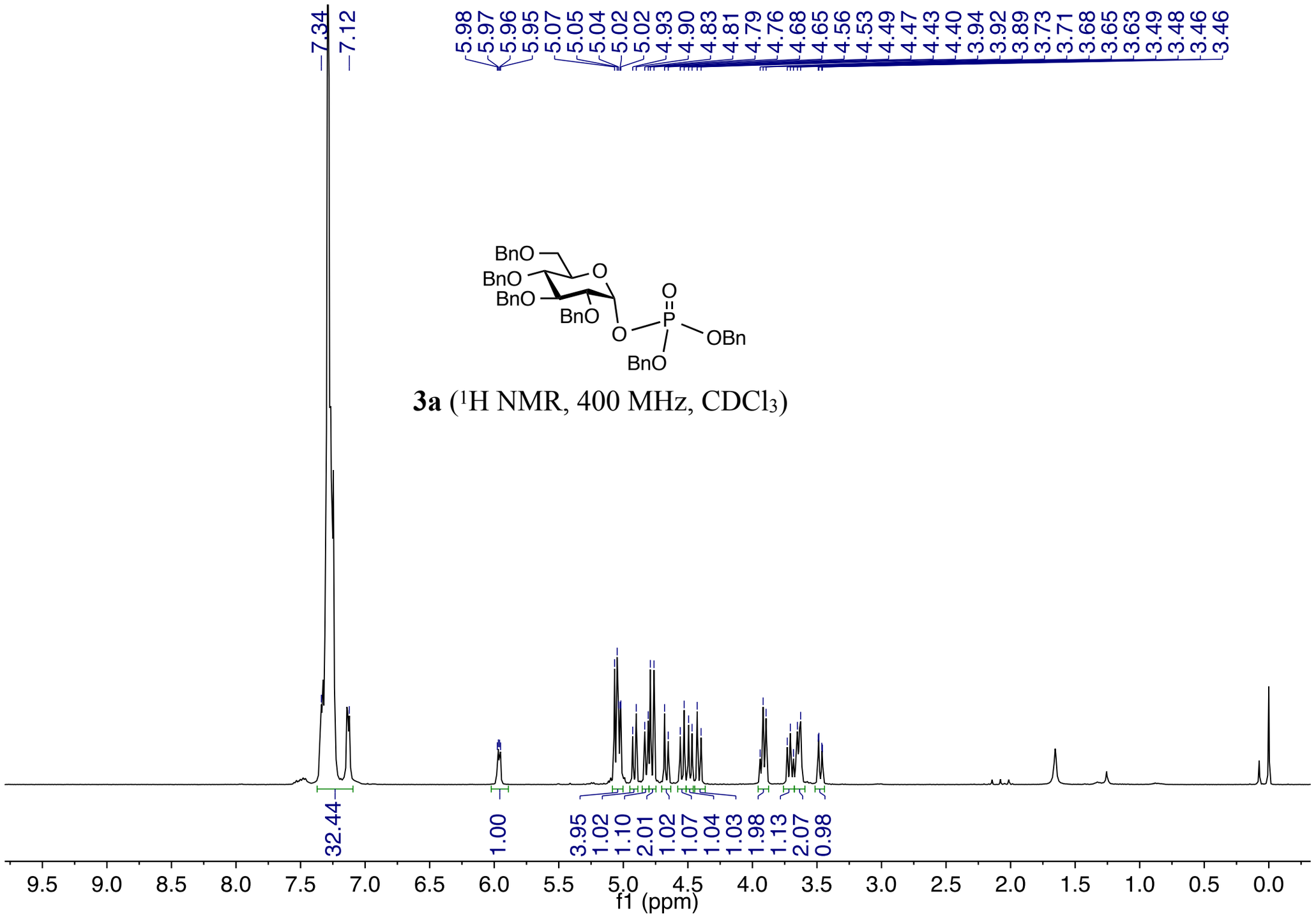
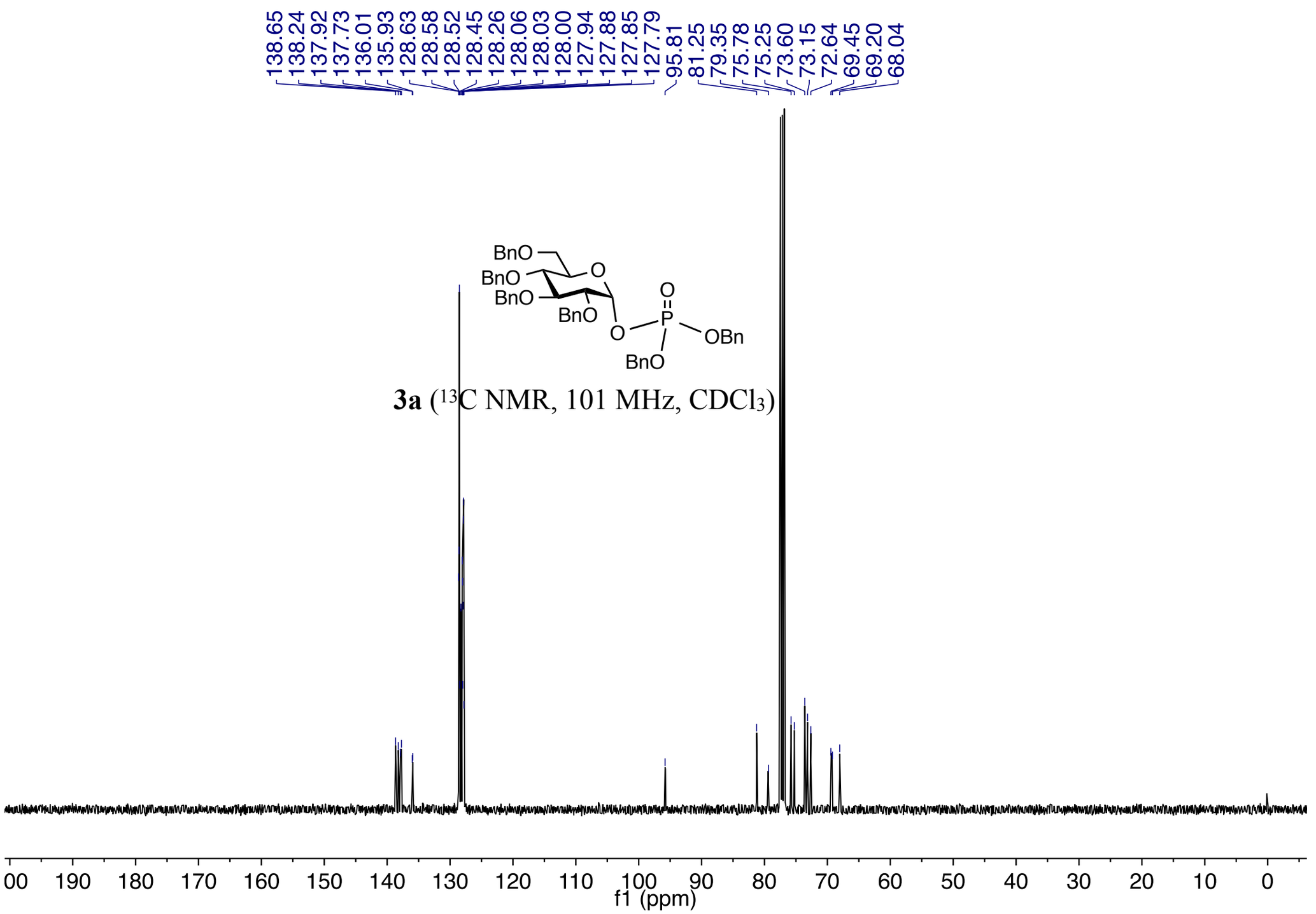
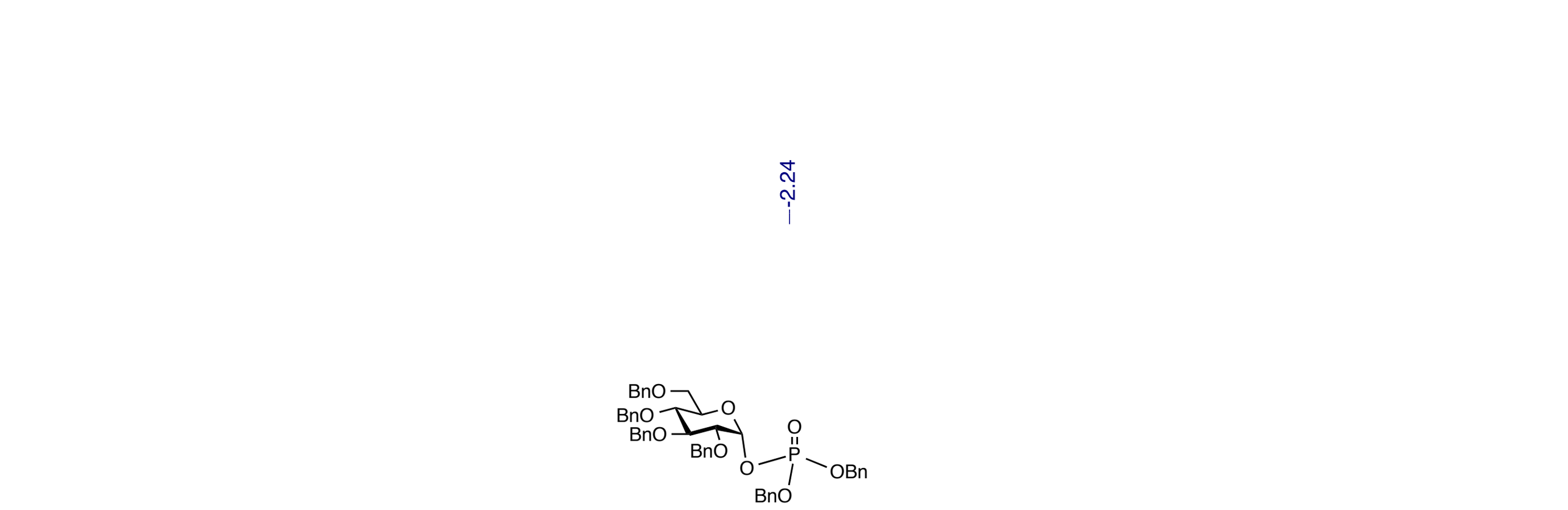
NMR Spectra:



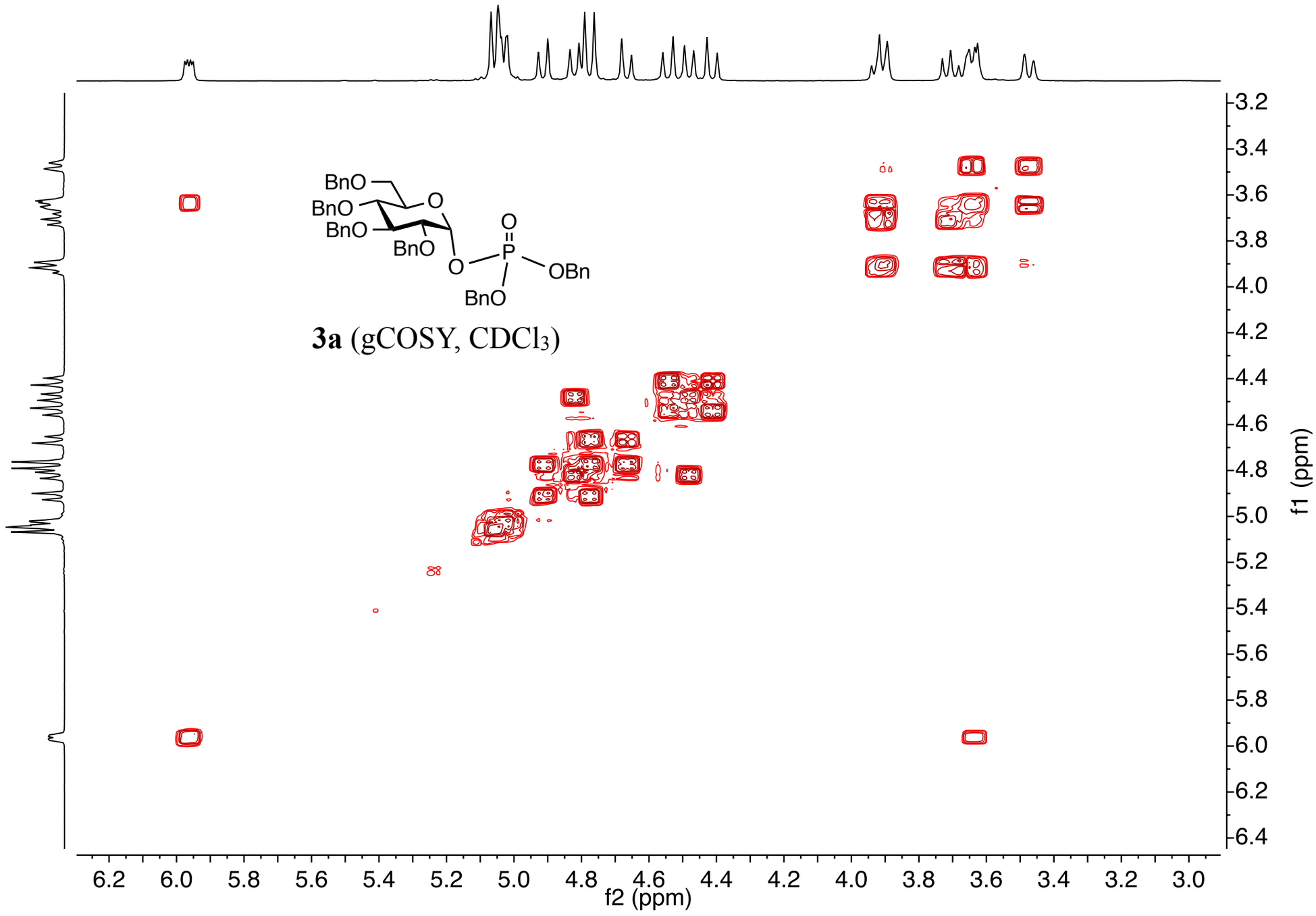
3a (^{1}H NMR, 400 MHz, $CDCl_3$)

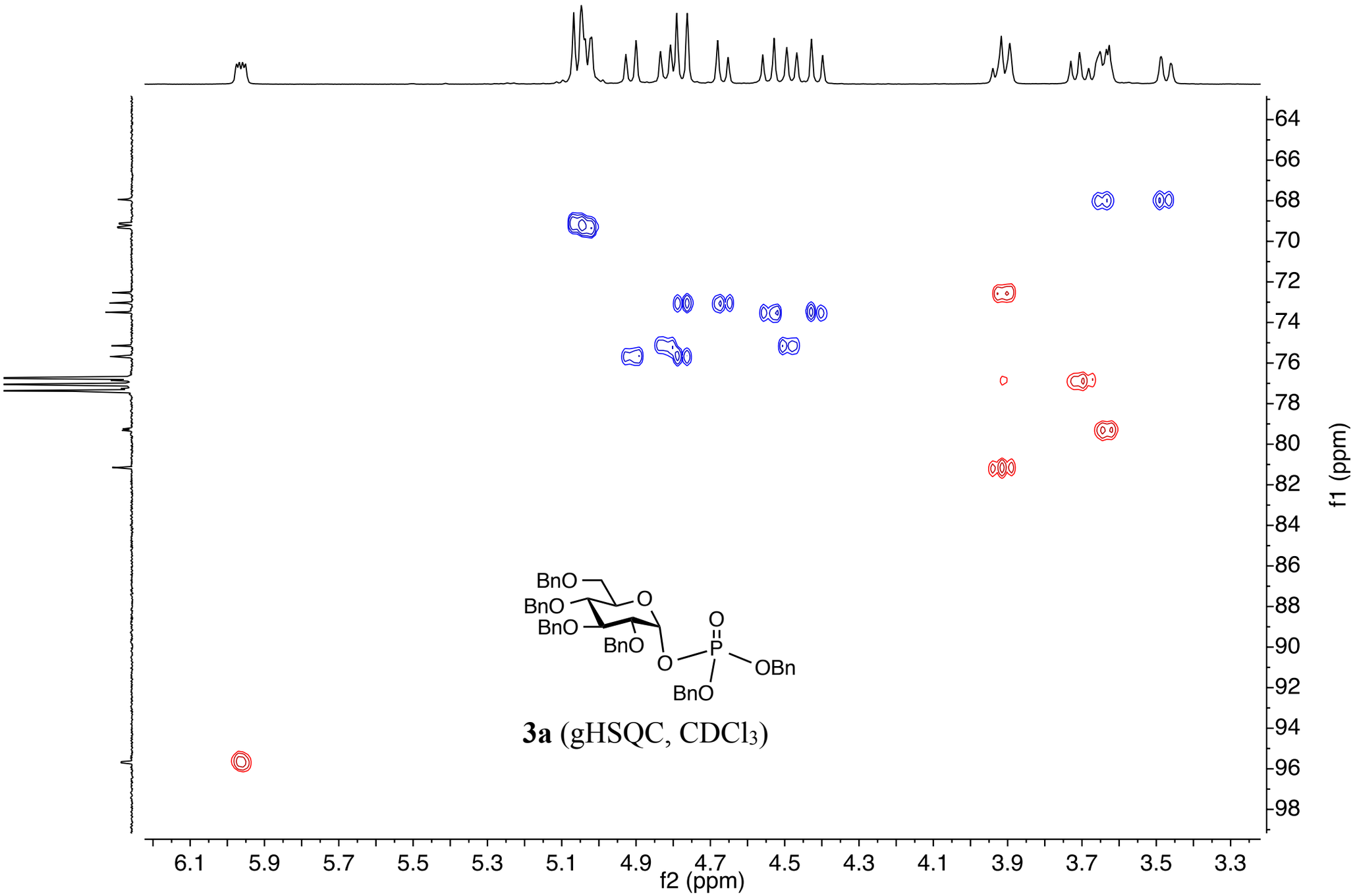


3a (^{13}C NMR, 101 MHz, $CDCl_3$)

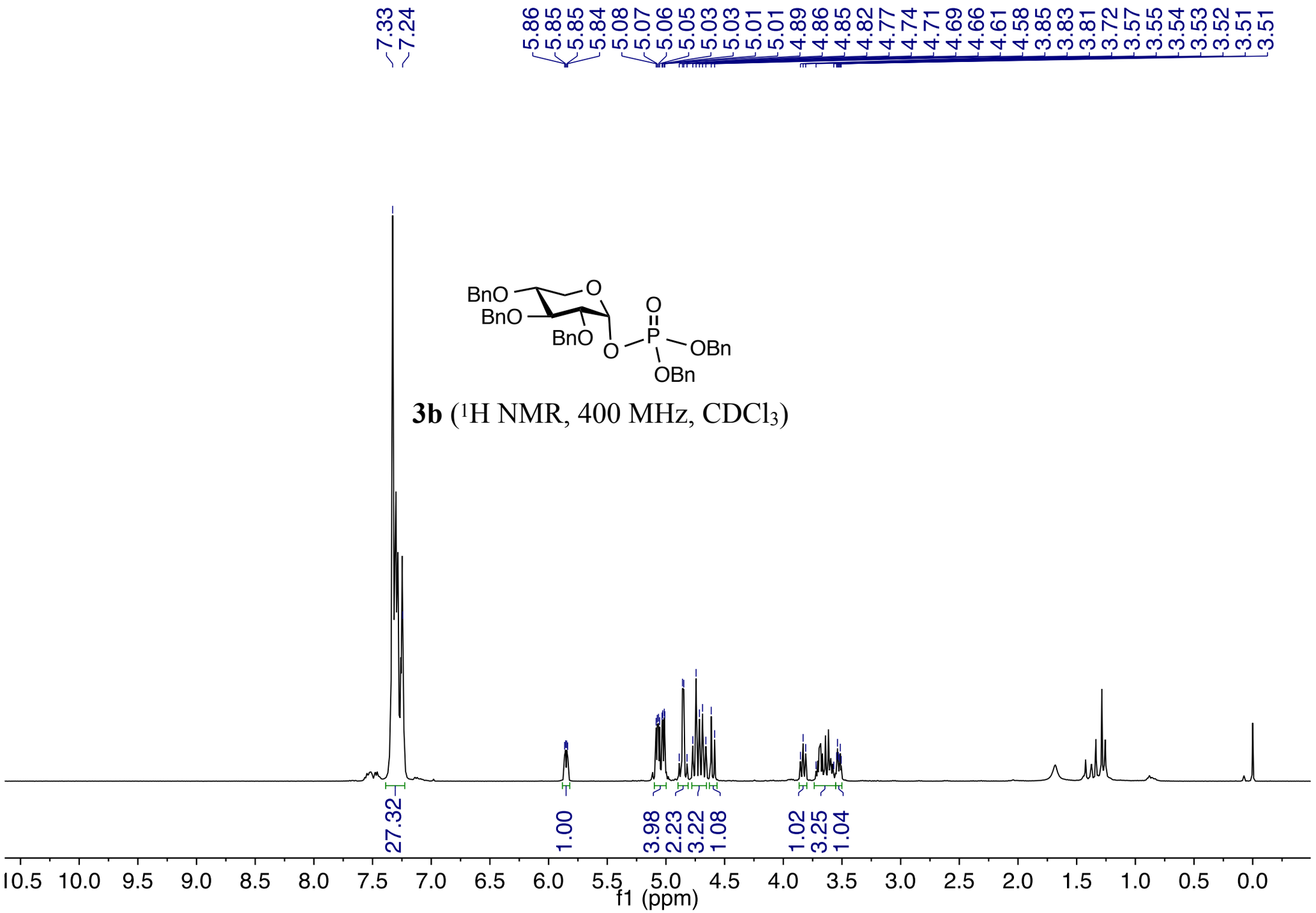


3a (^{31}P NMR, 162 MHz, $CDCl_3$)

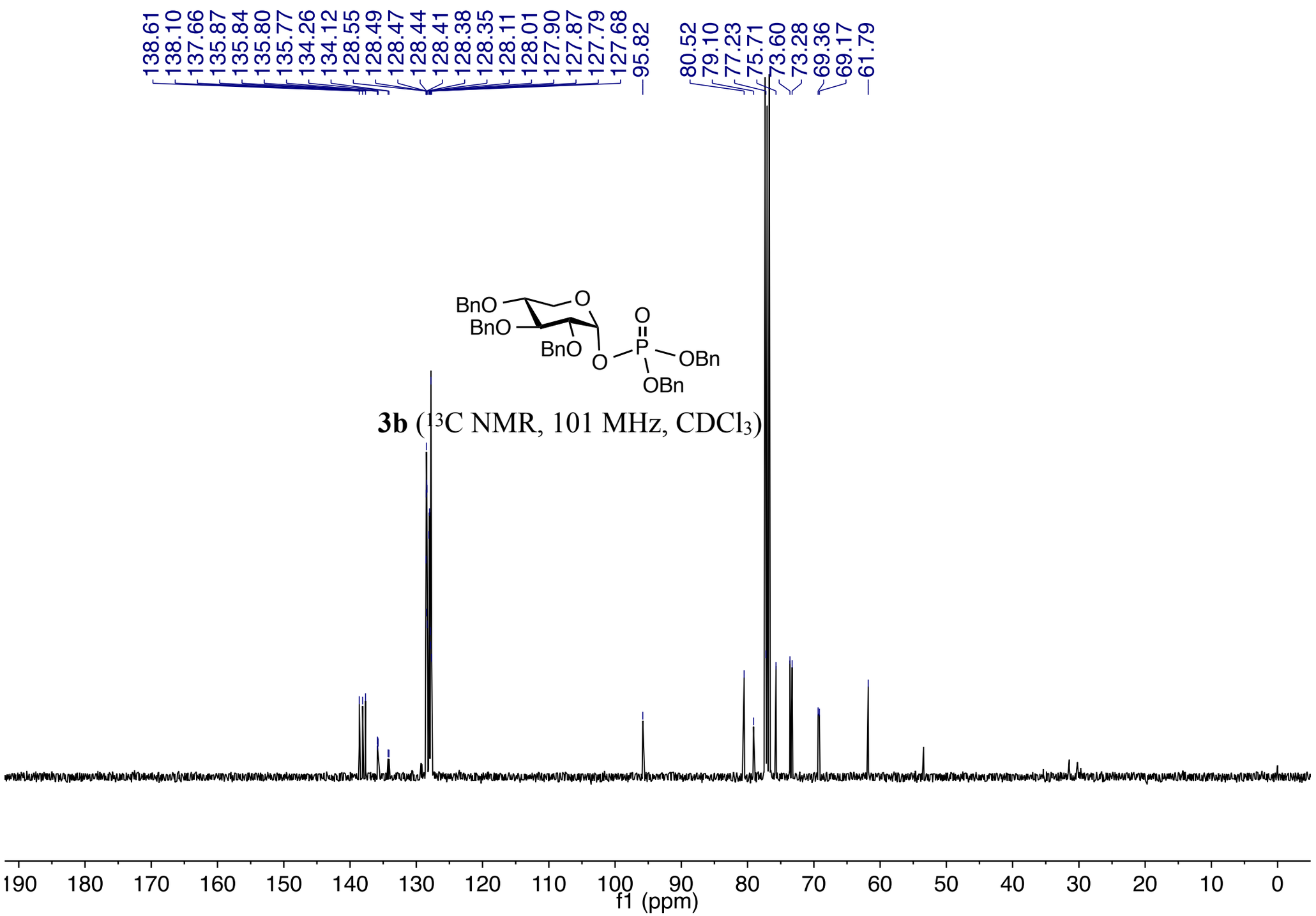

BnO
BnO
BnO
BnO
O
O
P
O
OBn
BnO
3a (gCOSY, CDCl3)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
f1 (ppm)



3a (gHSQC, $CDCl_3$)

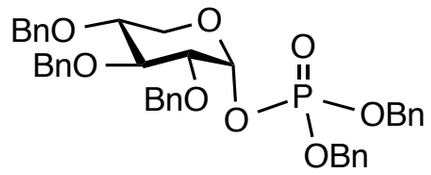


3b (^{1}H NMR, 400 MHz, $CDCl_3$)

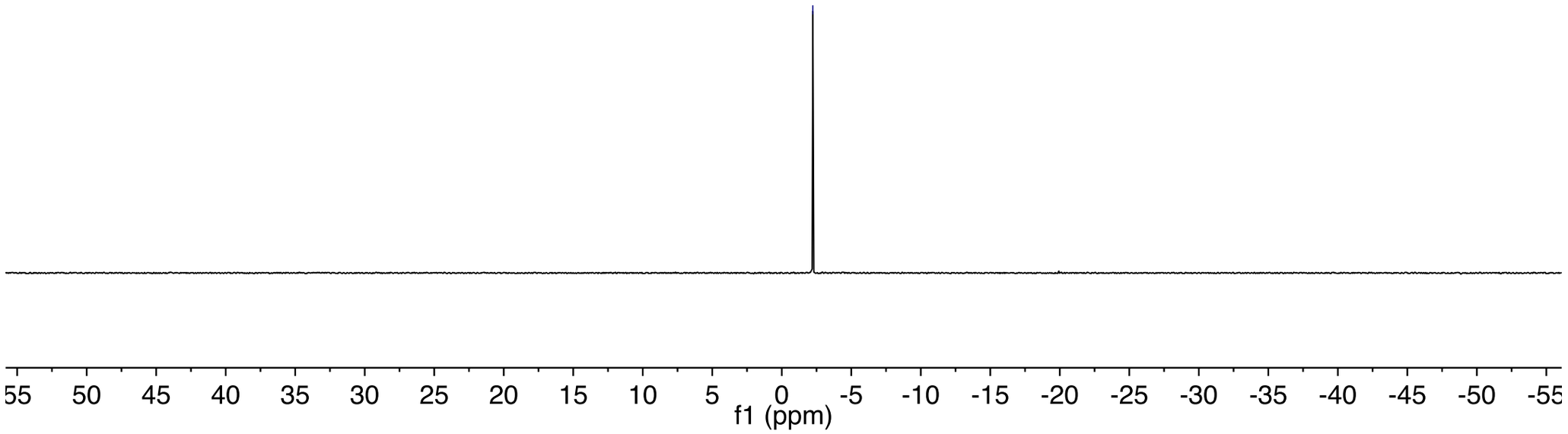


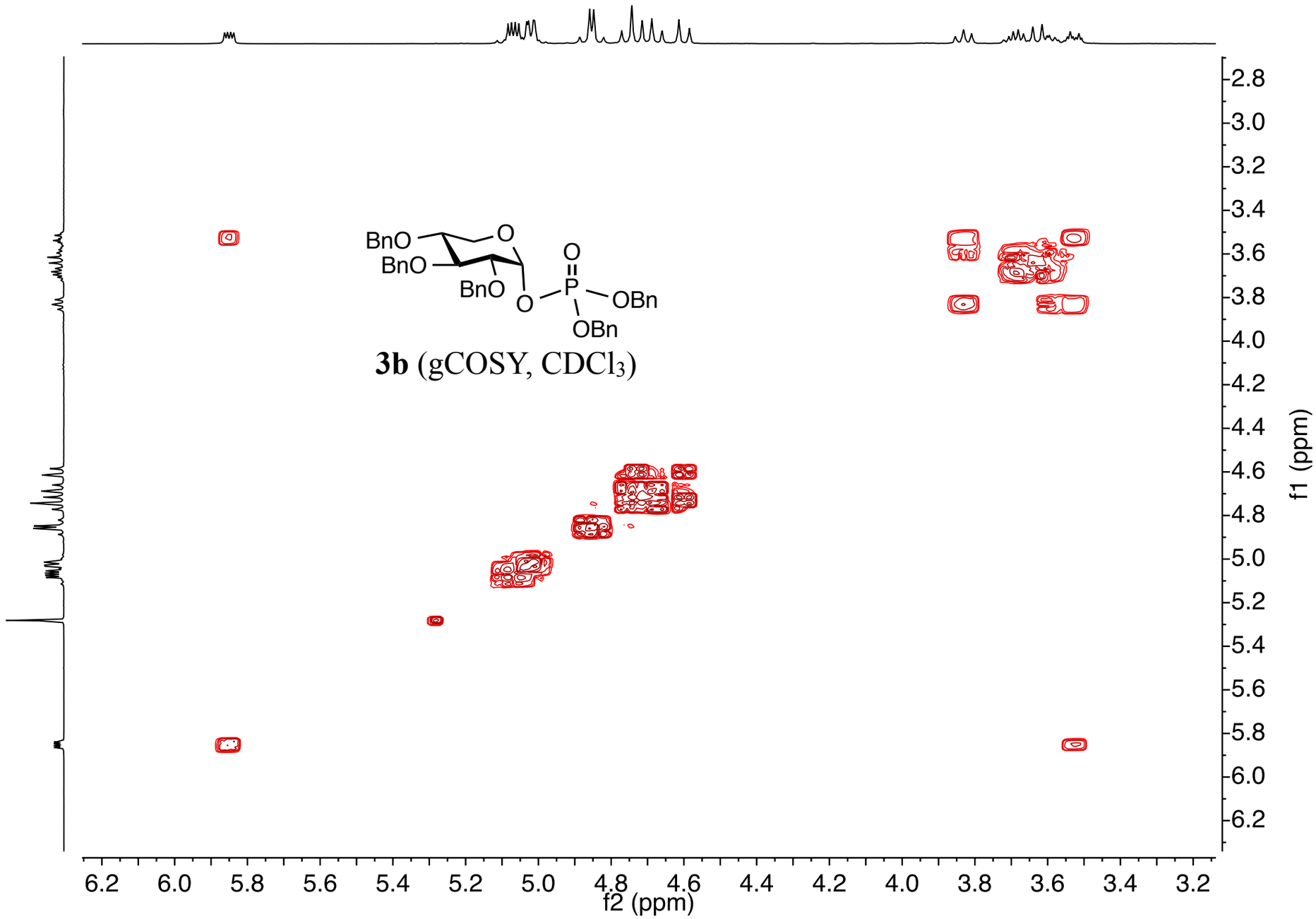
3b (^{13}C NMR, 101 MHz, $CDCl_3$)

—-2.24

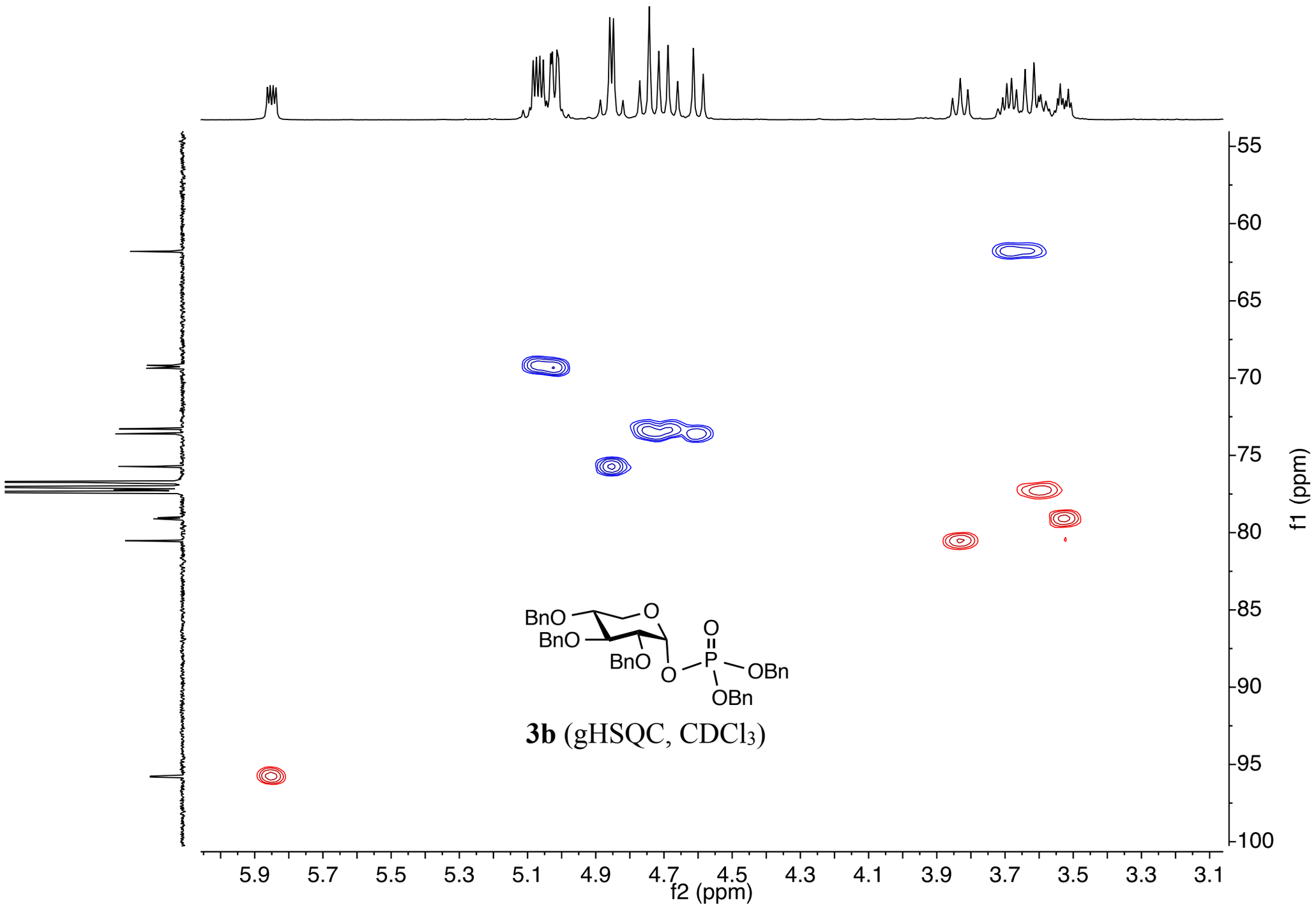


3b (^{31}P NMR, 162 MHz, $CDCl_3$)

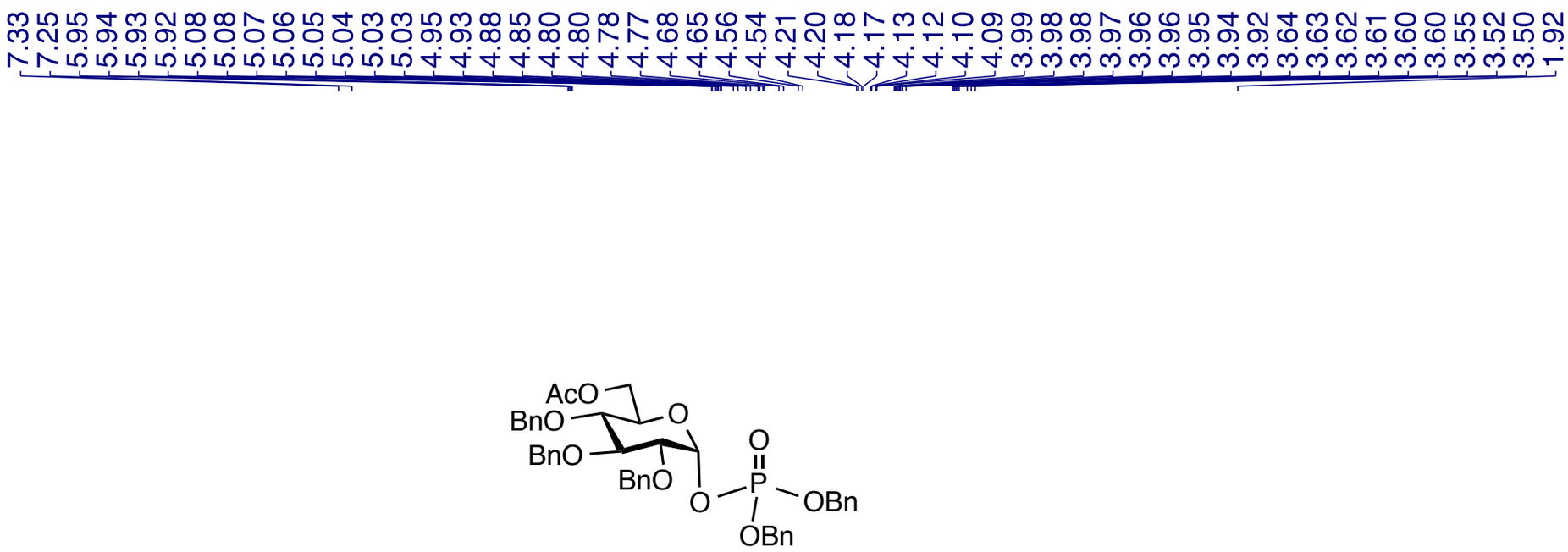




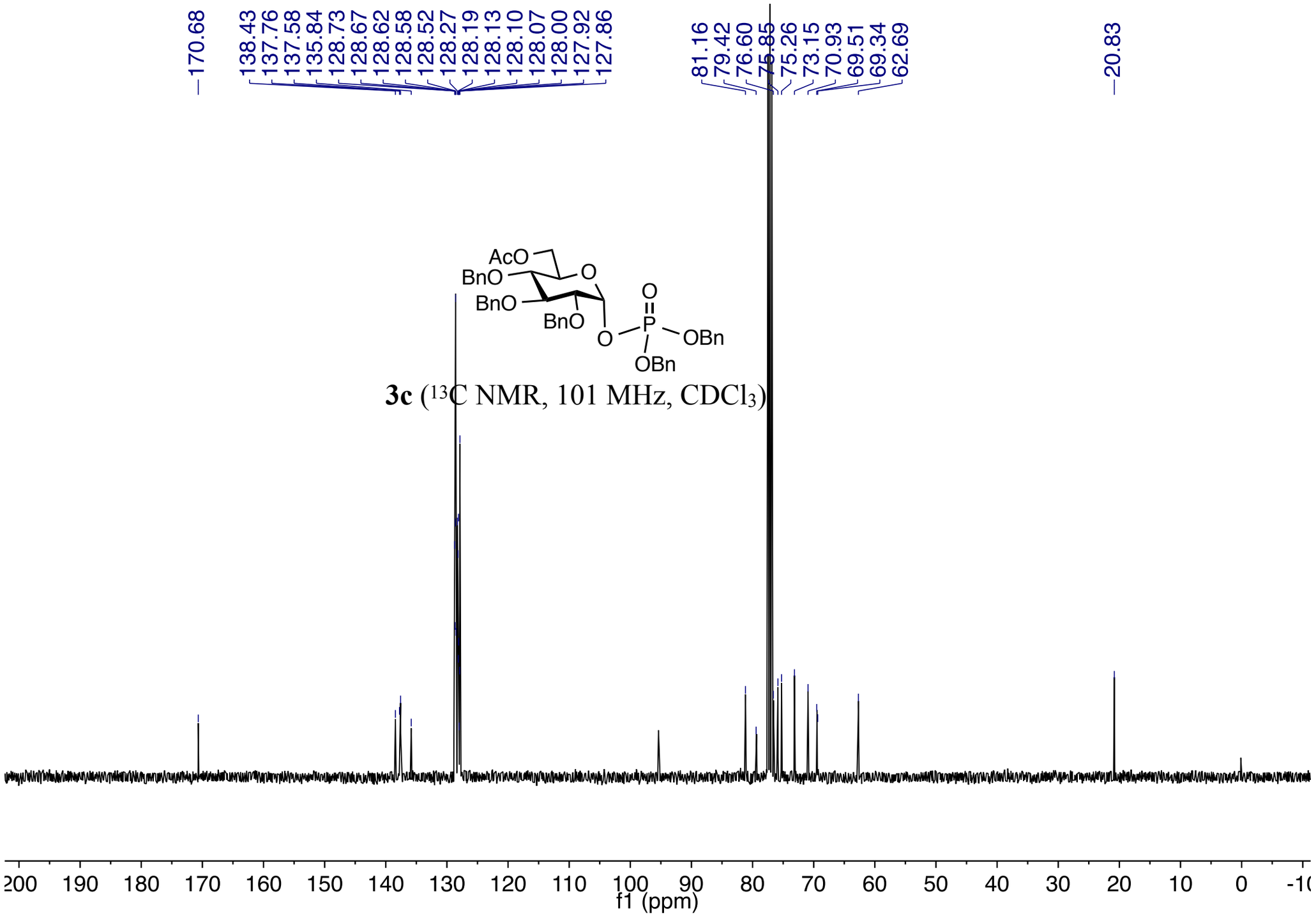
3b (gCOSY, $CDCl_3$)



3b (gHSQC, $CDCl_3$)

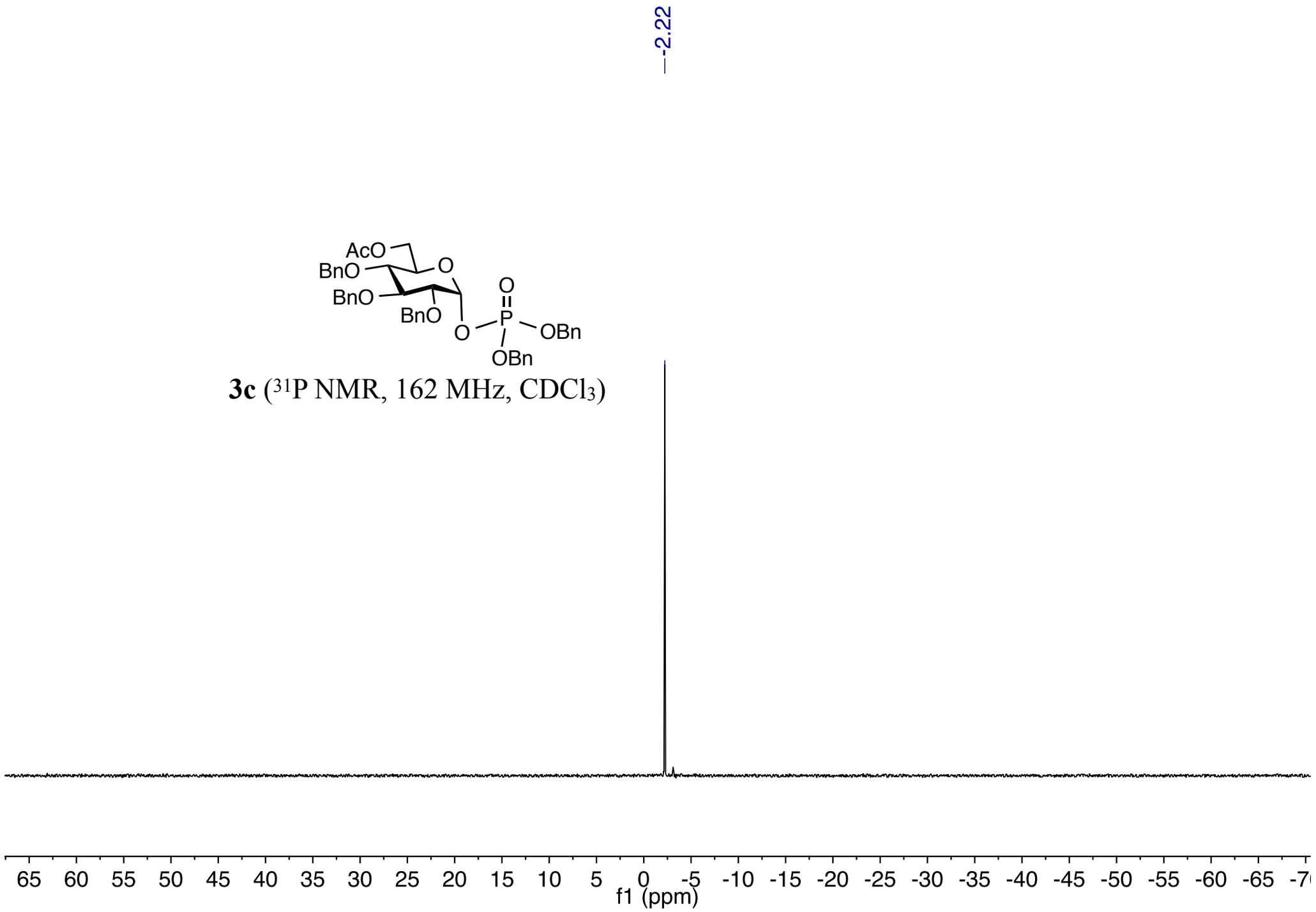


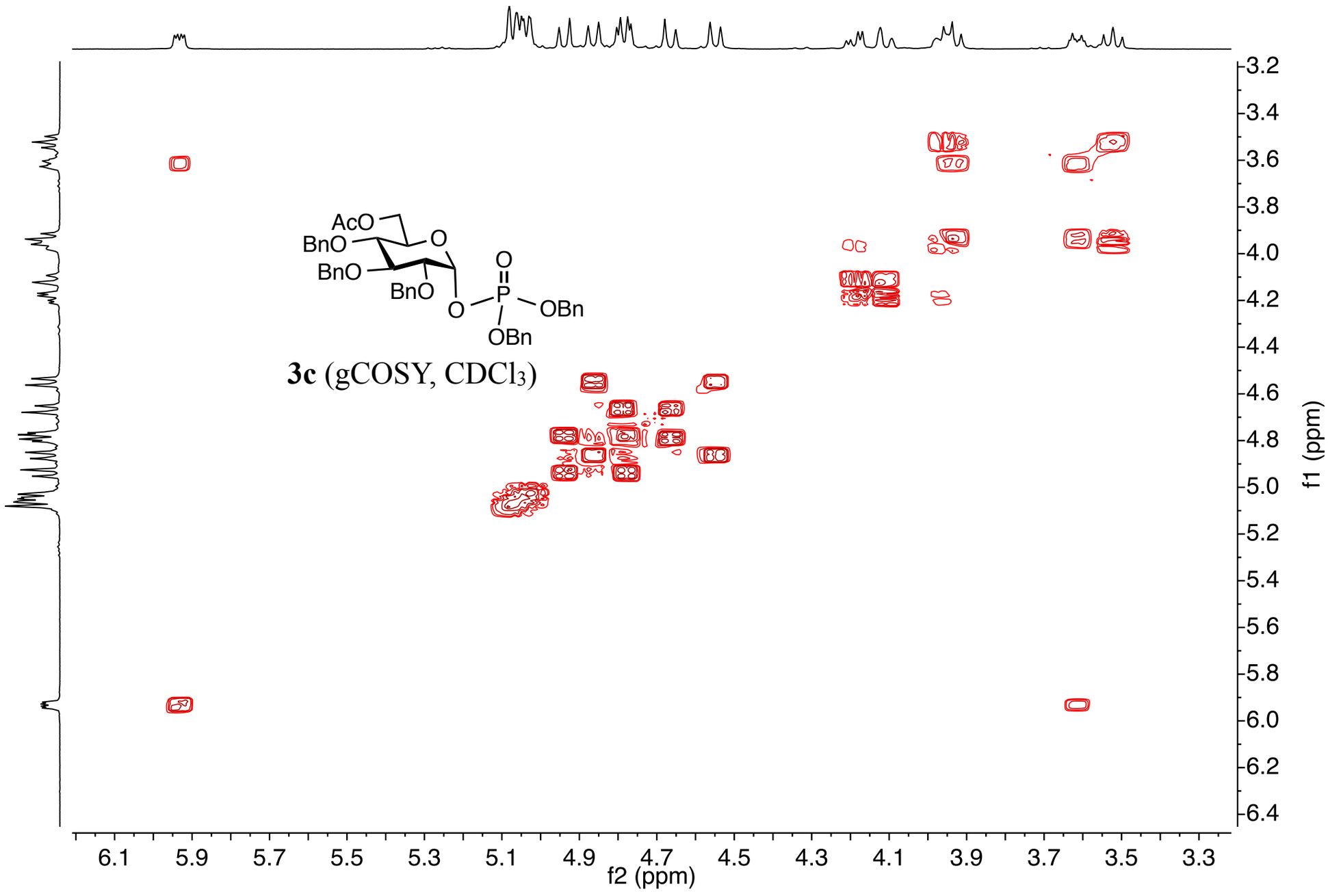
3c (^{1}H NMR, 400 MHz, $CDCl_3$)

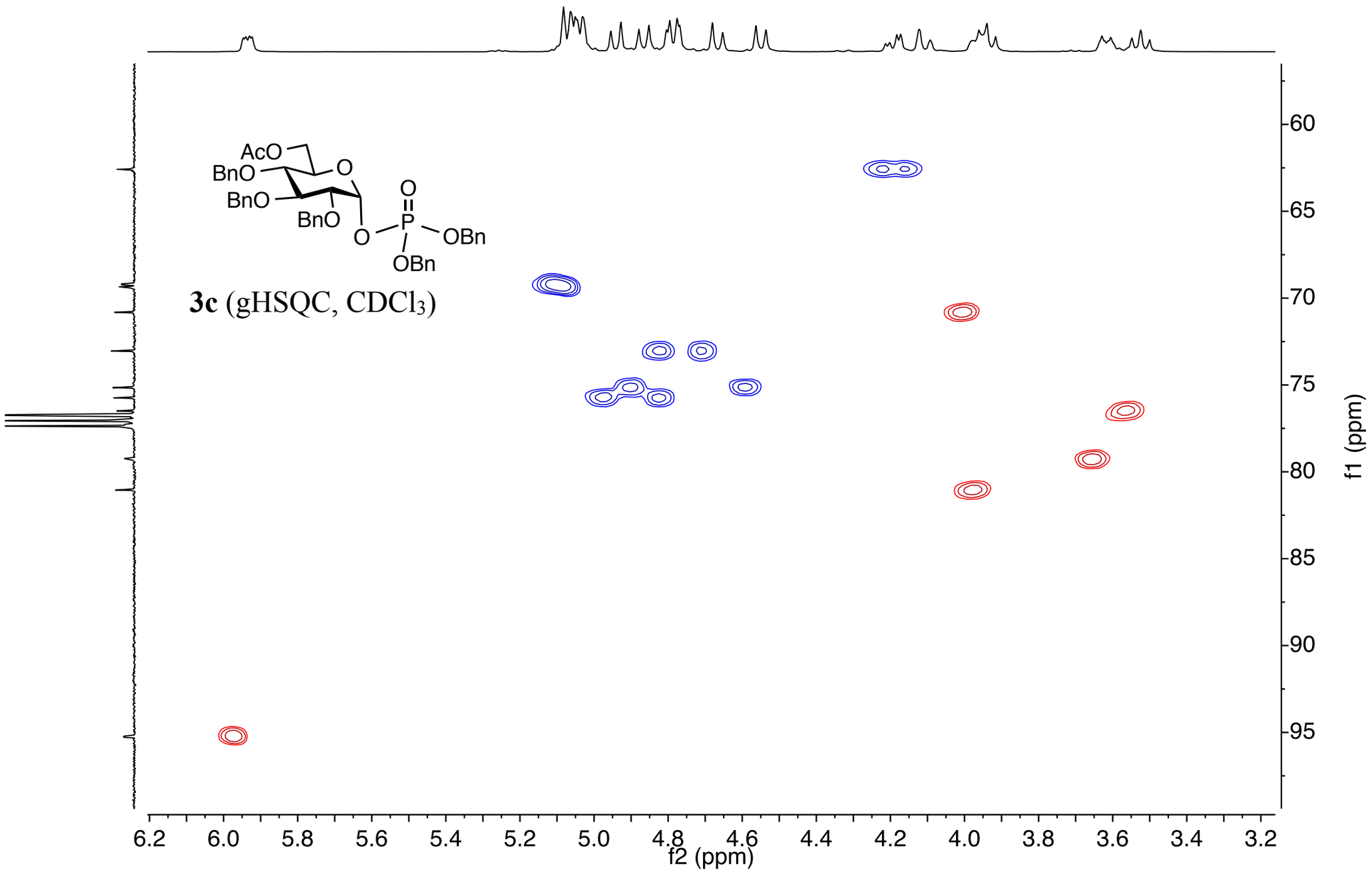


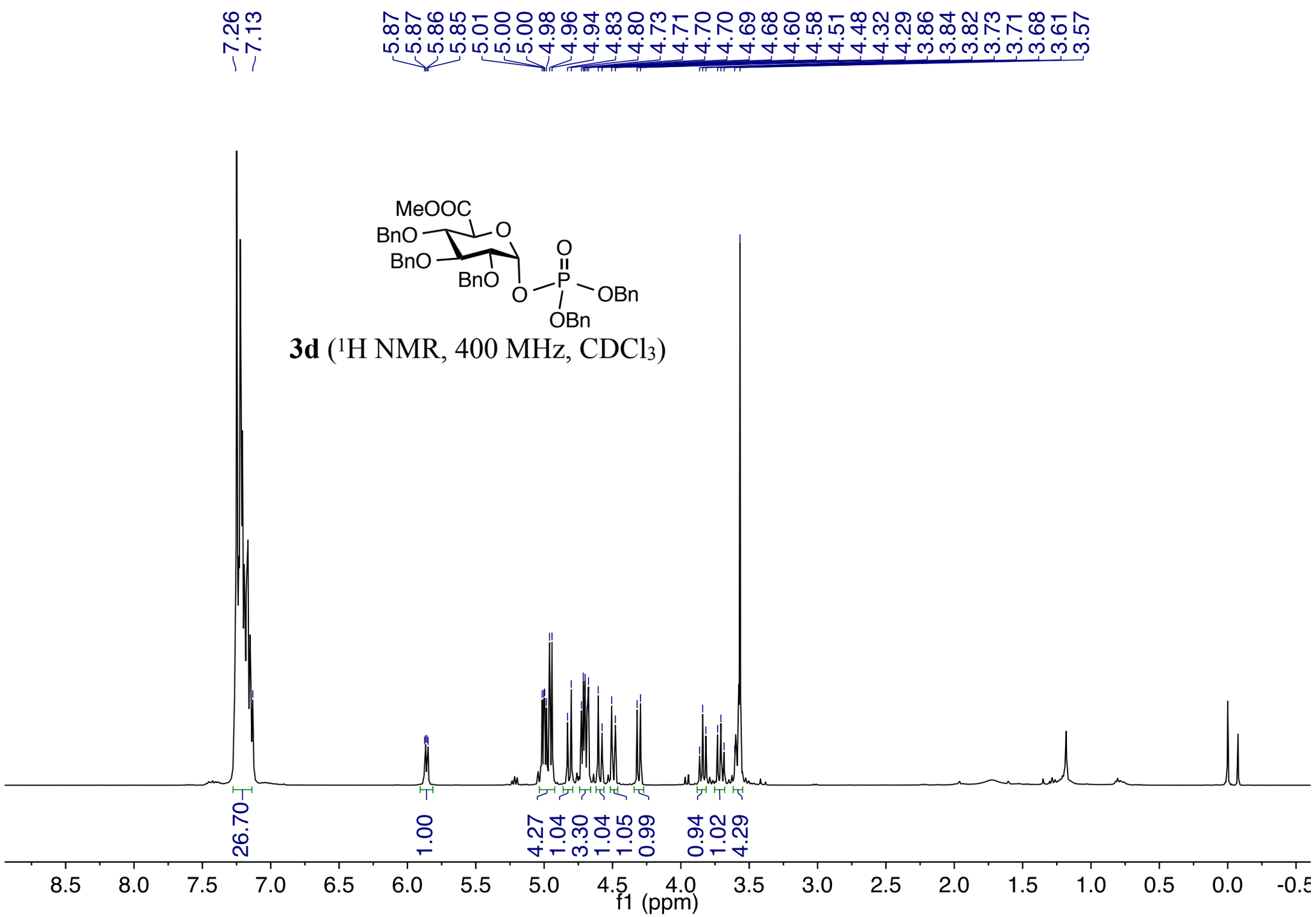
3c (^{13}C NMR, 101 MHz, $CDCl_3$)

3c (^{31}P NMR, 162 MHz, $CDCl_3$)




AcO
BnO
BnO
BnO
O
O
P
O
OBn
OBn
3c (gCOSY, CDCl3)
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
f1 (ppm)
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
f2 (ppm)

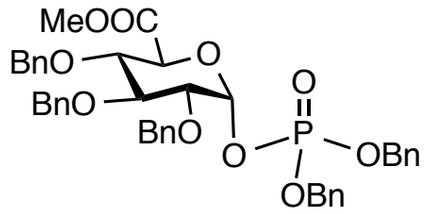

AcO
BnO
BnO
BnO
O
O
P
O
OBn
OBn
3c (gHSQC, CDCl3)
60
65
70
75
80
85
90
95
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)



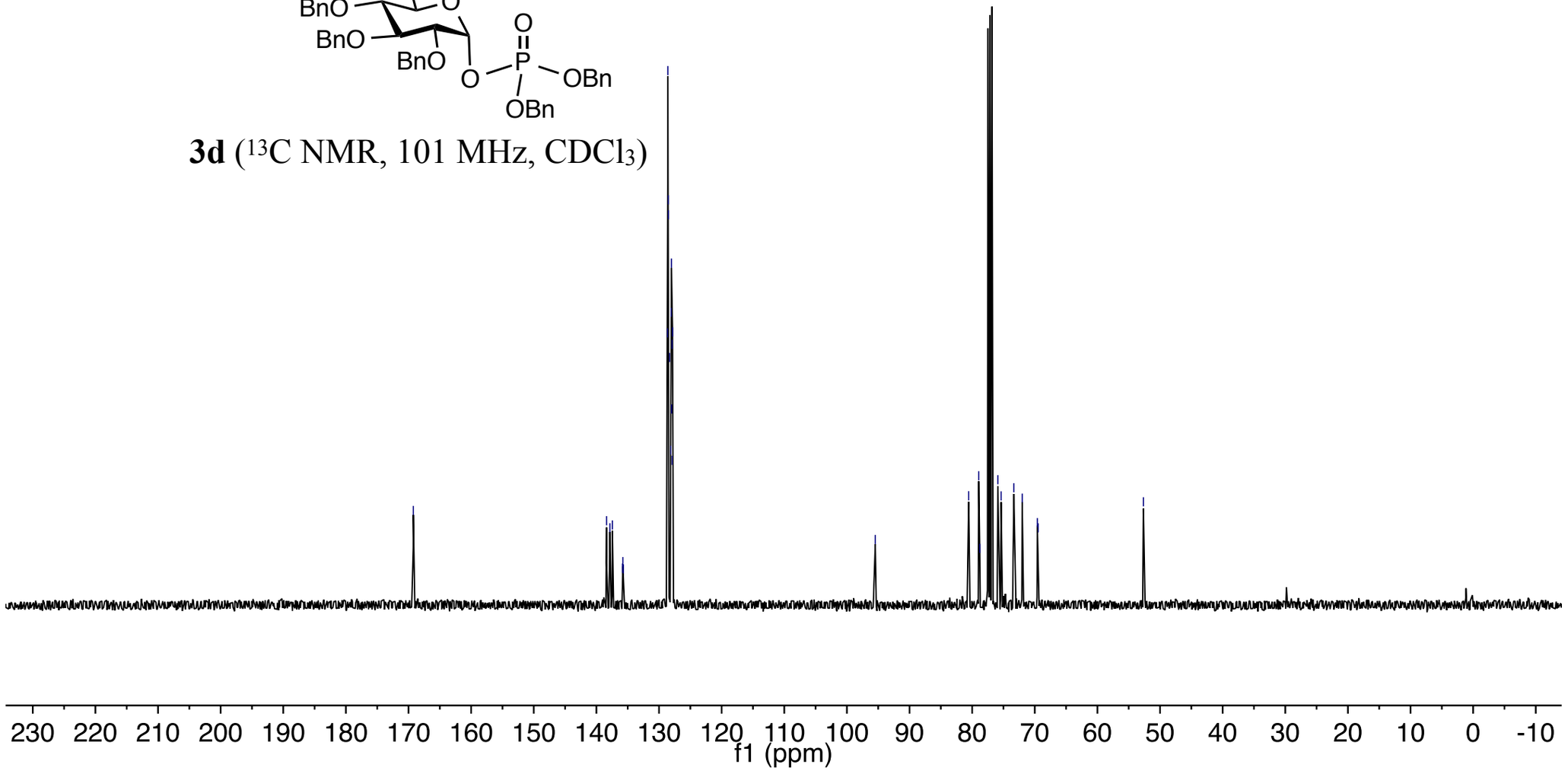
3d (^{1}H NMR, 400 MHz, $CDCl_3$)

169.24
138.38
137.84
137.45
135.83
135.77
135.70
128.65
128.59
128.54
128.52
128.32
128.12
128.05
128.01
128.00
127.93
127.89
127.85

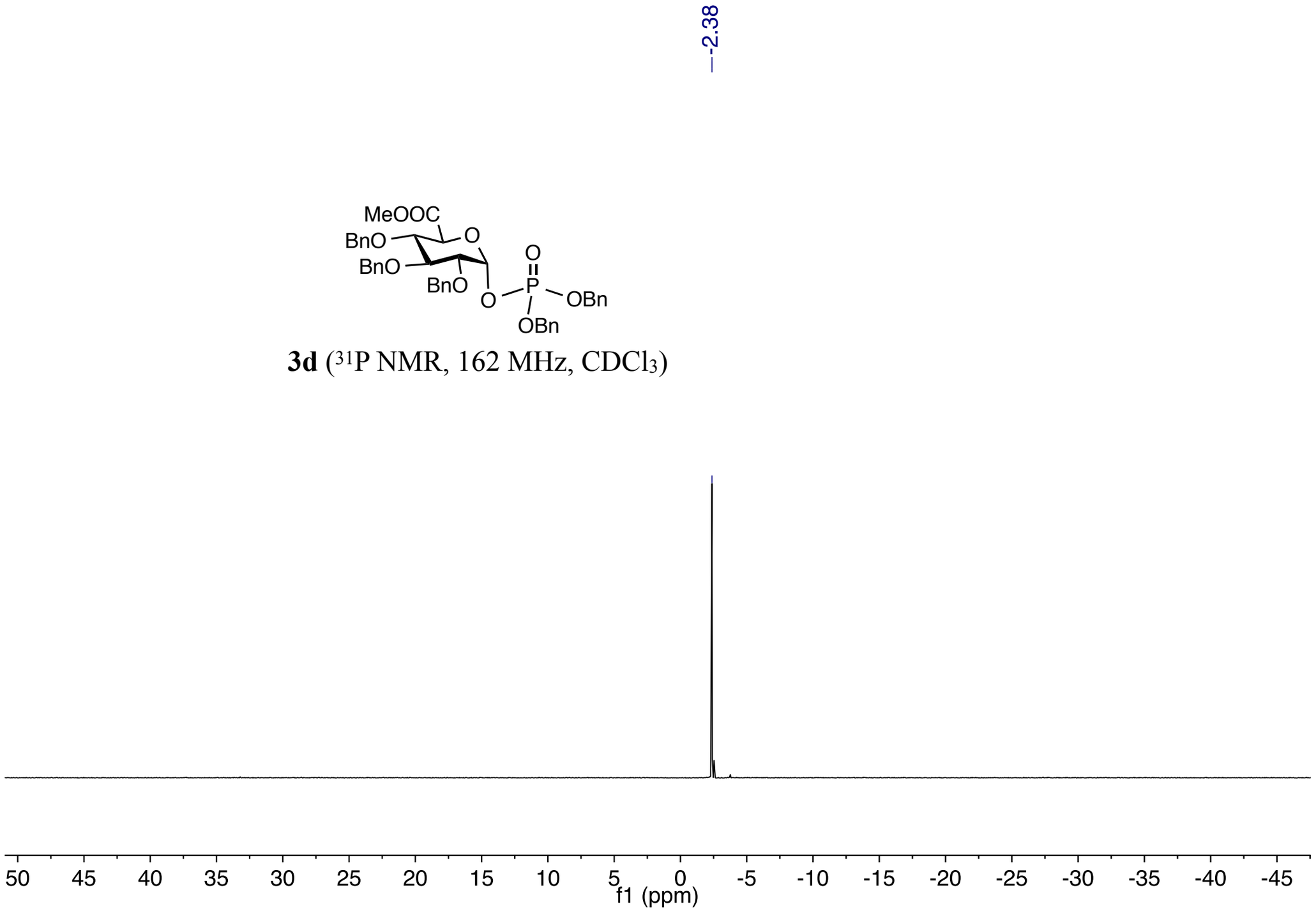
95.47
80.55
78.94
78.78
75.90
75.37
73.34
72.00
69.59
69.46
52.65

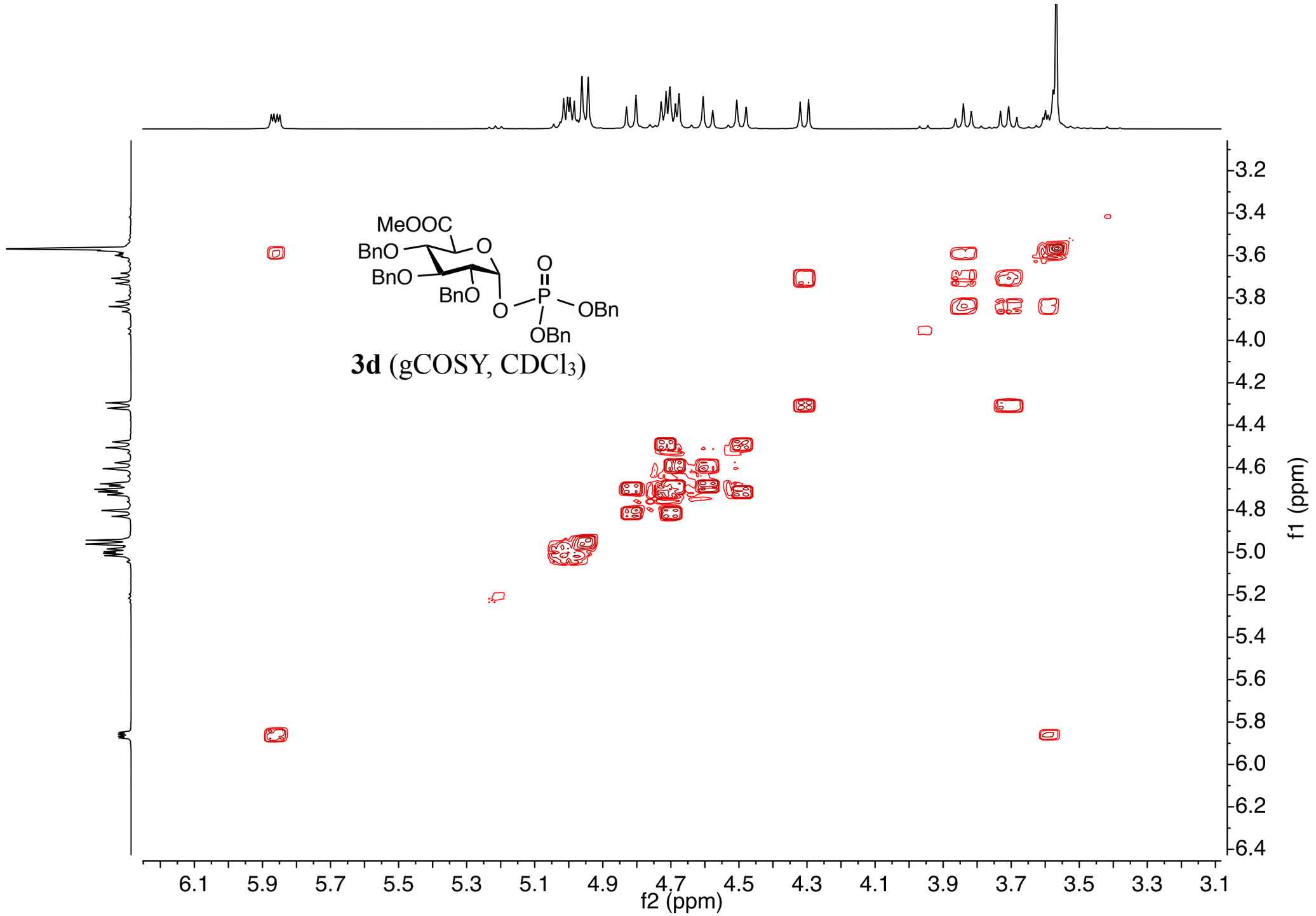


3d (^{13}C NMR, 101 MHz, $CDCl_3$)

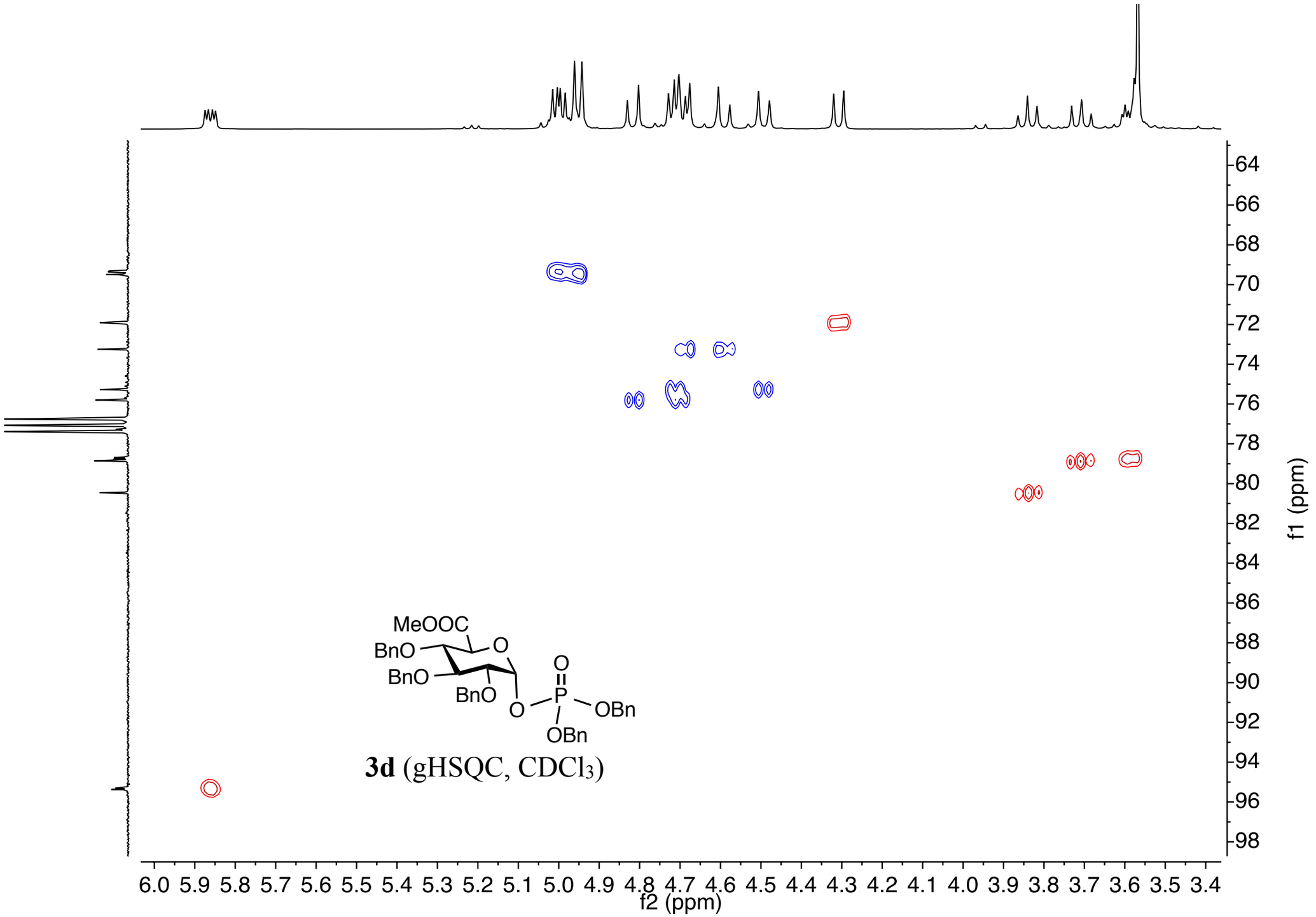


3d (^{31}P NMR, 162 MHz, $CDCl_3$)

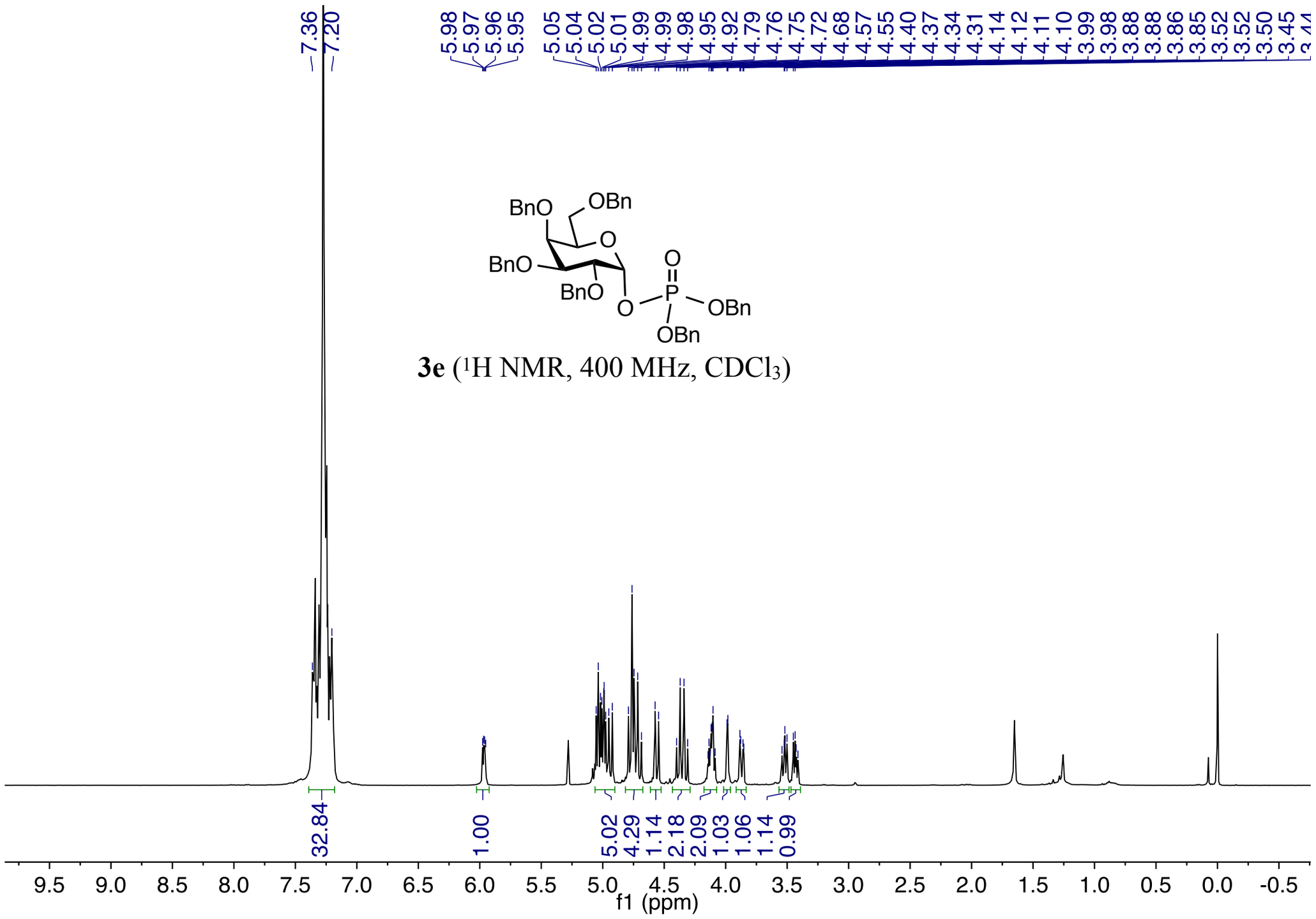




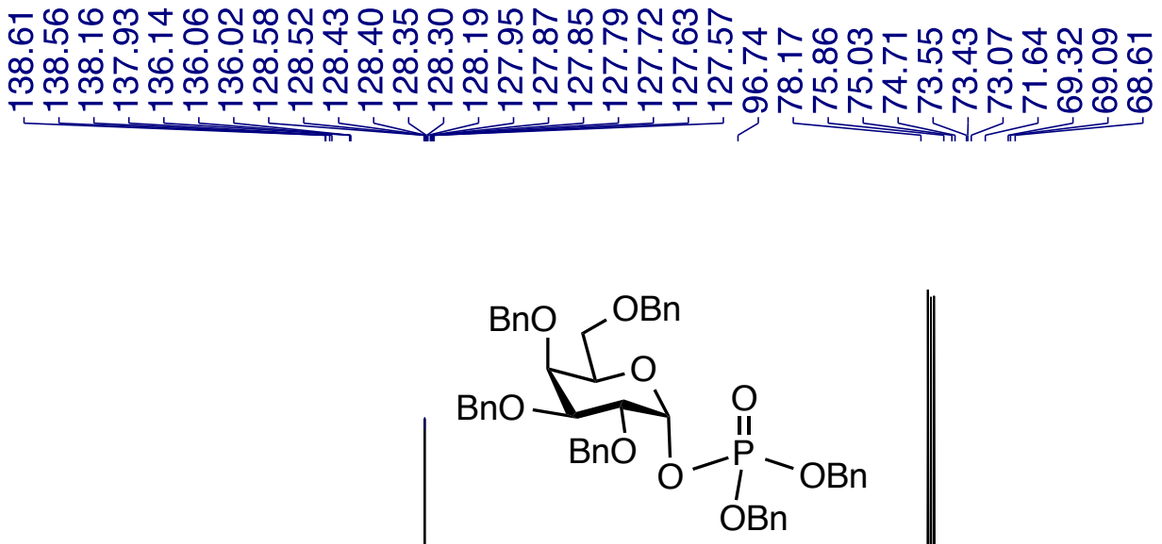
3d (gCOSY, $CDCl_3$)



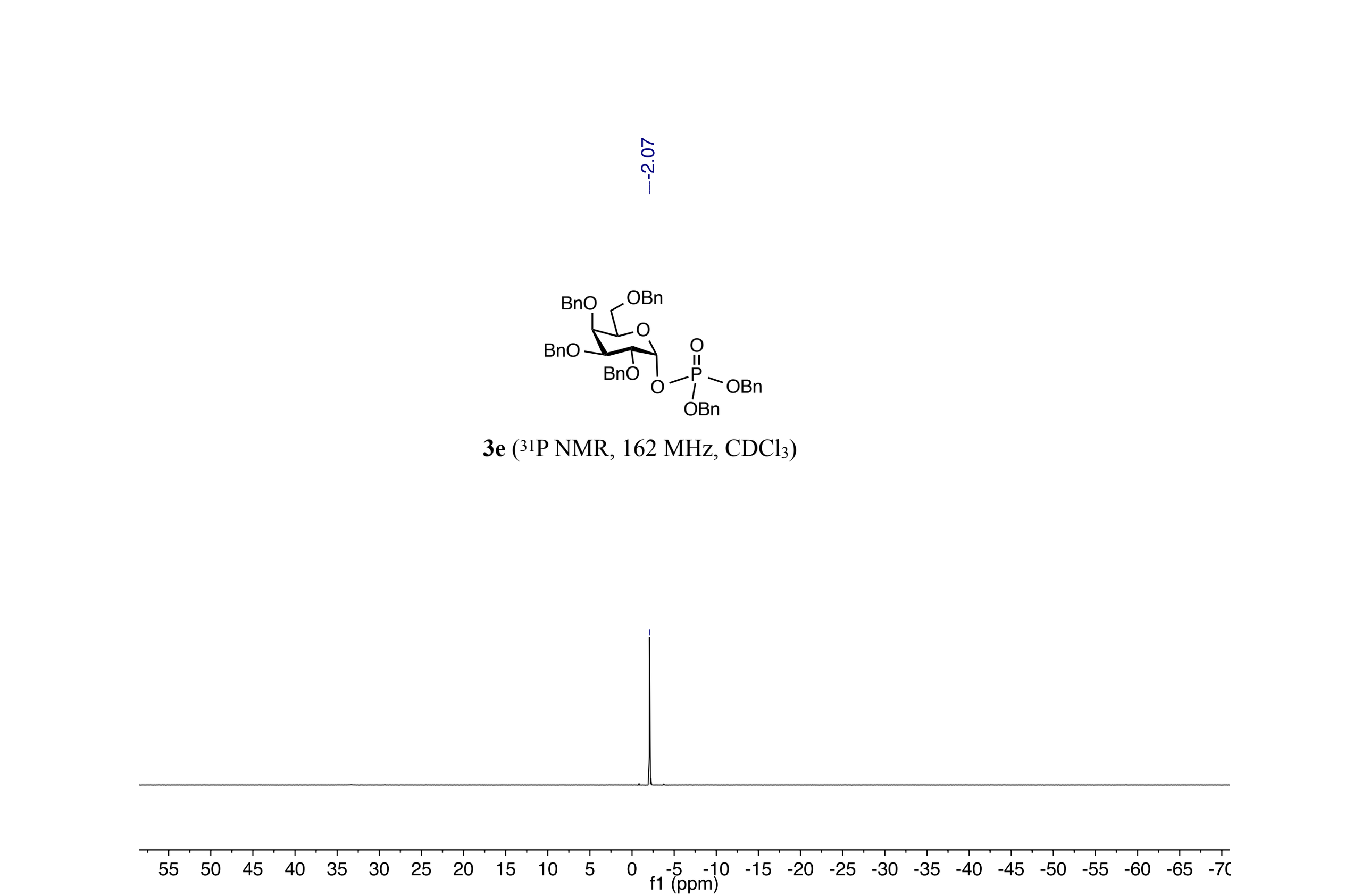
3d (gHSQC, $CDCl_3$)



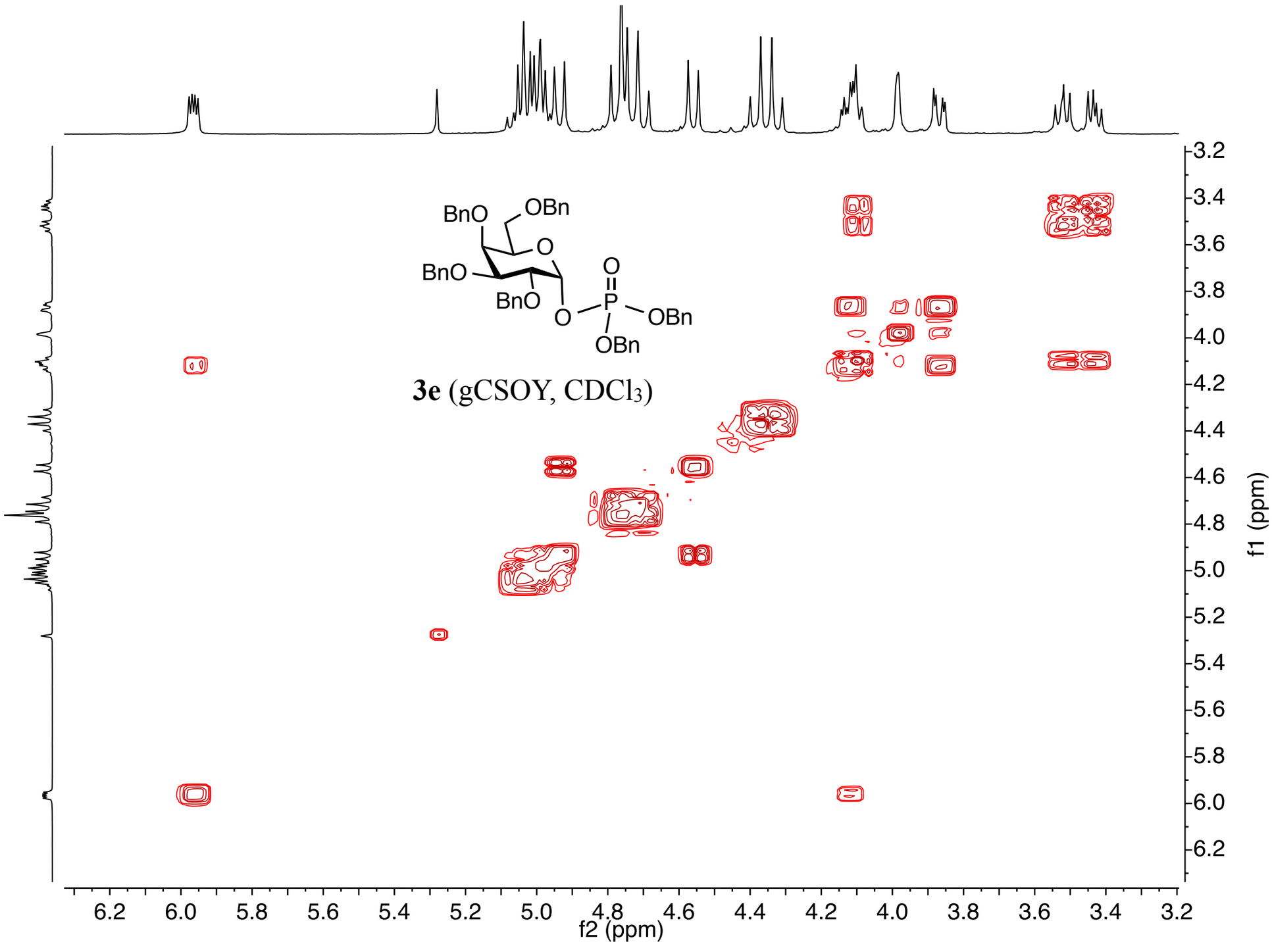
3e (^{1}H NMR, 400 MHz, $CDCl_3$)

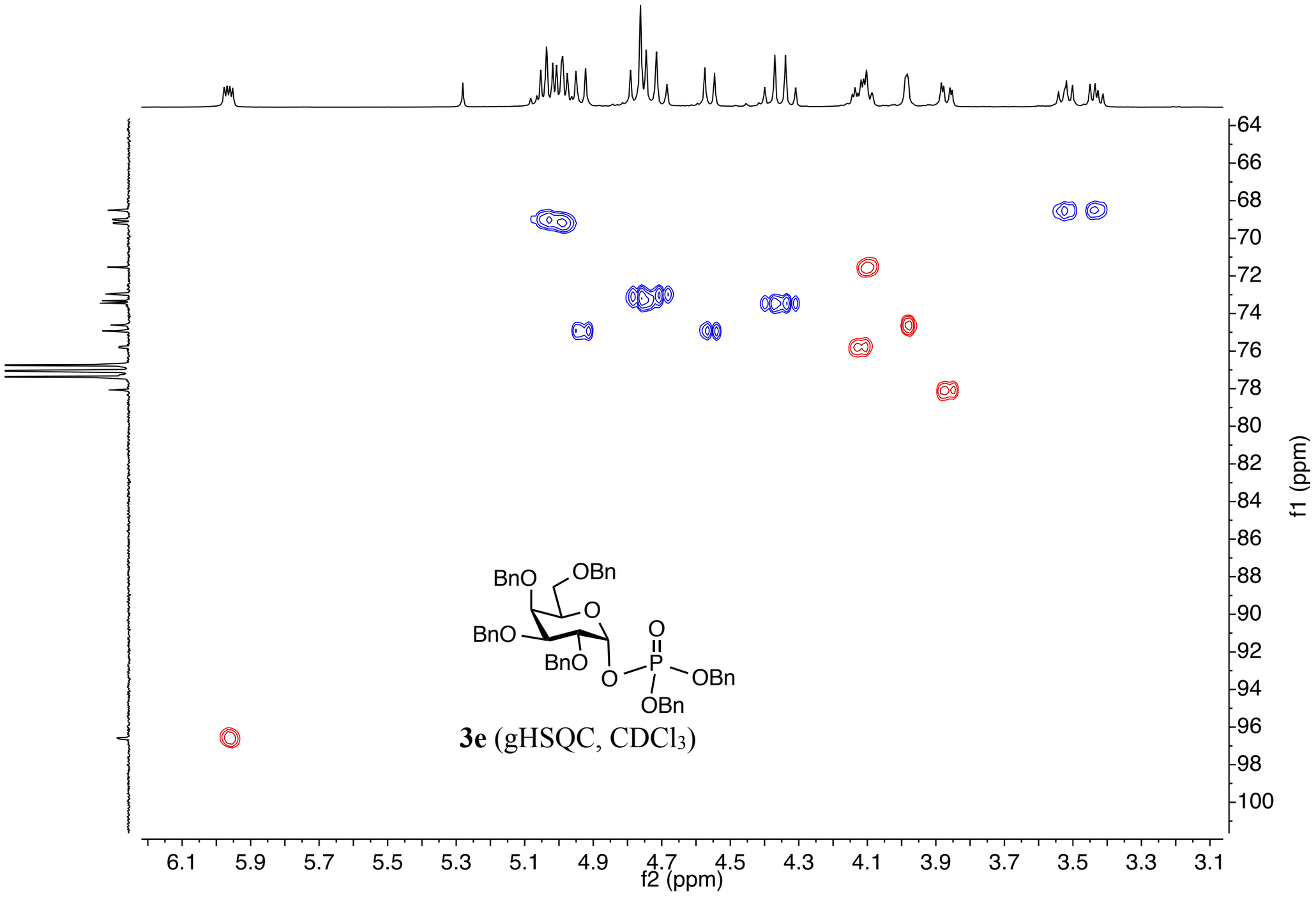


3e (^{13}C NMR, 101 MHz, $CDCl_3$)

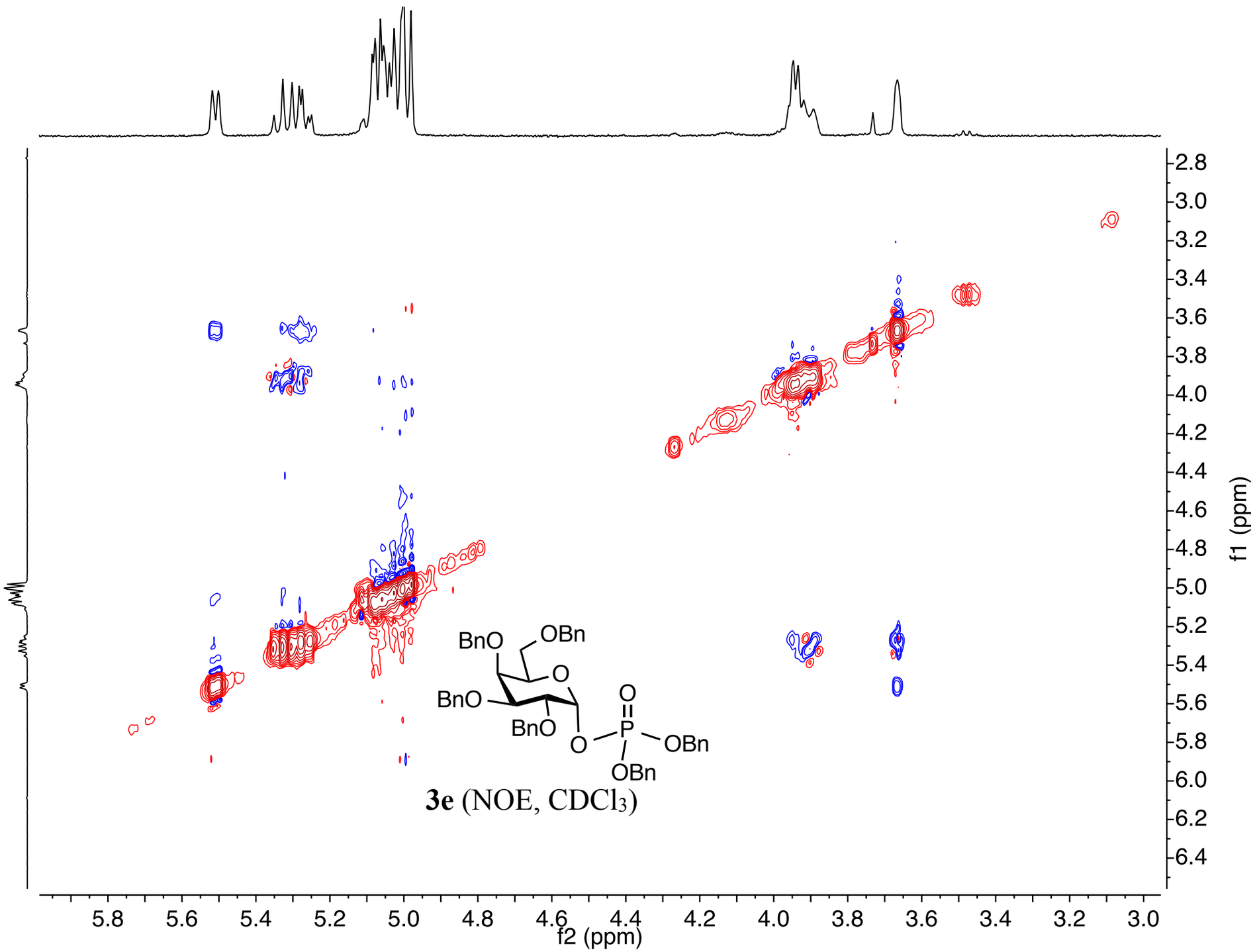


3e (^{31}P NMR, 162 MHz, $CDCl_3$)

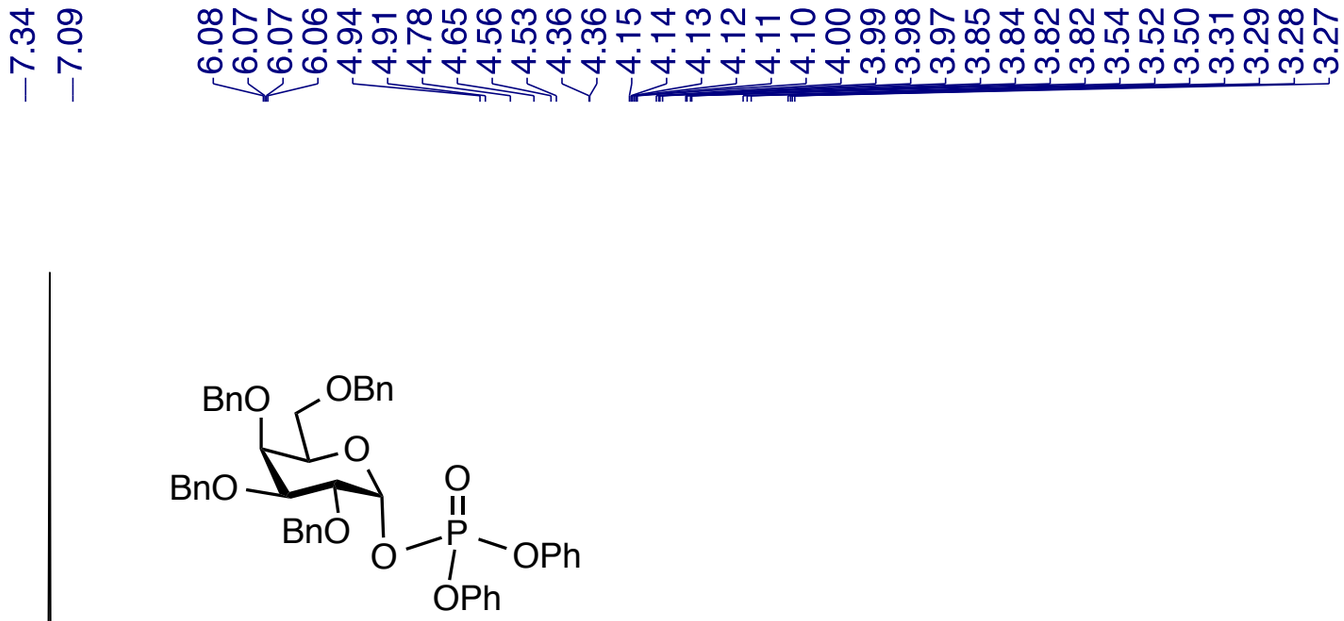

BnO
OBn
O
BnO
BnO
O
P
O
OBn
OBn
3e (gCSOY, CDCl3)
f2 (ppm)
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2



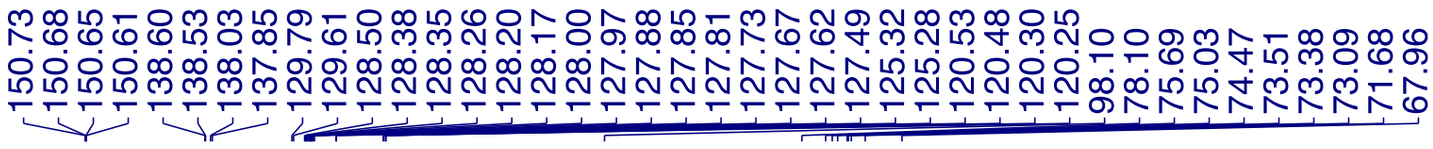
3e (gHSQC, $CDCl_3$)

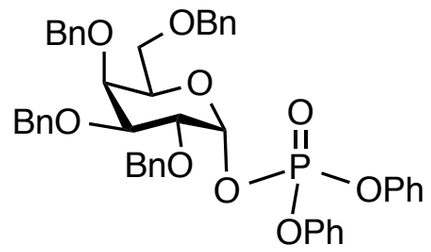

2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
f1 (ppm)
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)
BnO
OBn
O
BnO
BnO
O
P
O
OBn
OBn

3e (NOE, $CDCl_3$)

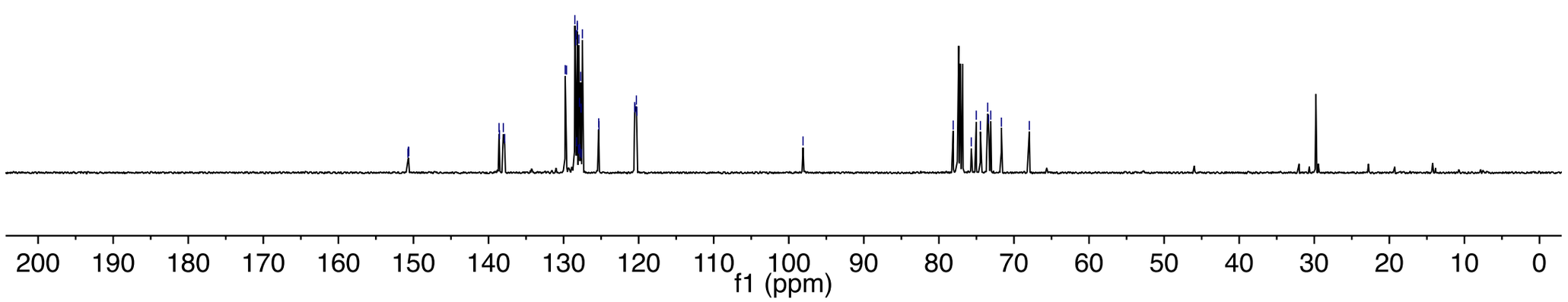


3e' (^{1}H NMR, 400 MHz, $CDCl_3$)

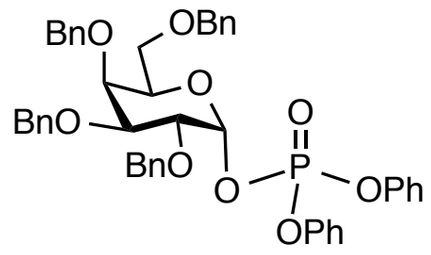




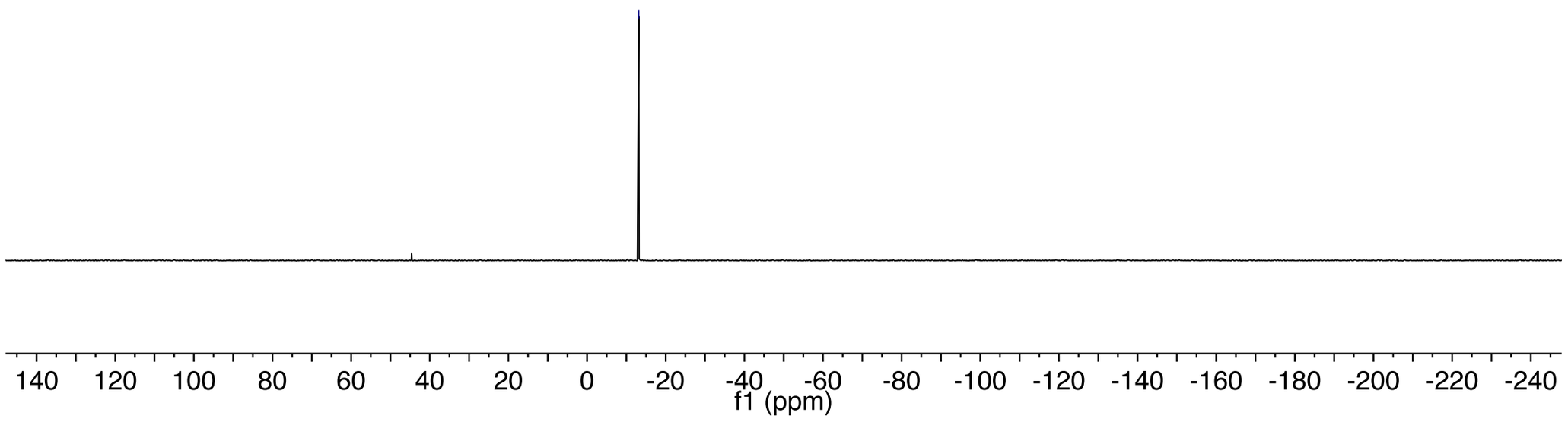
3e' (^{13}C NMR, 101 MHz, $CDCl_3$)

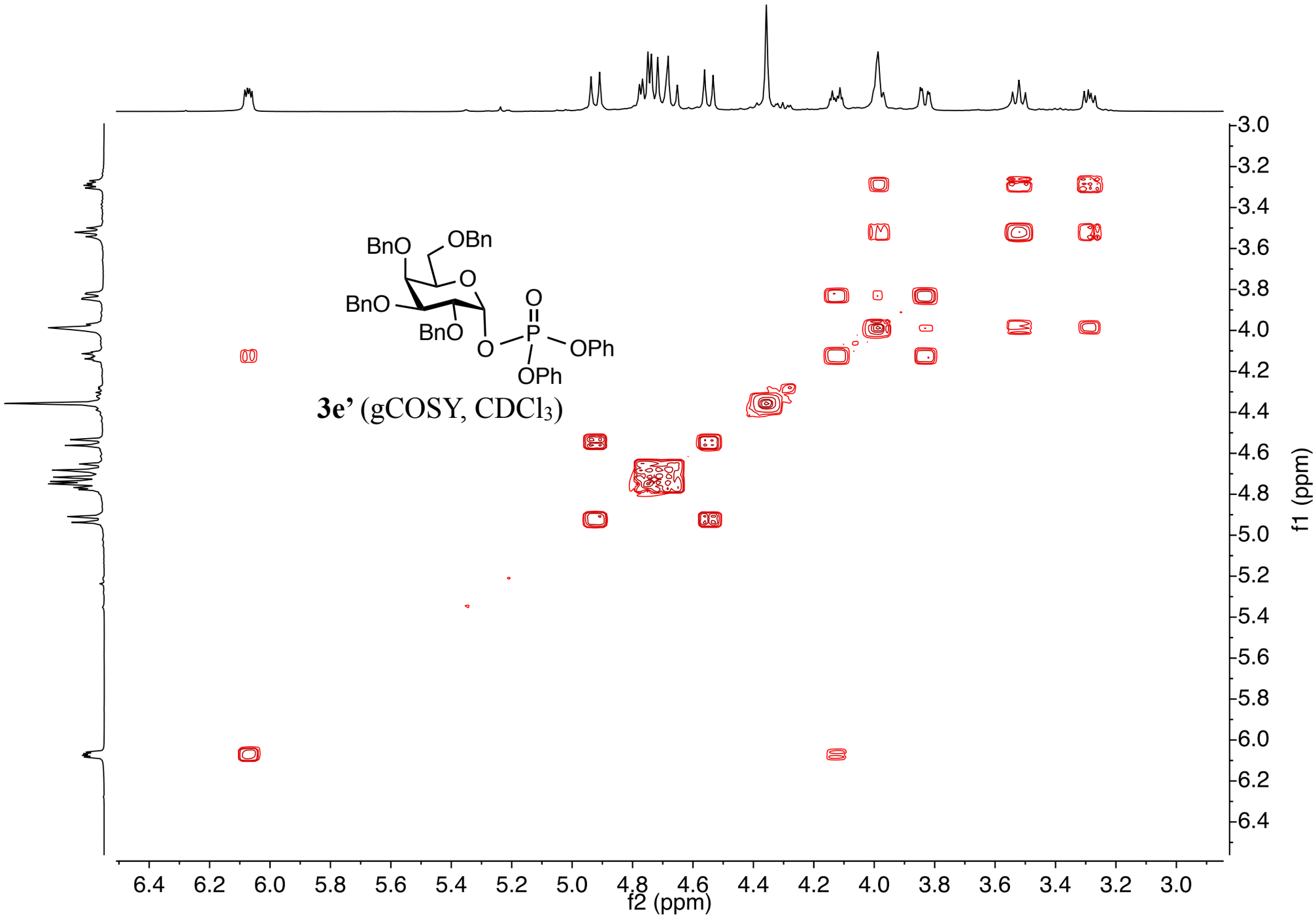


-13.15

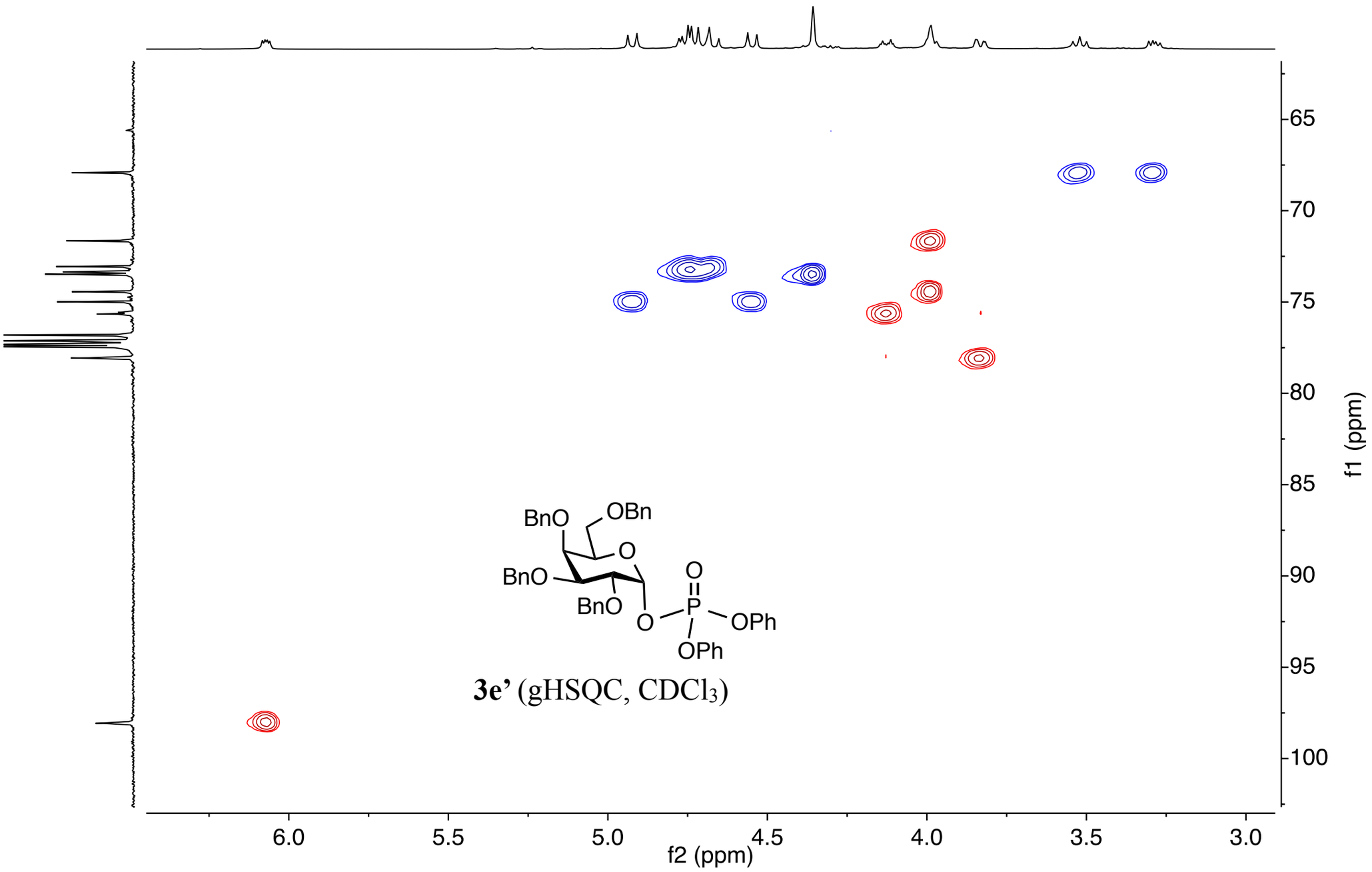


3e' (^{31}P NMR, 162 MHz, $CDCl_3$)

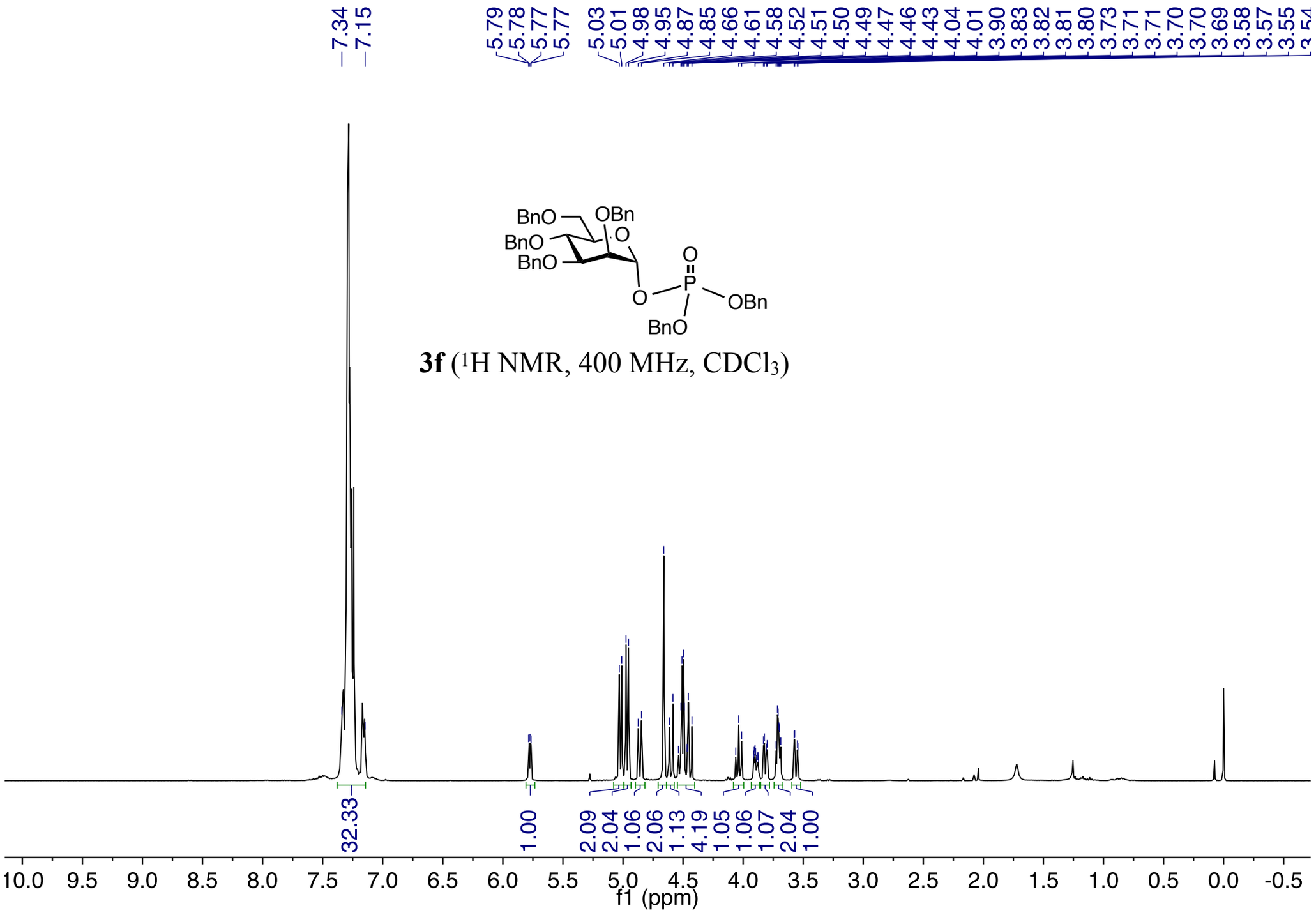




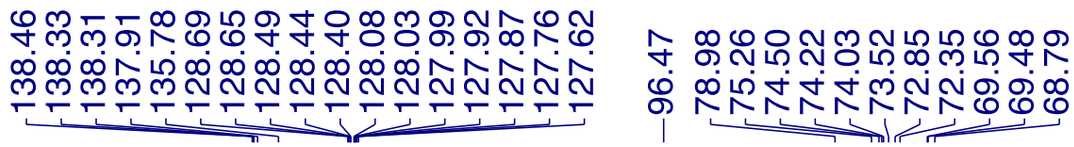
3e' (gCOSY, $CDCl_3$)

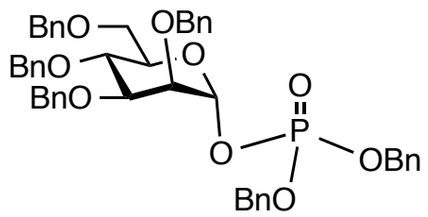


3e' (gHSQC, $CDCl_3$)

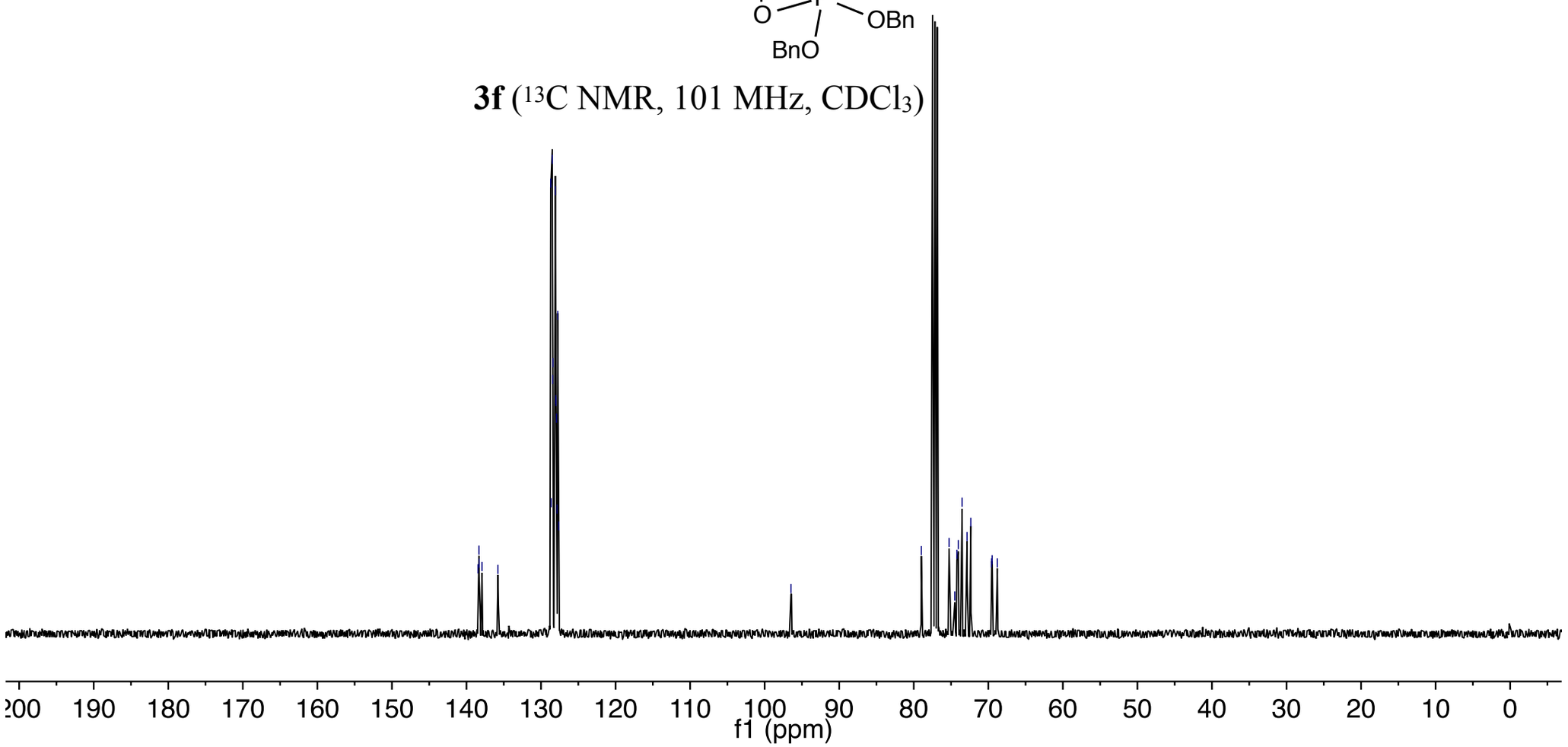


3f (^{1}H NMR, 400 MHz, $CDCl_3$)

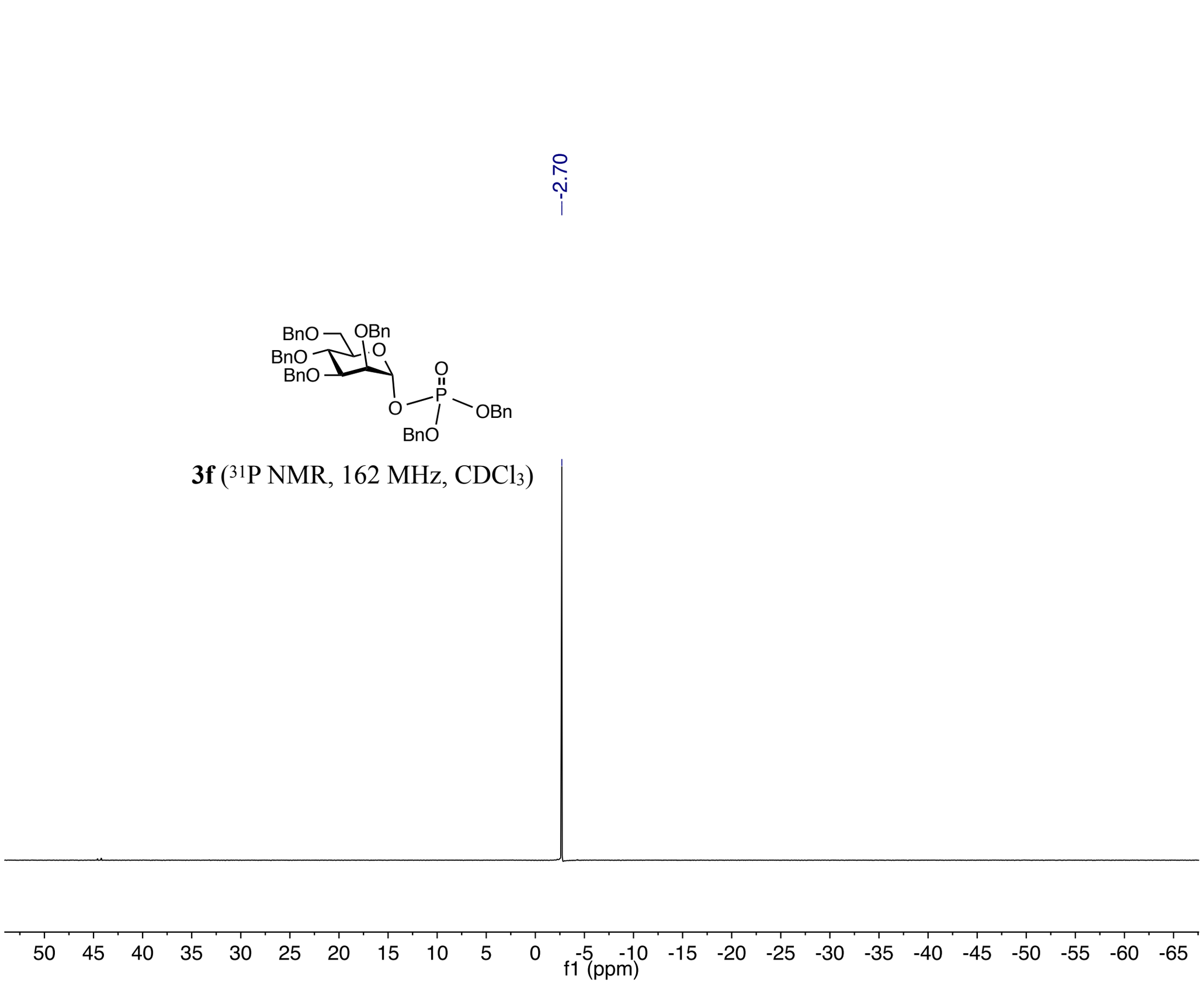


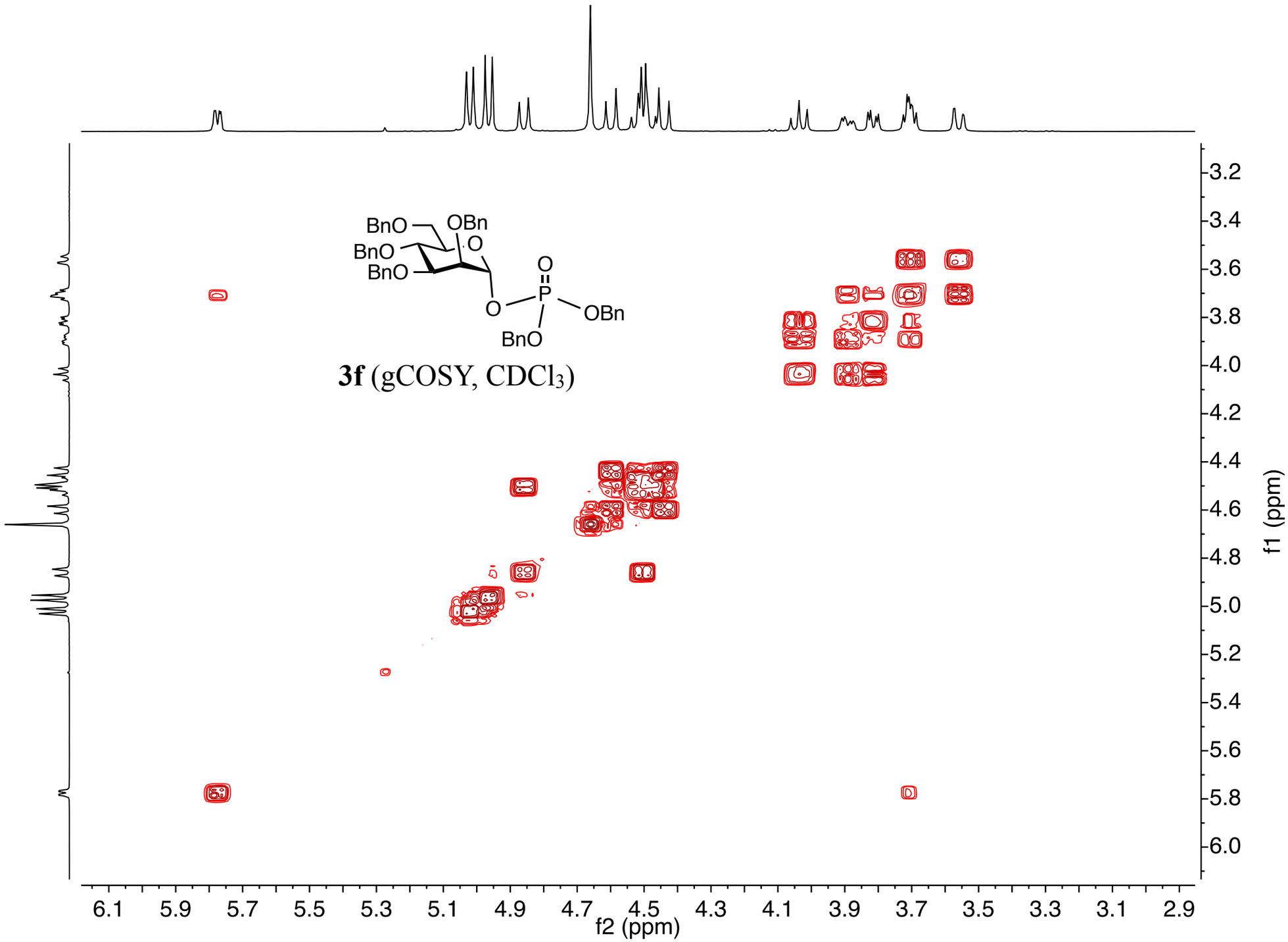


3f (^{13}C NMR, 101 MHz, $CDCl_3$)

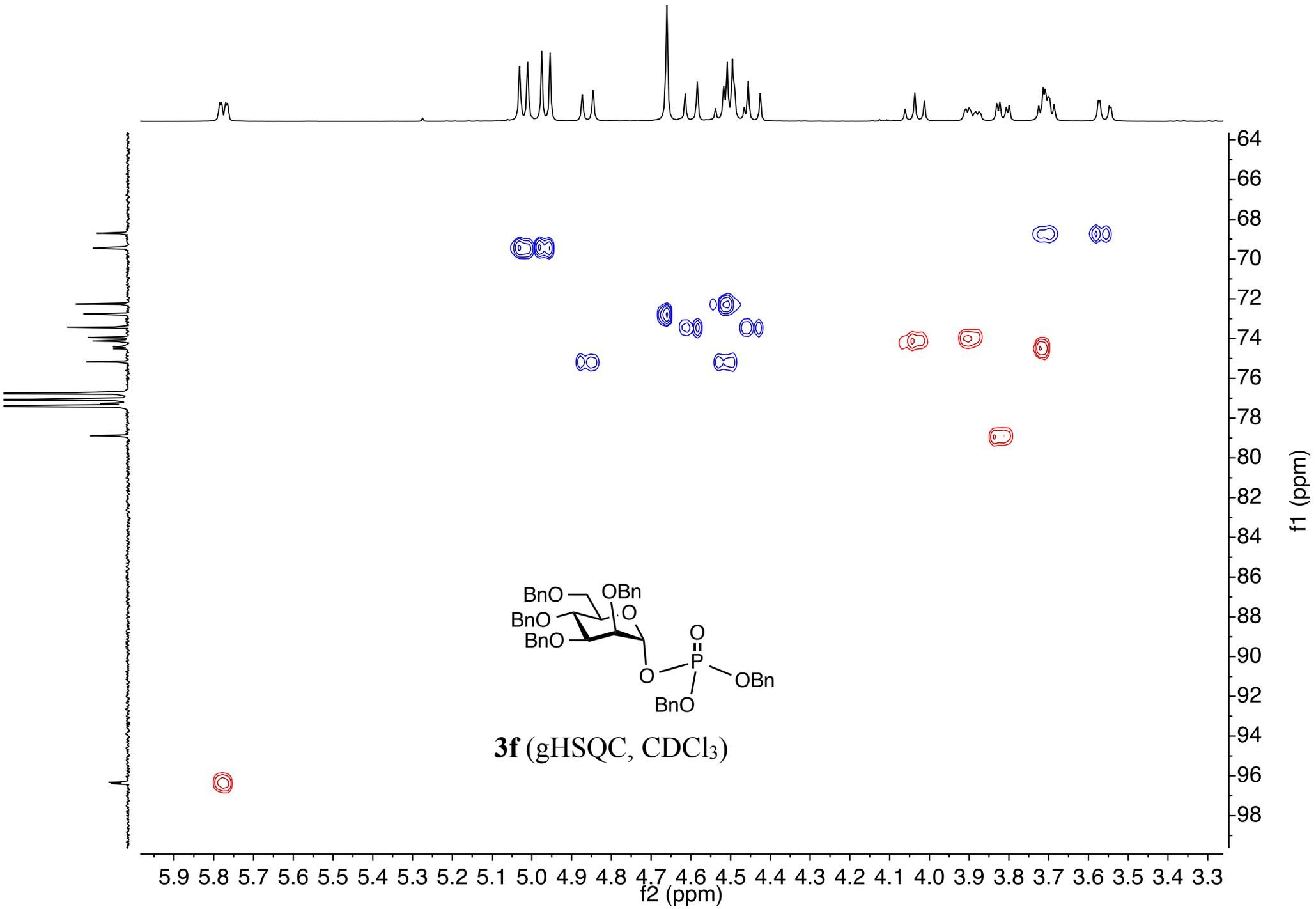


3f (^{31}P NMR, 162 MHz, $CDCl_3$)

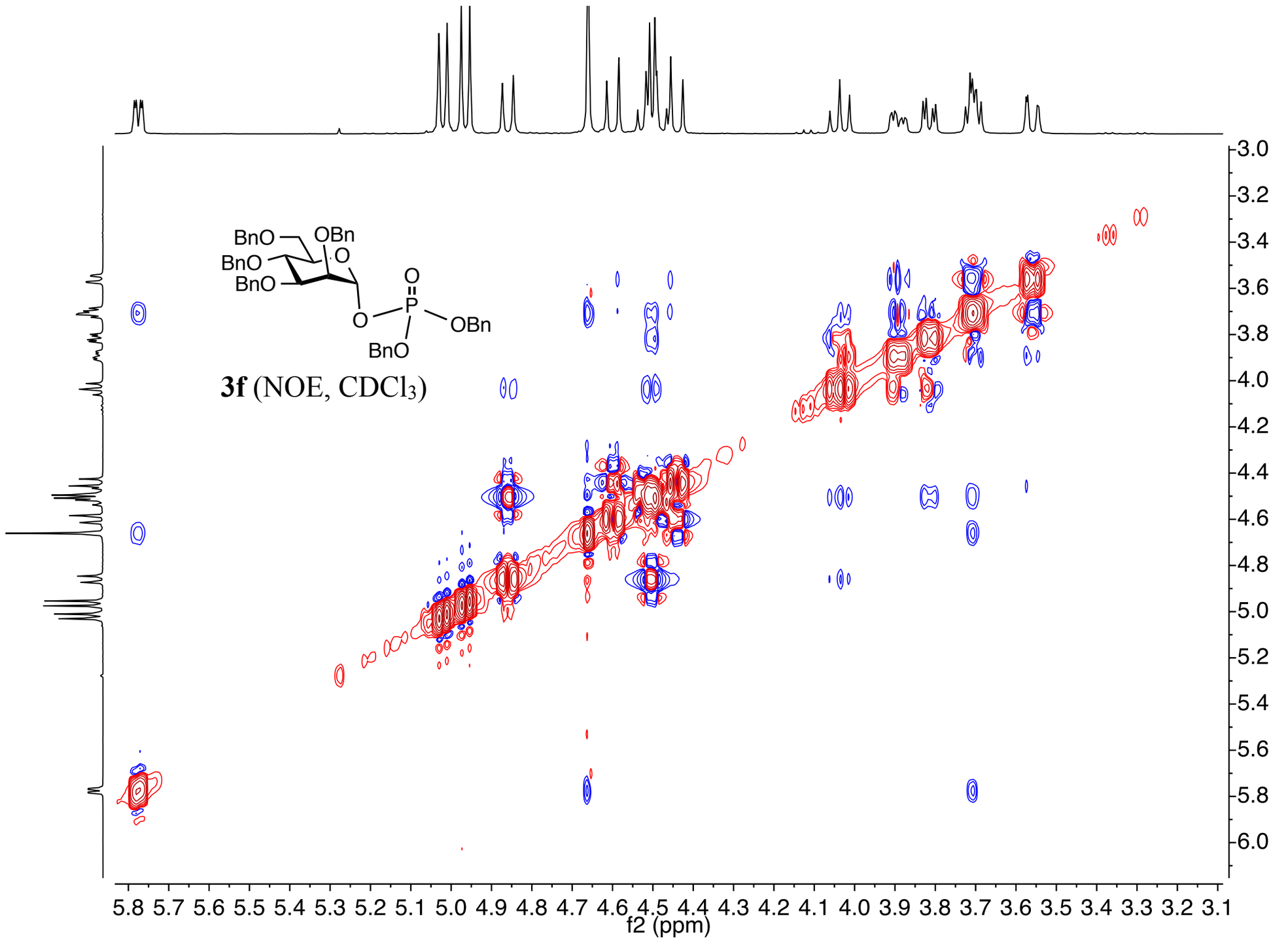




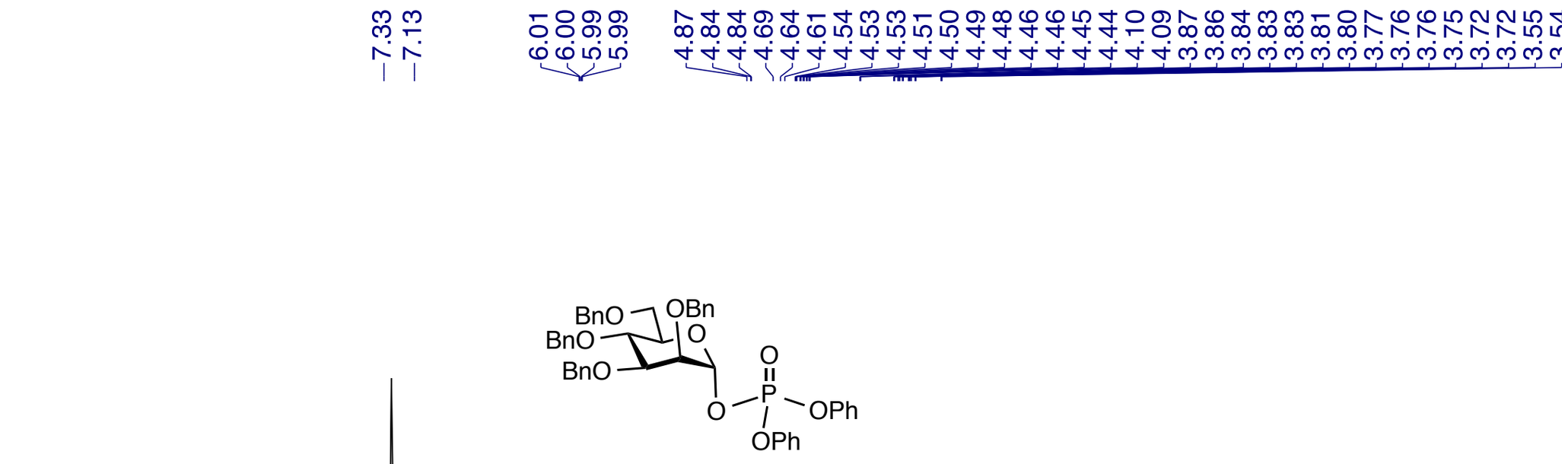
3f (gCOSY, $CDCl_3$)



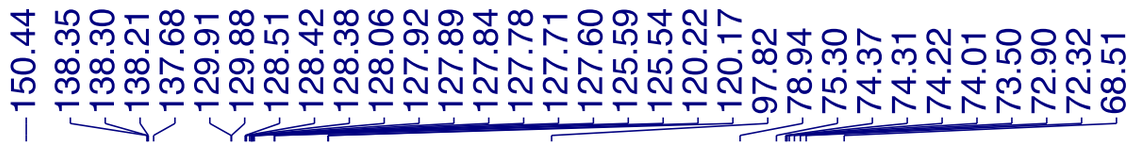
3f (gHSQC, $CDCl_3$)

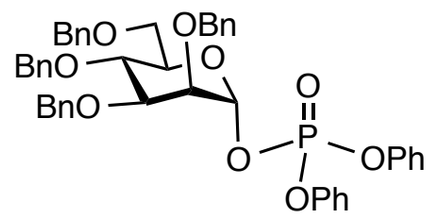


3f (NOE, $CDCl_3$)

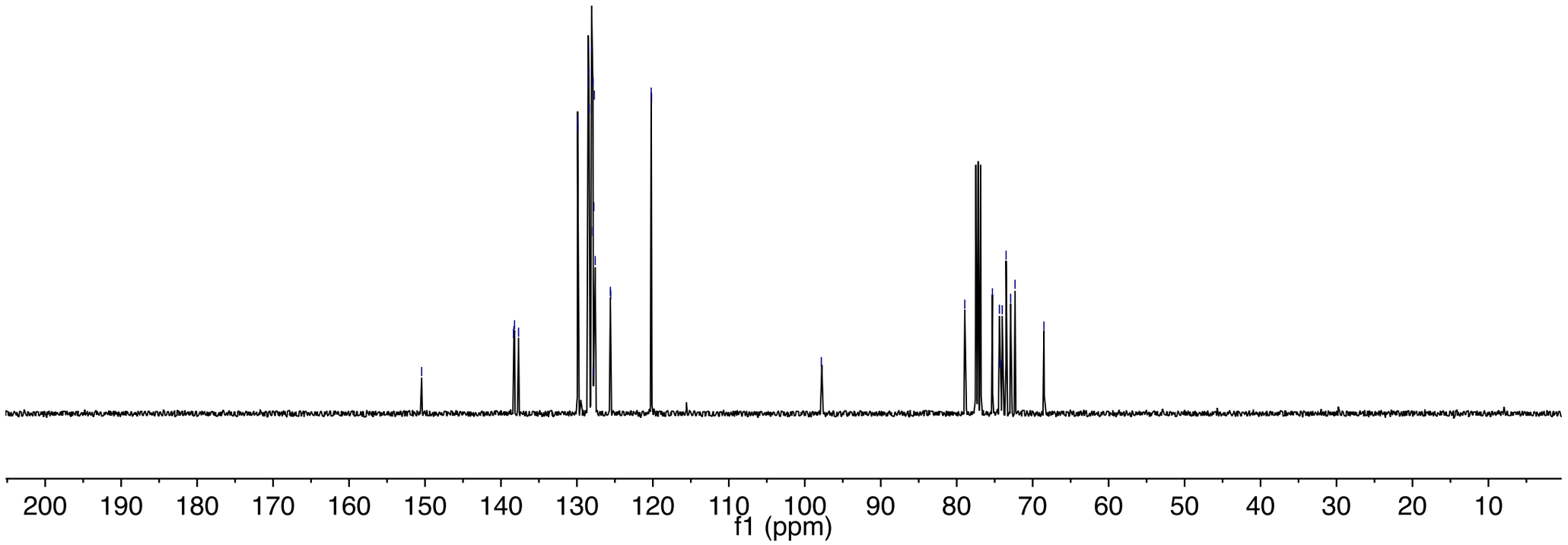


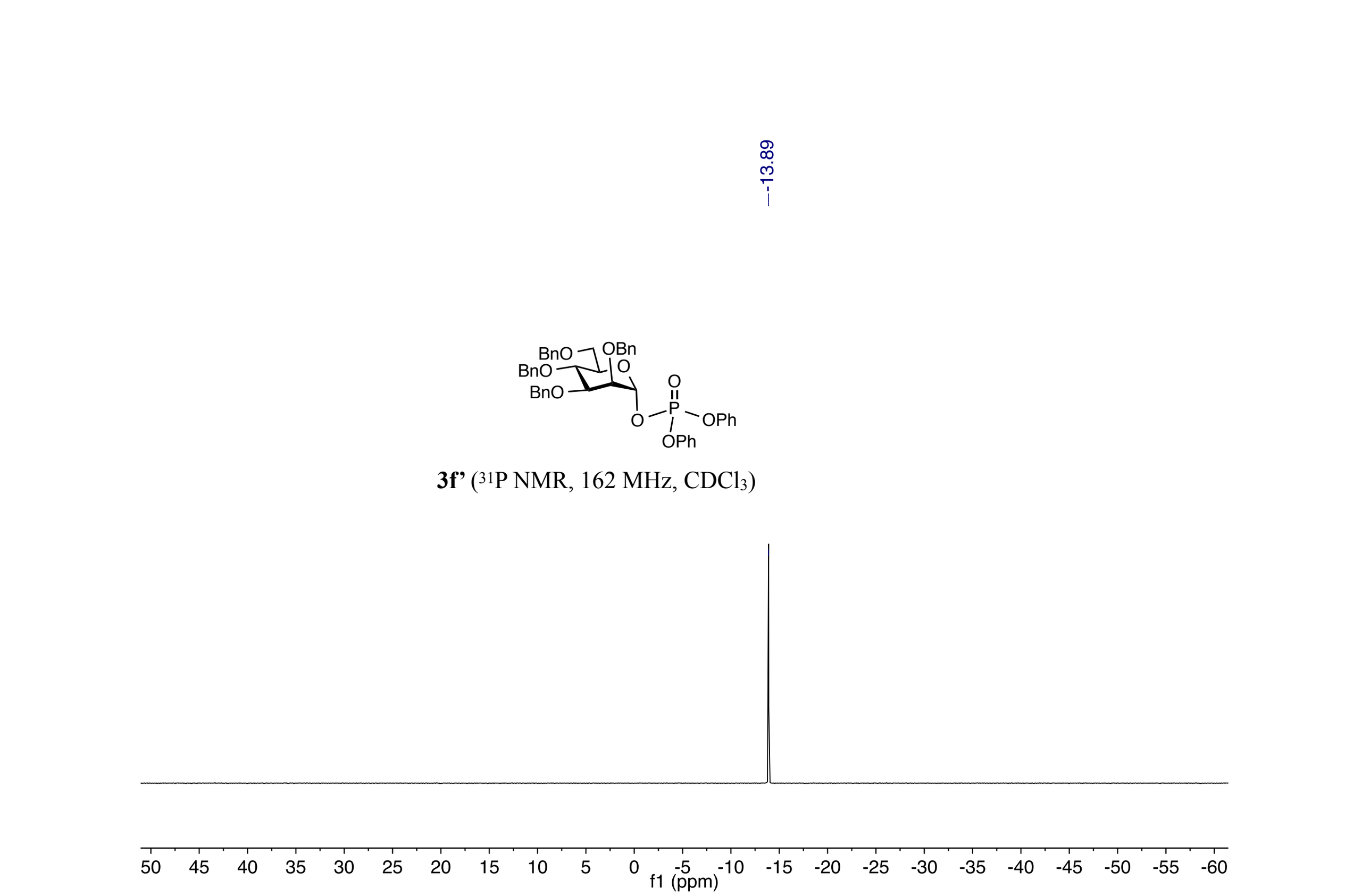
3f' (^{1}H NMR, 400 MHz, $CDCl_3$)



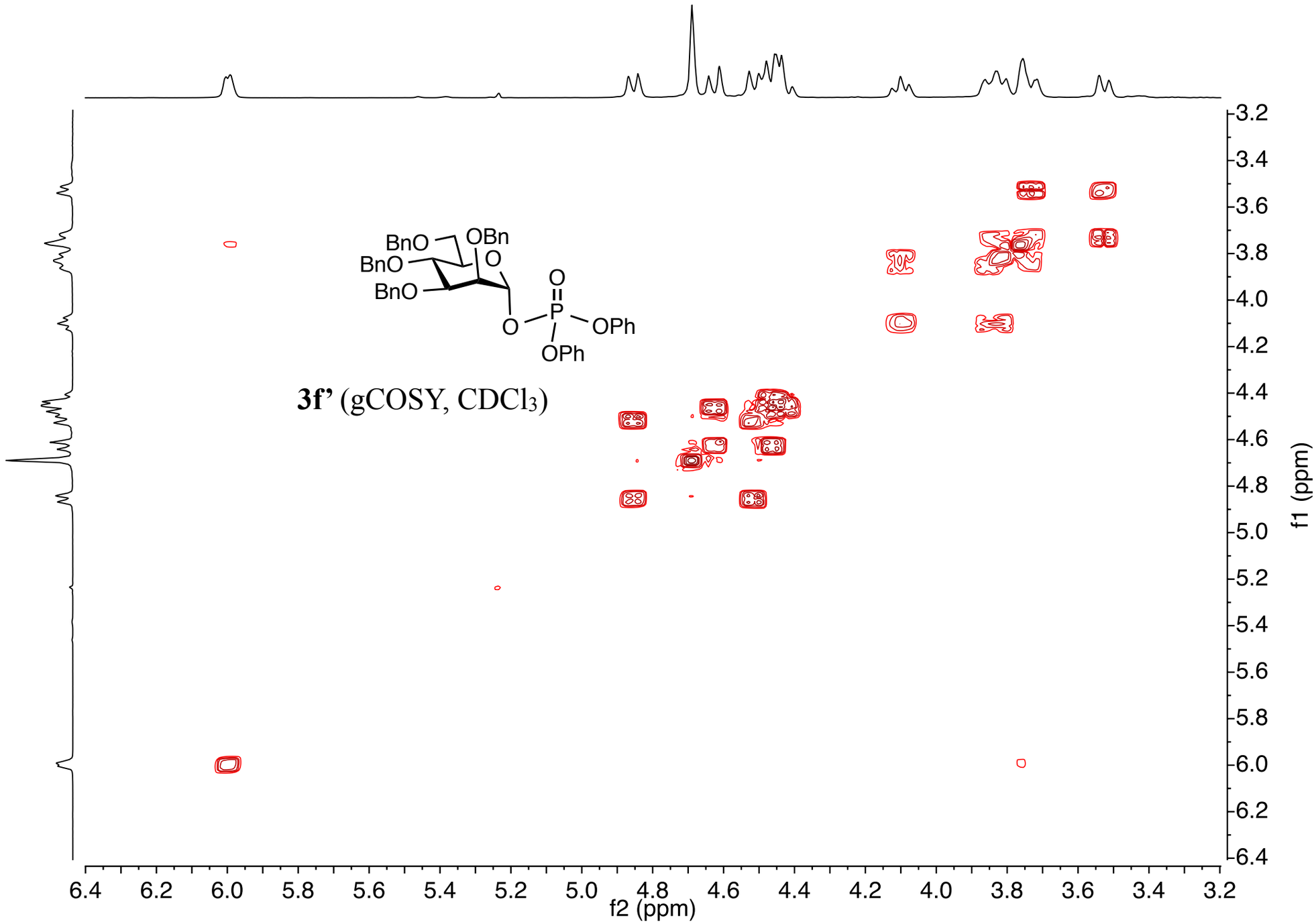


3f' (^{13}C NMR, 101 MHz, $CDCl_3$)

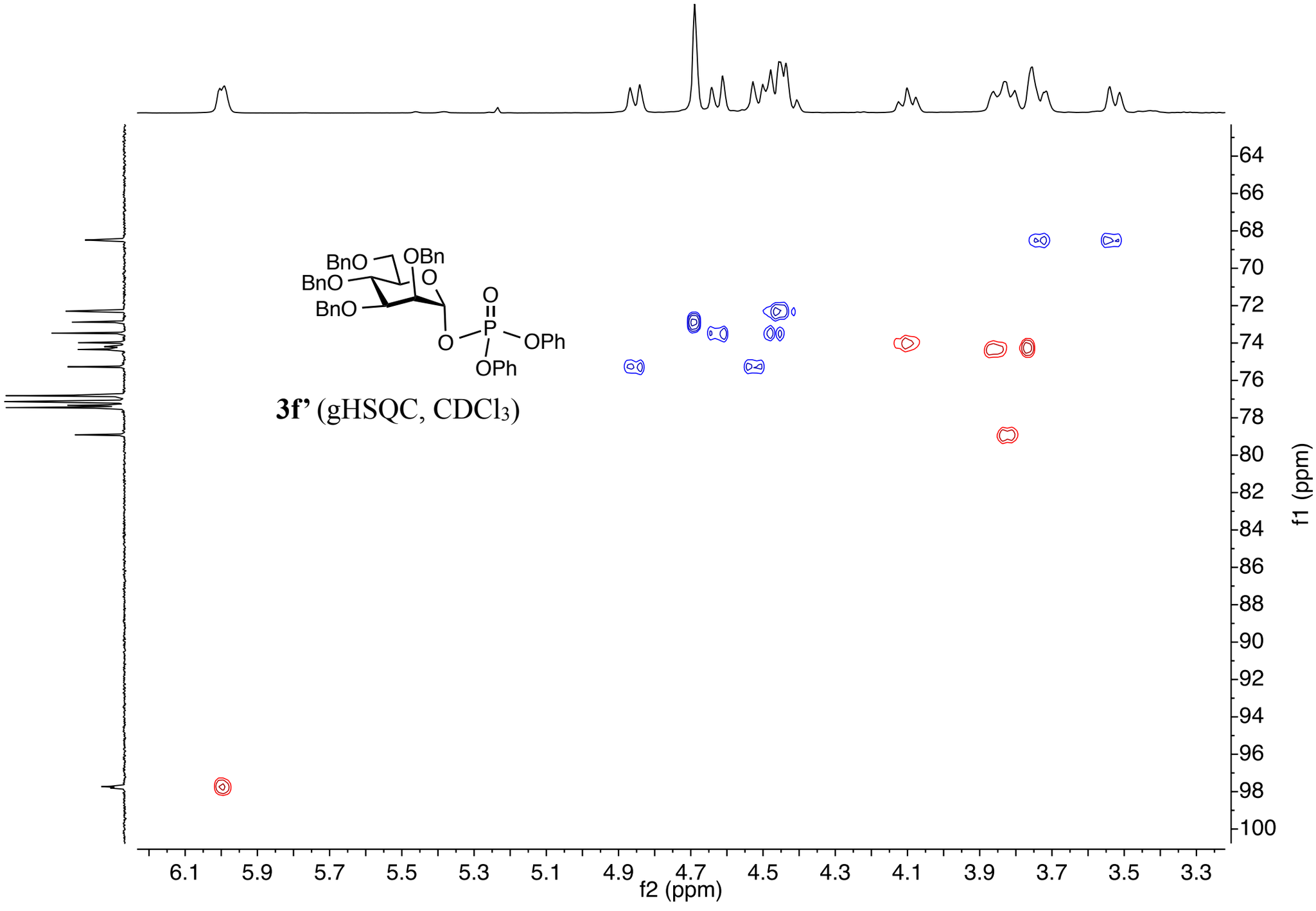




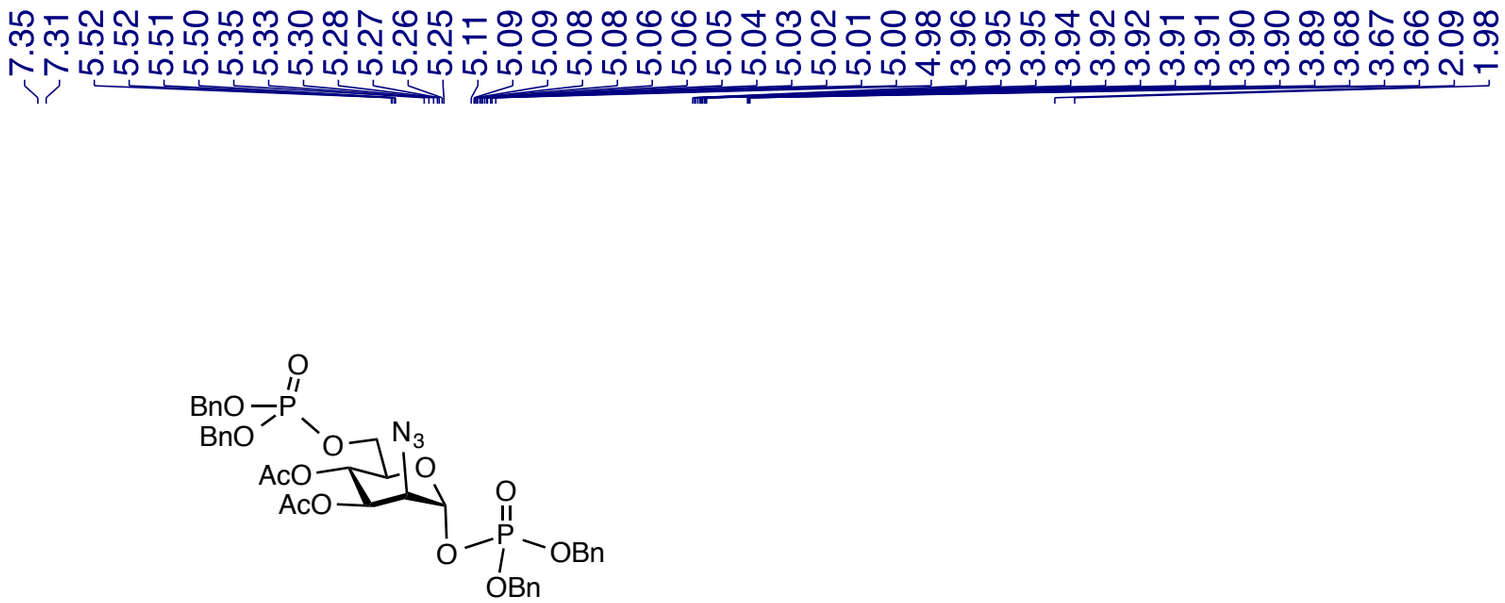
3f' (^{31}P NMR, 162 MHz, $CDCl_3$)



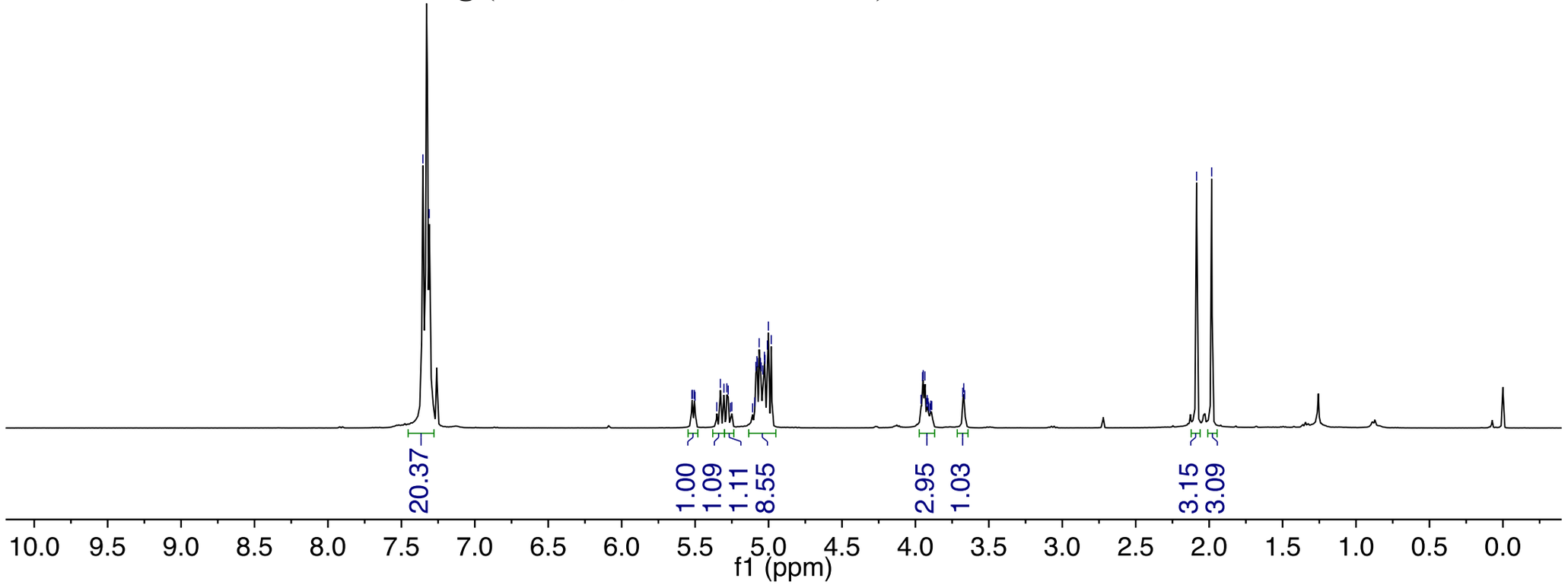
3f' (gCOSY, $CDCl_3$)

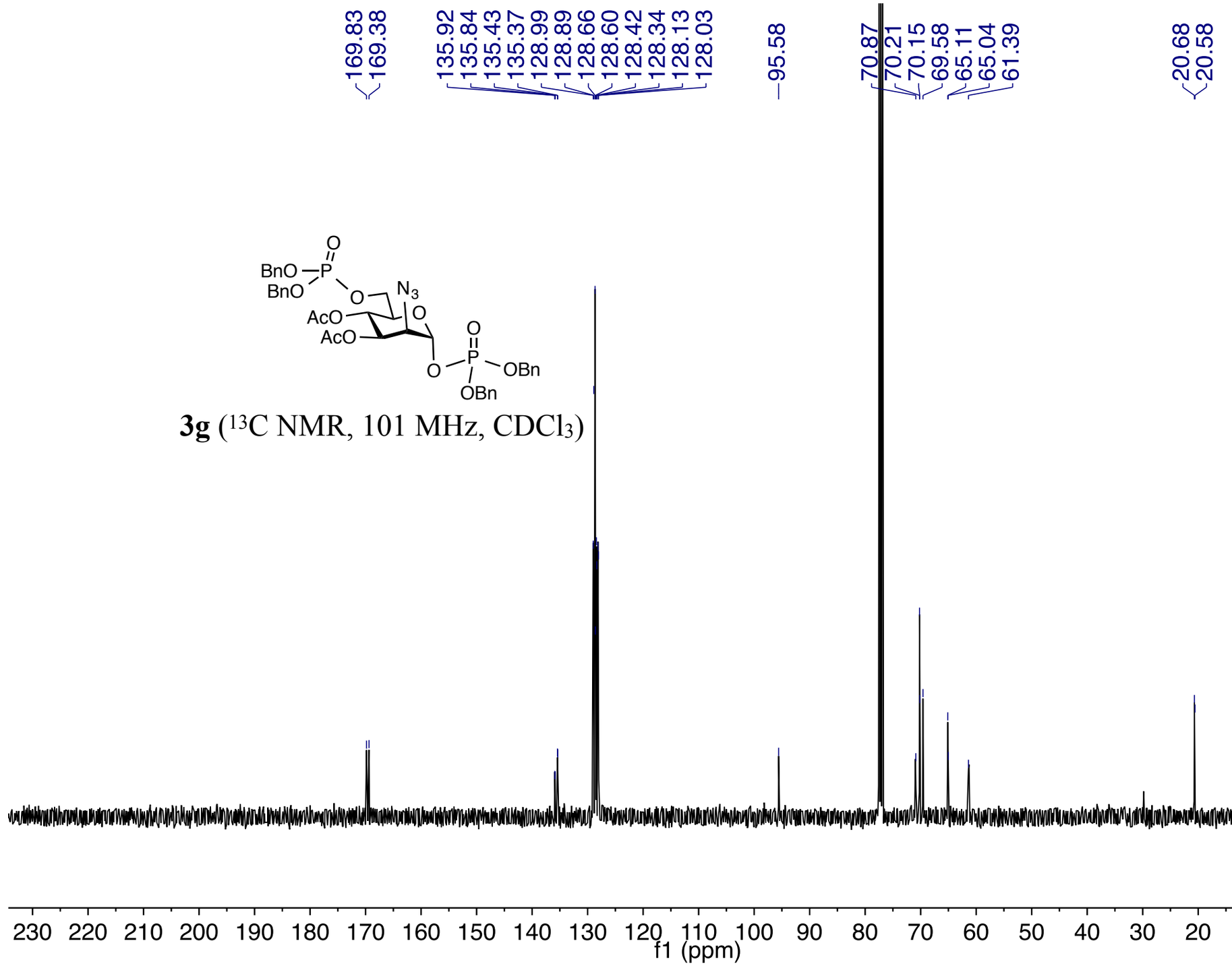


3f' (gHSQC, $CDCl_3$)



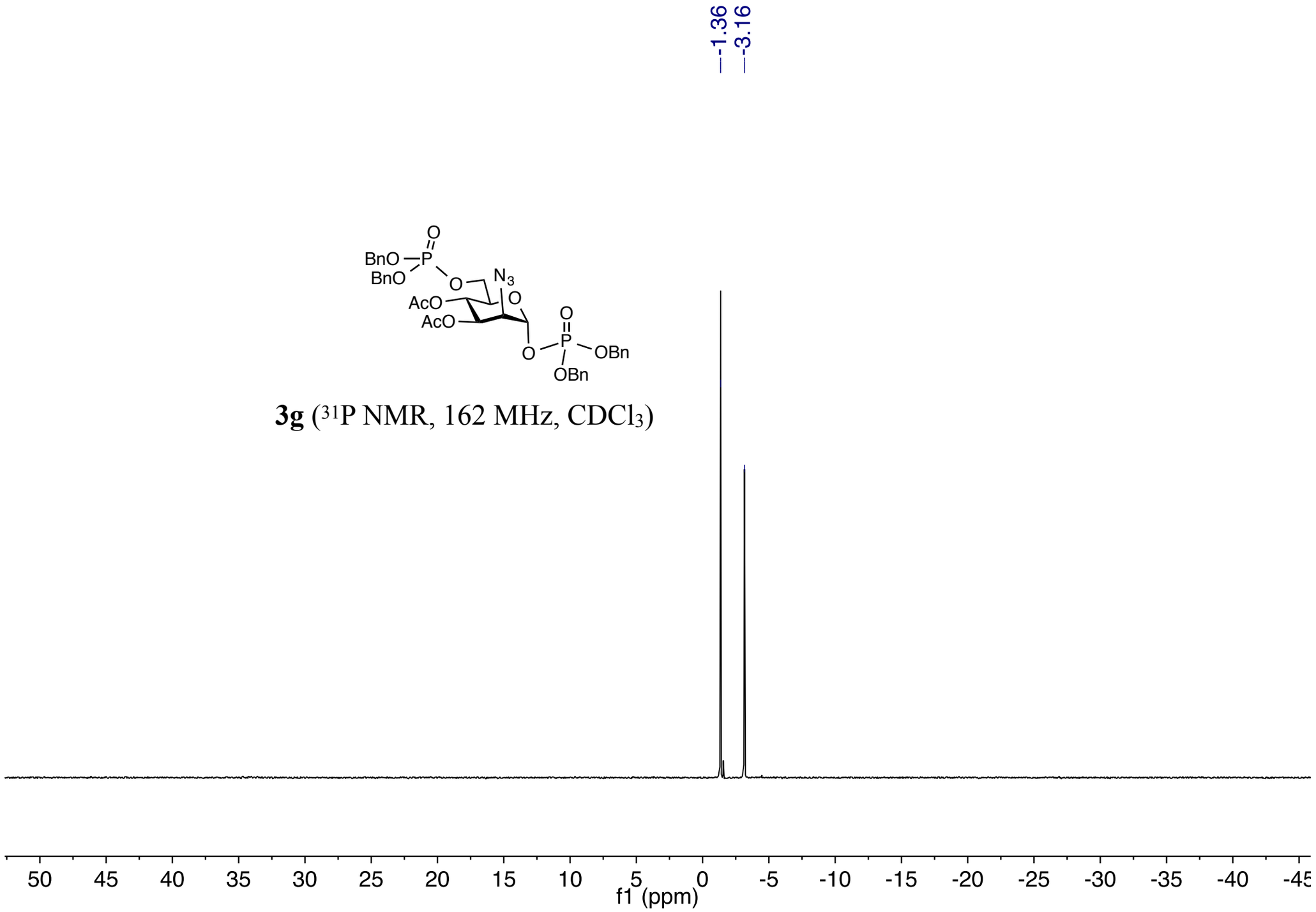
3g (^{1}H NMR, 400 MHz, $CDCl_3$)

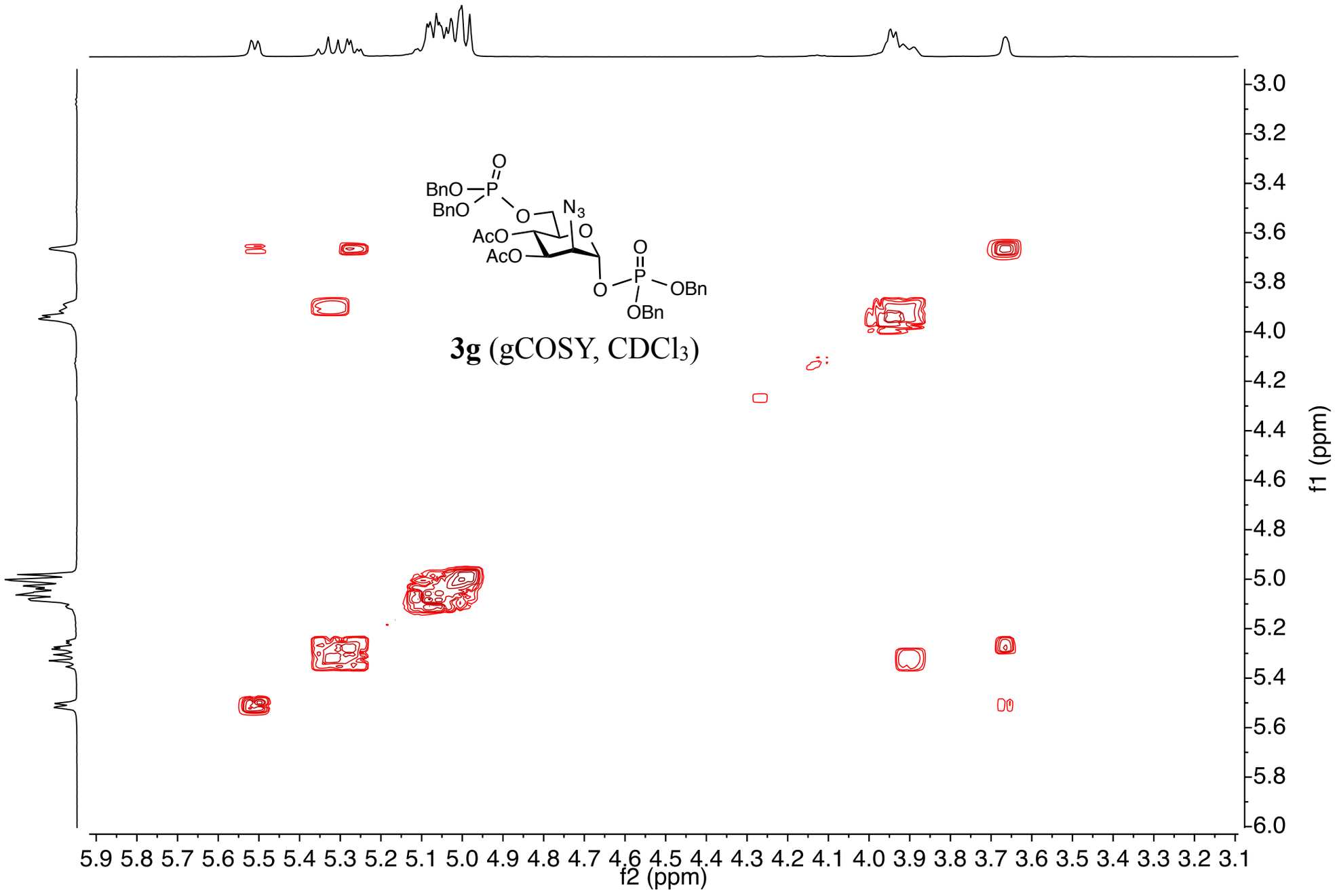




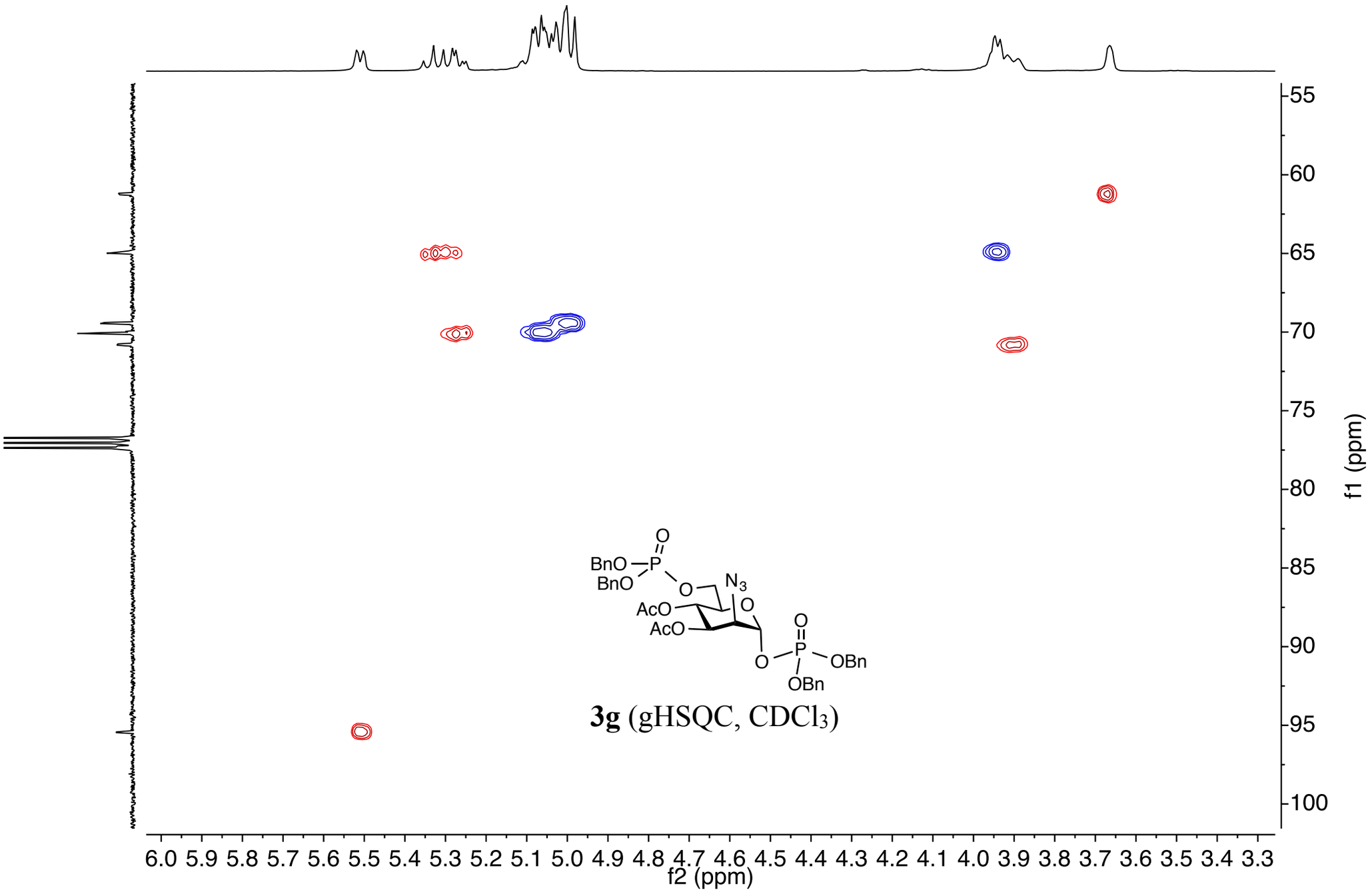
3g (^{13}C NMR, 101 MHz, $CDCl_3$)

3g (^{31}P NMR, 162 MHz, $CDCl_3$)

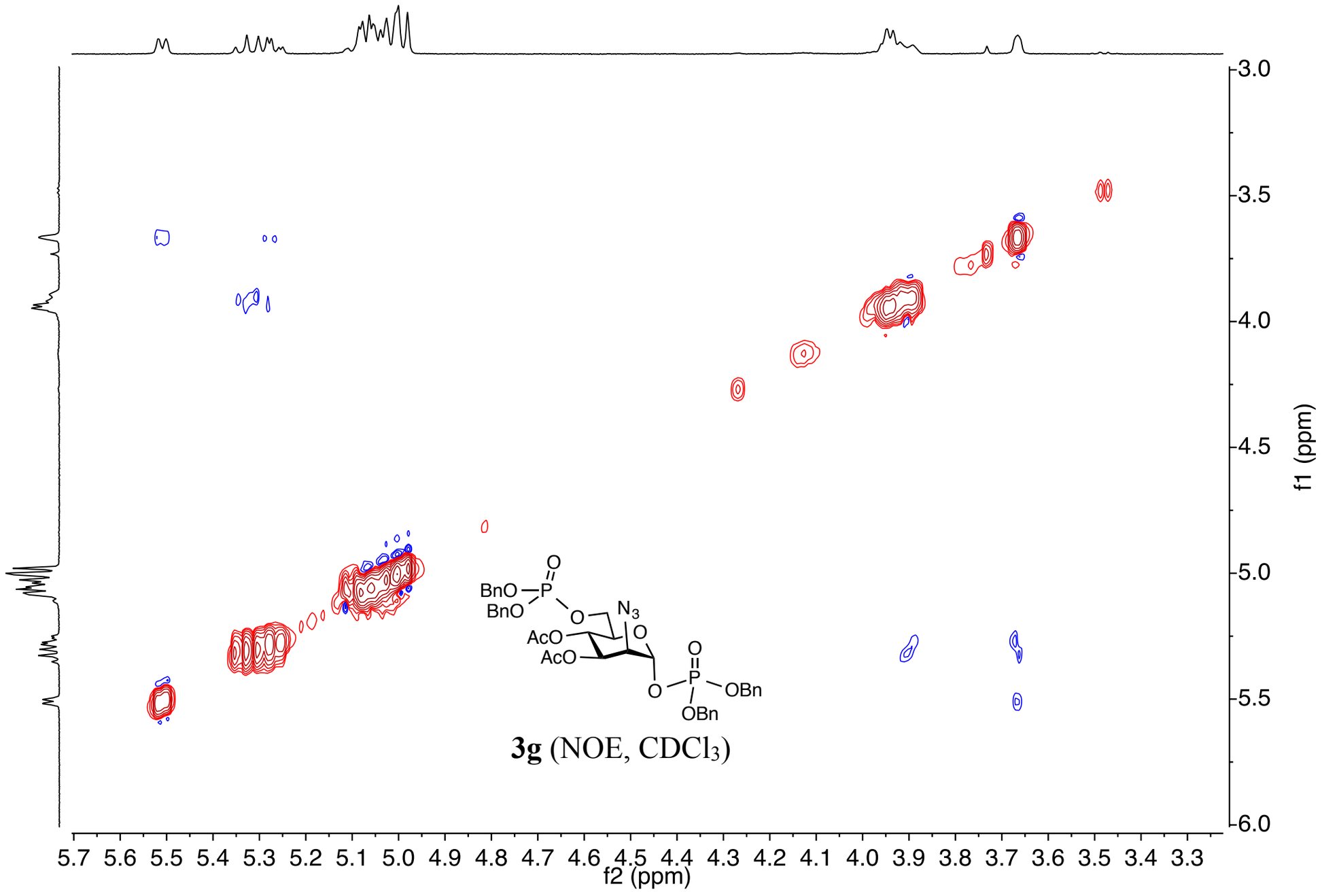




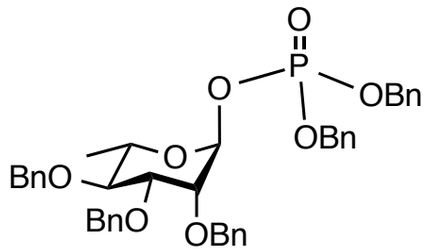
3g (gCOSY, $CDCl_3$)



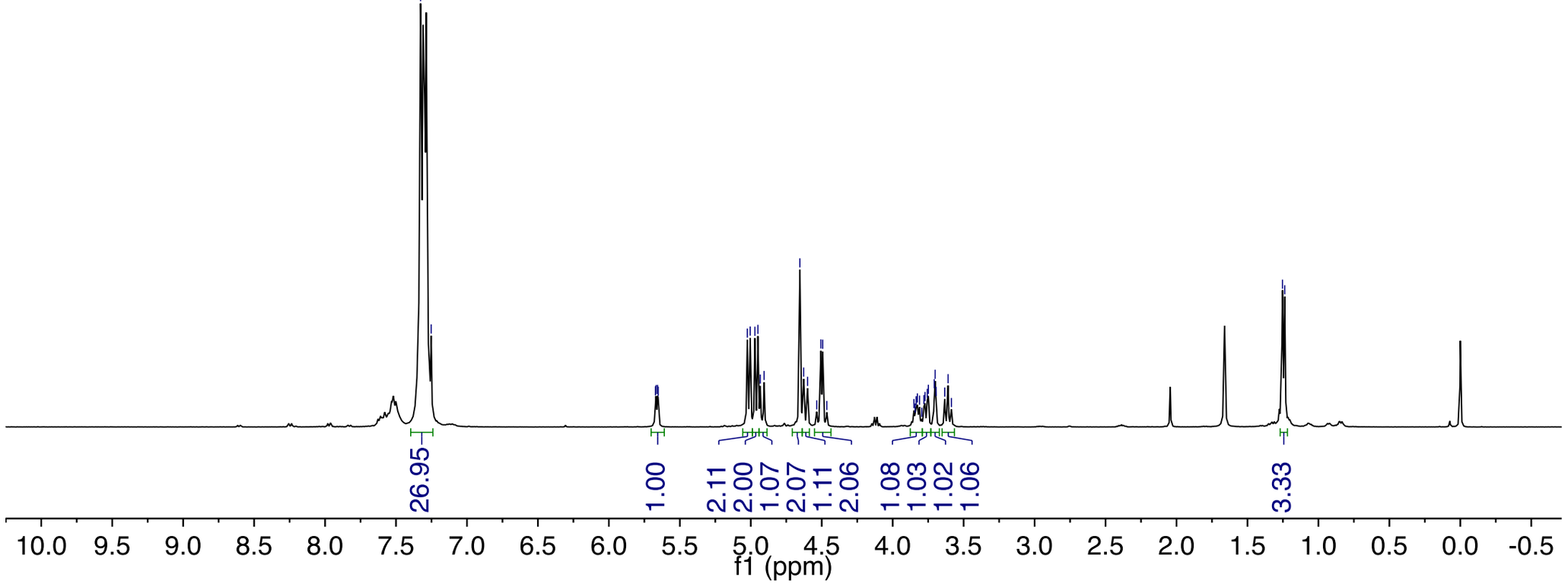
3g (gHSQC, $CDCl_3$)

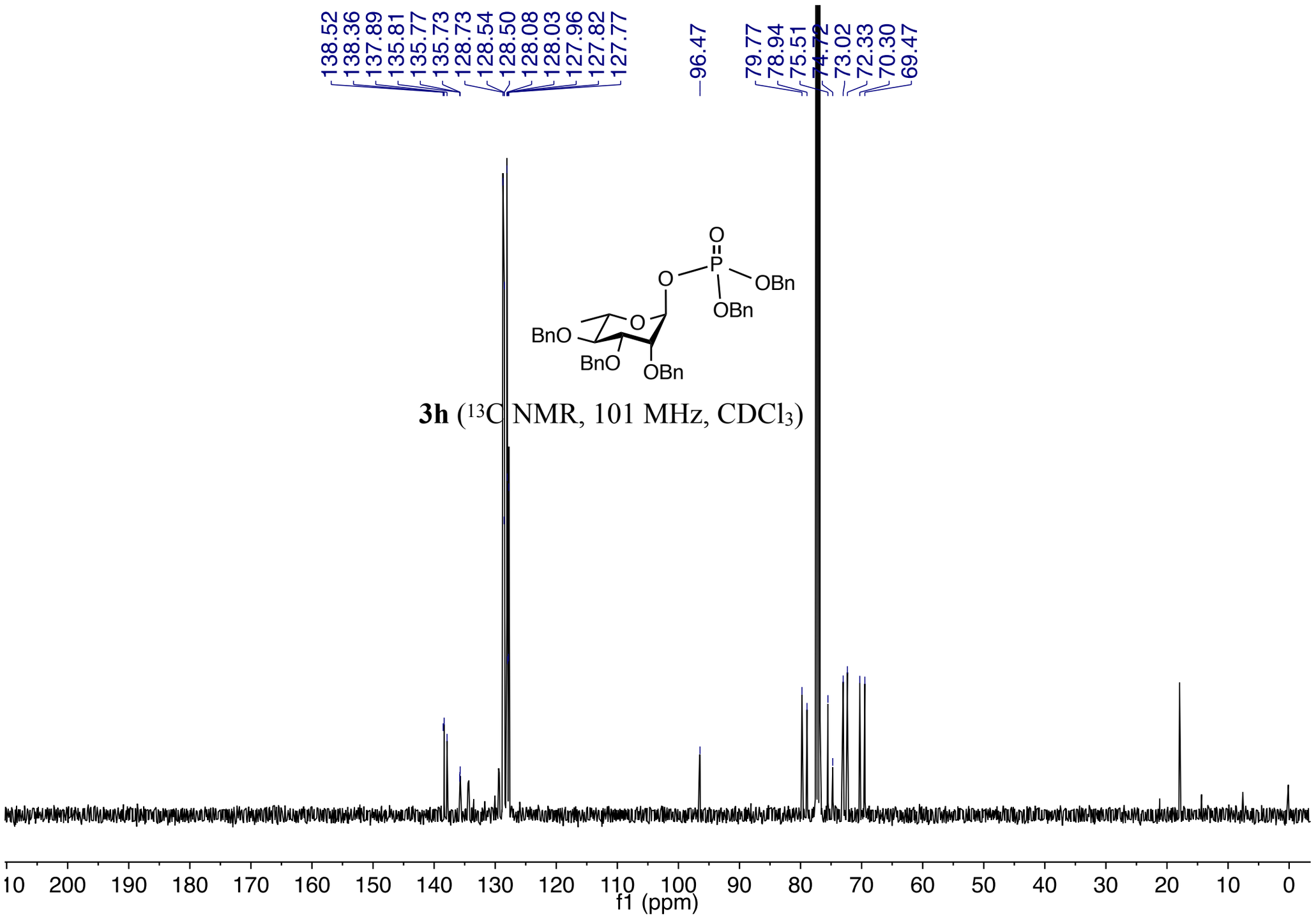

3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
5.7 5.6 5.5 5.4 5.3 5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3
f2 (ppm)
BnO
BnO
P
O
O
N3
O
AcO
AcO
O
P
O
OBn
OBn

3g (NOE, $CDCl_3$)

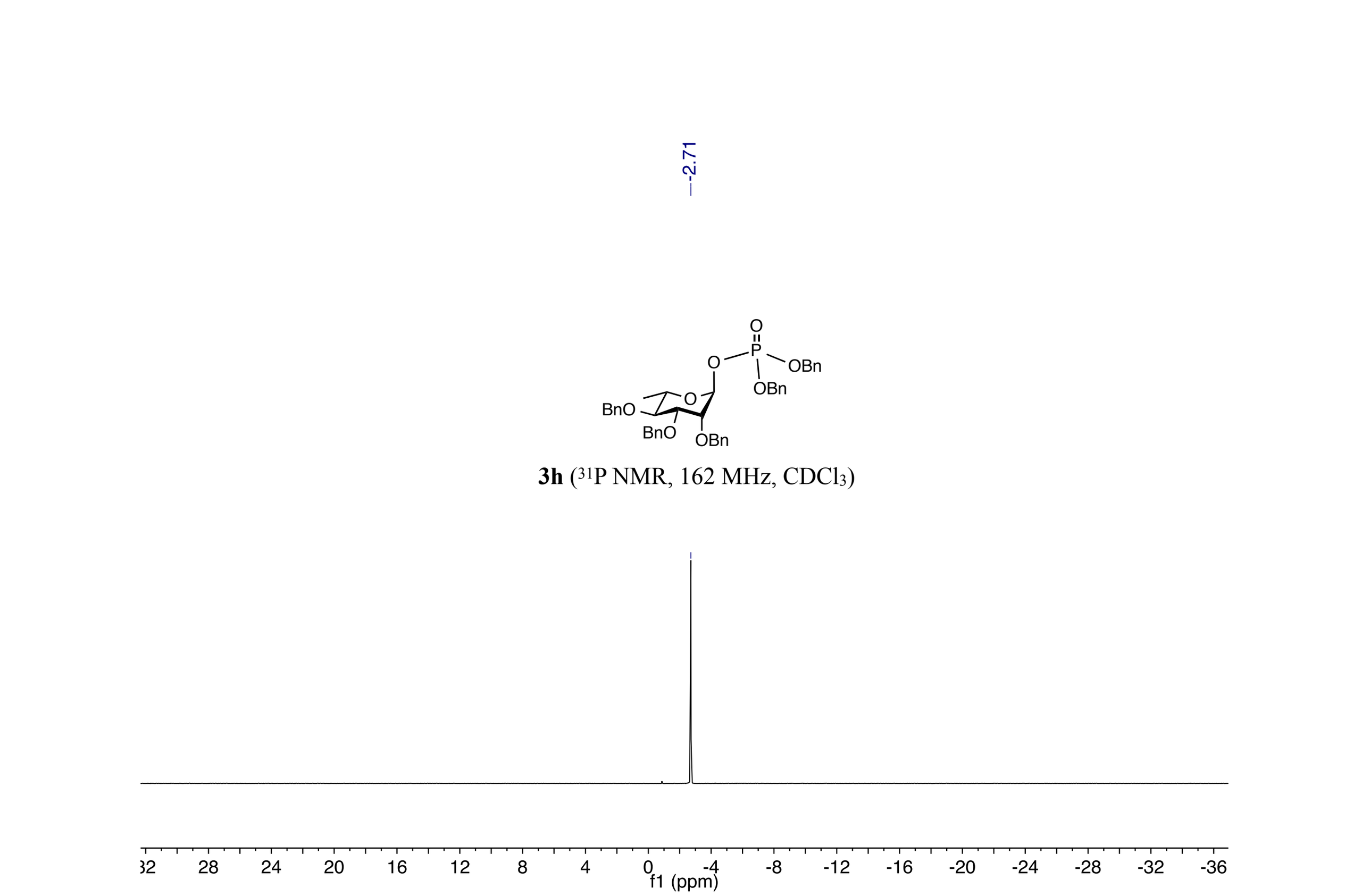


3h (^{1}H NMR, 400 MHz, $CDCl_3$)

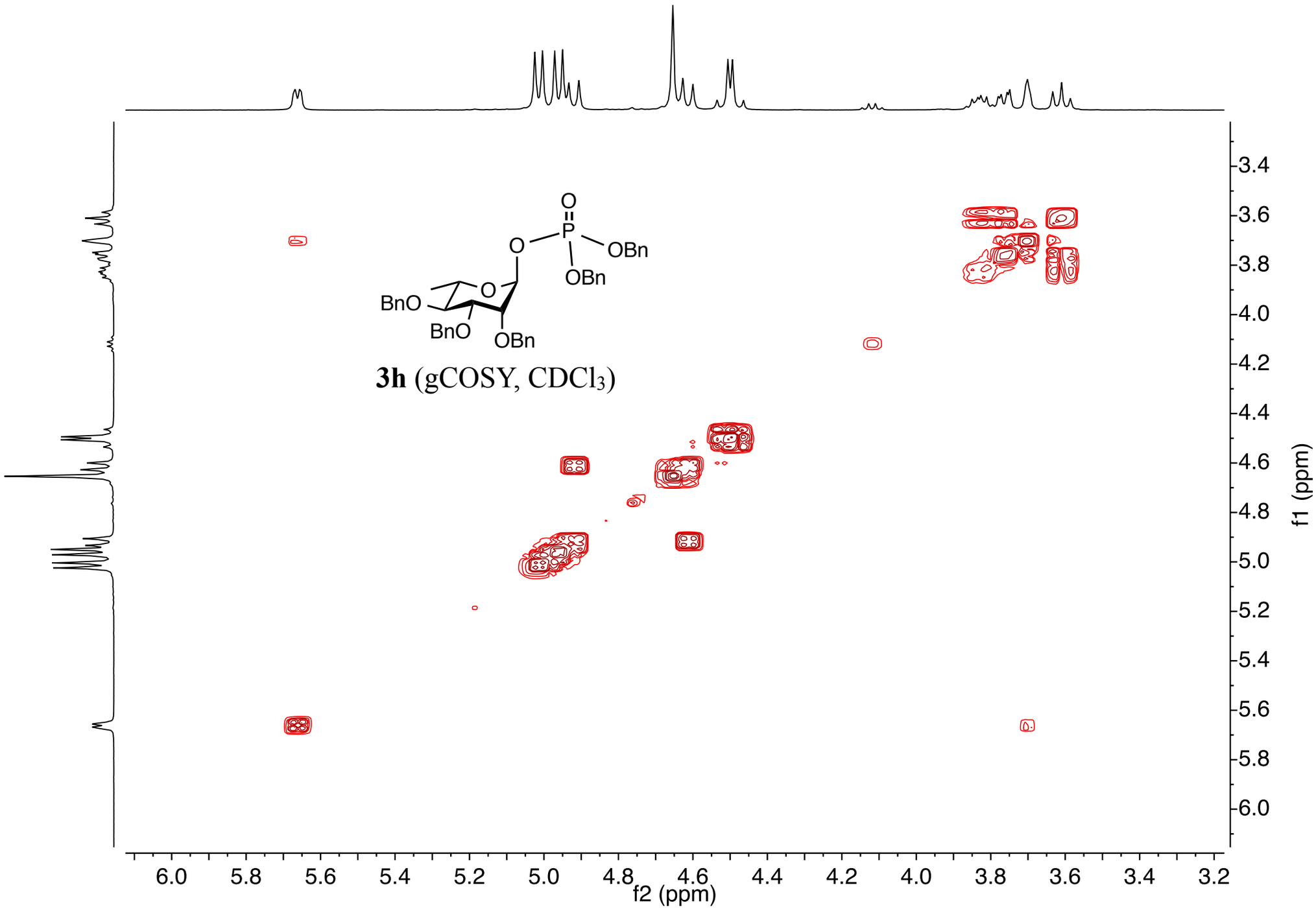




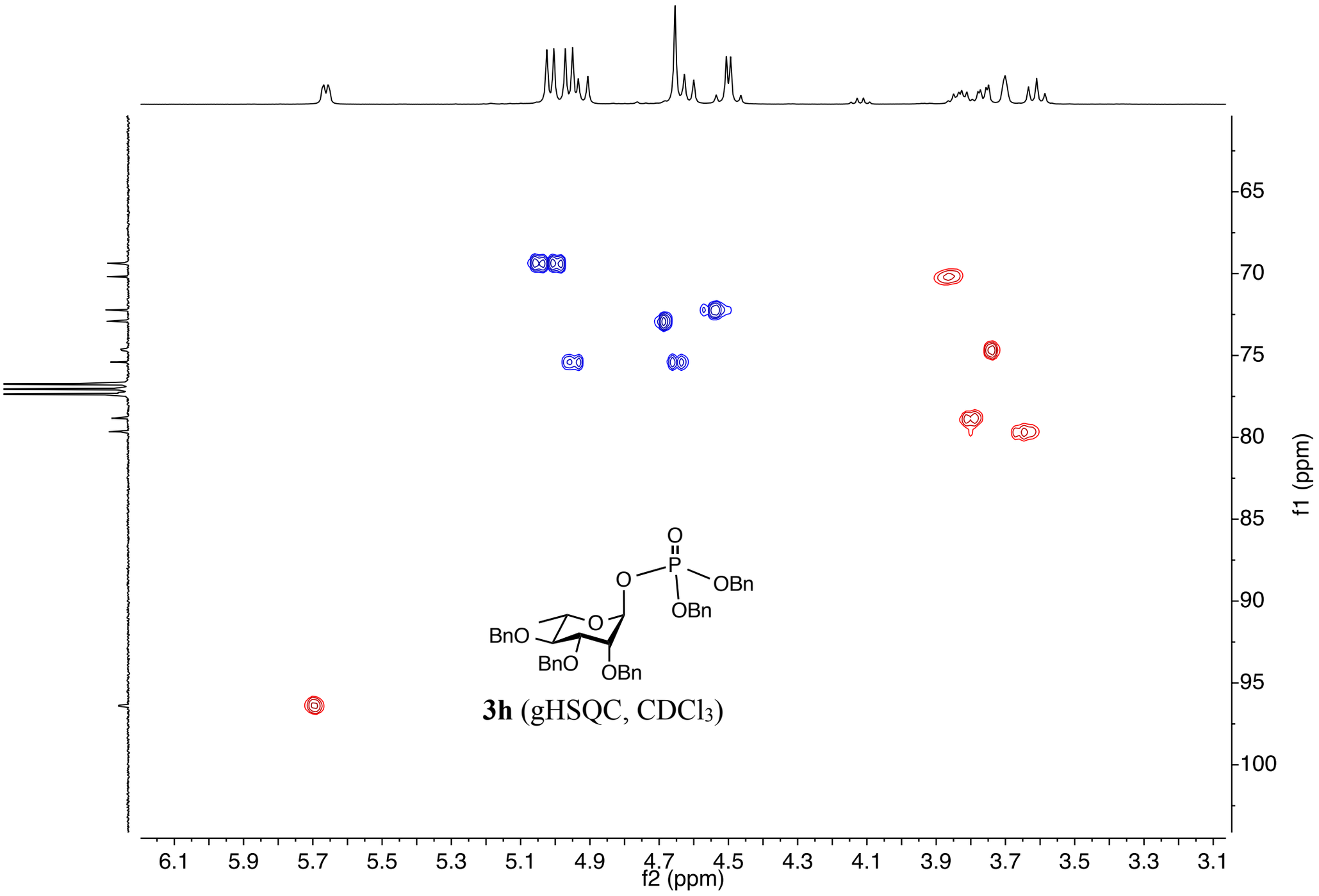
3h (^{13}C NMR, 101 MHz, $CDCl_3$)



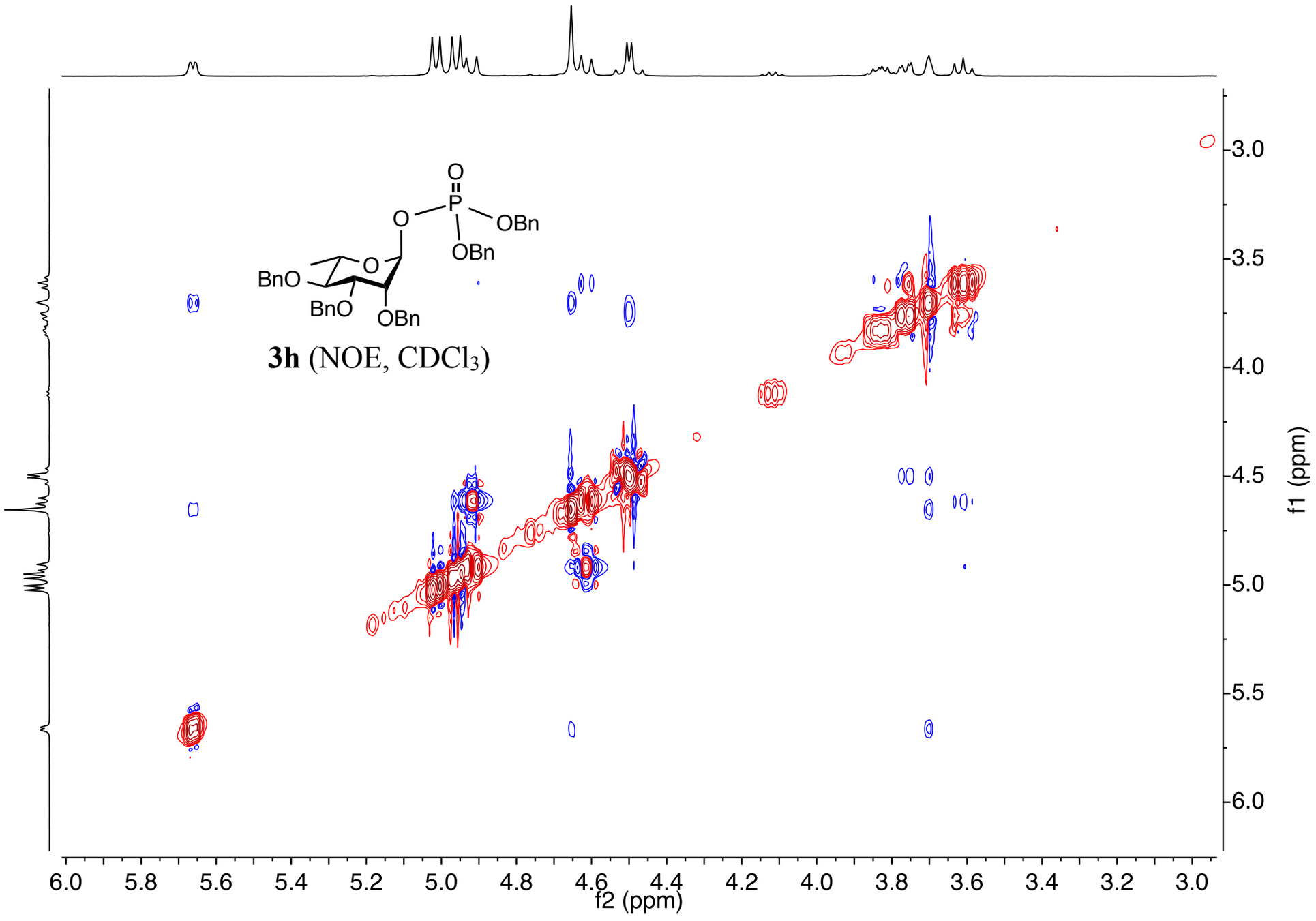
3h (^{31}P NMR, 162 MHz, $CDCl_3$)

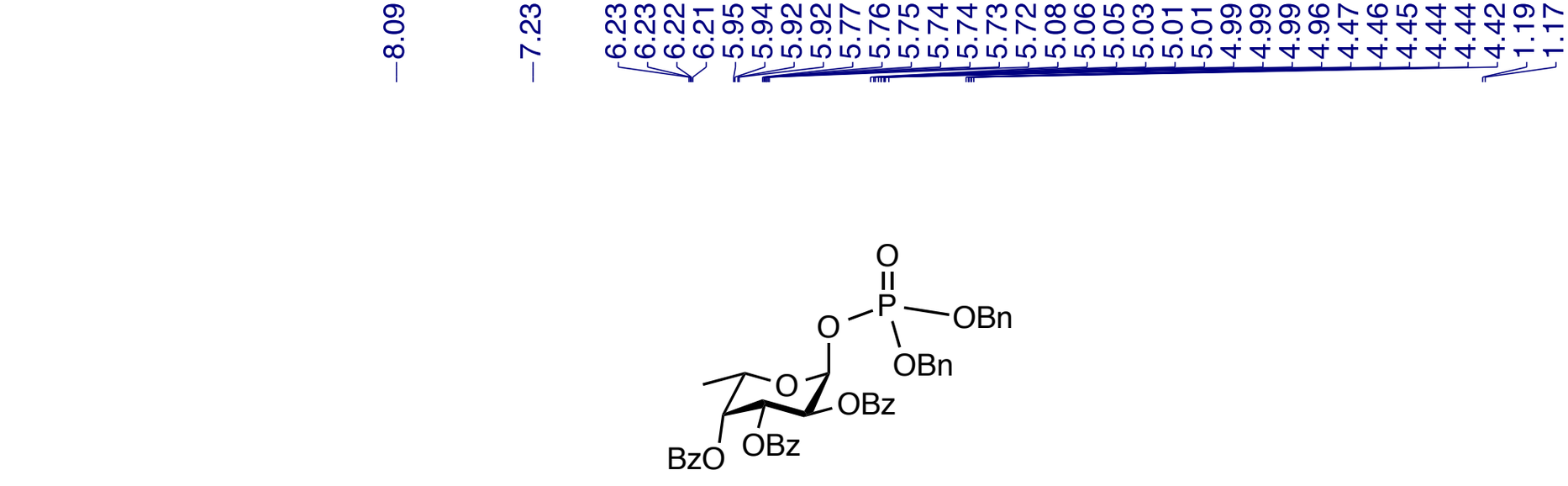


3h (gCOSY, $CDCl_3$)

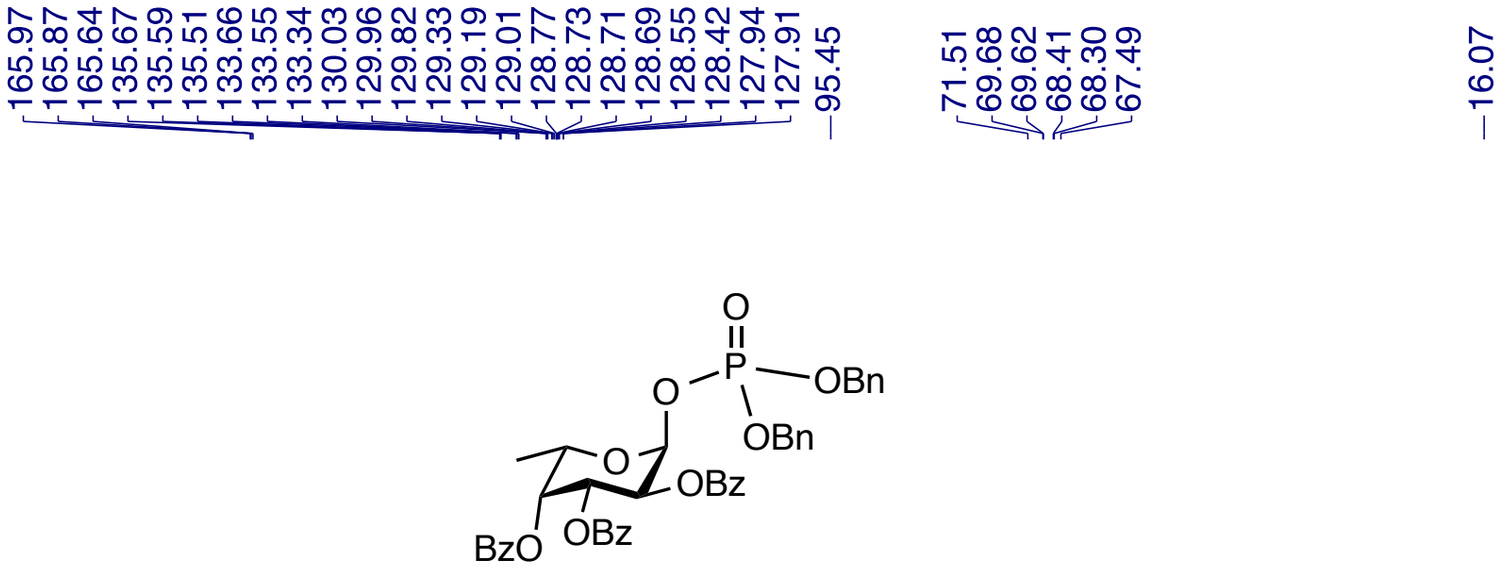


3h (gHSQC, $CDCl_3$)

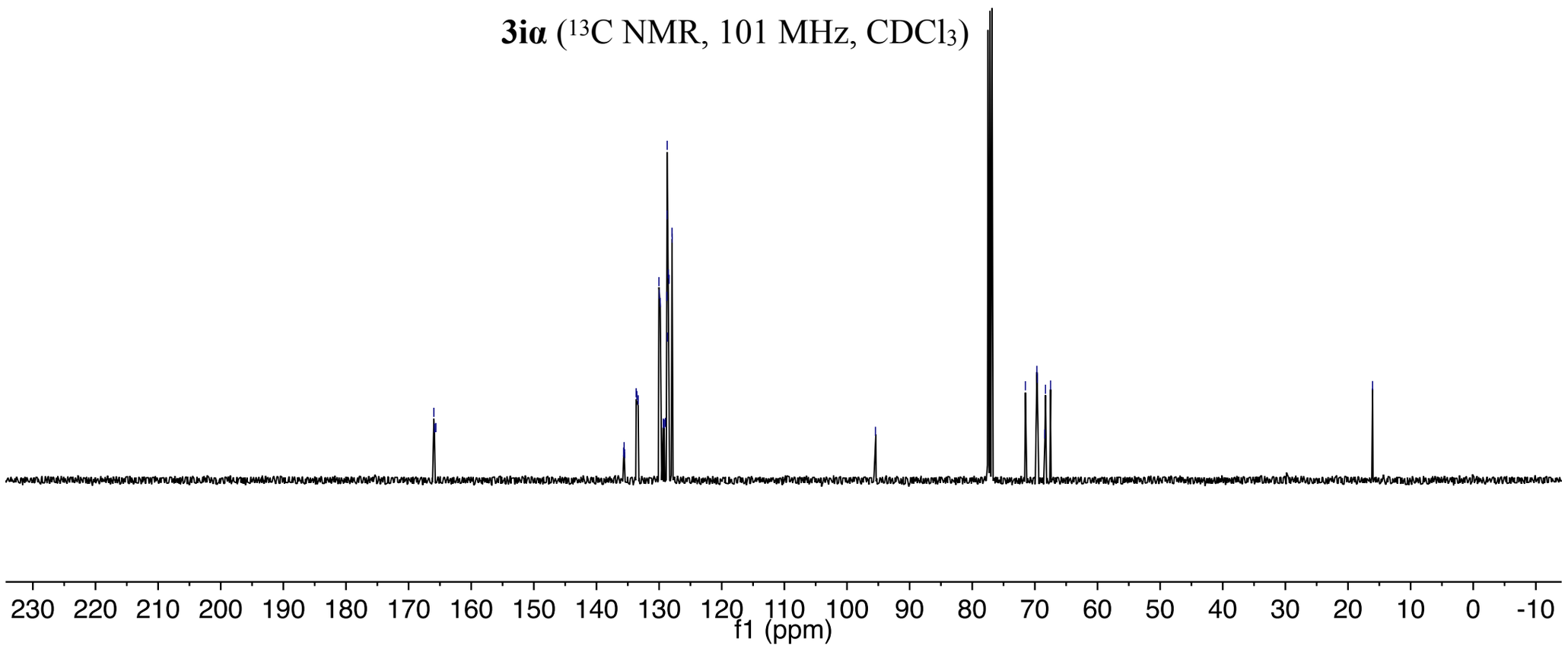

O
P
O
OBn
OBn
BnO
O
BnO
OBn
3h (NOE, CDCl3)
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)

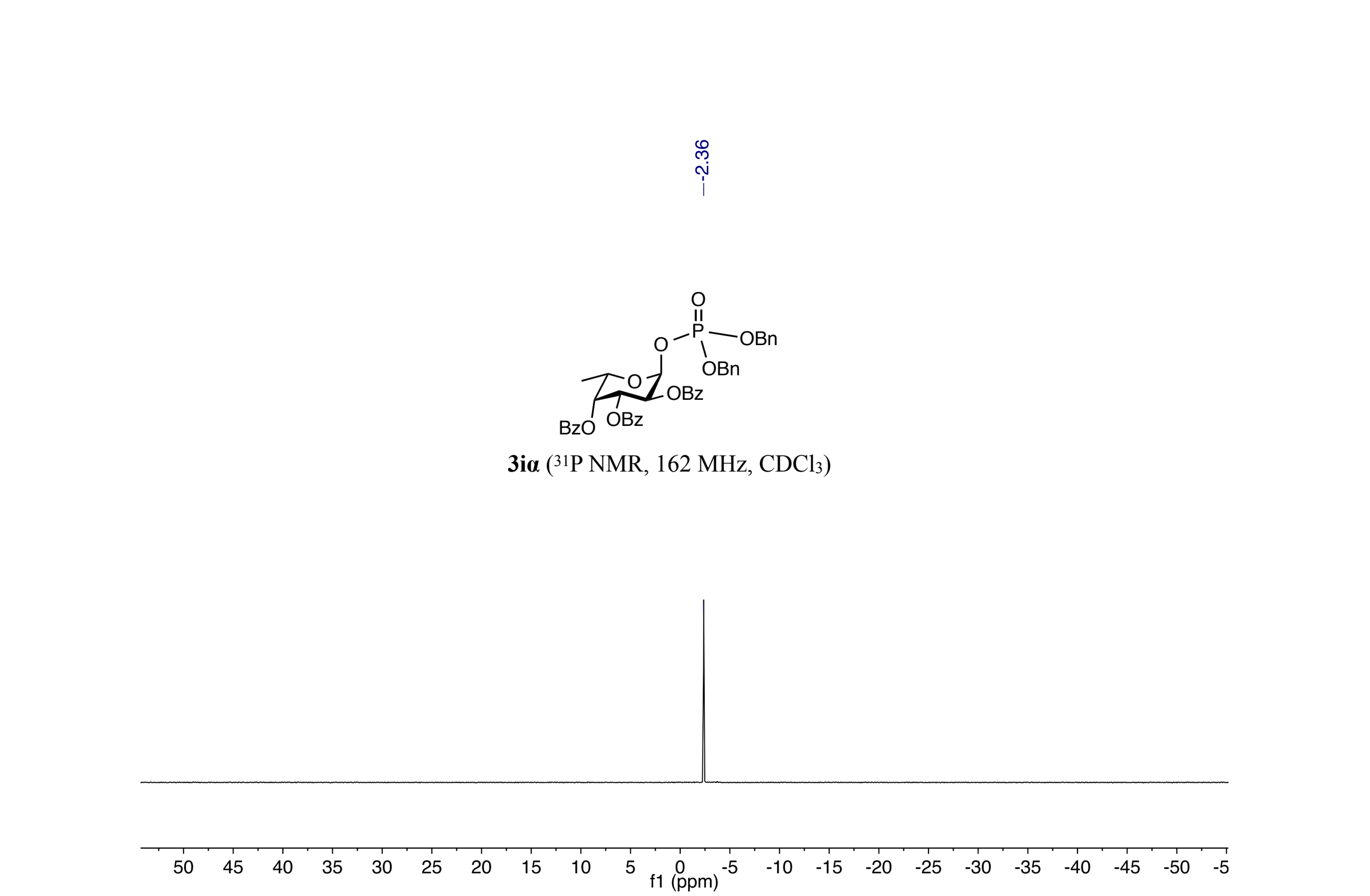


3iα (^{1}H NMR, 400 MHz, $CDCl_3$)

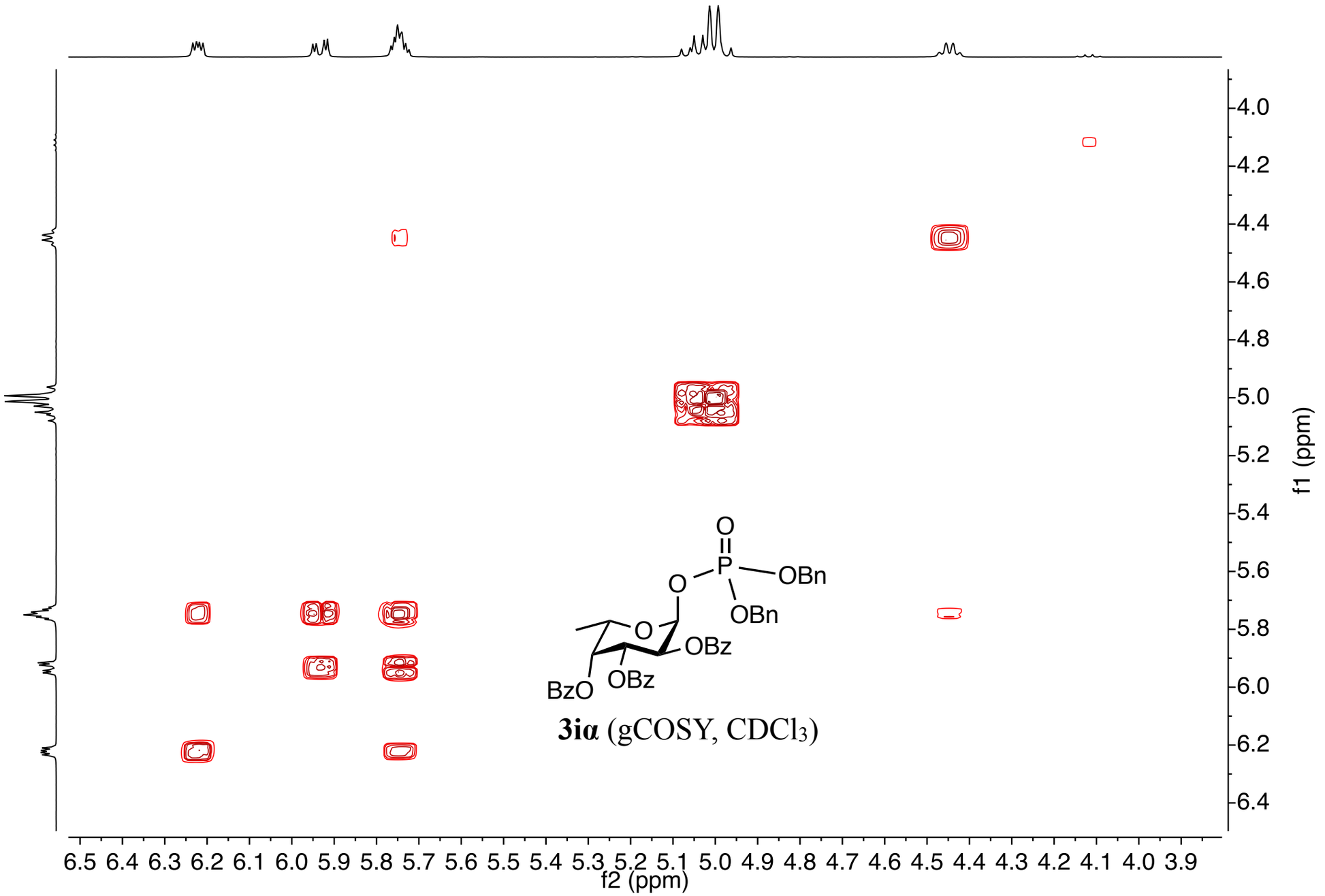


3iα (^{13}C NMR, 101 MHz, $CDCl_3$)

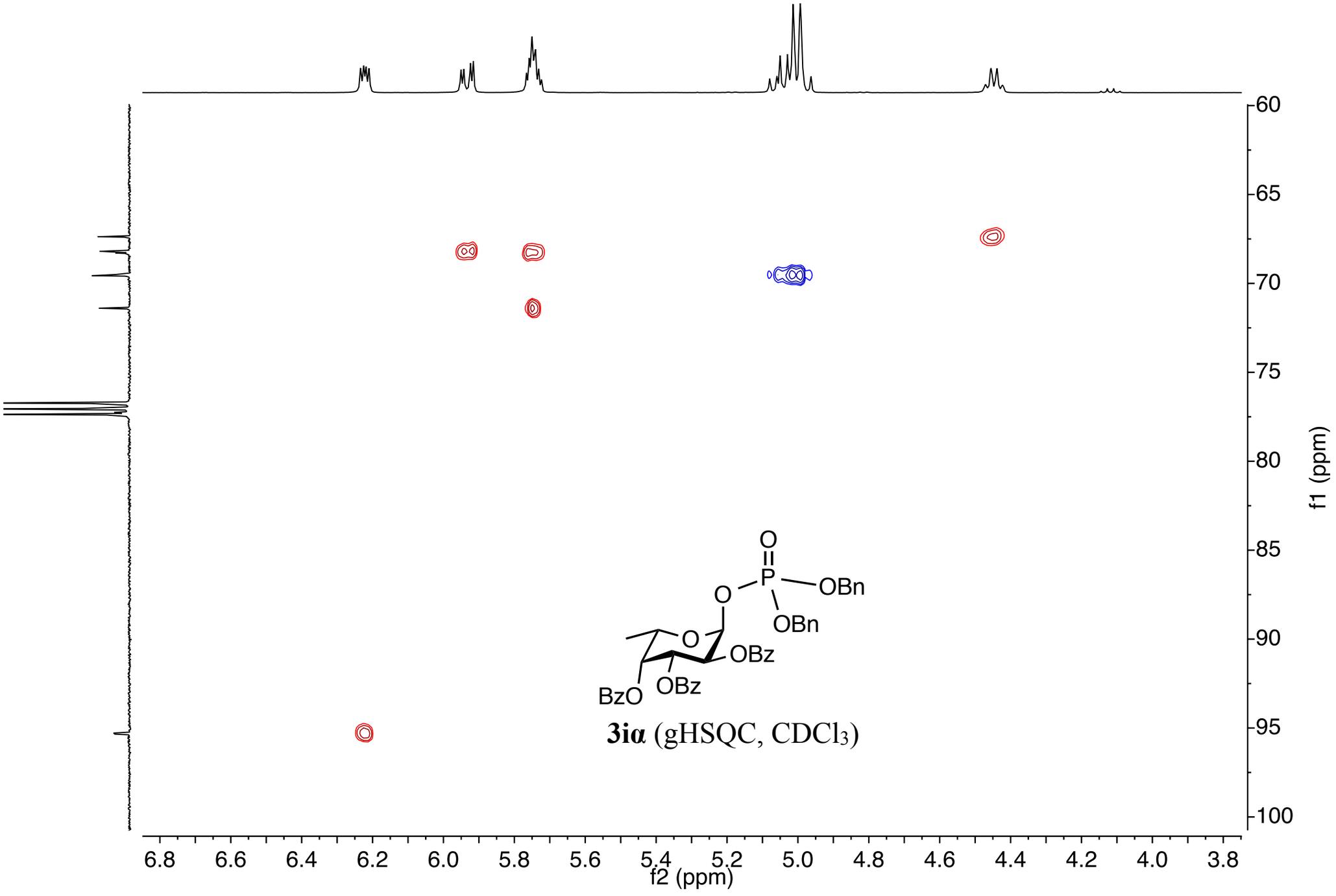




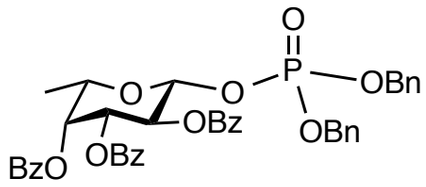
3iα (^{31}P NMR, 162 MHz, $CDCl_3$)



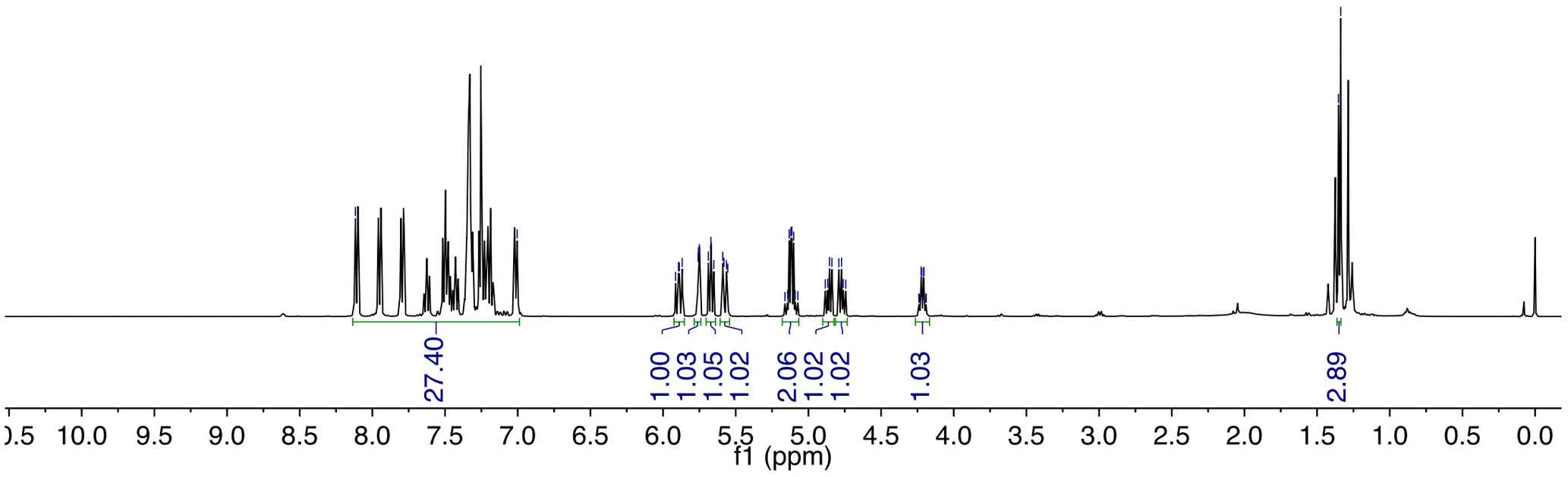
3iα (gCOSY, $CDCl_3$)

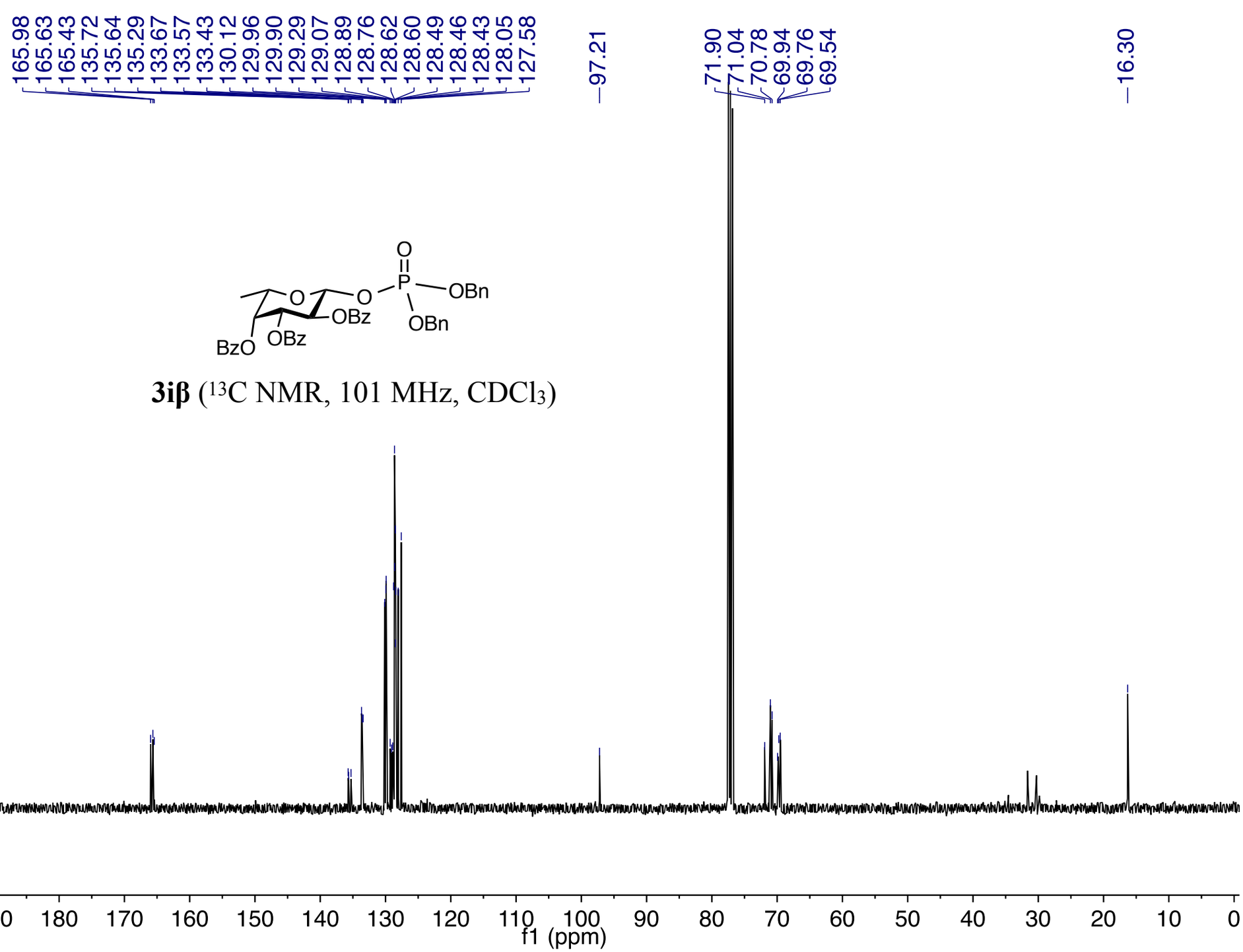


3iα (gHSQC, $CDCl_3$)

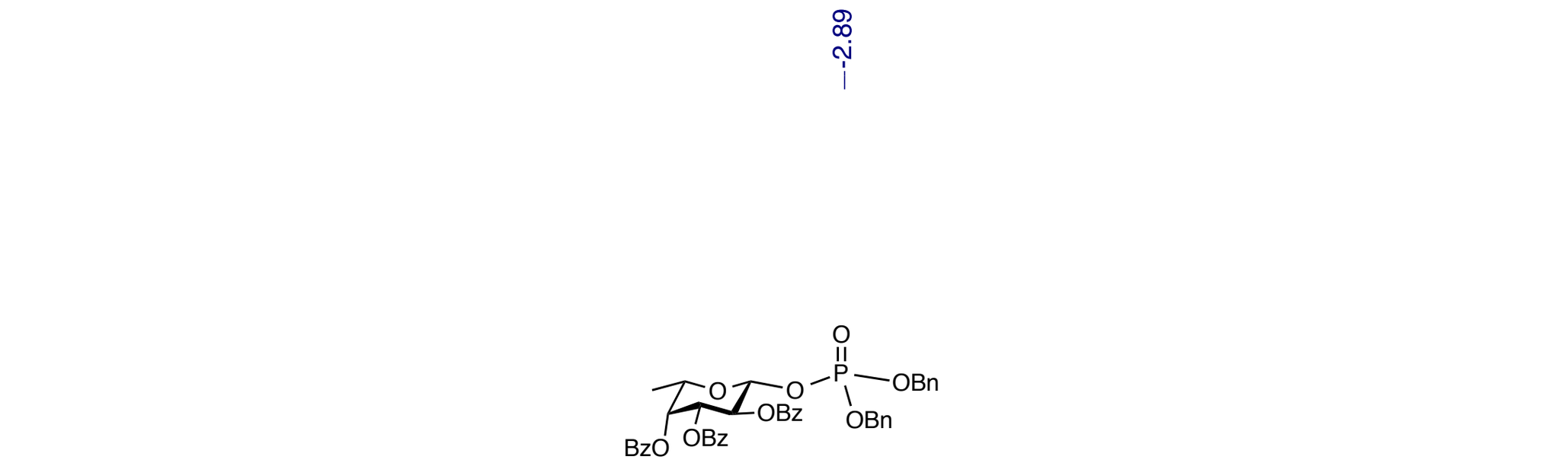


3iβ (^{1}H NMR, 400 MHz, $CDCl_3$)

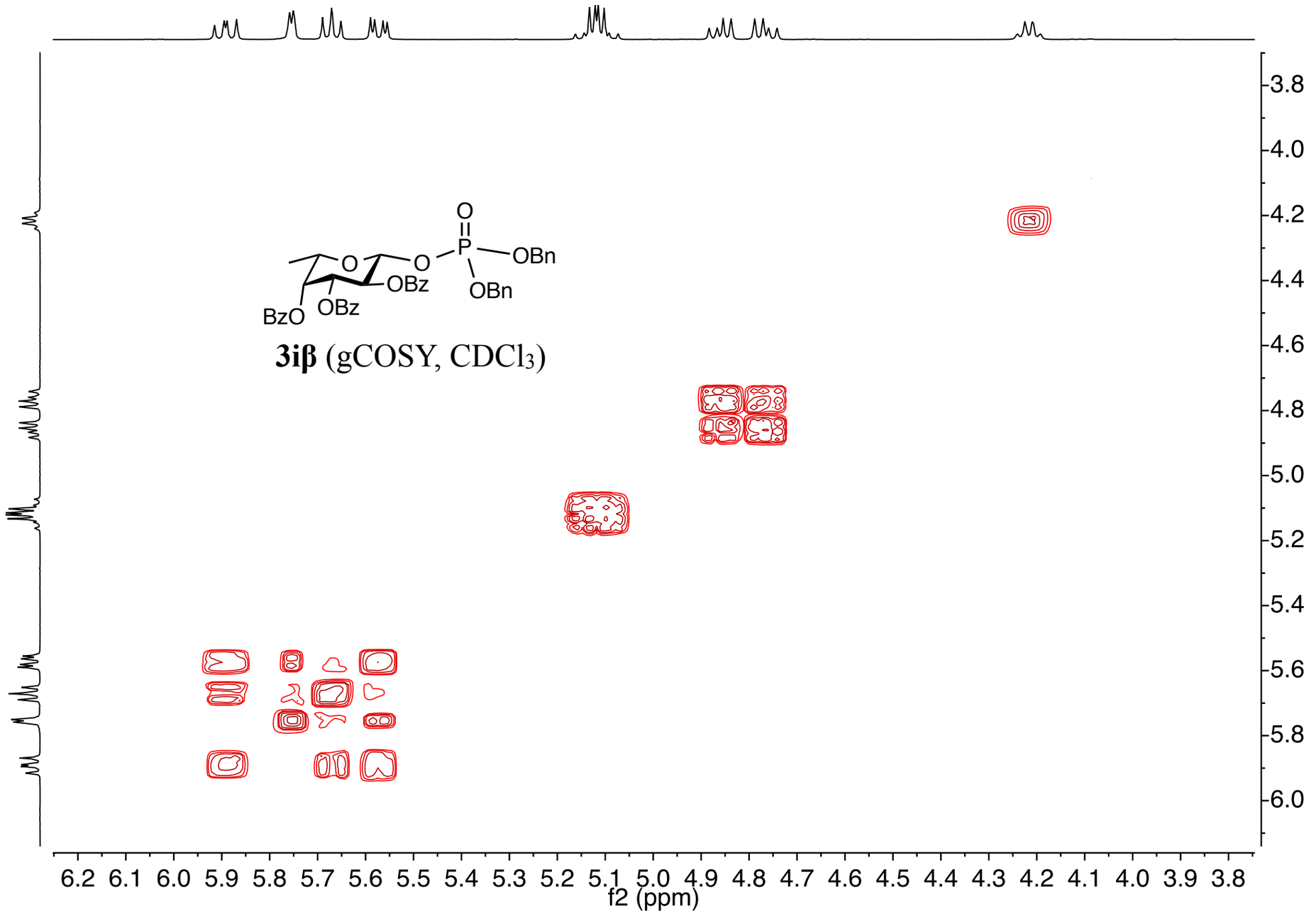




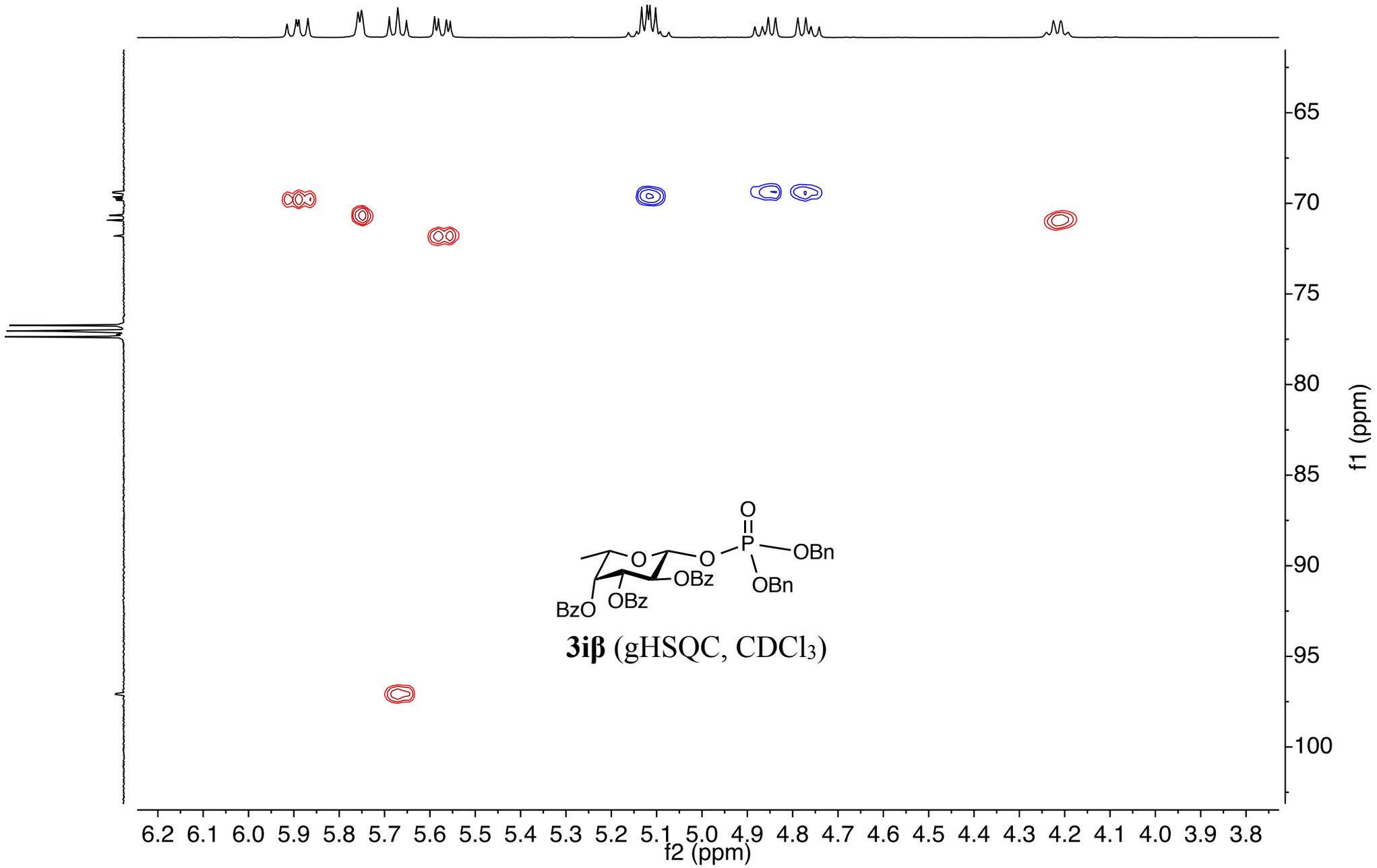
3iβ (^{13}C NMR, 101 MHz, $CDCl_3$)



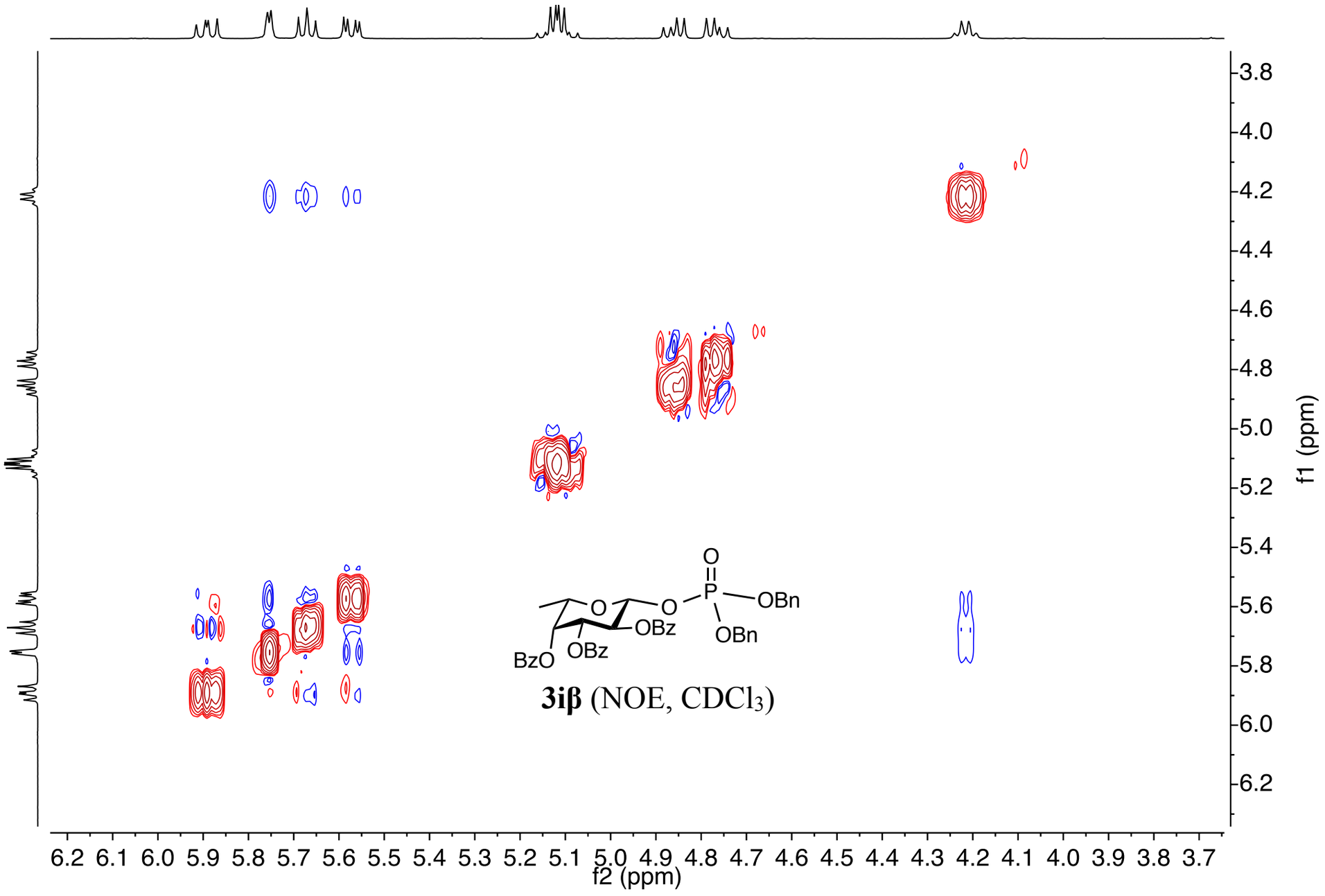
3iβ (^{31}P NMR, 162 MHz, $CDCl_3$)



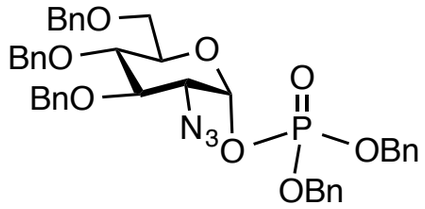
3iβ (gCOSY, $CDCl_3$)



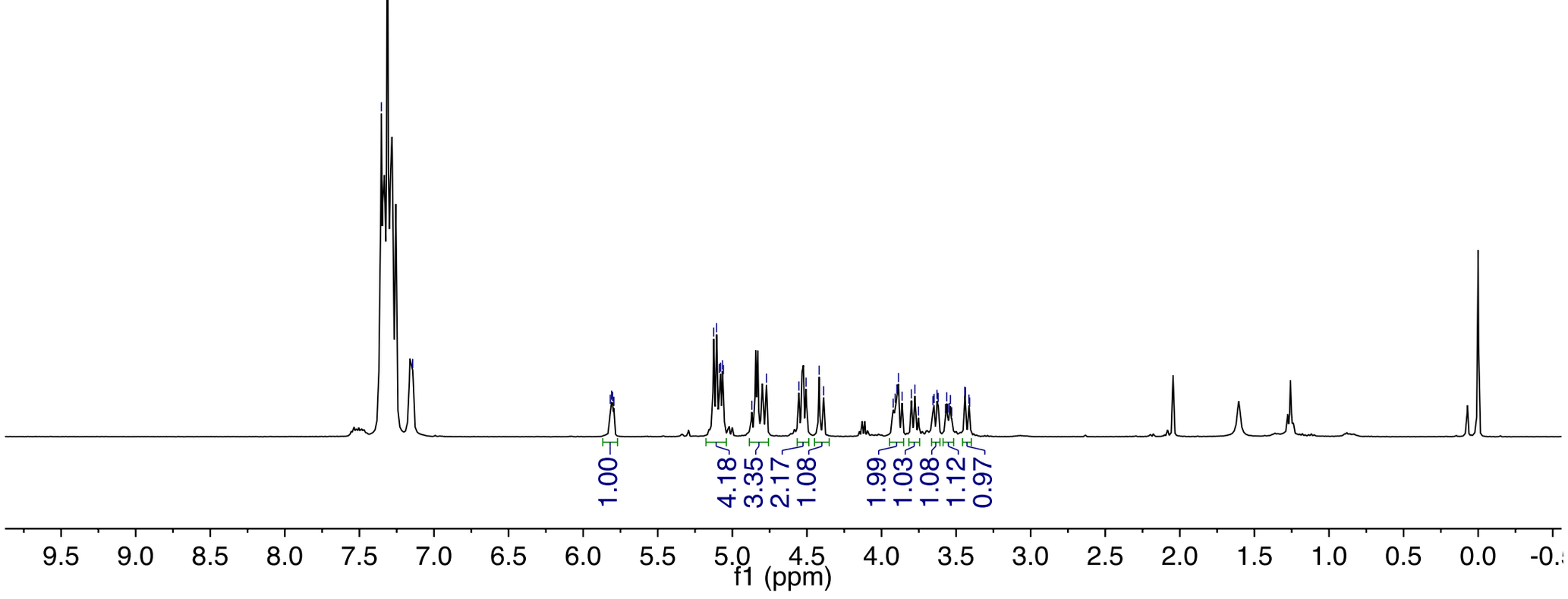
3iβ (gHSQC, $CDCl_3$)

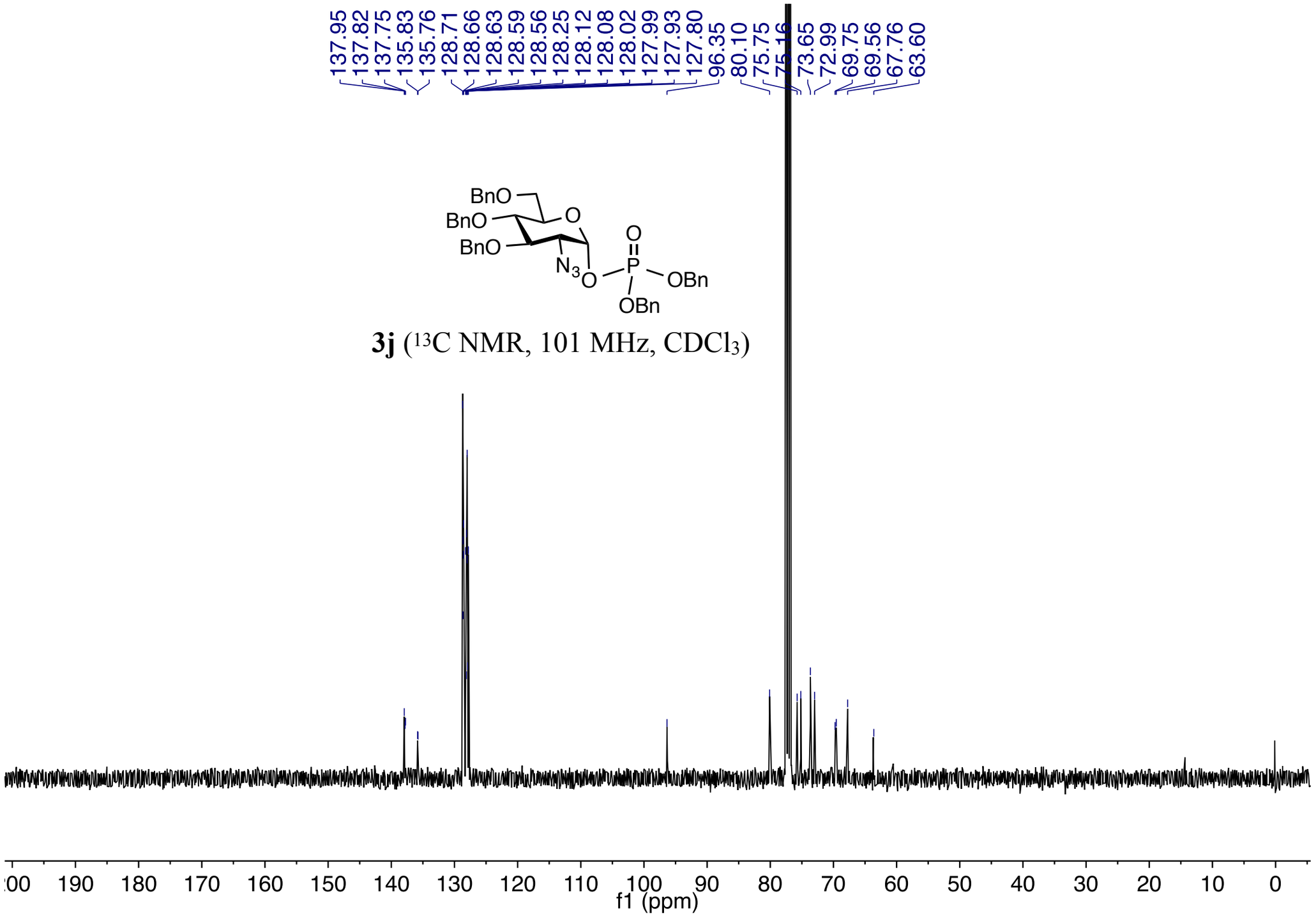


3iβ (NOE, $CDCl_3$)

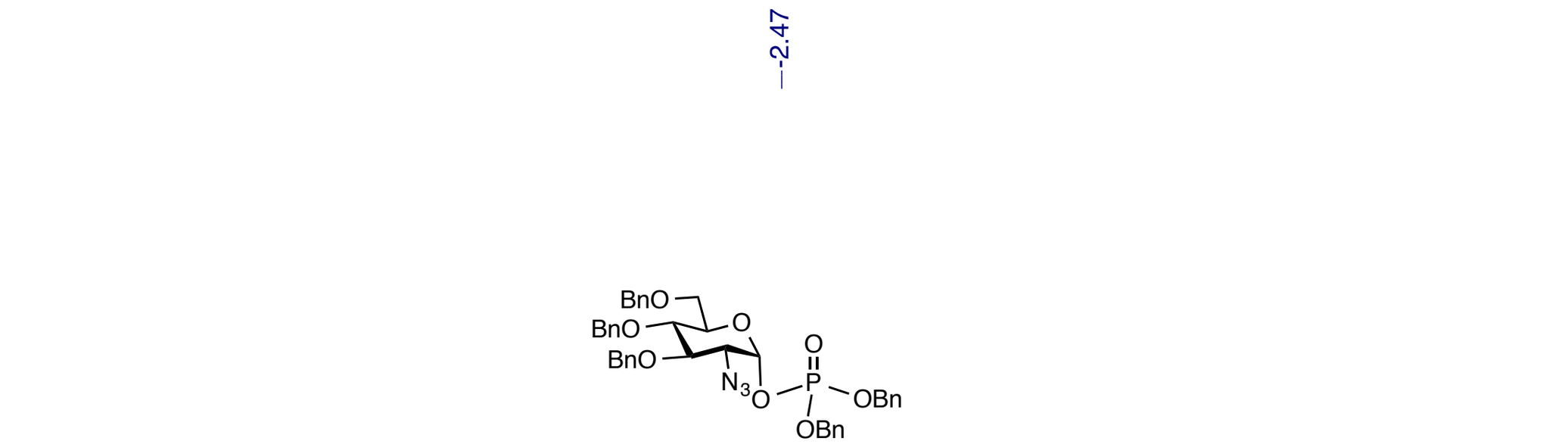


3j (^{1}H NMR, 400 MHz, $CDCl_3$)

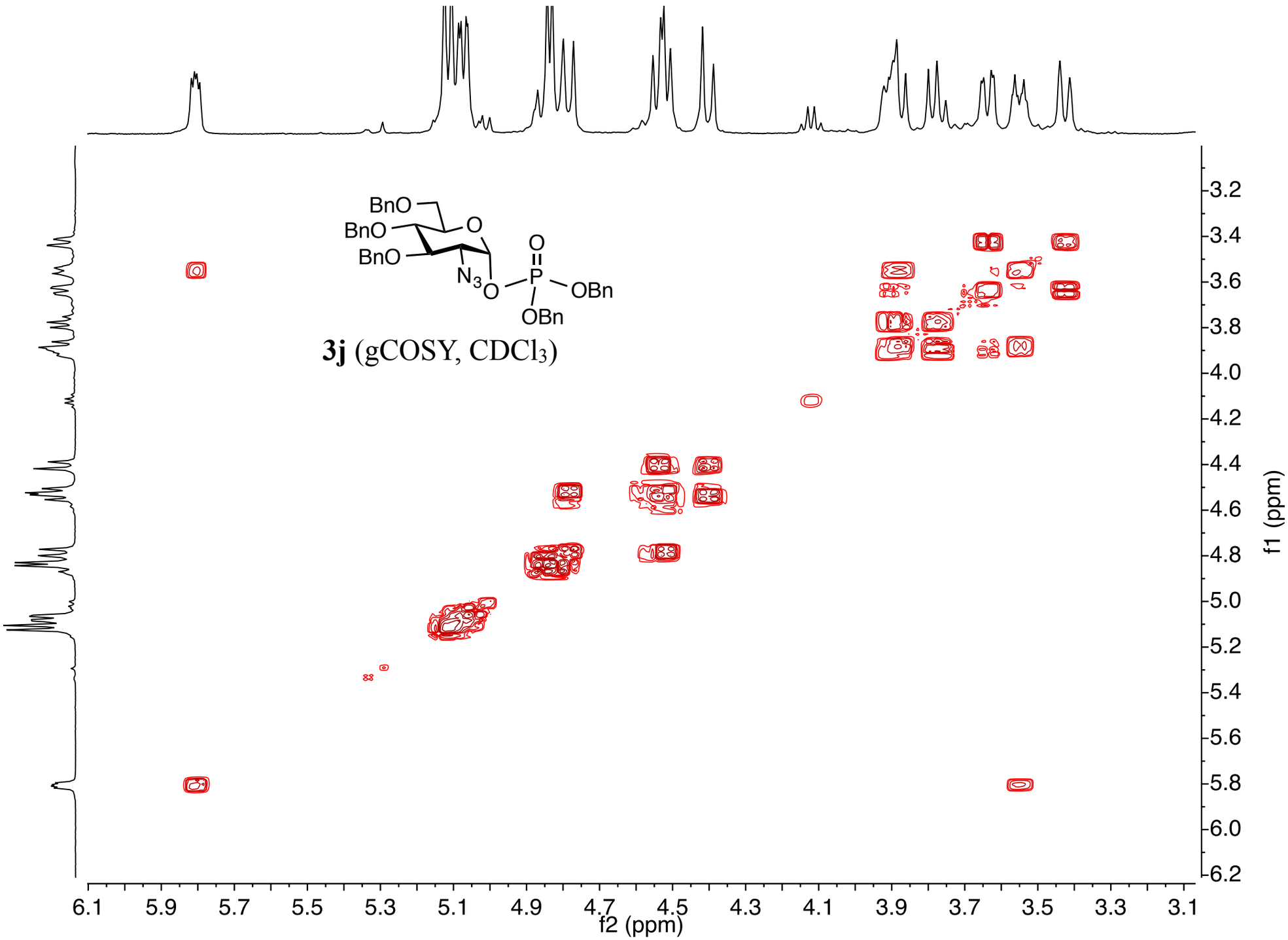




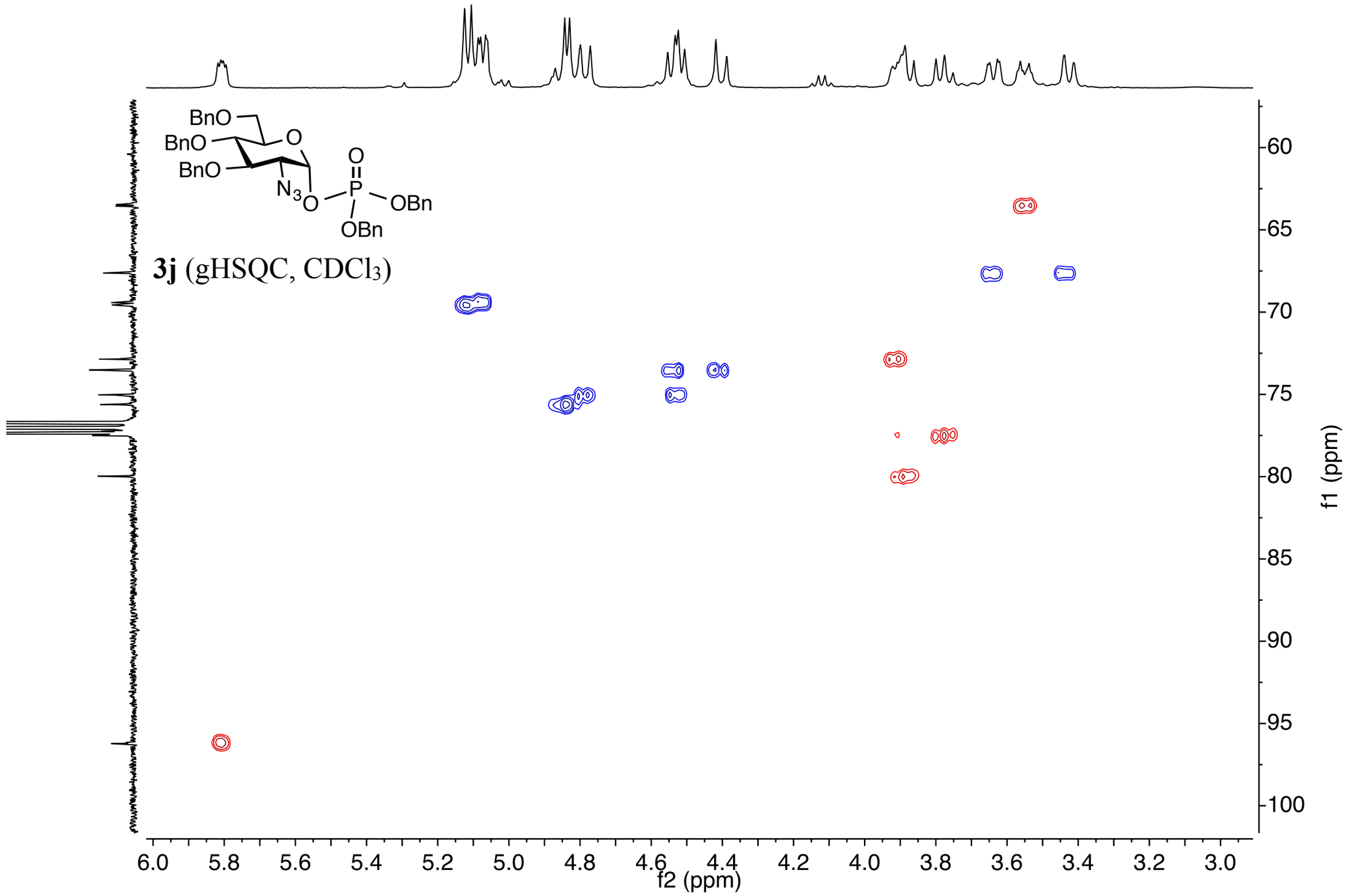
3j (^{13}C NMR, 101 MHz, $CDCl_3$)

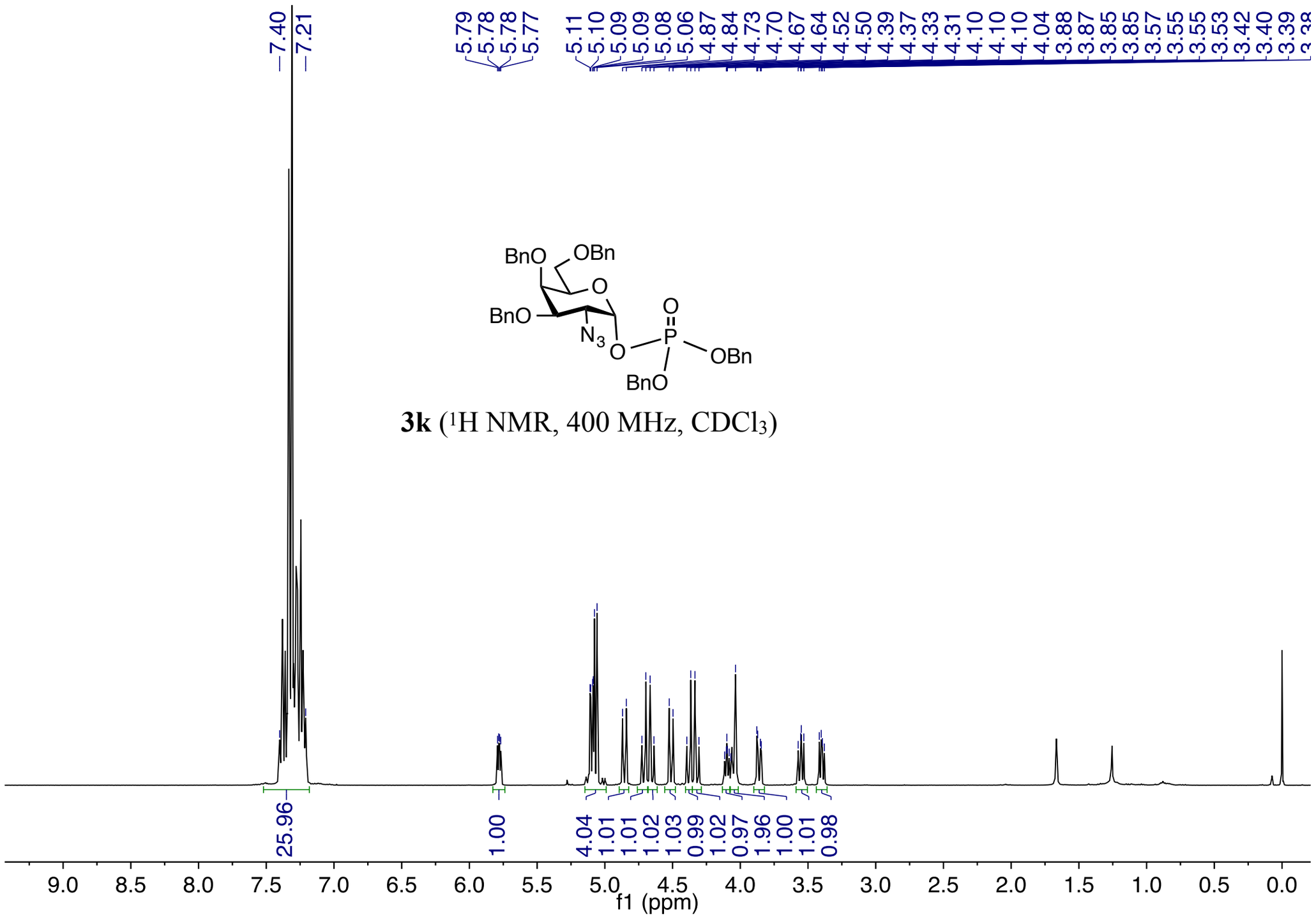


3j (^{31}P NMR, 162 MHz, $CDCl_3$)

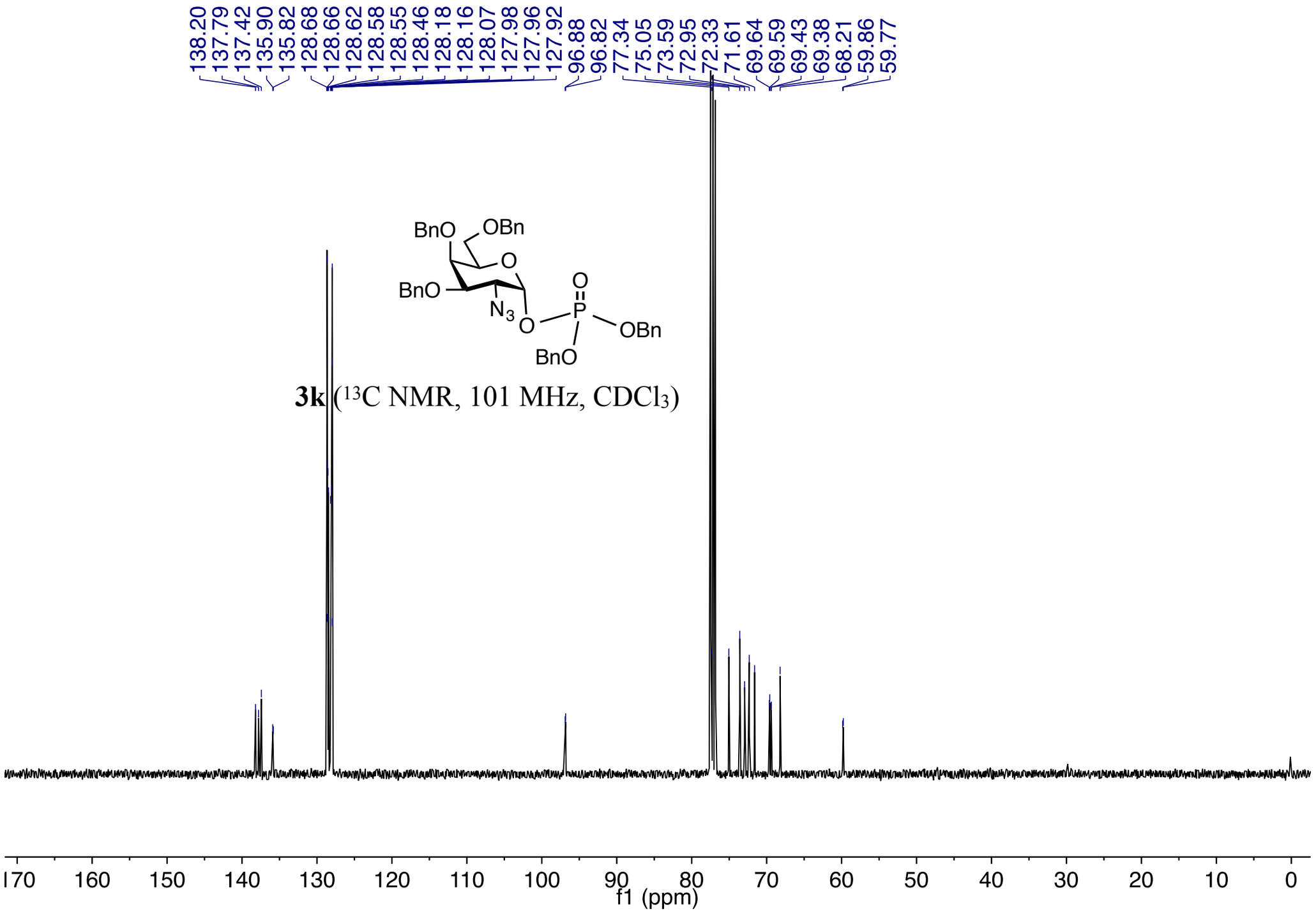


3j (gCOSY, $CDCl_3$)


BnO
BnO
BnO
O
N3
O
P
O
OBn
OBn
3j (gHSQC, CDCl3)
60
65
70
75
80
85
90
95
100
f1 (ppm)
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)

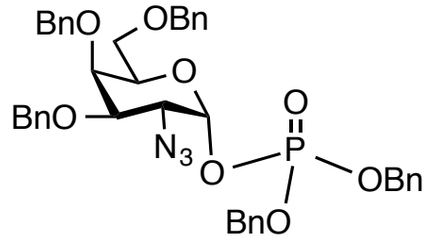


3k (^{1}H NMR, 400 MHz, $CDCl_3$)

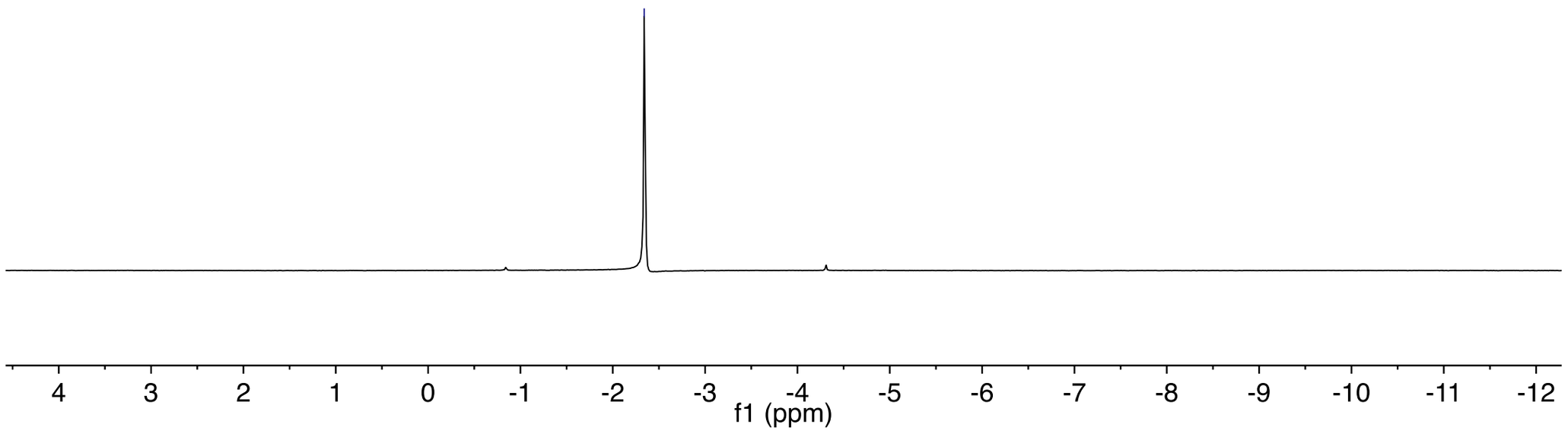


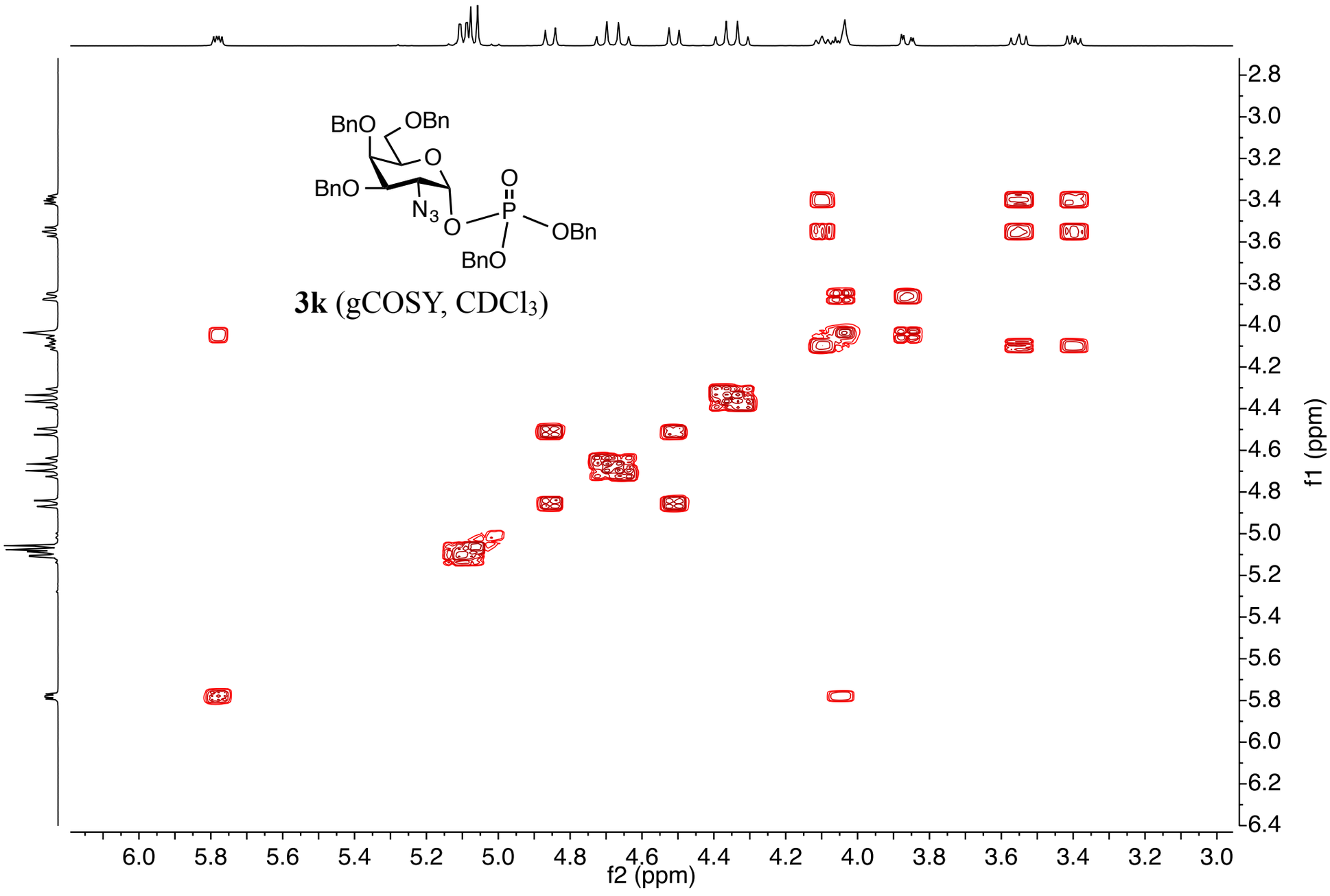
3k (^{13}C NMR, 101 MHz, $CDCl_3$)

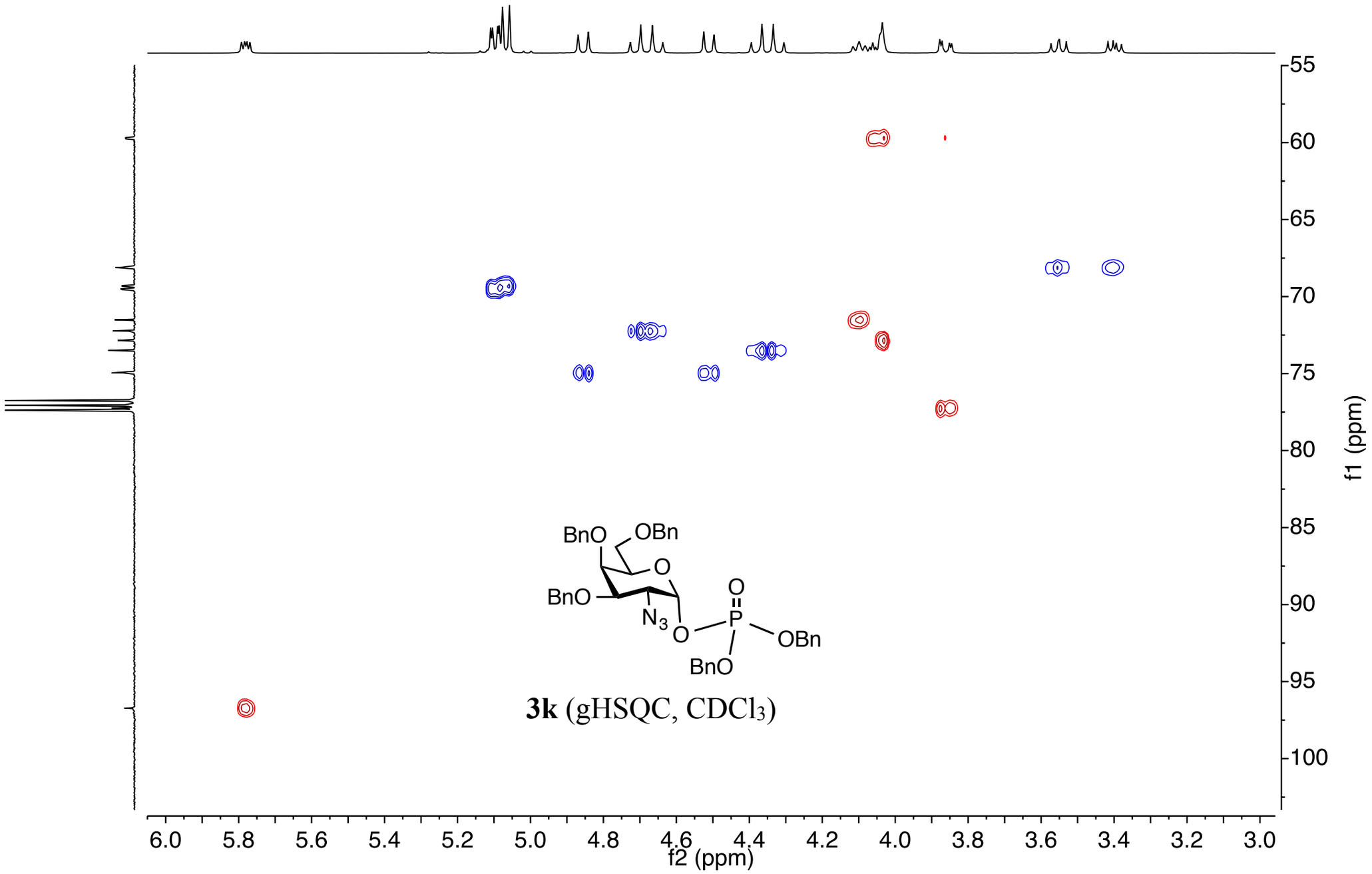
-2.34



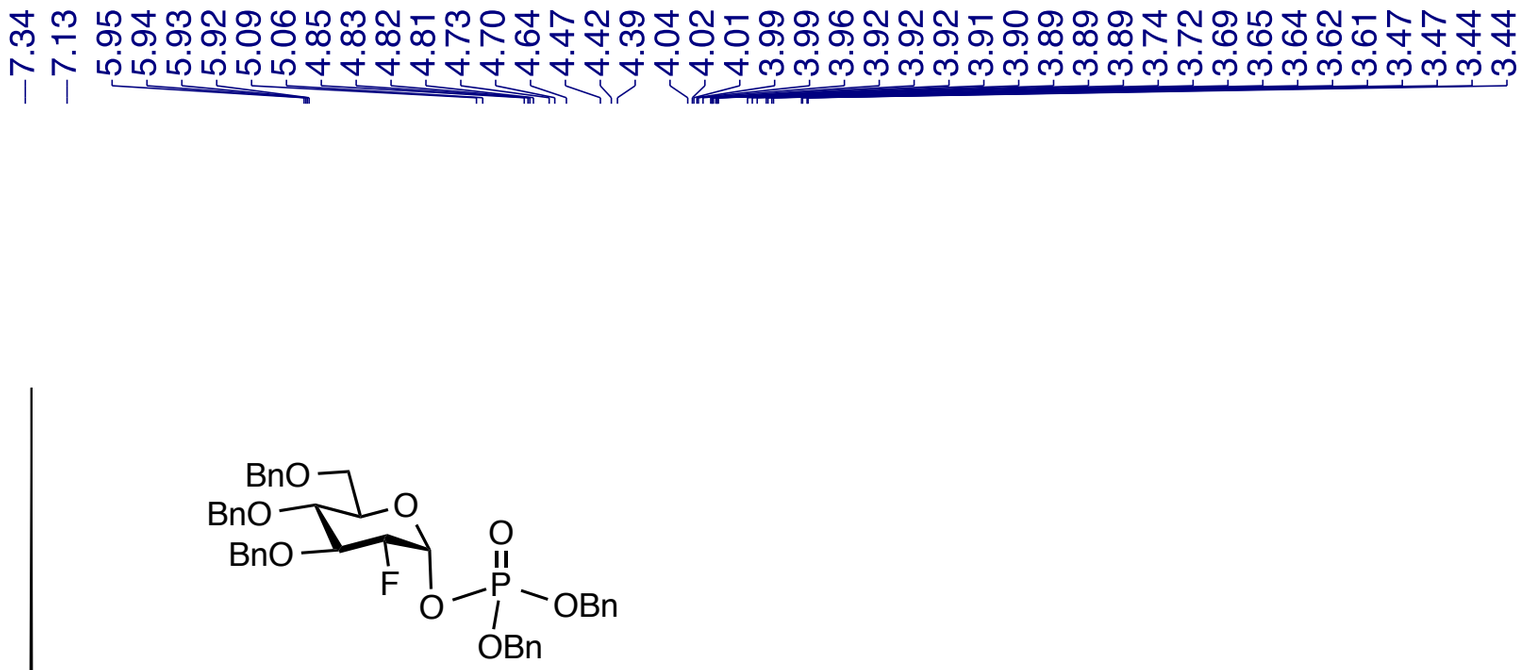
3k (^{31}P NMR, 162 MHz, $CDCl_3$)



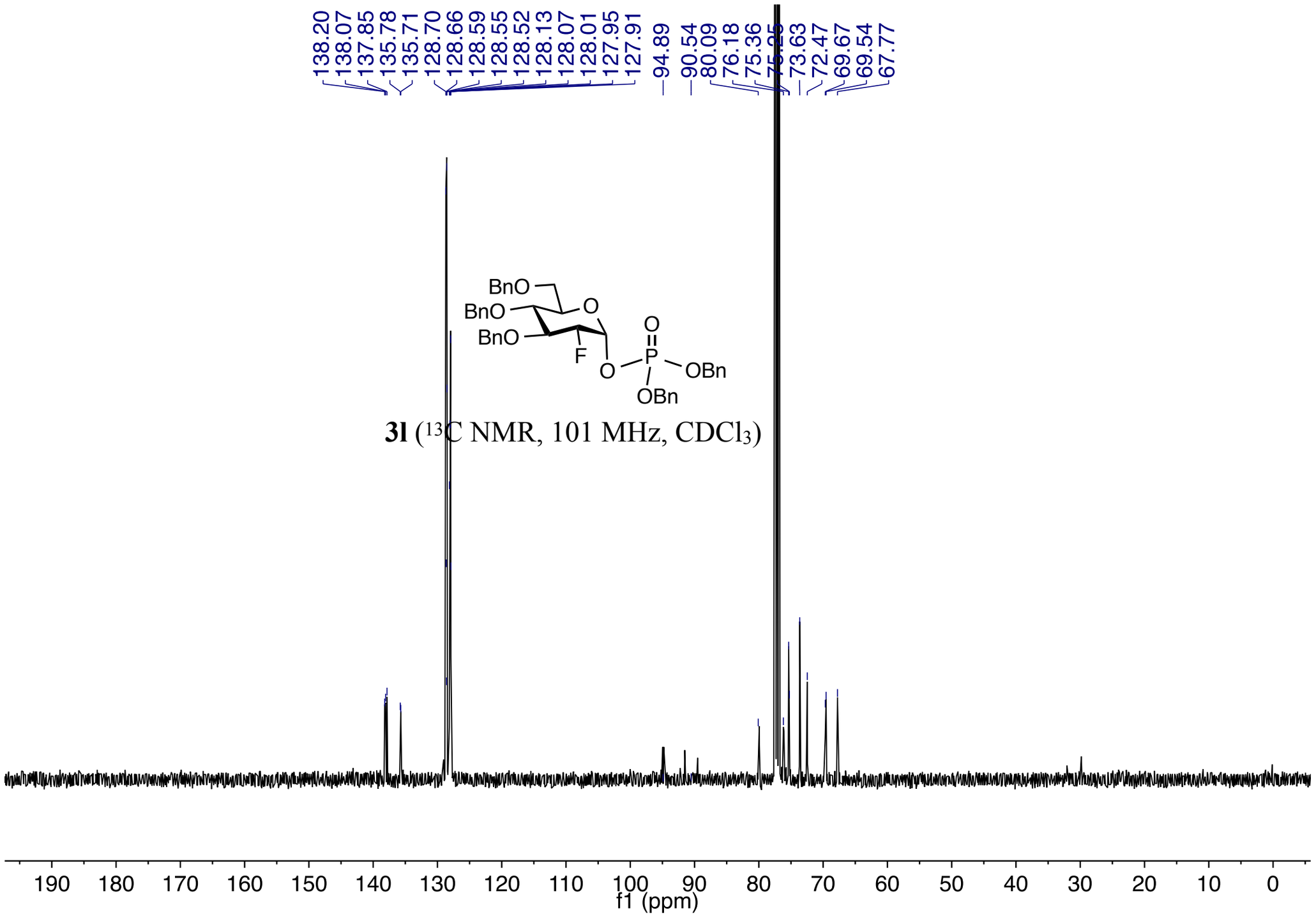

BnO
OBn
O
BnO
N3
O
P
O
OBn
BnO
3k (gCOSY, CDCl3)
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
f1 (ppm)
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)



3k (gHSQC, $CDCl_3$)

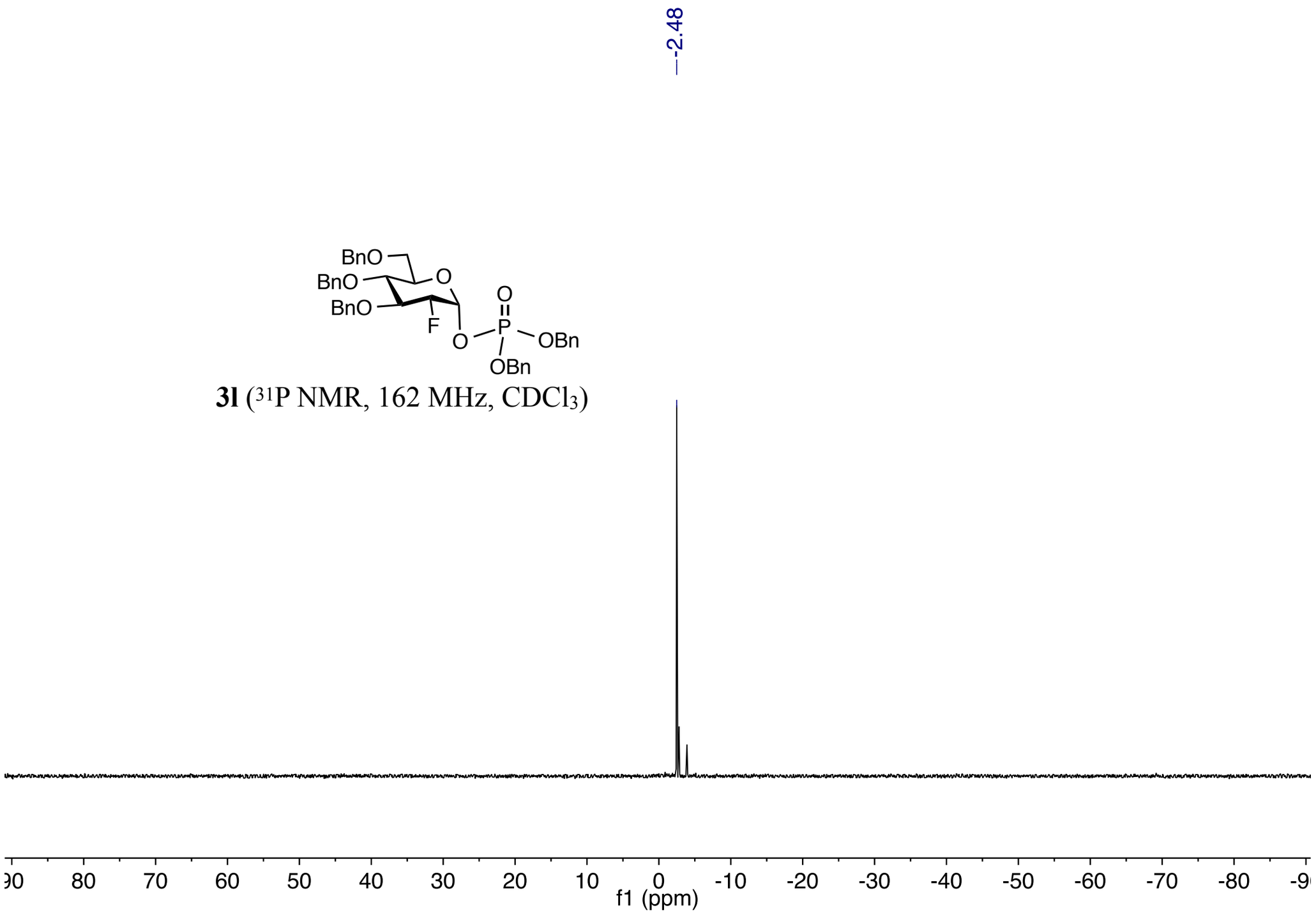


3l (^{1}H NMR, 400 MHz, $CDCl_3$)

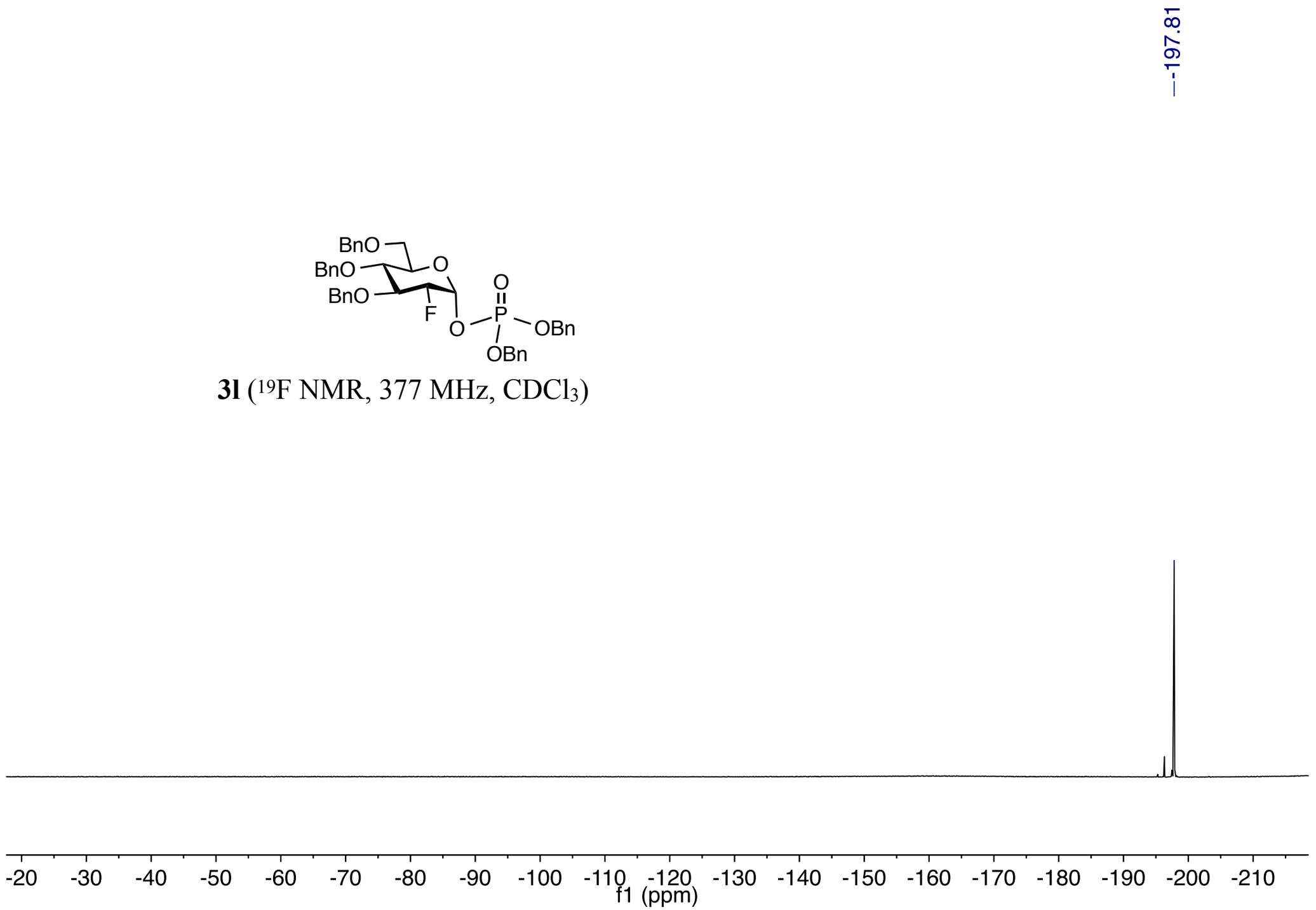


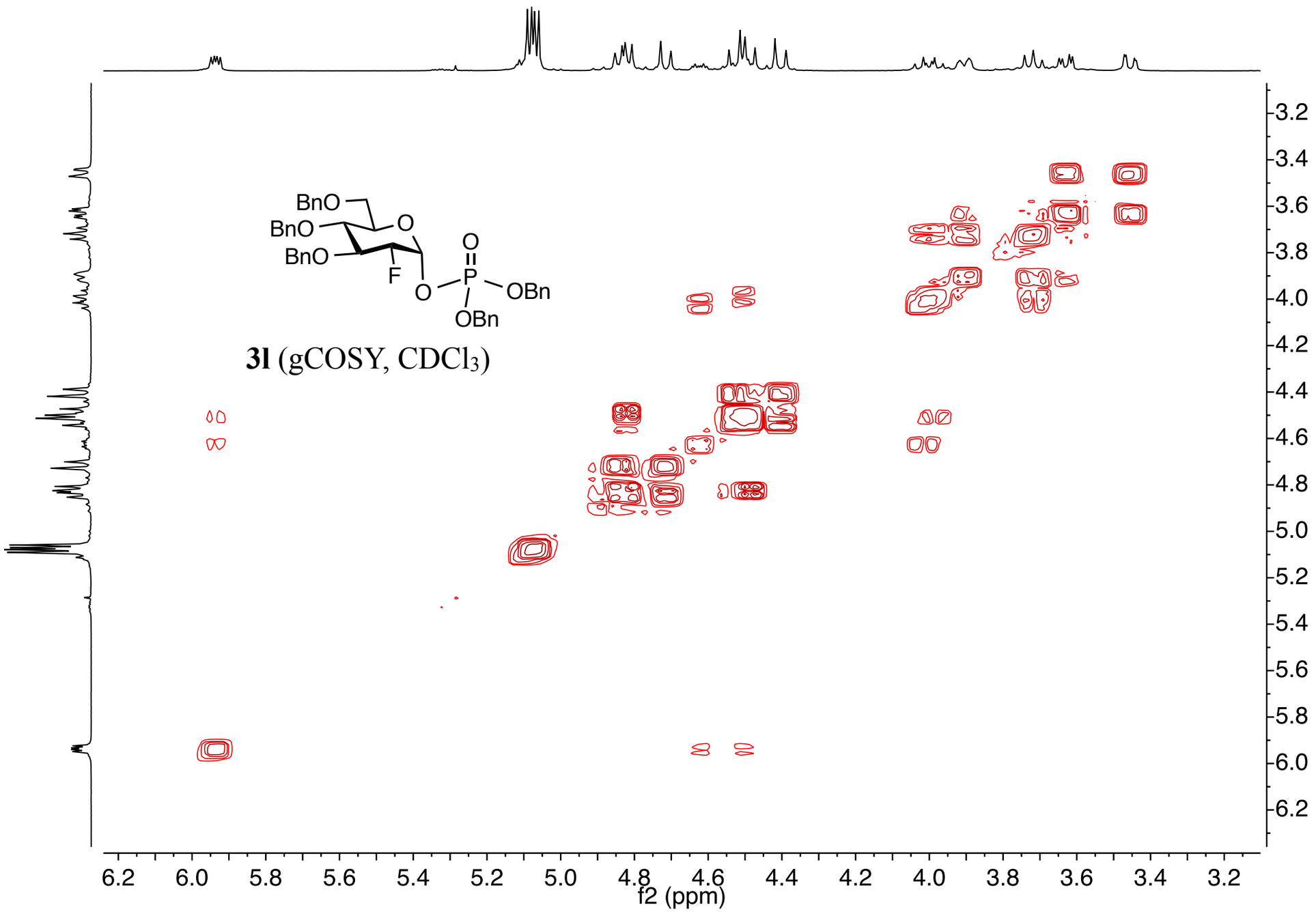
3l (^{13}C NMR, 101 MHz, $CDCl_3$)

3l (^{31}P NMR, 162 MHz, $CDCl_3$)

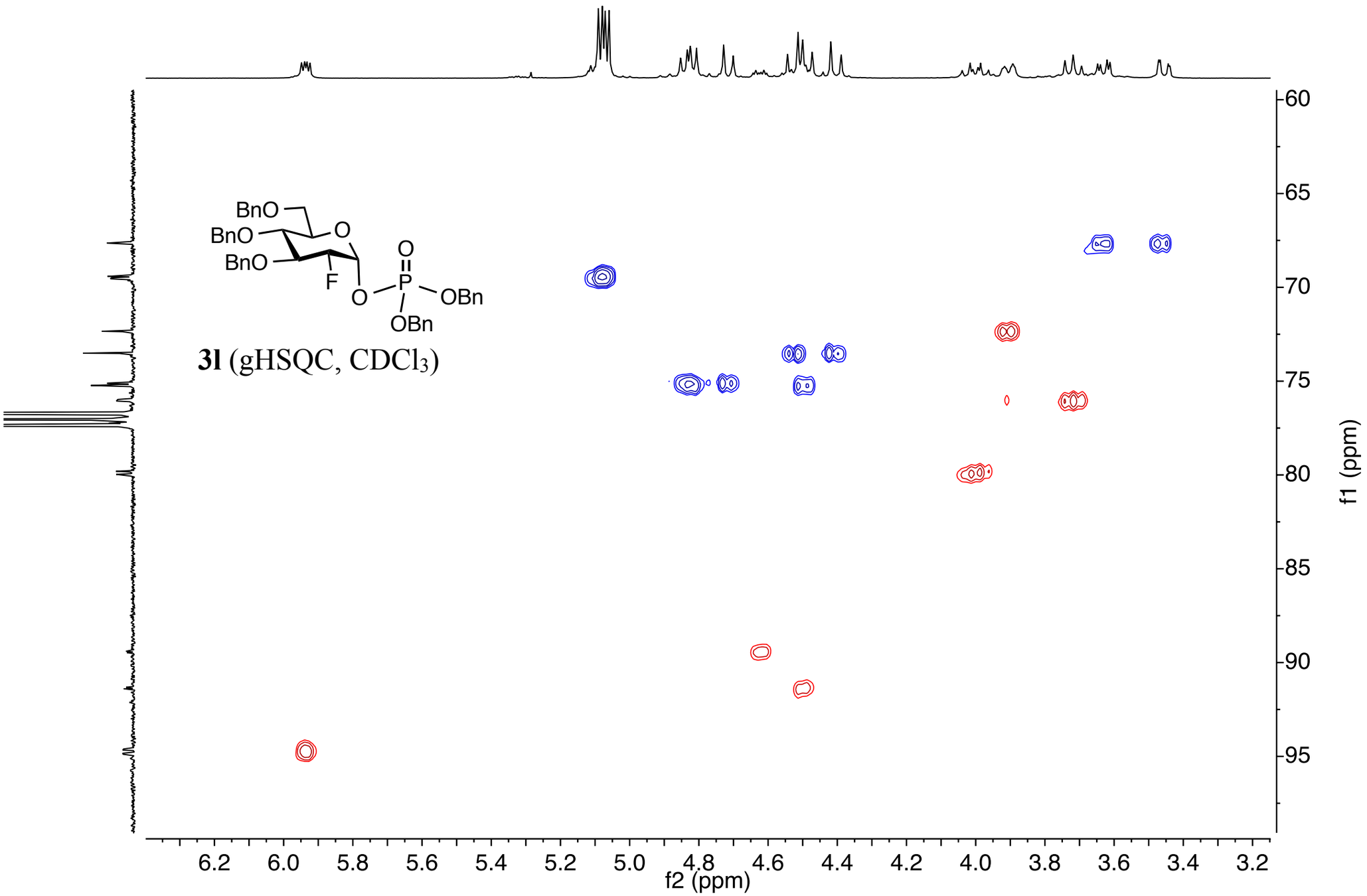


3l (^{19}F NMR, 377 MHz, $CDCl_3$)

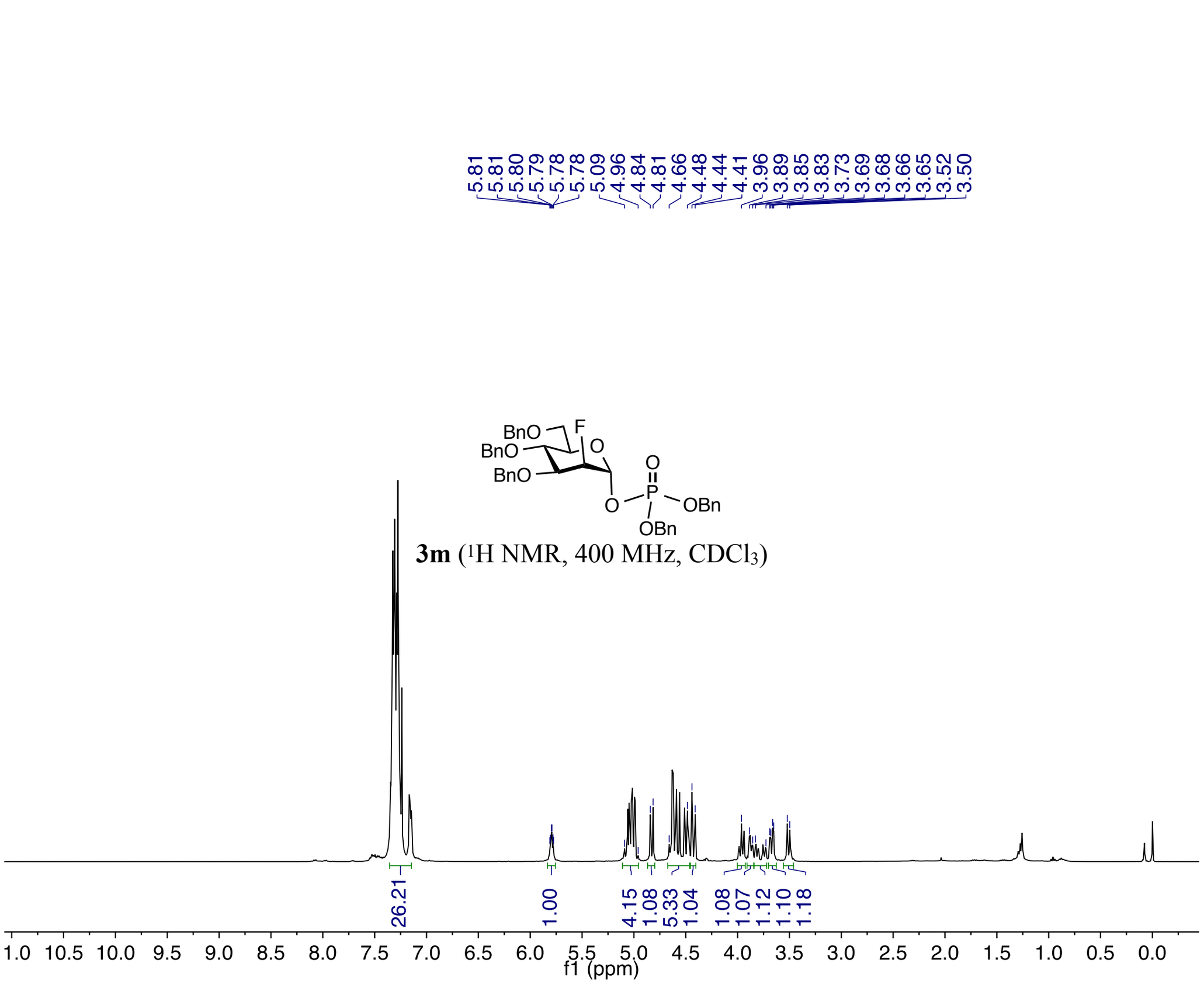




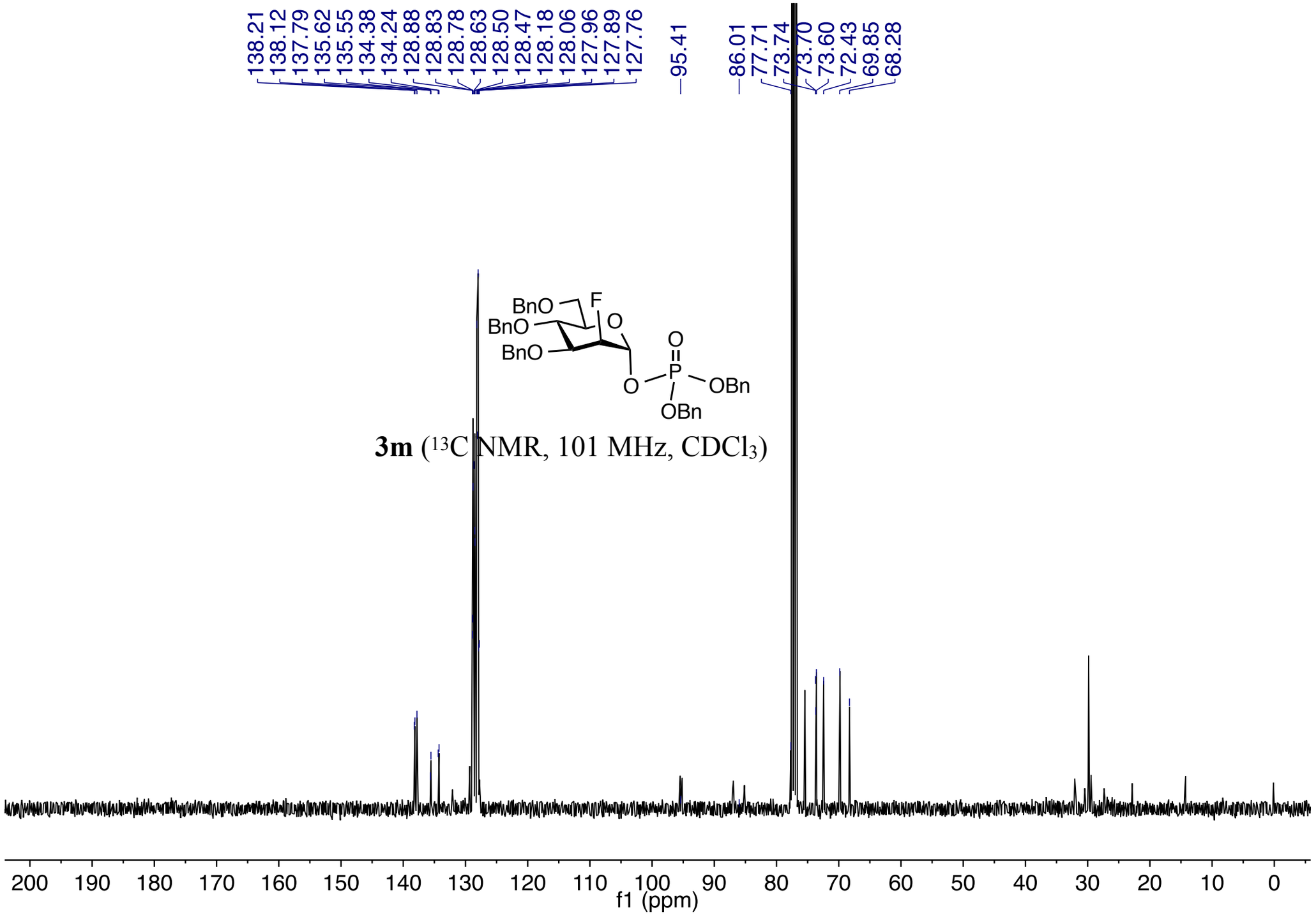
3l (gCOSY, $CDCl_3$)



3l (gHSQC, $CDCl_3$)

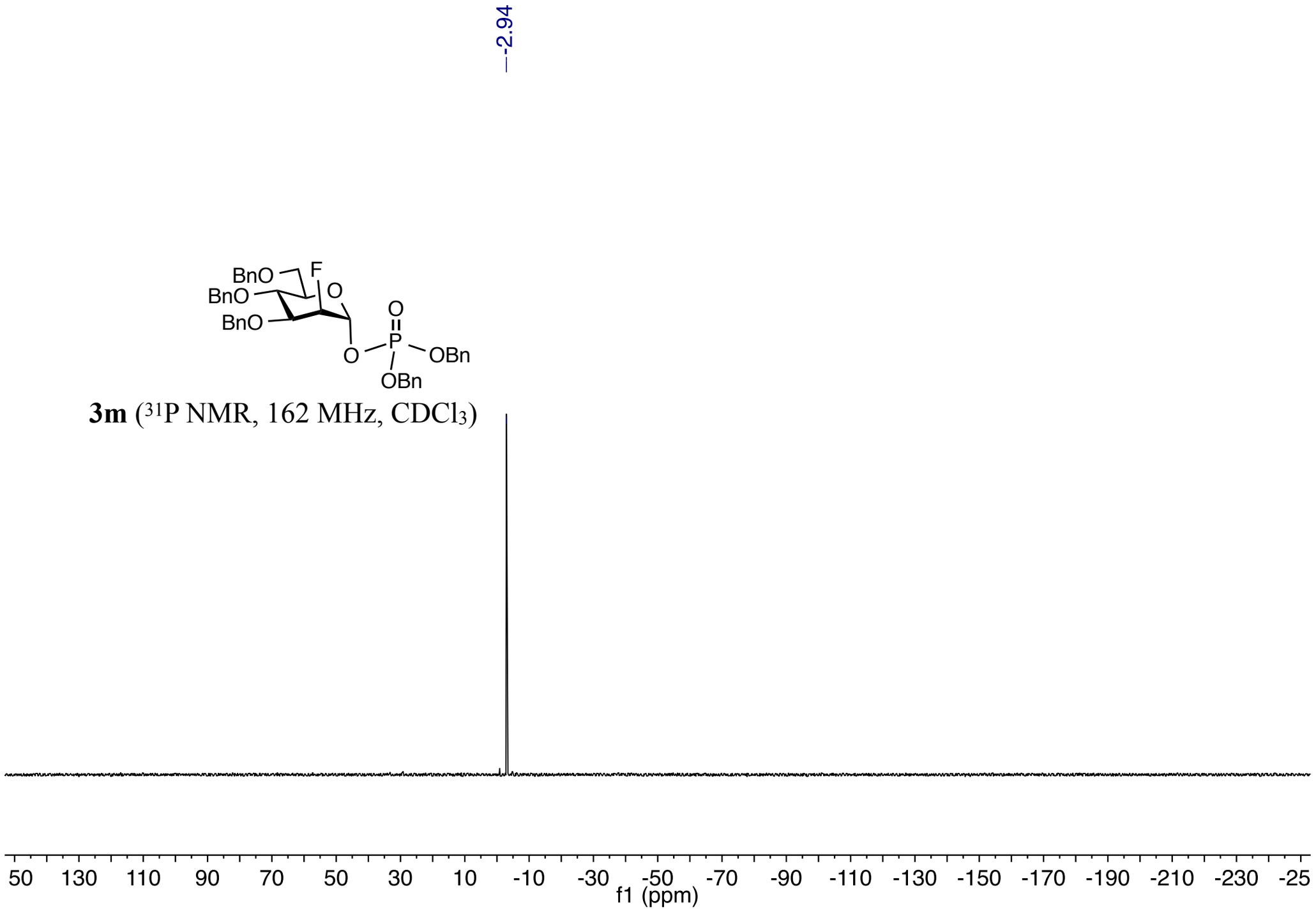


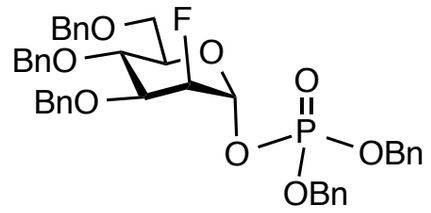
3m (^{1}H NMR, 400 MHz, $CDCl_3$)



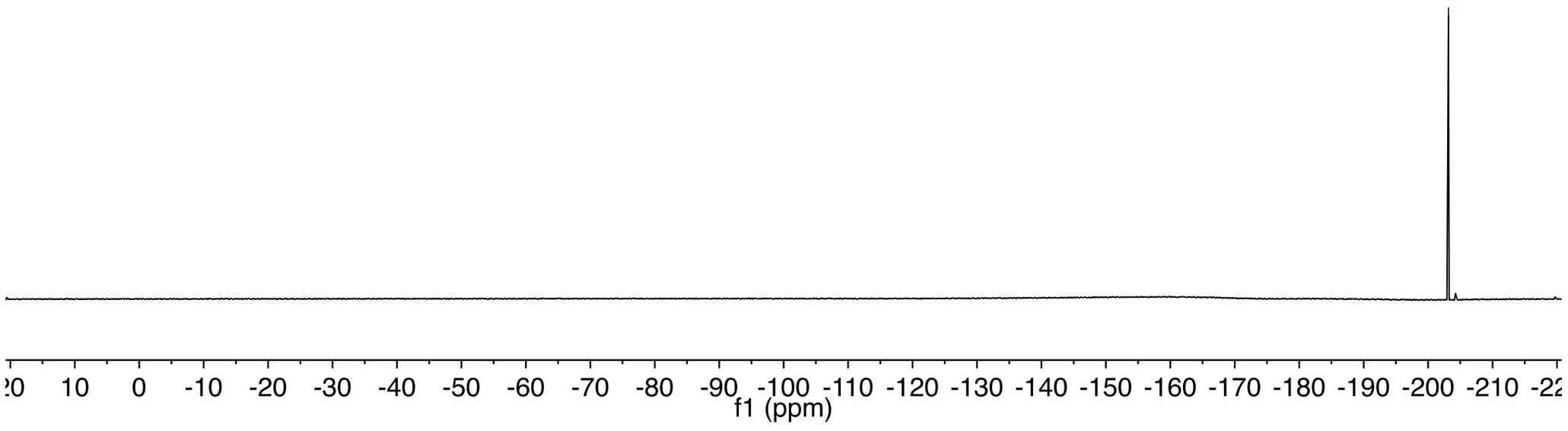
3m (^{13}C NMR, 101 MHz, $CDCl_3$)

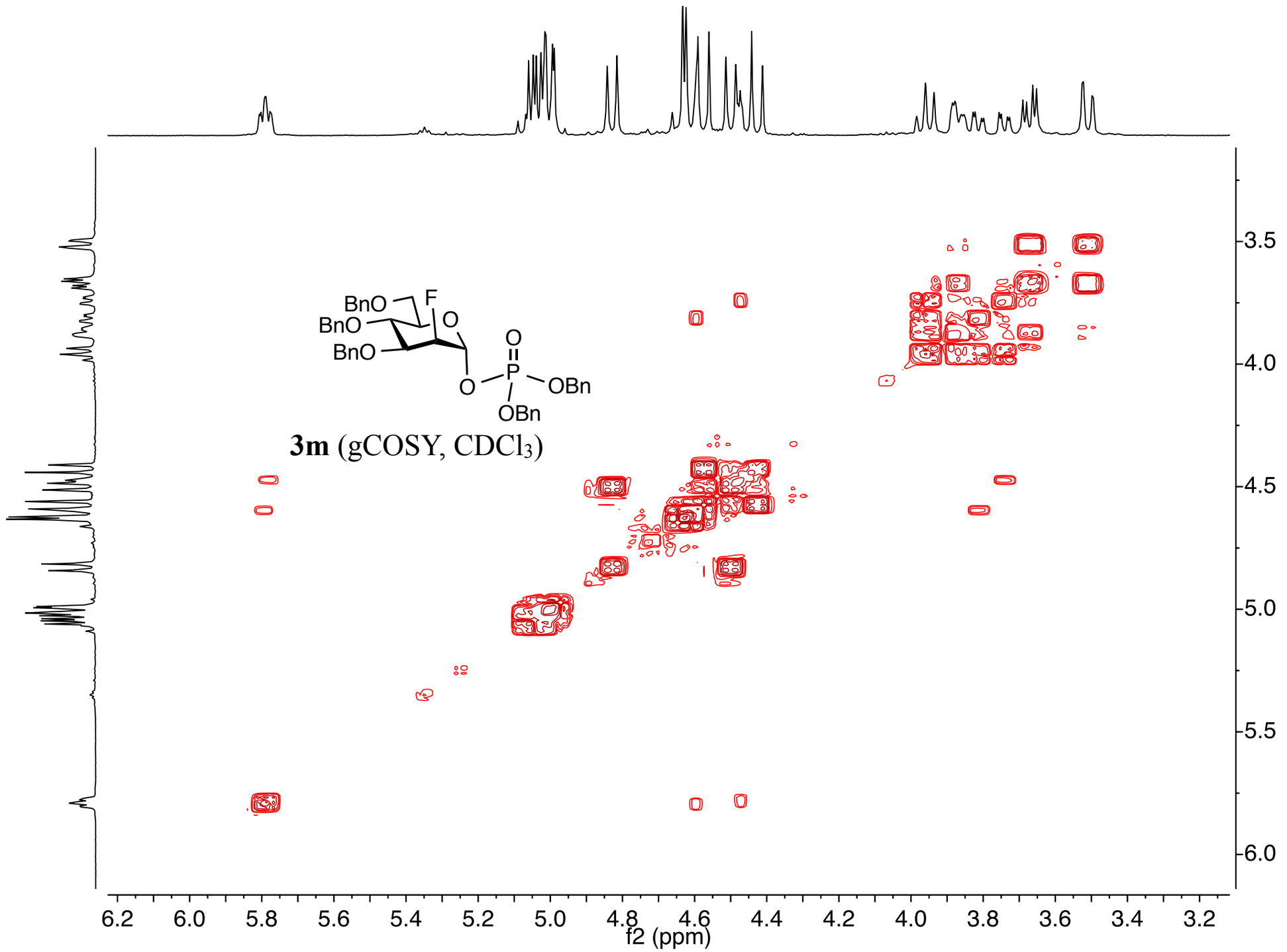
3m (^{31}P NMR, 162 MHz, $CDCl_3$)

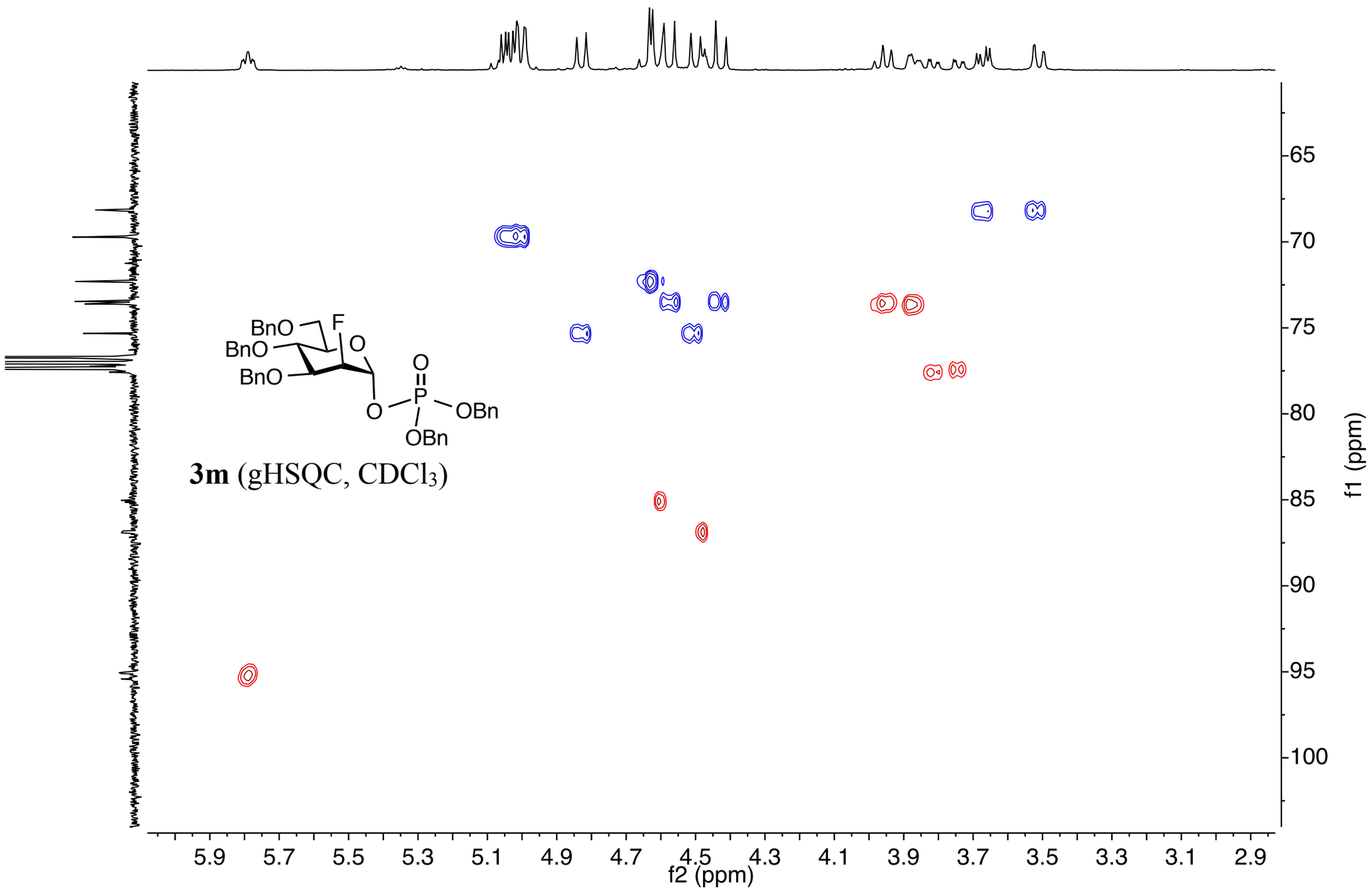


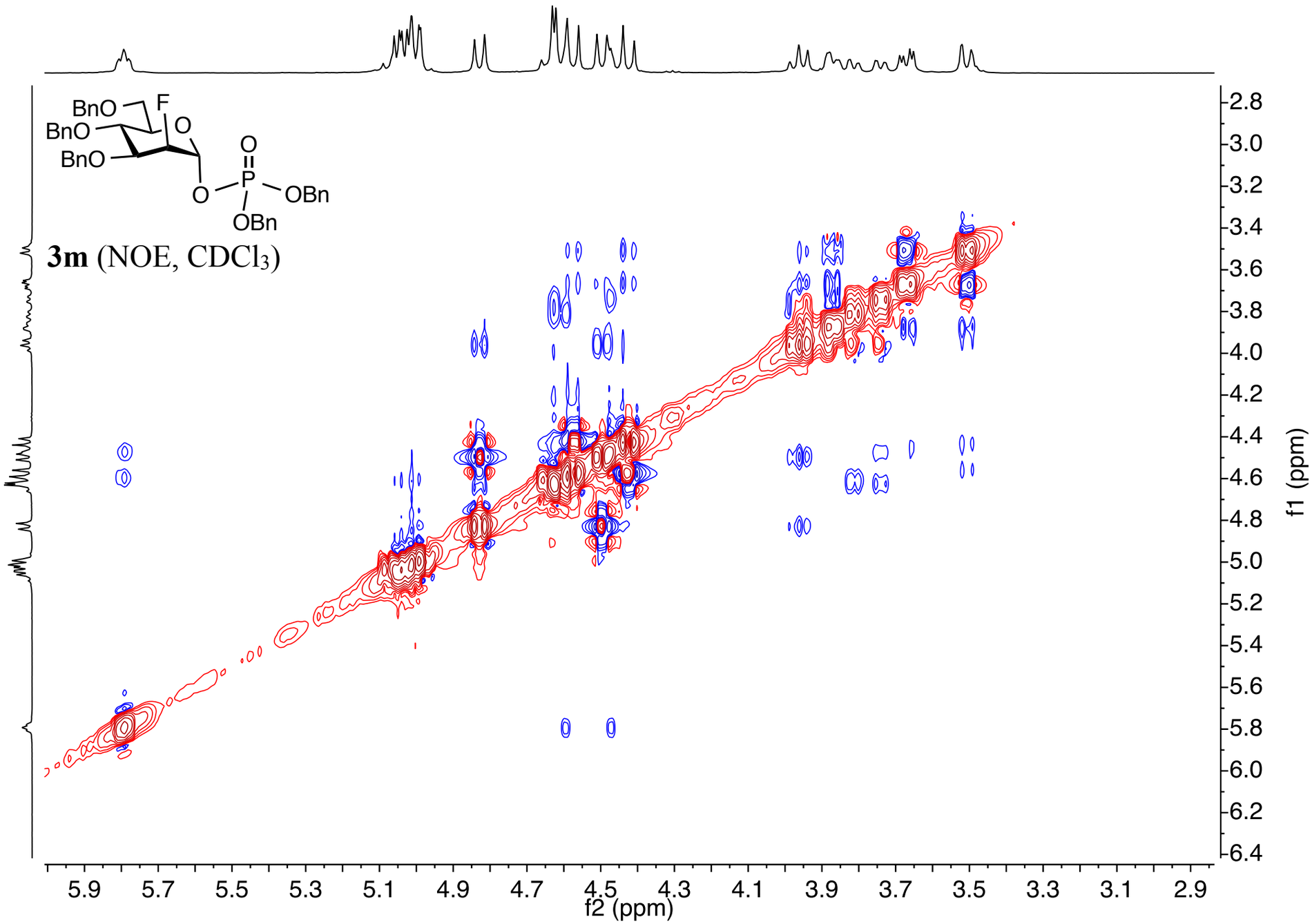


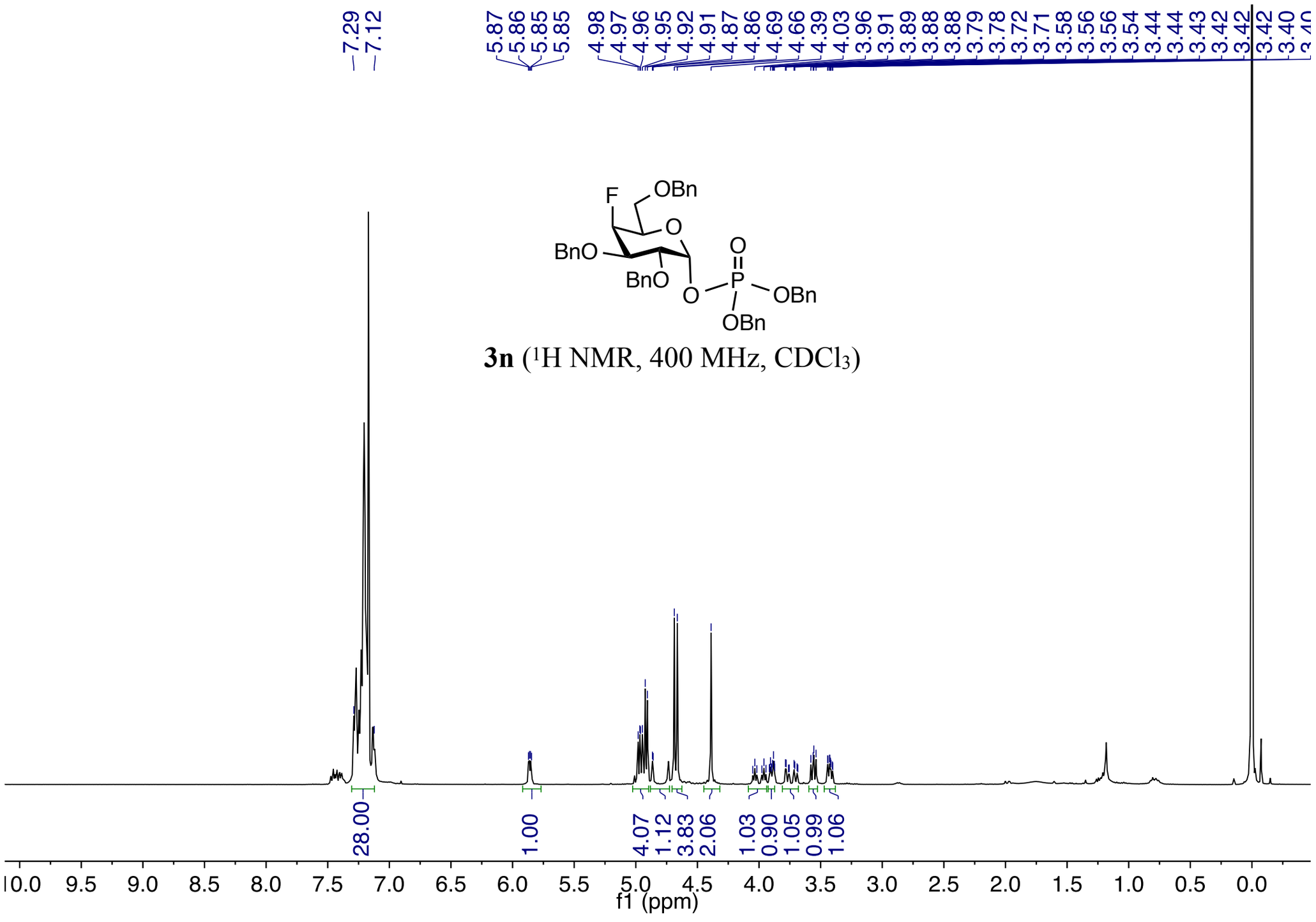
3m (^{19}F NMR, 377 MHz, $CDCl_3$)




BnO
BnO
BnO
F
O
O
P
O
OBn
OBn
3m (gCOSY, CDCl3)
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)


BnO
BnO
BnO
F
O
O
P
O
OBn
OBn
3m (gHSQC, CDCl3)
65
70
75
80
85
90
95
100
f1 (ppm)
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
f2 (ppm)

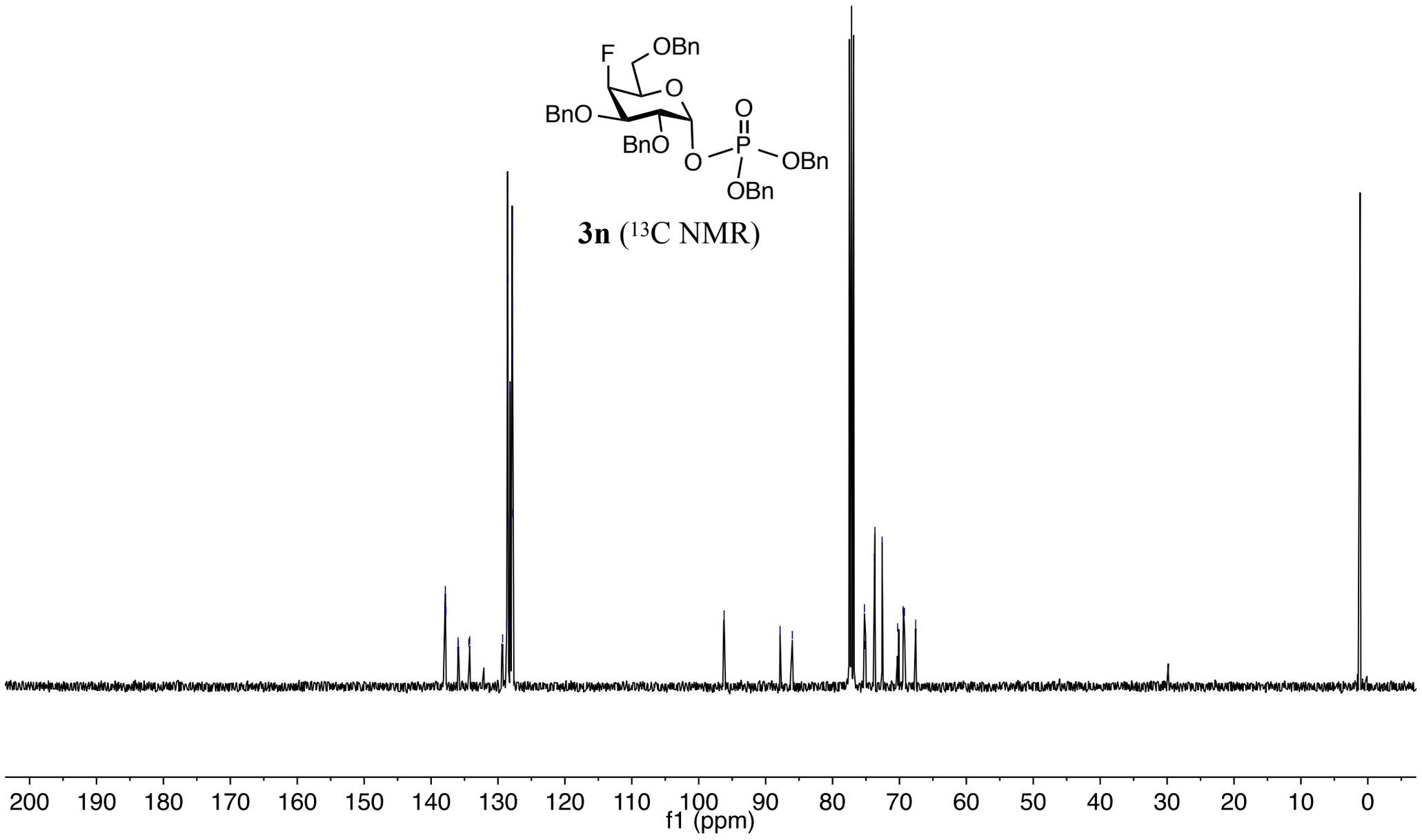

BnO
BnO
BnO
F
O
O
P
O
OBn
OBn
3m (NOE, CDCl3)
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
f1 (ppm)
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
f2 (ppm)

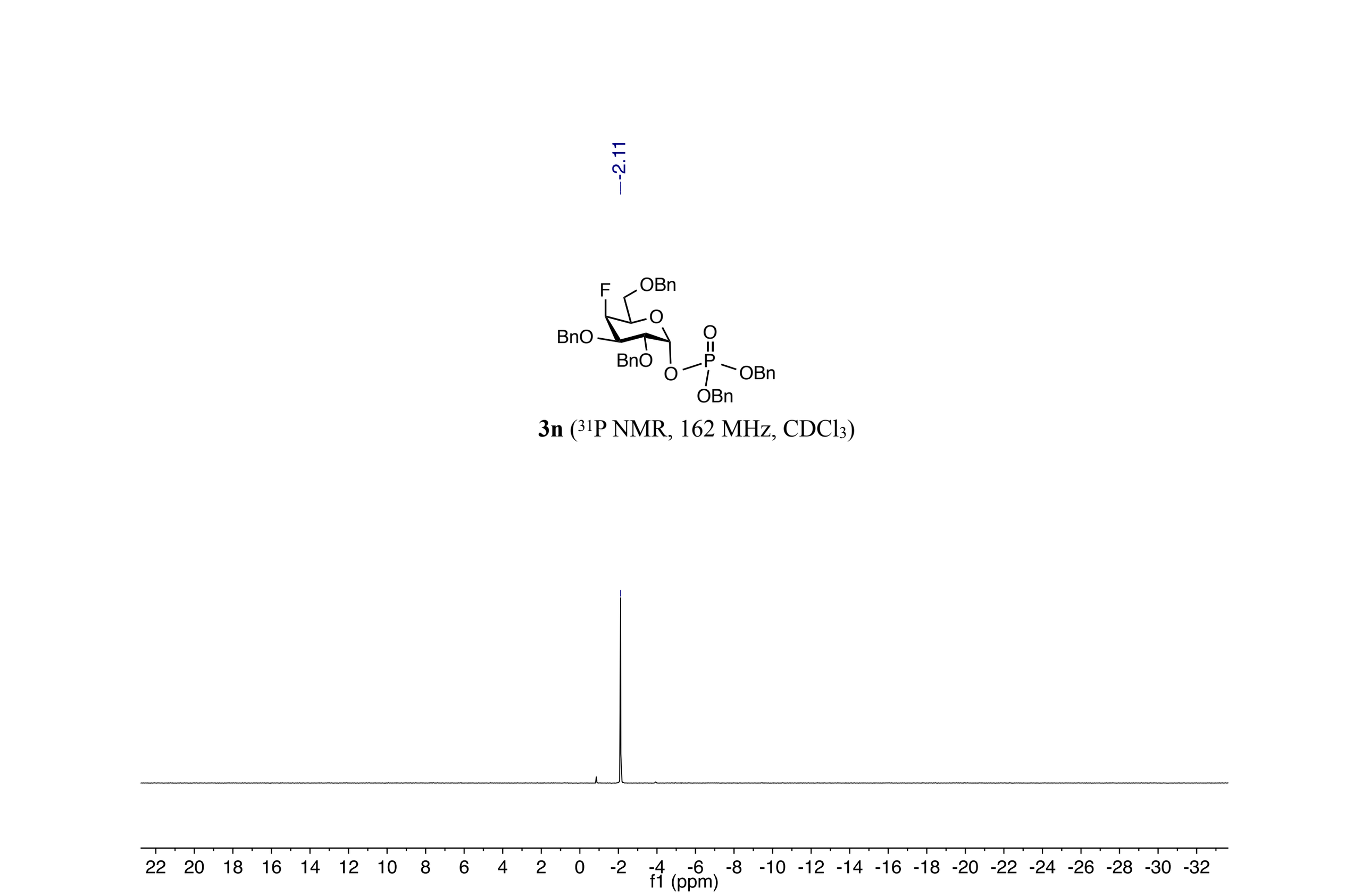


3n (^{1}H NMR, 400 MHz, $CDCl_3$)

137.95
137.87
137.78
135.97
135.94
135.89
135.86
134.36
134.22
129.43
129.31
128.68
128.63
128.57
128.56
128.52
128.46
128.19
128.07
127.97
127.94
127.89
127.87
127.84
96.20
87.83
86.01
75.23
75.13
73.75
73.67
72.60
70.28
69.46
69.25
67.58

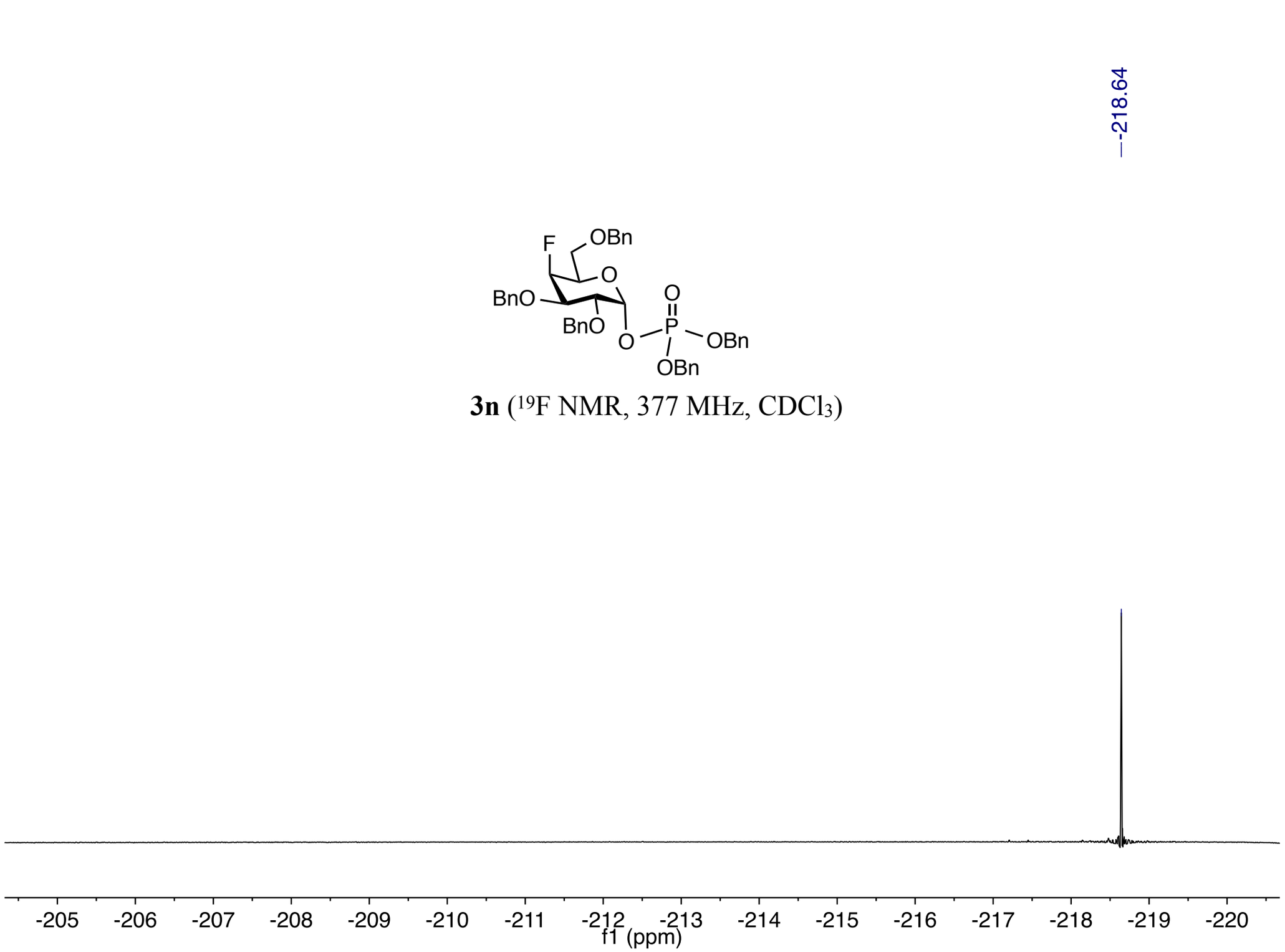
3n (^{13}C NMR)

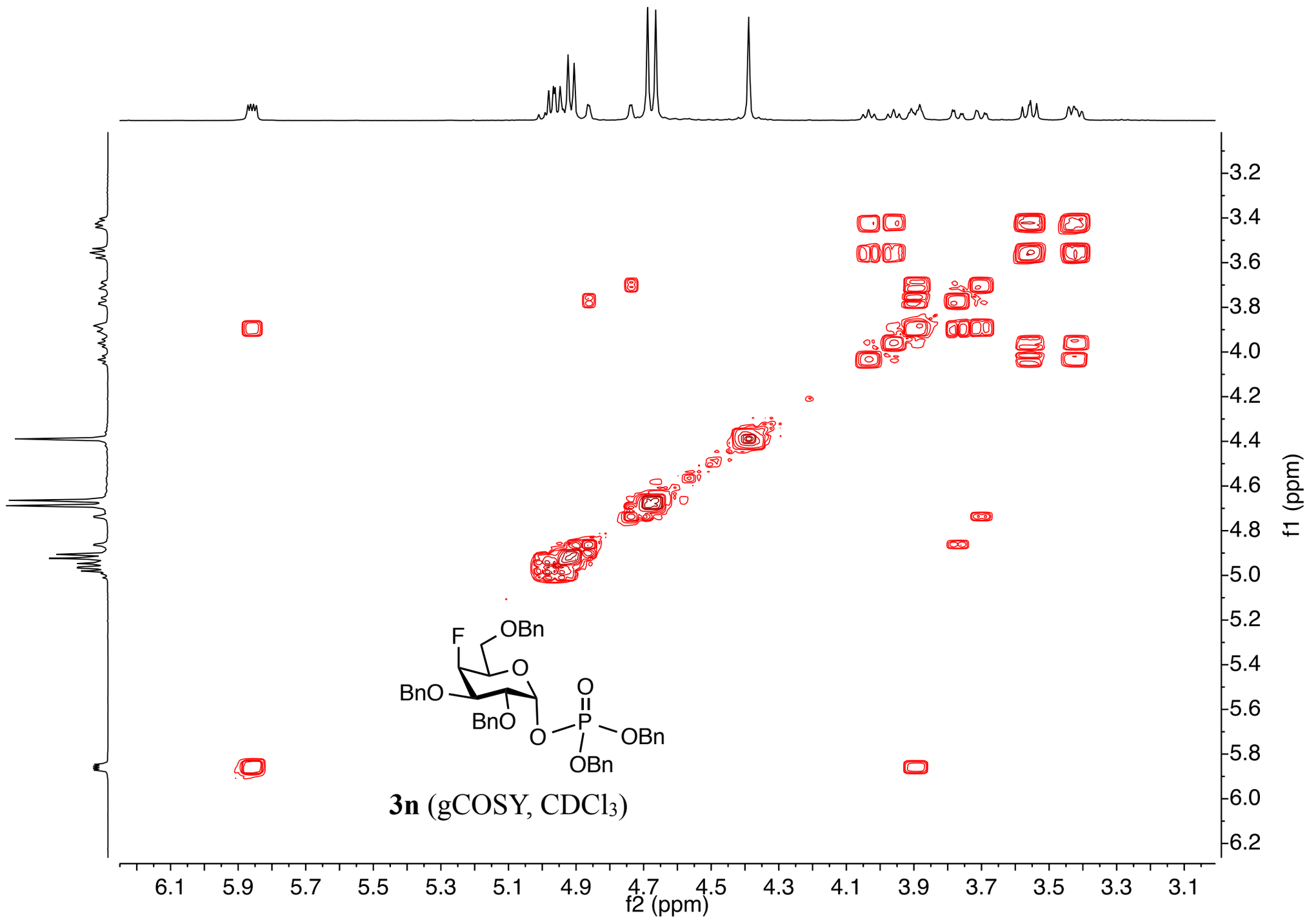




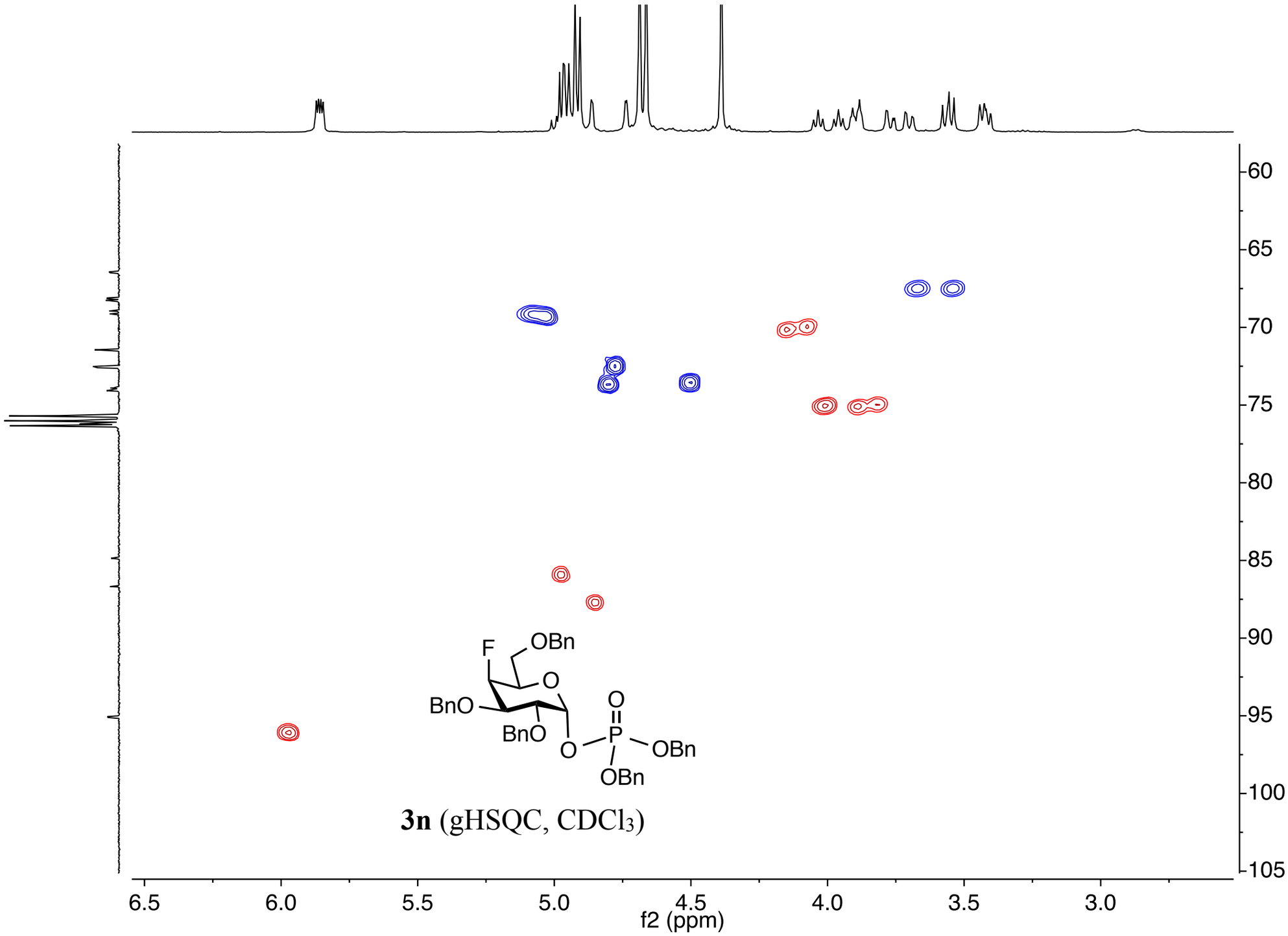
3n (^{31}P NMR, 162 MHz, $CDCl_3$)

3n (^{19}F NMR, 377 MHz, $CDCl_3$)

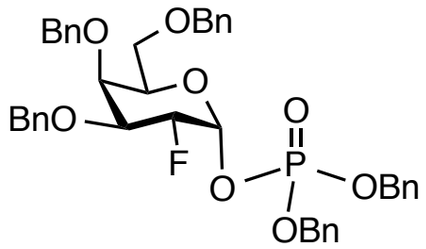




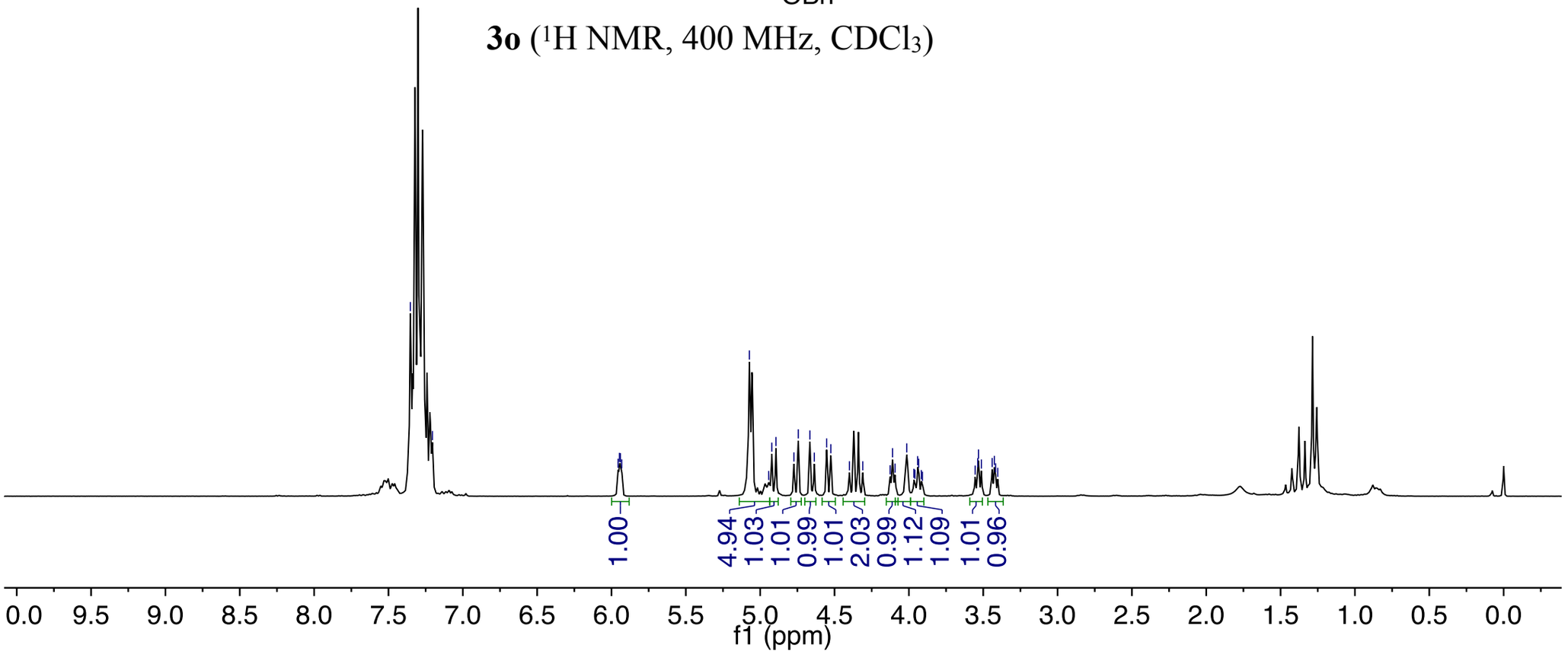
3n (gCOSY, $CDCl_3$)

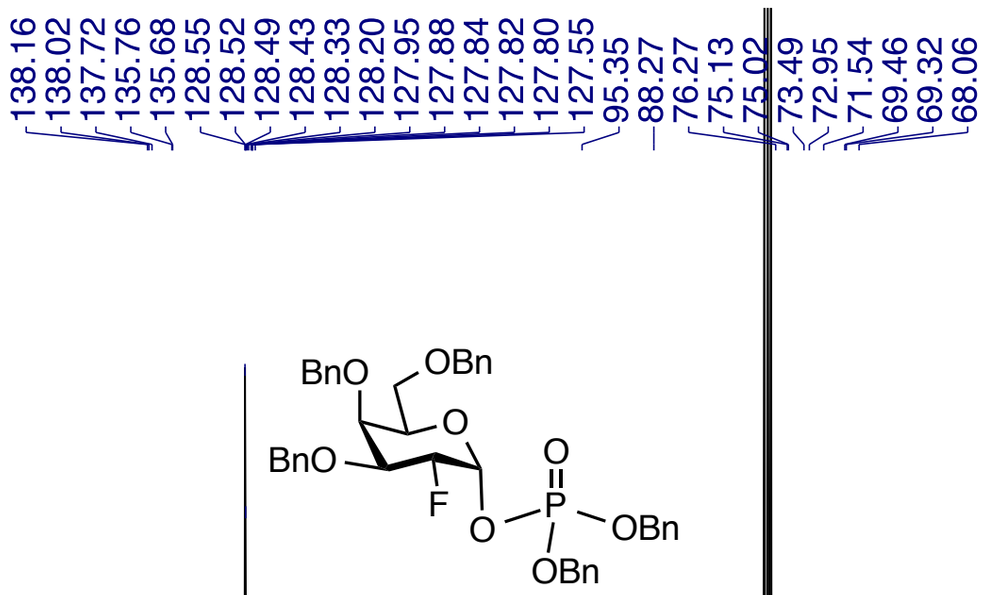


3n (gHSQC, $CDCl_3$)

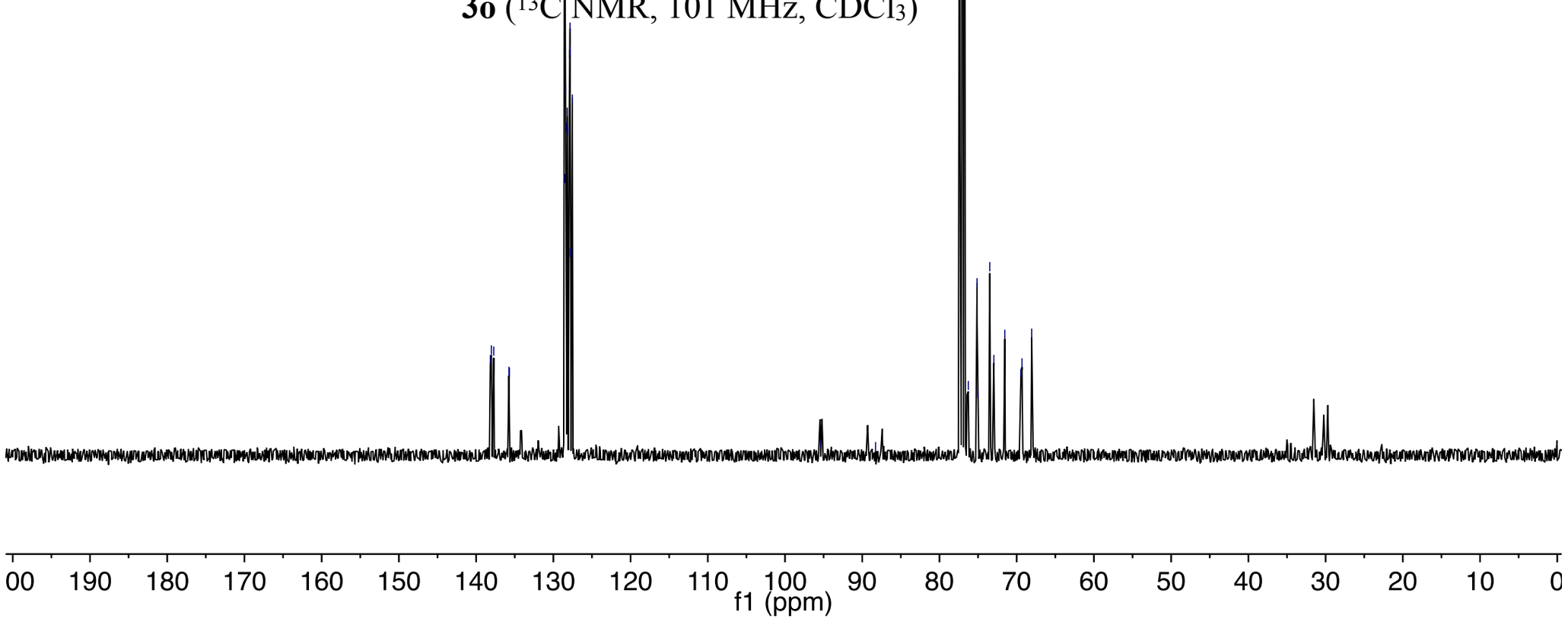


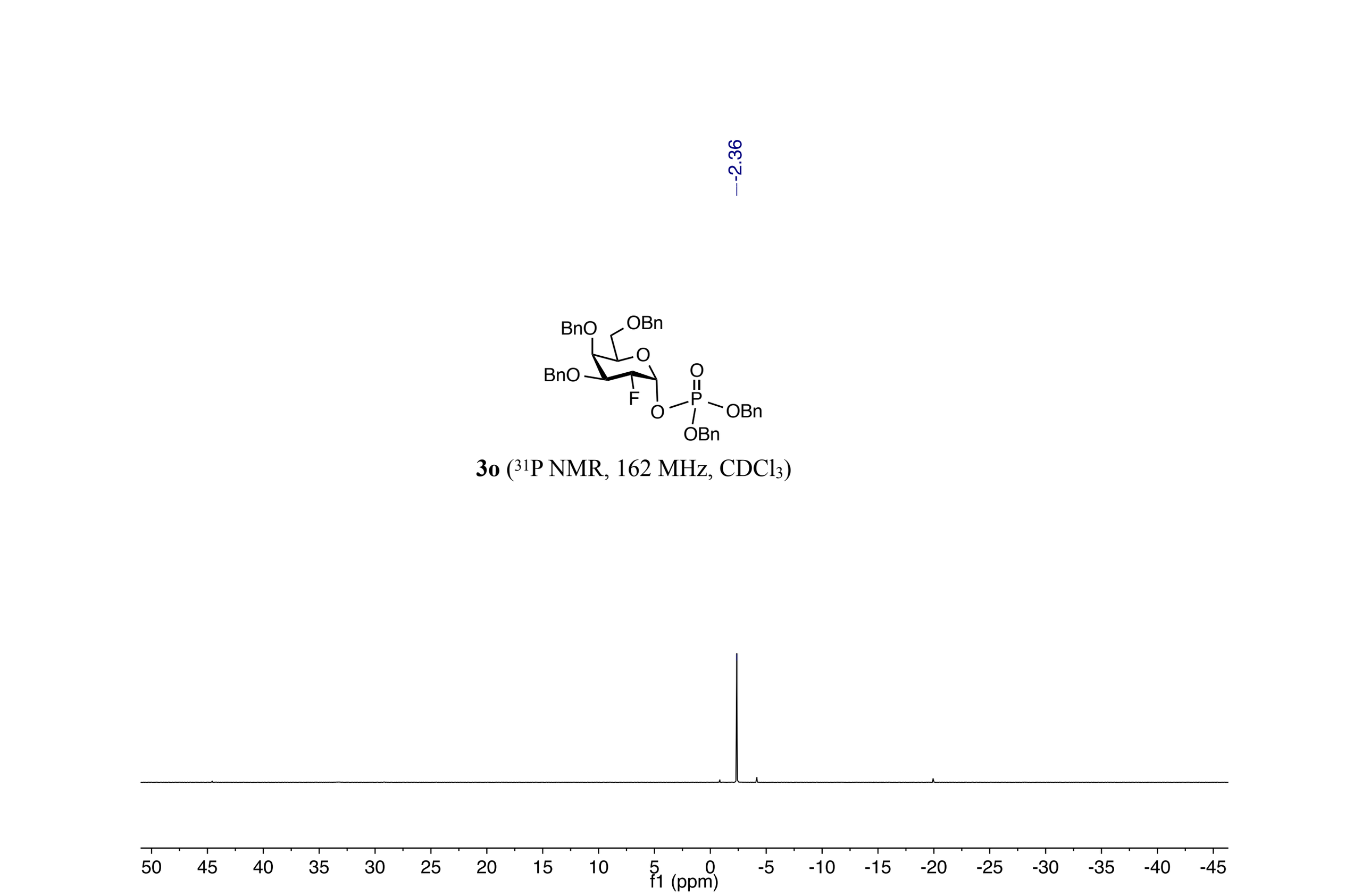
3o (^{1}H NMR, 400 MHz, $CDCl_3$)





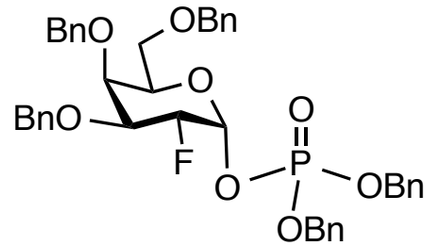
3o (^{13}C NMR, 101 MHz, $CDCl_3$)



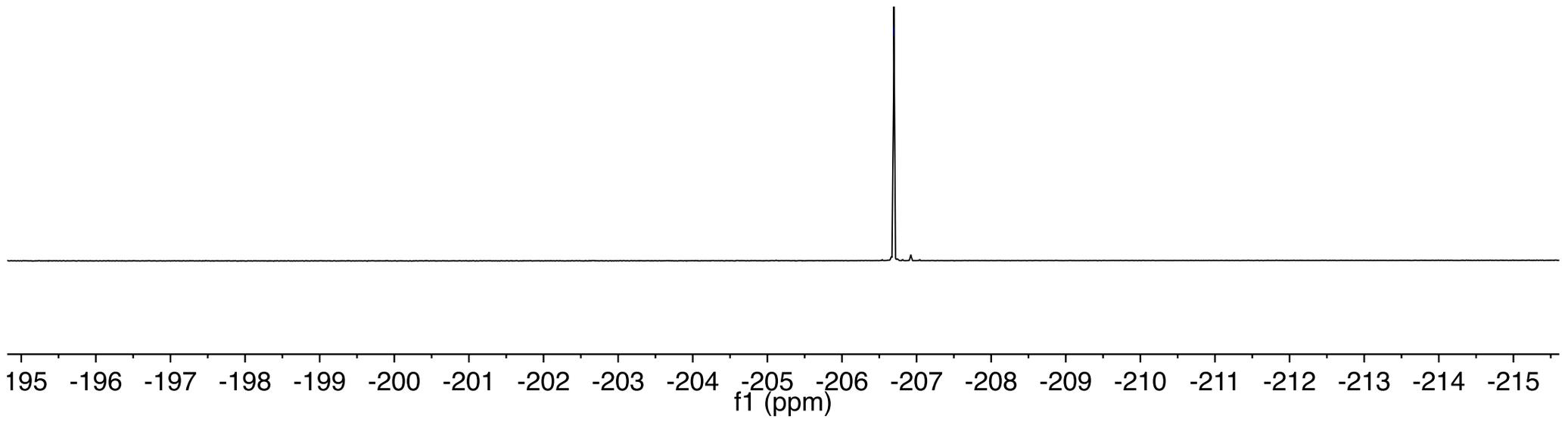


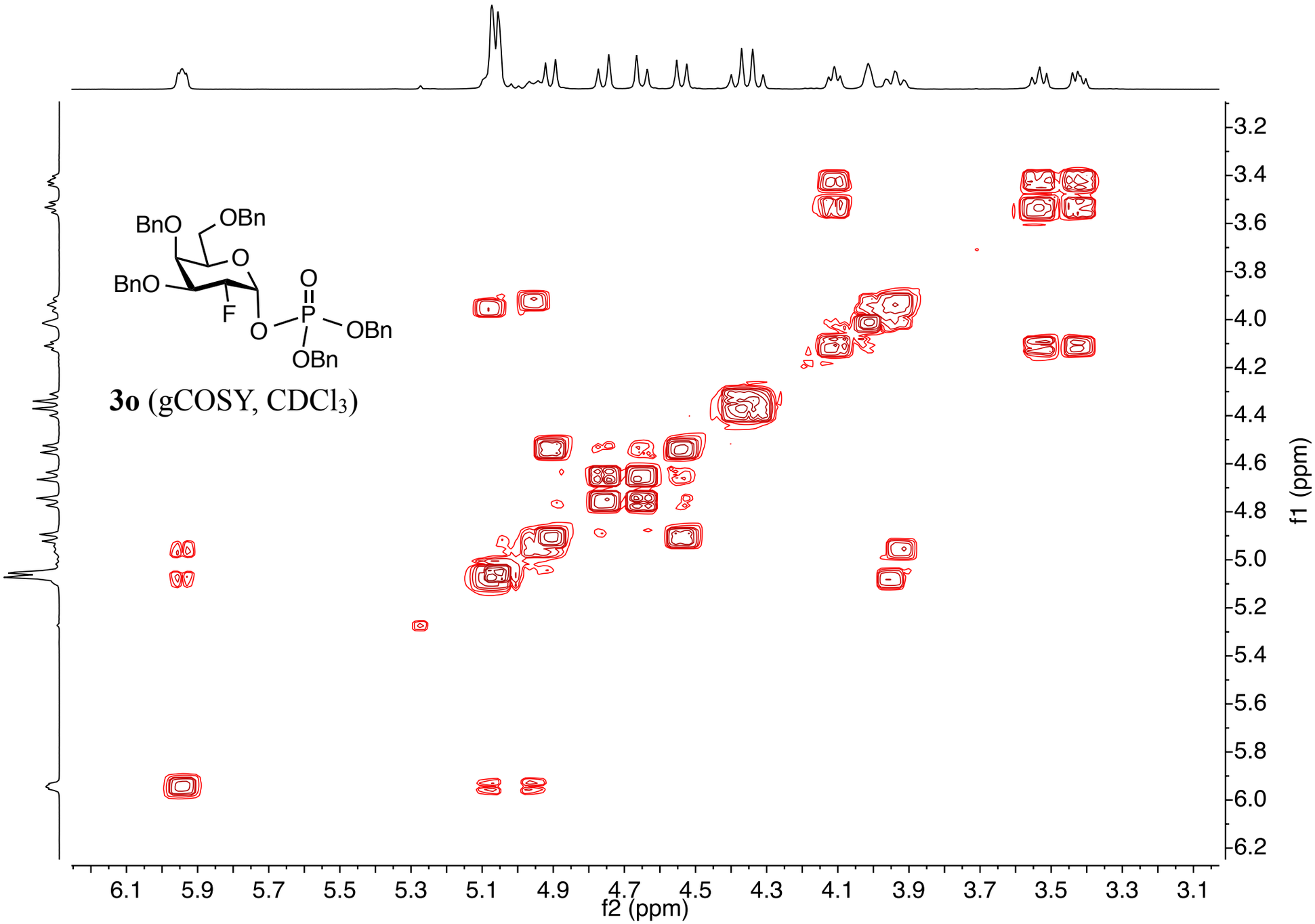
3o (^{31}P NMR, 162 MHz, $CDCl_3$)

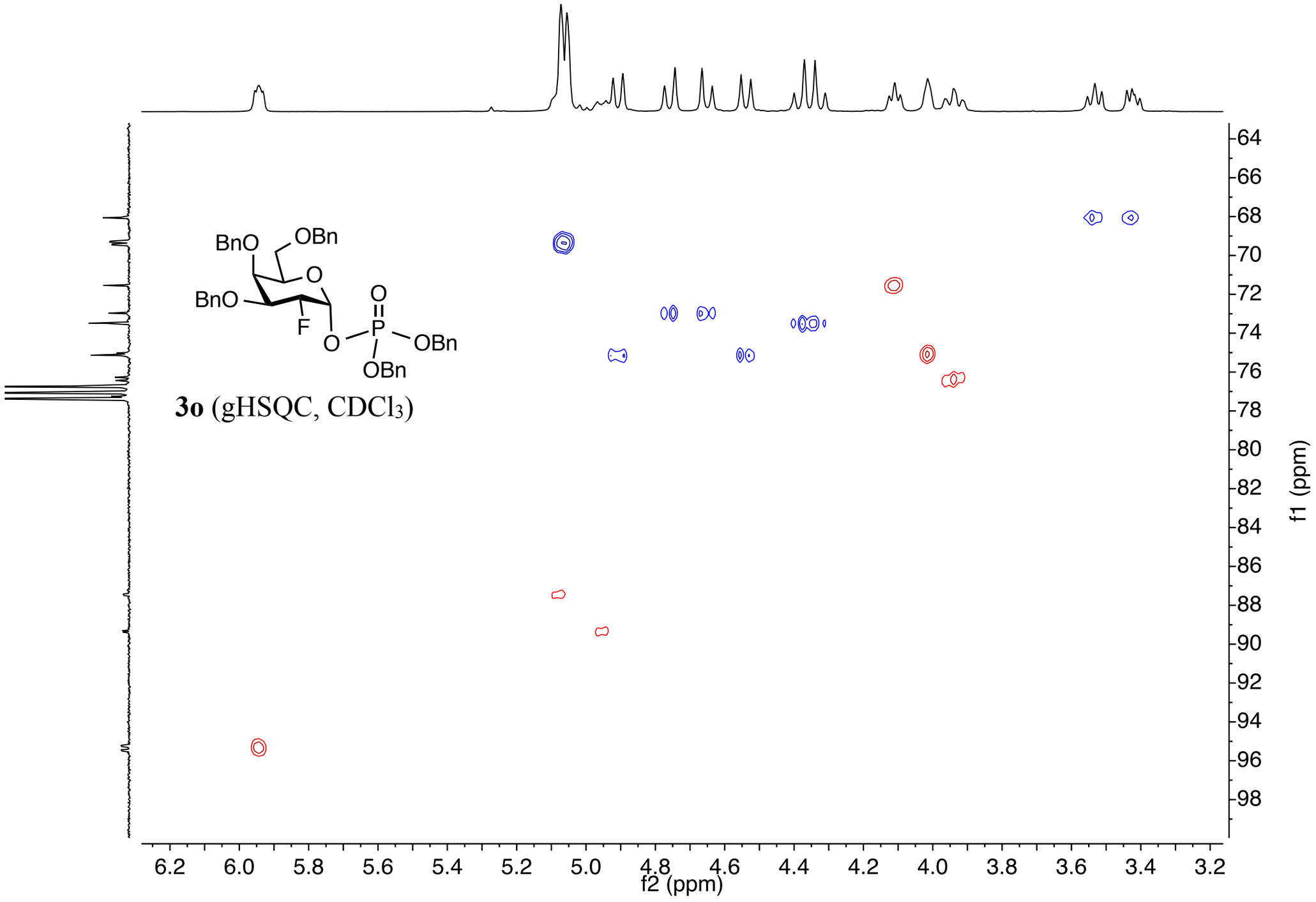
-206.69

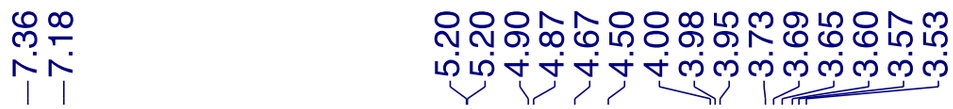


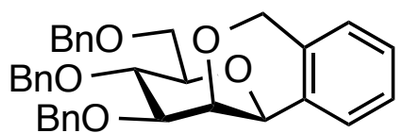
3o (^{19}F NMR, 377 MHz, $CDCl_3$)



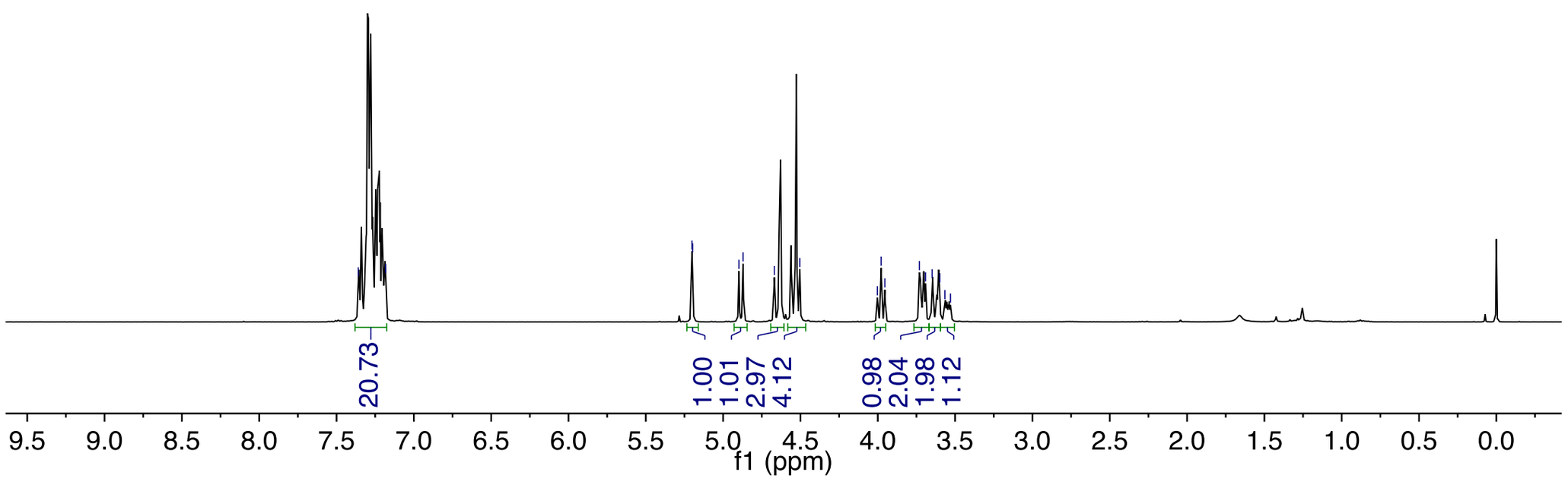

BnO
OBn
O
BnO
F
O
P
O
OBn
OBn
3o (gCOSY, CDCl3)
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
f1 (ppm)
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
f2 (ppm)

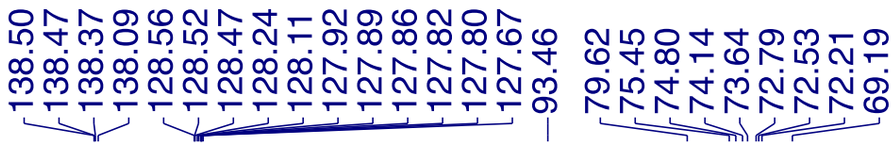

BnO
OBn
O
BnO
F
O
P
O
OBn
OBn
3o (gHSQC, CDCl3)
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)



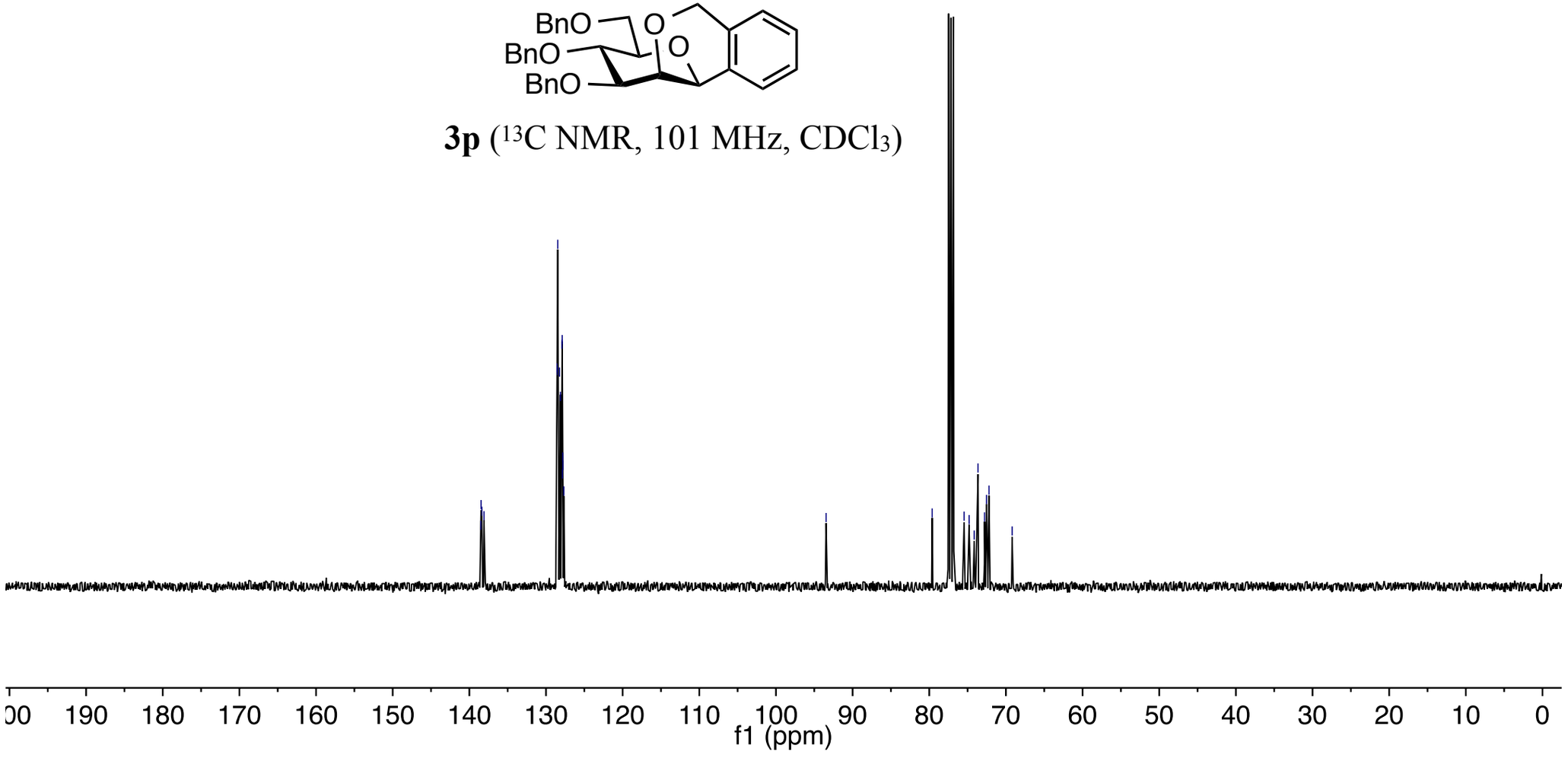


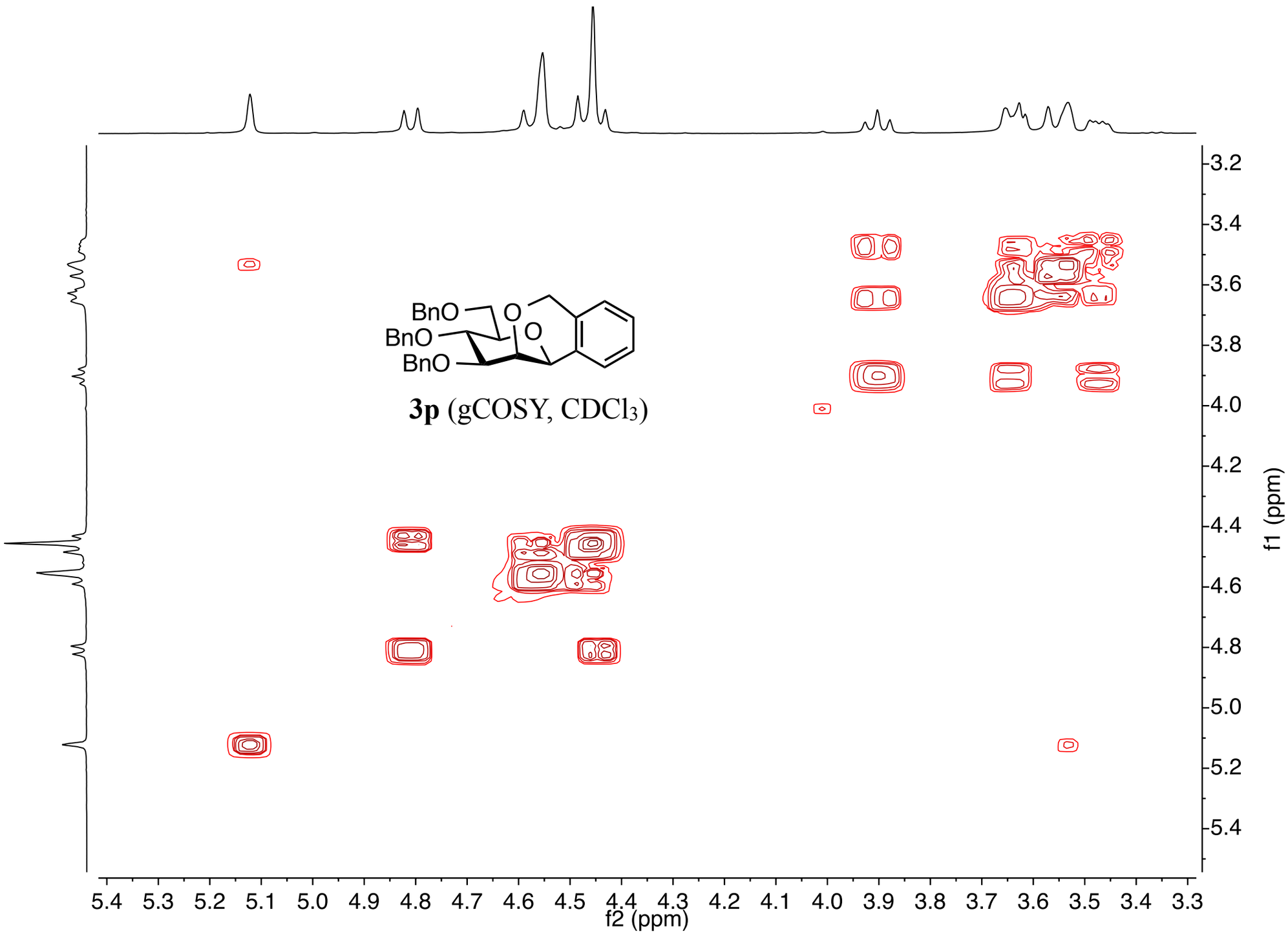
3p (^{1}H NMR, 400 MHz, $CDCl_3$)



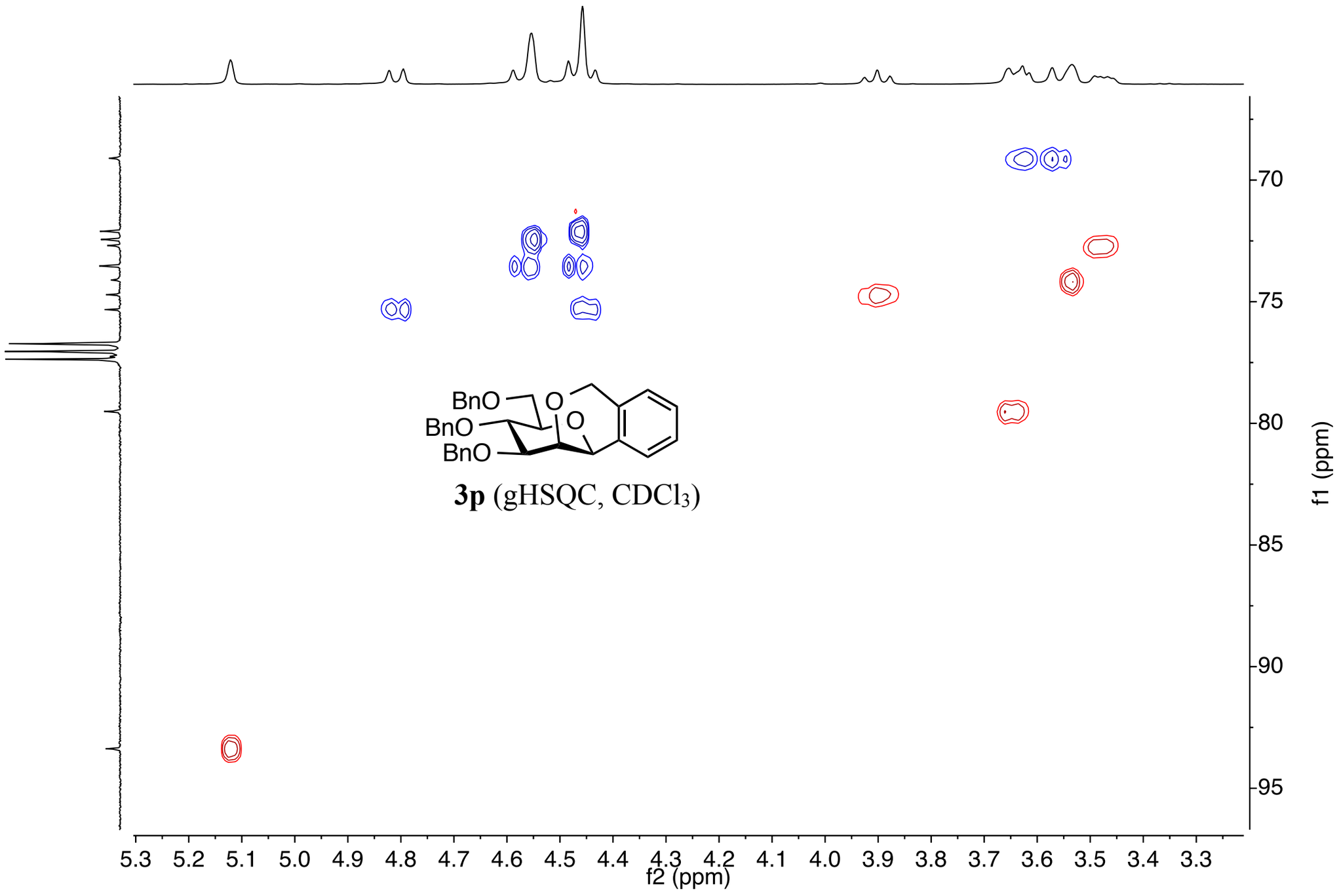


3p (^{13}C NMR, 101 MHz, $CDCl_3$)

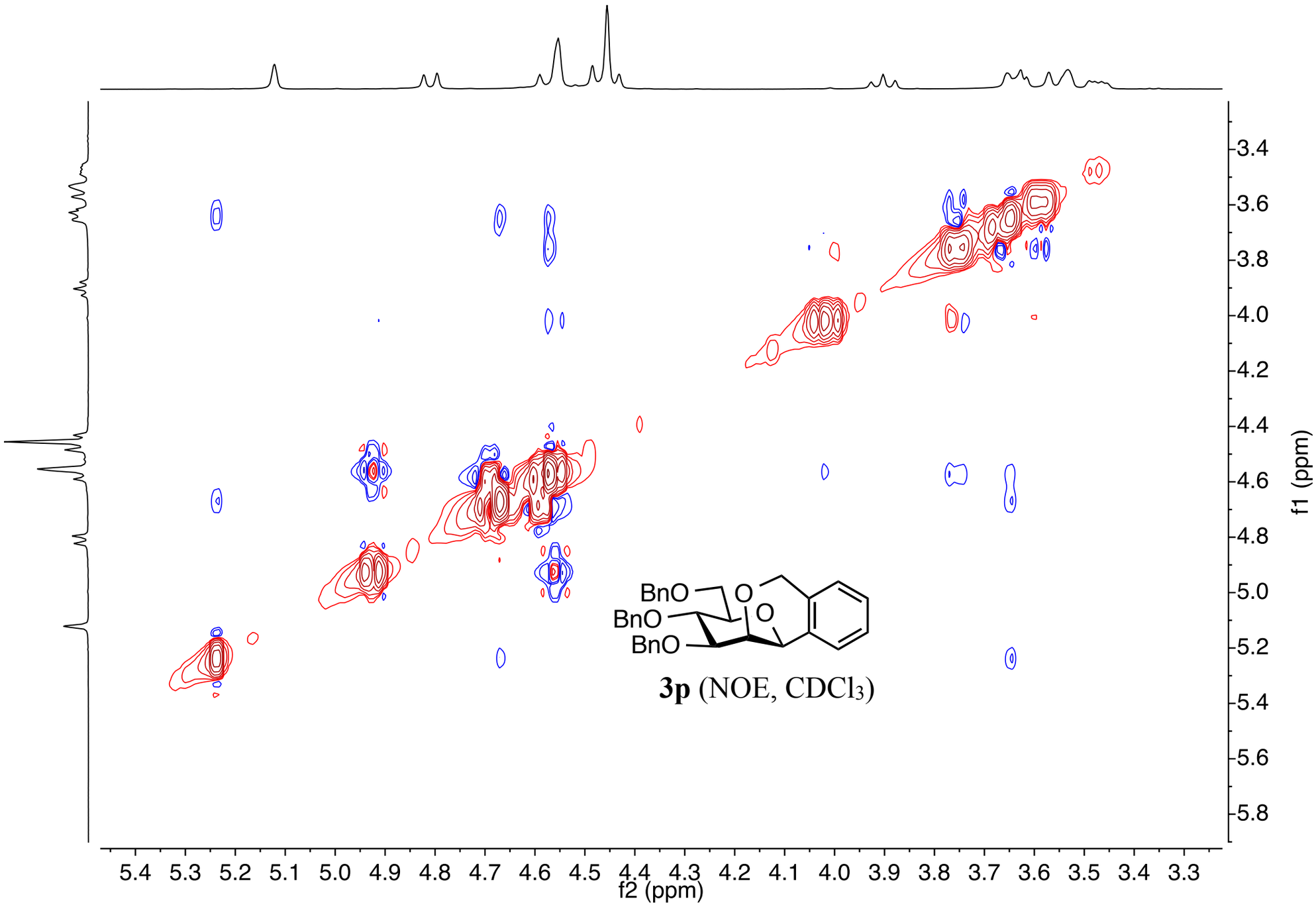




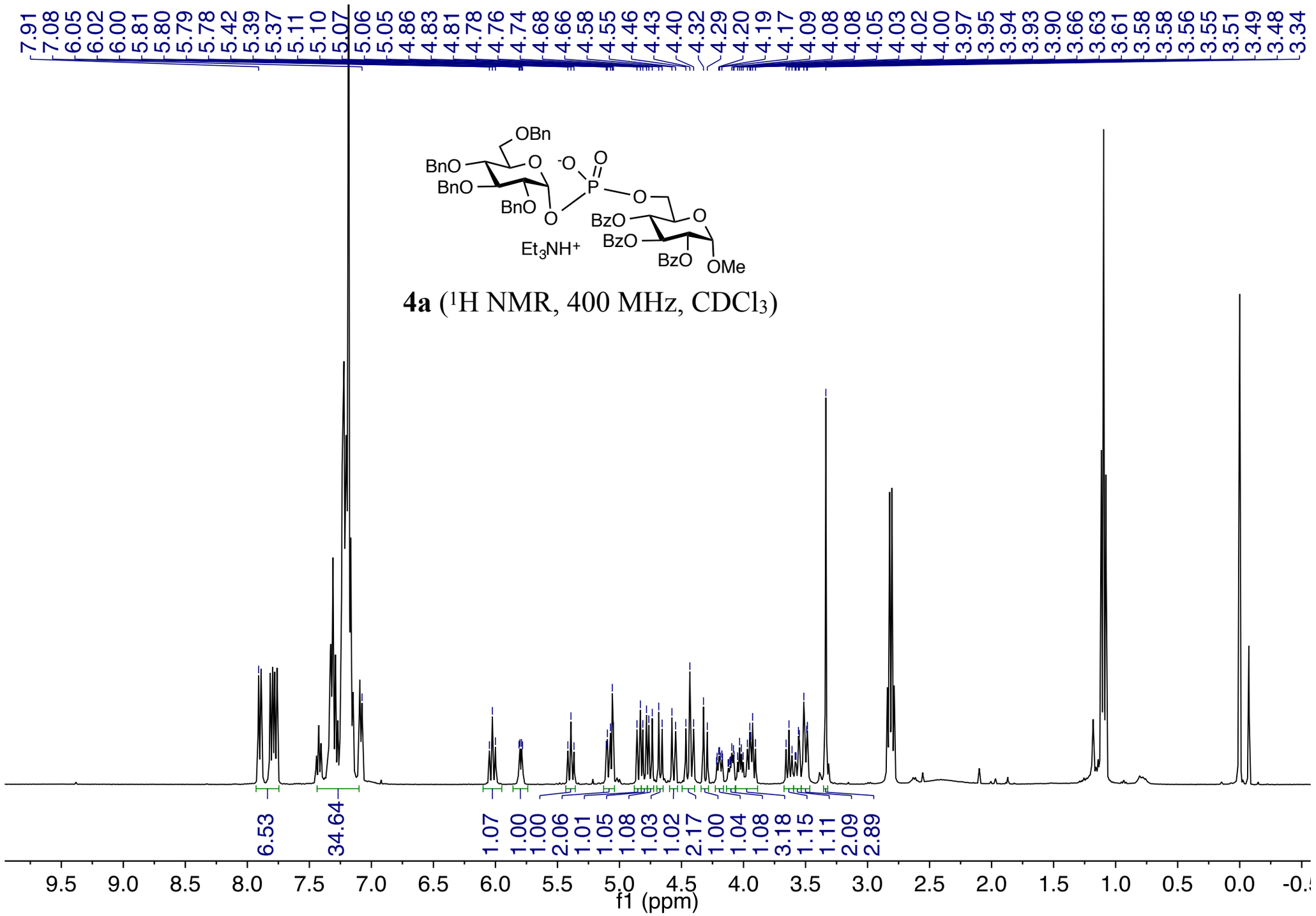
3p (gCOSY, $CDCl_3$)



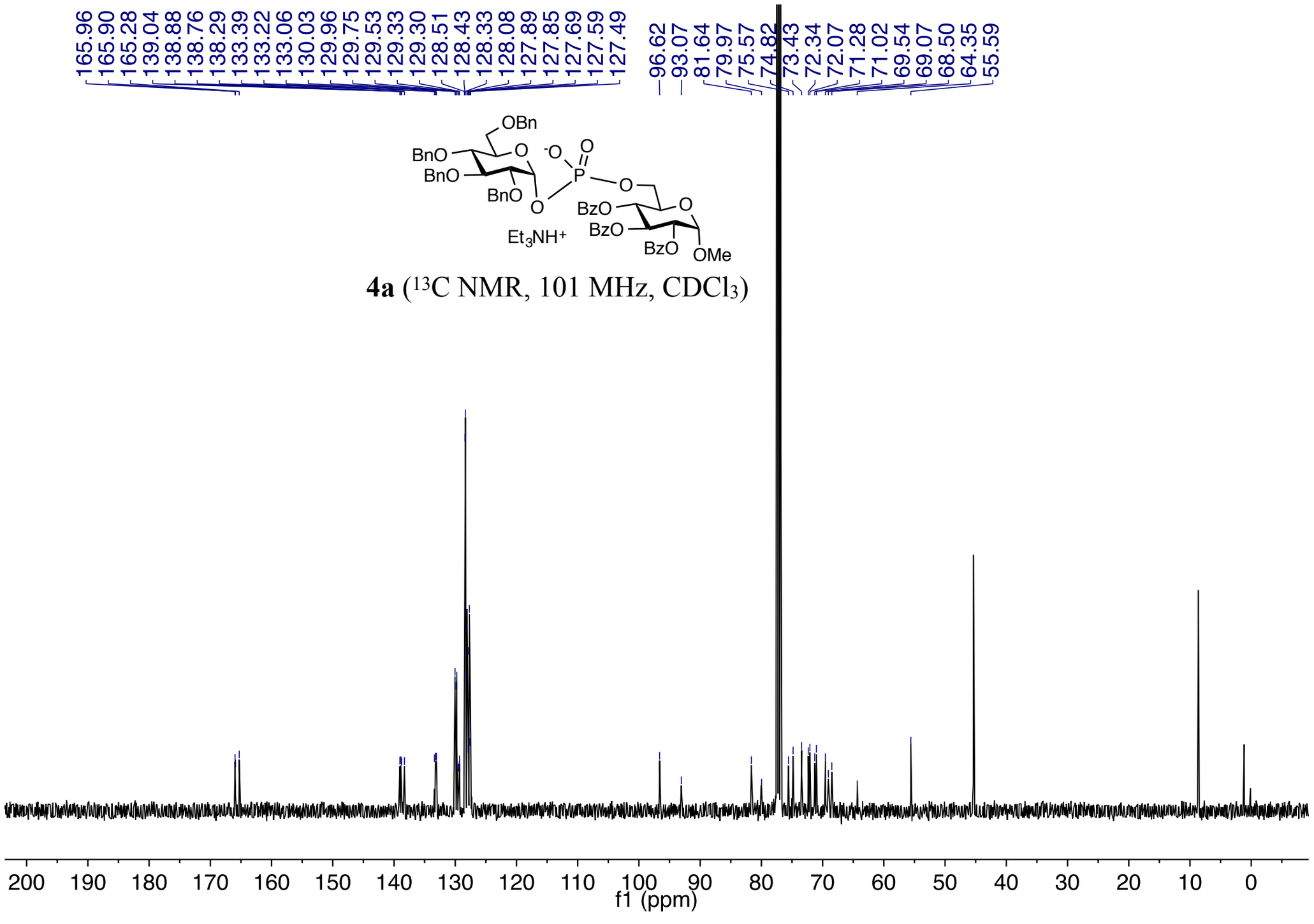
3p (gHSQC, $CDCl_3$)


3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
f1 (ppm)
5.4 5.3 5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3
f2 (ppm)
BnO
BnO
BnO
O
O

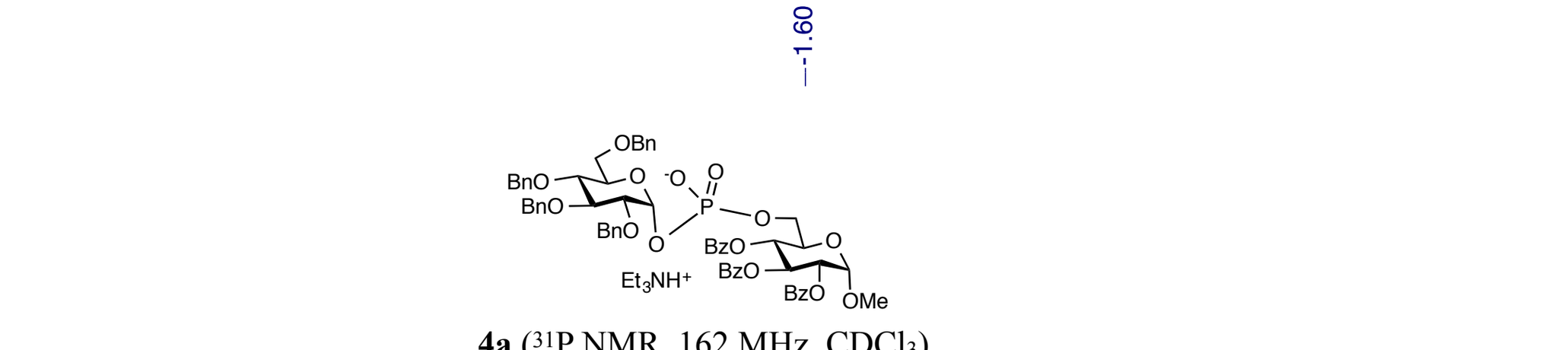
3p (NOE, $CDCl_3$)



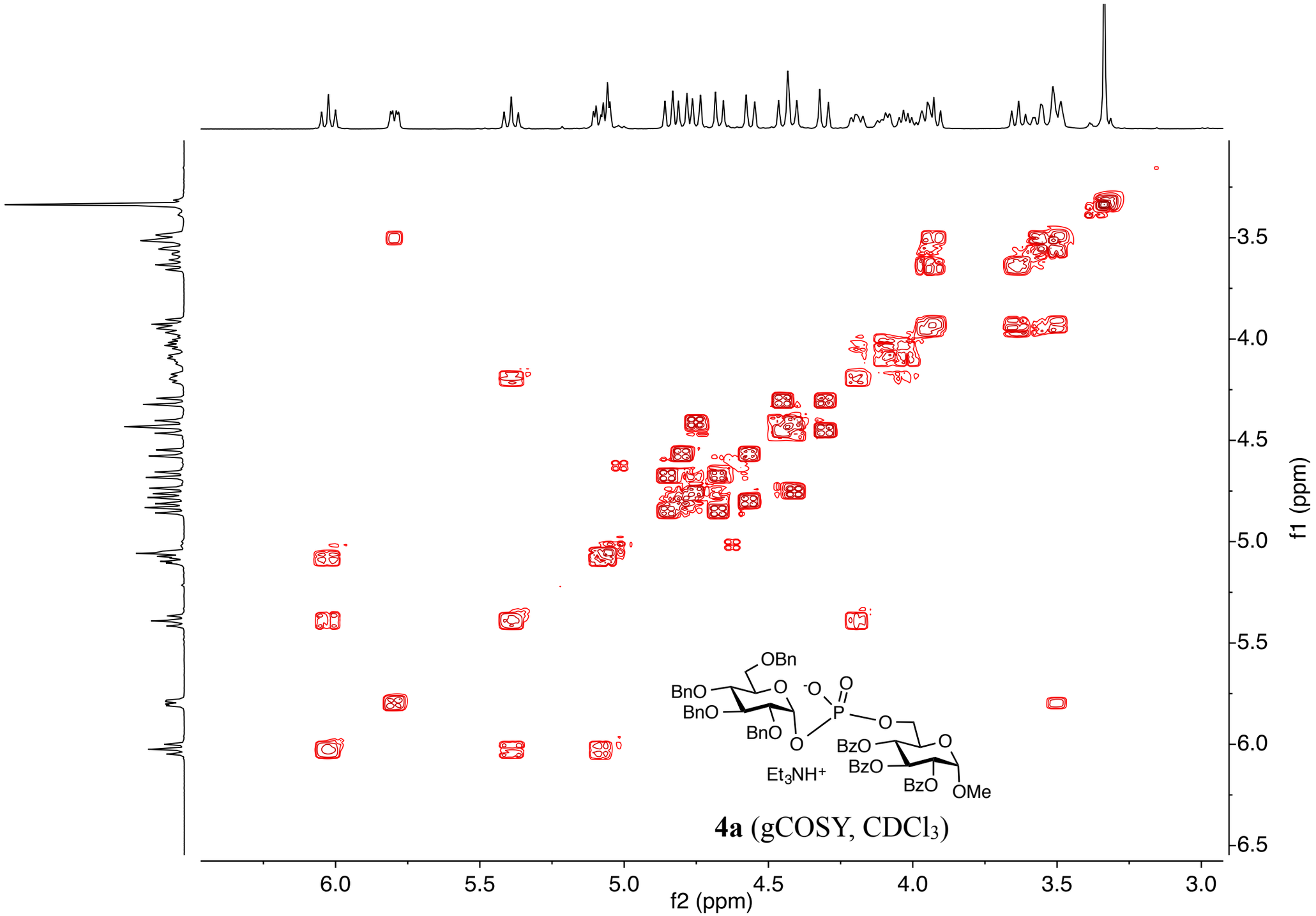
4a (^{1}H NMR, 400 MHz, $CDCl_3$)



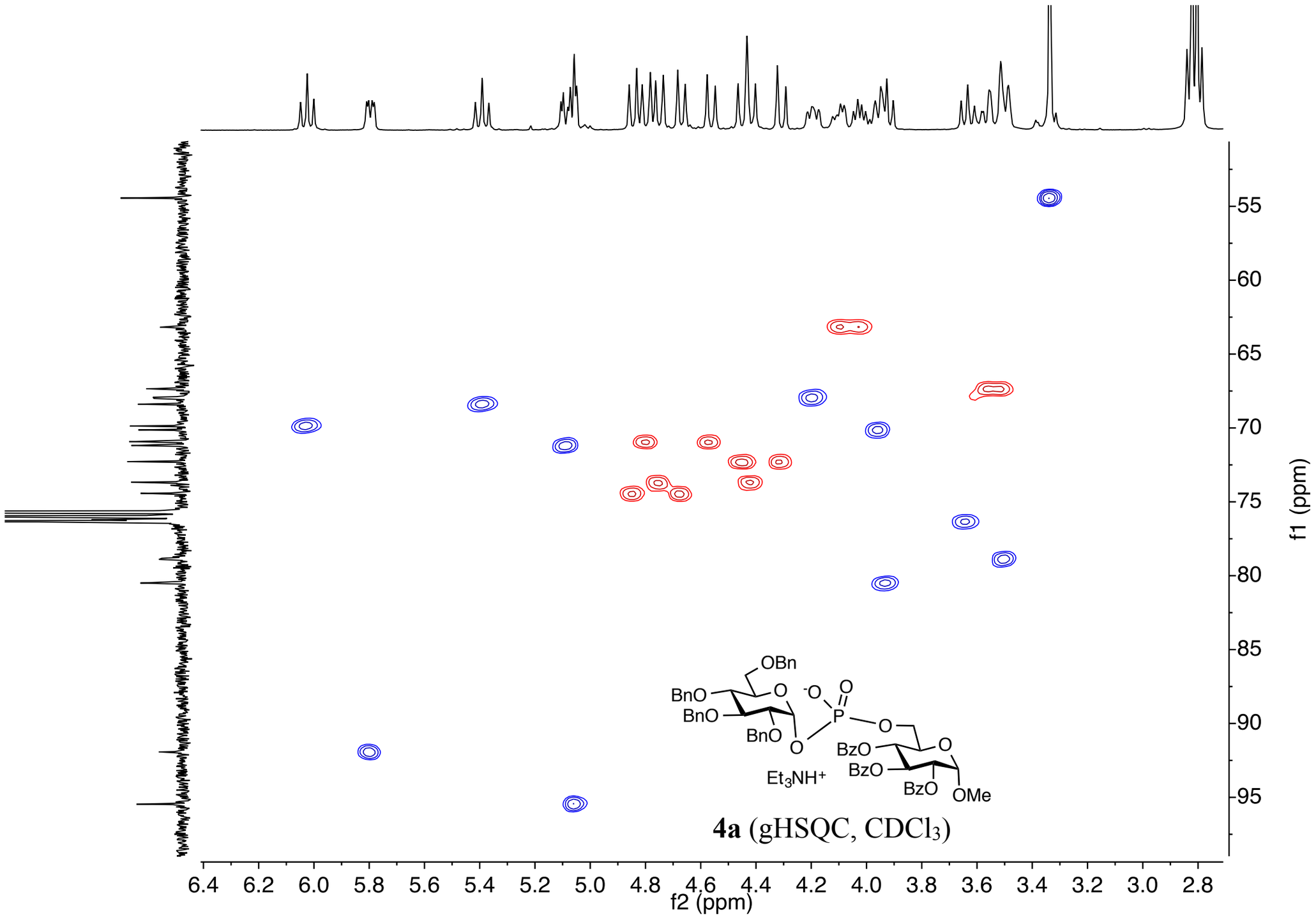
4a (^{13}C NMR, 101 MHz, $CDCl_3$)



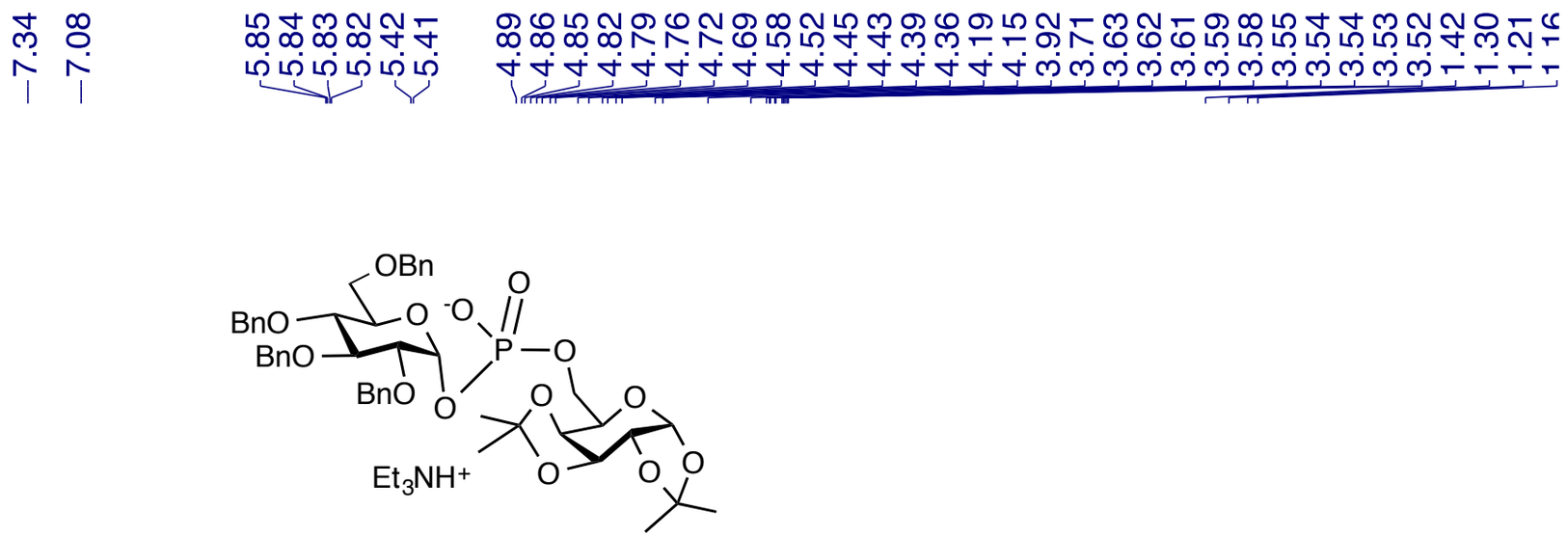
4a (^{31}P NMR, 162 MHz, $CDCl_3$)



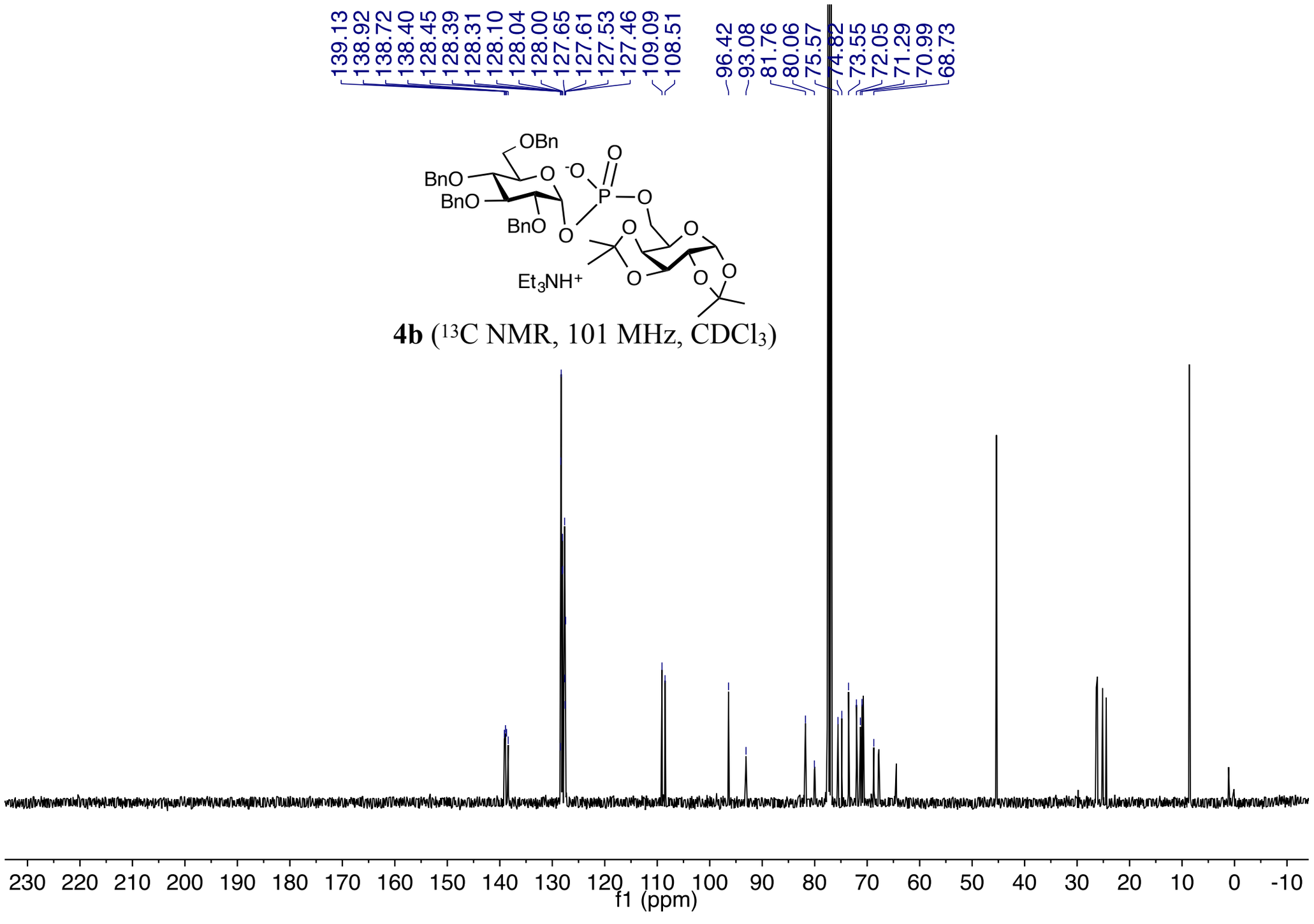
4a (gCOSY, $CDCl_3$)



4a (gHSQC, $CDCl_3$)

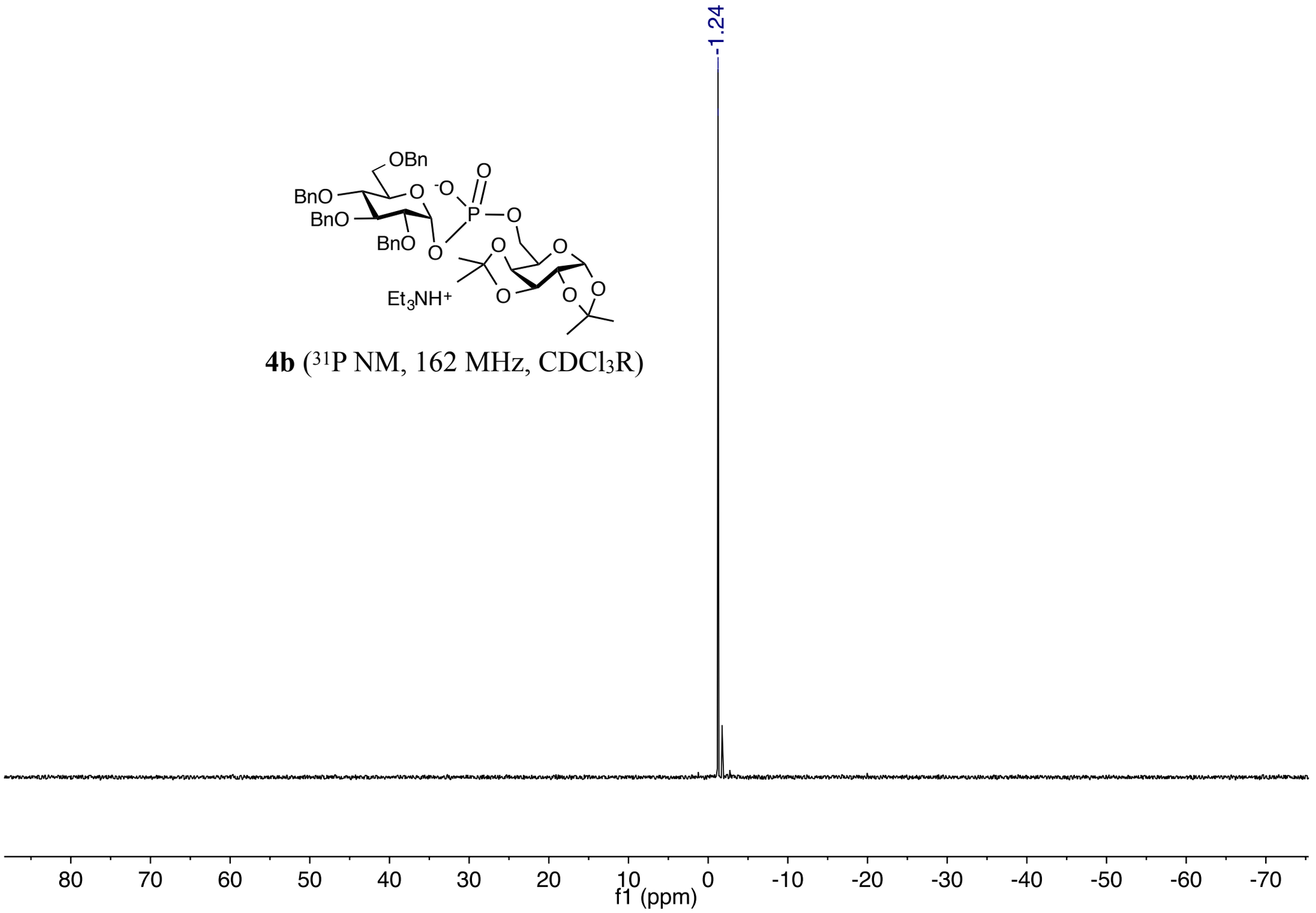


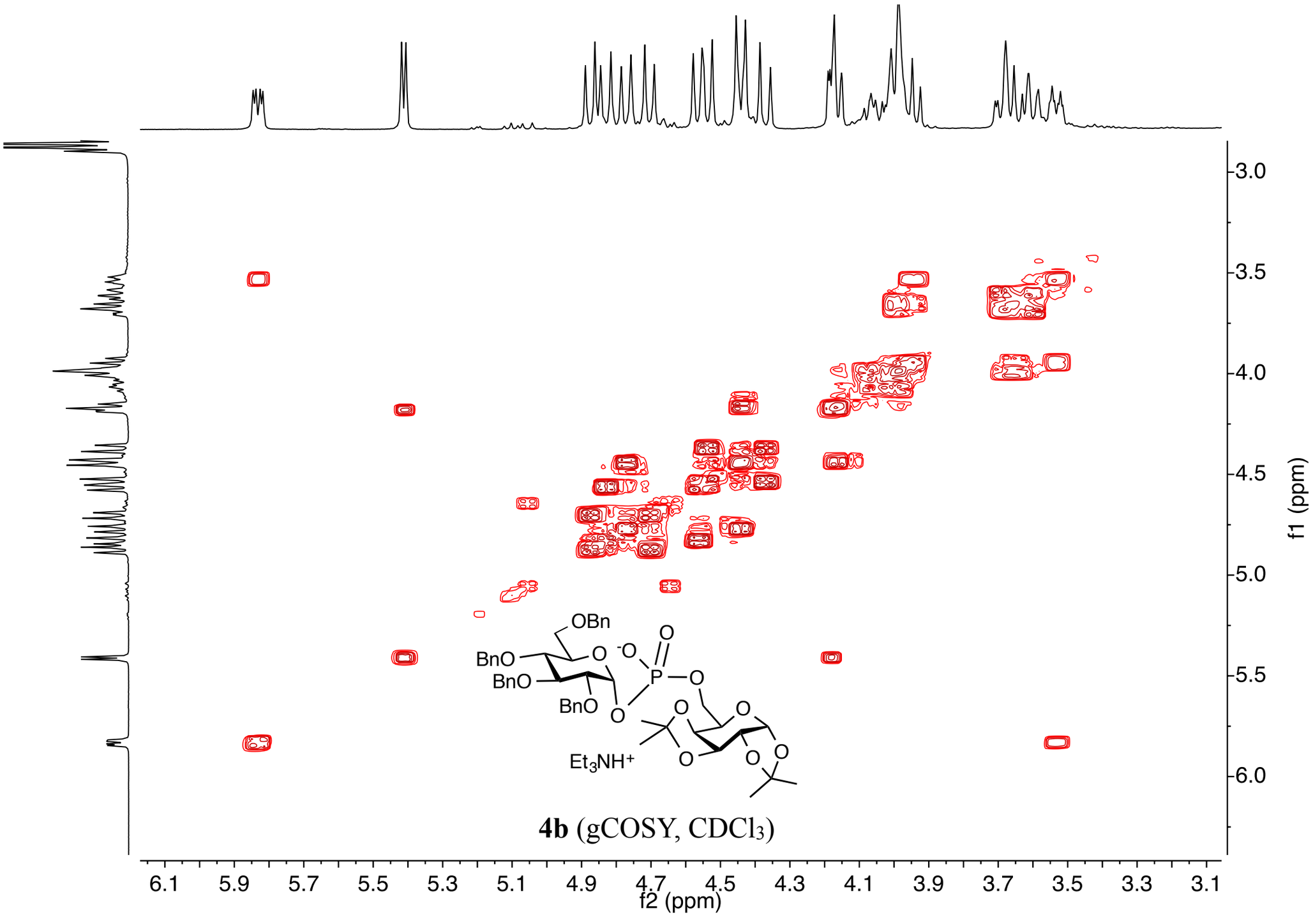
4b (^{1}H NMR, 400 MHz, $CDCl_3$)



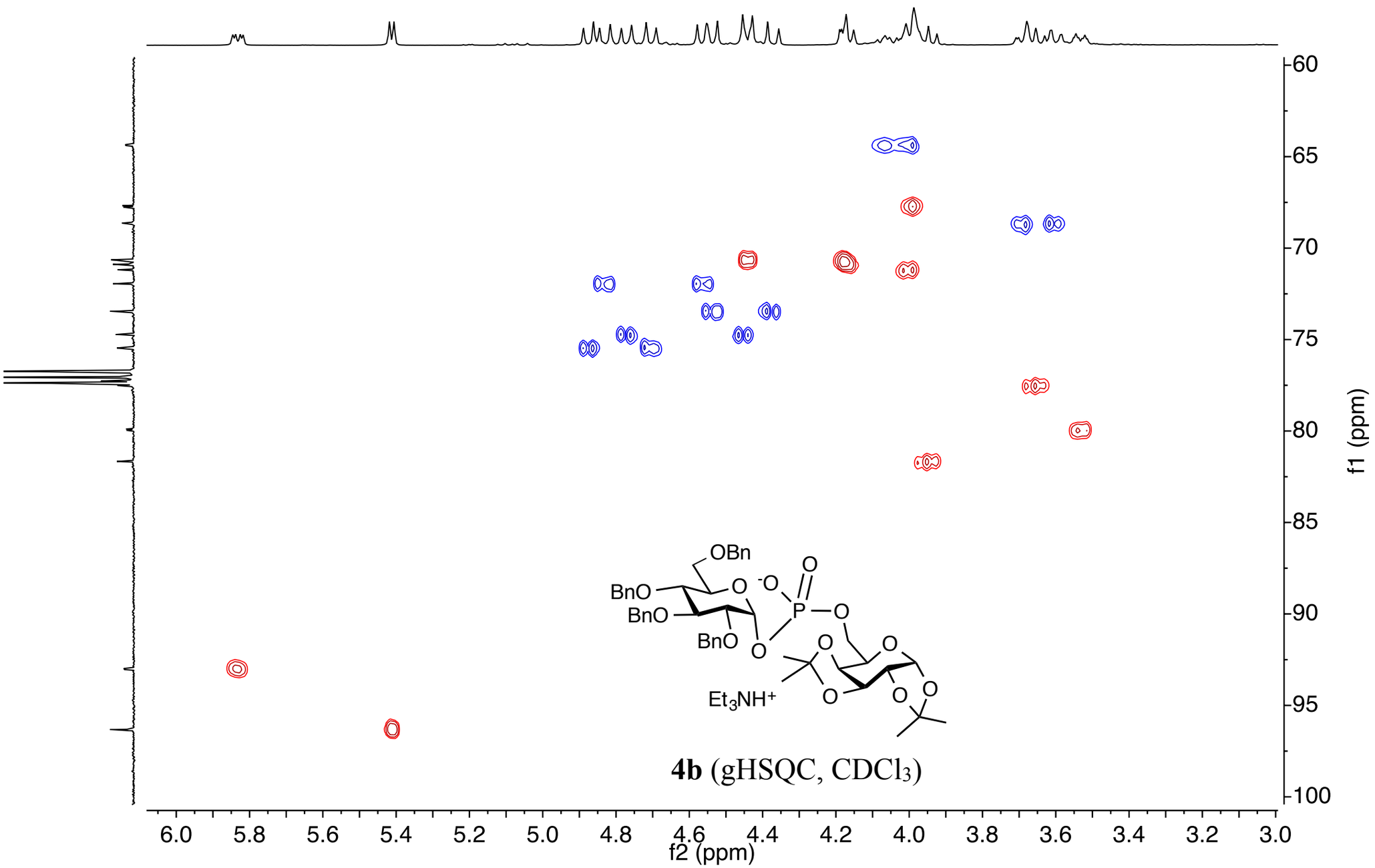
4b (^{13}C NMR, 101 MHz, $CDCl_3$)

4b (^{31}P NM, 162 MHz, $CDCl_3$R)

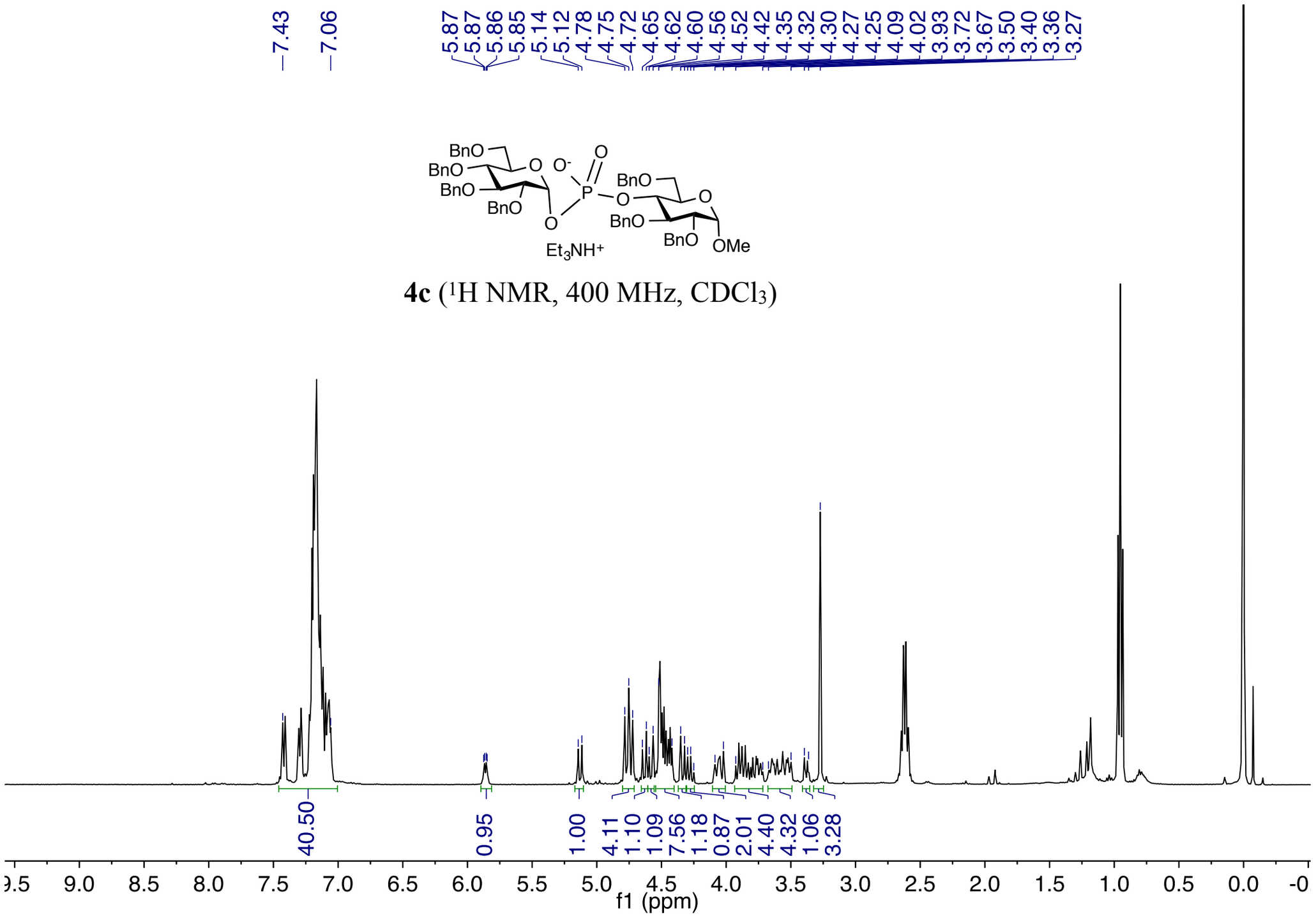




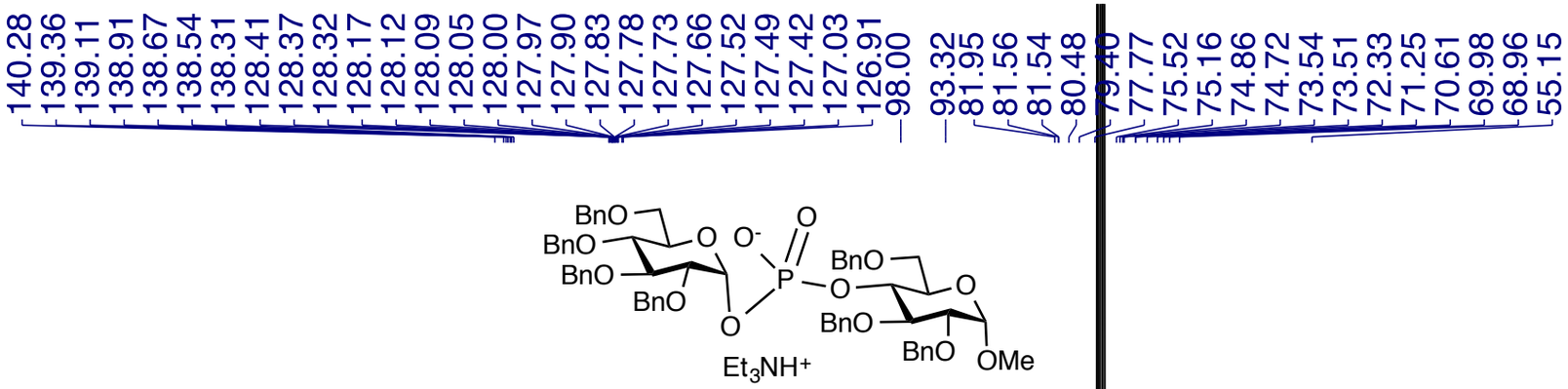
4b (gCOSY, $CDCl_3$)



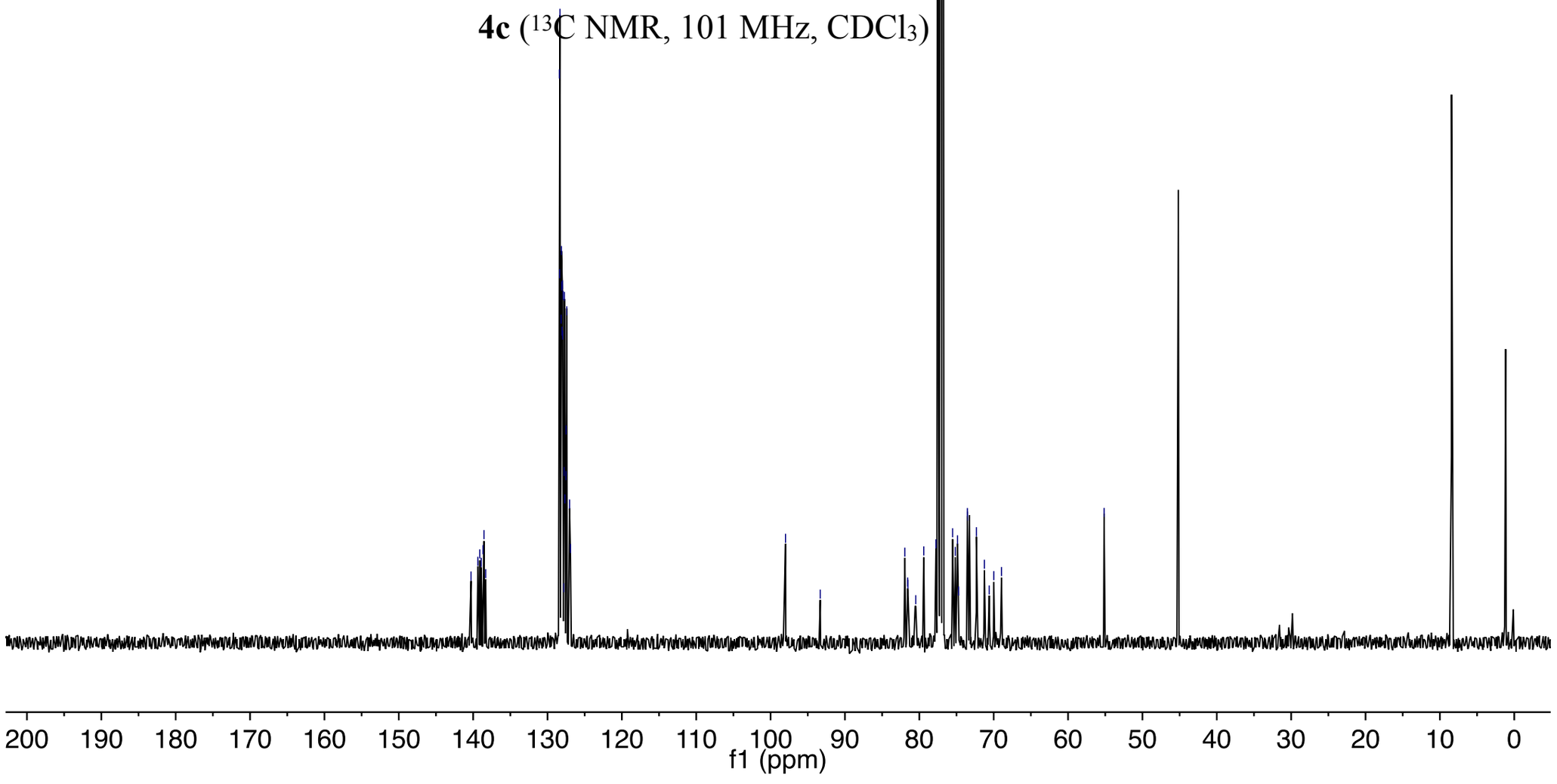
4b (gHSQC, $CDCl_3$)

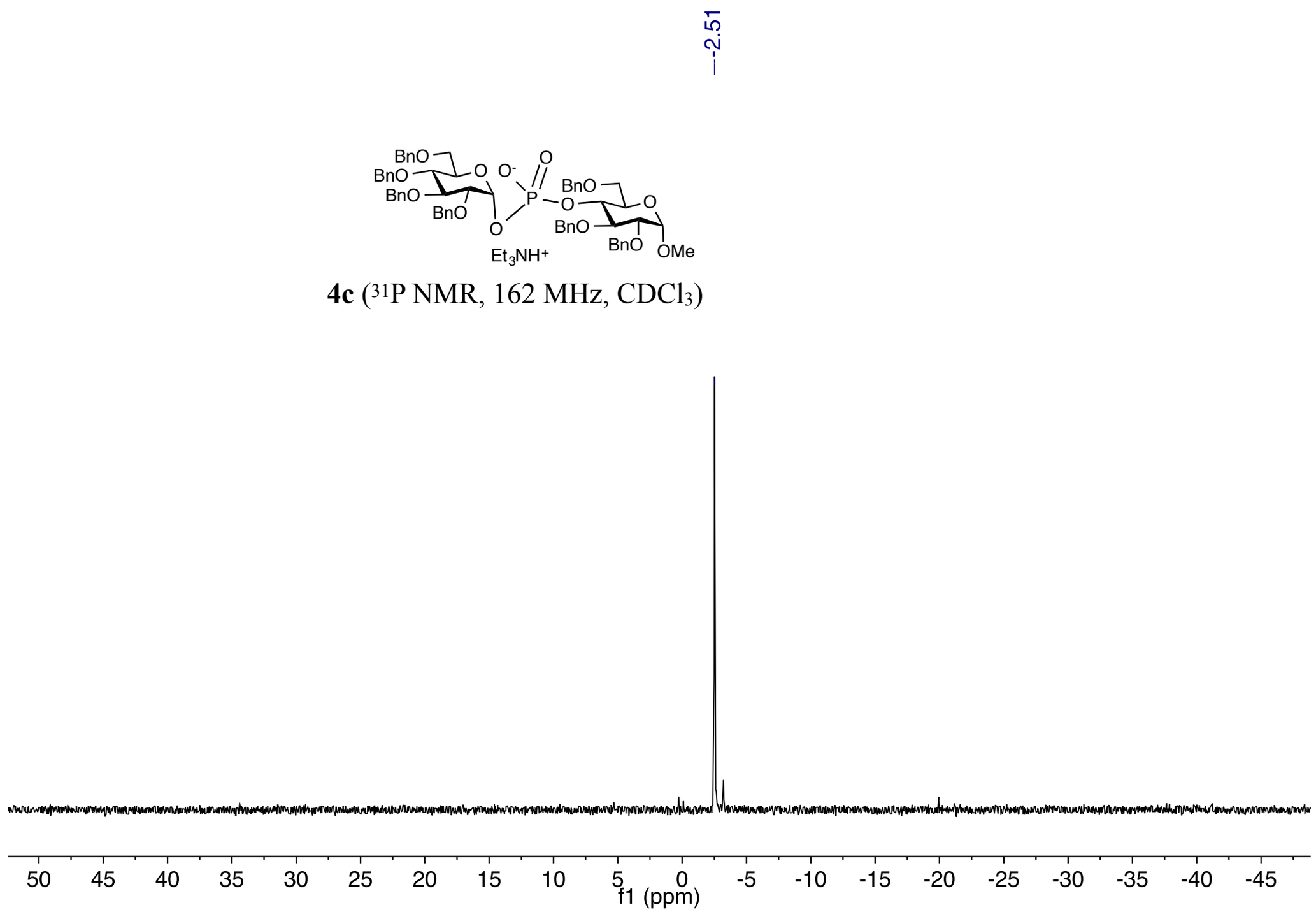


4c (^{1}H NMR, 400 MHz, $CDCl_3$)

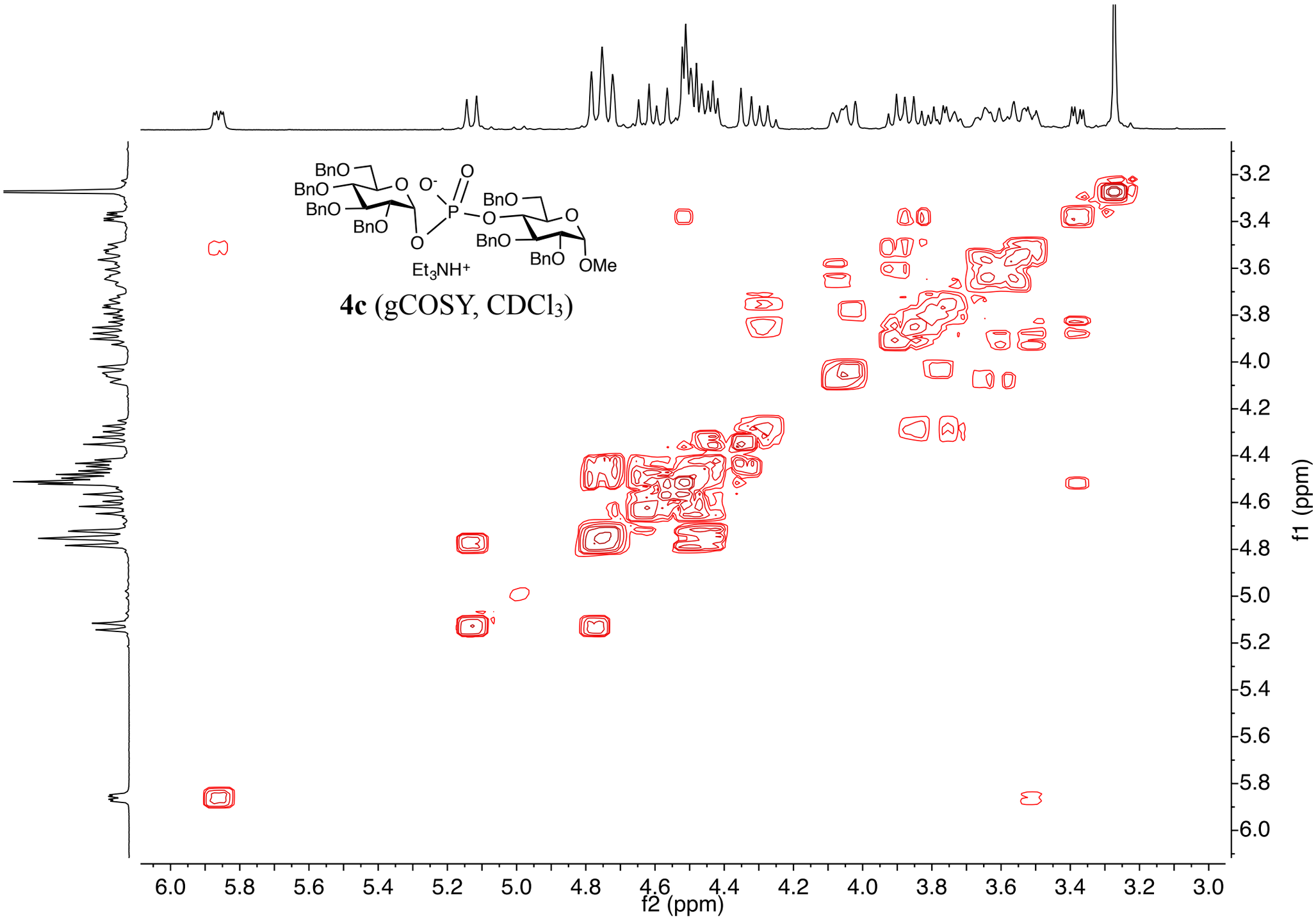


4c (^{13}C NMR, 101 MHz, $CDCl_3$)

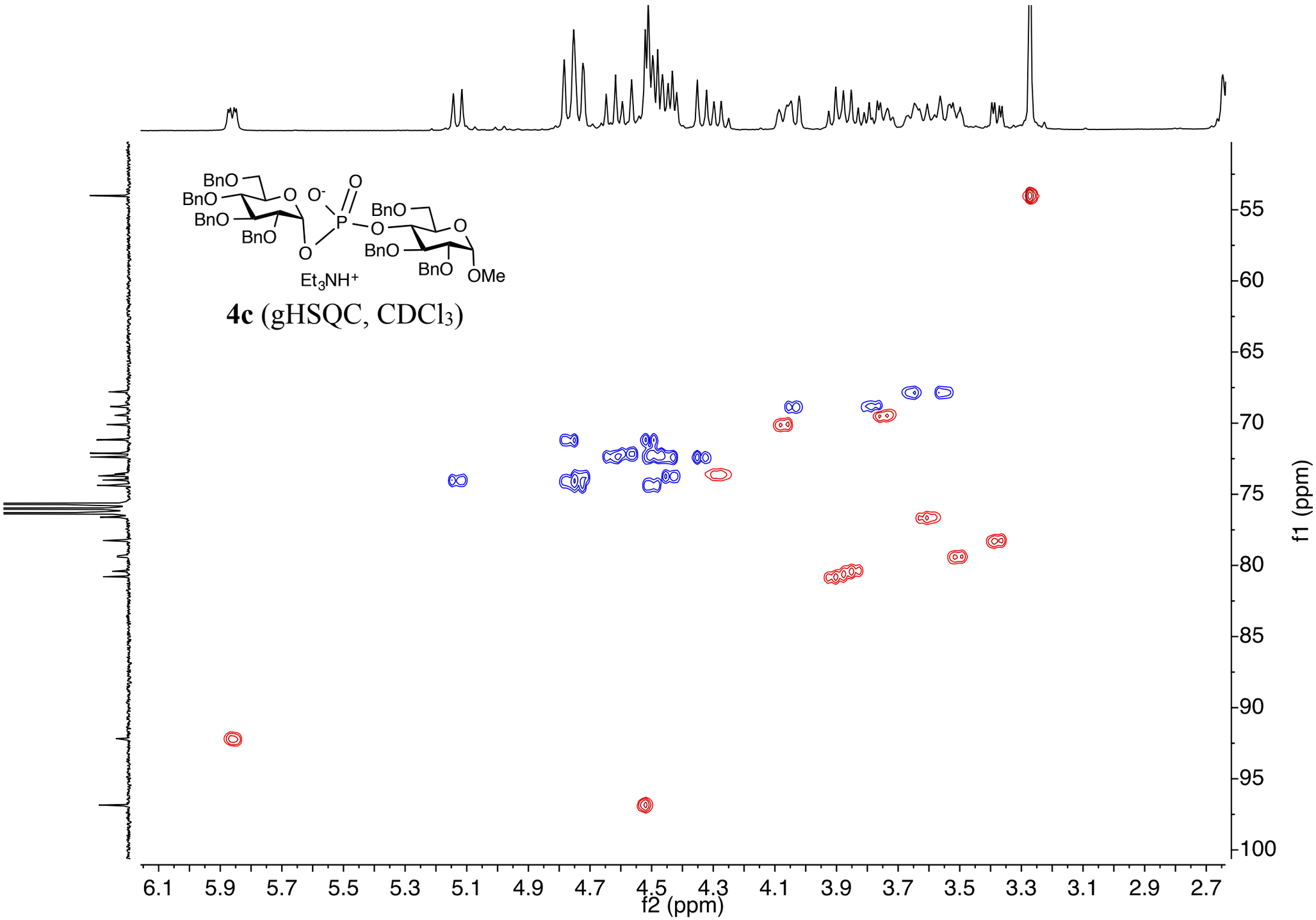


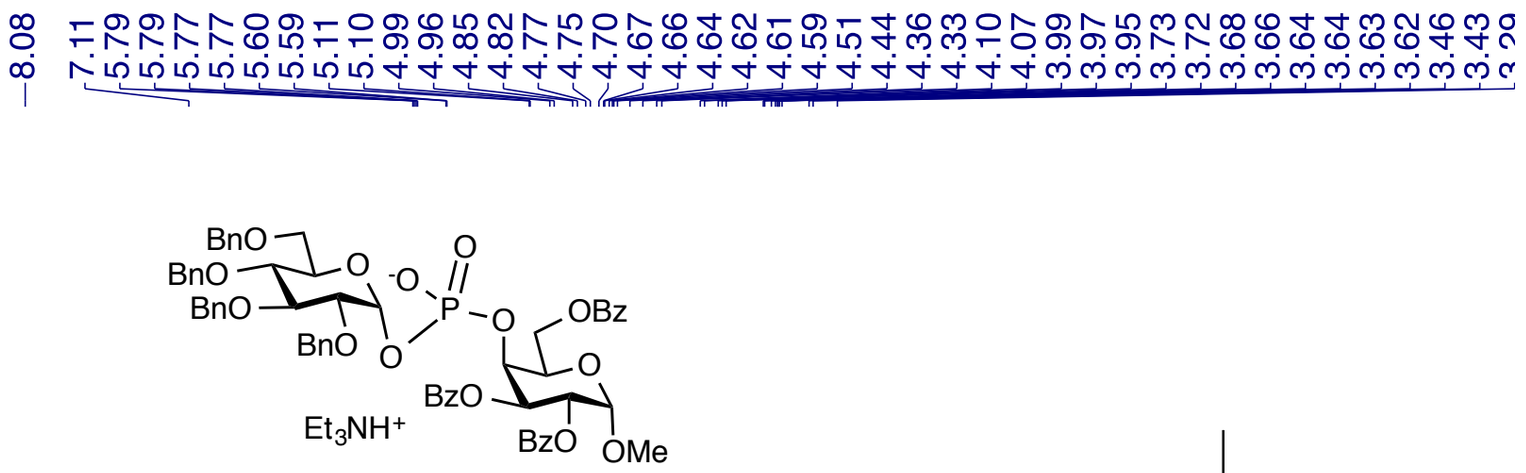


4c (^{31}P NMR, 162 MHz, $CDCl_3$)

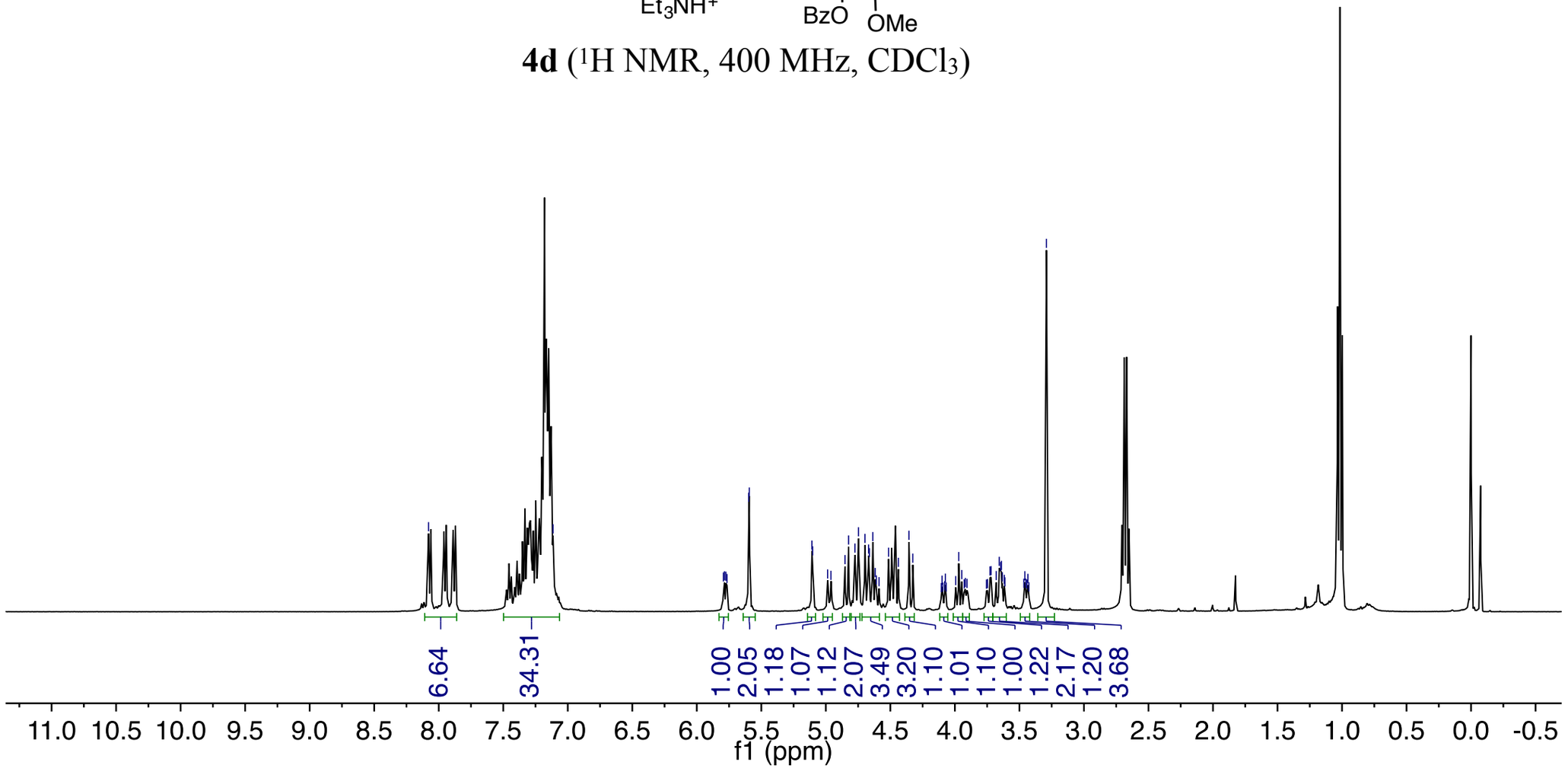


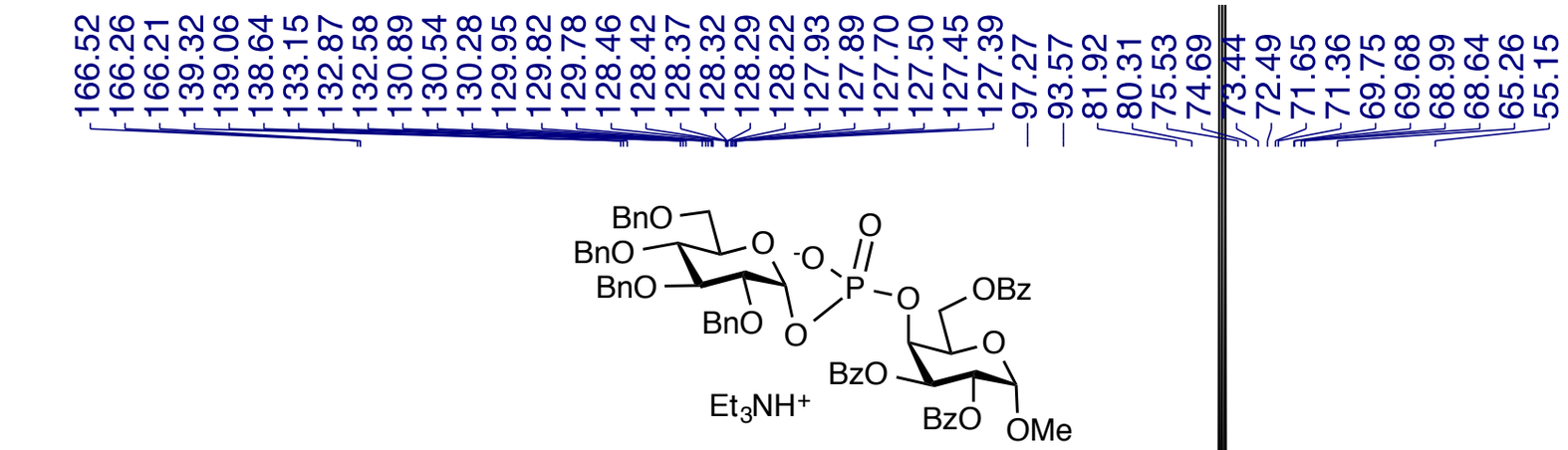
4c (gCOSY, $CDCl_3$)


BnO
BnO
BnO
BnO
O
O-
O
P
O
BnO
O
BnO
BnO
OMe
Et3NH+
4c (gHSQC, CDCl3)
55
60
65
70
75
80
85
90
95
100
f1 (ppm)
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
f2 (ppm)

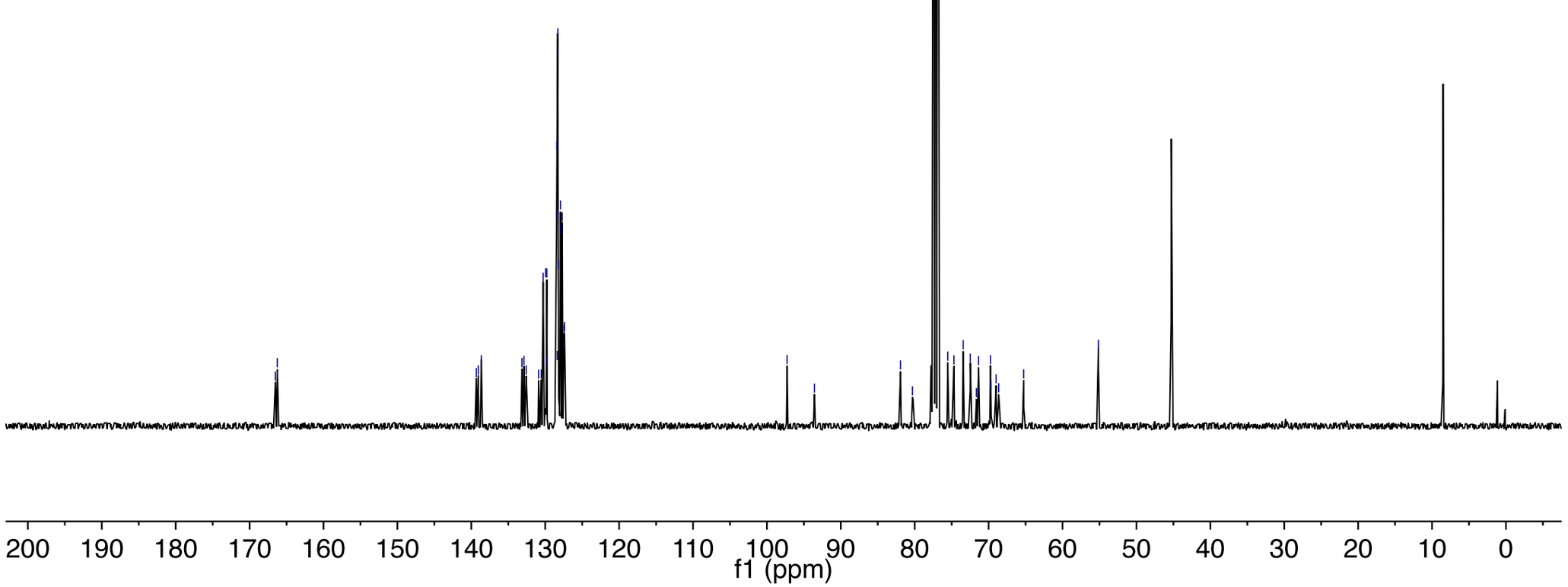


4d (^{1}H NMR, 400 MHz, $CDCl_3$)

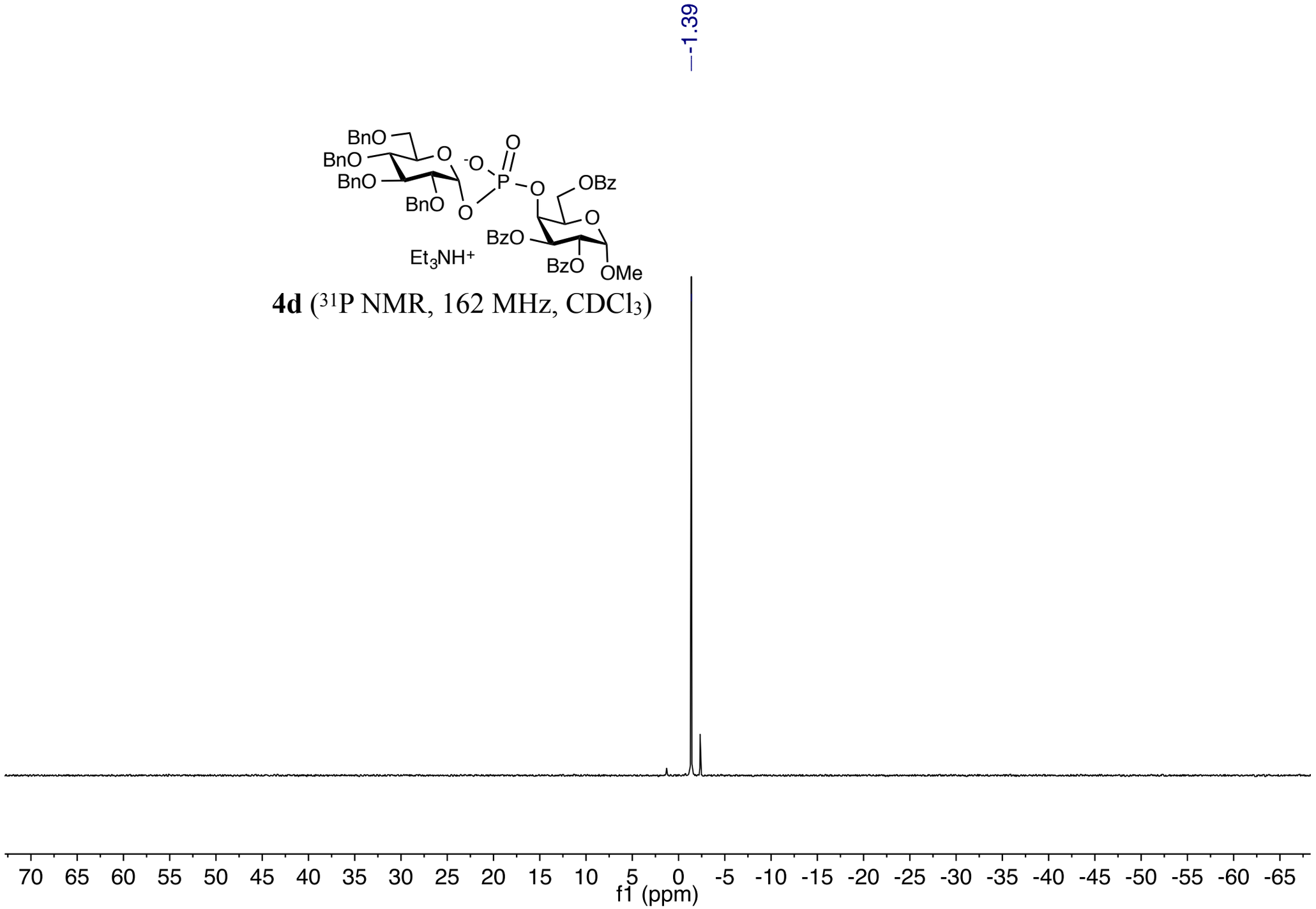


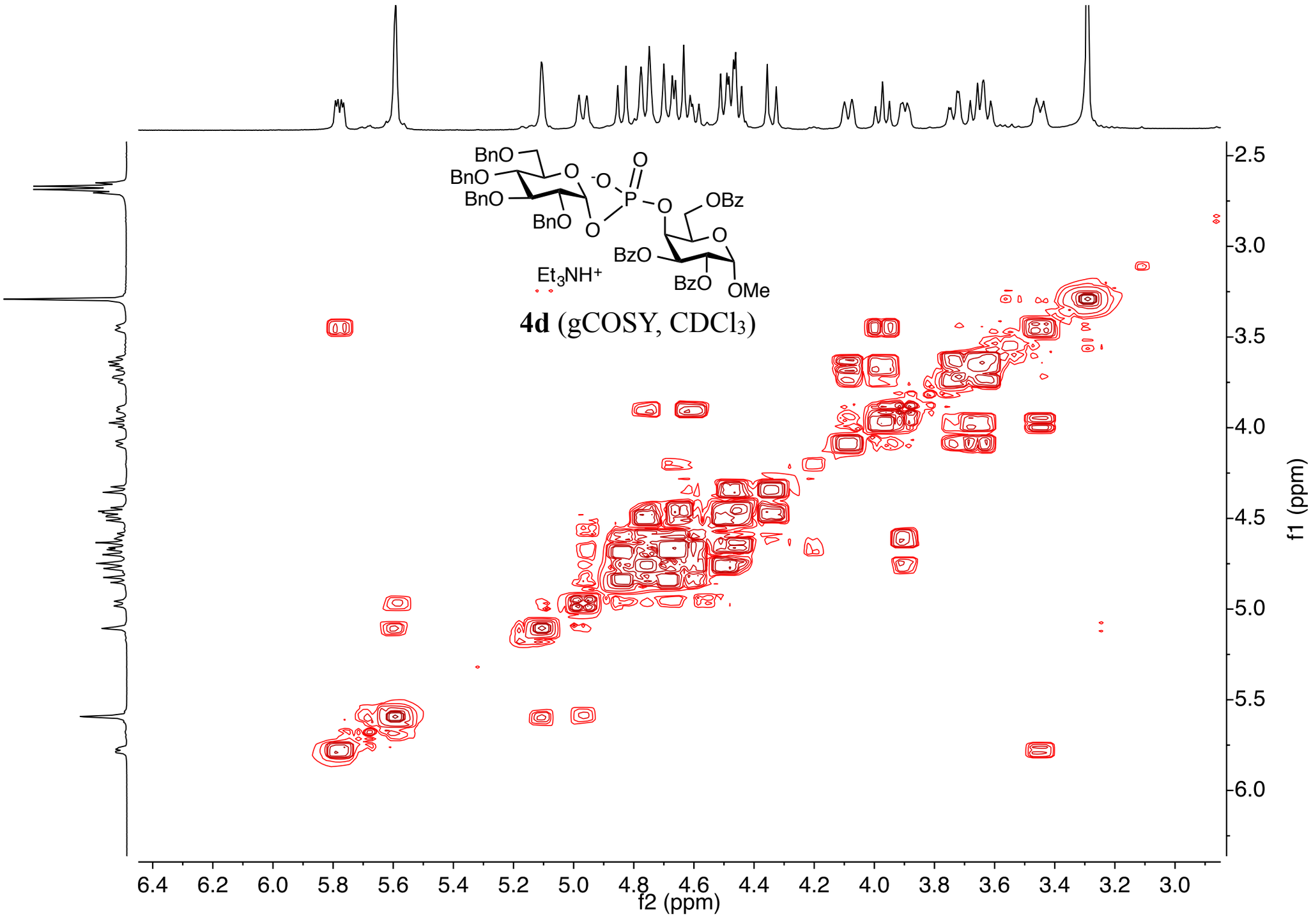


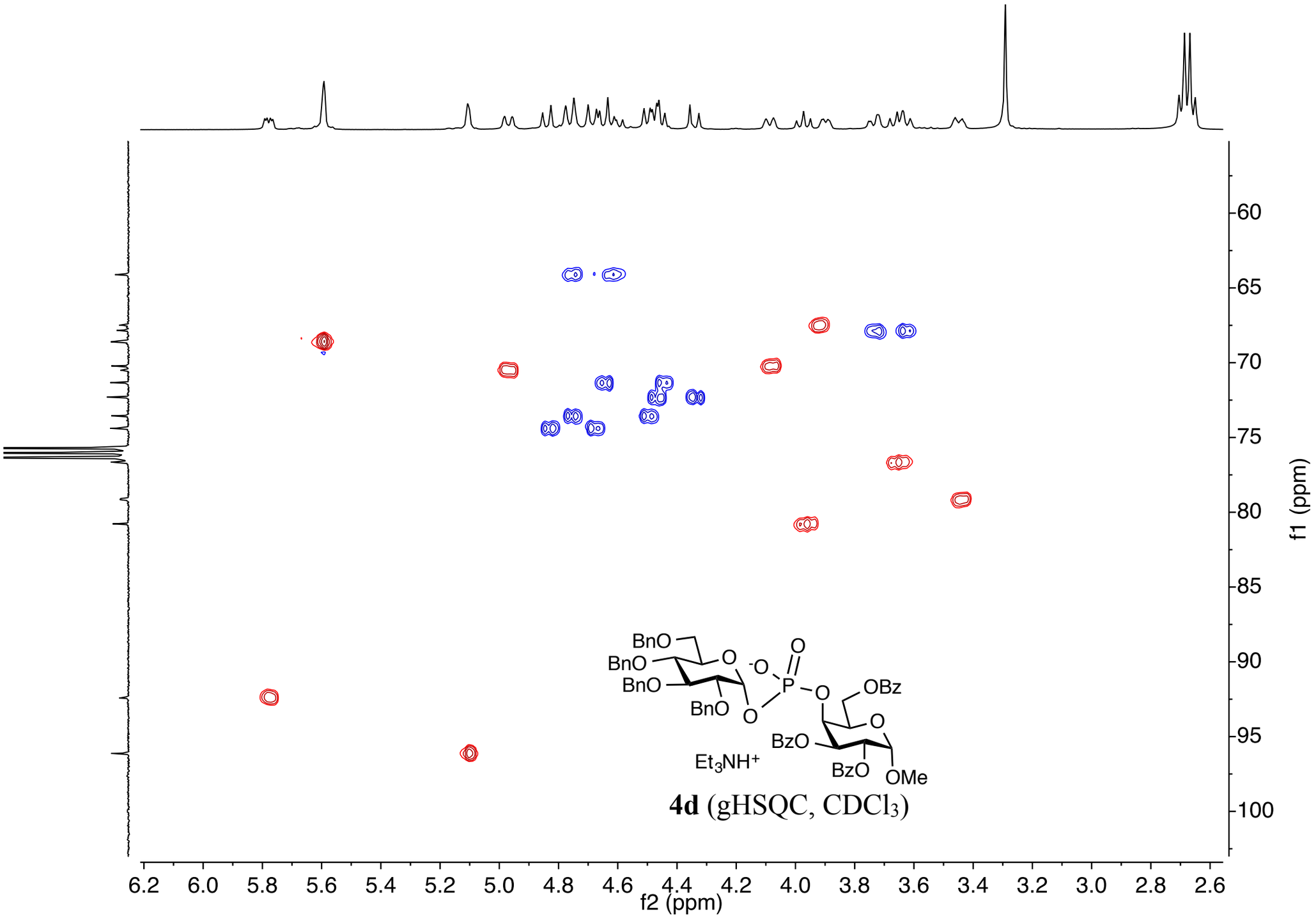
4d (^{13}C NMR, 101 MHz, $CDCl_3$)



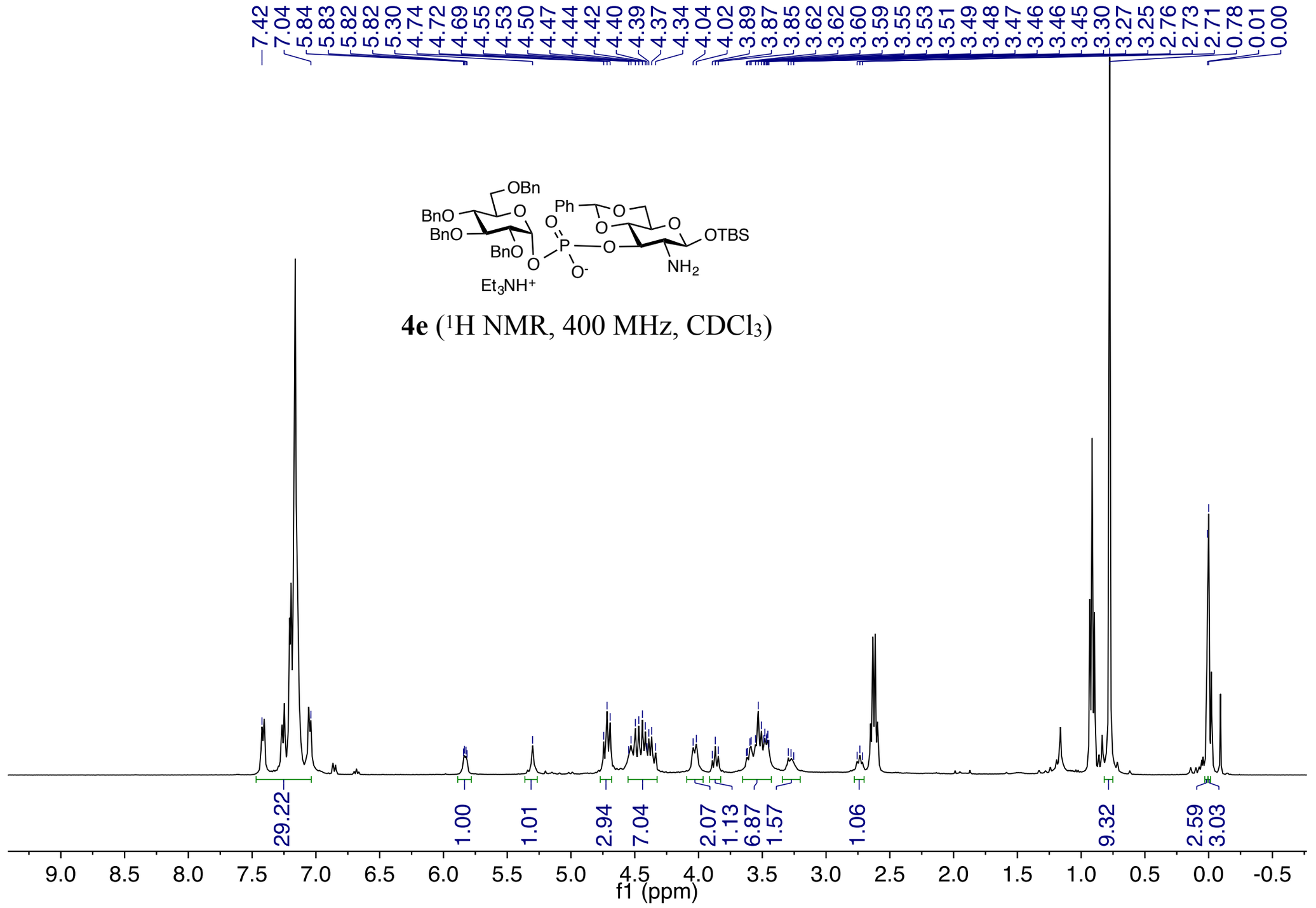
4d (^{31}P NMR, 162 MHz, $CDCl_3$)



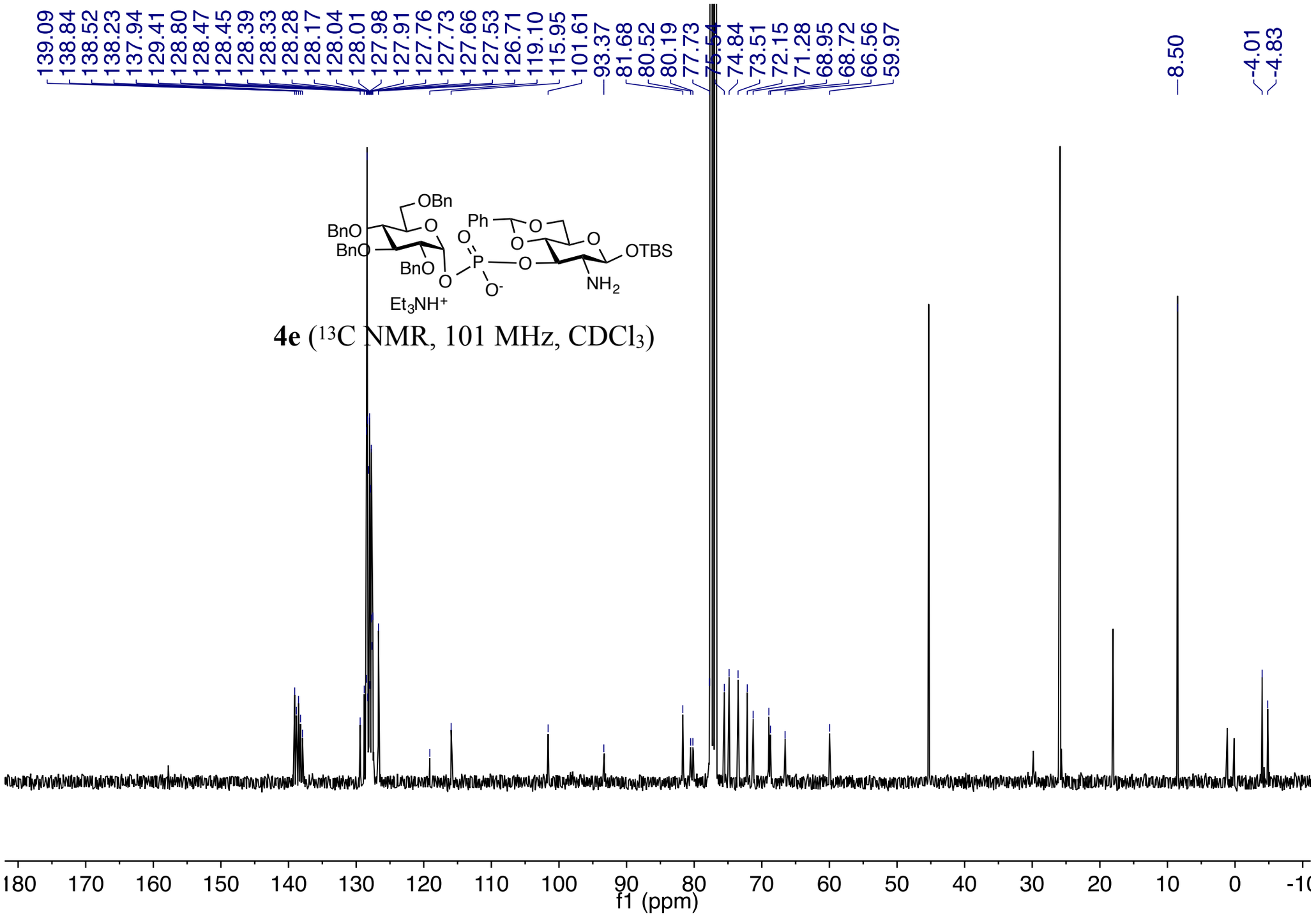

BnO
BnO
BnO
BnO
O
O
-O
P
O
OBz
O
BzO
BzO
OMe
Et3NH+
4d (gCOSY, CDCl3)
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)



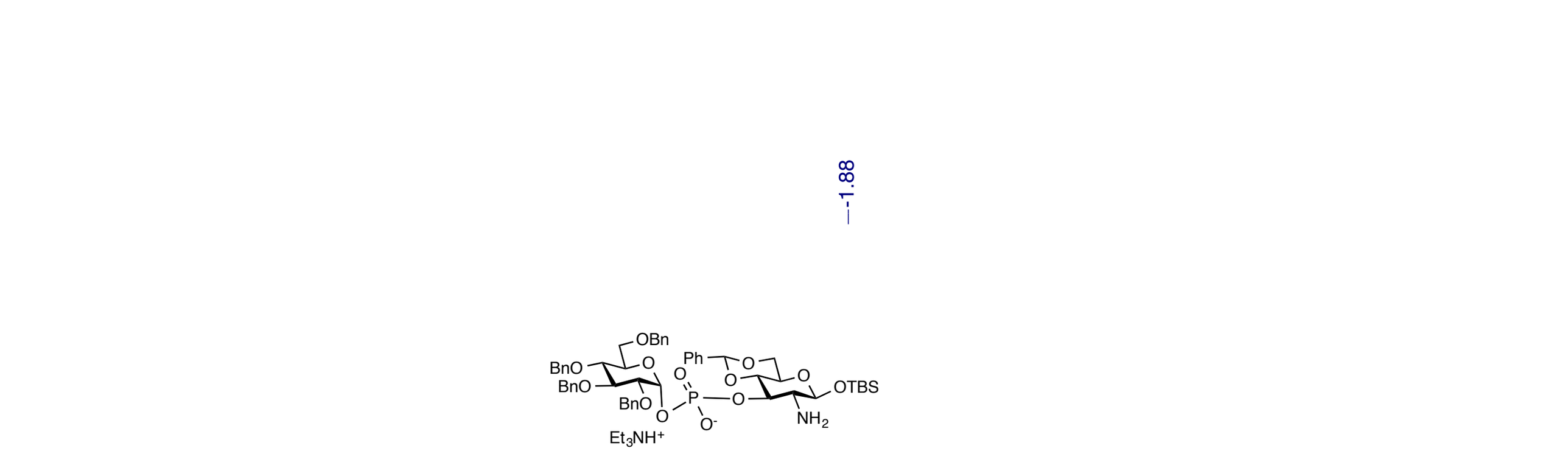
4d (gHSQC, $CDCl_3$)



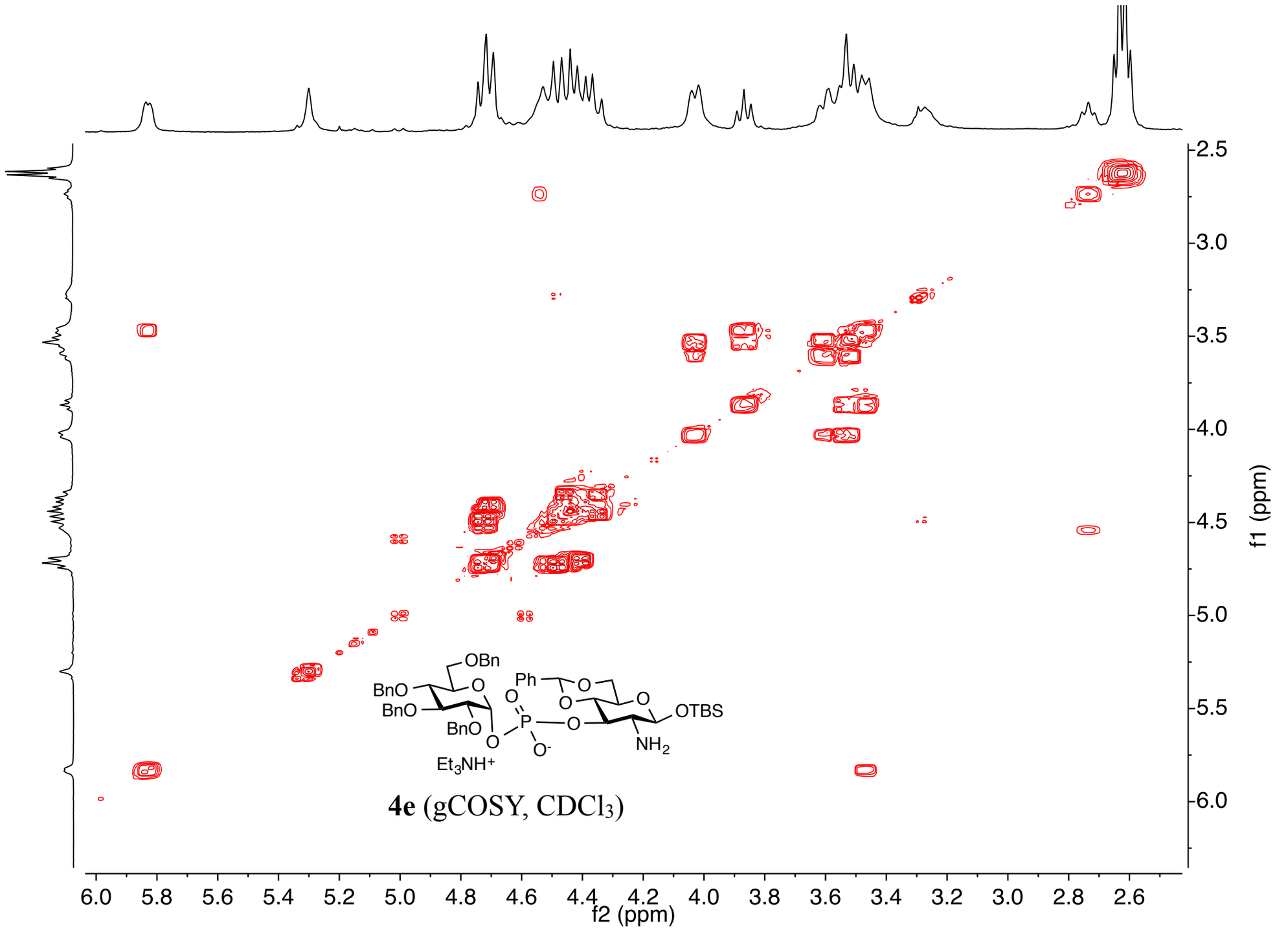
4e (^{1}H NMR, 400 MHz, $CDCl_3$)



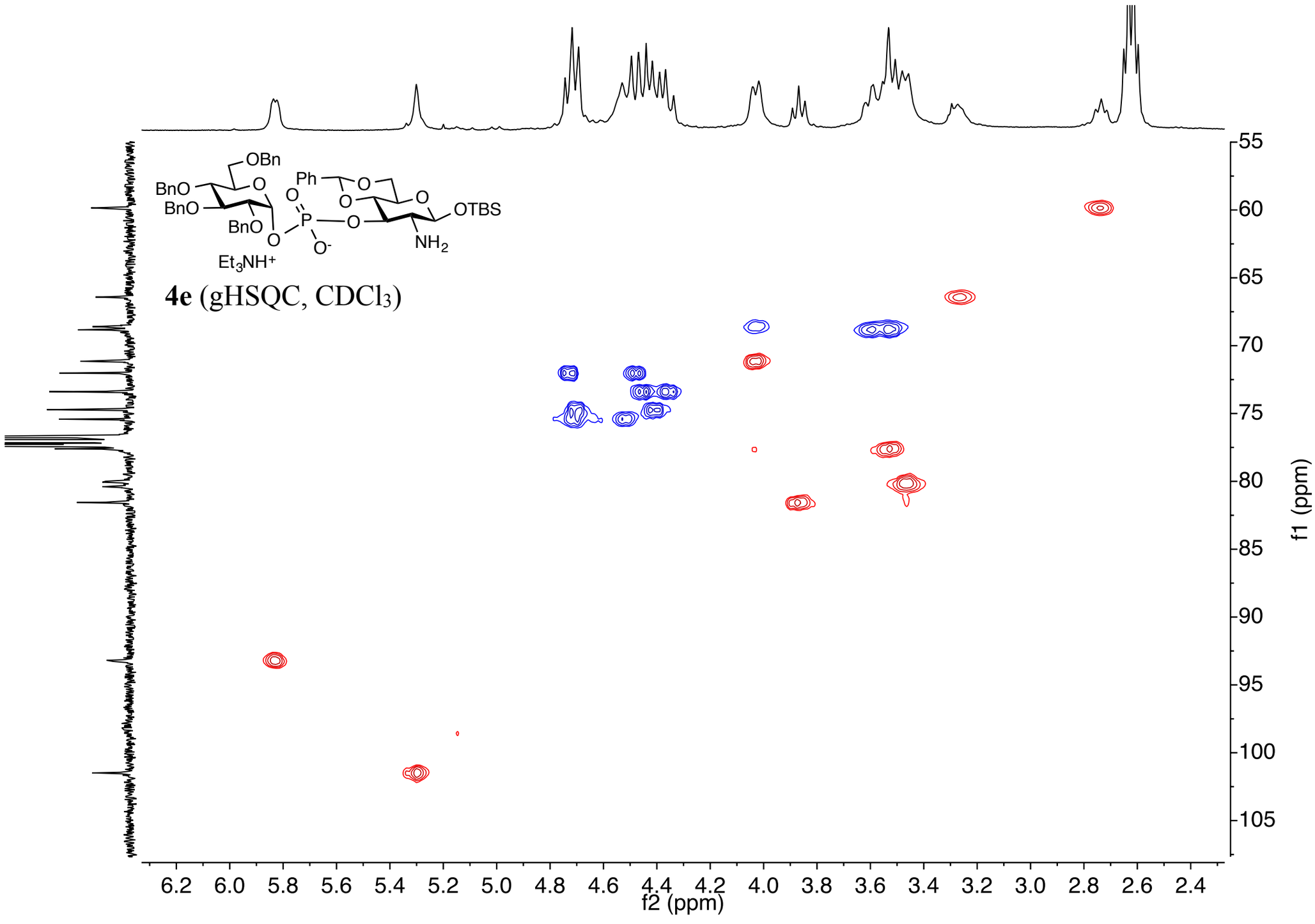
4e (^{13}C NMR, 101 MHz, $CDCl_3$)

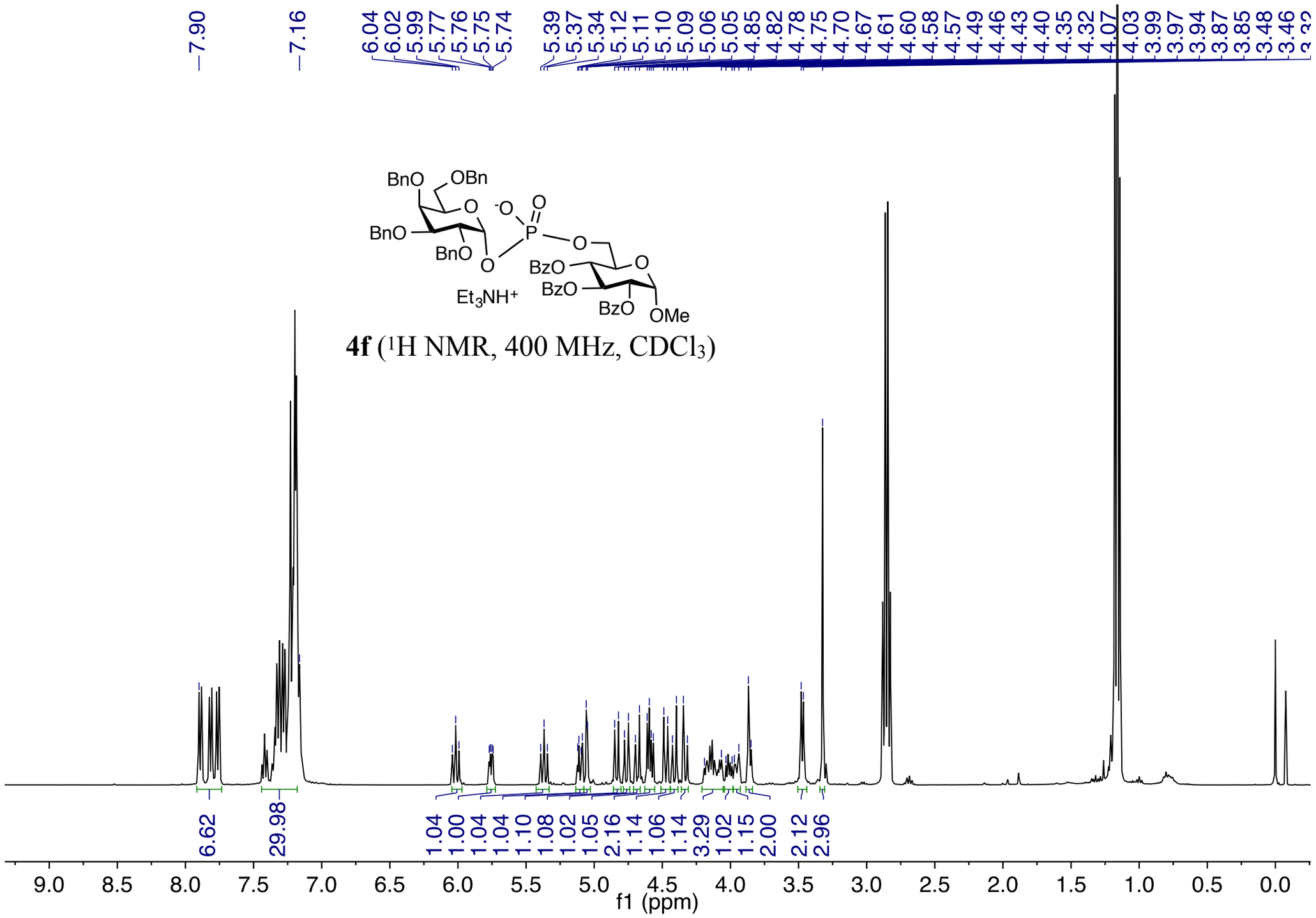


4e (^{31}P NMR, 162 MHz, $CDCl_3$)

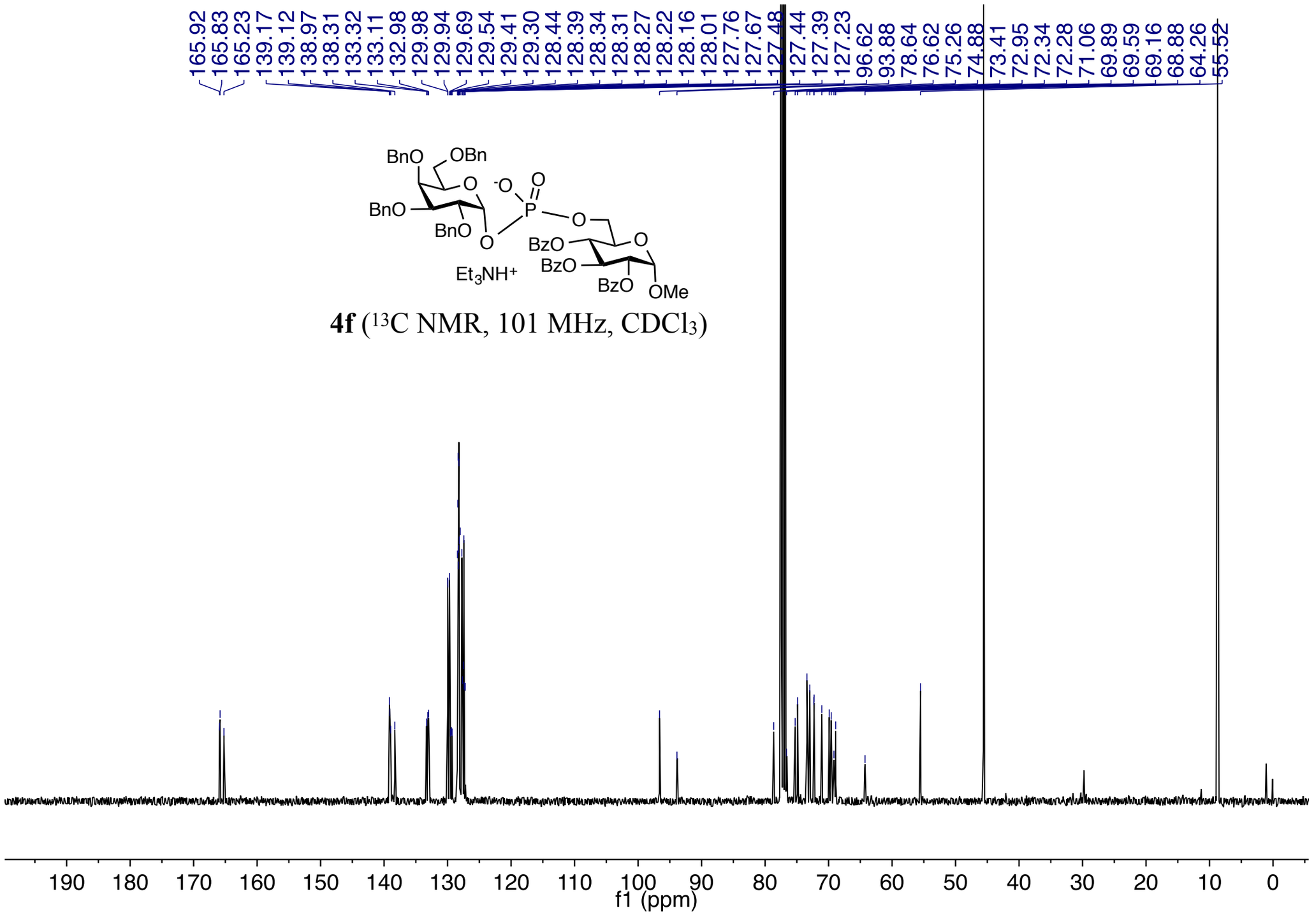


4e (gCOSY, $CDCl_3$)


OBn
BnO
BnO
BnO
O
O
Ph
O
O
O
O
P
O
O
O
OTBS
NH2
O-
Et3NH+
4e (gHSQC, CDCl3)
55
60
65
70
75
80
85
90
95
100
105
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
f2 (ppm)

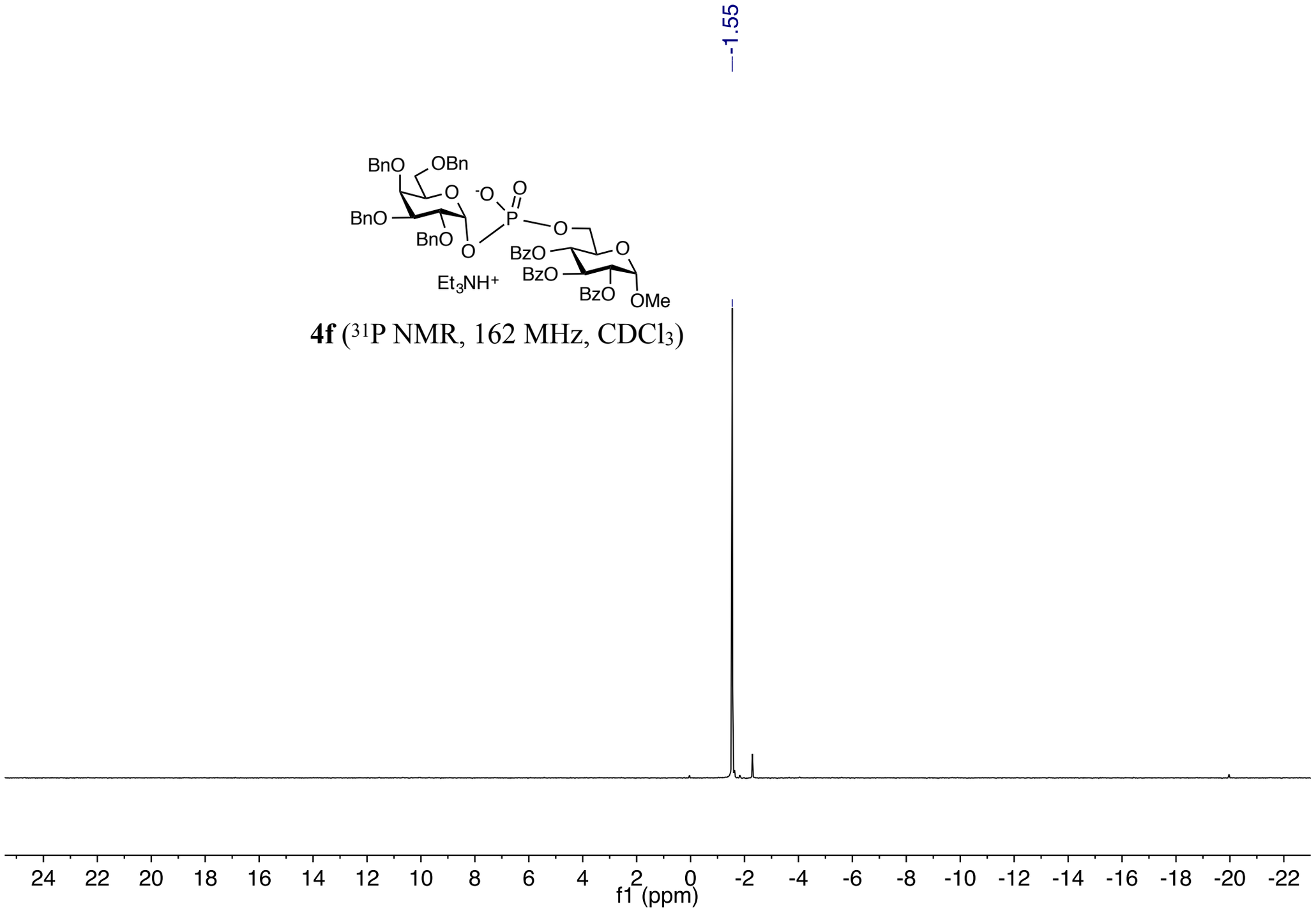


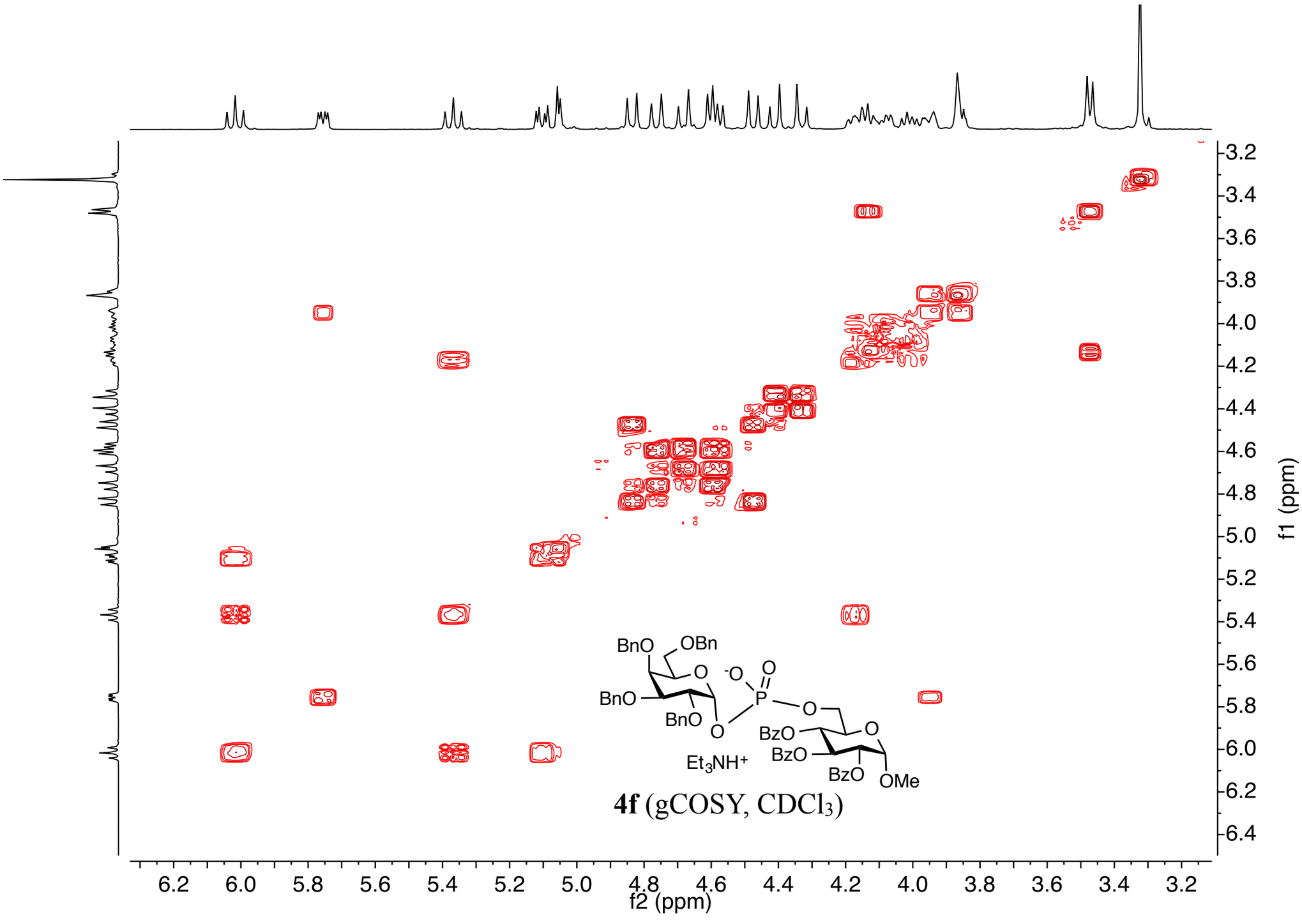
4f (^{1}H NMR, 400 MHz, $CDCl_3$)



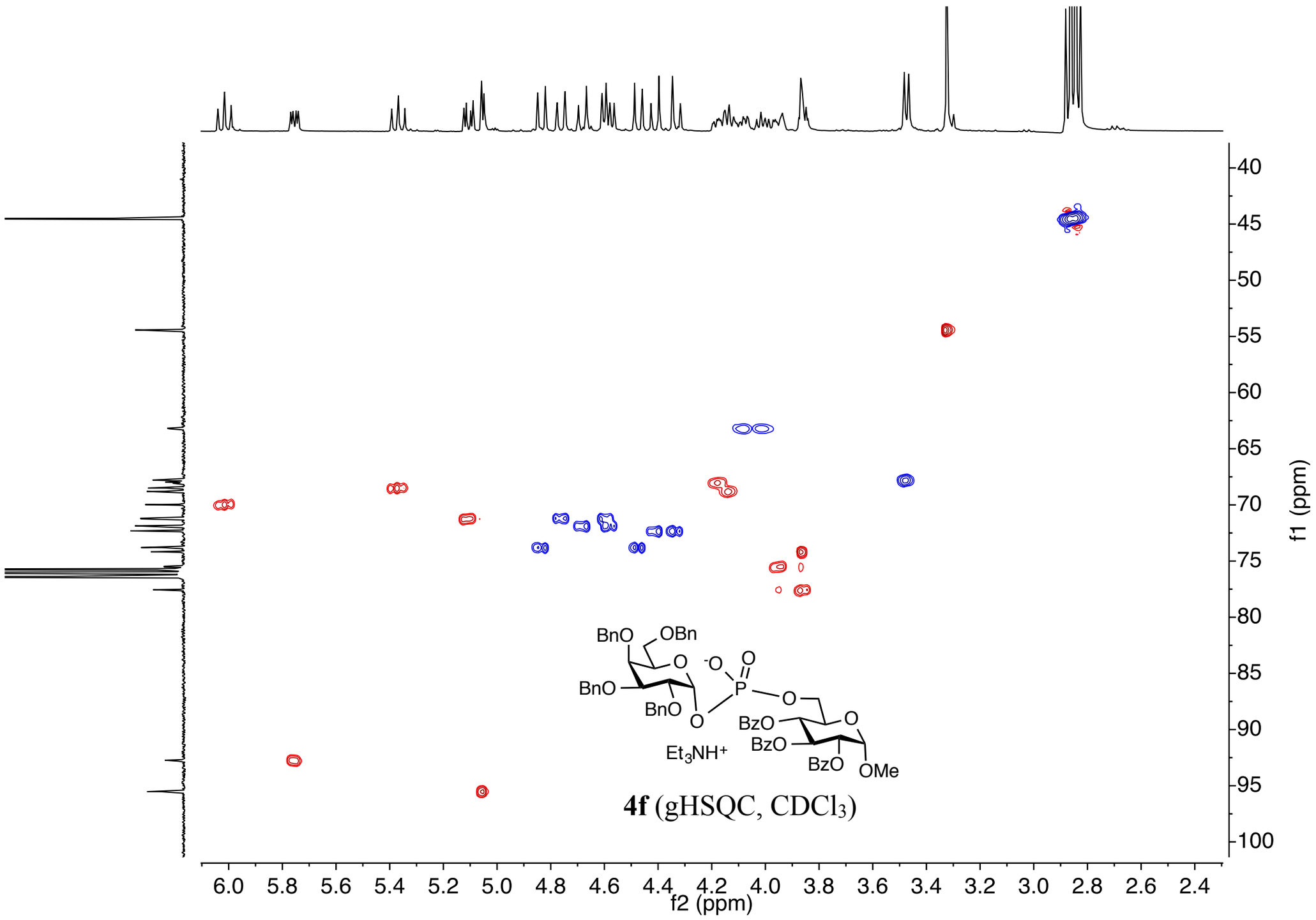
4f (^{13}C NMR, 101 MHz, $CDCl_3$)

4f (^{31}P NMR, 162 MHz, $CDCl_3$)

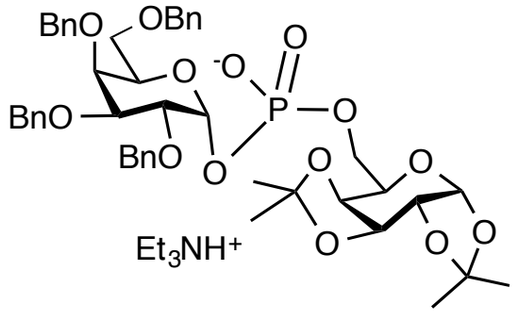




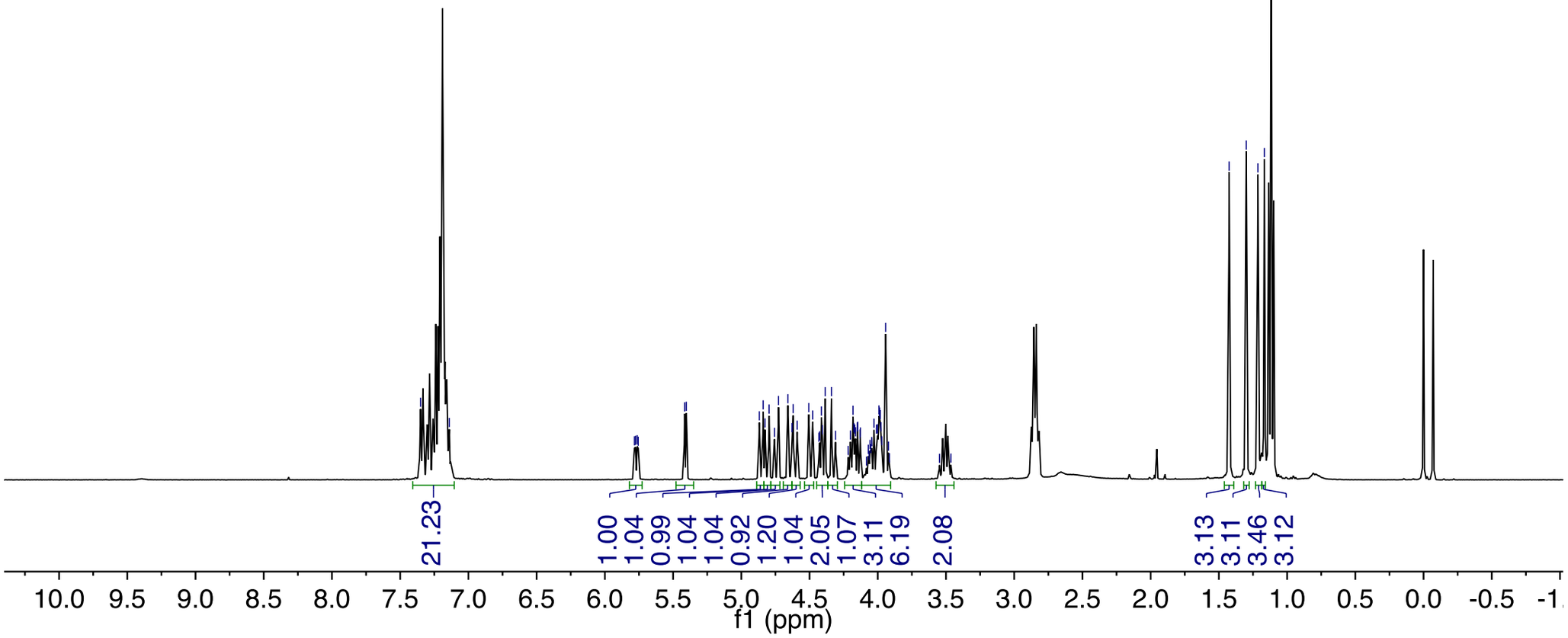
4f (gCOSY, $CDCl_3$)

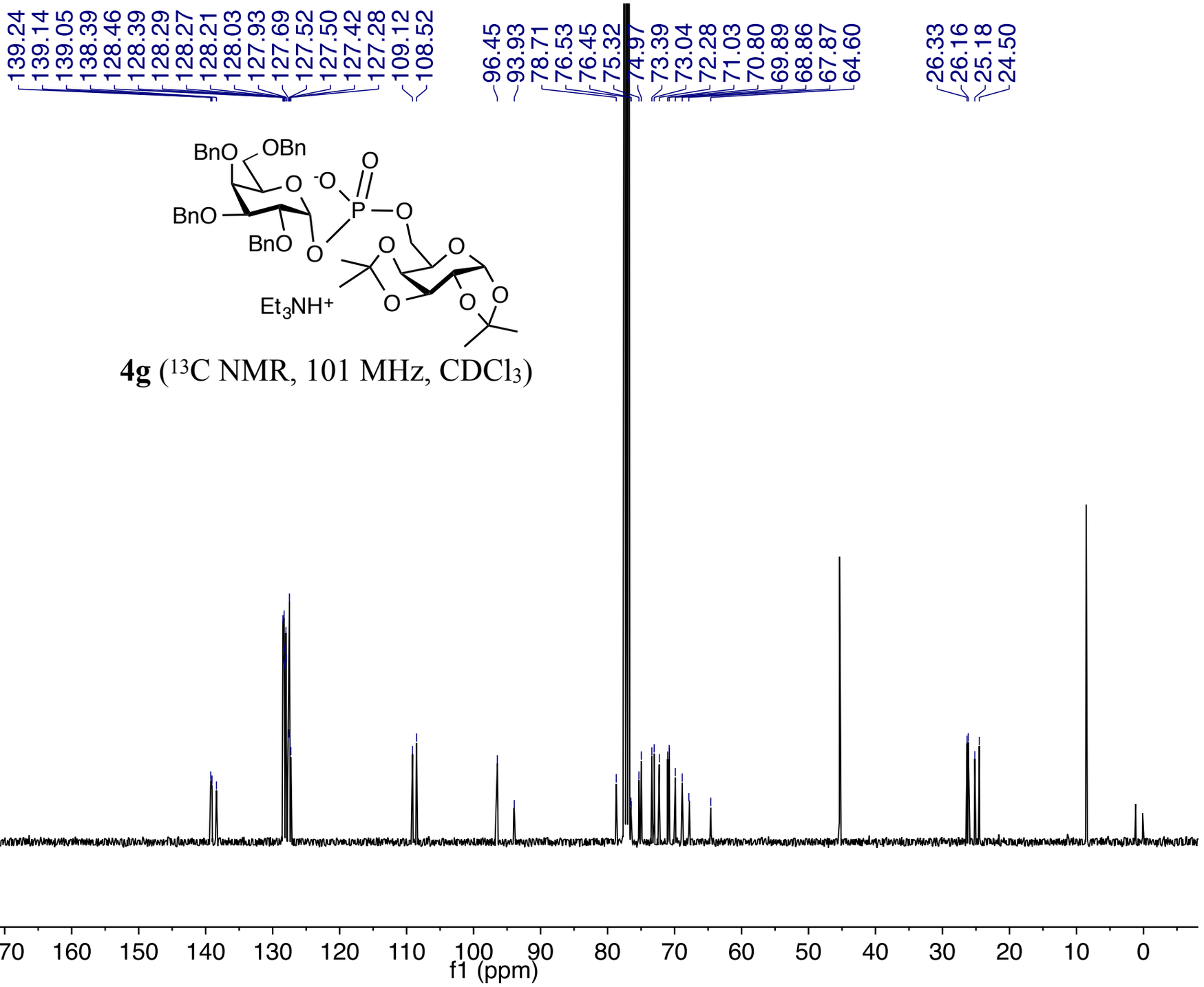


4f (gHSQC, $CDCl_3$)

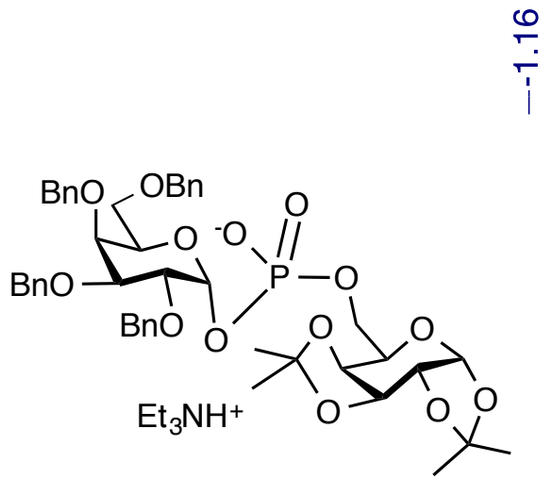


4g (^{1}H NMR, 400 MHz, $CDCl_3$)

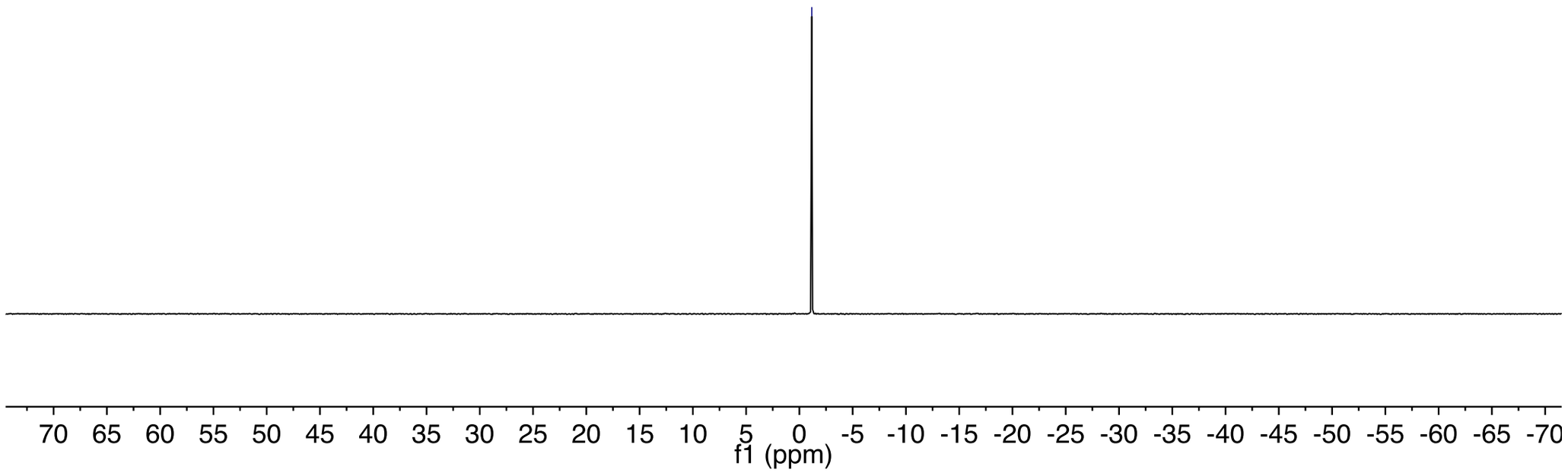


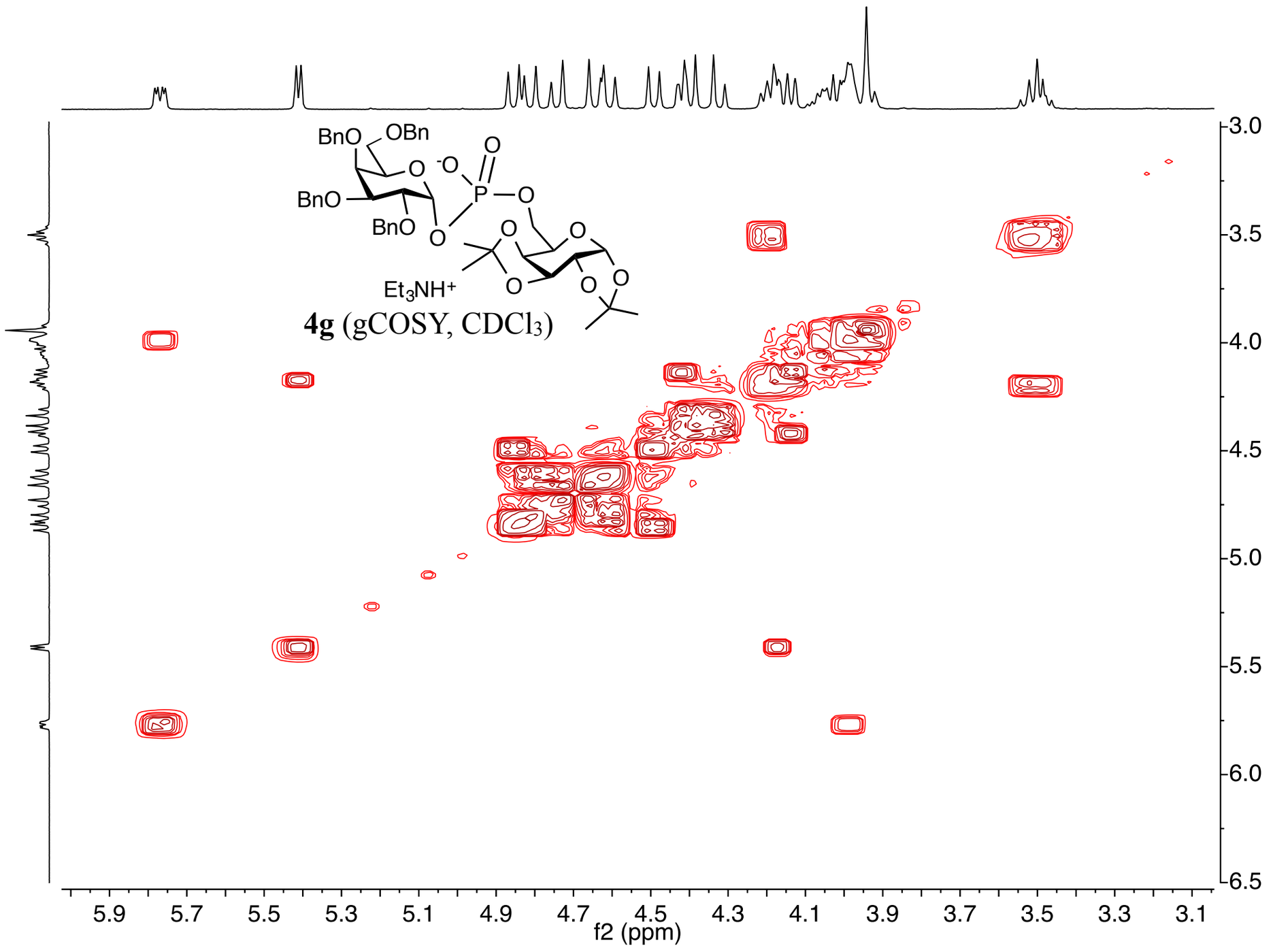


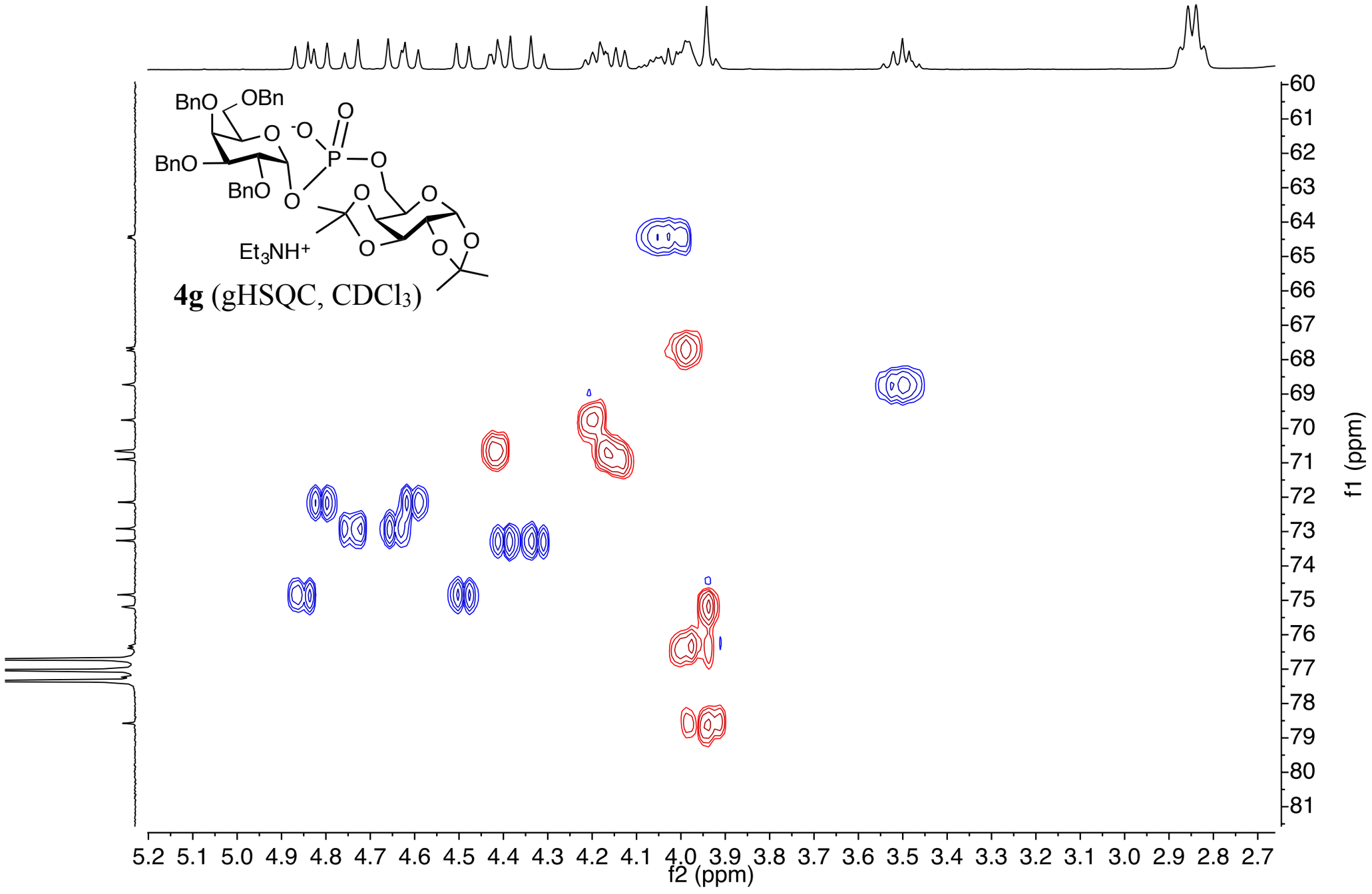
4g (^{13}C NMR, 101 MHz, $CDCl_3$)

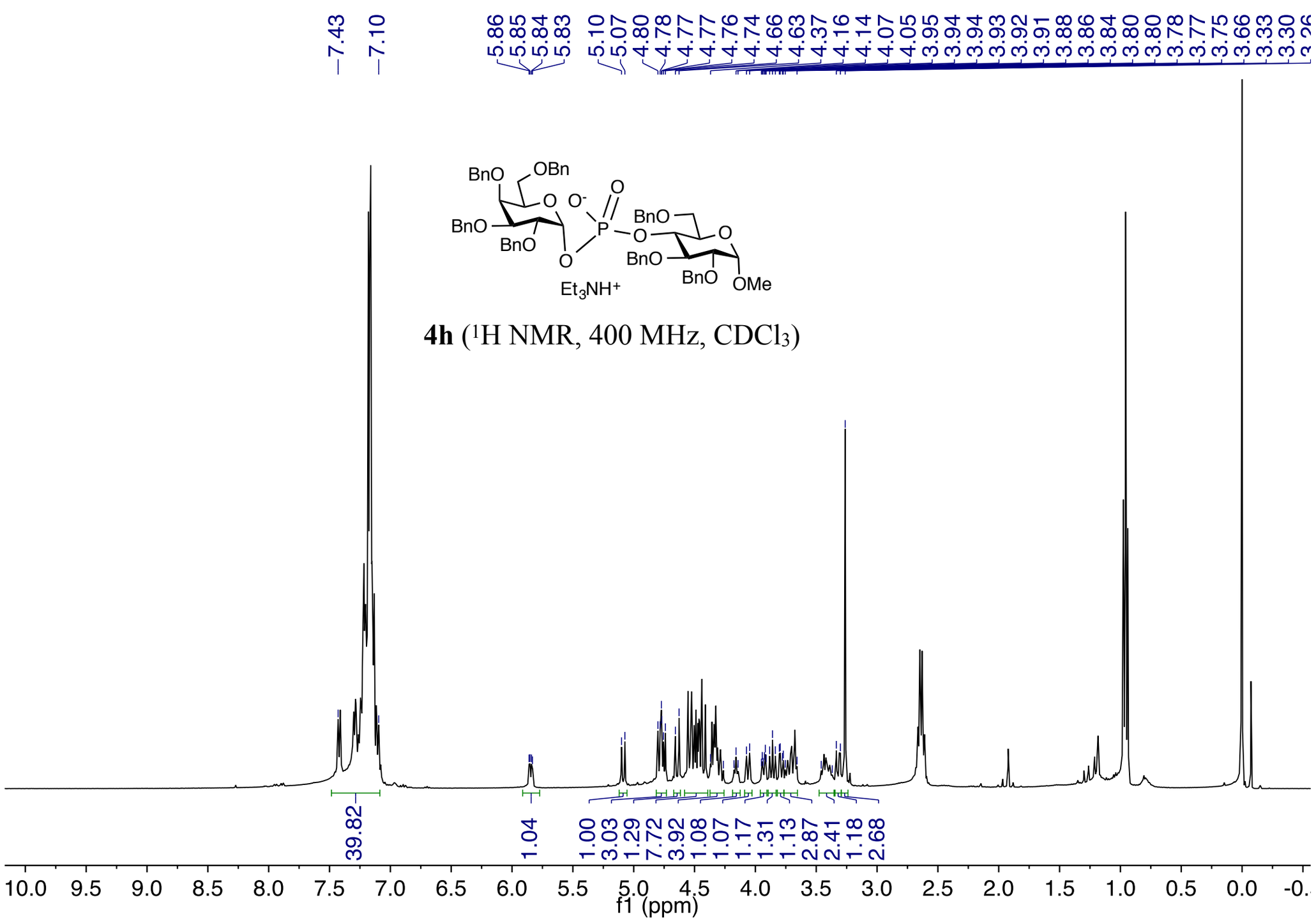


4g (^{31}P NMR, 162 MHz, $CDCl_3$)




BnO
OBn
BnO
BnO
O
-O
P
Et3NH+
4g (gCOSY, CDCl3)
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
f1 (ppm)
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
f2 (ppm)


BnO
OBn
BnO
BnO
O
-O
P
O
O
O
O
O
O
O
Et3NH+
4g (gHSQC, CDCl3)
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
f1 (ppm)
5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7
f2 (ppm)



4h (^{1}H NMR, 400 MHz, $CDCl_3$)

140.23
139.40
139.28
138.97
138.91
138.57
138.26
128.46
128.40
128.33
128.29
128.26
128.22
128.15
128.11
128.05
127.98
127.75
127.59
127.46
127.42
127.31
127.26
127.08
127.02
97.97
94.17
81.51
79.55
78.74
75.39
75.25
74.91
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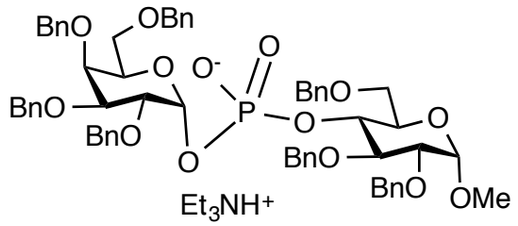
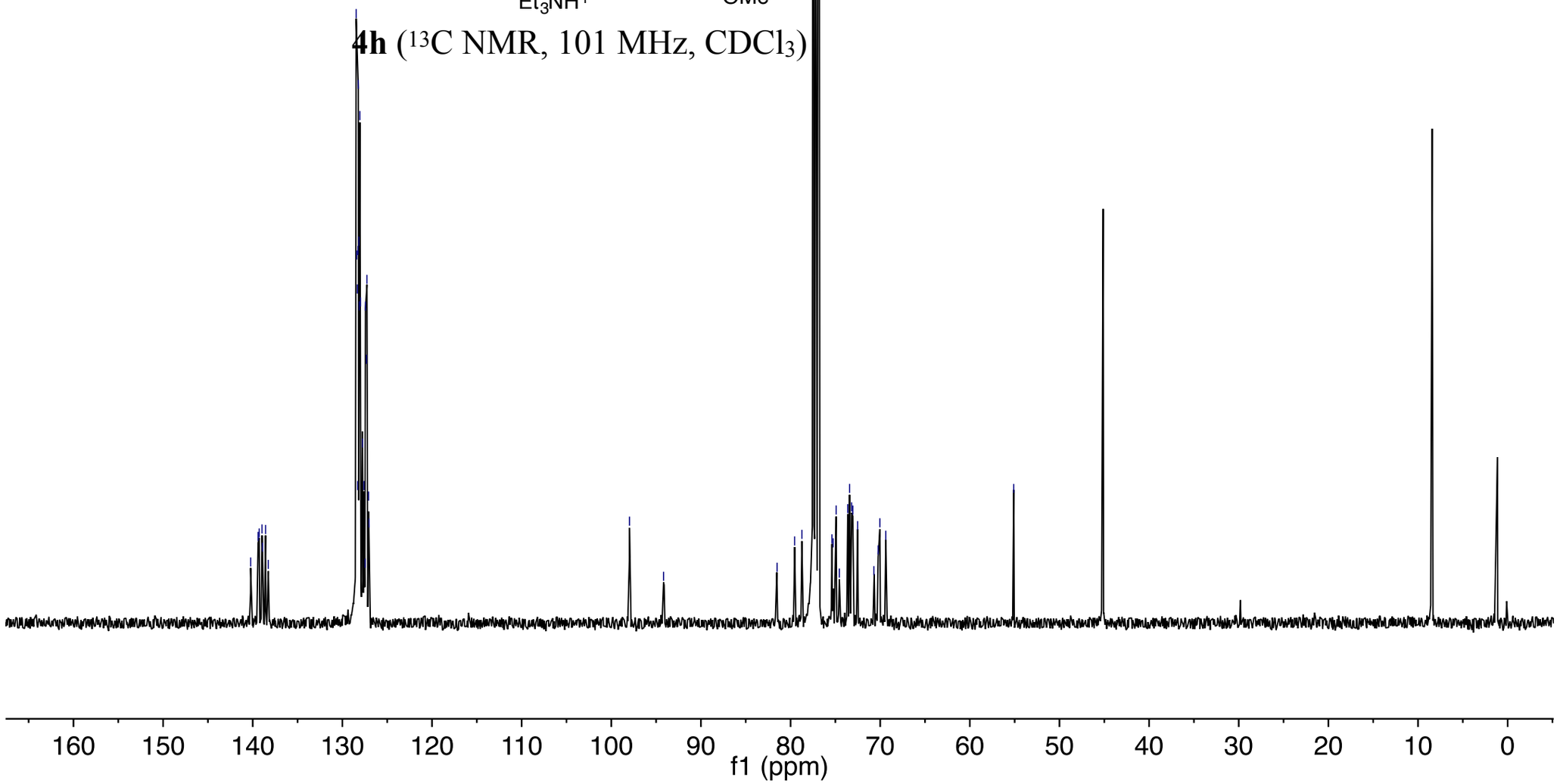
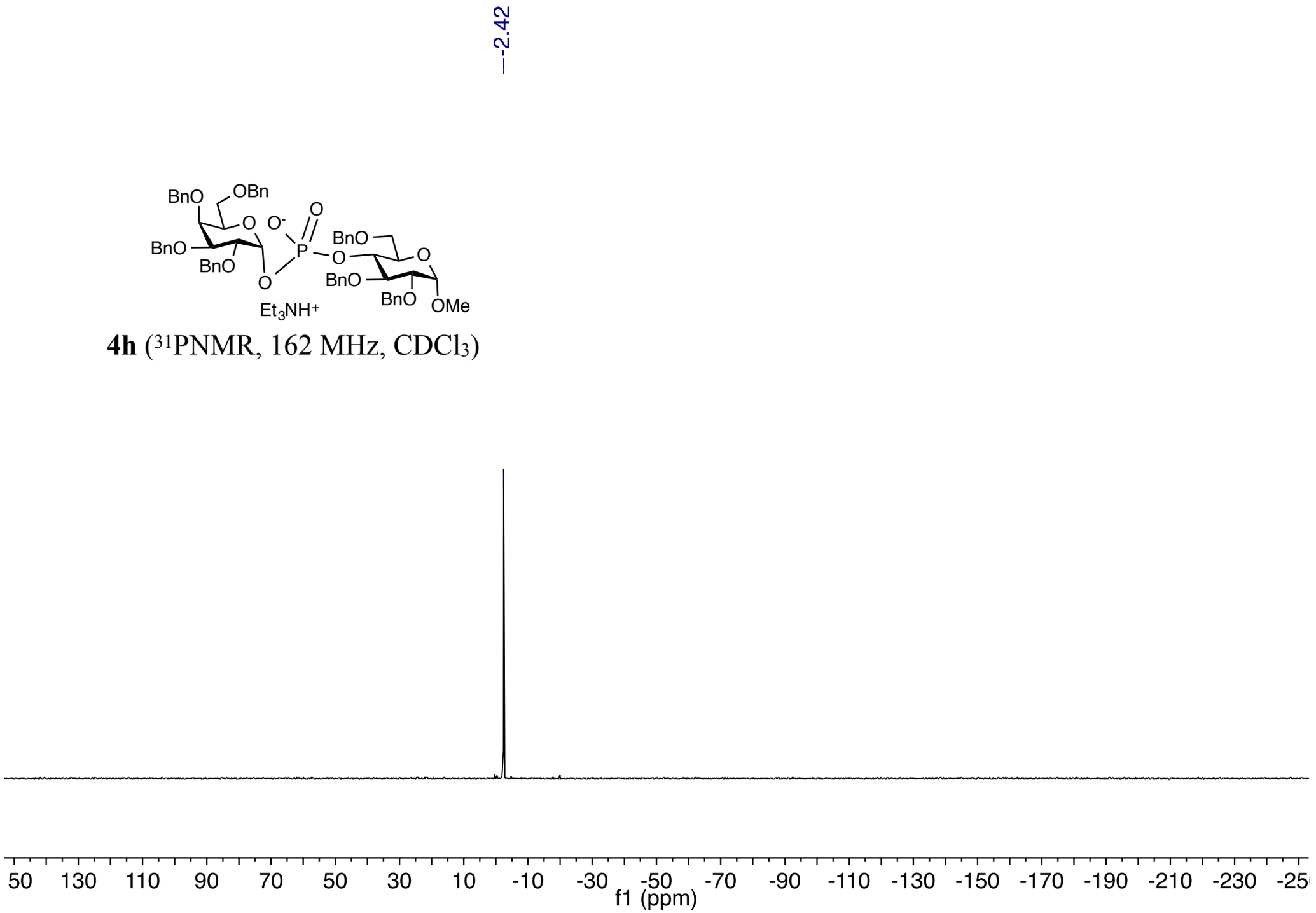
73.62
73.41
73.19
73.06
72.52
70.70
70.23
70.04
69.37
55.10

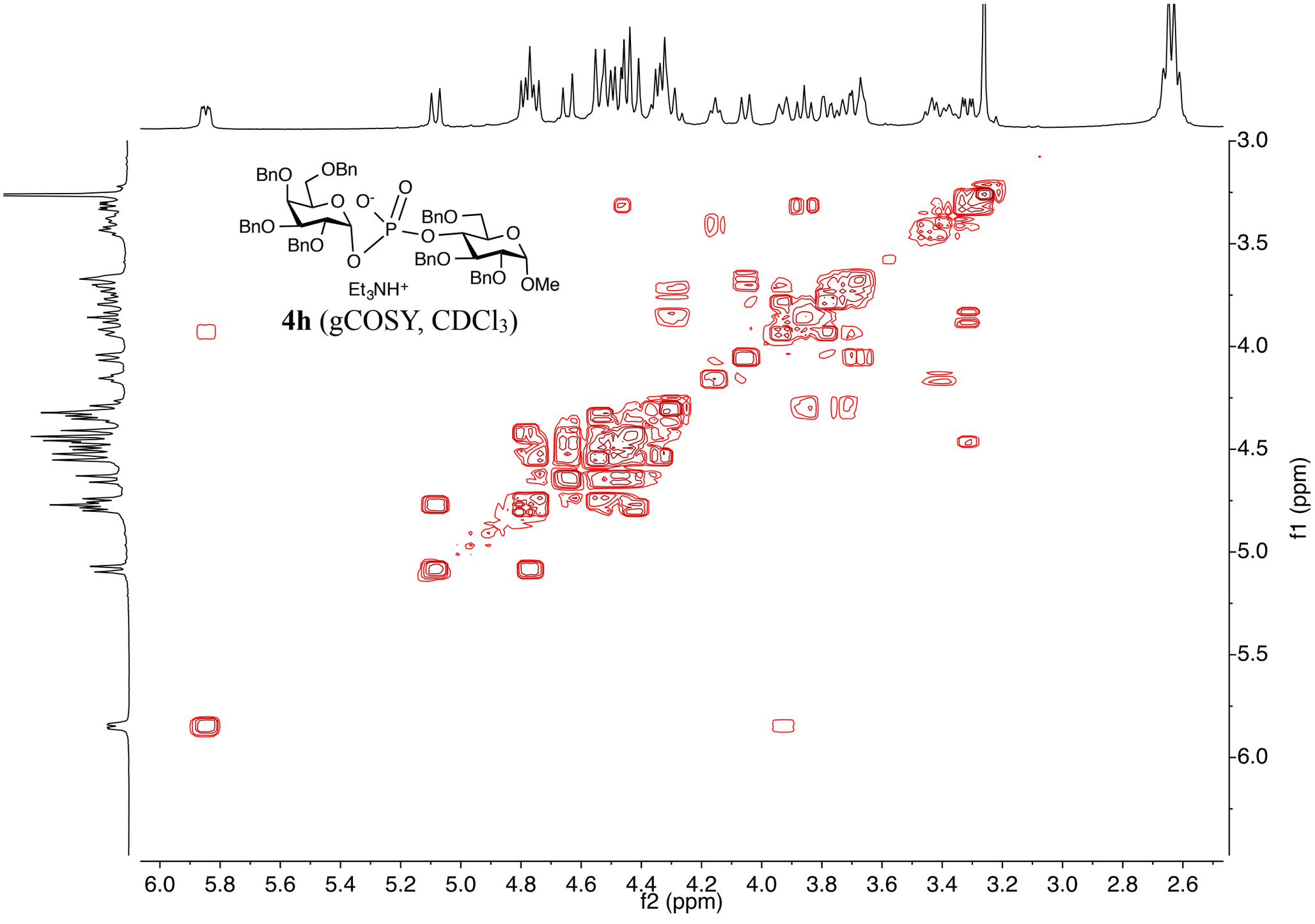


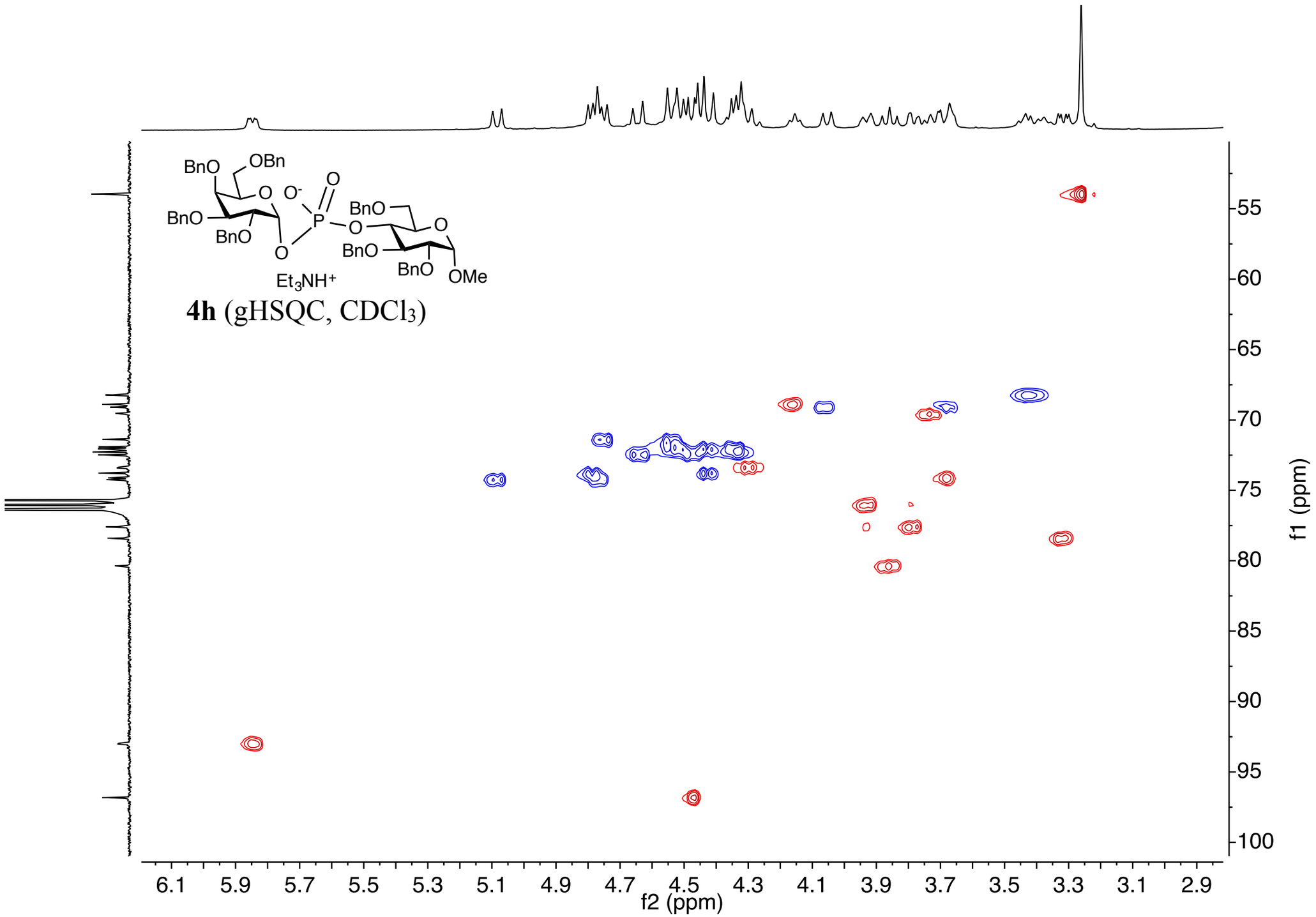
4h (^{13}C NMR, 101 MHz, $CDCl_3$)

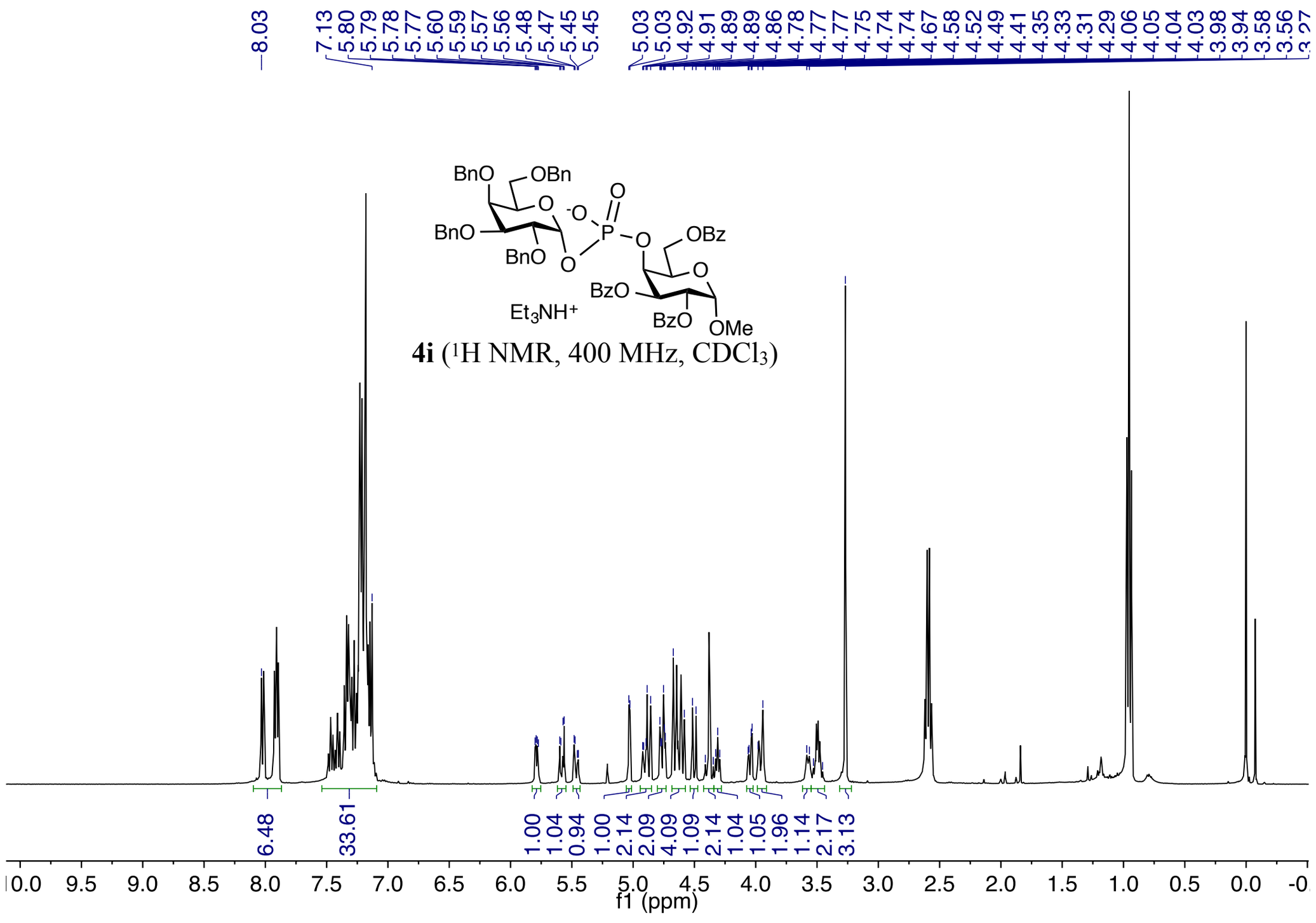


4h (^{31}PNMR, 162 MHz, $CDCl_3$)

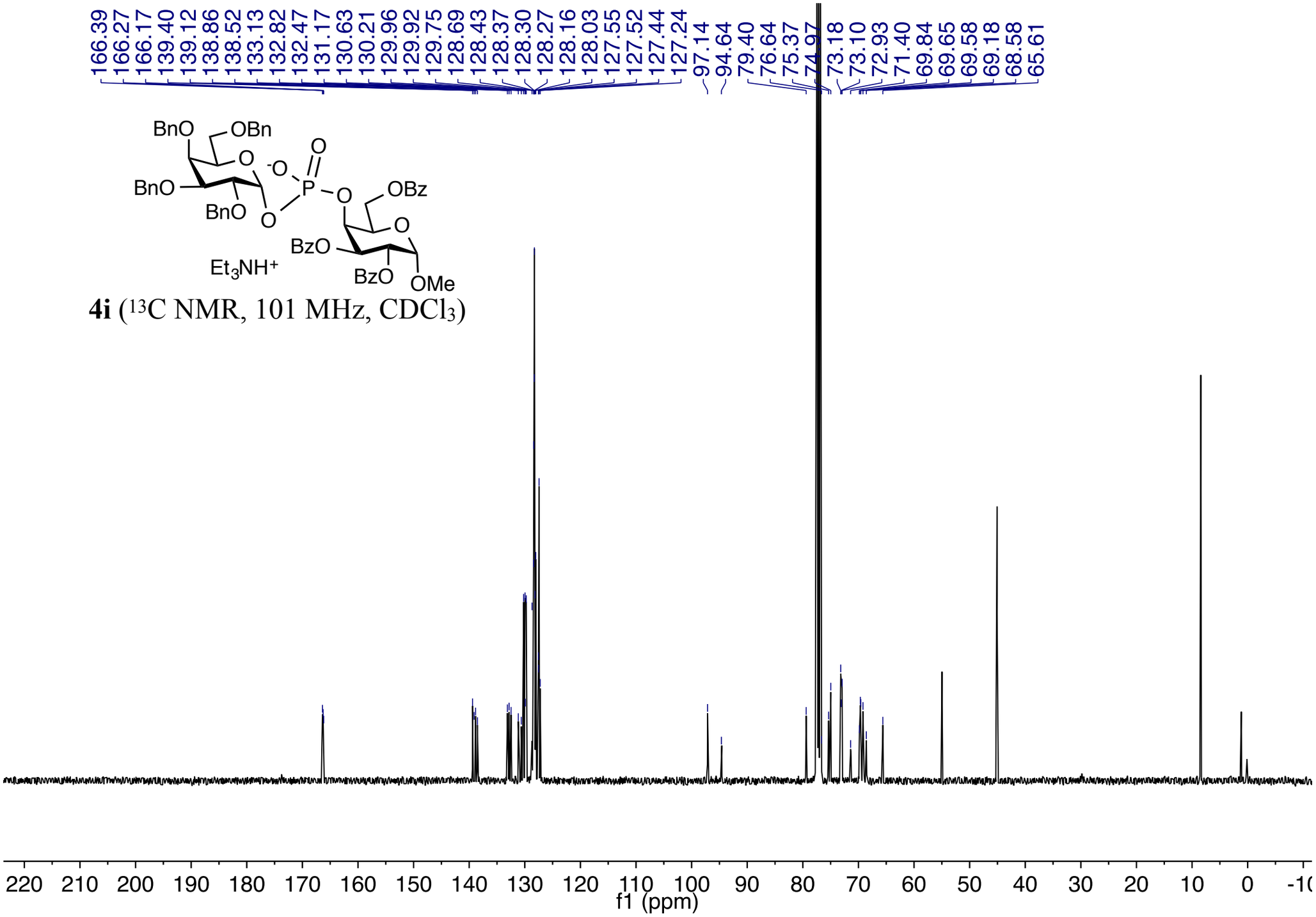



BnO
OBn
O
O-
O
BnO
BnO
P
O
BnO
O
O
BnO
BnO
OMe
Et3NH+
4h (gCOSY, CDCl3)
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
f2 (ppm)

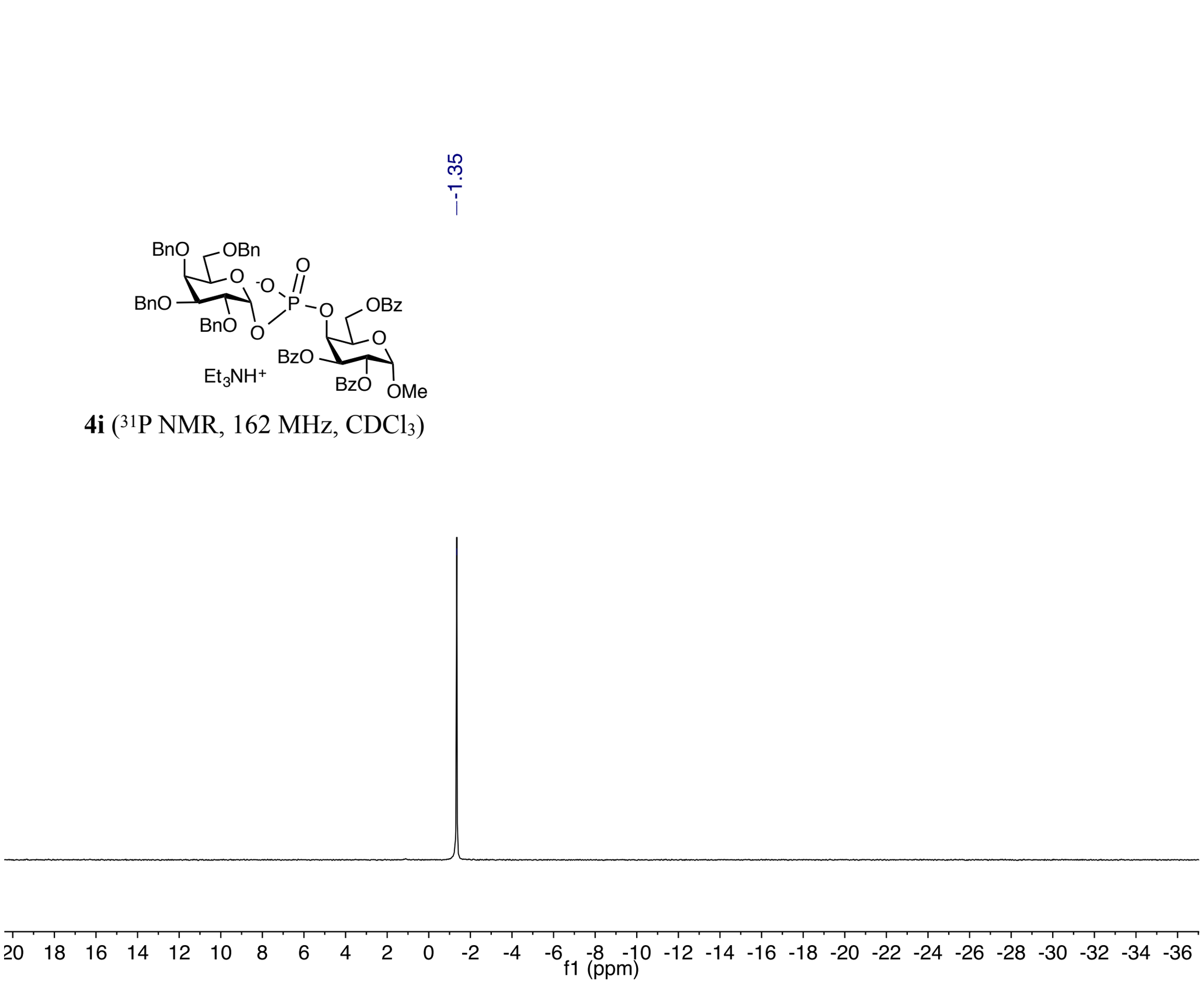

BnO
OBn
O
O-
O
BnO
BnO
P
BnO
O
O
BnO
BnO
BnO
OMe
Et3NH+
4h (gHSQC, CDCl3)
55
60
65
70
75
80
85
90
95
100
f1 (ppm)
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
f2 (ppm)



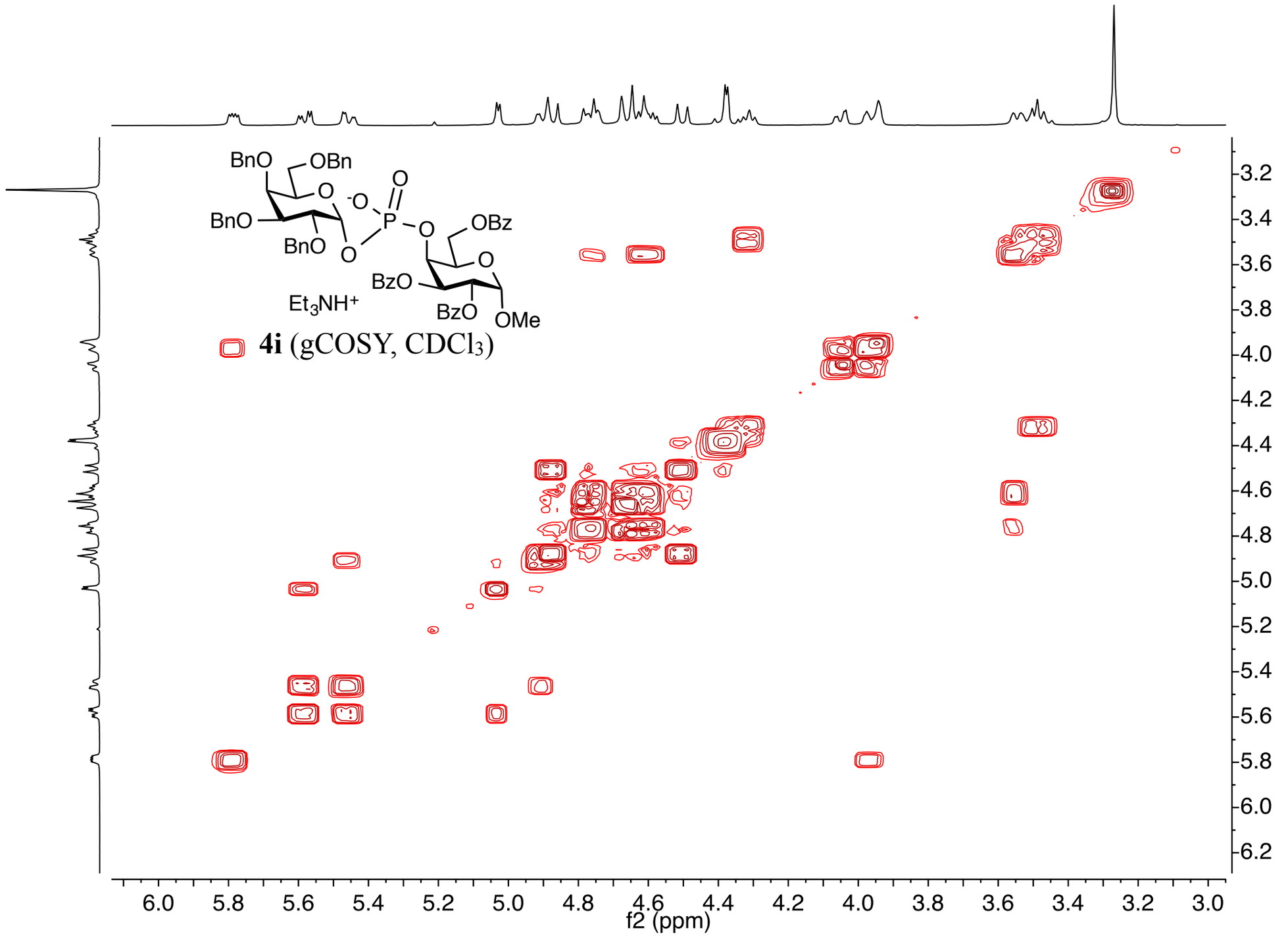
4i (^{1}H NMR, 400 MHz, $CDCl_3$)

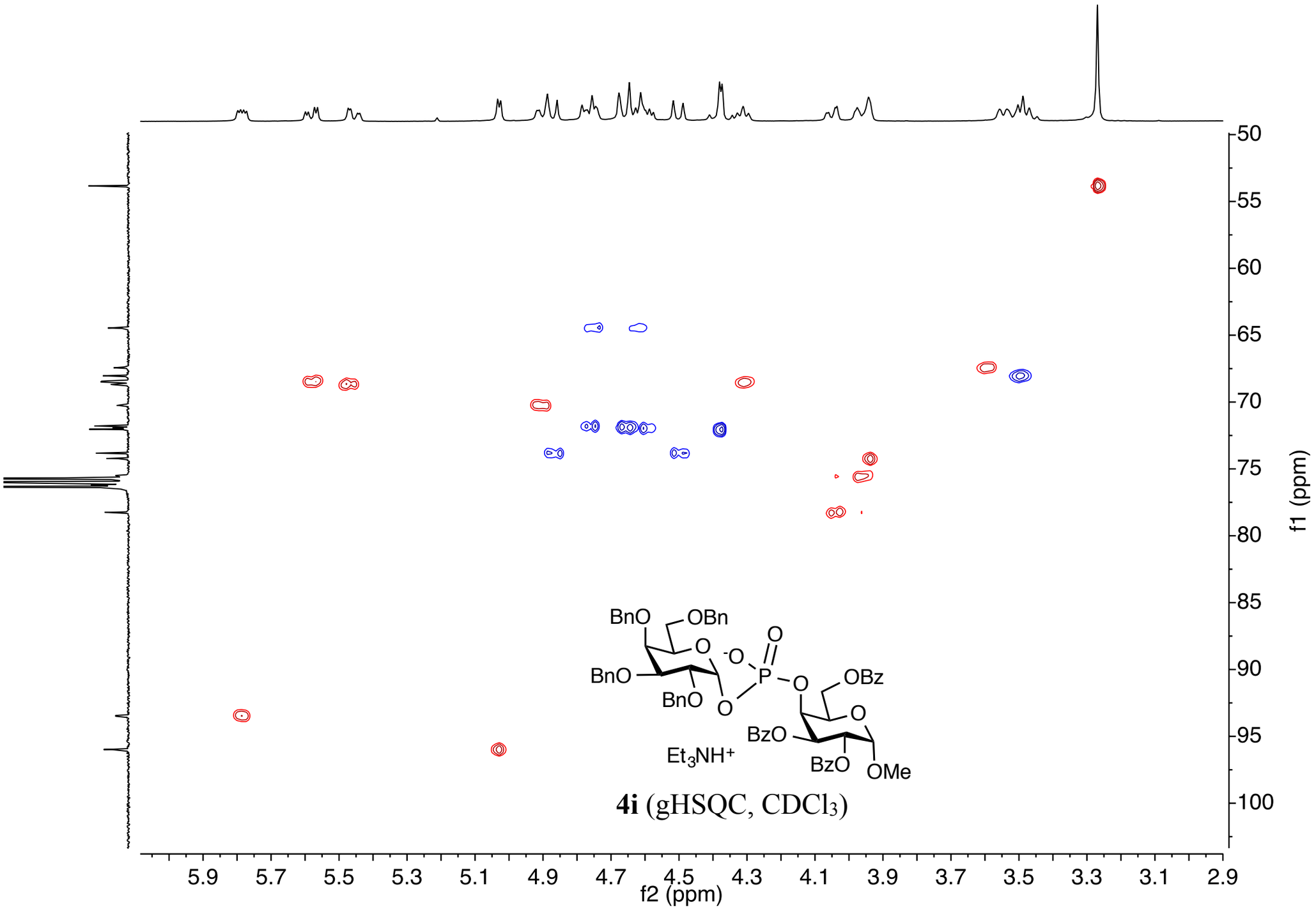


4i (^{13}C NMR, 101 MHz, $CDCl_3$)

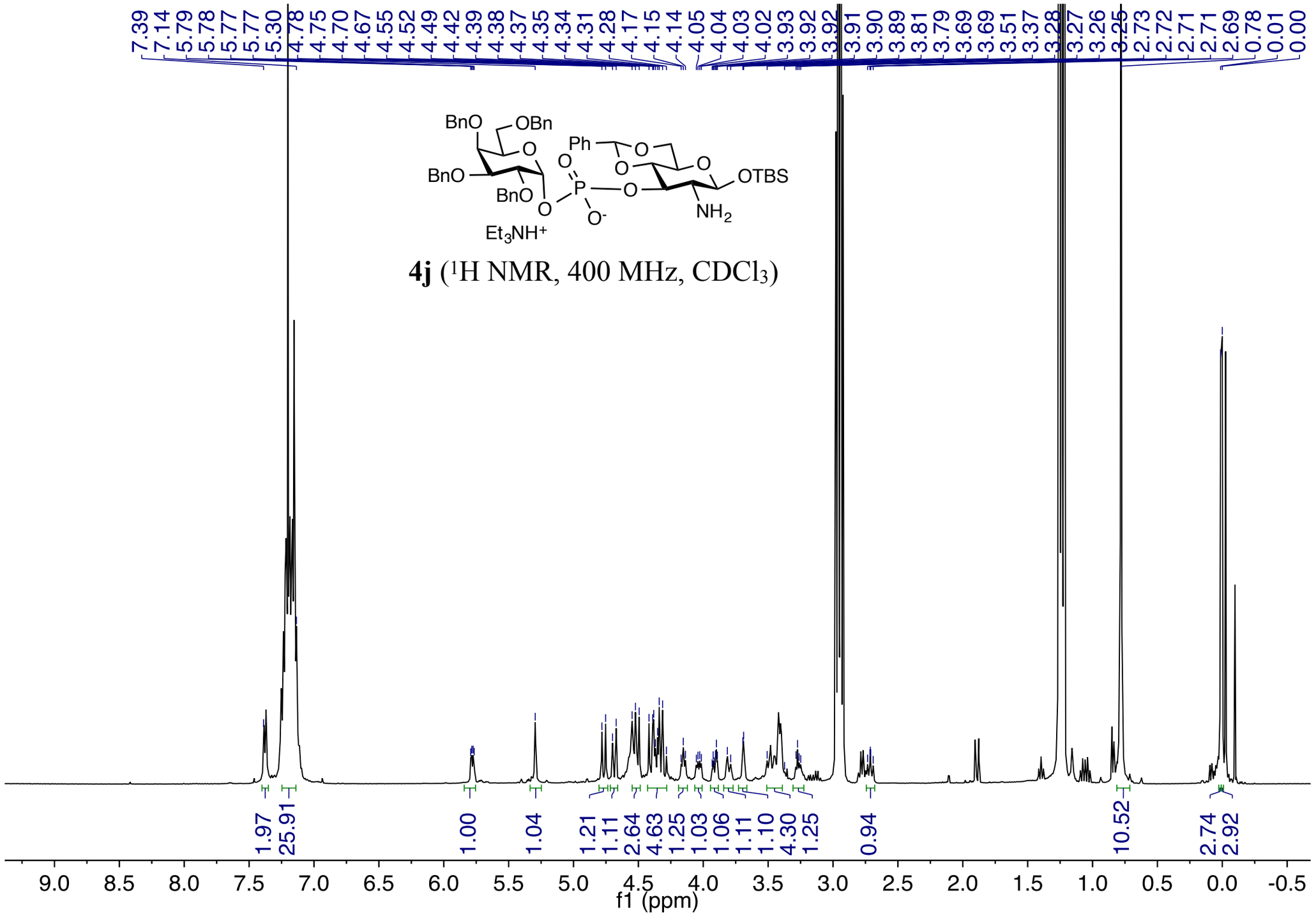


4i (^{31}P NMR, 162 MHz, $CDCl_3$)

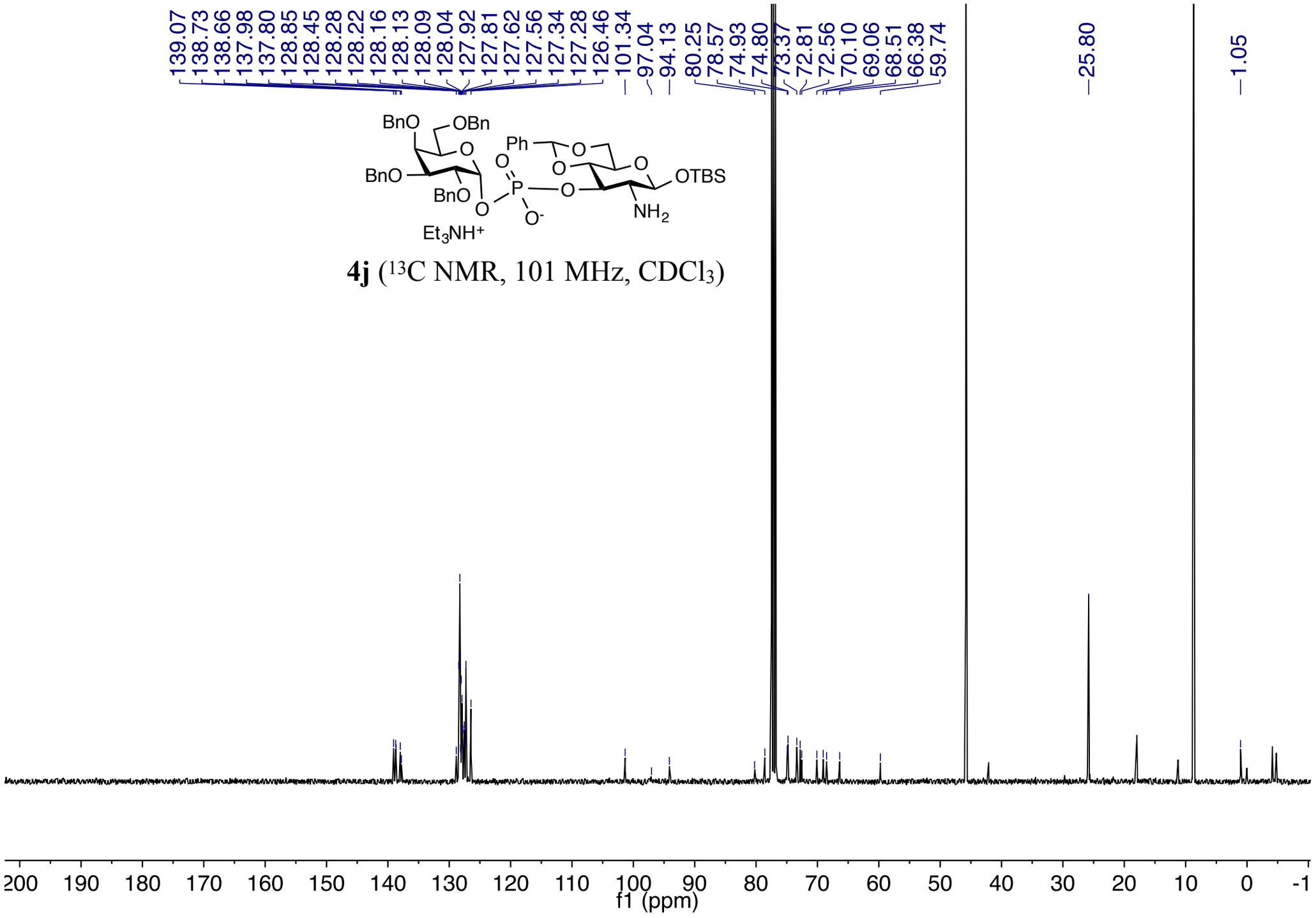

BnO
OBn
O
-O
P
O
BnO
BnO
O
O
OBz
O
BzO
Et3NH+
BzO
OMe
4i (gCOSY, CDCl3)
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
f1 (ppm)
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)



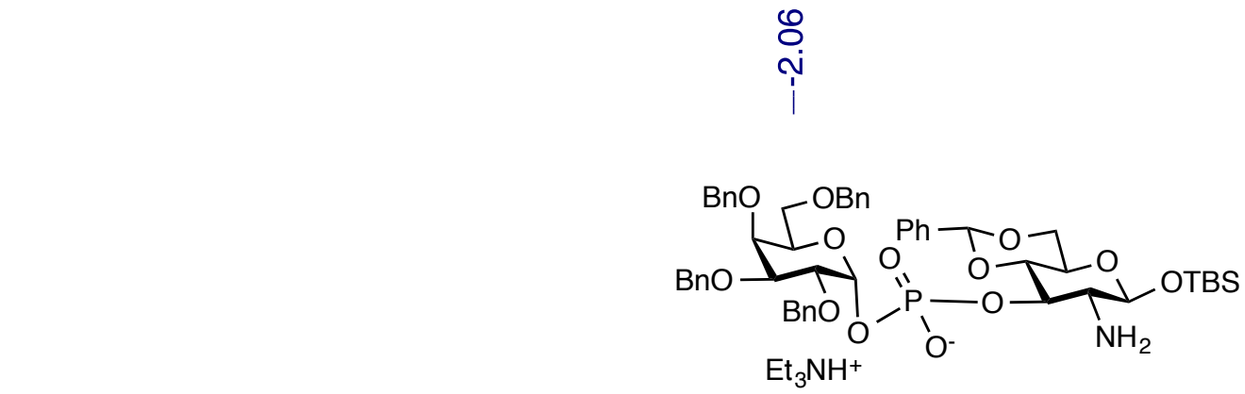
4i (gHSQC, $CDCl_3$)



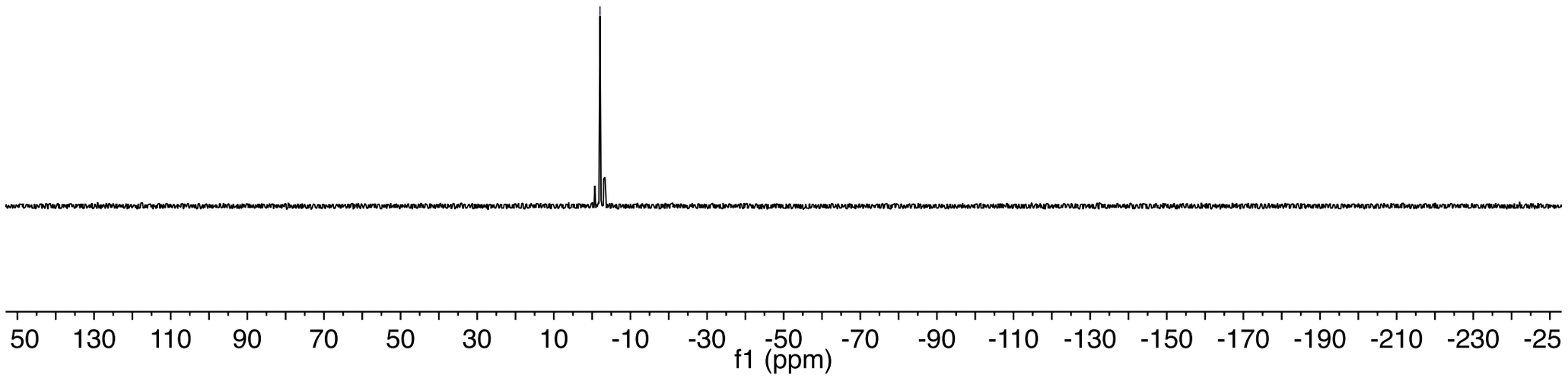
4j (^{1}H NMR, 400 MHz, $CDCl_3$)

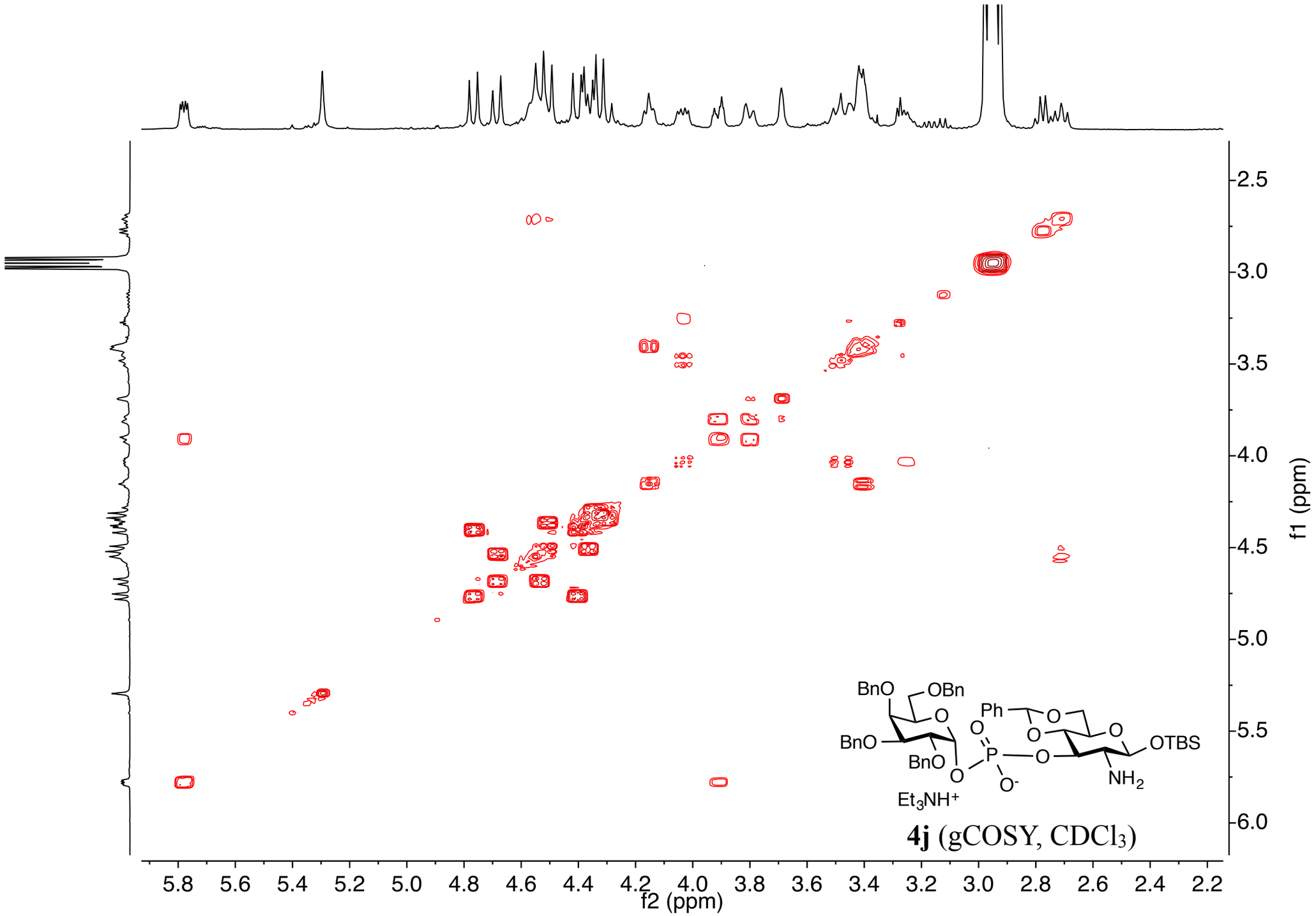


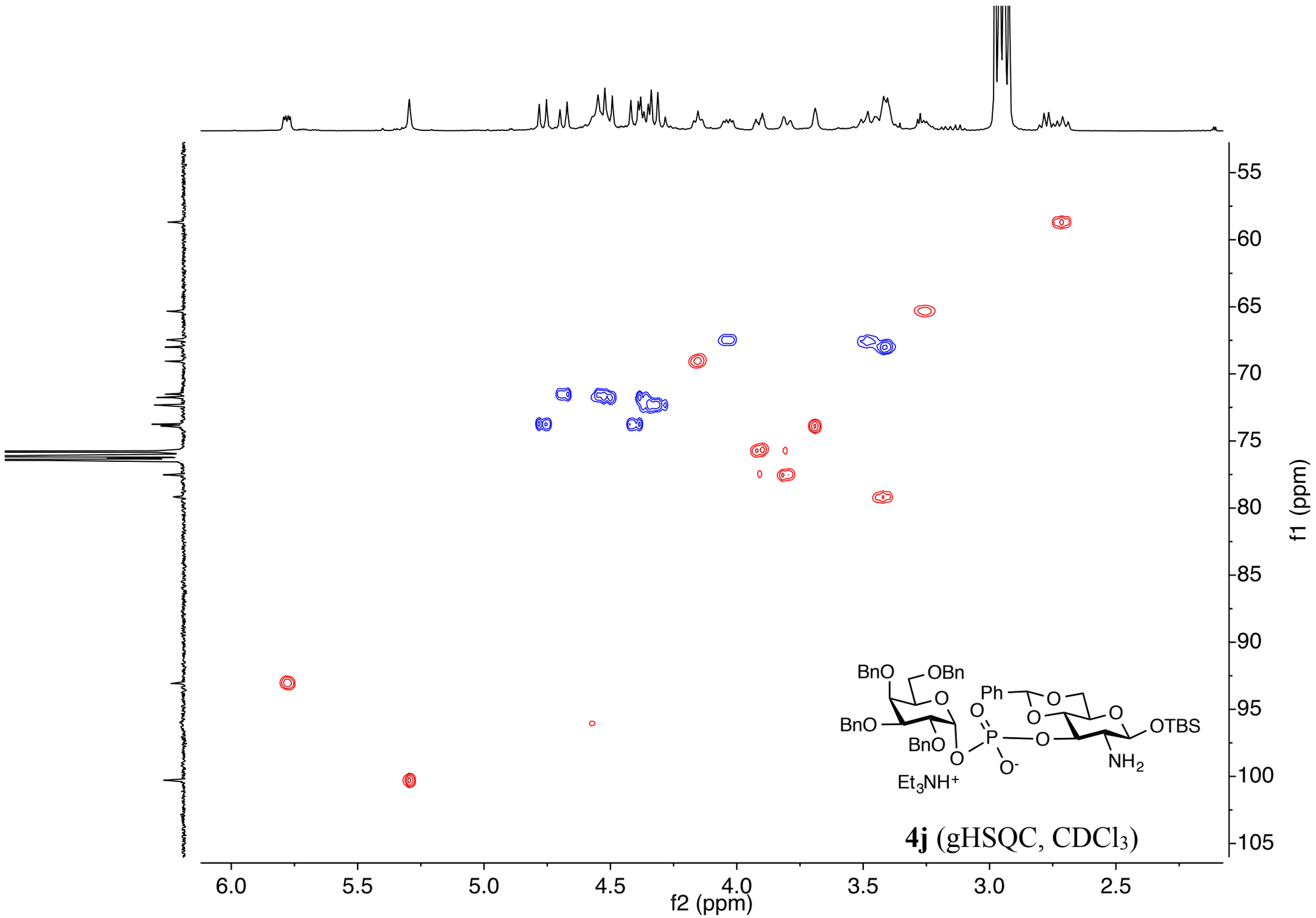
4j (^{13}C NMR, 101 MHz, $CDCl_3$)

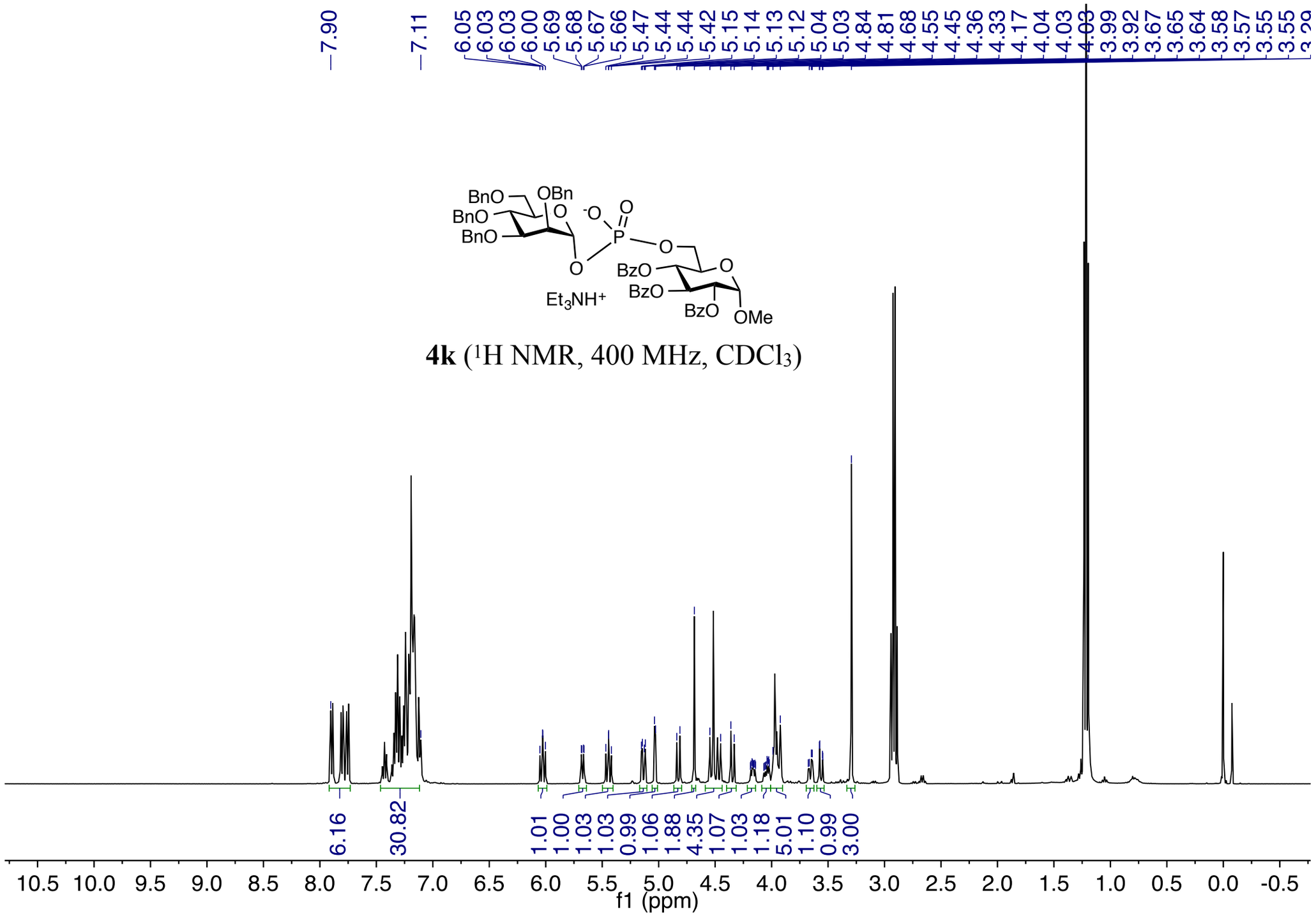


4j (^{31}P NMR, 162 MHz, $CDCl_3$)

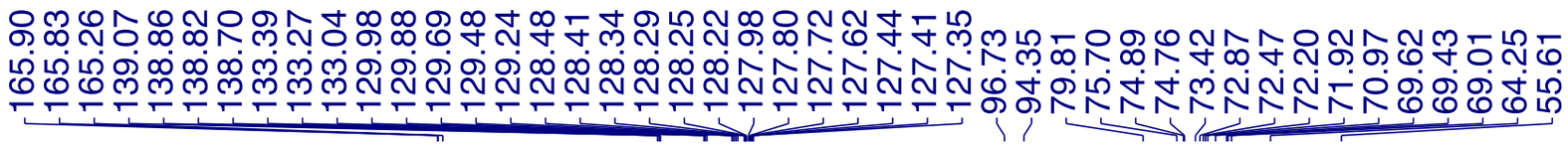


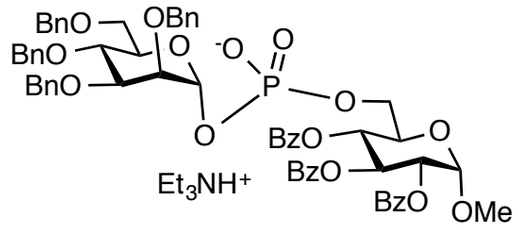

BnO
OBn
O
BnO
BnO
O
Et3NH+
Ph
O
O
O
O
P
O
O-
O
OTBS
NH2
4j (gCOSY, CDCl3)
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
f2 (ppm)


55
60
65
70
75
80
85
90
95
100
105
f1 (ppm)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
f2 (ppm)
BnO
OBn
O
BnO
BnO
O
Et3NH+
Ph
O
O
O
O
P
O
O-
O
OTBS
NH2
4j (gHSQC, CDCl3)

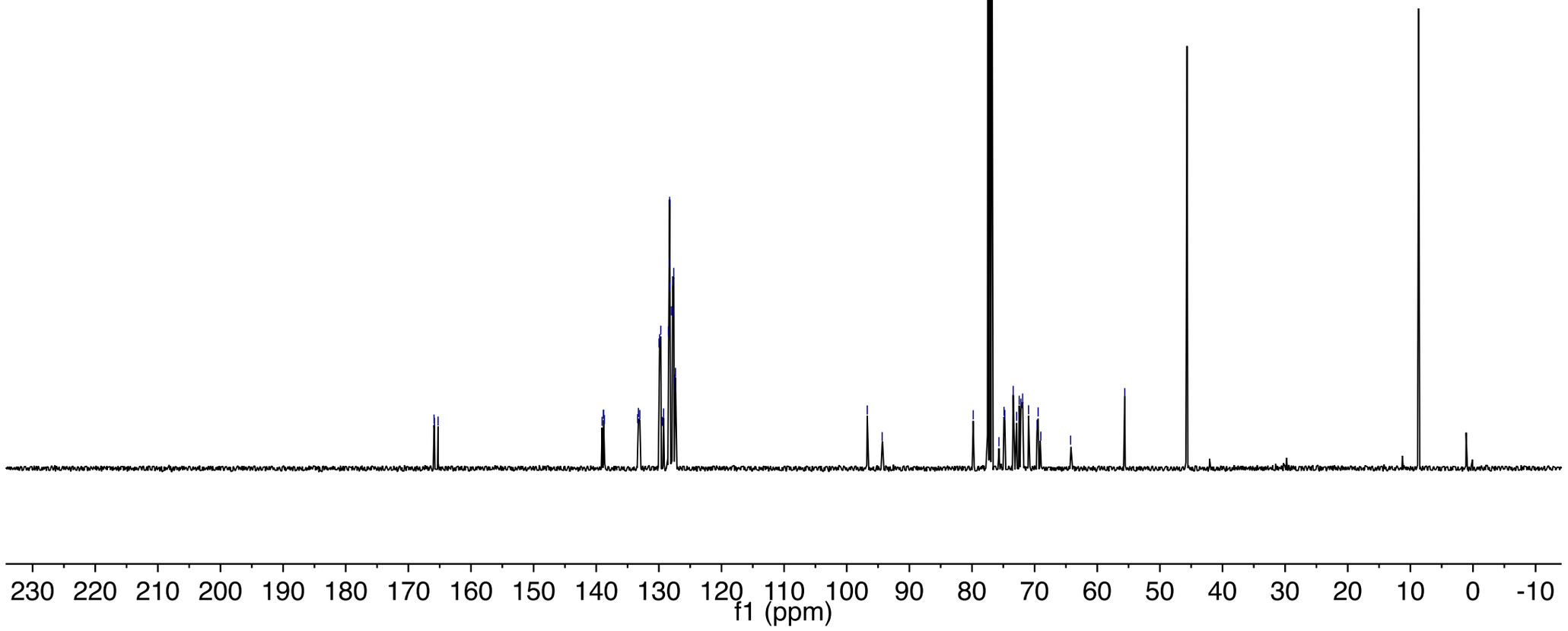


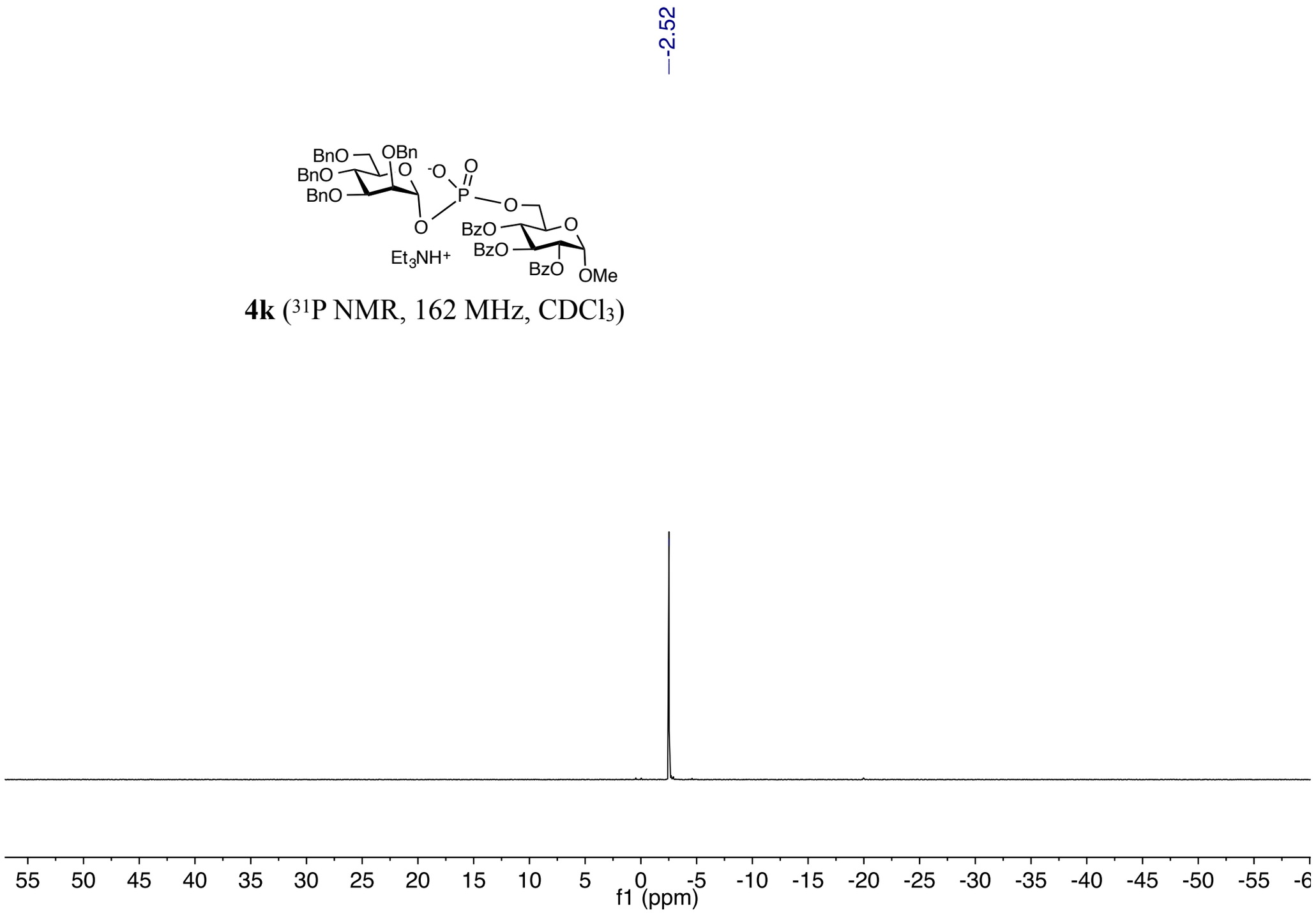
4k (^{1}H NMR, 400 MHz, $CDCl_3$)



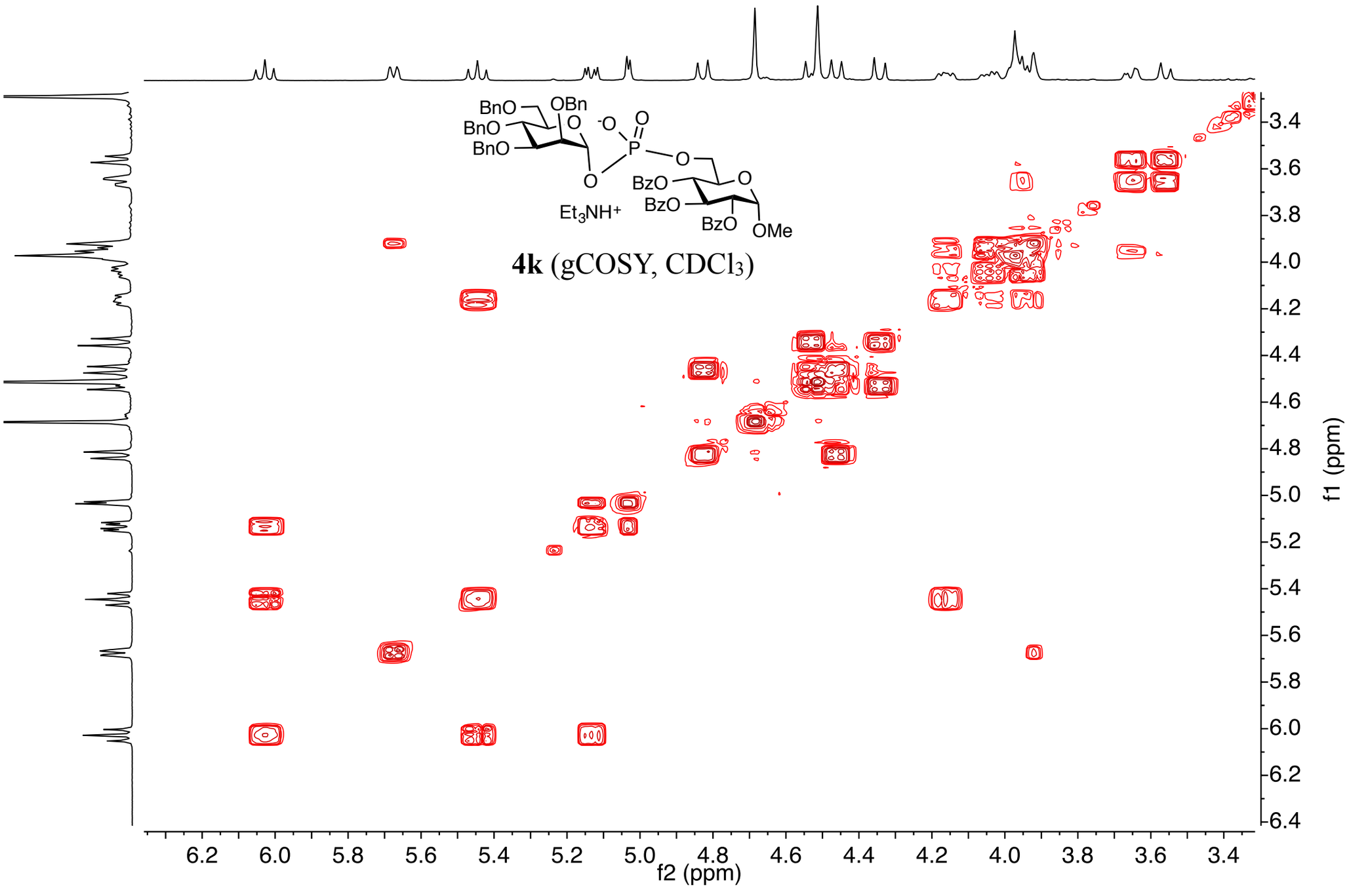


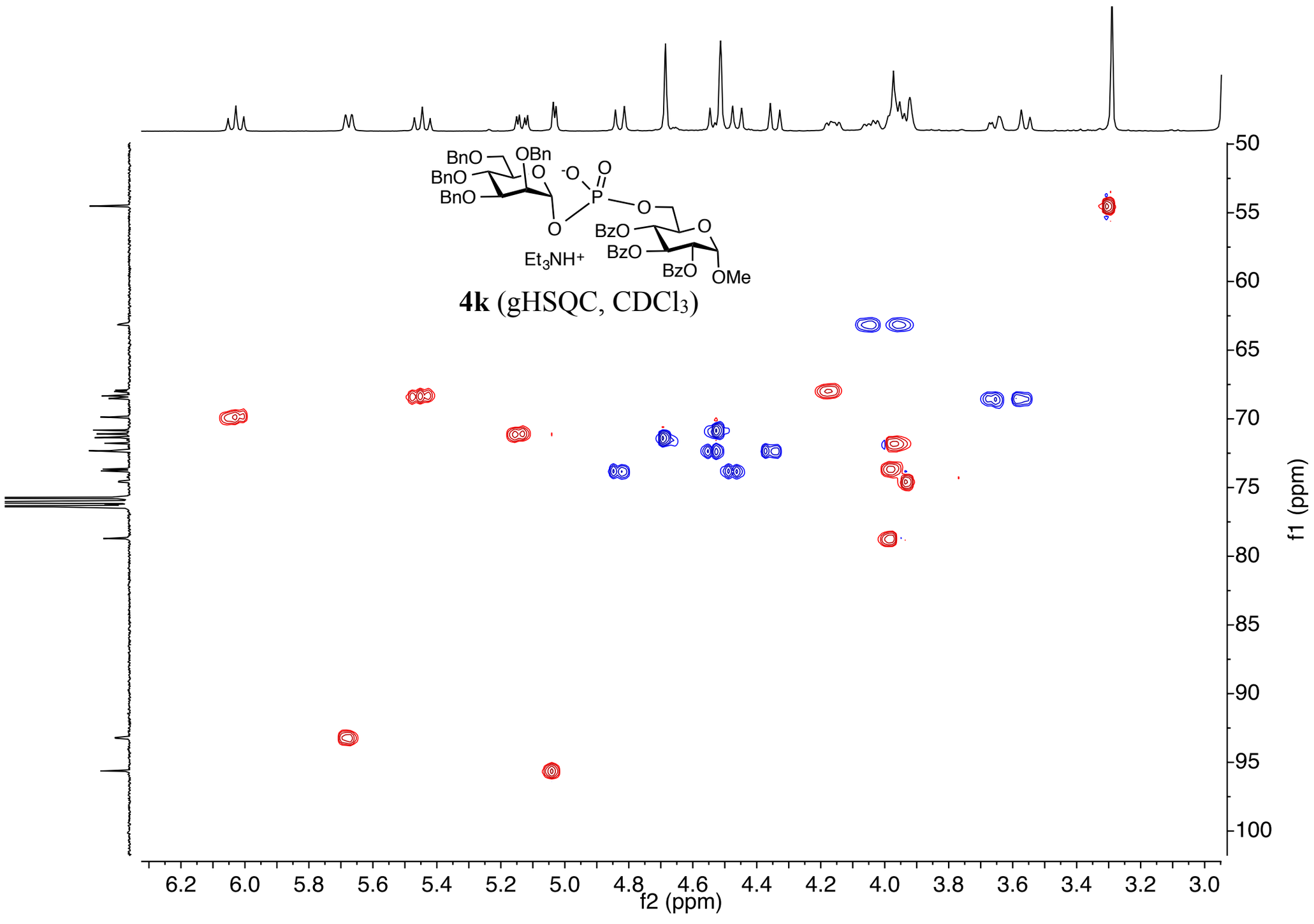
4k (^{13}C NMR, 101 MHz, $CDCl_3$)

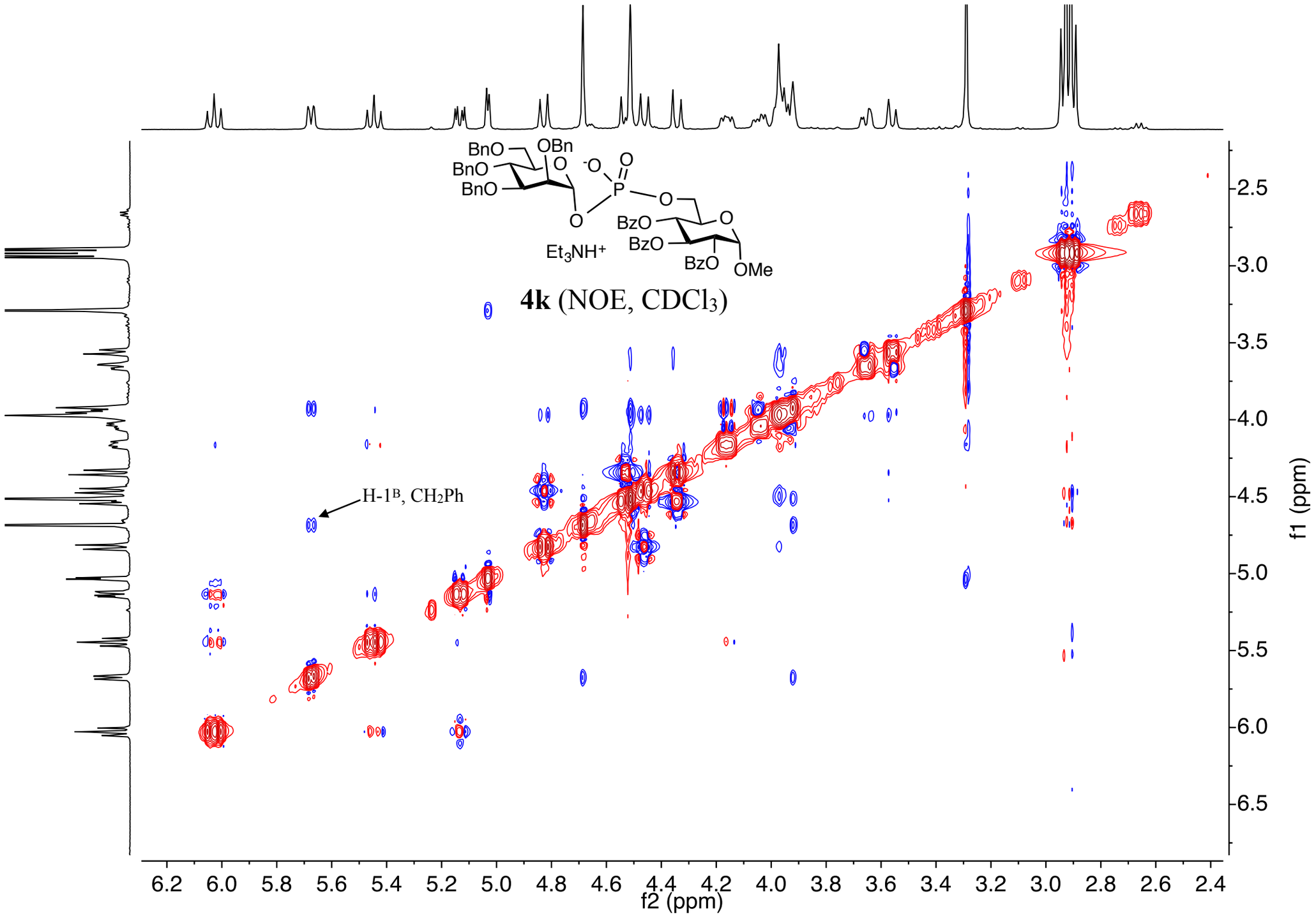


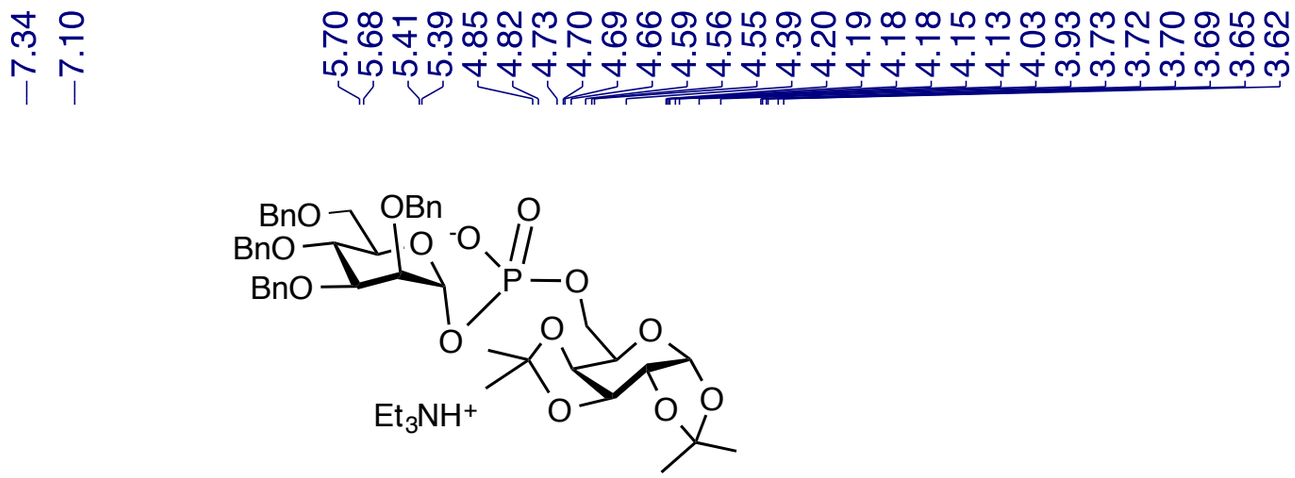


4k (^{31}P NMR, 162 MHz, $CDCl_3$)

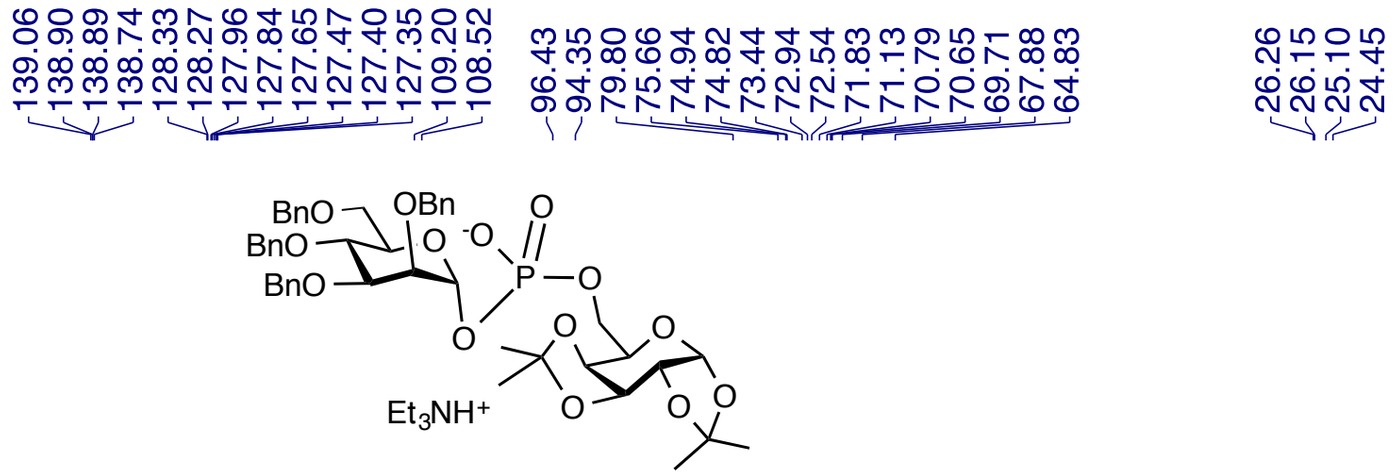

BnO
OBn
BnO
BnO
O
-O
O
P
O
O
BzO
O
BzO
BzO
OMe
Et3NH+
4k (gCOSY, CDCl3)
f2 (ppm)
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4


BnO
OBn
BnO
O
BnO
-O
O
P
O
O
BzO
O
BzO
BzO
OMe
Et3NH+
4k (gHSQC, CDCl3)
50
55
60
65
70
75
80
85
90
95
100
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)

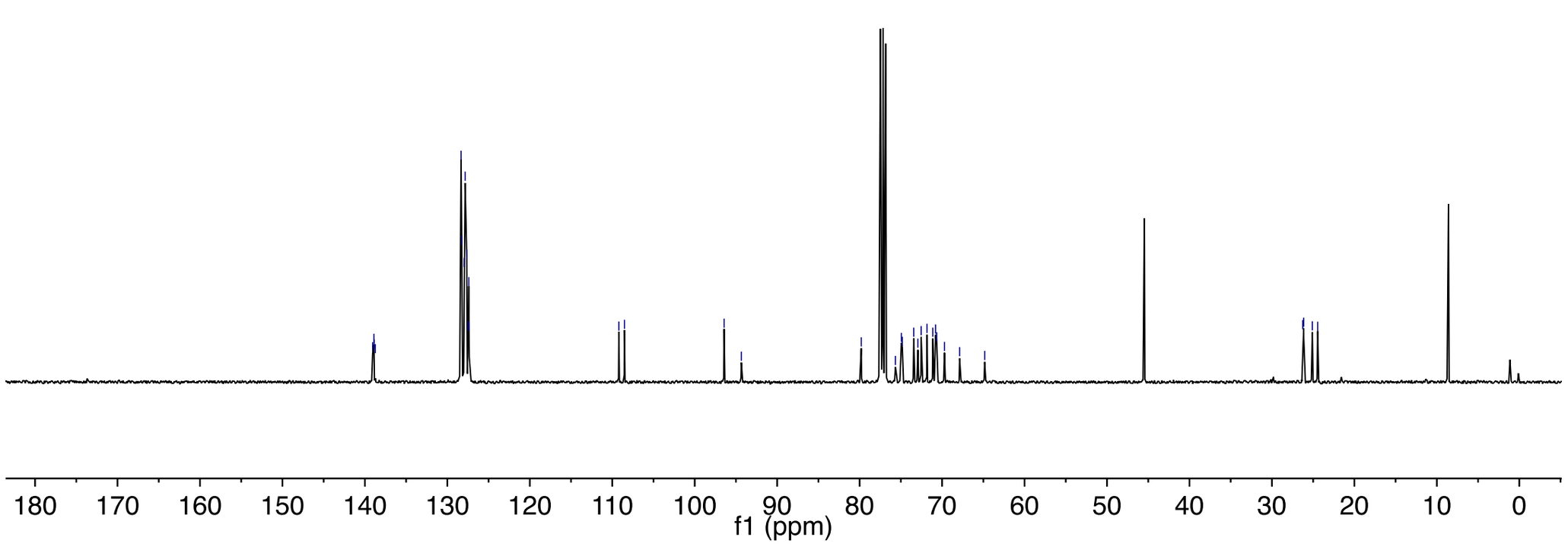

BnO
OBn
BnO
BnO
O
-O
O
P
O
O
BzO
BzO
BzO
OMe
Et3NH+
4k (NOE, CDCl3)
H-1B, CH2Ph
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
f2 (ppm)

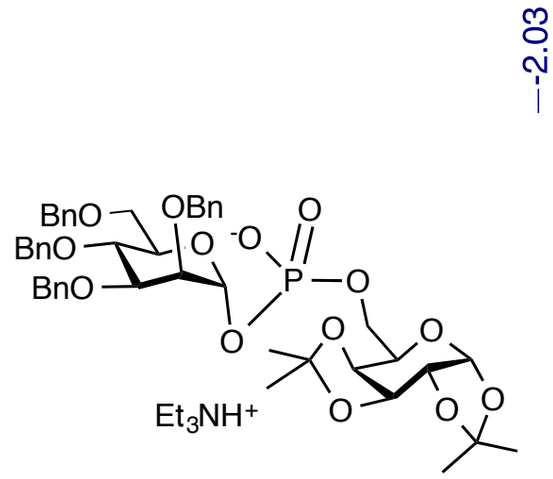


4l (^{1}H NMR, 400 MHz, $CDCl_3$)

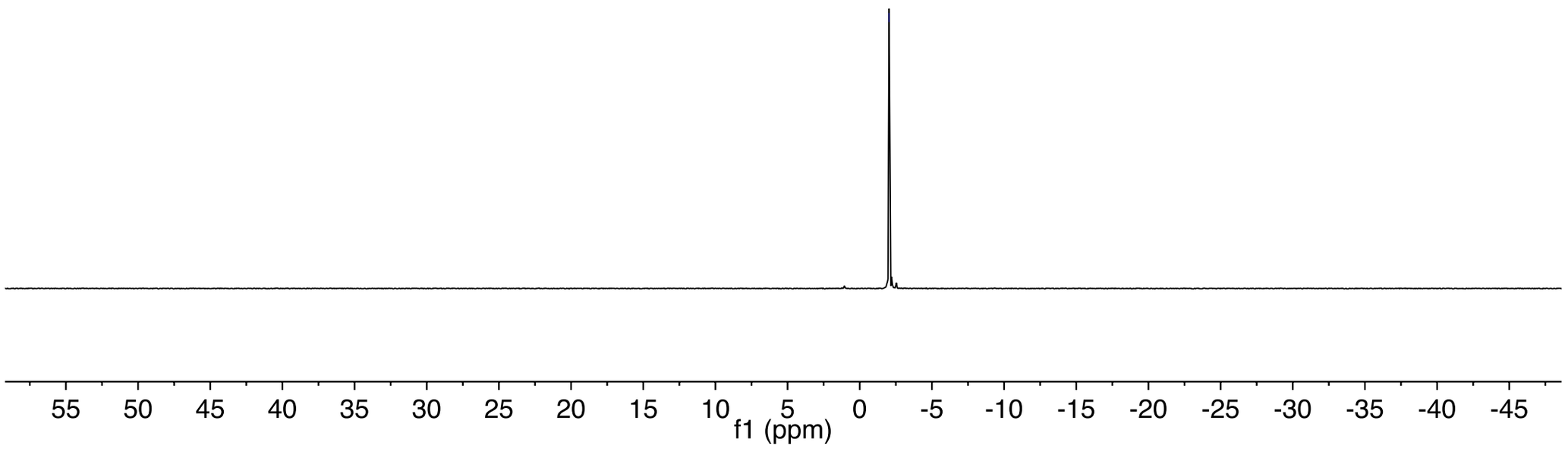


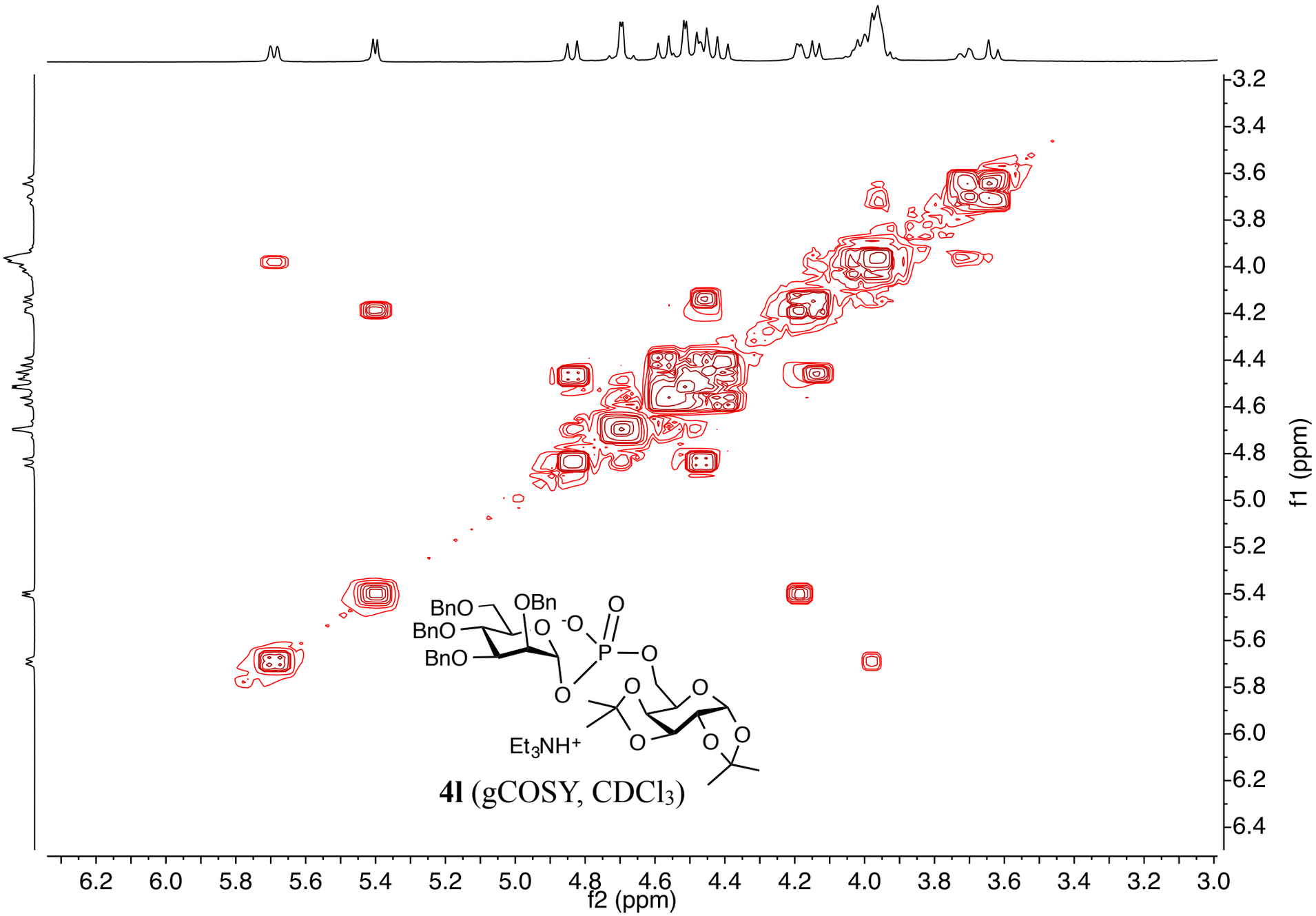
4l (^{13}C NMR, 101 MHz, $CDCl_3$)



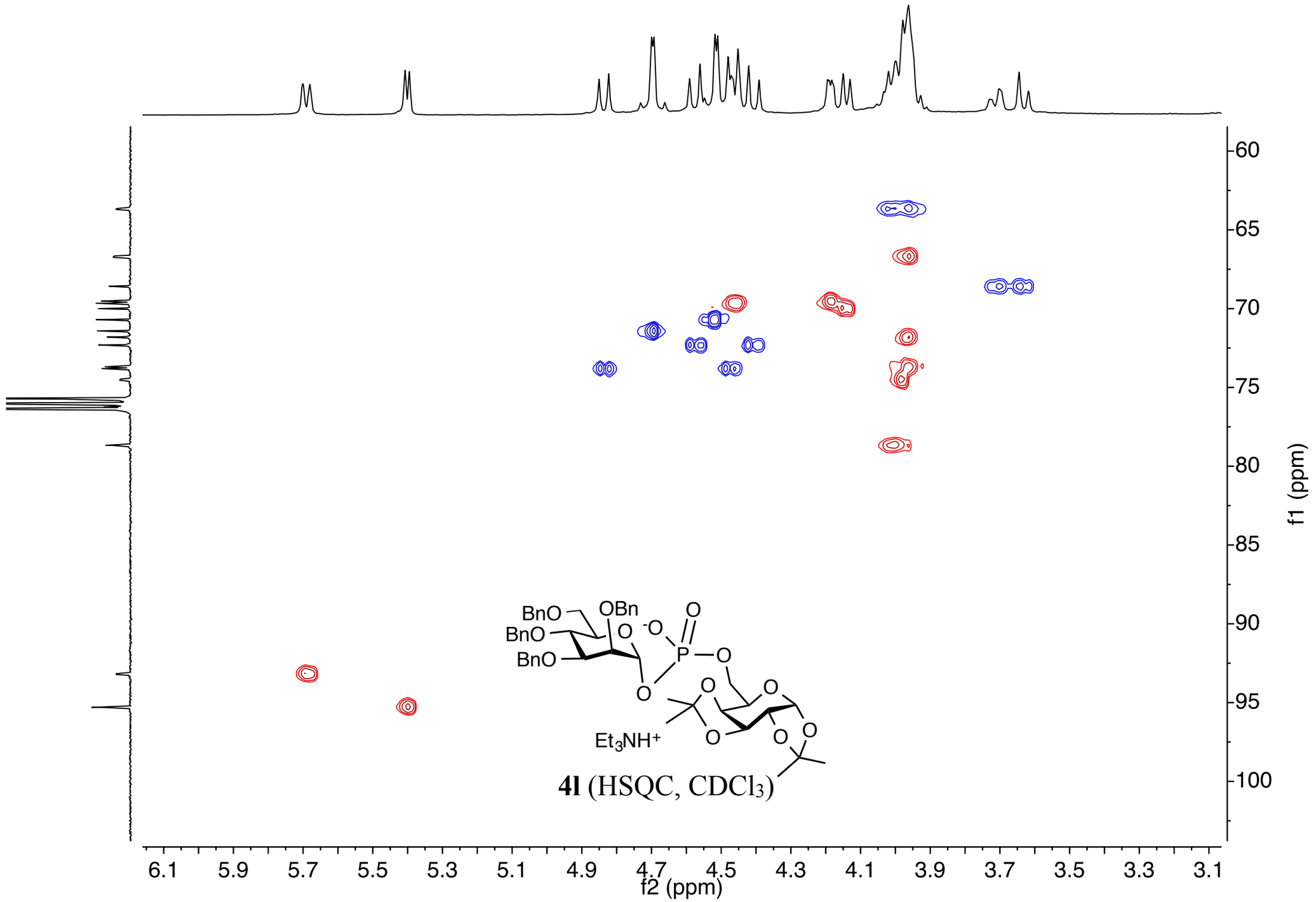


4l (^{31}P NMR, 162 MHz, $CDCl_3$)

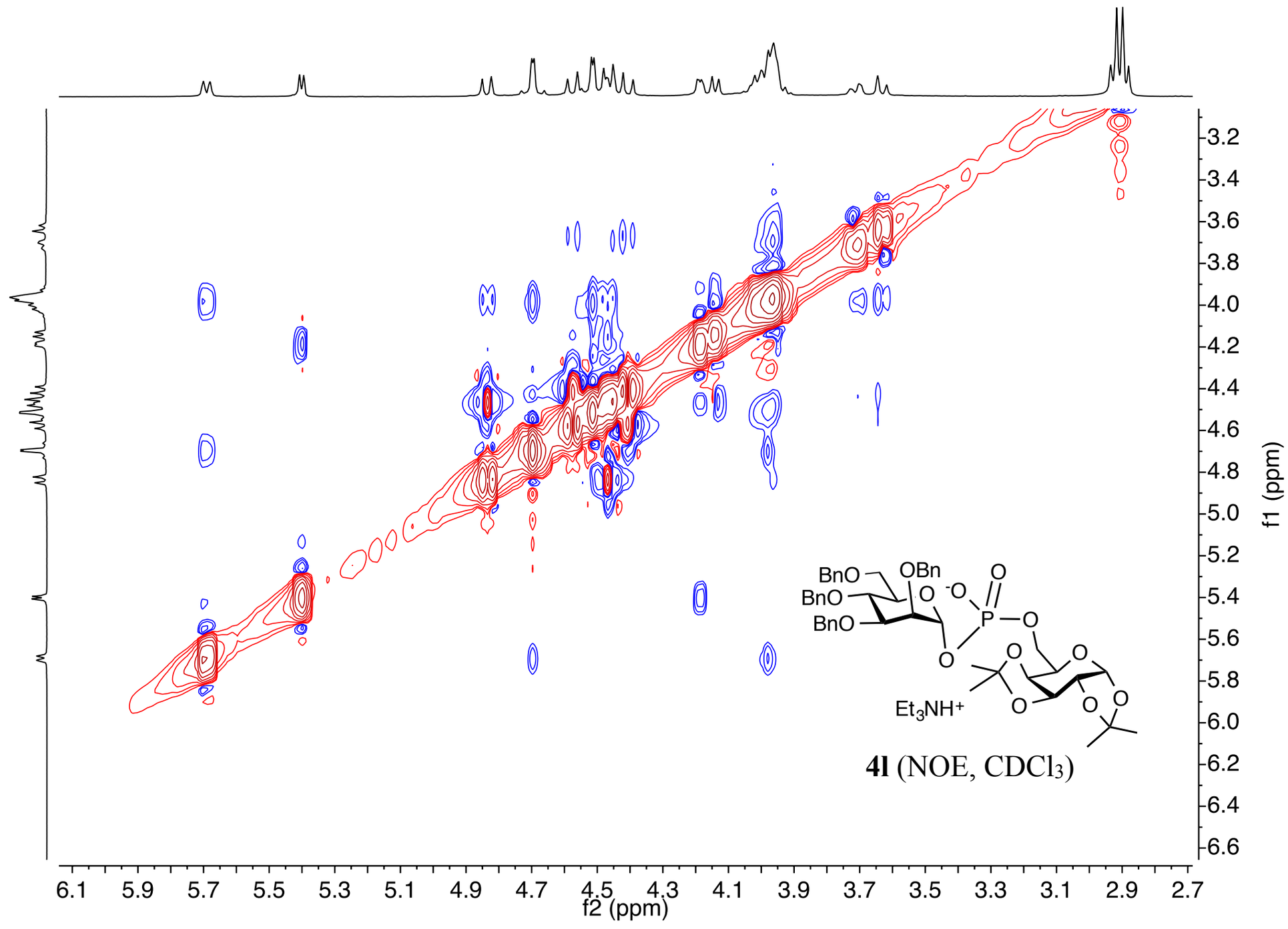




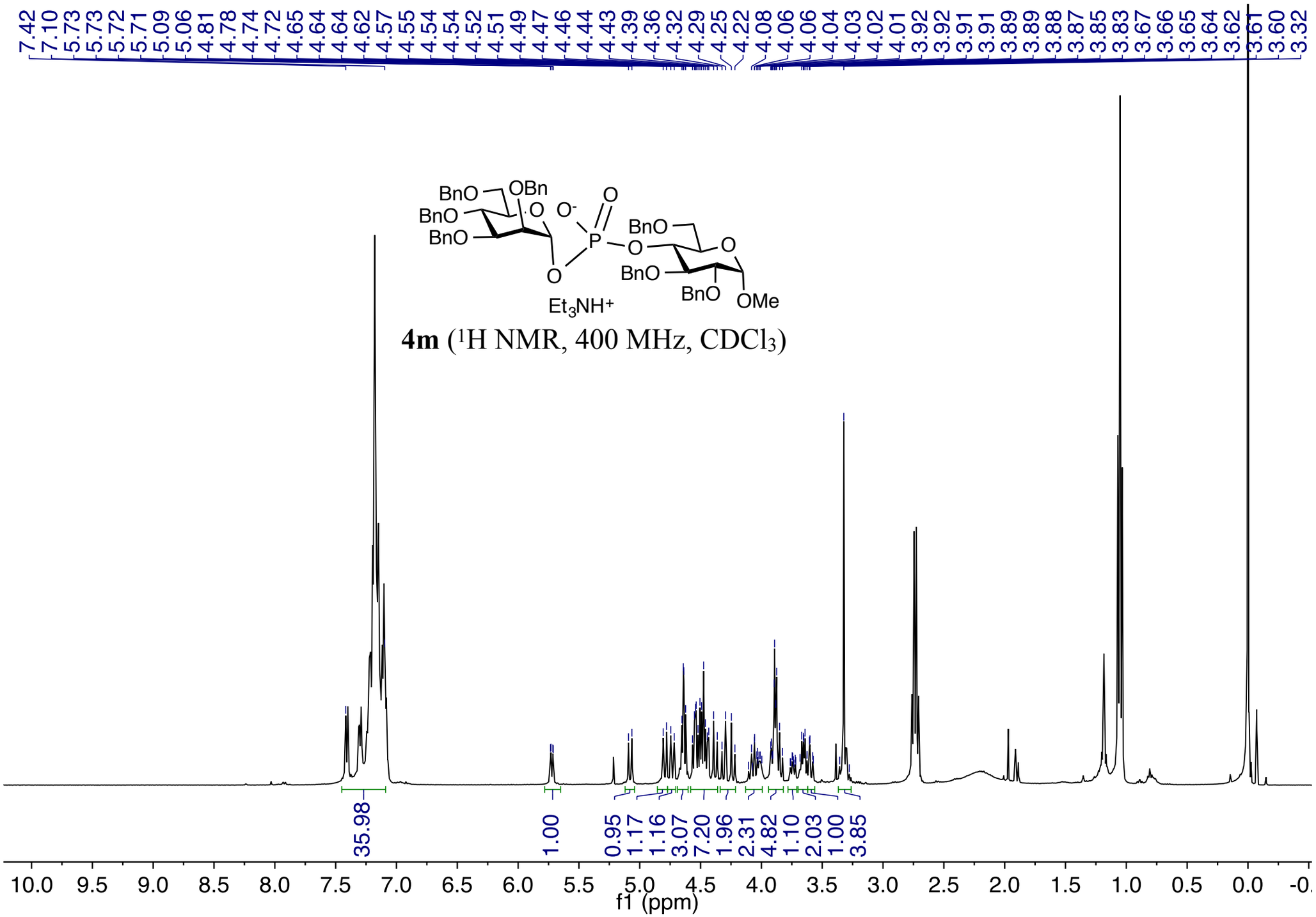
4l (gCOSY, $CDCl_3$)



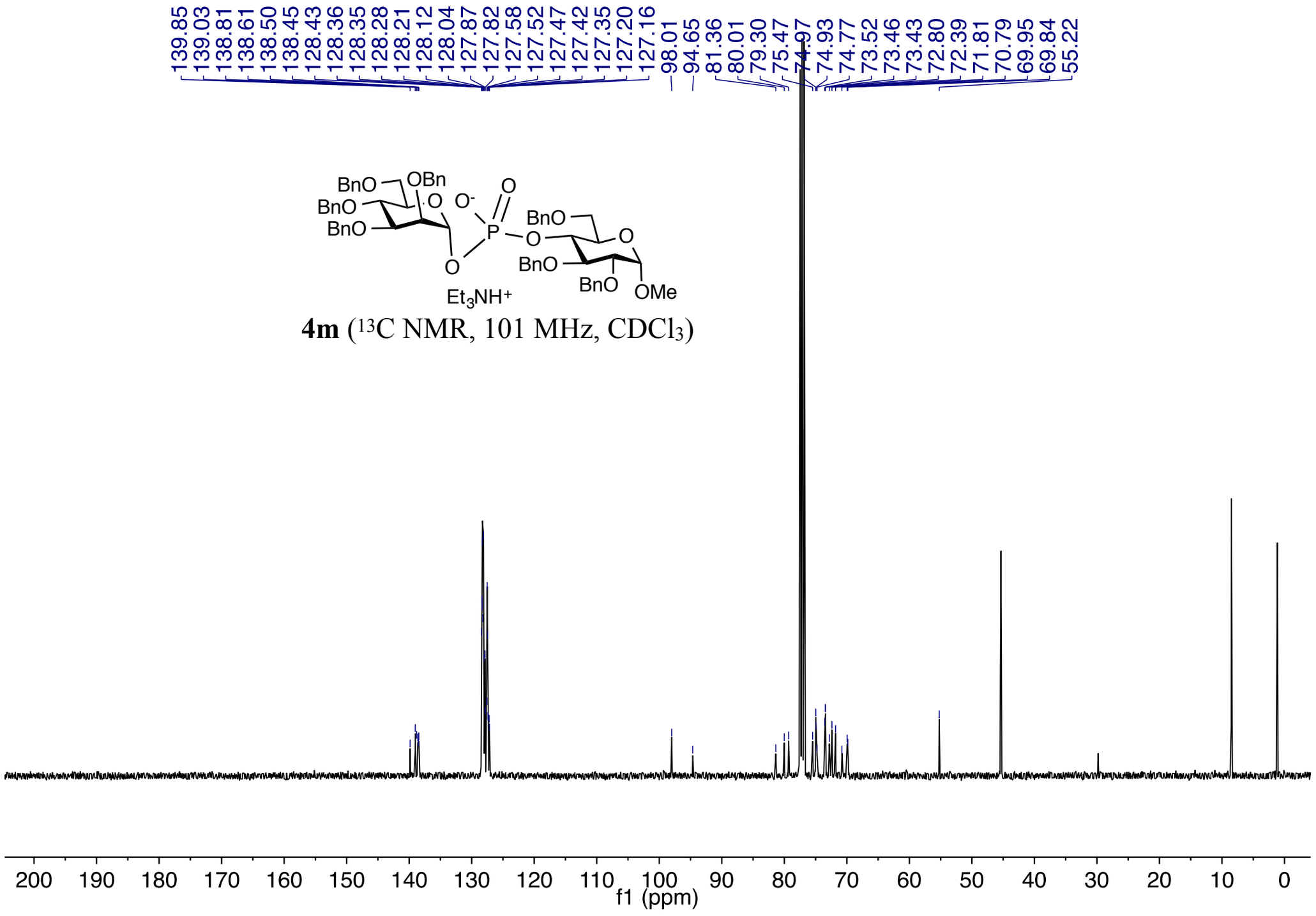
4l (HSQC, $CDCl_3$)



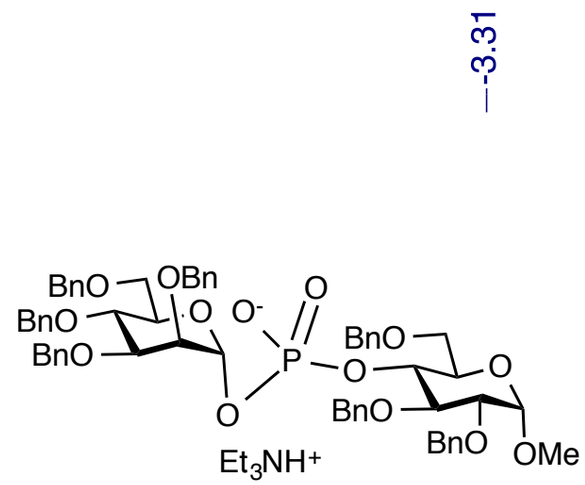
4l (NOE, $CDCl_3$)



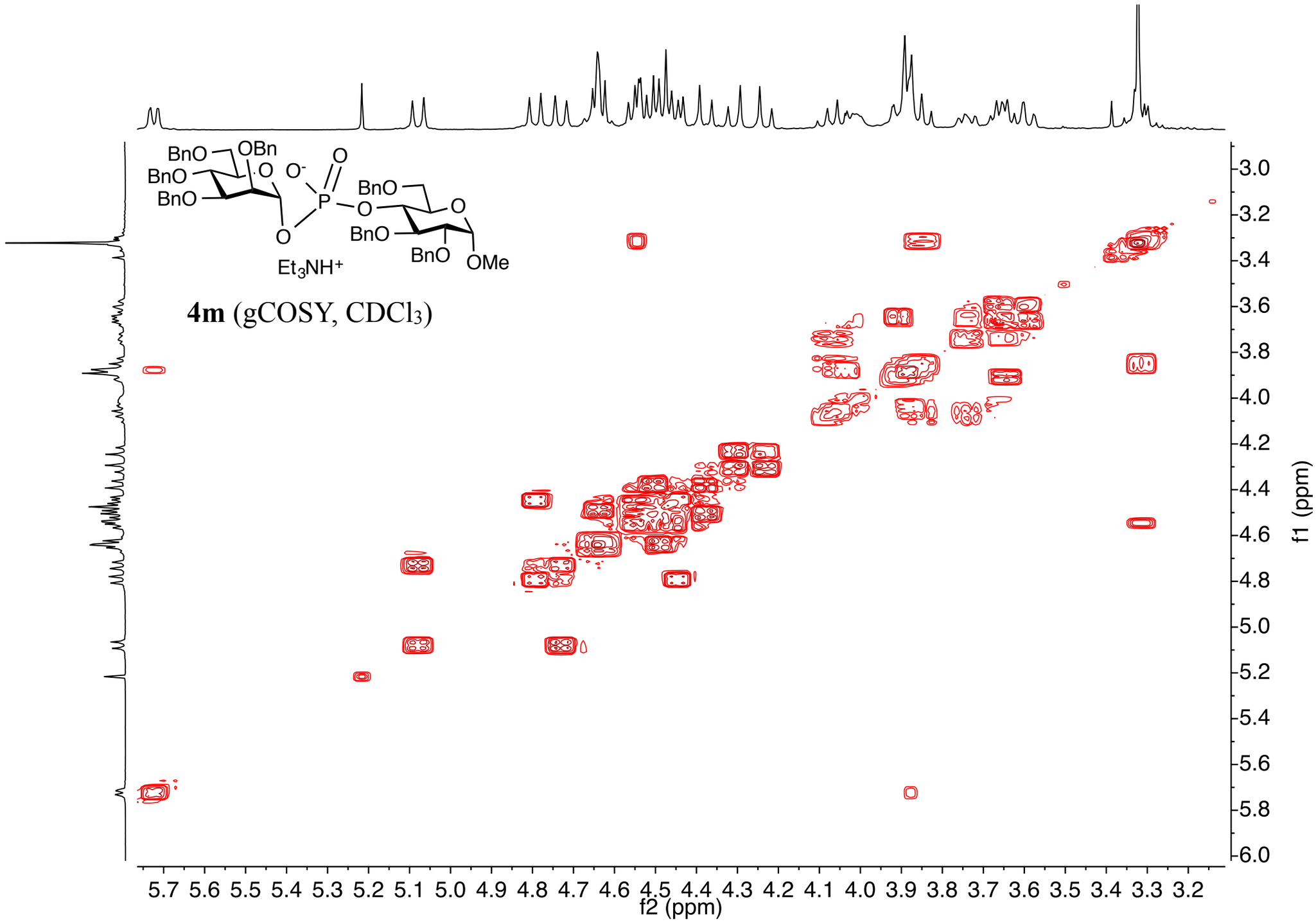
4m (^{1}H NMR, 400 MHz, $CDCl_3$)

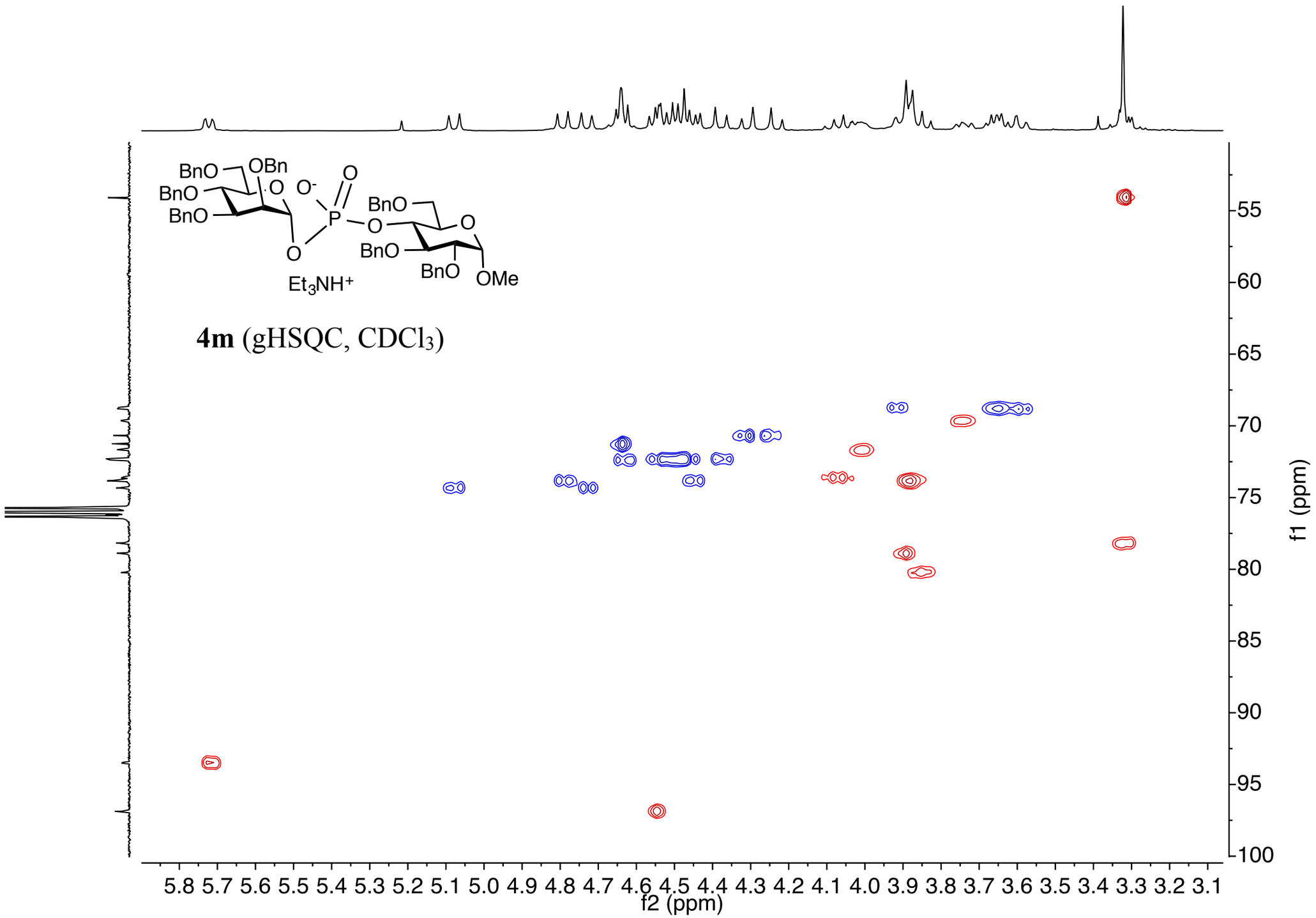


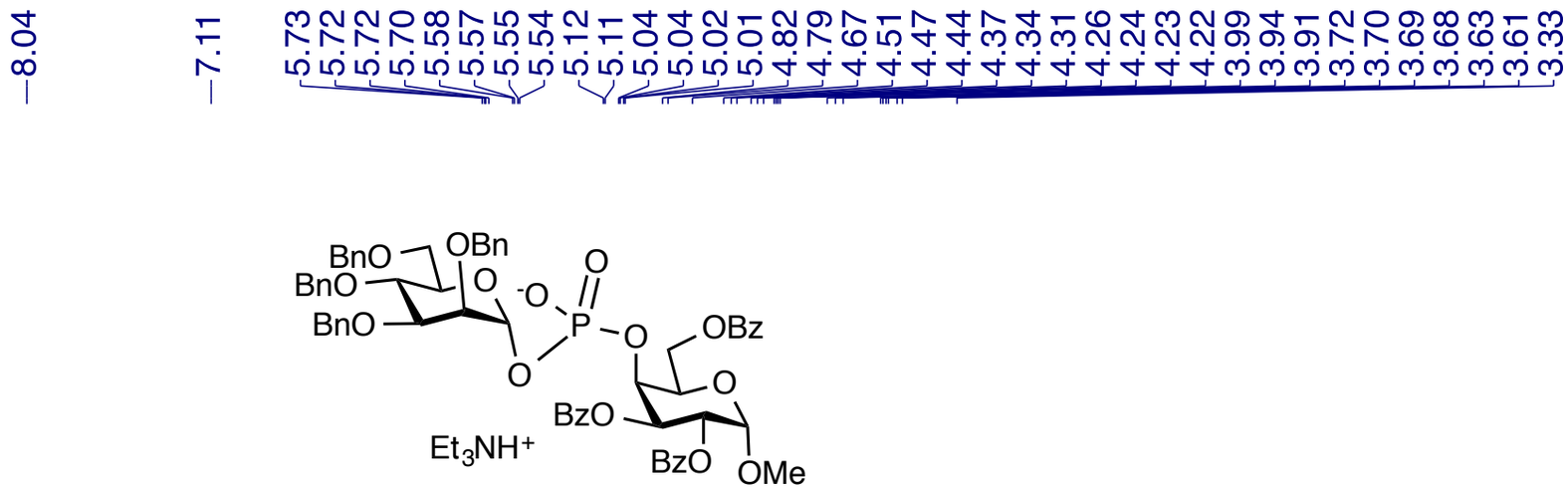
4m (^{13}C NMR, 101 MHz, $CDCl_3$)



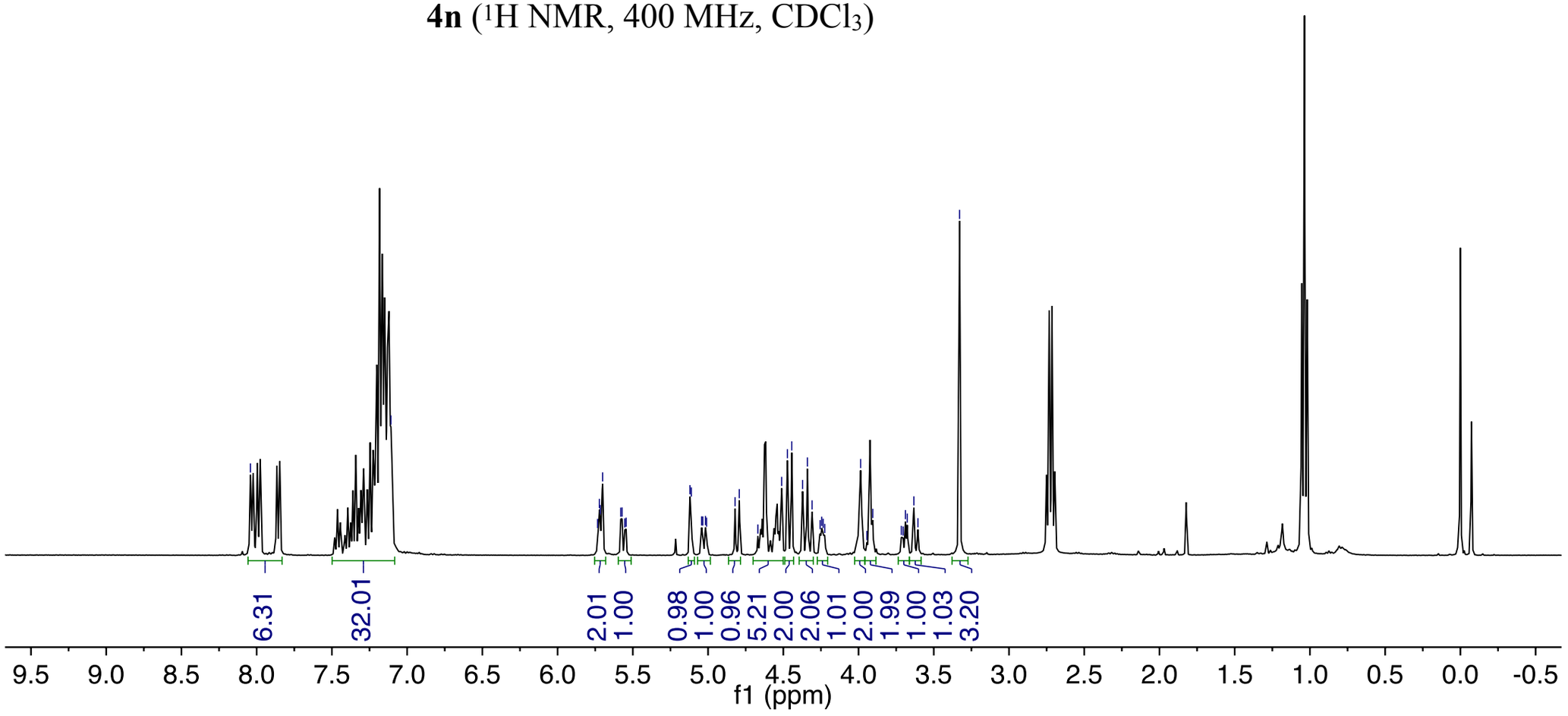
4m (^{31}P NMR, 162 MHz, $CDCl_3$)

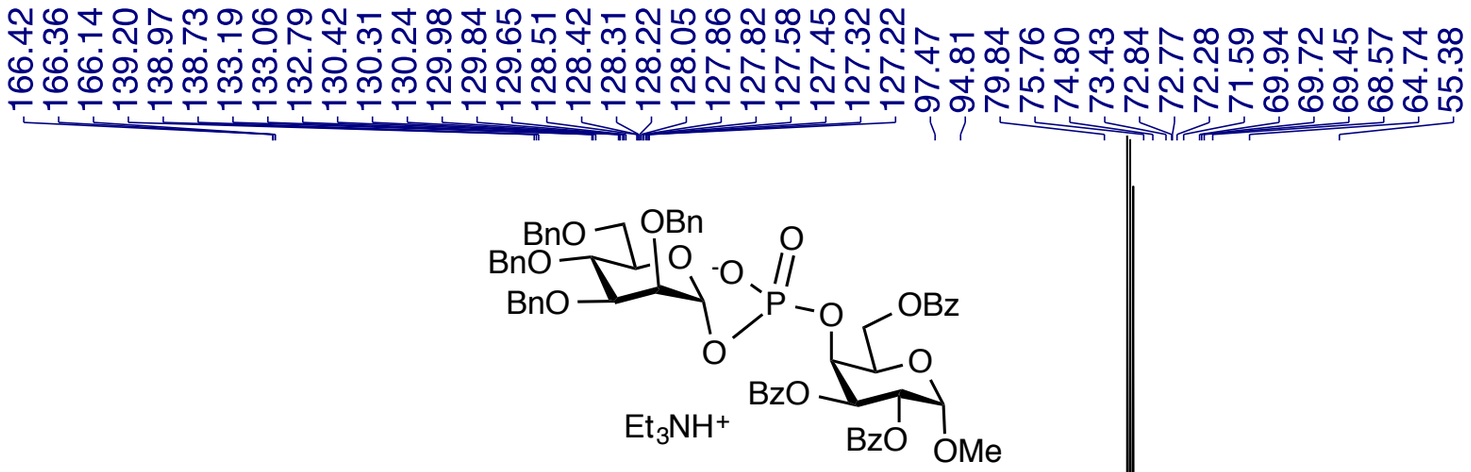

BnO
OBn
BnO
BnO
O
O-
P
O
O
BnO
O
BnO
O
BnO
OMe
Et3NH+
4m (gCOSY, CDCl3)
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
f1 (ppm)
5.7 5.6 5.5 5.4 5.3 5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3 3.2
f2 (ppm)


BnO
OBn
BnO
BnO
O
O-
P
O
O
Et3NH+
BnO
O
BnO
BnO
O
OMe
4m (gHSQC, CDCl3)
55
60
65
70
75
80
85
90
95
100
f1 (ppm)
5.8 5.7 5.6 5.5 5.4 5.3 5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3 3.2 3.1
f2 (ppm)

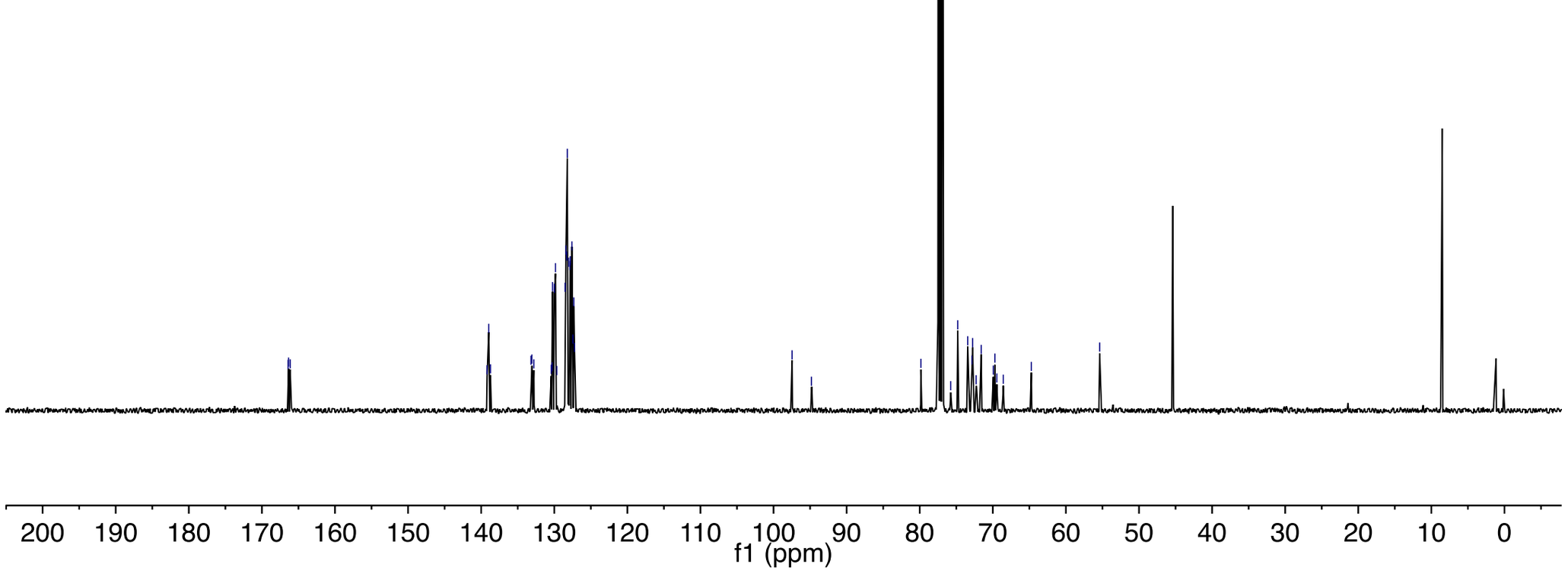


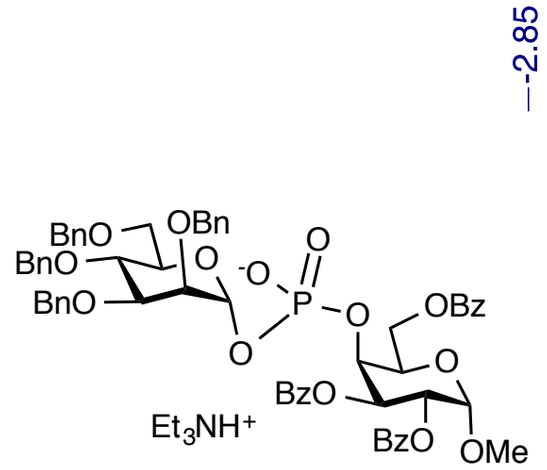
4n (^{1}H NMR, 400 MHz, $CDCl_3$)



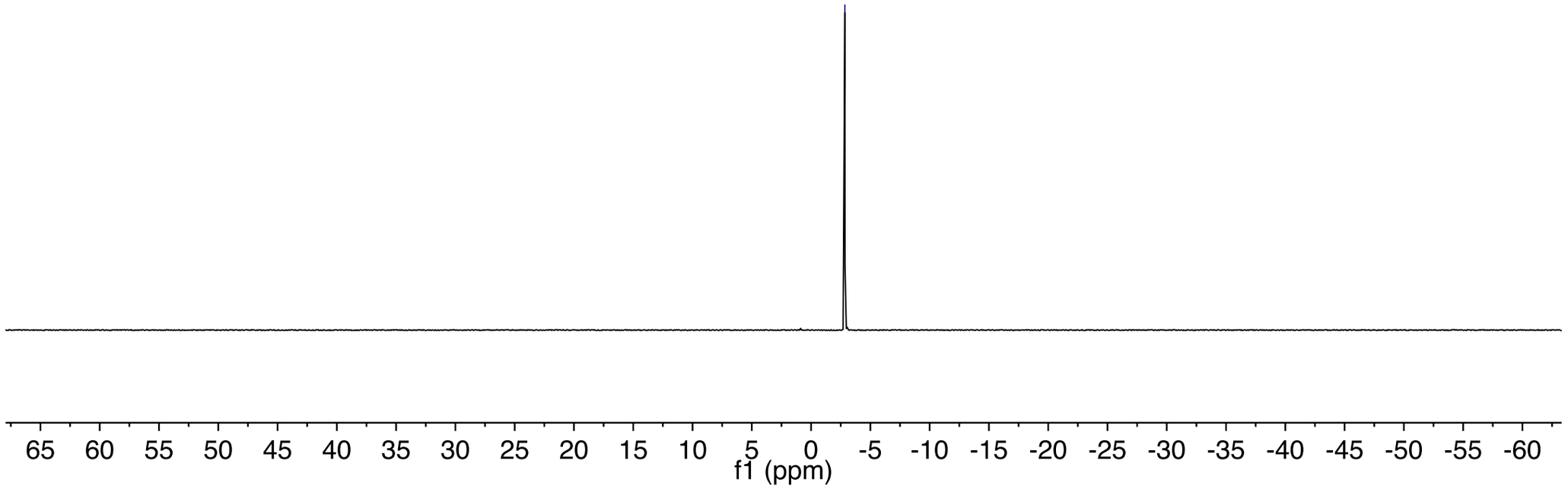


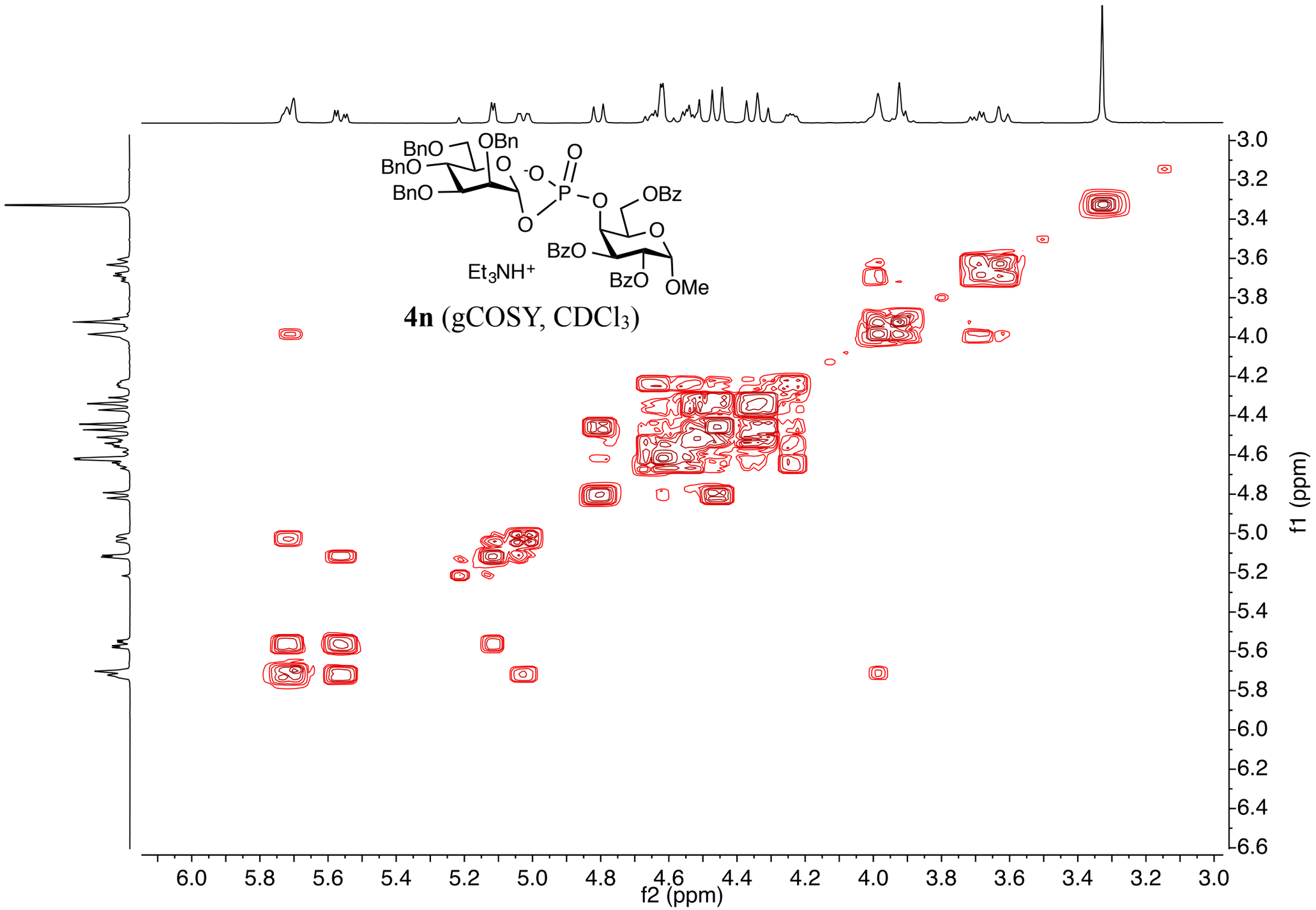
4n (^{13}C NMR, 101 MHz, $CDCl_3$)



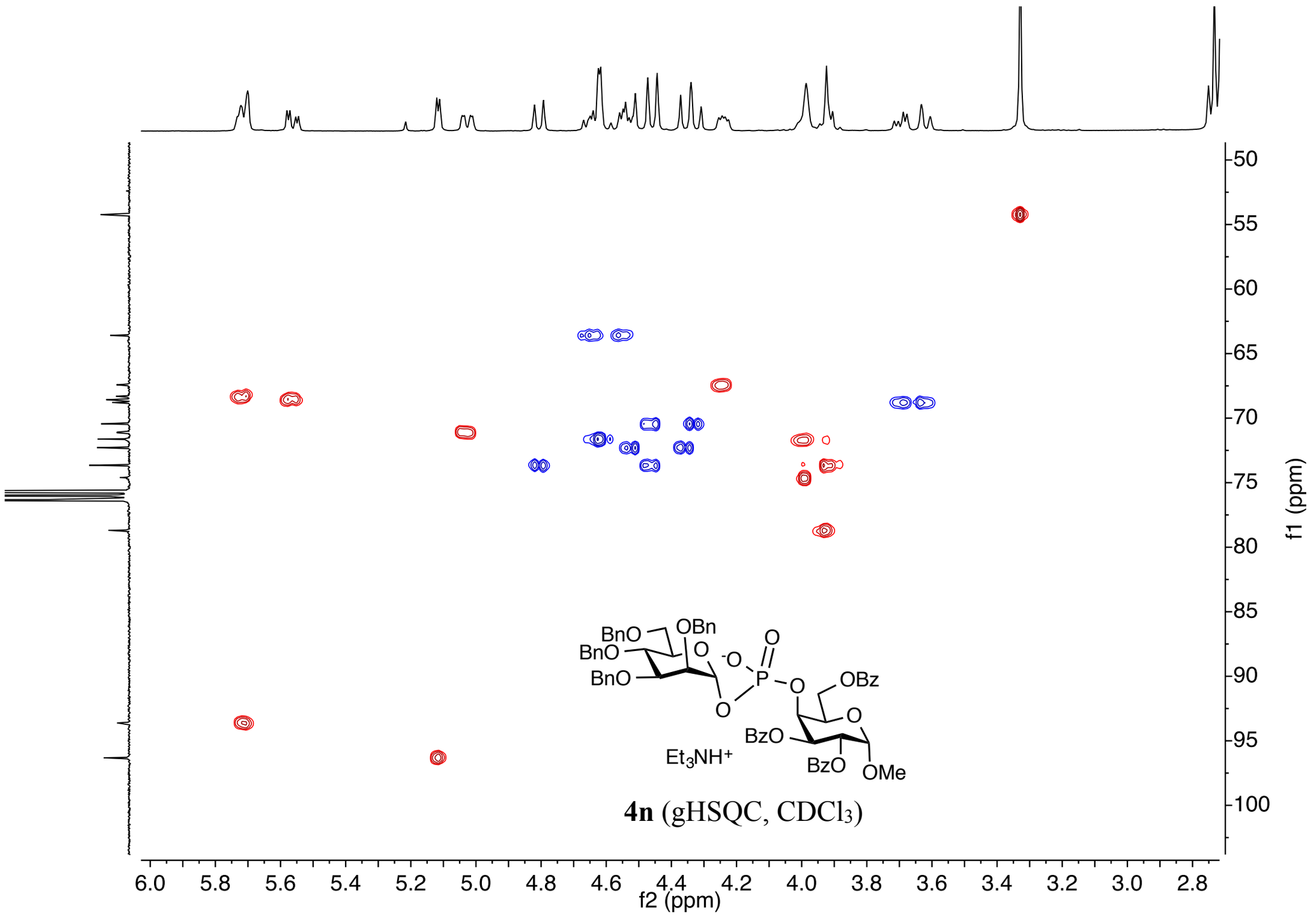


4n (^{31}P NMR, 162 MHz, $CDCl_3$)

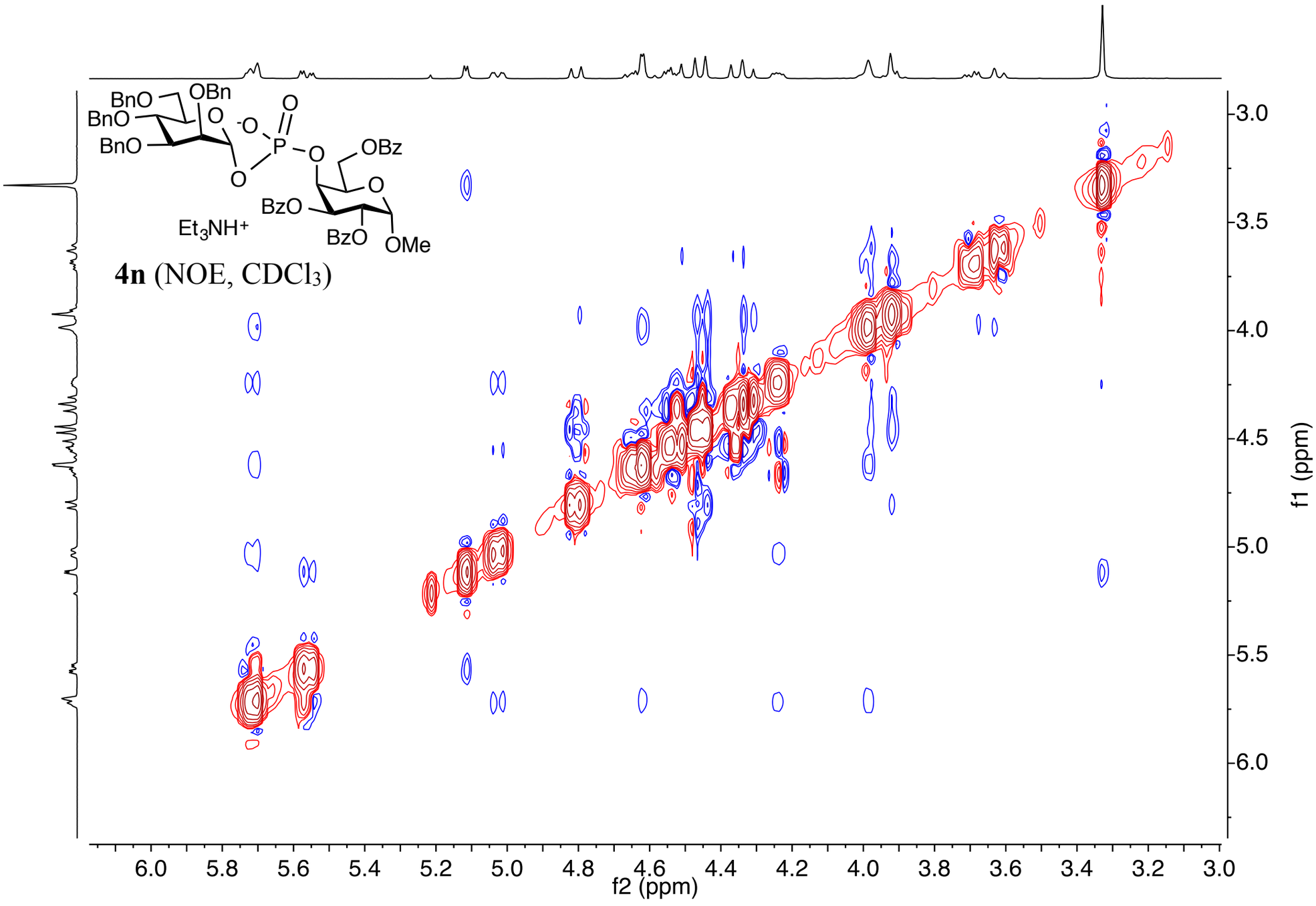


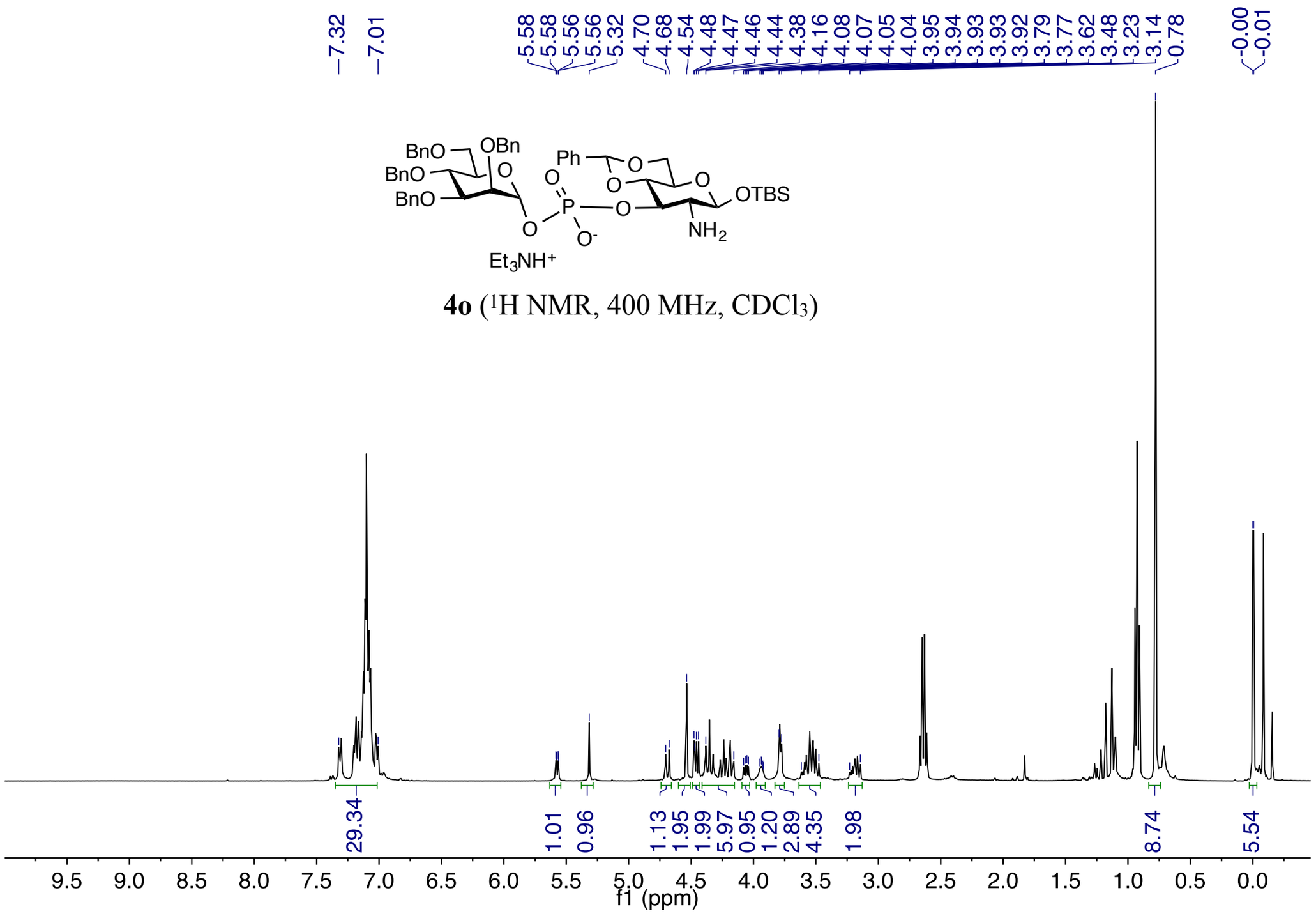


4n (gCOSY, $CDCl_3$)

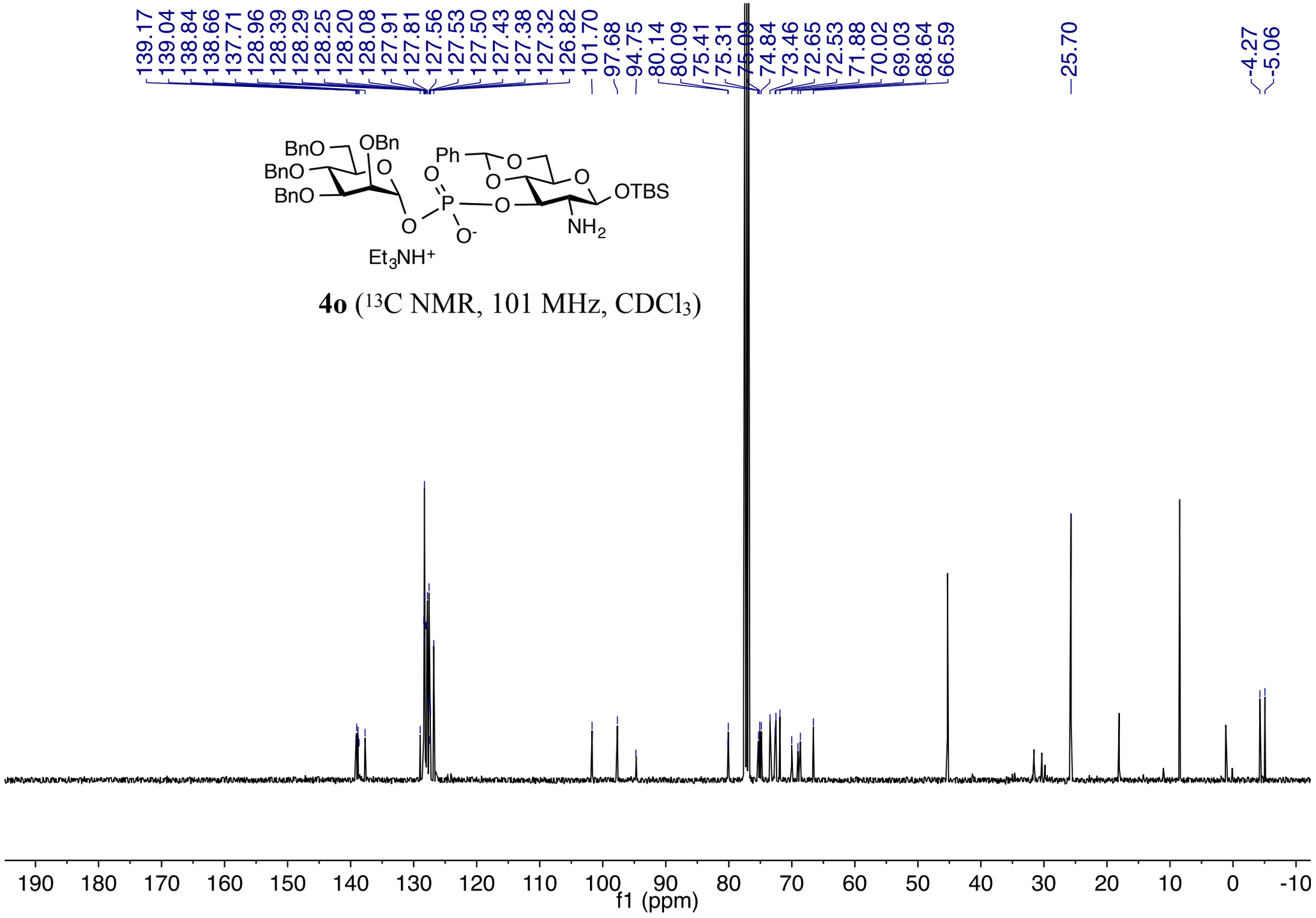


4n (gHSQC, $CDCl_3$)

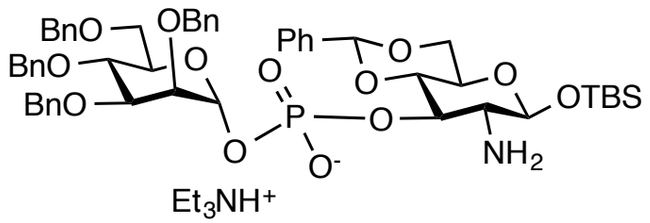

BnO
OBn
BnO
BnO
O
-O
P
O
O
O
OBz
O
BzO
BzO
OMe
Et3NH+
4n (NOE, CDCl3)
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)



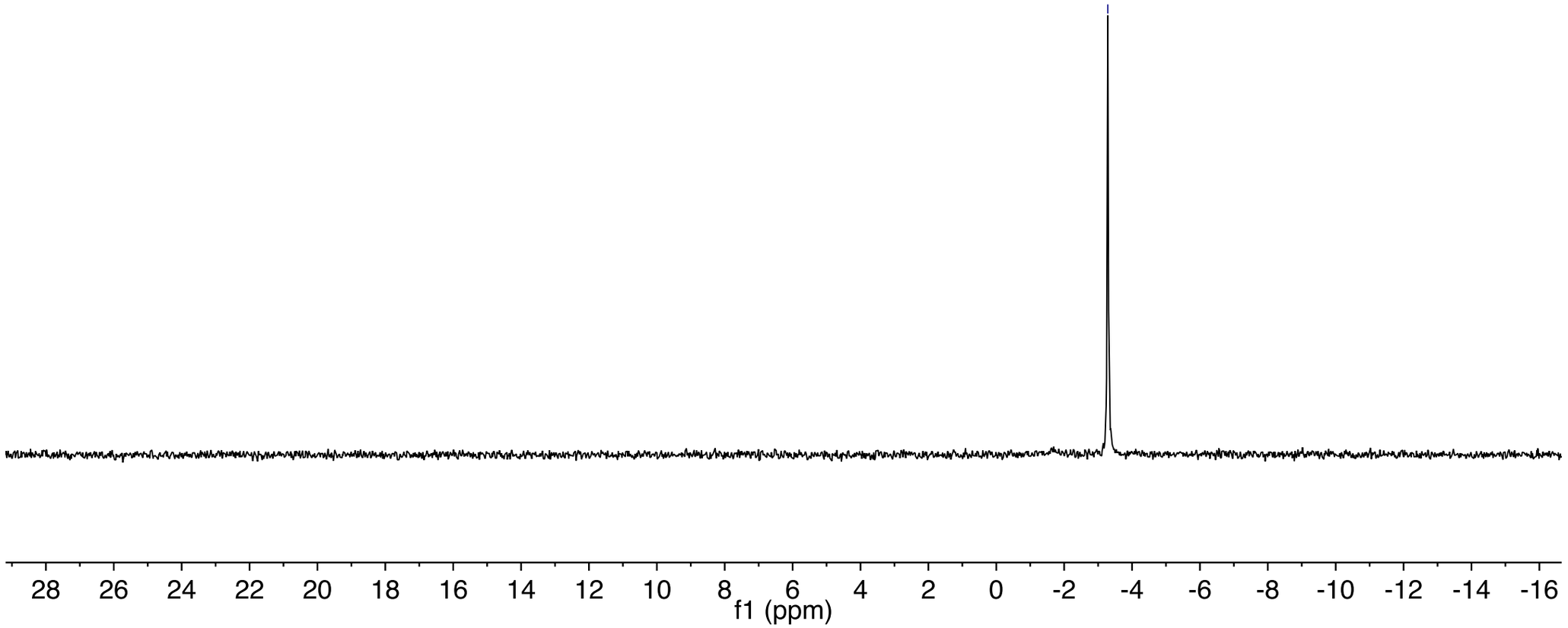
4o (^{1}H NMR, 400 MHz, $CDCl_3$)

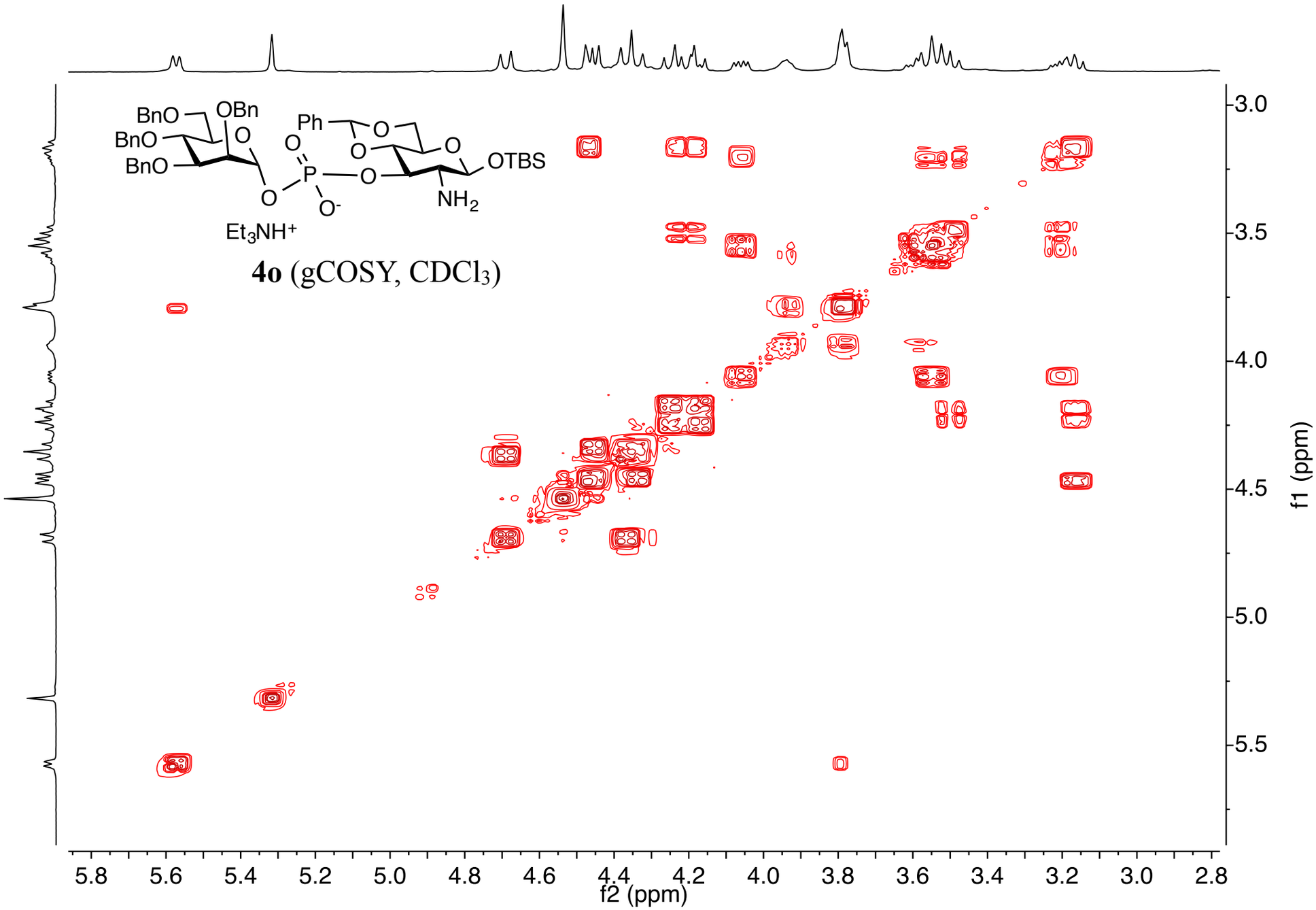


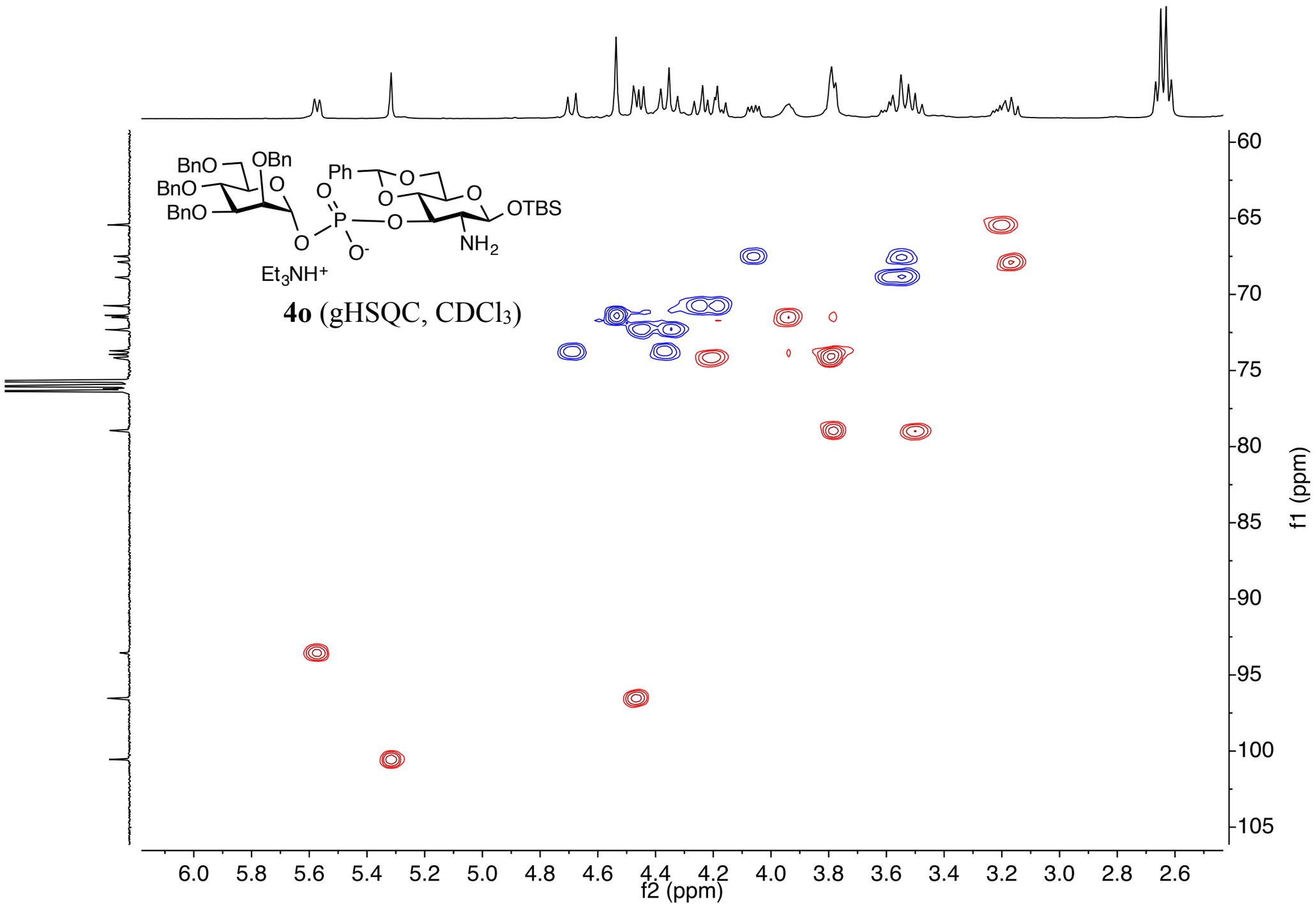
4o (^{13}C NMR, 101 MHz, $CDCl_3$)

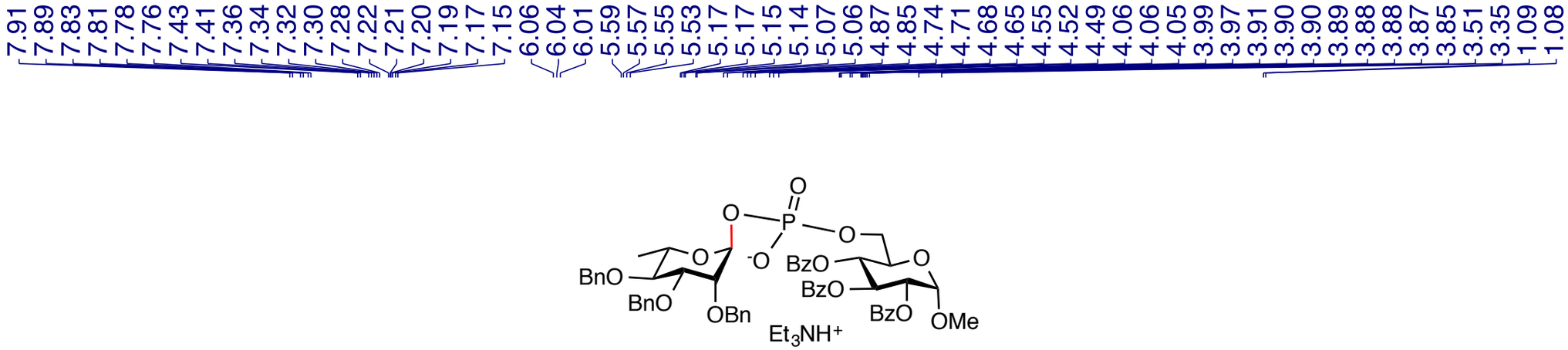


4o (^{31}P NMR, 162 MHz, $CDCl_3$)

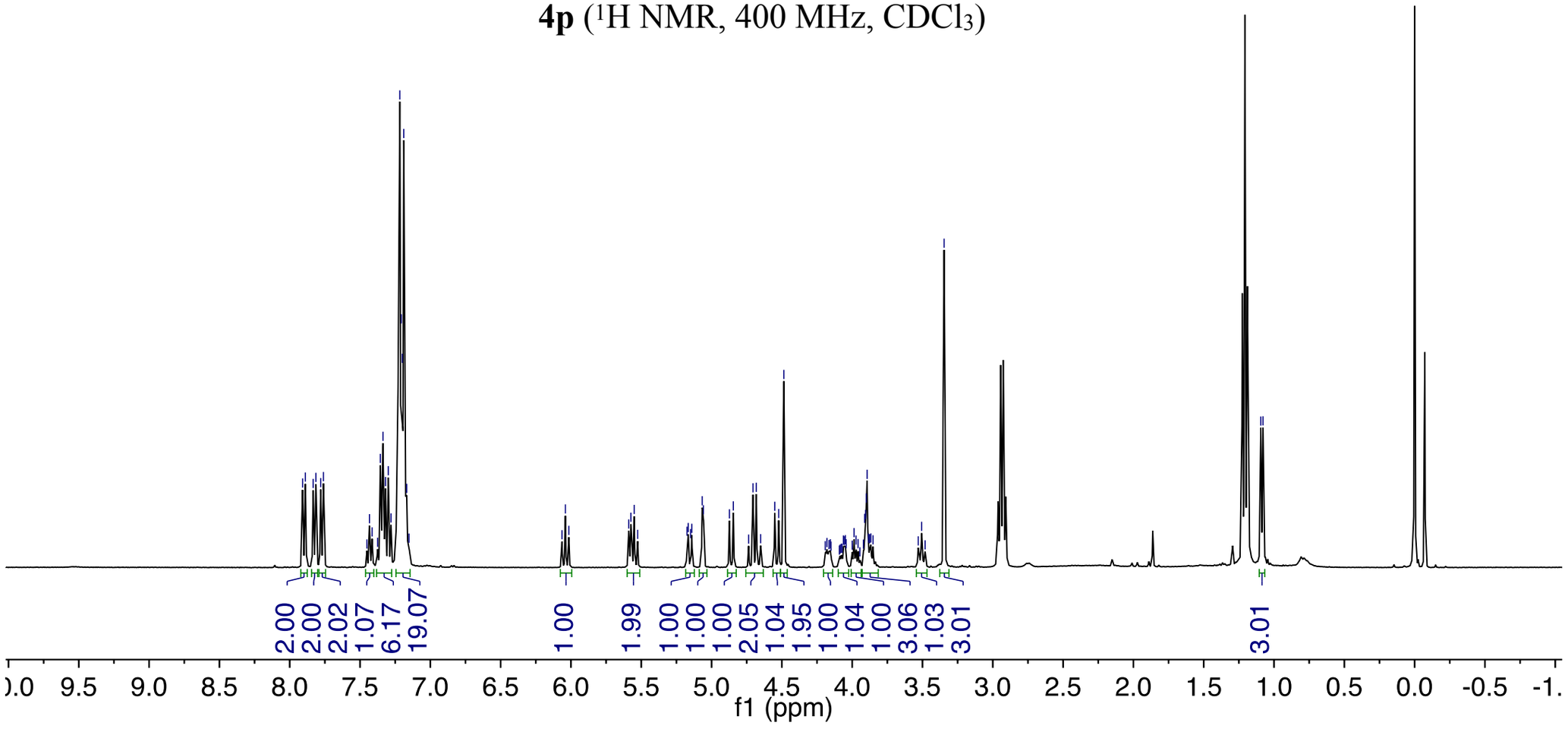


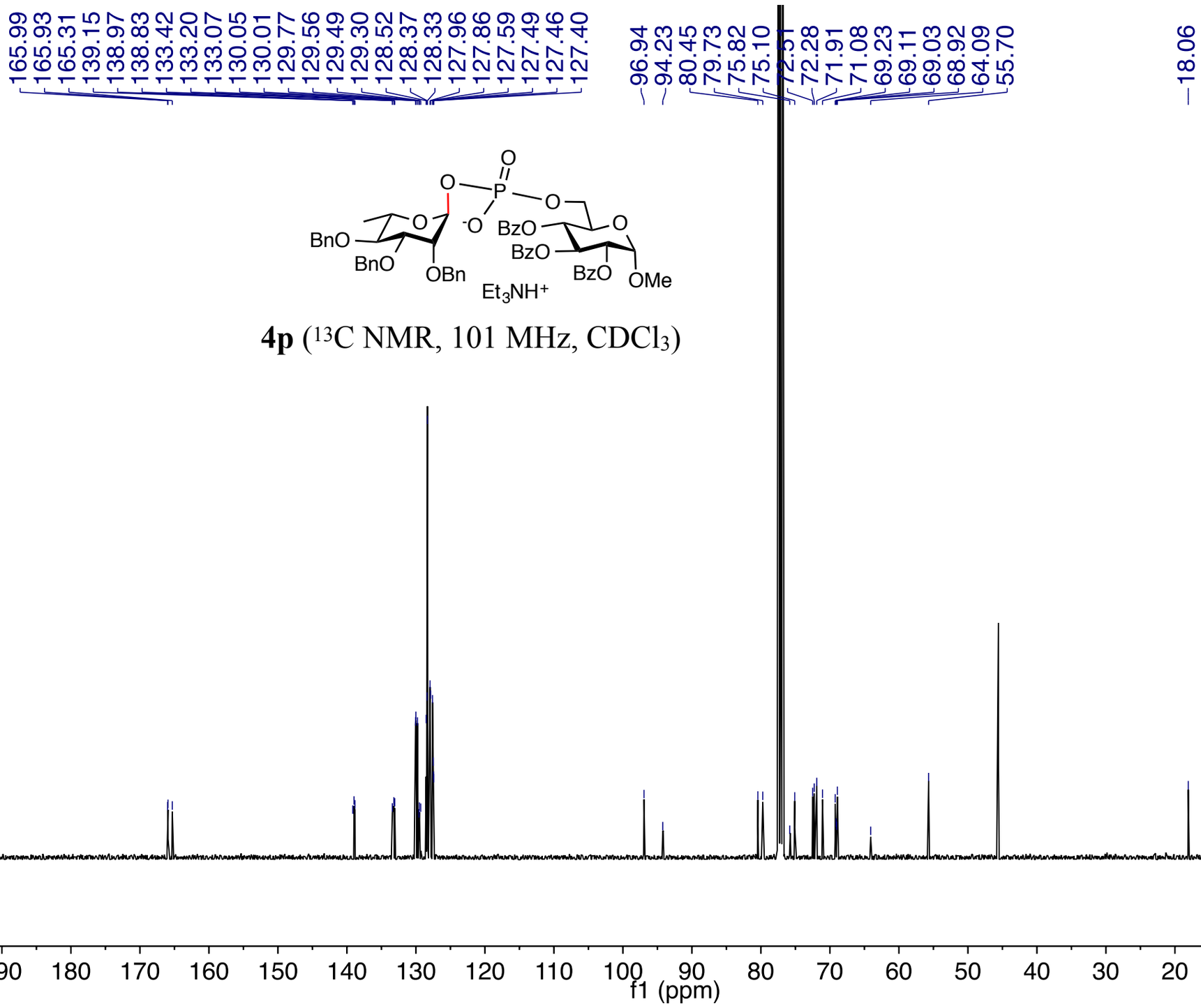

BnO
BnO
BnO
OBn
O
O
P
O
O-
Ph
O
O
O
O
OTBS
NH2
Et3NH+
4o (gCOSY, CDCl3)
3.0
3.5
4.0
4.5
5.0
5.5
f1 (ppm)
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
f2 (ppm)


BnO
BnO
BnO
OBn
O
O
P
O
O-
Et3NH+
Ph
O
O
O
O
OTBS
NH2
4o (gHSQC, CDCl3)
60
65
70
75
80
85
90
95
100
105
f1 (ppm)
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
f2 (ppm)



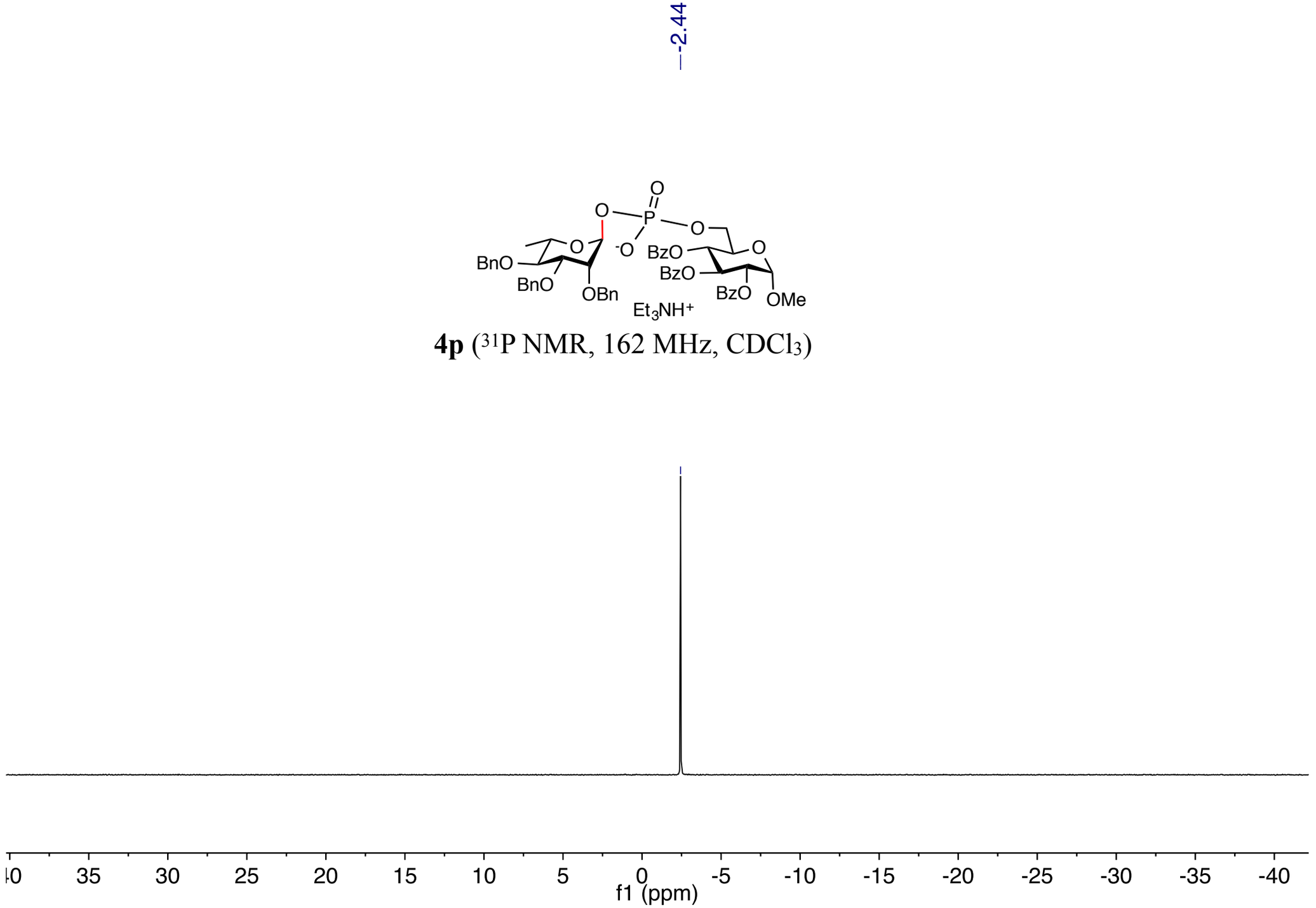
4p (^{1}H NMR, 400 MHz, $CDCl_3$)

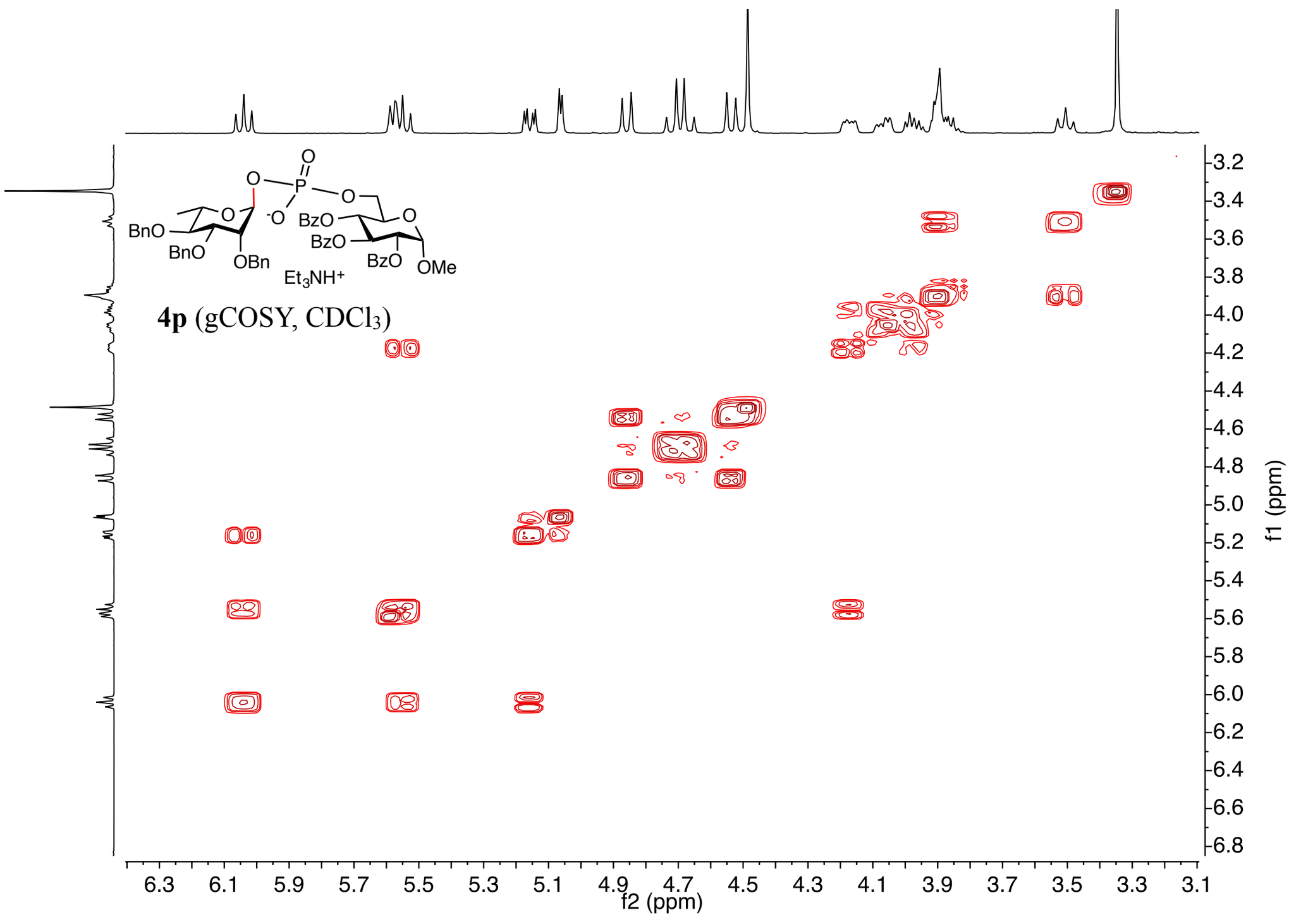


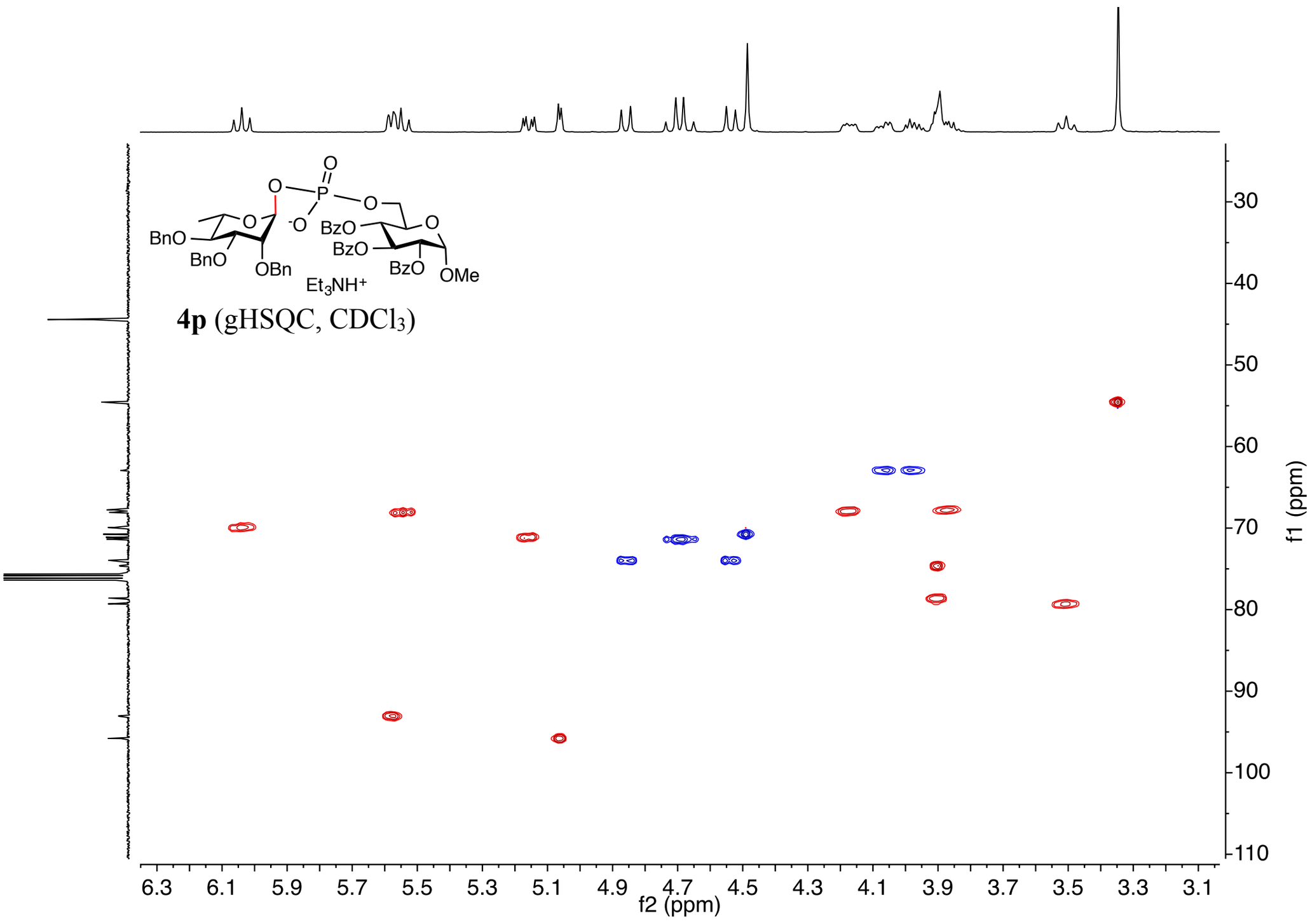


4p (^{13}C NMR, 101 MHz, $CDCl_3$)

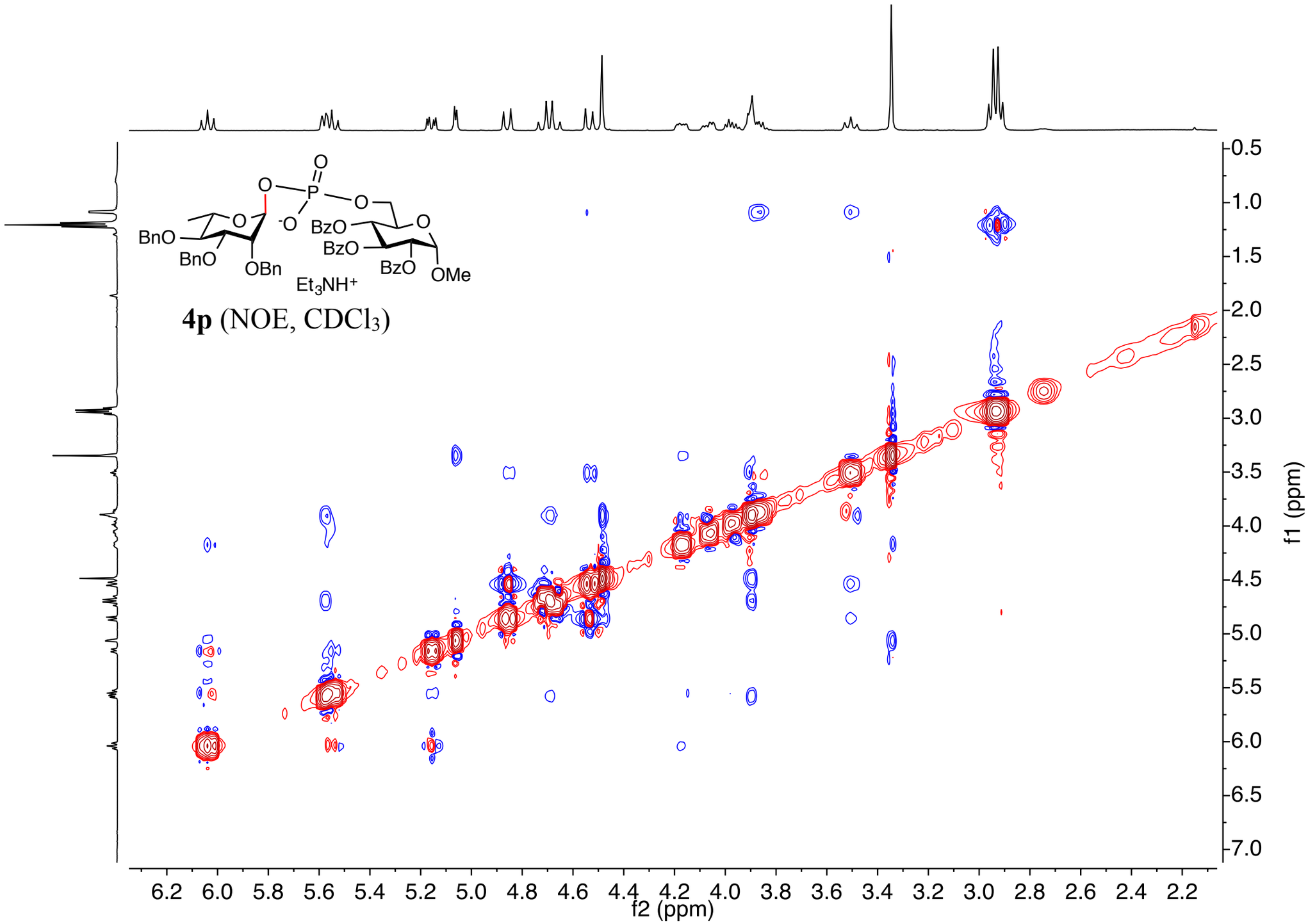
4p (^{31}P NMR, 162 MHz, $CDCl_3$)



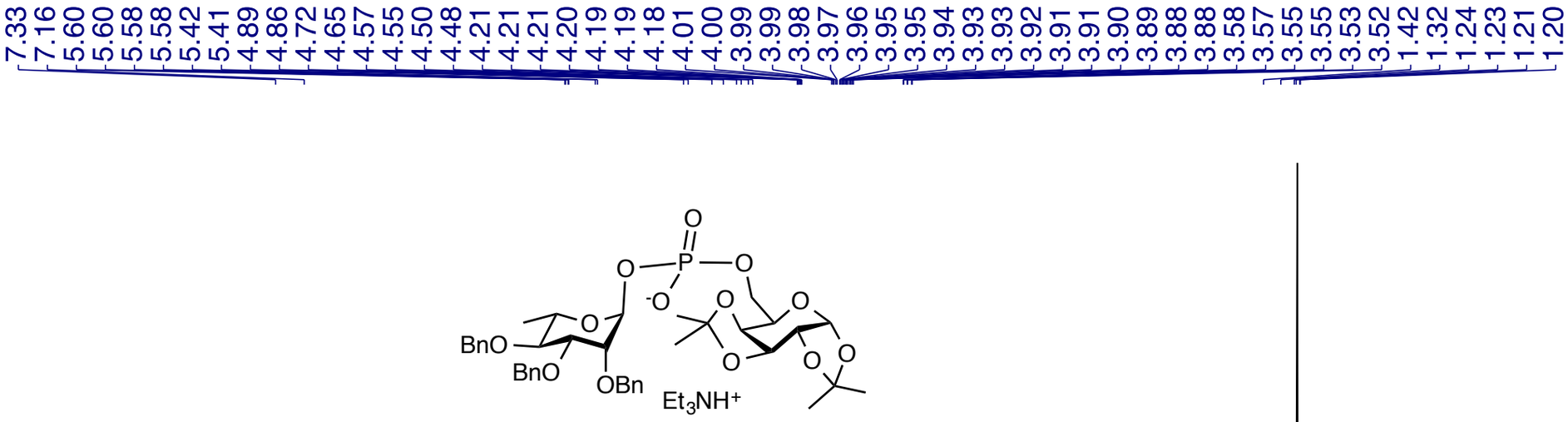

BnO
BnO
OBn
BzO
BzO
BzO
OMe
Et3NH+
4p (gCOSY, CDCl3)
f1 (ppm)
f2 (ppm)
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1



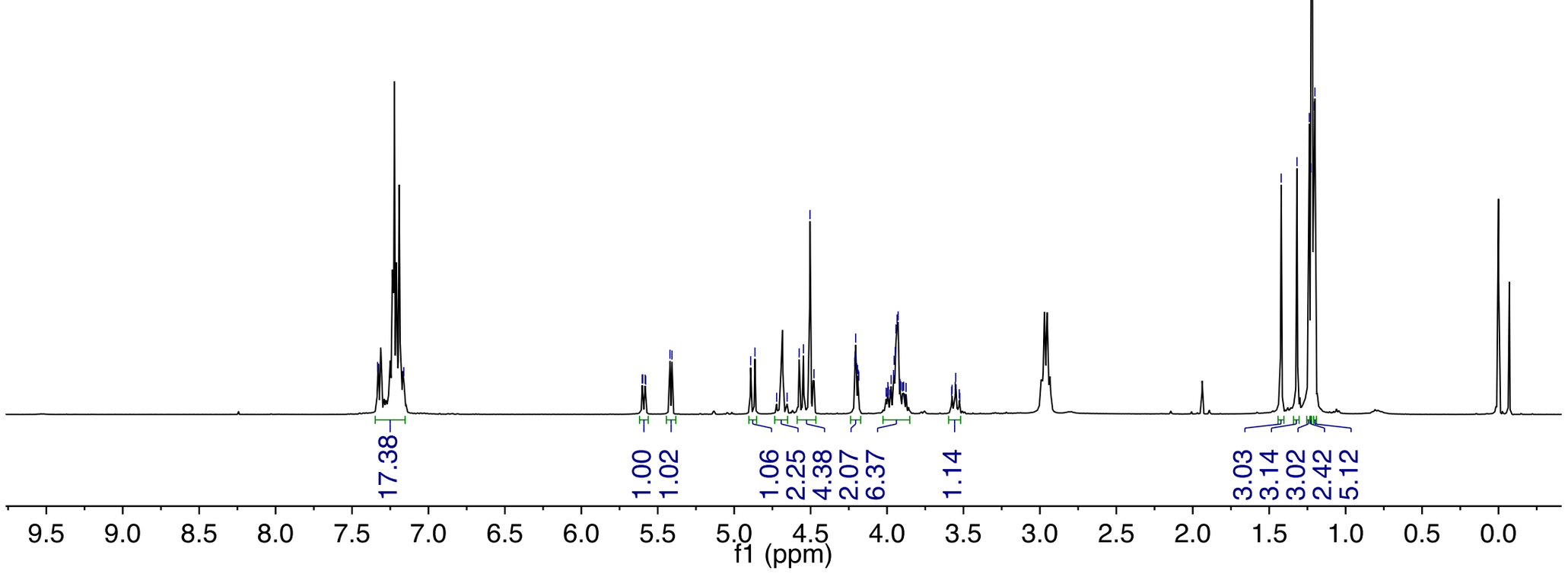
4p (gHSQC, $CDCl_3$)

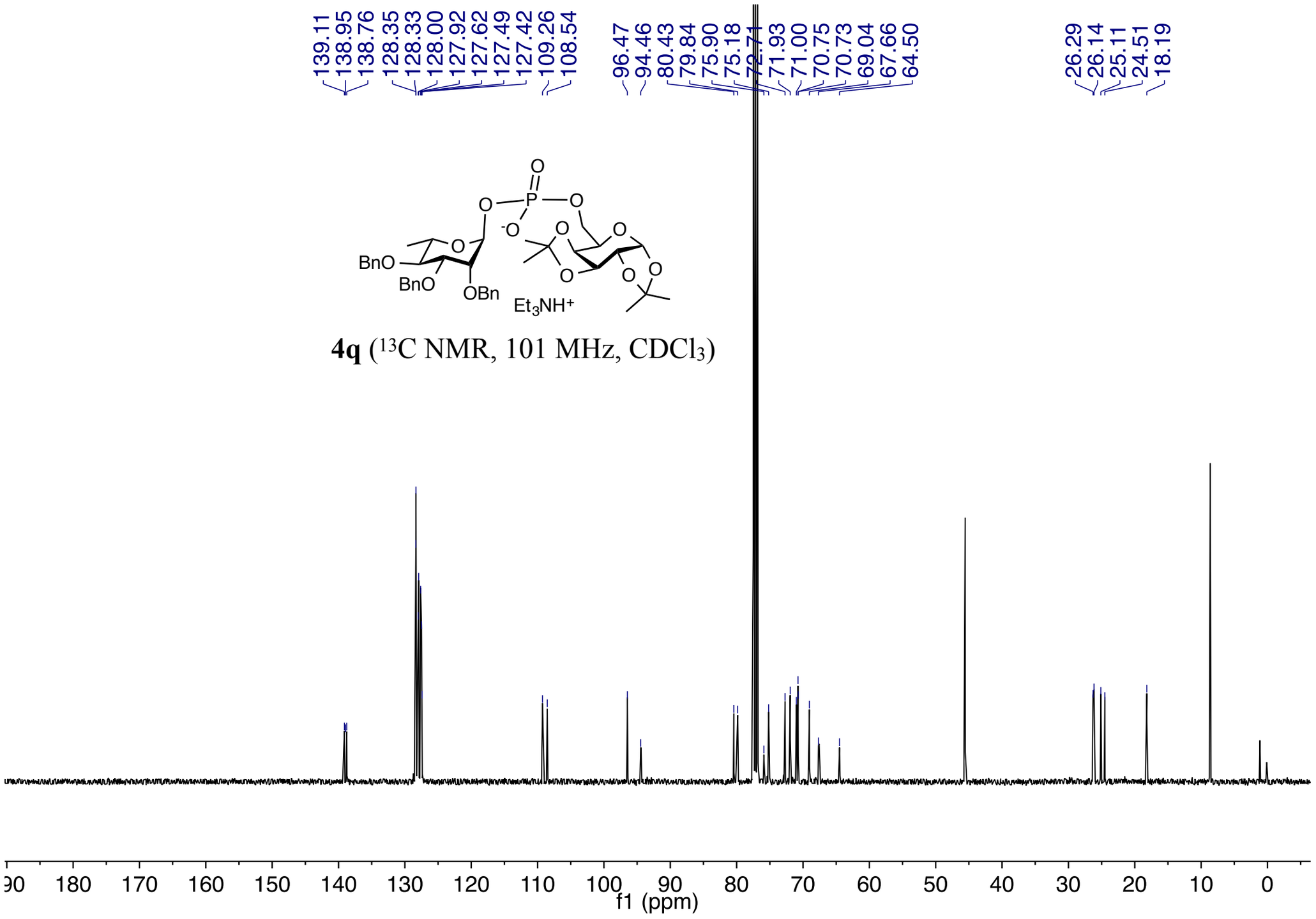

BnO
BnO
OBn
O
O
P
O
-O
BzO
BzO
BzO
OMe
Et3NH+
f1 (ppm)
f2 (ppm)
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2

4p (NOE, $CDCl_3$)

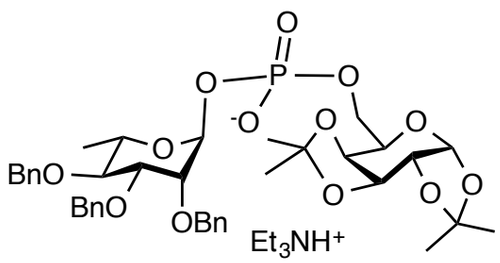


4q (^{1}H NMR, 400 MHz, $CDCl_3$)



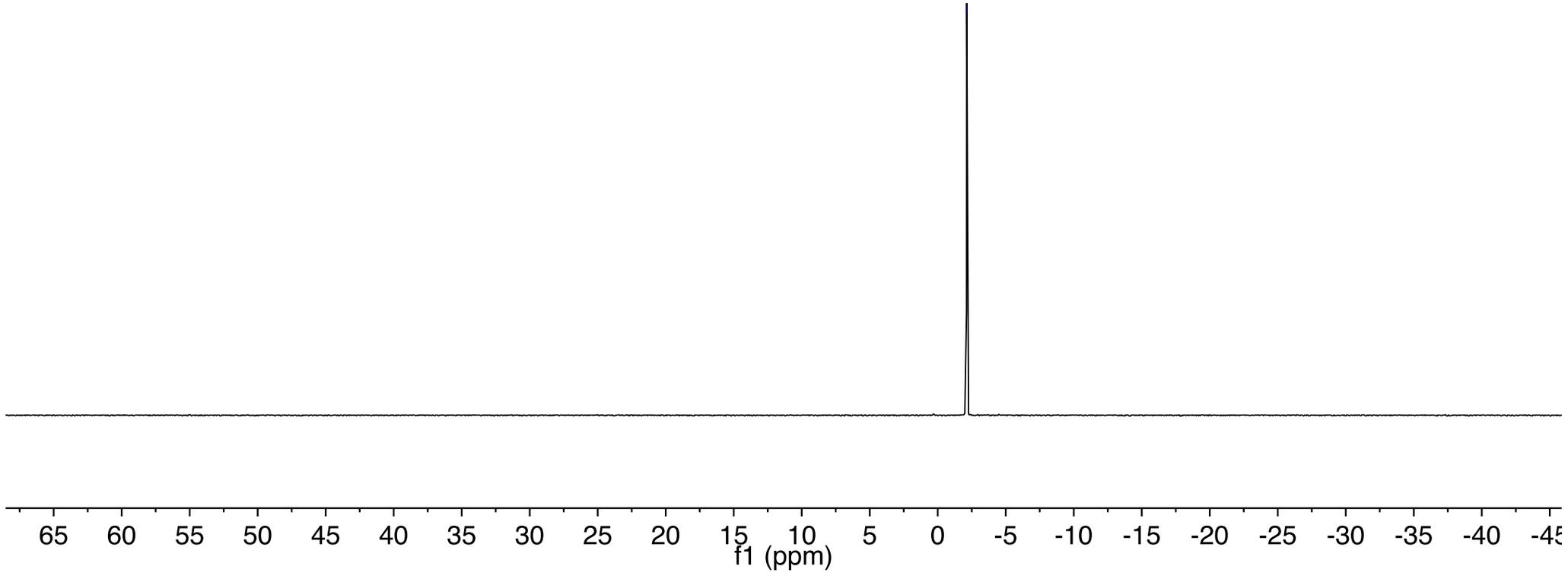


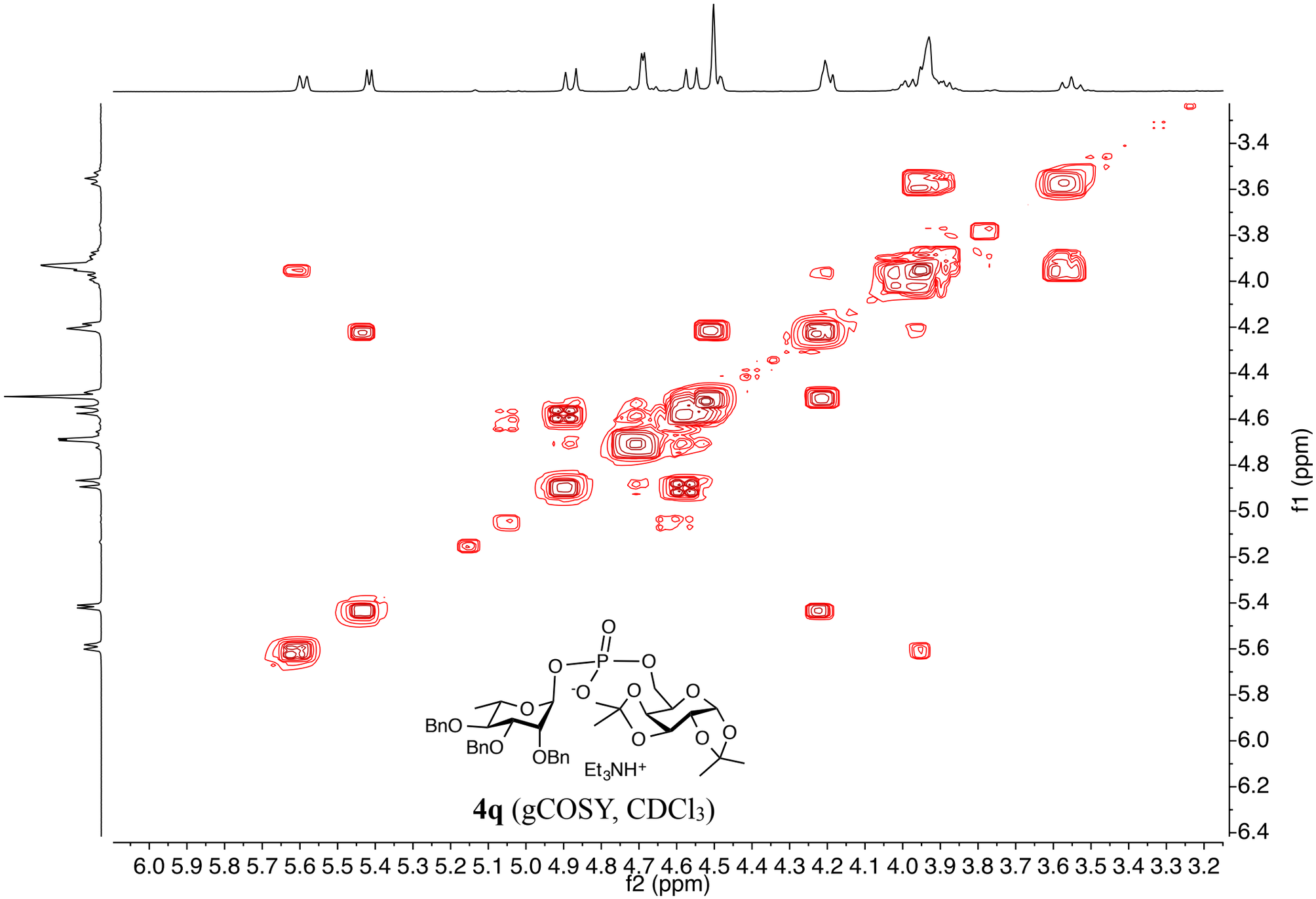
4q (^{13}C NMR, 101 MHz, $CDCl_3$)



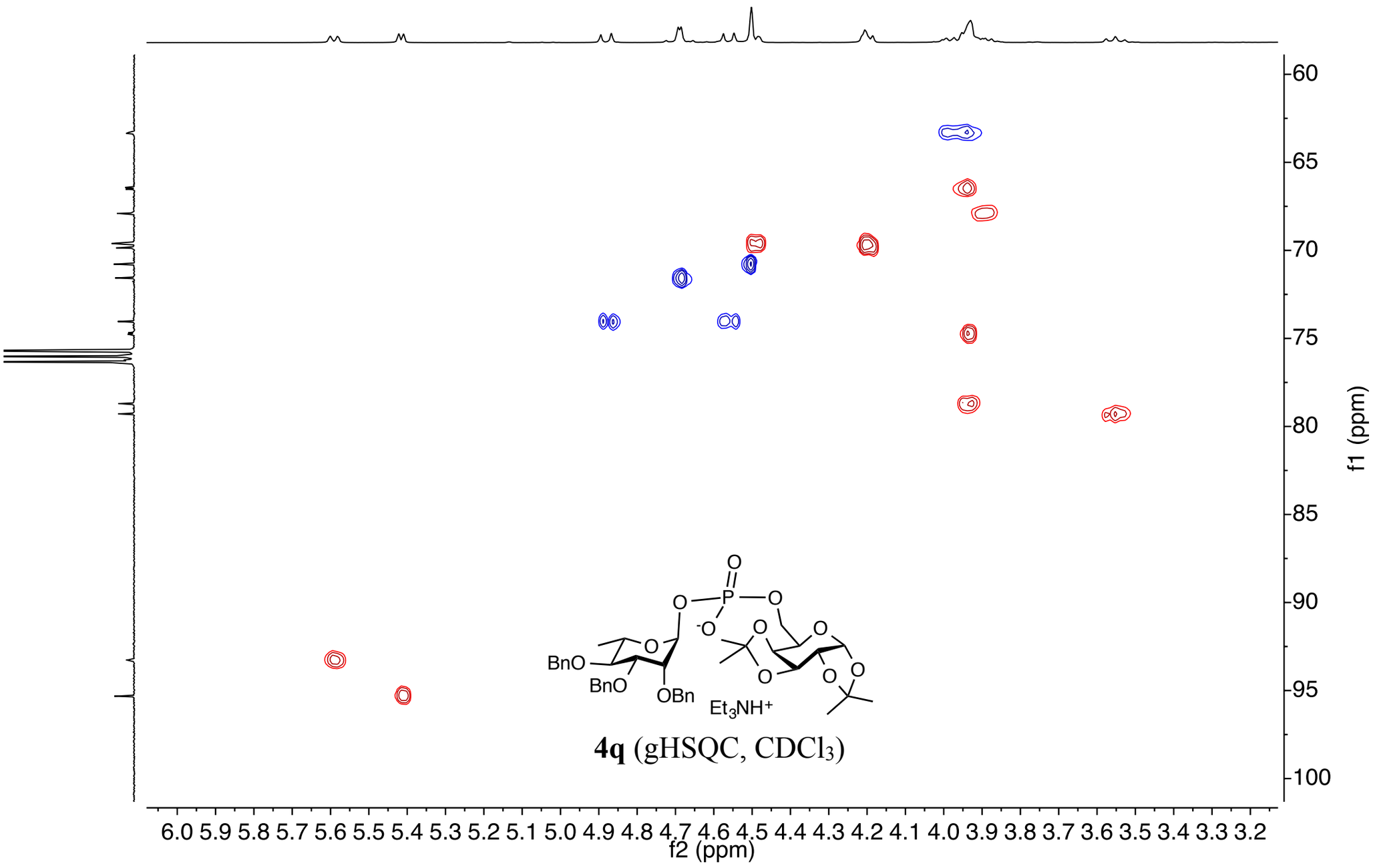
-2.13

4q (^{31}P NMR, 162 MHz, $CDCl_3$)



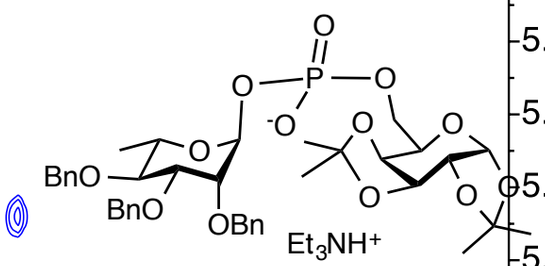


4q (gCOSY, $CDCl_3$)



4q (gHSQC, $CDCl_3$)

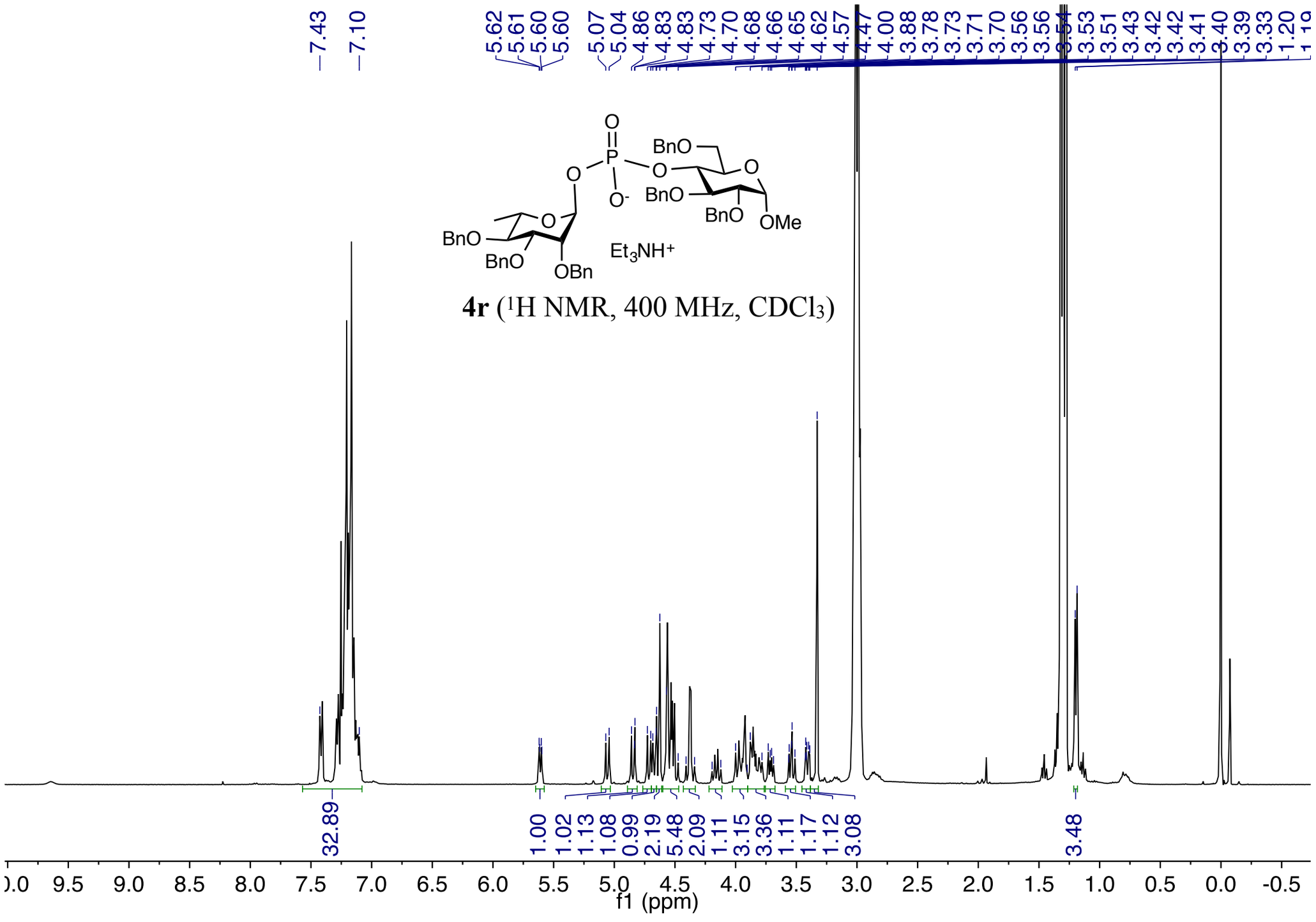
H-1^{B}, CH_2Ph



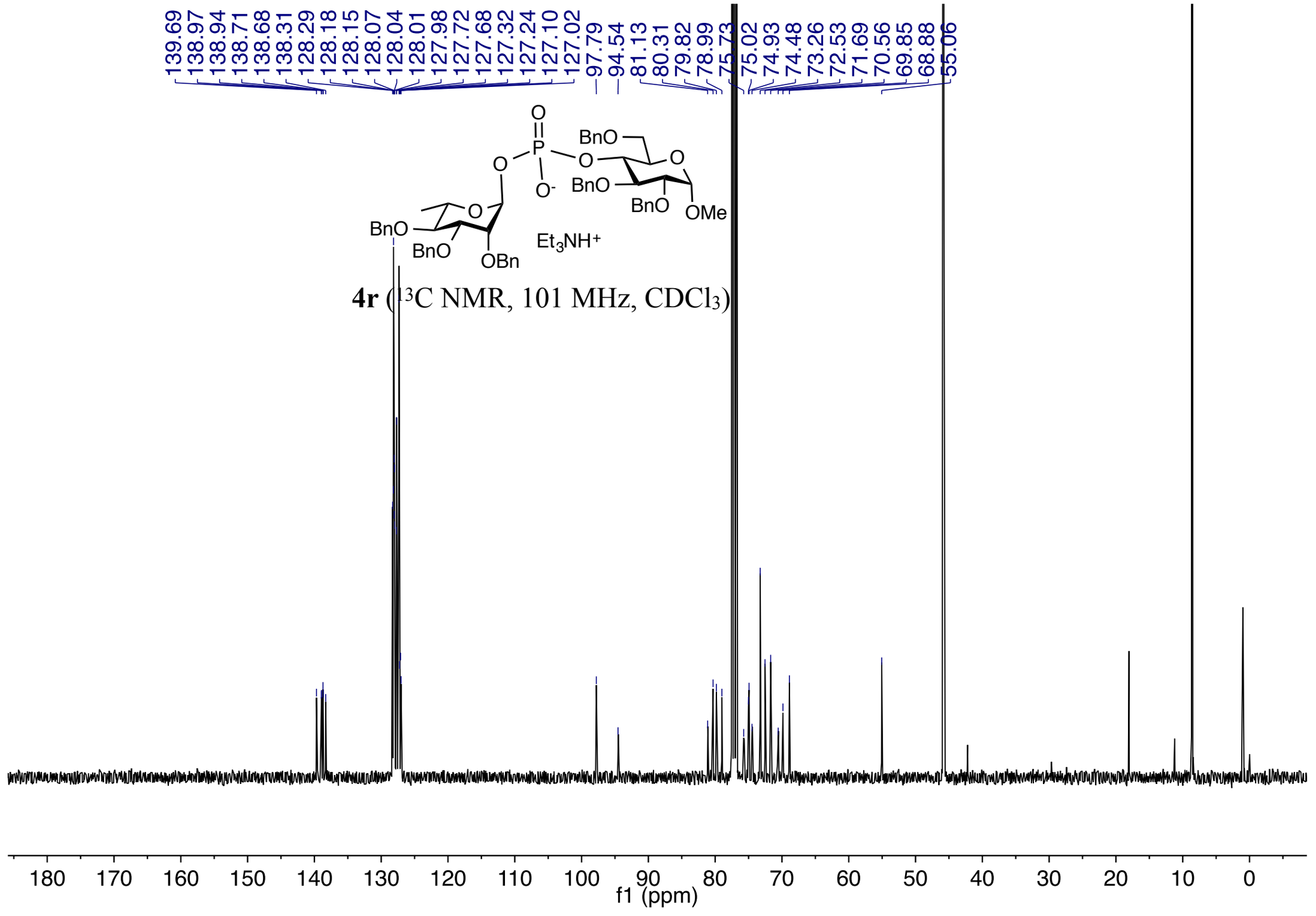
4q (NOE, $CDCl_3$)

f2 (ppm)

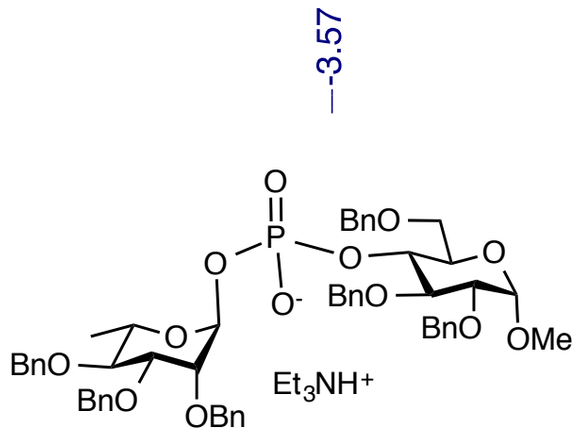
f1 (ppm)



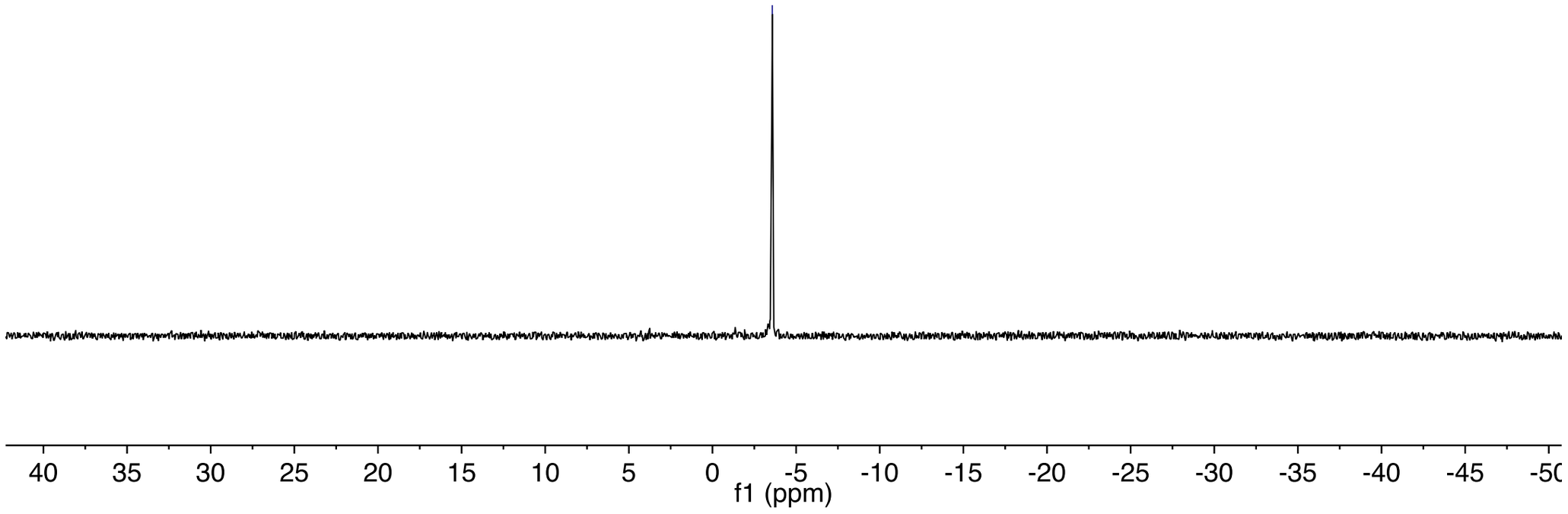
4r (^{1}H NMR, 400 MHz, $CDCl_3$)

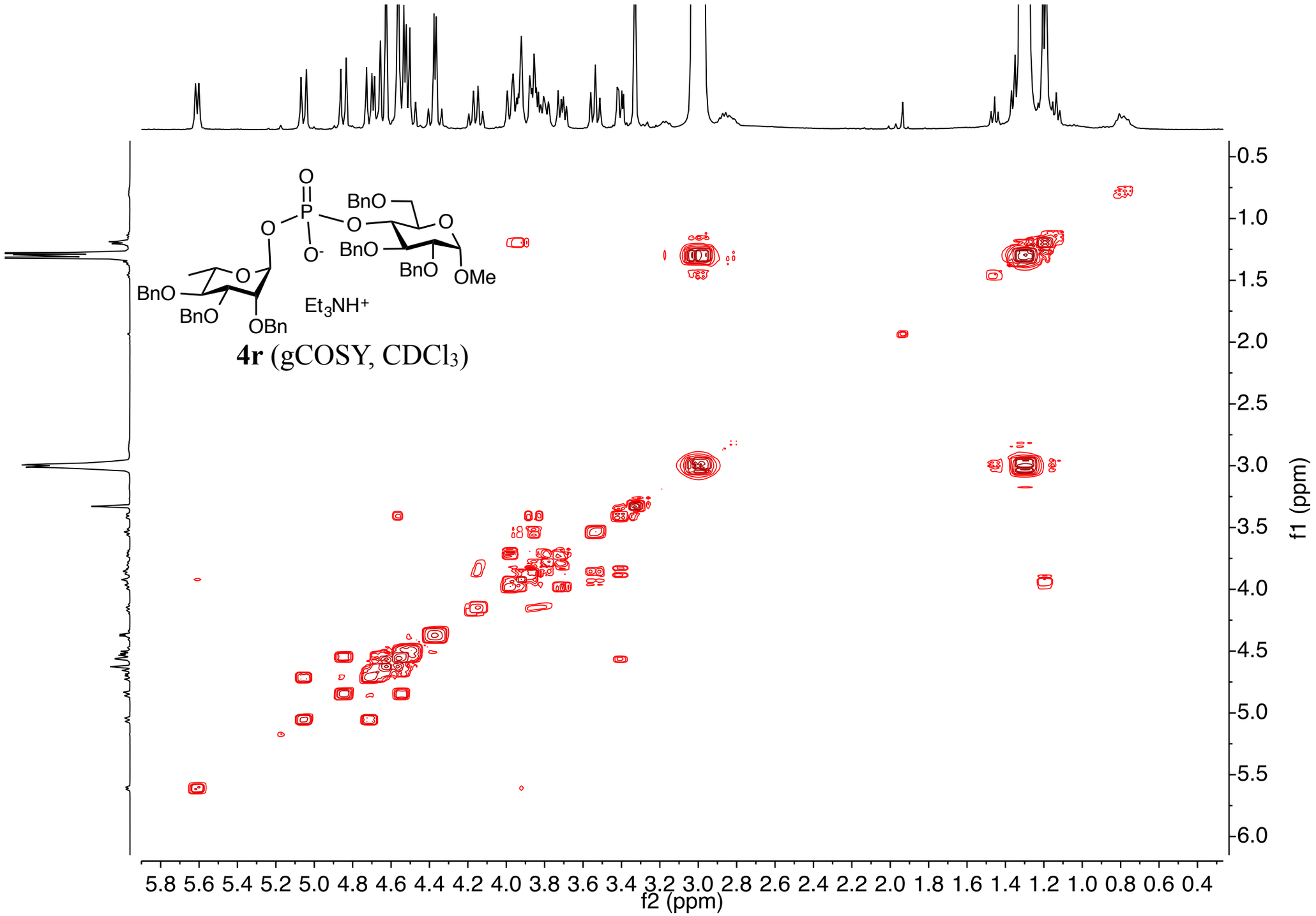


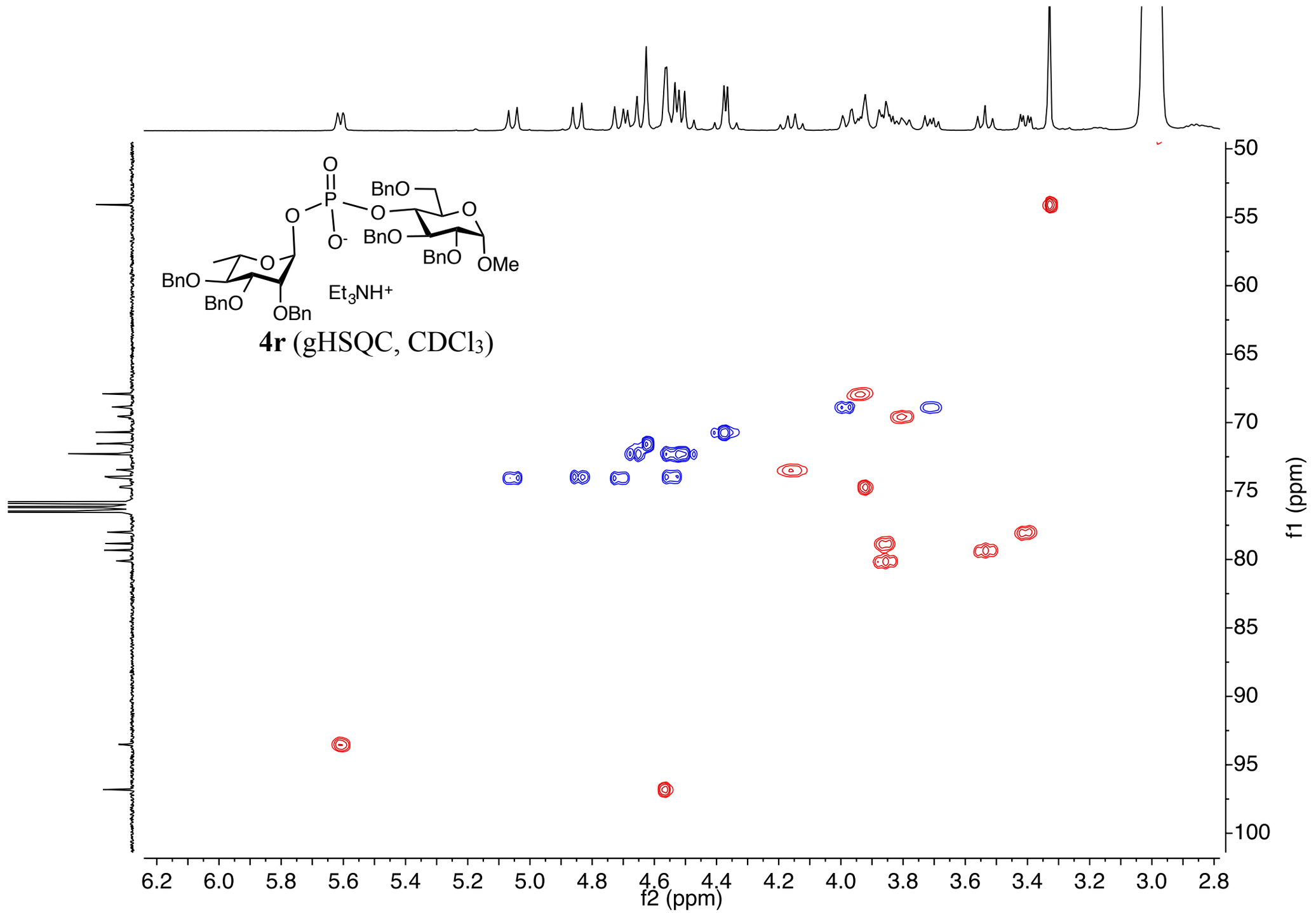
4r (^{13}C NMR, 101 MHz, $CDCl_3$)

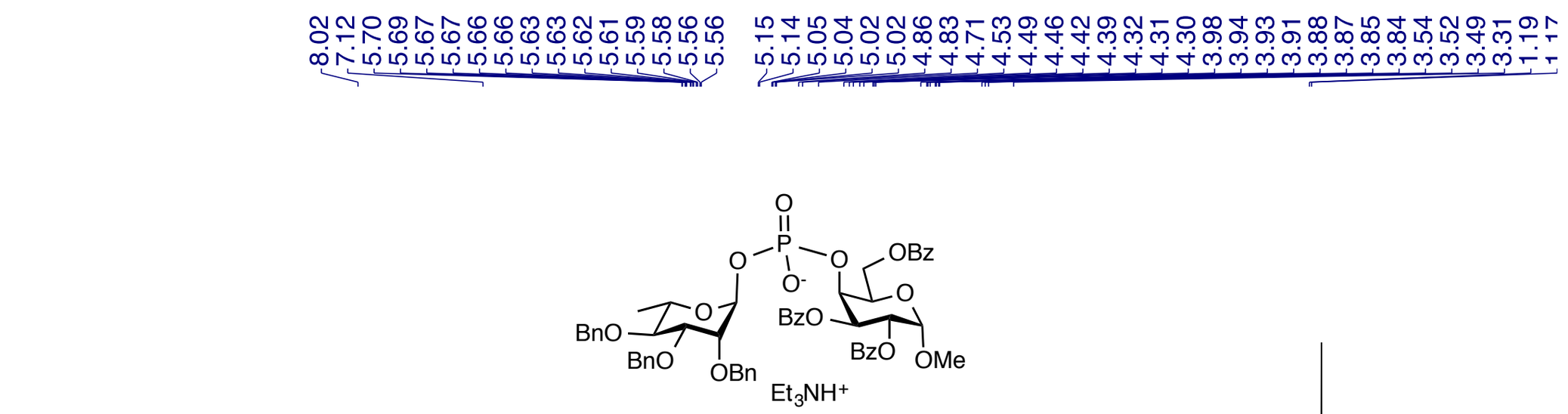


4r (^{31}P NMR, 162 MHz, $CDCl_3$)

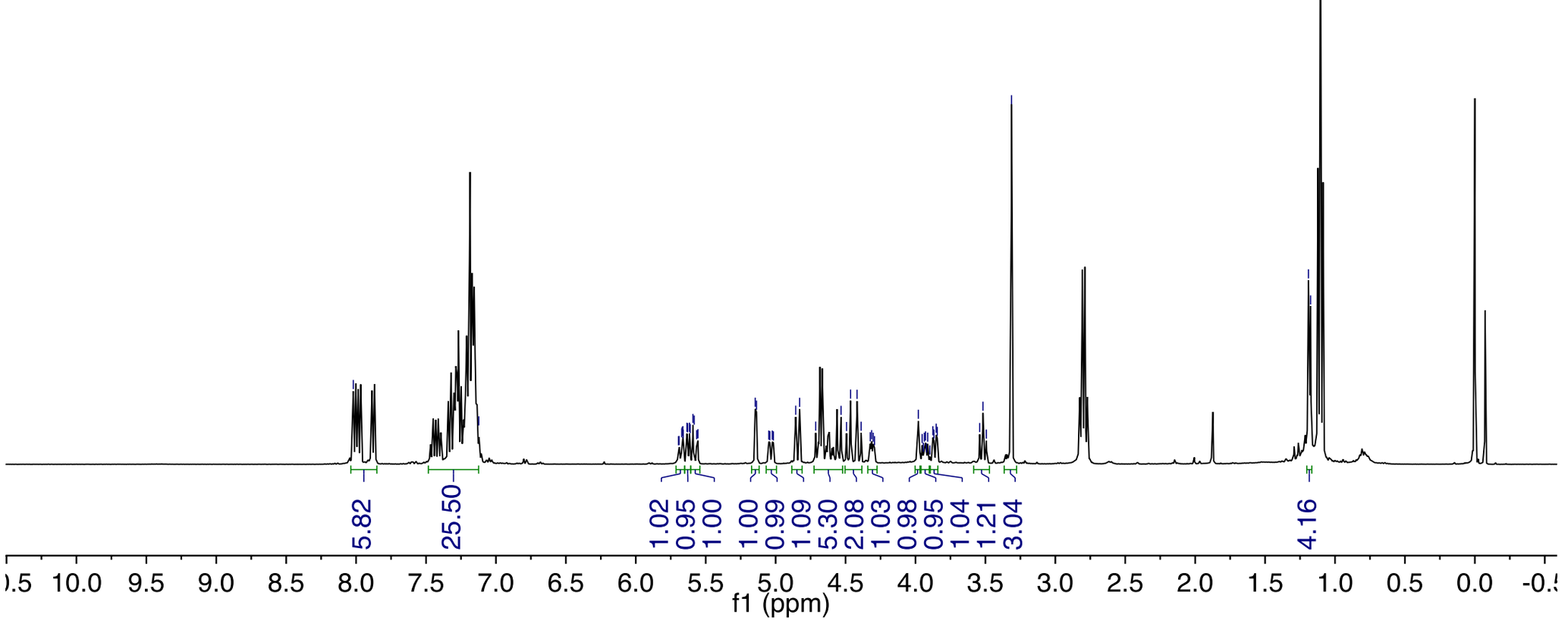


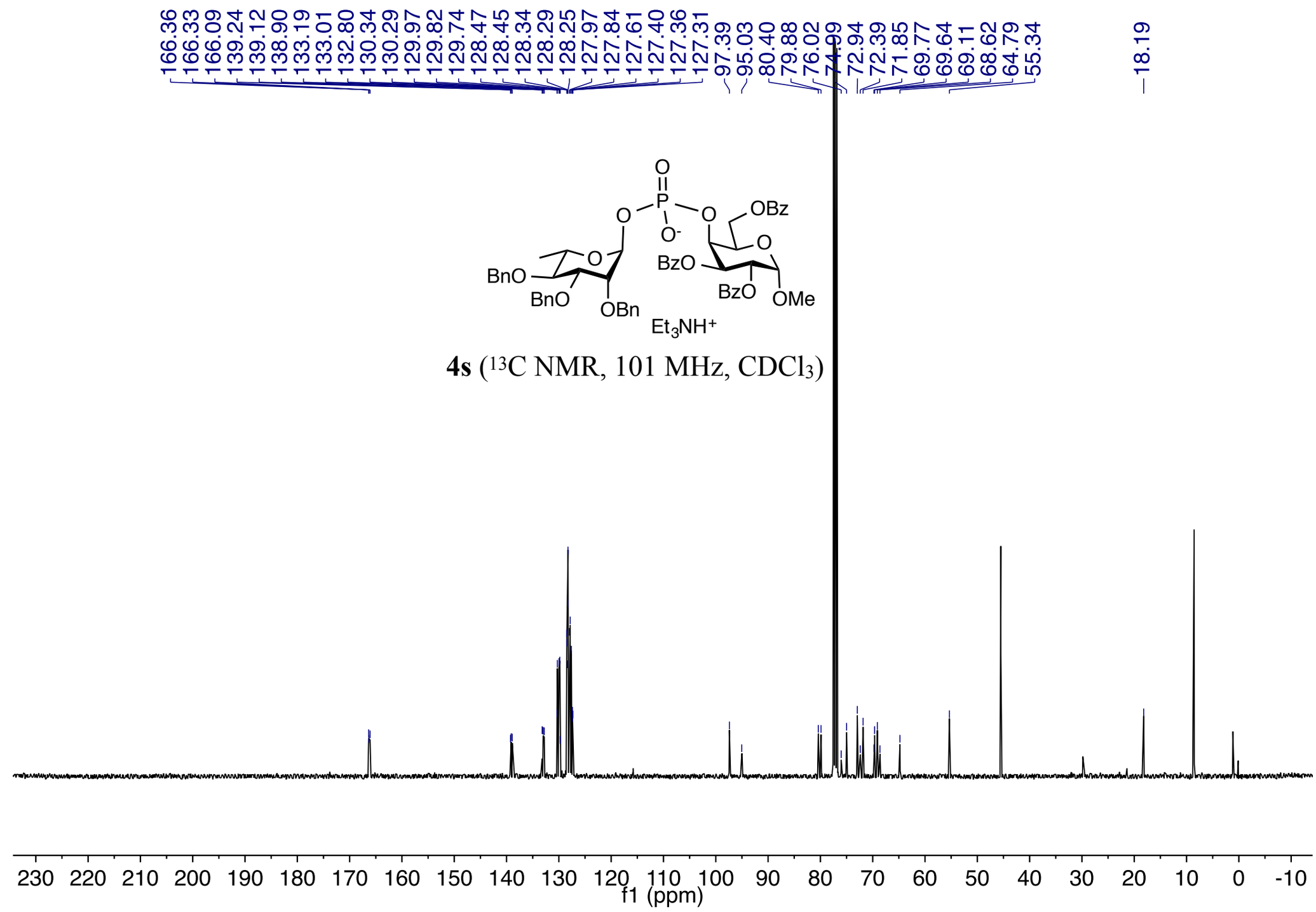

O
P
O
O-
BnO
BnO
BnO
O
O
BnO
BnO
OBn
OMe
Et3NH+
4r (gCOSY, CDCl3)
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0.4
f2 (ppm)


O
P
O
O-
O
BnO
BnO
O
BnO
BnO
O
BnO
OMe
O
BnO
BnO
OBn
Et3NH+
4r (gHSQC, CDCl3)
50
55
60
65
70
75
80
85
90
95
100
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
f2 (ppm)

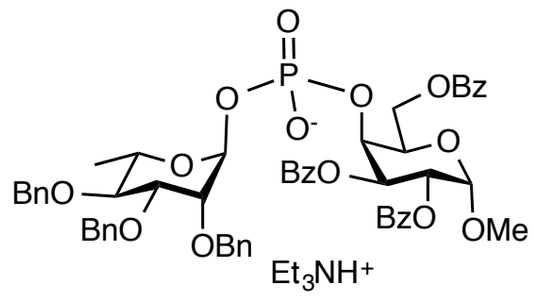


4s (^{1}H NMR, 400 MHz, $CDCl_3$)

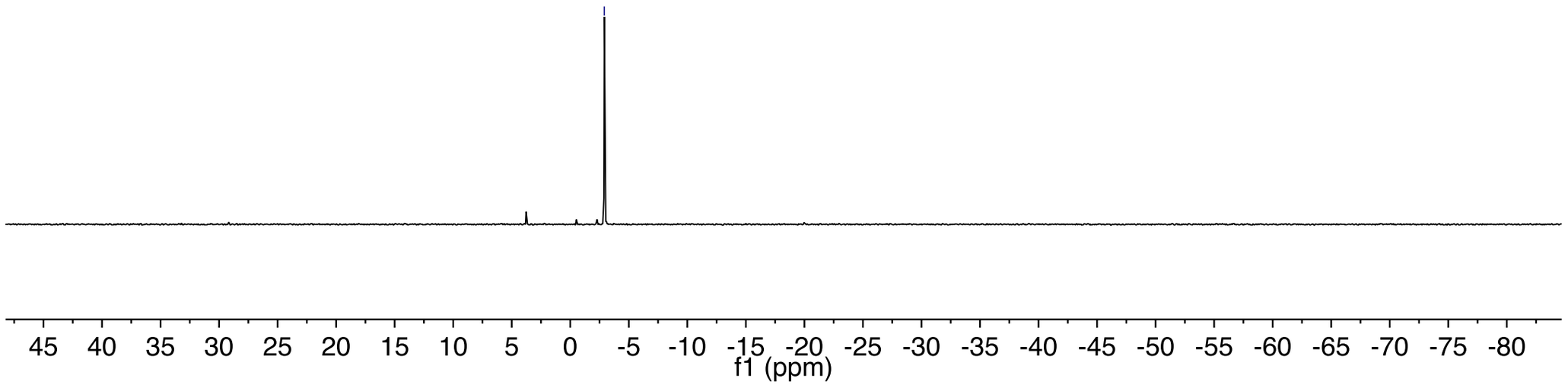


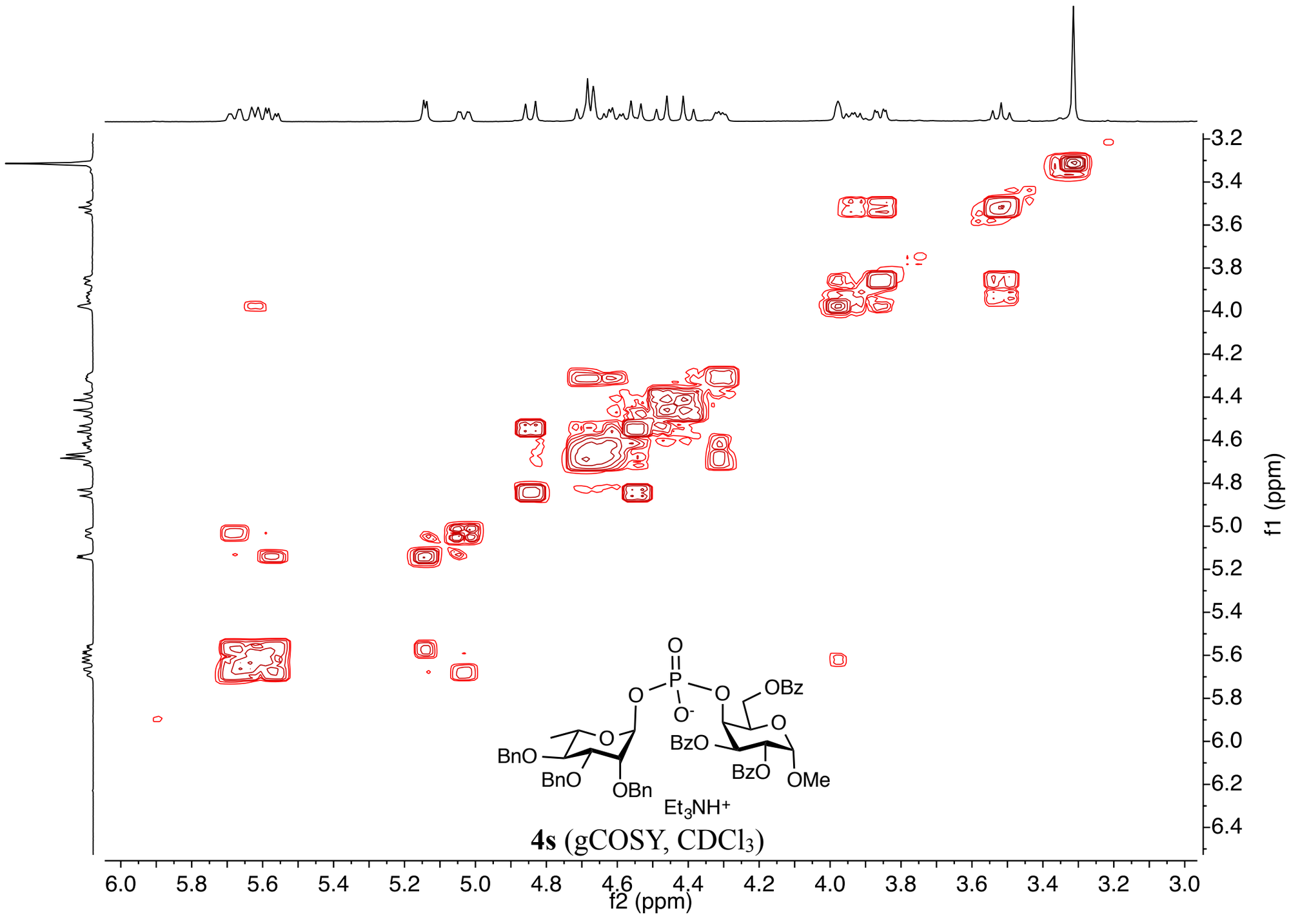


4s (^{13}C NMR, 101 MHz, $CDCl_3$)

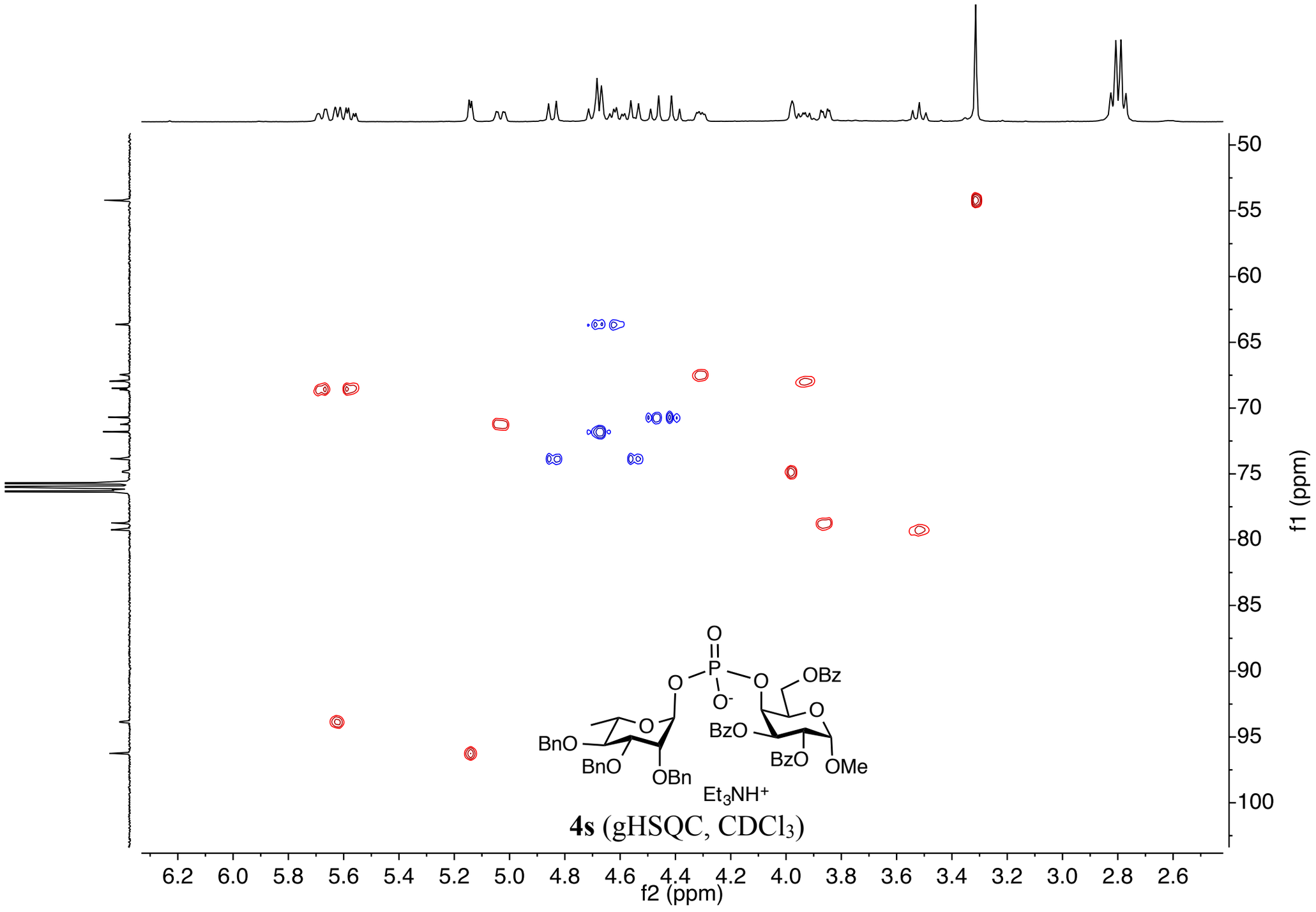


4s (^{31}P NMR, 162 MHz, $CDCl_3$)

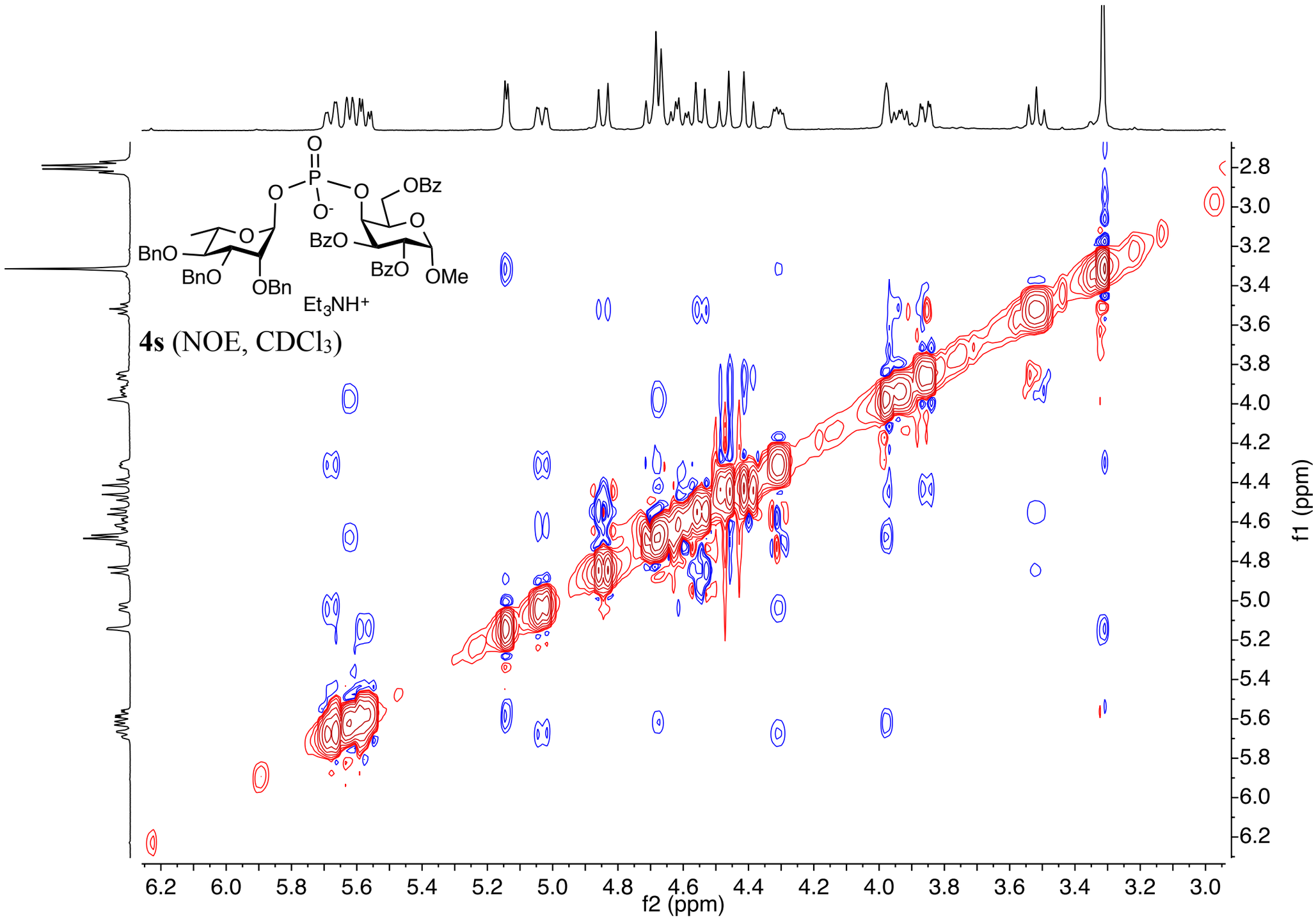


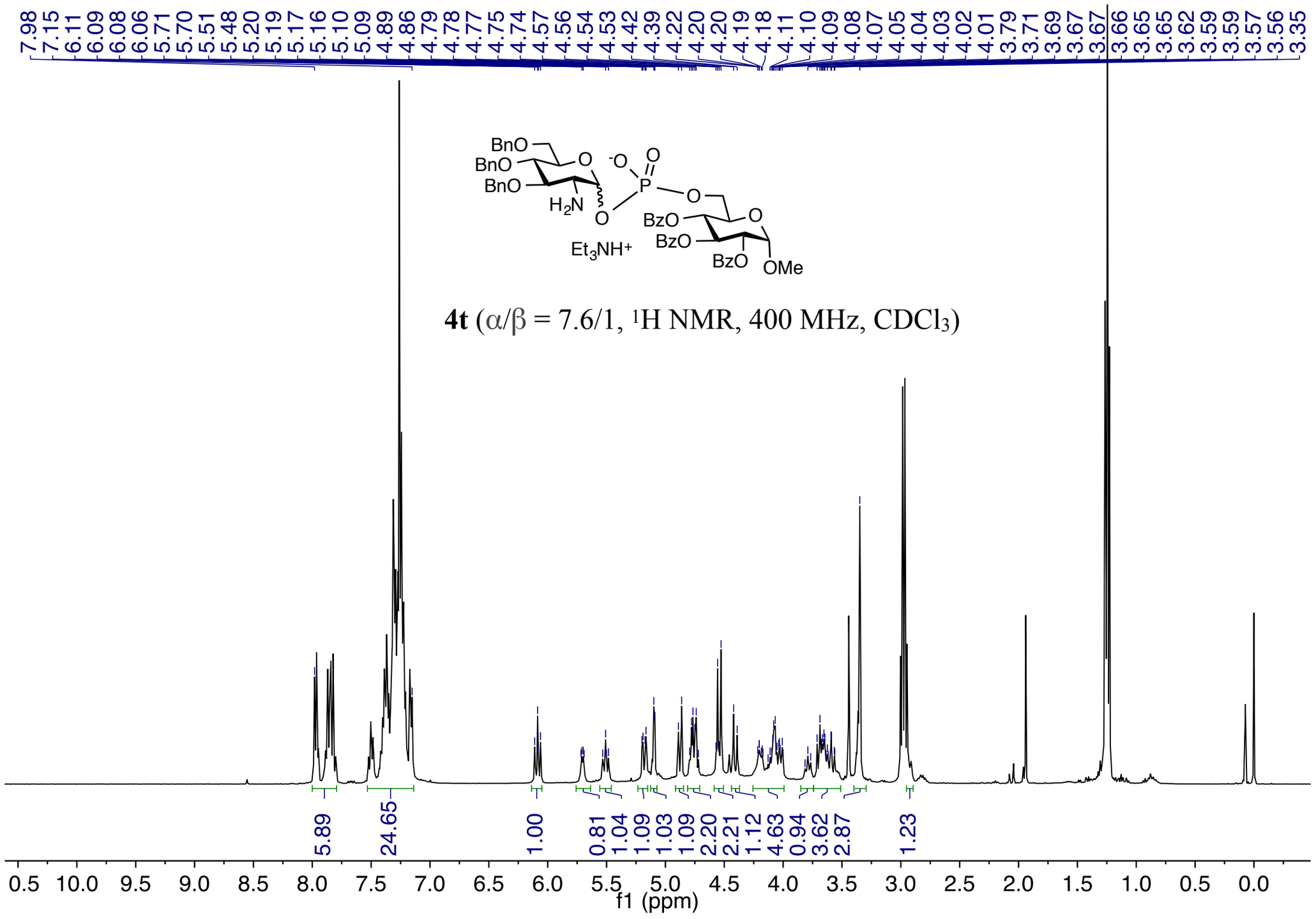


4s (gCOSY, $CDCl_3$)

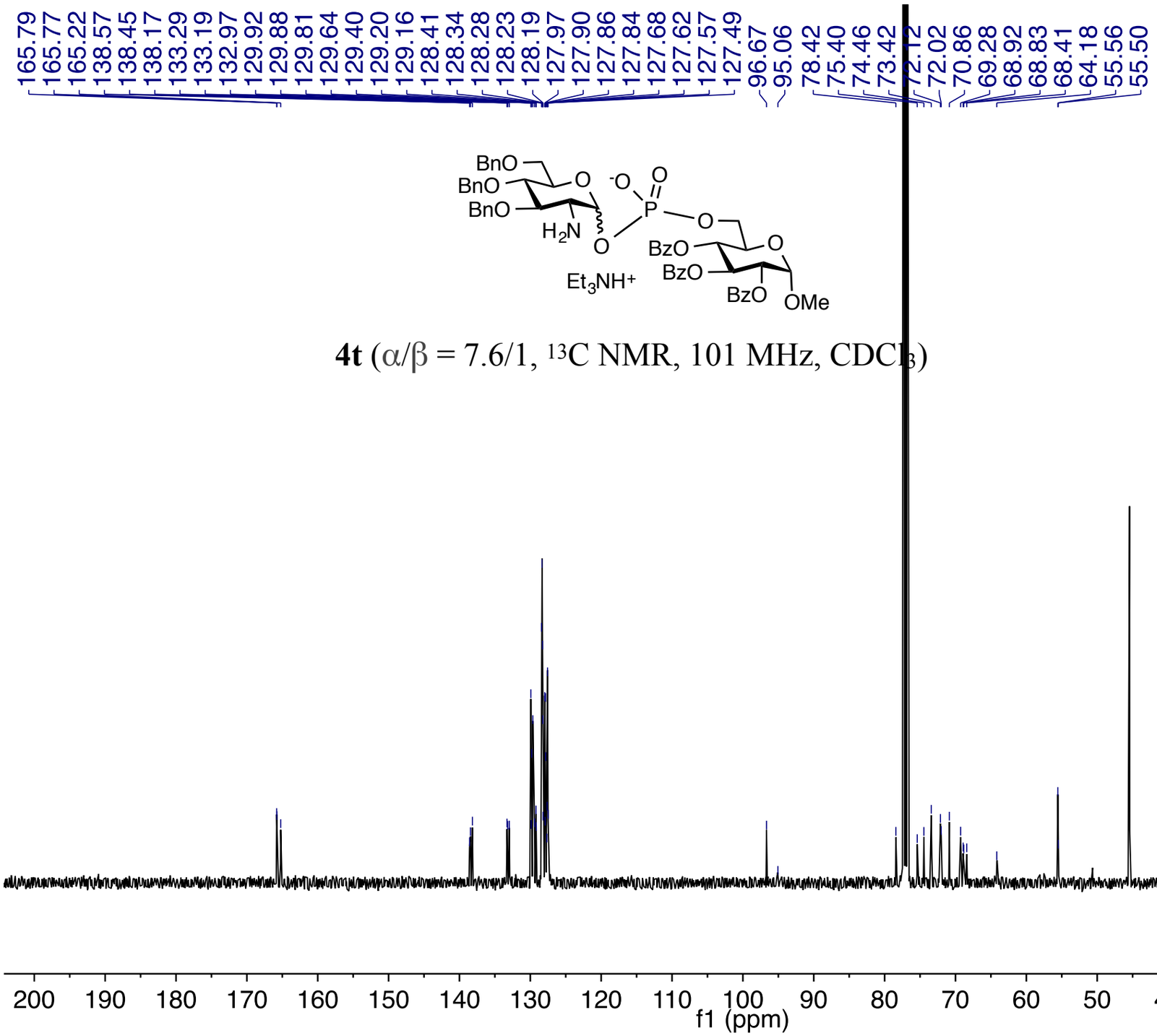


4s (gHSQC, $CDCl_3$)

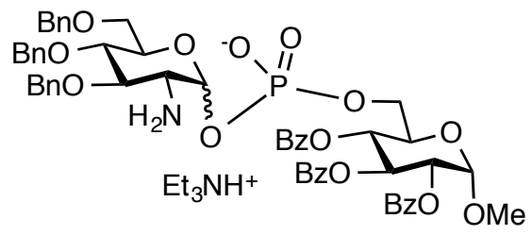

O
P
O
O
O-
O
OBz
BnO
BnO
OBn
O
BzO
BzO
OMe
Et3NH+
4s (NOE, CDCl3)
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
f1 (ppm)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)



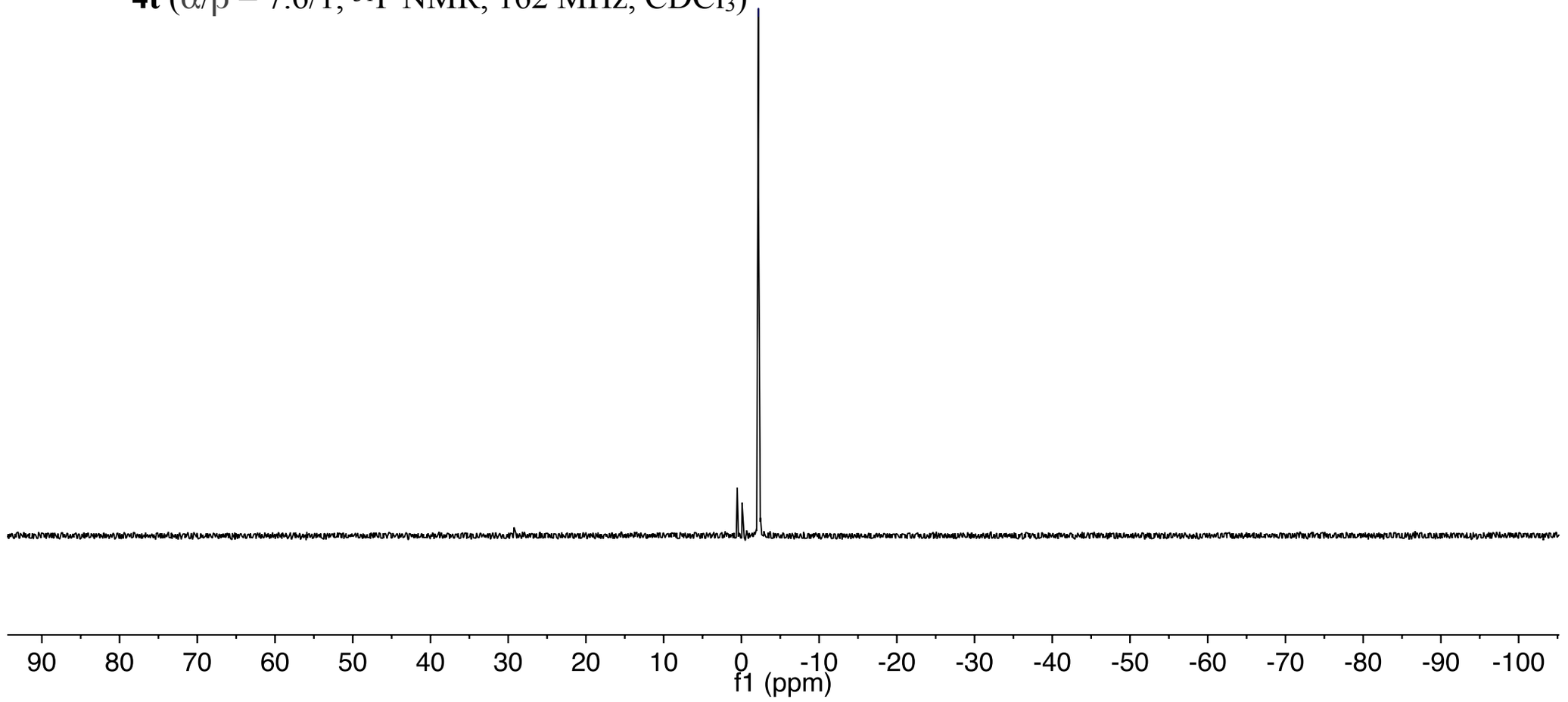
4t (α/β = 7.6/1, ^{1}H NMR, 400 MHz, $CDCl_3$)

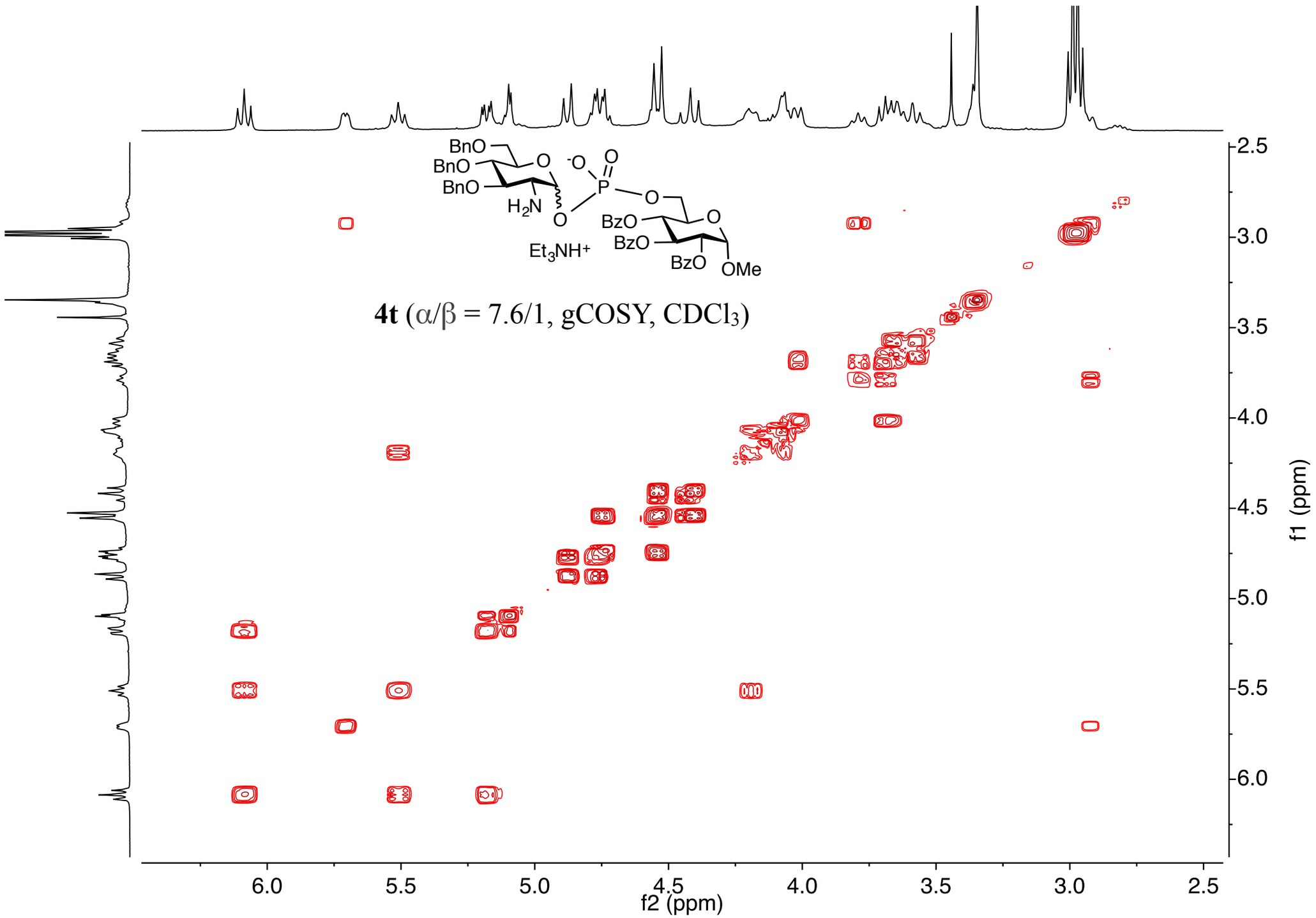


4t (α/β = 7.6/1, ^{13}C NMR, 101 MHz, $CDCl_3$)

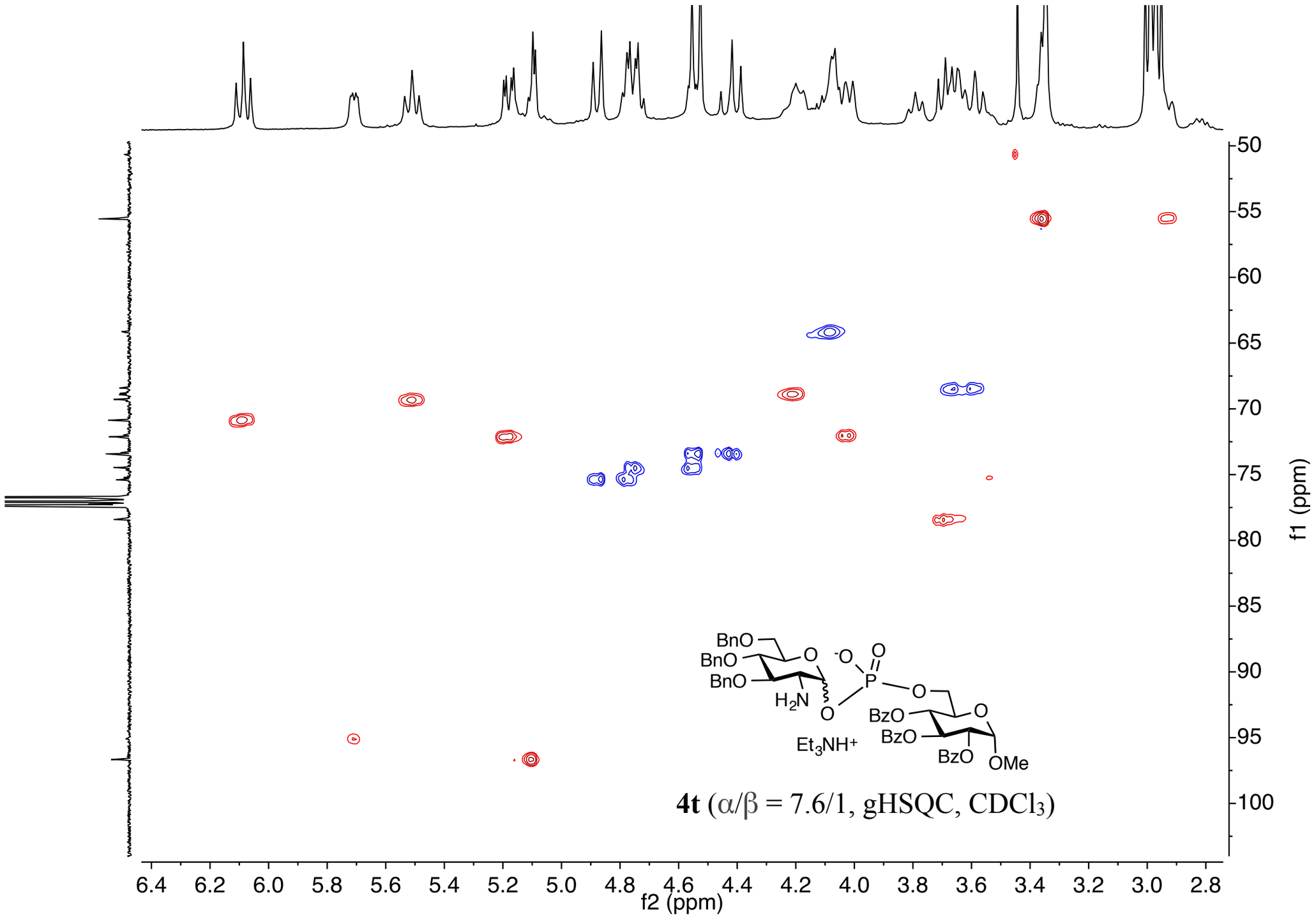


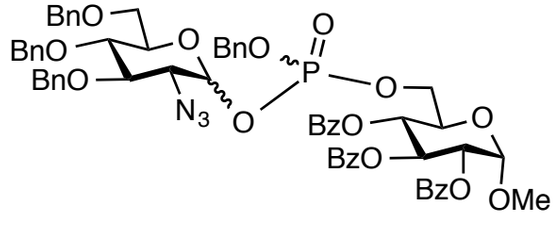
4t (α/β = 7.6/1, ^{31}P NMR, 162 MHz, $CDCl_3$)



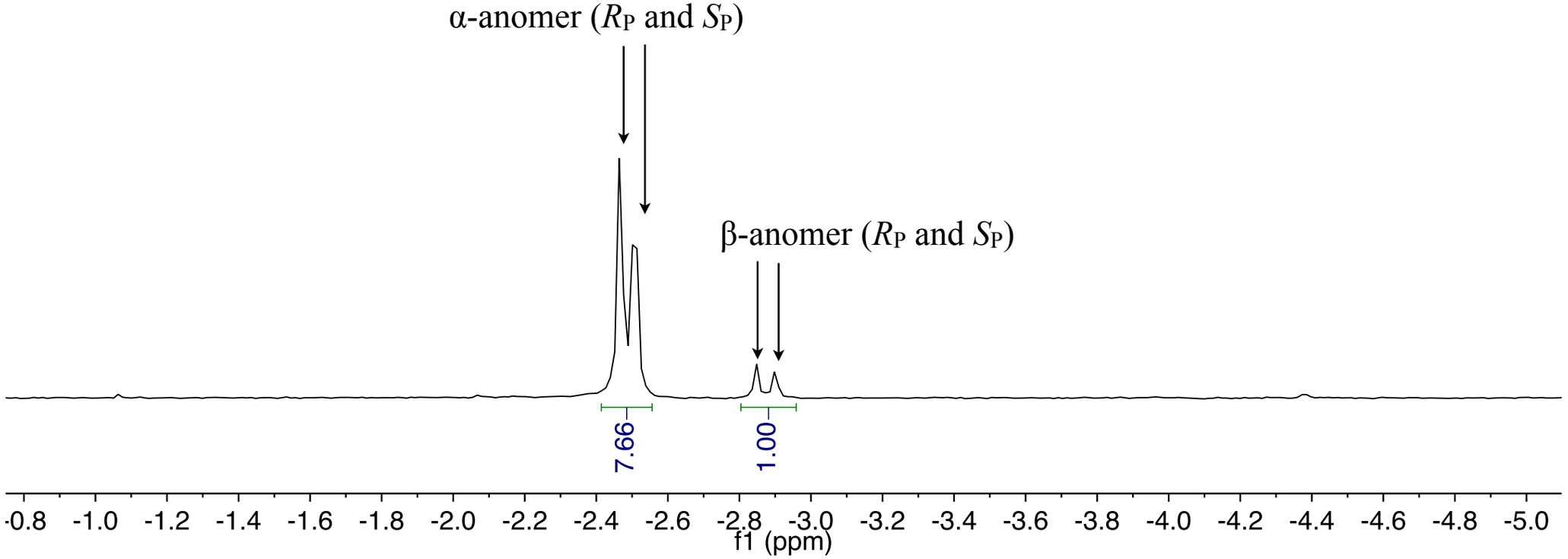


4t (α/β = 7.6/1, gCOSY, $CDCl_3$)

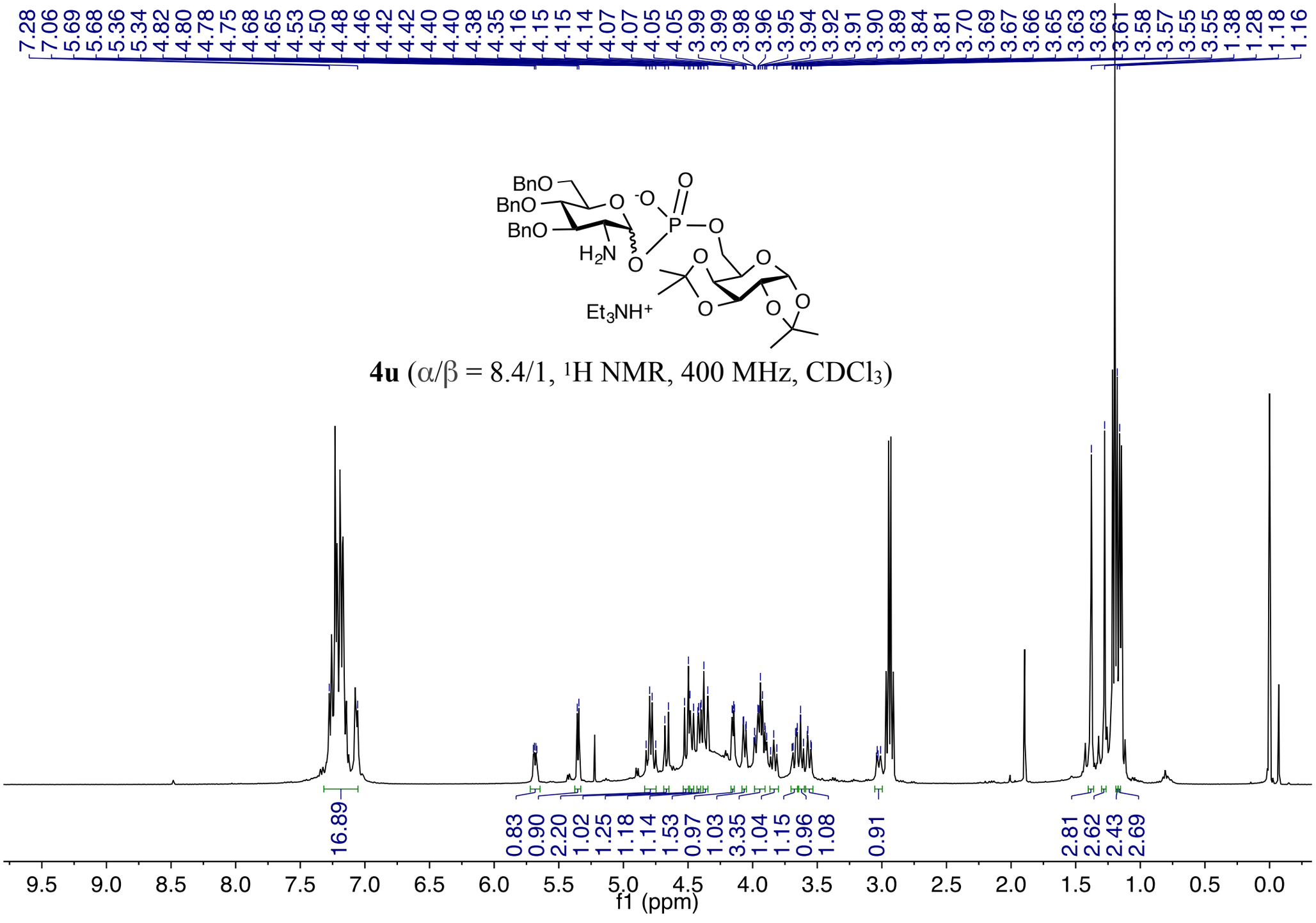

BnO
BnO
BnO
O
H2N
O
-O
O
P
O
O
BzO
BzO
BzO
OMe
Et3NH+
4t (α/β = 7.6/1, gHSQC, CDCl3)
f2 (ppm)
f1 (ppm)

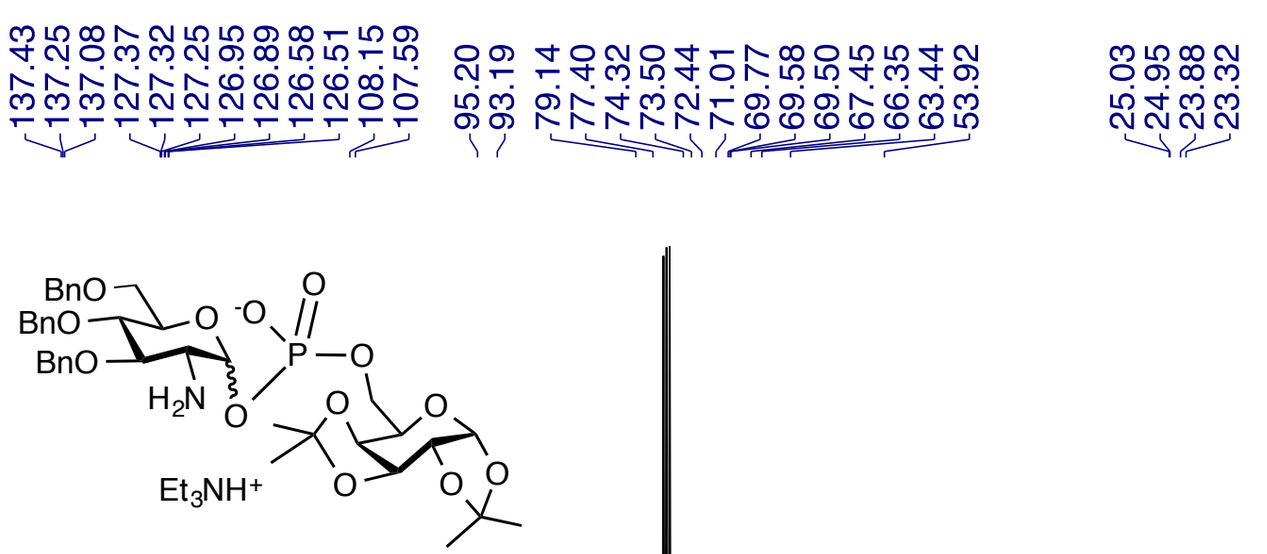


The α/β ratio was determined to be 7.6/1 by ^{31}P NMR

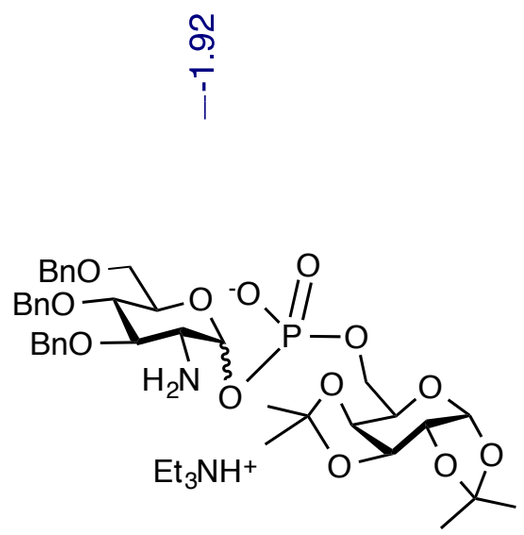


4u (α/β = 8.4/1, ^{1}H NMR, 400 MHz, $CDCl_3$)

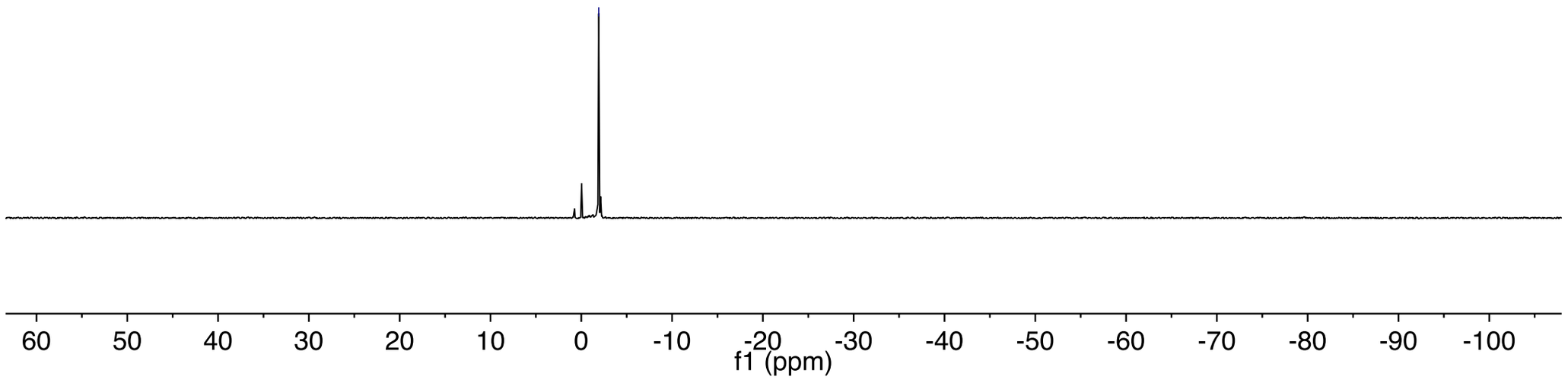


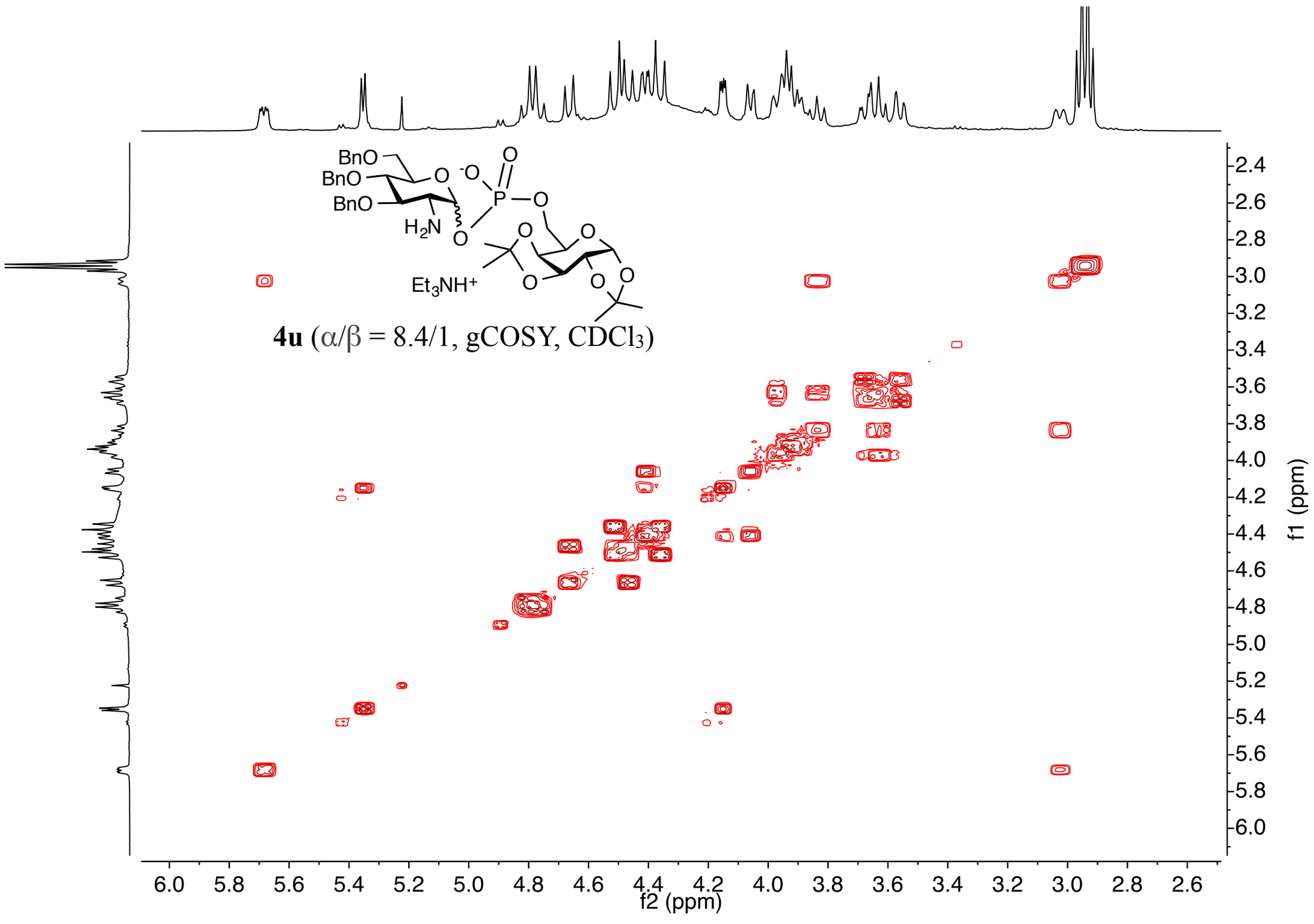


4u (α/β = 8.4/1, ^{13}C NMR, 101 MHz, $CDCl_3$)

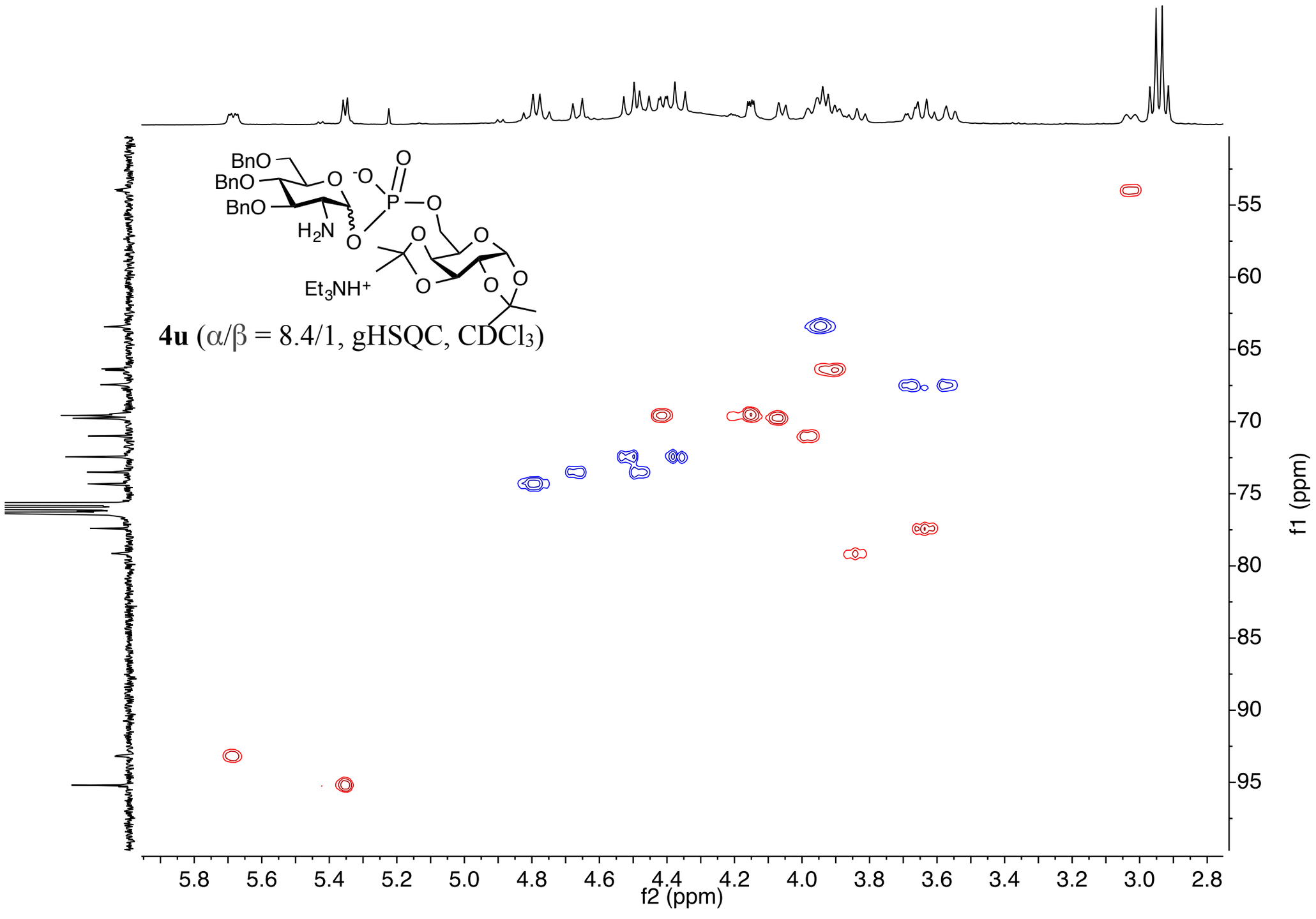


4u (α/β = 8.4/1, ^{31}P NMR, 162 MHz, $CDCl_3$)

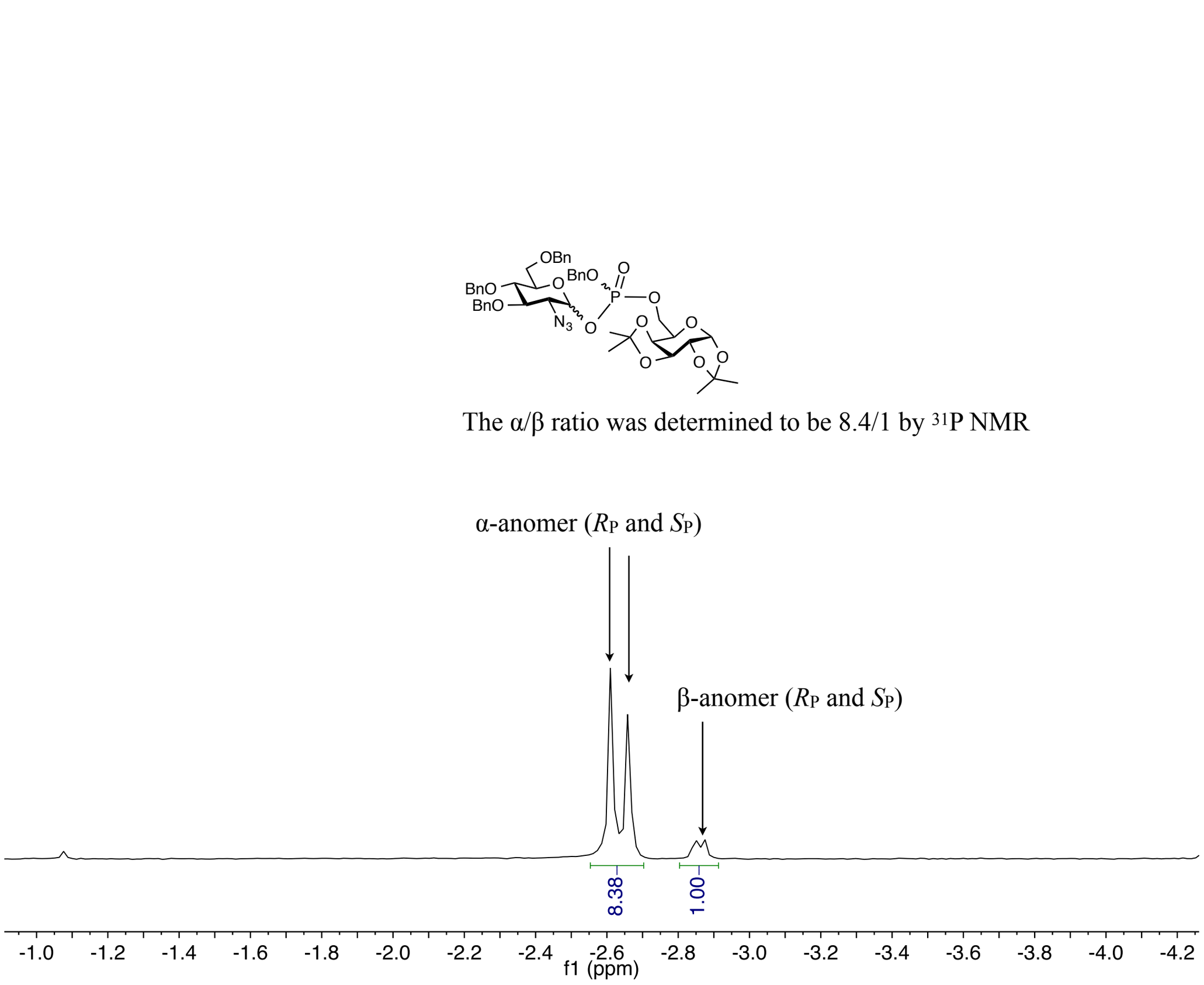


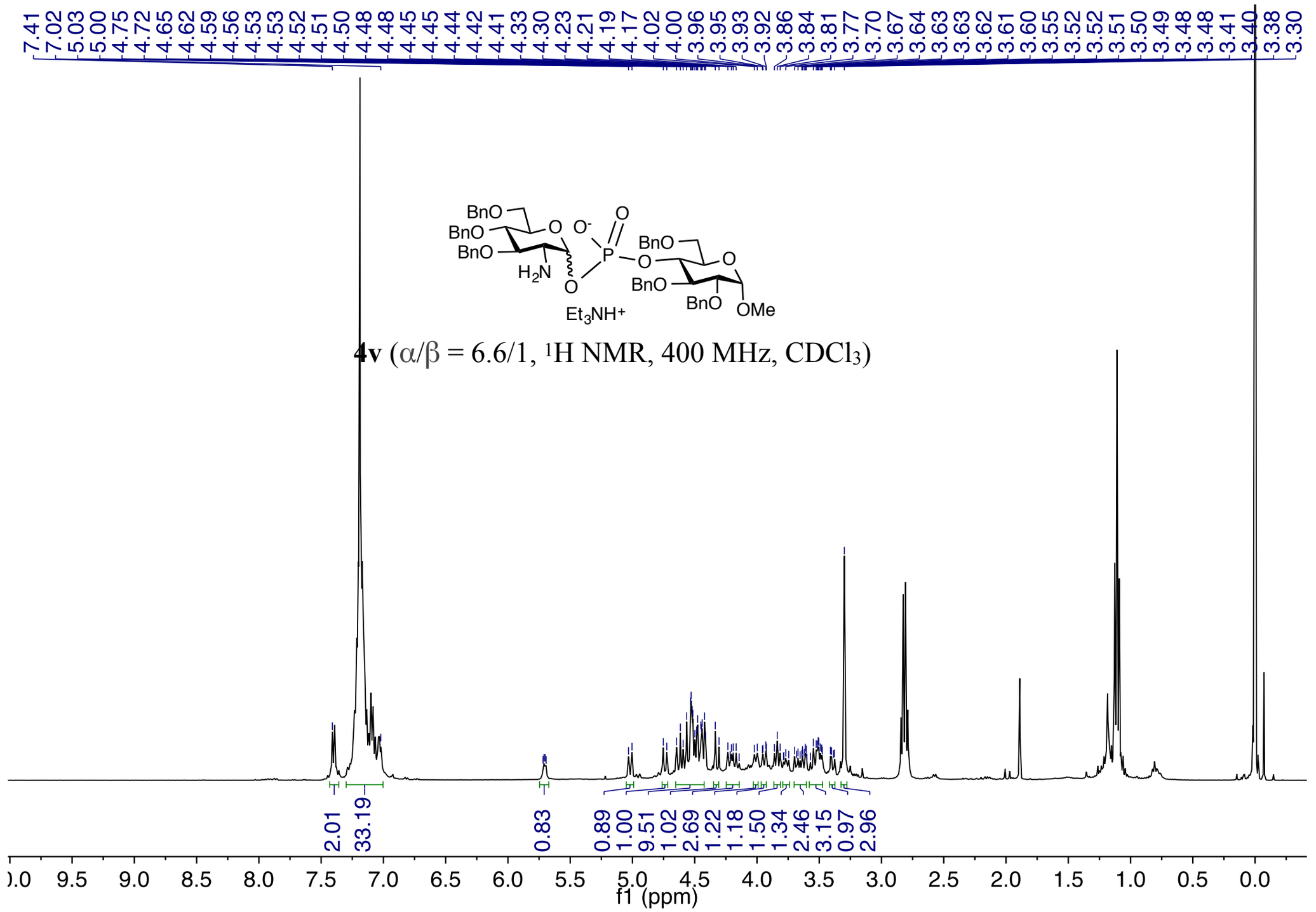


4u (α/β = 8.4/1, gCOSY, $CDCl_3$)

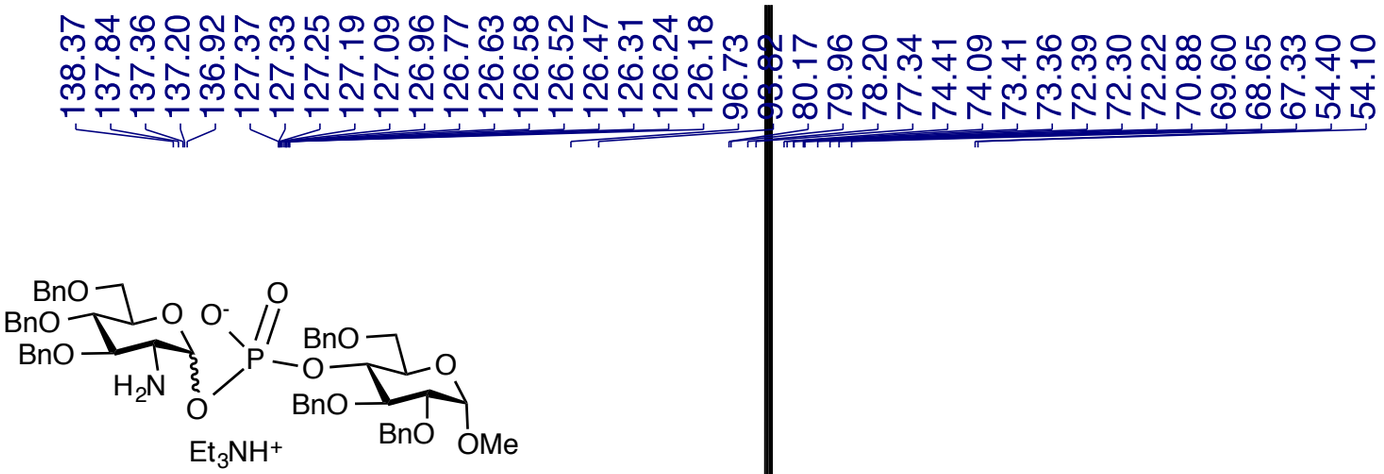

BnO
BnO
BnO
O
-O
P
O
O
H2N
O
O
O
O
O
O
O
Et3NH+
4u (α/β = 8.4/1, gHSQC, CDCl3)
55
60
65
70
75
80
85
90
95
f1 (ppm)
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
f2 (ppm)

The α/β ratio was determined to be 8.4/1 by ^{31}P NMR

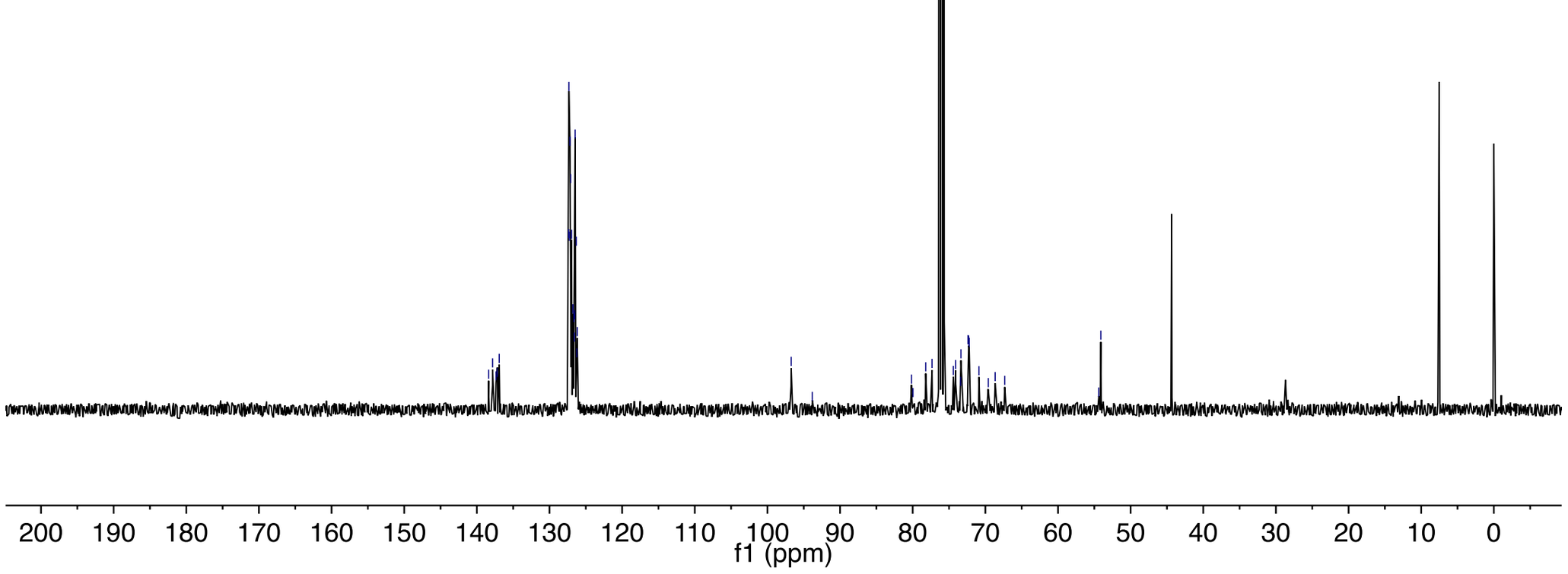


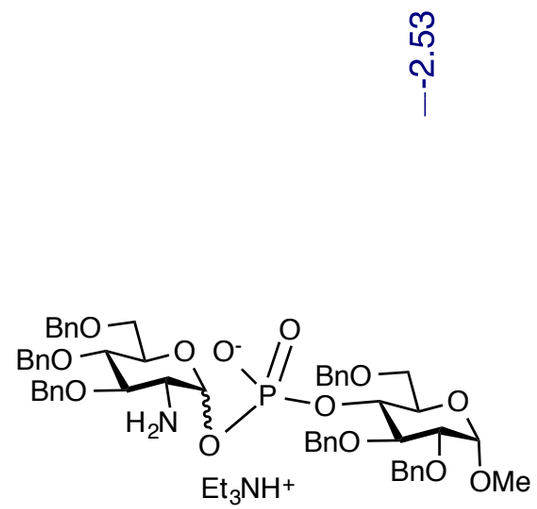


4v (α/β = 6.6/1, ^{1}H NMR, 400 MHz, $CDCl_3$)

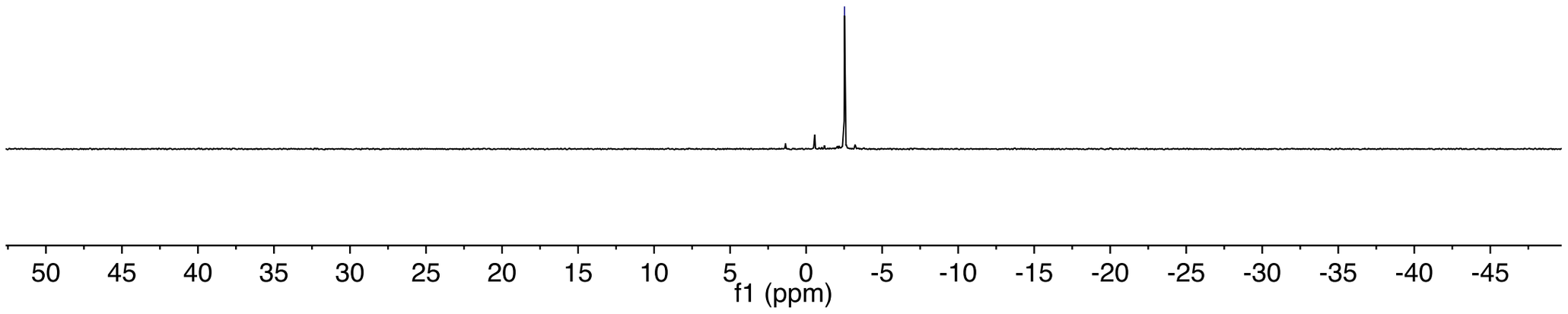


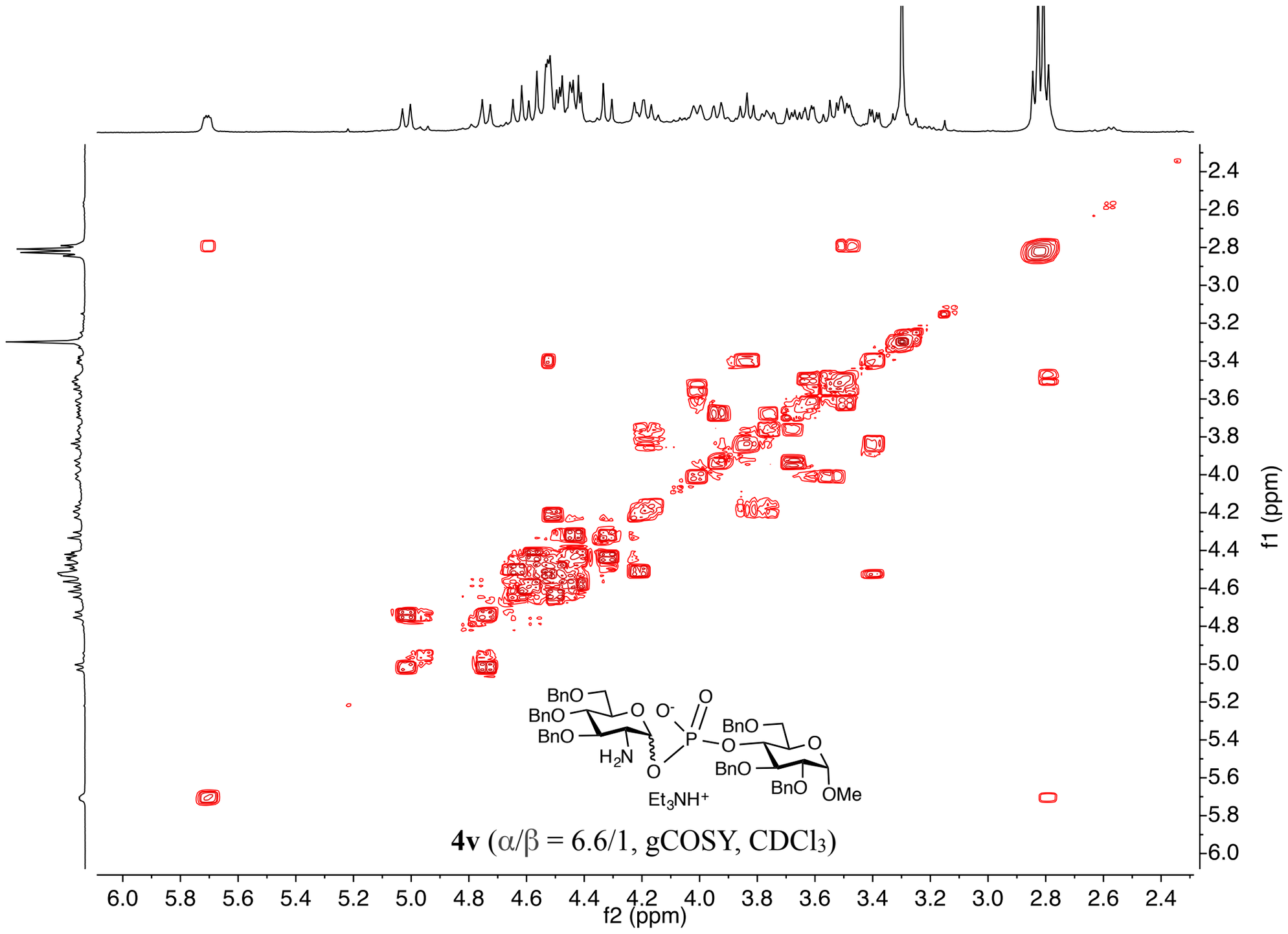
4v (α/β = 6.6/1, ^{13}C NMR, 101 MHz, $CDCl_3$)



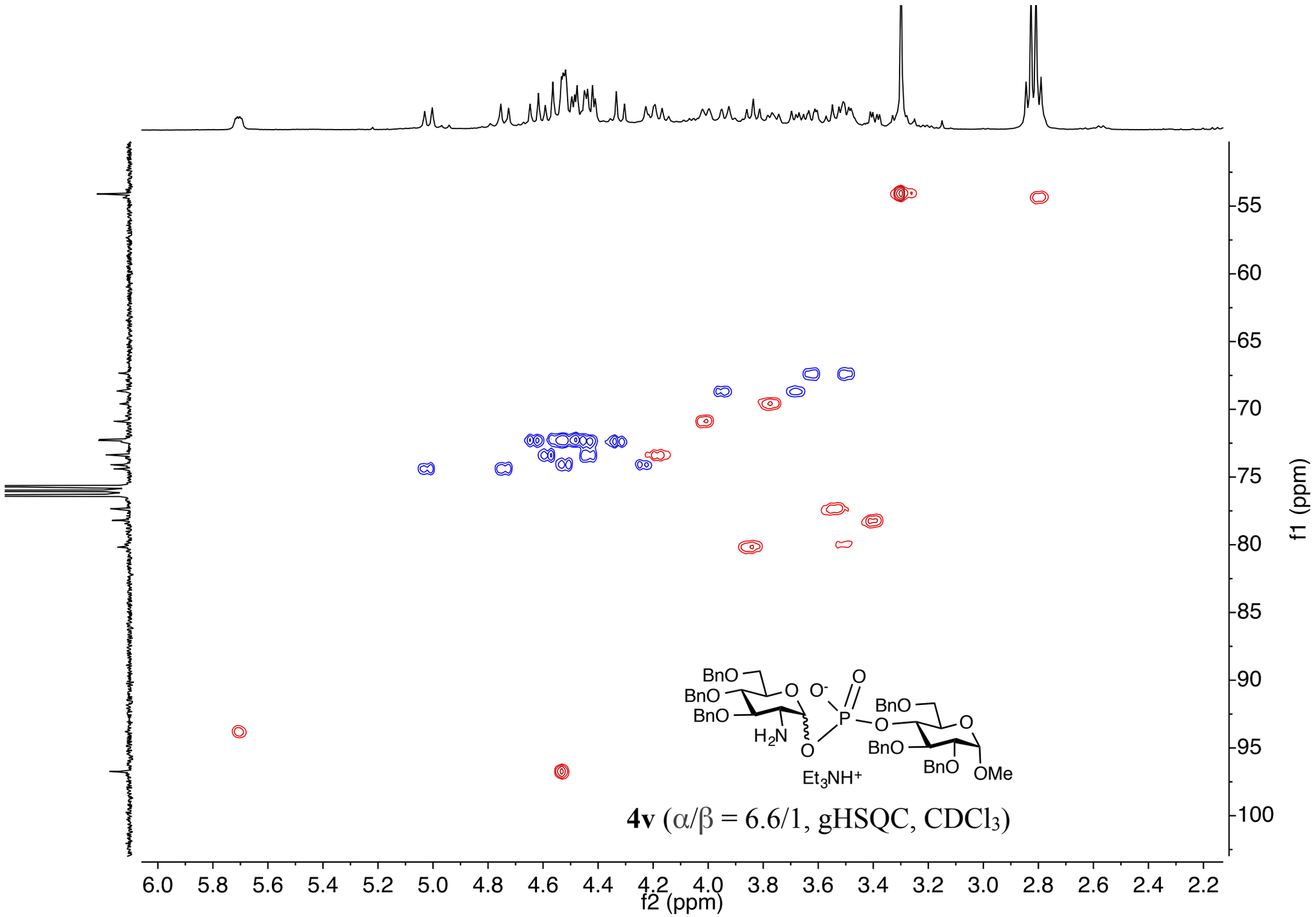


4v (α/β = 6.6/1, ^{31}P NMR, 162 MHz, $CDCl_3$)

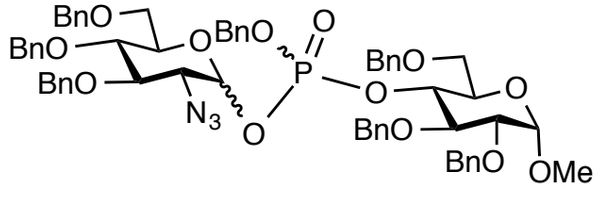




4v (α/β = 6.6/1, gCOSY, $CDCl_3$)



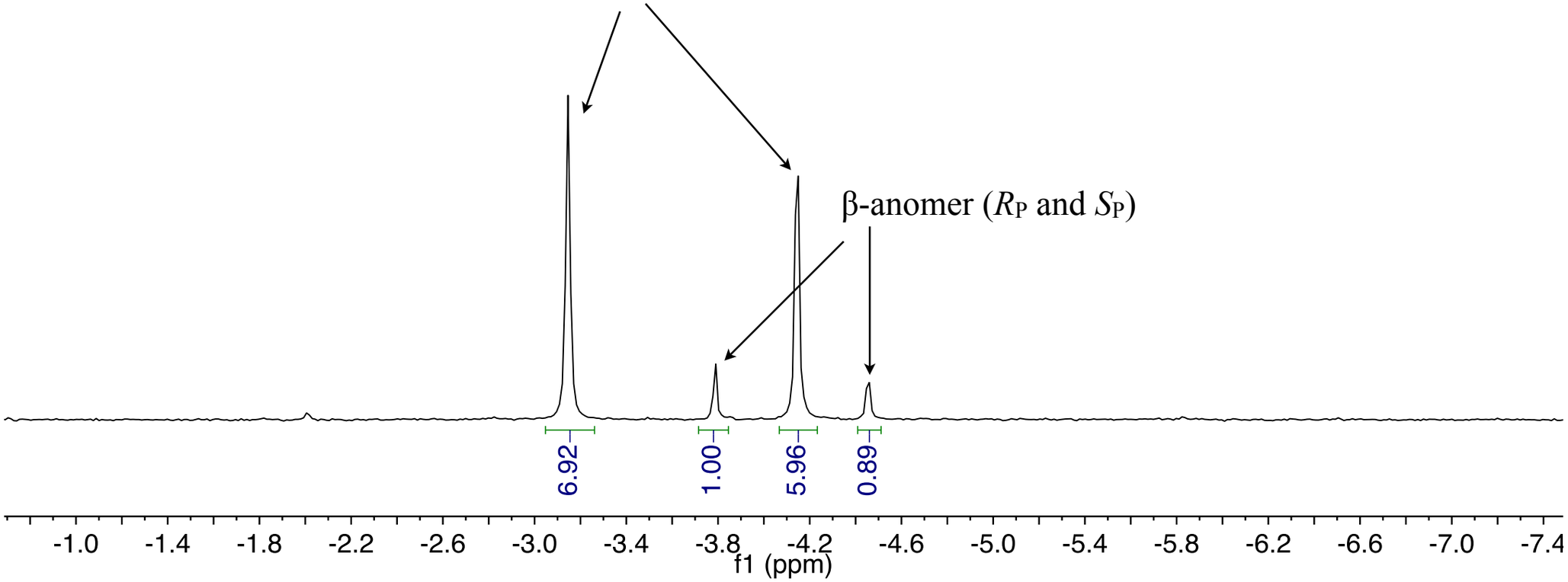
4v (α/β = 6.6/1, gHSQC, $CDCl_3$)

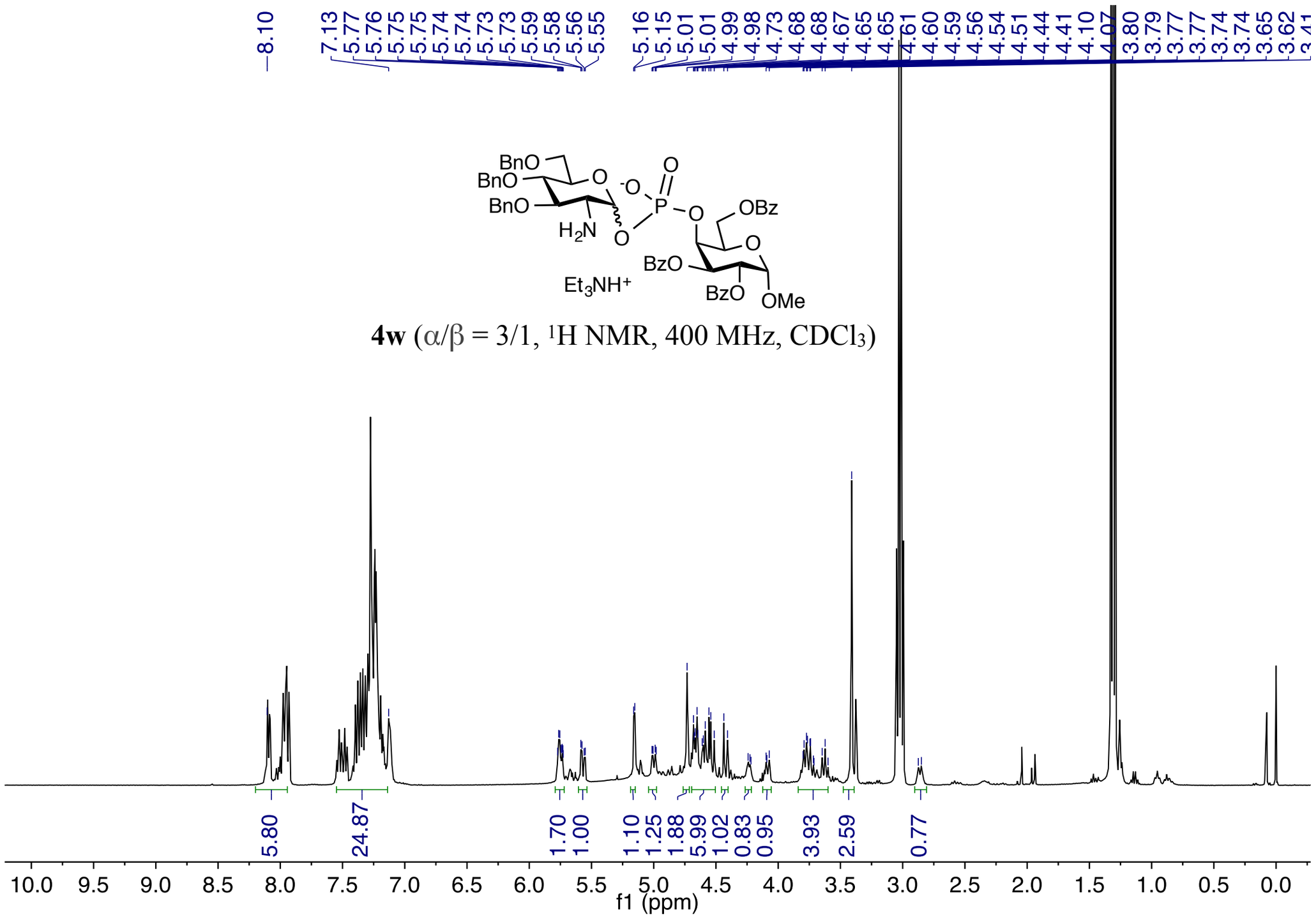


The α/β ratio was determined to be 6.6/1 by ^{31}P NMR

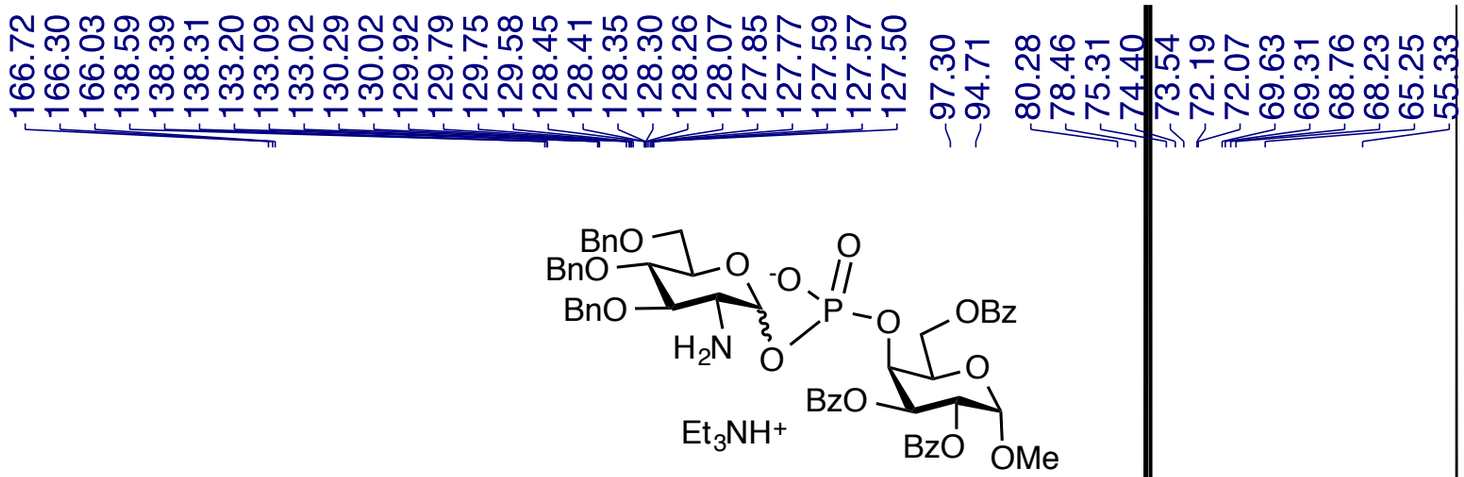
α-anomer (R_P and S_P)

β-anomer (R_P and S_P)

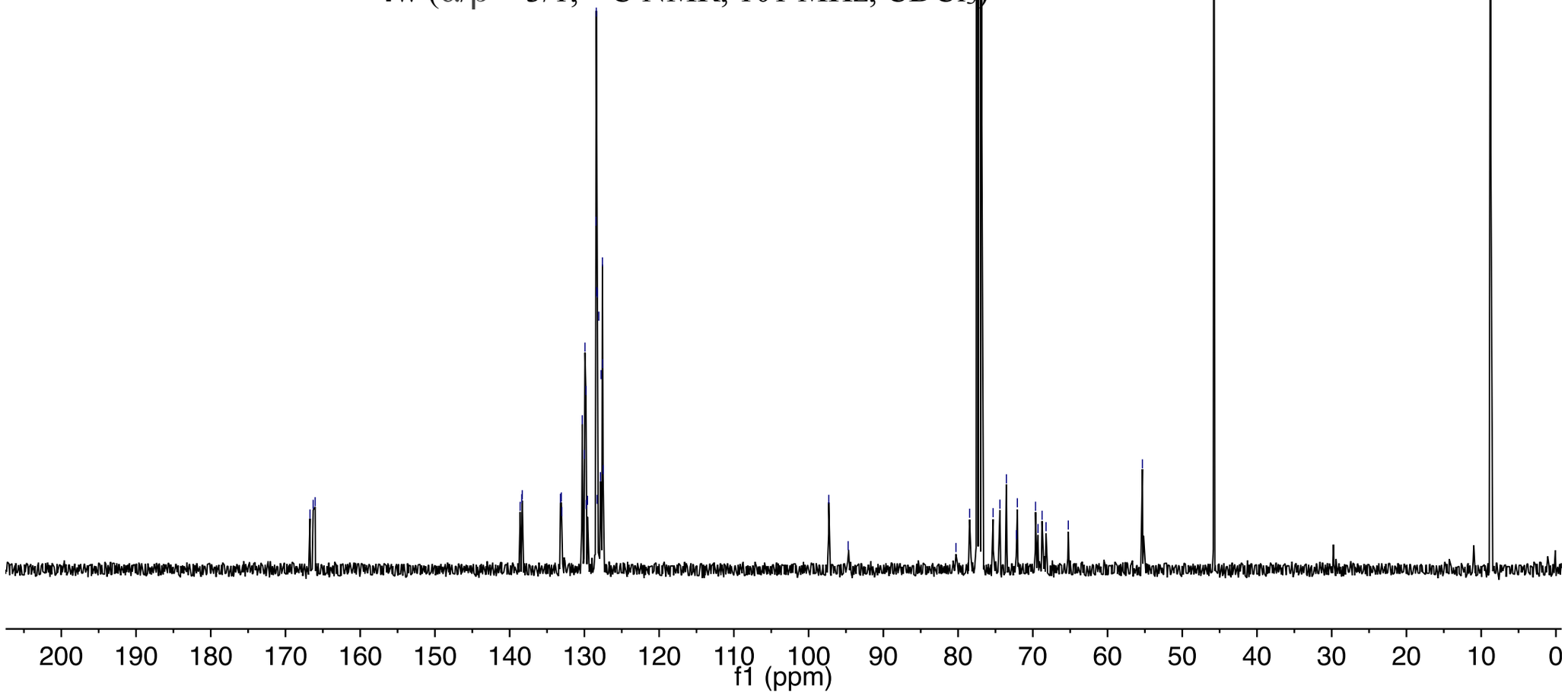


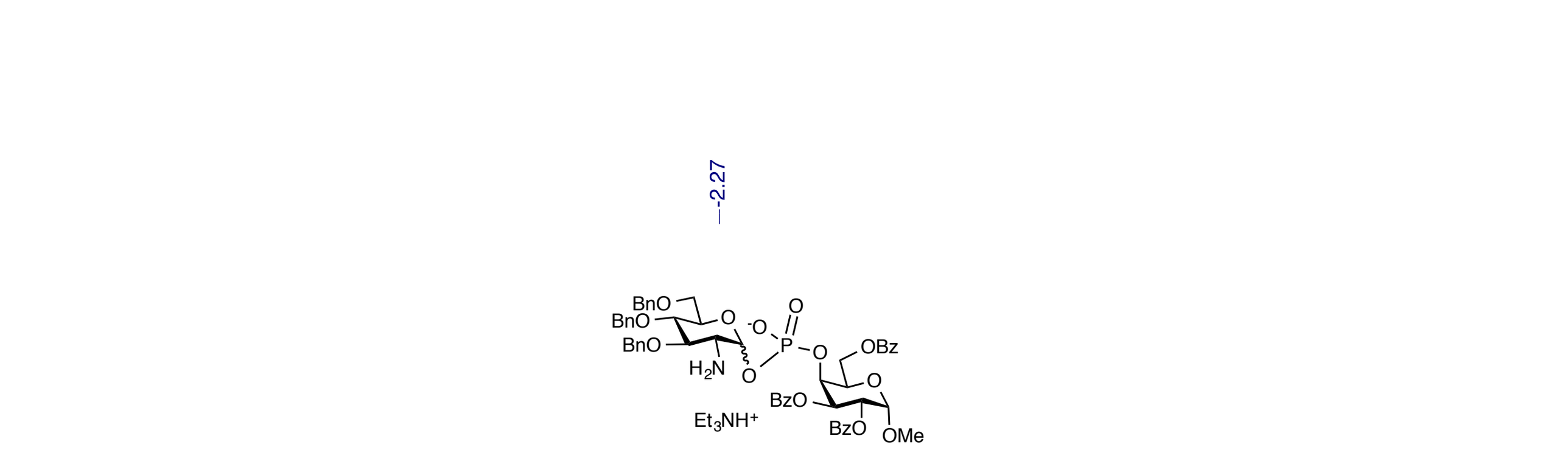


4w (α/β = 3/1, ^{1}H NMR, 400 MHz, $CDCl_3$)

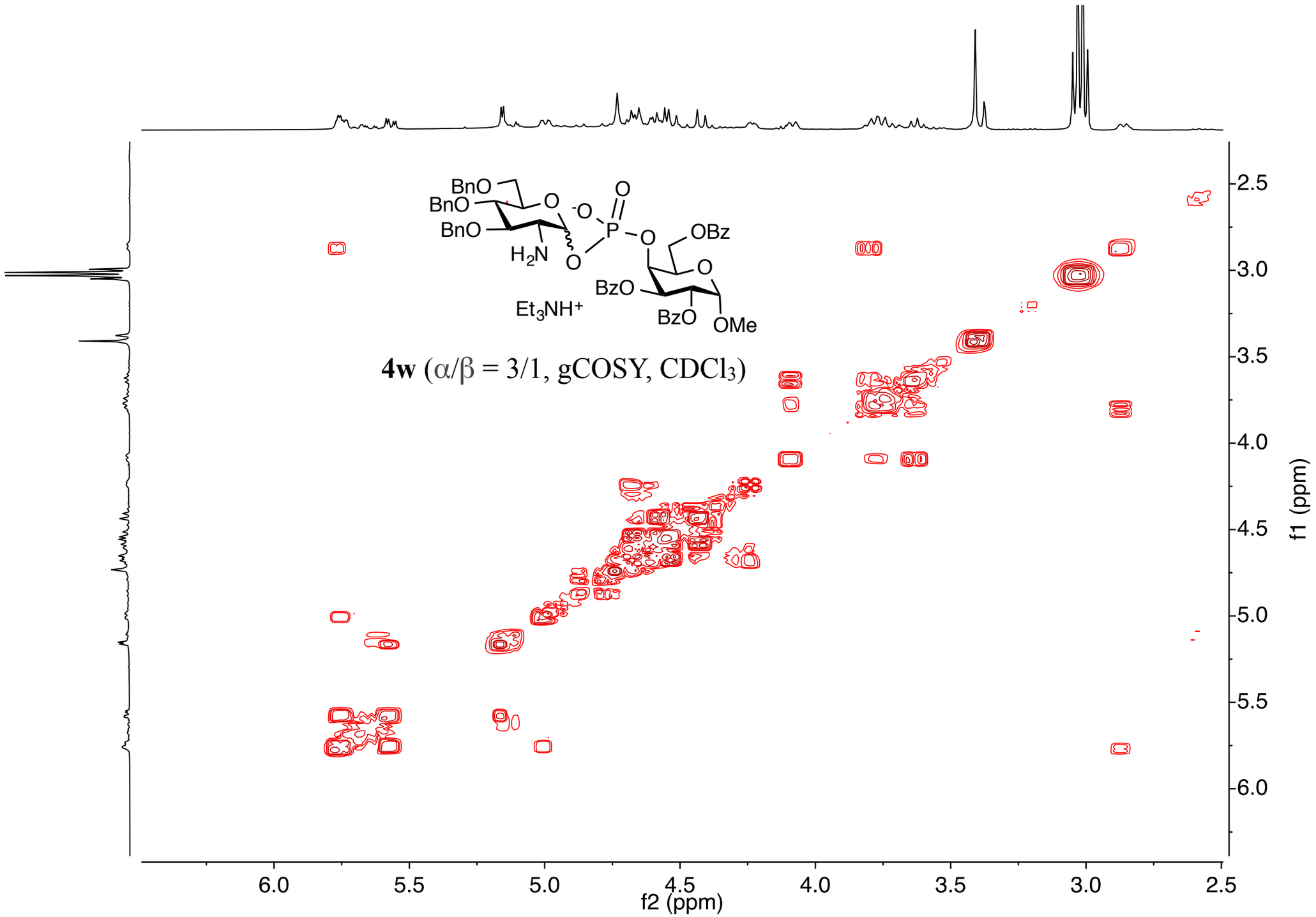


4w (α/β = 3/1, ^{13}C NMR, 101 MHz, $CDCl_3$)

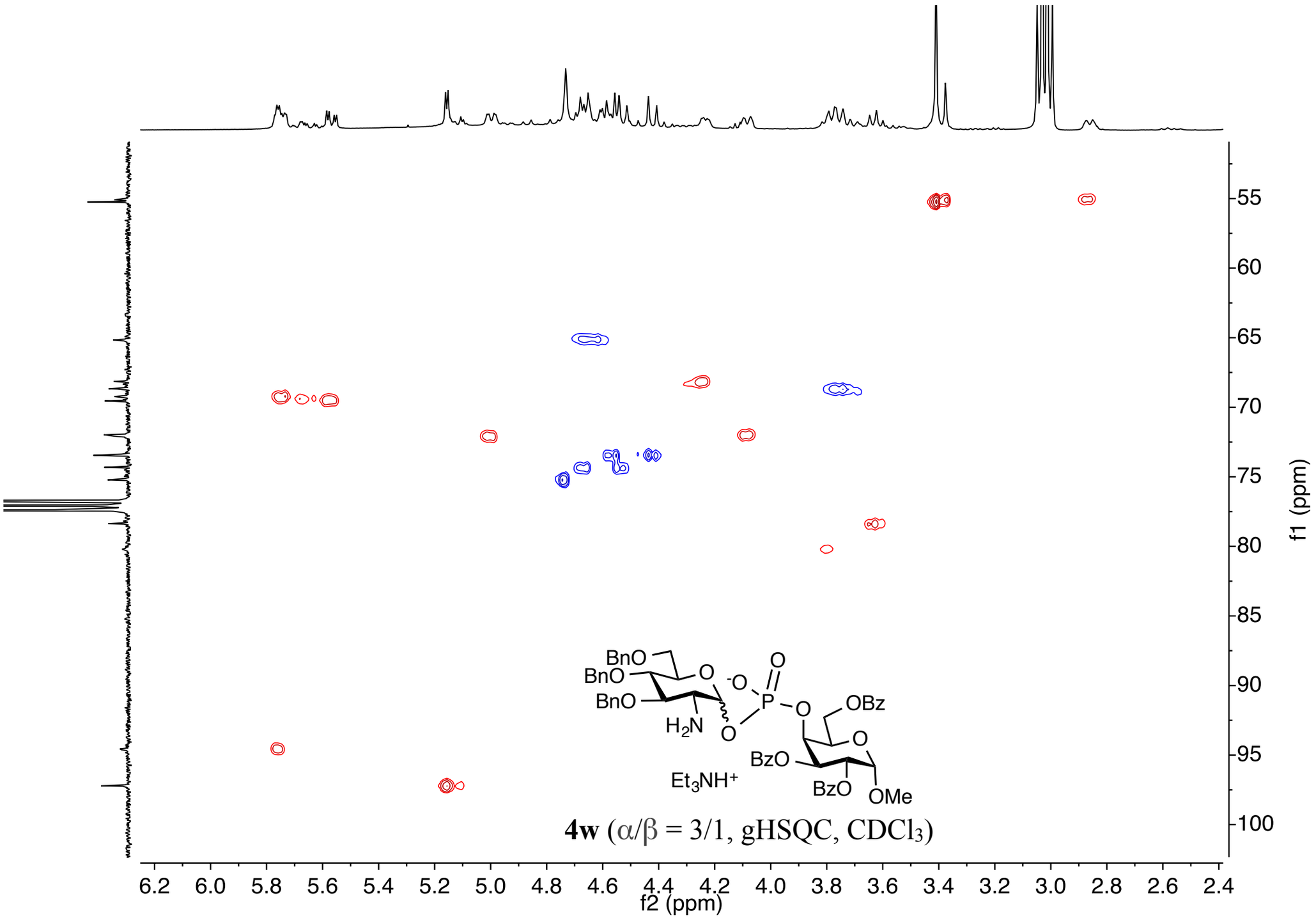




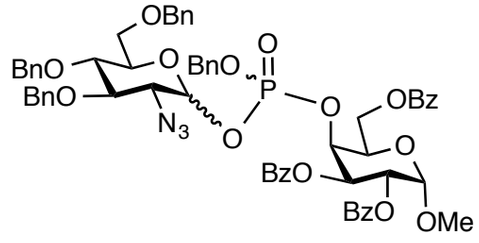
4w (α/β = 3/1, ^{31}P NMR, 162 MHz, $CDCl_3$)



4w (α/β = 3/1, gCOSY, $CDCl_3$)



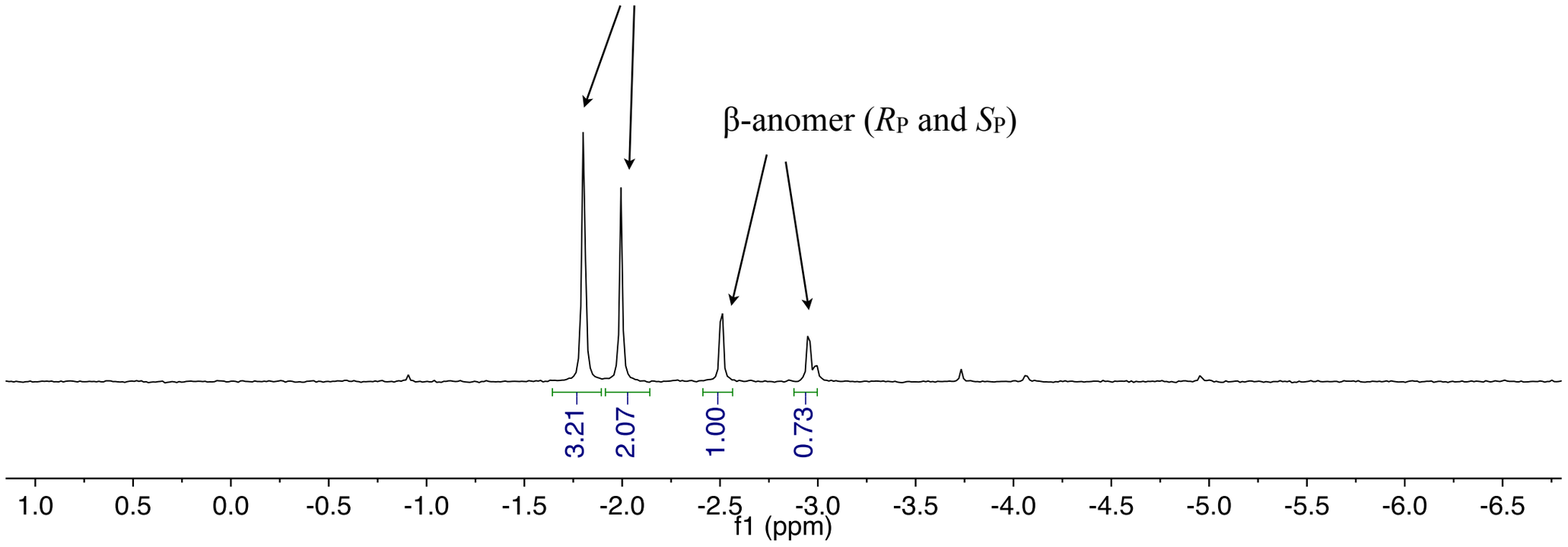
4w (α/β = 3/1, gHSQC, $CDCl_3$)

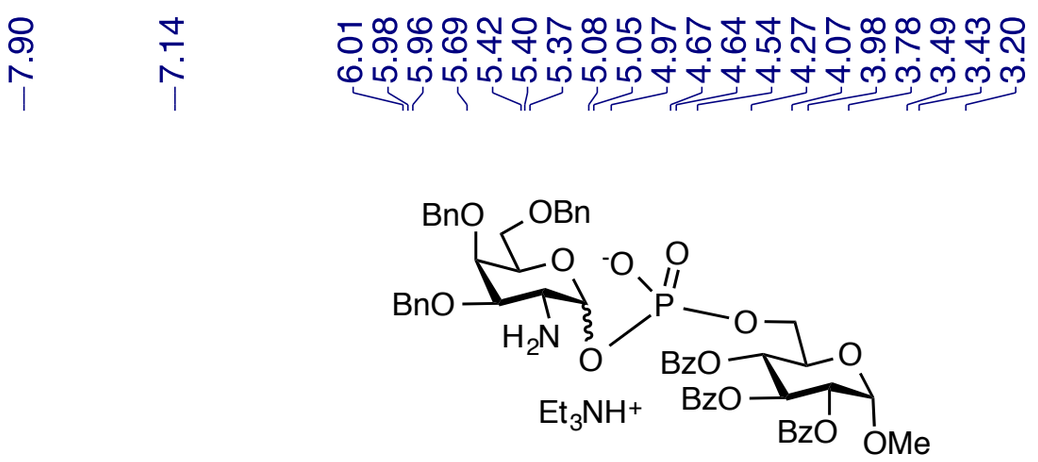


The α/β ratio was determined to be 3/1 by ^{31}P NMR

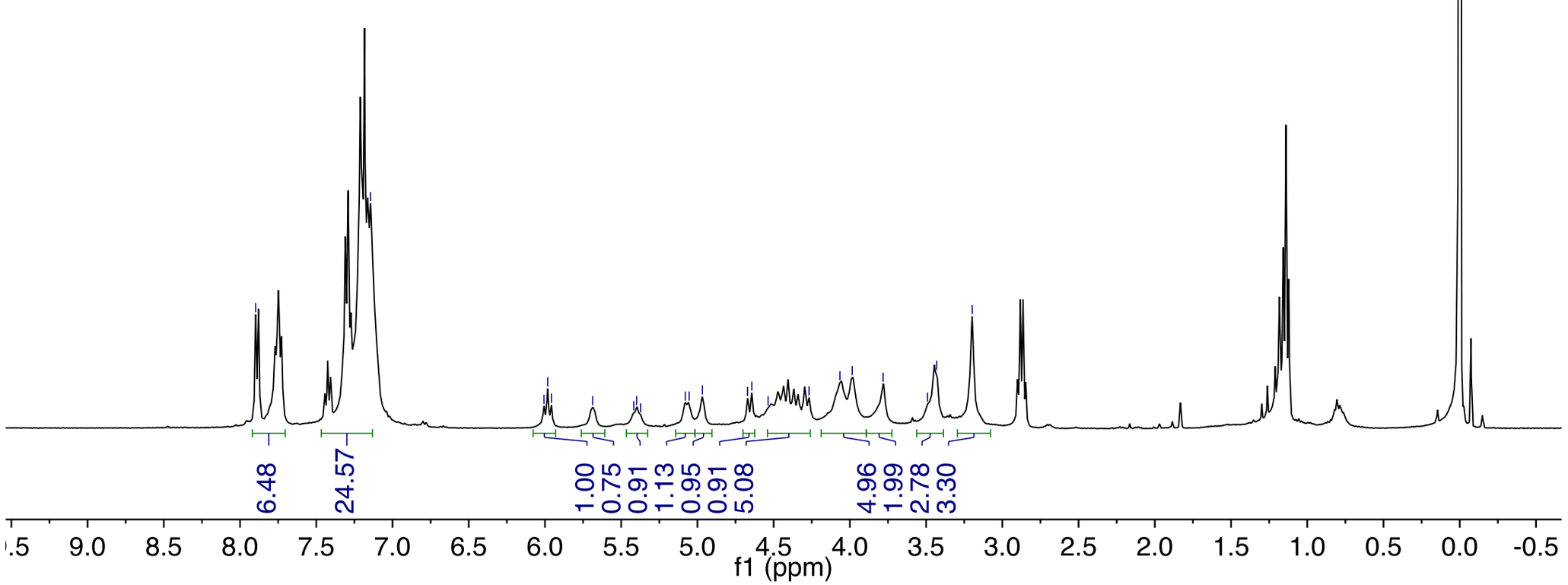
α-anomer (R_P and S_P)

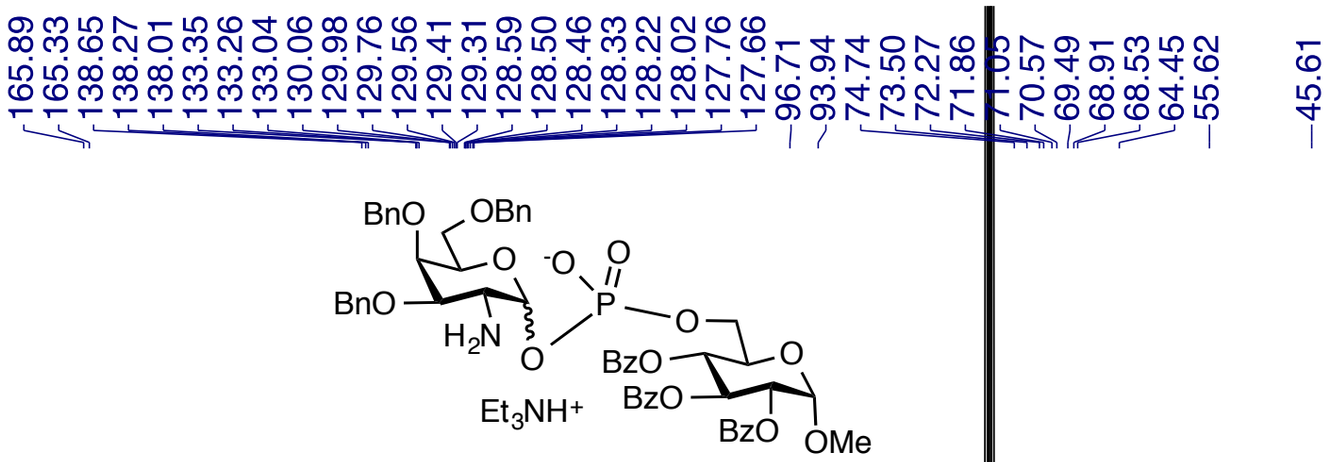
β-anomer (R_P and S_P)



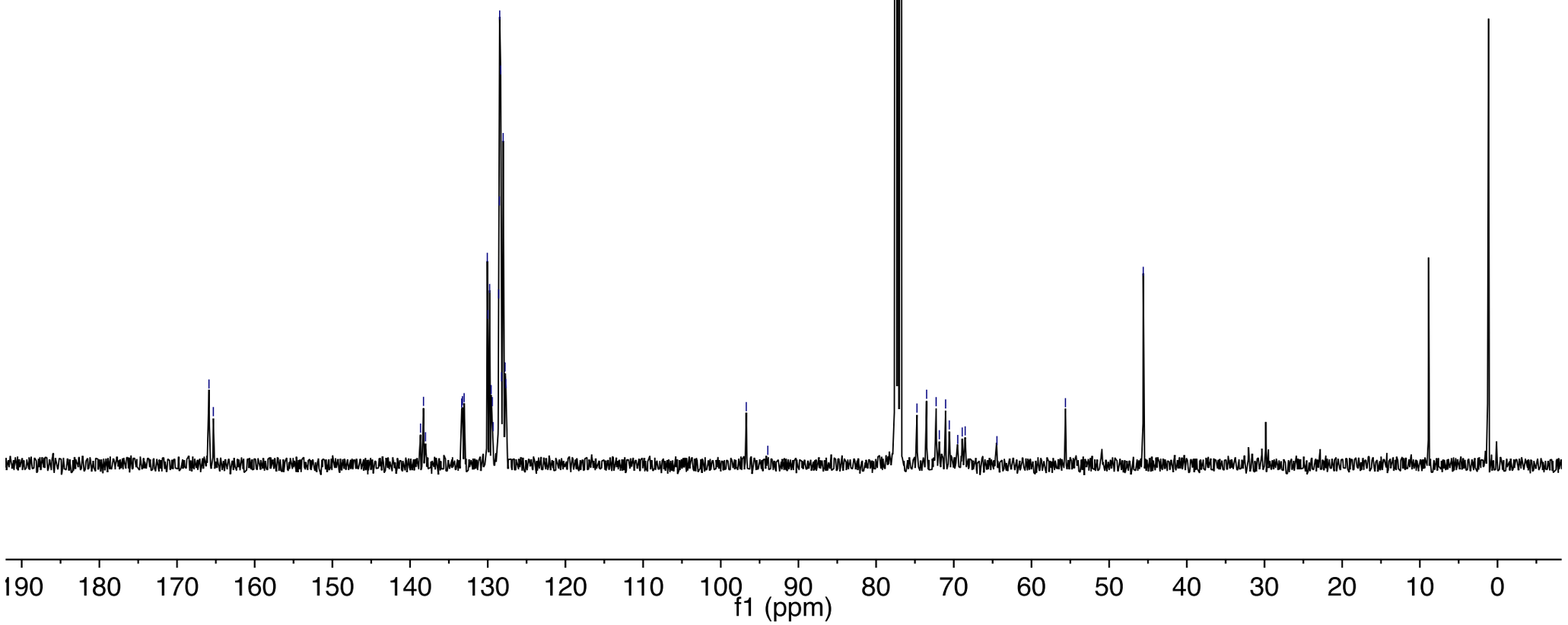


4x (α/β = 9.7/1, ^{1}H NMR, 400 MHz, $CDCl_3$)

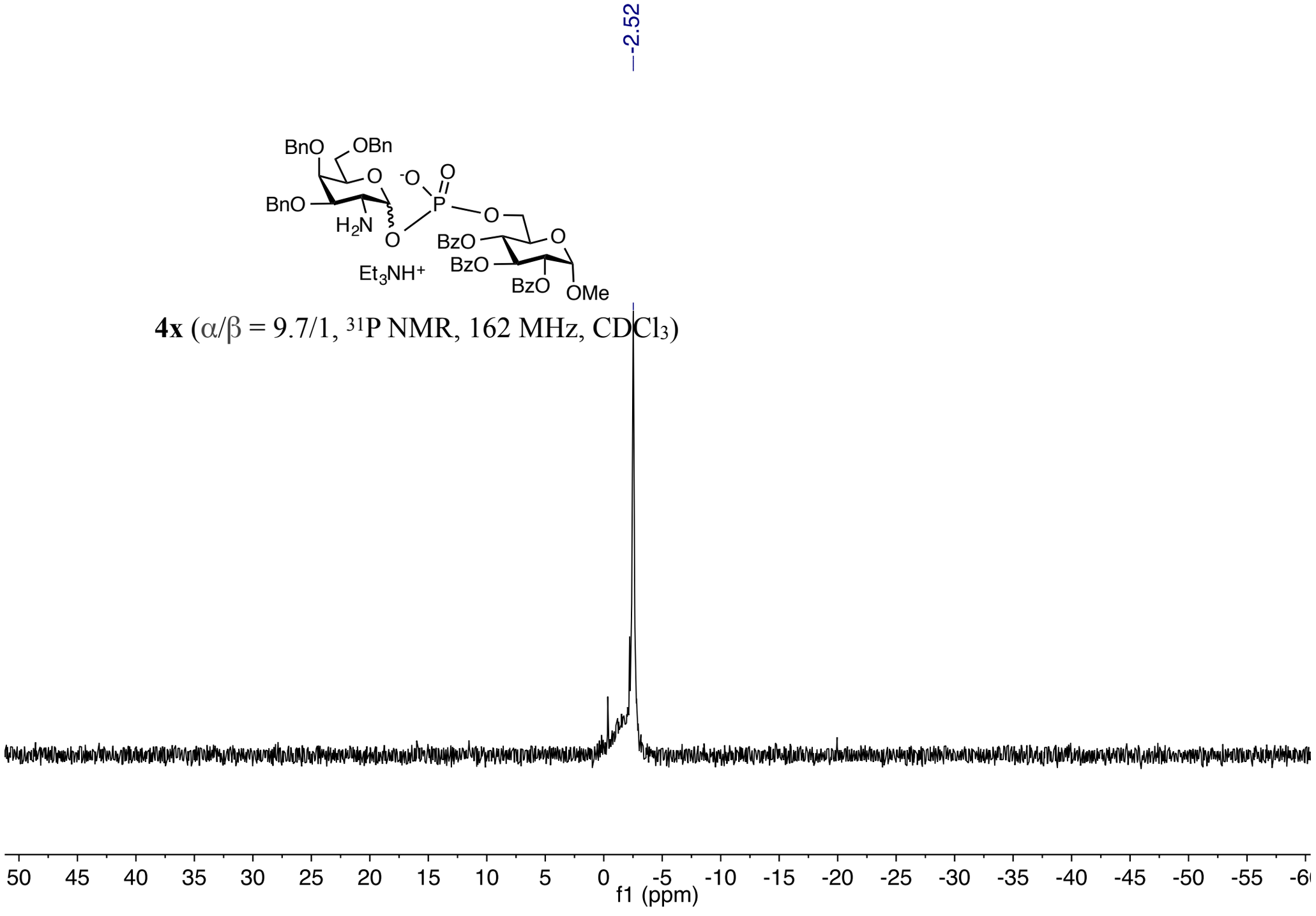


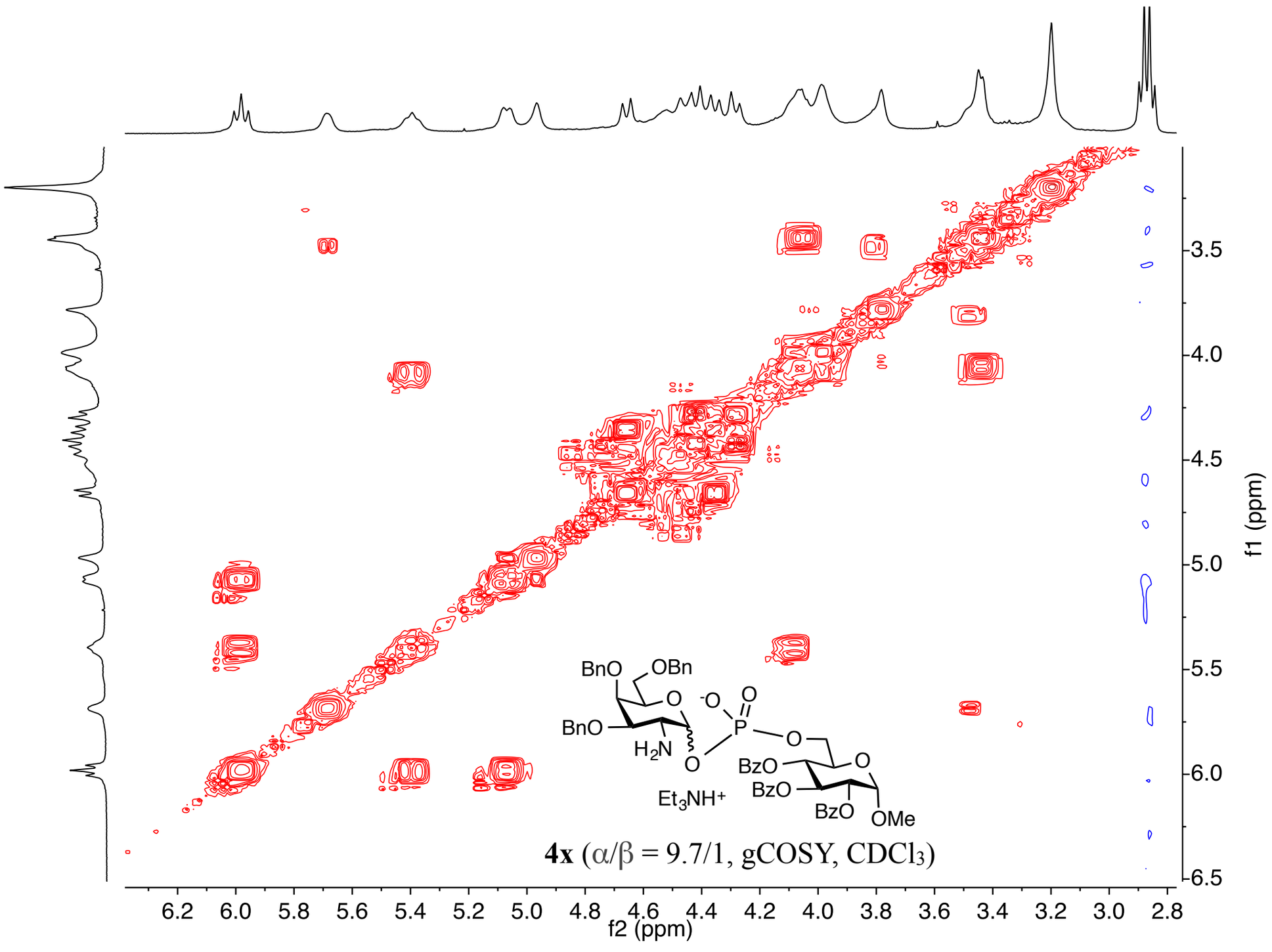


4x (α/β = 9.7/1, ^{13}C NMR, 101 MHz, $CDCl_3$)

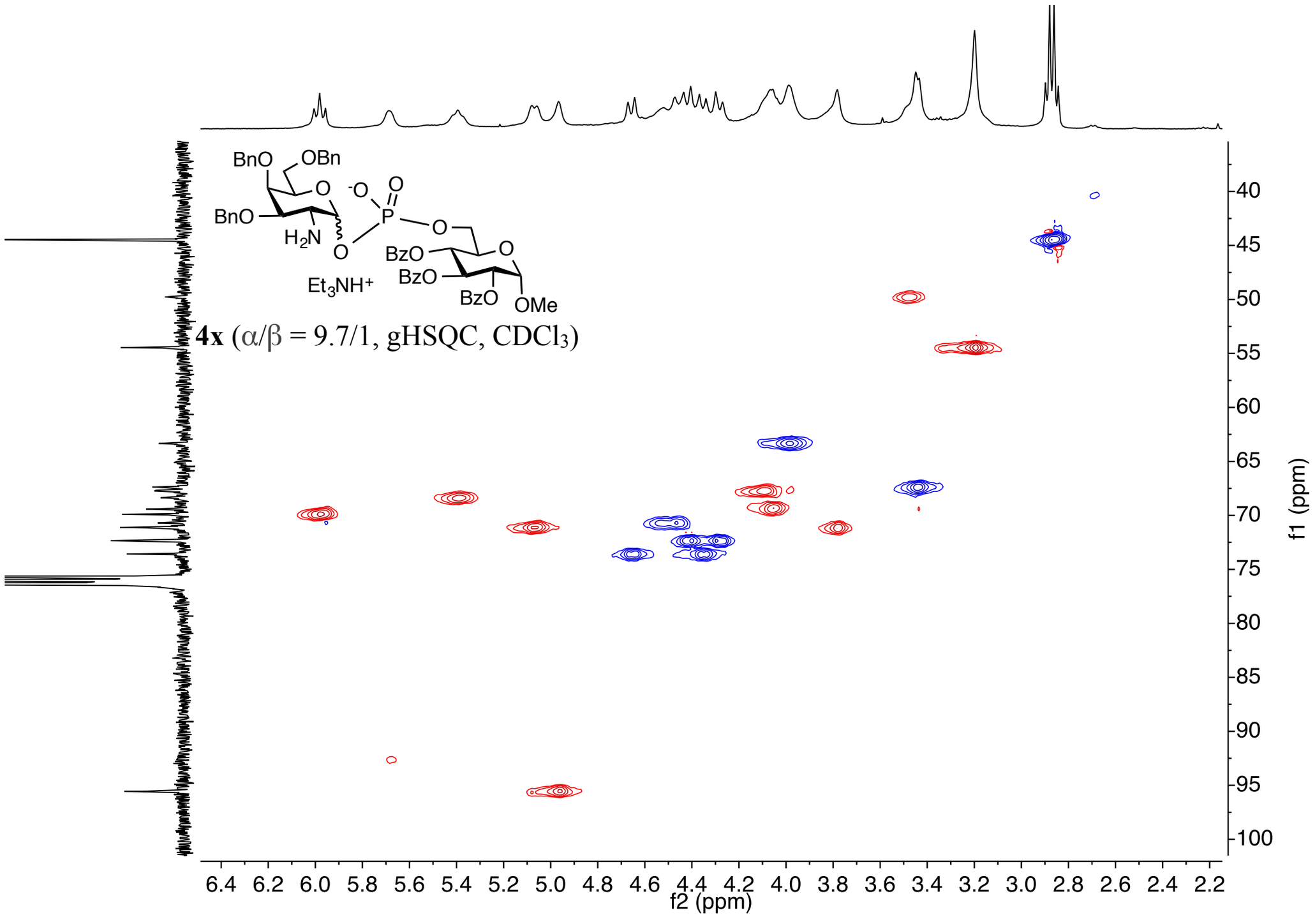


4x (α/β = 9.7/1, ^{31}P NMR, 162 MHz, $CDCl_3$)

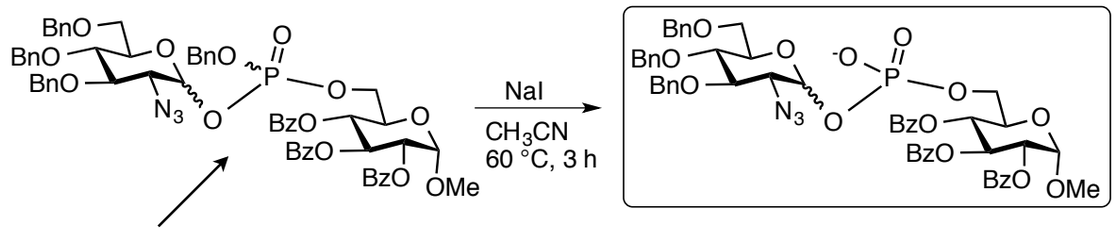




4x (α/β = 9.7/1, gCOSY, $CDCl_3$)

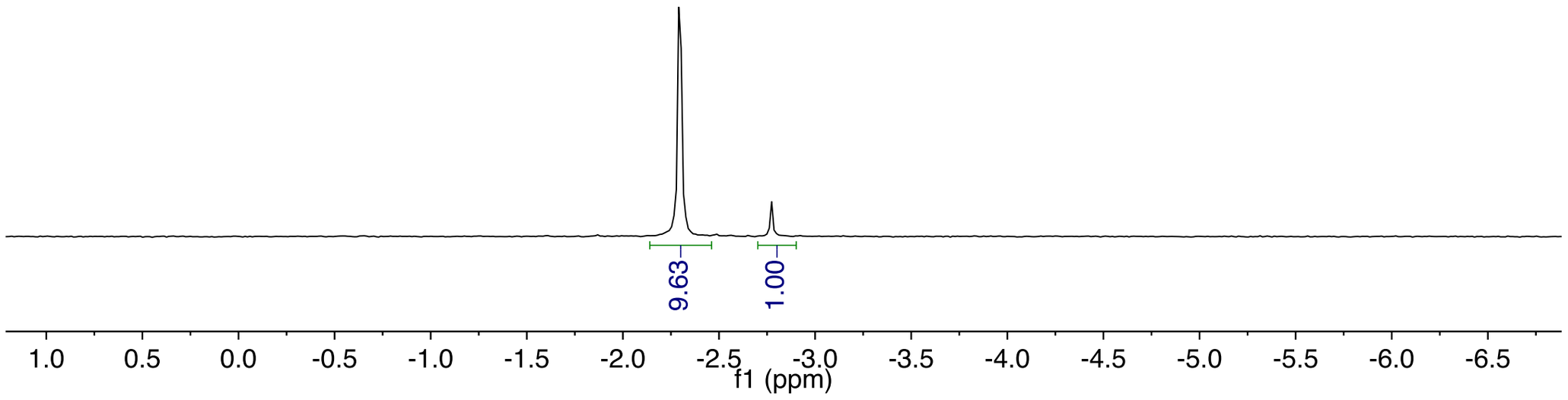


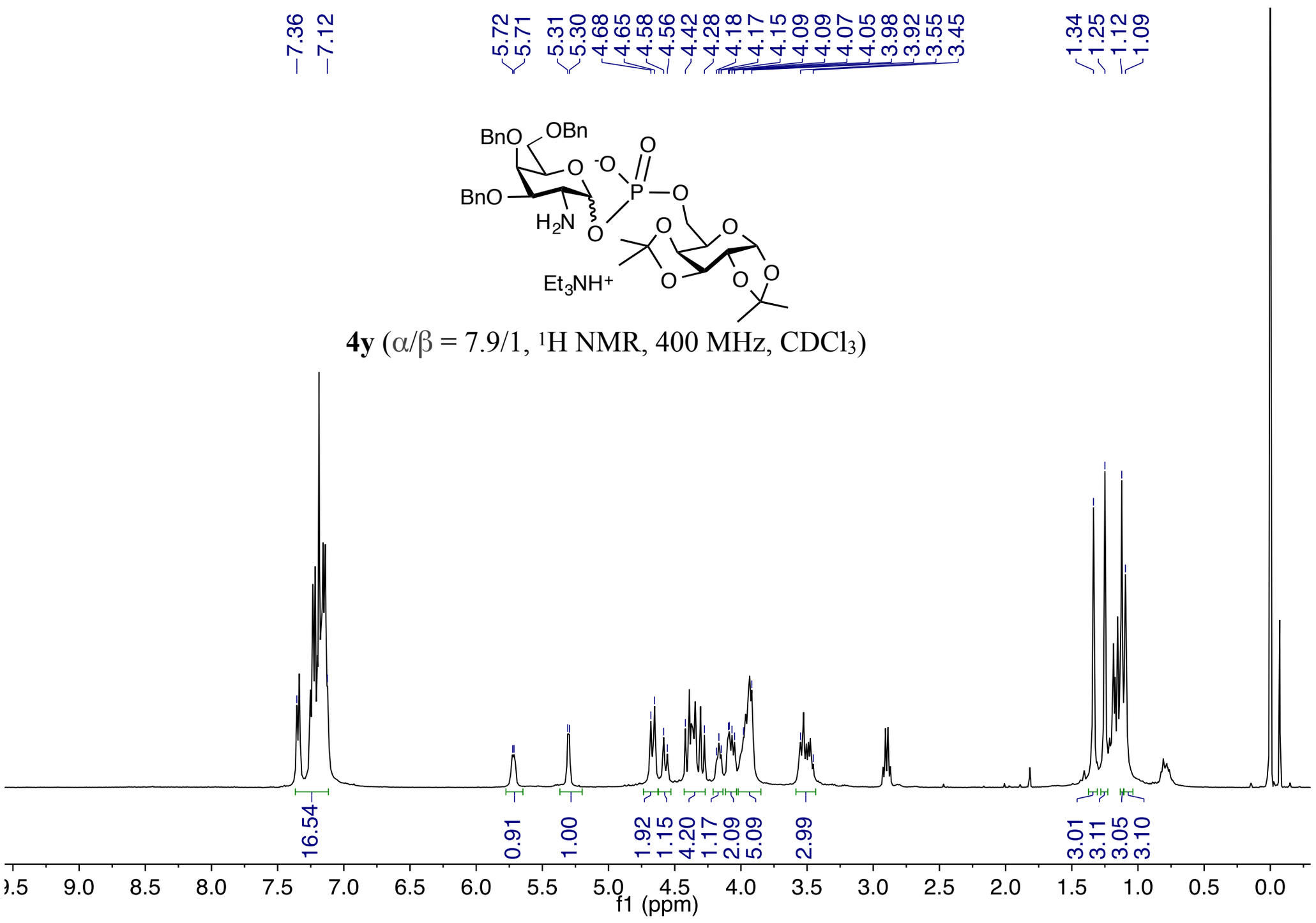
4x (α/β = 9.7/1, gHSQC, $CDCl_3$)



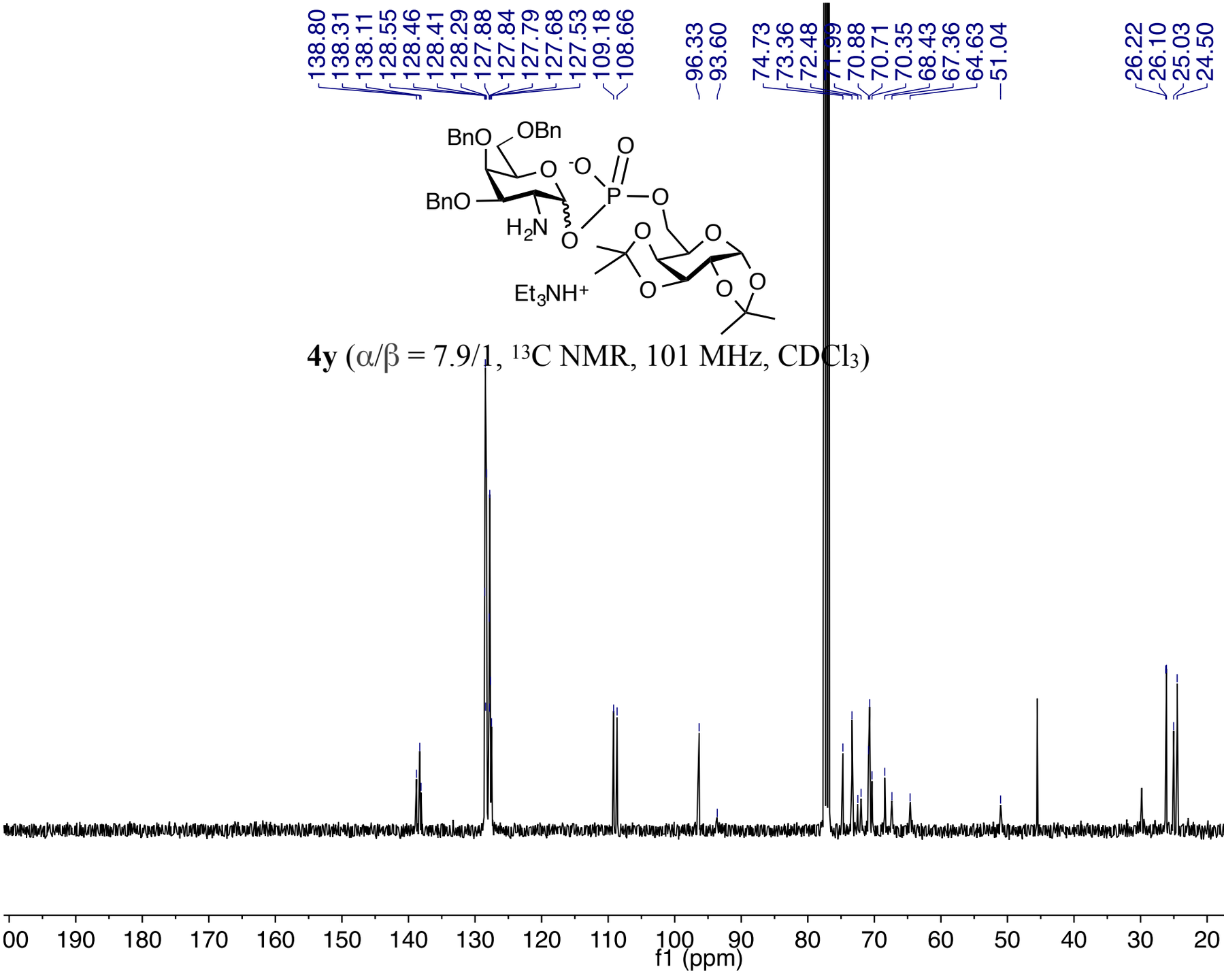
^{31}P NMR signals don't separate

α/β = 9.7/1 determined by ^{31}P NMR

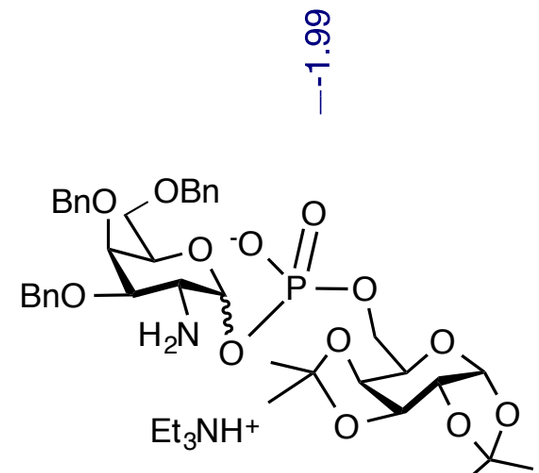




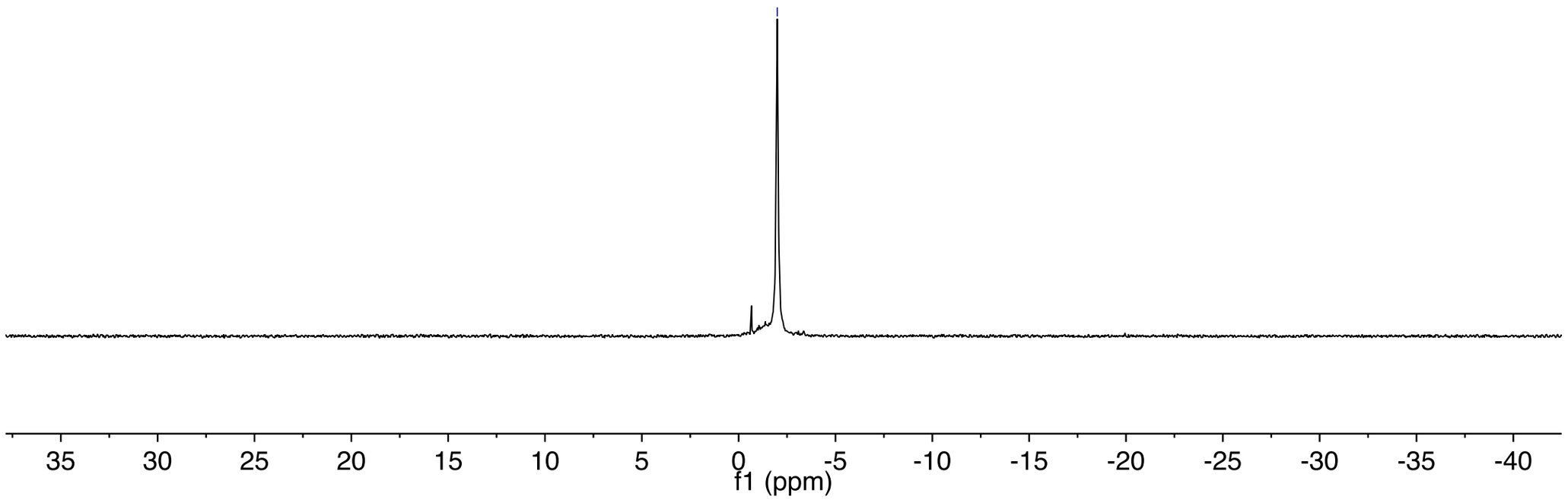
4y (α/β = 7.9/1, ^{1}H NMR, 400 MHz, $CDCl_3$)

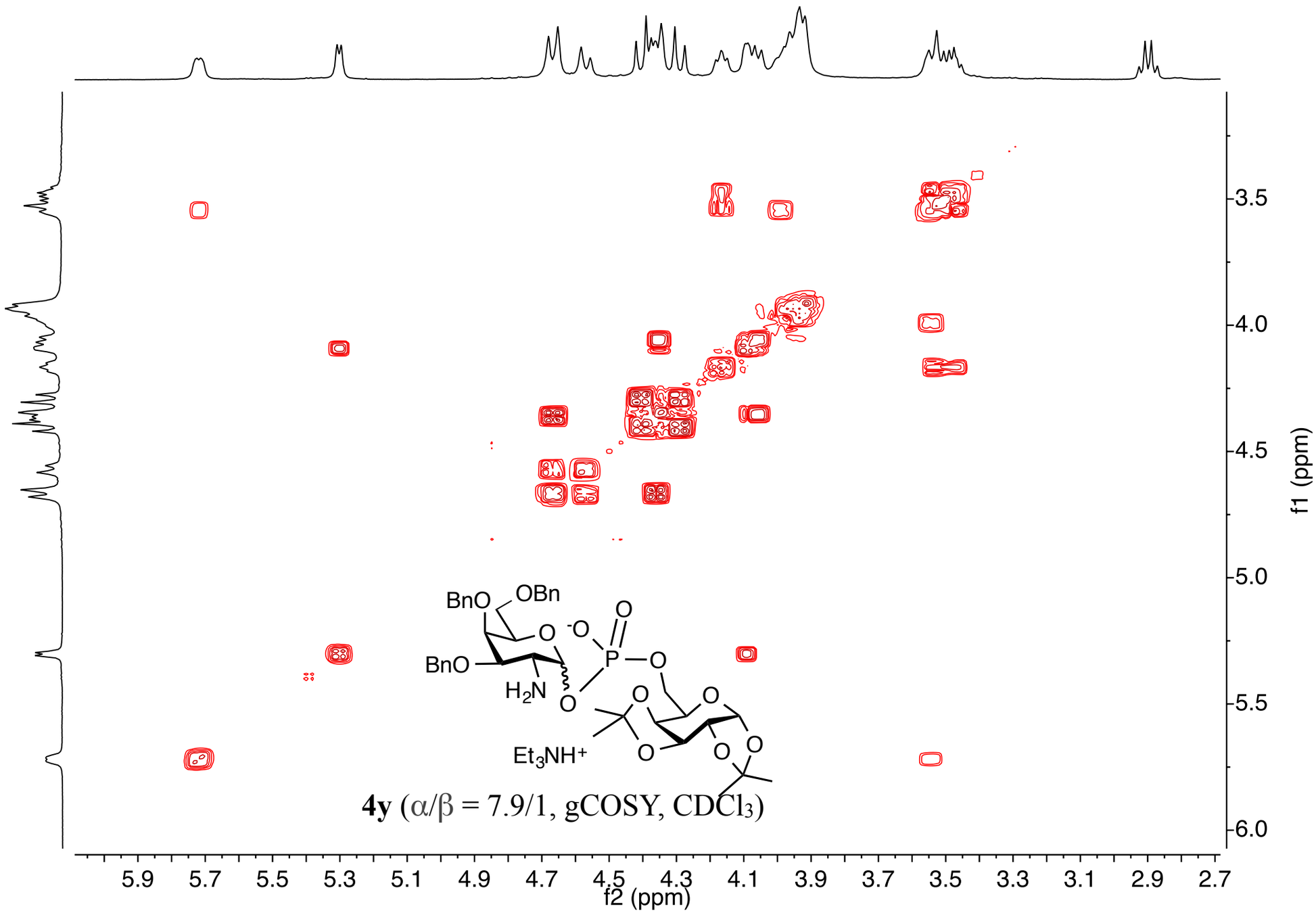


4y (α/β = 7.9/1, ^{13}C NMR, 101 MHz, $CDCl_3$)

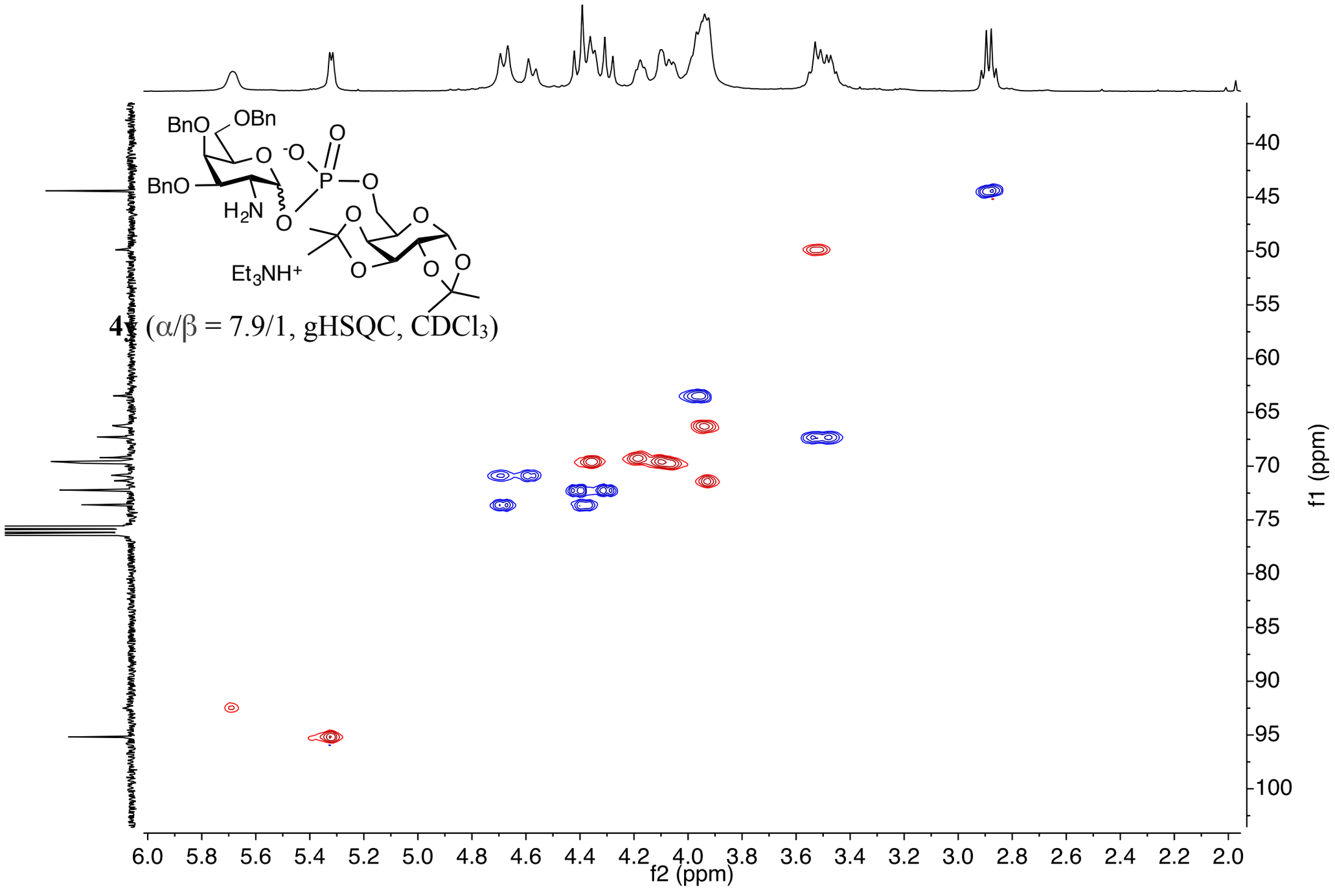


4y (α/β = 7.9/1, ^{31}P NMR)



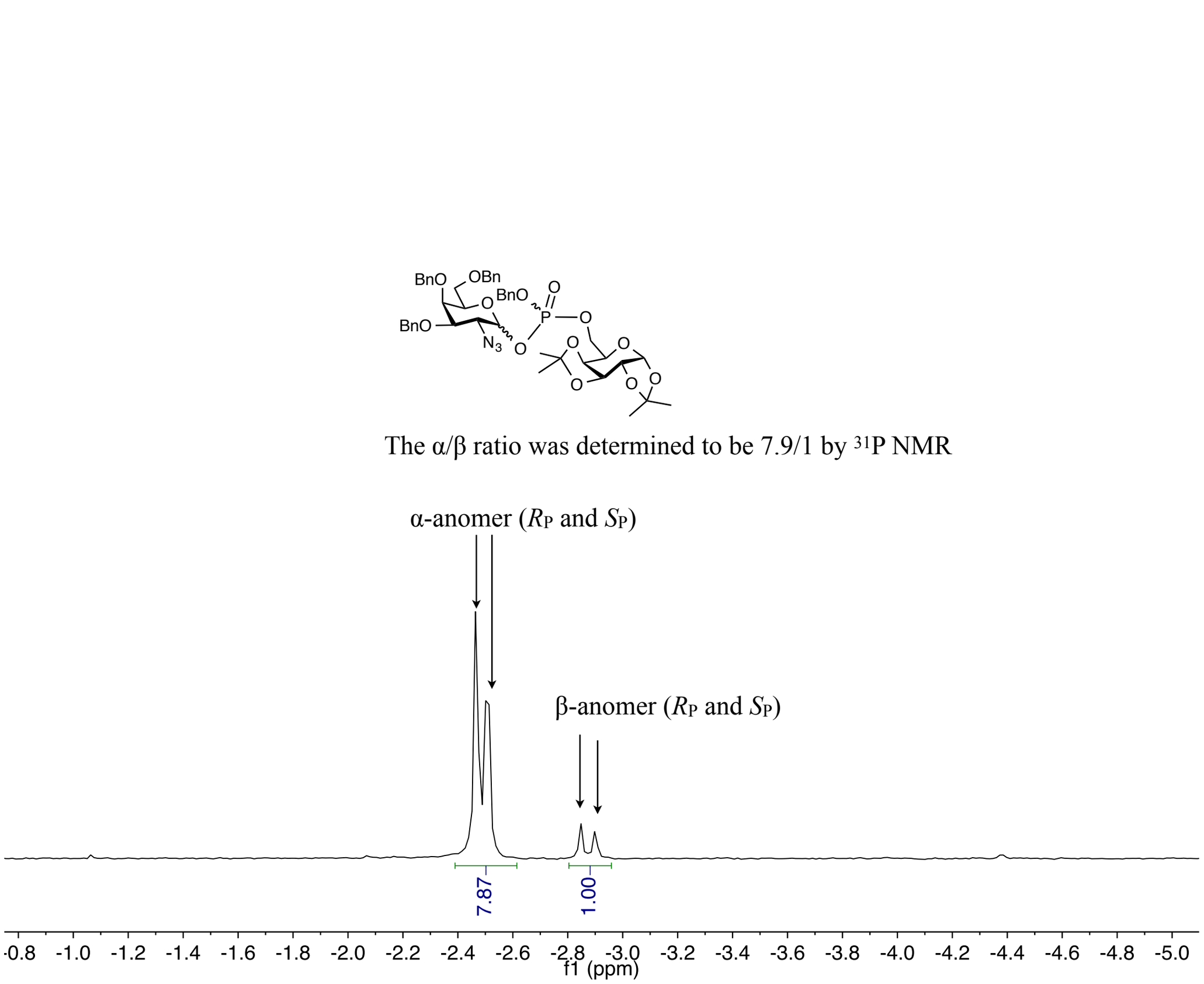


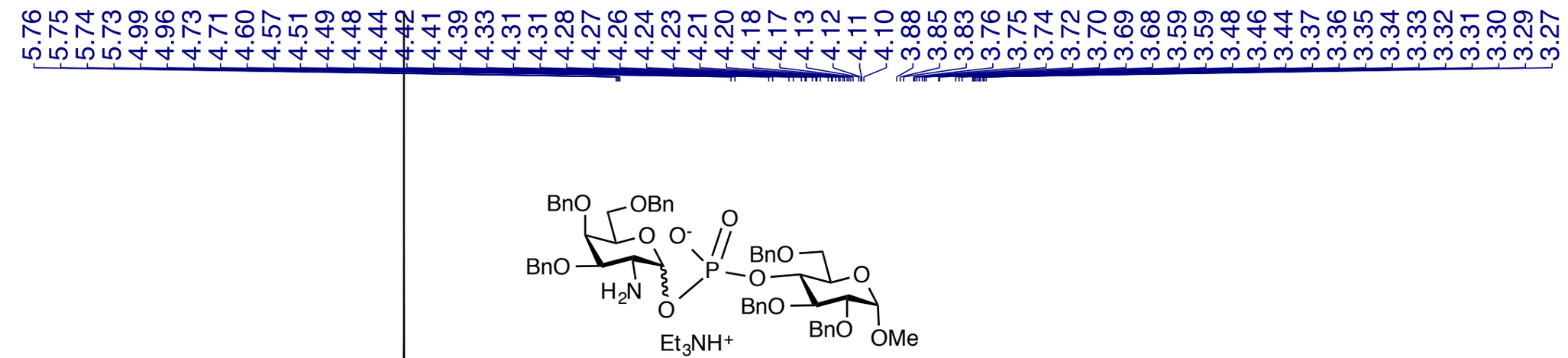
4y (α/β = 7.9/1, gCOSY, $CDCl_3$)



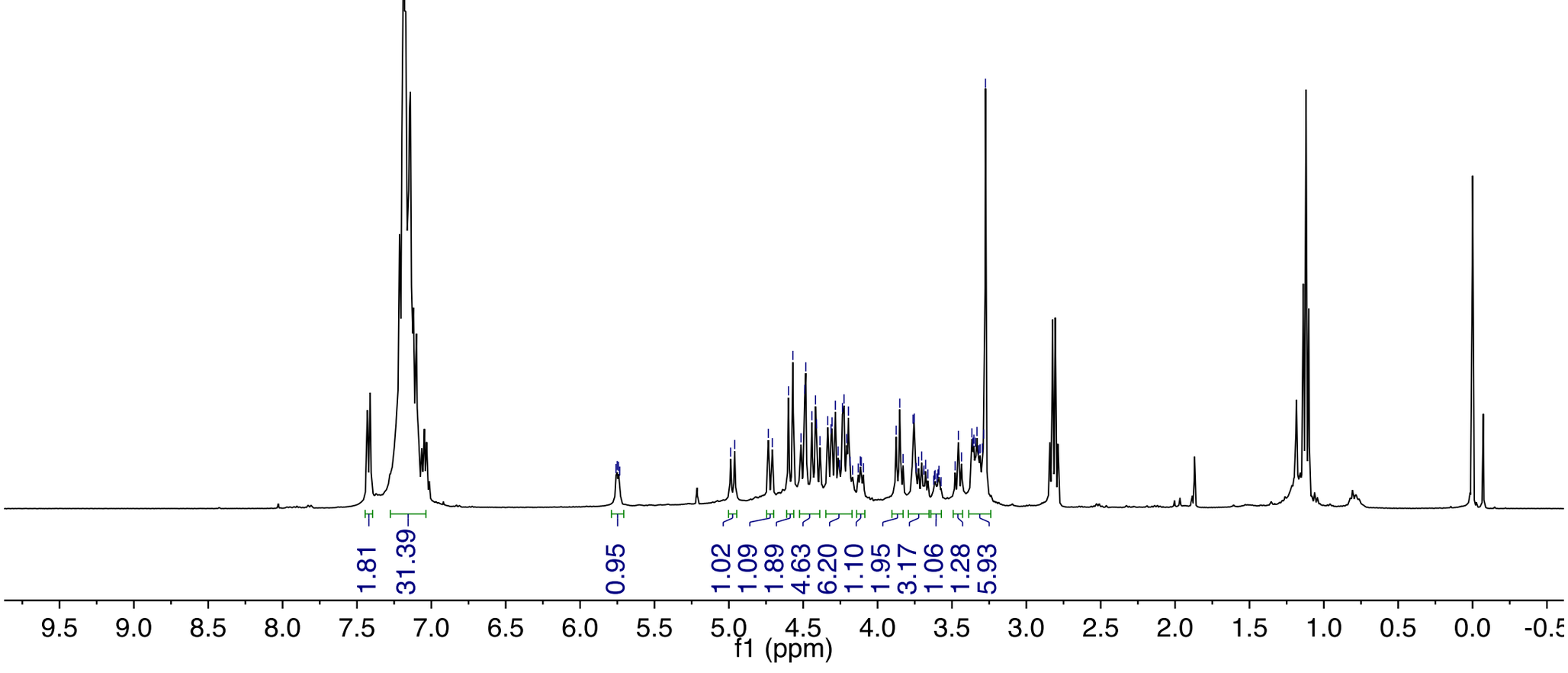
4v (α/β = 7.9/1, gHSQC, $CDCl_3$)

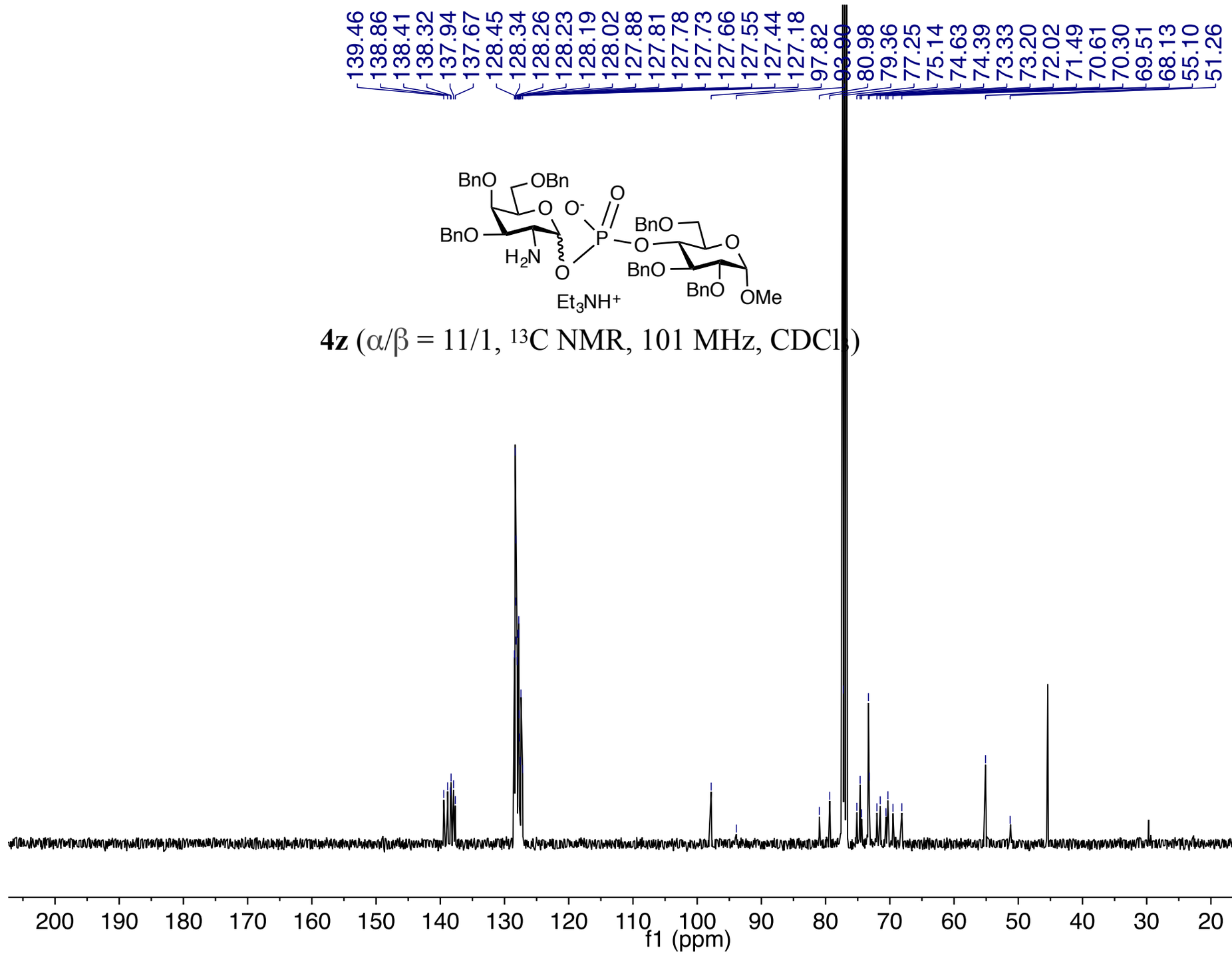
The α/β ratio was determined to be 7.9/1 by ^{31}P NMR





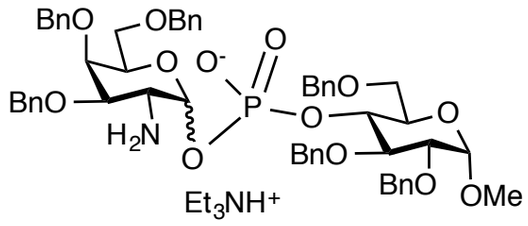
4z (α/β = 11/1, ^{1}H NMR, 400 MHz, $CDCl_3$)



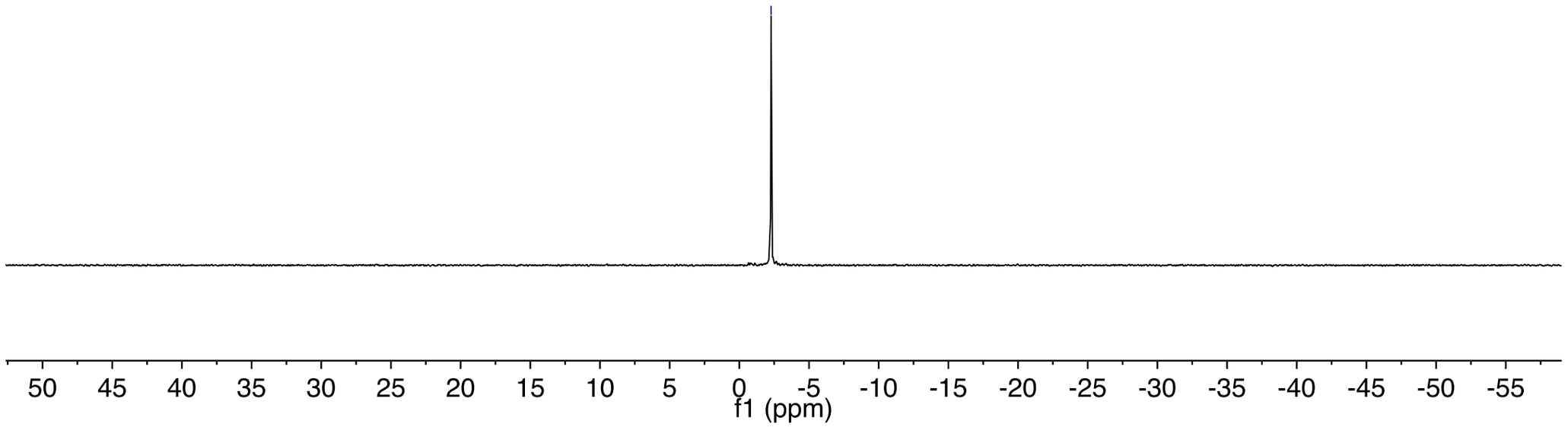


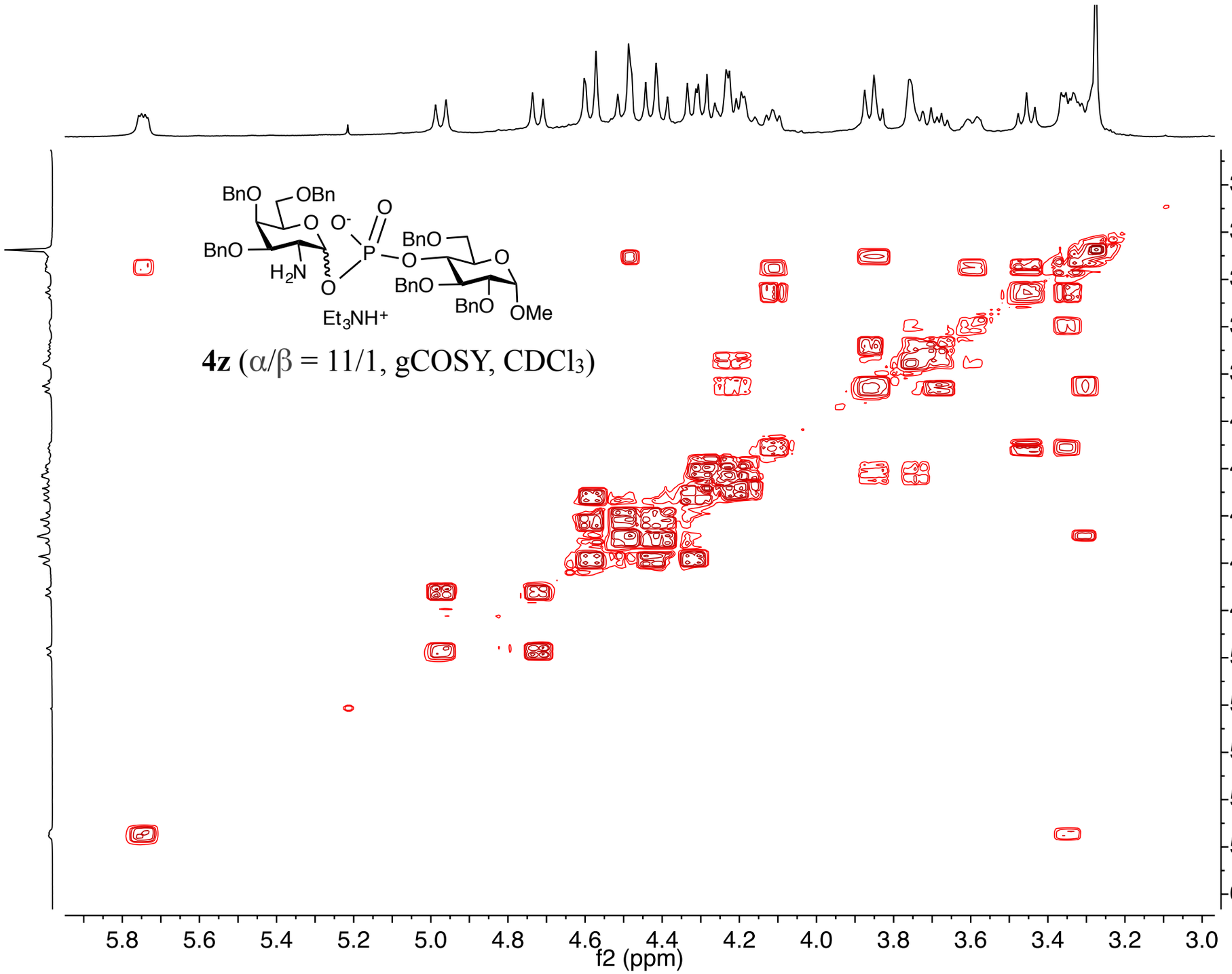
4z (α/β = 11/1, ^{13}C NMR, 101 MHz, $CDCl_3$)

-2.28

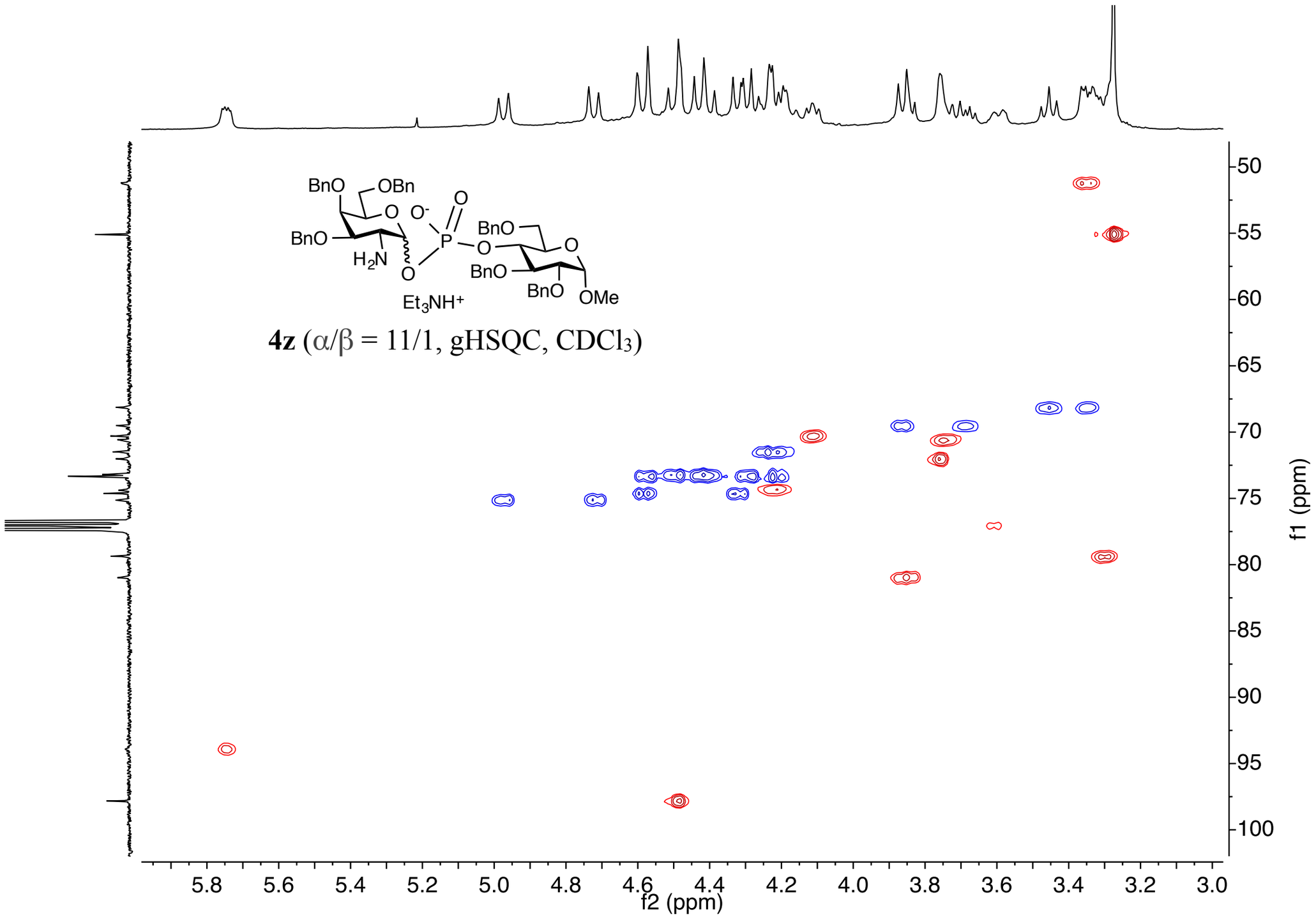


4z (α/β = 11/1, ^{31}P NMR, 162 MHz, $CDCl_3$)

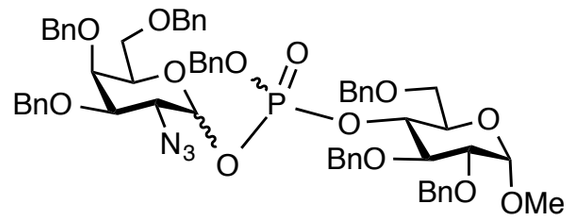




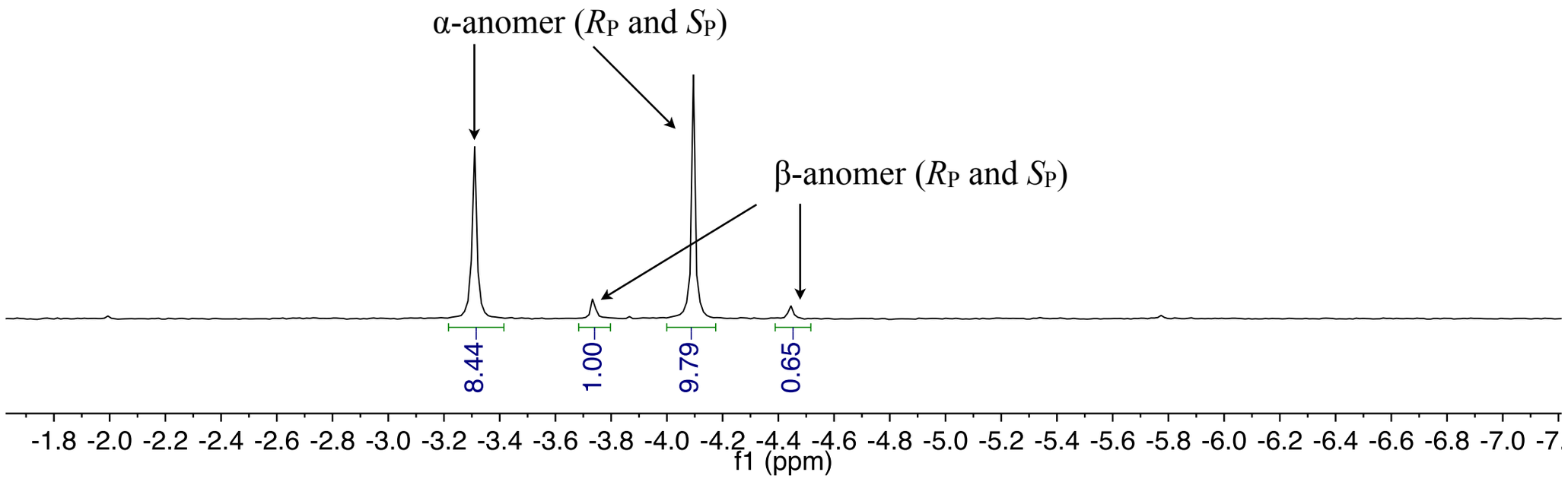
4z (α/β = 11/1, gCOSY, $CDCl_3$)

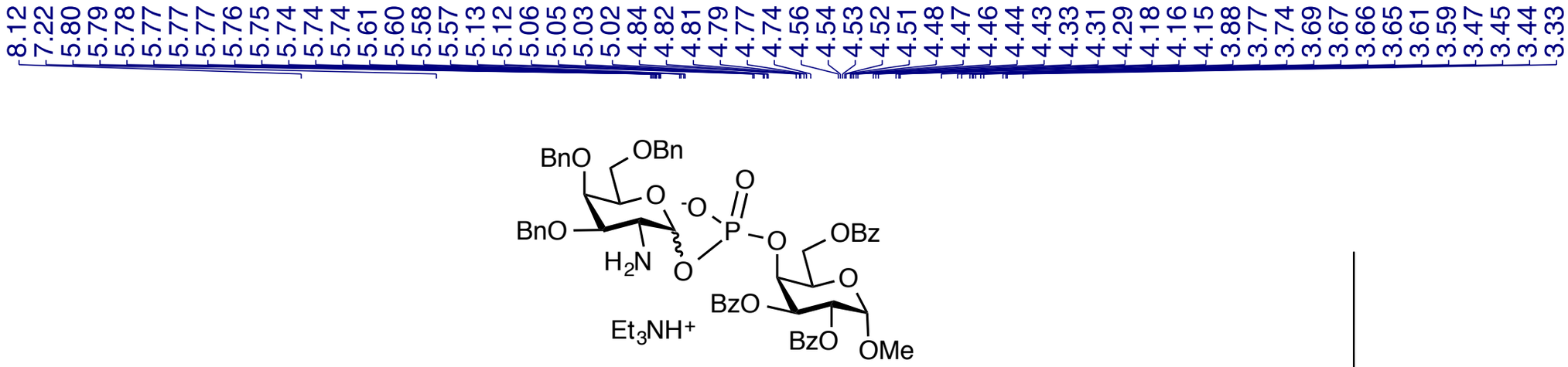


4z (α/β = 11/1, gHSQC, $CDCl_3$)

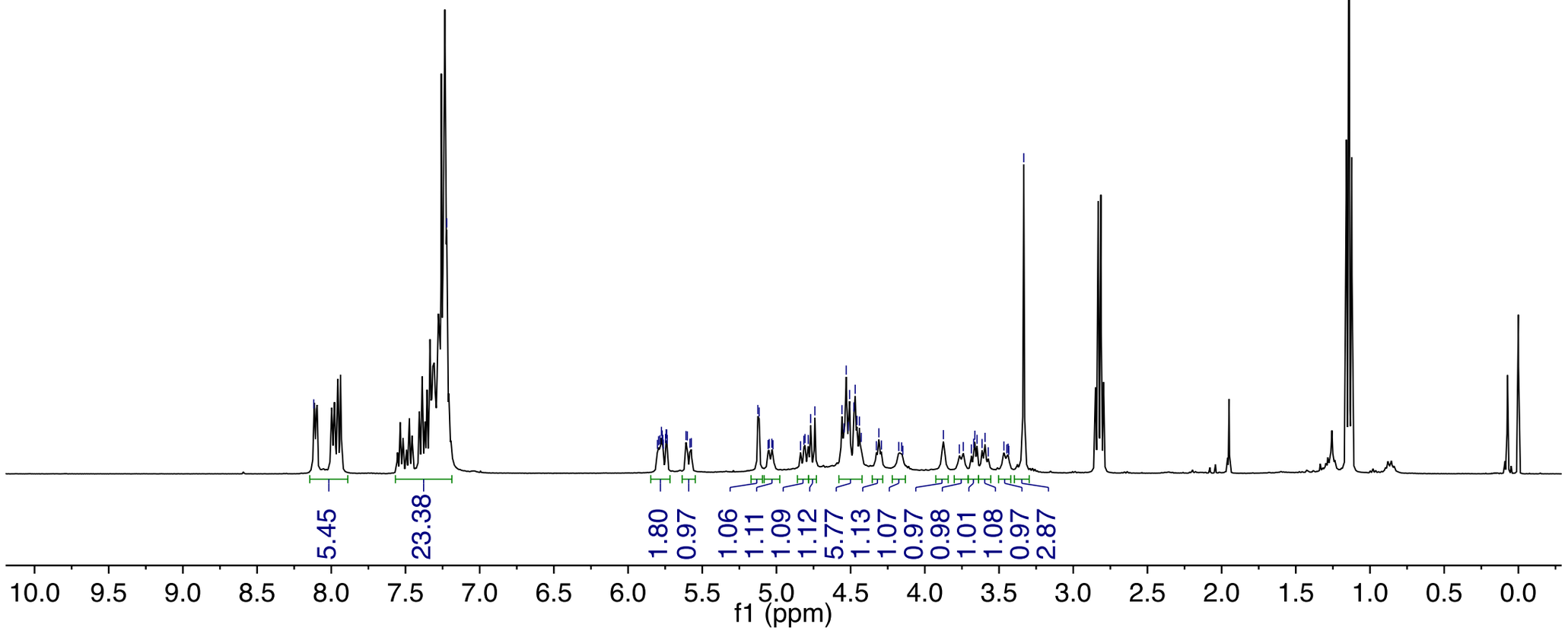


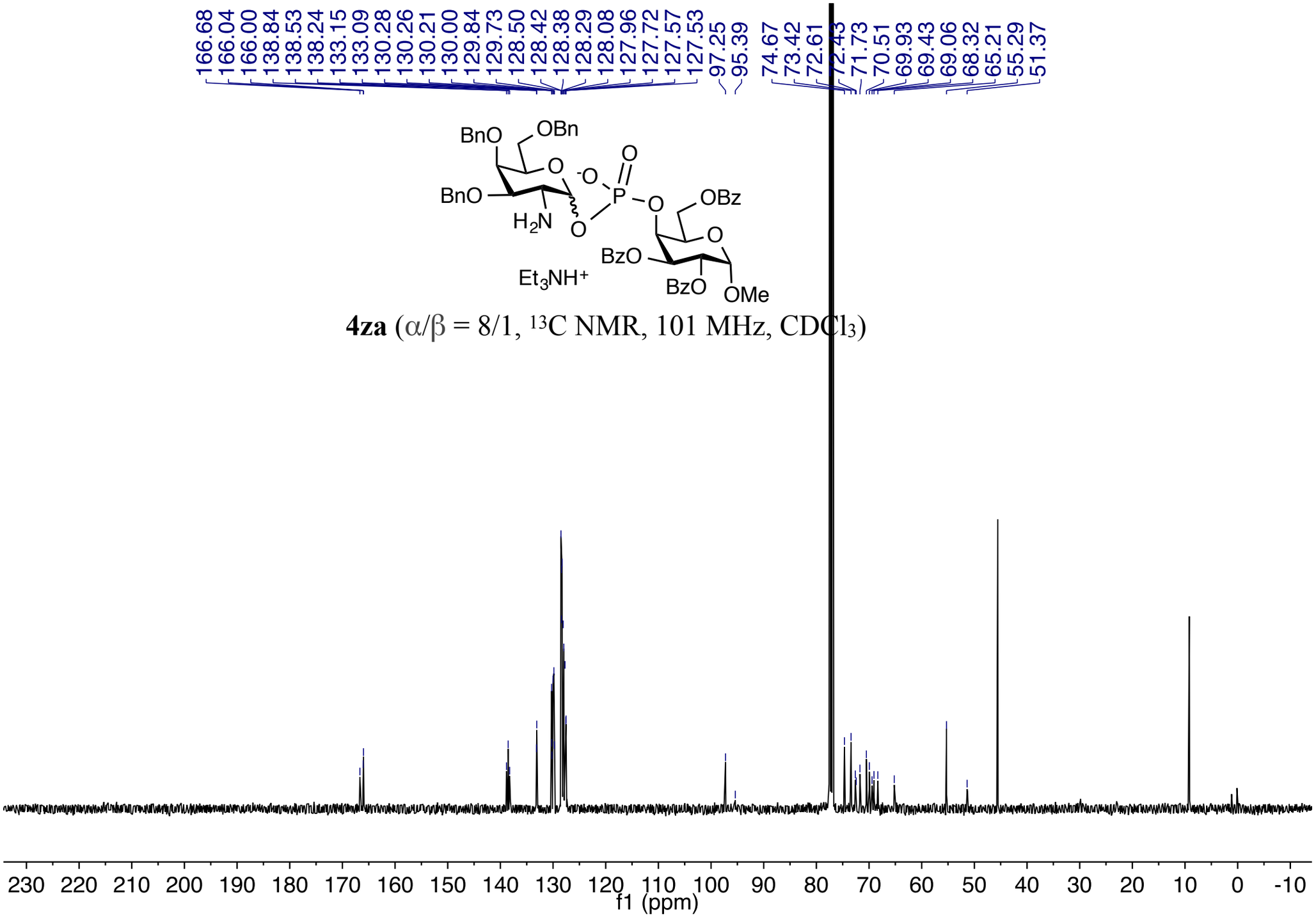
The α/β ratio was determined to be 11/1 by ^{31}P NMR



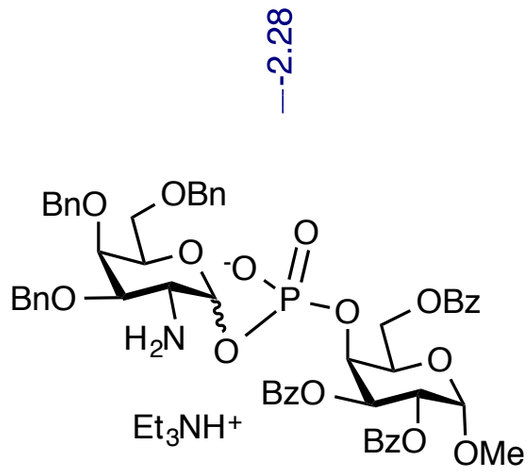


4za (α/β = 8/1, ^{1}H NMR, 400 MHz, $CDCl_3$)

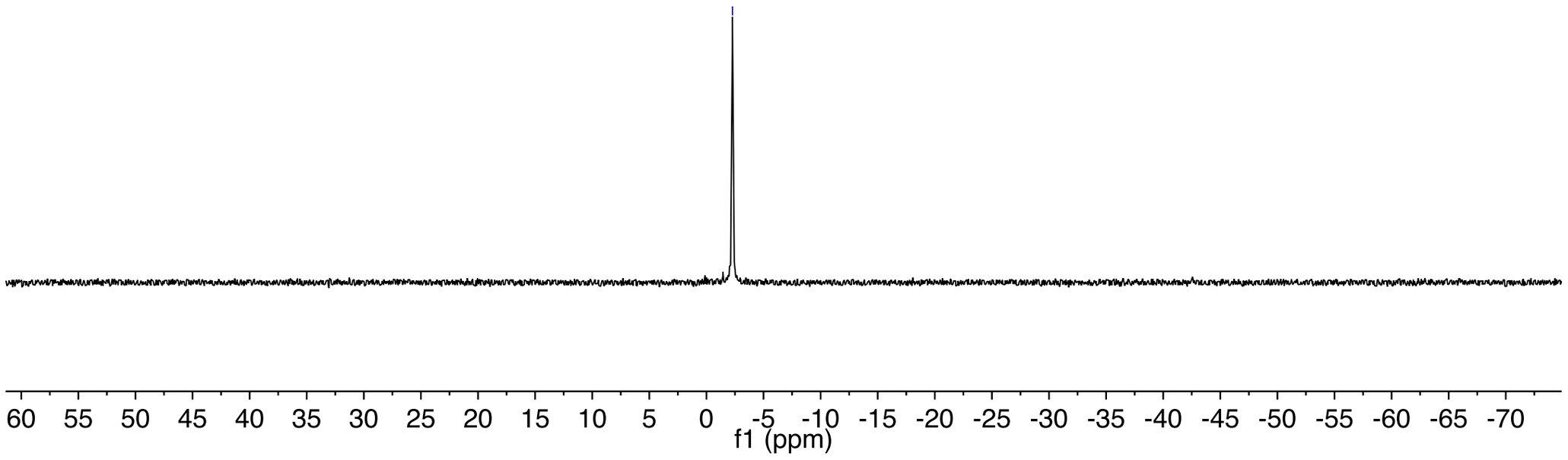


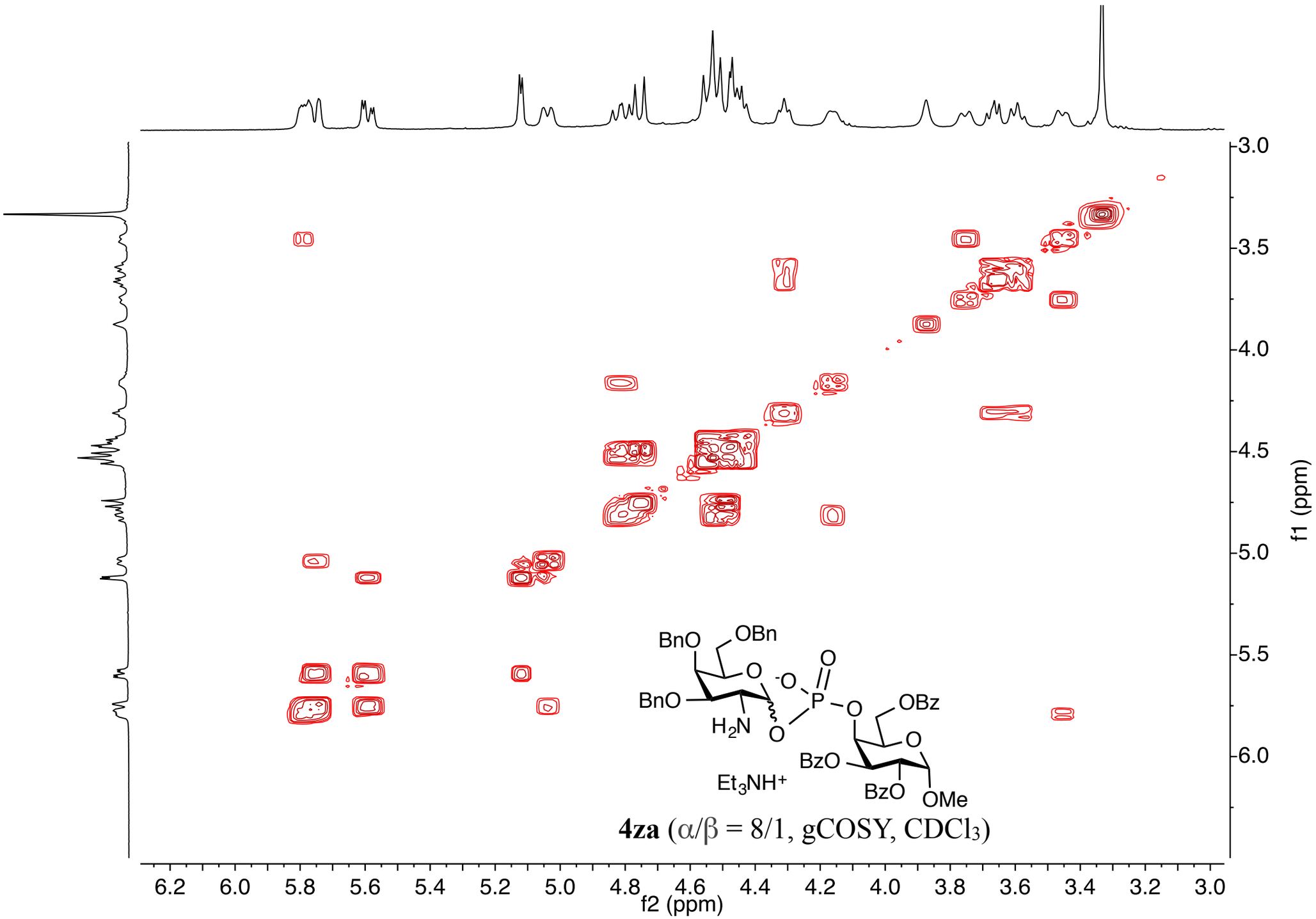


4za (α/β = 8/1, ^{13}C NMR, 101 MHz, $CDCl_3$)

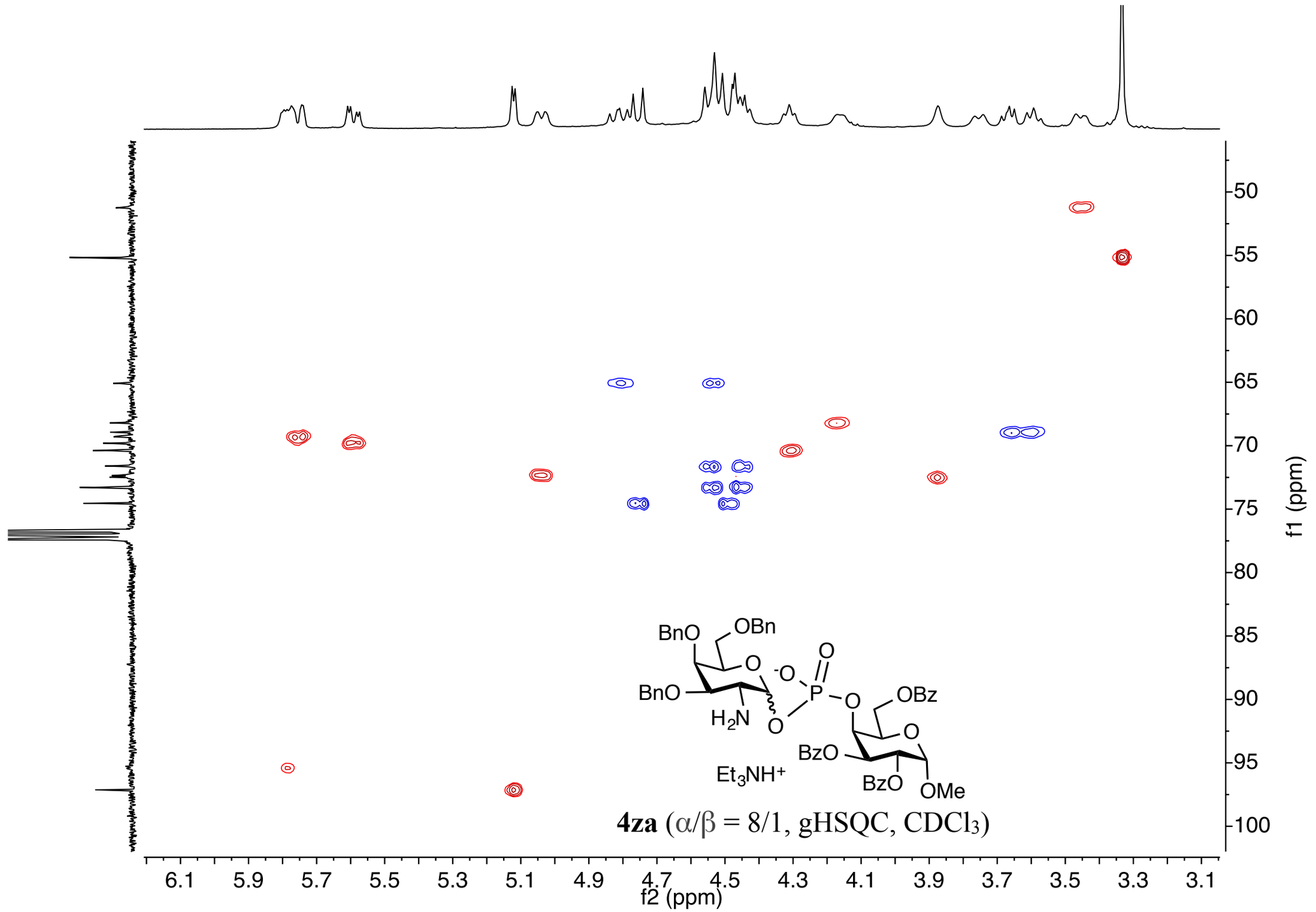


4za (α/β = 8/1, ^{31}P NMR, 162 MHz, $CDCl_3$)

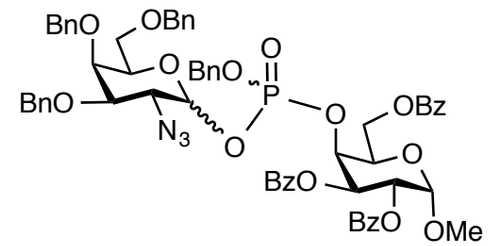




4za (α/β = 8/1, gCOSY, $CDCl_3$)



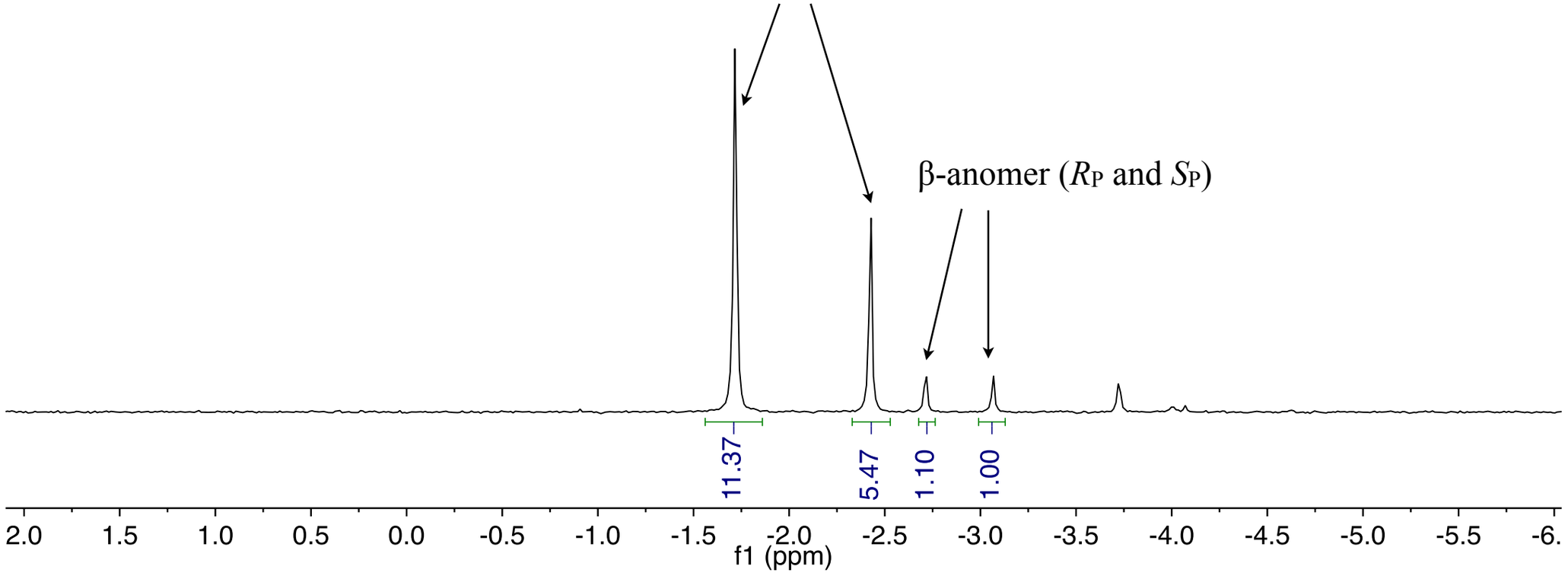
4za (α/β = 8/1, gHSQC, $CDCl_3$)

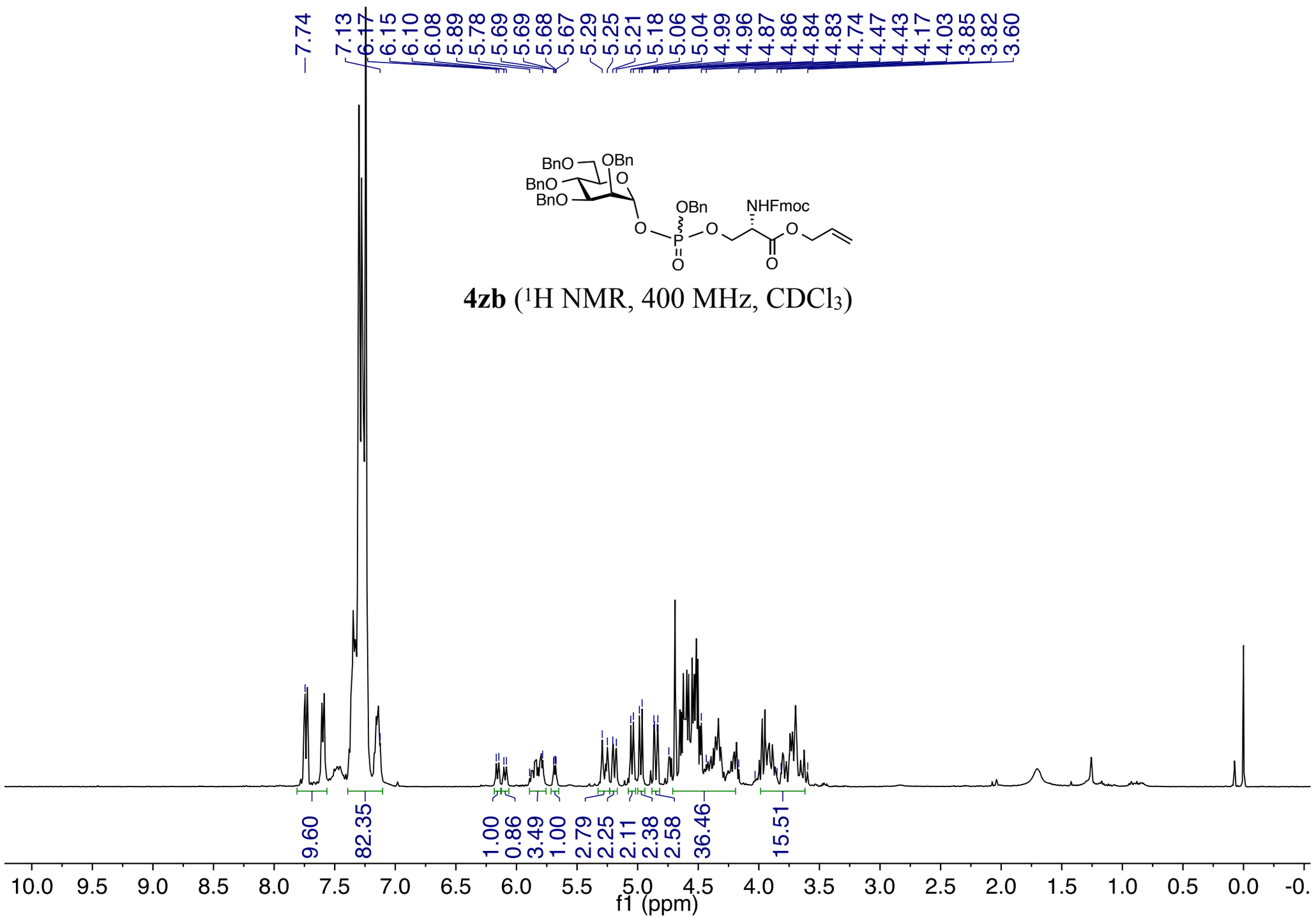


The α/β ratio was determined to be 8/1 by ^{31}P NMR

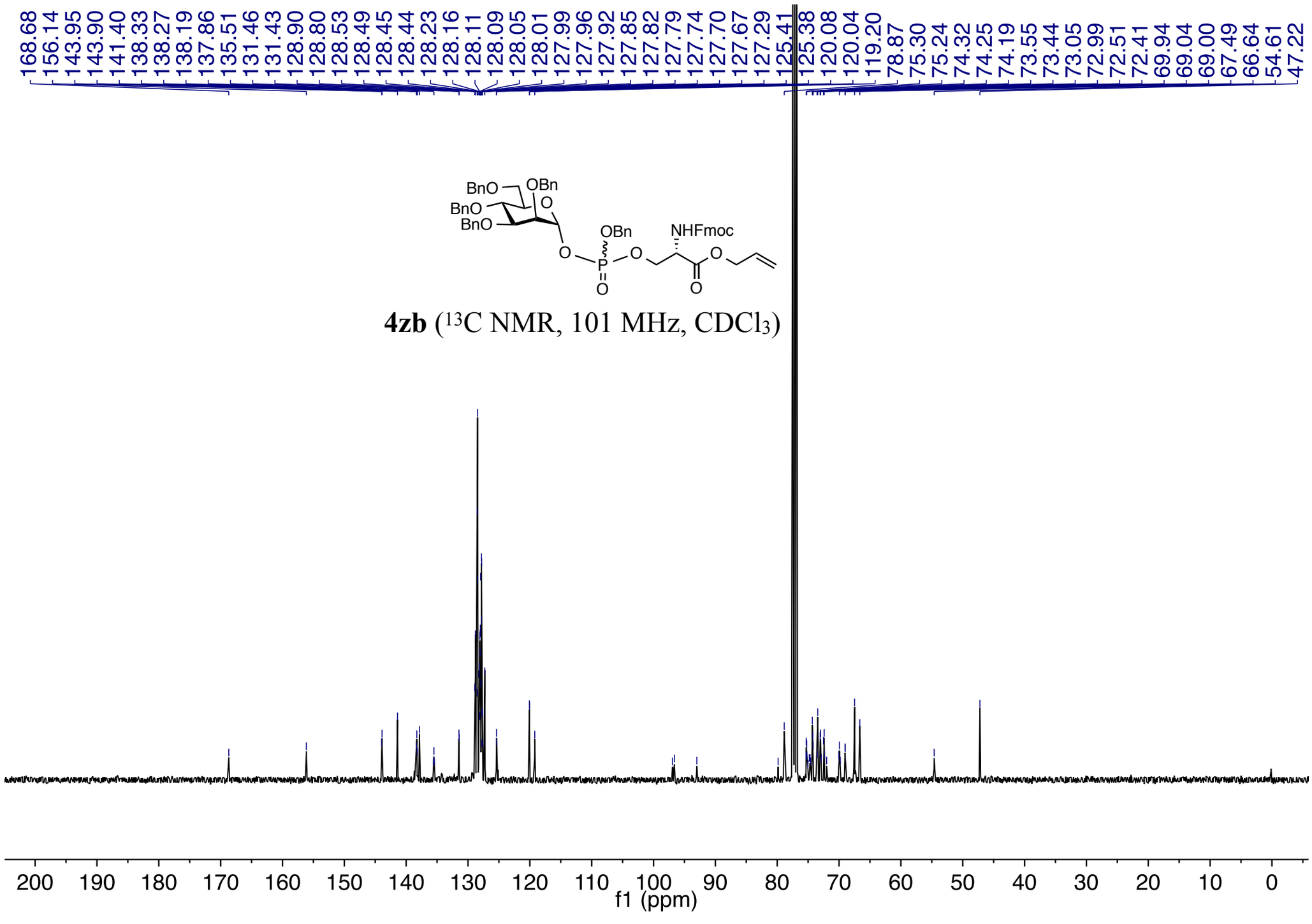
α-anomer (R_P and S_P)

β-anomer (R_P and S_P)

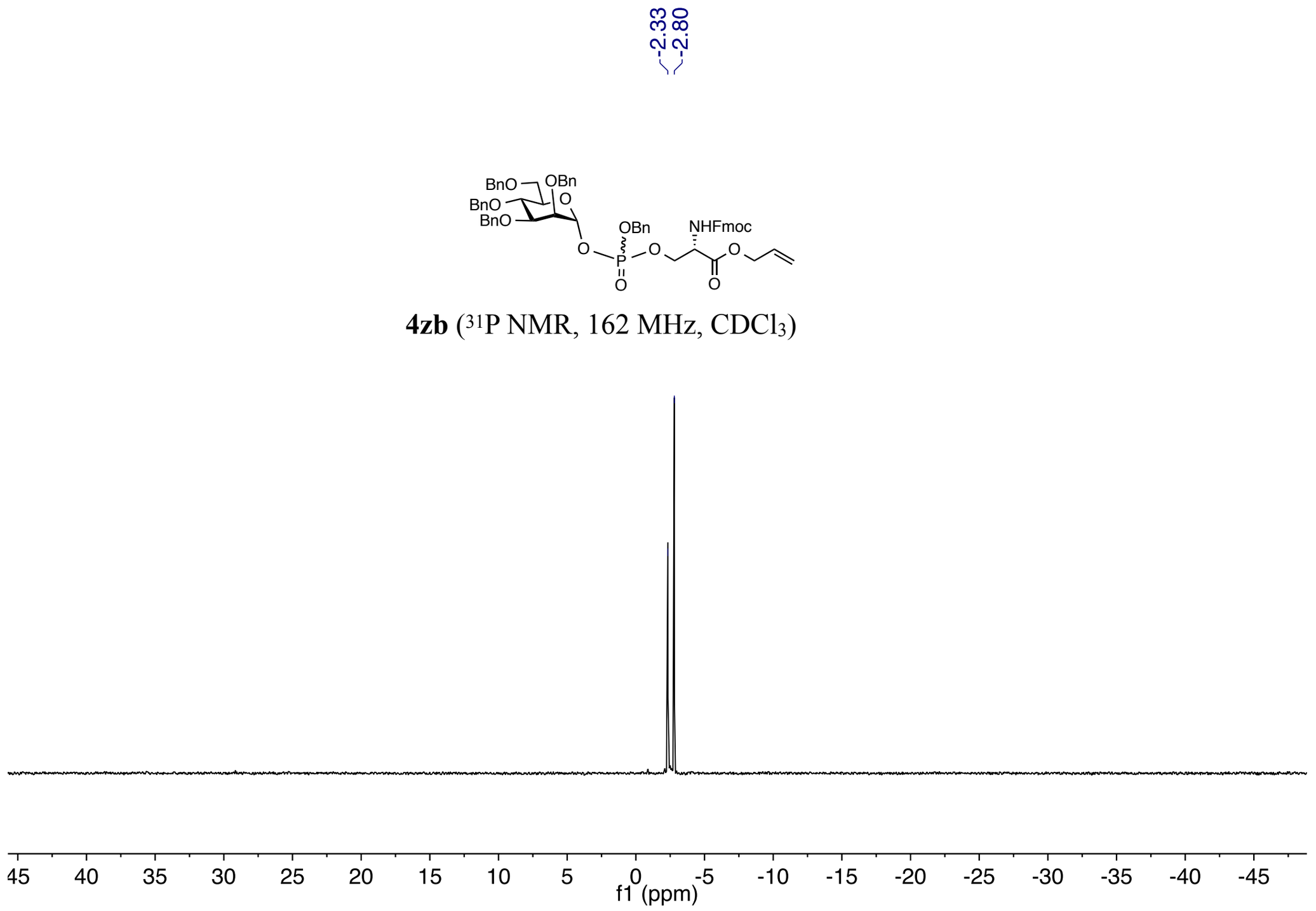




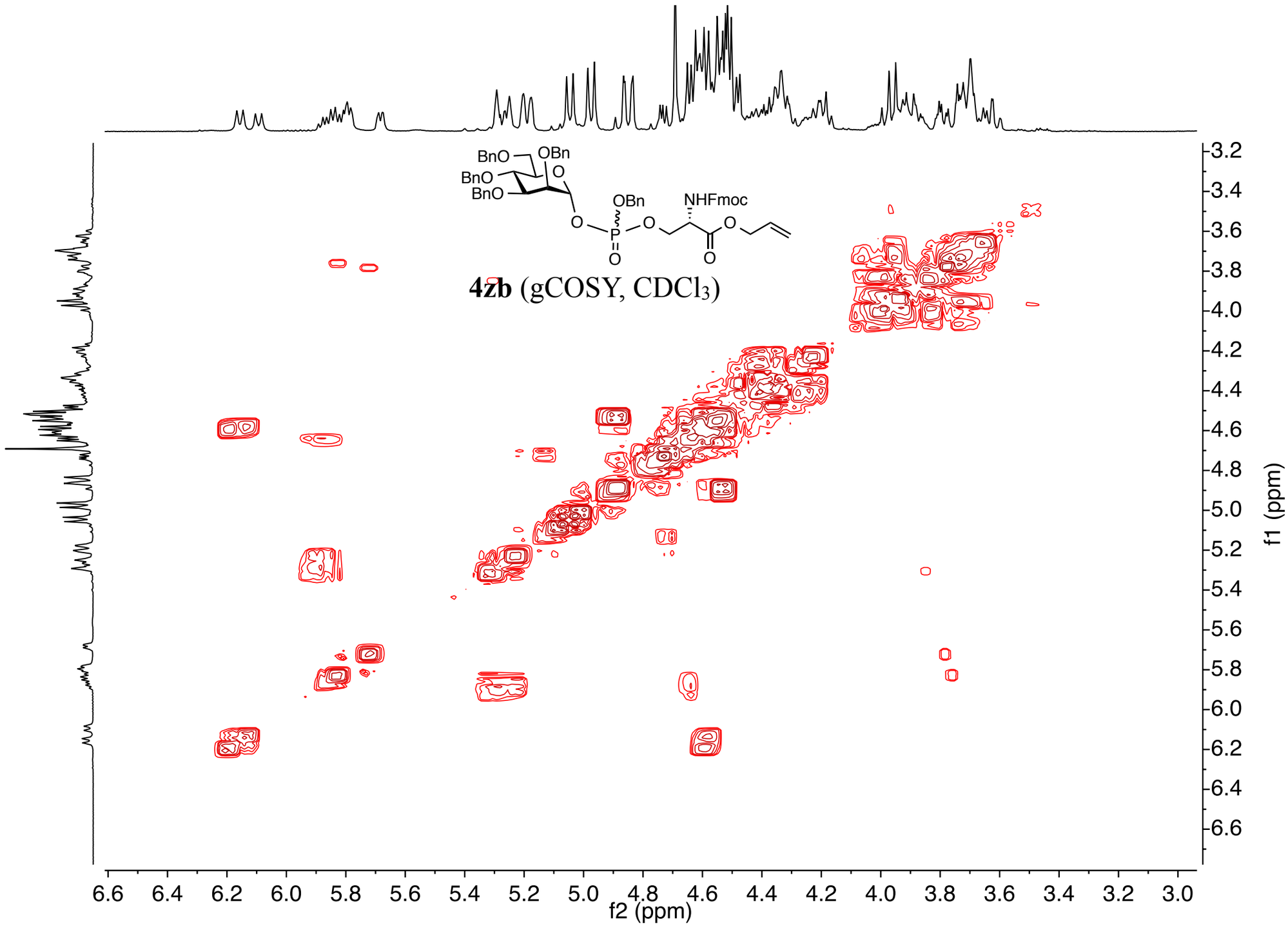
4zb (^{1}H NMR, 400 MHz, $CDCl_3$)

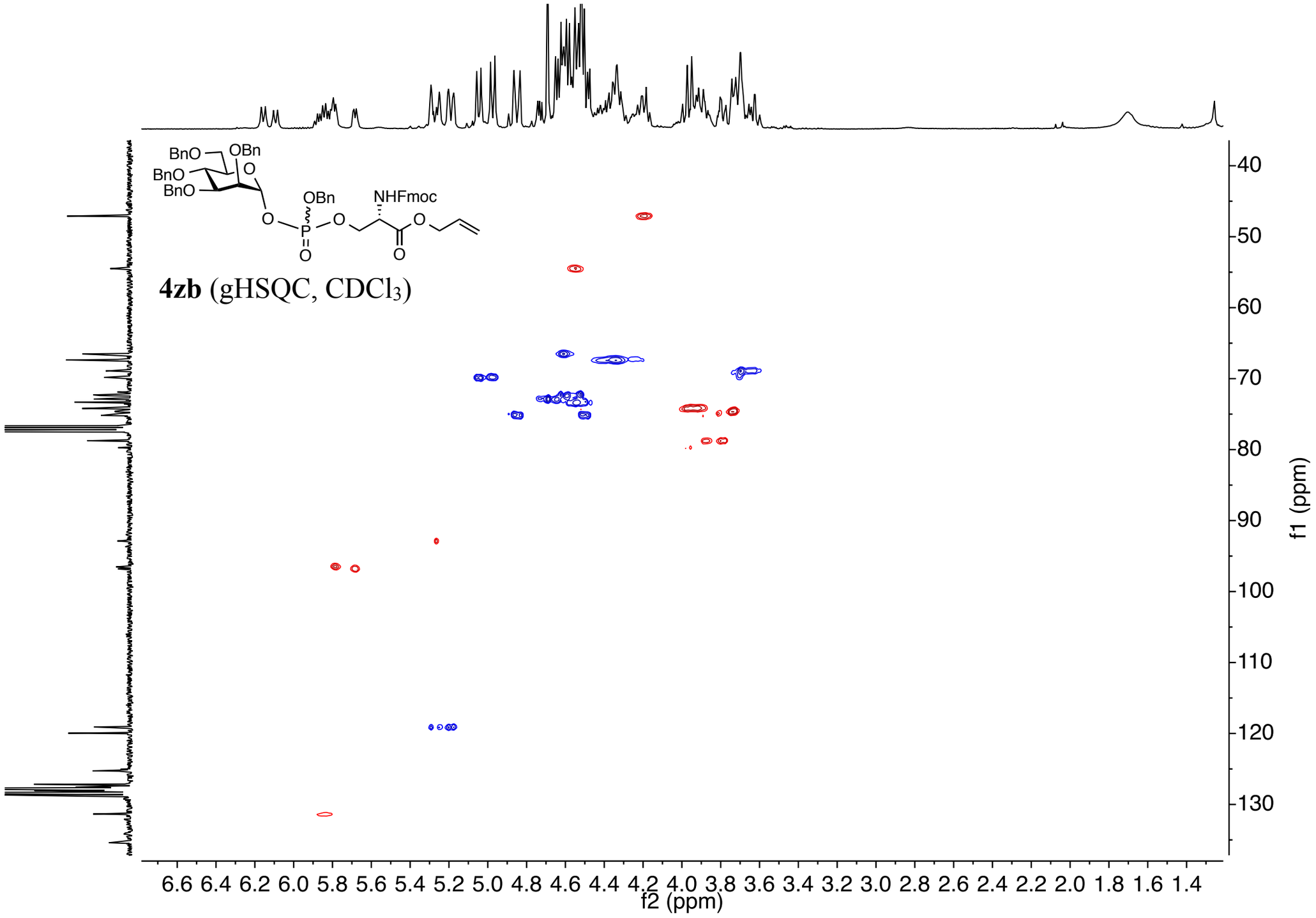


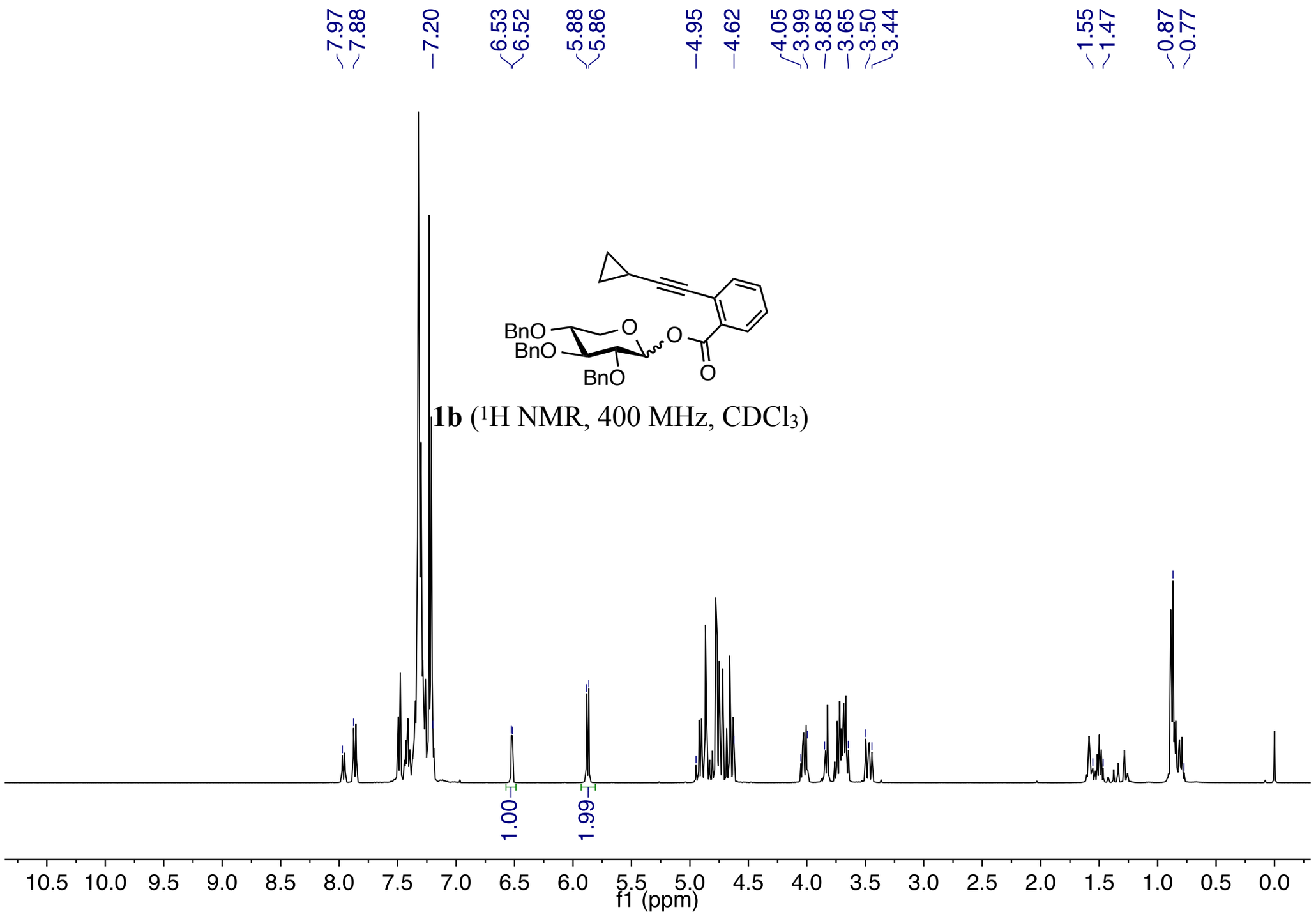
4zb (^{13}C NMR, 101 MHz, $CDCl_3$)



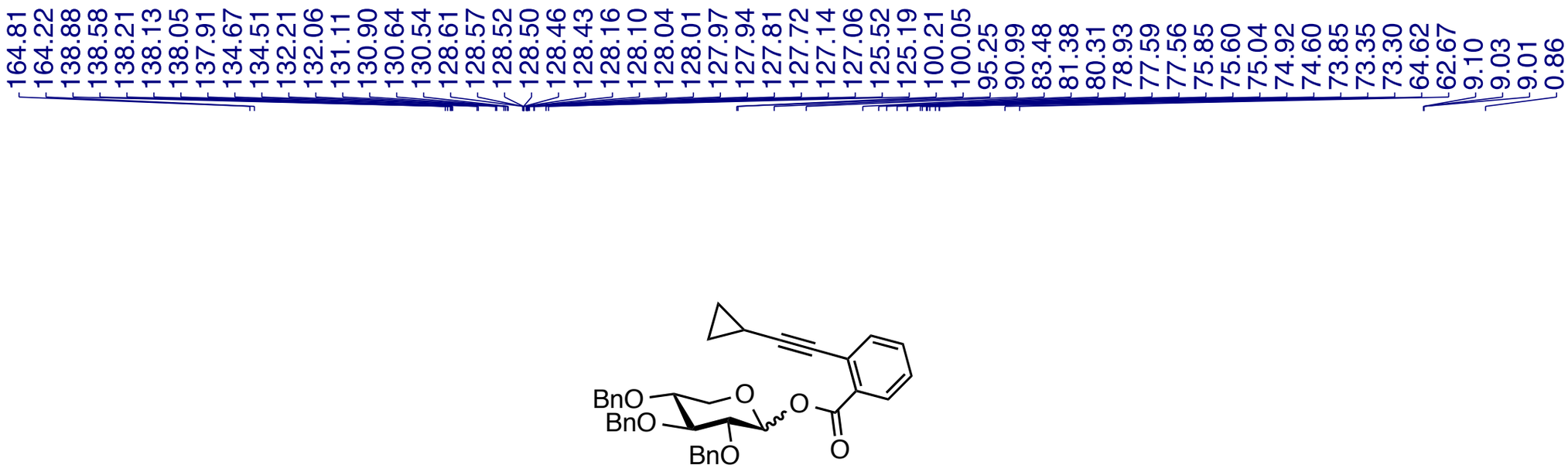
4zb (^{31}P NMR, 162 MHz, $CDCl_3$)


BnO
OBn
BnO
O
BnO
OBn
NHFmoc
O
P
O
O
O
O
O
4zb (gCOSY, CDCl3)
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
f1 (ppm)
6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0
f2 (ppm)

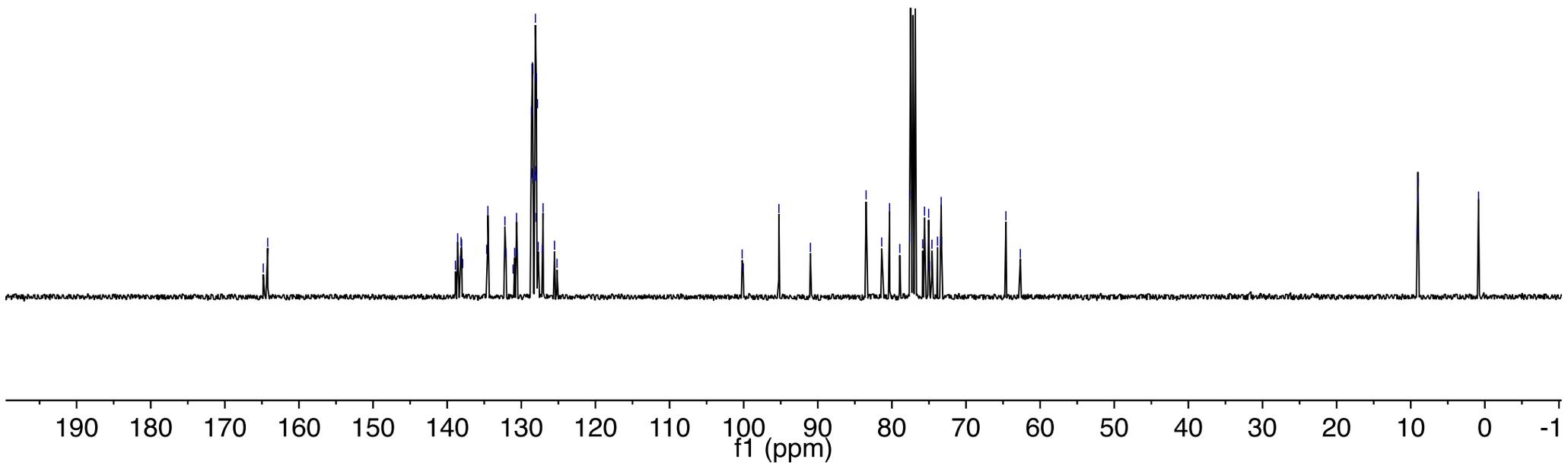

BnO
OBn
BnO
O
BnO
OBn
NHFmoc
O
P
O
O
O
O
O
4zb (gHSQC, CDCl3)
40
50
60
70
80
90
100
110
120
130
f1 (ppm)
6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4
f2 (ppm)

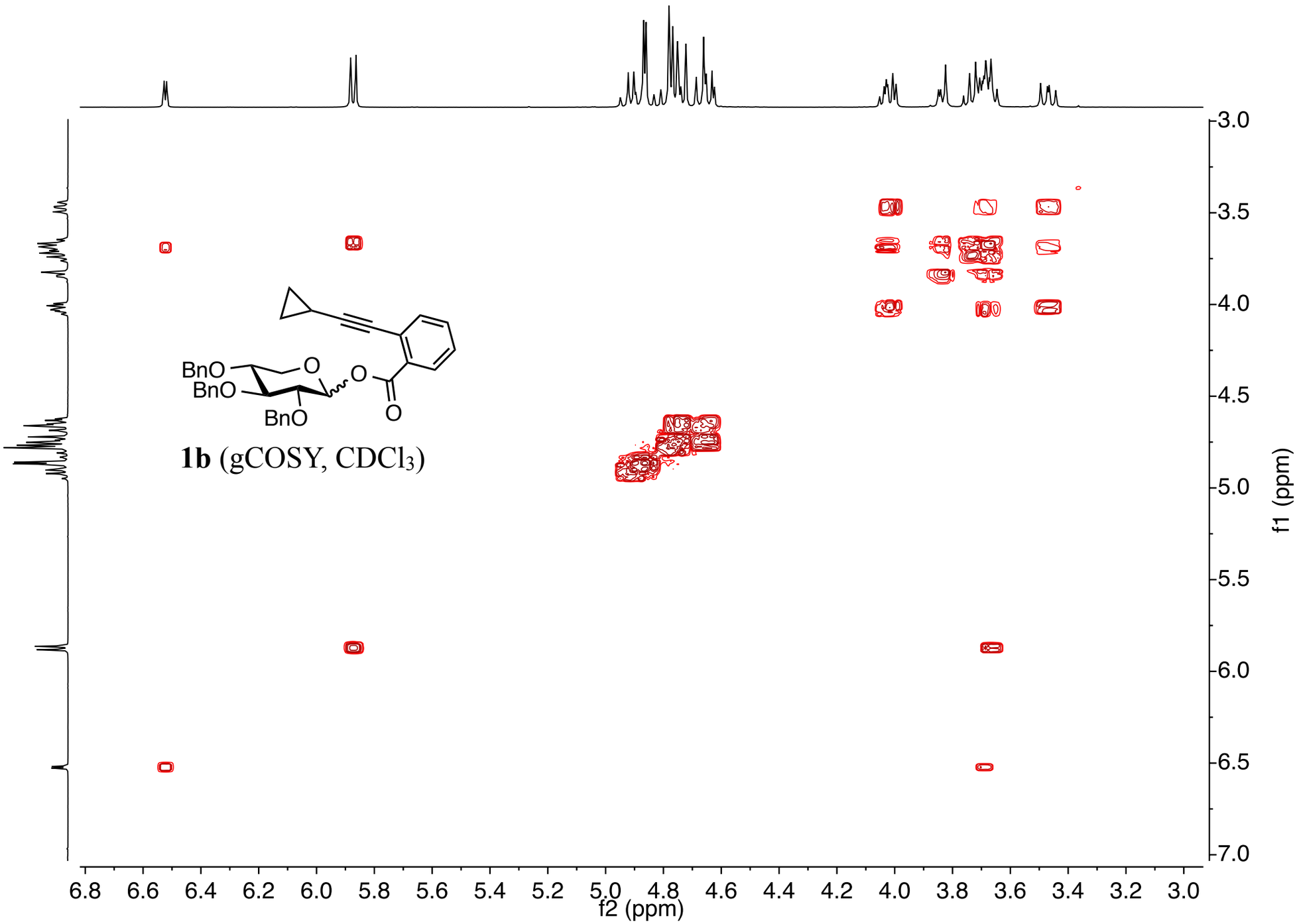


1b (^{1}H NMR, 400 MHz, $CDCl_3$)

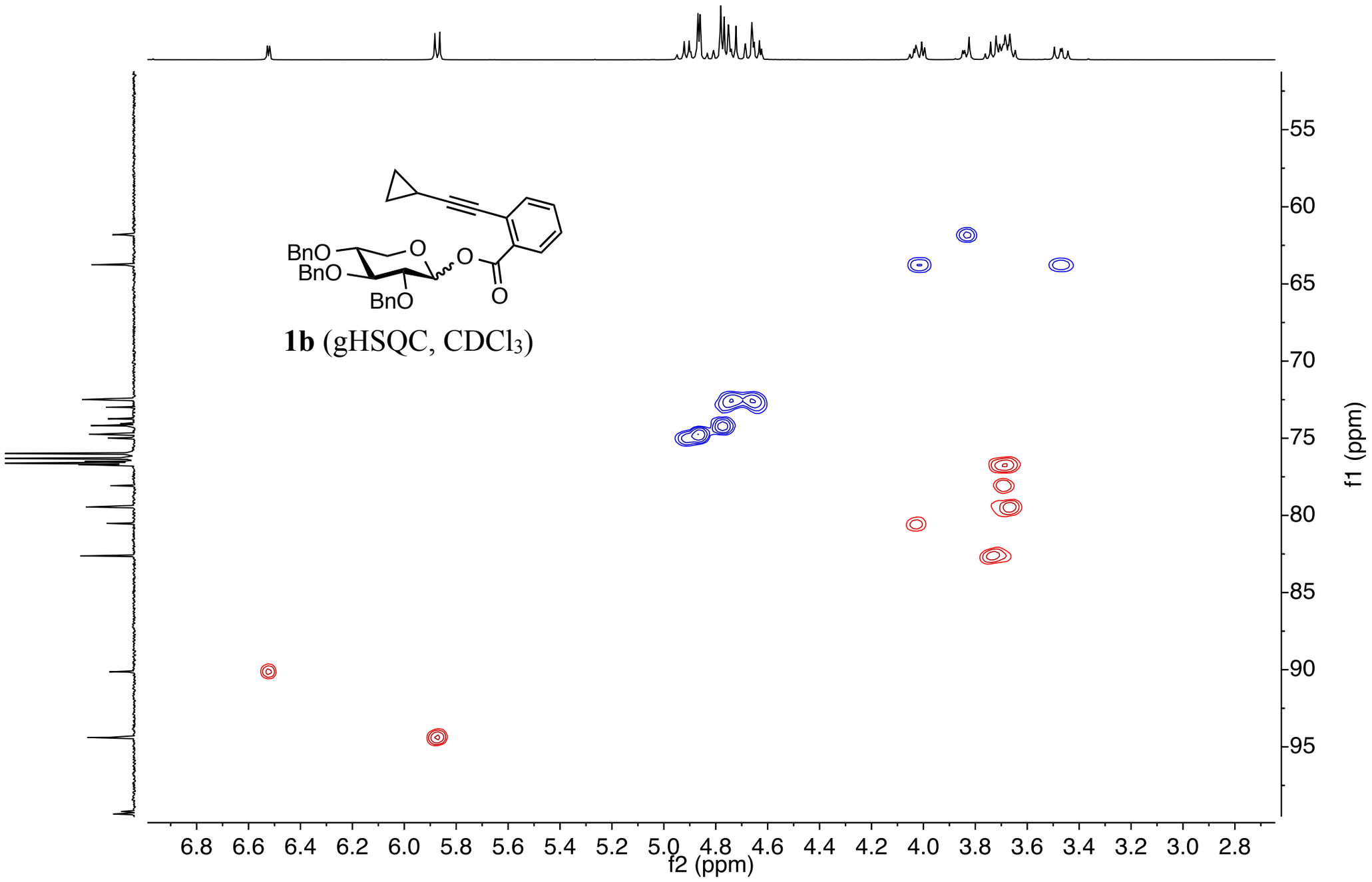


1b (^{13}C NMR, 101 MHz, $CDCl_3$)

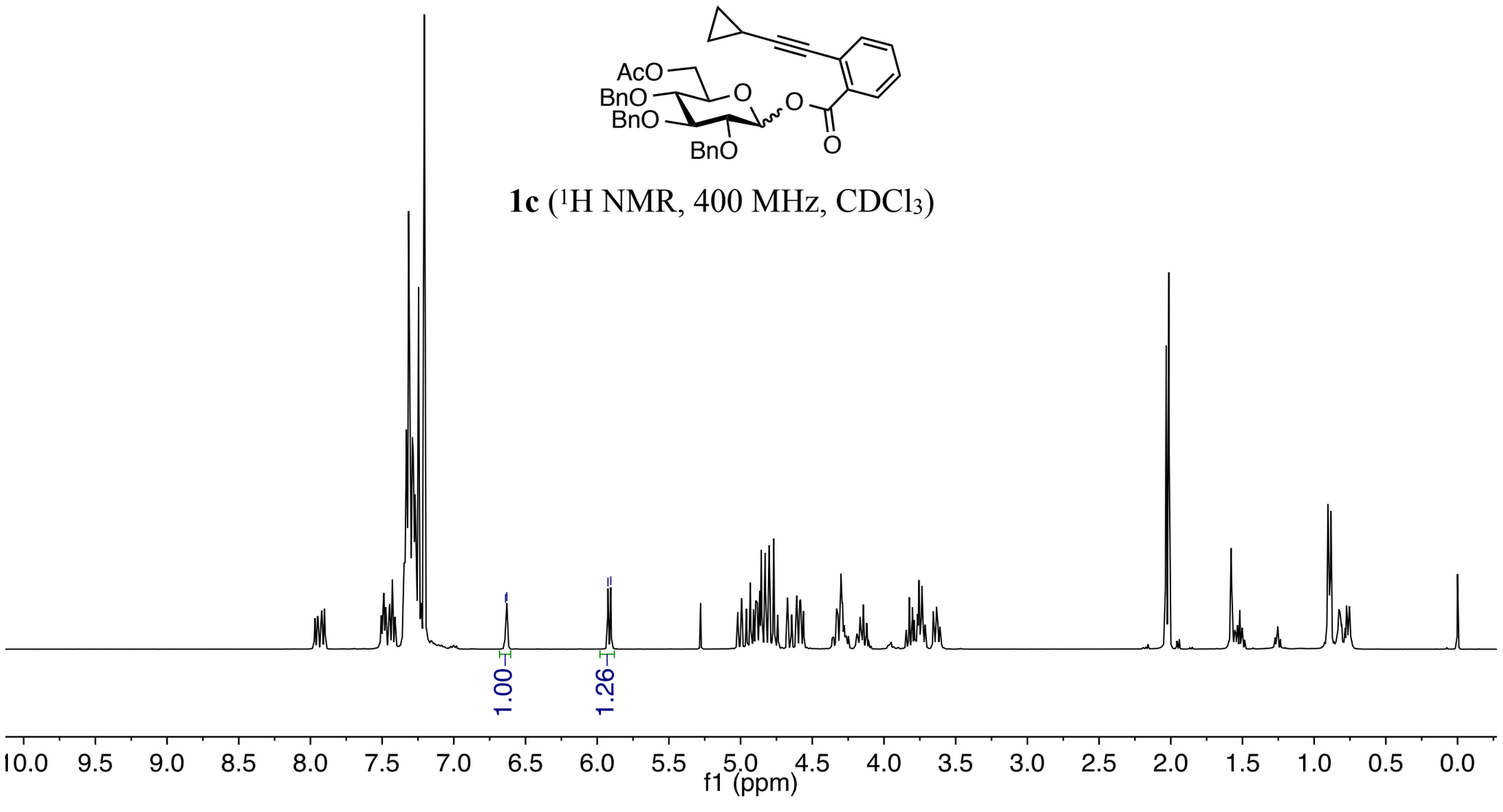




1b (gCOSY, $CDCl_3$)

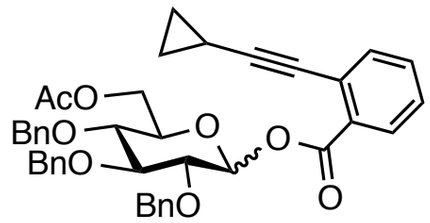


1b (gHSQC, $CDCl_3$)

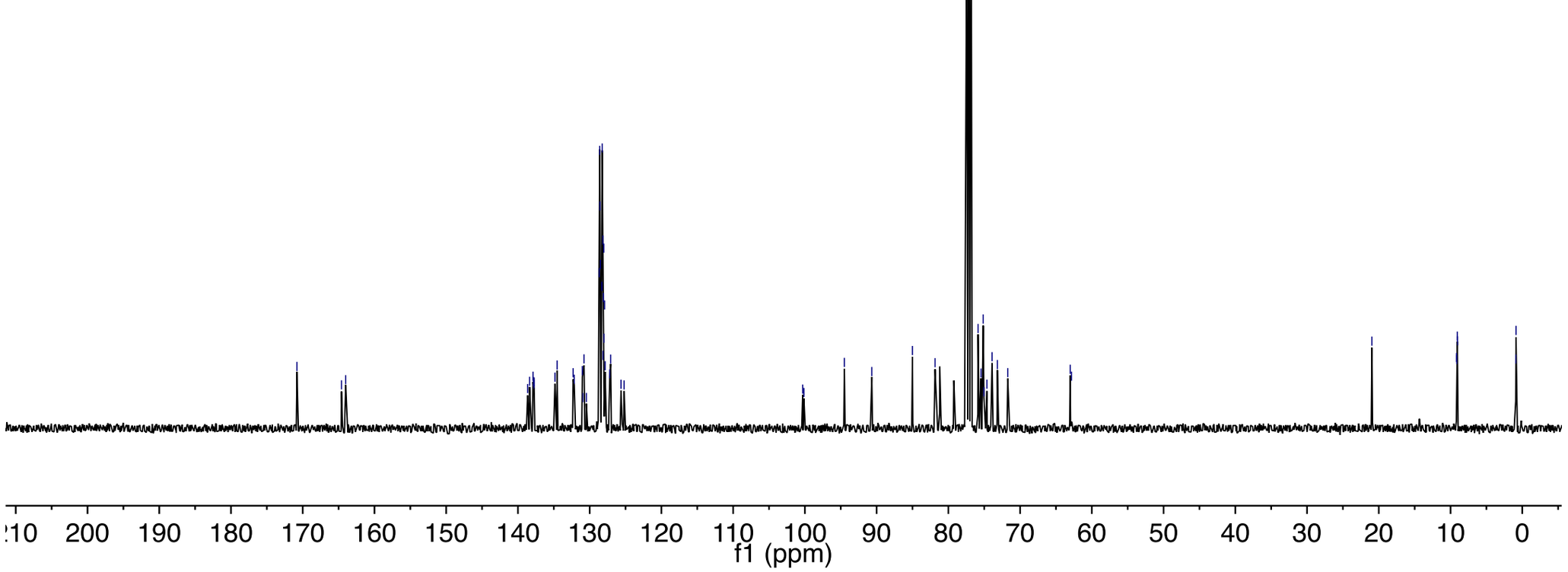


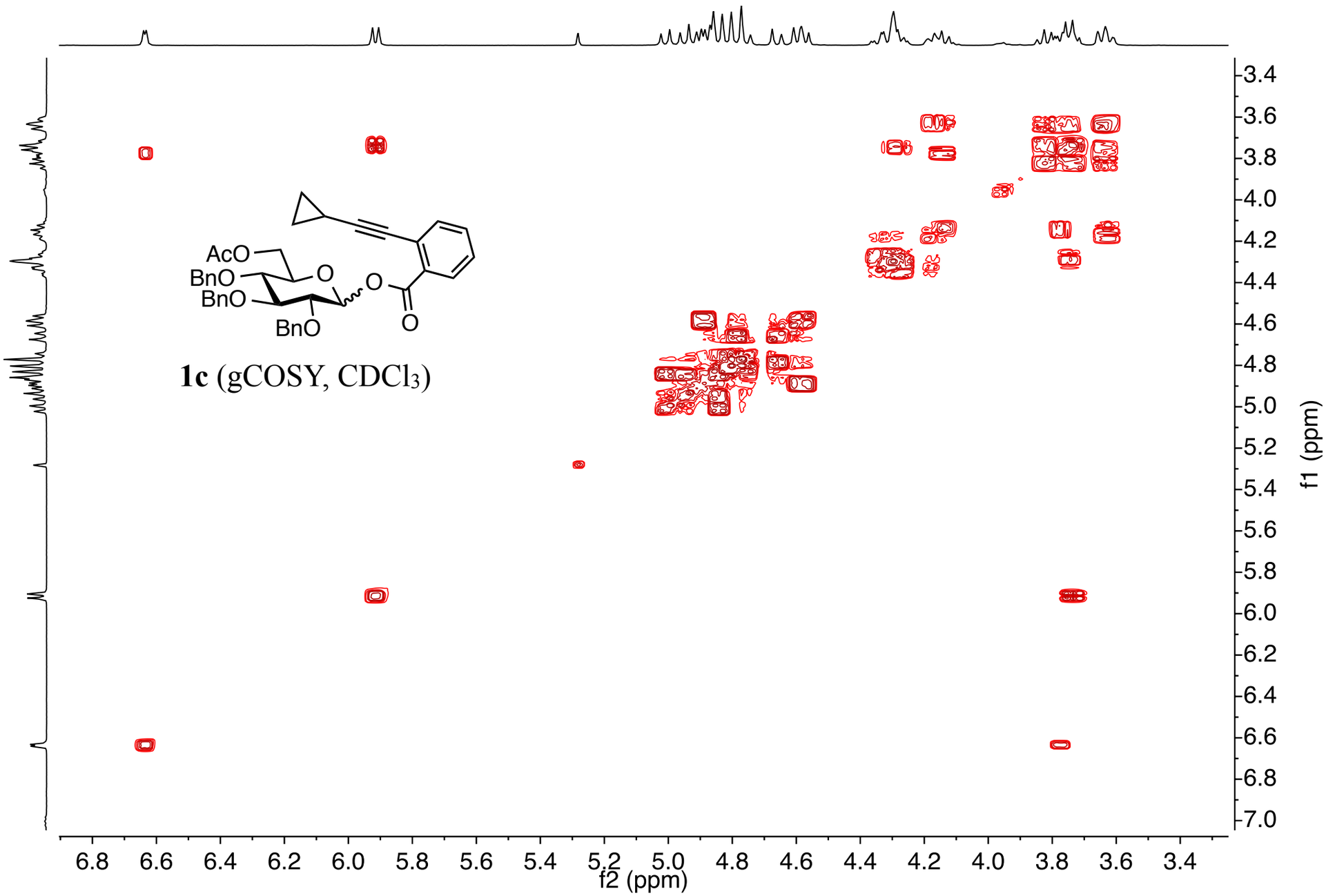
1c (^{1}H NMR, 400 MHz, $CDCl_3$)

170.80
164.59
164.01
138.65
138.38
137.89
137.85
137.77
137.74
134.84
134.54
132.30
132.16
131.02
130.96
130.79
130.46
128.67
128.60
128.57
128.50
128.30
128.26
128.16
128.14
128.08
128.04
128.02
127.93
127.85
127.20
127.07
125.63
125.20
100.31
100.14
94.50
90.67
85.01
81.86
75.86
75.45
75.15
75.05
74.63
73.91
73.16
71.72
63.02
62.84
20.96
9.16
9.12
9.05
9.02
0.90
0.87

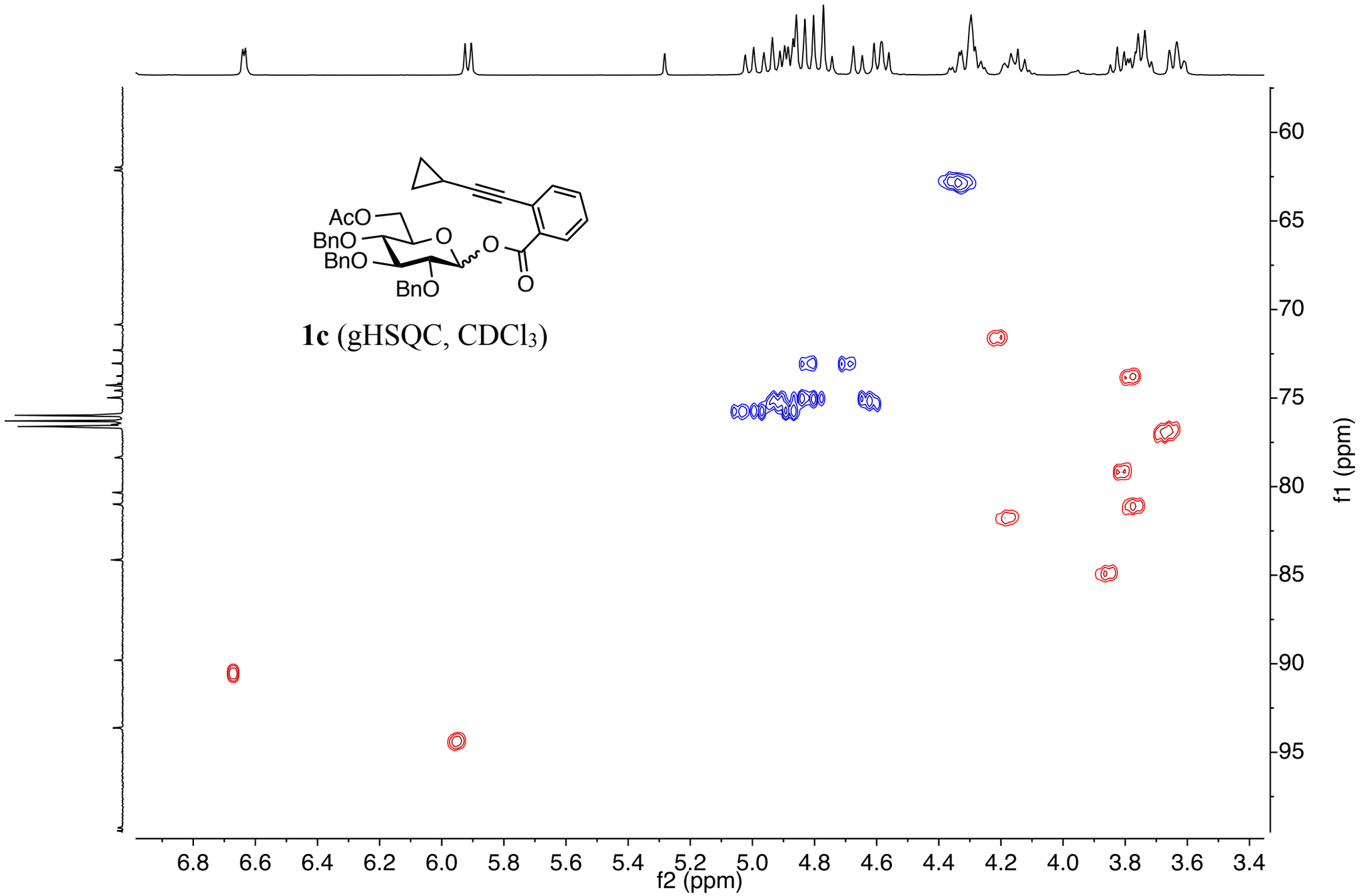


1c (^{13}C NMR, 101 MHz, $CDCl_3$)

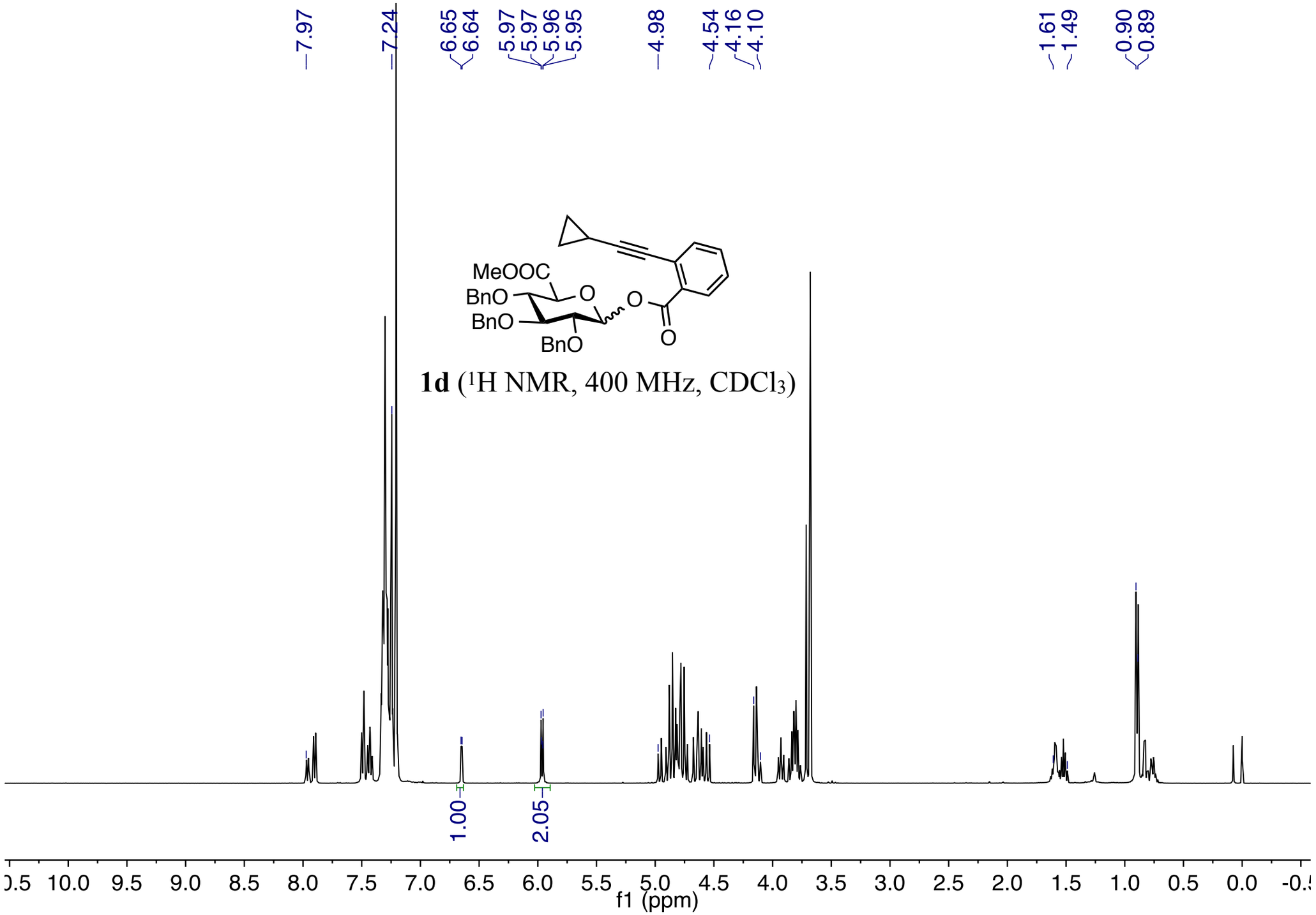




1c (gCOSY, $CDCl_3$)

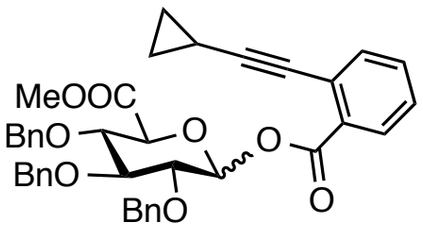


1c (gHSQC, $CDCl_3$)

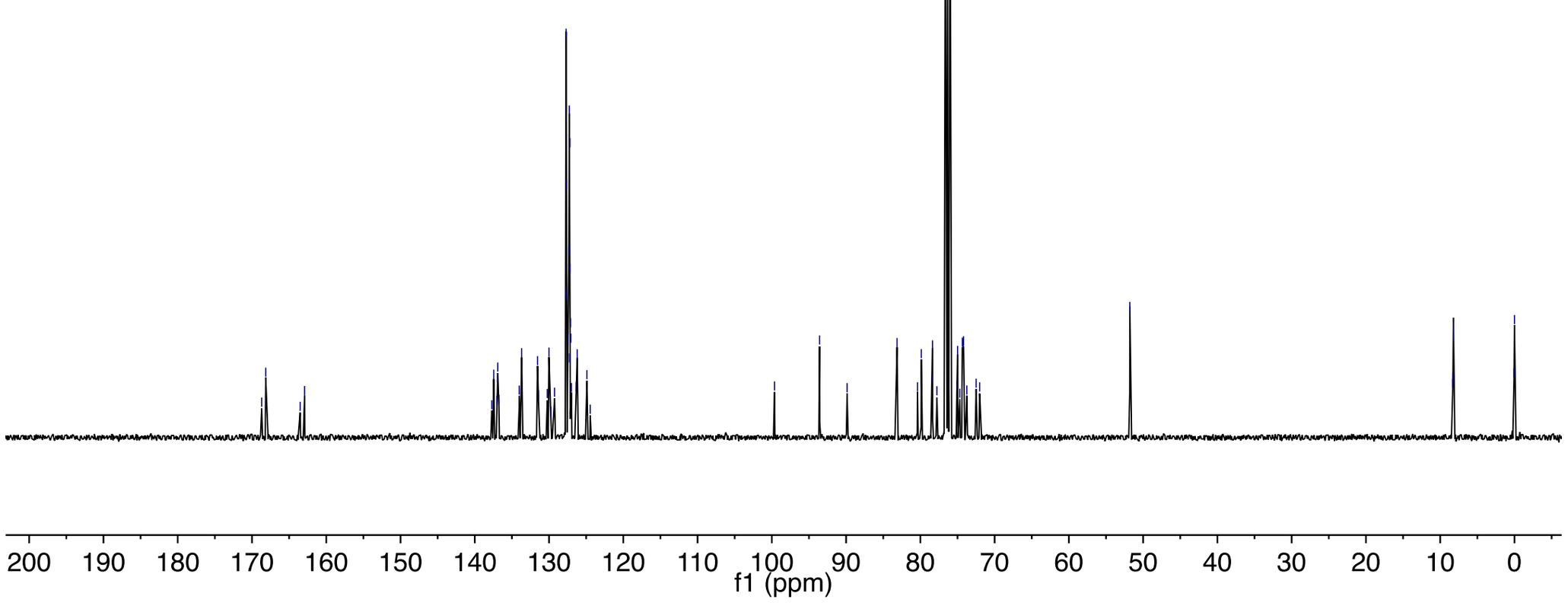


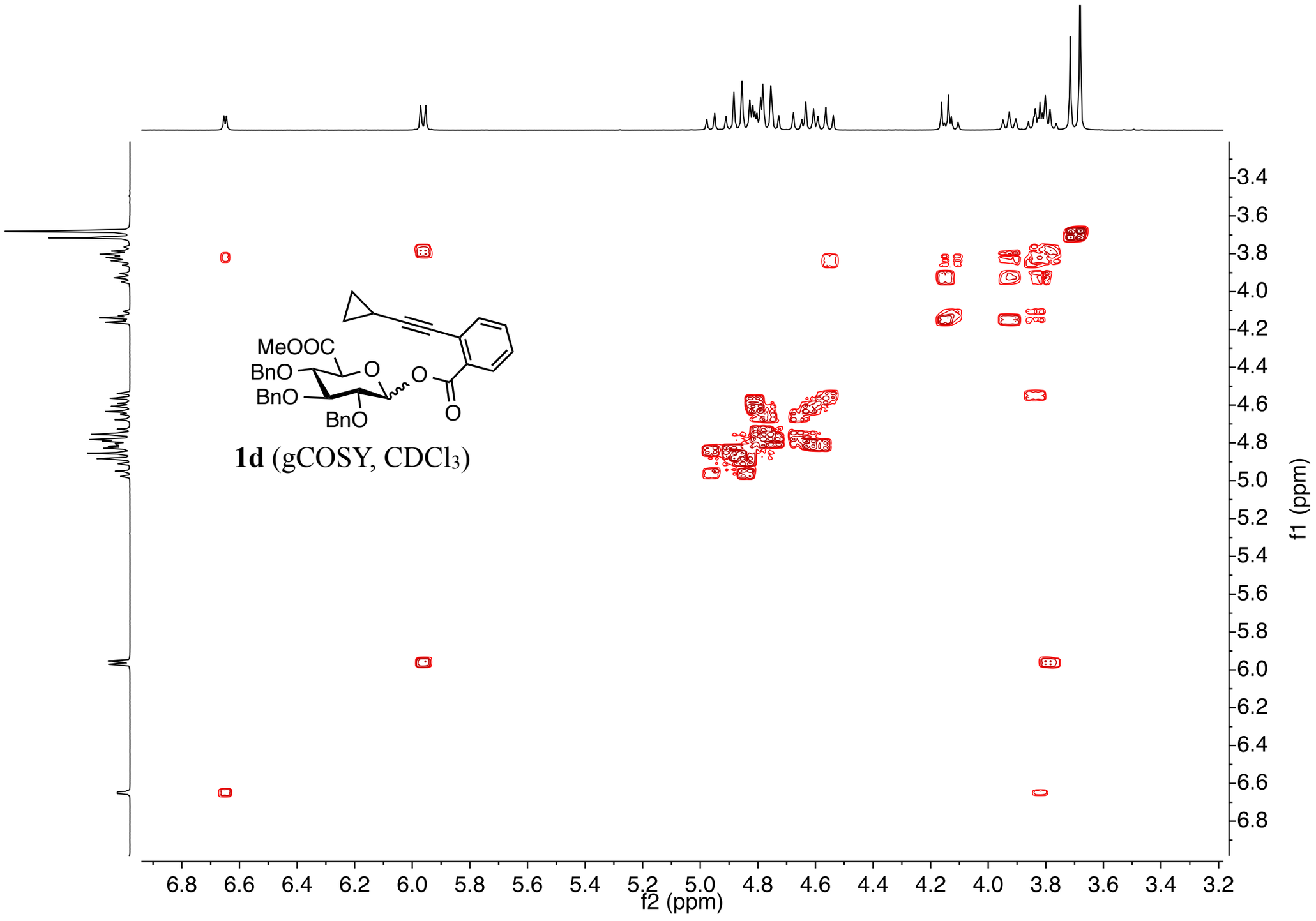
1d (^{1}H NMR, 400 MHz, $CDCl_3$)

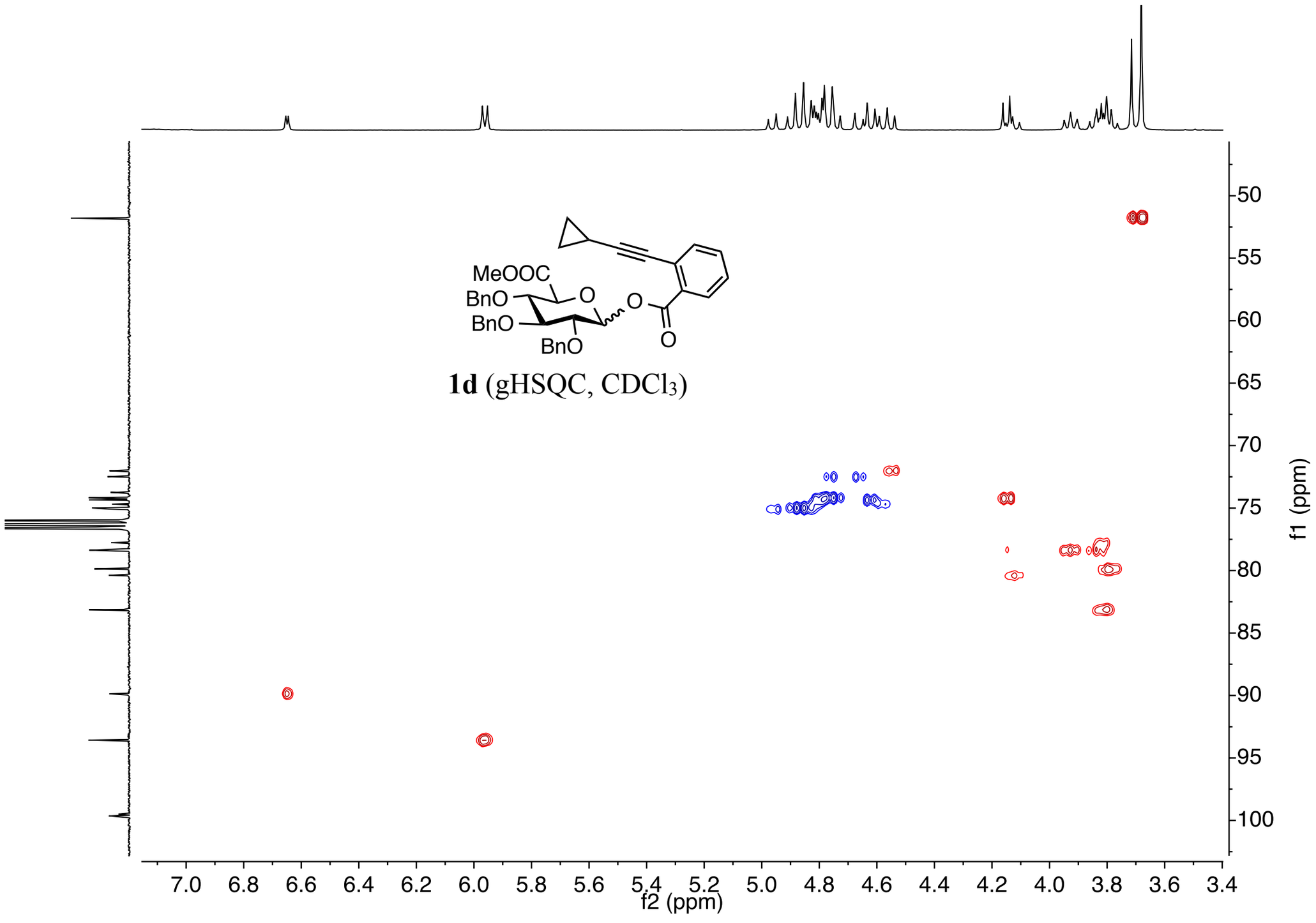
168.70
168.15
163.52
162.92
137.71
137.45
137.02
136.96
136.90
136.75
134.01
133.69
131.55
131.42
130.23
130.01
129.26
127.73
127.70
127.67
127.65
127.44
127.34
127.27
127.23
127.20
127.18
127.10
127.07
126.99
126.35
126.21
124.90
99.64
93.57
89.87
83.14
80.39
79.87
78.39
78.37
77.77
75.09
74.99
74.68
74.35
74.22
74.18
73.74
72.49
72.01
51.79
8.35
8.29
8.23
8.20
0.06
-0.00



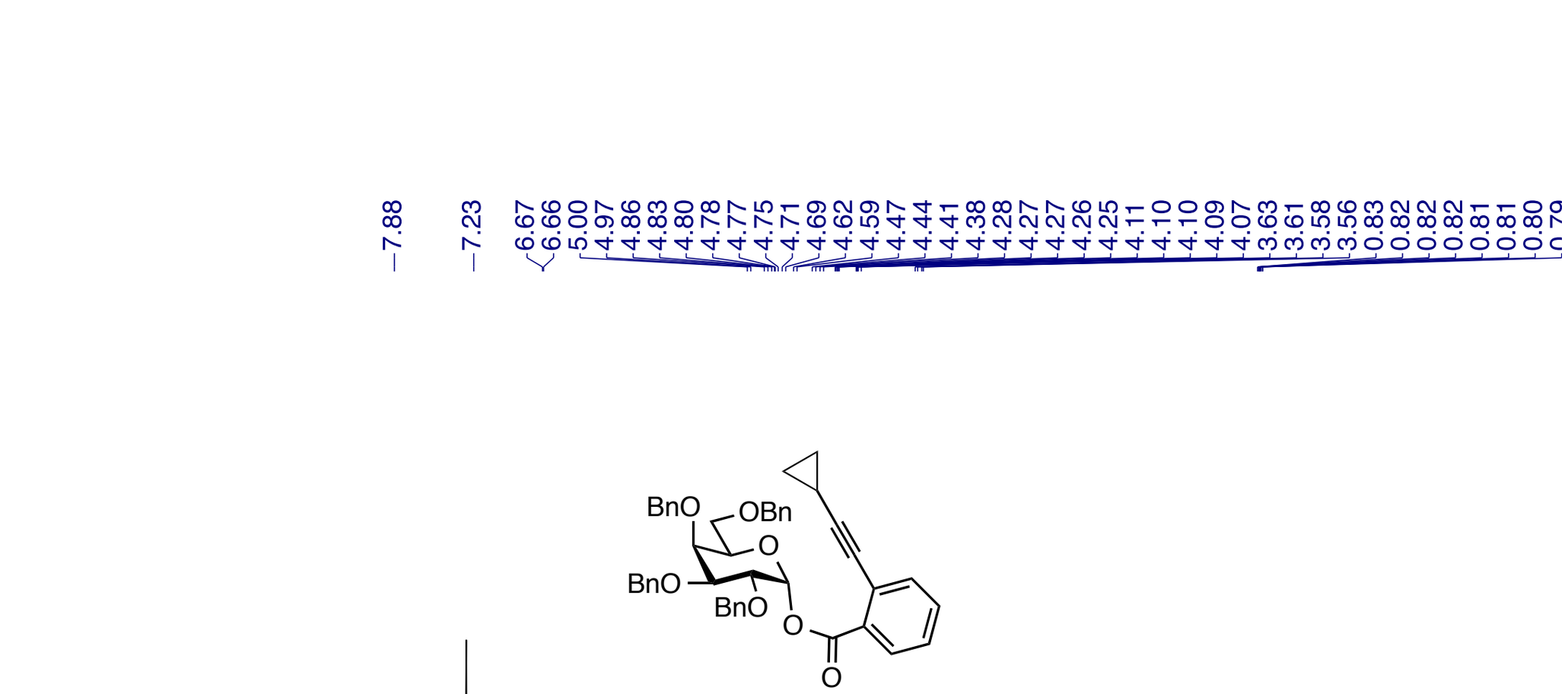
1d (^{13}C NMR, 101 MHz, $CDCl_3$)



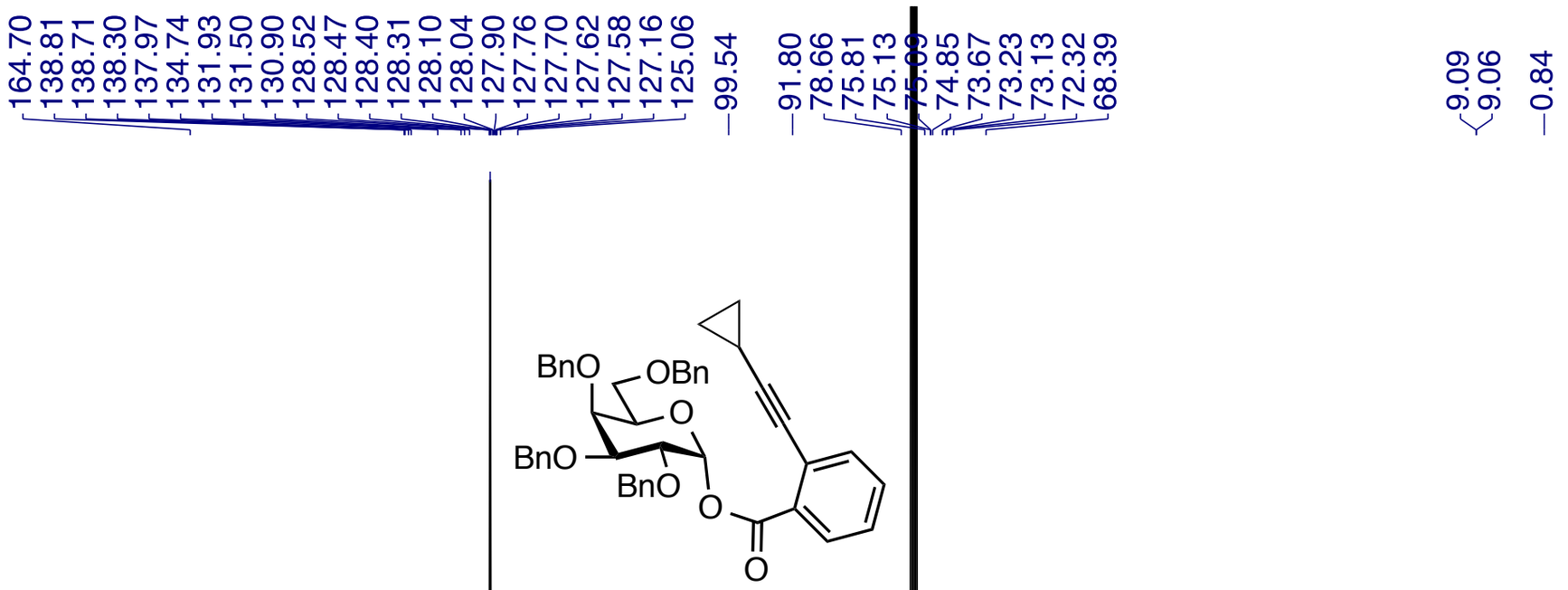

MeOOC
BnO
BnO
BnO
O
O
O
1d (gCOSY, CDCl3)
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
f1 (ppm)
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)



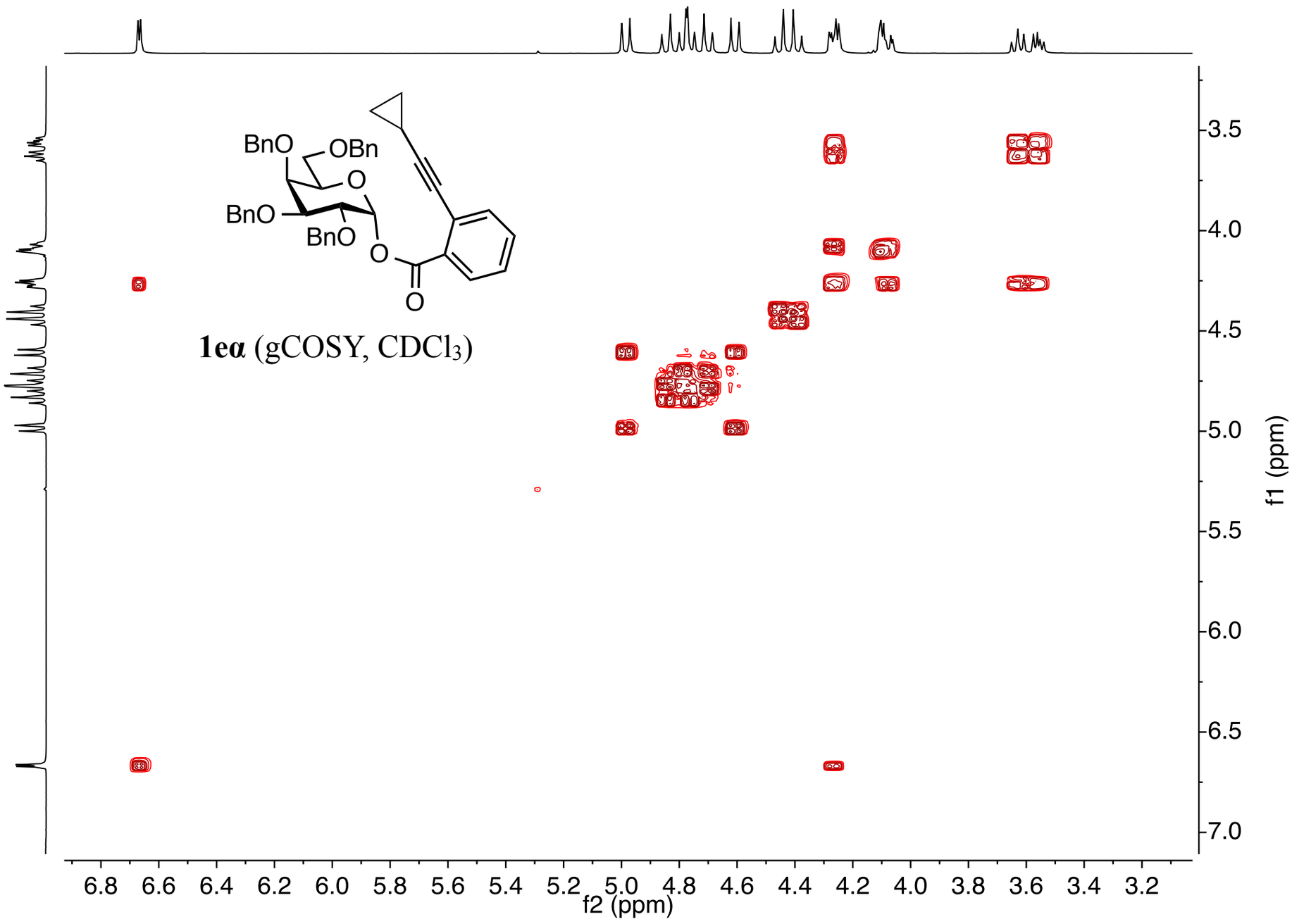
1d (gHSQC, $CDCl_3$)

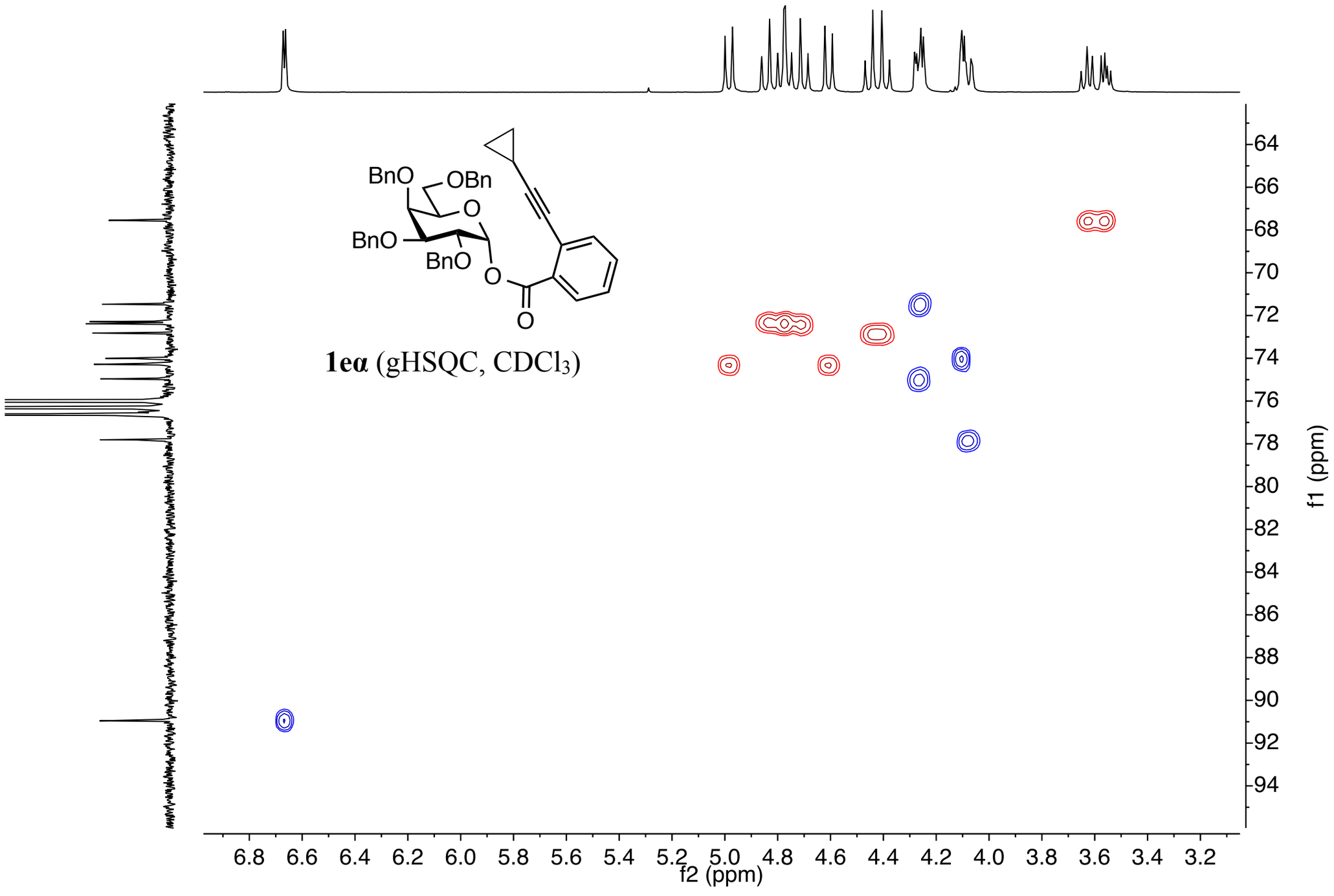


1eα (^{1}H NMR, 400 MHz, $CDCl_3$)

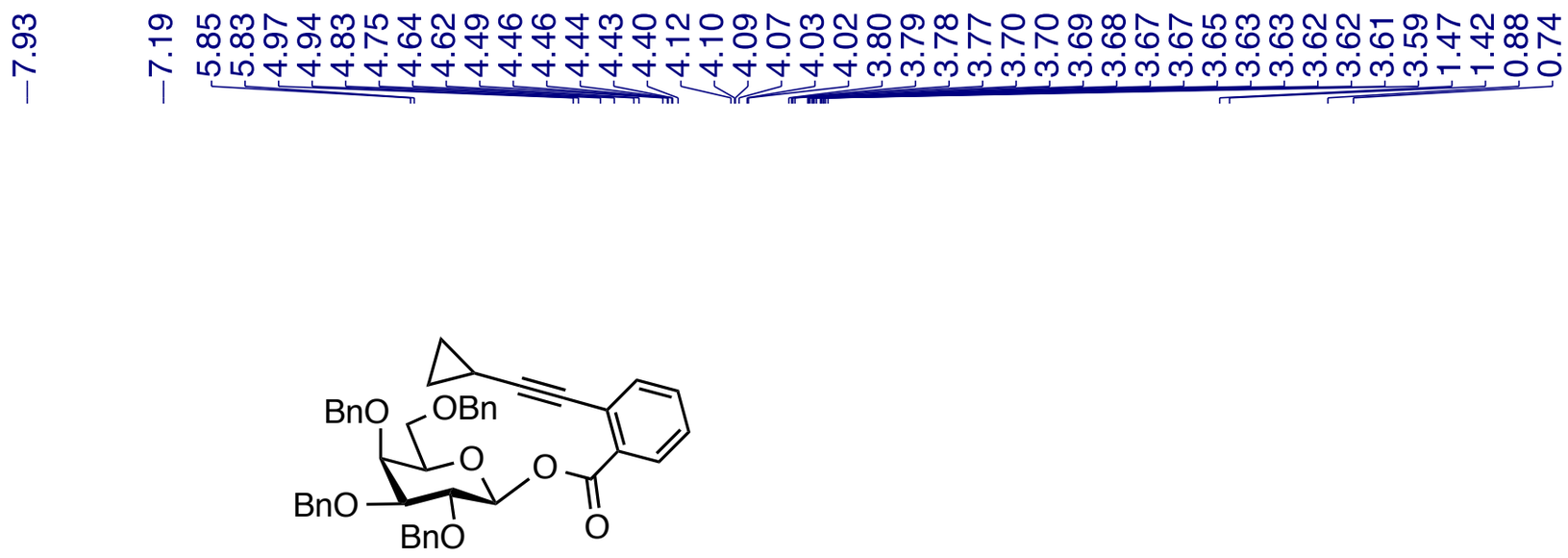


1eα (^{13}C NMR, 101 MHz, $CDCl_3$)

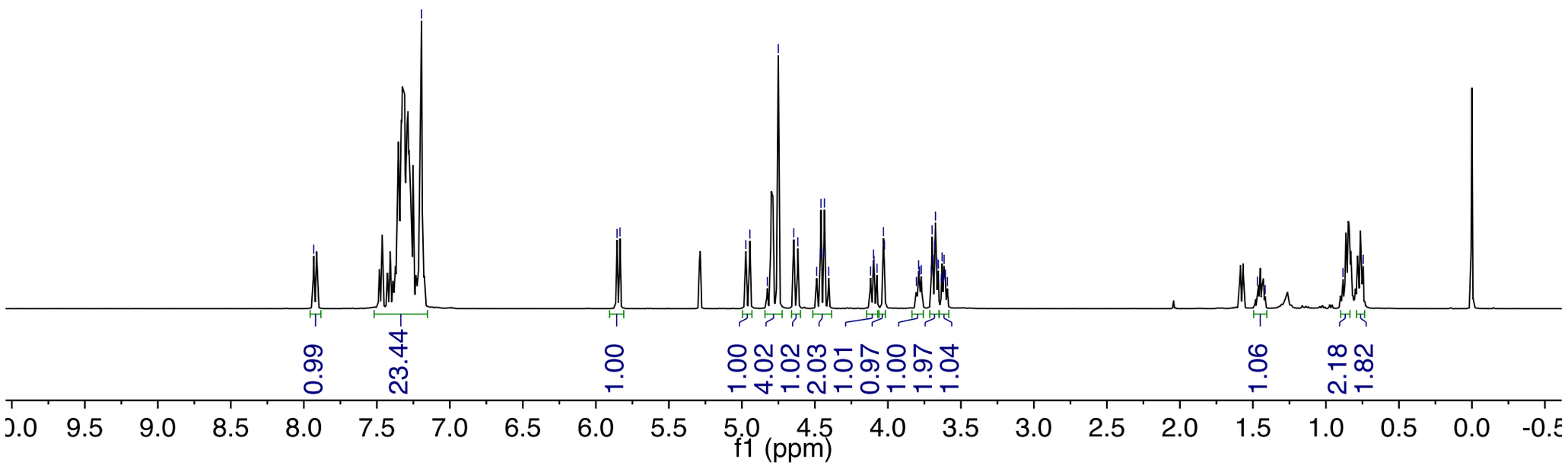

BnO
OBn
O
BnO
BnO
O
O
1eα (gCOSY, CDCl3)
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
f1 (ppm)
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)

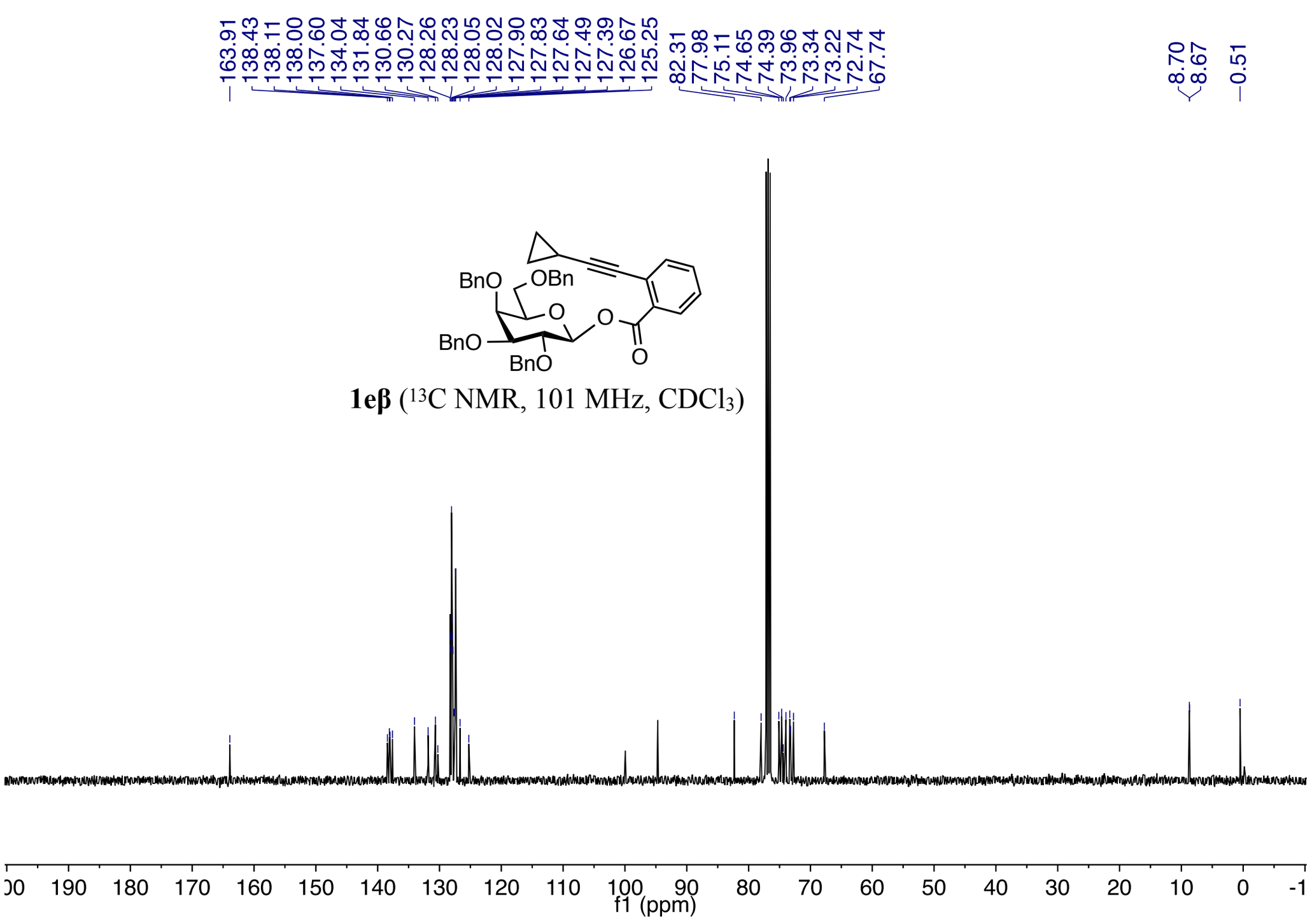


1eα (gHSQC, $CDCl_3$)

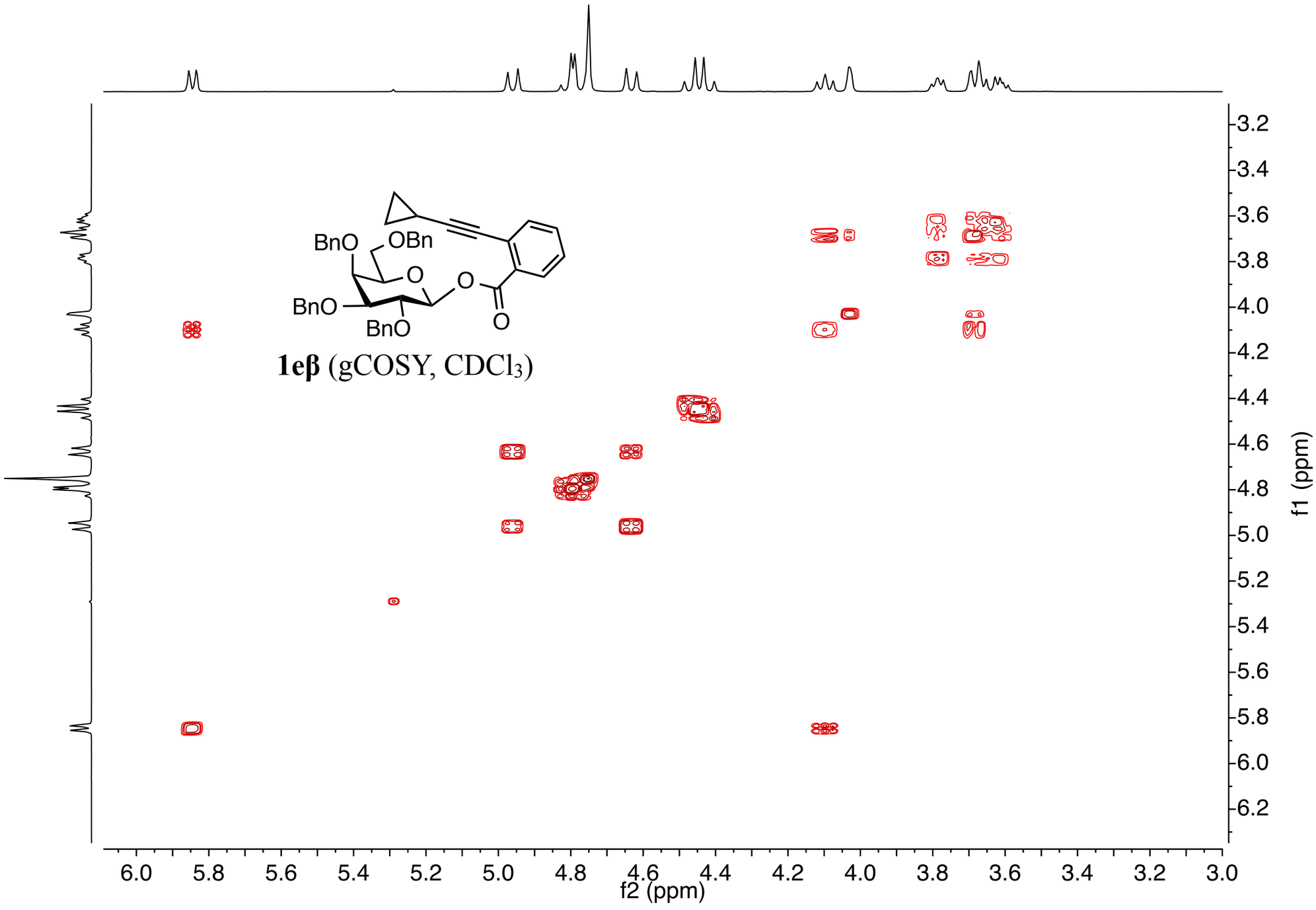


1eβ (^{1}H NMR, 400 MHz, $CDCl_3$)

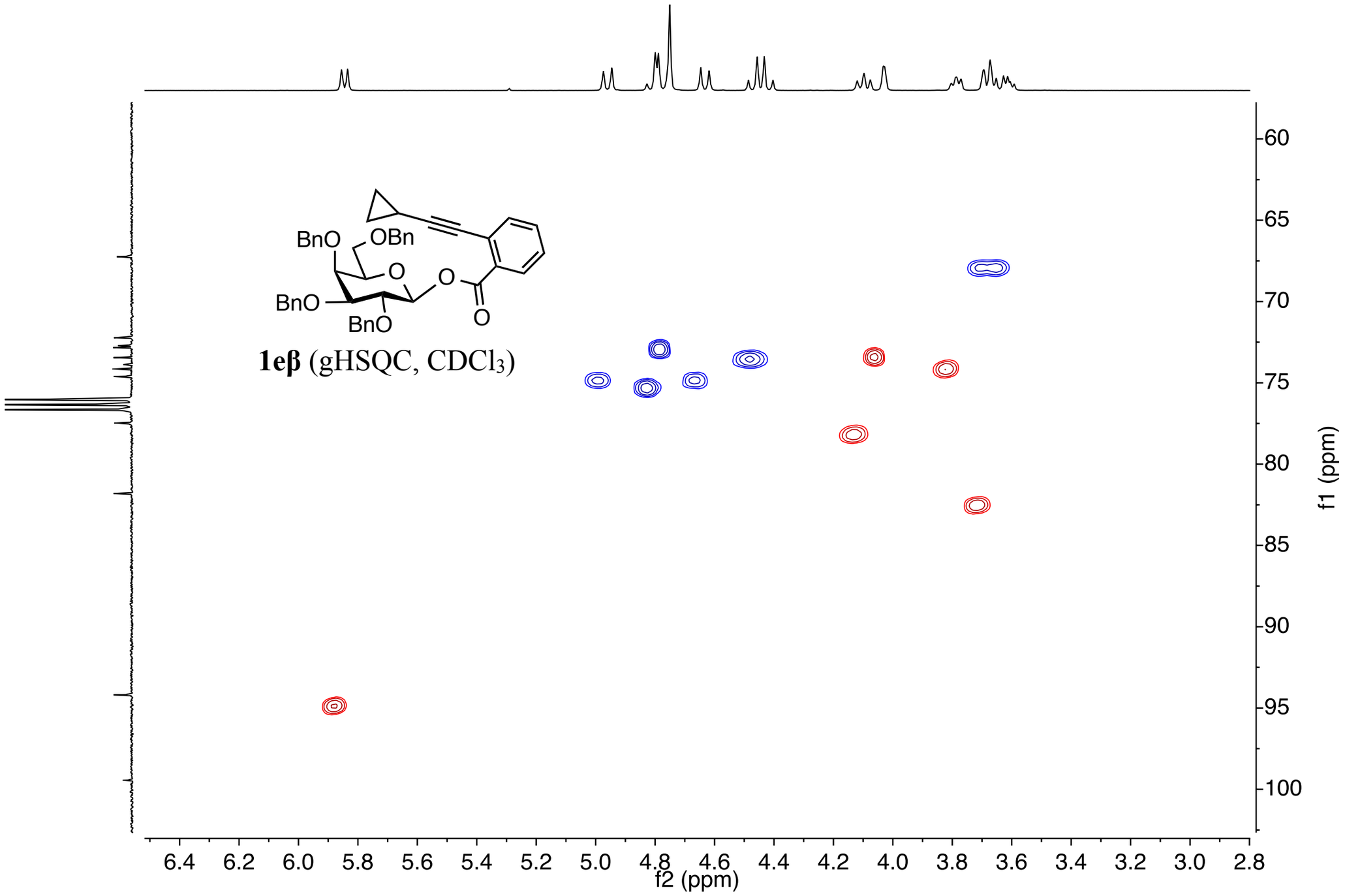


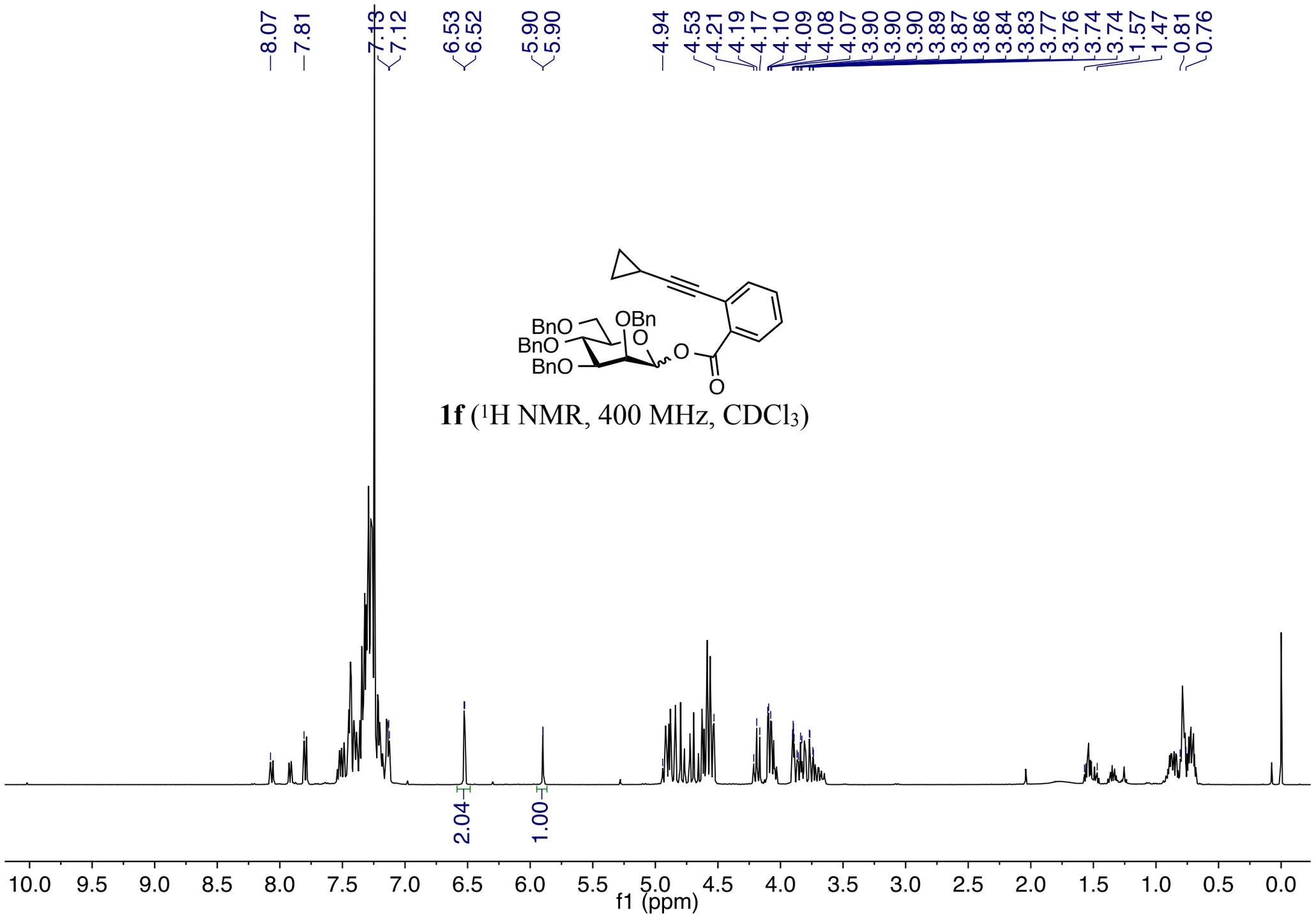


1eβ (^{13}C NMR, 101 MHz, $CDCl_3$)

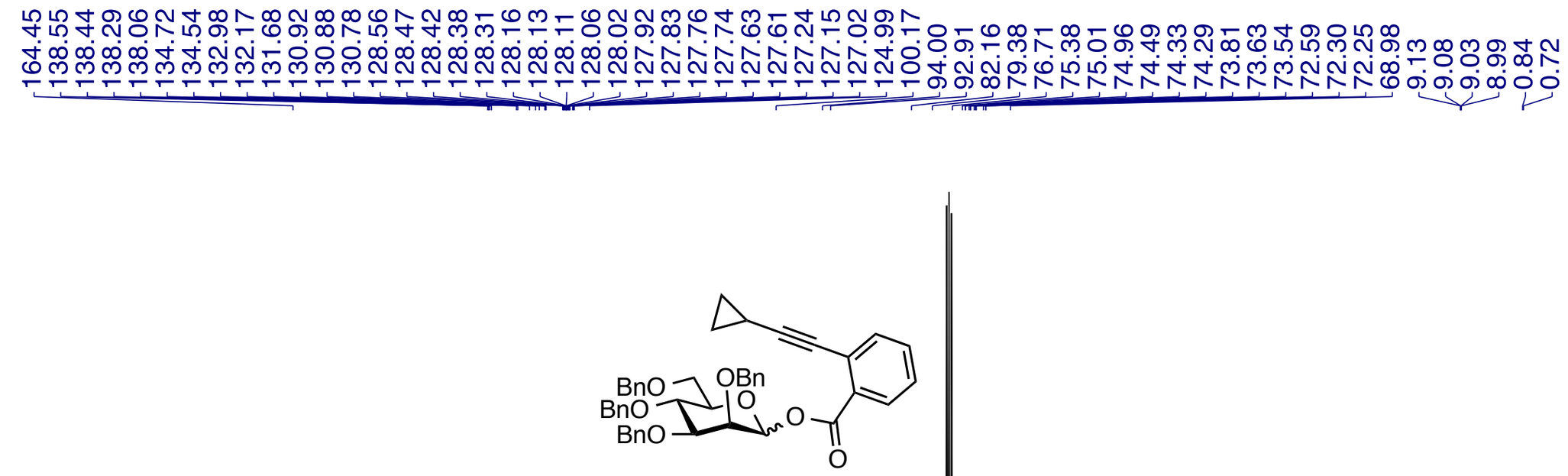


1eβ (gCOSY, $CDCl_3$)

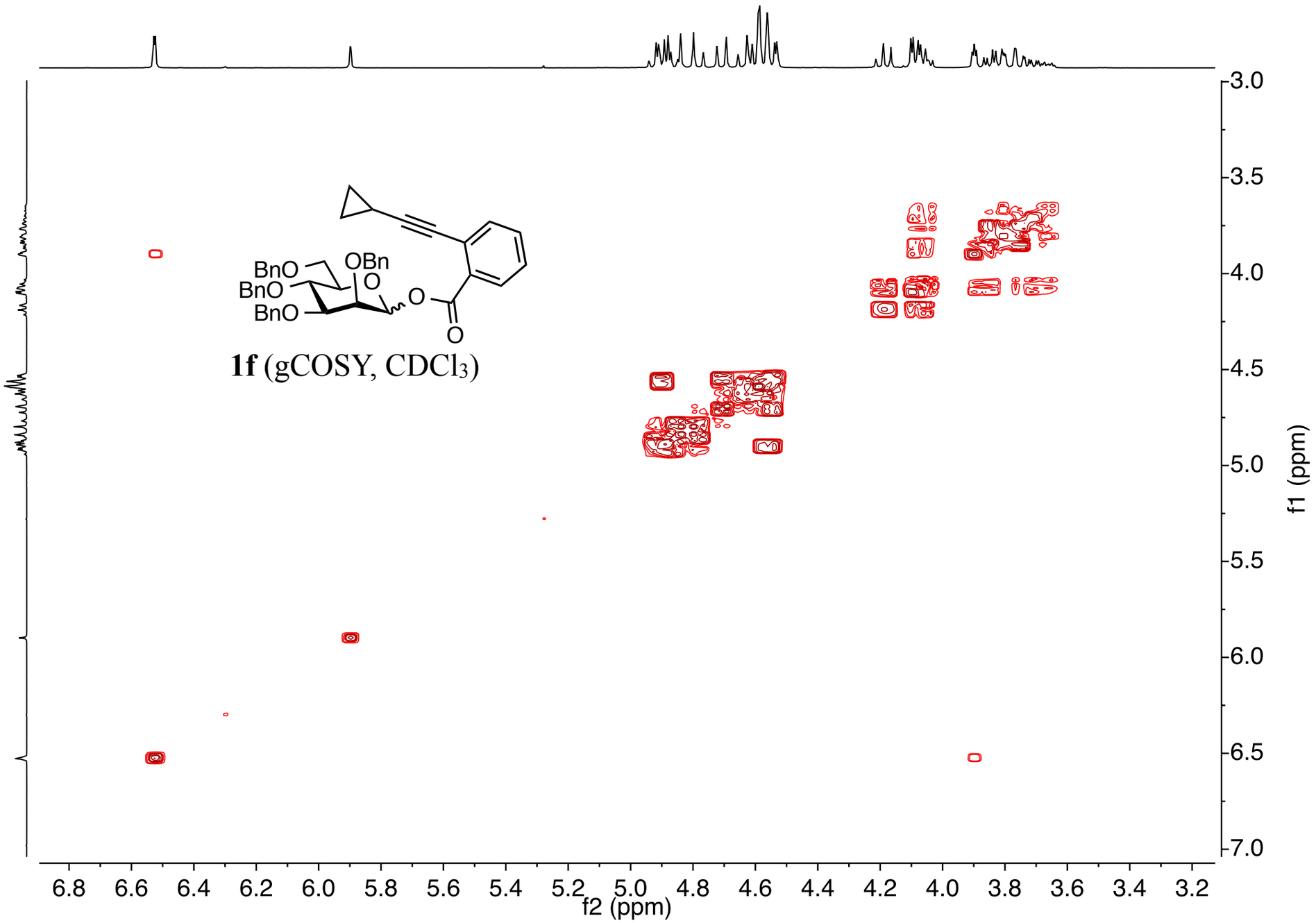

BnO
OBn
O
O
BnO
BnO
O
1eβ (gHSQC, CDCl3)
60
65
70
75
80
85
90
95
100
f1 (ppm)
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
f2 (ppm)



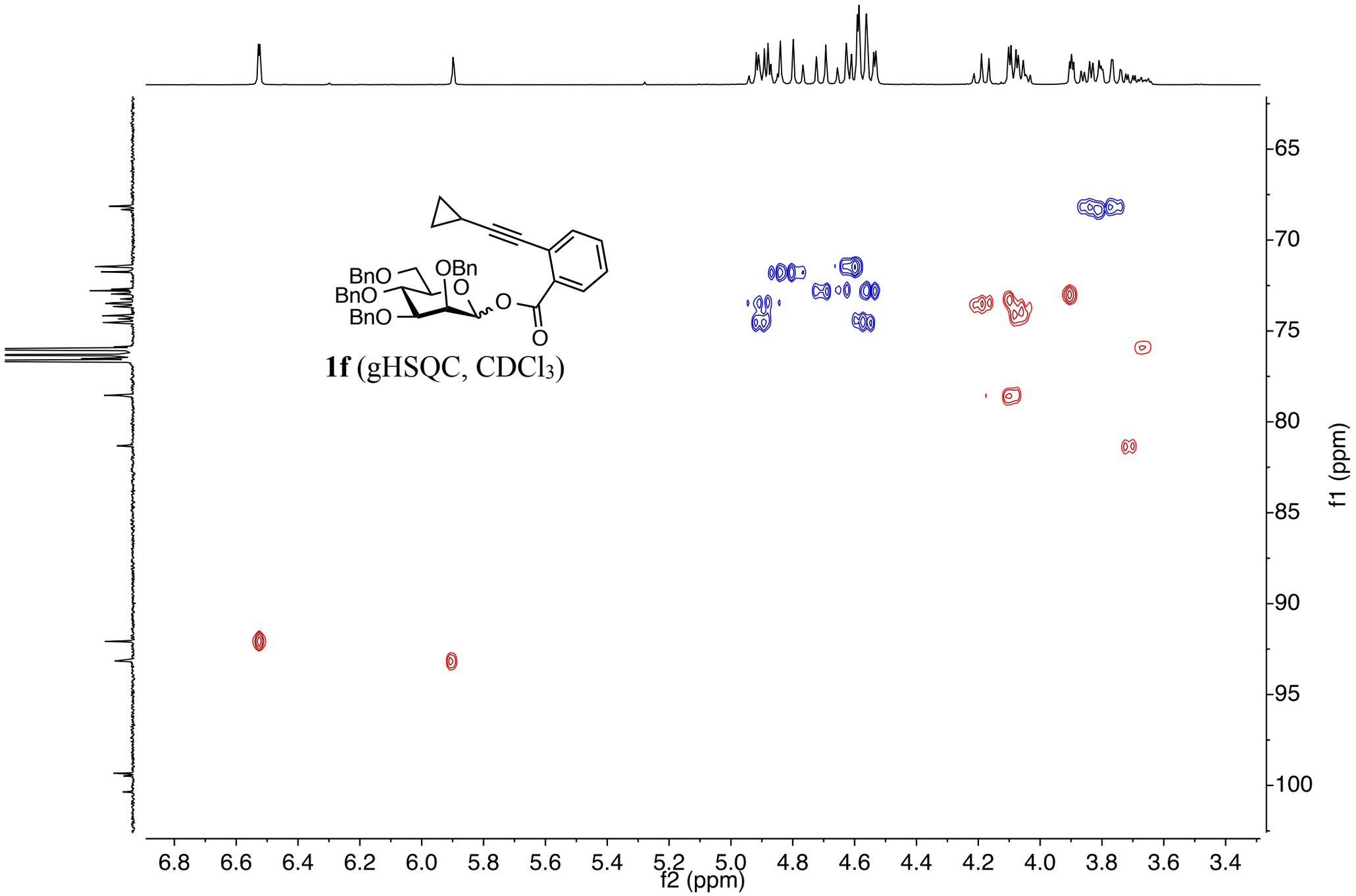
1f (^{1}H NMR, 400 MHz, $CDCl_3$)



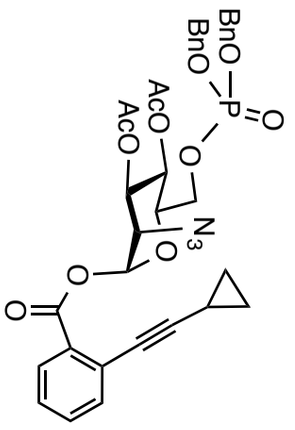
1f (^{13}C NMR, 101 MHz, $CDCl_3$)

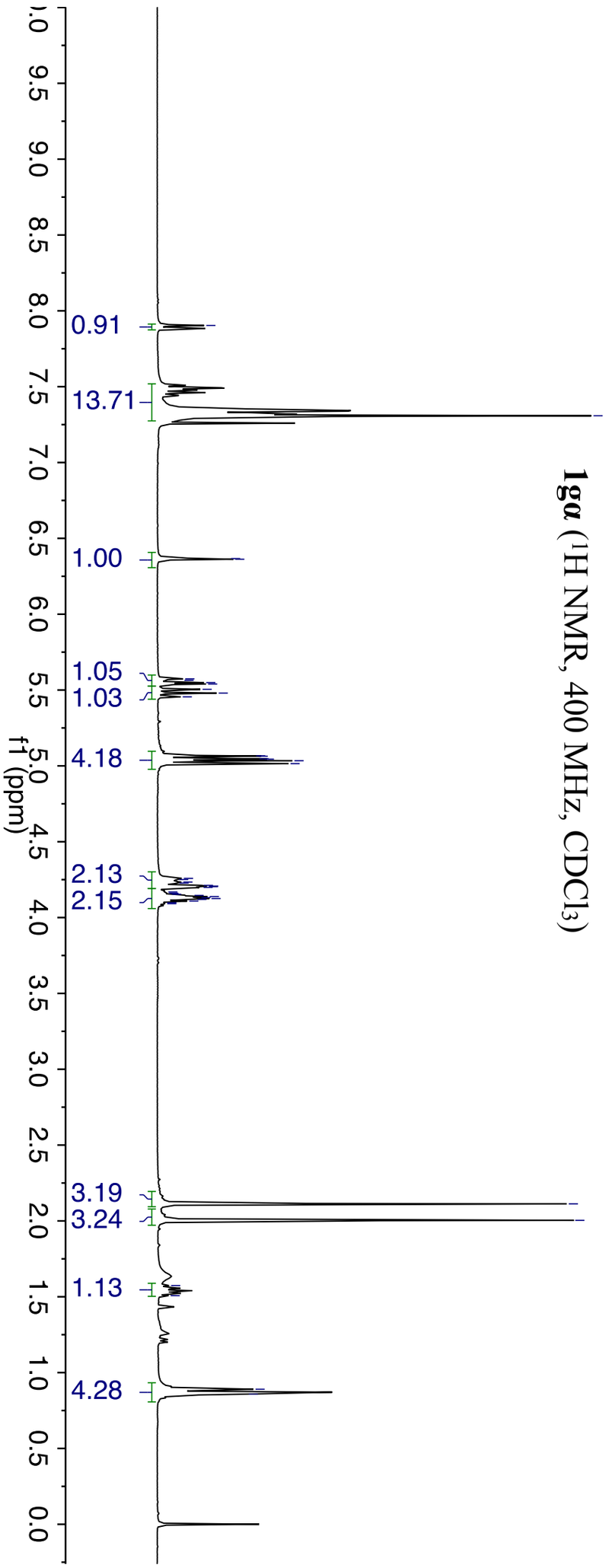


1f (gCOSY, $CDCl_3$)

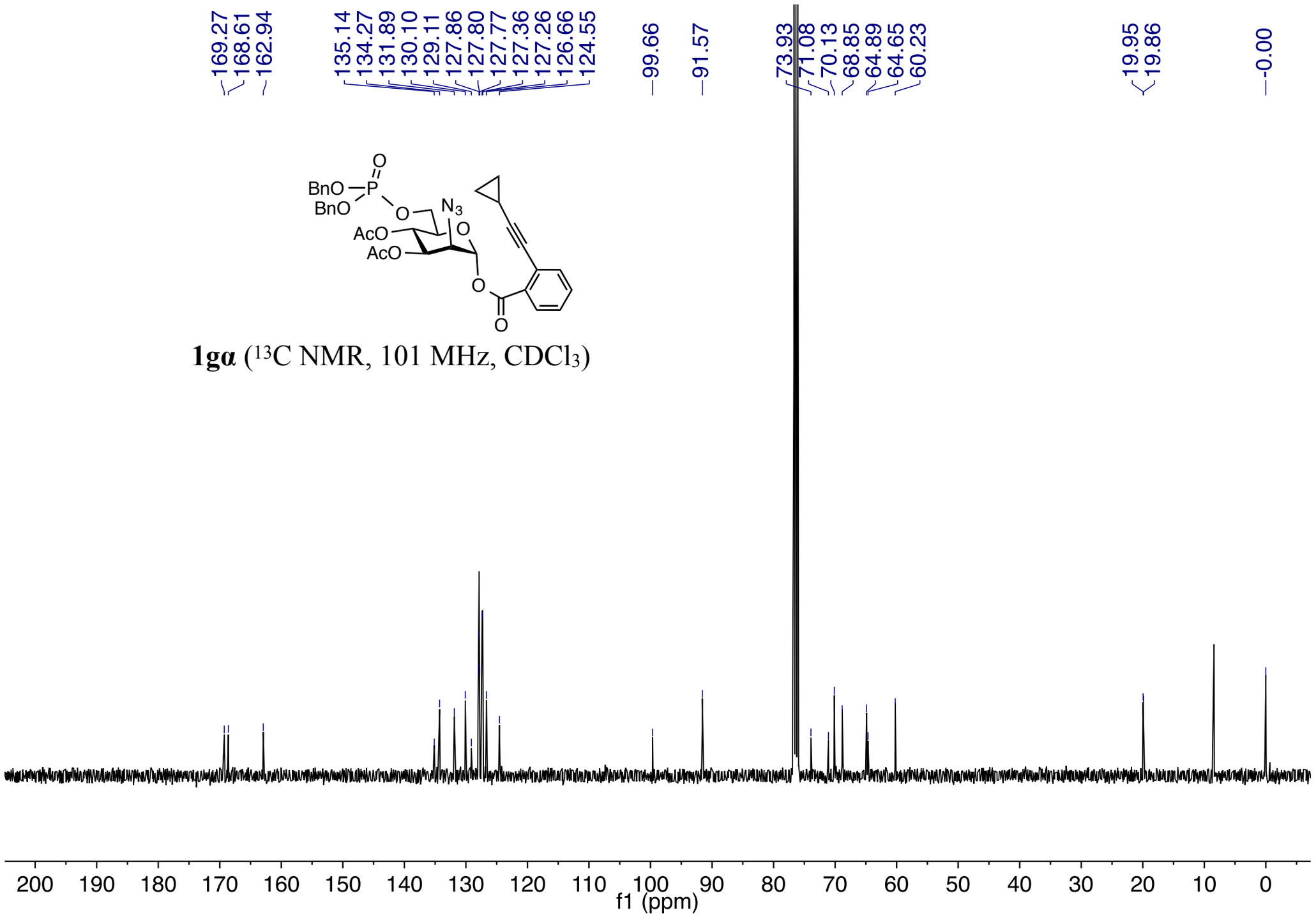

BnO
BnO
BnO
OBn
O
O
O
1f (gHSQC, CDCl3)
65
70
75
80
85
90
95
100
f1 (ppm)
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
f2 (ppm)

1ga (^{1}H NMR, 400 MHz, $CDCl_3$)



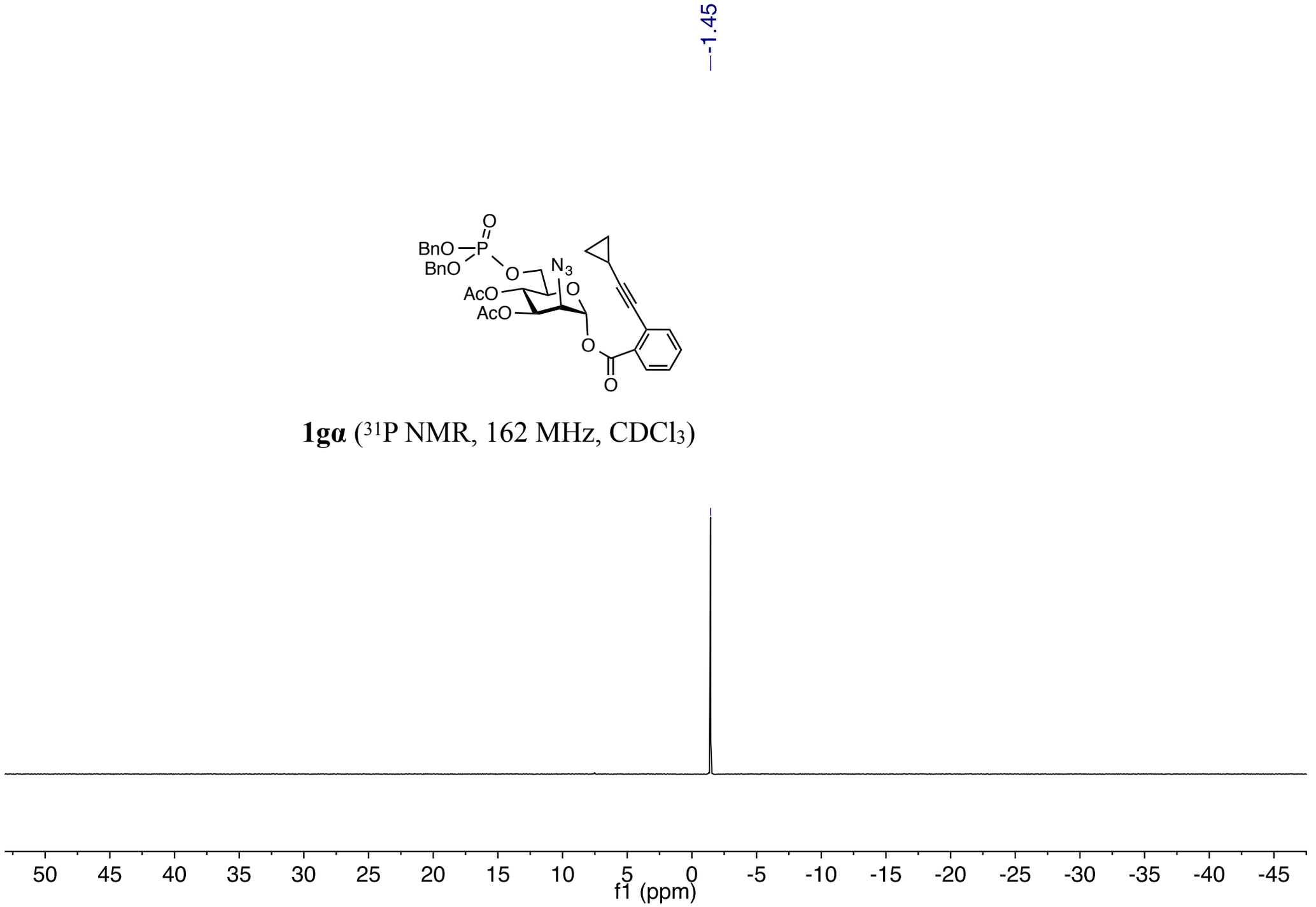


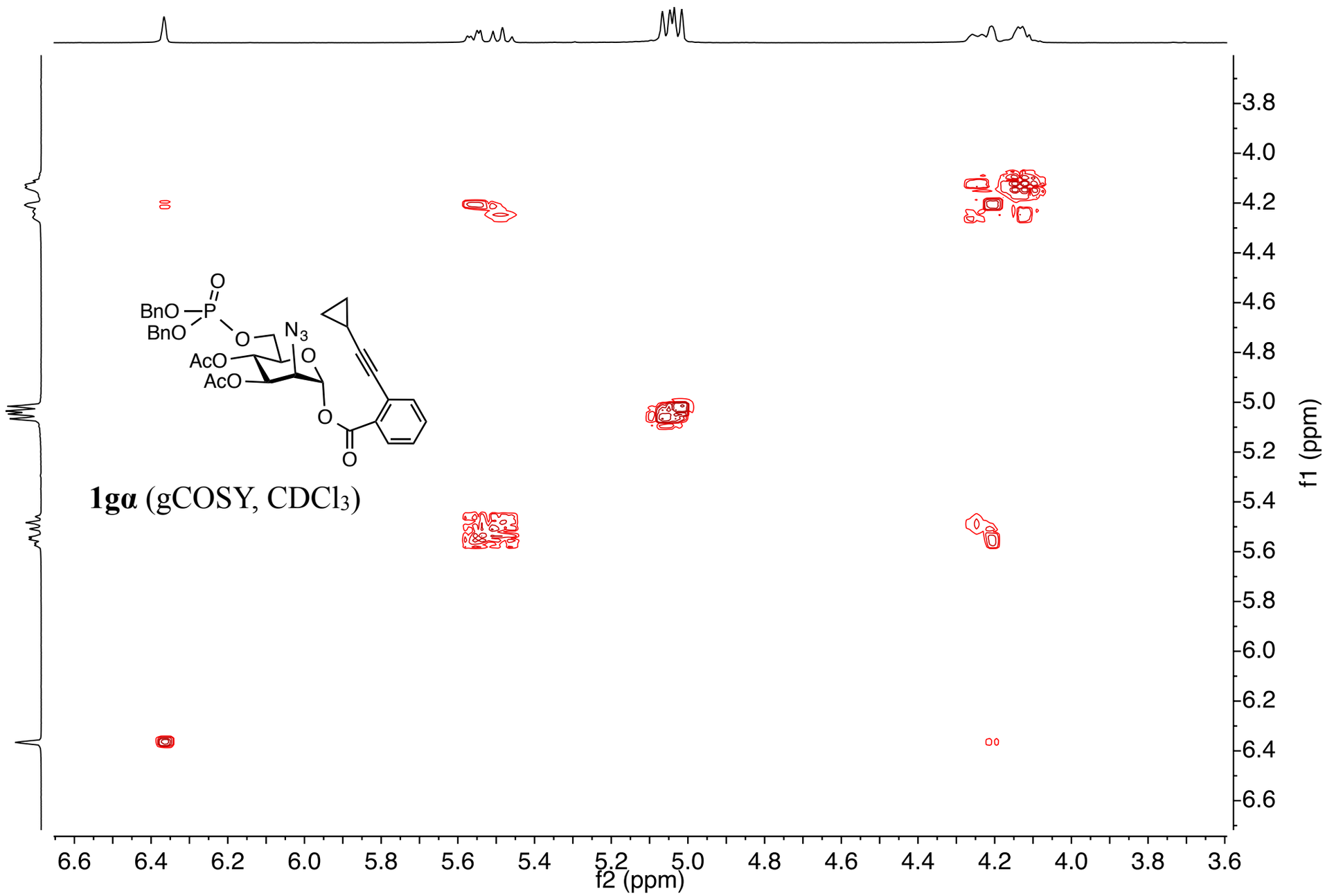
7.90
7.31
6.37
6.36
5.57
5.56
5.55
5.54
5.50
5.48
5.46
5.07
5.06
5.05
5.04
5.03
5.01
4.26
4.25
4.23
4.23
4.21
4.21
4.20
4.20
4.17
4.16
4.15
4.15
4.14
4.13
4.13
4.12
4.11
4.10
4.09
2.11
2.00
1.57
1.51
0.89
0.86



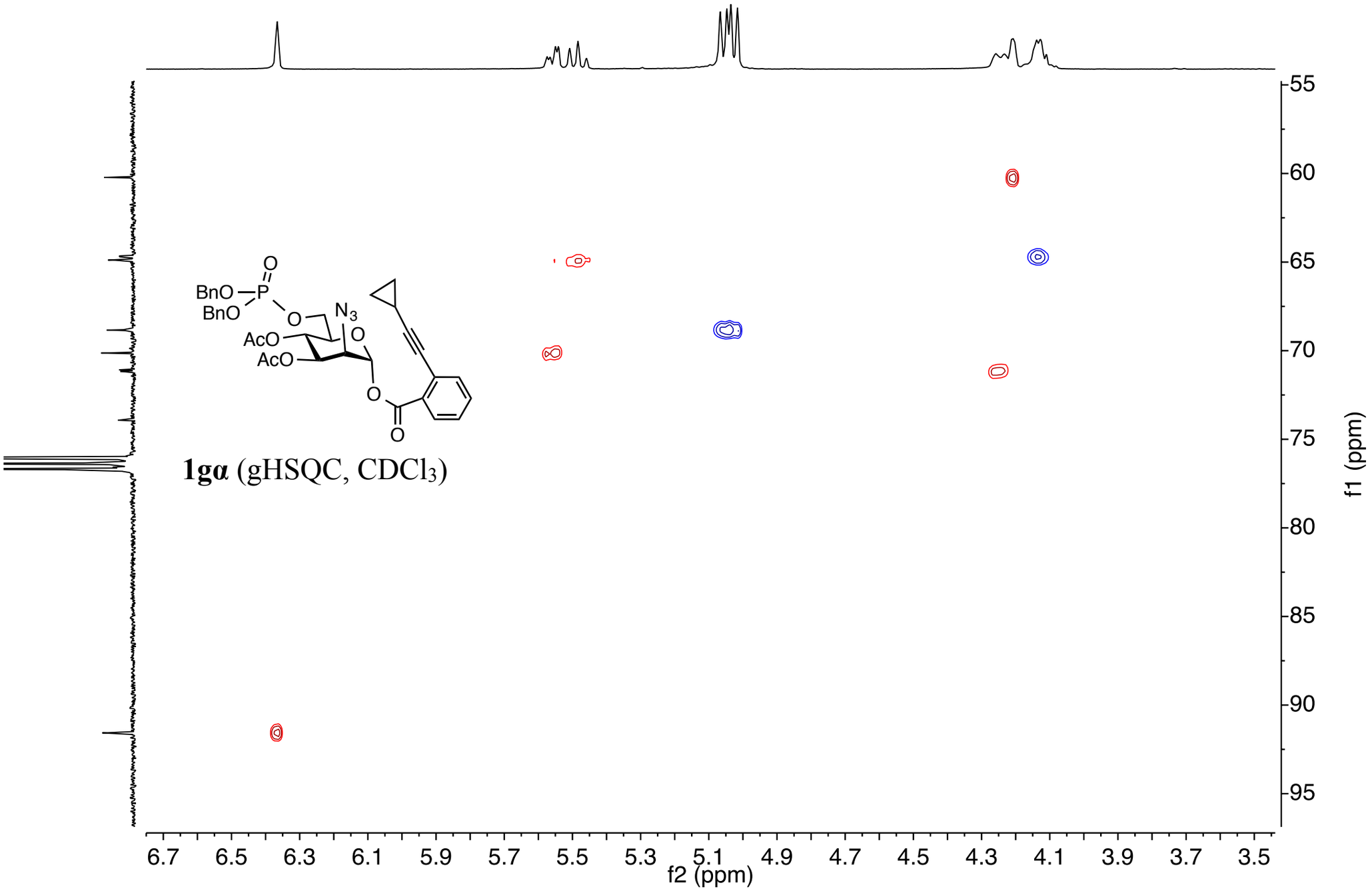
1gα (^{13}C NMR, 101 MHz, $CDCl_3$)

1gα (^{31}P NMR, 162 MHz, $CDCl_3$)

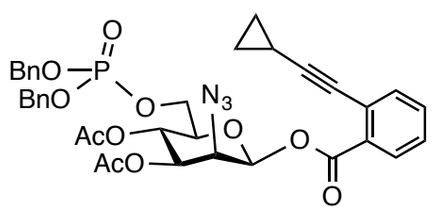




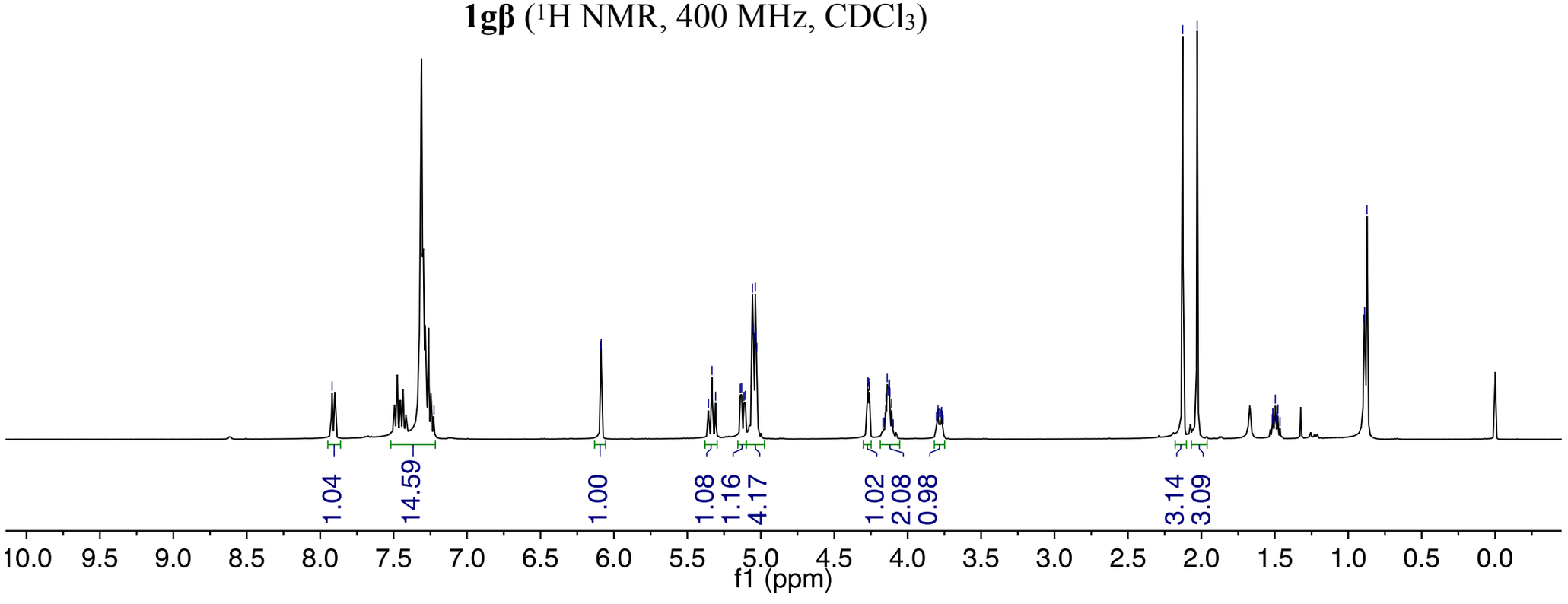
1gα (gCOSY, $CDCl_3$)



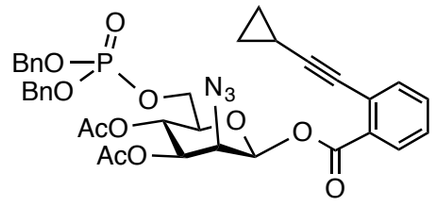
1gα (gHSQC, $CDCl_3$)



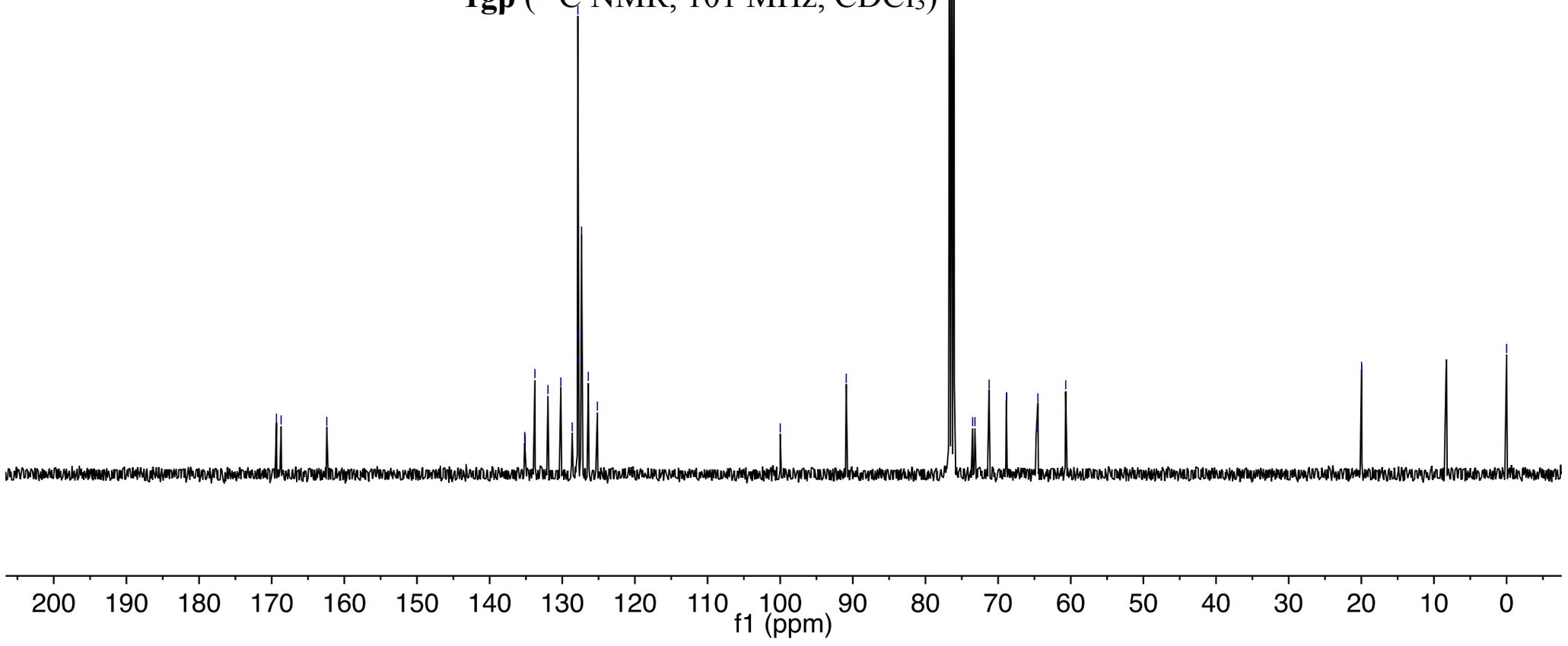
1gβ (^{1}H NMR, 400 MHz, $CDCl_3$)



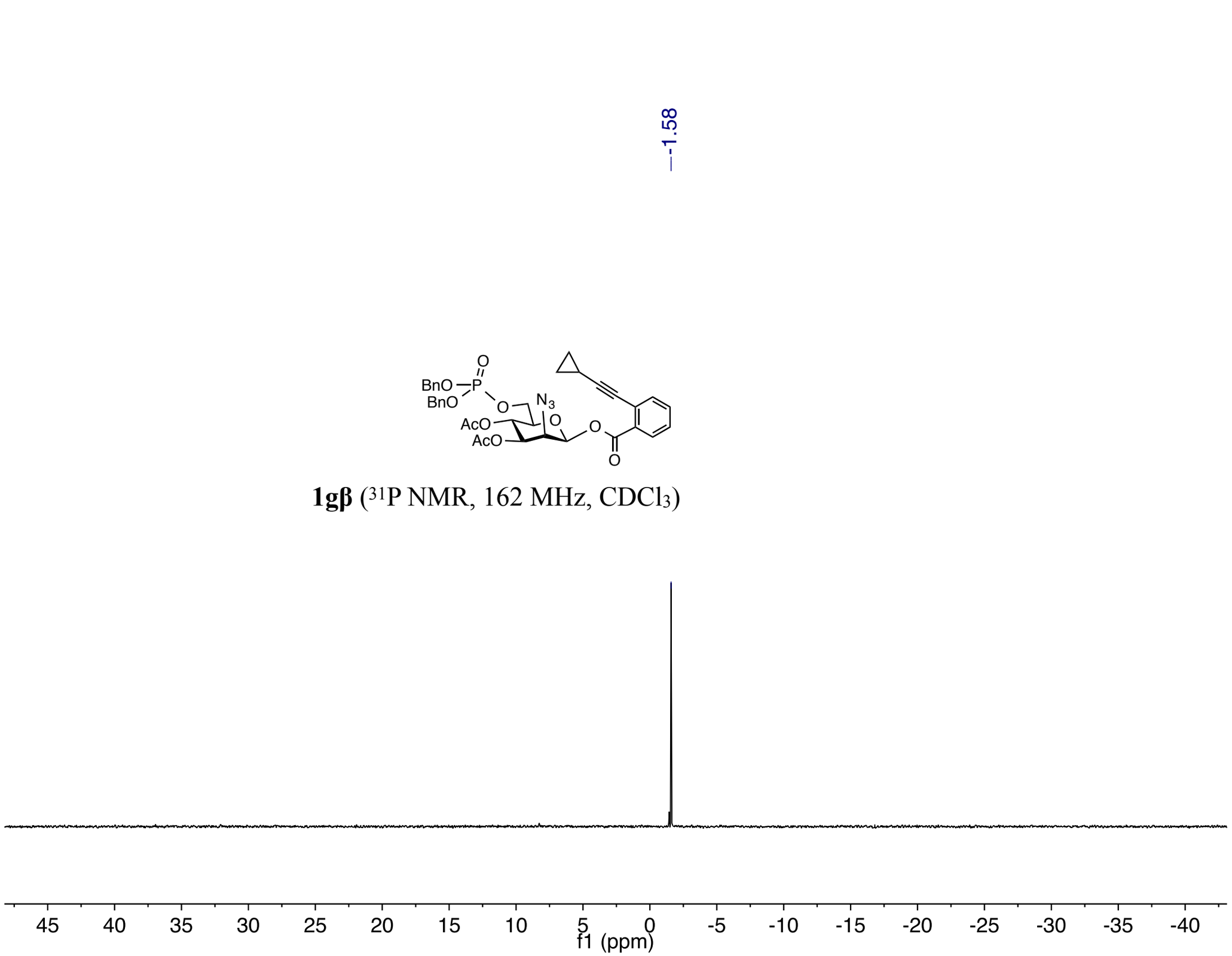
169.35
168.70
162.42
135.17
135.14
135.10
133.76
131.97
130.19
128.63
127.86
127.79
127.76
127.35
127.31
126.42
125.16
100.00
90.91
73.51
73.19
71.24
68.87
68.81
64.71
64.53
60.69
19.97
19.94
0.00

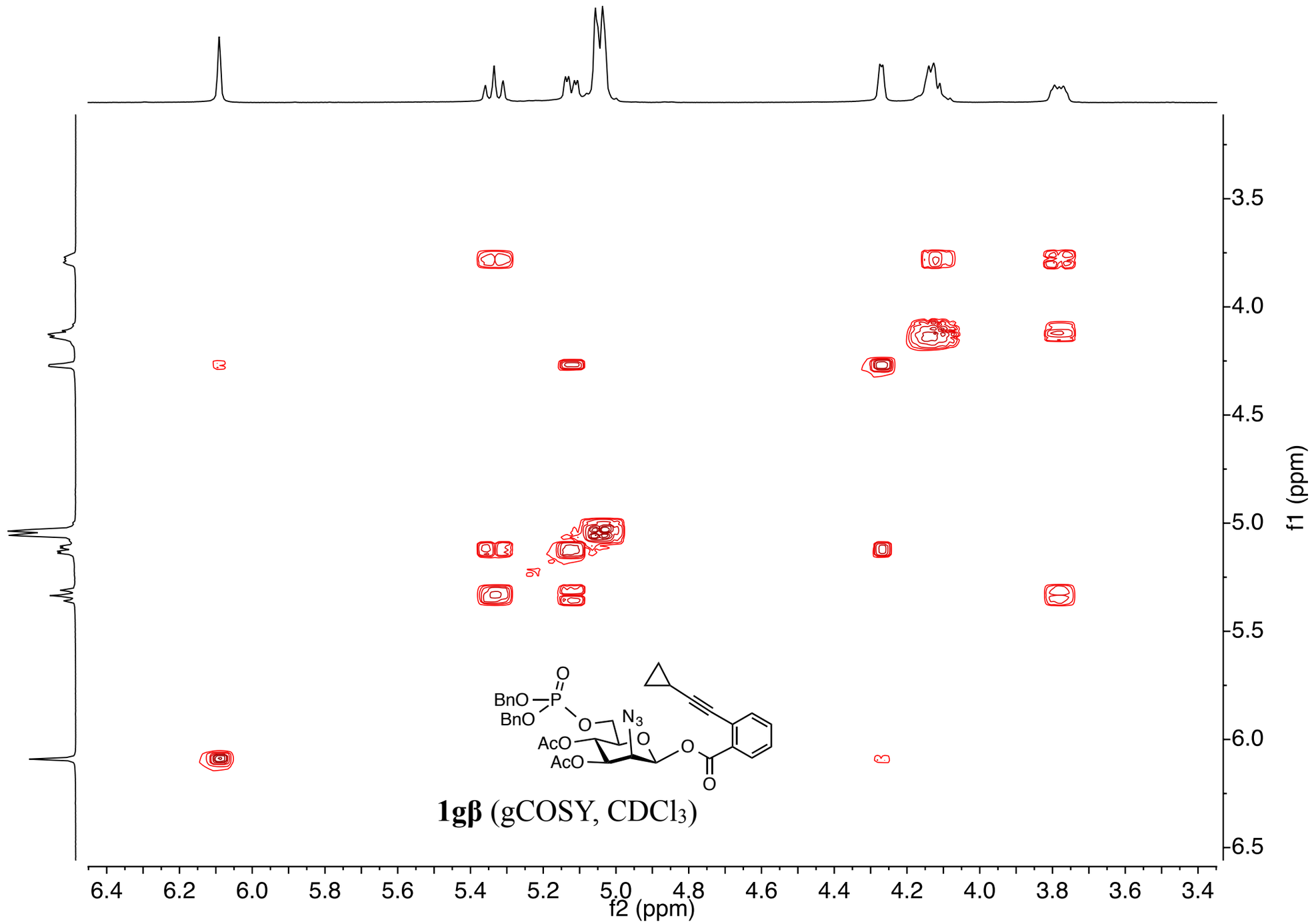


1gβ (^{13}C NMR, 101 MHz, $CDCl_3$)

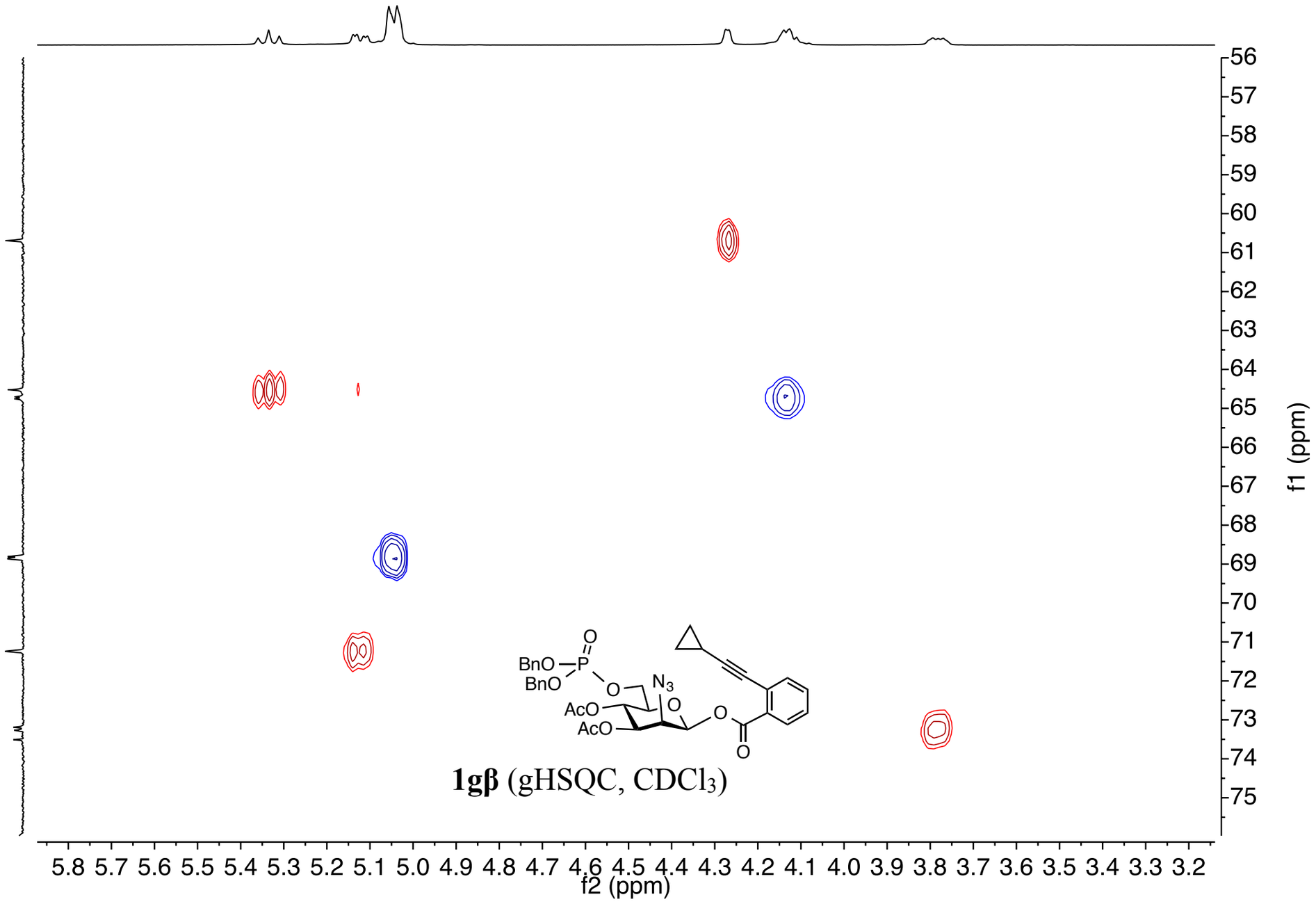


1gβ (^{31}P NMR, 162 MHz, $CDCl_3$)



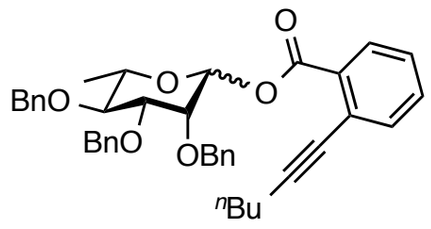


1gβ (gCOSY, $CDCl_3$)

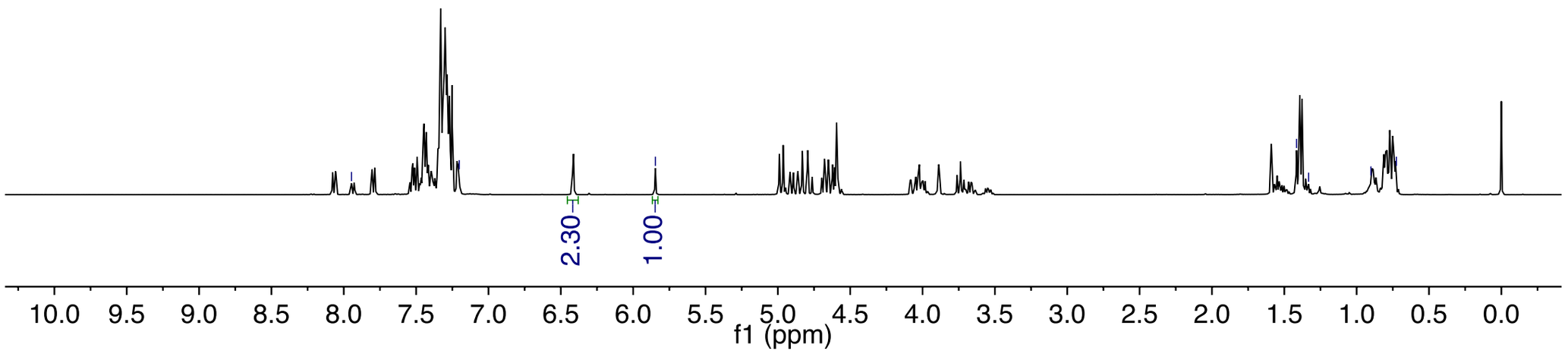


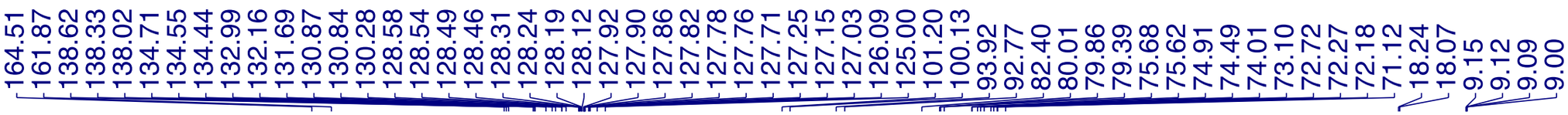
1gβ (gHSQC, $CDCl_3$)

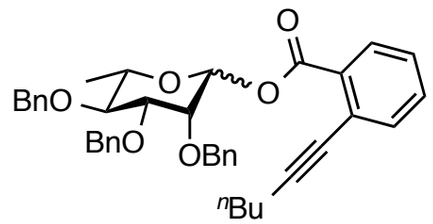
7.95
7.20
5.85
1.42
1.33
0.90
0.73



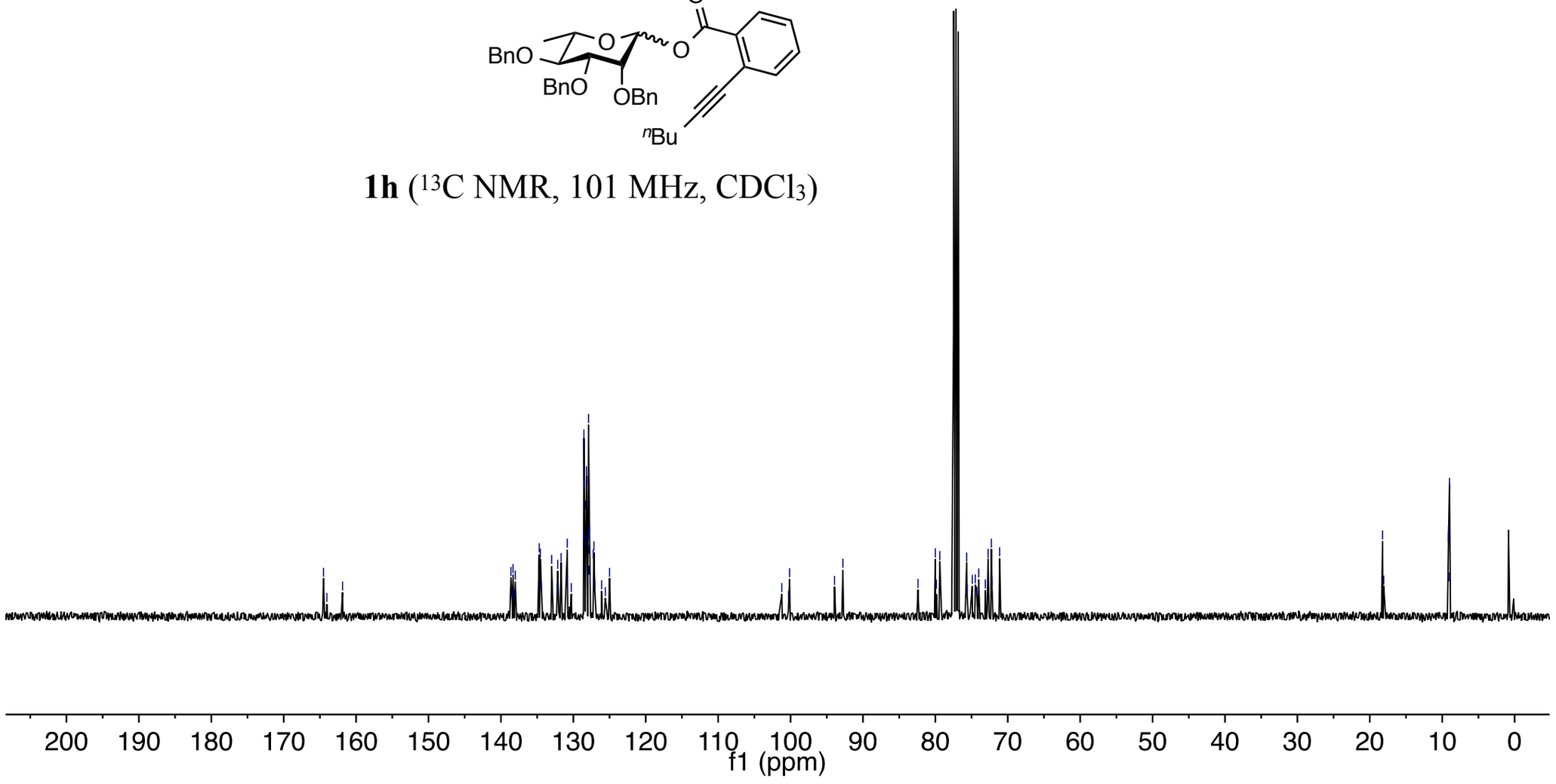
1h (^{1}H NMR, 400 MHz, $CDCl_3$)

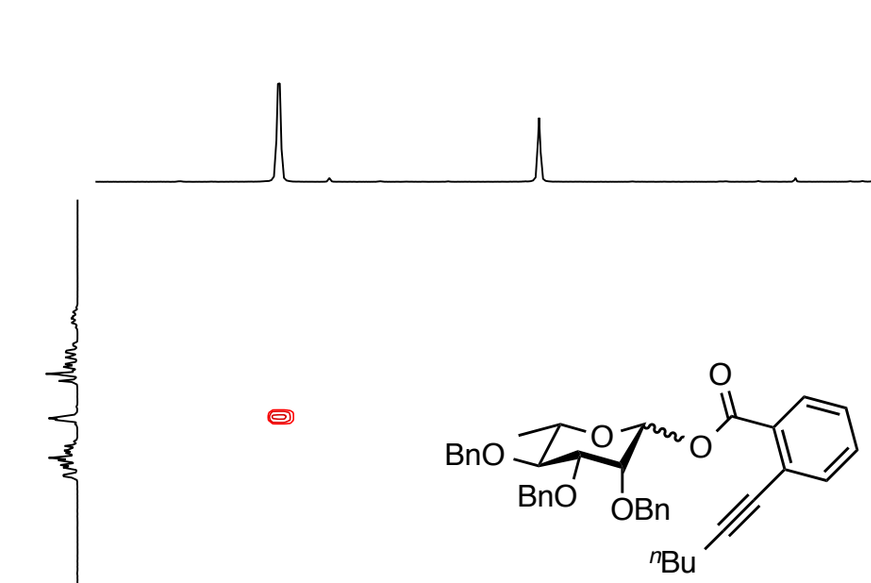




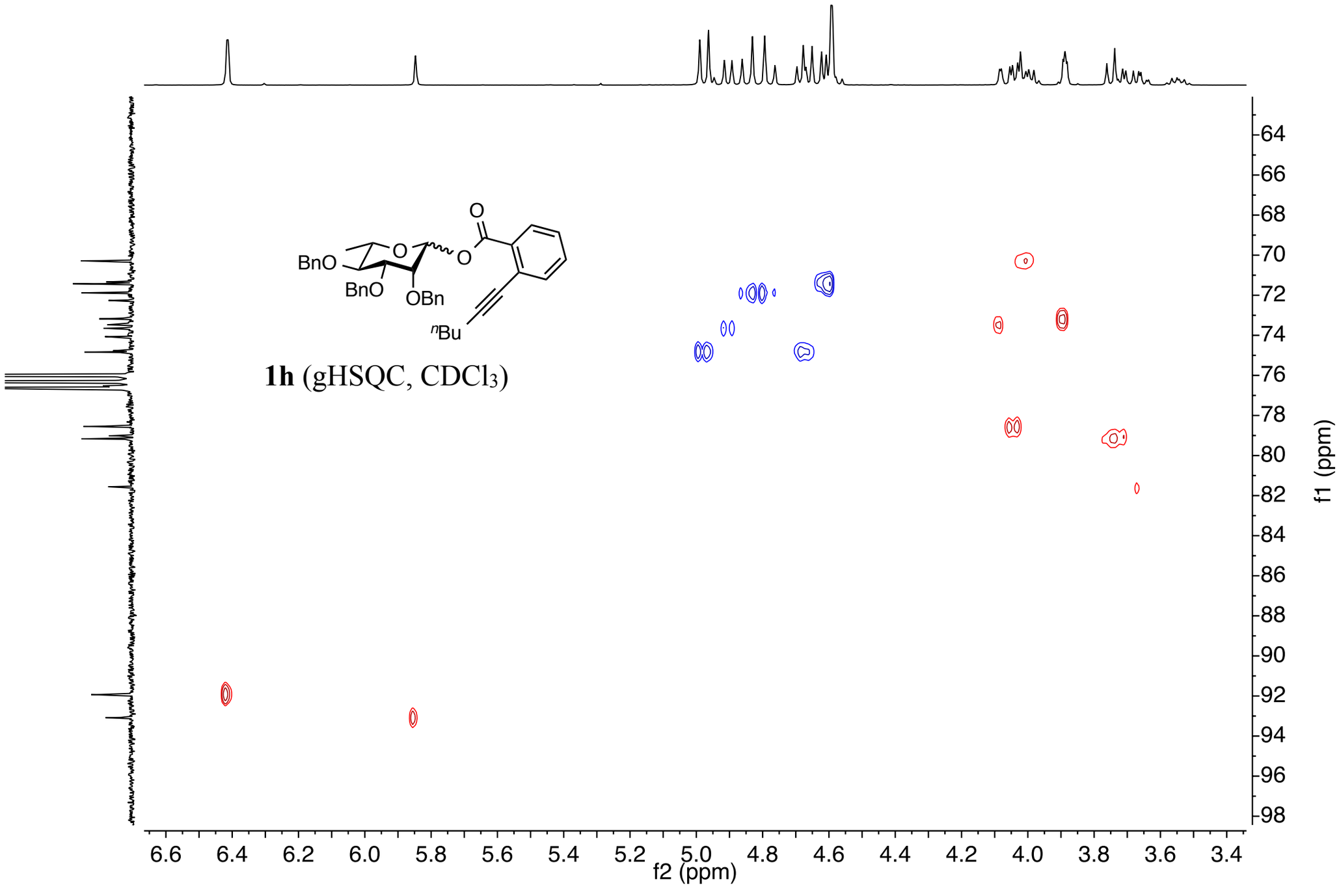


1h (^{13}C NMR, 101 MHz, $CDCl_3$)

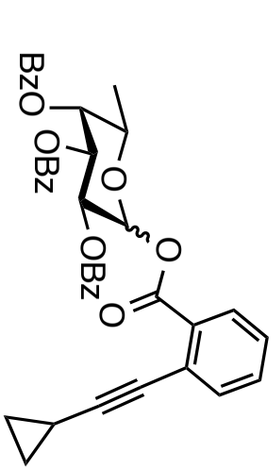


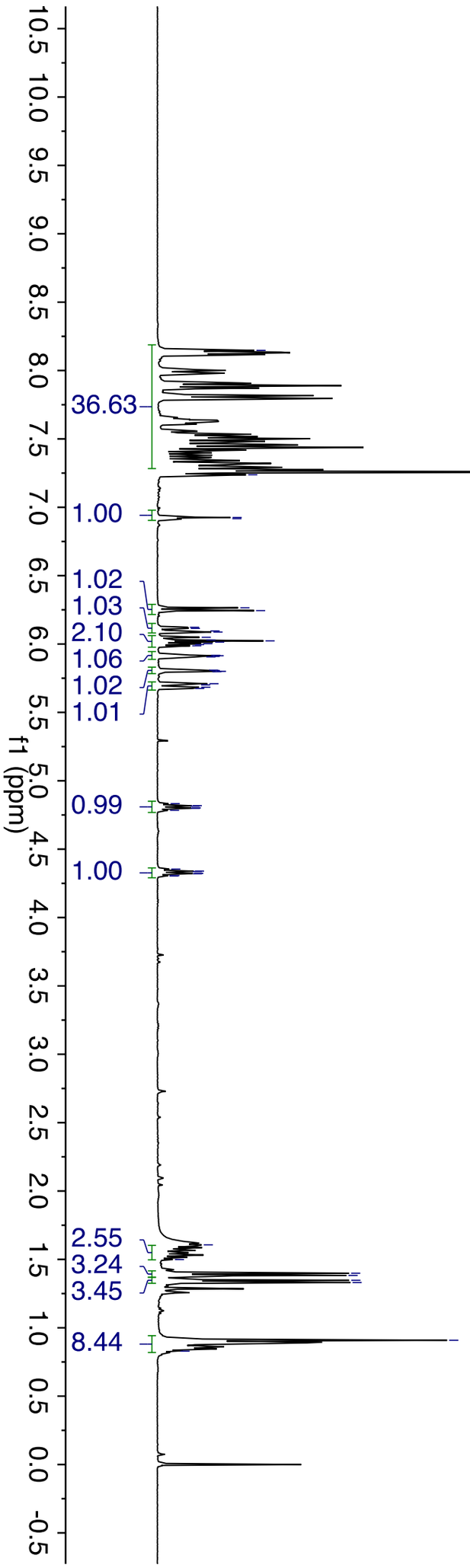


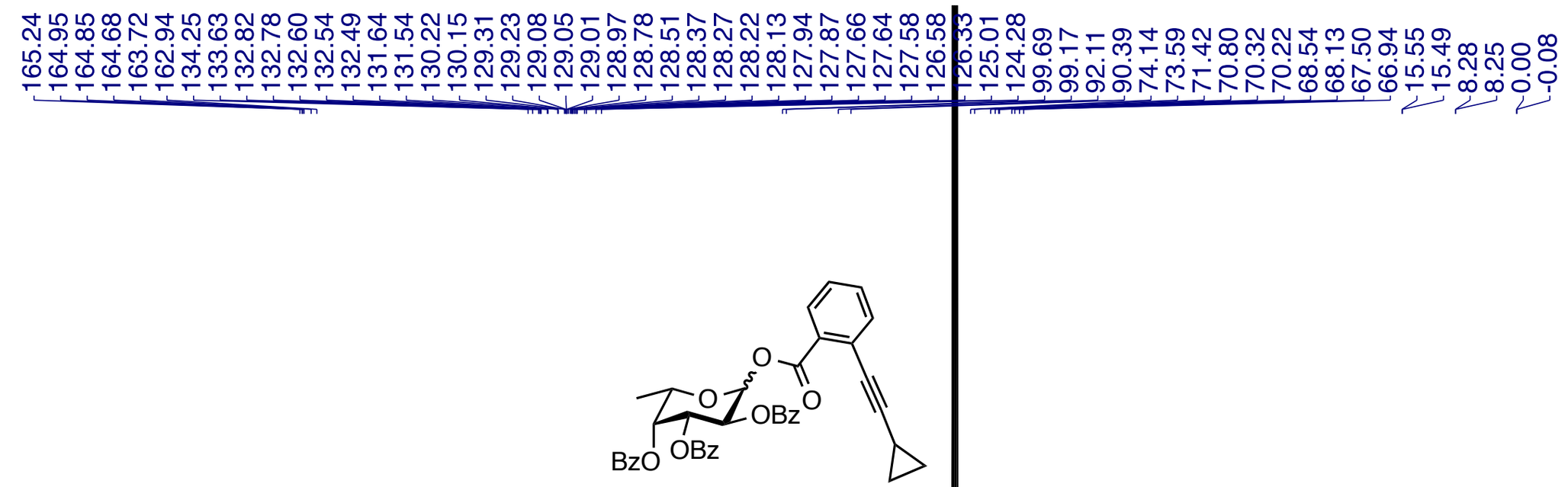
1h (gCOSY, $CDCl_3$)


BnO
BnO
OBn
O
O
O
nBu
1h (gHSQC, CDCl3)
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
f1 (ppm)
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
f2 (ppm)

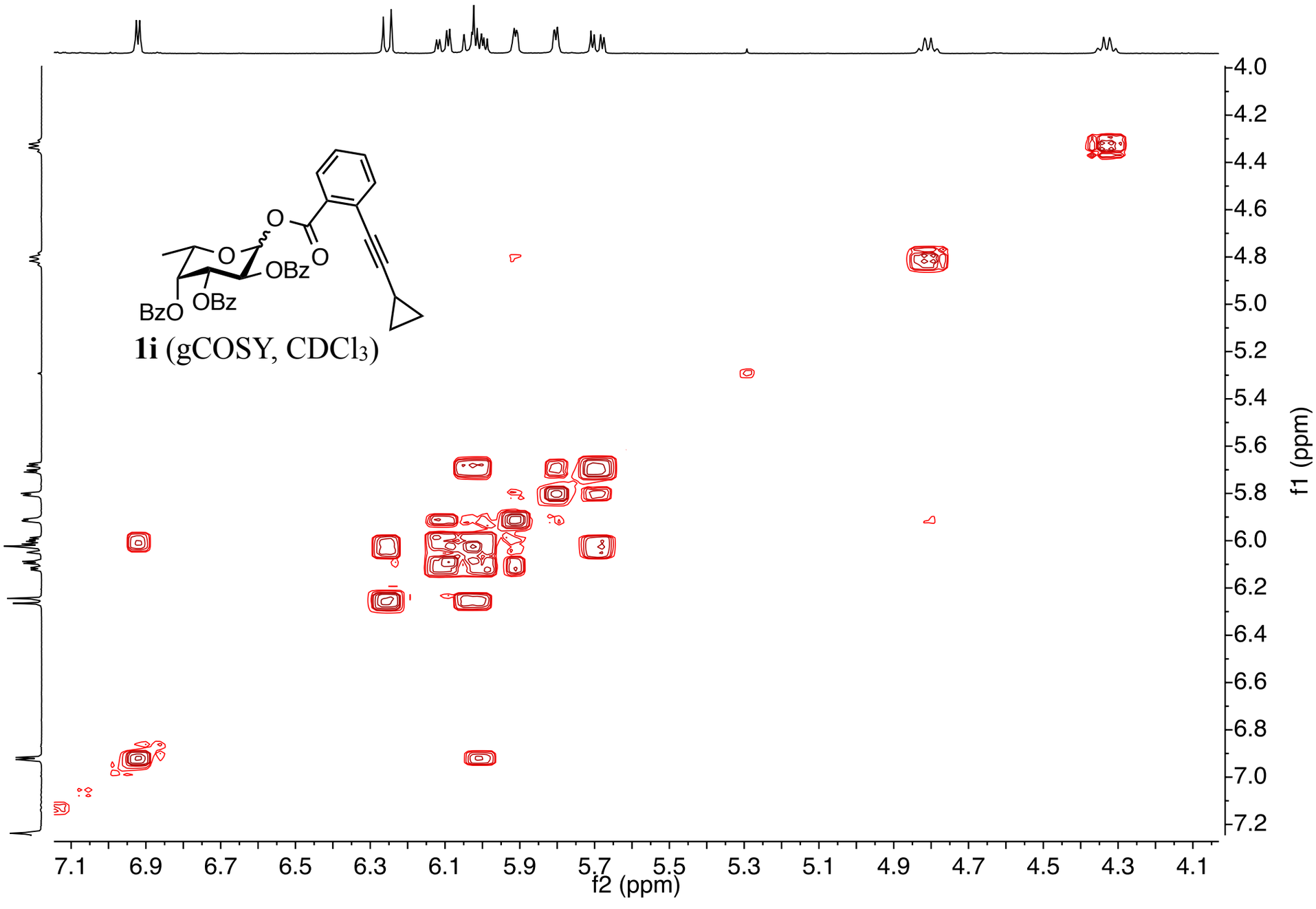
1i (^{1}H NMR, 400 MHz, $CDCl_3$)

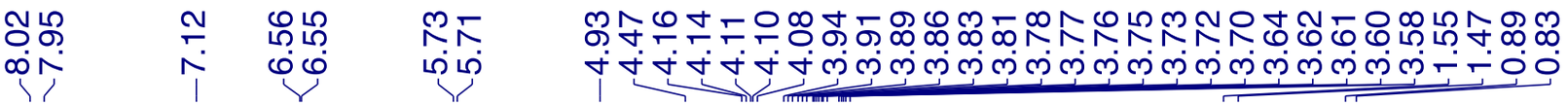


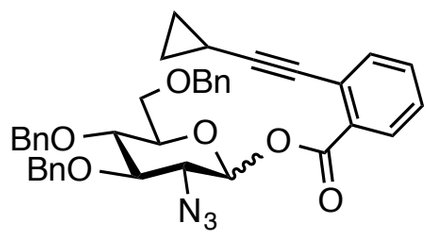




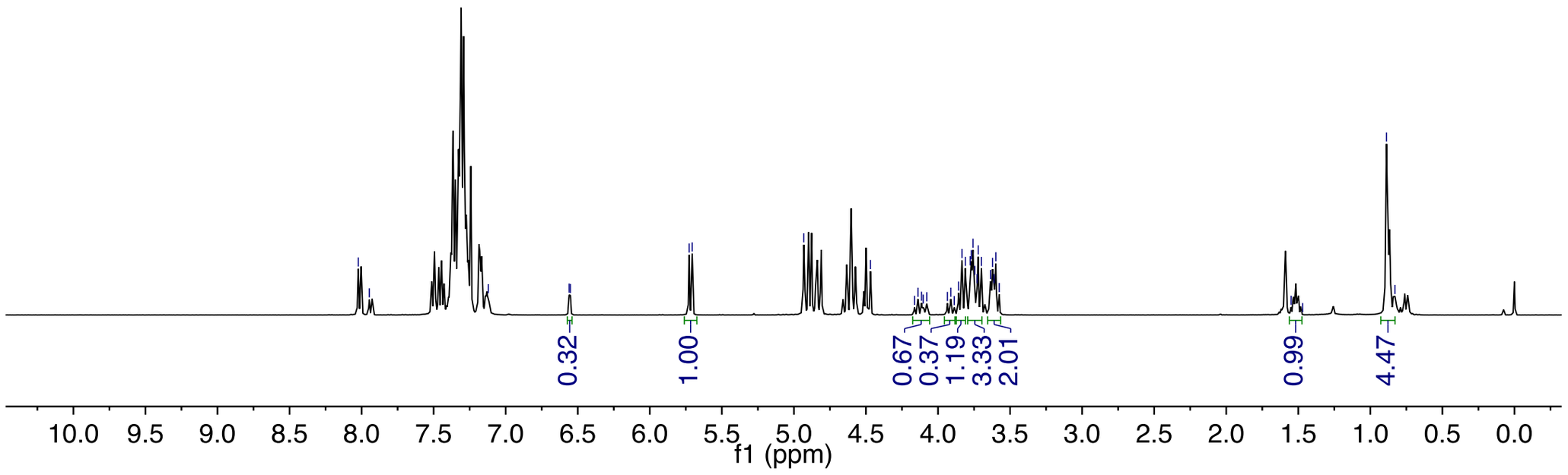
1i (^{13}C NMR, 101 MHz, $CDCl_3$)

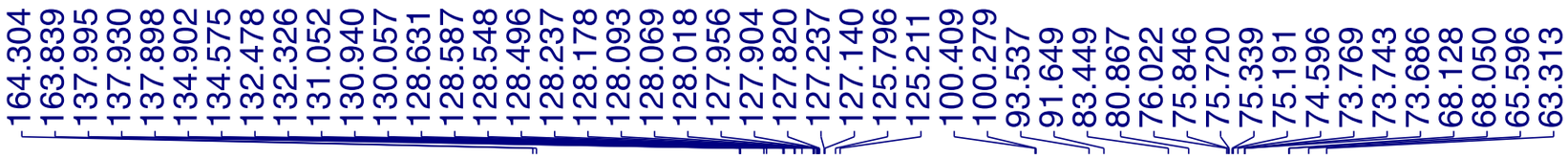

O
O
OBz
O
BzO
OBz
1i (gCOSY, CDCl3)
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
f1 (ppm)
7.1
6.9
6.7
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
f2 (ppm)

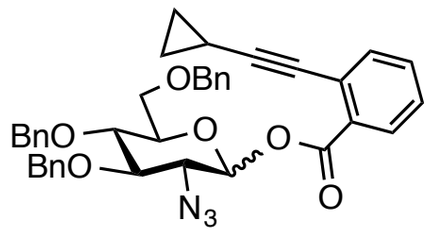




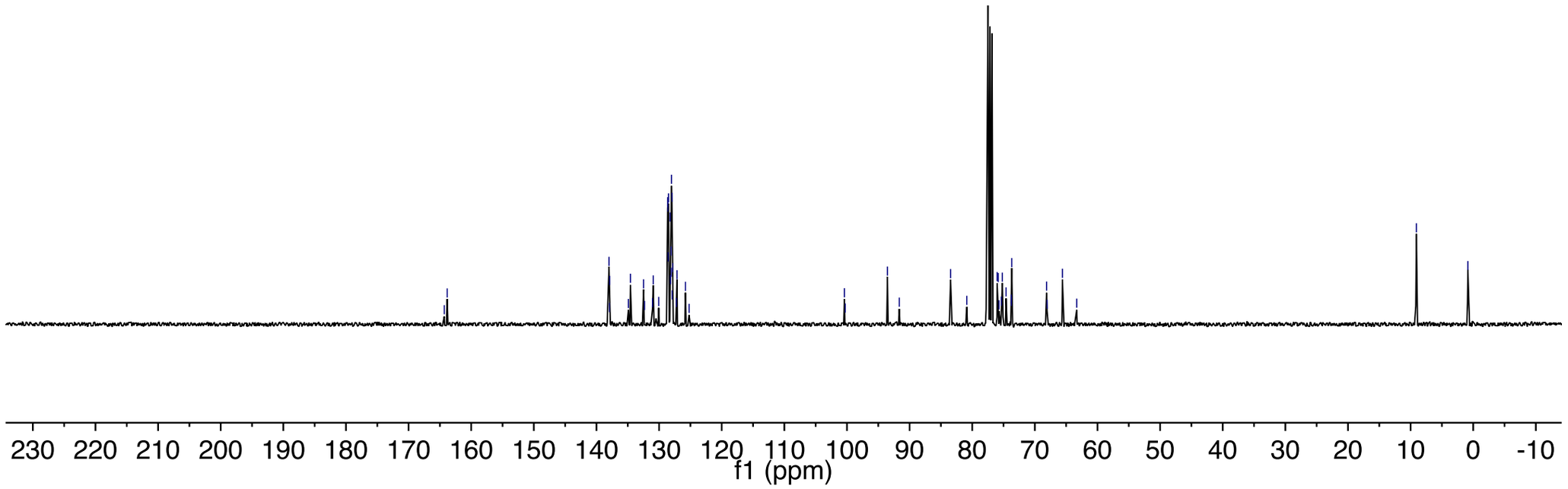
1j (^{1}H NMR, 400 MHz, $CDCl_3$)

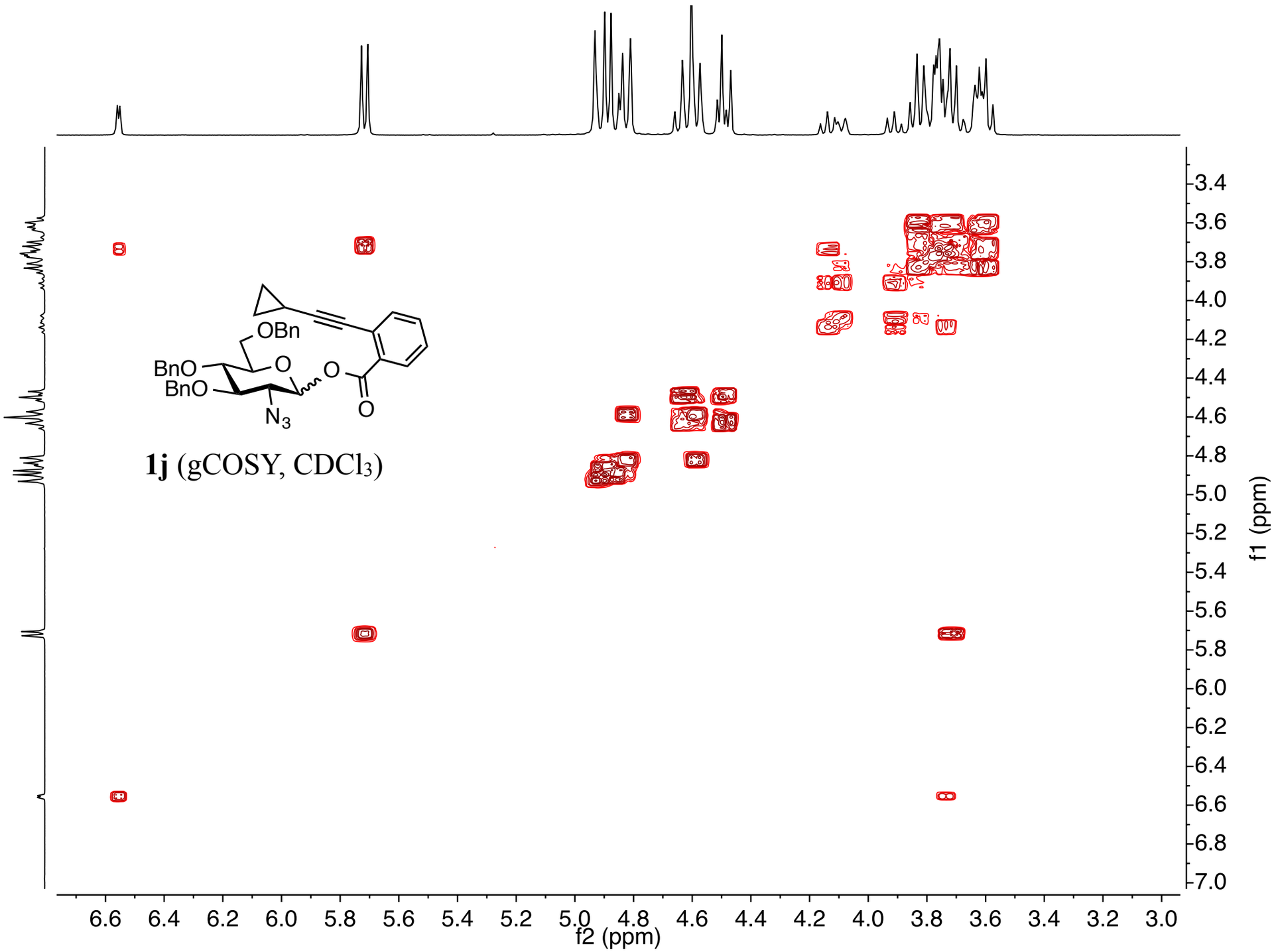


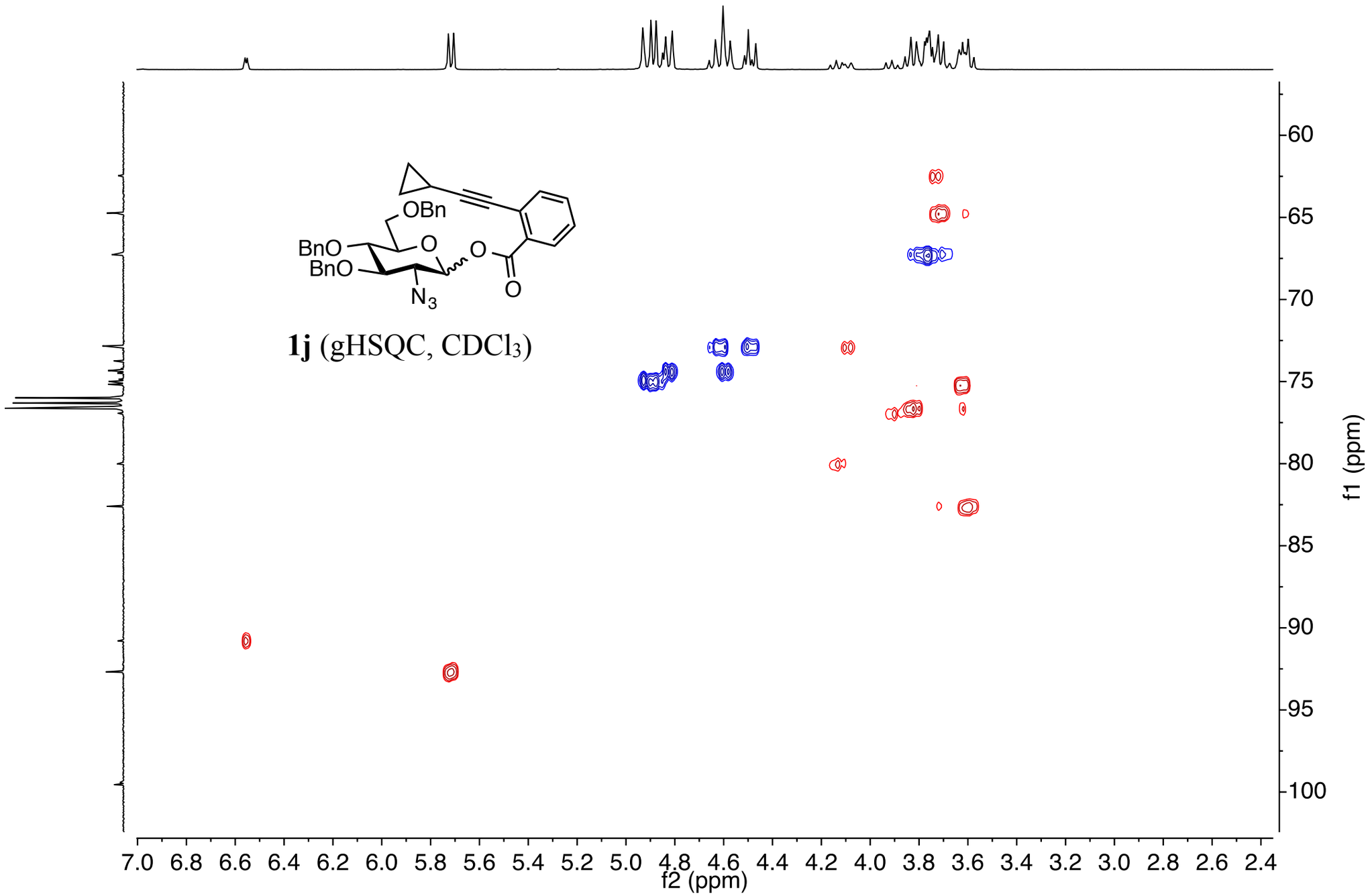


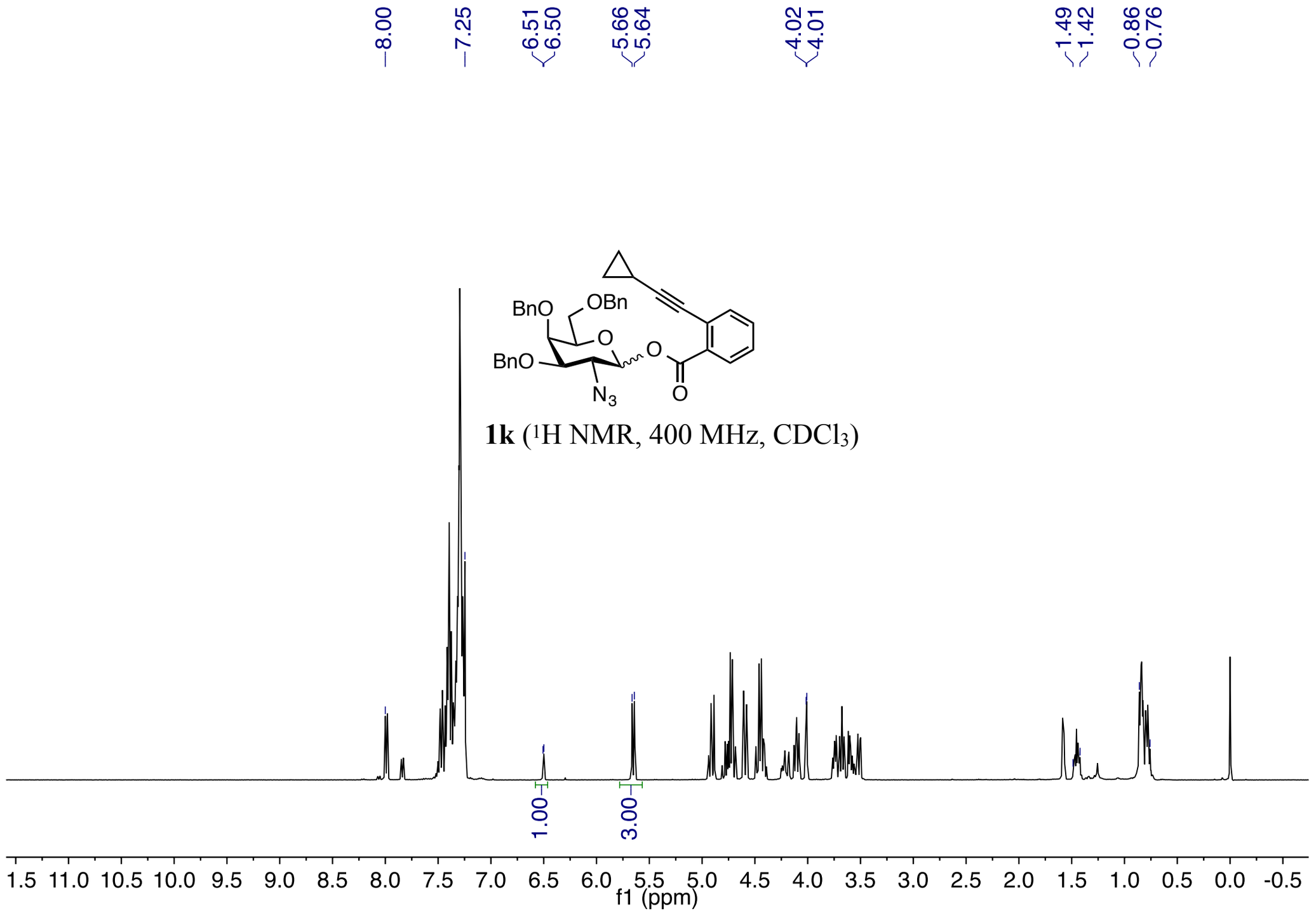


1j (^{13}C NMR, 101 MHz, $CDCl_3$)

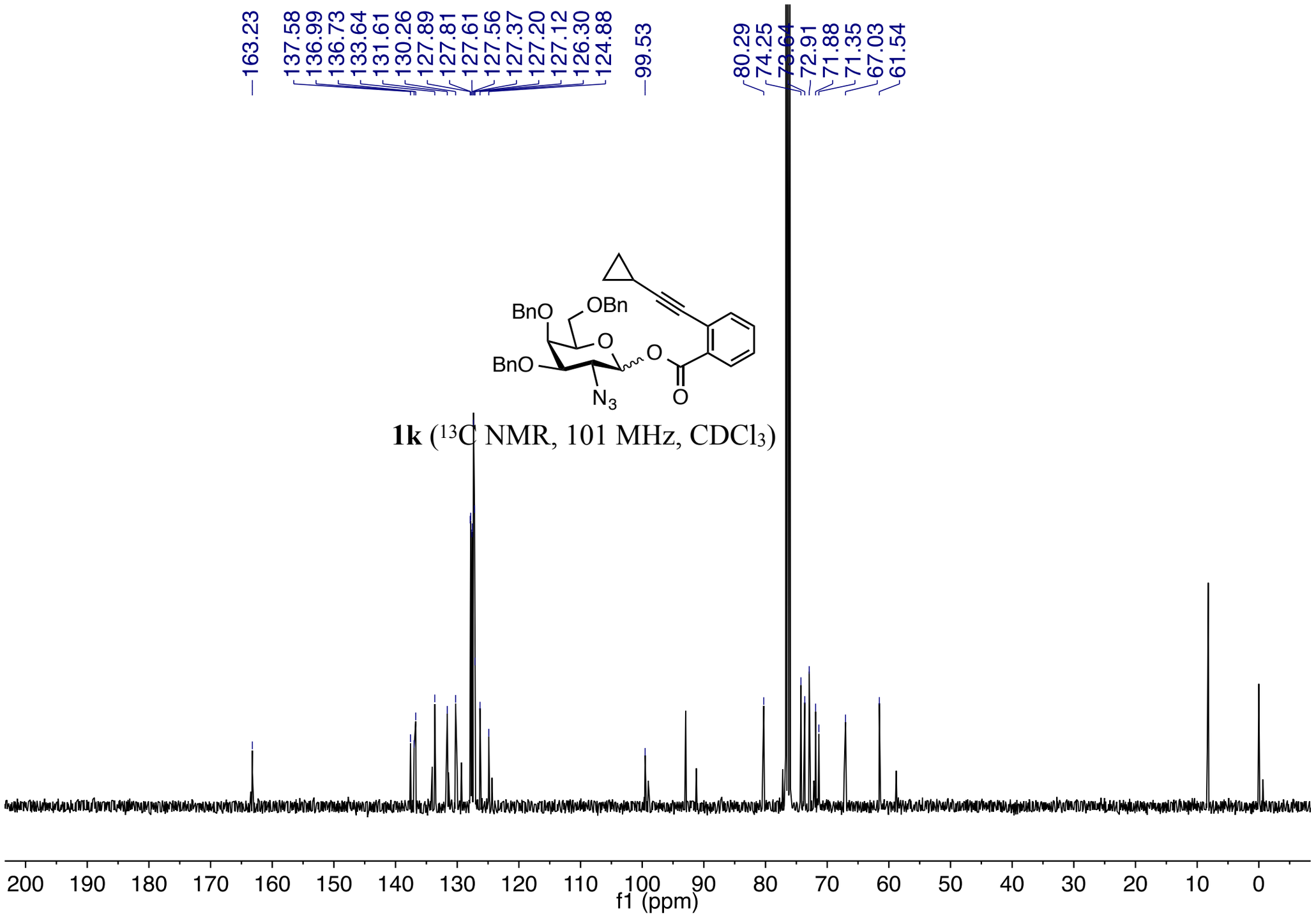



OBn
BnO
BnO
O
O
O
N3
1j (gCOSY, CDCl3)
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
f1 (ppm)
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
f2 (ppm)

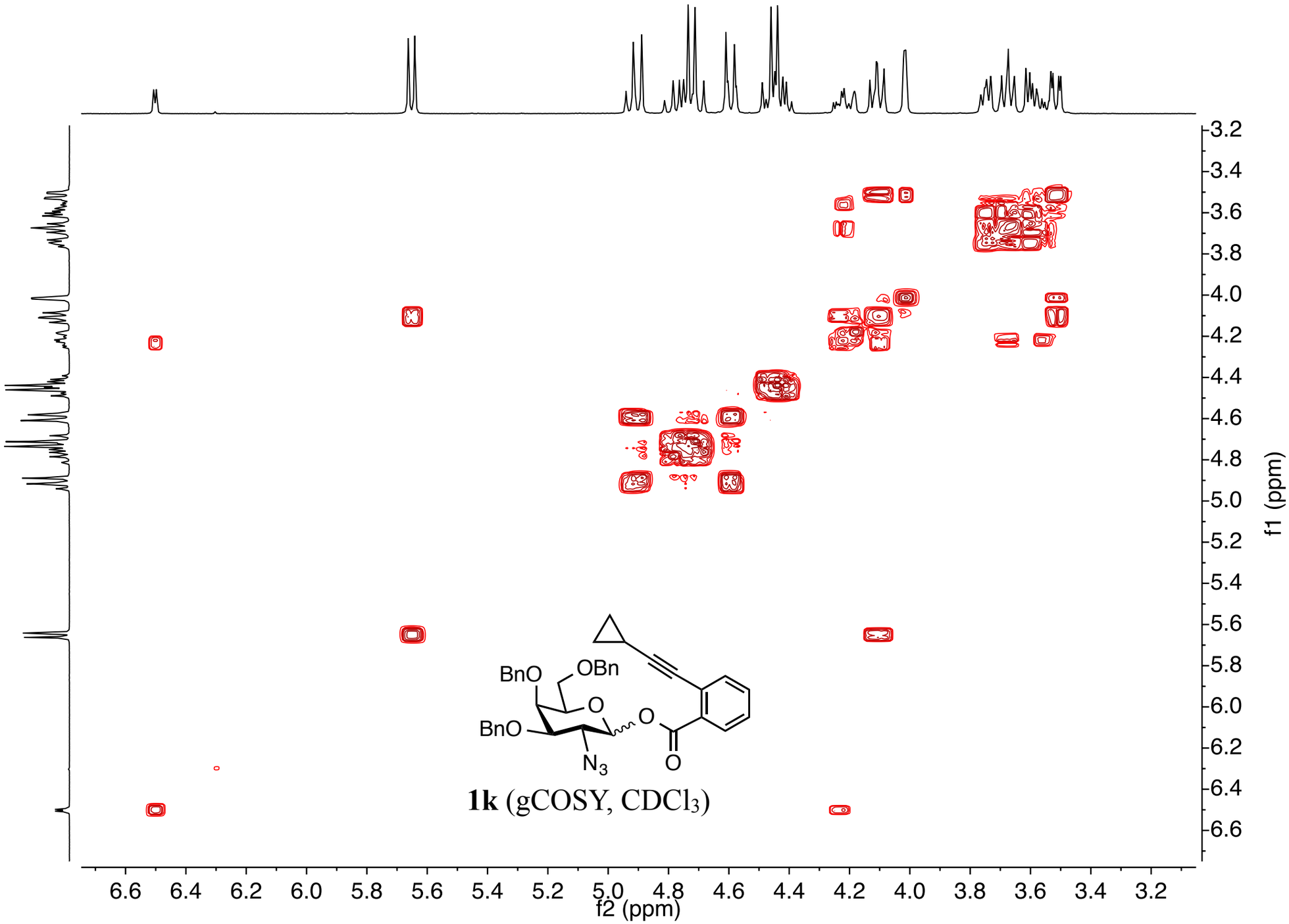

OBn
BnO
BnO
O
O
O
N3
1j (gHSQC, CDCl3)
60
65
70
75
80
85
90
95
100
f1 (ppm)
7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4
f2 (ppm)



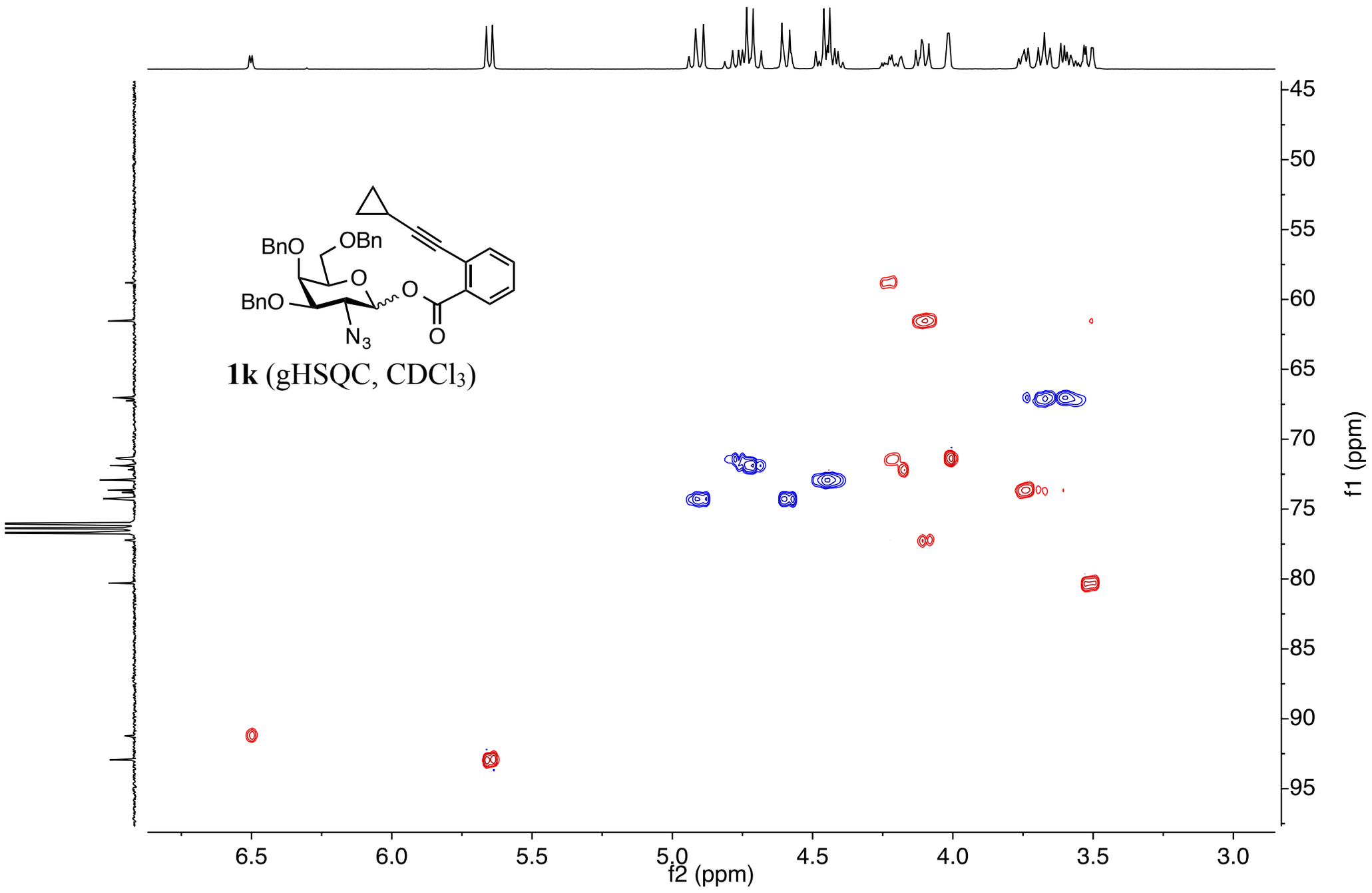
1k (^{1}H NMR, 400 MHz, $CDCl_3$)

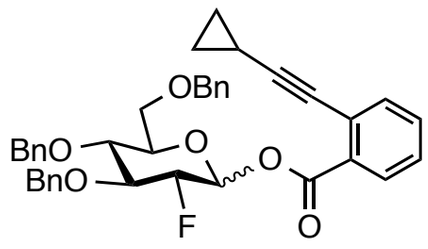


1k (^{13}C NMR, 101 MHz, $CDCl_3$)

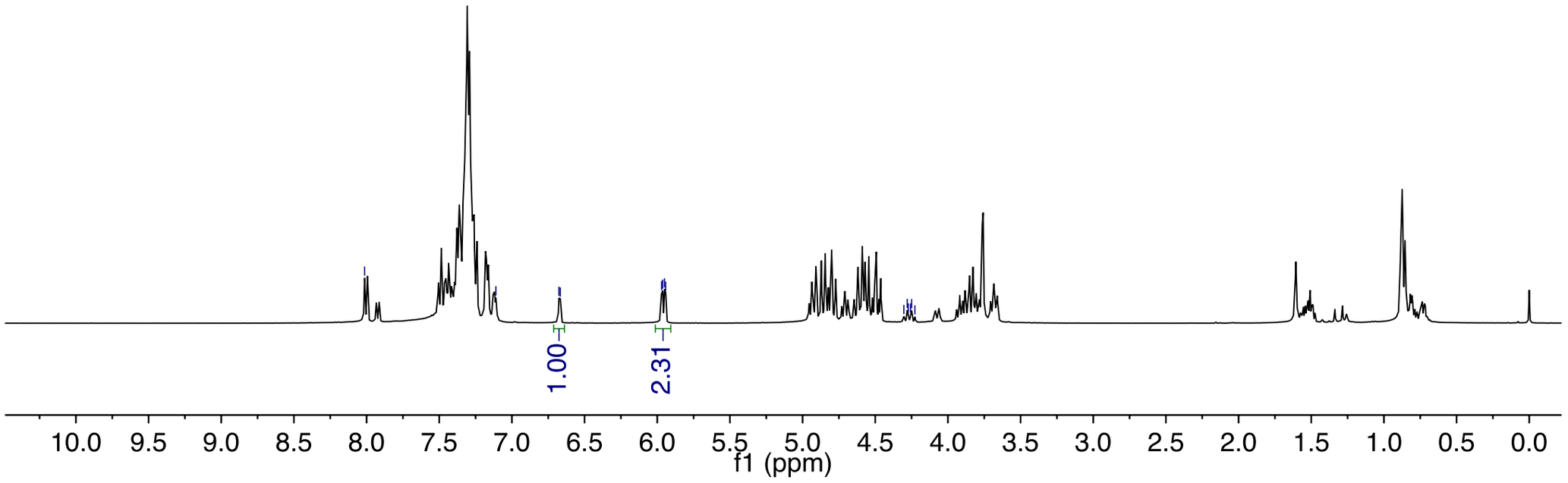


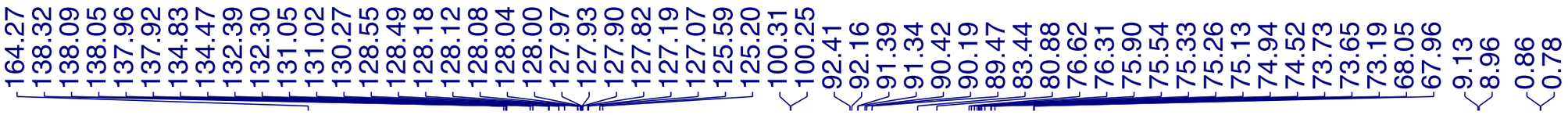
1k (gCOSY, $CDCl_3$)

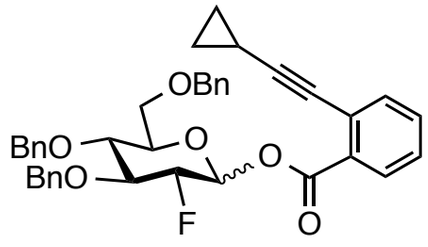

BnO
OBn
O
BnO
O
N3
O
1k (gHSQC, CDCl3)
45
50
55
60
65
70
75
80
85
90
95
f1 (ppm)
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
f2 (ppm)



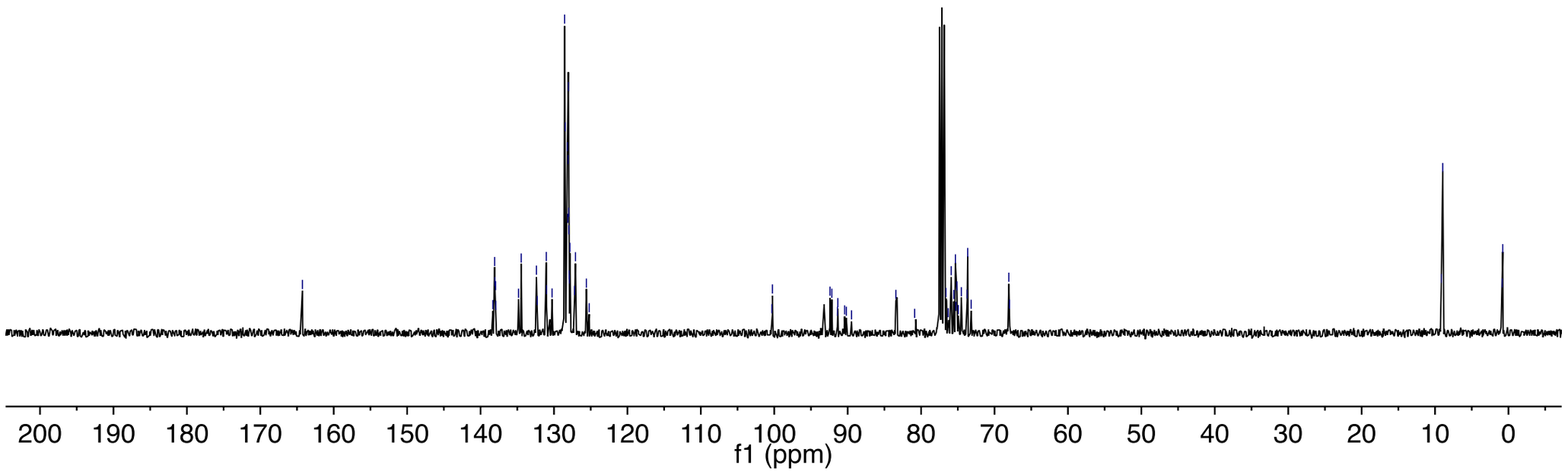
11 (^{1}H NMR, 400 MHz, $CDCl_3$)



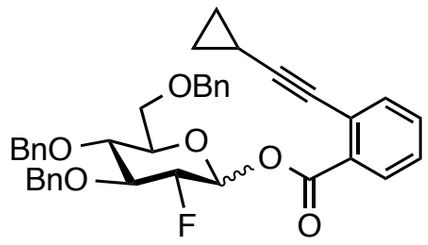




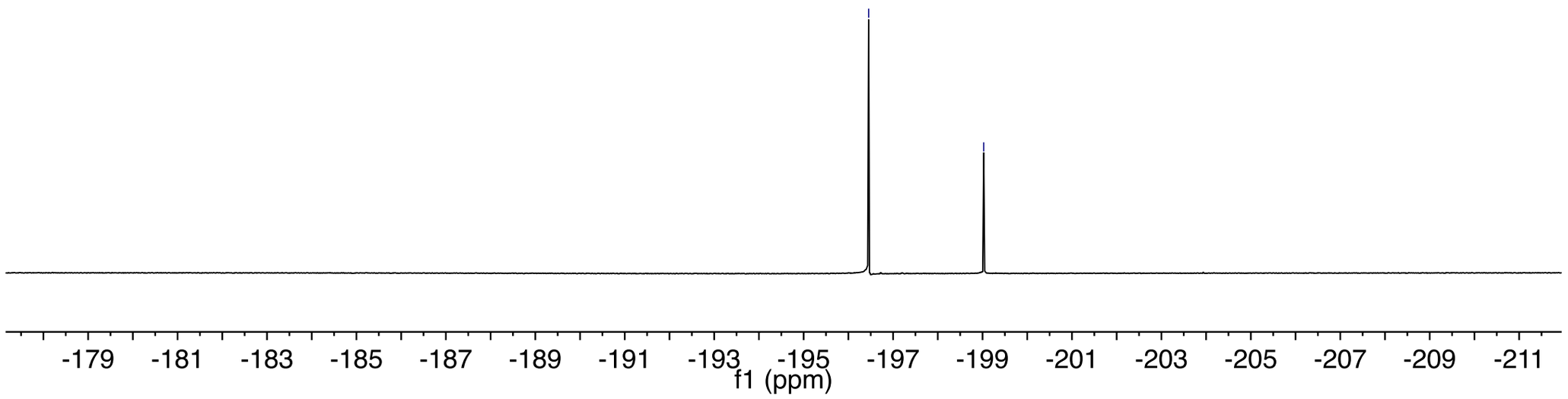
1l (^{13}C NMR, 101 MHz, $CDCl_3$)

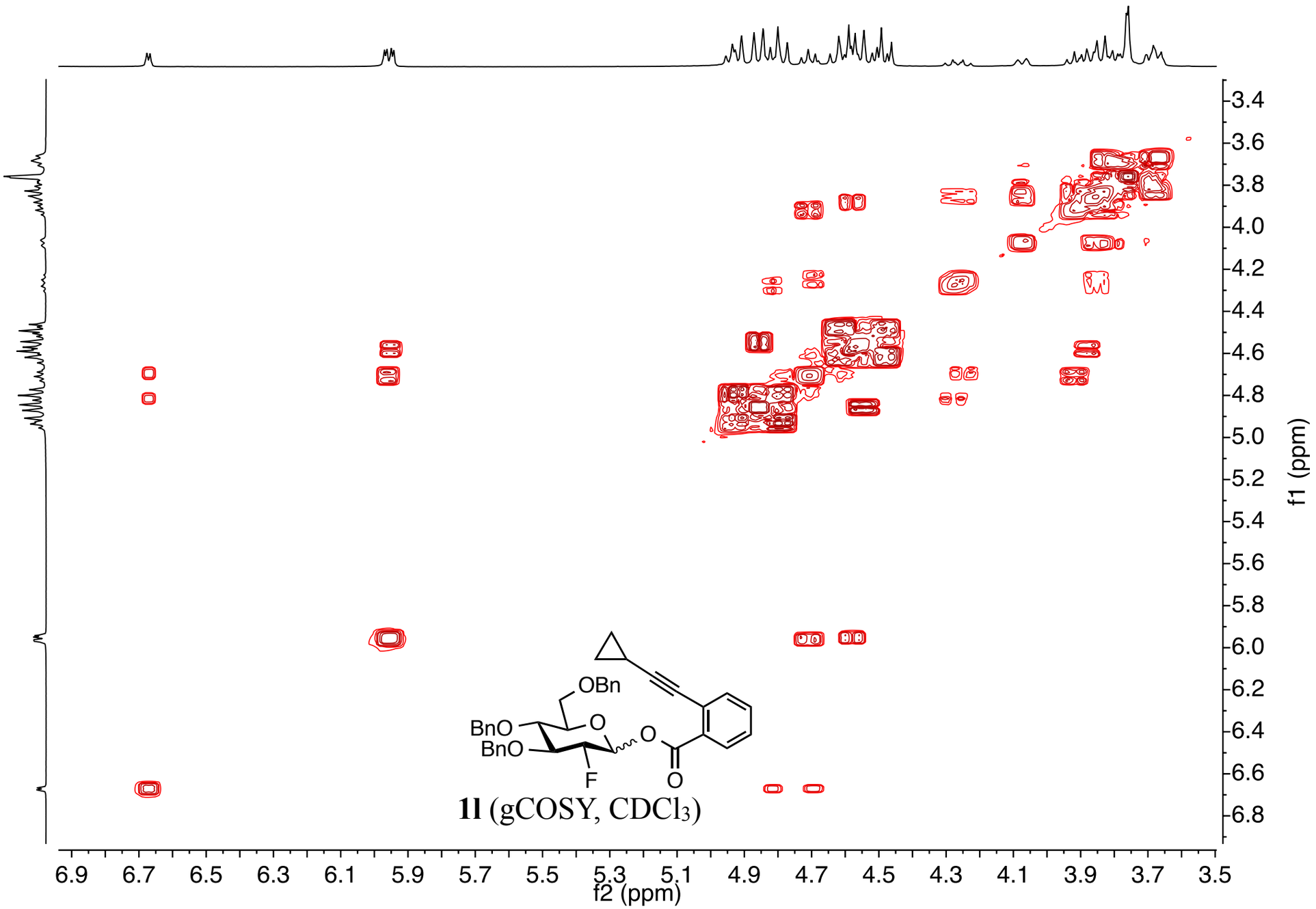


-196.45
-199.03

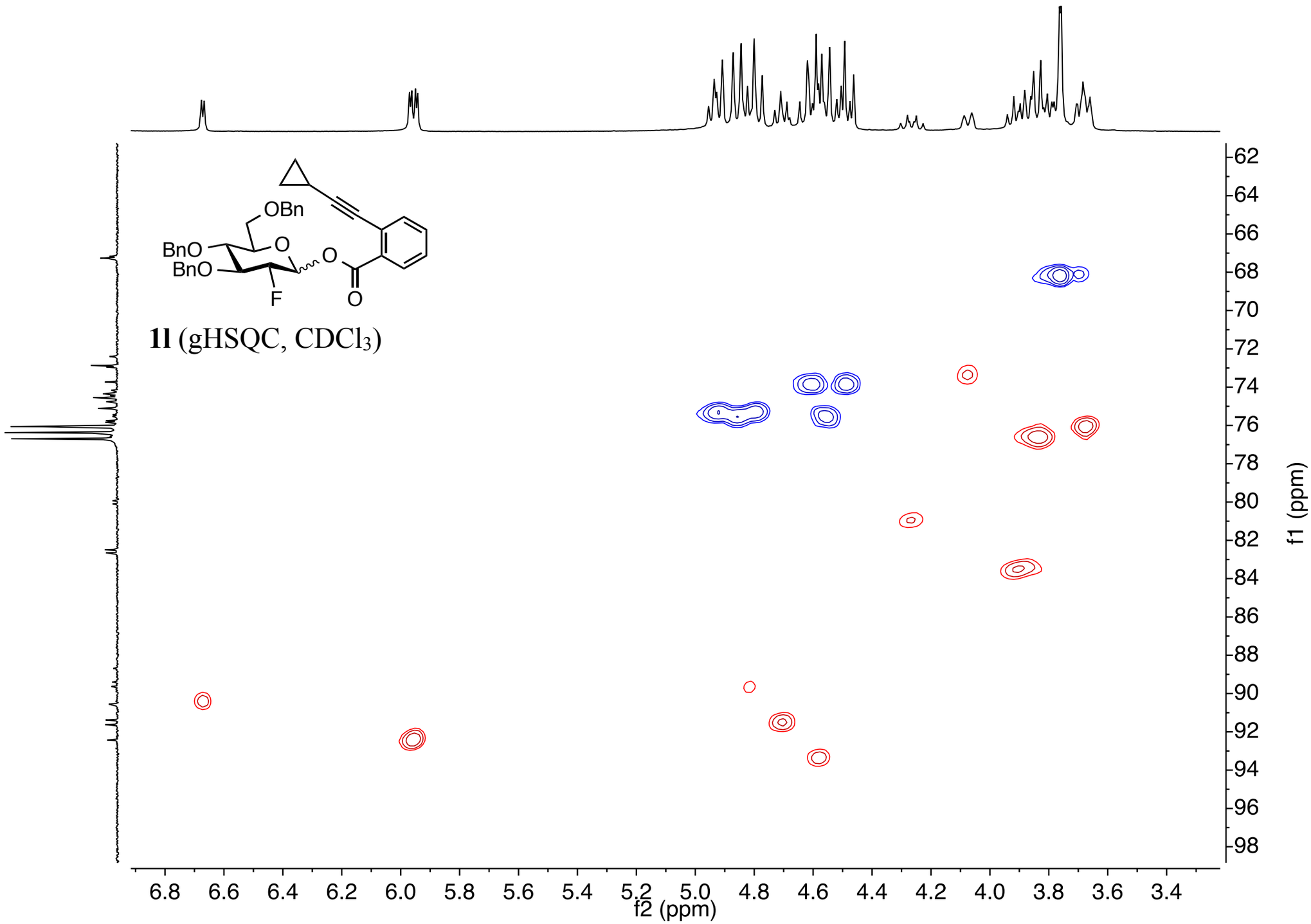


1l (^{19}F NMR)



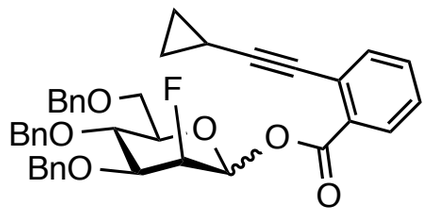


1l (gCOSY, $CDCl_3$)

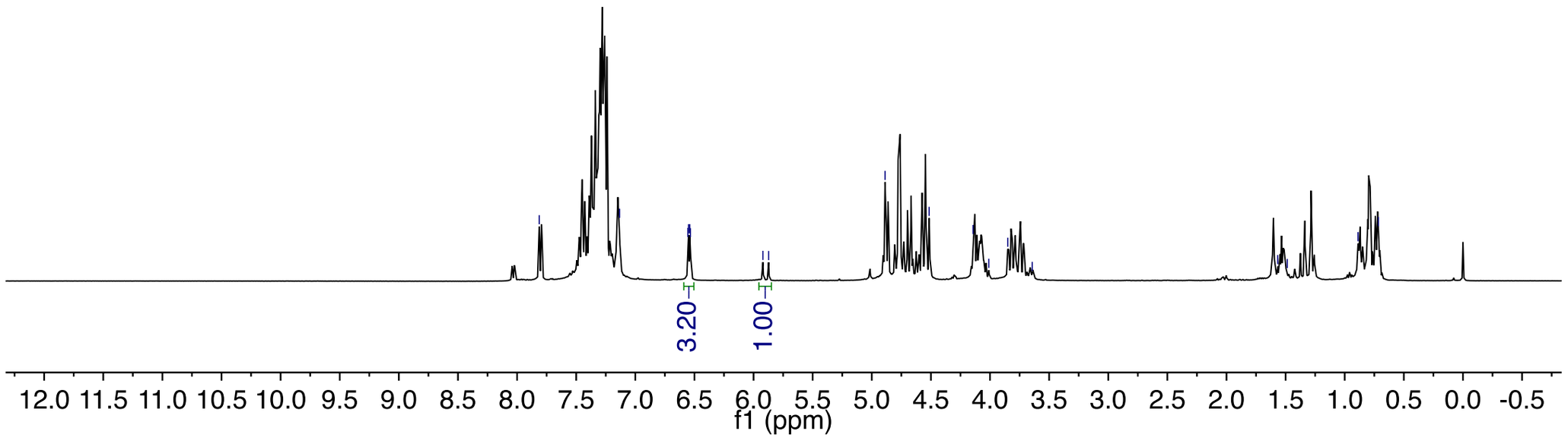


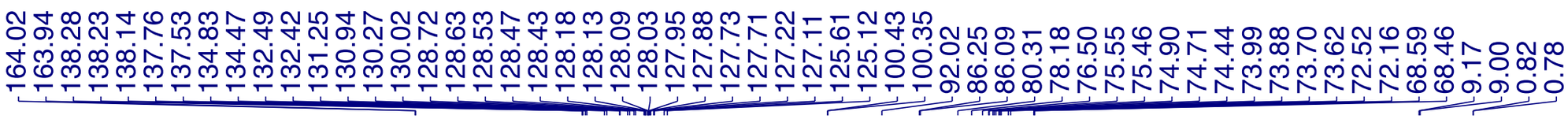
11 (gHSQC, $CDCl_3$)

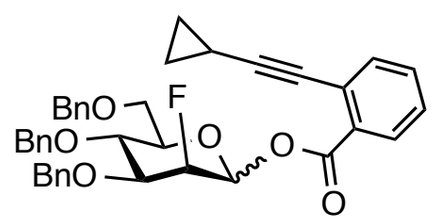
7.81
7.13
6.56
6.55
6.54
6.53
5.92
5.87
4.89
4.51
4.14
4.01
3.85
3.64
1.57
1.49
0.89
0.71



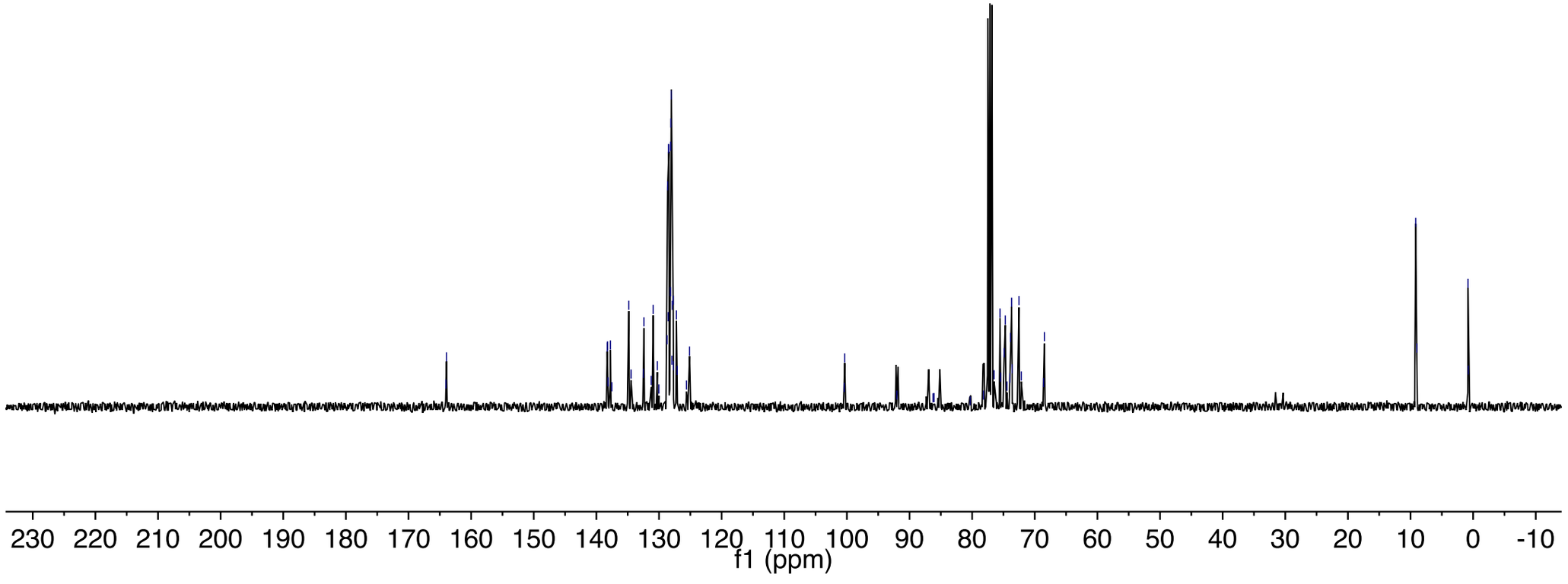
1m (^{1}H NMR, 400 MHz, $CDCl_3$)





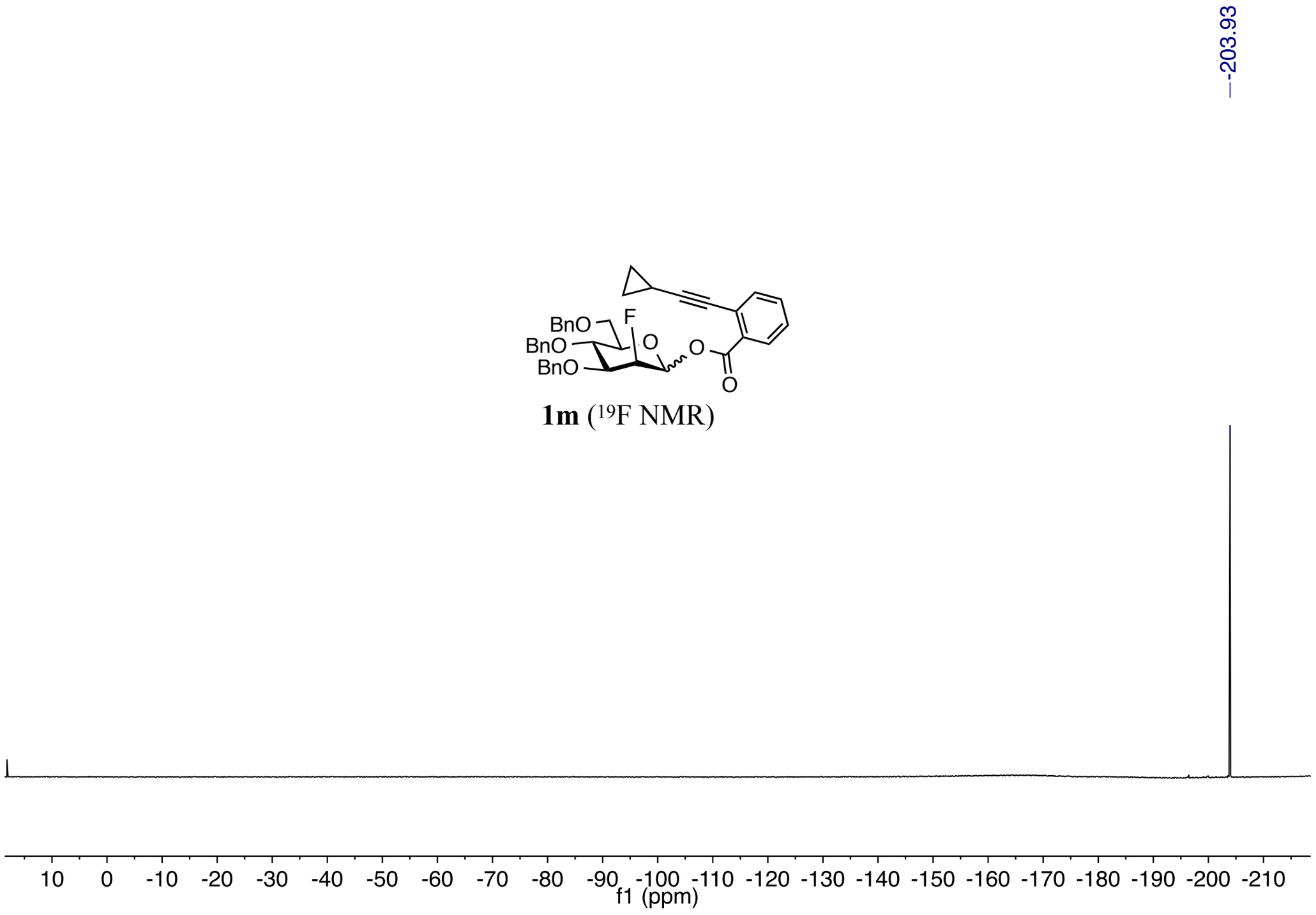


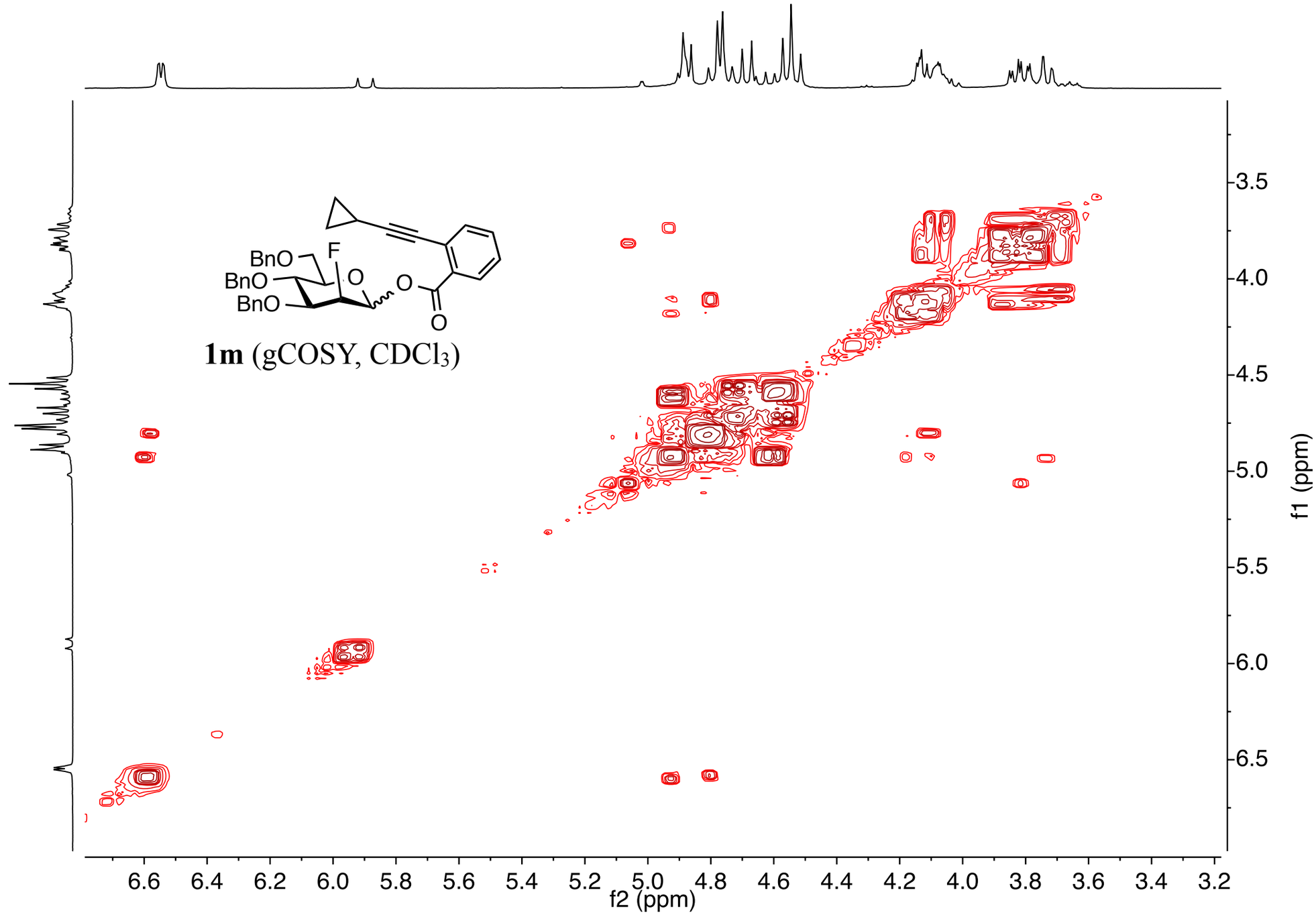
1m (^{13}C NMR, 101 MHz, $CDCl_3$)

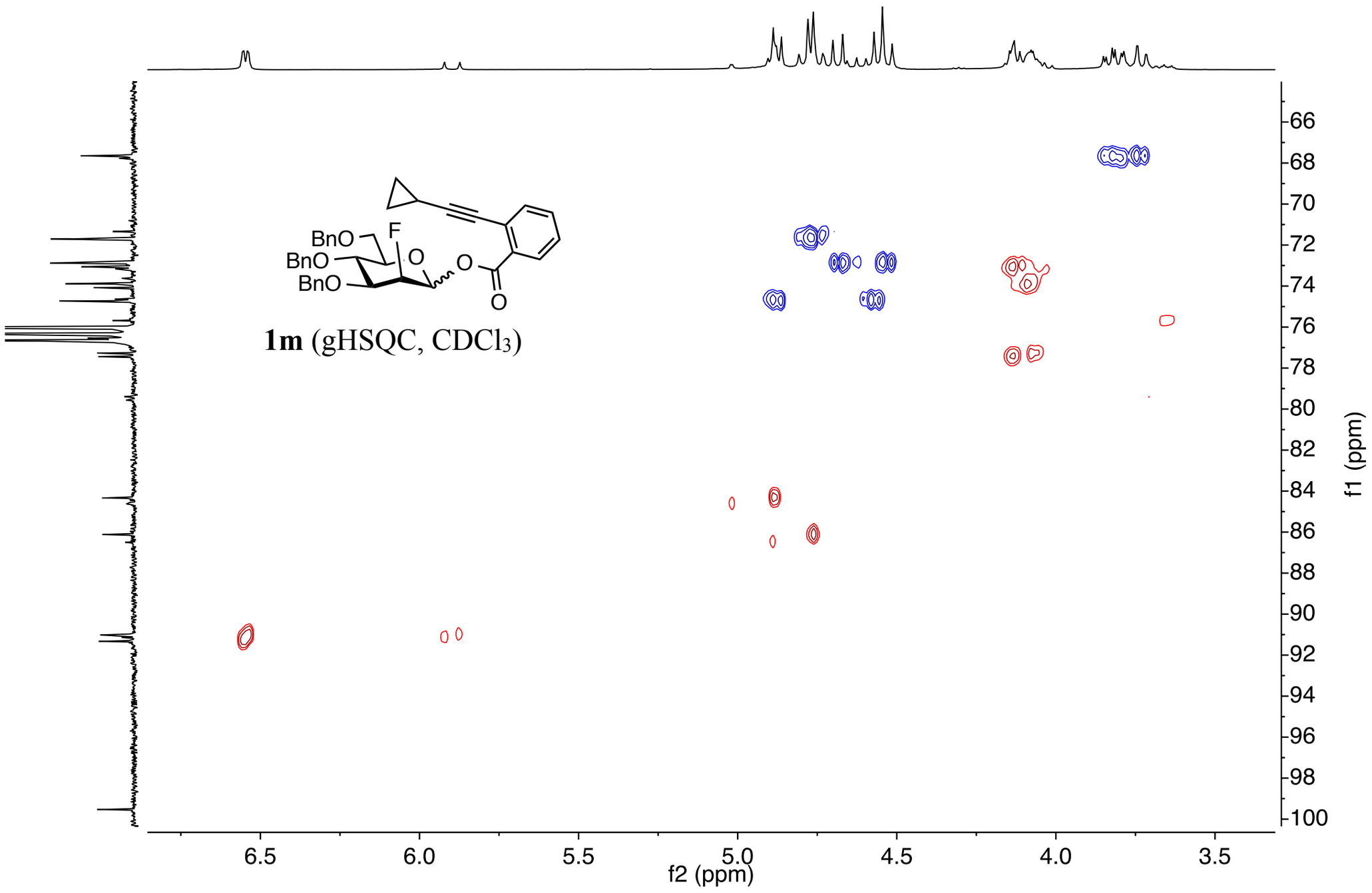


BnO
BnO
BnO
F
O
O
O

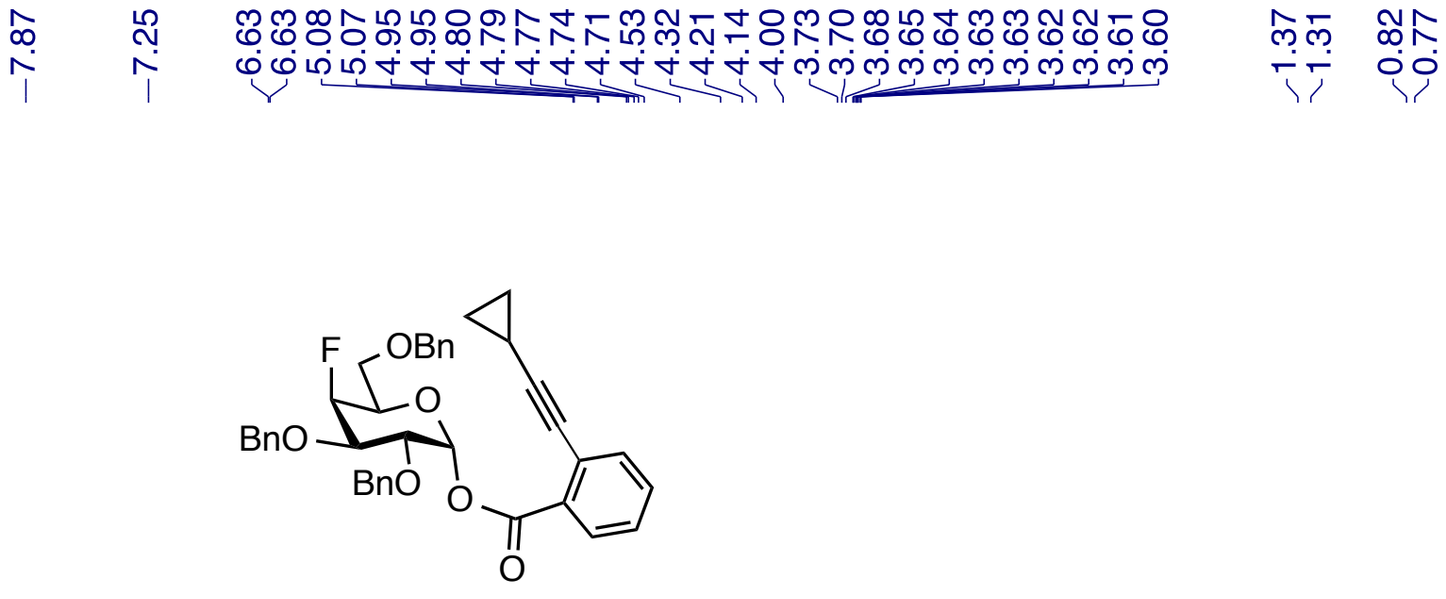
1m (^{19}F NMR)


-203.93
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)

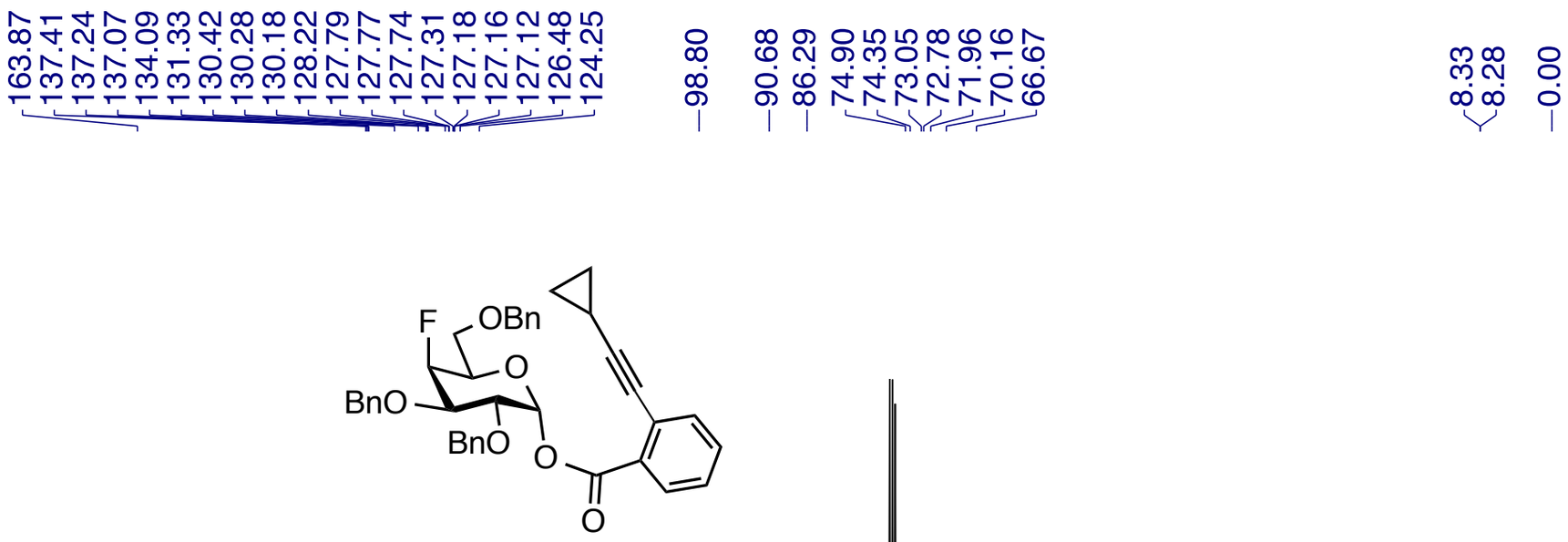

BnO
BnO
BnO
F
O
O
O
1m (gCOSY, CDCl3)
3.5
4.0
4.5
5.0
5.5
6.0
6.5
f1 (ppm)
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)



1m (gHSQC, $CDCl_3$)



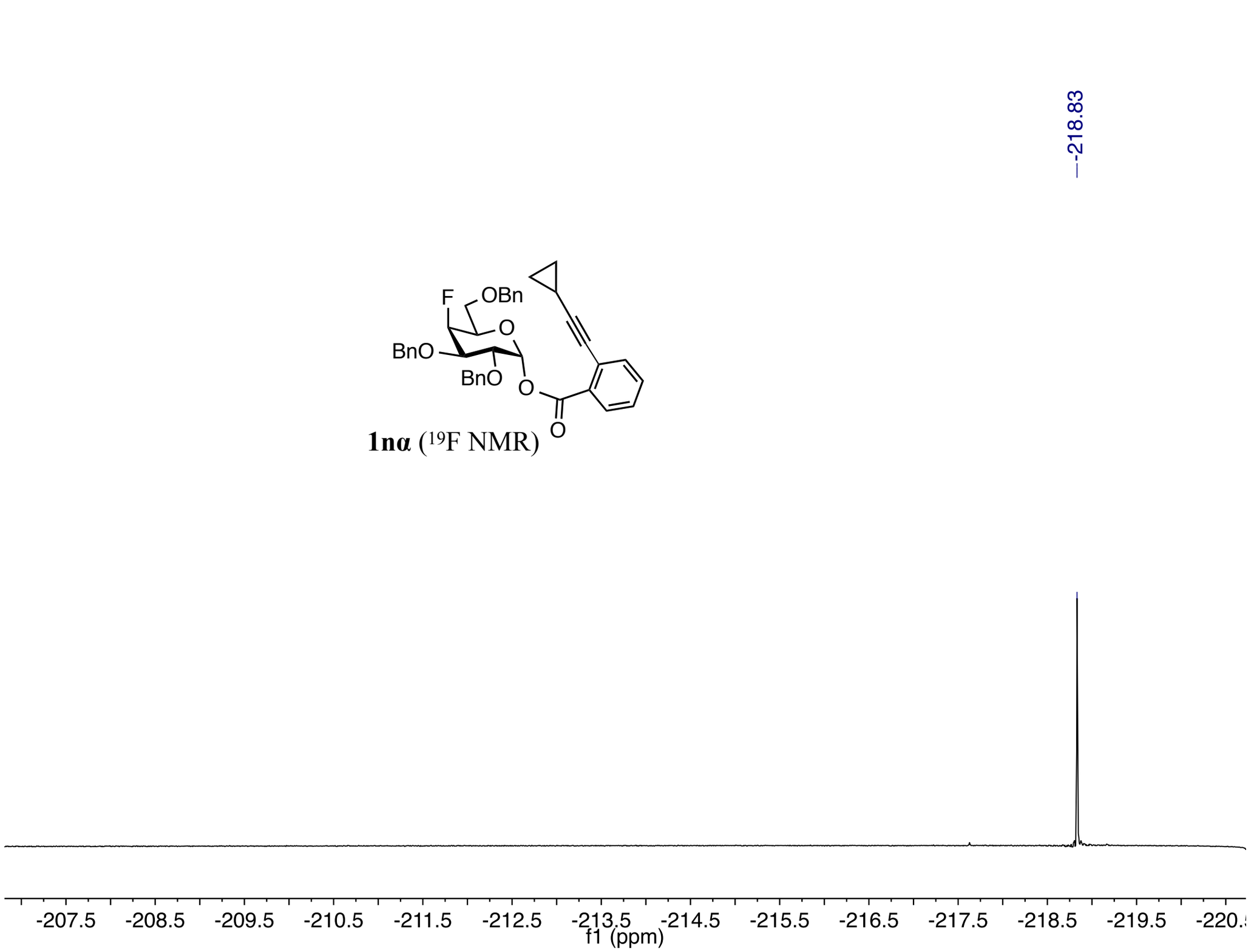
1nα (^{1}H NMR, 400 MHz, $CDCl_3$)

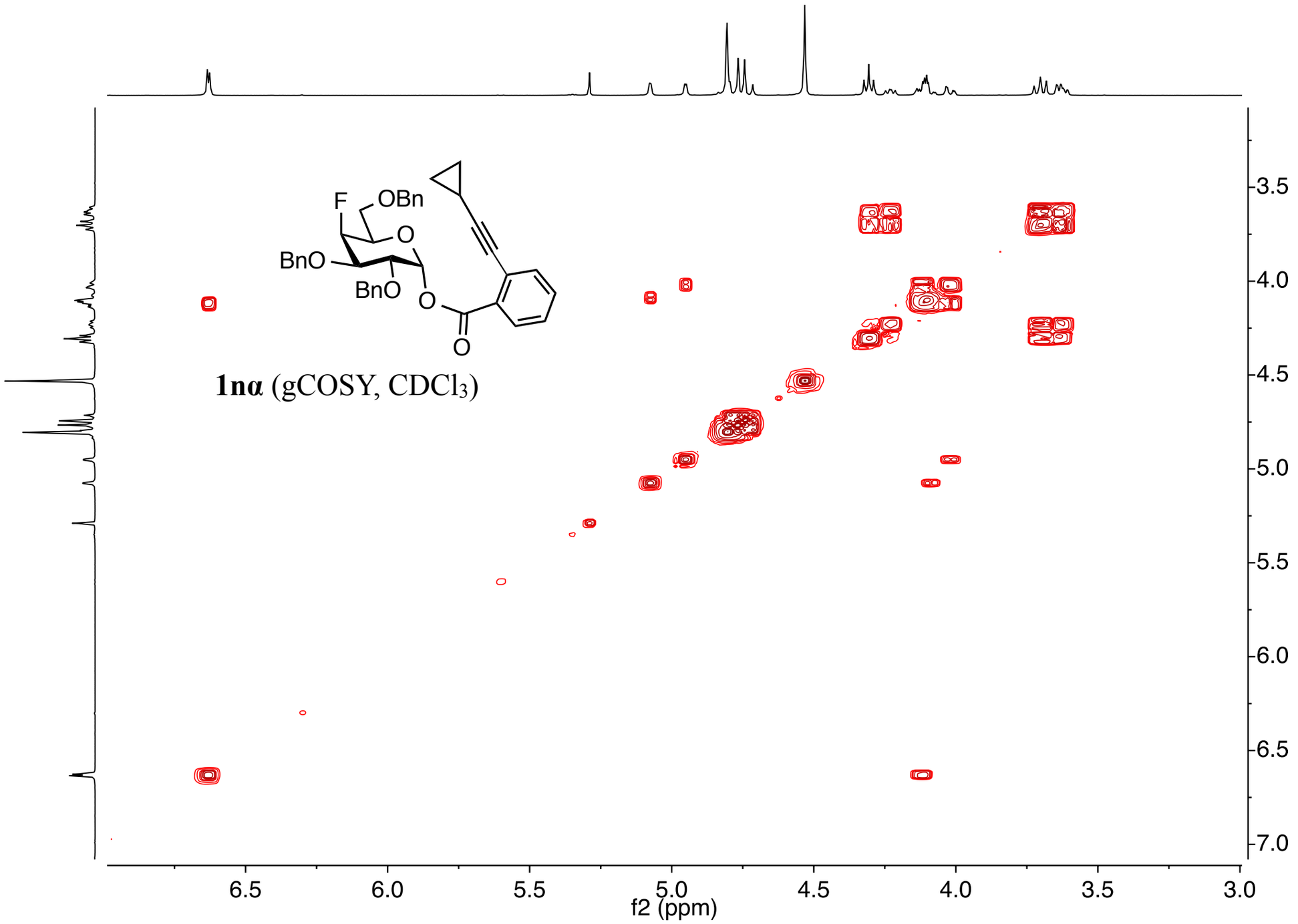


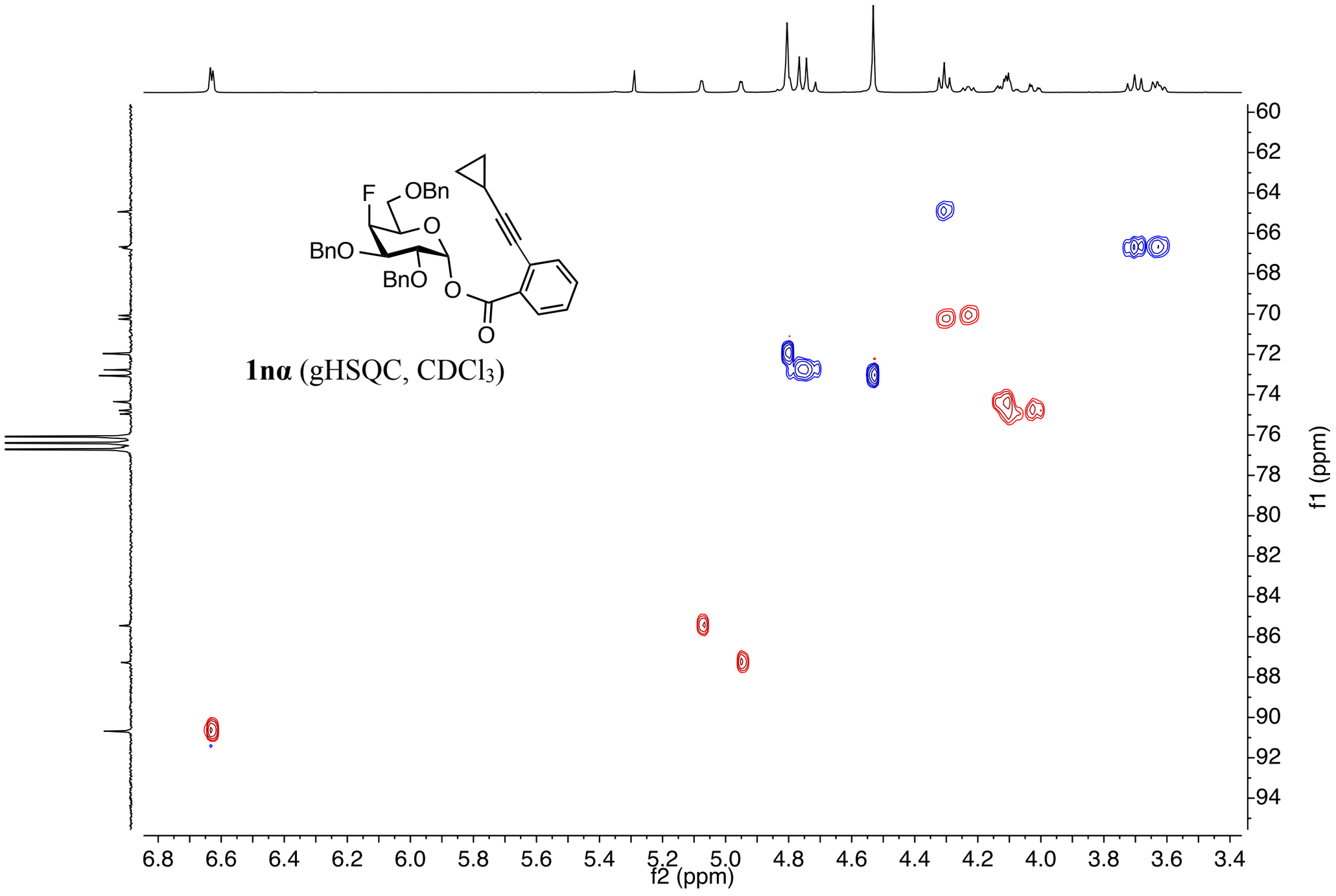
1nα (^{13}C NMR, 101 MHz, $CDCl_3$)

F
OBn
O
BnO
BnO
O
O

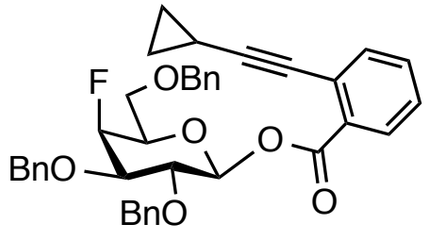
1nα (^{19}F NMR)


-218.83
-207.5
-208.5
-209.5
-210.5
-211.5
-212.5
-213.5
-214.5
-215.5
-216.5
-217.5
-218.5
-219.5
f1 (ppm)

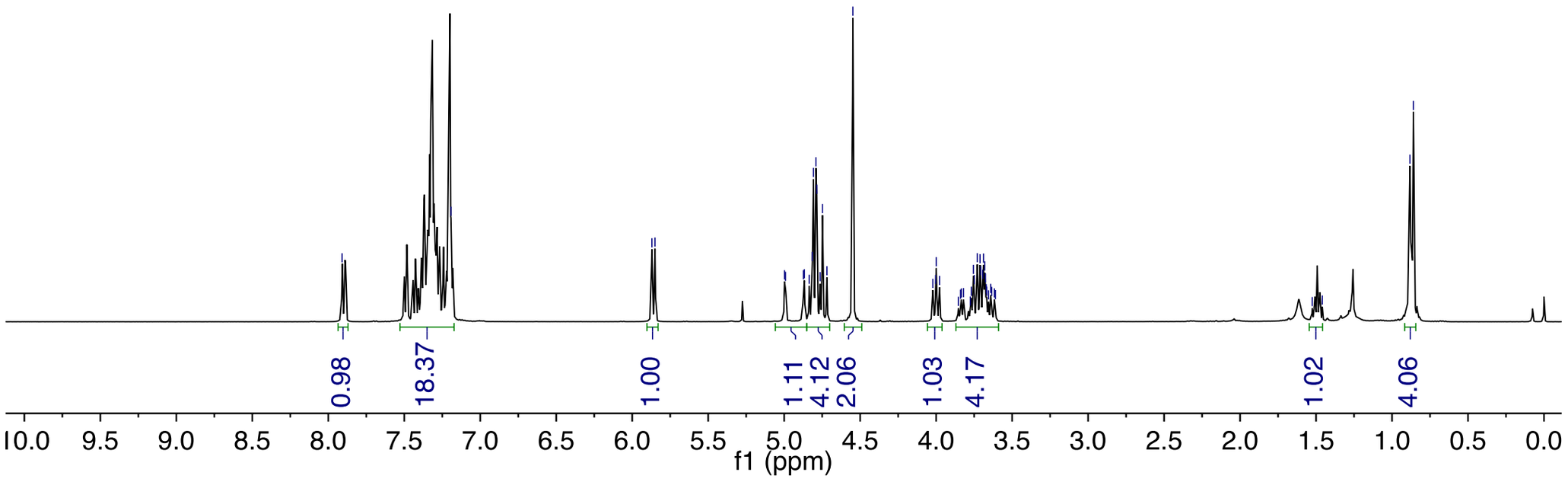

F
OBn
O
BnO
BnO
O
O
1nα (gCOSY, CDCl3)
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
f1 (ppm)
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
f2 (ppm)



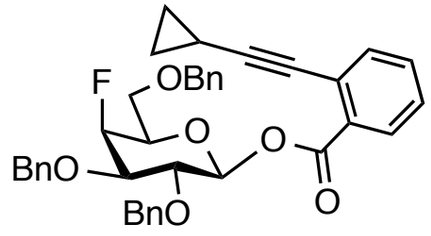
1nα (gHSQC, $CDCl_3$)



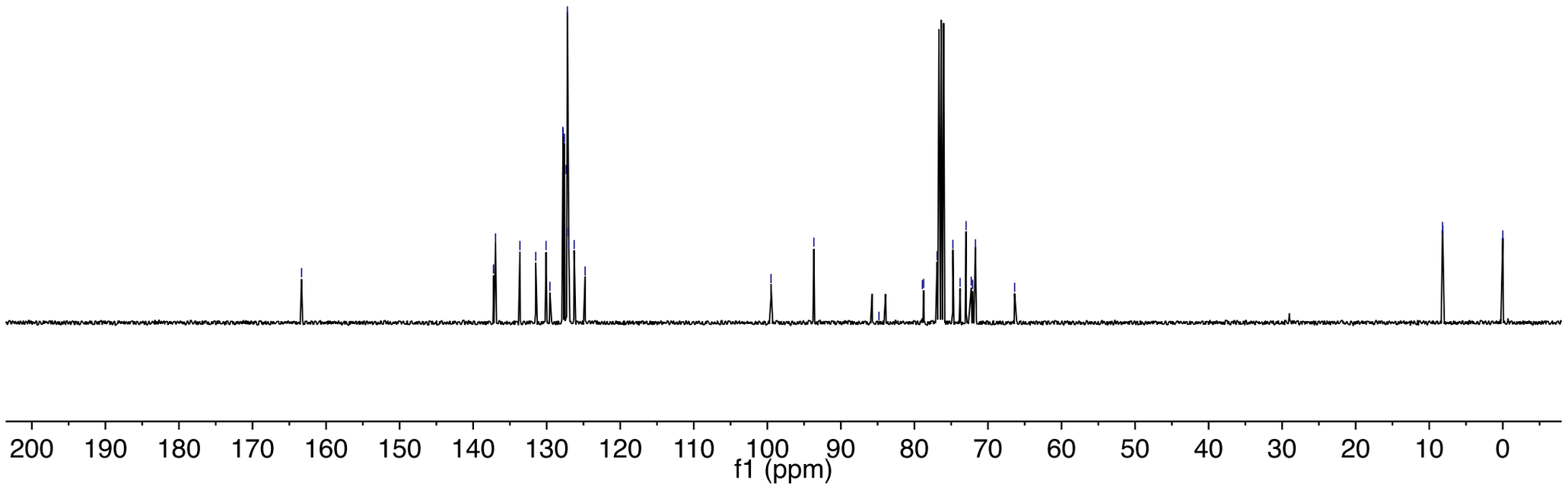
1nβ (^{1}H NMR, 400 MHz, $CDCl_3$)

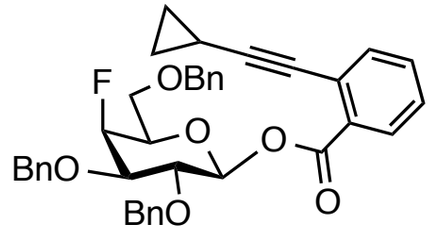


163.33
137.23
136.96
133.64
131.49
130.08
129.56
127.80
127.78
127.59
127.37
127.24
127.18
126.99
126.26
124.77
99.50
93.67
84.82
78.92
78.74
76.92
74.77
73.79
72.98
72.28
72.10
71.71
66.37
8.20
8.16
-0.00

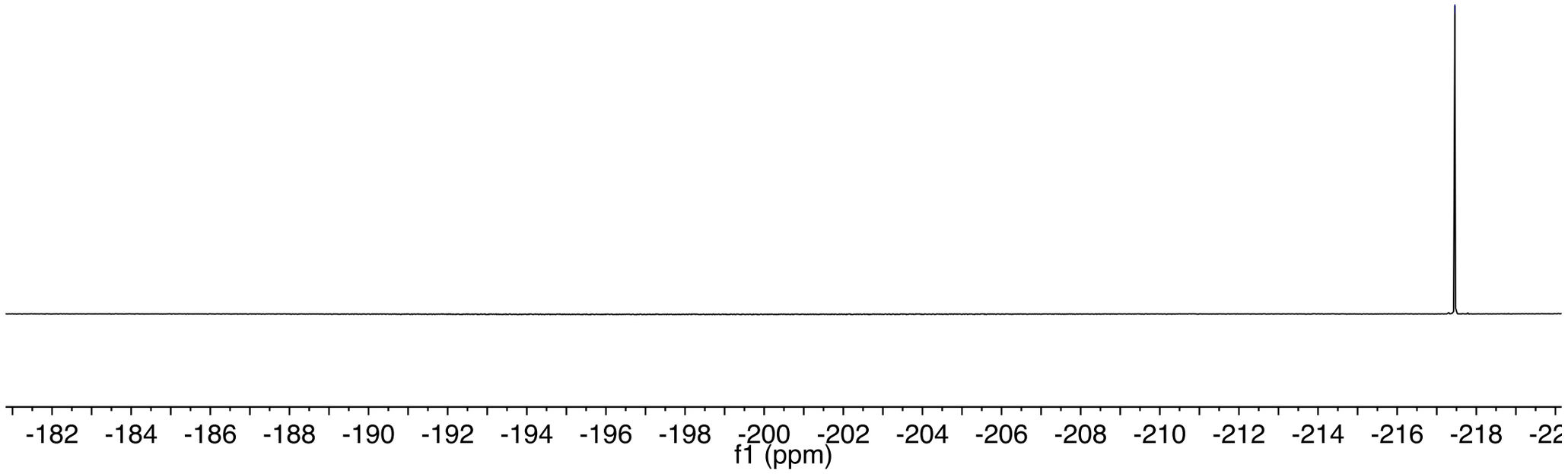


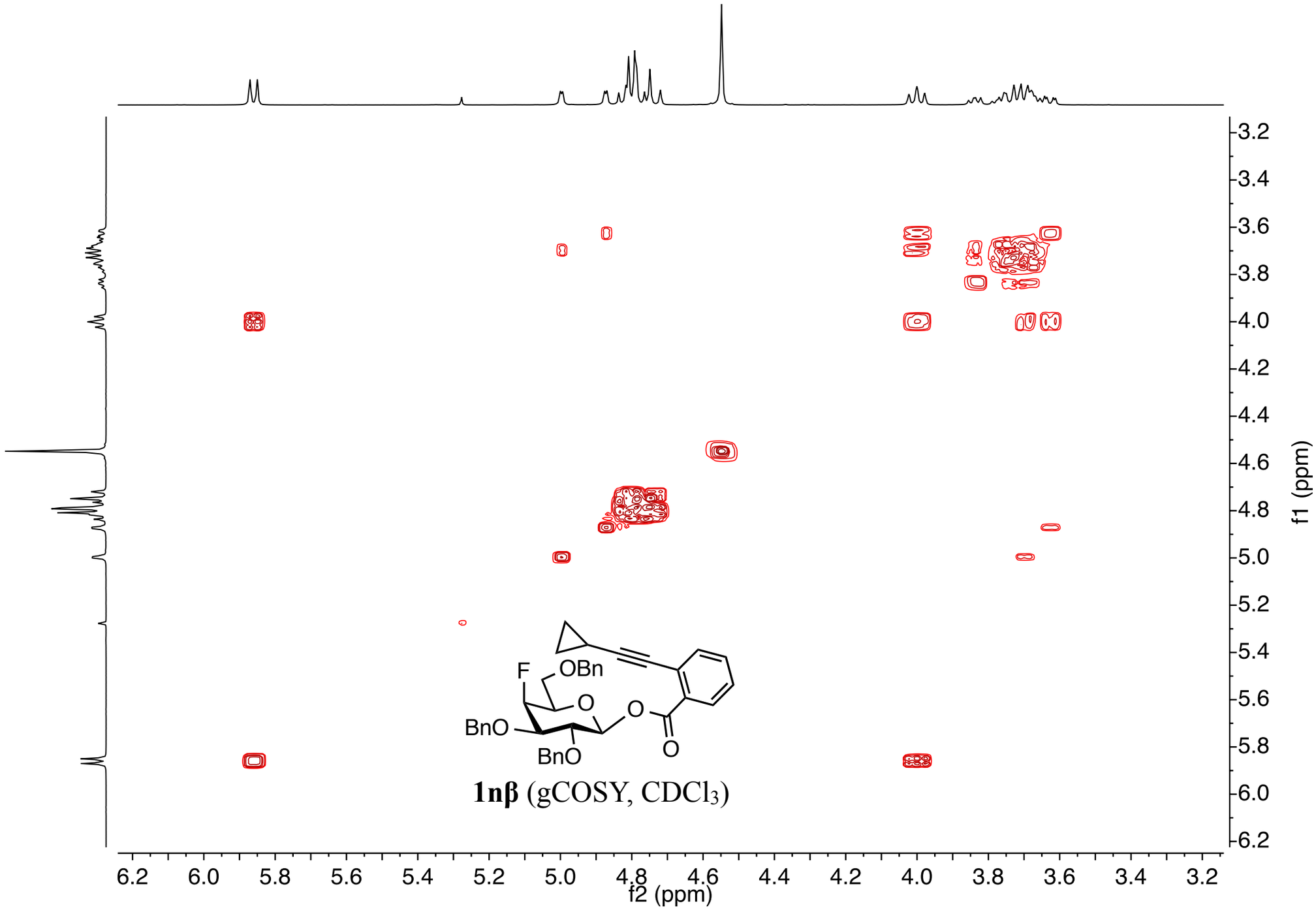
1nβ (^{13}C NMR, 101 MHz, $CDCl_3$)



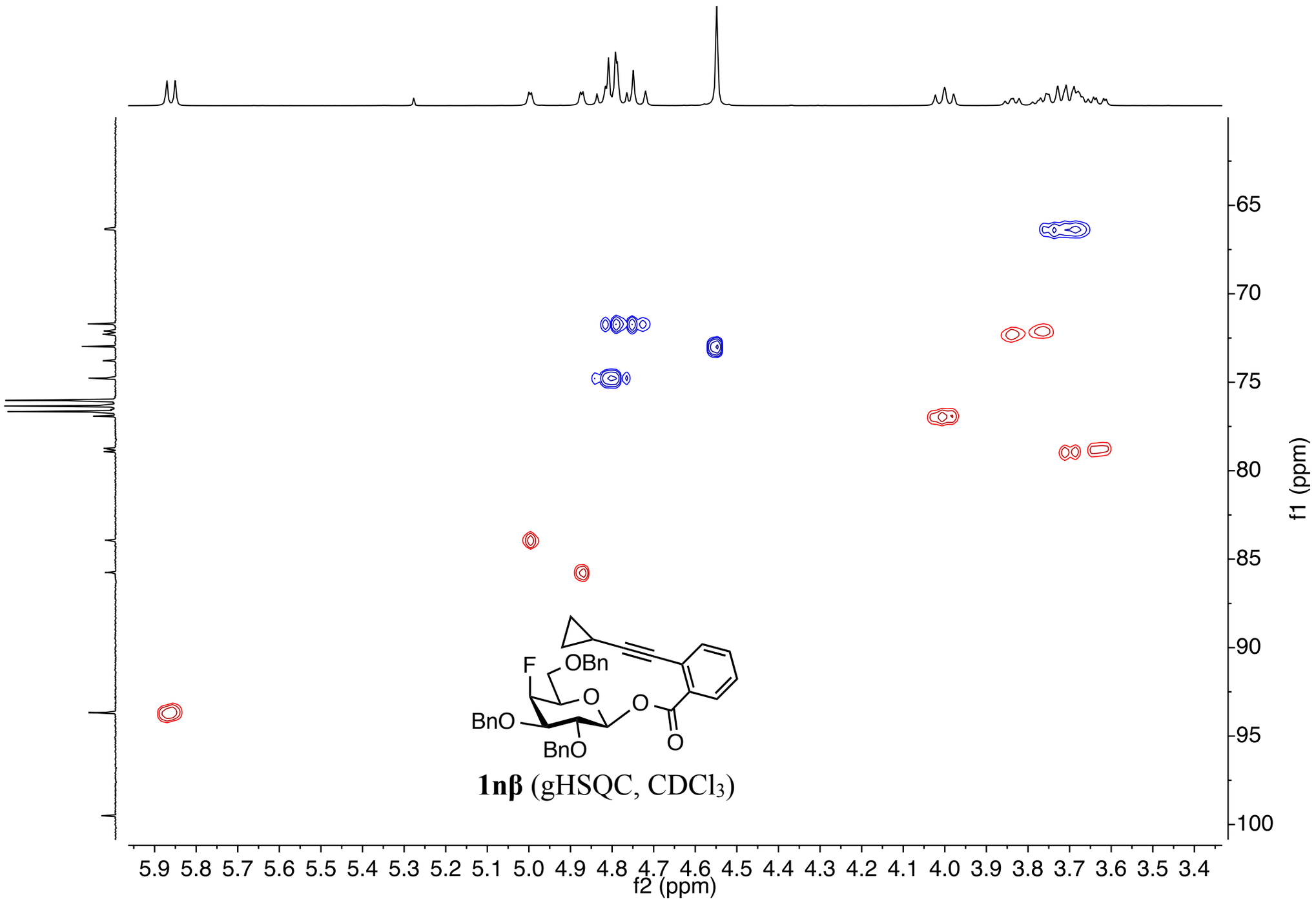

F
OBn
O
O
BnO
BnO
O

1nβ (^{19}F NMR)

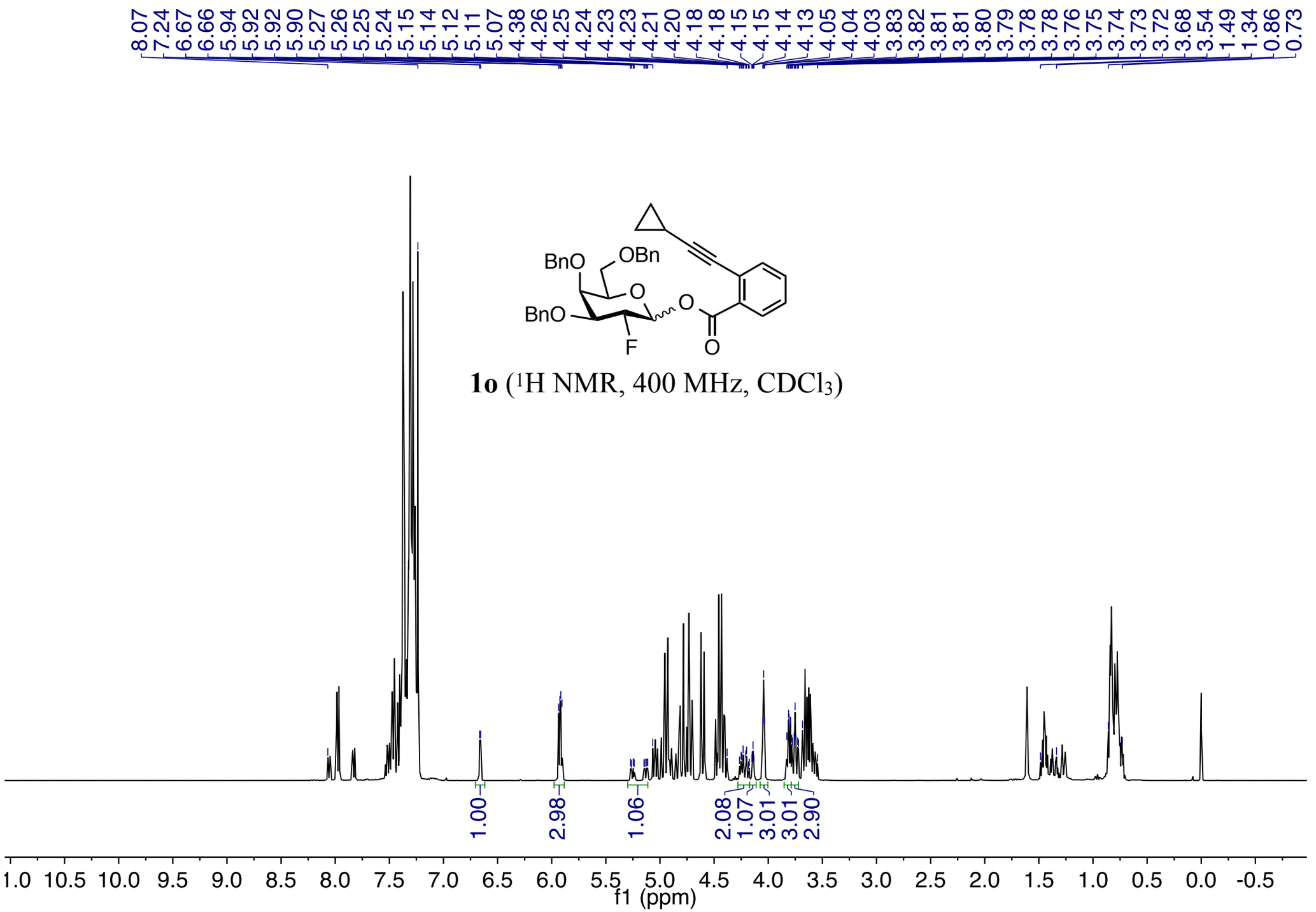

-217.46
-182
-184
-186
-188
-190
-192
-194
-196
-198
-200
-202
-204
-206
-208
-210
-212
-214
-216
-218
f1 (ppm)



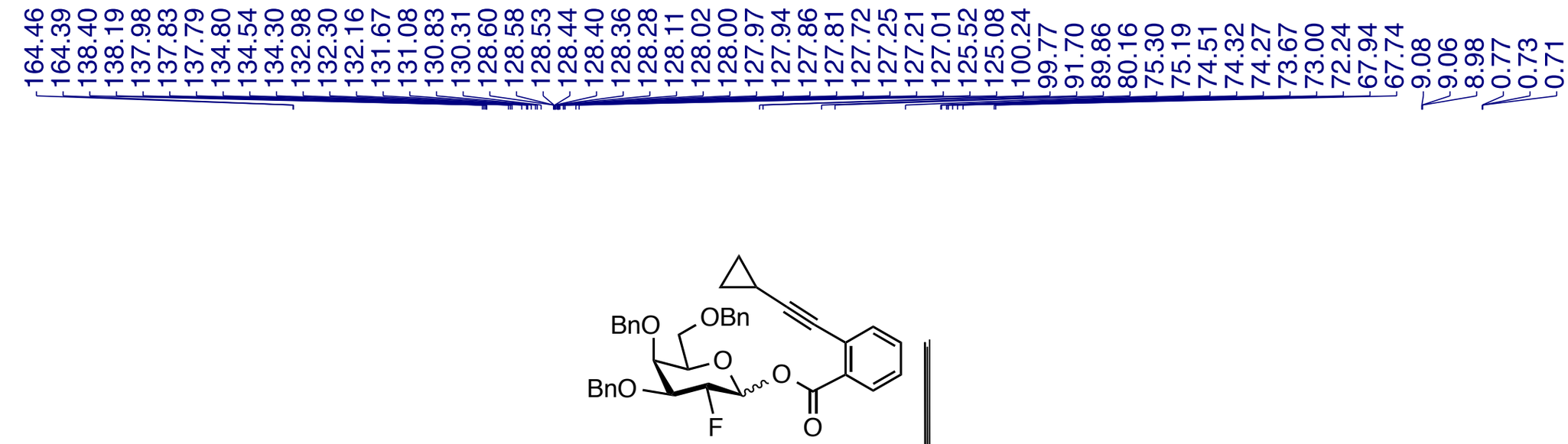
1nβ (gCOSY, $CDCl_3$)



1nβ (gHSQC, $CDCl_3$)



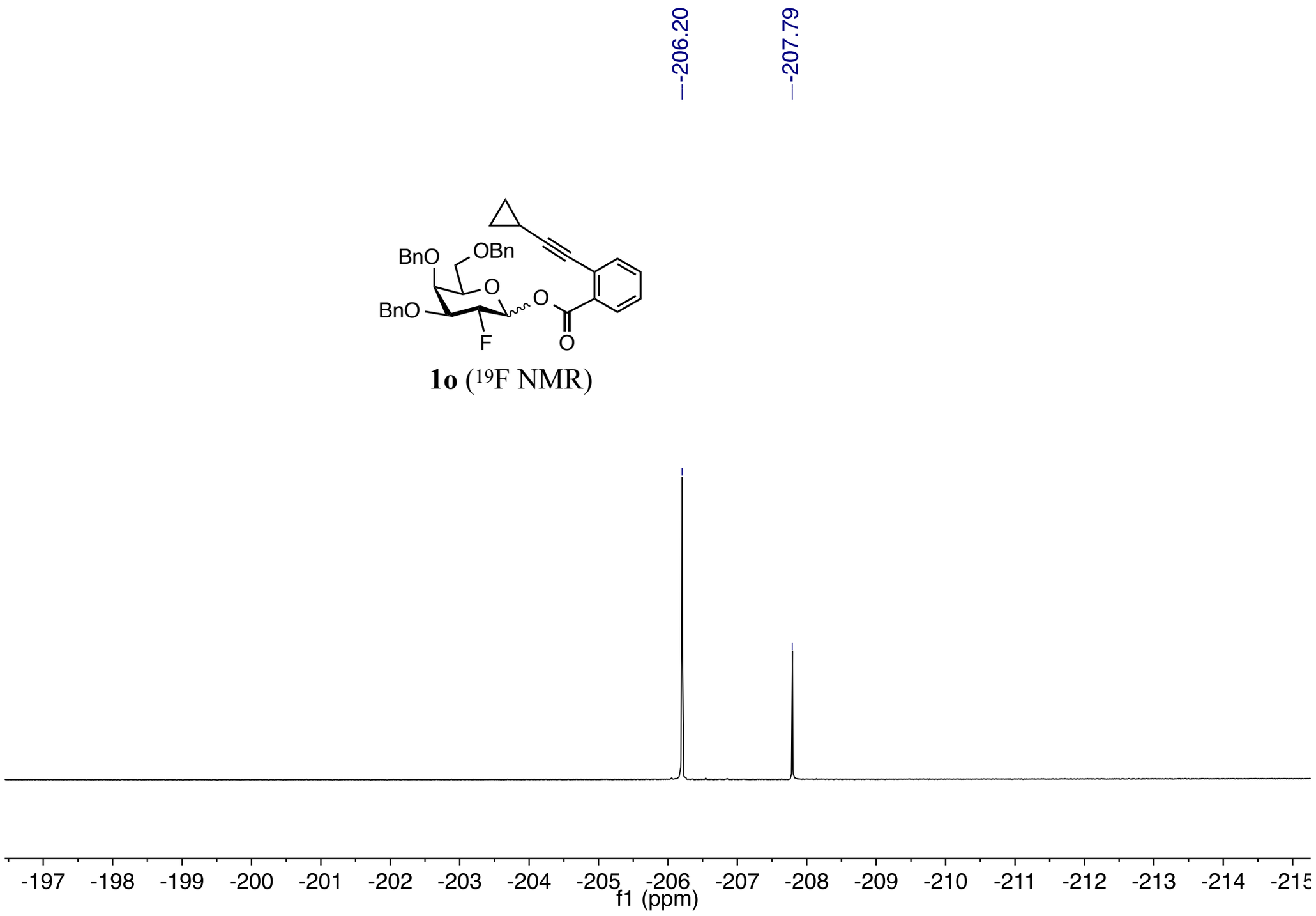
1o (^{1}H NMR, 400 MHz, $CDCl_3$)

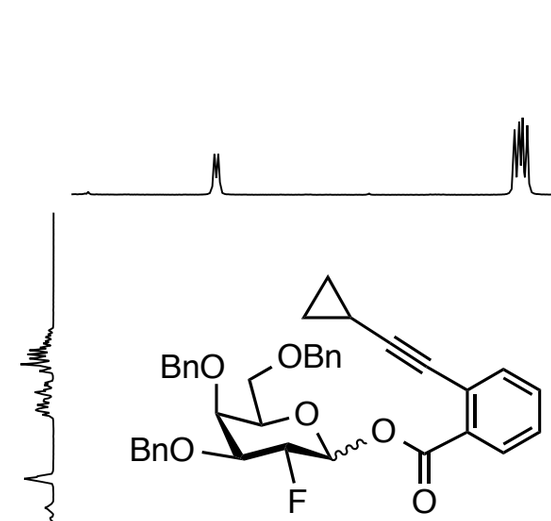


1o (^{13}C NMR, 101 MHz, $CDCl_3$)

BnO
OBn
O
O
BnO
F
O

1o (^{19}F NMR)

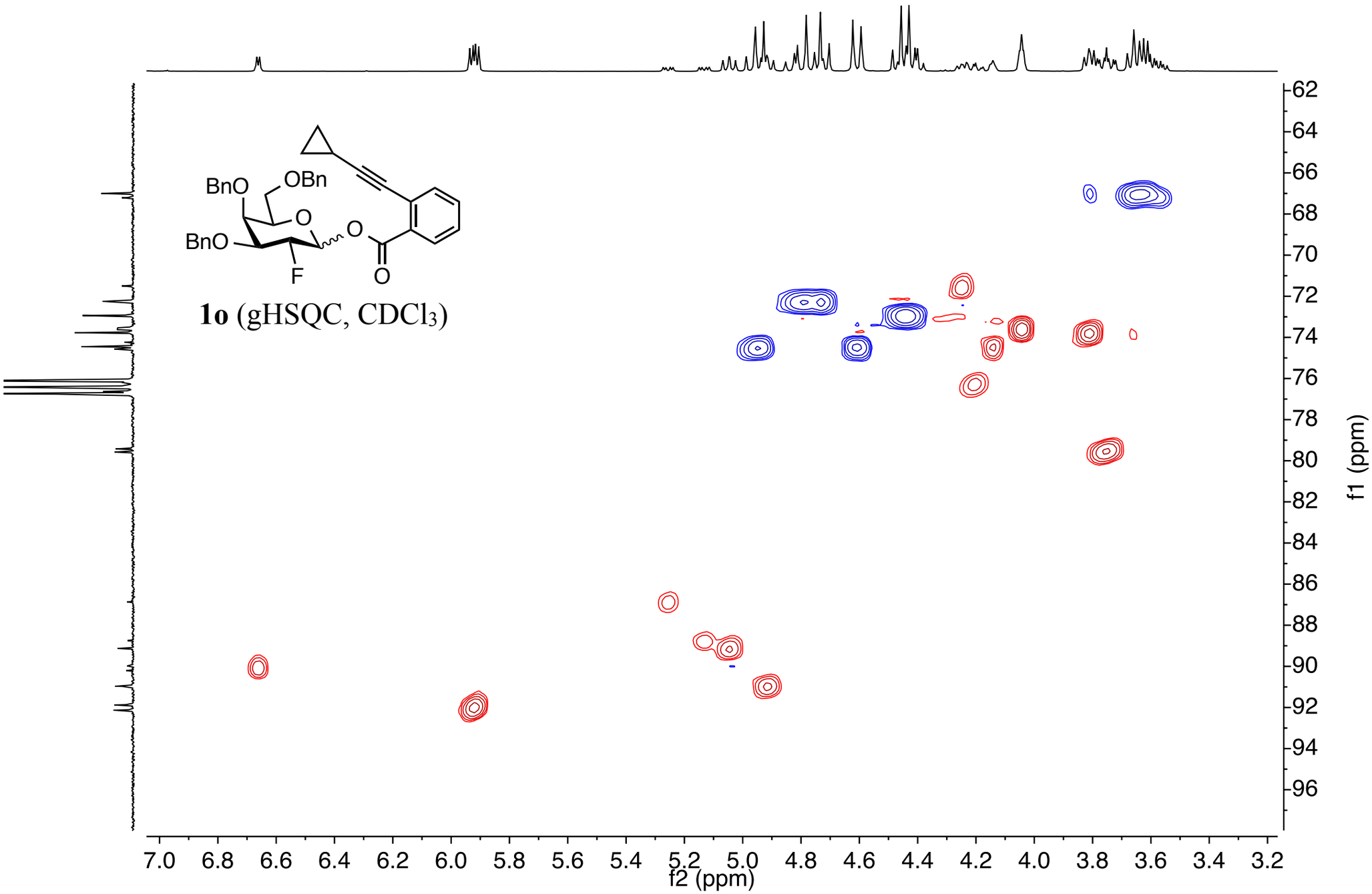

-206.20
-207.79
-197
-198
-199
-200
-201
-202
-203
-204
-205
-206
-207
-208
-209
-210
-211
-212
-213
-214
-215
f1 (ppm)

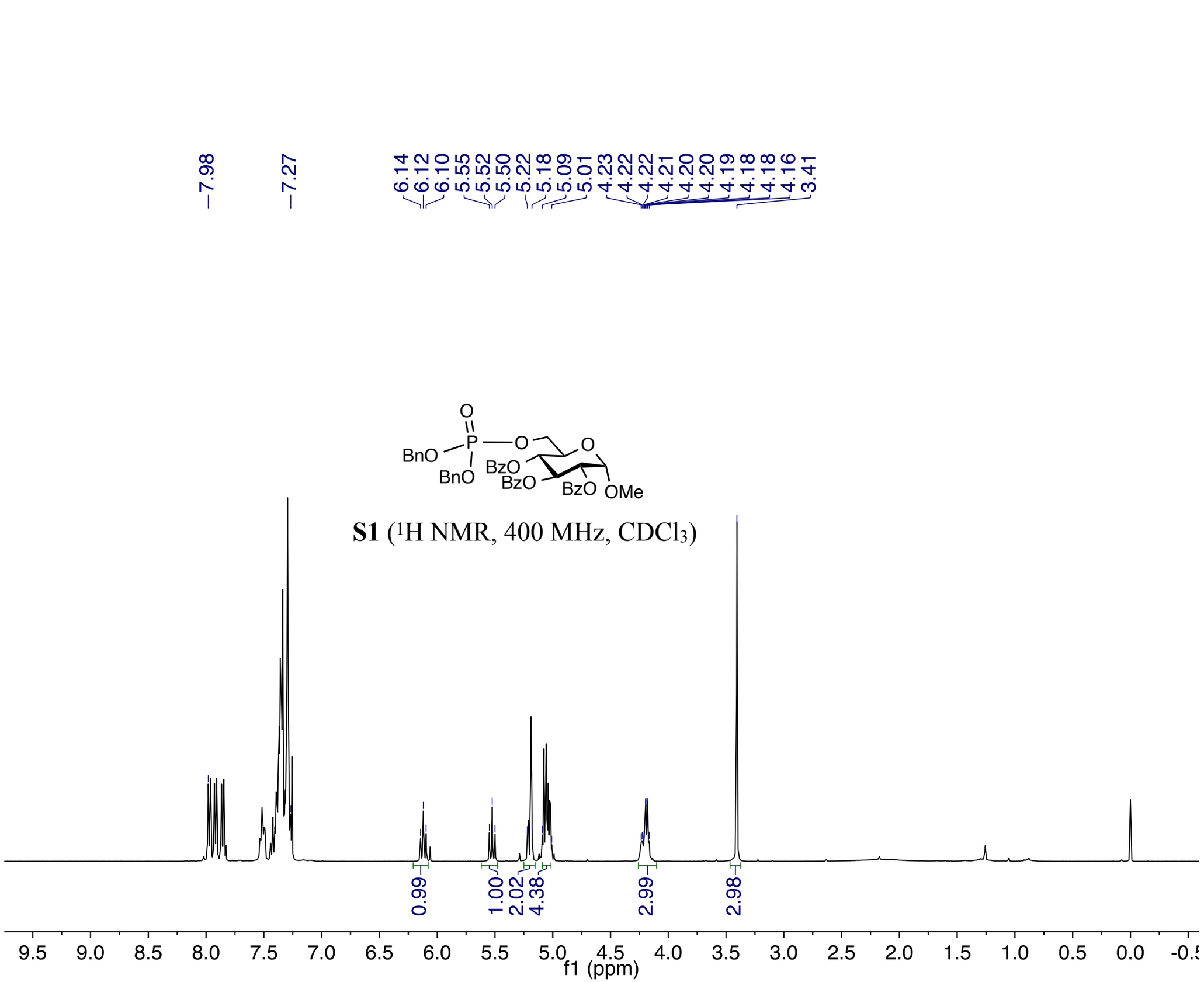


1o (gCOSY, $CDCl_3$)

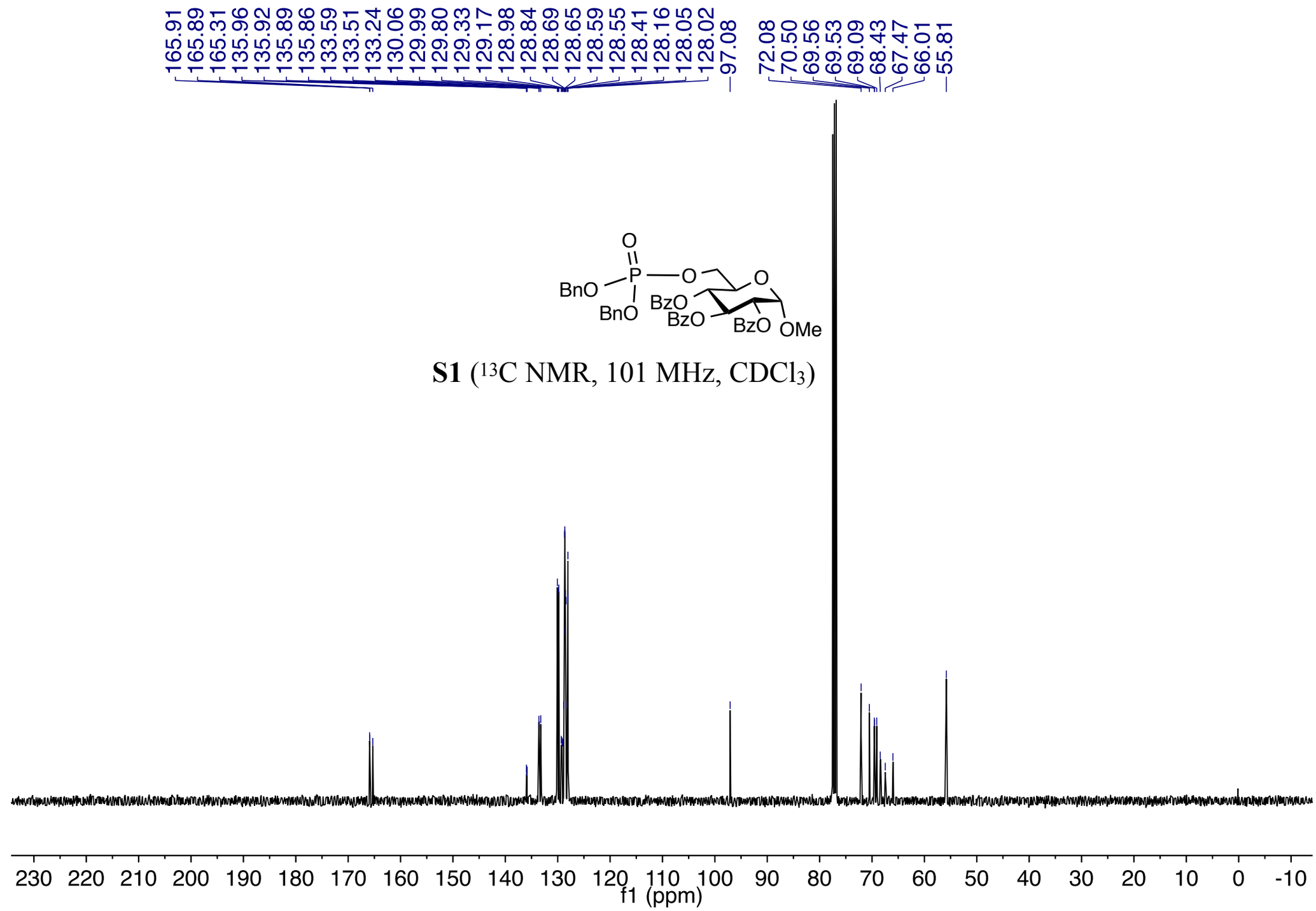
f2 (ppm)

f1 (ppm)

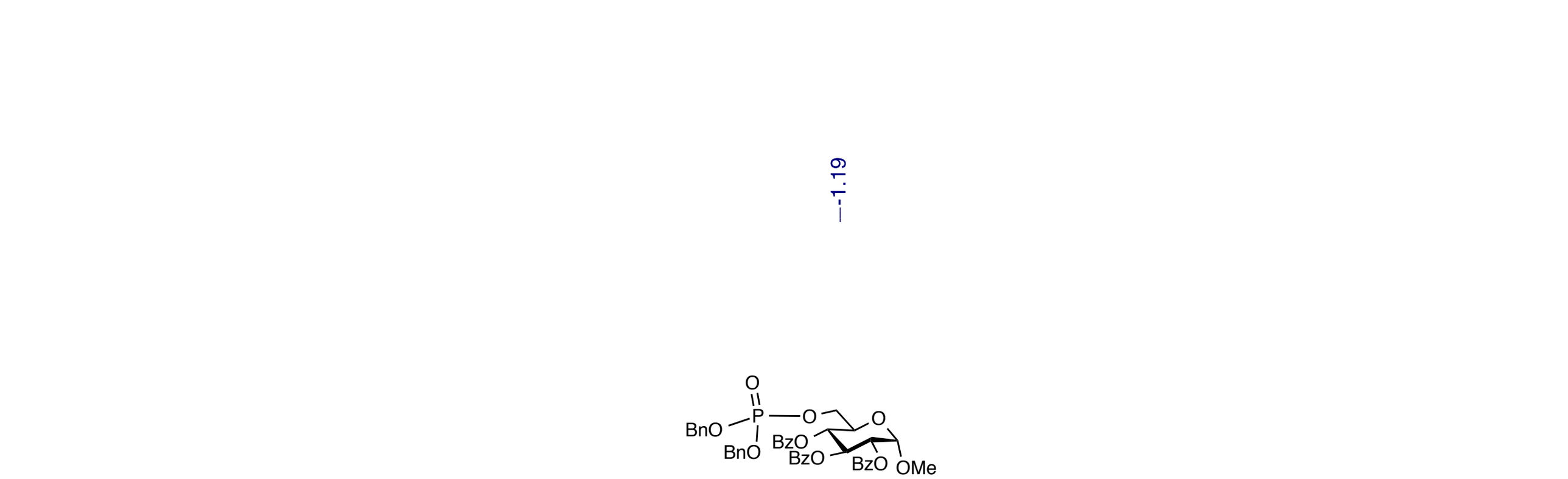

BnO
OBn
O
BnO
O
F
O
1o (gHSQC, CDCl3)
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
f1 (ppm)
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)



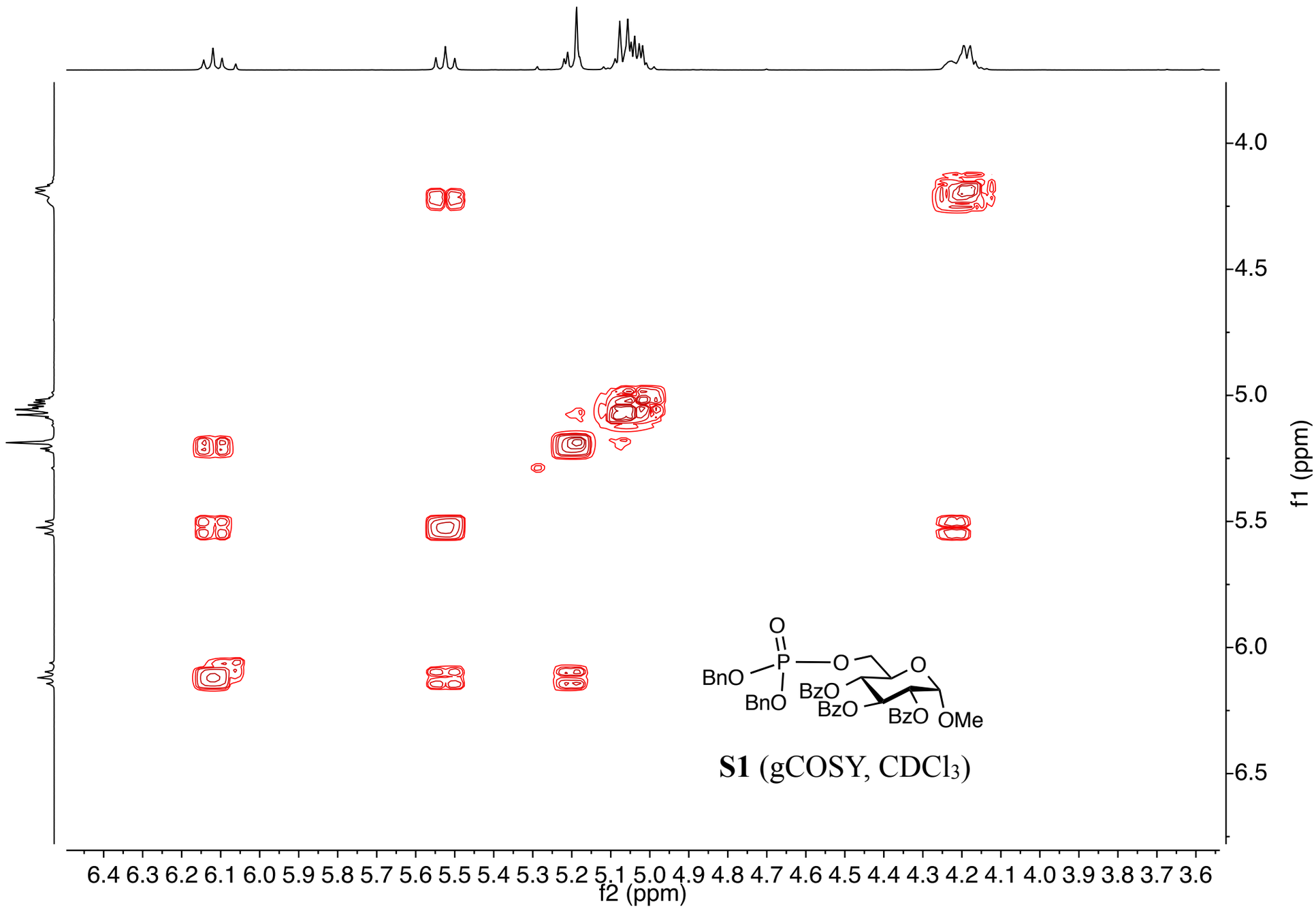
S1 (^{1}H NMR, 400 MHz, $CDCl_3$)



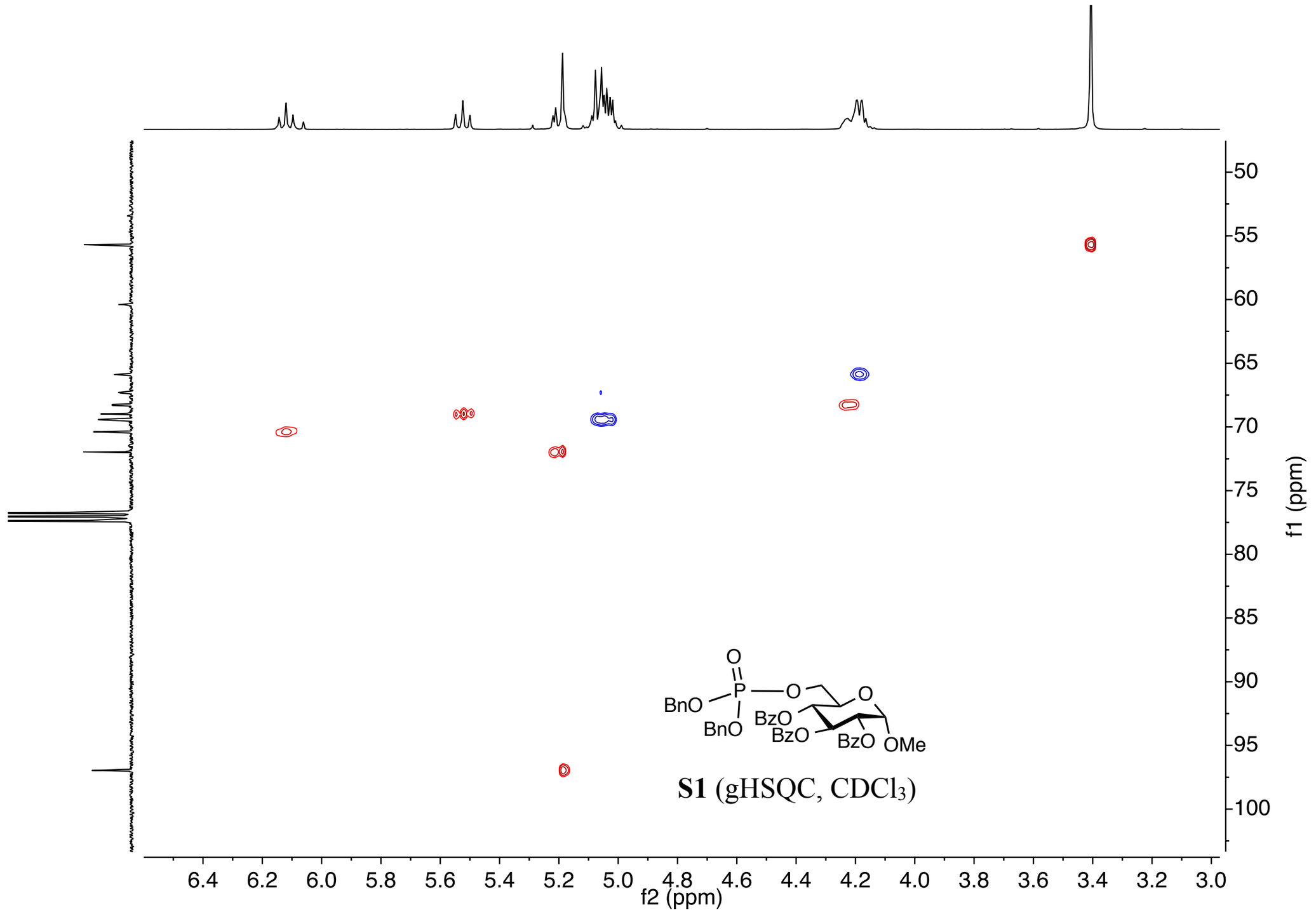
S1 (^{13}C NMR, 101 MHz, $CDCl_3$)



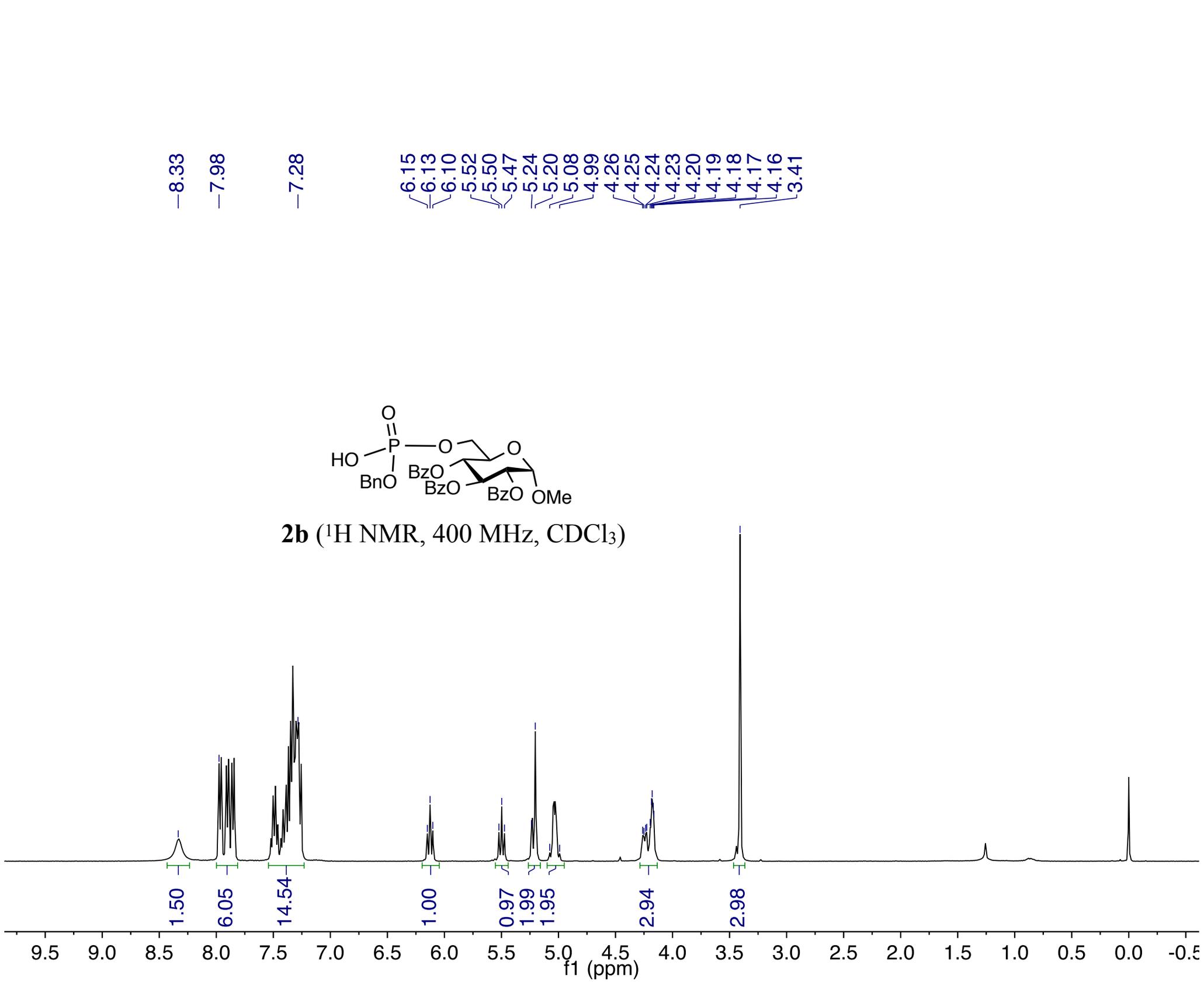
S1 (^{31}P NMR, 162 MHz, $CDCl_3$)



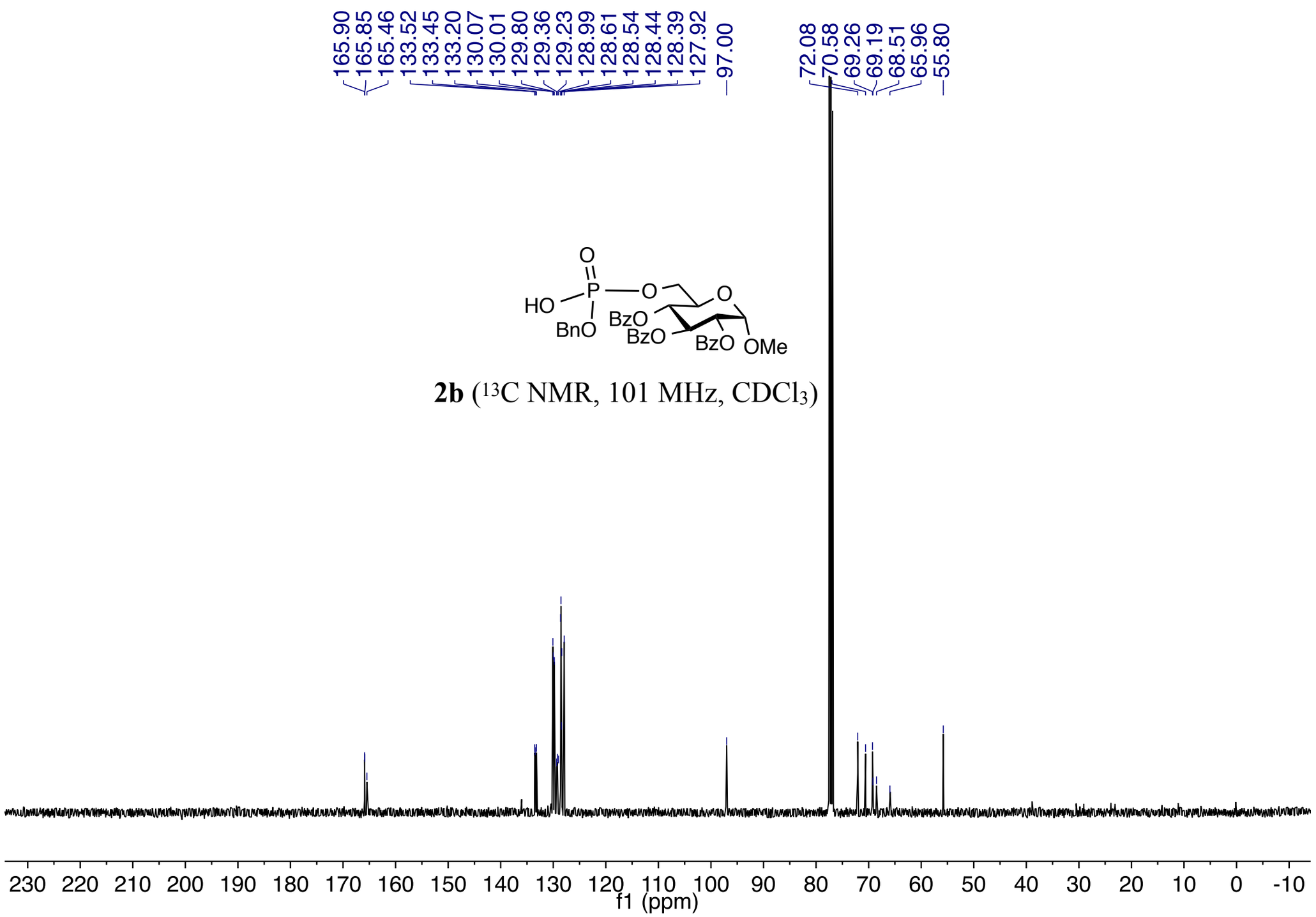
S1 (gCOSY, $CDCl_3$)



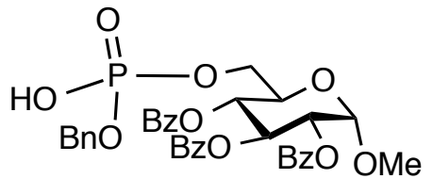
S1 (gHSQC, $CDCl_3$)



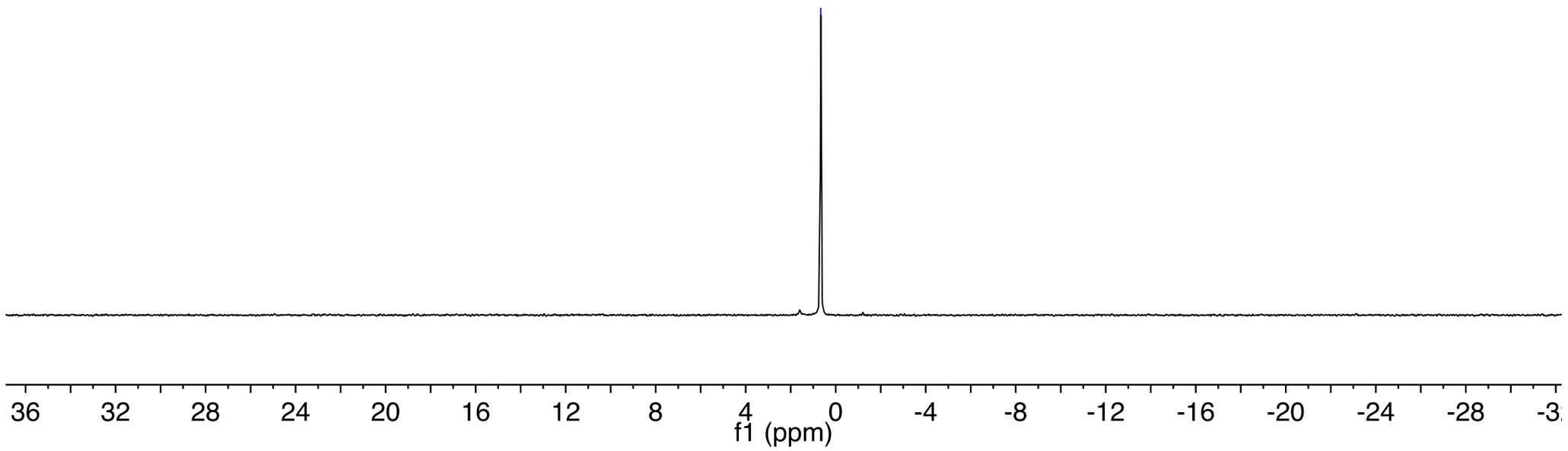
2b (^{1}H NMR, 400 MHz, $CDCl_3$)

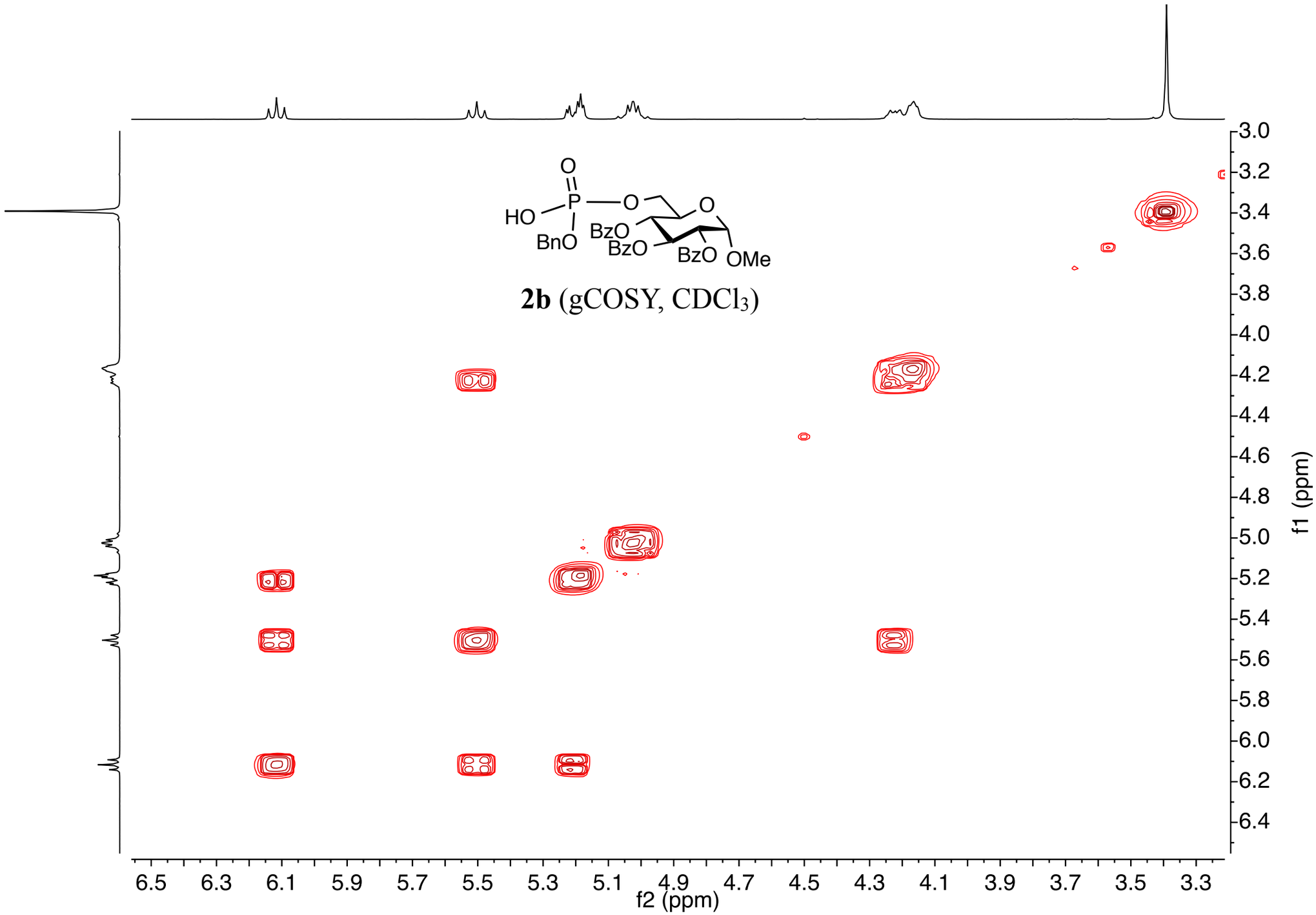


2b (^{13}C NMR, 101 MHz, $CDCl_3$)

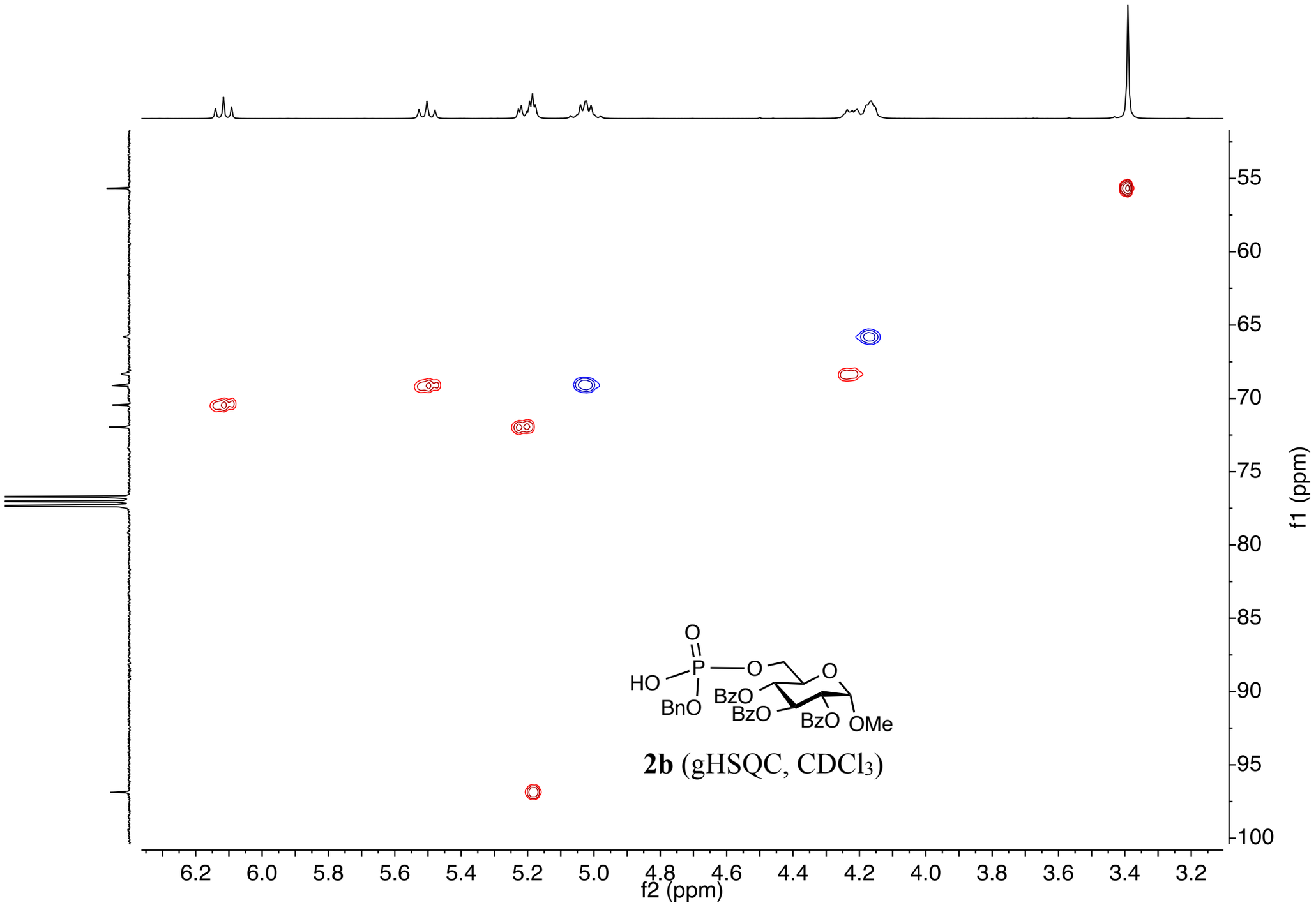


2b (^{31}P NMR, 162 MHz, $CDCl_3$)

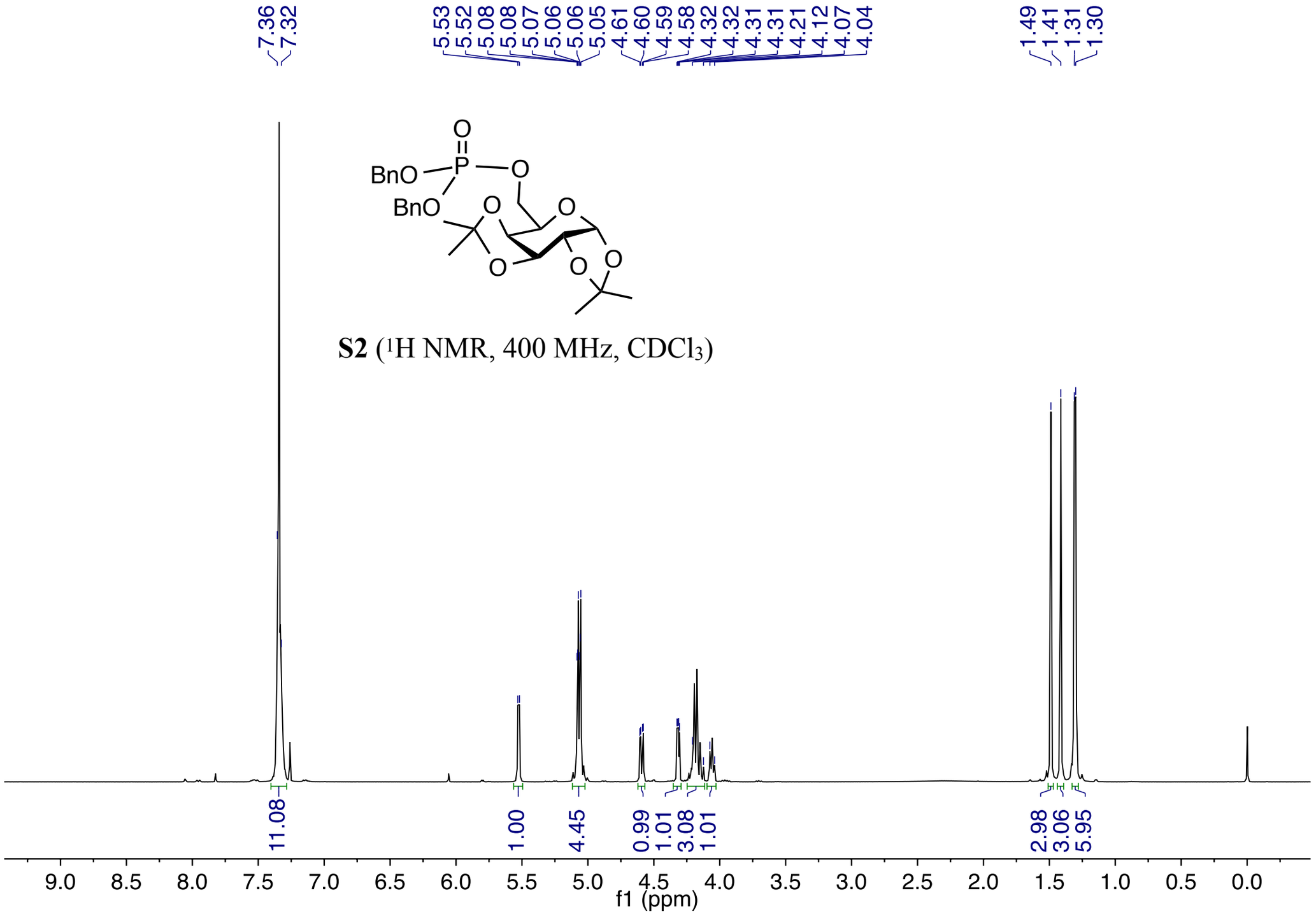




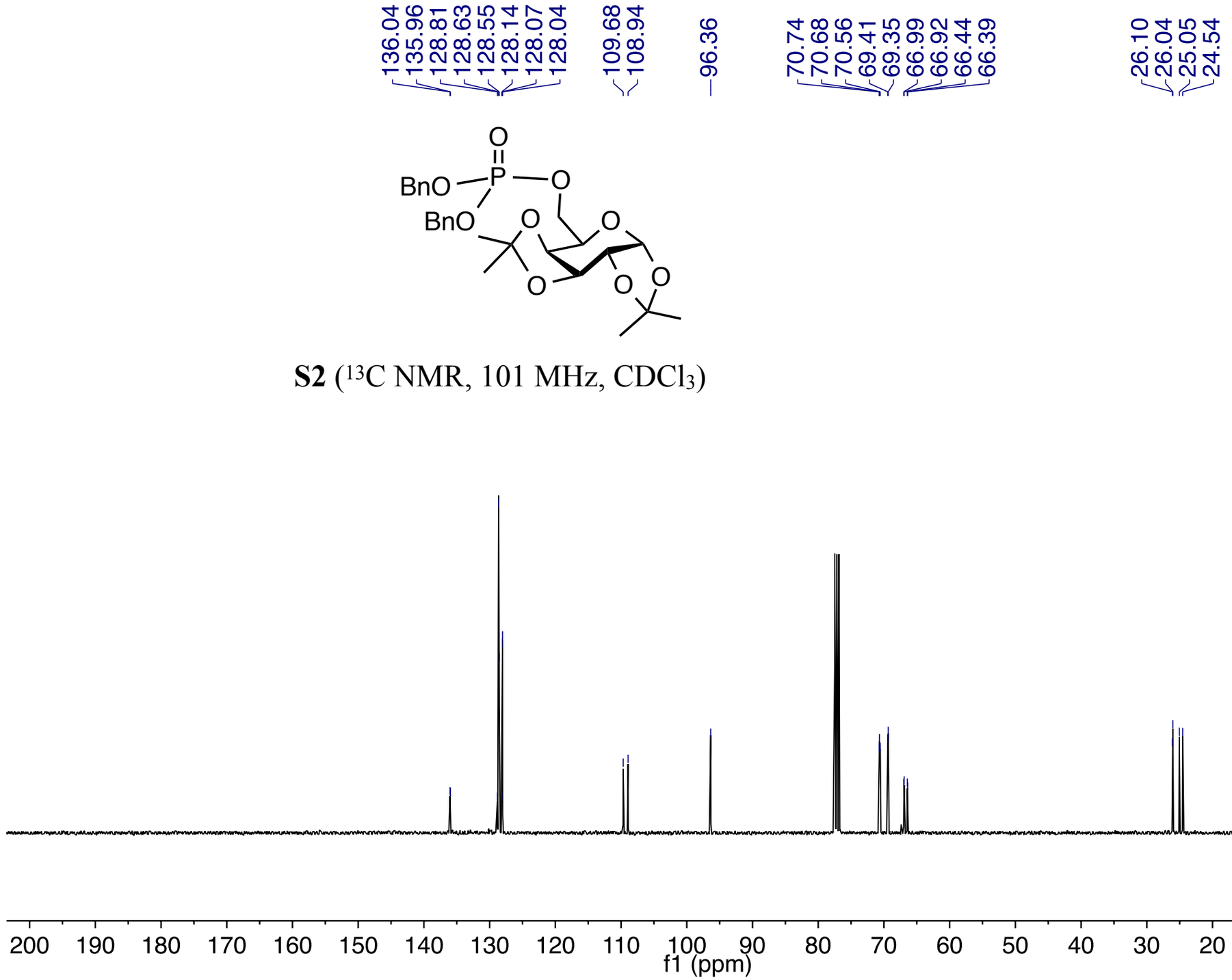
2b (gCOSY, $CDCl_3$)



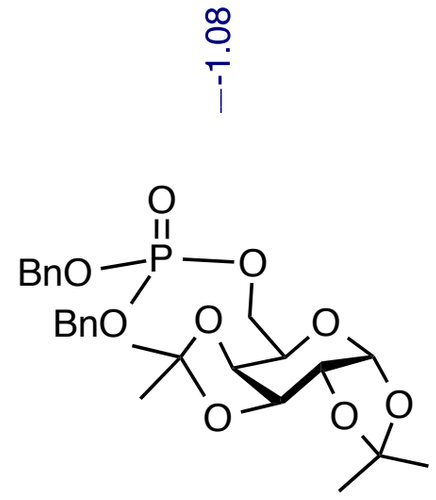
2b (gHSQC, $CDCl_3$)



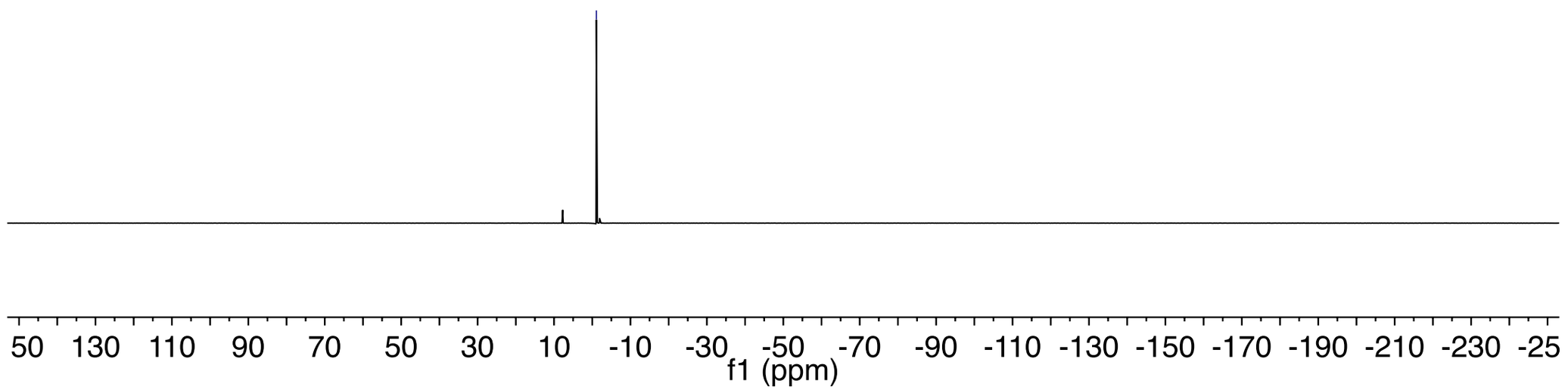
S2 (^{1}H NMR, 400 MHz, $CDCl_3$)

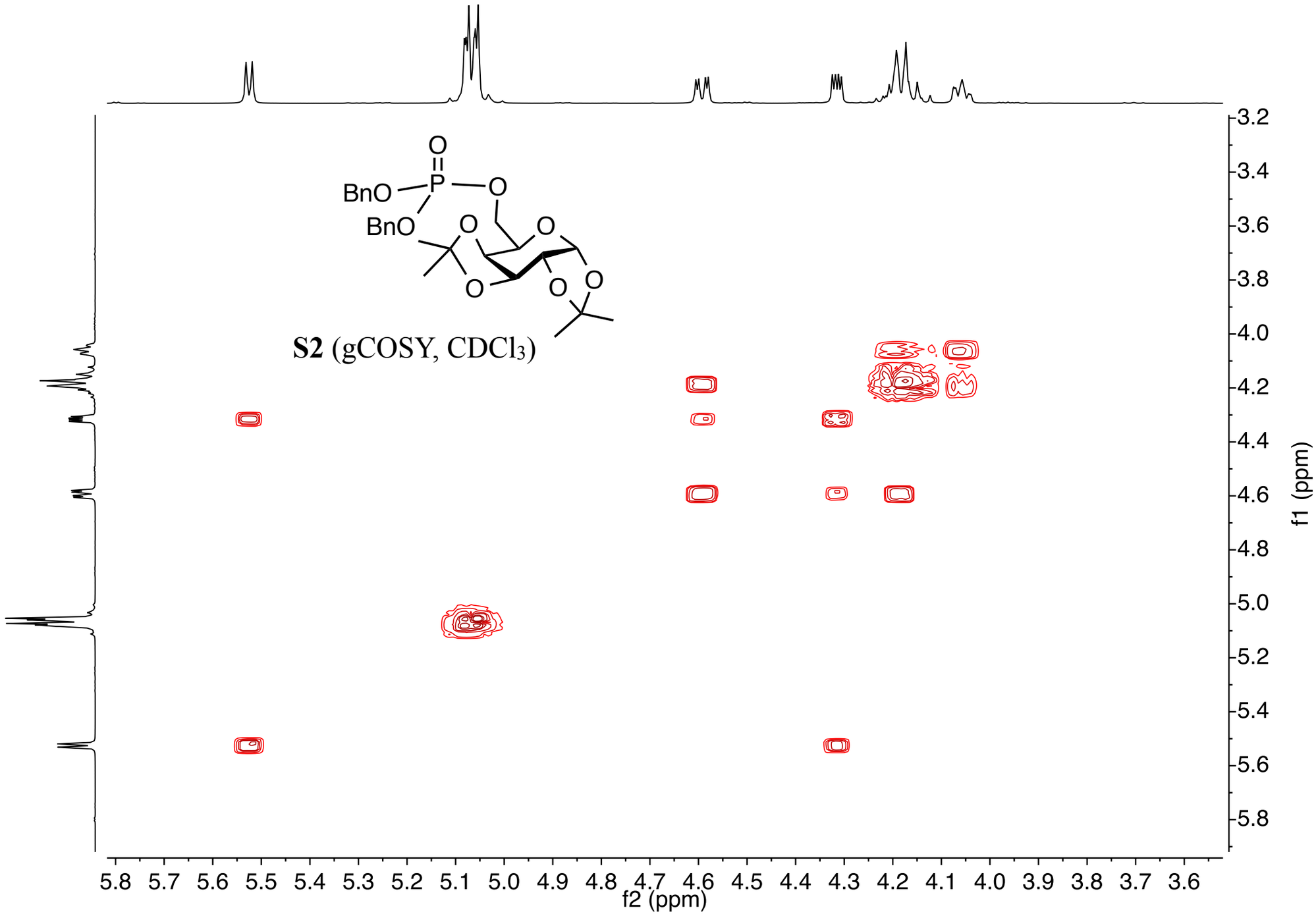


S2 (^{13}C NMR, 101 MHz, $CDCl_3$)

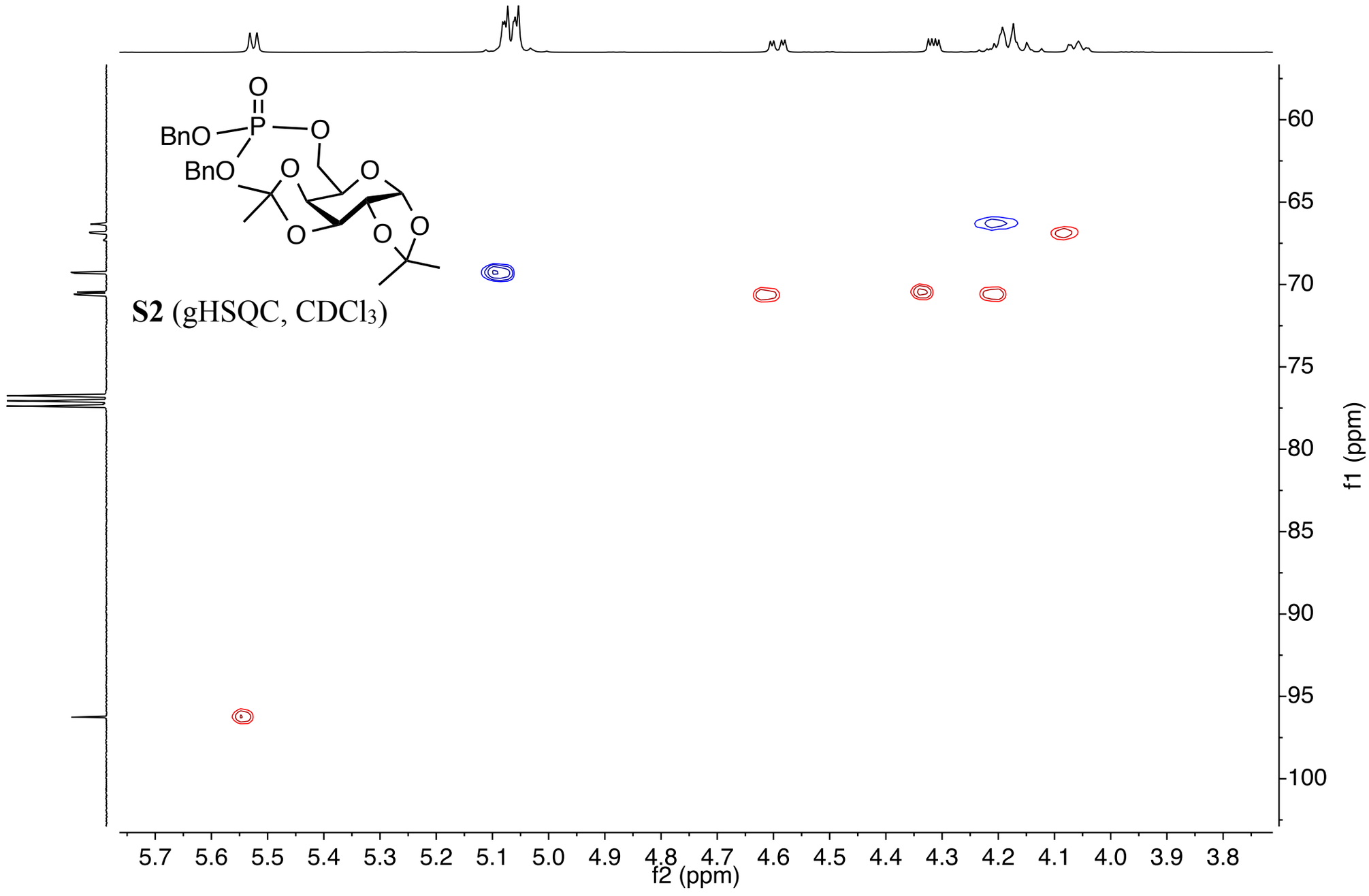


S2 (^{31}P NMR, 162 MHz, $CDCl_3$)

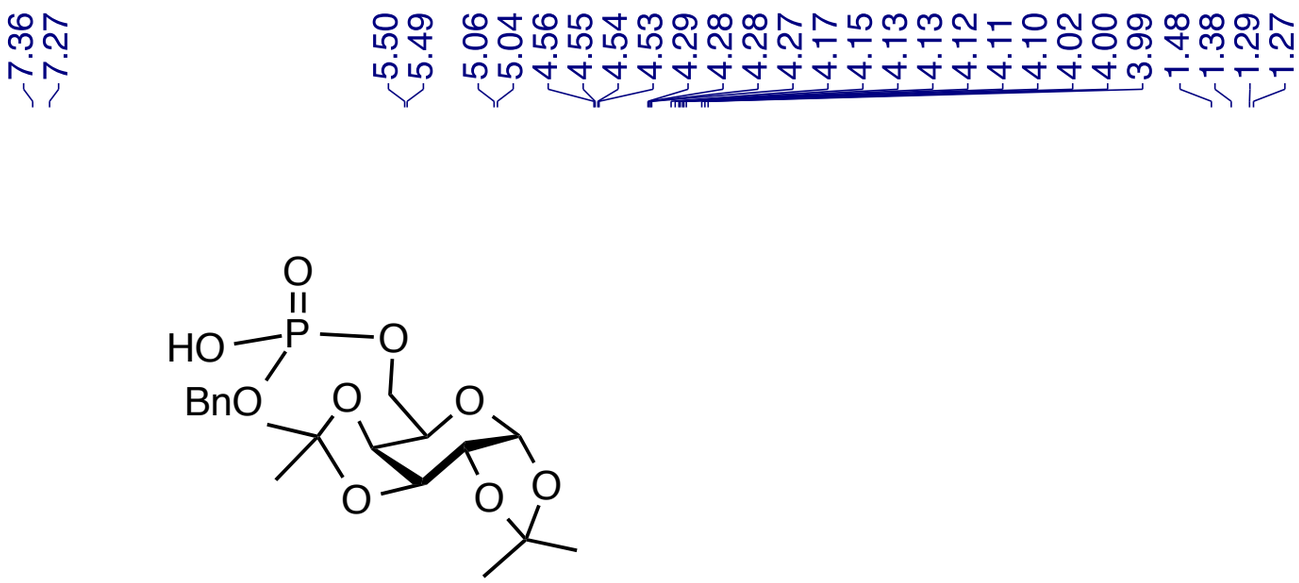




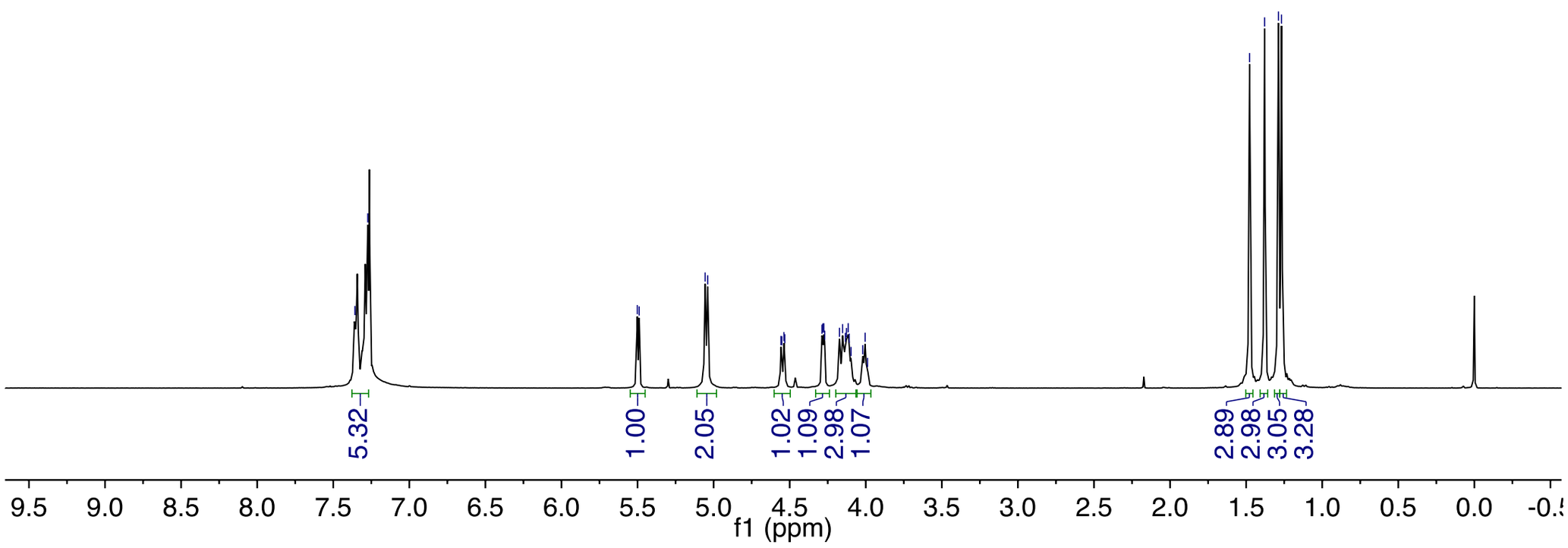
S2 (gCOSY, $CDCl_3$)

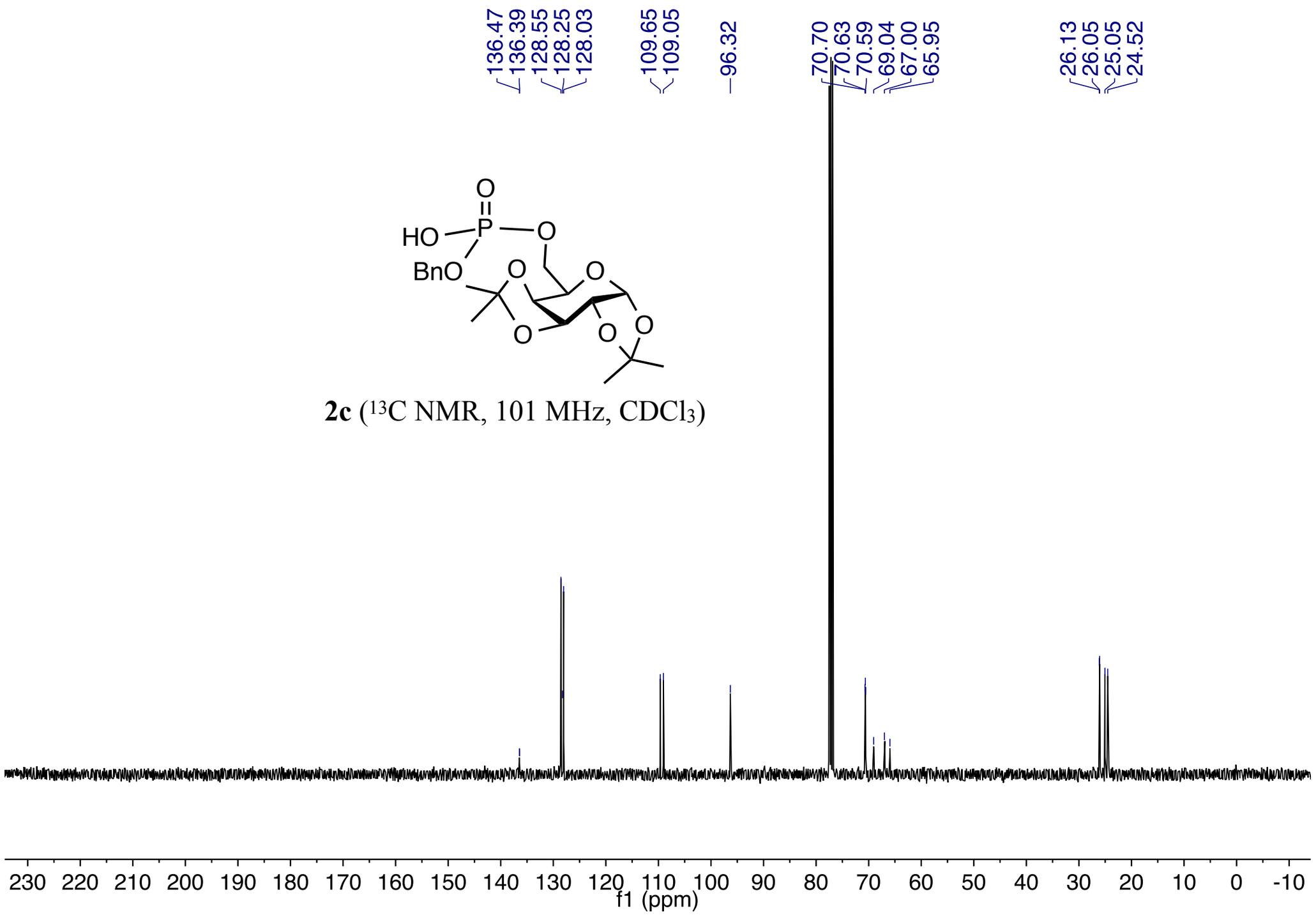


S2 (gHSQC, $CDCl_3$)



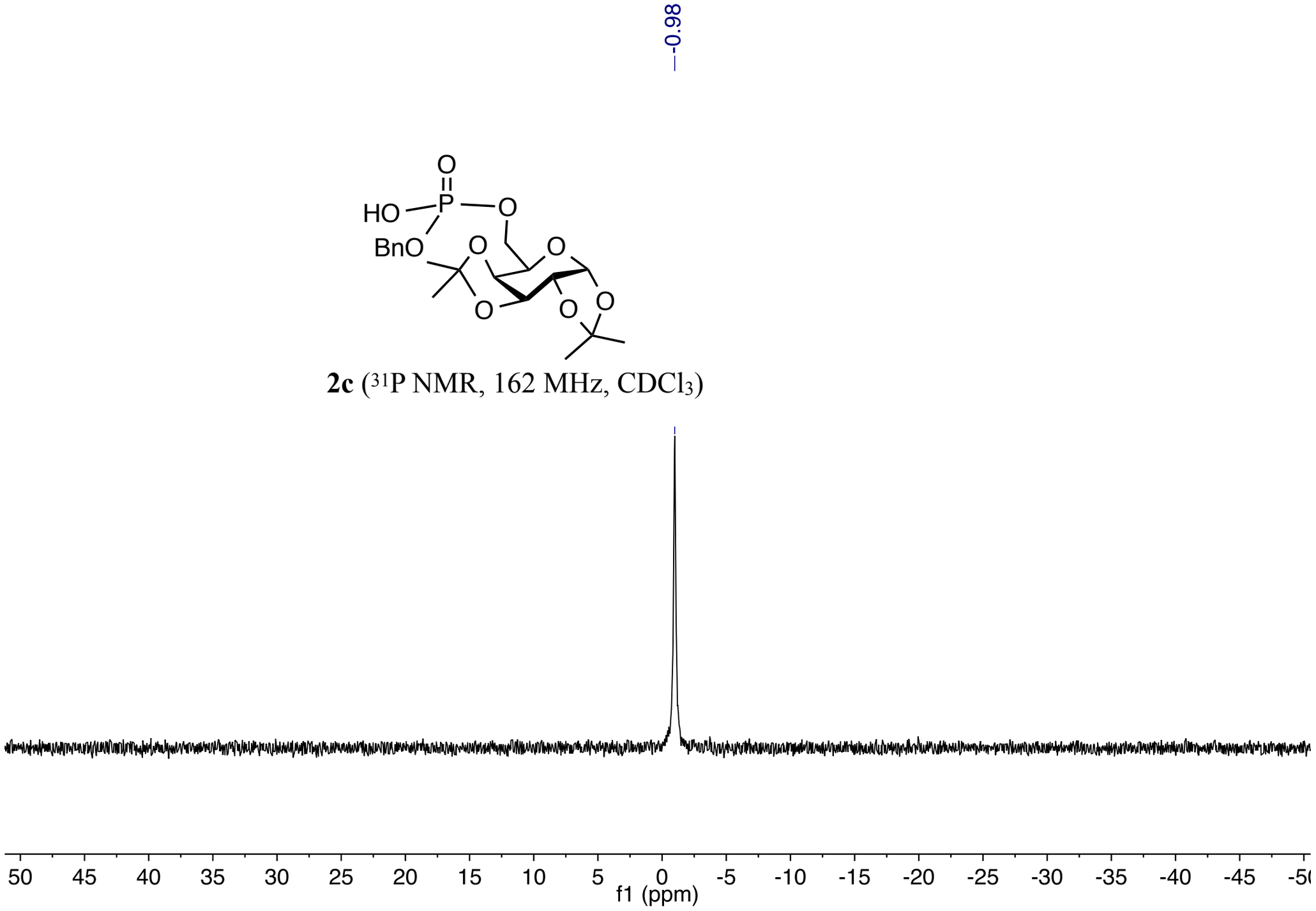
2c (^{1}H NMR, 400 MHz, $CDCl_3$)

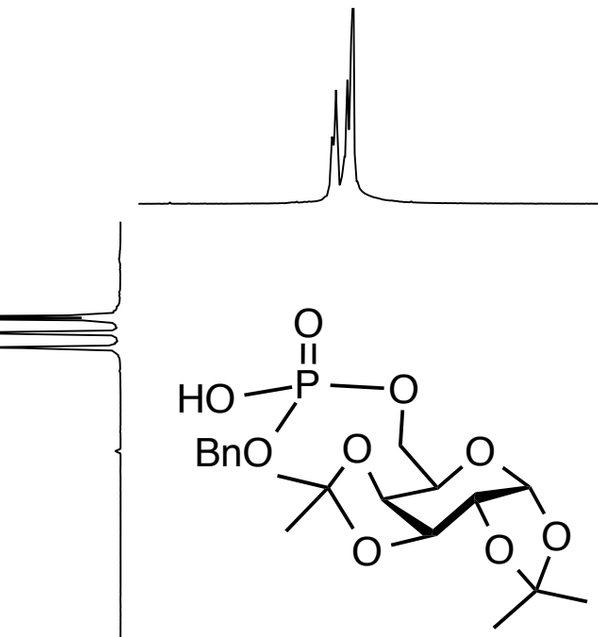




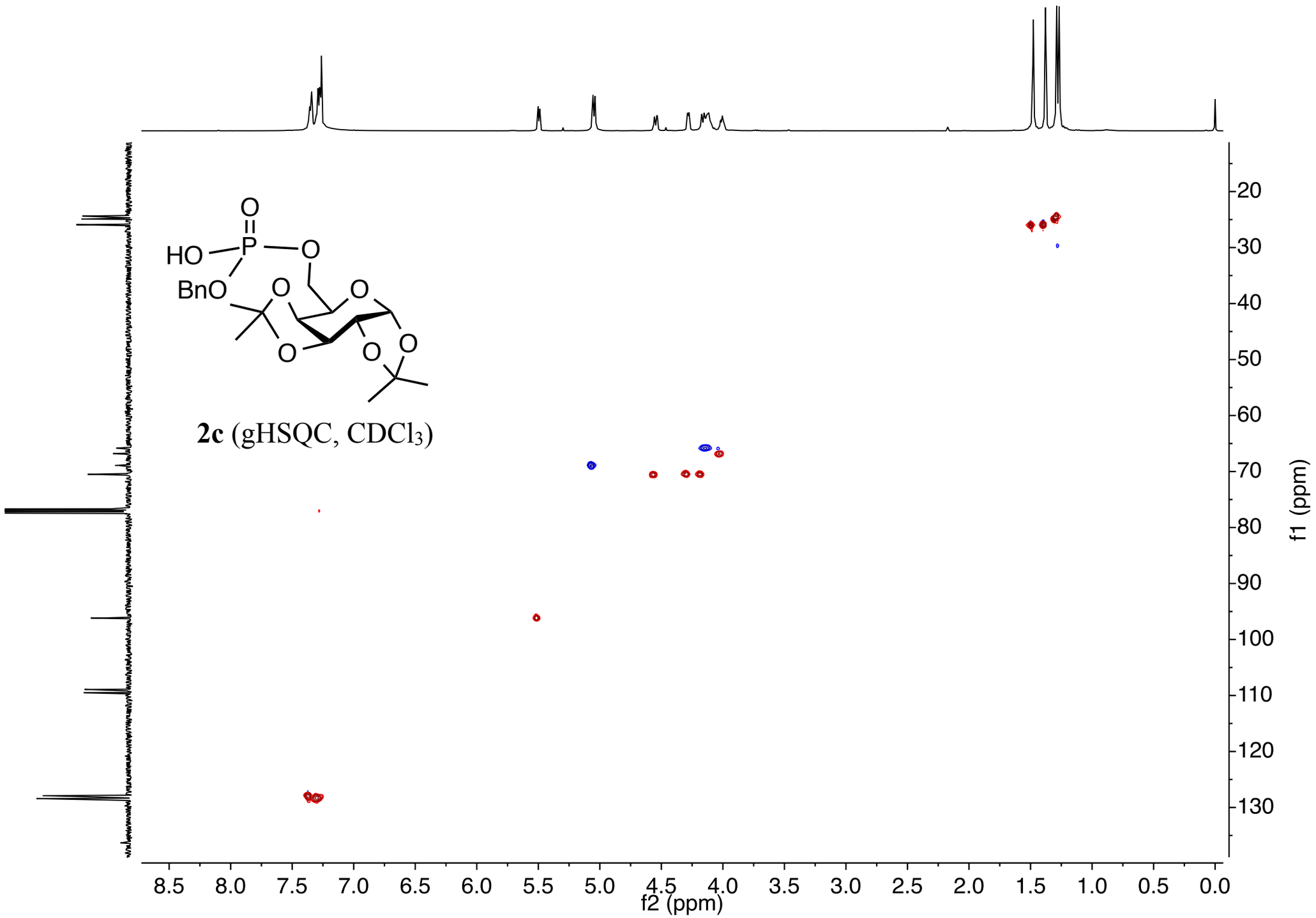
2c (^{13}C NMR, 101 MHz, $CDCl_3$)

2c (^{31}P NMR, 162 MHz, $CDCl_3$)

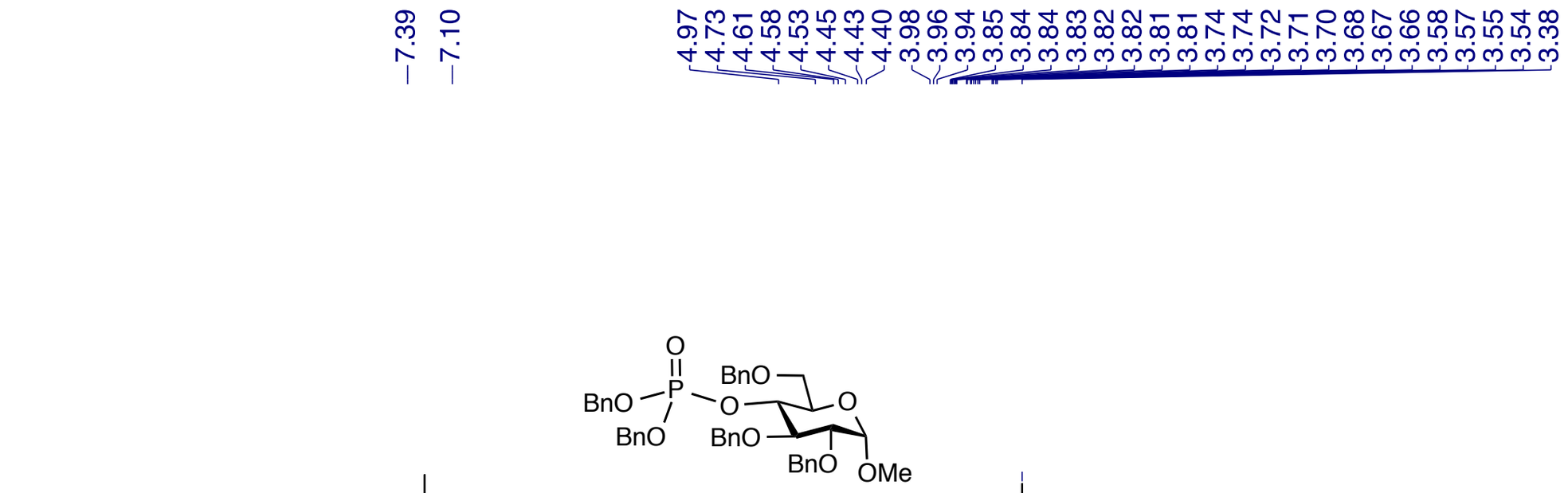




2c (gCOSY, $CDCl_3$)

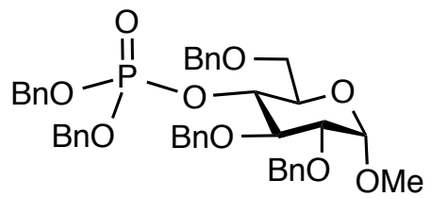


2c (gHSQC, $CDCl_3$)

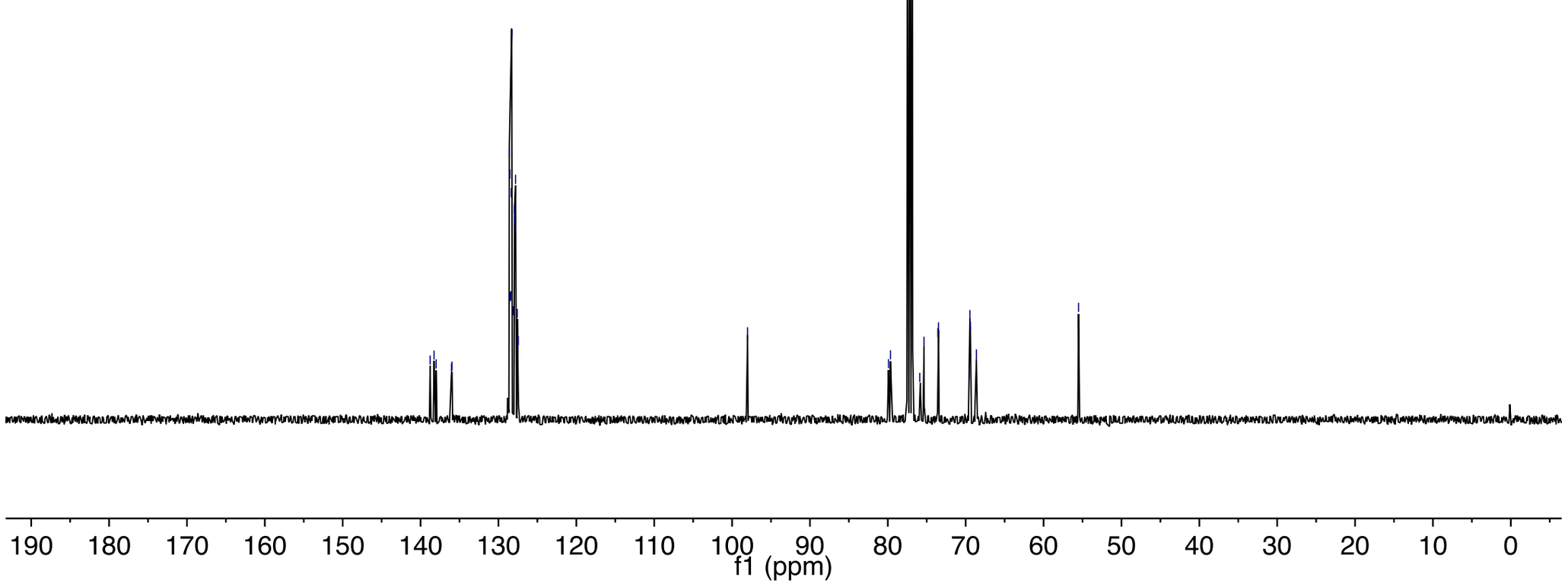


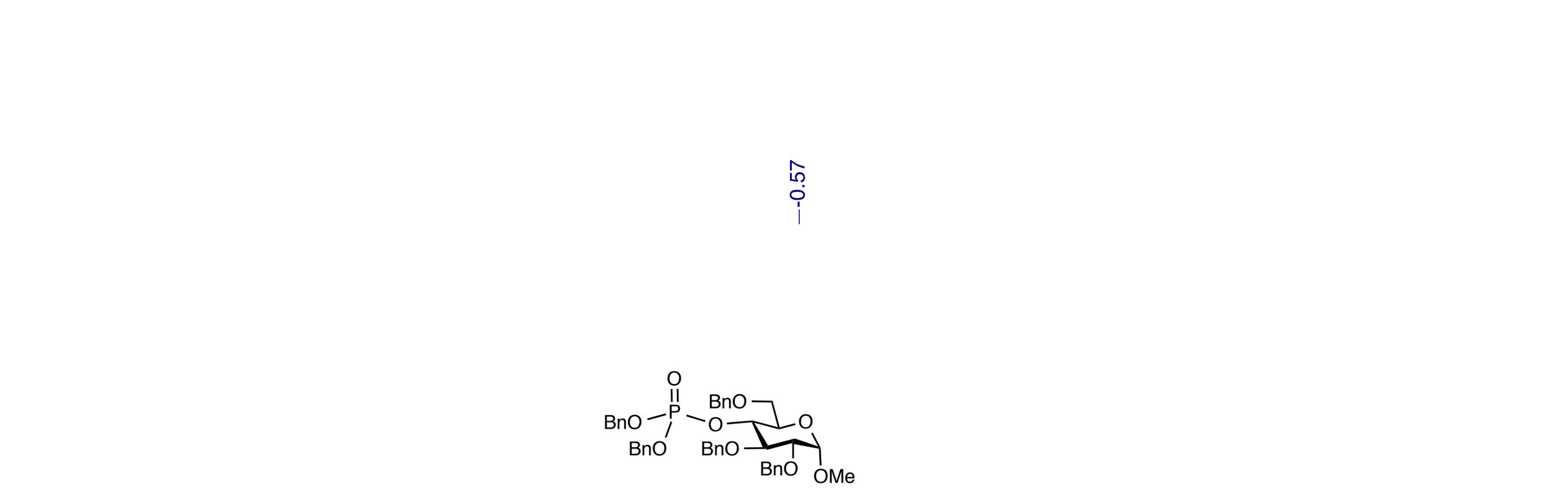
S3 (^{1}H NMR, 400 MHz, $CDCl_3$)

138.77
138.27
137.99
136.04
135.96
128.59
128.53
128.48
128.40
128.36
128.30
128.12
127.94
127.91
127.81
127.77
127.57
127.45
98.01
79.92
79.65
75.90
75.35
73.58
73.49
69.53
69.46
69.41
68.62
55.51

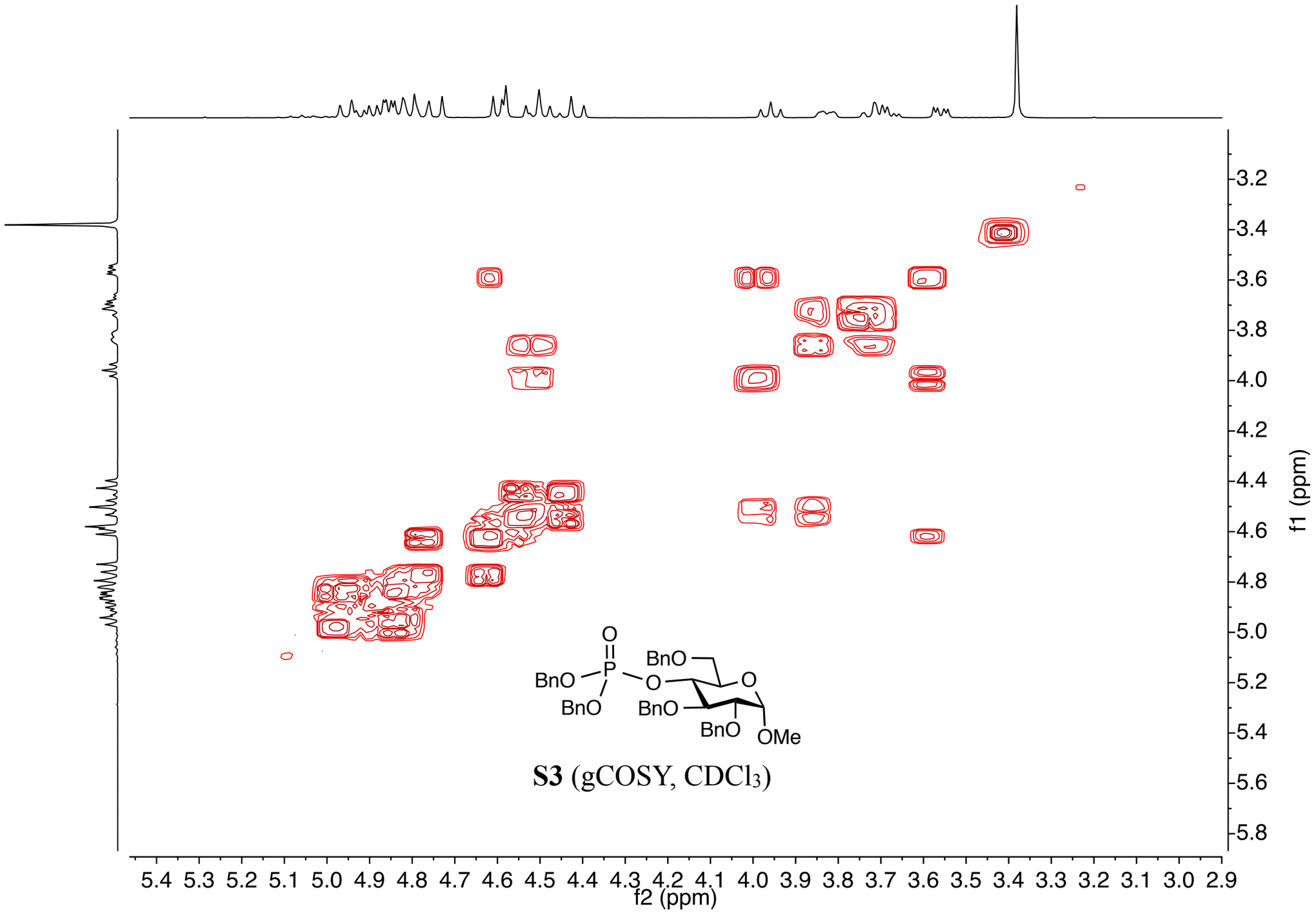


S3 (^{13}C NMR, 101 MHz, $CDCl_3$)

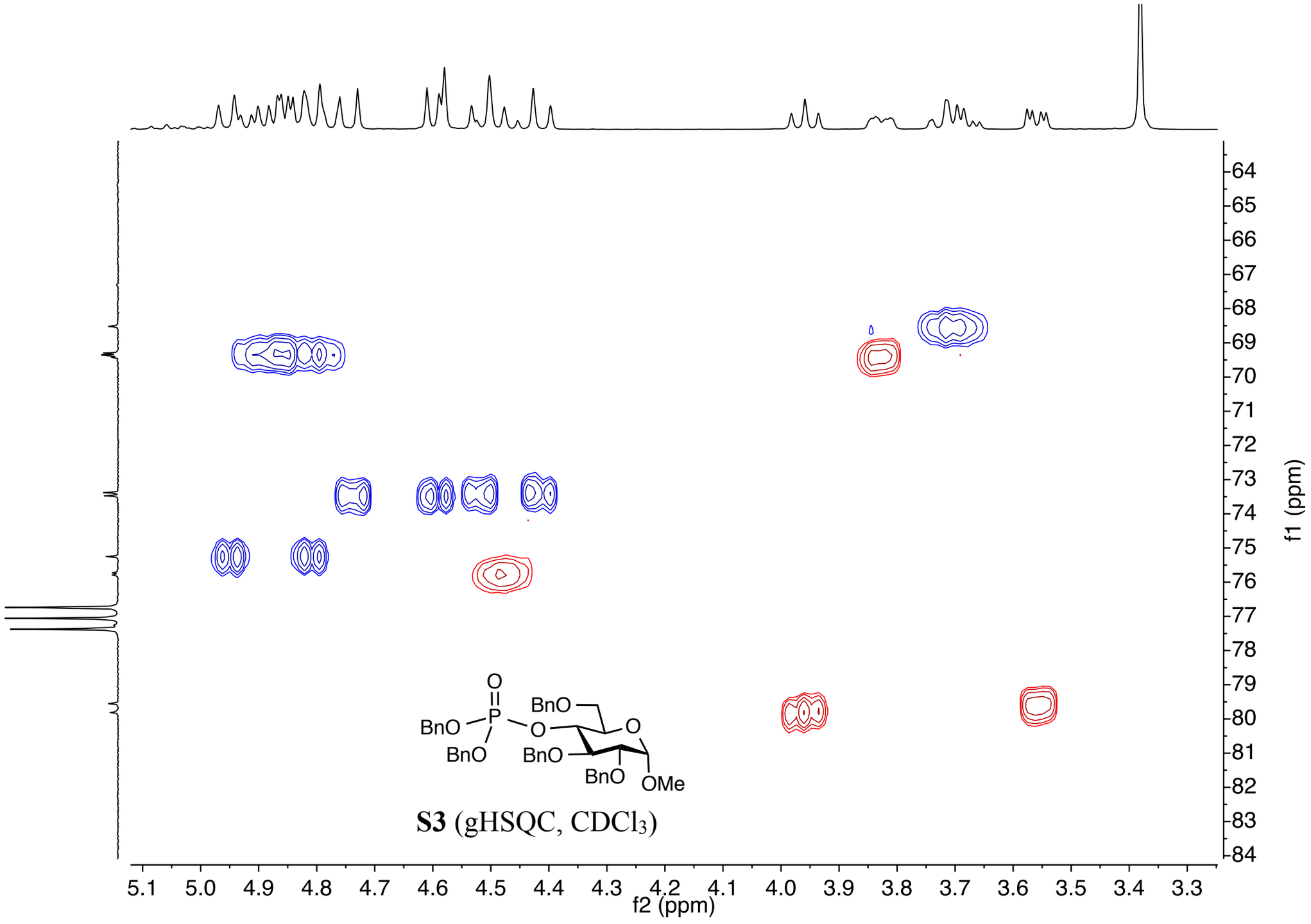




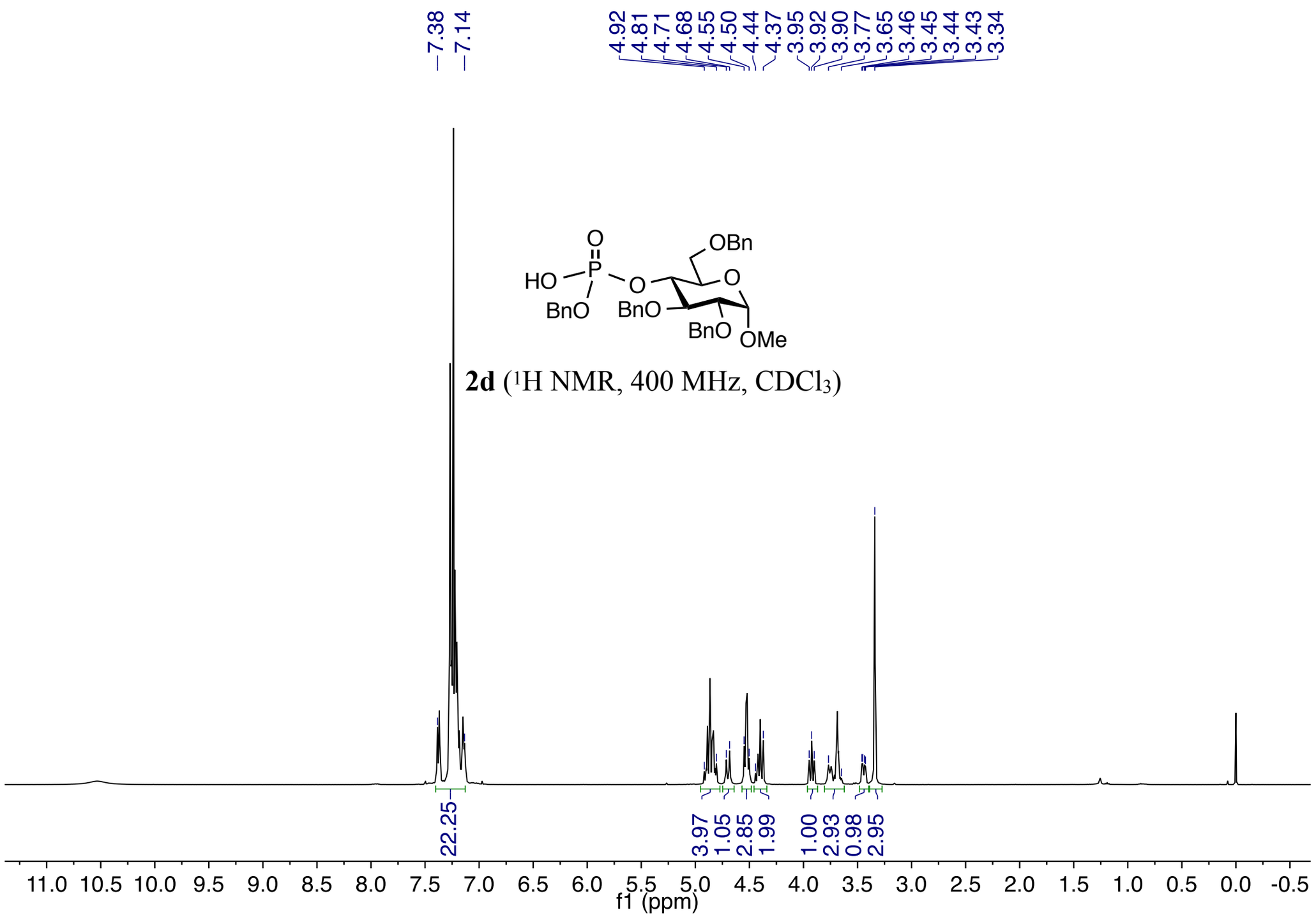
S3 (^{31}P NMR, 162 MHz, $CDCl_3$)



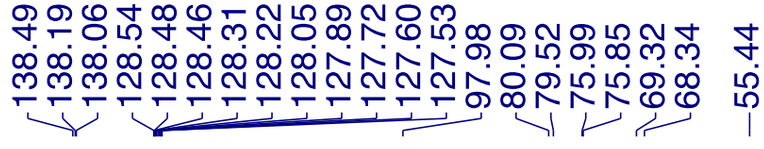
S3 (gCOSY, $CDCl_3$)

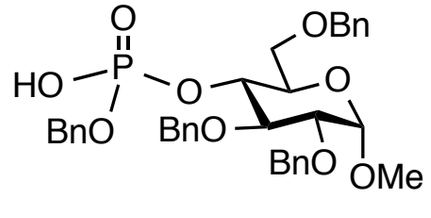


S3 (gHSQC, $CDCl_3$)

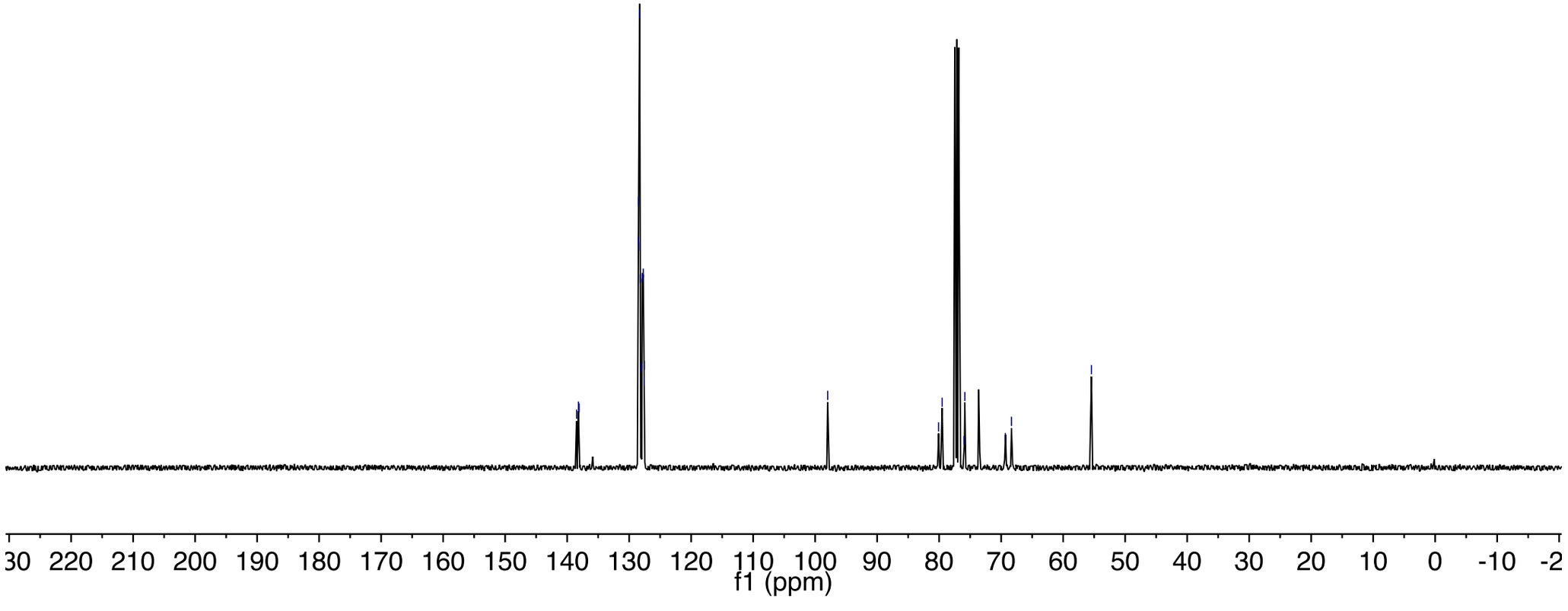


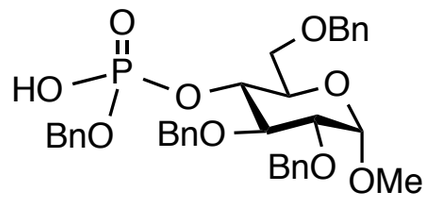
2d (^{1}H NMR, 400 MHz, $CDCl_3$)



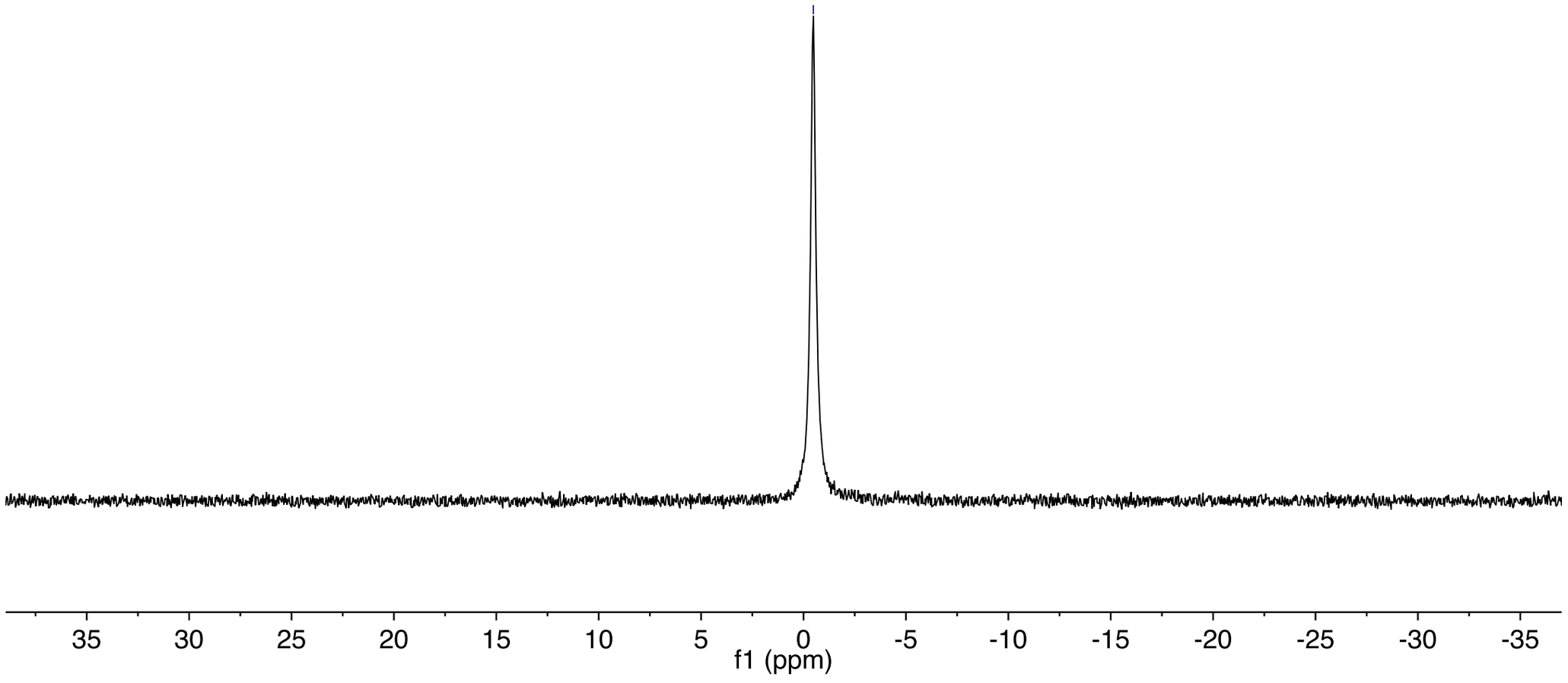


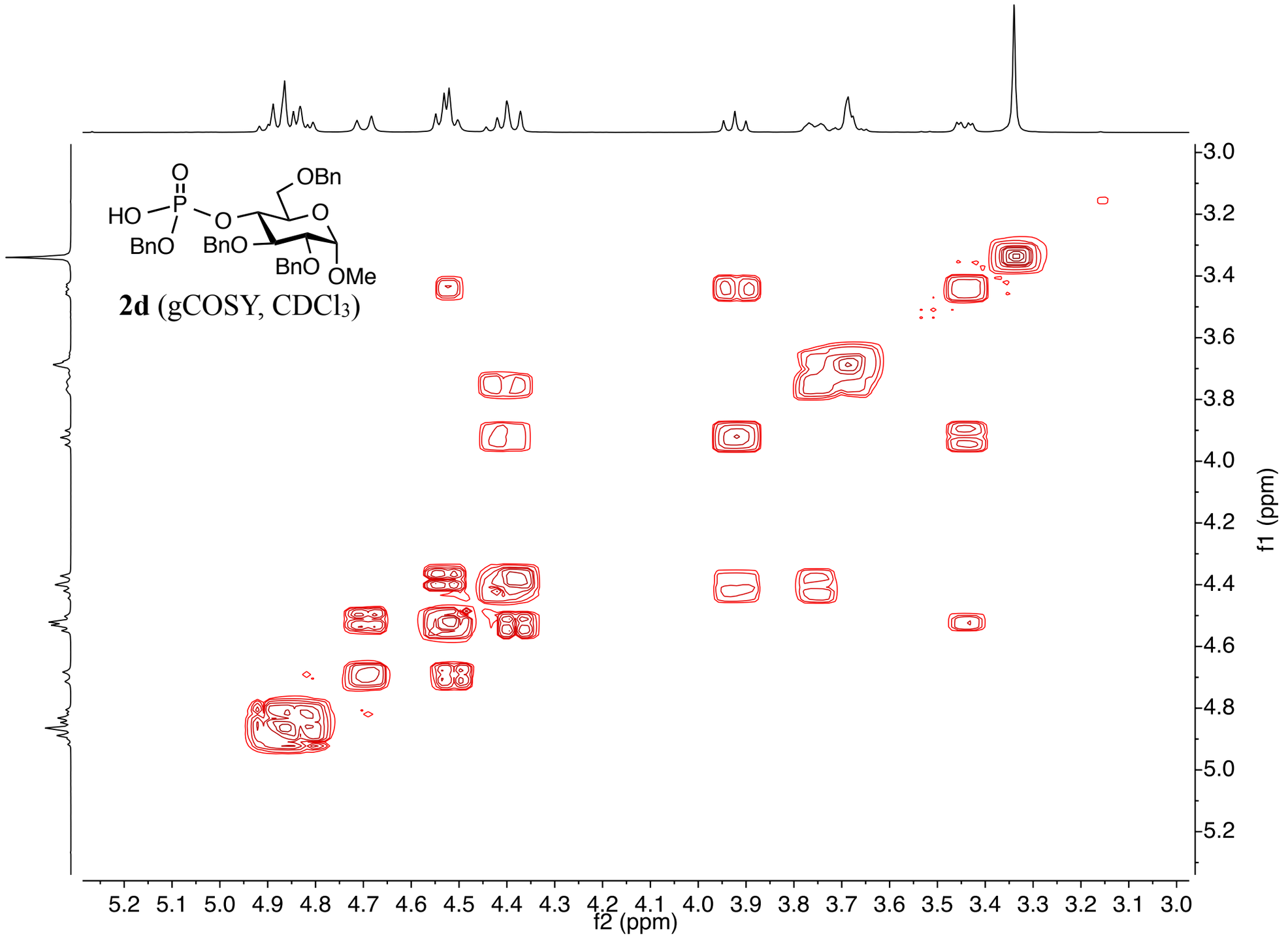
2d (^{13}C NMR, 101 MHz, $CDCl_3$)

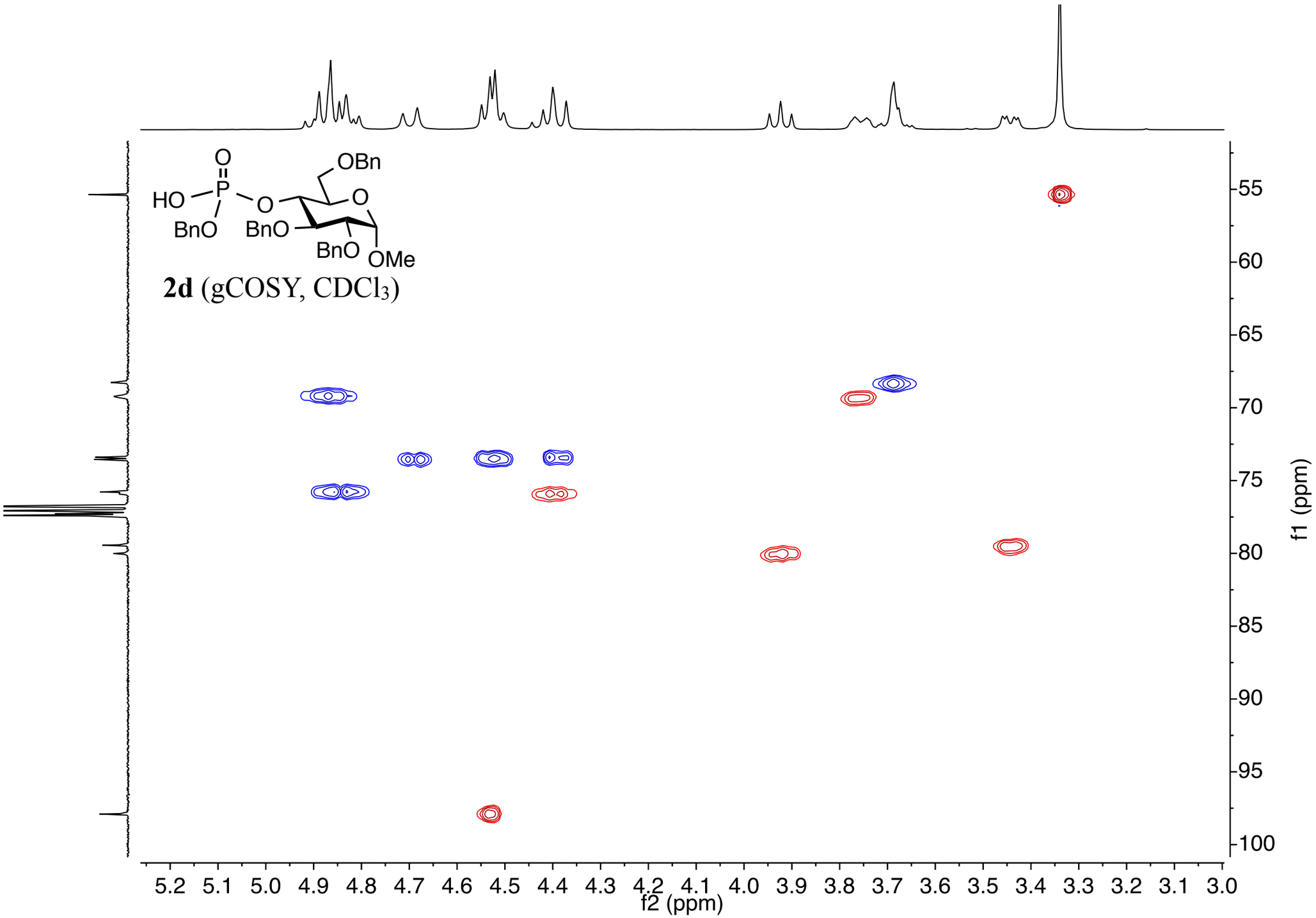


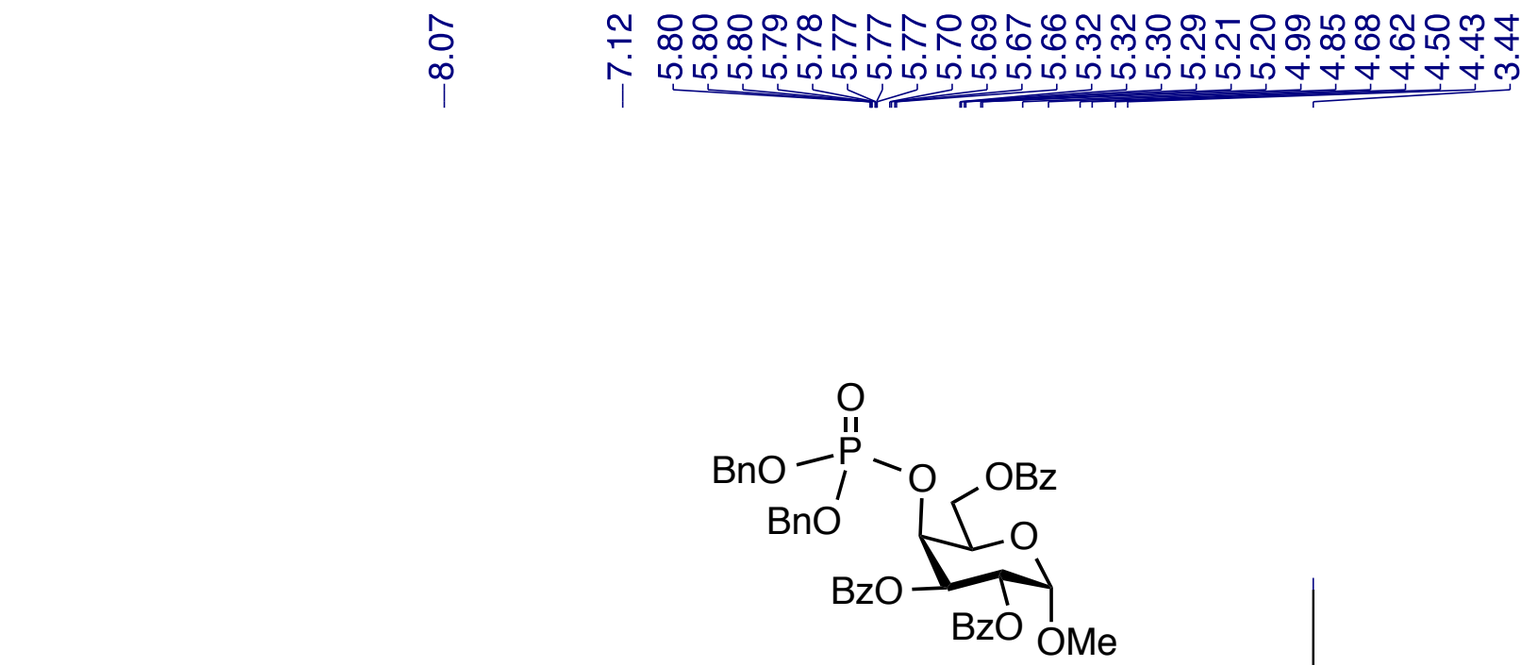


2d (^{31}P NMR, 162 MHz, $CDCl_3$)

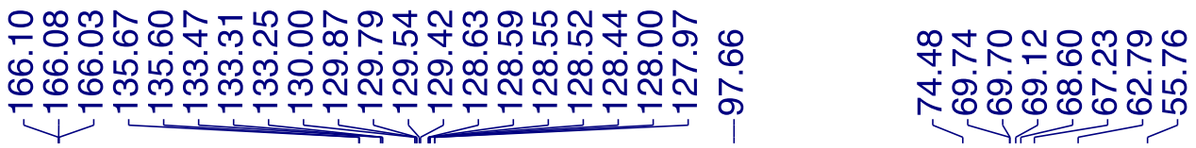


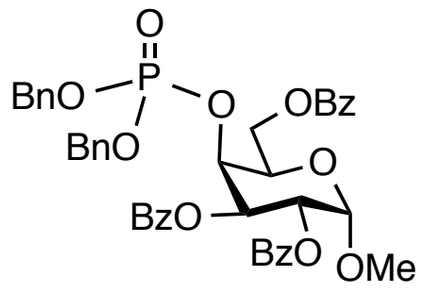

O
HO
P
O
OBn
O
BnO
BnO
BnO
OMe
2d (gCOSY, CDCl3)
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
f1 (ppm)
5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3 3.2 3.1 3.0
f2 (ppm)


O
HO
P
O
OBn
O
BnO
BnO
BnO
OMe
2d (gCOSY, CDCl3)
55
60
65
70
75
80
85
90
95
100
f1 (ppm)
5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3 3.2 3.1 3.0
f2 (ppm)

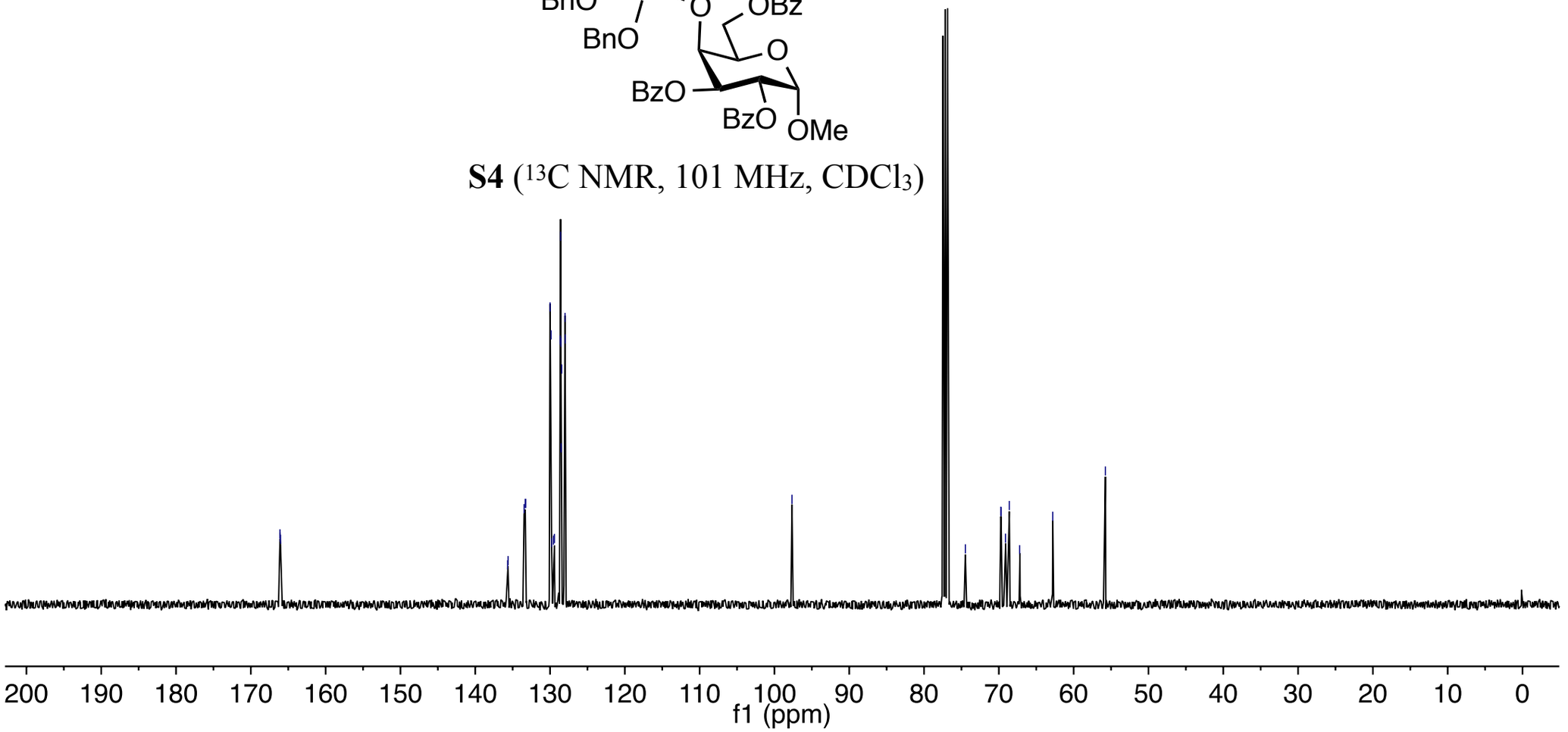


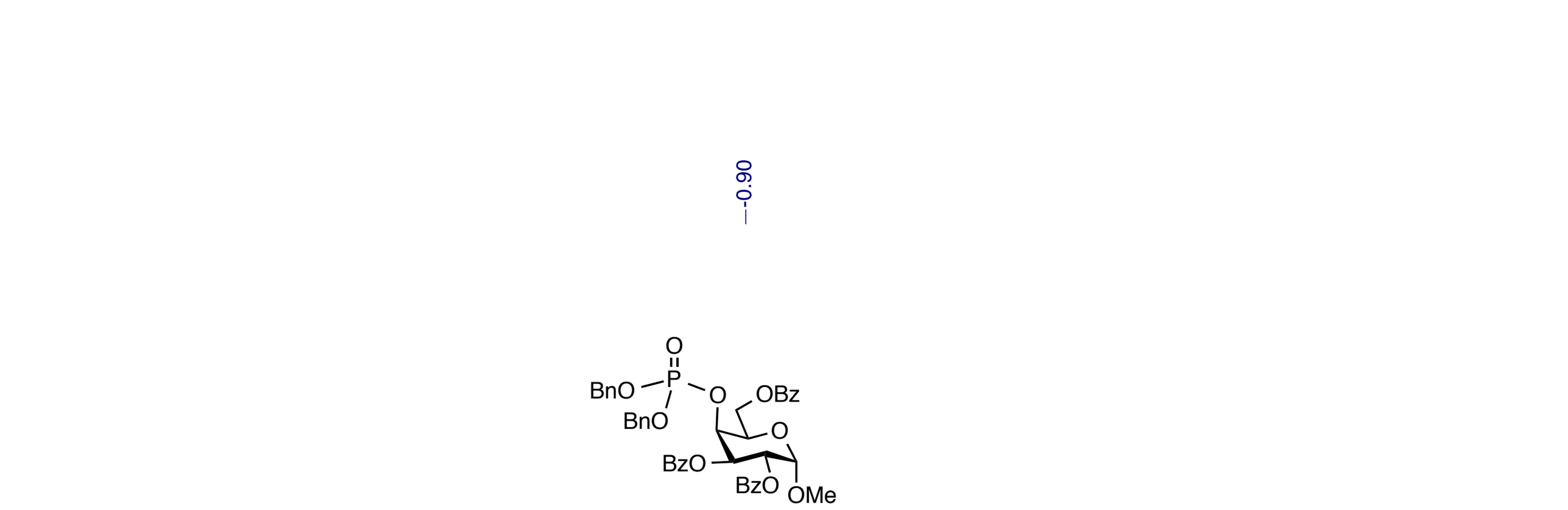
S4 (^{1}H NMR, 400 MHz, $CDCl_3$)



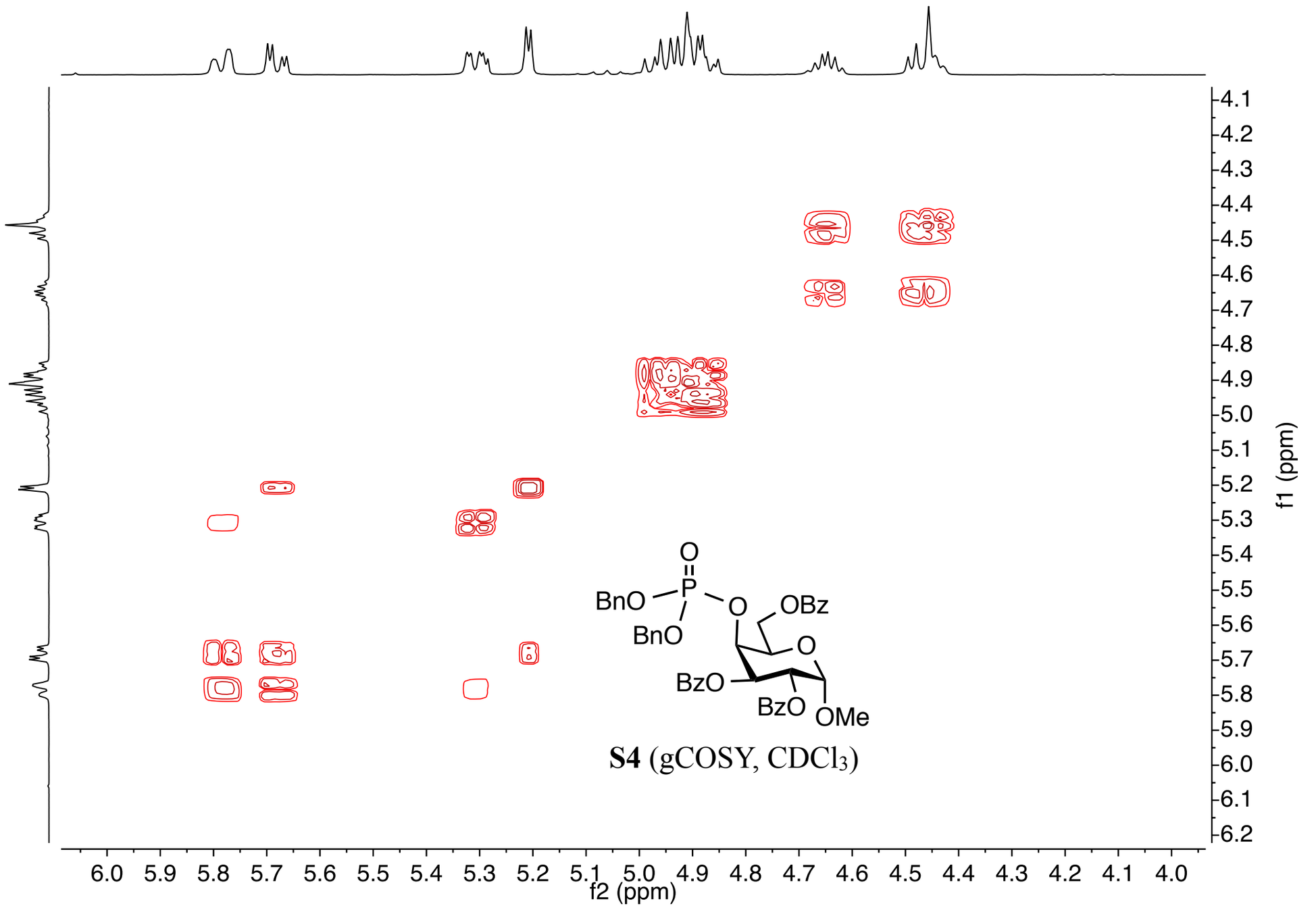


S4 (^{13}C NMR, 101 MHz, $CDCl_3$)

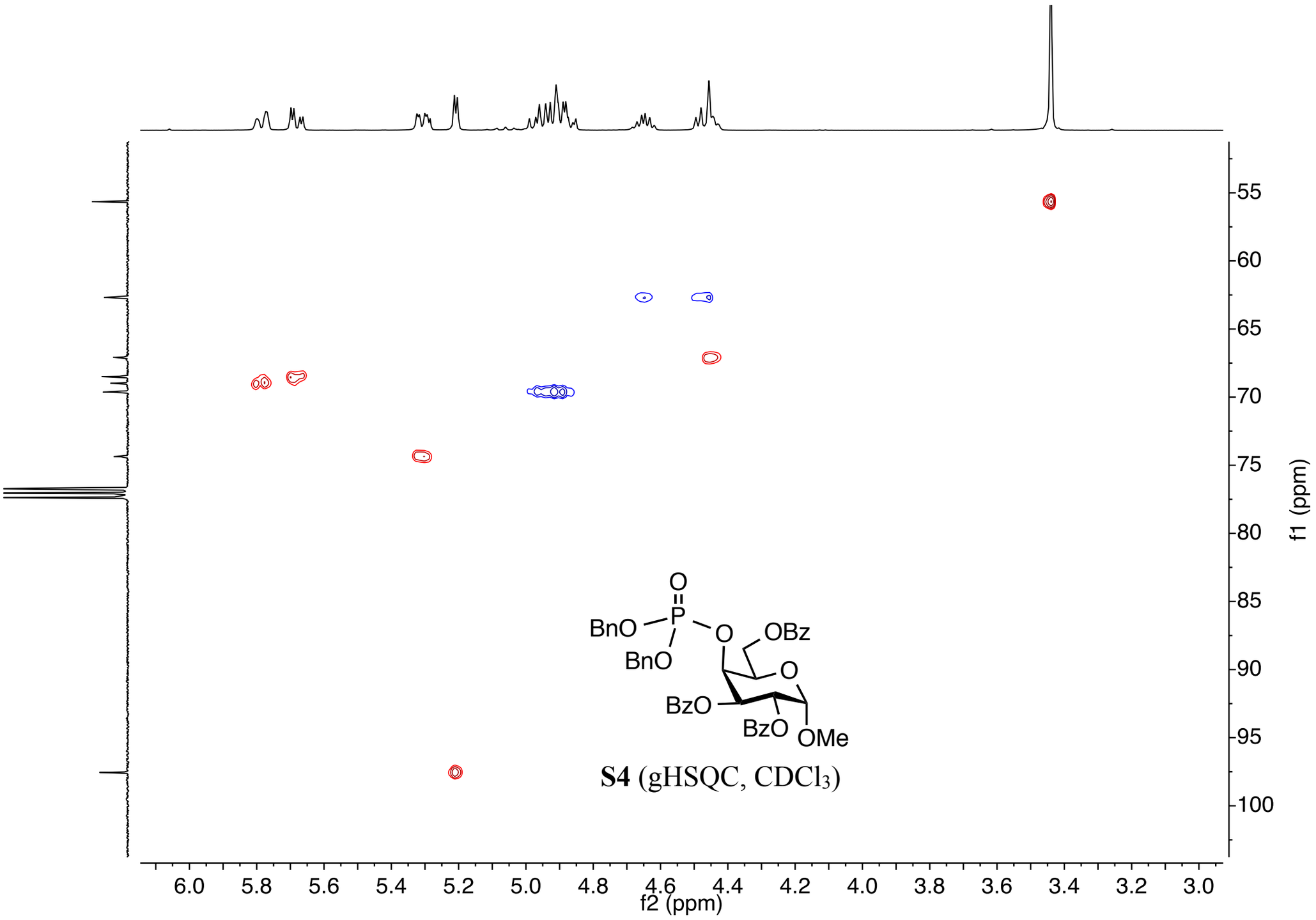




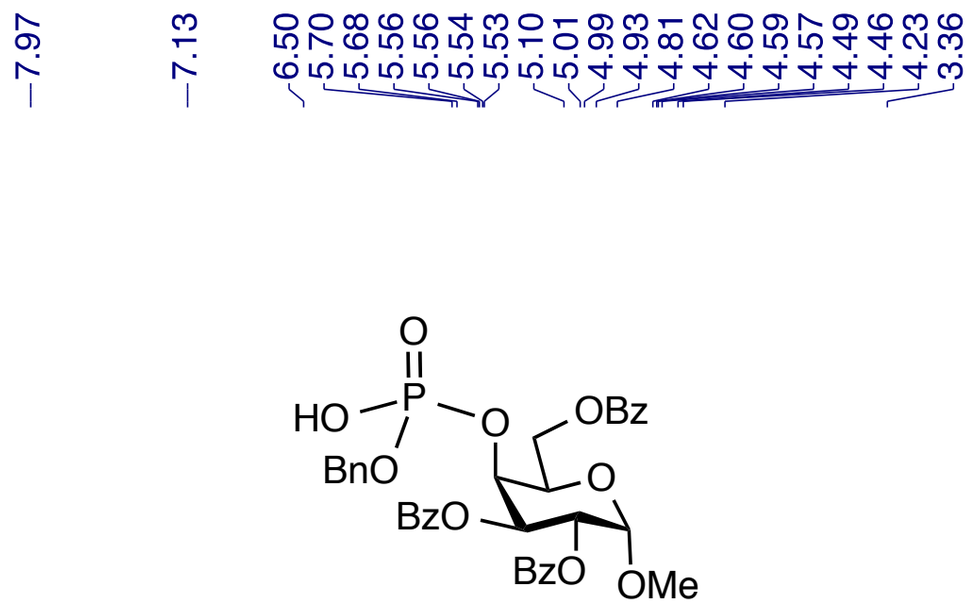
S4 (^{31}P NMR, 162 MHz, $CDCl_3$)



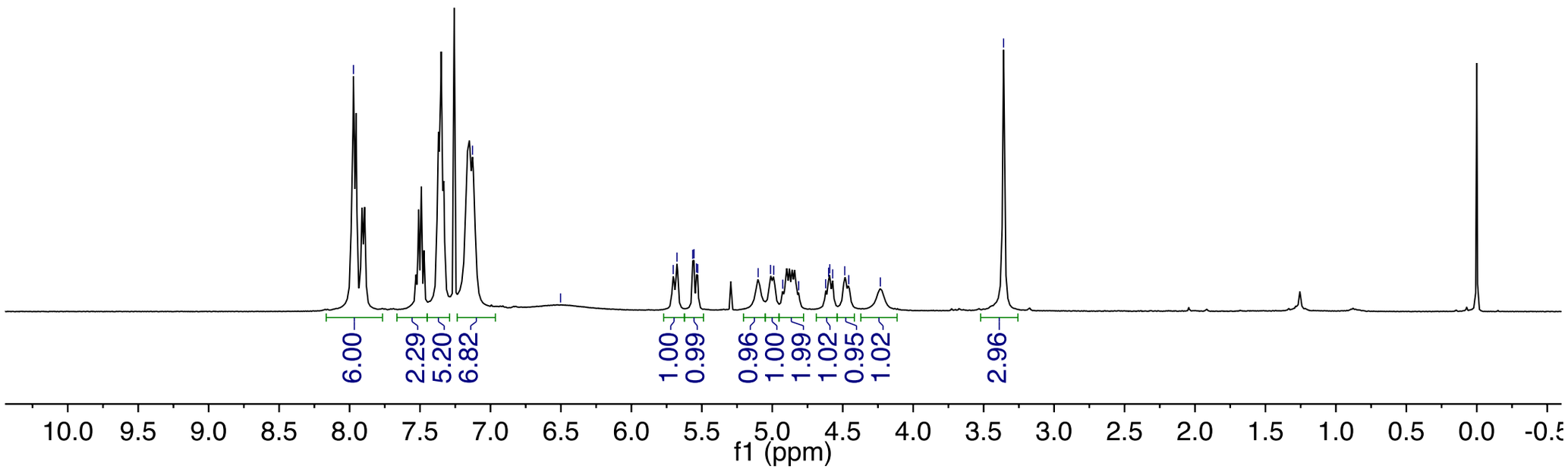
S4 (gCOSY, $CDCl_3$)

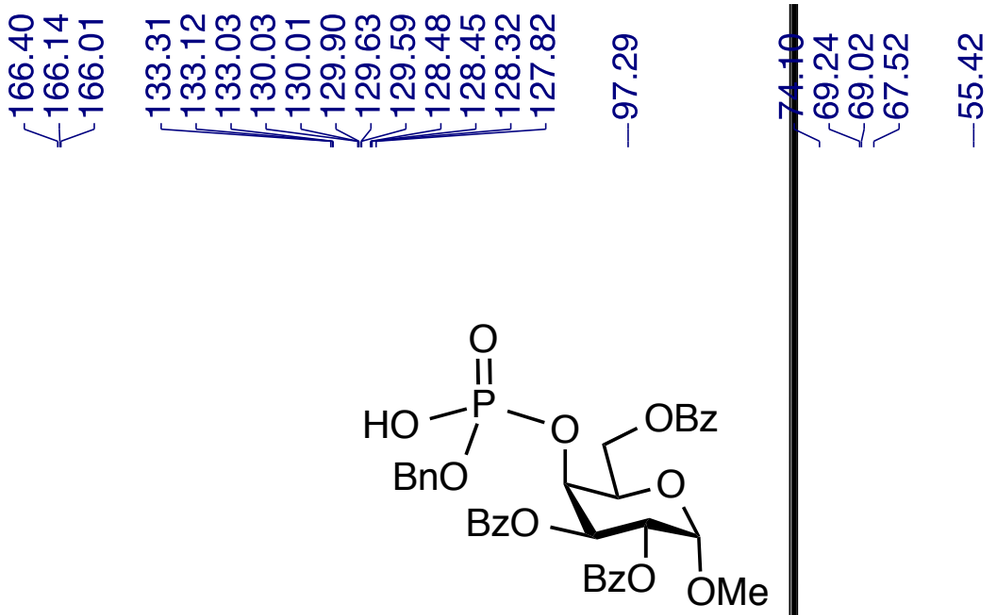


S4 (gHSQC, $CDCl_3$)

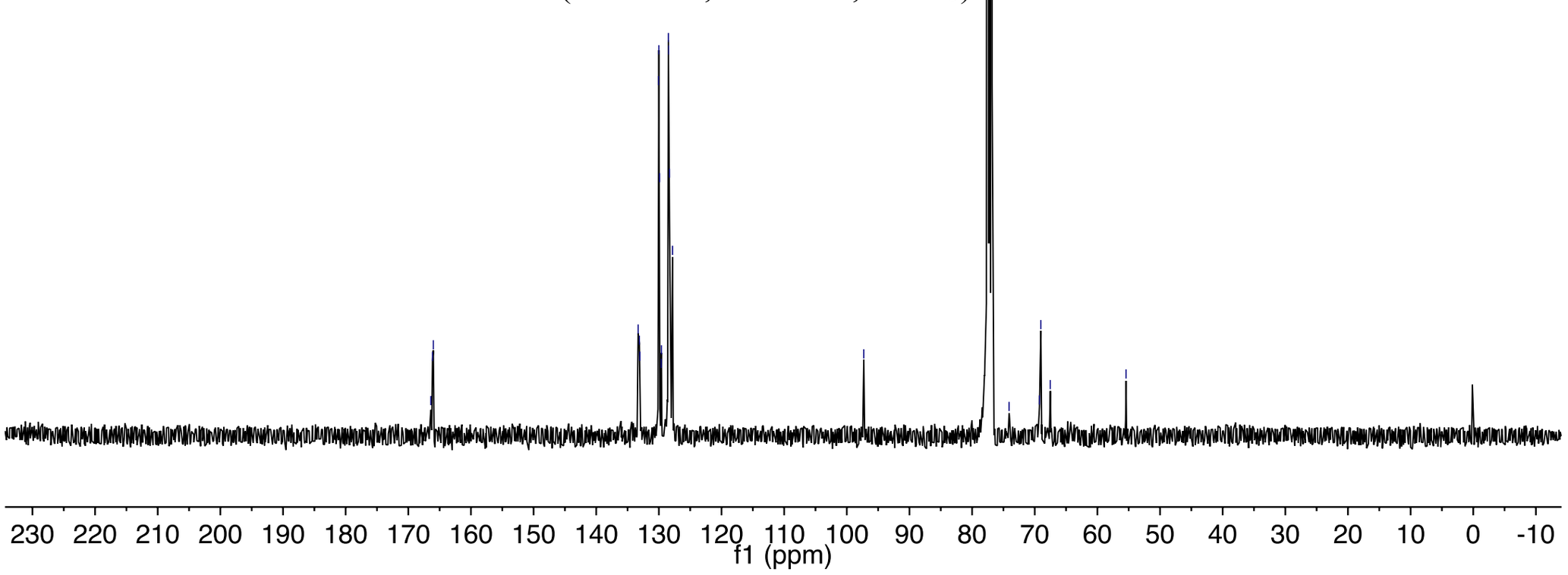


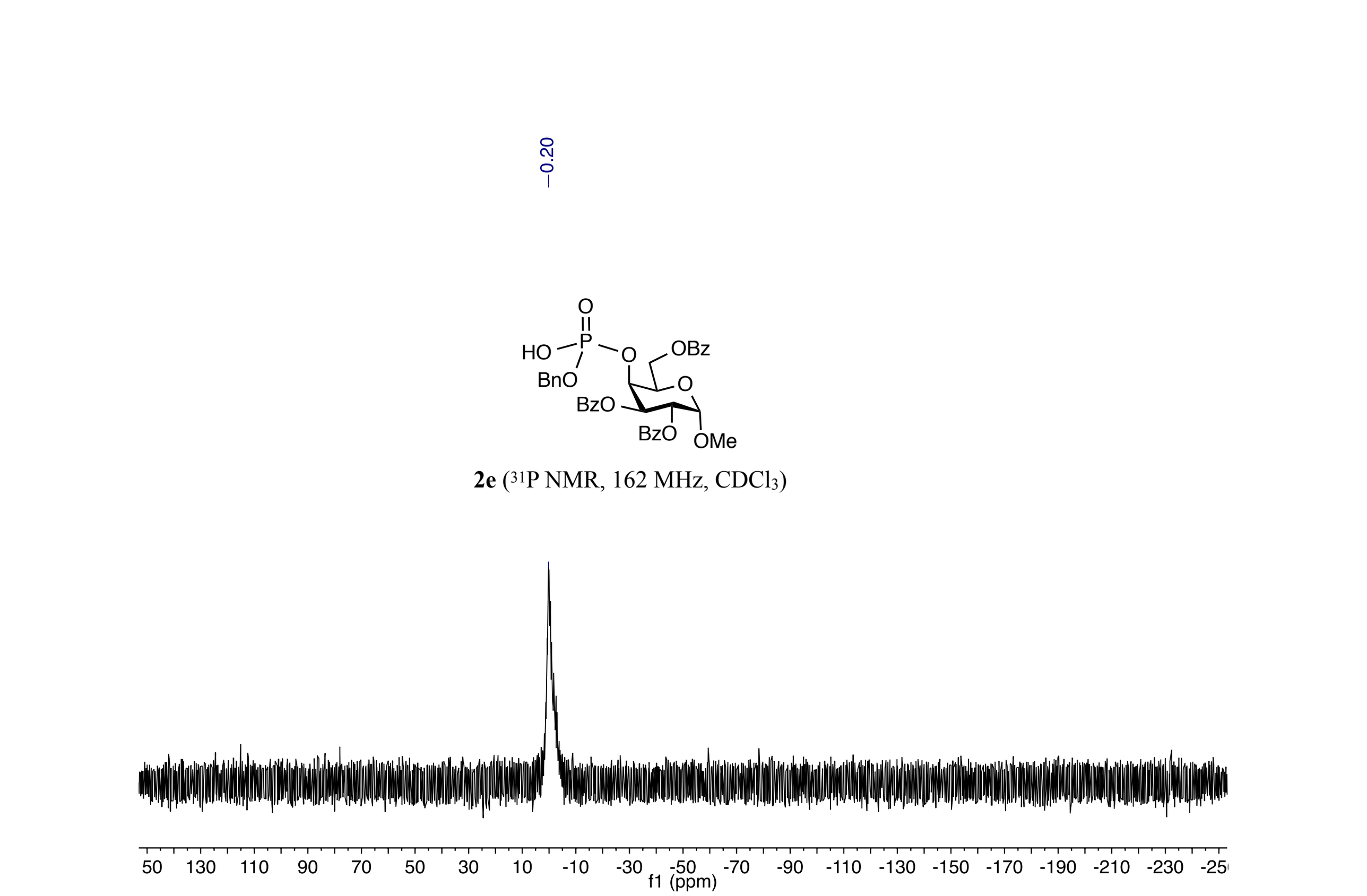
2e (^{1}H NMR, 400 MHz, $CDCl_3$)



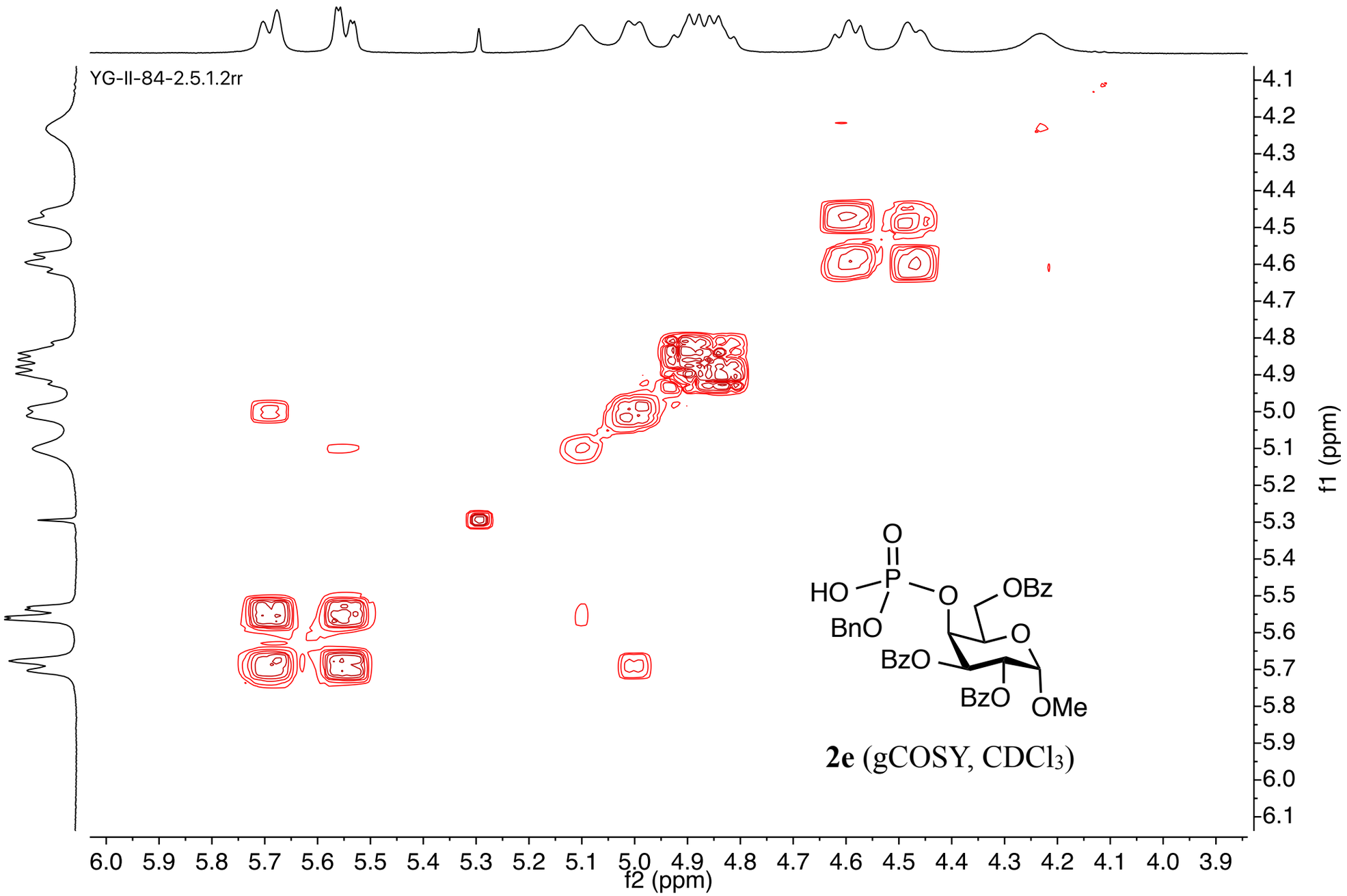


2e (^{13}C NMR, 101 MHz, $CDCl_3$)



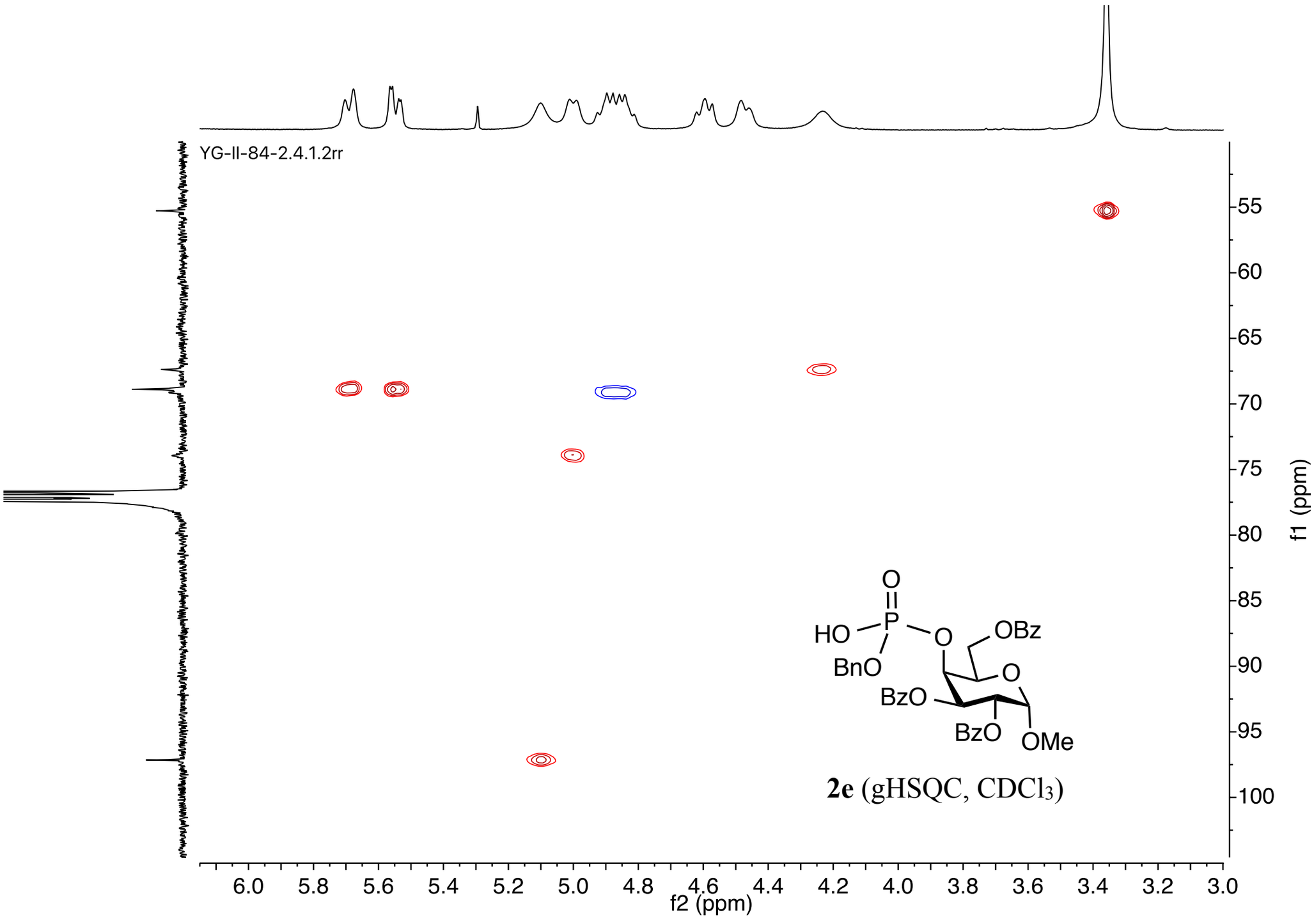


2e (^{31}P NMR, 162 MHz, $CDCl_3$)

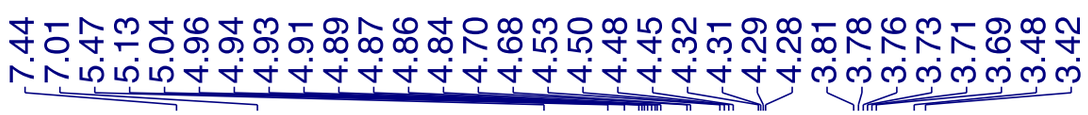


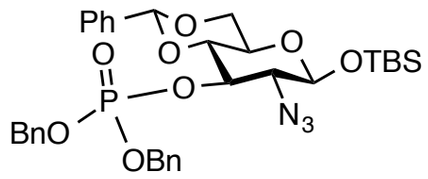
2e (gCOSY, $CDCl_3$)

YG-II-84-2.4.1.2rr

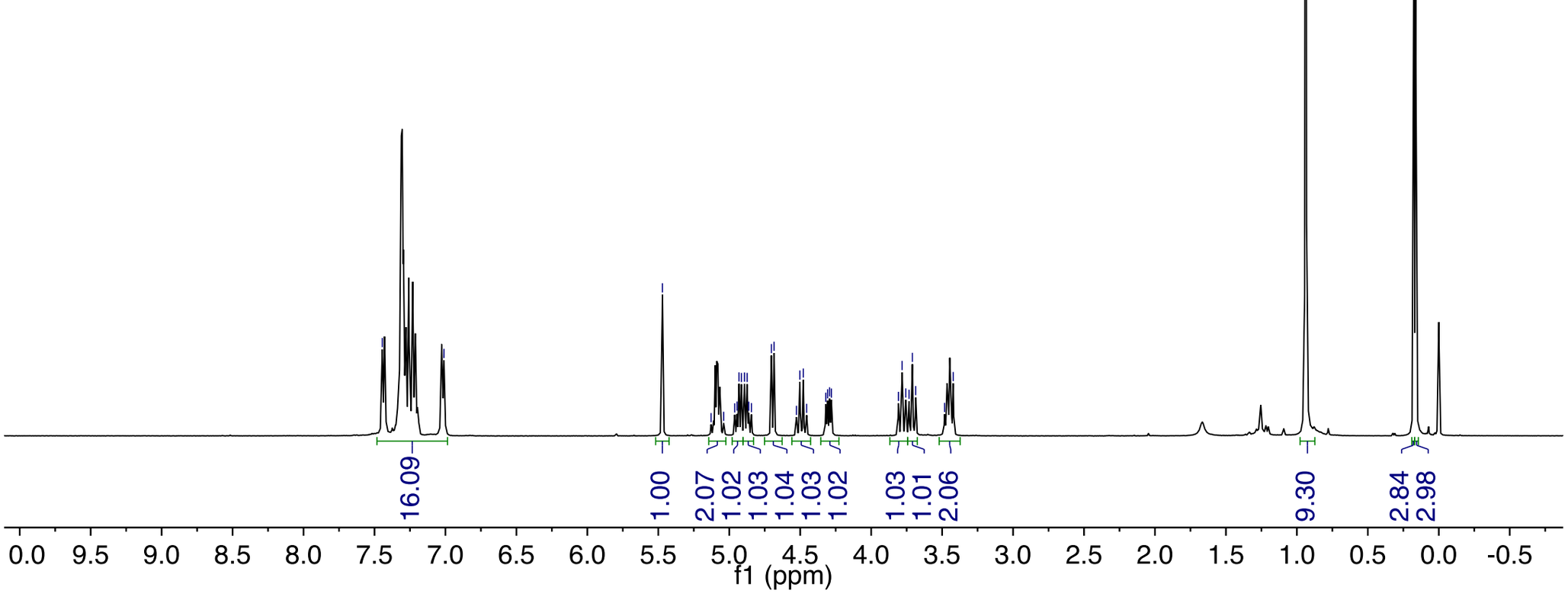


2e (gHSQC, $CDCl_3$)



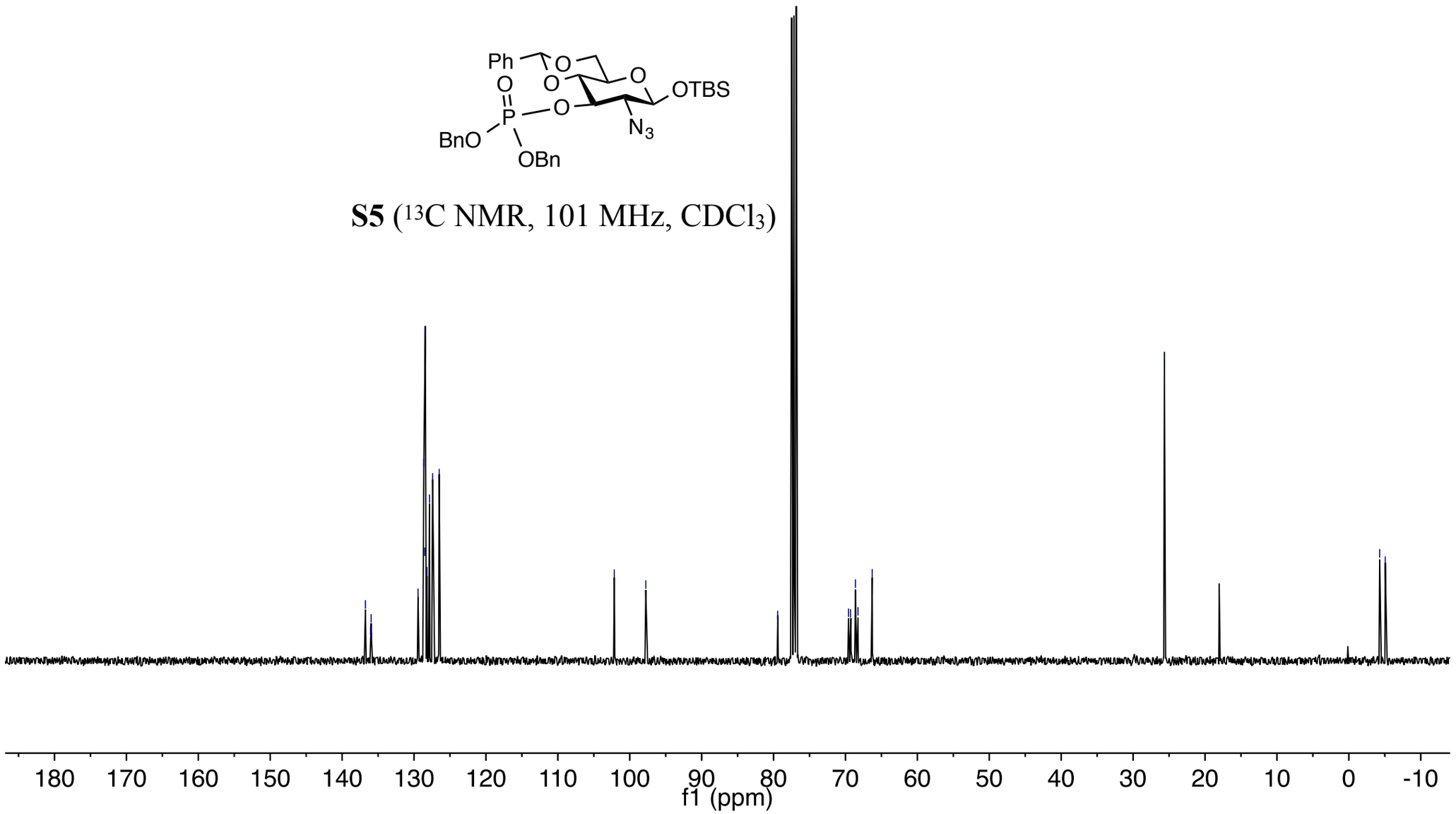


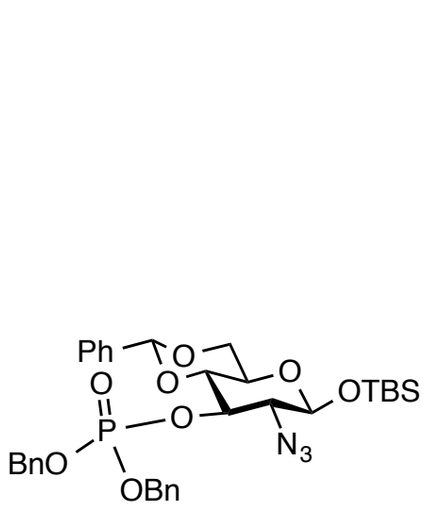
S5 (^{1}H NMR, 400 MHz, $CDCl_3$)



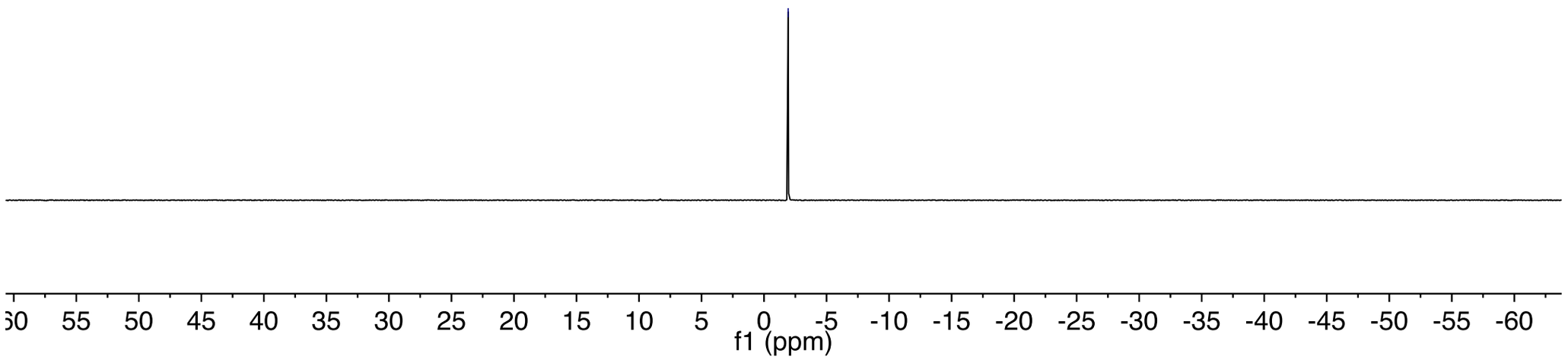
136.76
136.05
135.97
135.89
129.44
128.63
128.50
128.44
128.20
127.85
127.42
126.50
102.15
97.77
79.43
69.57
69.30
68.61
68.27
66.28
25.65
-4.29
-5.07

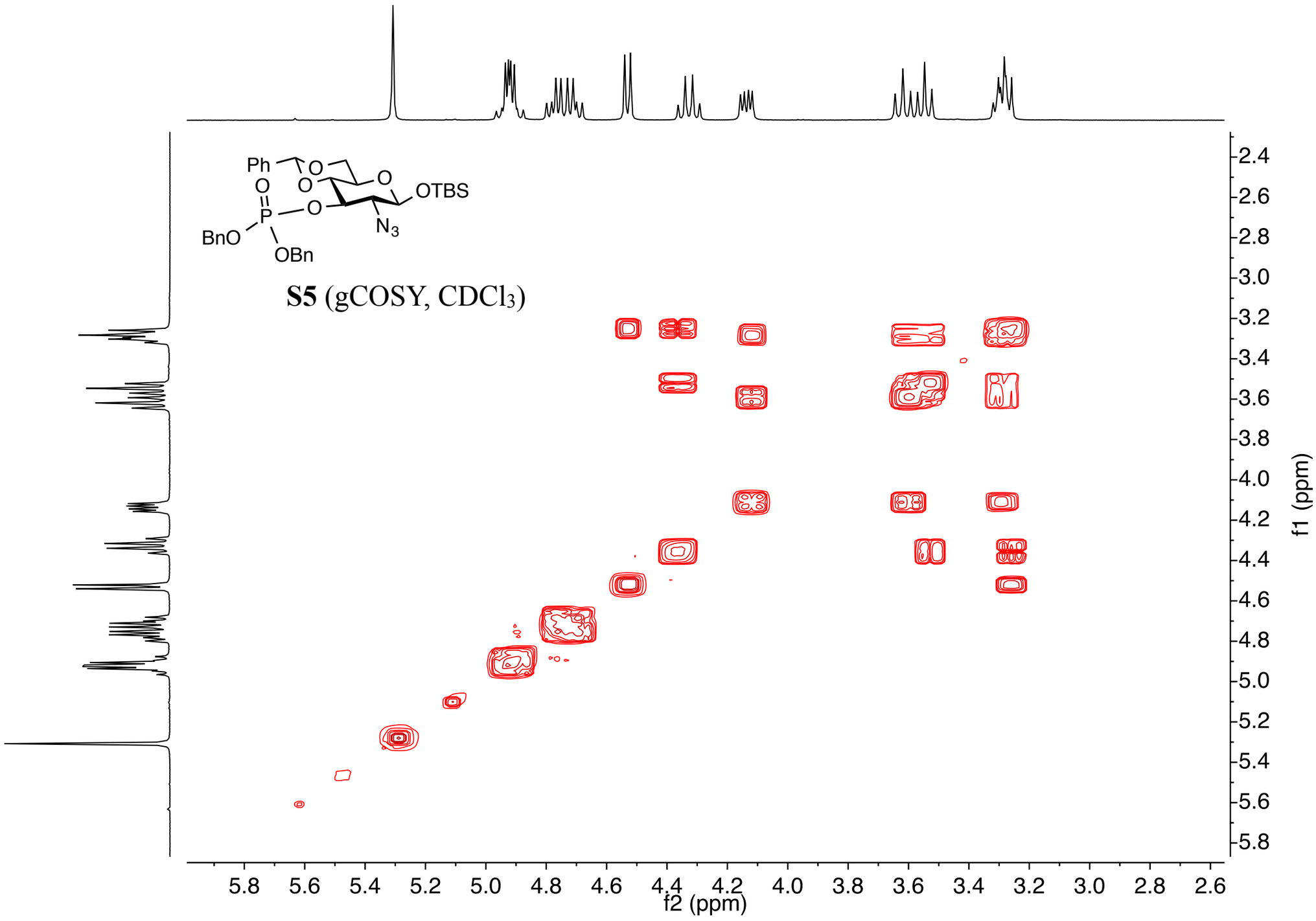
S5 (^{13}C NMR, 101 MHz, $CDCl_3$)



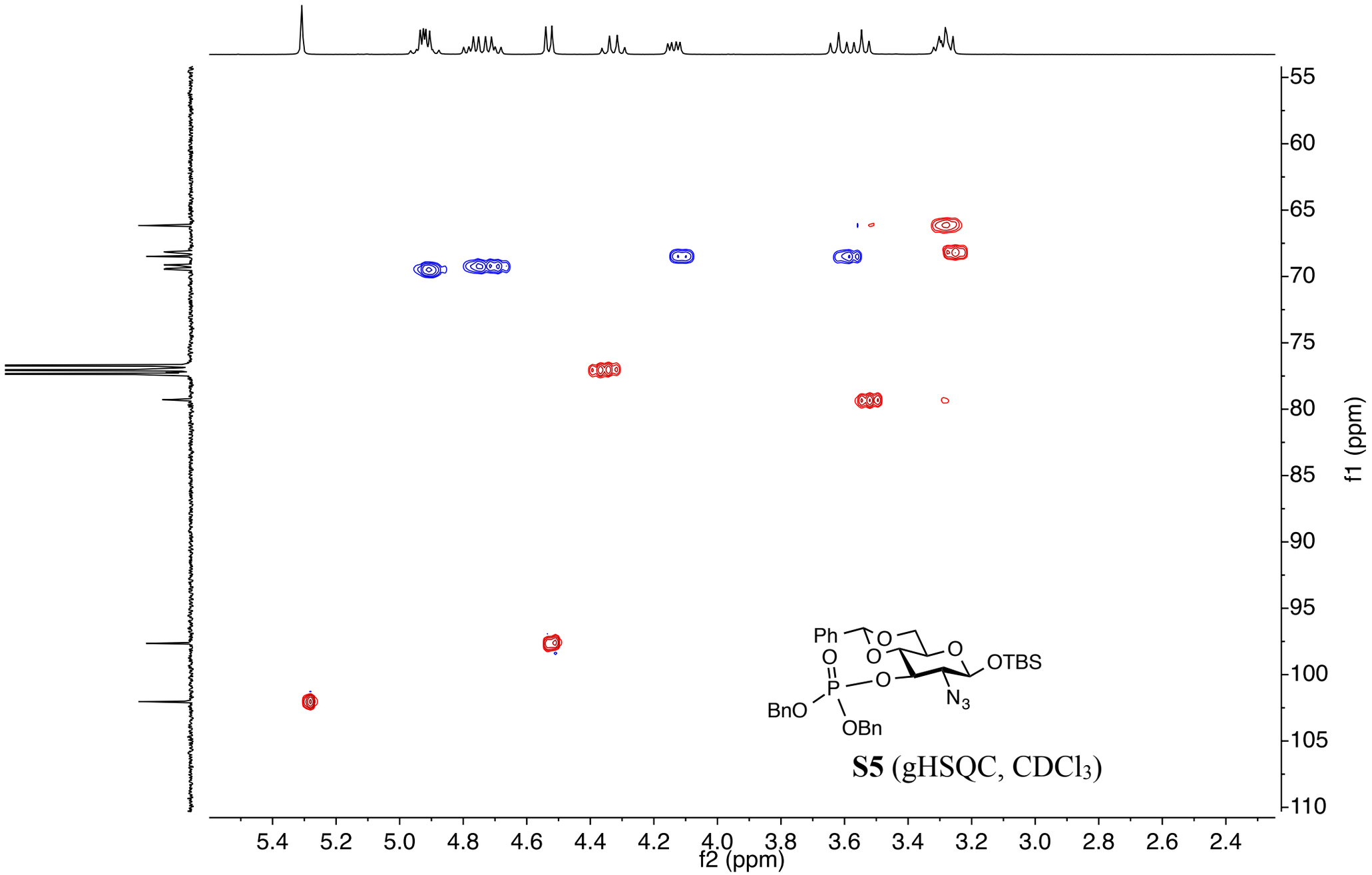


S5 (^{31}P NMR, 162 MHz, $CDCl_3$)

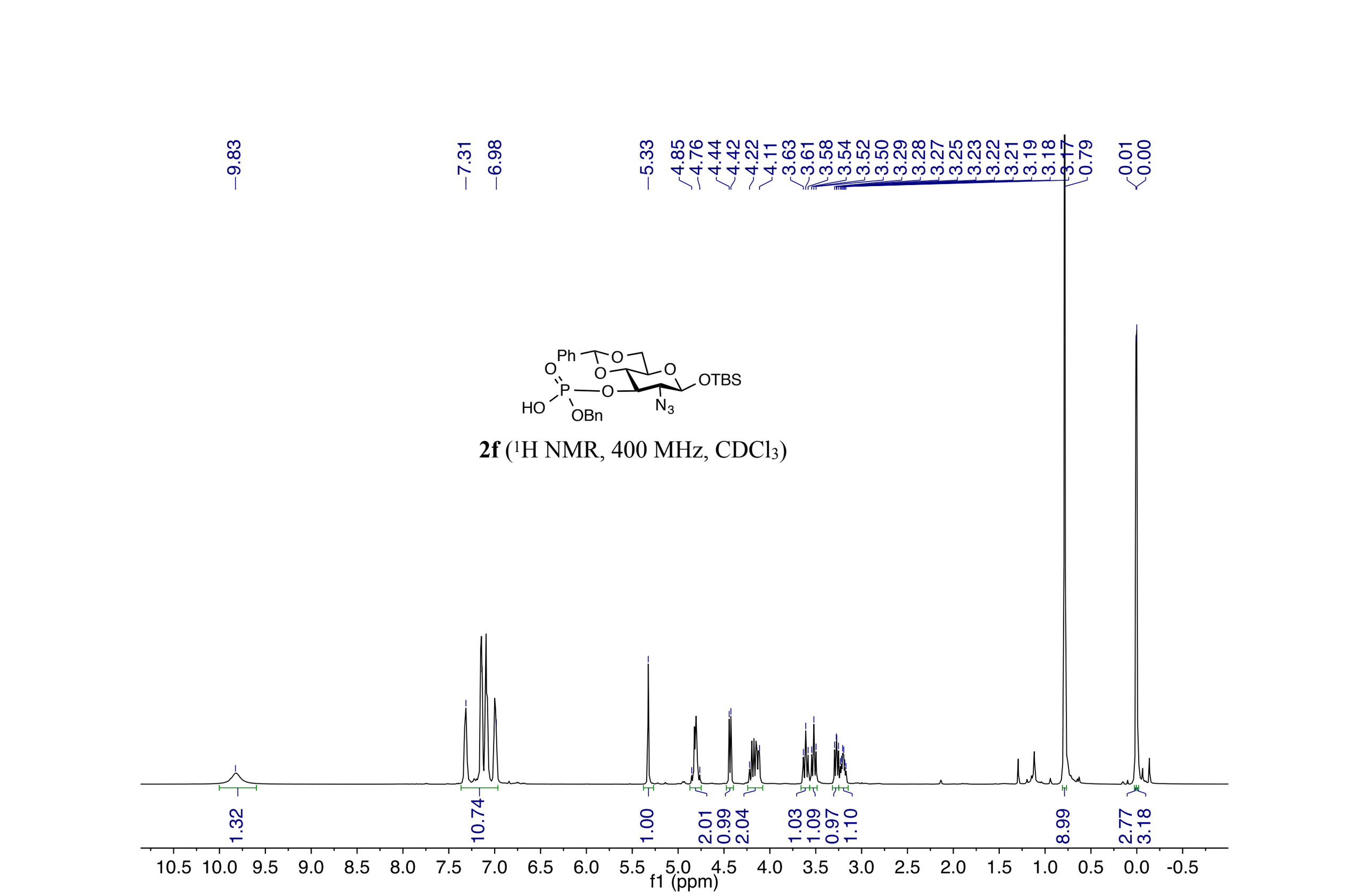




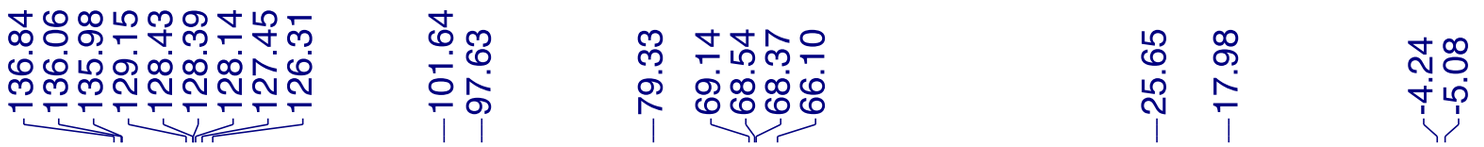
S5 (gCOSY, $CDCl_3$)

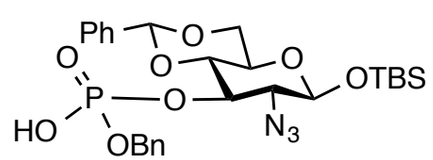


S5 (gHSQC, $CDCl_3$)

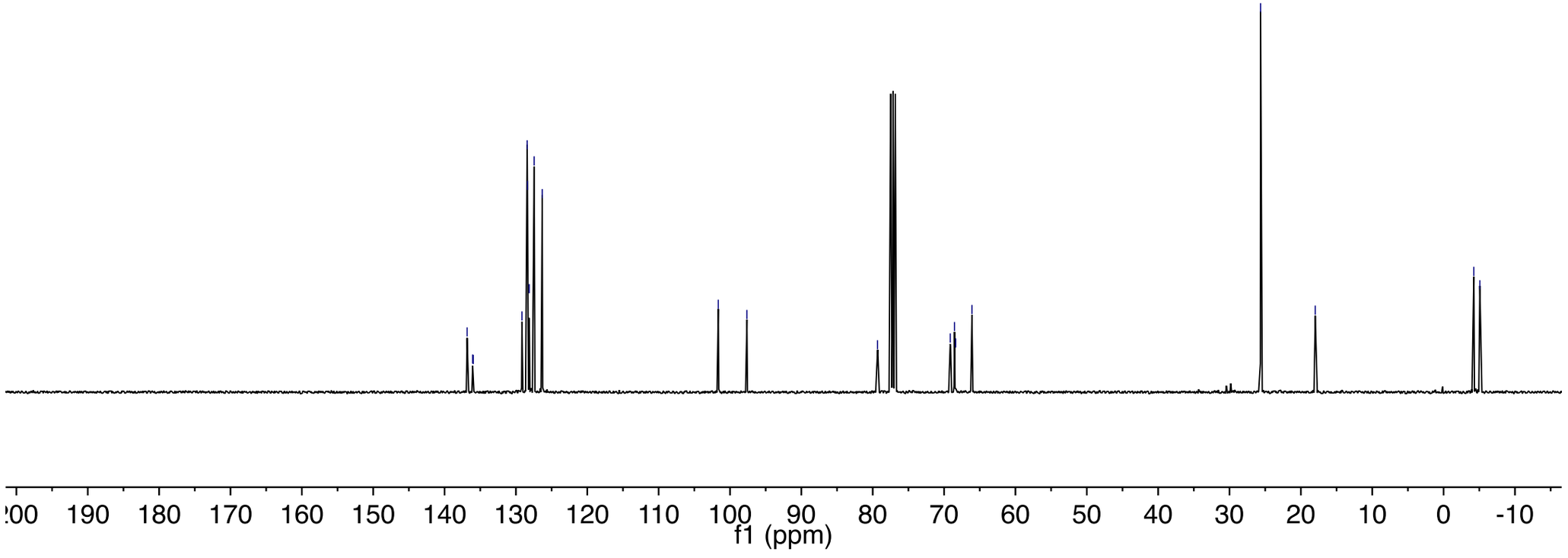


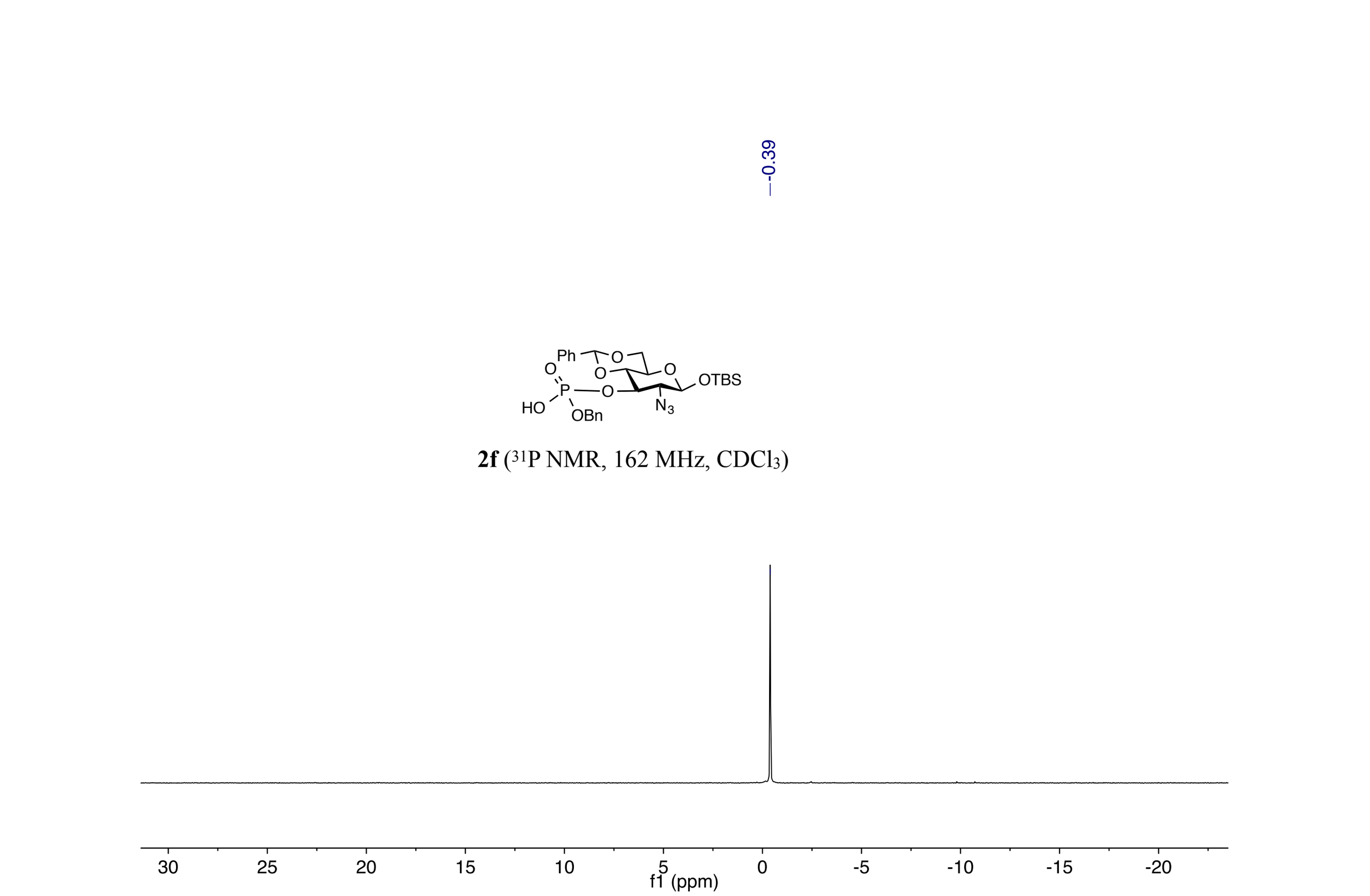
2f (^{1}H NMR, 400 MHz, $CDCl_3$)



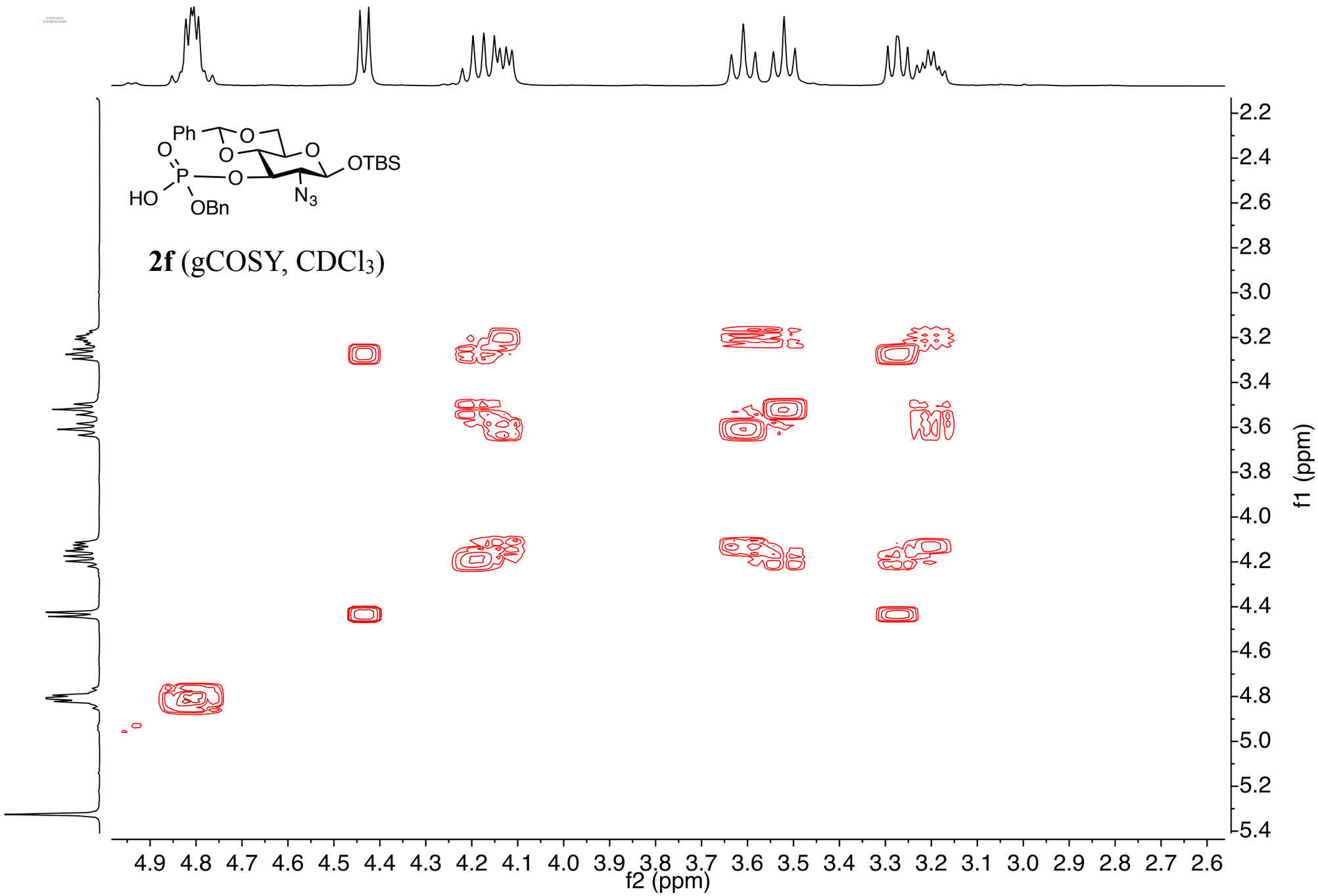


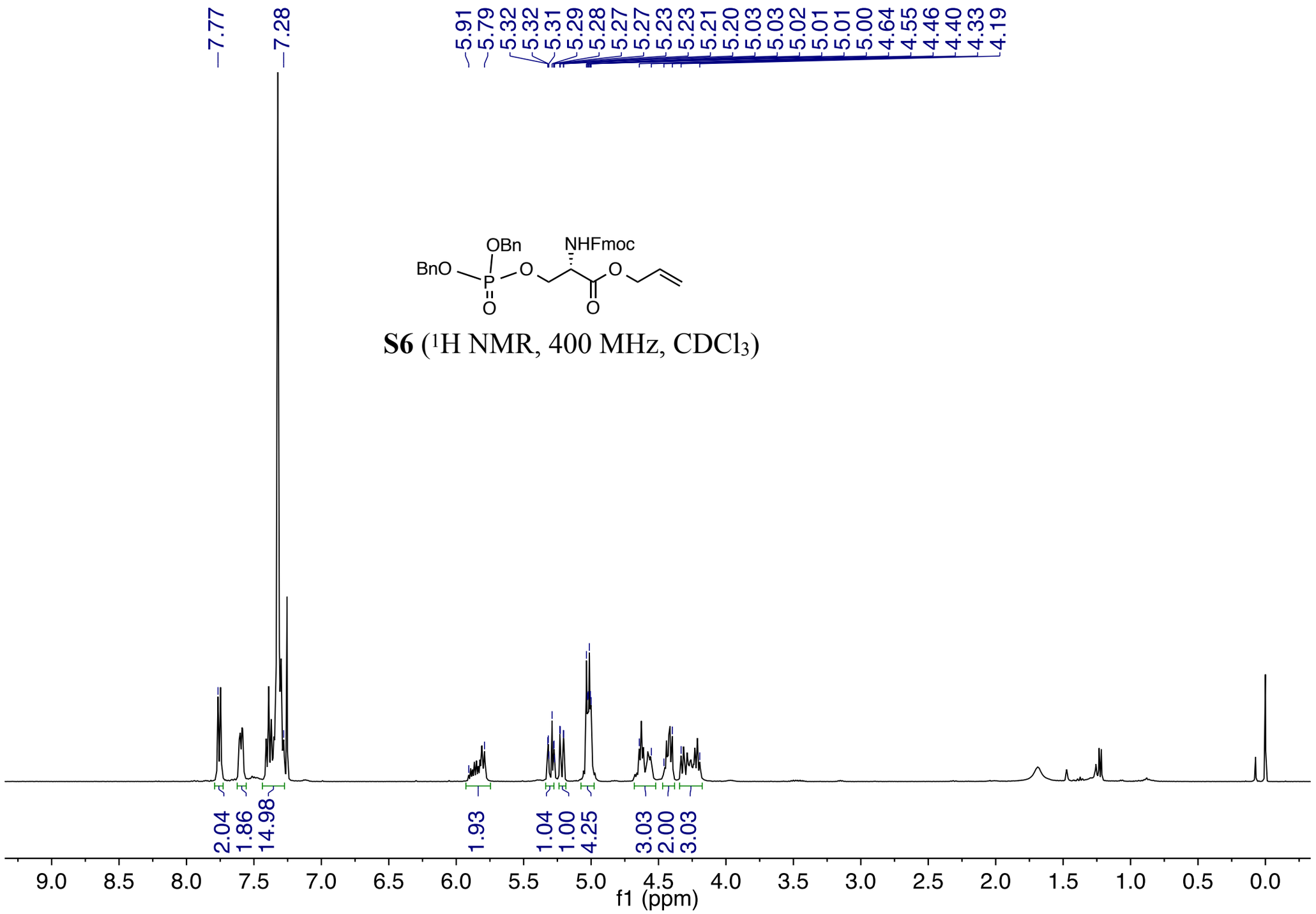
2f (^{13}C NMR, 101 MHz, $CDCl_3$)



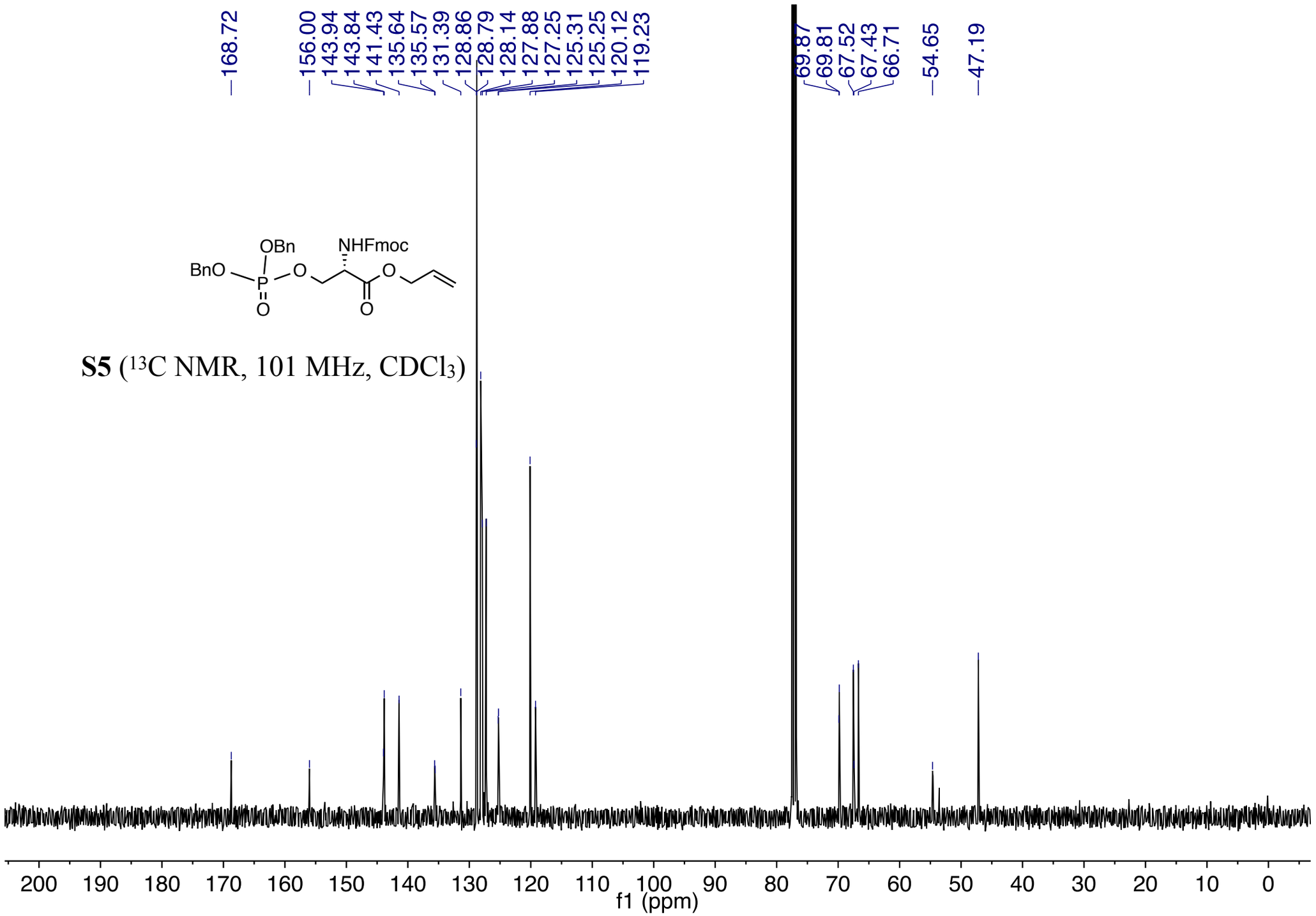


2f (^{31}P NMR, 162 MHz, $CDCl_3$)

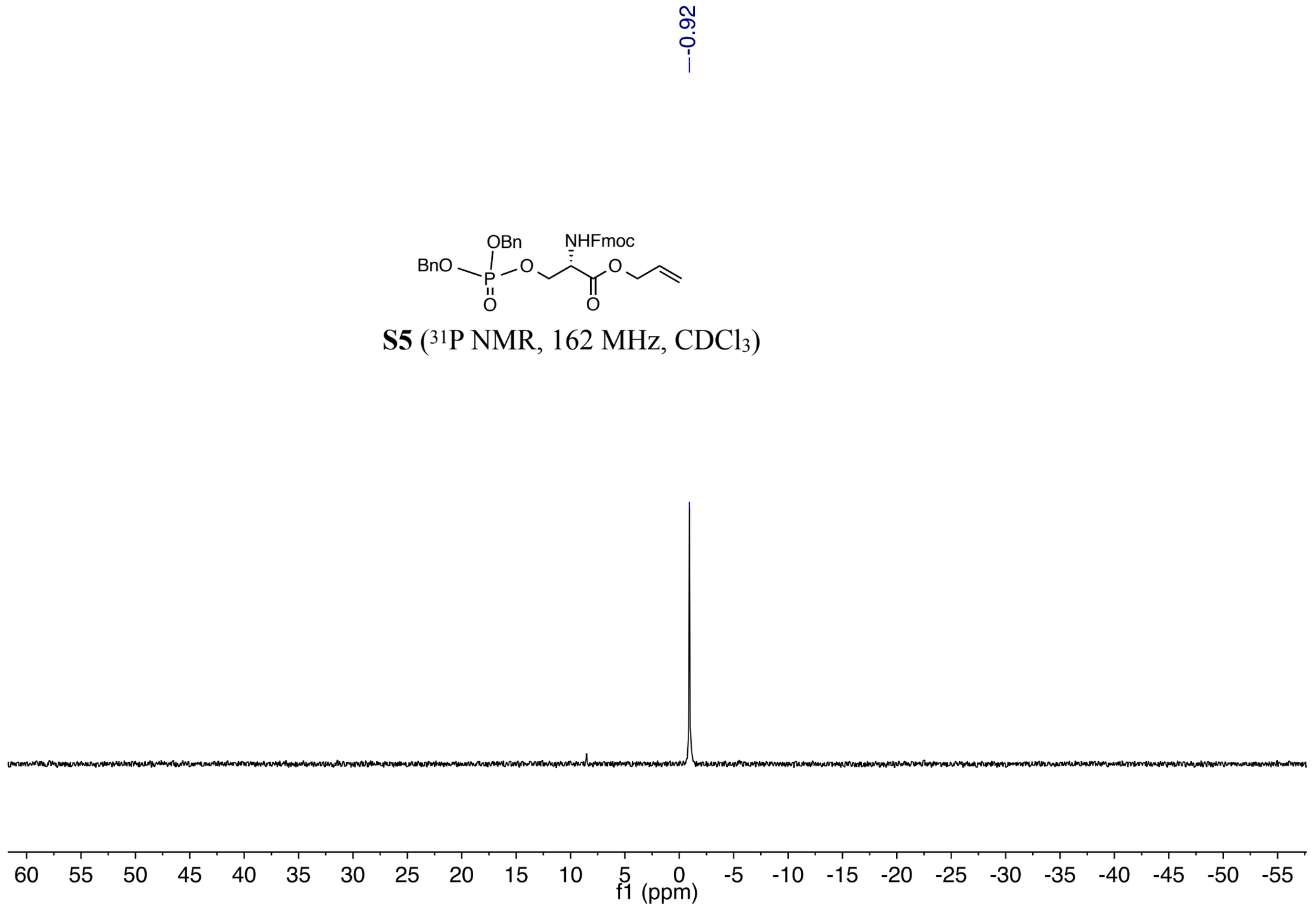

Ph
O
O
O
O
OTBS
P
O
HO
OBn
N3
2f (gCOSY, CDCl3)
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
f1 (ppm)
4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6
f2 (ppm)



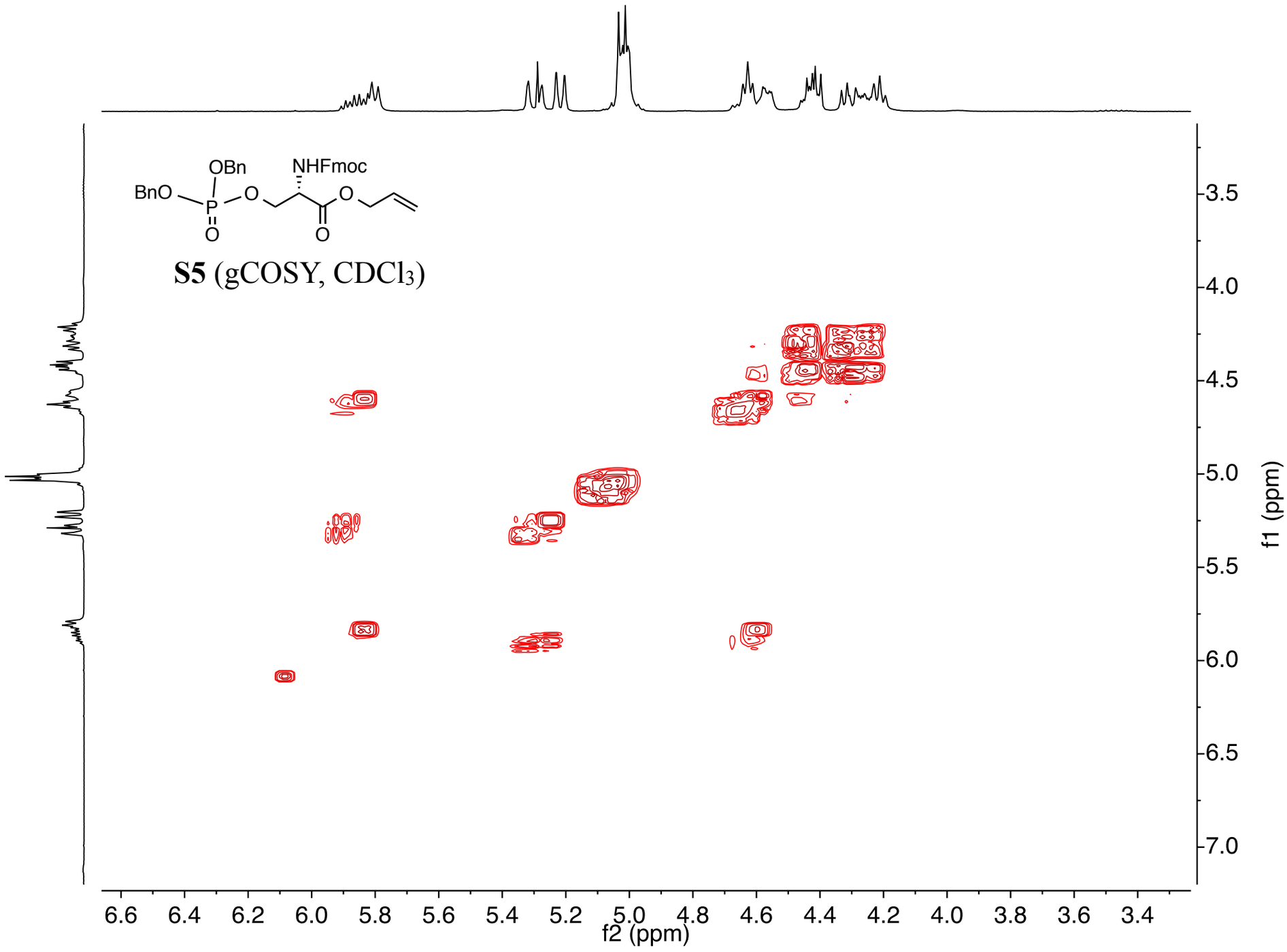
S6 (^{1}H NMR, 400 MHz, $CDCl_3$)



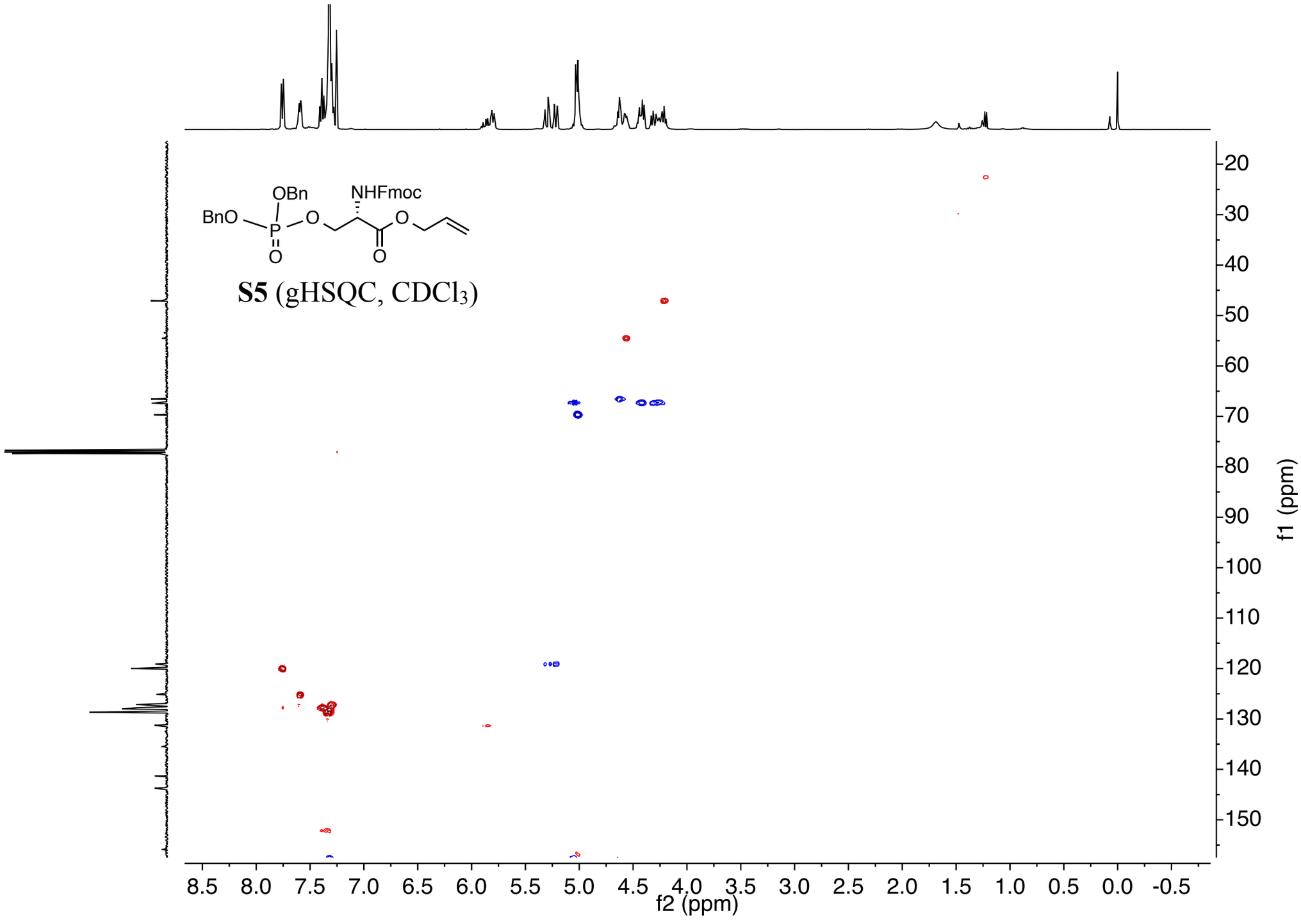
S5 (^{13}C NMR, 101 MHz, $CDCl_3$)



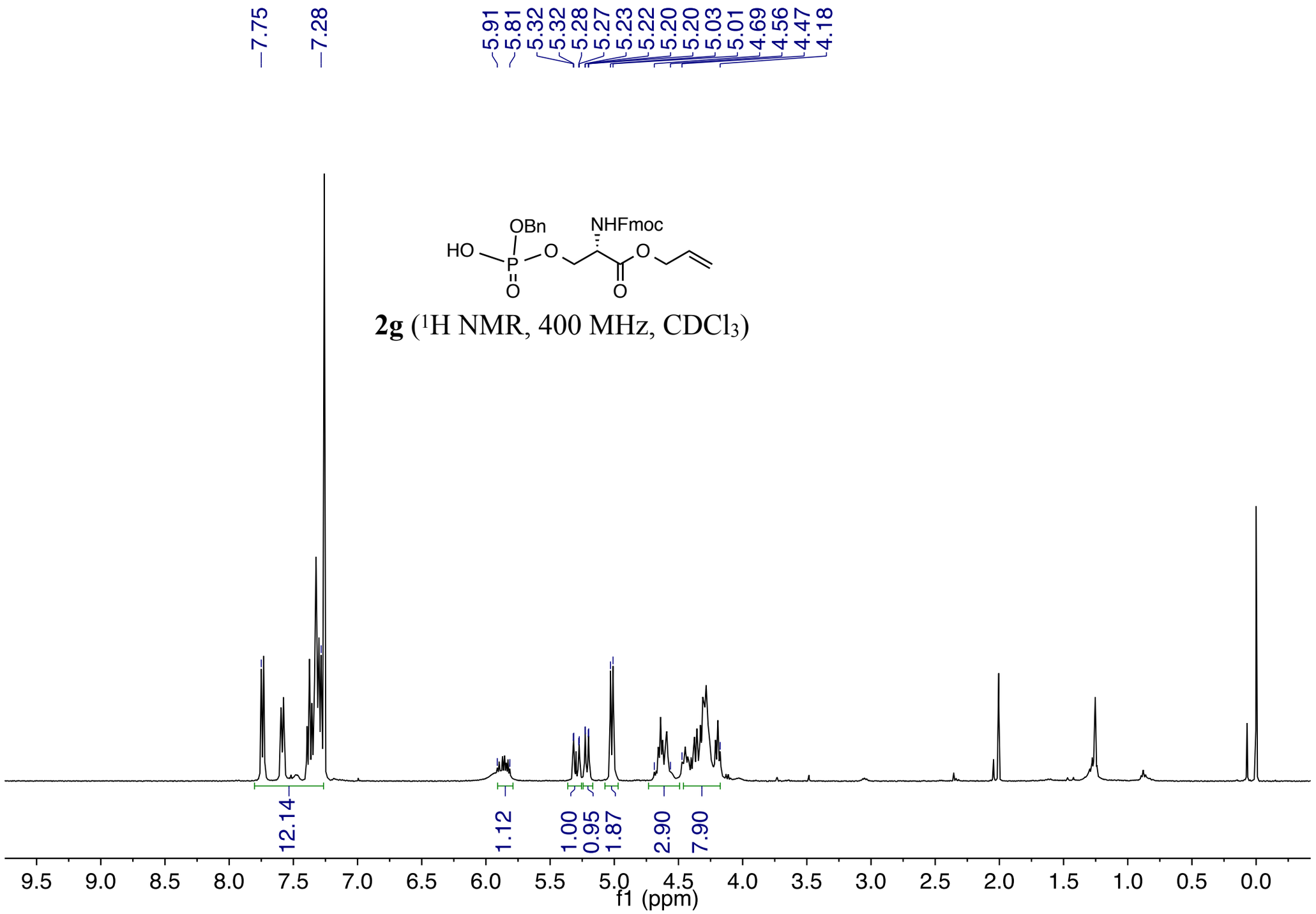
S5 (^{31}P NMR, 162 MHz, $CDCl_3$)



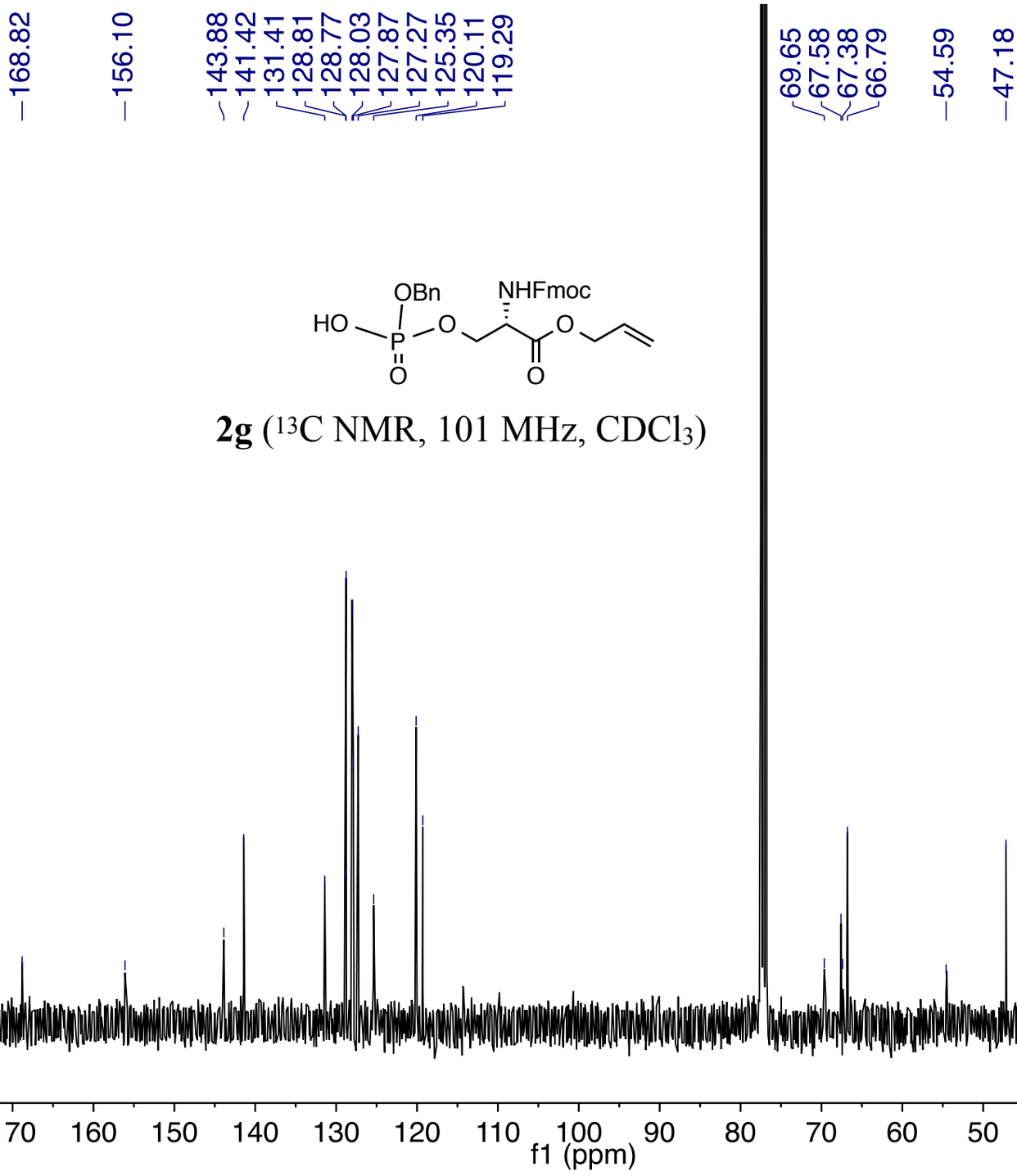
S5 (gCOSY, $CDCl_3$)



S5 (gHSQC, $CDCl_3$)

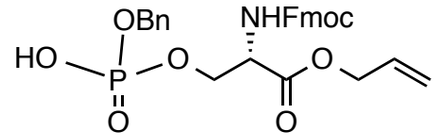


2g (^{1}H NMR, 400 MHz, $CDCl_3$)

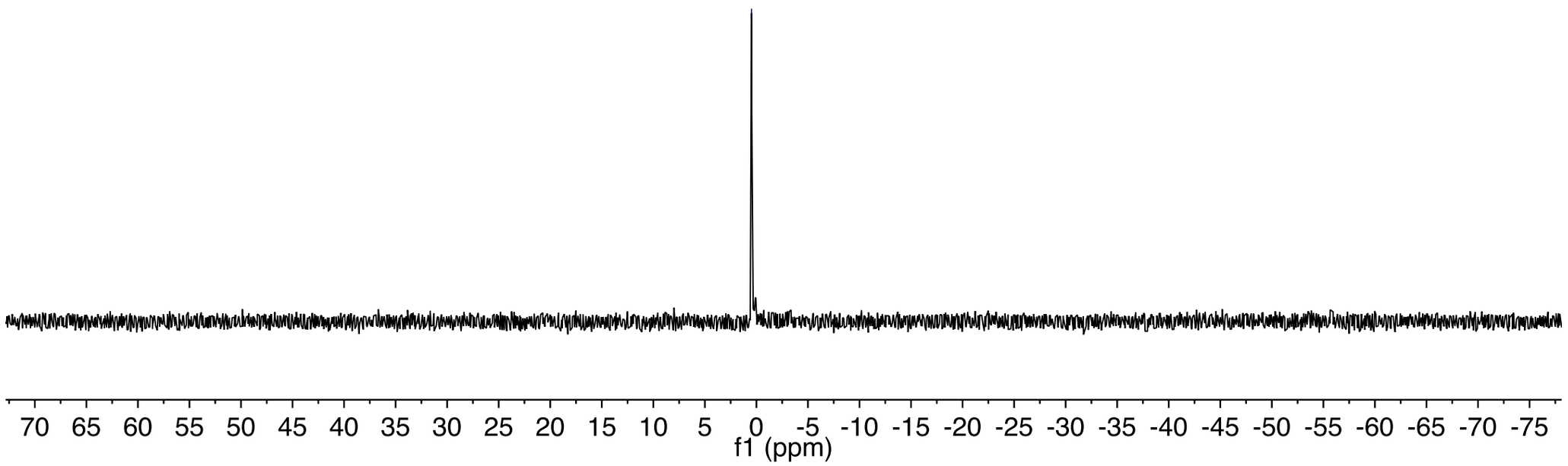


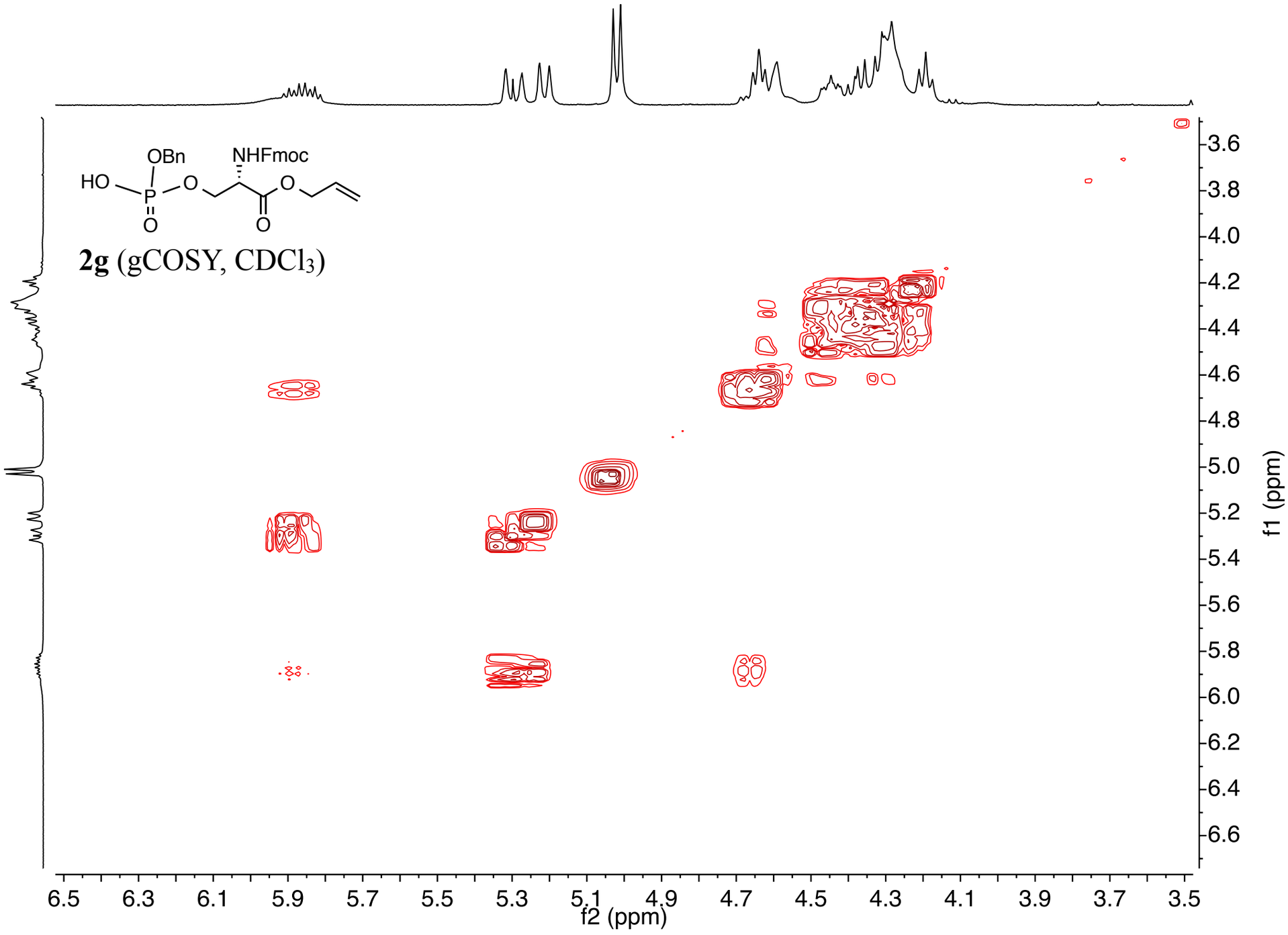
2g (^{13}C NMR, 101 MHz, $CDCl_3$)

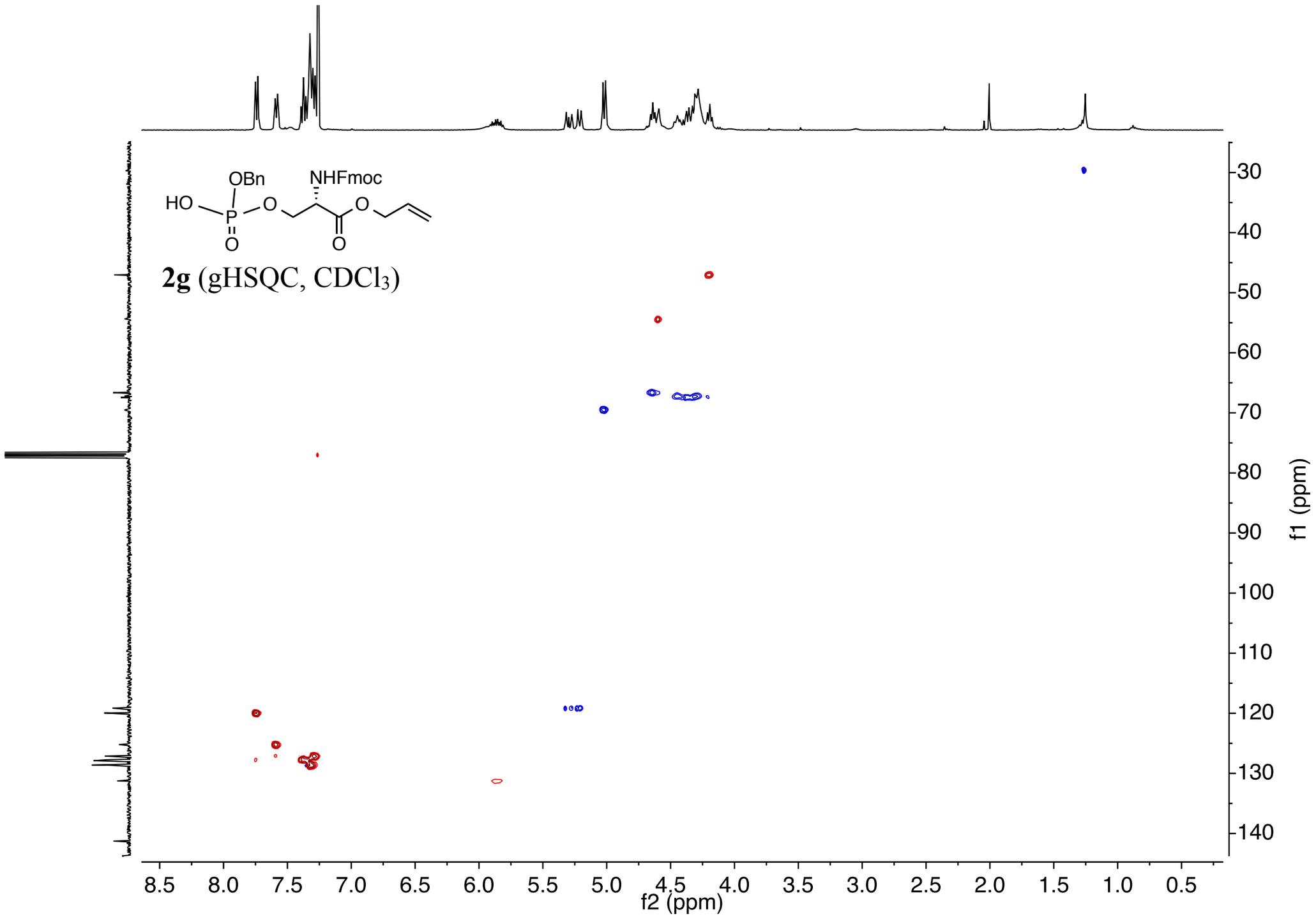
−0.48

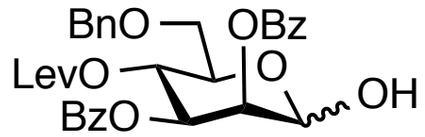


2g (^{31}P NMR, 162 MHz, $CDCl_3$)

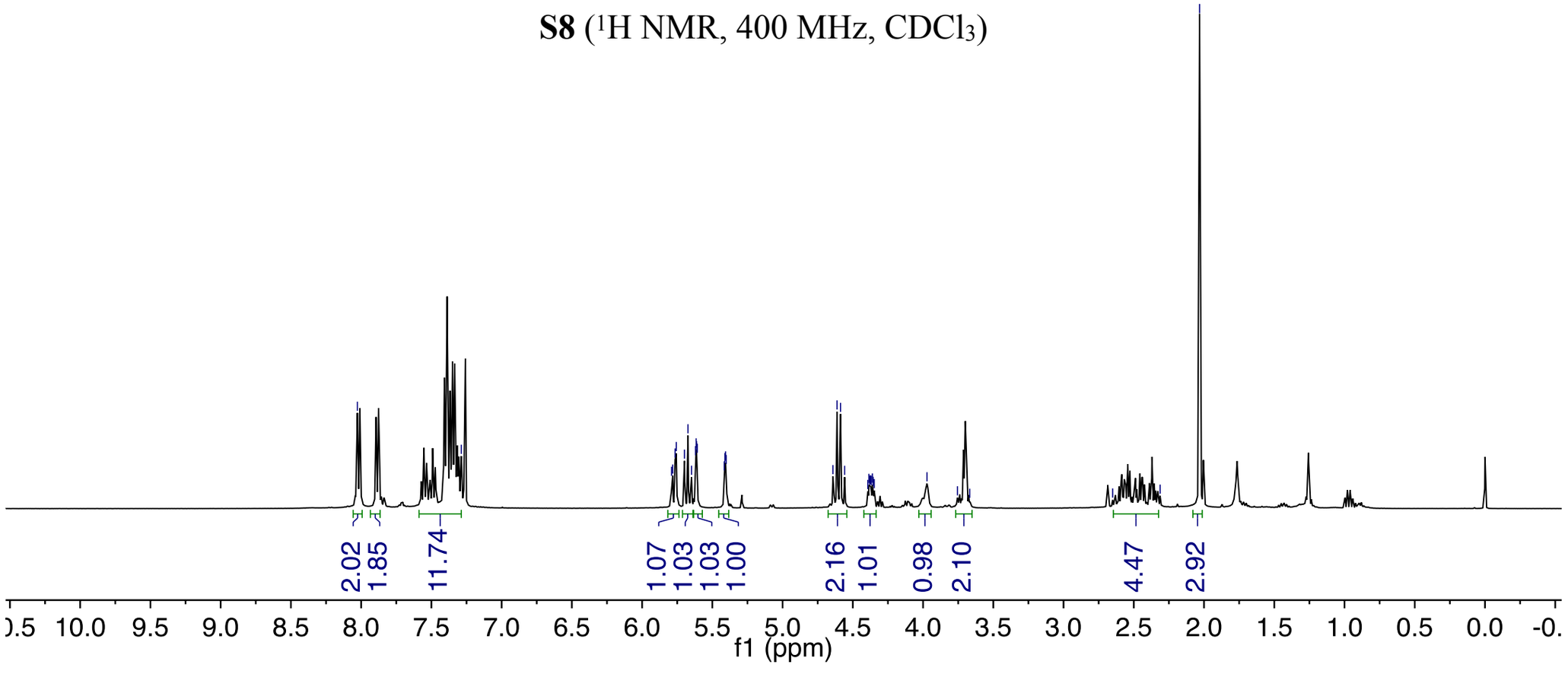



OBn
NHFmoc
HO
P
O
O
O
O
O
2g (gCOSY, CDCl3)
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
f1 (ppm)
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
f2 (ppm)

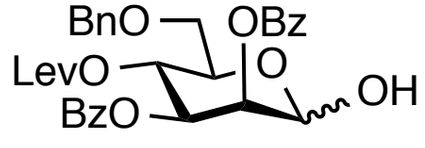

OBn
NHFmoc
HO
P
O
O
O
O
O
2g (gHSQC, CDCl3)
30
40
50
60
70
80
90
100
110
120
130
140
f1 (ppm)
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f2 (ppm)



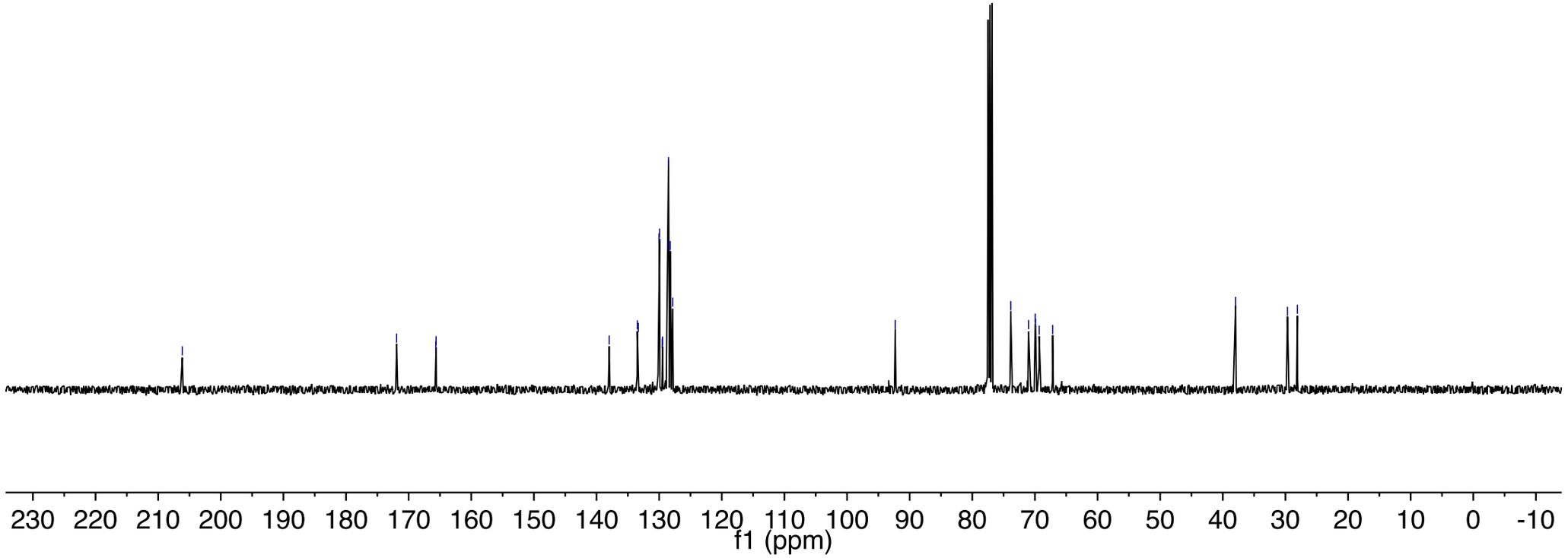
S8 (^{1}H NMR, 400 MHz, $CDCl_3$)

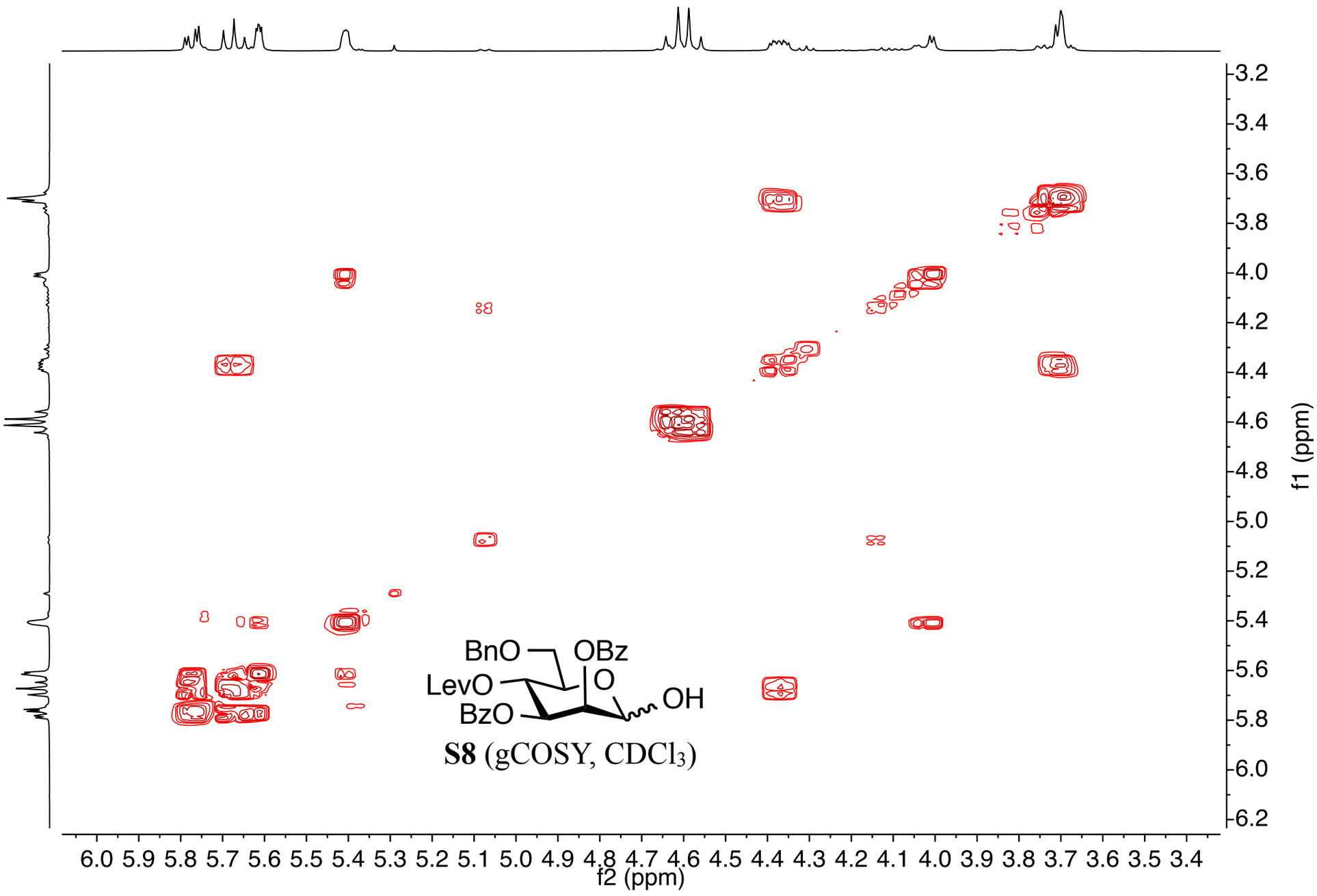


206.15
171.92
165.67
165.62
137.98
133.49
133.32
130.03
129.94
129.51
129.45
128.65
128.51
128.23
127.85
92.31
73.86
71.01
69.96
69.89
69.31
67.16
37.96
29.67
28.09

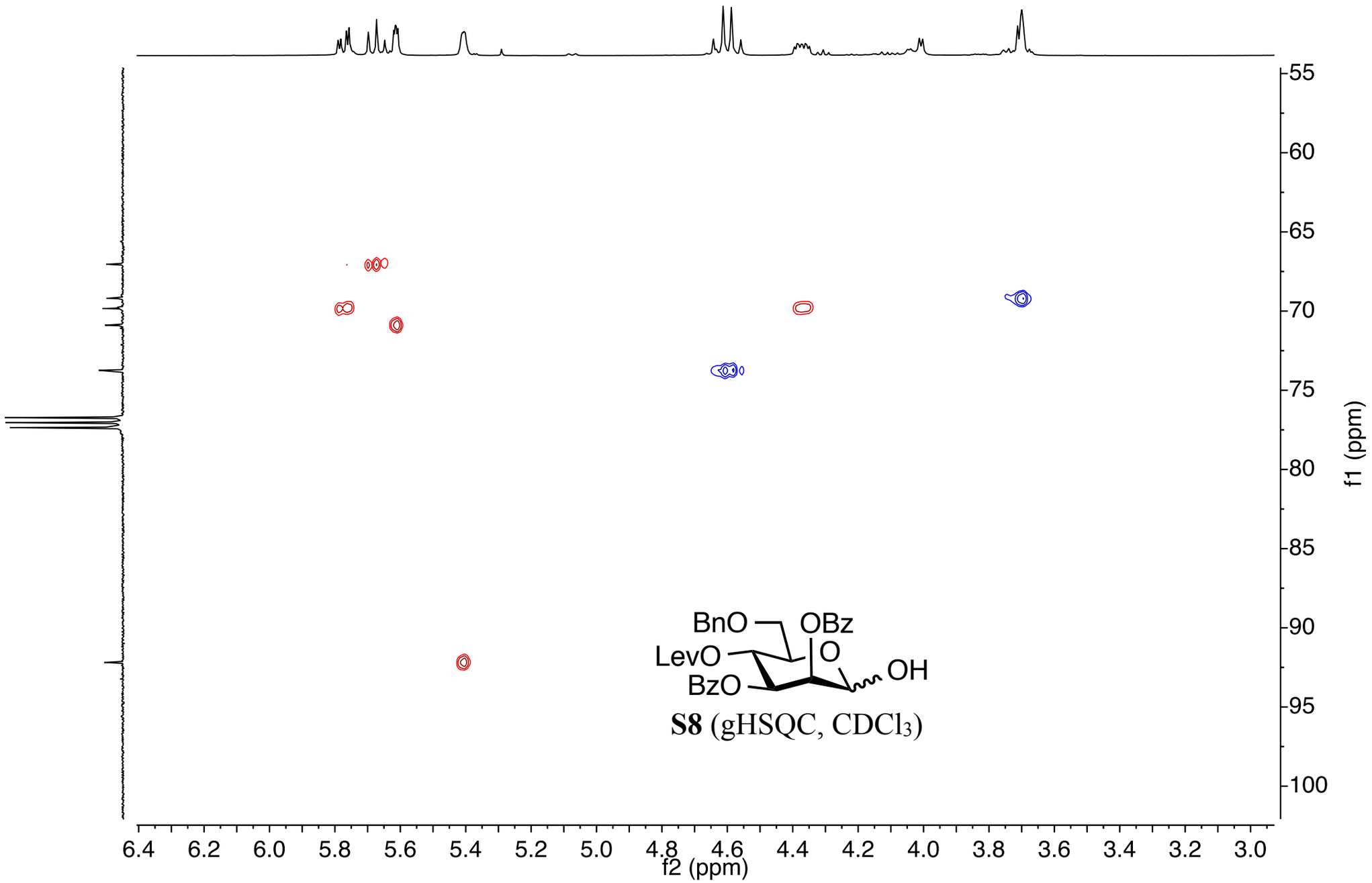


S8 (^{13}C NMR, 101 MHz, $CDCl_3$)

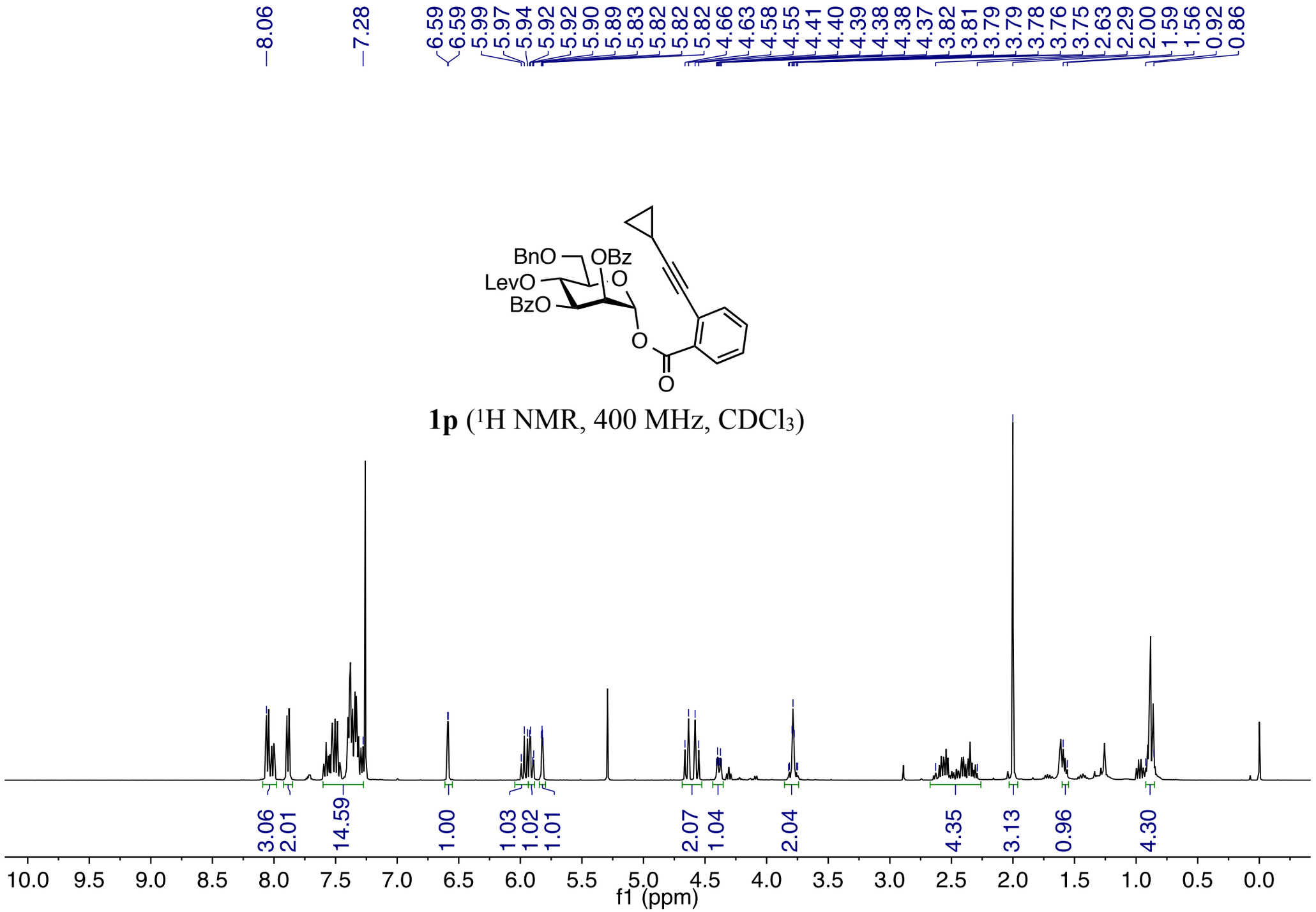




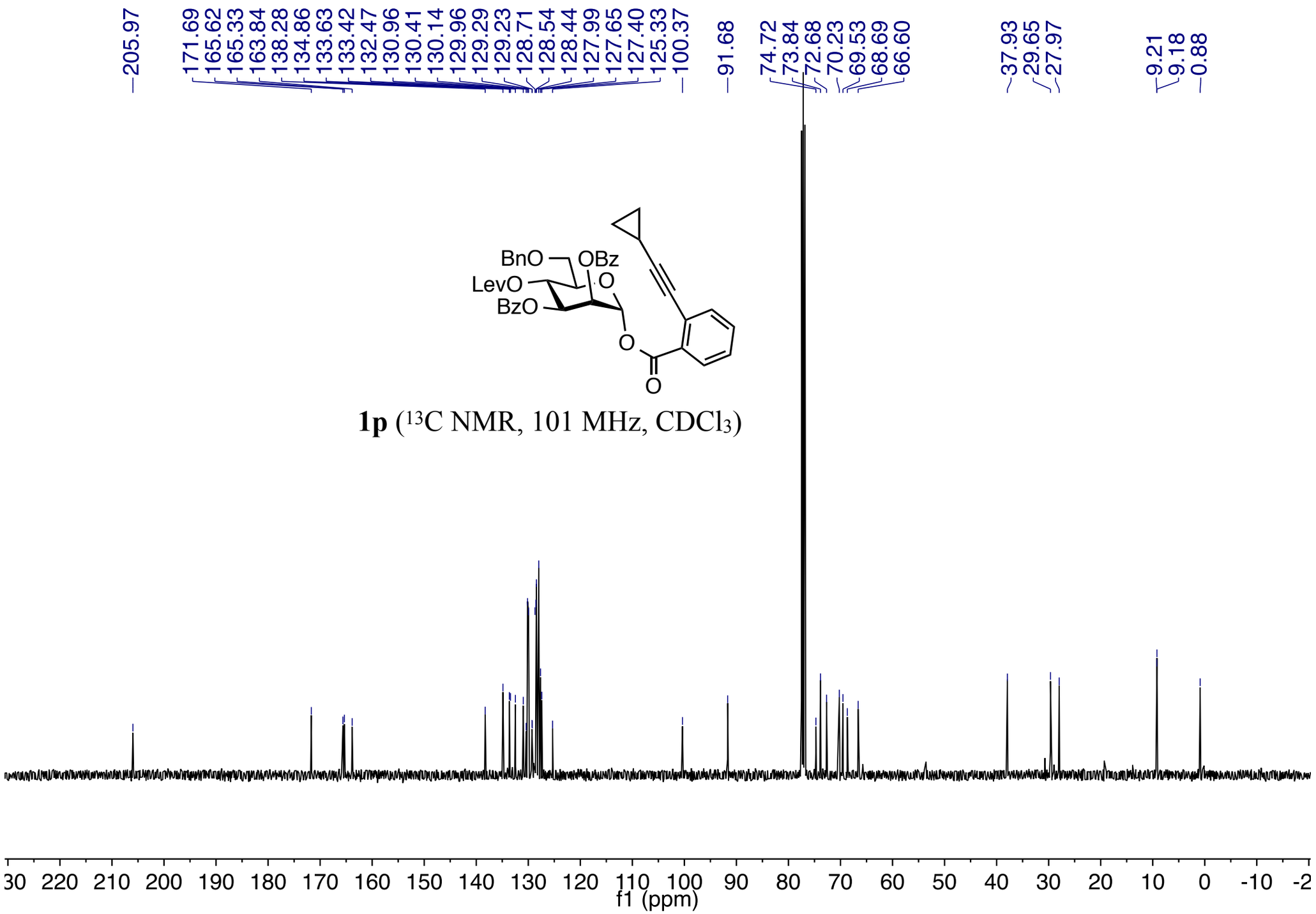
S8 (gCOSY, $CDCl_3$)



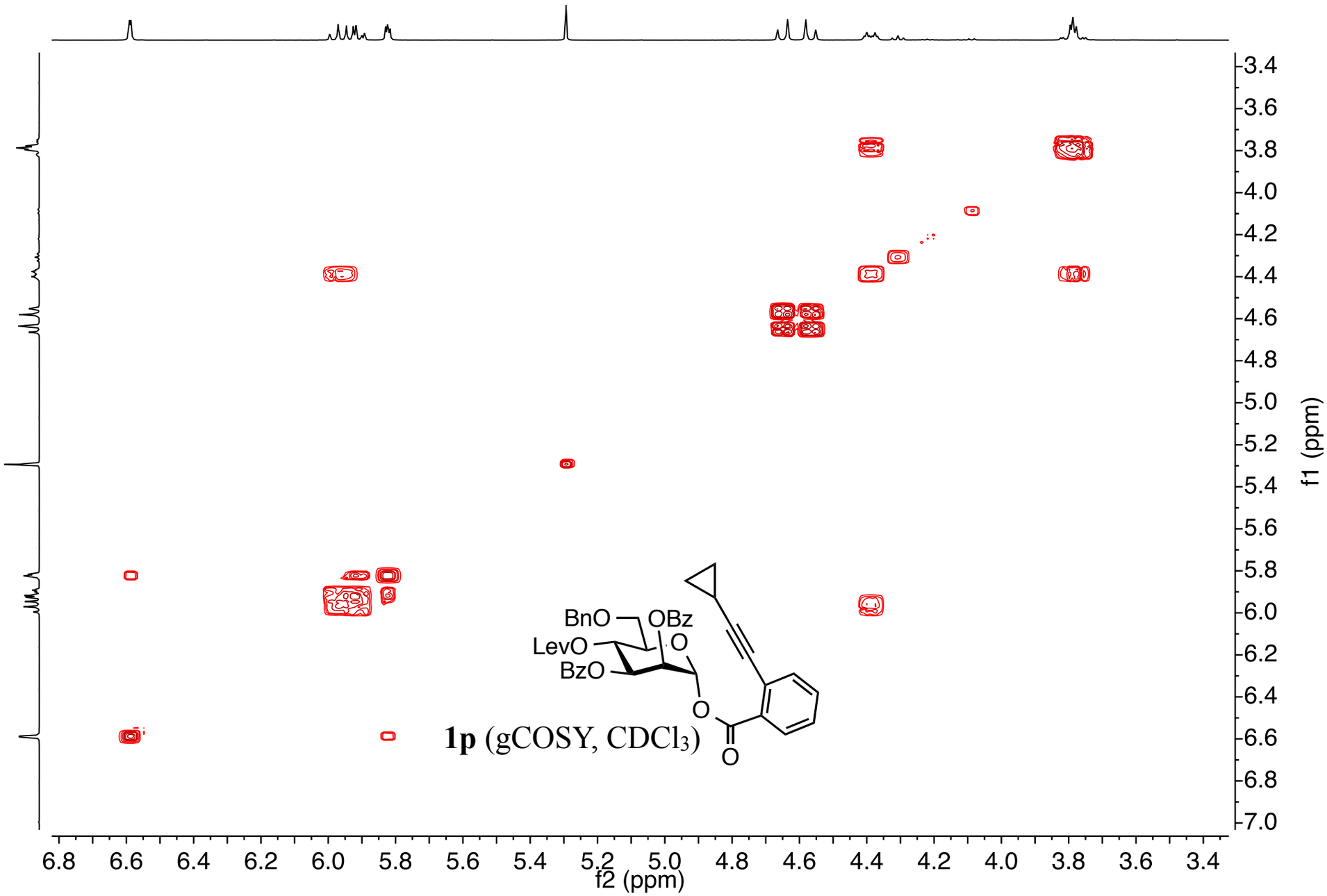
S8 (gHSQC, $CDCl_3$)

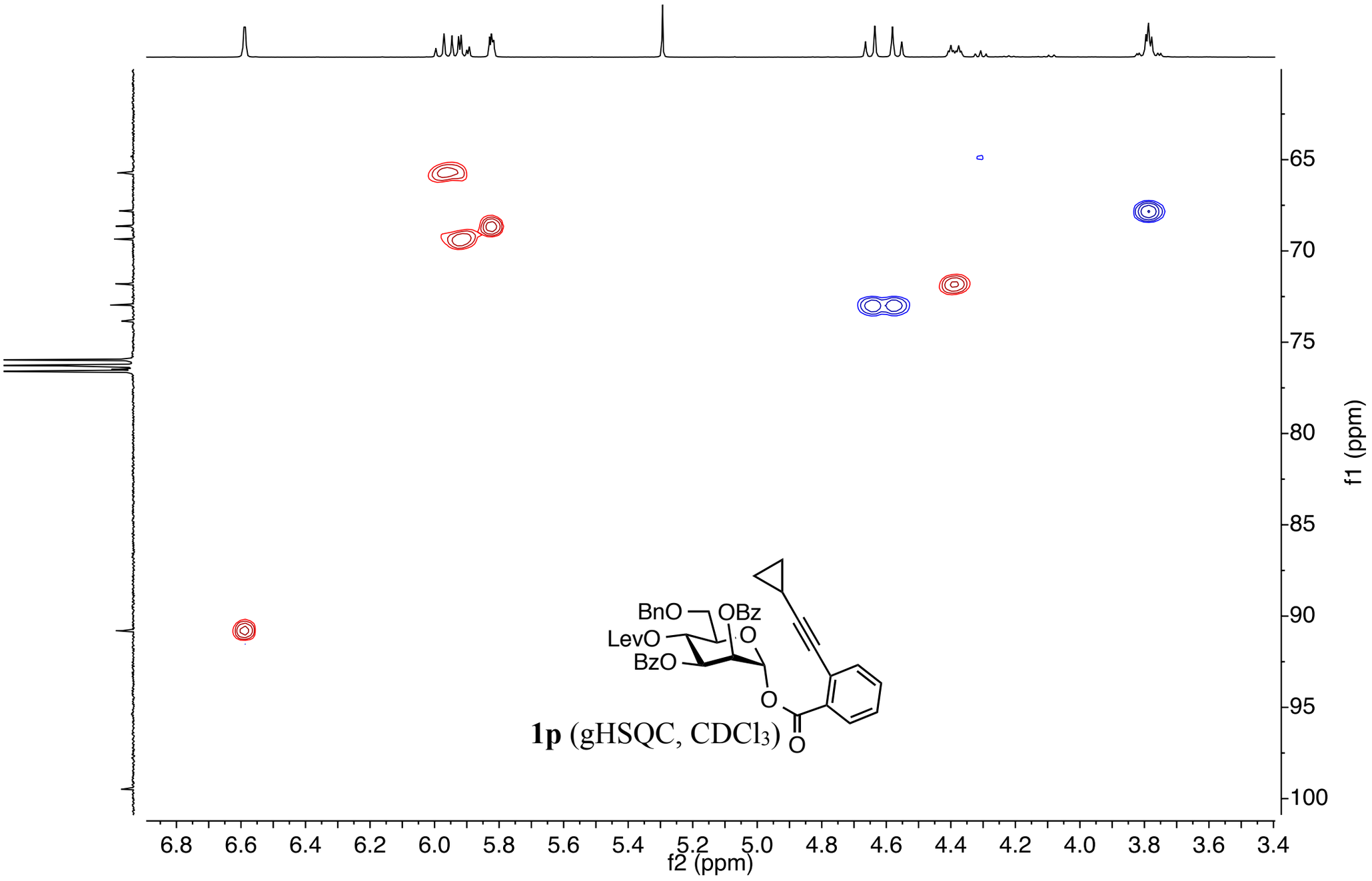


1p (^{1}H NMR, 400 MHz, $CDCl_3$)

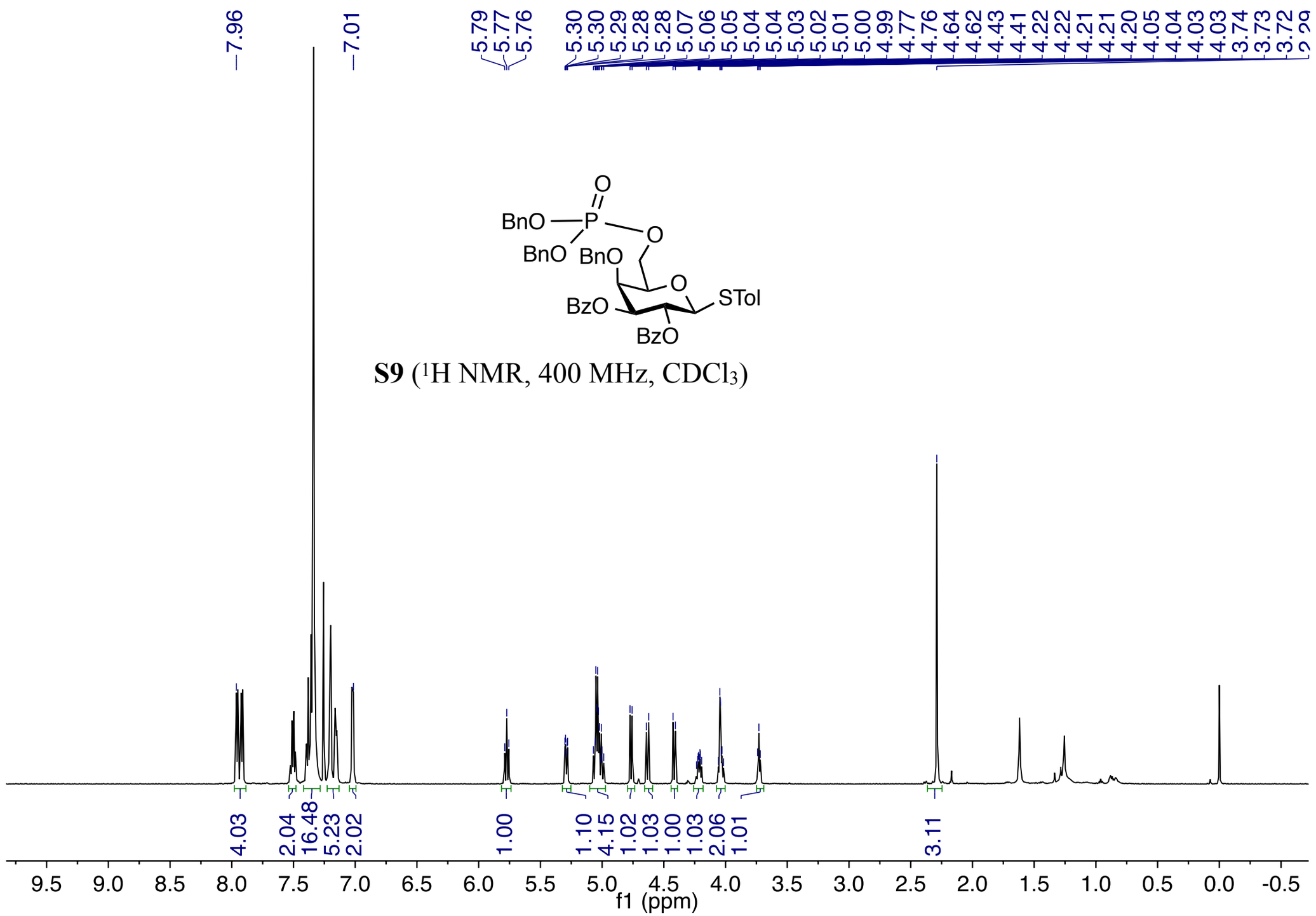


1p (^{13}C NMR, 101 MHz, $CDCl_3$)

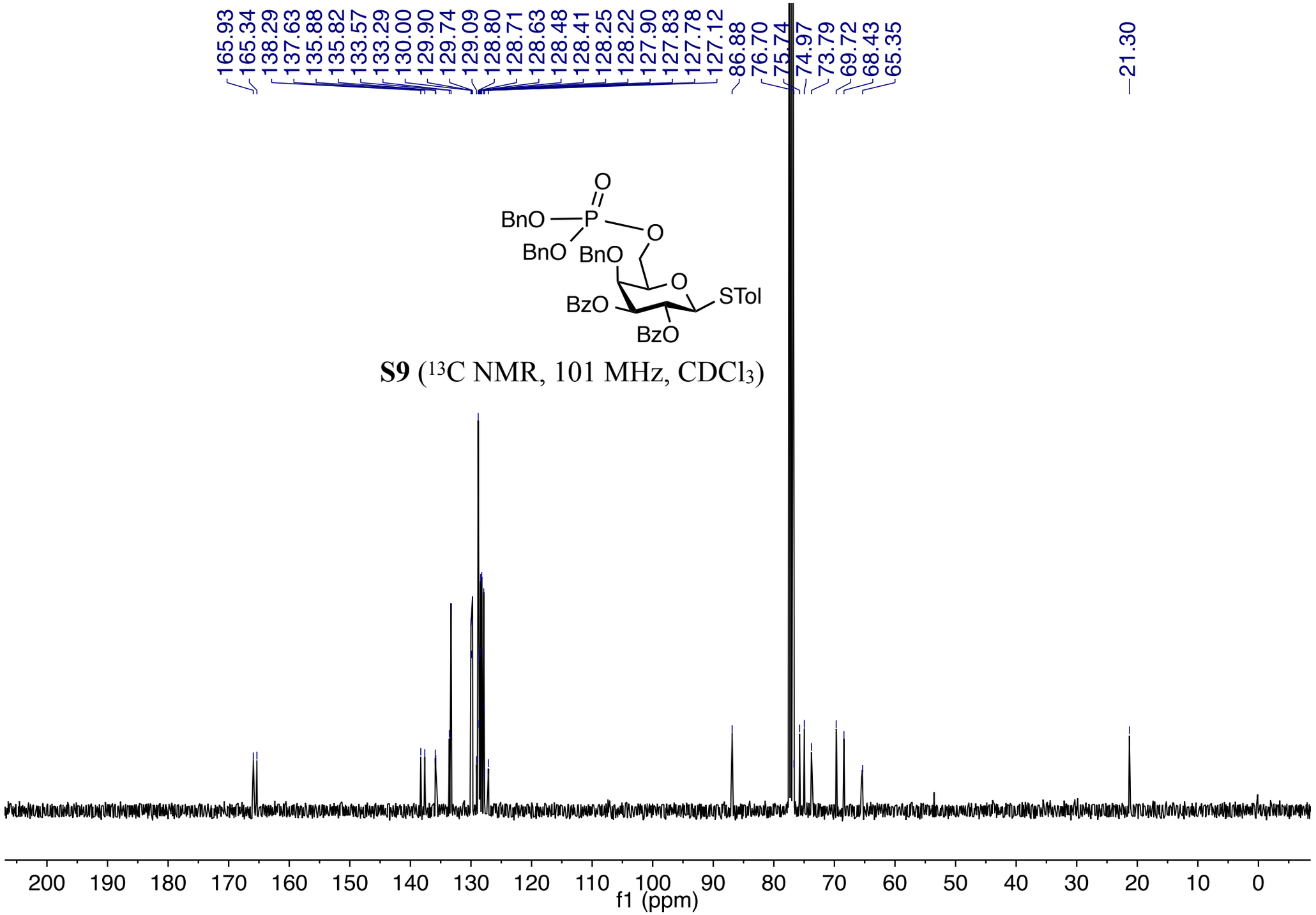

BnO
OBz
LevO
O
BzO
O
O
1p (gCOSY, CDCl3)
f2 (ppm)
f1 (ppm)
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0



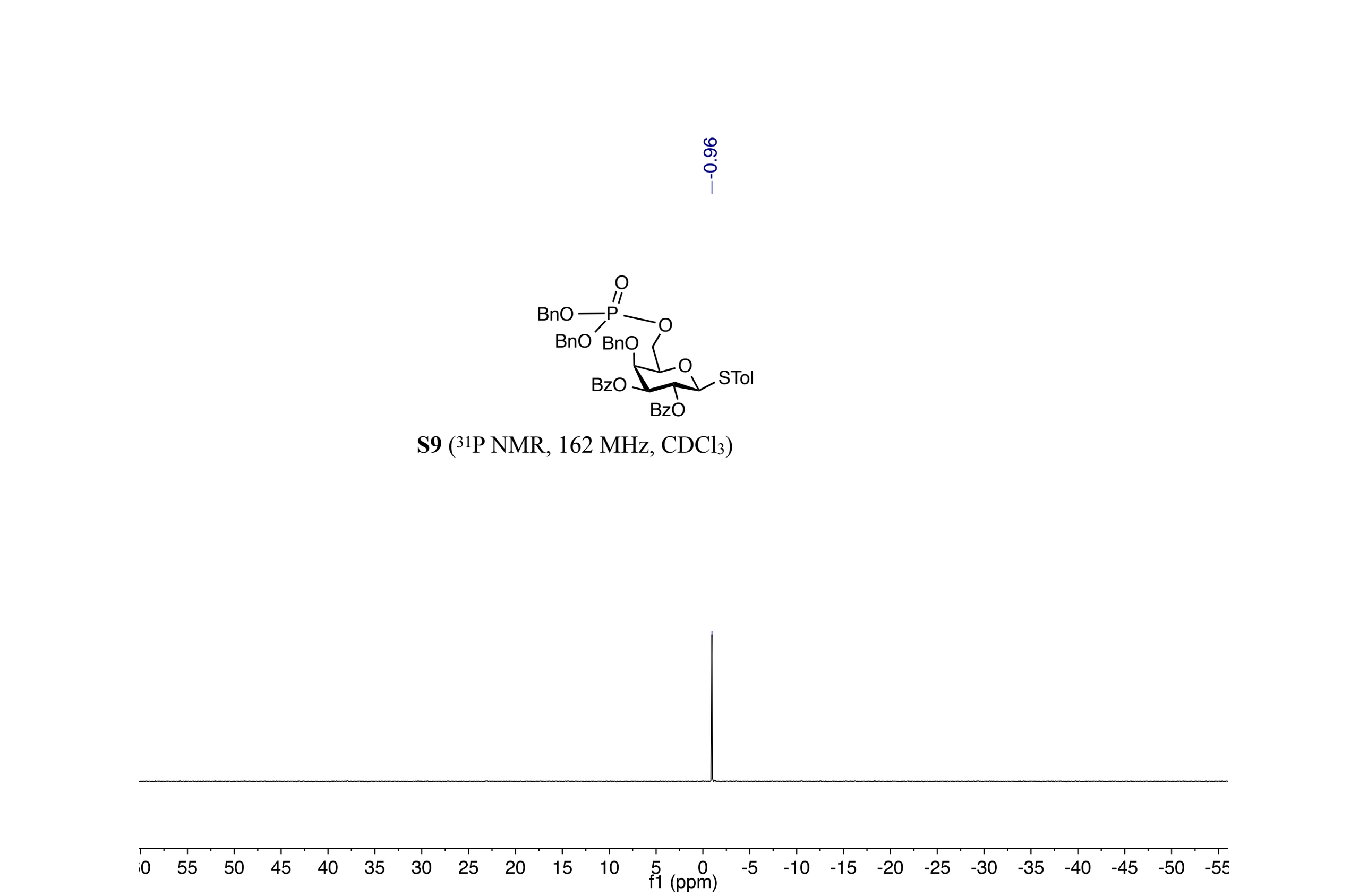
1p (gHSQC, $CDCl_3$)



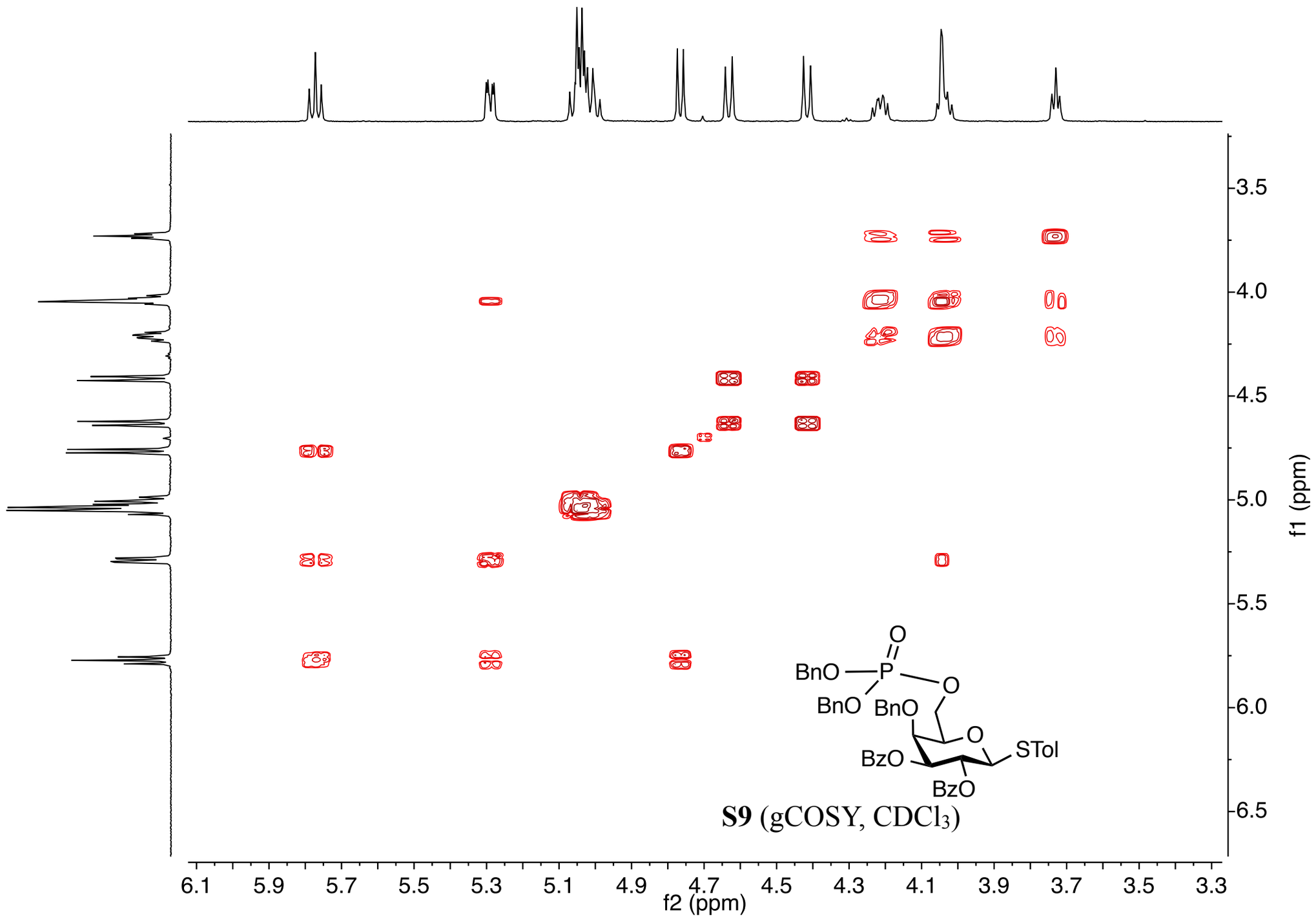
S9 (^{1}H NMR, 400 MHz, $CDCl_3$)



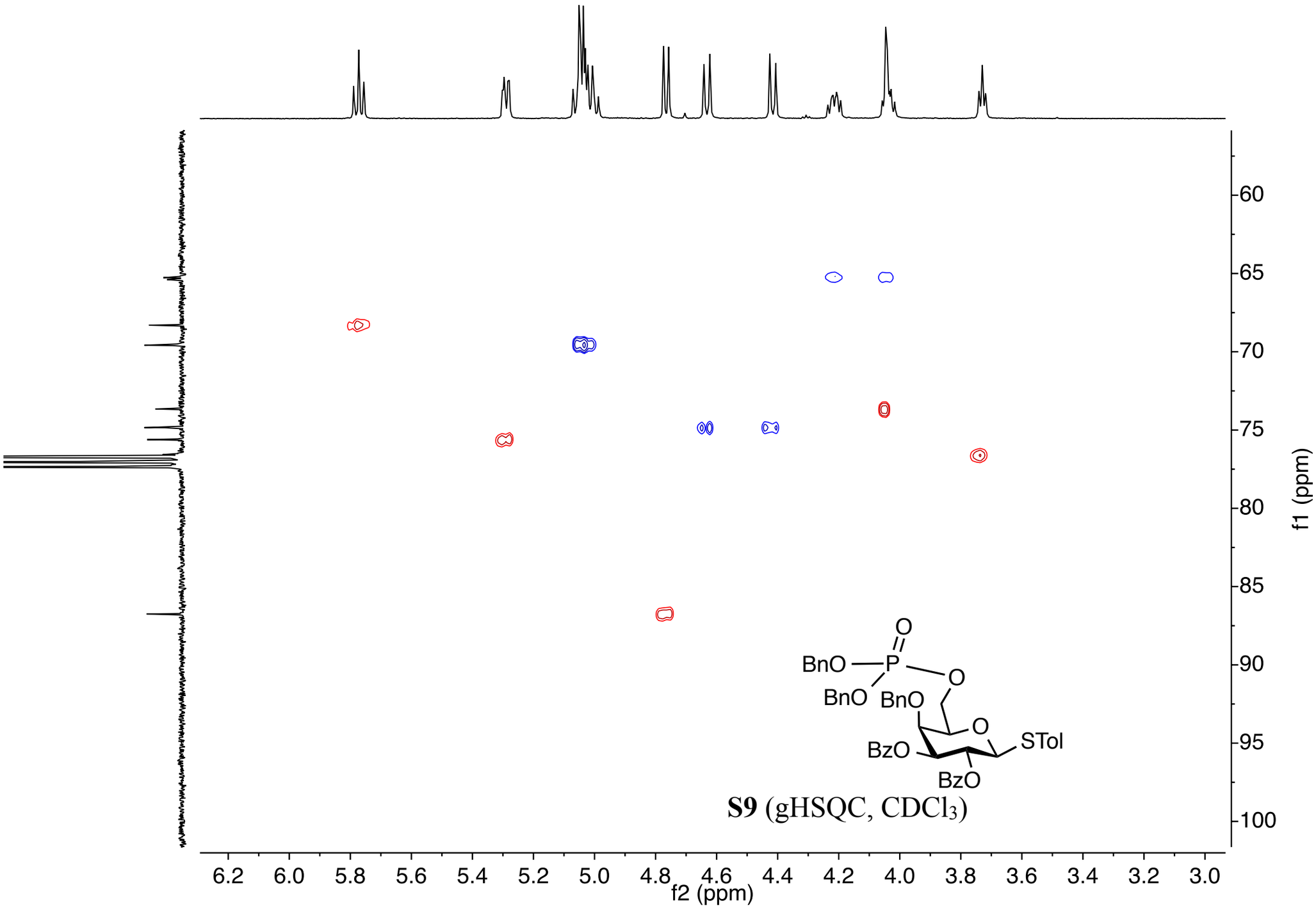
S9 (^{13}C NMR, 101 MHz, $CDCl_3$)



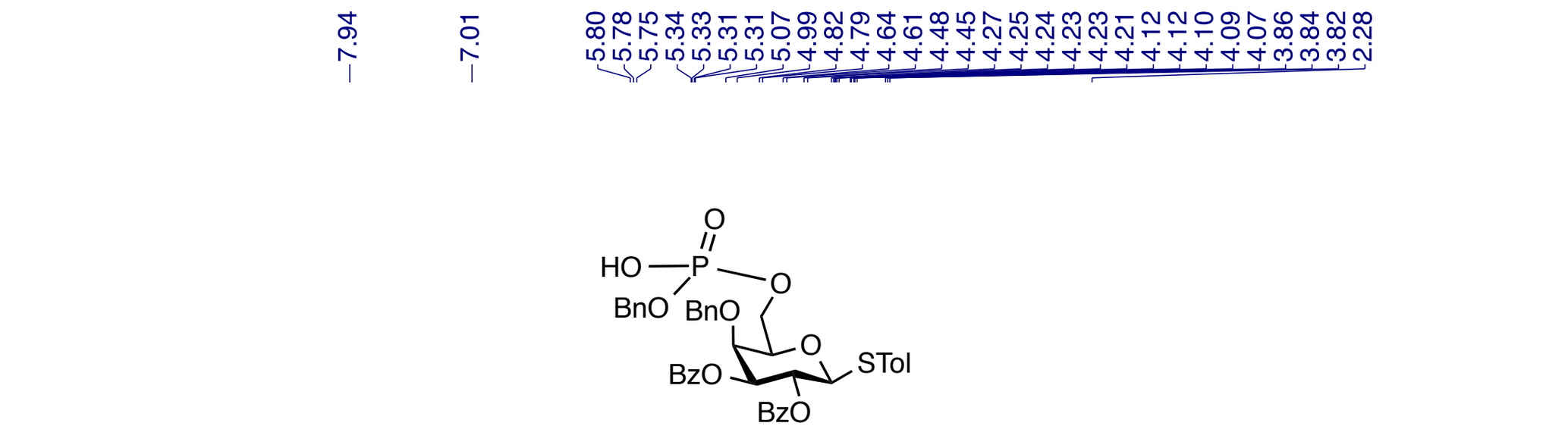
S9 (^{31}P NMR, 162 MHz, $CDCl_3$)



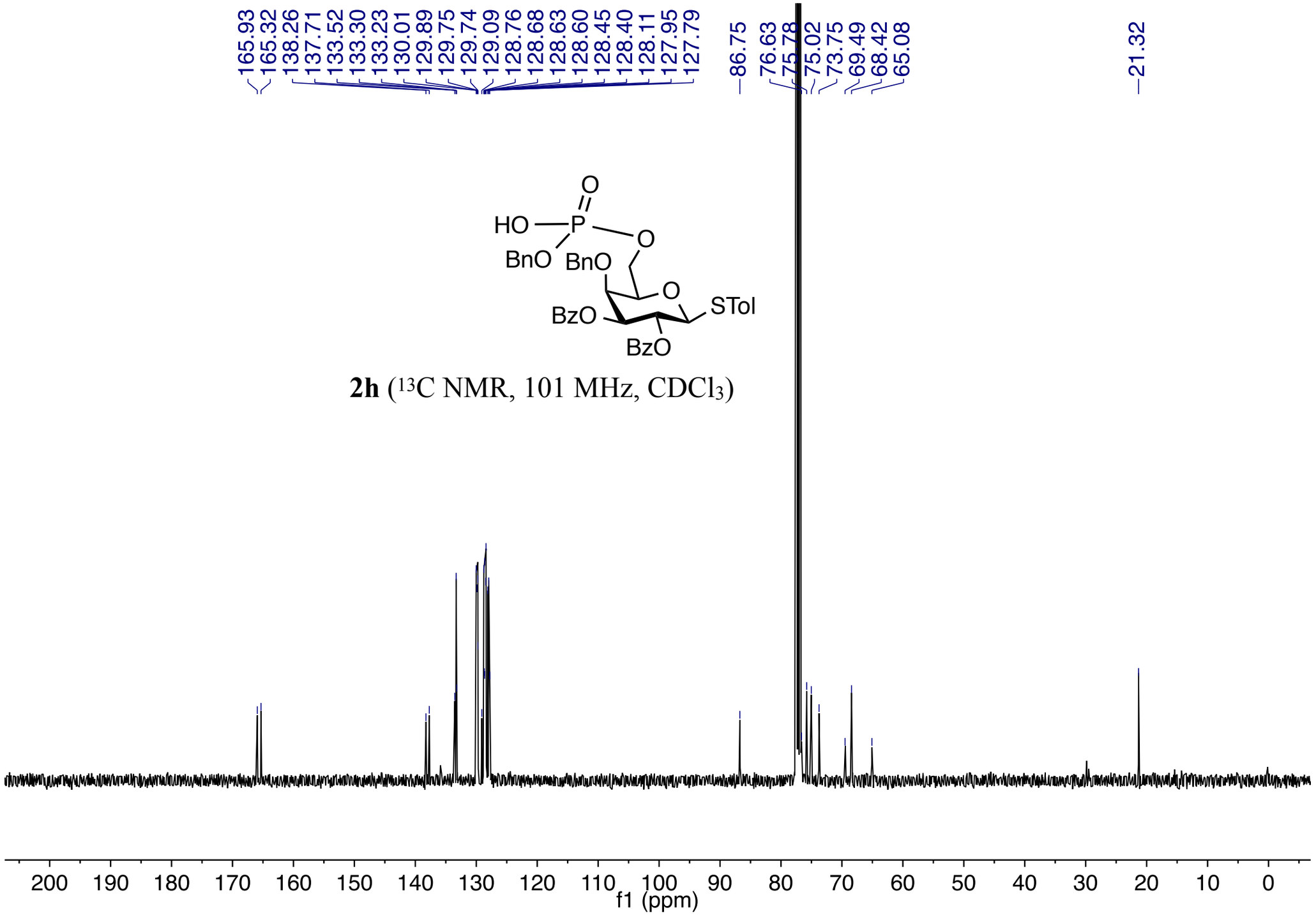
S9 (gCOSY, $CDCl_3$)



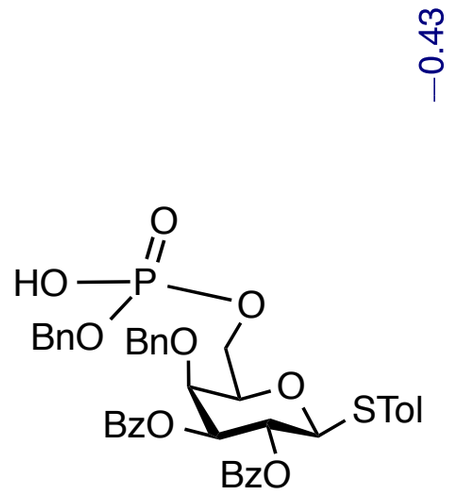
S9 (gHSQC, $CDCl_3$)



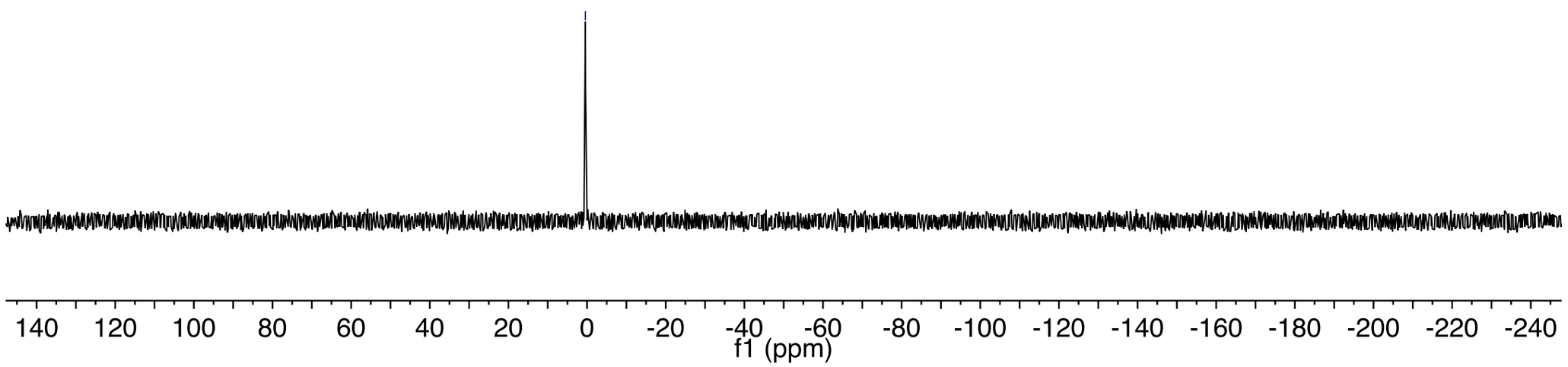
2h (^{1}H NMR, 400 MHz, $CDCl_3$)

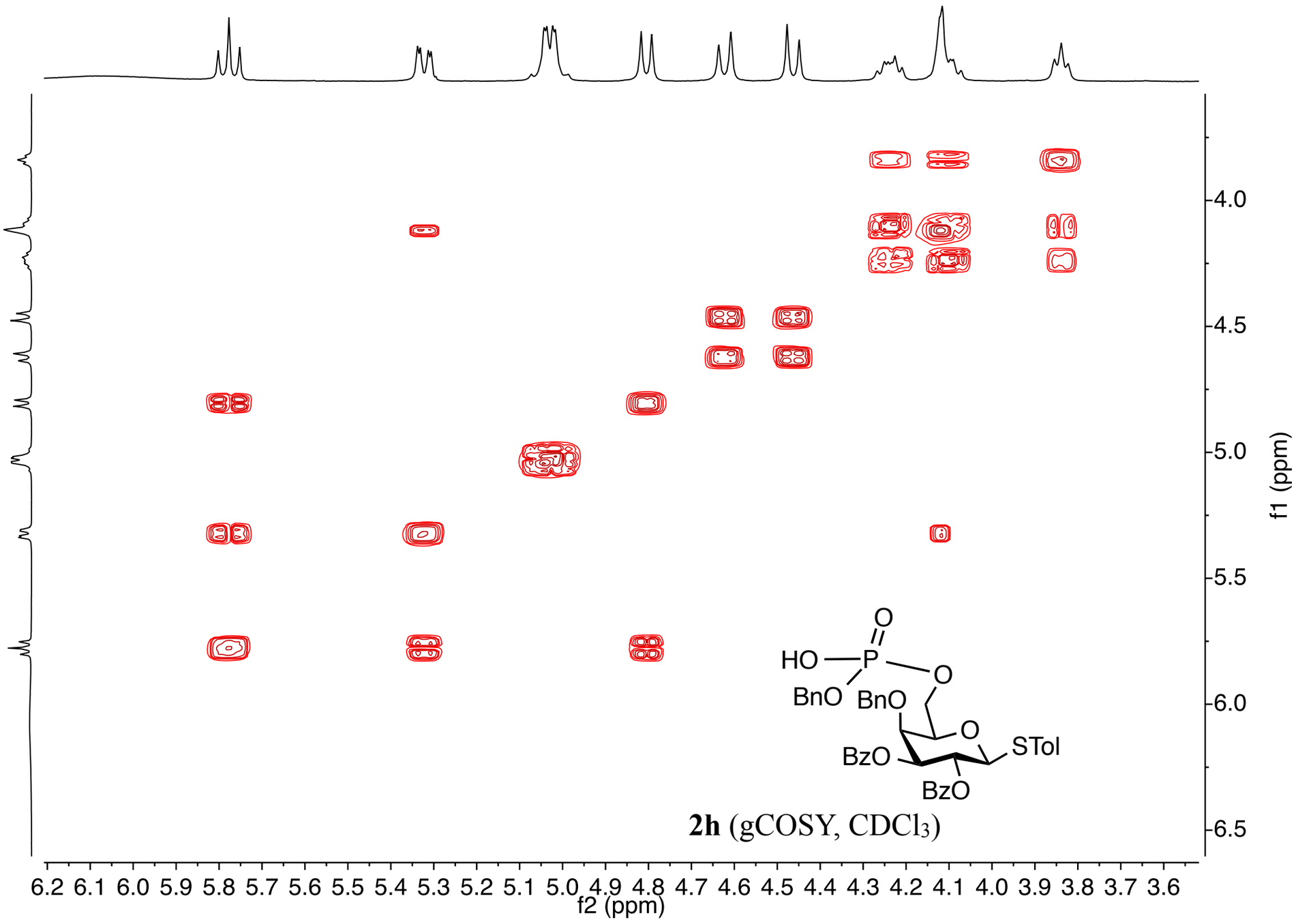


2h (^{13}C NMR, 101 MHz, $CDCl_3$)

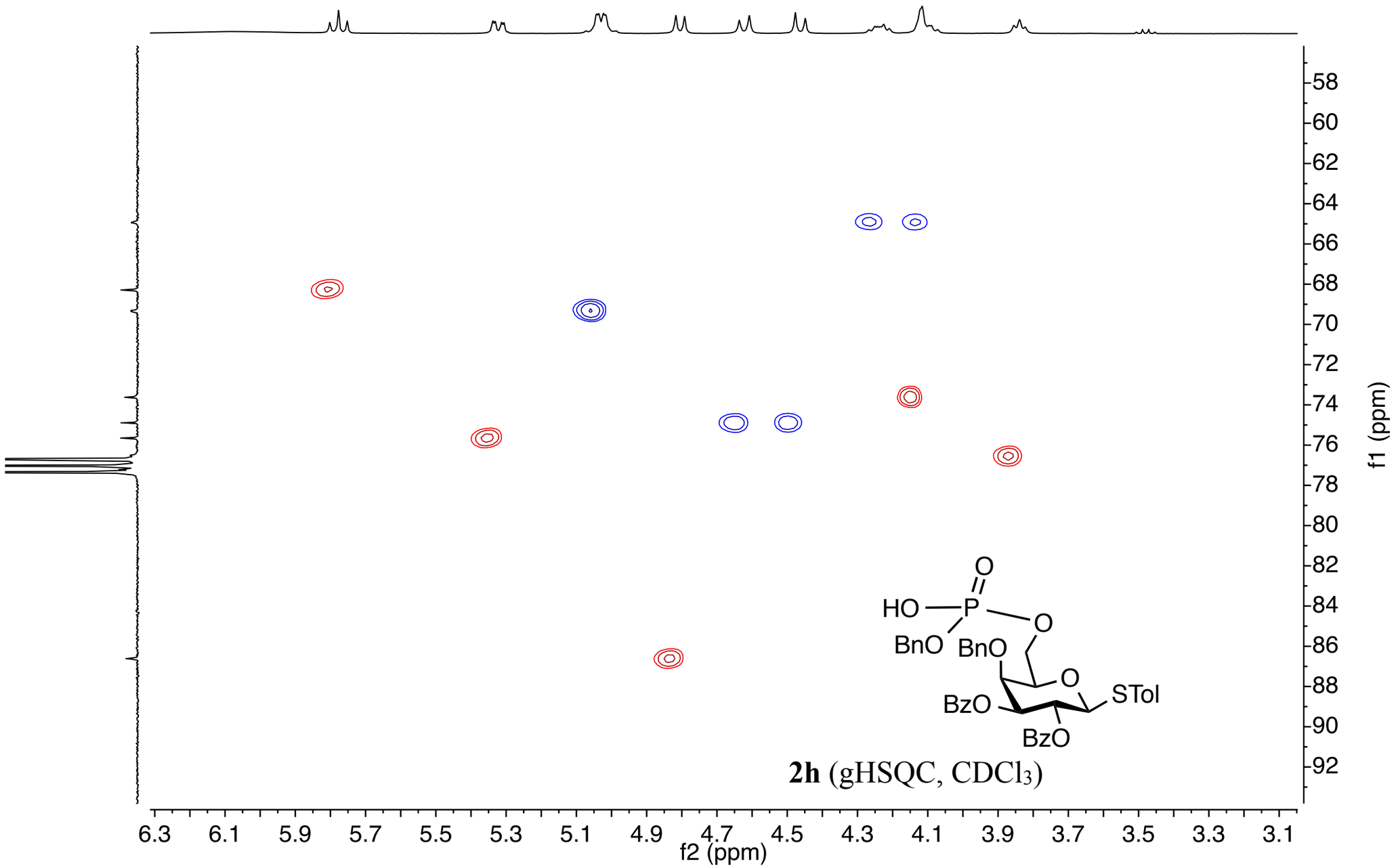


2h (^{31}P NMR, 162 MHz, $CDCl_3$)

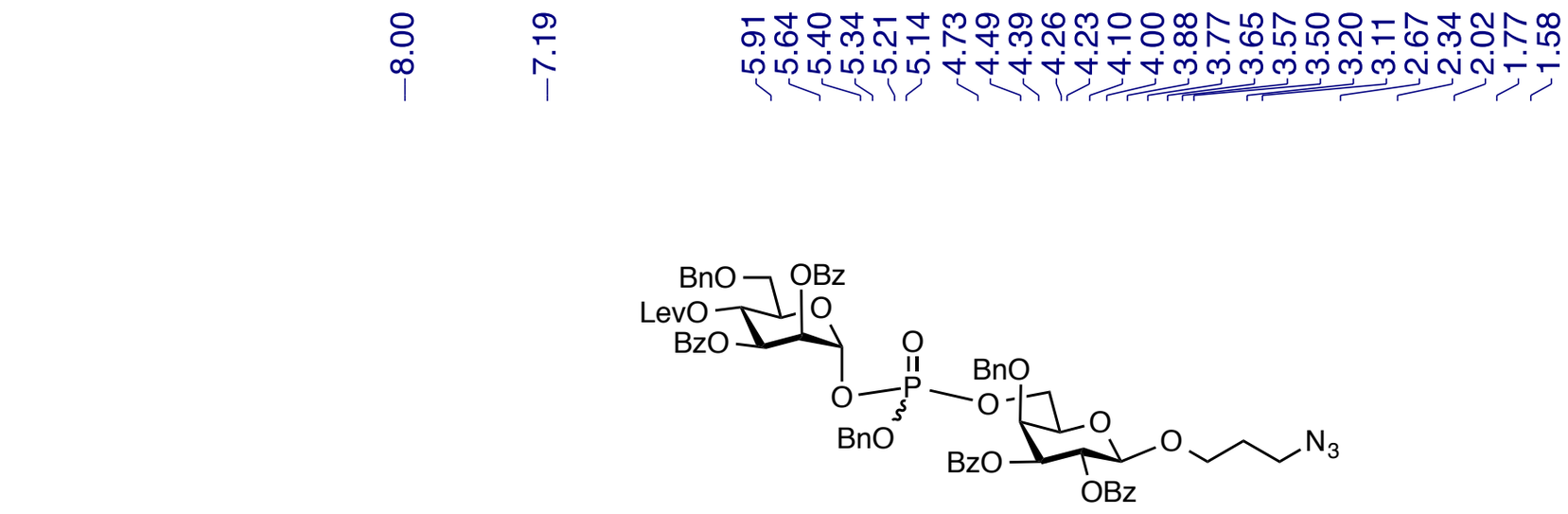




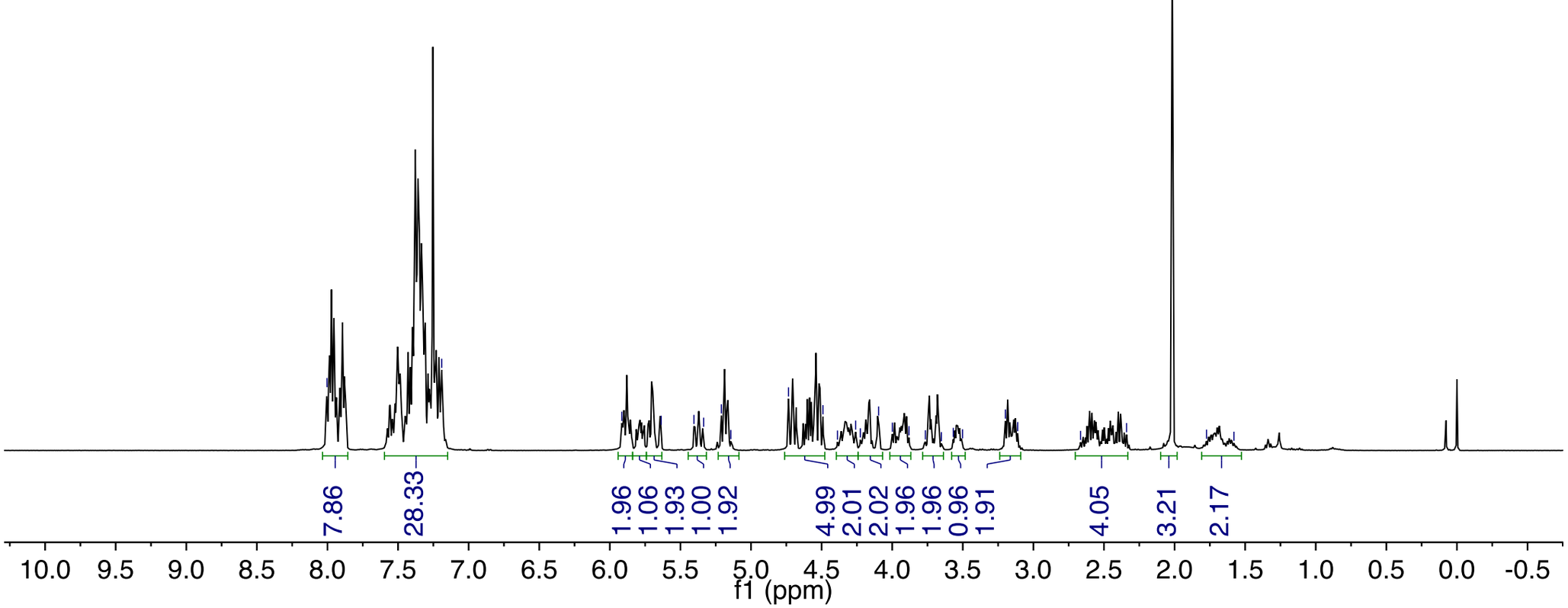
2h (gCOSY, $CDCl_3$)



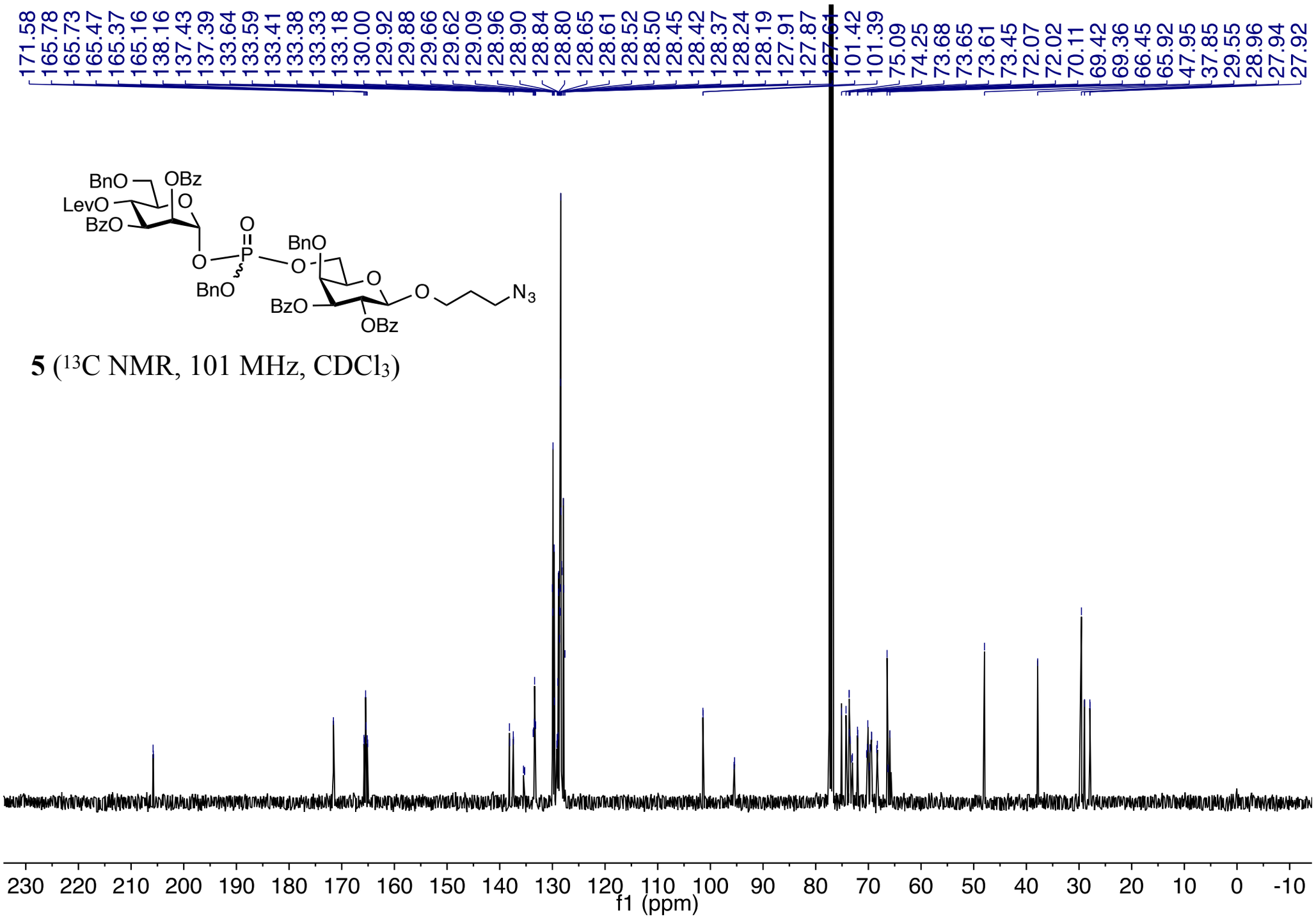
2h (gHSQC, $CDCl_3$)

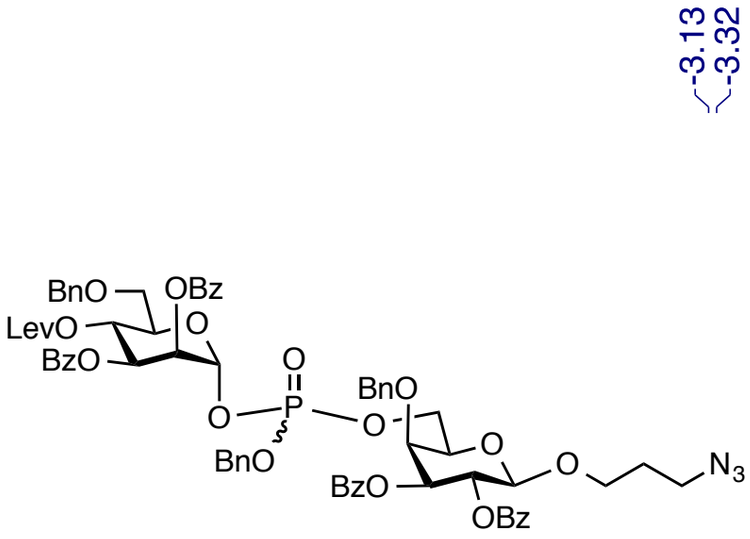


5 (^{1}H NMR, 400 MHz, $CDCl_3$)

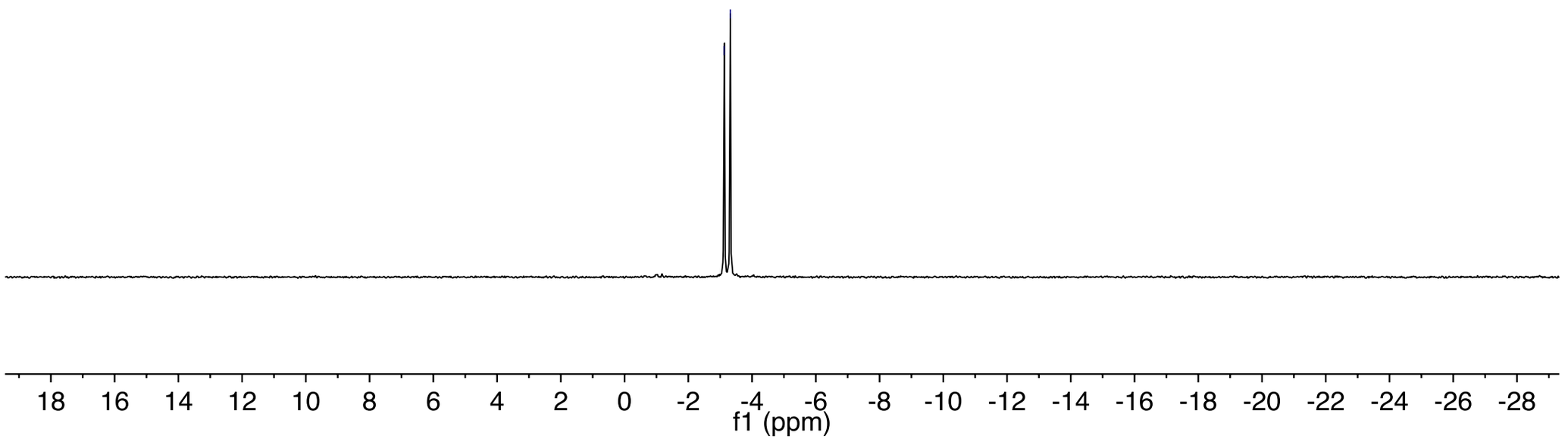


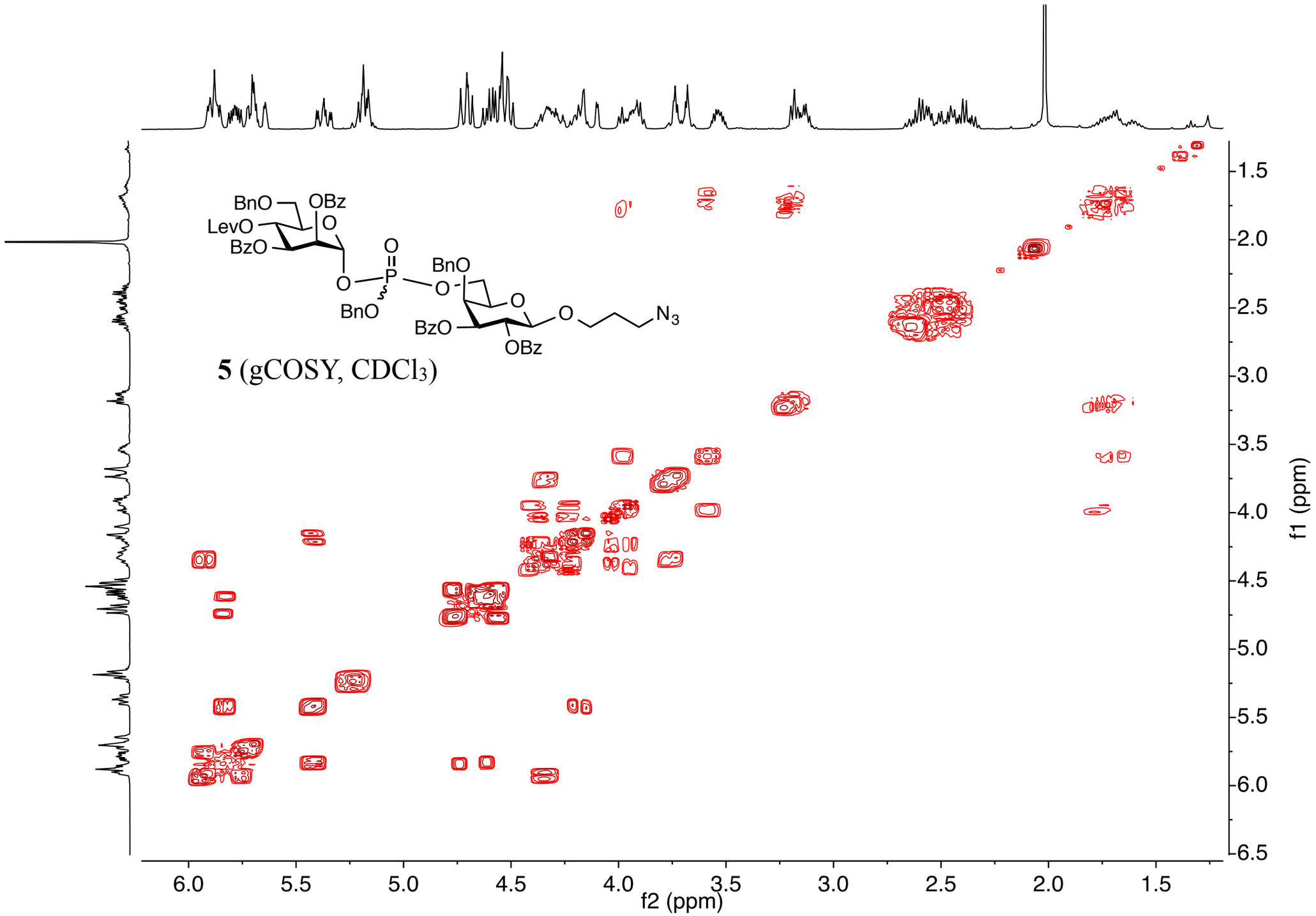
5 (^{13}C NMR, 101 MHz, $CDCl_3$)

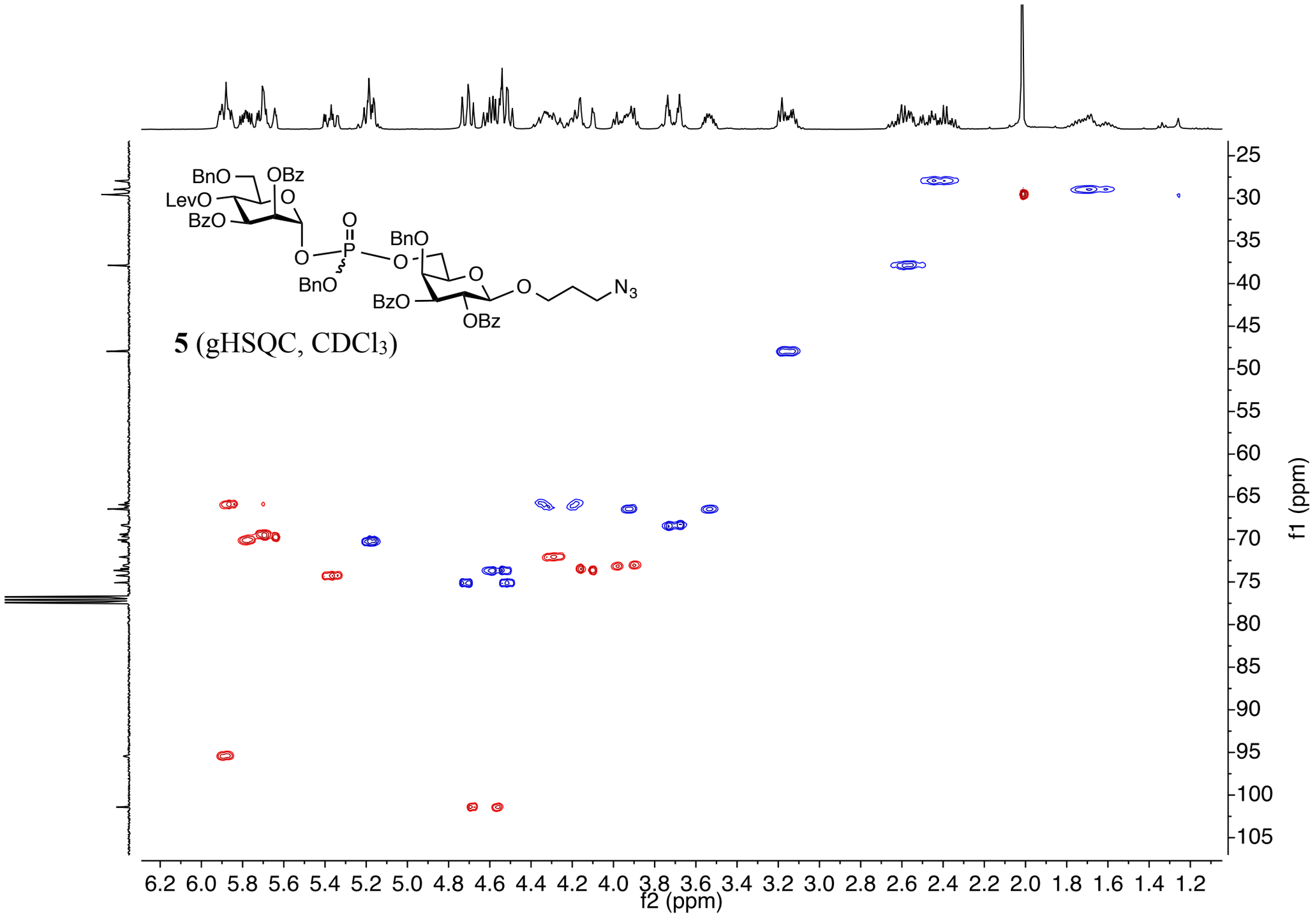


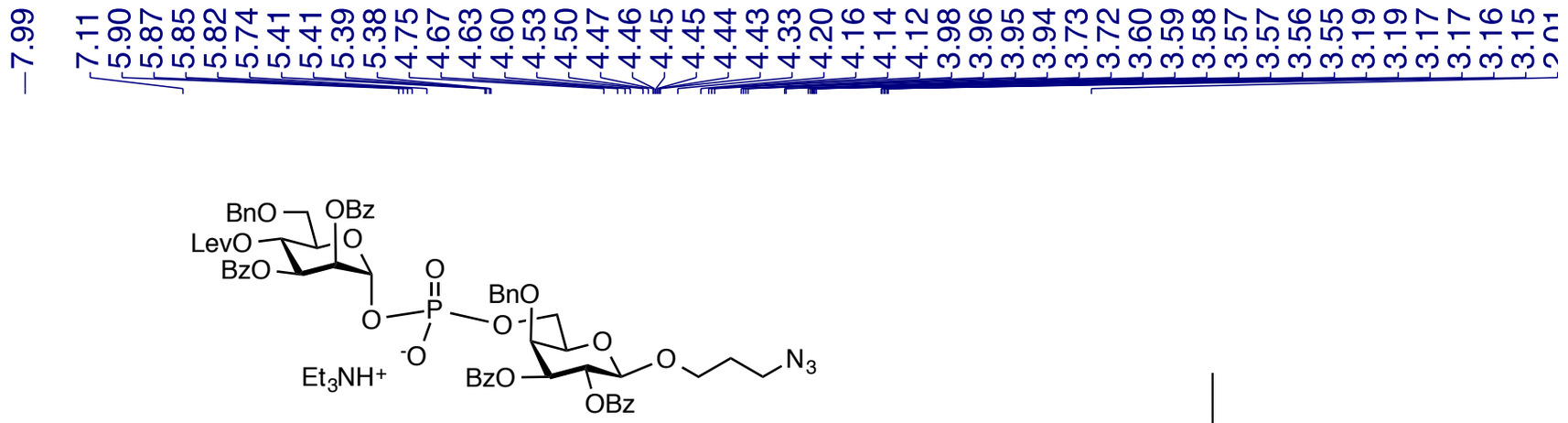


5 (^{31}P NMR, 162 MHz, $CDCl_3$)

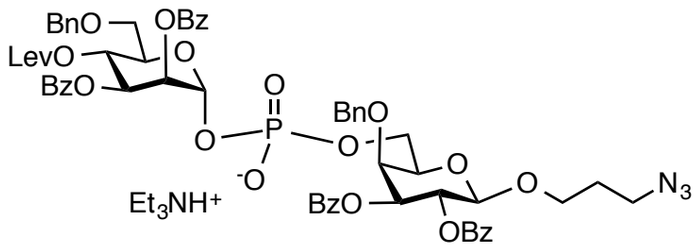



BnO
OBz
LevO
O
BzO
O
P
O
BnO
O
BnO
O
BzO
O
O
N3
OBz
5 (gCOSY, CDCl3)
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
f1 (ppm)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
f2 (ppm)

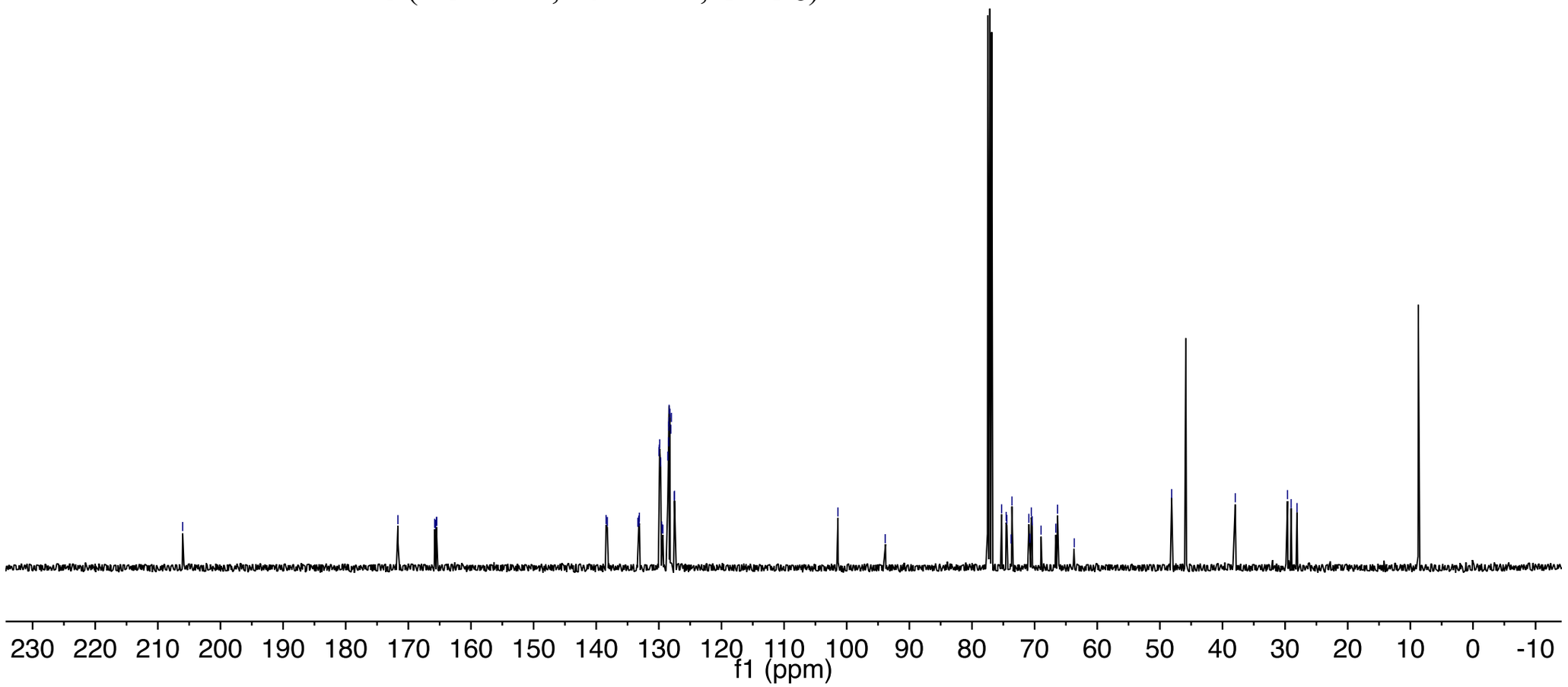

BnO
OBz
LevO
O
BzO
O
P
O
BnO
BnO
O
O
O
N3
BzO
OBz
5 (gHSQC, CDCl3)
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
f1 (ppm)
6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 1.2
f2 (ppm)

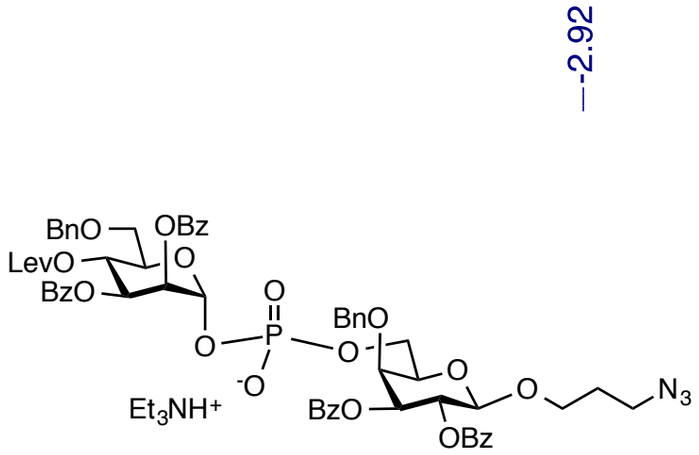


6 (^{1}H NMR, 400 MHz, $CDCl_3$)

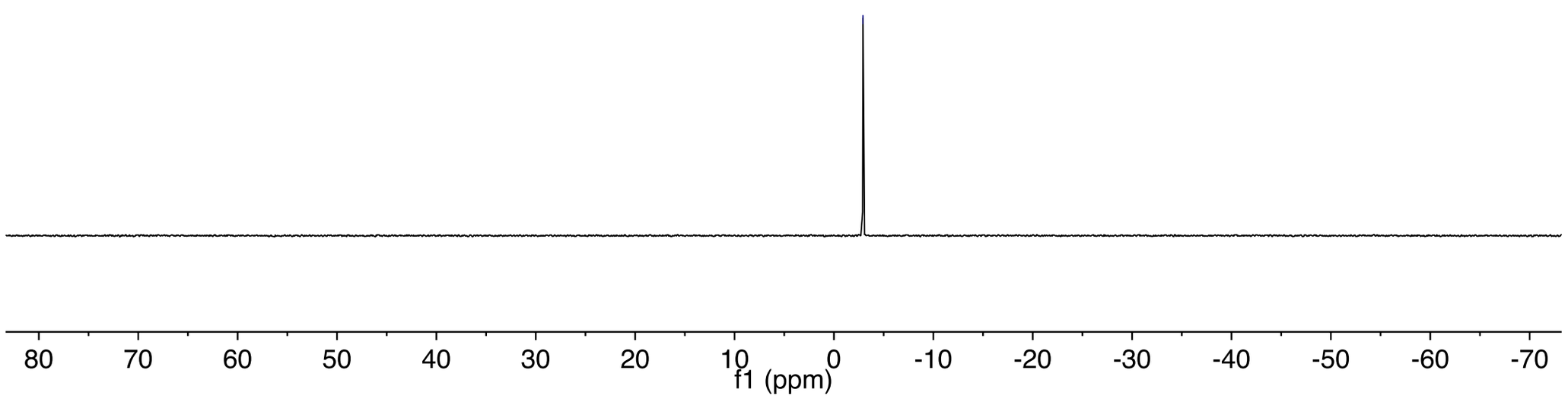


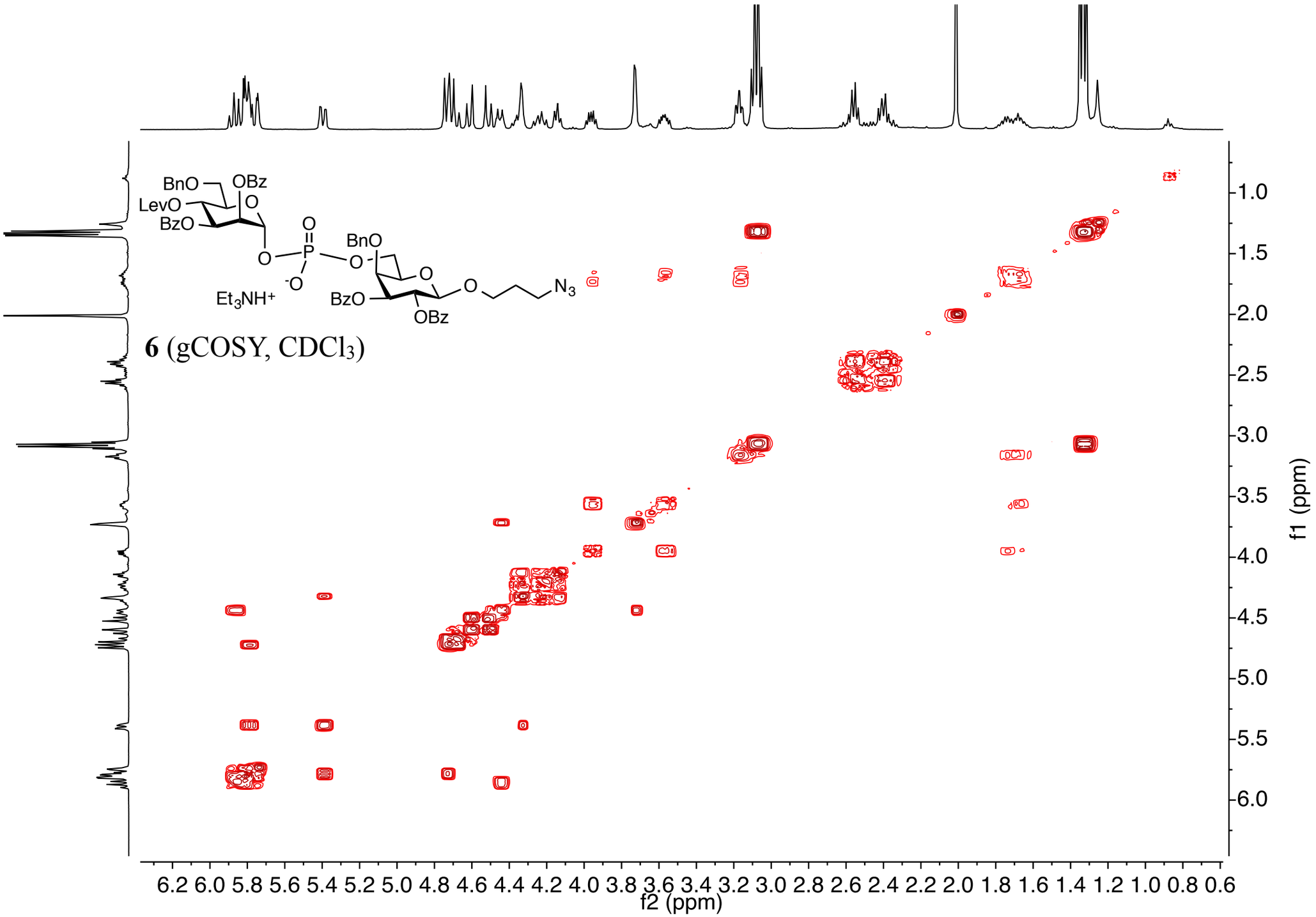
6 (^{13}C NMR, 101 MHz, $CDCl_3$)

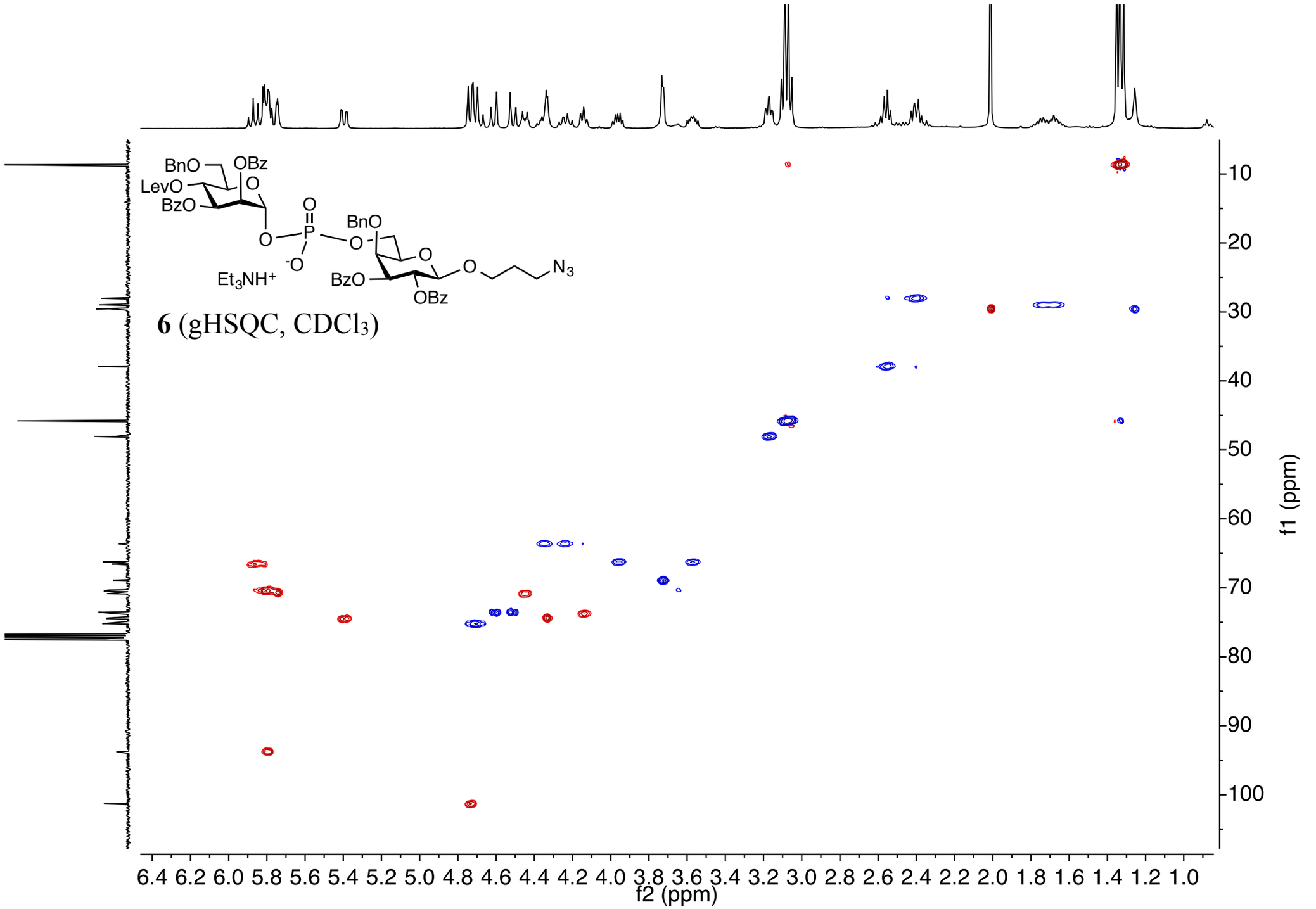


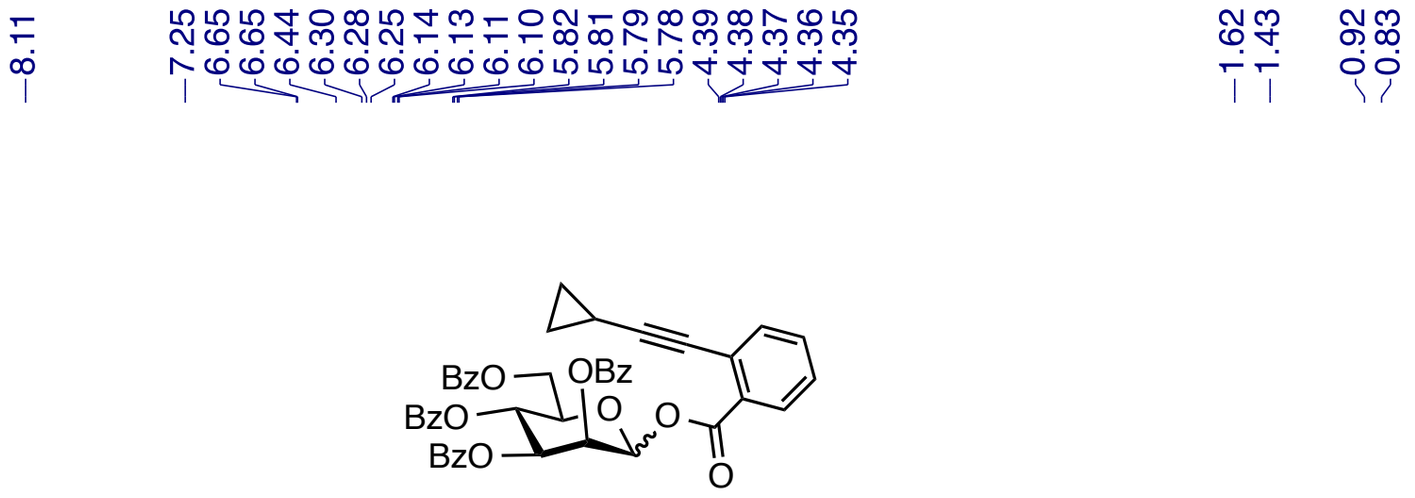


6 (^{31}P NMR, 162 MHz, $CDCl_3$)

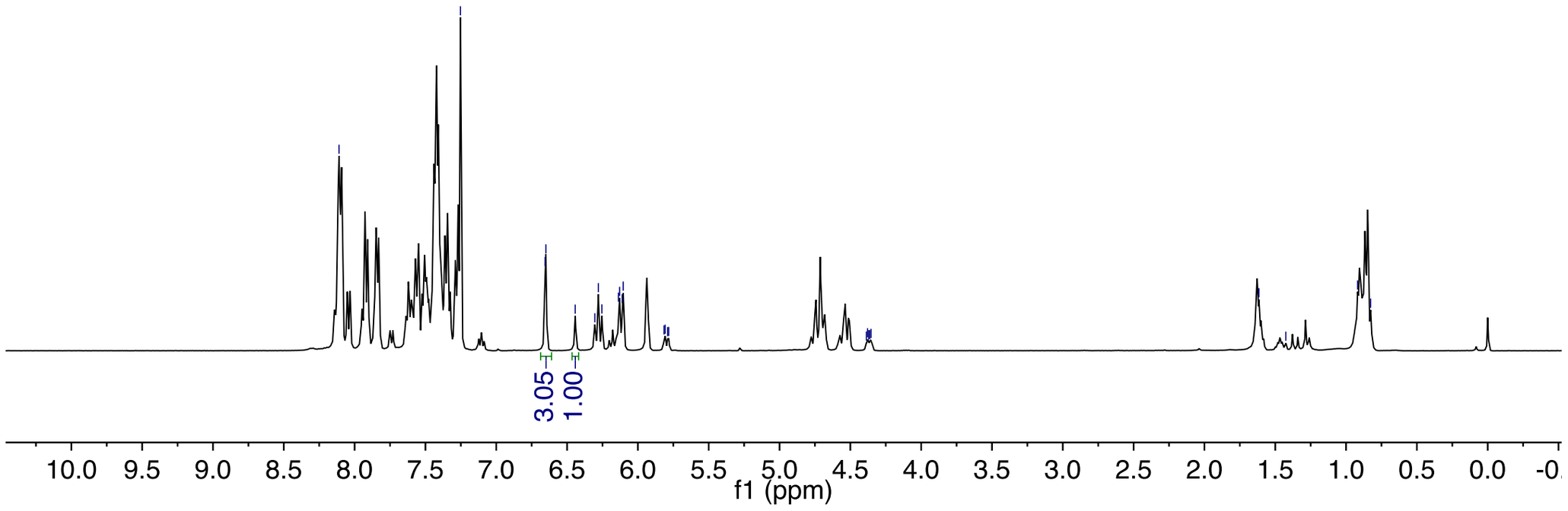



BnO
OBz
LevO
O
BzO
O
P
O
-O
Et3NH+
BnO
O
O
O
N3
BzO
OBz
6 (gCOSY, CDCl3)
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 1.2 1.0 0.8 0.6
f2 (ppm)


BnO
OBz
LevO
O
BzO
O
P
O
O
-O
Et3NH+
BnO
O
O
BzO
OBz
O
N3
6 (gHSQC, CDCl3)
10
20
30
40
50
60
70
80
90
100
f1 (ppm)
6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 1.2 1.0
f2 (ppm)



1q (^{1}H NMR, 400 MHz, $CDCl_3$)



166.21
165.61
165.59
165.46
165.42
165.26
163.88
134.83
134.32
133.75
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133.62
133.58
133.50
133.44
133.17
132.56
132.42
130.91
130.87
130.36
130.13
130.08
129.97
129.94
129.91
129.87
129.84
129.23
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128.93
128.87
128.79
128.73
128.61
128.57
128.49
127.45
127.02
125.84
125.32
100.41
91.78
91.44
74.74
73.50
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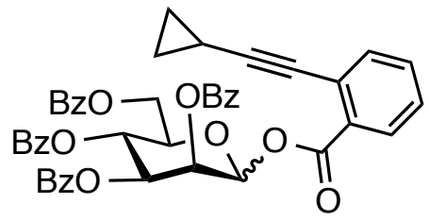
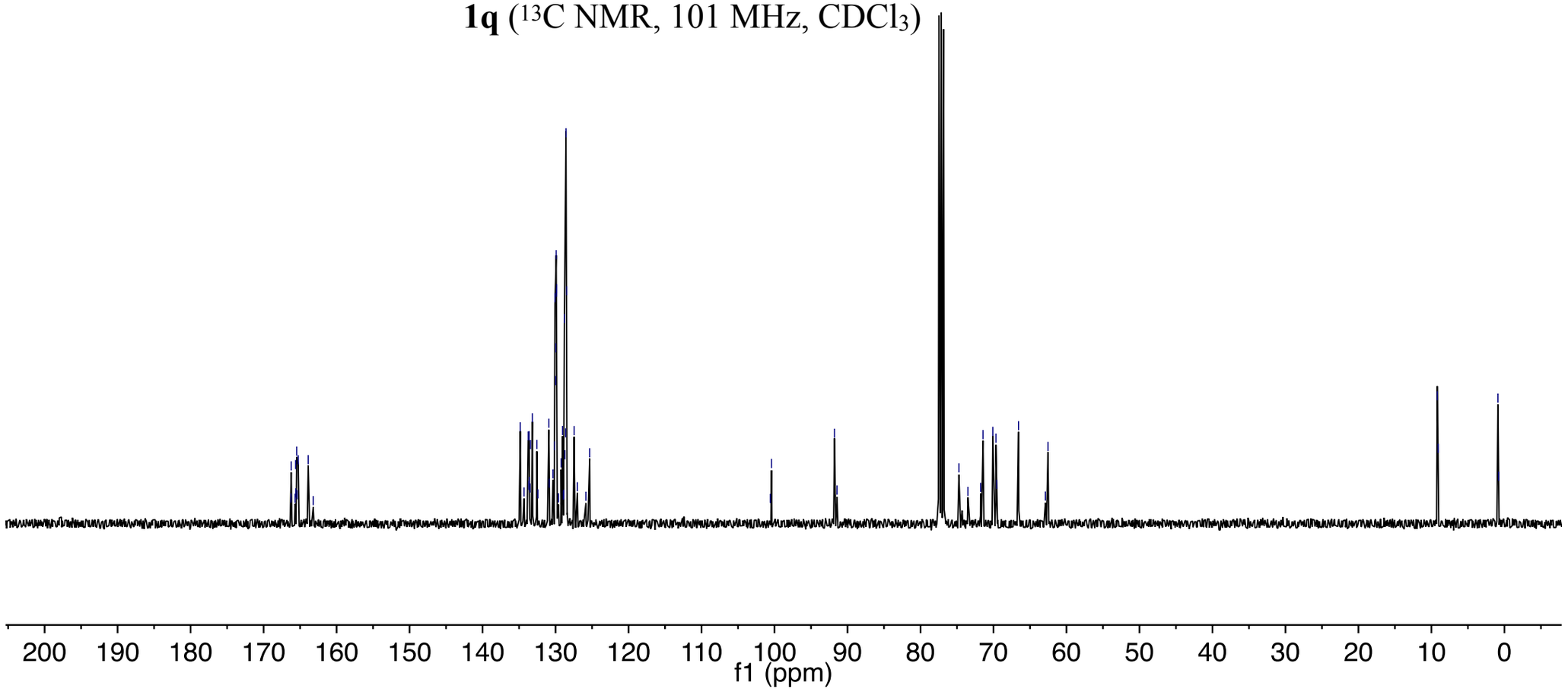
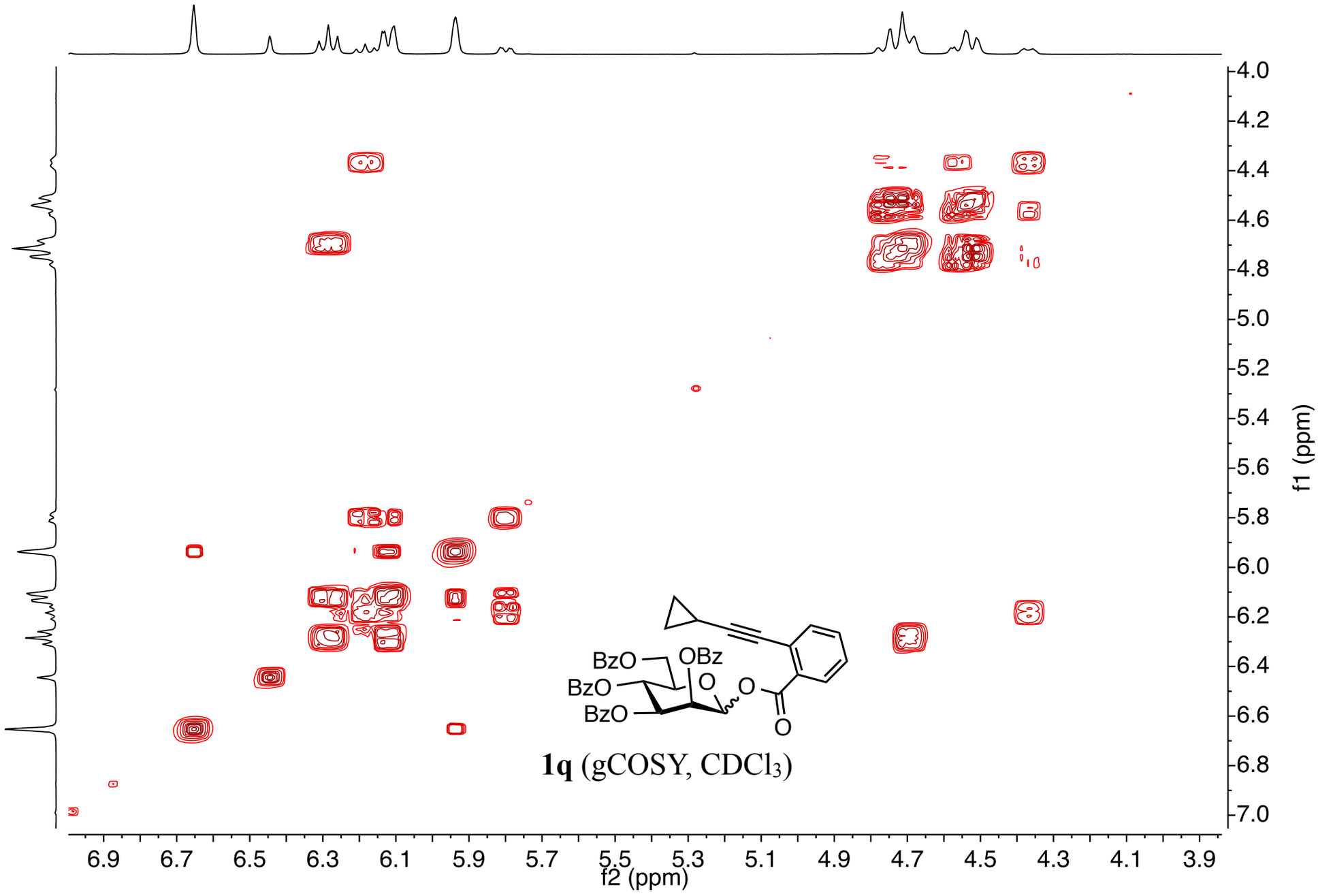
0.89
0.79

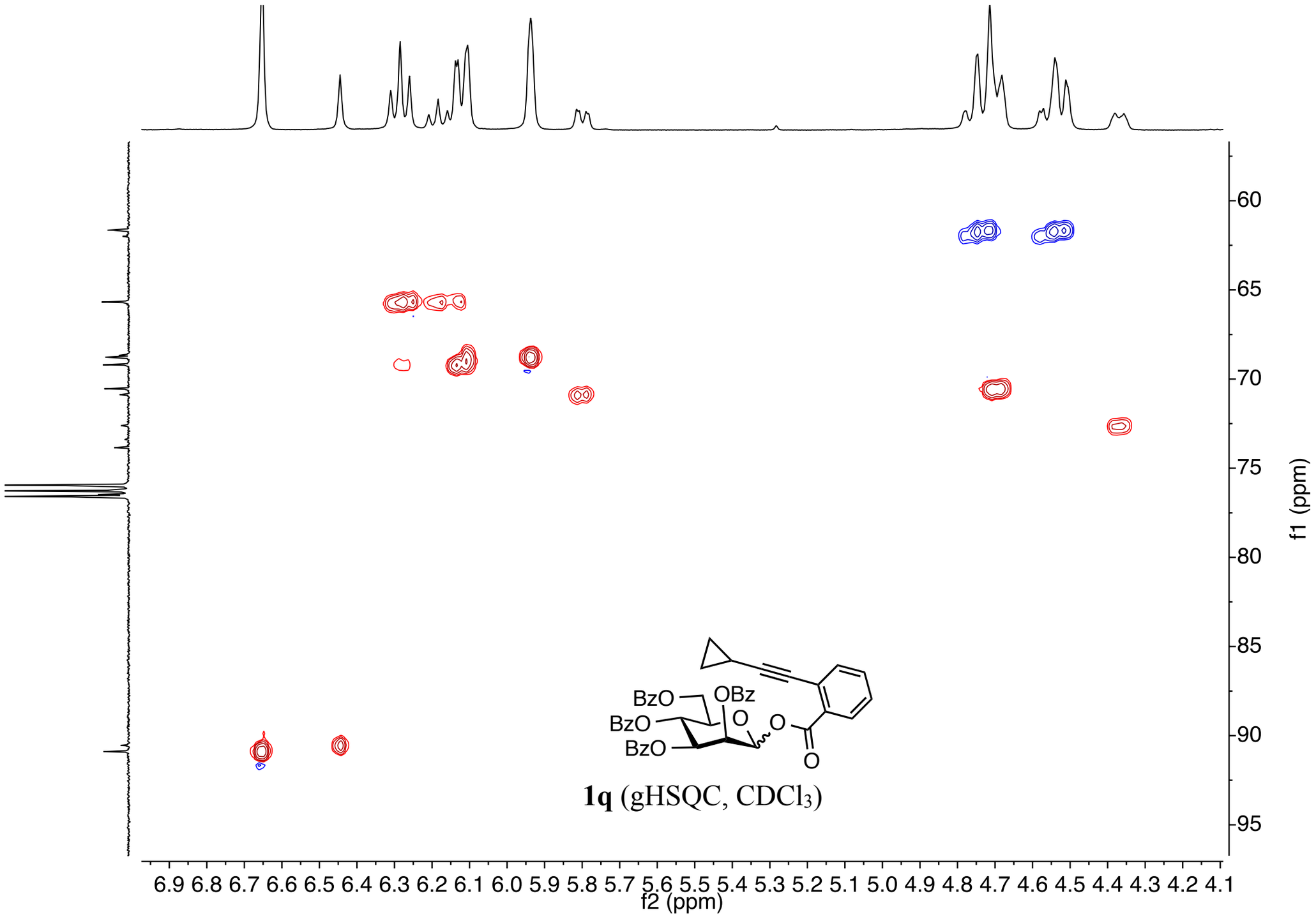


1q (^{13}C NMR, 101 MHz, $CDCl_3$)

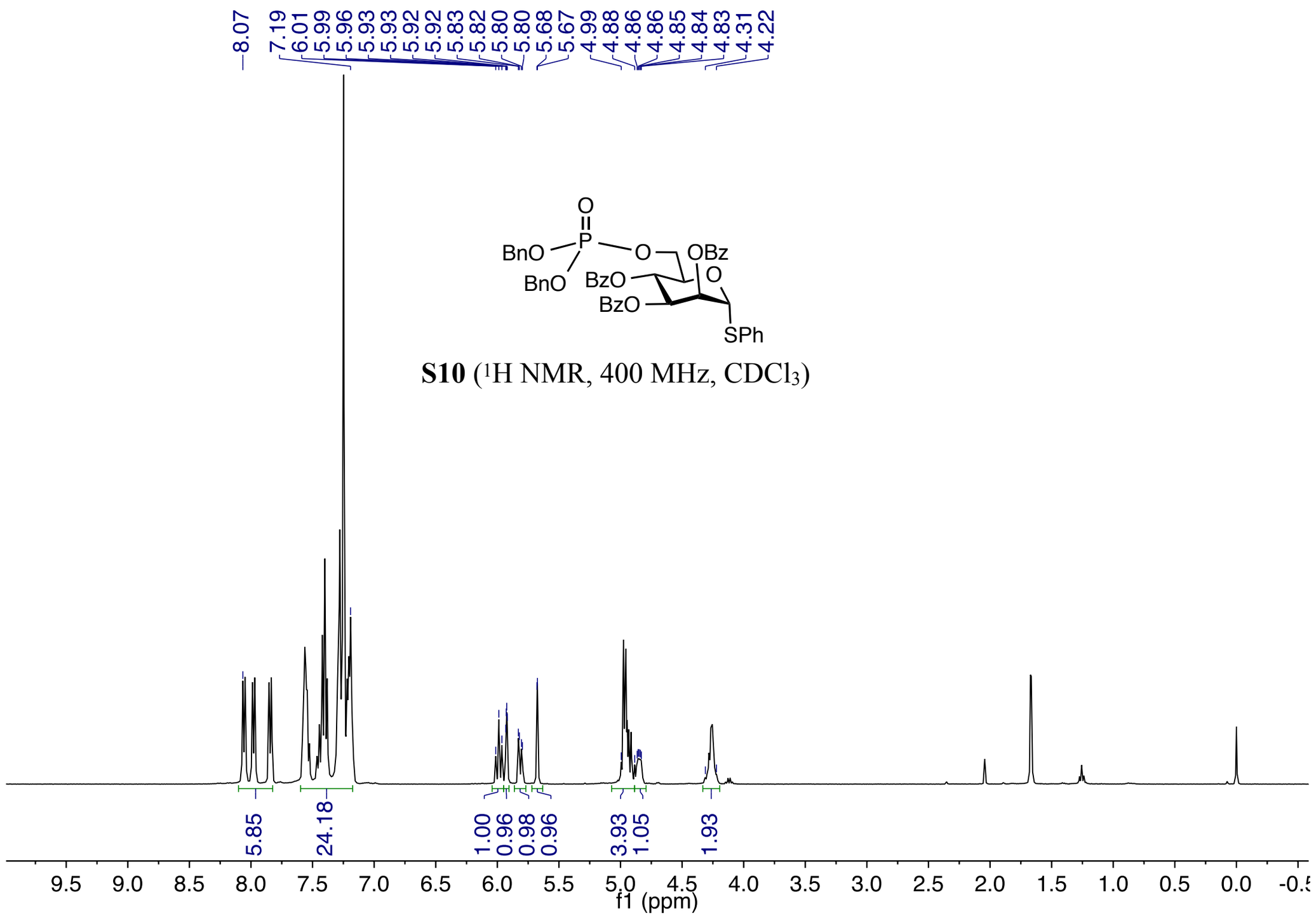




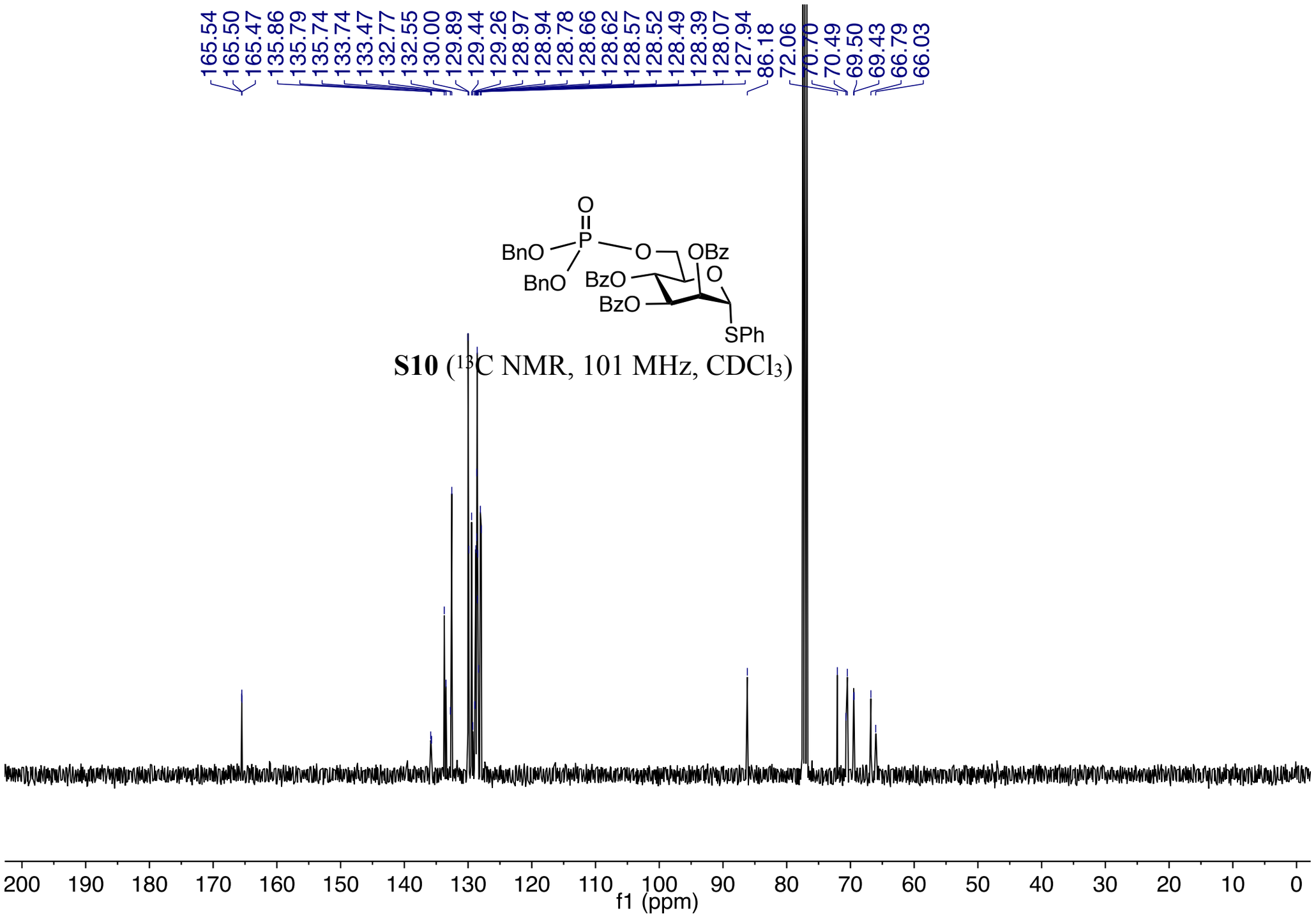
1q (gCOSY, $CDCl_3$)



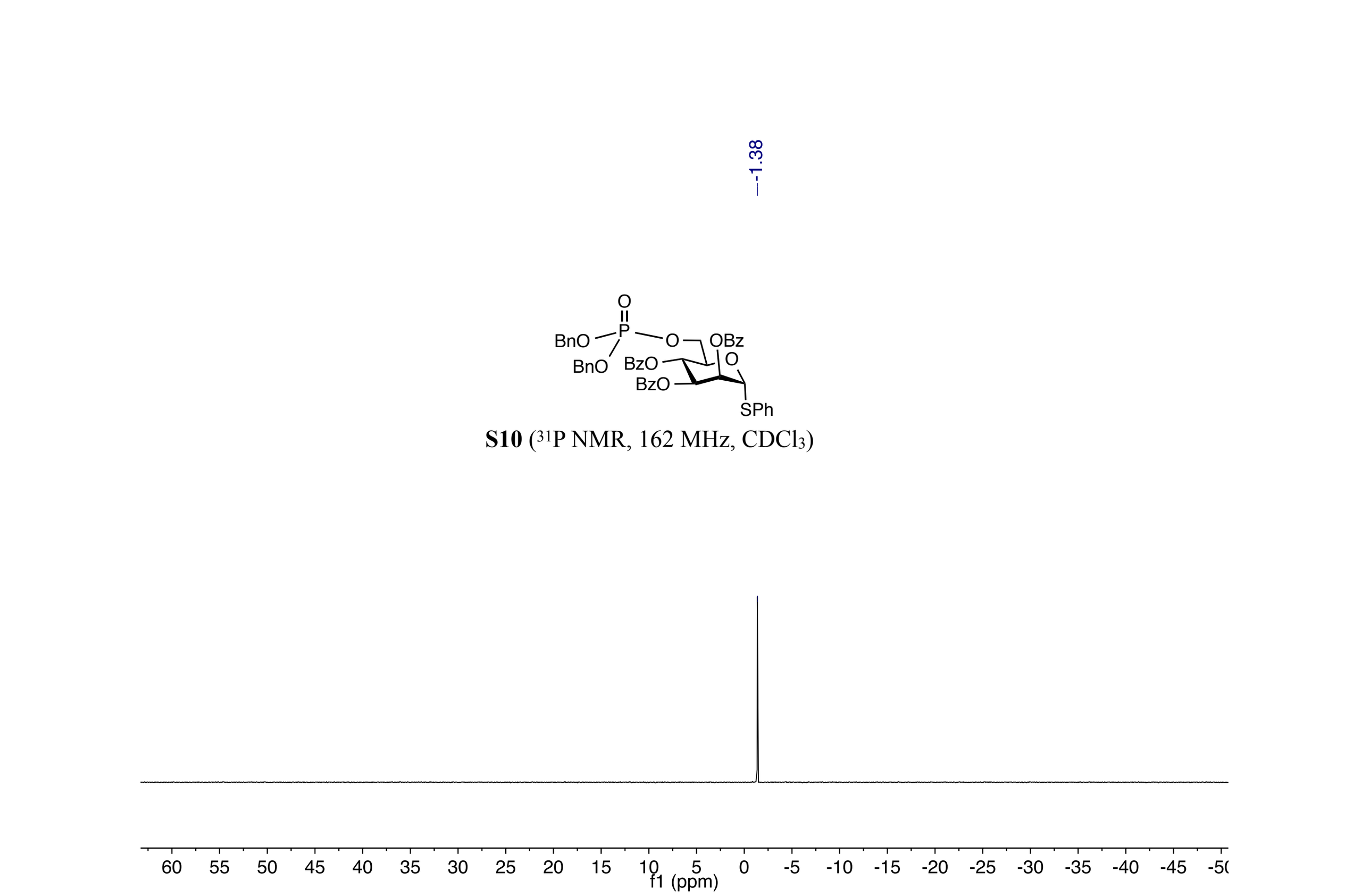
1q (gHSQC, $CDCl_3$)



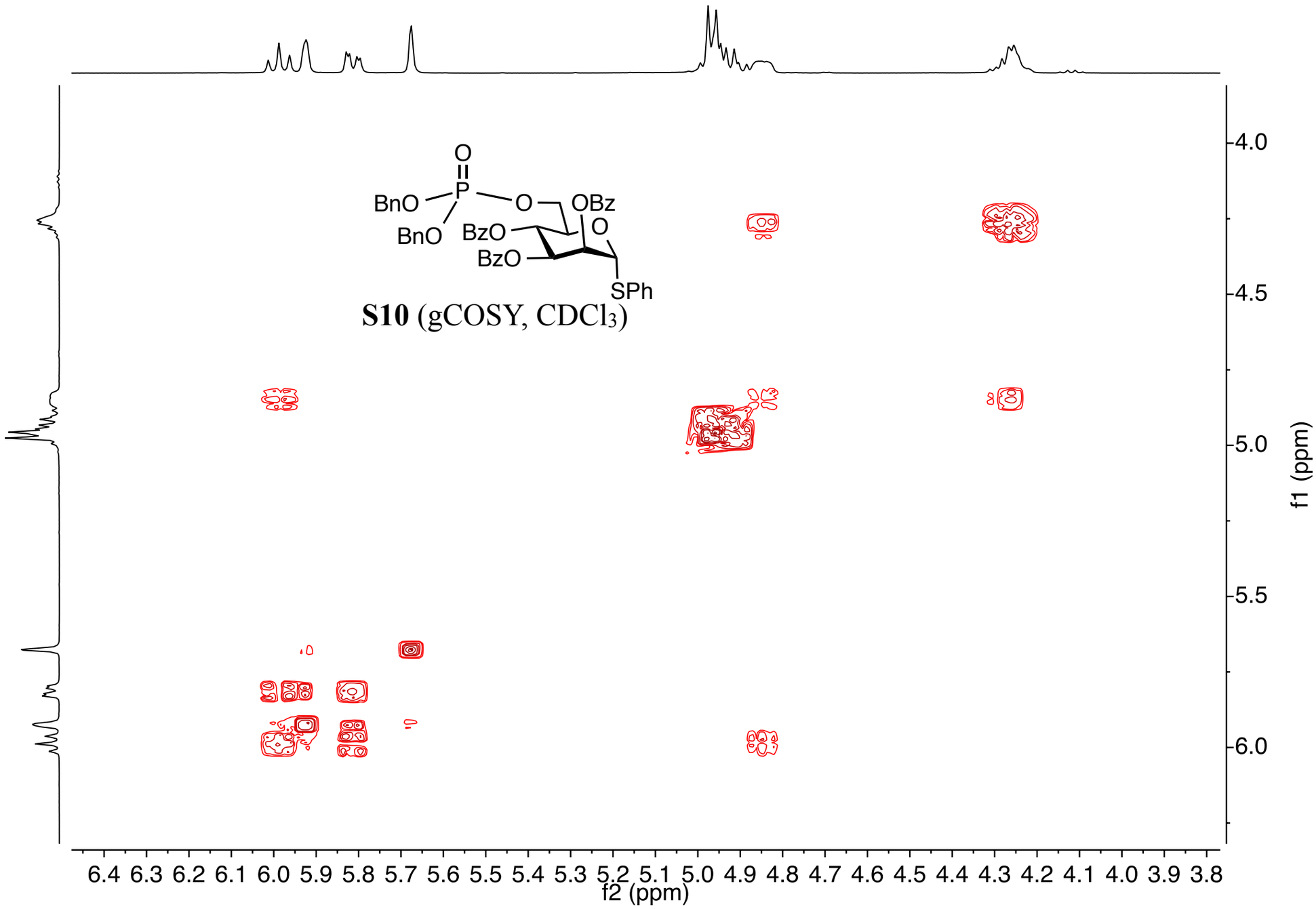
S10 (^{1}H NMR, 400 MHz, $CDCl_3$)



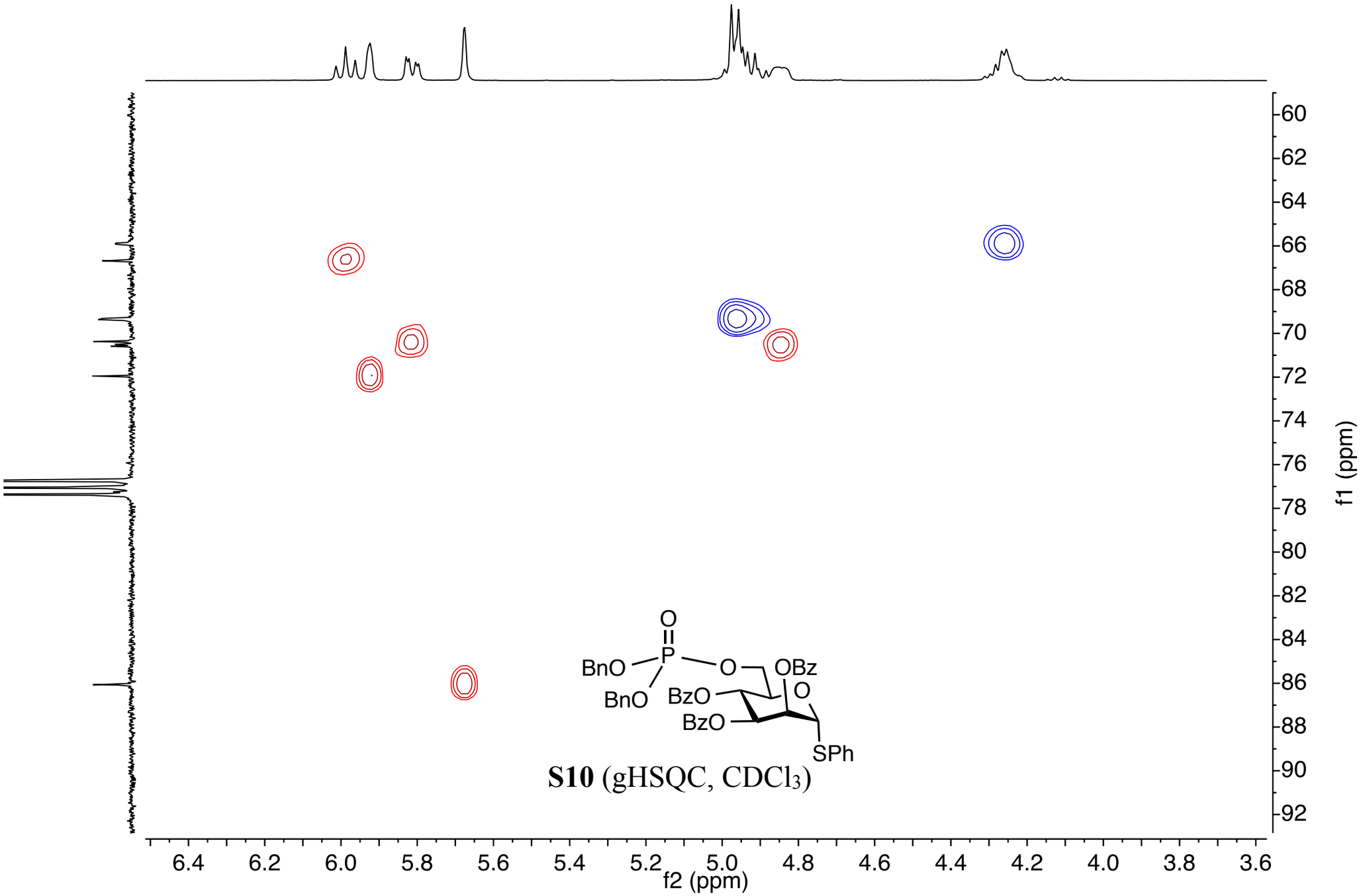
S10 (^{13}C NMR, 101 MHz, $CDCl_3$)



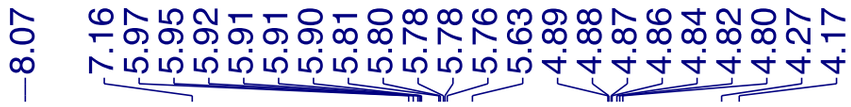
S10 (^{31}P NMR, 162 MHz, $CDCl_3$)

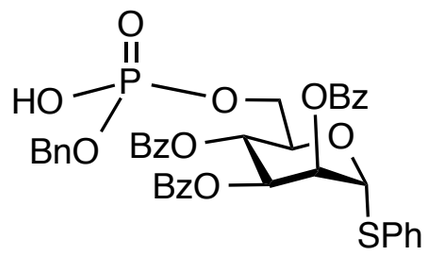


S10 (gCOSY, $CDCl_3$)

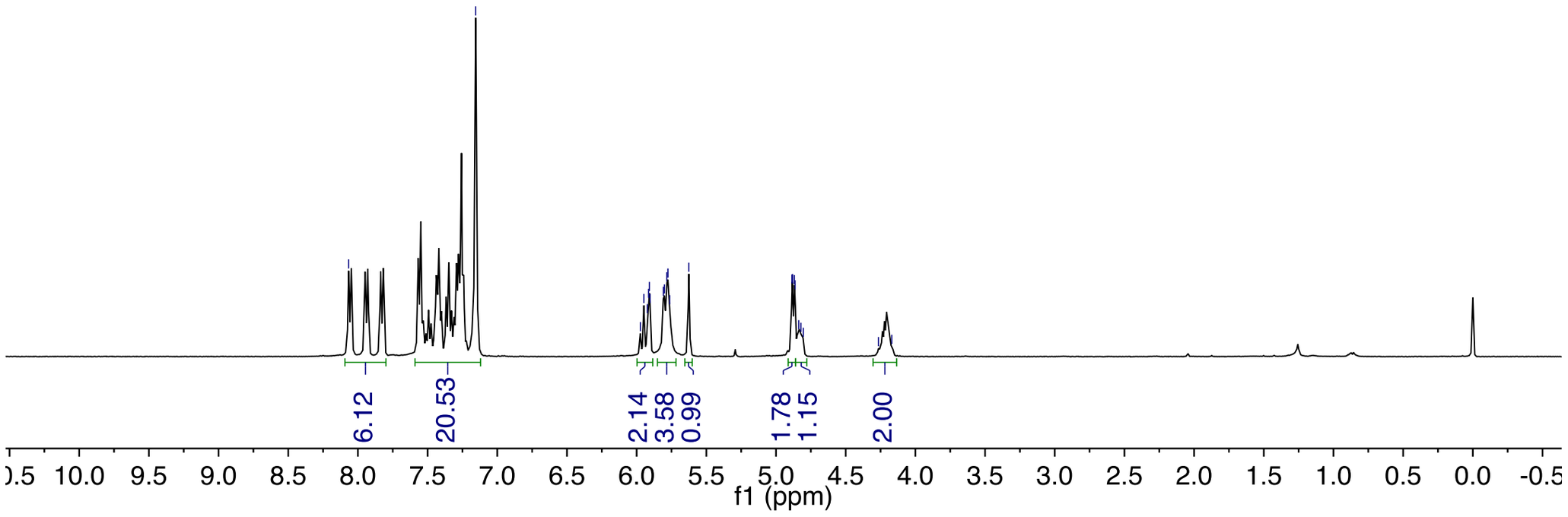


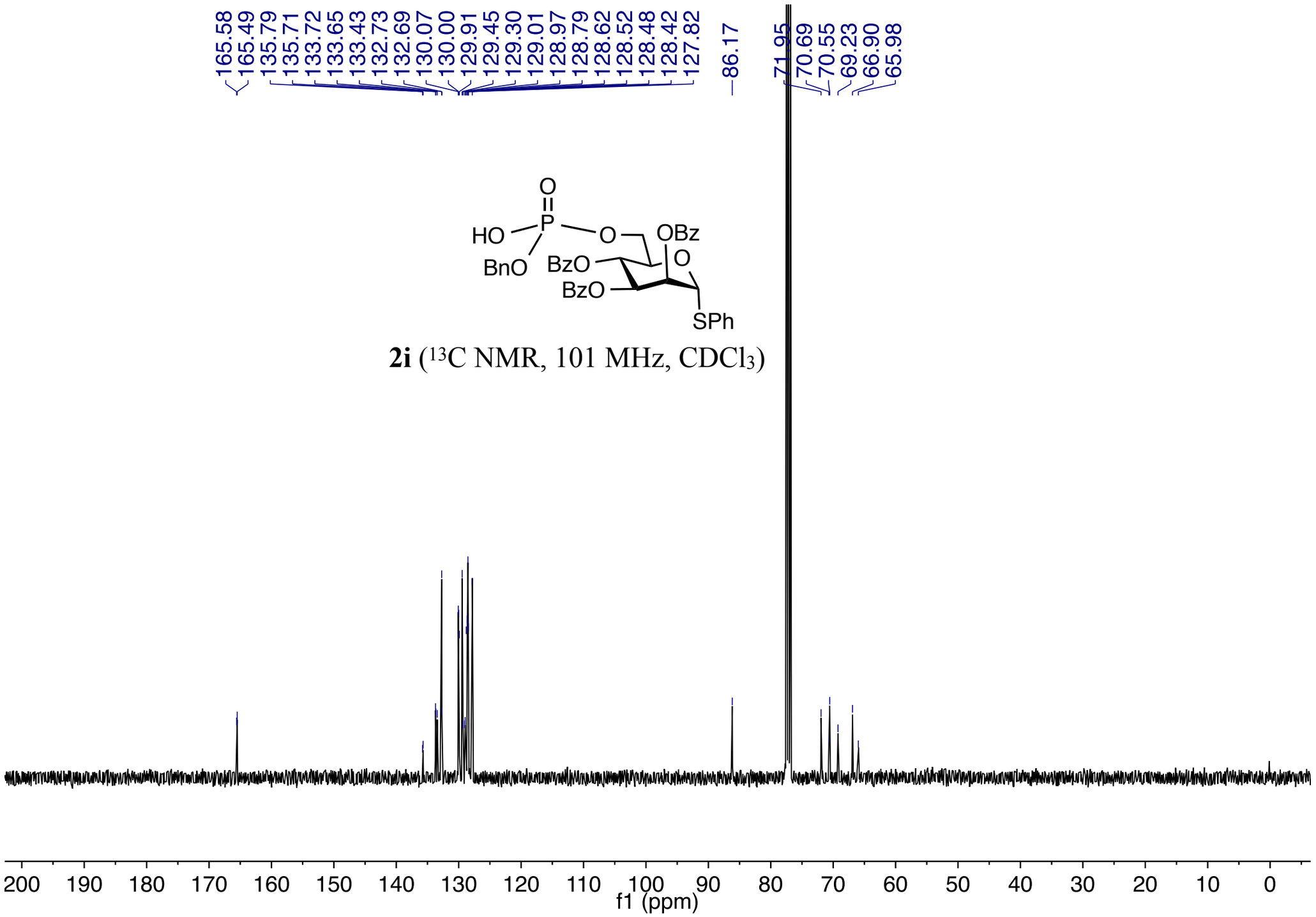
S10 (gHSQC, $CDCl_3$)





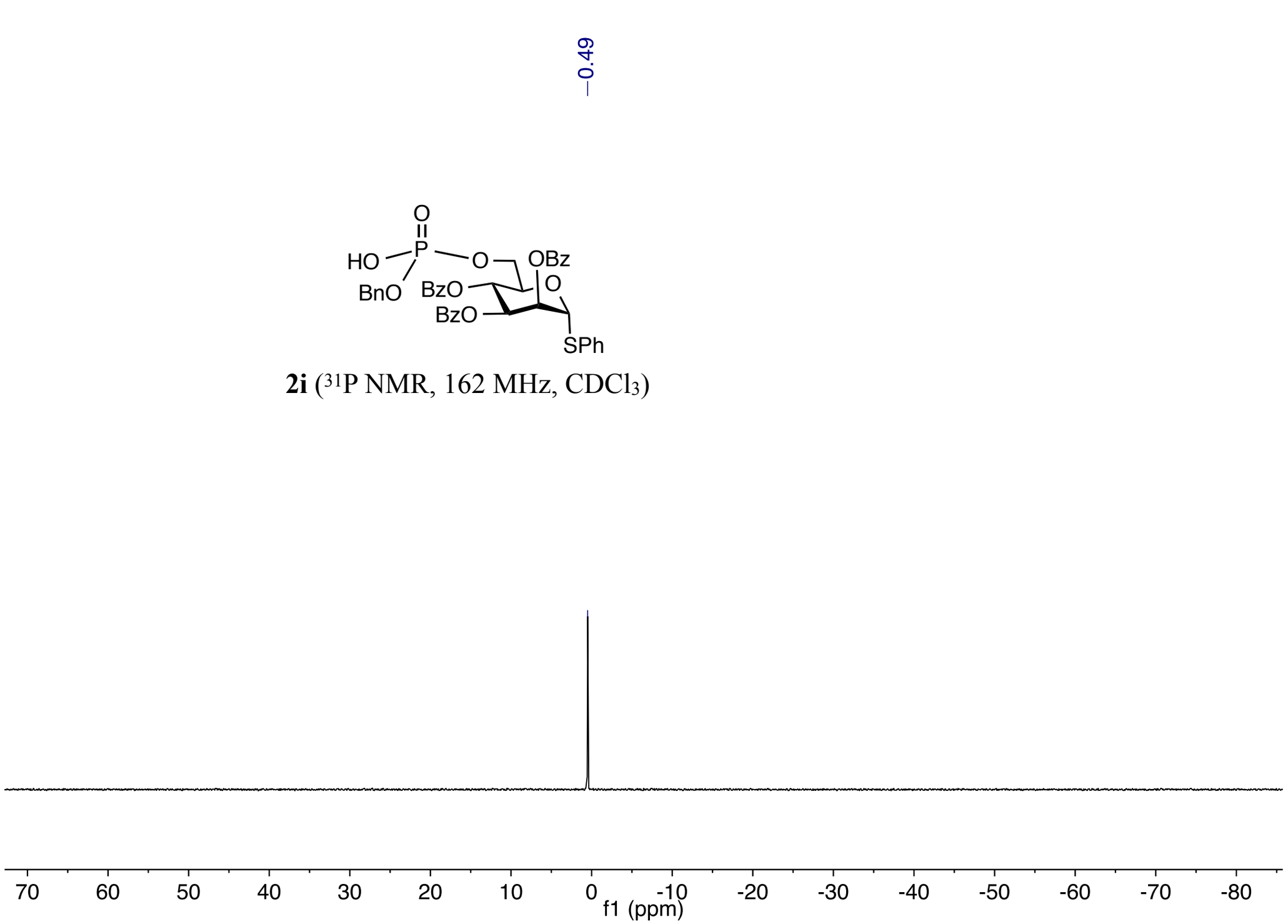
2i (^{1}H NMR, 400 MHz, $CDCl_3$)

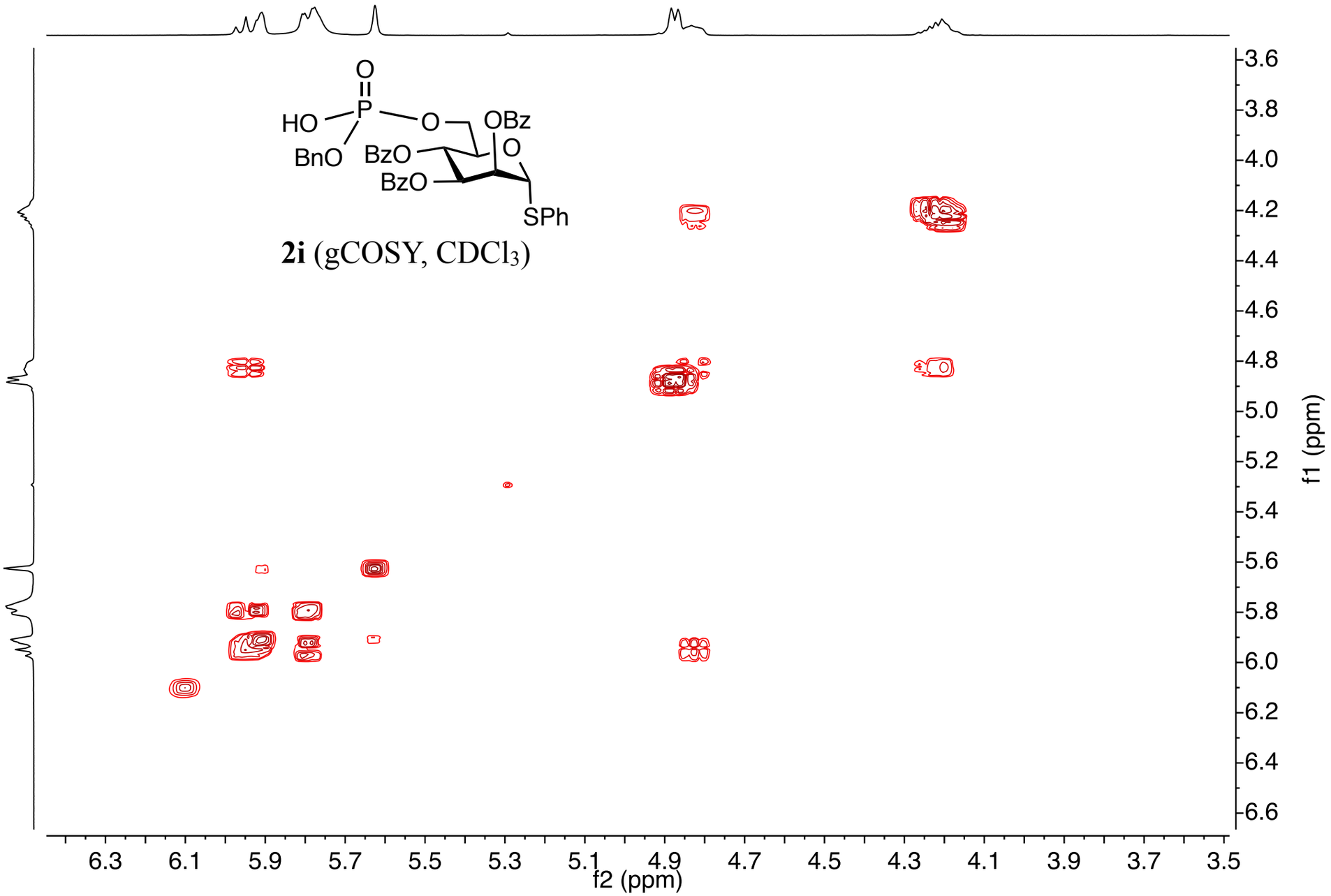




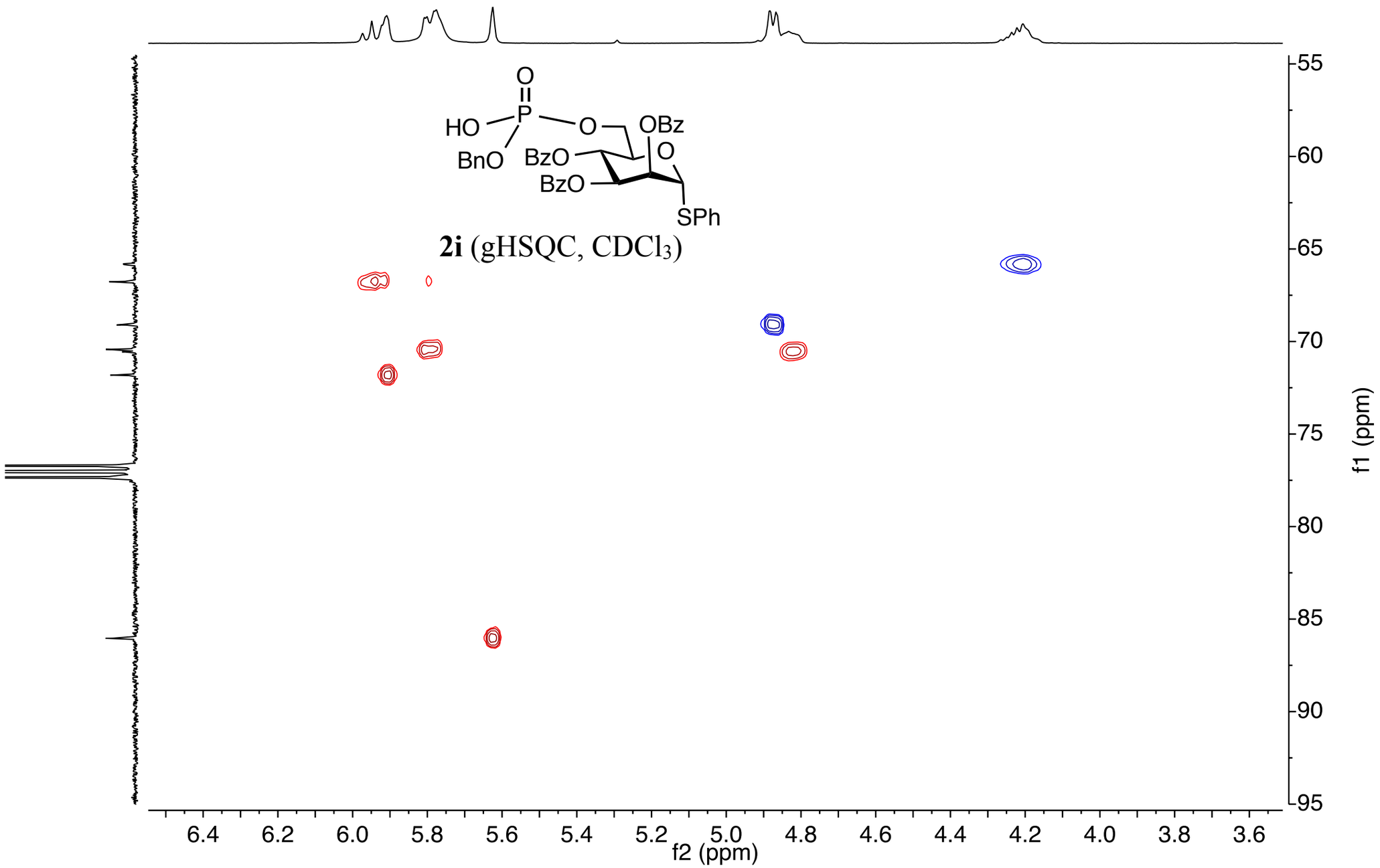
2i (^{13}C NMR, 101 MHz, $CDCl_3$)

2i (^{31}P NMR, 162 MHz, $CDCl_3$)

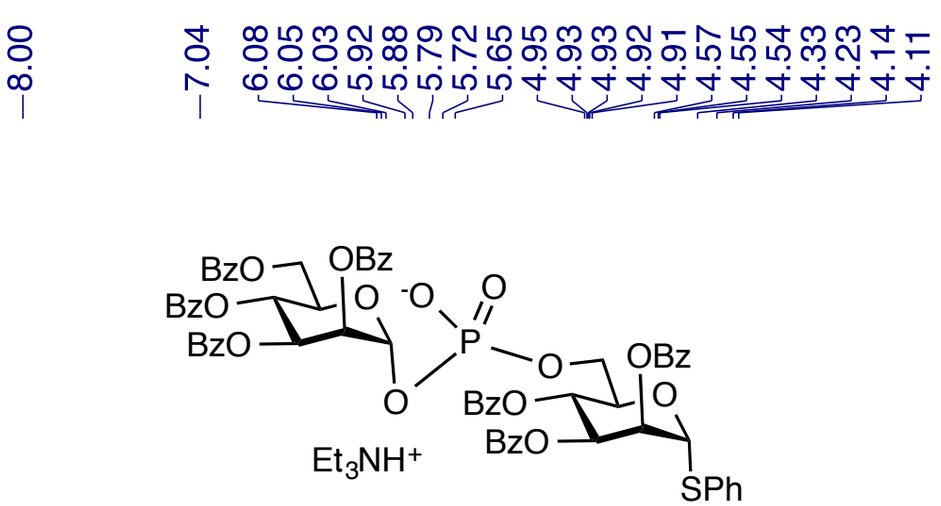




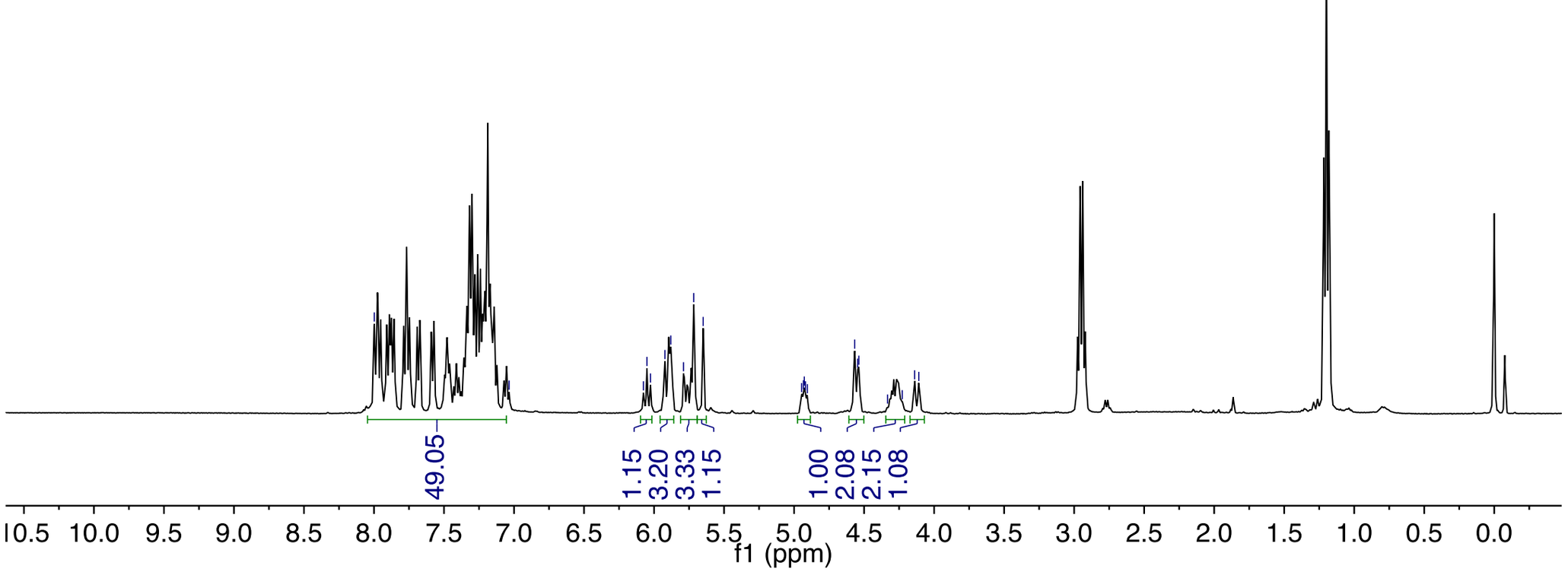
2i (gCOSY, $CDCl_3$)

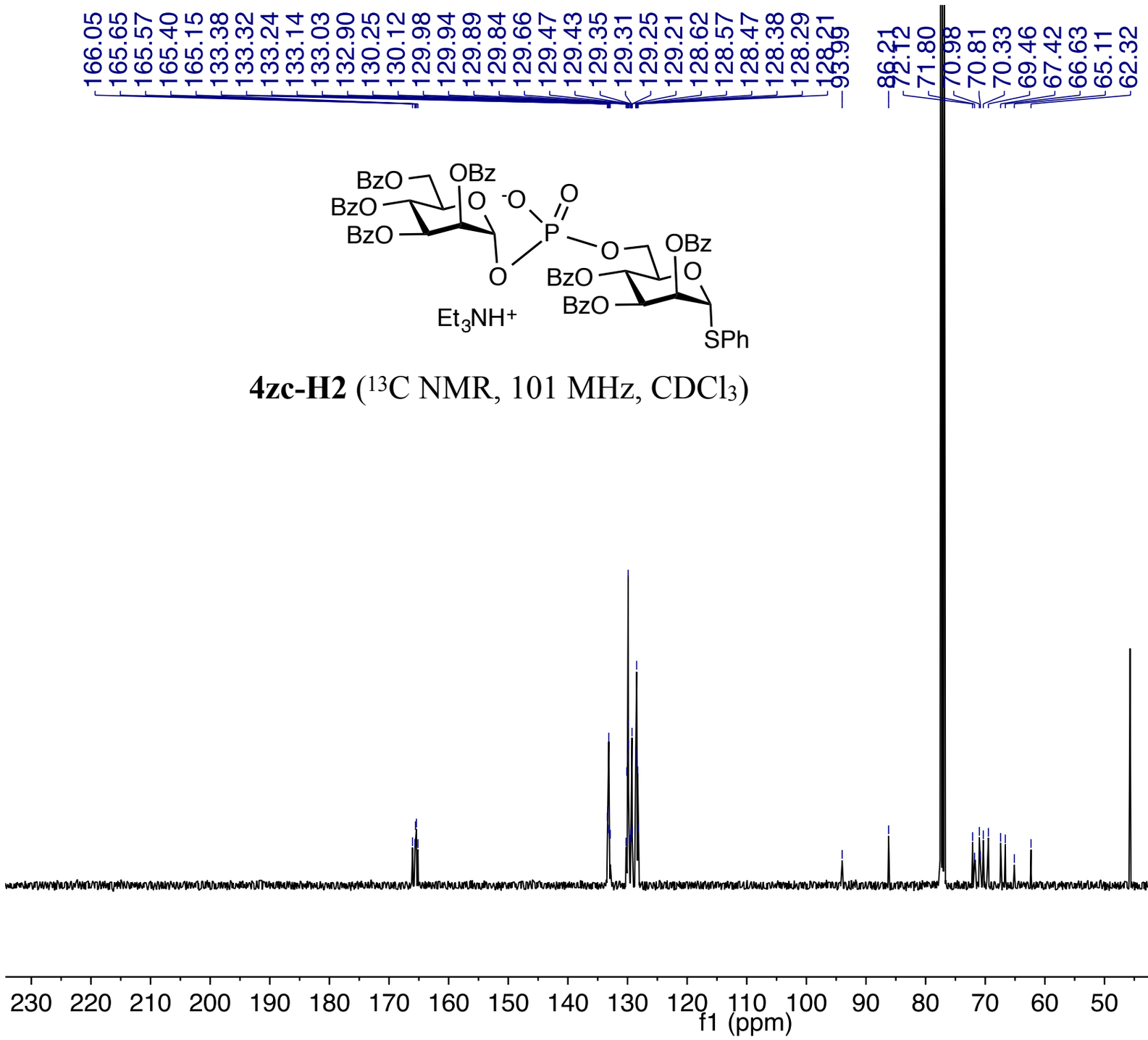


2i (gHSQC, $CDCl_3$)



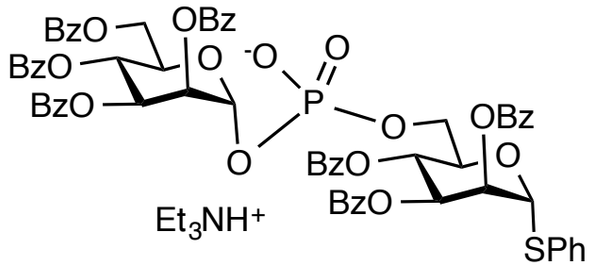
4zc-H2 (^{1}H NMR, 400 MHz, $CDCl_3$)



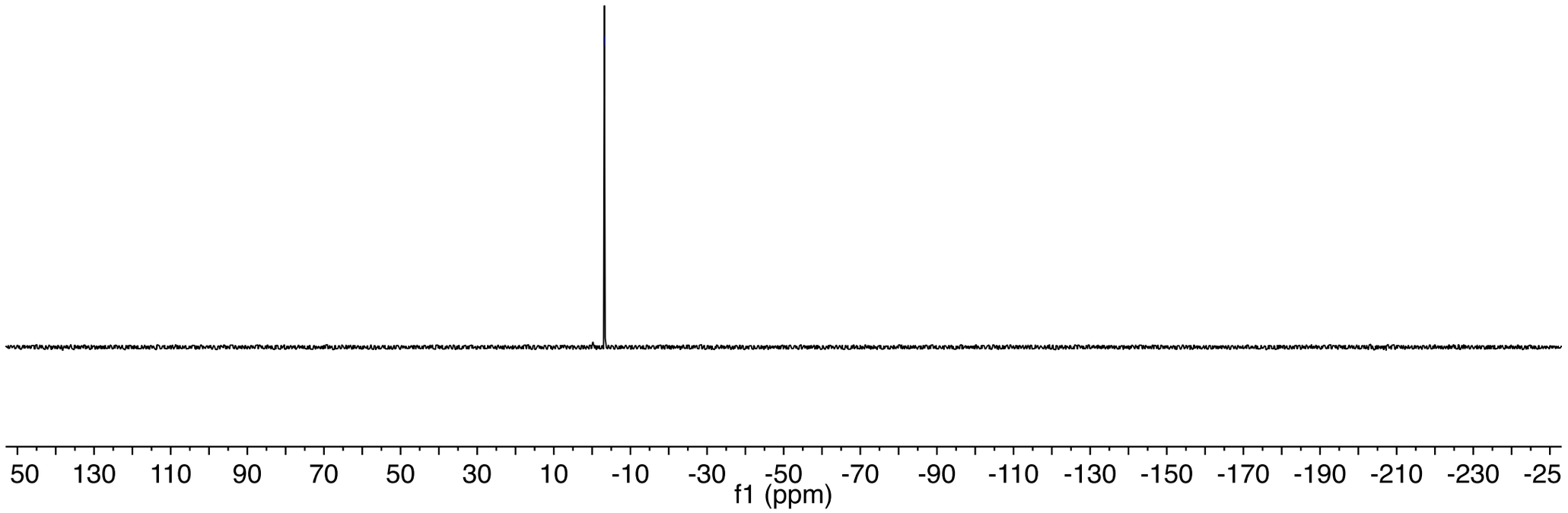


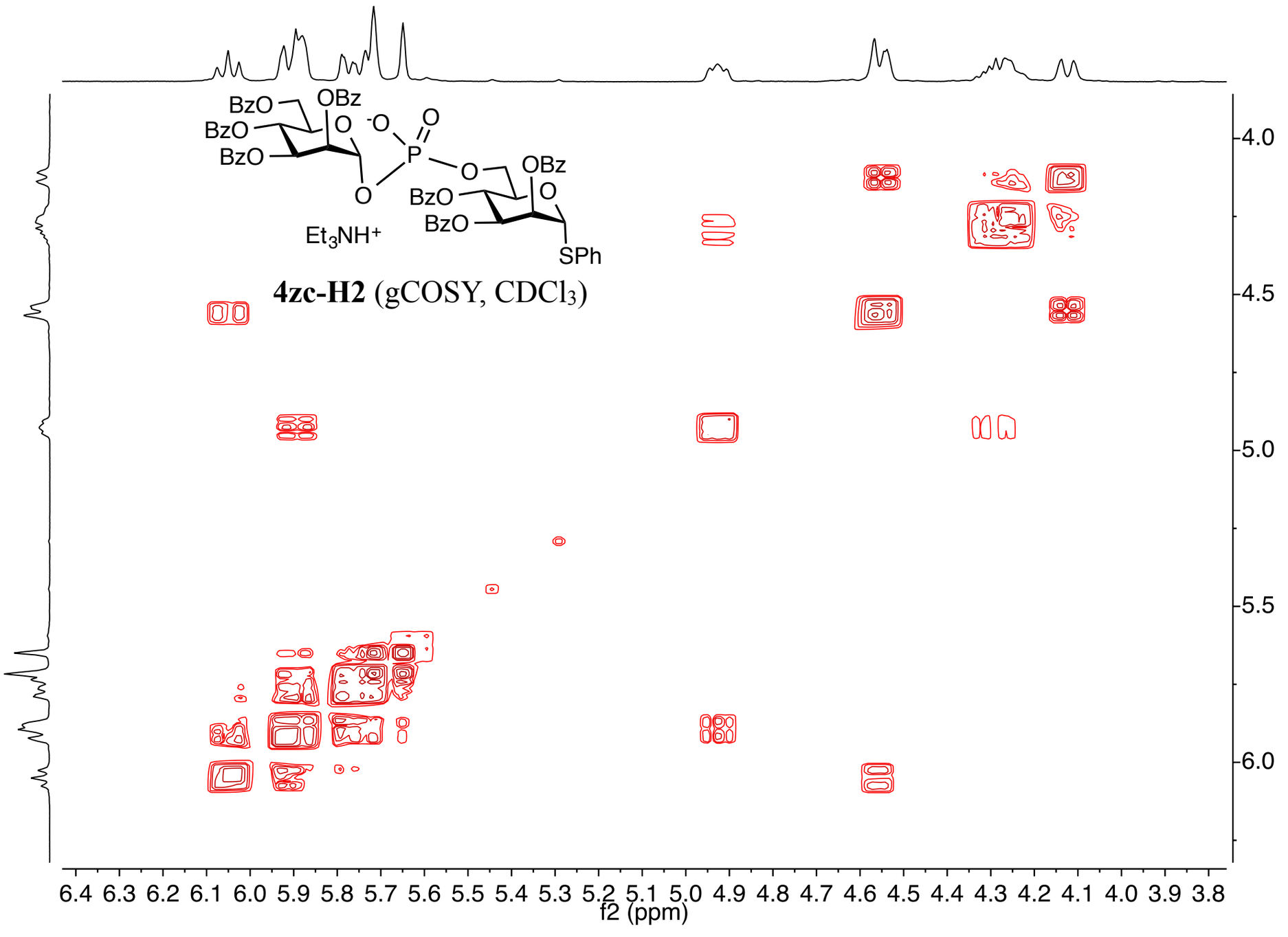
4zc-H2 (^{13}C NMR, 101 MHz, $CDCl_3$)

—3.19

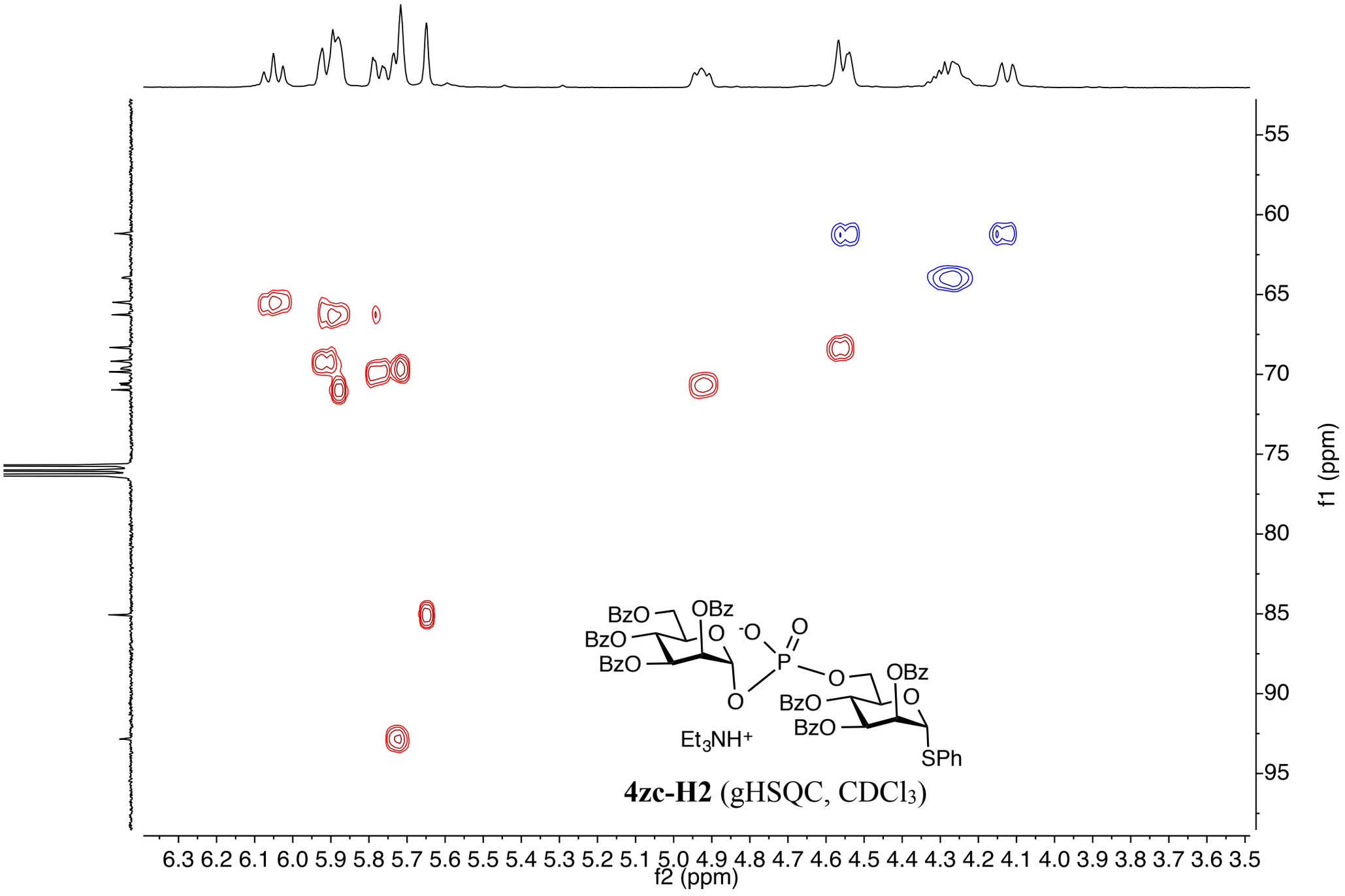


4zc-H2 (^{31}P NMR, 162 MHz, $CDCl_3$)

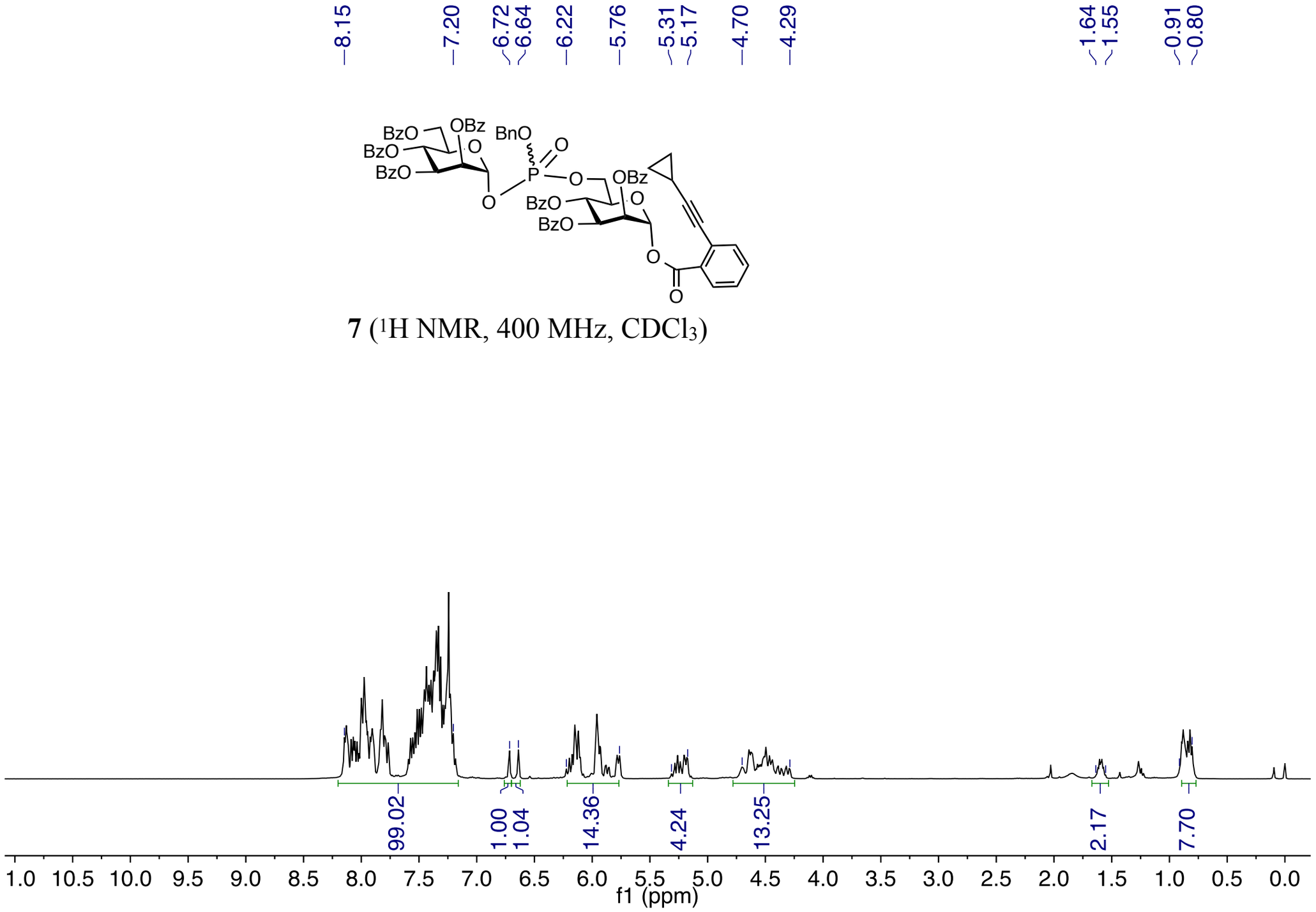




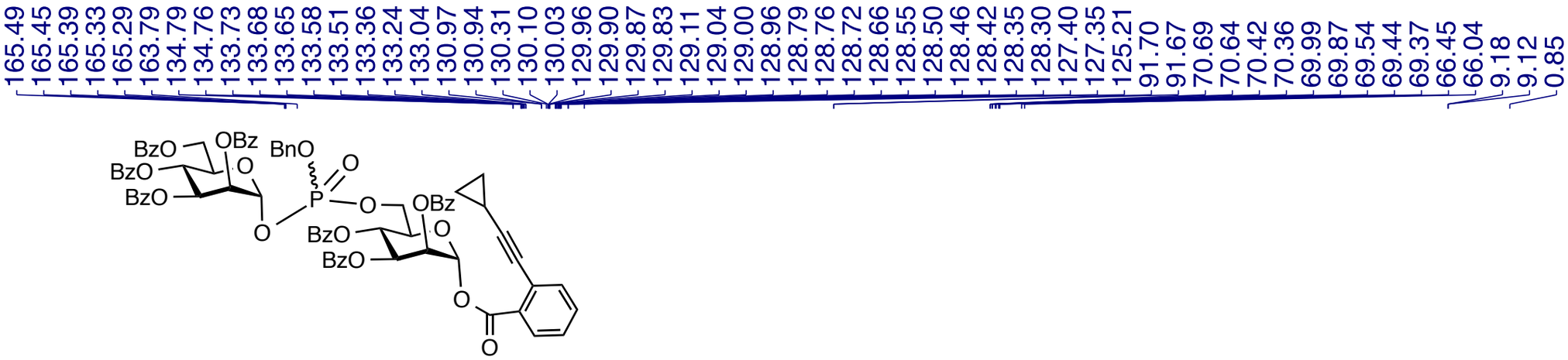
4zc-H2 (gCOSY, $CDCl_3$)



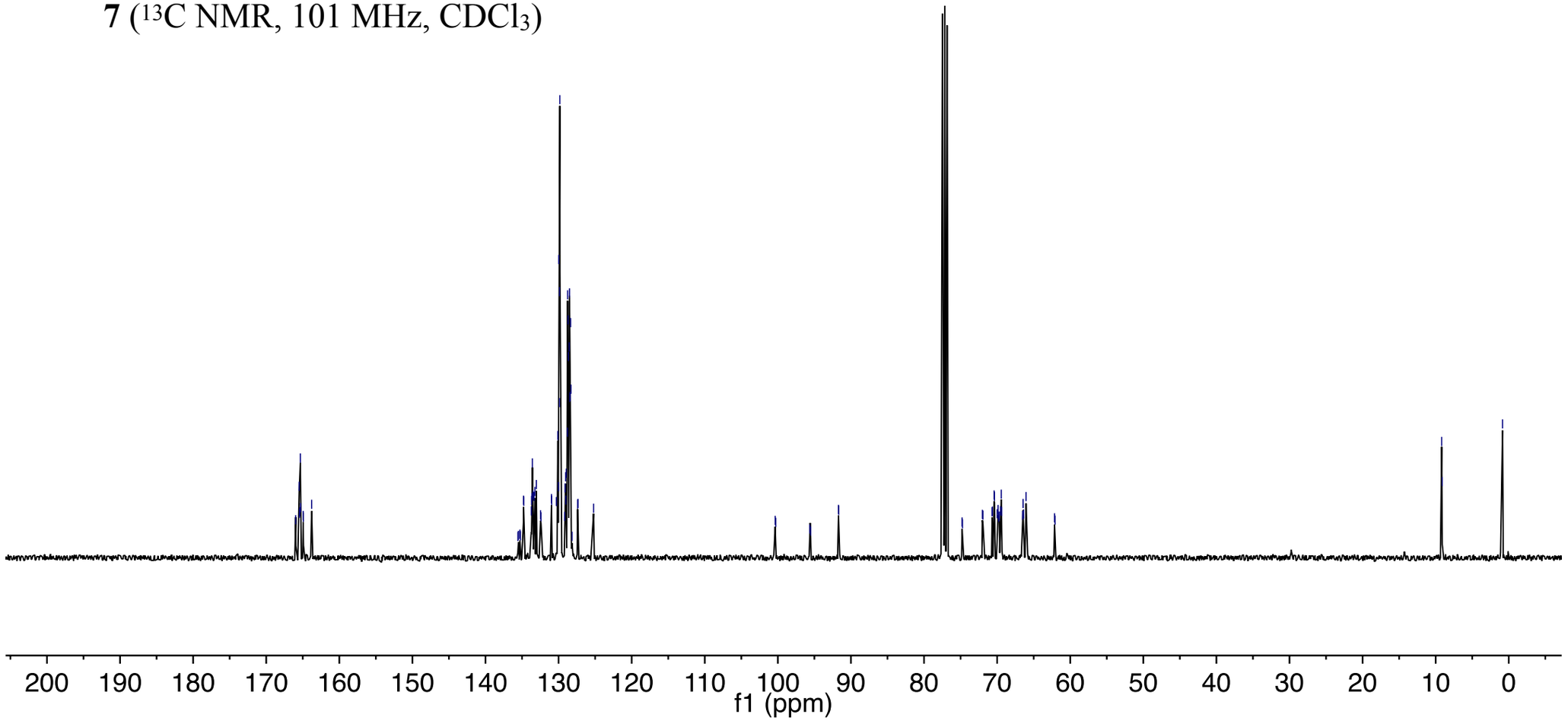
4zc-H2 (gHSQC, $CDCl_3$)

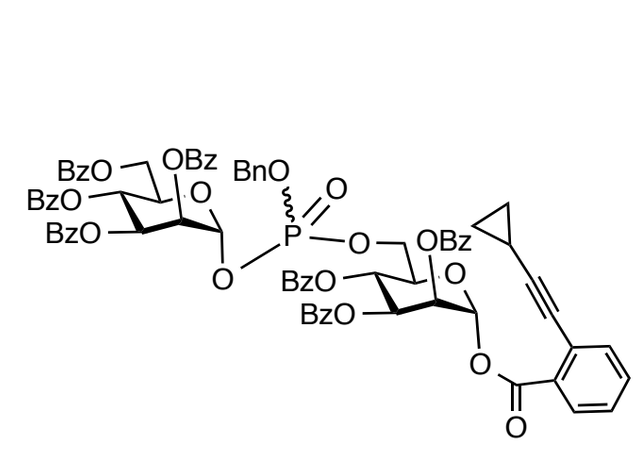


7 (^{1}H NMR, 400 MHz, $CDCl_3$)

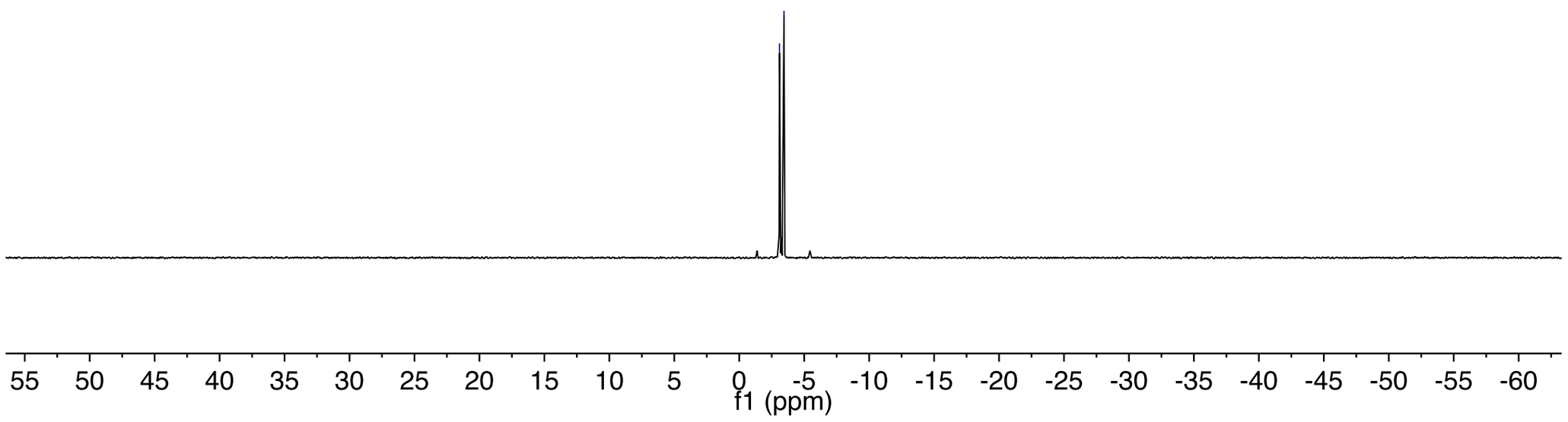


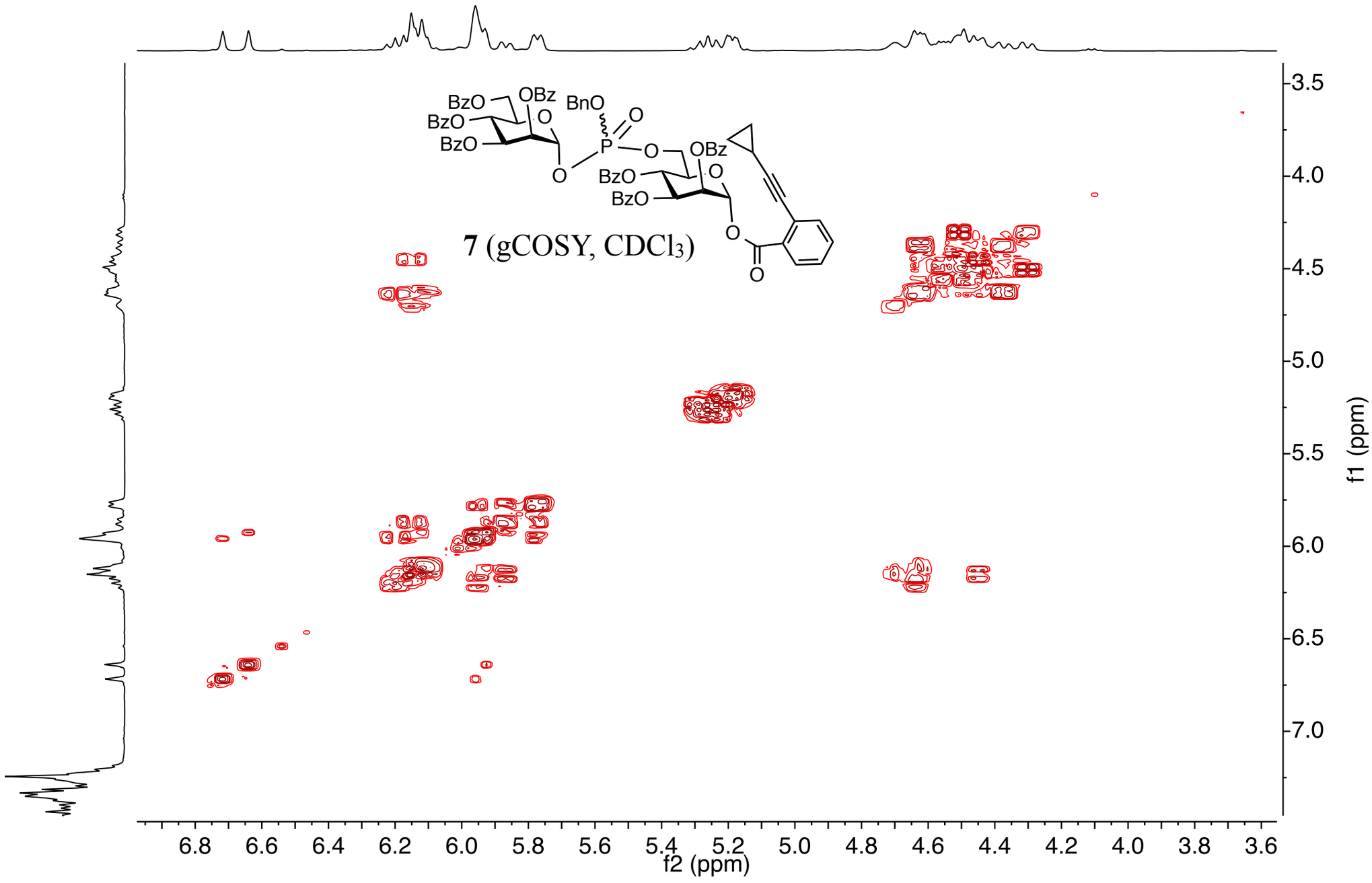
7 (^{13}C NMR, 101 MHz, $CDCl_3$)

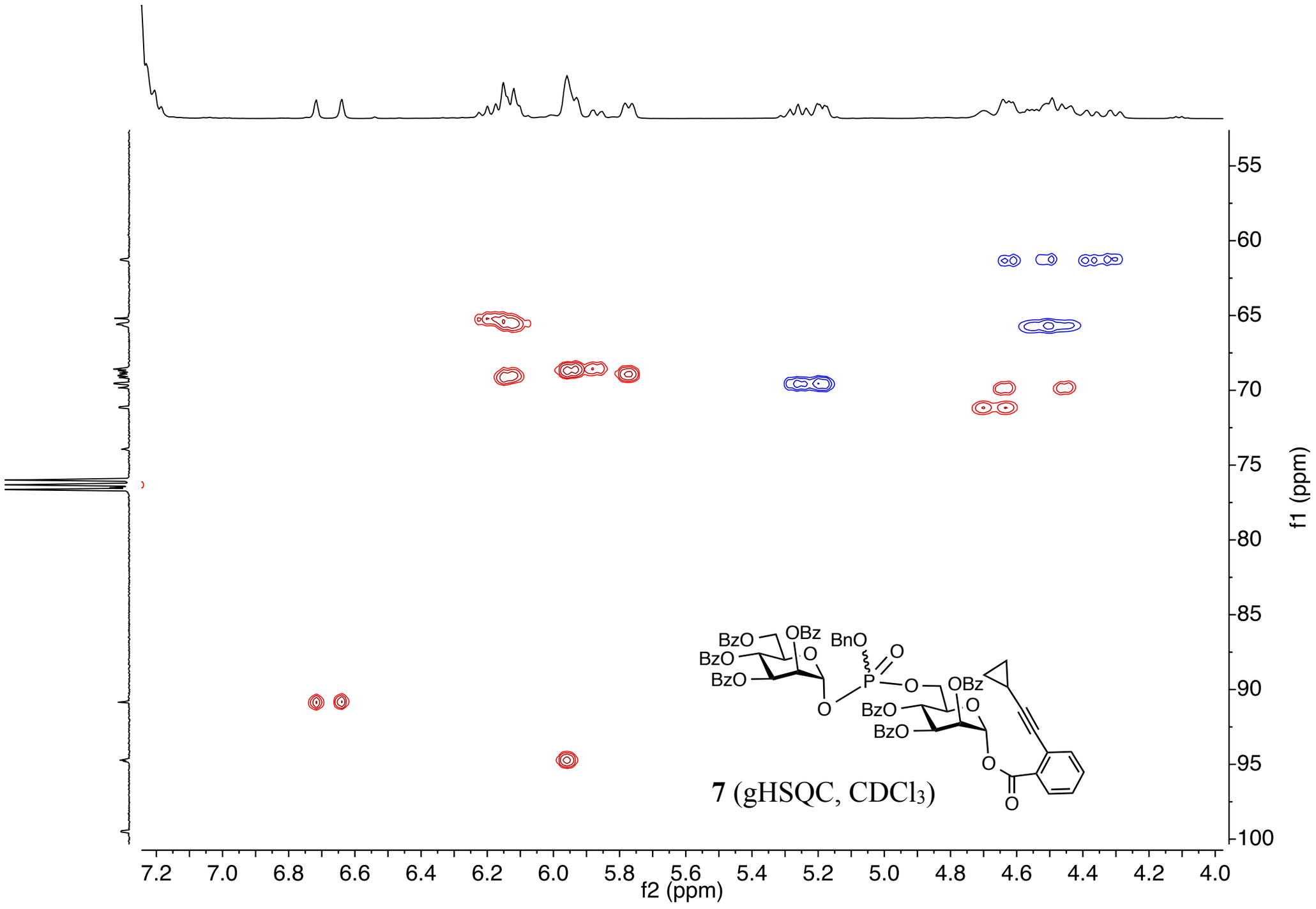


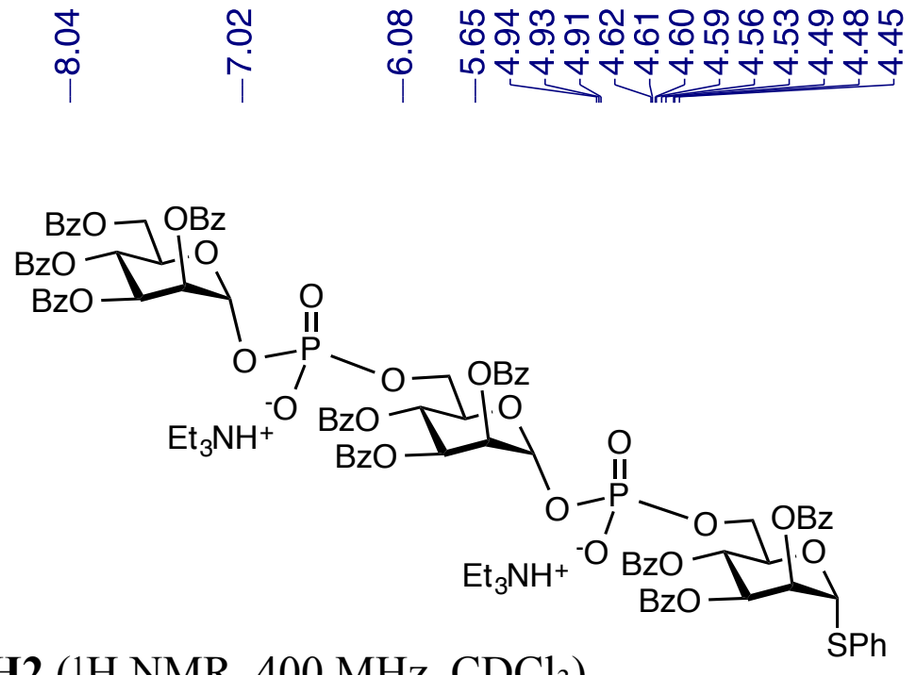


7 (^{31}P NMR, 162 MHz, $CDCl_3$)

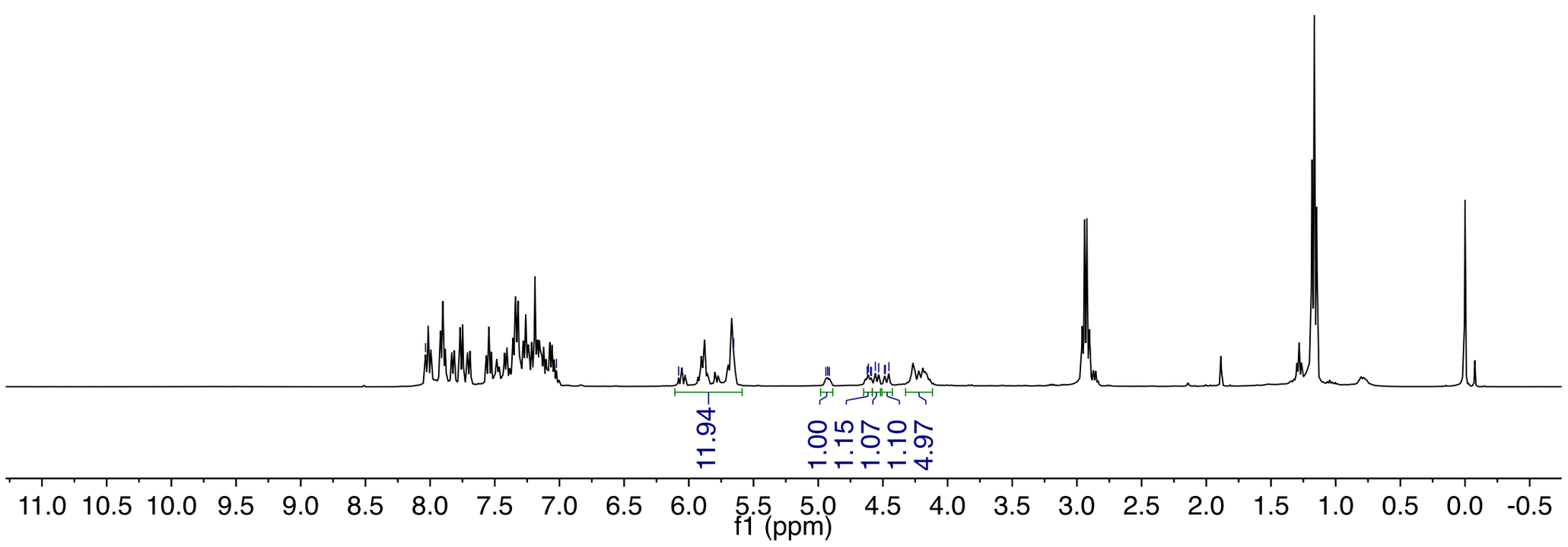



BzO
OBz
BnO
BzO
O
O
BzO
P
O
OBz
O
BzO
BzO
O
O
O
7 (gCOSY, CDCl3)
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
f1 (ppm)
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
f2 (ppm)


55
60
65
70
75
80
85
90
95
100
f1 (ppm)
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
f2 (ppm)
BzO
OBz
BnO
O
P
7 (gHSQC, CDCl3)



8-H2 (^{1}H NMR, 400 MHz, $CDCl_3$)



166.10
165.72
165.67
165.59
165.57
165.45
165.35
165.23
165.18
165.08
133.40
133.36
133.24
133.18
133.08
133.01
132.97
132.82
130.25
130.15
130.12
130.00
129.93
129.90
129.82
129.78
129.68
129.58
129.47
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129.29
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129.21
128.65
128.60
128.56
128.50
128.44
128.37
128.32
128.16
93.92
93.87
93.79
93.74
86.08
72.13
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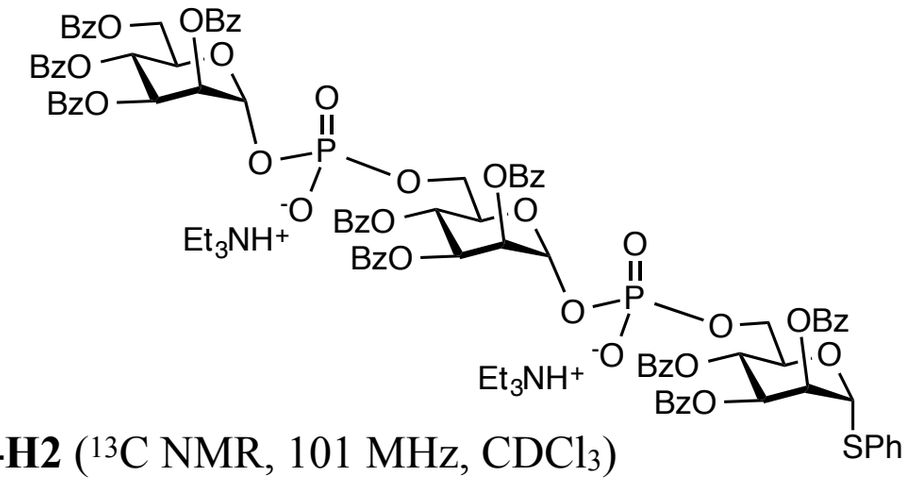
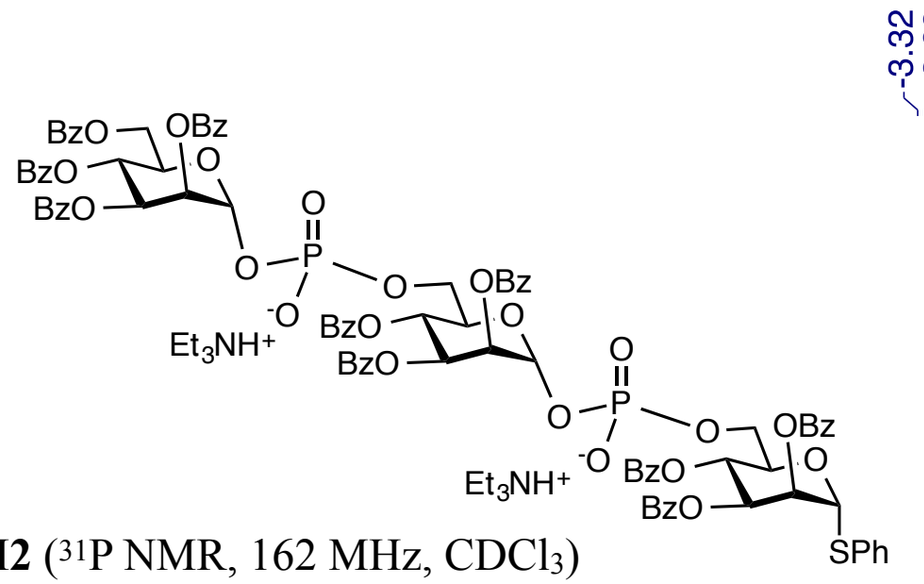
70.17
69.46
67.59
67.45
66.65
65.36
65.02
62.43



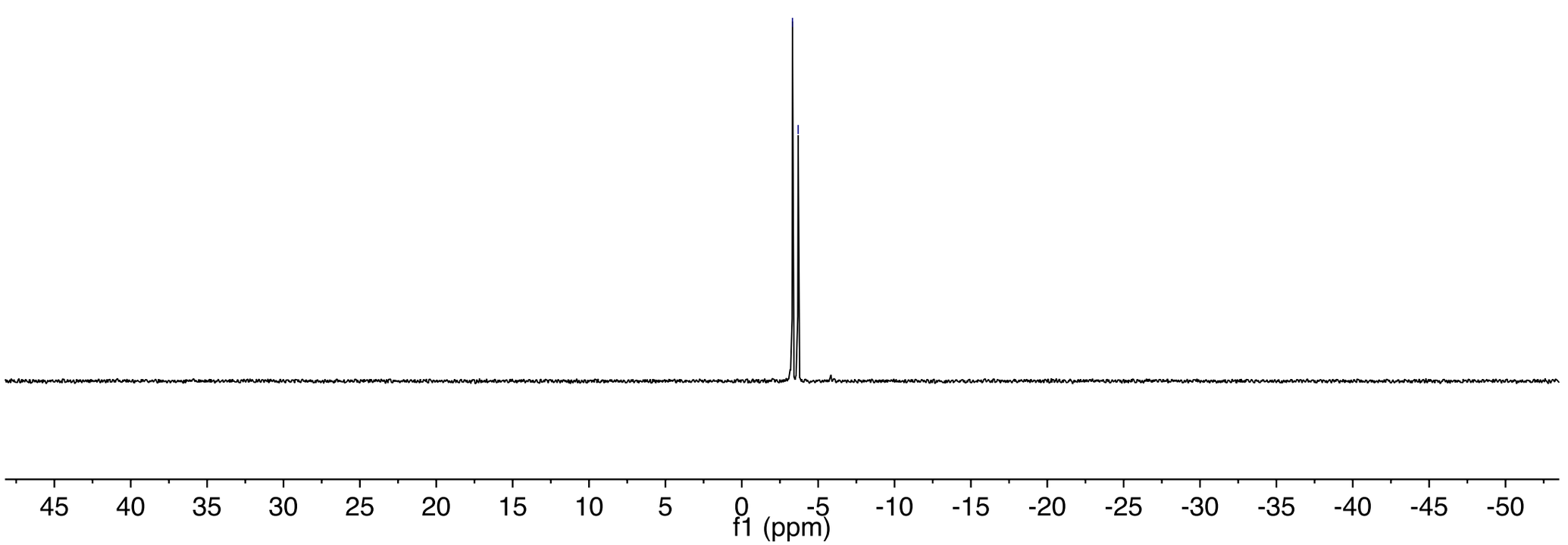
8-H2 (^{13}C NMR, 101 MHz, $CDCl_3$)

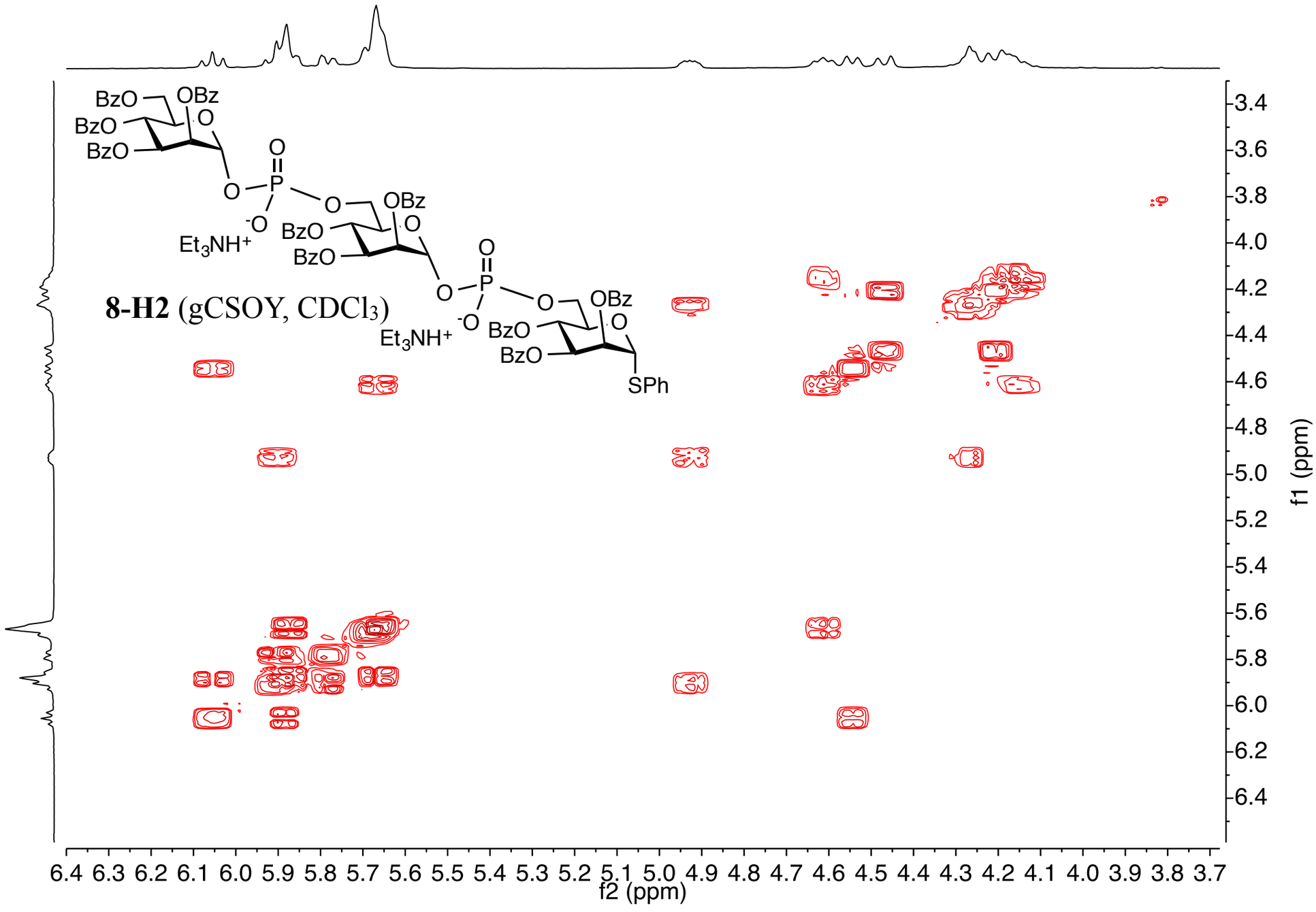
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0

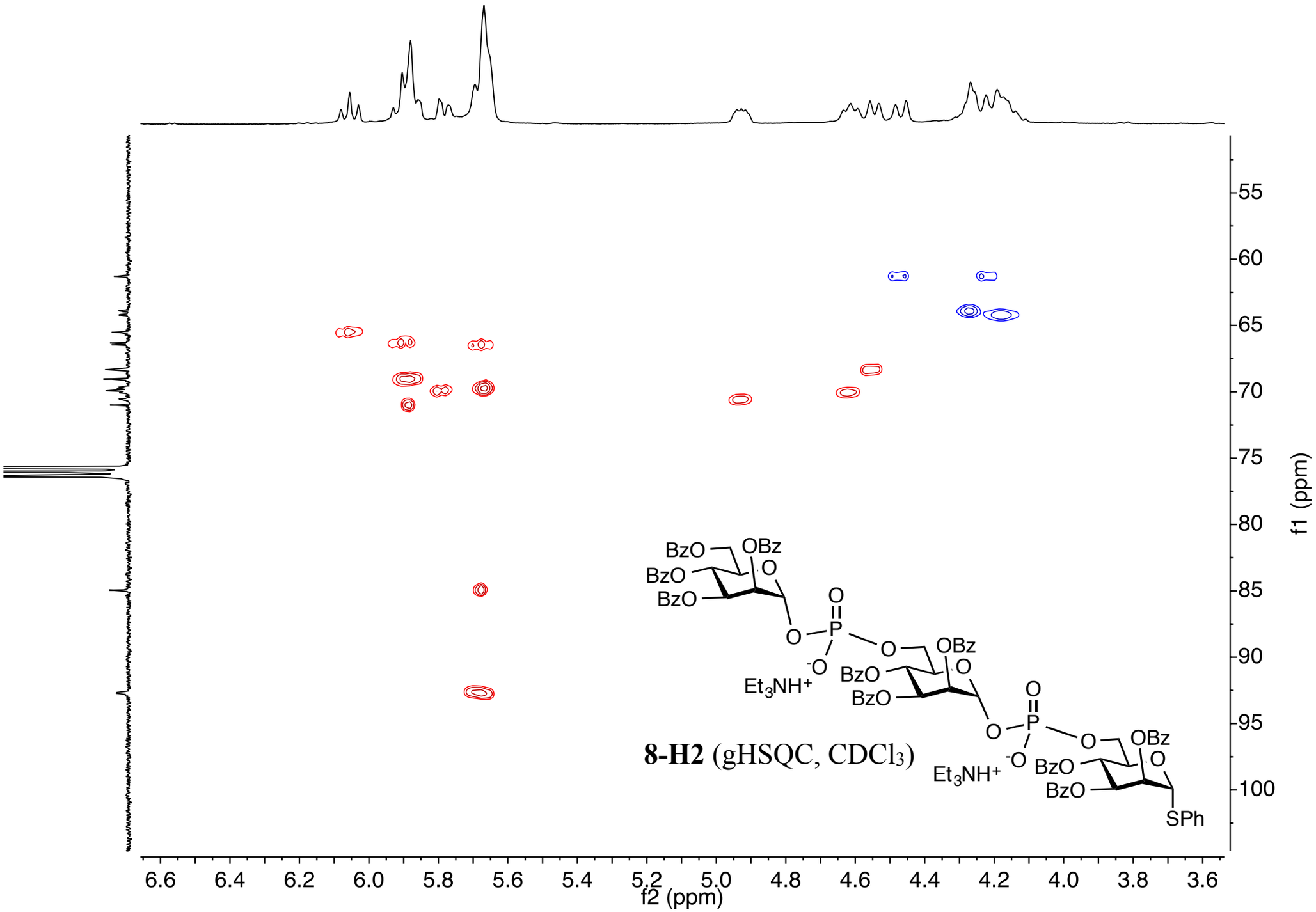
f1 (ppm)



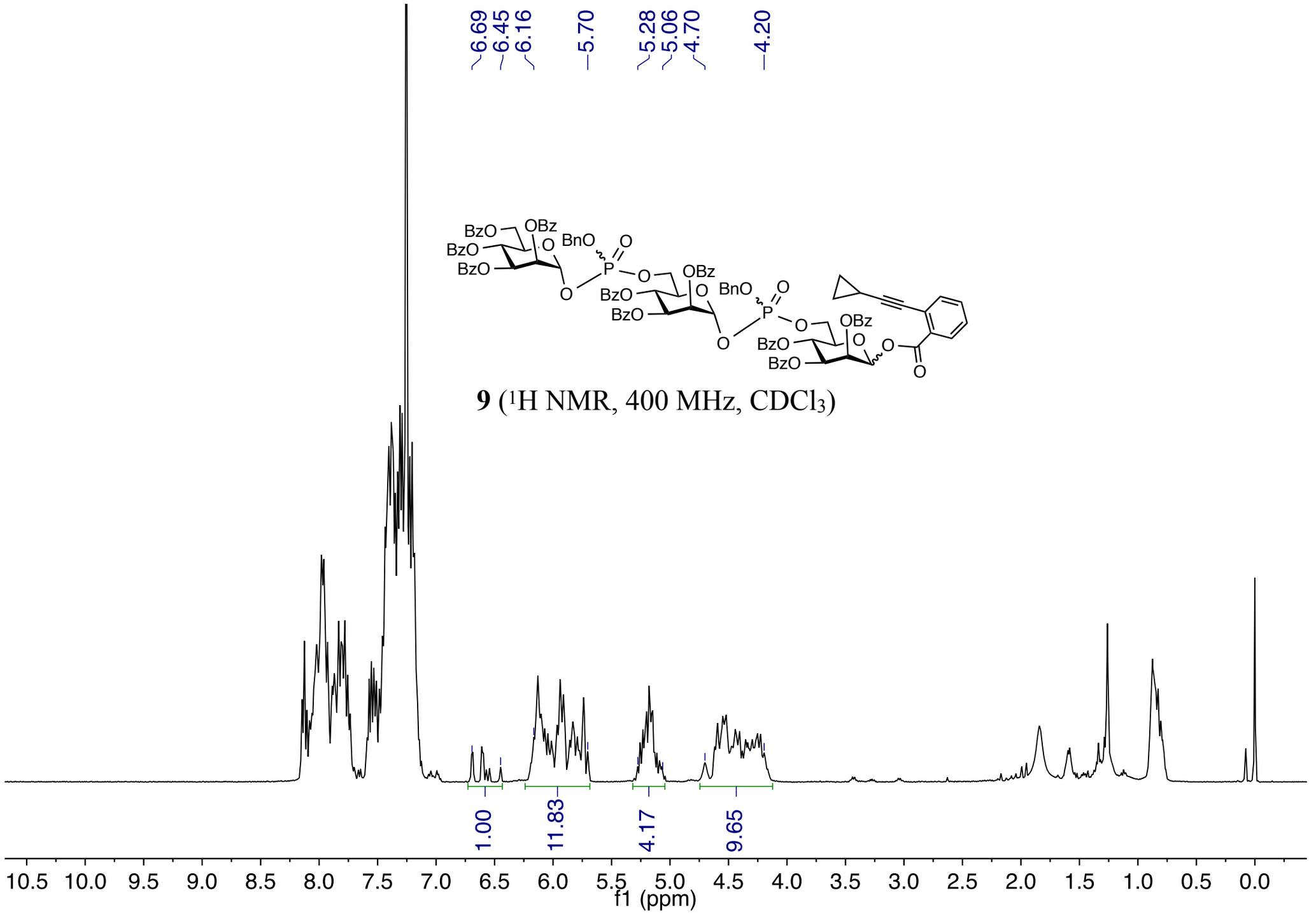
8-H2 (^{31}P NMR, 162 MHz, $CDCl_3$)



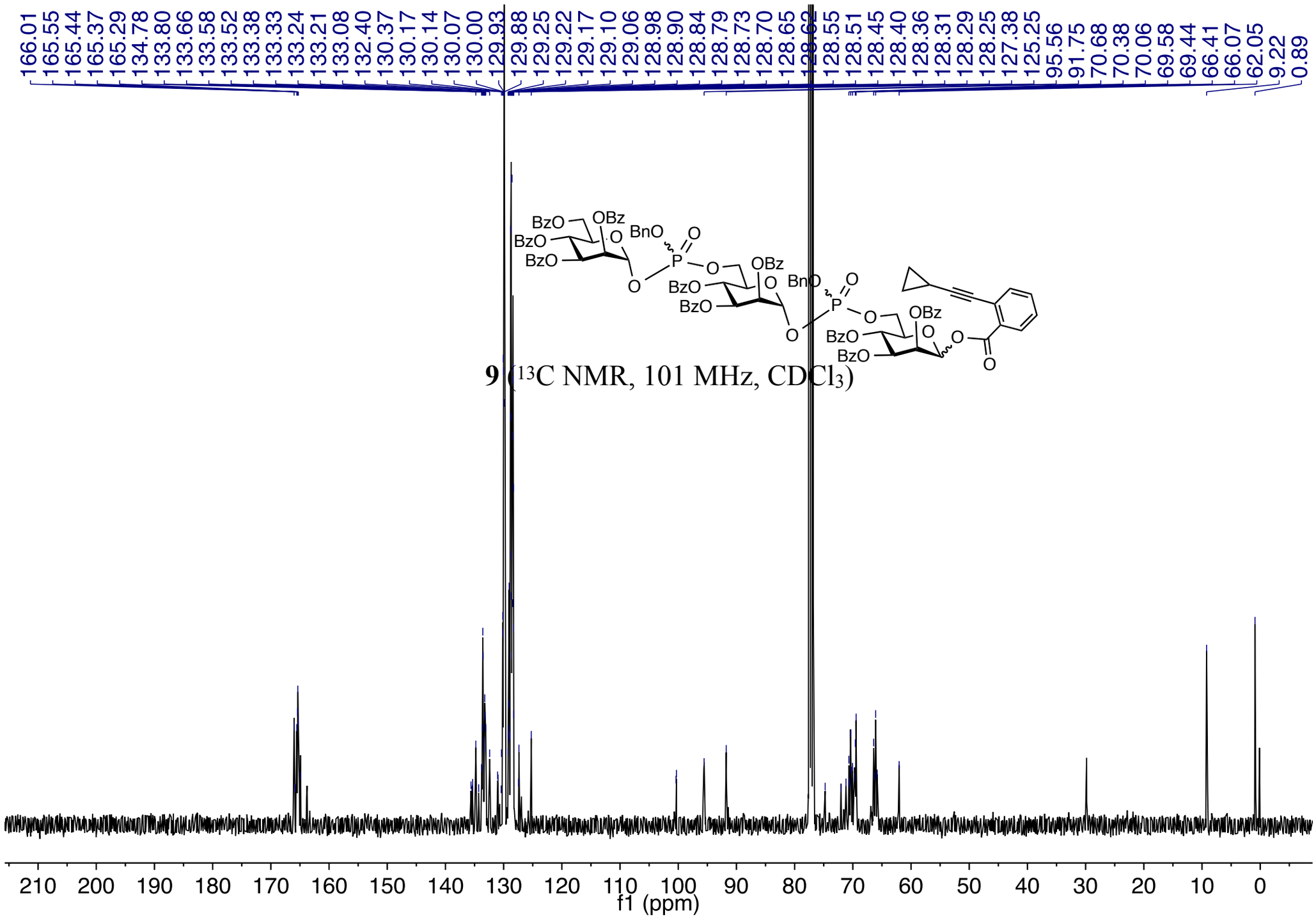

BzO
OBz
O
BzO
BzO
O
P
O
-O
Et3NH+
O
OBz
BzO
BzO
8-H2 (gCSOY, CDCl3)
O
P
O
-O
Et3NH+
O
OBz
BzO
BzO
SPh
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
f1 (ppm)
6.4 6.3 6.2 6.1 6.0 5.9 5.8 5.7 5.6 5.5 5.4 5.3 5.2 5.1 5.0 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7
f2 (ppm)



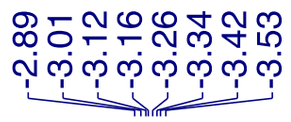
8-H2 (gHSQC, $CDCl_3$)

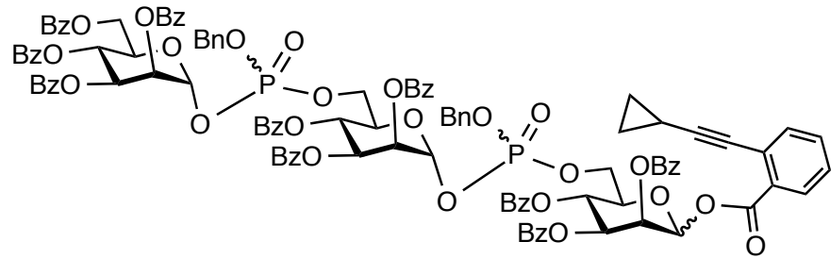


9 (^{1}H NMR, 400 MHz, $CDCl_3$)

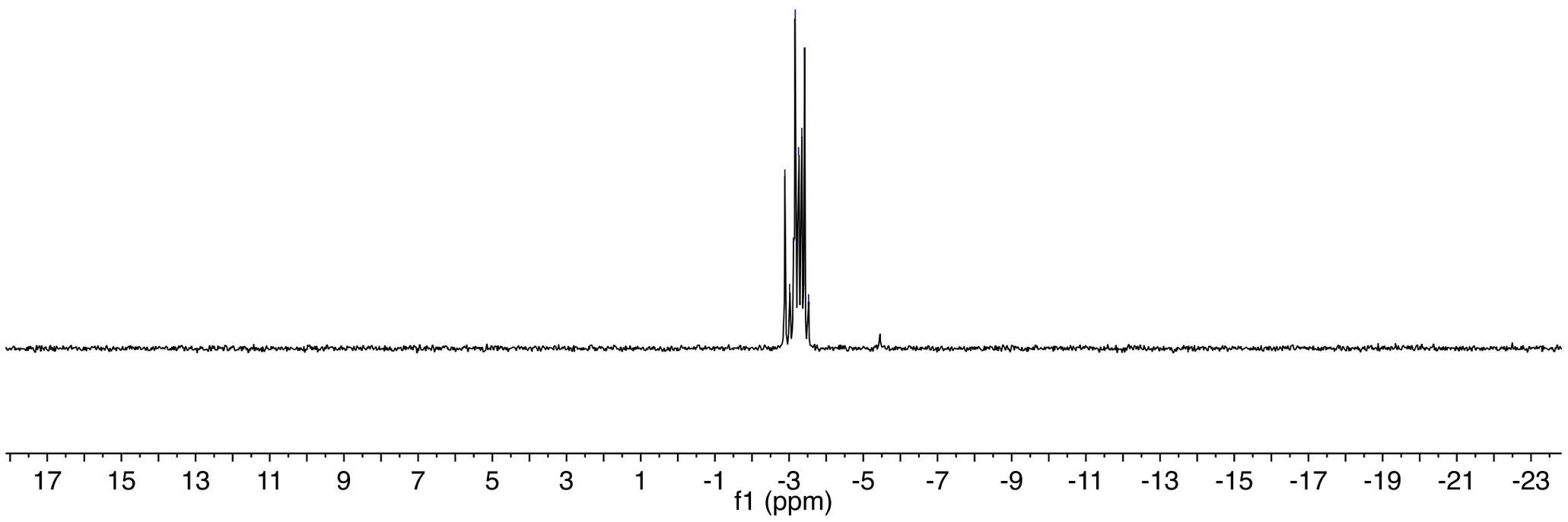


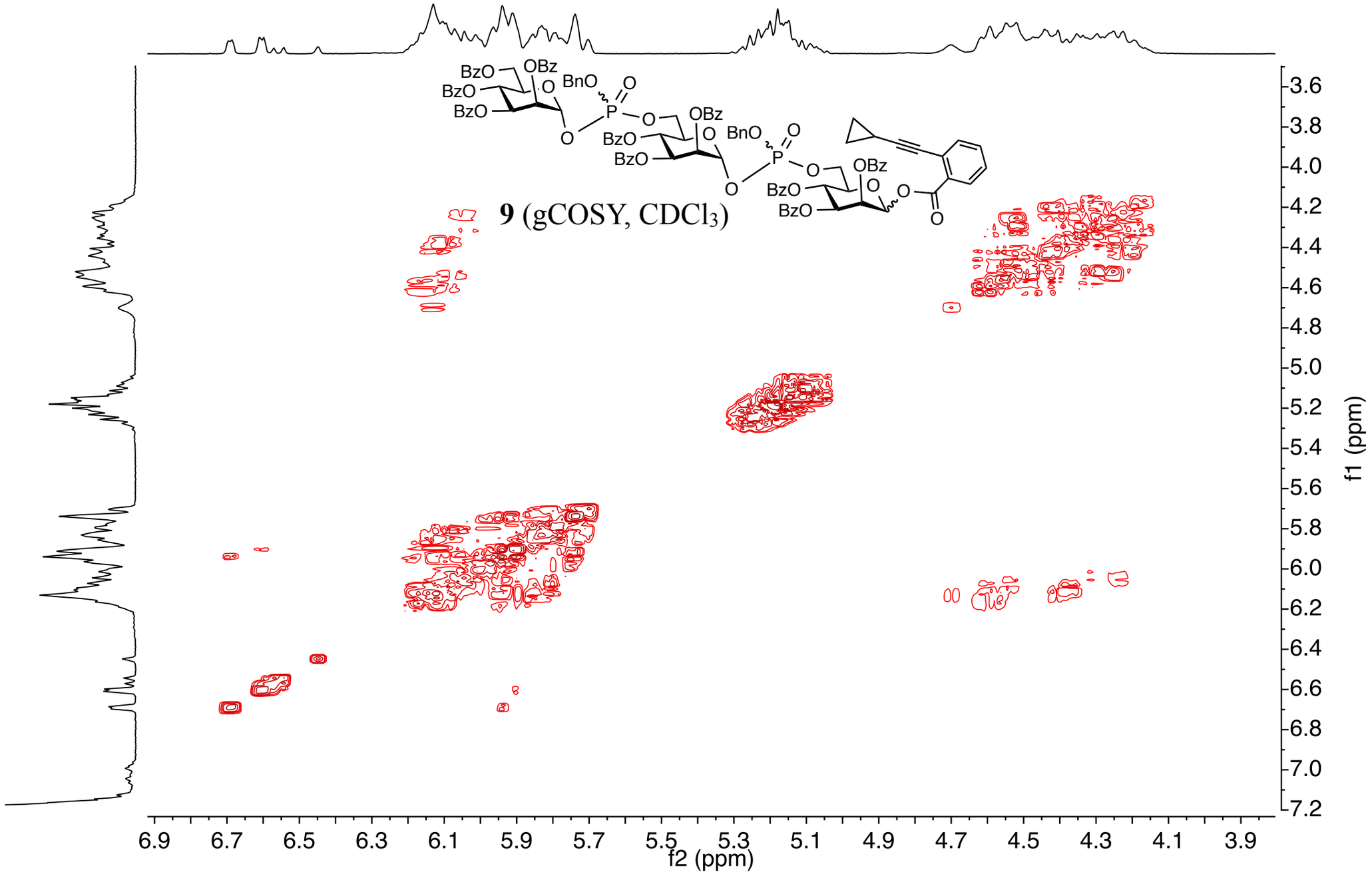
9 (^{13}C NMR, 101 MHz, $CDCl_3$)

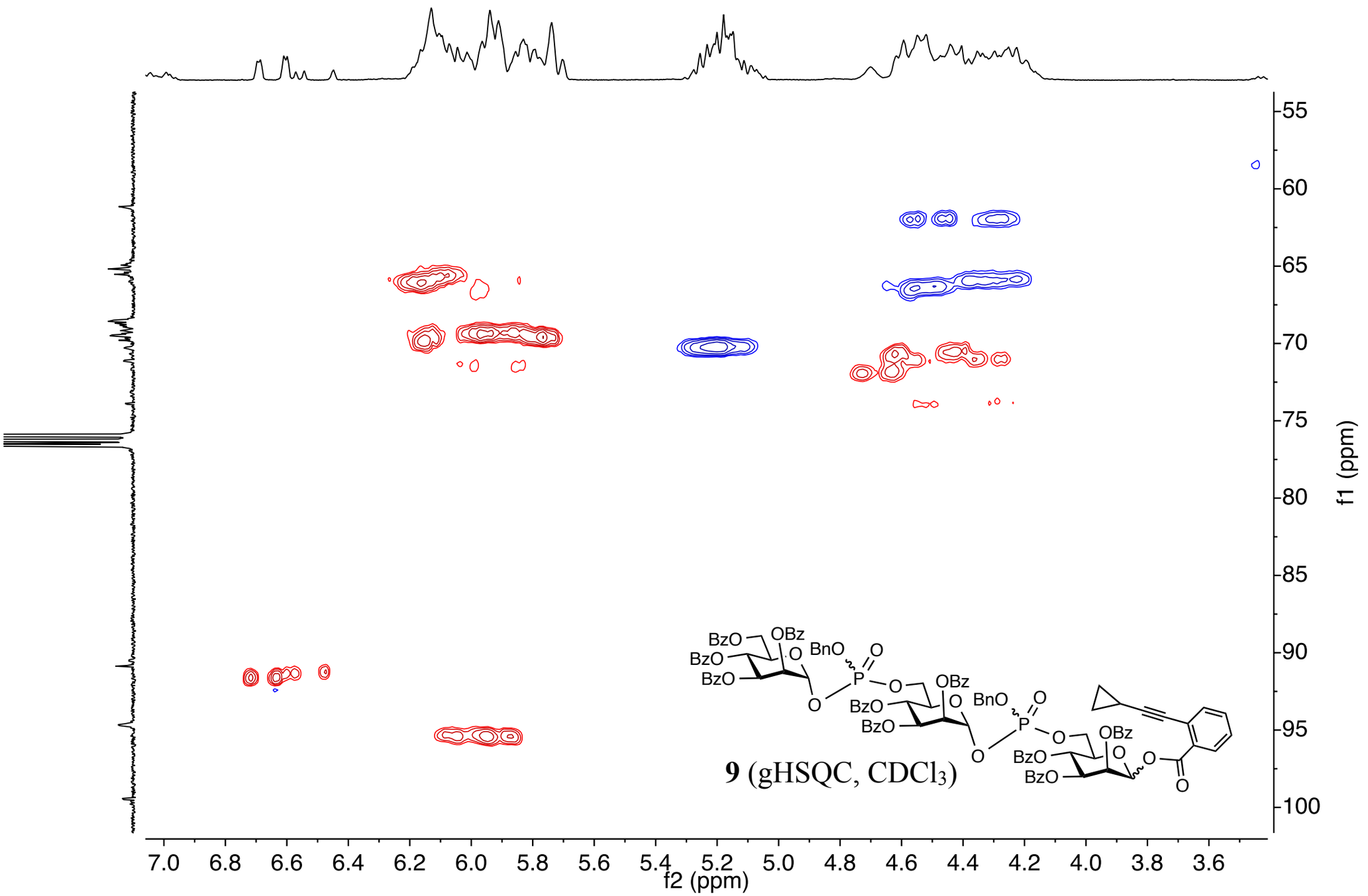


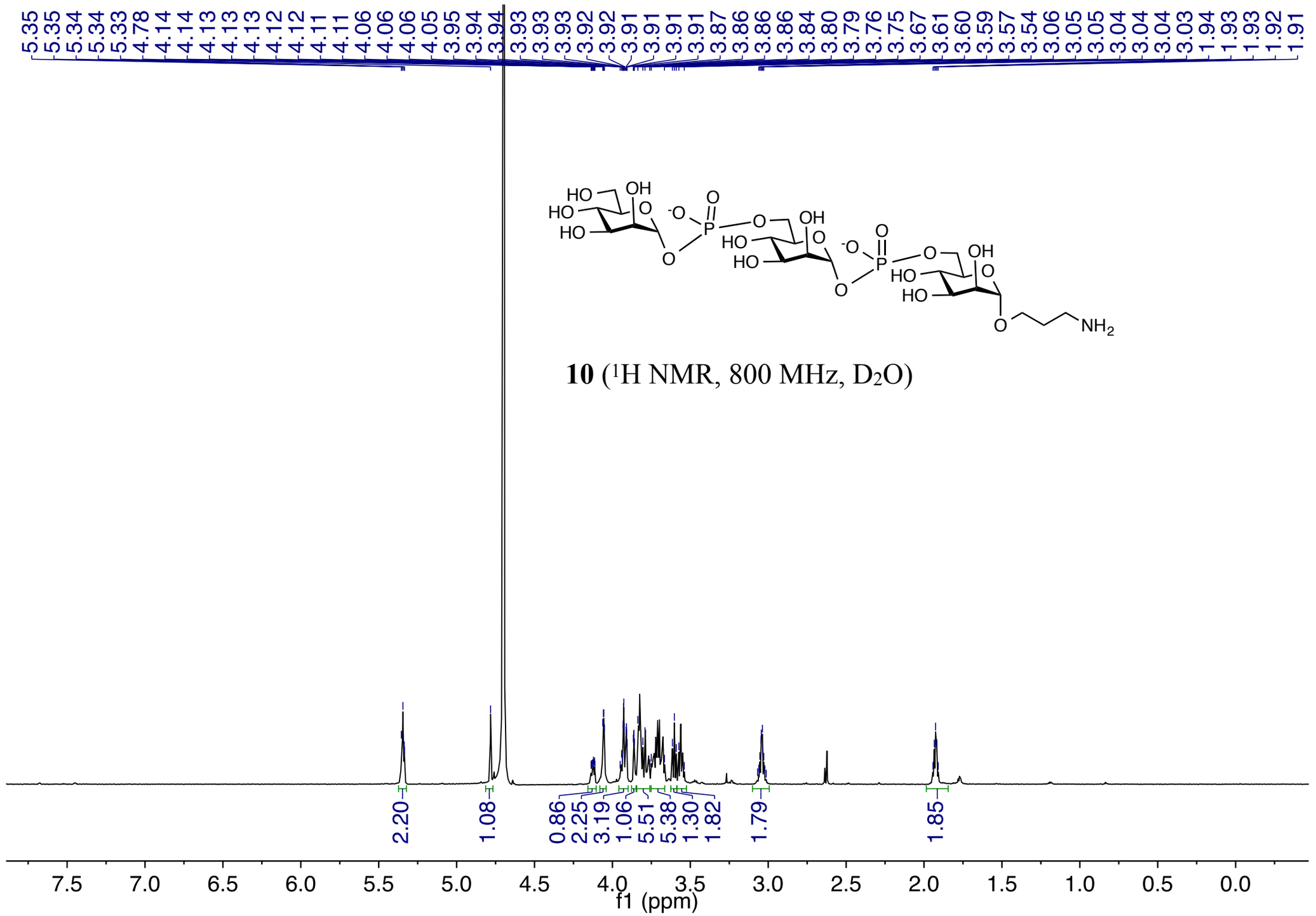


9 (^{31}P NMR, 162 MHz, $CDCl_3$)

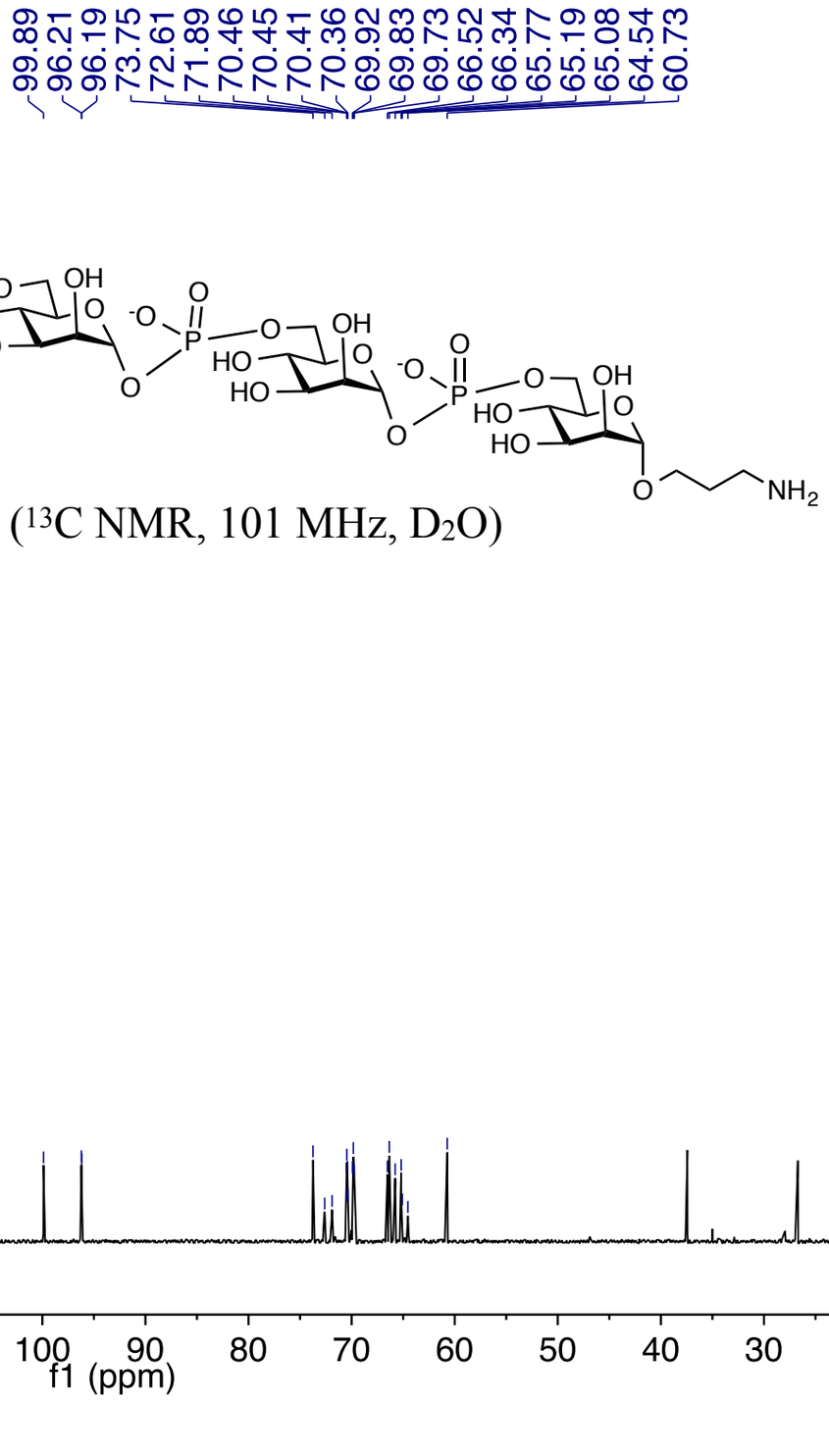



BzO
OBz
BnO
O
P
BzO
BzO
BzO
O
O
OBz
BnO
O
P
O
OBz
BzO
BzO
O
O
O
9 (gCOSY, CDCl3)
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
f1 (ppm)
6.9
6.7
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
f2 (ppm)

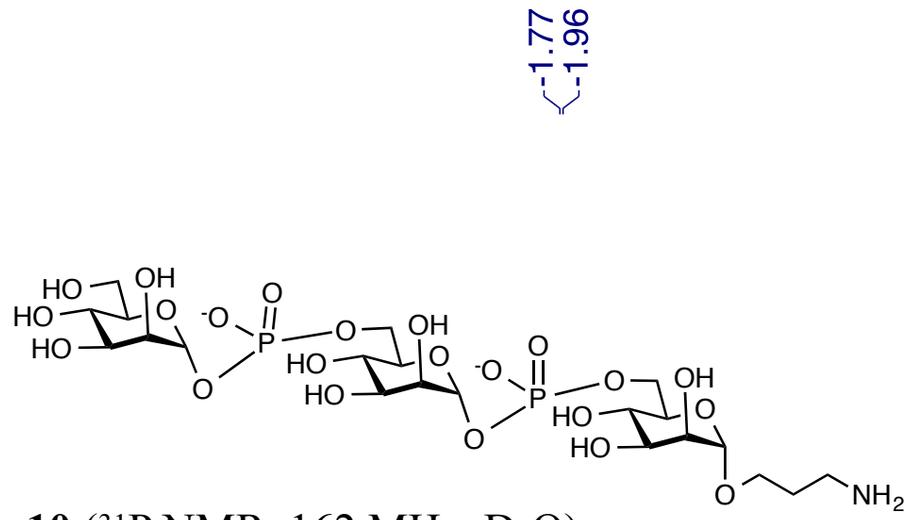

55
60
65
70
75
80
85
90
95
100
f1 (ppm)
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
f2 (ppm)
BzO
OBz
BnO
O
P
9 (gHSQC, CDCl3)



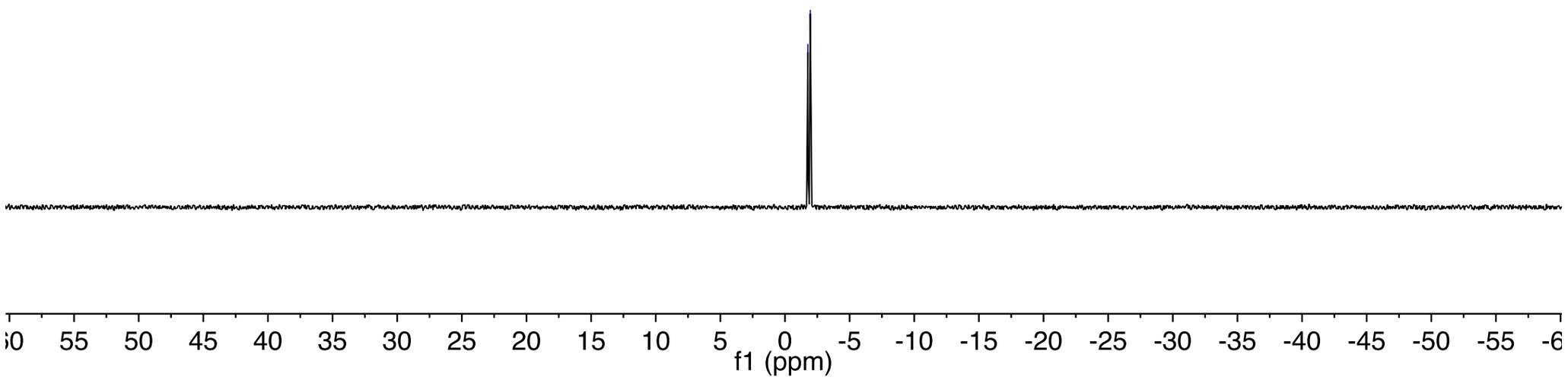
10 (^{1}H NMR, 800 MHz, D_2O)

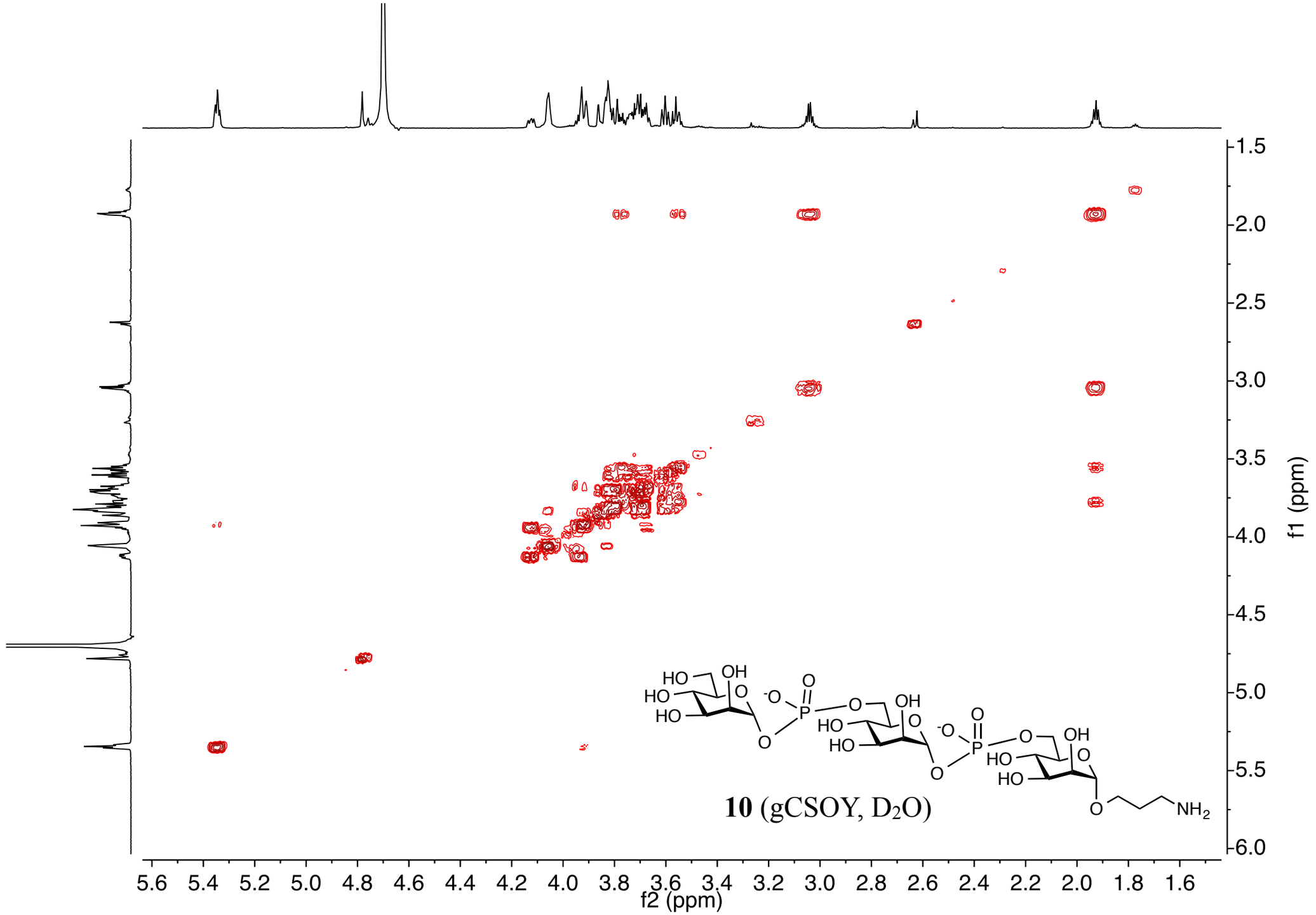


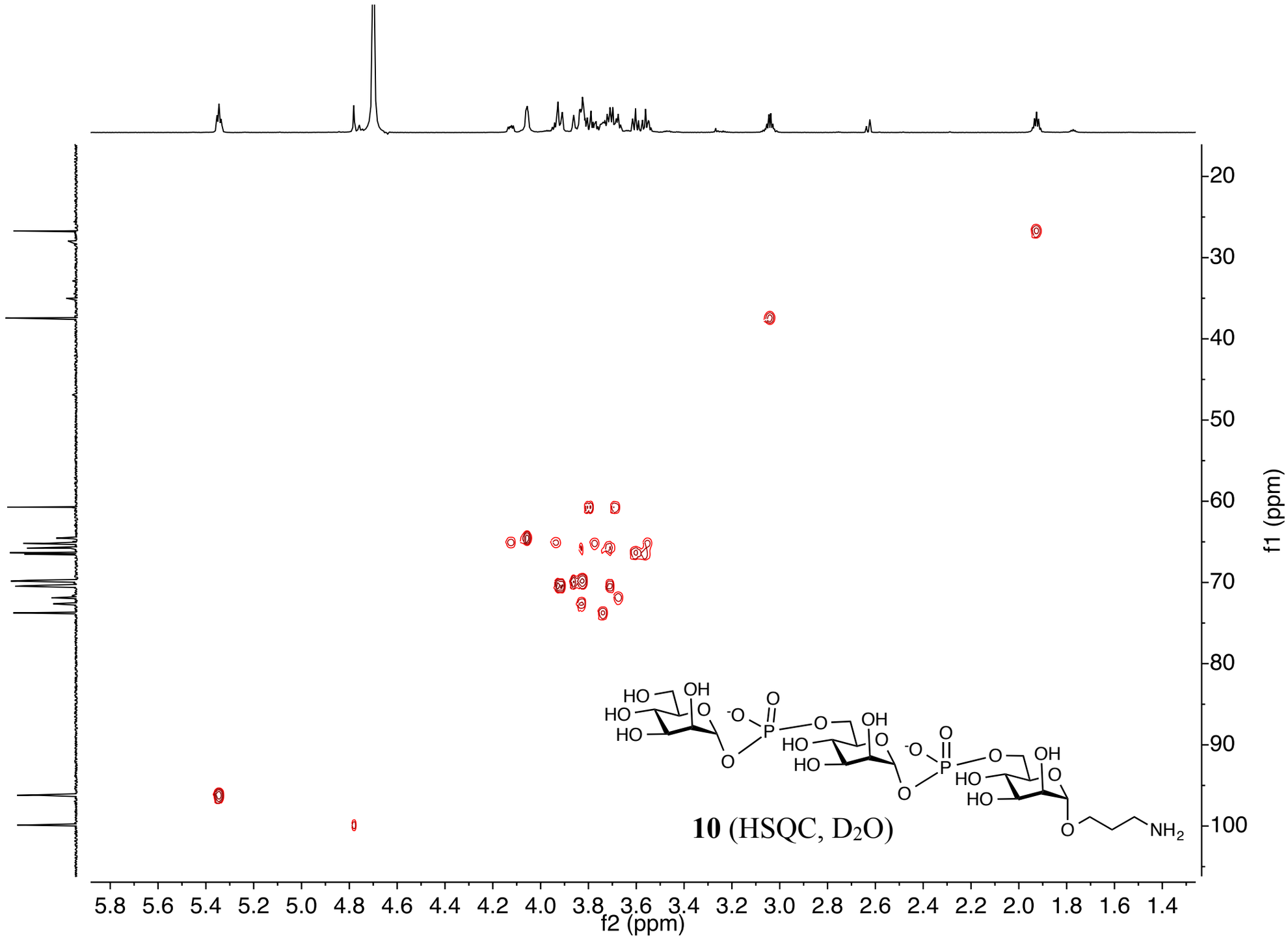
10 (^{13}C NMR, 101 MHz, D_2O)



10 (^{31}P NMR, 162 MHz, D_2O)




1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)
5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6
f2 (ppm)
HO
OH
O
-O
P
NH2
10 (gCSOY, D2O)


20
30
40
50
60
70
80
90
100
f1 (ppm)
5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4
f2 (ppm)
HO
OH
O
-O
P
NH2
10 (HSQC, D2O)