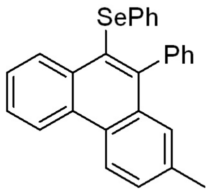
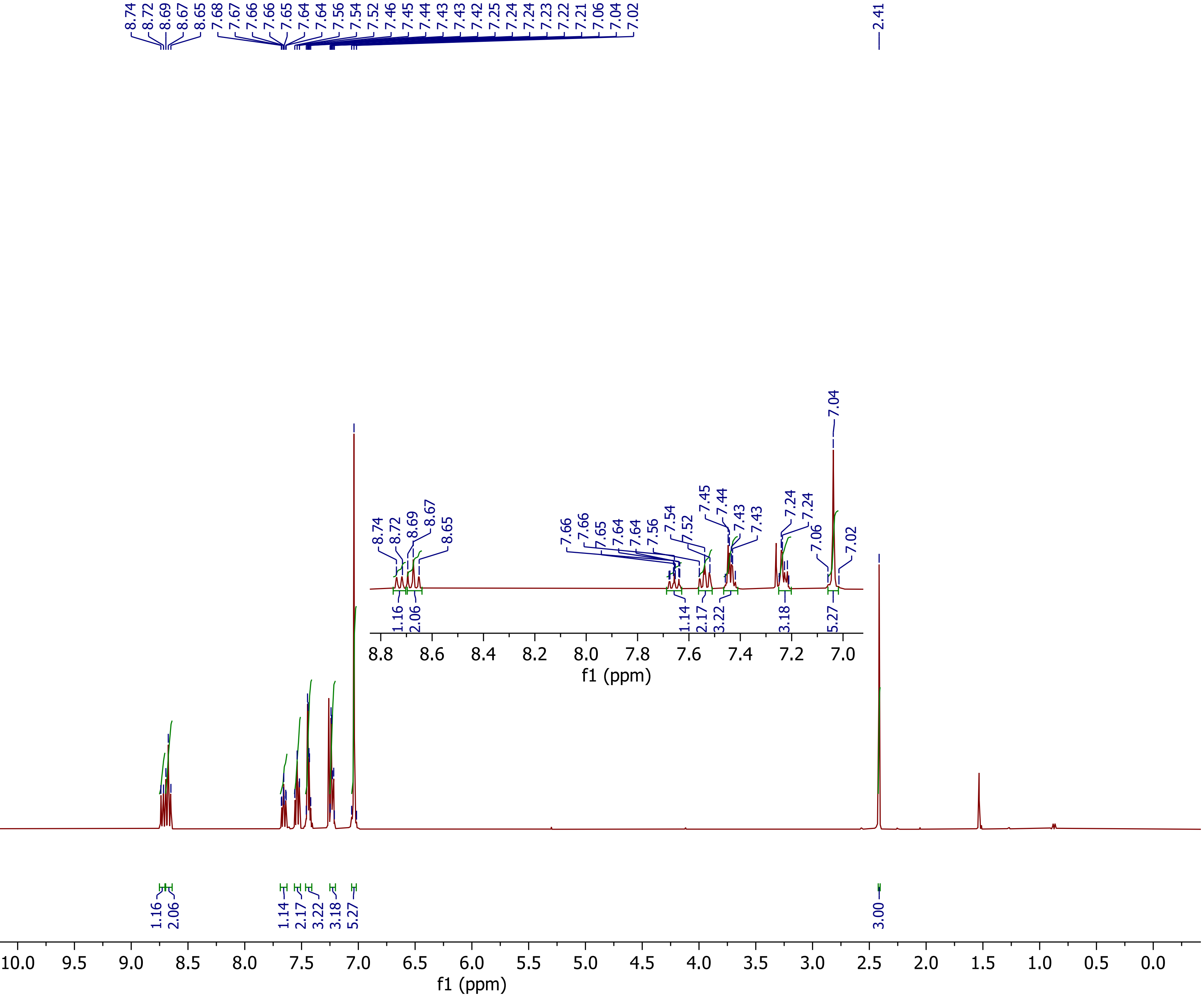
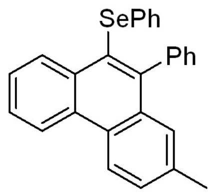
Selanyl and tellanyl electrophiles as driving force in construction of sophisticated polyaromatic hydrocarbons

Pavel Arsenyan,* Alla Petrenko, Sergey Belyakov

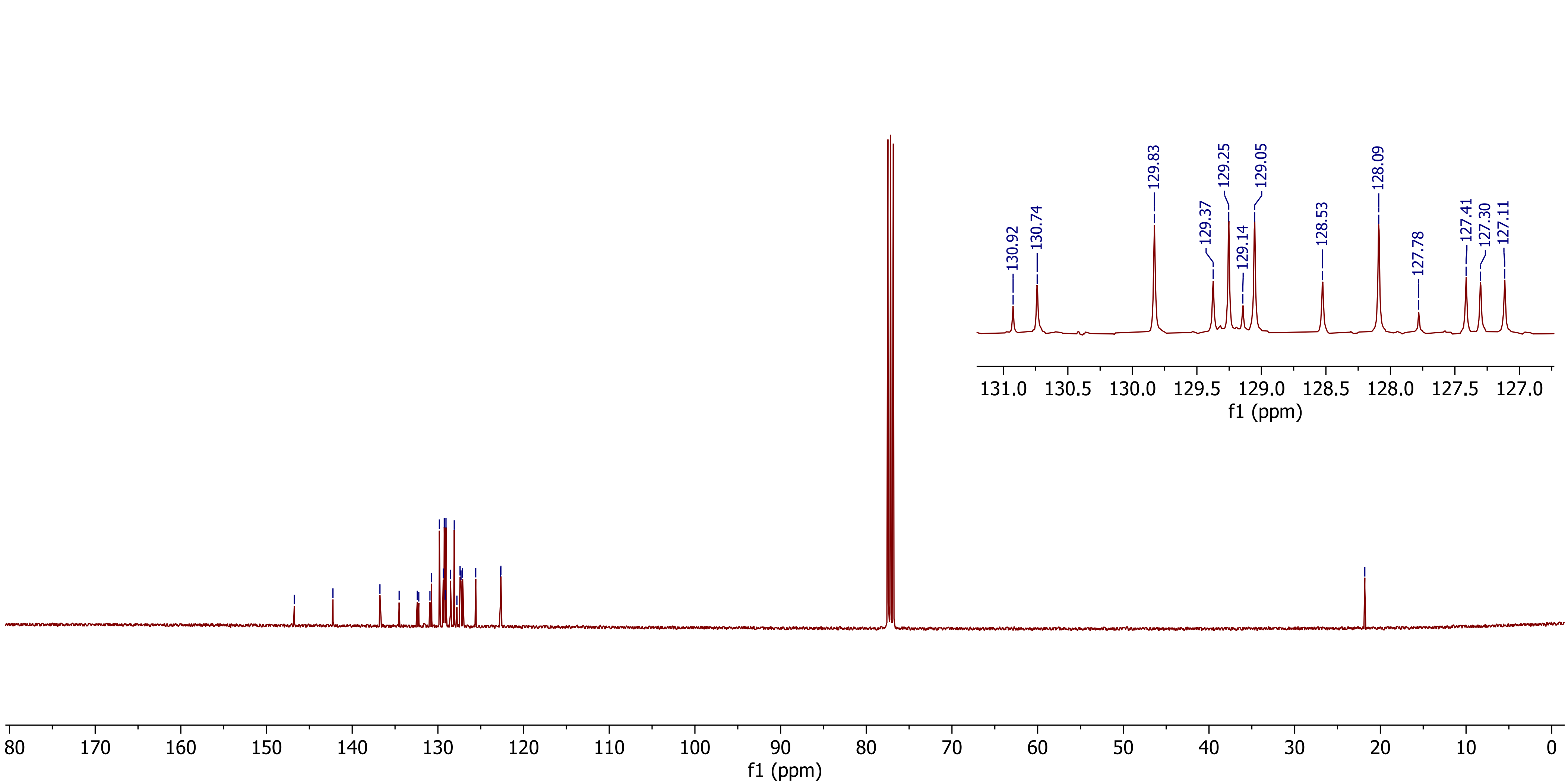

SePh
Ph

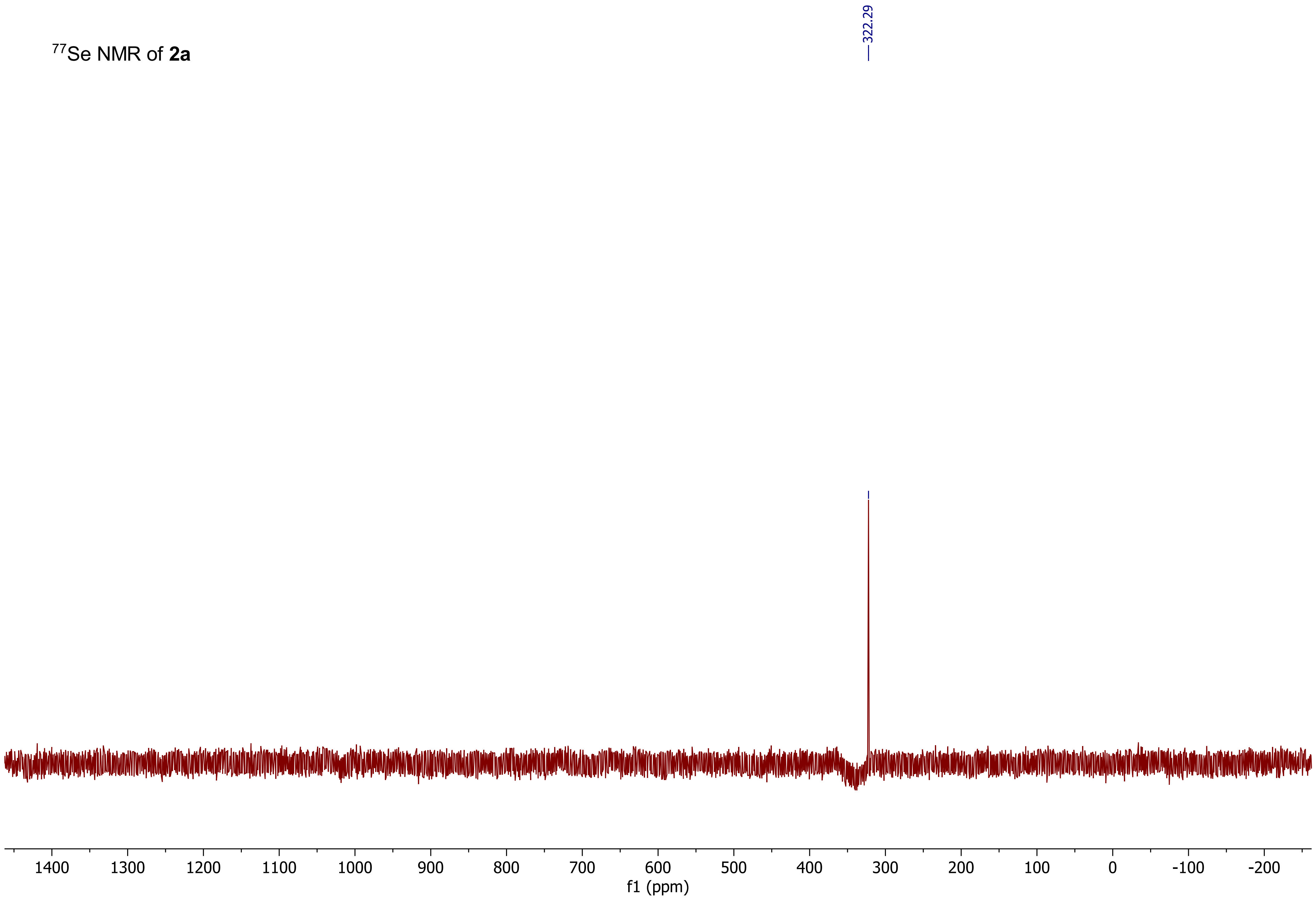
2a


8.74 8.72 8.69 8.67 8.65 7.68 7.67 7.66 7.66 7.65 7.64 7.64 7.56 7.54 7.52 7.46 7.45 7.44 7.43 7.43 7.42 7.25 7.24 7.24 7.23 7.22 7.21 7.06 7.04 7.02
2.41
1.16 2.06 1.14 2.17 3.22 3.18 5.27 3.00
f1 (ppm)

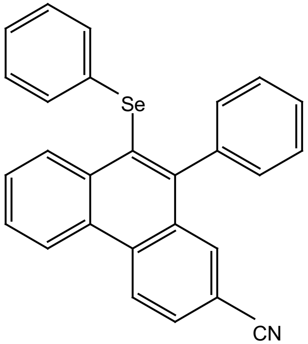

SePh
Ph

2a

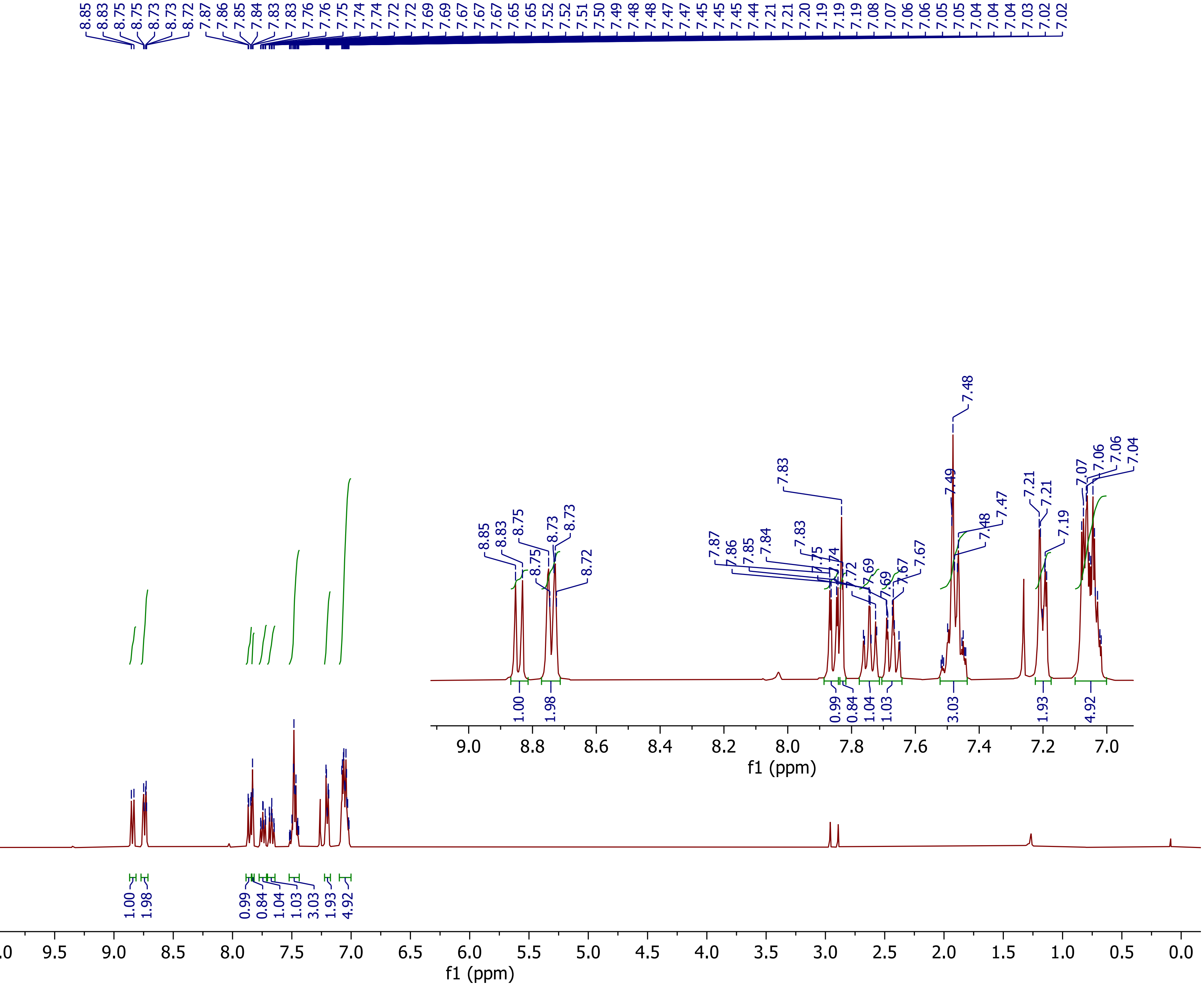

146.76
142.25
136.76
134.52
132.41
132.23
130.92
130.74
129.83
129.37
129.25
129.14
129.05
128.53
128.09
127.78
127.41
127.30
127.11
125.58
122.69
122.65
21.81
f1 (ppm)

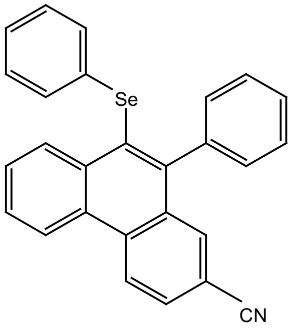


^{77}Se NMR of **2a**
322.29
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
-200
f1 (ppm)

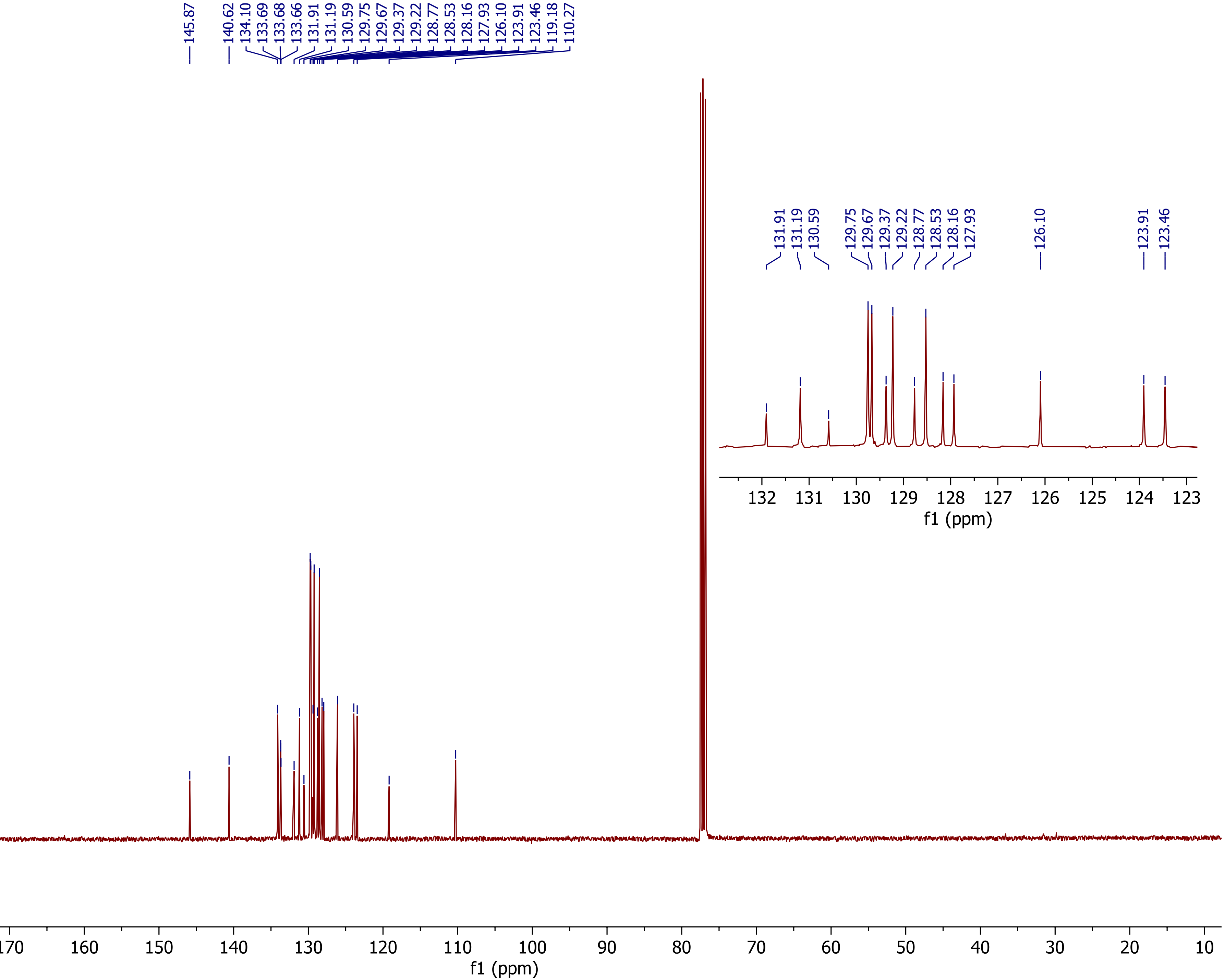

Se
CN

2b

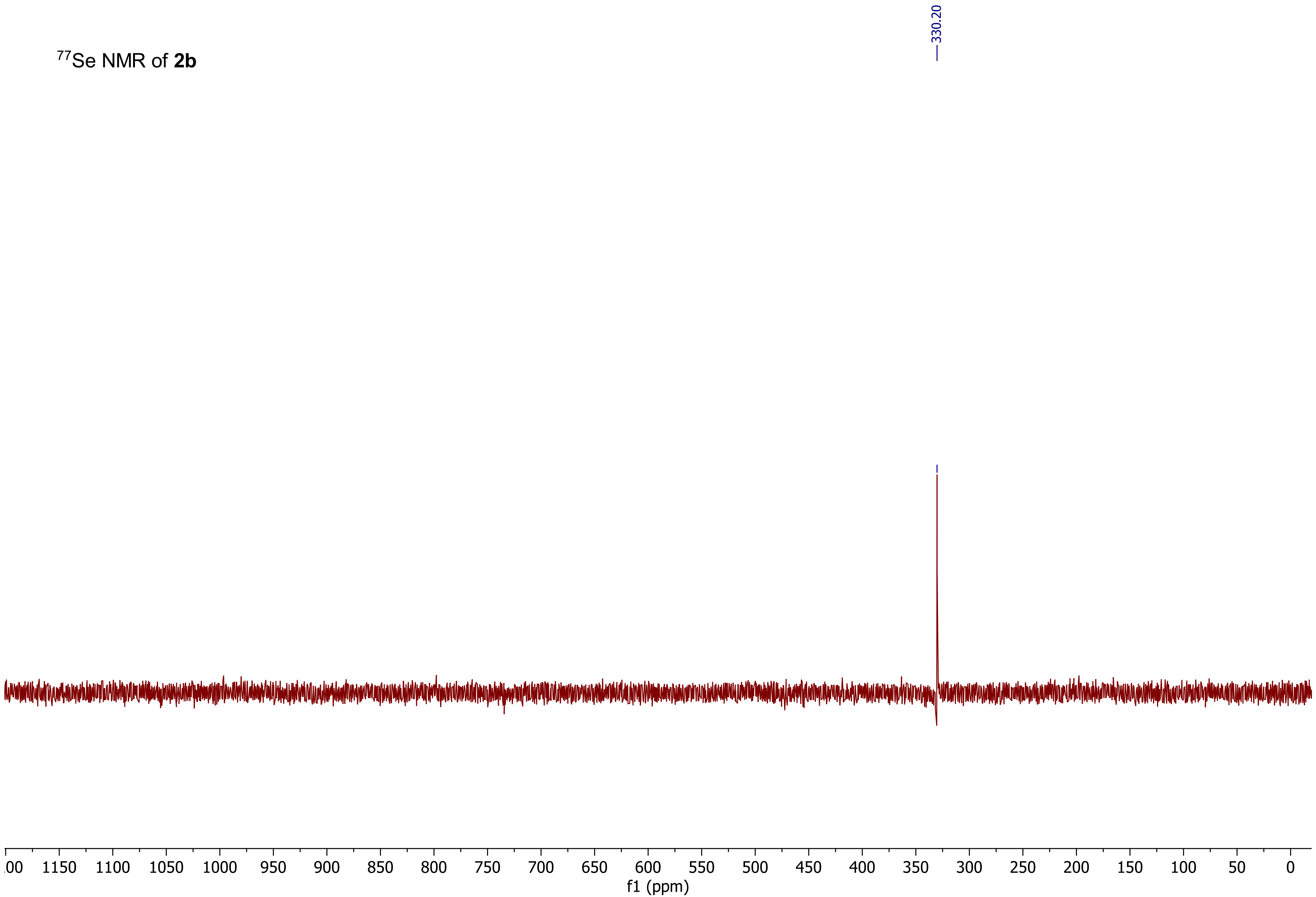

8.85 8.83 8.75 8.75 8.73 8.73 8.72 7.87 7.86 7.85 7.84 7.83 7.83 7.76 7.76 7.75 7.74 7.74 7.72 7.72 7.69 7.69 7.67 7.67 7.67 7.65 7.65 7.52 7.52 7.51 7.50 7.49 7.48 7.48 7.47 7.47 7.45 7.45 7.45 7.44 7.21 7.21 7.20 7.19 7.19 7.19 7.08 7.07 7.06 7.06 7.05 7.05 7.04 7.04 7.04 7.03 7.02 7.02
1.00 1.98 0.99 0.84 1.04 1.03 3.03 1.93 4.92
9.0 8.8 8.6 8.4 8.2 8.0 7.8 7.6 7.4 7.2 7.0
f1 (ppm)
11.5 11.0 10.5 10.0 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
f1 (ppm)

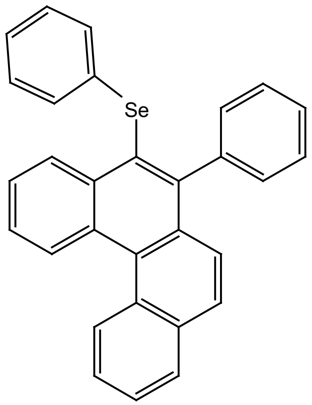

Se
CN

2b

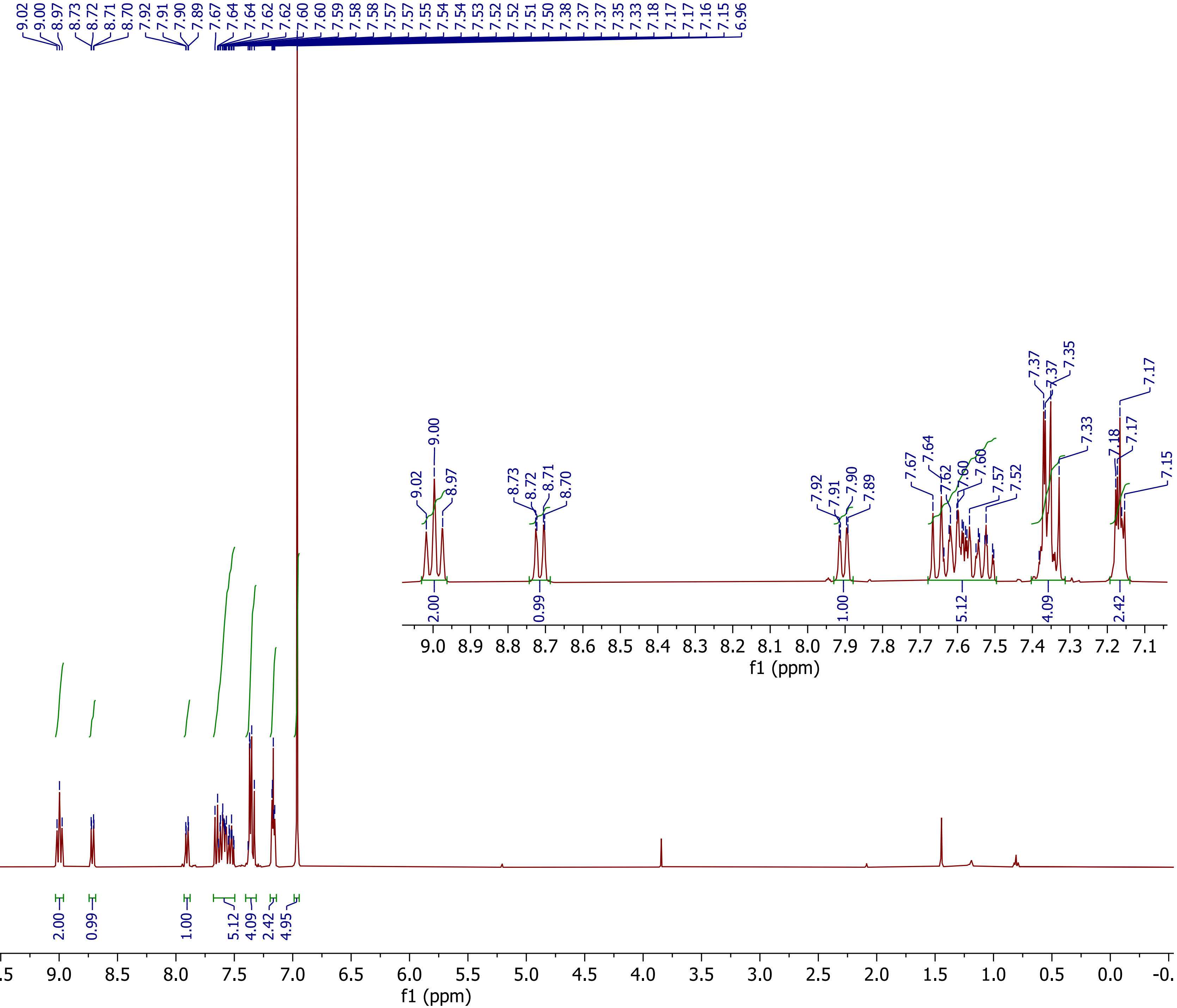

145.87
140.62
134.10
133.69
133.68
133.66
131.91
131.19
130.59
129.75
129.67
129.37
129.22
128.77
128.53
128.16
127.93
126.10
123.91
123.46
119.18
110.27
f1 (ppm)

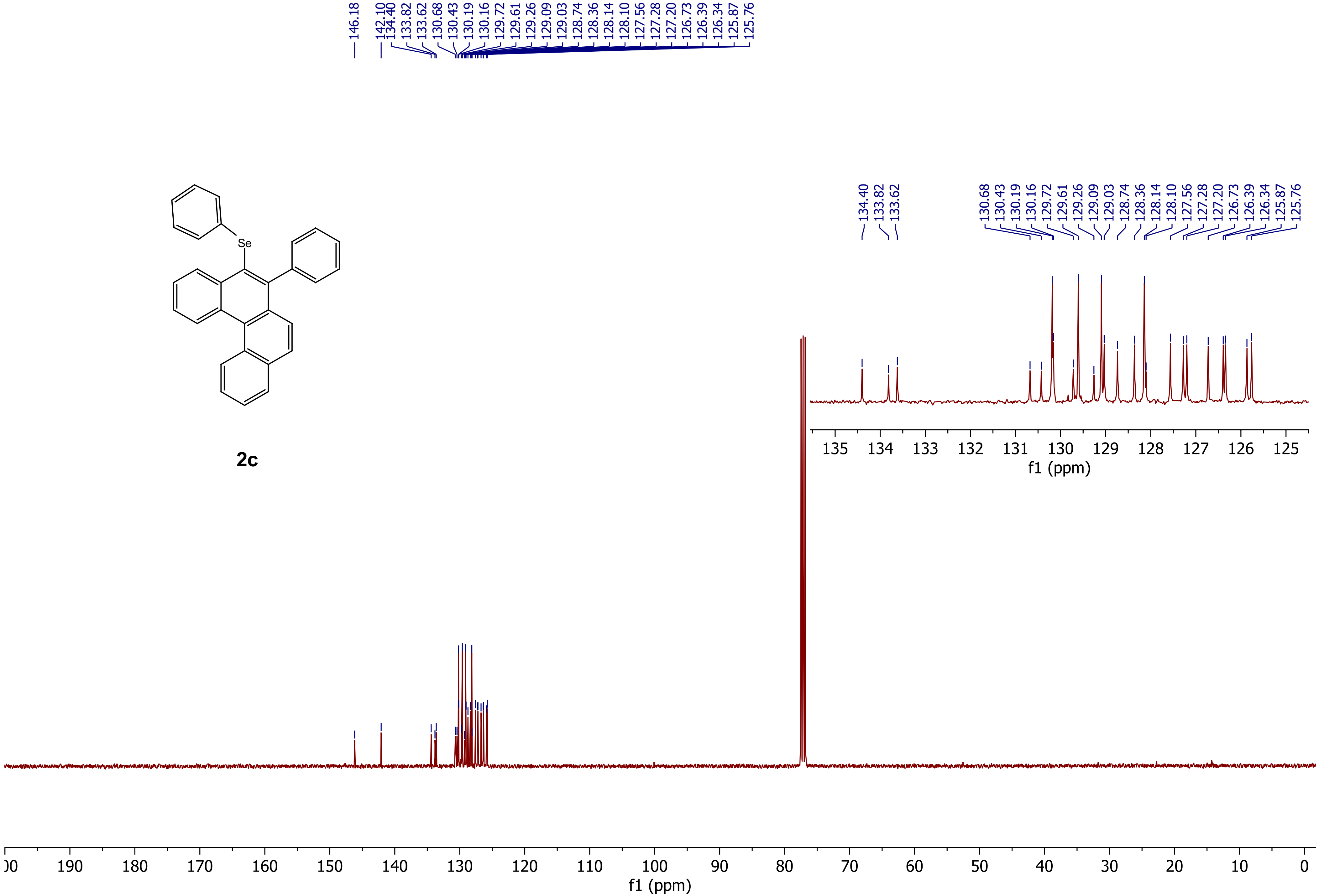
^{77}Se NMR of **2b**



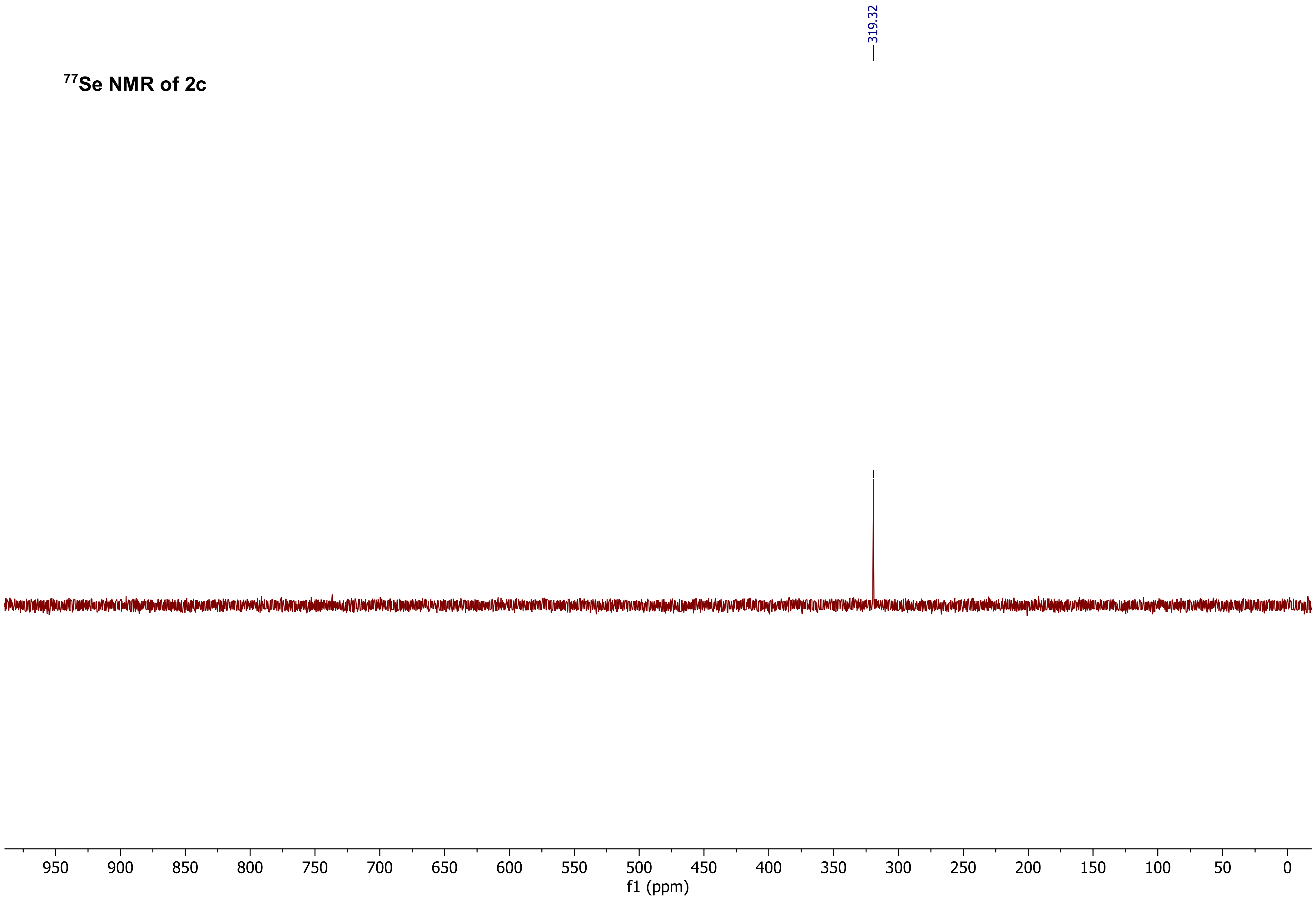


2c

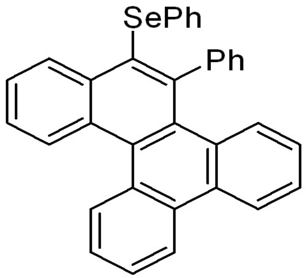

9.02 9.00 8.97 8.73 8.72 8.71 8.70 7.92 7.91 7.90 7.89 7.67 7.64 7.64 7.62 7.62 7.60 7.60 7.59 7.58 7.58 7.57 7.57 7.55 7.54 7.54 7.53 7.52 7.52 7.51 7.50 7.38 7.37 7.37 7.35 7.33 7.18 7.17 7.17 7.16 7.15 6.96
2.00 0.99 1.00 5.12 4.09 2.42 4.95
f1 (ppm)


Se
146.18
142.10
134.40
133.82
133.62
130.68
130.43
130.19
130.16
129.72
129.61
129.26
129.09
129.03
128.74
128.36
128.14
128.10
127.56
127.28
127.20
126.73
126.39
126.34
125.87
125.76
f1 (ppm)
f1 (ppm)

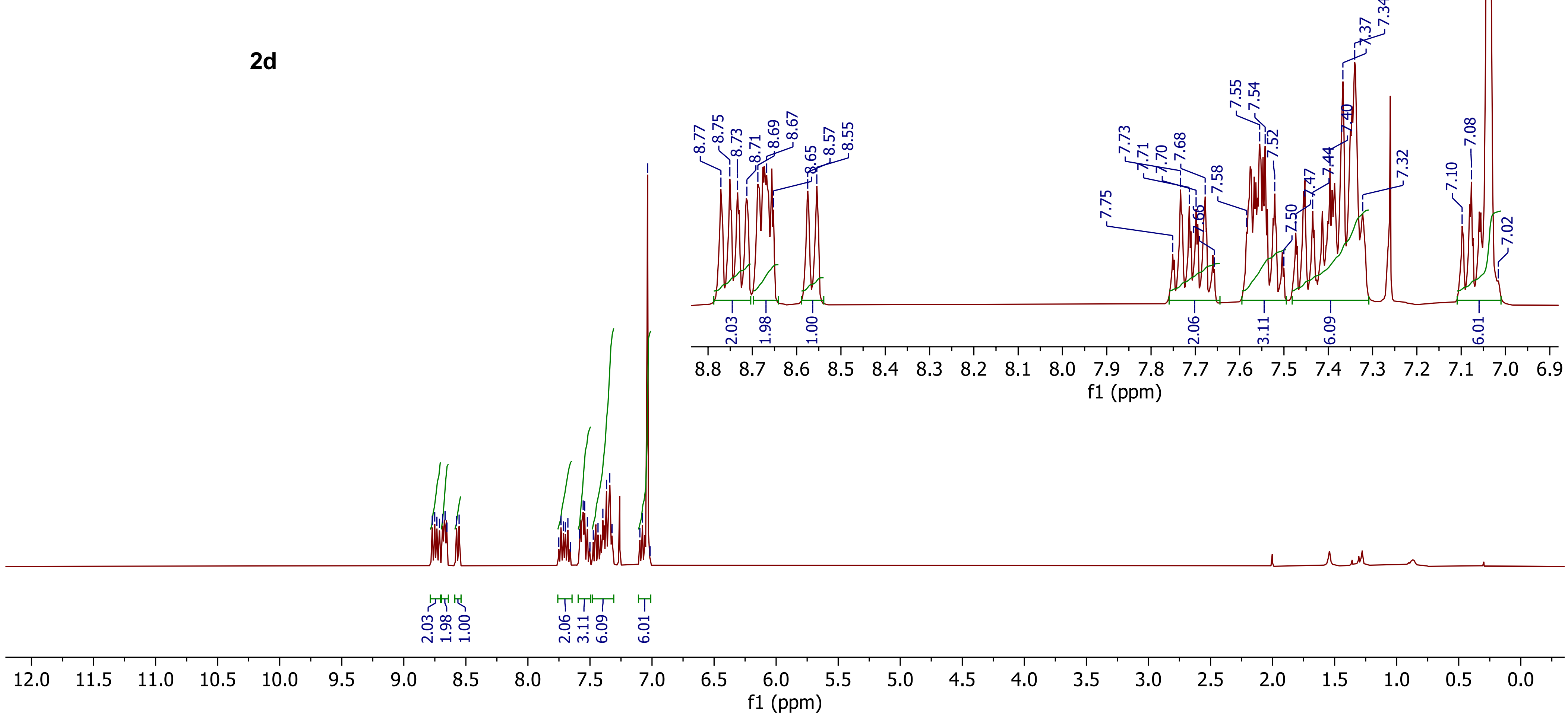
2c

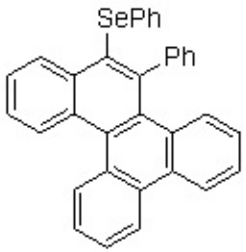


^{77}Se NMR of 2c
319.32
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
f1 (ppm)

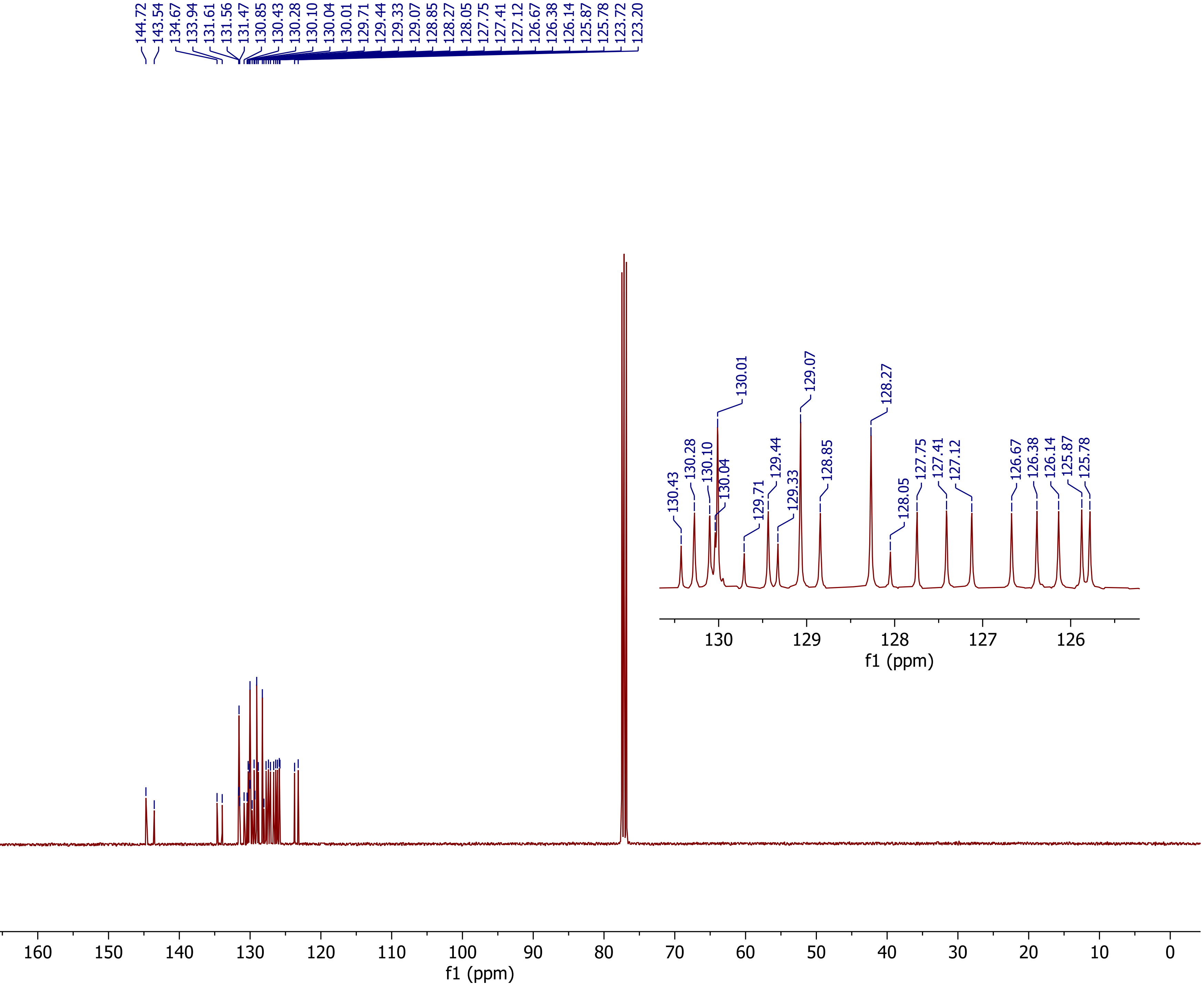

SePh
Ph

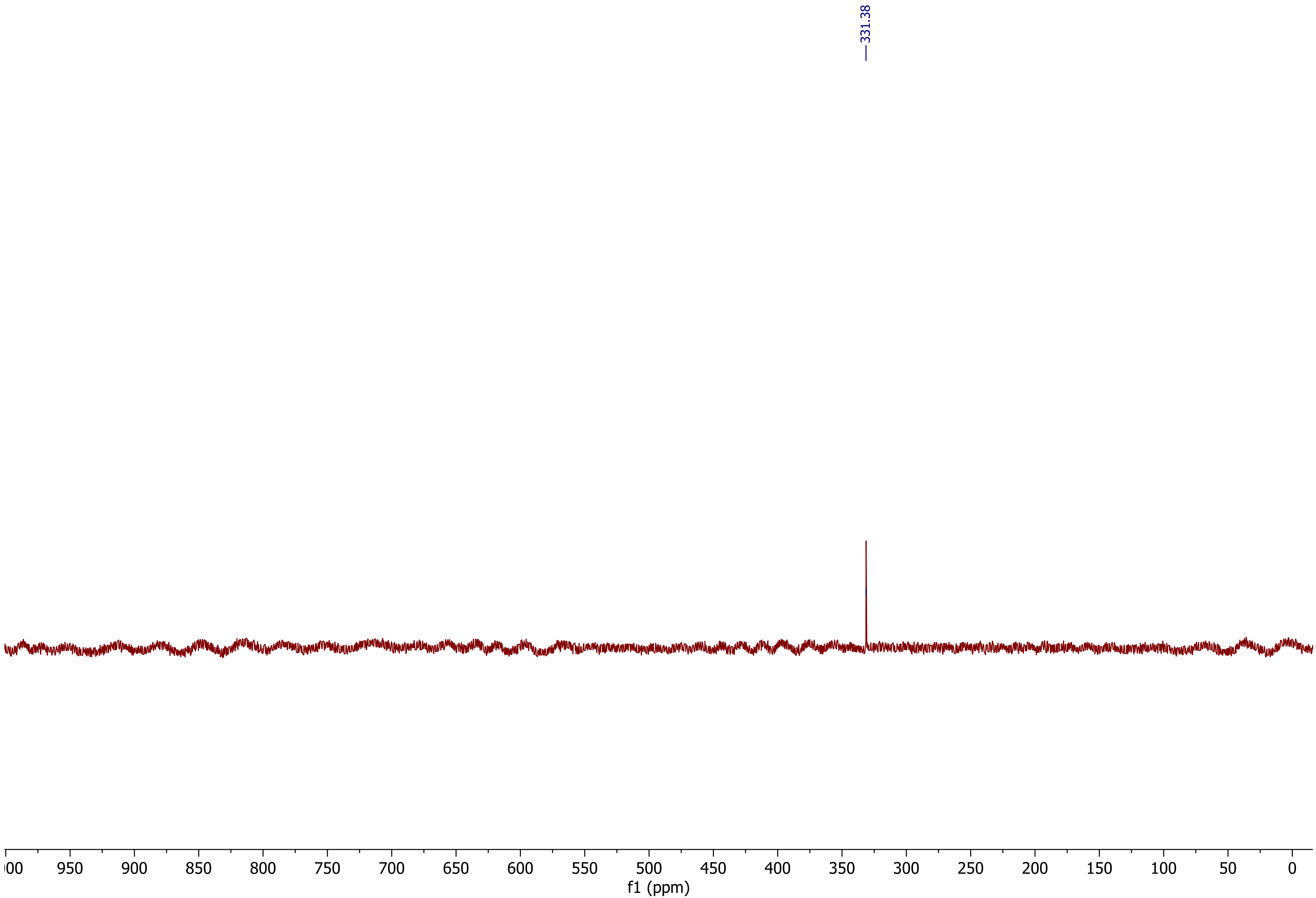
2d

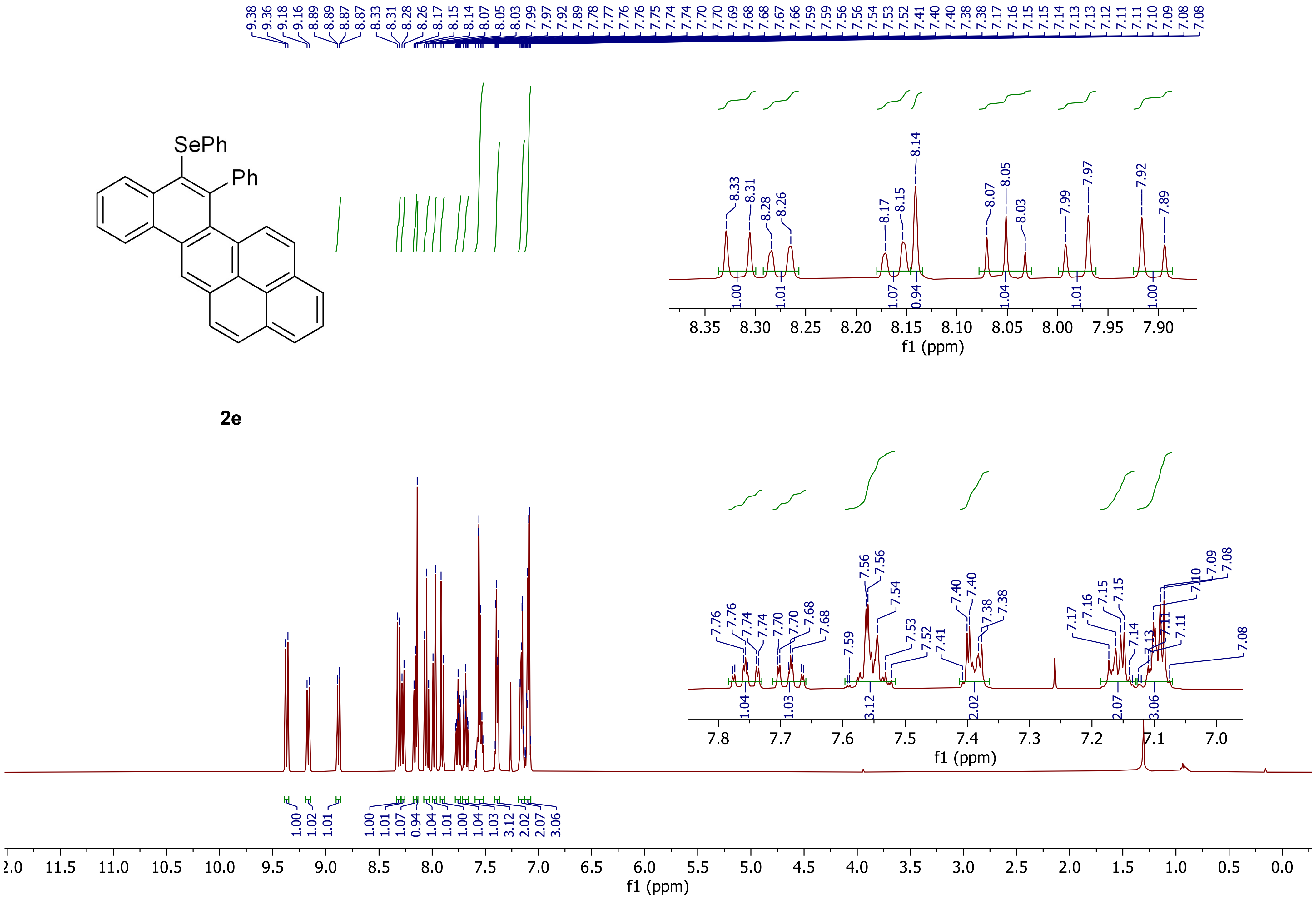

8.77 8.75 8.73 8.71 8.69 8.67 8.65 8.57 8.55 7.75 7.73 7.71 7.70 7.68 7.66 7.58 7.55 7.54 7.52 7.50 7.47 7.44 7.40 7.37 7.34 7.32 7.10 7.08 7.04 7.02
2.03
1.98
1.00
2.06
3.11
6.09
6.01
f1 (ppm)
f1 (ppm)

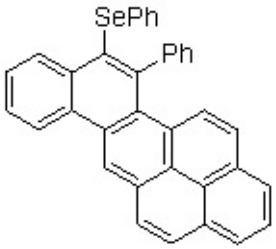

SePh
Ph

2d

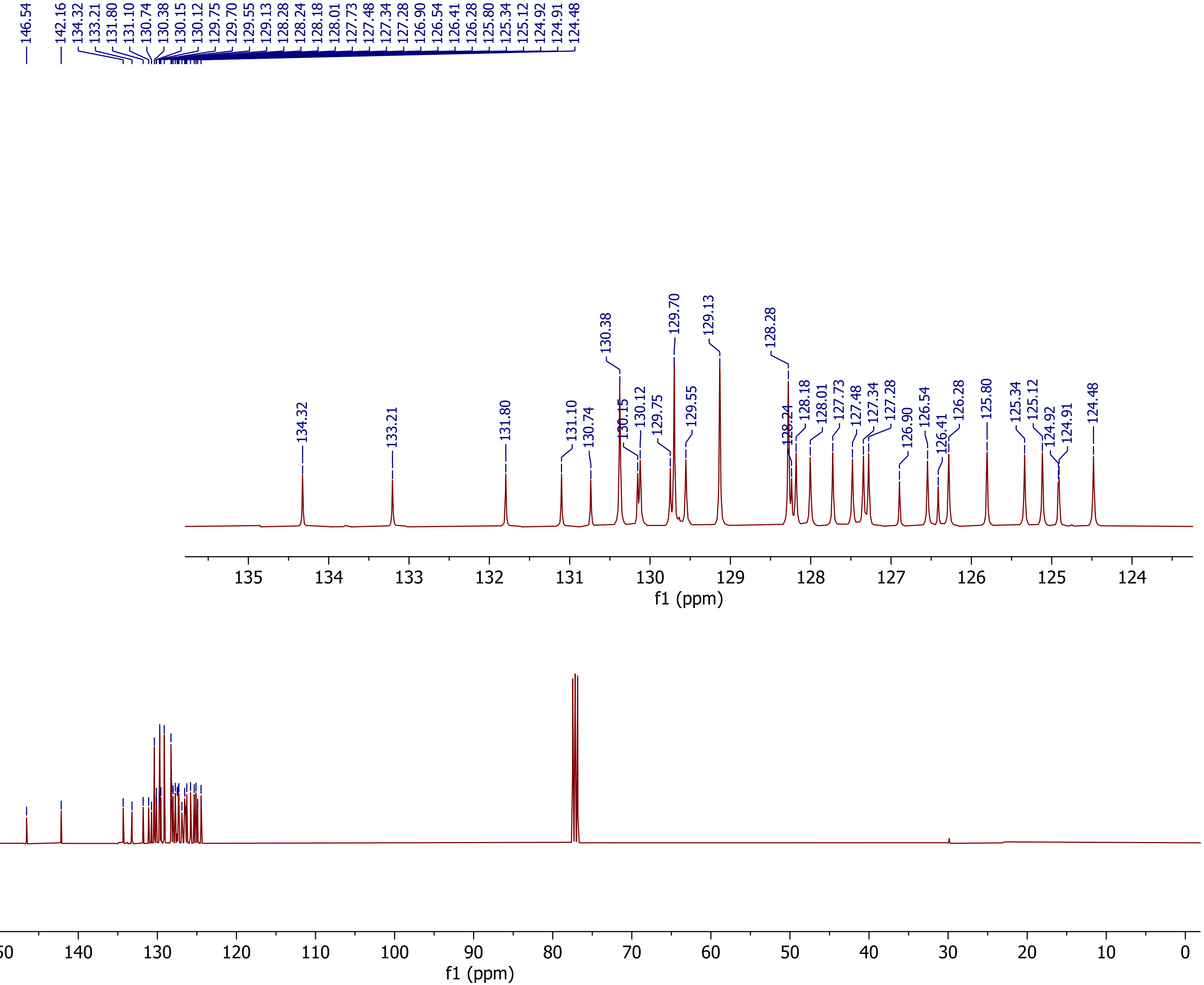

144.72
143.54
134.67
133.94
131.61
131.56
131.47
130.85
130.43
130.28
130.10
130.04
130.01
129.71
129.44
129.33
129.07
128.85
128.27
128.05
127.75
127.41
127.12
126.67
126.38
126.14
125.87
125.78
123.72
123.20
f1 (ppm)

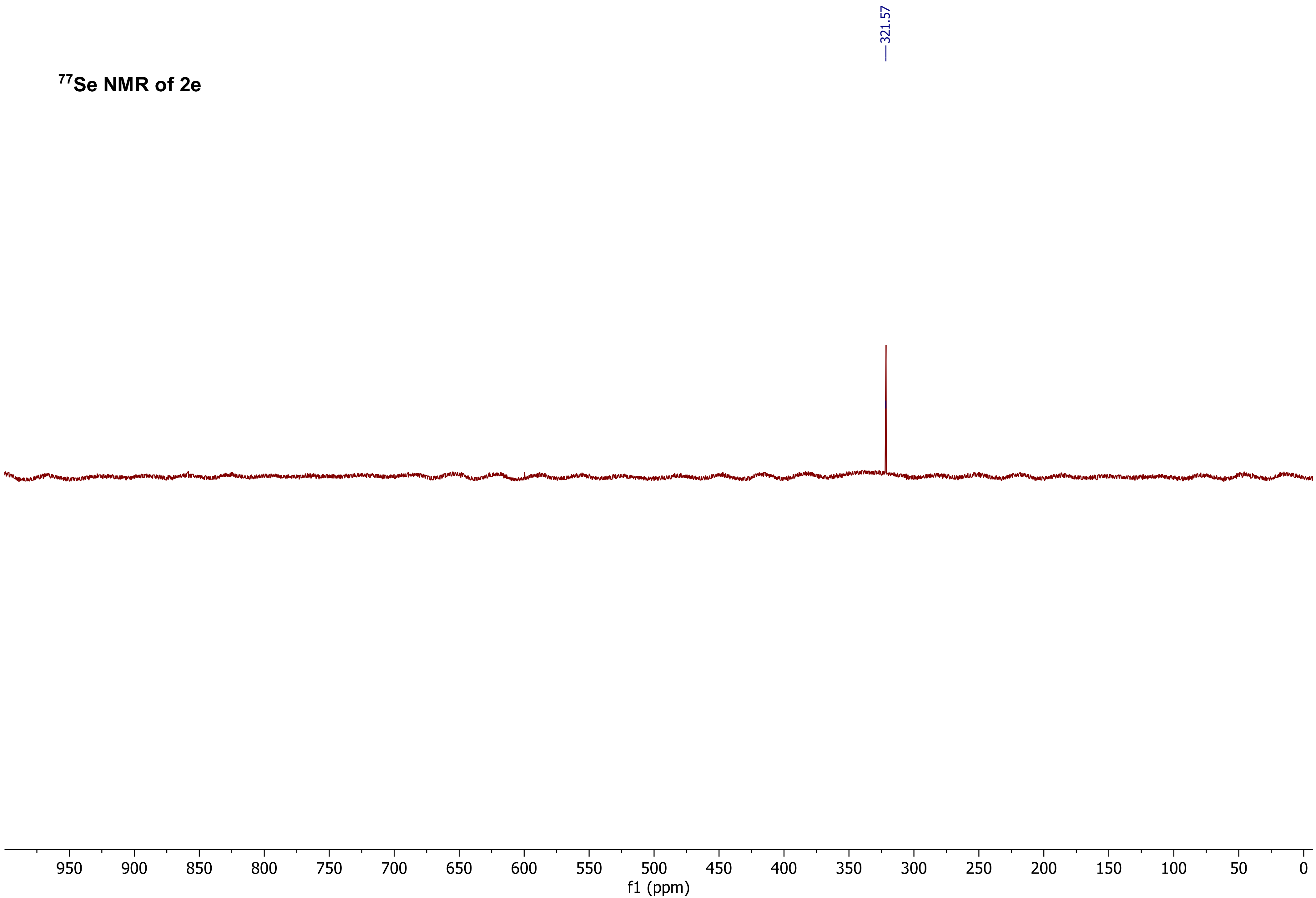

331.38
00
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
f1 (ppm)

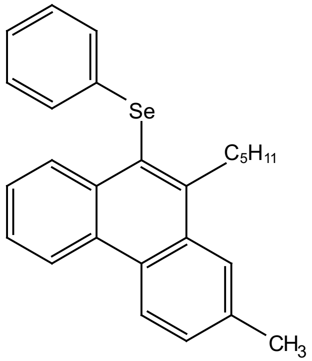

SePh
Ph
2e
f1 (ppm)



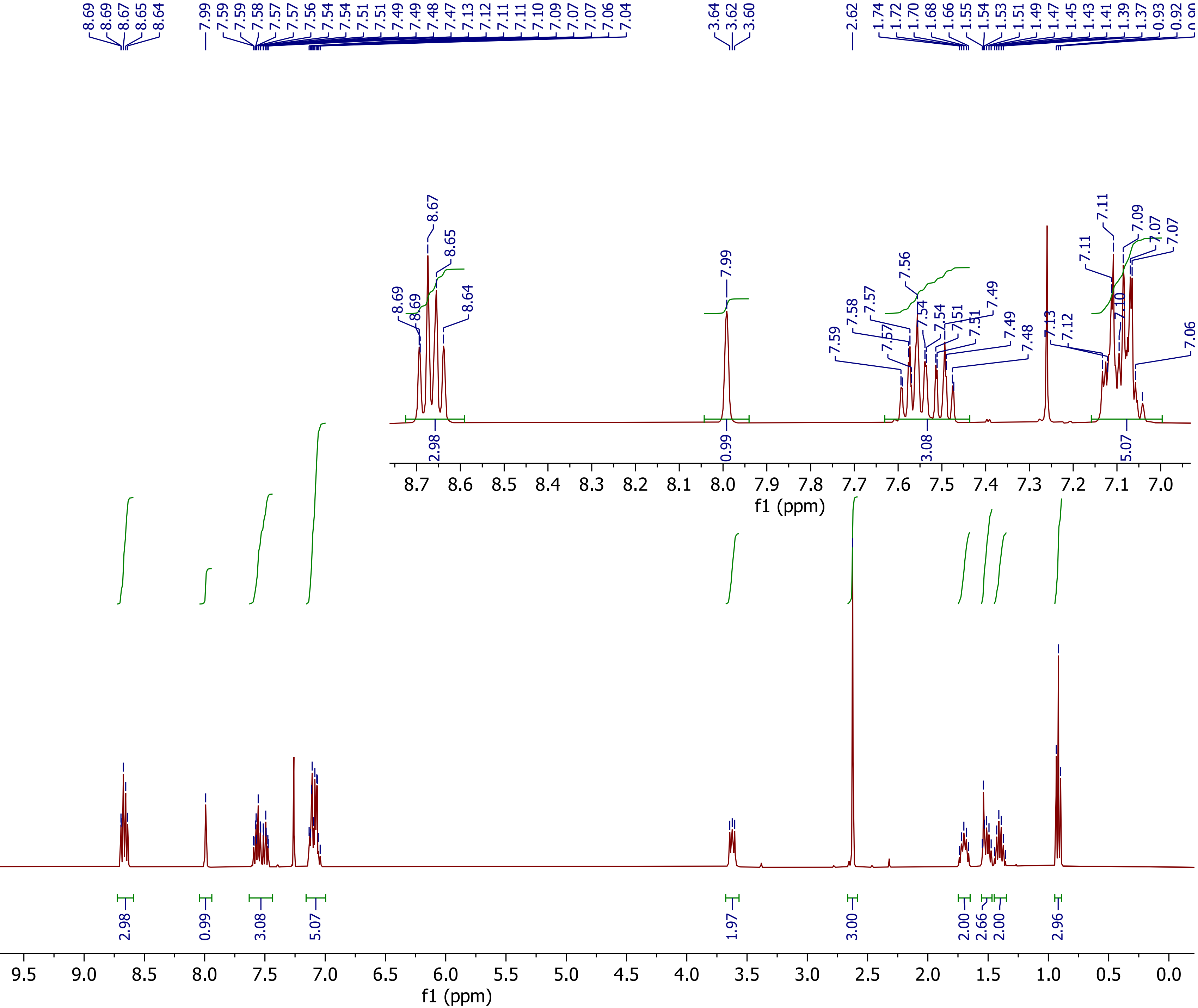
2e

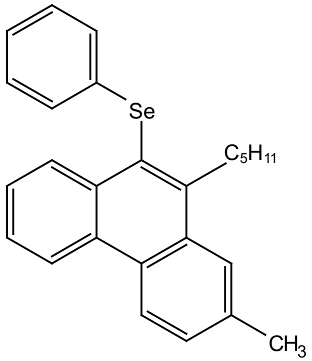

146.54
142.16
134.32
133.21
131.80
131.10
130.74
130.38
130.15
130.12
129.75
129.70
129.55
129.13
128.28
128.24
128.18
128.01
127.73
127.48
127.34
127.28
126.90
126.54
126.41
126.28
125.80
125.34
125.12
124.92
124.91
124.48
f1 (ppm)
f1 (ppm)


77Se NMR of 2e
321.57
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
f1 (ppm)

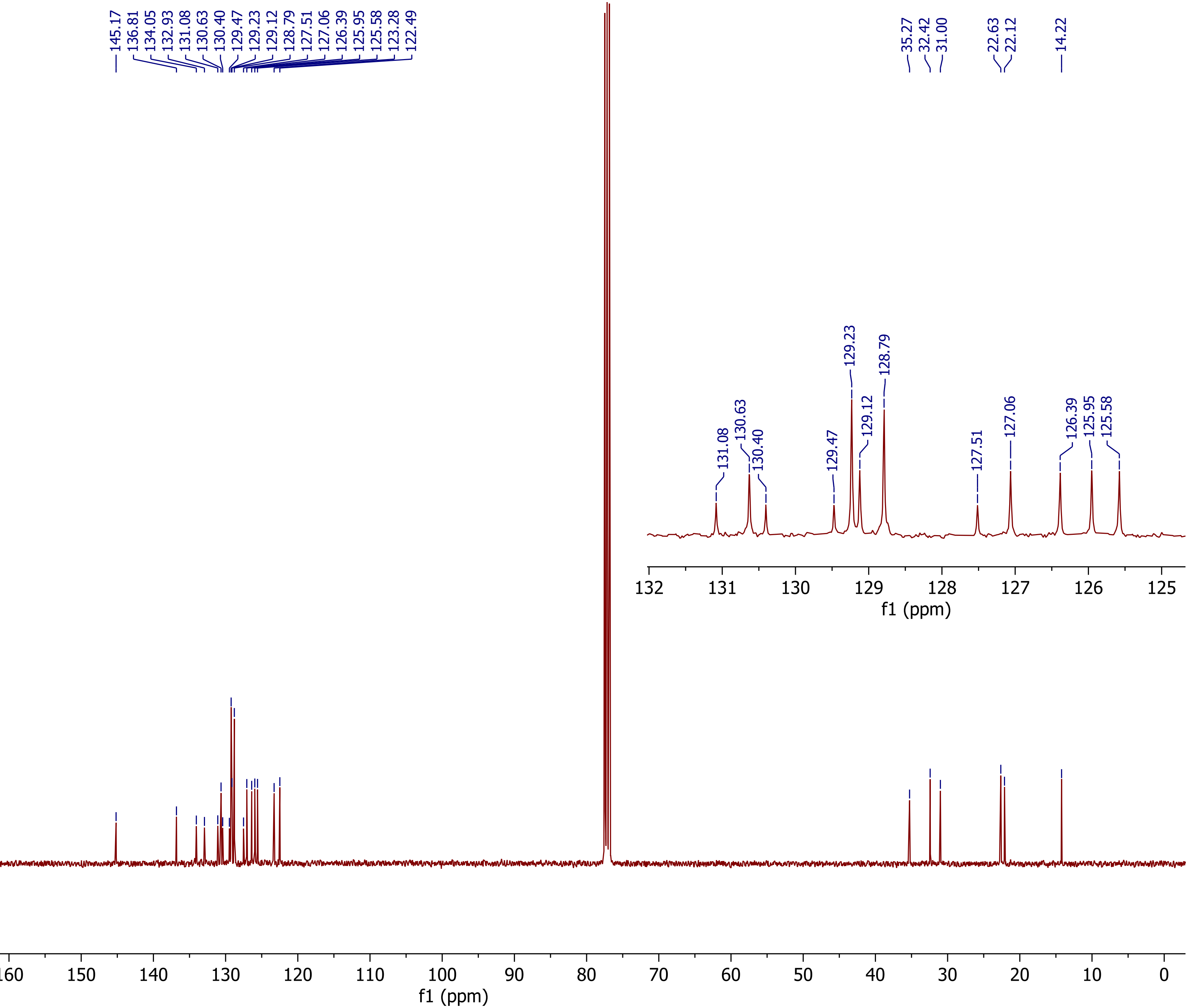

Se
C5H11
CH3

2f

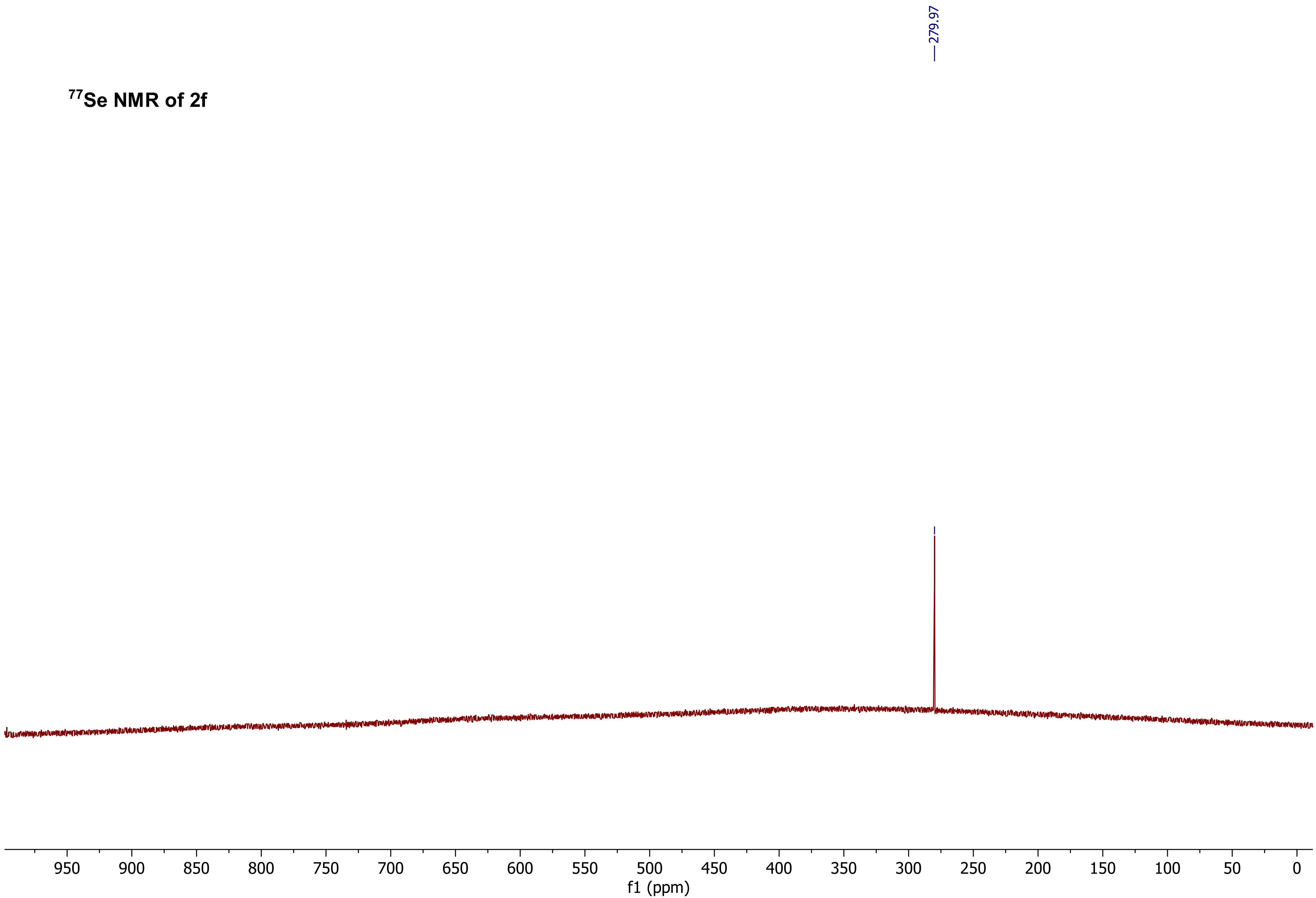

8.69 8.69 8.67 8.65 8.64 7.99 7.59 7.59 7.58 7.57 7.57 7.56 7.54 7.54 7.51 7.51 7.49 7.49 7.48 7.47 7.13 7.12 7.11 7.11 7.10 7.09 7.07 7.07 7.06 7.04 3.64 3.62 3.60 2.62 1.74 1.72 1.70 1.68 1.66 1.55 1.54 1.53 1.51 1.49 1.47 1.45 1.43 1.41 1.39 1.37 0.93 0.92
2.98
0.99
3.08
5.07
1.97
3.00
2.00
2.66
2.00
2.96
f1 (ppm)

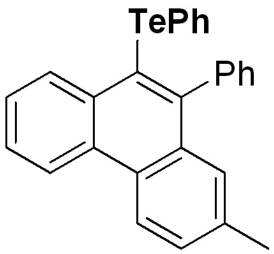

Se
C_5H_{11}
CH_3

2f

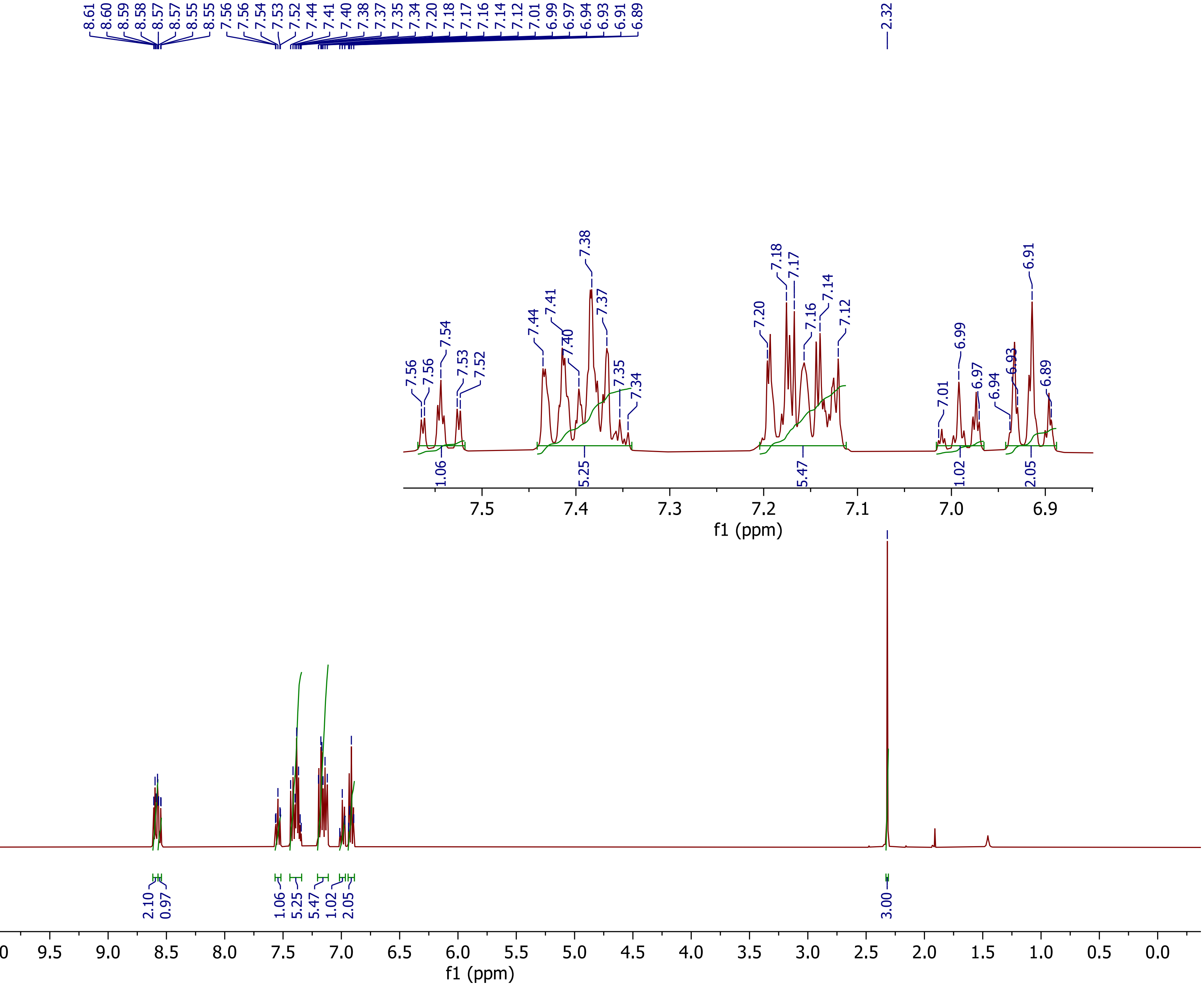

145.17
136.81
134.05
132.93
131.08
130.63
130.40
129.47
129.23
129.12
128.79
127.51
127.06
126.39
125.95
125.58
123.28
122.49
35.27
32.42
31.00
22.63
22.12
14.22
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)
131.08
130.63
130.40
129.47
129.23
129.12
128.79
127.51
127.06
126.39
125.95
125.58
132 131 130 129 128 127 126 125
f1 (ppm)

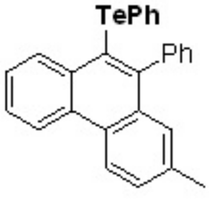
^{77}Se NMR of 2f



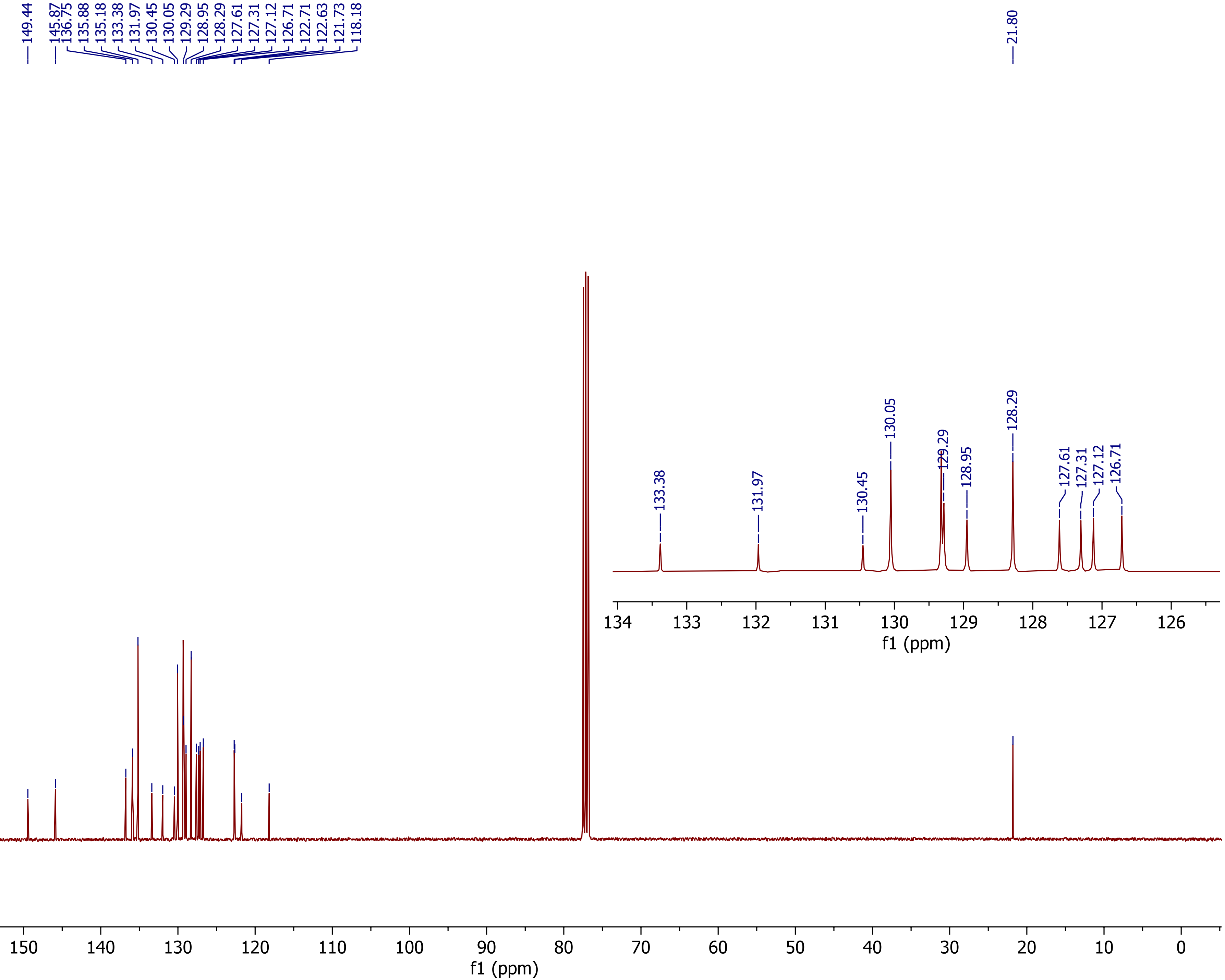

TePh
Ph

2g

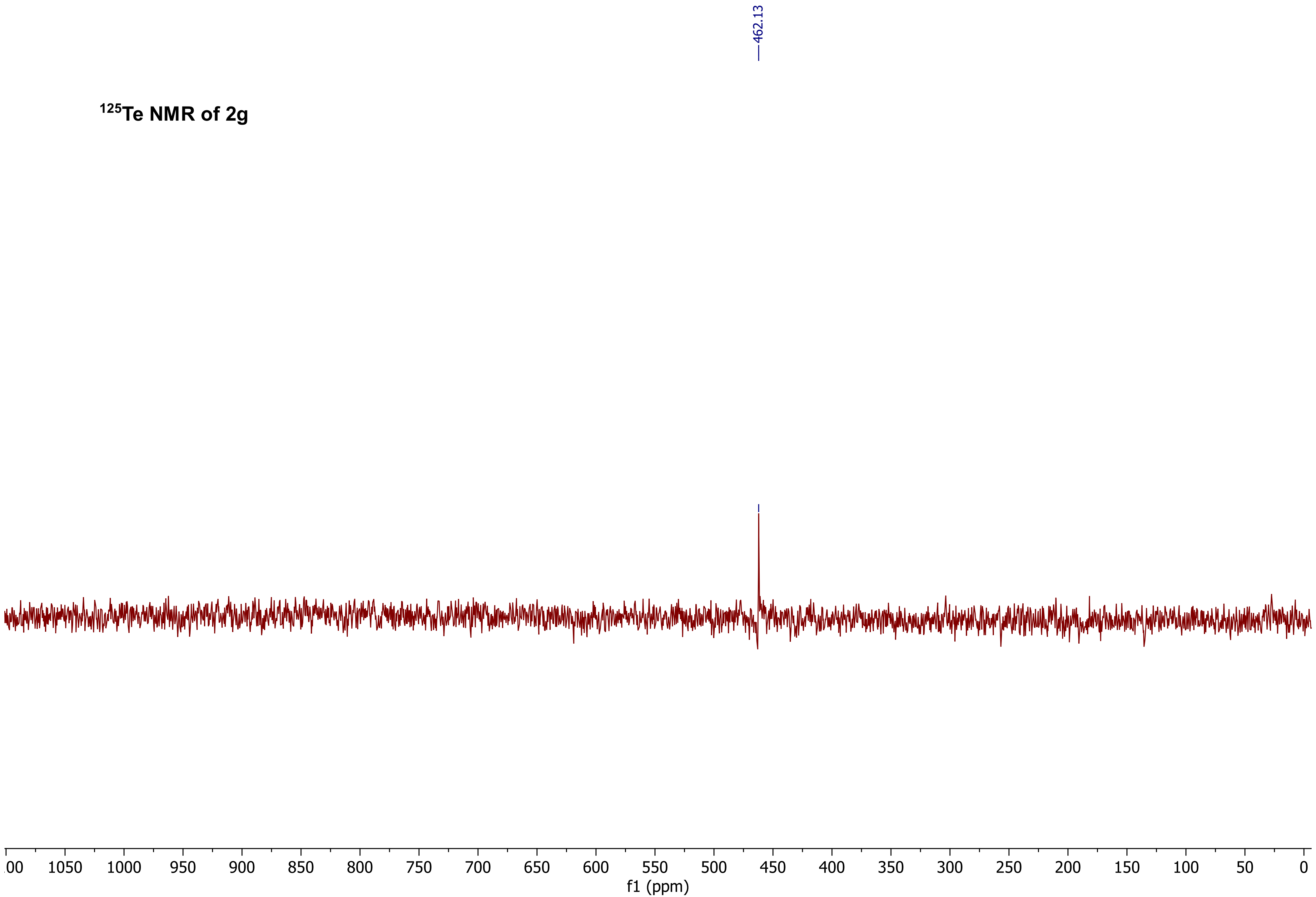

8.61 8.60 8.59 8.58 8.57 8.57 8.55 8.55 7.56 7.56 7.54 7.53 7.52 7.44 7.41 7.40 7.38 7.37 7.35 7.34 7.20 7.18 7.17 7.16 7.14 7.12 7.01 6.99 6.97 6.94 6.93 6.91 6.89
2.32
1.06
5.25
5.47
1.02
2.05
f1 (ppm)
2.10
0.97
3.00
f1 (ppm)



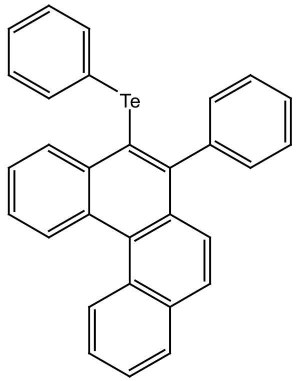
2g



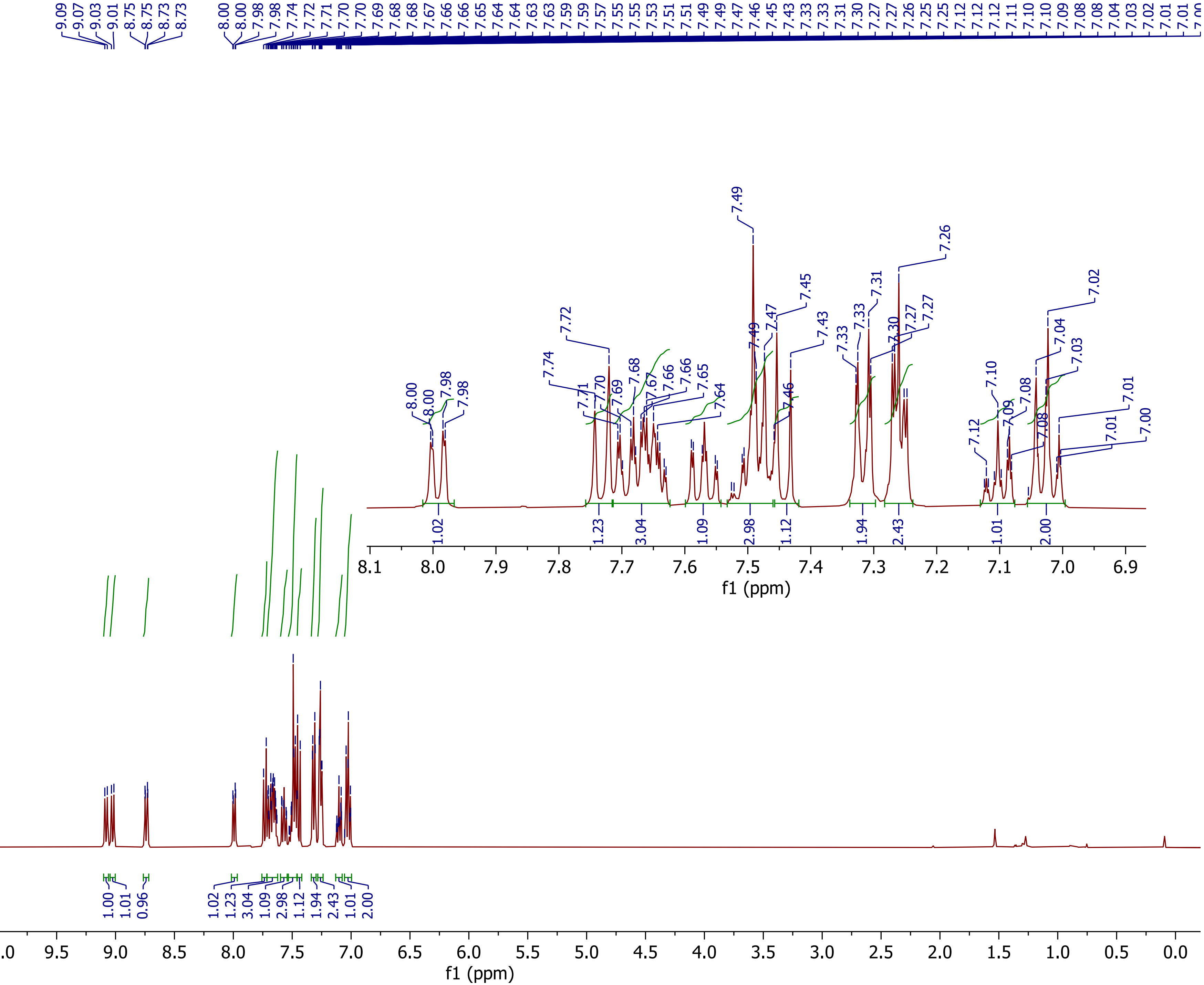
149.44
145.87
136.75
135.88
135.18
133.38
131.97
130.45
130.05
129.29
128.95
128.29
127.61
127.31
127.12
126.71
122.71
122.63
121.73
118.18
21.80
f1 (ppm)

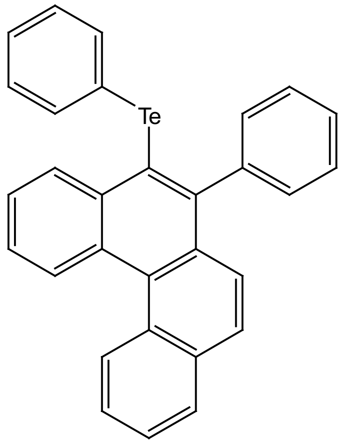


125Te NMR of 2g
462.13
00
1050
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
f1 (ppm)

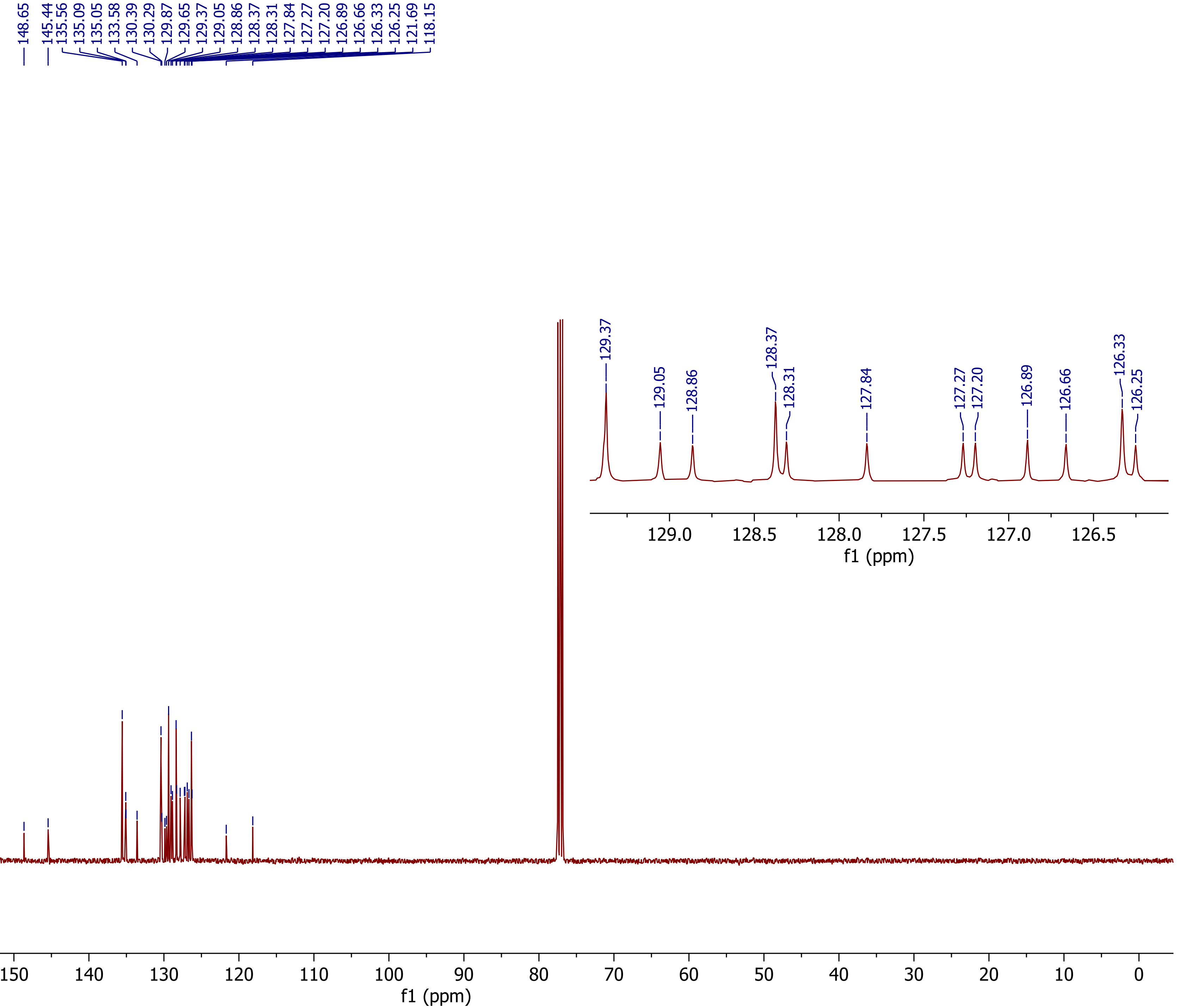


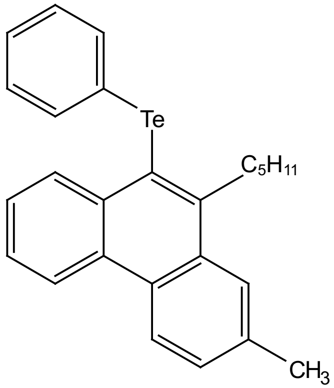
2h



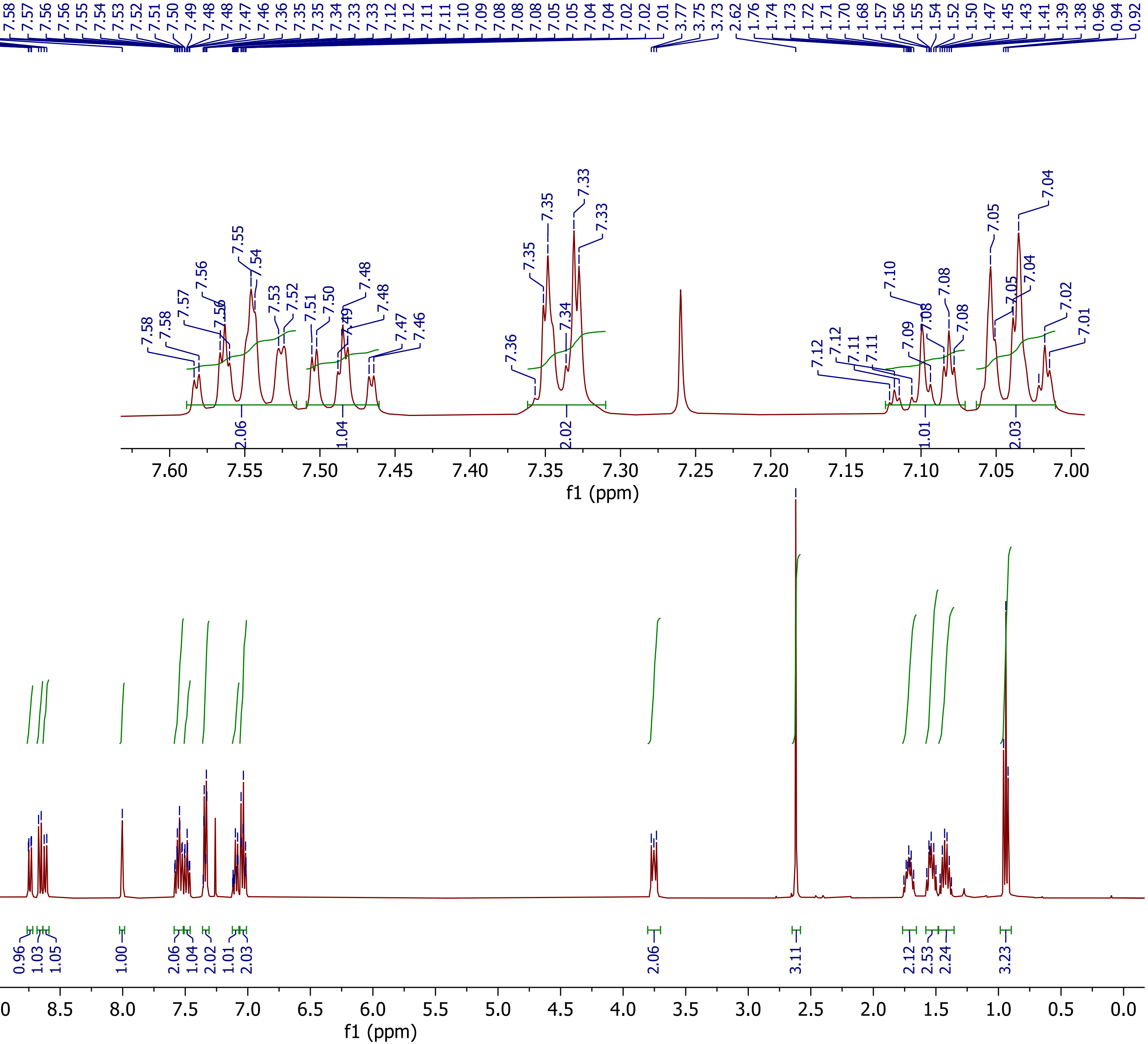

Te

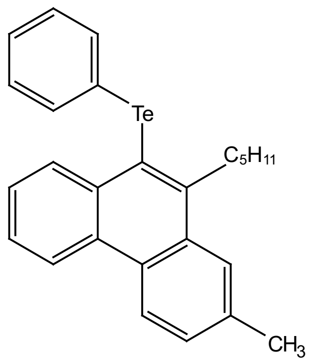
2h


148.65
145.44
135.56
135.09
135.05
133.58
130.39
130.29
129.87
129.65
129.37
129.05
128.86
128.37
128.31
127.84
127.27
127.20
126.89
126.66
126.33
126.25
121.69
118.15
129.0
128.5
128.0
127.5
127.0
126.5
f1 (ppm)
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

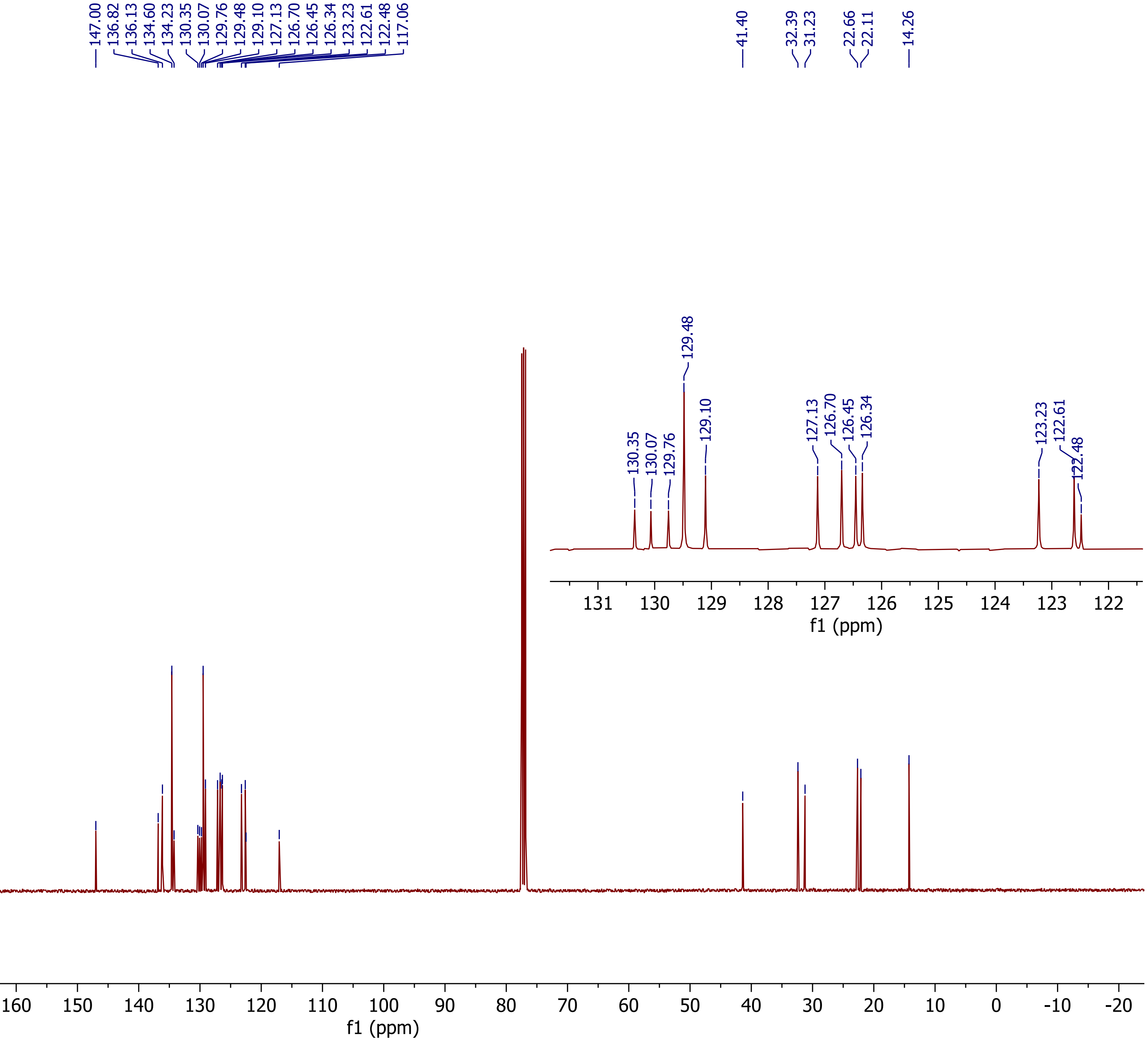

Te
C5H11
CH3

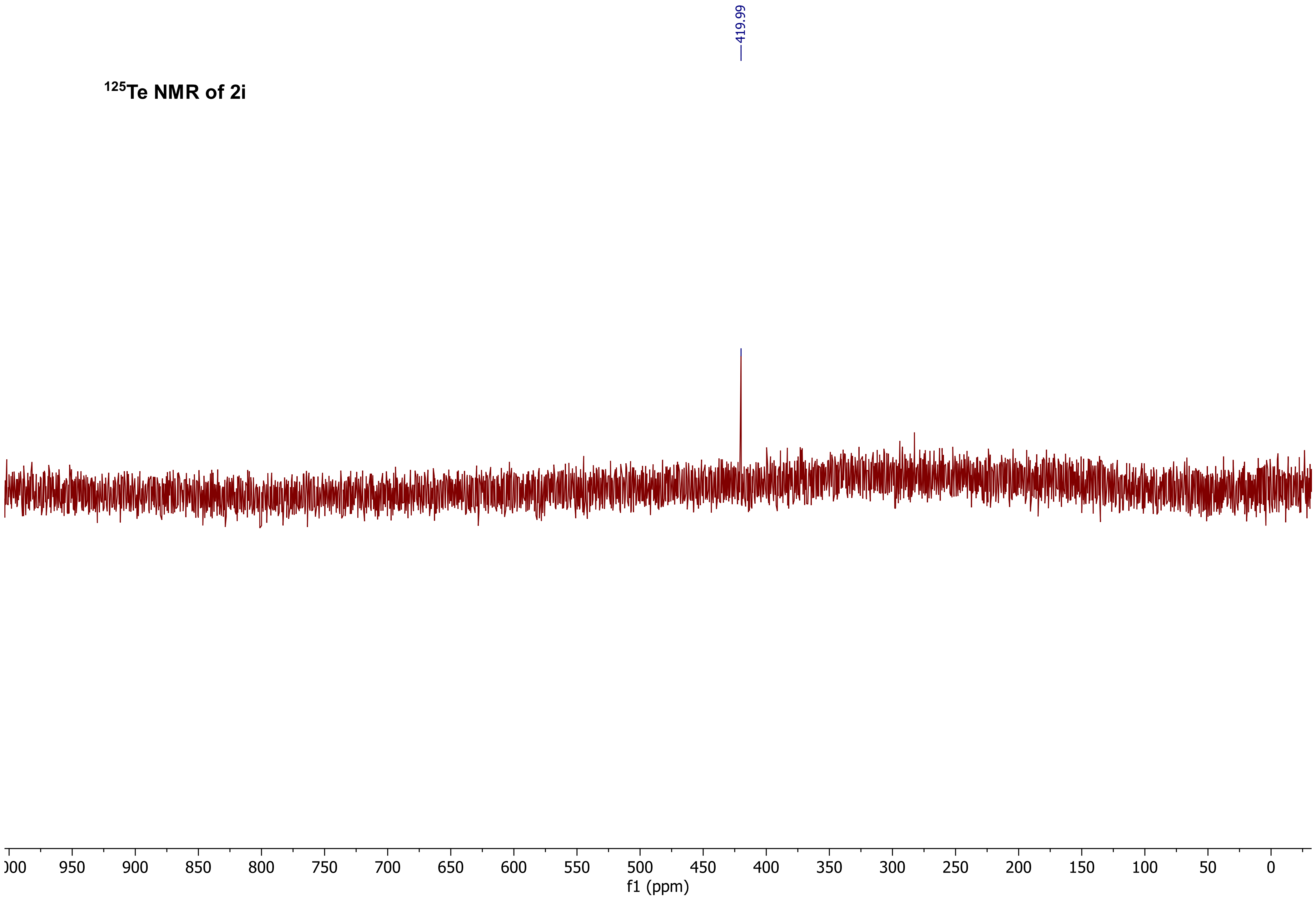
2i


8.75 8.75 8.73 8.73 8.67 8.65 8.63 8.61 8.00 7.58 7.58 7.57 7.56 7.56 7.55 7.54 7.53 7.52 7.51 7.50 7.49 7.48 7.48 7.47 7.46 7.36 7.35 7.35 7.34 7.33 7.33 7.12 7.12 7.11 7.11 7.10 7.09 7.08 7.08 7.05 7.05 7.04 7.04 7.02 7.01 3.77 3.75 3.73 2.62 1.76 1.74 1.73 1.72 1.71 1.70 1.68 1.57 1.56 1.55 1.54 1.52 1.50 1.47 1.45 1.43 1.41 1.39 1.38 0.96 0.94 0.92
2.06
1.04
2.02
1.01
2.03
7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00
f1 (ppm)
0.96 1.03 1.05 1.00 2.06 1.04 2.02 1.01 2.03 2.06 3.11 2.12 2.53 2.24 3.23
2.0 11.5 11.0 10.5 10.0 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
f1 (ppm)

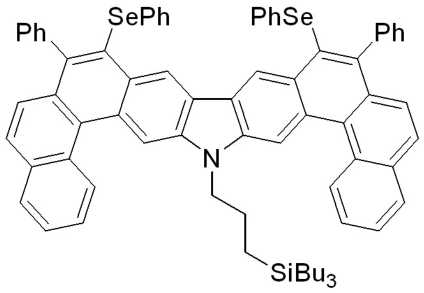

Te
C5H11
CH3

2i

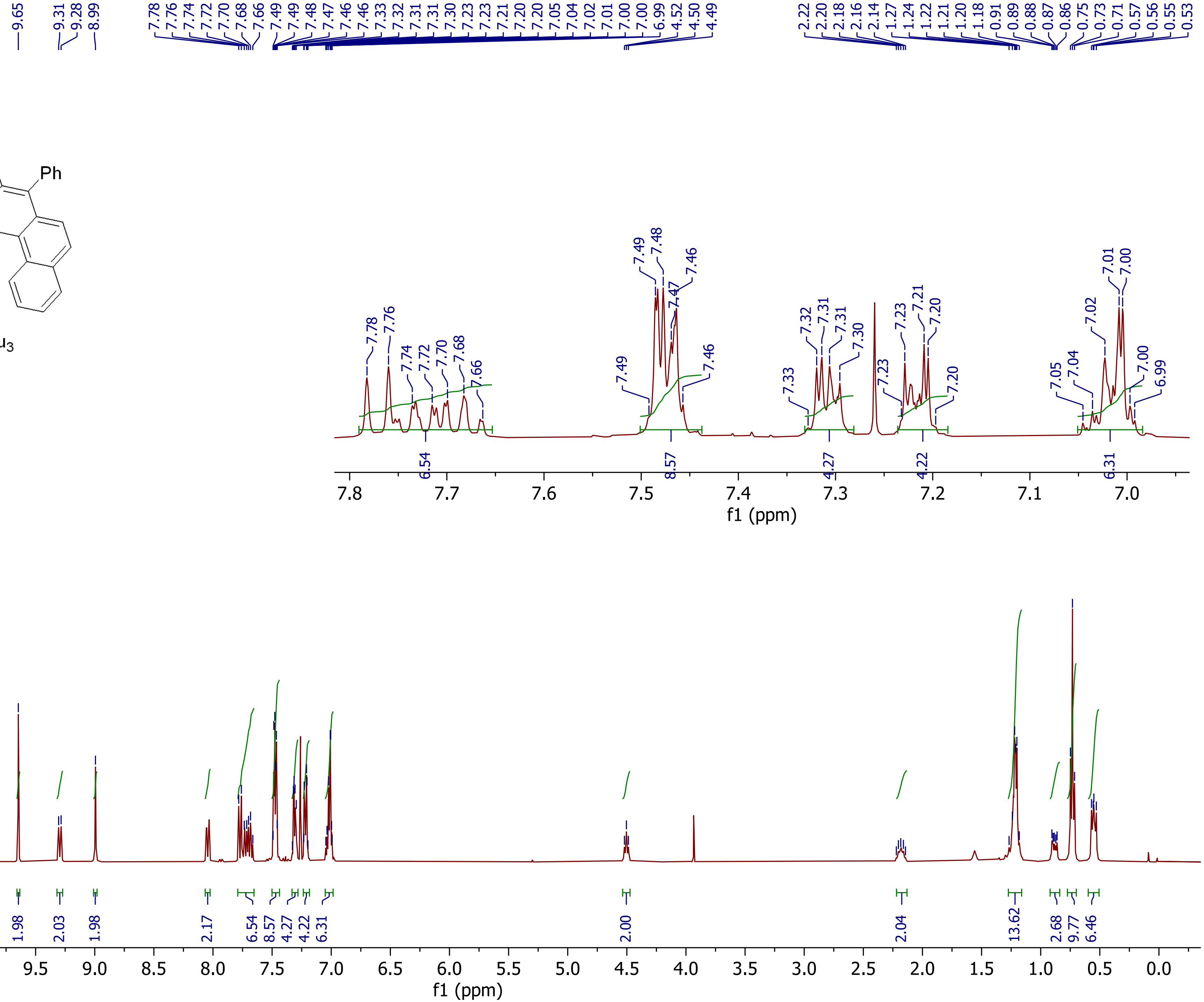

147.00
136.82
136.13
134.60
134.23
130.35
130.07
129.76
129.48
129.10
127.13
126.70
126.45
126.34
123.23
122.61
122.48
117.06
41.40
32.39
31.23
22.66
22.11
14.26
130.35
130.07
129.76
129.48
129.10
127.13
126.70
126.45
126.34
123.23
122.61
122.48
131 130 129 128 127 126 125 124 123 122
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

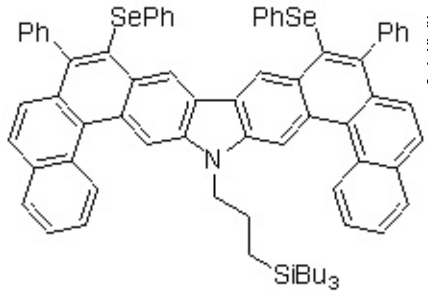


^{125}Te NMR of 2i
419.99
f1 (ppm)
000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0

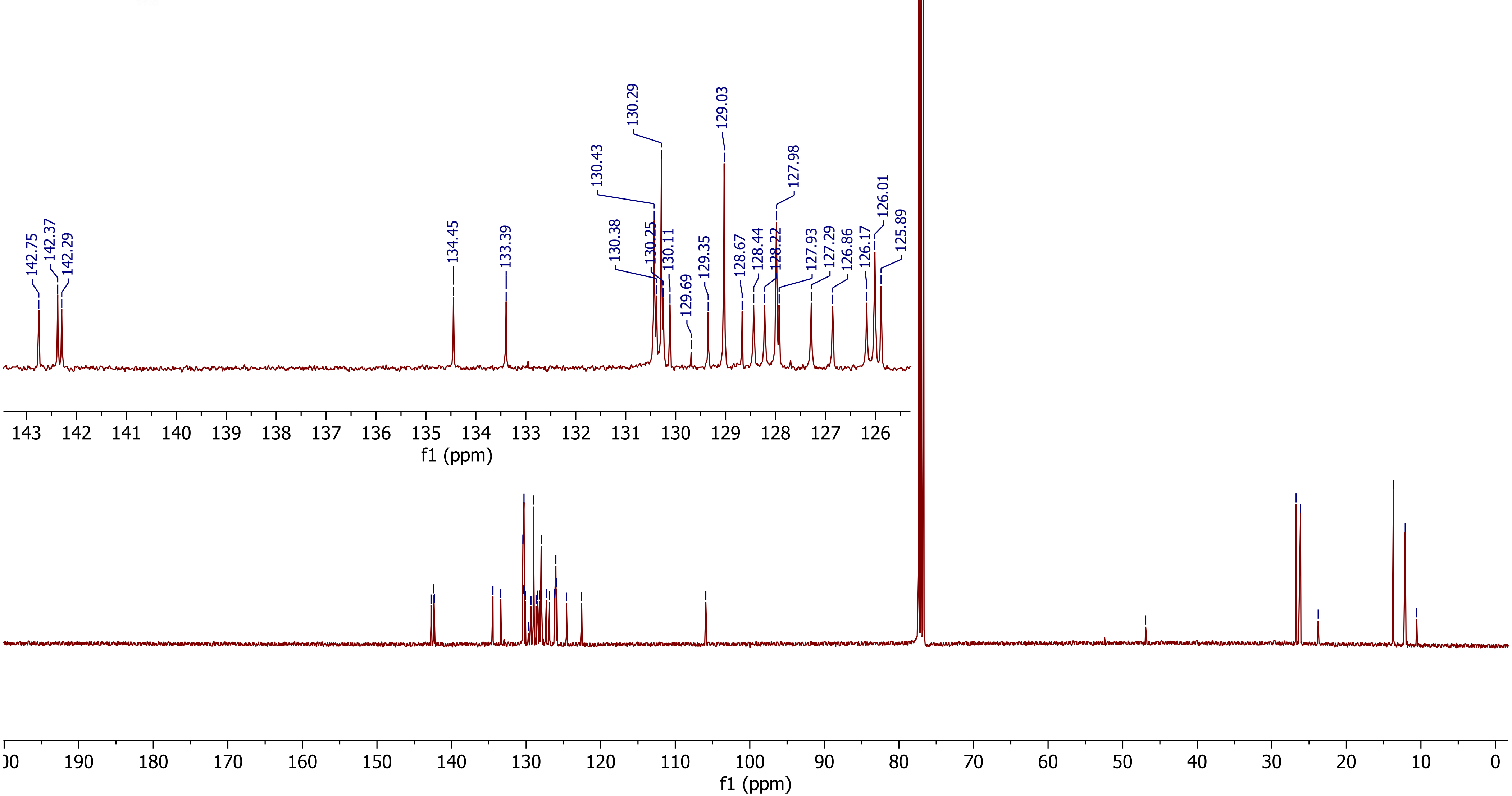

Ph
SePh
PhSe
Ph
N
SiBu3

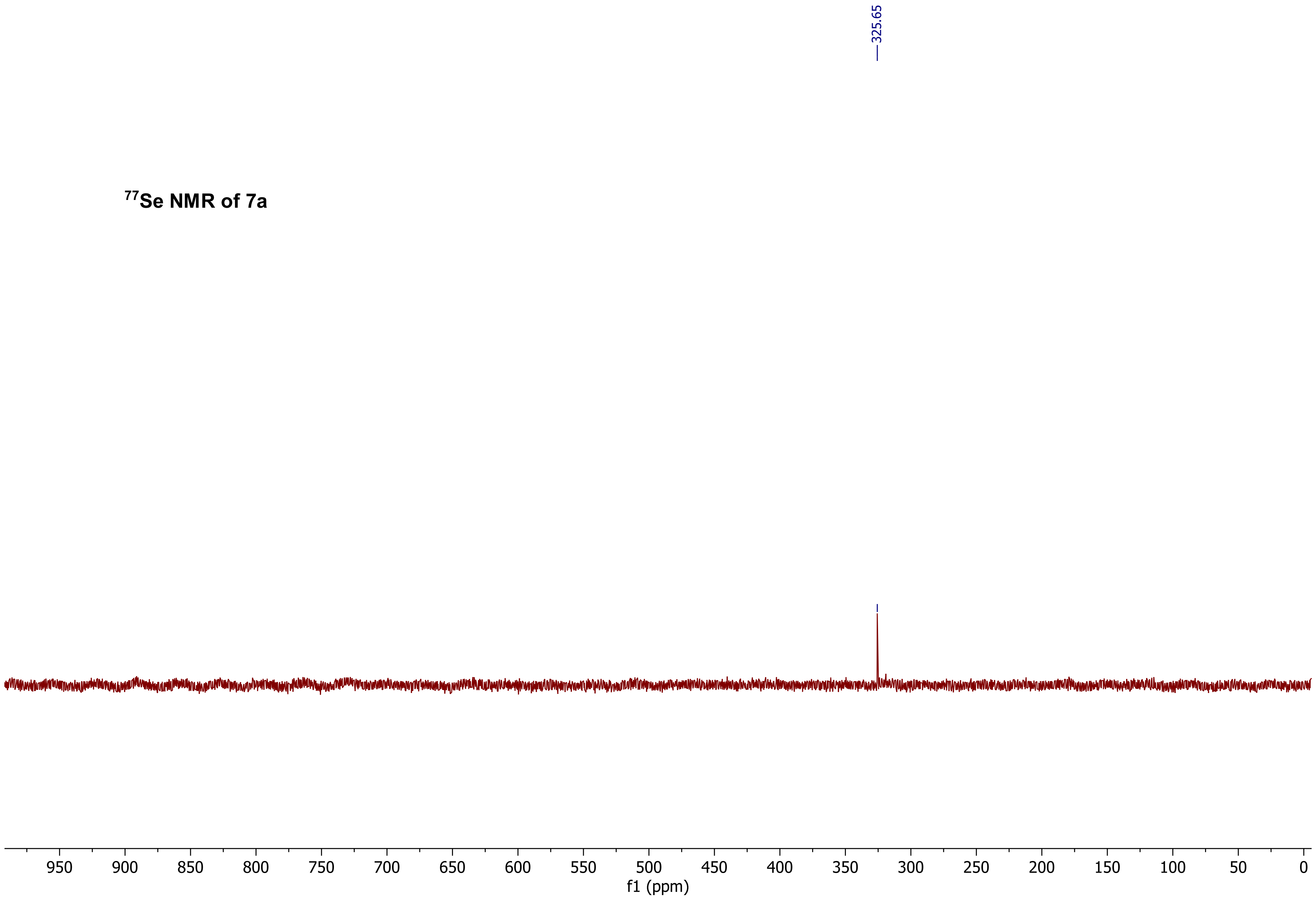
7a


9.65
9.31
9.28
8.99
7.78
7.76
7.74
7.72
7.70
7.68
7.66
7.49
7.49
7.48
7.47
7.46
7.46
7.33
7.32
7.31
7.31
7.30
7.23
7.23
7.21
7.20
7.20
7.05
7.04
7.02
7.01
7.00
7.00
6.99
4.52
4.50
4.49
2.22
2.20
2.18
2.16
2.14
1.27
1.24
1.22
1.21
1.20
1.18
0.91
0.89
0.88
0.87
0.86
0.75
0.73
0.71
0.57
0.56
0.55
0.53
6.54
8.57
4.27
4.22
6.31
f1 (ppm)
1.98
2.03
1.98
2.17
6.54
8.57
4.27
4.22
6.31
2.00
2.04
13.62
2.68
9.77
6.46
f1 (ppm)

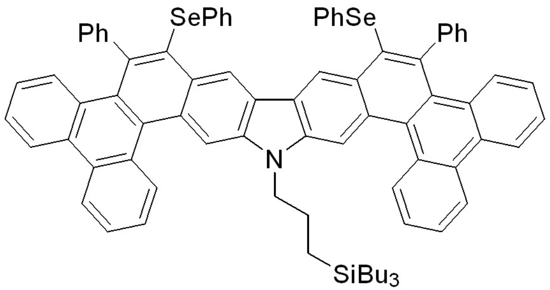

Ph
SePh
PhSe
Ph
N
SiBu3

7a

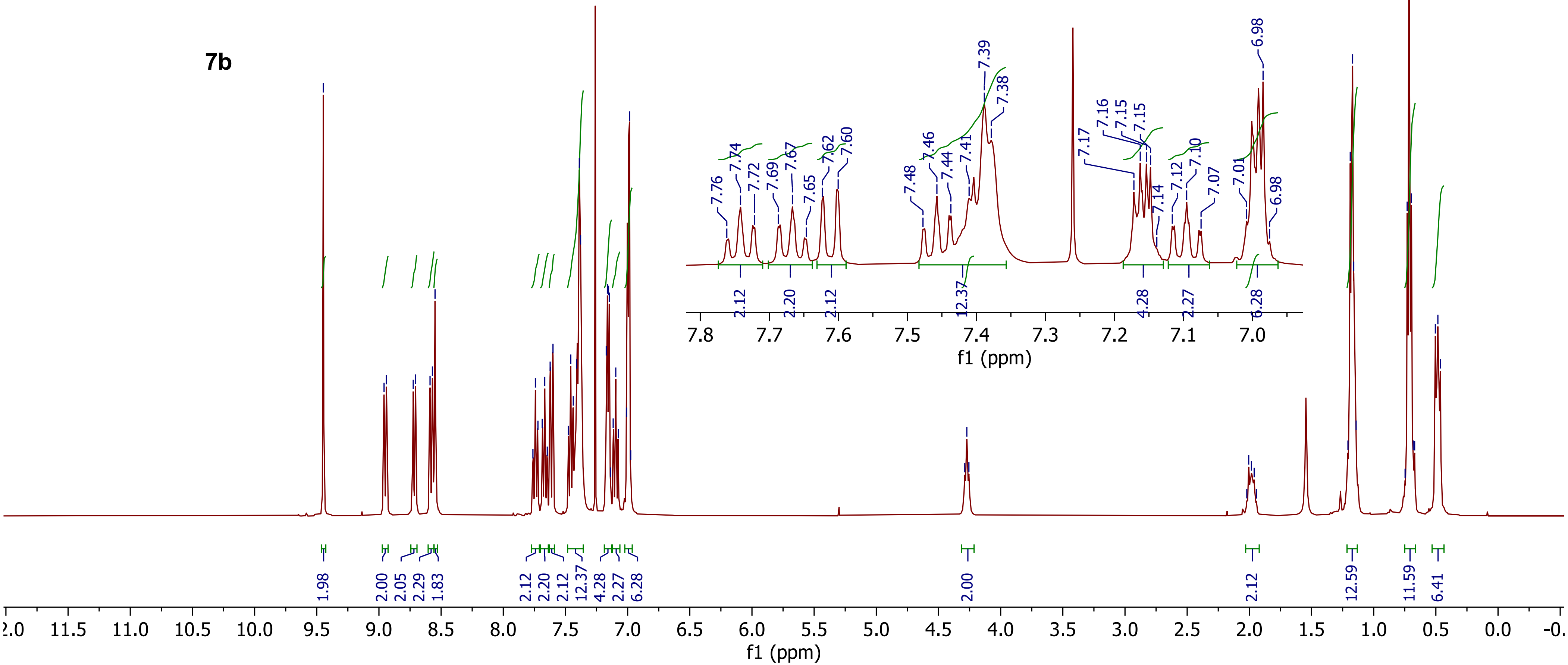

134.45
133.39
130.43
130.38
130.29
130.25
130.11
129.69
129.35
129.03
128.67
128.44
128.22
127.98
127.93
127.29
126.86
126.17
126.01
125.89
124.59
122.55
105.90
46.91
26.74
26.14
23.78
13.69
12.11
10.56
142.75
142.37
142.29
f1 (ppm)
f1 (ppm)



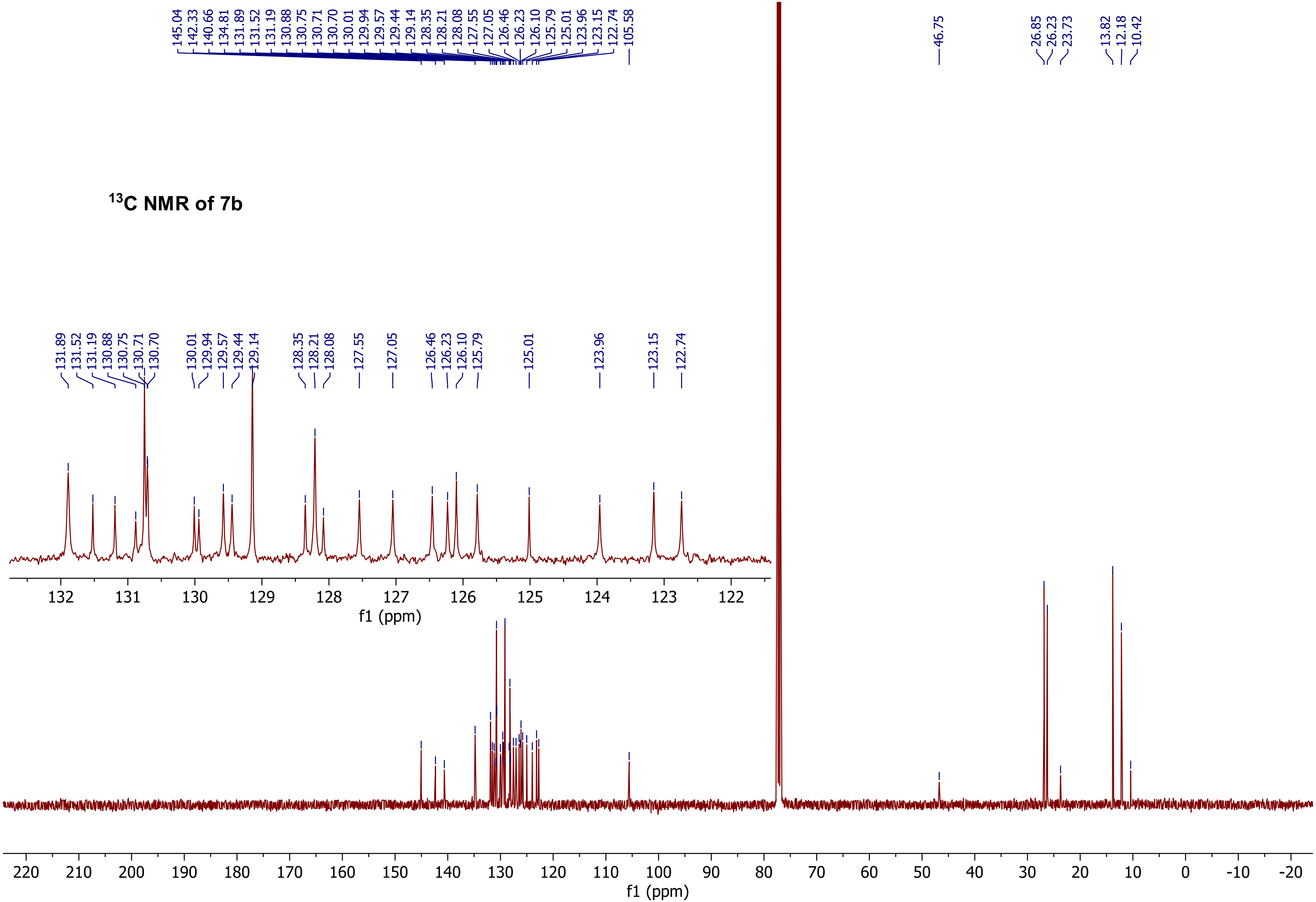
325.65
77Se NMR of 7a
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
f1 (ppm)


Ph
SePh
PhSe
Ph
N
SiBu3

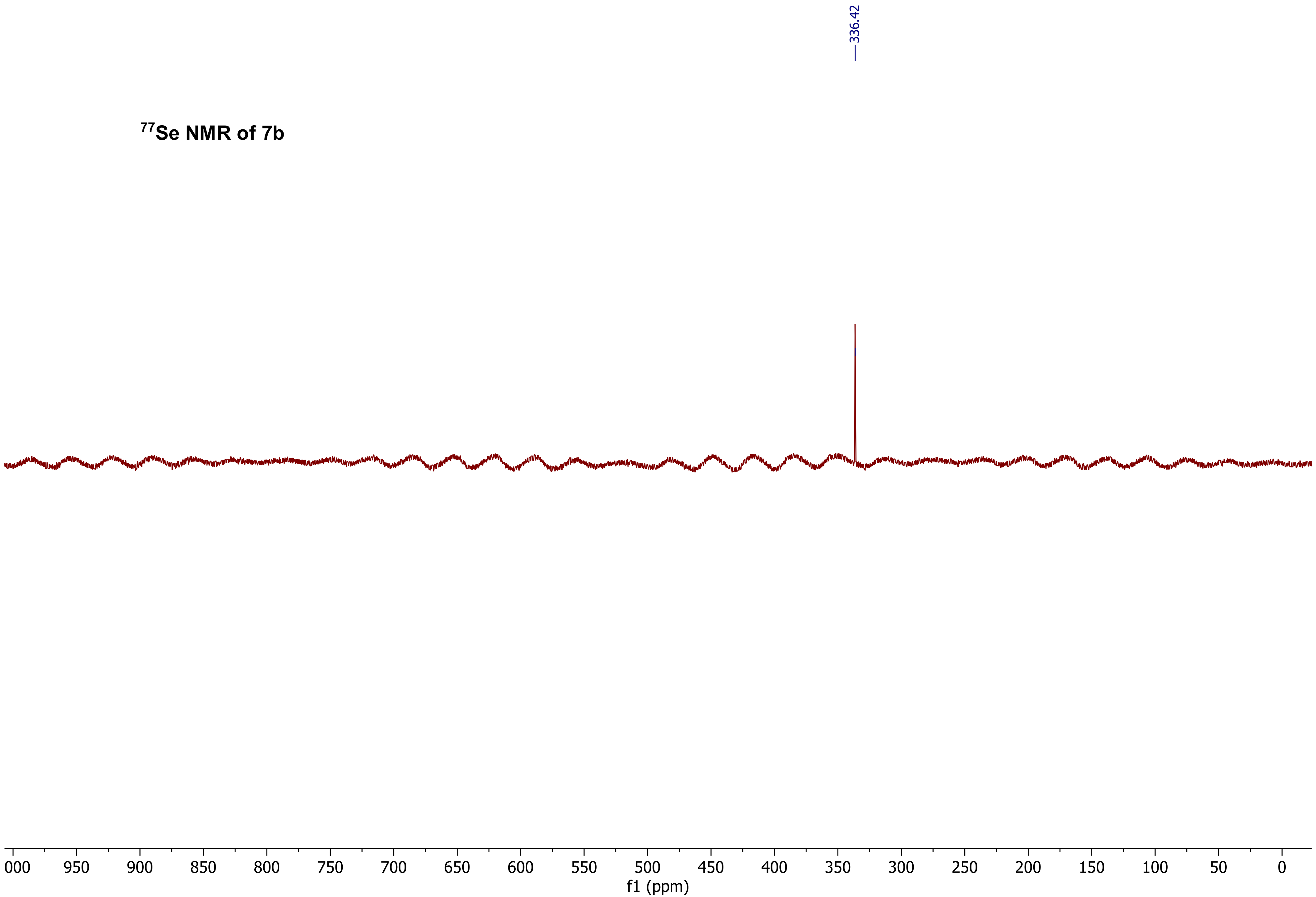
7b

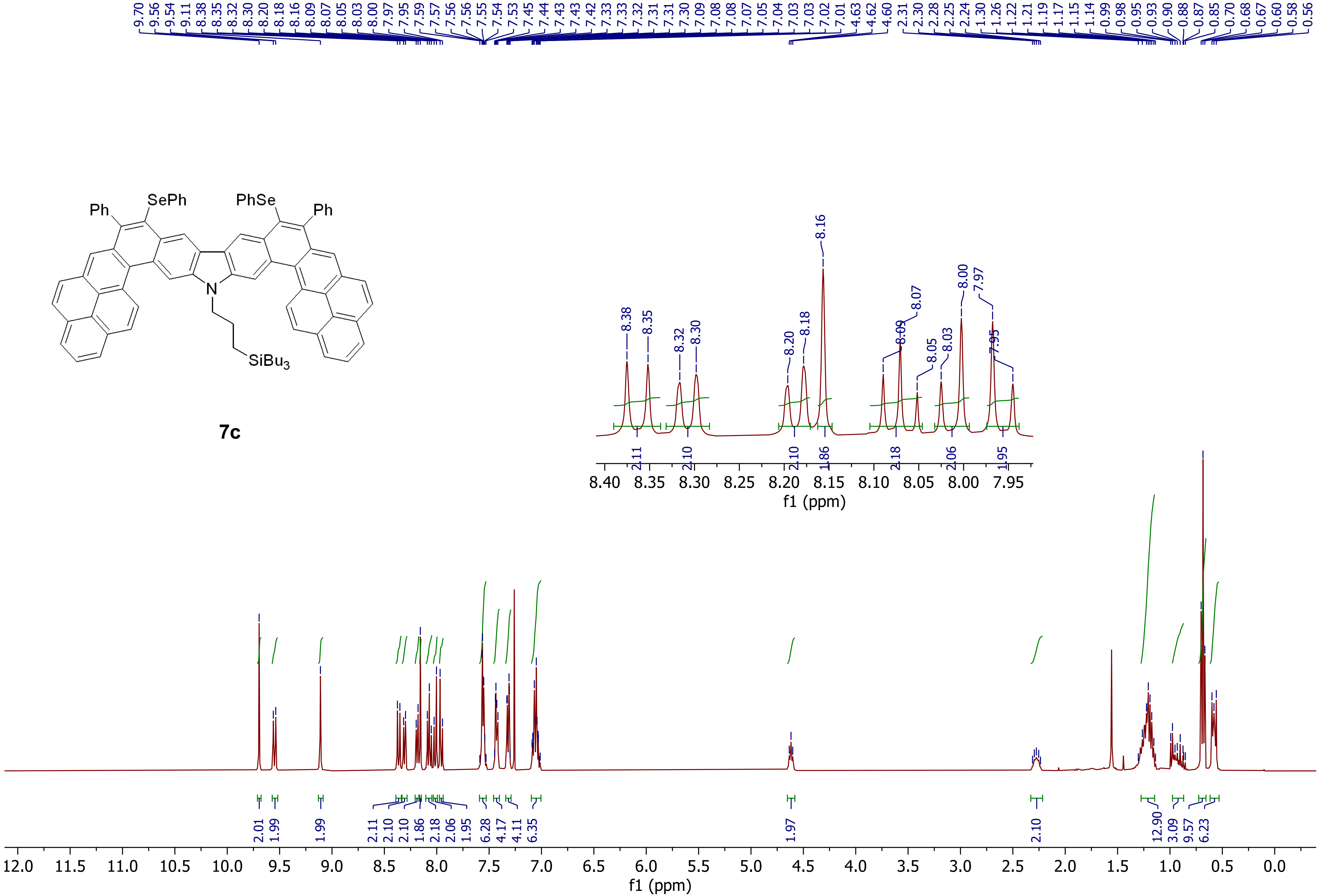

9.45 8.96 8.94 8.72 8.71 8.59 8.57 8.55 7.76 7.74 7.72 7.69 7.67 7.65 7.62 7.60 7.48 7.46 7.44 7.41 7.39 7.38 7.17 7.16 7.15 7.15 7.14 7.12 7.10 7.07 7.01 6.98 6.98 4.29 4.27 4.26
2.02 2.01 1.98 1.96 1.94 1.21 1.19 1.17 1.16 1.14 0.75 0.73 0.71 0.70 0.68 0.67 0.50 0.48 0.46
1.98 2.00 2.05 2.29 1.83 2.12 2.20 2.12 12.37 4.28 2.27 6.28 2.00 2.12 12.59 11.59 6.41
2.12 2.20 2.12 12.37 4.28 2.27 6.28
f1 (ppm)
f1 (ppm)

^{13}C NMR of 7b

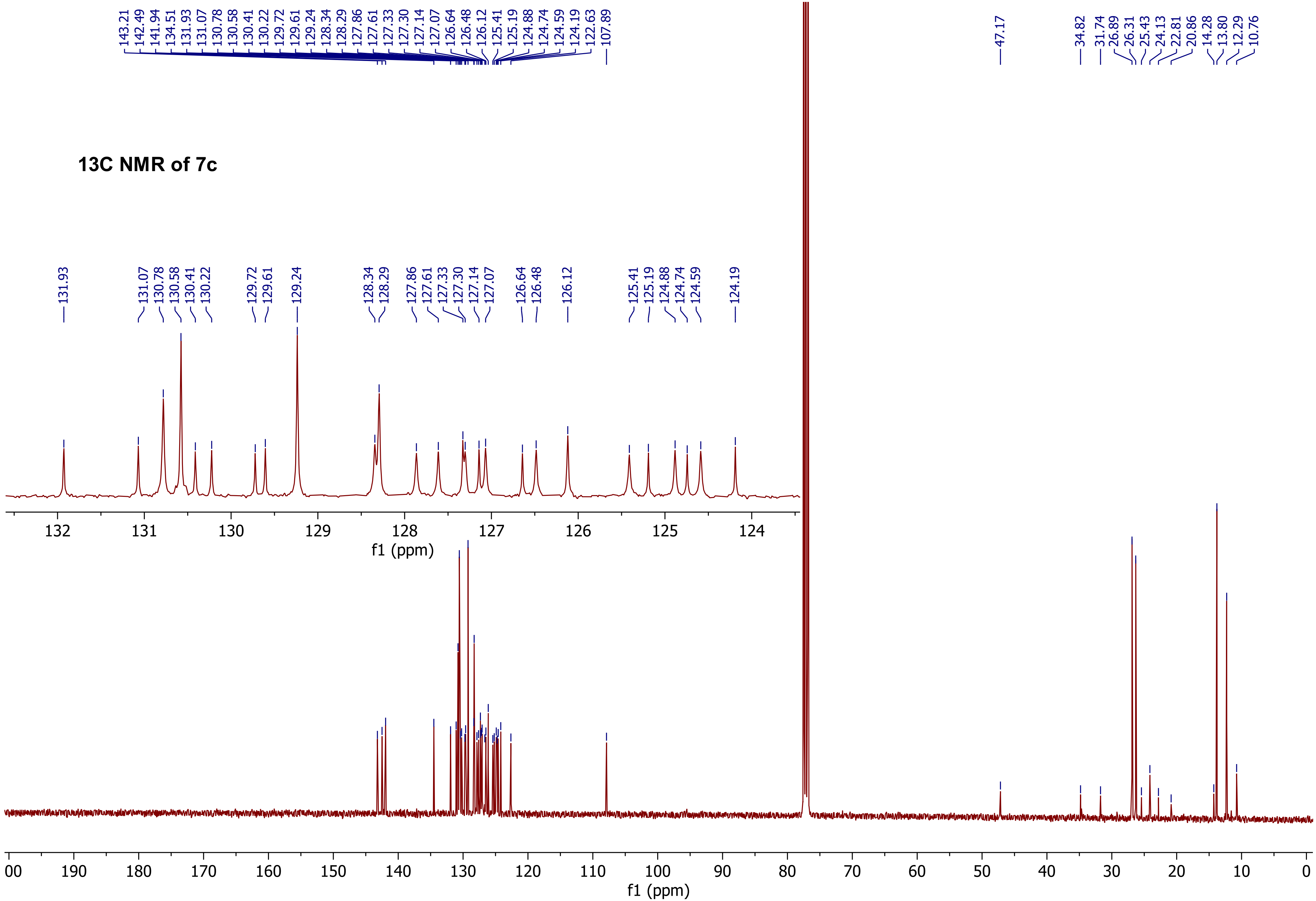


^{77}Se NMR of 7b





Ph
SePh
PhSe
Ph
N
SiBu3
7c
9.70 9.56 9.54 9.11 8.38 8.35 8.32 8.30 8.20 8.18 8.16 8.09 8.07 8.05 8.03 8.00 7.97 7.95 7.59 7.57 7.56 7.55 7.54 7.53 7.45 7.44 7.43 7.43 7.42 7.33 7.33 7.32 7.31 7.31 7.30 7.09 7.08 7.08 7.07 7.05 7.04 7.03 7.03 7.02 7.01 4.63 4.62 4.60 2.31 2.30 2.28 2.25 2.24 1.30 1.26 1.22 1.21 1.19 1.17 1.15 1.14 0.99 0.98 0.95 0.93 0.90 0.88 0.87 0.85 0.70 0.68 0.67 0.60 0.58 0.56
2.01 1.99 1.99 2.11 2.10 2.10 1.86 2.18 2.06 1.95 6.28 4.17 4.11 6.35 1.97 2.10 12.90 3.09 9.57 6.23
12.0 11.5 11.0 10.5 10.0 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
f1 (ppm)
8.38 8.35 8.32 8.30 8.20 8.18 8.16 8.09 8.07 8.05 8.03 8.00 7.97 7.95
2.11 2.10 2.10 1.86 2.18 2.06 1.95
8.40 8.35 8.30 8.25 8.20 8.15 8.10 8.05 8.00 7.95
f1 (ppm)


13C NMR of 7c
143.21
142.49
141.94
134.51
131.93
131.07
130.78
130.58
130.41
130.22
129.72
129.61
129.24
128.34
128.29
127.86
127.61
127.33
127.30
127.14
127.07
126.64
126.48
126.12
125.41
125.19
124.88
124.74
124.59
124.19
122.63
107.89
47.17
34.82
31.74
26.89
26.31
25.43
24.13
22.81
20.86
14.28
13.80
12.29
10.76
f1 (ppm)

^{77}Se NMR of 7c