H), 5.77 (d, J = 9.6 Hz, 1H), 5.11 (s, 1H), 3.44 (s, 3H), 2.35 (s, 3H), 1.48 (s, 9H) ppm; $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 155.4, 139.5, 133.4, 129.3, 128.6, 126.6, 123.0, 83.7, 80.2, 55.6, 28.4, 21.5 ppm; HRMS (ESI) m/z : $[M + Na]^+$ Calcd for $C_{14}H_{21}NO_3Na^+$, 274.1414, found 274.1418.

***tert*-Butyl ((3-chlorophenyl)(methoxy)methyl)carbamate (1i)**. White solid (2.17 g, 47%, PE:EA = 9:1, R_f = 0.25); mp 87-88 °C; IR (film): ν_{max} 2980, 2933, 1712, 1518, 1363, 1242, 1171, 769 cm^{-1} ; 1H NMR (400 MHz, $CDCl_3$) δ 7.43-7.38 (m, 1H), 7.31-7.25 (m, 3H), 5.79 (d, J = 9.6 Hz, 1H), 5.13 (d, J = 8.4 Hz, 1H), 3.45 (s, 3H), 1.48 (s, 9H) ppm; $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 155.4, 141.7, 134.6, 129.9, 128.6, 126.4, 124.3, 82.9, 80.4, 55.7, 28.4 ppm; HRMS (ESI) m/z : $[M + Na]^+$ Calcd for $C_{13}H_{18}ClNO_3Na^+$, 294.0867, found 294.0871.

***tert*-Butyl ((3-bromophenyl)(methoxy)methyl)carbamate (1j)**. White solid (2.51 g, 47%, PE:EA = 9:1, R_f = 0.25); mp 84-85 °C; IR (film): ν_{max} 2980, 2932, 1700, 1514, 1365,

1245, 1165, 782 cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 7.63-7.56 (m, 1H), 7.48-7.40 (m, 1H), 7.37-7.31 (m, 1H), 7.25-7.19 (m, 1H), 5.80 (d, $J = 10.0$ Hz, 1H), 5.11 (d, $J = 5.6$ Hz, 1H), 3.45 (s, 3H), 1.49 (s, 9H) ppm; $^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz, CDCl_3) δ 156.3, 141.9, 131.6, 130.2, 129.3, 124.8, 122.8, 82.8, 80.5, 55.8, 28.4 ppm; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{13}\text{H}_{18}\text{BrNO}_3\text{Na}^+$, 338.0362, found 338.0365.

***tert*-Butyl (methoxy(*o*-tolyl)methyl)carbamate (1k).** White solid (2.90 g, 72%, PE:EA = 9:1, $R_f = 0.25$); mp 131-132 $^\circ\text{C}$; ^1H NMR (400 MHz, CDCl_3) δ 7.51-7.44 (m, 1H), 7.23-7.14 (m, 3H), 5.91 (d, $J = 10.0$ Hz, 1H), 5.05 (d, $J = 8.4$ Hz, 1H), 3.44 (s, 3H), 2.33 (s, 3H), 1.46 (s, 9H) ppm.

***tert*-Butyl (cyclopropyl(methoxy)methyl)carbamate (1l).** Colorless oil (2.39 g, 70%, PE:EA = 9:1, $R_f = 0.25$); IR (film): ν_{max} 2978, 2932, 1710, 1516, 1365, 1244, 1171, 782 cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 5.06-4.91 (m, 1H), 4.58-4.43 (m, 1H), 3.34 (s, 3H), 1.46 (s, 9H), 1.08-0.99 (m, 1H), 0.55-0.36 (m, 4H) ppm; $^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz, CDCl_3) δ 155.5, 84.8, 79.8, 55.6, 28.4, 15.6, 2.1, 1.3 ppm; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_3\text{Na}^+$, 288.1570, found 288.1571.

***tert*-Butyl (cyclohexyl(methoxy)methyl)carbamate (1m).** White solid (1.33 g, 79%, PE:EA = 9:1, $R_f = 0.25$); IR (film): ν_{max} 2929, 2853, 1700, 1516, 1365, 1173, 1078, 957 cm^{-1} ; mp 74-75 $^\circ\text{C}$; ^1H NMR (400 MHz, CDCl_3) δ 4.82 (d, $J = 10.0$ Hz, 1H), 4.63-4.48 (m, 1H), 3.33 (s, 3H), 1.83-1.61 (m, 5H), 1.49-1.42 (m, 1H), 1.46 (s, 9H), 1.28-1.00 (m, 5H) ppm; $^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz, CDCl_3) δ 155.9, 86.7, 79.6, 55.6, 42.9, 28.4, 27.9, 26.4, 25.9, 25.8 ppm; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{13}\text{H}_{25}\text{NO}_3\text{Na}^+$, 266.1727, found 266.1728.

***tert*-Butyl (1-methoxybutyl)carbamate (1n).** Colorless oil (2.42 g, 70%, PE:EA = 9:1, $R_f = 0.25$); IR (film): ν_{max} 2963, 2871, 1710, 1514, 1365, 1175, 942, 767 cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 4.96-4.72 (m, 2H), 3.34 (s, 3H), 1.69-1.57 (m, 1H), 1.54-1.49 (m, 1H), 1.46 (s, 9H), 1.43-1.34 (m, 2H), 0.93 (t, 3H) ppm; $^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz, CDCl_3) δ 155.7, 82.9, 79.7, 55.4, 37.8, 28.4, 18.3, 13.8 ppm; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{10}\text{H}_{21}\text{NO}_3\text{Na}^+$, 226.1414, found 226.1411.

***tert*-Butyl (1-methoxy-2-methylpropyl)carbamate (1o).** Colorless oil (1.98 g, 57%, PE:EA = 9:1, $R_f = 0.25$); ^1H NMR (400 MHz, CDCl_3) δ 4.79 (d, $J = 9.6$ Hz, 1H), 4.56 (dd, $J = 10.0$ Hz, 5.6 Hz, 1H), 3.34 (s, 3H), 1.84-1.72 (m, 1H), 1.46 (s, 9H), 0.96-0.89 (m, 6H) ppm.

***tert*-Butyl (1-methoxy-3-methylbutyl)carbamate (1p).** Colorless oil (2.32 g, 63%, PE:EA = 9:1, $R_f = 0.25$); ^1H NMR (400 MHz, CDCl_3) δ 4.92-4.84 (m, 1H), 4.83-4.67 (m,

1H), 3.34 (s, 3H), 1.77-1.66 (m, 1H), 1.60-1.51 (m, 1H), 1.46 (s, 9H), 1.42-1.32 (m, 1H), 0.96-0.88 (m, 6H) ppm.

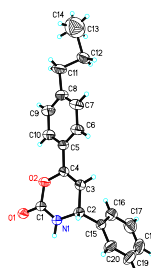
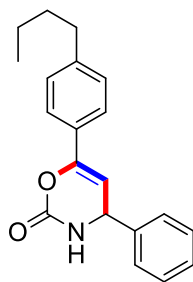
tert-Butyl (1-methoxy-3-phenylpropyl)carbamate (1q). White solid (3.56 g, 79%, PE:EA = 9:1, Rf = 0.25); mp 78-79 °C; IR (film): ν_{\max} 2976, 2933, 1712, 1514, 1363, 1167, 1045, 698 cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 7.31-7.24 (m, 2H), 7.23-7.11 (m, 3H), 4.83 (s, 1H), 3.35 (s, 3H), 2.77-2.60 (m, 2H), 2.02-1.89 (m, 1H), 1.88-1.76 (m, 1H), 1.46 (s, 9H) ppm; $^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz, CDCl_3) δ 155.6, 141.4, 128.6, 128.5, 126.1, 82.6, 79.5, 55.4, 37.5, 31.4, 28.3 ppm; HRMS (ESI) m/z: $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_3\text{Na}^+$, 288.1570, found 288.1571.

tert-Butyl (2-(benzyloxy)-1-methoxyethyl)carbamate (1r). Colorless oil (3.15 g, 66%, PE:EA = 9:1, Rf = 0.25); IR (film): ν_{\max} 2976, 2931, 1712, 1500, 1365, 1169, 739, 694 cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 7.37-7.27 (m, 5H), 5.28 (d, $J = 9.2$ Hz, 1H), 4.98 (d, $J = 9.6$ Hz, 1H), 4.61-4.53 (m, 2H), 3.60-3.48 (m, 2H), 3.38 (s, 3H), 1.46 (s, 9H) ppm; $^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz, CDCl_3) δ 155.5, 137.8, 128.5, 127.9, 81.3, 80.0, 73.7, 71.4, 55.7, 28.4 ppm; HRMS (ESI) m/z: $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_4\text{Na}^+$, 304.1519, found 304.1512.

tert-Butyl (methoxy(thiophen-2-yl)methyl)carbamate (1s). White solid (1.74 g, 42%, PE:EA = 9:1, Rf = 0.25); mp 78-79 °C; IR (film): ν_{\max} 2980, 2929, 1710, 1504, 1242, 1165, 1076, 698 cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 7.30-7.21 (m, 1H), 7.06-7.02 (m, 1H), 6.99-6.94 (m, 1H), 6.05 (d, $J = 9.6$ Hz, 1H), 5.26 (d, $J = 4.8$ Hz, 1H), 3.47 (s, 3H), 1.49 (s, 9H) ppm; $^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz, CDCl_3) δ 156.1, 143.2, 126.9, 125.6, 124.7, 80.8, 80.5, 55.8, 28.4 ppm; HRMS (ESI) m/z: $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{11}\text{H}_{17}\text{NO}_3\text{SNa}^+$, 266.0821, found 266.0823.

II.X-Ray Structure for compound 3ae

ORTEP drawing of the X-ray crystallographic structure of 3ae



CCDC 2168786. For detailed crystallographic data, please refer to the Cambridge Crystallographic Data Centre at <http://ccdc.cam.ac.uk>.

Table 1. Crystal data and structure refinement for **3ae**.

Identification code	3ae	
Empirical formula	$C_{20}H_{21}NO_2$	
Formula weight	307.38	
Temperature	293(2)K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P -1	
Unit cell dimensions	$a = 9.6668(6)$ Å	$\alpha = 91.153(2)^\circ$.
	$b = 13.1481(7)$ Å	$\beta = 94.071(2)^\circ$.
	$c = 13.9023(9)$ Å	$\gamma = 104.497(2)^\circ$.
Volume	$1705.09(18)$ Å ³	
Z	4	
Density (calculated)	1.197 Mg/m ³	
Absorption coefficient	0.077 mm ⁻¹	
F(000)	656	
Crystal size	0.190 x 0.150 x 0.110 mm ³	
Theta range for data collection	2.722 to 25.998°.	
Index ranges	-11 ≤ h ≤ 11, -16 ≤ k ≤ 16, -17 ≤ l ≤ 17	

Reflections collected	33470
Independent reflections	6677 [R(int) = 0.0549]
Completeness to theta = 25.242°	99.7%
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.7456 and 0.7006
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	6677 / 112 / 492
Goodness-of-fit on F ²	1.036
Final R indices [I>2sigma(I)]	R1 = 0.0639, wR2 = 0.1495
R indices (all data)	R1 = 0.1155, wR2 = 0.1848
Extinction coefficient	0.028(5)
Largest diff. peak and hole	0.173 and -0.160 e.Å ⁻³

Table 1. Atomic coordinates ($\times 10^4$) and equivalent isotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for **3ae**. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
O(1)	3009(2)	3956(1)	3893(1)	85(1)
O(2)	3600(2)	5291(1)	2956(1)	73(1)
N(1)	5354(2)	4724(2)	3833(1)	66(1)
C(1)	3982(3)	4622(2)	3596(2)	65(1)
C(2)	6569(2)	5523(2)	3519(2)	62(1)
C(3)	6002(3)	6232(2)	2866(2)	66(1)
C(4)	4636(3)	6114(2)	2620(2)	60(1)
C(5)	3961(3)	6773(2)	1987(2)	65(1)
C(6)	4715(3)	7760(2)	1756(2)	88(1)
C(7)	4074(4)	8377(2)	1169(2)	102(1)
C(8)	2672(4)	8042(3)	801(2)	94(1)
C(9)	1934(3)	7060(3)	1034(2)	98(1)
C(10)	2559(3)	6434(2)	1618(2)	85(1)
C(11)	1838(11)	8631(8)	134(7)	101(3)
C(12)	2709(7)	9071(5)	-716(5)	98(2)
C(13)	1629(16)	9899(11)	-1198(11)	239(8)
C(14)	717(10)	9125(7)	-1947(7)	141(3)
C(11')	2221(19)	8976(11)	285(11)	110(6)

C(12')	1942(16)	8637(10)	-760(10)	149(5)
C(13')	2038(10)	9688(7)	-1426(6)	78(2)
C(14')	508(16)	9485(17)	-1442(17)	195(8)
C(15)	7617(2)	5013(2)	3062(2)	63(1)
C(16)	7448(3)	4709(2)	2108(2)	87(1)
C(17)	8414(5)	4232(3)	1708(3)	121(1)
C(18)	9553(5)	4073(3)	2277(5)	137(2)
C(19)	9723(4)	4375(3)	3214(4)	131(2)
C(20)	8769(3)	4848(2)	3616(2)	92(1)
O(3)	4202(2)	-3102(1)	4833(1)	69(1)
O(4)	4850(2)	-1532(1)	4225(1)	66(1)
N(2)	6506(2)	-2192(2)	5110(1)	67(1)
C(21)	5171(2)	-2322(2)	4748(2)	59(1)
C(22)	7727(2)	-1294(2)	5022(2)	67(1)
C(23)	7215(3)	-478(2)	4480(2)	71(1)
C(24)	5889(2)	-601(2)	4117(2)	60(1)
C(25)	5293(3)	151(2)	3561(2)	61(1)
C(26)	6120(3)	1151(2)	3414(2)	78(1)
C(27)	5580(3)	1857(2)	2886(2)	86(1)
C(28)	4197(4)	1603(2)	2487(2)	84(1)
C(29)	3369(3)	611(2)	2639(2)	89(1)
C(30)	3895(3)	-106(2)	3167(2)	81(1)
C(31)	3687(15)	2452(11)	1957(8)	88(3)
C(32)	3466(9)	2214(7)	878(7)	121(3)
C(33)	3693(11)	3422(10)	302(8)	159(3)
C(34)	2226(10)	3184(10)	-20(9)	206(5)
C(31')	3430(20)	2271(18)	1825(13)	121(9)
C(32')	4208(10)	2559(8)	892(8)	85(3)
C(33')	2740(15)	2903(8)	320(9)	129(4)
C(34')	3310(20)	4016(9)	406(12)	182(6)
C(35)	8917(2)	-1661(2)	4568(2)	66(1)
C(36)	9794(3)	-2136(2)	5128(2)	80(1)
C(37)	10837(3)	-2528(2)	4724(3)	96(1)
C(38)	11007(3)	-2447(2)	3761(3)	105(1)
C(39)	10149(4)	-1980(3)	3200(3)	111(1)
C(40)	9105(3)	-1583(2)	3595(2)	90(1)

III. Copies of ^1H NMR, ^{13}C NMR and ^{19}F NMR Spectrum

NMR spectra of compound 1a

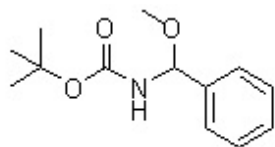
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5.809

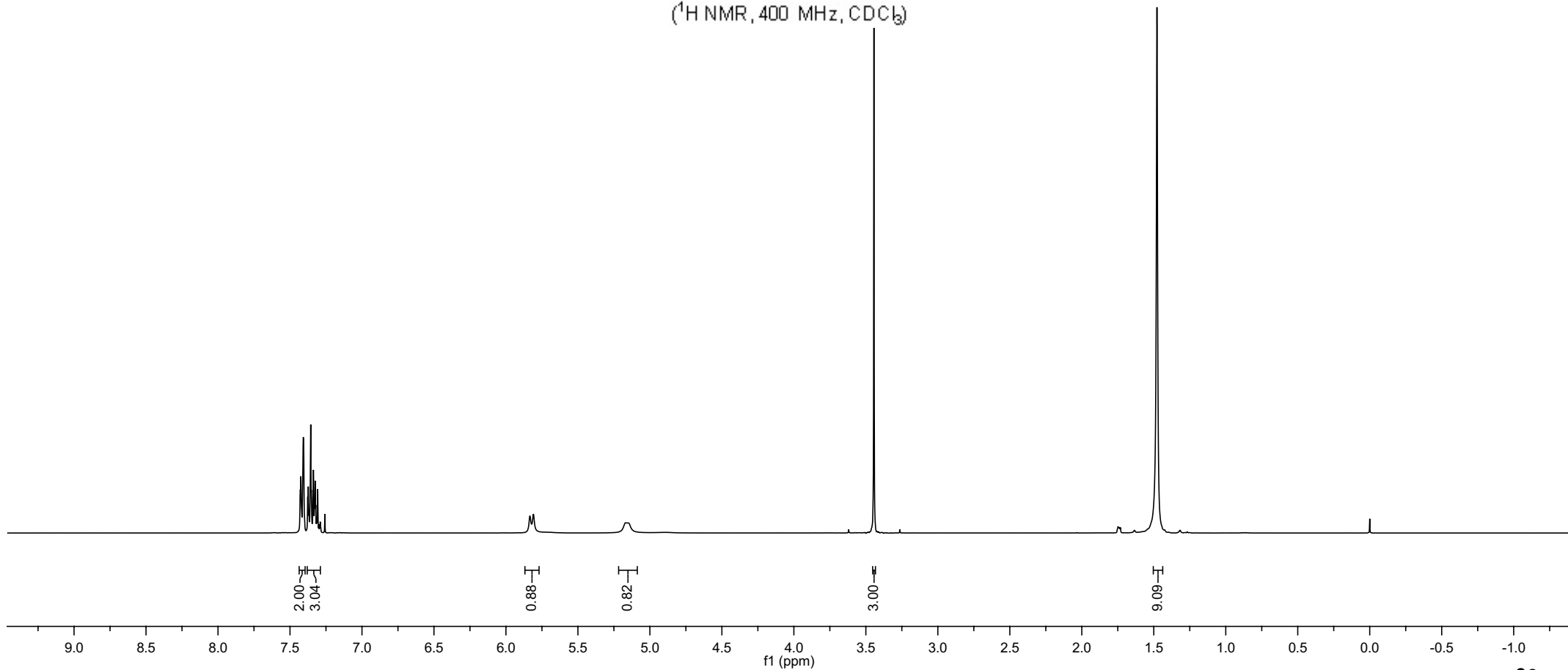
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3.444

1.478



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound **1b**

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7.150

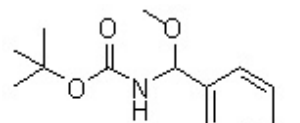
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5.136
5.117

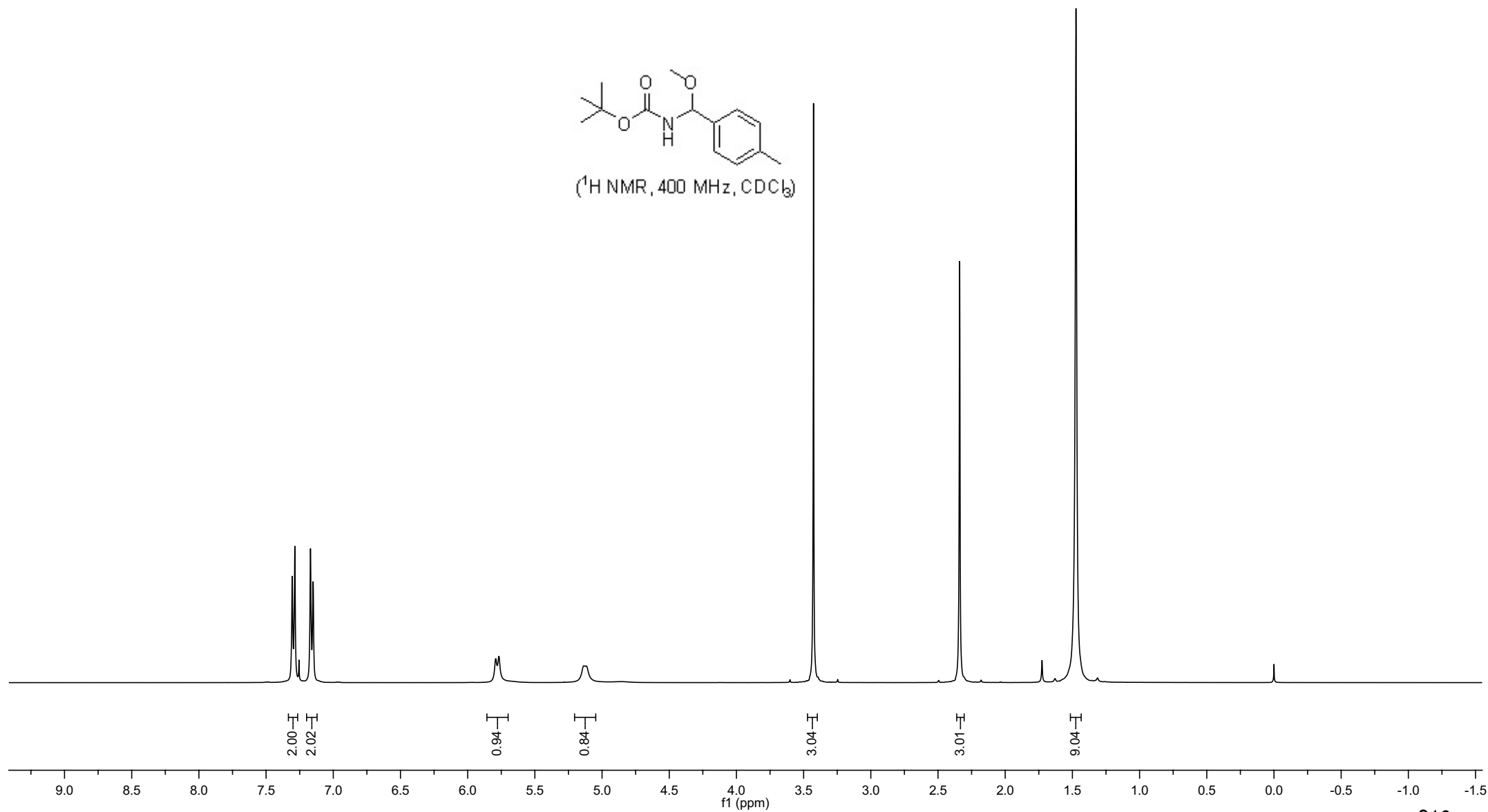
3.426

2.339

1.473



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 1c

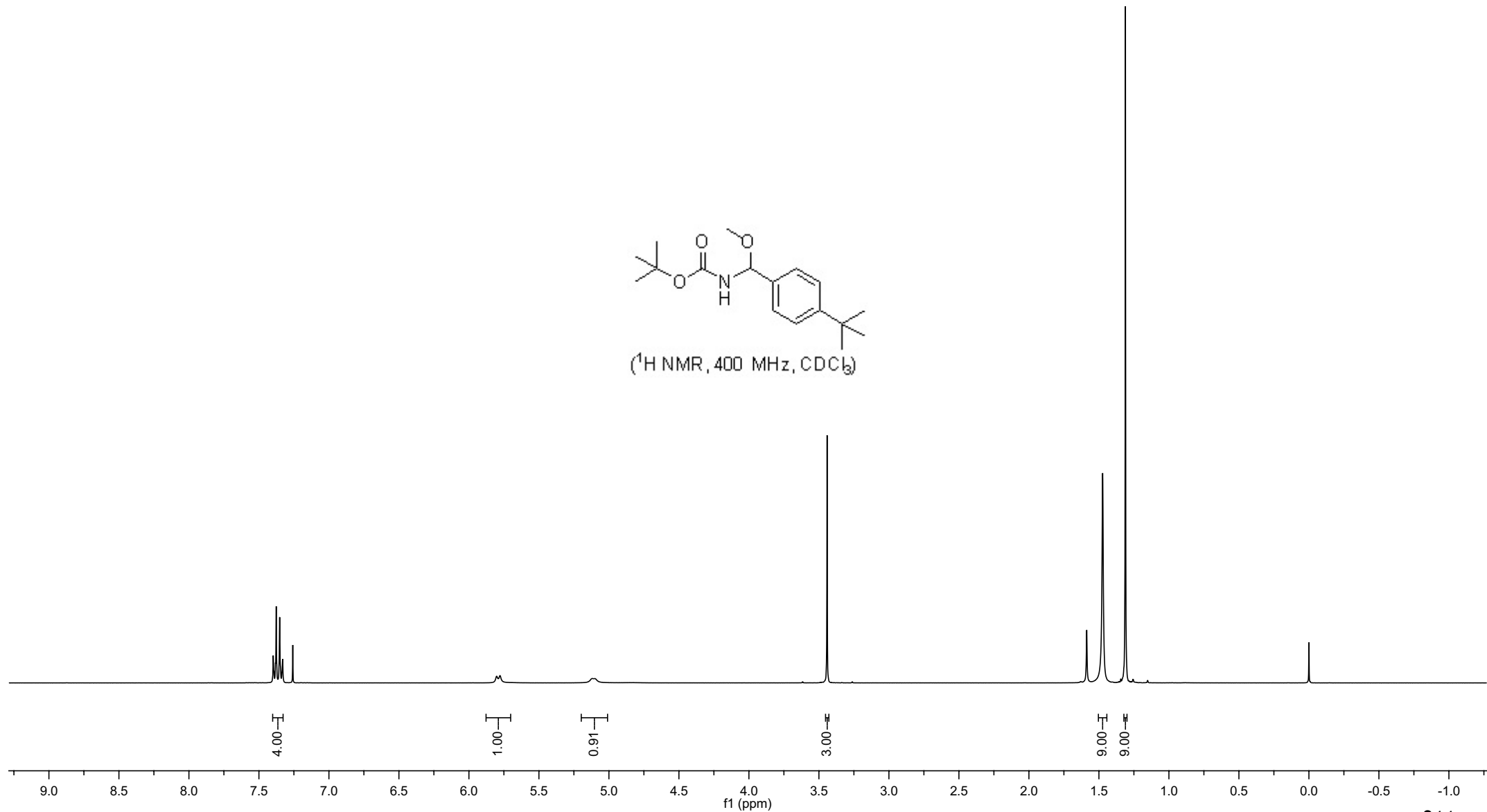
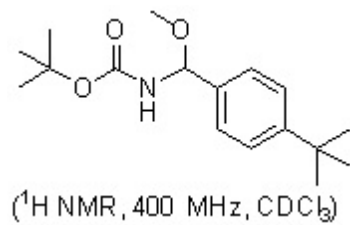
7.398
7.393
7.382
7.376
7.352
7.331

5.802
5.778

5.119
5.100

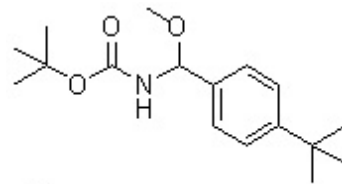
3.441

1.587
1.473
1.311

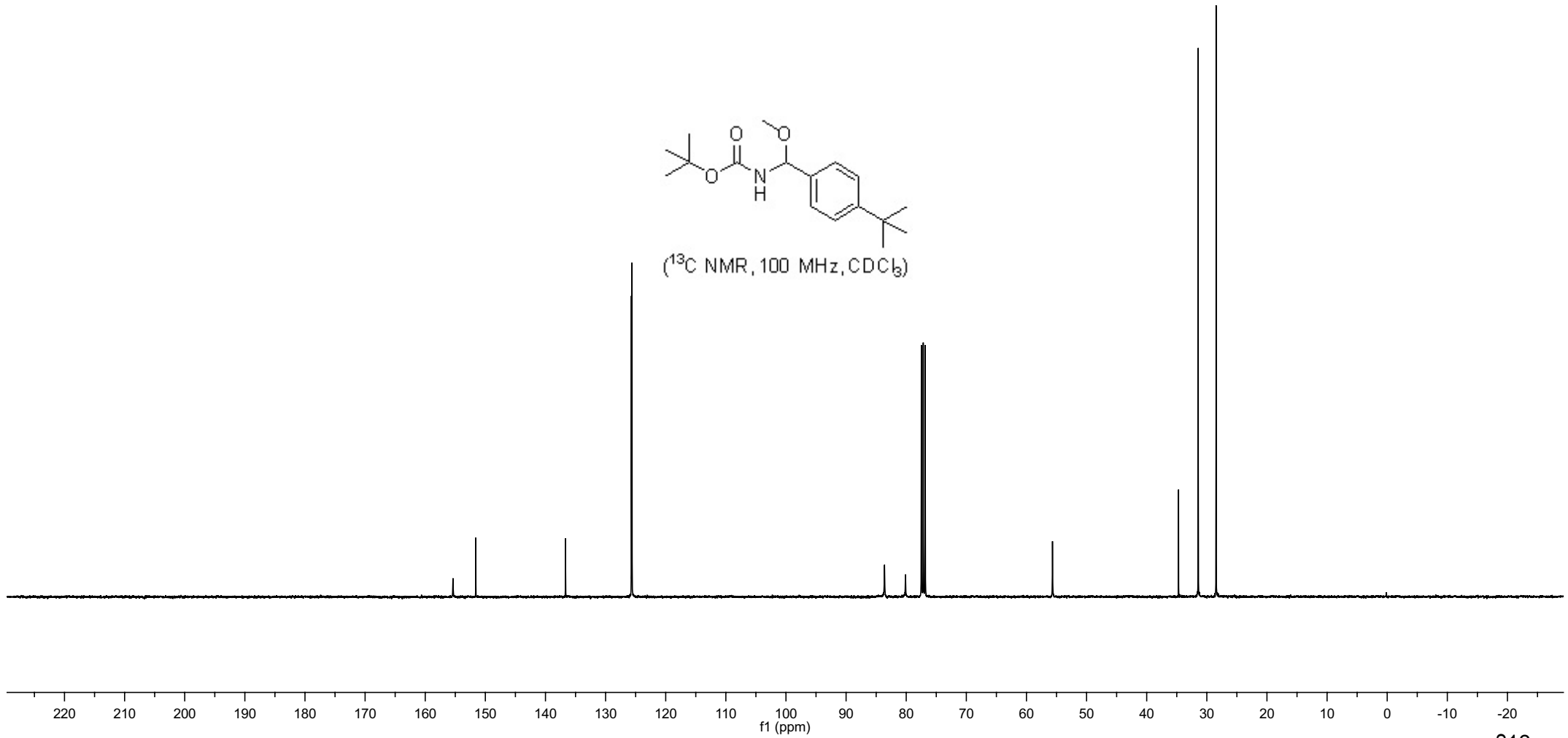


NMR spectra of compound 1c

- 155.382
- 151.585
- 136.663
- 125.709
- 125.604
- 83.612
- 80.119
- 55.669
- 34.703
- 31.433
- 28.457



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 1d

7.344
7.323

6.888
6.866

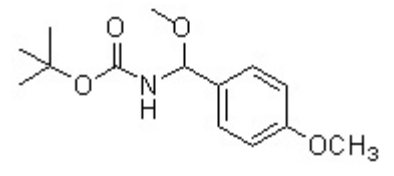
5.782
5.758

5.167
5.147

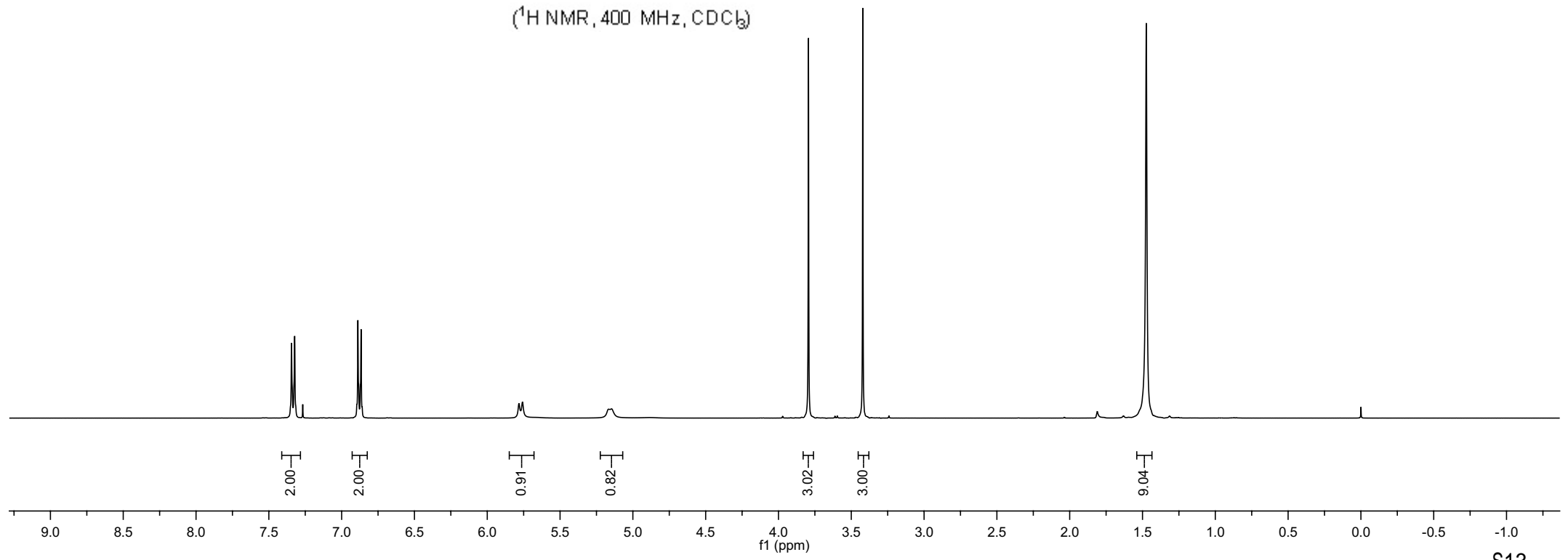
3.794

3.421

1.474



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 1e

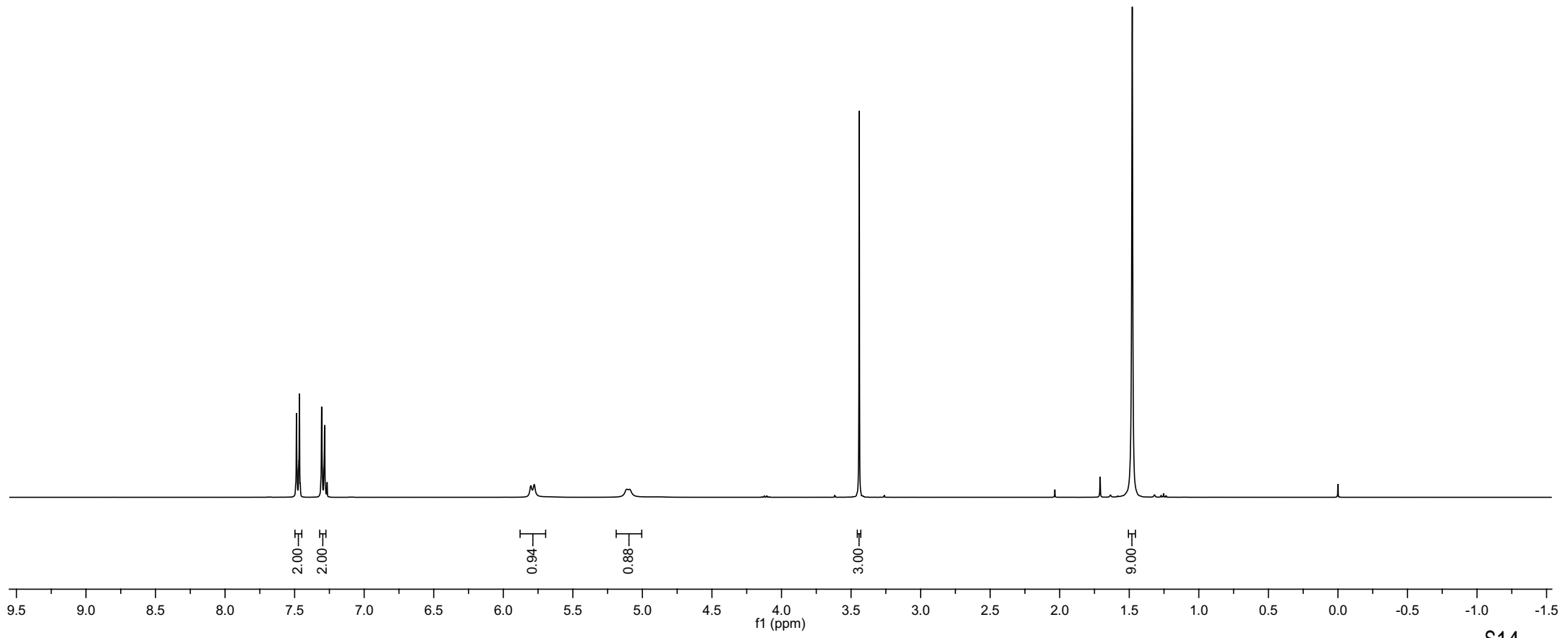
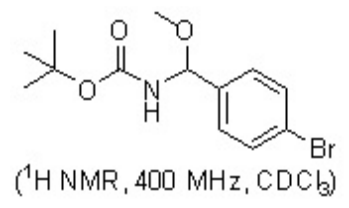
7.487
7.470
7.465
7.306
7.284

5.802
5.778

5.113
5.092

3.441

1.479



NMR spectra of compound 1f

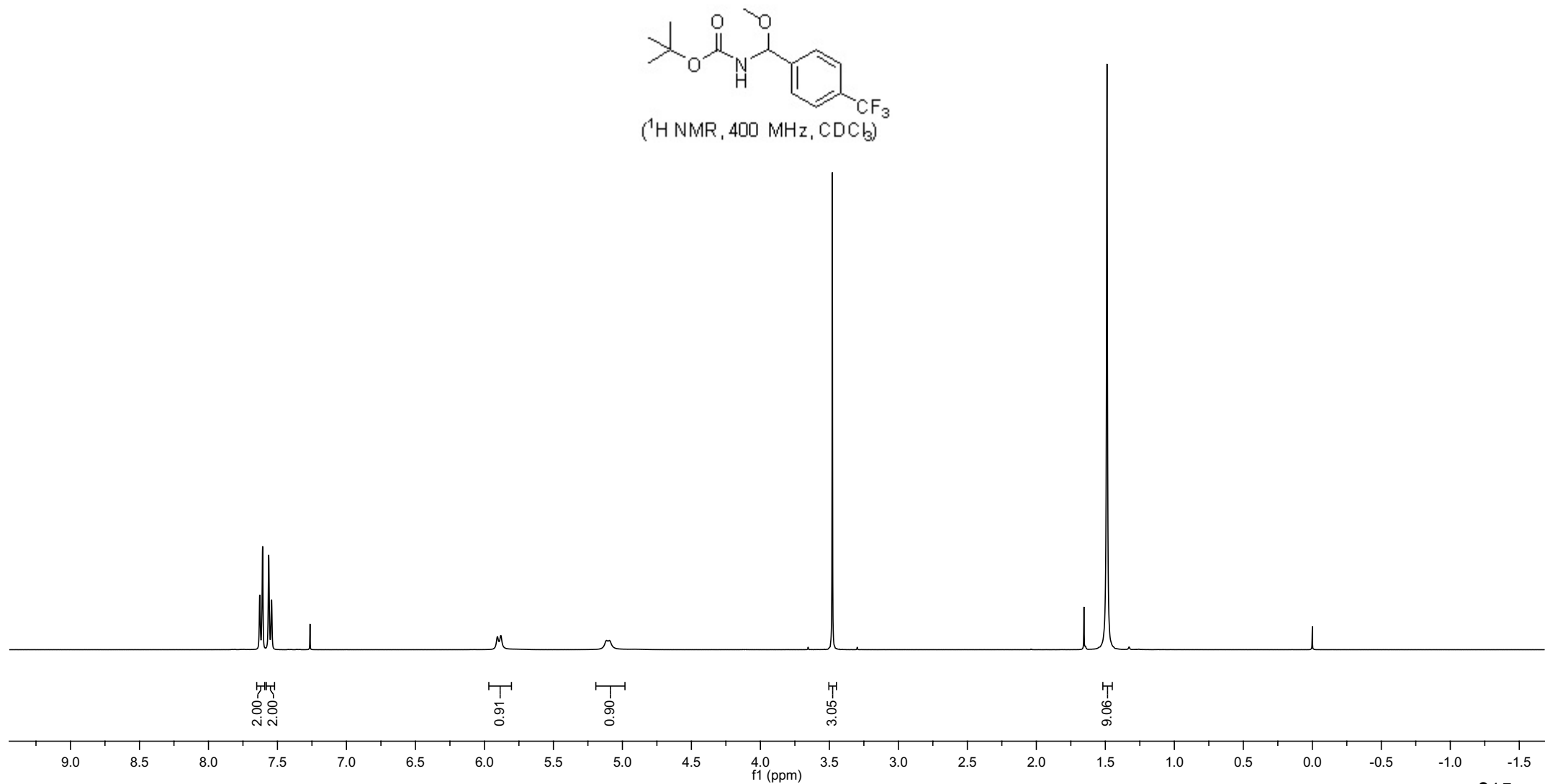
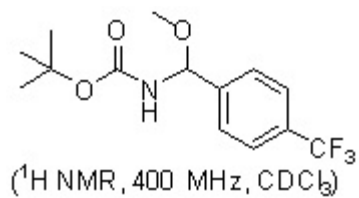
7.629
7.608
7.563
7.543

5.906
5.881

5.115
5.094

3.478

1.488



NMR spectra of compound 1g

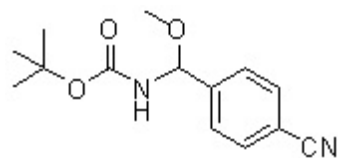
7.664
7.643
7.567
7.546

5.904
5.880

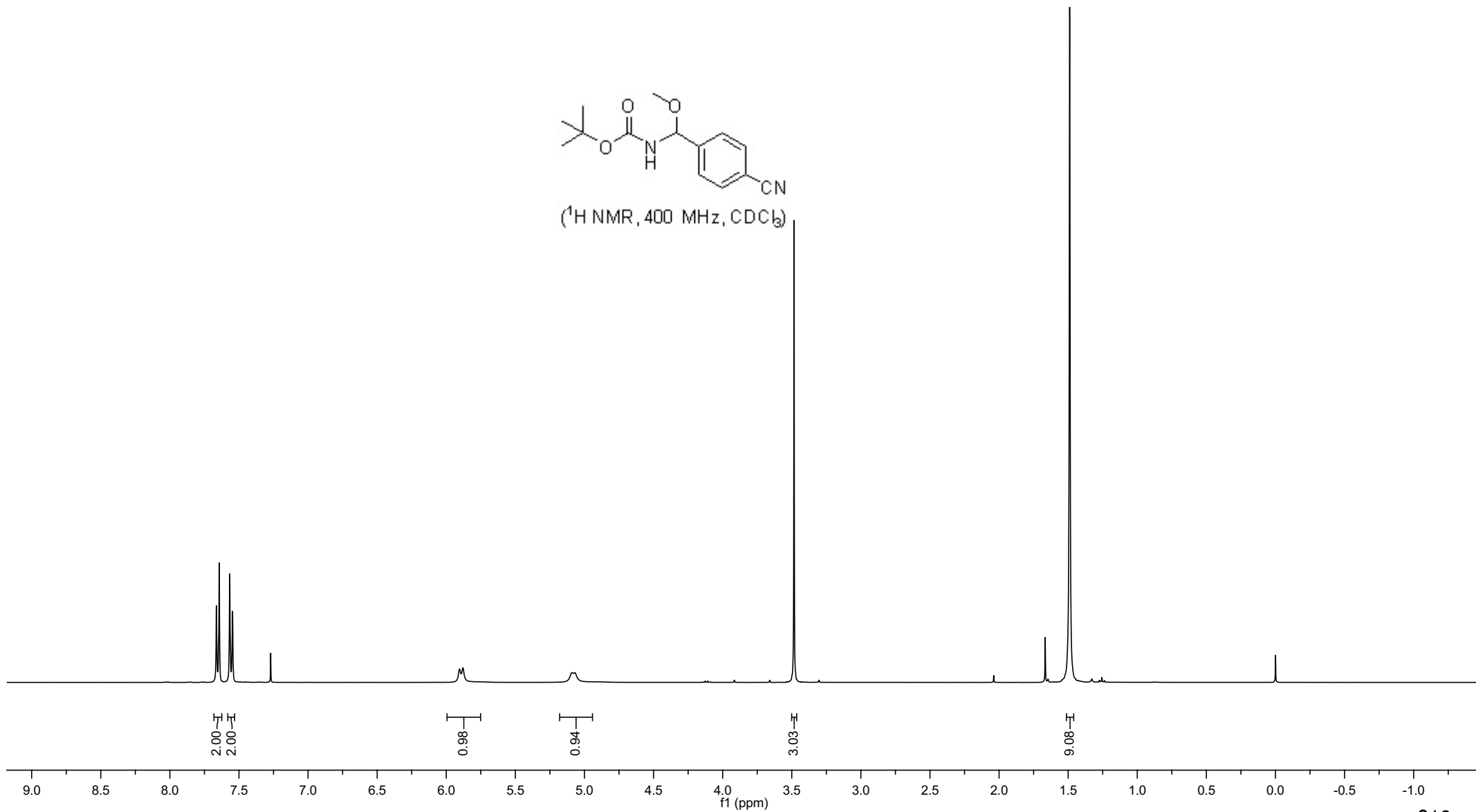
5.091
5.069

3.484

1.489



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 1h

7.263
7.255
7.244
7.226
7.210
7.191
7.131
7.114

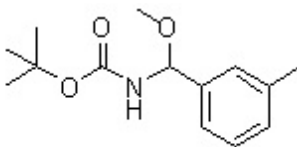
5.788
5.764

5.135

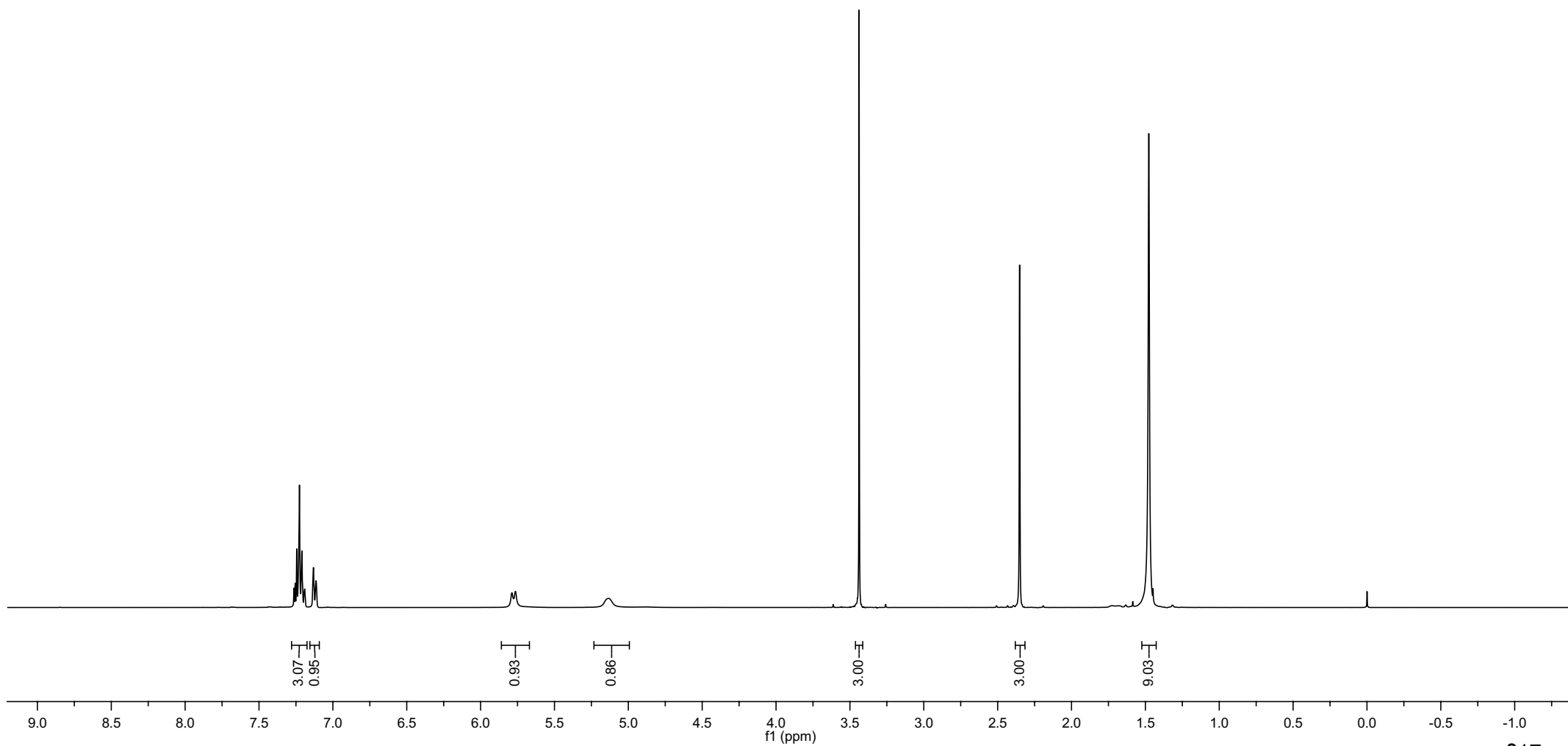
3.438

2.351

1.477



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound **1h**

— 155.387

— 139.535
— 138.426

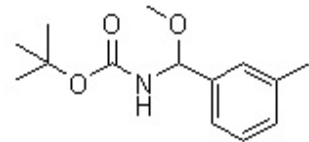
— 129.274
— 128.611
— 126.637
— 123.040

— 83.763
— 80.180

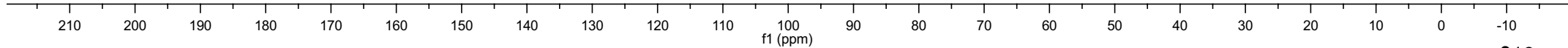
— 55.644

— 28.449

— 21.522



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 1i

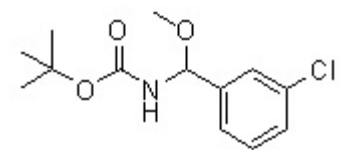
7.432
7.299
7.285
7.283
7.271
7.267

5.818
5.794

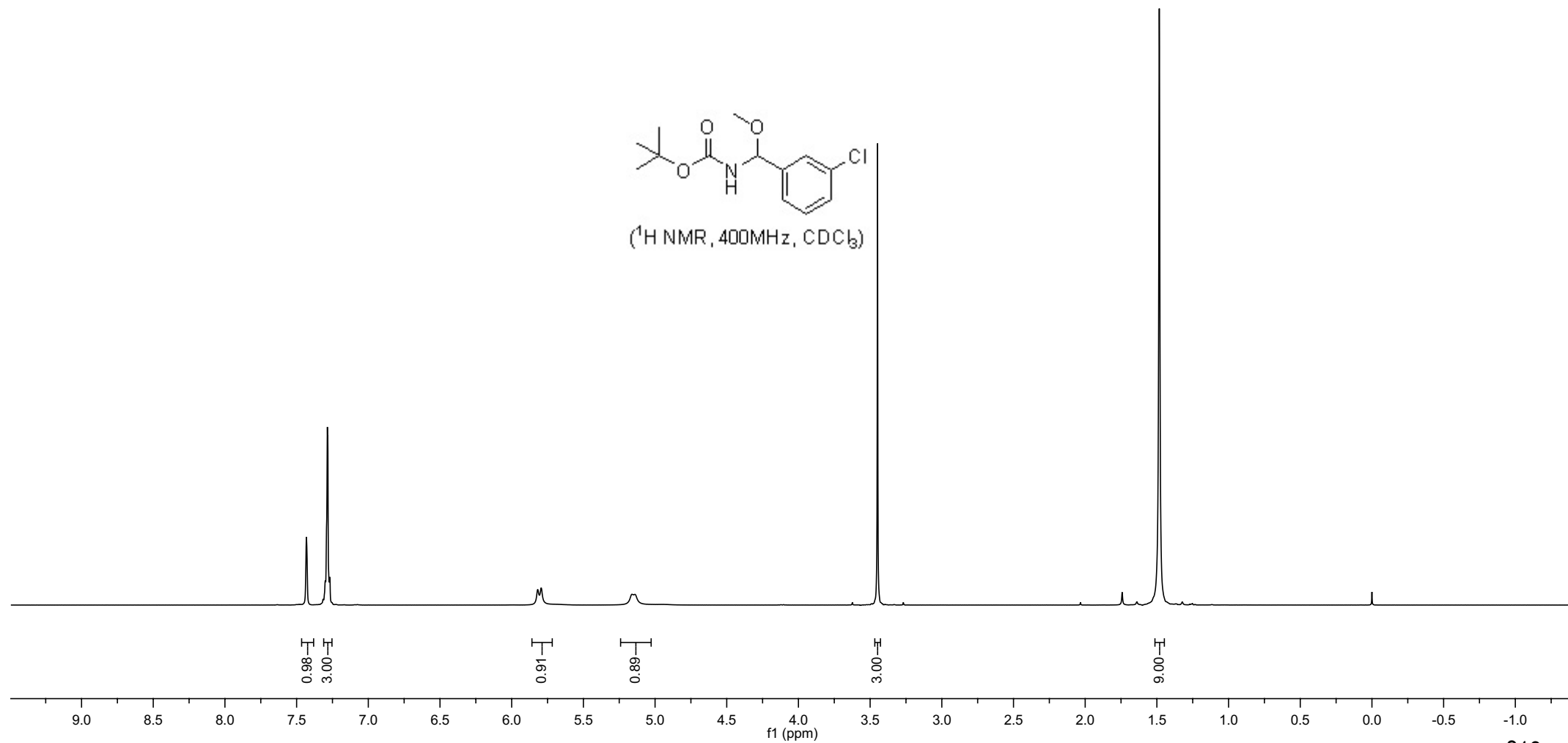
5.161
5.140

3.448

1.483



(¹H NMR, 400MHz, CDCl₃)



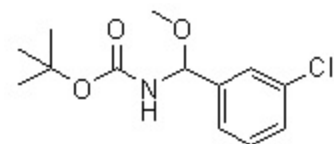
NMR spectra of compound 1i

— 155.365
— 141.681
— 134.582
— 129.904
— 128.617
— 126.367
— 124.327

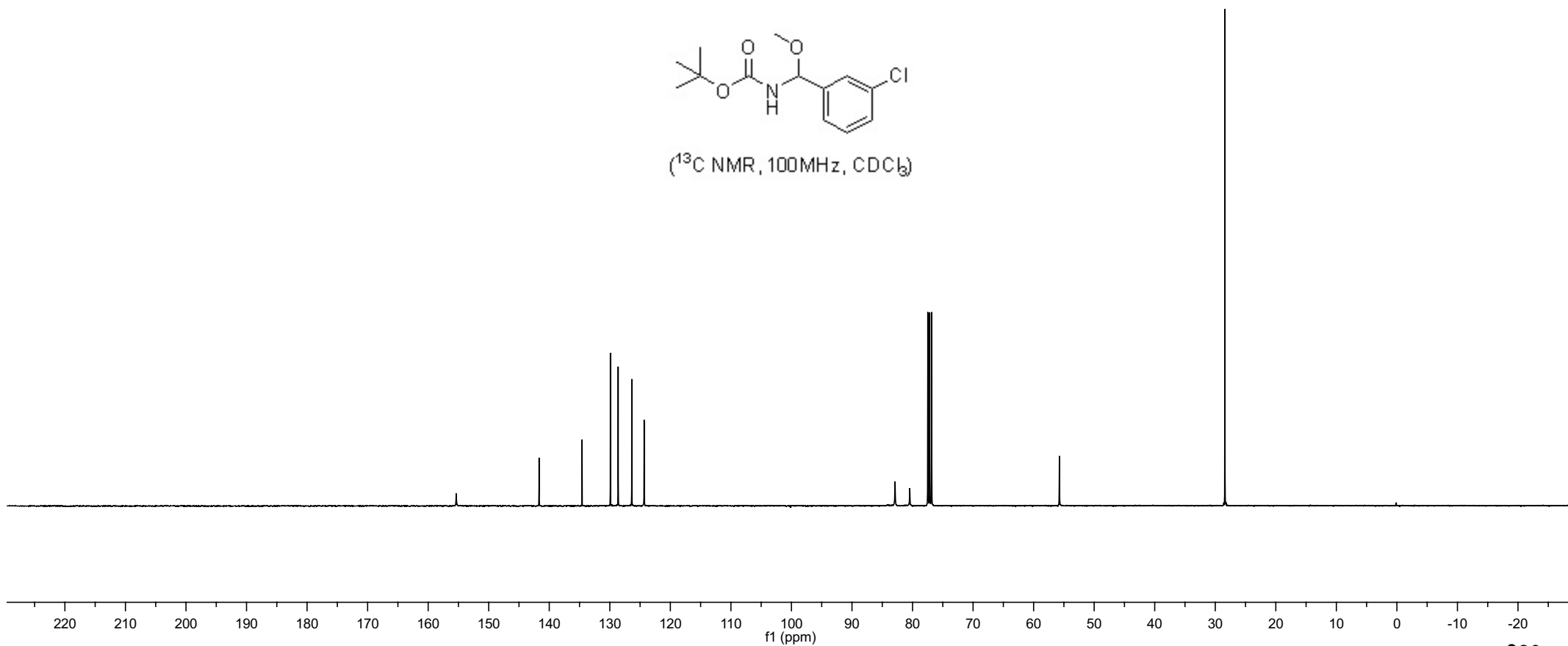
— 82.888
— 80.458

— 55.745

— 28.409



(¹³C NMR, 100MHz, CDCl₃)



NMR spectra of compound 1j

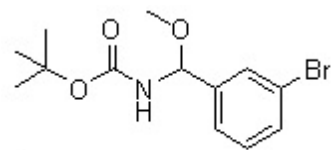
7.591
7.452
7.432
7.356
7.337
7.241
7.222
7.202

5.815
5.790

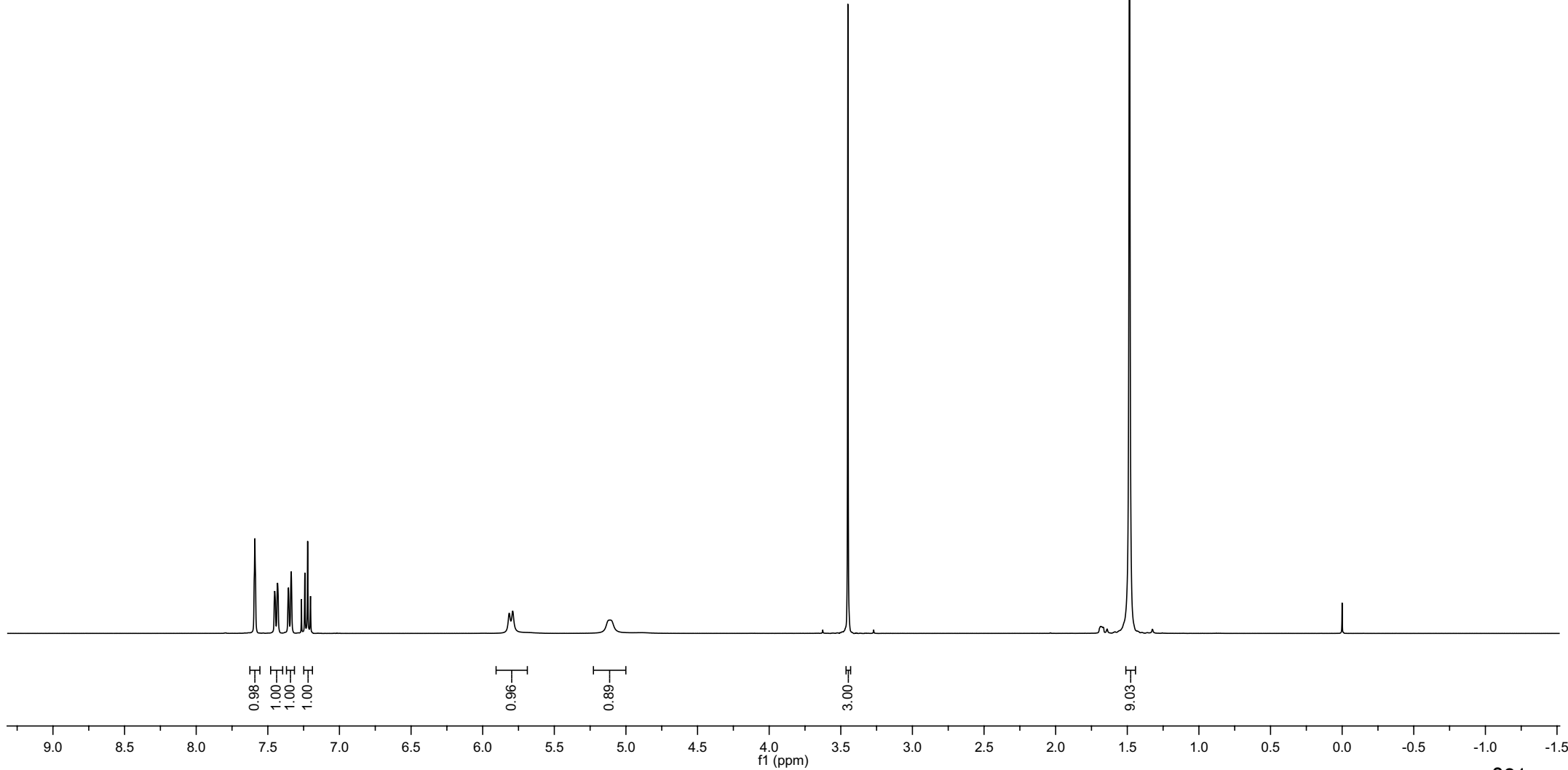
5.120
5.106

3.451

1.485



(¹H NMR, 400MHz, CDCl₃)



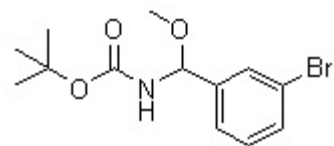
NMR spectra of compound **1j**

— 155.348
— 141.926
— 131.591
— 130.211
— 129.282
— 124.813
— 122.754

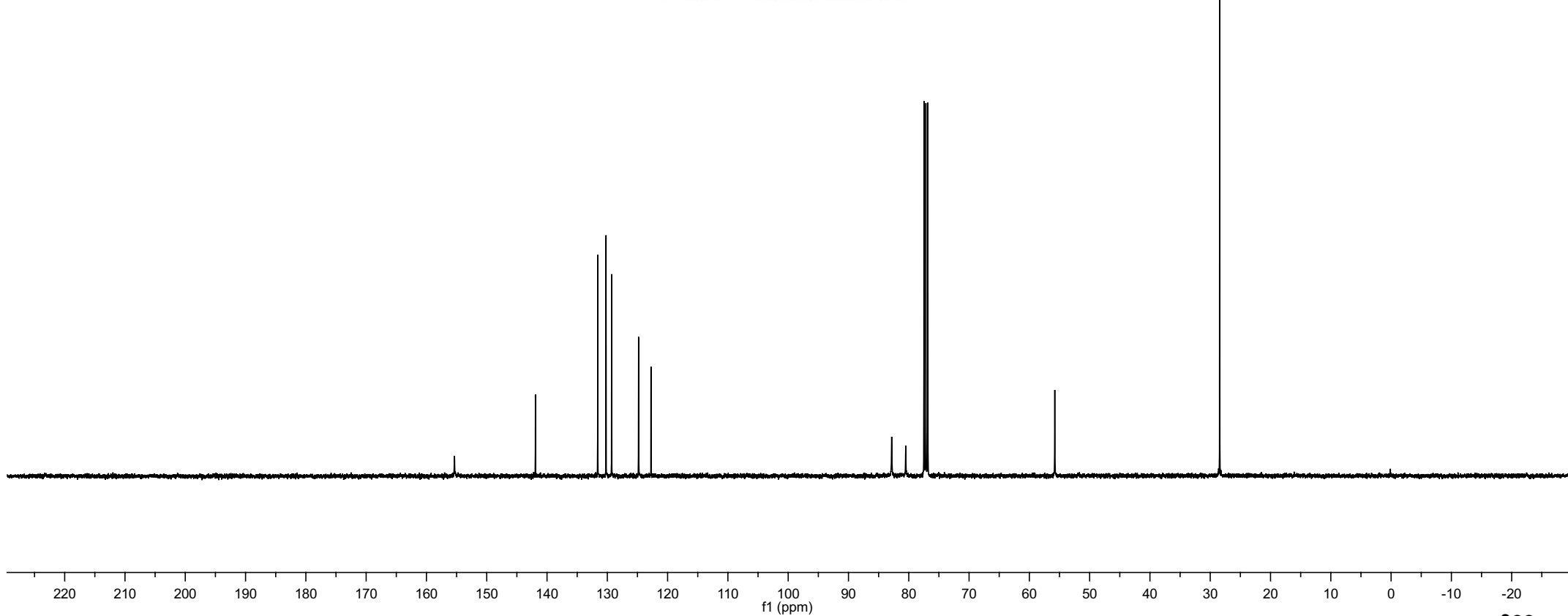
— 82.838
— 80.496

— 55.781

— 28.429



(¹³C NMR, 100MHz, CDCl₃)



NMR spectra of compound 1k

7.492
7.478
7.469
7.217
7.206
7.197
7.194
7.181
7.168
7.158
7.145

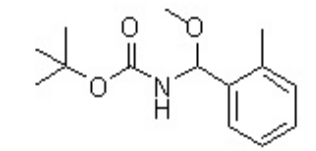
5.930
5.906

5.073
5.052

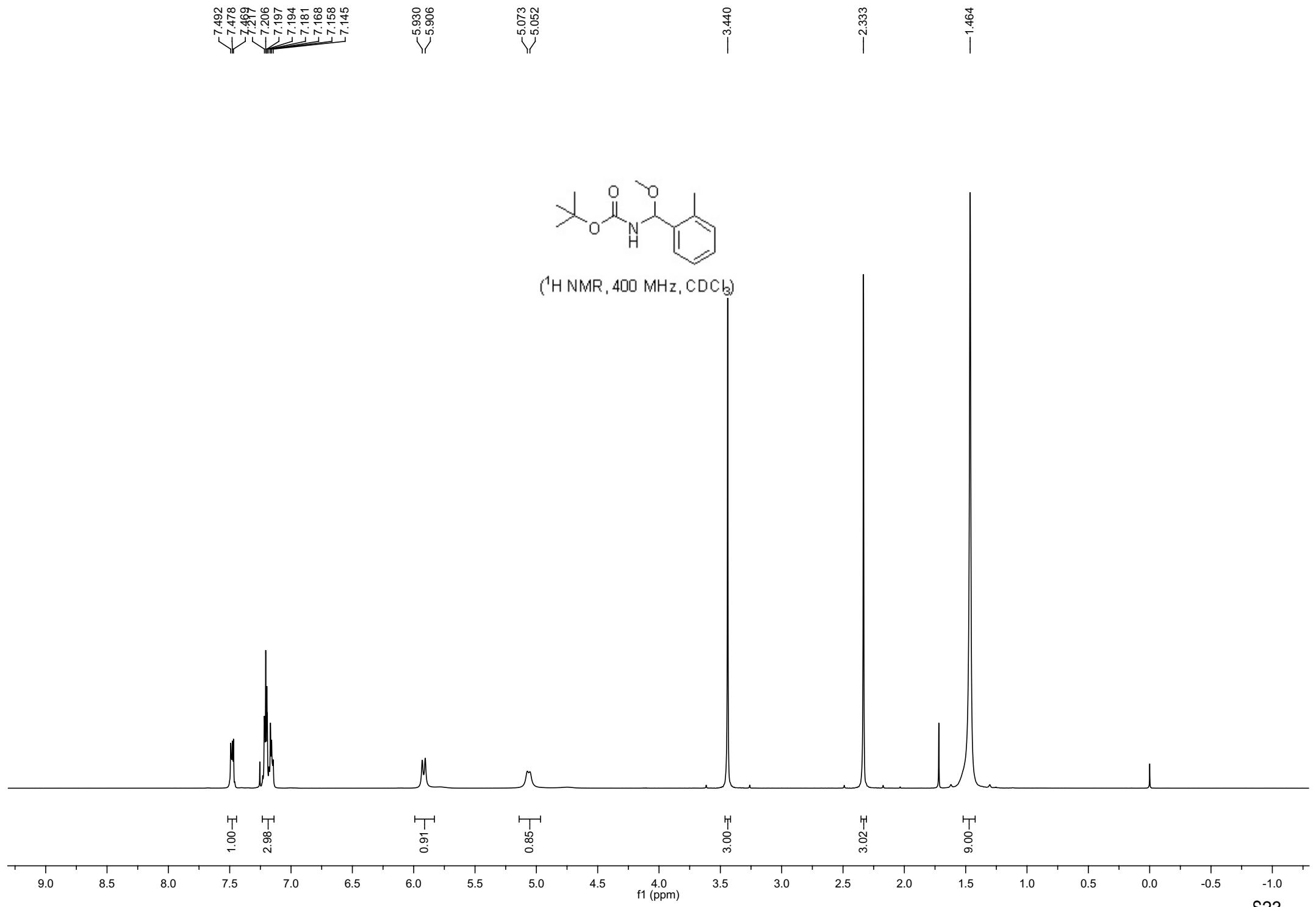
3.440

2.333

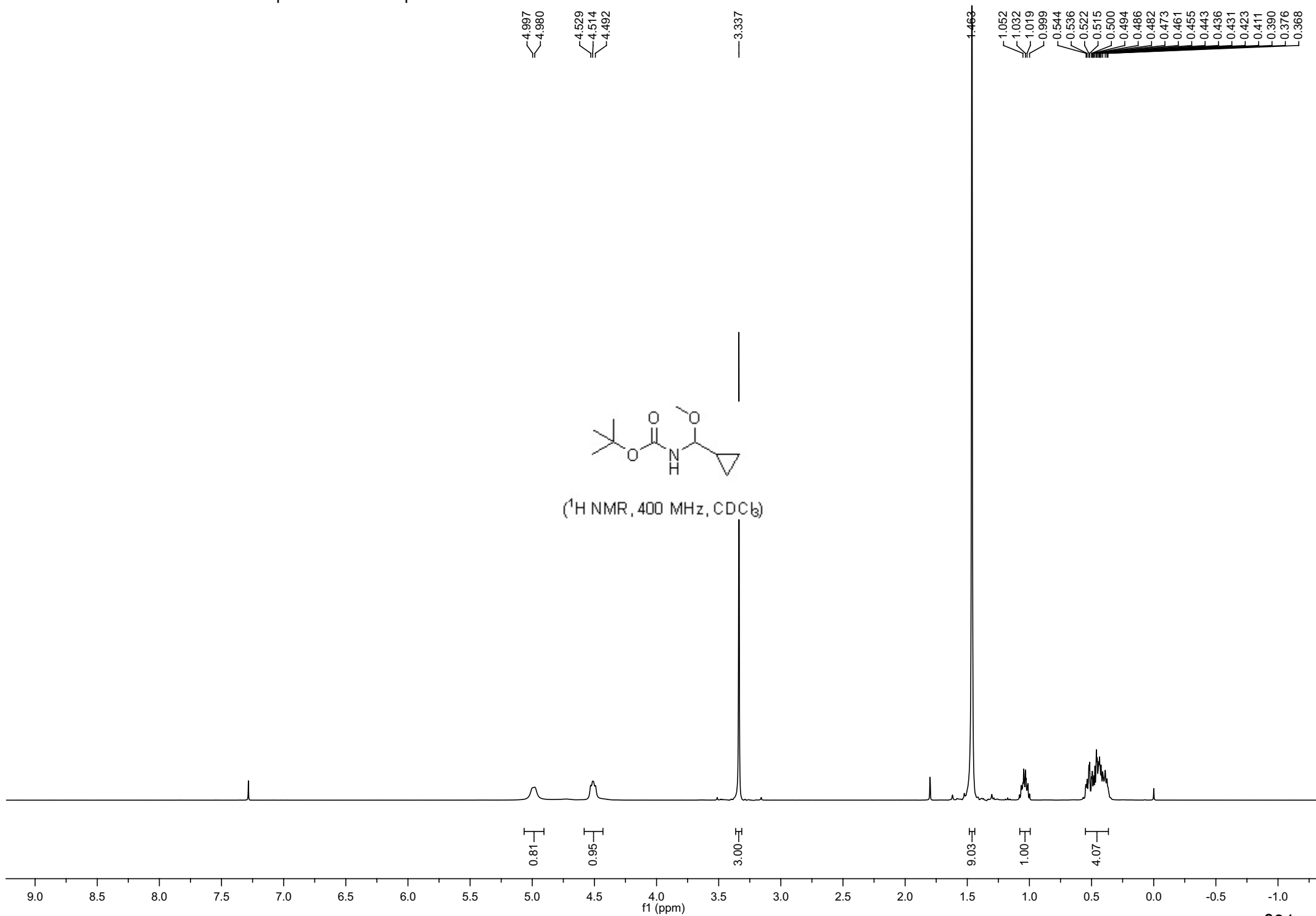
1.464



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 11



NMR spectra of compound 11

— 155.537

— 84.772

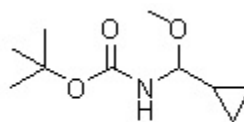
— 79.805

— 55.585

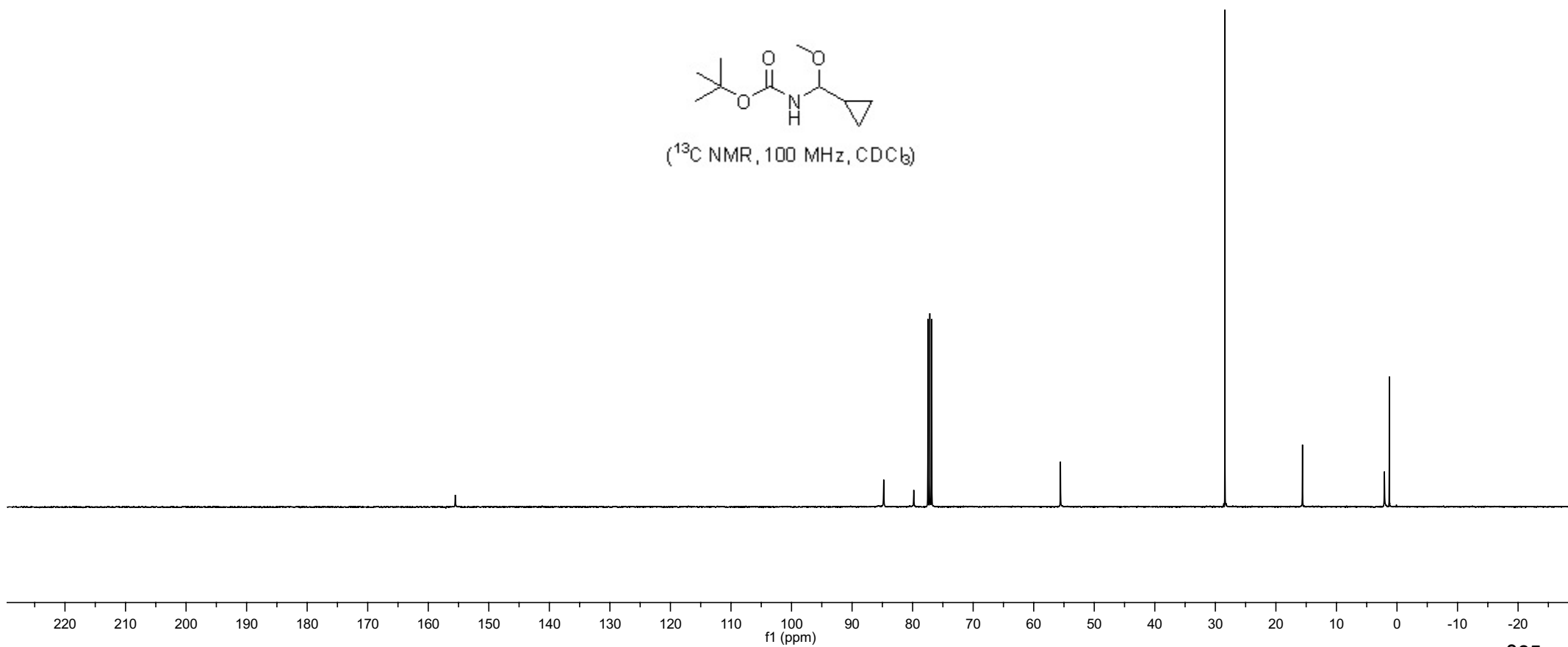
— 28.421

— 15.610

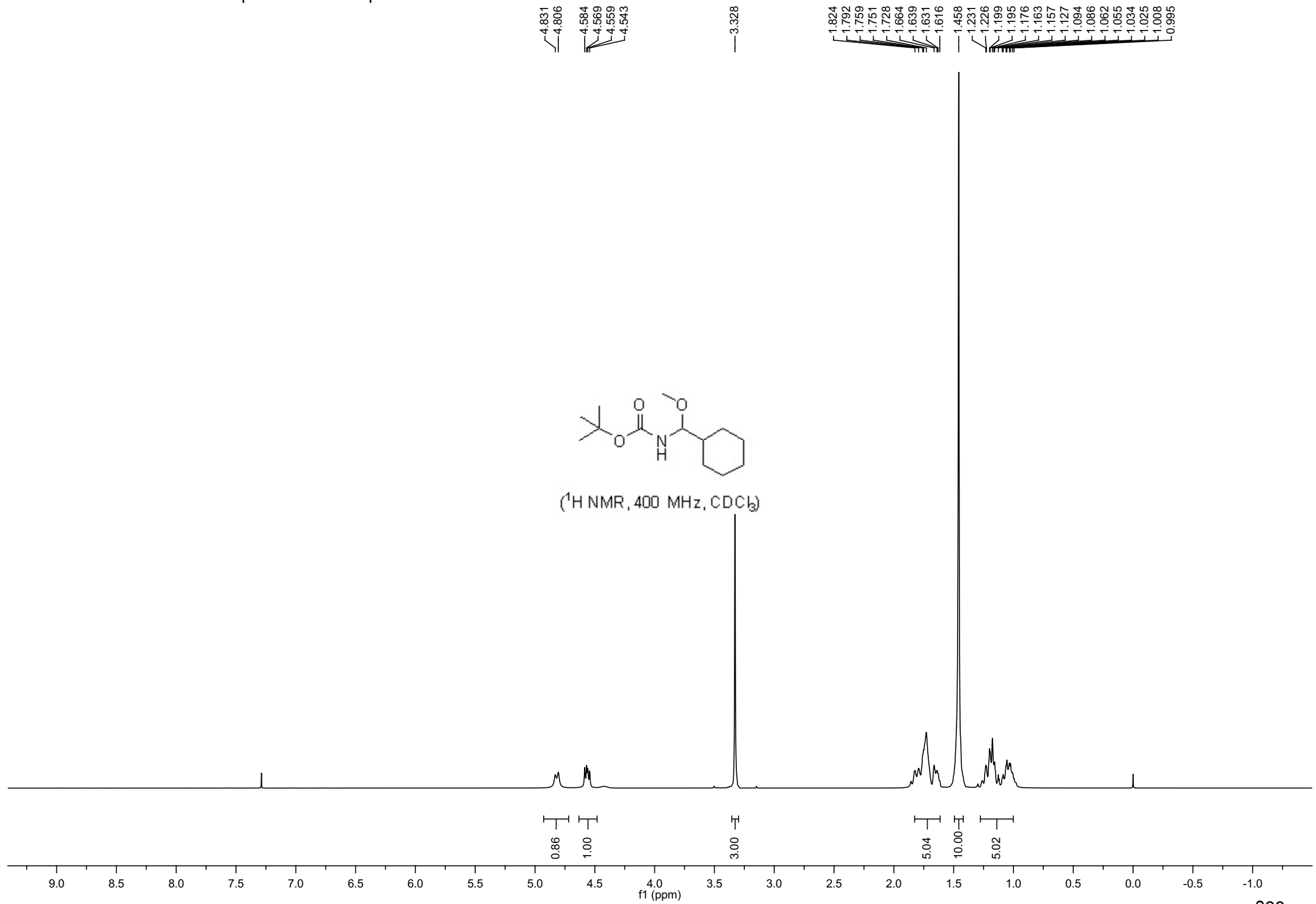
— 2.077
— 1.271



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound **1m**



NMR spectra of compound 1m

— 155.940

— 86.743

— 79.601

— 55.673

— 42.940

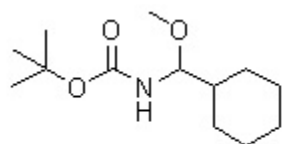
— 28.431

— 27.986

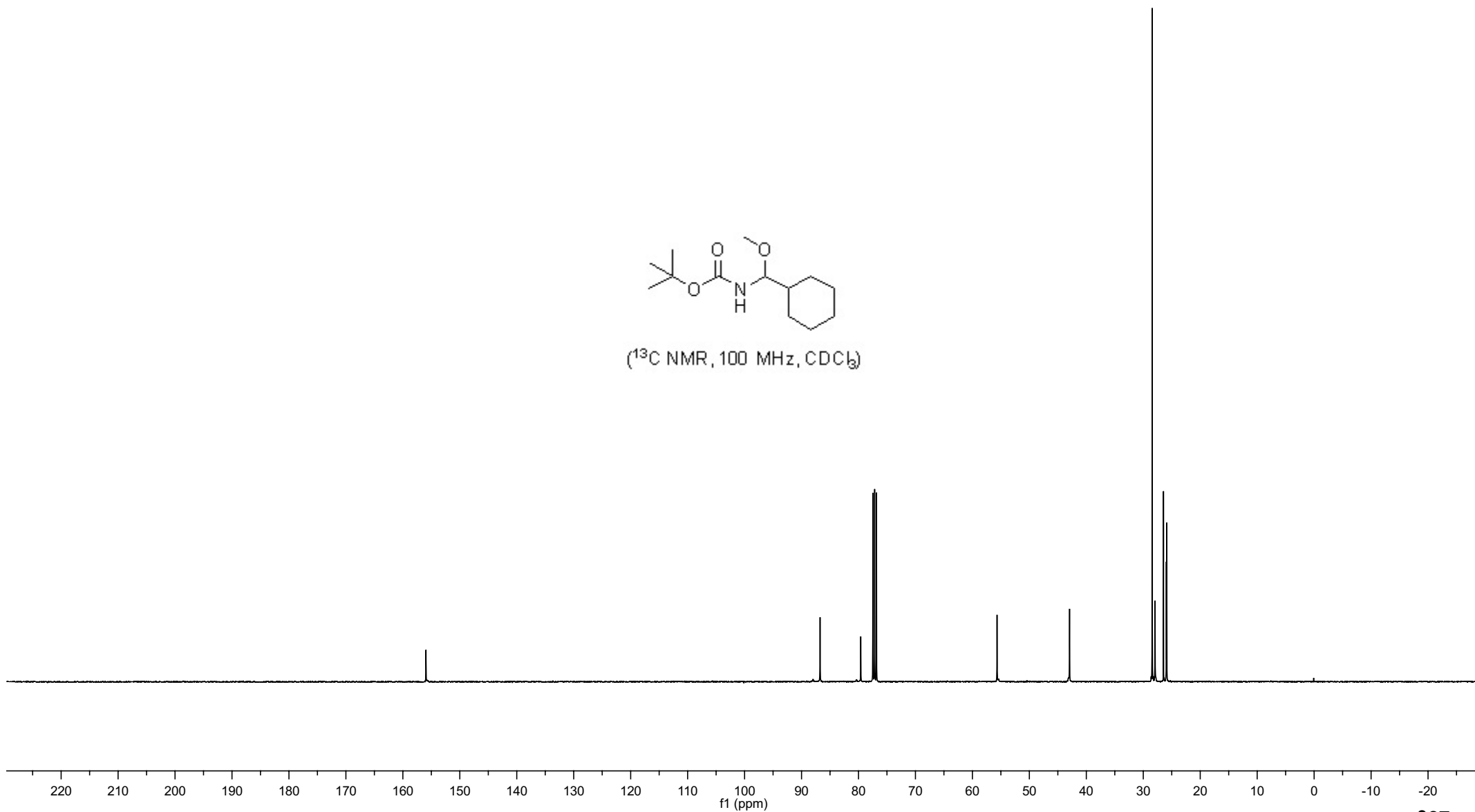
— 26.451

— 25.950

— 25.875



(¹³C NMR, 100 MHz, CDCl₃)

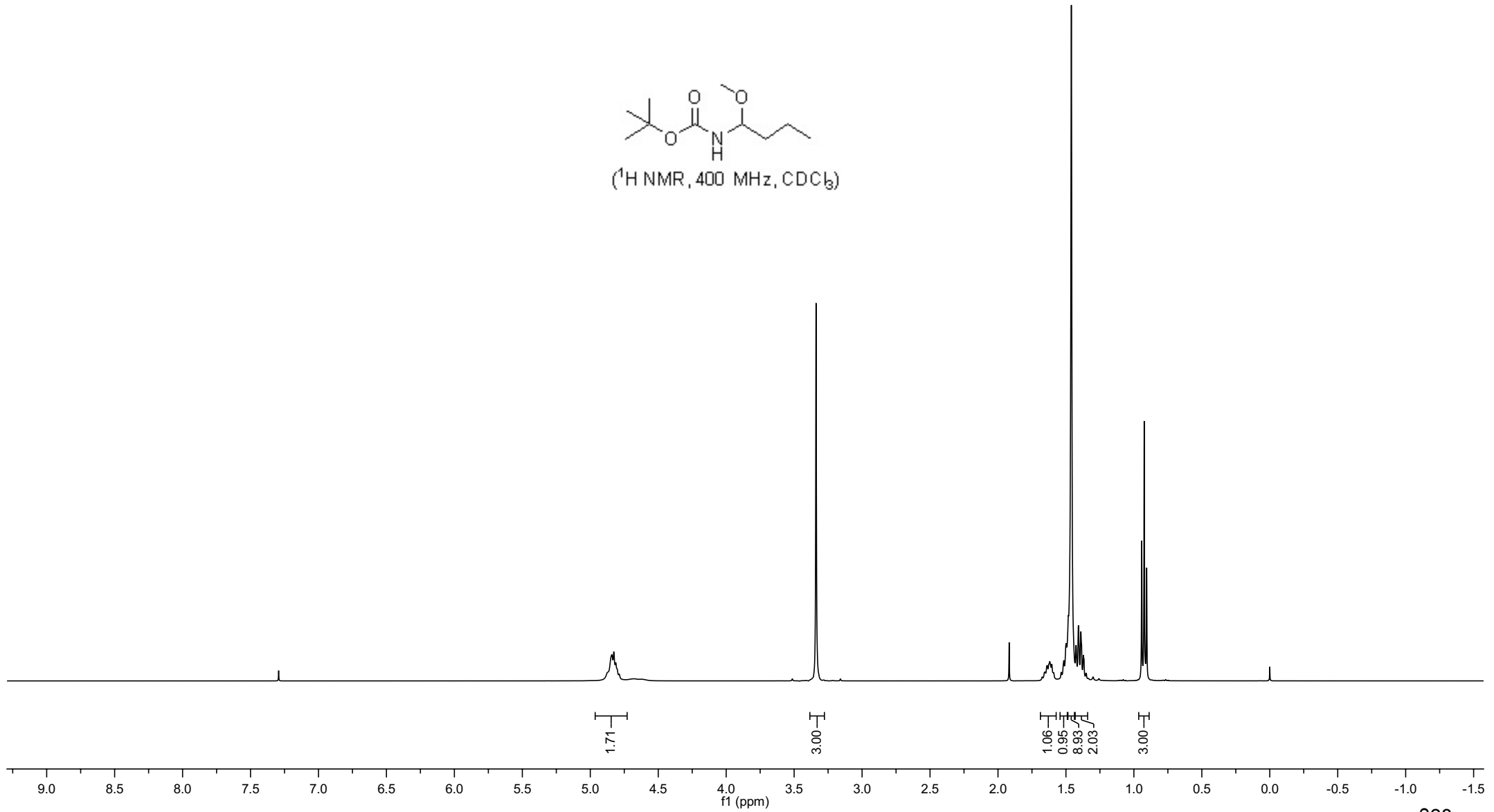
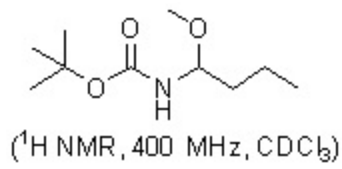


NMR spectra of compound 1n

4.870
4.841
4.827
4.812
4.803
4.787

3.339

1.654
1.639
1.619
1.604
1.535
1.515
1.498
1.460
1.426
1.408
1.390
1.371
0.942
0.924
0.906



NMR spectra of compound 1n

— 155.680

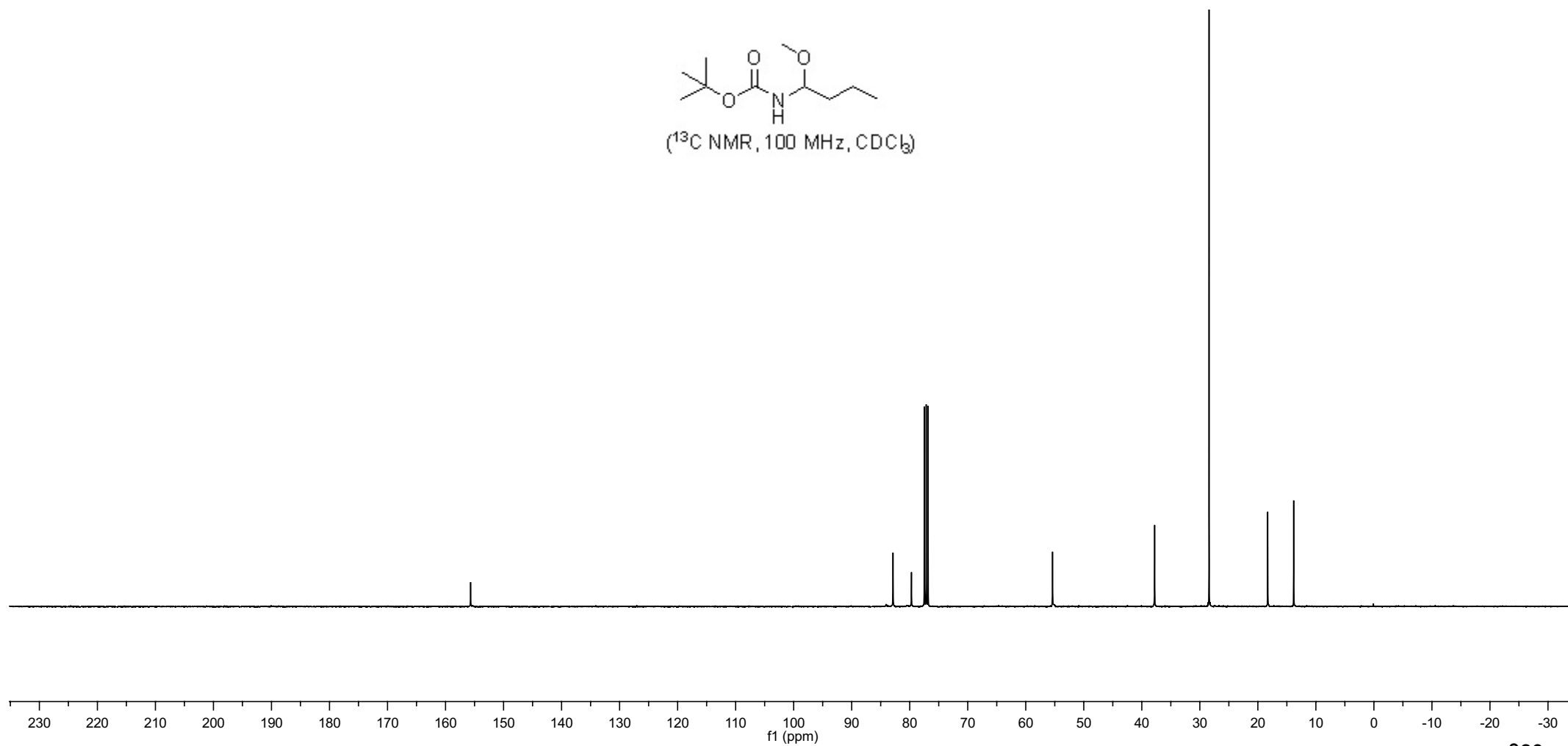
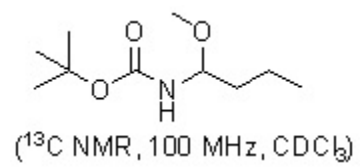
— 82.878
— 79.701

— 55.387

— 37.786

— 28.408

— 18.303
— 13.826



NMR spectra of compound 10

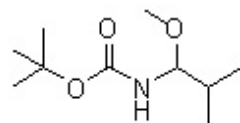
4.810
4.786

4.589
4.575
4.564
4.549

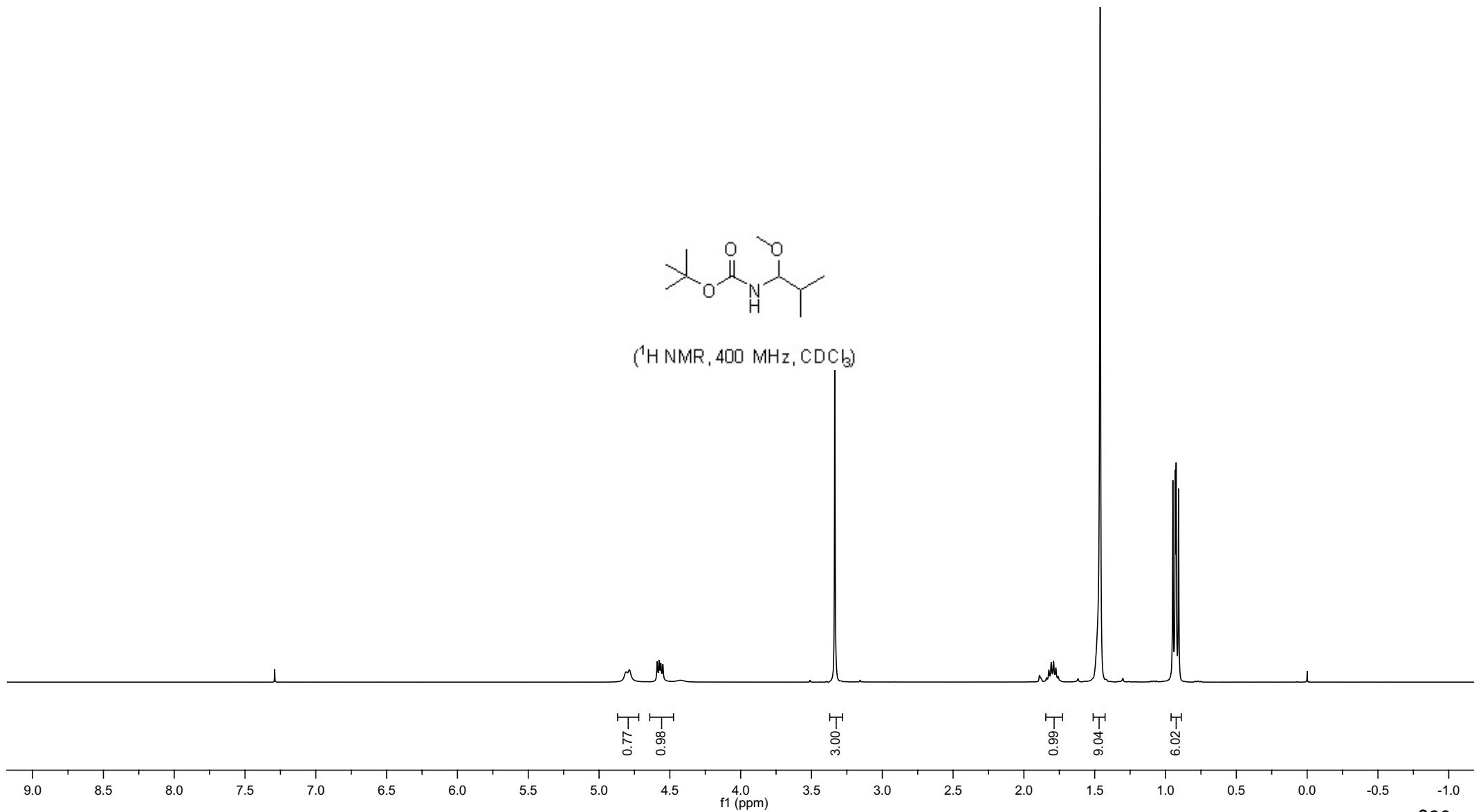
3.335

1.840
1.807
1.791
1.774
1.758
1.462

0.948
0.931
0.925
0.908



(¹H NMR, 400 MHz, CDCl₃)

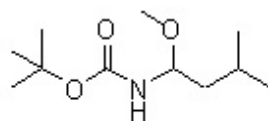


NMR spectra of compound **1p**

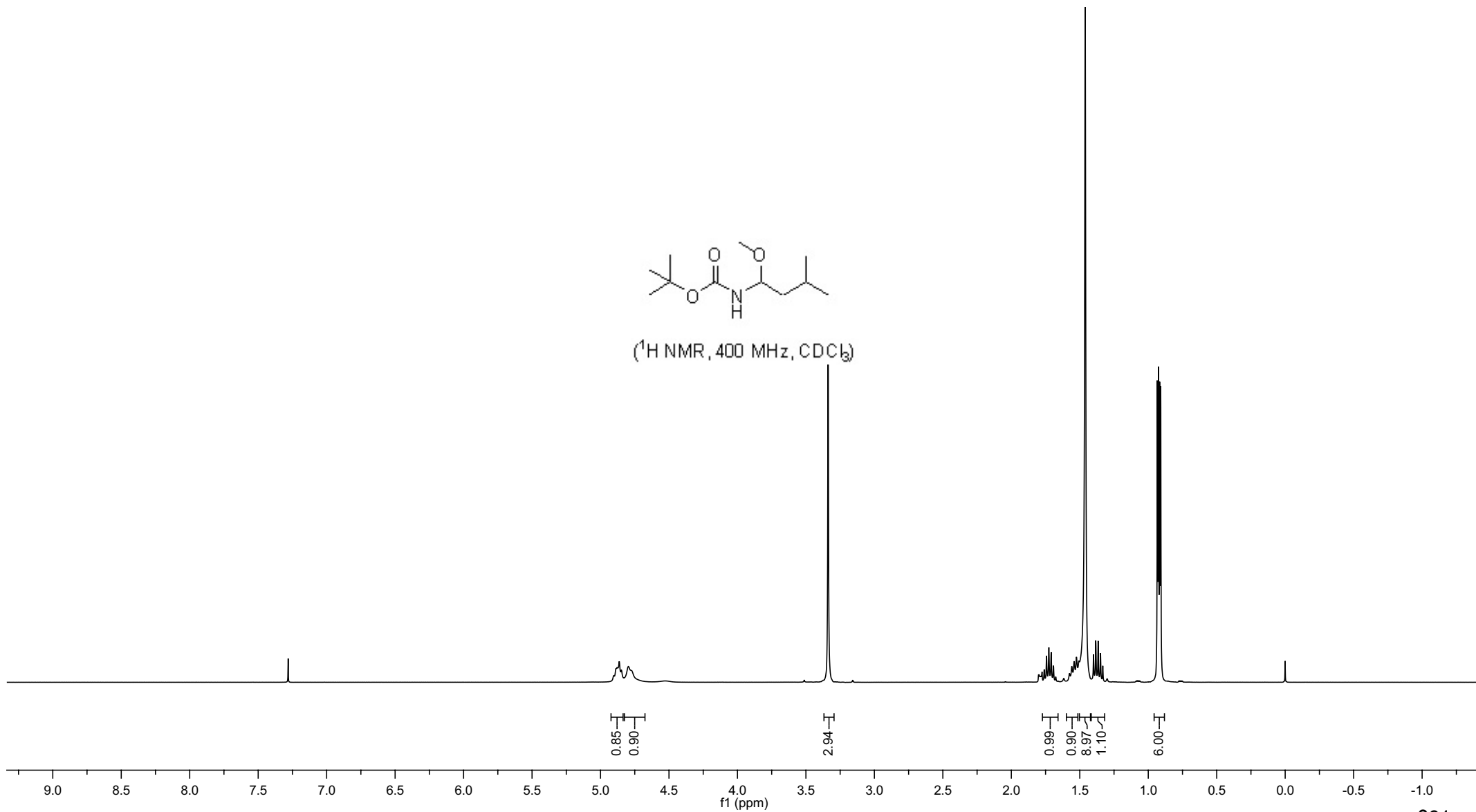
4.904
4.887
4.879
4.863
4.847
4.796
4.775

3.338

1.760
1.743
1.726
1.709
1.692
1.524
1.400
1.366
1.332
0.933
0.926
0.917
0.909



(¹H NMR, 400 MHz, CDCl₃)



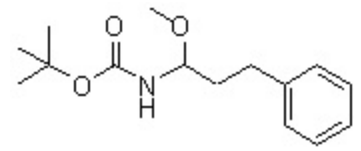
NMR spectra of compound 1q

7.292
7.272
7.254
7.195
7.181
7.162

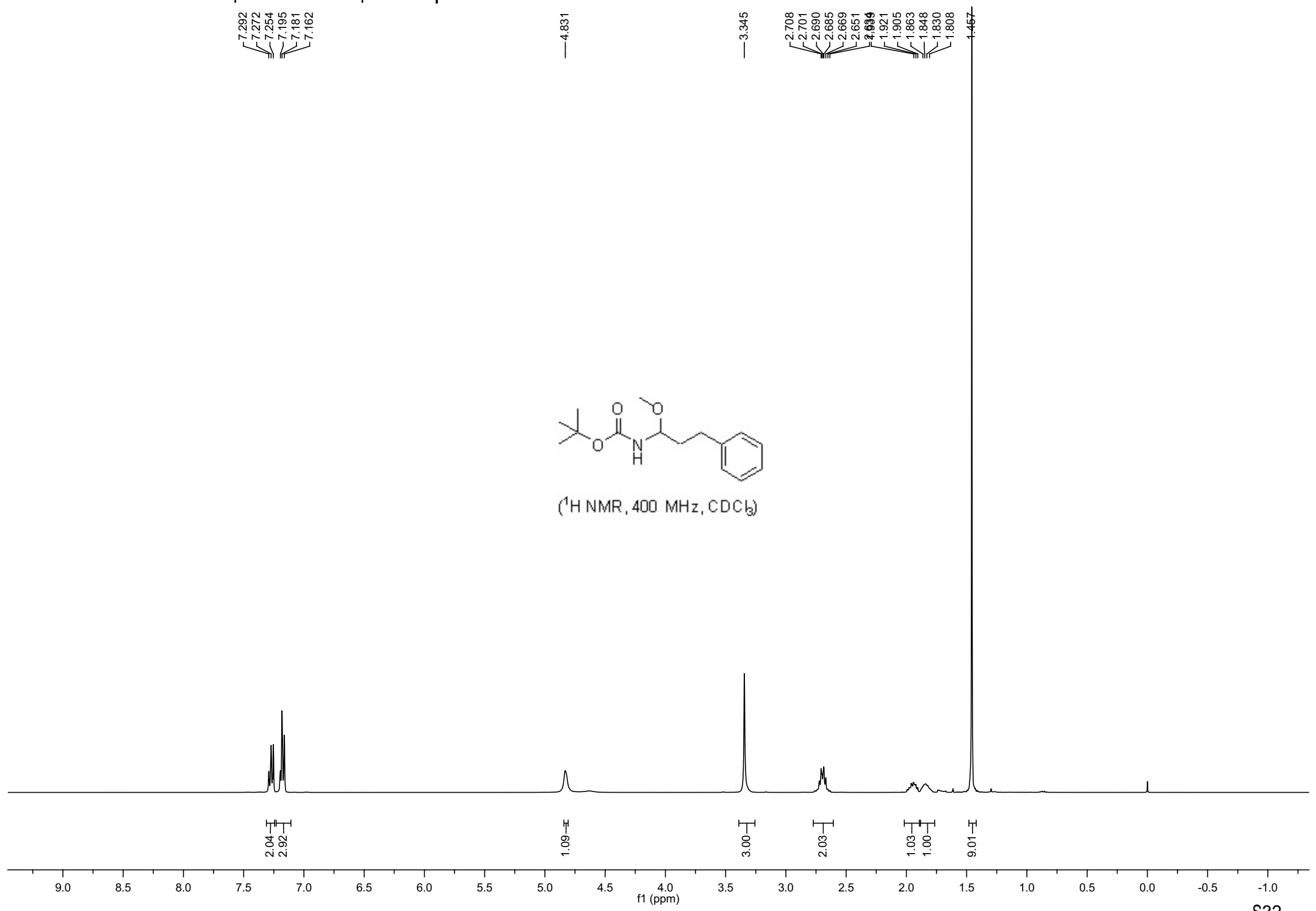
4.831

3.345

2.708
2.701
2.690
2.685
2.669
2.651
2.634
1.921
1.905
1.863
1.848
1.830
1.808
1.457



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 1q

—155.577

—141.372

—128.564

—126.101

—82.596

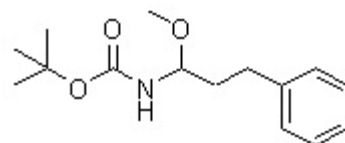
—79.859

—55.457

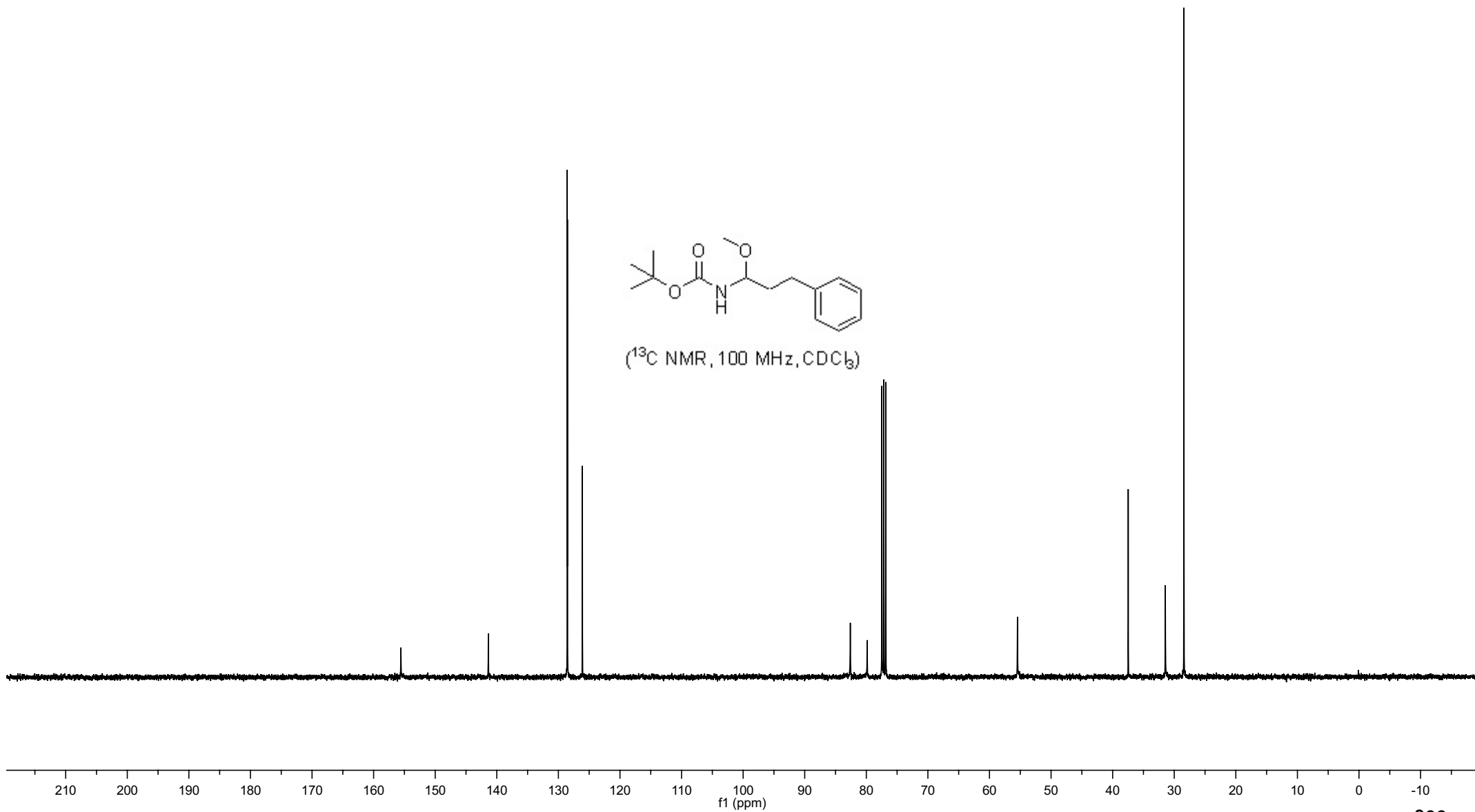
—37.467

—31.446

—28.425



(¹³C NMR, 100 MHz, CDCl₃)



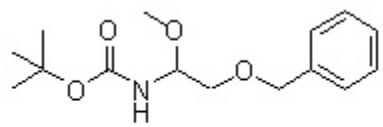
NMR spectra of compound 1r

7.367
7.360
7.351
7.346
7.339
7.331
7.323
7.318
7.305
7.299
7.292
7.287
7.283
7.273
7.269

5.312
5.289
5.009
4.985
4.615
4.585
4.568
4.538

3.566
3.554
3.526
3.516
3.501
3.491
3.378

1.457



(¹H NMR, 400 MHz, CDCl₃)

5.00

0.82

0.96

2.00

2.00

3.00

9.02

9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0

f1 (ppm)

NMR spectra of compound 1r

—155.603

—137.823

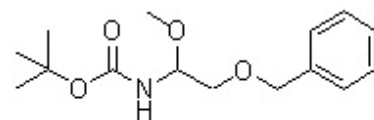
—128.605
—128.525

—81.281
—79.976

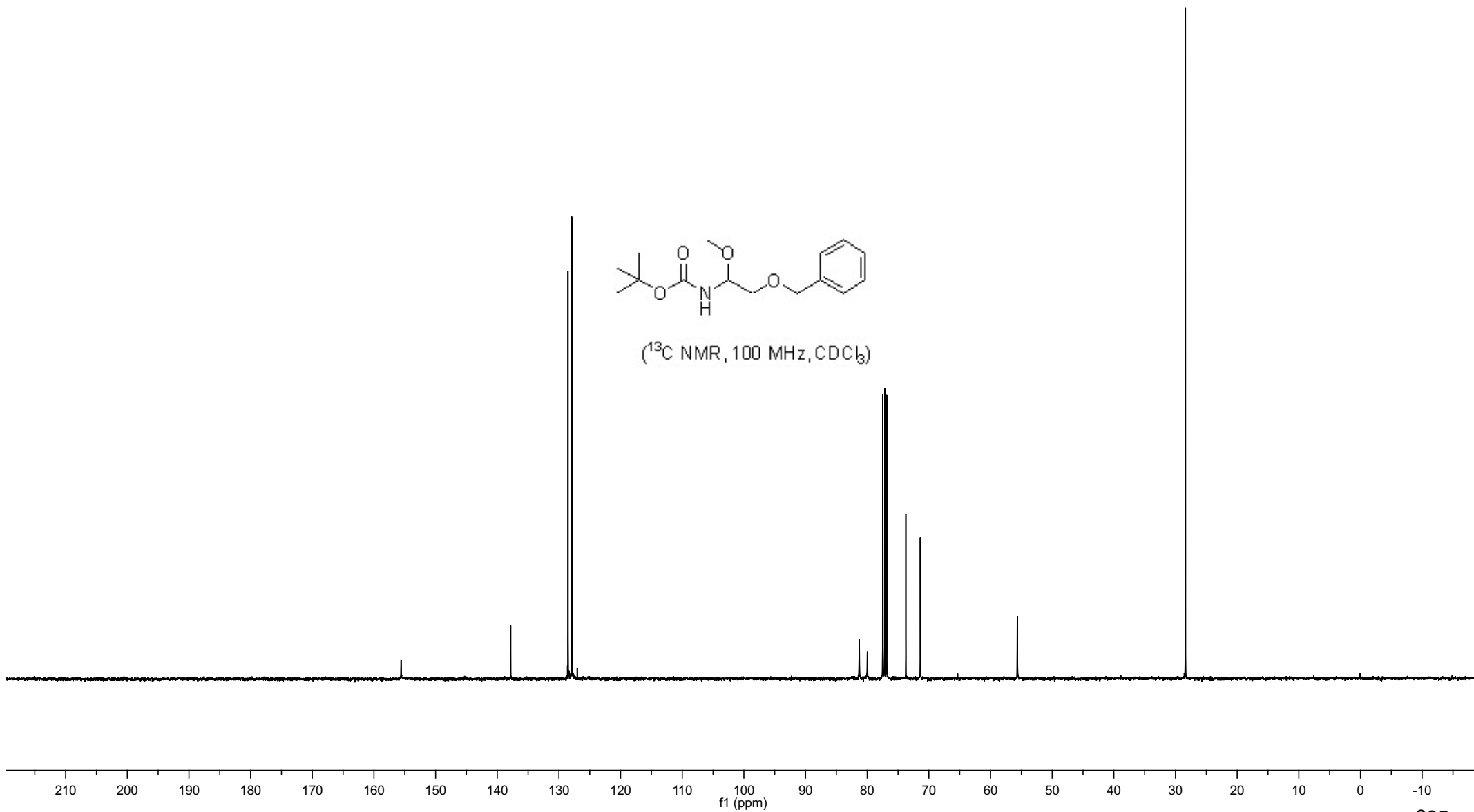
—73.728
—71.387

—55.658

—28.388



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 1s

7.270
7.268
7.263
7.258
7.255

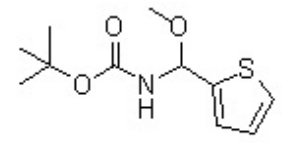
7.039
6.982
6.973
6.970
6.961

6.074
6.050

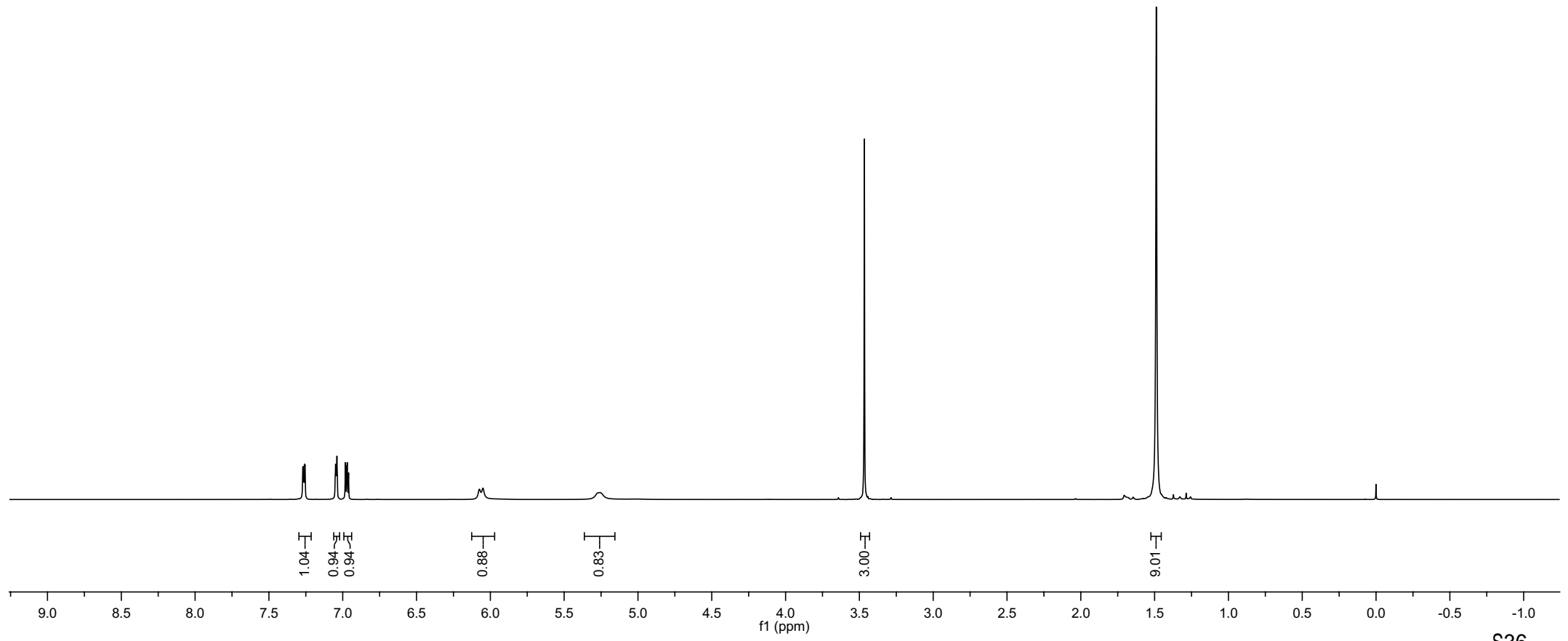
5.268
5.256

3.466

1.489



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 1s

—155.113

—143.199

—126.893

—125.627

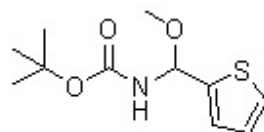
—124.741

—80.767

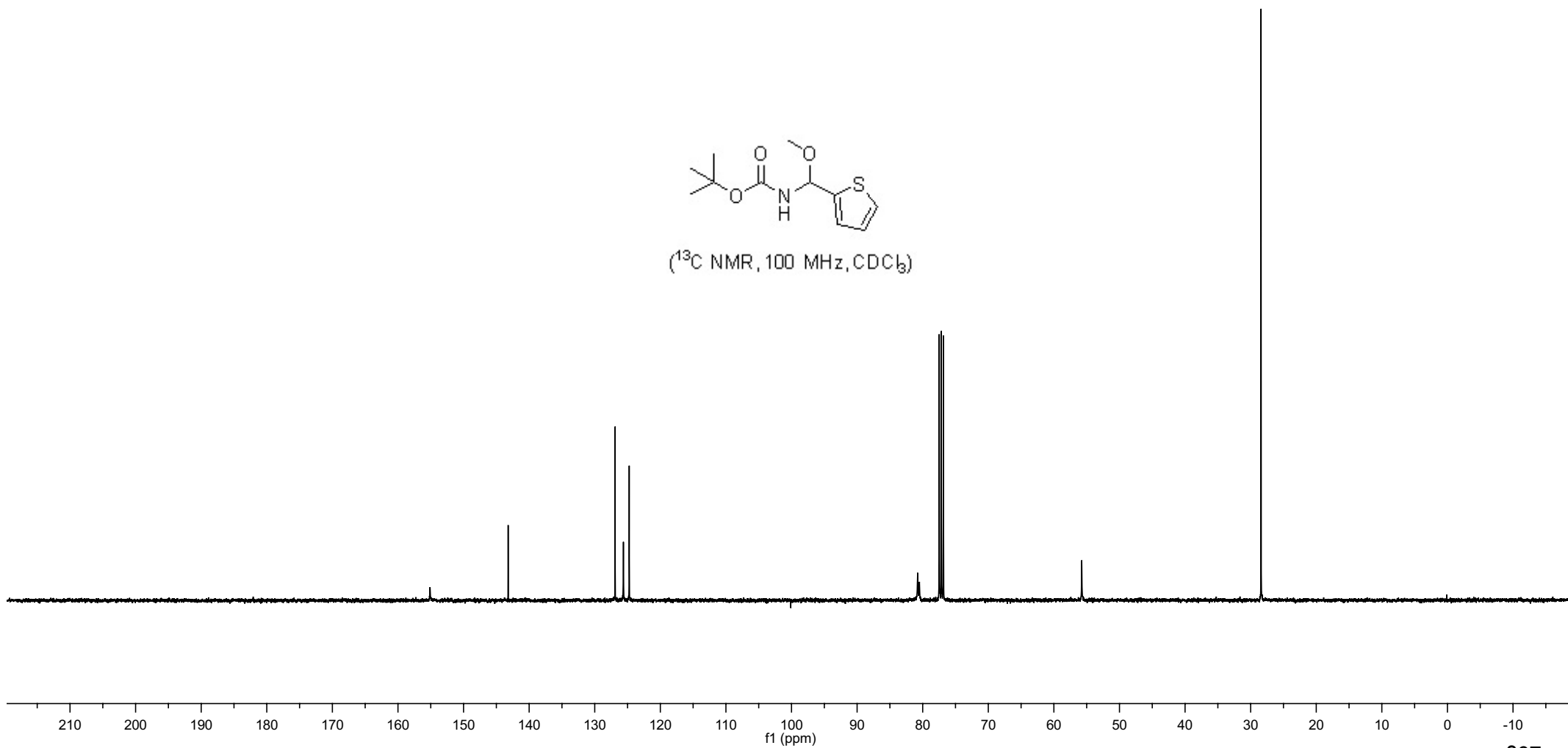
—80.497

—55.764

—28.414



(¹³C NMR, 100 MHz, CDCl₃)



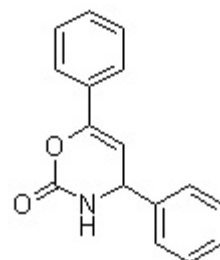
NMR spectra of compound 3aa

8.433

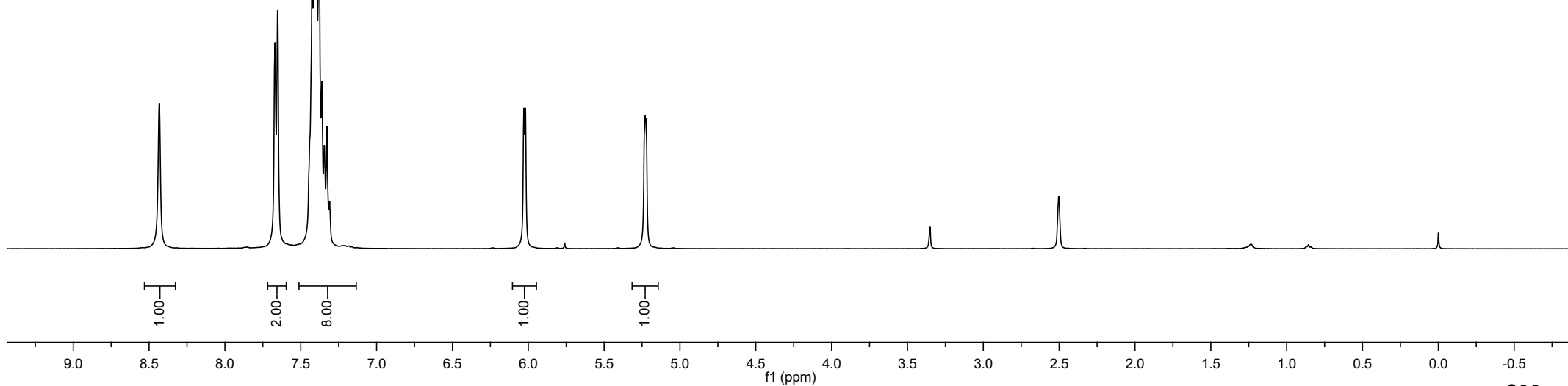
7.669
7.653
7.425
7.407
7.395
7.378
7.361
7.345
7.327

6.028
6.020

5.230
5.226



(¹H NMR, 400 MHz, DMSO-*d*₆)



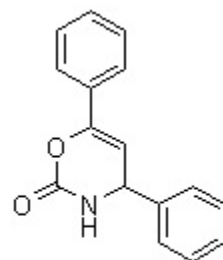
NMR spectra of compound 3aa

—149.137
—146.106
—142.679

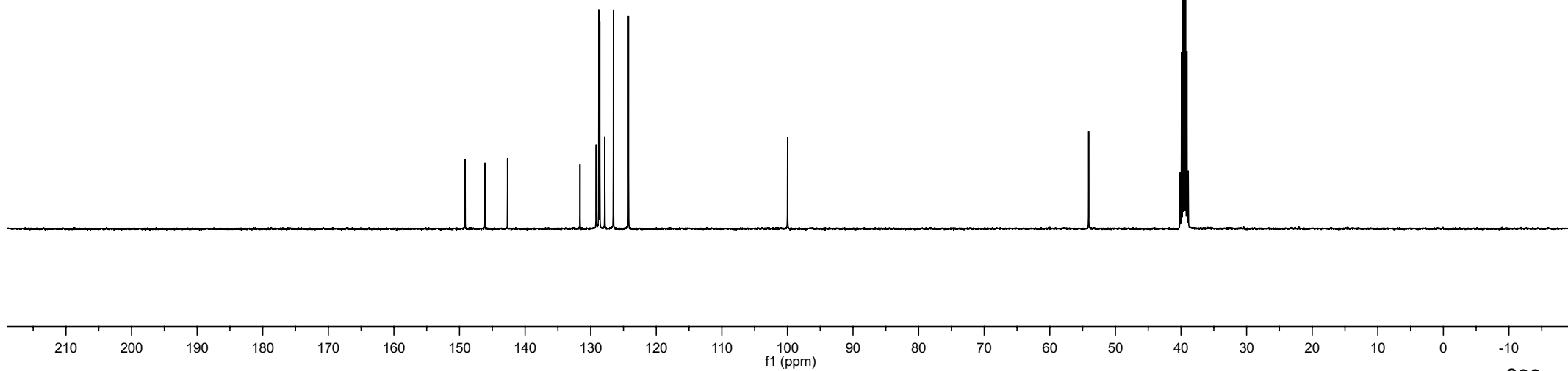
—131.627
—129.162
—128.768
—128.611
—127.852
—126.537
—124.236

—99.985

—54.084



(¹³C NMR, 100 MHz, DMSO-d₆)



NMR spectra of compound 3ab

8.354

7.599
7.577
7.570

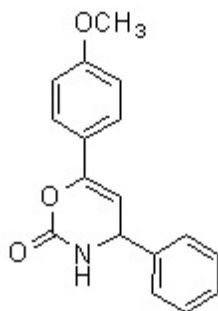
7.367
7.334
7.299

6.982
6.960

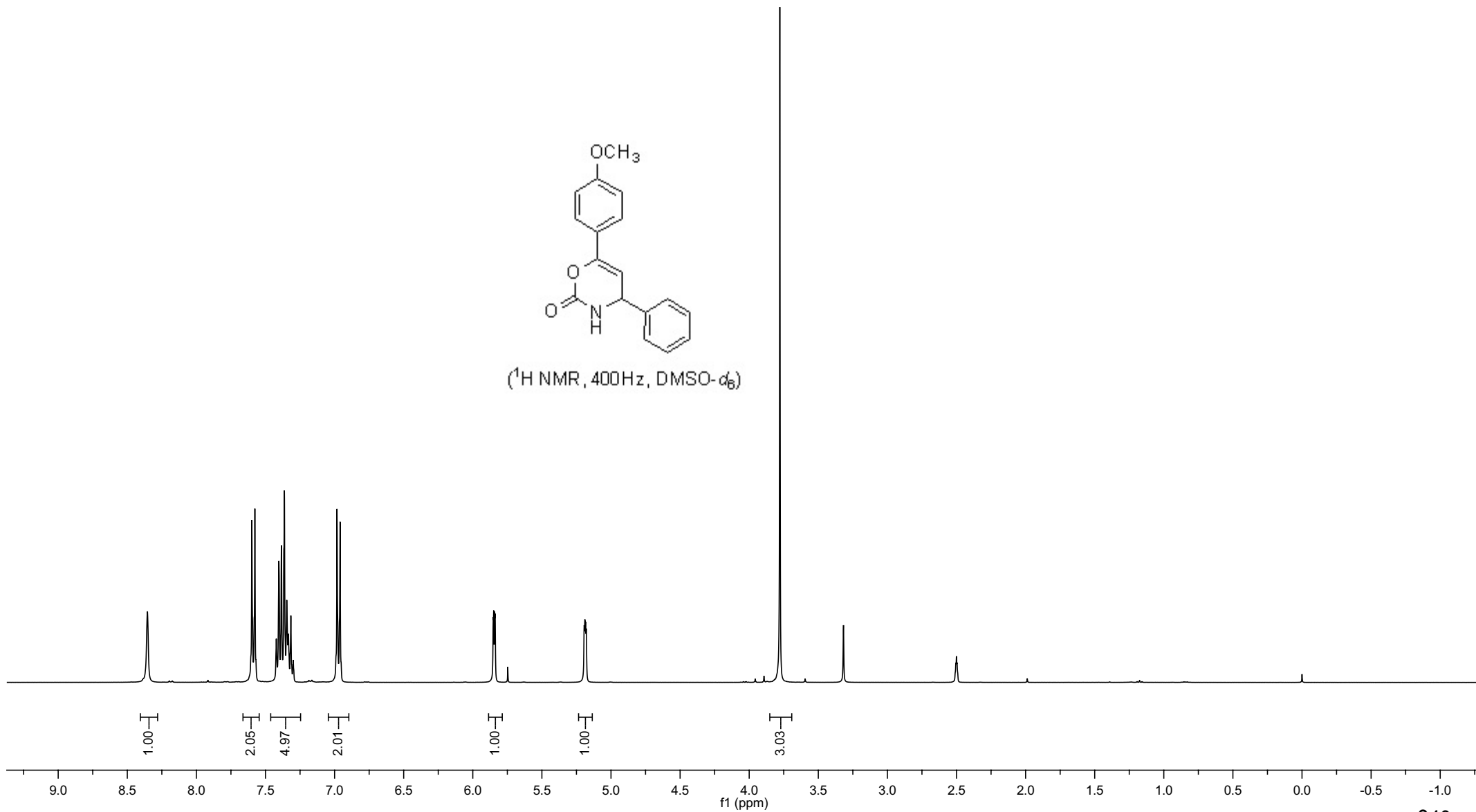
5.852
5.849
5.842
5.838

5.194
5.189
5.184
5.179

3.778



(¹H NMR, 400Hz, DMSO-d₆)



NMR spectra of compound **3ab**

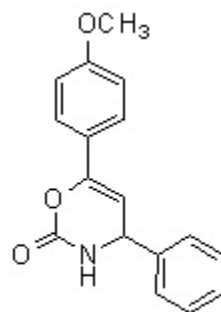
— 159.962
— 149.248
— 146.080
— 142.916

— 128.725
— 127.769
— 126.486
— 125.785
— 124.105

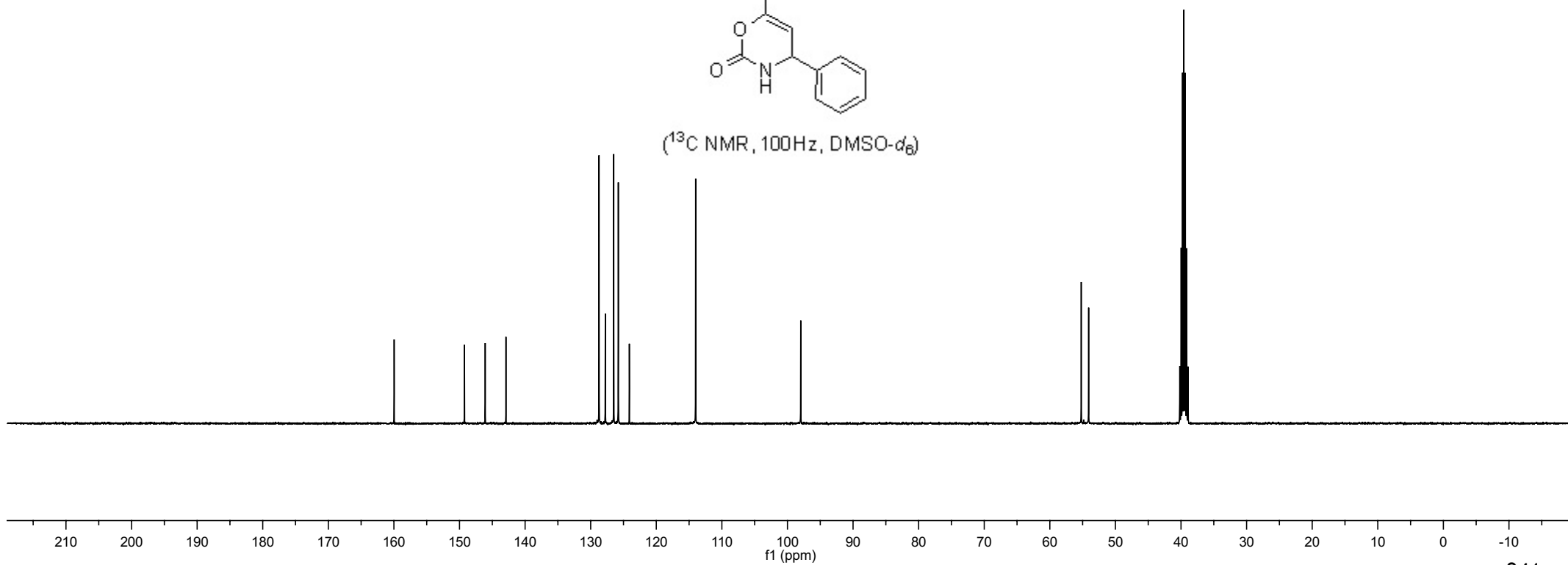
— 114.000

— 97.975

— 55.212
— 54.083



(¹³C NMR, 100Hz, DMSO-*d*₆)



NMR spectra of compound 3ac

8.340

7.579
7.557

7.359
7.333
7.297

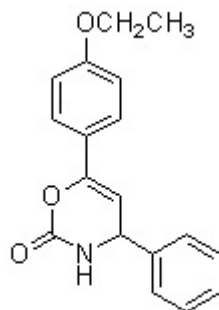
6.959
6.937

5.838
5.828

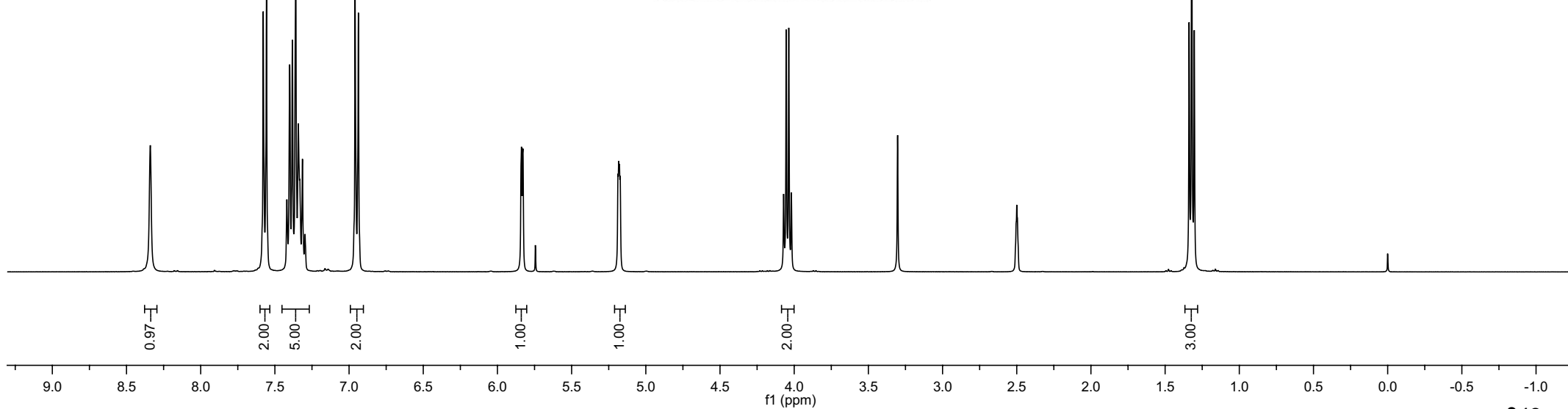
5.187
5.183
5.178
5.173

4.071
4.054
4.037
4.019

1.338
1.321
1.304



(¹H NMR, 400 MHz, DMSO-*d*₆)



NMR spectra of compound 3ac

— 159.236
— 149.249
— 146.127
— 142.928

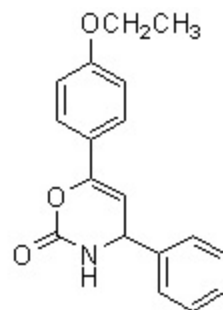
— 128.717
— 127.758
— 126.476
— 125.784
— 123.964

— 114.448

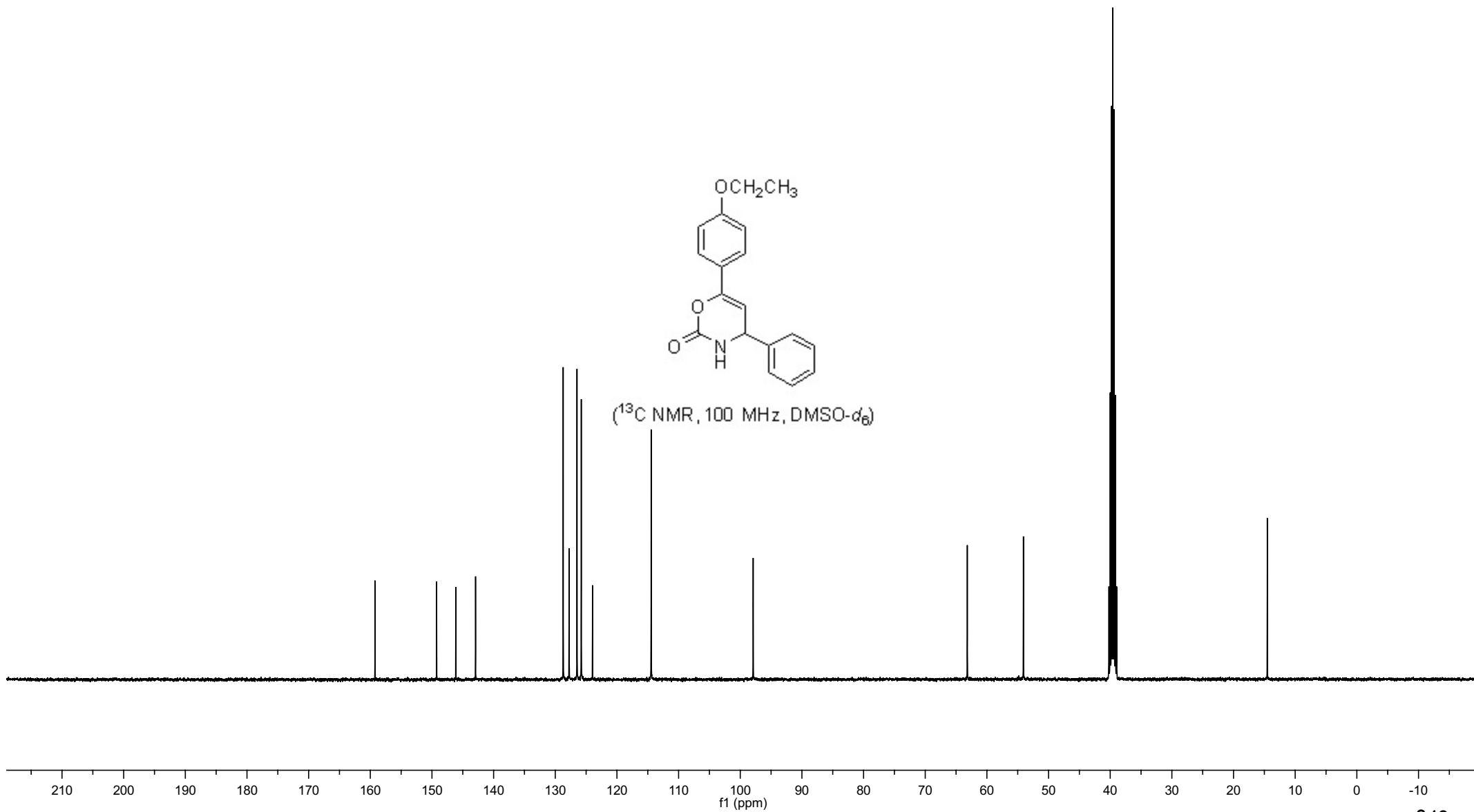
— 97.905

— 63.175
— 54.076

— 14.522



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3ad

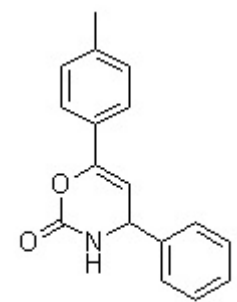
8.395

7.566
7.546
7.440
7.421
7.403
7.377
7.358
7.336
7.252
7.232

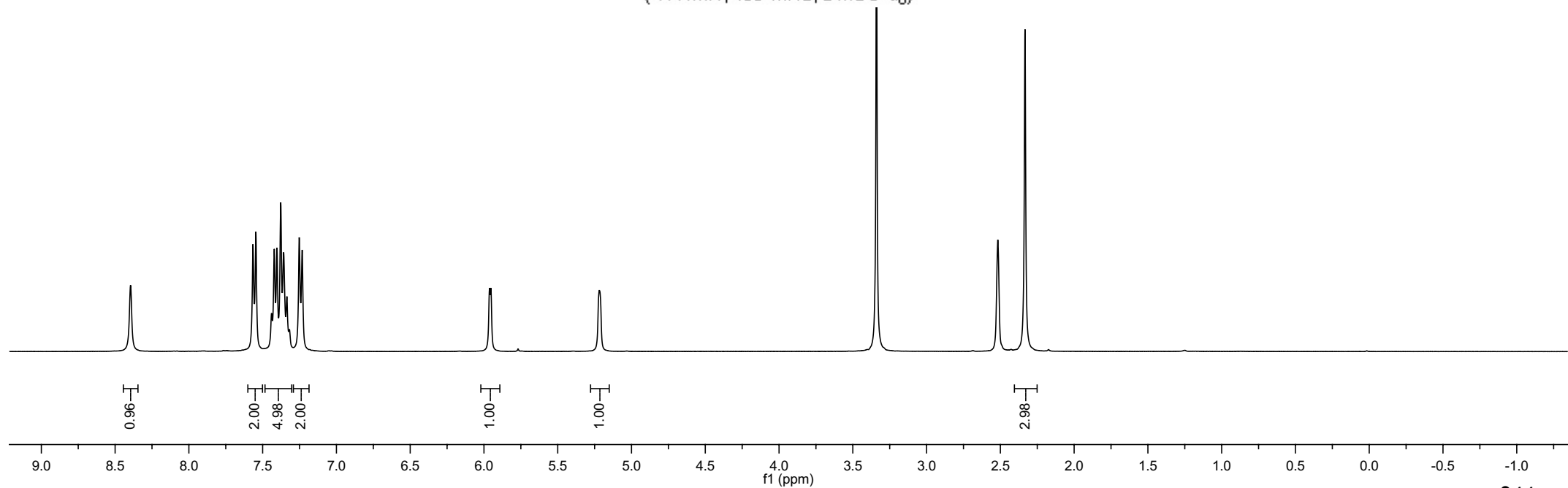
5.962
5.954

5.218

2.333



(¹H NMR, 400 MHz, DMSO-d₆)



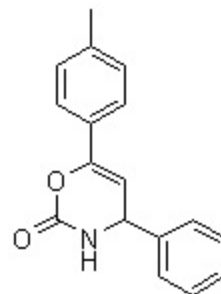
NMR spectra of compound **3ad**

— 149.198
— 146.175
— 142.786
— 138.737
— 129.165
— 128.881
— 128.749
— 127.804
— 126.485
— 124.173

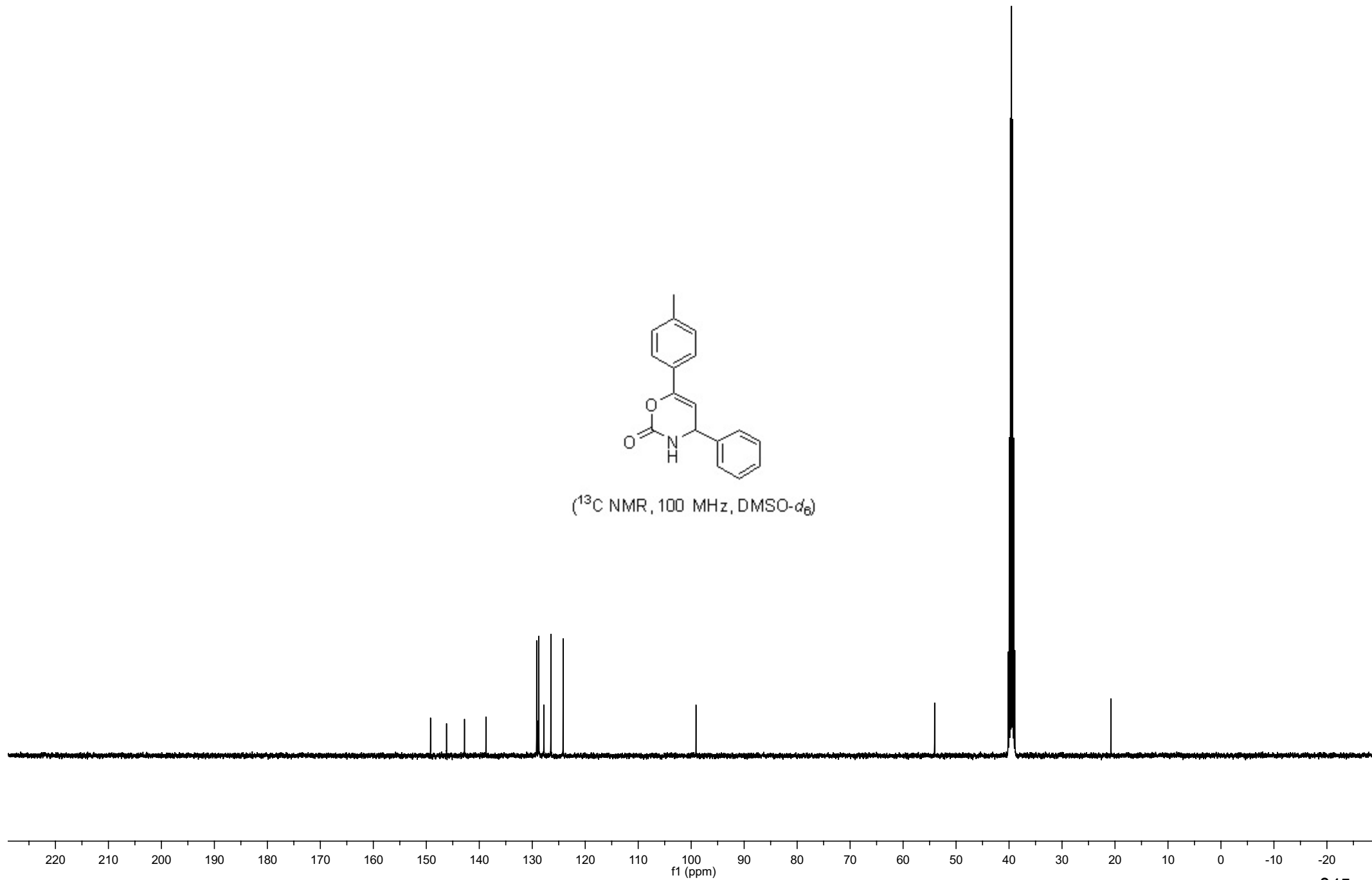
— 99.085

— 54.045

— 20.769



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3ae

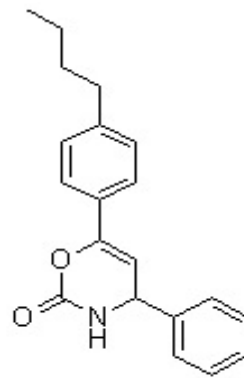
7.547
7.526
7.317
7.183
7.162

6.252

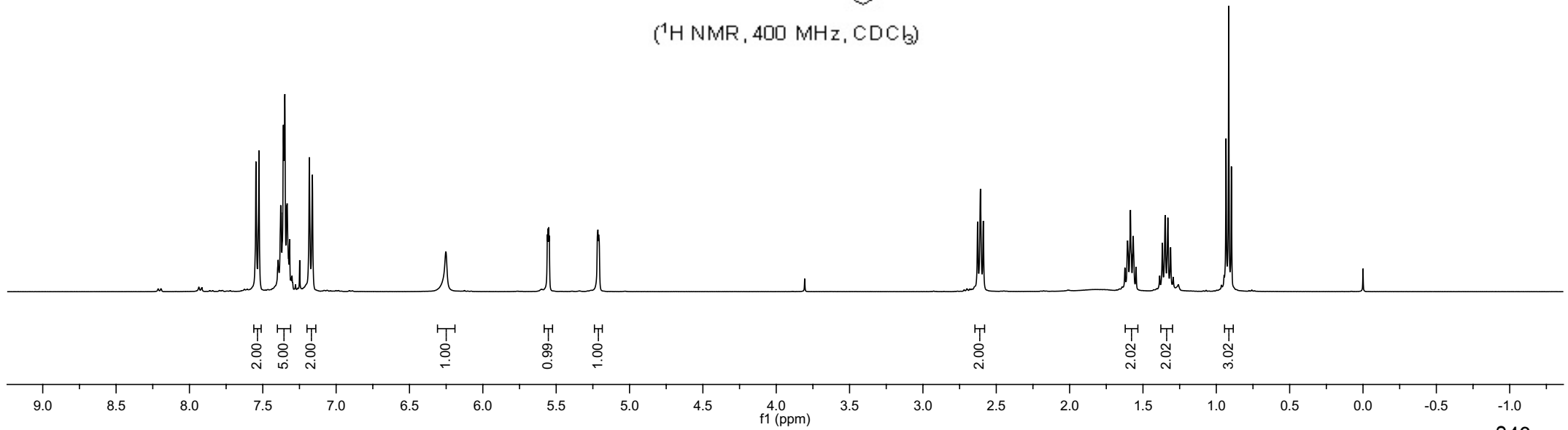
5.560
5.556
5.551
5.547
5.216
5.210

2.627
2.608
2.589

1.623
1.605
1.585
1.567
1.547
1.349
1.312
0.934
0.915
0.897



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound **3ae**

— 150.489
— 147.744
— 144.619
— 141.682

— 129.159
— 128.956
— 128.617
— 128.567
— 126.717
— 124.723

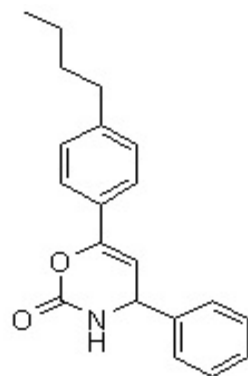
— 97.959

— 55.776

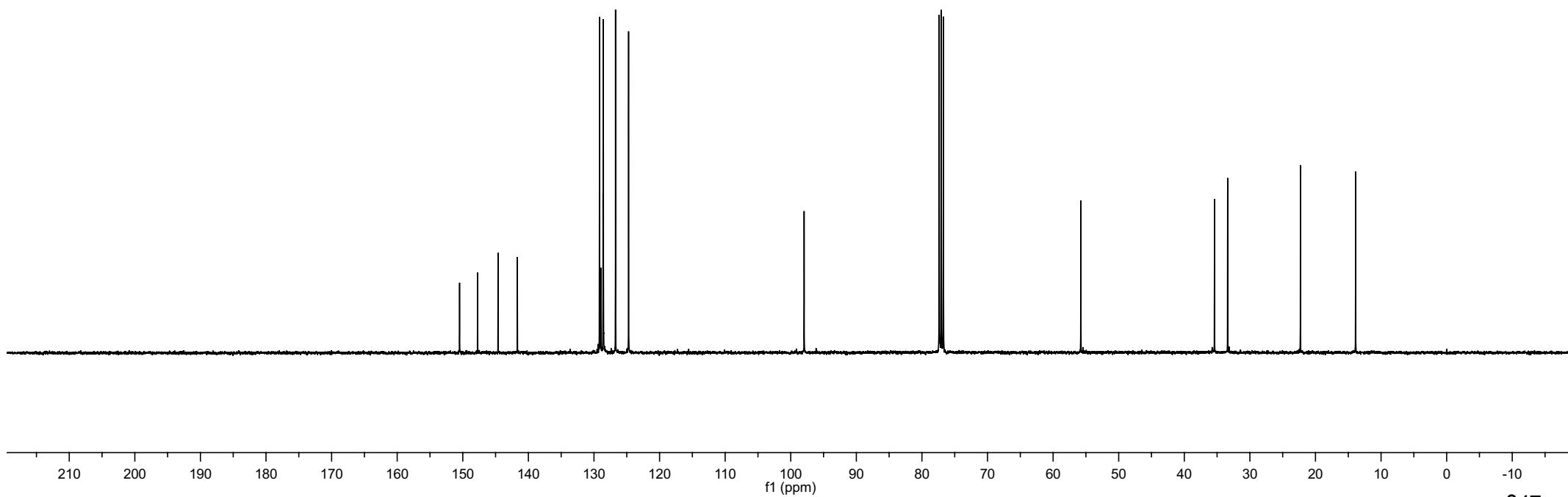
— 35.393
— 33.389

— 22.290

— 13.879

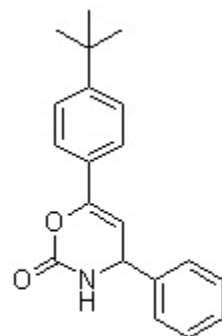


(¹³C NMR, 100 MHz, CDCl₃)

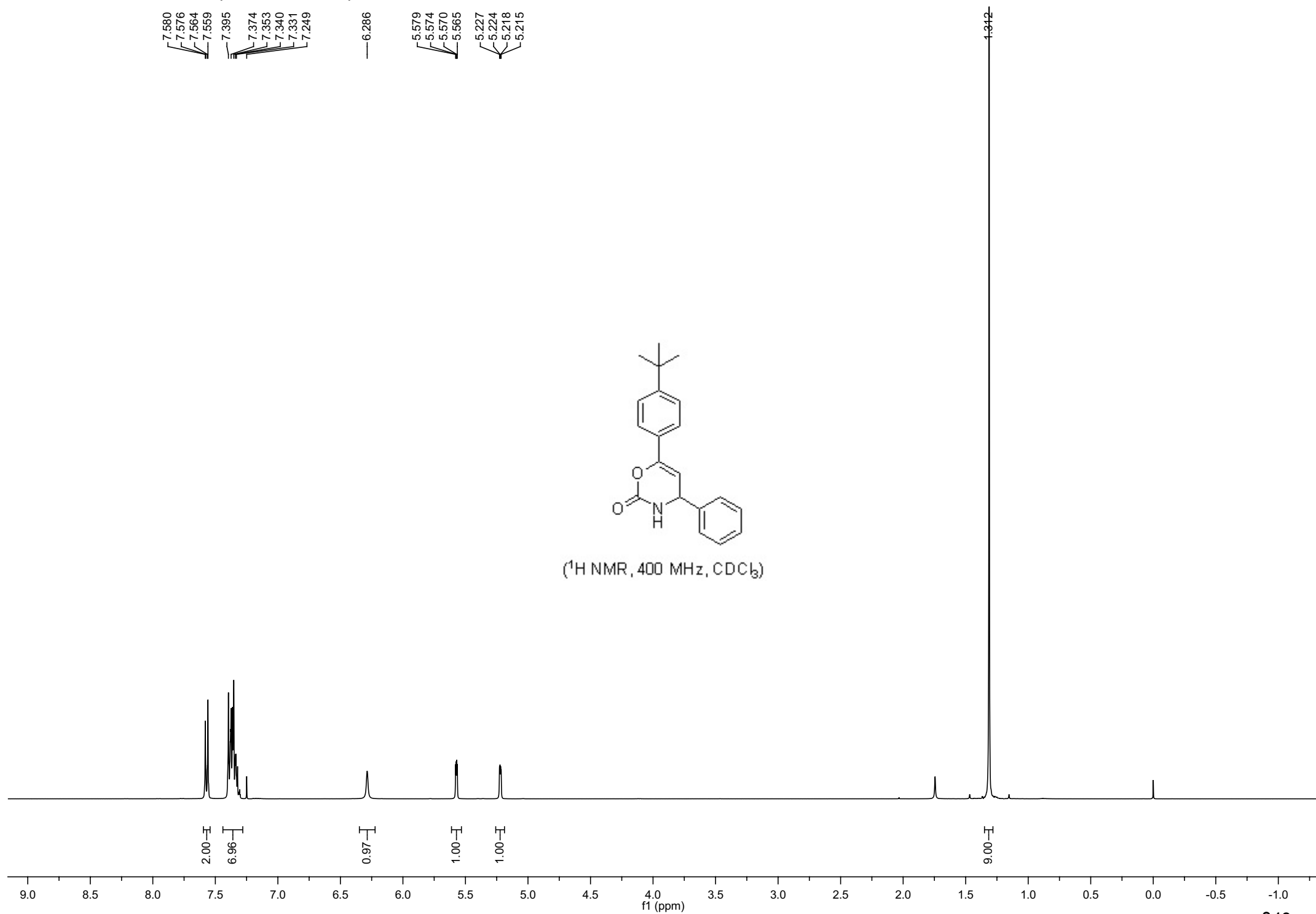


NMR spectra of compound 3af

7.580
7.576
7.564
7.559
7.395
7.374
7.353
7.340
7.331
7.249
6.286
5.579
5.574
5.570
5.565
5.227
5.224
5.218
5.215



(¹H NMR, 400 MHz, CDCl₃)



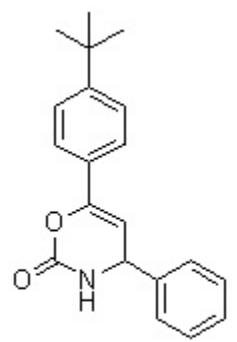
NMR spectra of compound 3af

152.814
150.497
147.679
141.706
129.156
128.741
128.614
126.741
125.453
124.558

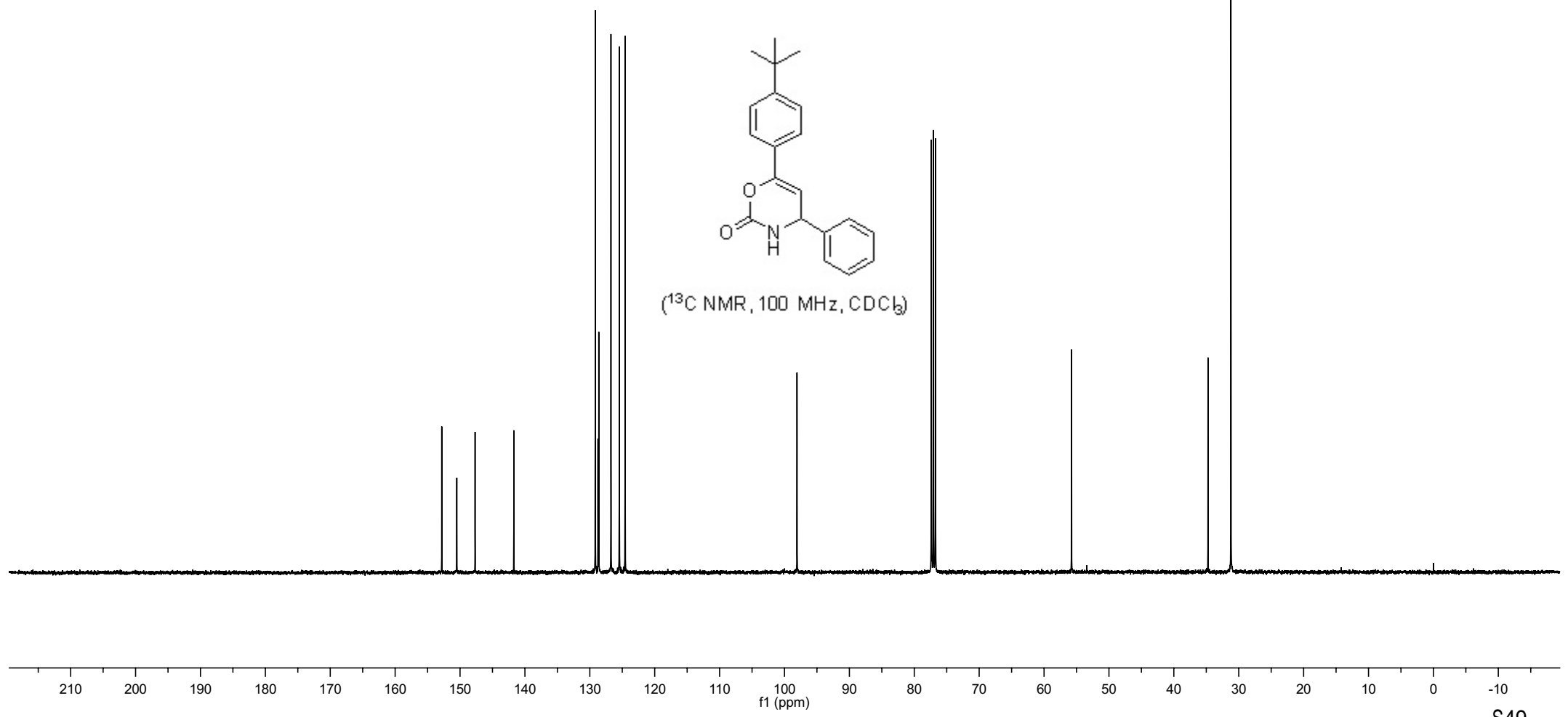
98.071

55.767

34.736
31.204

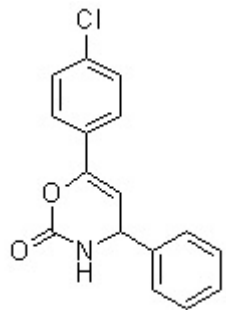


(¹³C NMR, 100 MHz, CDCl₃)

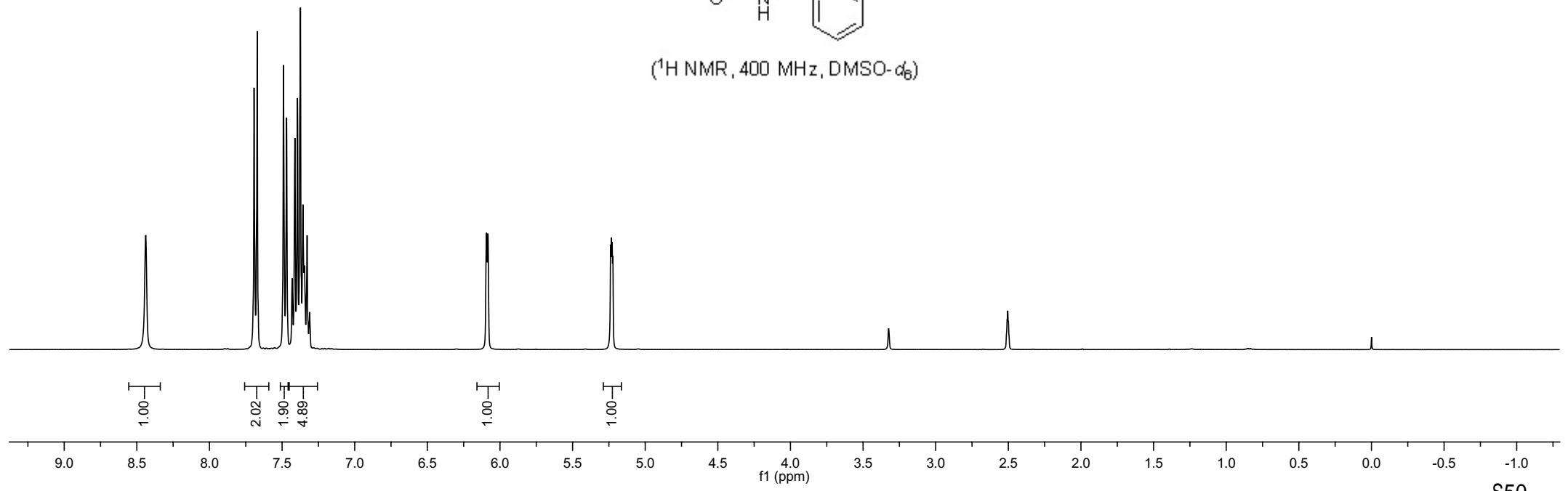


NMR spectra of compound 3ag

8.439
7.693
7.671
7.490
7.374
7.356
7.349
7.346
7.328
7.314
7.310
6.093
6.083
5.238
5.233
5.228
5.223



(¹H NMR, 400 MHz, DMSO-*d*₆)



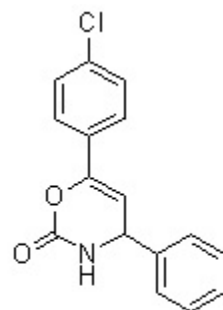
NMR spectra of compound 3ag

— 148.907
— 145.140
— 142.473

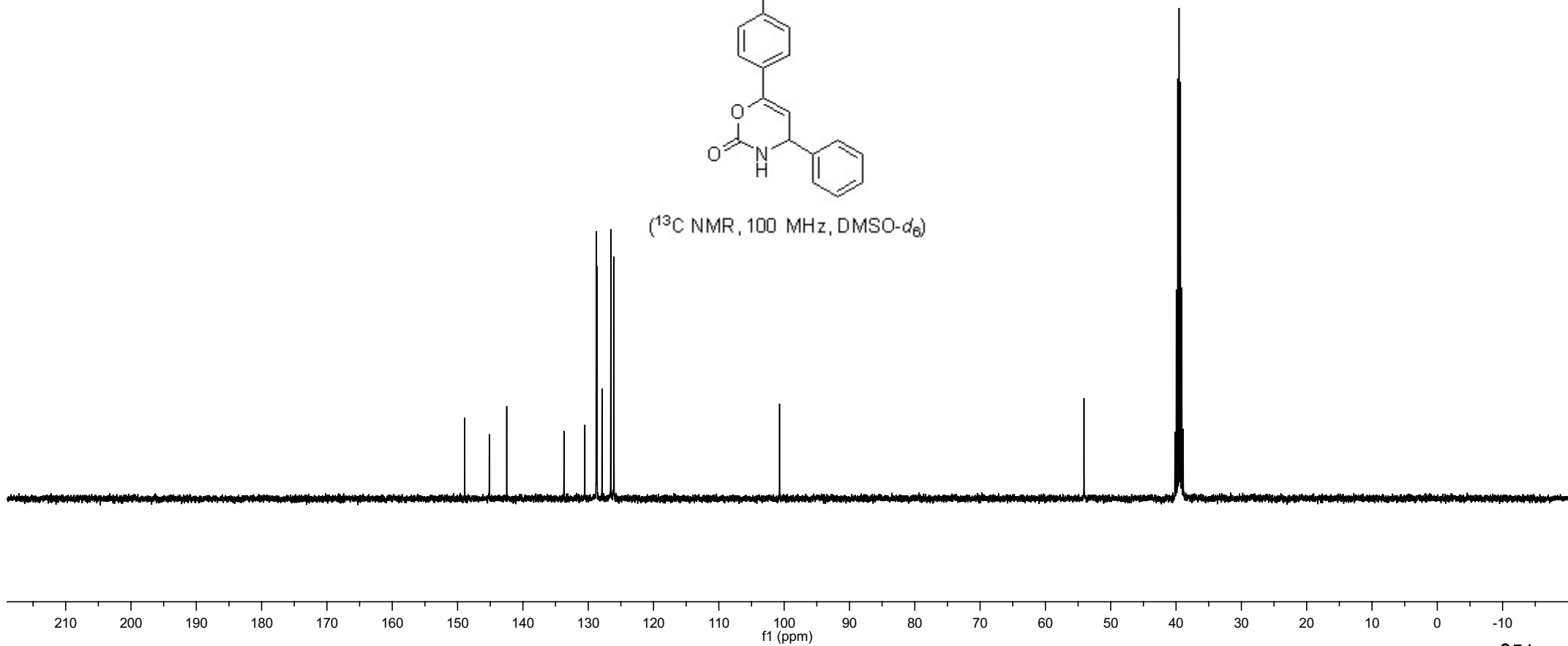
— 133.711
— 130.514
— 128.769
— 128.654
— 127.882
— 126.545
— 126.063

— 100.701

— 54.095



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3ah

8.443

7.615

7.398

7.374

7.353

7.345

7.328

7.314

7.307

6.110

6.106

6.099

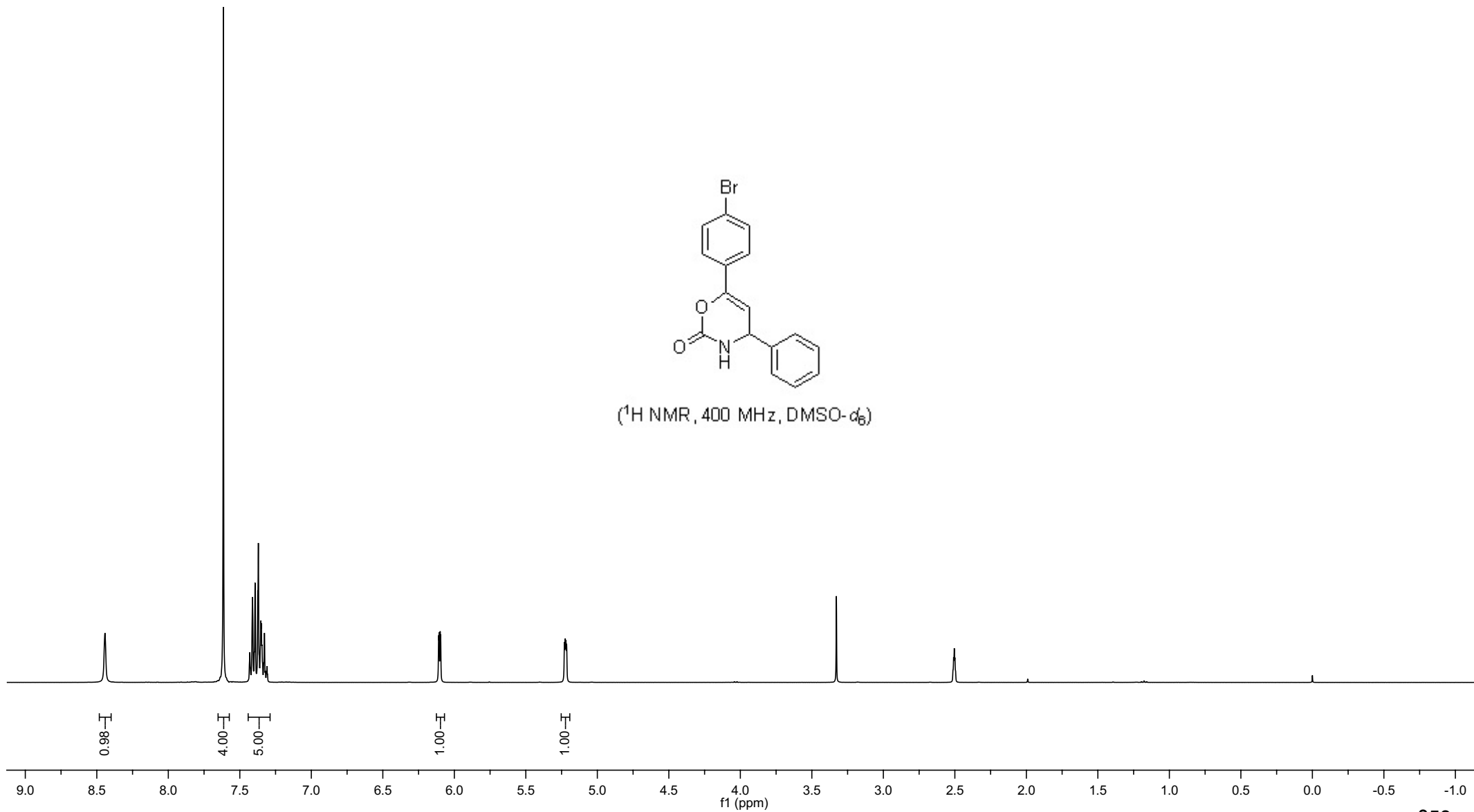
6.096

5.230

5.225

5.220

5.215

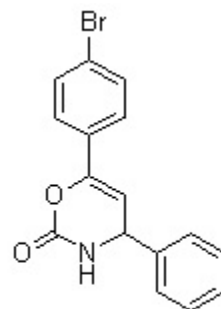


NMR spectra of compound 3ah

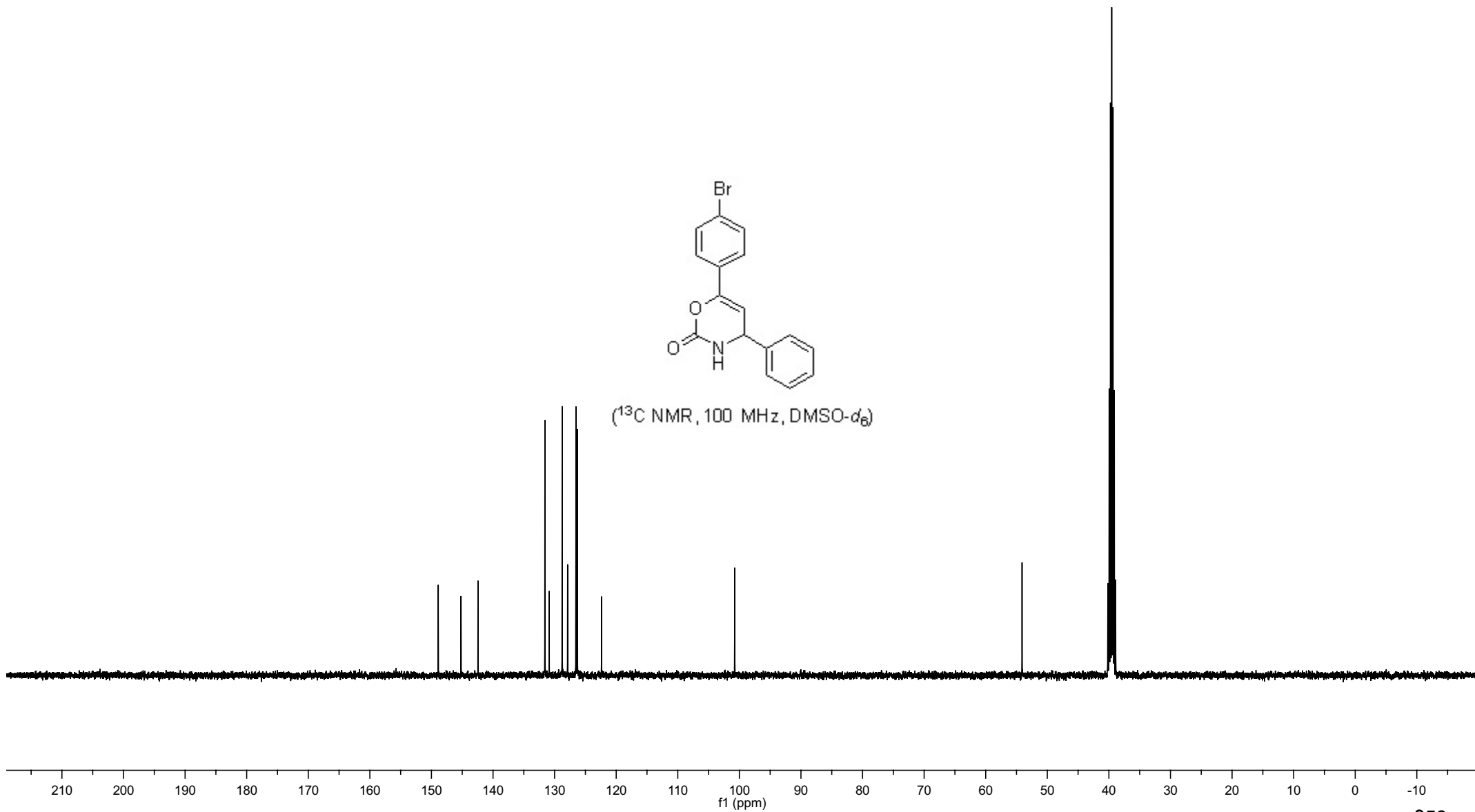
148.893
145.196
142.439
131.576
128.773
127.887
126.543
126.305
122.375

100.756

54.097

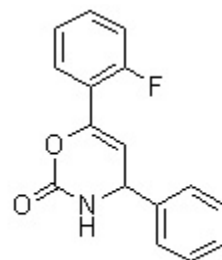


(¹³C NMR, 100 MHz, DMSO-*d*₆)

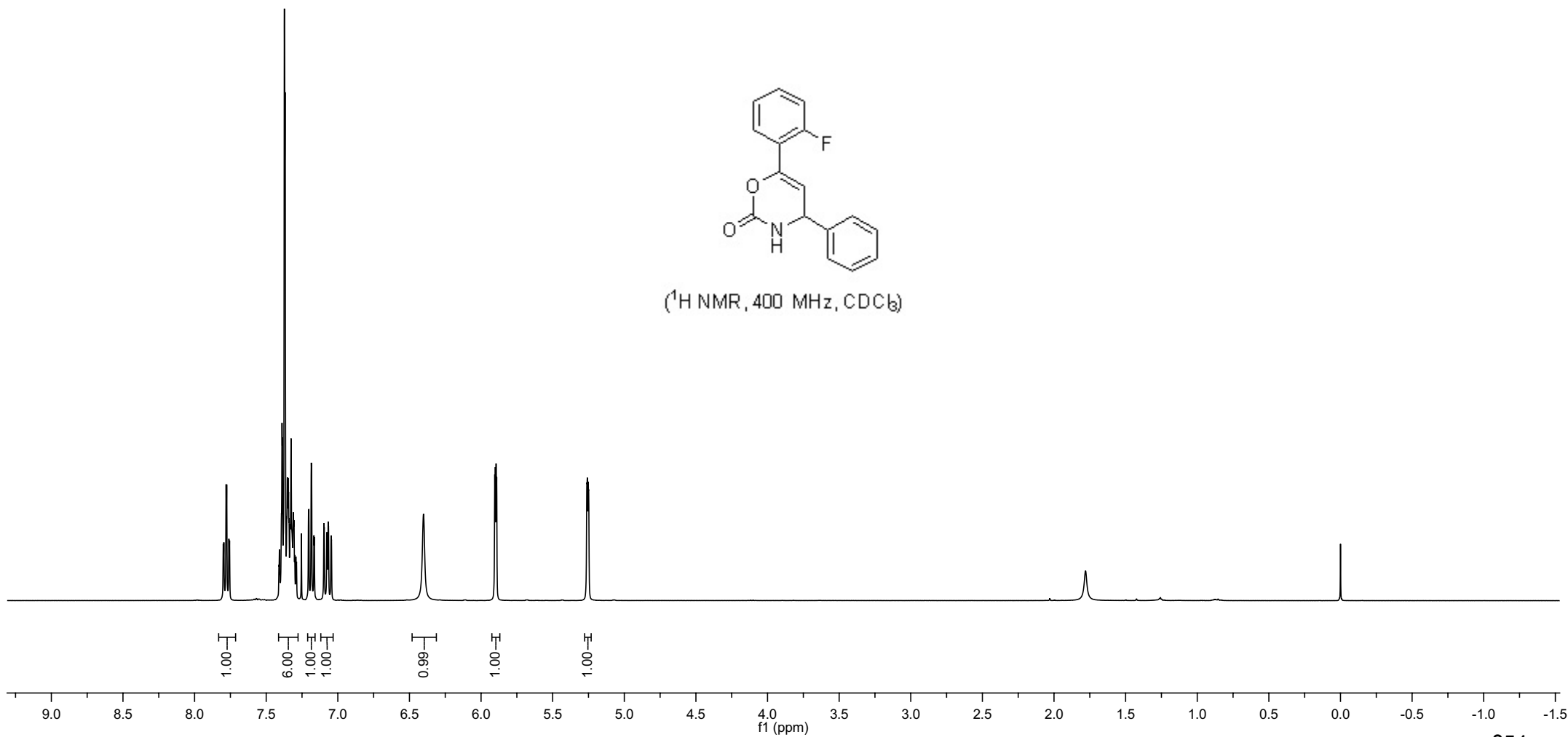


NMR spectra of compound 3ai

7.800
7.795
7.780
7.776
7.760
7.756
7.387
7.352
7.334
7.301
7.202
7.164
7.074
7.045
— 6.402
5.905
5.900
5.895
5.891
5.261
5.258
5.252
5.249



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 3ai

— 161.198
— 158.692

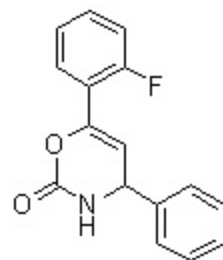
— 150.259

— 142.128
— 142.081
— 141.281
— 129.196
— 127.893
— 127.875
— 126.742
— 124.242

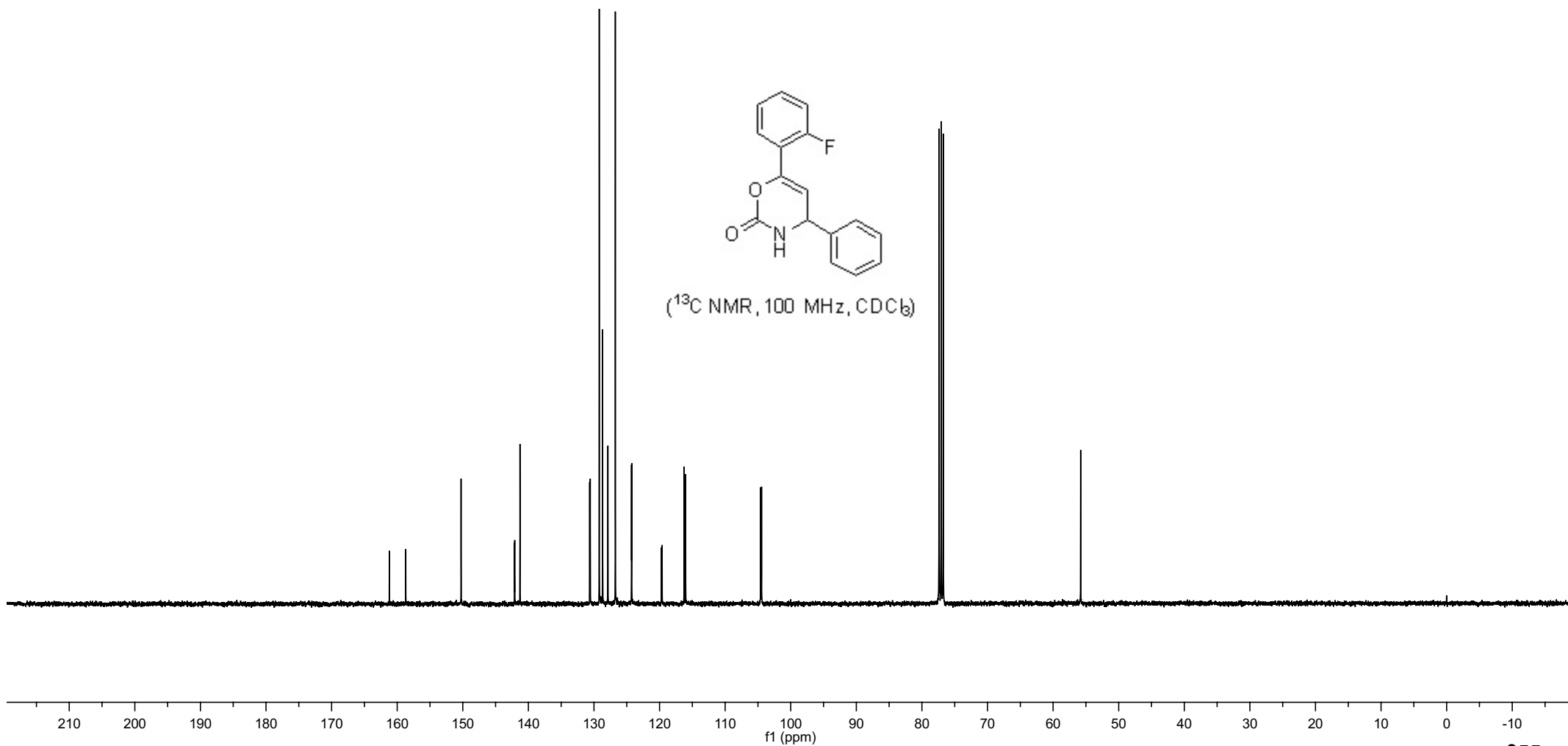
— 119.608
— 116.252
— 116.026

— 104.596
— 104.449

— 55.800
— 55.790

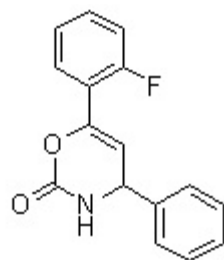


(¹³C NMR, 100 MHz, CDCl₃)

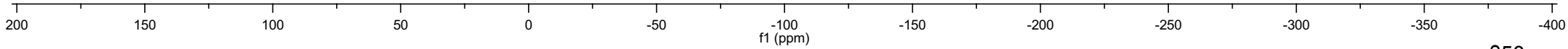


NMR spectra of compound 3ai

-112.325



(¹⁹F NMR, 376 MHz, CDCl₃)



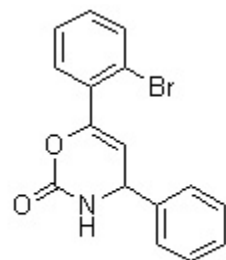
NMR spectra of compound 3aj

7.594
7.409
7.402
7.395
7.380
7.374
7.366
7.359
7.352
7.346
7.337
7.329
7.321
7.318
7.302
7.299
7.295
7.255
7.244
7.240
7.224
7.220
7.205
7.201

6.281

5.464
5.459
5.455
5.450

5.248
5.244
5.239
5.236



(¹H NMR, 400 MHz, CDCl₃)

1.00
1.00
6.00
1.00

1.00

1.00

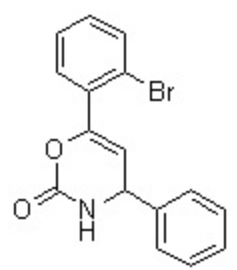
1.00

9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0

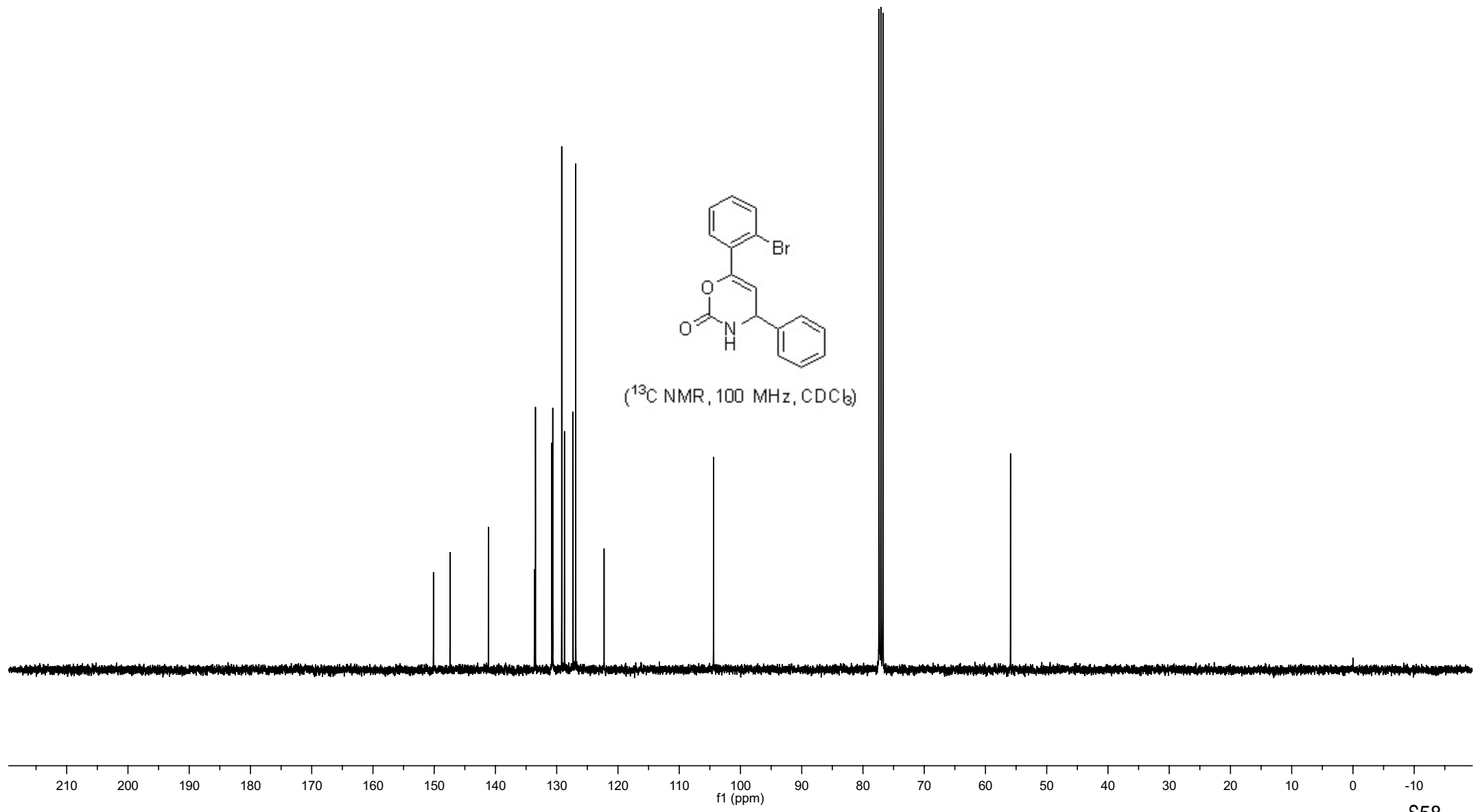
f1 (ppm)

NMR spectra of compound 3aj

- 150.127
- 147.410
- 141.153
- 133.641
- 133.465
- 129.185
- 126.903
- 122.263
- 104.396
- 55.915



(¹³C NMR, 100 MHz, CDCl₃)



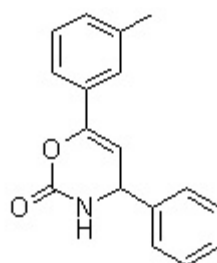
NMR spectra of compound 3ak

8.379
7.372
7.342
7.339
7.327
7.321
7.315
7.308
7.304
7.296
7.277
7.205
7.186

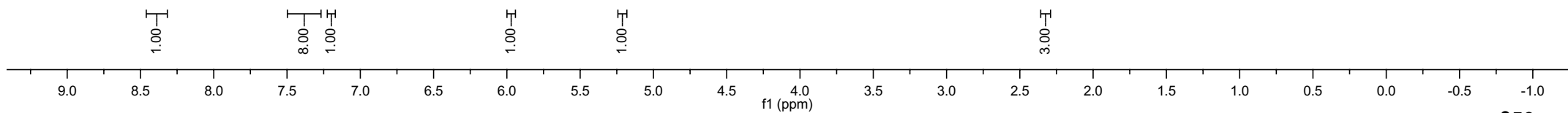
5.978
5.974
5.967
5.964

5.220
5.215
5.210
5.205

2.322



(¹H NMR, 400 MHz, DMSO-*d*₆)



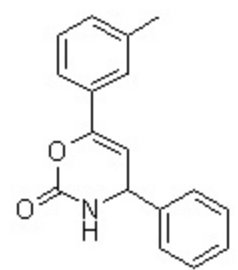
NMR spectra of compound 3ak

—149.195
—146.268
—142.731
—137.851
—128.745
—128.480
—127.814
—126.491
—124.758
—121.439

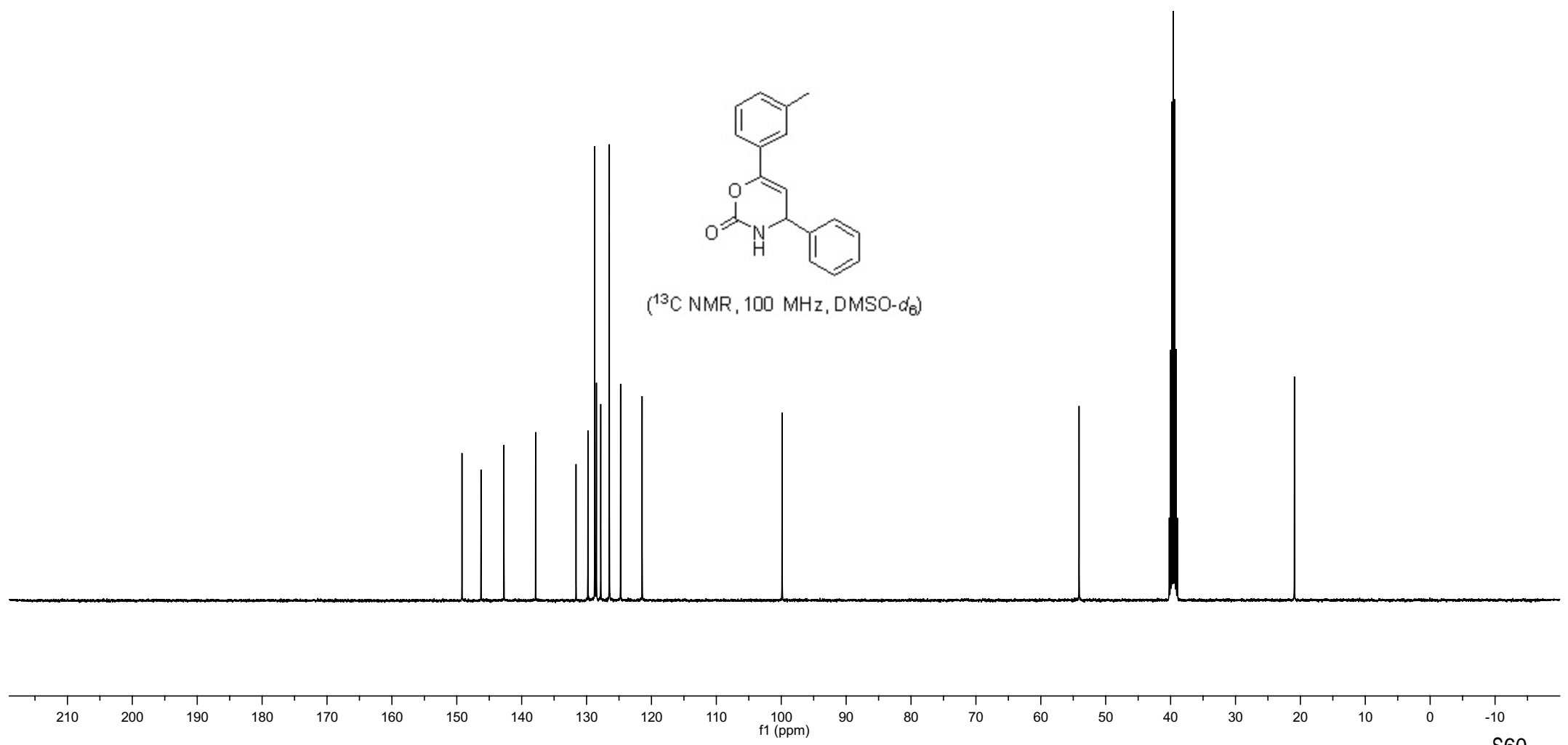
—99.864

—54.103

—20.915



(¹³C NMR, 100 MHz, DMSO-d₆)



NMR spectra of compound 3aI

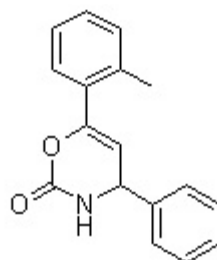
8.392

7.417
7.411
7.400
7.396
7.351
7.345
7.338
7.325
7.311
7.293
7.260
7.241
7.222
7.204

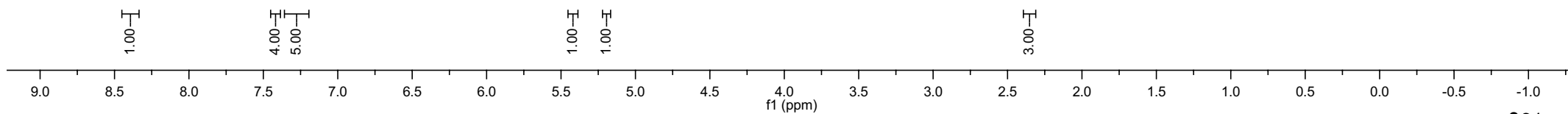
5.426
5.419
5.416

5.205
5.199
5.195
5.190

2.354



(¹H NMR, 400 MHz, DMSO-*d*₆)



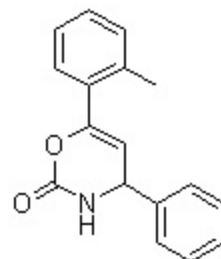
NMR spectra of compound 3al

149.278
147.936
142.822
135.877
132.665
130.534
129.255
128.774
128.607
127.844
126.516
125.859

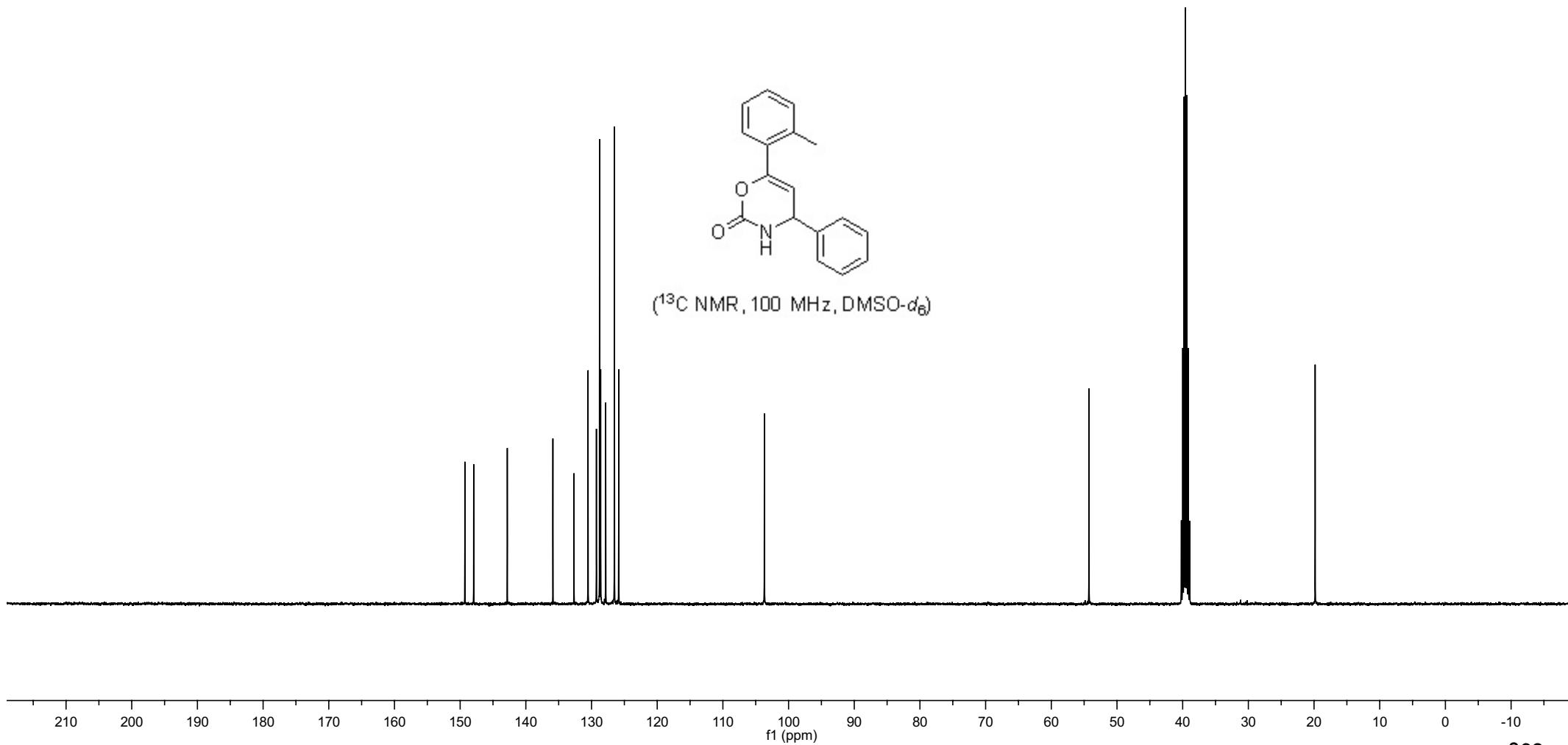
103.680

54.265

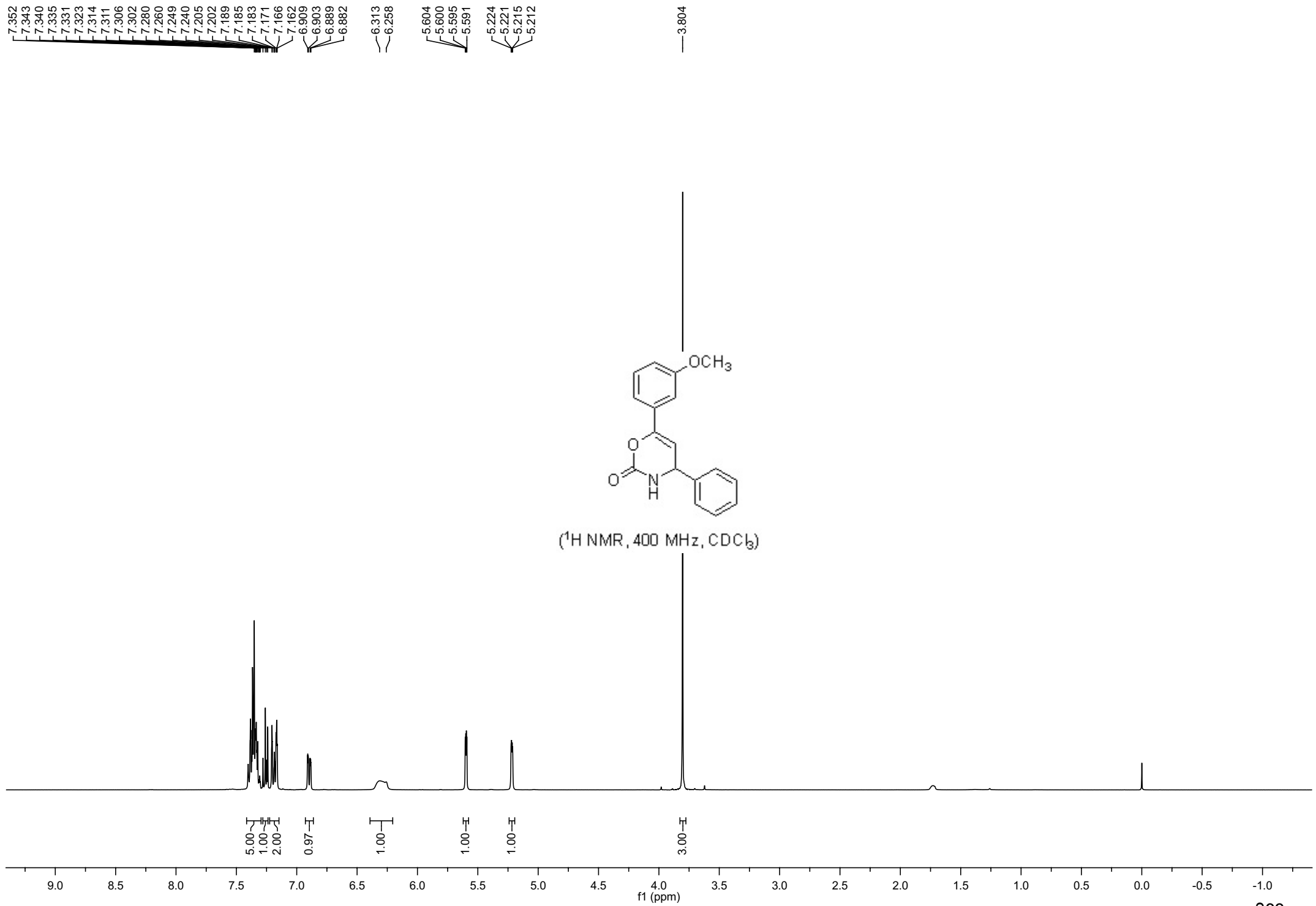
19.828



(¹³C NMR, 100 MHz, DMSO-*d*₆)

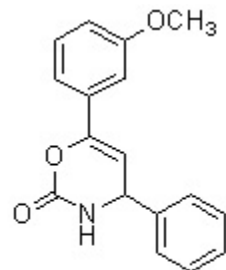


NMR spectra of compound 3am

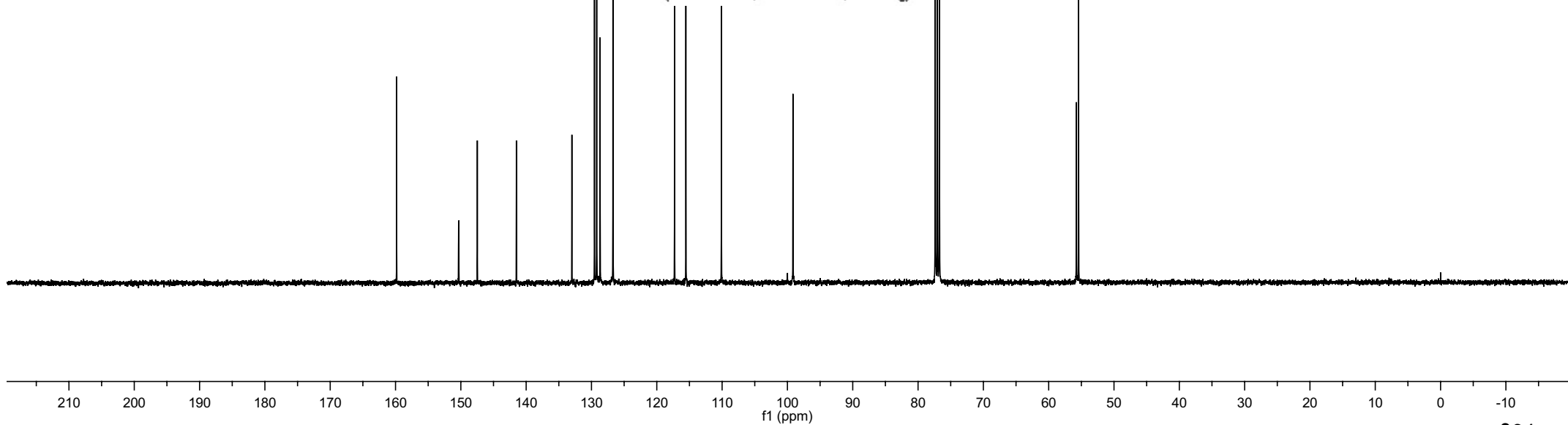


NMR spectra of compound 3am

159.836
150.341
147.475
141.495
132.998
129.541
129.198
128.660
126.709
117.282
115.546
110.108
99.151
55.756
55.415



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 3an

8.450

7.688

7.666

7.512

7.414

7.396

7.374

7.351

7.335

7.312

6.132

6.129

6.122

6.118

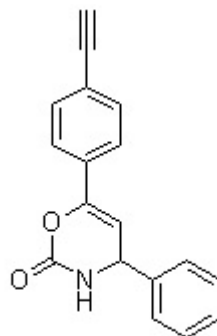
5.250

5.245

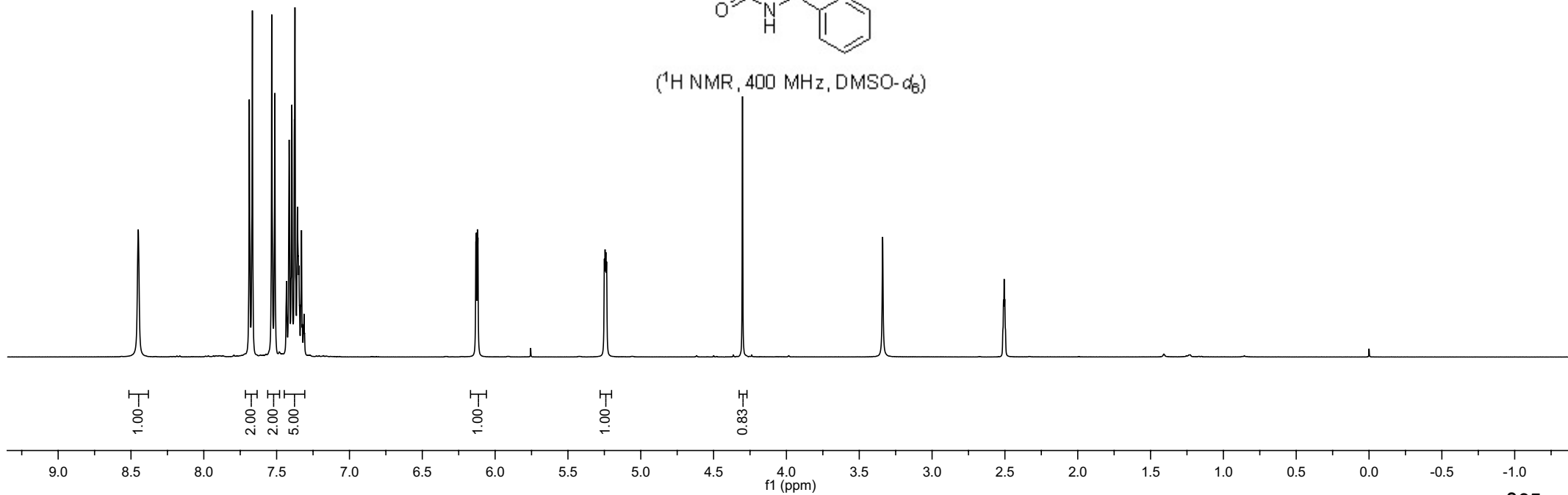
5.240

5.235

4.302

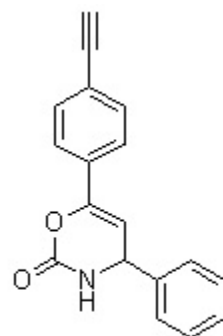


(¹H NMR, 400 MHz, DMSO-*d*₆)

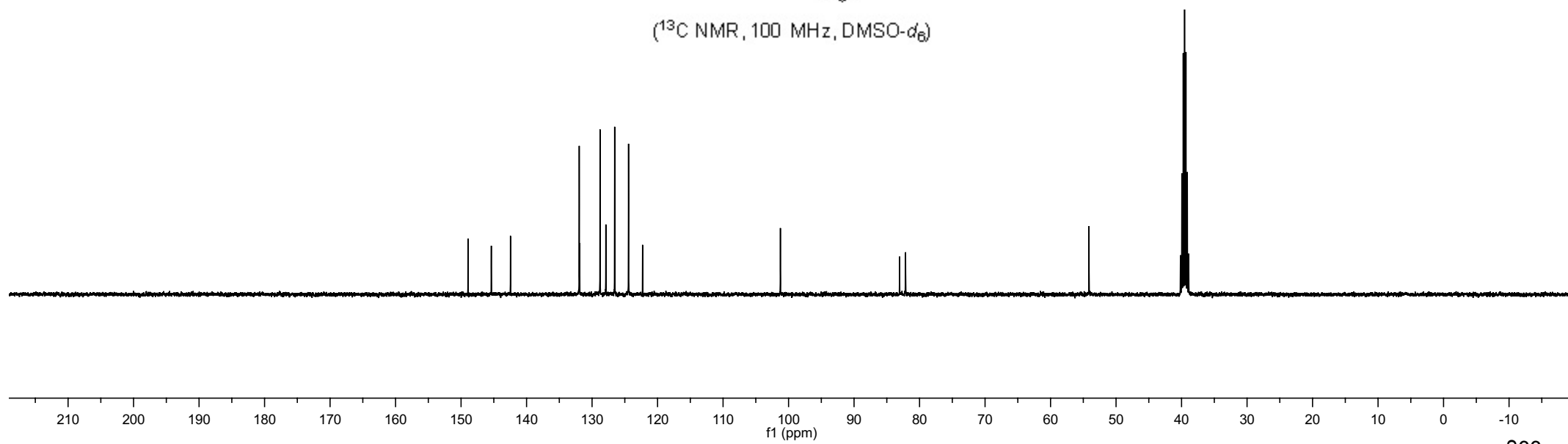


NMR spectra of compound **3an**

— 148.937
— 145.383
— 142.455
— 131.958
— 131.895
— 128.780
— 127.894
— 126.548
— 124.429
— 122.286
— 101.247
— 83.047
— 82.137
— 54.130

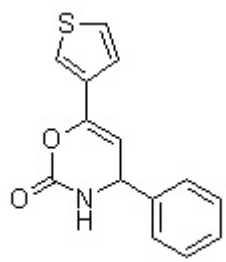


(¹³C NMR, 100 MHz, DMSO-*d*₆)

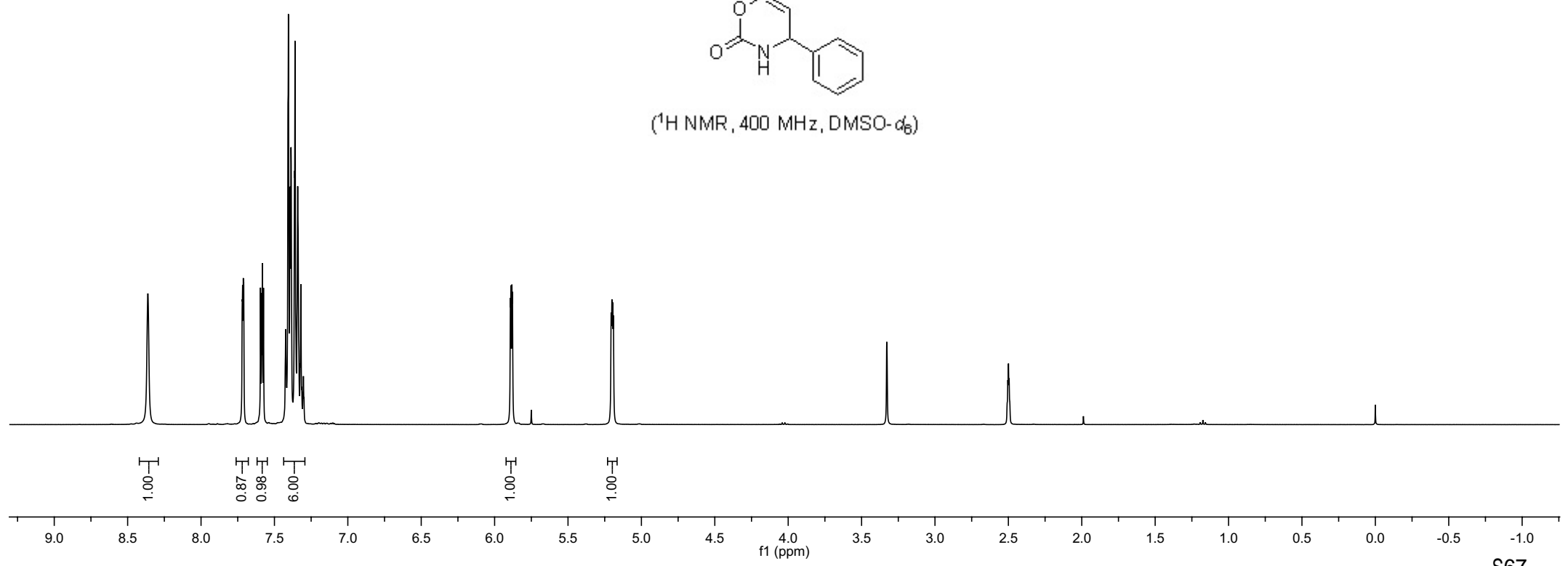


NMR spectra of compound 3ao

8.362
 7.719
 7.717
 7.712
 7.709
 7.575
 7.405
 7.363
 7.359
 7.341
 7.325
 7.320
 7.302
 5.892
 5.889
 5.882
 5.879
 5.206
 5.201
 5.196
 5.191

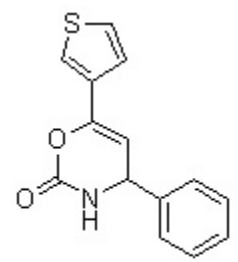


(¹H NMR, 400 MHz, DMSO-*d*₆)

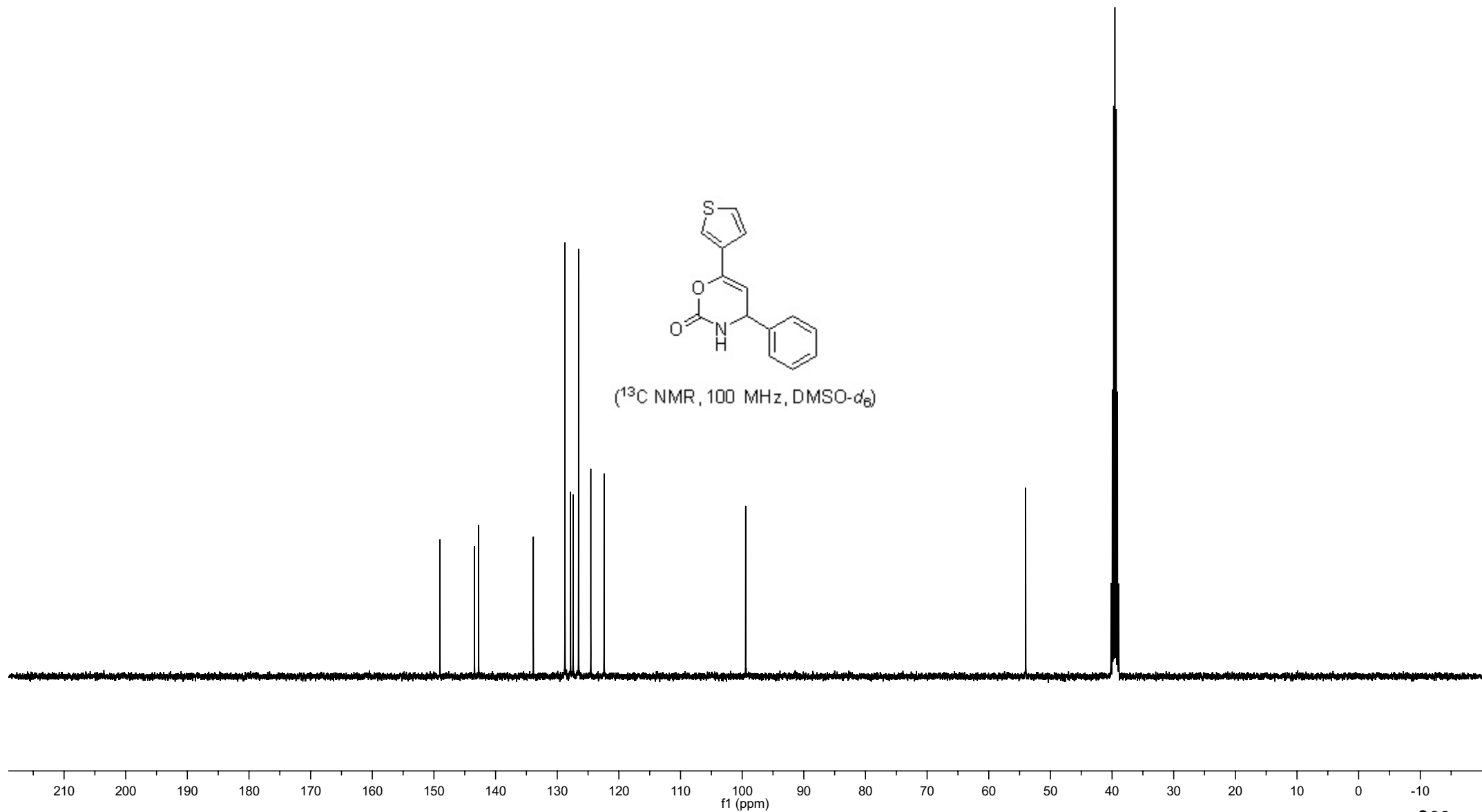


NMR spectra of compound **3ao**

— 149.025
— 143.426
— 142.749
— 133.875
— 128.751
— 127.843
— 127.424
— 126.539
— 124.553
— 122.399
— 99.440
— 54.013



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3ap

8.463

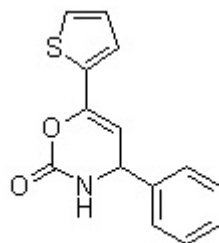
7.606
7.595

7.394
7.310

7.116
7.106
7.104
7.094

5.852
5.850
5.842
5.840

5.218
5.213
5.208
5.204



(¹H NMR, 400 MHz, DMSO-*d*₆)

1.00

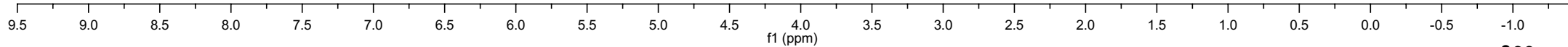
0.97

6.00

1.00

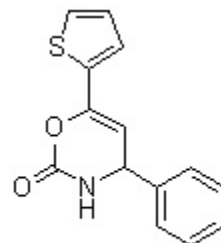
1.00

1.00

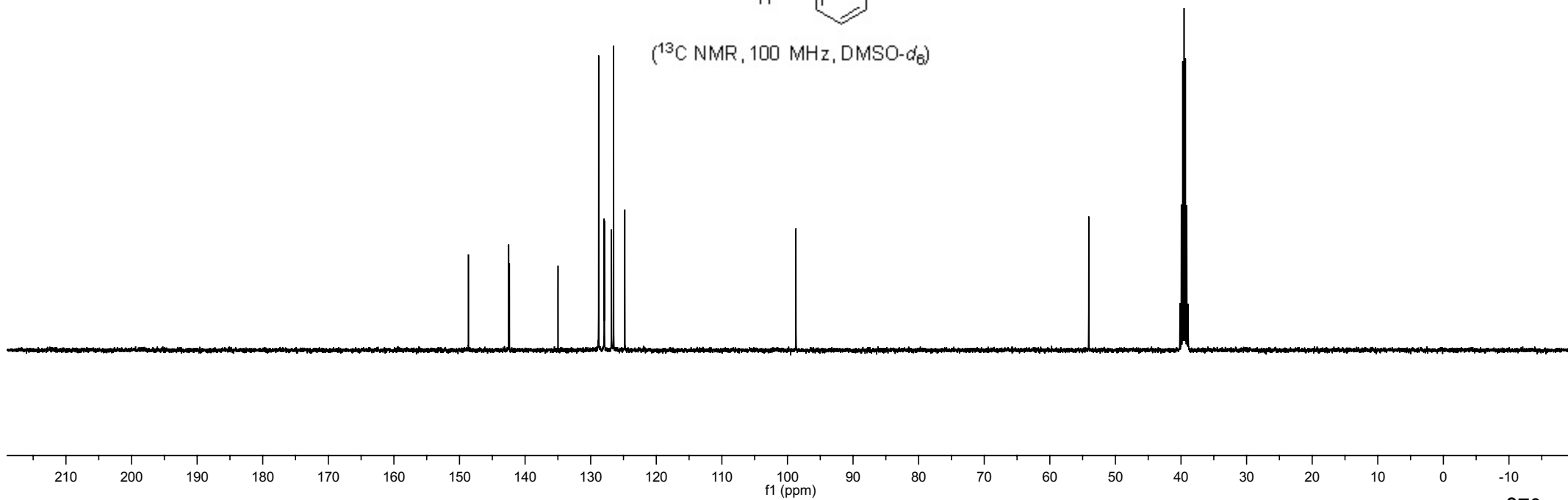


NMR spectra of compound 3ap

— 148.640
— 142.501
— 142.392
— 134.978
— 128.788
— 127.955
— 127.901
— 126.831
— 126.505
— 124.797
— 98.711
— 54.068



(¹³C NMR, 100 MHz, DMSO-*d*₆)



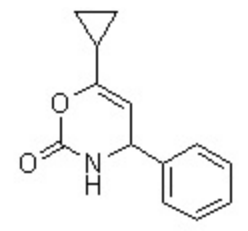
NMR spectra of compound 3aq

7.388
7.385
7.381
7.372
7.368
7.364
7.352
7.349
7.329
7.325
7.321
7.313
7.307
7.299
7.292
7.285
7.281
7.275
7.264

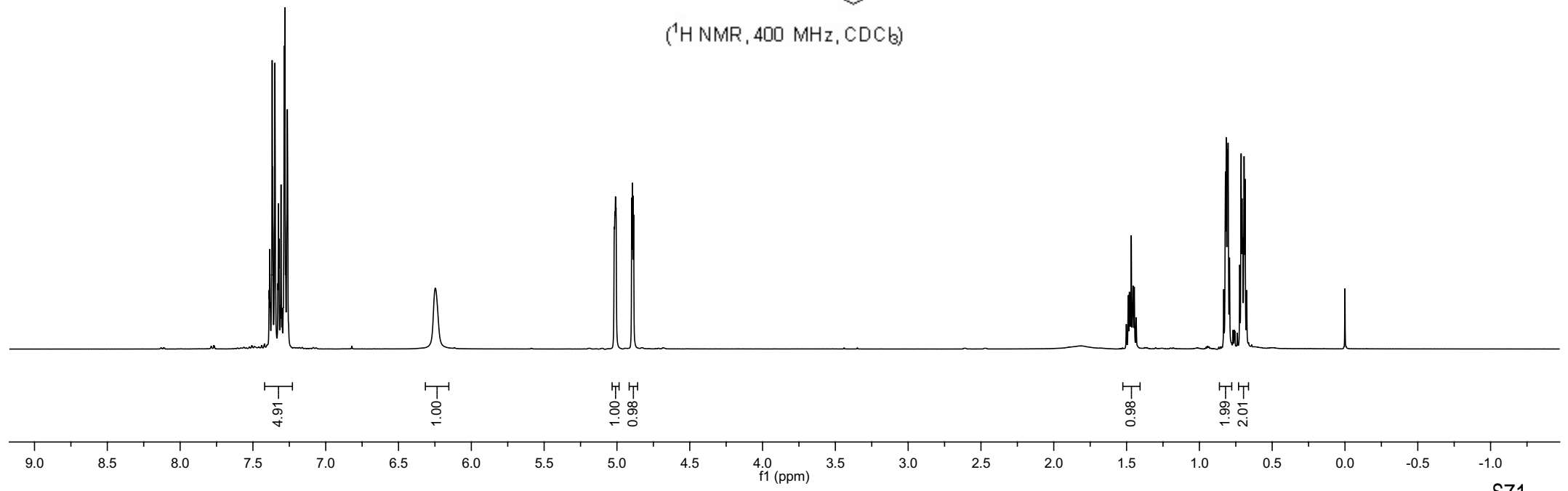
6.247

5.018
5.014
5.010
5.006
4.898
4.894
4.890
4.885

1.502
1.489
1.481
1.476
1.468
1.459
1.455
1.447
1.434
0.833
0.820
0.816
0.807
0.803
0.793
0.723
0.713
0.707
0.702
0.693
0.687
0.675



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound **3aq**

—150.587

—142.022

—129.040

—128.412

—126.511

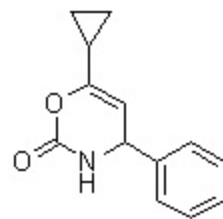
—97.132

—55.455

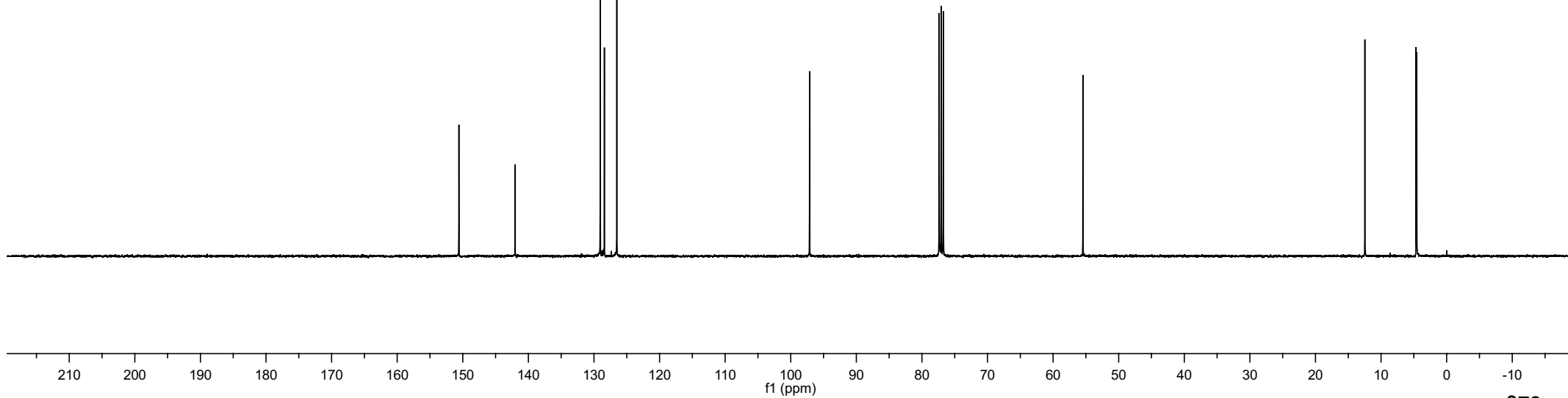
—12.468

—4.658

—4.558



(¹³C NMR, 100 MHz, CDCl₃)



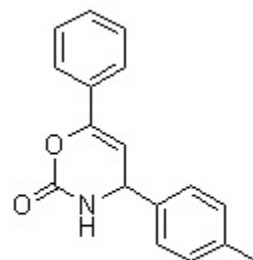
NMR spectra of compound 3ba

7.631
7.623
7.620
7.612
7.607
7.599
7.547
7.342
7.333
7.244
7.223
7.188
7.168

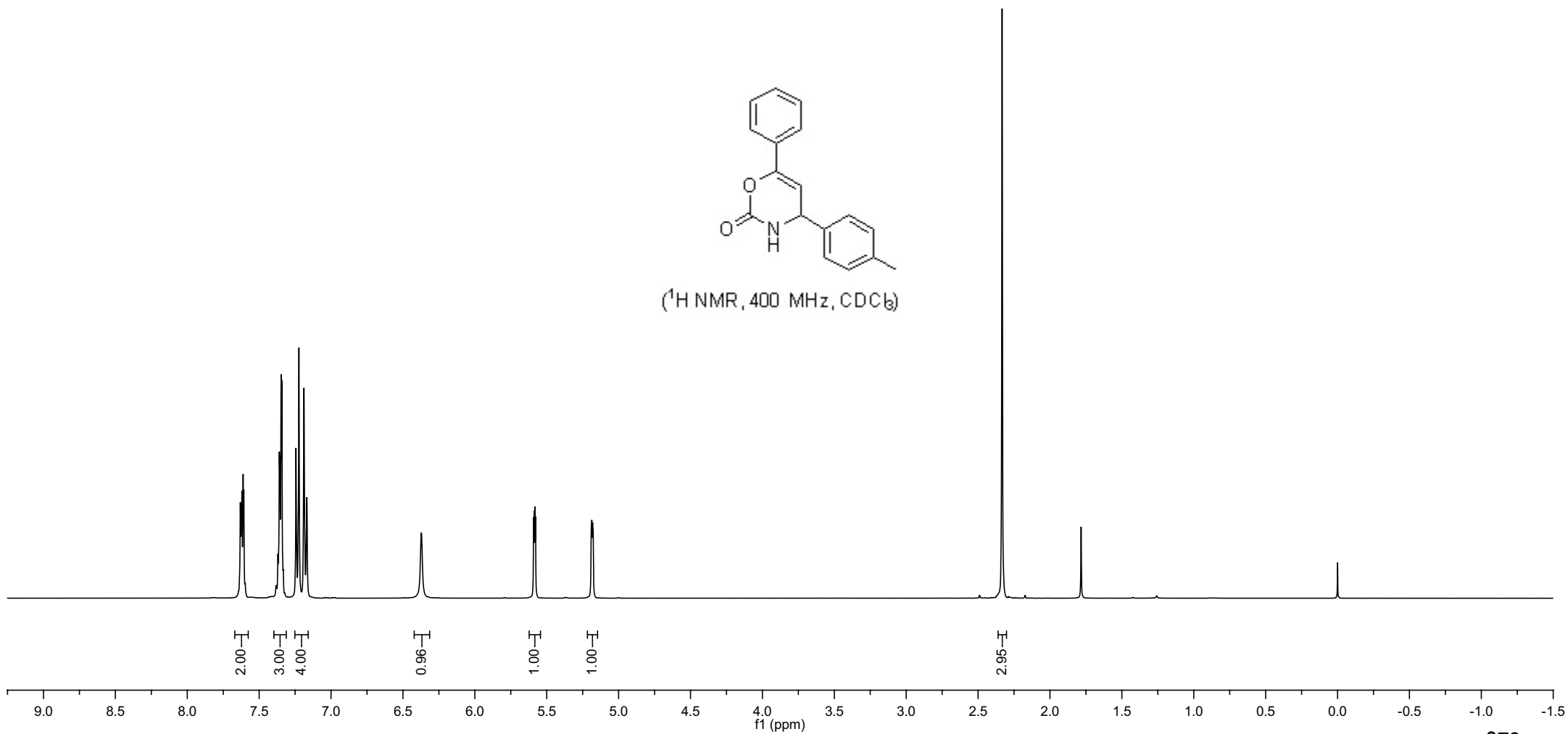
6.372

5.591
5.587
5.582
5.578
5.190
5.186
5.181
5.178

2.333



(¹H NMR, 400 MHz, CDCl₃)



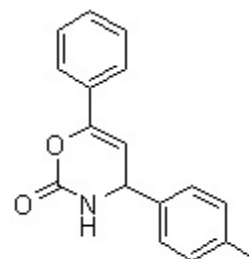
NMR spectra of compound **3ba**

— 150.499
— 147.460
— 138.644
— 138.529
— 131.627
— 129.823
— 129.404
— 128.506
— 126.865
— 124.766

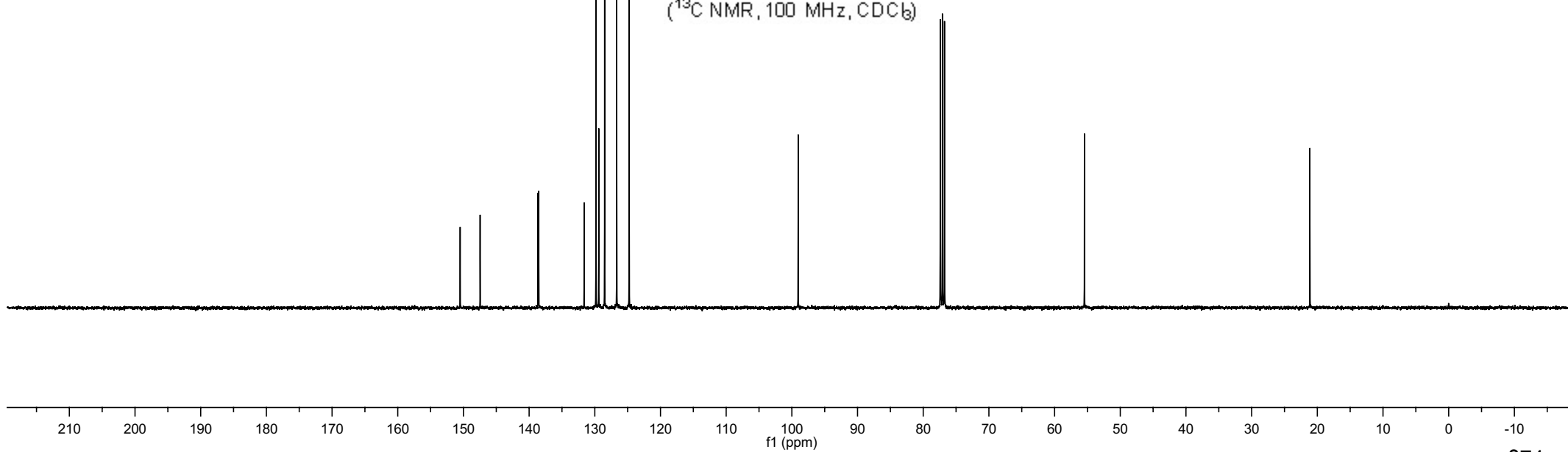
— 99.038

— 55.454

— 21.133



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 3ca

8.342

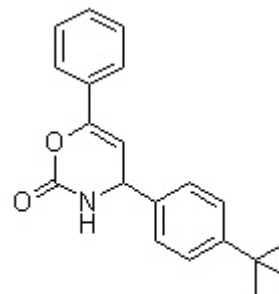
7.666
7.662
7.646
7.643

7.412
7.401
7.394
7.389
7.382
7.292
7.272

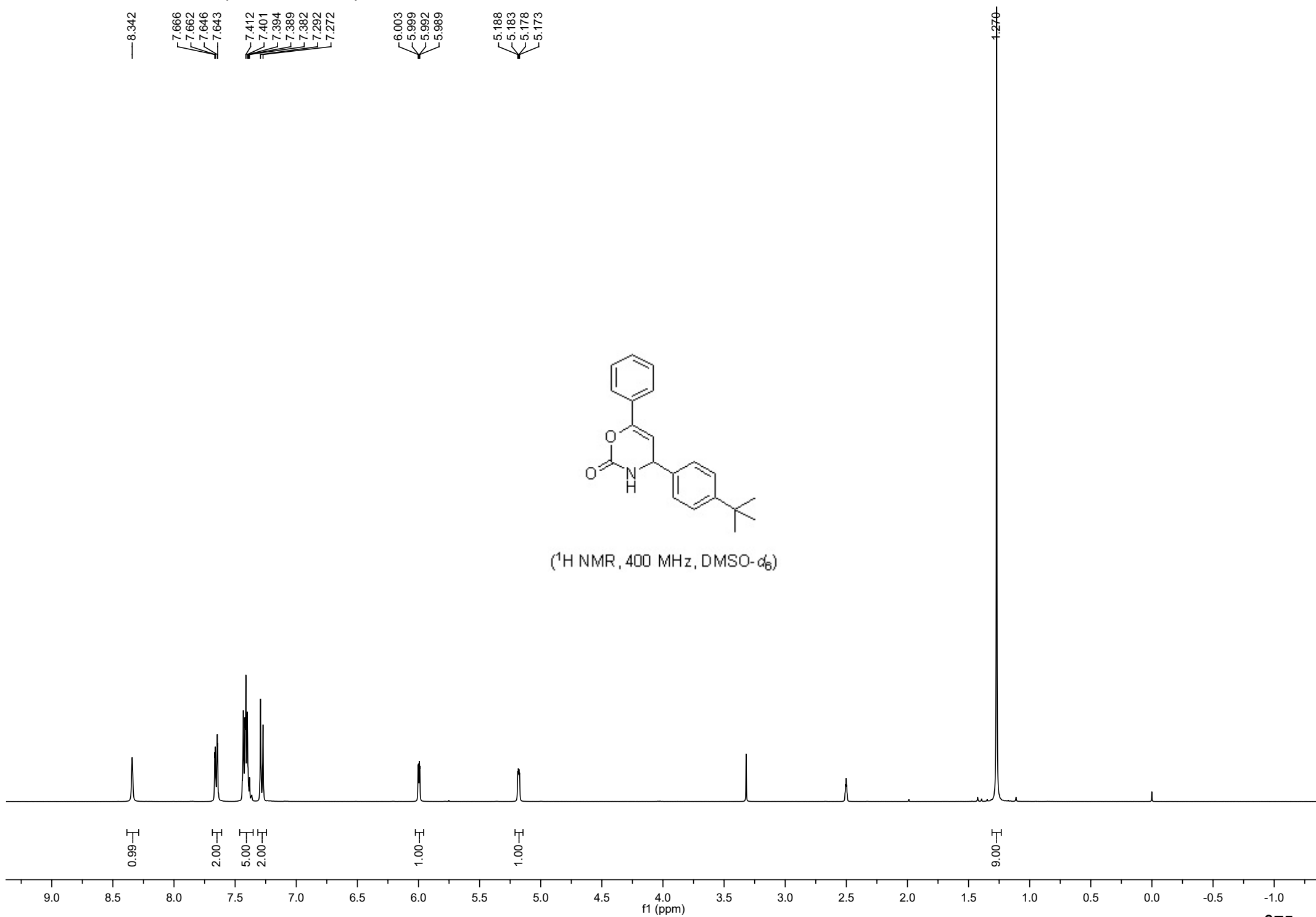
6.003
5.999
5.992
5.989

5.188
5.183
5.178
5.173

1.270



(¹H NMR, 400 MHz, DMSO-*d*₆)



NMR spectra of compound 3ca

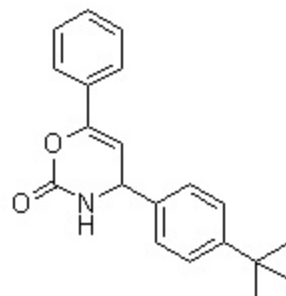
150.878
149.615
146.503
140.249

132.173
129.604
129.085
126.796
126.002
124.708

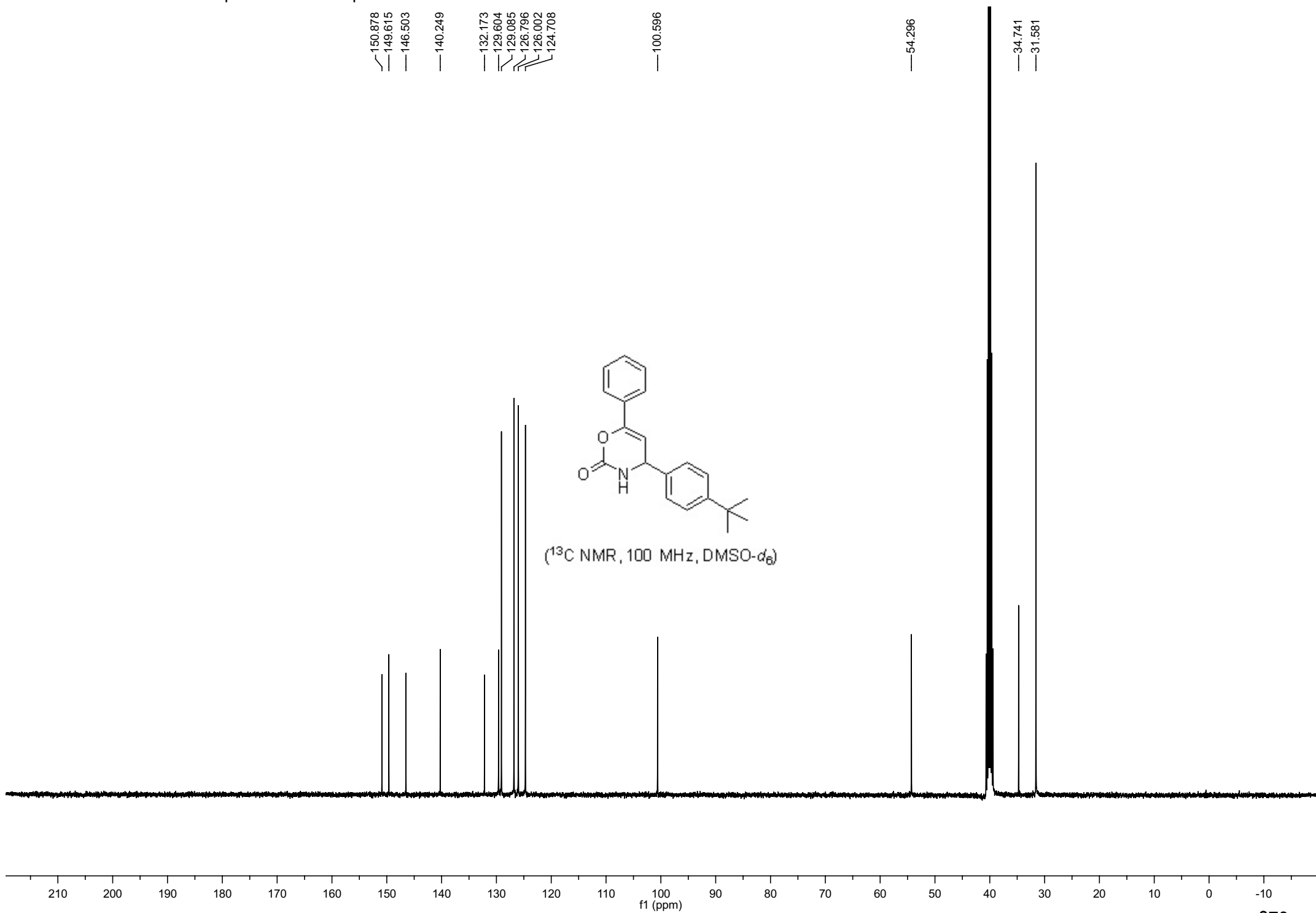
100.596

54.296

34.741
31.581



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3da

8.351

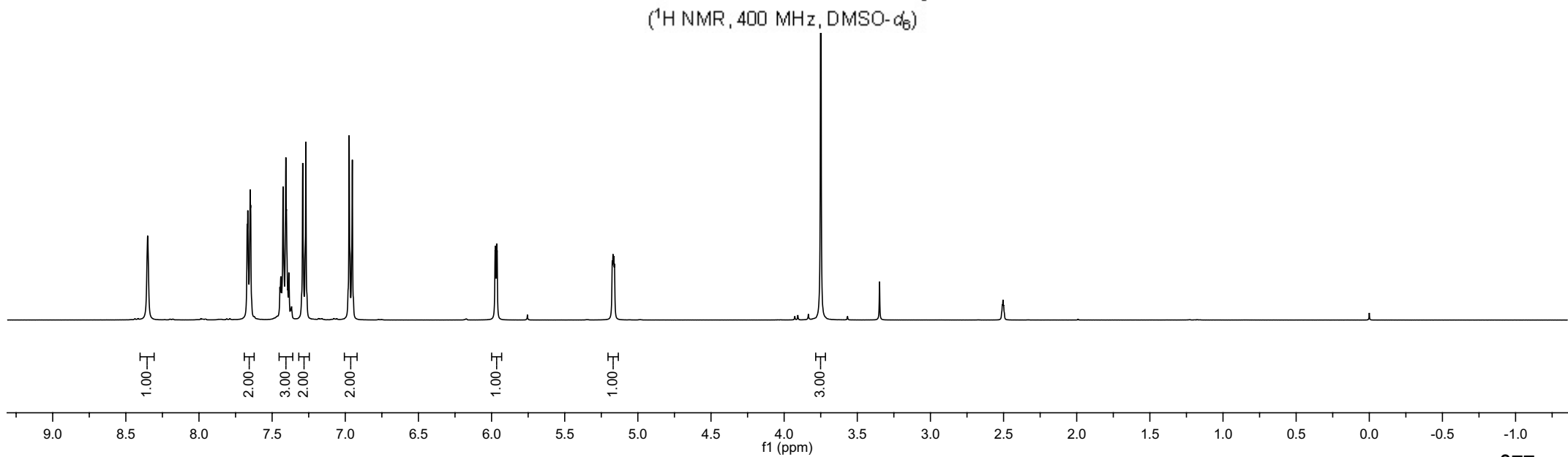
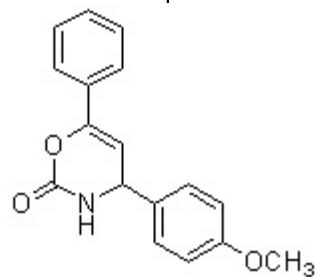
7.670
7.666
7.650
7.647

7.425
7.393
7.269
6.973
6.952

5.976
5.972
5.965
5.962

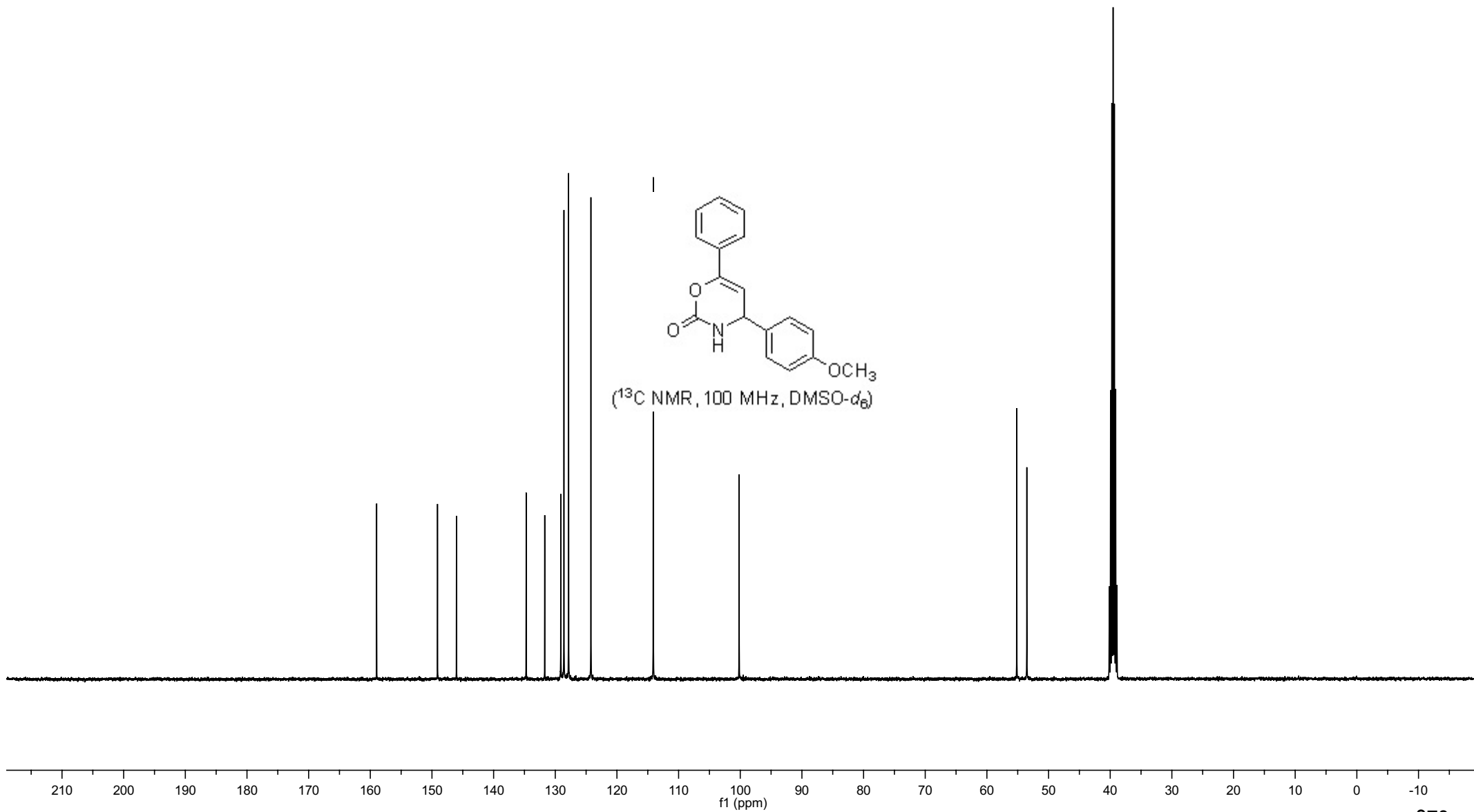
5.175
5.170
5.165
5.160

3.749



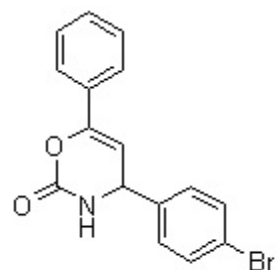
NMR spectra of compound 3da

— 158.970
— 149.101
— 146.024
— 134.723
— 131.710
— 127.843
— 124.218
— 114.104
— 100.183
— 55.156
— 53.520

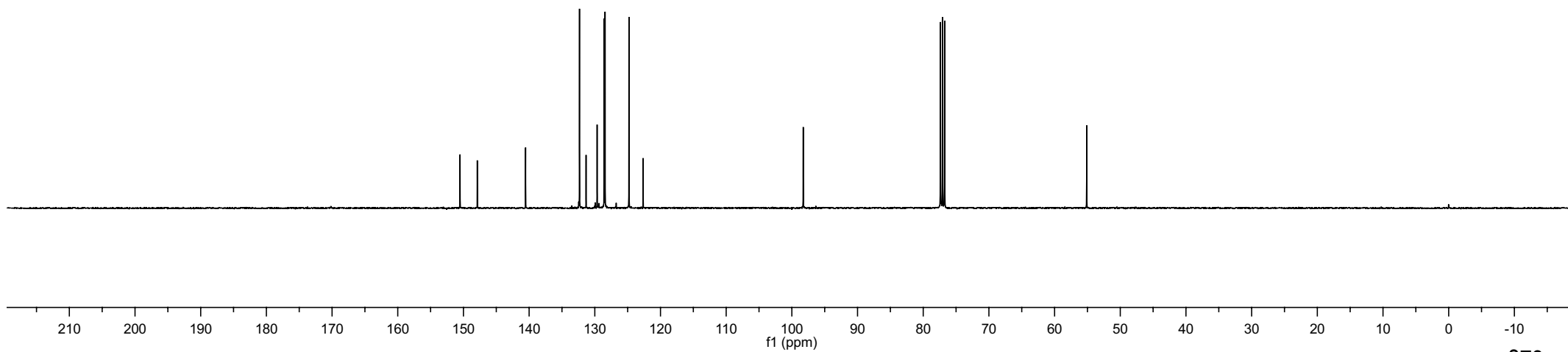


NMR spectra of compound 3ea

—150.518
—147.889
—140.538
—132.331
—129.647
—128.580
—128.437
—124.798
—122.648
—98.265
—55.110

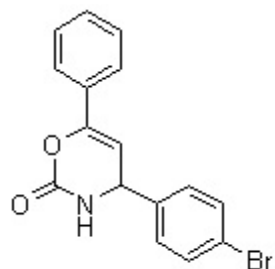


(¹³C NMR, 100 MHz, CDCl₃)

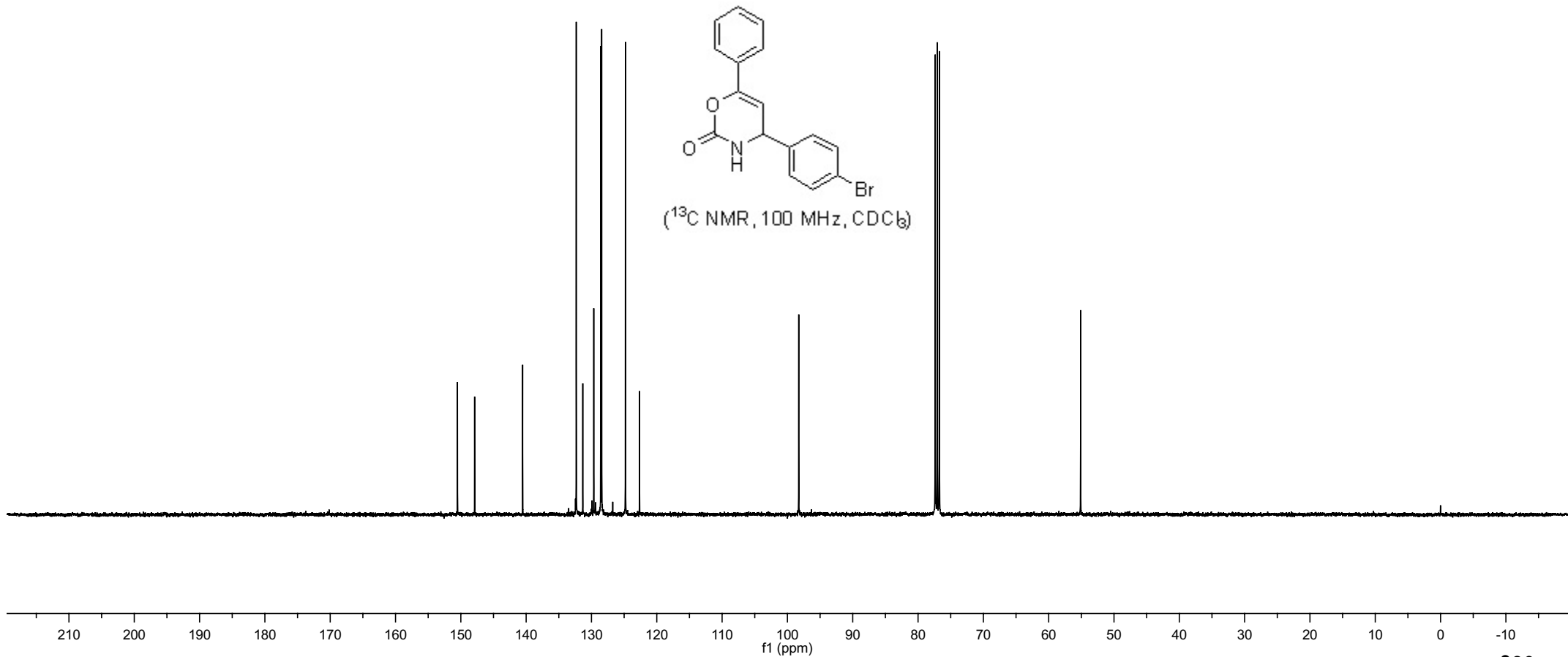


NMR spectra of compound 3ea

—150.518
—147.889
—140.538
—132.331
—129.647
—128.580
—128.437
—124.798
—122.648
—98.265
—55.110



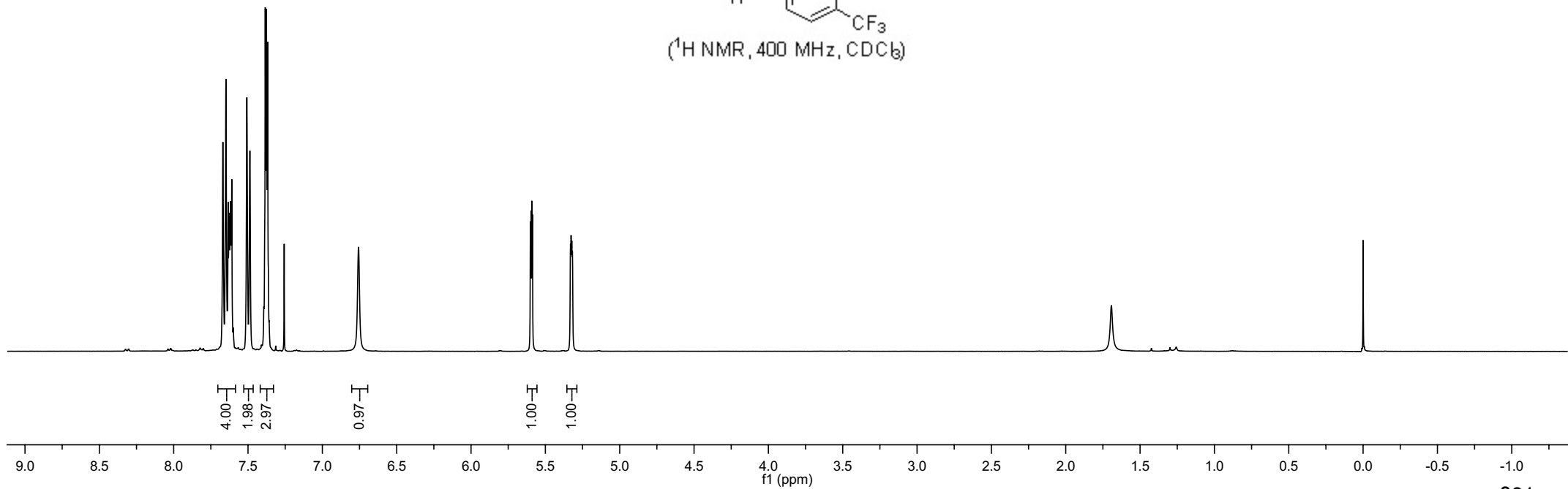
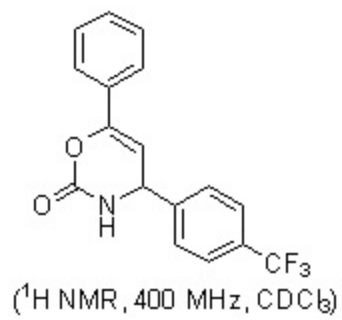
(¹³C NMR, 100 MHz, CDCl₃)



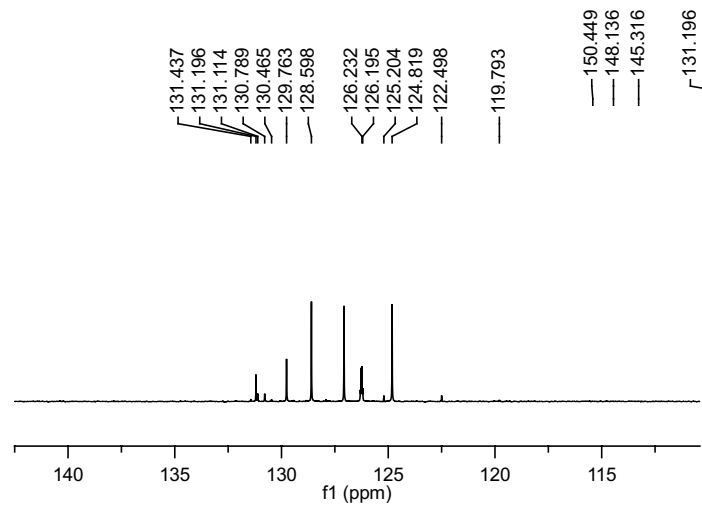
NMR spectra of compound 3fa

7.669
7.649
7.634
7.626
7.624
7.620
7.617
7.613
7.609
7.508
7.487
7.394
7.384
7.376
7.368
7.358
7.257
— 6.757

5.601
5.596
5.591
5.587
5.331
5.327
5.322
5.318



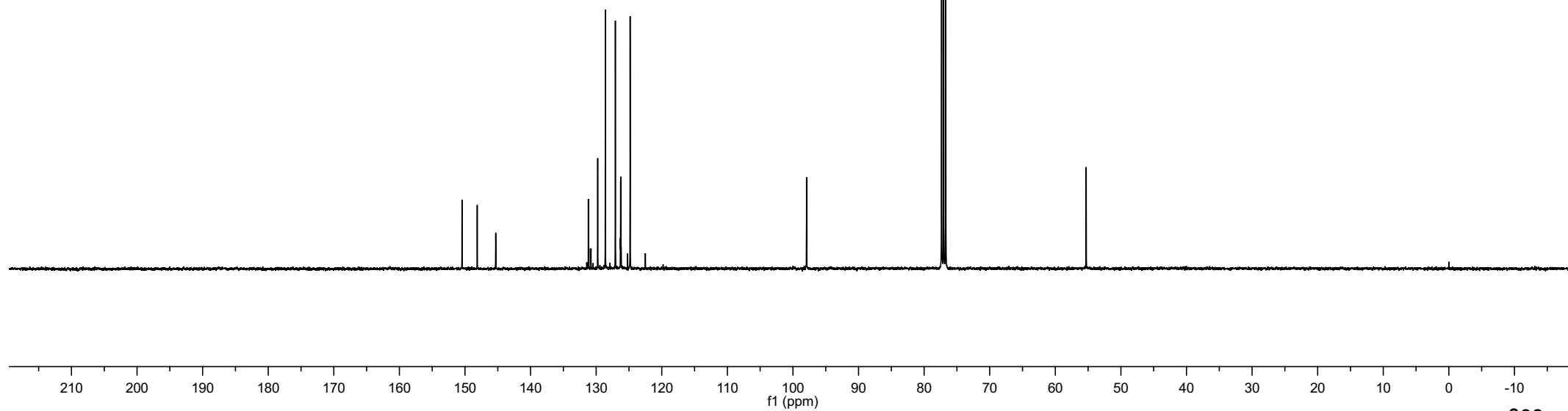
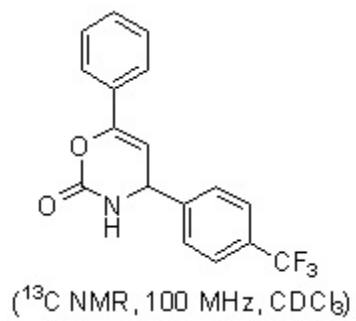
NMR spectra of compound 3fa



- 150.449
- 148.136
- 145.316
- 131.196
- 129.763
- 127.910
- 126.306
- 126.232
- 125.204
- 122.498
- 119.793

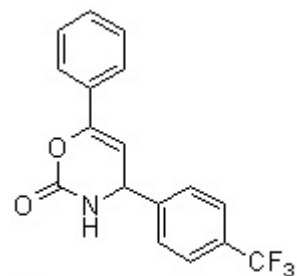
97.923

55.293

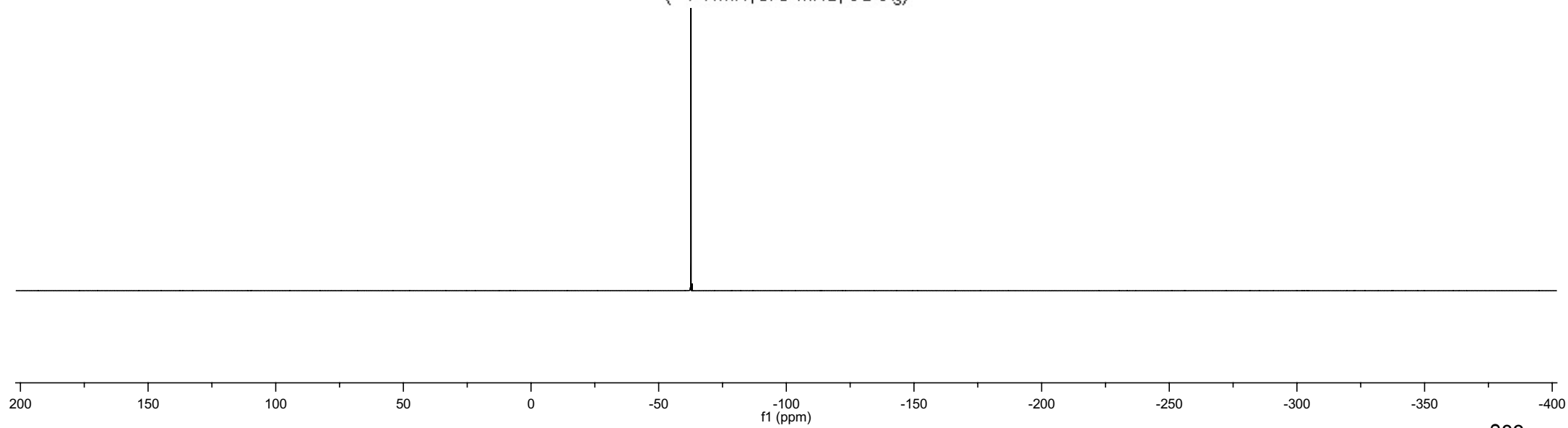


NMR spectra of compound 3fa

—62.650

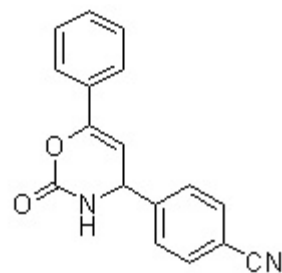


(¹⁹F NMR, 376 MHz, CDCl₃)

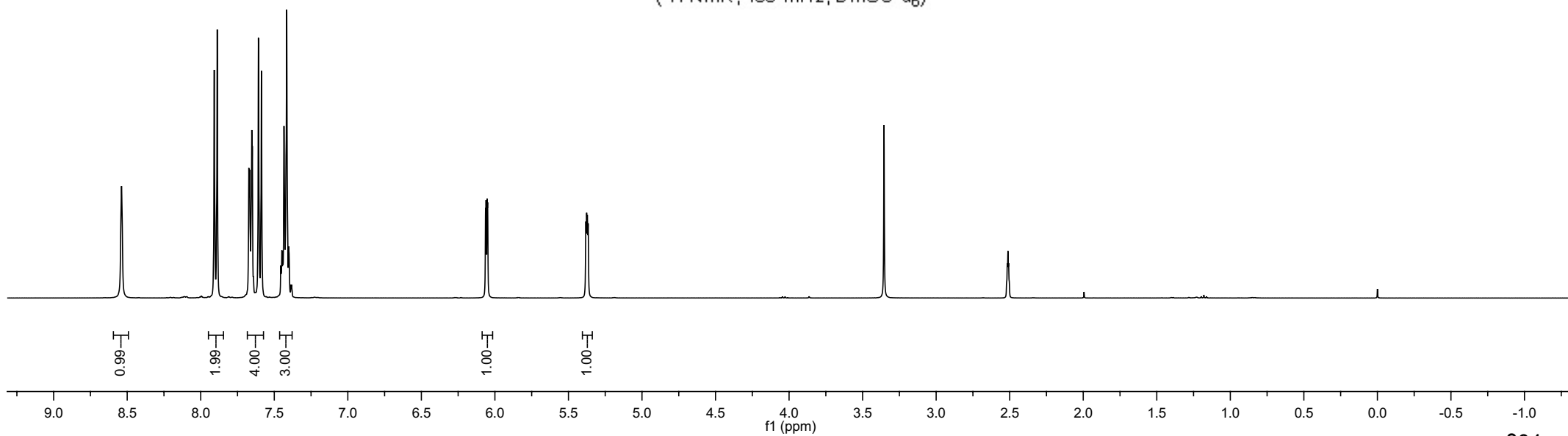


NMR spectra of compound **3ga**

8.538
 7.908
 7.888
 7.587
 7.456
 7.448
 7.443
 7.434
 7.416
 7.402
 6.063
 6.060
 6.053
 6.050
 5.381
 5.376
 5.371
 5.366



(¹H NMR, 400 MHz, DMSO-*d*₆)



NMR spectra of compound 3ga

148.987
147.876
146.652

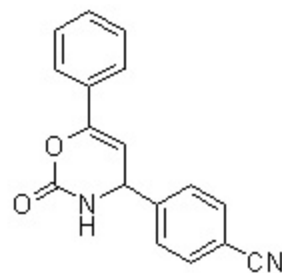
132.827
131.411
129.345
128.624
127.535
124.319

118.621

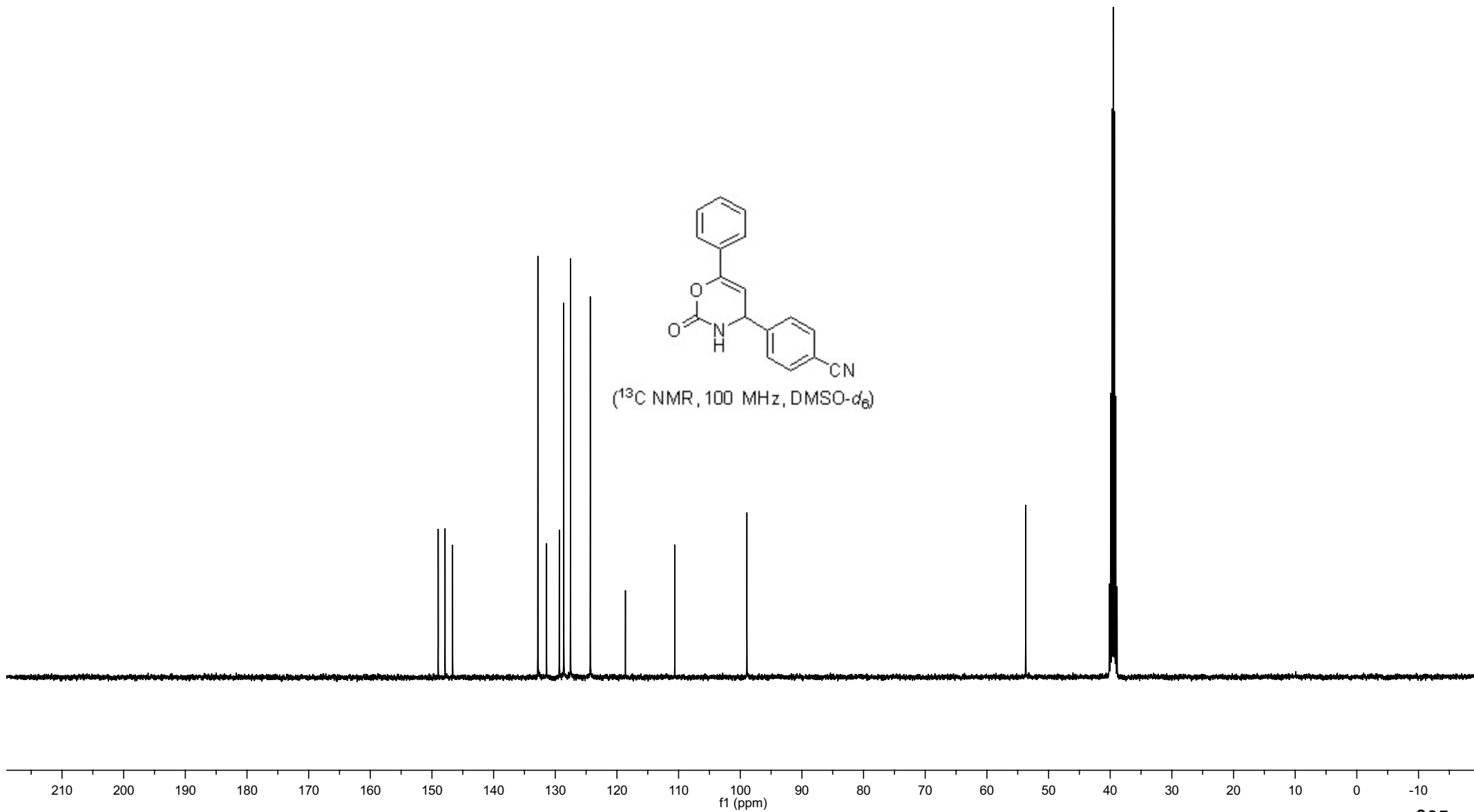
110.613

98.919

53.703



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3ha

8.392

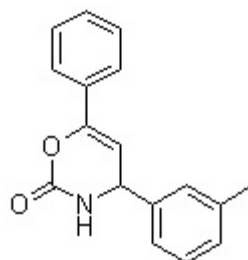
7.677
7.661
7.658
7.651

7.436
7.417
7.405
7.397
7.379
7.303
7.182
7.141

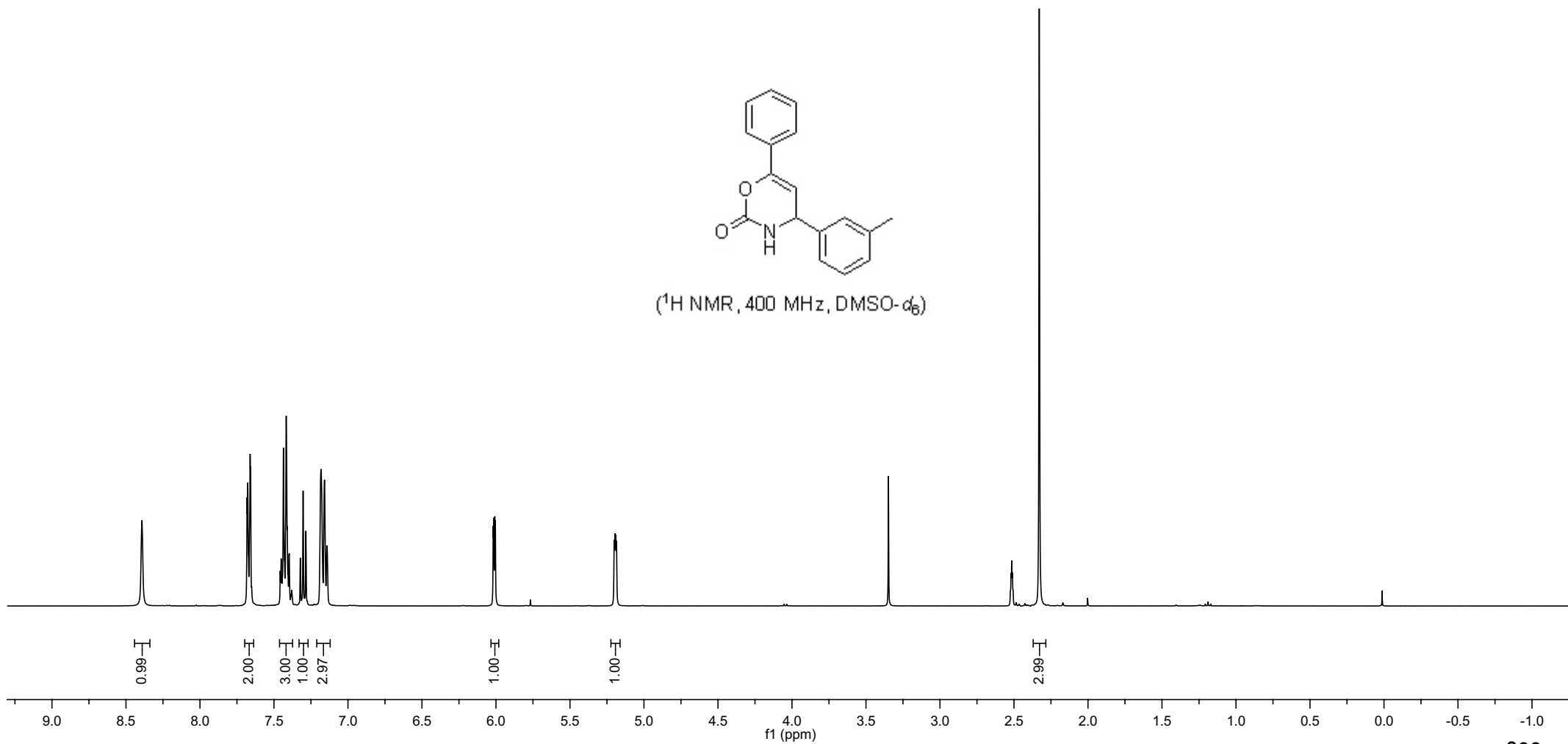
6.018
6.015
6.008
6.004

5.201
5.196
5.191
5.186

2.329

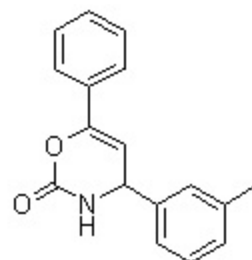


(¹H NMR, 400 MHz, DMSO-*d*₆)

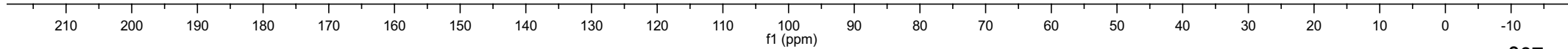


NMR spectra of compound 3ha

— 149.135
— 146.012
— 142.637
— 137.958
— 131.644
— 127.001
— 124.221
— 123.650
— 100.028
— 54.088
— 20.990



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3a

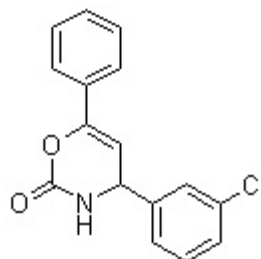
8.489

7.682
7.666
7.662
7.655

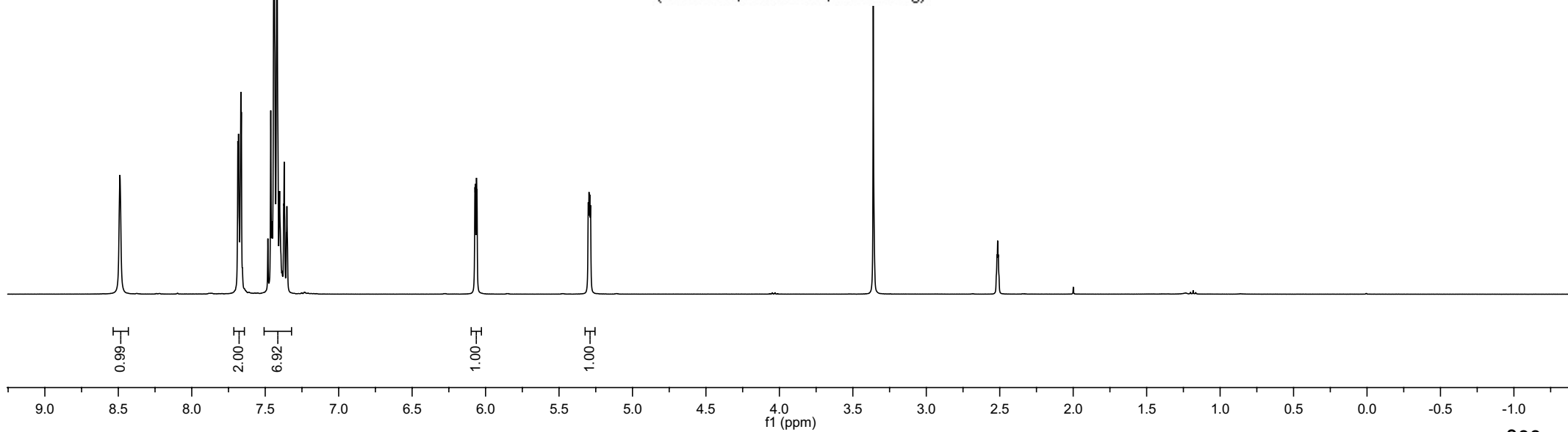
7.420
7.402
7.385
7.374
7.371
7.355
7.352

6.072
6.069
6.062
6.059

5.301
5.296
5.291
5.286



(¹H NMR, 400 MHz, DMSO-*d*₆)



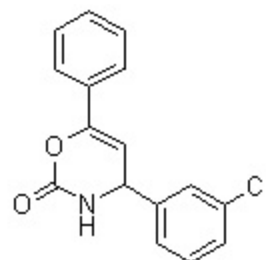
NMR spectra of compound 3a

149.006
146.439
145.066

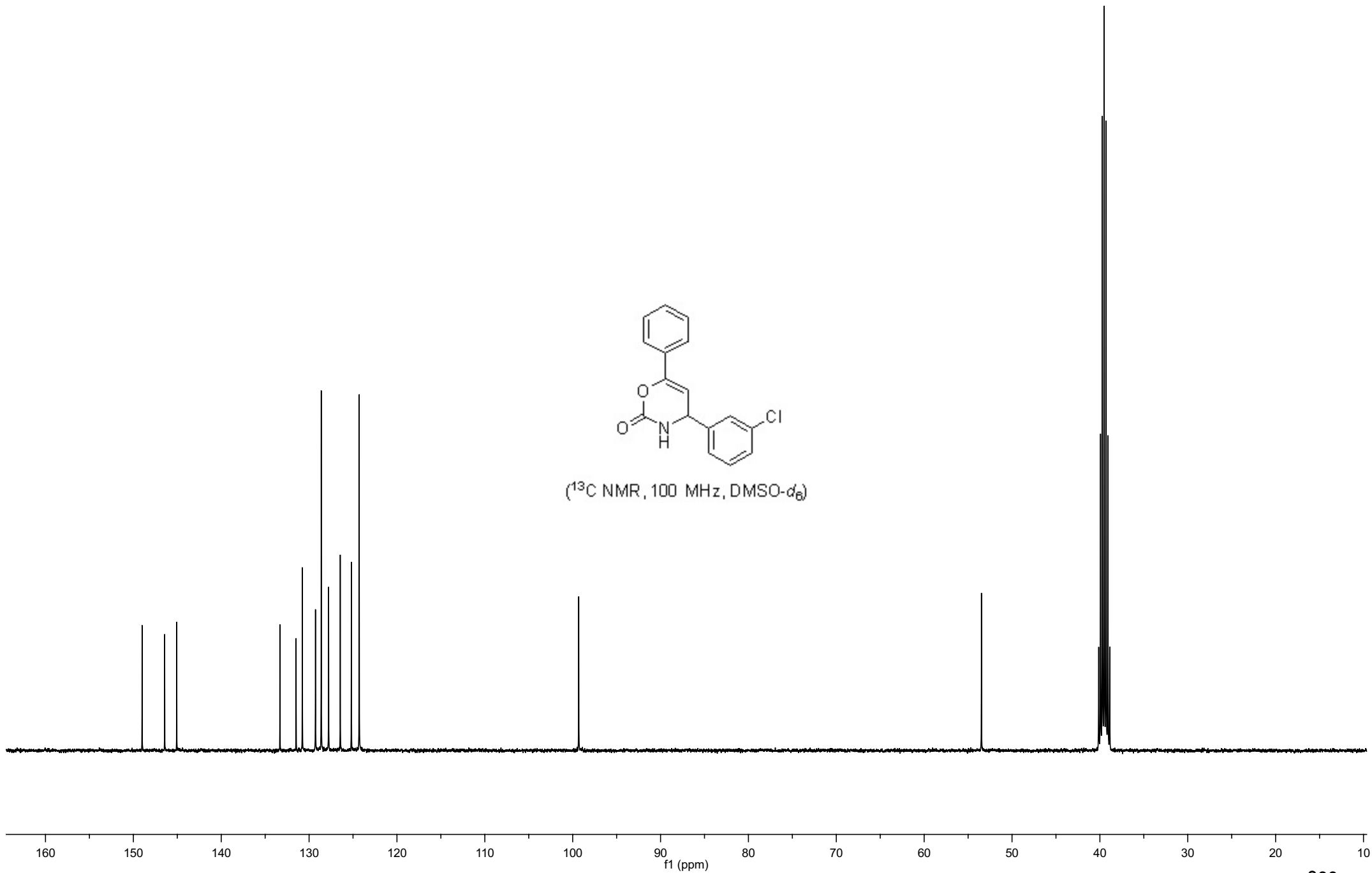
133.318
131.479
130.767
129.272
128.616
127.781
126.452
125.189
124.297

99.313

53.480



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3ja

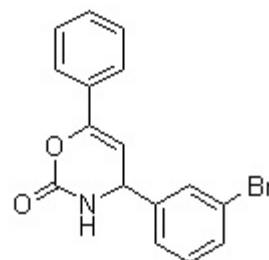
8.474
7.659
7.537
7.529
7.524
7.455
7.447
7.433
7.414
7.398
7.397
7.391
7.384

6.065
6.062
6.055
6.052

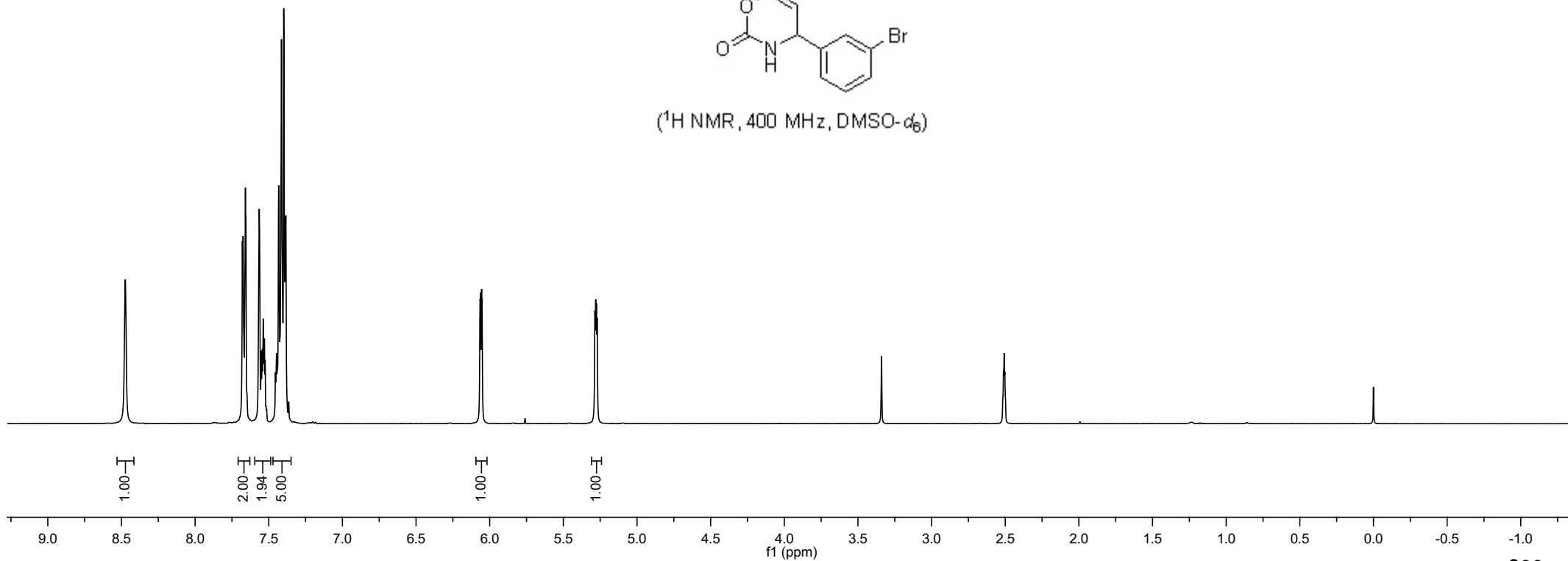
5.286
5.280
5.275
5.270

3.340

2.512
2.507
2.503



(¹H NMR, 400 MHz, DMSO-*d*₆)

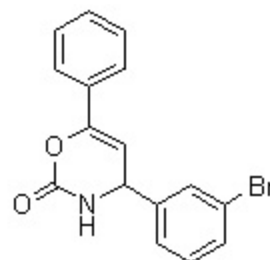


NMR spectra of compound 3j a

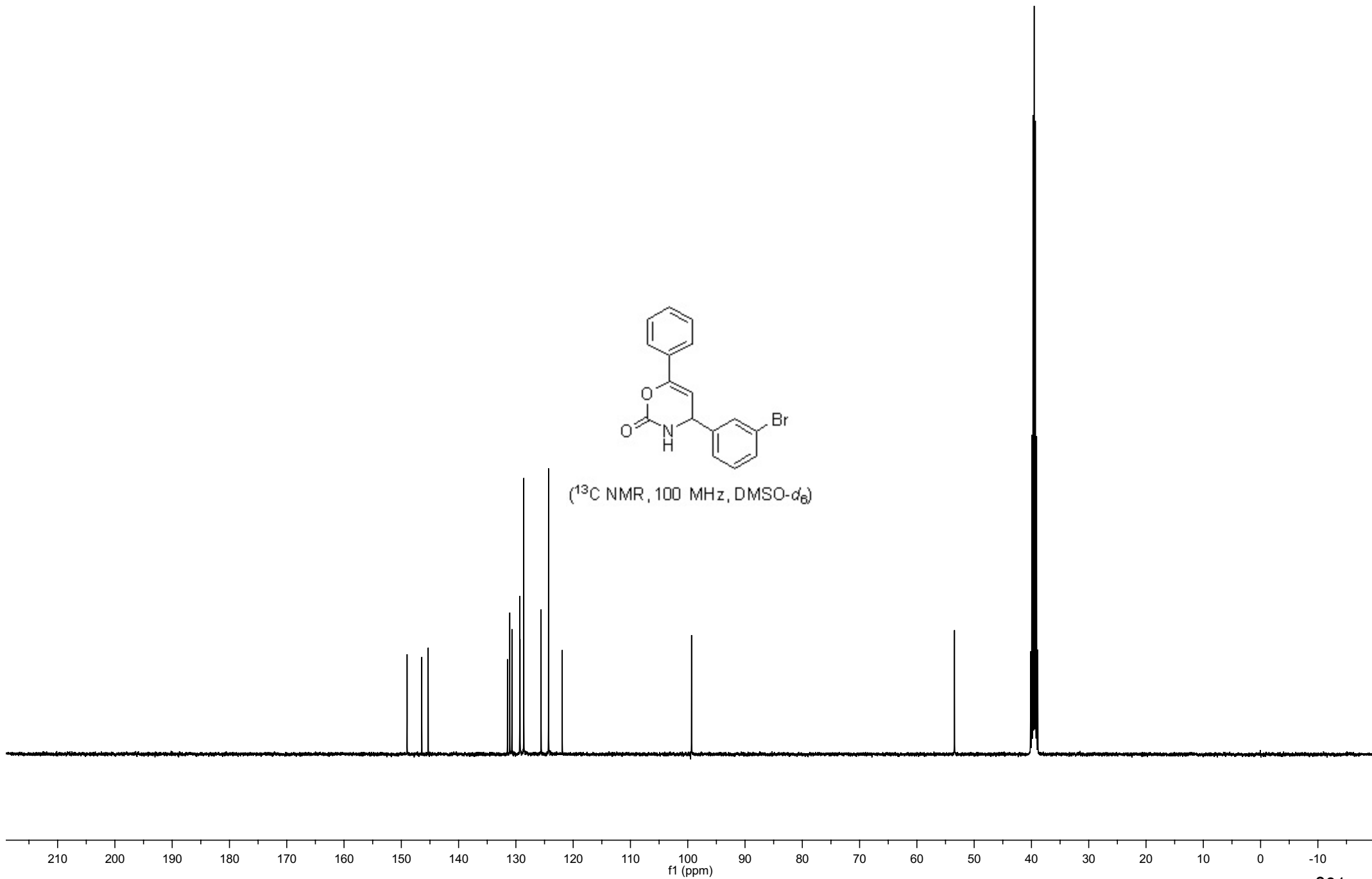
148.988
146.425
145.305
131.069
130.691
129.326
129.275
128.620
125.597
124.298
121.904

99.334

53.439



(¹³C NMR, 100 MHz, DMSO-*d*₆)



NMR spectra of compound 3ka

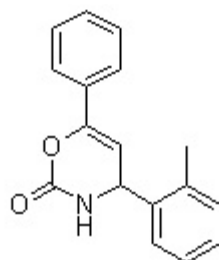
8.286

7.679
7.675
7.659
7.606
7.380
7.366
7.300
7.270
7.249
7.236
7.217
7.204

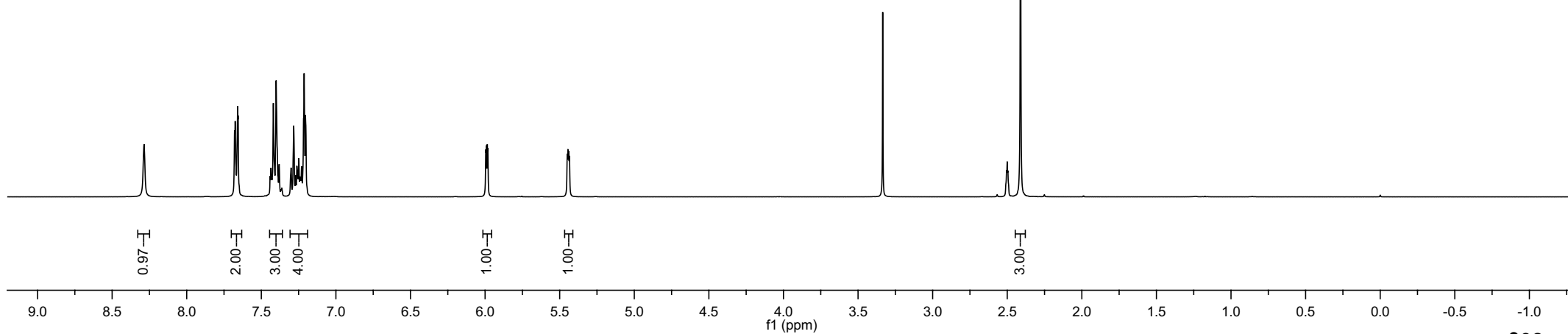
5.995
5.992
5.985
5.982

5.449
5.444
5.439
5.435

2.411



(¹H NMR, 400 MHz, DMSO-*d*₆)



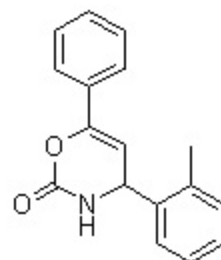
NMR spectra of compound 3ka

— 149.381
— 146.254
— 140.332
— 134.838
— 131.663
— 130.658
— 129.103
— 128.563
— 127.633
— 126.567
— 124.207

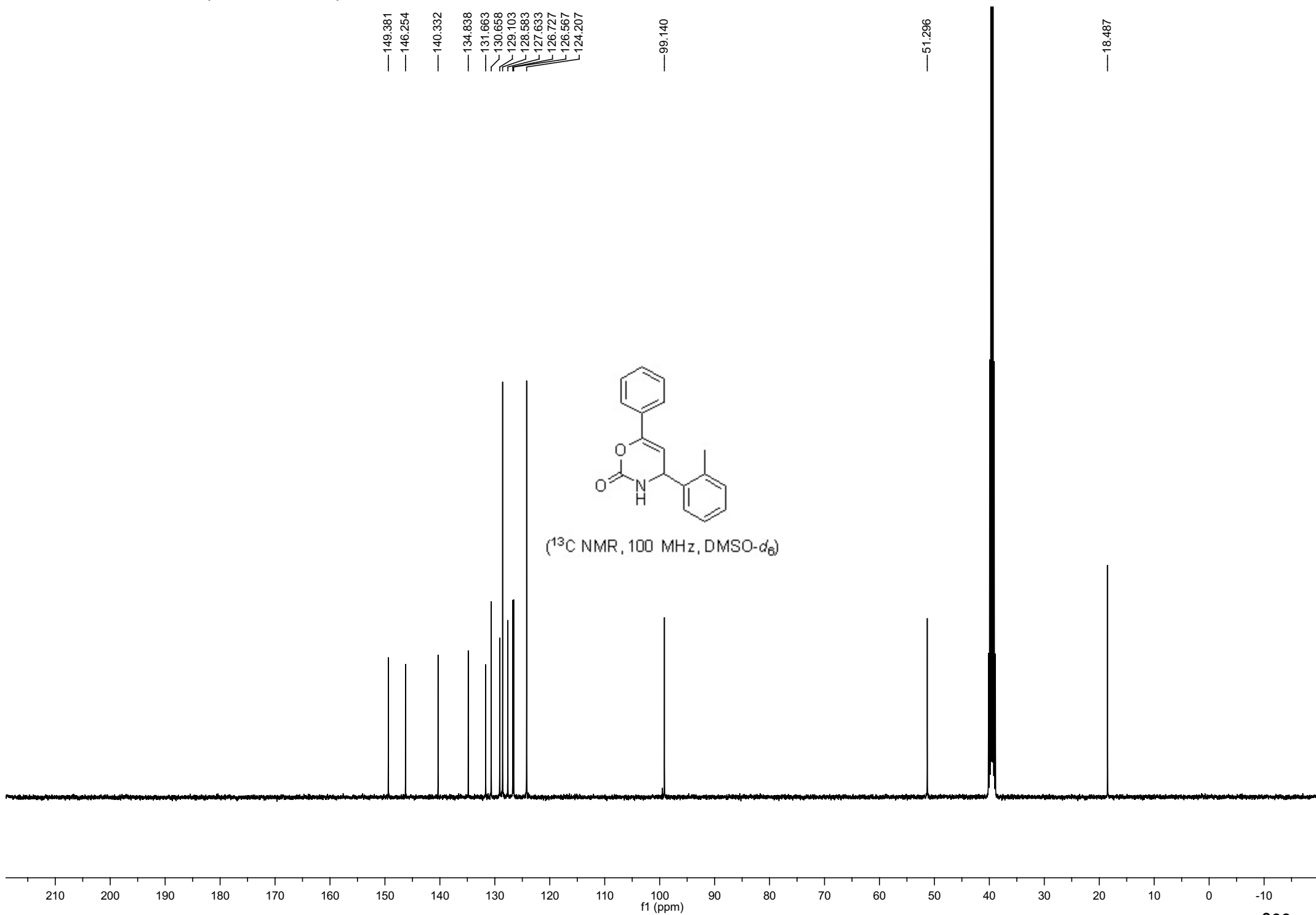
— 99.140

— 51.296

— 18.487



(¹³C NMR, 100 MHz, DMSO-*d*₆)



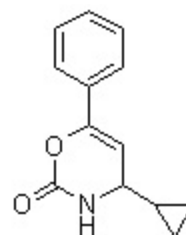
NMR spectra of compound 31a

7.667
7.661
7.657
7.651
7.647
7.643
7.405
7.396
7.391
7.383
7.367
7.364
7.355
7.350

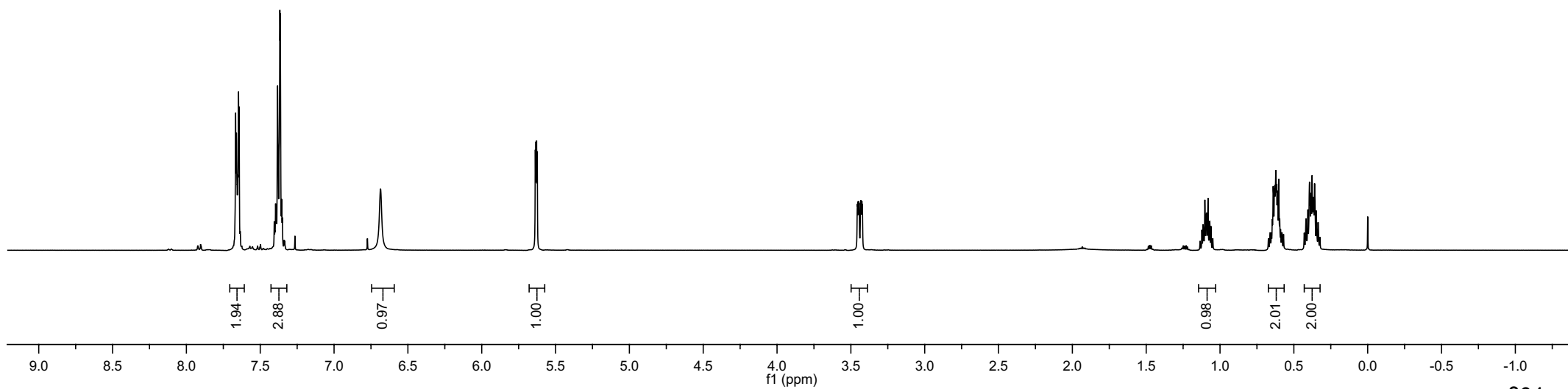
5.637
5.633
5.628
5.624

3.456
3.453
3.448
3.444
3.434
3.431
3.426
3.422

1.135
1.123
1.115
1.103
1.091
1.081
1.069
1.061
1.049
0.632
0.610
0.570
0.429
0.418
0.405
0.394
0.389
0.383
0.377
0.371
0.369
0.365
0.360
0.348
0.335
0.323



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 31a

— 149.186
— 145.992

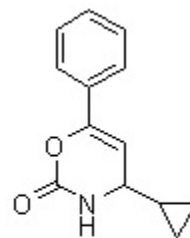
— 129.845
— 126.515
— 122.783

— 96.328

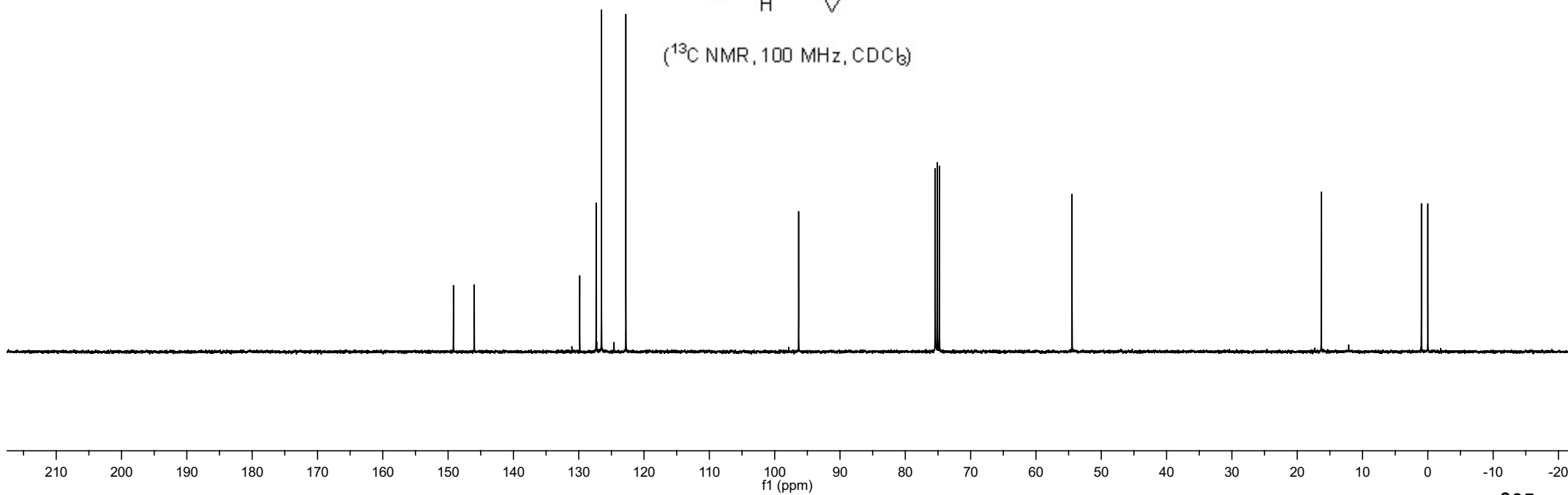
— 54.469

— 16.312

— 0.984
— -0.003



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 3ma

7.651
7.646
7.642
7.635
7.631
7.627
7.620

7.392
7.368
7.349
7.329

6.641

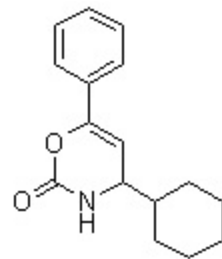
5.539
5.534
5.529
5.524

4.026
4.021
4.016
4.011
4.006
4.001

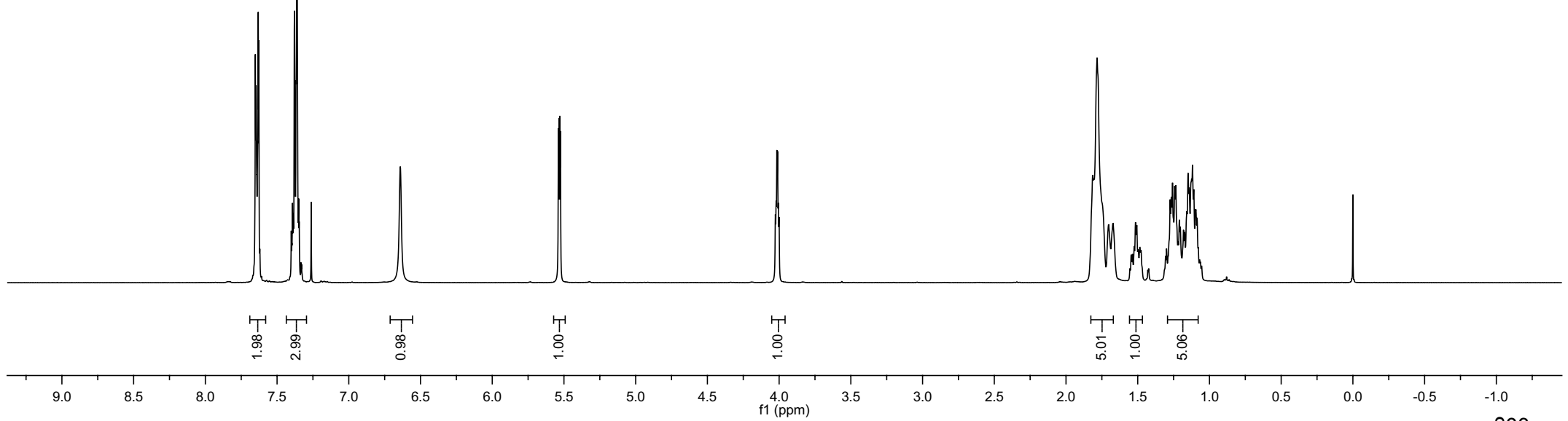
1.814
1.807
1.783
1.703
1.672

1.477

1.306
1.299
1.289
1.274
1.266
1.257
1.242
1.235
1.219
1.210
1.203
1.181
1.173
1.158
1.149
1.142
1.124
1.118
1.109
1.098
1.094
1.086
1.078
1.069
1.063
1.054



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 3ma

—151.977
—148.726

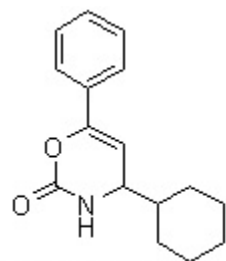
—131.871
—128.465
—124.661

—97.340

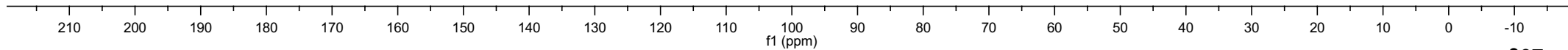
—56.235

—44.735

↙27.982
↘27.604
↙26.247
↘25.986



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 3na

7.646
7.641
7.636
7.630
7.622
7.379
7.378
7.361
— 6.996

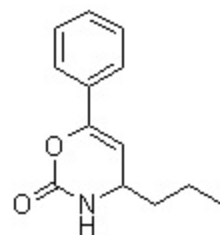
5.547
5.543
5.538
5.534

4.213
4.200

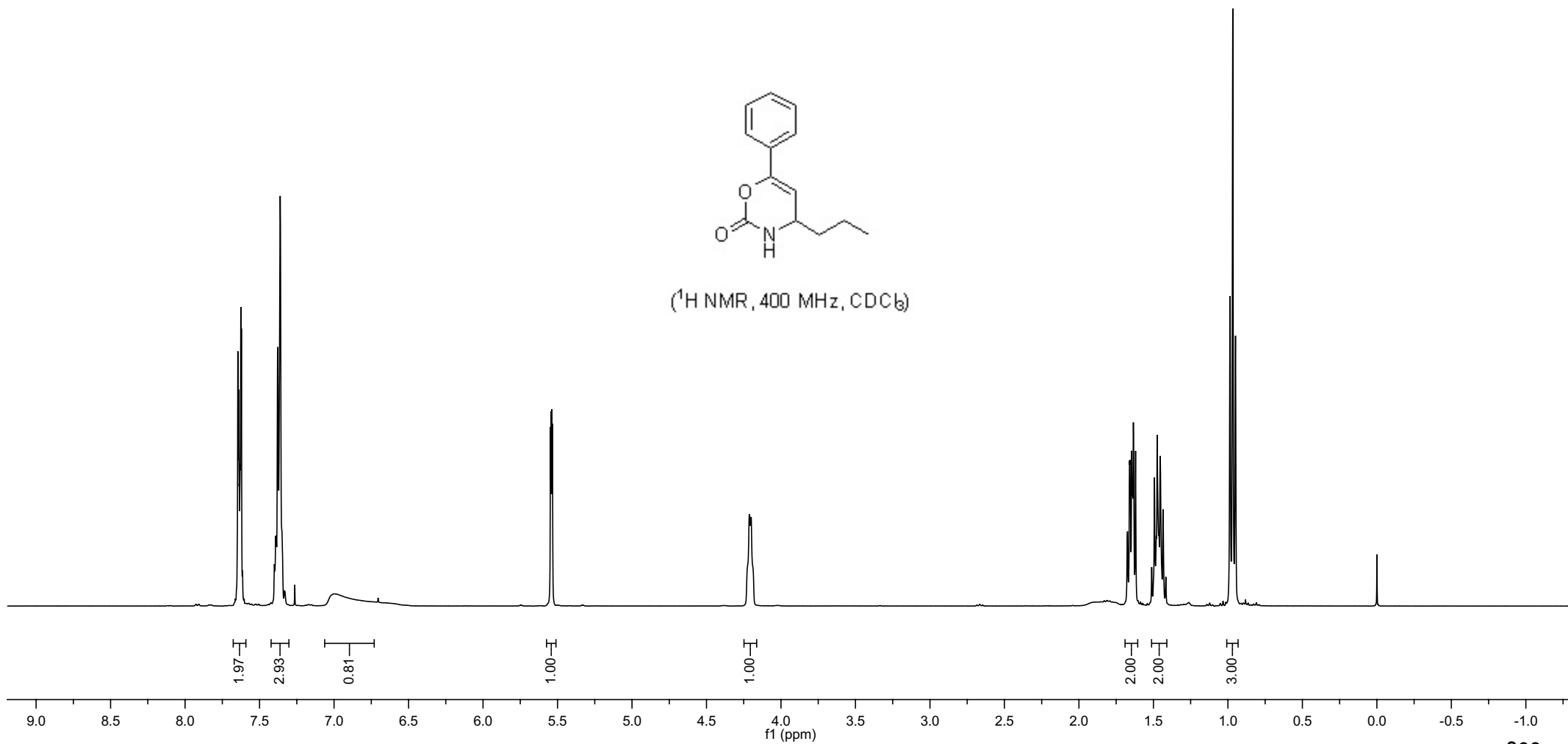
1.674
1.660
1.658
1.646
1.643
1.639
1.634
1.620

1.474
1.454
1.417

0.985
0.967
0.949



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 3na

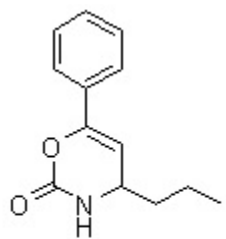
— 151.886
— 148.084

— 131.831
— 128.470
— 124.644

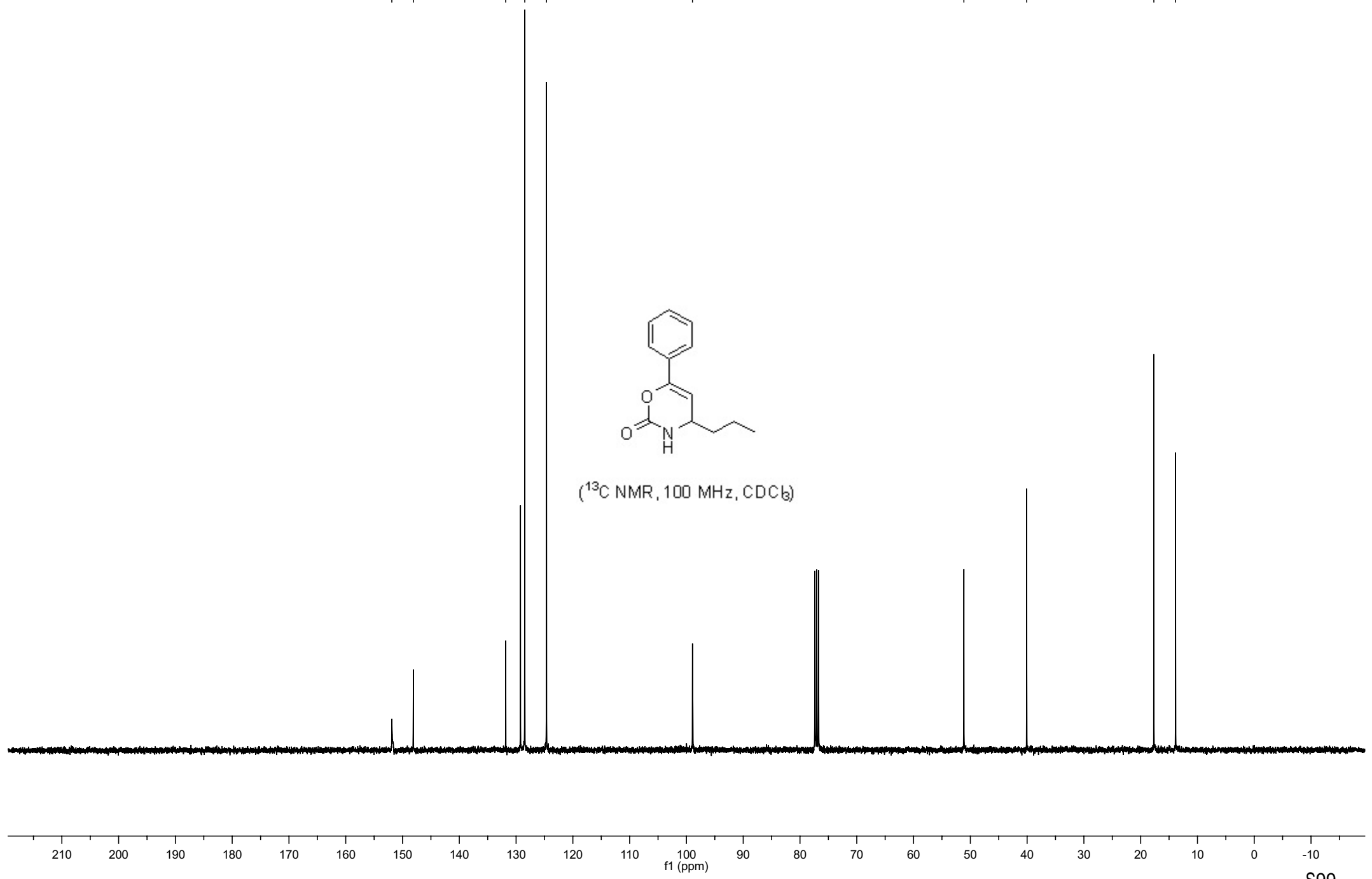
— 98.933

— 51.138
— 40.074

— 17.678
— 13.860



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 30a

7.654
7.649
7.644
7.638
7.634
7.630
7.385
7.369
7.366
7.358
7.353

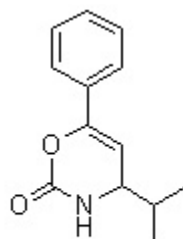
6.621

5.520
5.516
5.511
5.506

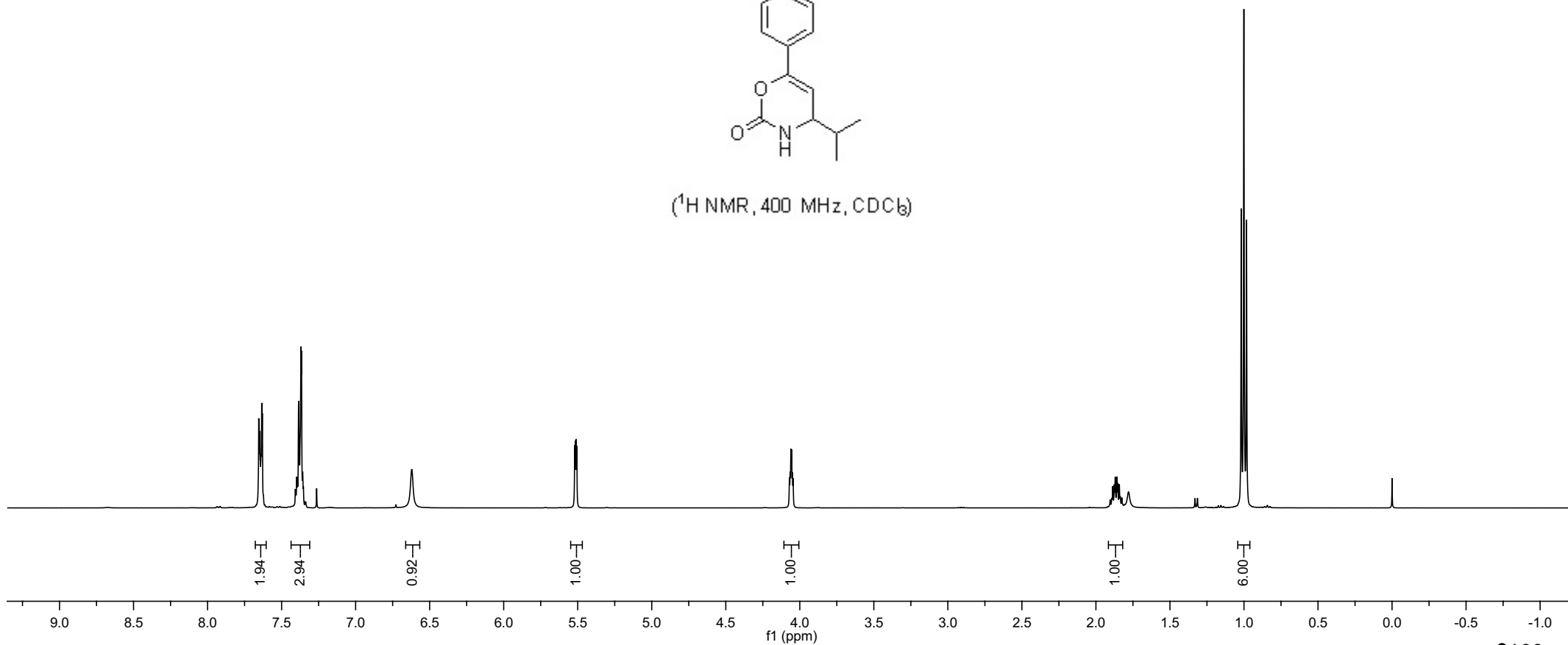
4.070
4.065
4.060
4.055
4.050
4.045

1.904
1.893
1.887
1.876
1.870
1.859
1.852
1.842
1.835
1.825

1.019
1.001
0.983



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 30a

— 151.945
— 148.971

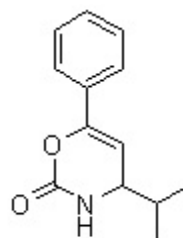
— 131.827
— 128.478
— 124.680

— 96.849

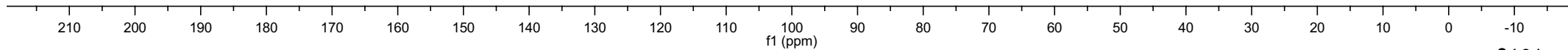
— 56.808

— 34.604

— 17.313
— 17.055



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 3pa

7.645
7.640
7.625
7.621

7.383
7.367
7.364
7.355
7.351

6.509

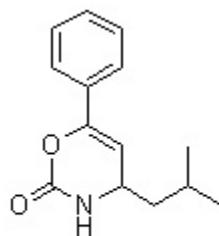
5.568
5.564
5.559
5.555

4.255
4.251
4.246
4.235
4.230
4.226
4.217
4.213
4.208

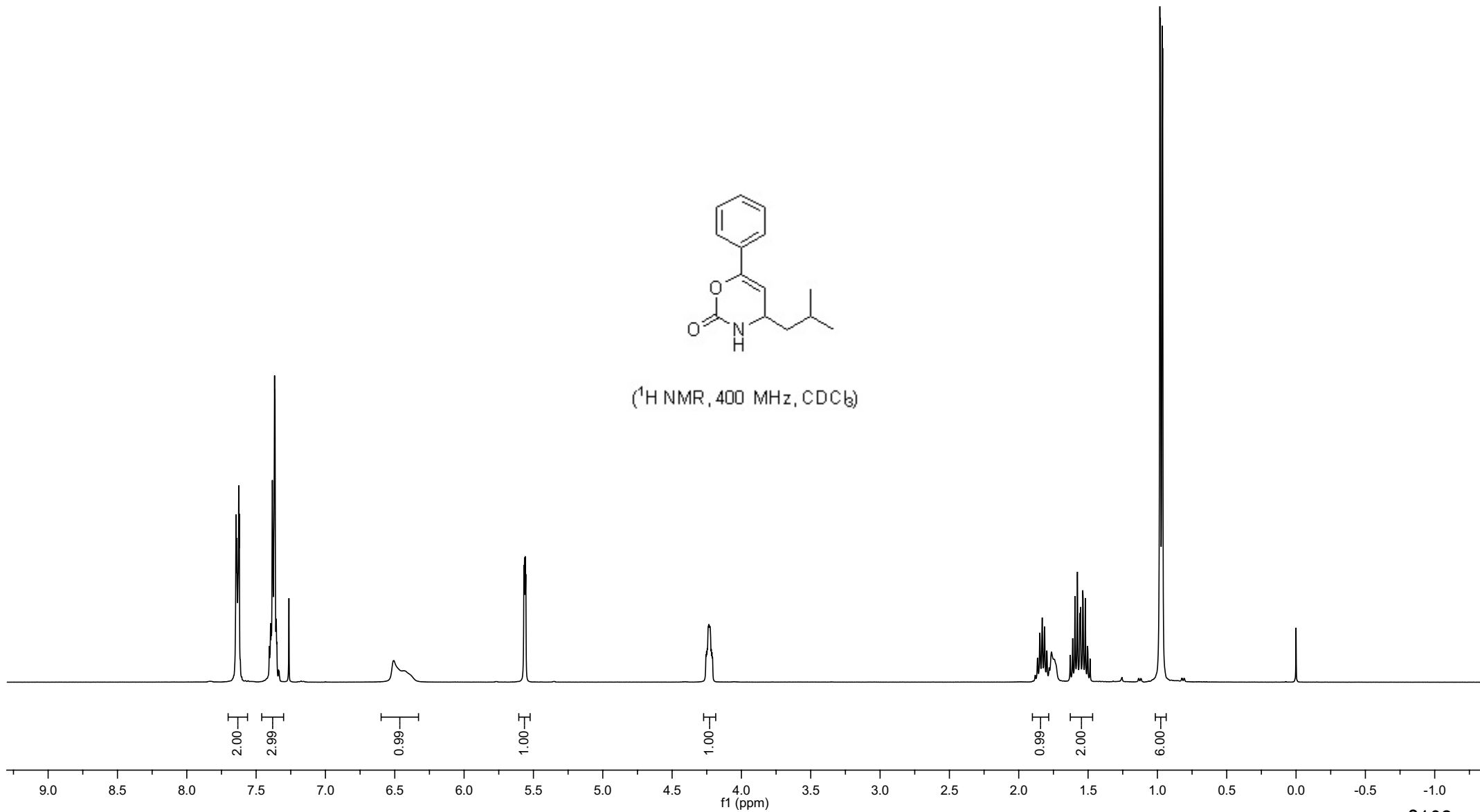
1.881
1.864
1.848
1.831
1.814
1.797
1.780

1.577
1.538
1.485

0.982
0.979
0.966
0.962



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 3pa

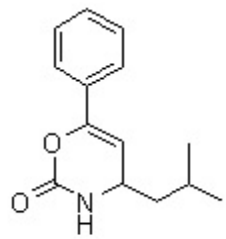
151.442
151.387
147.954

131.845
128.484
124.668

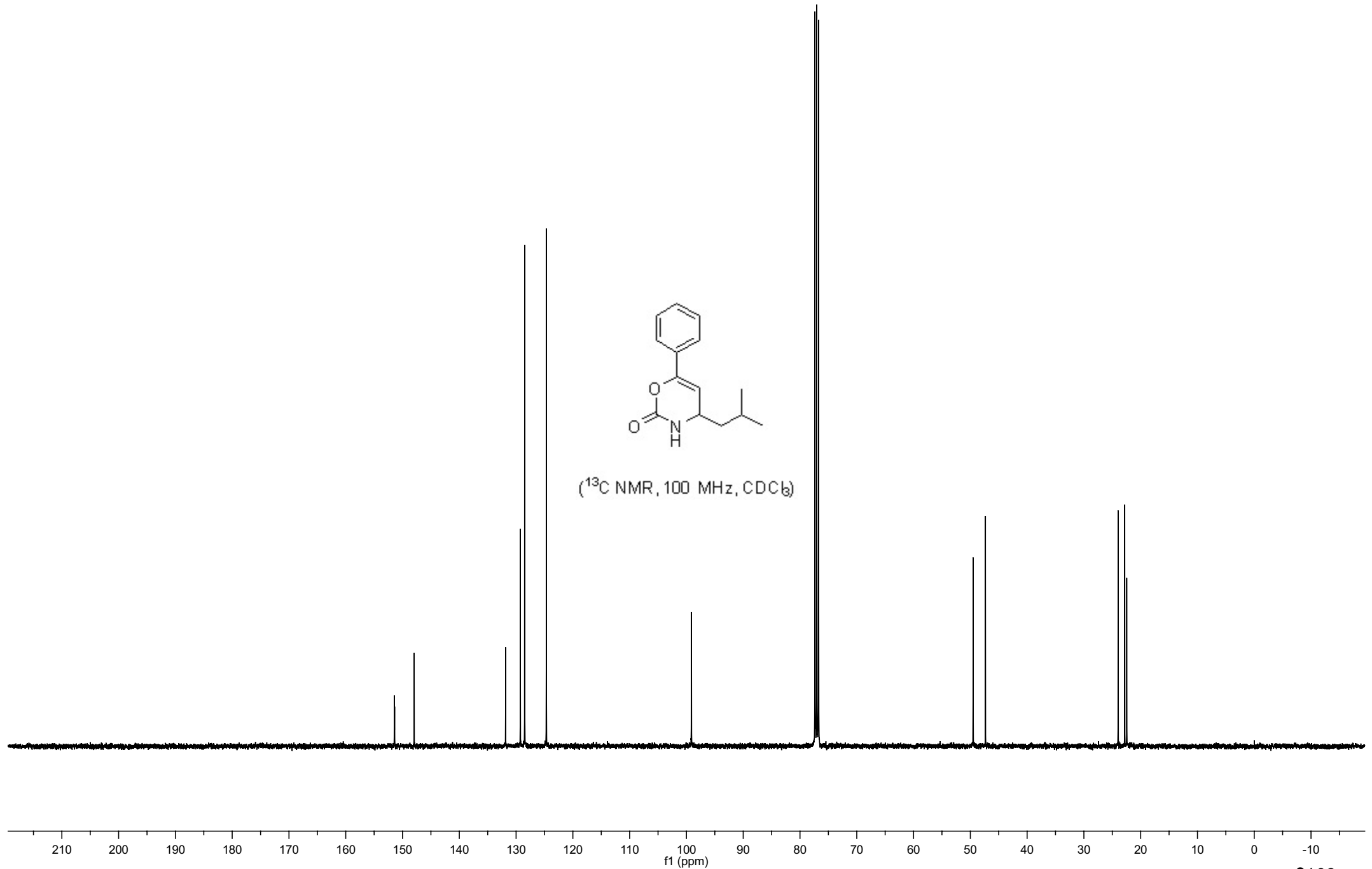
99.129

49.509
47.341

23.966
22.810
22.456



(¹³C NMR, 100 MHz, CDCl₃)



NMR spectra of compound 3qa

7.624
7.618
7.615
7.613
7.604
7.600
7.592

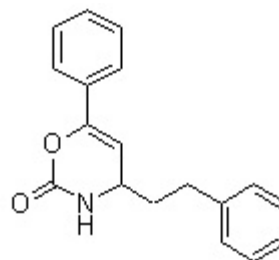
7.370
7.293
7.208
7.165
6.897

5.530
5.526
5.521
5.517

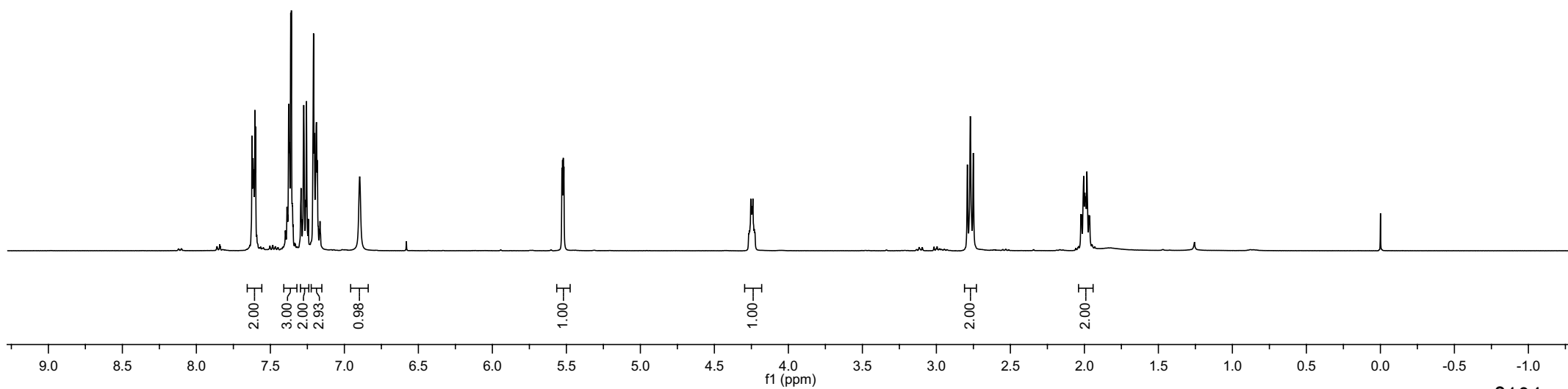
4.268
4.263
4.254
4.249
4.244
4.240
4.230
4.226

2.791
2.771
2.751

2.023
2.019
2.004
1.997
1.992
1.983
1.969
1.964

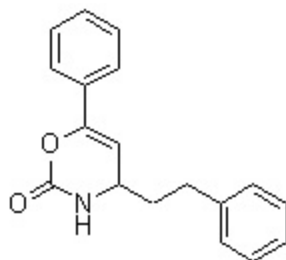


(¹H NMR, 400 MHz, DMSO-d₆)

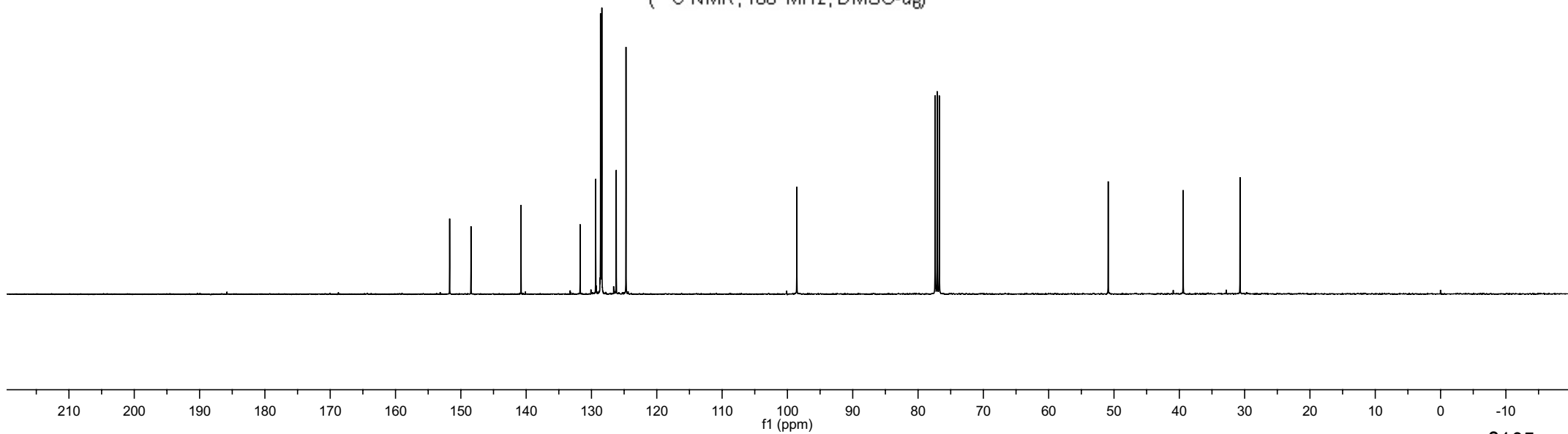


NMR spectra of compound 3qa

- 151.712
- 148.449
- 140.789
- 131.733
- 129.356
- 128.616
- 128.514
- 128.408
- 126.207
- 124.713
- 98.563
- 50.887
- 39.415
- 30.707

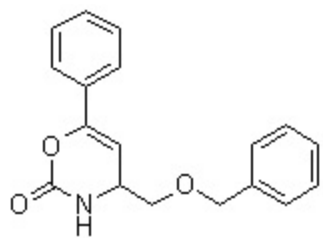


(¹³C NMR, 100 MHz, DMSO-d₆)

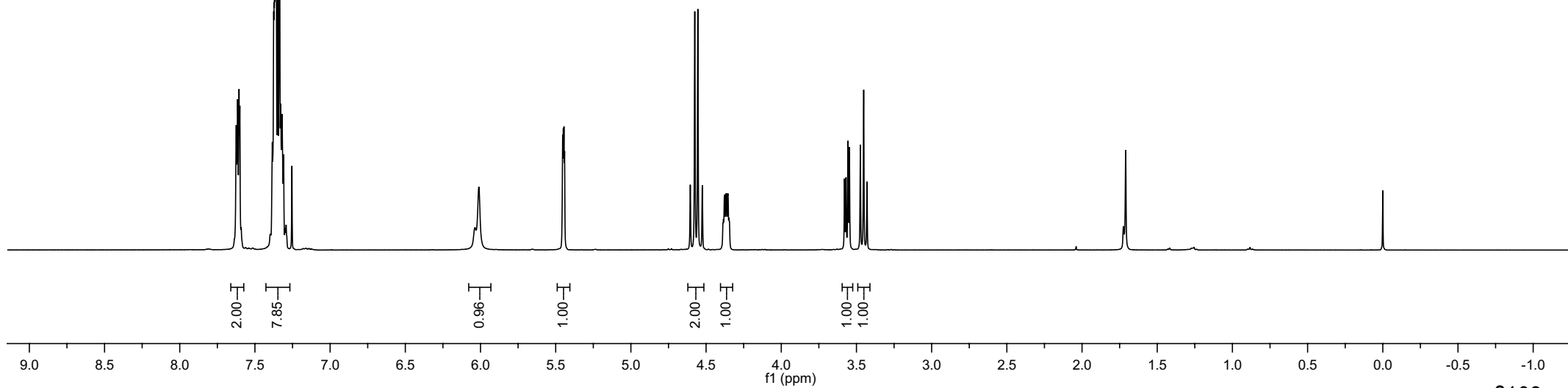


NMR spectra of compound 3ra

7.625, 7.615, 7.606, 7.600, 7.591, 7.384, 7.372, 7.364, 7.349, 7.329, 7.309, 7.293, 6.037, 6.011, 5.454, 5.449, 5.445, 5.441, 4.605, 4.575, 4.555, 4.525, 4.375, 4.357, 4.348, 3.579, 3.570, 3.557, 3.547, 3.474, 3.452, 3.429



(¹H NMR, 400 MHz, CDCl₃)



NMR spectra of compound 3sa

8.609

7.687

7.683

7.667

7.654

7.418

7.111

7.110

7.041

7.032

7.028

7.019

6.106

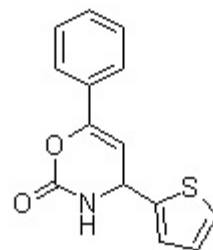
6.096

5.554

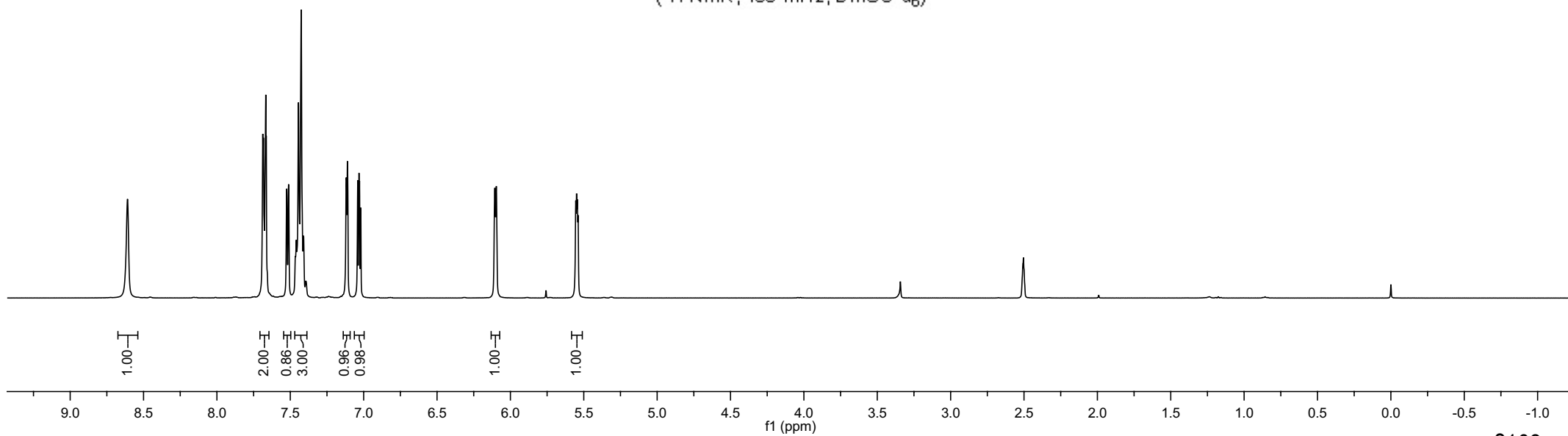
5.549

5.544

5.539



(¹H NMR, 400 MHz, DMSO-*d*₆)



NMR spectra of compound 3sa

