

Supporting Information

An Efficient Approach to *trans*-4-hydroxy-5-substituted 2-Pyrrolidinones through Stereoselective Tandem Barbier

Process: Divergent Syntheses of (3*R*,4*S*)- Statines, (+)-Preussin and (-)-Hapolasin

Chang-Mei Si,^{a,§} Lu-Ping Shao,^{a,§} Zhuo-Ya Mao,^{a,b} Wen Zhou^a and Bang-Guo Wei^{a,b,*}

^a *Department of Natural Products Chemistry, School of Pharmacy, Fudan University, 826 Zhangheng Road, Shanghai, 201203, China*

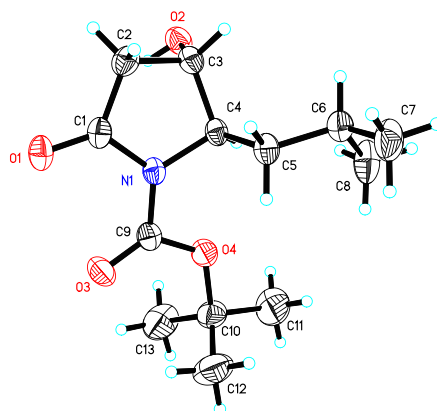
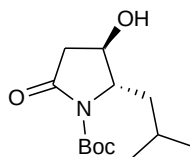
^b *Institutes of Biomedical Sciences, Fudan University, 130 Dongan Road, Shanghai 200032, China*

bgwei1974@fudan.edu.cn

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ORTEP drawing of the X-ray crystallographic structure of **9m**



CCDC-1517141. For detailed crystallographic data, please refer to the Cambridge Crystallographic Data Centre at:
http://www.ccdc.cam.ac.uk/data_request/cif.

7.173
7.153
7.062
7.042

4.931

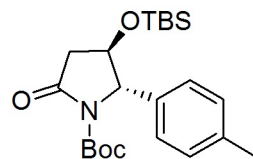
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4.057

2.870
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2.356
2.341

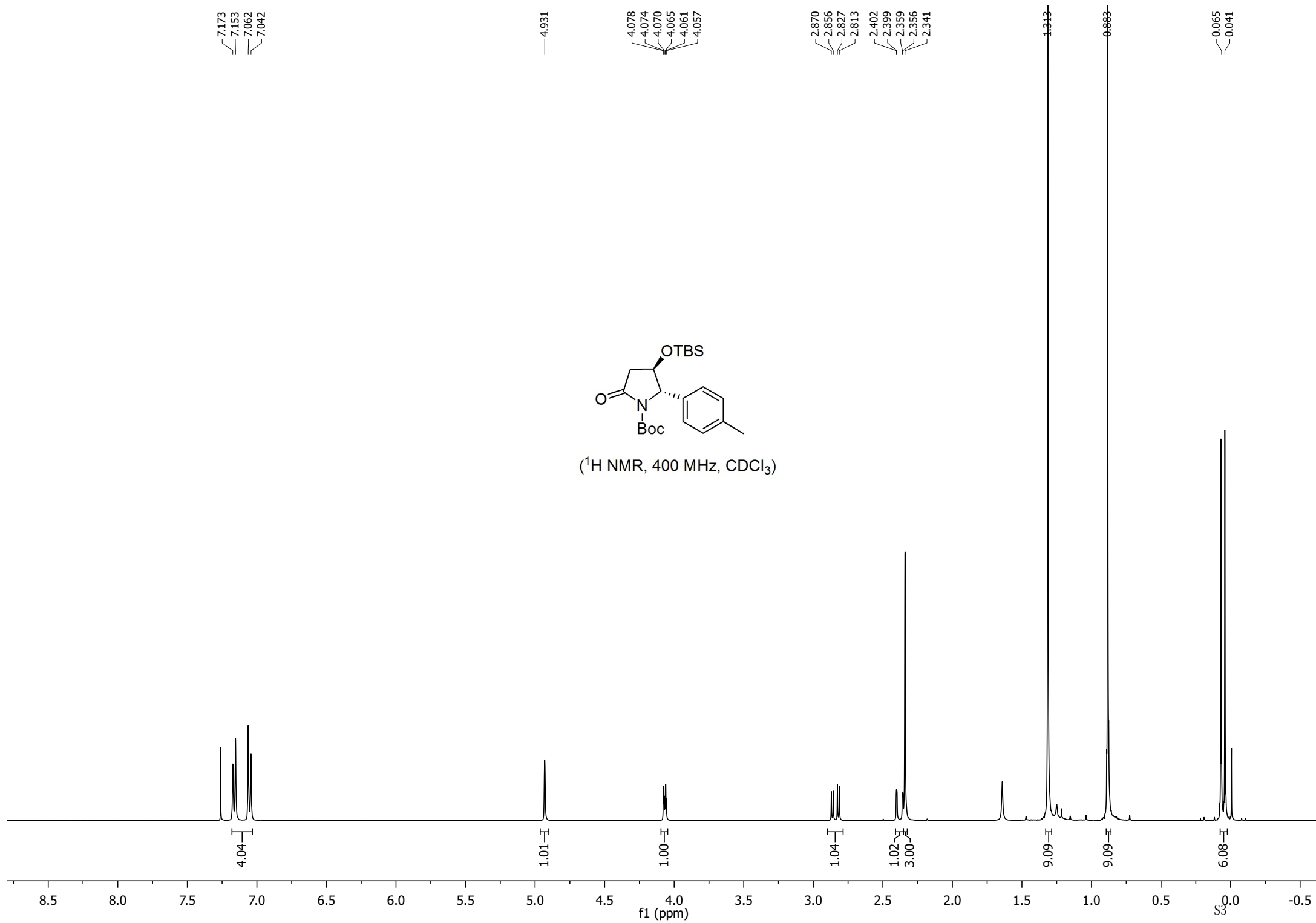
1.313

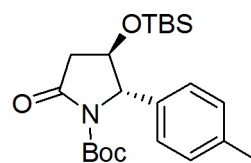
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0.065
0.041

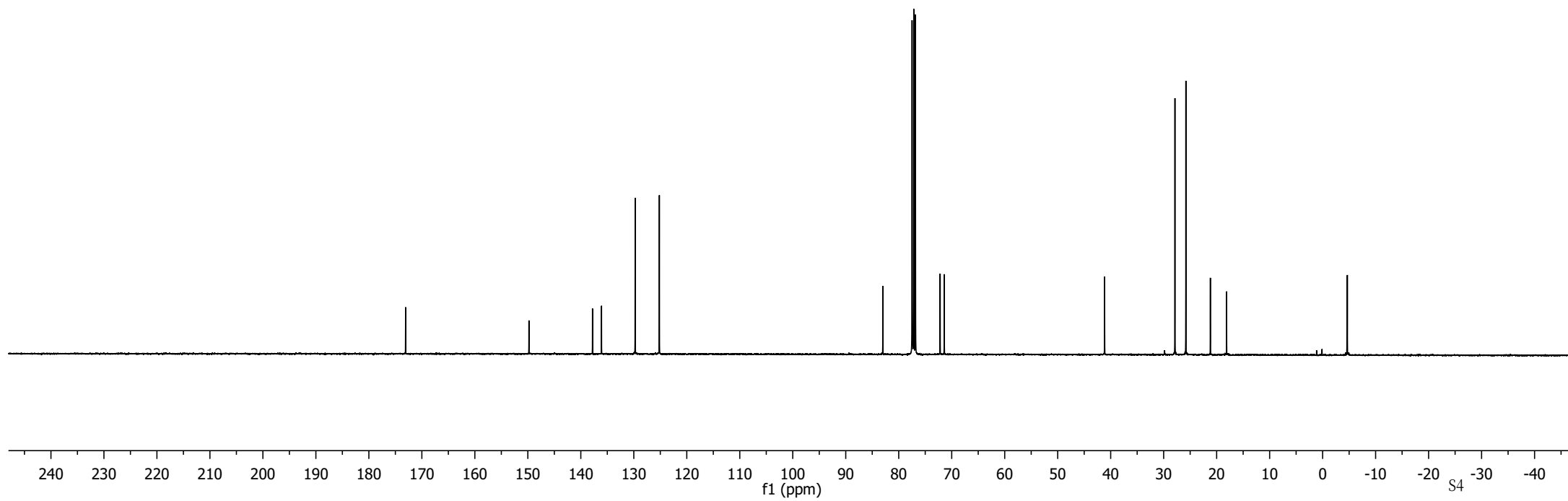


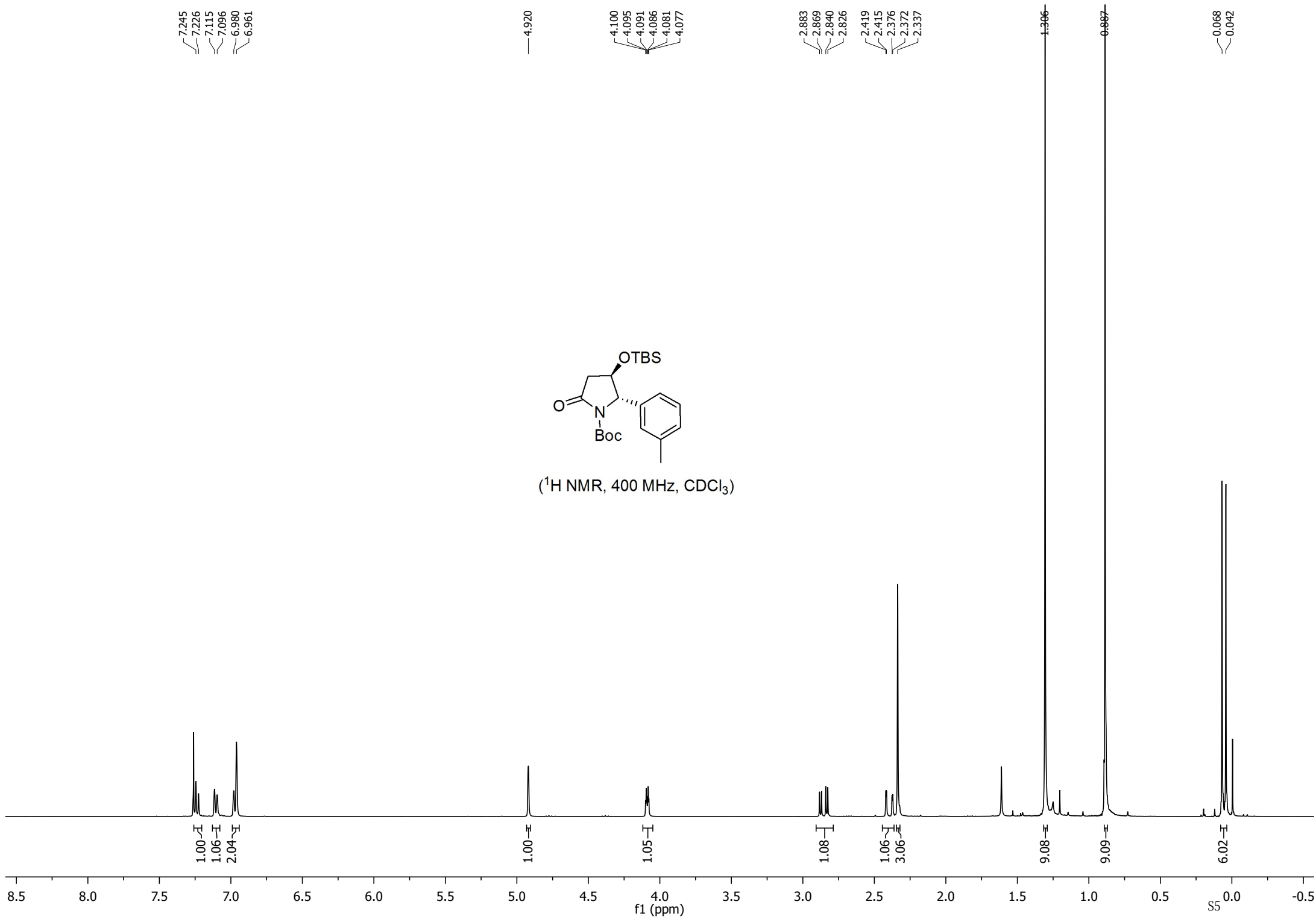
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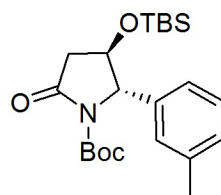




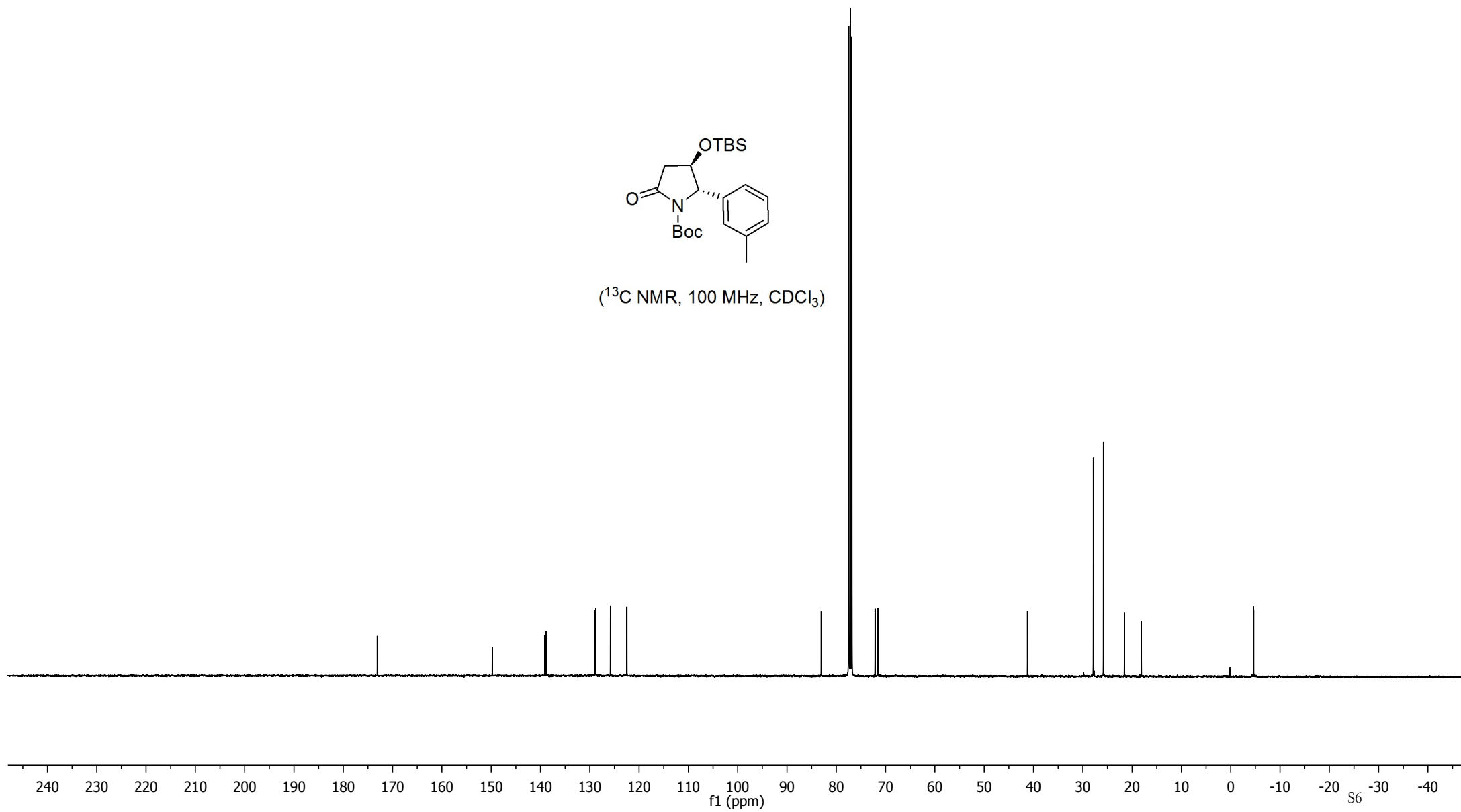
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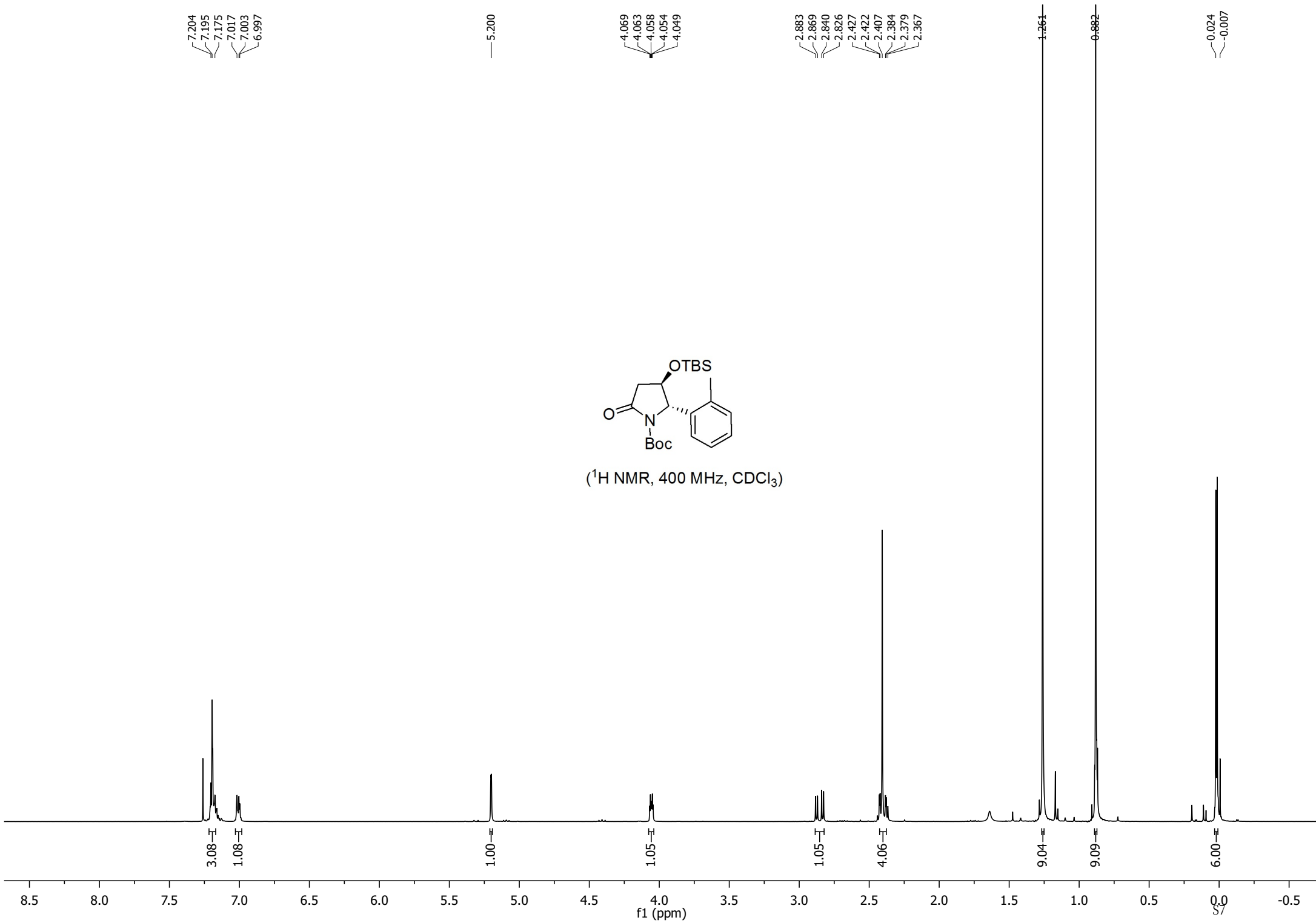


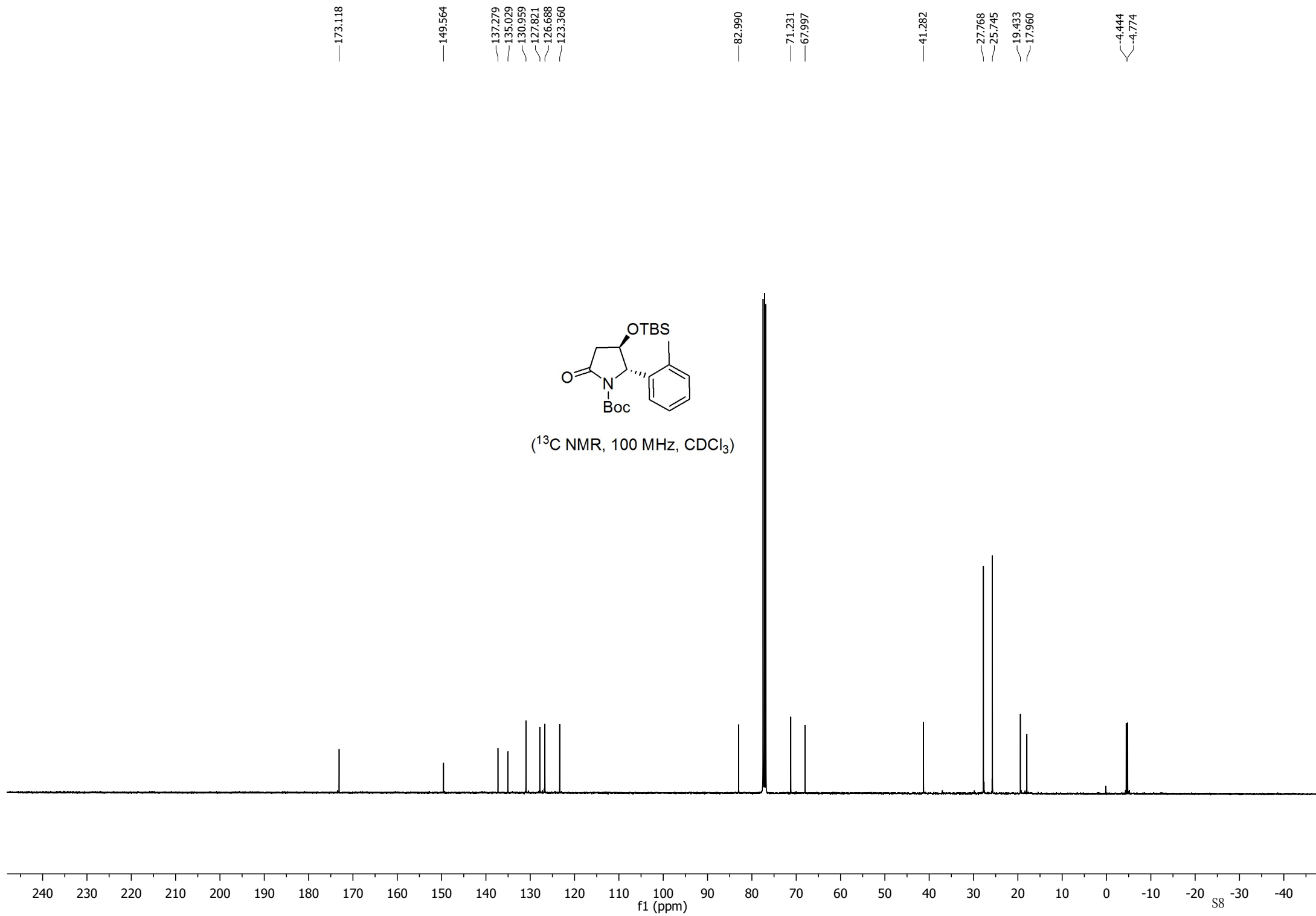


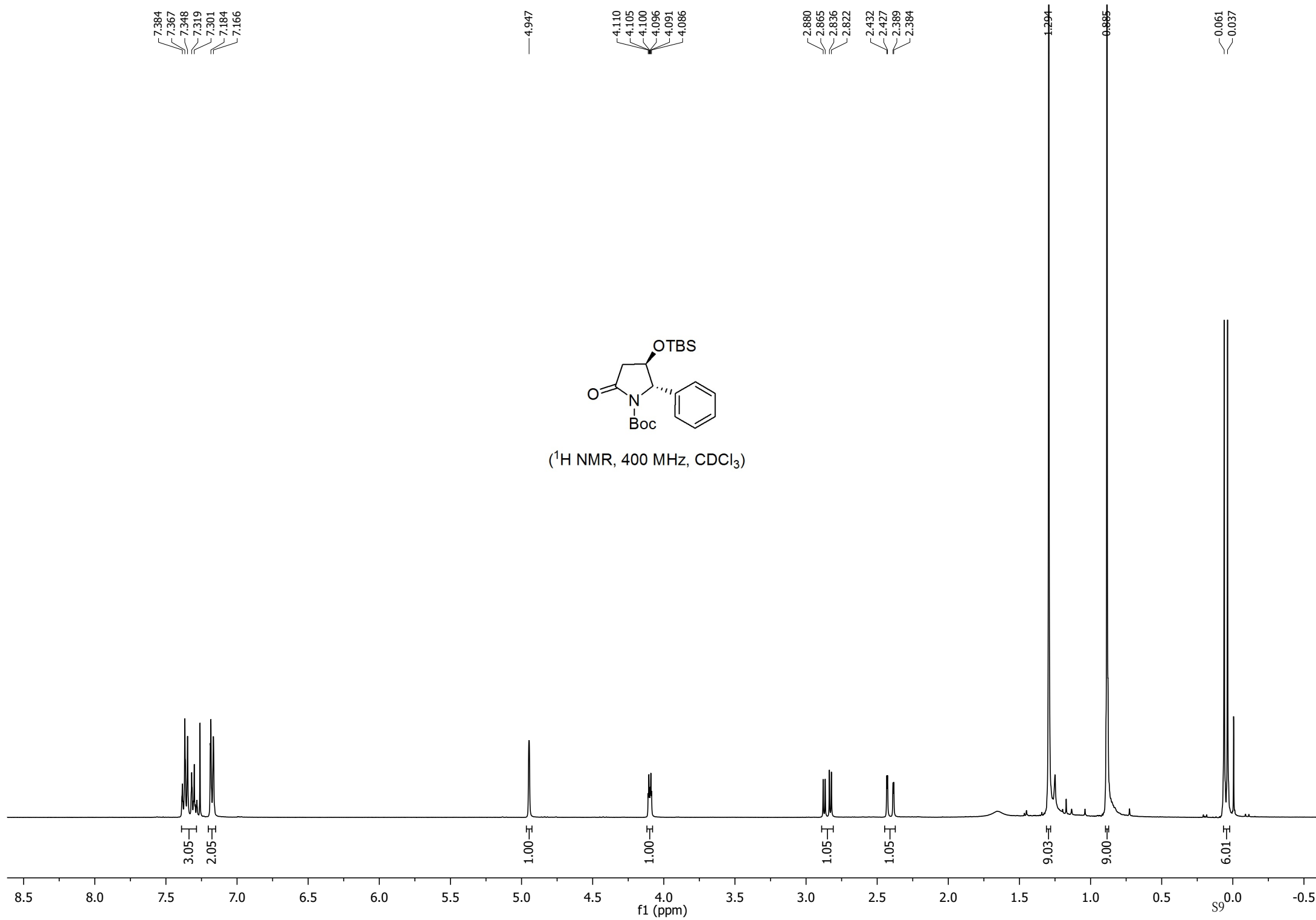


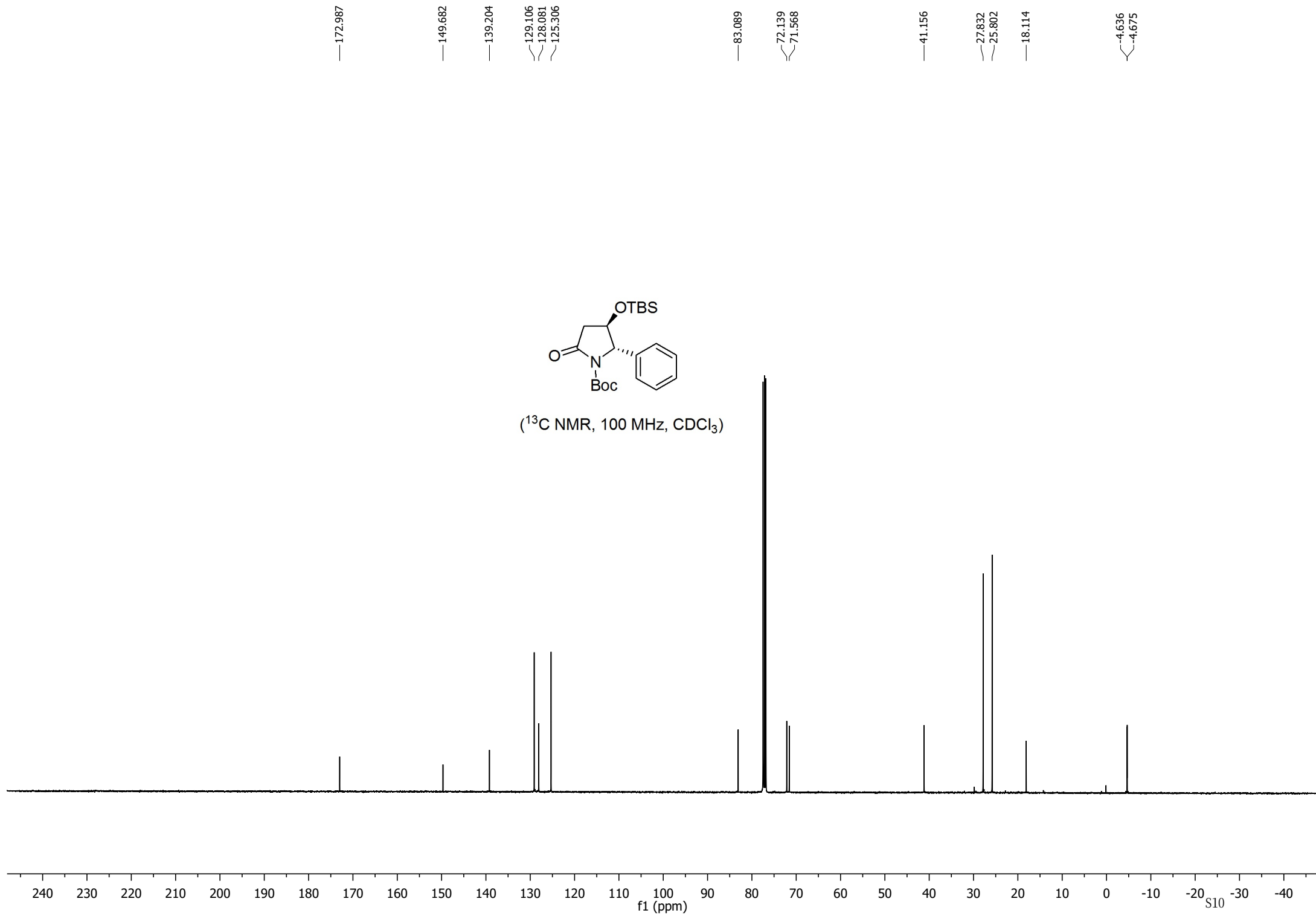
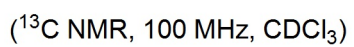
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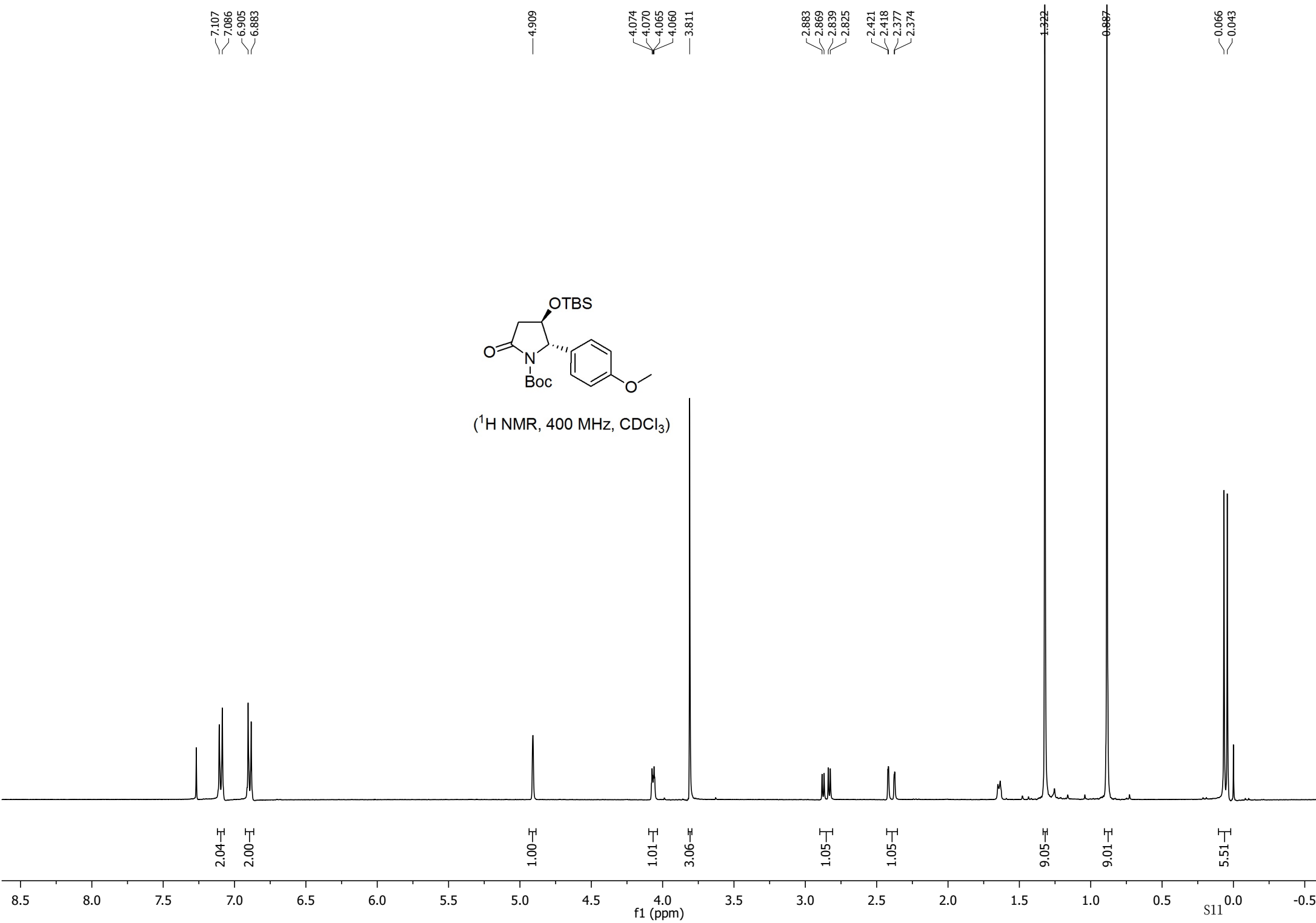


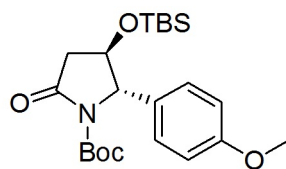




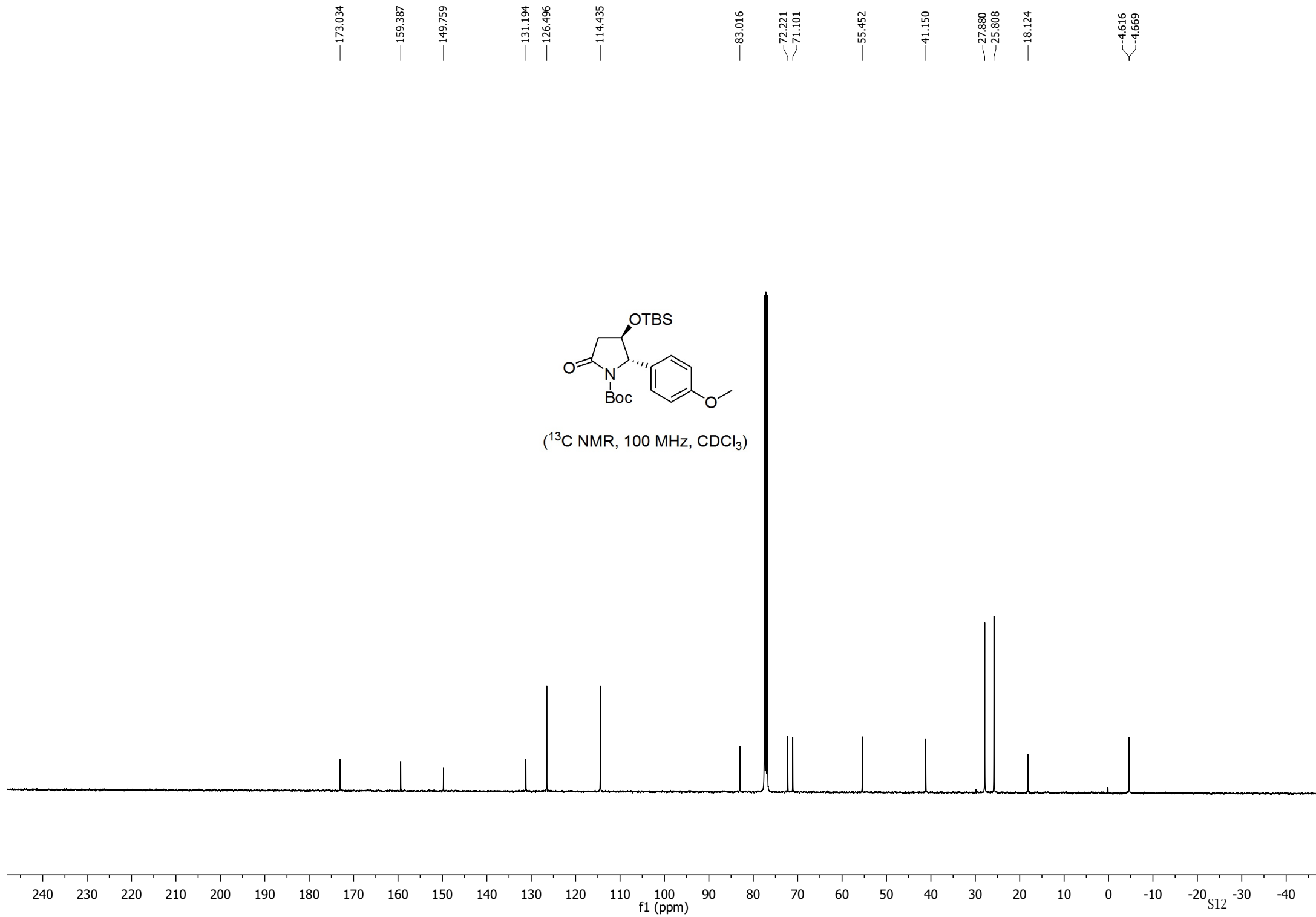


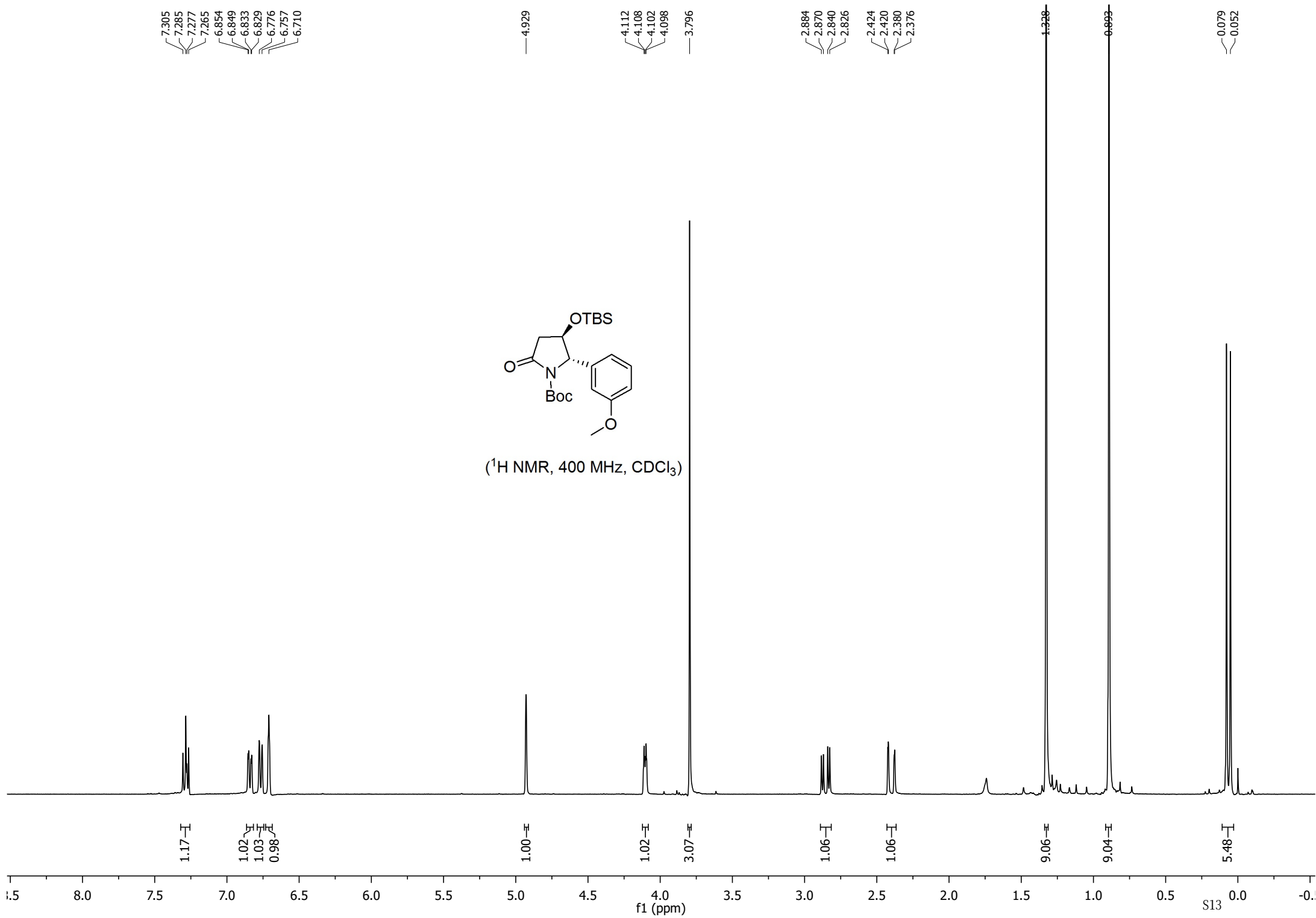


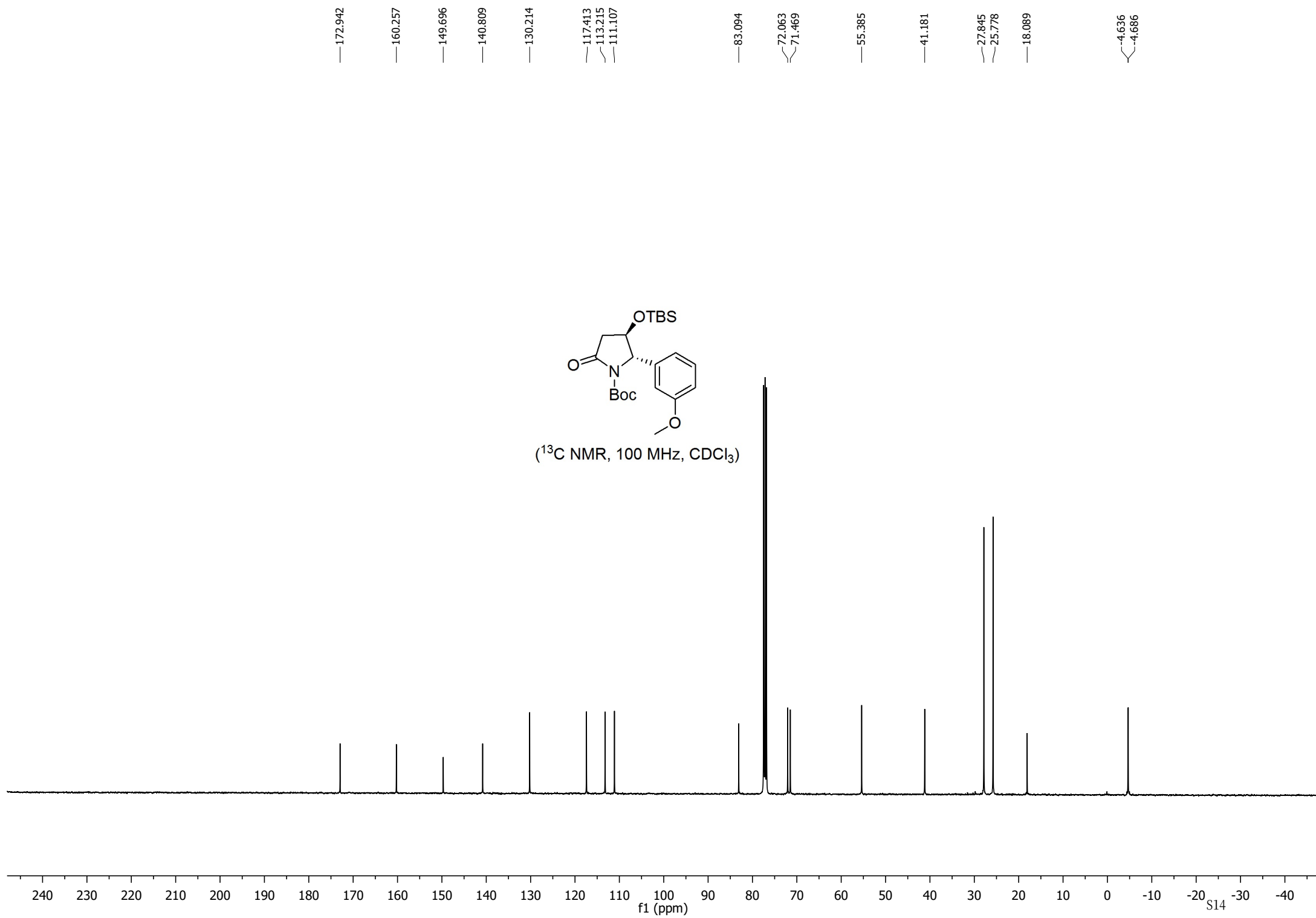


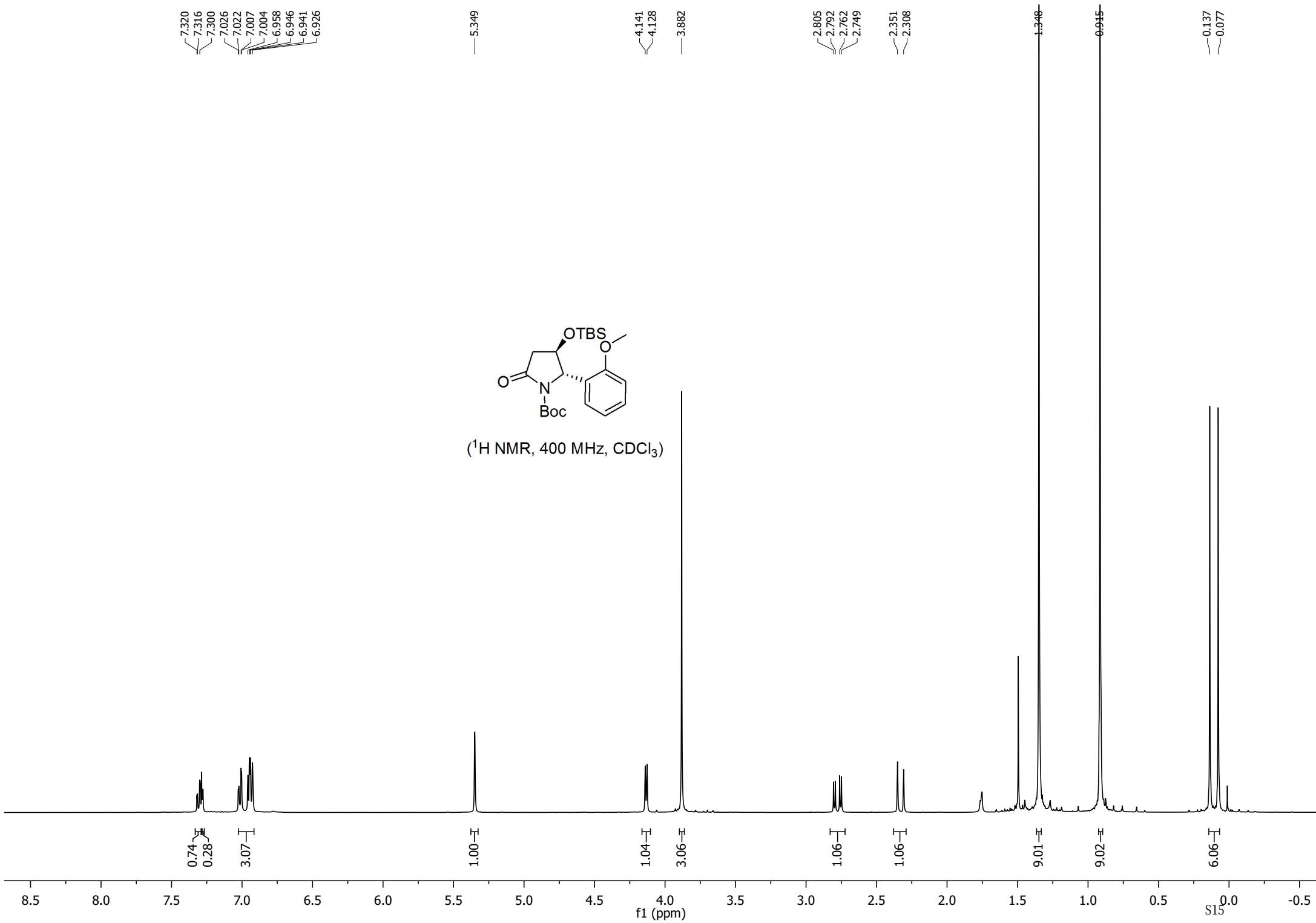


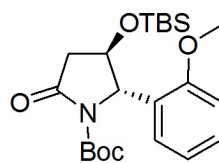
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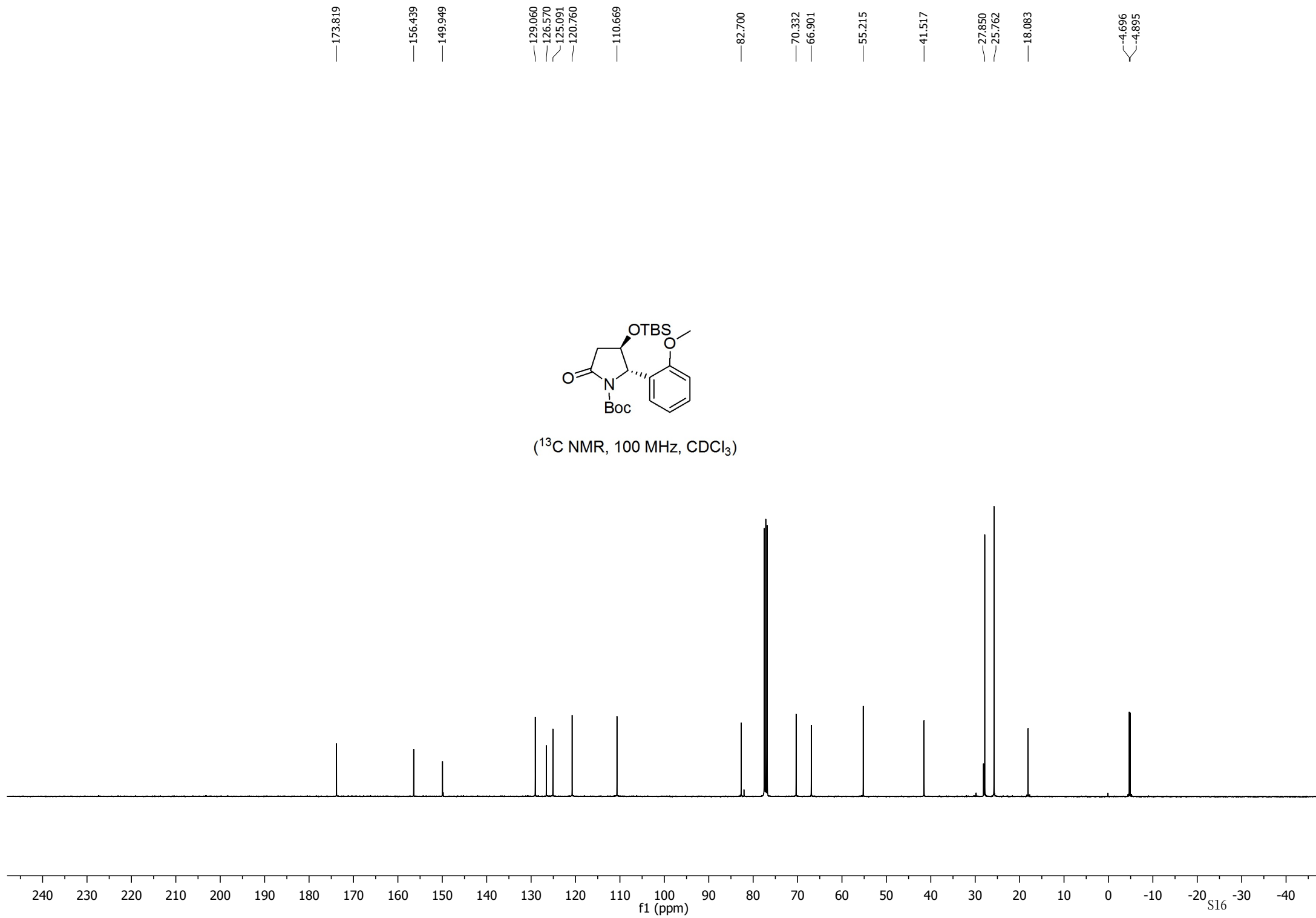


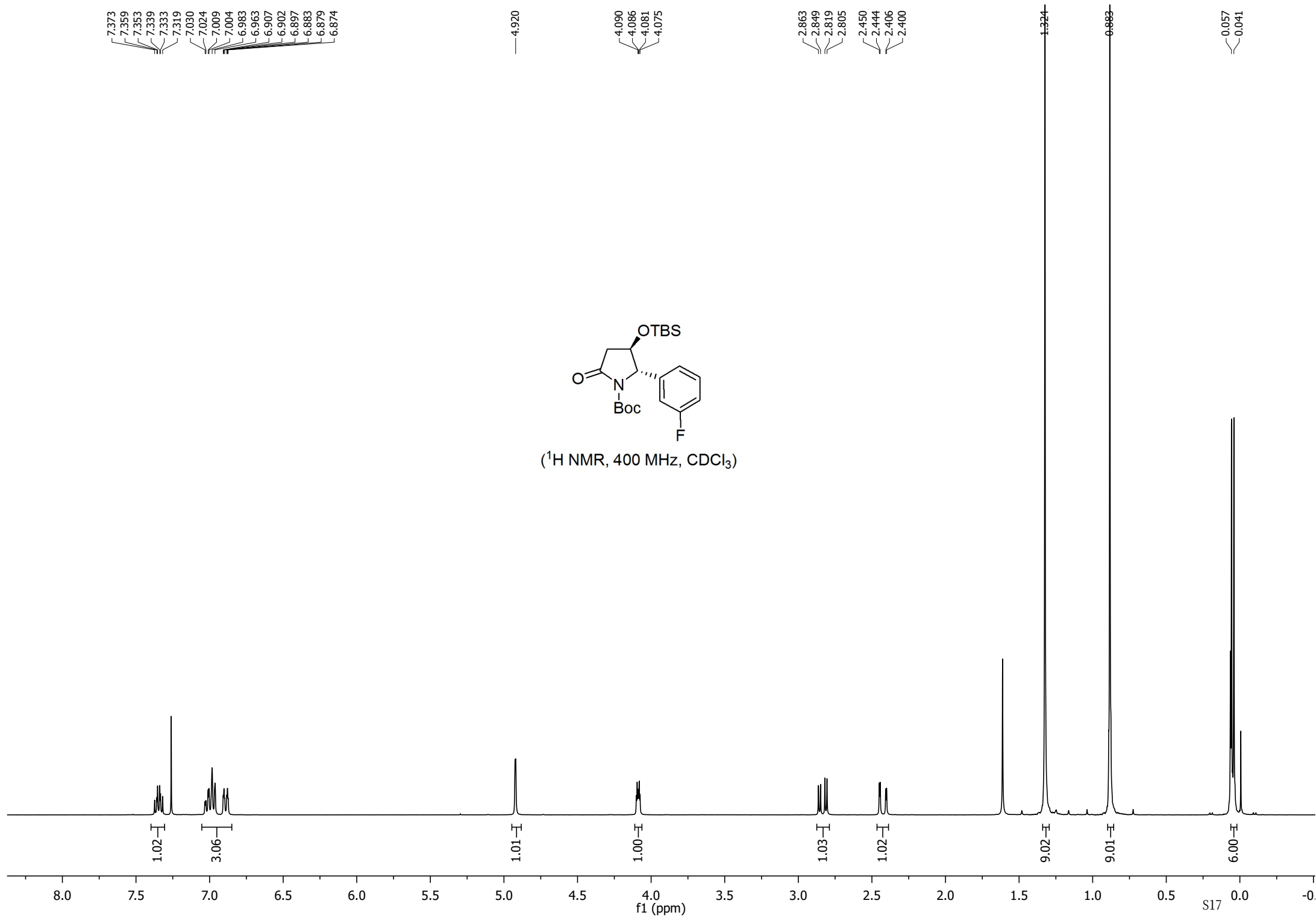


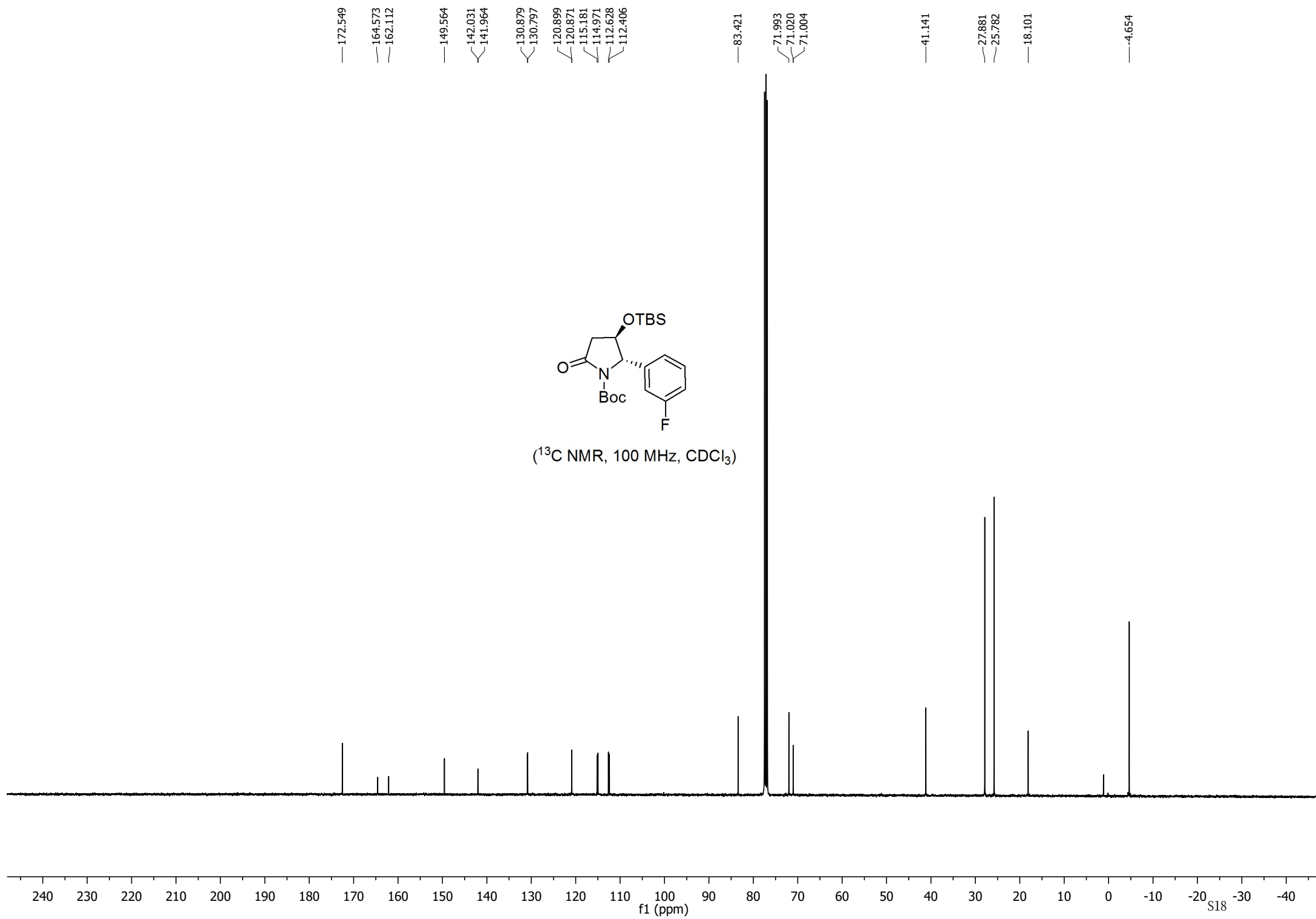


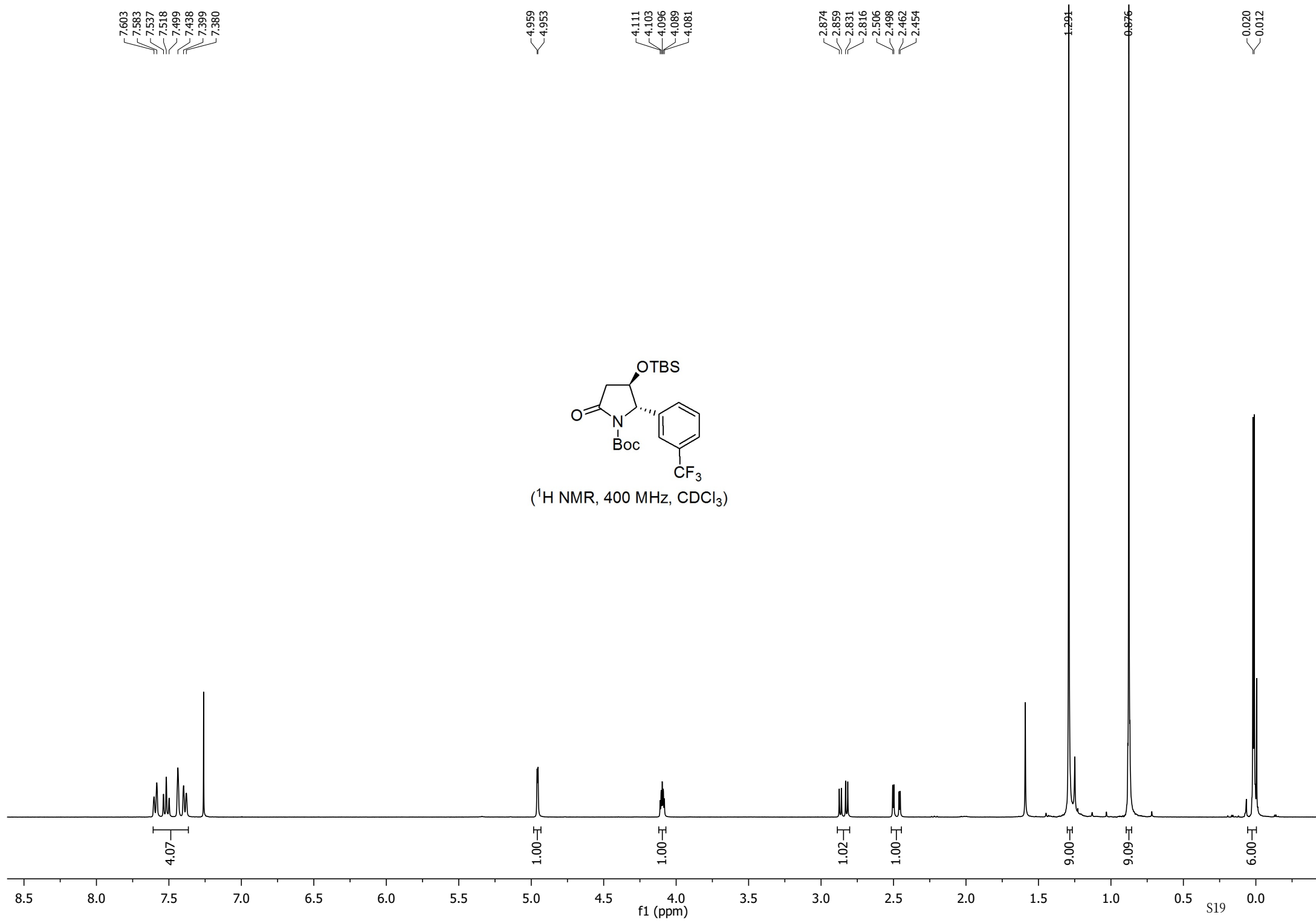


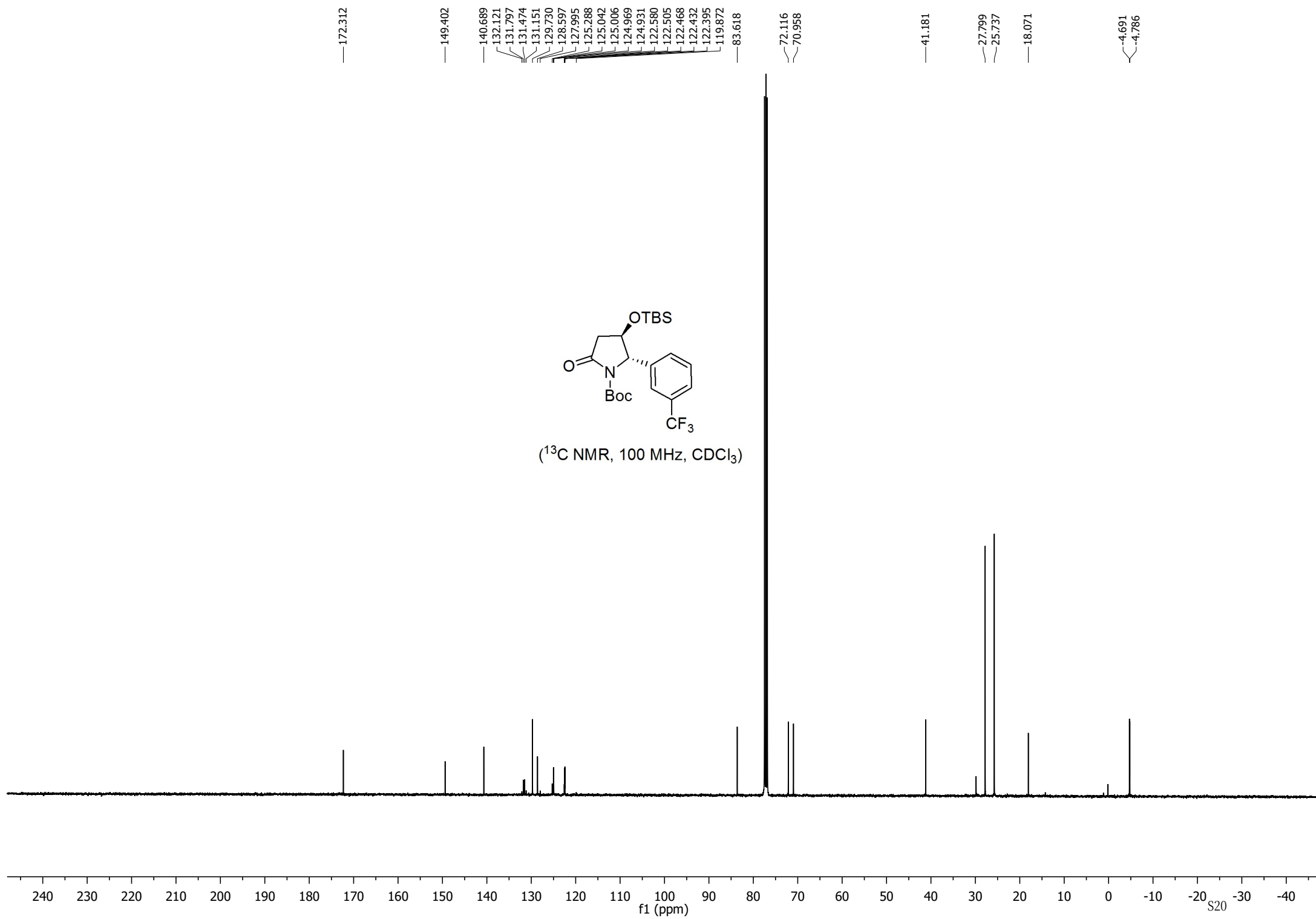
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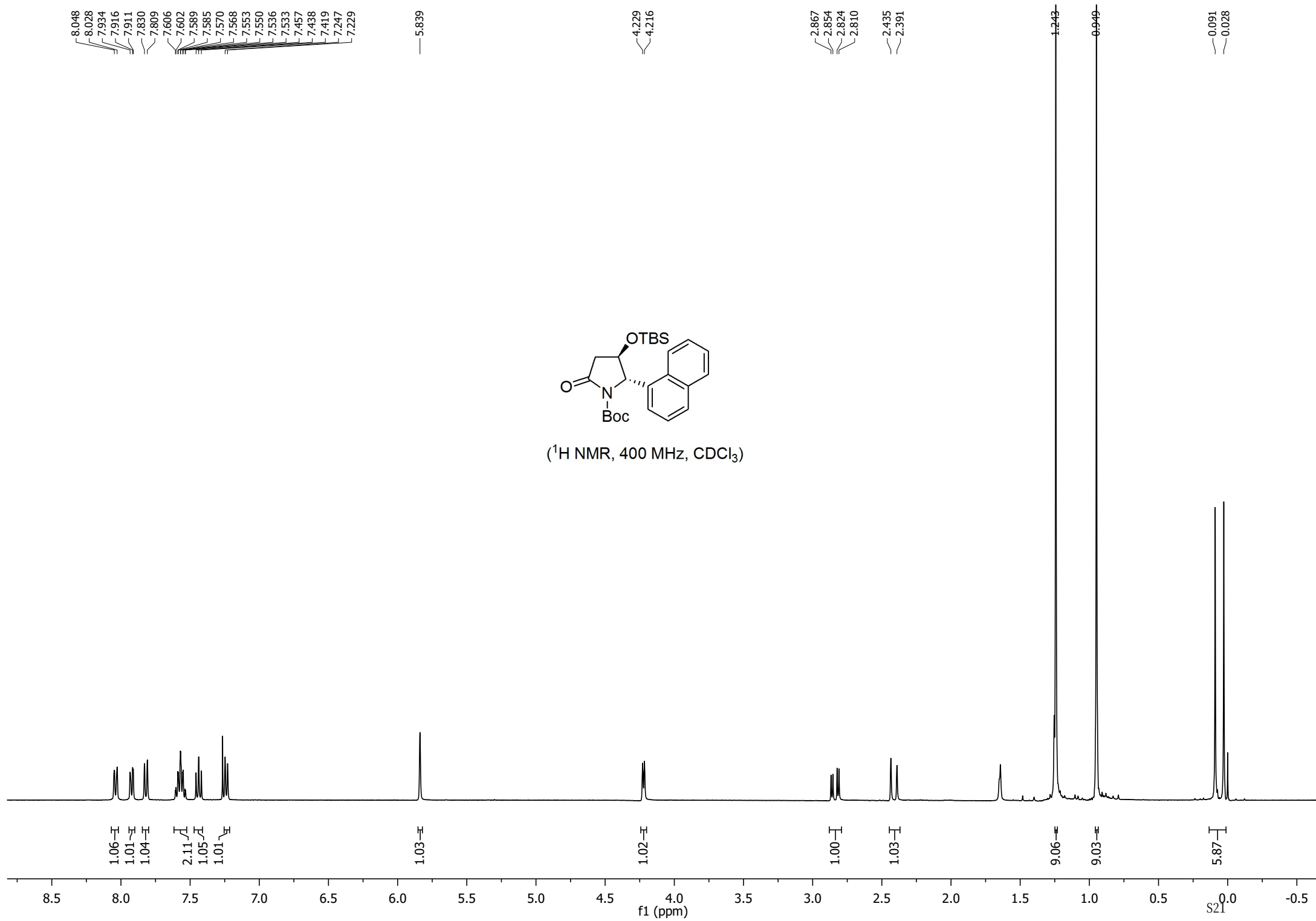


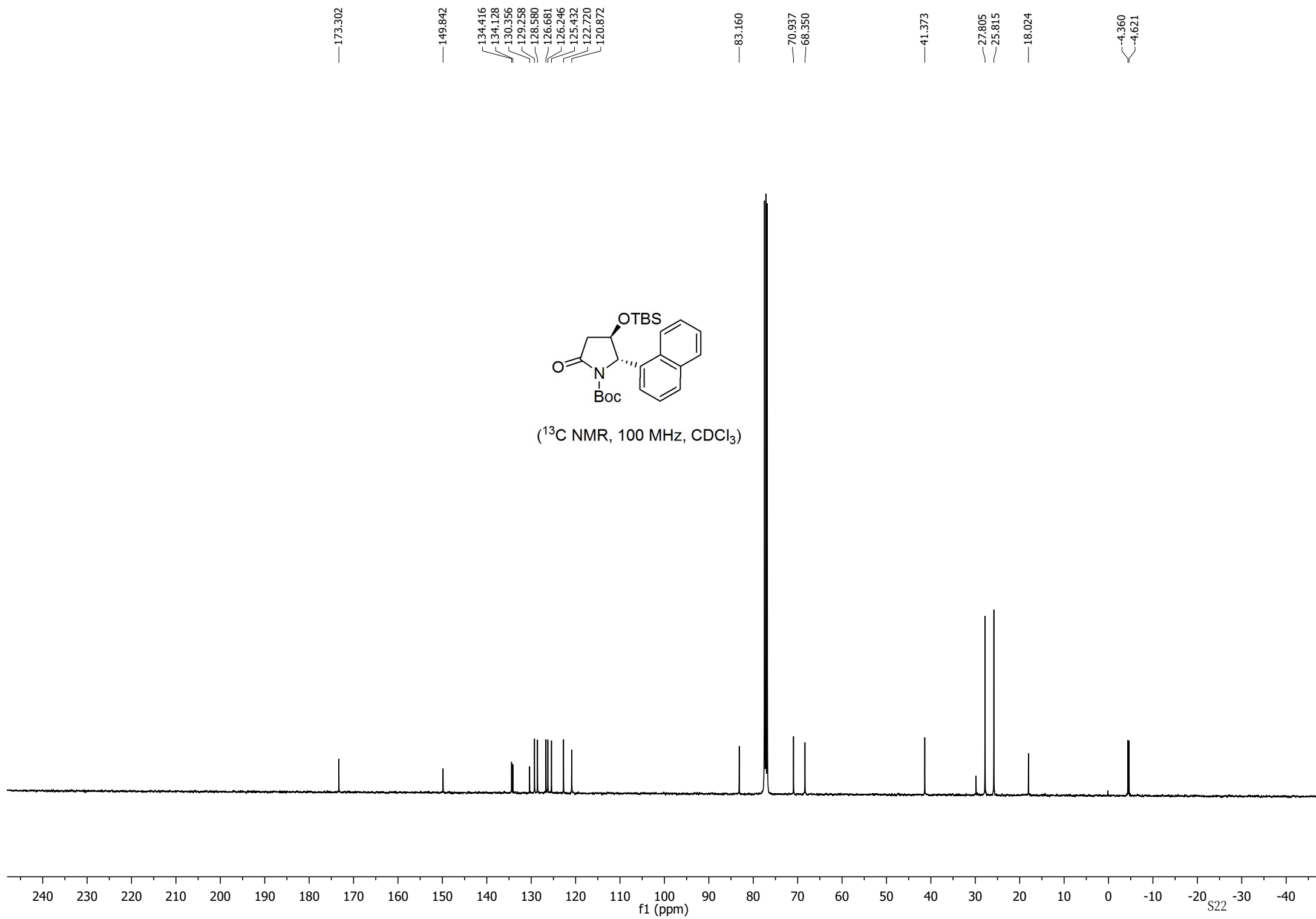


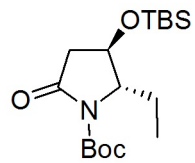




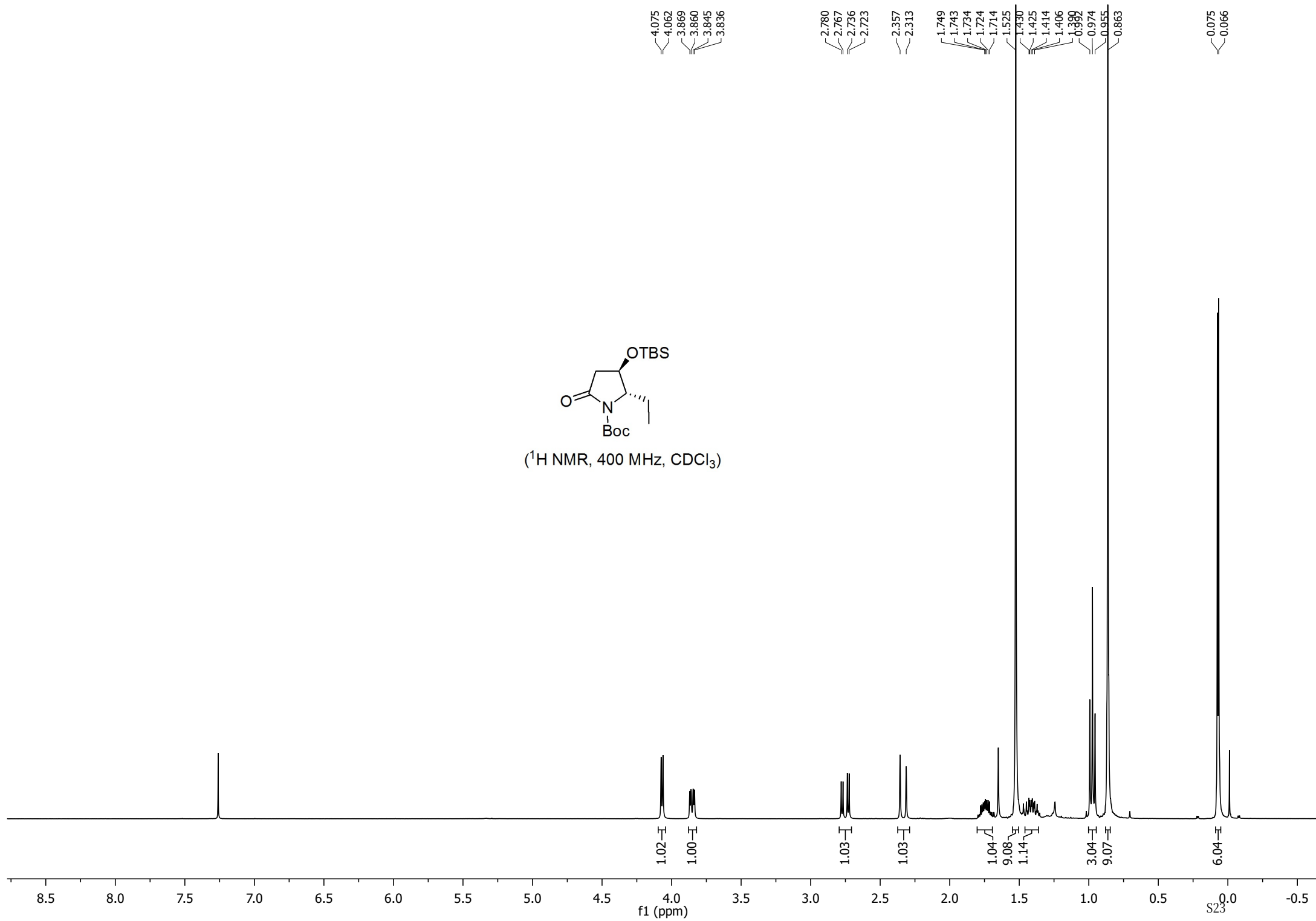




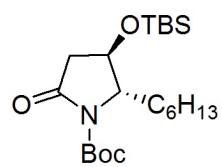




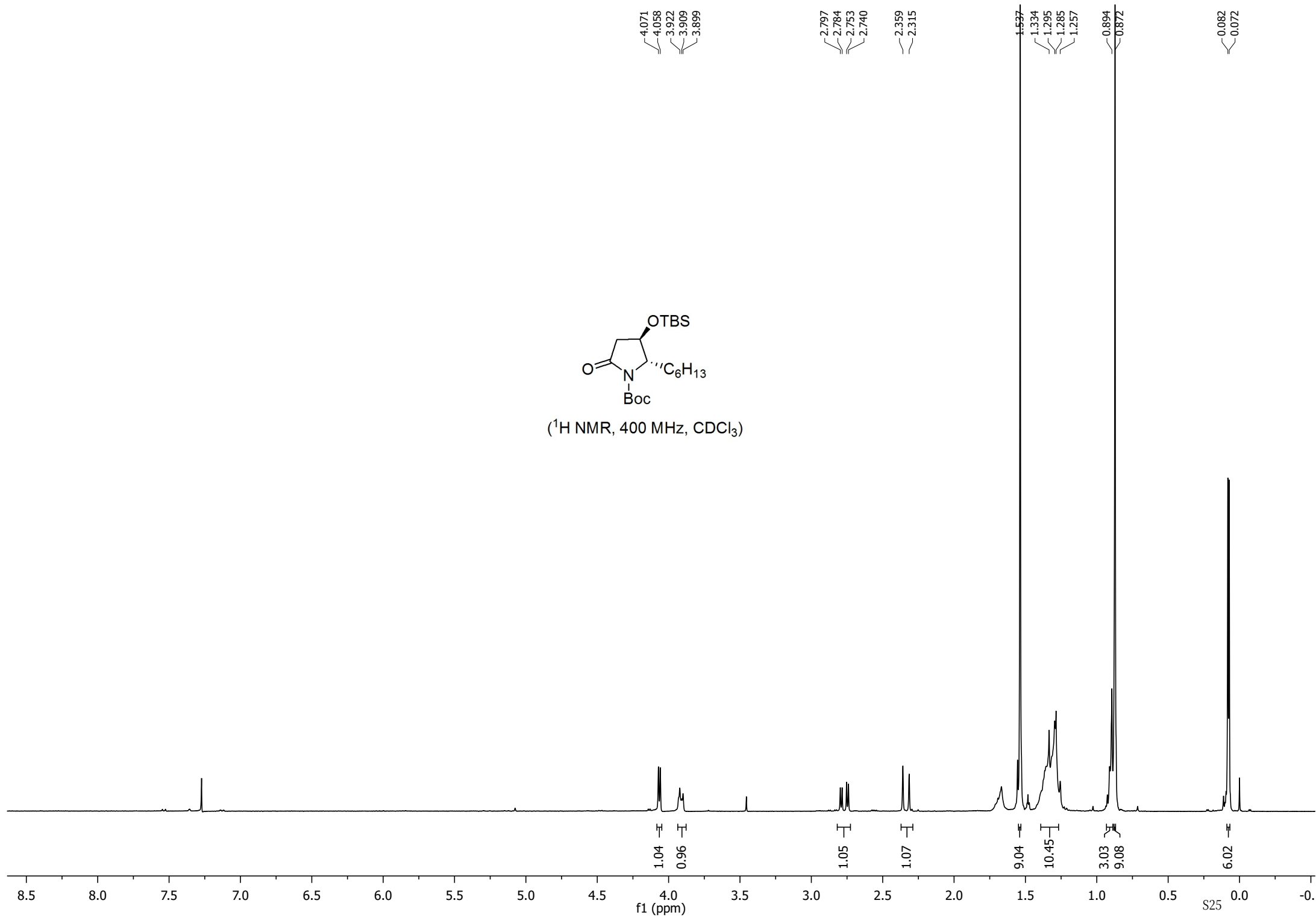
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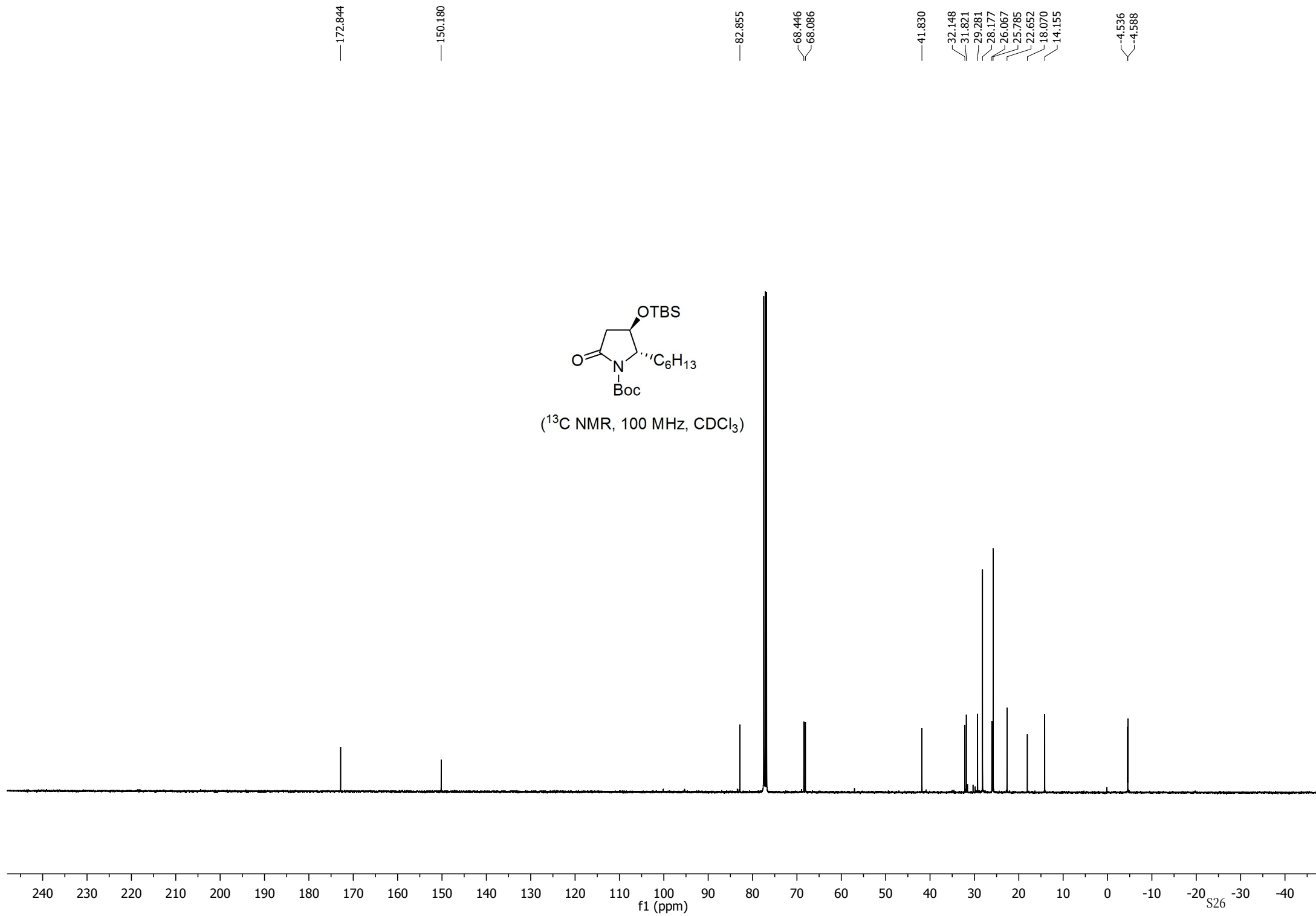
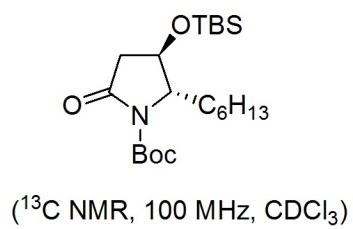


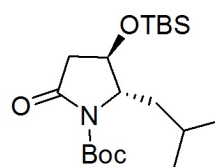




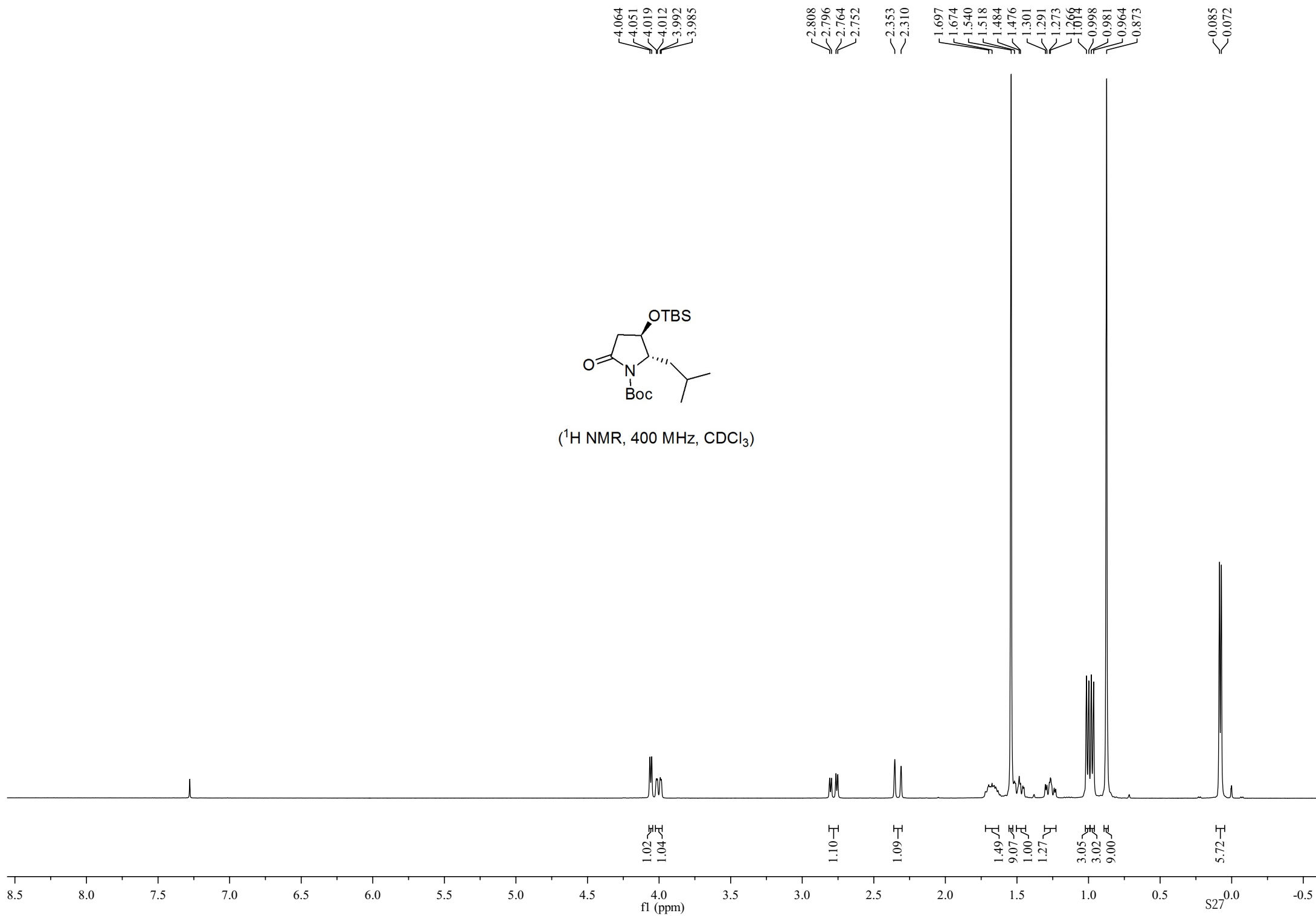
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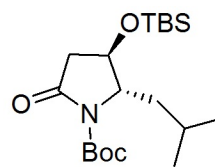




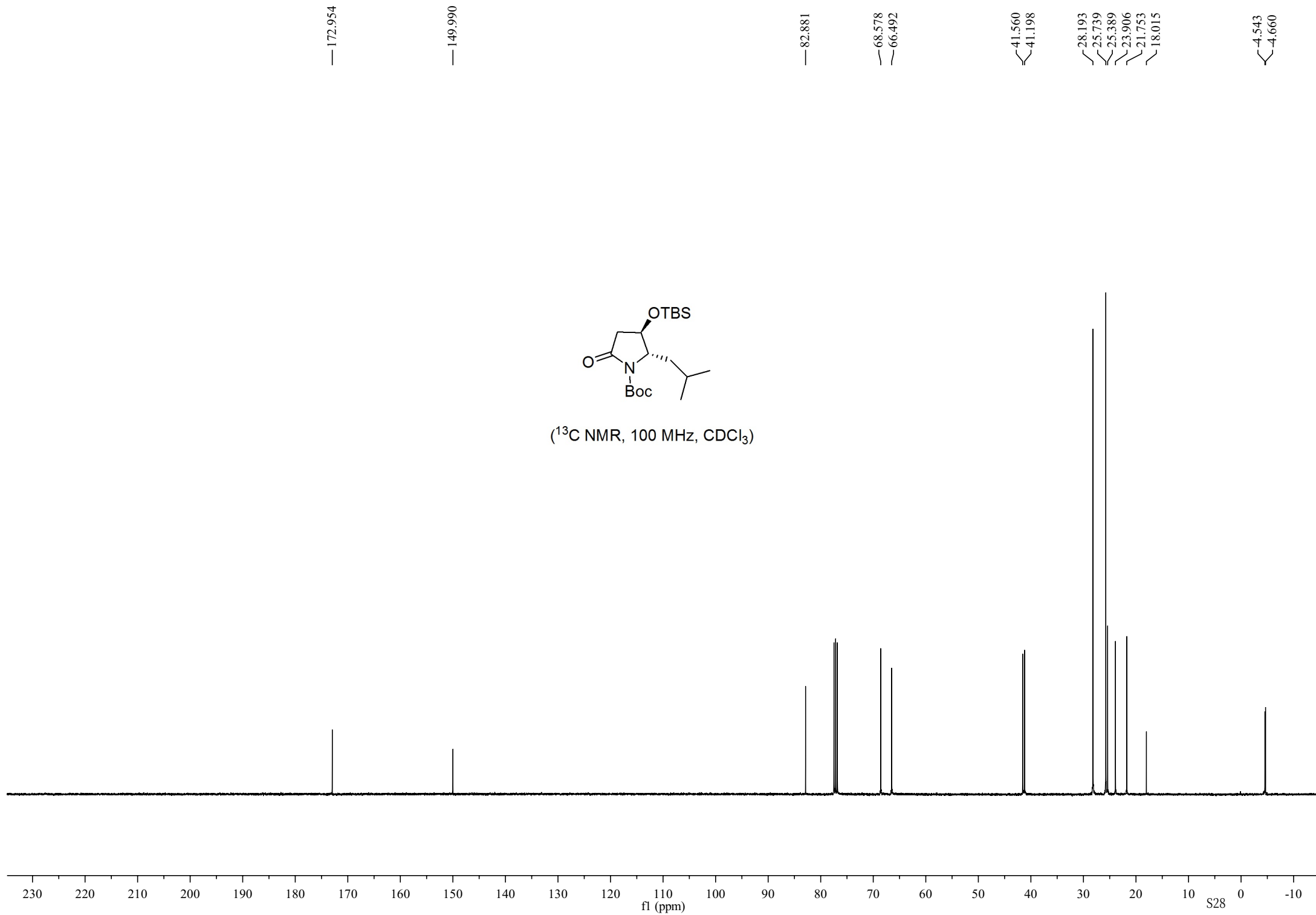


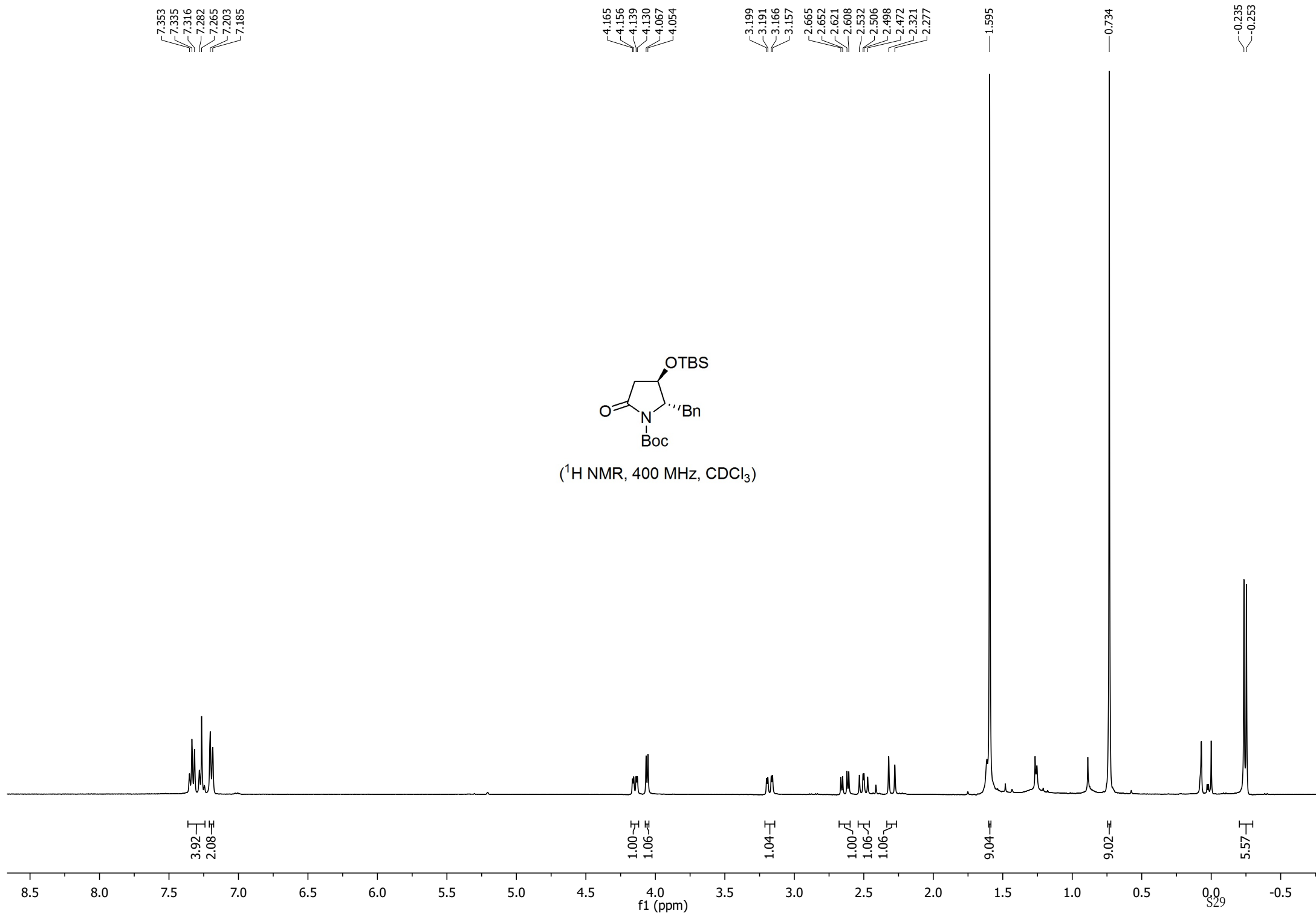
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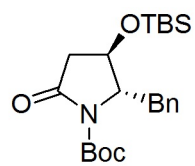




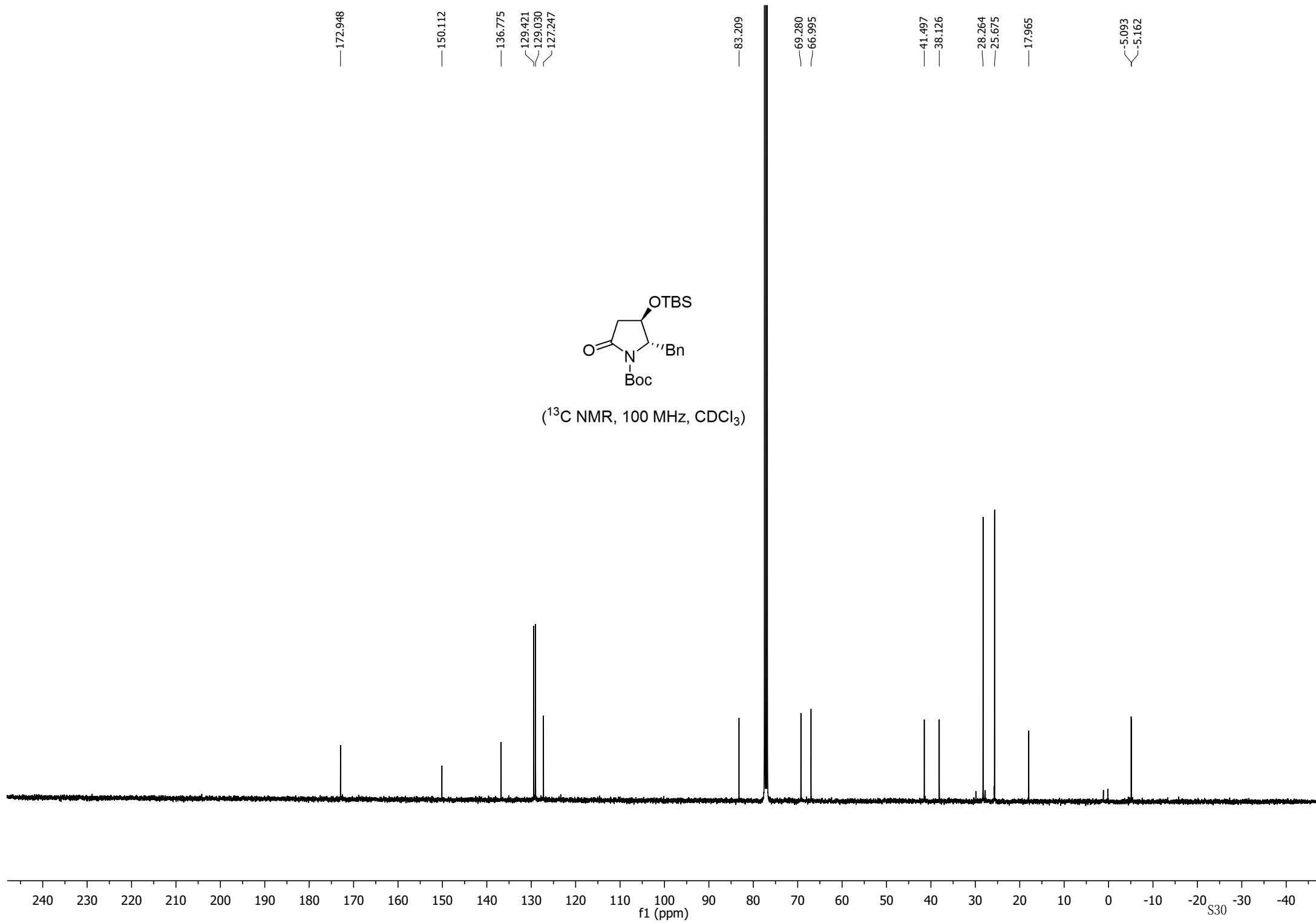
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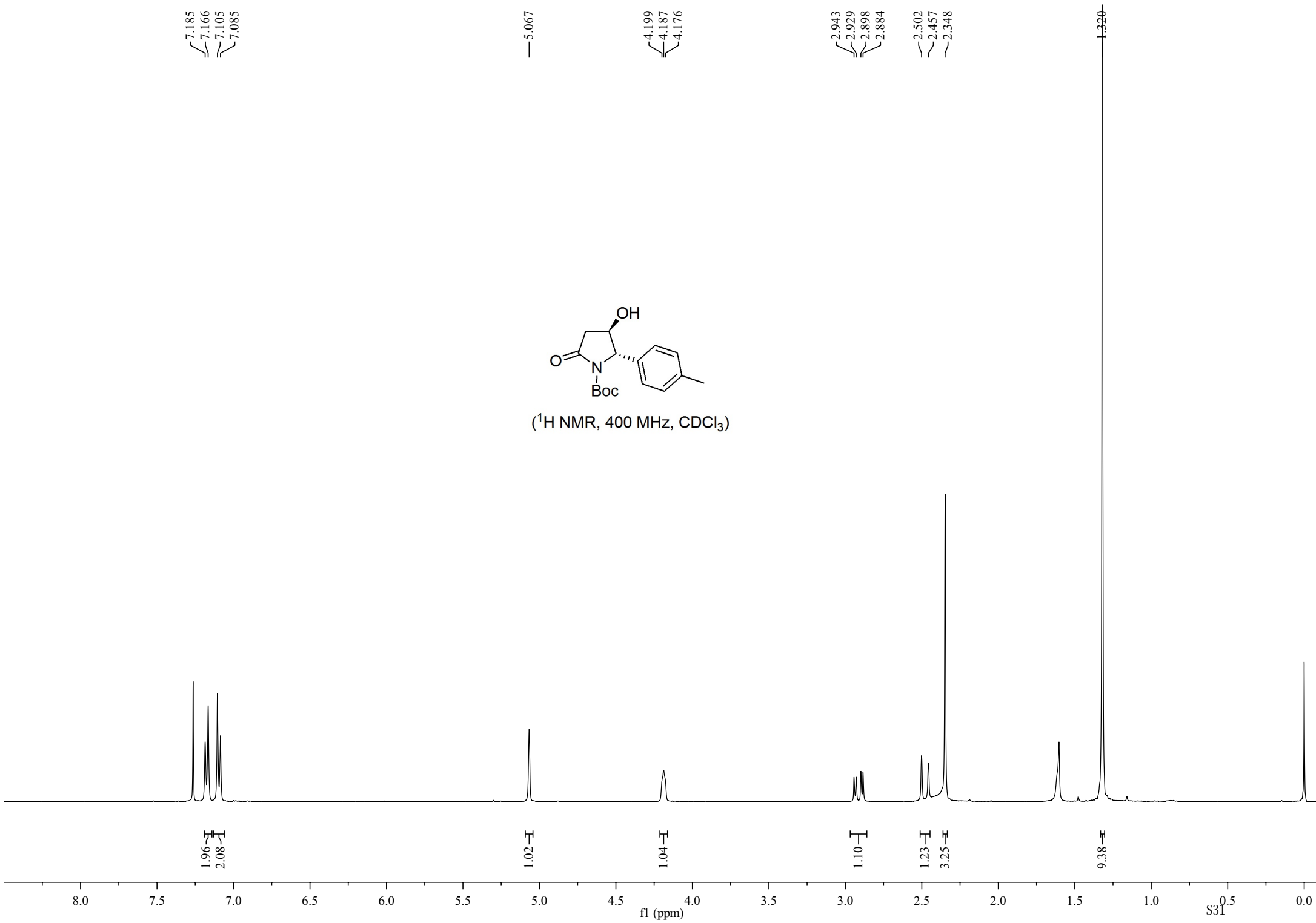






(^{13}C NMR, 100 MHz, CDCl_3)





137.956
135.722
129.783
125.197

172.843

149.730

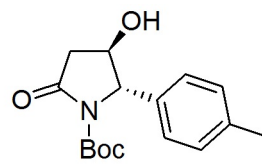
83.254

71.526
70.822

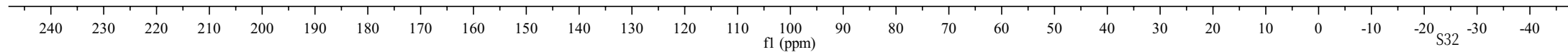
40.629

27.910

21.196



(¹³C NMR, 100 MHz, CDCl₃)



7.267
7.251
7.232
7.124
7.104
7.016
7.000

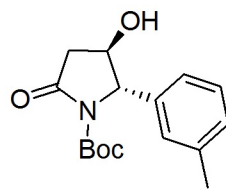
5.072

4.223
4.211
4.198

2.948
2.933
2.903
2.888

2.525
2.480
2.343

1.305



(¹H NMR, 400 MHz, CDCl₃)

1.07
0.94
1.94

0.98

1.00

1.25

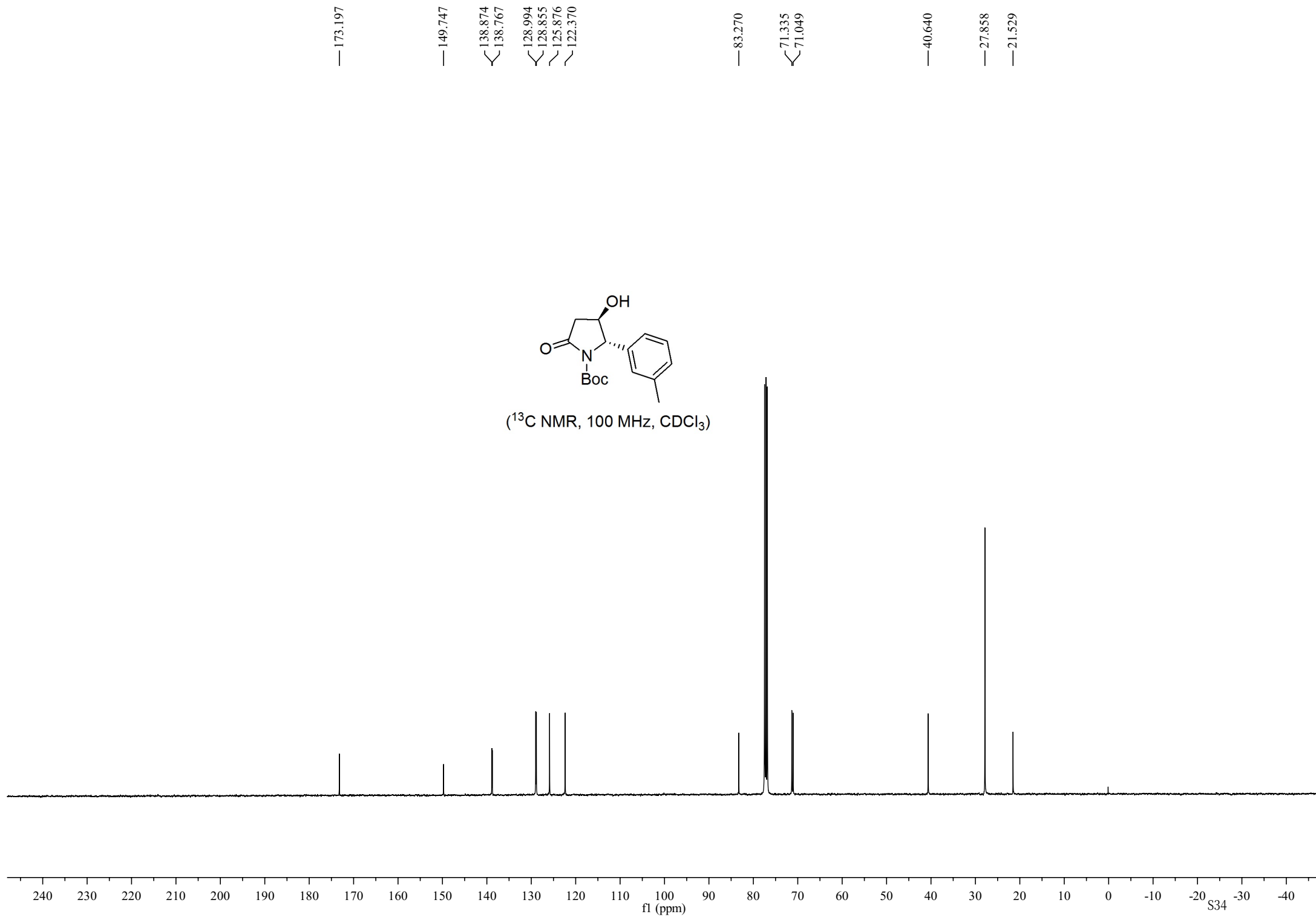
1.05
2.99

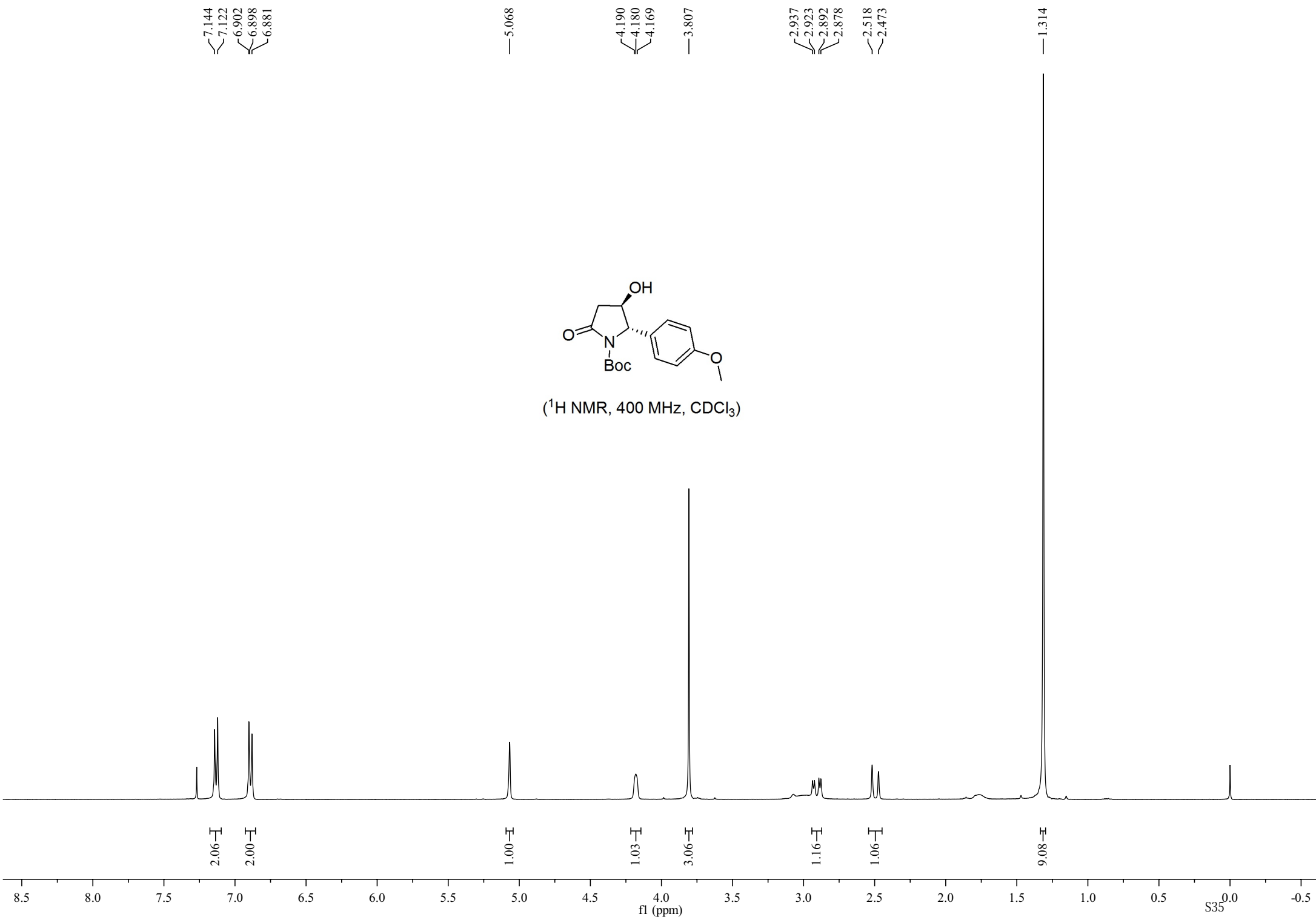
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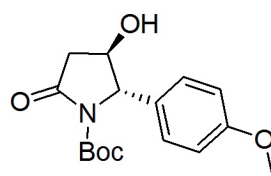
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fl (ppm)

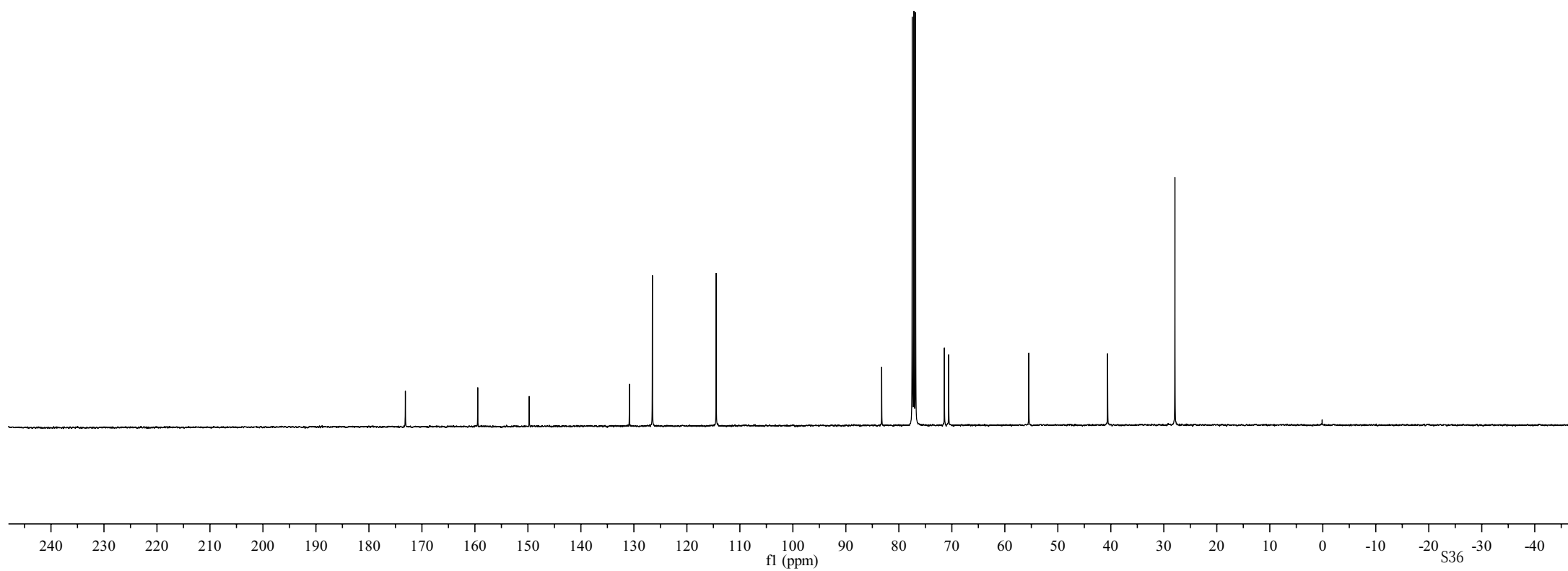
S33

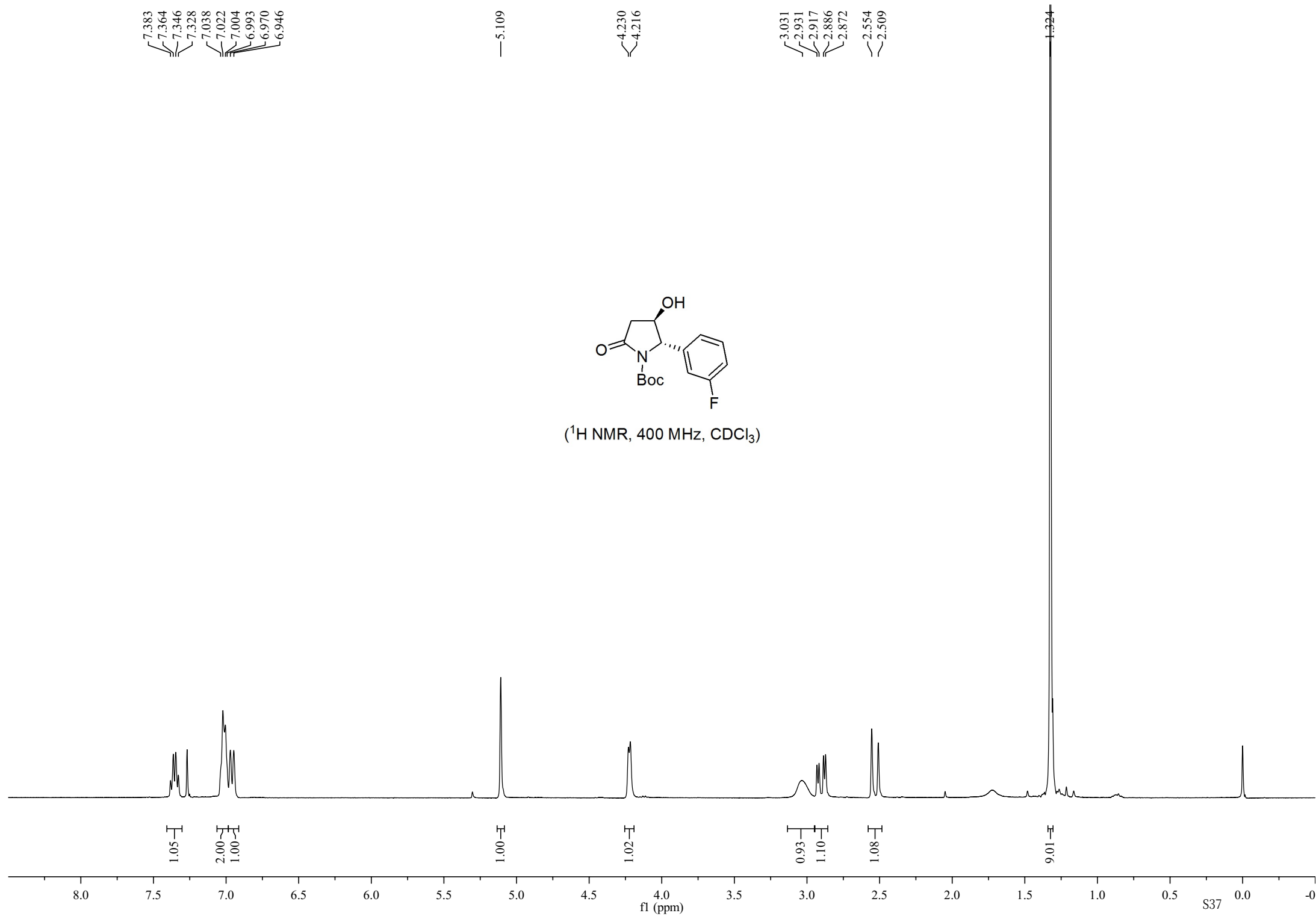


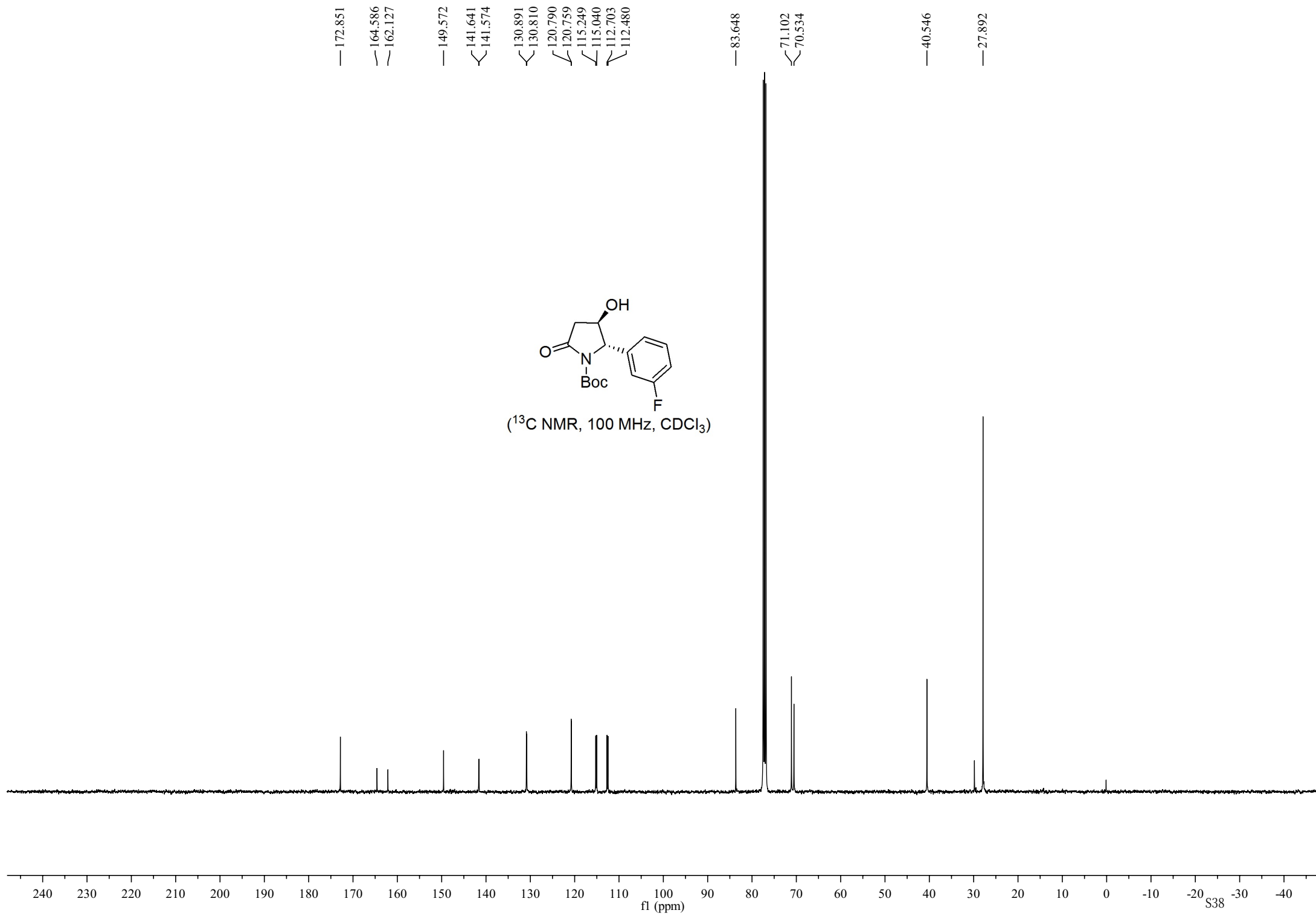




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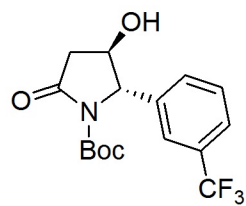
7.612
7.592
7.548
7.528
7.512
7.435
7.416

5.167

4.267
4.263
4.252
4.239

3.059
2.945
2.930
2.900
2.885
2.591
2.546

1.300



(¹H NMR, 400 MHz, CDCl₃)

1.04
2.03
0.99

1.00

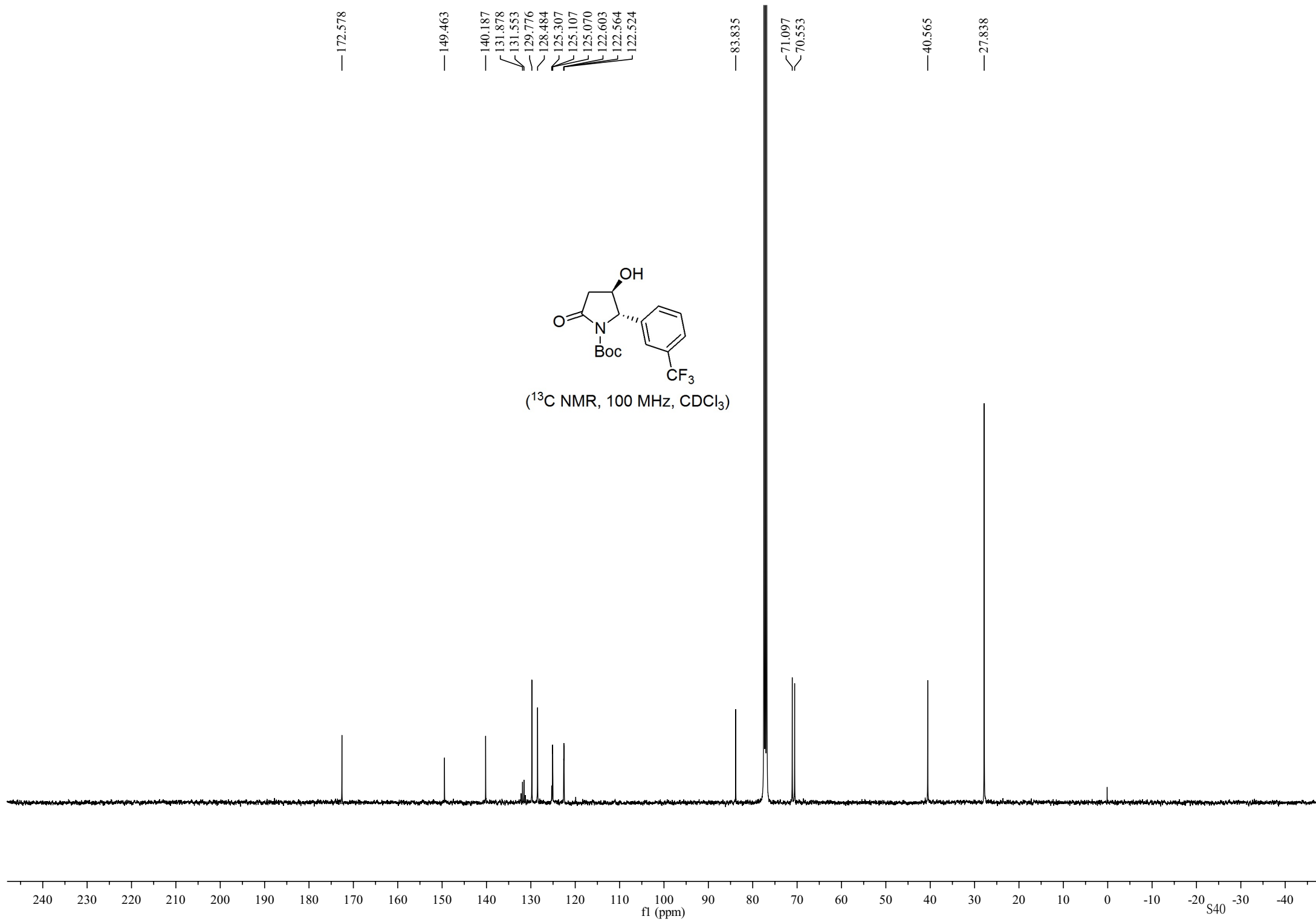
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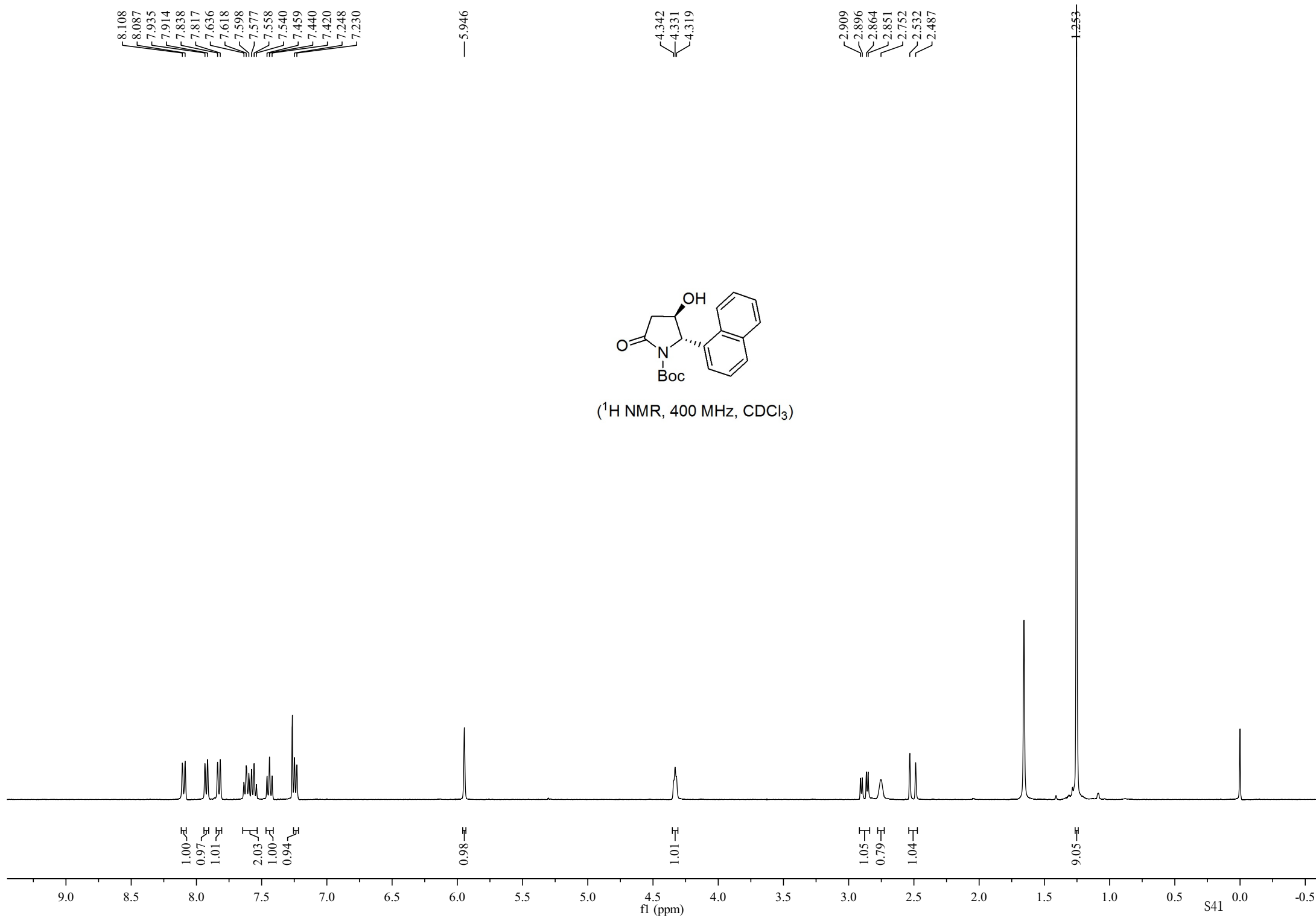
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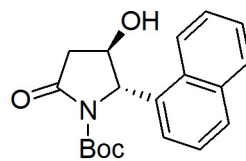
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9.16

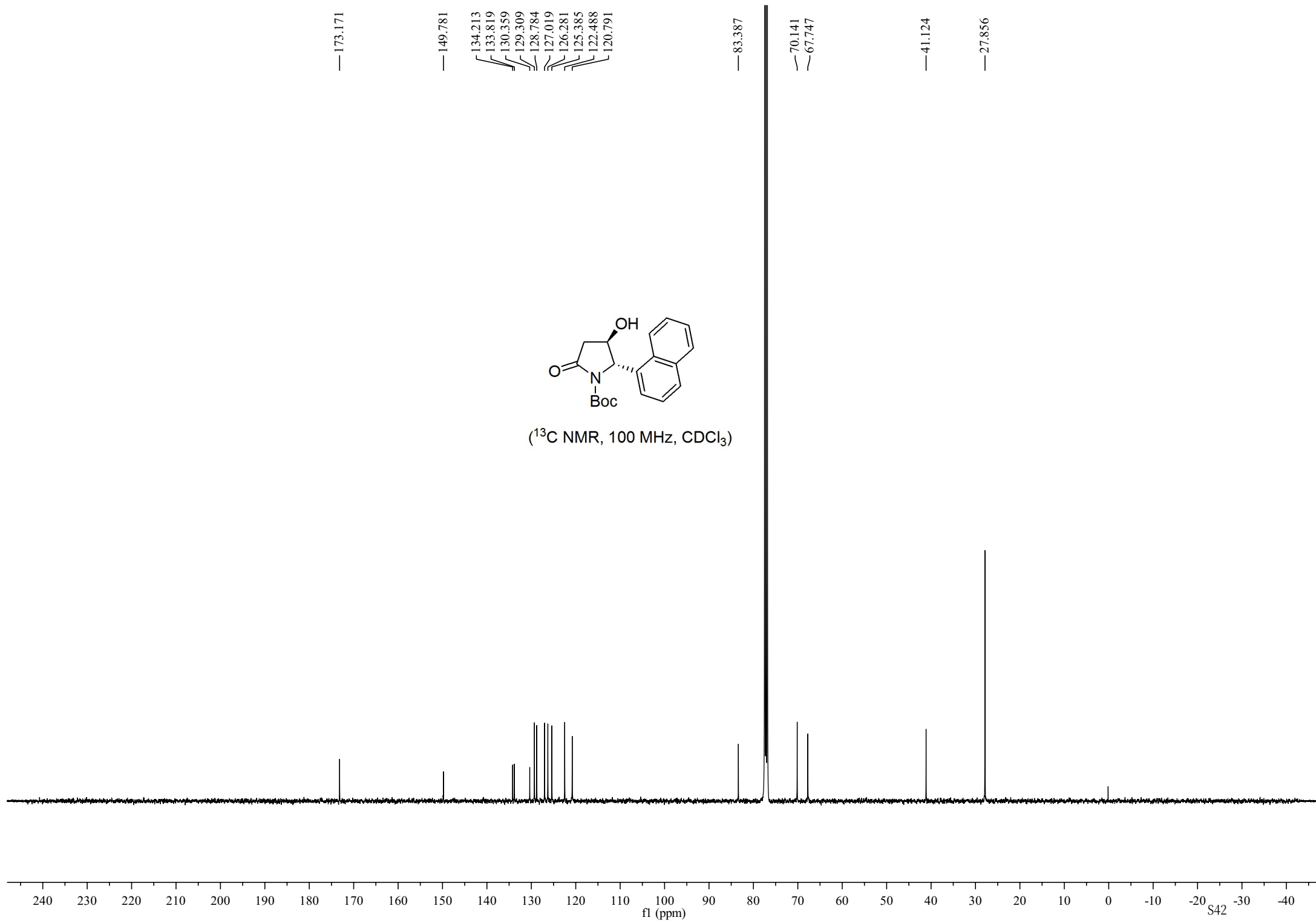
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f1 (ppm)

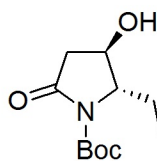




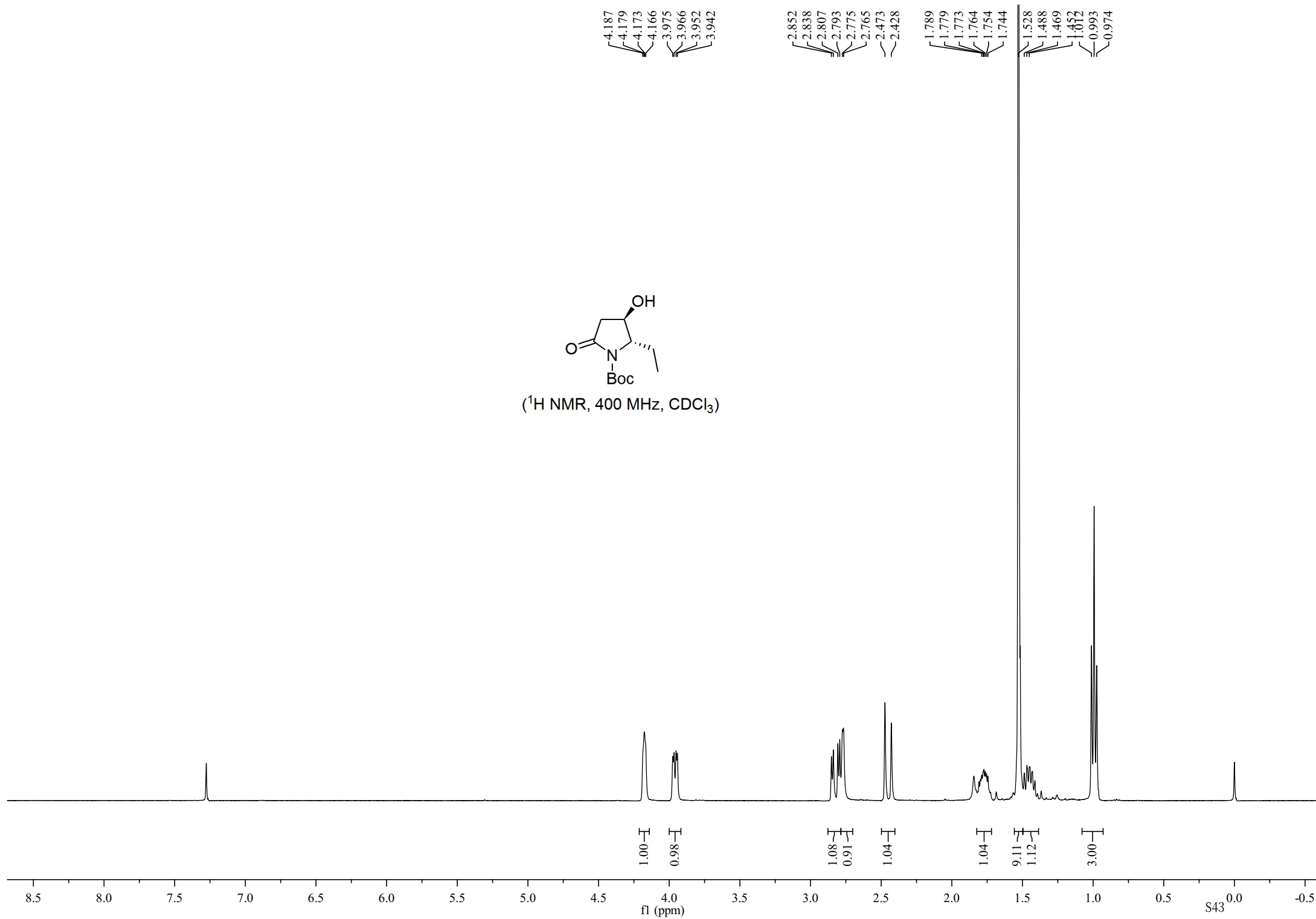


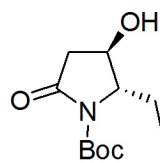
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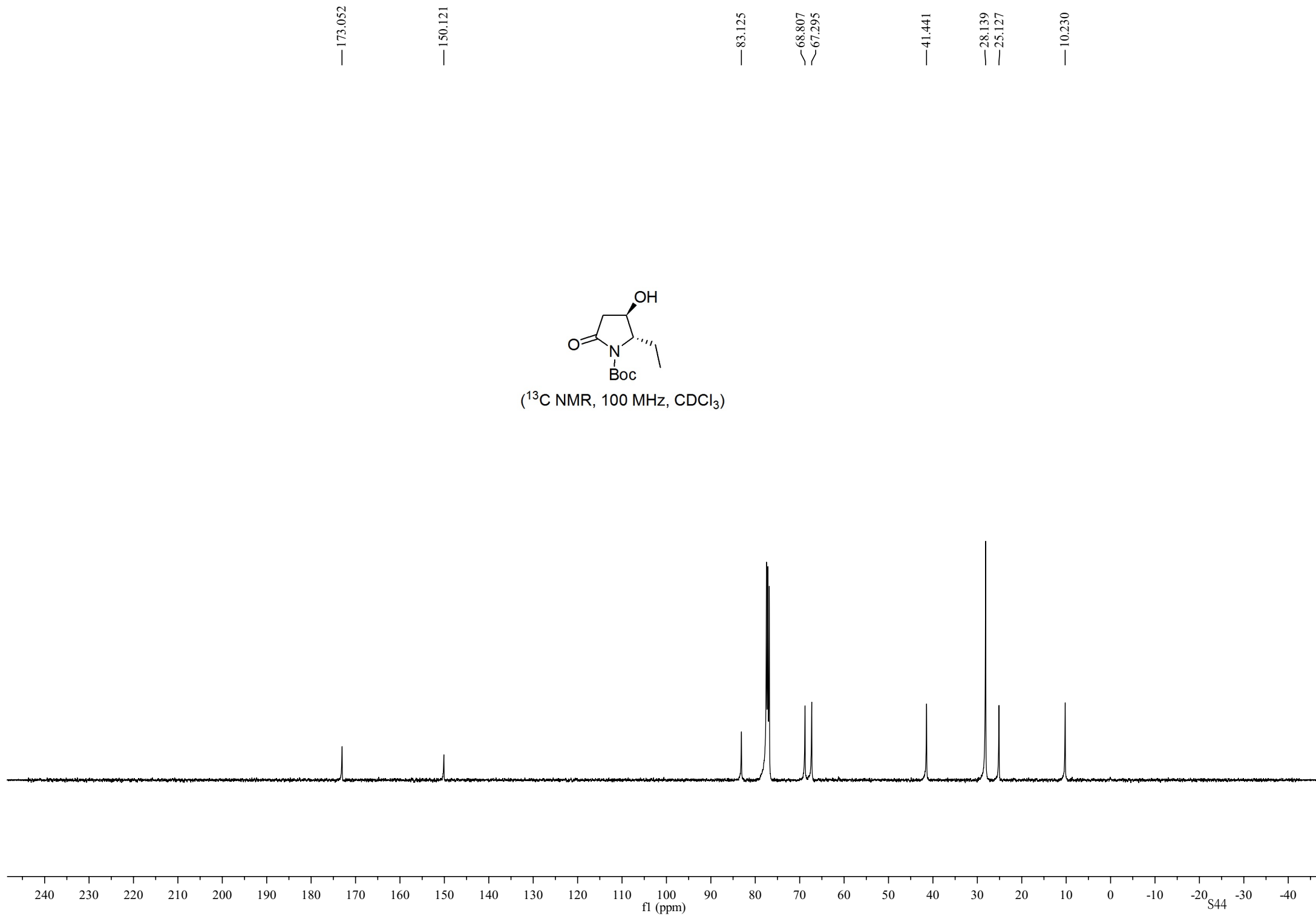


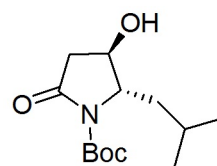
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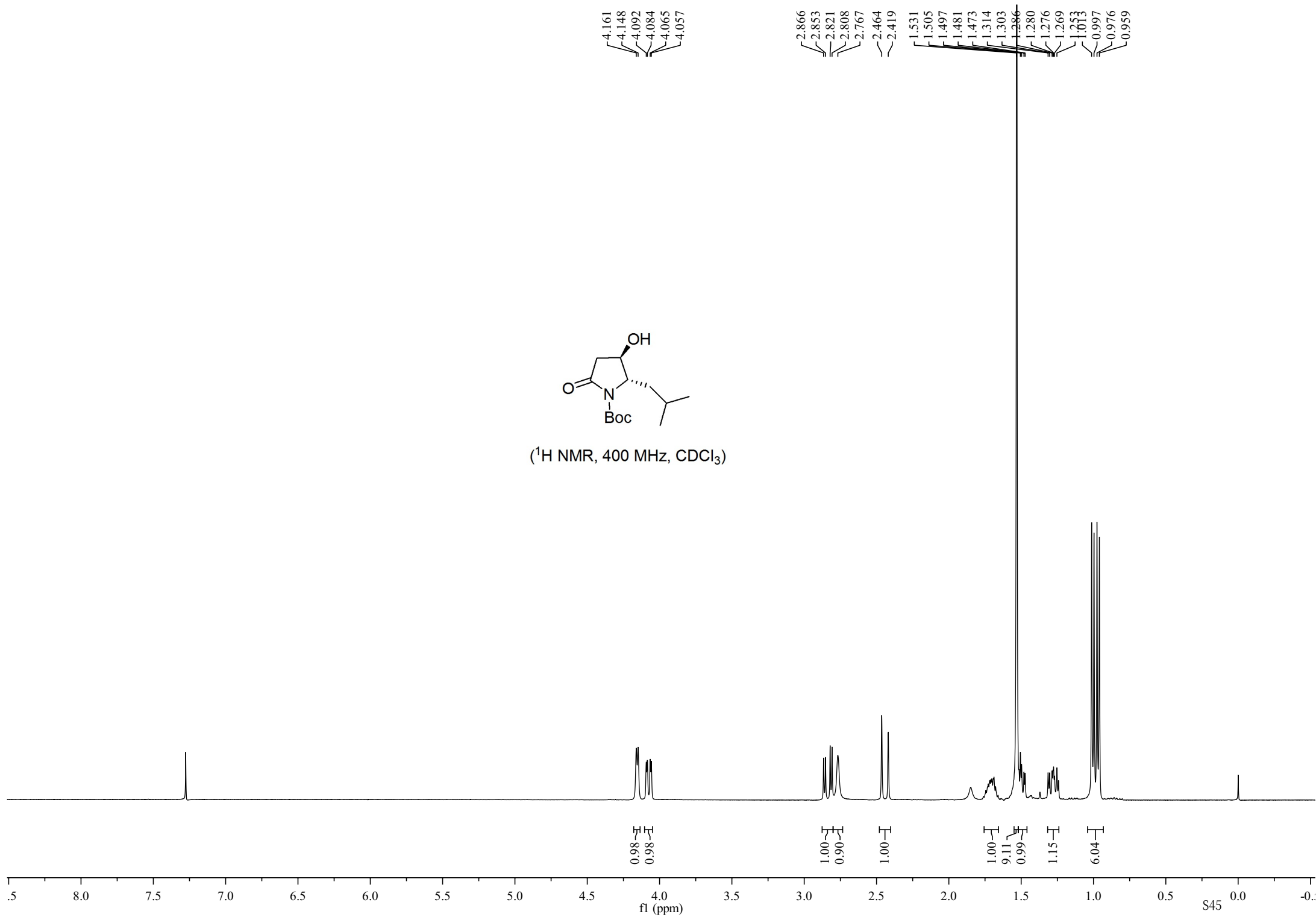


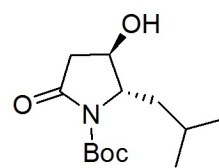
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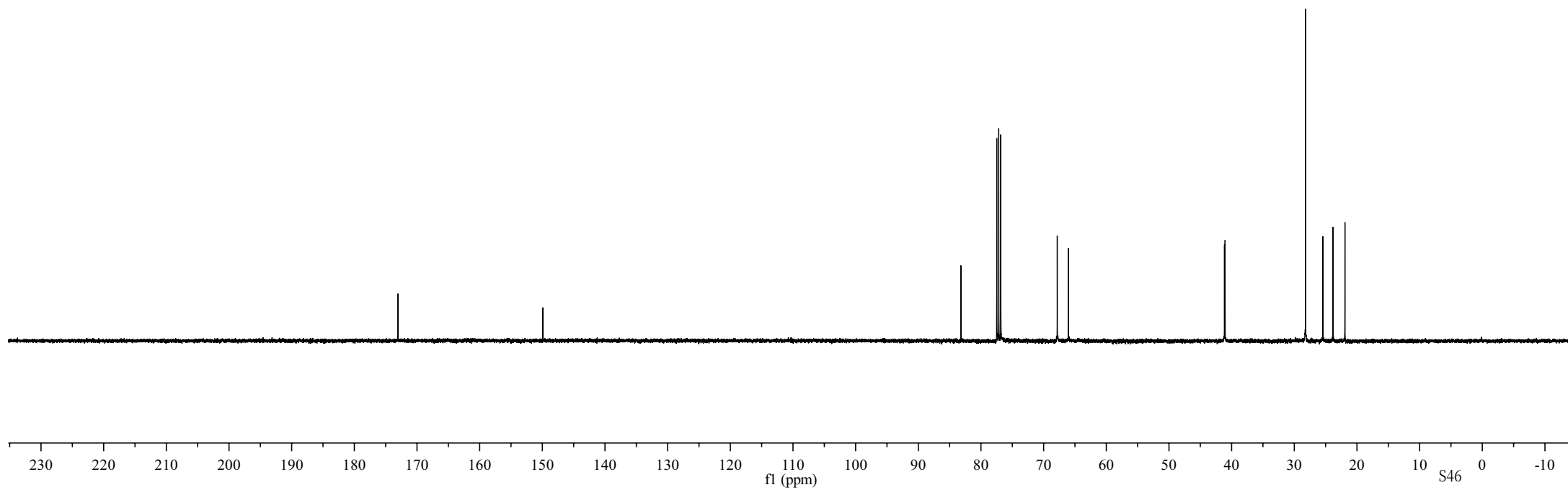


(¹H NMR, 400 MHz, CDCl₃)





(¹³C NMR, 100 MHz, CDCl₃)

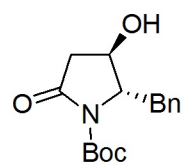


7.344
7.326
7.308
7.282
7.267
7.264
7.245
7.187
7.170

4.299
4.290
4.276
4.267
4.163
4.150

3.163
3.154
3.129
3.120
2.687
2.664
2.653
2.629
2.538
2.524
2.493
2.479
2.351
2.306

1.573



(¹H NMR, 400 MHz, CDCl₃)

3.41
2.06

1.00
1.03

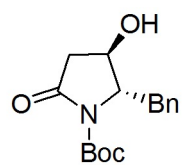
1.07

1.04
1.07
2.03

9.00

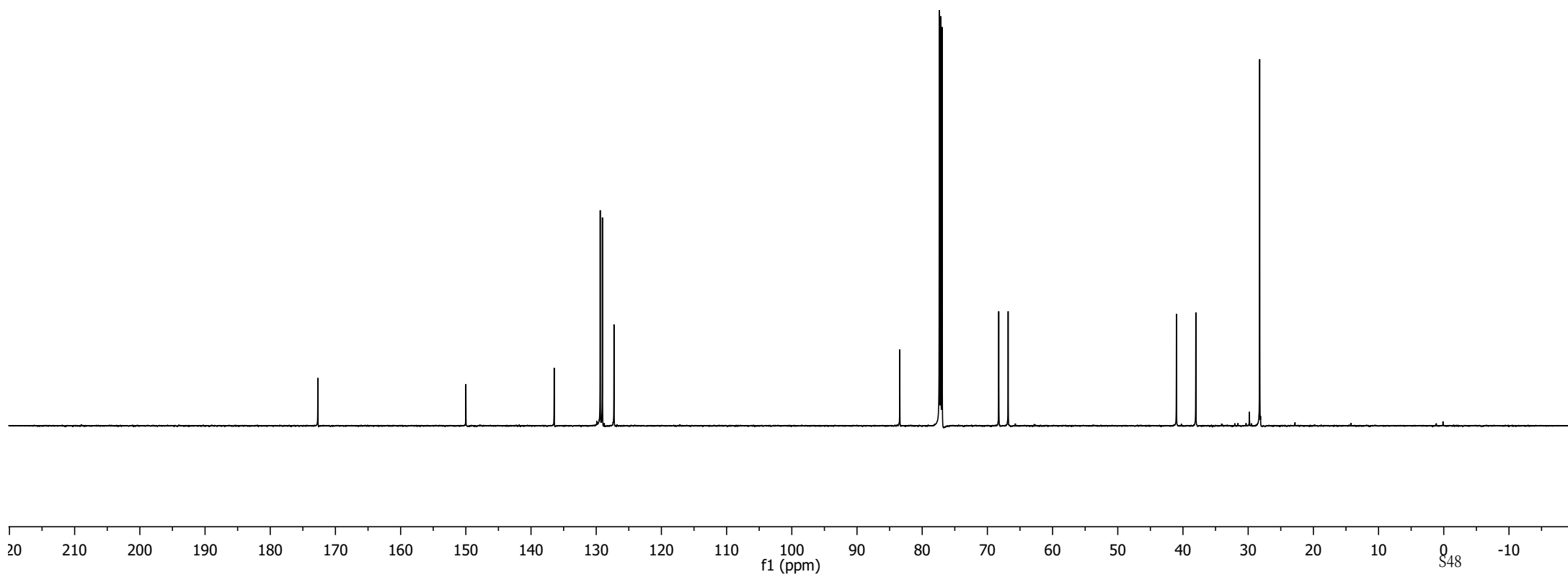
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f1 (ppm)

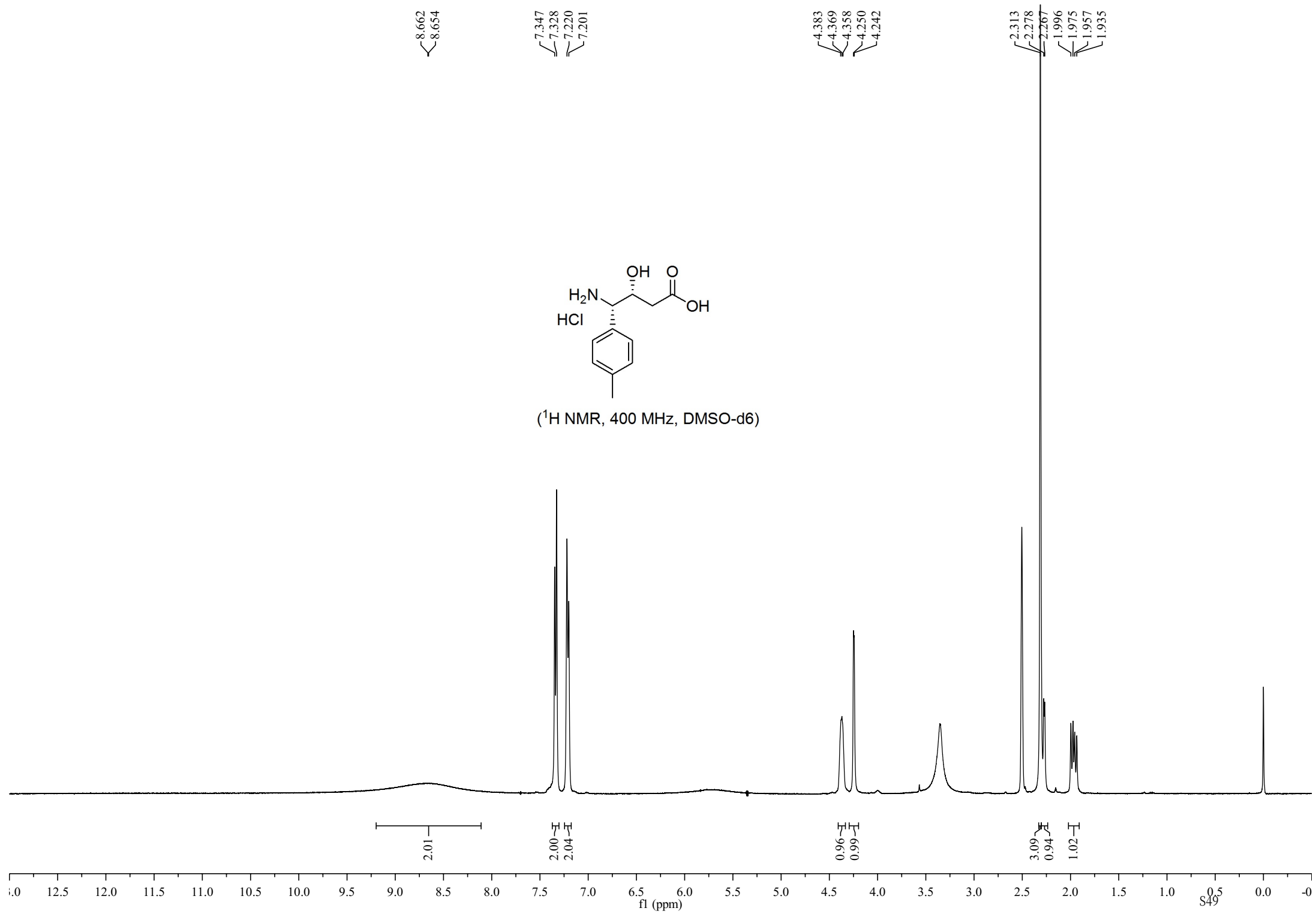
S47

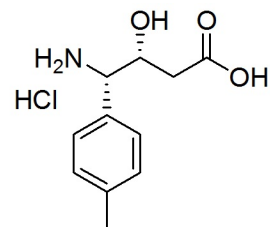


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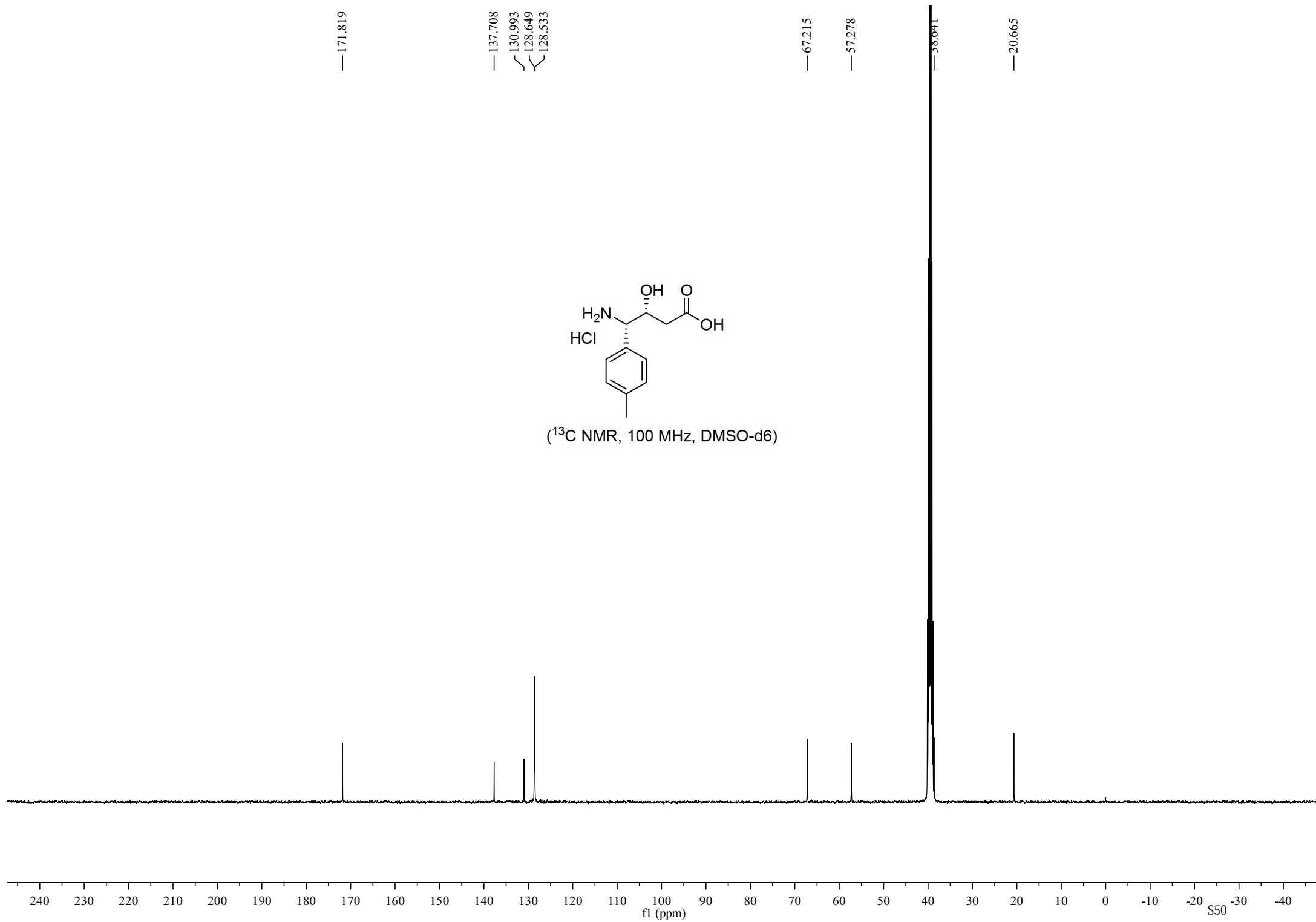
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136.450
129.385
129.049
127.273
83.438
68.257
66.814
41.004
38.029
28.233

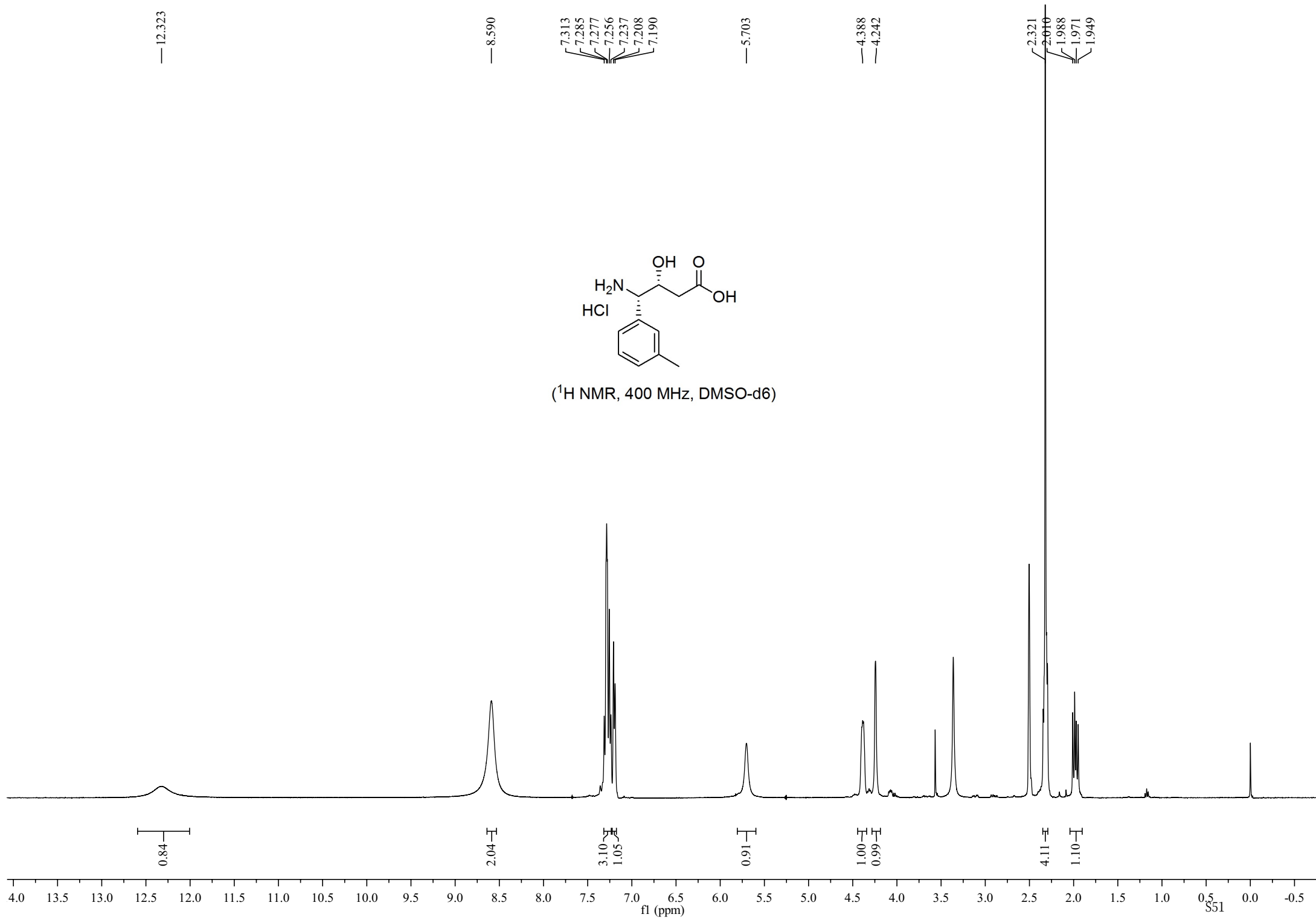


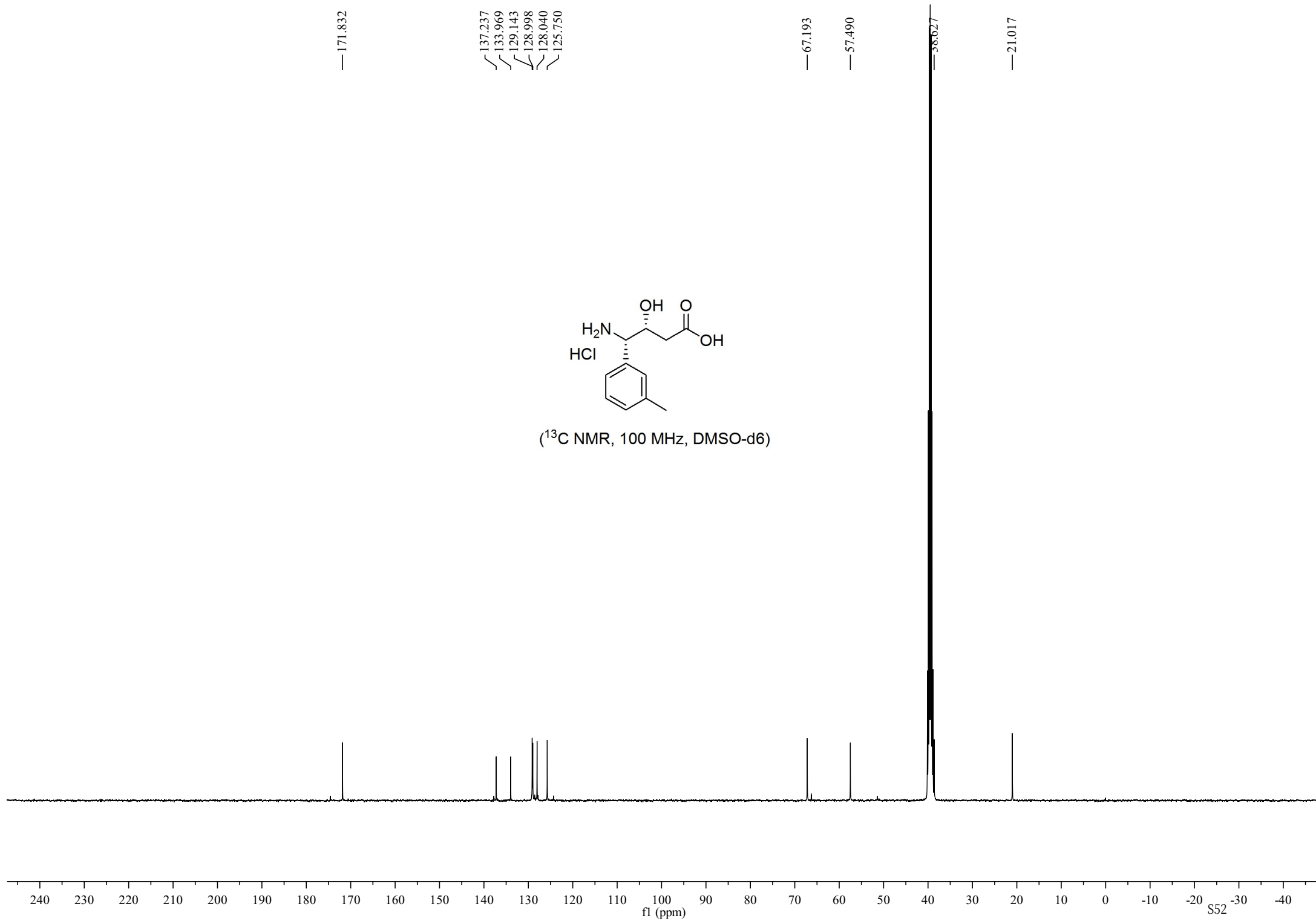


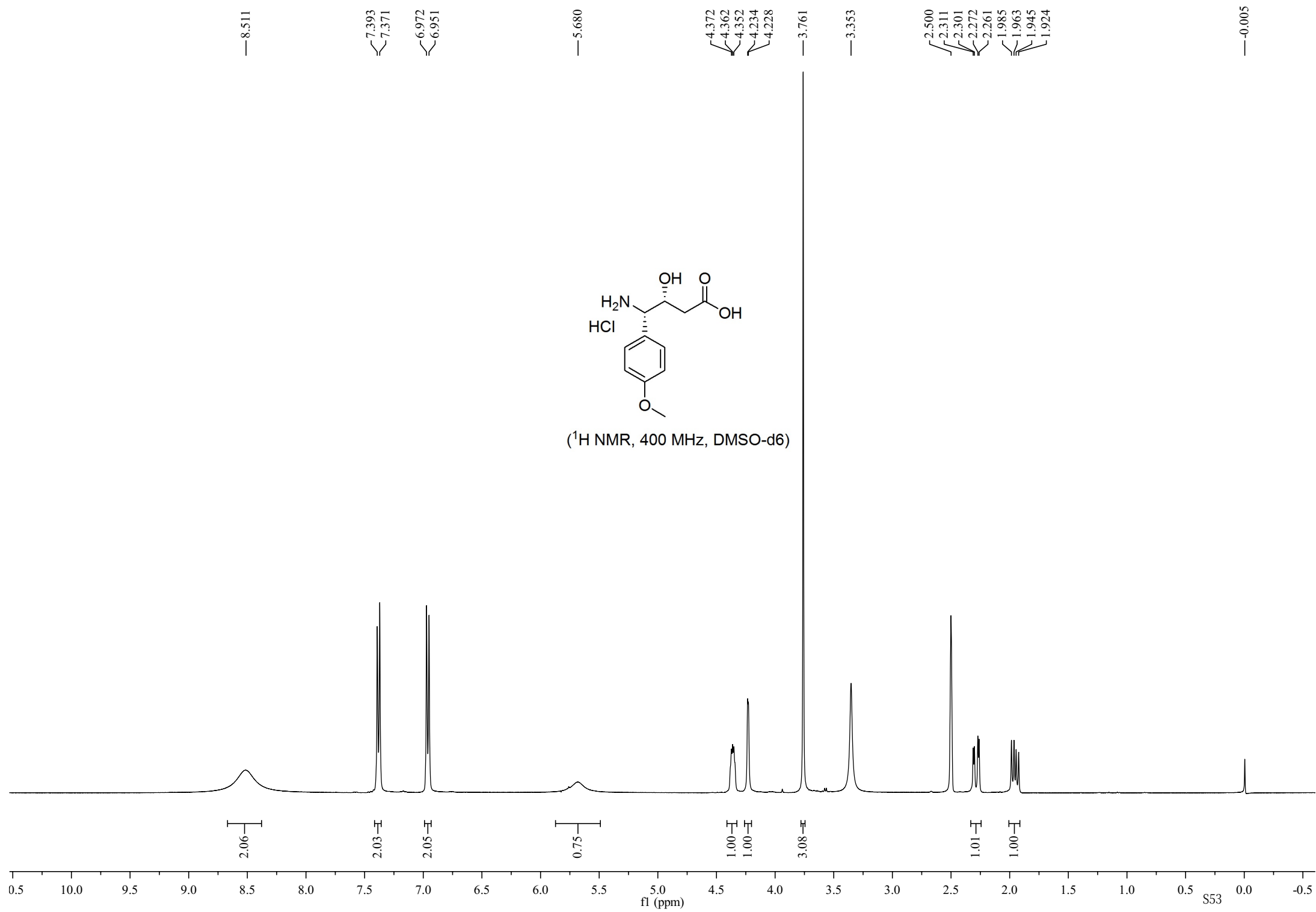


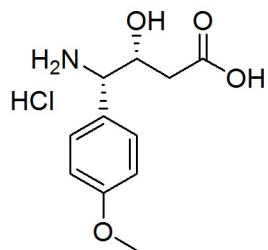
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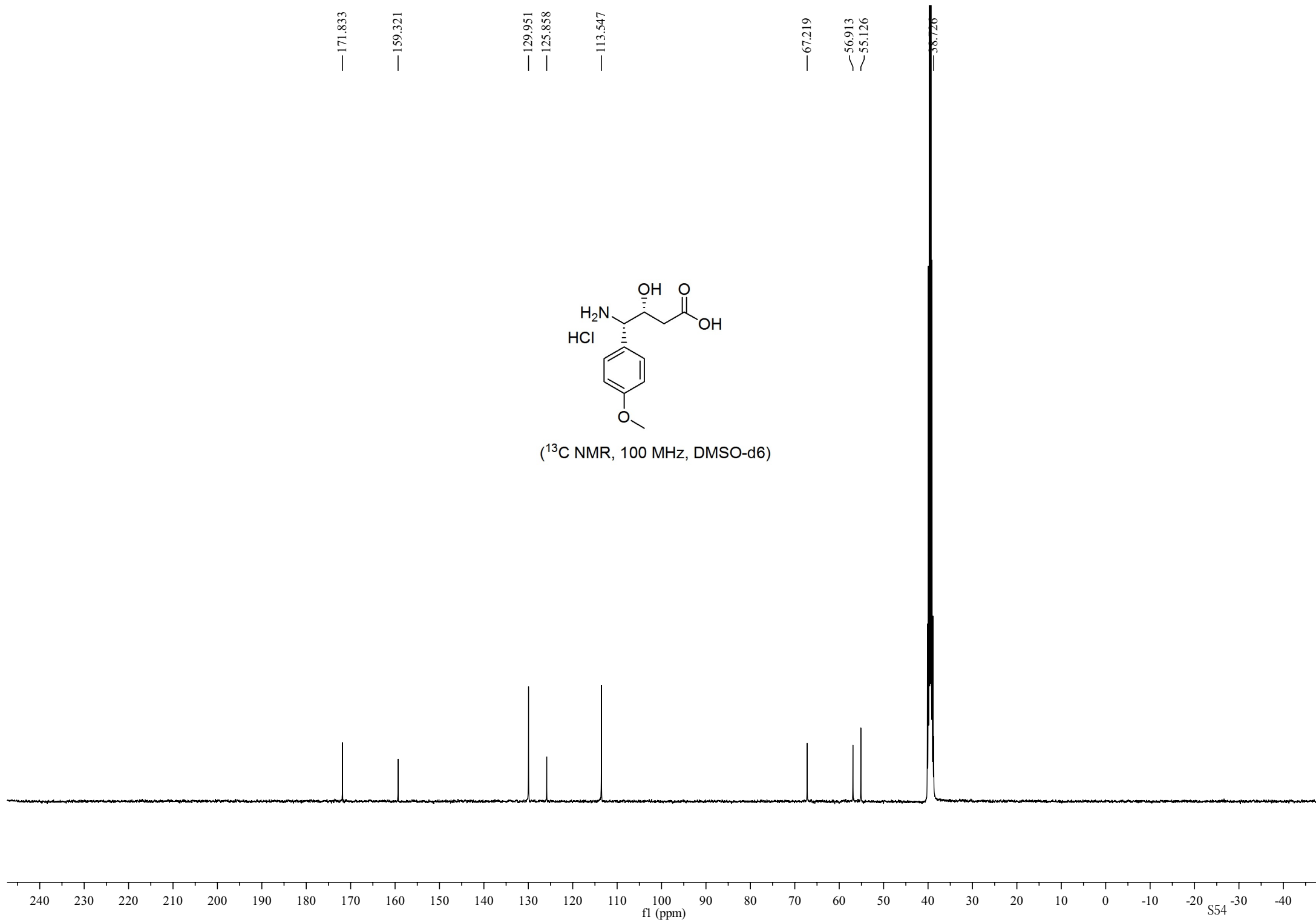


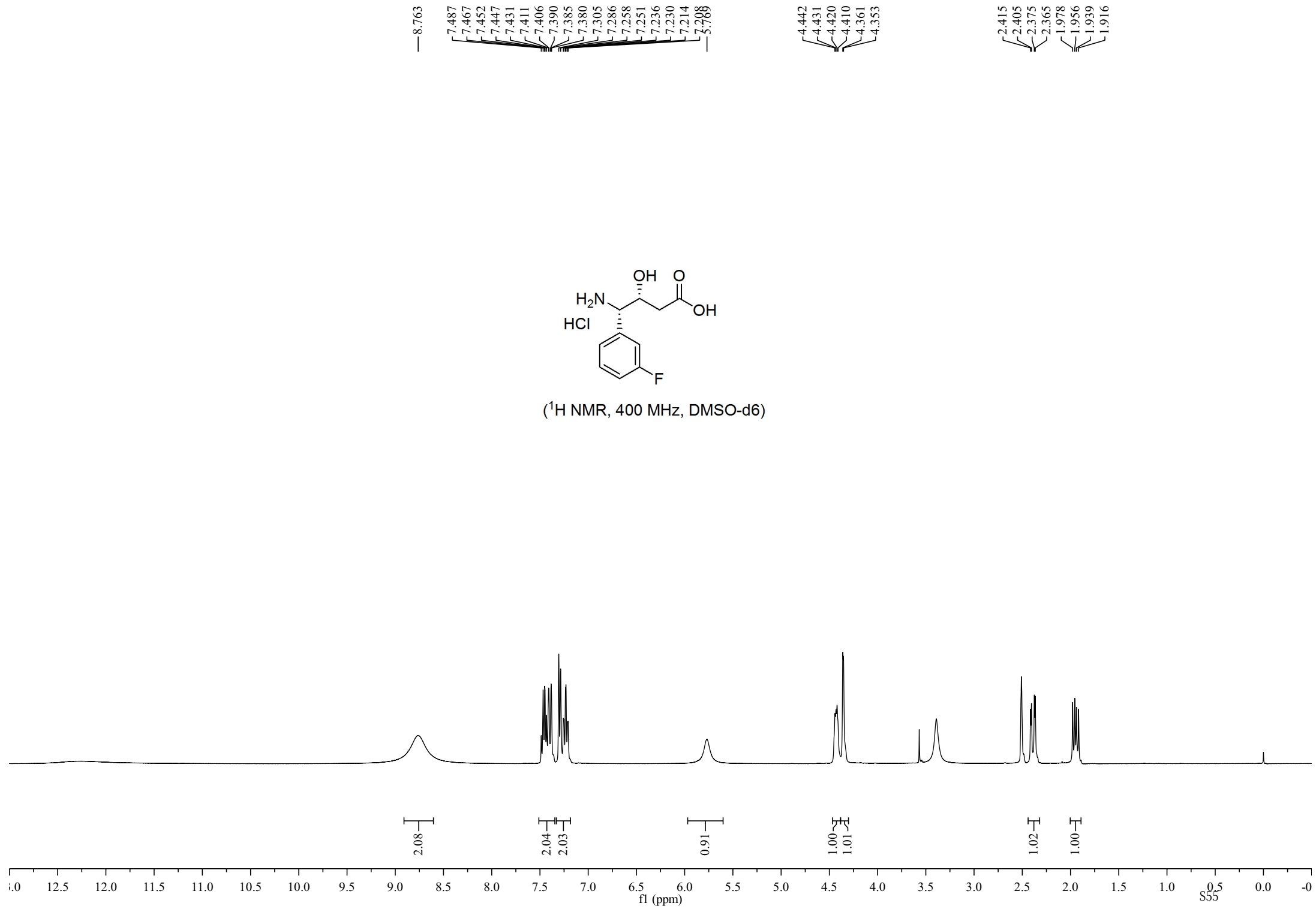


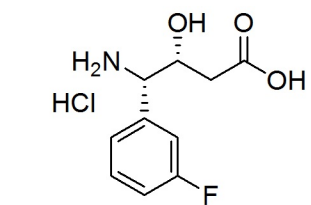




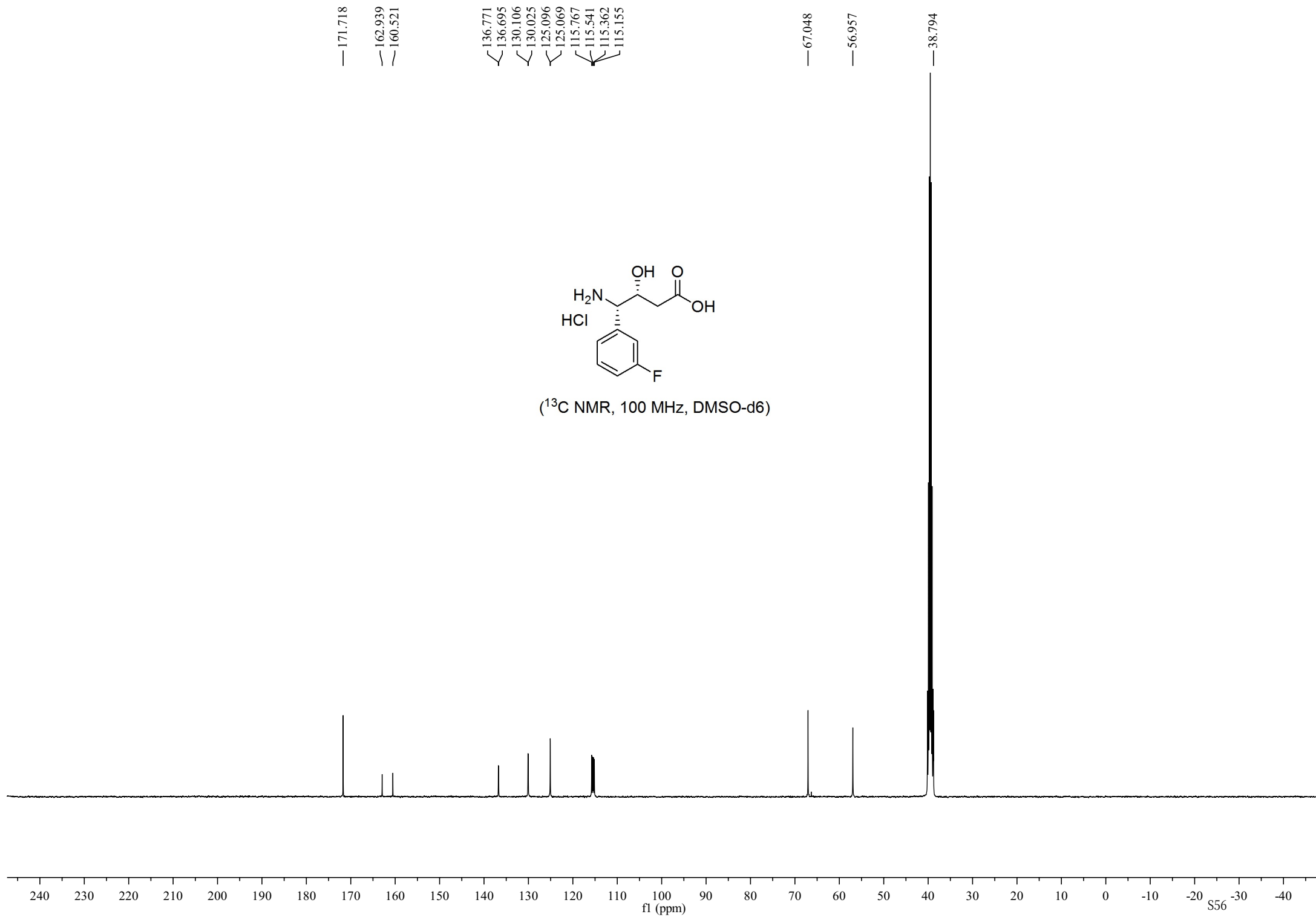
(¹³C NMR, 100 MHz, DMSO-d₆)

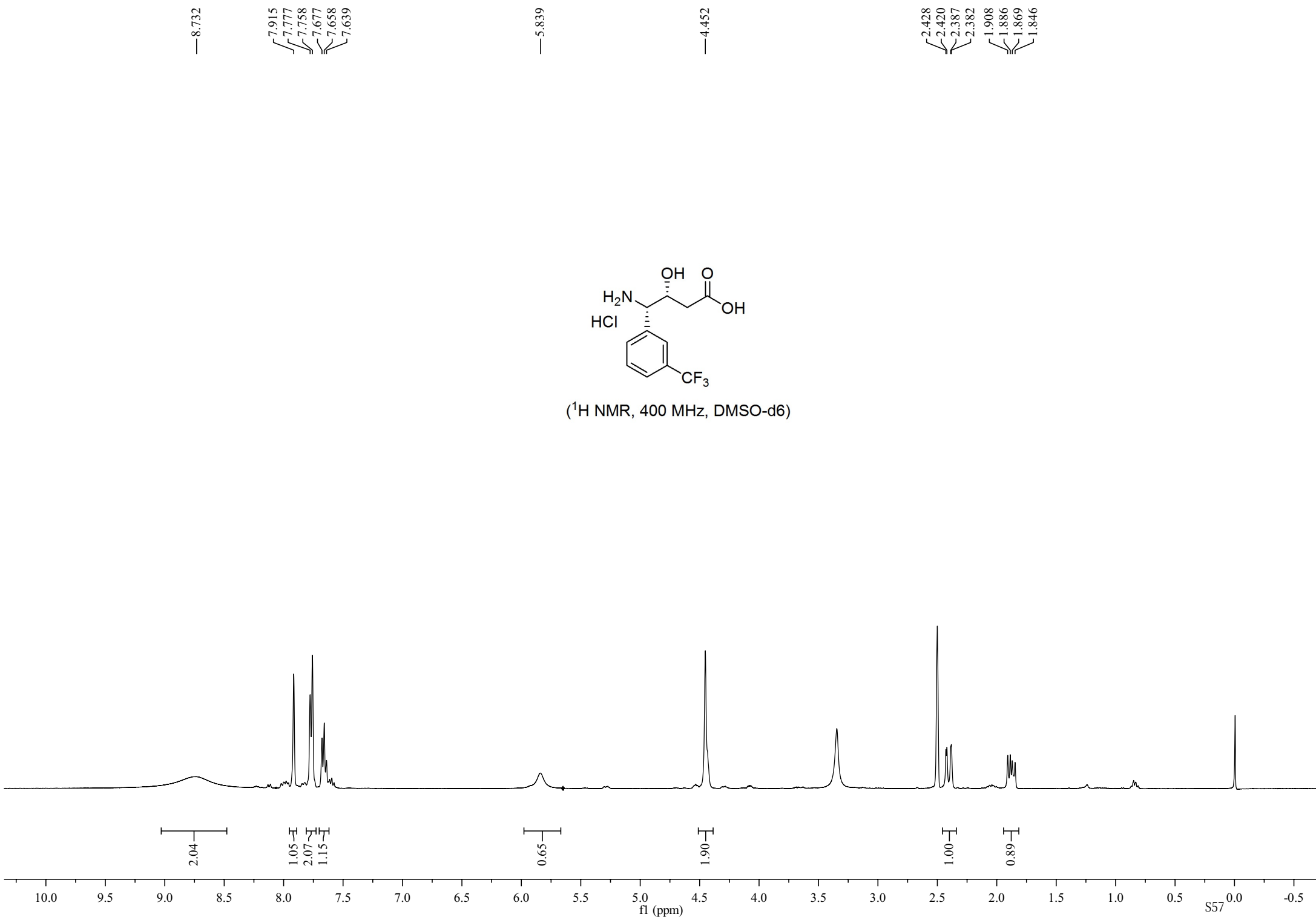


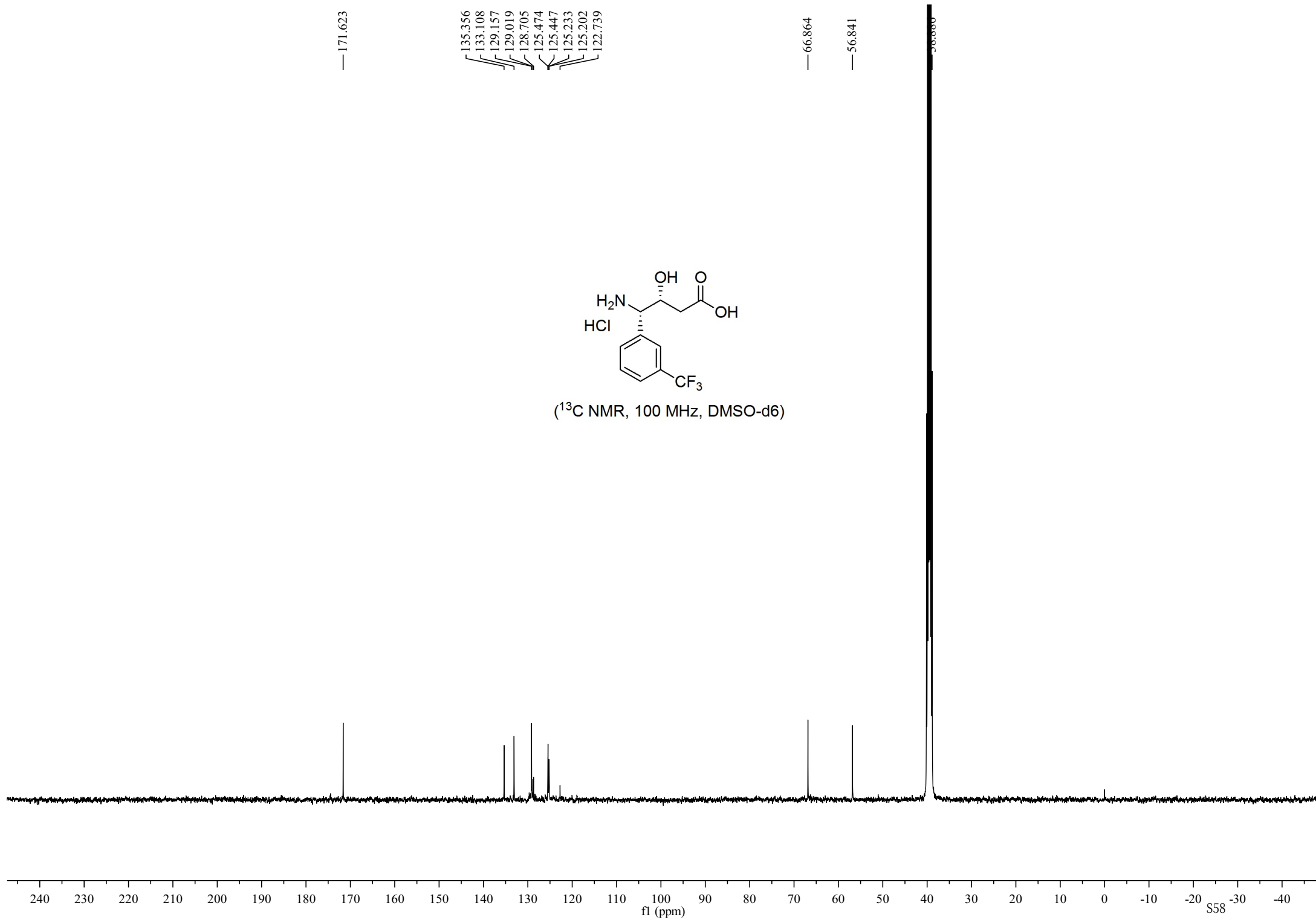
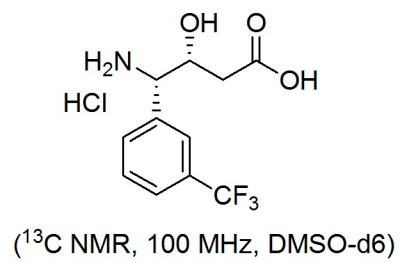




(¹³C NMR, 100 MHz, DMSO-d₆)







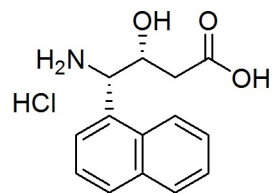
8.559
8.217
8.196
8.031
8.027
8.010
7.990
7.791
7.773
7.659
7.655
7.642
7.638
7.632
7.621
7.613
7.593
7.576

5.921

5.271

4.516

2.280
2.271
2.240
2.231
2.063
2.040
2.023
2.000



(¹H NMR, 400 MHz, DMSO-d₆)

2.08

1.03

1.99

0.99

3.06

0.91

0.96

0.97

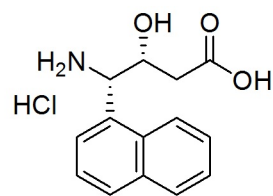
0.95

1.00

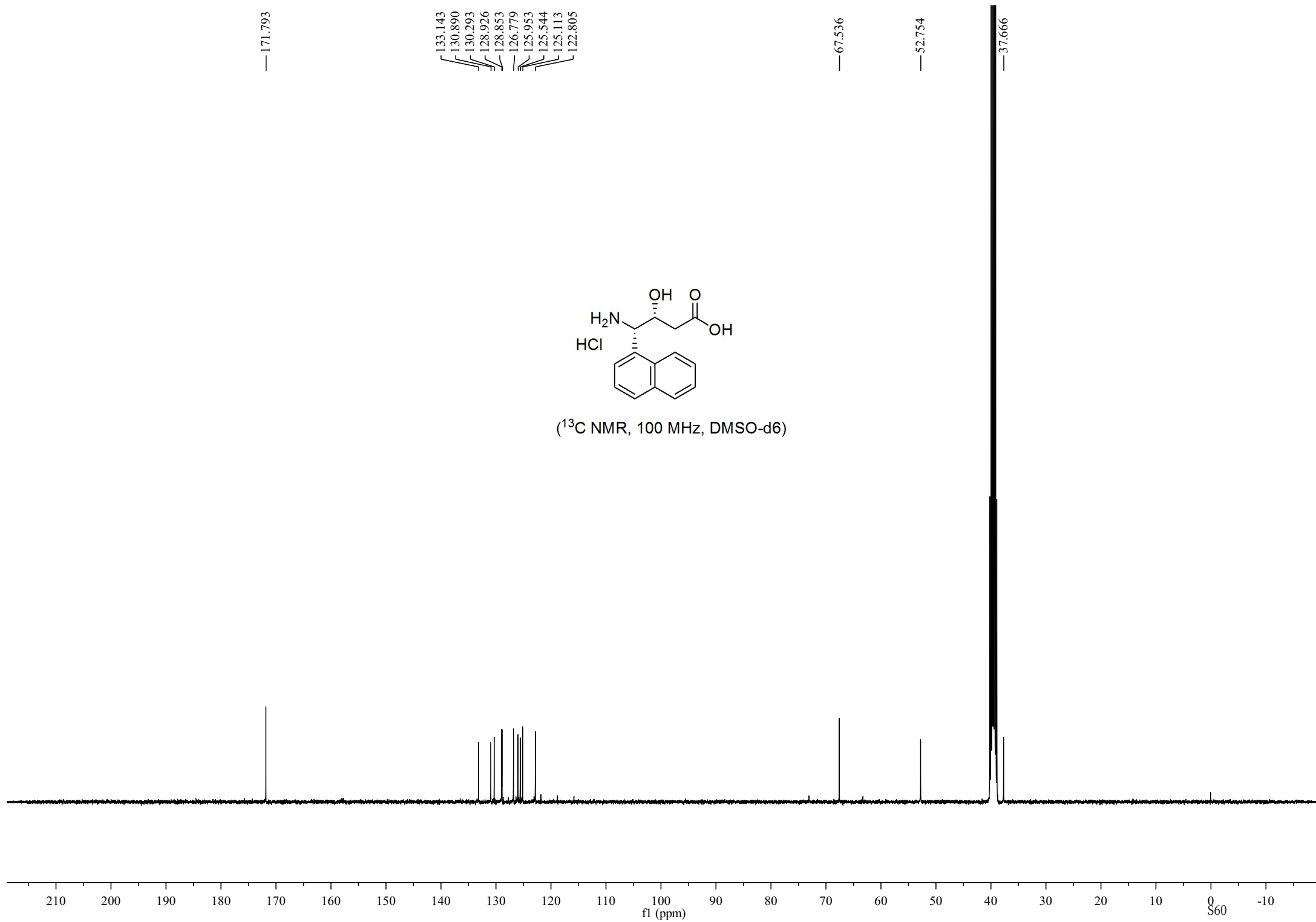
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5

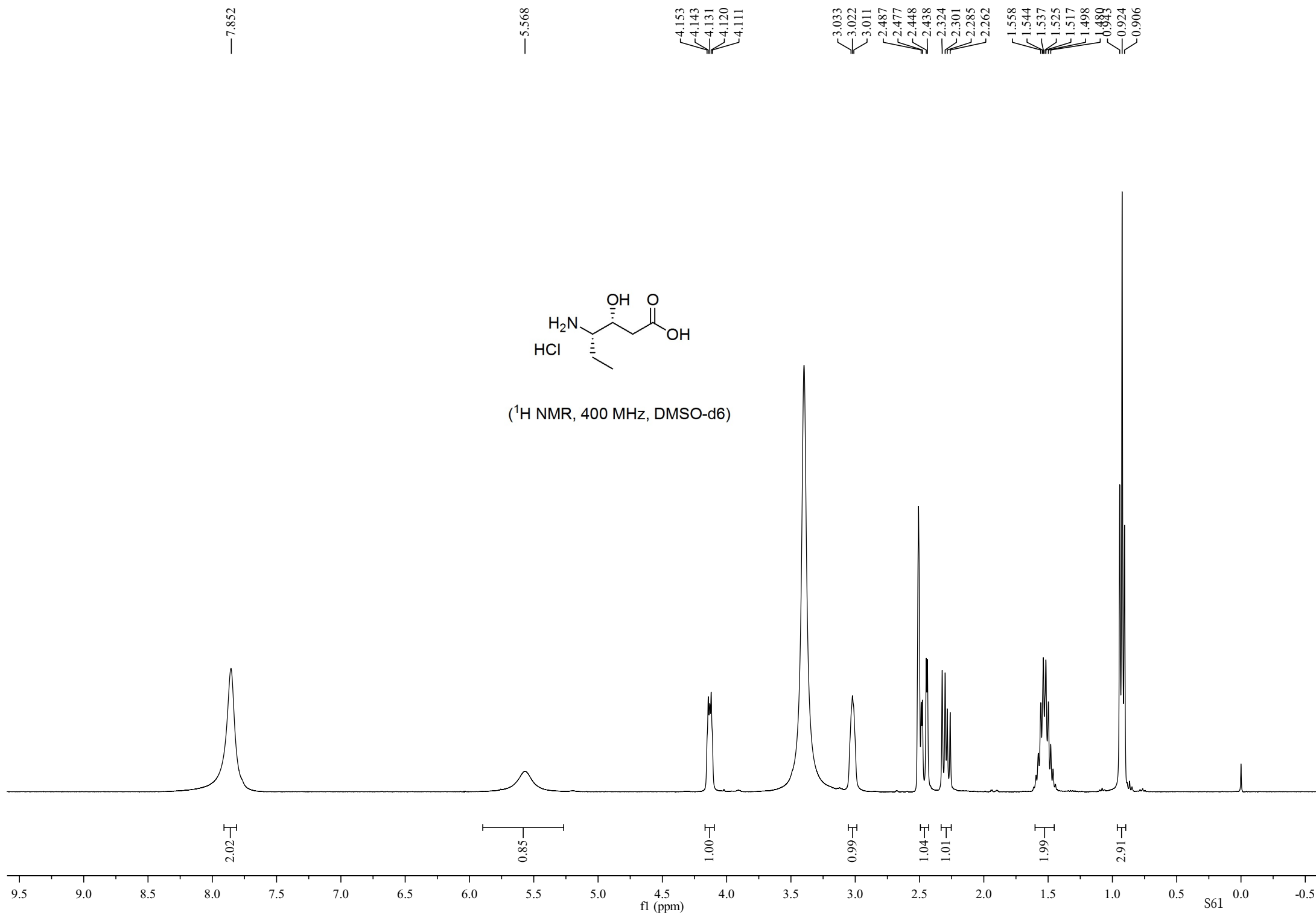
fl (ppm)

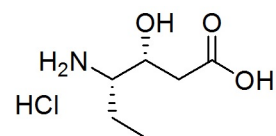
S59



(¹³C NMR, 100 MHz, DMSO-d₆)







(¹³C NMR, 100 MHz, DMSO-d₆)

— 172.189

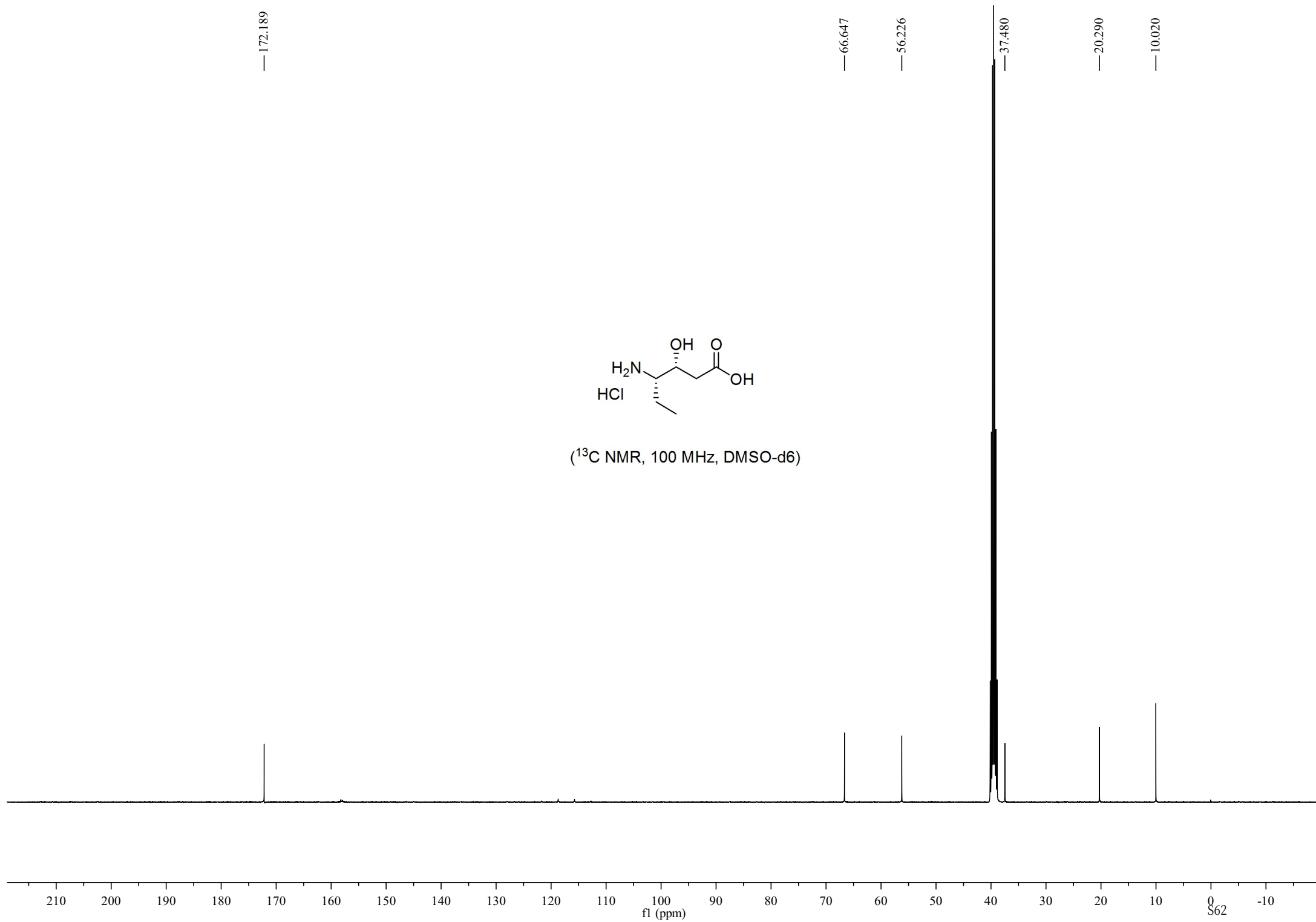
— 66.647

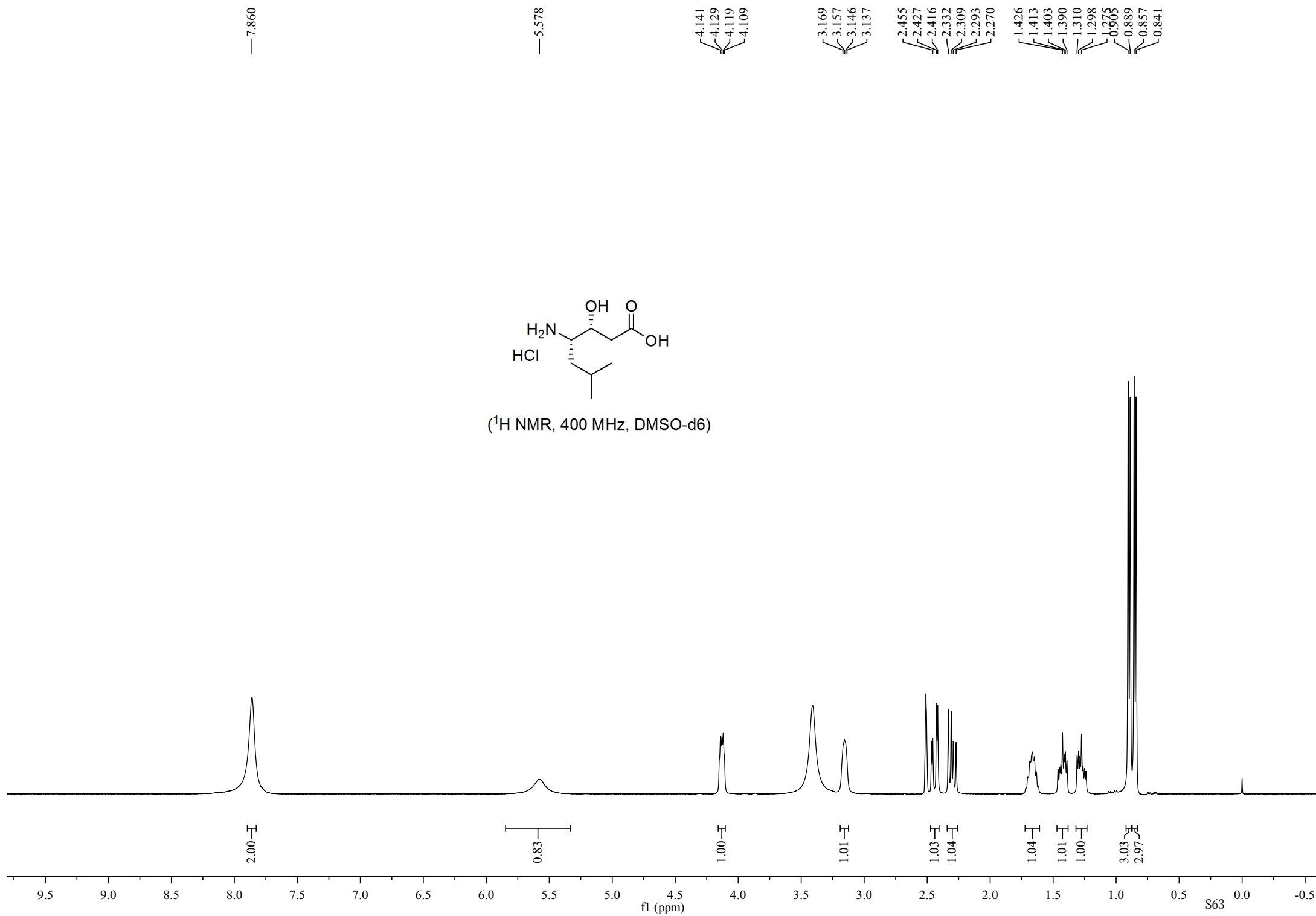
— 56.226

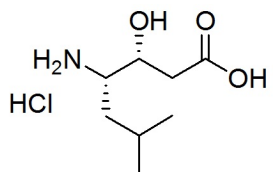
— 37.480

— 20.290

— 10.020







(¹³C NMR, 100 MHz, DMSO-d₆)

—172.119

—67.014

—52.892

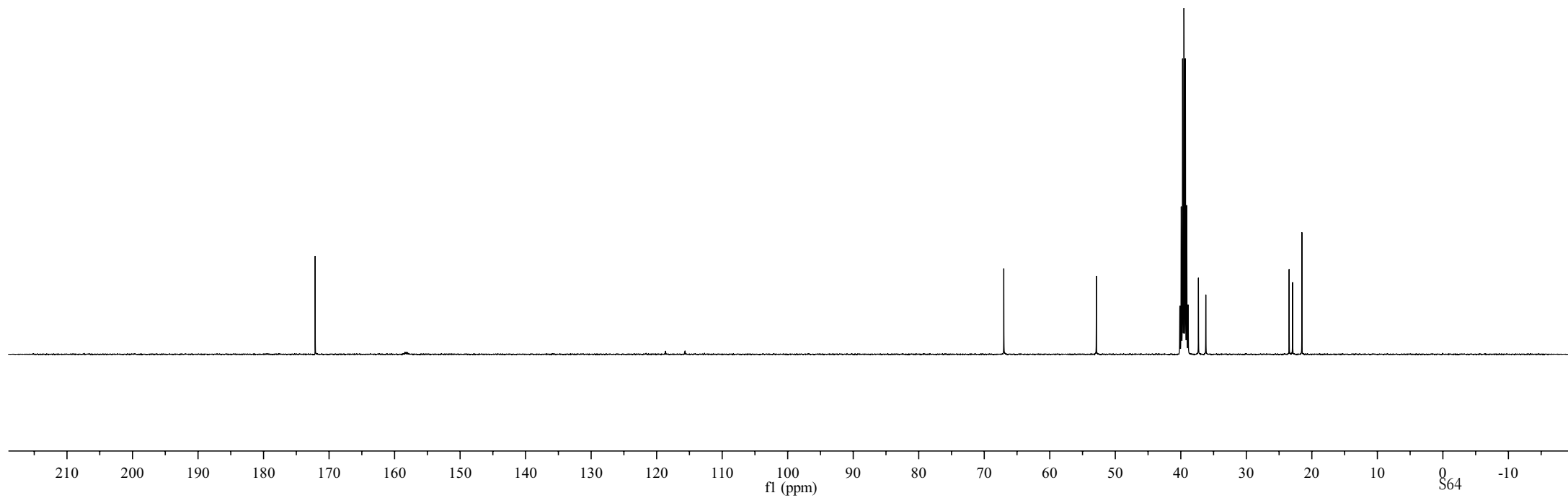
—37.311

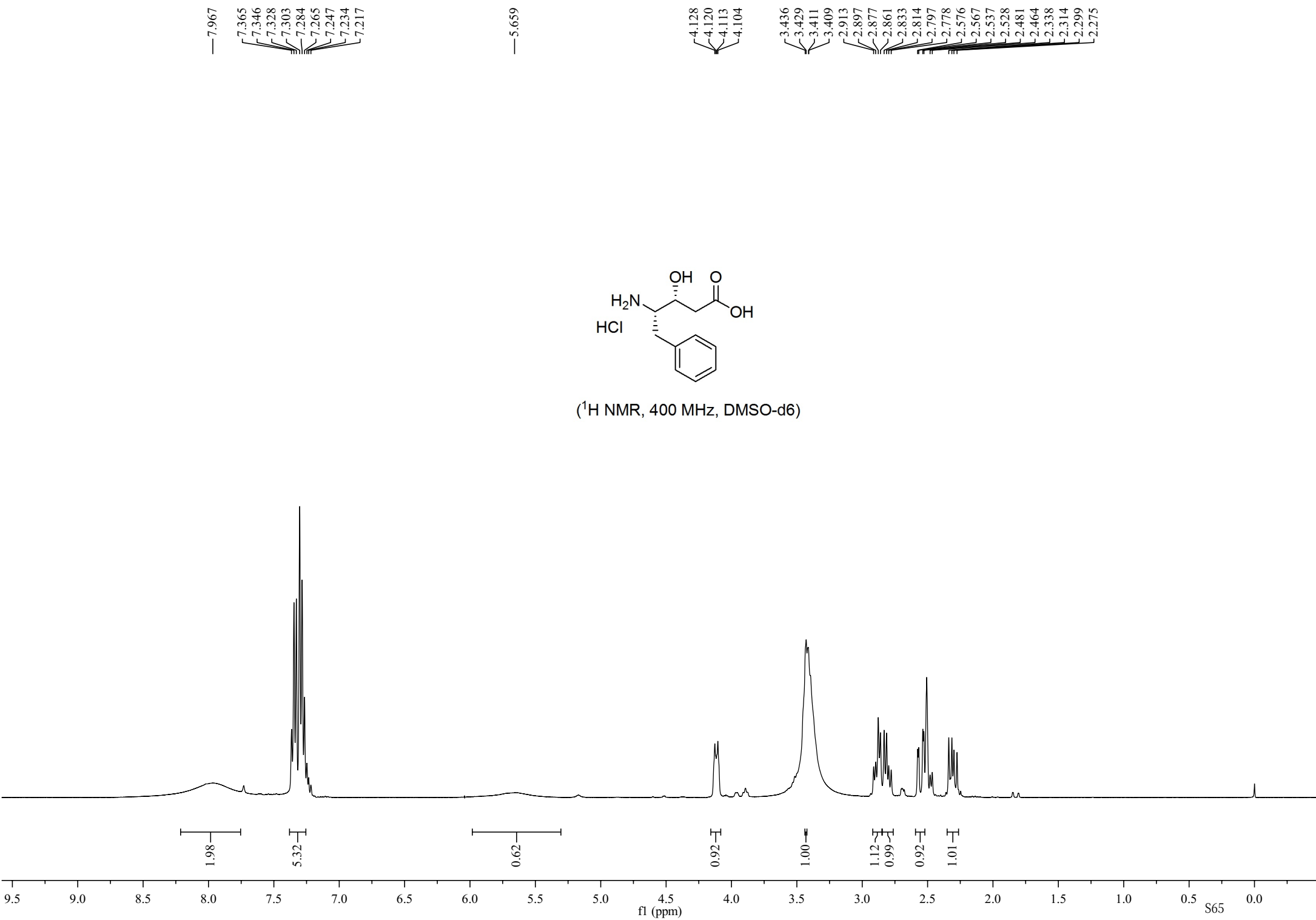
—36.184

—23.465

—22.936

—21.524





— 172.174

— 136.617

— 129.202

— 128.564

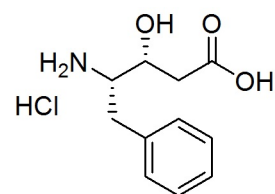
— 126.756

— 66.419

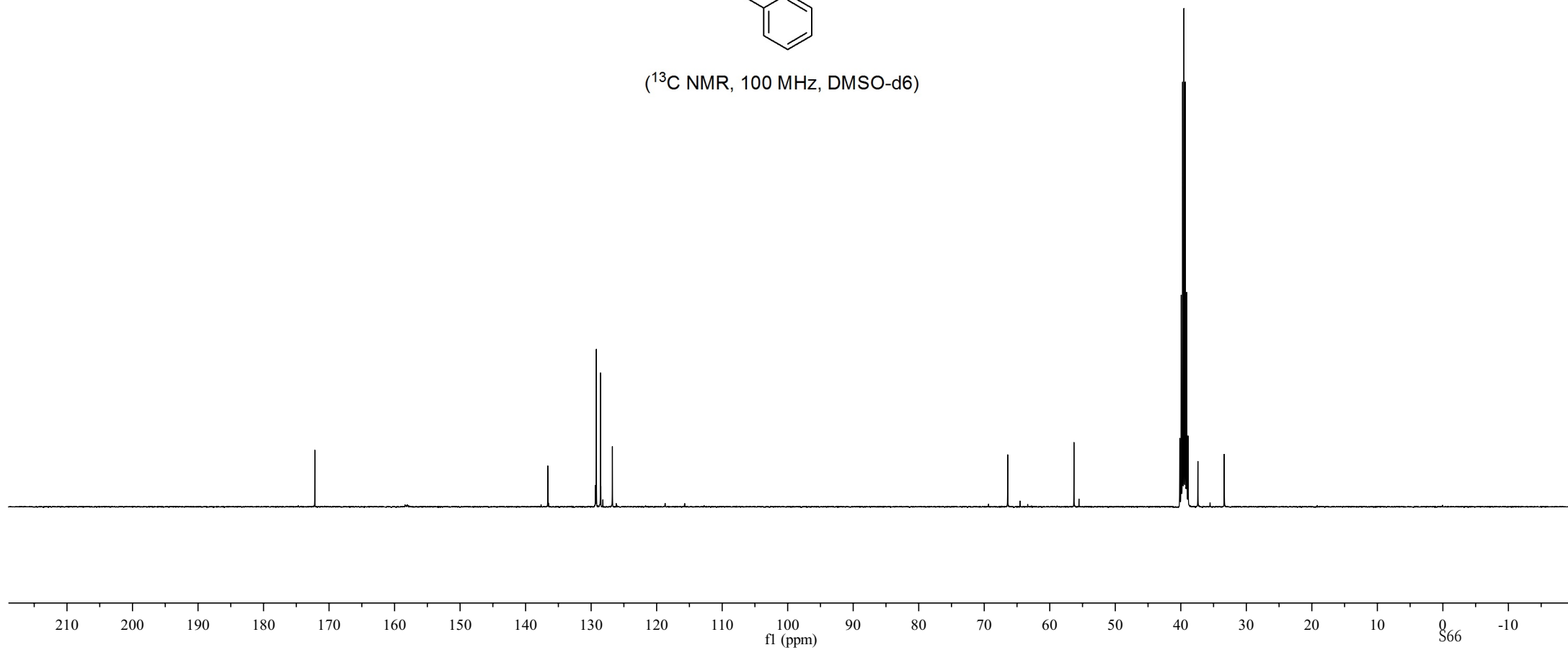
— 56.307

— 37.390

— 33.369



(¹³C NMR, 100 MHz, DMSO-d₆)



7.312
7.301
7.280
7.264
7.253
7.242
7.232
7.221

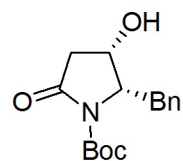
4.515
4.496
4.481
4.467
4.451
4.435

3.155
3.140

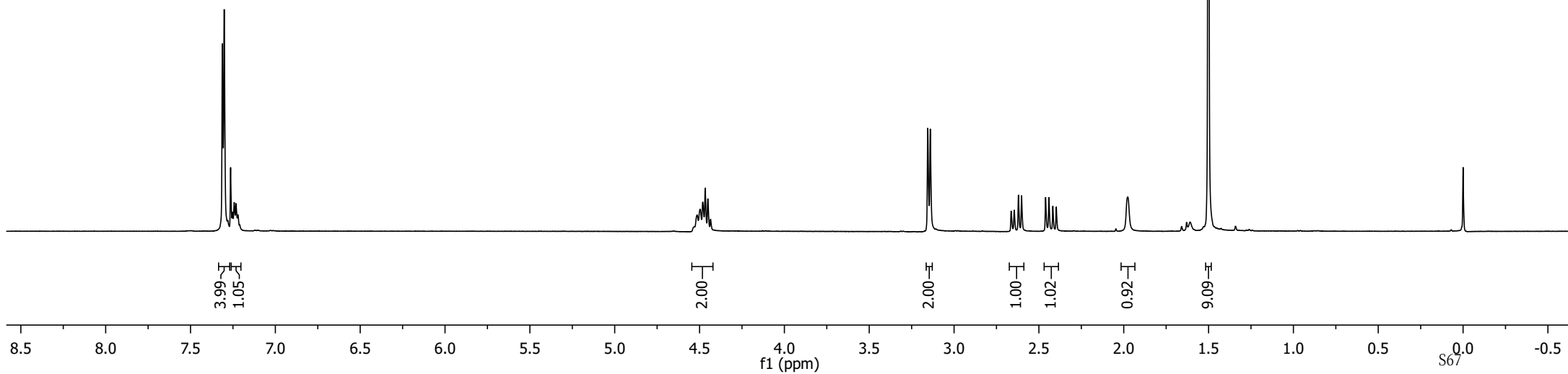
2.663
2.645
2.621
2.602
2.461
2.441
2.418
2.397

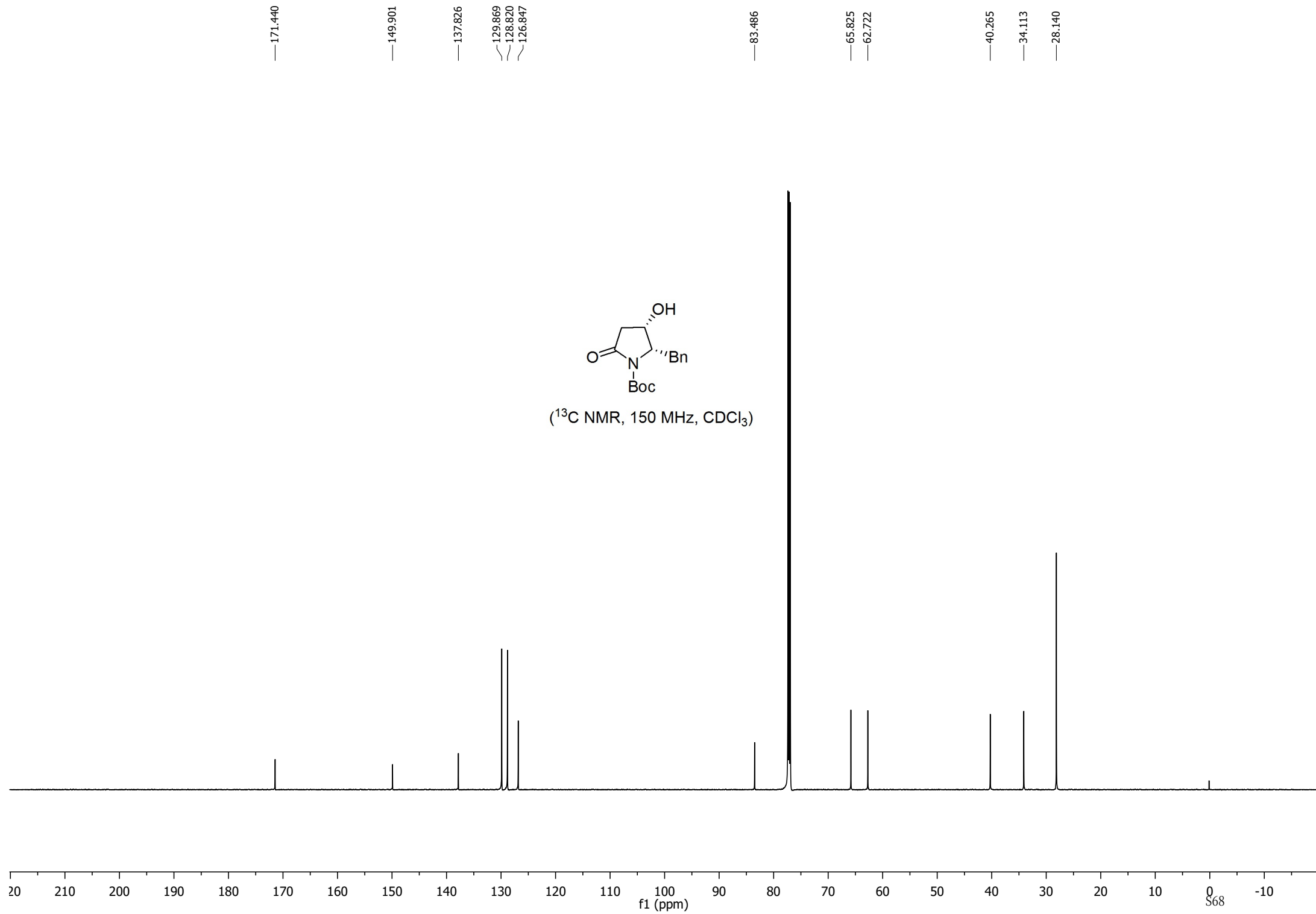
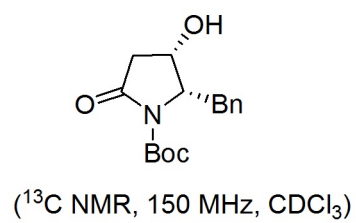
— 1.977

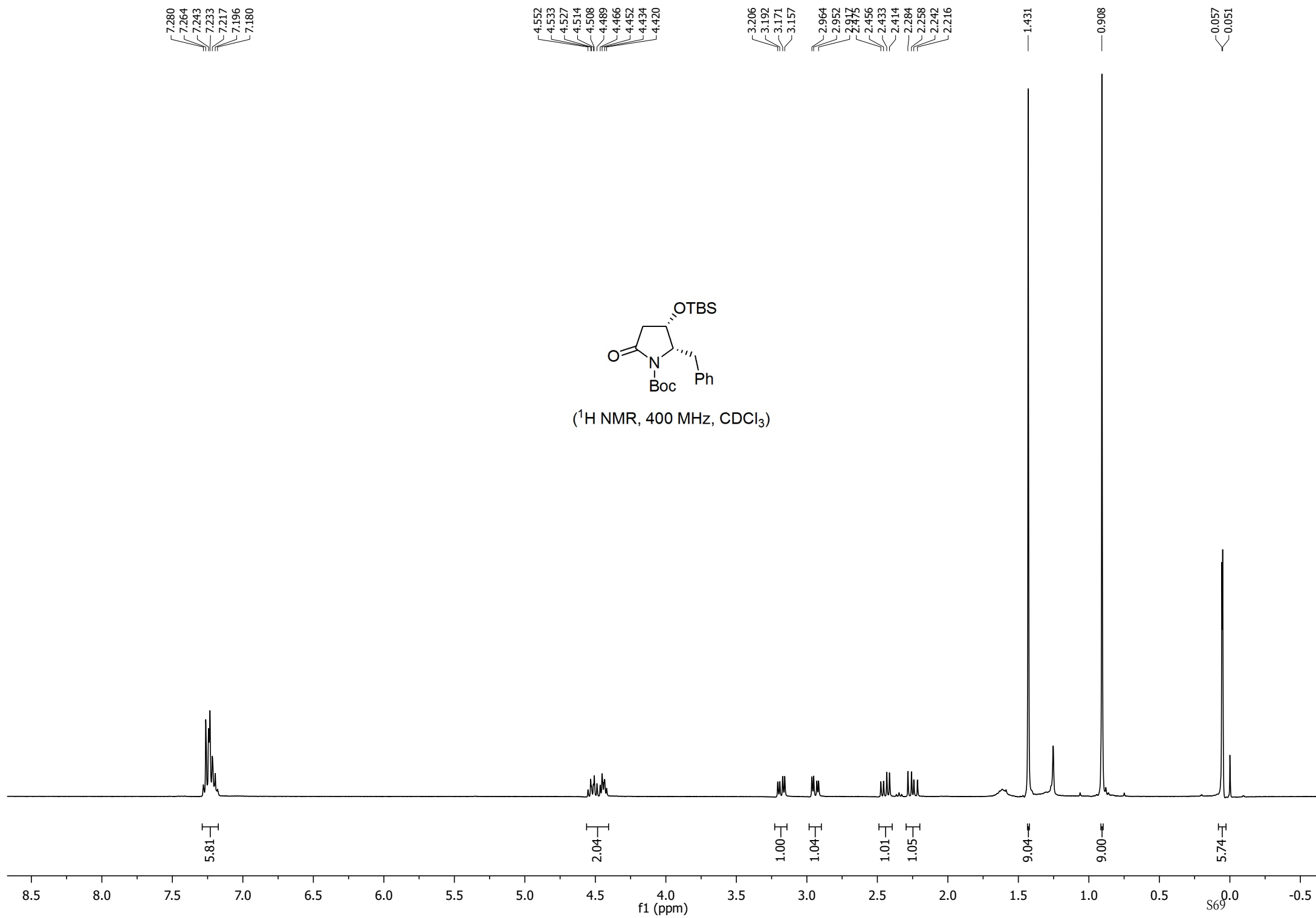
1.502

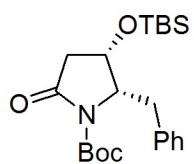


(¹H NMR, 400 MHz, CDCl₃)

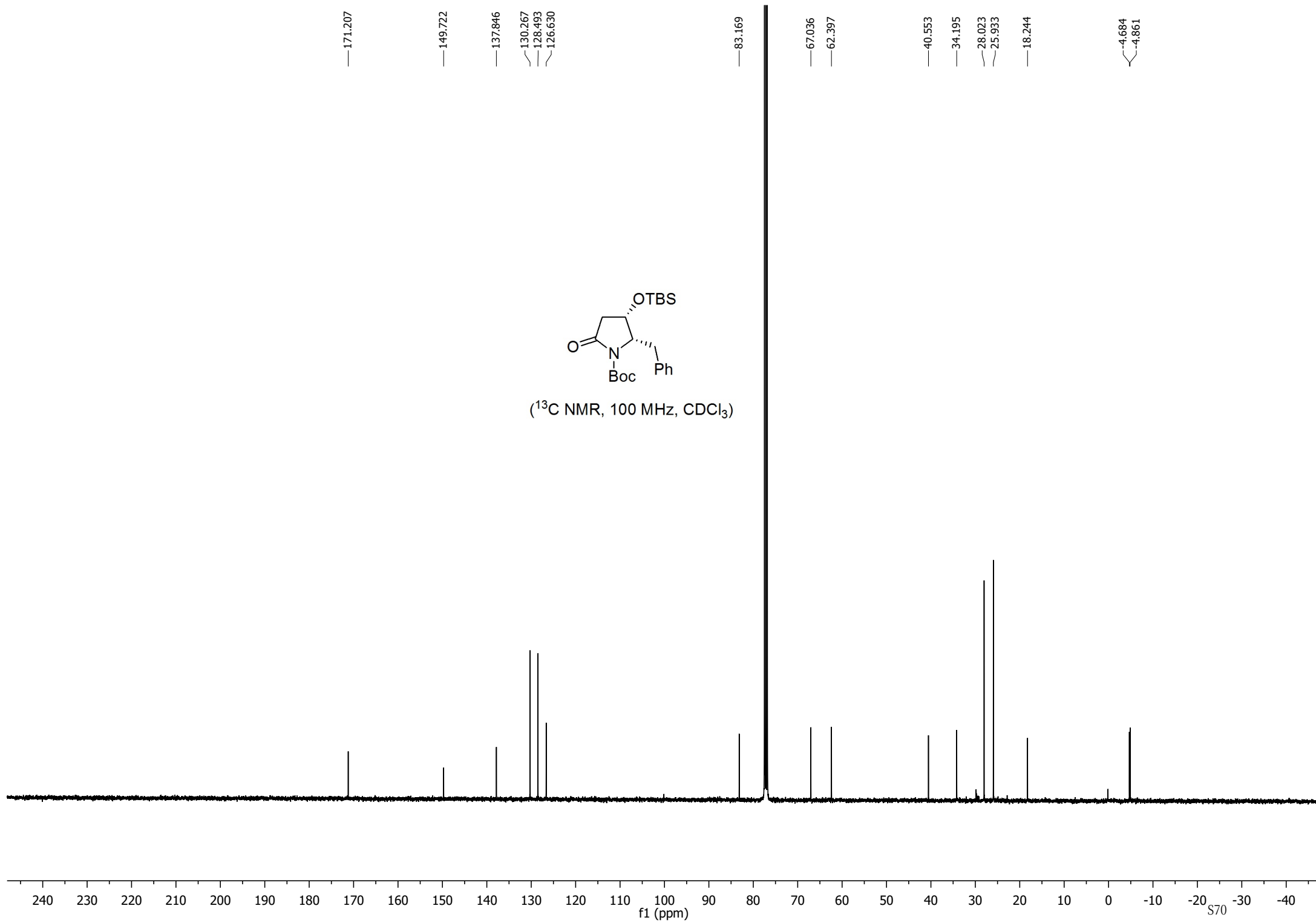








(^{13}C NMR, 100 MHz, CDCl_3)



7.293
7.289
7.274
7.268
7.260
7.197
7.190
7.183
7.179
7.176
7.171
7.162
7.154

4.195
4.179
4.171
4.155

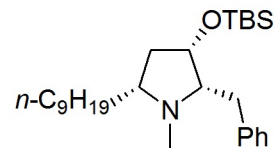
3.111
3.091
3.075
3.055
2.827
2.817
2.792
2.782
2.502

2.239
2.073

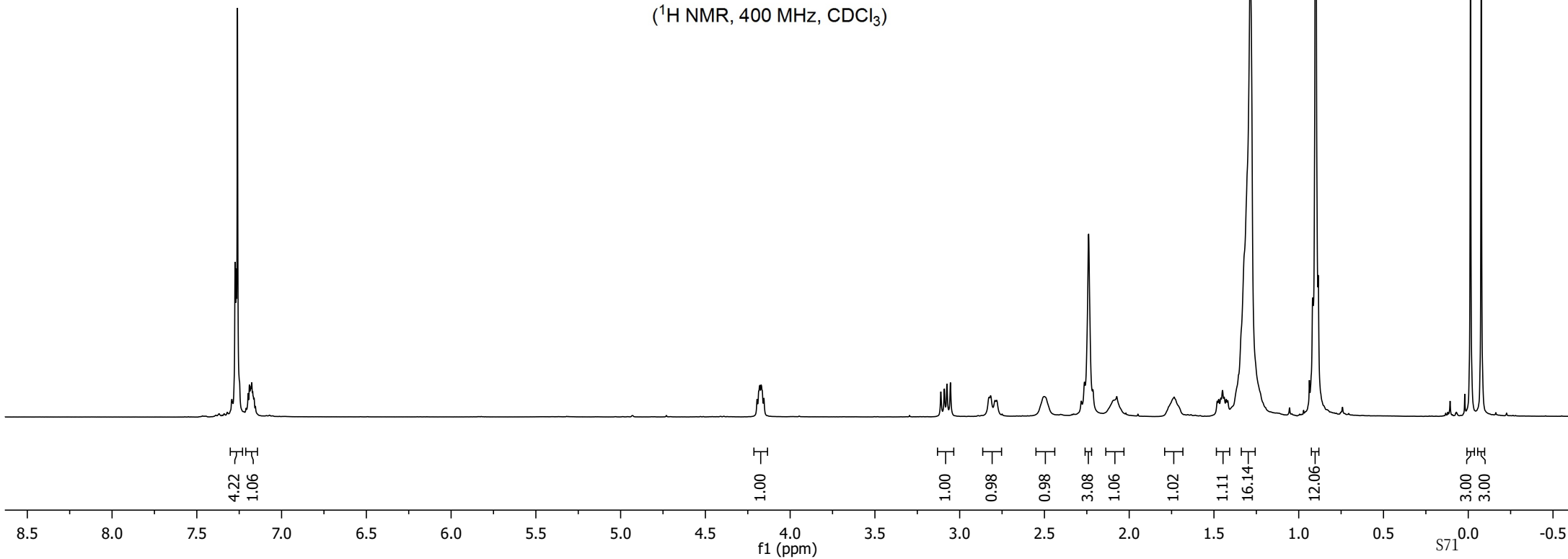
1.735

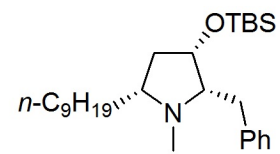
1.472
1.460
1.450
1.440
1.428
1.386
1.357
0.918
0.900
0.885

-0.013
-0.077

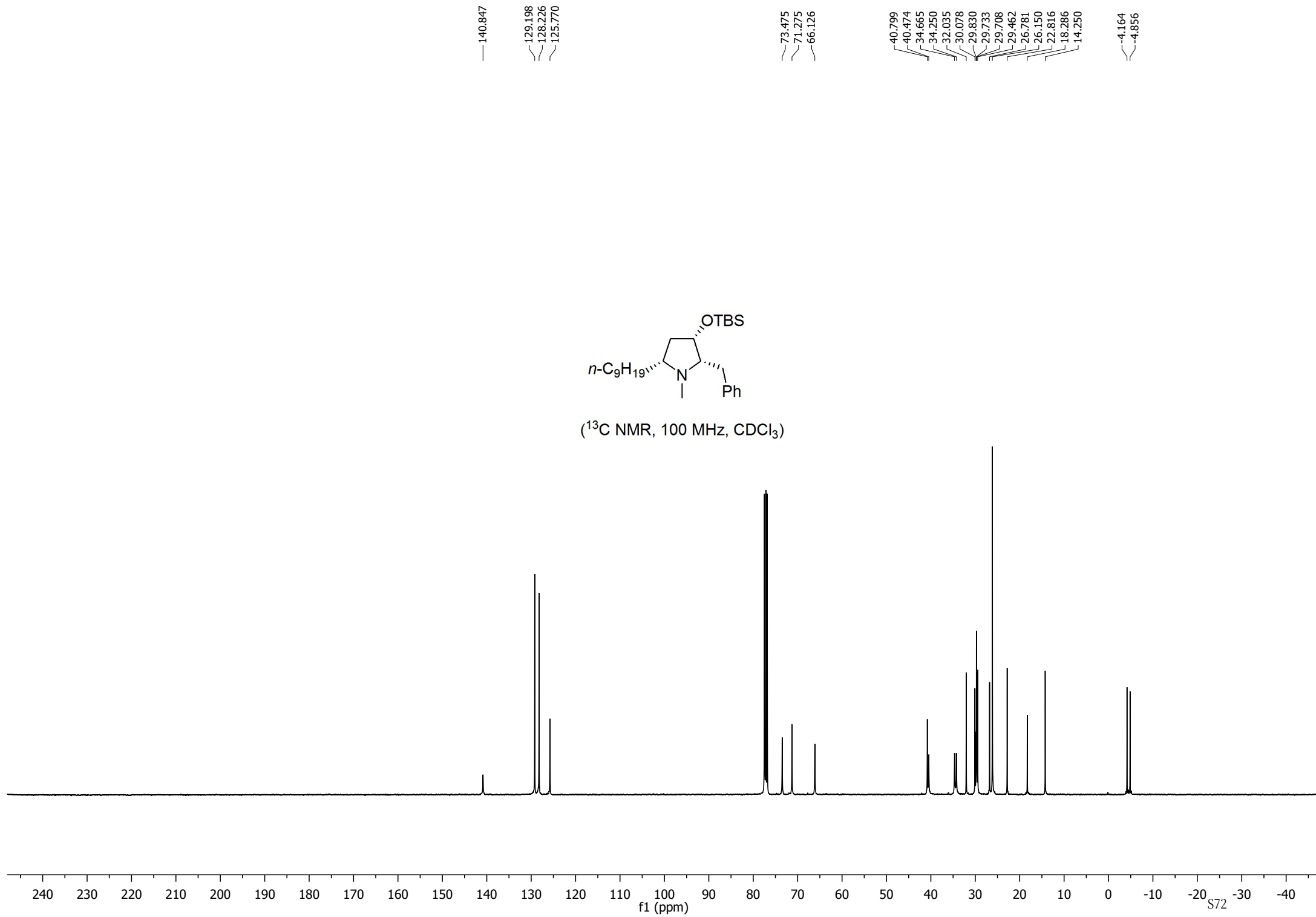


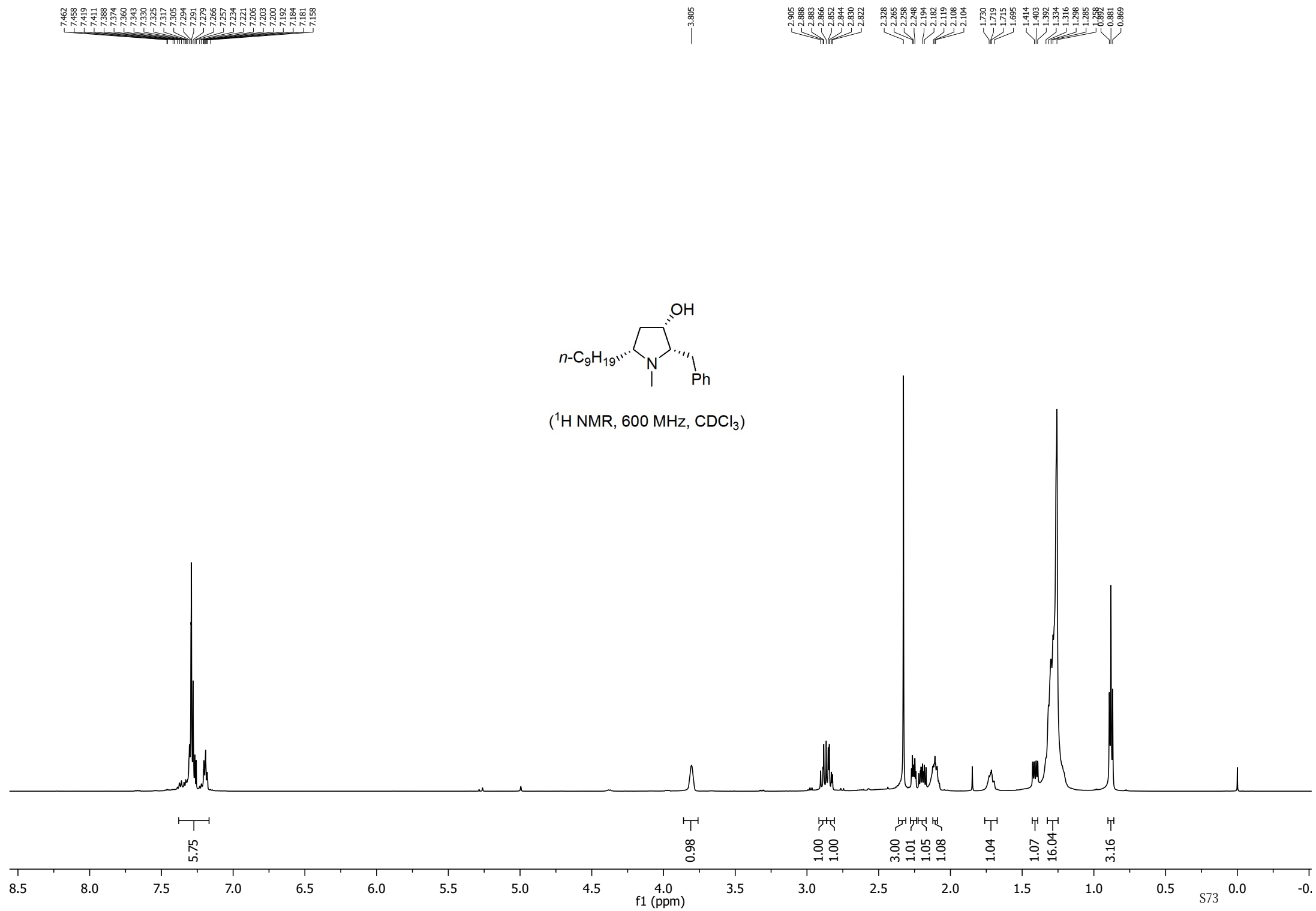
(¹H NMR, 400 MHz, CDCl₃)

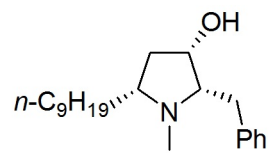




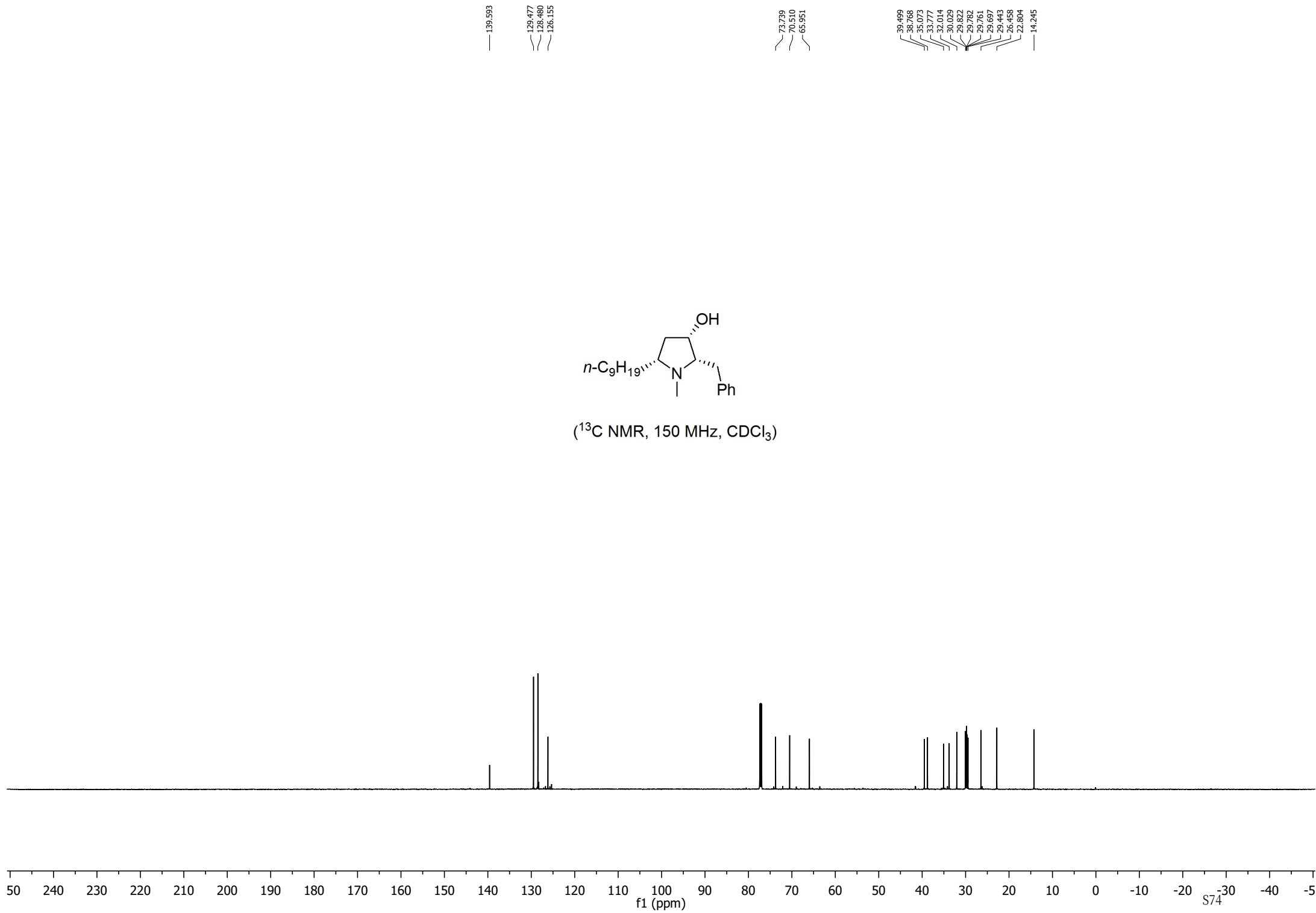
(¹³C NMR, 100 MHz, CDCl₃)

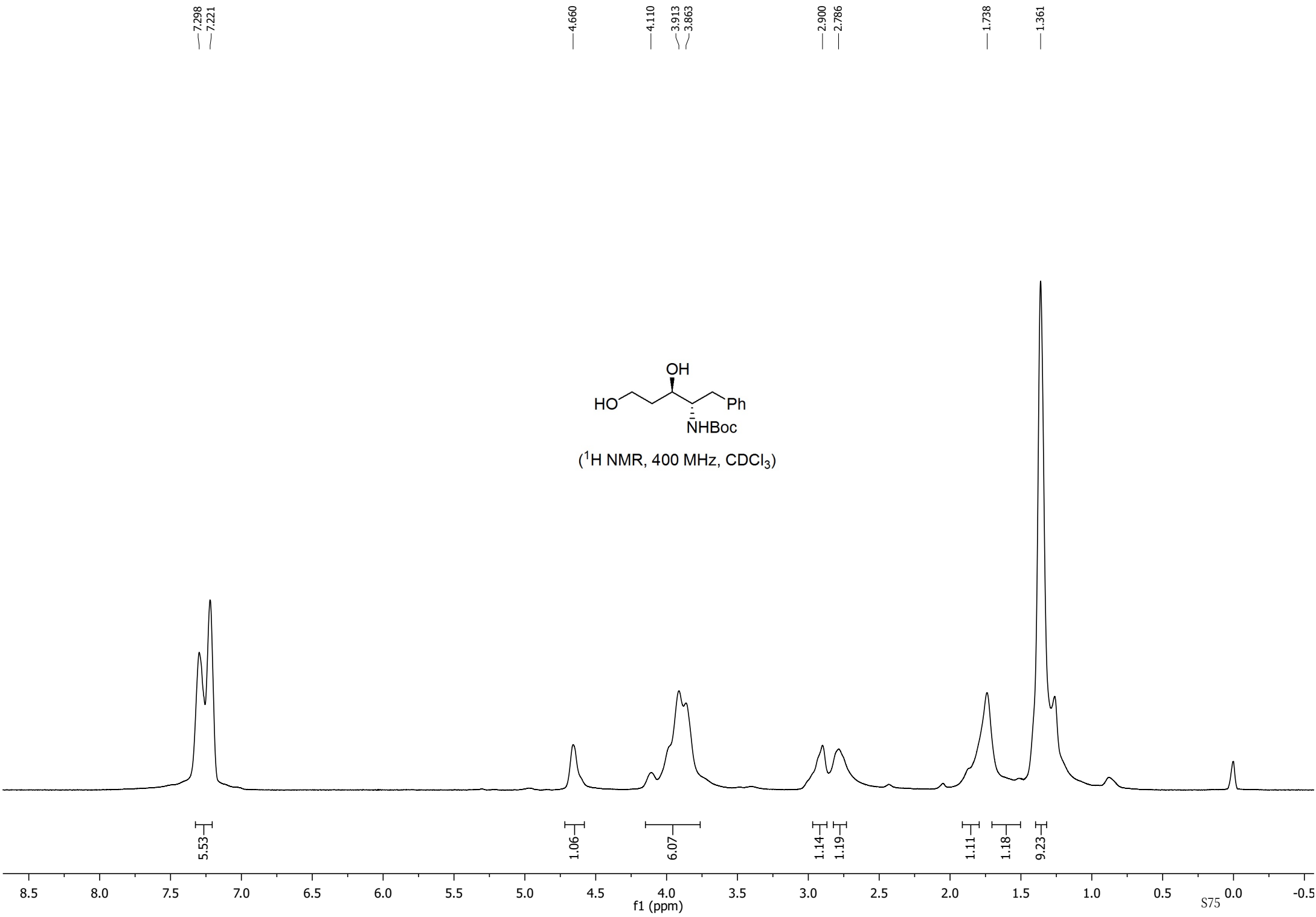


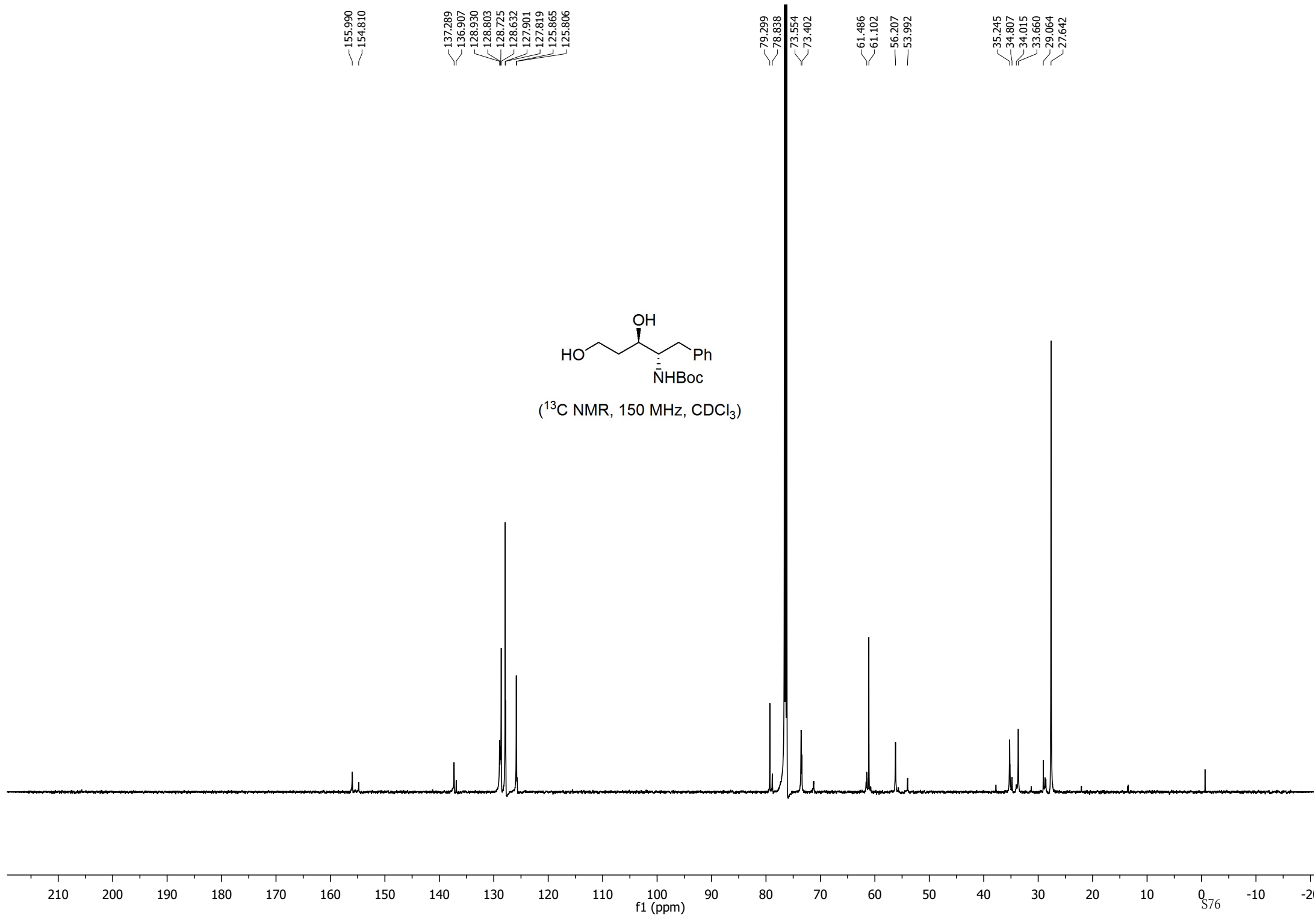
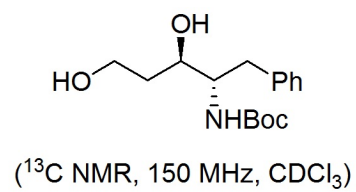


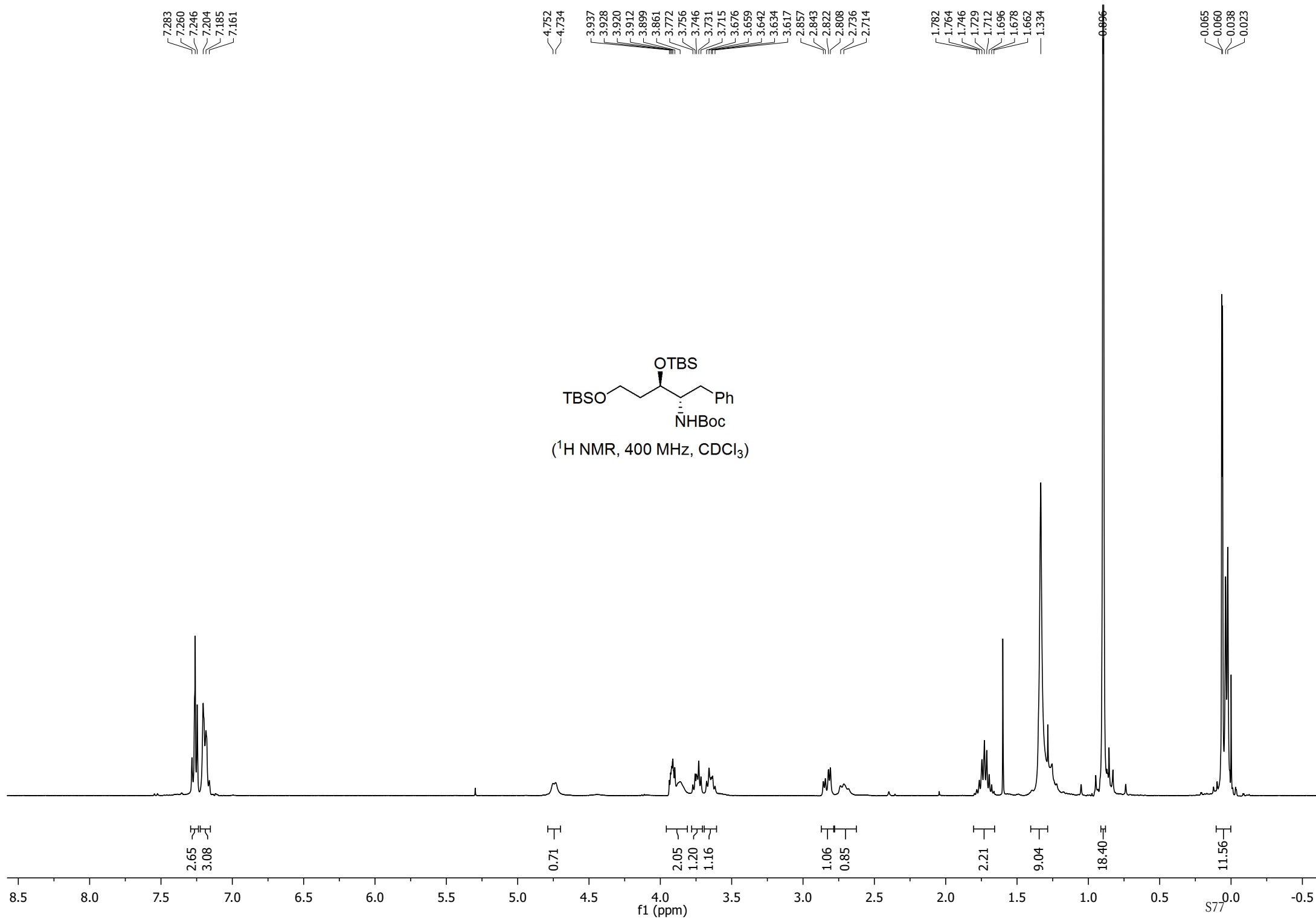


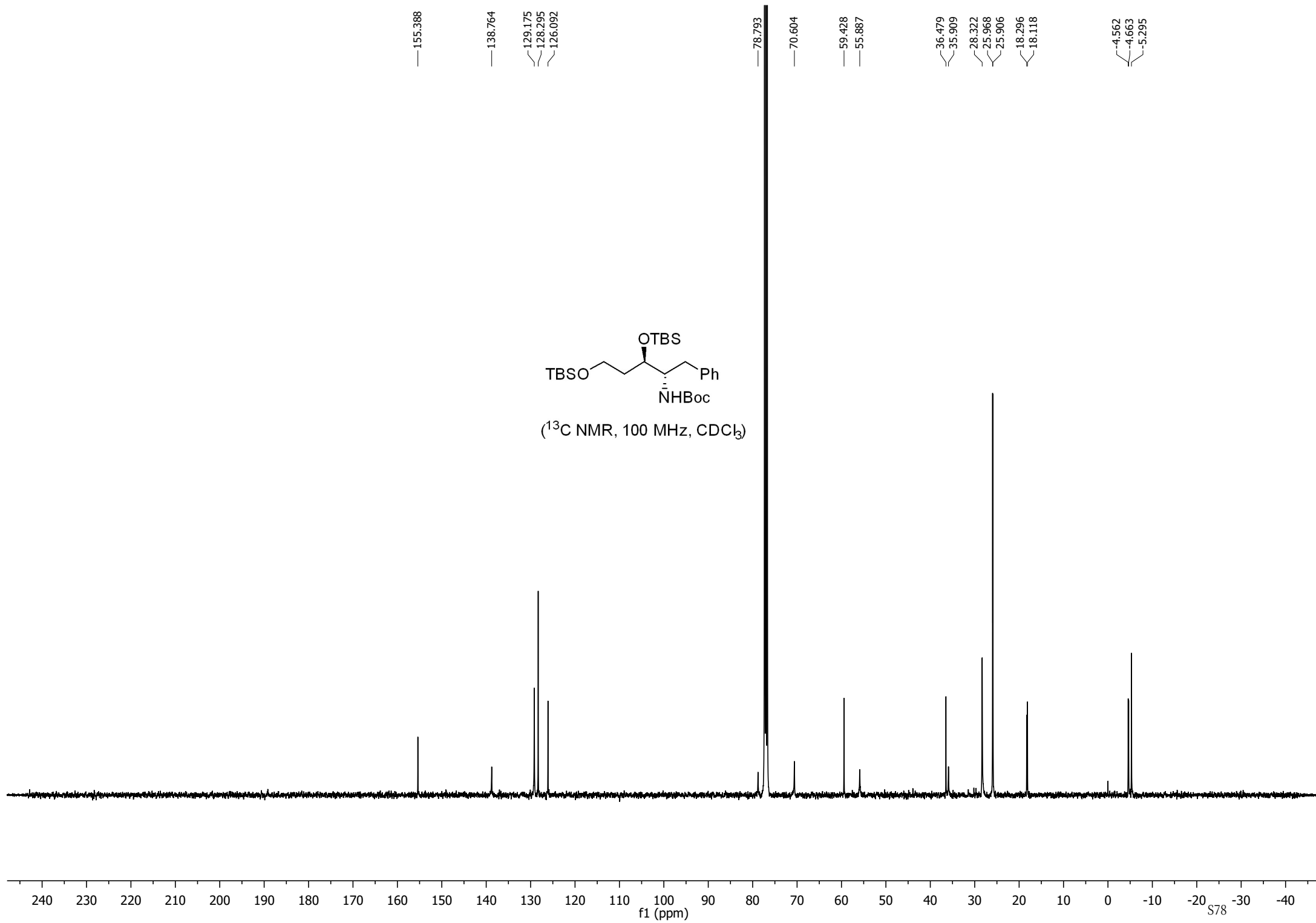
(¹³C NMR, 150 MHz, CDCl₃)

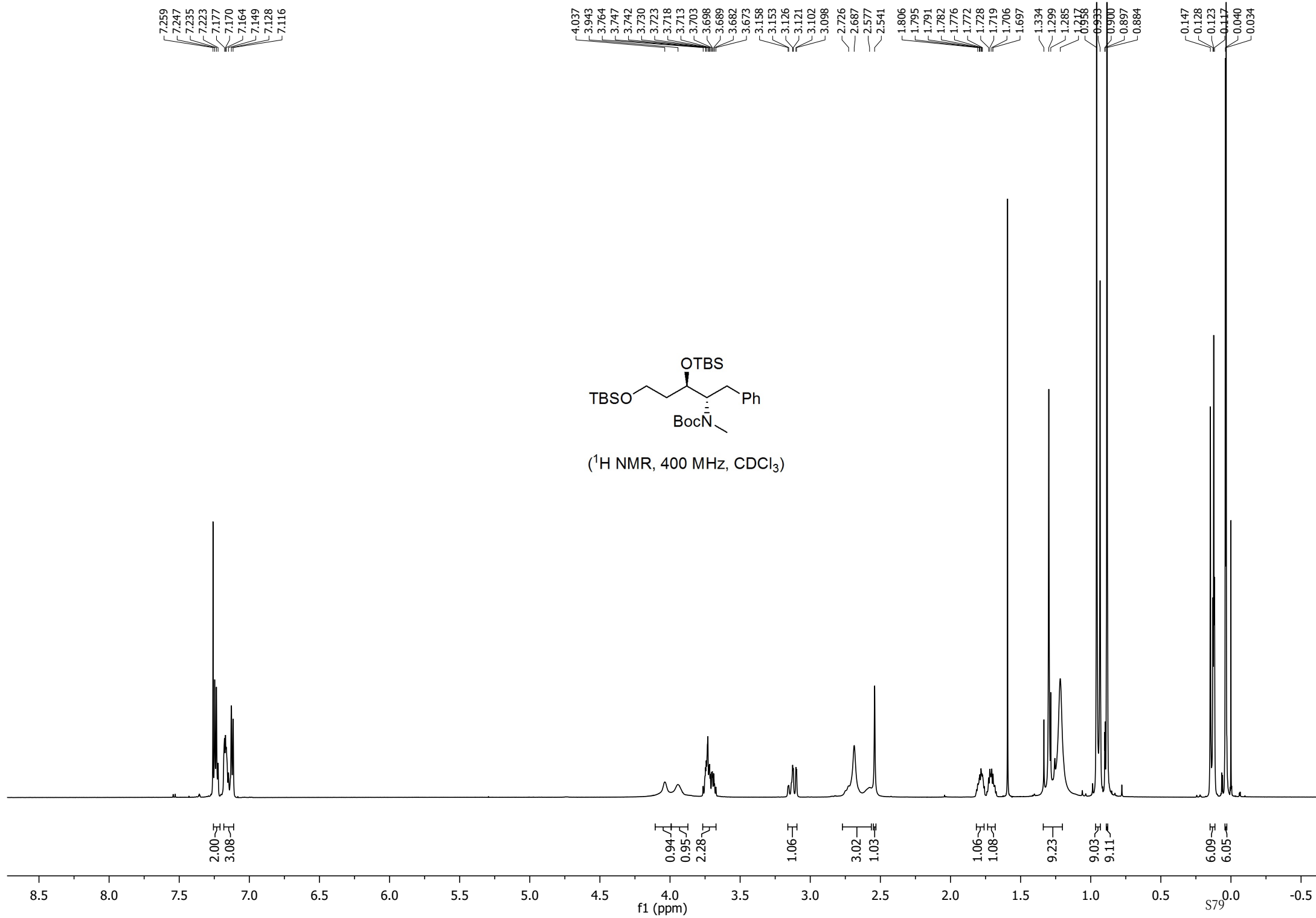












7.266
7.248
7.229
7.201
7.180
7.162
7.146
7.129

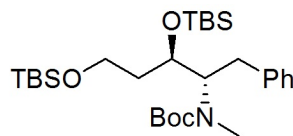
4.019
4.009
3.748
3.730
3.712

2.746
2.716
2.689
2.607

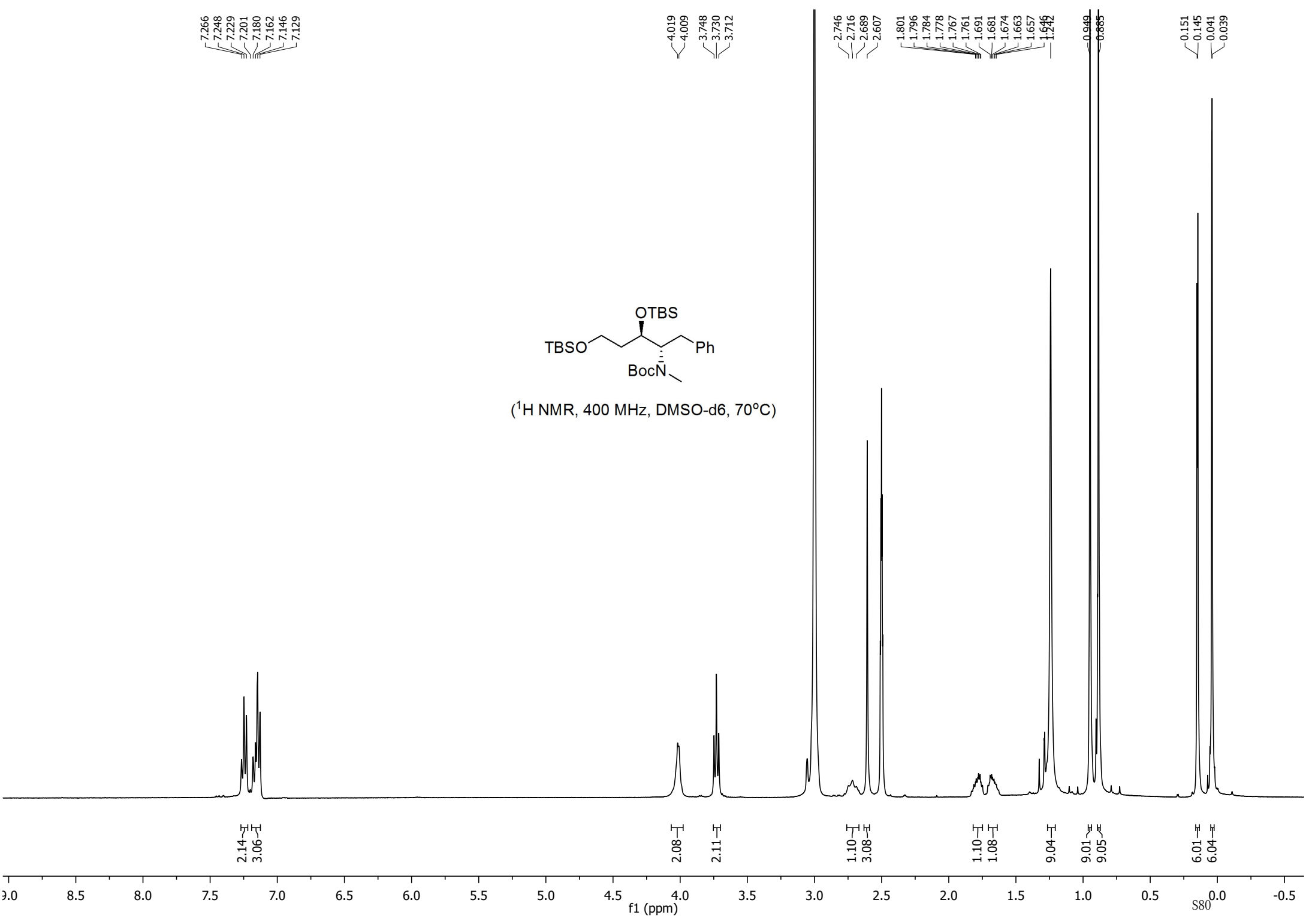
1.801
1.796
1.784
1.778
1.767
1.761
1.691
1.681
1.674
1.663
1.657
1.646
1.642

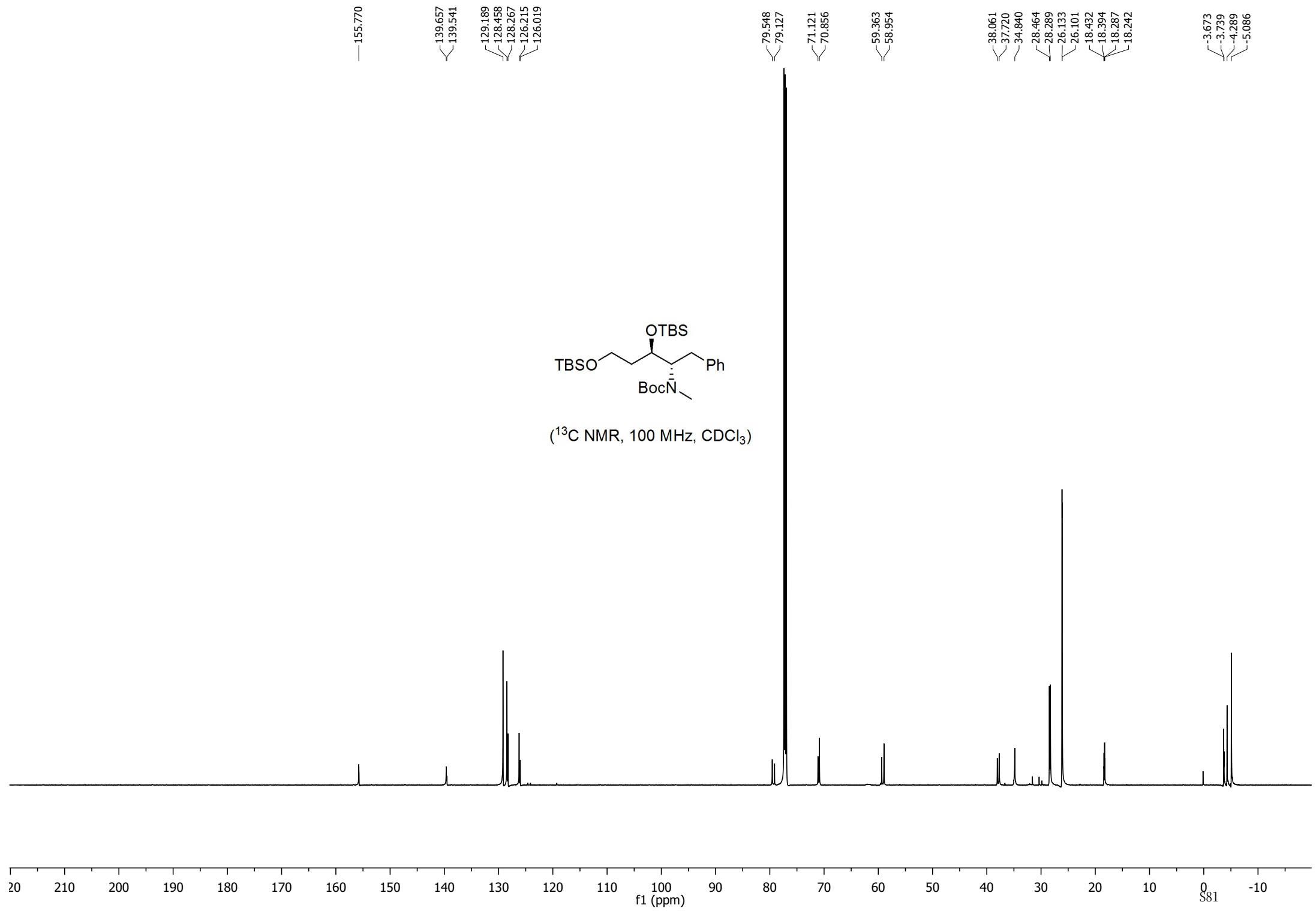
0.949
0.885

0.151
0.145
0.041
0.039



(¹H NMR, 400 MHz, DMSO-d₆, 70°C)





7.266
7.248
7.229
7.215
7.211
7.178
7.160
7.152
7.149
7.132

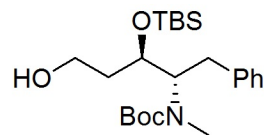
4.041
4.028
4.016
4.005

3.574
3.559
3.544
3.531

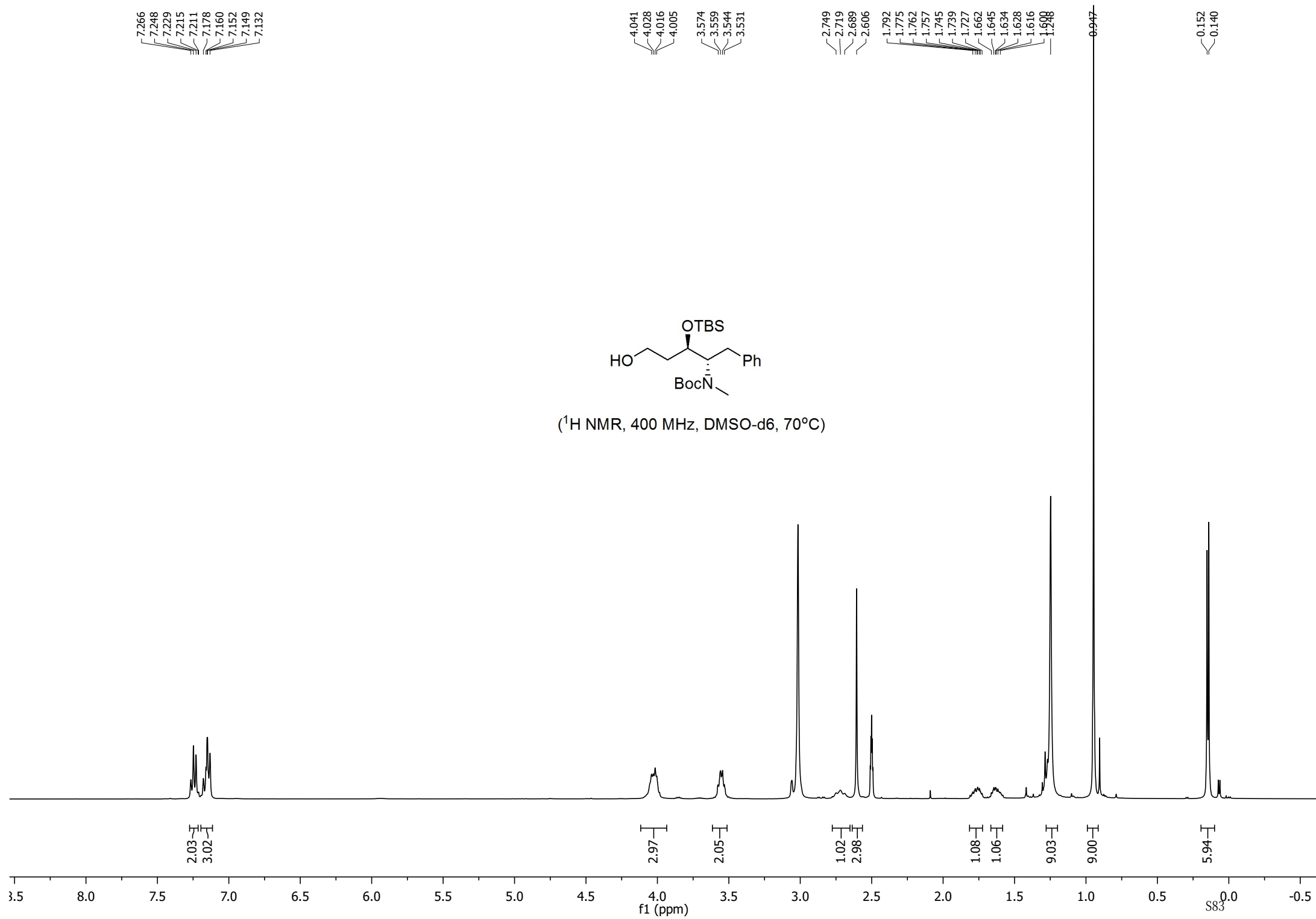
2.749
2.719
2.689
2.606

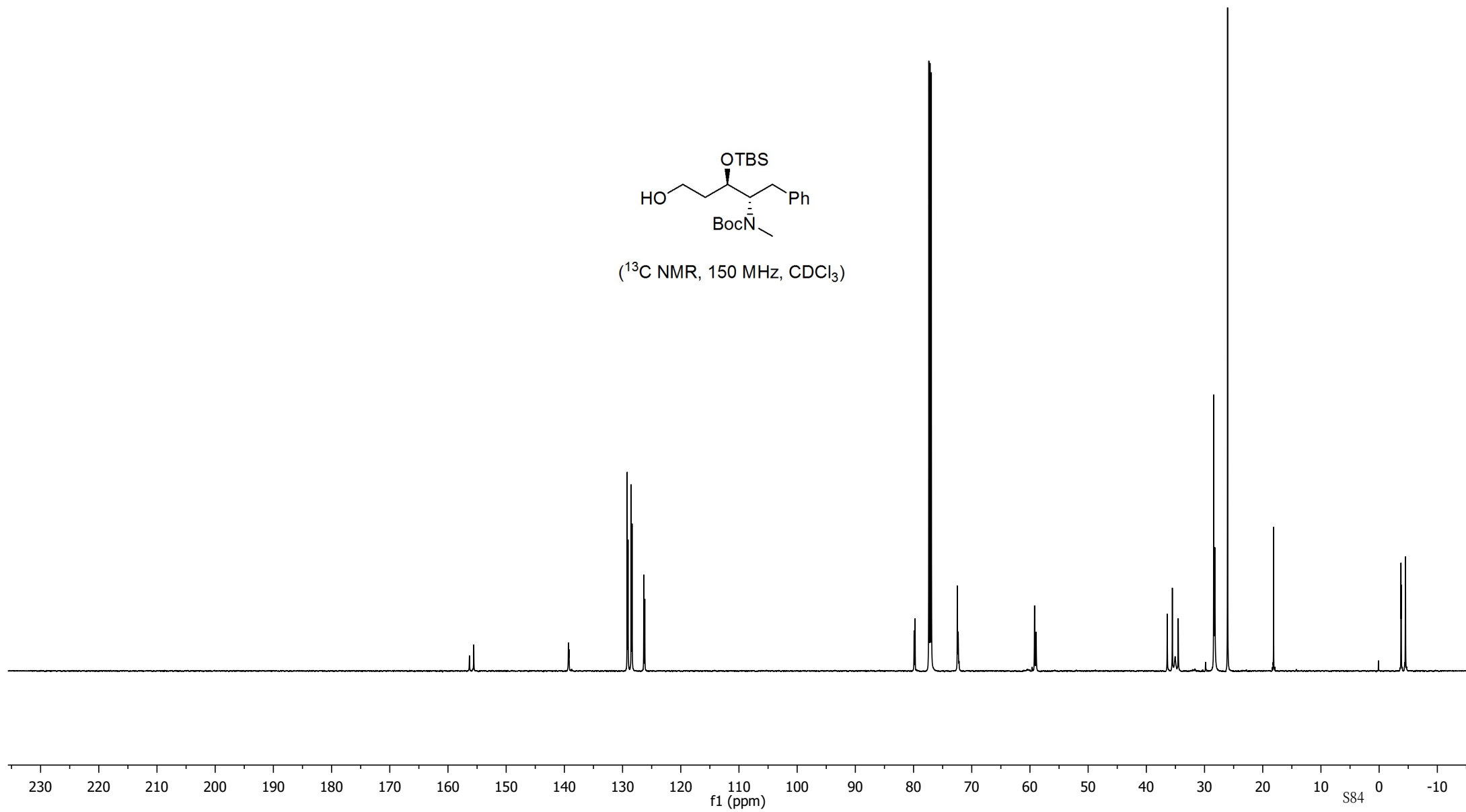
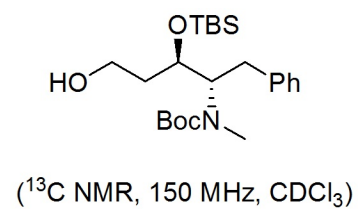
1.792
1.775
1.762
1.757
1.745
1.739
1.727
1.662
1.645
1.634
1.628
1.616
1.598
1.588

0.152
0.140



(¹H NMR, 400 MHz, DMSO-d₆, 70°C)





7.381
7.357
7.347
7.322
7.263
7.255
7.237
7.198
7.178
7.168
7.149

5.262
5.250
5.242
5.221
5.212
5.190
5.181
5.164
5.151
5.133
5.121
4.872
4.861

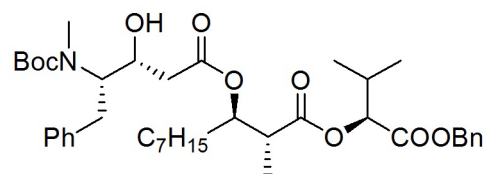
4.291
4.262
4.129
4.069

3.308
3.279
3.184
3.158
3.149

2.851
2.844
2.834
2.600
2.585
2.575
2.526
2.398
2.373
2.259
2.248

1.720
1.700
1.684
1.578
1.567
1.531

1.335
1.256
1.237
0.991
0.974
0.962
0.952
0.935
0.896
0.881
0.863



(¹H NMR, 400 MHz, CDCl₃)

