

Chirality Extension of an Oxazine Building Block En Route to Total Syntheses of (+)-Hyacinthacine A₂ and Sphingofungin B

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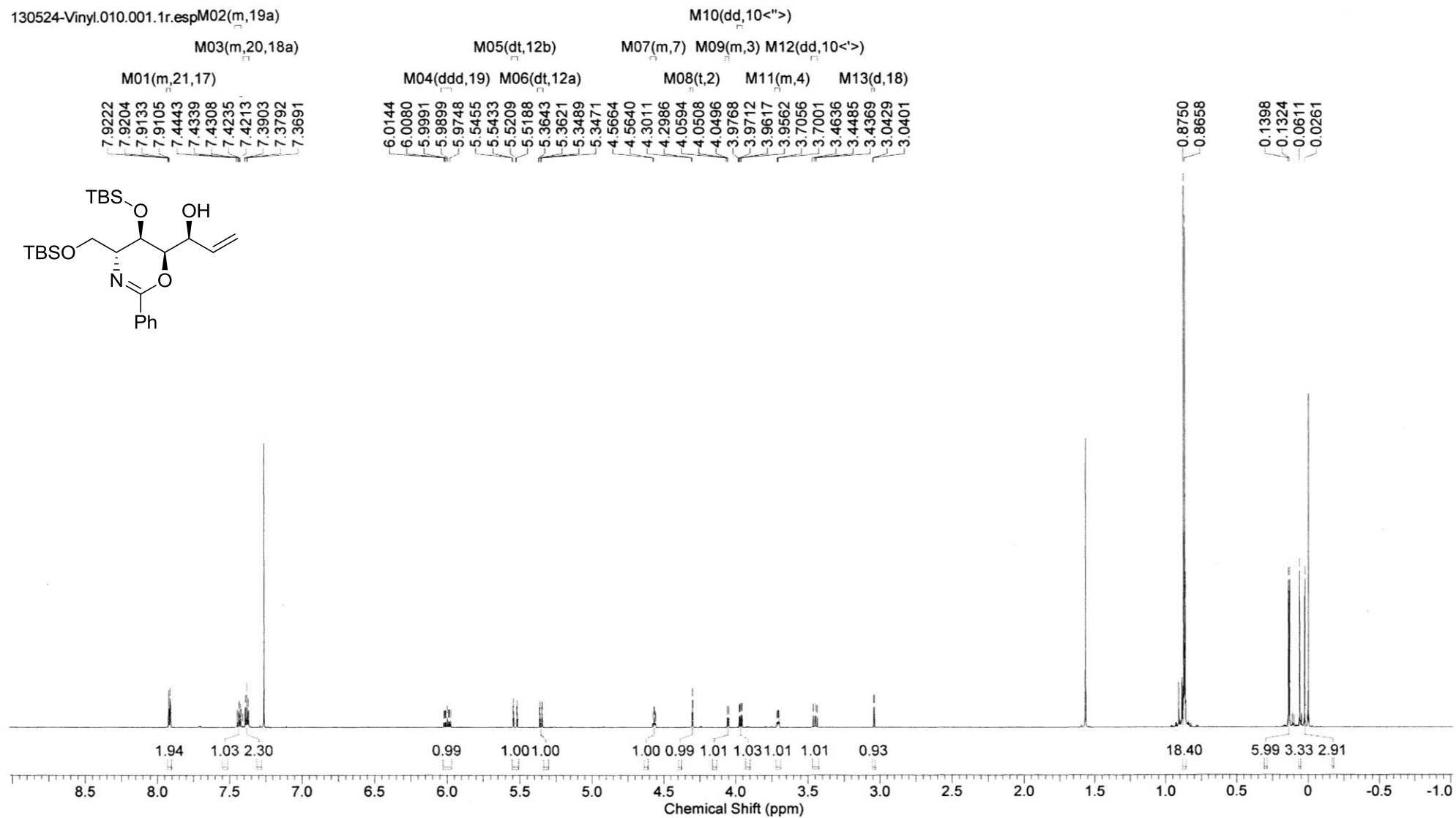
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whham@skku.edu

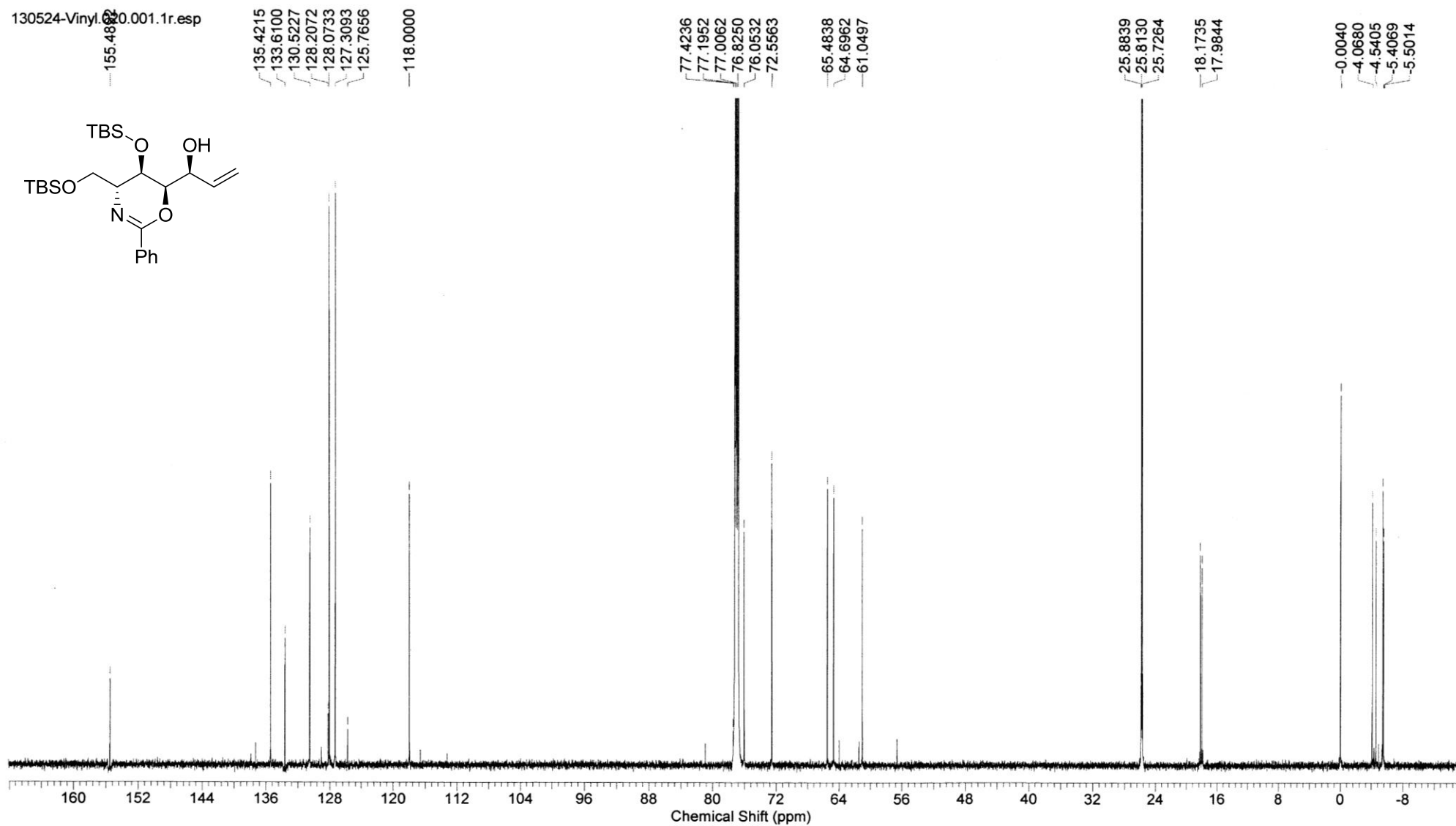
Supporting information

S2 ¹ H NMR of <i>syn</i> -5a	S28 ¹ H NMR of precursor of 8
S3 ¹³ C NMR of <i>syn</i> -5a	S29 ¹³ C NMR of precursor of 8
S4 ¹ H NMR of <i>anti</i> -5a	S30 ¹ H NMR of 8
S5 ¹³ C NMR of <i>anti</i> -5a	S31 ¹³ C NMR of 8
S6 NOESY of <i>trans</i> -6	S32 ¹ H NMR of 7
S7 NOESY of <i>cis</i> -6	S33 ¹³ C NMR of 7
S8 ¹ H NMR of <i>syn</i> -5b	S34 ¹ H NMR of 9
S9 ¹³ C NMR of <i>syn</i> -5b	S35 ¹³ C NMR of 9
S10 ¹ H NMR of <i>anti</i> -5b	S36 ¹ H NMR of 1
S11 ¹³ C NMR of <i>anti</i> -5b	S37 ¹³ C NMR of 1
S12 ¹ H NMR of <i>syn</i> -5c	S38 Comparison of reported NMR data with those of 1
S13 ¹³ C NMR of <i>syn</i> -5c	S39 ¹ H NMR of 13
S14 ¹ H NMR of <i>anti</i> -5c	S40 ¹³ C NMR of 13
S15 ¹³ C NMR of <i>anti</i> -5c	S41 ¹ H NMR of 14
S16 ¹ H NMR of <i>syn</i> -5d	S42 ¹³ C NMR of 14
S17 ¹³ C NMR of <i>syn</i> -5d	S43 ¹ H NMR of 15
S18 ¹ H NMR of <i>anti</i> -5d	S44 ¹³ C NMR of 15
S19 ¹³ C NMR of <i>anti</i> -5d	S45 ¹ H NMR of 16
S20 ¹ H NMR of <i>syn</i> -5e	S46 ¹³ C NMR of 16
S21 ¹³ C NMR of <i>syn</i> -5e	S47 ¹ H NMR of 17
S22 ¹ H NMR of <i>anti</i> -5e	S48 ¹³ C NMR of 17
S23 ¹³ C NMR of <i>anti</i> -5e	S49 ¹ H NMR of 2
S24 ¹ H NMR of <i>syn</i> -5f	S50 ¹³ C NMR of 2
S25 ¹³ C NMR of <i>syn</i> -5f	S51 Comparison of reported NMR data with those of 2
S26 ¹ H NMR of <i>anti</i> -5f	
S27 ¹³ C NMR of <i>anti</i> -5f	

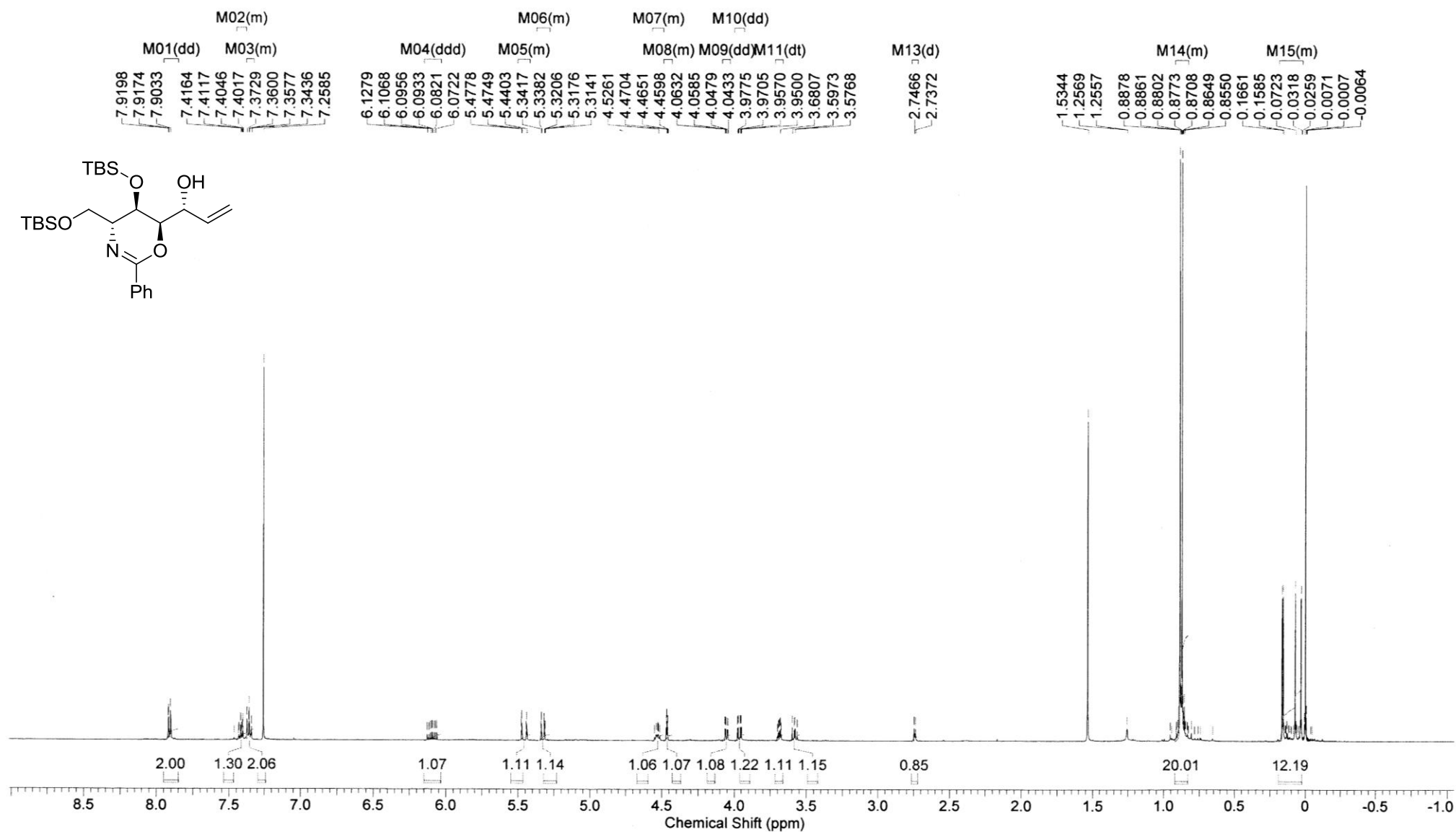
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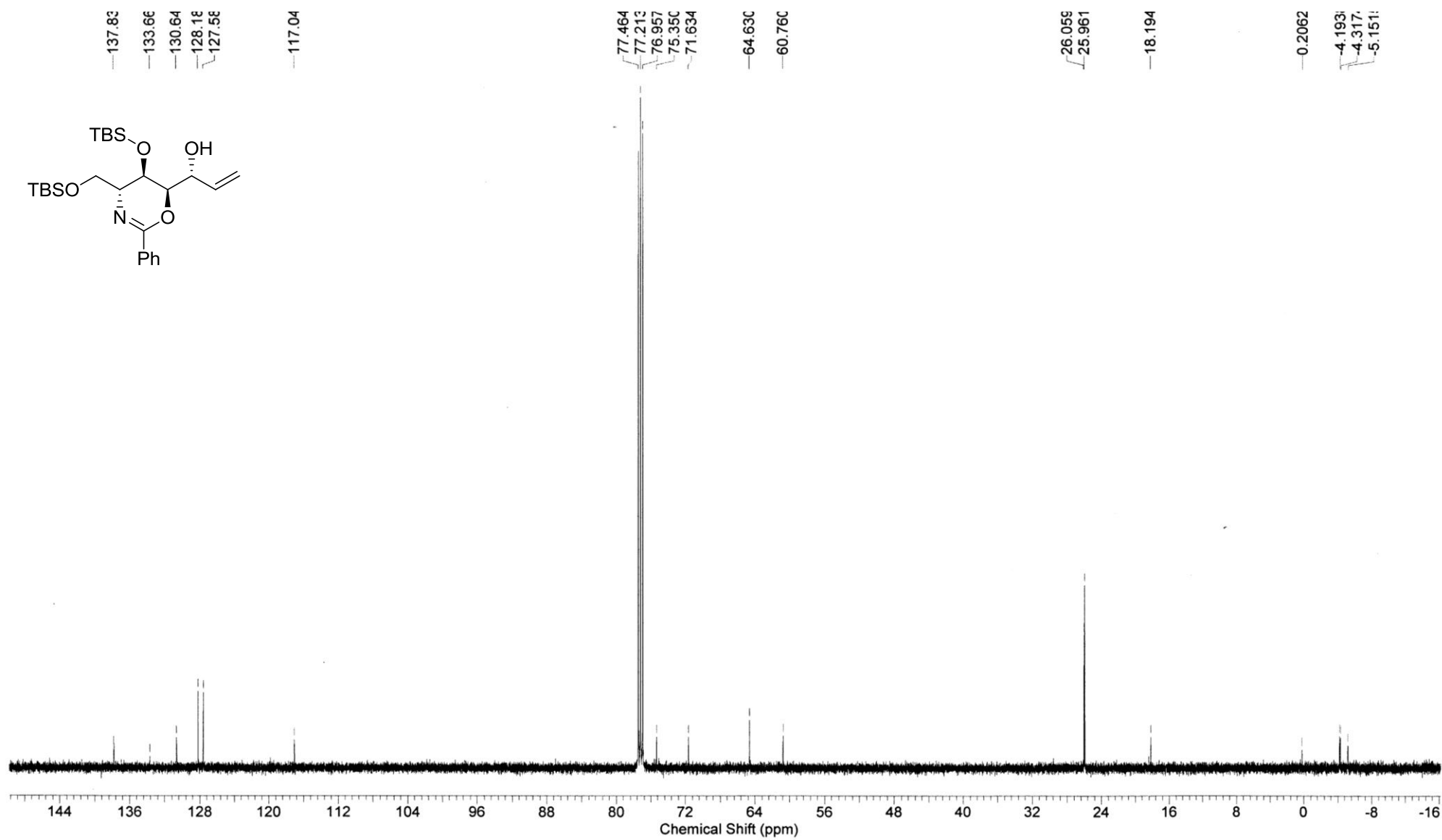
syn-5a (175 MHz, CDCl₃)



anti-5a (500 MHz, CDCl₃)

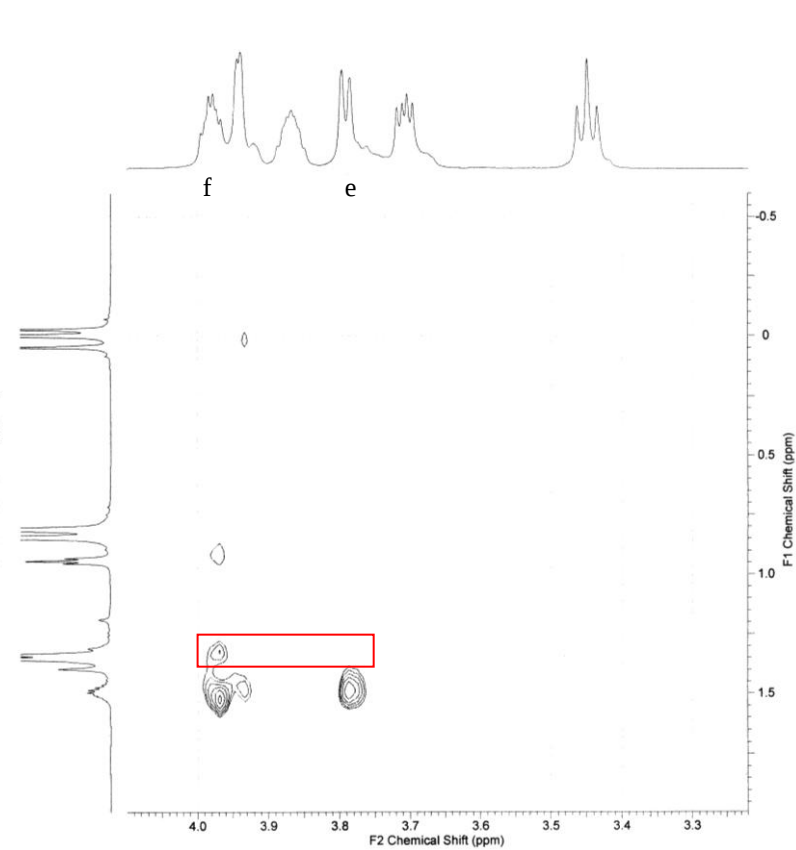
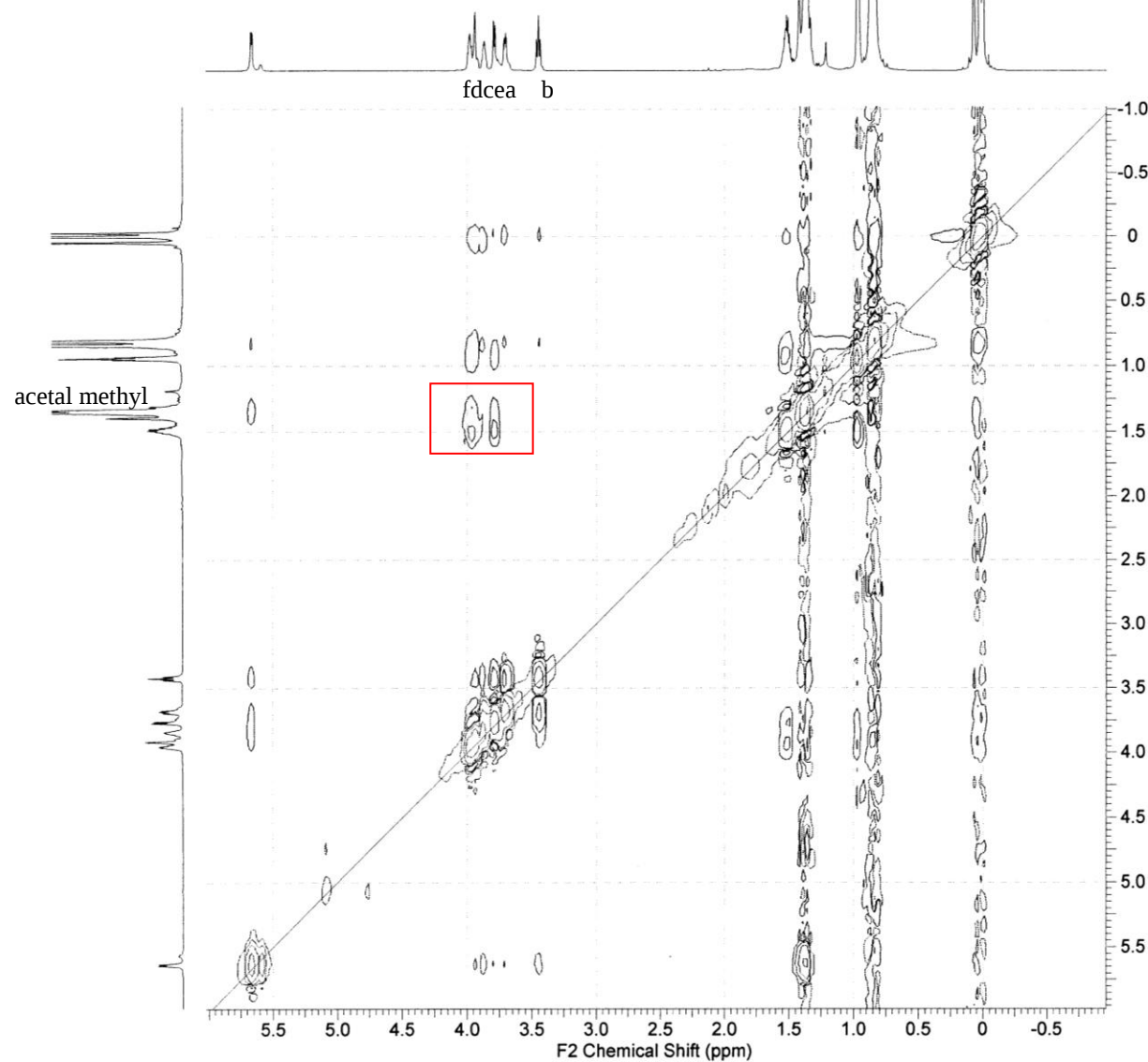
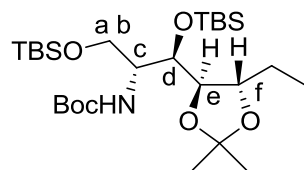


anti-5a (125 MHz, CDCl₃)



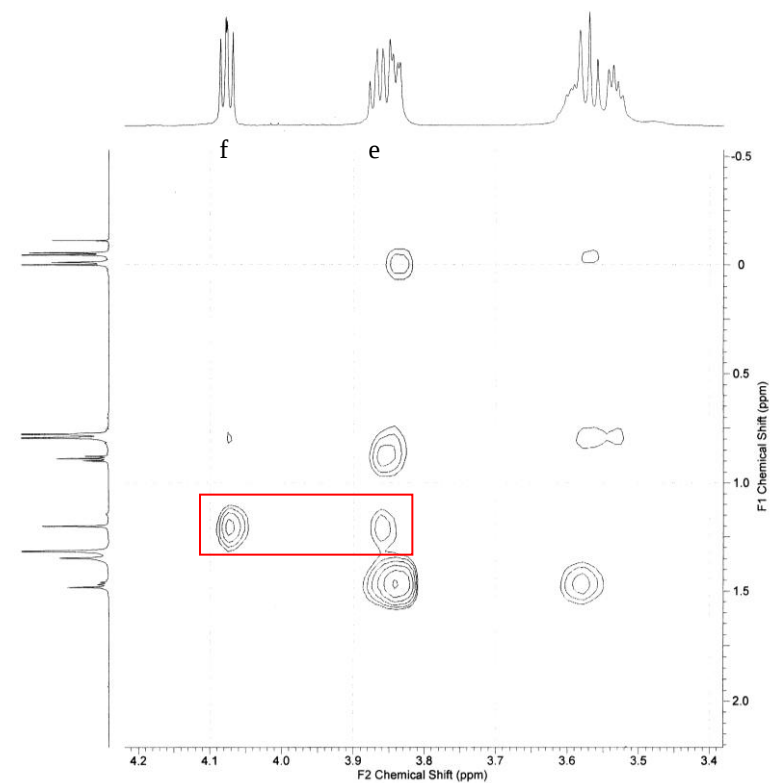
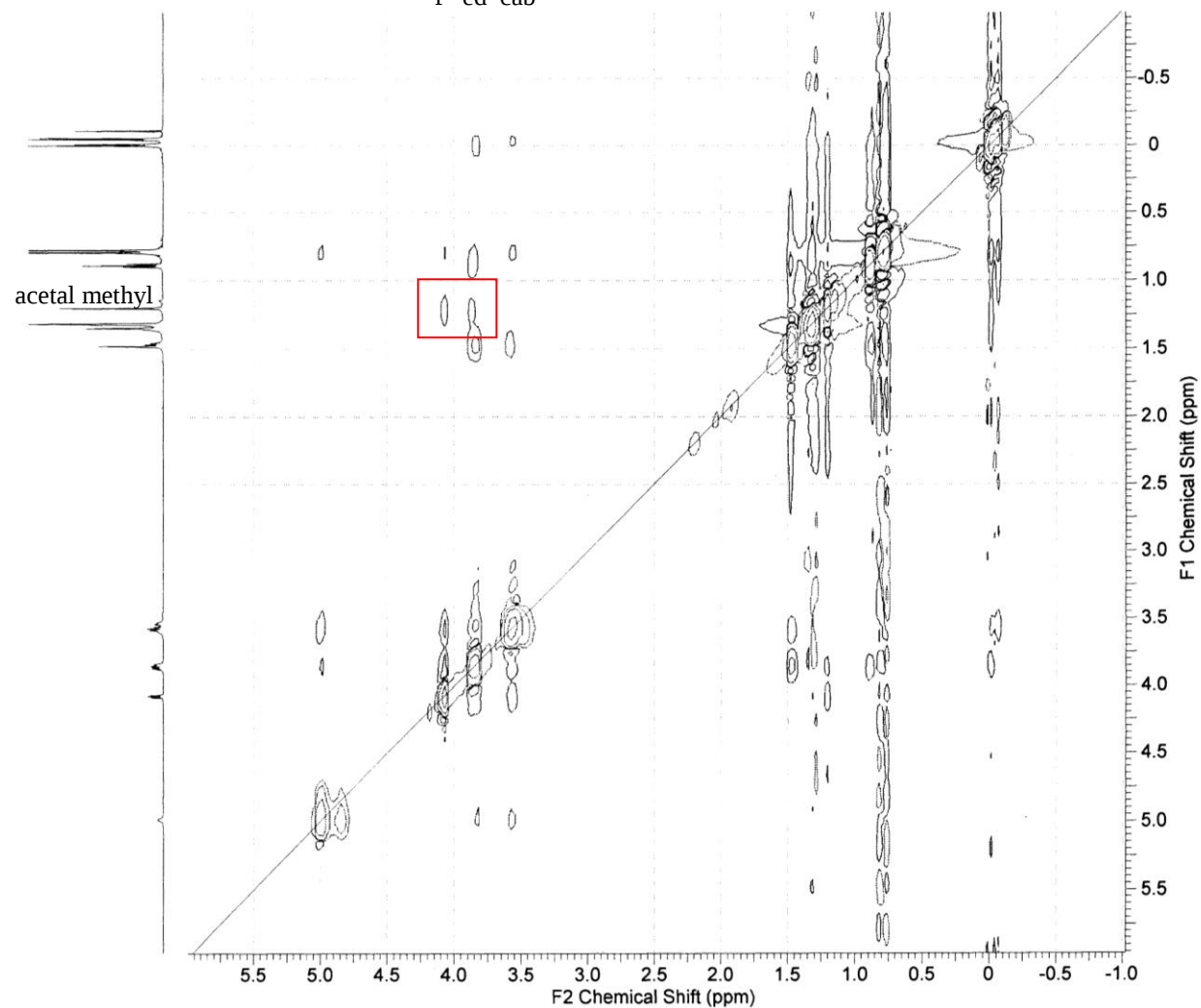
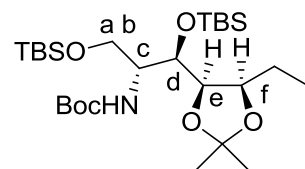
trans-6 (NOESY)

MIS-8.011.001.2rr.esp

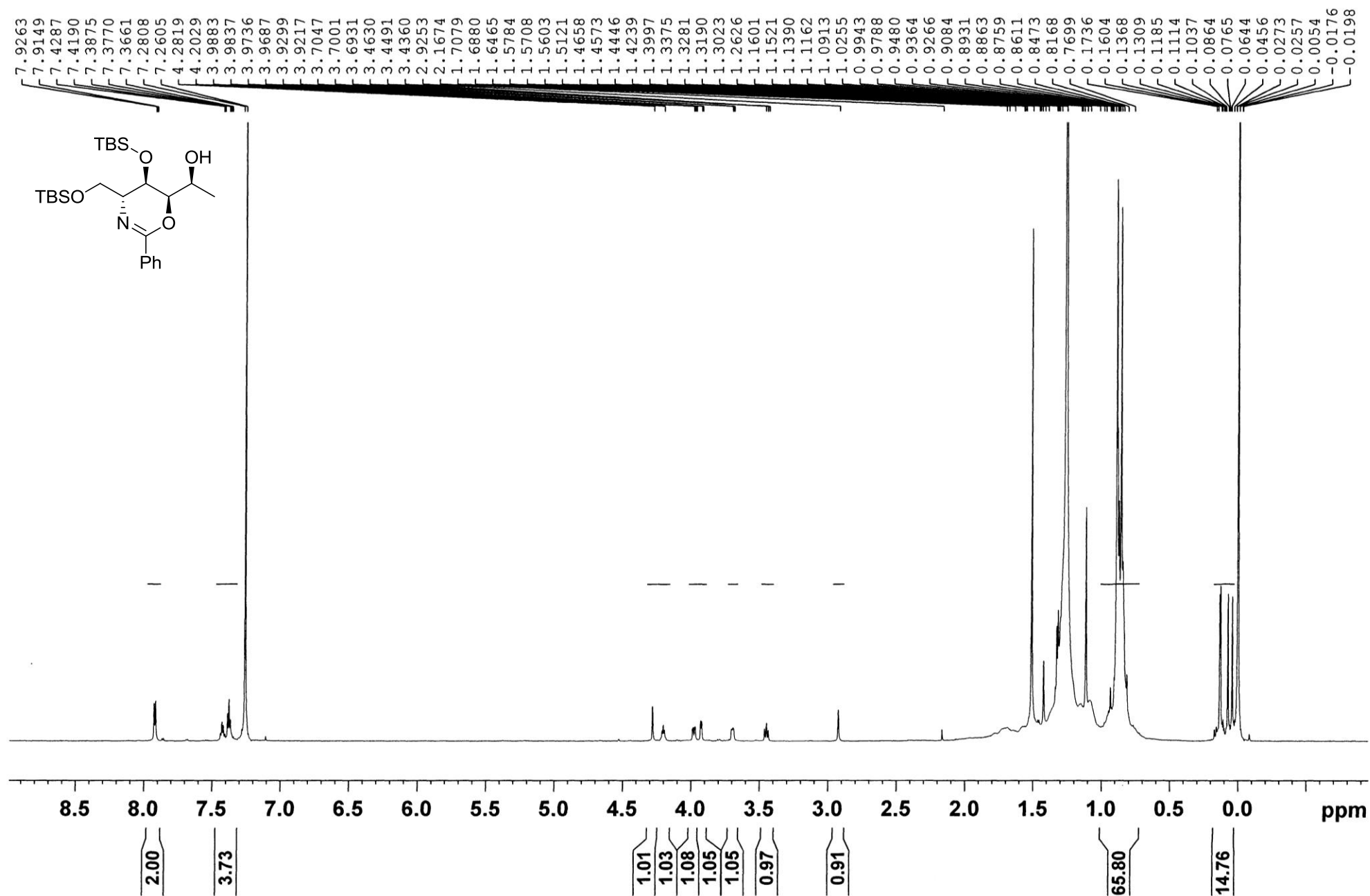


cis-6 (NOESY)

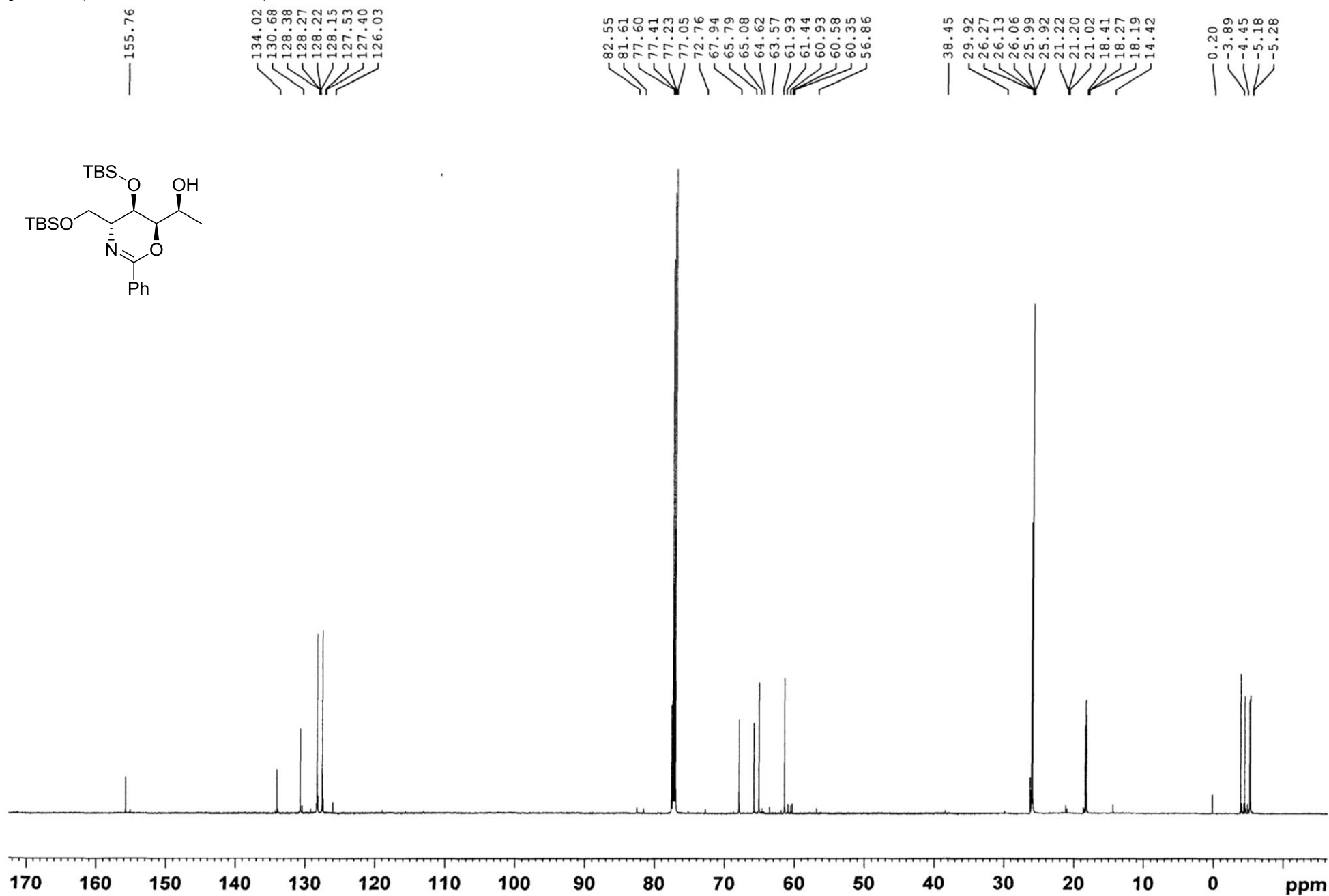
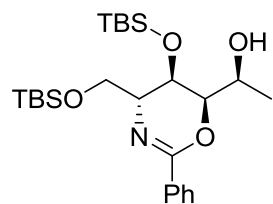
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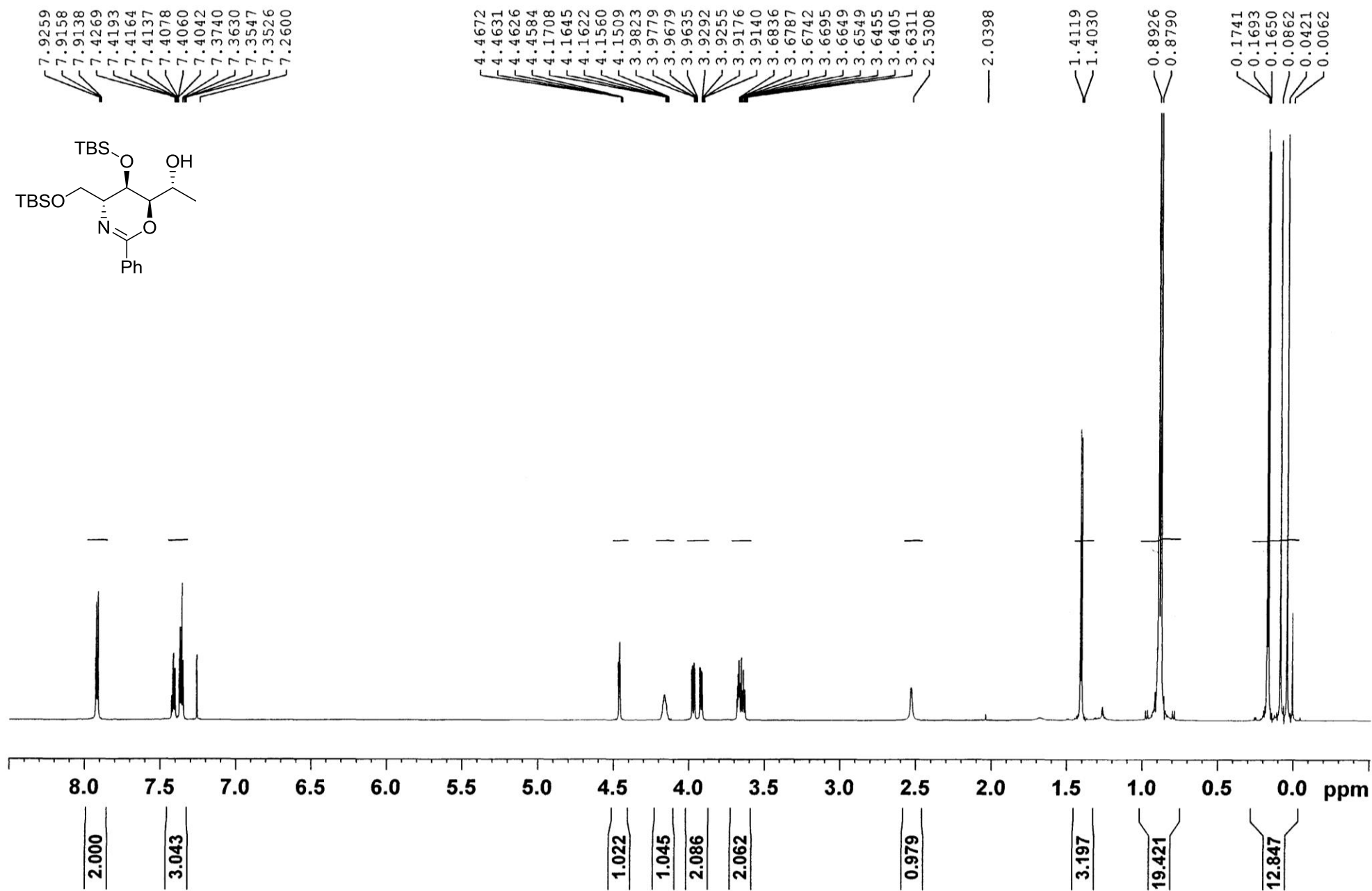
syn-5b (700 MHz, CDCl₃)



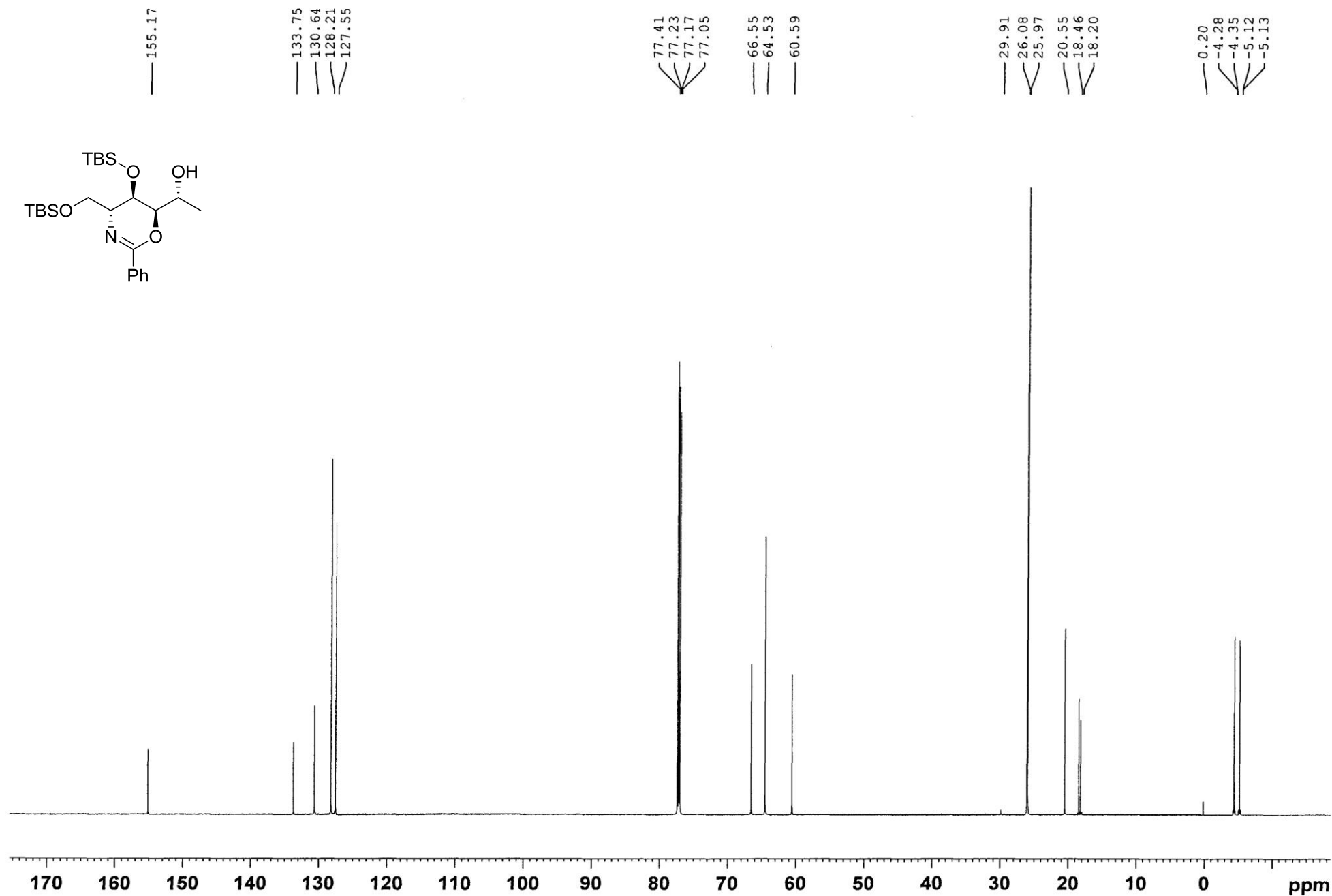
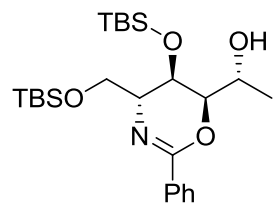
syn-5b (175 MHz, CDCl₃)



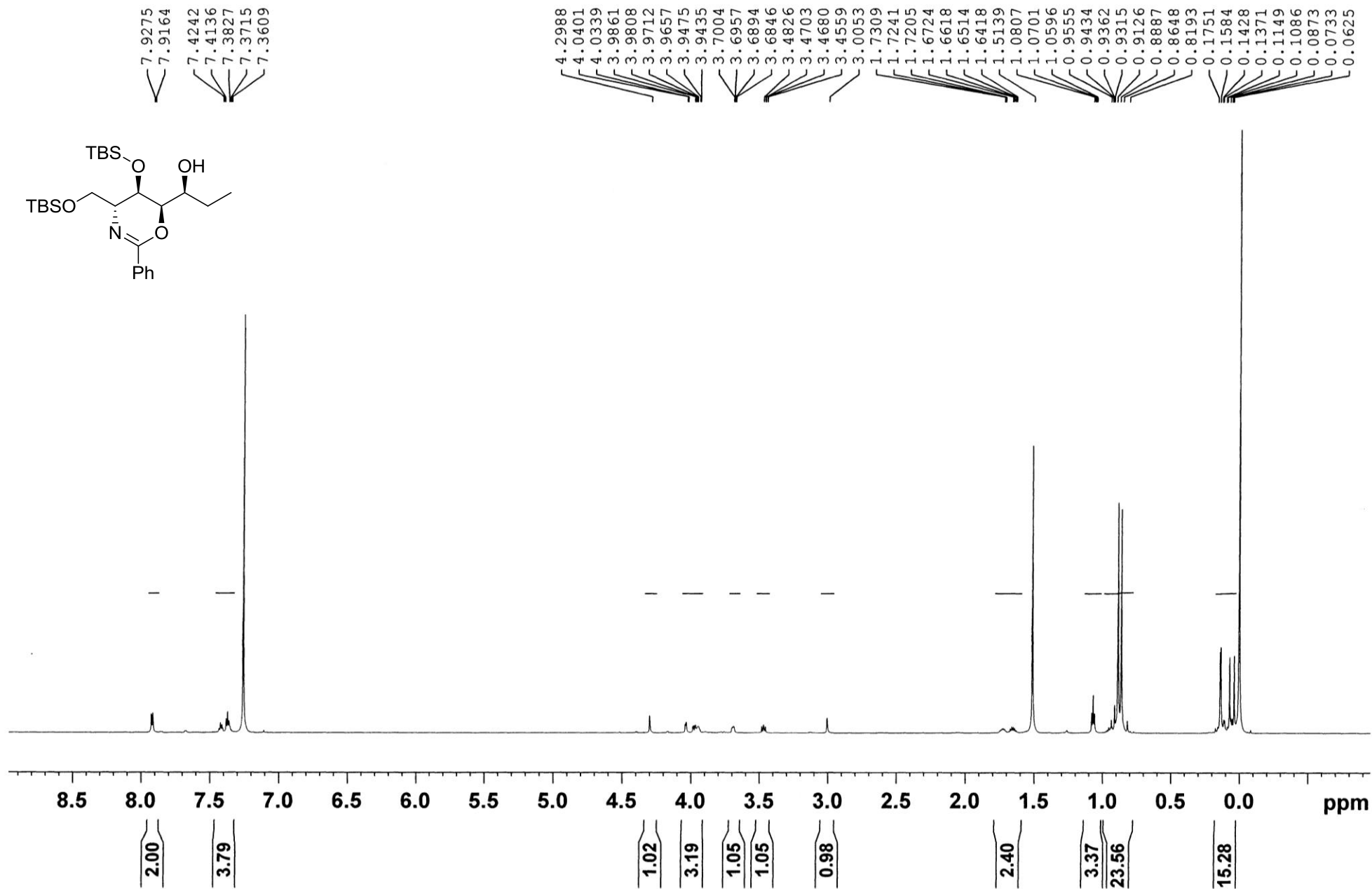
anti-**5b** (700 MHz, CDCl₃)



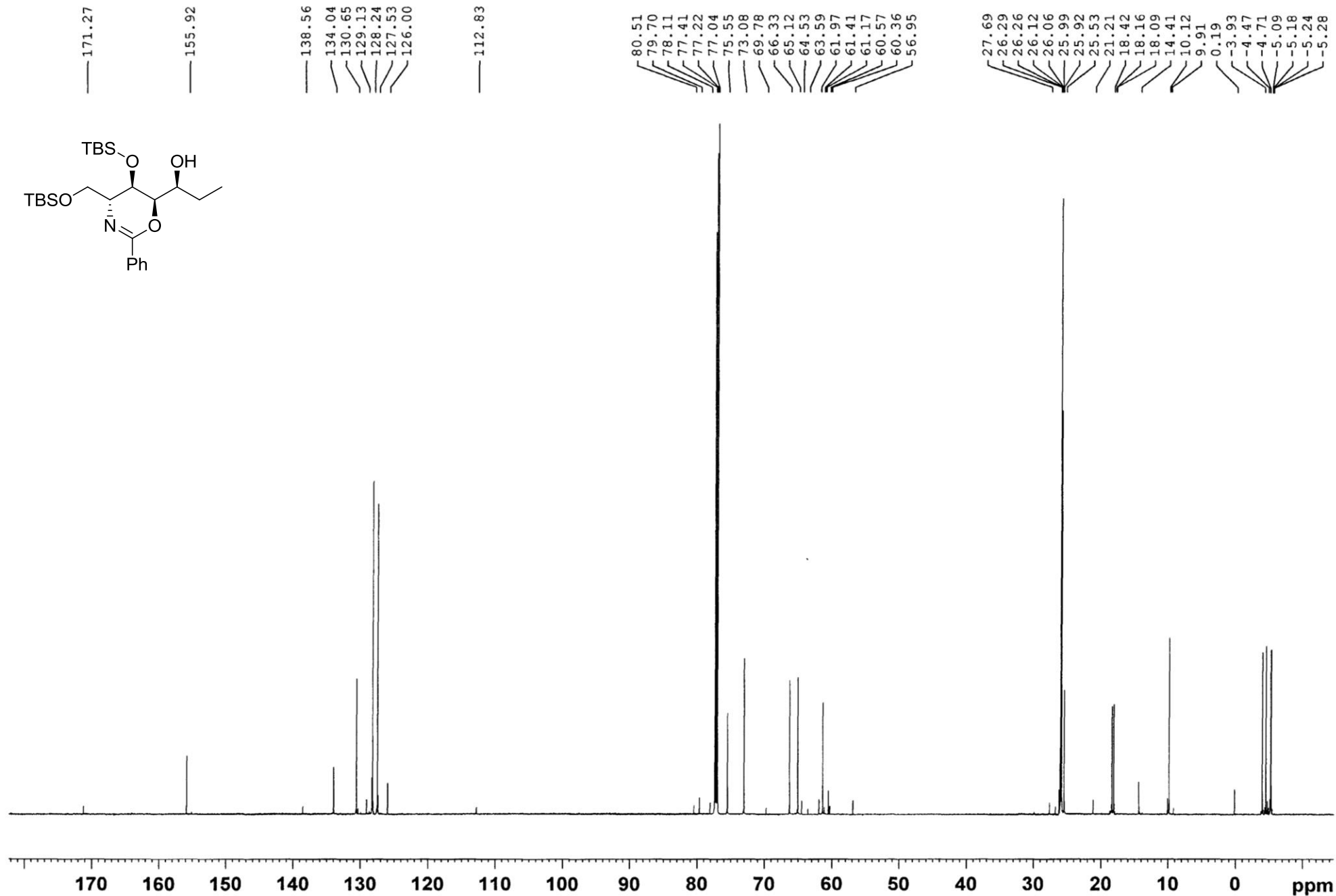
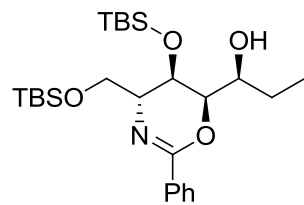
anti-**5b** (175 MHz, CDCl₃)



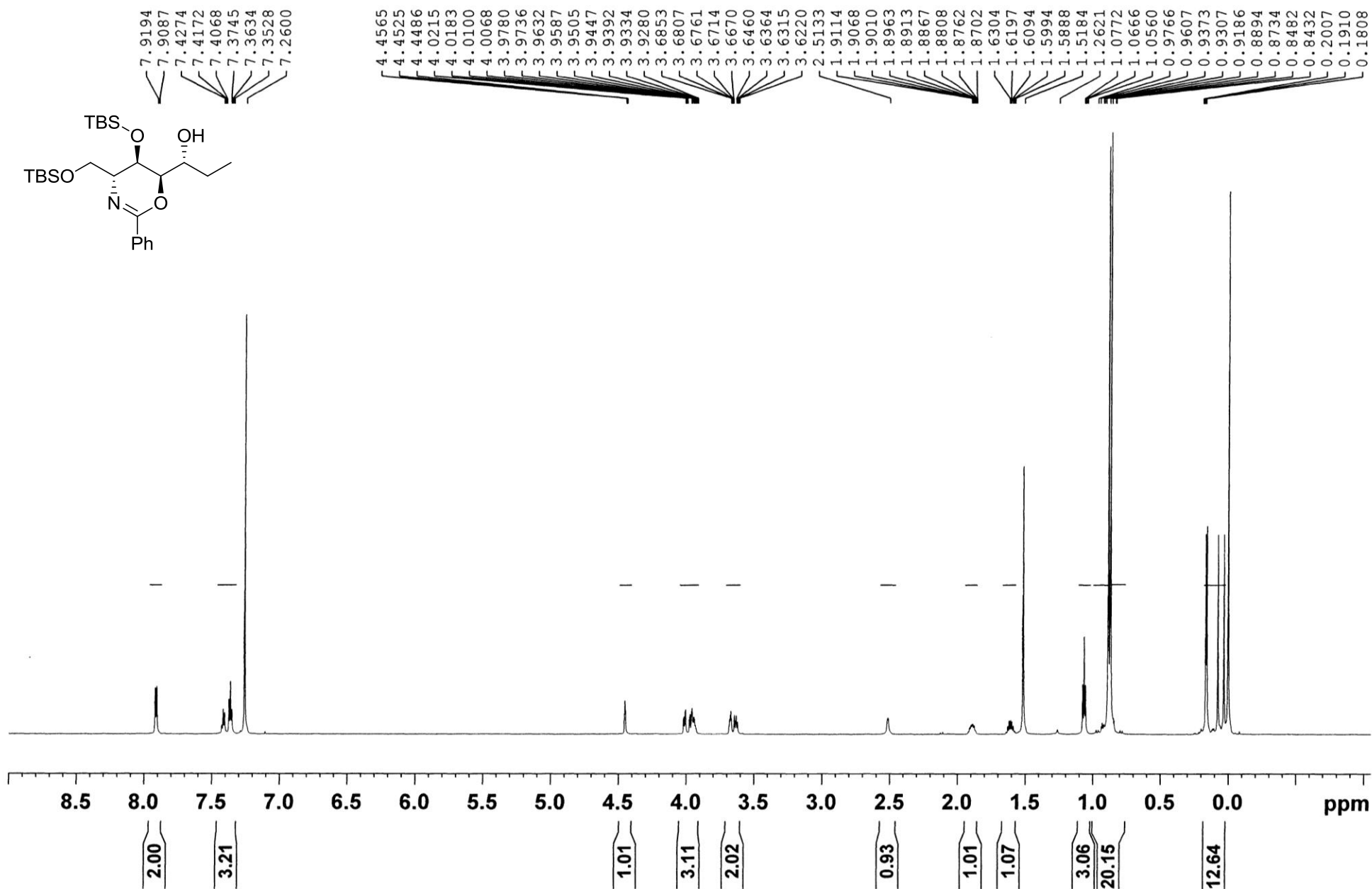
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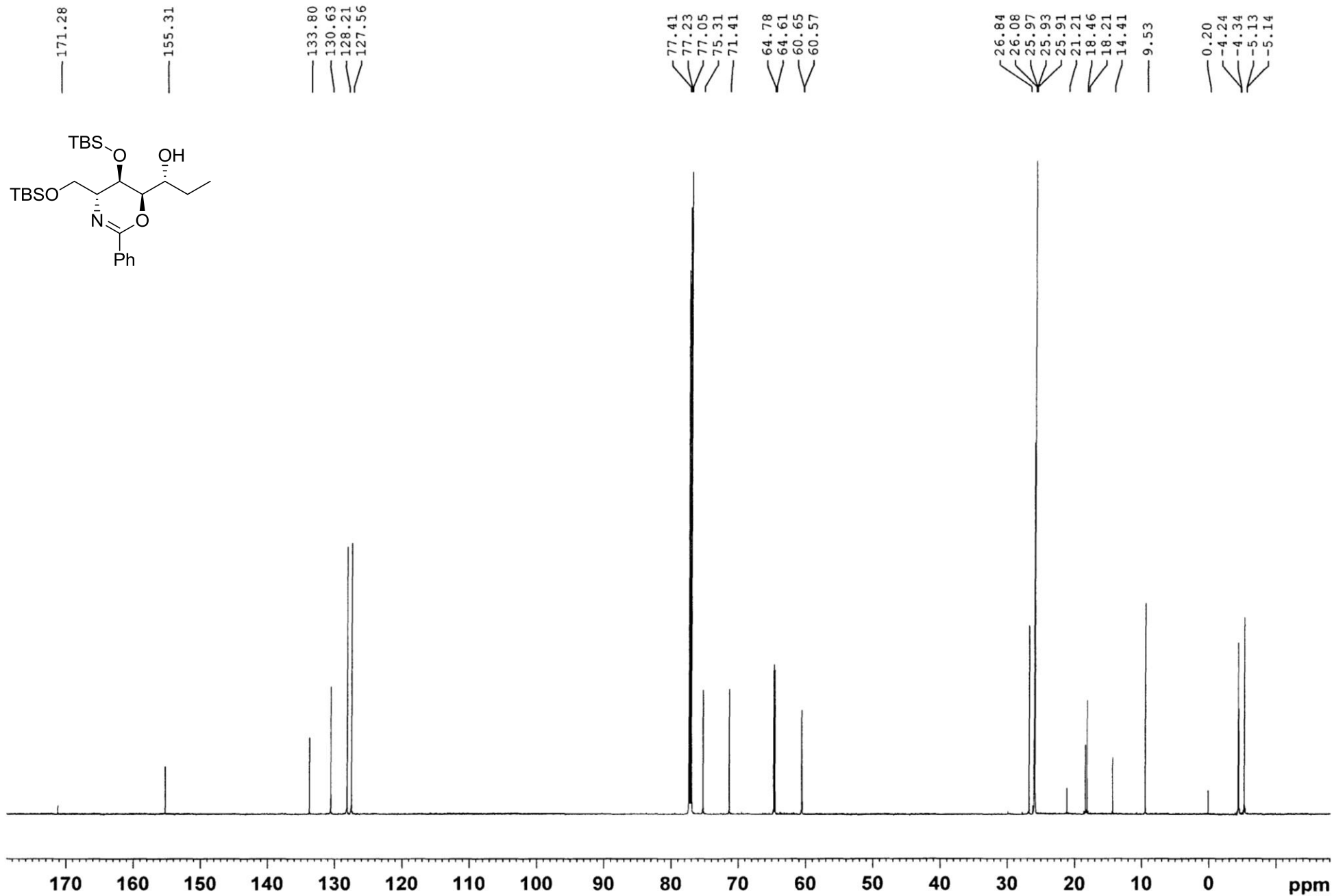
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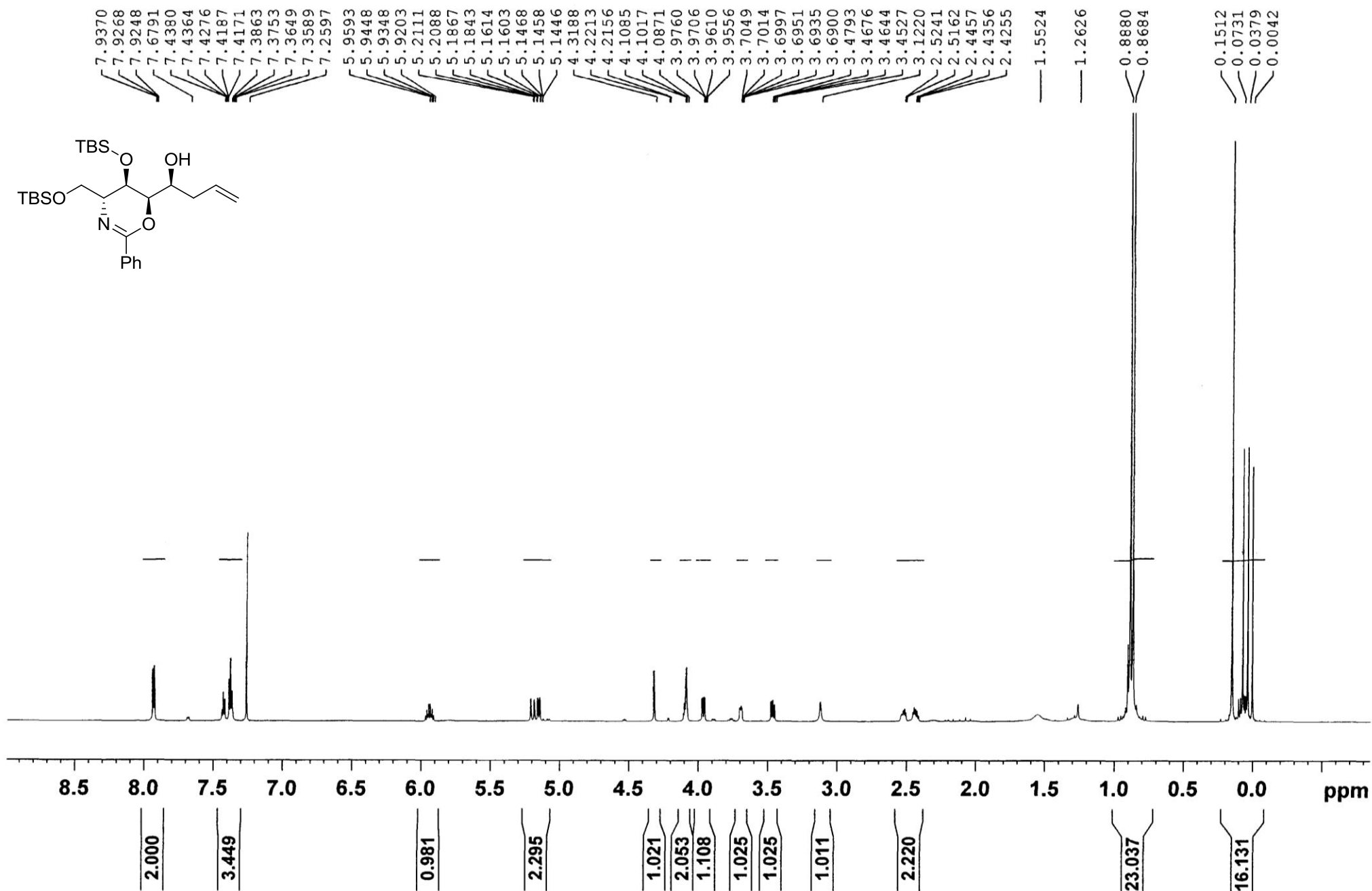
anti-5c (700 MHz, CDCl₃)



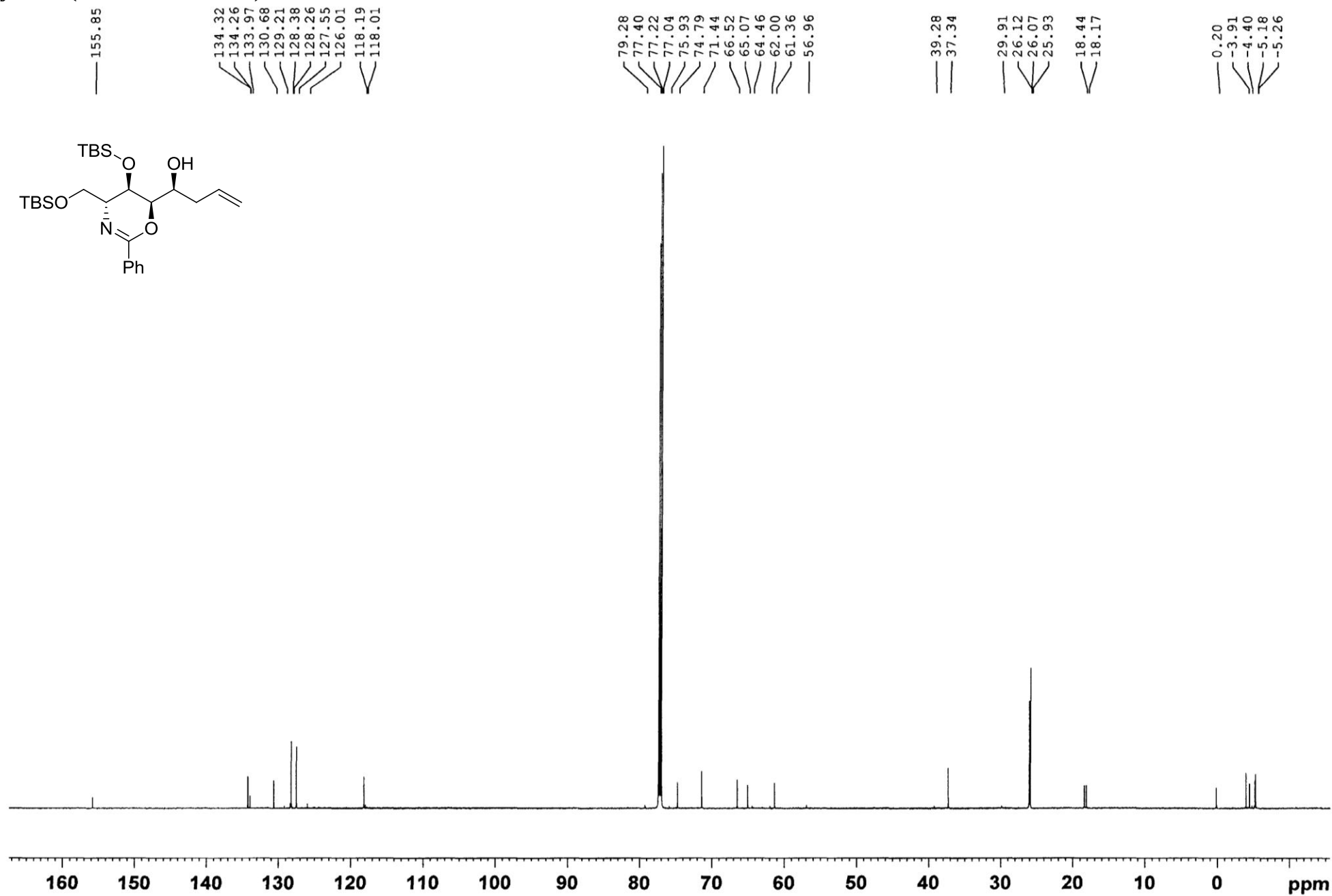
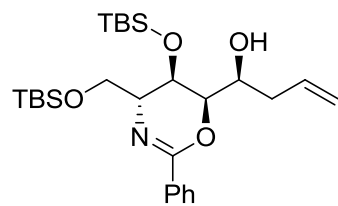
anti-**5c** (175 MHz, CDCl₃)



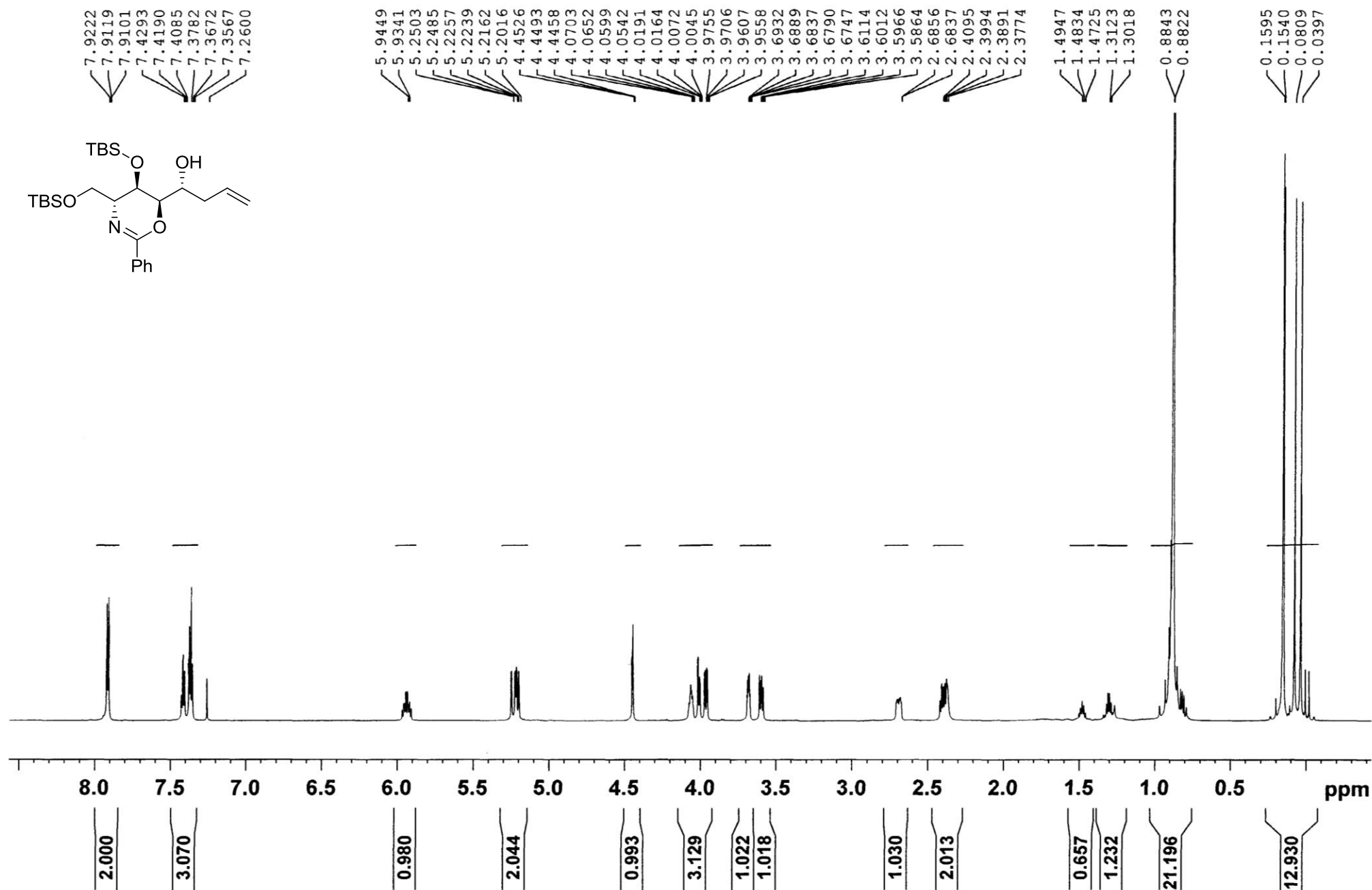
syn-5d (700 MHz, CDCl₃)



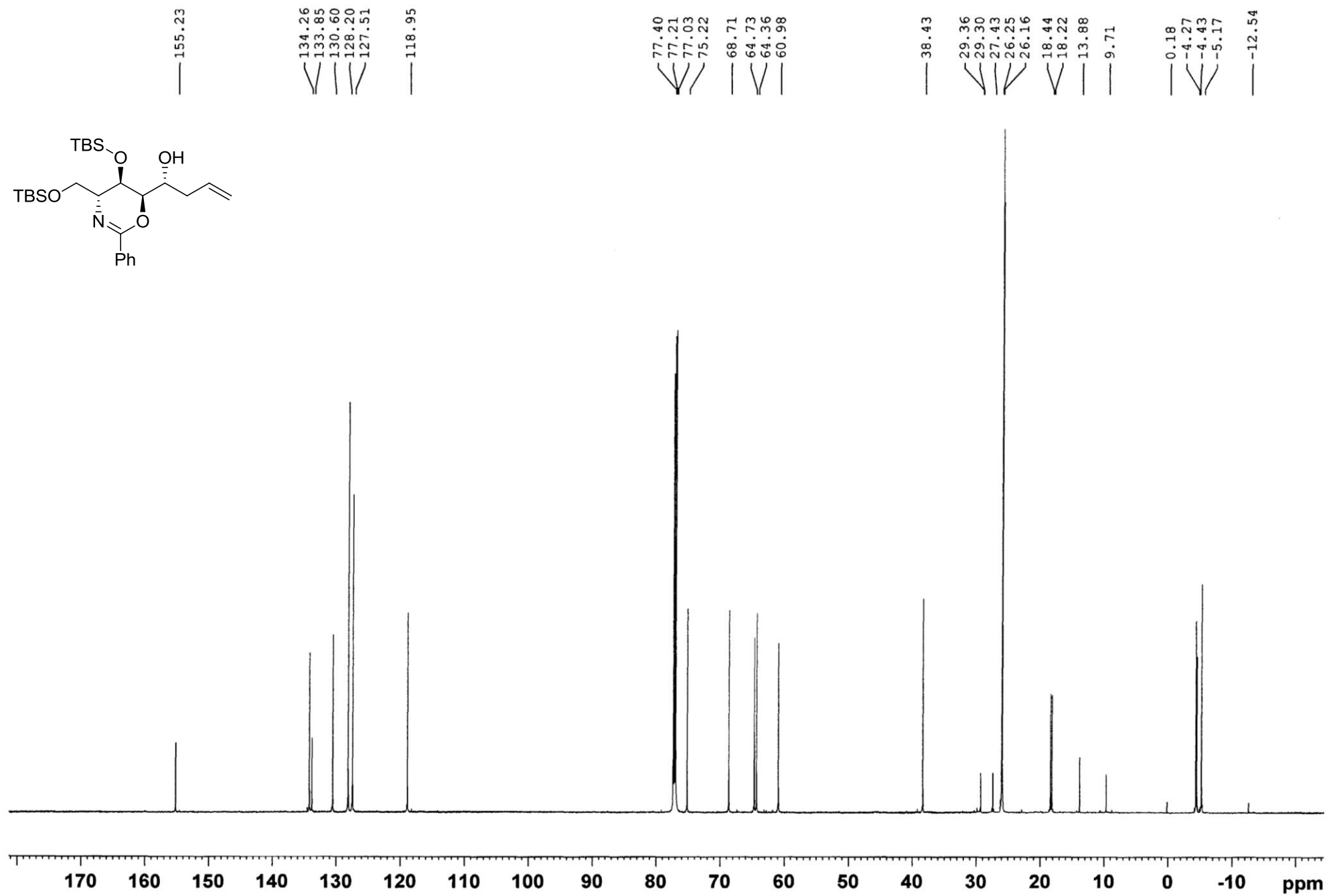
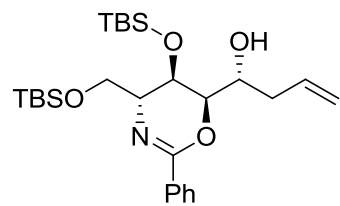
syn-5d (175 MHz, CDCl₃)



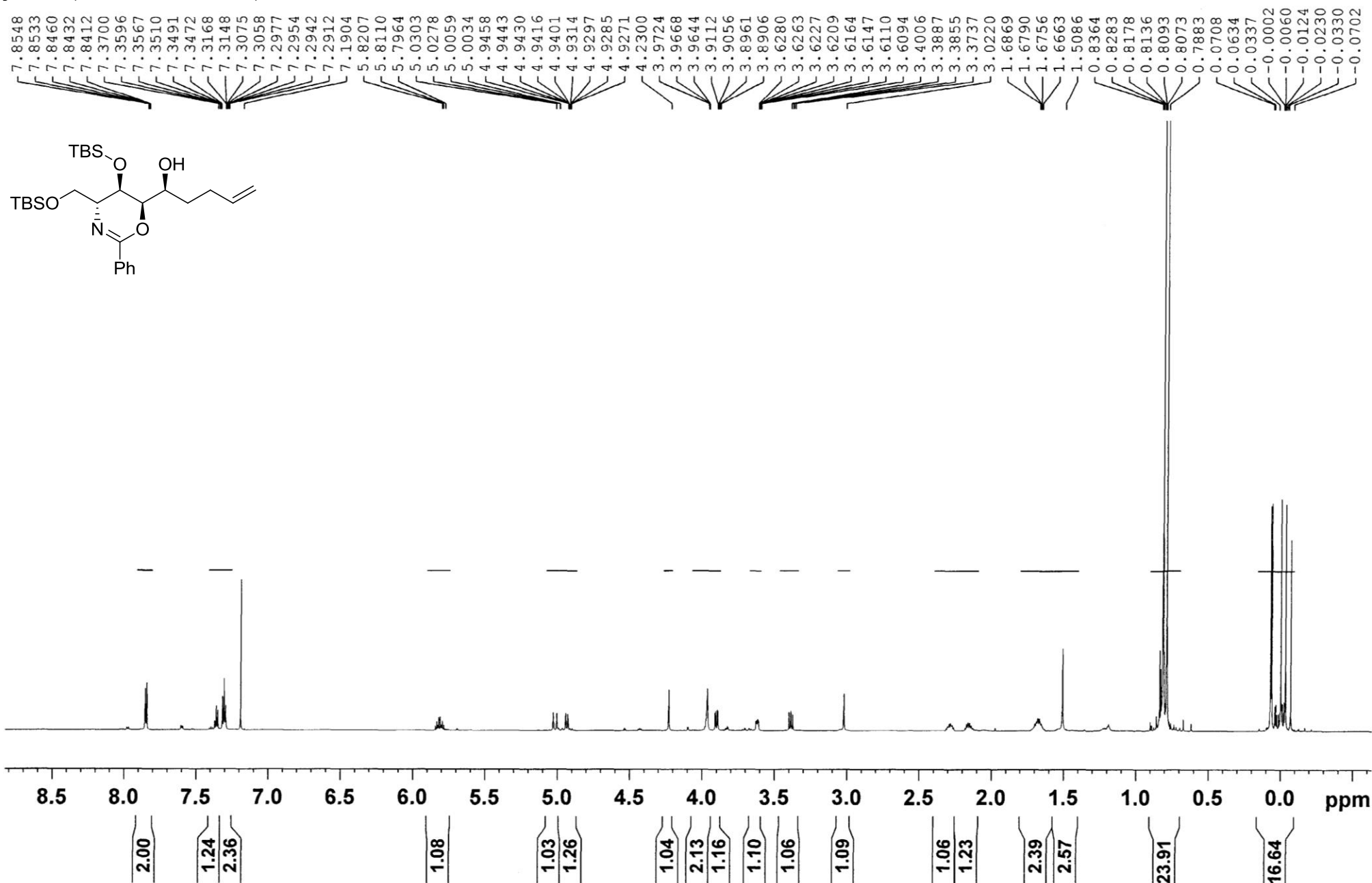
anti-**5d** (700 MHz, CDCl₃)



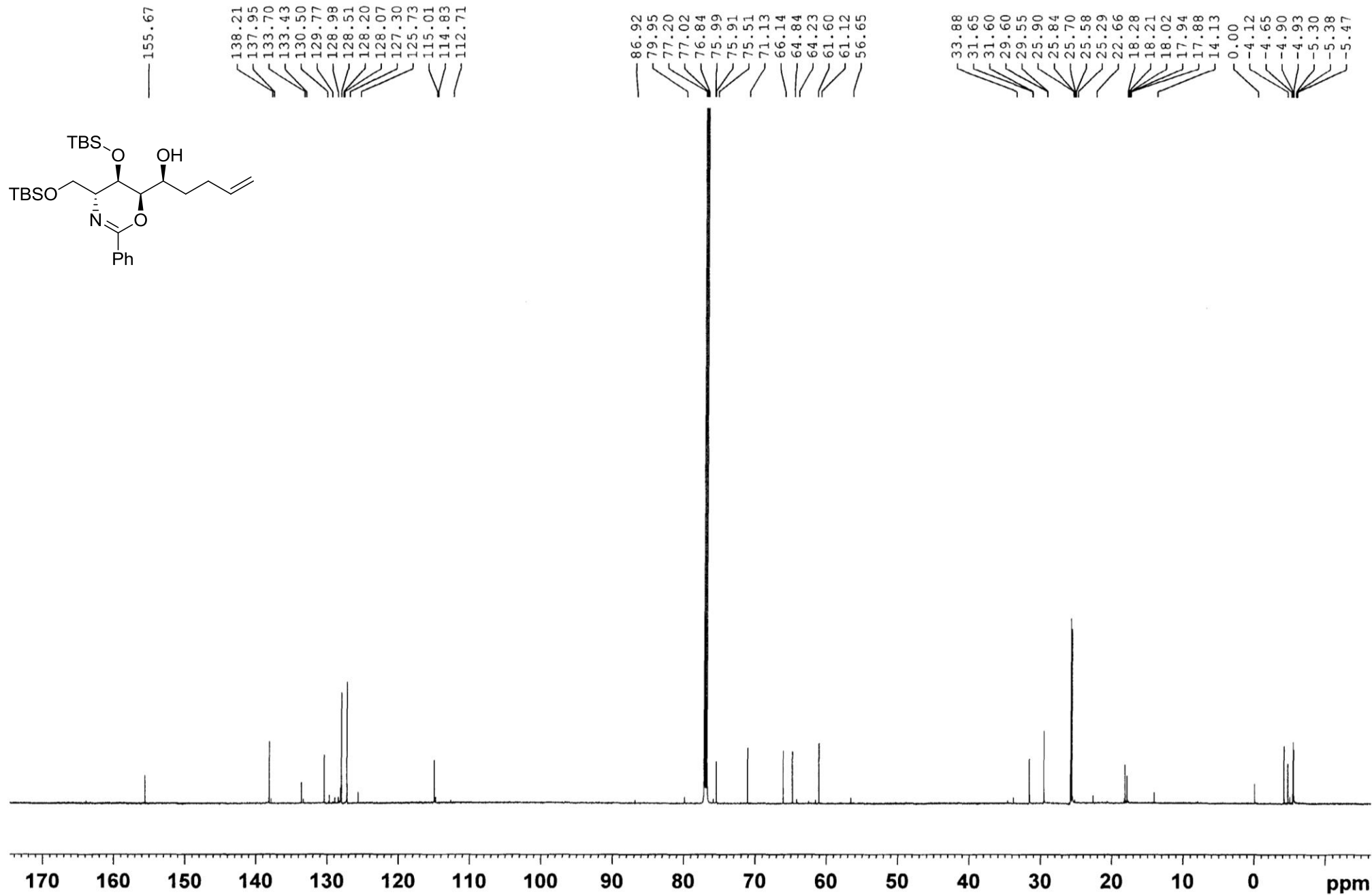
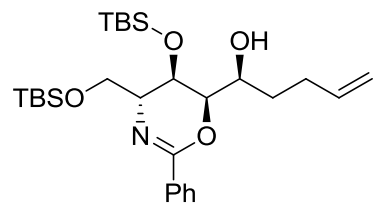
anti-**5d** (175 MHz, CDCl₃)



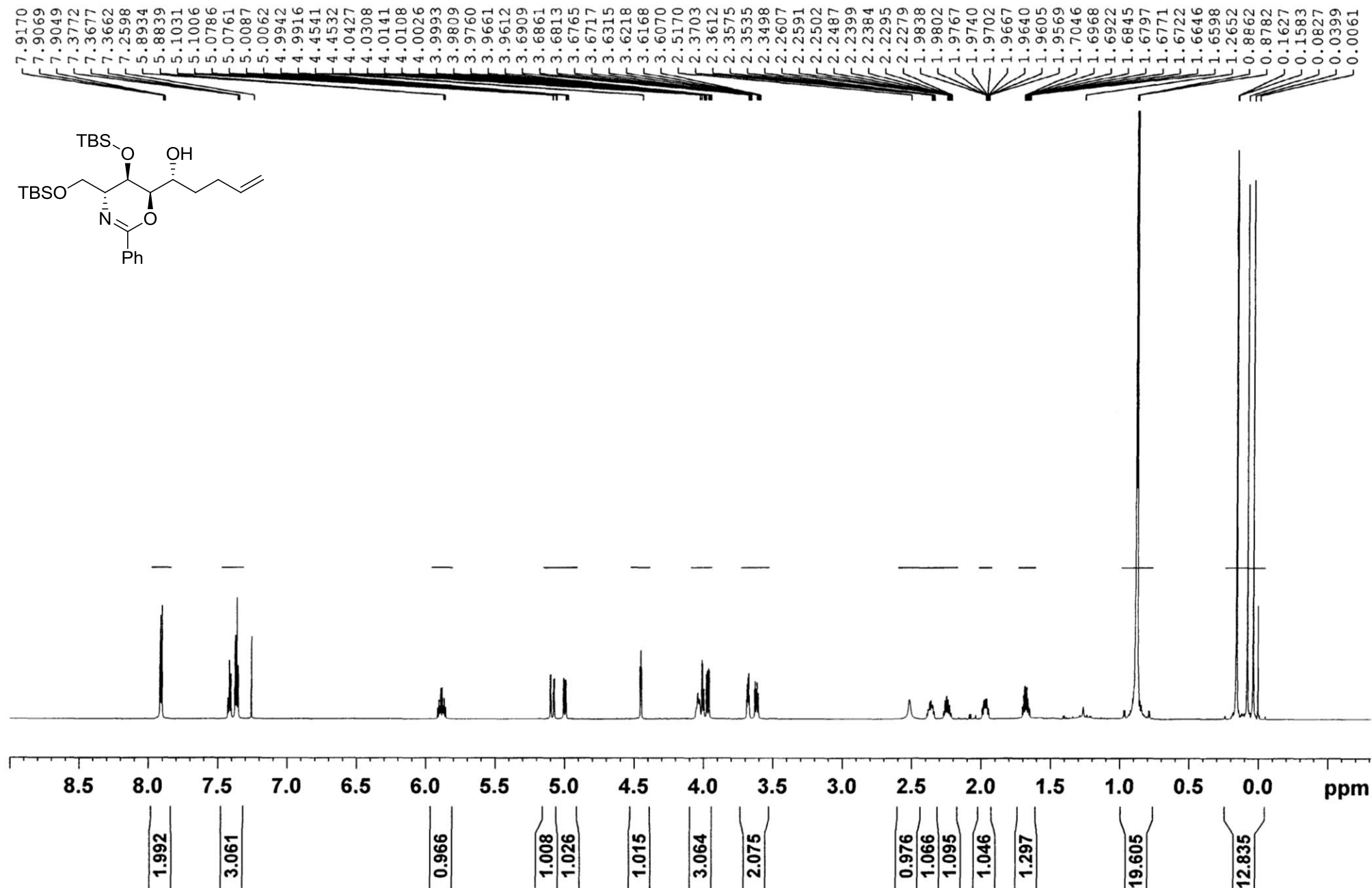
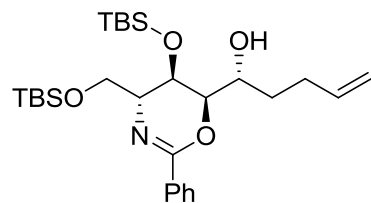
syn-5e (700 MHz, CDCl₃)



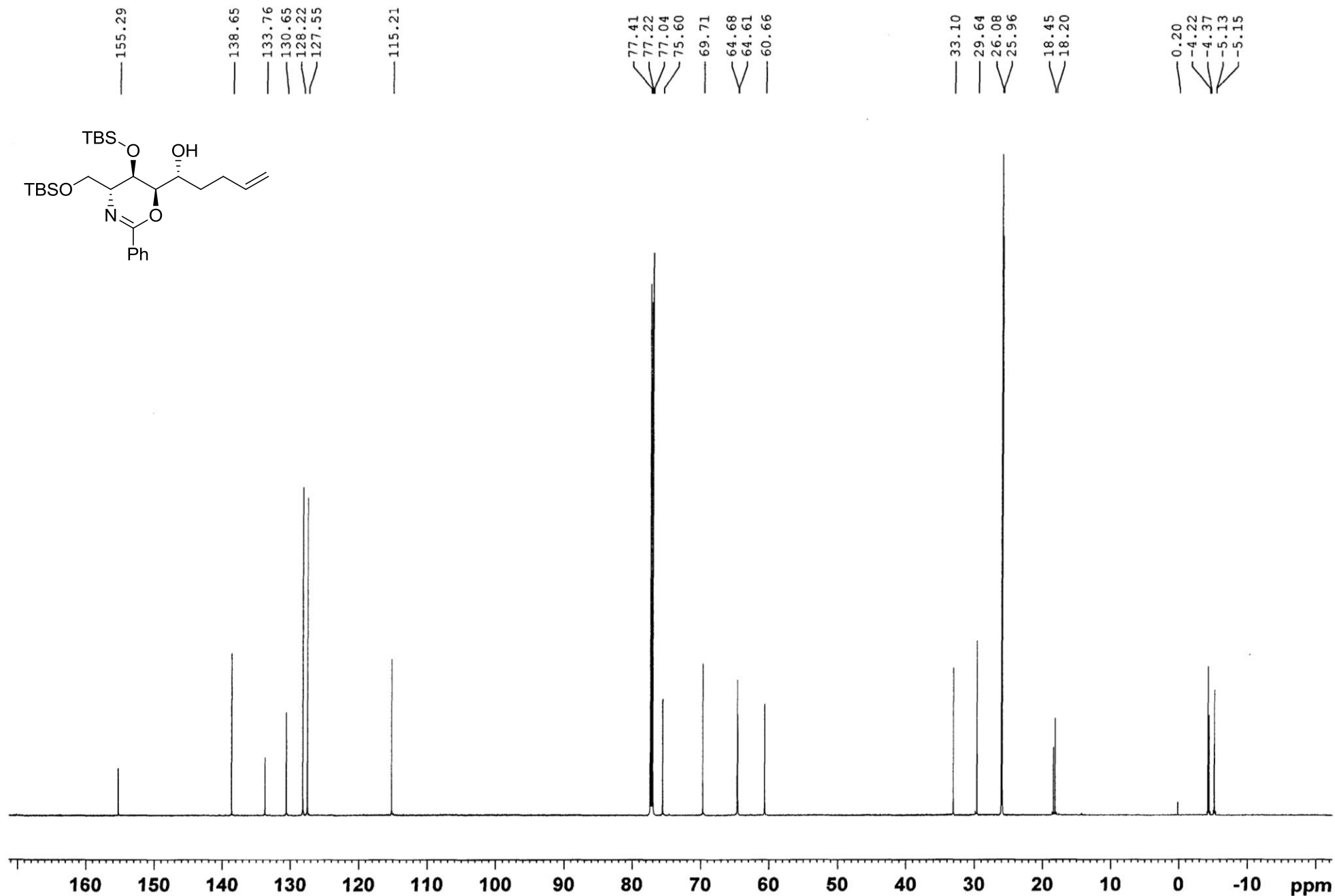
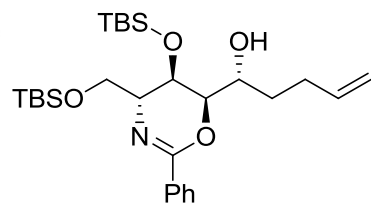
syn-5e (175 MHz, CDCl₃)



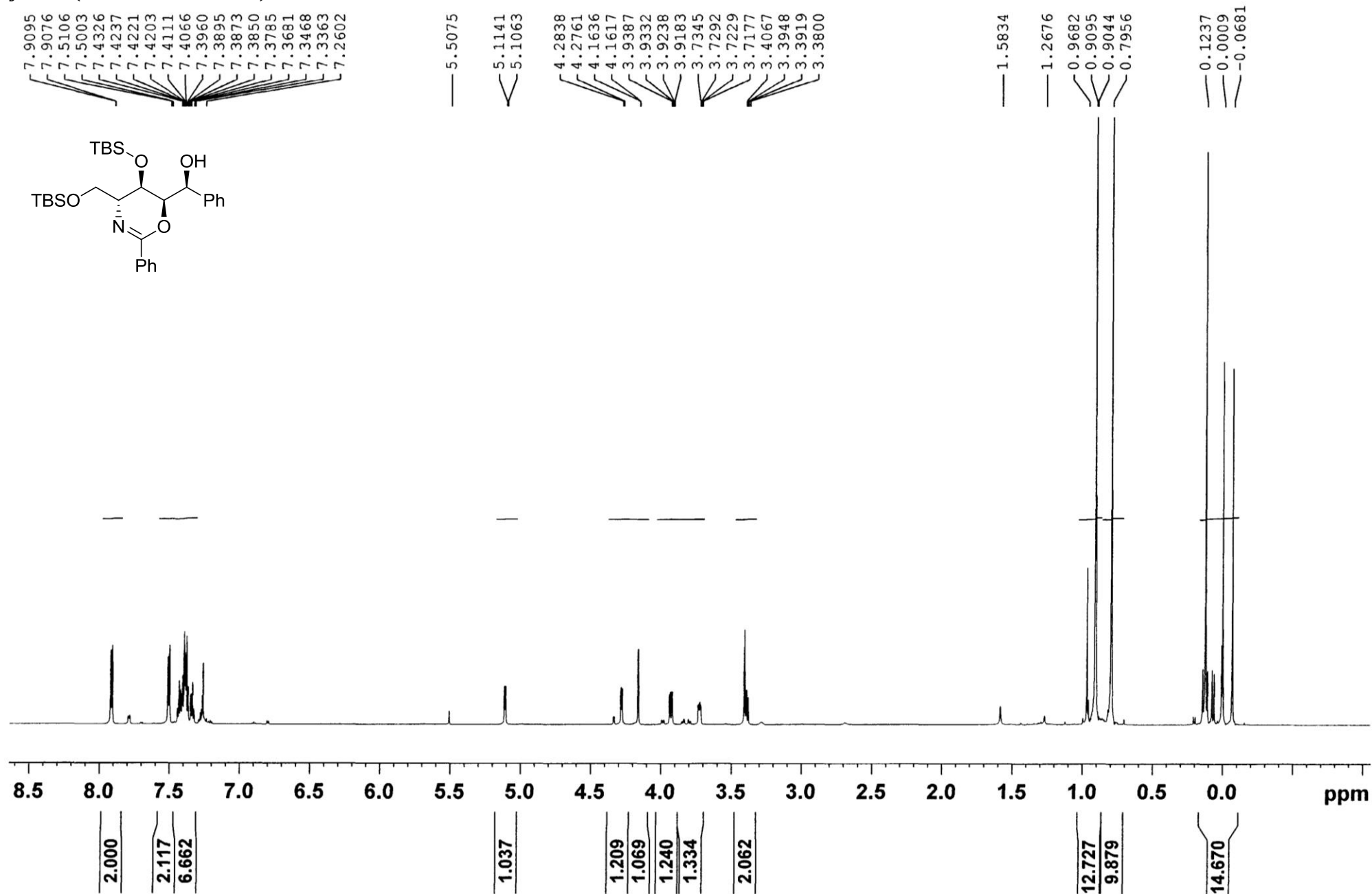
anti-5e (700 MHz, CDCl₃)



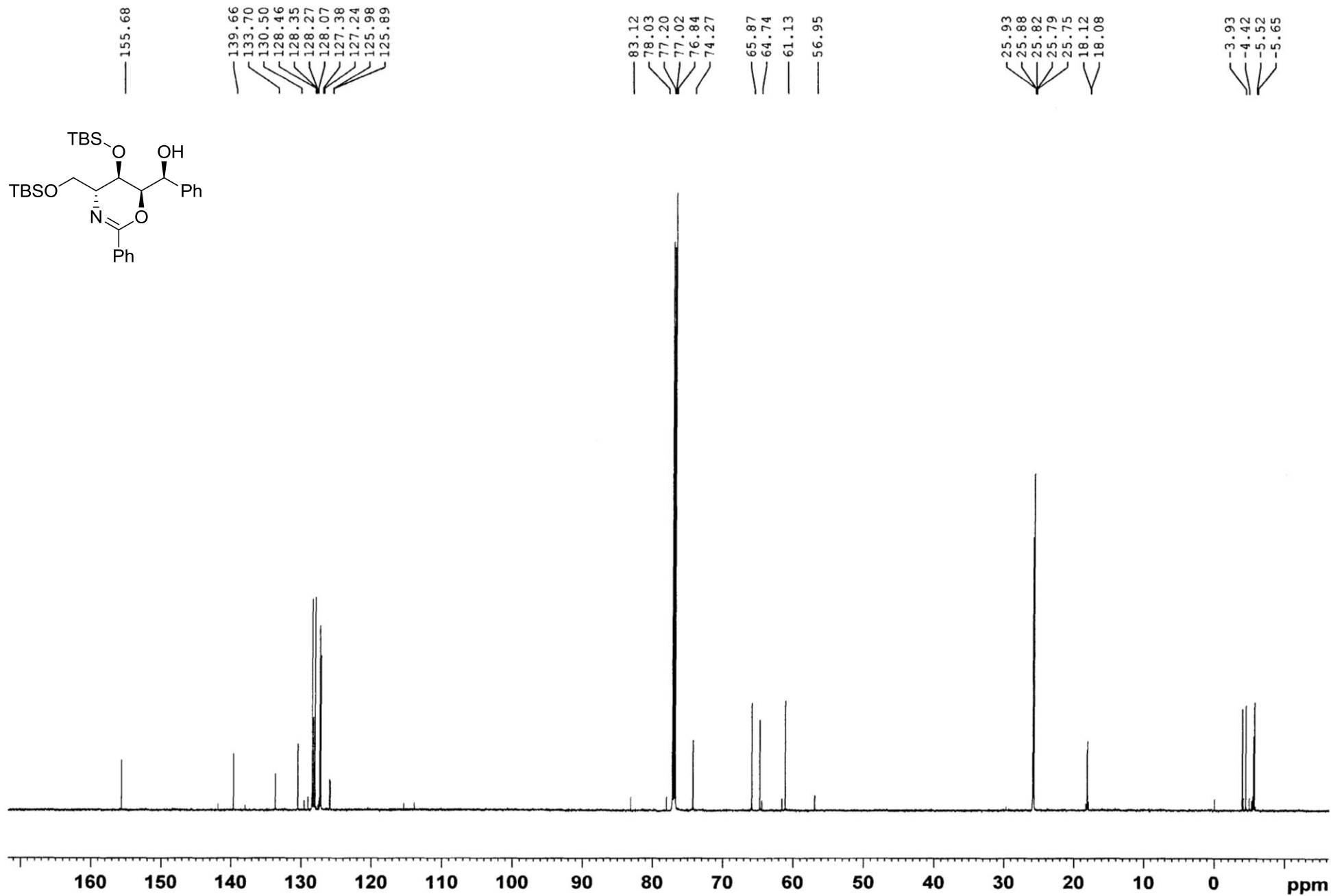
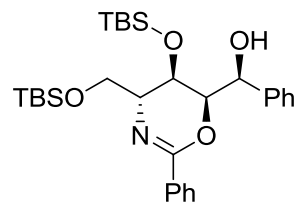
anti-**5e** (175 MHz, CDCl₃)



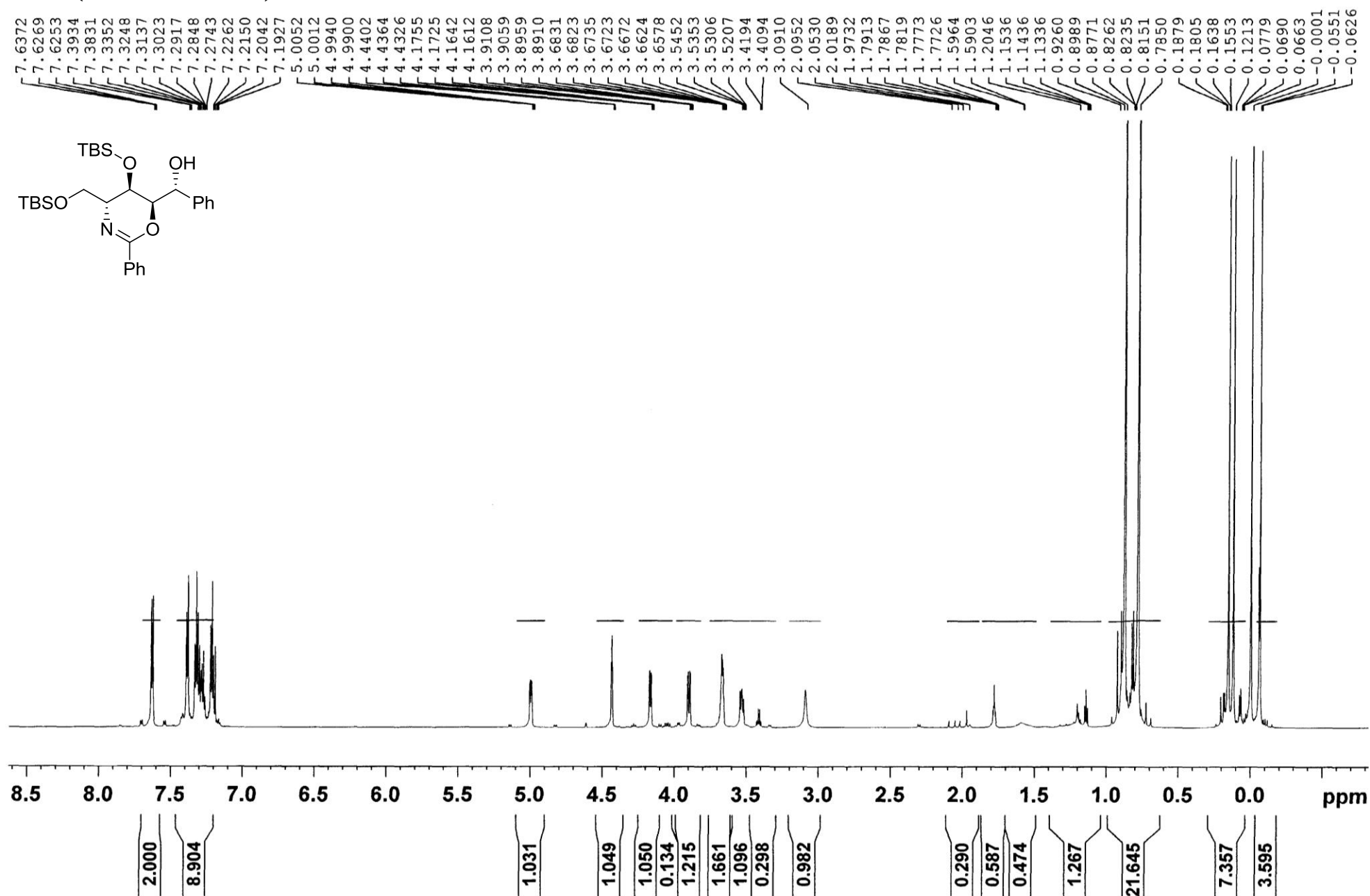
syn-5f (700 MHz, CDCl₃)



syn-5f (175 MHz, CDCl₃)

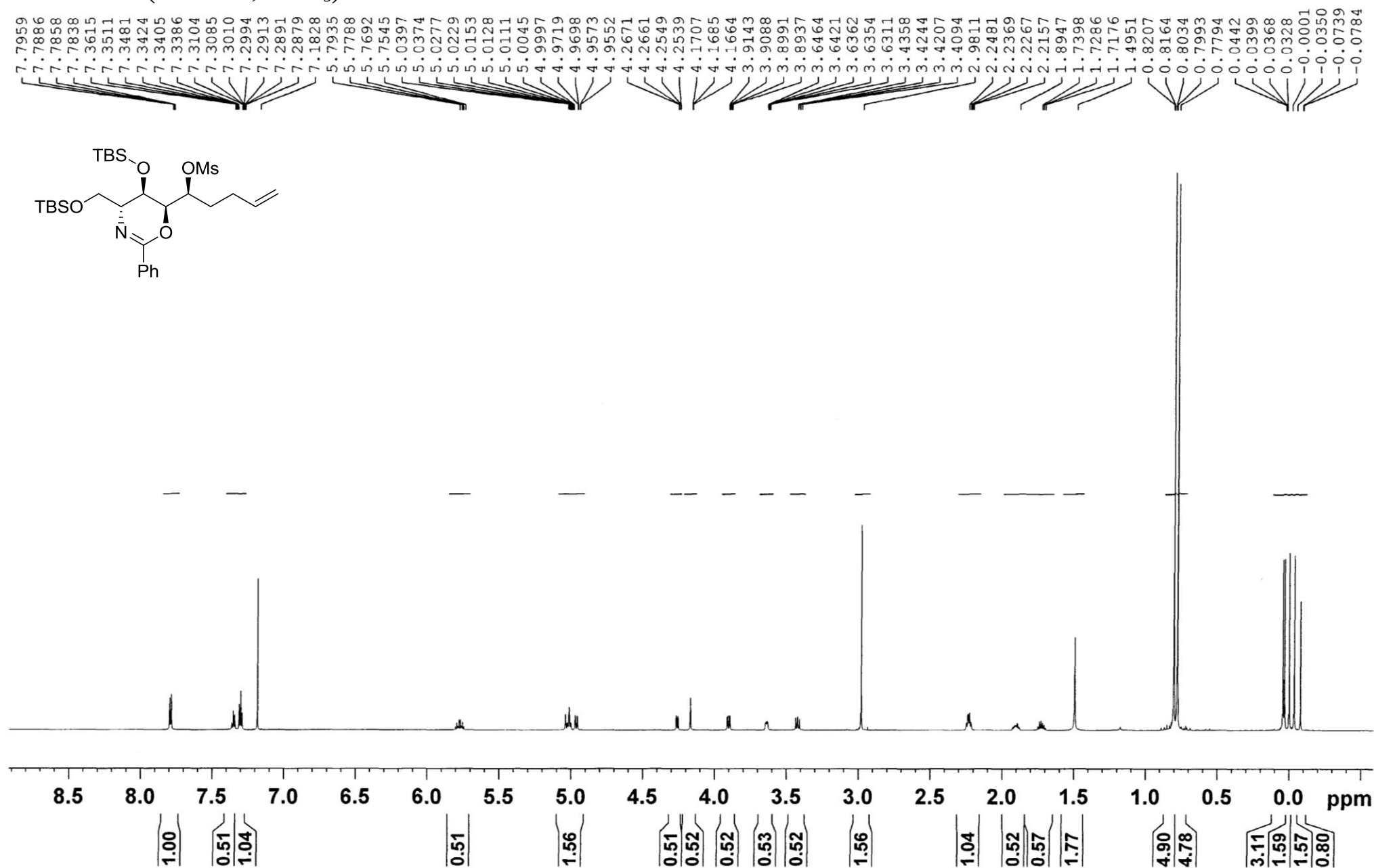


anti-**5f** (700 MHz, CDCl₃)



[illegible]

Precursor of **8** (700 MHz, CDCl₃)

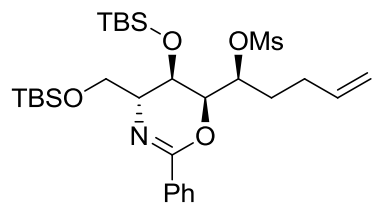


Chemical structure of the compound is shown above the spectrum. The structure is a substituted oxazolidinone derivative, featuring a phenyl group (Ph), a TBSO group, an OMs group, and a vinyl group.

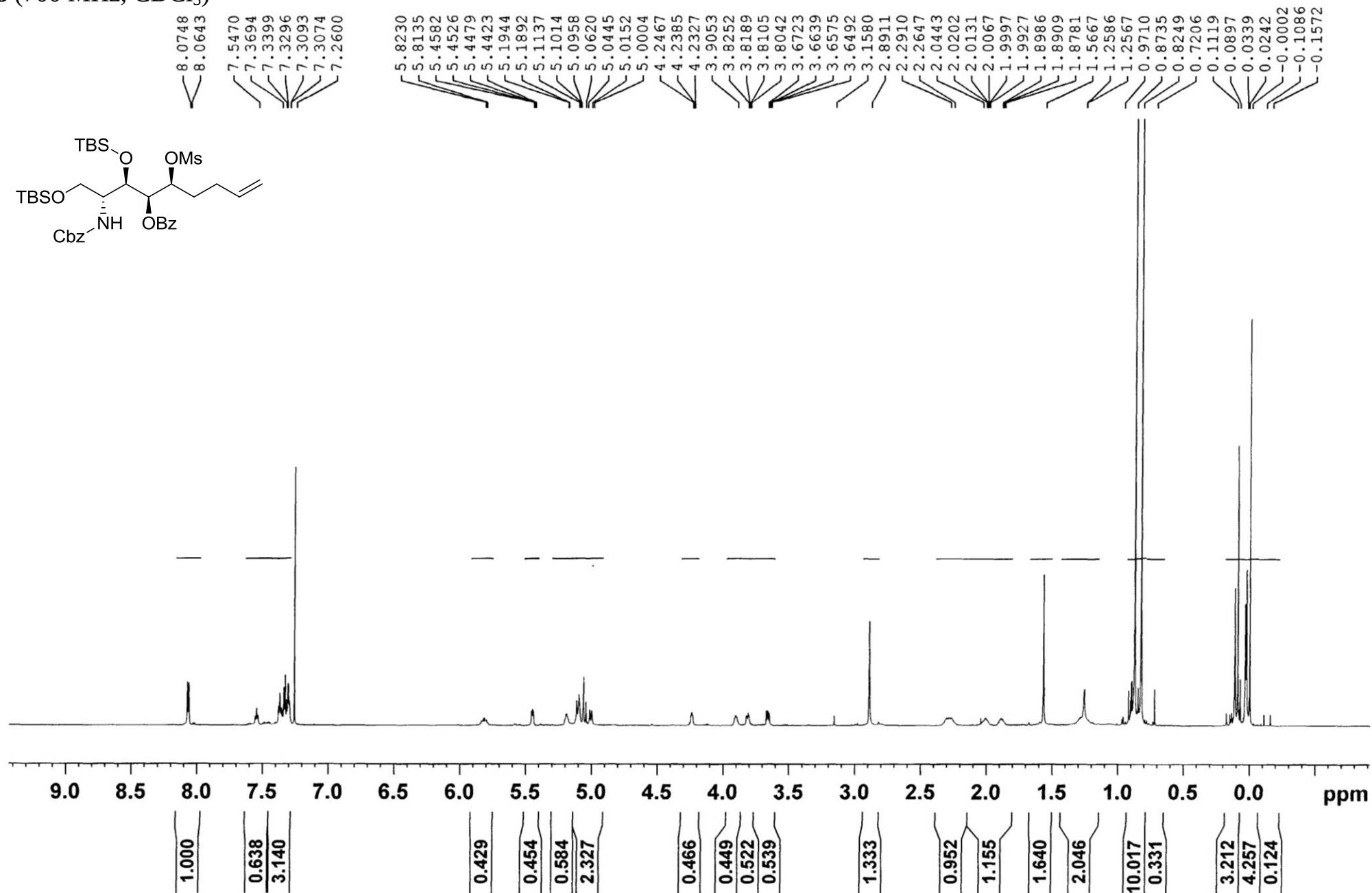
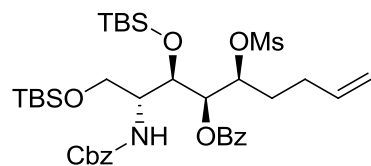
¹³C NMR spectrum (CDCl₃) showing peaks at the following chemical shifts (ppm):

- 155.89
- 136.84
- 133.84
- 130.54
- 128.18
- 127.36
- 115.72
- 82.38
- 77.19
- 77.00
- 76.82
- 74.94
- 64.51
- 63.99
- 60.60
- 38.79
- 29.56
- 28.43
- 25.77
- 25.64
- 18.11
- 17.97
- 0.01
- 3.90
- 4.61
- 5.43
- 5.52

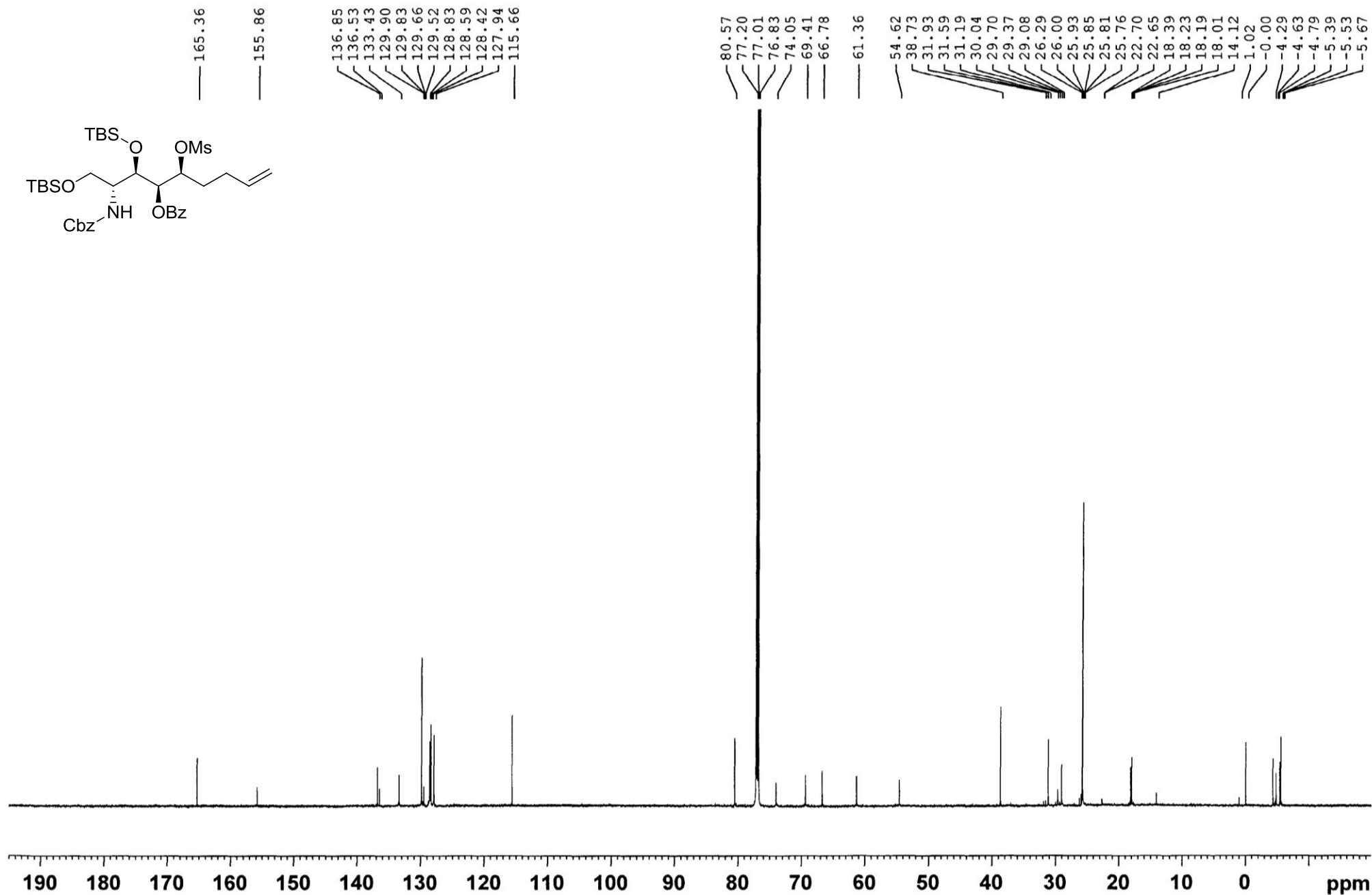
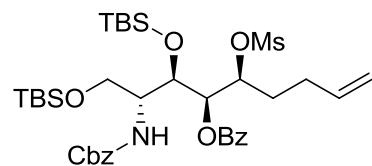
ppm



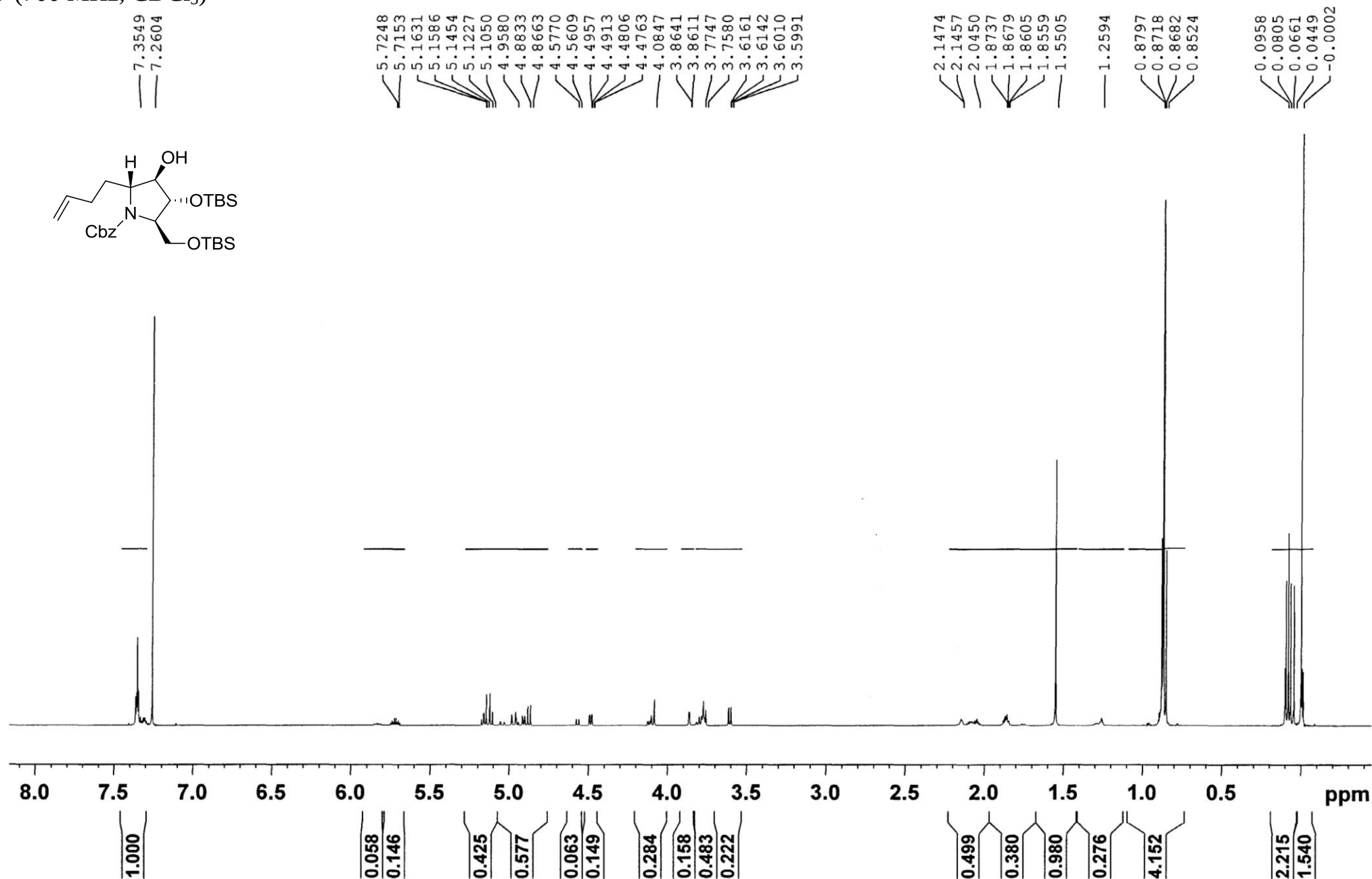
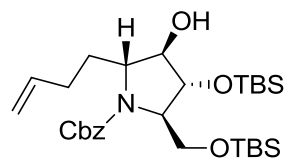
8 (700 MHz, CDCl₃)



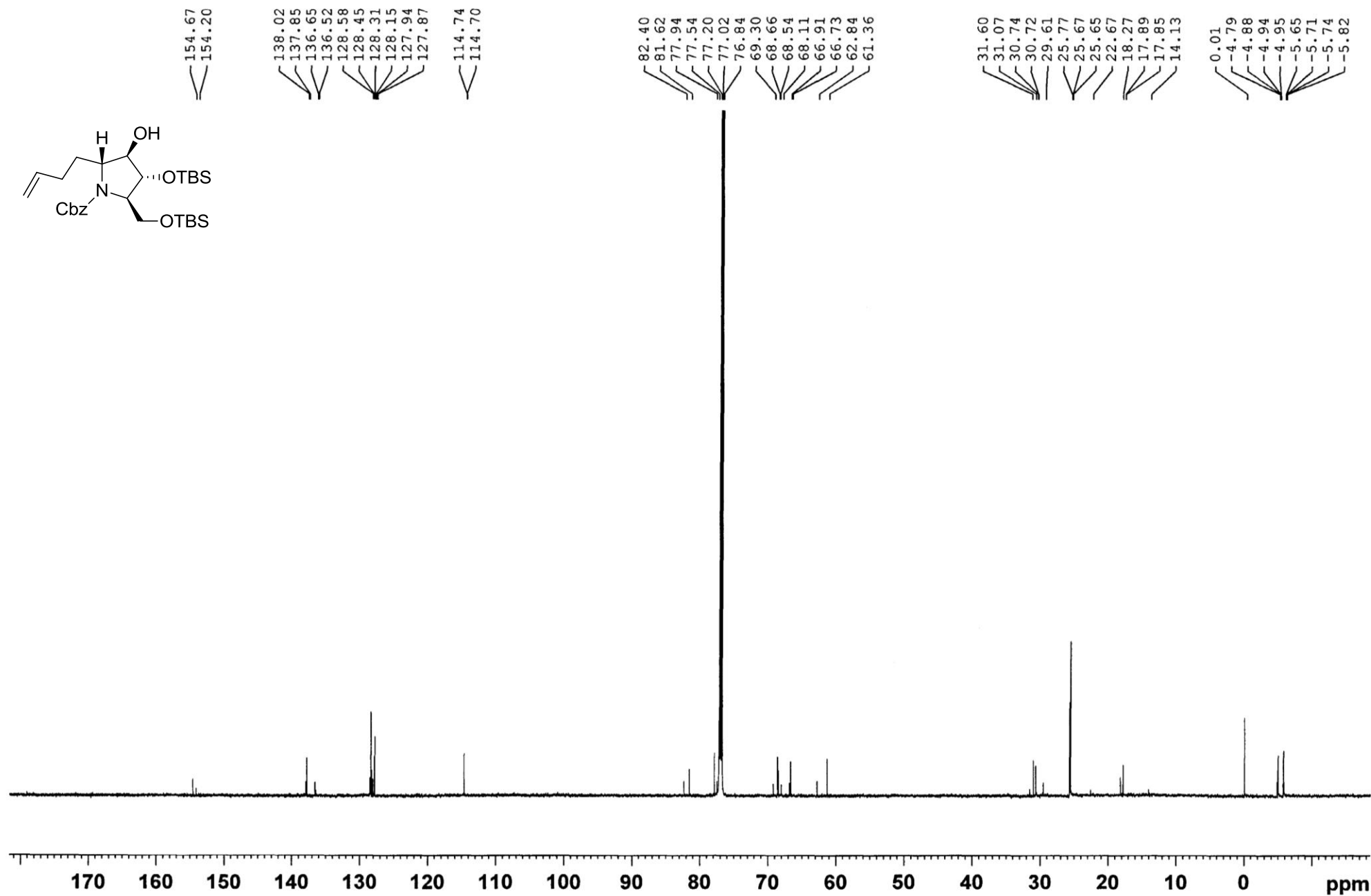
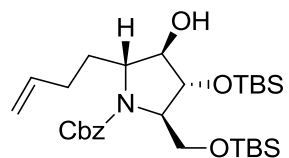
8 (175 MHz, CDCl₃)



7 (700 MHz, CDCl₃)



7 (175 MHz, CDCl₃)



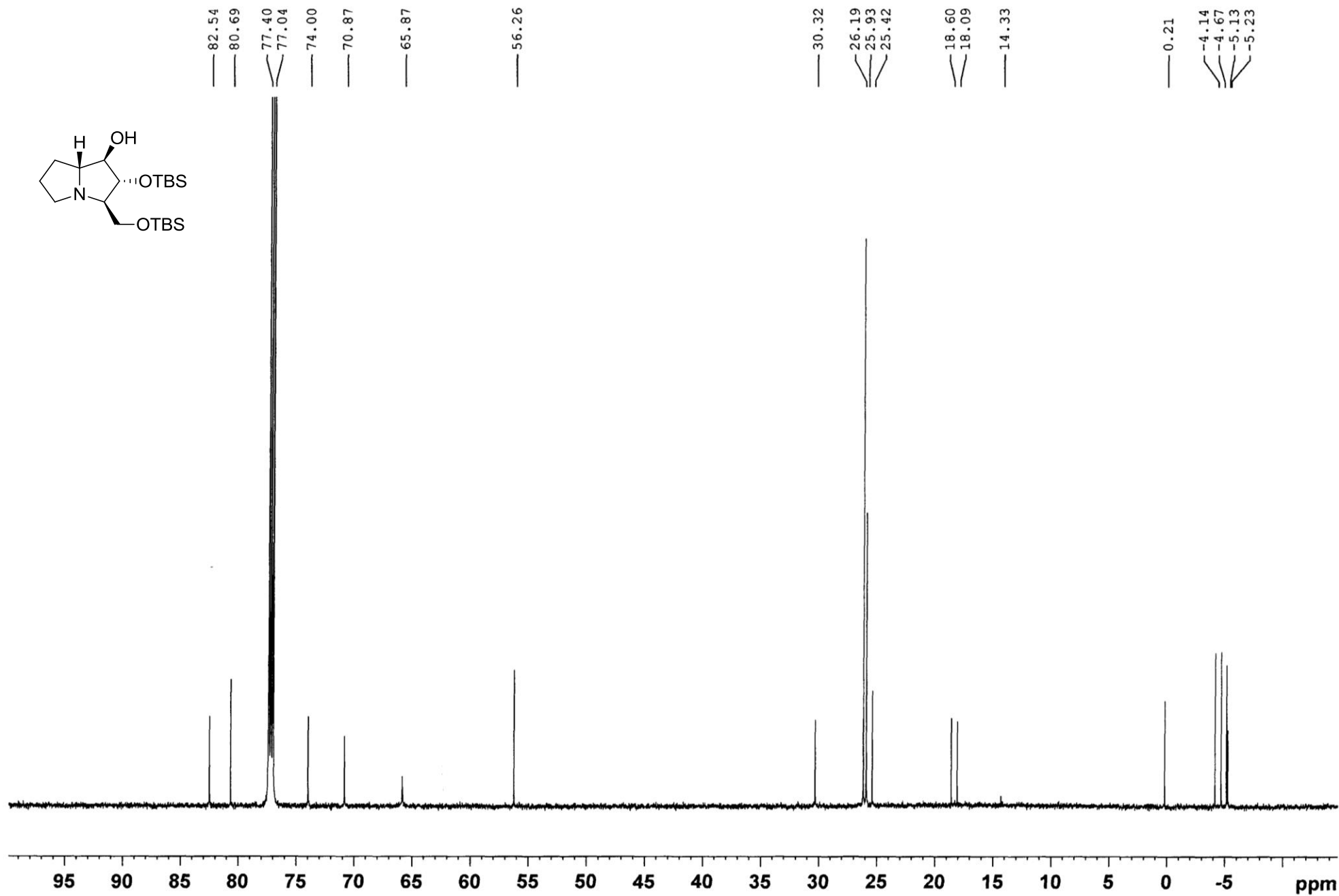
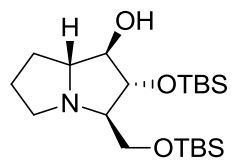
Chemical structure of compound 10: C1CCN(C1)[C@H](O)[C@@H](OSi(C)(C)C)[C@H](OSi(C)(C)C)C1=CC=CC=C1

¹H NMR spectrum (CDCl₃) of compound 10. The x-axis represents chemical shift in ppm, ranging from 0.0 to 8.5. The spectrum shows several peaks, with integration values provided below the baseline and chemical shift values labeled above the peaks.

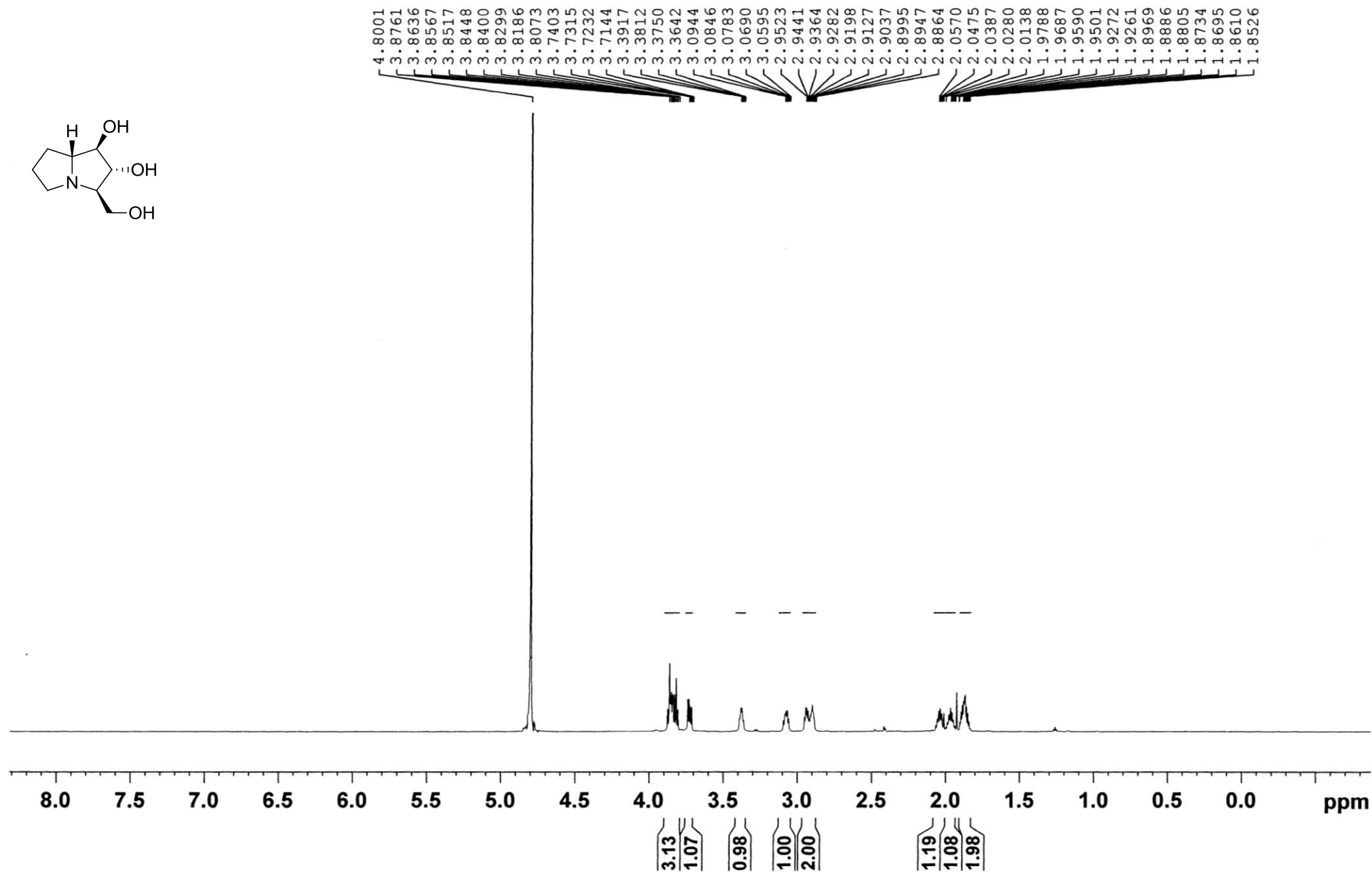
Integration values (from left to right): 1.00, 2.08, 1.00, 0.93, 0.94, 0.98, 0.97, 0.92, 0.83, 1.19, 1.36, 2.74, 20.59, 13.24.

Chemical shift values (from left to right): 3.9189, 3.9121, 3.9048, 3.7604, 3.7555, 3.7458, 3.7409, 3.7259, 3.6239, 3.6134, 3.4912, 3.3199, 3.0352, 3.0266, 2.8416, 2.7089, 2.3587, 2.1668, 2.0686, 2.0599, 2.0415, 2.0341, 2.0253, 1.9233, 1.8343, 1.8264, 1.7264, 1.7174, 1.7092, 1.6809, 1.5242, 1.2626, 0.9108, 0.8929, 0.1112, 0.0845, 0.0753, 0.0043.

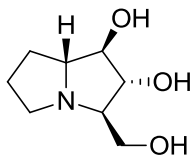
9 (175 MHz, CDCl₃)



1 (700 MHz, D₂O)



1 (175 MHz, D₂O)



— 79.47
— 76.25
— 69.31
— 66.85
— 65.72
— 61.23
— 54.93

— 34.57
— 29.36
— 24.35

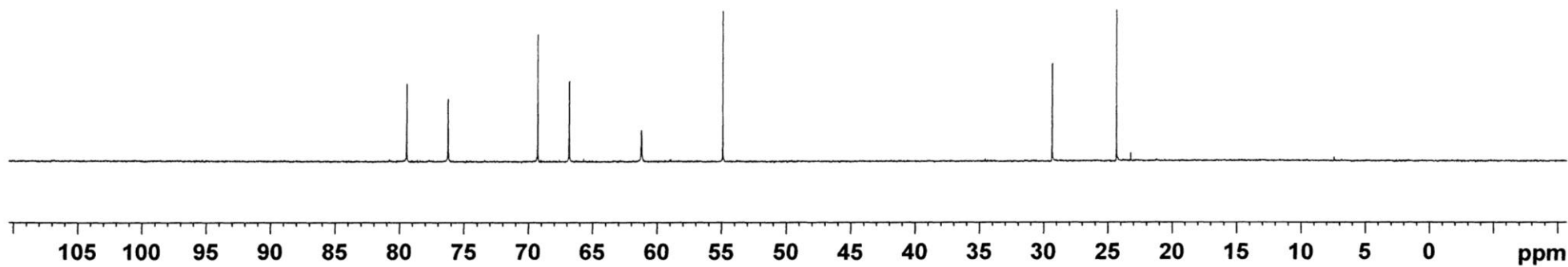


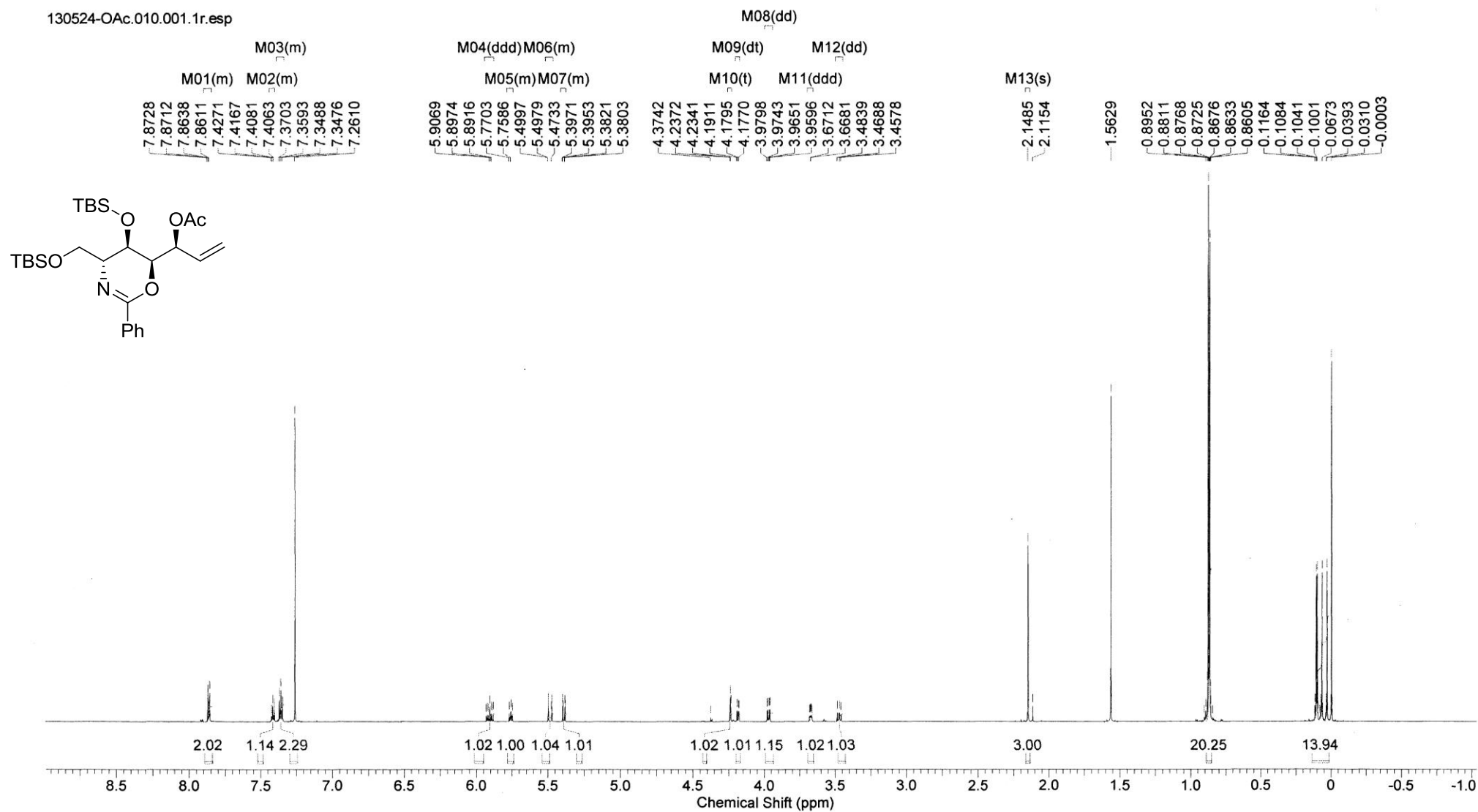
Table 1. Comparison of reported ¹H NMR data with those of **1**.

	Asano <i>et al.</i> ⁴ (natural product)	Fox <i>et al.</i> ^{5a} (pH 7.6)	Fox <i>et al.</i> ^{5a} (pH 9.0)	Izquierdo <i>et al.</i> ⁵ⁱ	This work
Solvent	D ₂ O	D ₂ O	D ₂ O	D ₂ O	D ₂ O
H-2	3.81 (t, <i>J</i> = 8.8 Hz, 1H)	4.08–3.97 (m, 3H)	3.87–3.76 (m, 3H)	3.79–3.71 (m, 3H)	3.88–3.80 (m, 3H)
H-8'	3.80 (dd, <i>J</i> = 11.8, 3.9 Hz, 1H)	-	-	-	-
H-1	3.76 (dd, <i>J</i> = 8.8, 7.1 Hz, 1H)	-	-	-	-
H-8	3.67 (dd, <i>J</i> = 11.87, 6.5 Hz, 1H)	3.95–3.87 (m, 2H)	3.70 (dd, <i>J</i> = 12.0, 6.3 Hz, 1H)	3.63 (dd, <i>J</i> = 12.1, 6.0 Hz, 1H)	3.75–3.71 (m, 1H)
H-7a	3.32 (m, 1H)	-	3.37–3.30 (m, 1H)	3.37 (m, 1H)	3.40–3.36 (m, 1H)
H-5	2.96 (ddd, <i>J</i> = 11.0, 7.3, 5.9 Hz, 1H)	3.54–3.45 (m, 1H)	3.08–2.99 (m, 1H)	3.04 (broad dt, <i>J</i> = 11.7, 6.5 Hz, 1H)	3.10–3.05 (m, 1H)
H-5	2.81 (dt, <i>J</i> = 11.0, 5.6 Hz)	3.42–3.32 (m, 2H)	2.95–2.82 (m, 2H)	2.93–2.85 (m, 2H)	2.96–2.88 (m, 2H)
H-3	2.77 (ddd, <i>J</i> = 8.8, 6.5, 3.9 Hz, 1H)	-	-	-	-
H-7	1.97 (m, 1H)	2.30–2.07 (m, 4H)	2.07–1.91 (m, 2H)	1.96–1.72 (m, 4H)	2.06–2.00 (m, 1H)
H-6	1.90 (m, 1H)	-	-	-	2.00–1.95 (m, 1H)
H-6	1.82 (m, 1H)	-	1.91–1.77 (m, 2H)	-	1.93–1.85 (m, 2H)
H-7	1.77 (m, 1H)	-	-	-	-

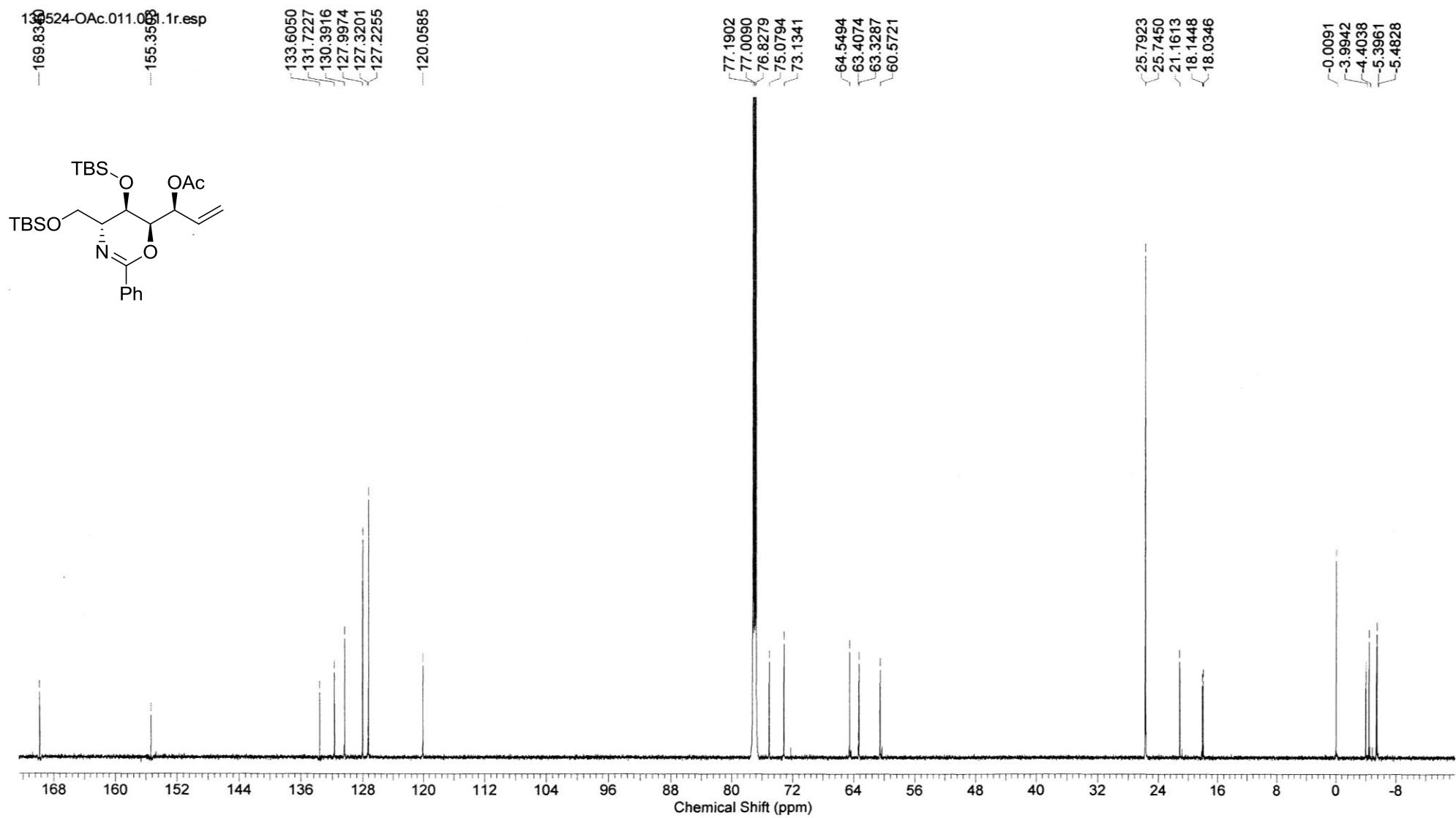
Table 2. Comparison of reported ¹³C NMR data with those of **1**.

	Asano <i>et al.</i> ⁴ (natural product)	Fox <i>et al.</i> ^{5a} (pH 7.6)	Fox <i>et al.</i> ^{5a} (pH 9.0)	Izquierdo <i>et al.</i> ⁵ⁱ	This work
Solvent	D ₂ O	D ₂ O	D ₂ O	D ₂ O	D ₂ O
C-1	82.9	81.0	82.5	81.09	79.4
C-2	79.8	77.2	79.3	77.72	76.3
C-3	72.1	73.0	72.2	71.47	69.3
C-7a	69.2	72.3	69.7	69.42	66.9
C-8	65.3	60.3	64.4	62.24	61.2
C-5	57.7	58.5	57.8	57.05	55.0
C-7	32.5	31.7	32.4	31.19	29.4
C-6	27.3	27.3	27.3	26.32	24.4

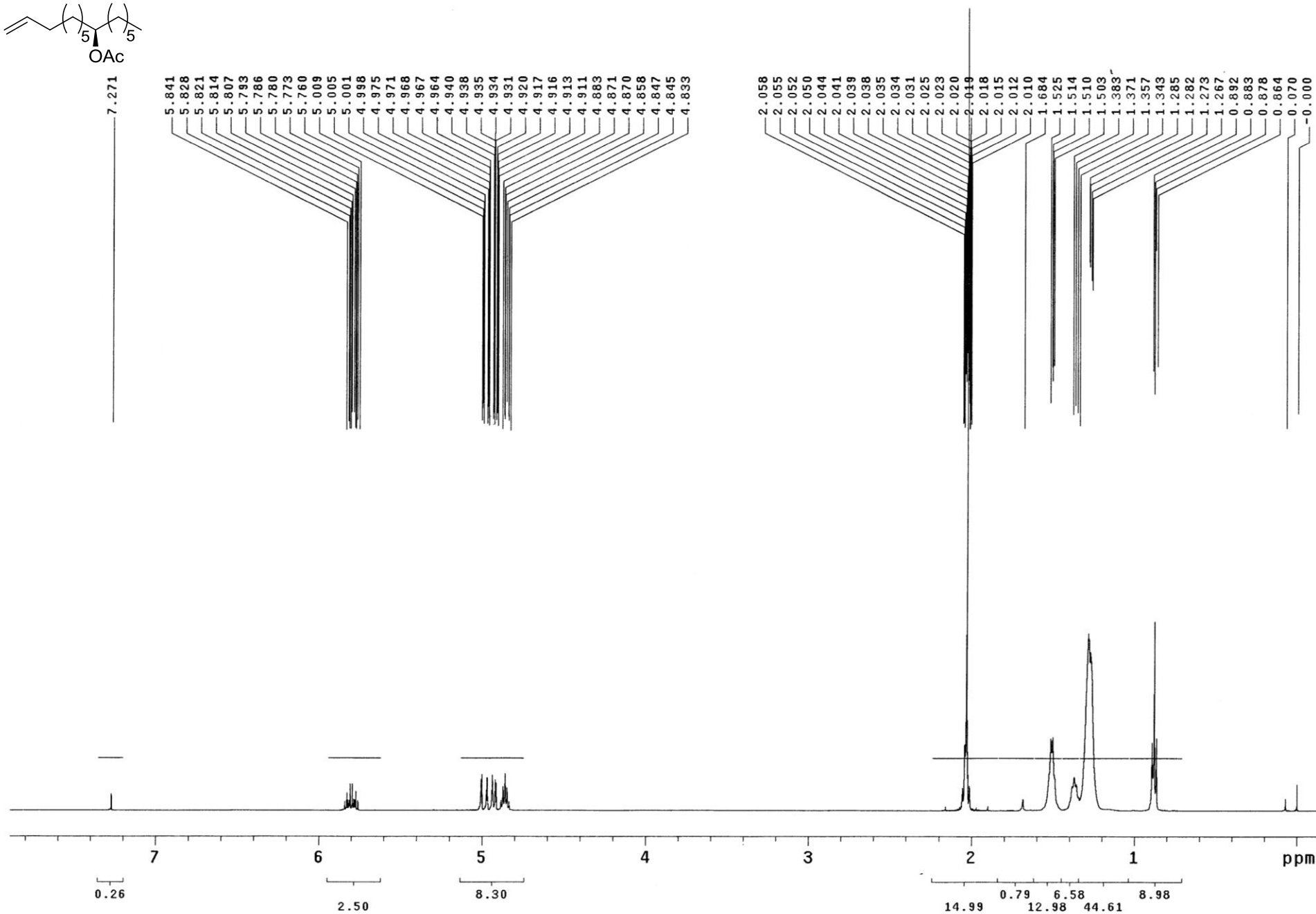
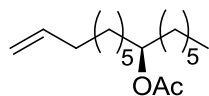
13 (700 MHz, CDCl₃)



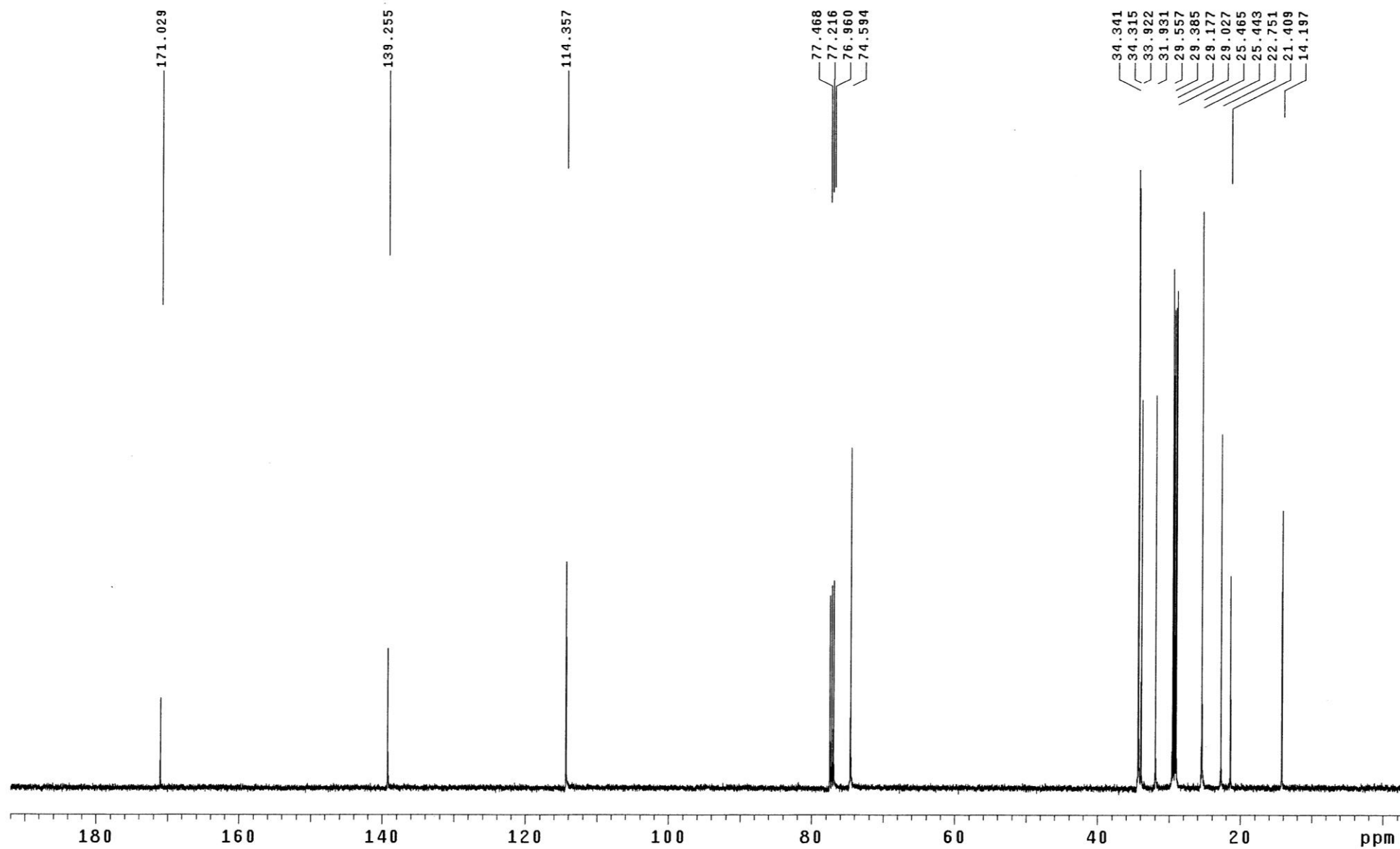
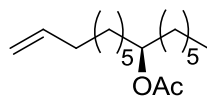
13 (175 MHz, CDCl₃)



14 (500 MHz, CDCl₃)

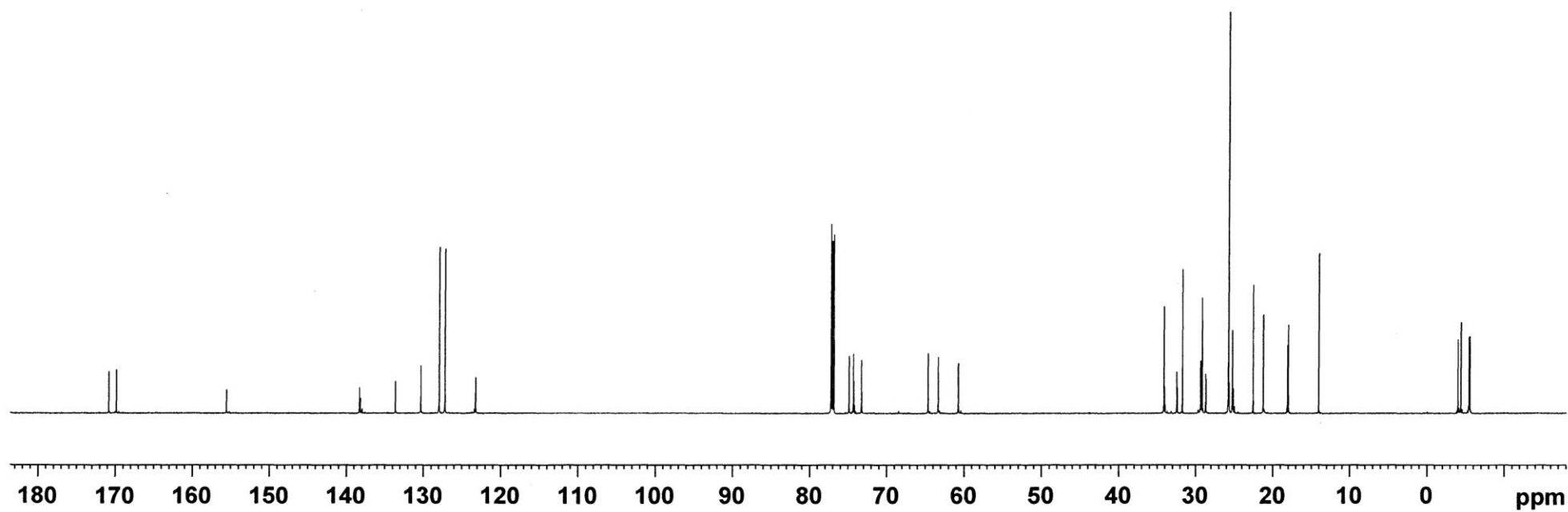
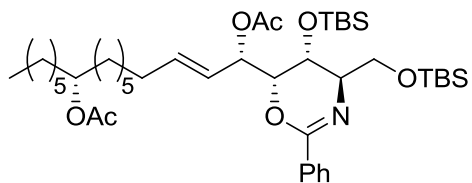


14 (125 MHz, CDCl₃)



[illegible]

	$\underbrace{\hspace{1.5cm}}$	170.89
	$\underbrace{\hspace{1.5cm}}$	169.90
	---	155.60
	$\underbrace{\hspace{1.5cm}}$	138.35
	$\underbrace{\hspace{1.5cm}}$	138.22
	---	133.66
	$\underbrace{\hspace{1.5cm}}$	130.37
	$\underbrace{\hspace{1.5cm}}$	127.98
	$\underbrace{\hspace{1.5cm}}$	127.23
	$\underbrace{\hspace{1.5cm}}$	123.28
	$\underbrace{\hspace{1.5cm}}$	123.24



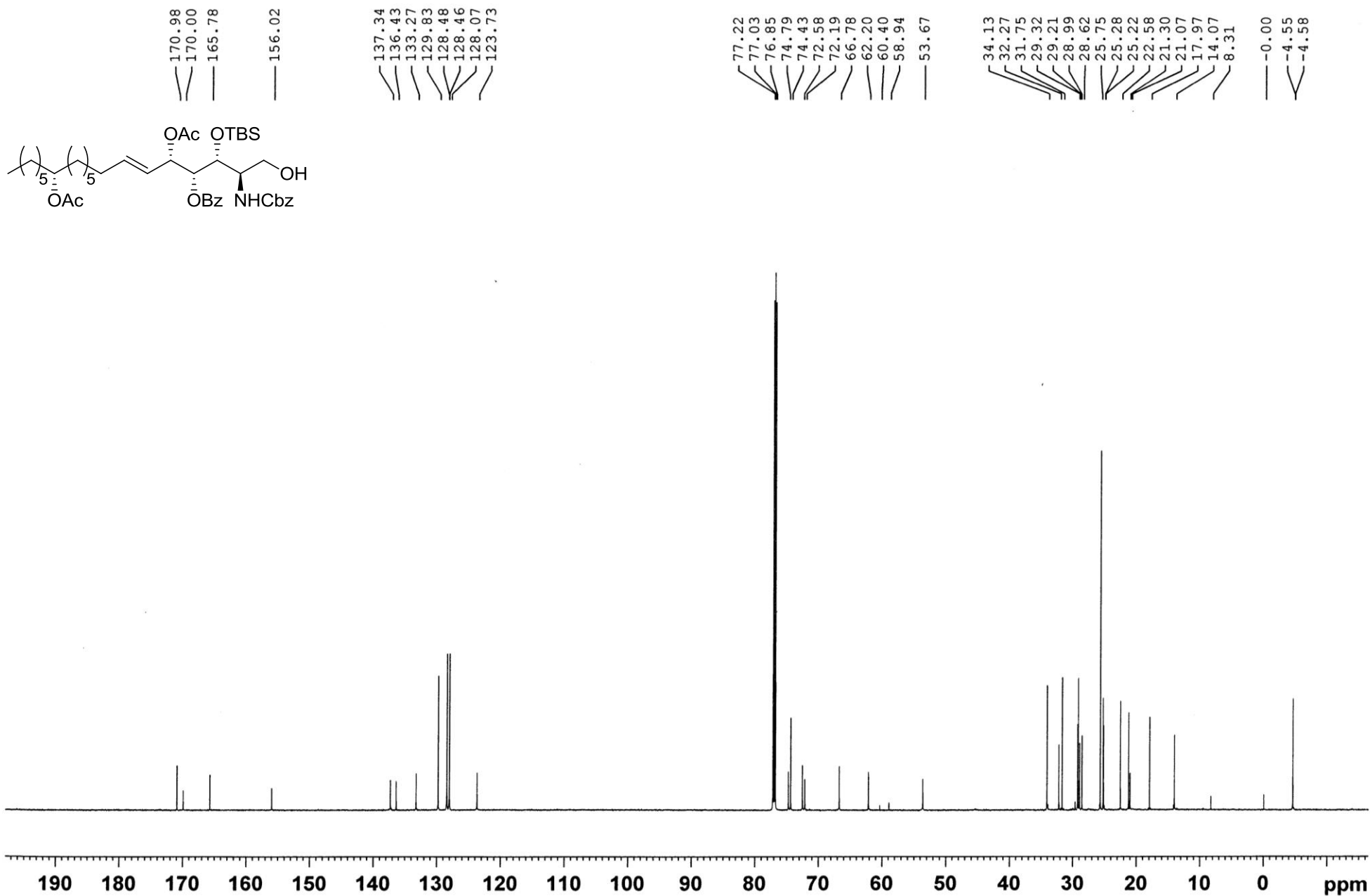
Chemical Structure:

*CC(C)(COC(=O)C)C#CCCC/C=C/[C@H](OC(=O)c1ccccc1)[C@@H](OC(=O)C)C[C@H](CO)Nc1ccccc1

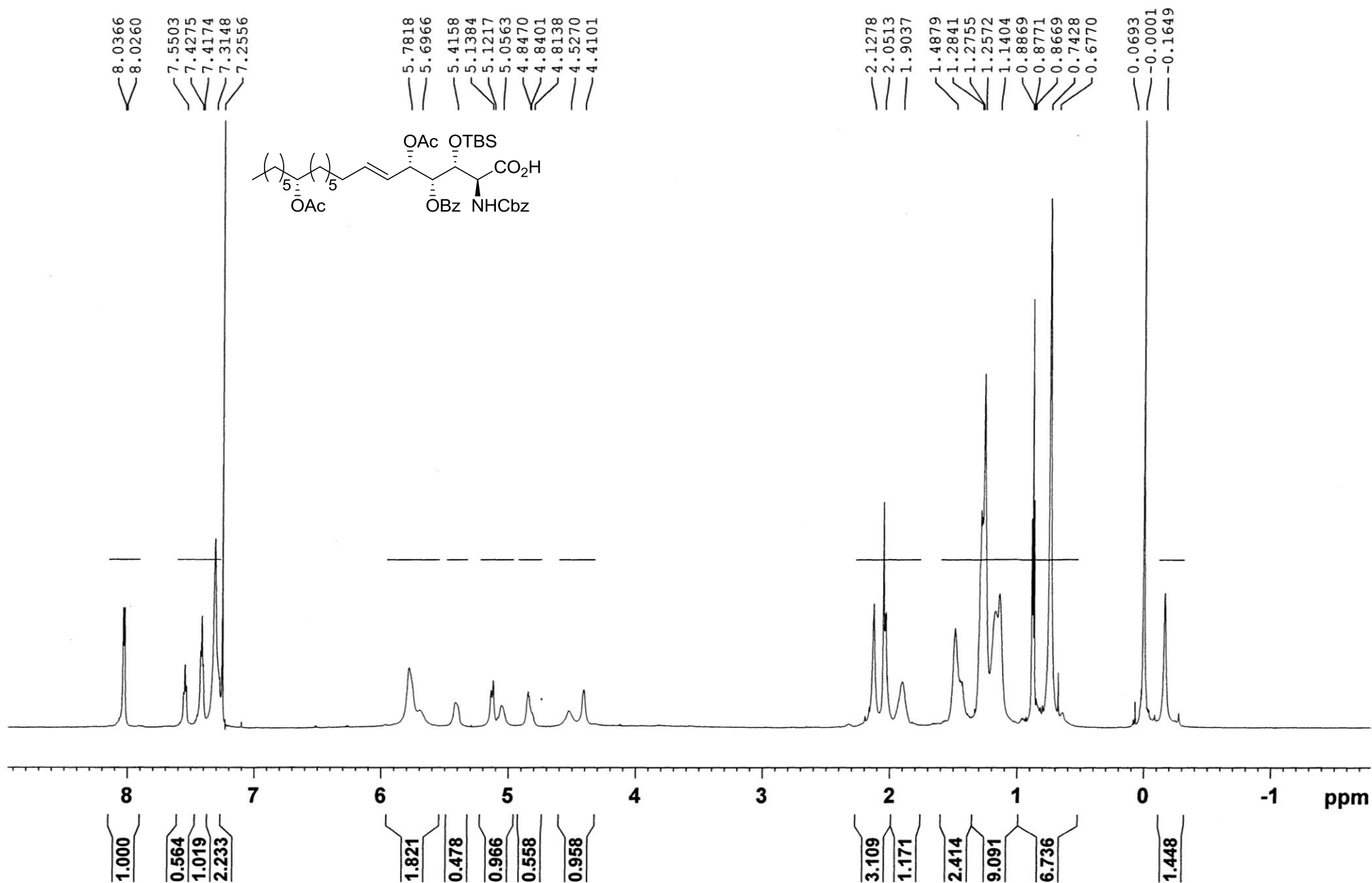
¹H NMR Spectrum Data:

Chemical Shift (ppm)	Integration
7.9770, 7.9667, 7.9651, 7.5198, 7.5092, 7.4986, 7.3685, 7.3576, 7.3467, 7.2982, 7.2880, 7.2862, 7.2780, 7.2691, 7.2647, 7.2596, 7.2533, 7.2084	2.103
5.5598, 5.5512, 5.4791, 5.4692, 5.3357, 5.3276, 5.3196, 5.0747, 5.0573, 5.0096, 4.9921, 4.7895, 4.7872, 4.7794, 4.7716, 4.7693, 4.2439, 4.2375, 4.2306, 3.9709, 3.9666, 3.7306, 3.7259, 3.6989, 3.6935, 3.6823, 3.6769	0.998, 1.012, 1.012, 2.225, 1.042, 1.077, 1.077
1.9851, 1.9822, 1.9743, 1.9701, 1.9096, 1.8998, 1.4435, 1.4355, 1.4329, 1.4235, 1.4131, 1.4056, 1.4014, 1.2470, 1.2366, 1.2292, 1.2194, 1.2109, 1.2008, 1.1906, 1.1742, 1.1599, 1.1496, 1.1390, 1.1246, 1.1231, 0.8320, 0.8221, 0.8118, 0.7551, -0.0001, -0.0555, -0.0632	0.354, 6.530, 2.545, 4.907, 20.276, 4.248, 10.679, 3.214, 3.897

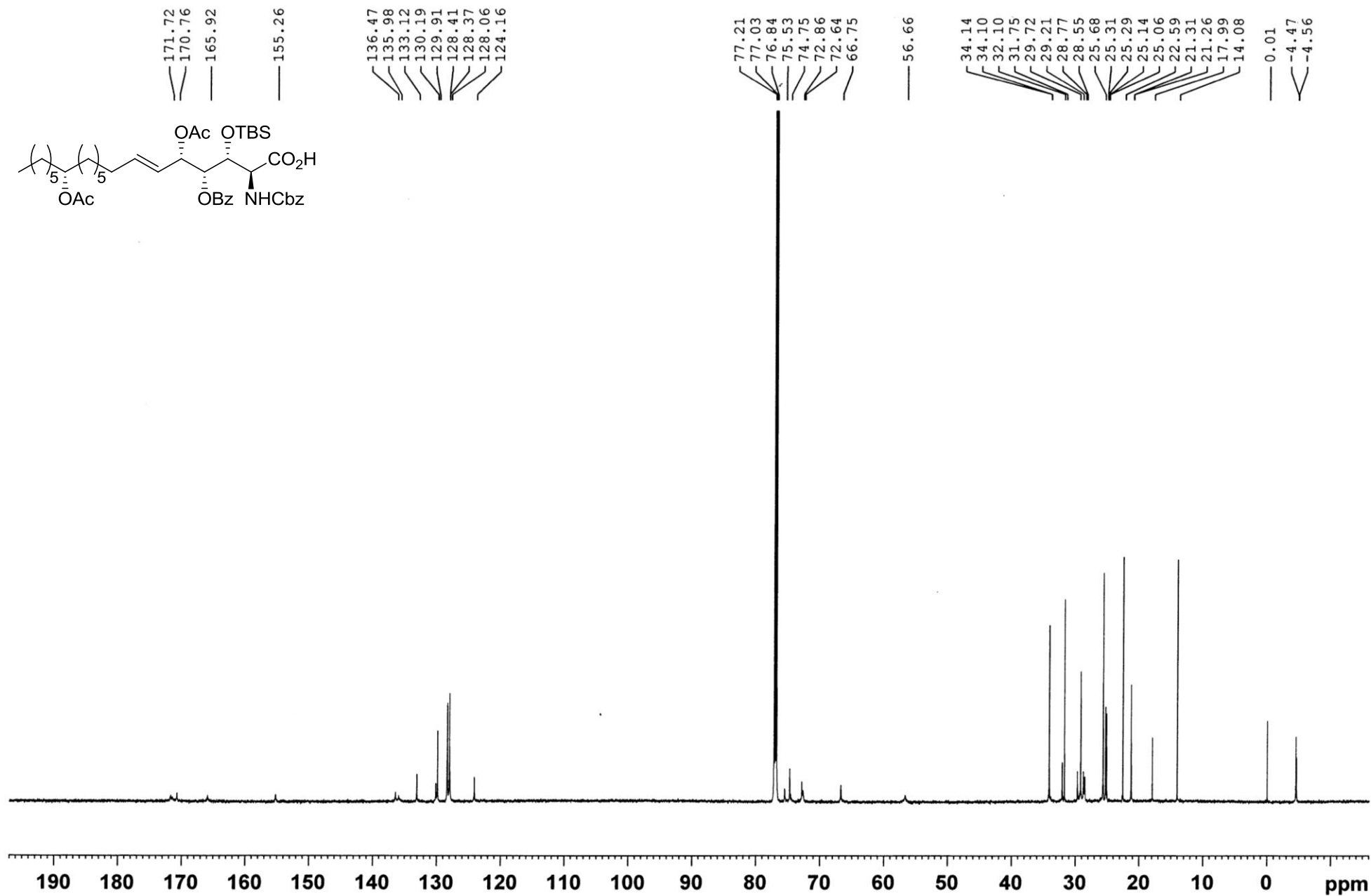
16 (175 MHz, CDCl₃)



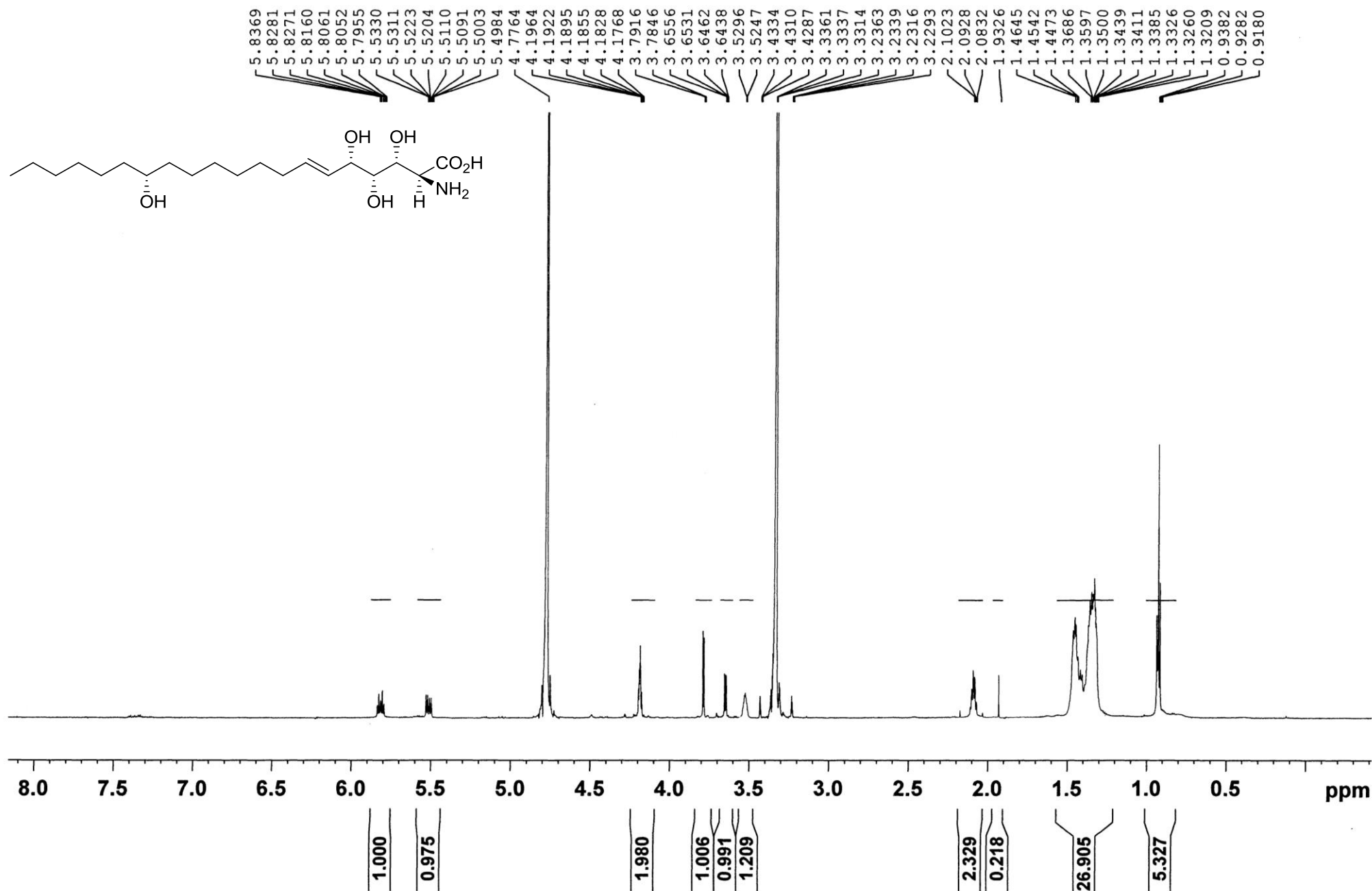
17 (700 MHz, CDCl₃)



17 (175 MHz, CDCl₃)



2 (700 MHz, CD₃OD)



2 (175 MHz, CD₃OD)

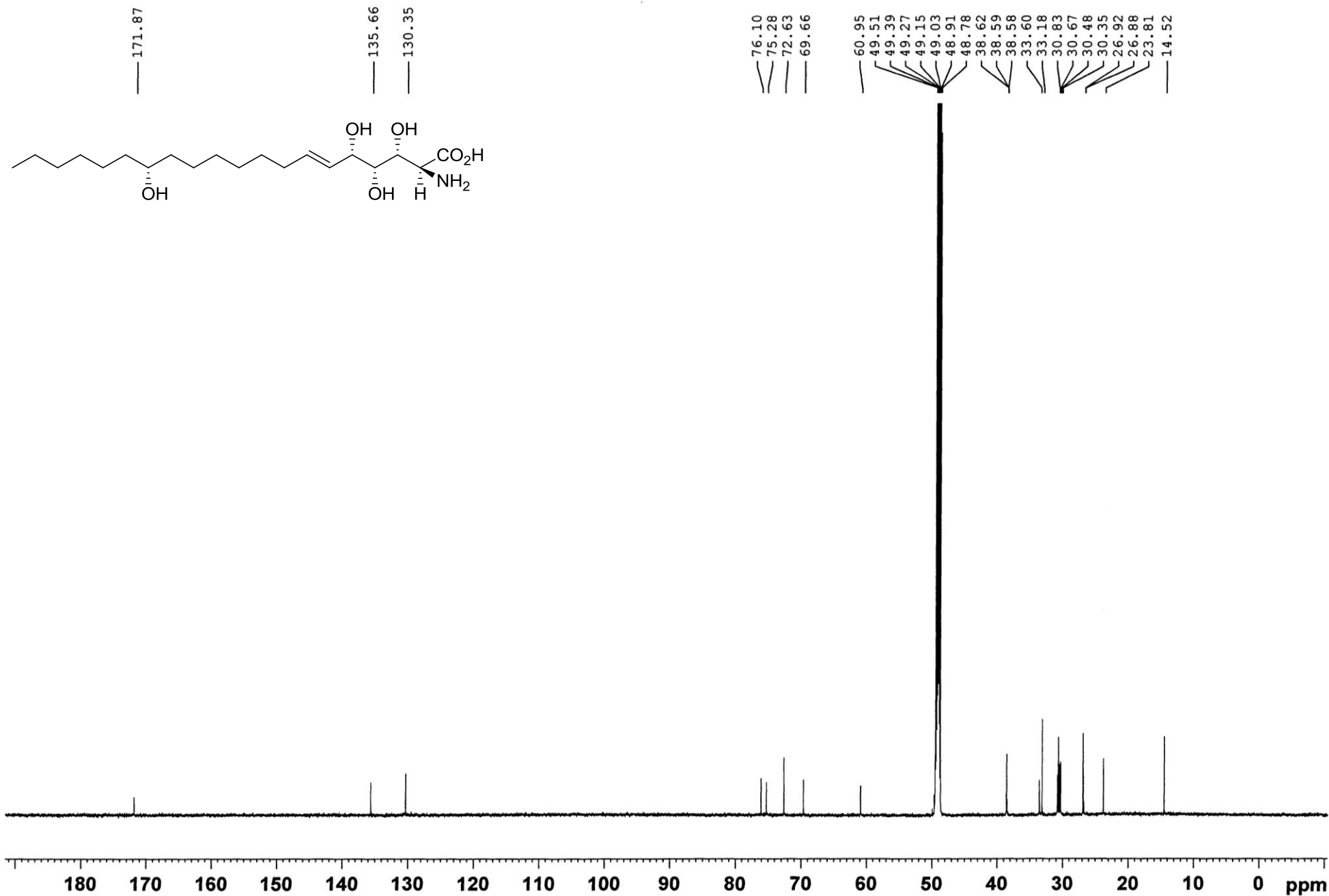


Table 3. Comparison of reported ^1H NMR data with those of 2.

	Kobayashi <i>et al.</i> ⁹	This work
Solvent	CD ₃ OD	CD ₃ OD
	0.89 (t, J = 6.4 Hz, 3H)	0.91 (t, J = 7.0 Hz, 3H)
	1.18–1.60 (m, 20H)	1.32–1.46 (m, 20H)
	1.98–2.06 (m, 2H)	2.08–2.10 (m, 2H)
	3.49 (brs, 1H)	3.52 (brs, 1H)
	3.60 (d, J = 6.9 Hz, 1H)	3.64 (dd, J = 6.5, 1.7 Hz, 1H)
	3.77 (d, J = 3.6 Hz, 1H)	3.78 (d, J = 4.9 Hz, 1H)
	4.06–4.10 (m, 2H)	4.17–4.19 (m, 2H)
	5.47 (dd, J = 15.2, 7.3 Hz, 1H)	5.51 (dd, J = 15.4, 7.4 Hz, 1H)
	5.77 (dt, J = 15.2, 6.6 Hz, 1H)	5.80 (dt, J = 14.6, 6.4 Hz, 1H)

Table 4. Comparison of reported ^{13}C NMR data with those of 2.

	Kobayashi <i>et al.</i> ⁹	This work
Solvent	CD ₃ OD	CD ₃ OD
	14.4	14.5
	23.7	23.8
	26.79	26.9
	26.82	-
	30.2	30.4
	30.4	30.5
	30.6	30.7
	30.7	30.8
	33.1	33.2
	33.5	33.6
	38.5	38.6
	60.8	61.0
	69.4	69.7
	72.5	72.6
	75.2	75.3
	76.0	76.1
	130.2	130.4
	135.5	135.7
	172.4	171.9