Supplementary Material

for

Sequential MCR *via* Staudinger/aza-Wittig *versus* cycloaddition reaction to access diversely functionalized 1-amino-1*H*-imidazole-2(3*H*)-thiones

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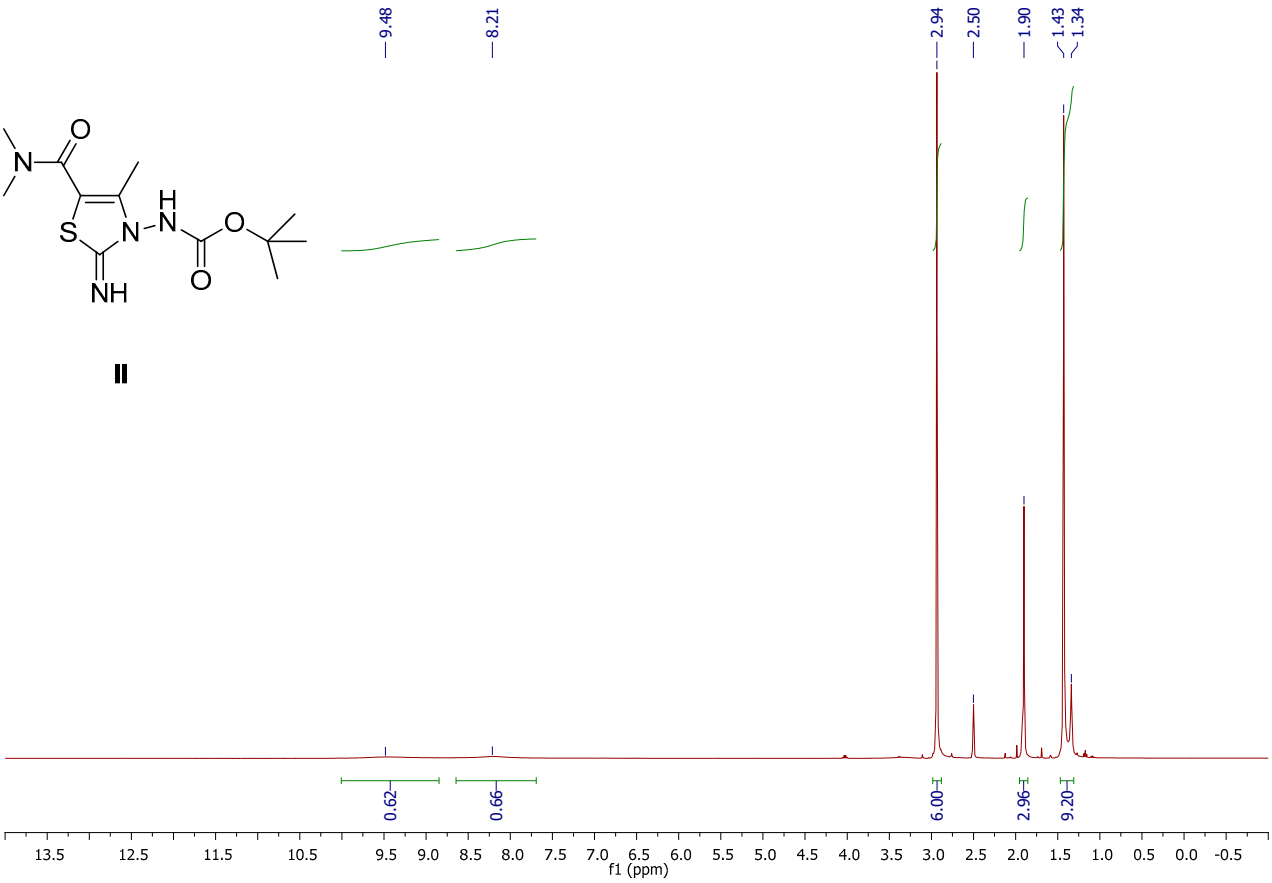
Procedure referred to in Scheme 2

To a stirred solution of 2-chloro-*N*,*N*-dimethyl-3-oxobutanamide (**A**) (1 mmol) in AcOH (4 mL), finely crashed potassium thiocyanate (**B**) (1.5 mmol) was added at room temperature. After 1 hour, *tert*-butyl hydrazinecarboxylate (**C**) (1 mmol) was added portionwise and quickly. In a short time, the reaction mixture turned yellow and was left to stir until the disappearance of **A** (TLC check, 2 h). The crude reaction mixture was then treated with a diluted solution of 5% NaOH until neutrality, extracted with EtOAc (50 mL), and washed with water (3 × 10 mL). The combined organic phases were dried (Na_2SO_4), concentrated under reduced pressure, and purified by column chromatography eluting with cyclohexane:EtOAc mixture (from 1:1 to pure EtOAc) to afford **II** as major product.

tert-Butyl (5-((dimethylamino)carbonyl)-2-imino-4-methyl-1,3-thiazol-3(2*H*)-yl)carbamate (**II**): Yield 48% (144.2 mg) white powder from EtOAc / light petroleum ether; Mp 157–161 °C (dec.); ^{1}H-NMR (400 MHz, DMSO-d_6) δ 1.34 and 1.43 (2 s, 9 H, OBu^{t}), 1.90 (s, 3 H, CH_3), 2.94 [s, 6 H, N(CH_3)$_2$], 8.21 (br s, 1 H, NH), 9.48 (br s, 1 H, NH); ^{13}C-NMR (100 MHz DMSO-d_6) δ 12.7, 27.6, 27.8, 36.7, 80.5, 98.5, 137.0, 154.6, 158.0, 162.8; IR (Nujol, ν, cm^{-1}): 3320, 3254, 3200, 1736, 1633, 1607; MS *m*/*z* (ESI): 301.15 (M + H)$^{+}$; calcd. for $C_{12}H_{20}N_4O_3S$ (300.38): C, 47.98; H, 6.71; N, 18.65; found: C, 48.07; H, 6.75; N, 18.69 [1].

The partition of some signals here, as well as in the following cases, is caused by the N1-amide rotameric effect [2].

II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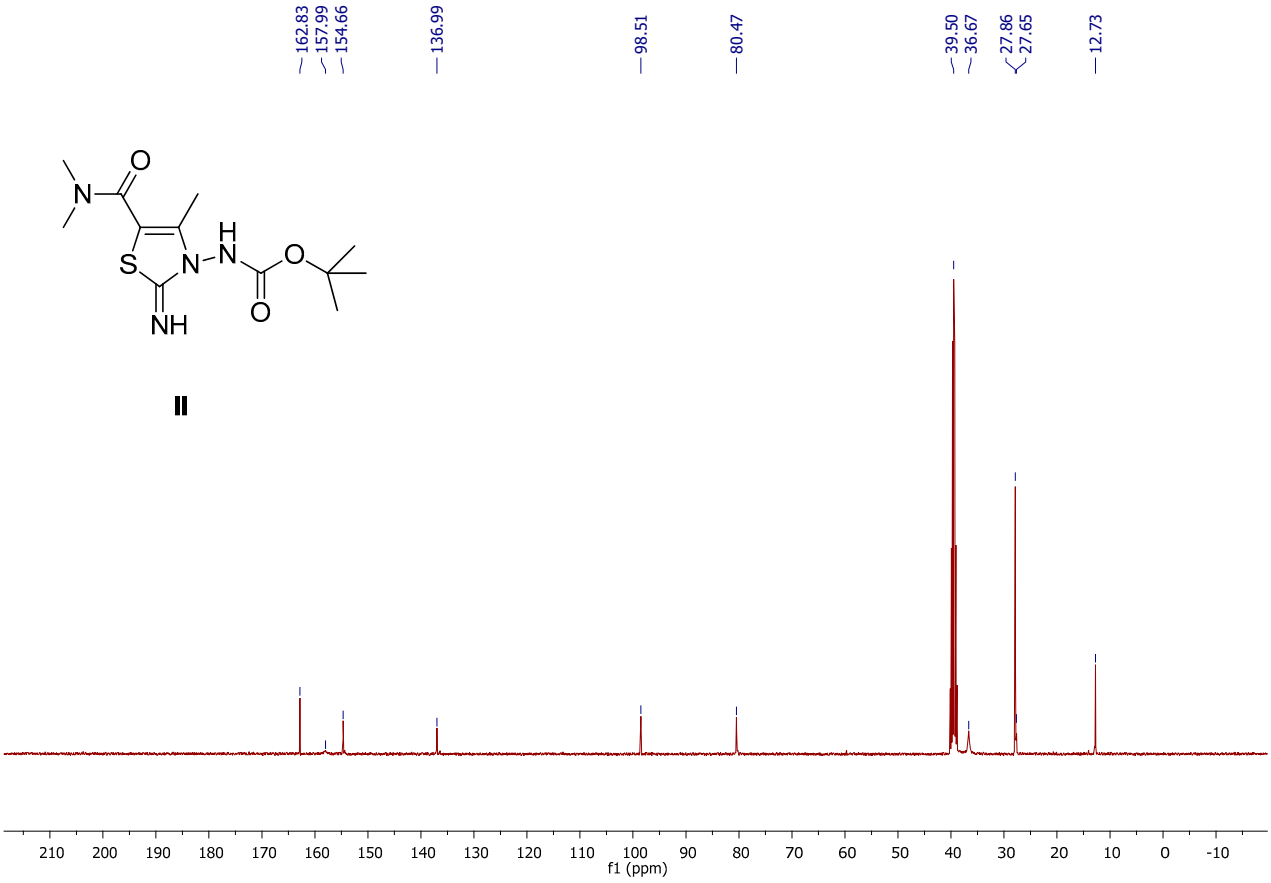
6.00
2.96
9.20
f1 (ppm)

II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36.67
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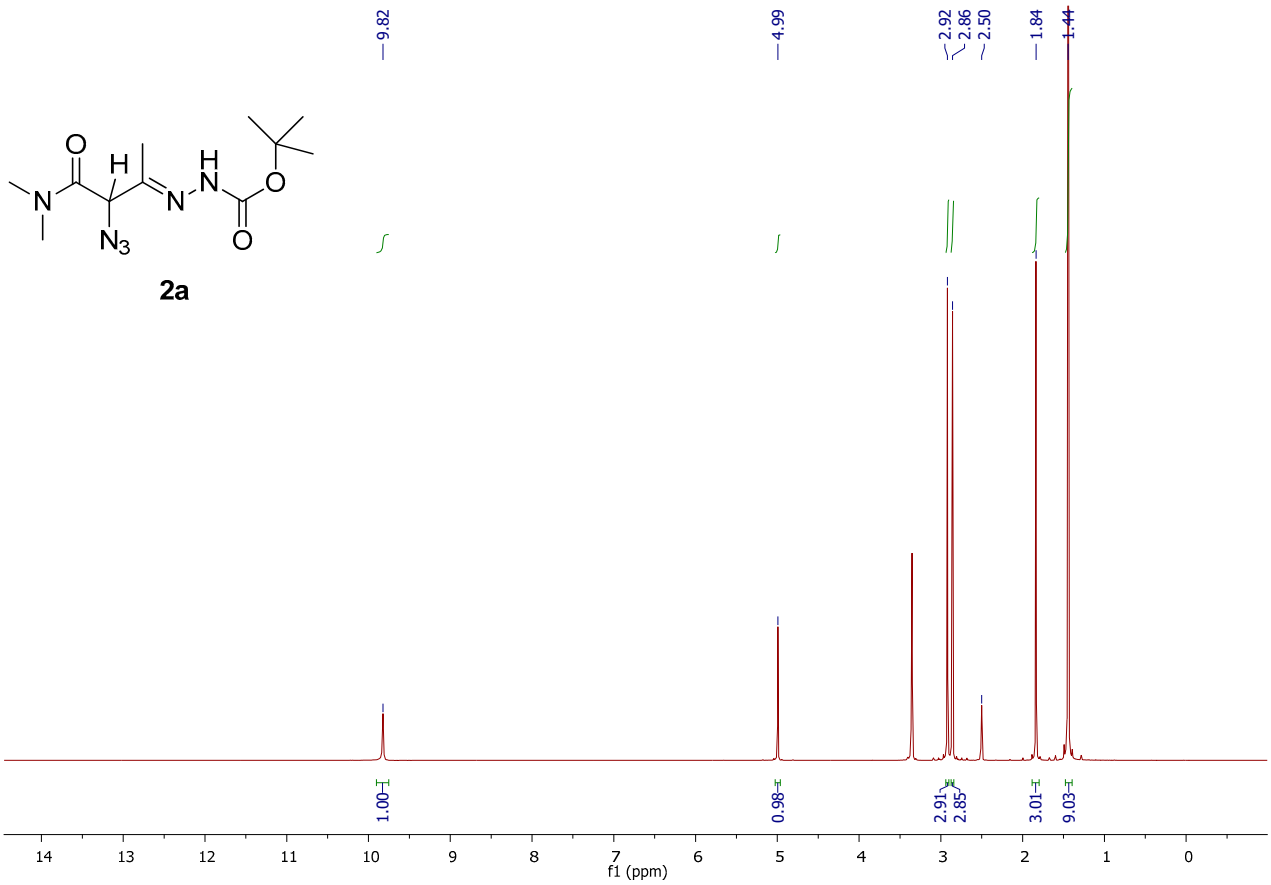
27.65
12.73
f1 (ppm)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3.01
9.03
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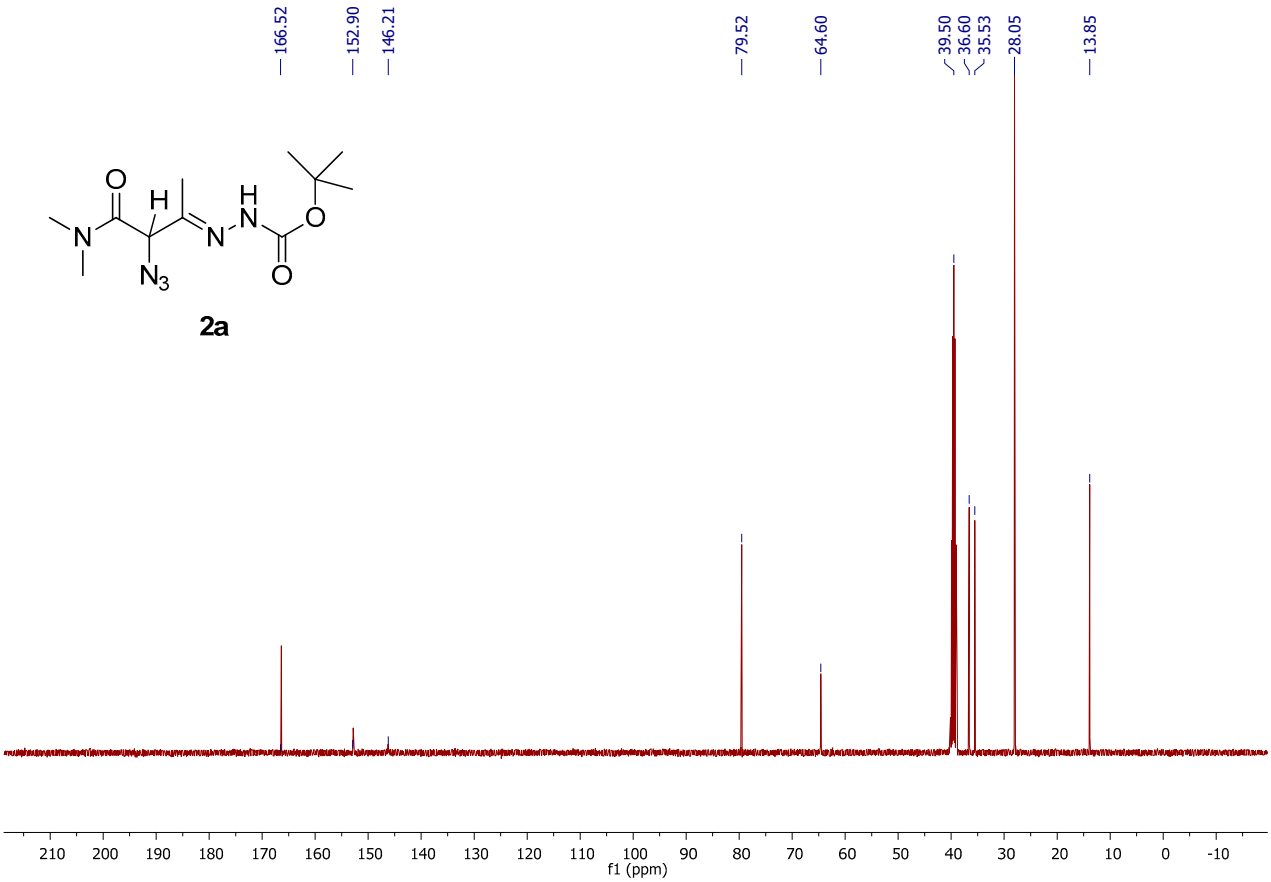
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13.85
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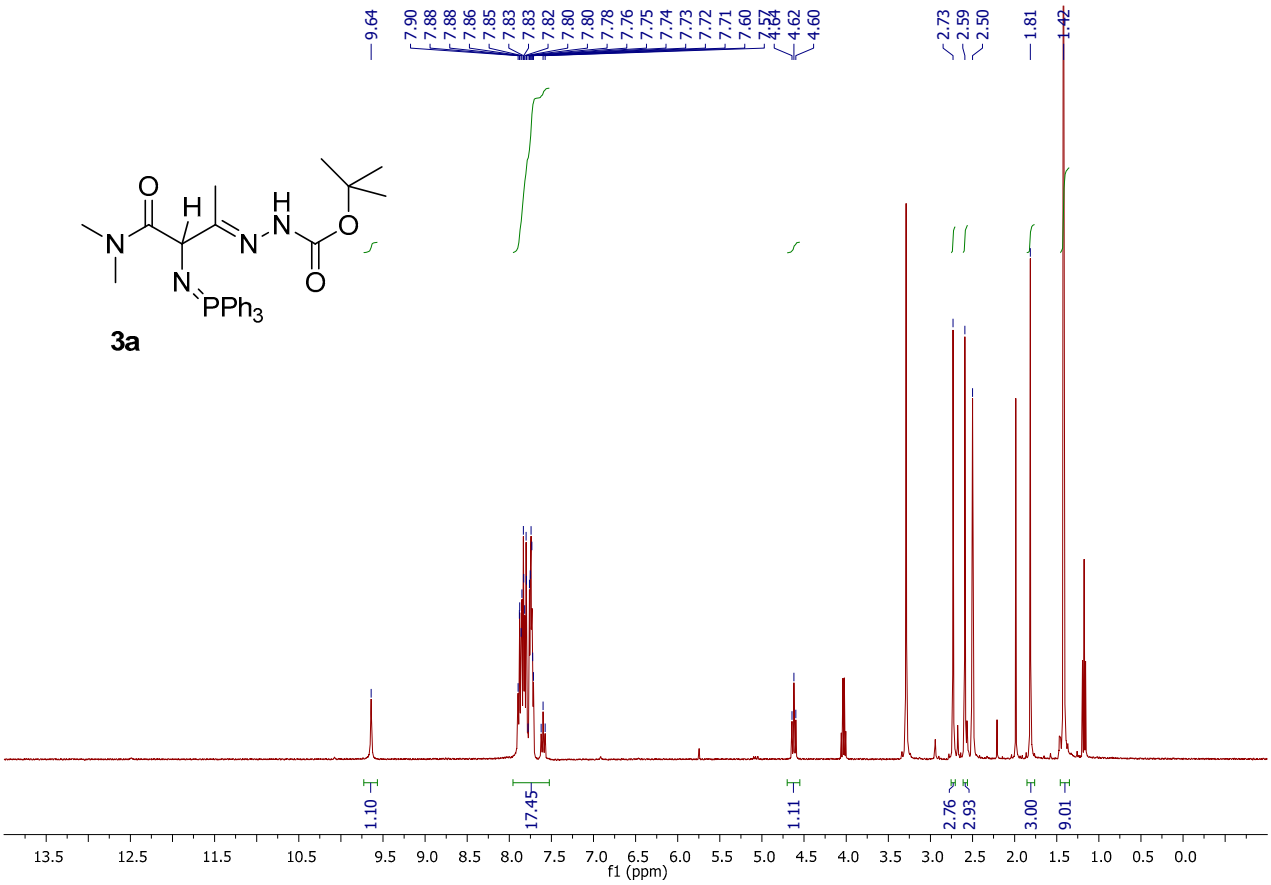
2a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7.76
7.75
7.74
7.73
7.72
7.71
7.60
4.64
4.62
4.60
2.73
2.59
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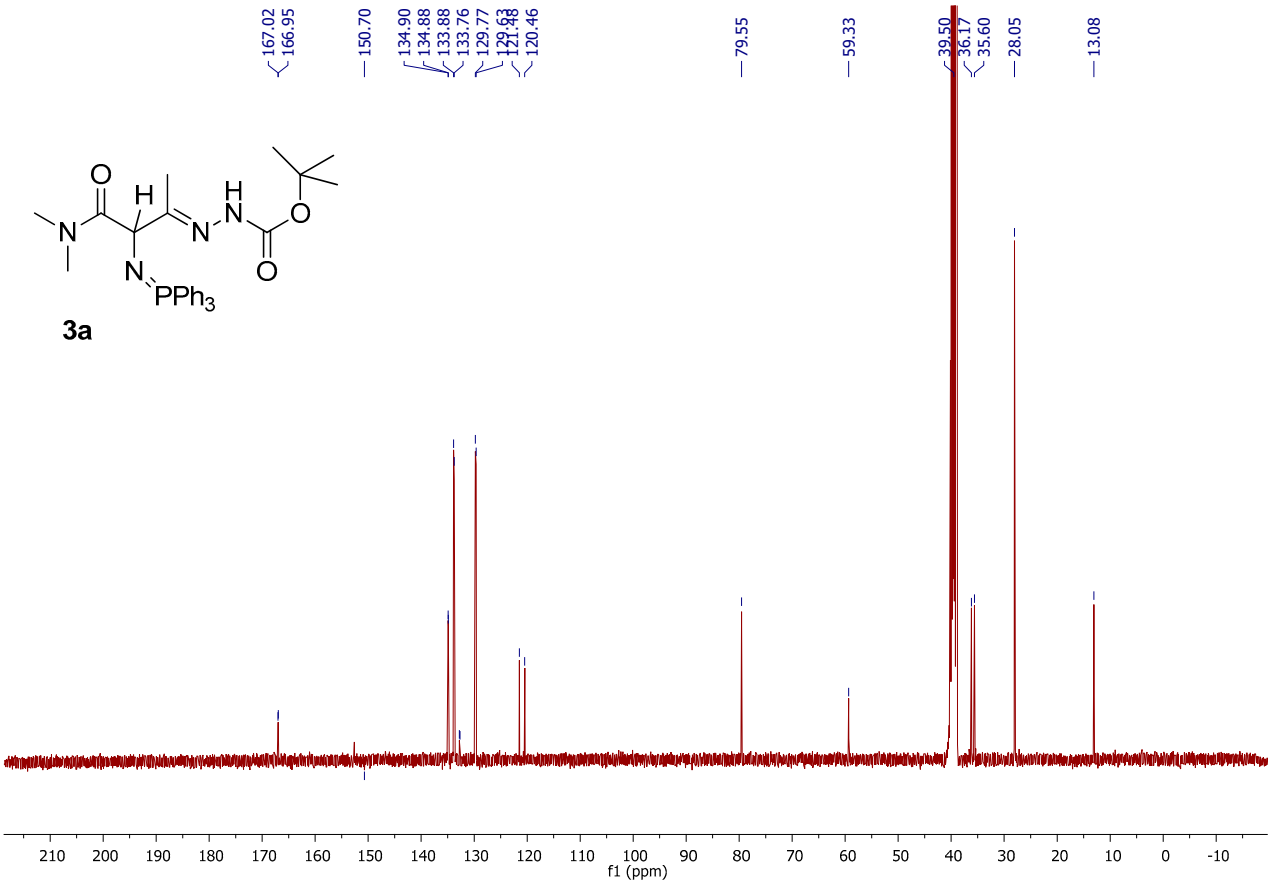
9.01
f1 (ppm)

3a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133.88
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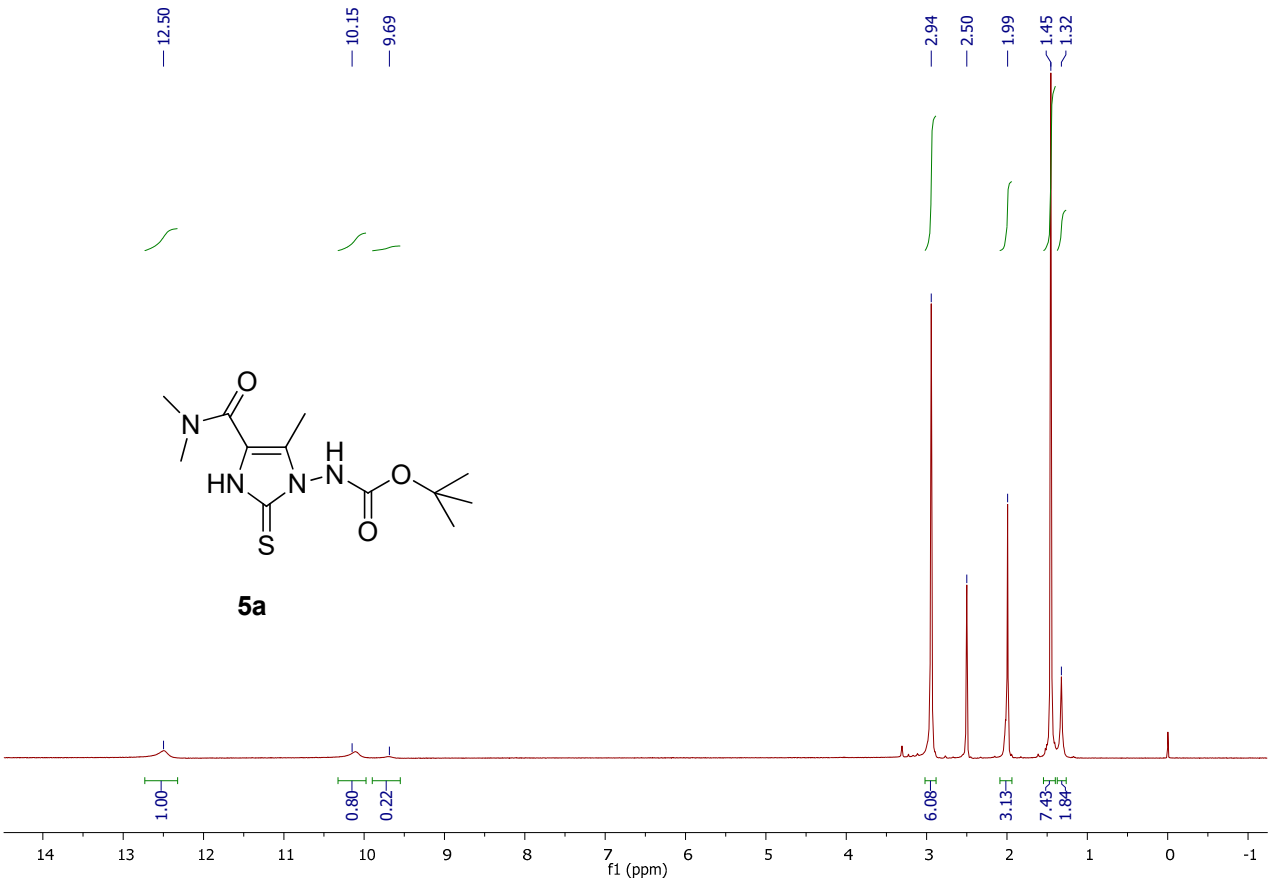
3a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7.43
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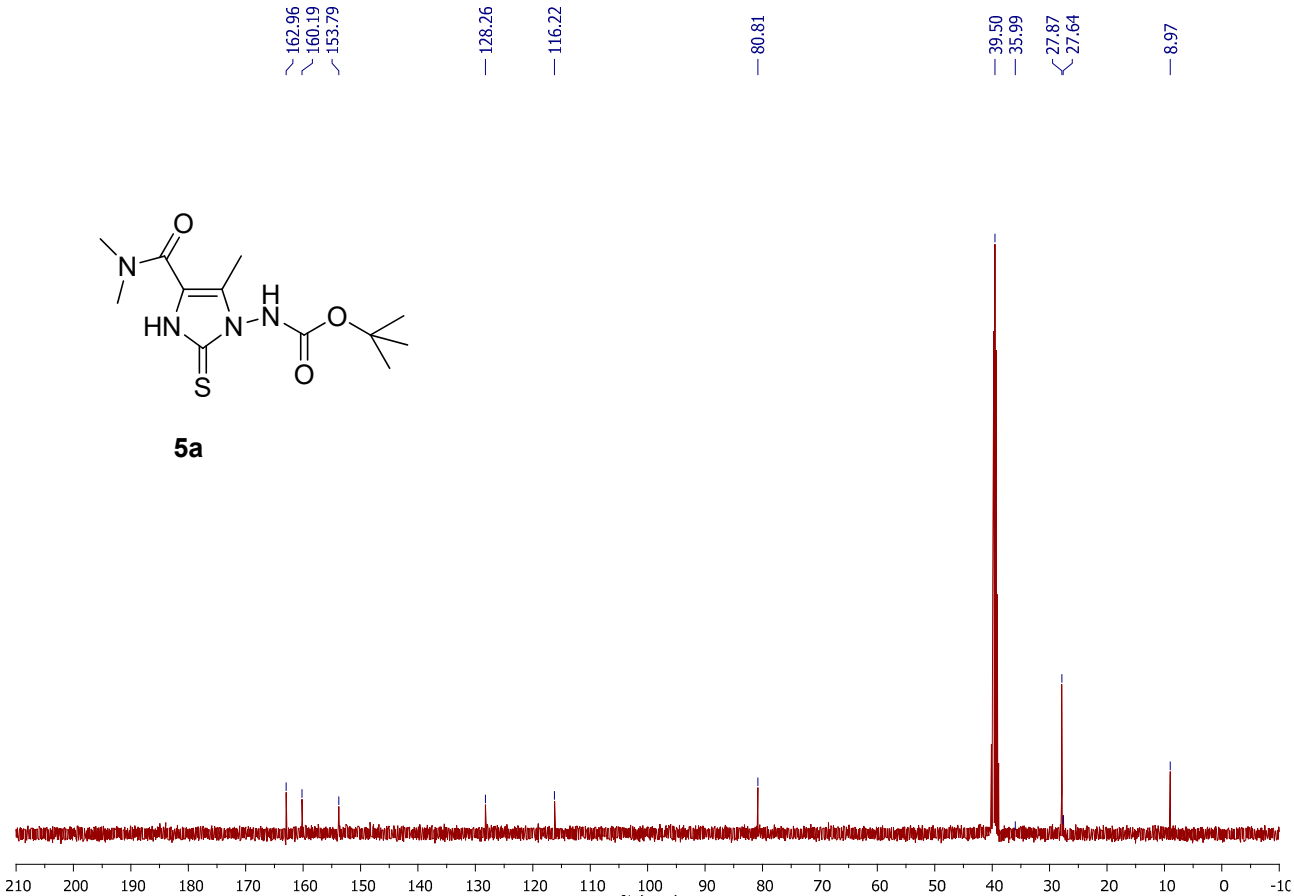
5a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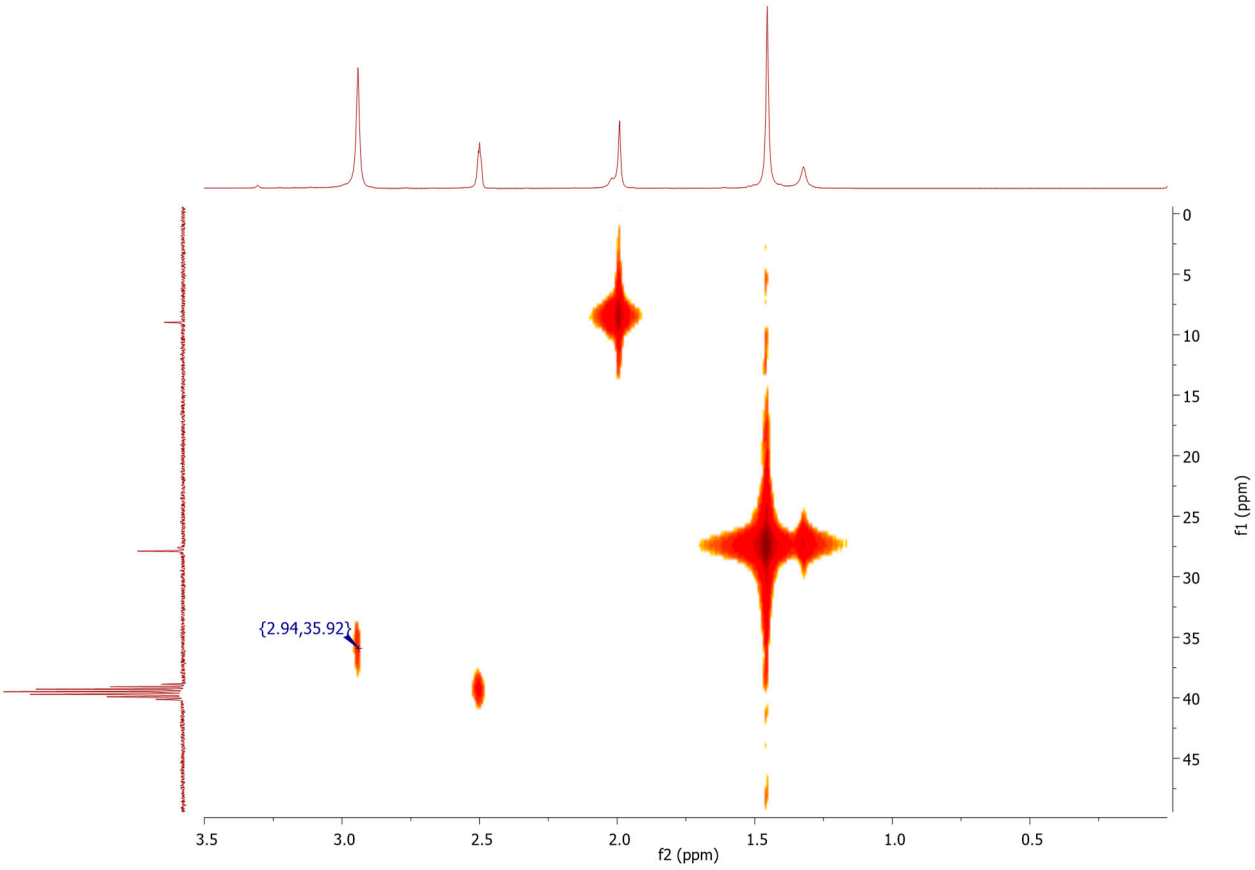
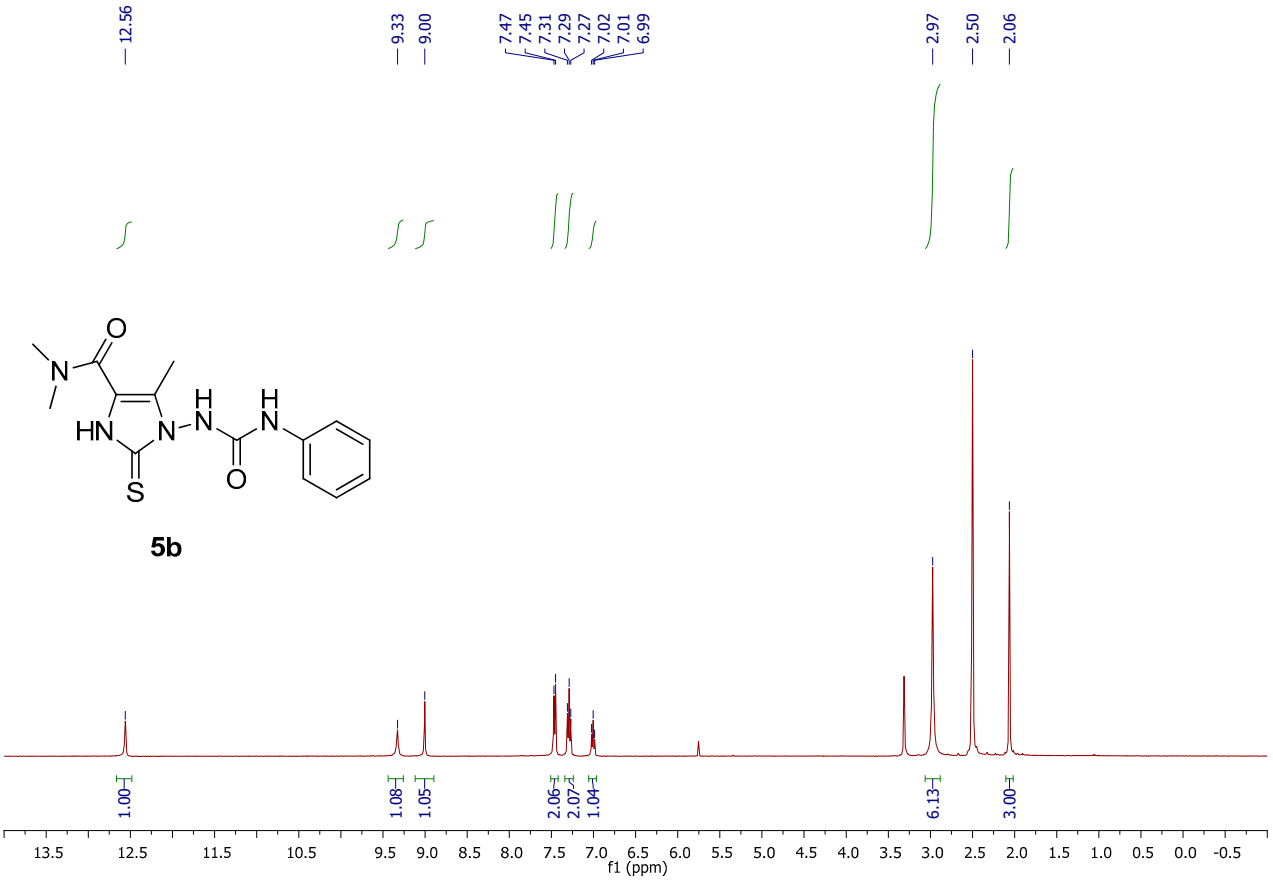
5a

HMQC 5a

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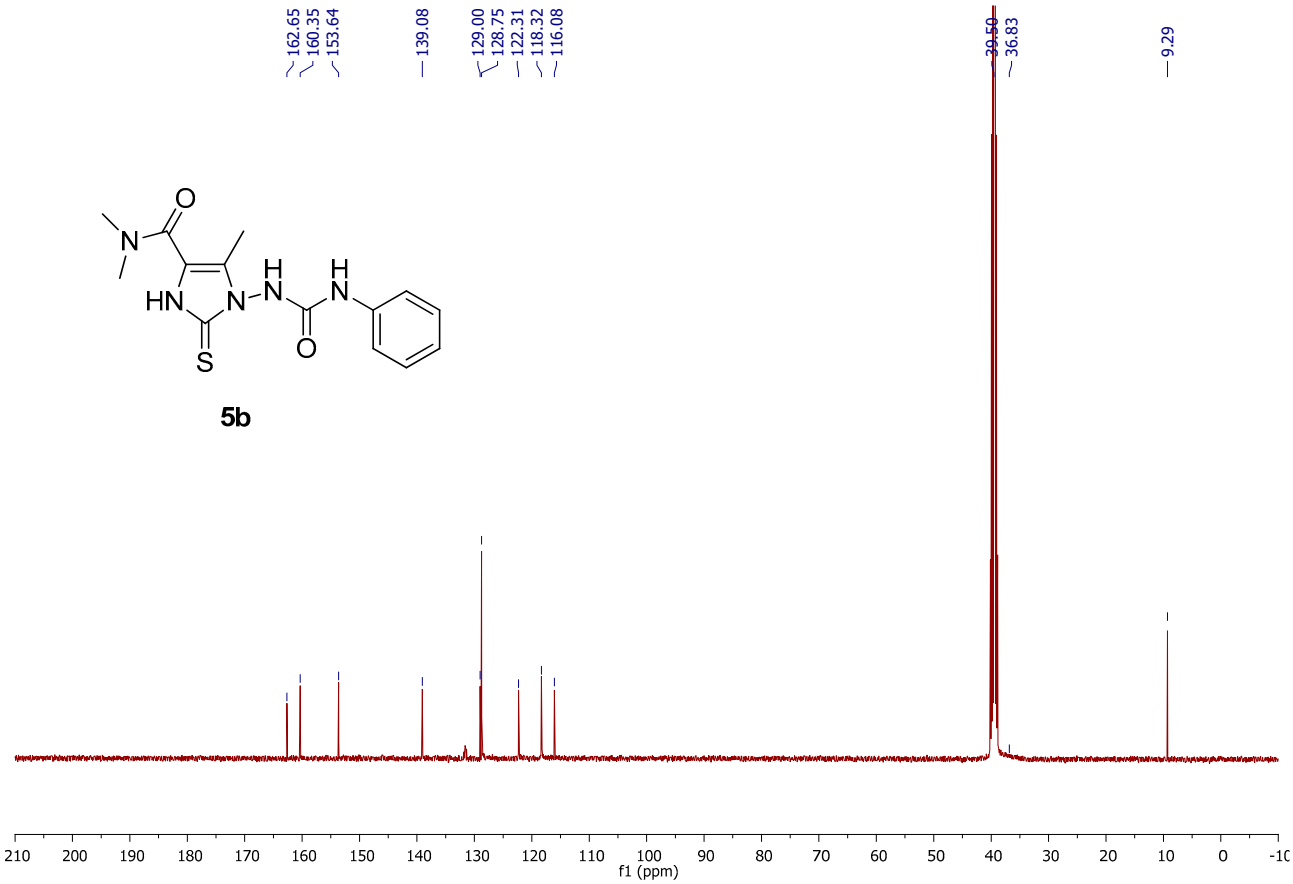
6.13
3.00
f1 (ppm)

5b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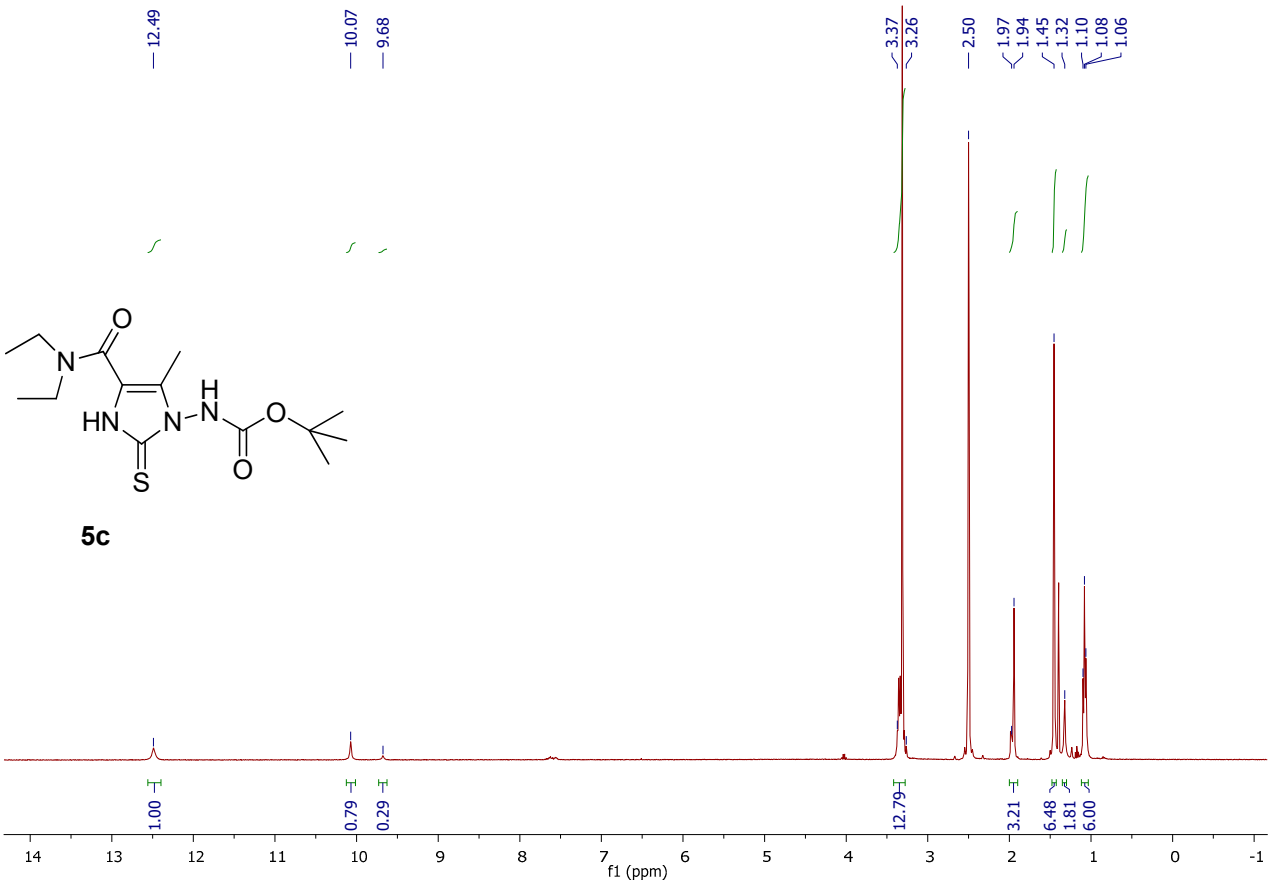
f1 (ppm)

5b


12.49
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1.94
1.45
1.32
1.10
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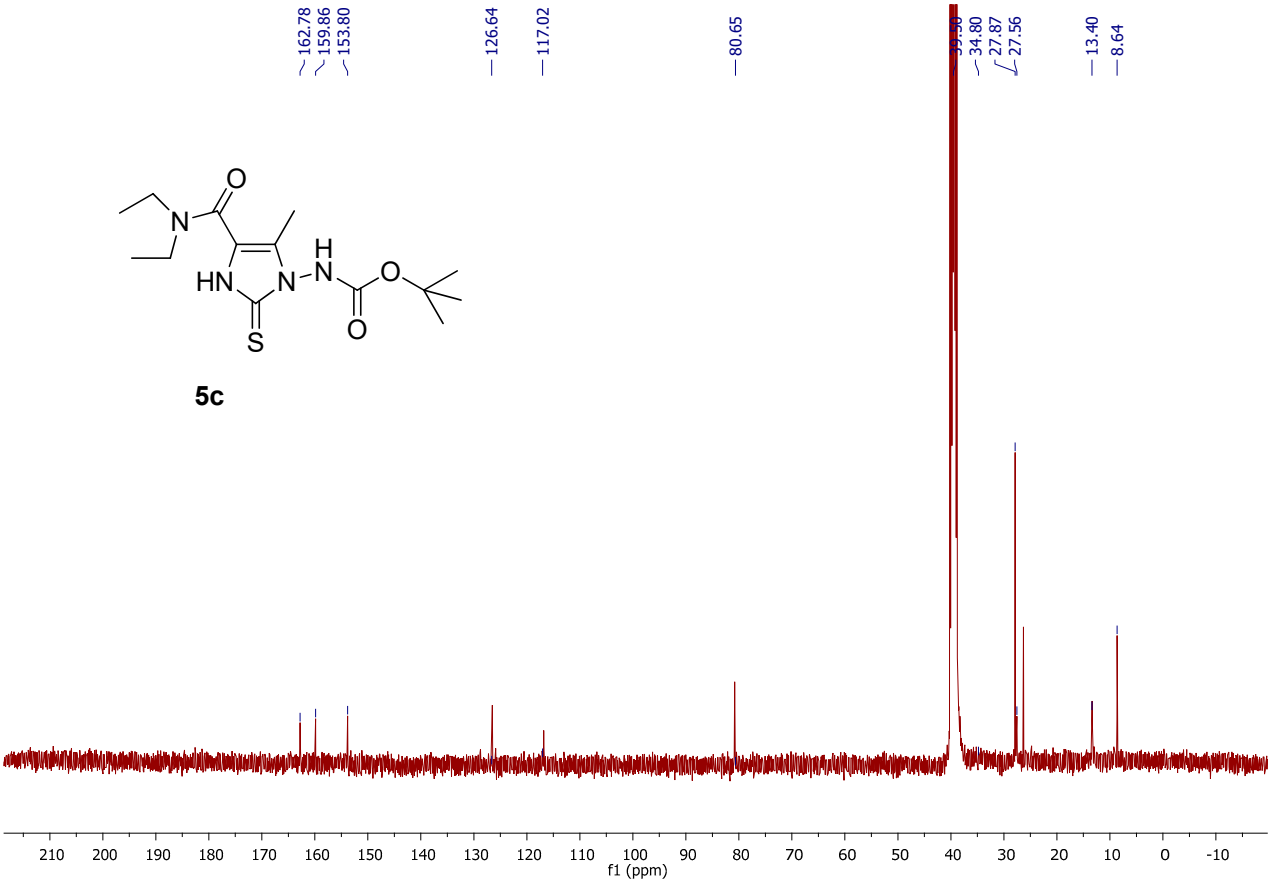
1.81
6.00
f1 (ppm)

5c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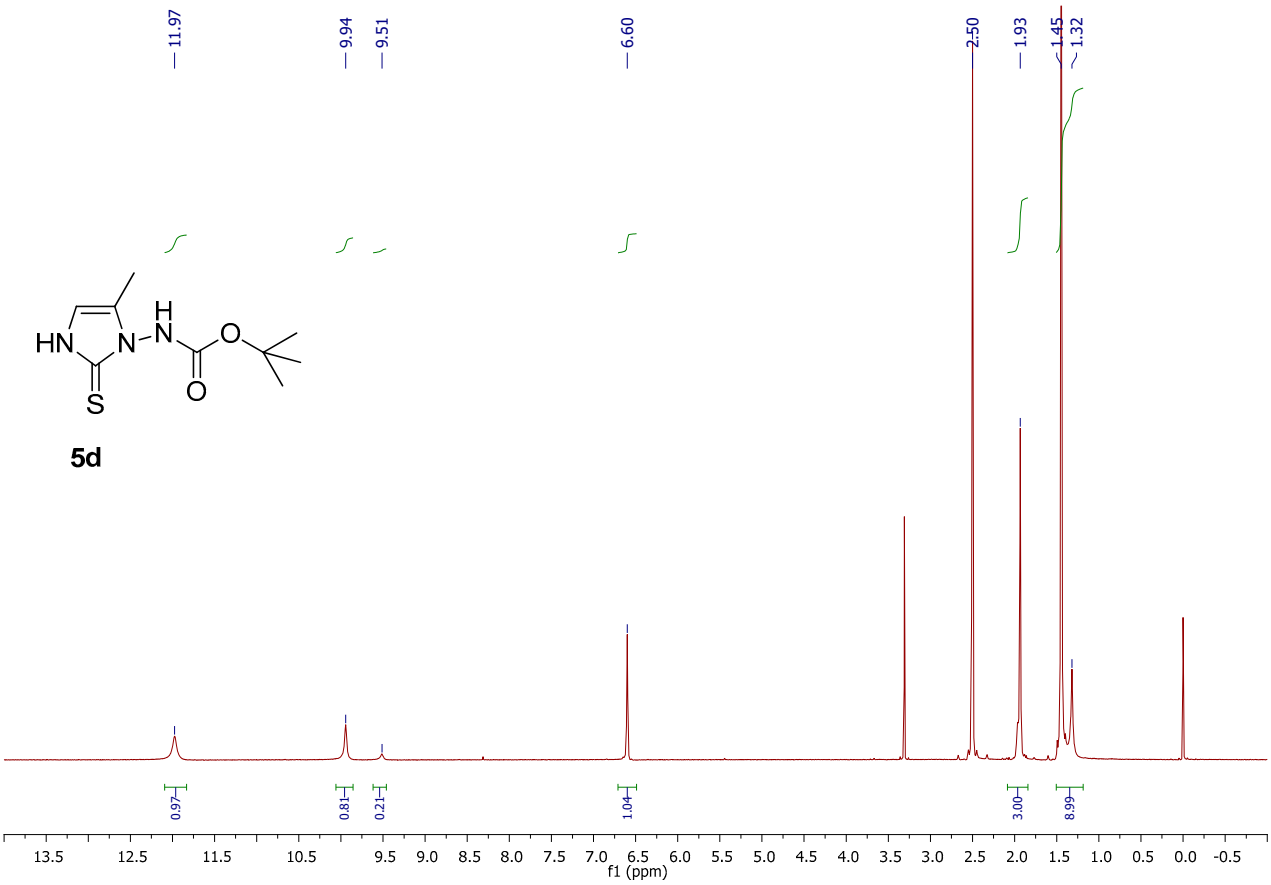
5c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1.32
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H
N
O
O
S
0.97
0.81
0.21
1.04
3.00
8.99
13.5 12.5 11.5 10.5 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
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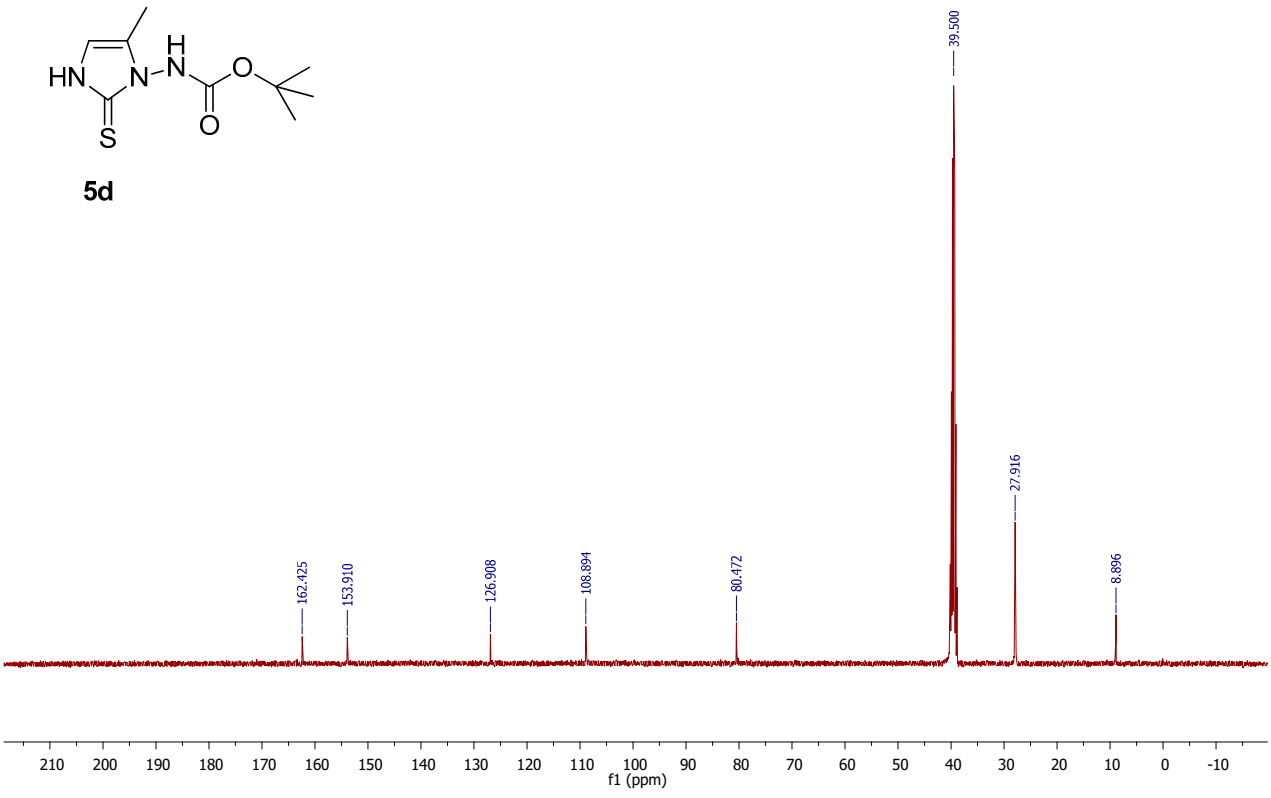
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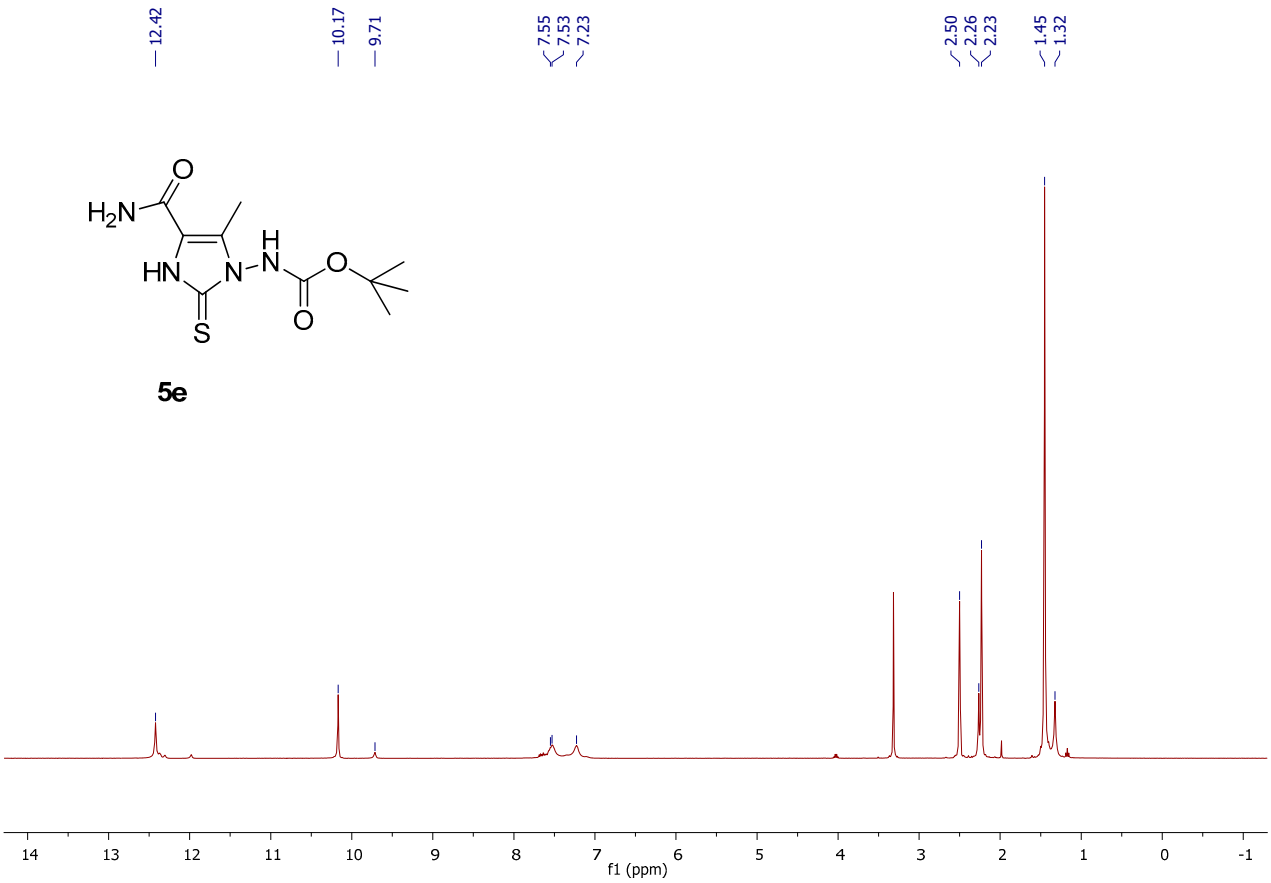
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1.32
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N
H
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O
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S
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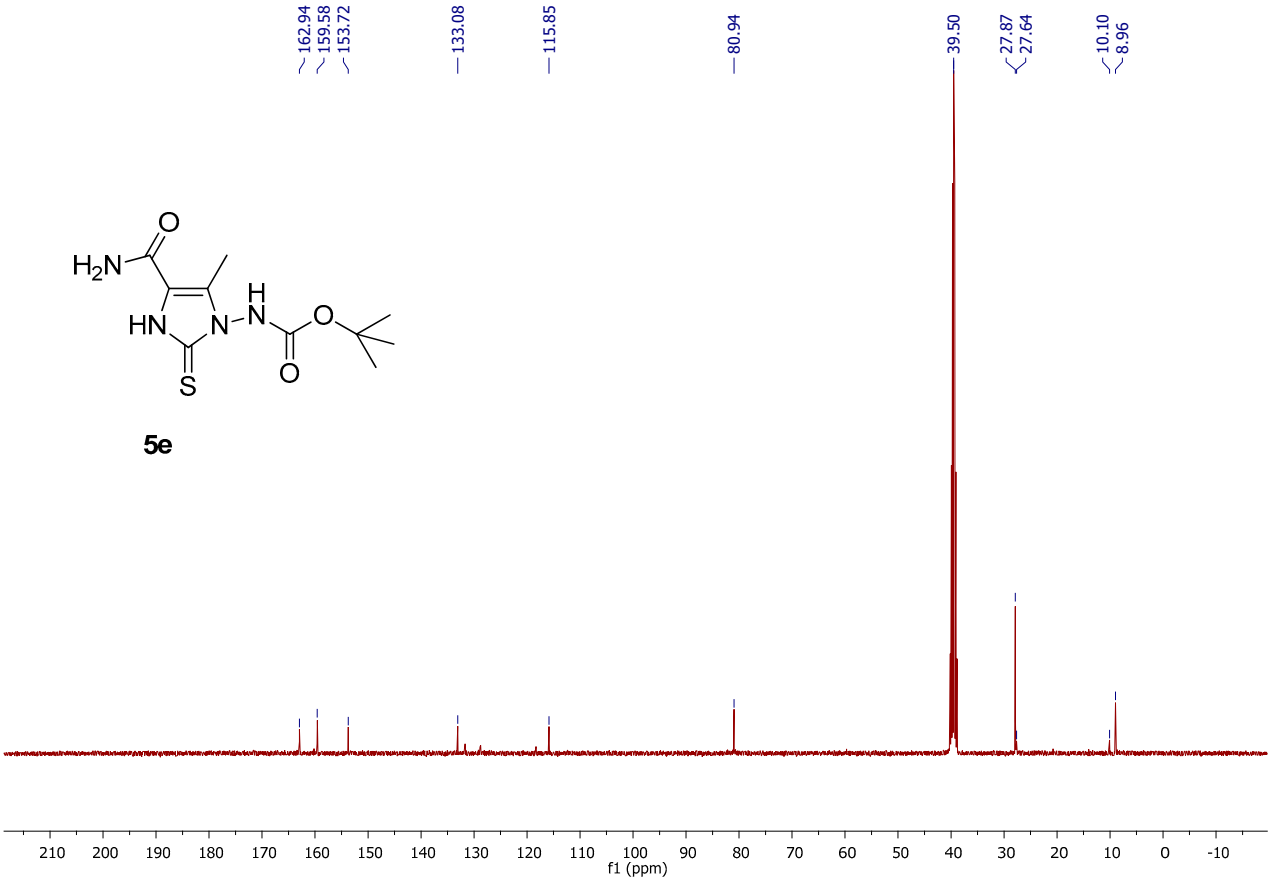
f1 (ppm)

5e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27.87
27.64
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8.96
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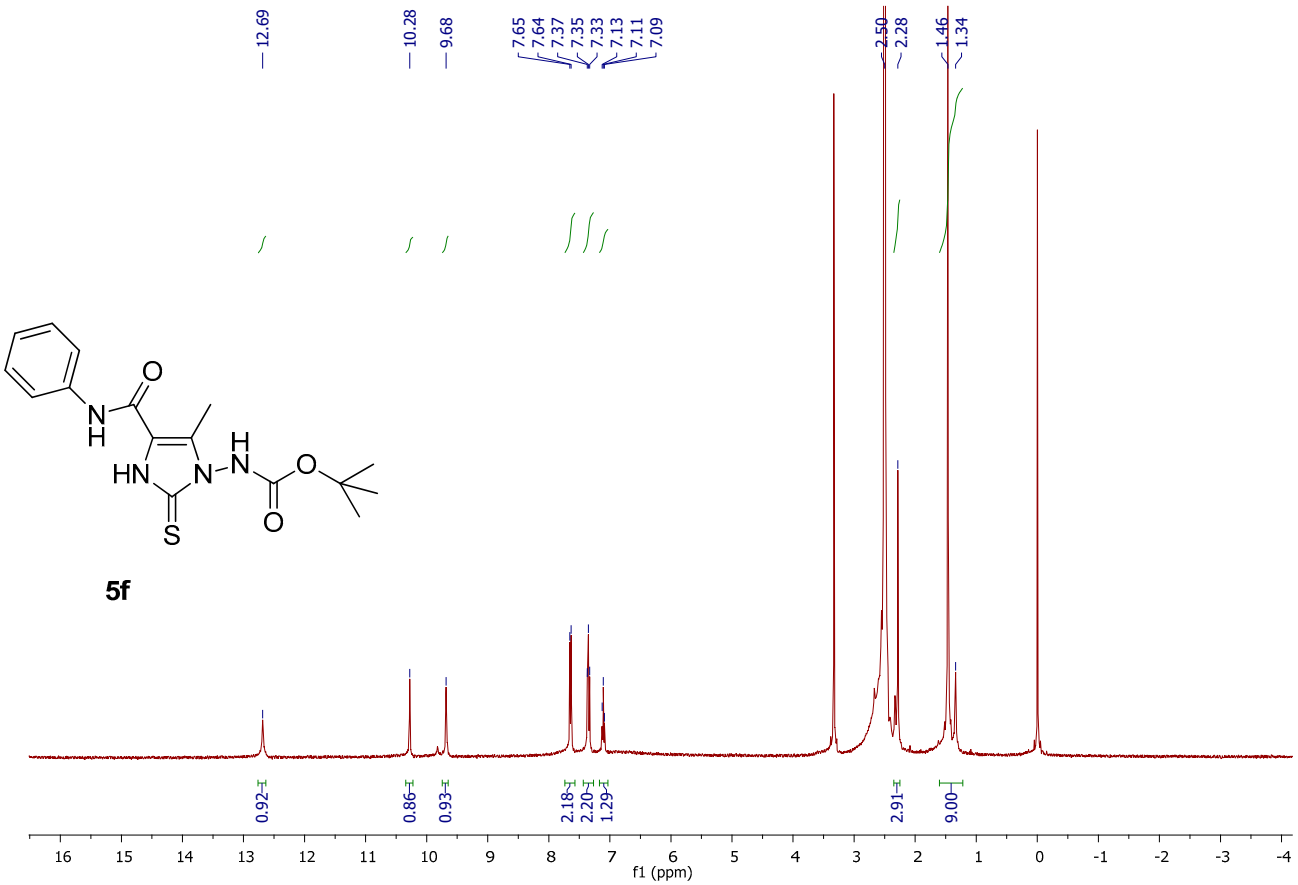
f1 (ppm)

5e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2.28
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2.91
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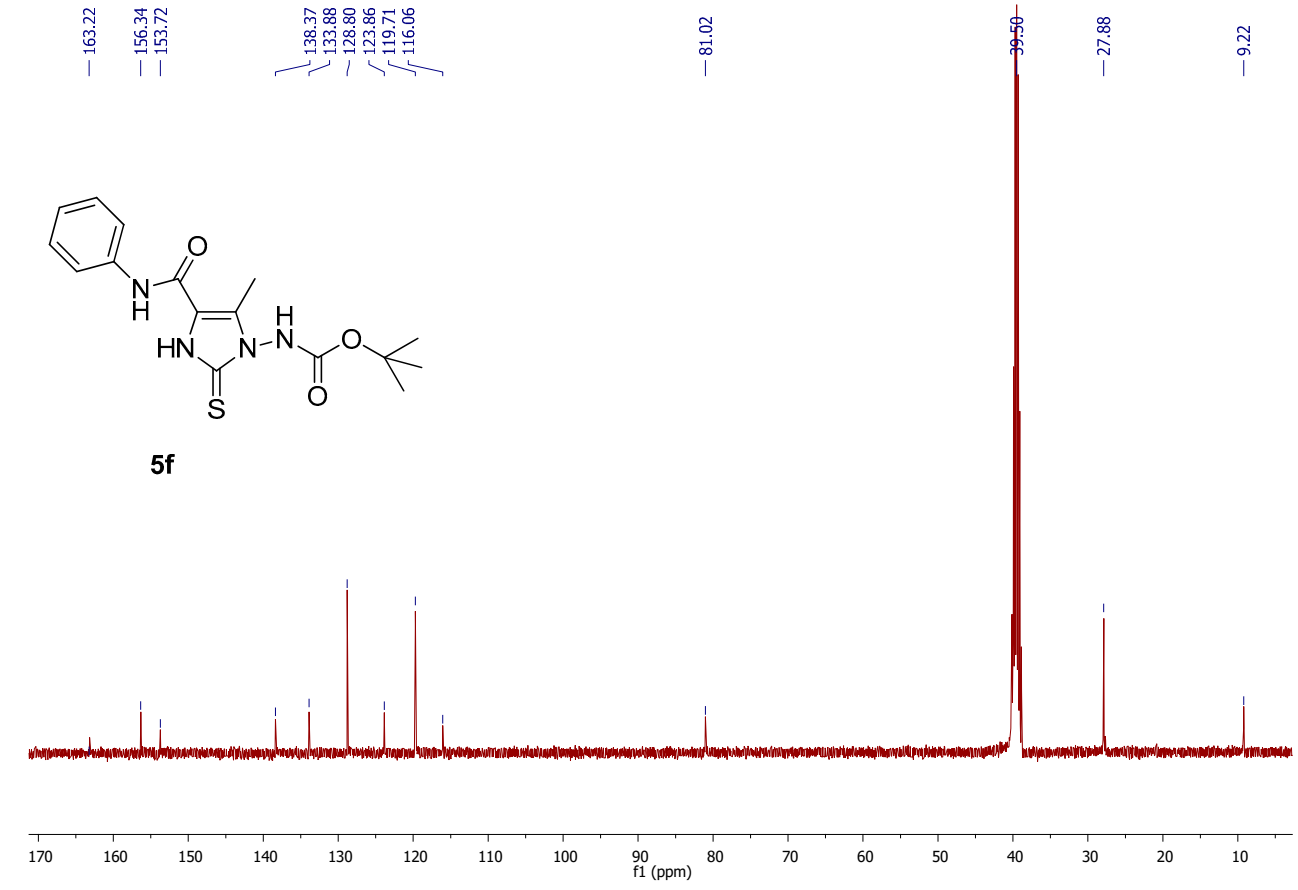
f1 (ppm)

5f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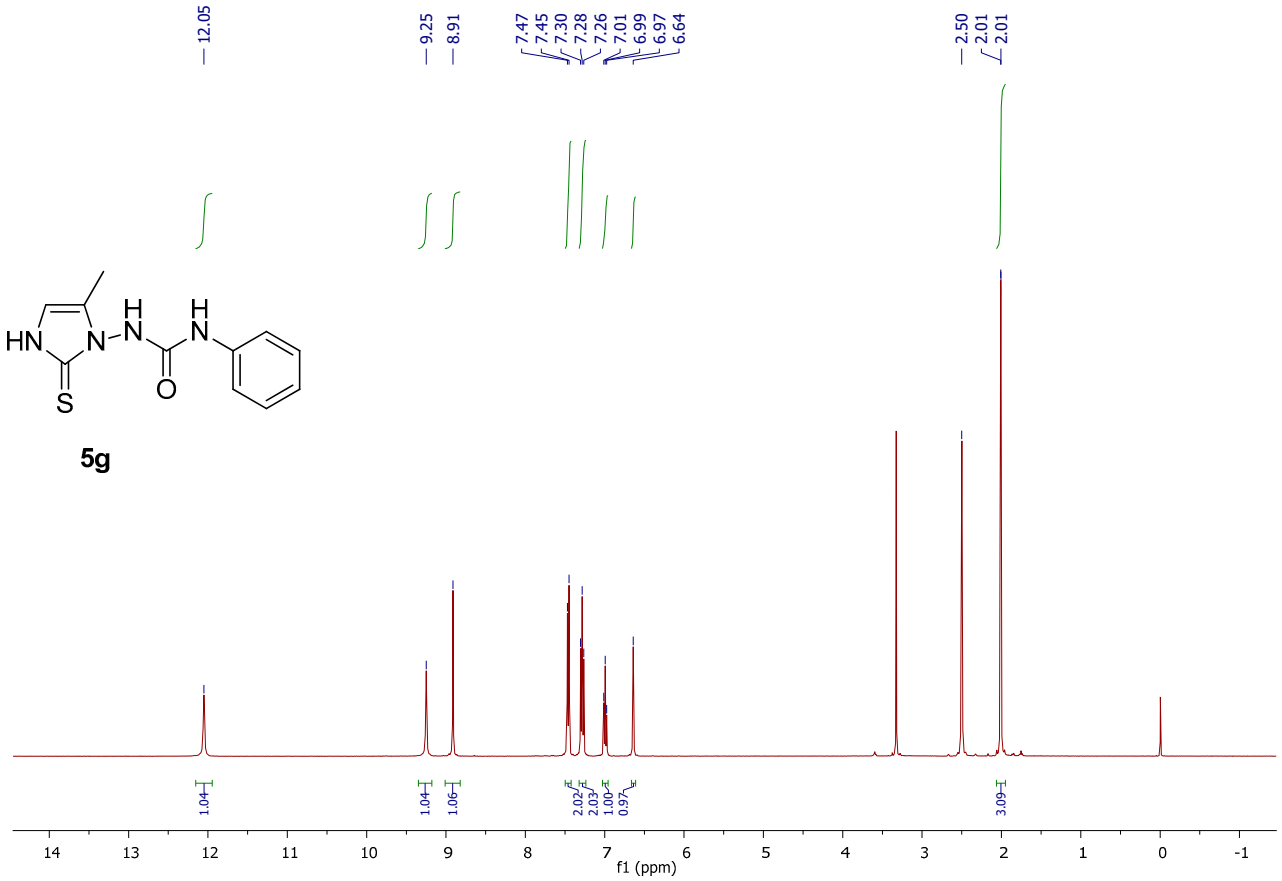
9.22
f1 (ppm)

5f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2.01
2.01
HN
N
H
N
H
N
O
S
1.04
1.04
1.06
2.02
2.03
1.00
0.97
3.09
14
13
12
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10
9
8
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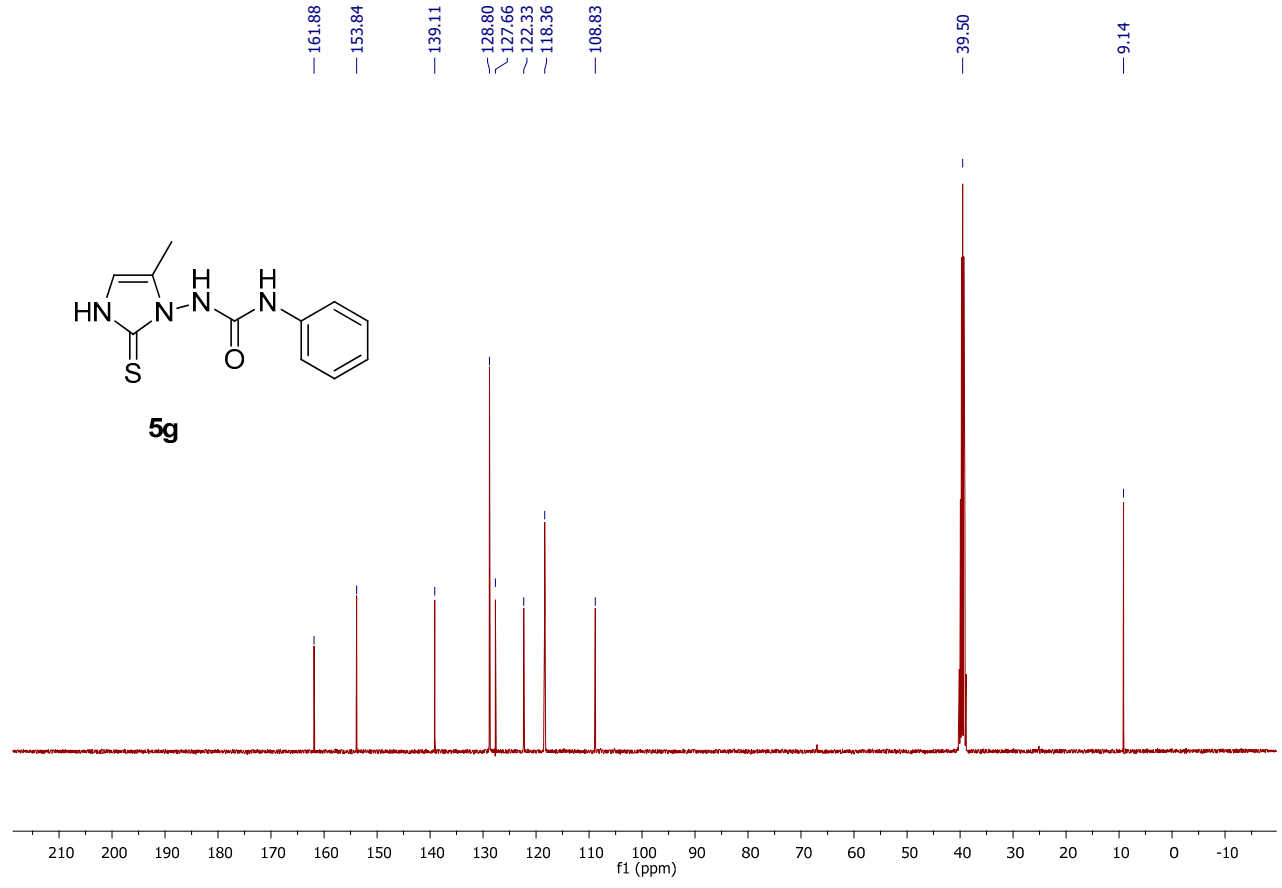
6
5
4
3
2
1
0
-1
f1 (ppm)

5g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N
H
N
O
S
210
200
190
180
170
160
150
140
130
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60
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40
30
20
10
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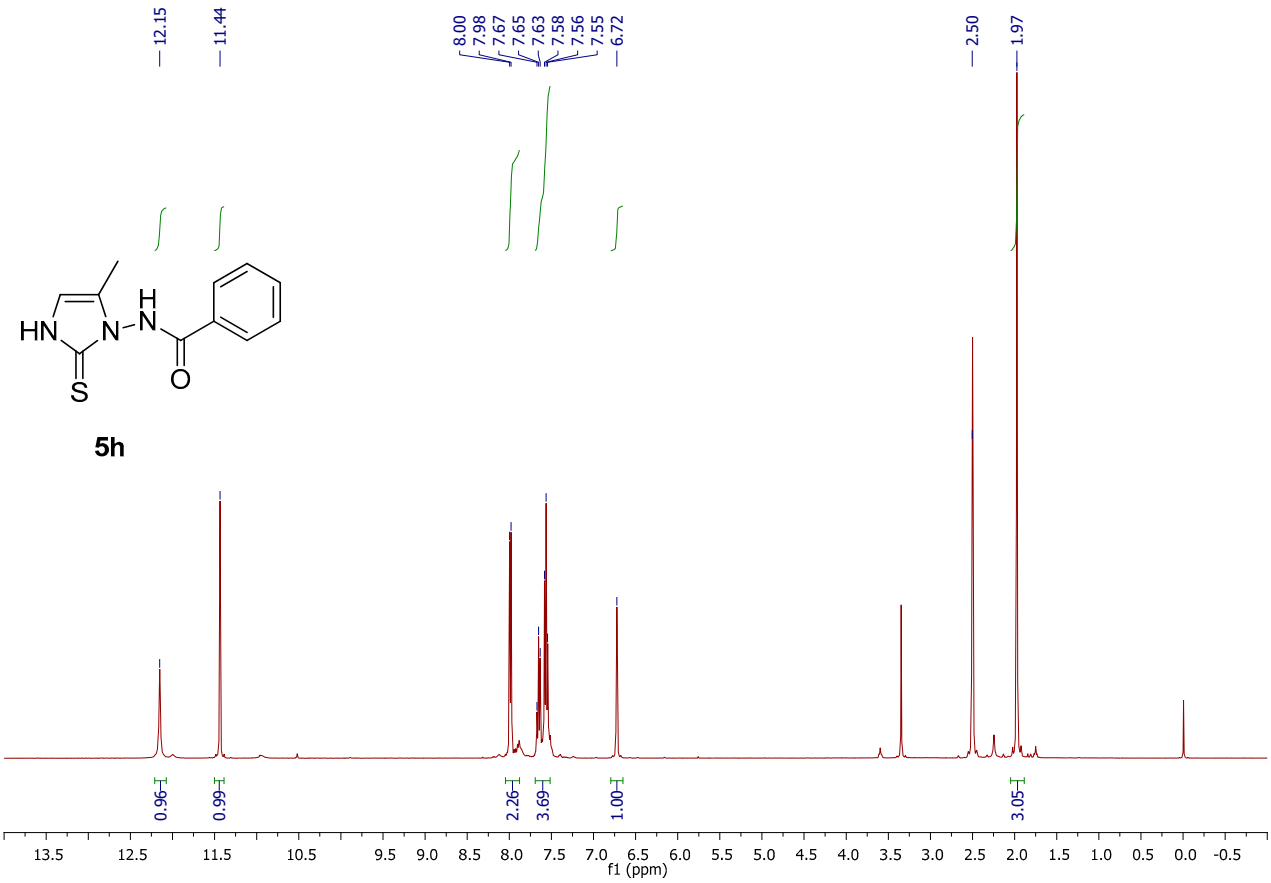
-10
f1 (ppm)

5g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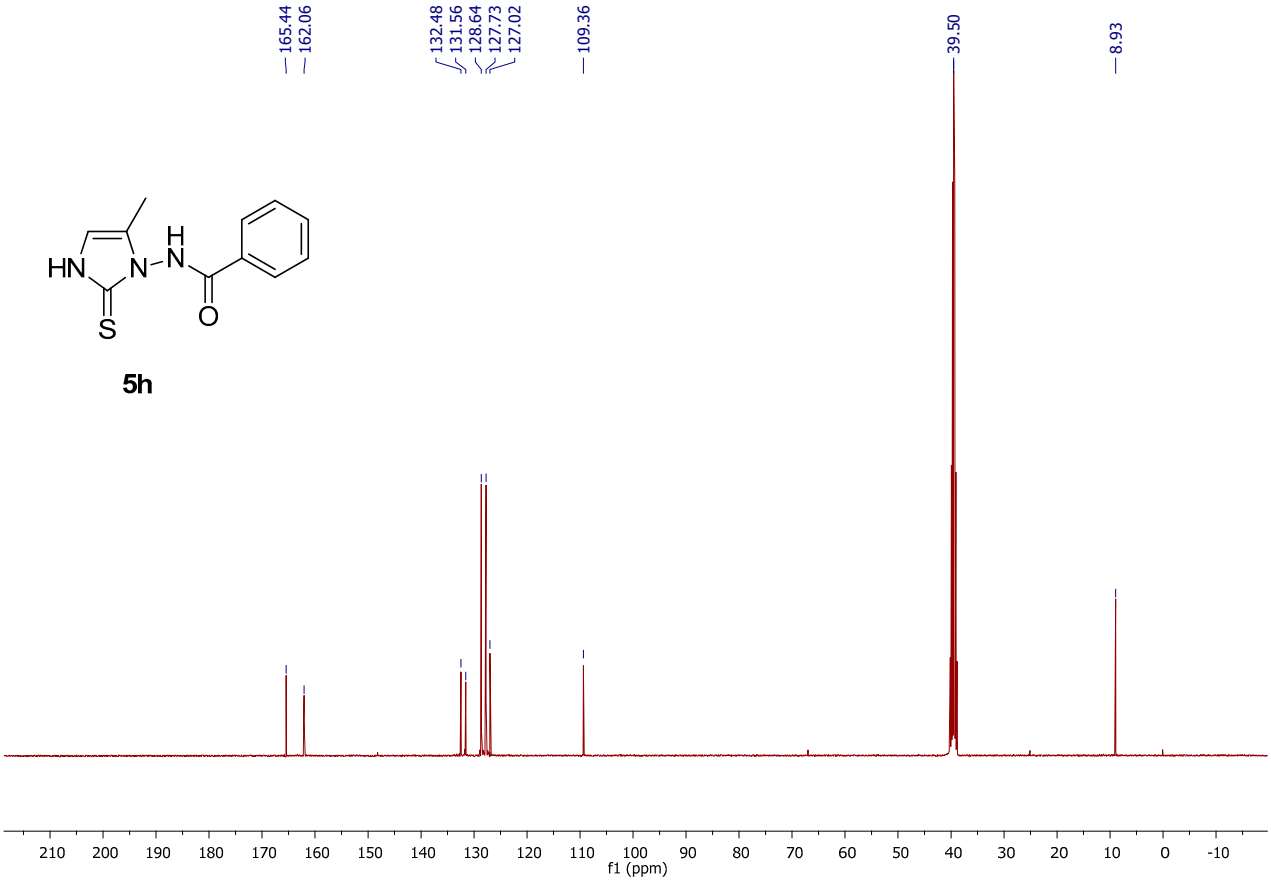
5h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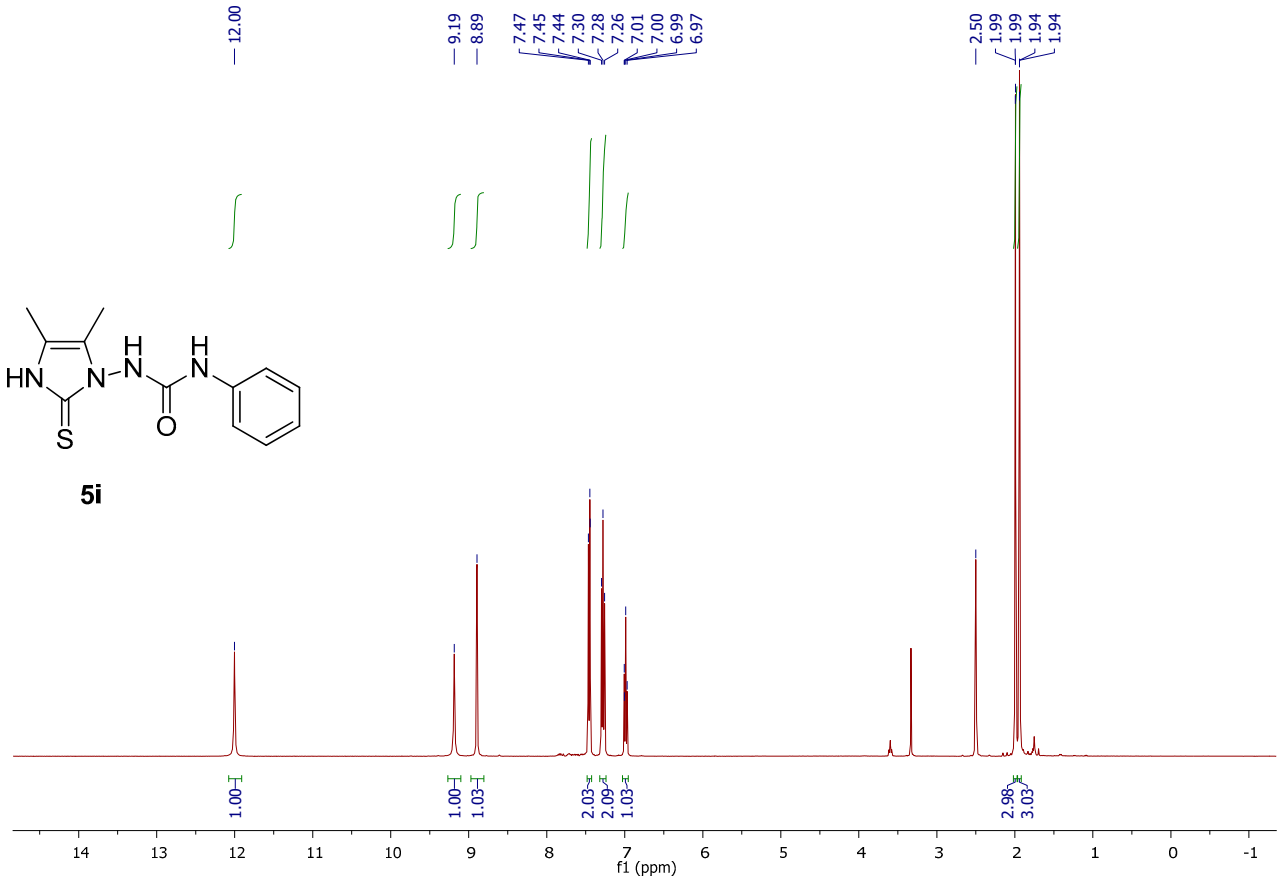
5h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1.03
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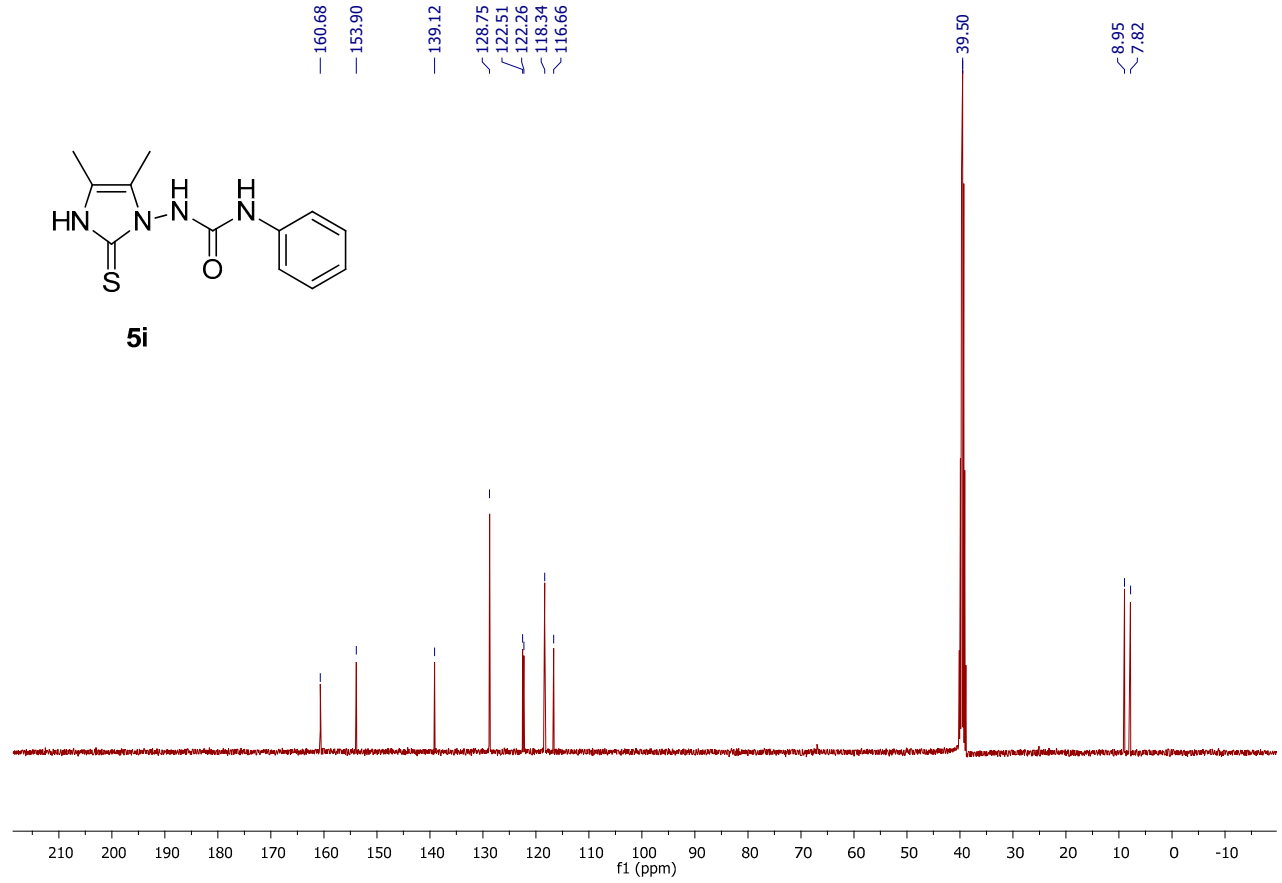
3.03
f1 (ppm)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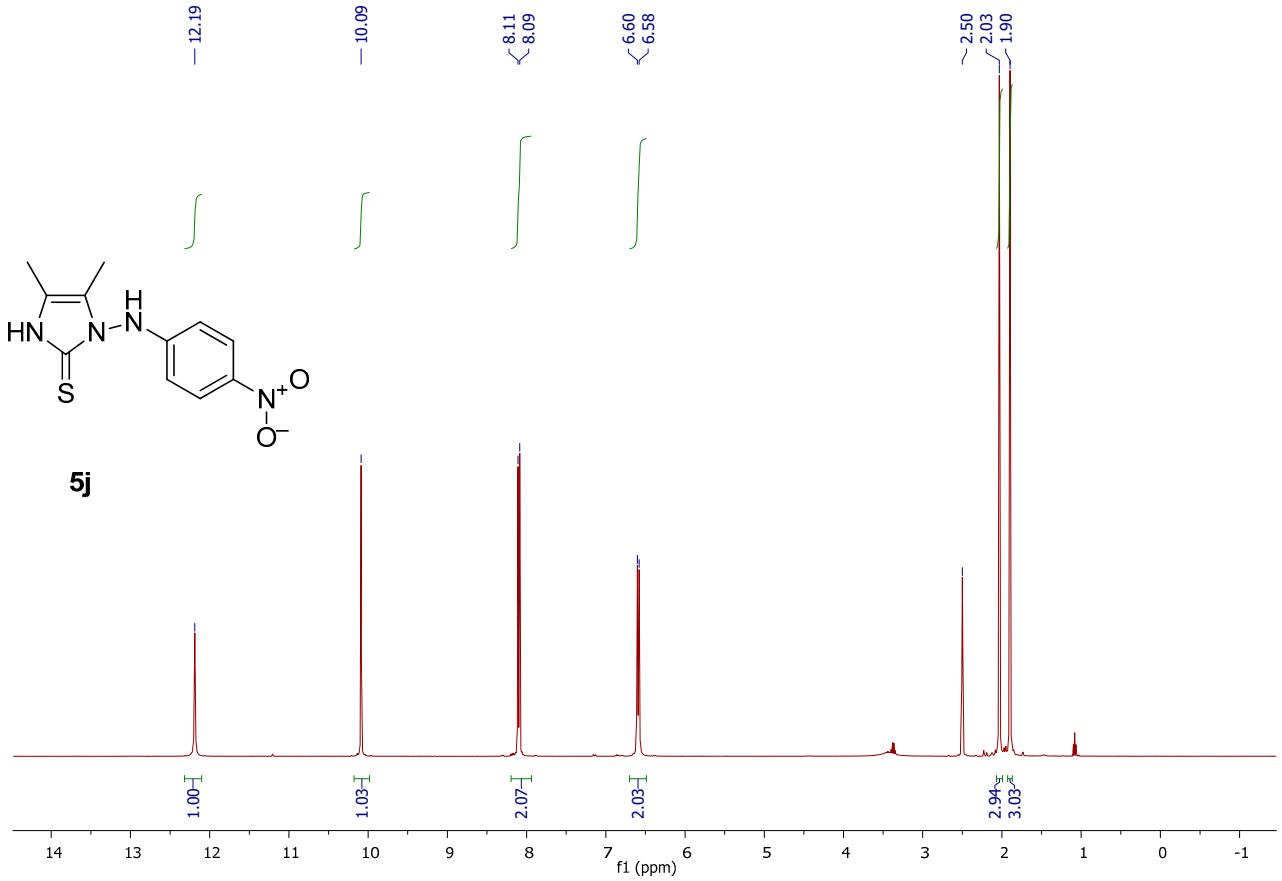
12.19
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8.09
6.60
6.58
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1.03
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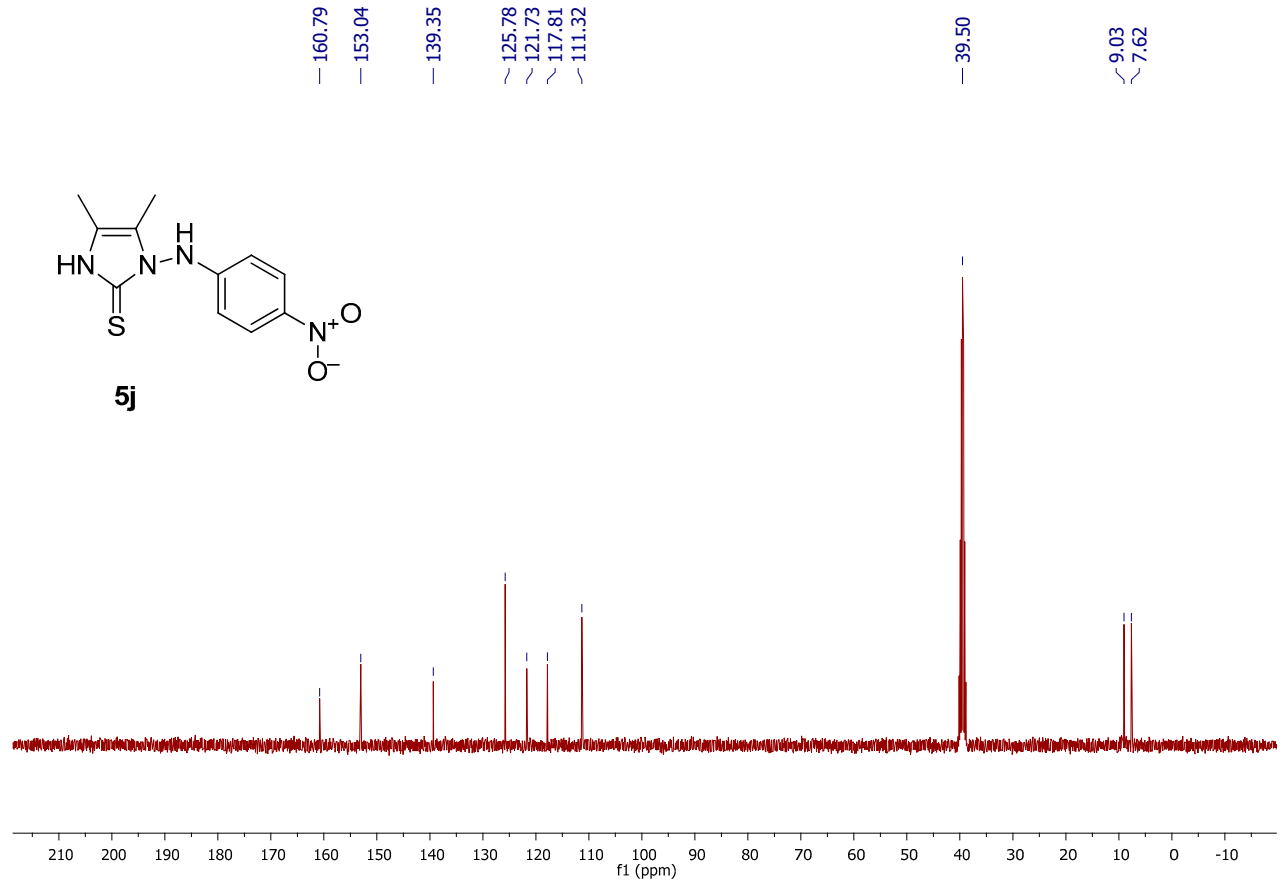
2.03
2.94
3.03
f1 (ppm)

5j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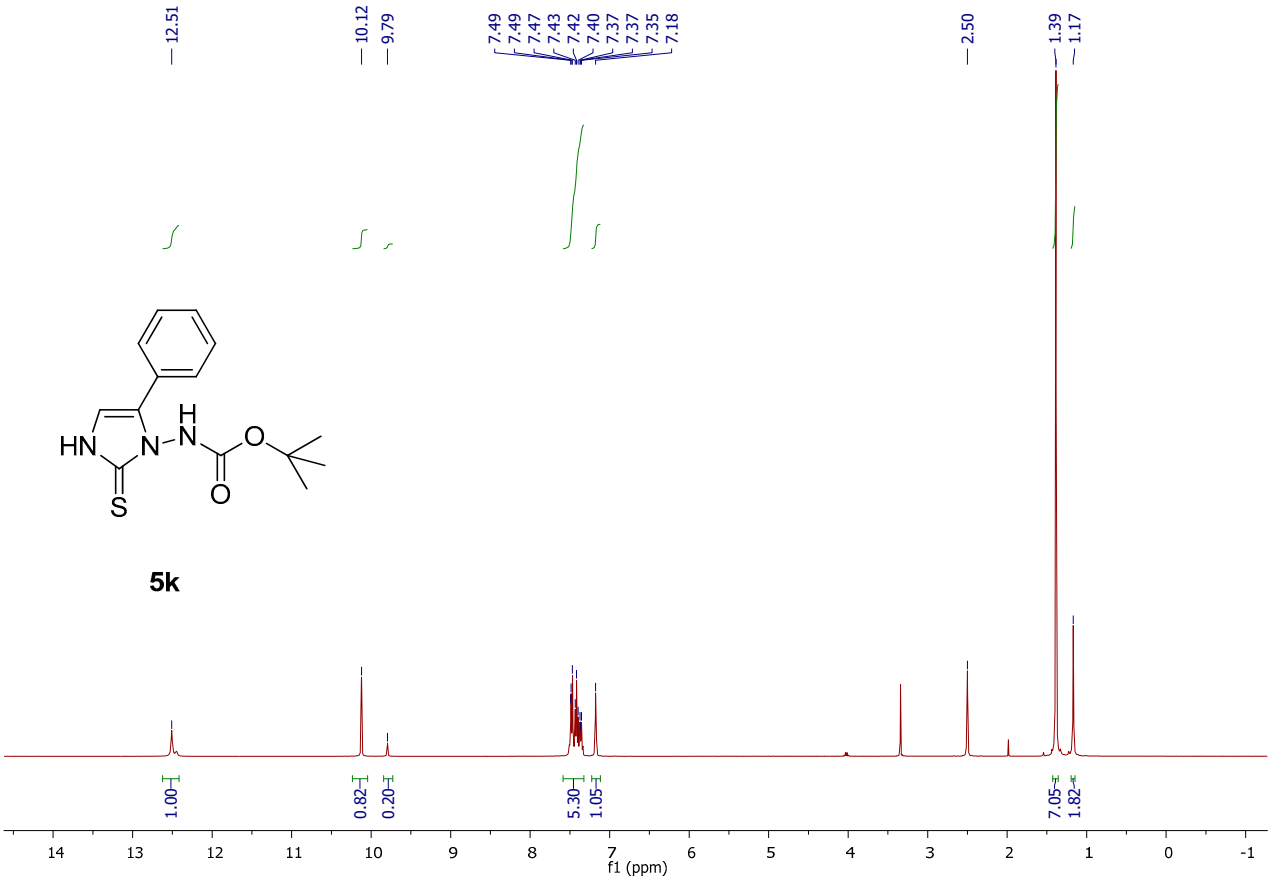
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7.43
7.42
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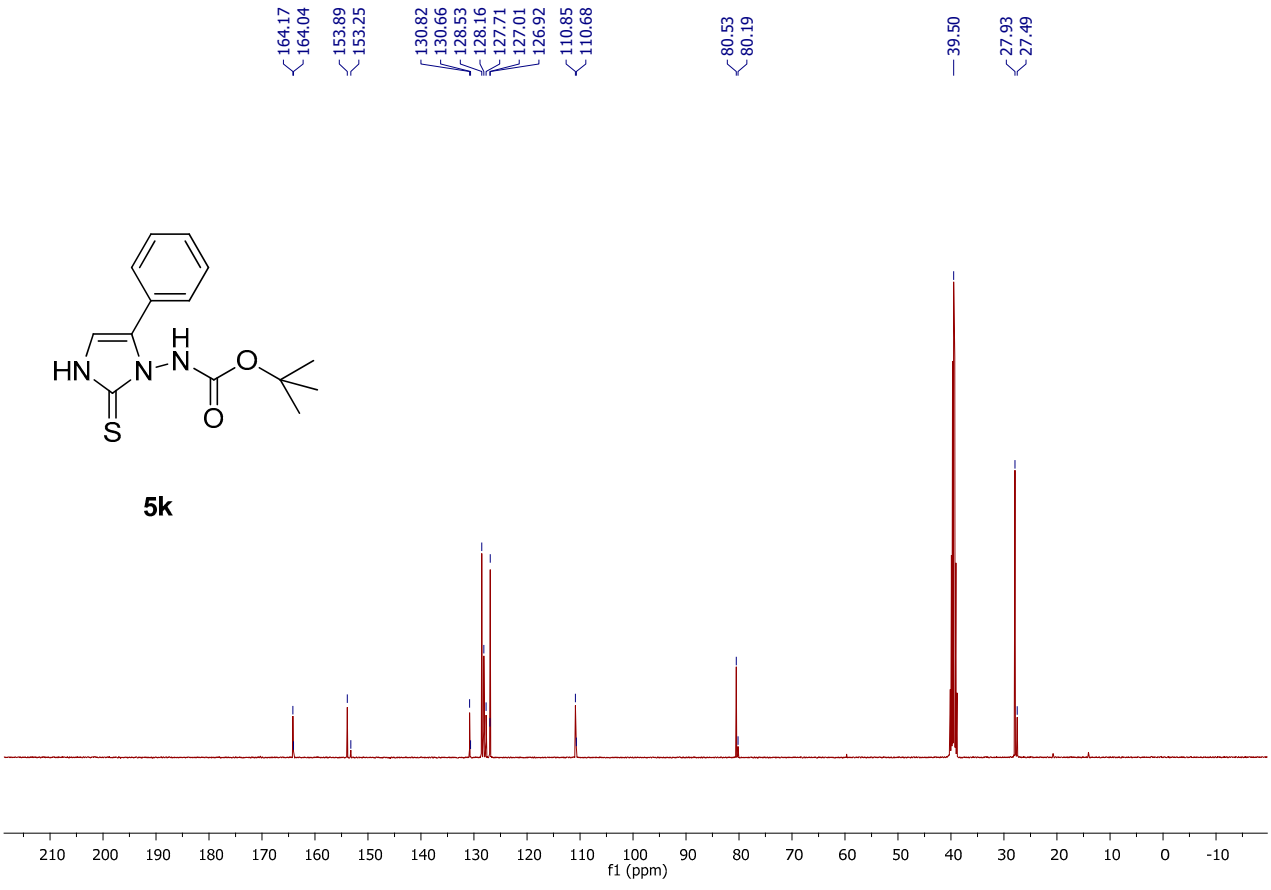
7.37
7.37
7.35
7.18
2.50
1.39
1.17
HN
N
H
N
O
O
S
1.00
0.82
0.20
5.30
1.05
7.05
1.82
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
f1 (ppm)

5k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153.25
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128.53
128.16
127.71
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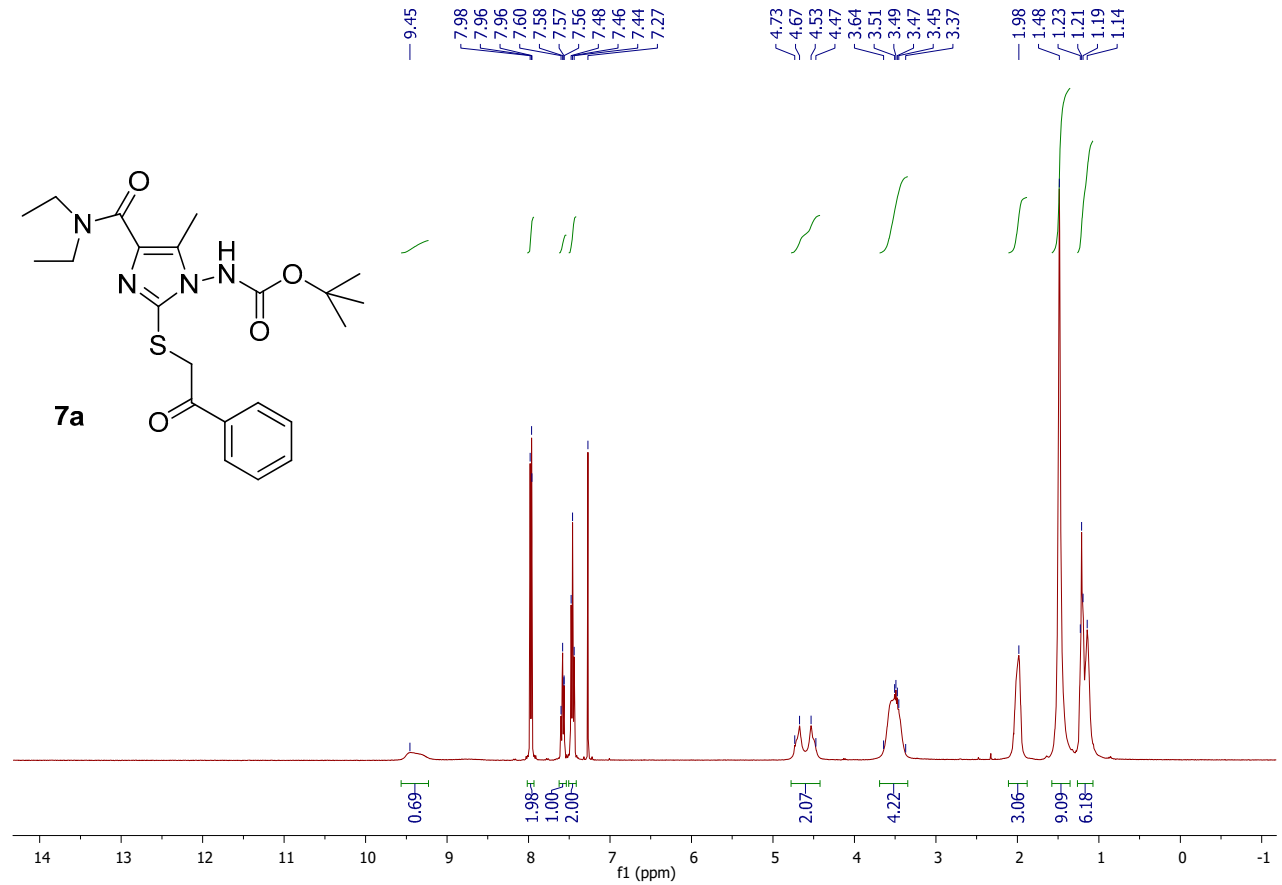
126.92
110.85
110.68
80.53
80.19
39.50
27.93
27.49
HN
N
H
N
O
O
S
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

5k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7.96
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7.57
7.56
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7.46
7.44
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4.73
4.67
4.53
4.47
3.64
3.51
3.49
3.47
3.45
3.37
1.98
1.48
1.23
1.21
1.19
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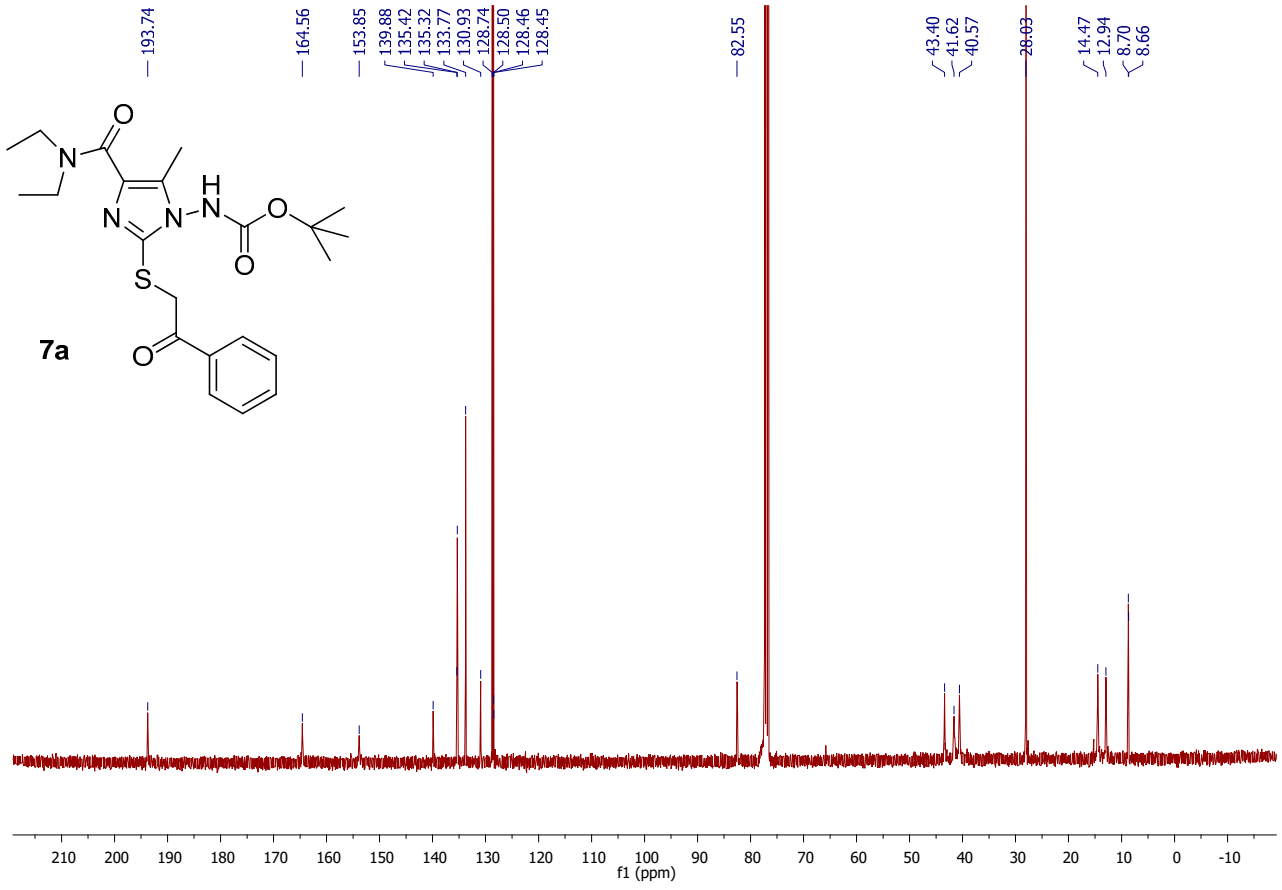
3.06
9.09
6.18
f1 (ppm)
7a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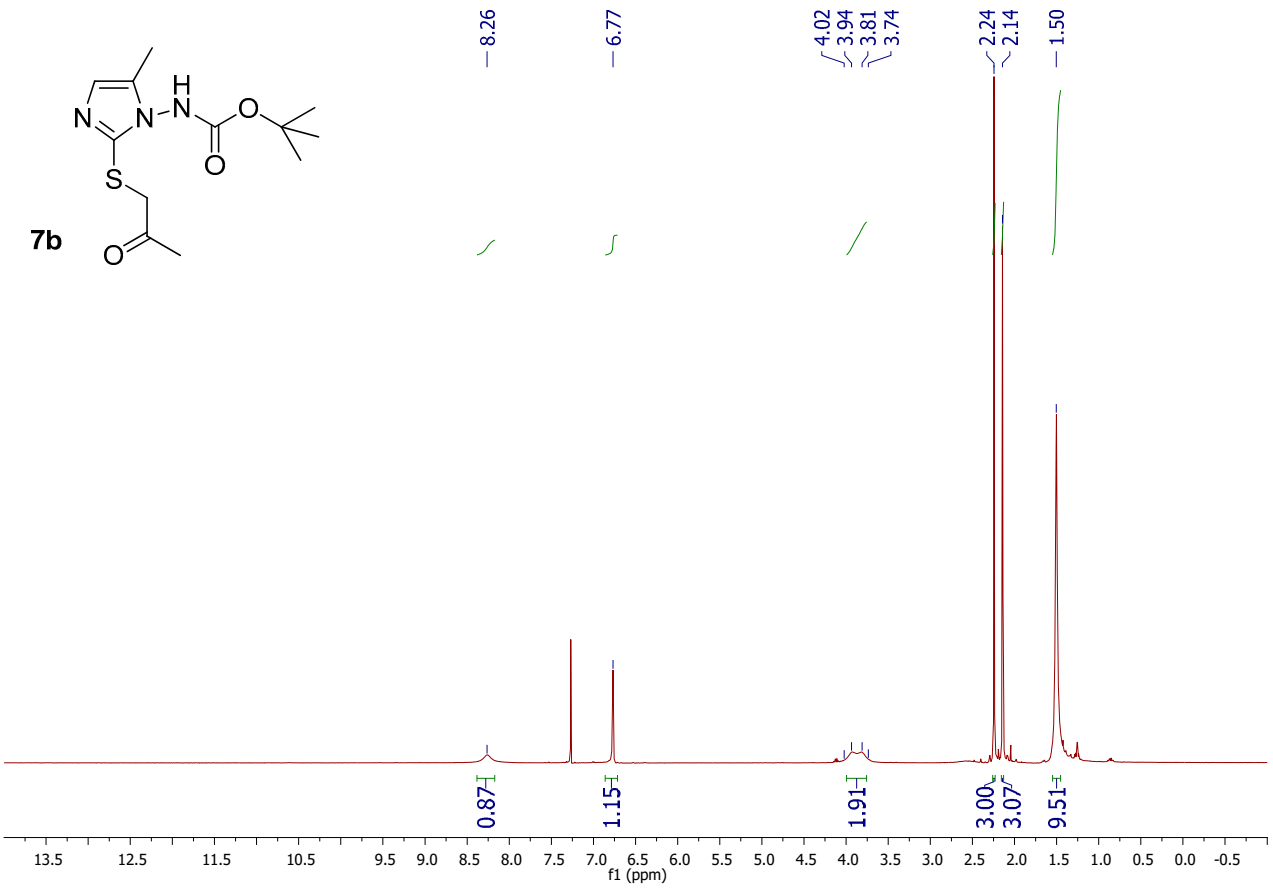
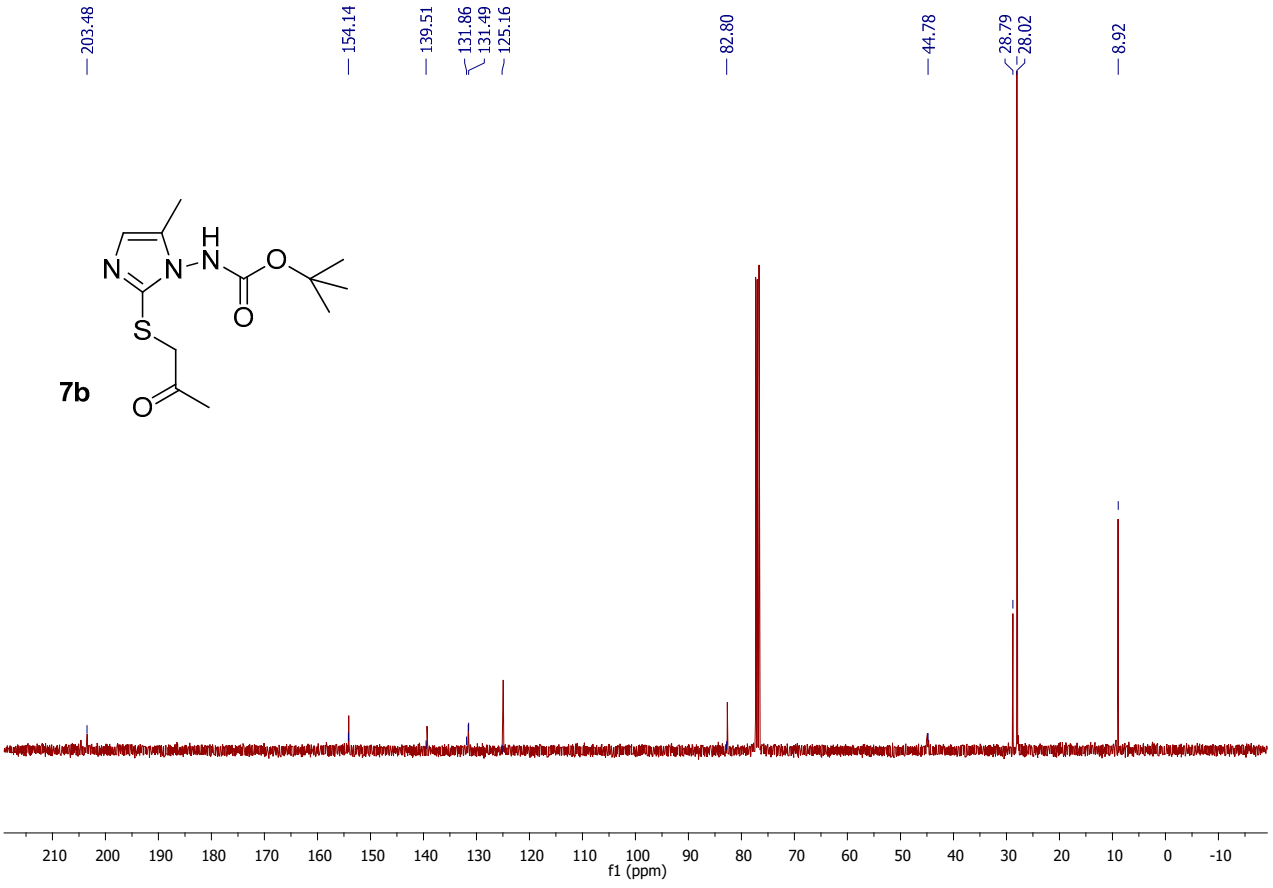
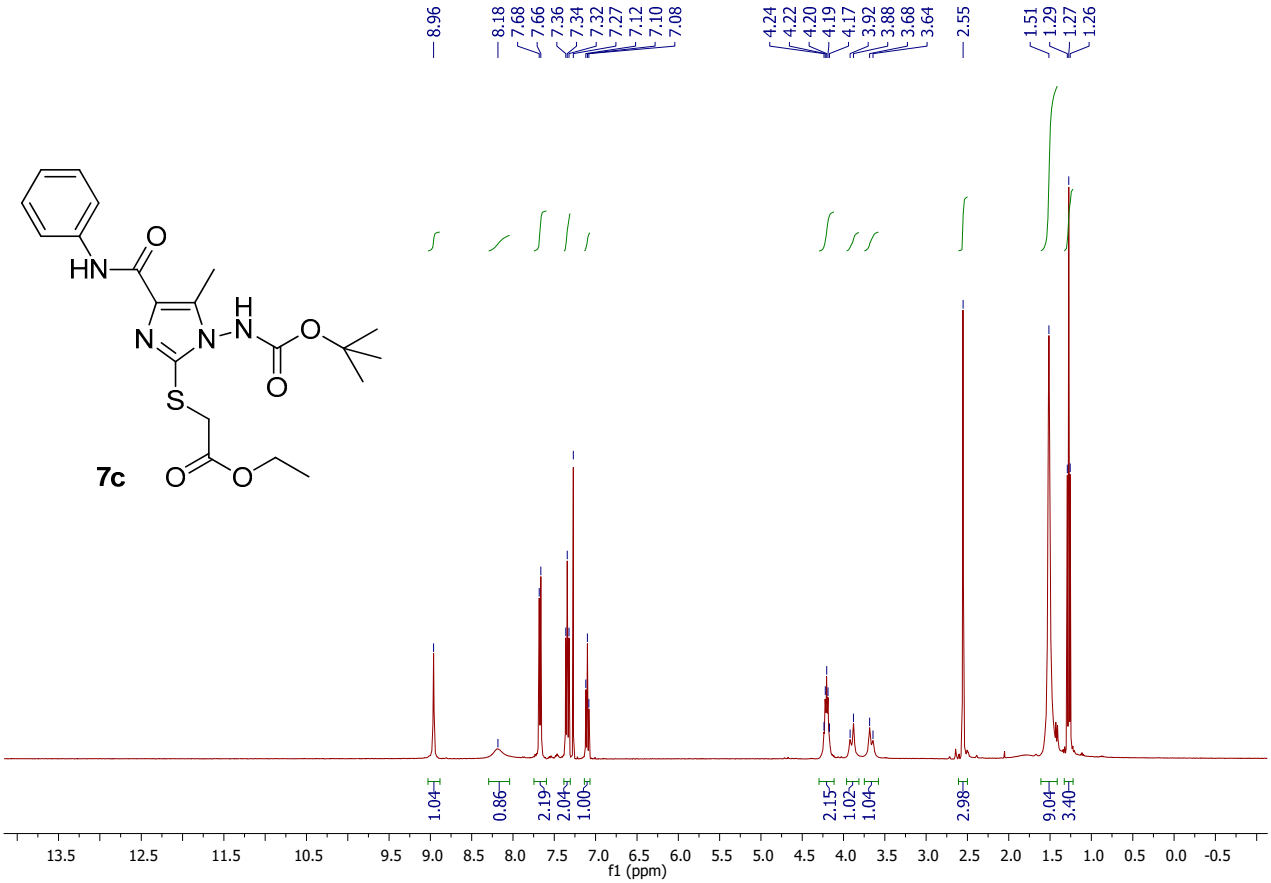
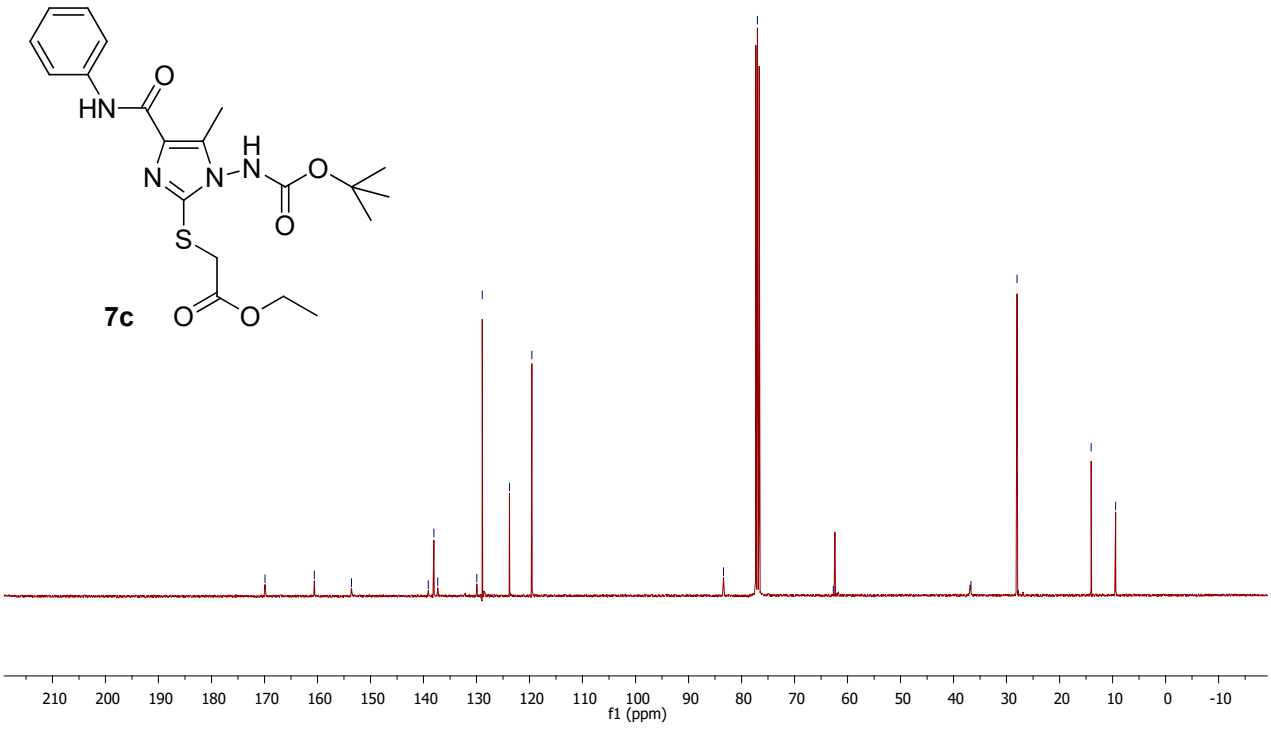
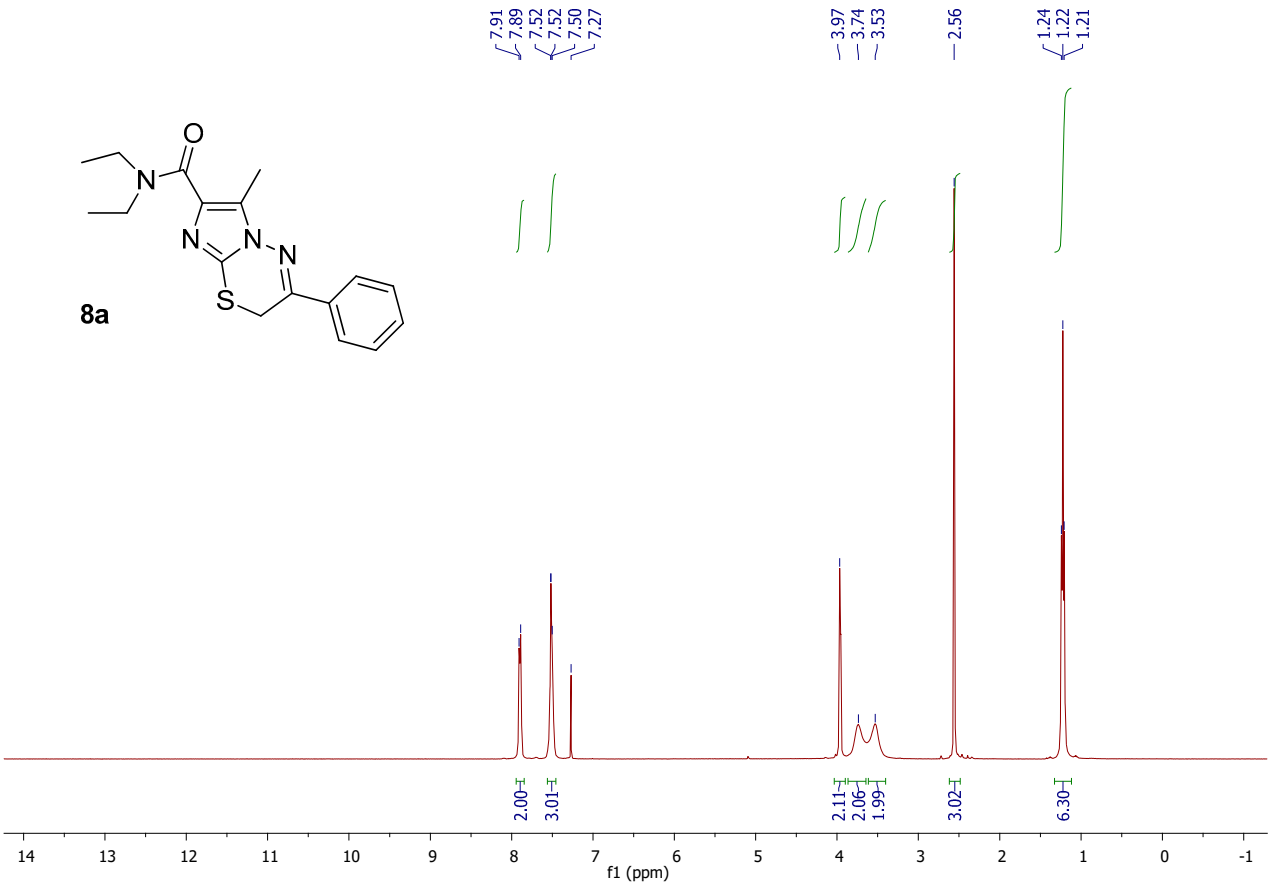
164.56
153.85
139.88
135.42
135.32
133.77
130.93
128.74
128.50
128.46
128.45
82.55
43.40
41.62
40.57
28.03
14.47
12.94
8.70
8.66
f1 (ppm)
7a

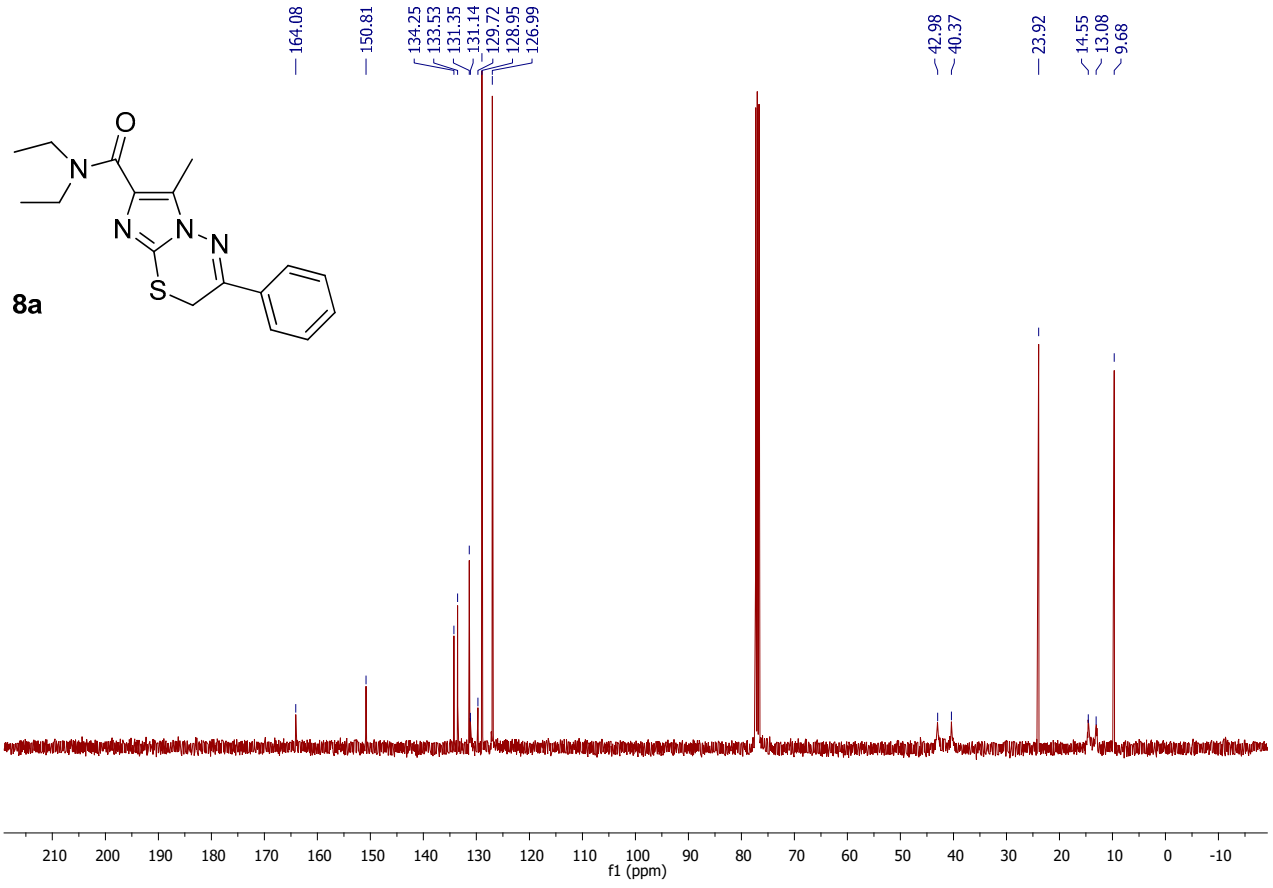

7b
8.26
6.77
4.02
3.94
3.81
3.74
2.24
2.14
1.50
0.87
1.15
1.91
3.00
3.07
9.51
f1 (ppm)


7b
203.48
154.14
139.51
131.86
131.49
125.16
82.80
44.78
28.79
28.02
8.92
f1 (ppm)

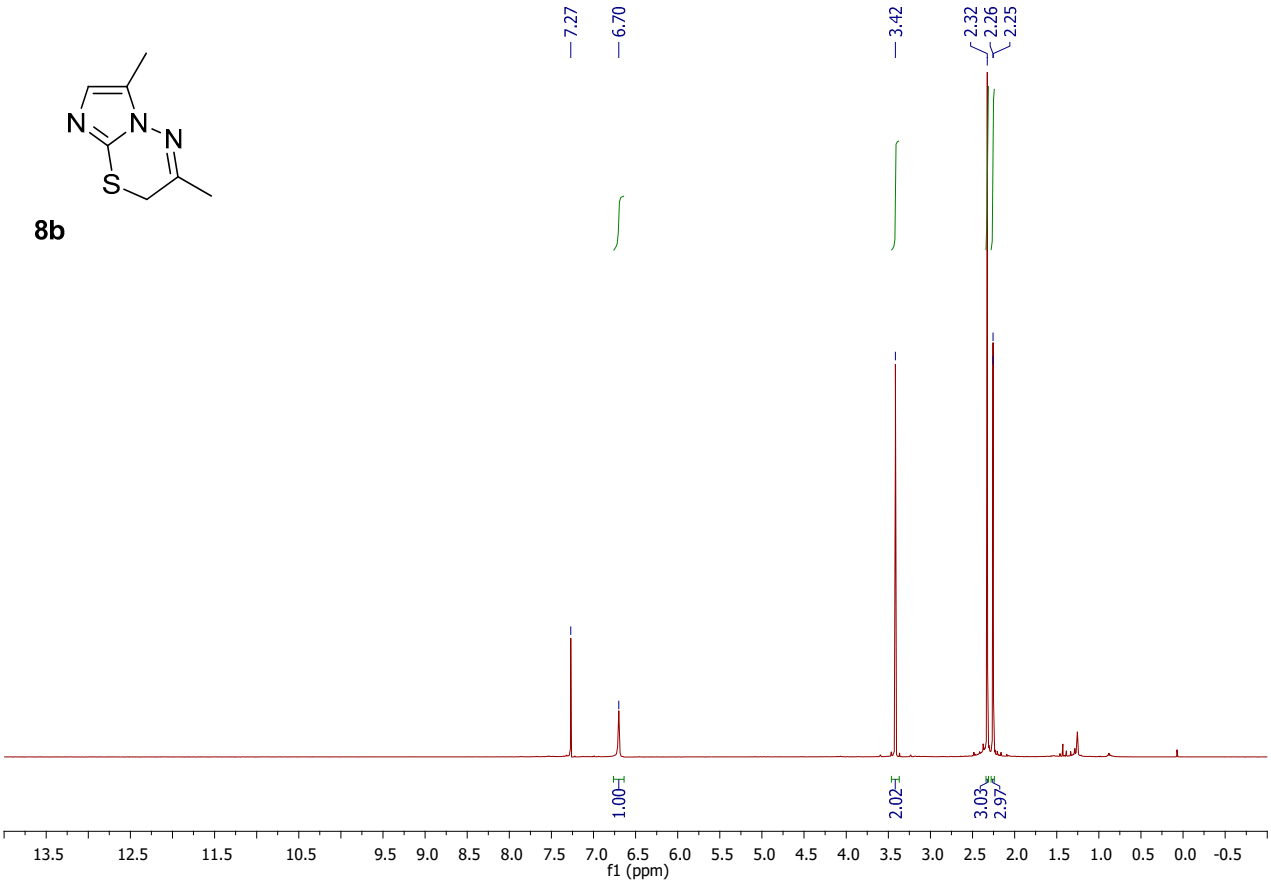

8.96
8.18
7.68
7.66
7.36
7.34
7.32
7.27
7.12
7.10
7.08
4.24
4.22
4.20
4.19
4.17
3.92
3.88
3.68
3.64
2.55
1.51
1.29
1.27
1.26
1.04
0.86
2.19
2.04
1.00
2.15
1.02
1.04
2.98
9.04
3.40
f1 (ppm)


169.90
160.61
153.60
139.08
138.04
137.32
129.94
128.91
123.77
119.57
83.41
77.00
62.71
36.73
28.02
14.04
9.43
f1 (ppm)

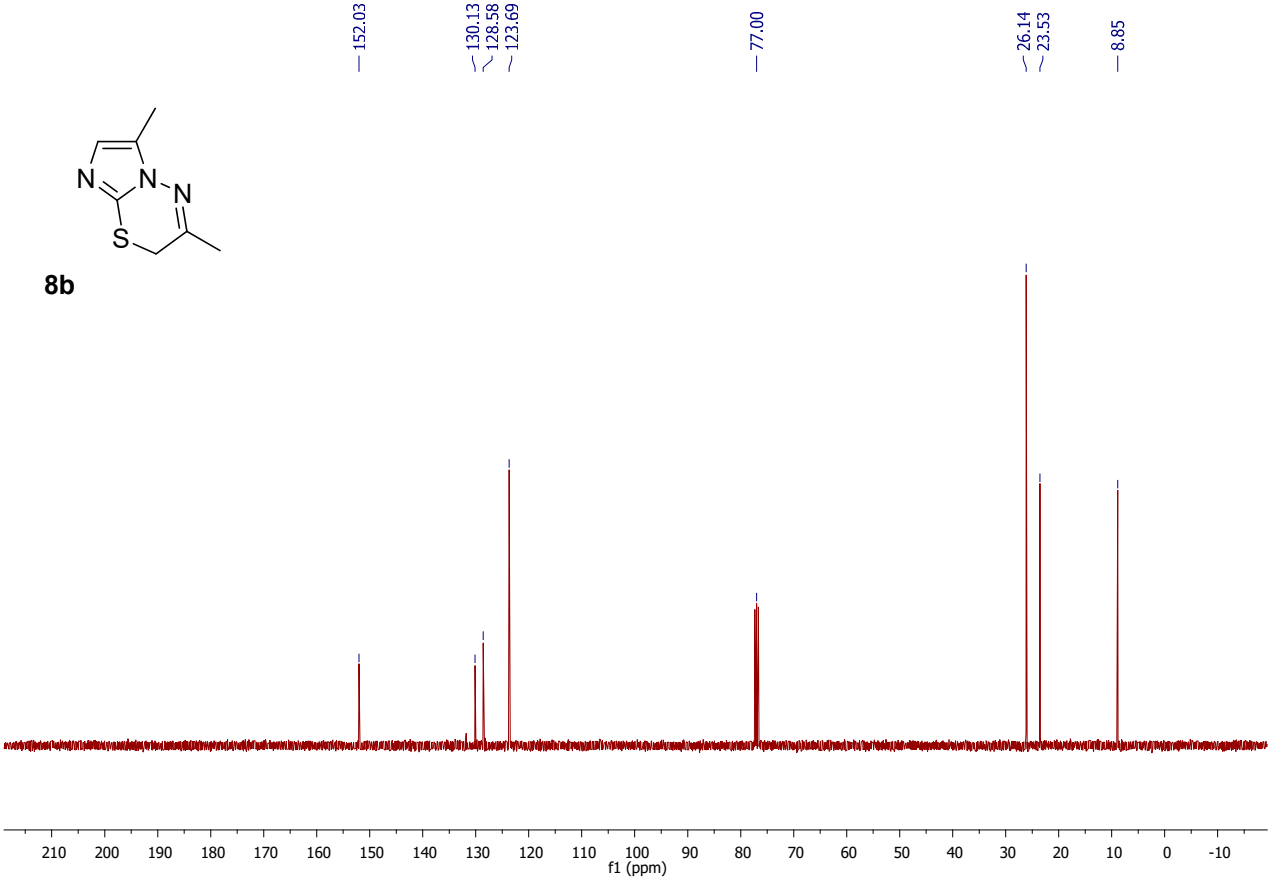

7.91
7.89
7.52
7.52
7.50
7.27
3.97
3.74
3.53
2.56
1.24
1.22
1.21
8a
2.00
3.01
2.11
2.06
1.99
3.02
6.30
f1 (ppm)

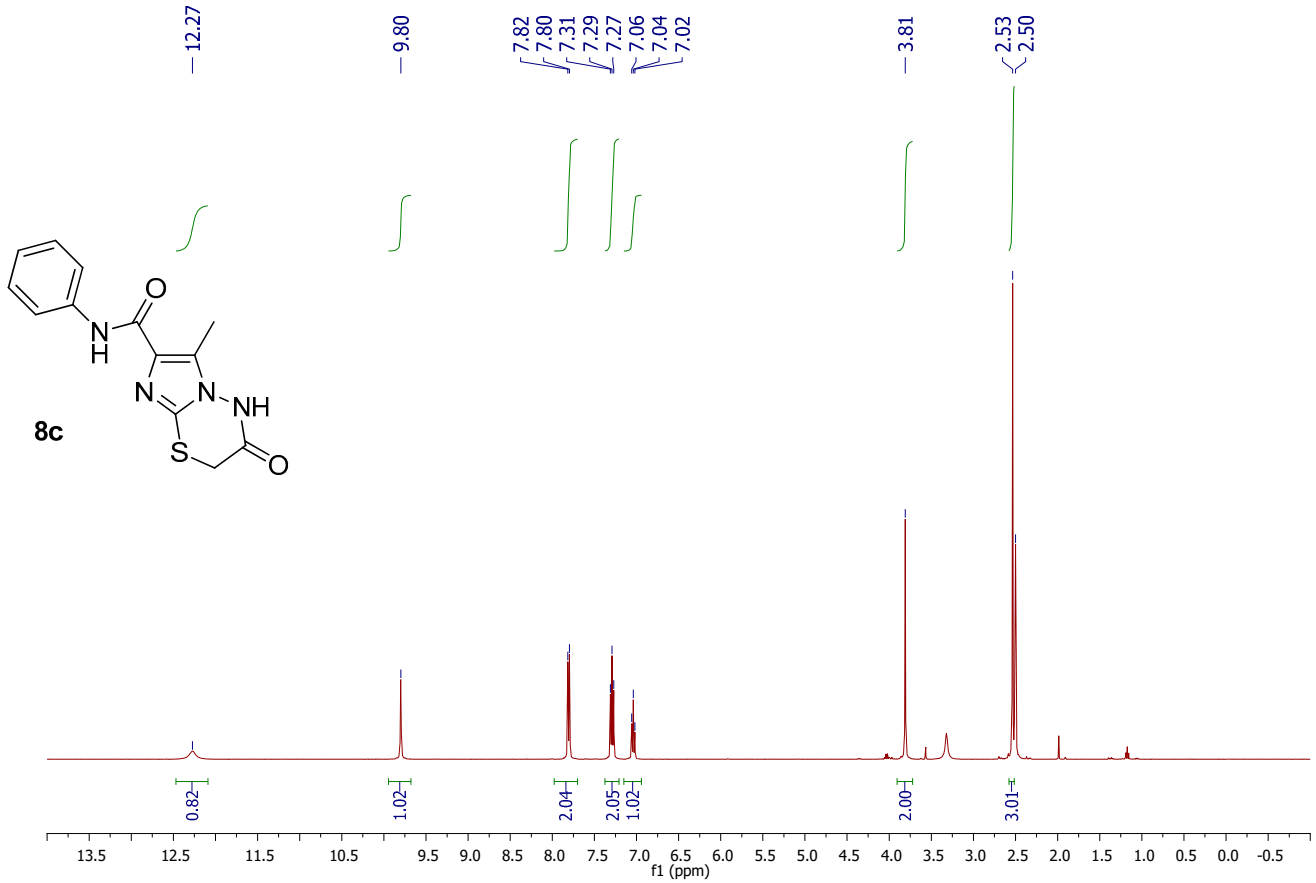

164.08
150.81
134.25
133.53
131.35
131.14
129.72
128.95
126.99
42.98
40.37
23.92
14.55
13.08
9.68
8a
f1 (ppm)

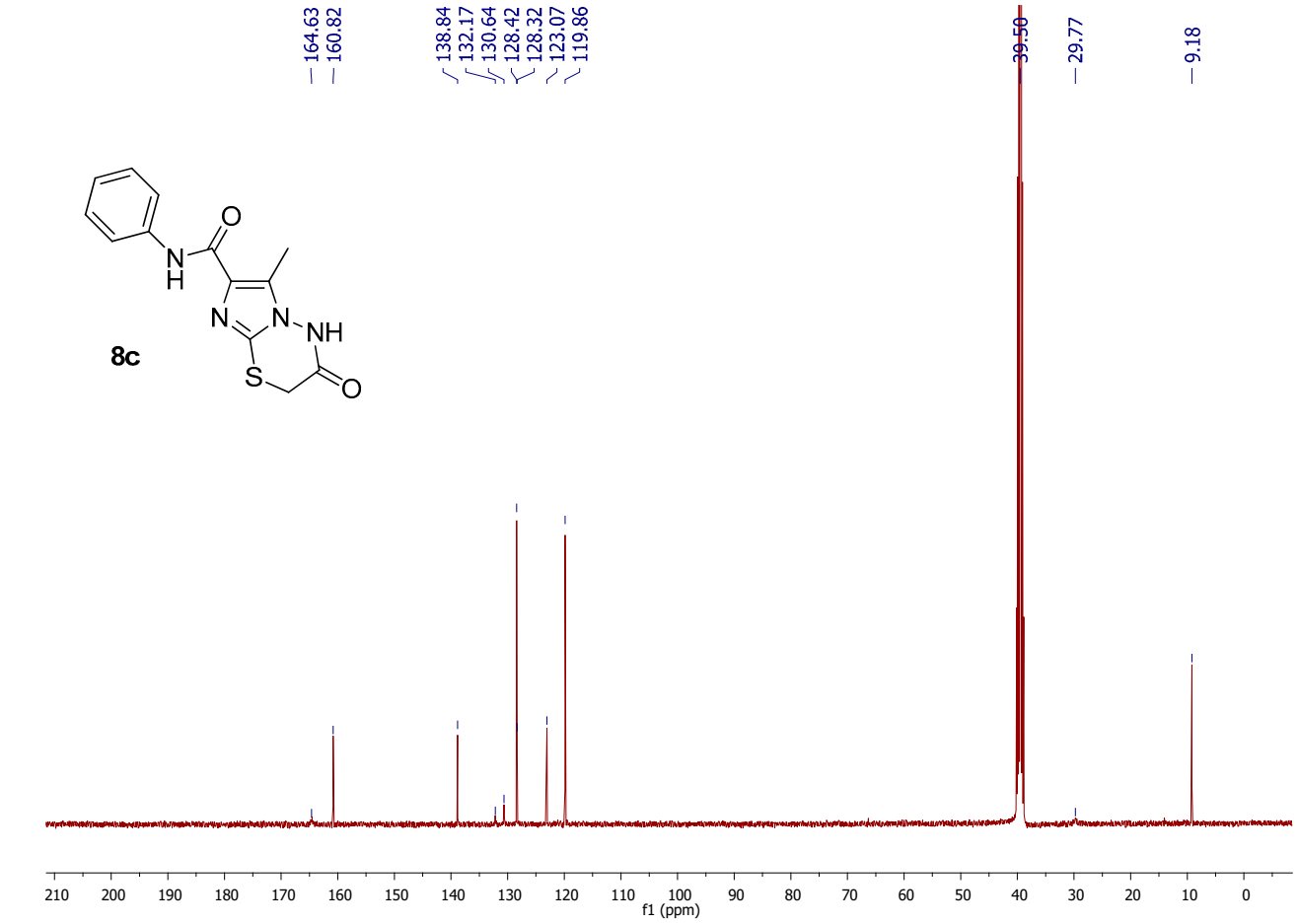
8b


7.27
6.70
3.42
2.32
2.26
2.25
1.00
2.02
3.03
2.97
f1 (ppm)

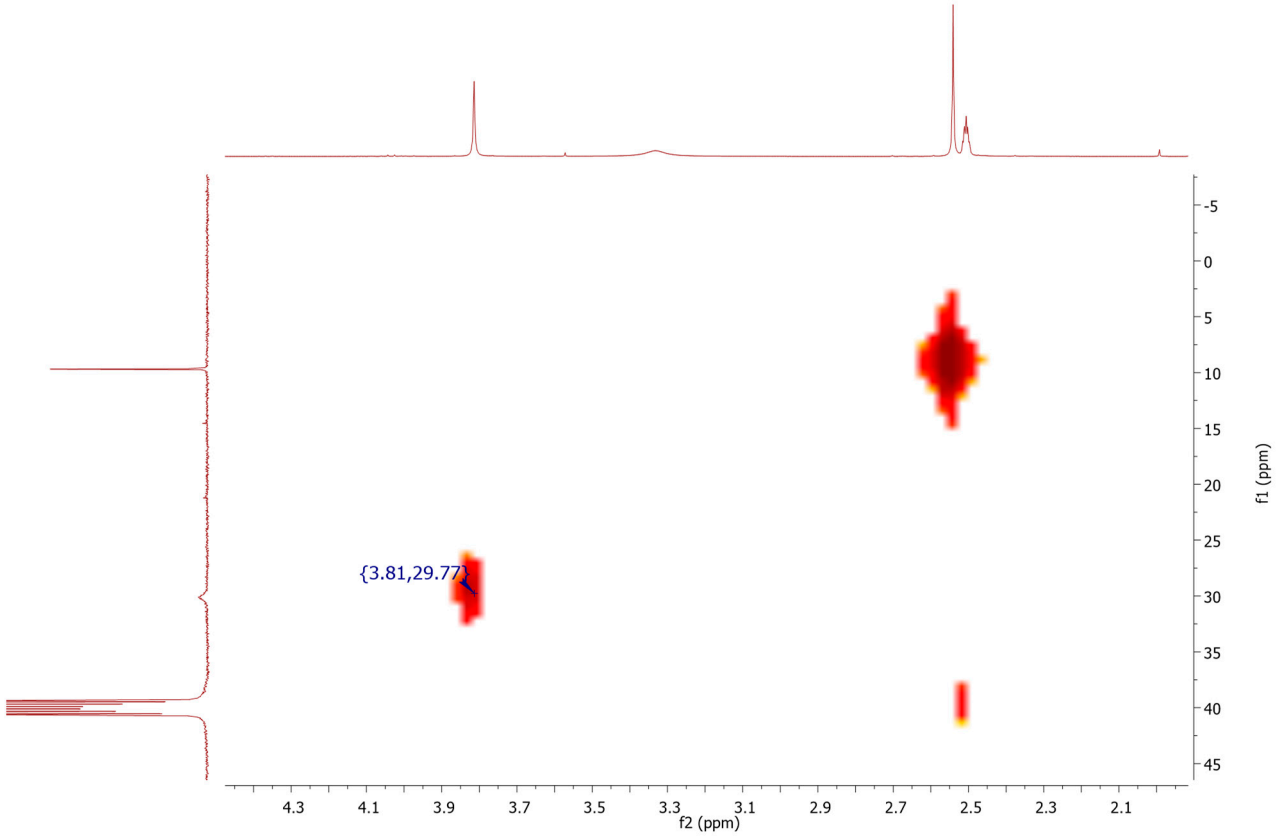
8b


152.03
130.13
128.58
123.69
77.00
26.14
23.53
8.85
f1 (ppm)


12.27
9.80
7.82
7.80
7.31
7.29
7.27
7.06
7.04
7.02
3.81
2.53
2.50
8c
0.82
1.02
2.04
2.05
1.02
2.00
3.01
f1 (ppm)


164.63
160.82
138.84
132.17
130.64
128.42
128.32
123.07
119.86
39.50
29.77
9.18
8c
f1 (ppm)

HMQC 8c



References:

1. [1] Attanasi, O. A.; Favi, G.; Filippone, P.; Perrulli, F. R.; Santeusanio, S. *Synlett* **2010**, 1859–1861, doi:10.1055/s-0030-1258108.
2. [2] Qi, L.-W.; Mao, J.-H.; Zhang, J.; Tan, B. *Nat. Chem.* **2018**, *10*, 58–64, doi:10.1038/NCHEM.2866.