Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.
This journal is © The Royal Society of Chemistry 2021

Supporting Information

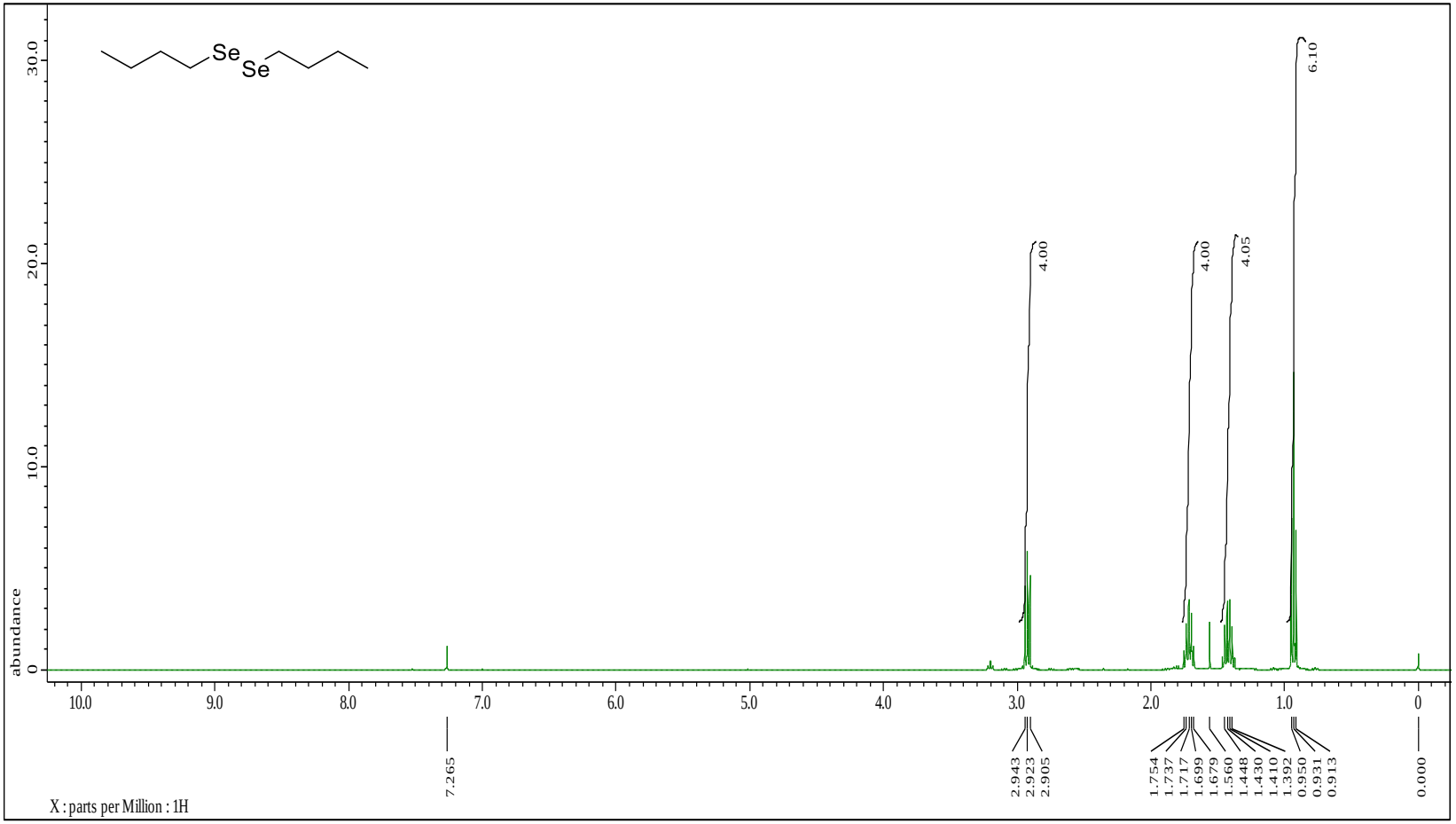
Synthesis of Selenated Tetracyclic Indoloazulenes *via* Iodine and Diorganyl Diselenides

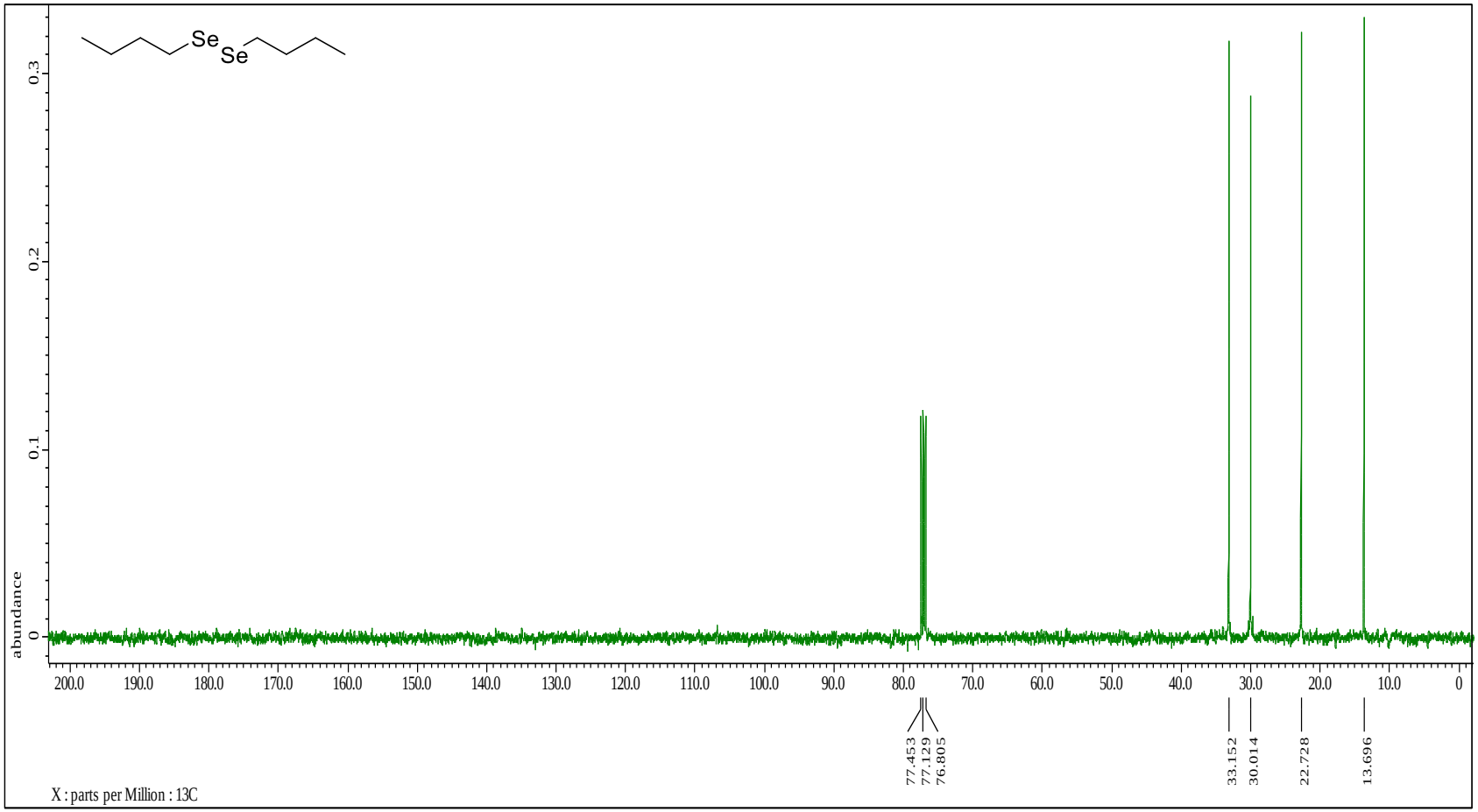
Khin Myat Noe Win,[a] Amol D. Sonawane[a] and Mamoru Koketsu*,[a]

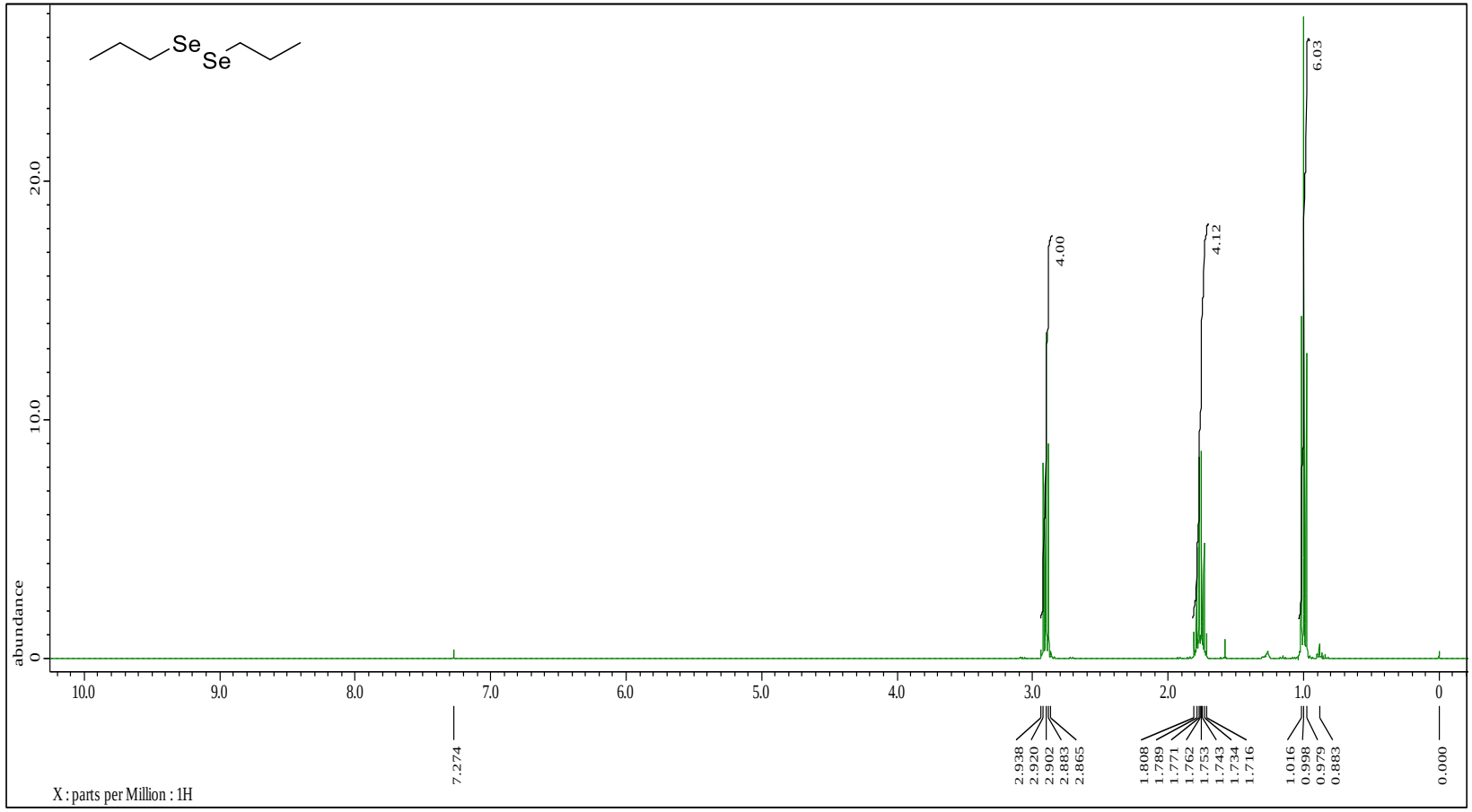
[a]Department of Chemistry and Biomolecular Science, Faculty of Engineering, Gifu University, Gifu 501-1193 Japan.

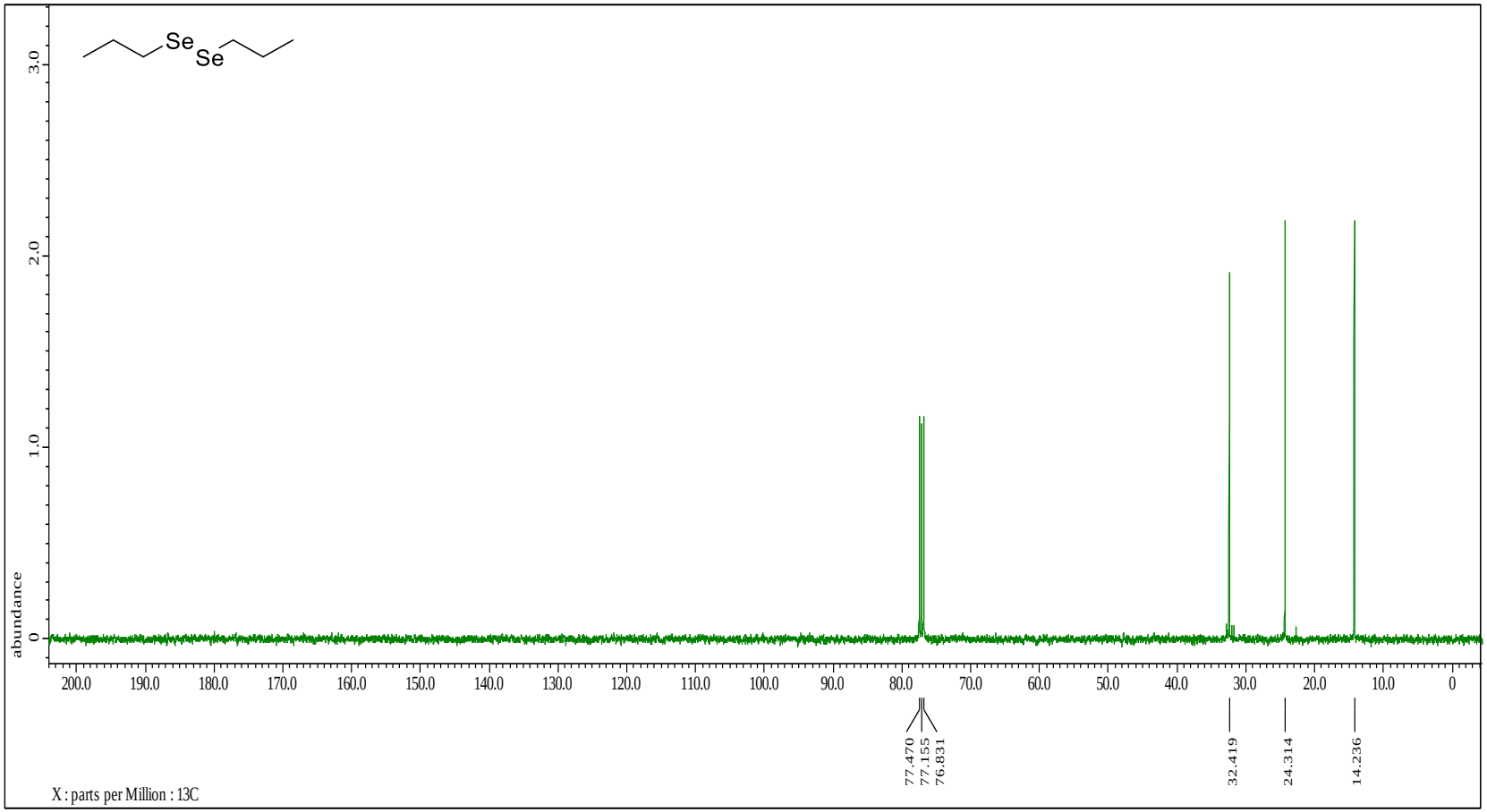
List of the Content:

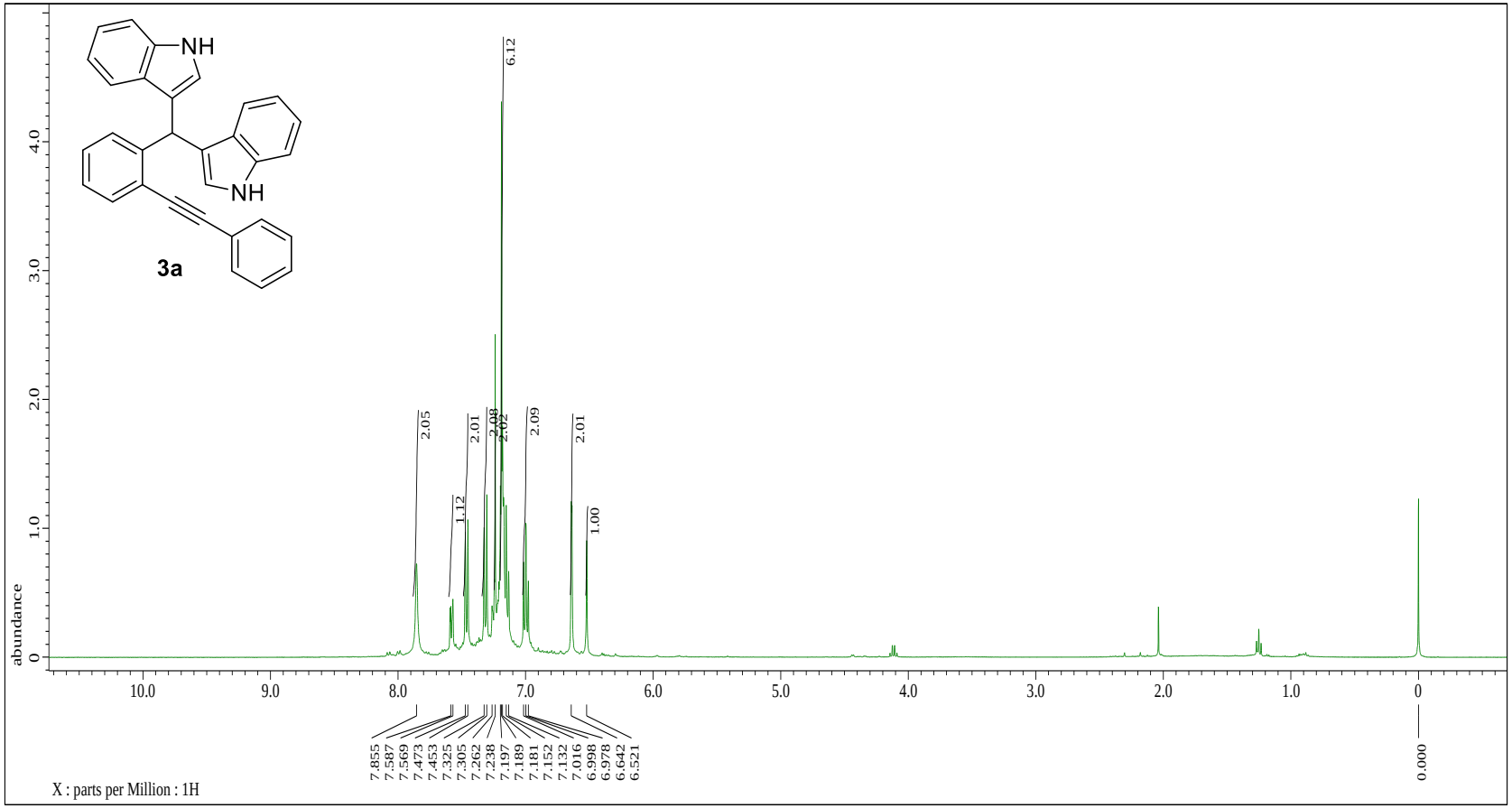
^{1}H NMR and ^{13}C NMR Spectra copies	2-45

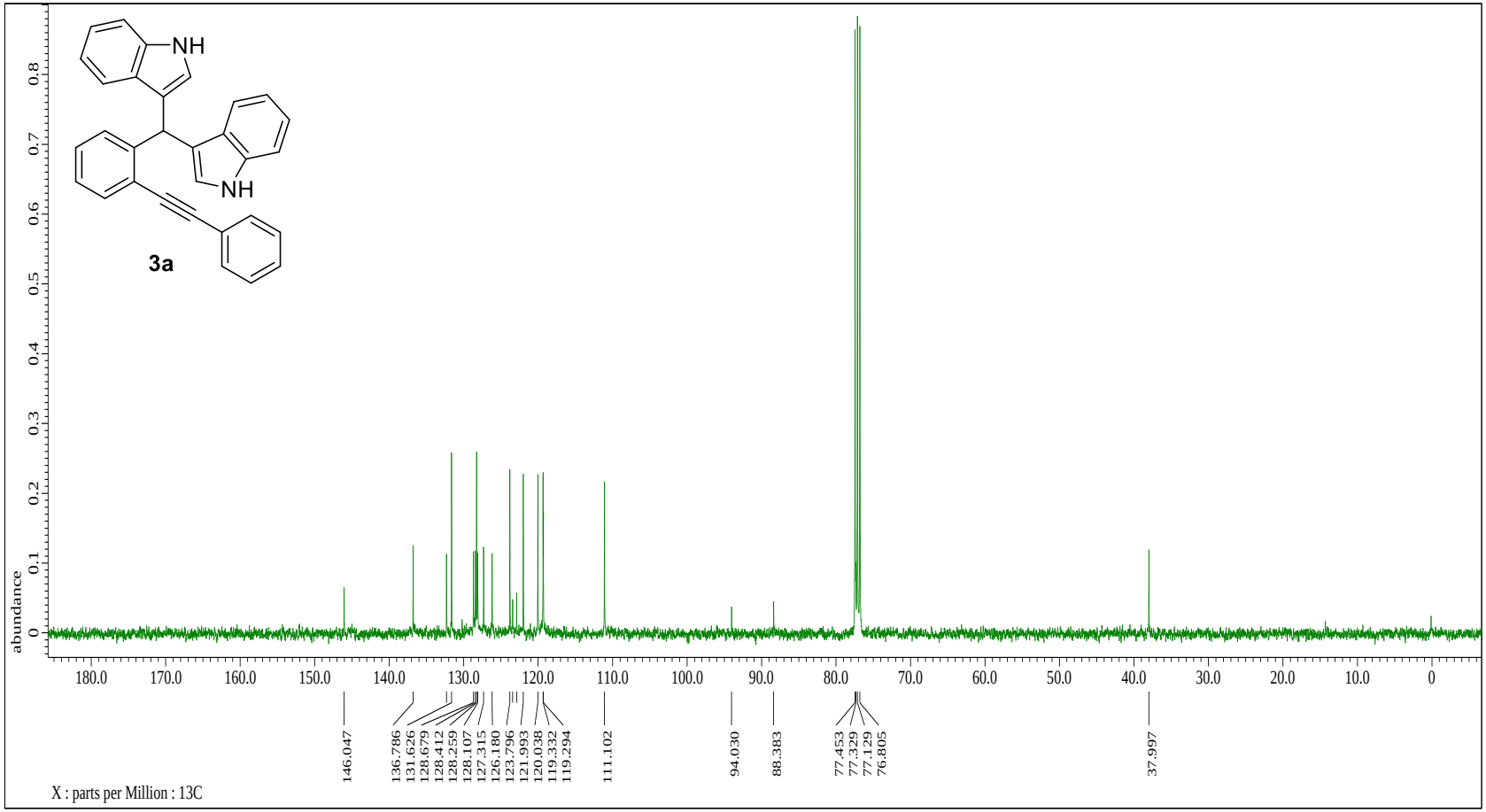

Se
Se
abundance
30.0
20.0
10.0
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
4.00
4.00
4.05
6.10
7.265
2.943
2.923
2.905
1.754
1.737
1.717
1.699
1.679
1.560
1.448
1.430
1.410
1.392
0.950
0.931
0.913
0.000
X : parts per Million : 1H

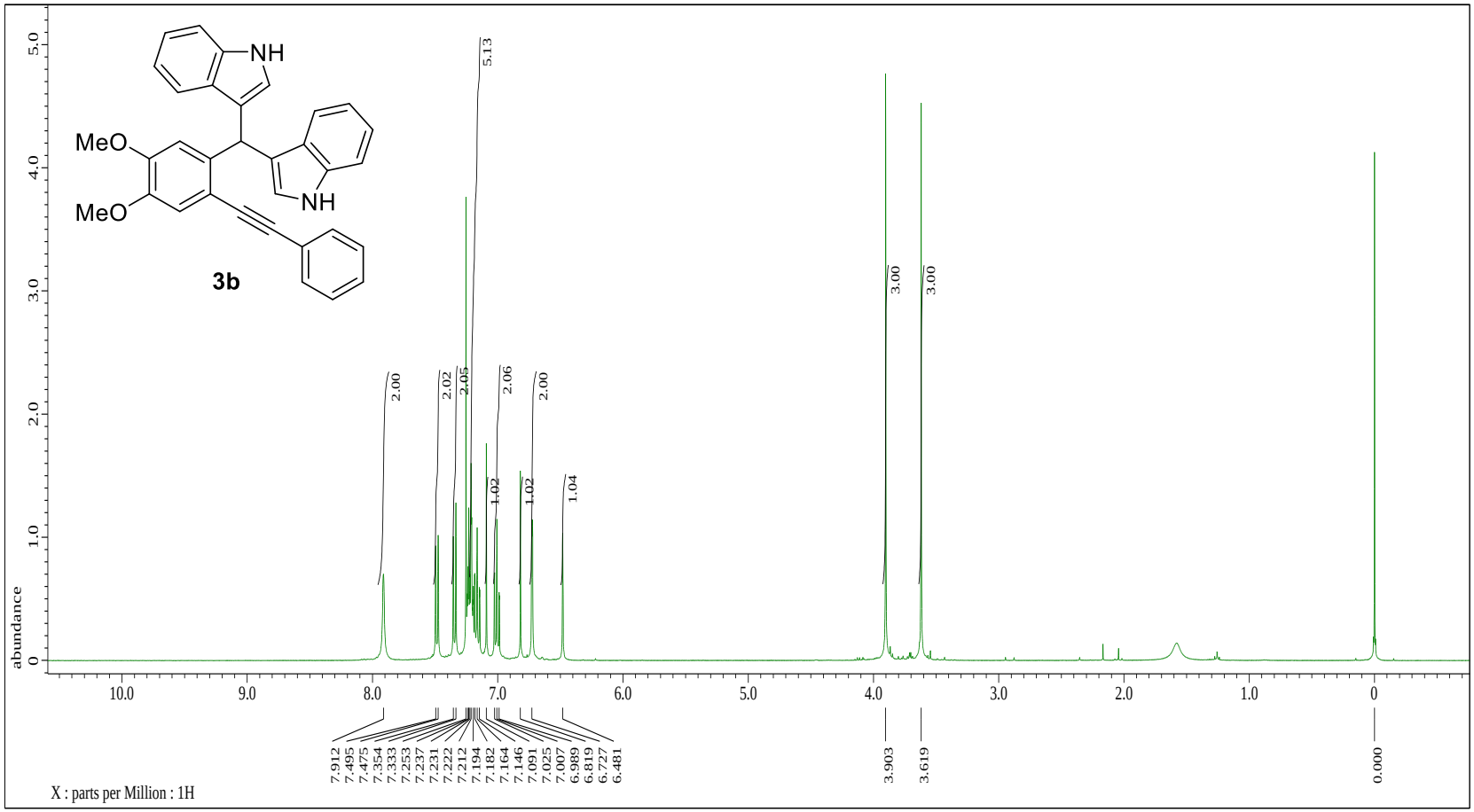

Se
Se
abundance
0.3
0.2
0.1
0
200.0
190.0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
77.453
77.129
76.805
33.152
30.014
22.728
13.696
X : parts per Million : 13C

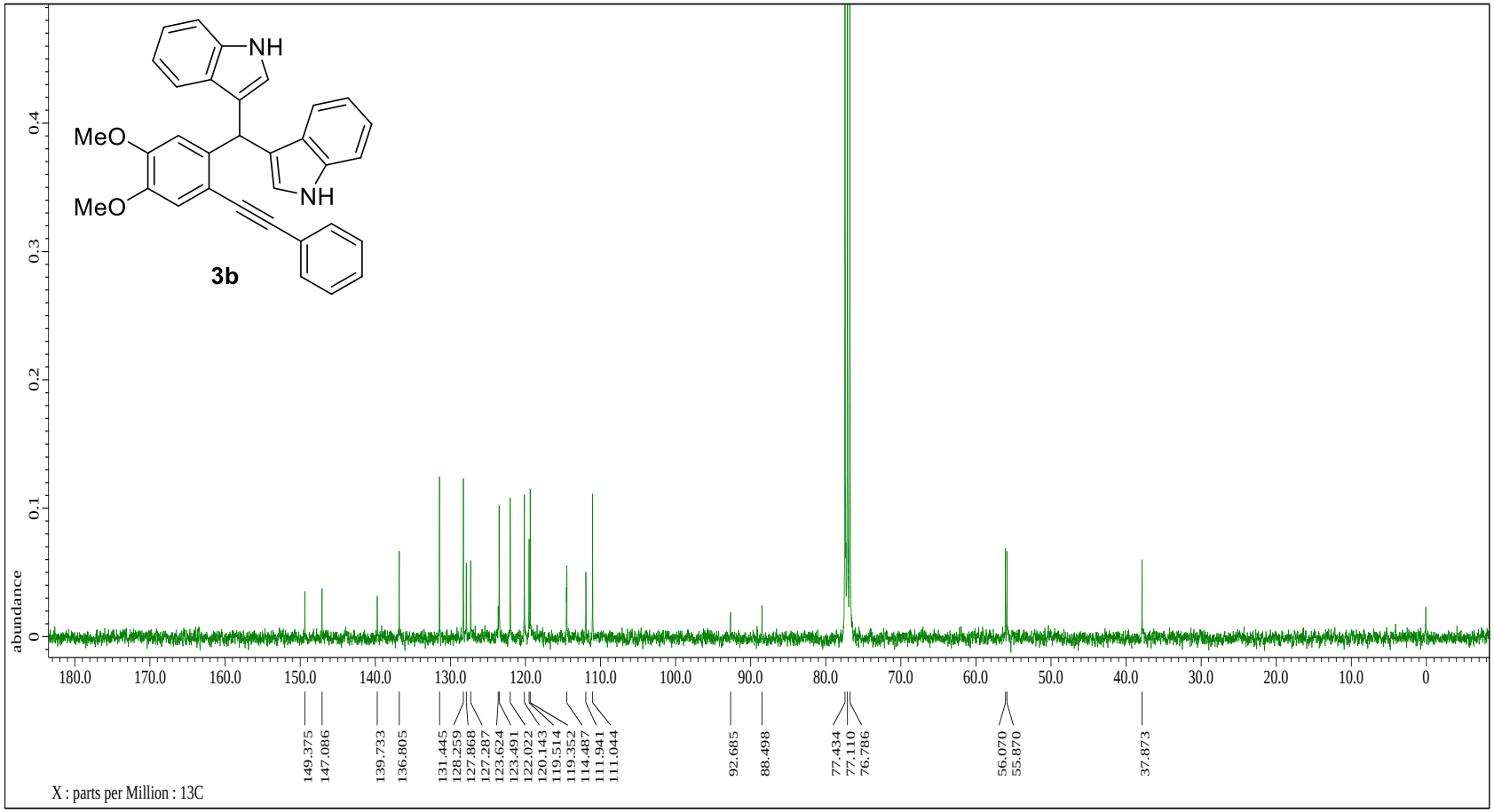

Se
Se
abundance
20.0
10.0
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
4.00
4.12
6.03
7.274
2.938
2.920
2.902
2.883
2.865
1.808
1.789
1.771
1.762
1.753
1.743
1.734
1.716
1.016
0.998
0.979
0.883
0.000
X : parts per Million : 1H

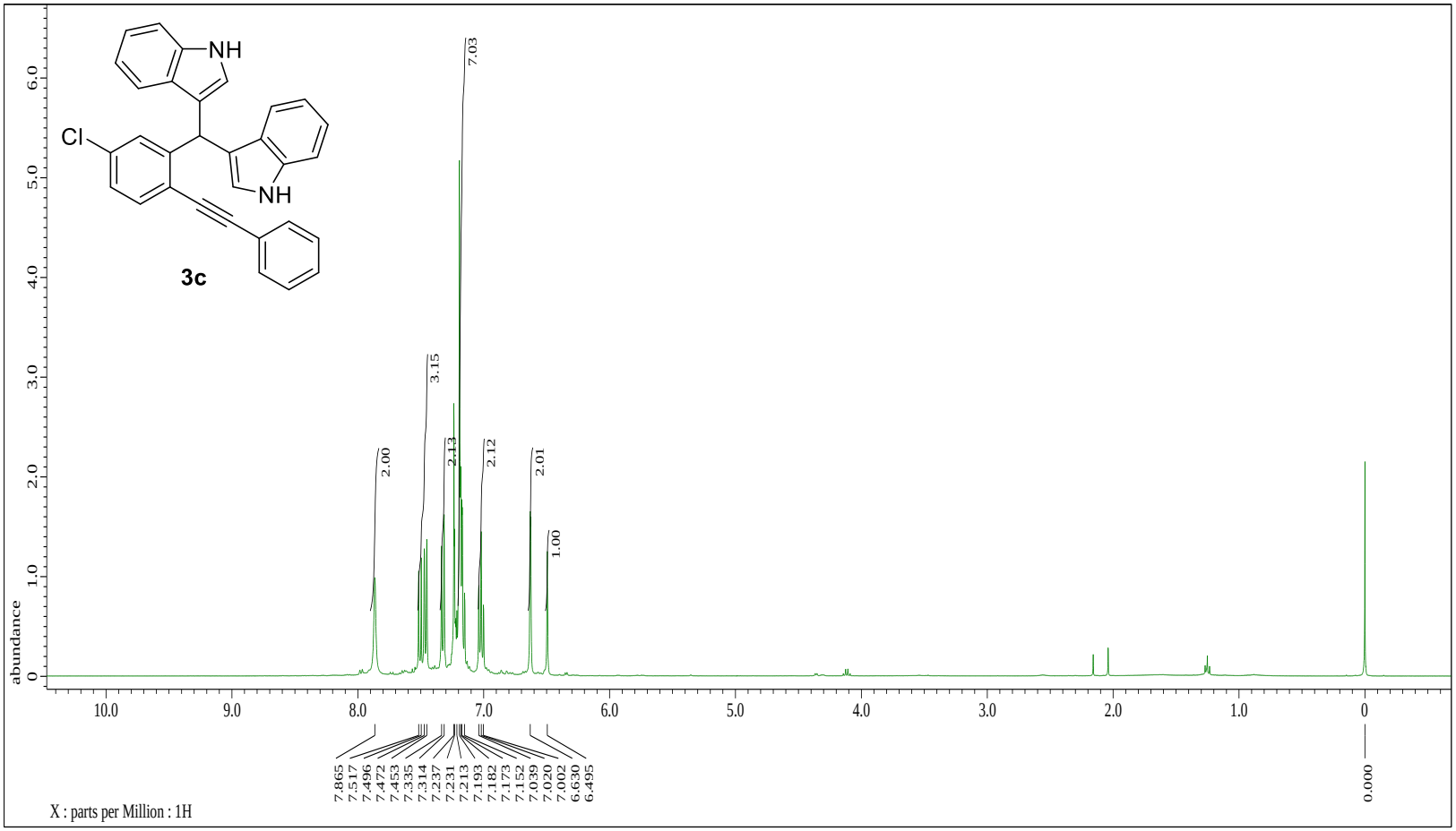

Se
Se
abundance
3.0
2.0
1.0
0
200.0
190.0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
77.470
77.155
76.831
32.419
24.314
14.236
X : parts per Million : 13C

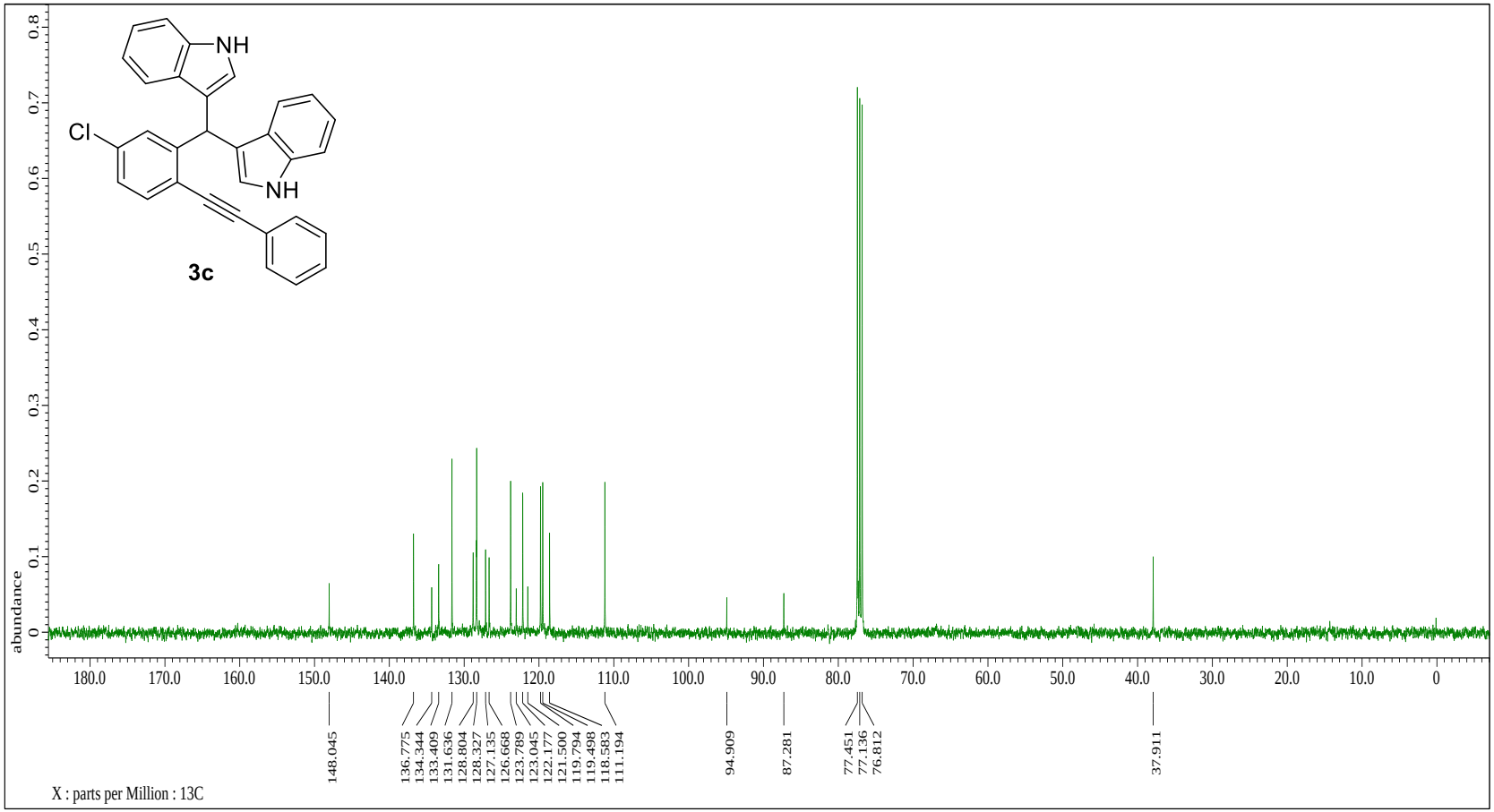

NH
NH
3a
abundance
X : parts per Million : 1H
6.12
2.05
2.01
2.08
2.02
2.09
2.01
1.12
1.00
7.855
7.587
7.569
7.473
7.453
7.325
7.305
7.262
7.238
7.197
7.189
7.181
7.152
7.132
7.016
6.998
6.978
6.642
6.521
0.000

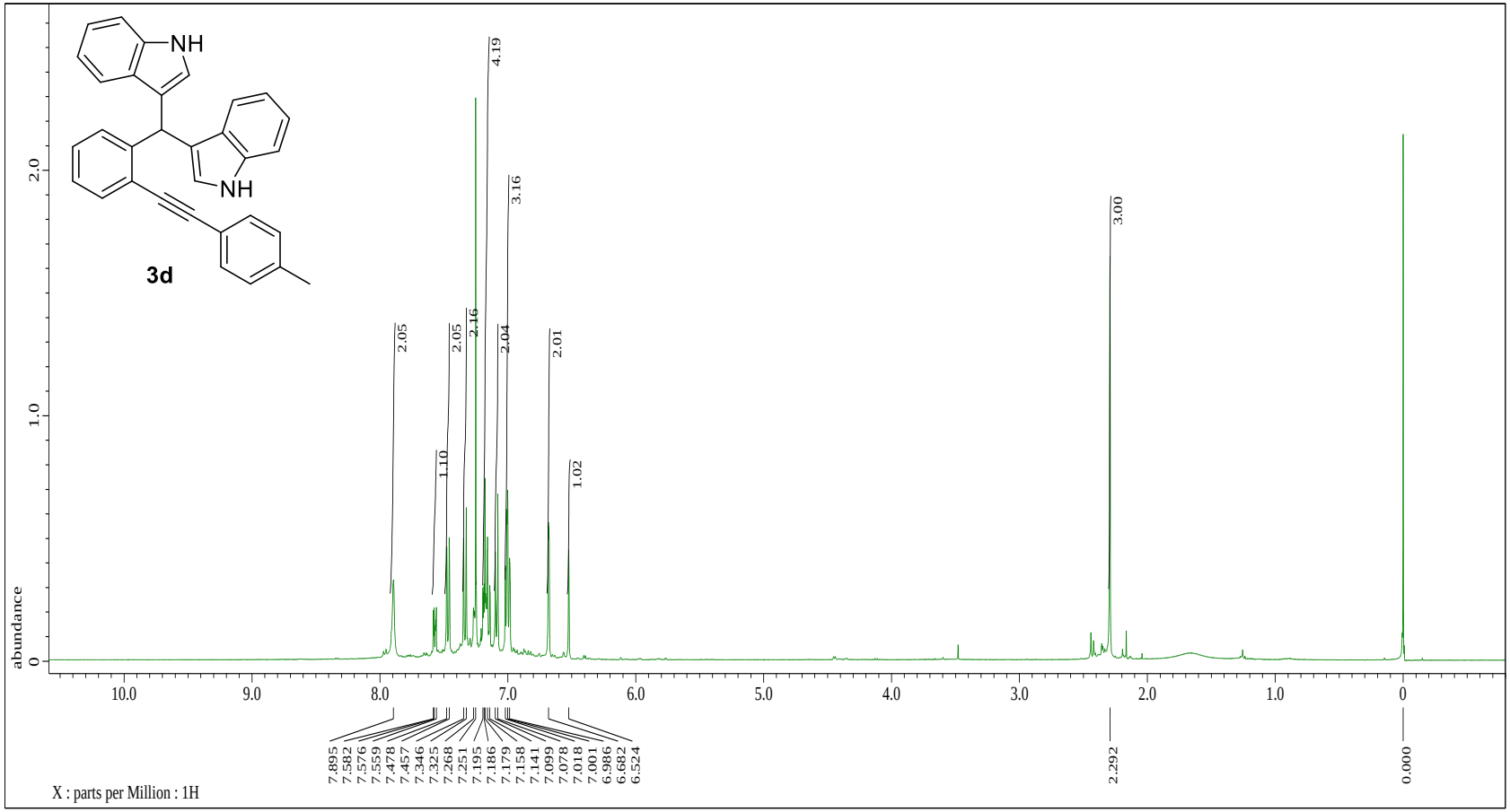

NH
NH
3a
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
146.047
136.786
131.626
128.679
128.412
128.259
128.107
127.315
126.180
123.796
121.993
120.038
119.332
119.294
111.102
94.030
88.383
77.453
77.329
77.129
76.805
37.997
X : parts per Million : 13C

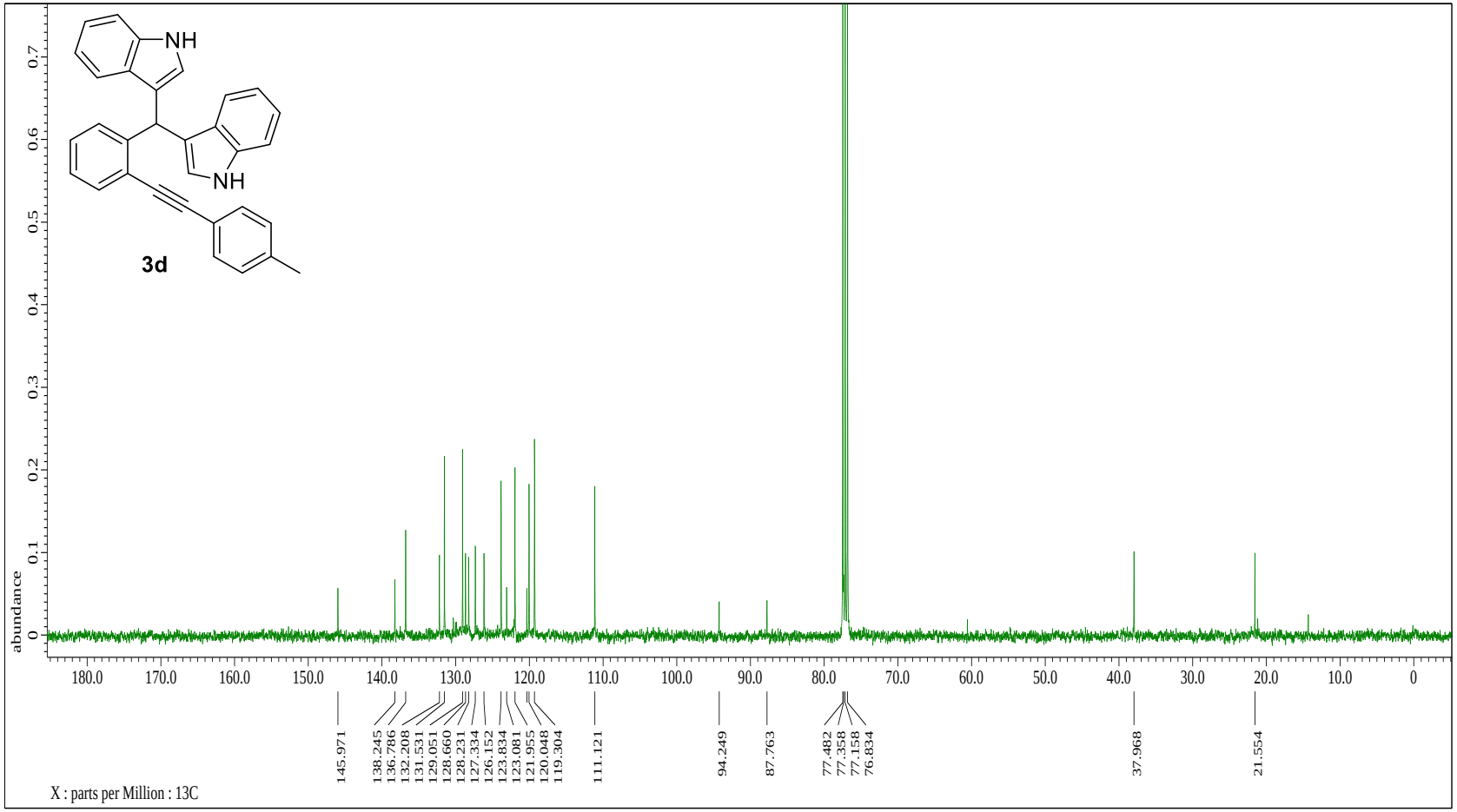

NH
MeO
MeO
NH
3b
abundance
X : parts per Million : 1H
2.00
2.02
2.05
5.13
2.06
2.00
1.02
1.02
1.04
3.00
3.00
7.912
7.495
7.475
7.354
7.333
7.253
7.237
7.231
7.222
7.212
7.194
7.182
7.164
7.146
7.091
7.025
7.007
6.989
6.819
6.727
6.481
3.903
3.619
0.000

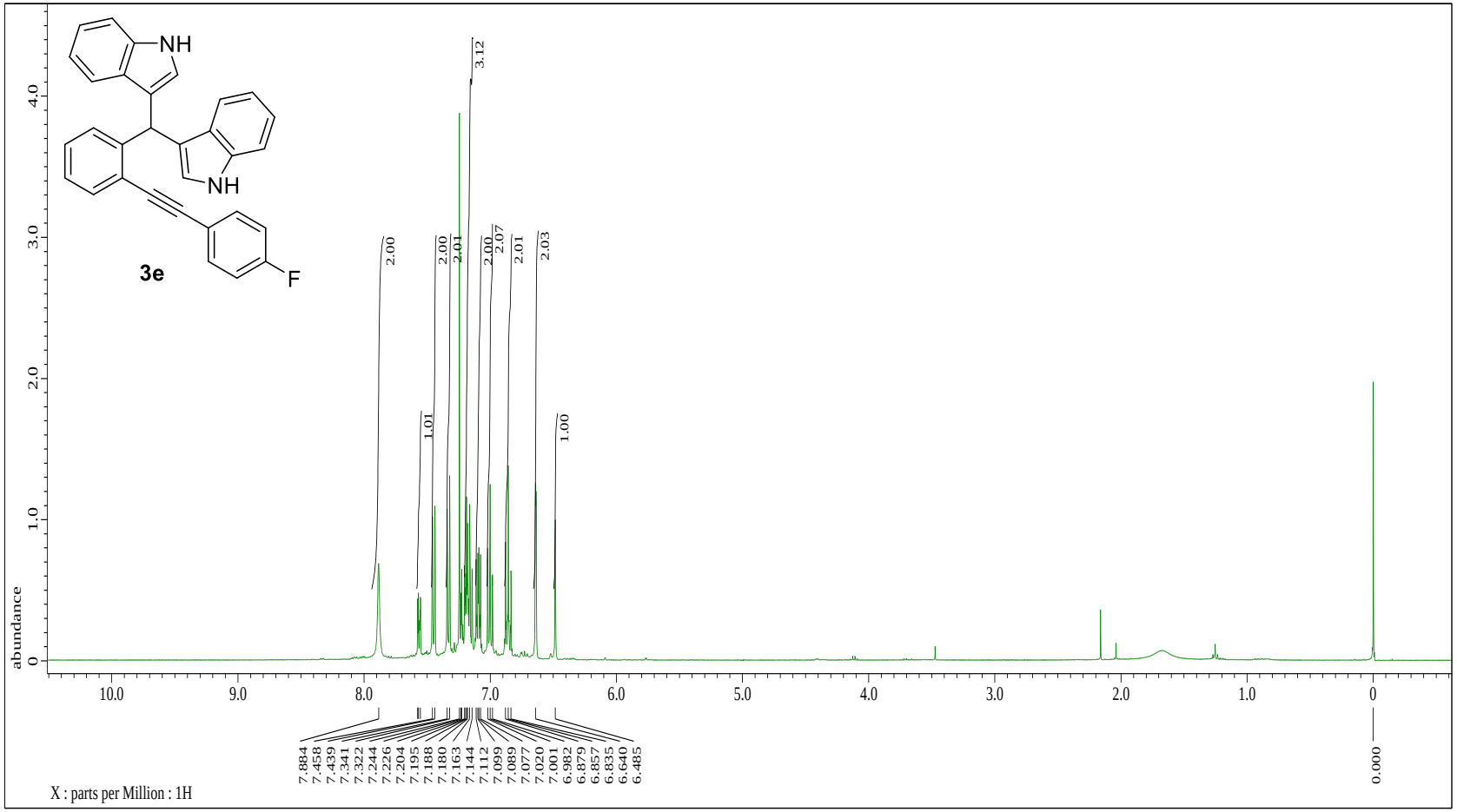

NH
MeO
MeO
NH
3b
abundance
0.4
0.3
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
149.375
147.086
139.733
136.805
131.445
128.259
127.868
127.287
123.624
123.491
122.022
120.143
119.514
119.352
114.487
111.941
111.044
92.685
88.498
77.434
77.110
76.786
56.070
55.870
37.873
X : parts per Million : 13C

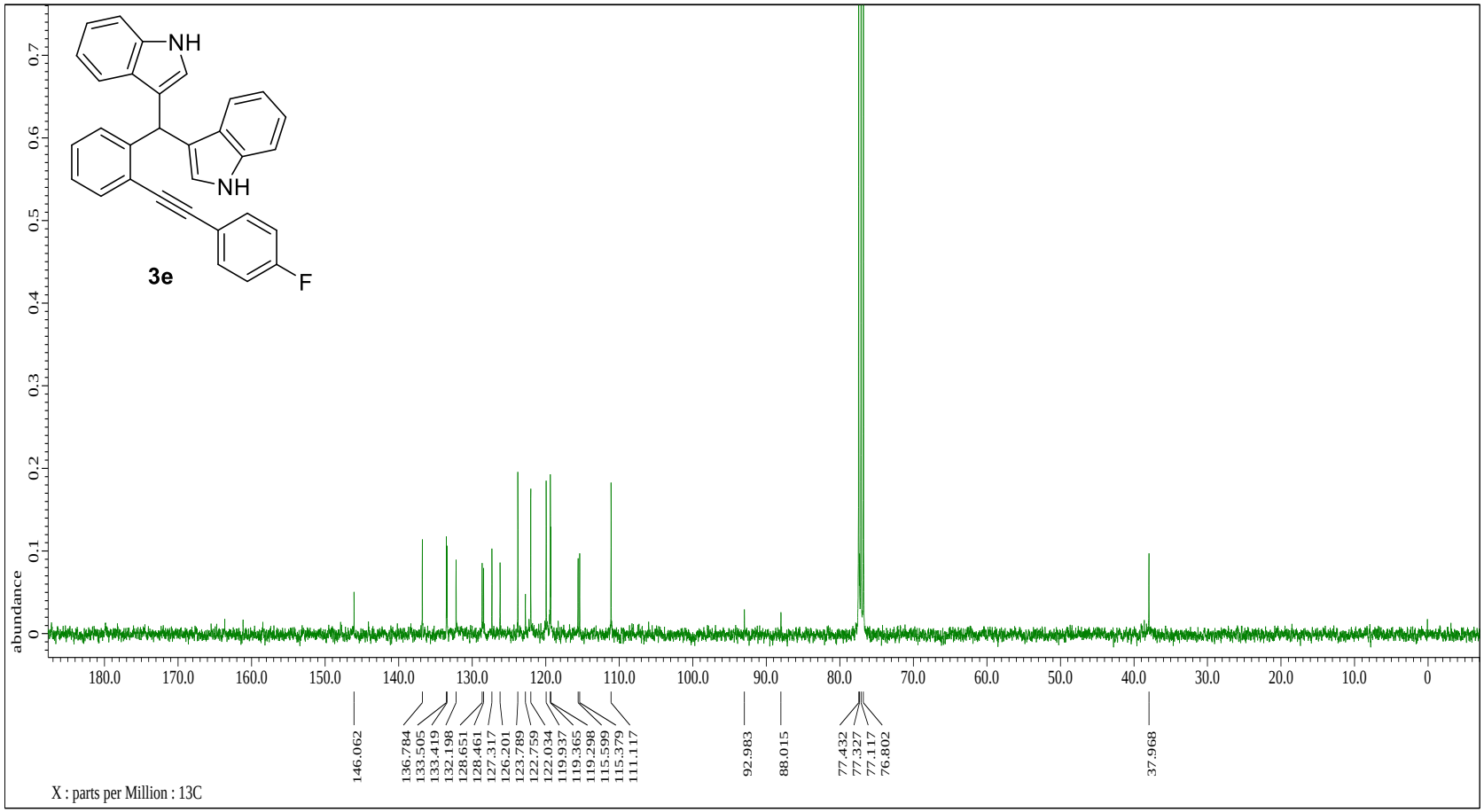

NH
Cl
NH
3c
7.03
3.15
2.00
2.13
2.12
2.01
1.00
abundance
0
1.0
2.0
3.0
4.0
5.0
6.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
7.865
7.517
7.496
7.472
7.453
7.335
7.314
7.237
7.231
7.213
7.193
7.182
7.173
7.152
7.039
7.020
7.002
6.630
6.495
0.000
X : parts per Million : 1H

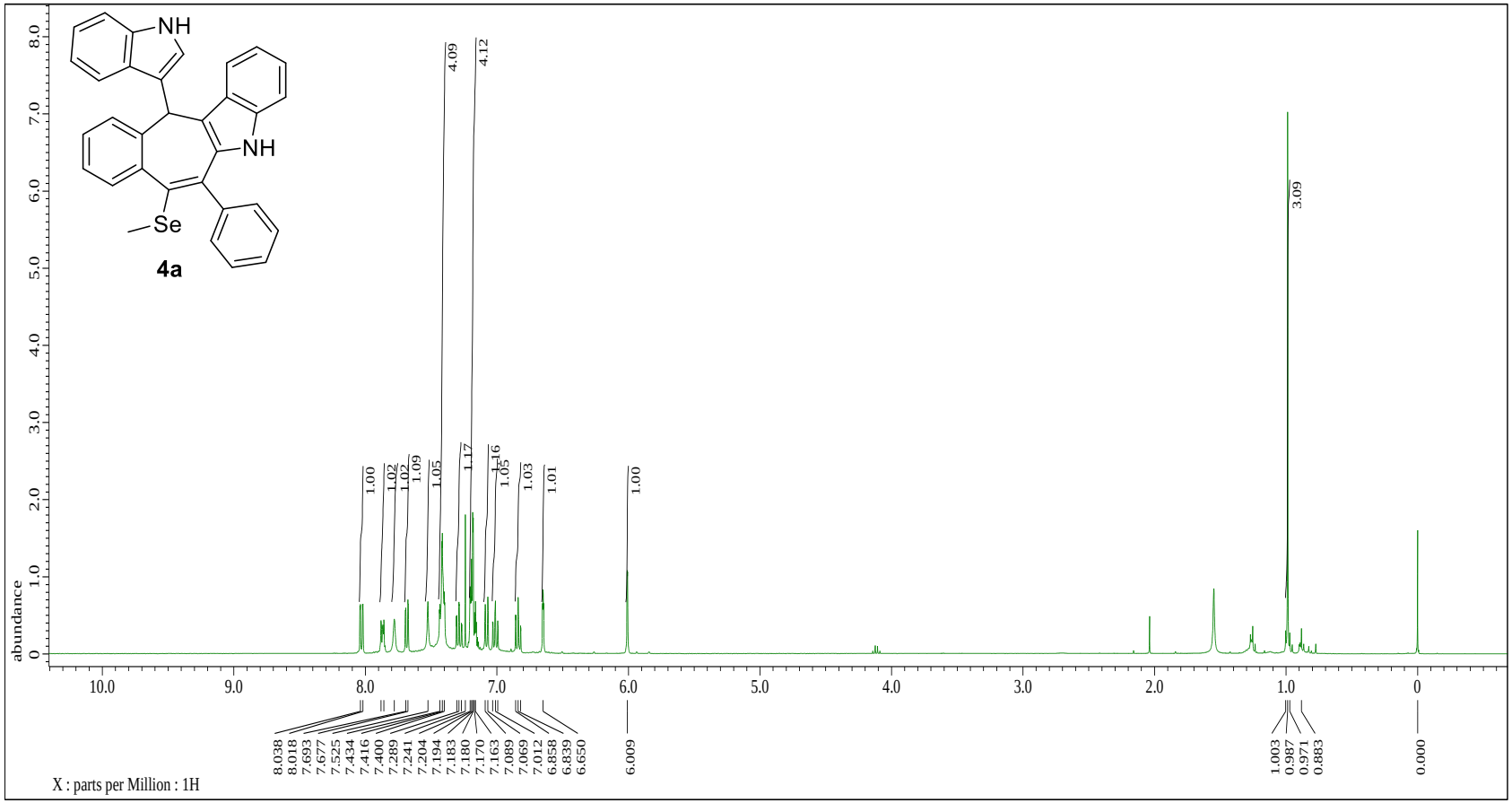

NH
Cl
NH
3c
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
148.045
136.775
134.344
133.409
131.636
128.804
128.327
127.135
126.668
123.789
123.045
122.177
121.500
119.794
119.498
118.583
111.194
94.909
87.281
77.451
77.136
76.812
37.911
X : parts per Million : 13C

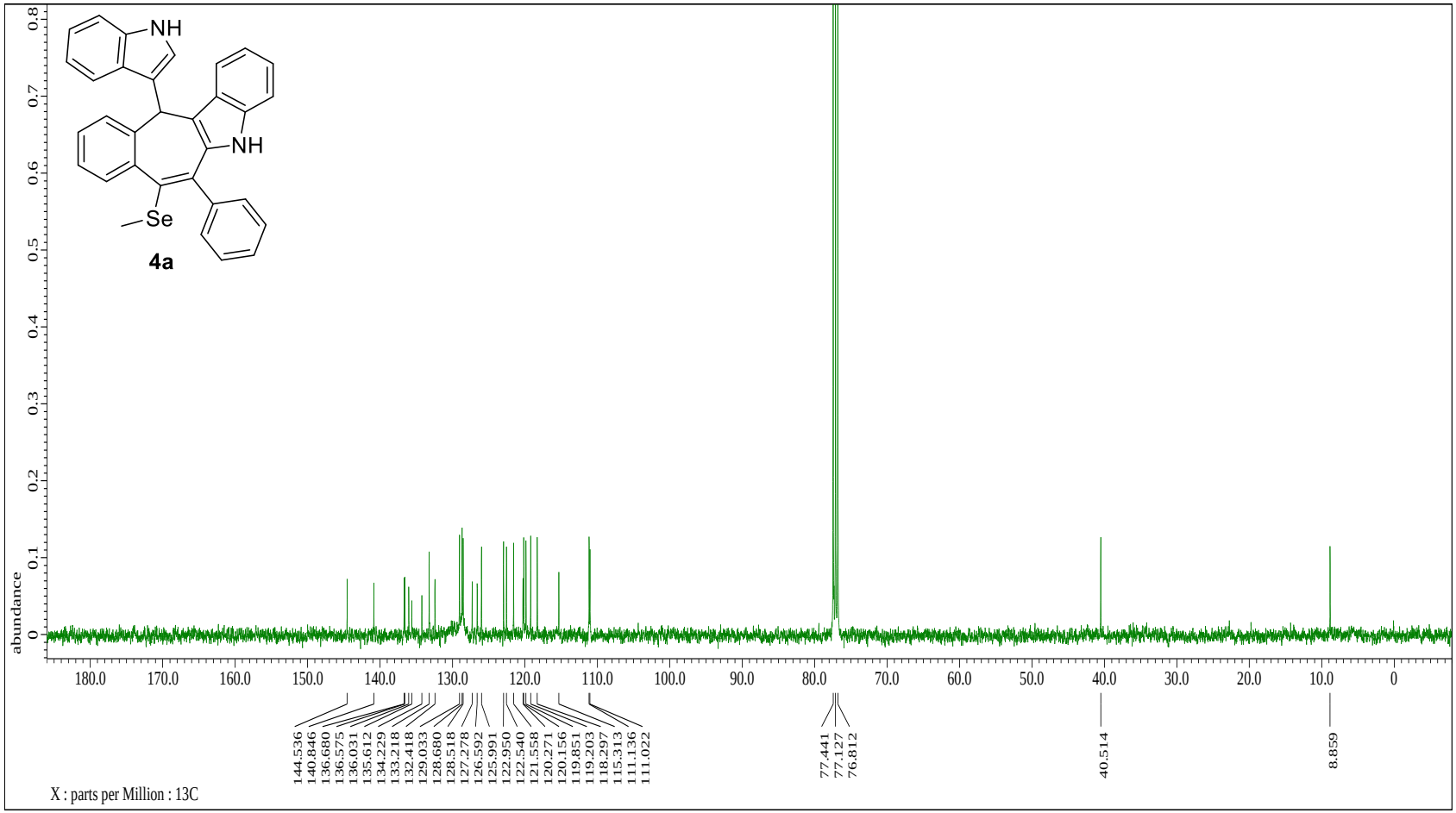

NH
NH
3d
abundance
2.0
1.0
0
2.05
1.10
2.05
2.16
4.19
2.04
3.16
2.01
1.02
3.00
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
7.895
7.582
7.576
7.559
7.478
7.457
7.346
7.325
7.268
7.251
7.195
7.186
7.179
7.158
7.141
7.099
7.078
7.018
7.001
6.986
6.682
6.524
2.292
0.000
X : parts per Million : 1H

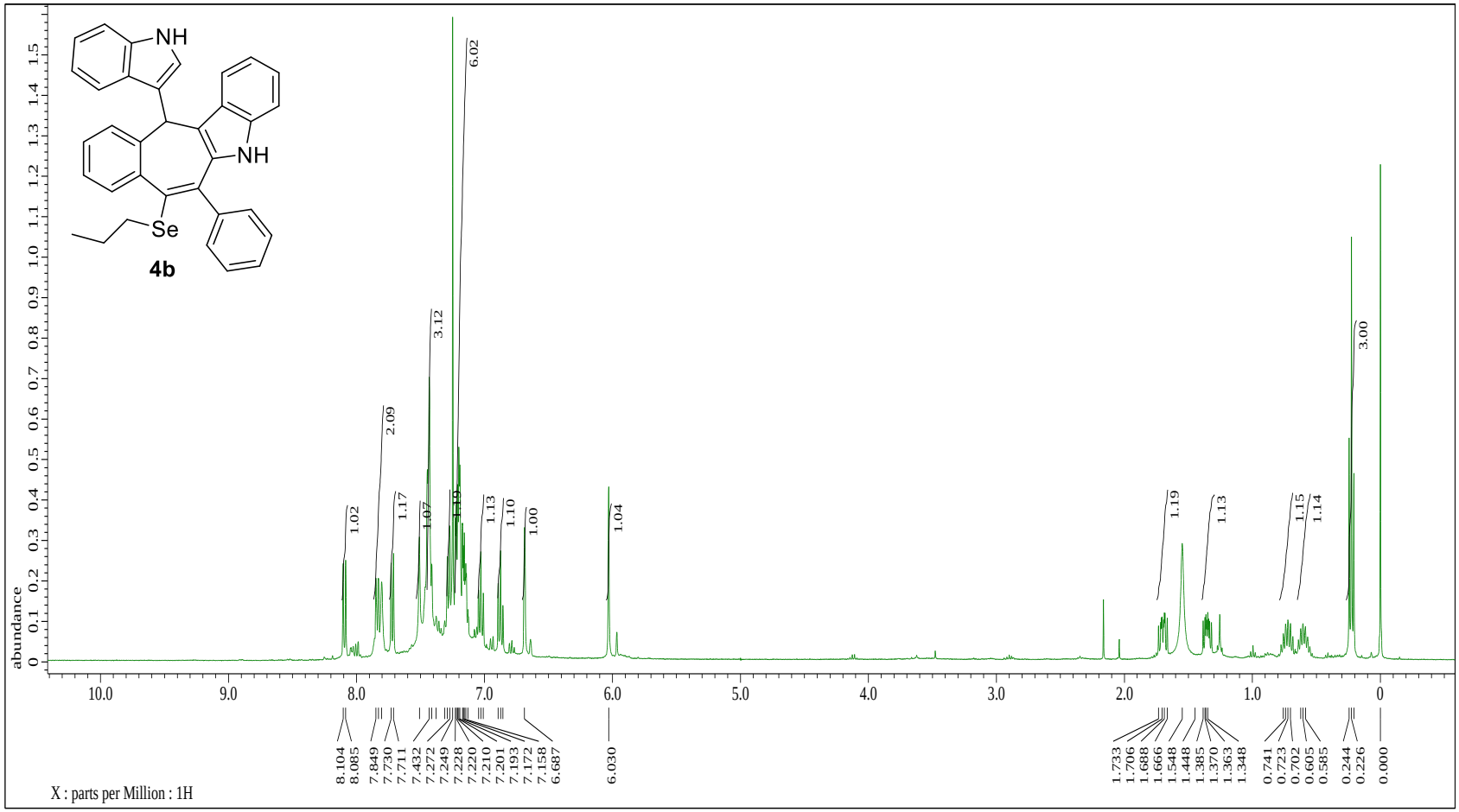

NH
NH
3d
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
145.971
138.245
136.786
132.208
131.531
129.051
128.660
128.231
127.334
126.152
123.834
123.081
121.955
120.048
119.304
111.121
94.249
87.763
77.482
77.358
77.158
76.834
37.968
21.554
X : parts per Million : 13C

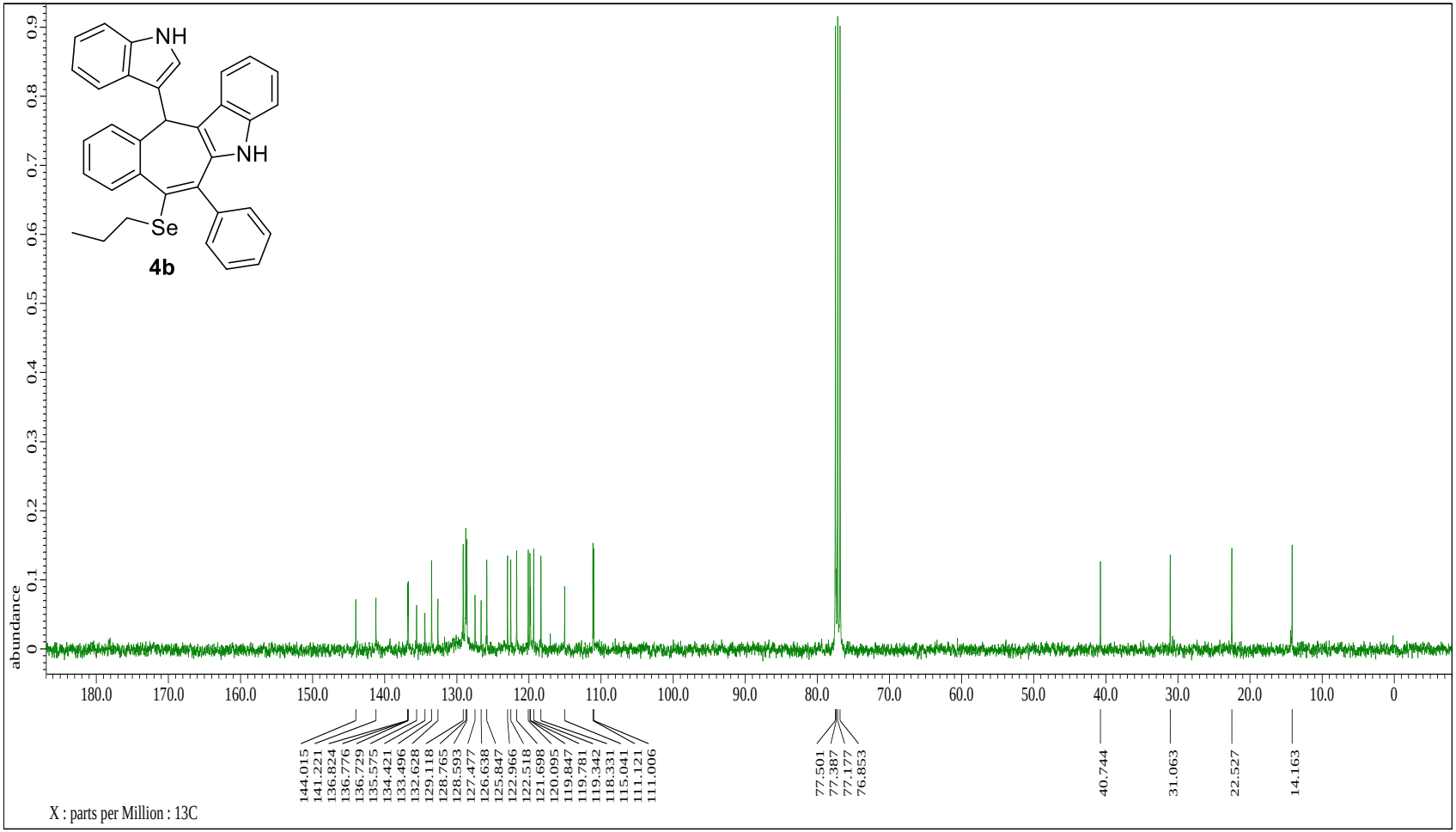

NH
NH
F
3e
abundance
X : parts per Million : 1H
2.00
1.01
2.00
2.01
3.12
2.00
2.07
2.01
2.03
1.00
0.000
7.884
7.458
7.439
7.341
7.322
7.244
7.226
7.204
7.195
7.188
7.180
7.163
7.144
7.112
7.099
7.089
7.077
7.020
7.001
6.982
6.879
6.857
6.835
6.640
6.485

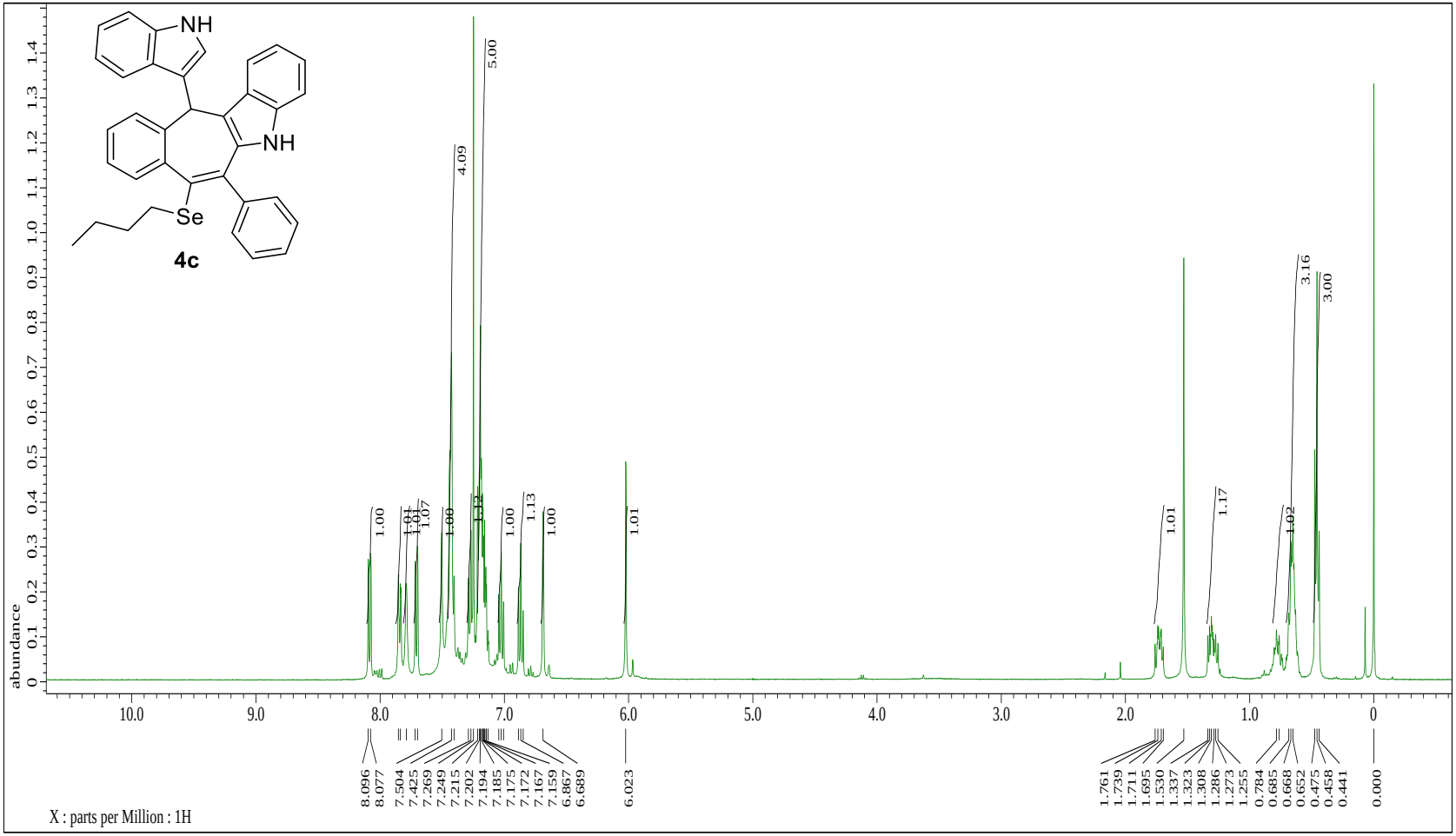

NH
NH
F
3e
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
146.062
136.784
133.505
133.419
132.198
128.651
128.461
127.317
126.201
123.789
122.759
122.034
119.937
119.365
119.298
115.599
115.379
111.117
92.983
88.015
77.432
77.327
77.117
76.802
37.968
X : parts per Million : 13C

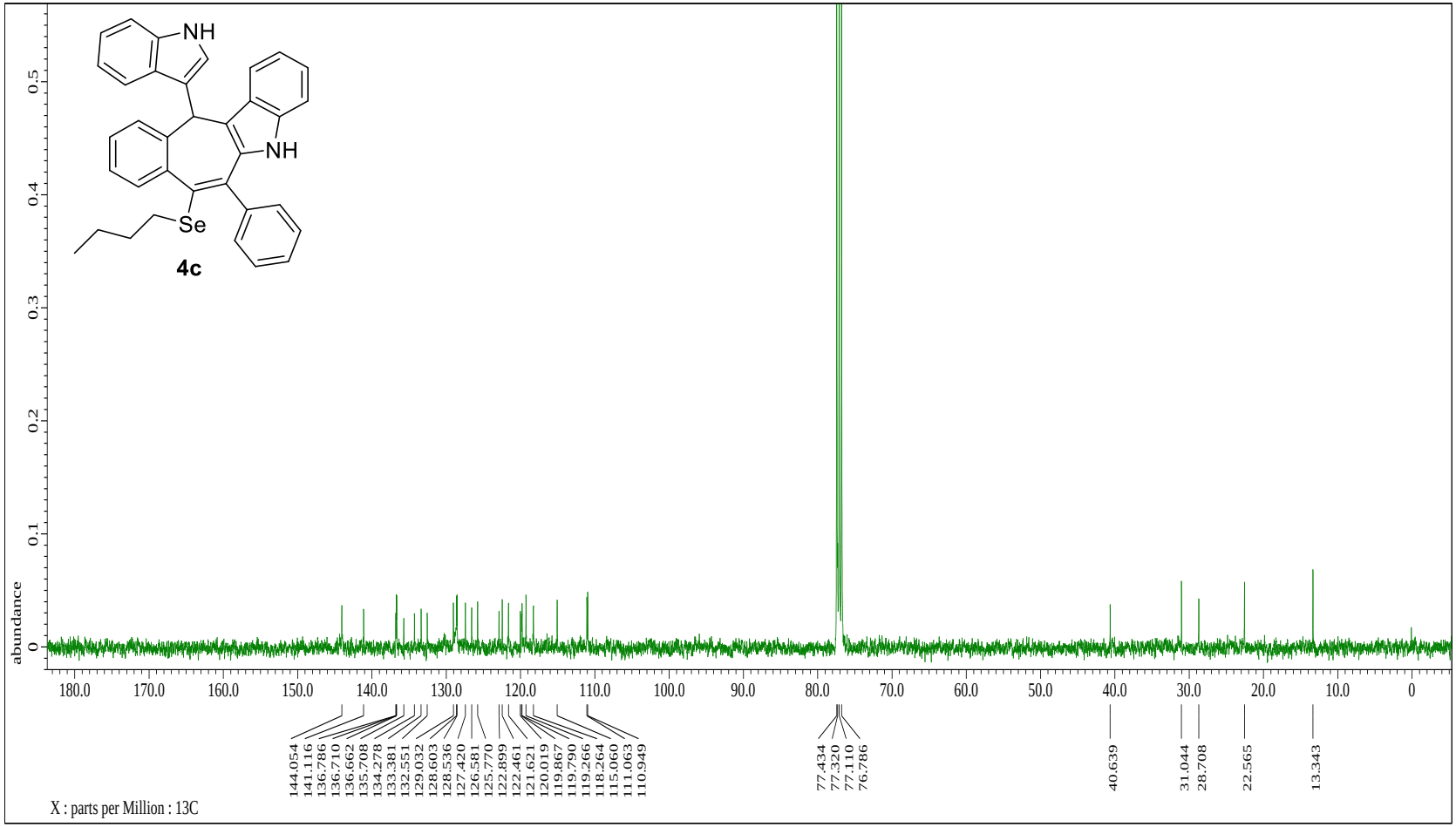

NH
NH
Se
4a
abundance
X : parts per Million : 1H
8.038
8.018
7.693
7.677
7.525
7.434
7.416
7.400
7.289
7.241
7.204
7.194
7.183
7.180
7.170
7.163
7.089
7.069
7.012
6.858
6.839
6.650
6.009
1.003
0.987
0.971
0.883
0.000
4.09
4.12
3.09
1.00
1.02
1.02
1.09
1.05
1.17
1.16
1.05
1.03
1.01
1.00

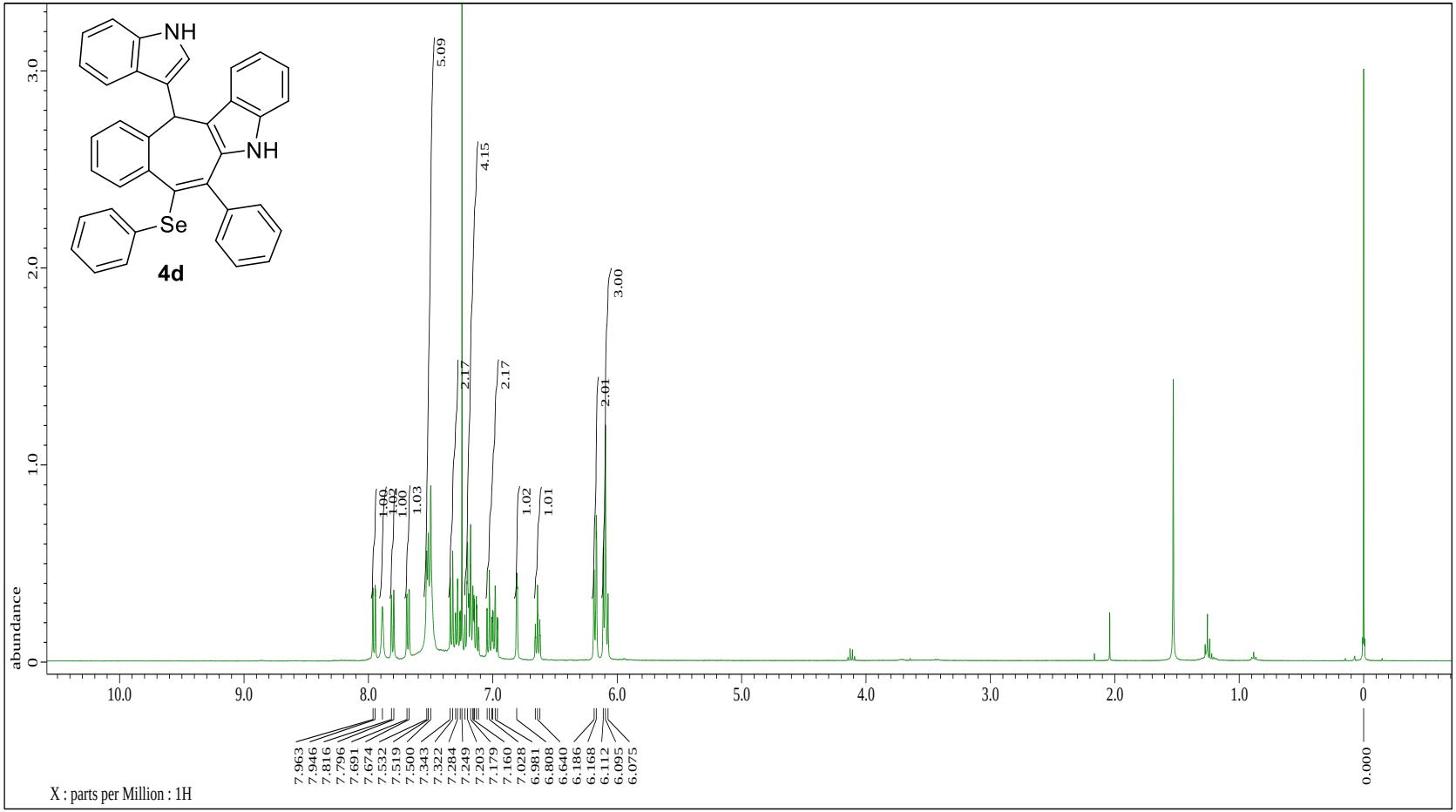

NH
NH
Se
4a
abundance
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
144.536
140.846
136.680
136.575
136.031
135.612
134.229
133.218
132.418
129.033
128.680
128.518
127.278
126.592
125.991
122.950
122.540
121.558
120.271
120.156
119.851
119.203
118.297
115.313
111.136
111.022
77.441
77.127
76.812
40.514
8.859
X : parts per Million : 13C

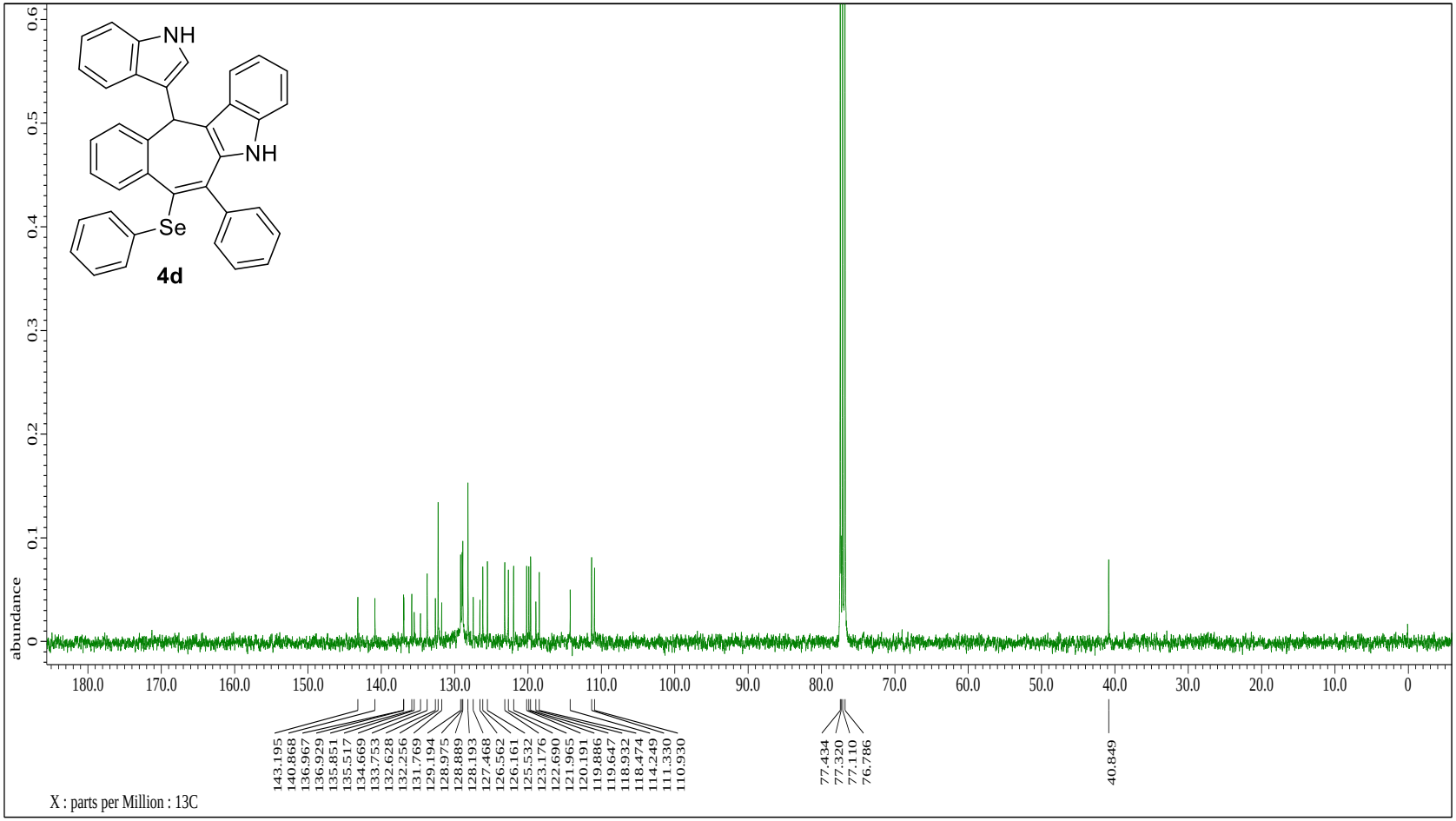

NH
NH
Se
4b
abundance
X : parts per Million : 1H
8.104
8.085
7.849
7.730
7.711
7.432
7.272
7.249
7.228
7.220
7.210
7.201
7.193
7.172
7.158
6.687
6.030
1.733
1.706
1.688
1.666
1.548
1.448
1.385
1.370
1.363
1.348
0.741
0.723
0.702
0.605
0.585
0.244
0.226
0.000

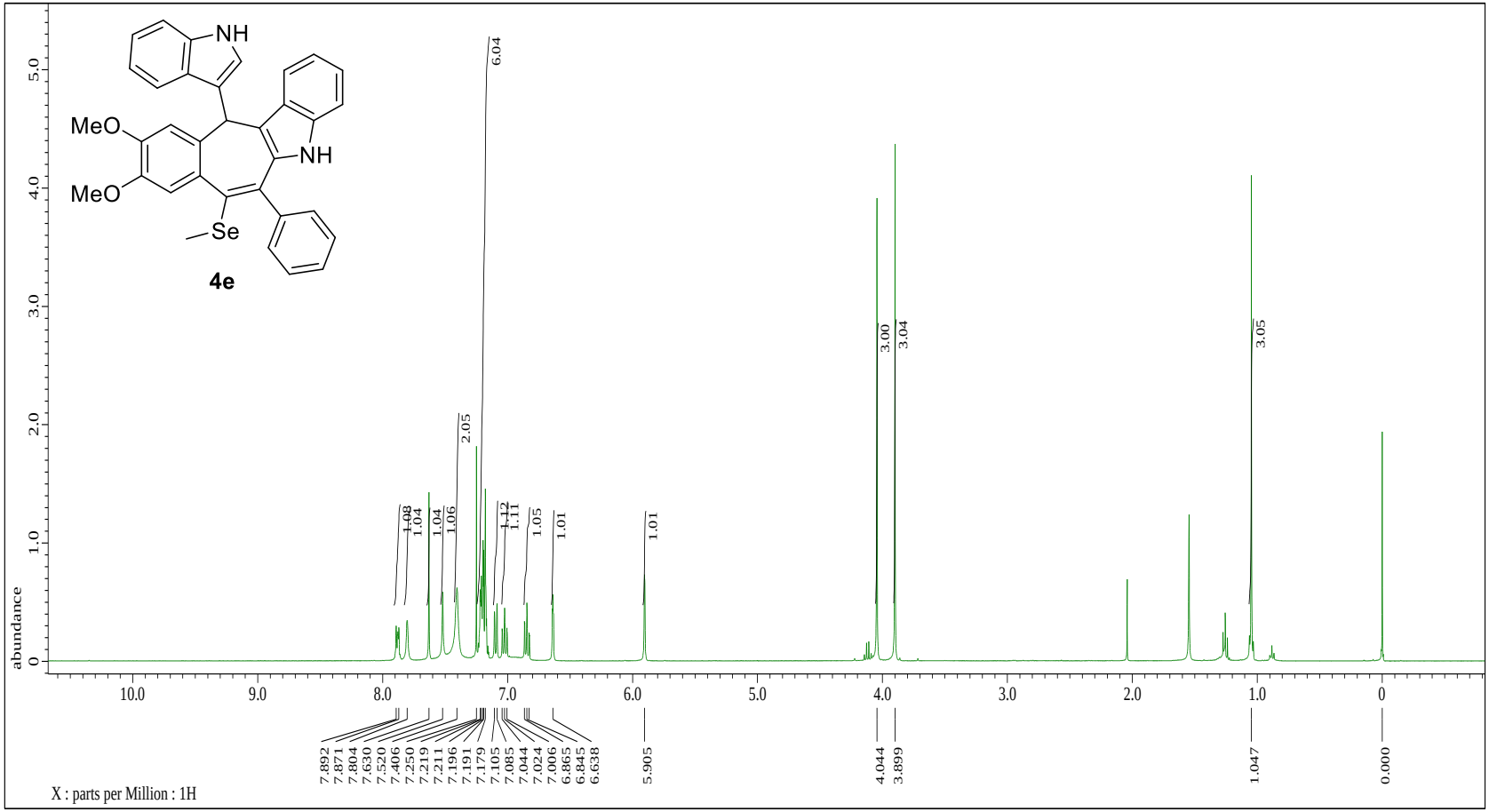

NH
NH
Se
4b
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
144.015
141.221
136.824
136.776
136.729
135.575
134.421
133.496
132.628
129.118
128.765
128.593
127.477
126.638
125.847
122.966
122.518
121.698
120.095
119.847
119.781
119.342
118.331
115.041
111.121
111.006
77.501
77.387
77.177
76.853
40.744
31.063
22.527
14.163
X : parts per Million : 13C

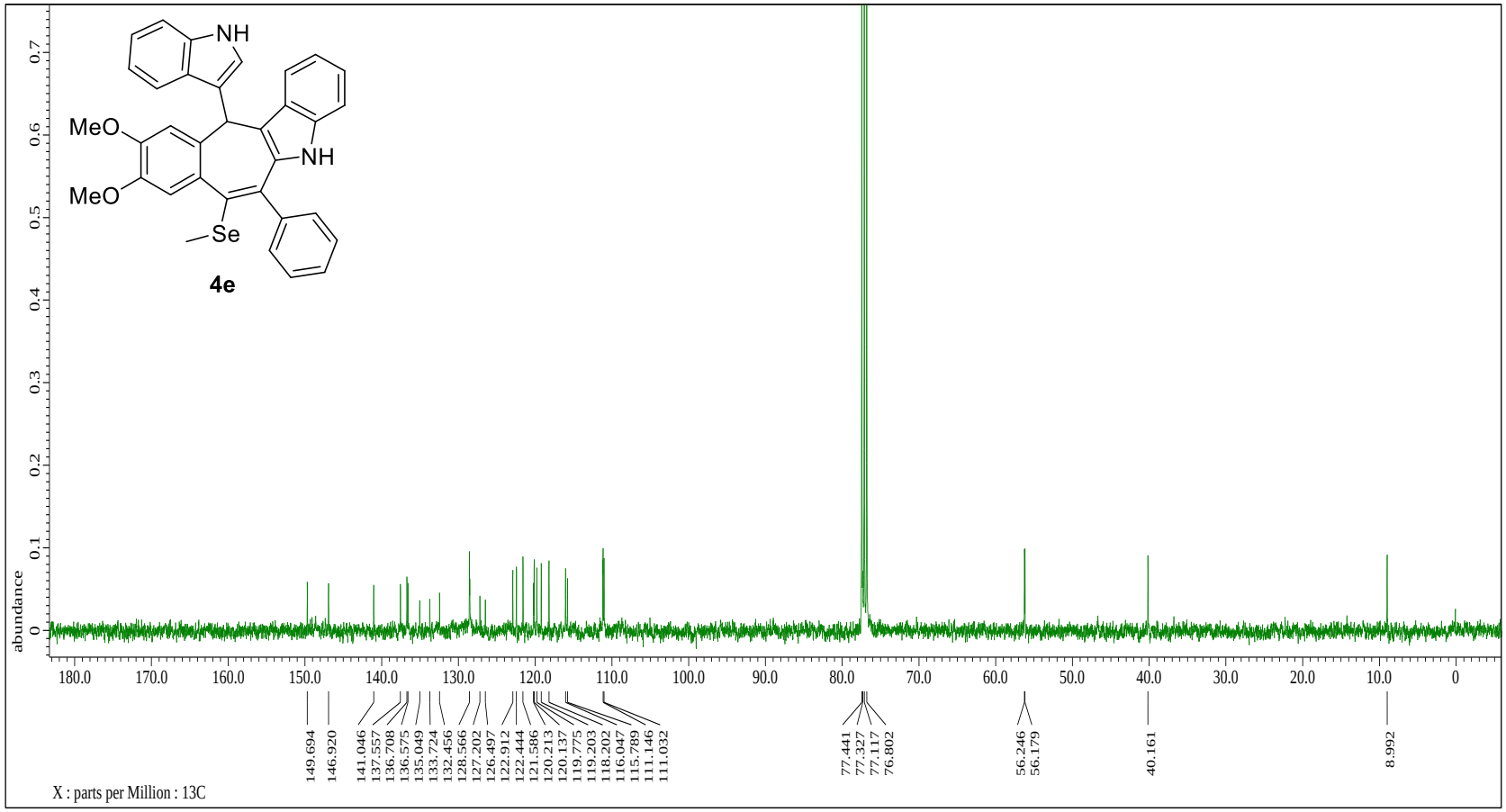

NH
NH
Se
4c
abundance
X : parts per Million : 1H
8.096
8.077
7.504
7.425
7.269
7.249
7.215
7.202
7.194
7.185
7.175
7.172
7.167
7.159
6.867
6.689
6.023
1.761
1.739
1.711
1.695
1.530
1.337
1.323
1.308
1.286
1.273
1.255
0.784
0.685
0.668
0.652
0.475
0.458
0.441
0.000

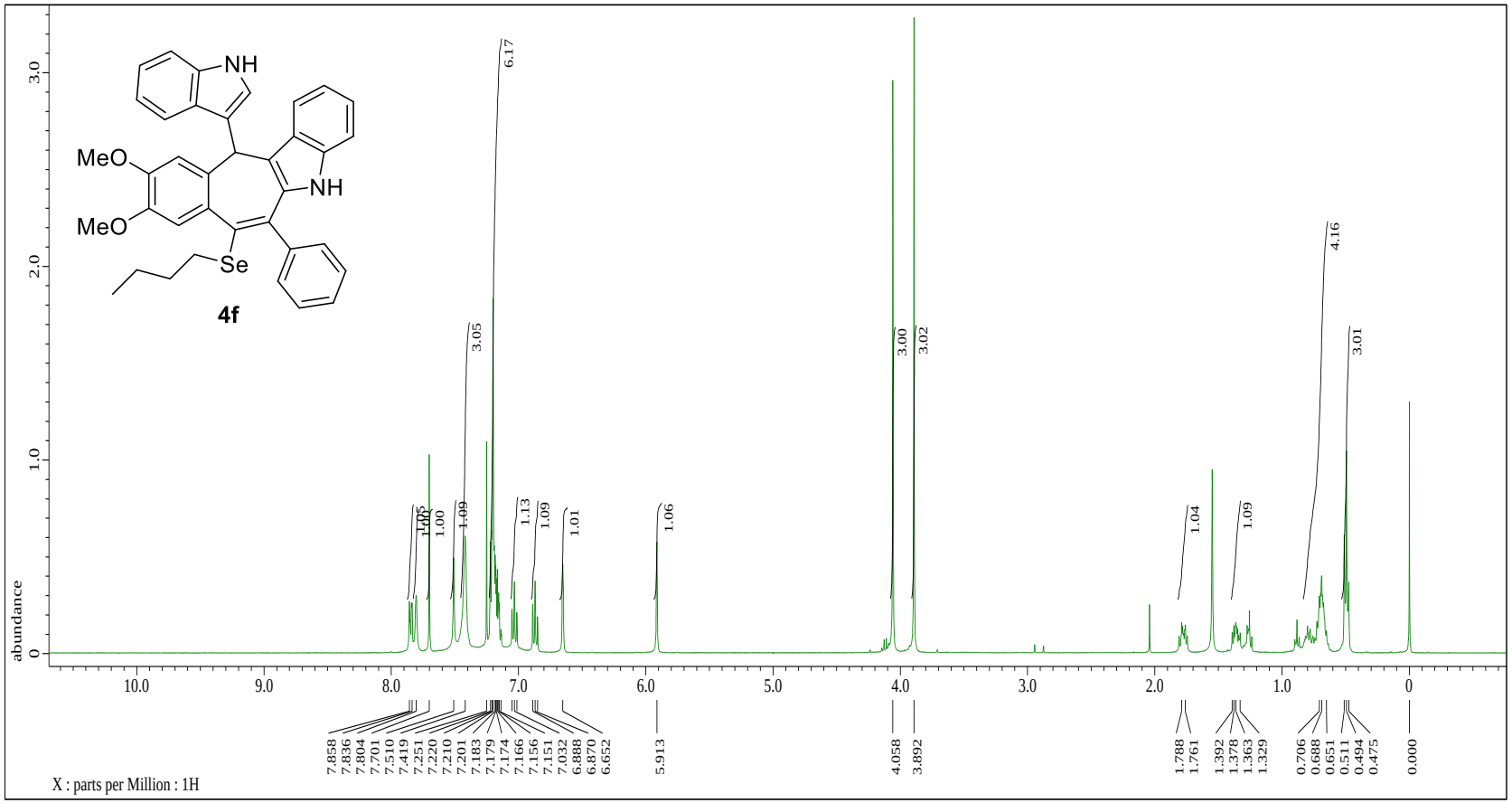

NH
NH
Se
4c
abundance
0
0.1
0.2
0.3
0.4
0.5
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
144.054
141.116
136.786
136.710
136.662
135.708
134.278
133.381
132.551
129.032
128.603
128.536
127.420
126.581
125.770
122.899
122.461
121.621
120.019
119.867
119.790
119.266
118.264
115.060
111.063
110.949
77.434
77.320
77.110
76.786
40.639
31.044
28.708
22.565
13.343
X : parts per Million : 13C

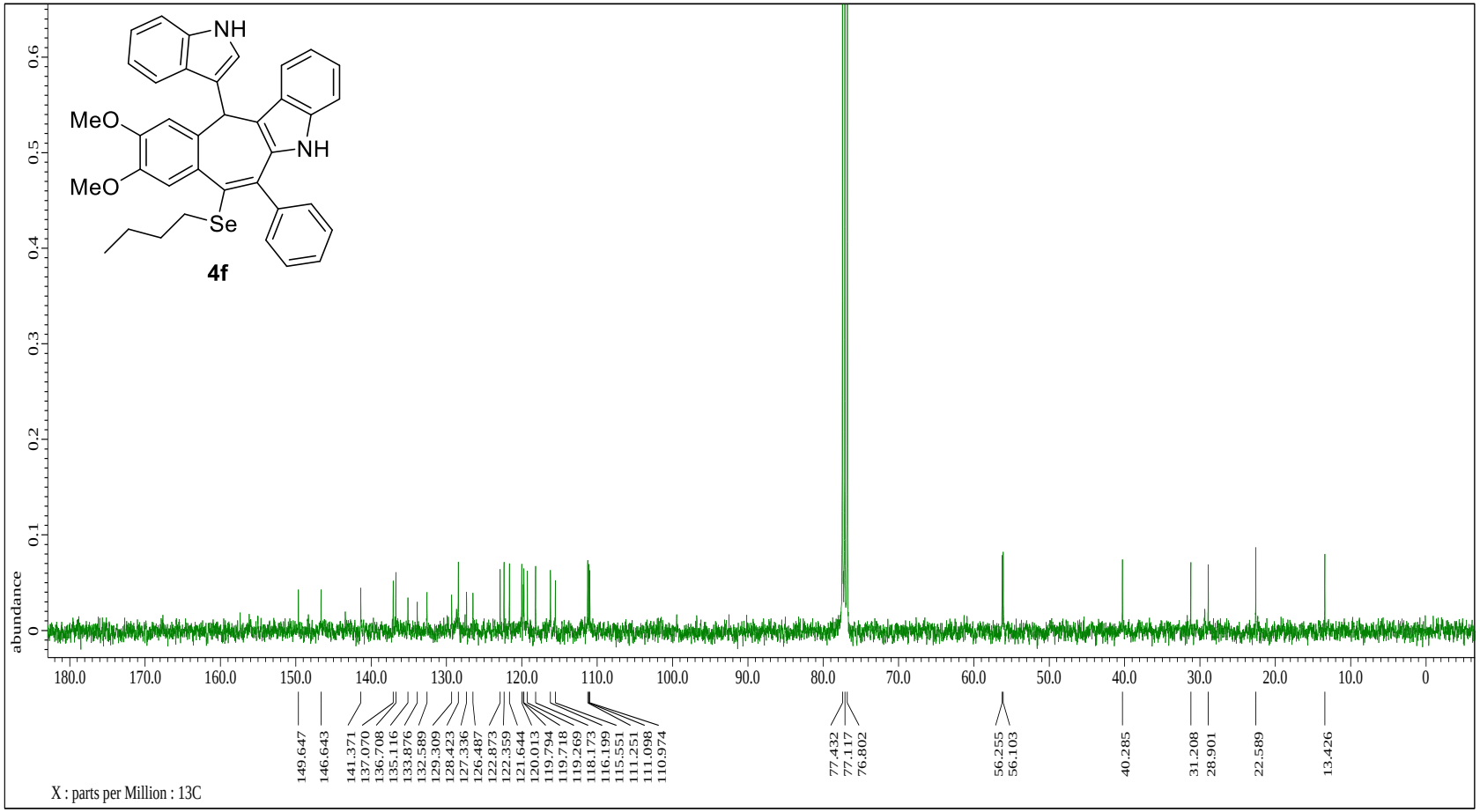

NH
NH
Se
4d
abundance
3.0
2.0
1.0
0
5.09
4.15
2.17
2.17
3.00
2.01
1.00
1.02
1.00
1.03
1.02
1.01
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
7.963
7.946
7.816
7.796
7.691
7.674
7.532
7.519
7.500
7.343
7.322
7.284
7.249
7.203
7.179
7.160
7.028
6.981
6.808
6.640
6.186
6.168
6.112
6.095
6.075
0.000
X : parts per Million : 1H

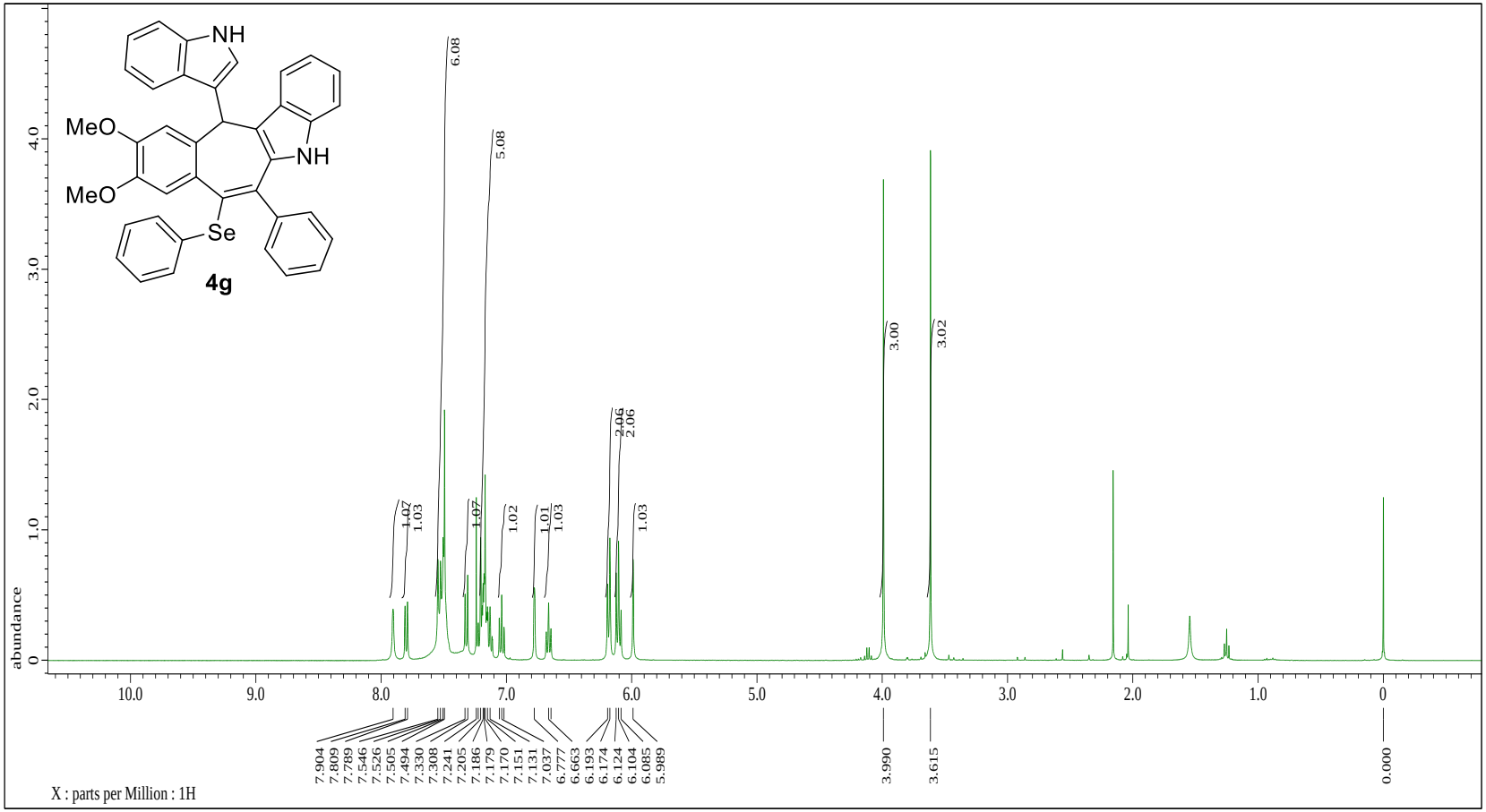

NH
NH
Se
4d
abundance
0.6
0.5
0.4
0.3
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
143.195
140.868
136.967
136.929
135.851
135.517
134.669
133.753
132.628
132.256
131.769
129.194
128.975
128.889
128.193
127.468
126.562
126.161
125.532
123.176
122.690
121.965
120.191
119.886
119.647
118.932
118.474
114.249
111.330
110.930
77.434
77.320
77.110
76.786
40.849
X : parts per Million : 13C

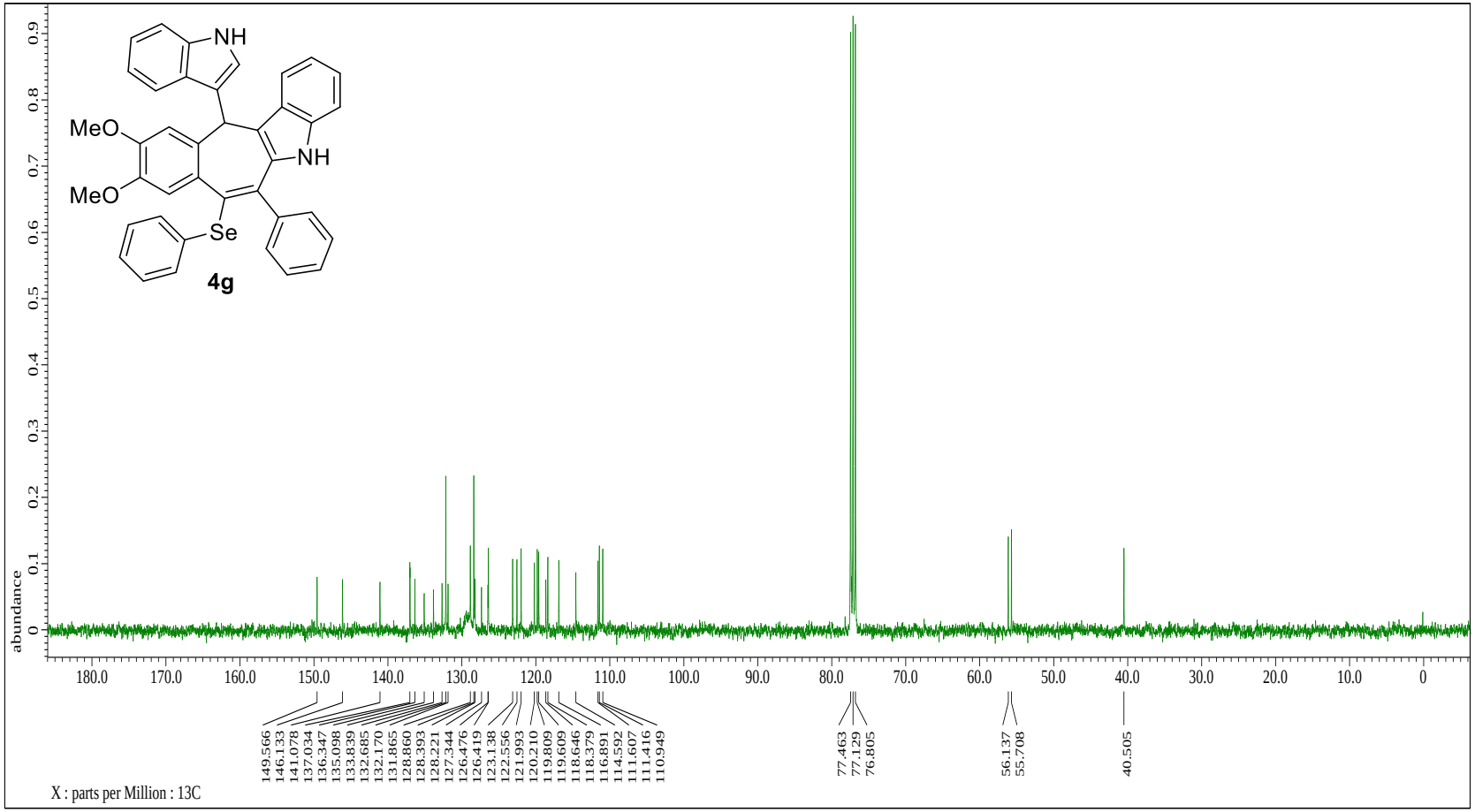

NH
MeO
MeO
NH
Se
4e
abundance
X : parts per Million : 1H
6.04
2.05
1.08
1.04
1.04
1.06
1.12
1.11
1.05
1.01
1.01
3.00
3.04
3.05
7.892
7.871
7.804
7.630
7.520
7.406
7.250
7.219
7.211
7.196
7.191
7.179
7.105
7.085
7.044
7.024
7.006
6.865
6.845
6.638
5.905
4.044
3.899
1.047
0.000

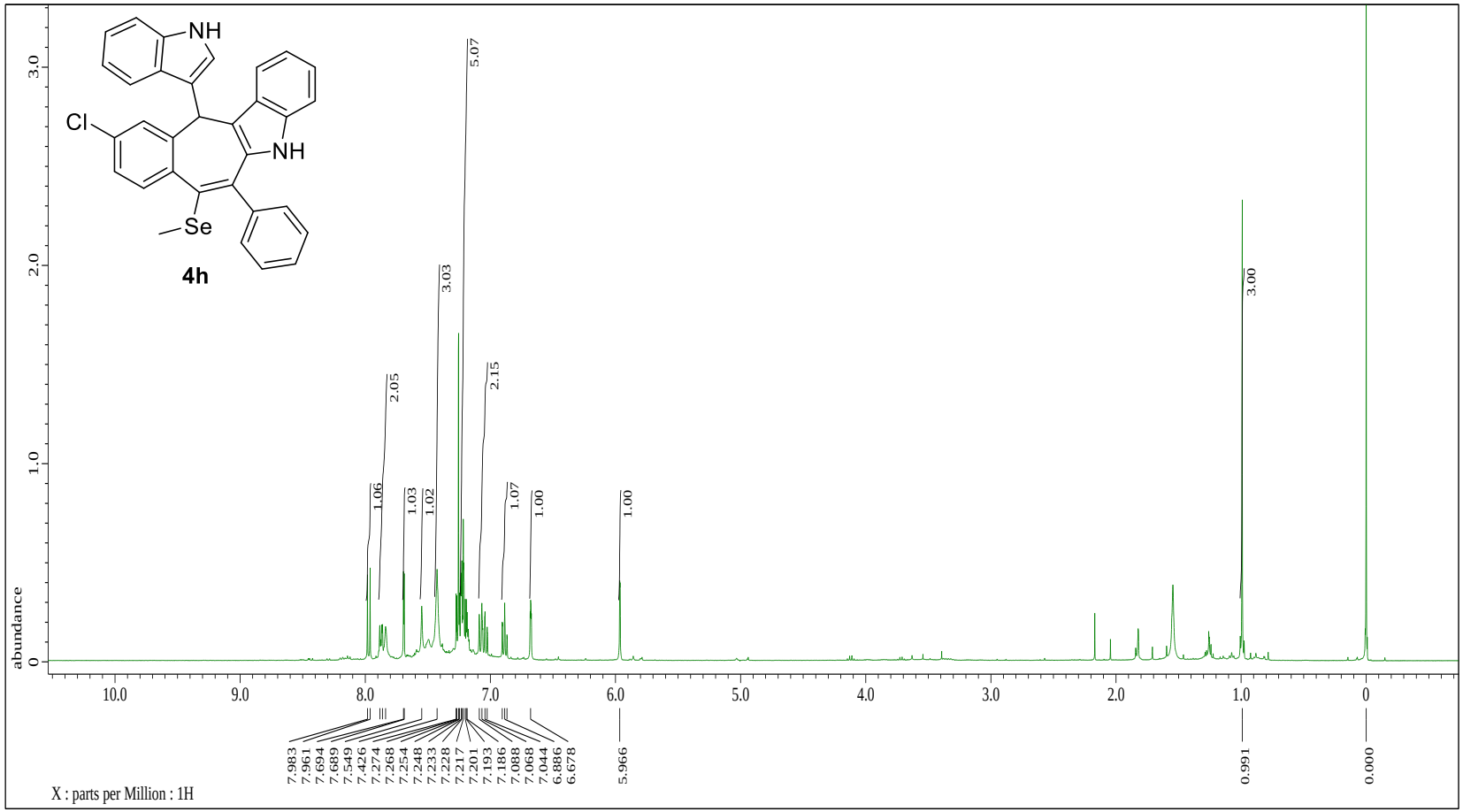

NH
MeO
MeO
NH
Se
4e
abundance
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
149.694
146.920
141.046
137.557
136.708
136.575
135.049
133.724
132.456
128.566
127.202
126.497
122.912
122.444
121.586
120.213
120.137
119.775
119.203
118.202
116.047
115.789
111.146
111.032
77.441
77.327
77.117
76.802
56.246
56.179
40.161
8.992
X : parts per Million : 13C

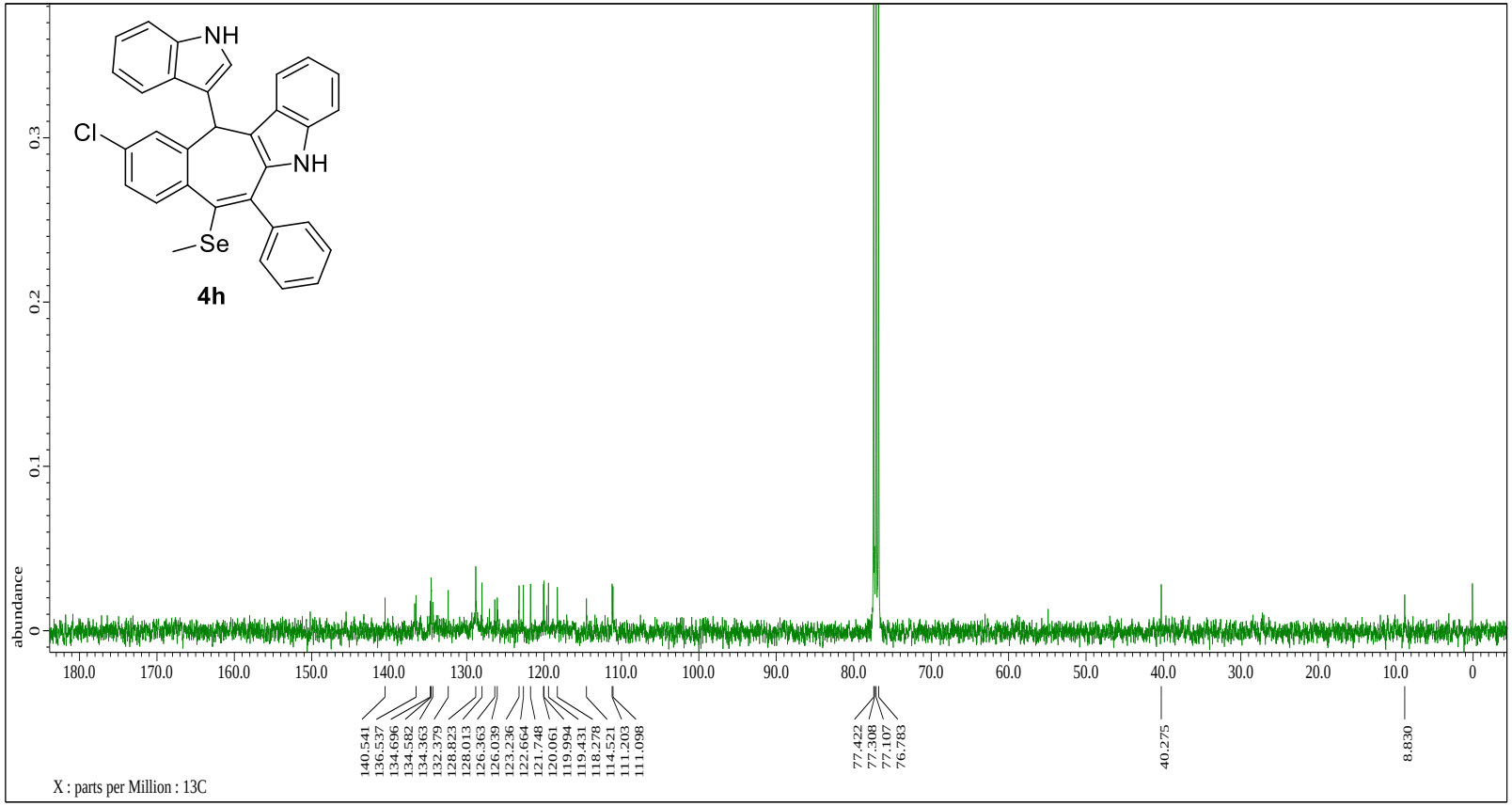

NH
MeO
MeO
NH
Se
4f
abundance
X : parts per Million : 1H
6.17
3.05
3.00
3.02
4.16
3.01
1.00
1.09
1.13
1.09
1.01
1.06
1.04
1.09
7.858
7.836
7.804
7.701
7.510
7.419
7.251
7.220
7.210
7.201
7.183
7.179
7.174
7.166
7.156
7.151
7.032
6.888
6.870
6.652
5.913
4.058
3.892
1.788
1.761
1.392
1.378
1.363
1.329
0.706
0.688
0.651
0.511
0.494
0.475
0.000

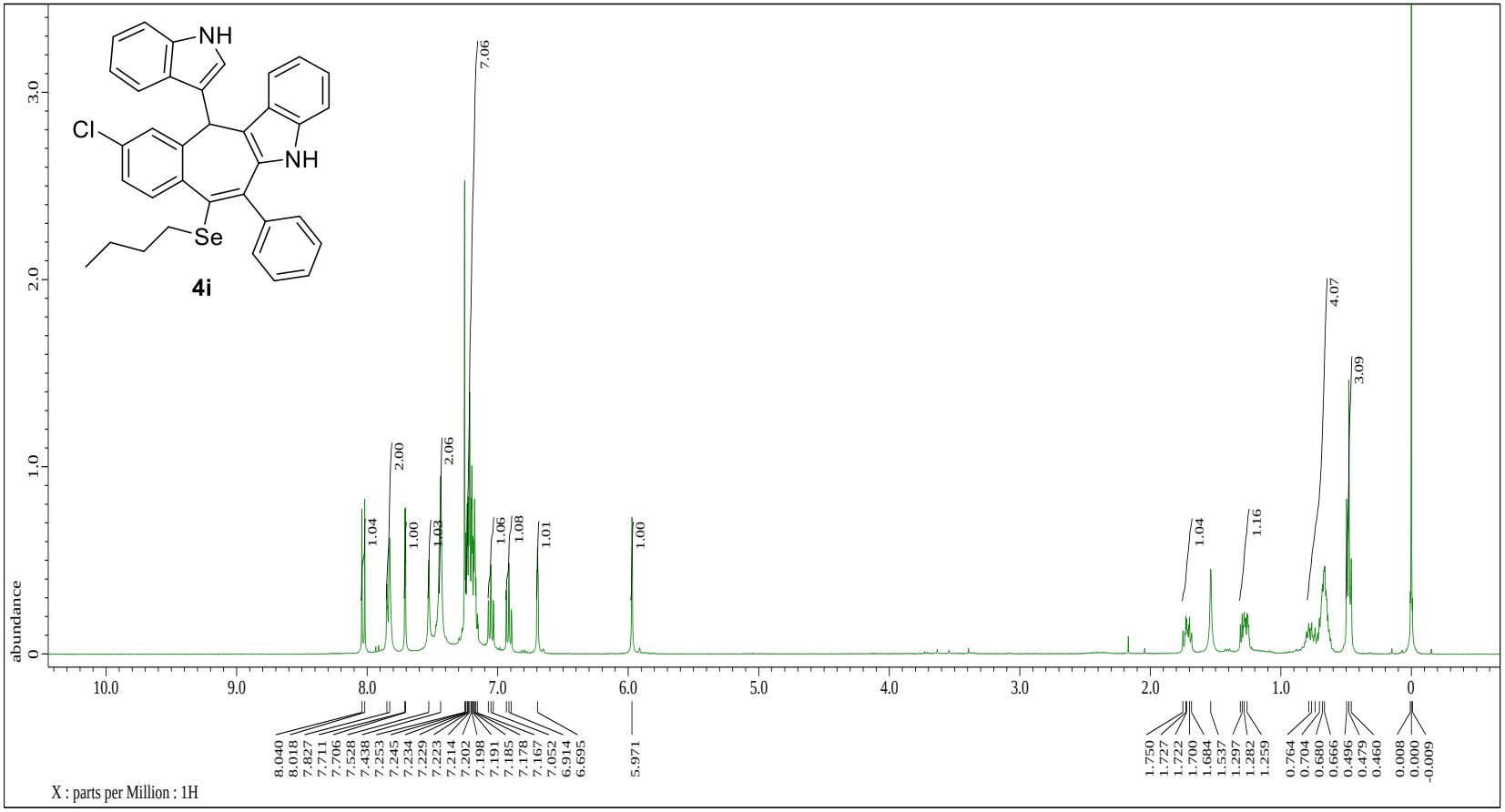

NH
MeO
MeO
NH
Se
4f
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
149.647
146.643
141.371
137.070
136.708
135.116
133.876
132.589
129.309
128.423
127.336
126.487
122.873
122.359
121.644
120.013
119.794
119.718
119.269
118.173
116.199
115.551
111.251
111.098
110.974
77.432
77.117
76.802
56.255
56.103
40.285
31.208
28.901
22.589
13.426
X : parts per Million : 13C

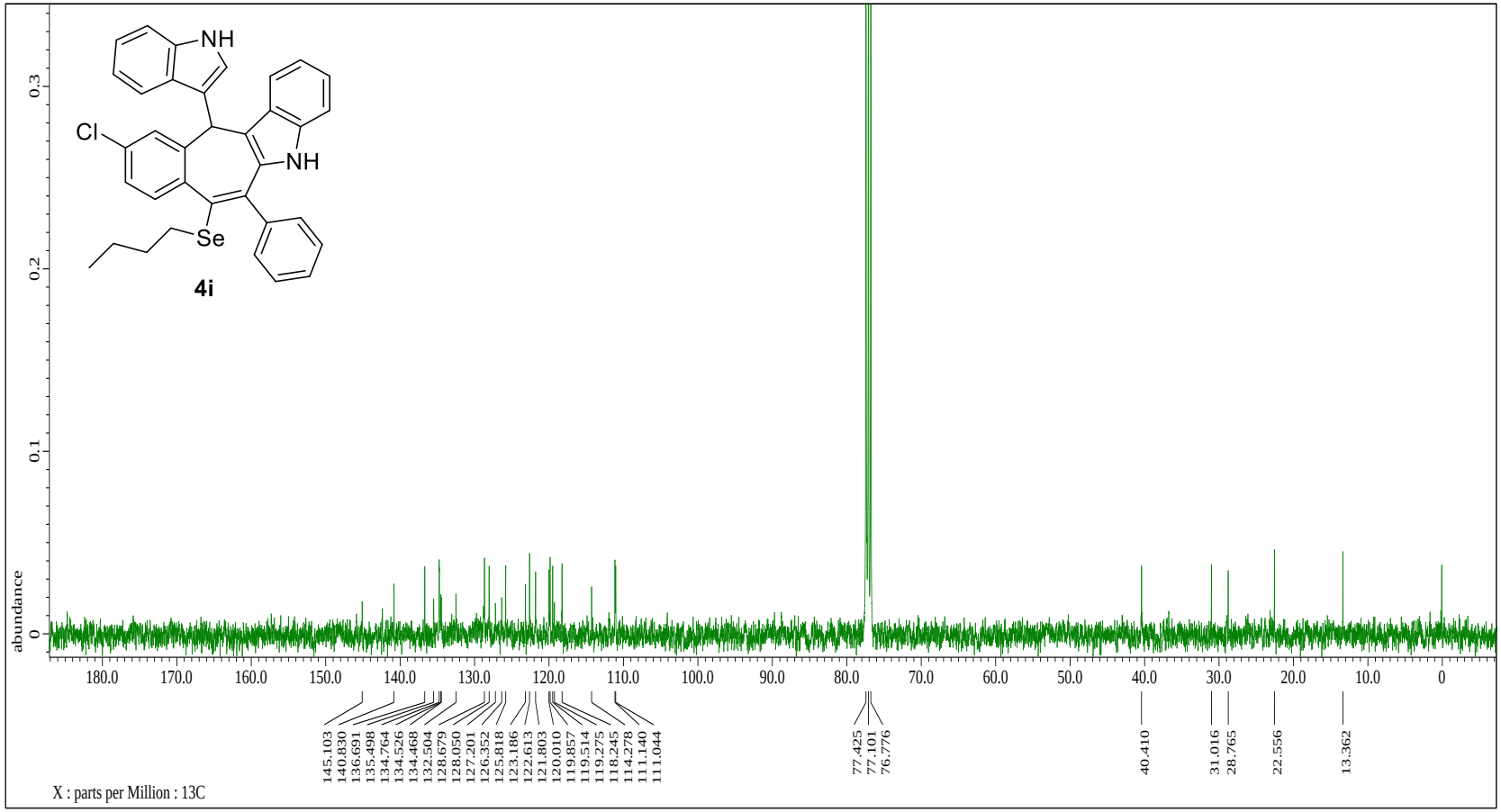

NH
MeO
MeO
NH
Se
4g
abundance
X : parts per Million : 1H
6.08
5.08
1.07
1.03
1.07
1.02
1.01
1.03
2.06
2.06
2.06
1.03
3.00
3.02
7.904
7.809
7.789
7.546
7.526
7.505
7.494
7.330
7.308
7.241
7.205
7.186
7.179
7.170
7.151
7.131
7.037
6.777
6.663
6.193
6.174
6.124
6.104
6.085
5.989
3.990
3.615
0.000

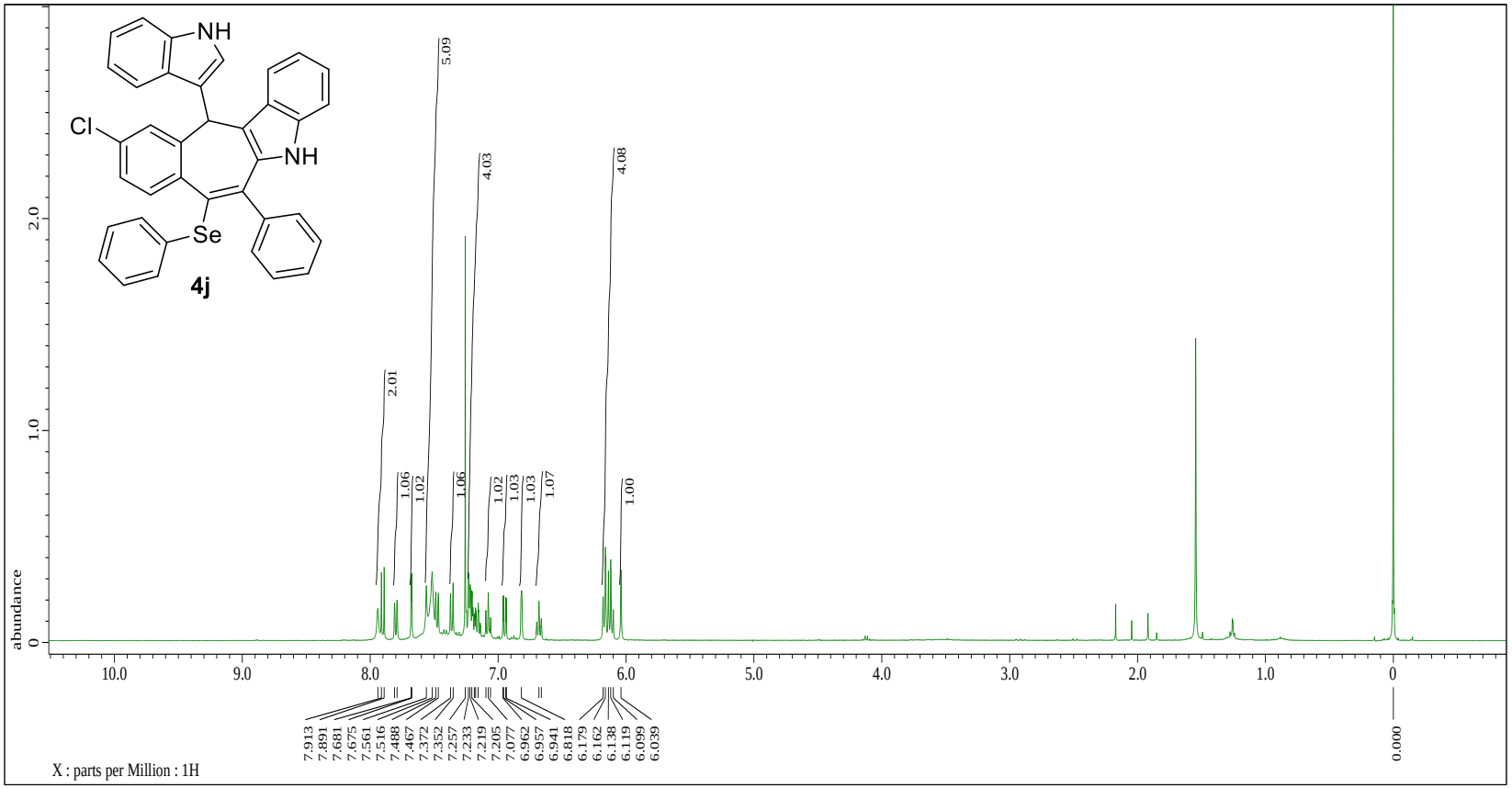

NH
MeO
MeO
NH
Se
4g
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
149.566
146.133
141.078
137.034
136.347
135.098
133.839
132.685
132.170
131.865
128.860
128.393
128.221
127.344
126.476
126.419
123.138
122.556
121.993
120.210
119.809
119.609
118.646
118.379
116.891
114.592
111.607
111.416
110.949
77.463
77.129
76.805
56.137
55.708
40.505
X : parts per Million : 13C

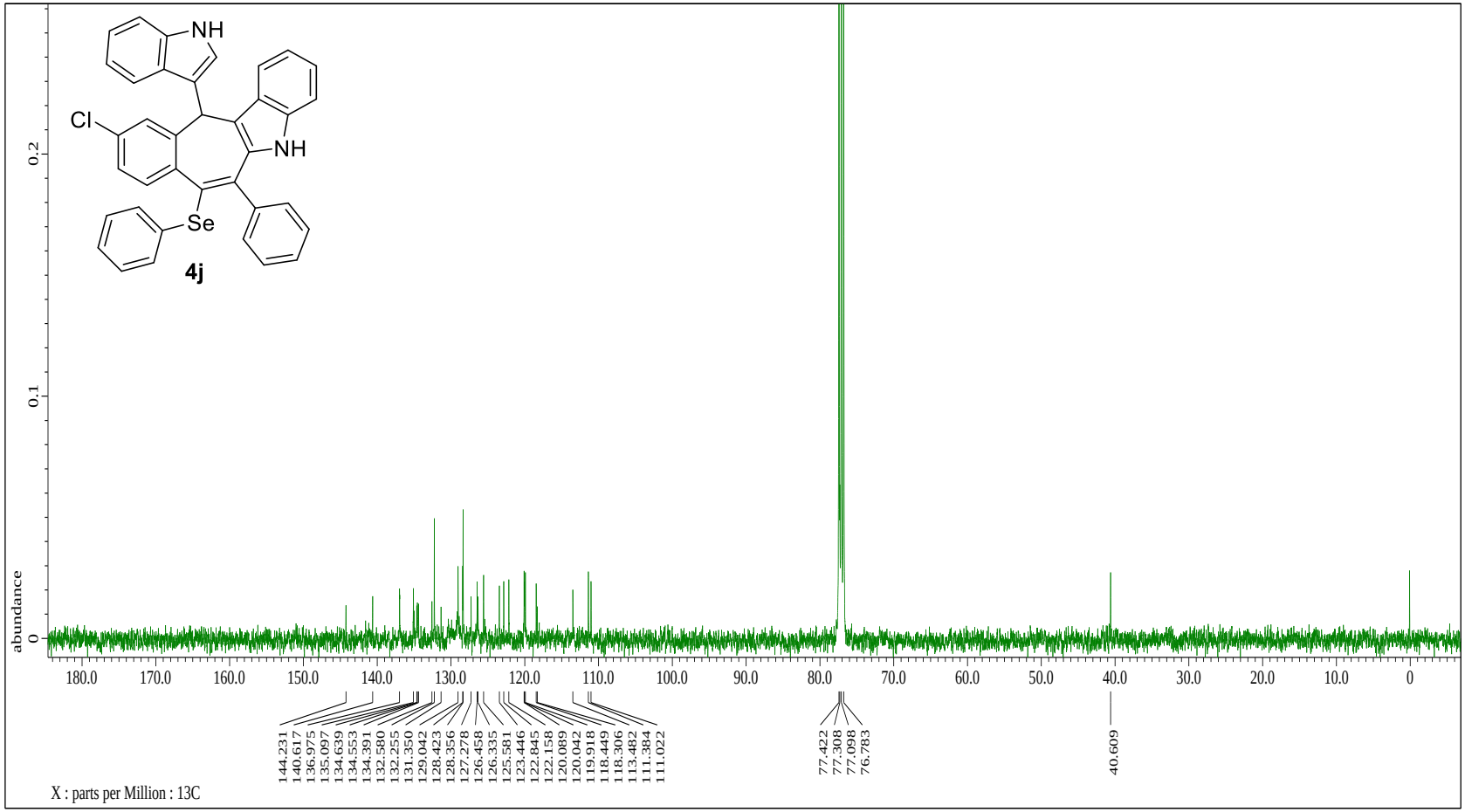

NH
Cl
NH
Se
4h
abundance
3.0
2.0
1.0
0
5.07
3.03
2.05
2.15
1.06
1.03
1.02
1.07
1.00
1.00
3.00
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
7.983
7.961
7.694
7.689
7.549
7.426
7.274
7.268
7.254
7.248
7.233
7.228
7.217
7.201
7.193
7.186
7.088
7.068
7.044
6.886
6.678
5.966
0.991
0.000
X : parts per Million : 1H

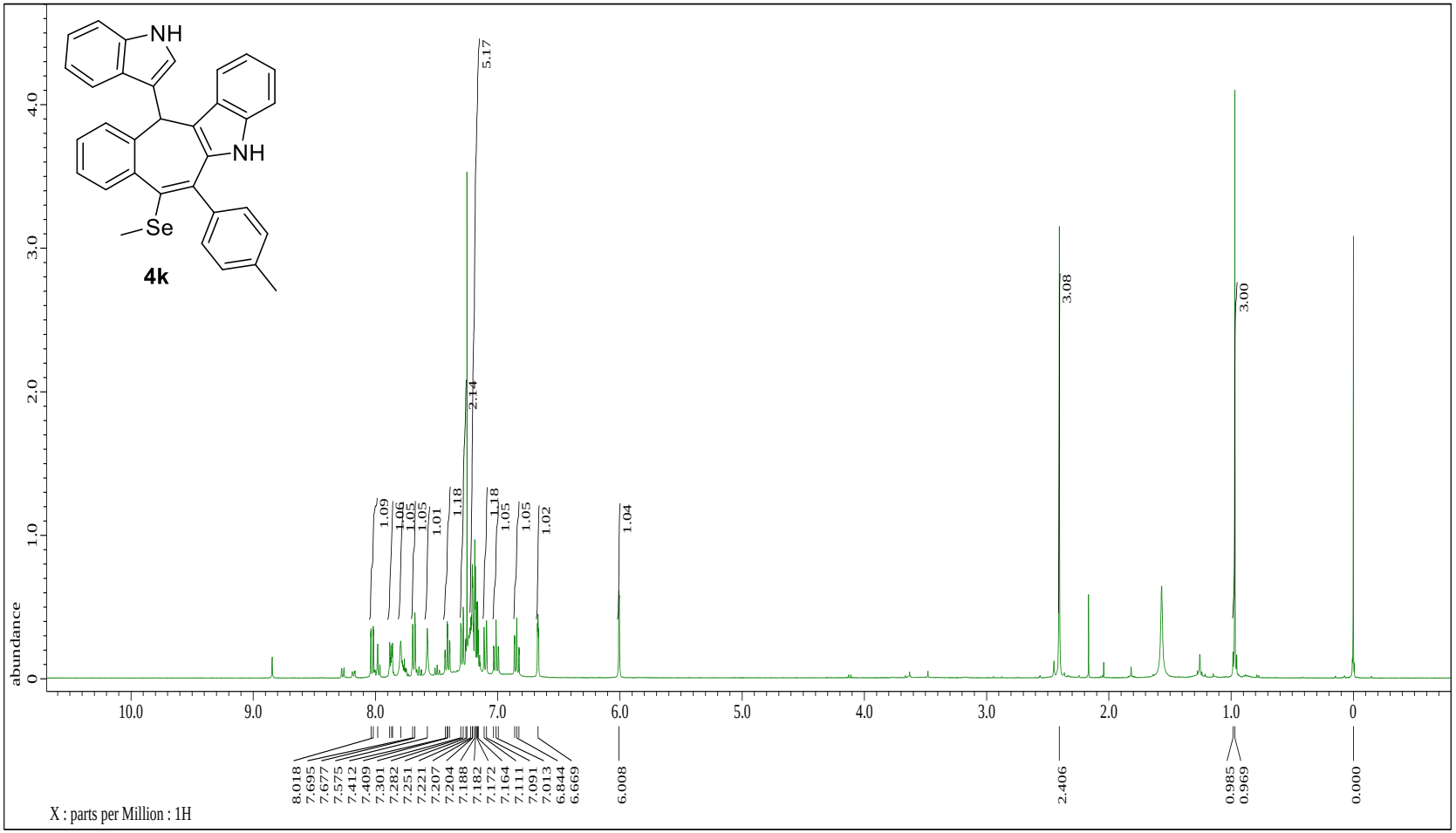

NH
Cl
NH
Se
4h
abundance
0.3
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
140.541
136.537
134.696
134.582
134.363
132.379
128.823
128.013
126.363
126.039
123.236
122.664
121.748
120.061
119.994
119.431
118.278
114.521
111.203
111.098
77.422
77.308
77.107
76.783
40.275
8.830
X : parts per Million : 13C

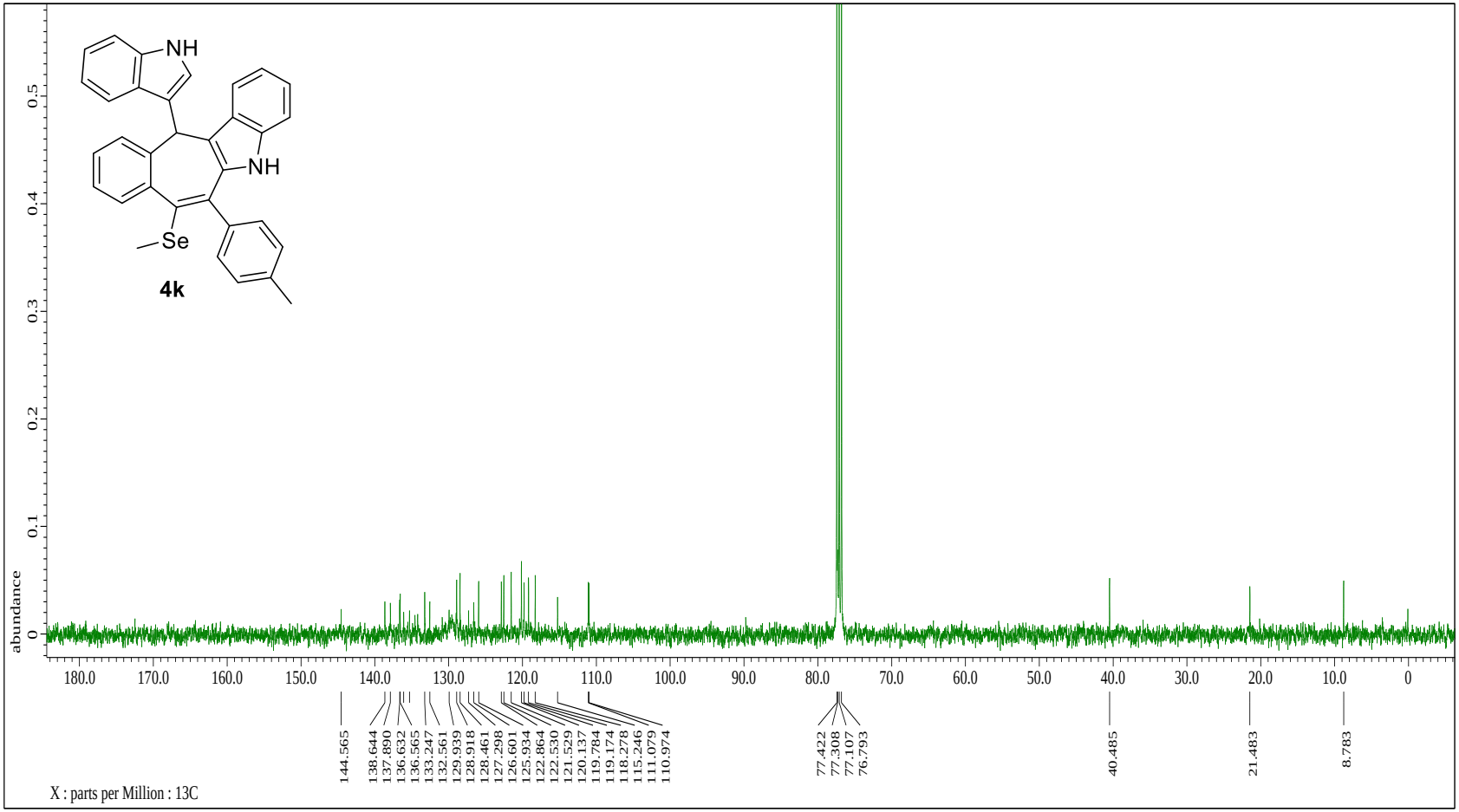

NH
Cl
NH
Se
4i
abundance
X : parts per Million : 1H

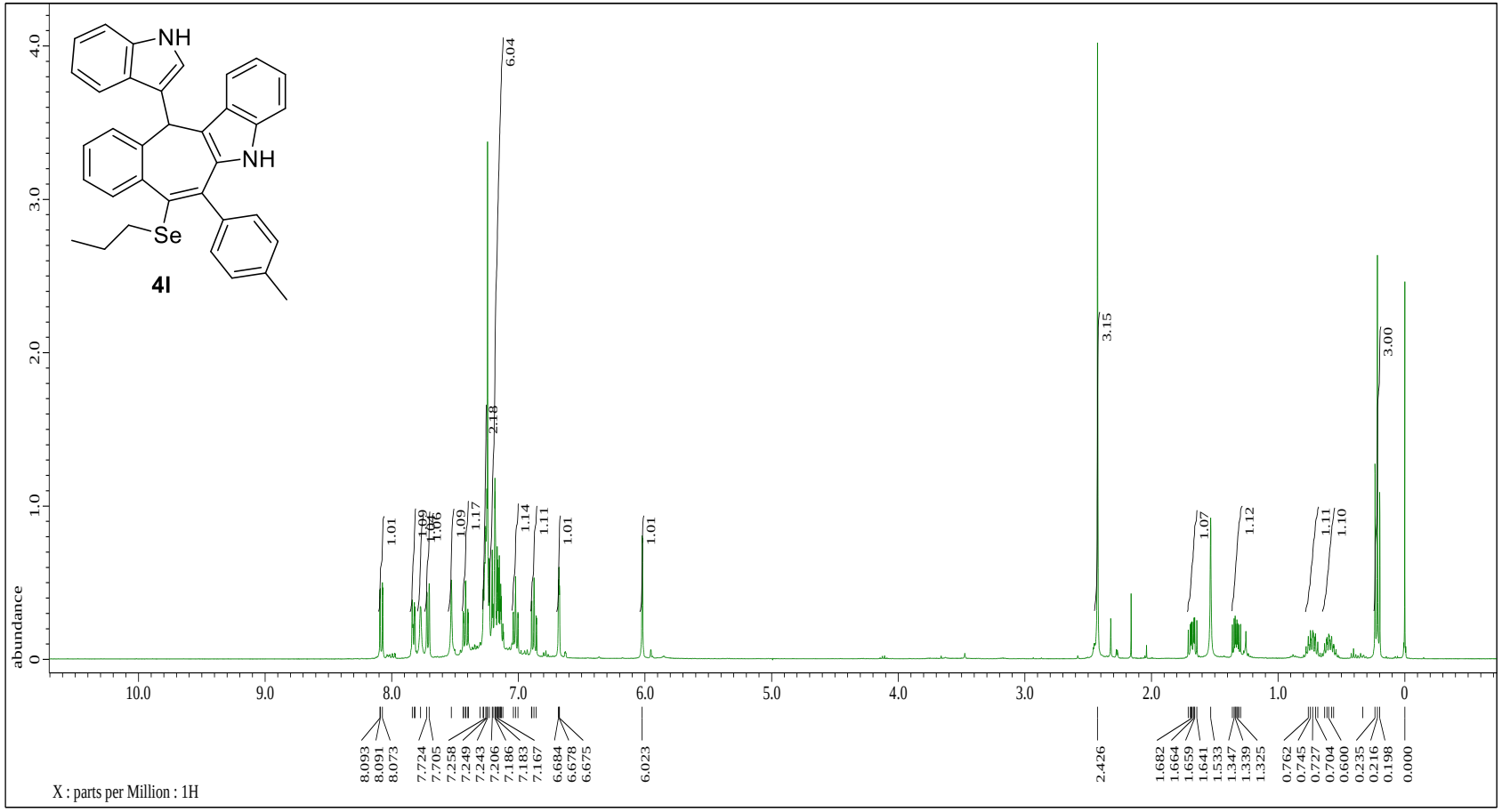

NH
Cl
NH
Se
4i
abundance
0.3
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
145.103
140.830
136.691
135.498
134.764
134.526
134.468
132.504
128.679
128.050
127.201
126.352
125.818
123.186
122.613
121.803
120.010
119.857
119.514
119.275
118.245
114.278
111.140
111.044
77.425
77.101
76.776
40.410
31.016
28.765
22.556
13.362
X : parts per Million : 13C

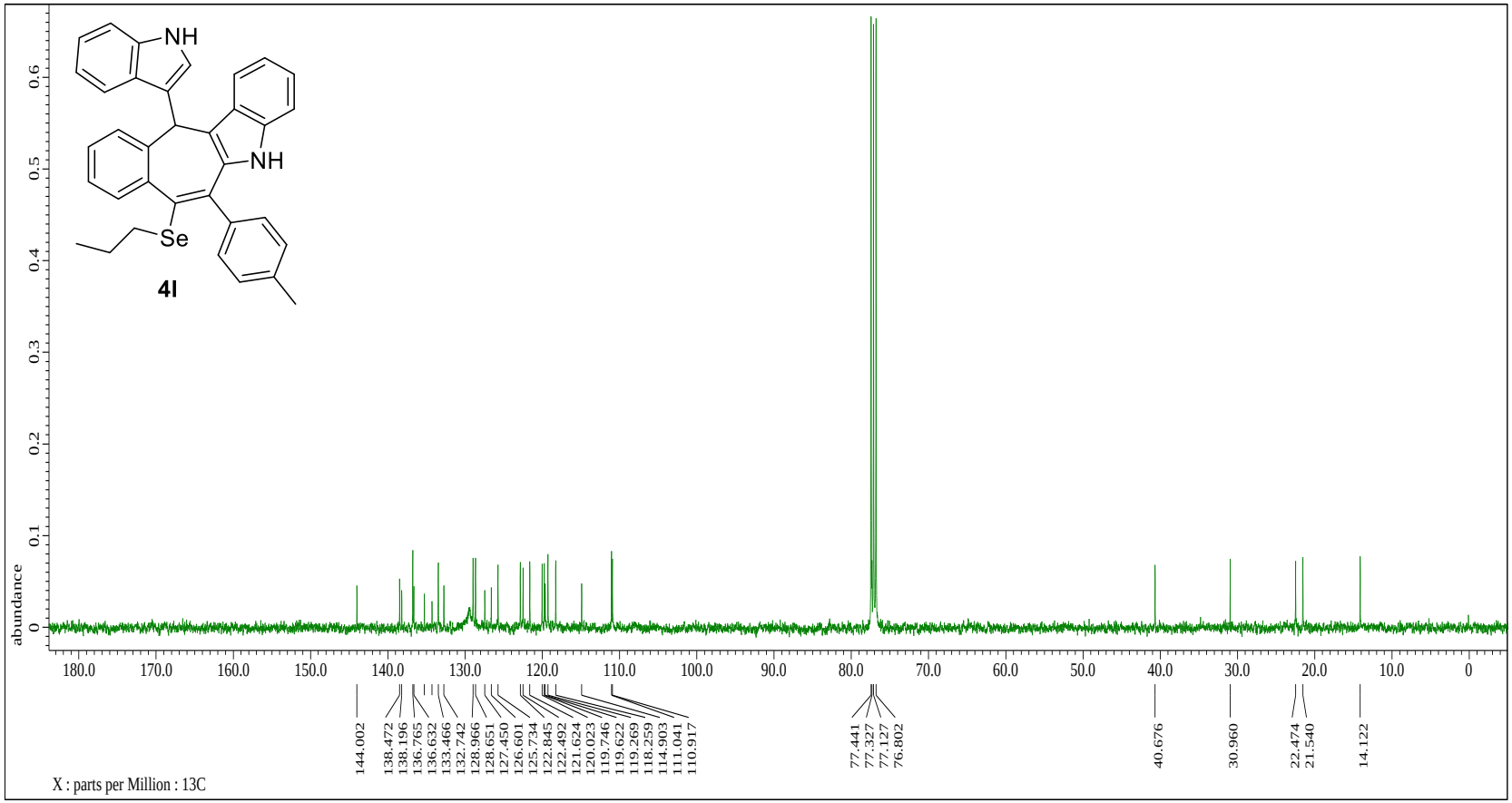

NH
Cl
NH
Se
4j
5.09
4.03
4.08
2.01
1.06
1.02
1.06
1.02
1.03
1.03
1.07
1.00
abundance
2.0
1.0
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
7.913
7.891
7.681
7.675
7.561
7.516
7.488
7.467
7.372
7.352
7.257
7.233
7.219
7.205
7.077
6.962
6.957
6.941
6.818
6.179
6.162
6.138
6.119
6.099
6.039
0.000
X : parts per Million : 1H

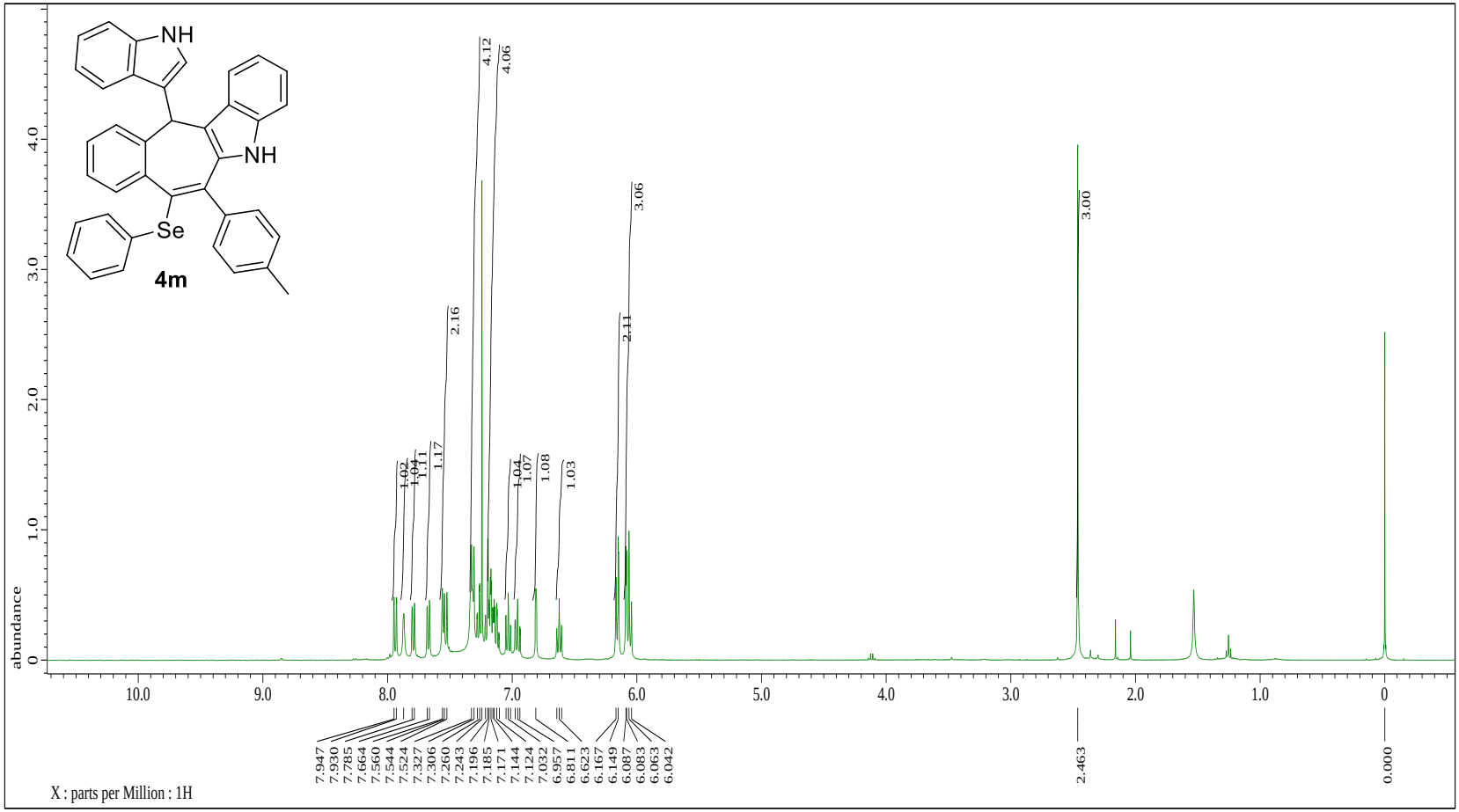

NH
Cl
NH
Se
4j
abundance
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
144.231
140.617
136.975
135.097
134.639
134.553
134.391
132.580
132.255
131.350
129.042
128.423
128.356
127.278
126.458
126.335
125.581
123.446
122.845
122.158
120.089
120.042
119.918
118.449
118.306
113.482
111.384
111.022
77.422
77.308
77.098
76.783
40.609
X : parts per Million : 13C

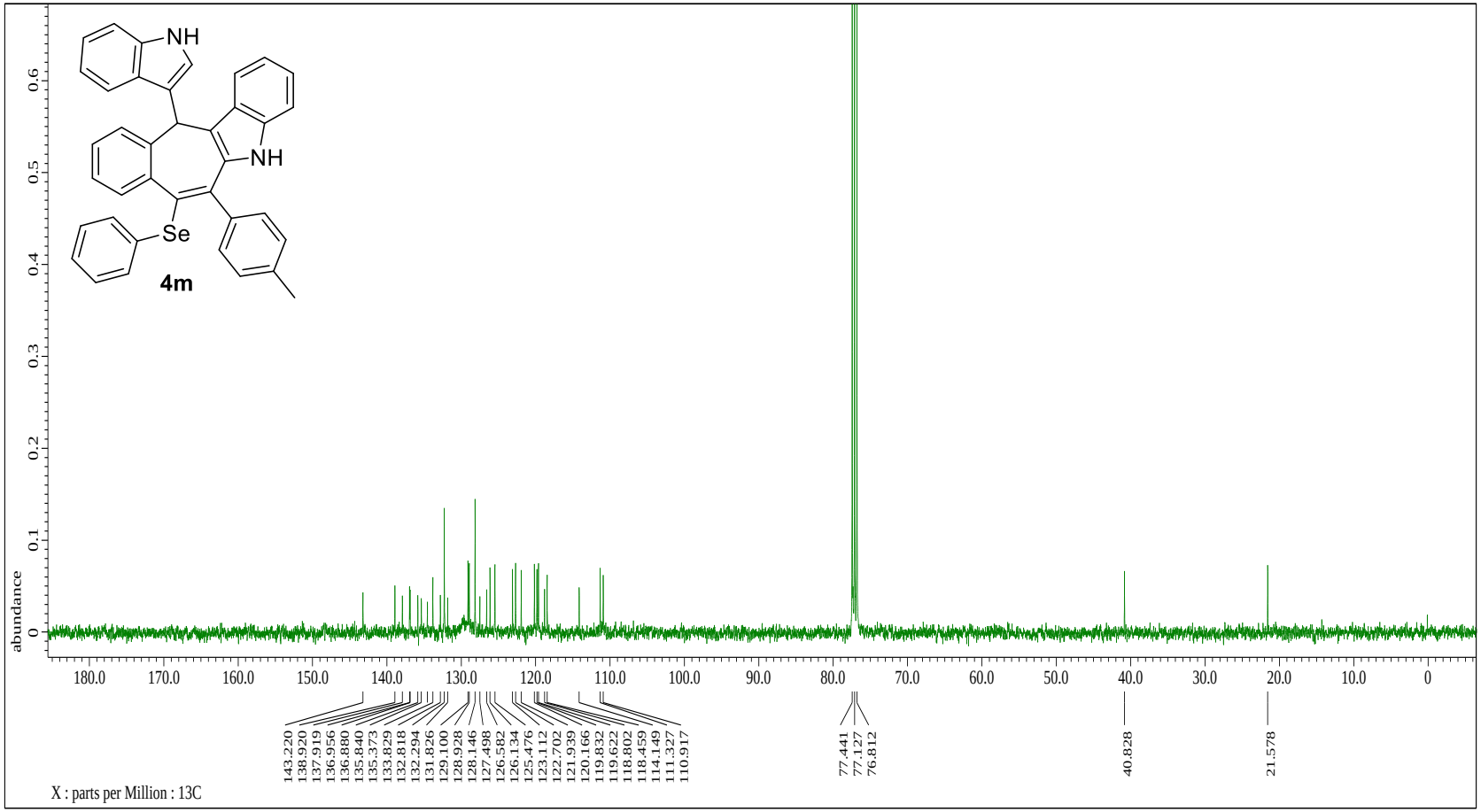

NH
NH
Se
4k
abundance
X : parts per Million : 1H
8.018
7.695
7.677
7.575
7.412
7.409
7.301
7.282
7.251
7.221
7.207
7.204
7.188
7.182
7.172
7.164
7.111
7.091
7.013
6.844
6.669
6.008
2.406
0.985
0.969
0.000
1.09
1.06
1.05
1.05
1.01
1.18
2.14
5.17
1.18
1.05
1.05
1.02
1.04
3.08
3.00

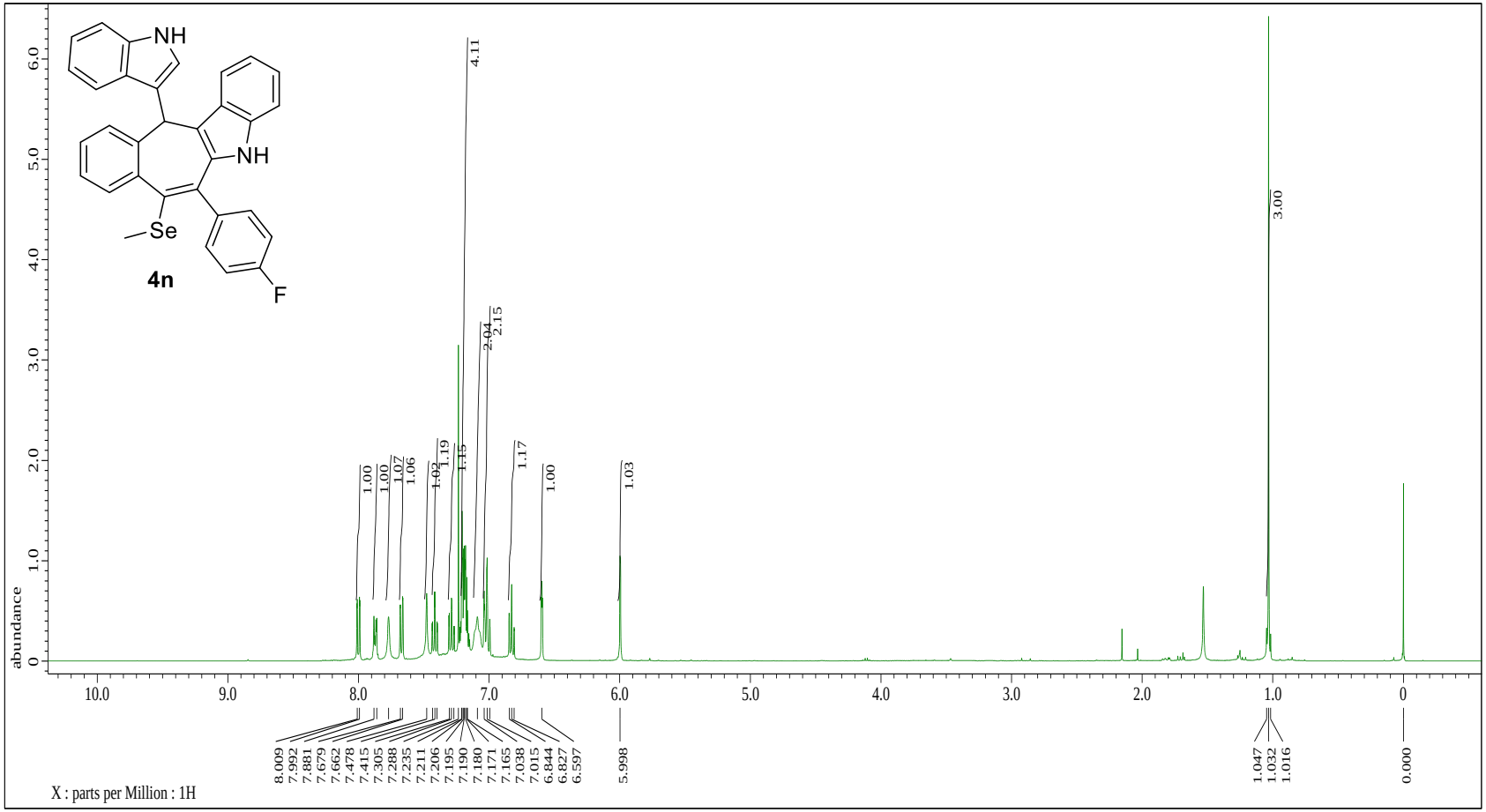

NH
NH
Se
4k
abundance
0
0.1
0.2
0.3
0.4
0.5
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
144.565
138.644
137.890
136.632
136.565
133.247
132.561
129.939
128.918
128.461
127.298
126.601
125.934
122.864
122.530
121.529
120.137
119.784
119.174
118.278
115.246
111.079
110.974
77.422
77.308
77.107
76.793
40.485
21.483
8.783
X : parts per Million : 13C

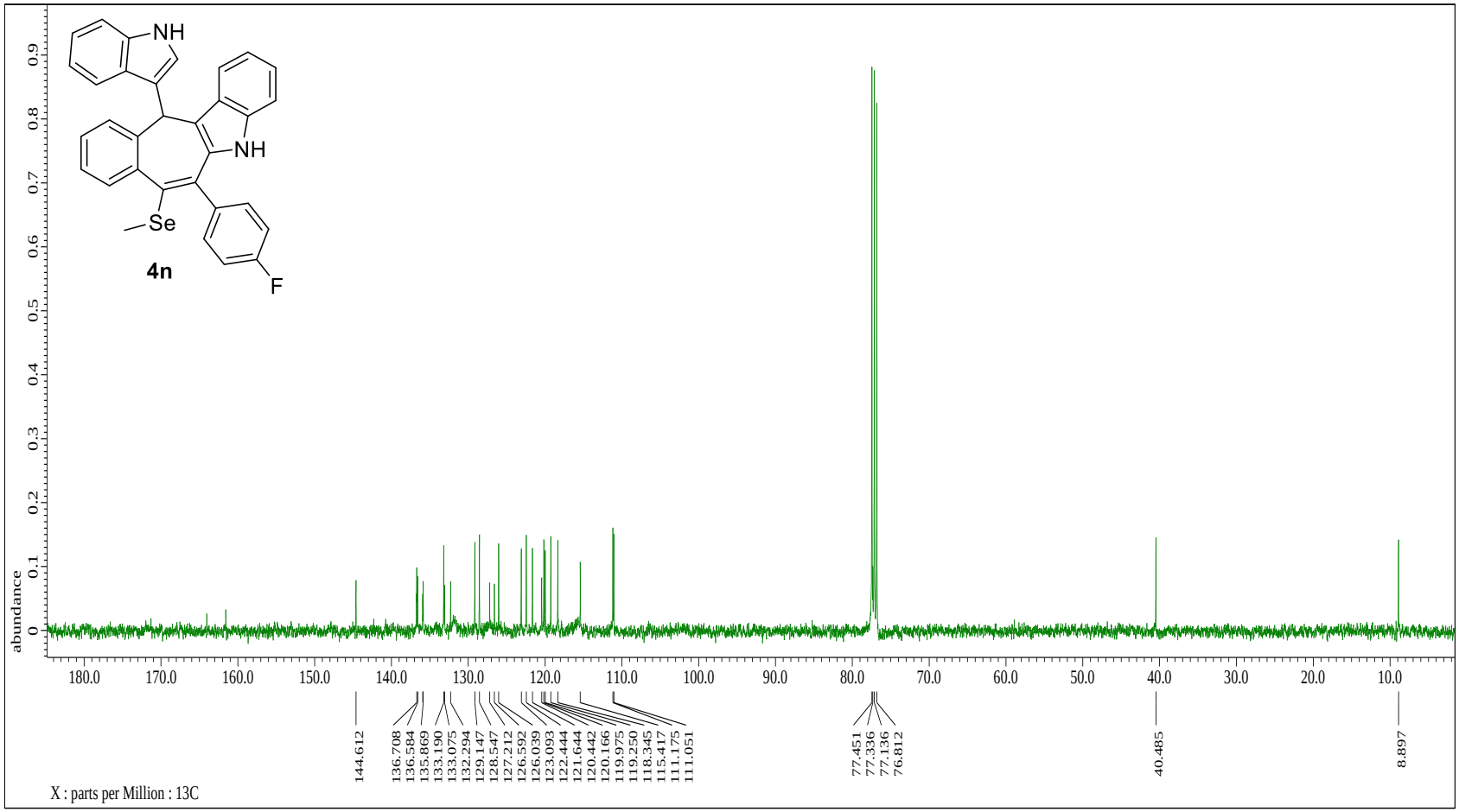

NH
NH
Se
4l
abundance
X : parts per Million : 1H

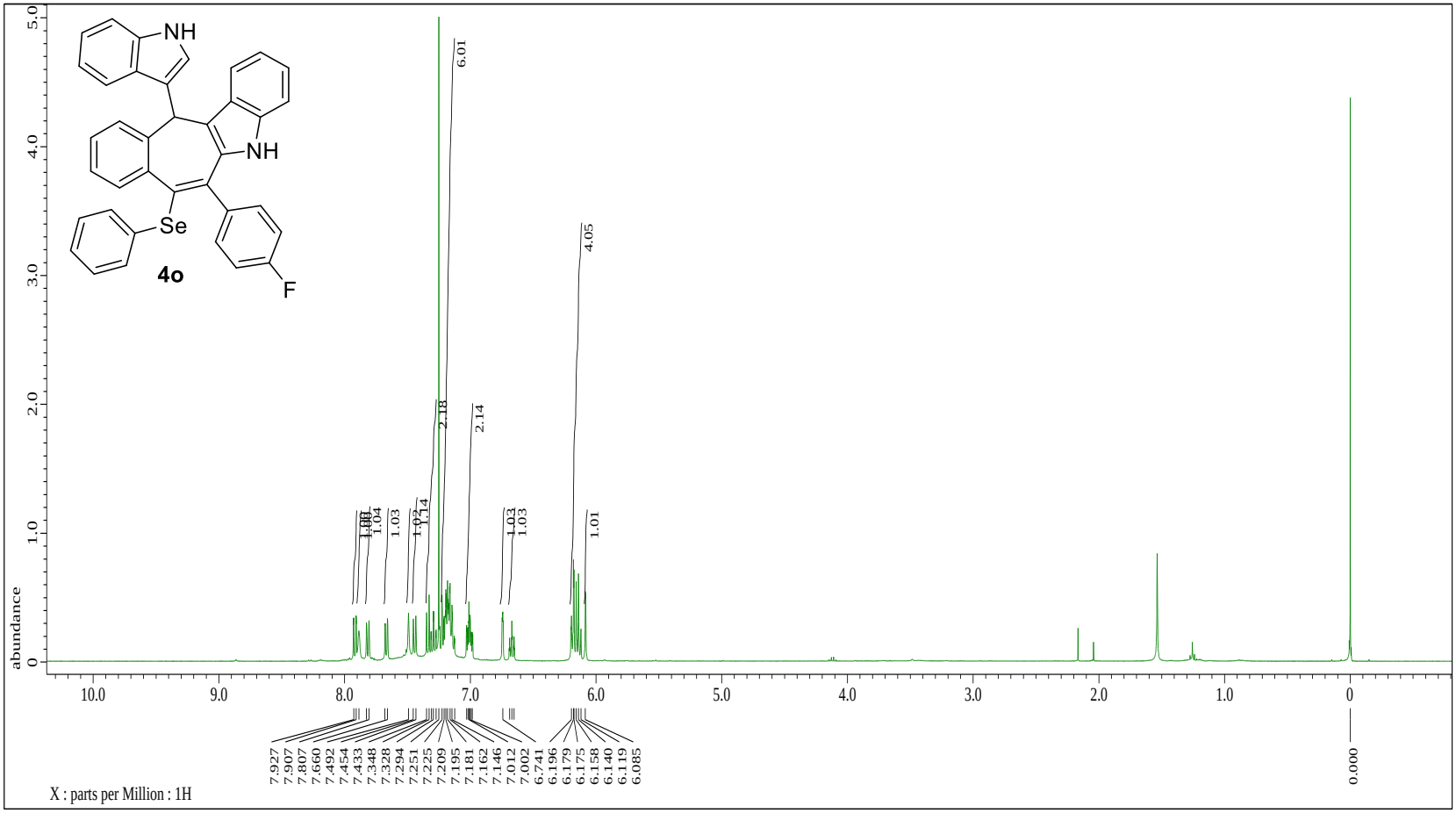

NH
NH
Se
4l
abundance
0.6
0.5
0.4
0.3
0.2
0.1
0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
144.002
138.472
138.196
136.765
136.632
133.466
132.742
128.966
128.651
127.450
126.601
125.734
122.845
122.492
121.624
120.023
119.746
119.622
119.269
118.259
114.903
111.041
110.917
77.441
77.327
77.127
76.802
40.676
30.960
22.474
21.540
14.122
X : parts per Million : 13C

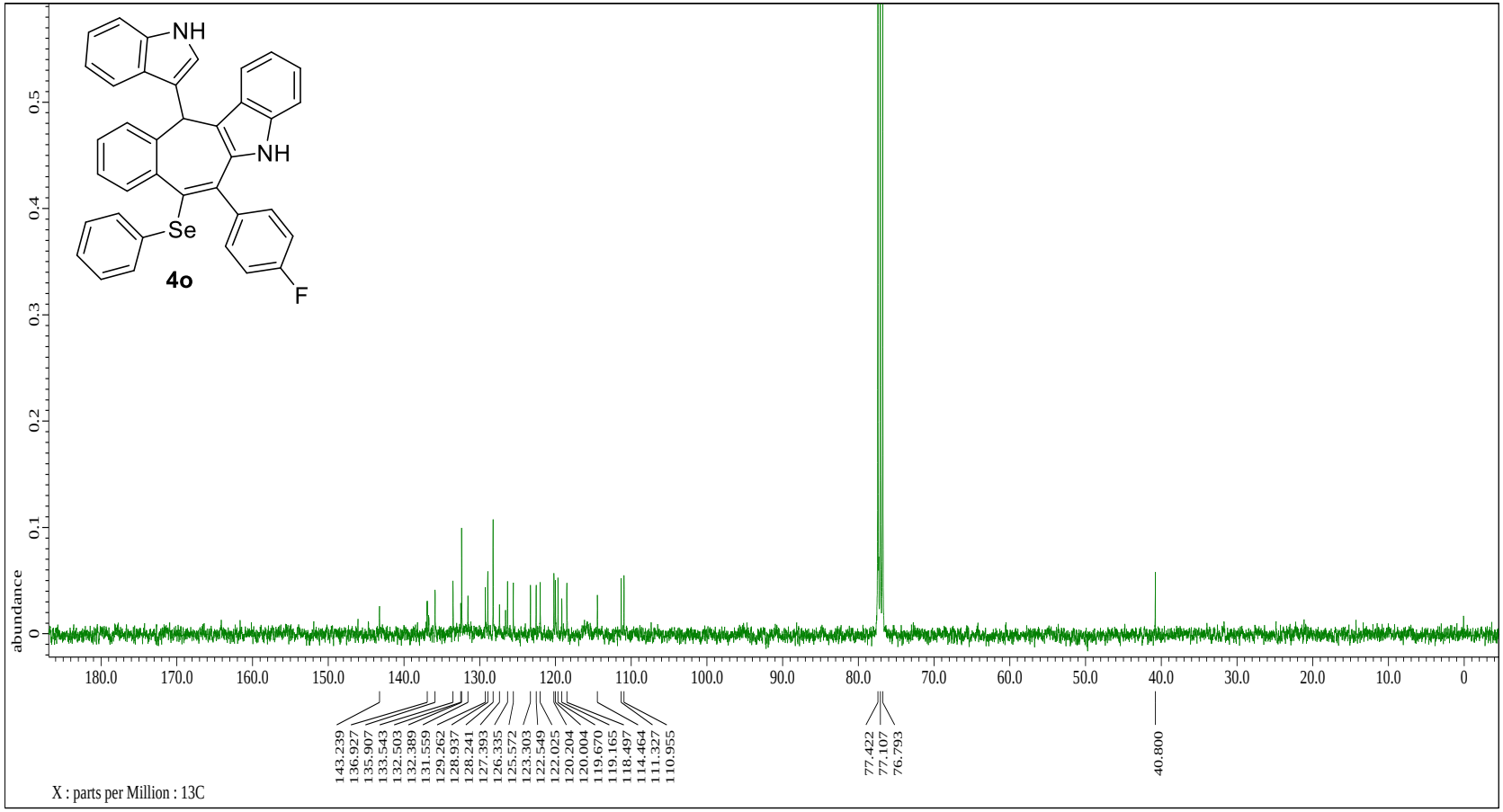

NH
NH
Se
4m
abundance
X : parts per Million : 1H
4.12
4.06
3.06
3.00
2.16
2.11
1.17
1.11
1.04
1.02
1.07
1.08
1.03
7.947
7.930
7.785
7.664
7.560
7.544
7.524
7.327
7.306
7.260
7.243
7.196
7.185
7.171
7.144
7.124
7.032
6.957
6.811
6.623
6.167
6.149
6.087
6.083
6.063
6.042
2.463
0.000


NH
NH
Se
4m
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
143.220
138.920
137.919
136.956
136.880
135.840
135.373
133.829
132.818
132.294
131.826
129.100
128.928
128.146
127.498
126.582
126.134
125.476
123.112
122.702
121.939
120.166
119.832
119.622
118.802
118.459
114.149
111.327
110.917
77.441
77.127
76.812
40.828
21.578
X : parts per Million : 13C


NH
NH
Se
F
4n
abundance
X : parts per Million : 1H
8.009
7.992
7.881
7.679
7.662
7.478
7.415
7.305
7.288
7.235
7.211
7.206
7.195
7.190
7.180
7.171
7.165
7.038
7.015
6.844
6.827
6.597
5.998
1.047
1.032
1.016
0.000


NH
NH
Se
F
4n
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
144.612
136.708
136.584
135.869
133.190
133.075
132.294
129.147
128.547
127.212
126.592
126.039
123.093
122.444
121.644
120.442
120.166
119.975
119.250
118.345
115.417
111.175
111.051
77.451
77.336
77.136
76.812
40.485
8.897
X : parts per Million : 13C


NH
NH
Se
F
4o
abundance
X : parts per Million : 1H
6.01
4.05
2.18
2.14
1.03
1.01
7.927
7.907
7.807
7.660
7.492
7.454
7.433
7.348
7.328
7.294
7.251
7.225
7.209
7.195
7.181
7.162
7.146
7.012
7.002
6.741
6.196
6.179
6.175
6.158
6.140
6.119
6.085
0.000


NH
NH
Se
F
4o
abundance
0
0.1
0.2
0.3
0.4
0.5
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
143.239
136.927
135.907
133.543
132.503
132.389
131.559
129.262
128.937
128.241
127.393
126.335
125.572
123.303
122.549
122.025
120.204
120.004
119.670
119.165
118.497
114.464
111.327
110.955
77.422
77.107
76.793
40.800
X : parts per Million : 13C