

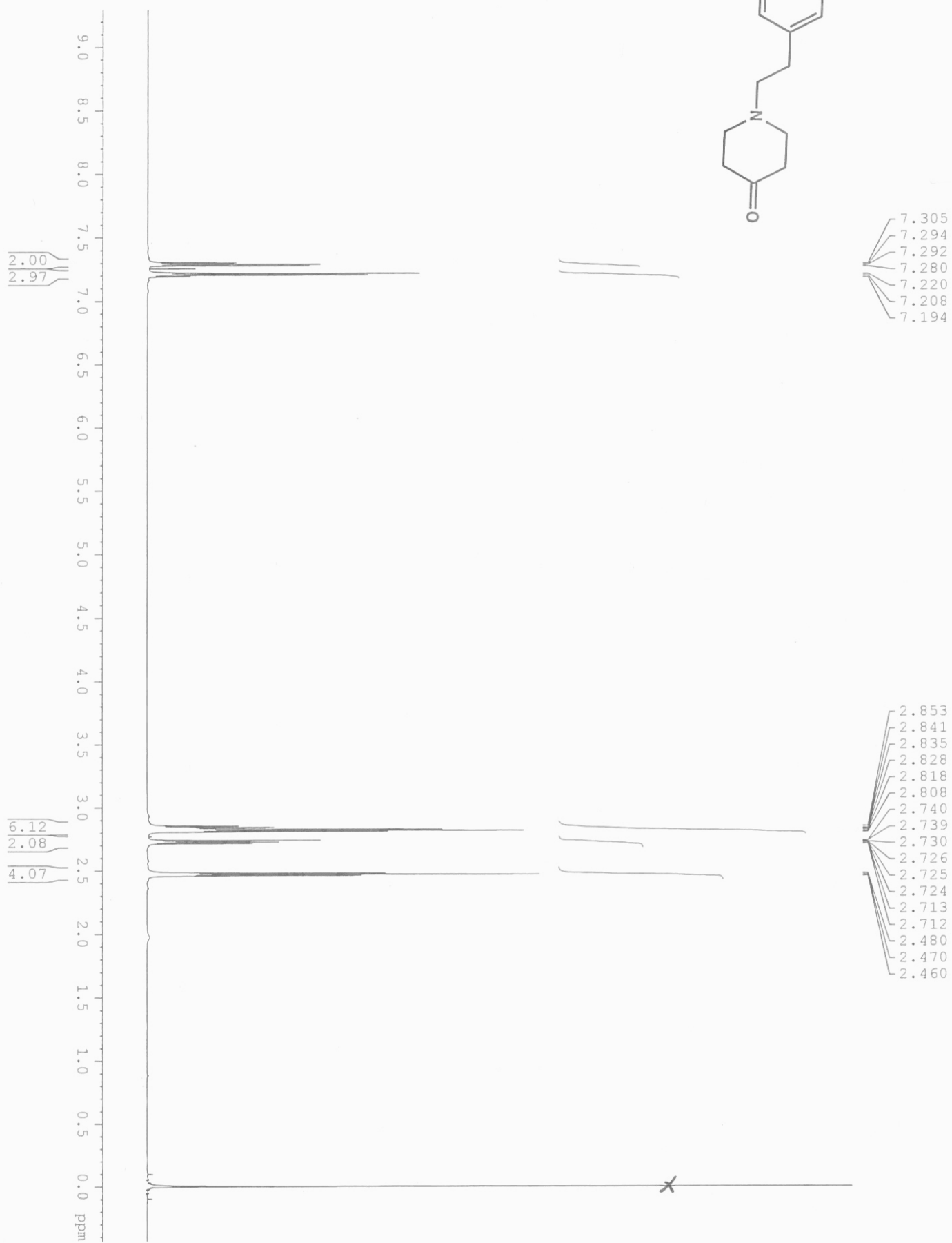
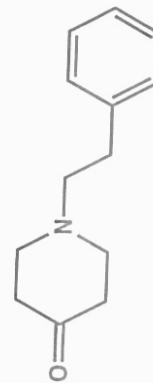
An efficient, optimized synthesis of fentanyl and related analogs

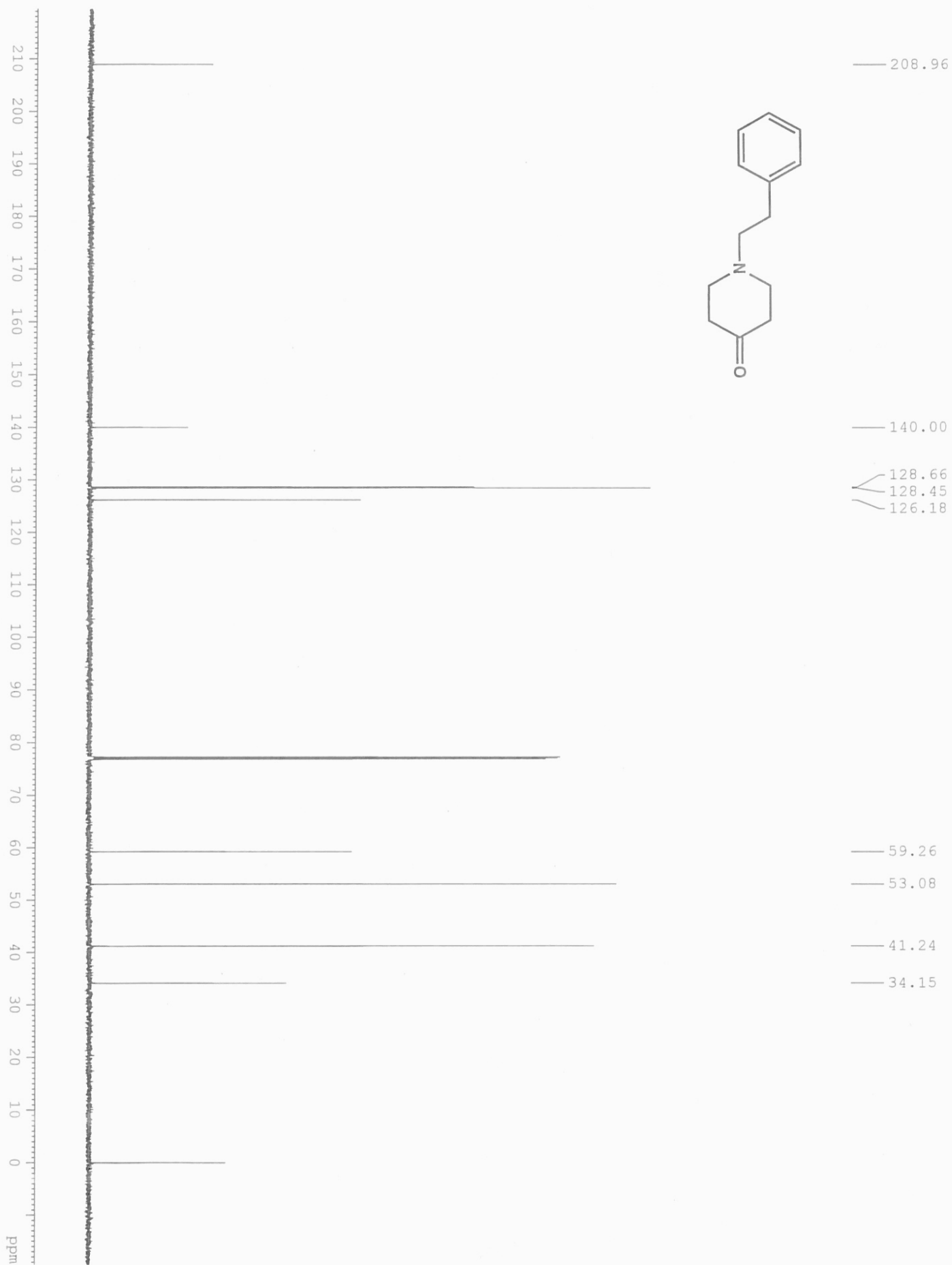
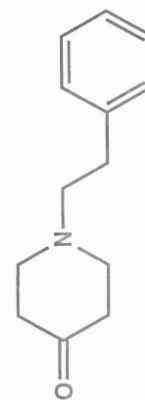
Carlos A. Valdez, Roald N. Leif and Brian P. Mayer*

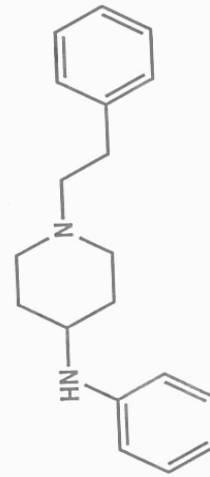
*Forensic Science Center, Lawrence Livermore National Laboratory
Livermore, CA 94550 USA*

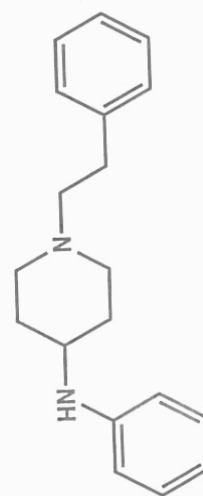
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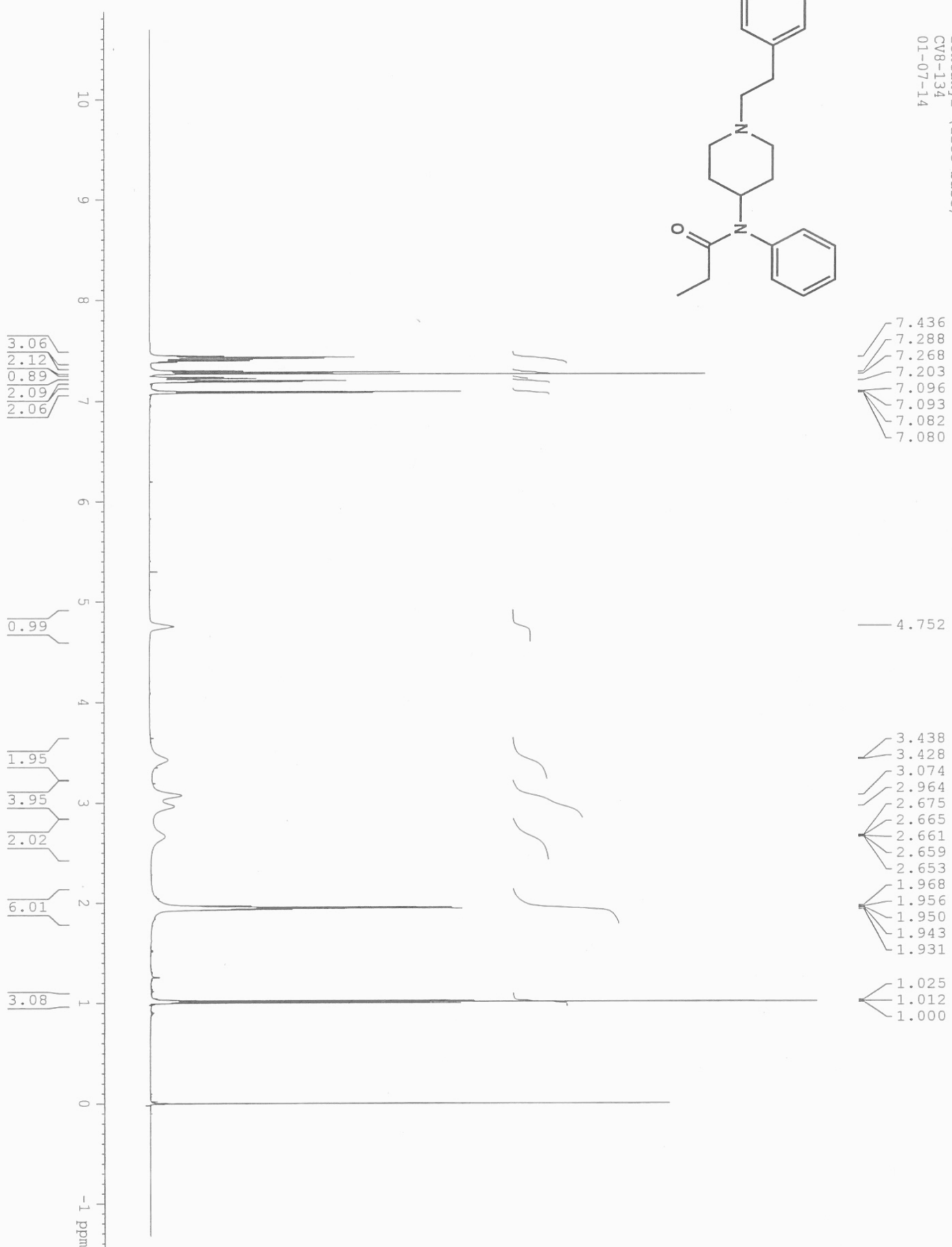
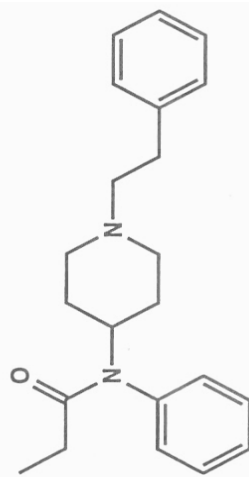




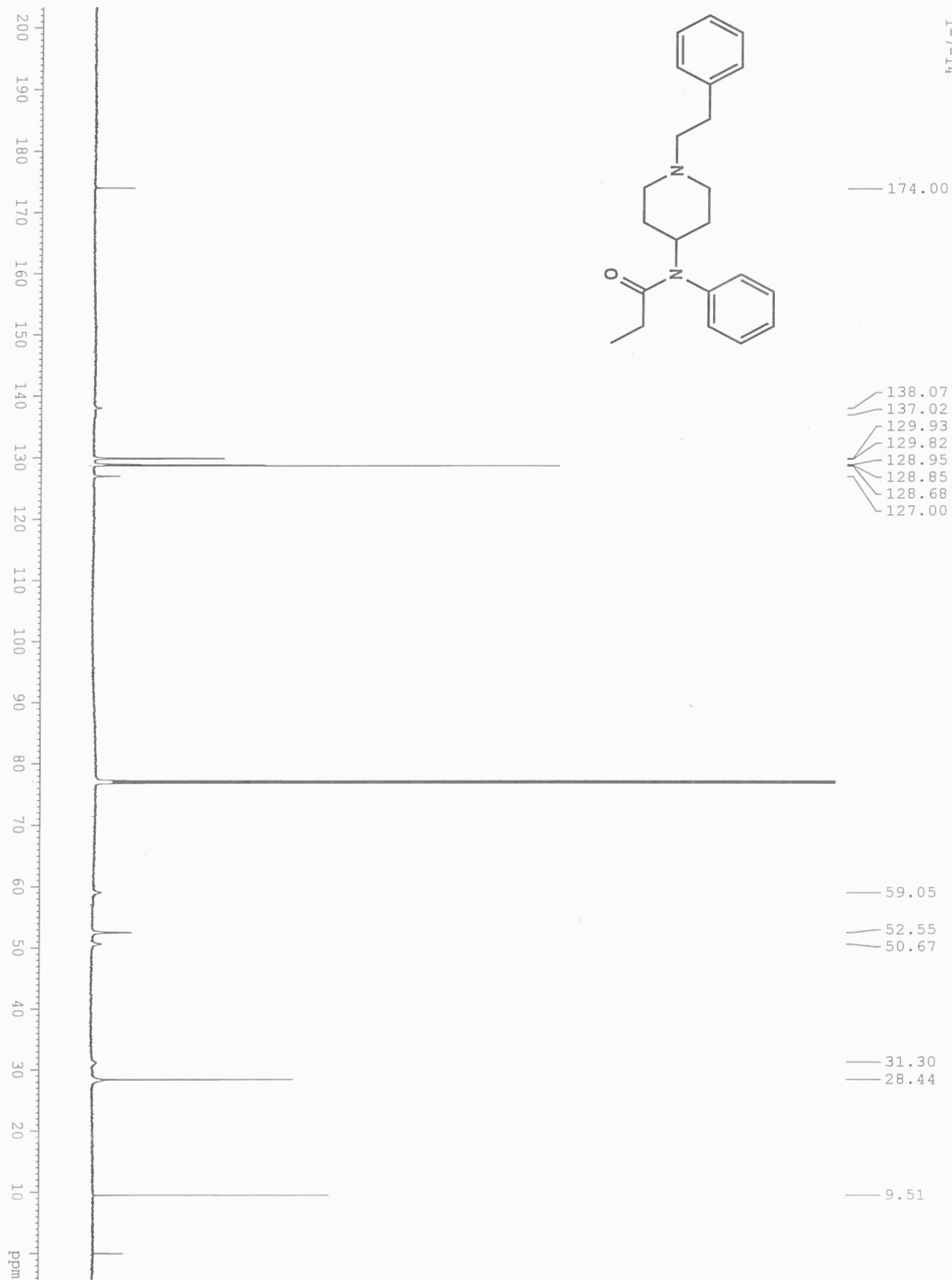
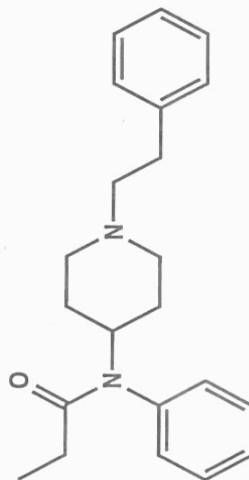




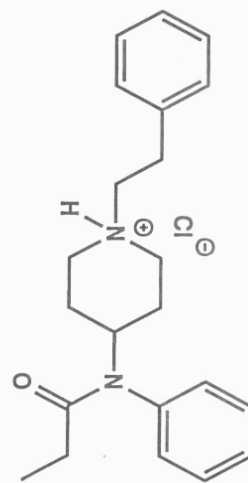
Fentanyl (Free base)
CV8-134
01-07-14



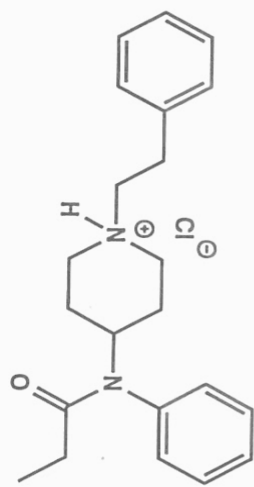
Fentanyl (Free base)
CV8-134
1-7-14



Fentanyl1 (HCl salt)
CV8-148
1-23-14



Fentanyl (HCl salt)
CV8-148
1-23-14



— 177.49

137.19
136.26
129.80
129.28
129.09
128.76
127.38

— 57.58

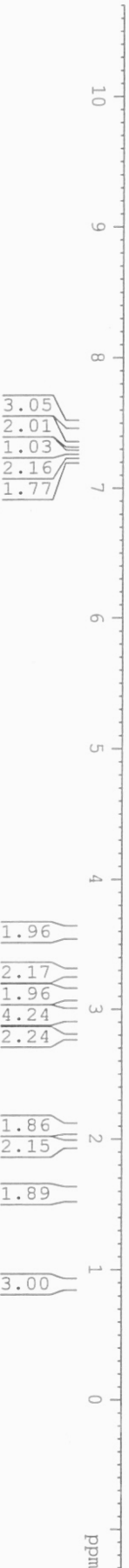
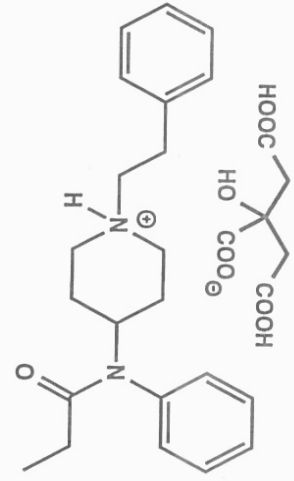
52.10
50.00

29.84
28.22
27.46

— 9.02



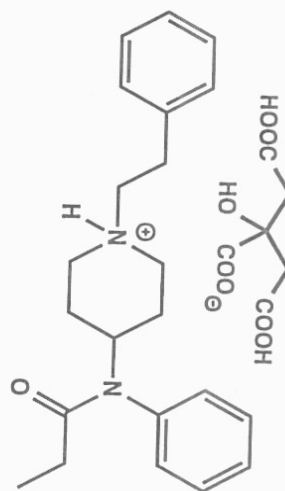
fentanyl (citrate salt)
CV8-139
01/08/14



- 7.492
- 7.480
- 7.337
- 7.324
- 7.252
- 7.251
- 7.238
- 7.221
- 7.208

- 3.596
- 3.574
- 3.296
- 3.290
- 3.289
- 3.289
- 3.282
- 3.268
- 3.133
- 3.129
- 3.111
- 3.107
- 3.090
- 3.086
- 2.983
- 2.969
- 2.957
- 2.931
- 2.794
- 2.768
- 2.089
- 2.066
- 1.978
- 1.966
- 1.953
- 1.941
- 1.612
- 1.605
- 1.589
- 1.583
- 1.567
- 1.562
- 1.545
- 1.539
- 0.900
- 0.888
- 0.887
- 0.875

Fentanyl citrate
CV8-139
01/08/14



177.48
177.07
173.60

137.19
136.27
129.80
129.29
129.10
128.77
127.38

73.38

57.58

52.10

49.99

43.34

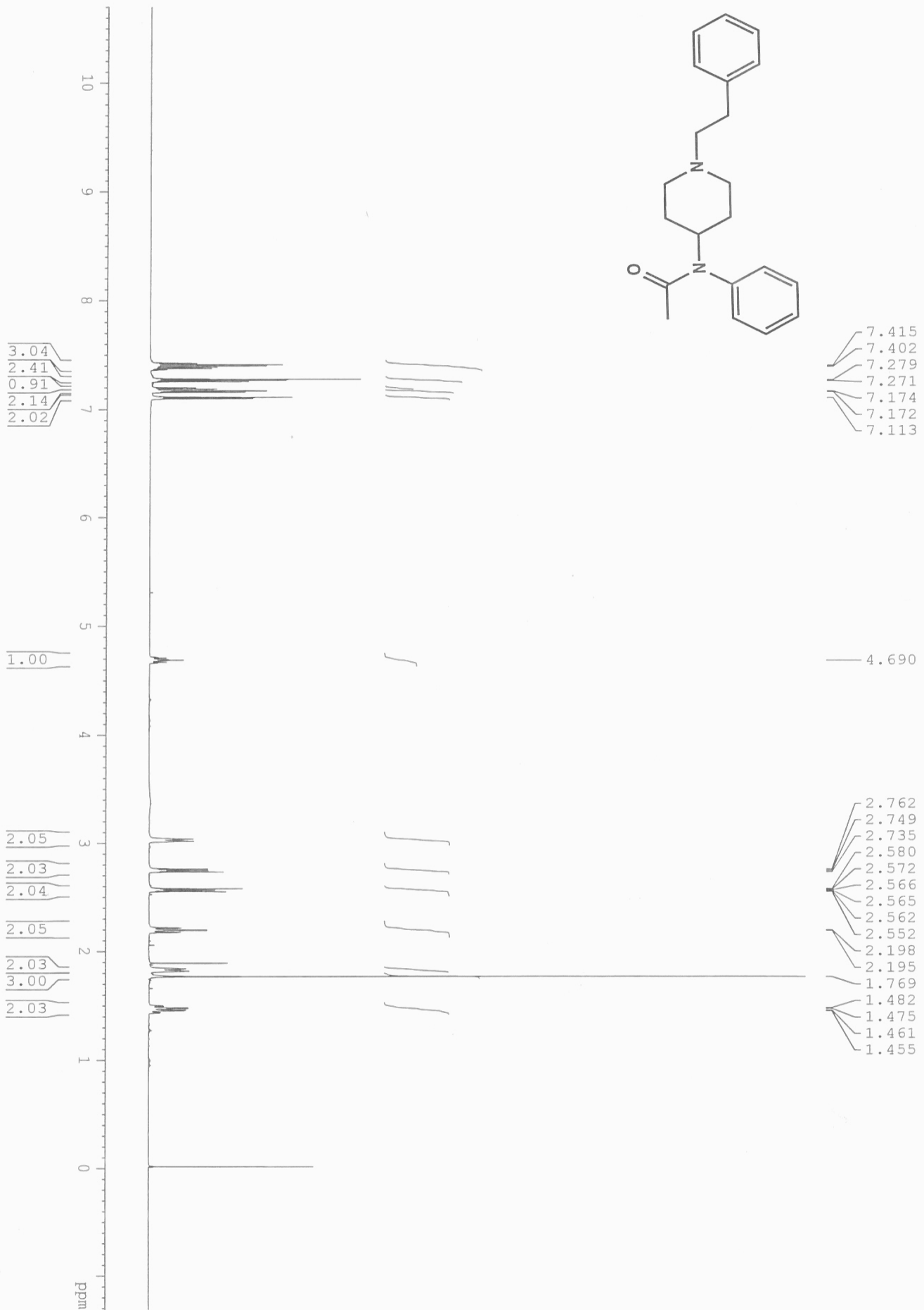
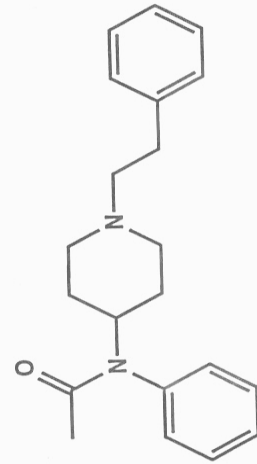
29.85

28.23

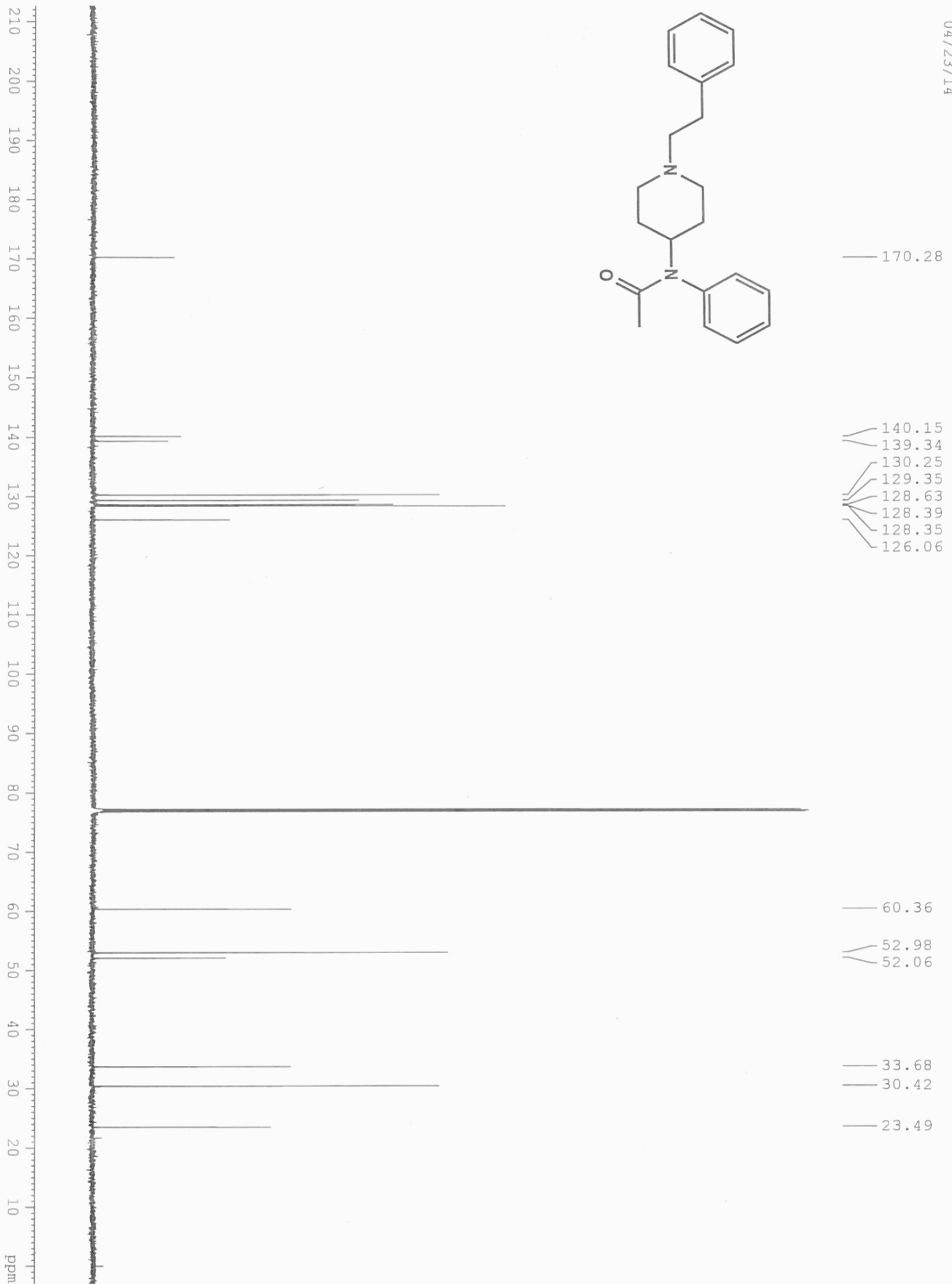
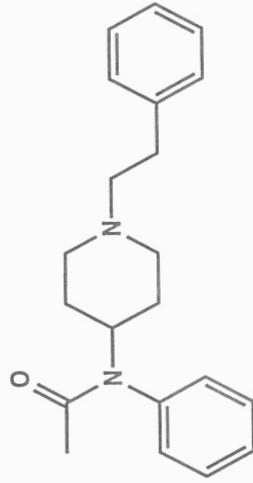
27.46

9.03

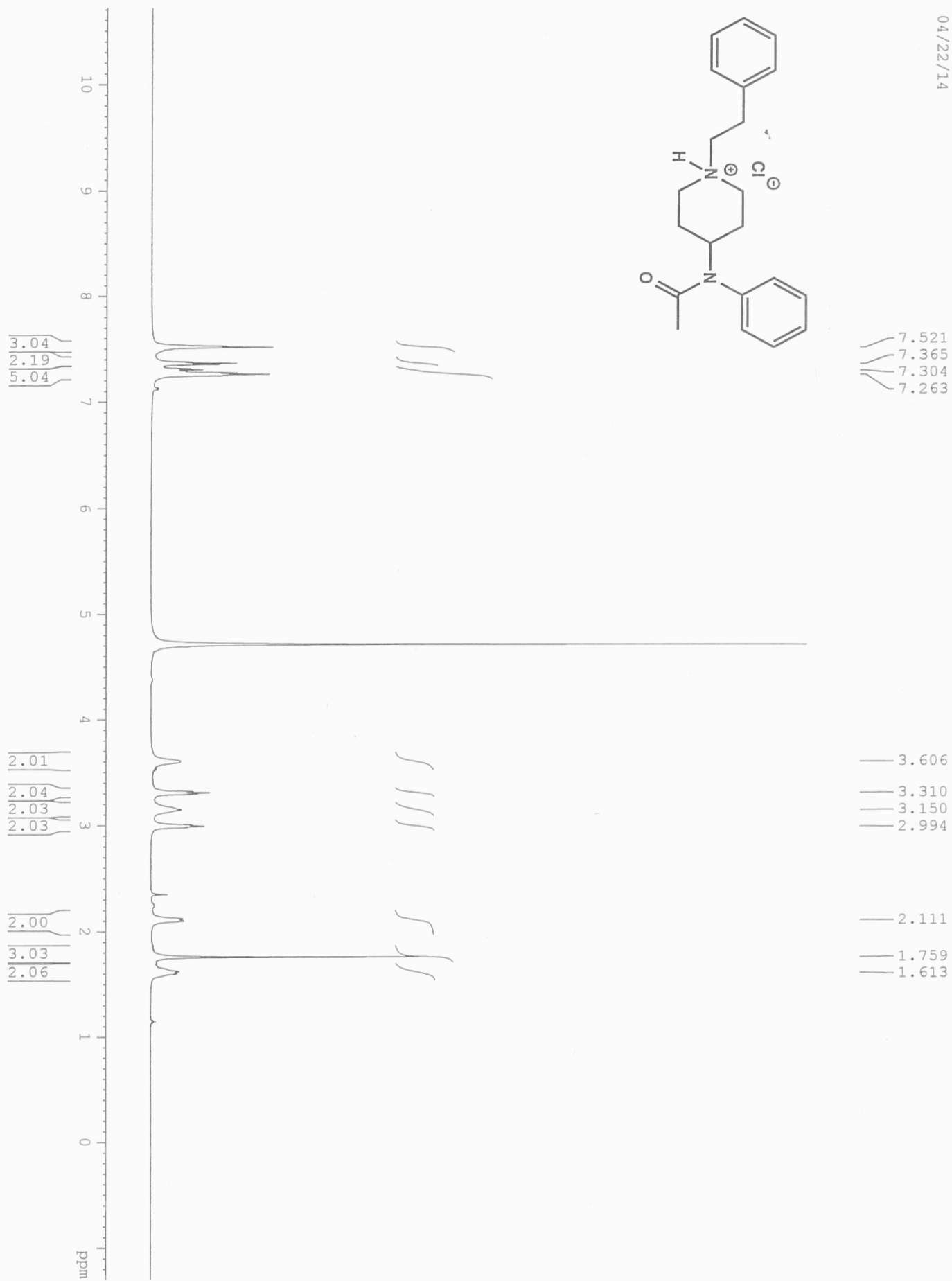
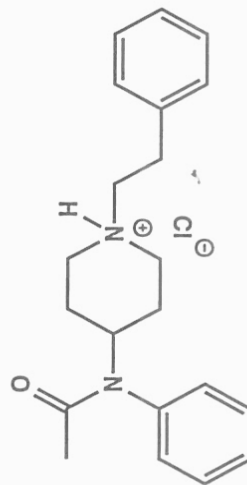
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm



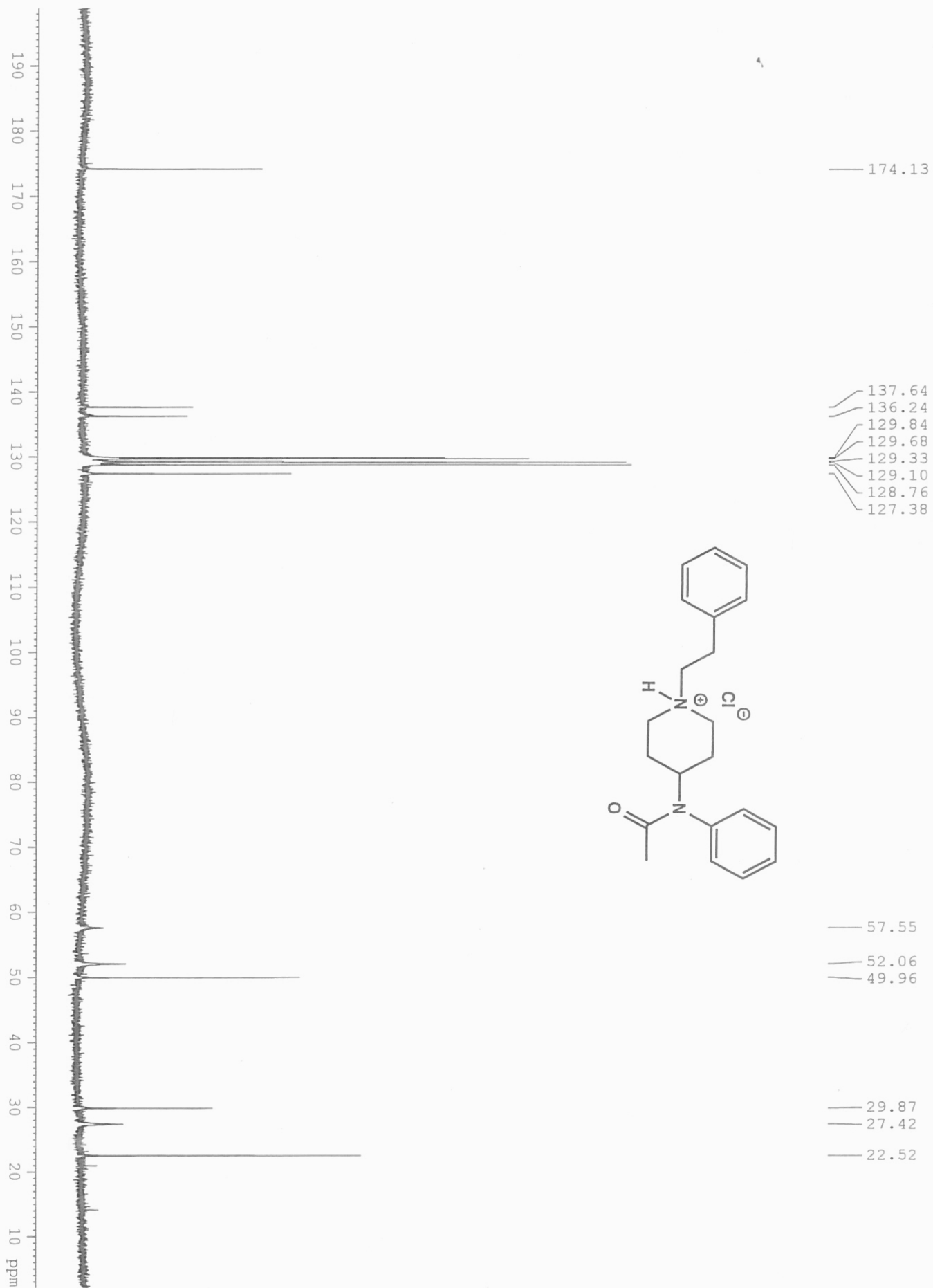
Acetyl[fentanyl] (Free base)
CV8-144
04/23/14



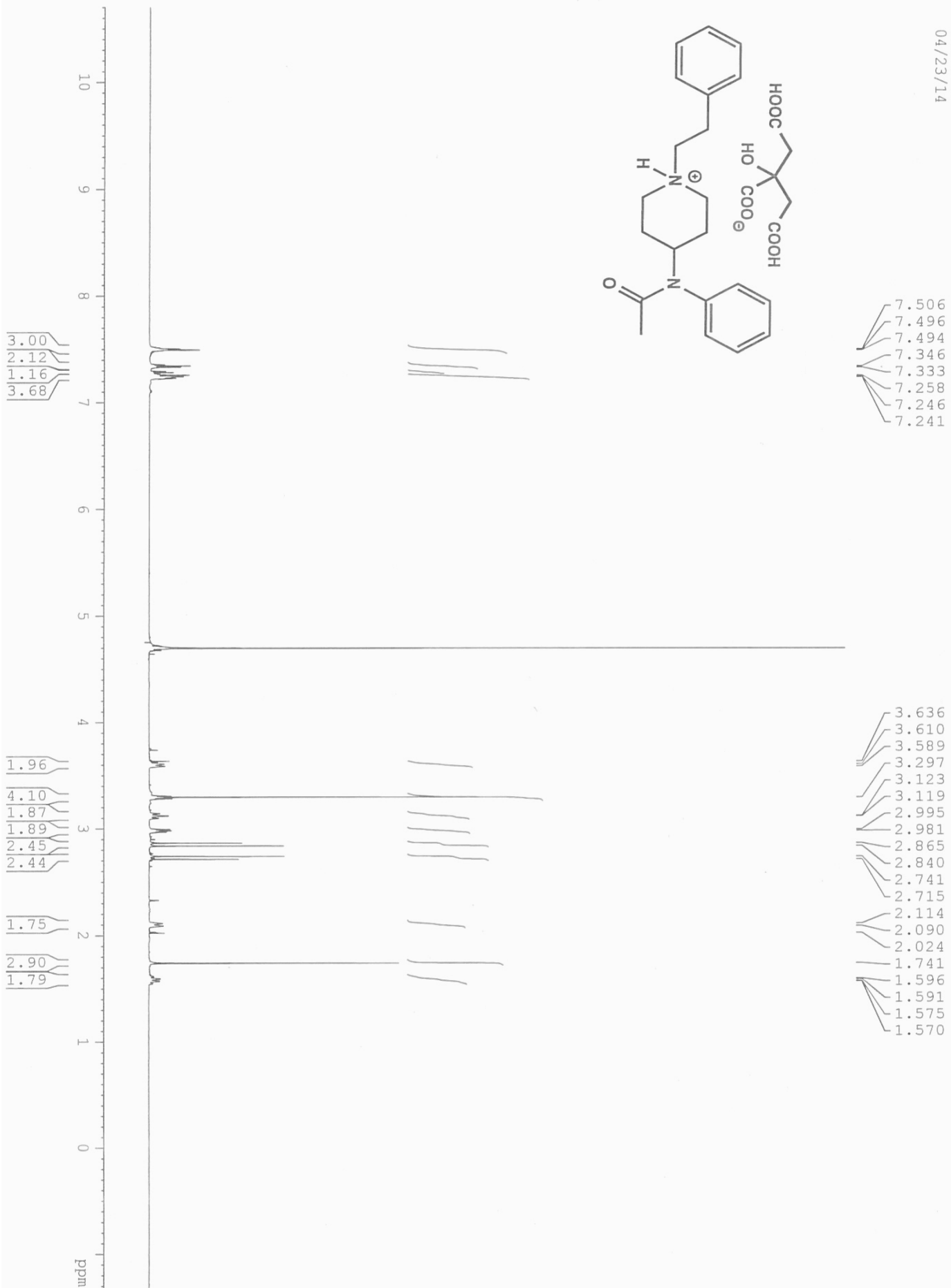
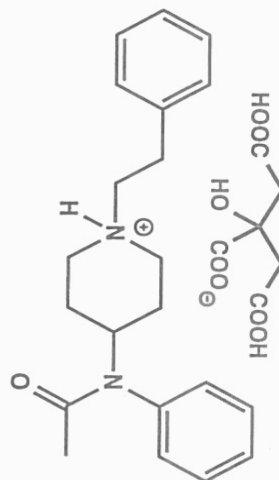
AcetylFentanyl1 (HCl salt)
CV8-150
04/22/14



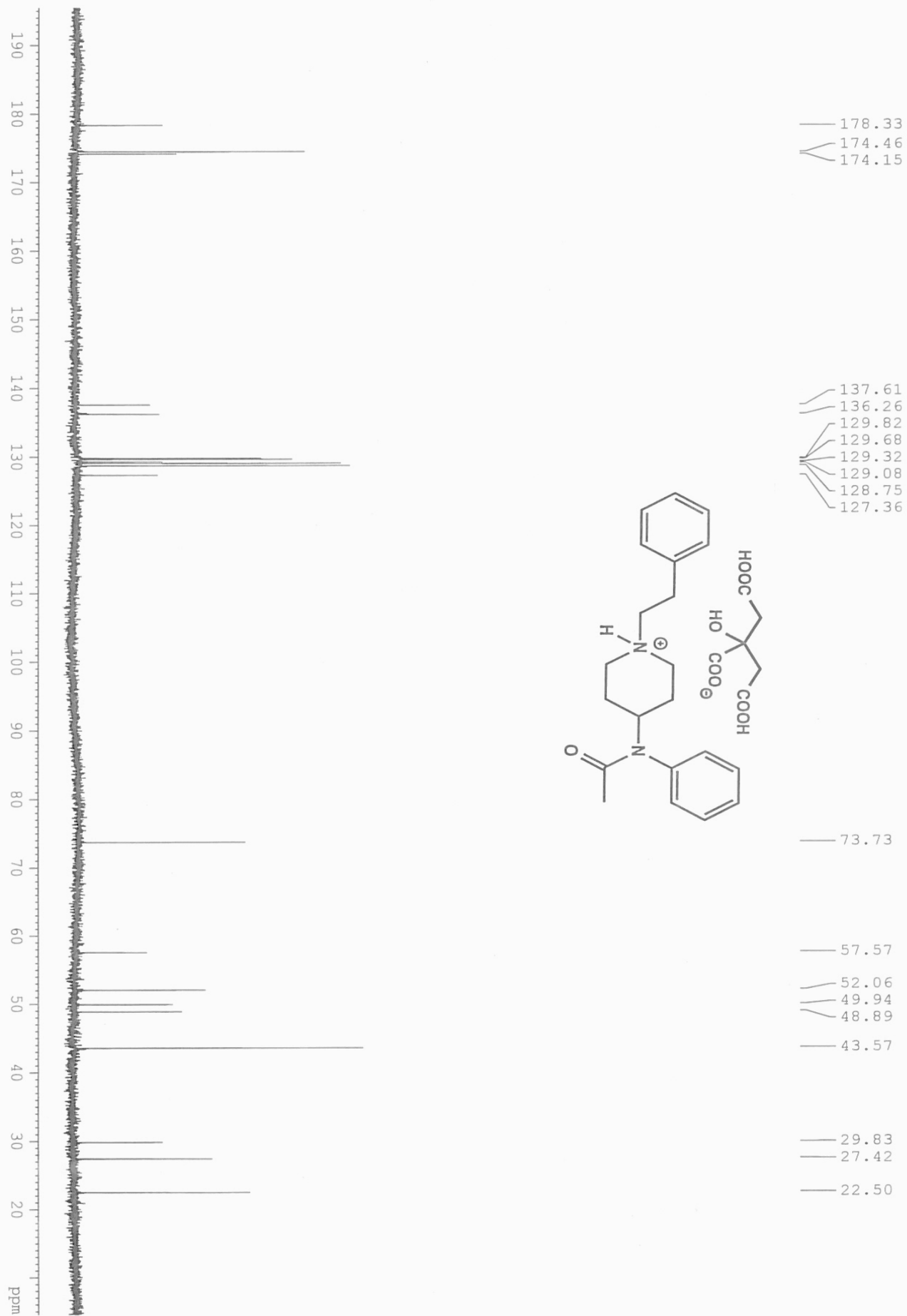
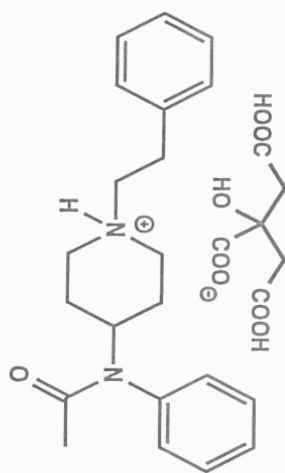
AcetylFentanyl1 (HCl salt)
CV8-150
04/22/14



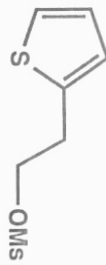
Acetyl[fentanyl] (citrate salt)
CV8-151
04/23/14



Acetylfentanyl (citrate salt)
CV8-151
04/23/14



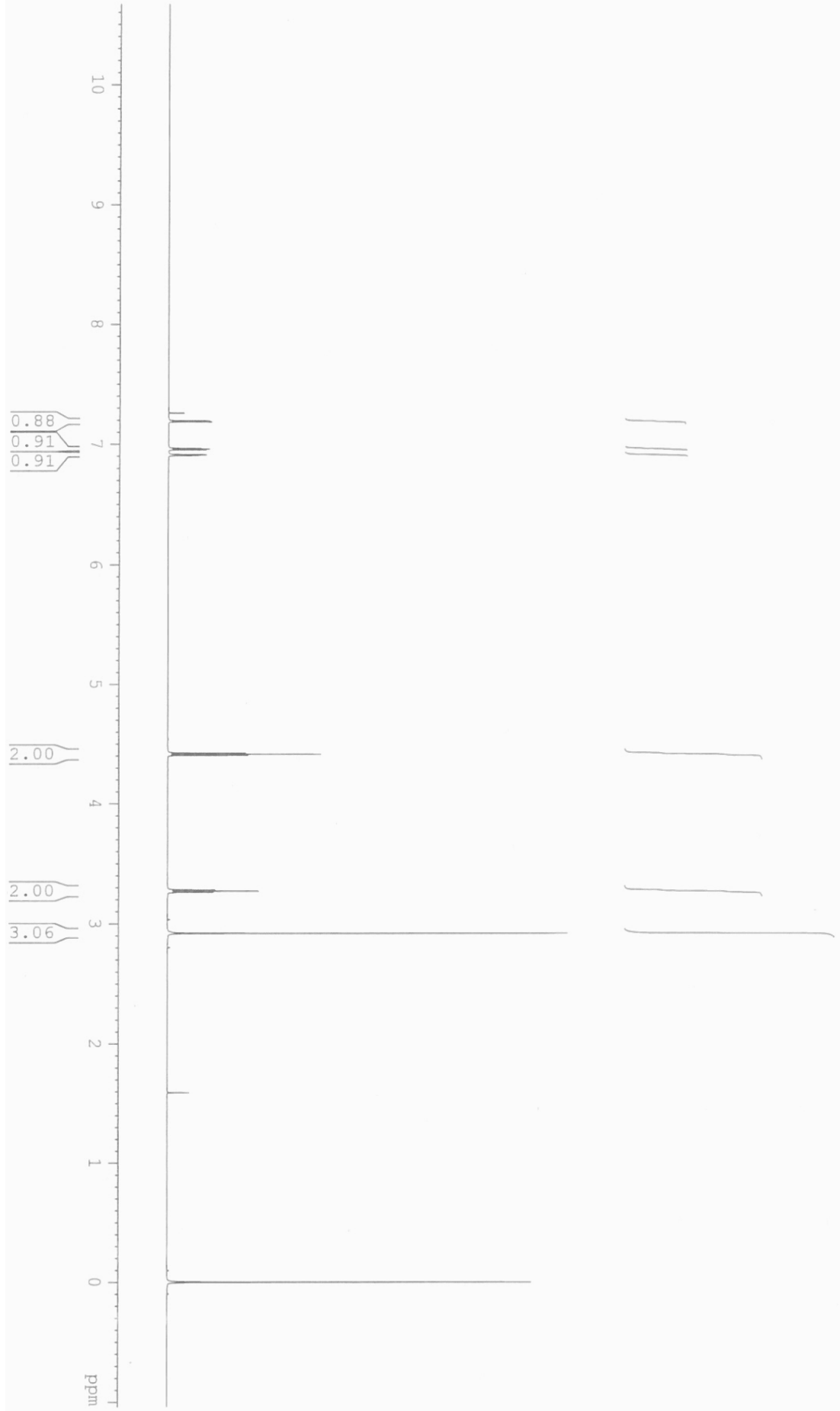
CV8-108
Thiophene ethanol mesylate
11-18-13



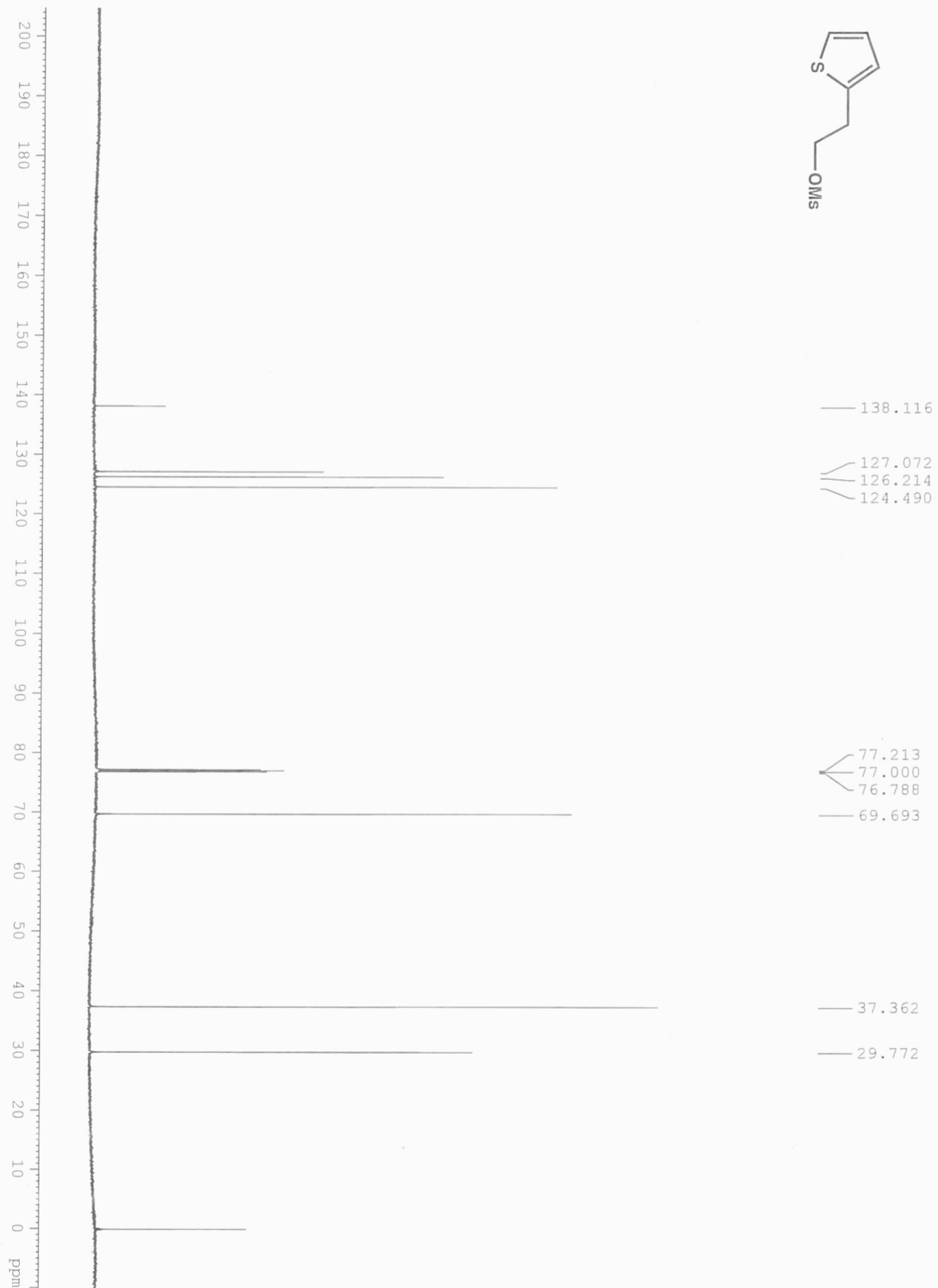
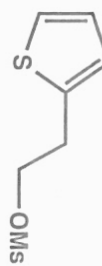
- 7.260
- 7.197
- 7.195
- 7.188
- 7.186
- 6.968
- 6.962
- 6.959
- 6.954
- 6.914
- 6.912
- 6.908
- 6.907

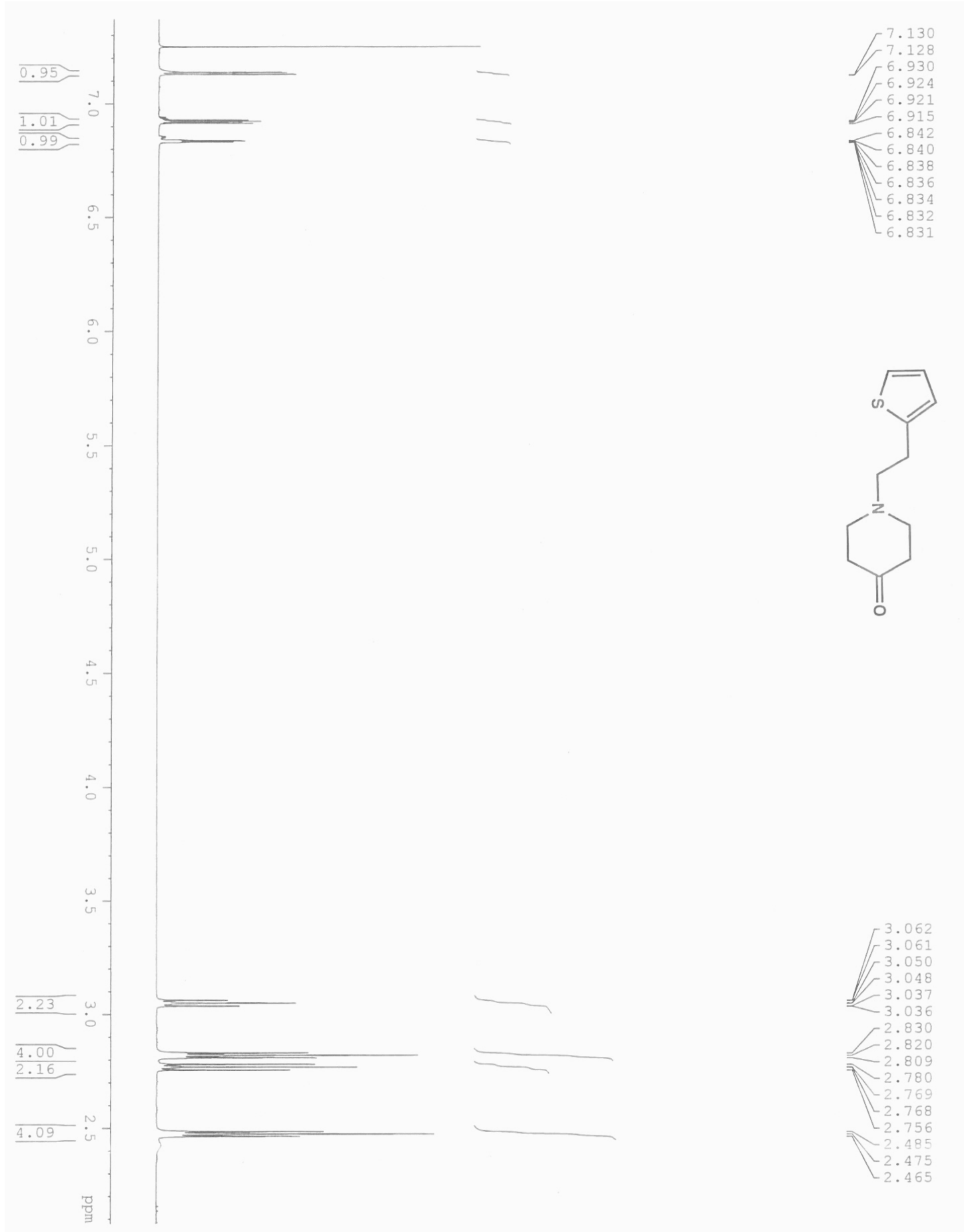
- 4.427
- 4.416
- 4.405

- 3.284
- 3.283
- 3.273
- 3.271
- 3.261
- 3.260
- 2.921

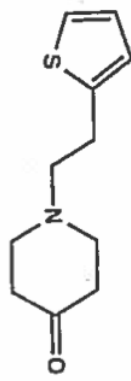


CV8-108
Thiophene ethanol mesylate
11-18-13





210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm



— 209.005

— 142.442

— 126.609
— 124.745
— 123.705

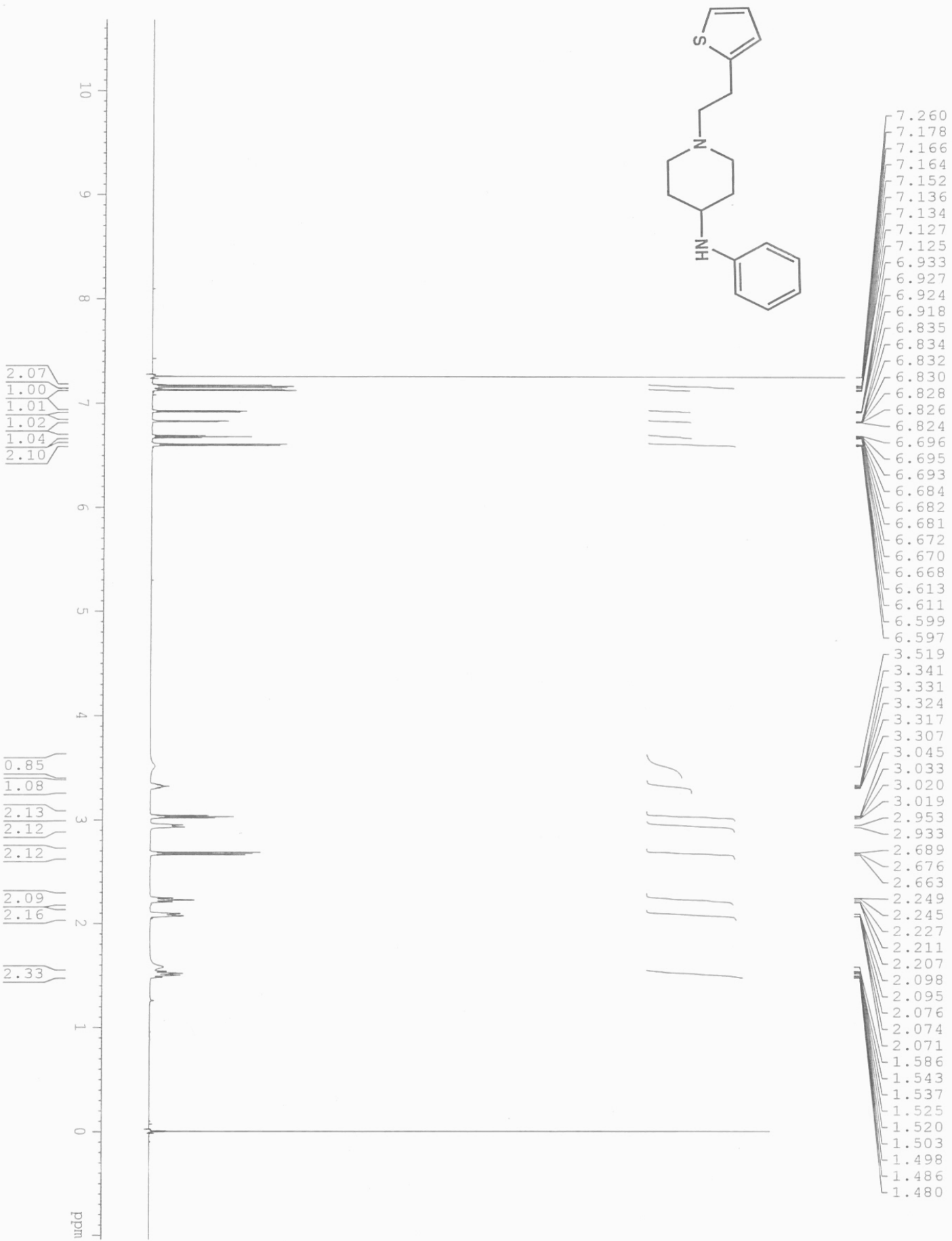
— 77.239
— 77.026
— 76.816

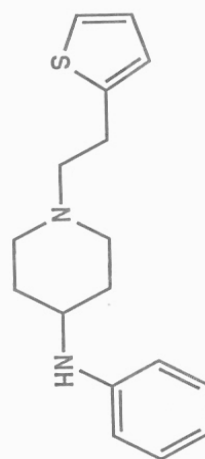
— 60.386

— 53.005

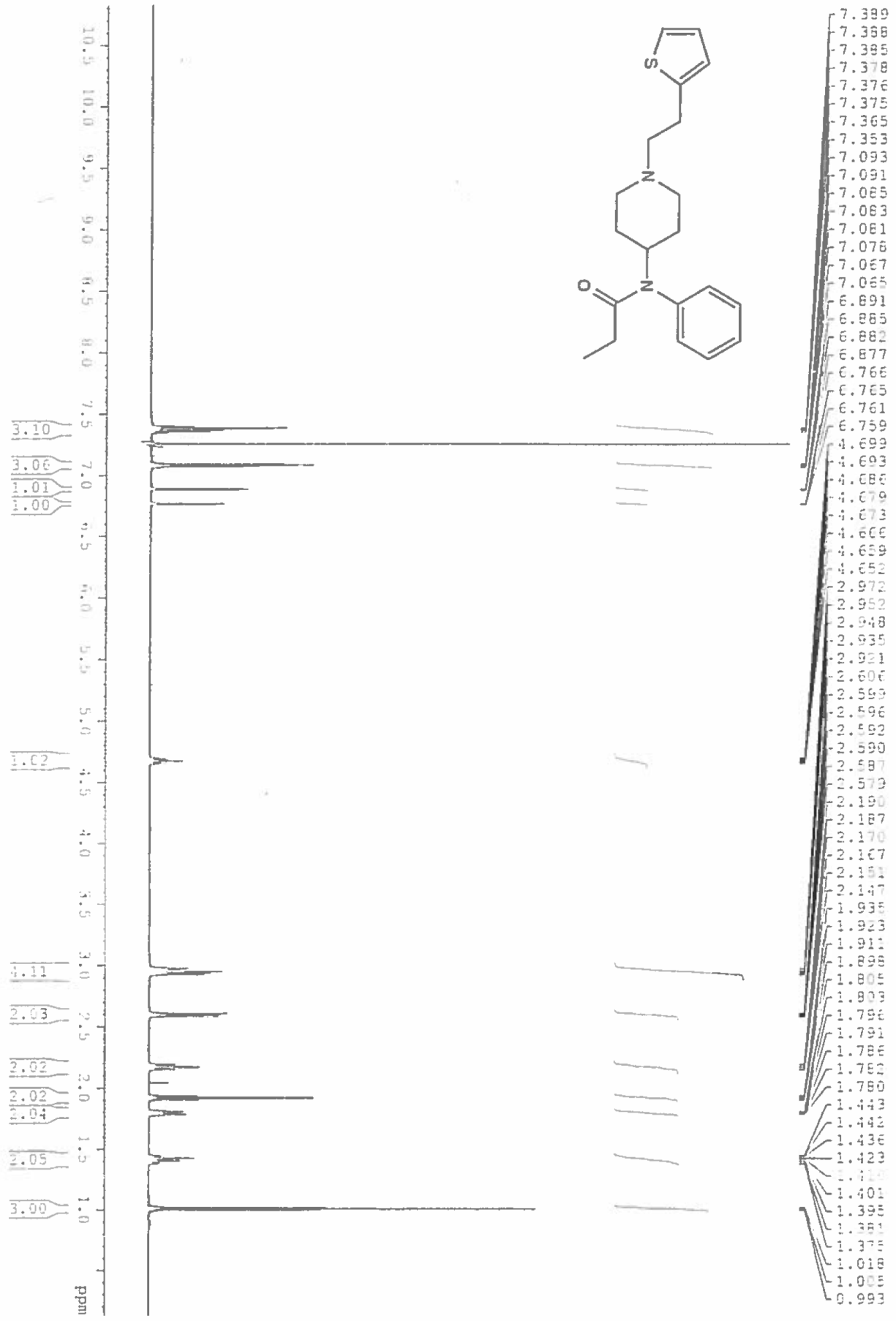
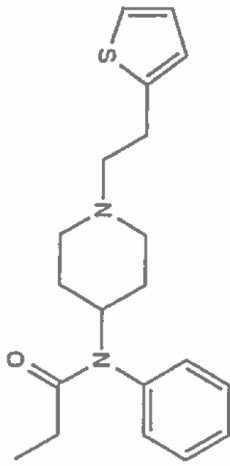
— 41.263

— 28.306

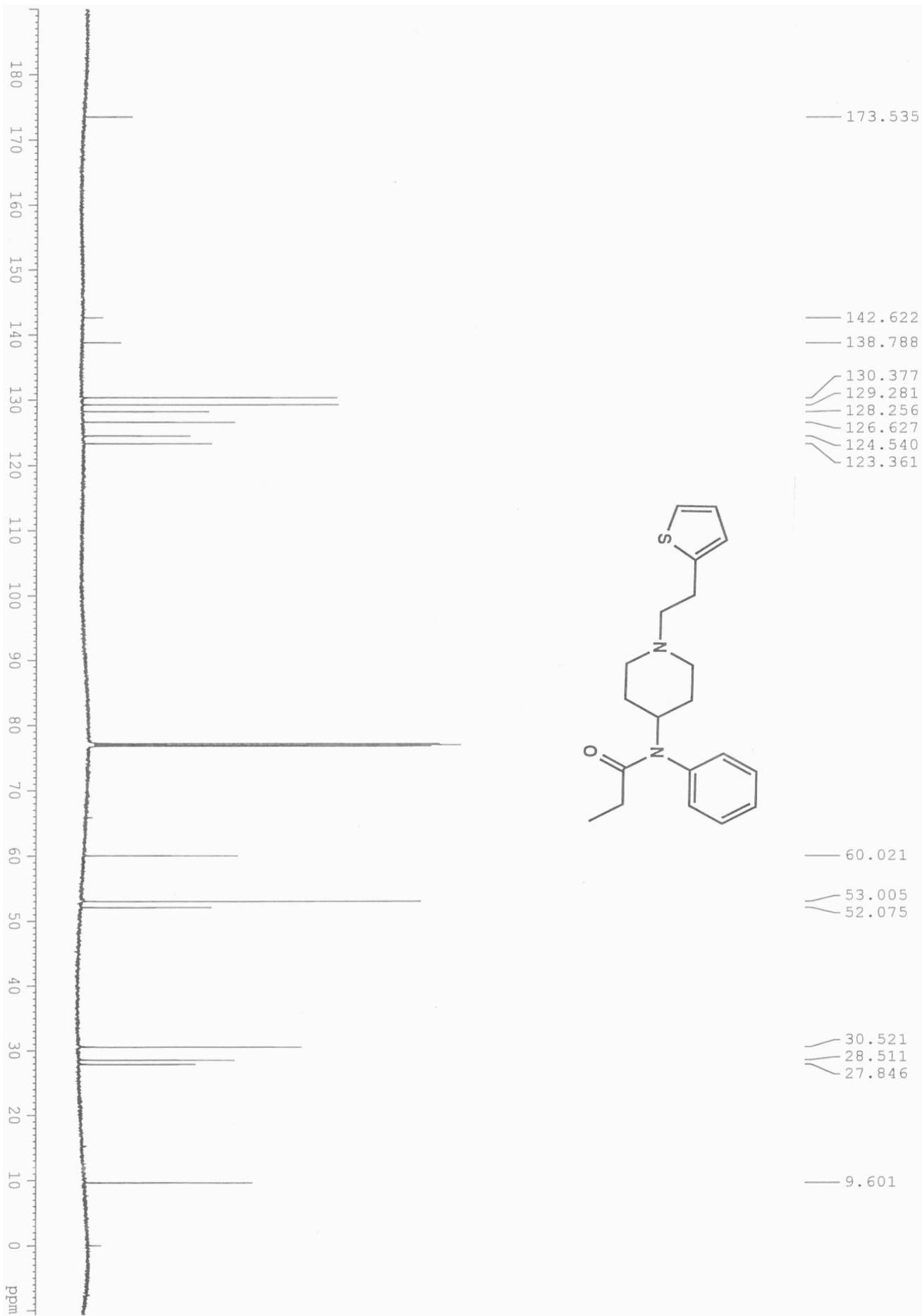
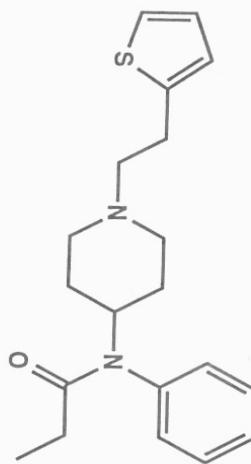


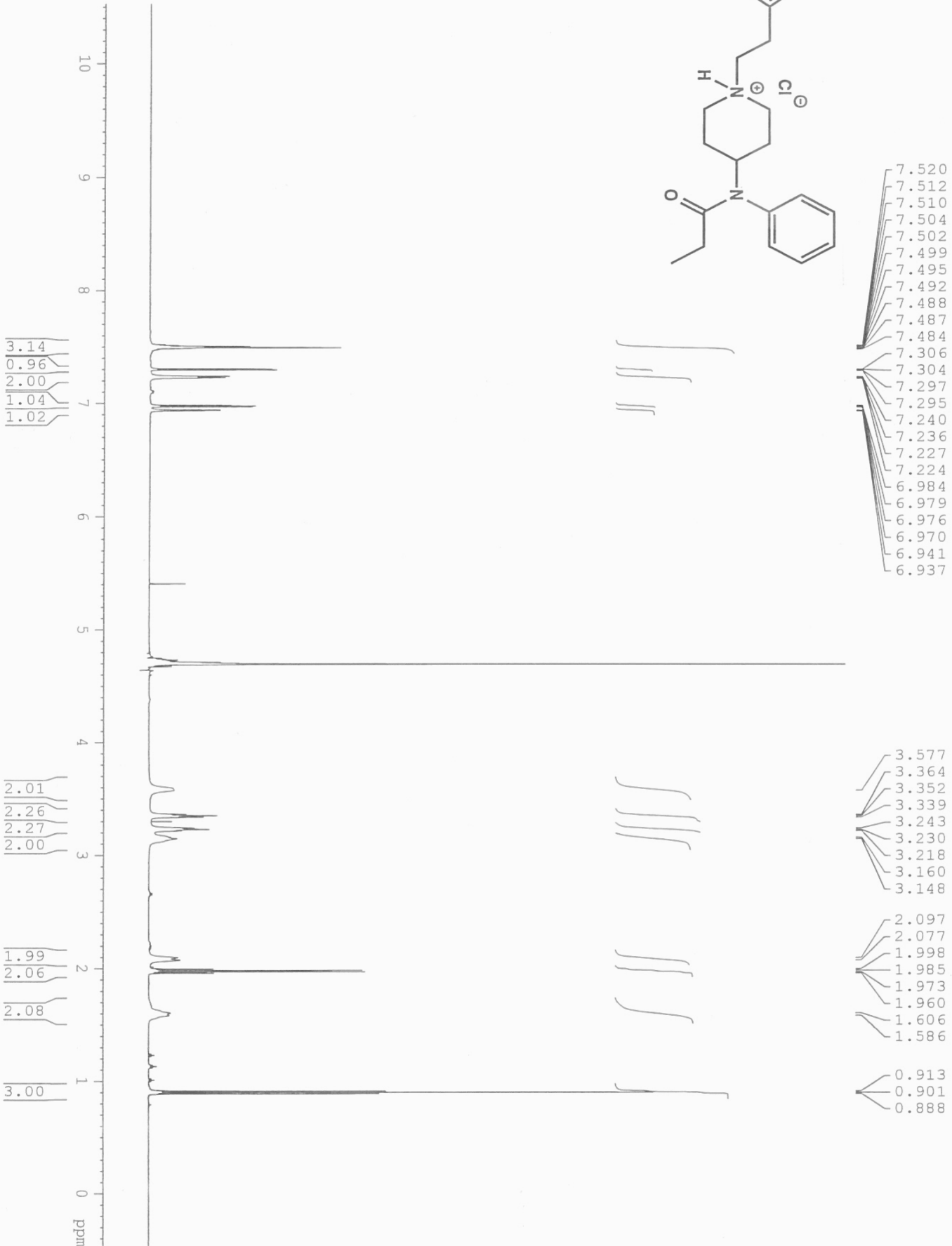
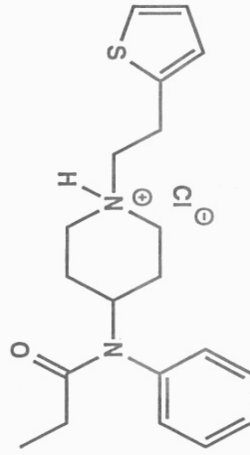


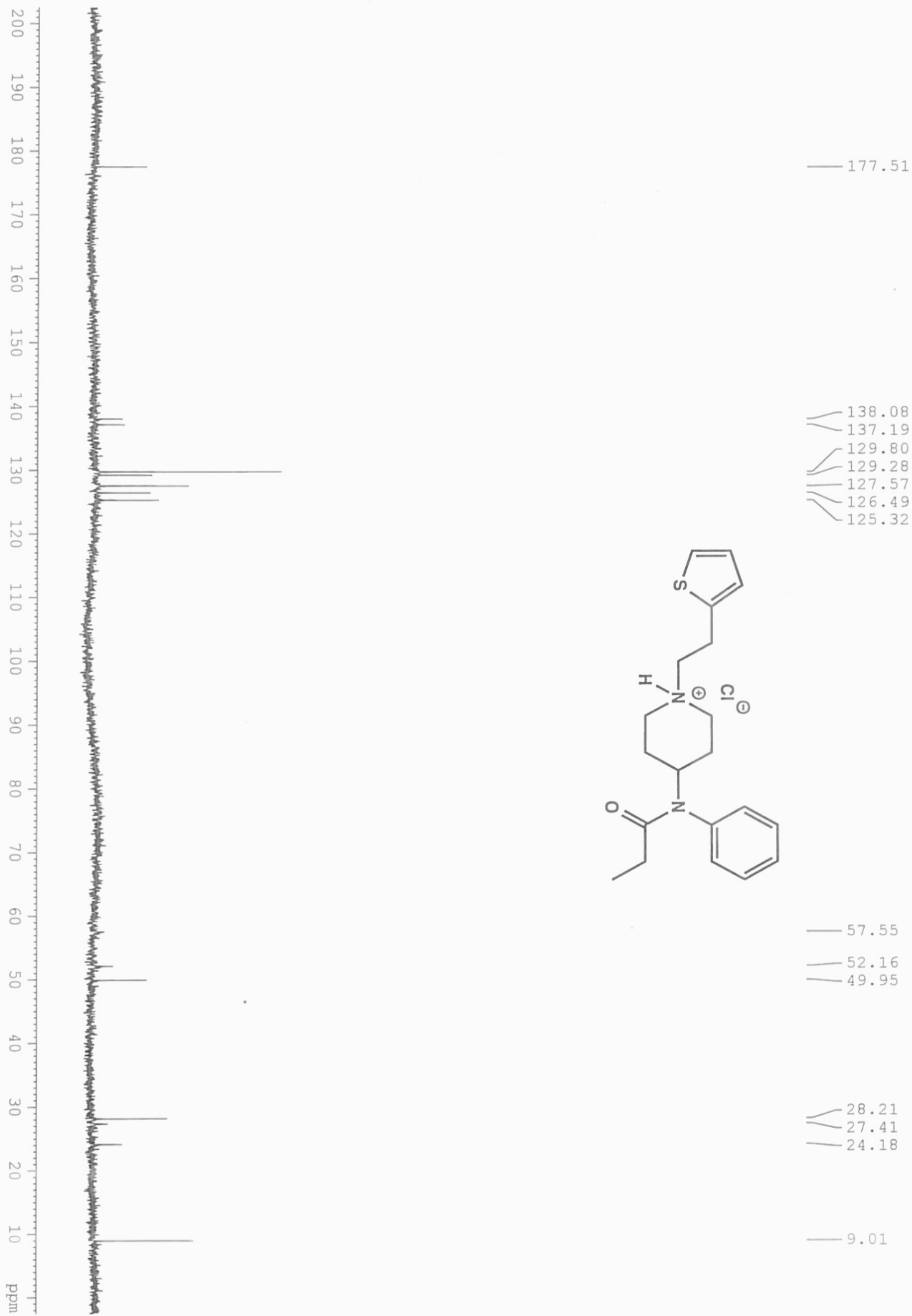
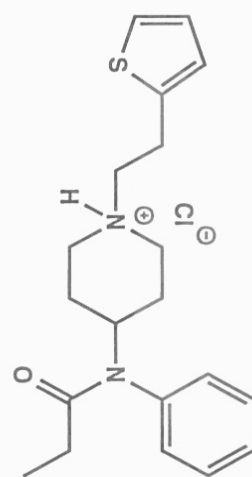
CV8-102
 Thioencanyl (free base)
 3-7-14

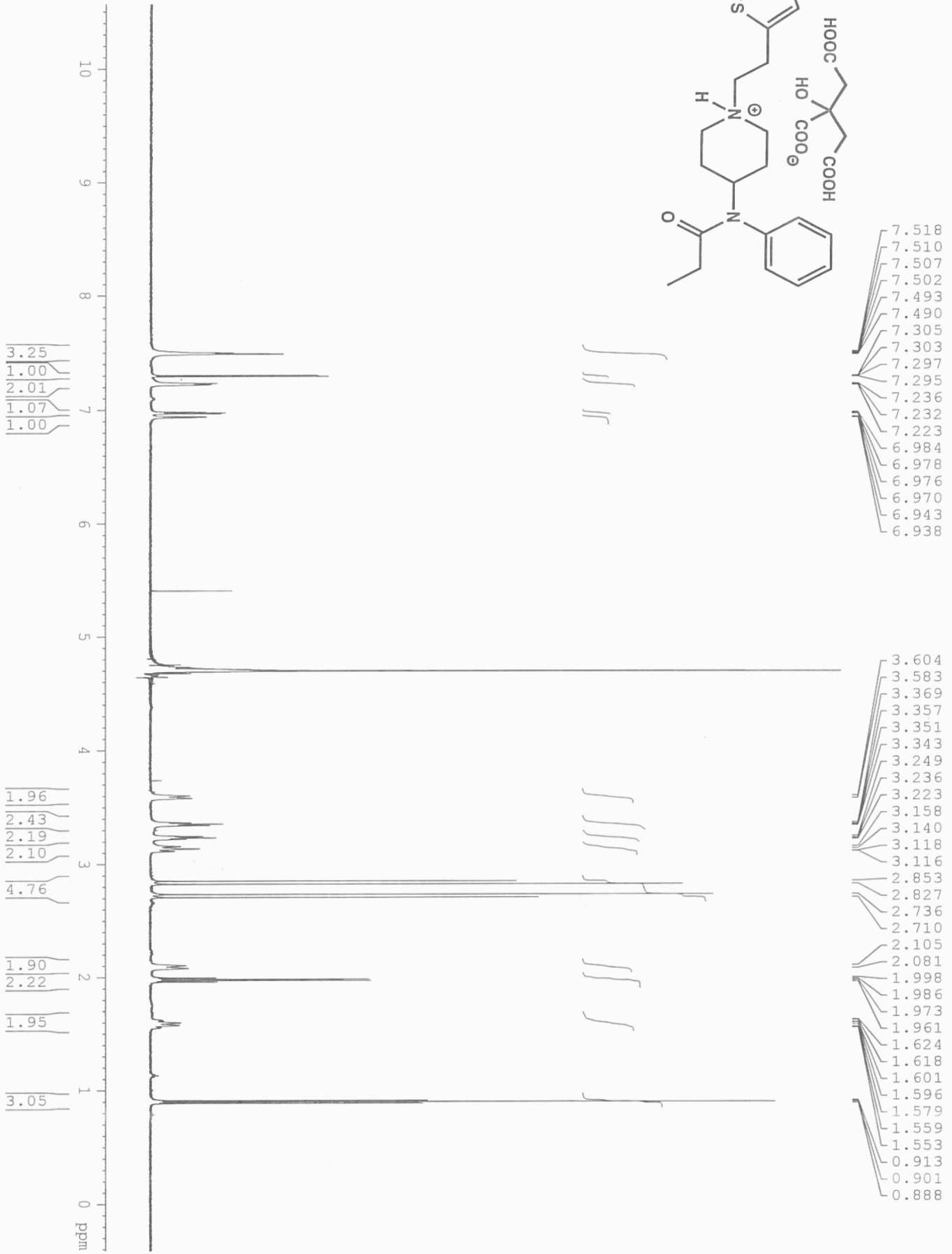
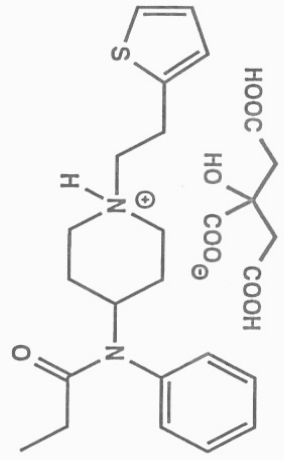


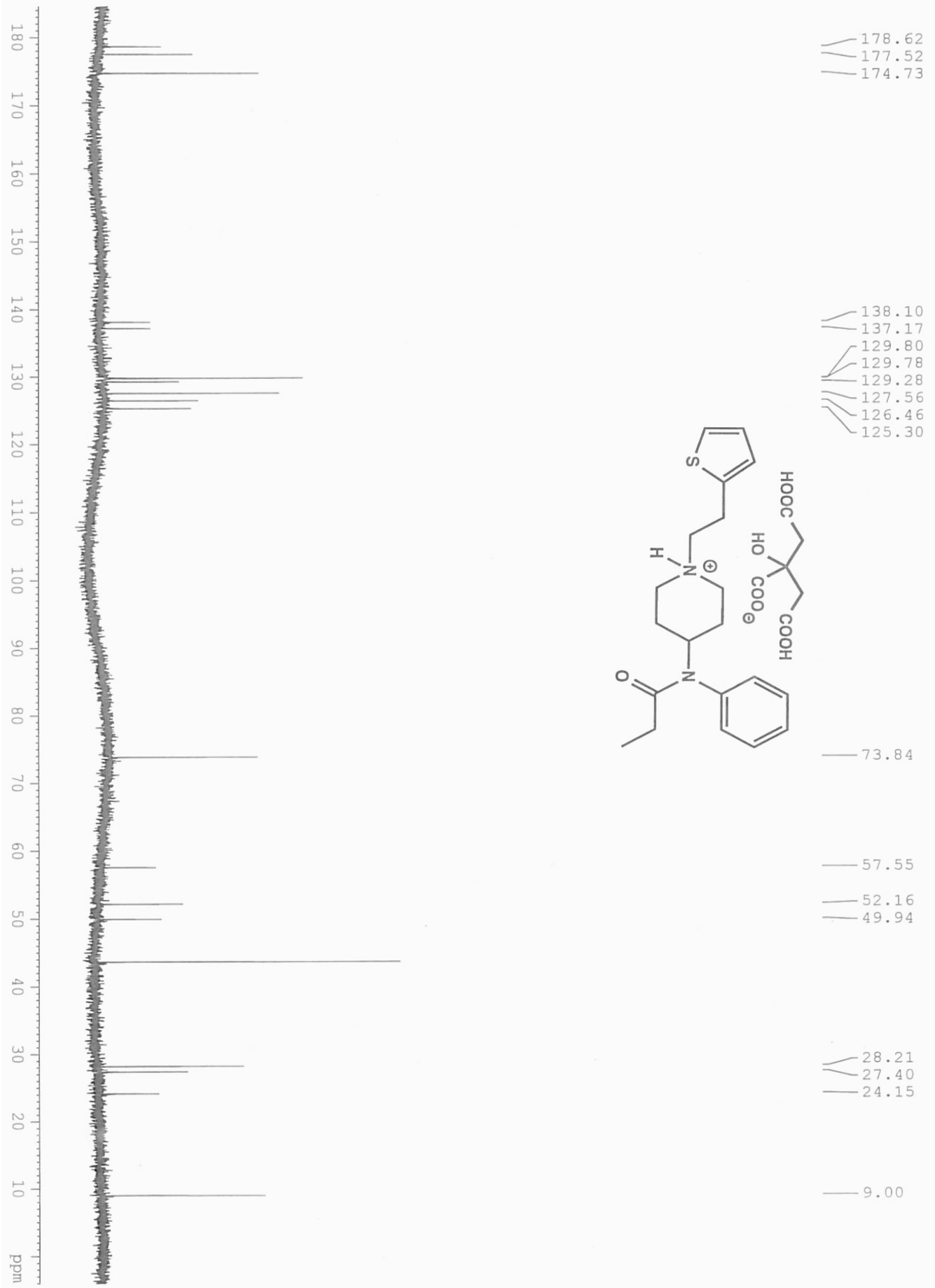
CV8-162
Thiofentanyl (Free base)
3-7-14



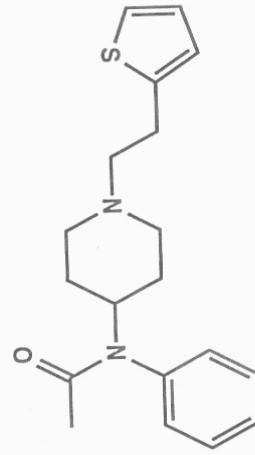




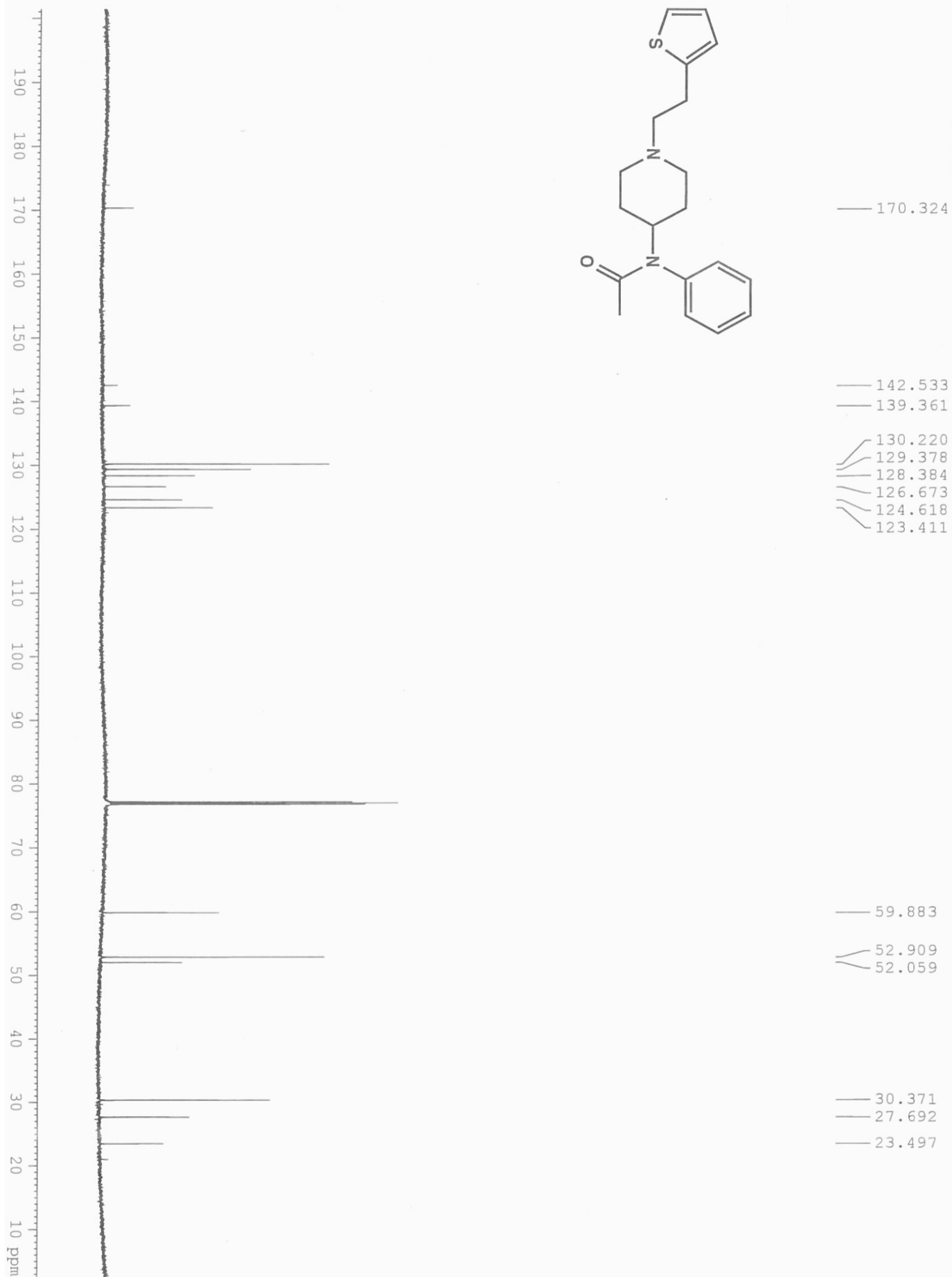
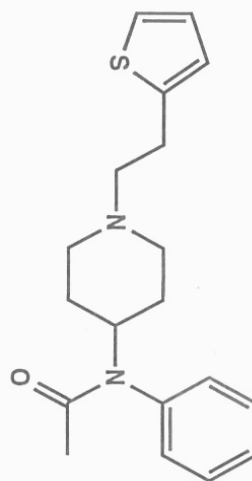




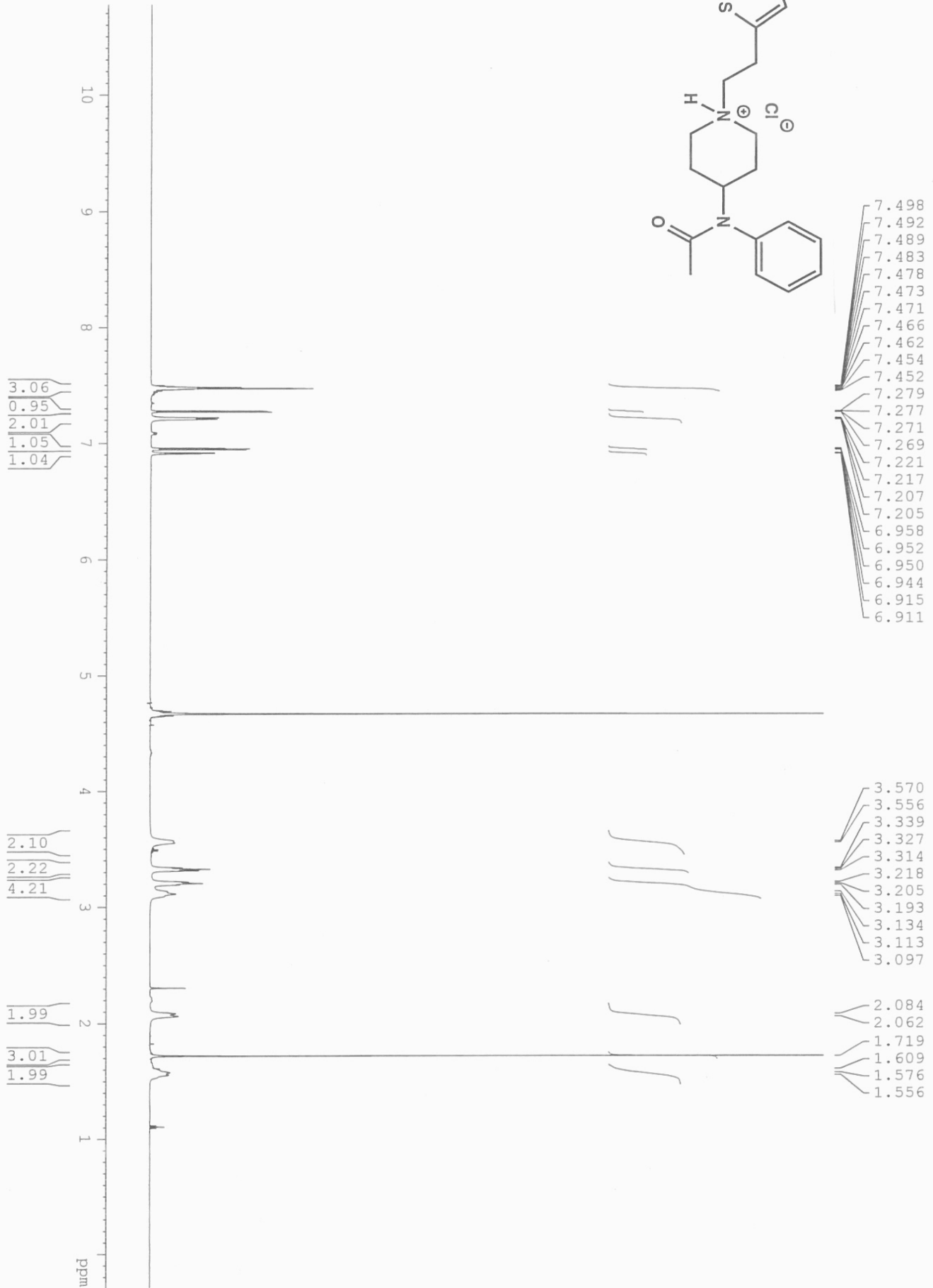
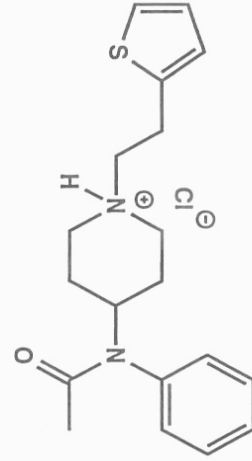
Acetyl[thiofentanyl] (free base)
5-6-14

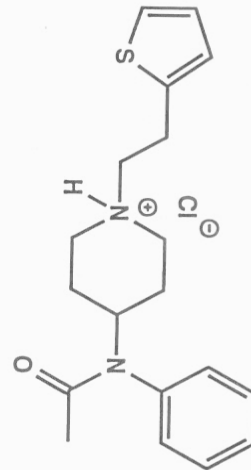


Acetylthiofentanyl 1 (Free base)
CV8-154
5-6-14



Acetylthiofentanyl (HCl salt)
CV8-180
5-7-14





174.096

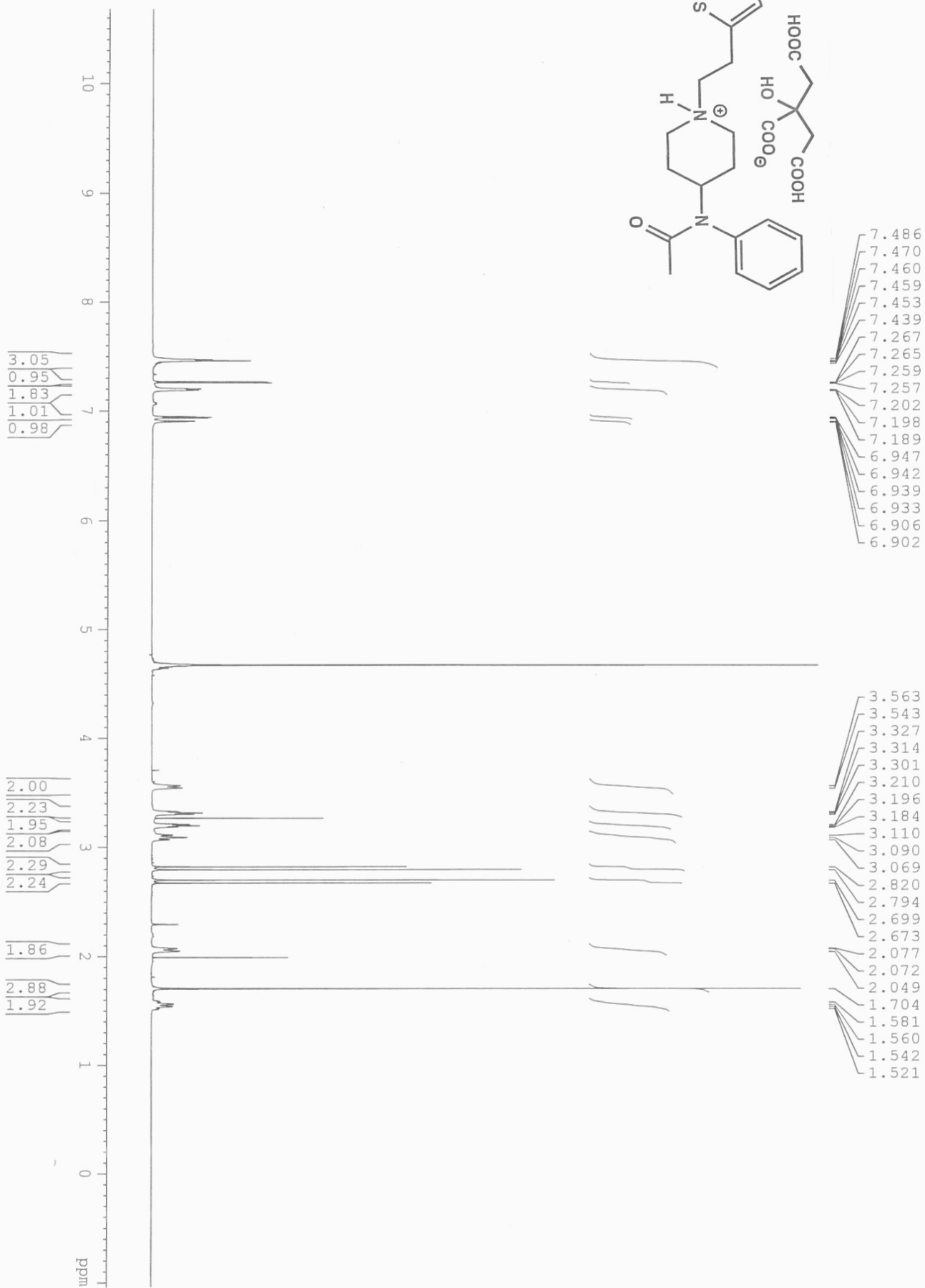
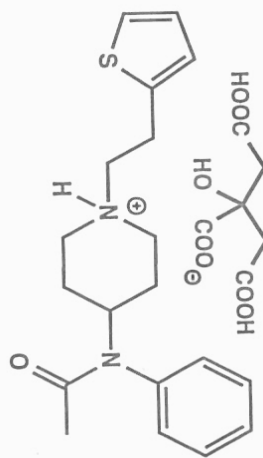
138.020
137.580
129.771
129.621
129.268
127.507
126.427
125.262

57.496

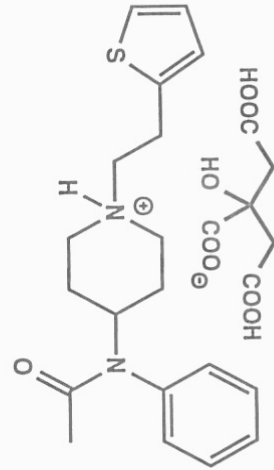
52.071
49.850

27.310
24.114
22.440





CV8-181
Acetylthiofentanyl citrate
5-7-14



178.277
174.417
174.055

138.053
137.536
129.764
129.613
129.267
127.509
126.407
125.230

73.654

57.471

52.054

49.826

43.515

27.298

24.081

22.442

