

**The Development of Natural Products as Phytotoxic Leads for Herbicide
Discovery**

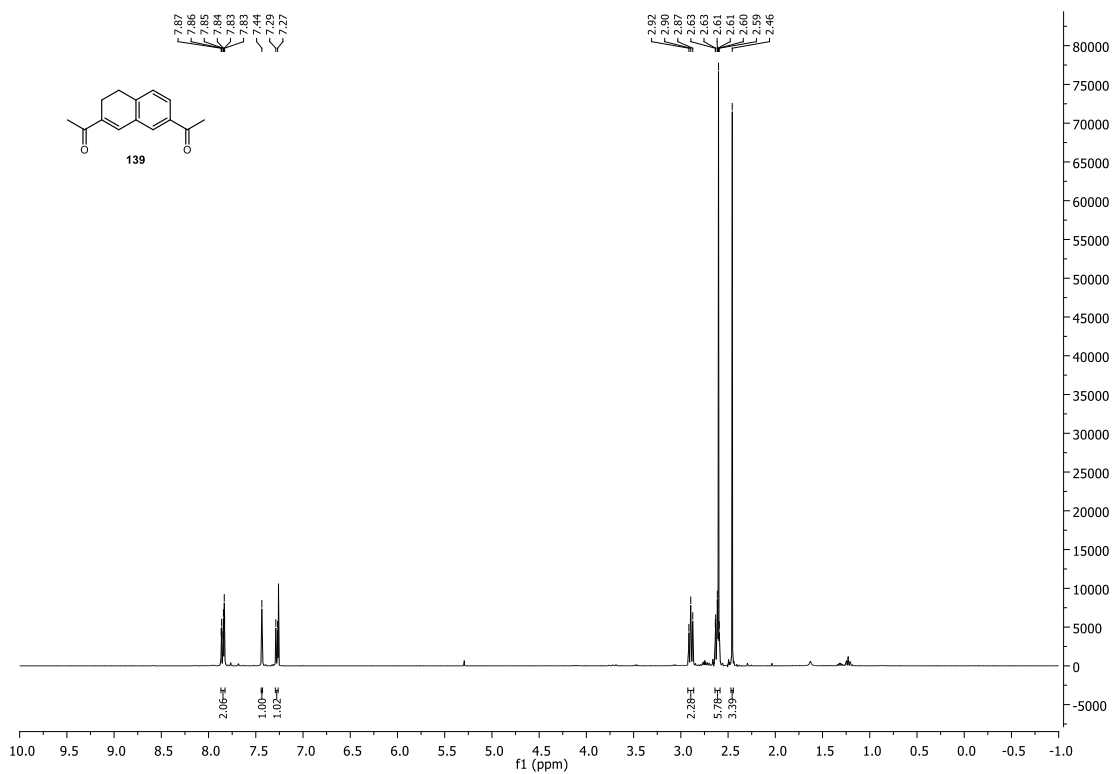
Mairi M. Littleson

October 2017

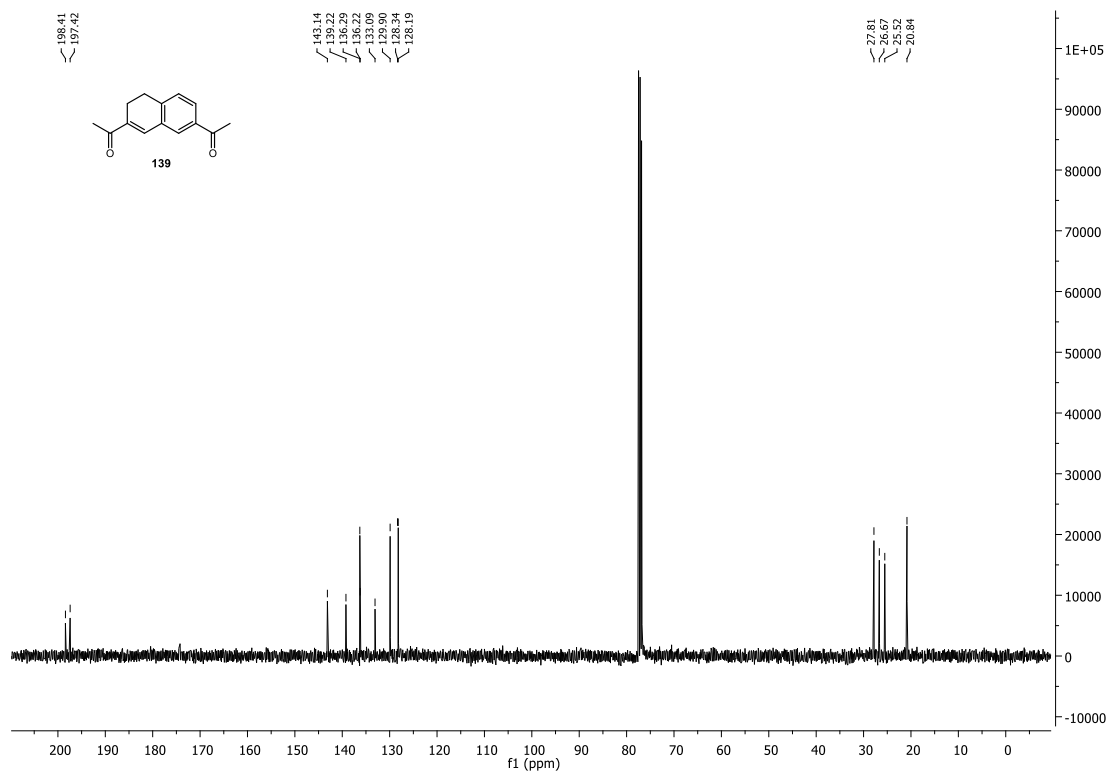
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Supporting Information

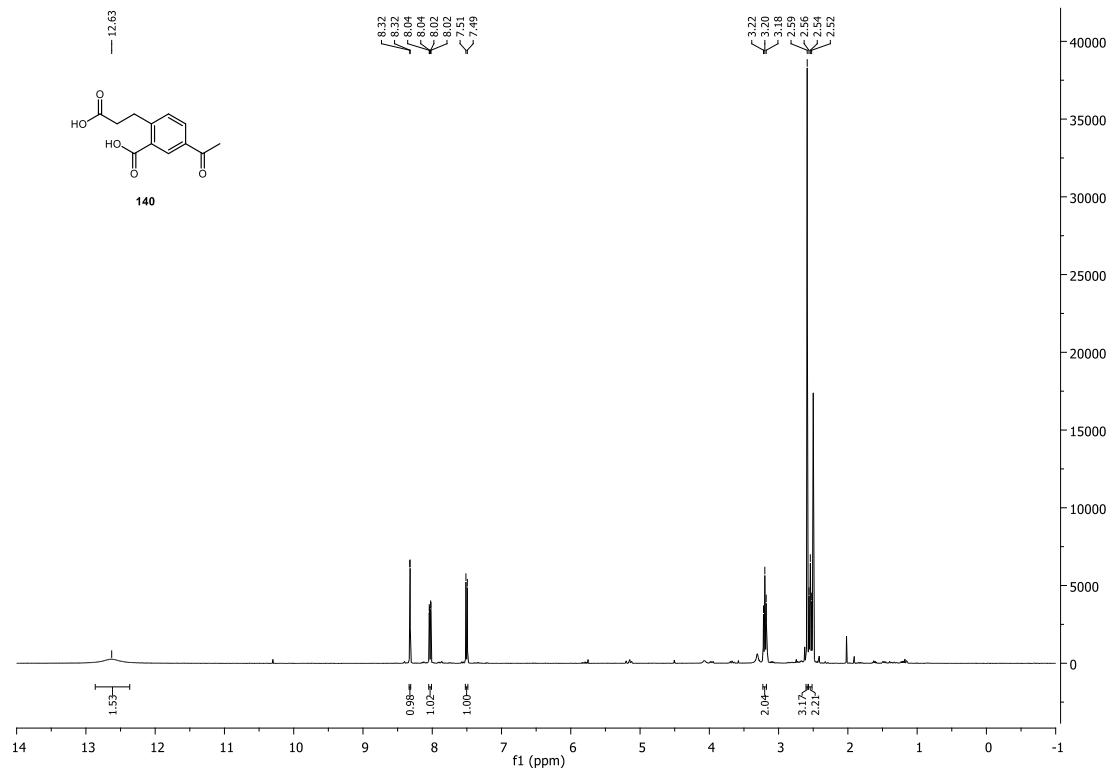
¹H NMR 139.



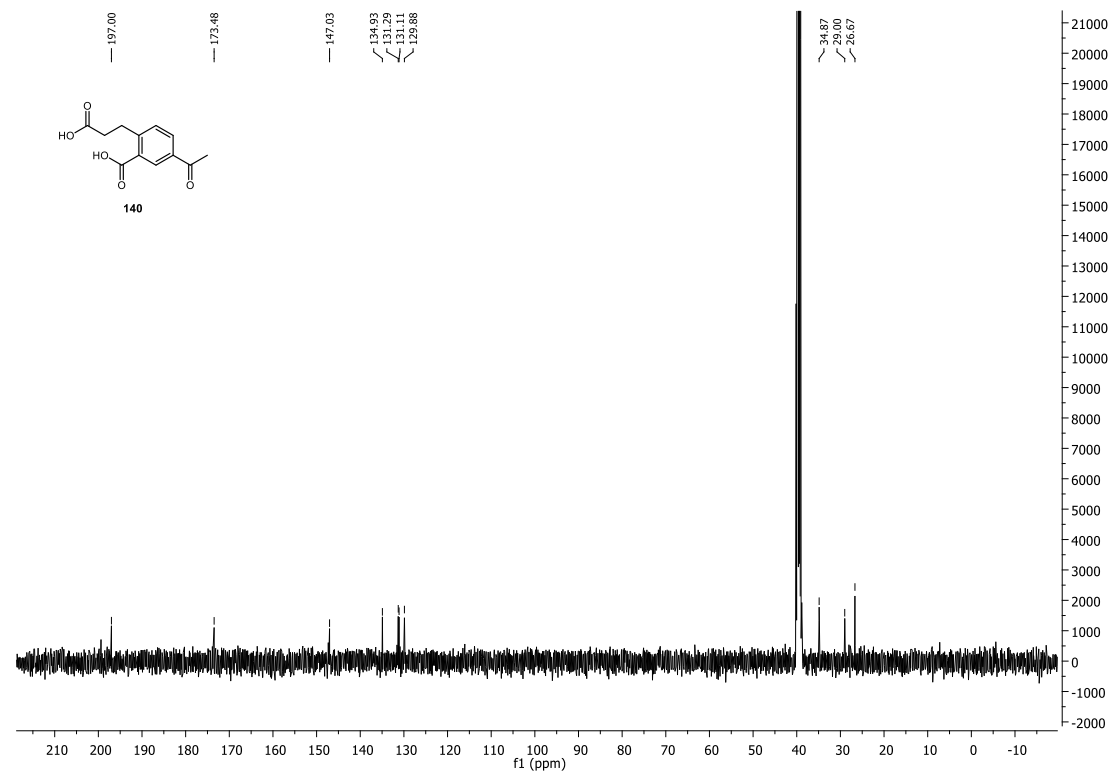
¹³C NMR 139.



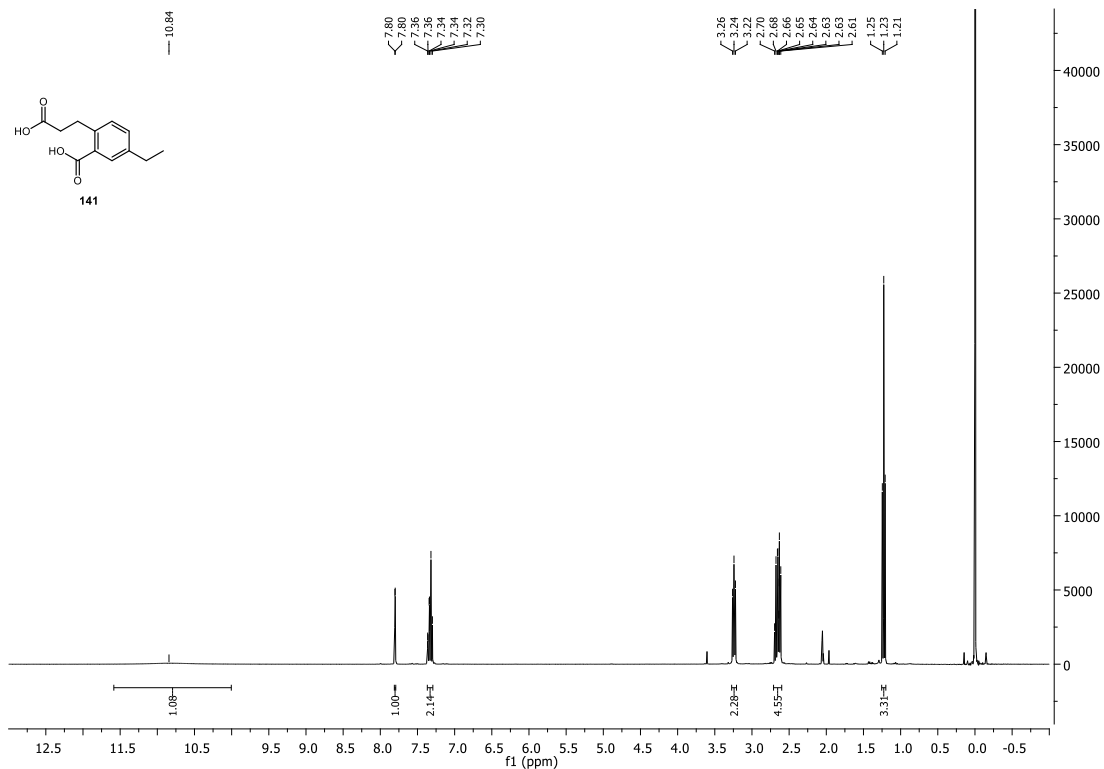
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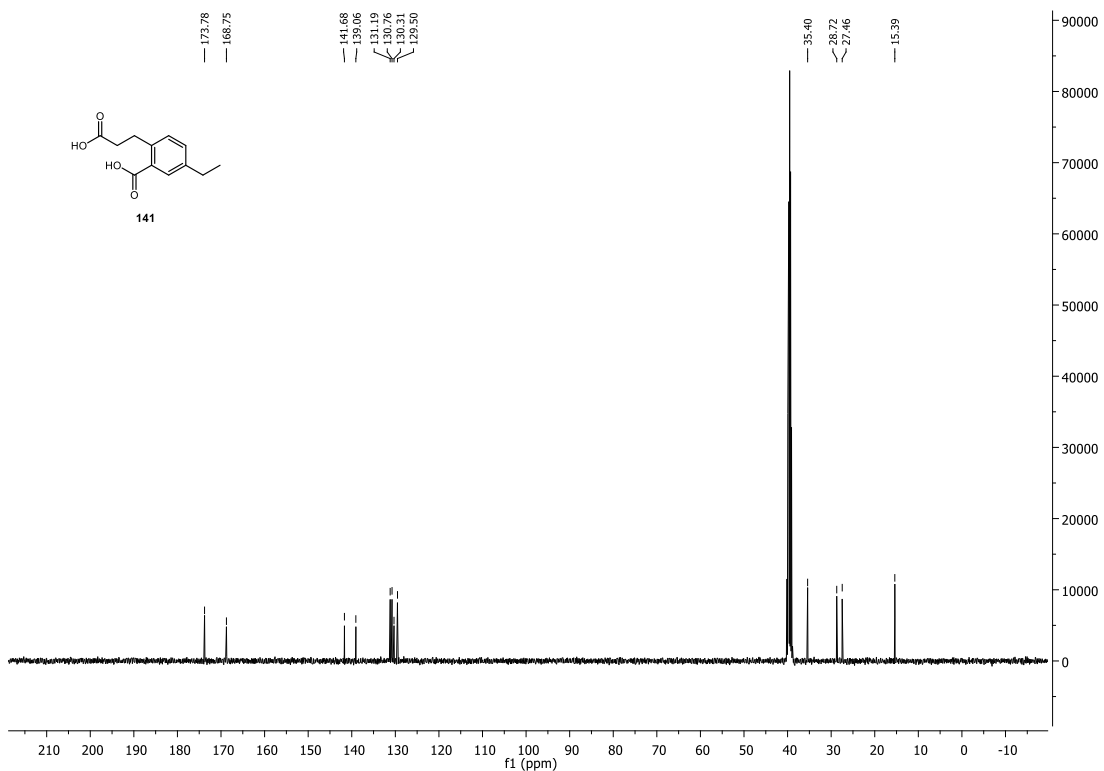
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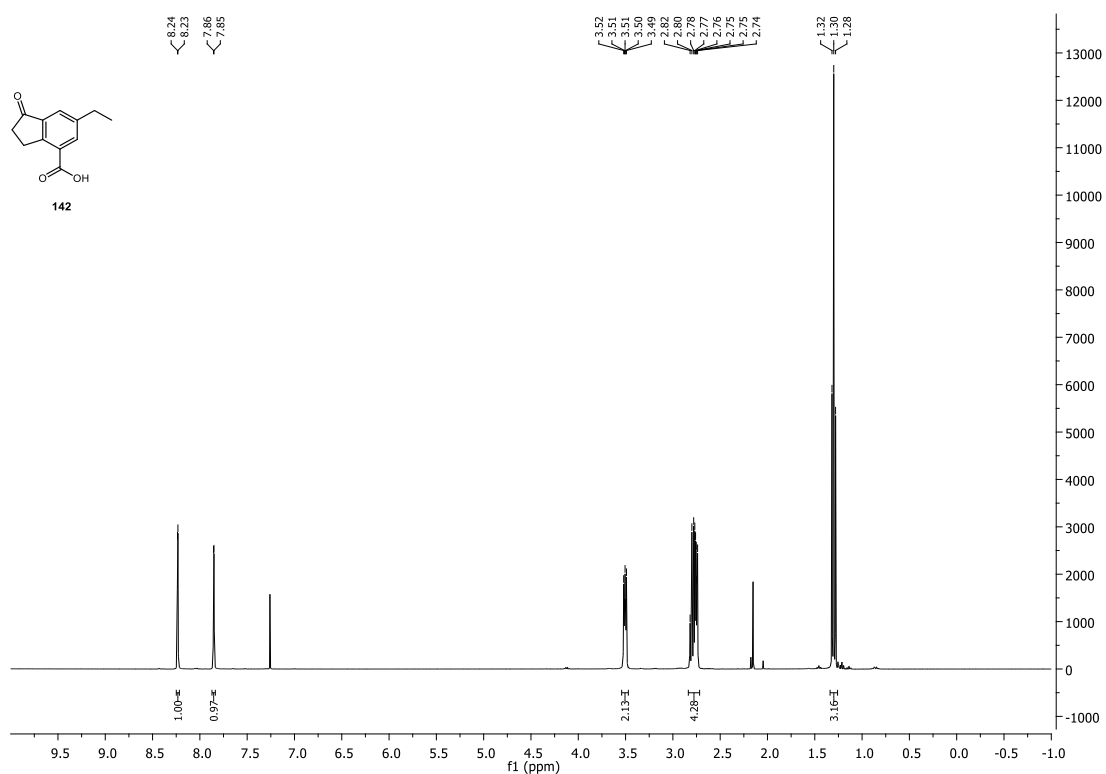
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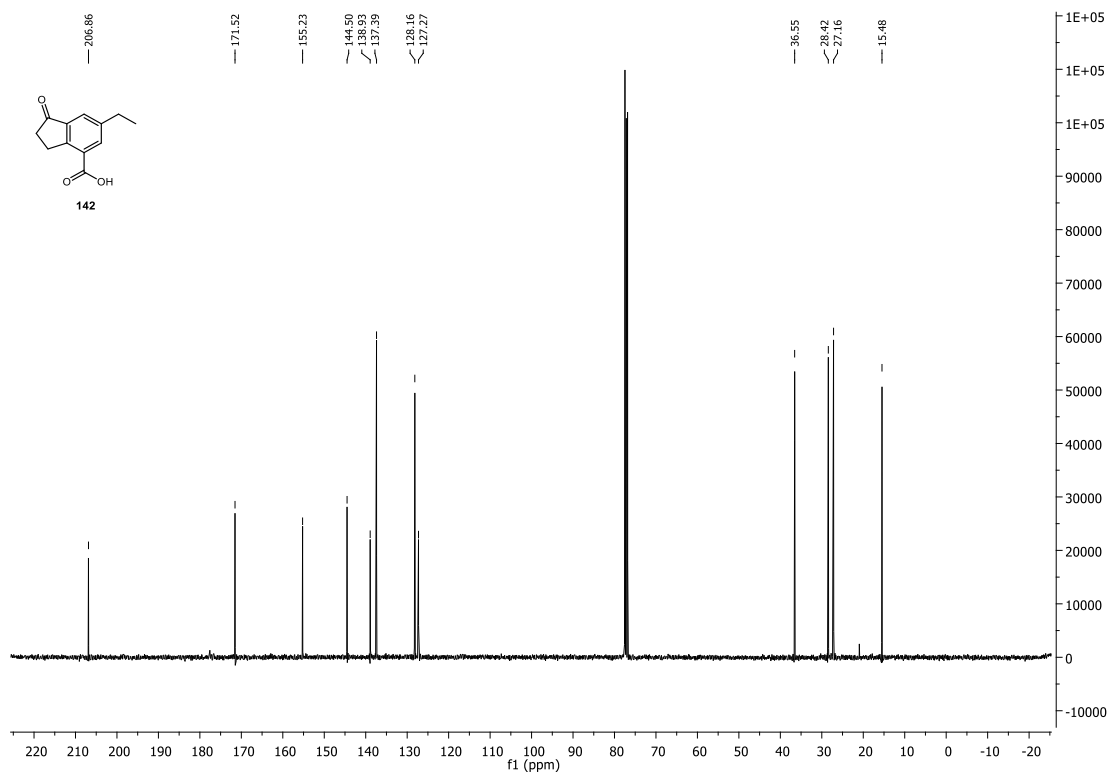
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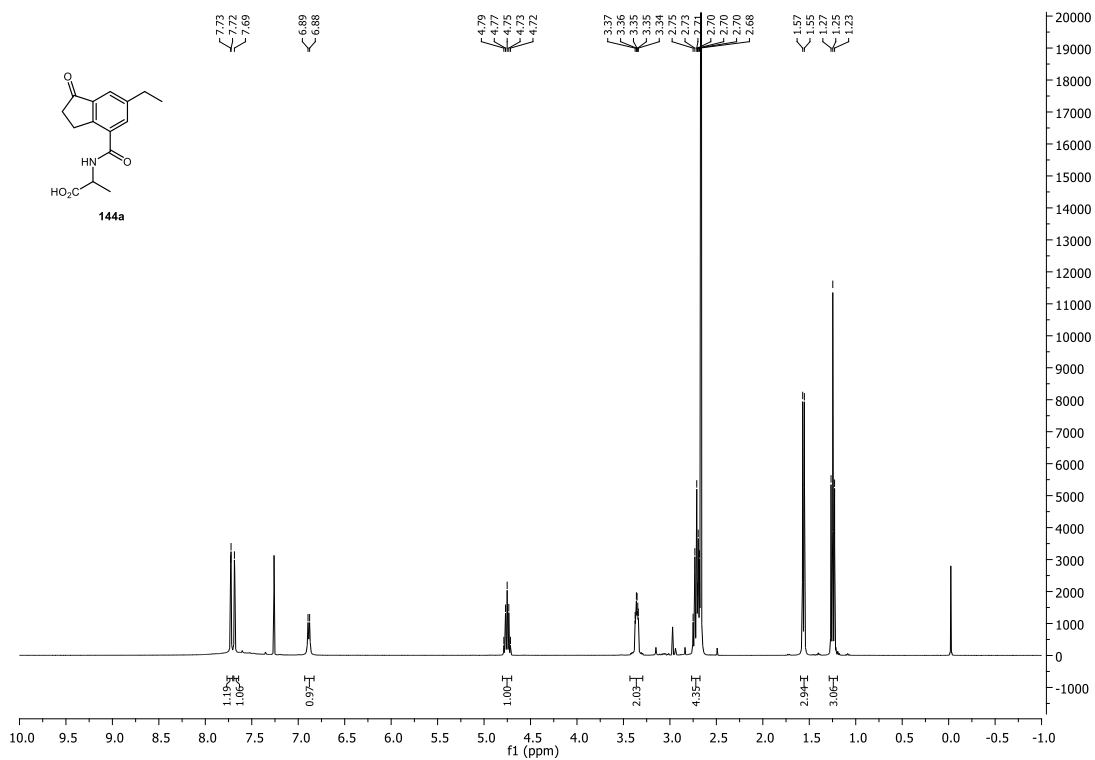
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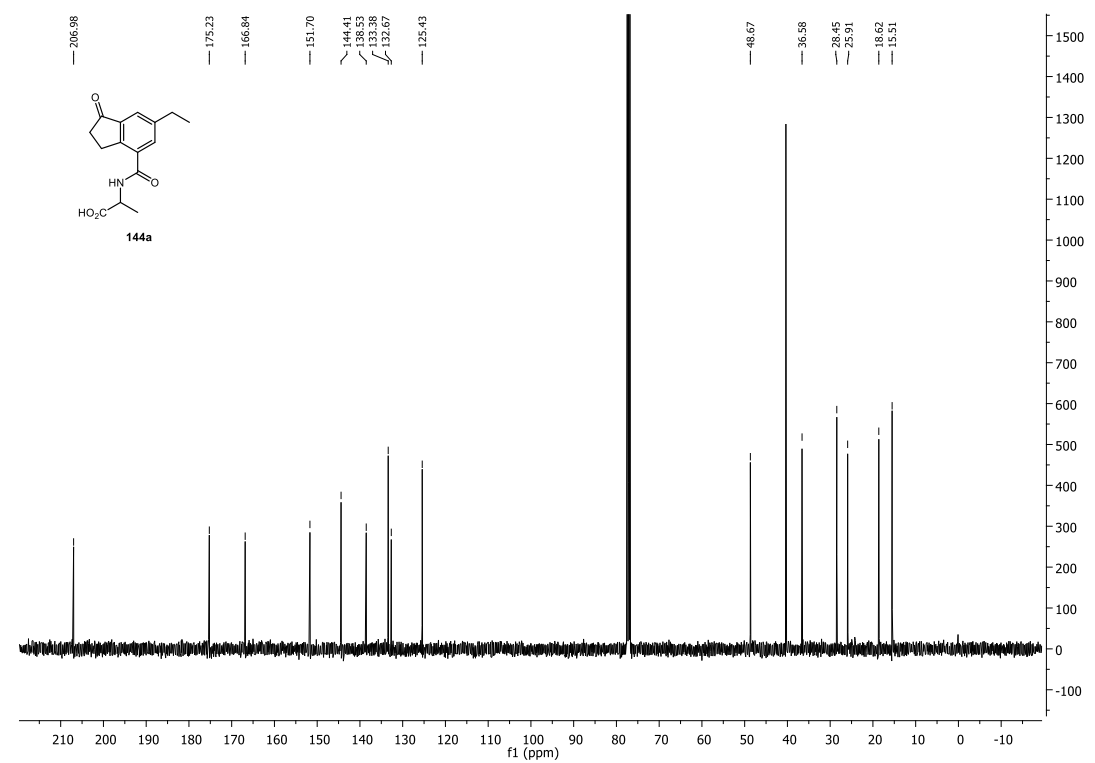
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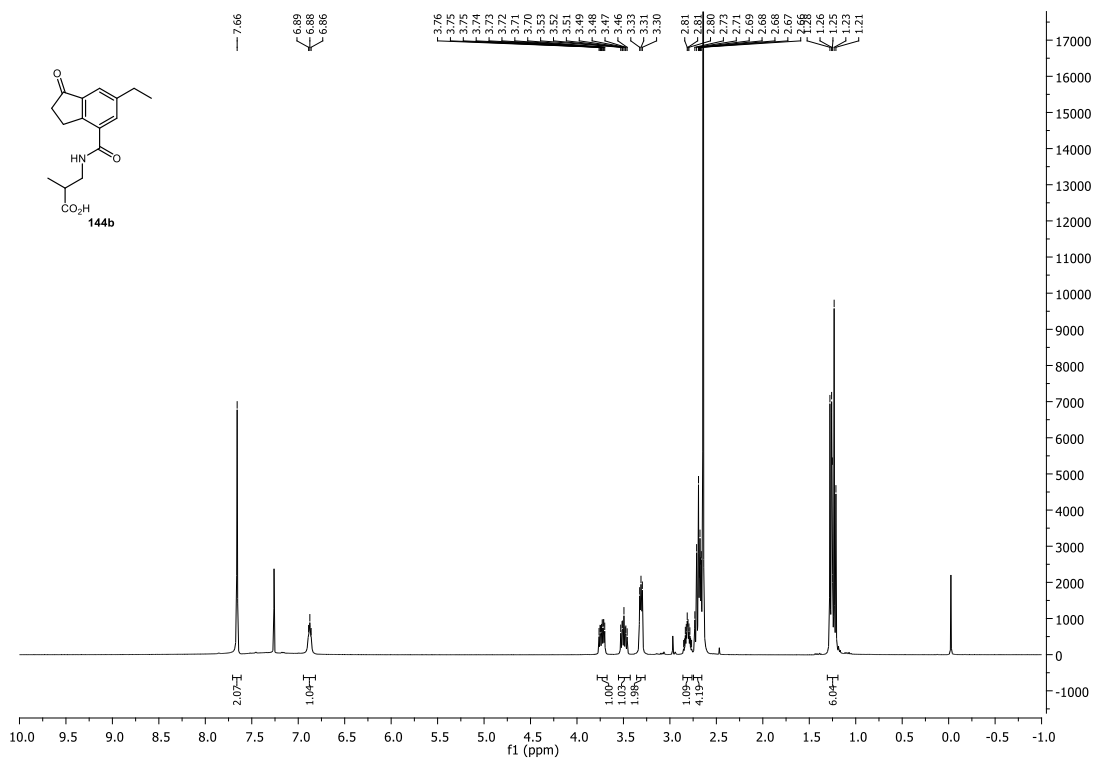
¹H NMR 144a.



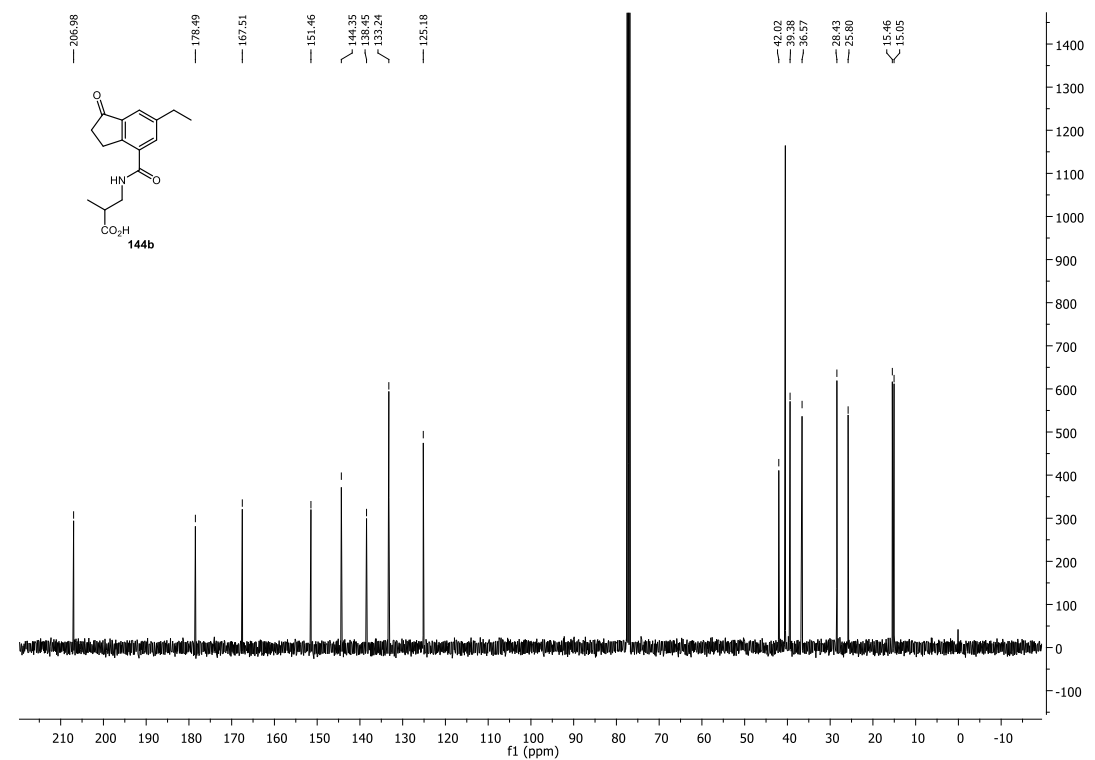
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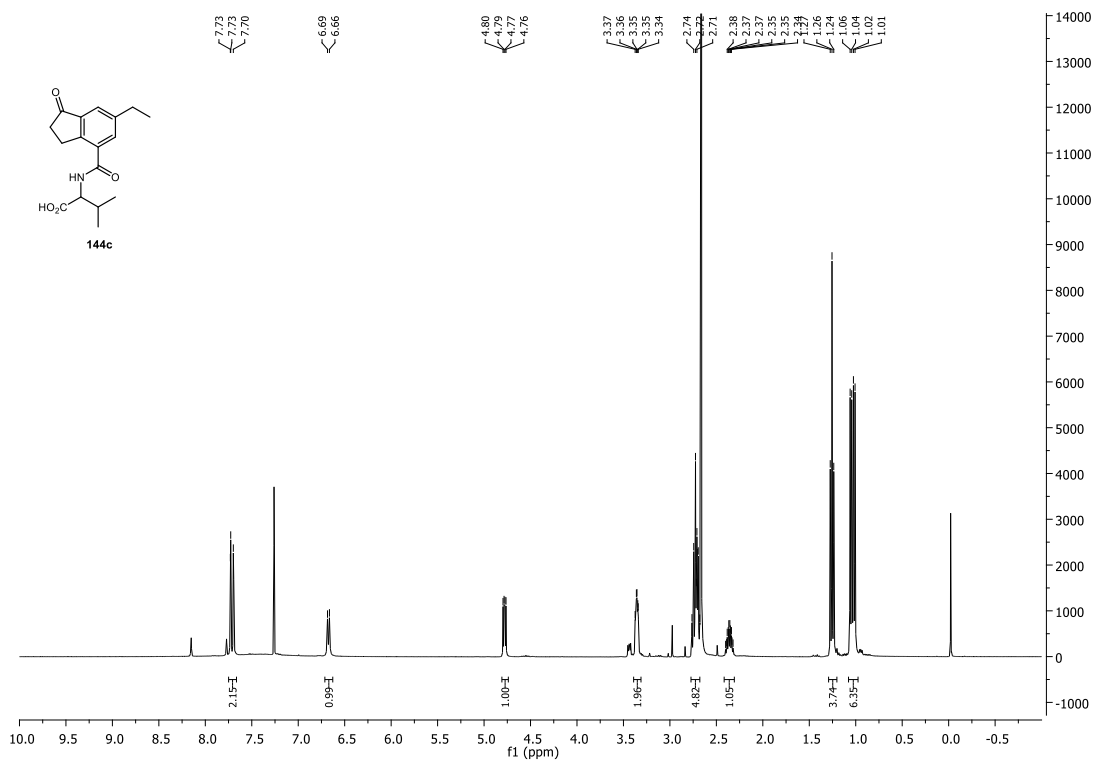
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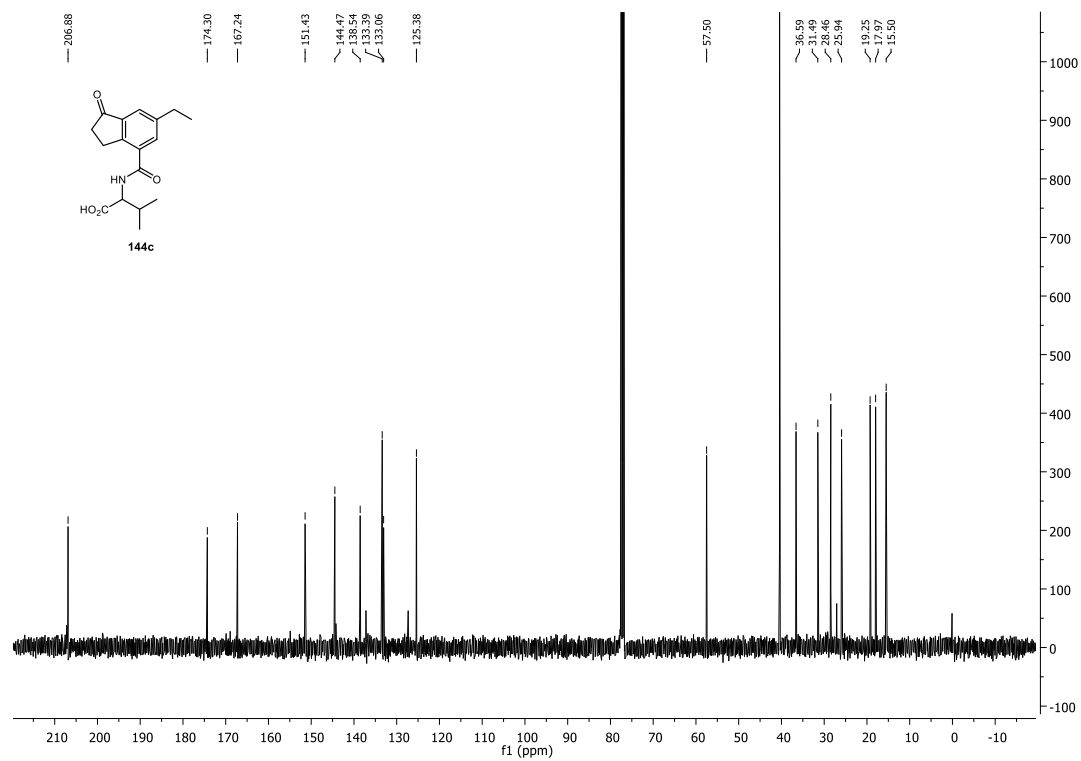
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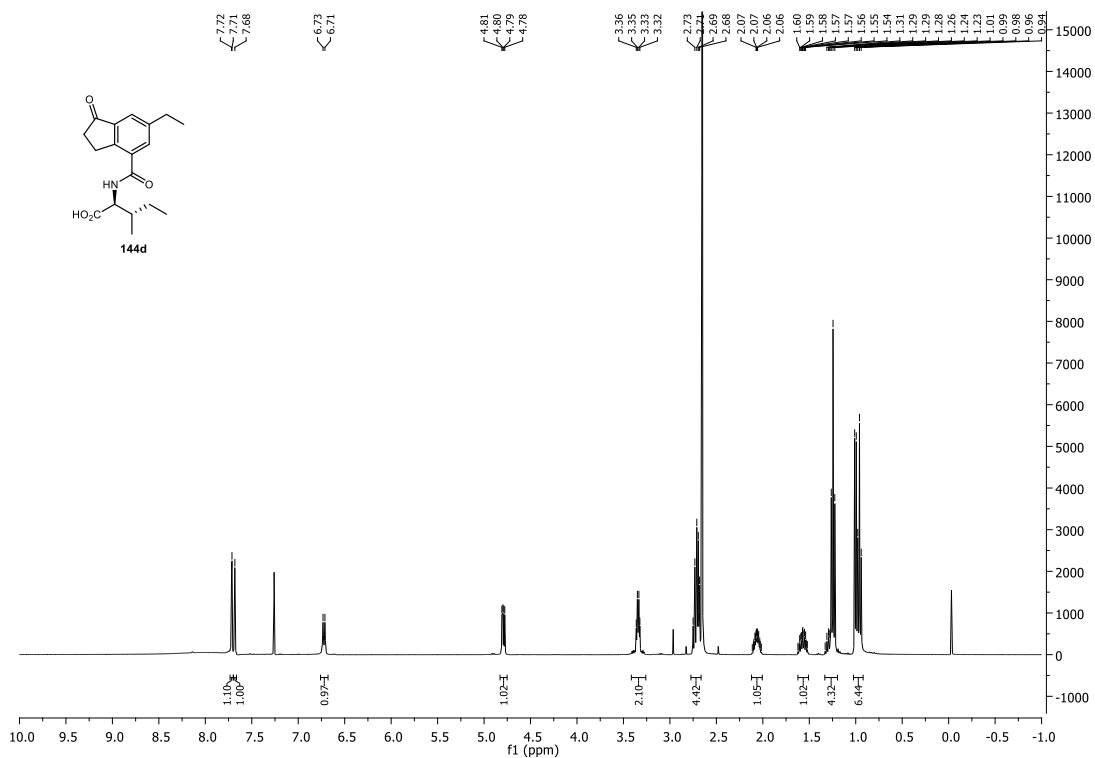
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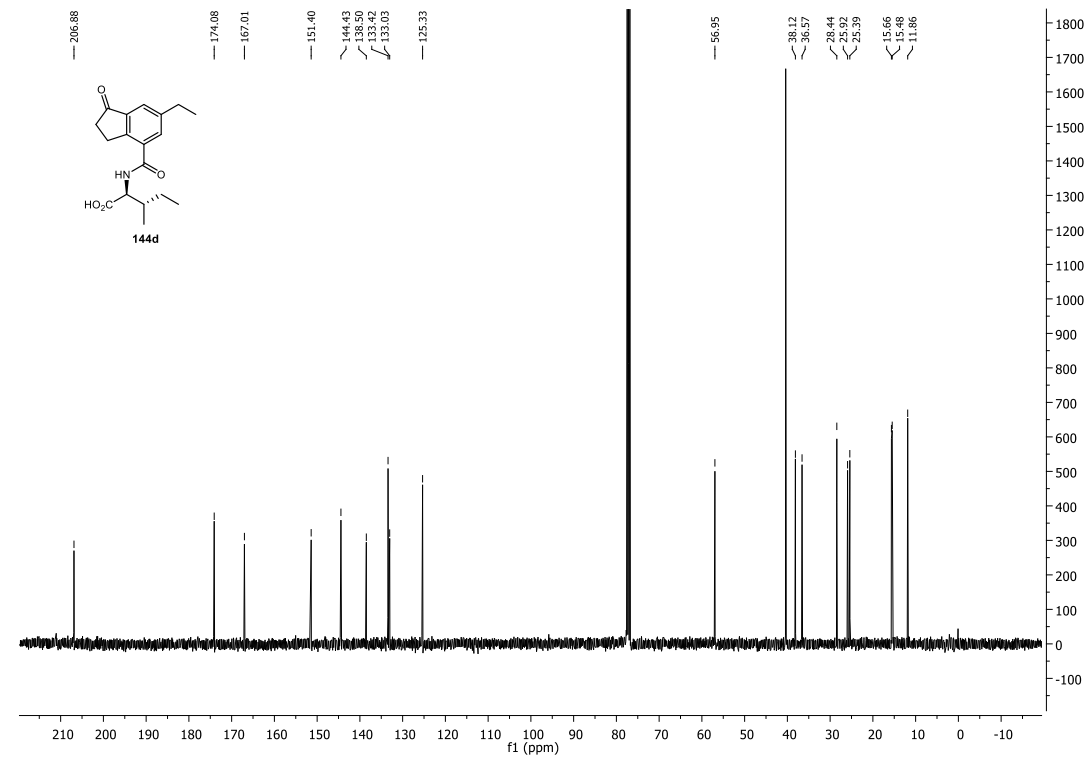
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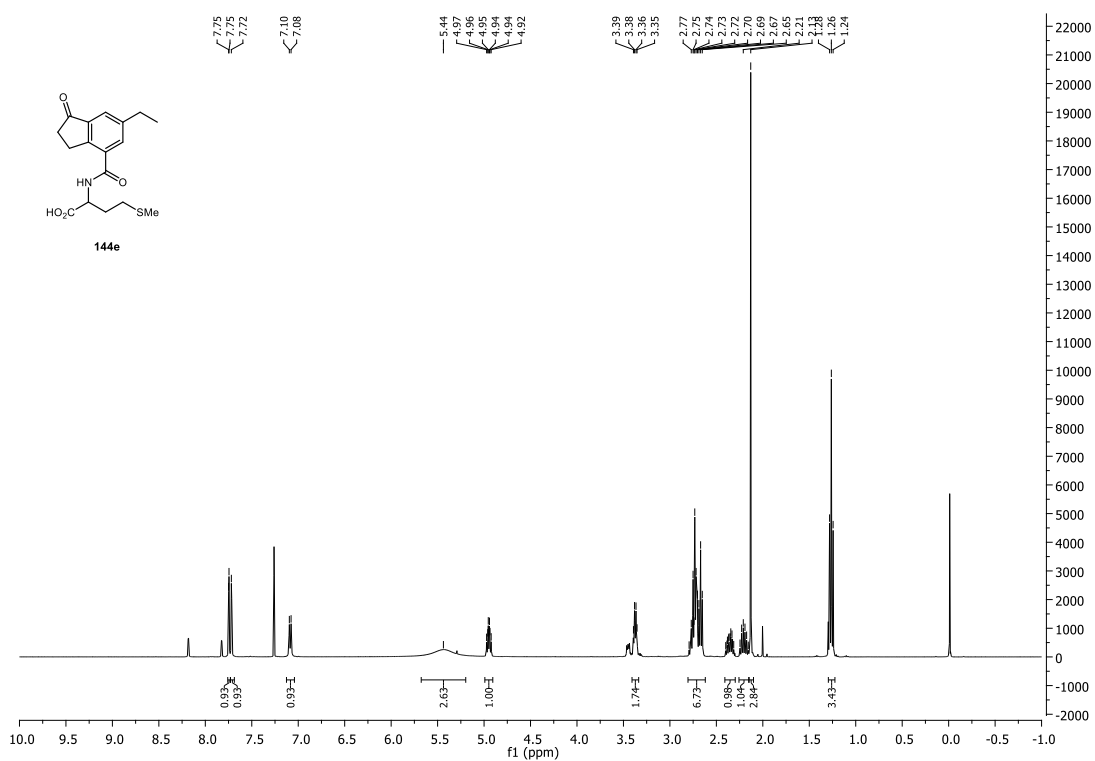
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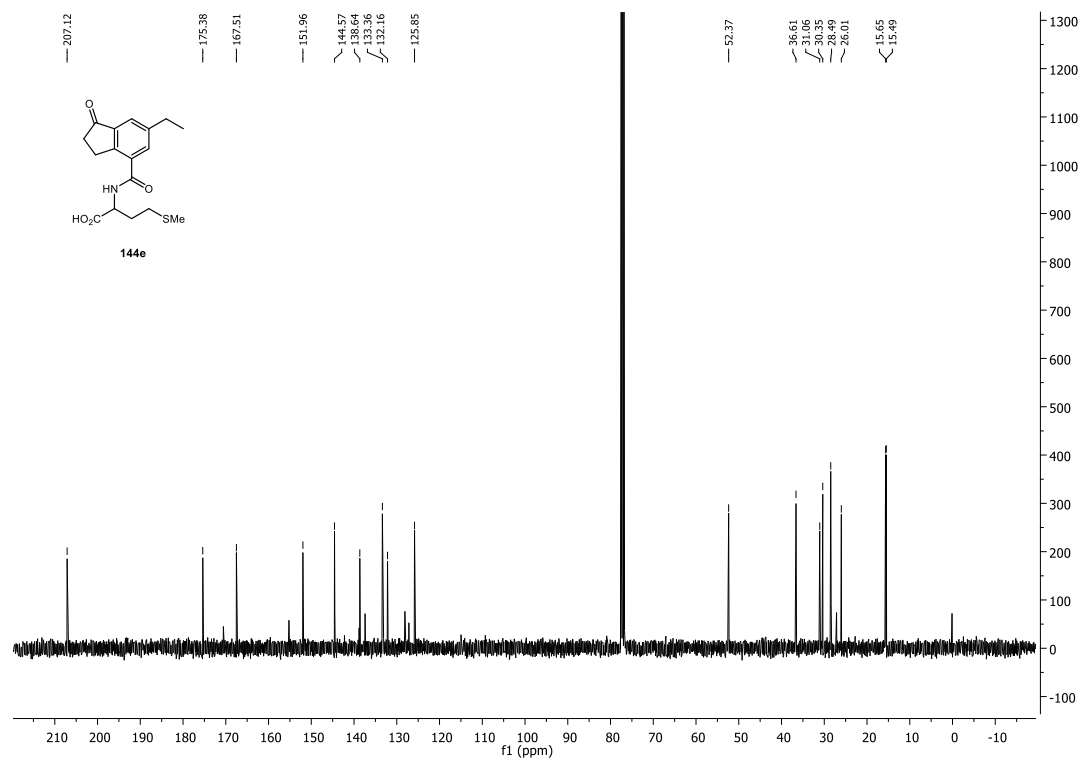
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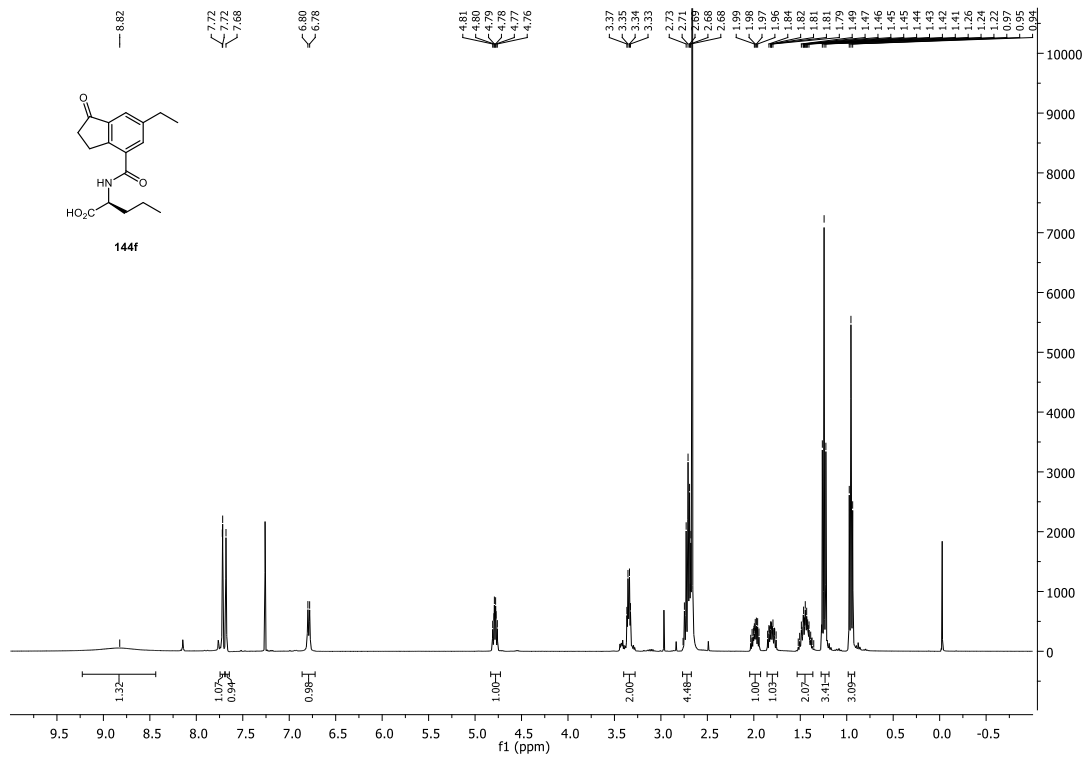
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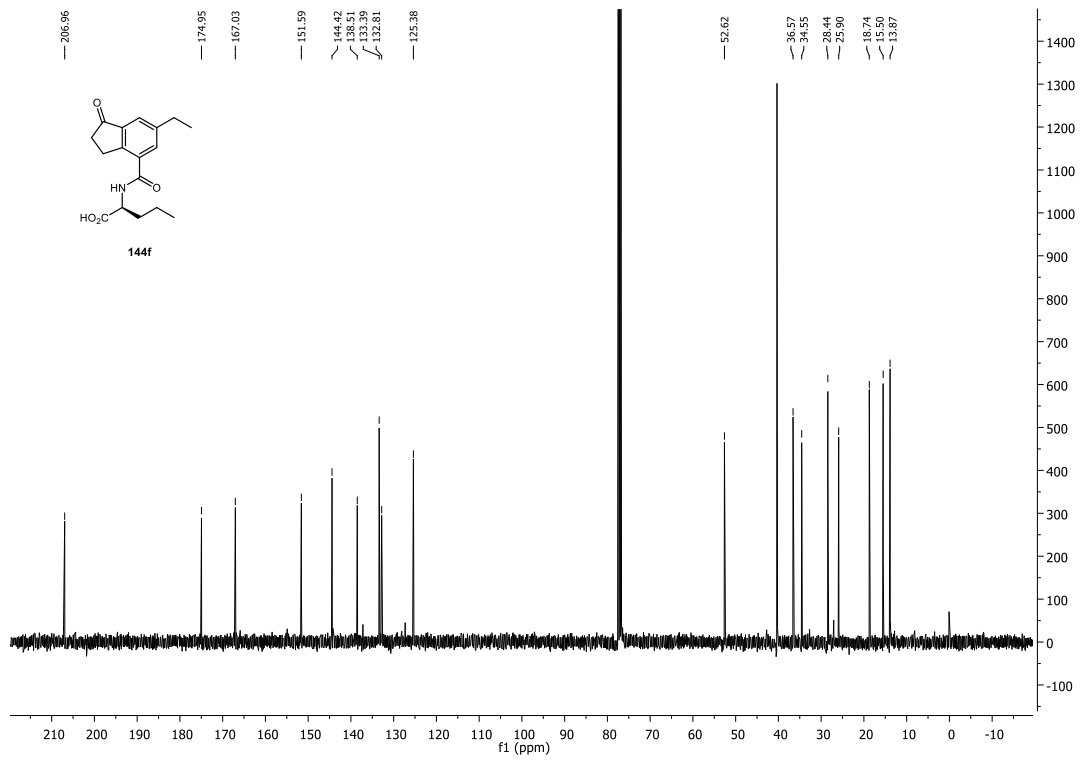
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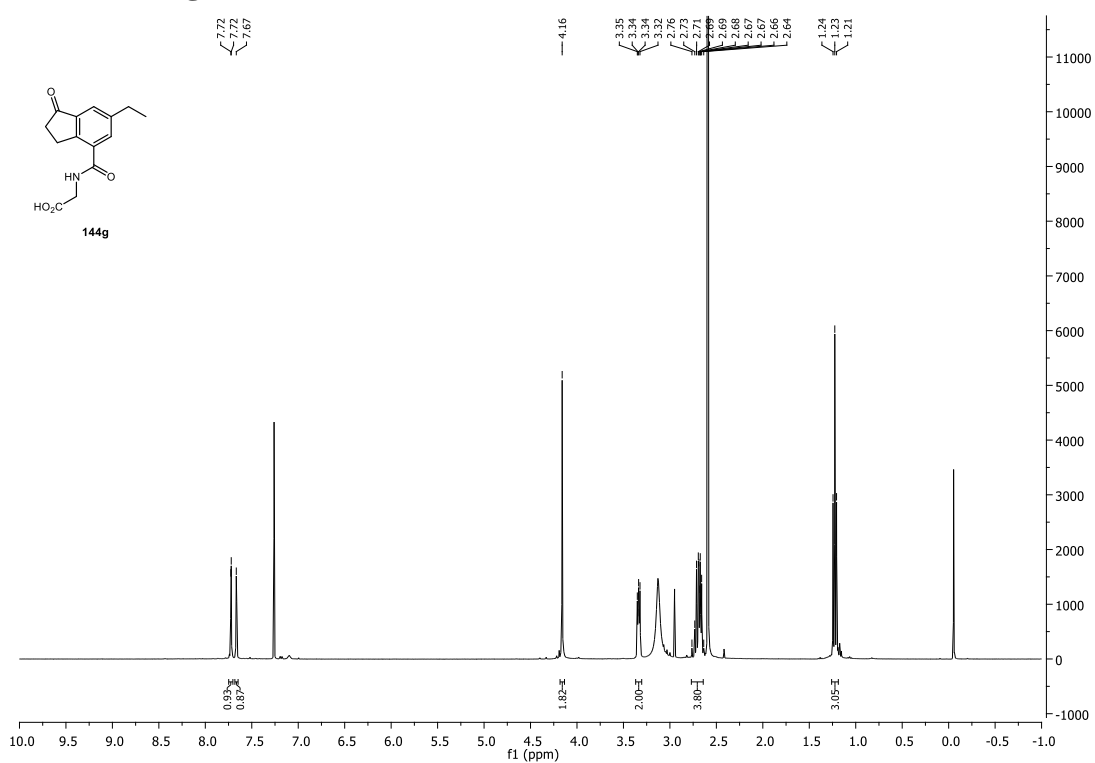
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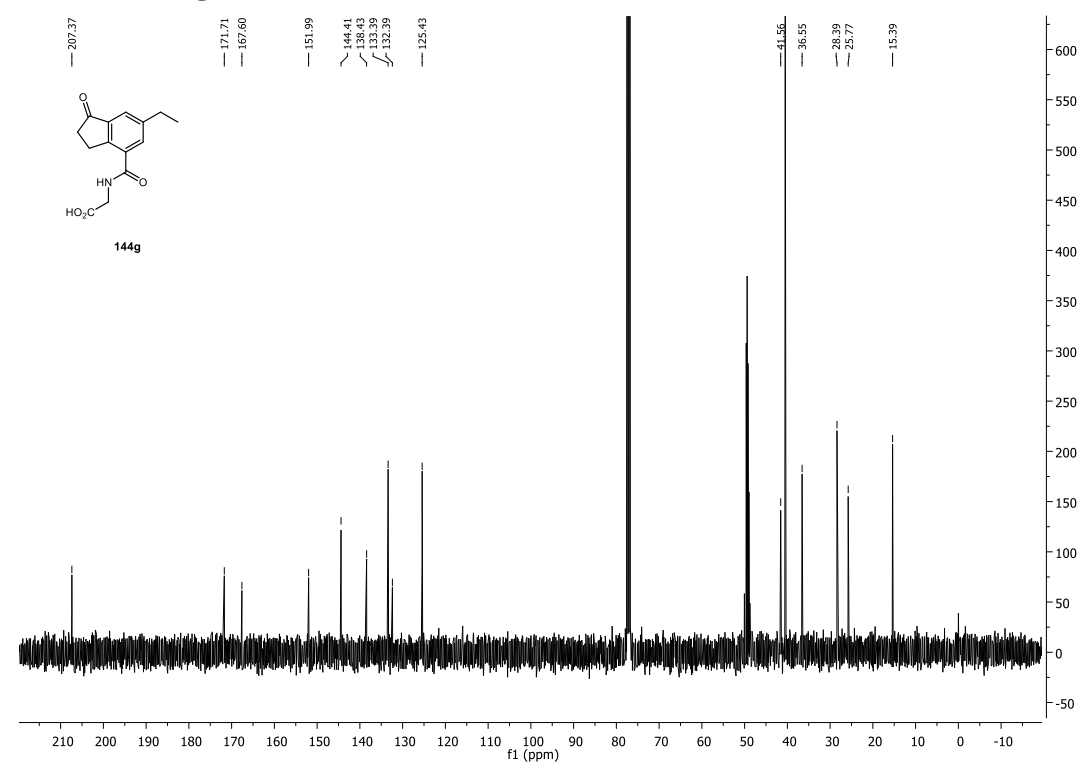
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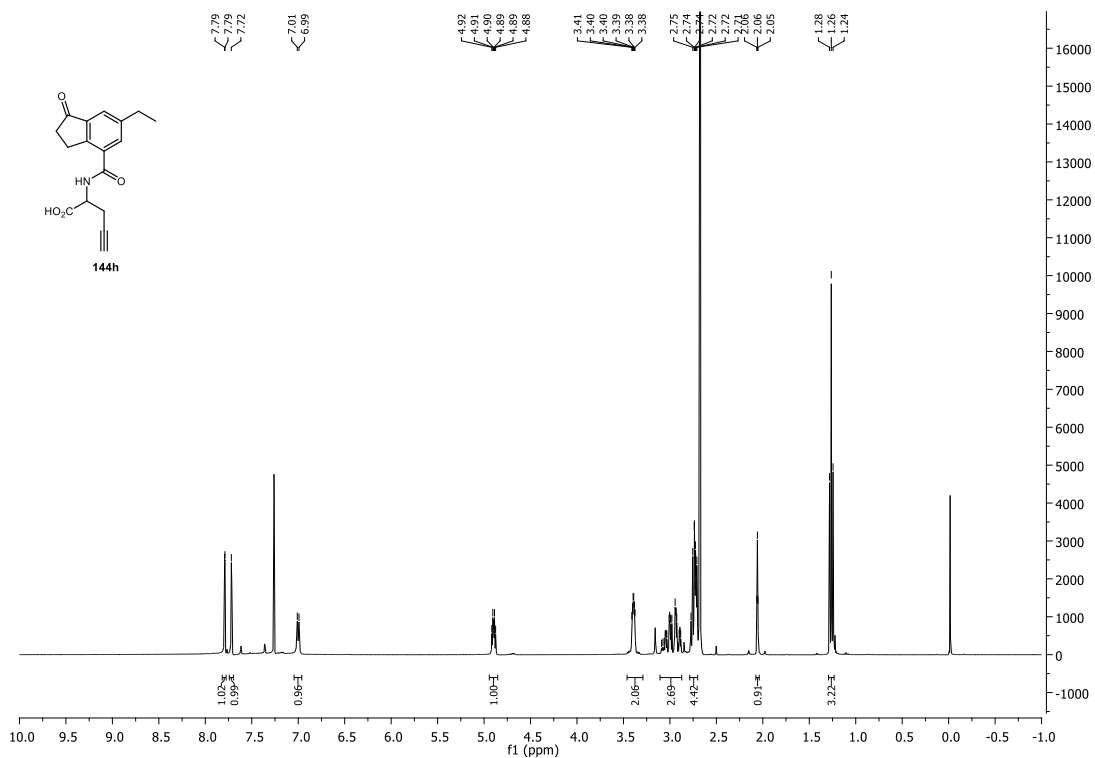
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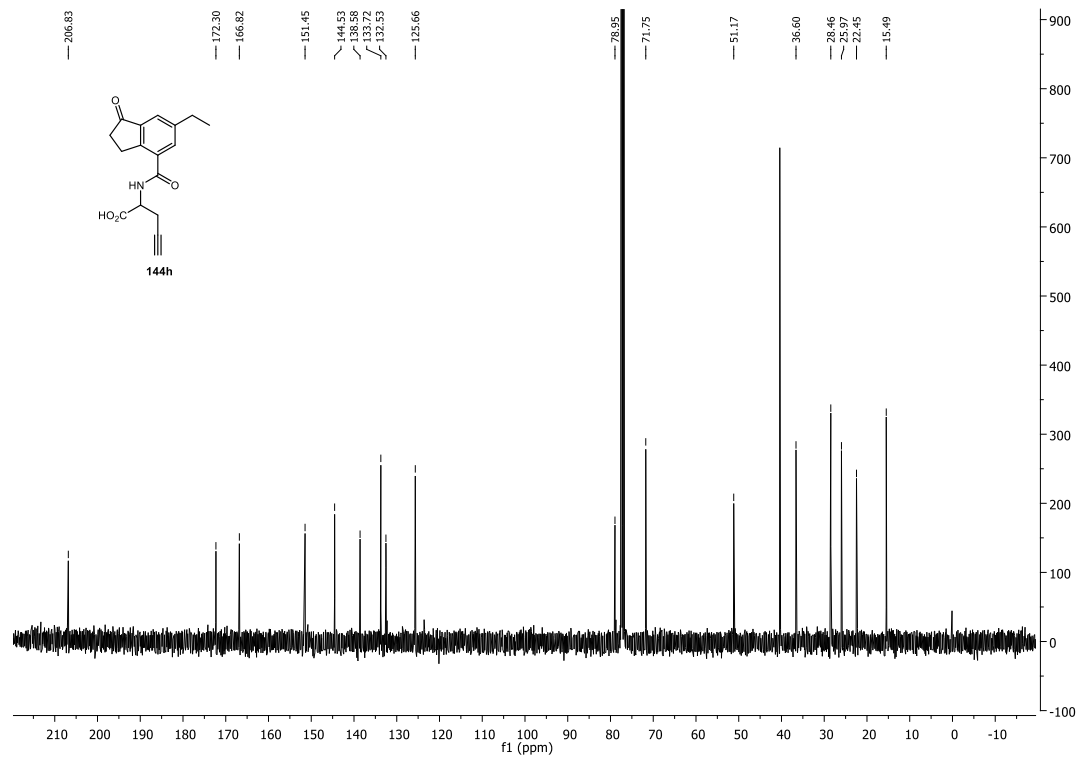
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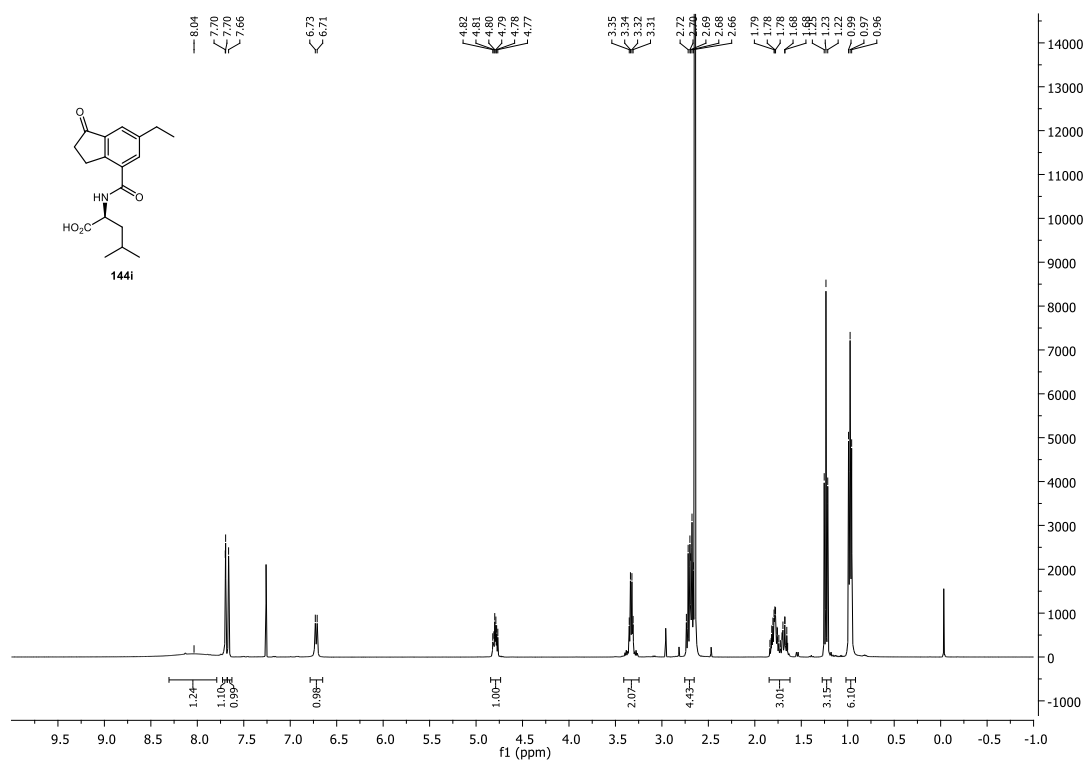
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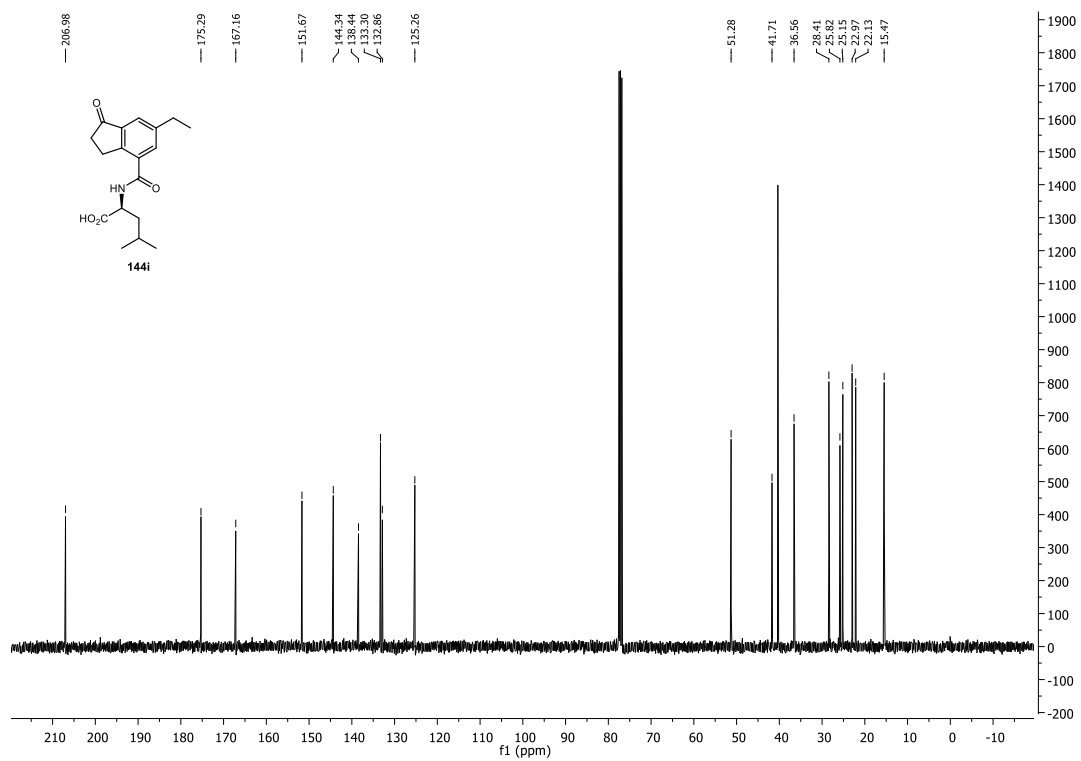
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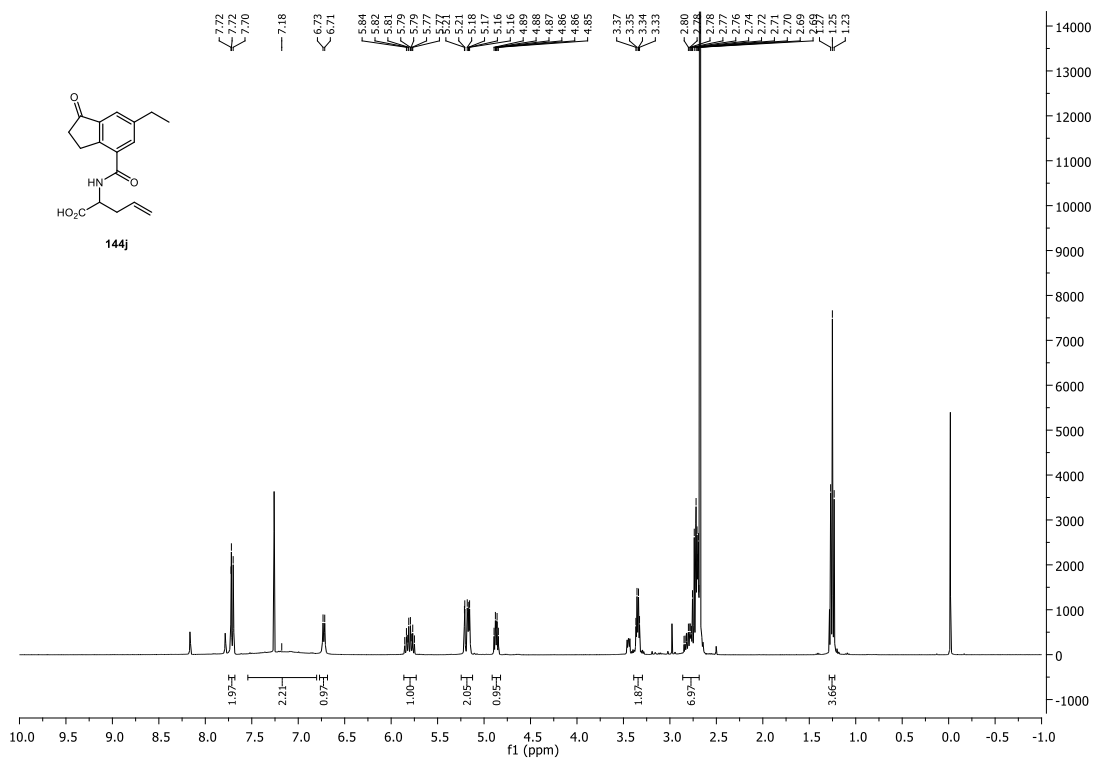
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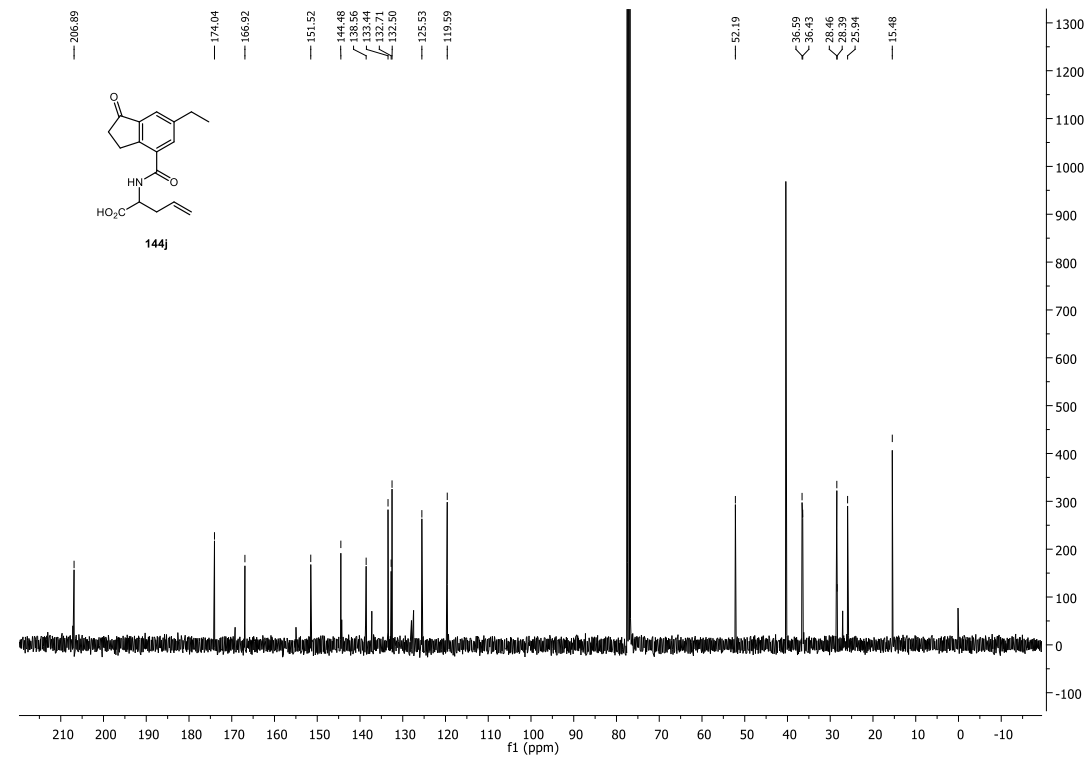
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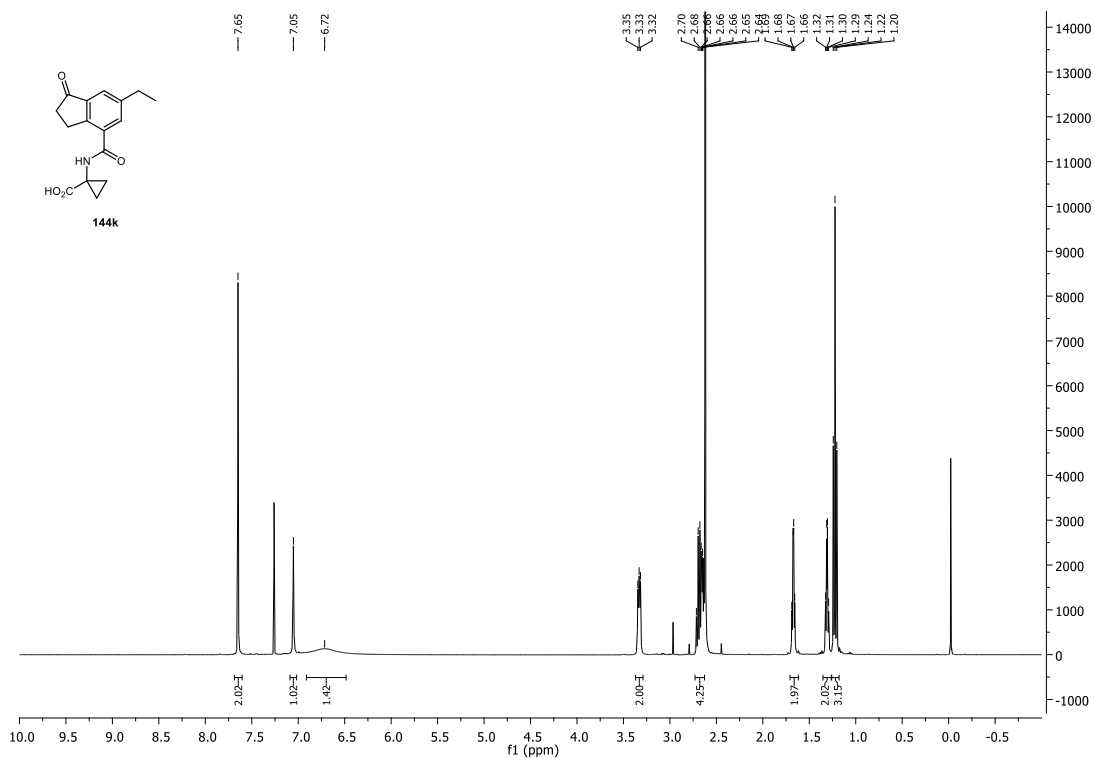
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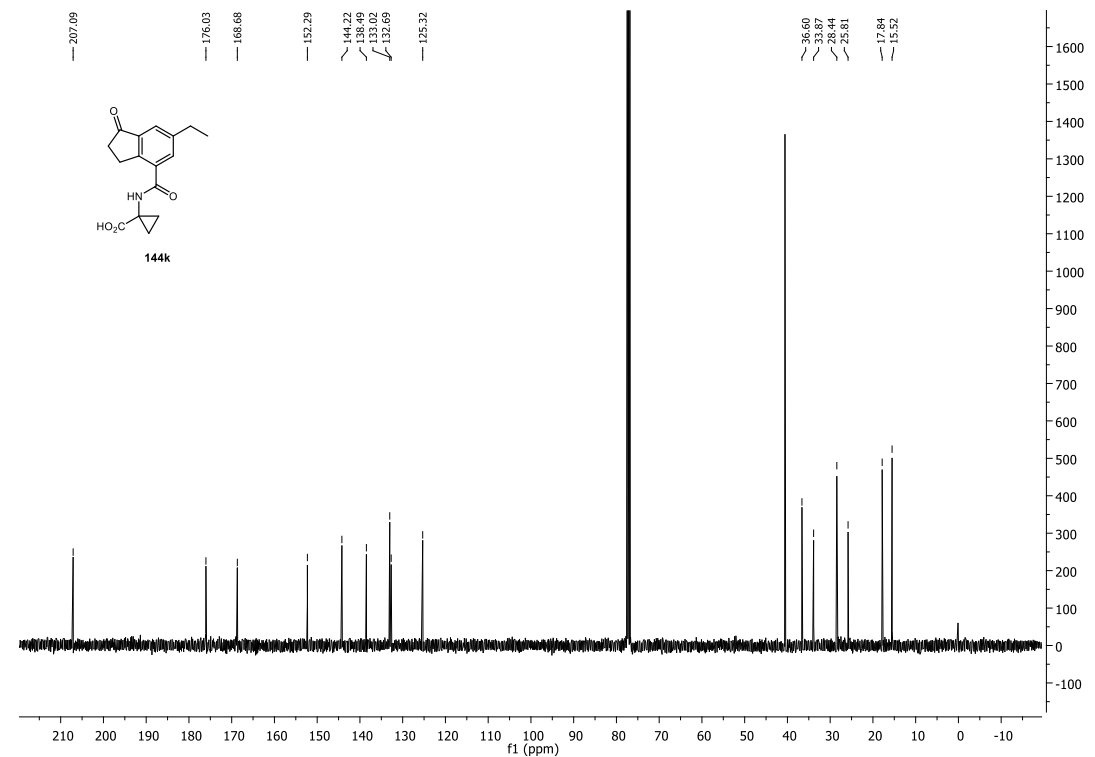
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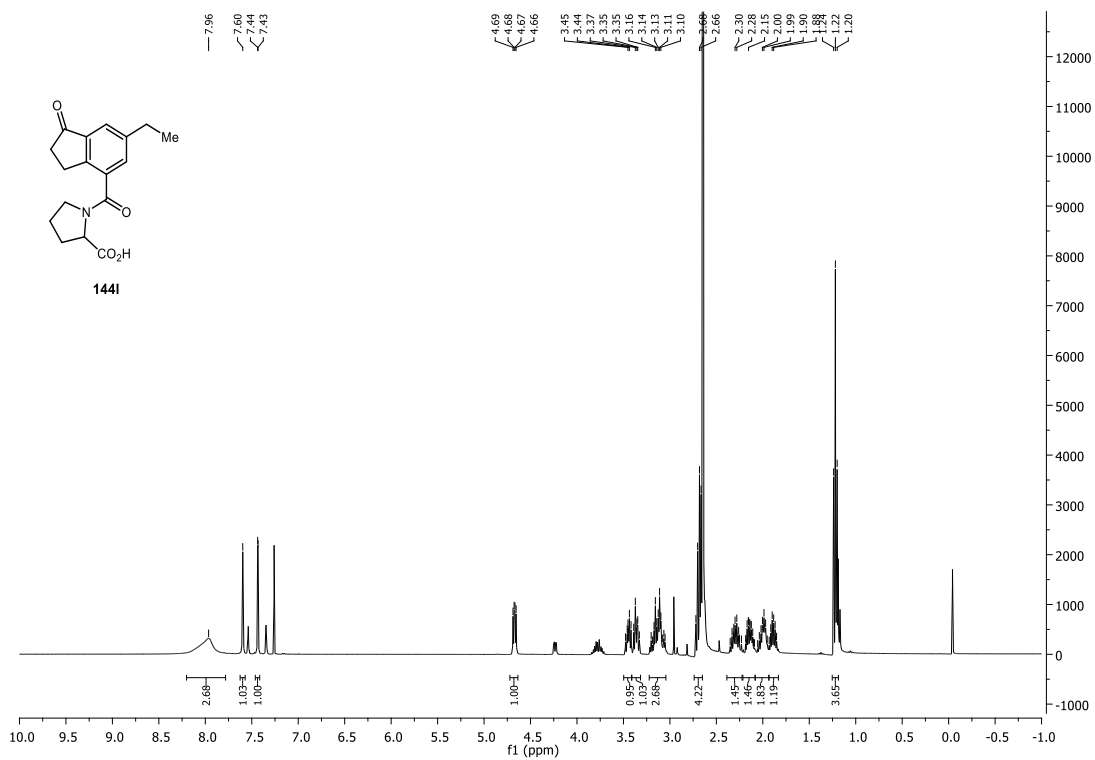
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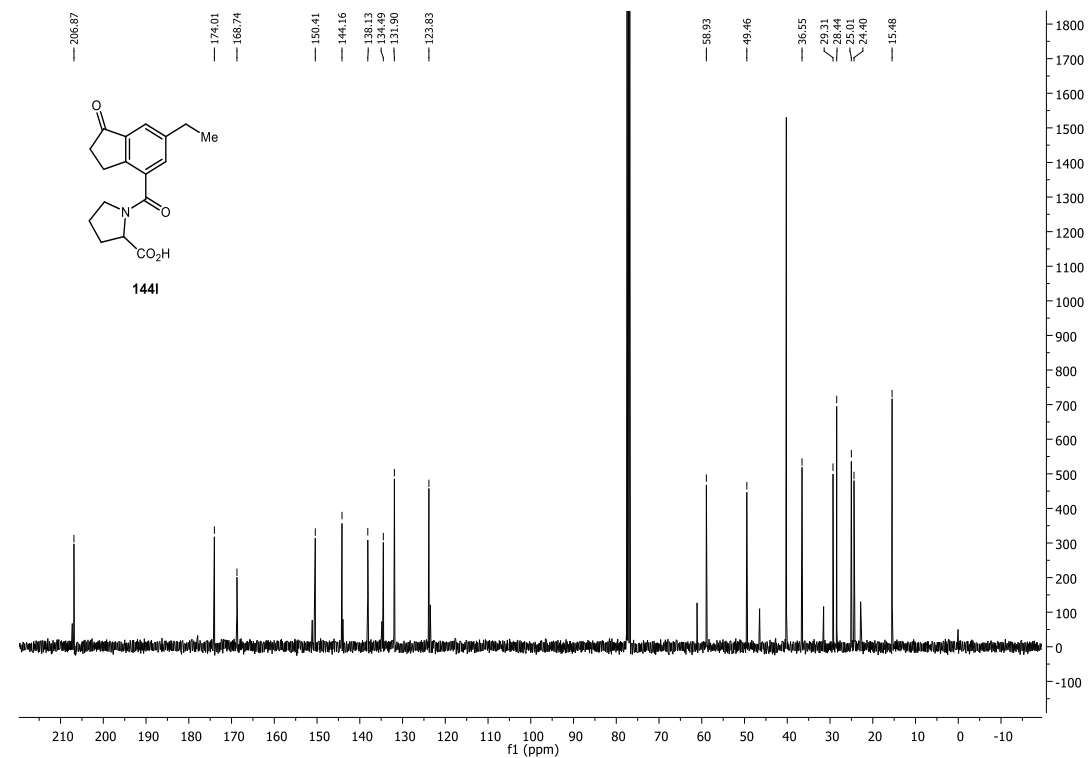
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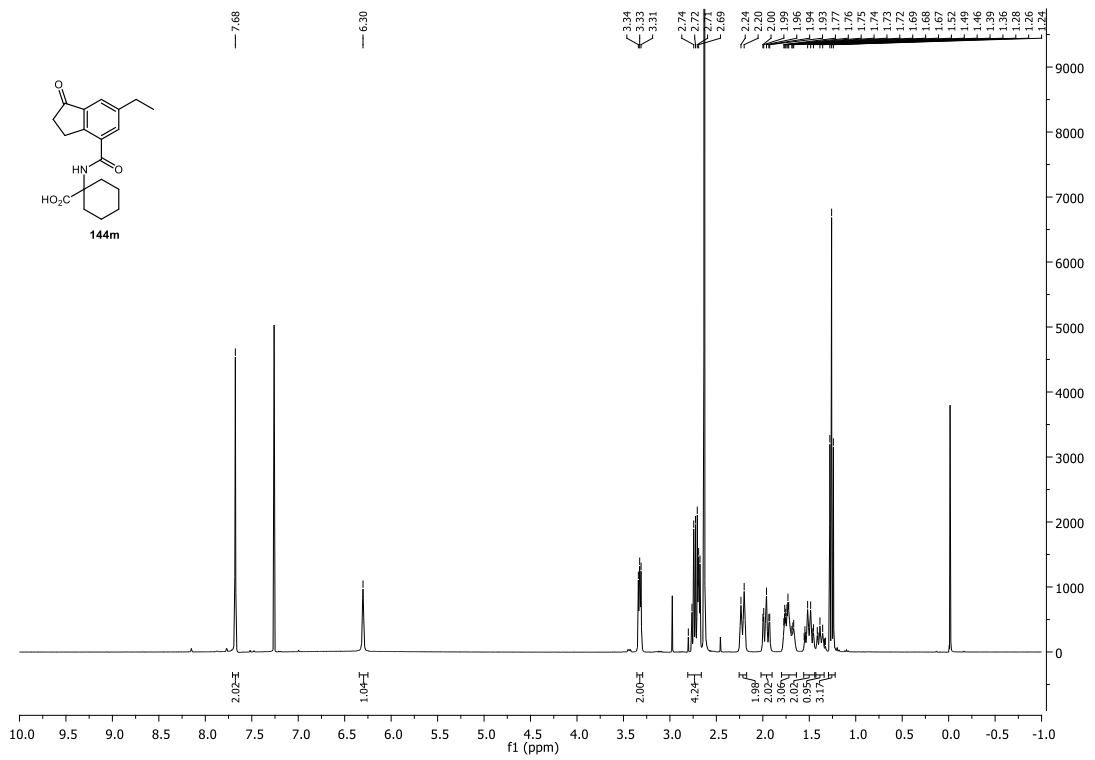
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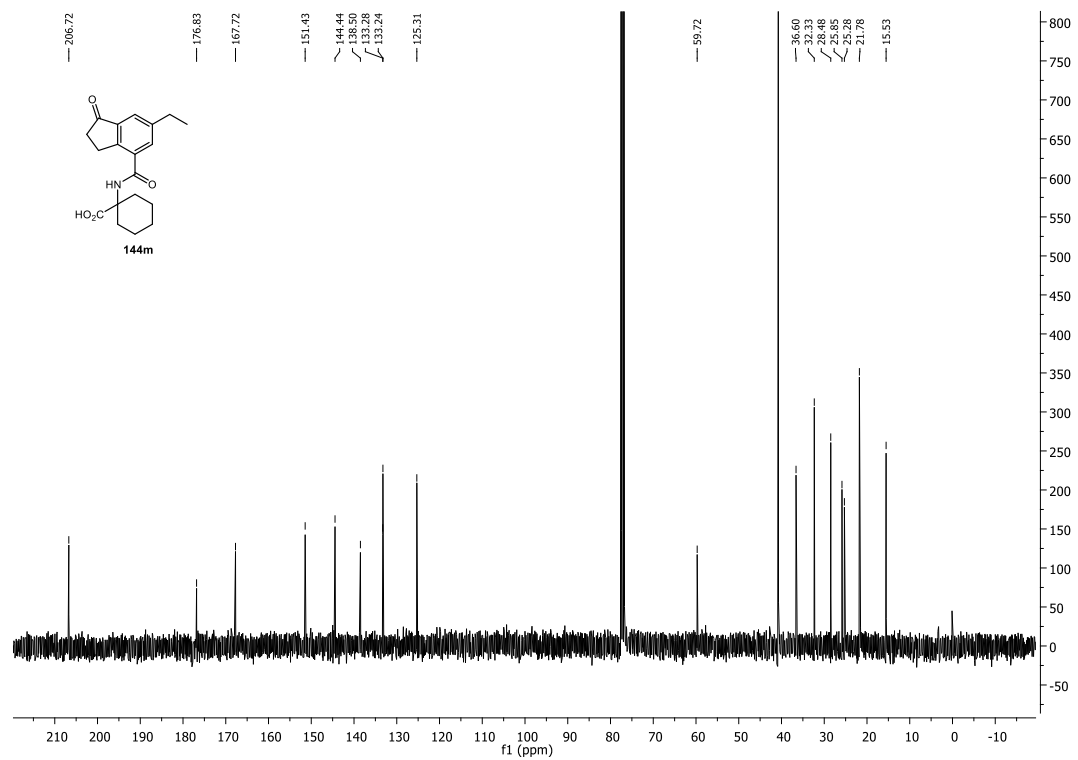
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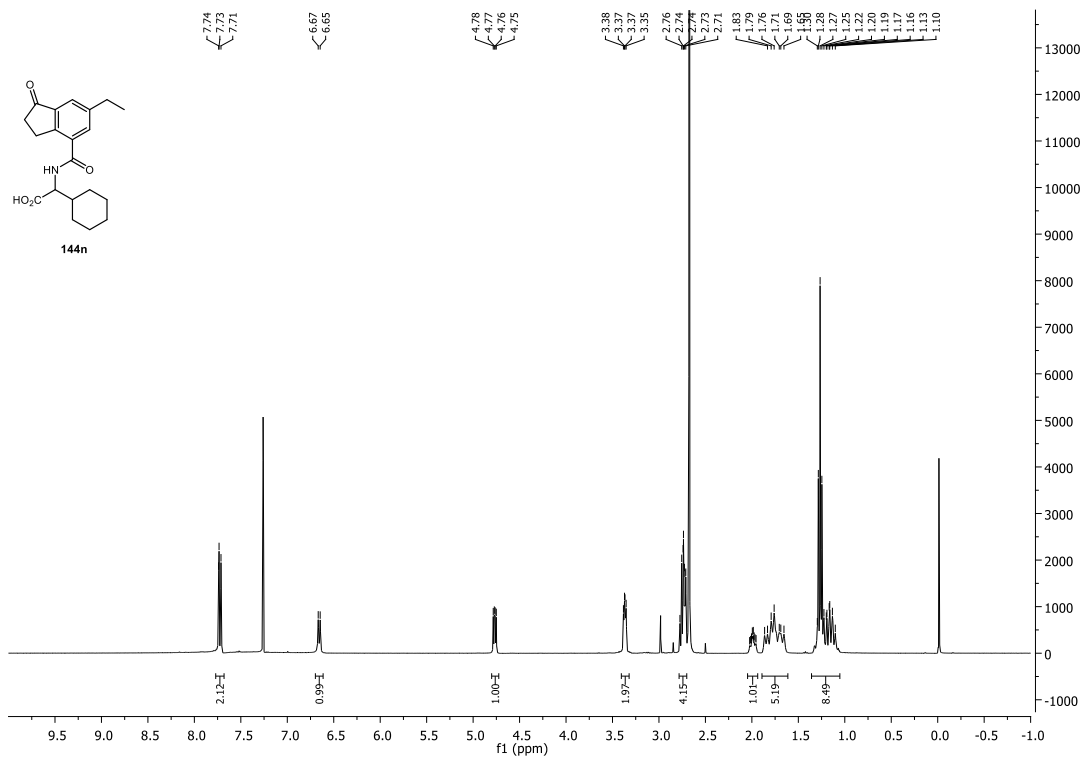
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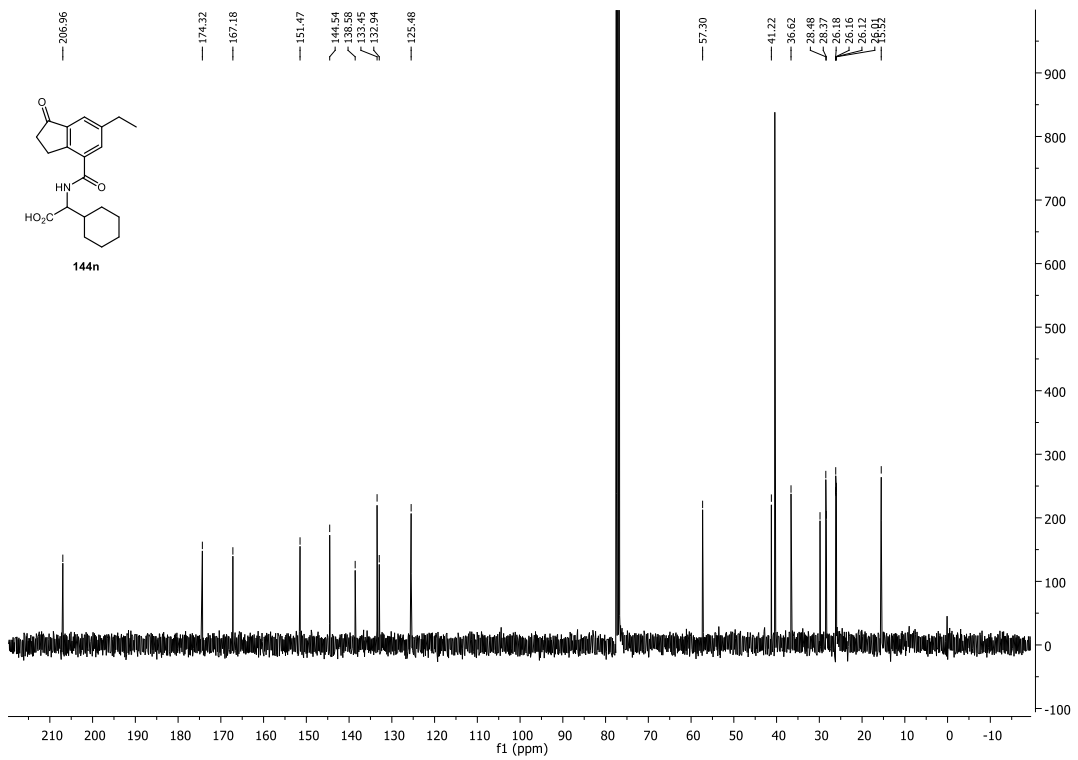
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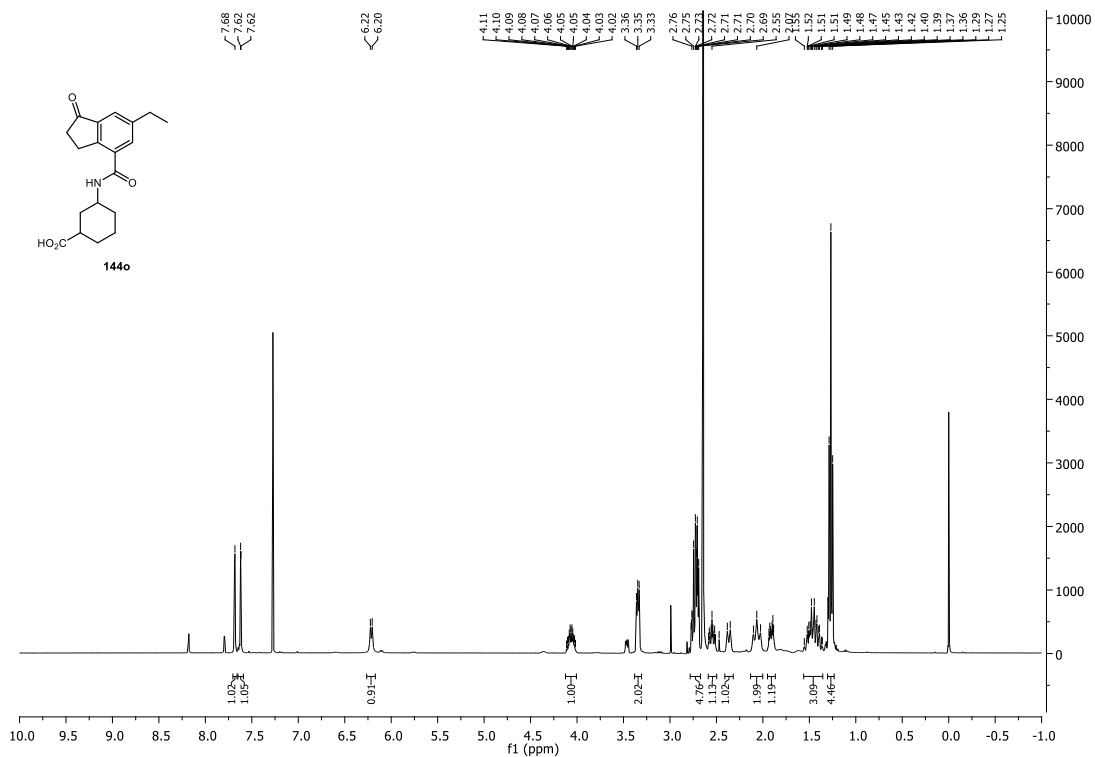
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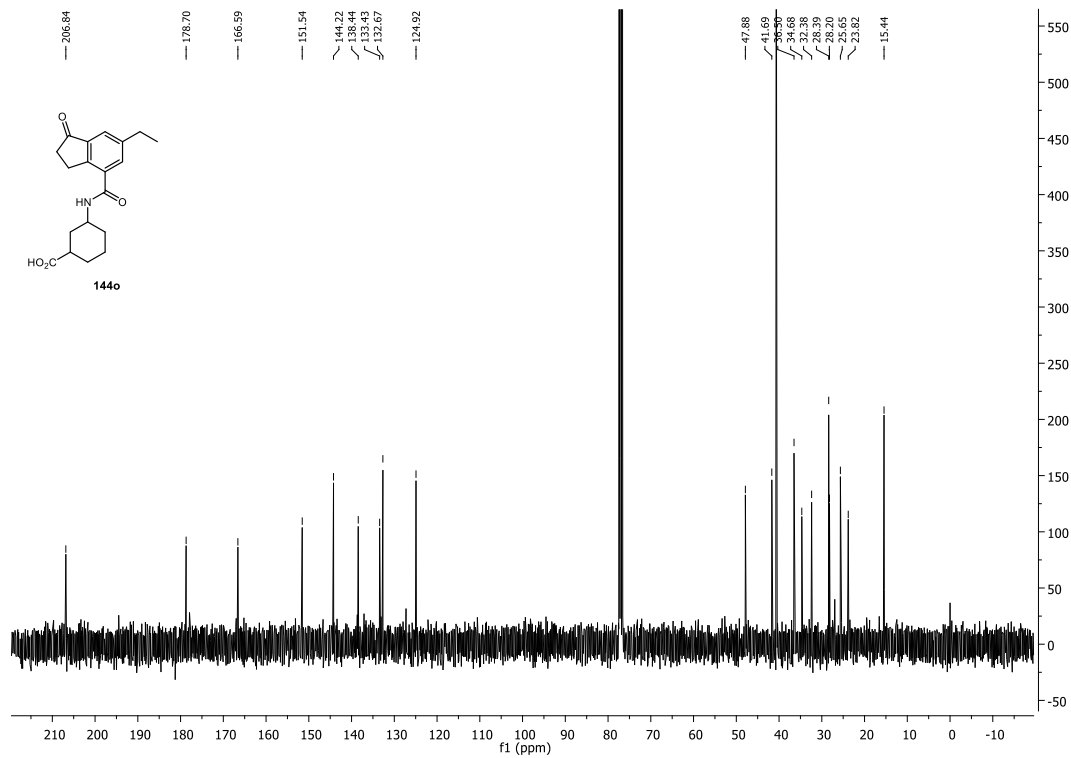
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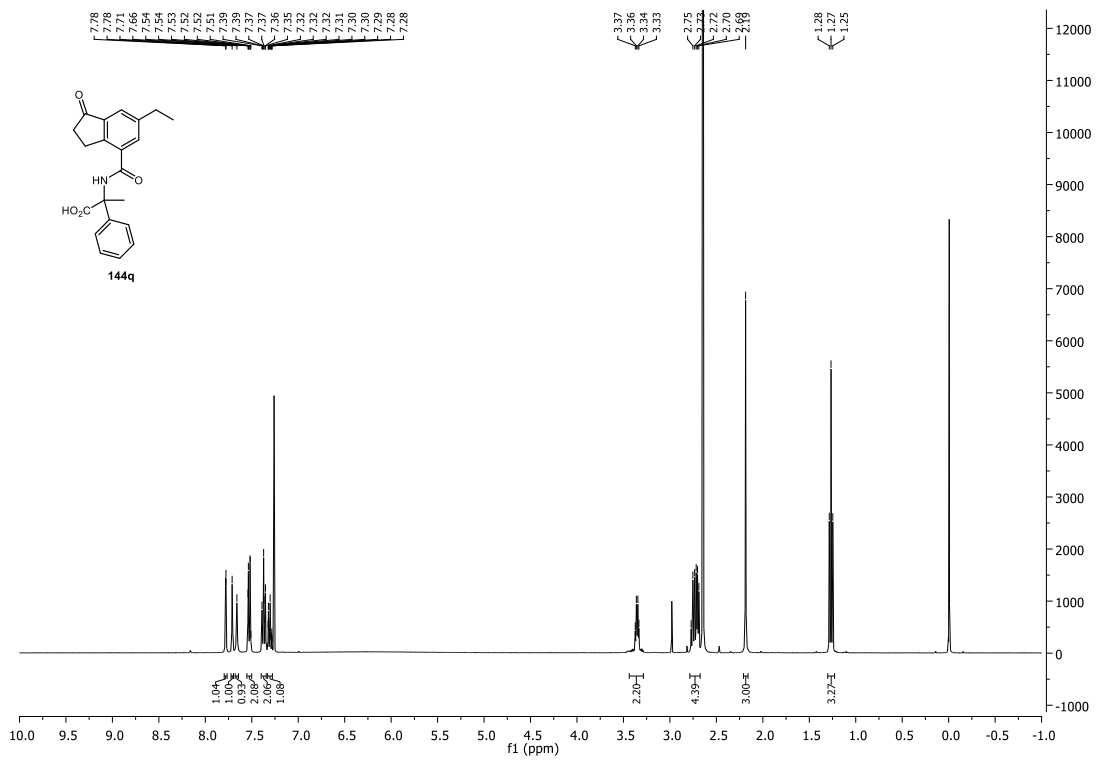
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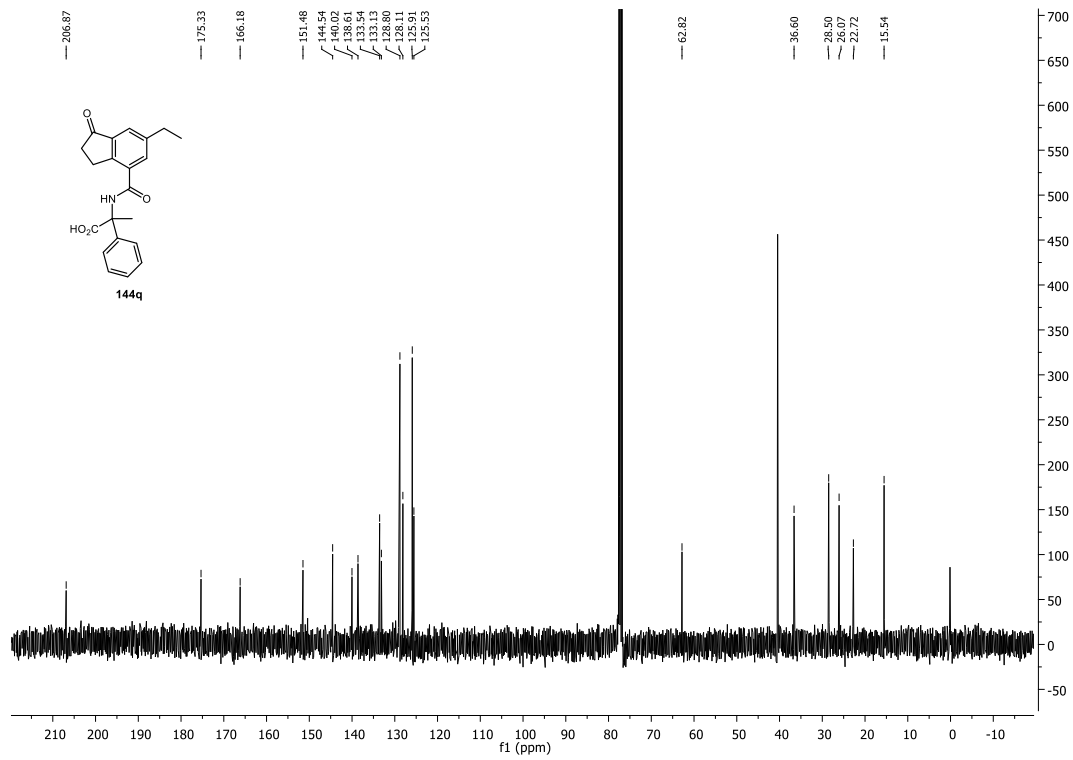
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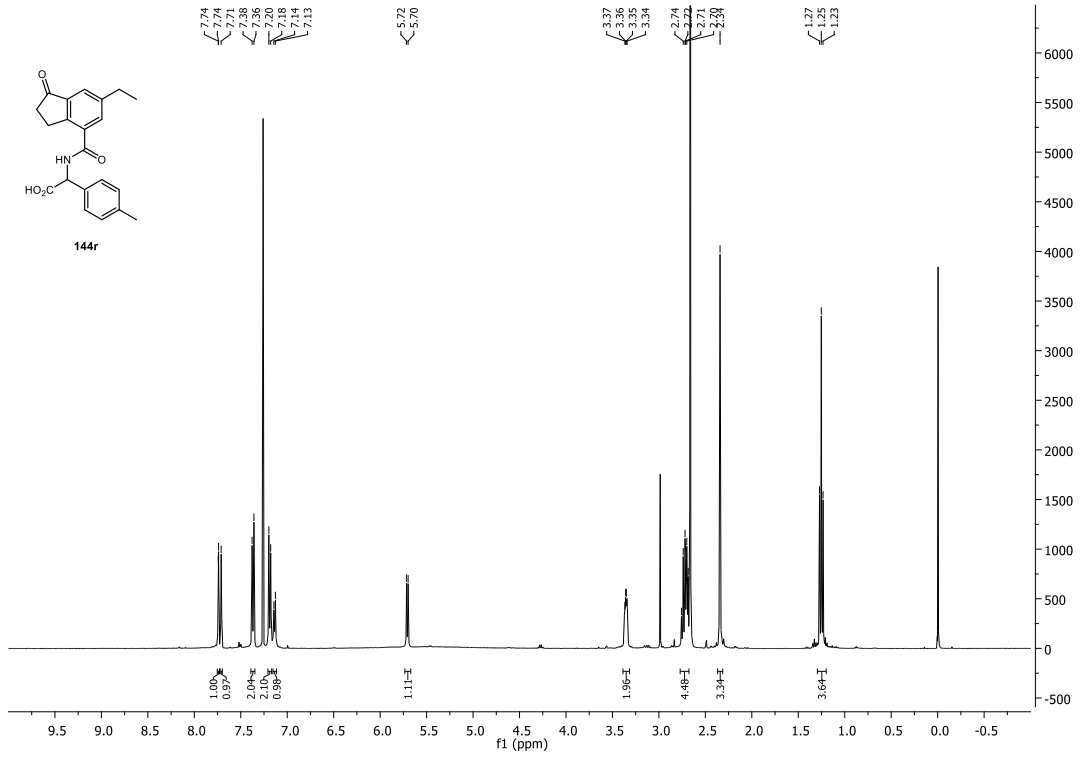
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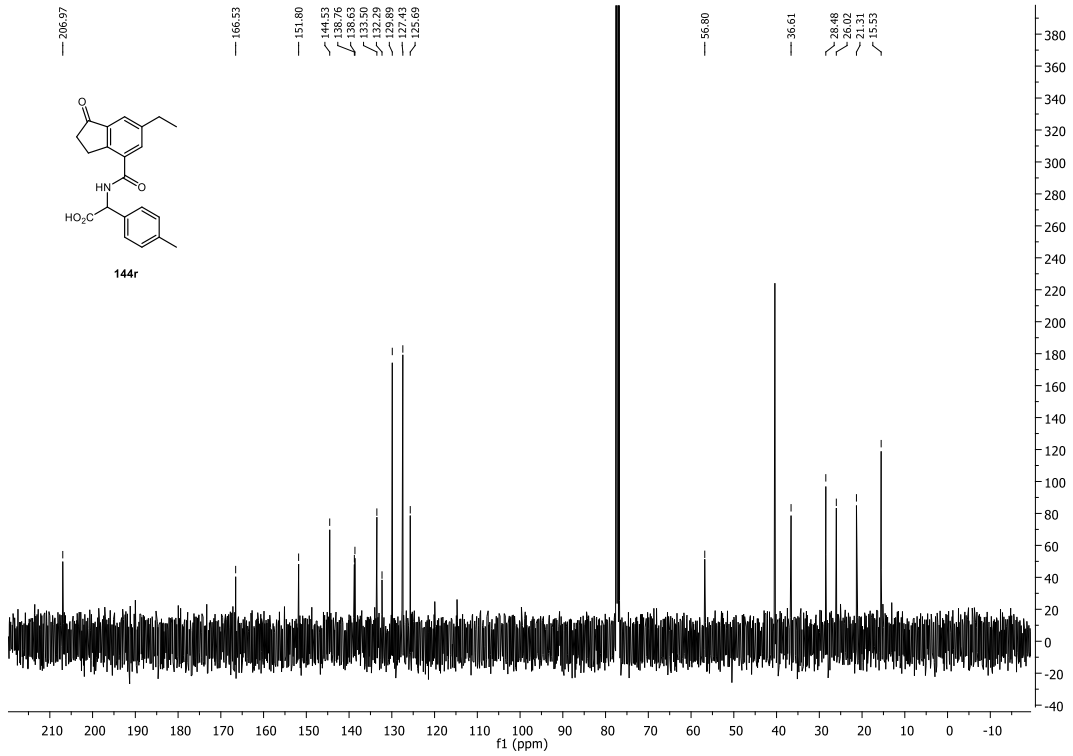
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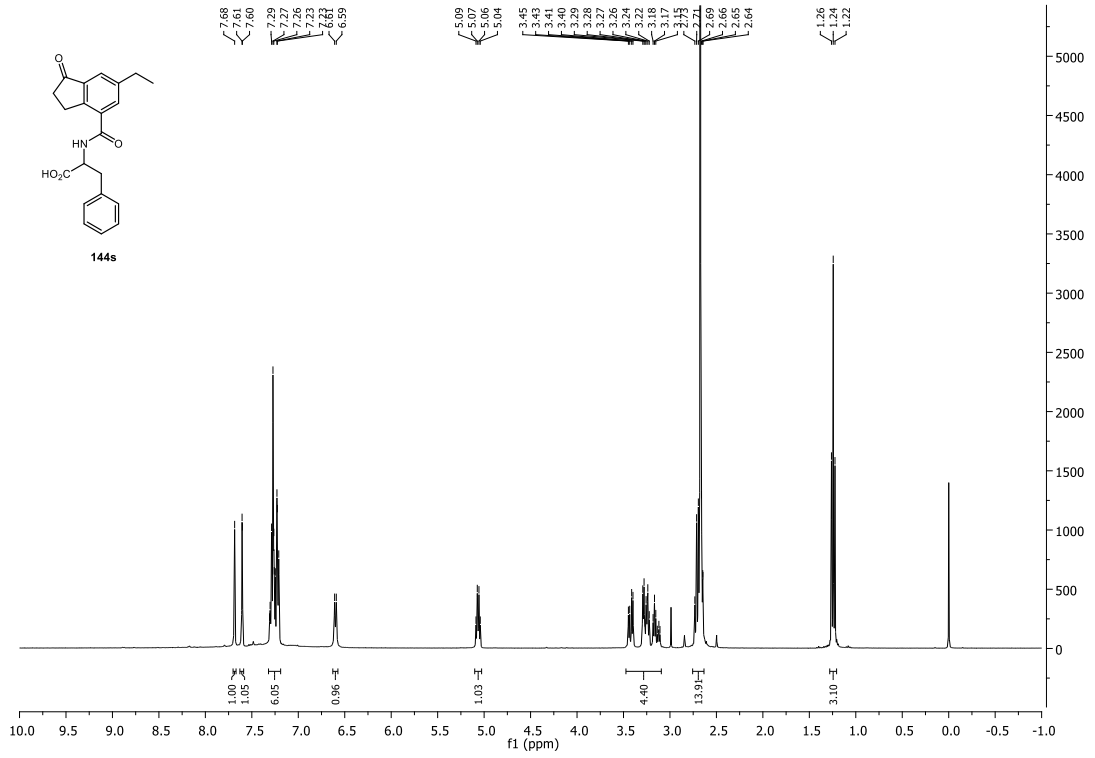
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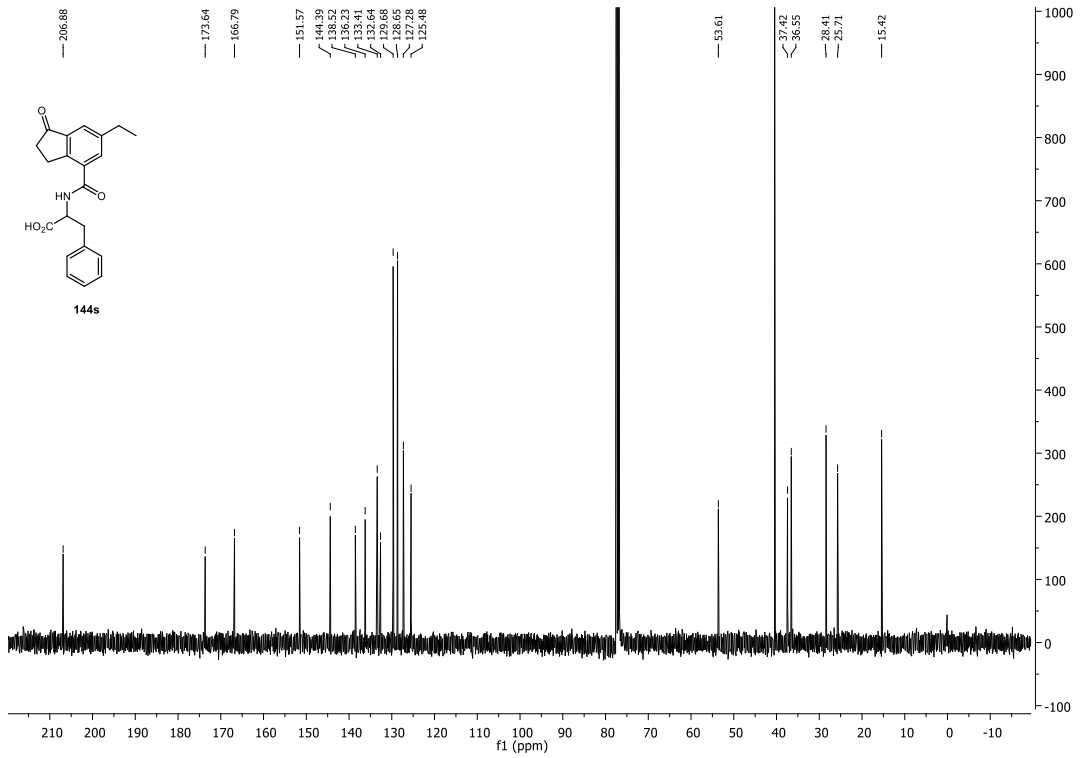
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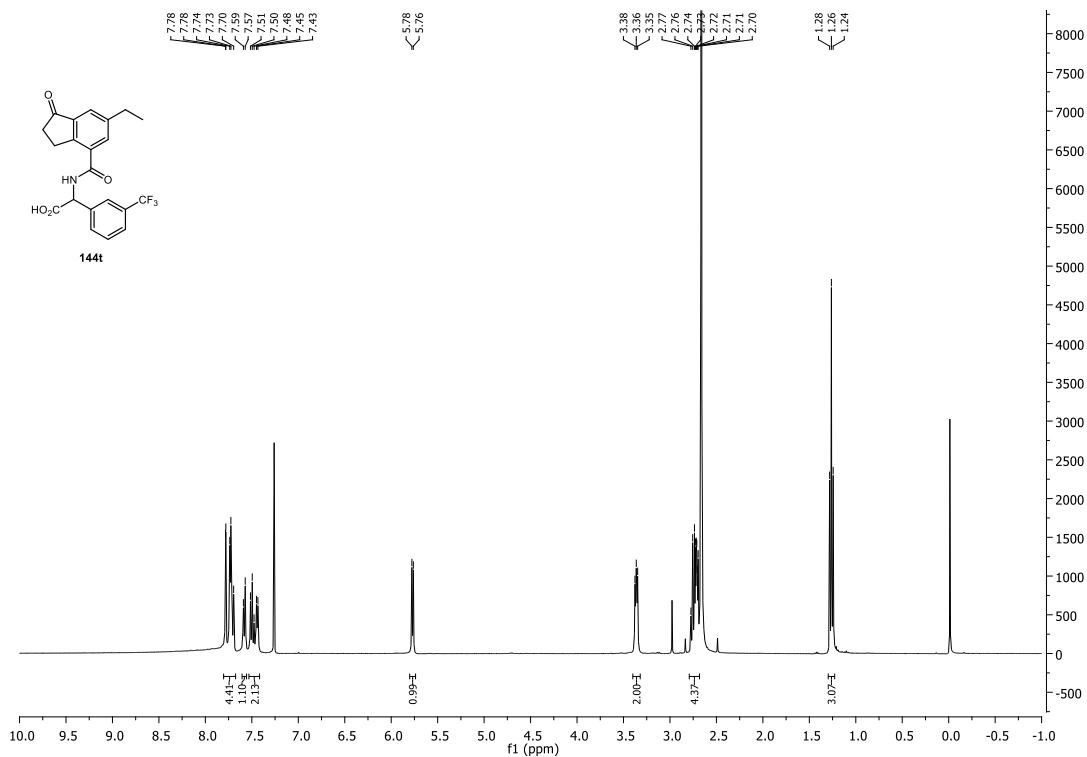
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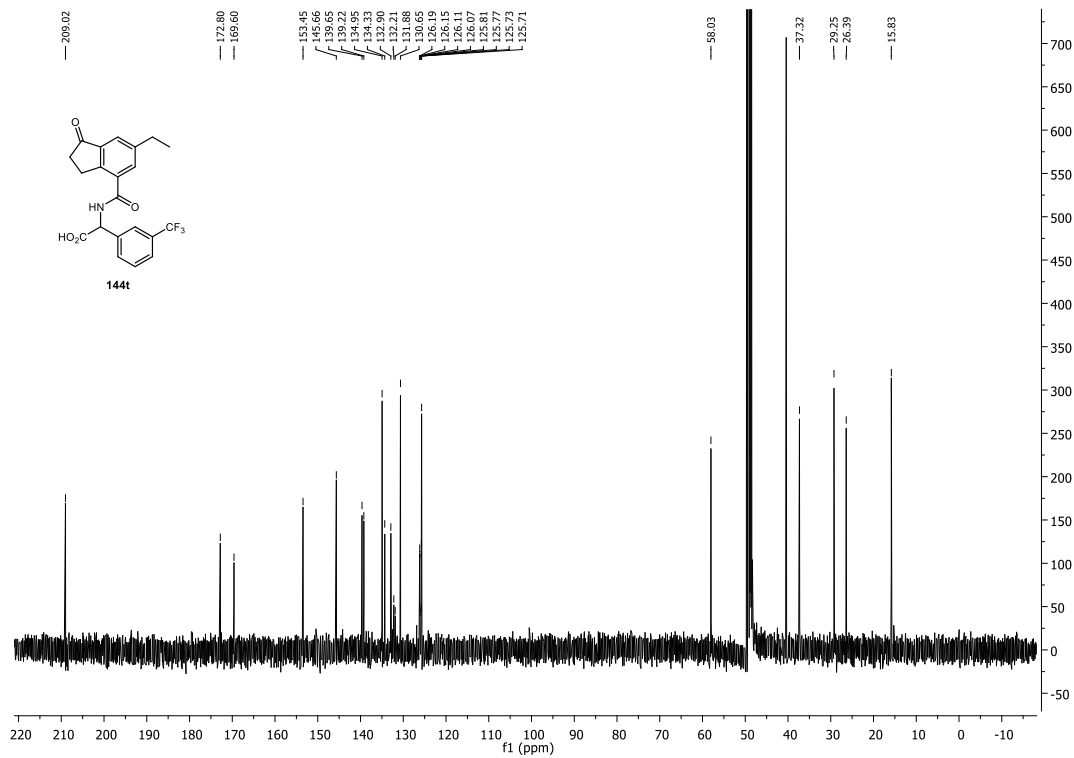
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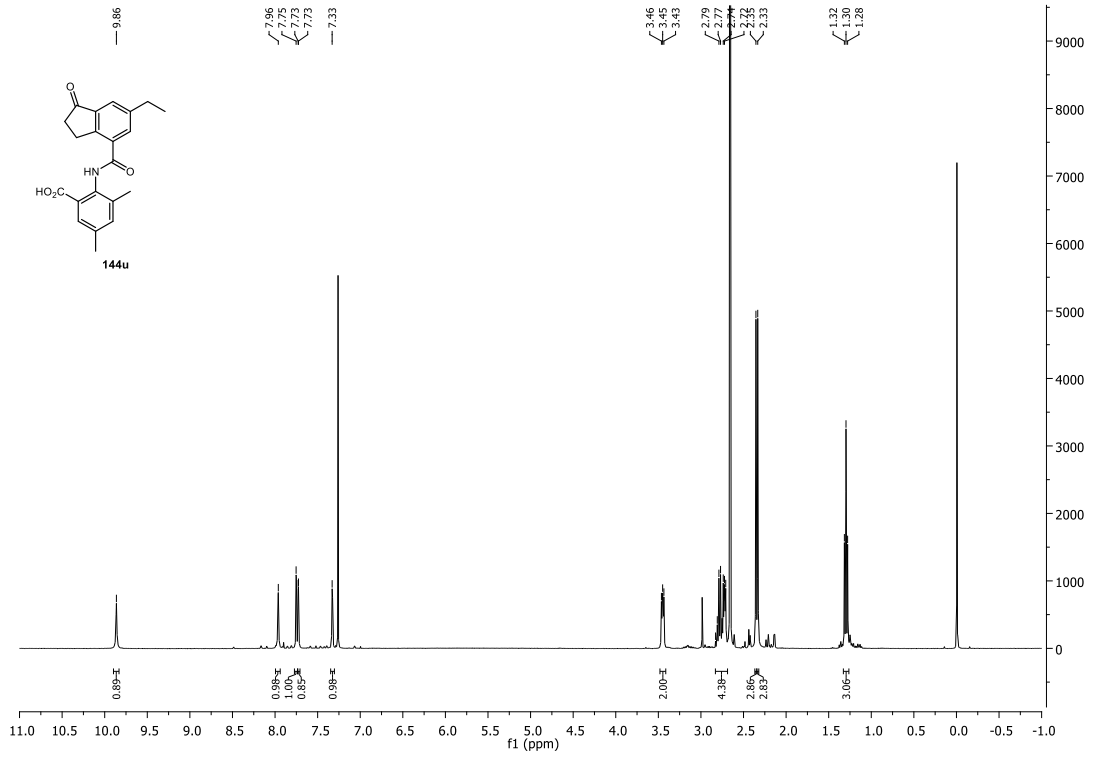
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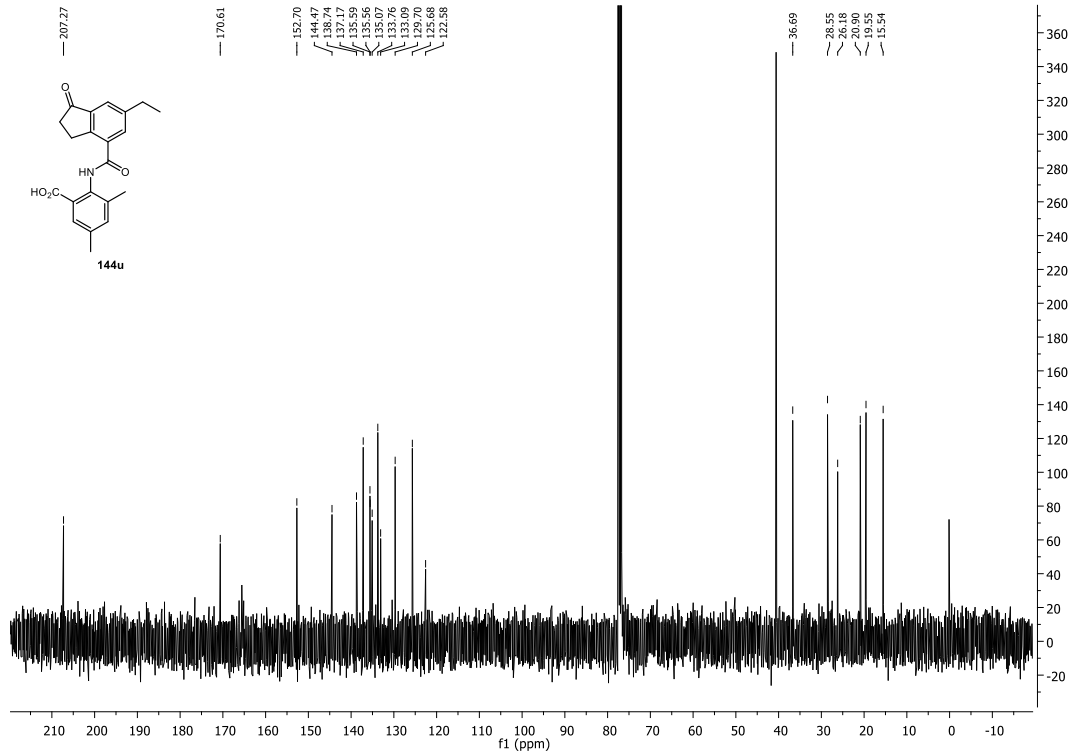
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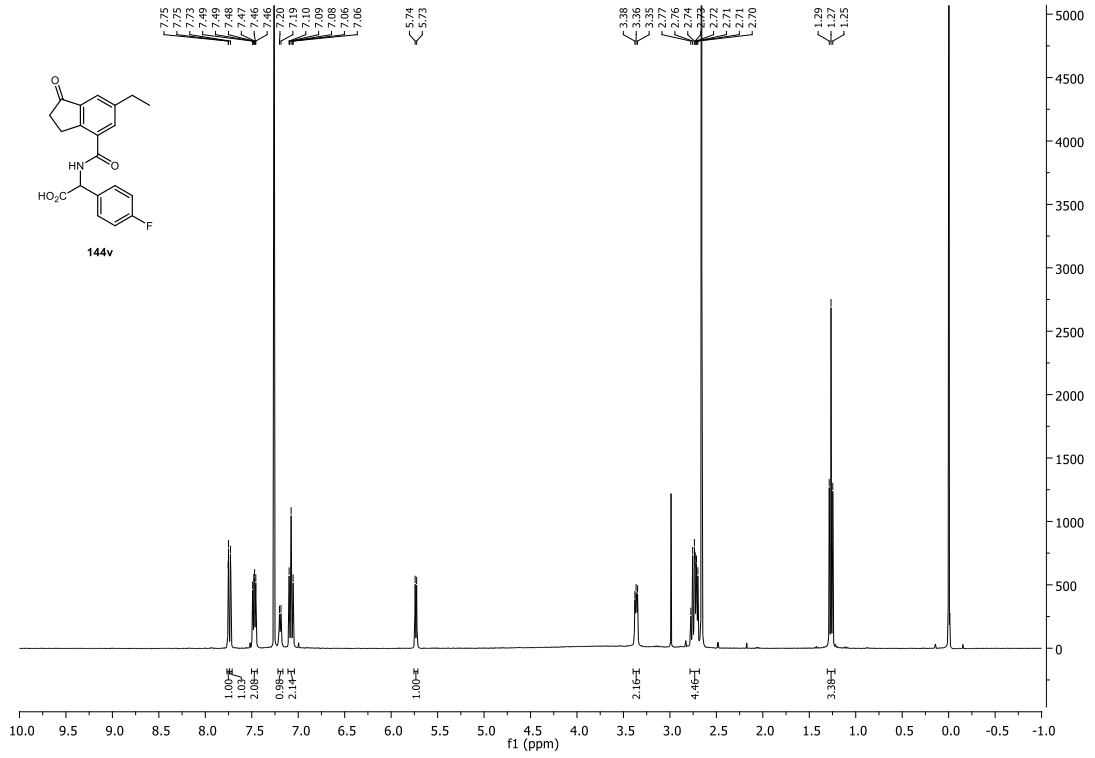
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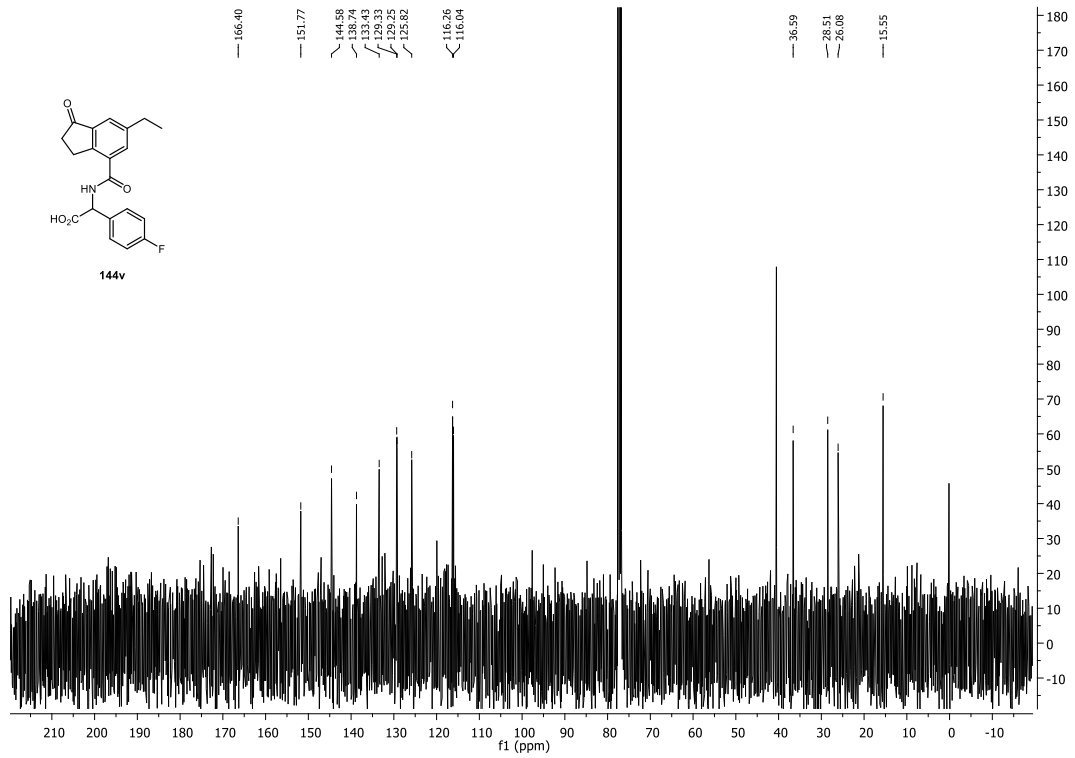
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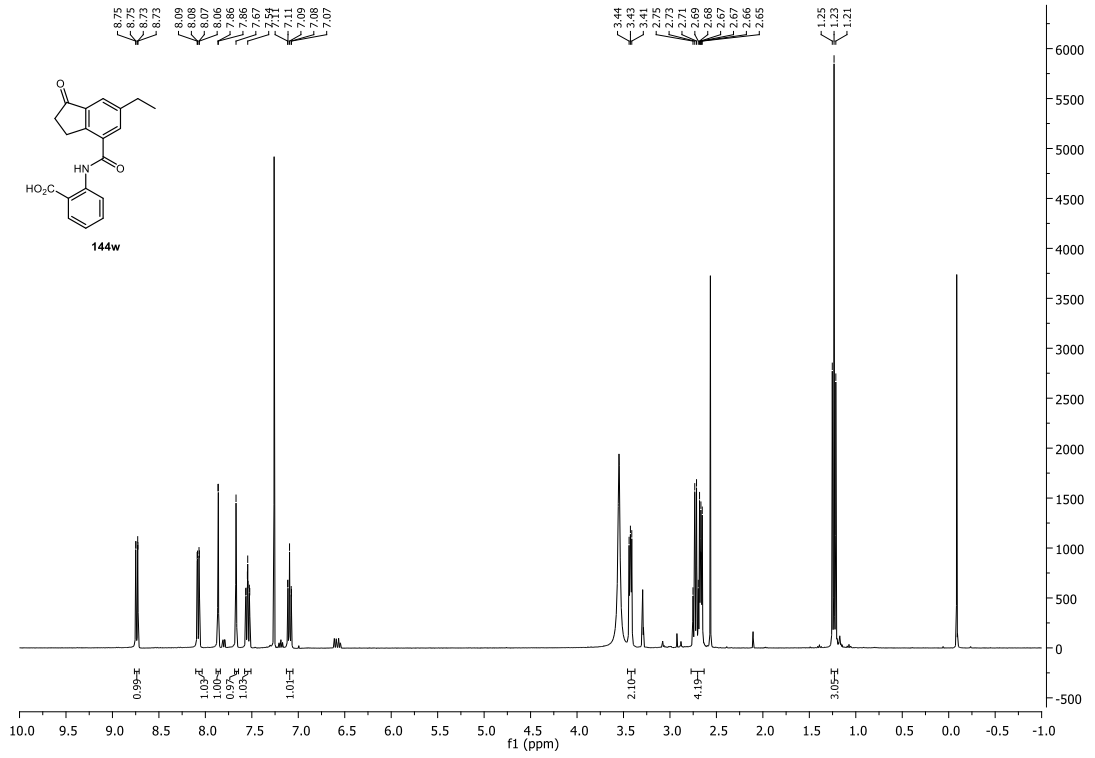
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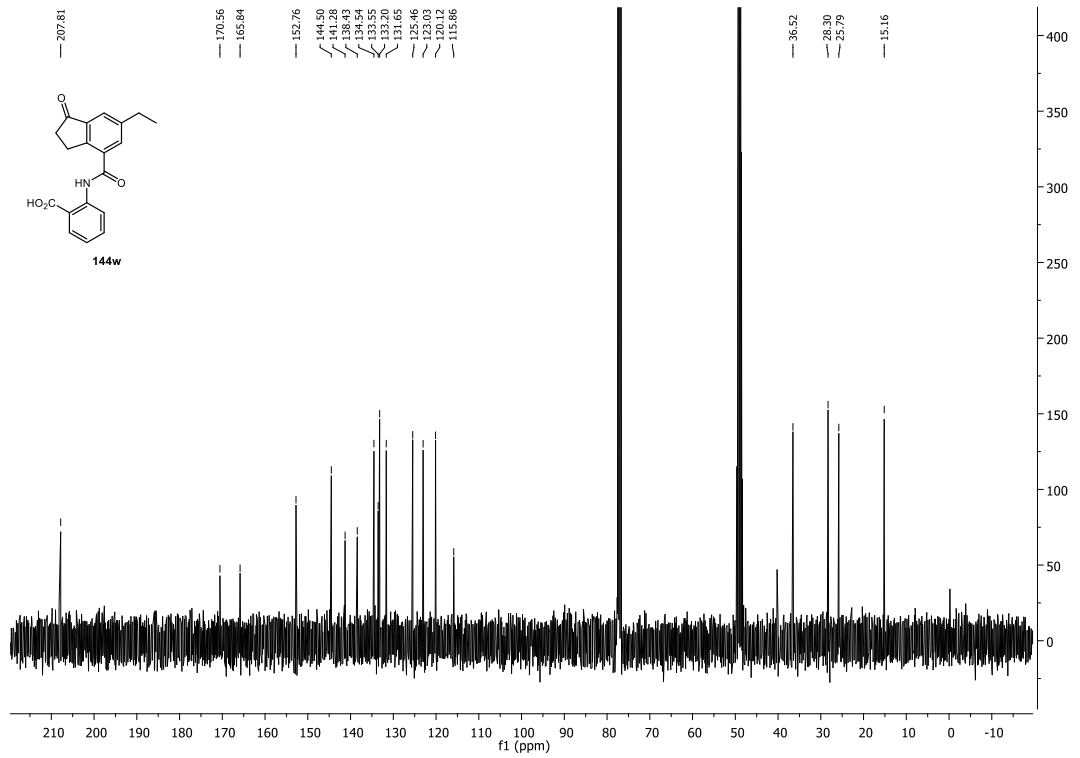
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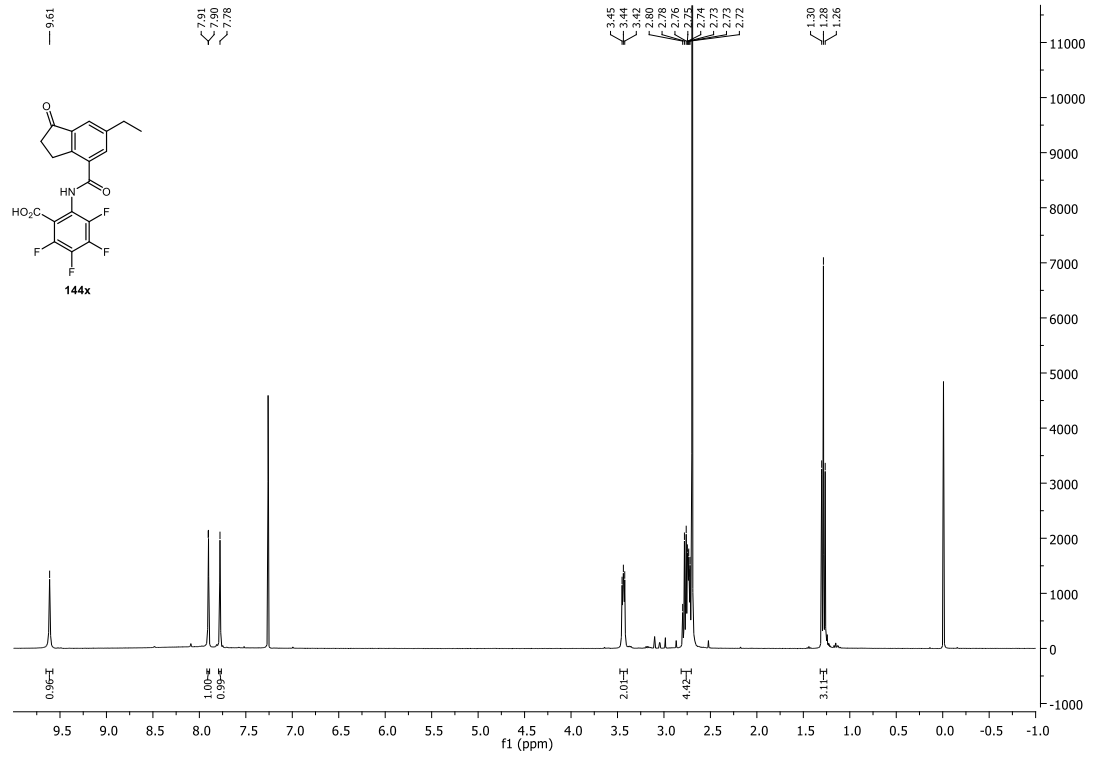
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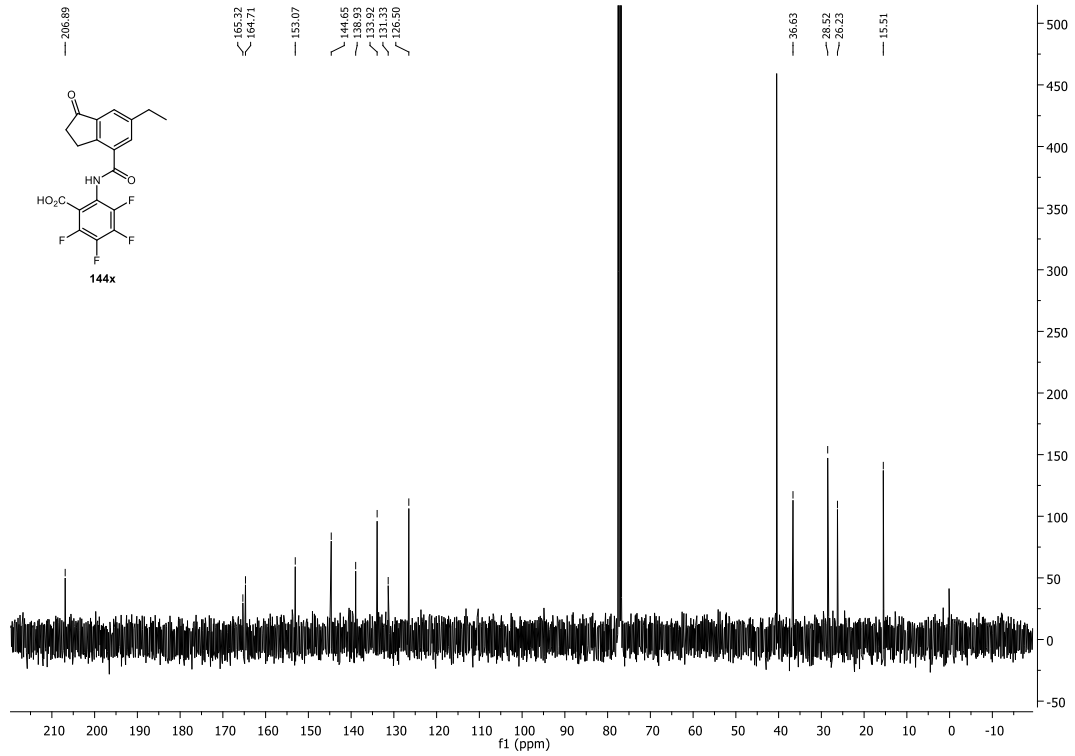
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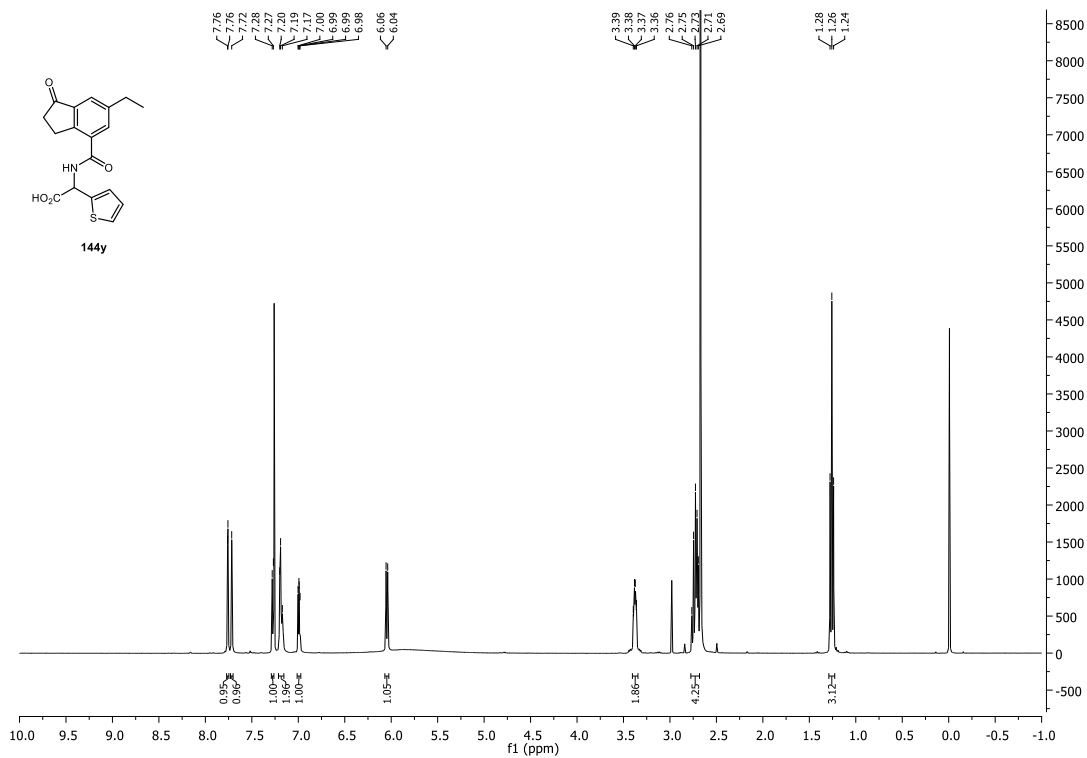
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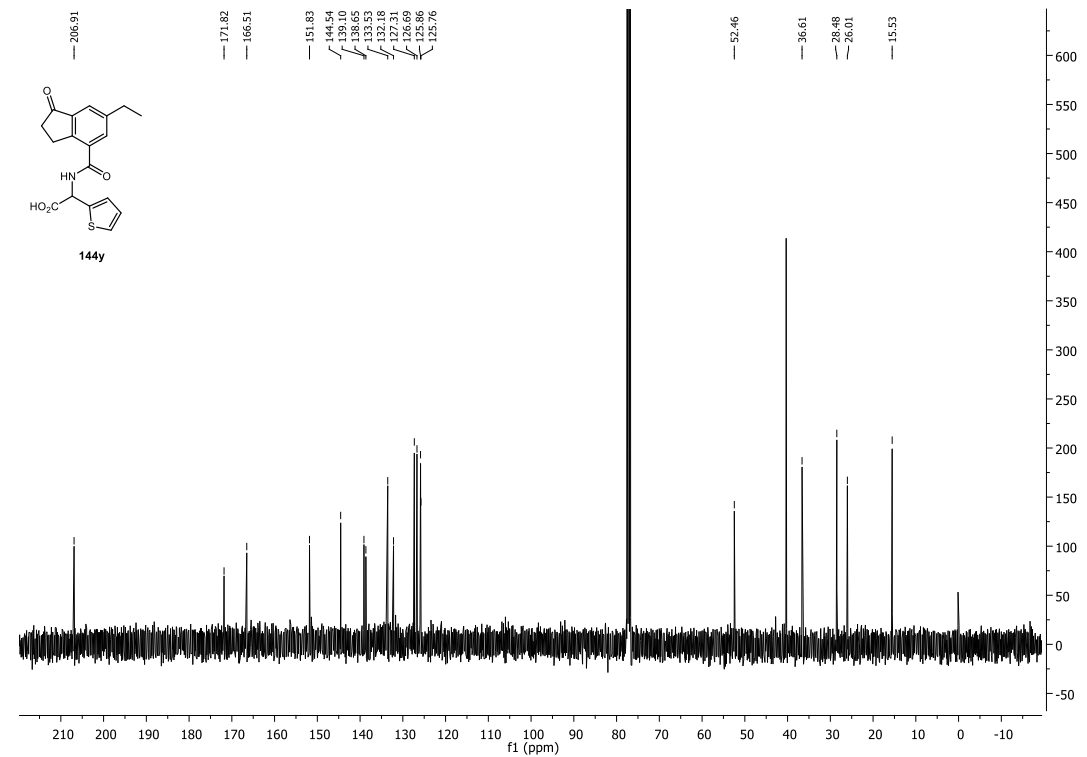
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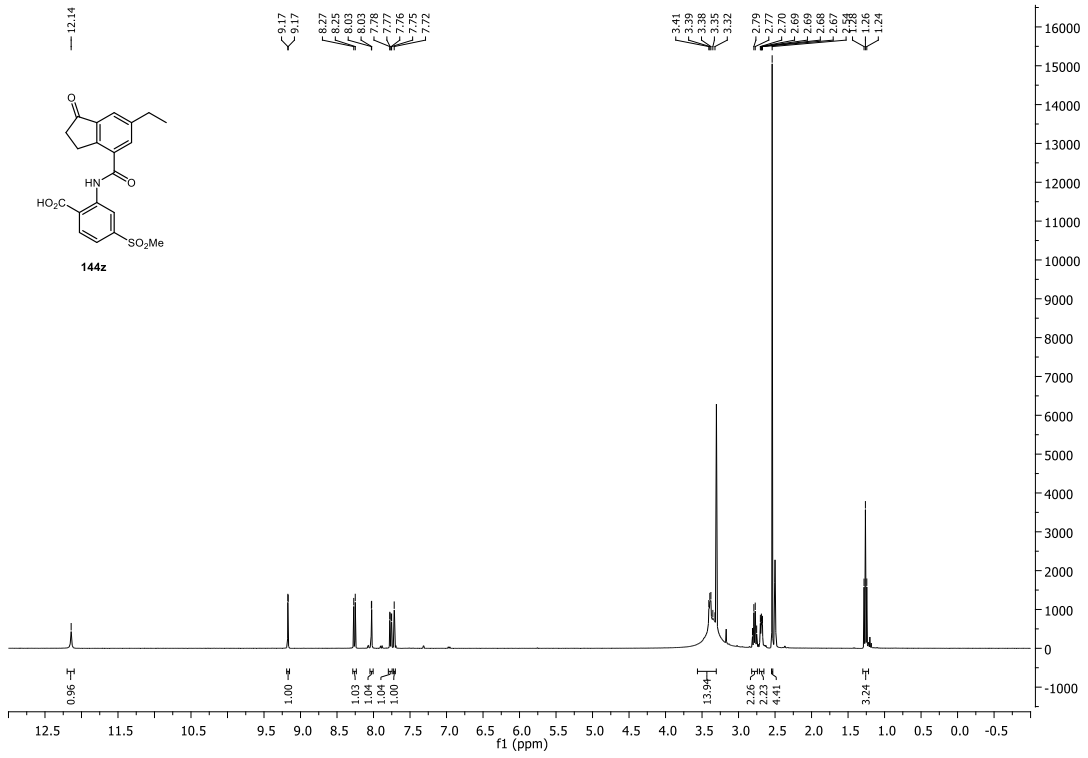
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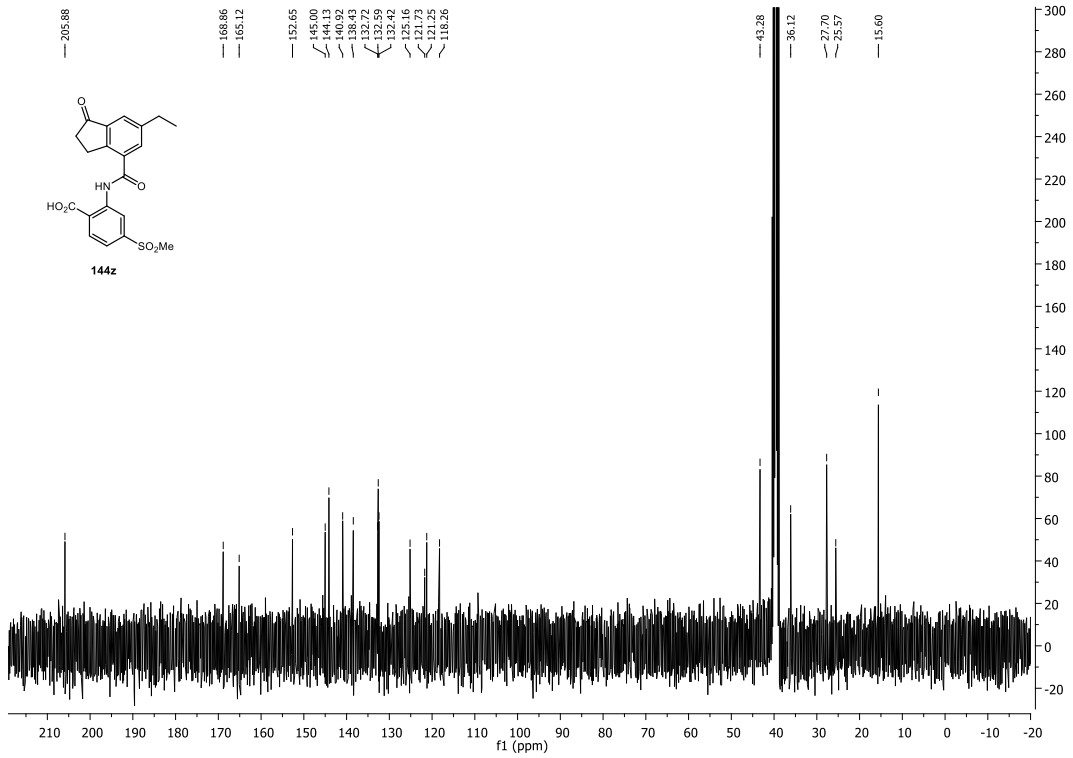
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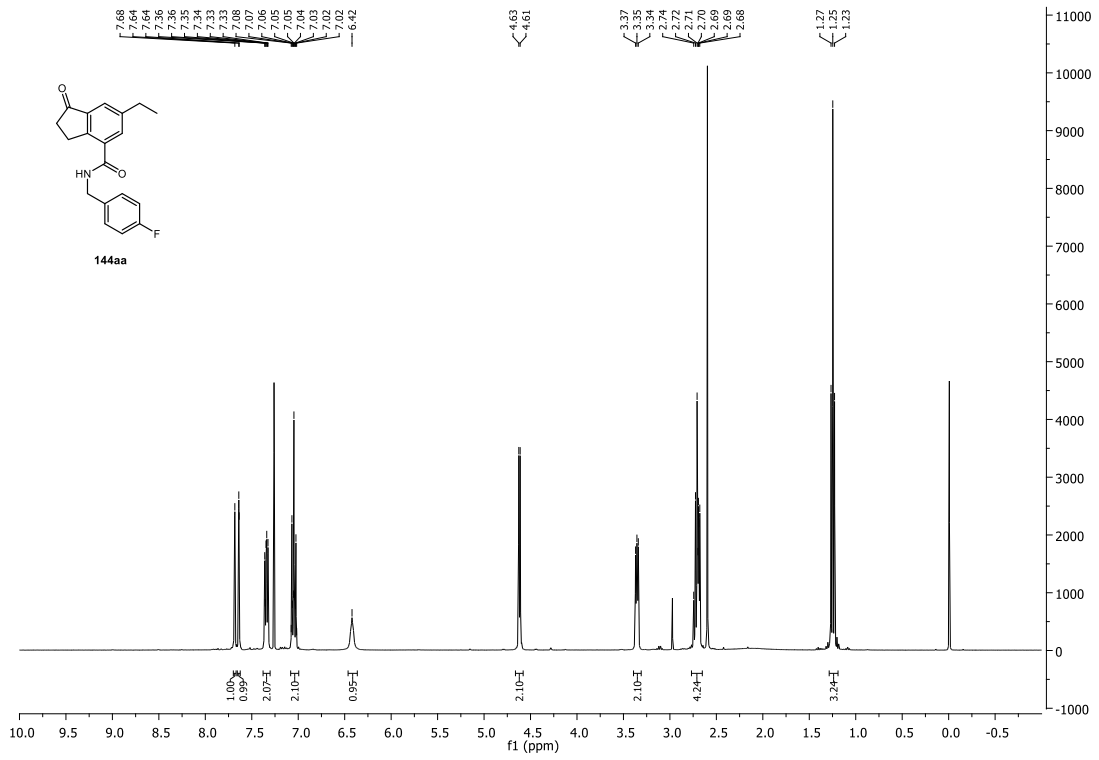
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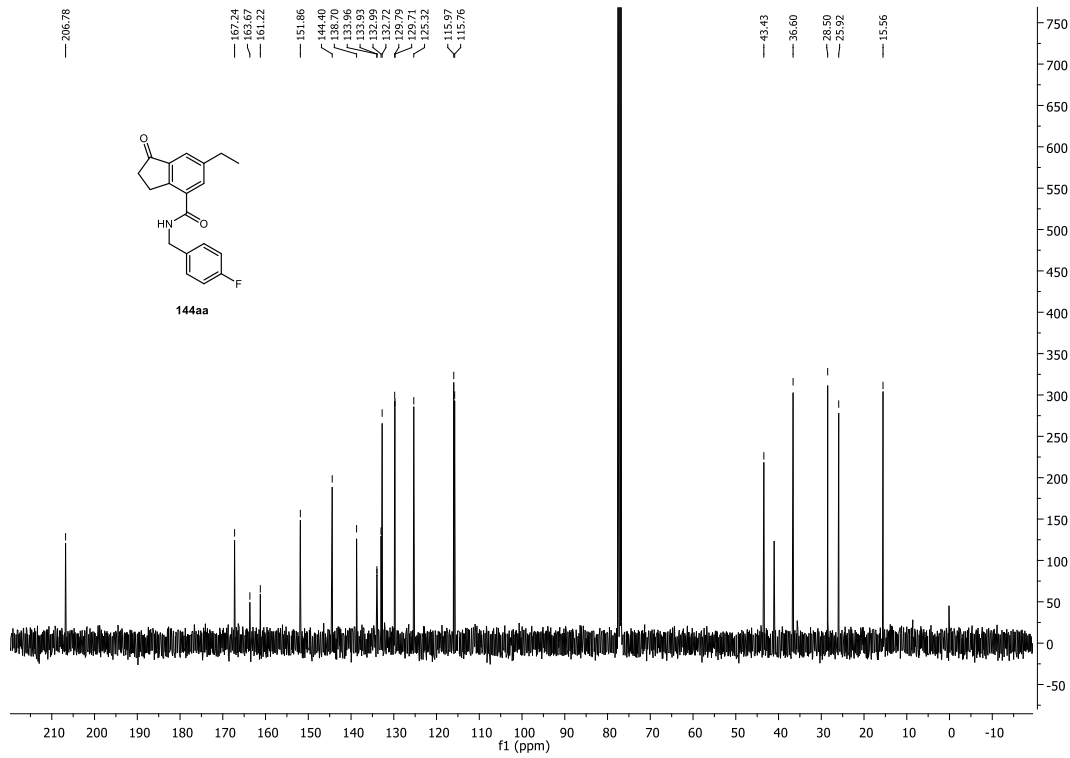
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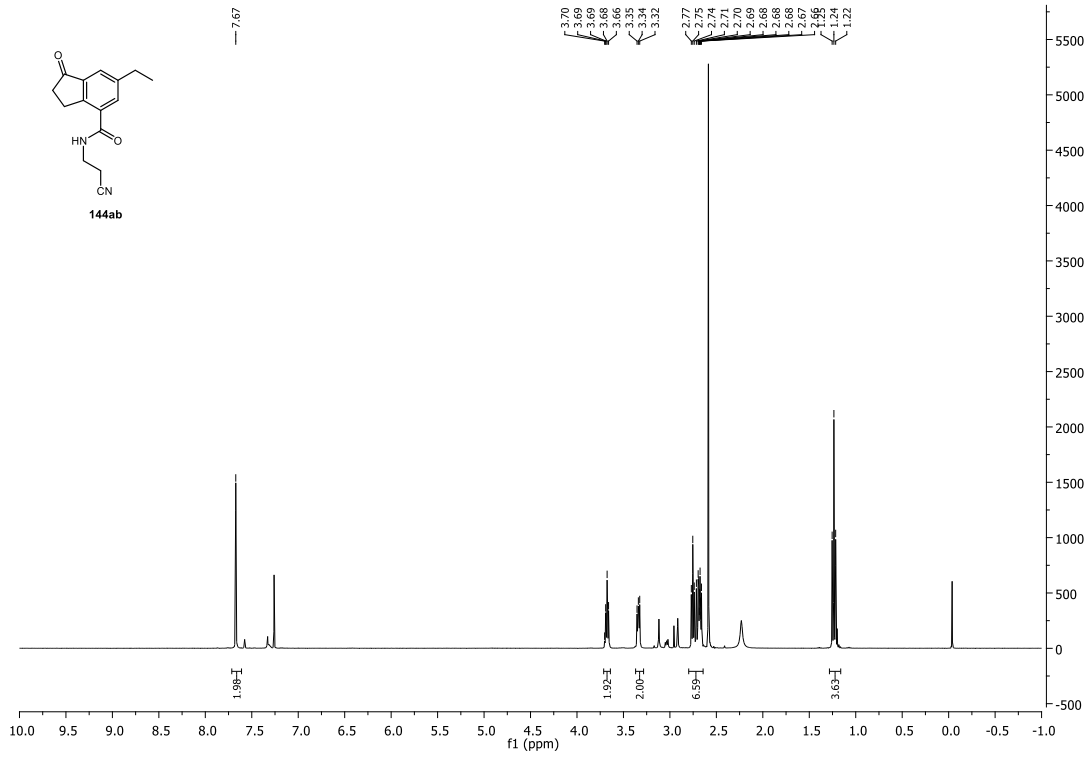
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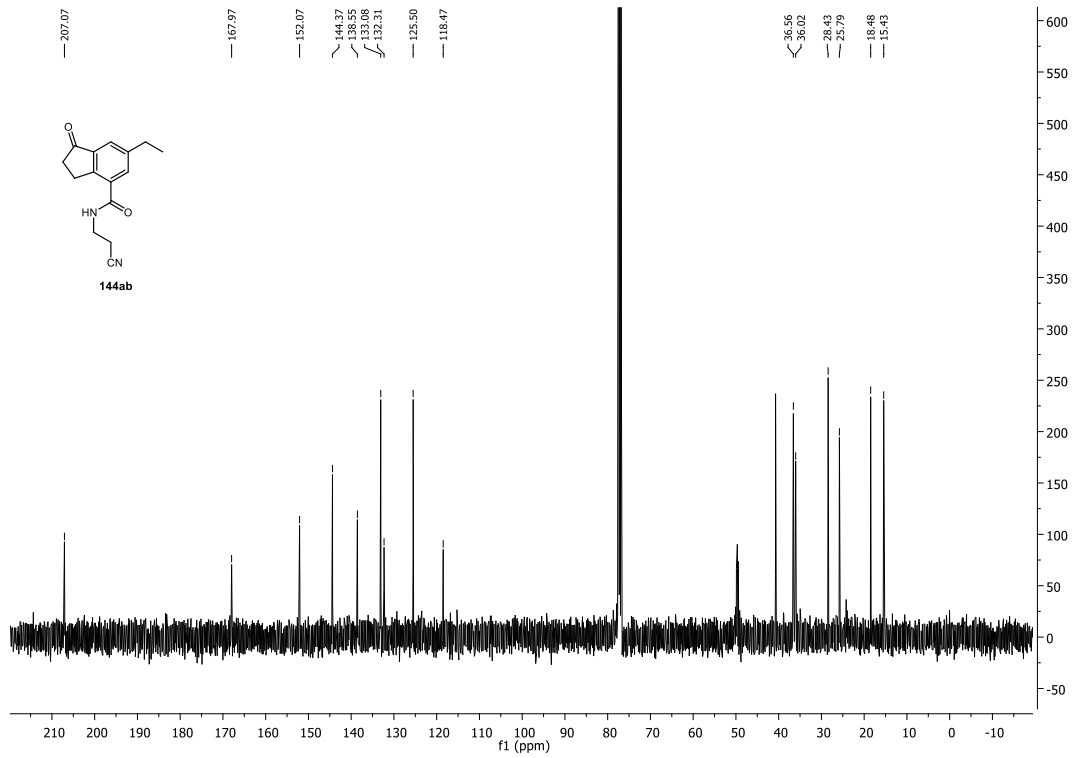
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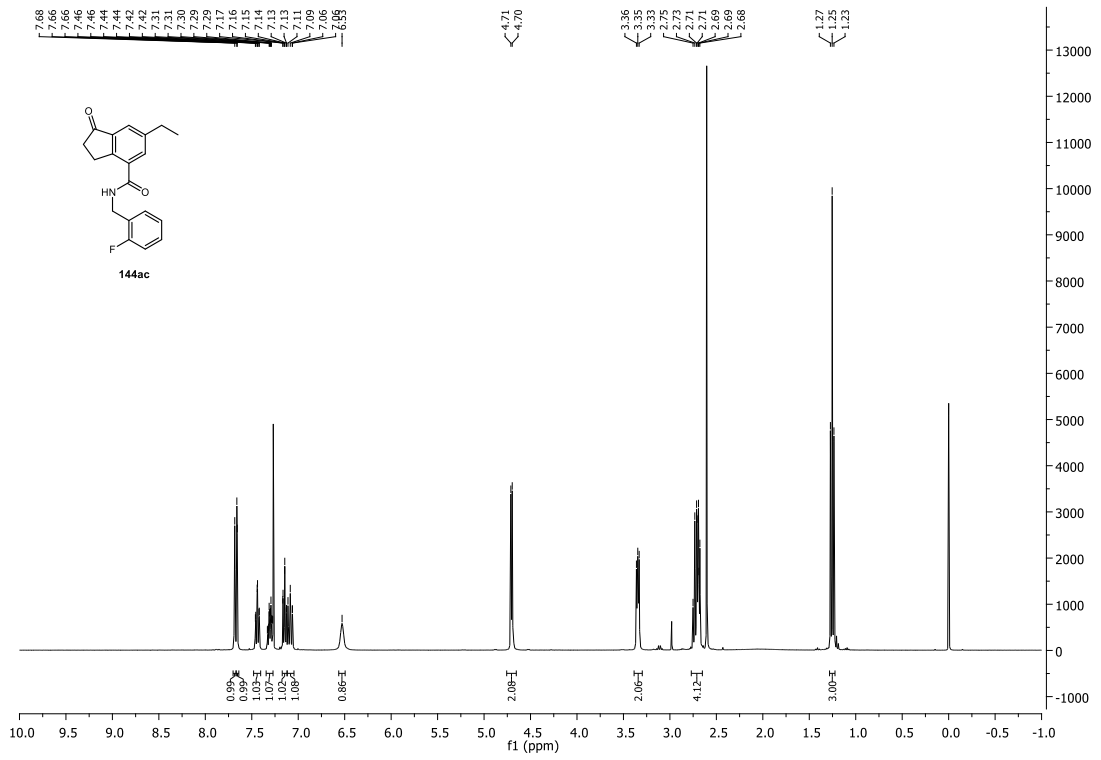
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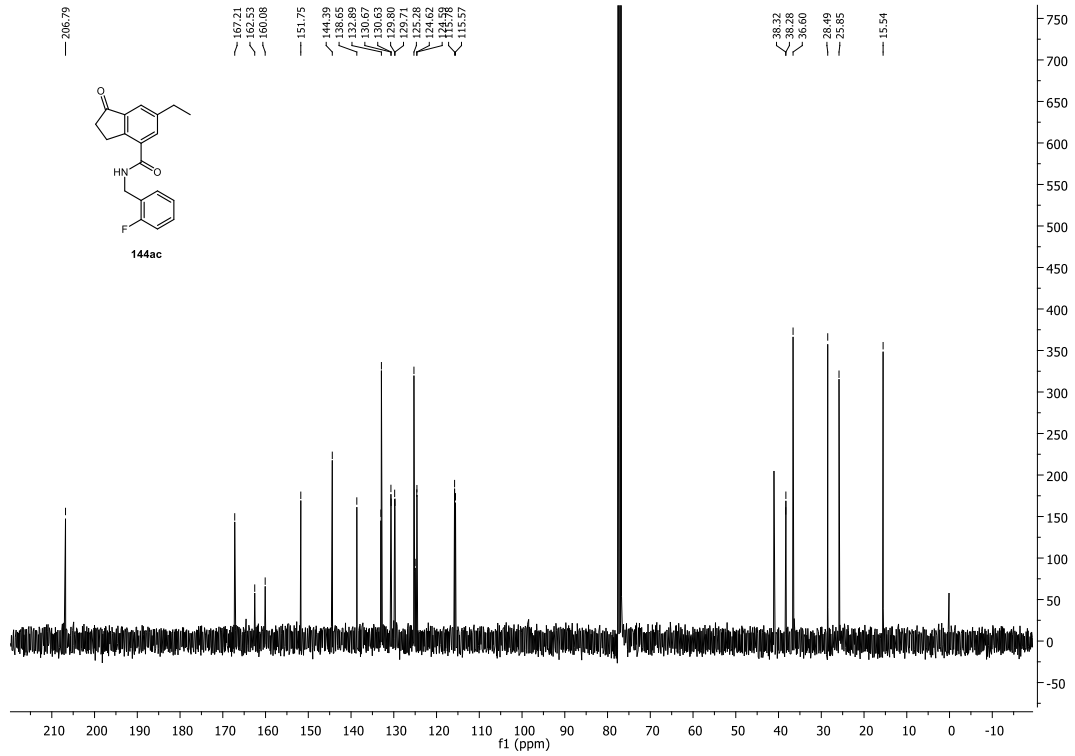
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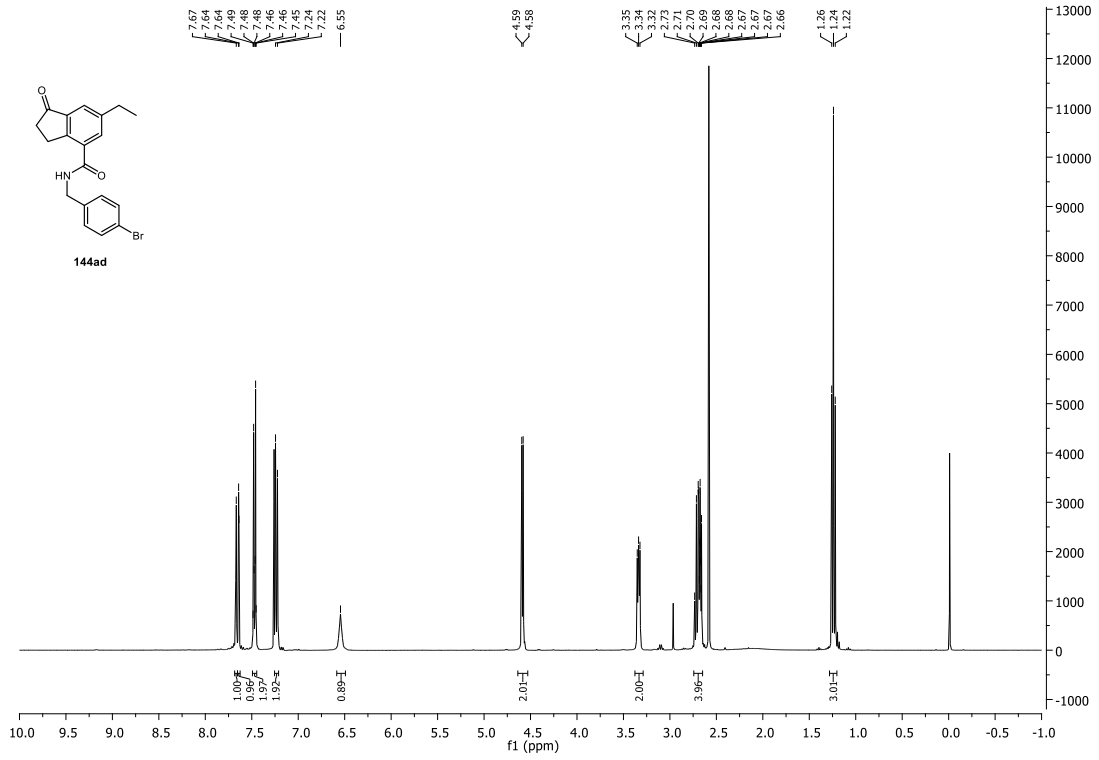
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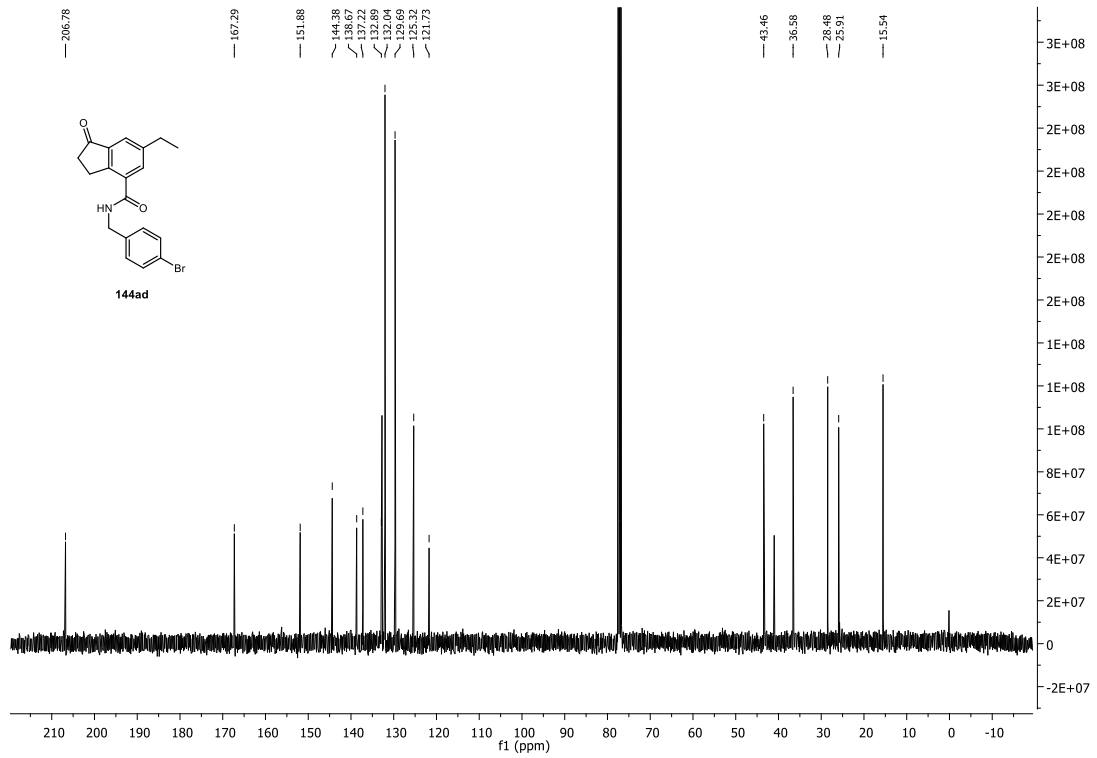
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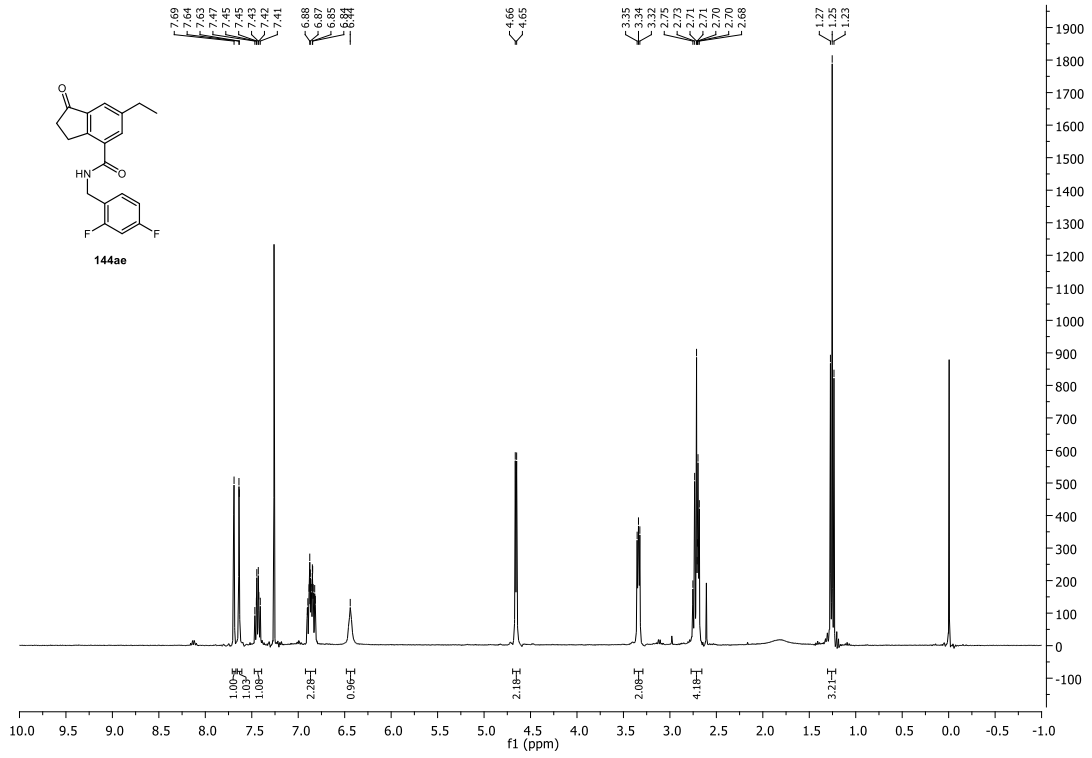
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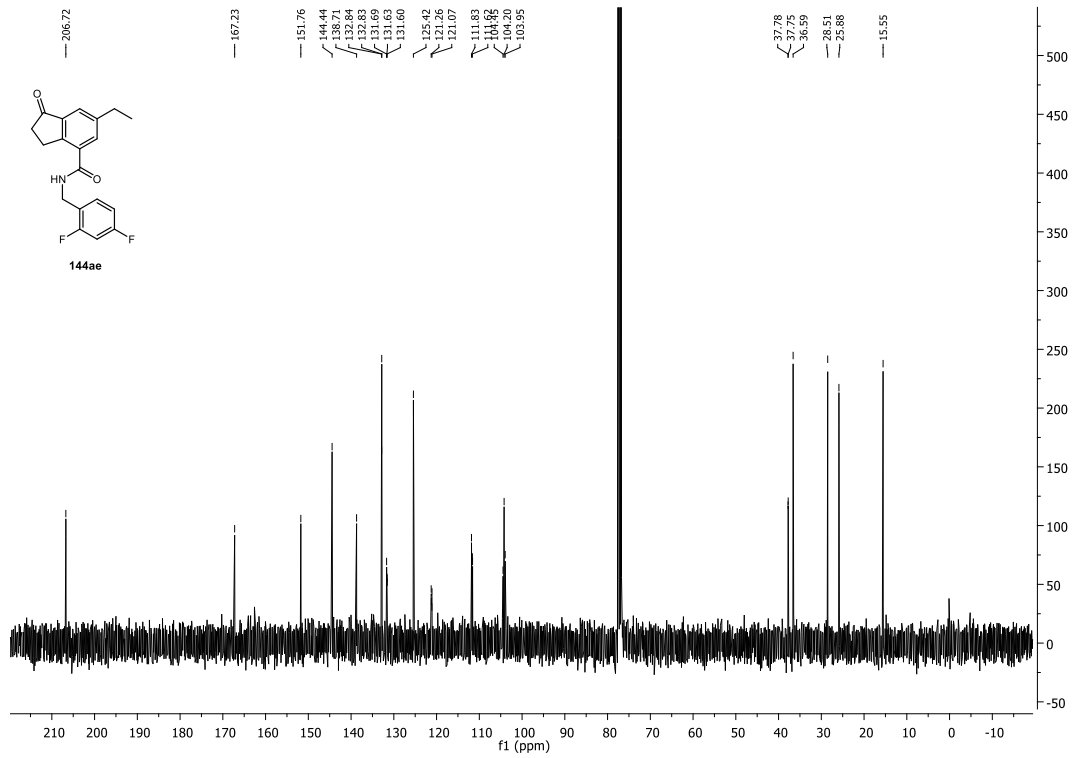
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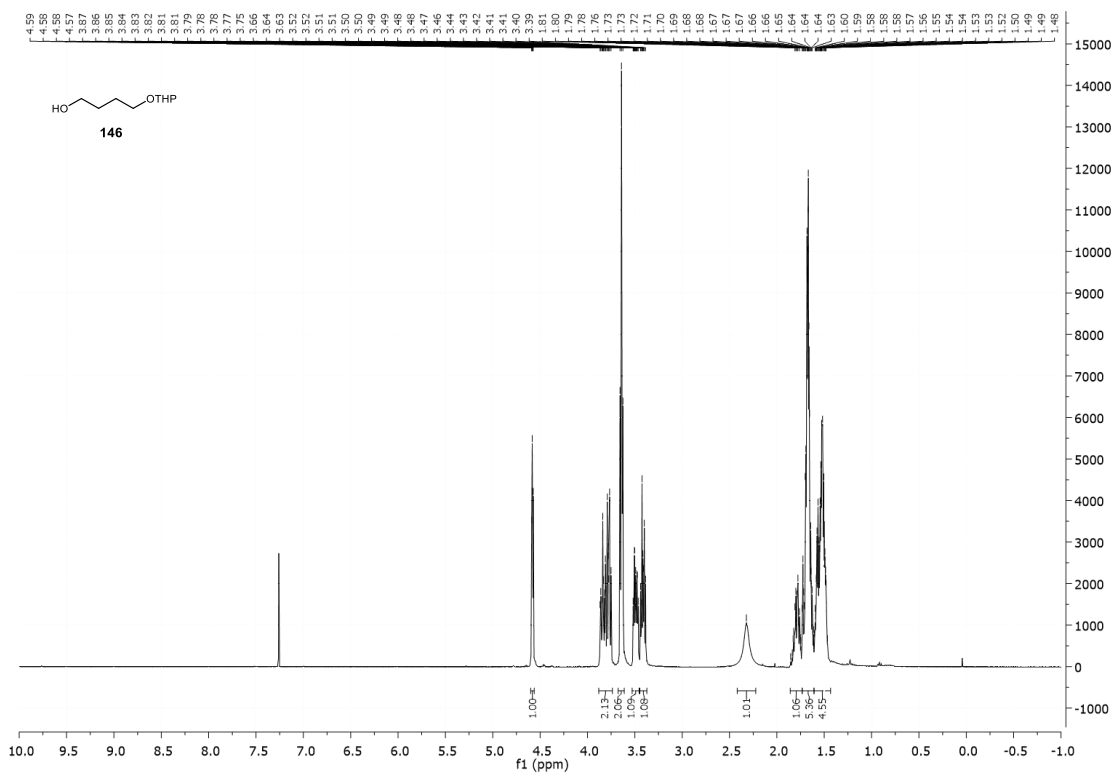
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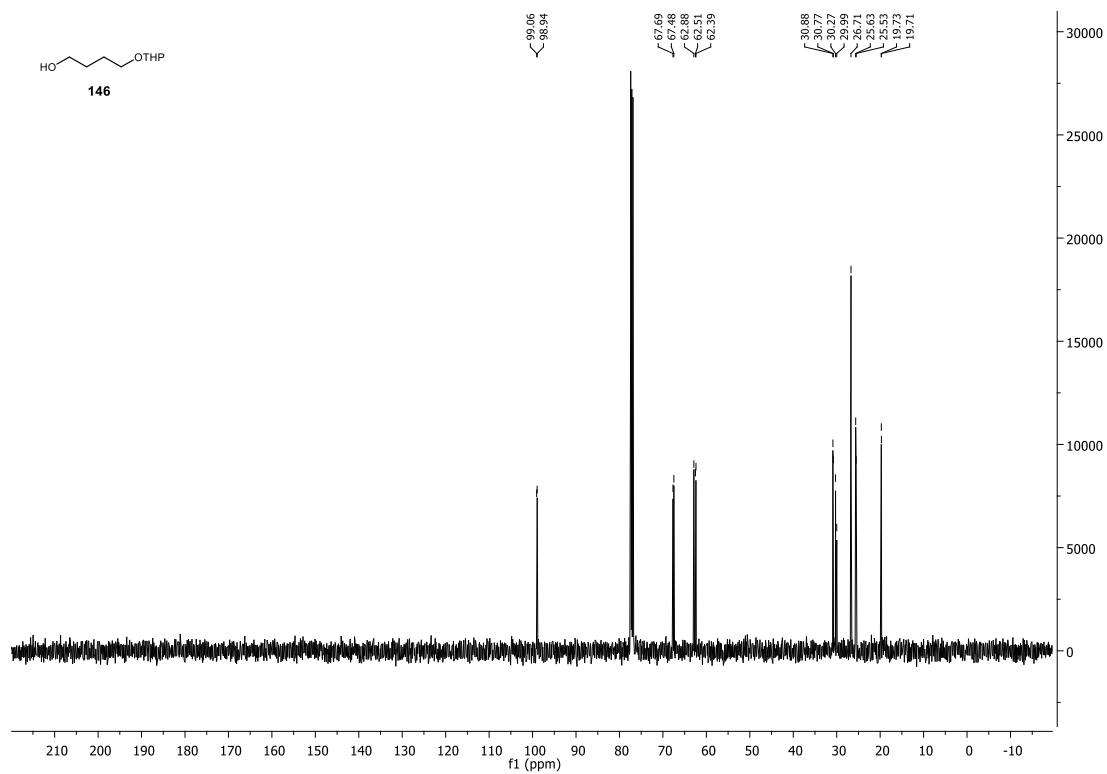
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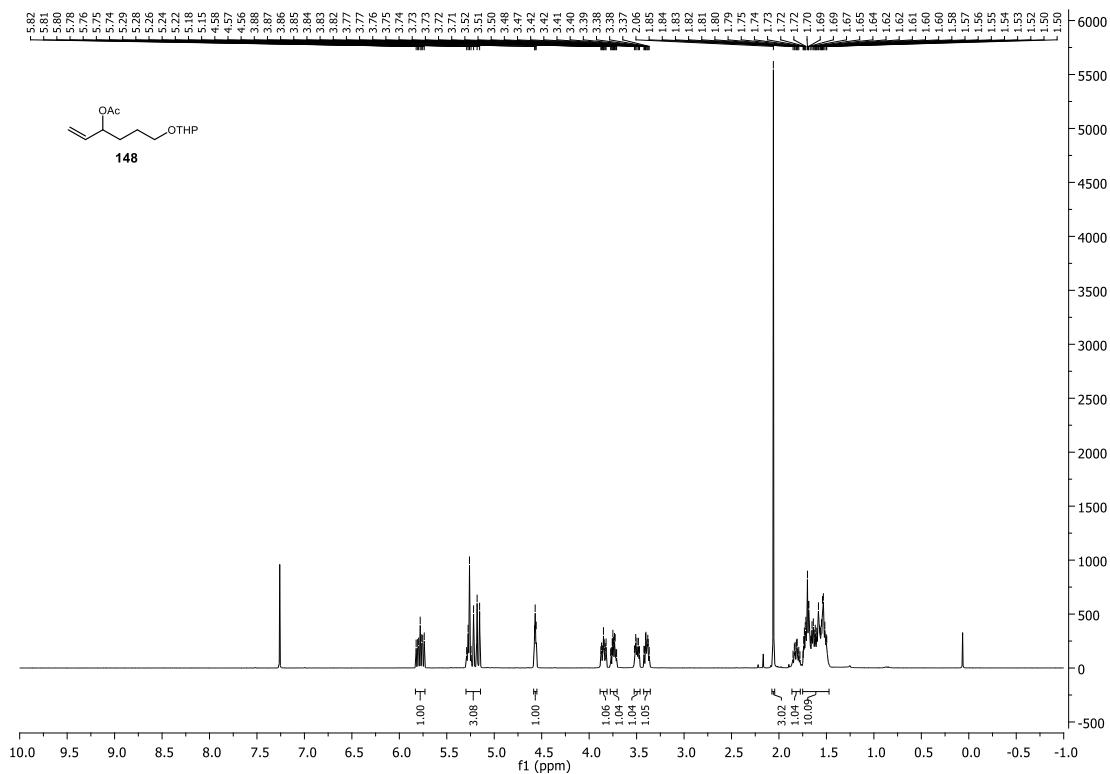
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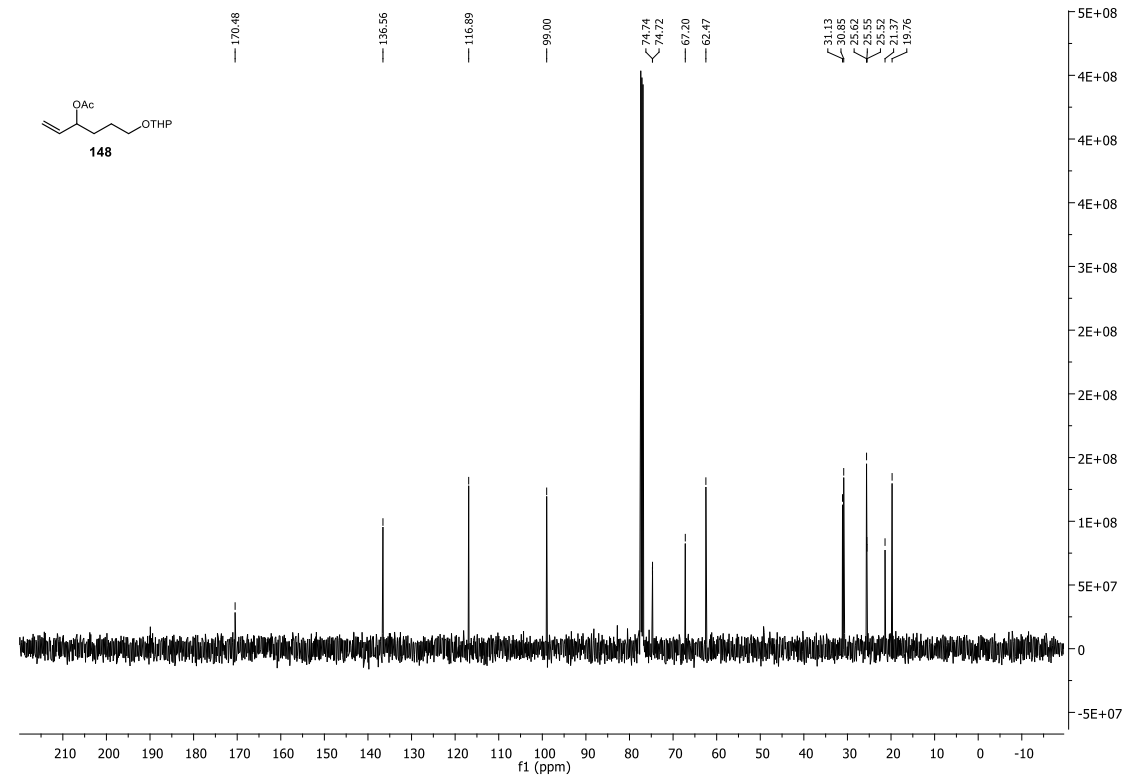
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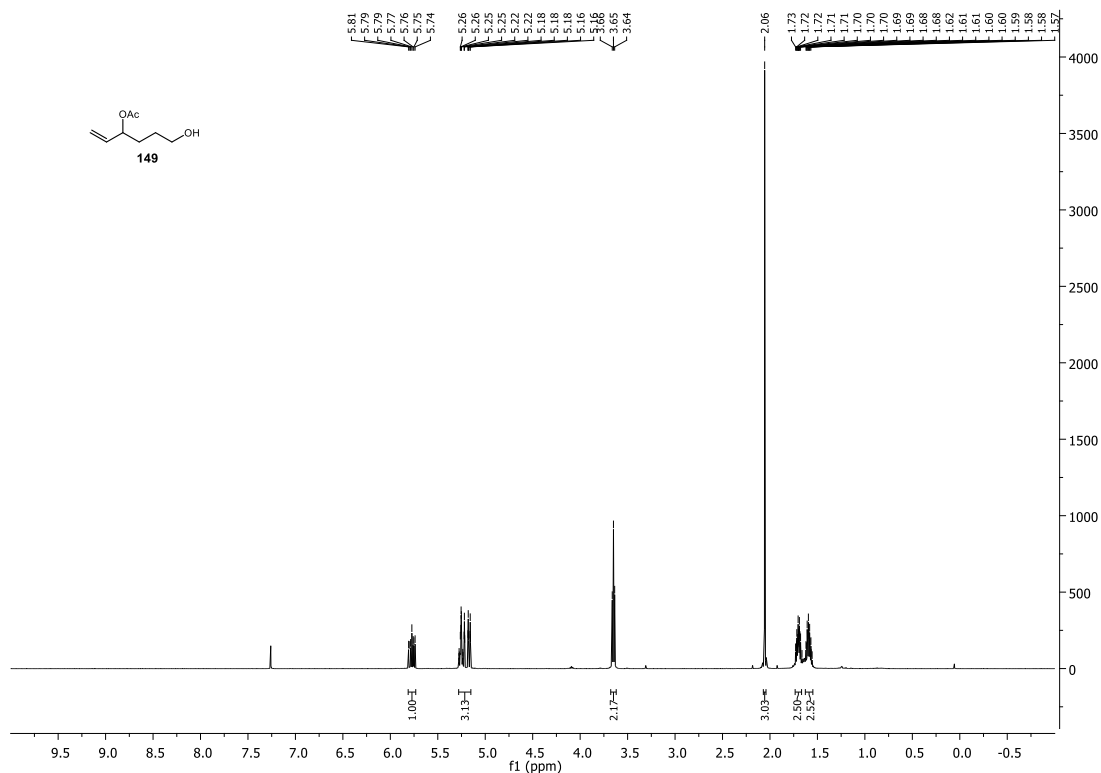
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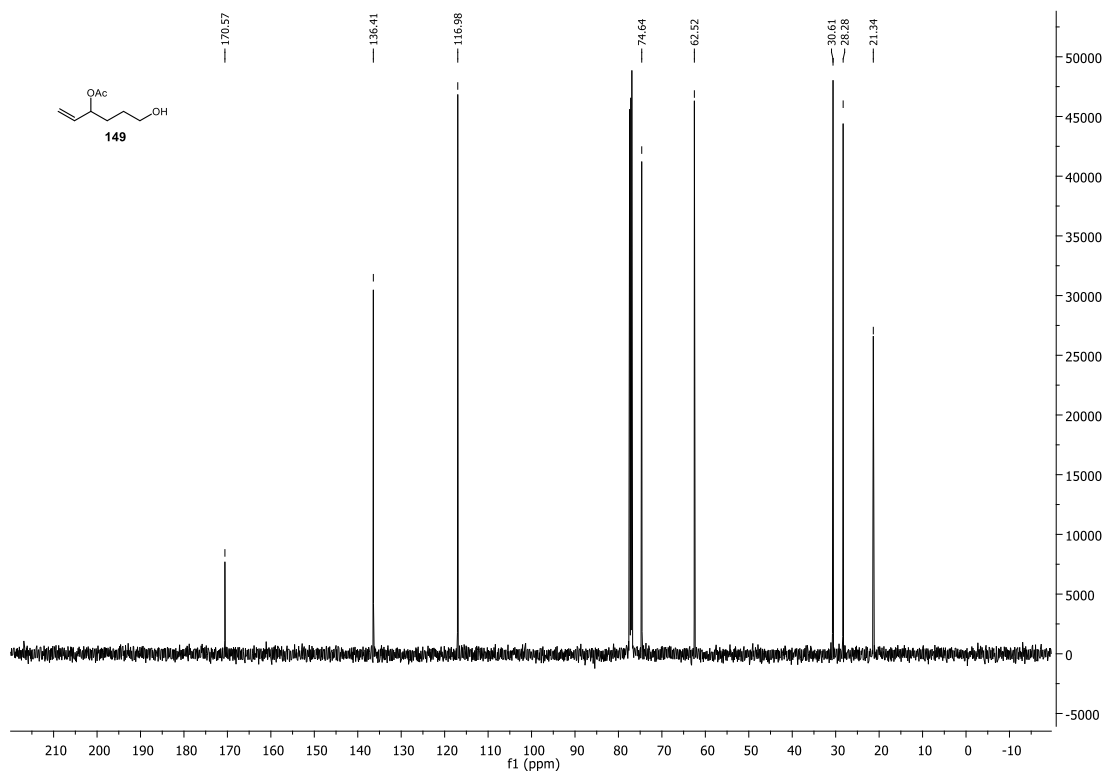
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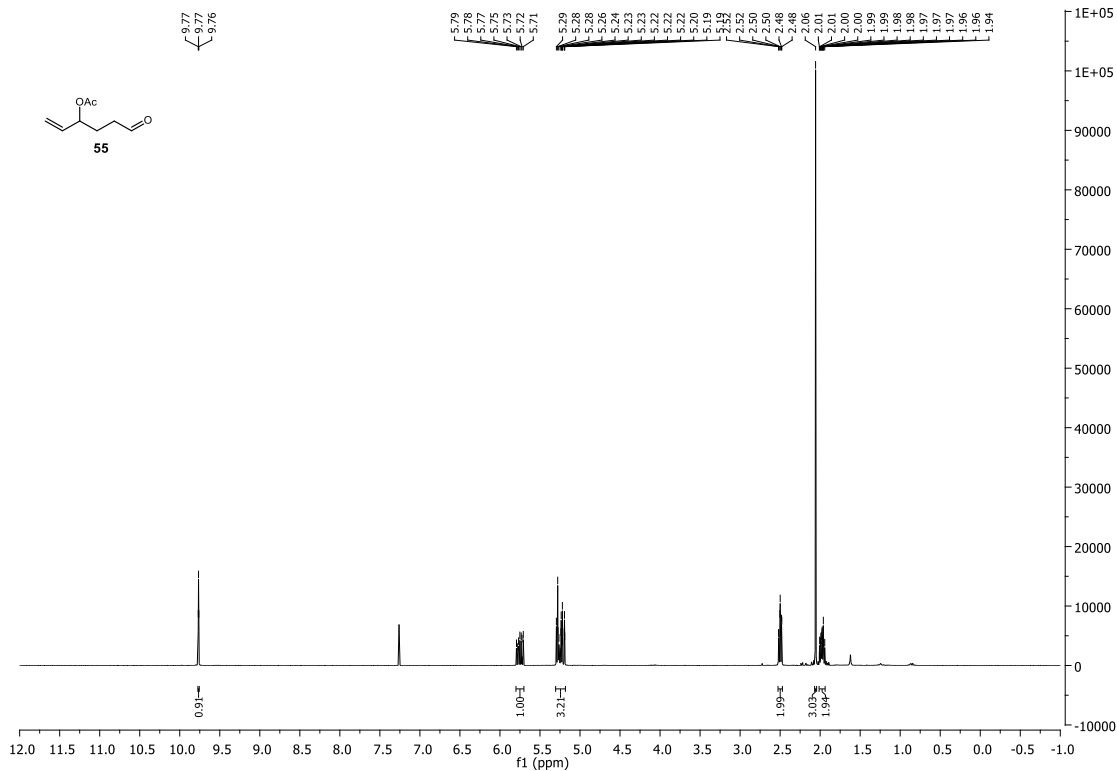
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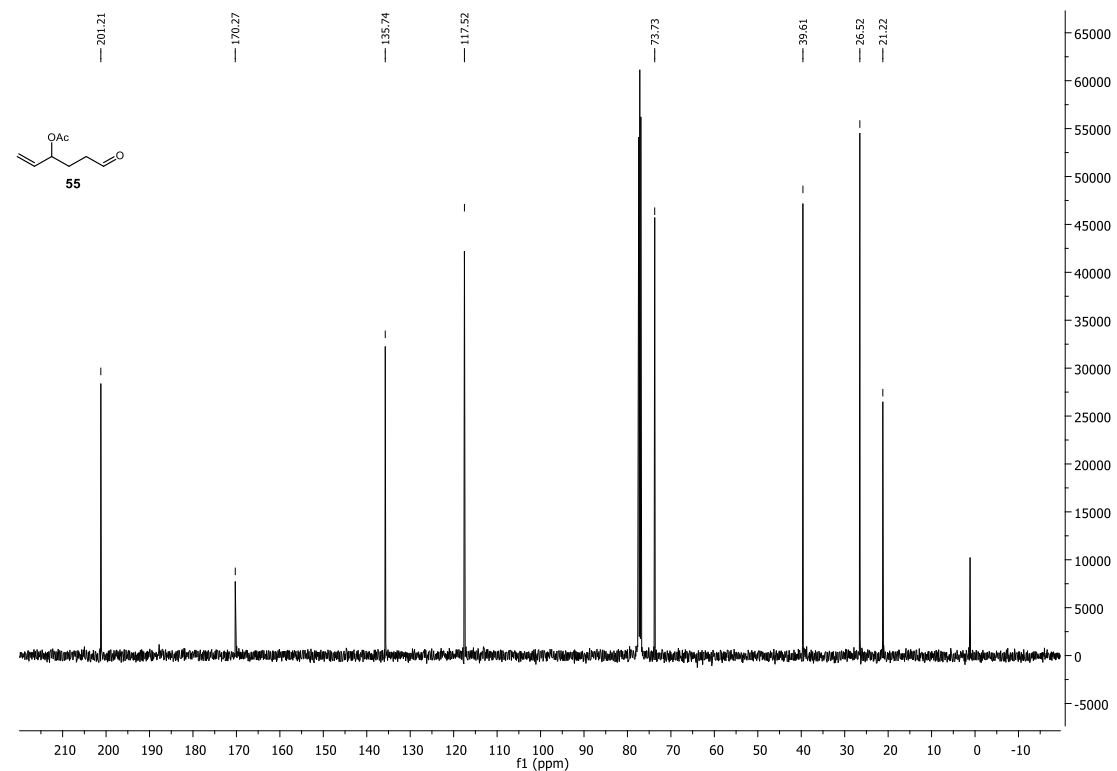
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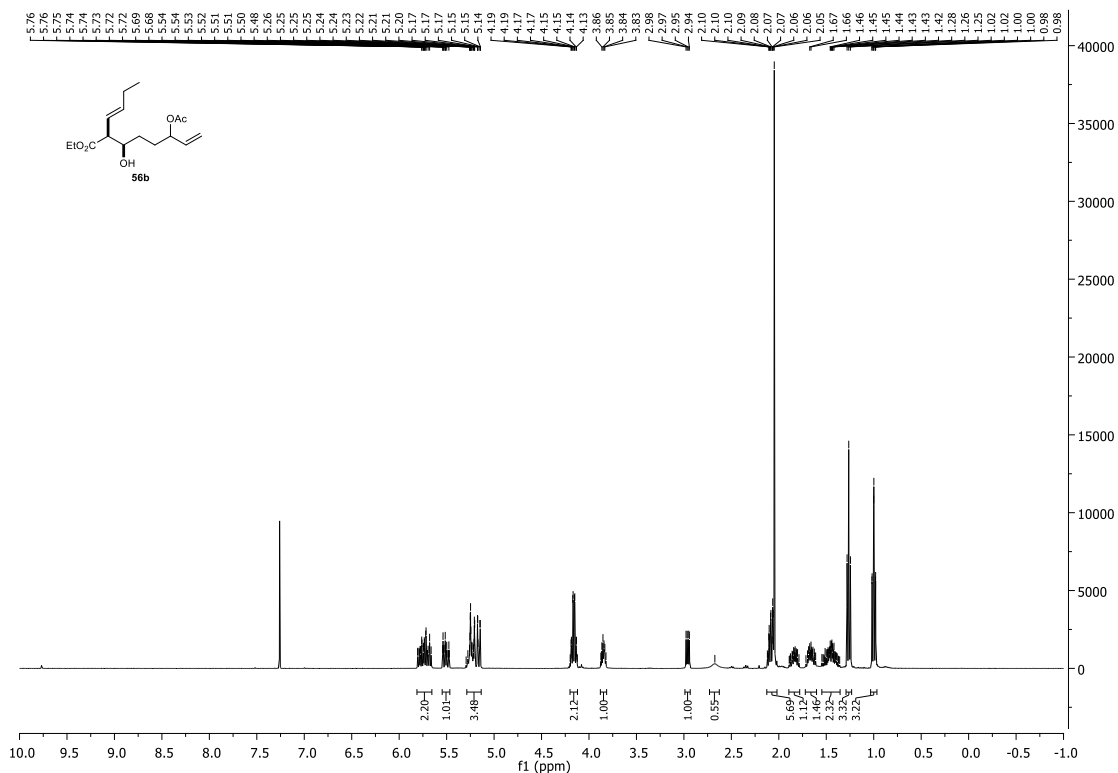
¹H NMR 55.



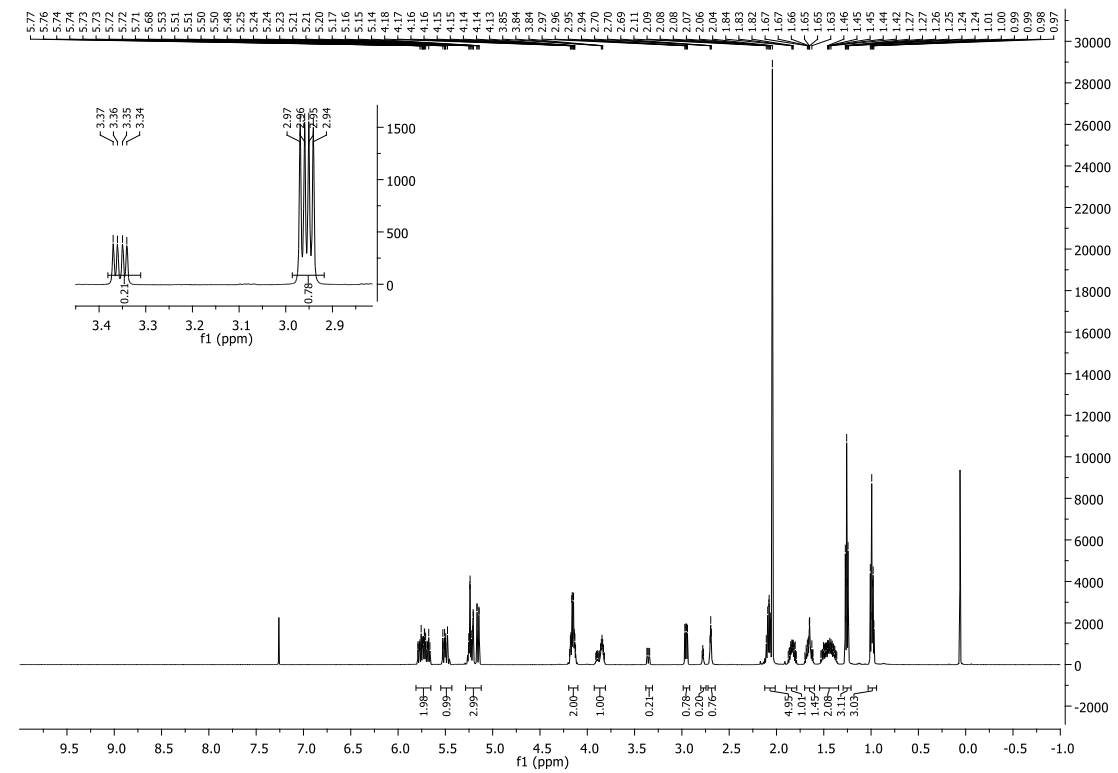
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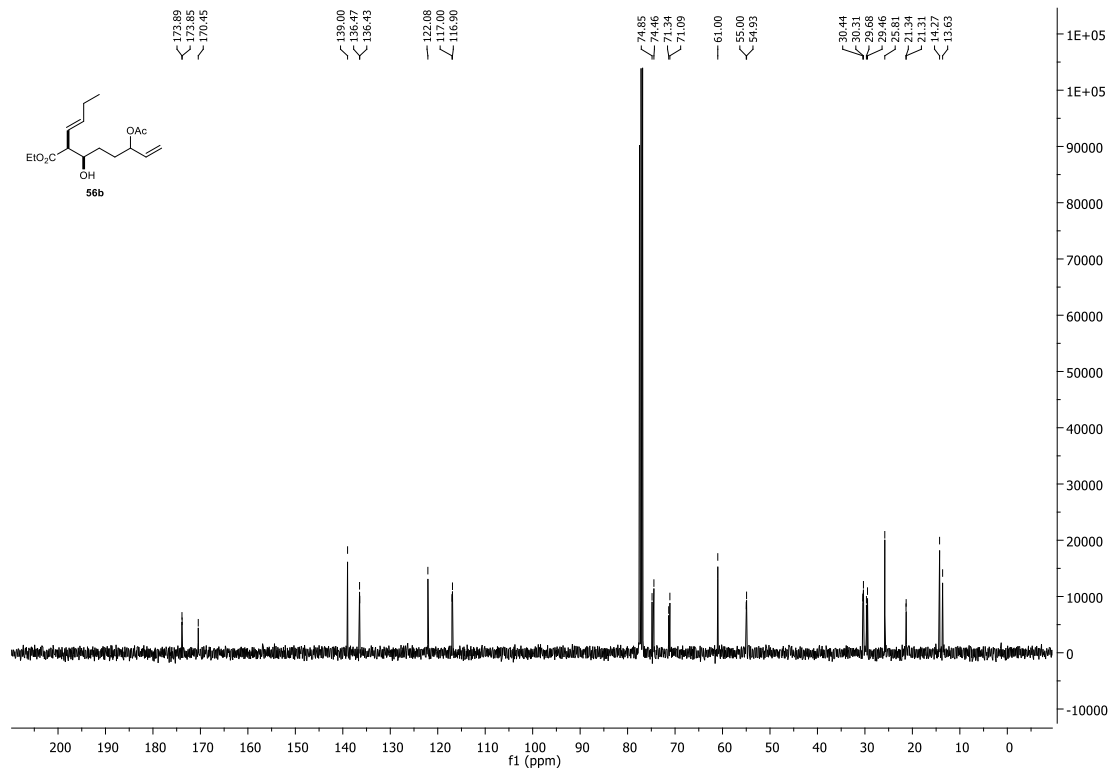
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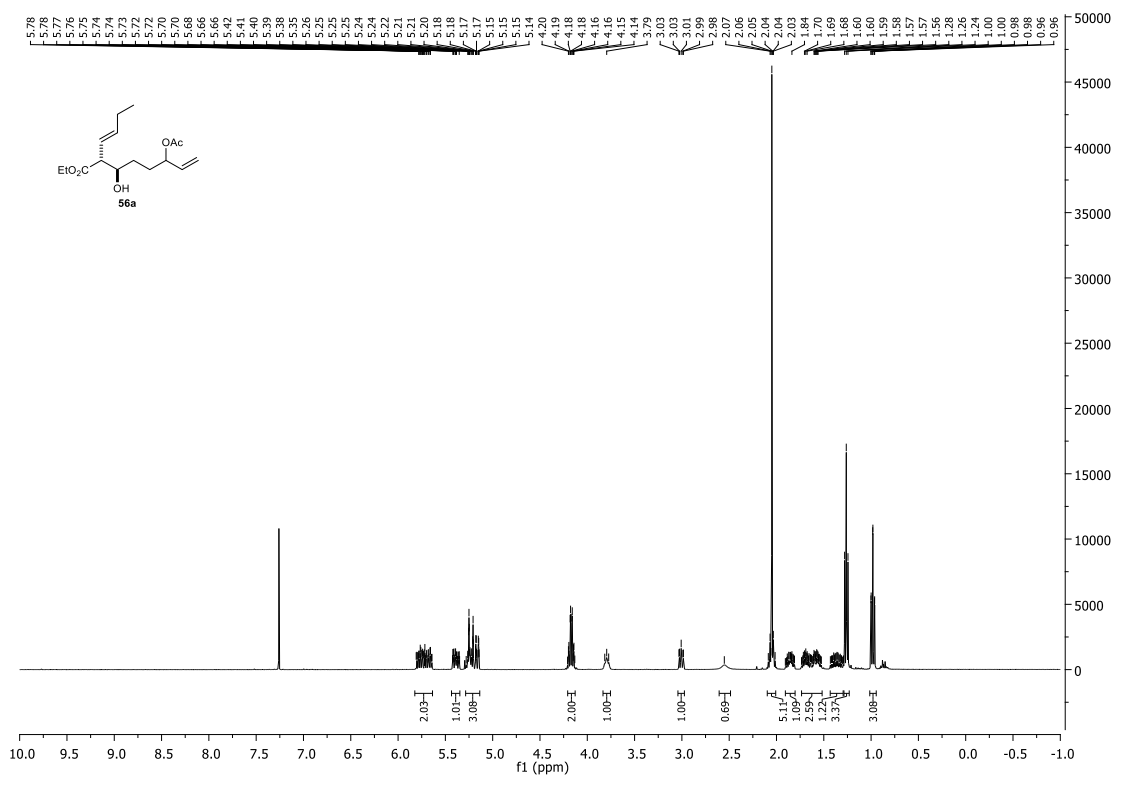
¹H NMR 56b showing alkene isomerization.



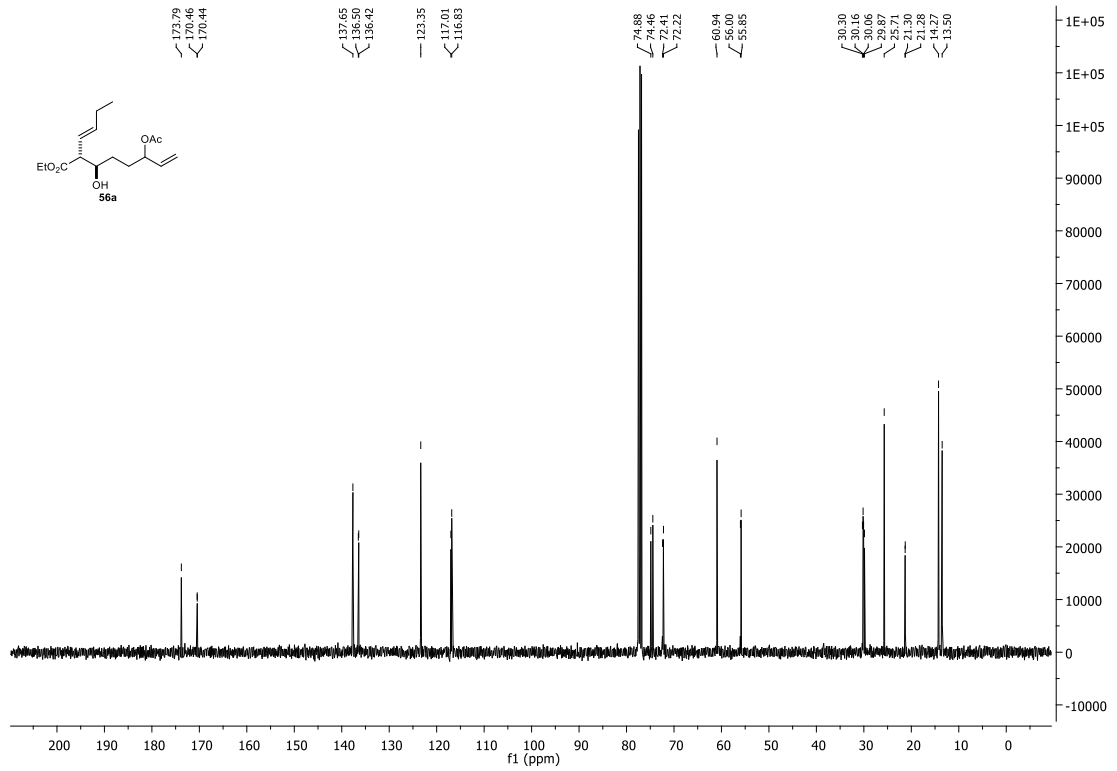
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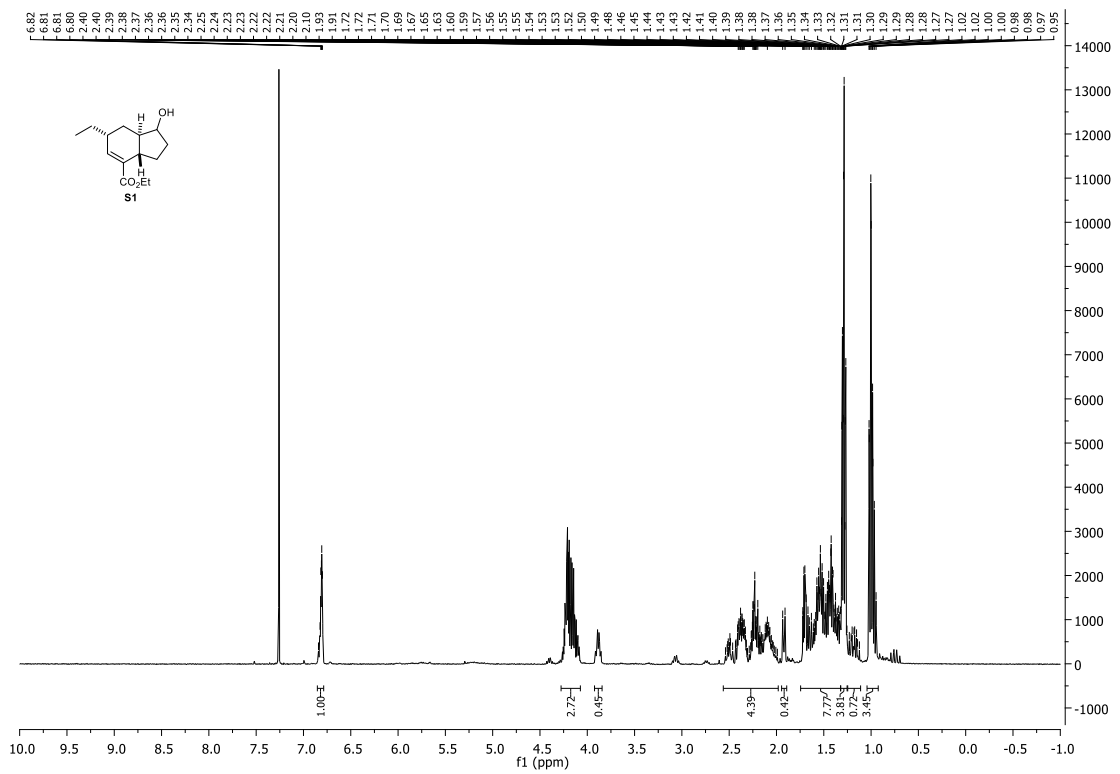
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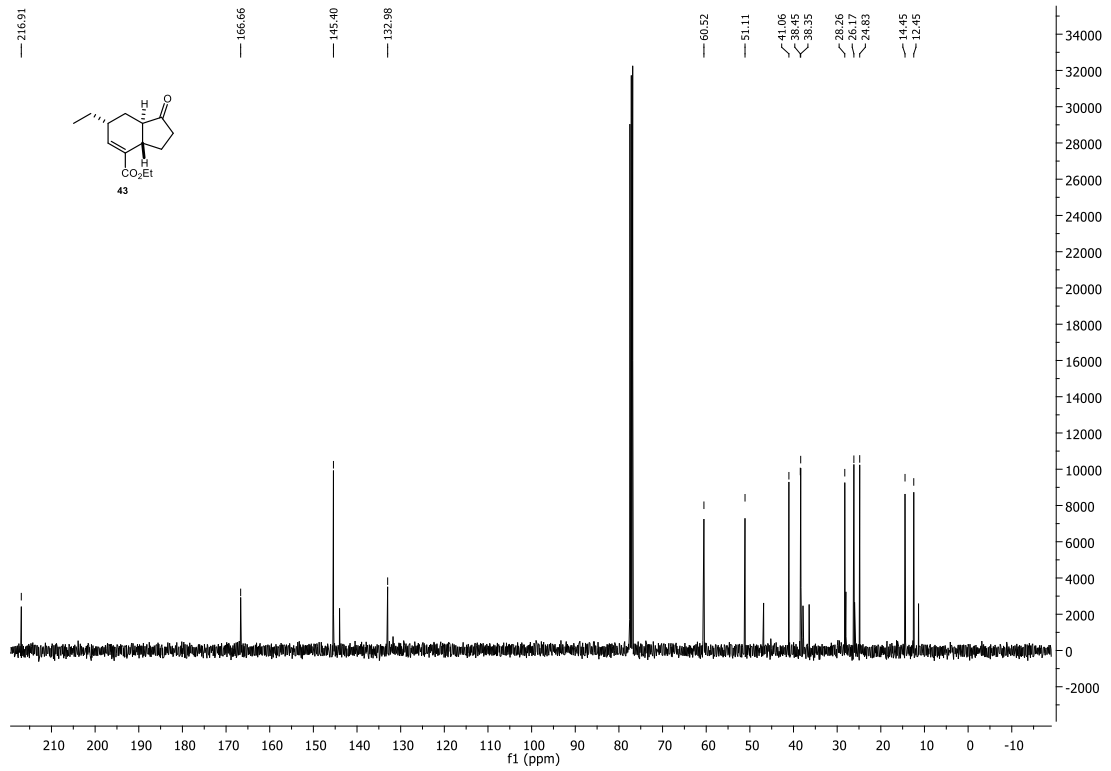
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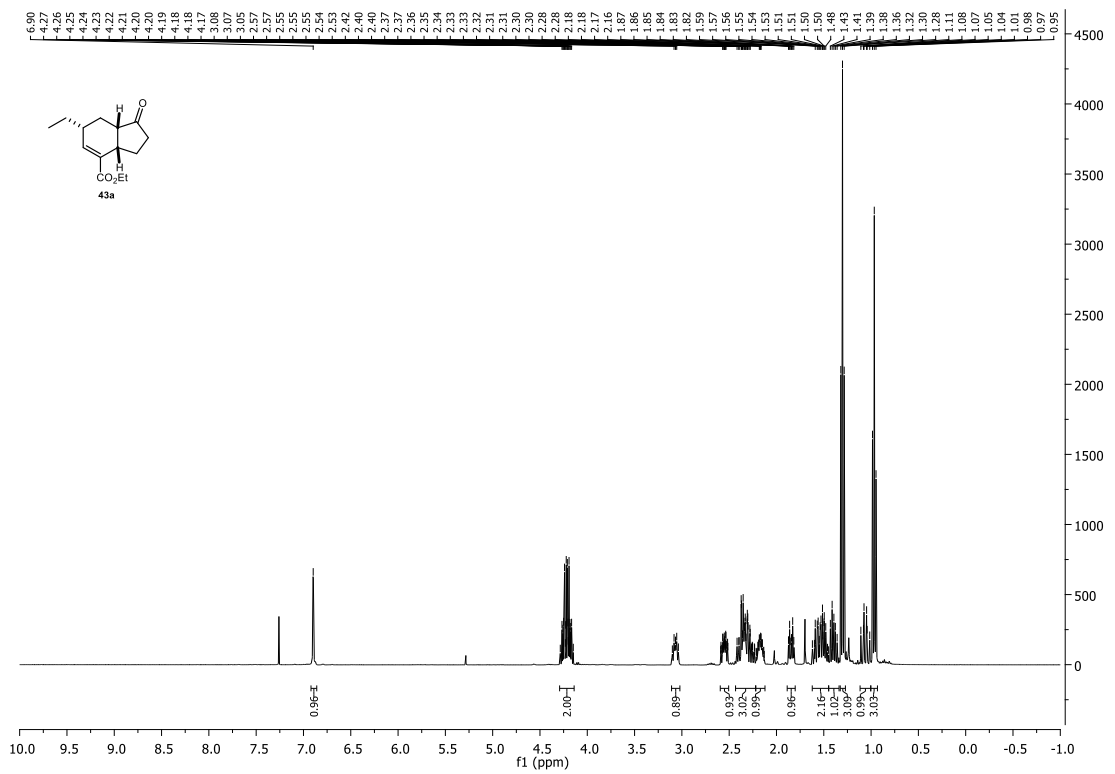
¹H NMR S1.



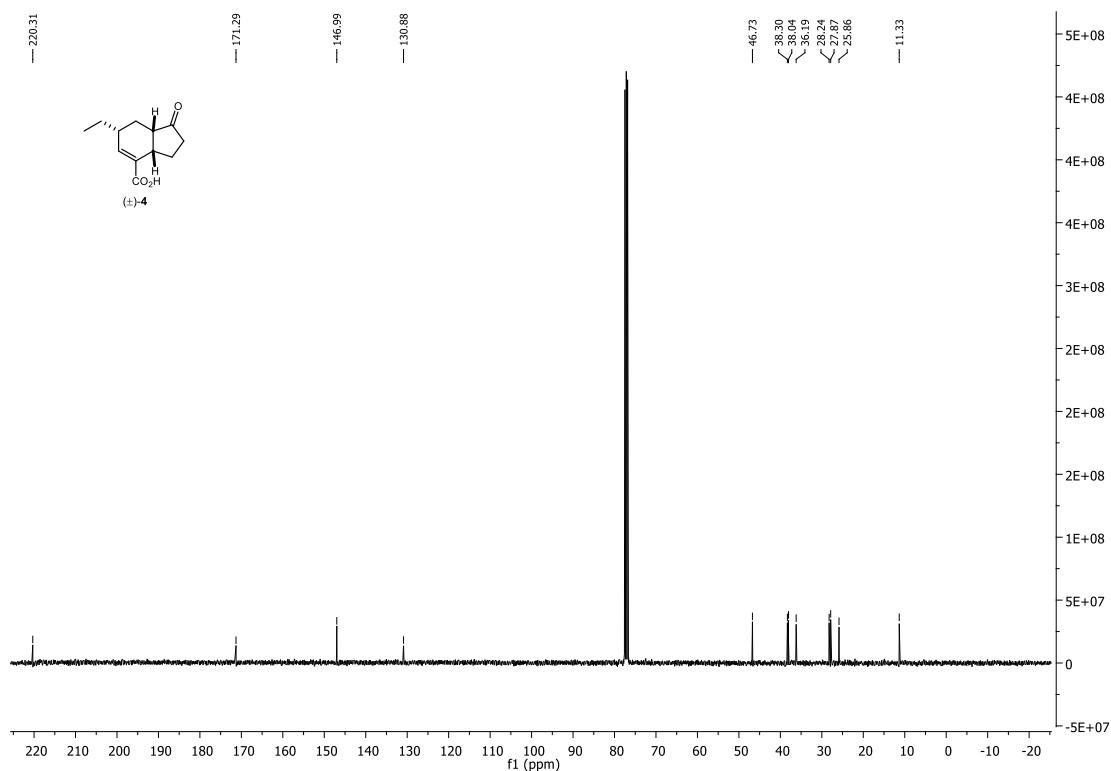
¹³C NMR 43.



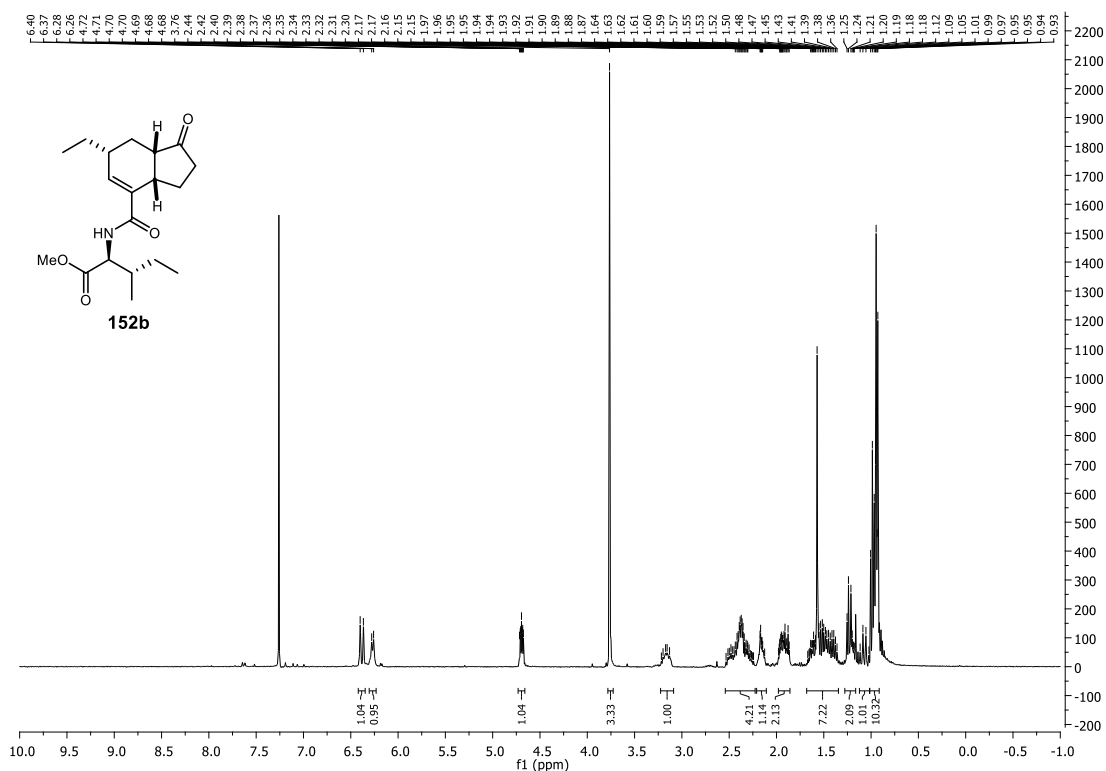
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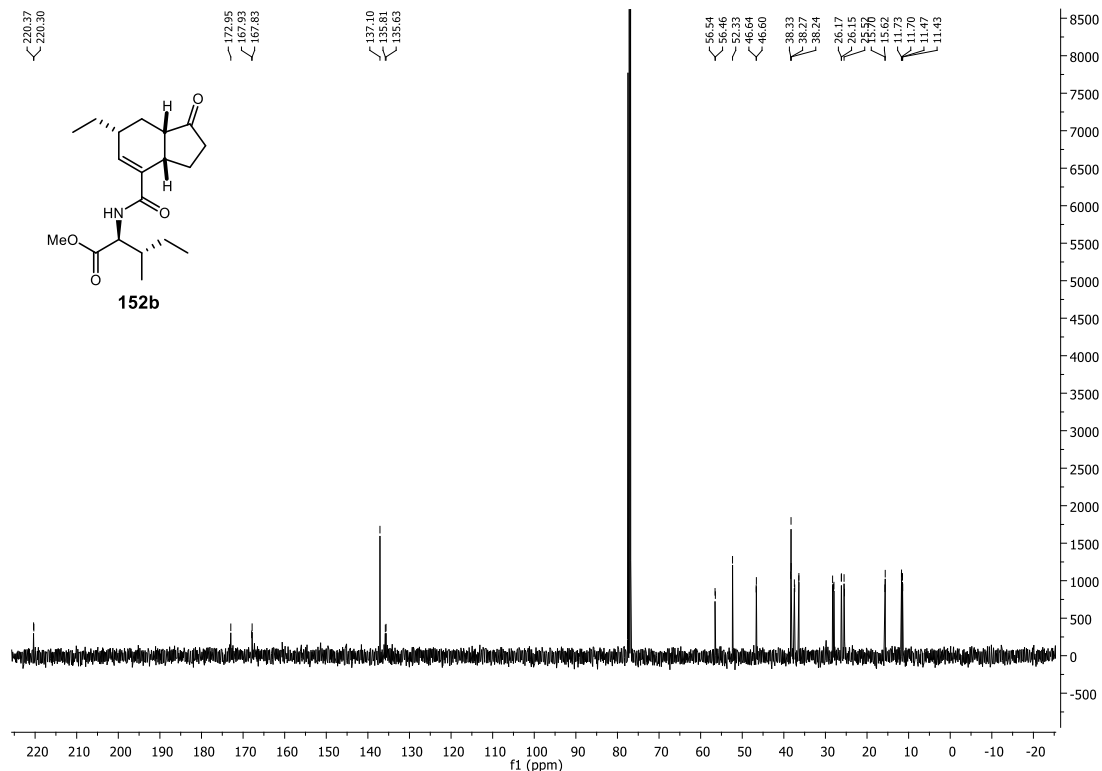
¹³C NMR (±)-4.



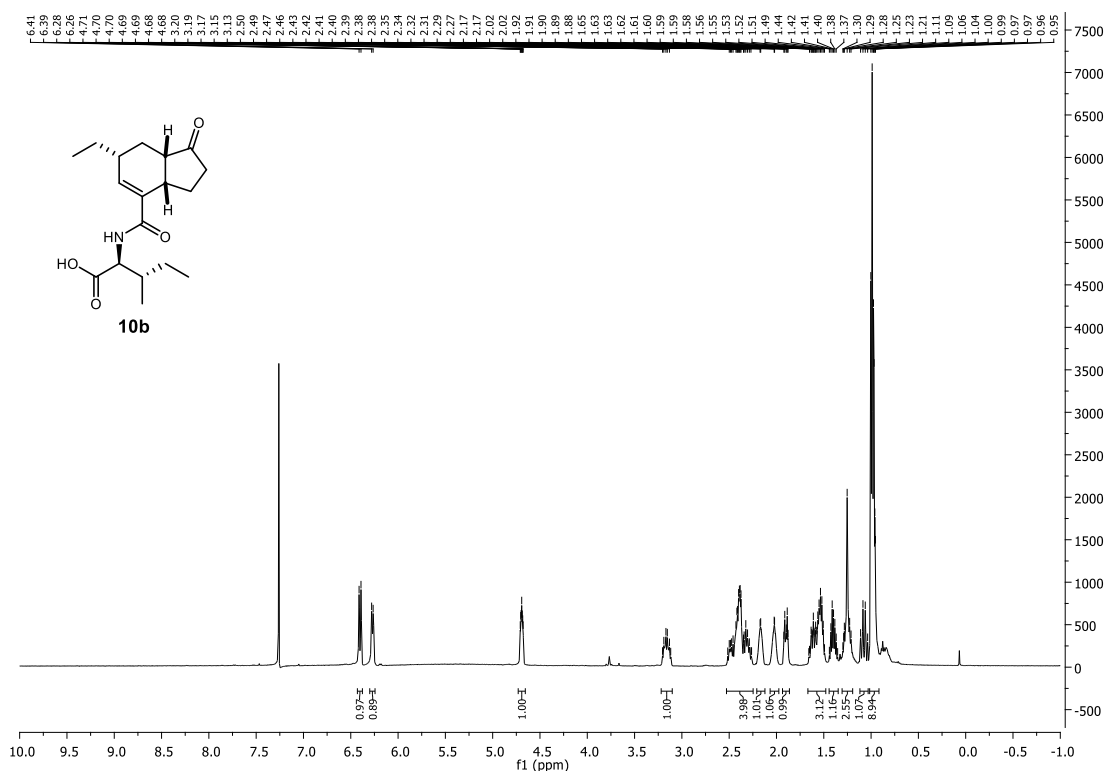
¹H NMR 152b.



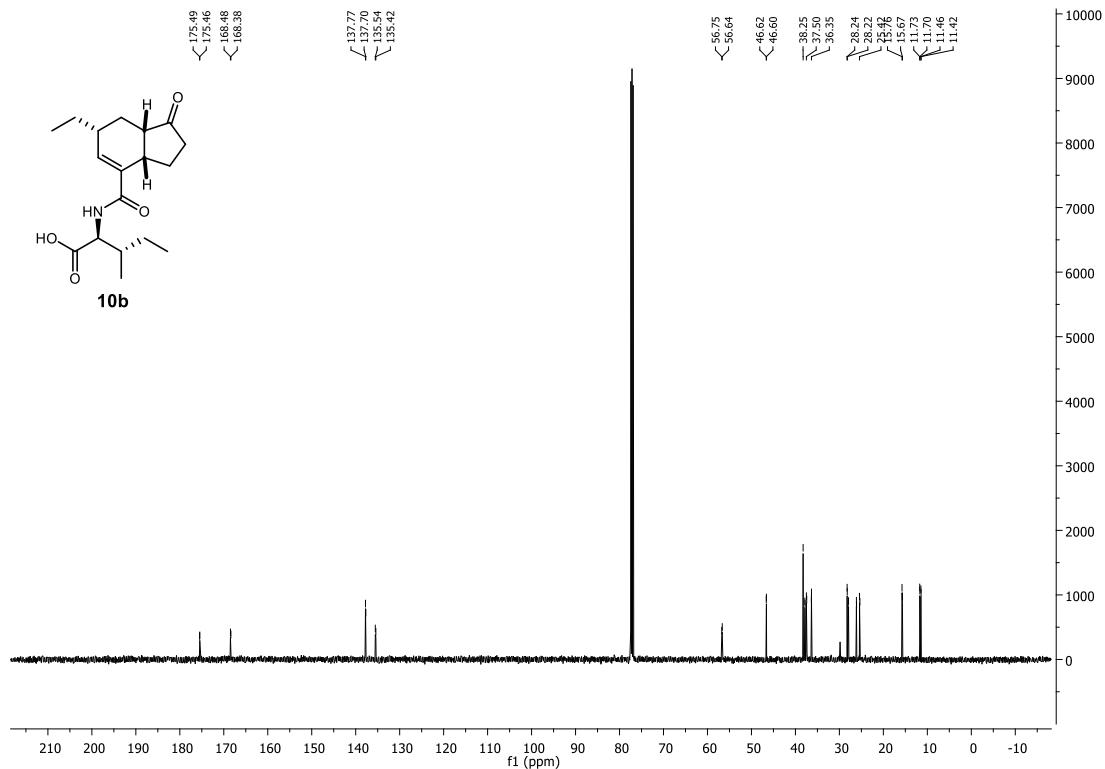
¹³C NMR 152b.



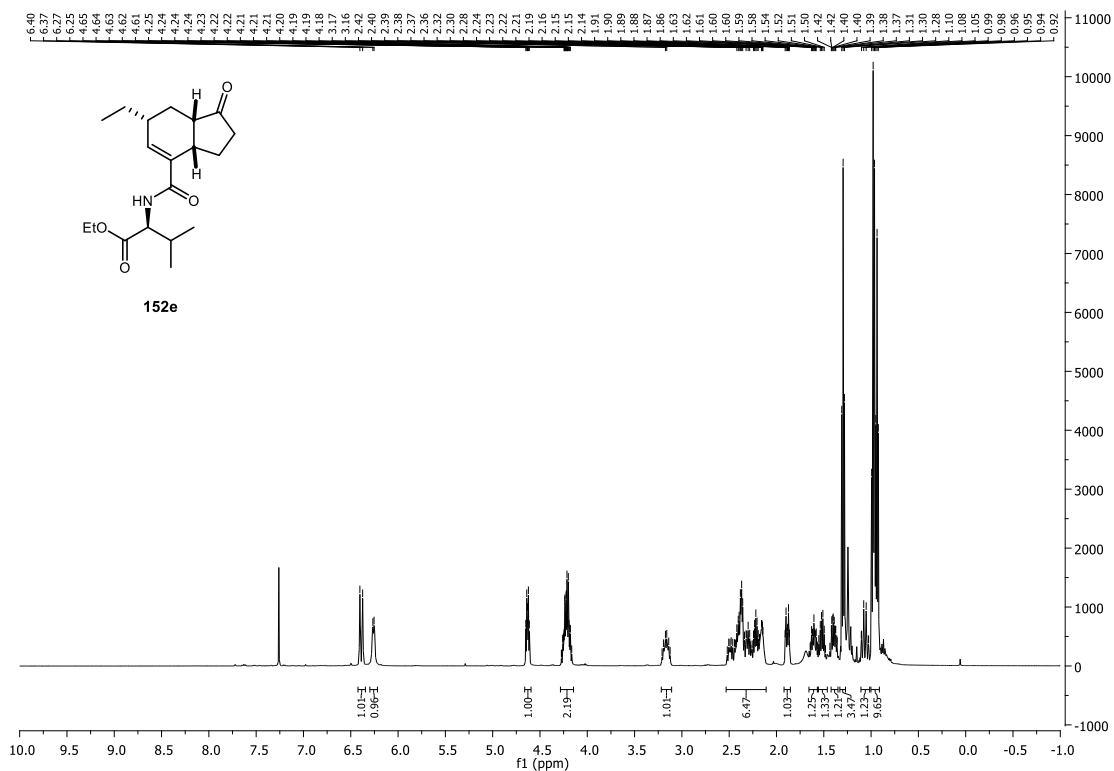
¹H NMR 10b.



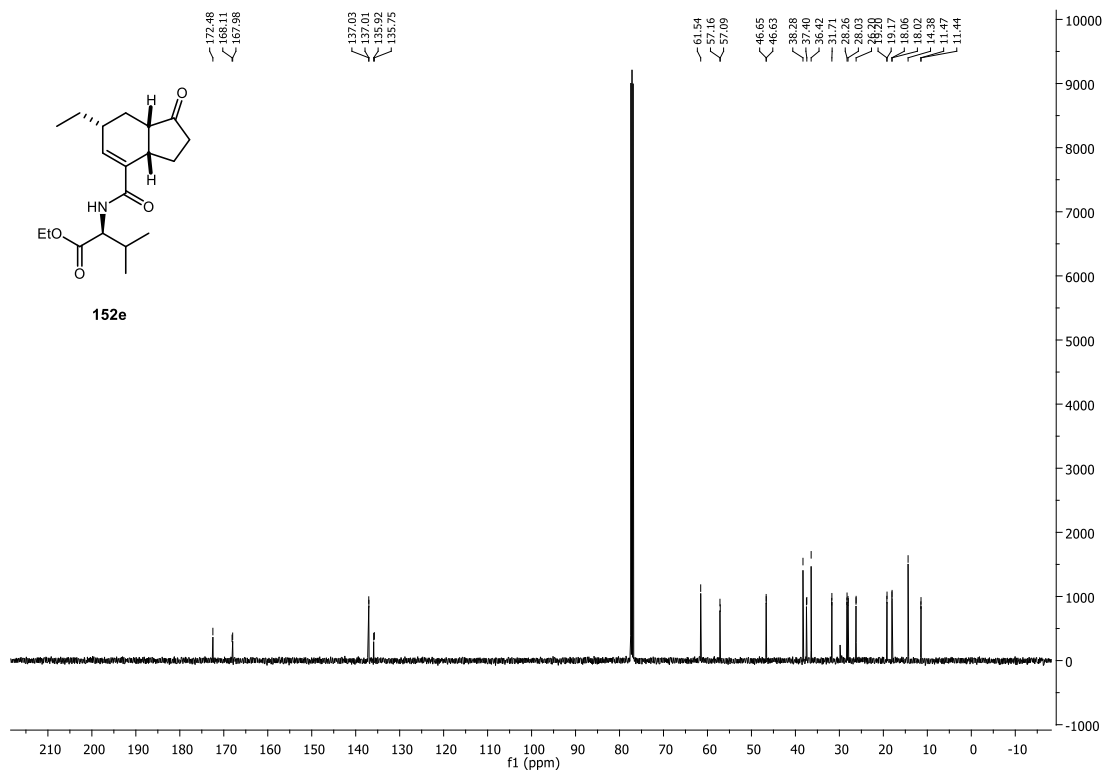
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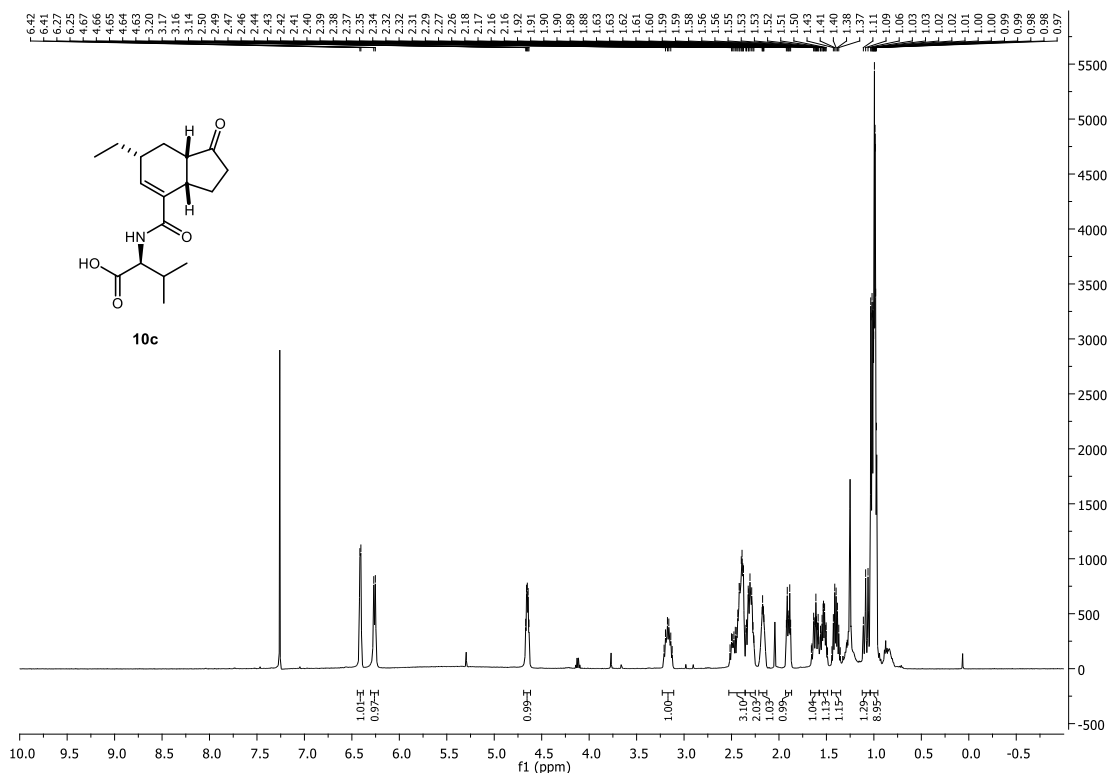
¹H NMR 152e.



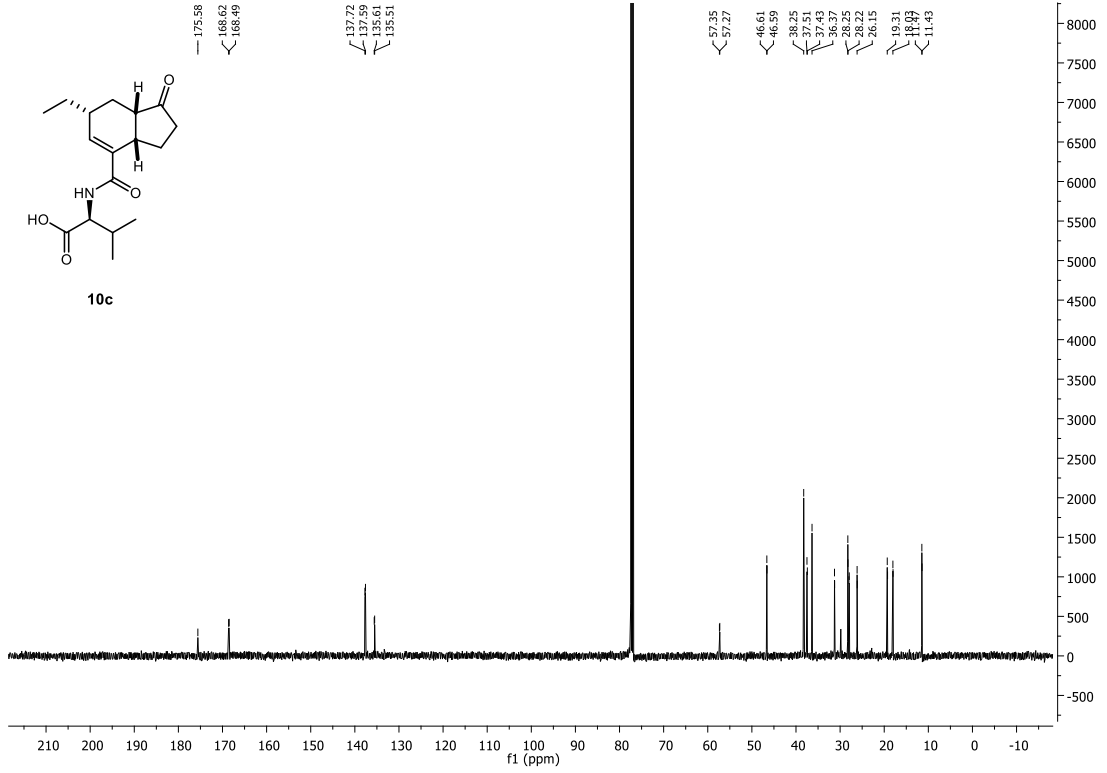
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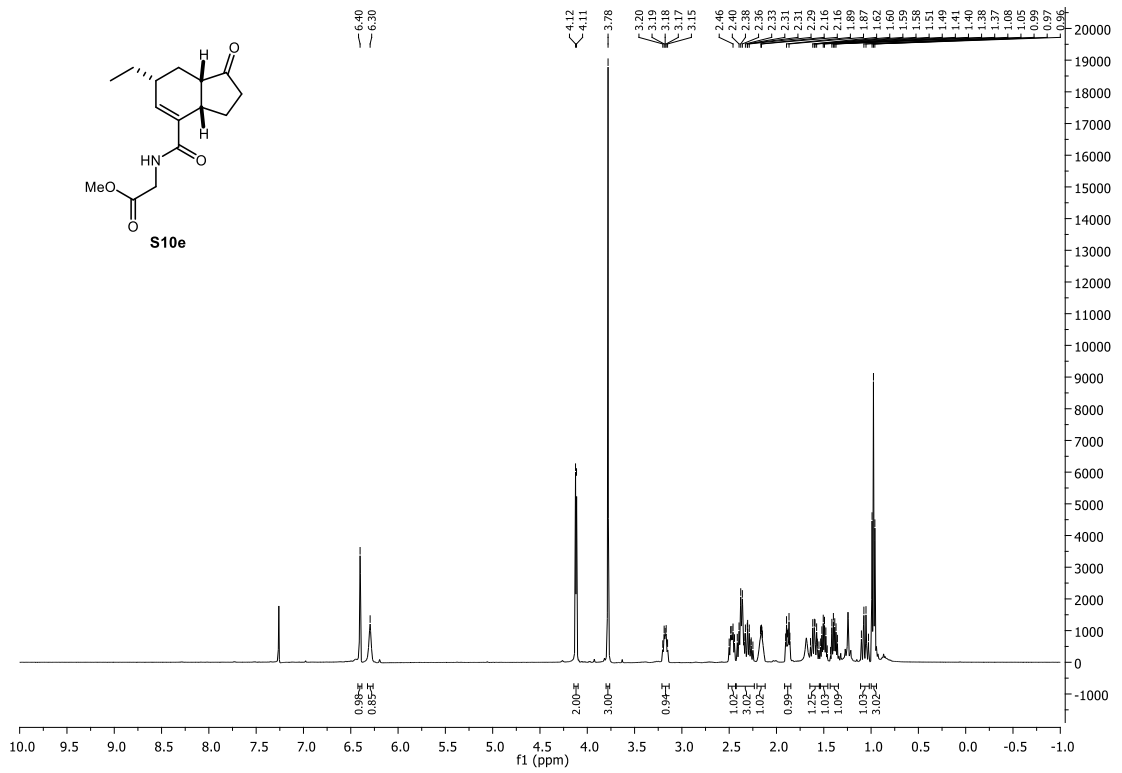
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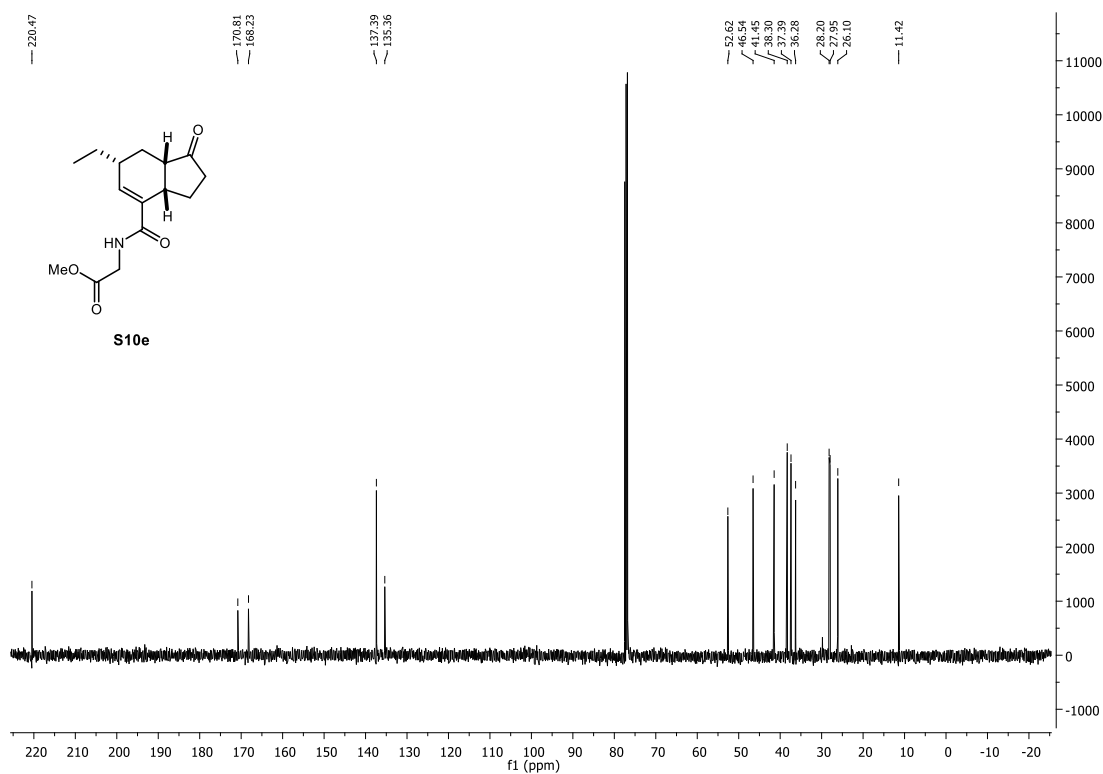
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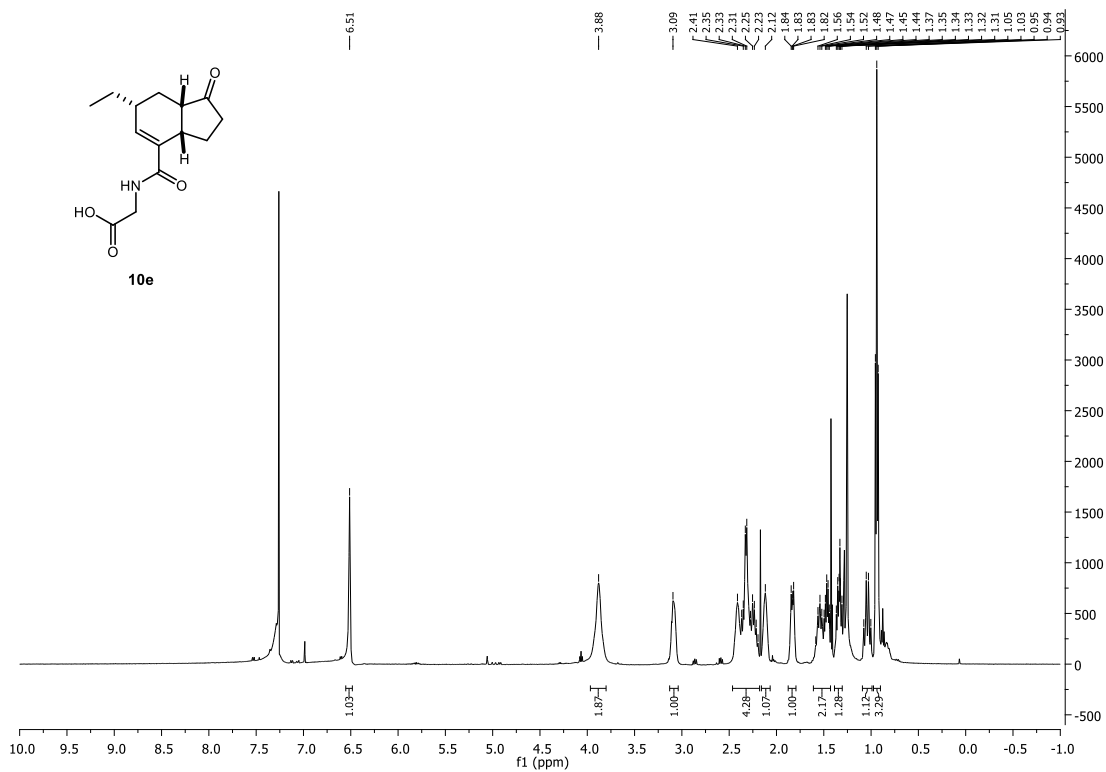
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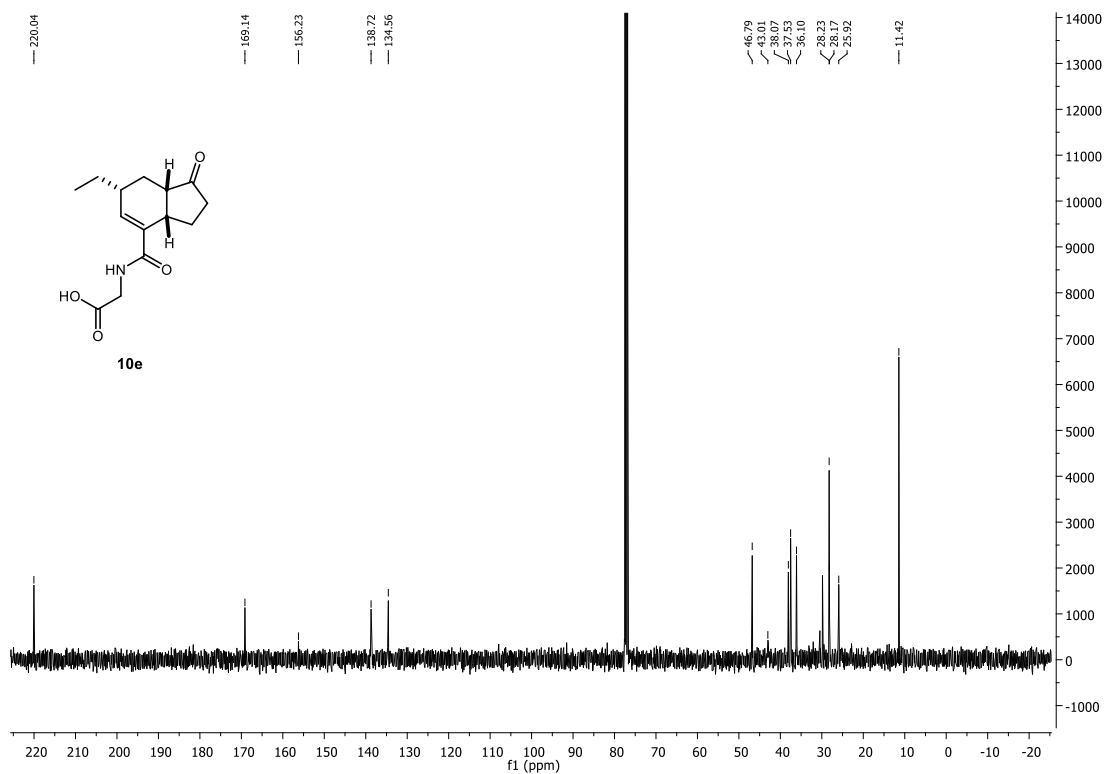
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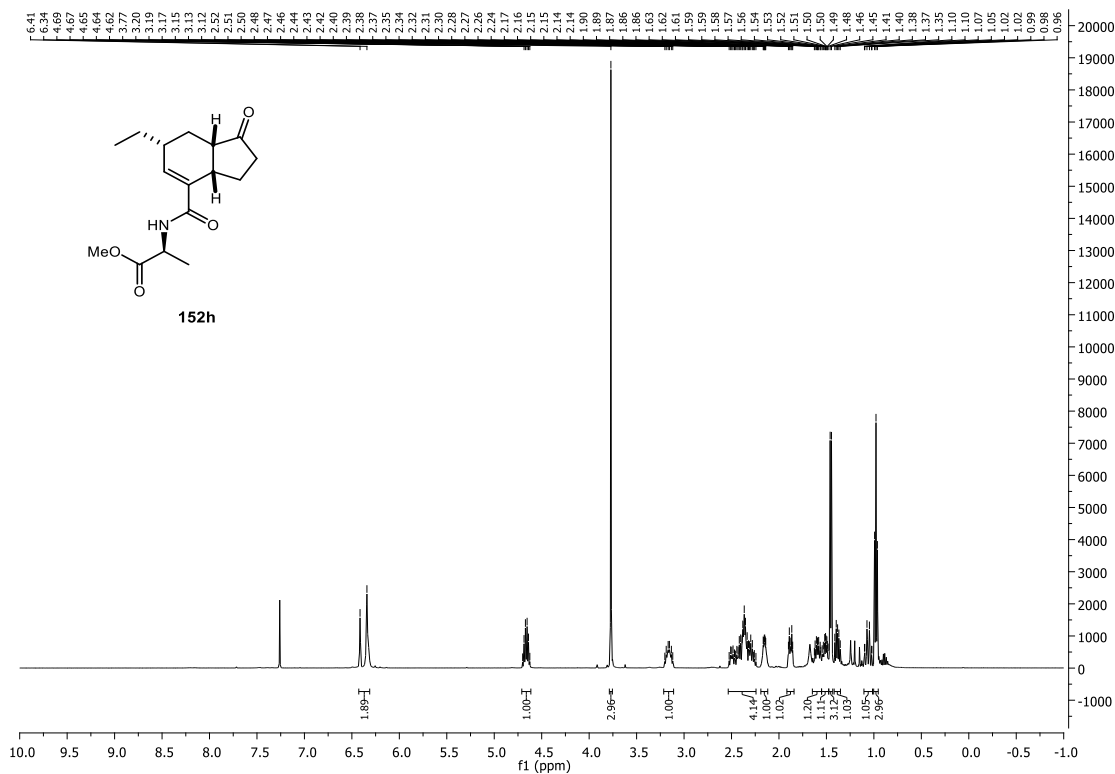
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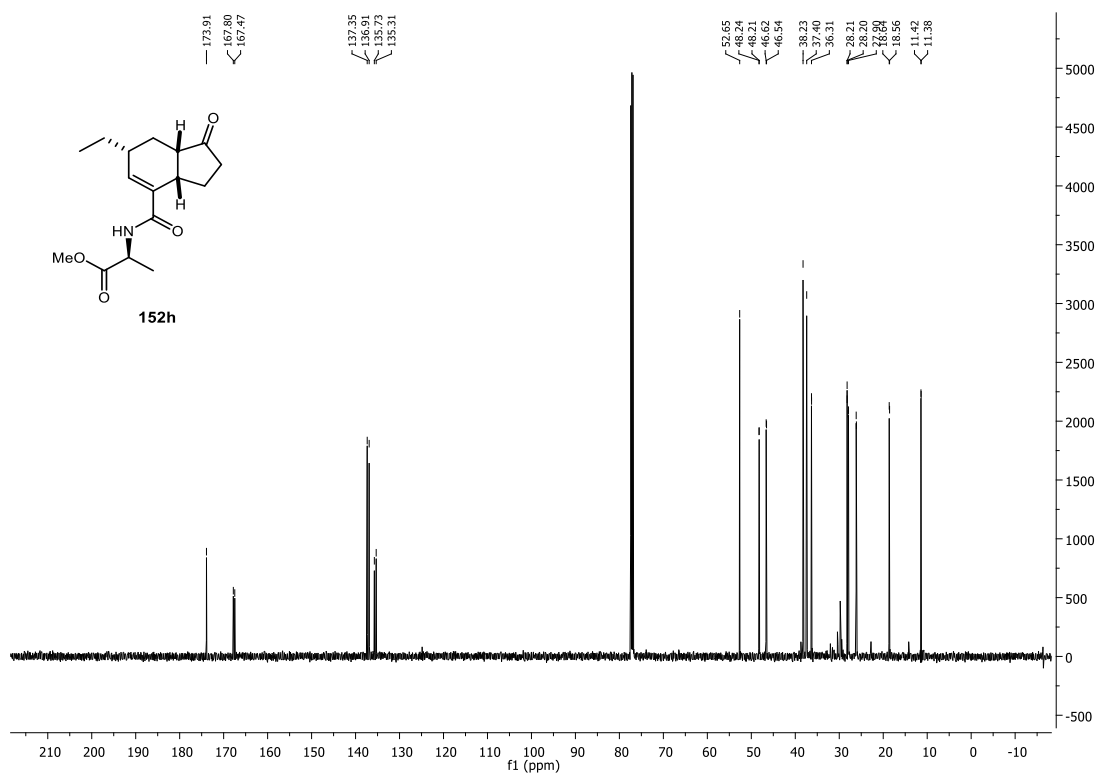
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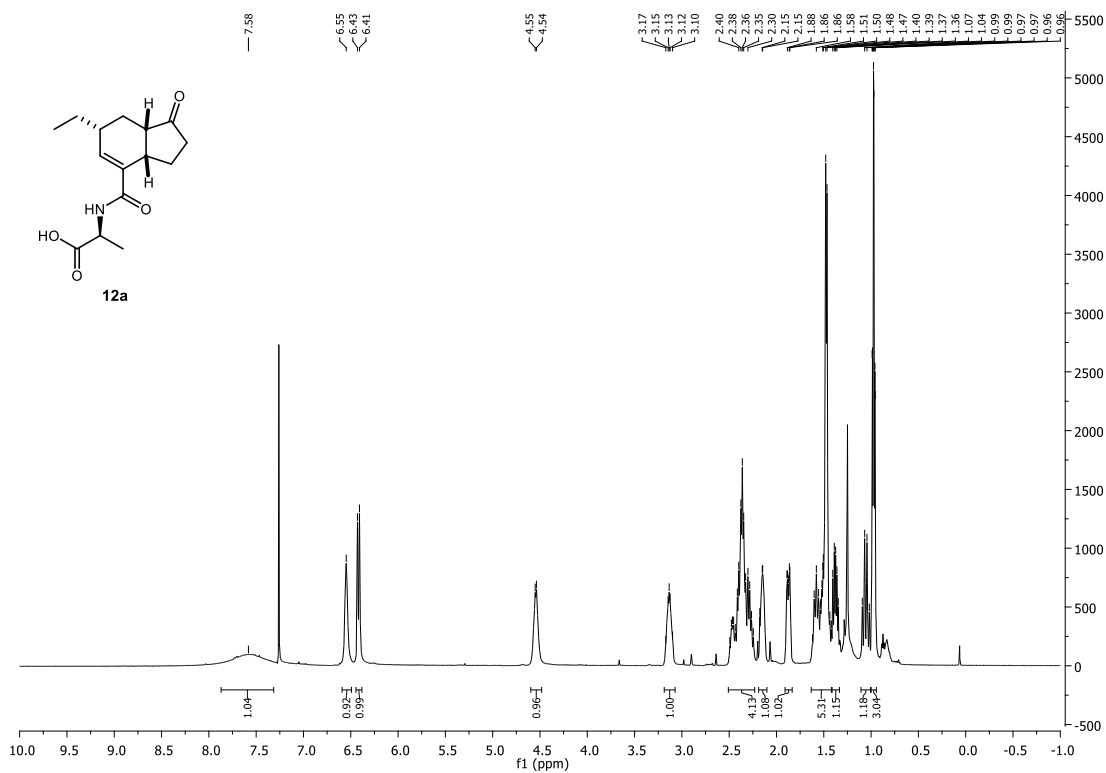
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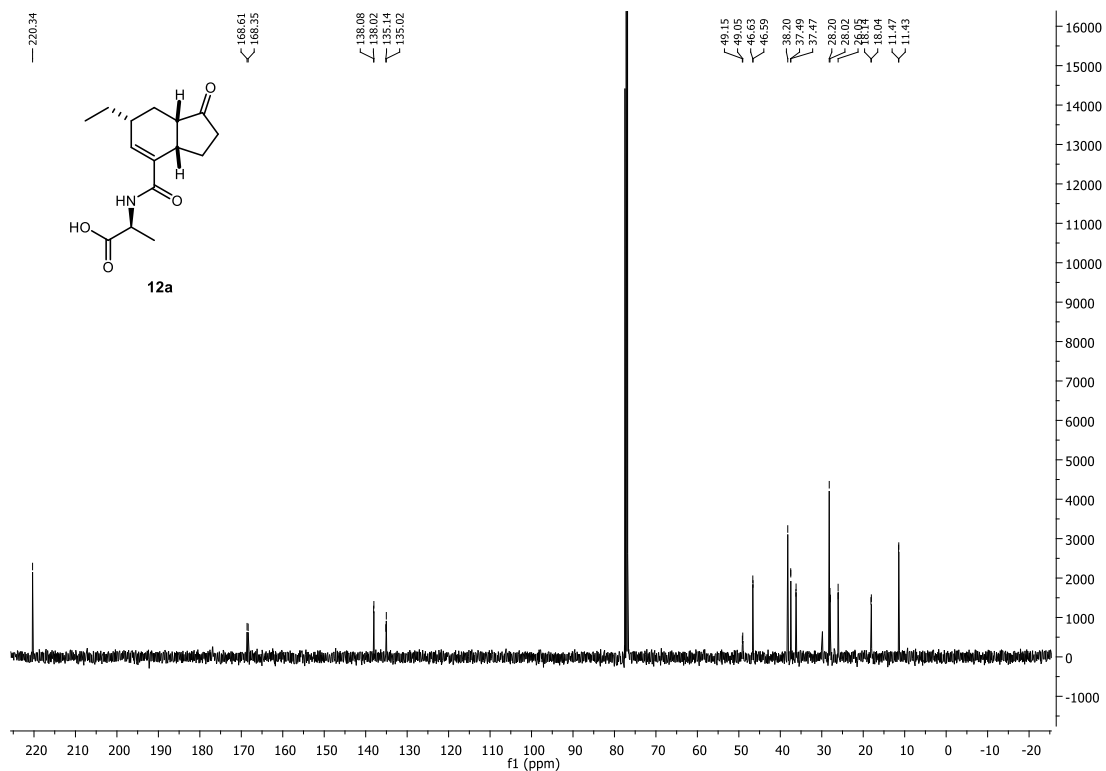
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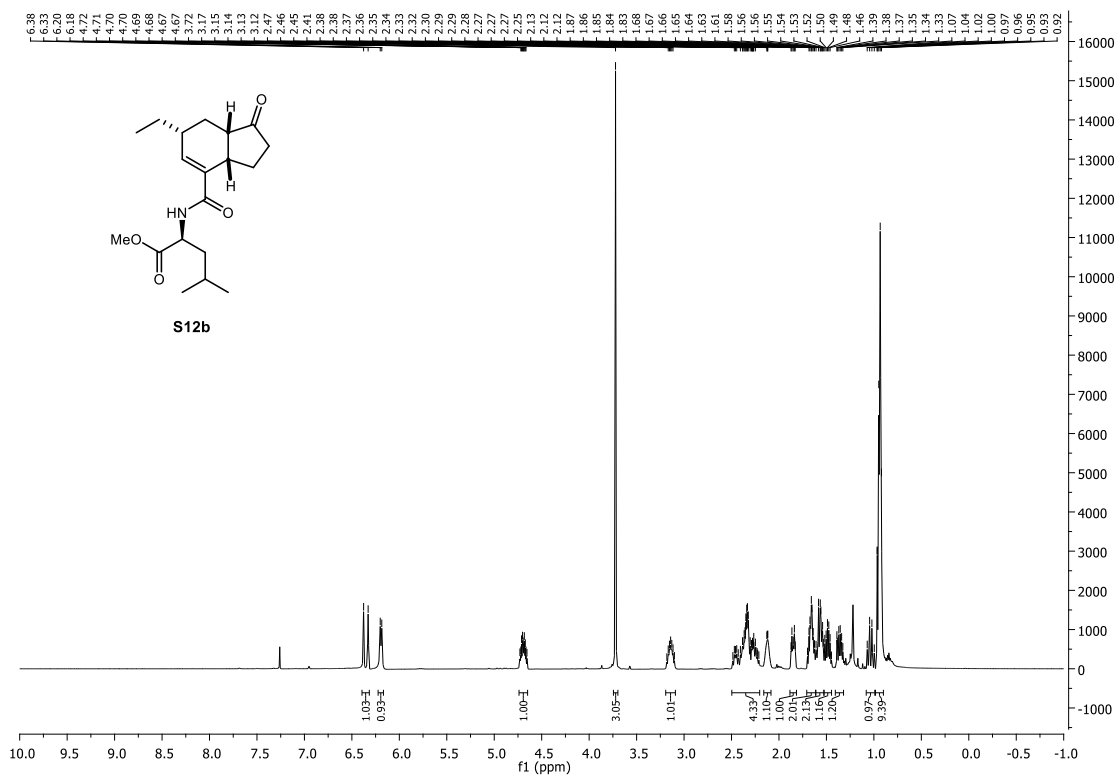
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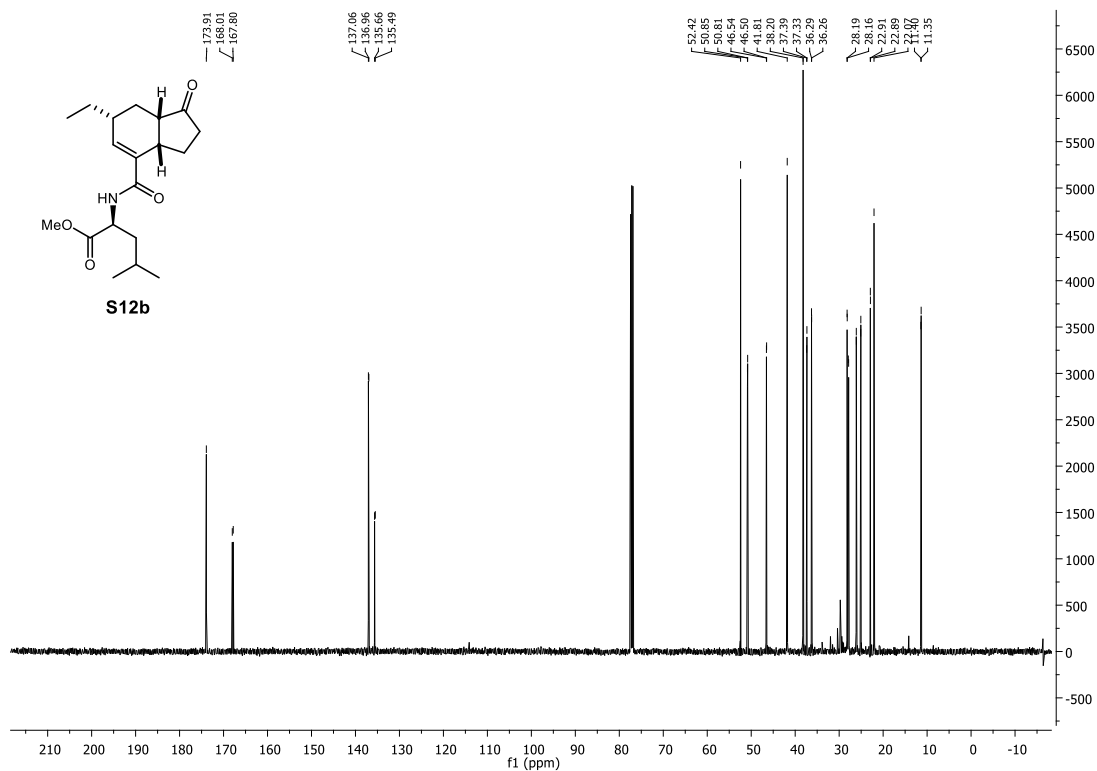
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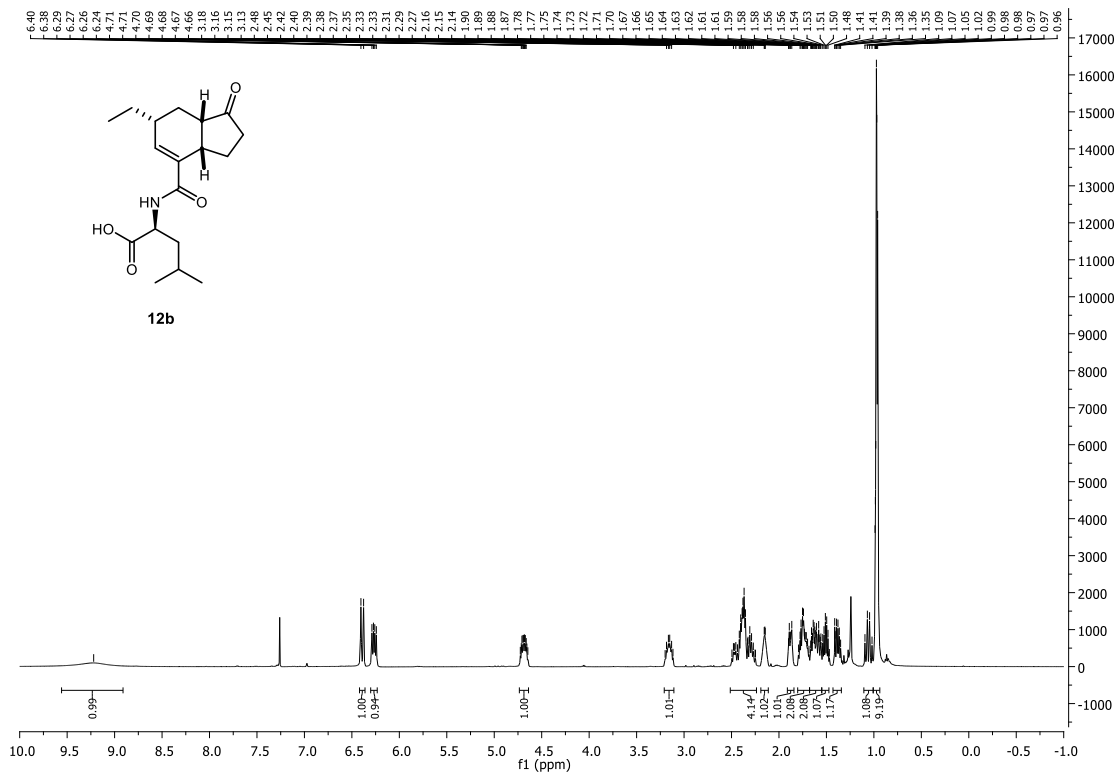
¹H NMR S12b.



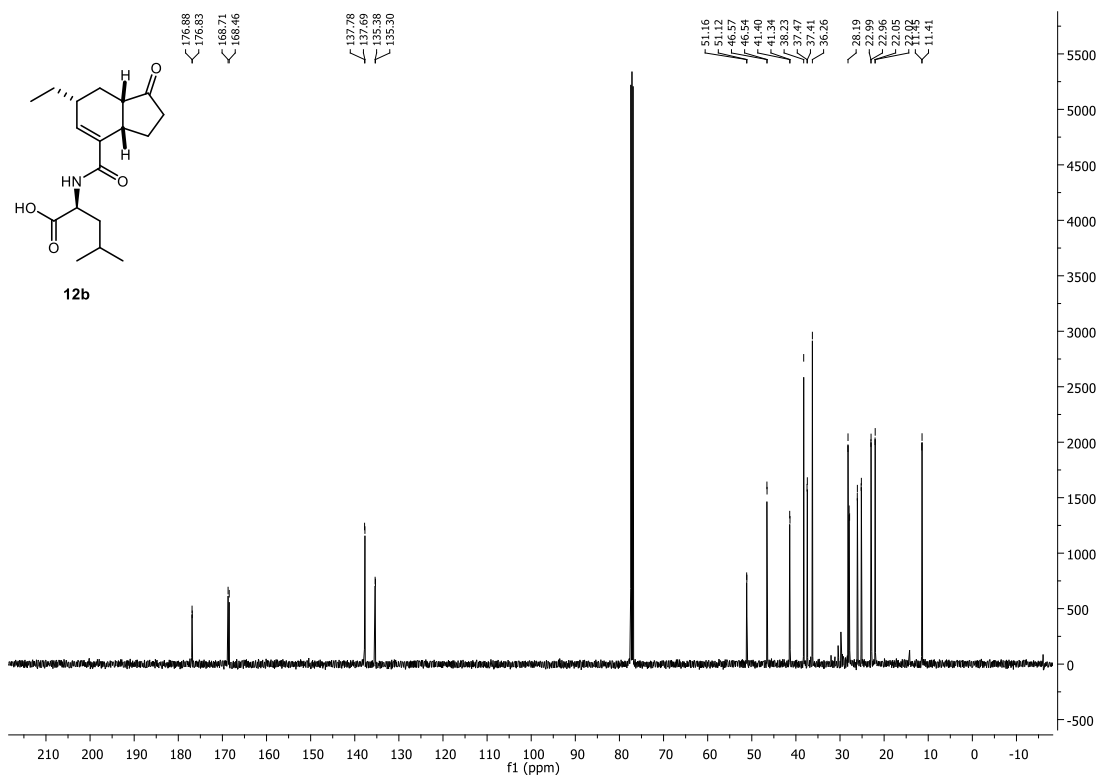
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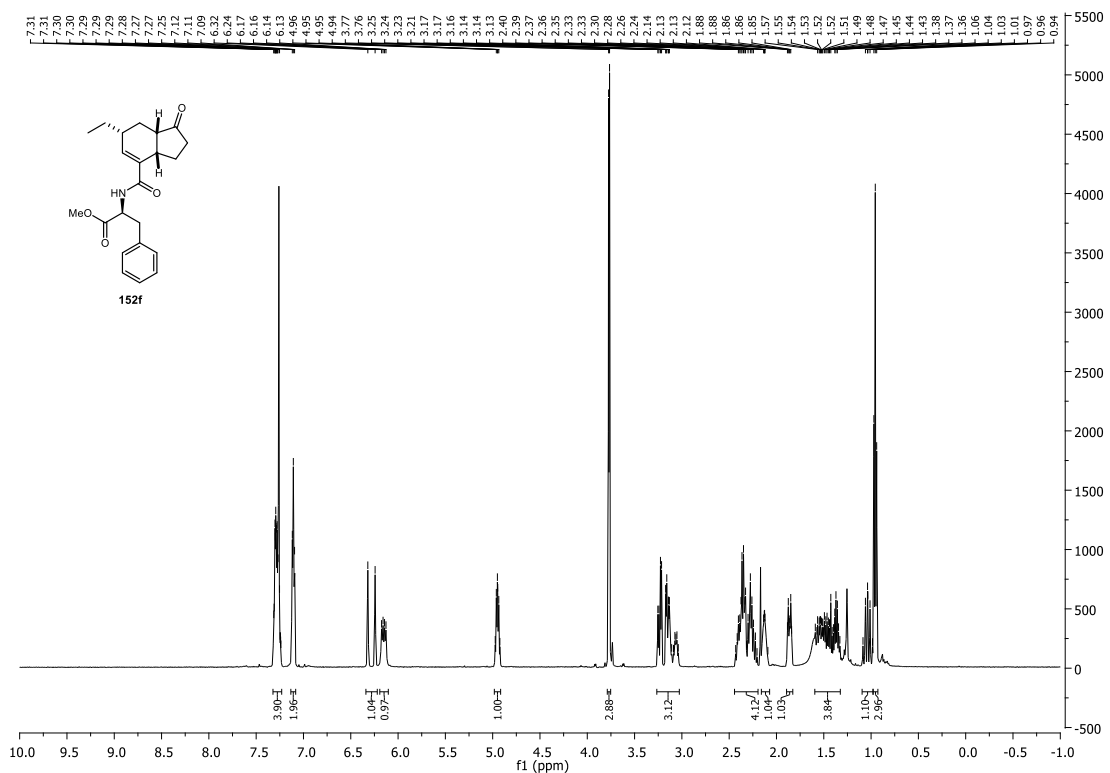
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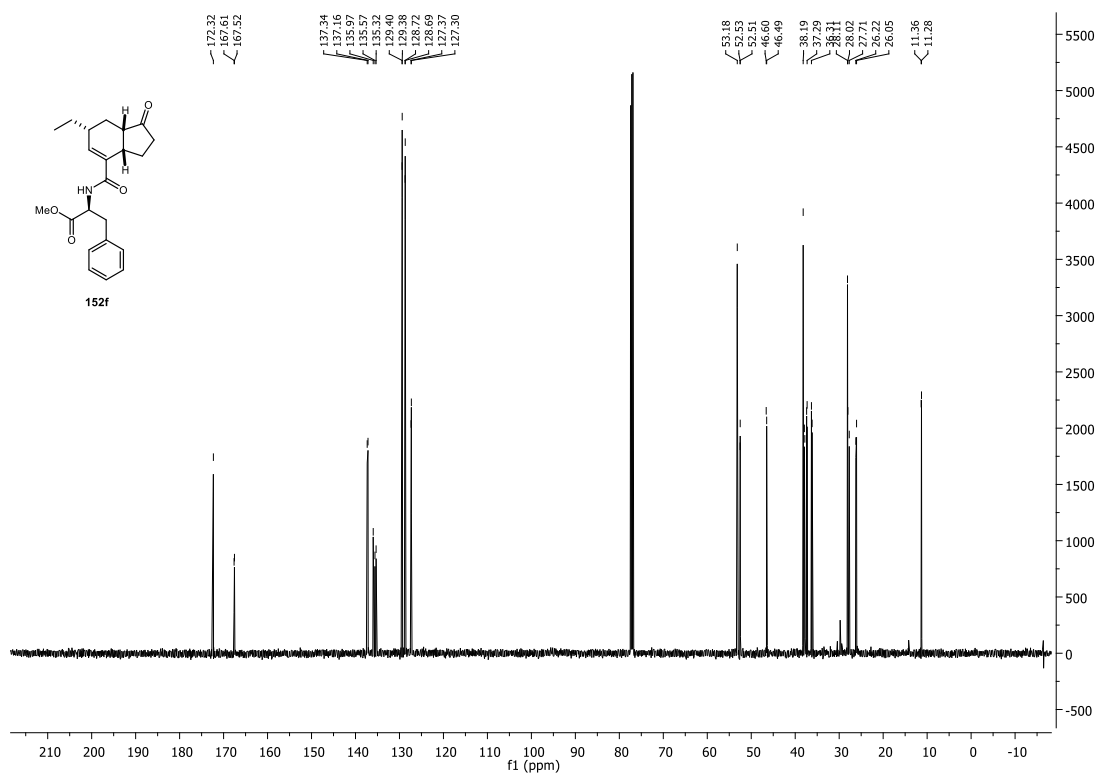
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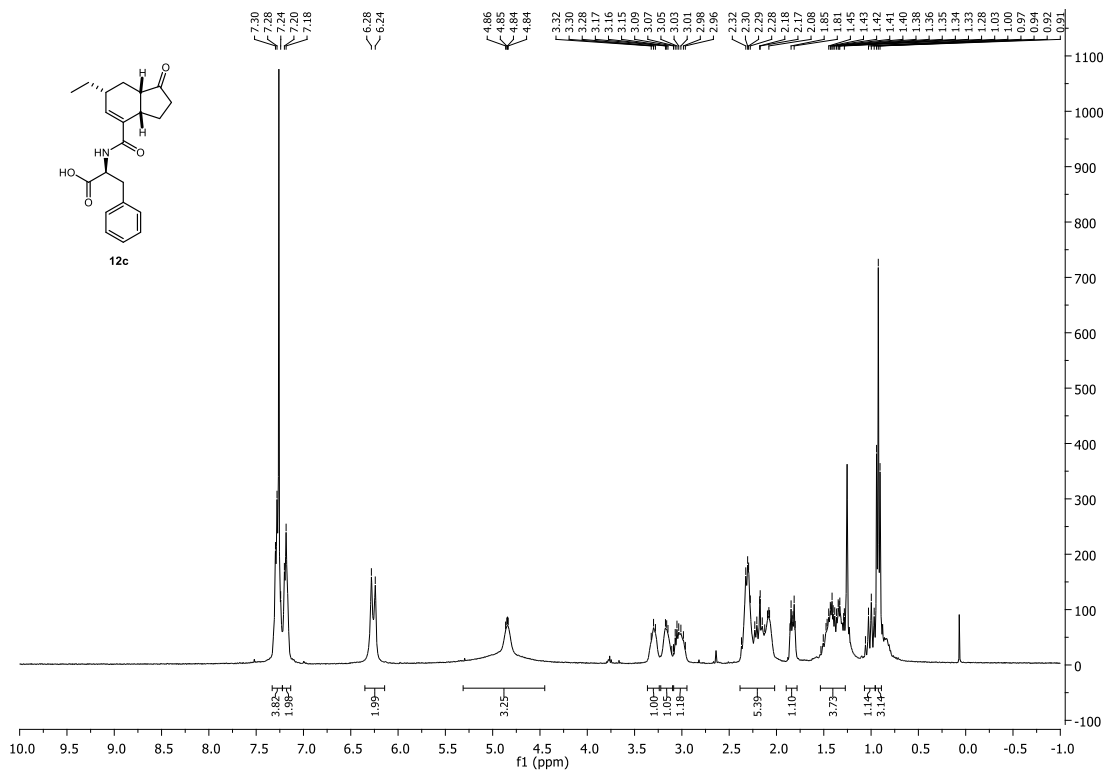
¹H NMR 152f.



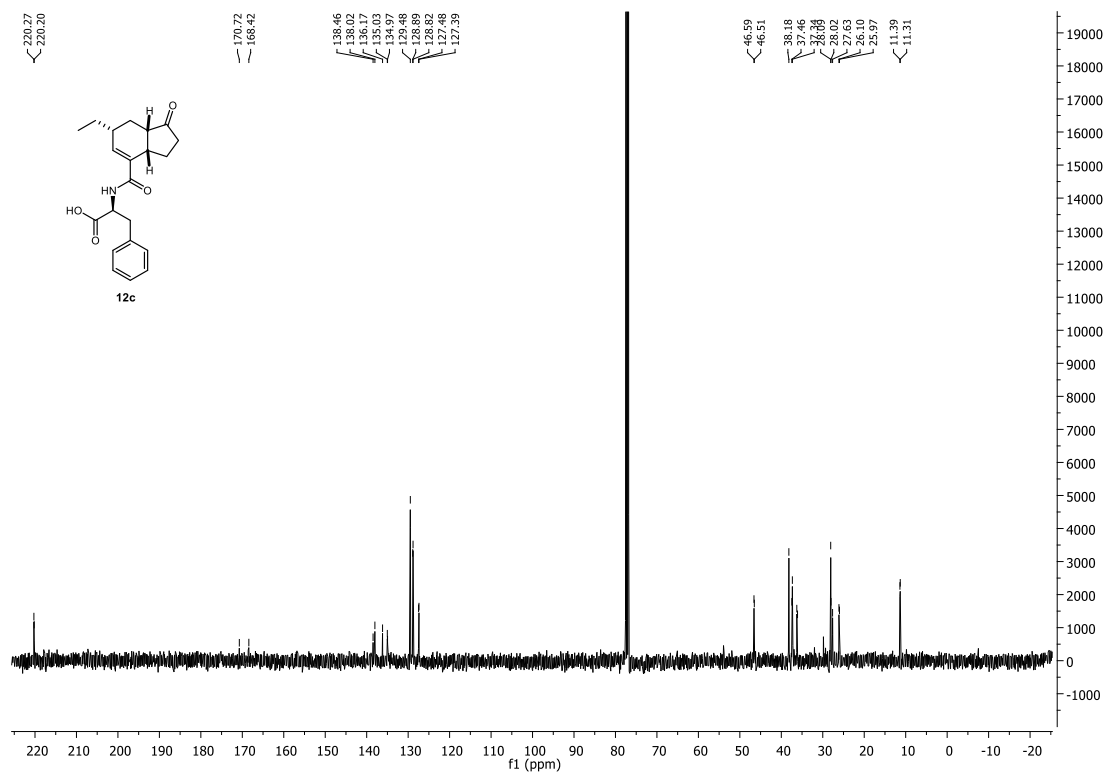
¹³C NMR 152f.



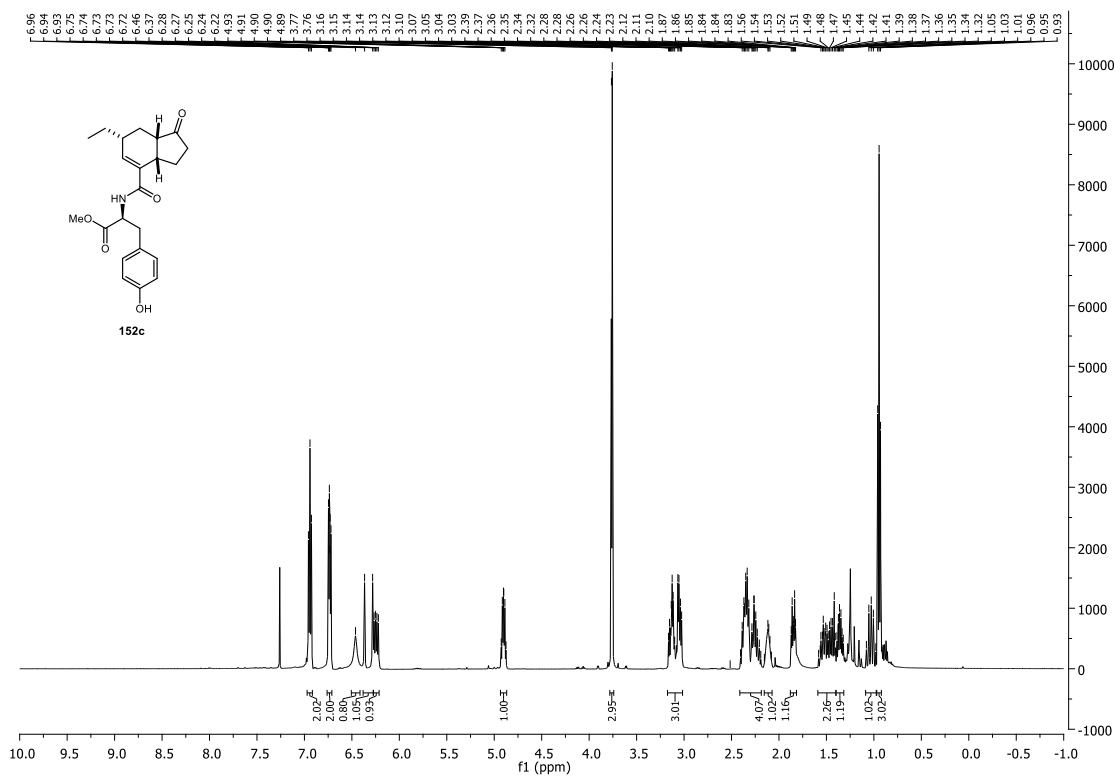
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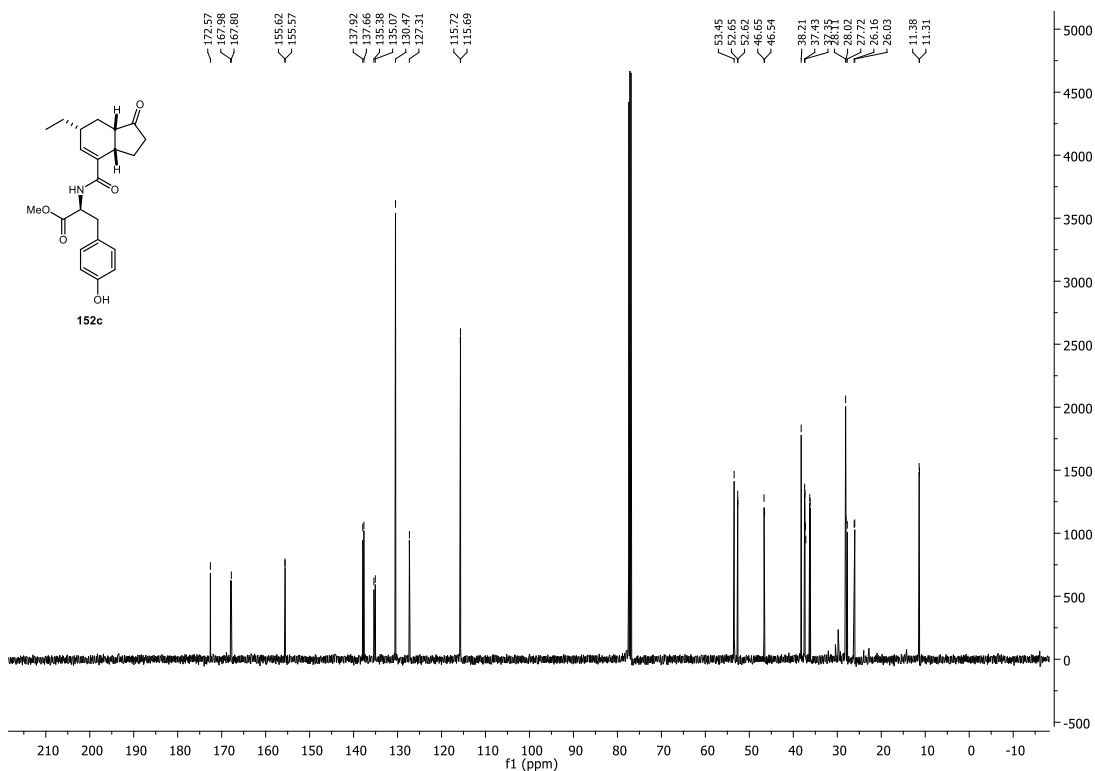
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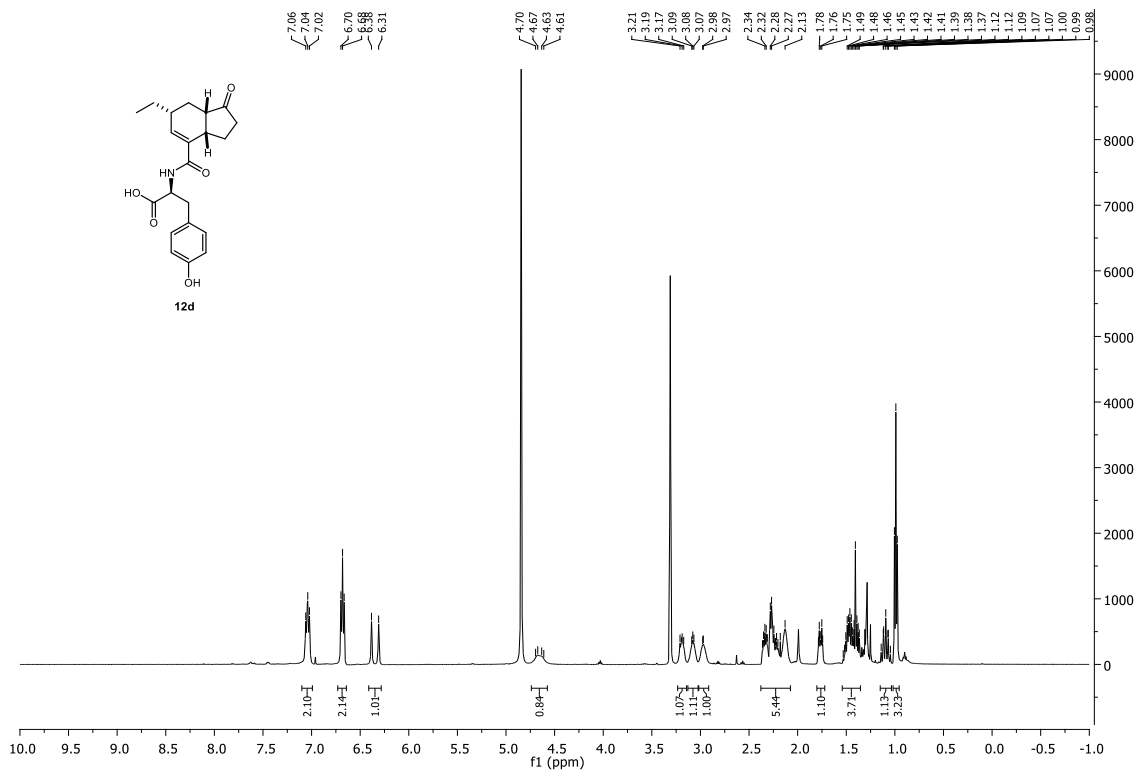
¹H NMR 152c.



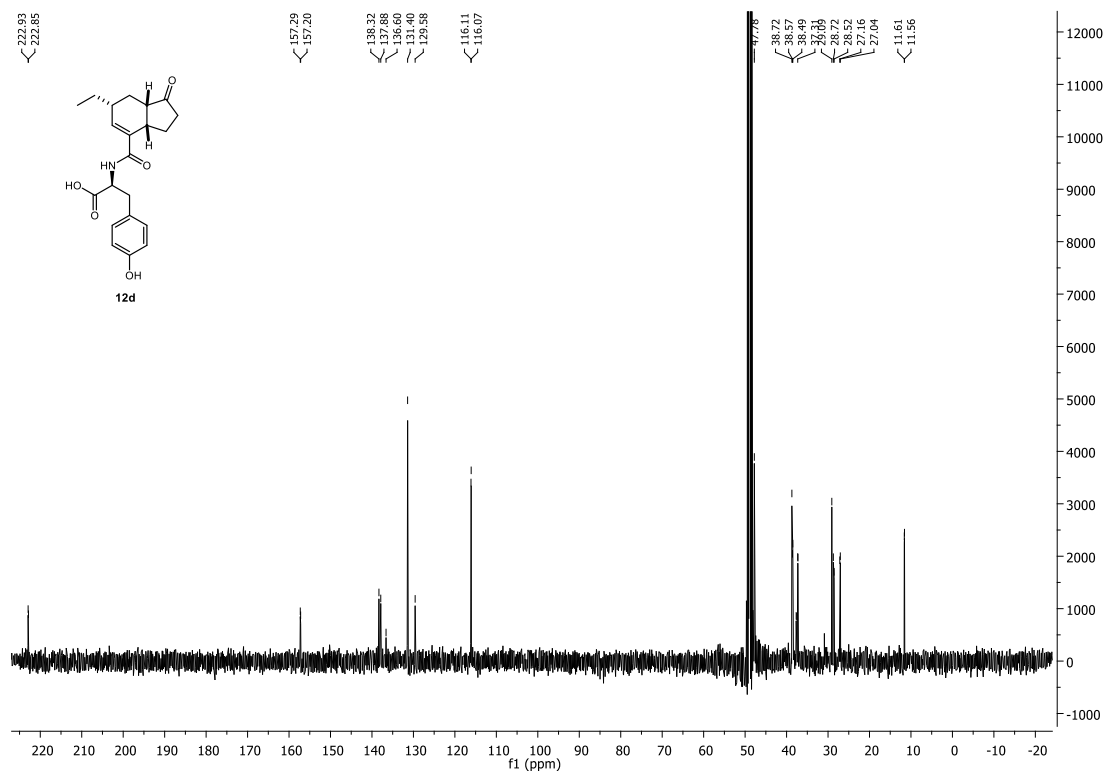
¹³C NMR 152c.



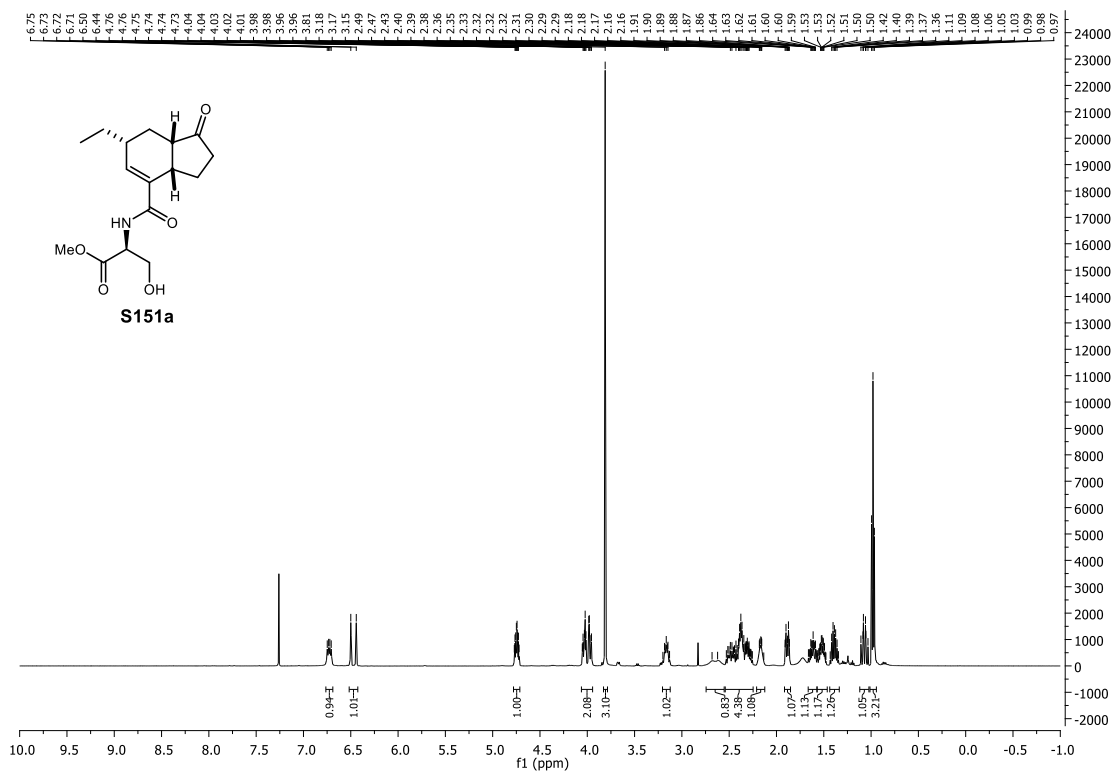
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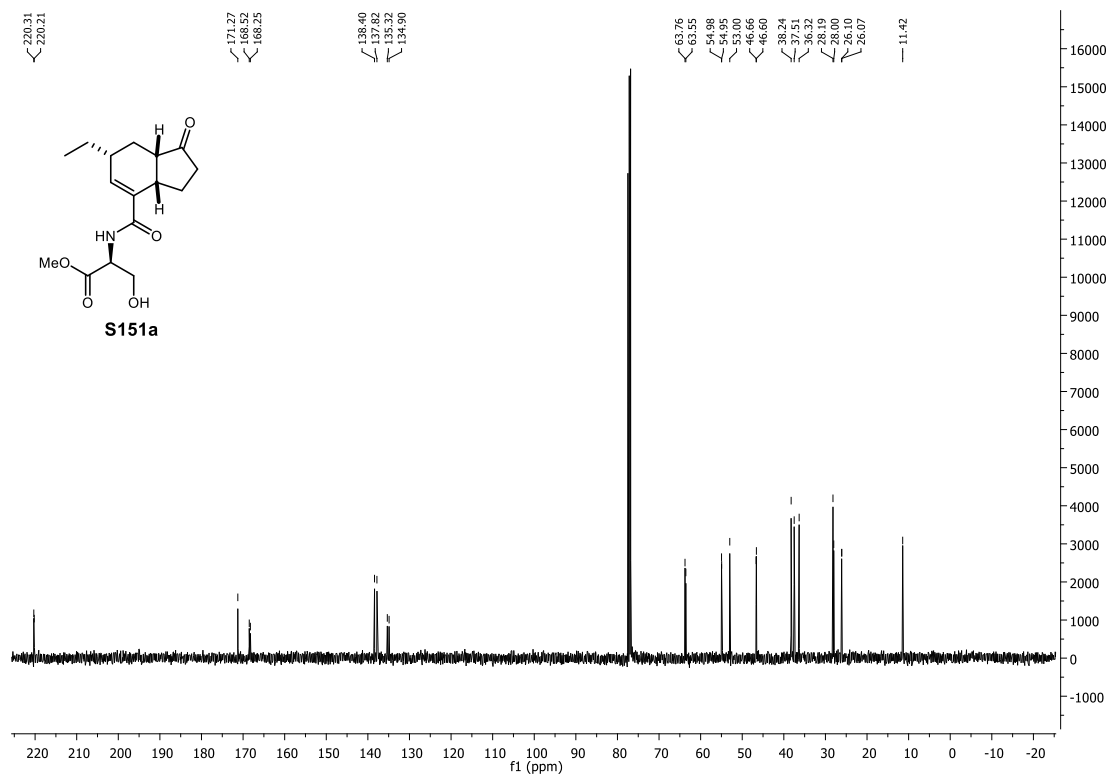
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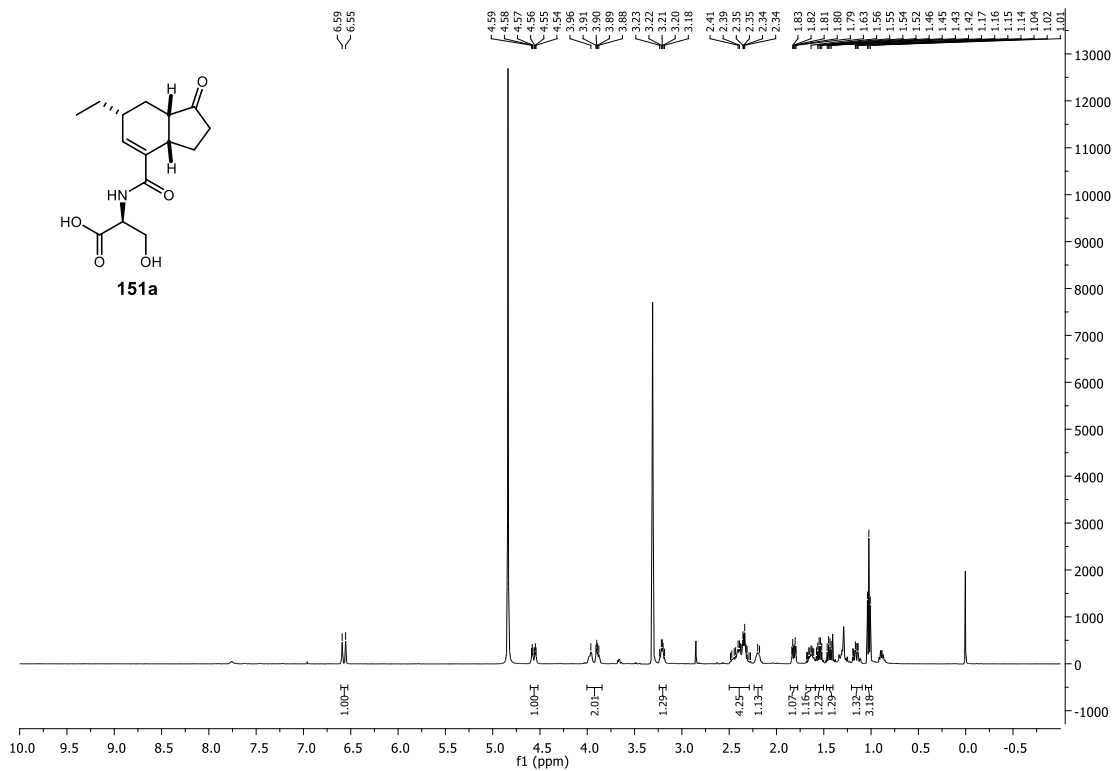
¹H NMR S151a.



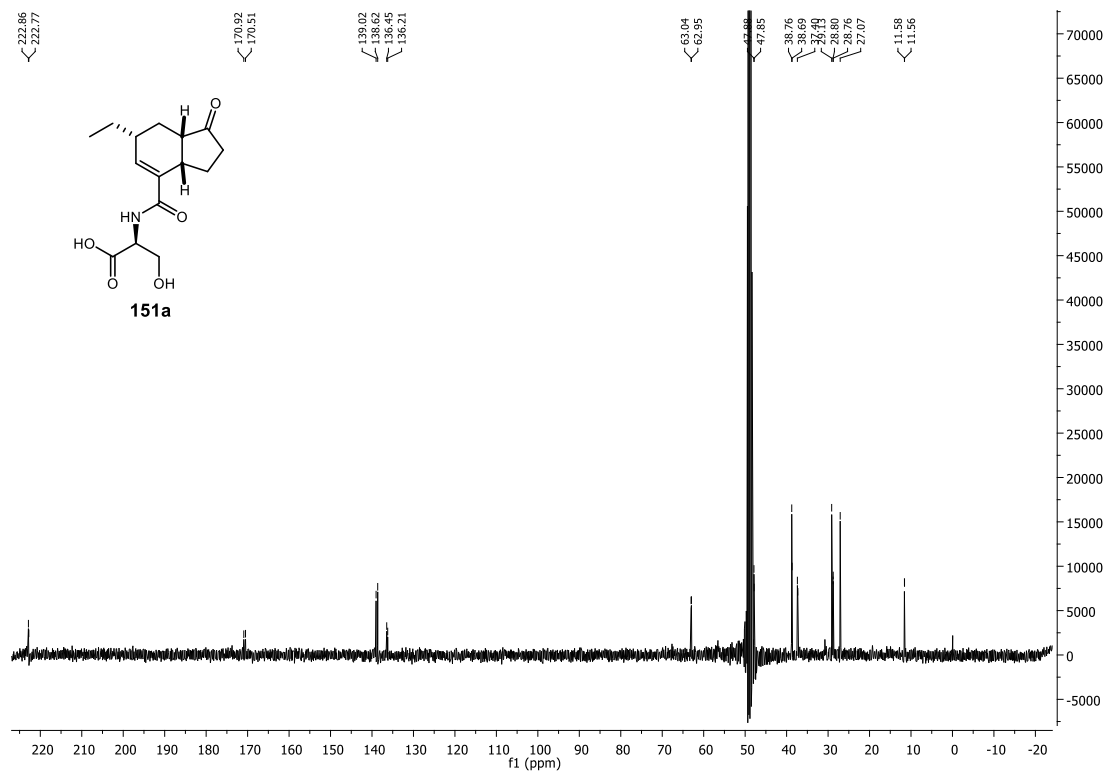
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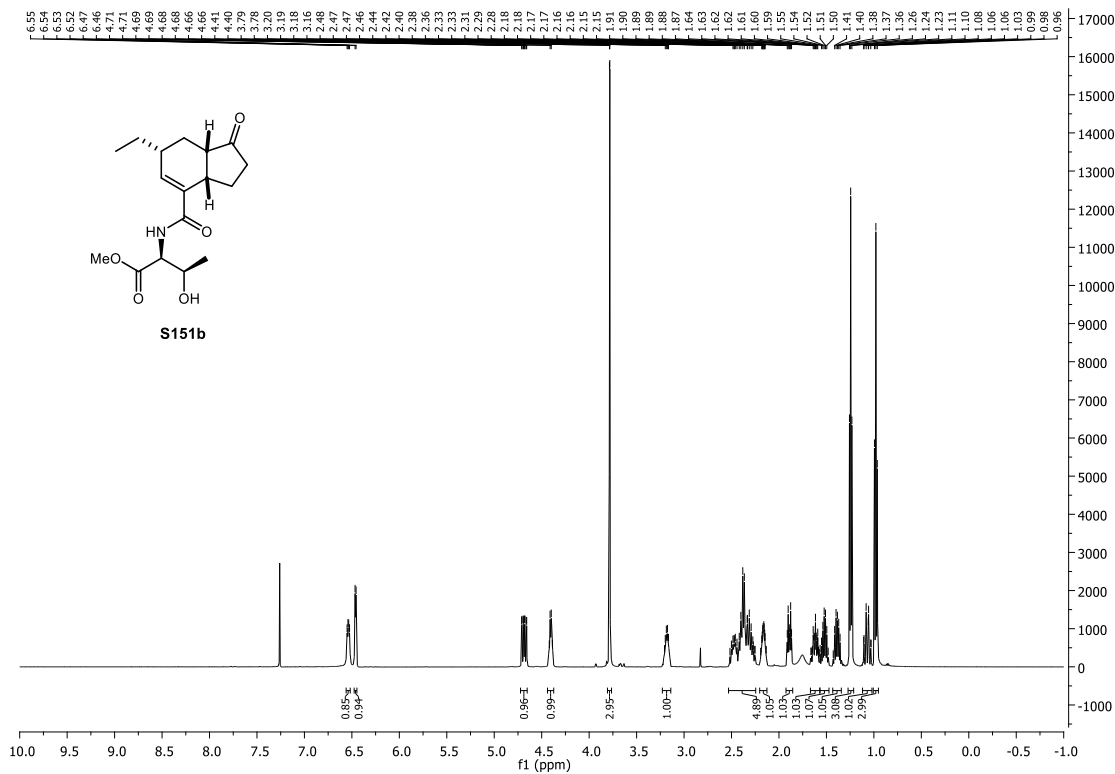
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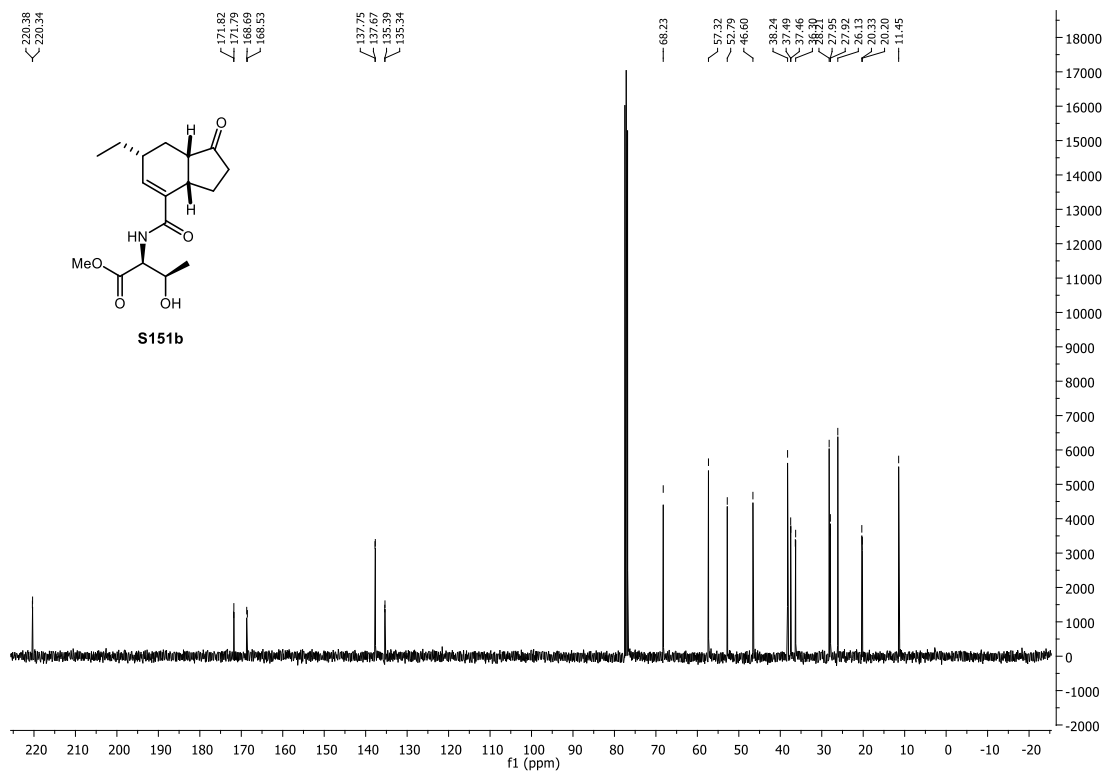
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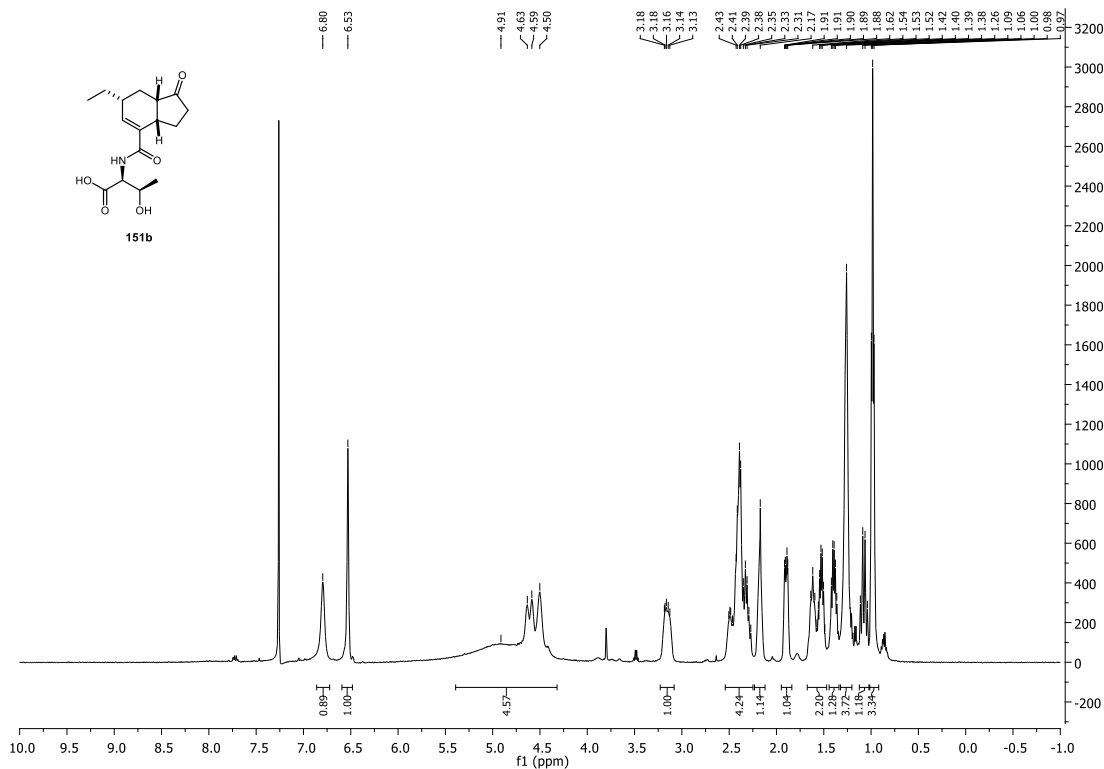
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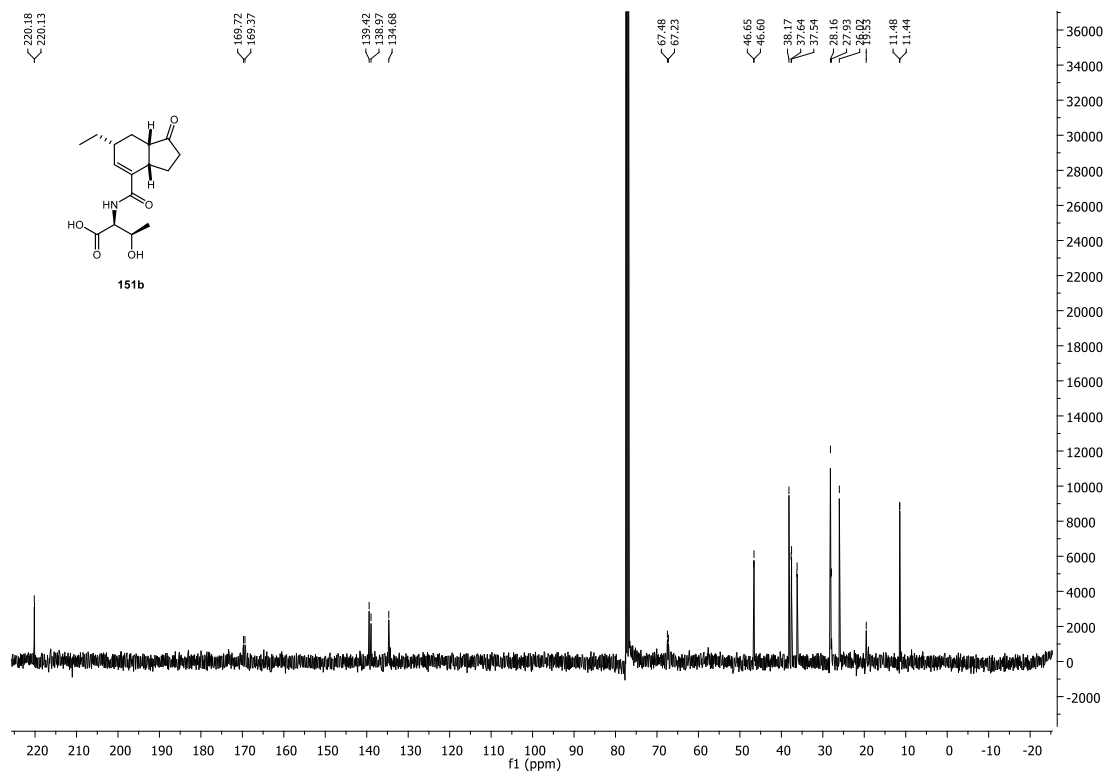
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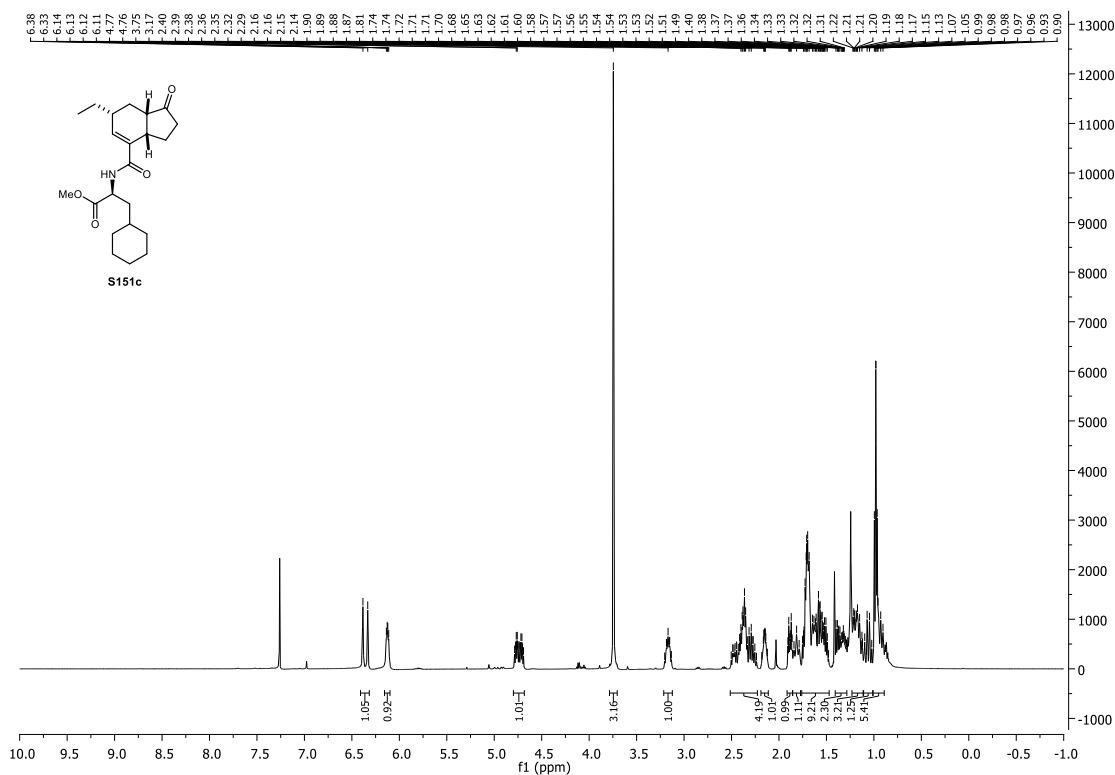
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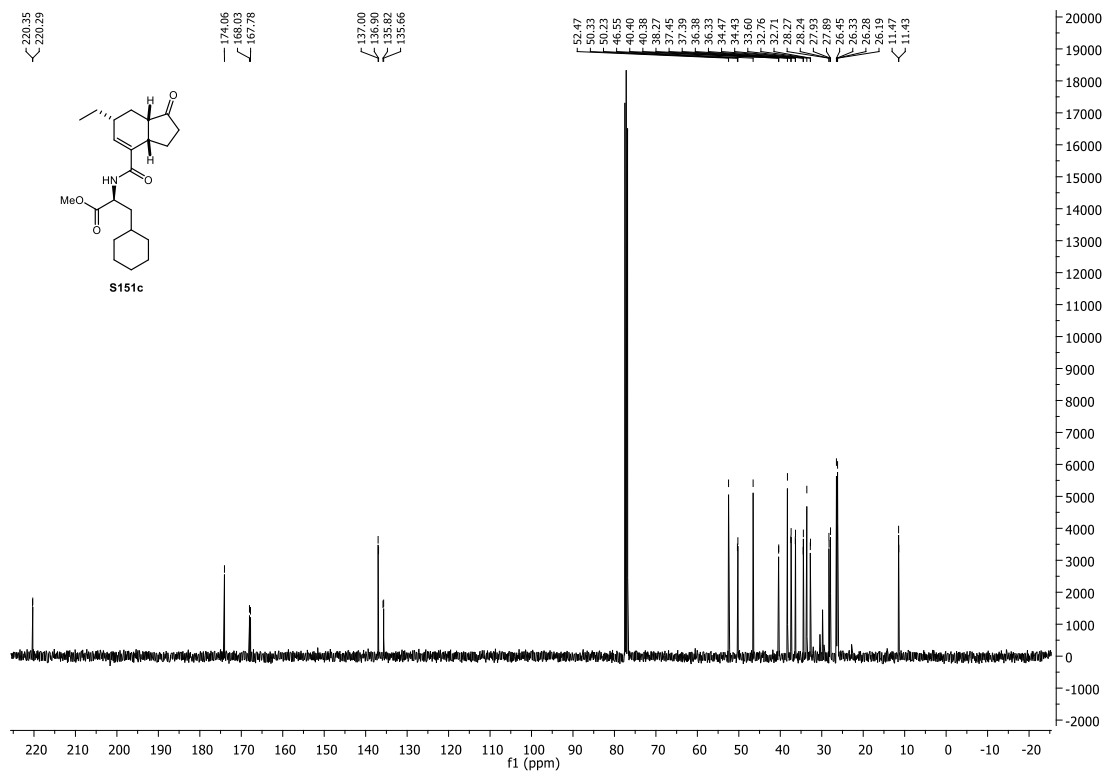
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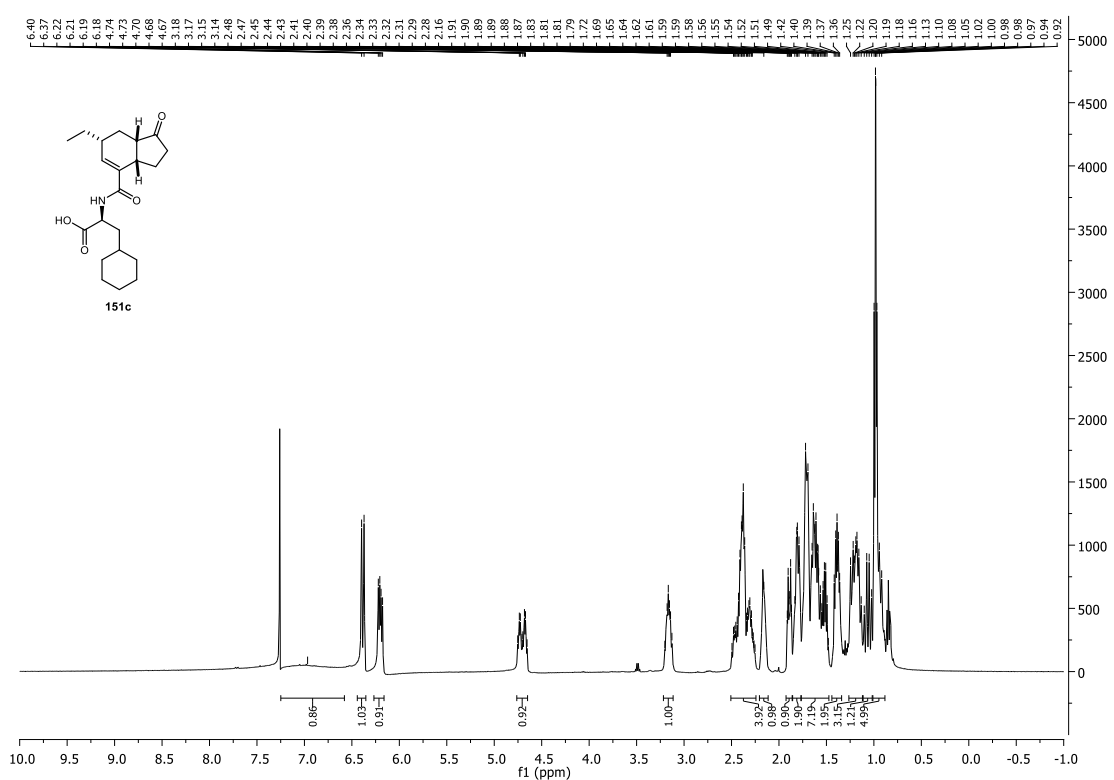
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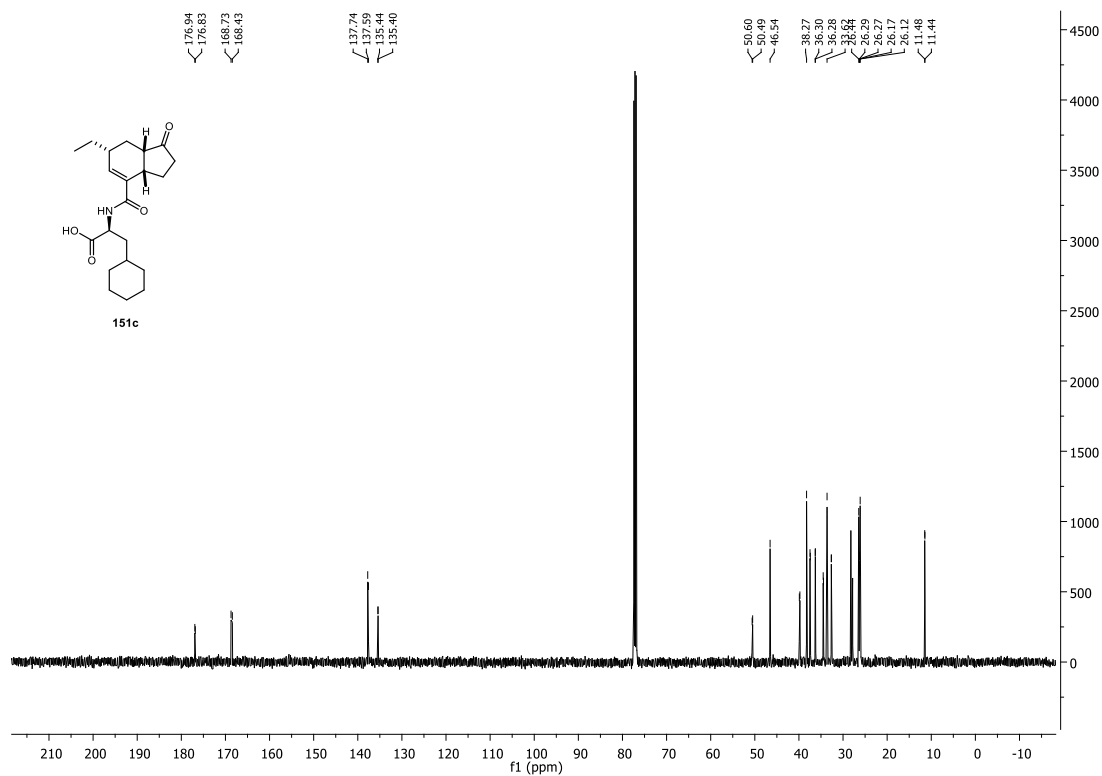
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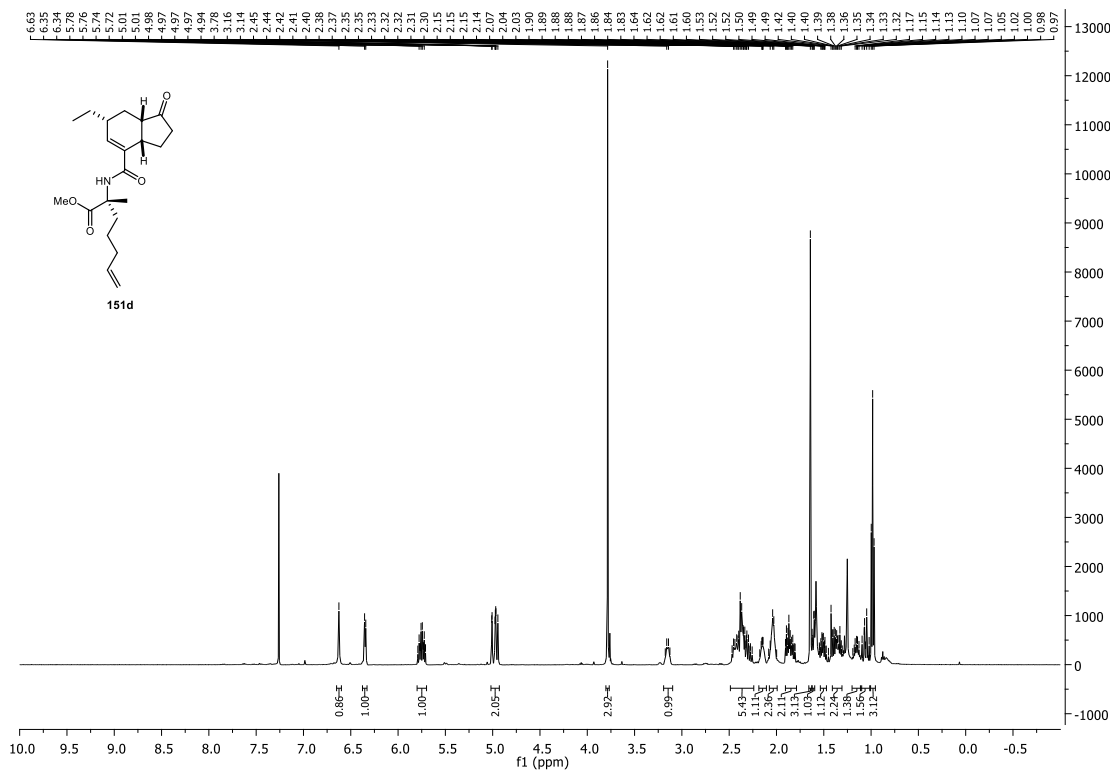
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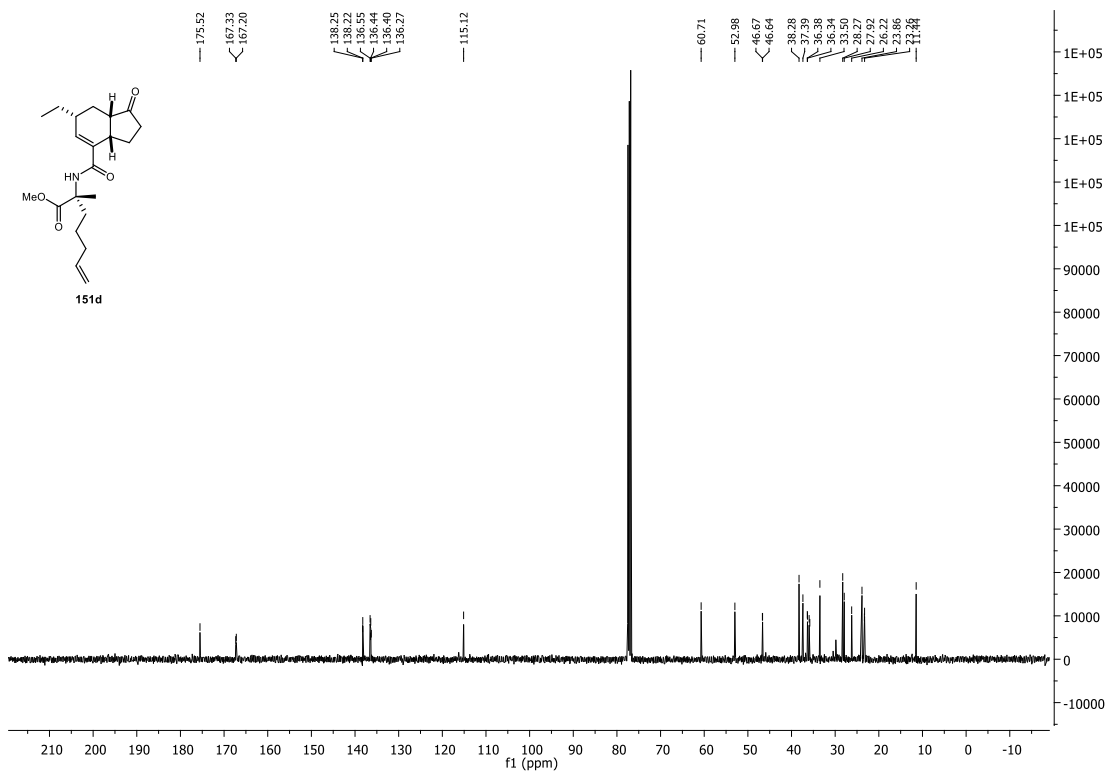
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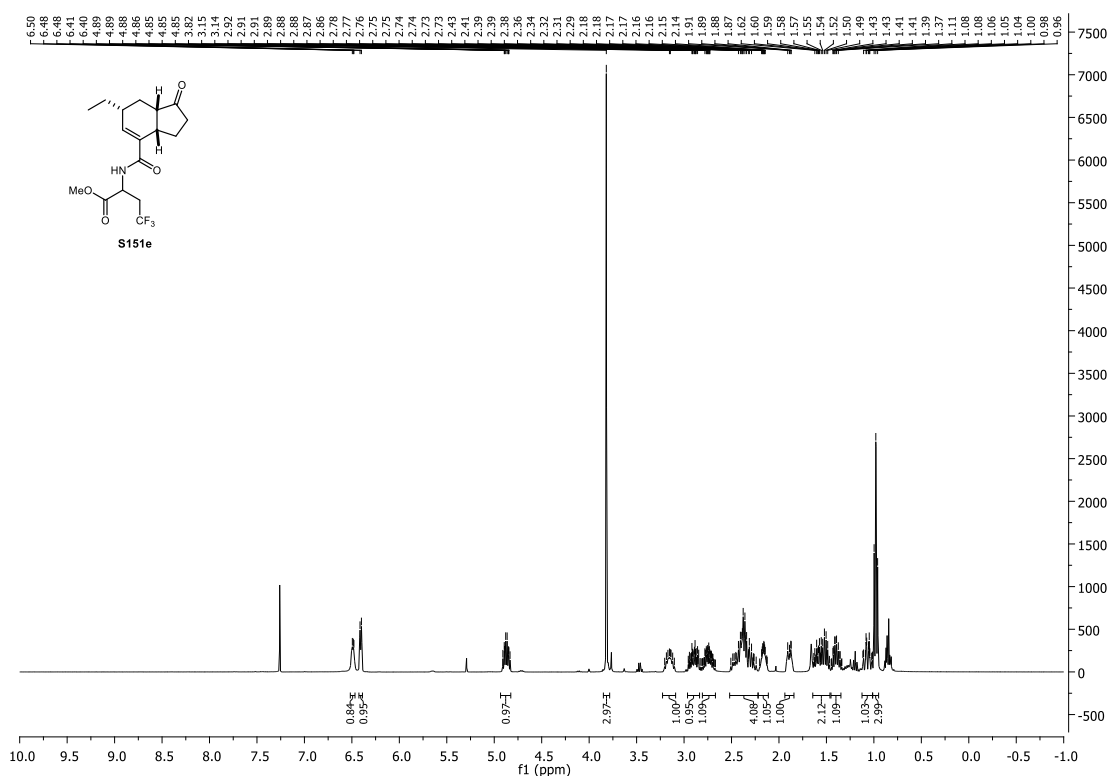
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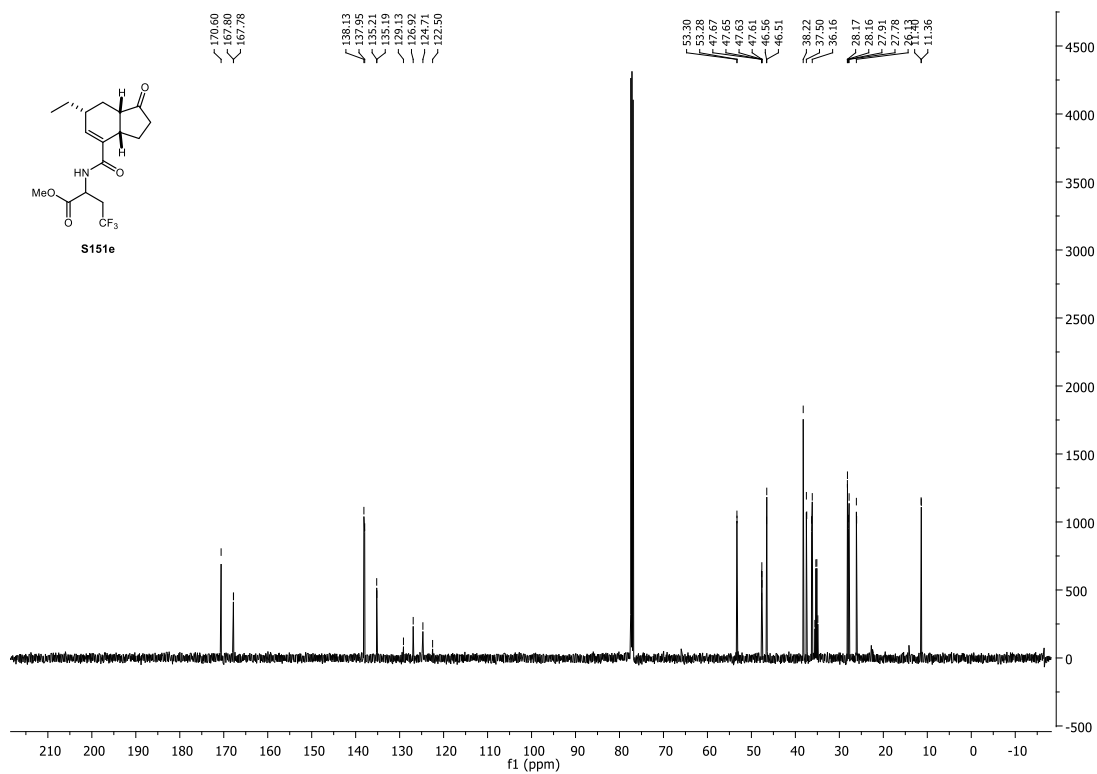
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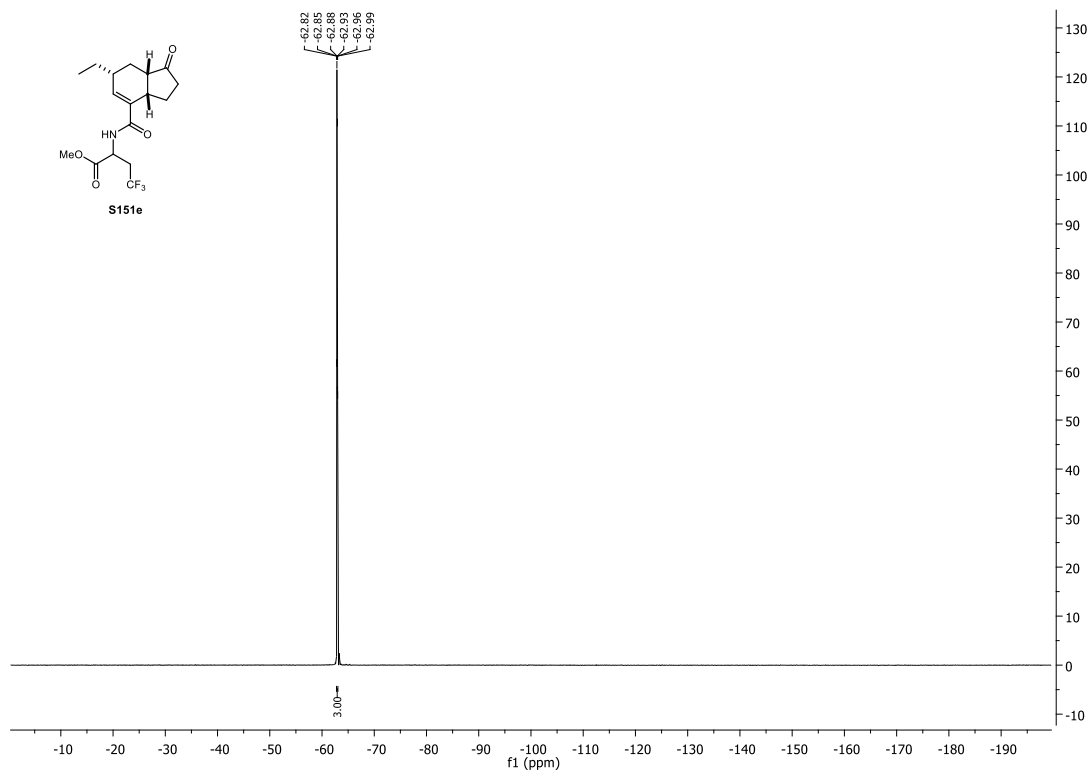
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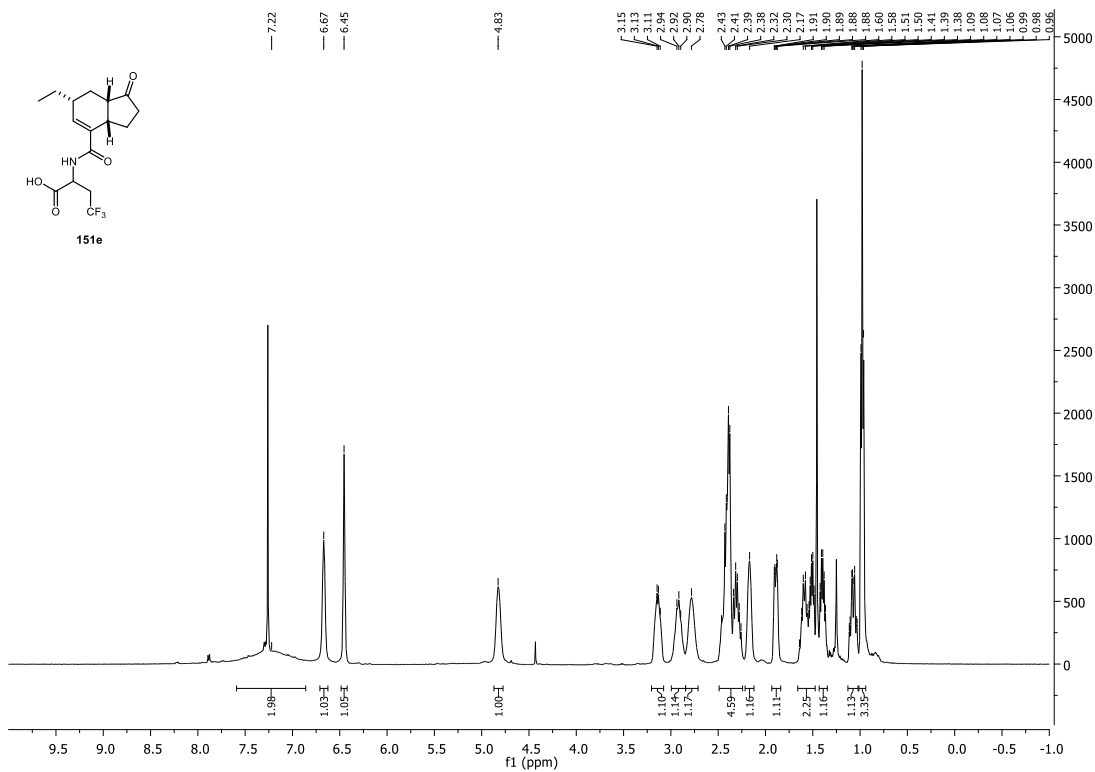
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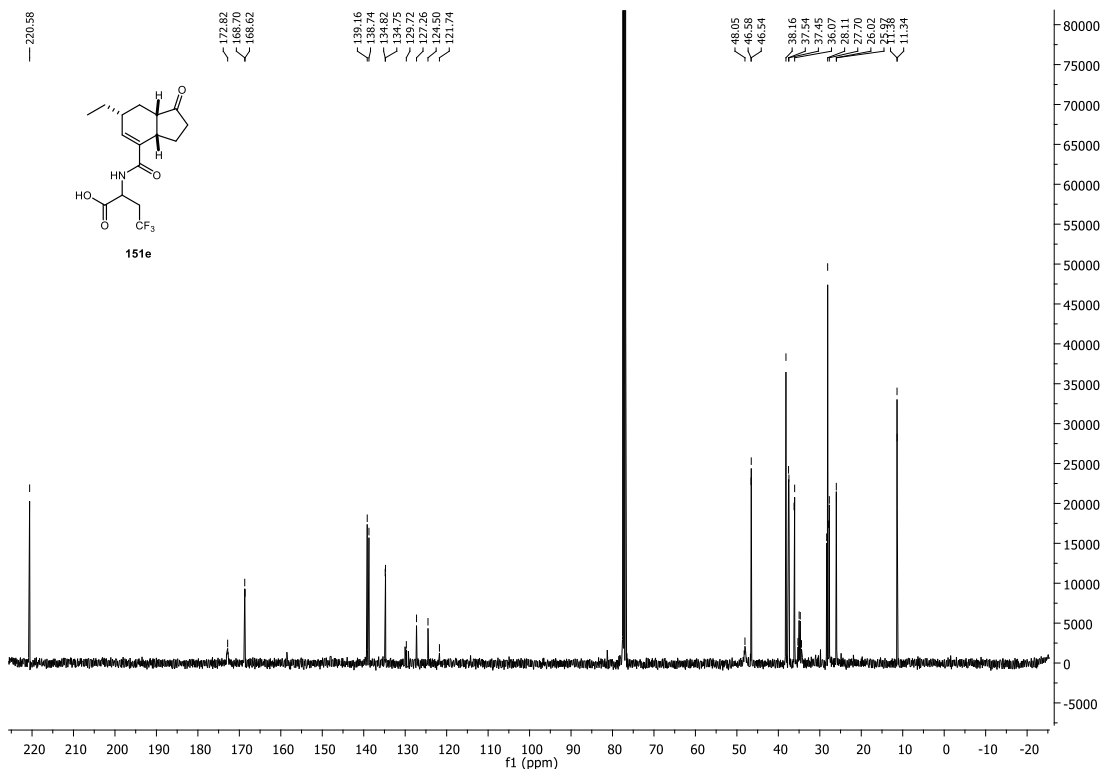
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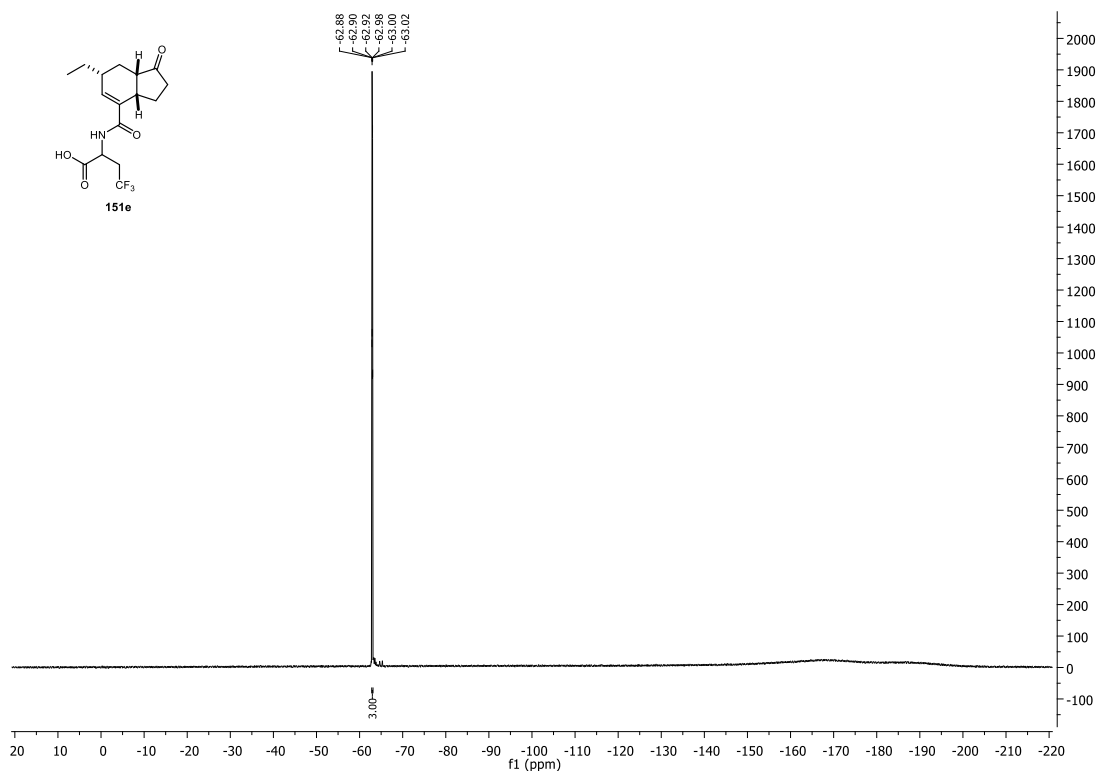
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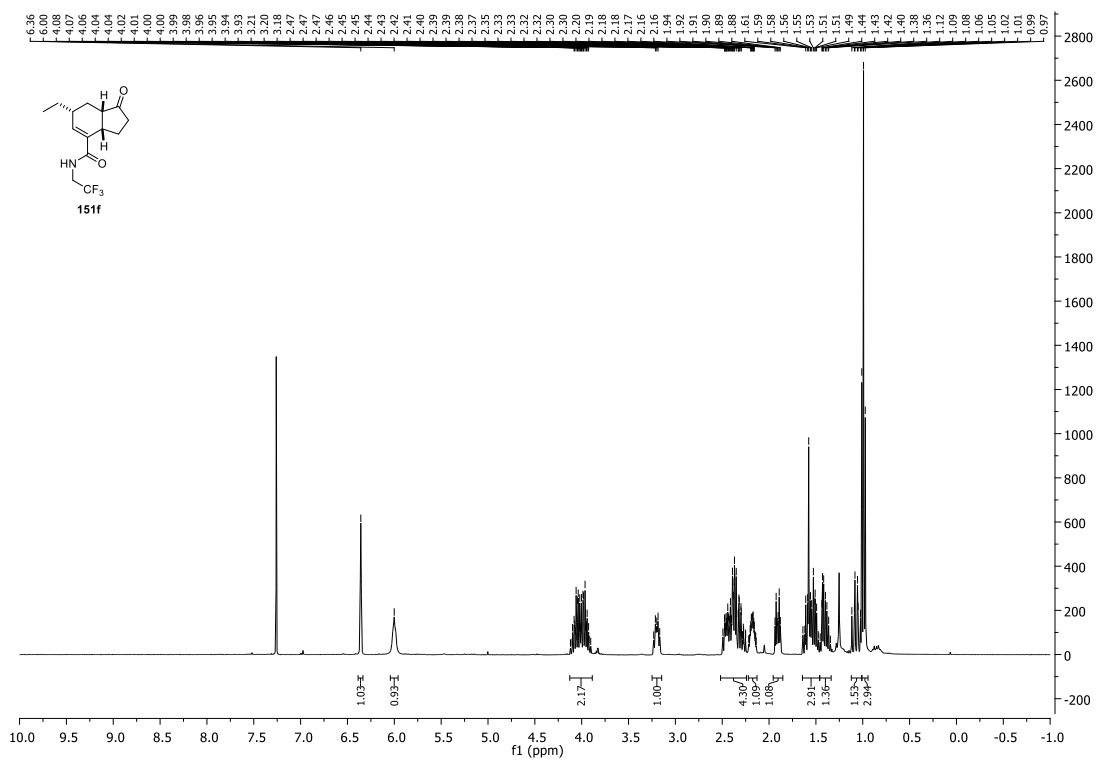
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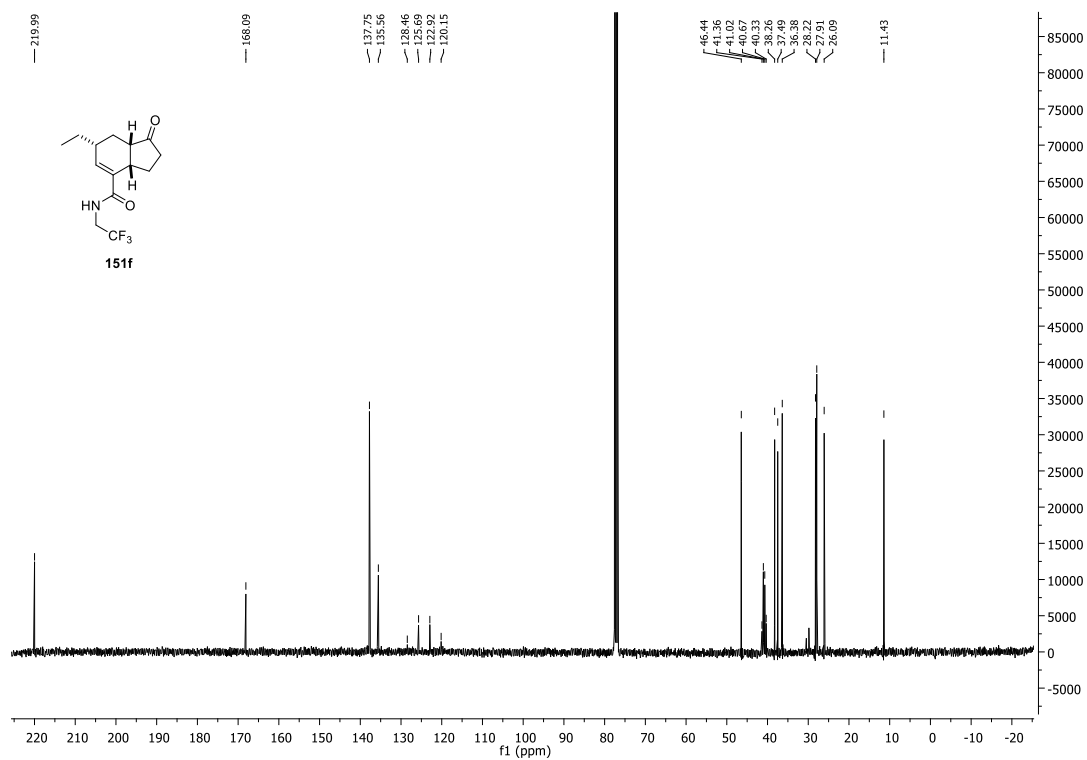
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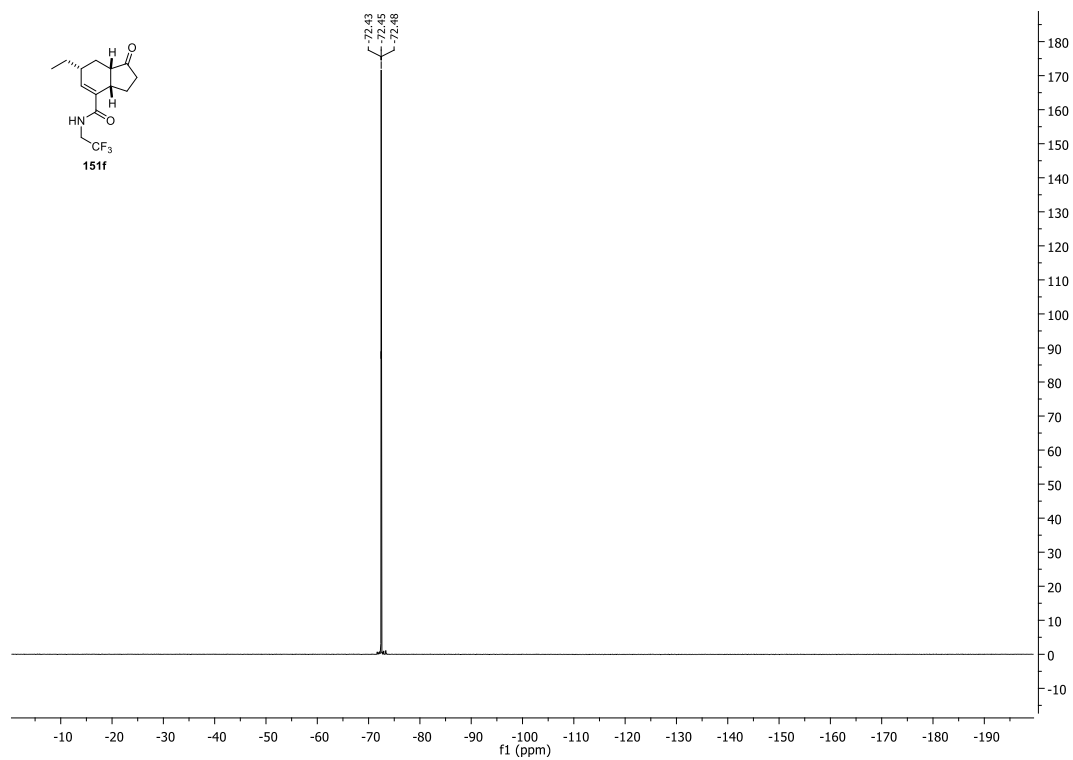
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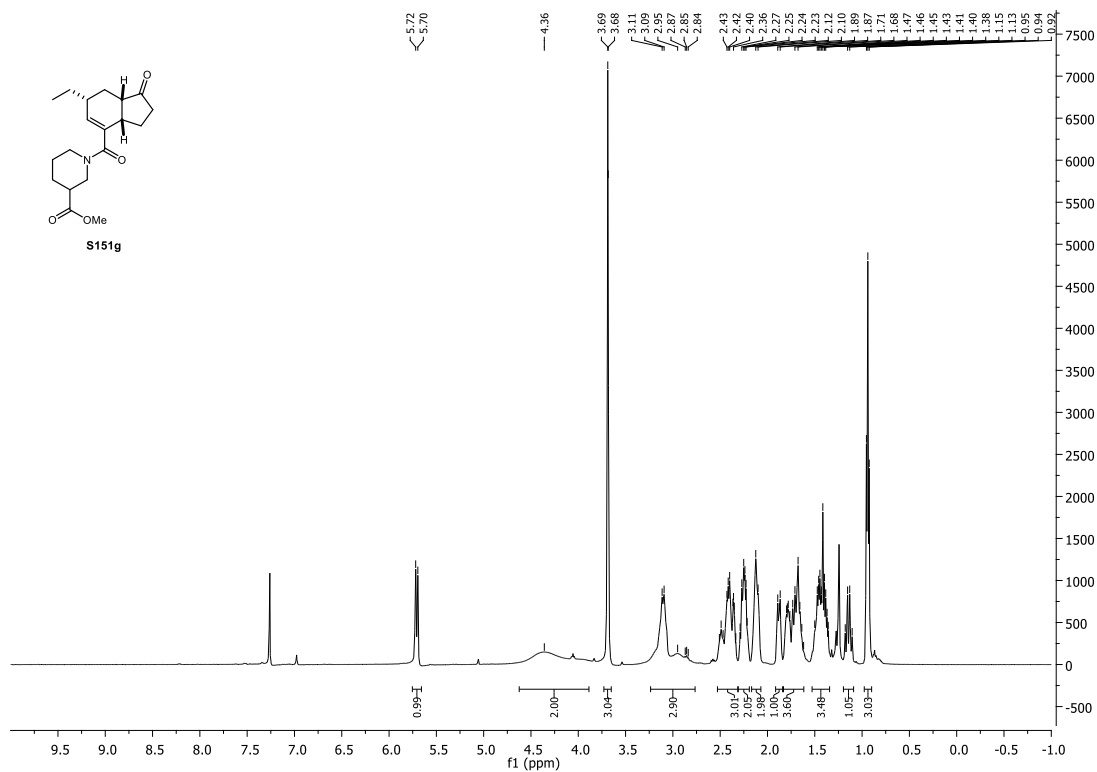
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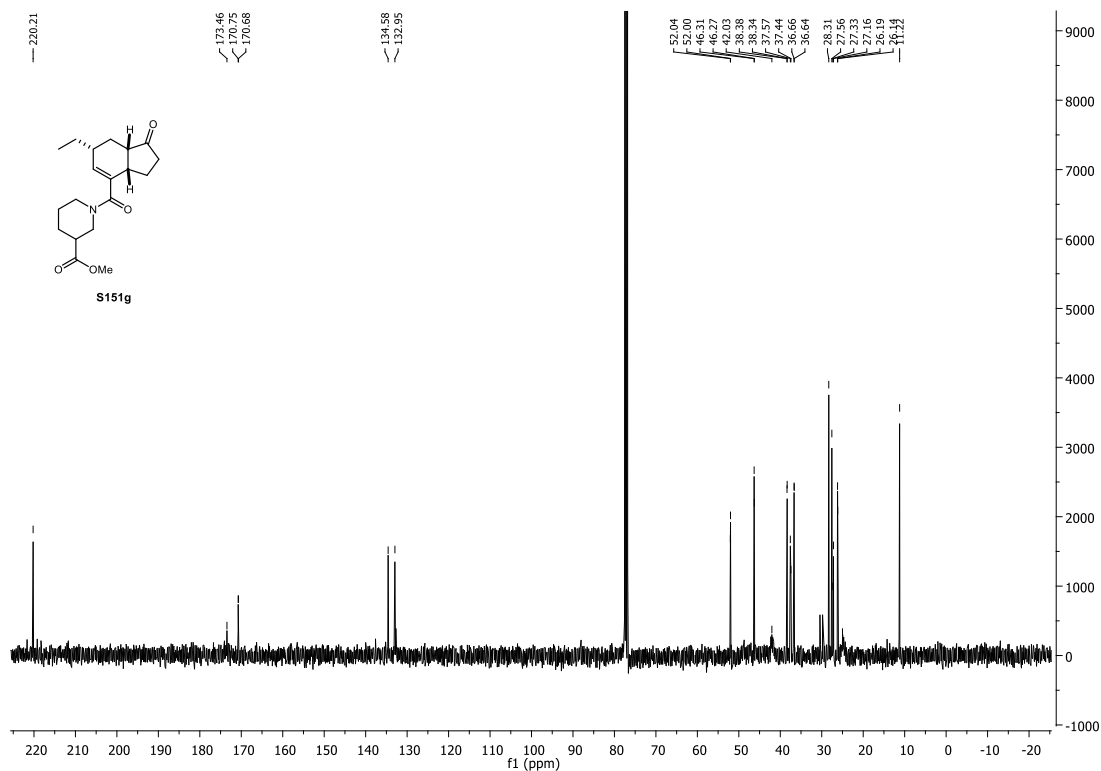
¹⁹F NMR 151f.



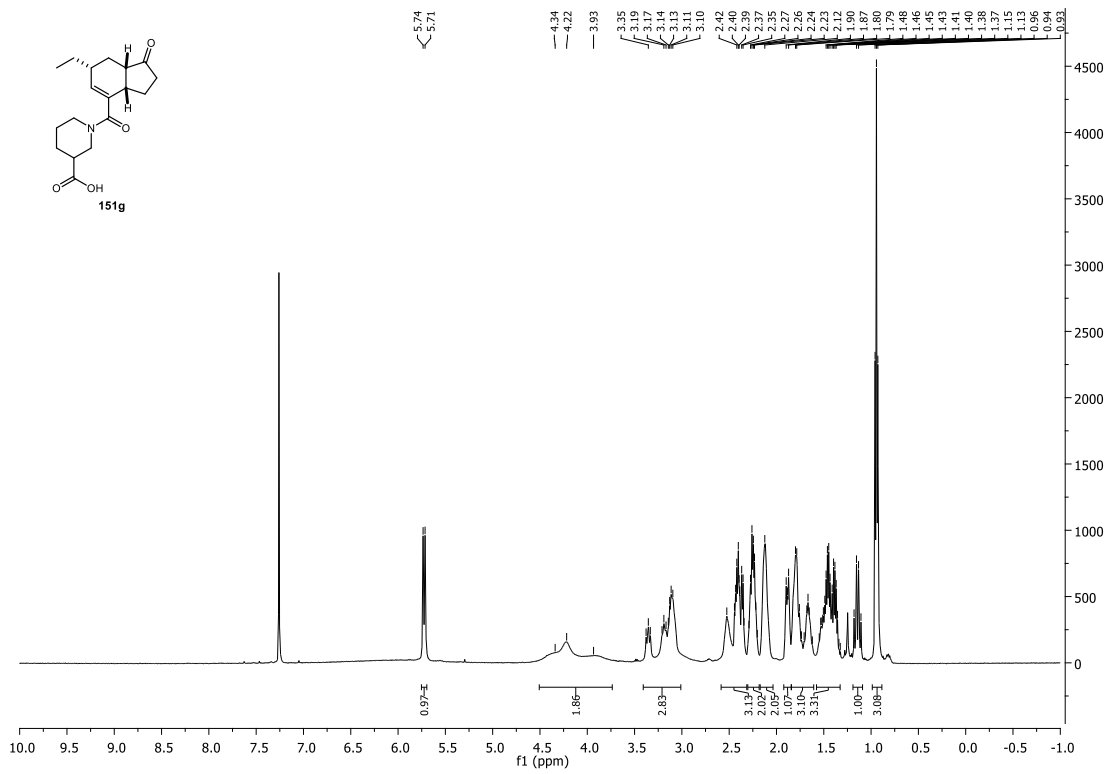
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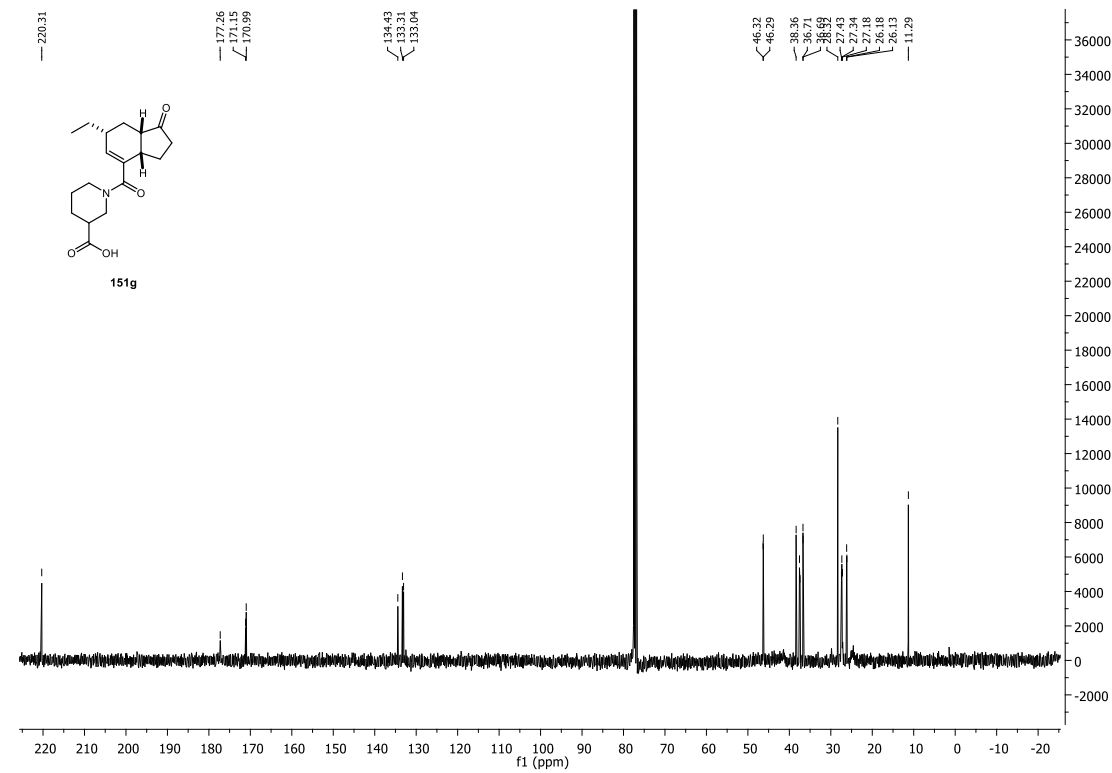
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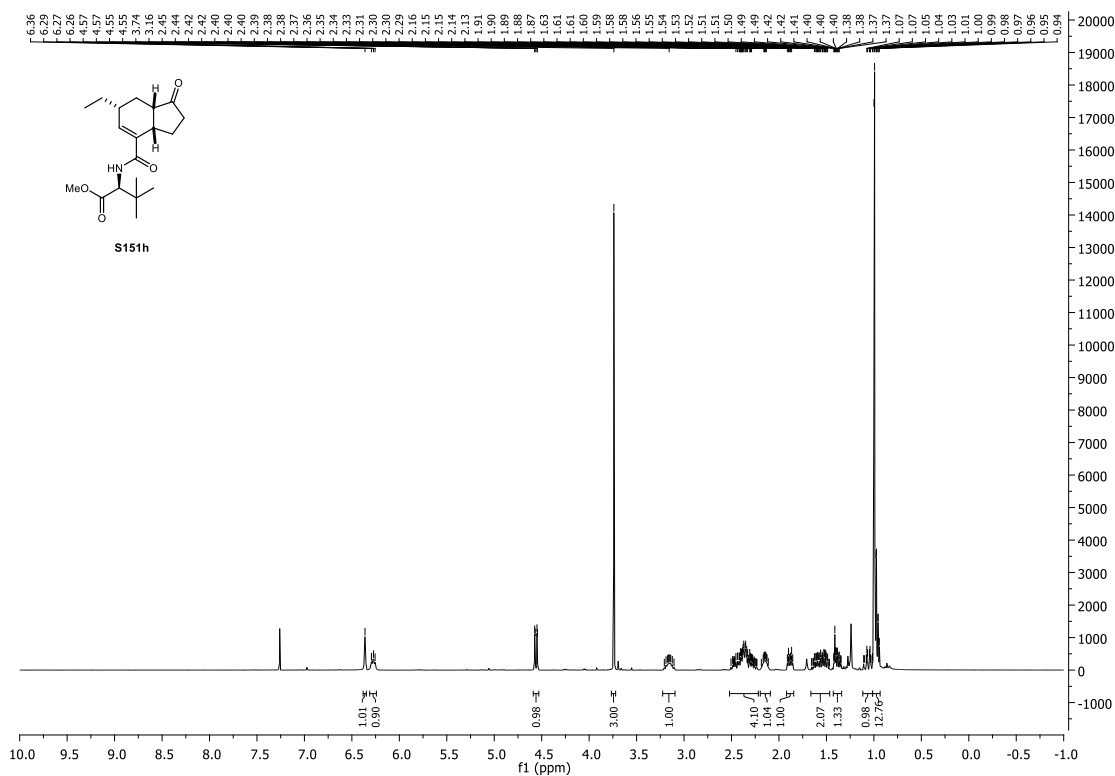
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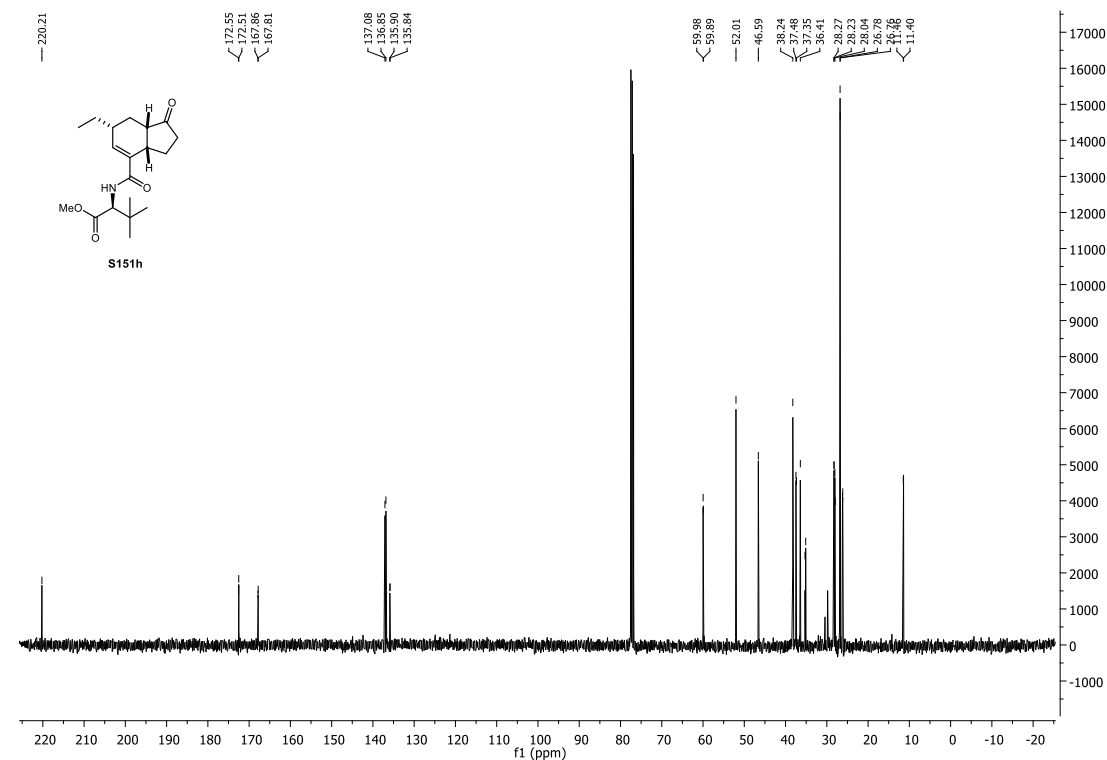
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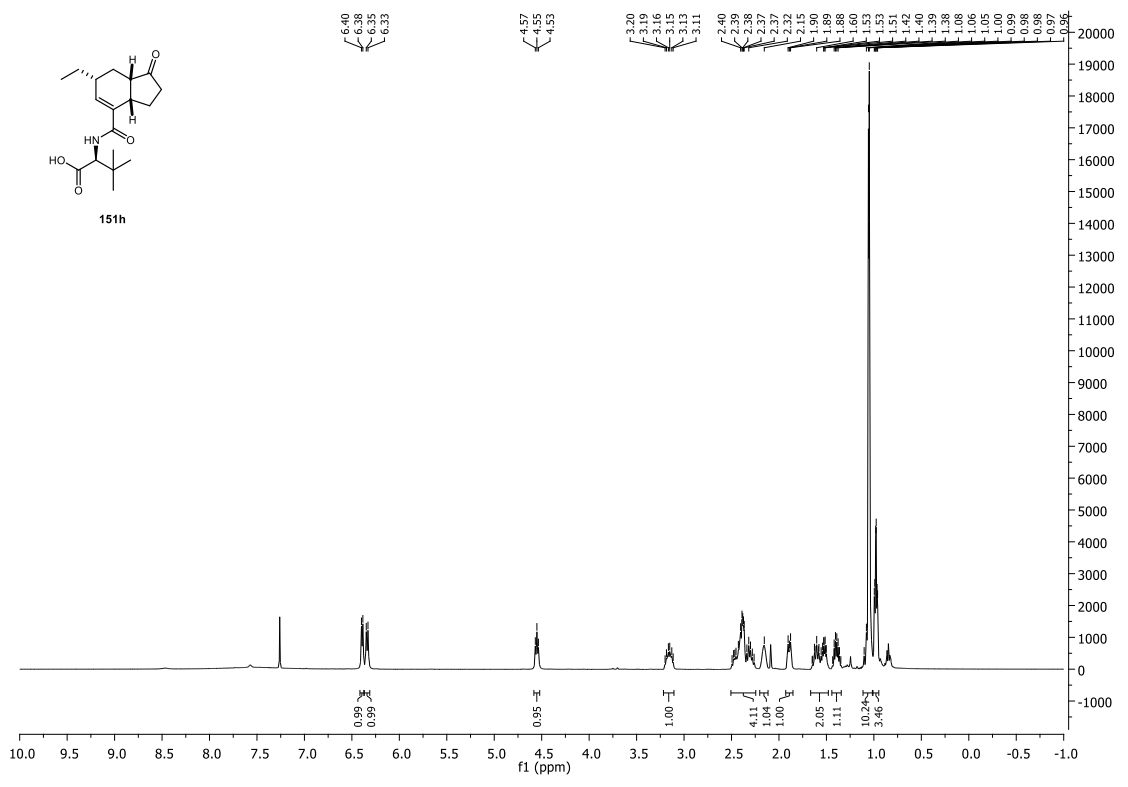
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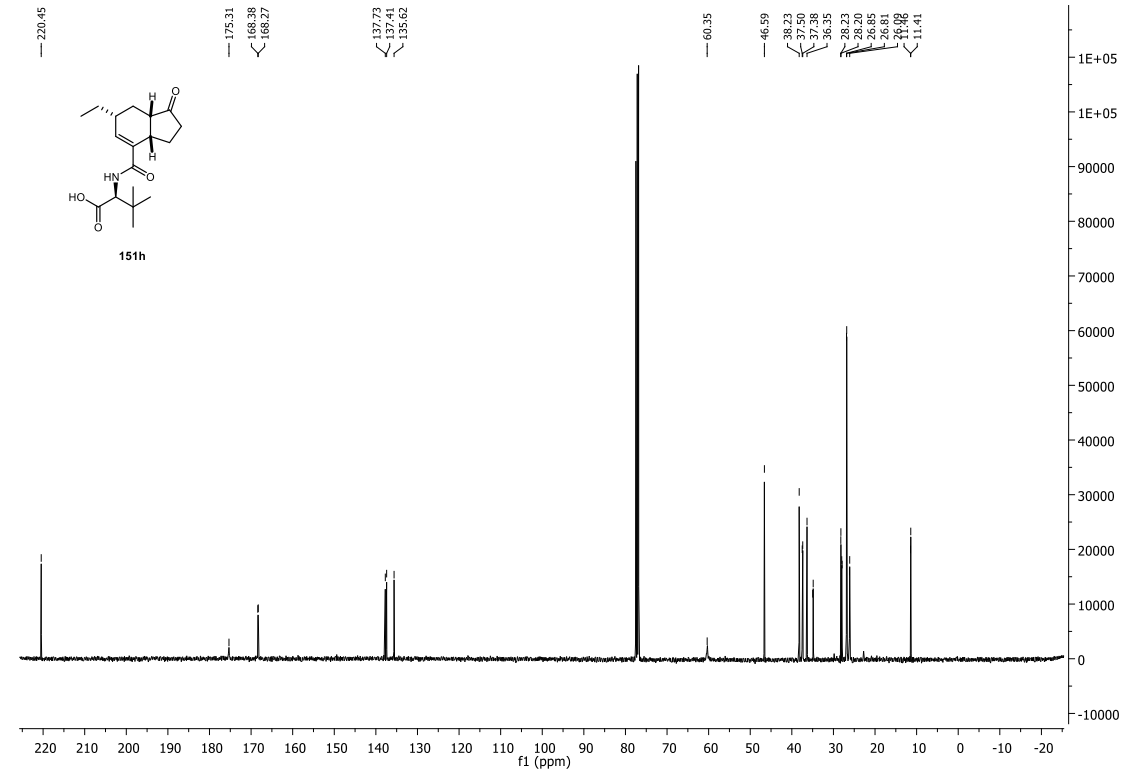
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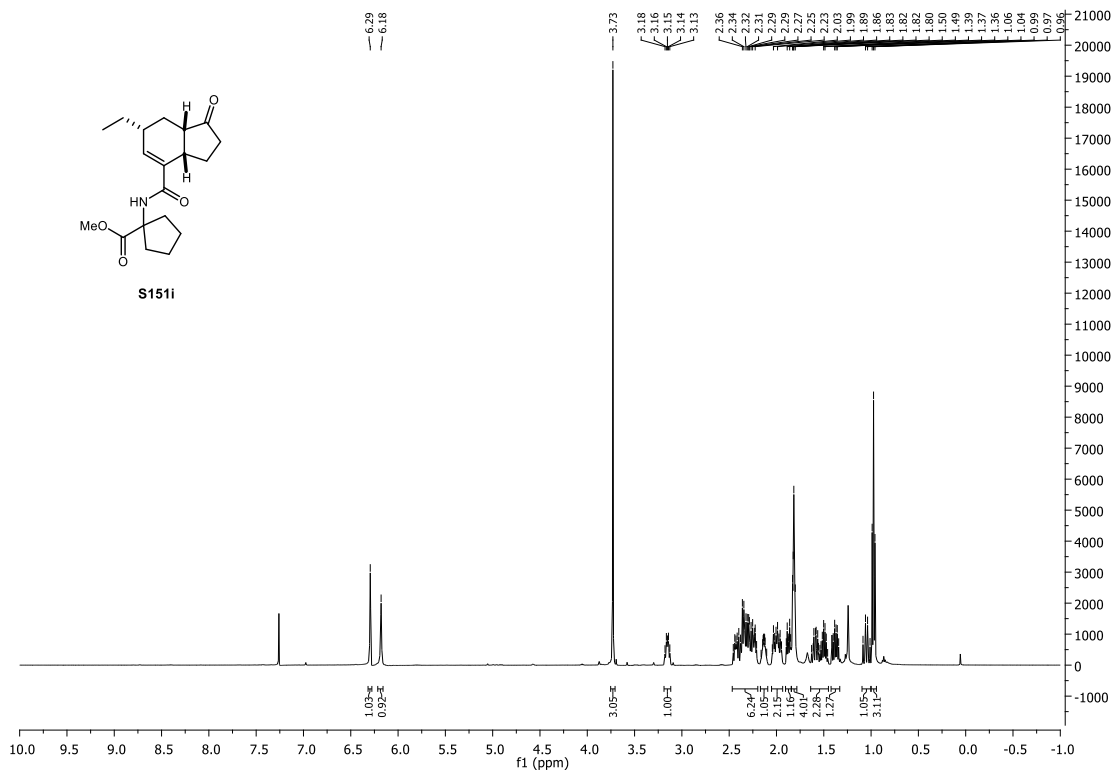
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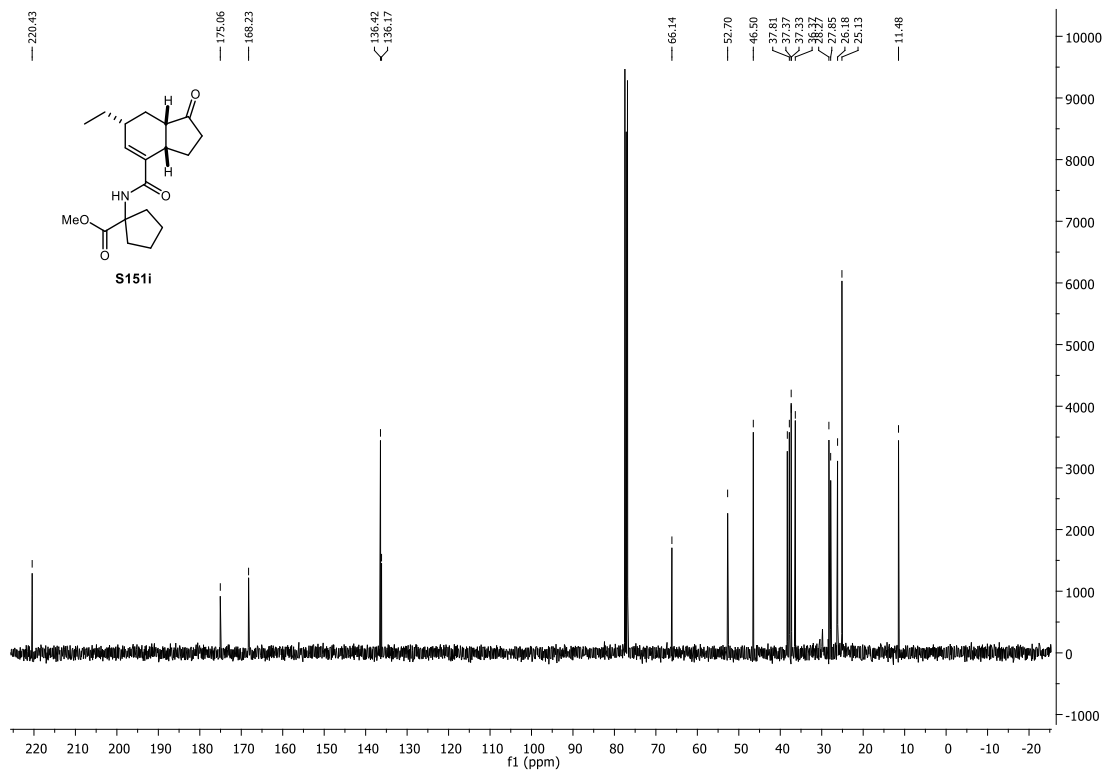
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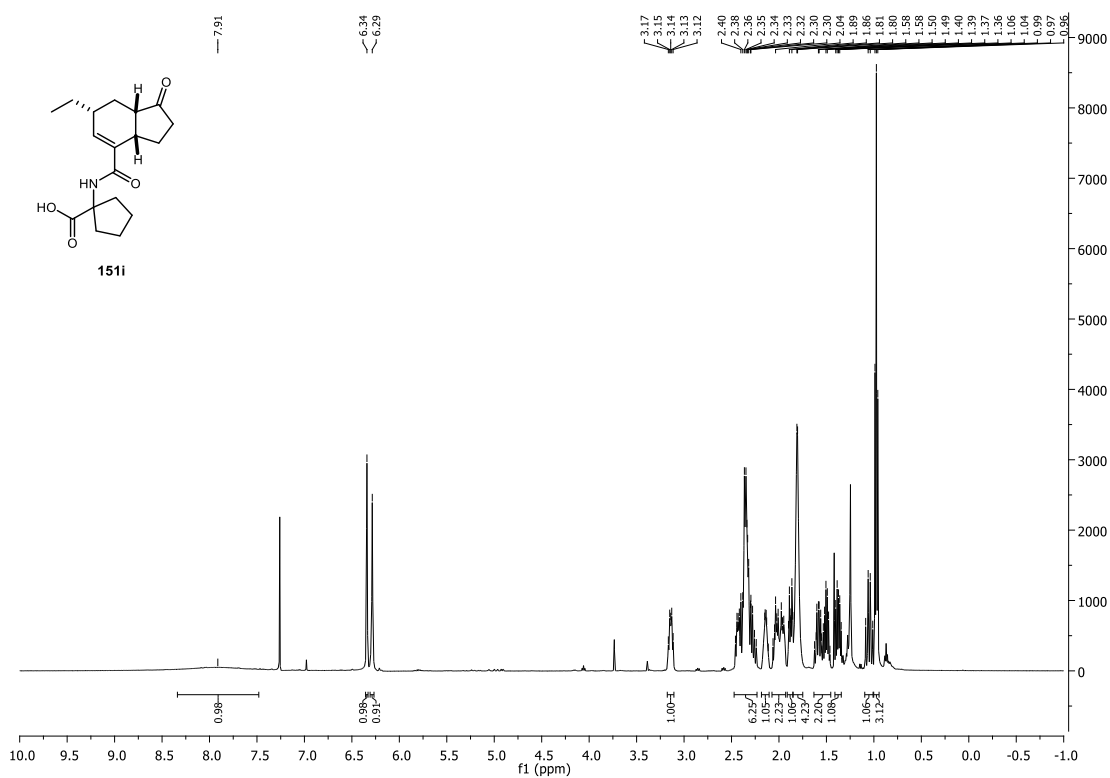
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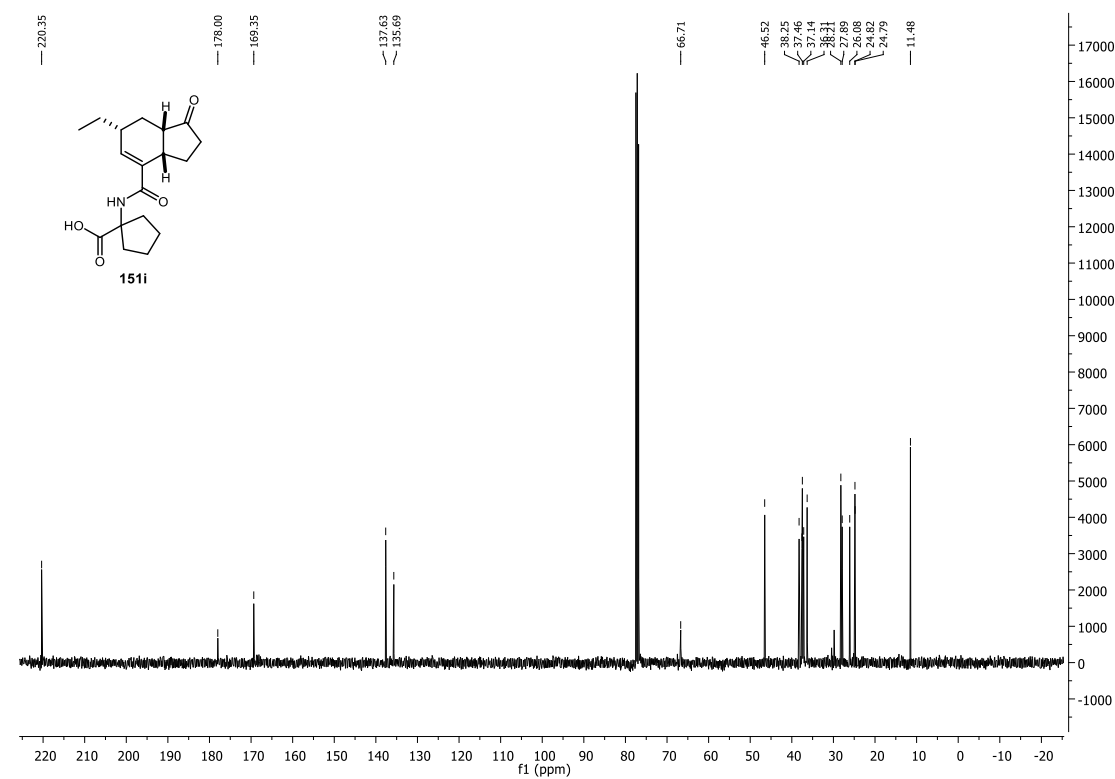
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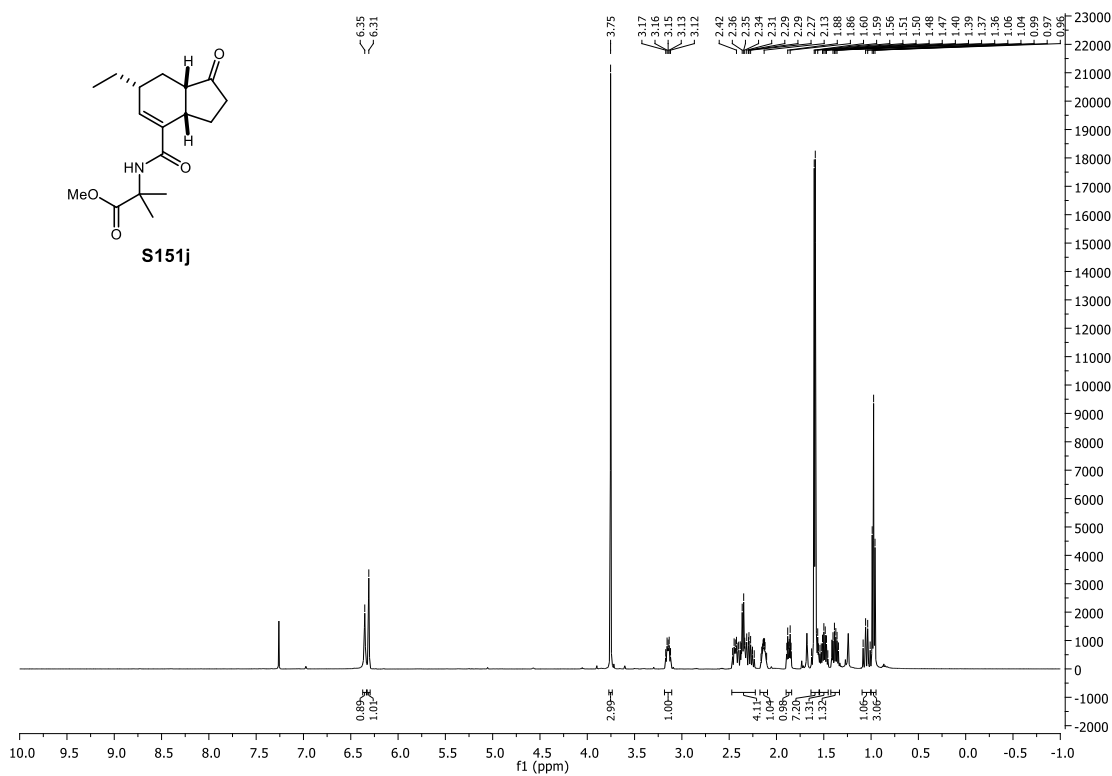
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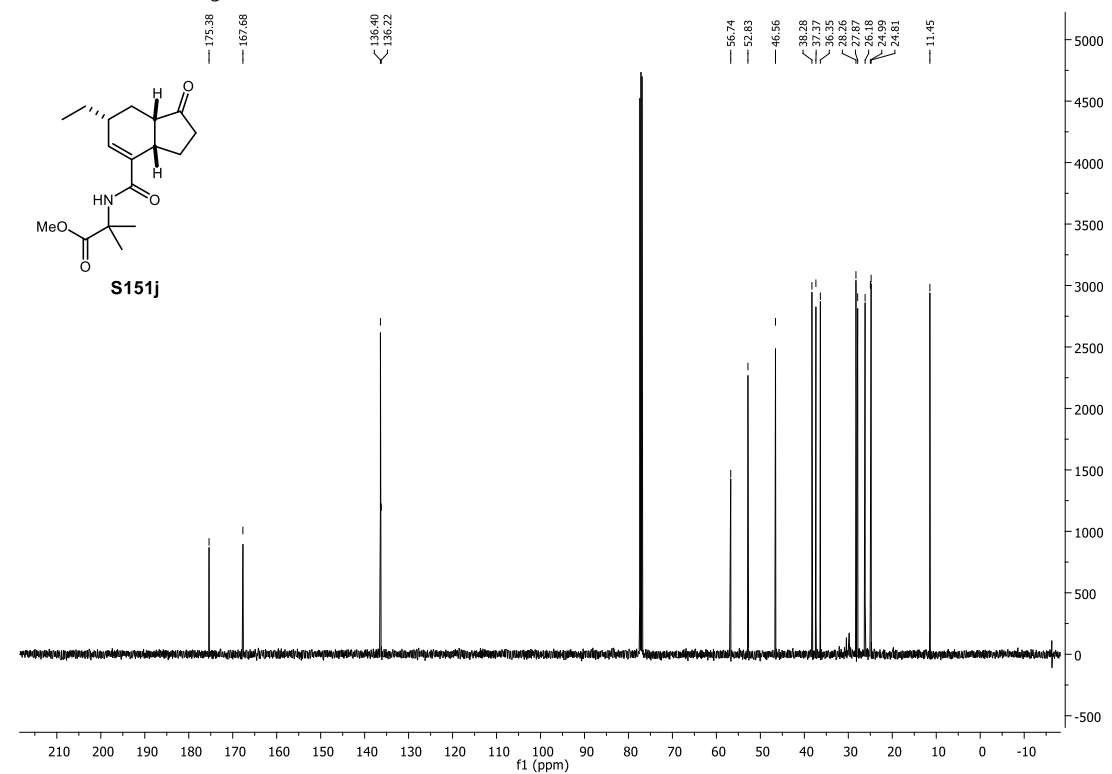
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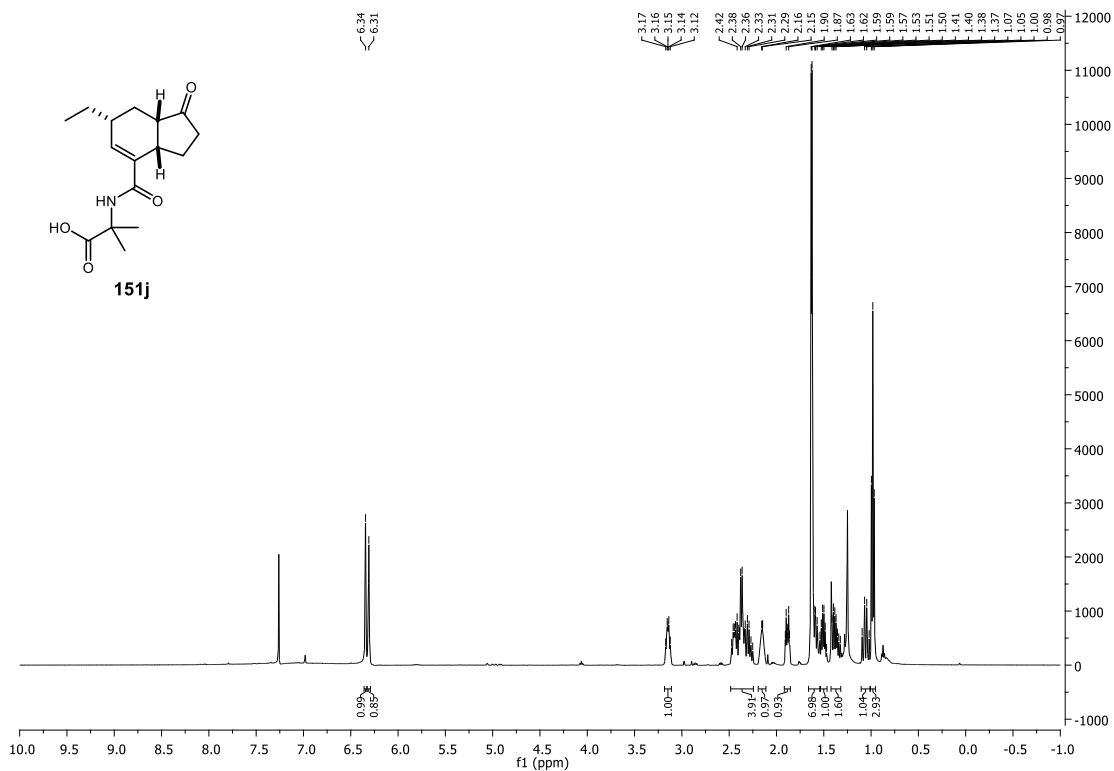
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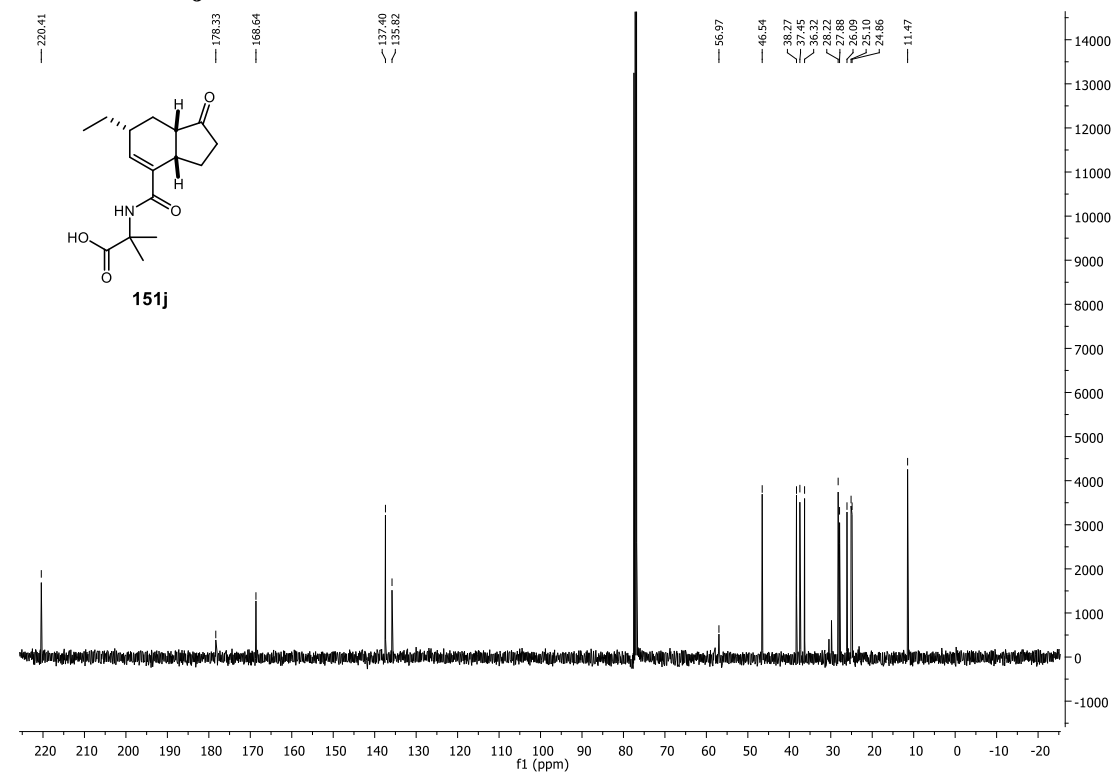
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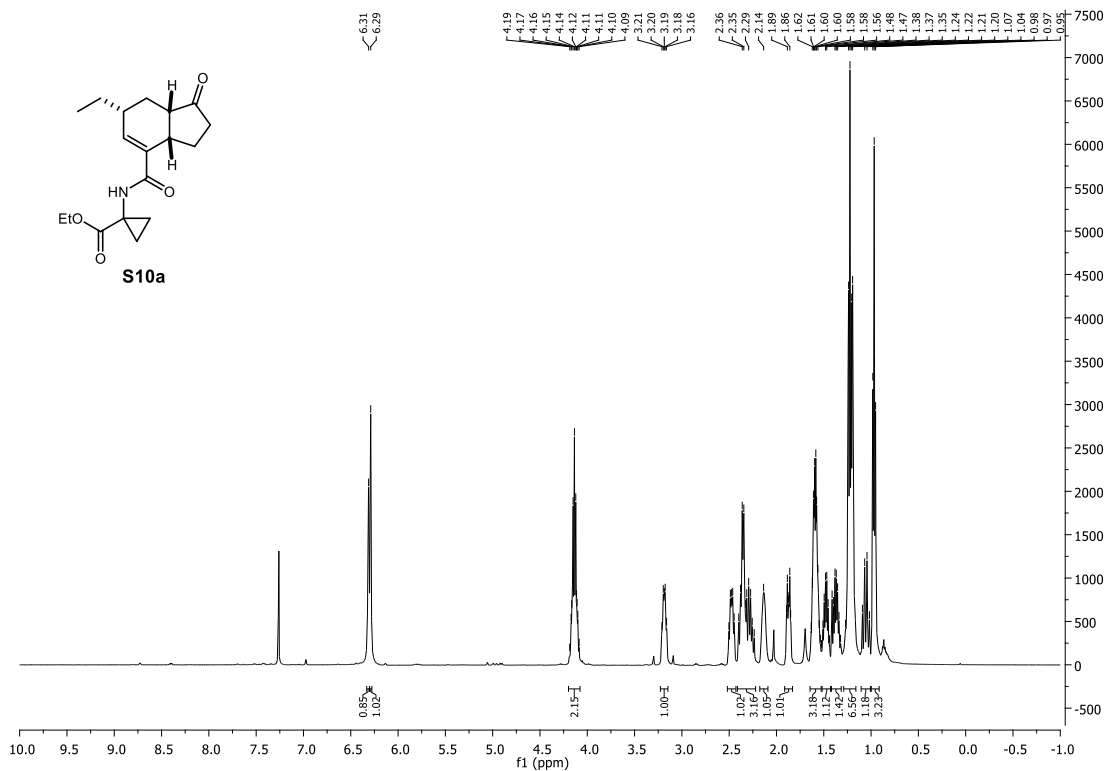
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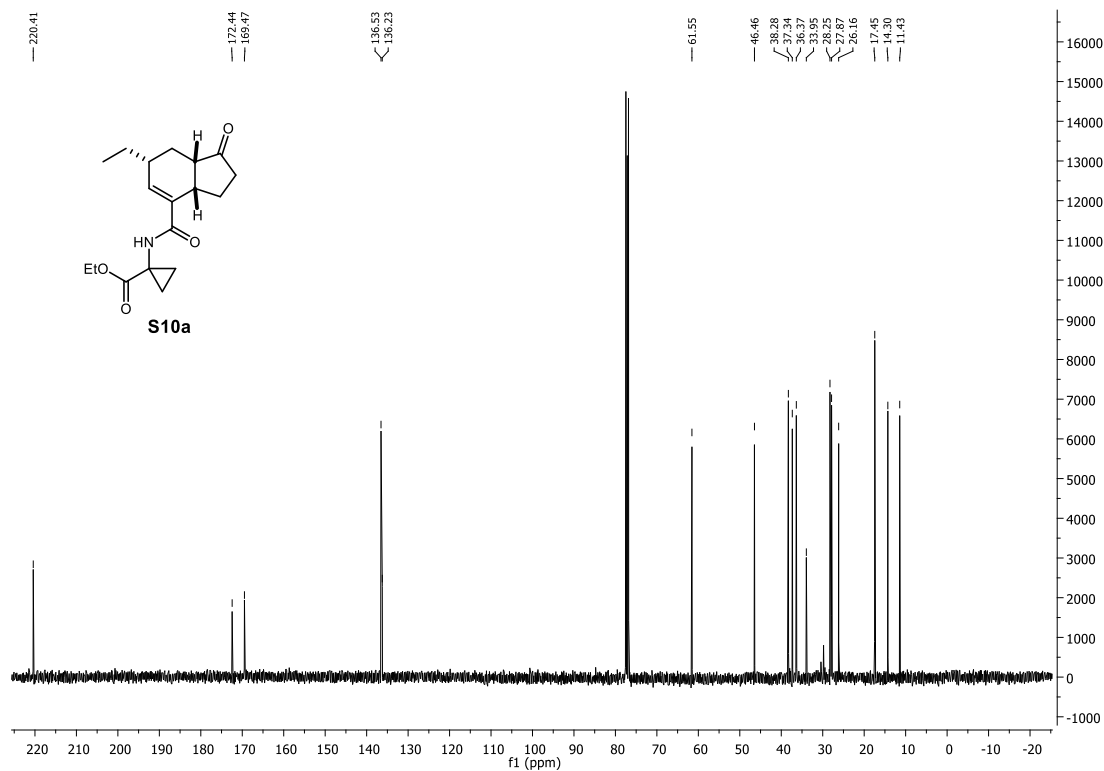
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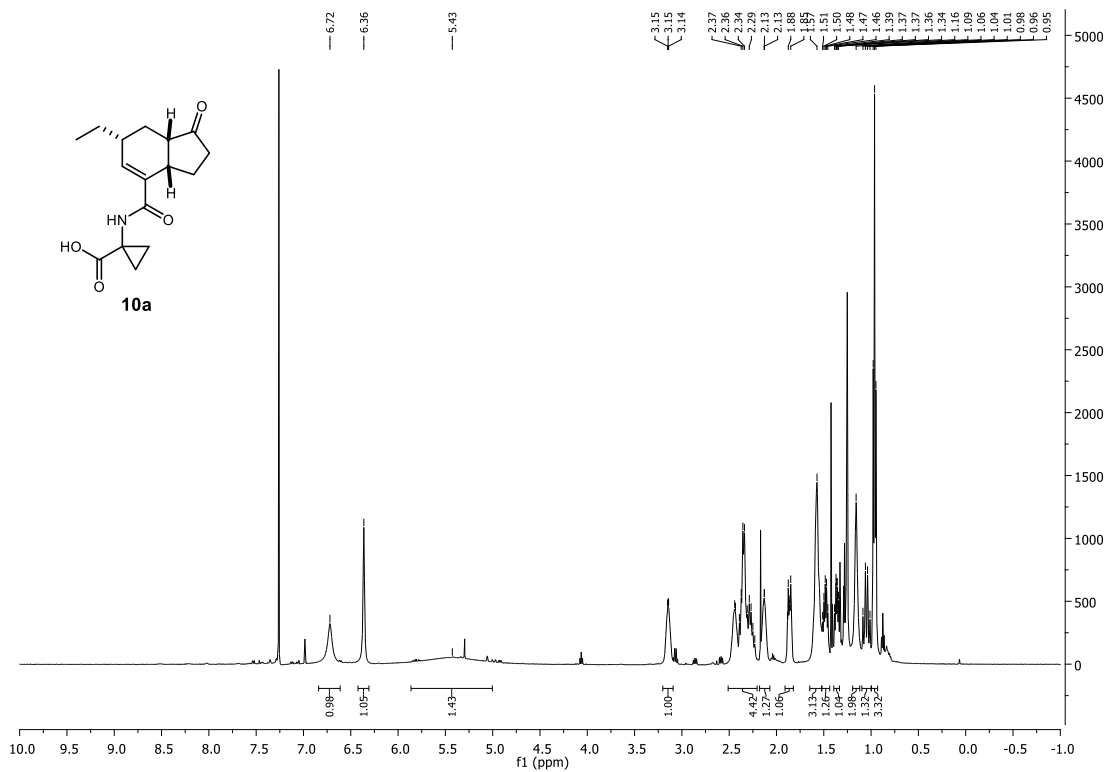
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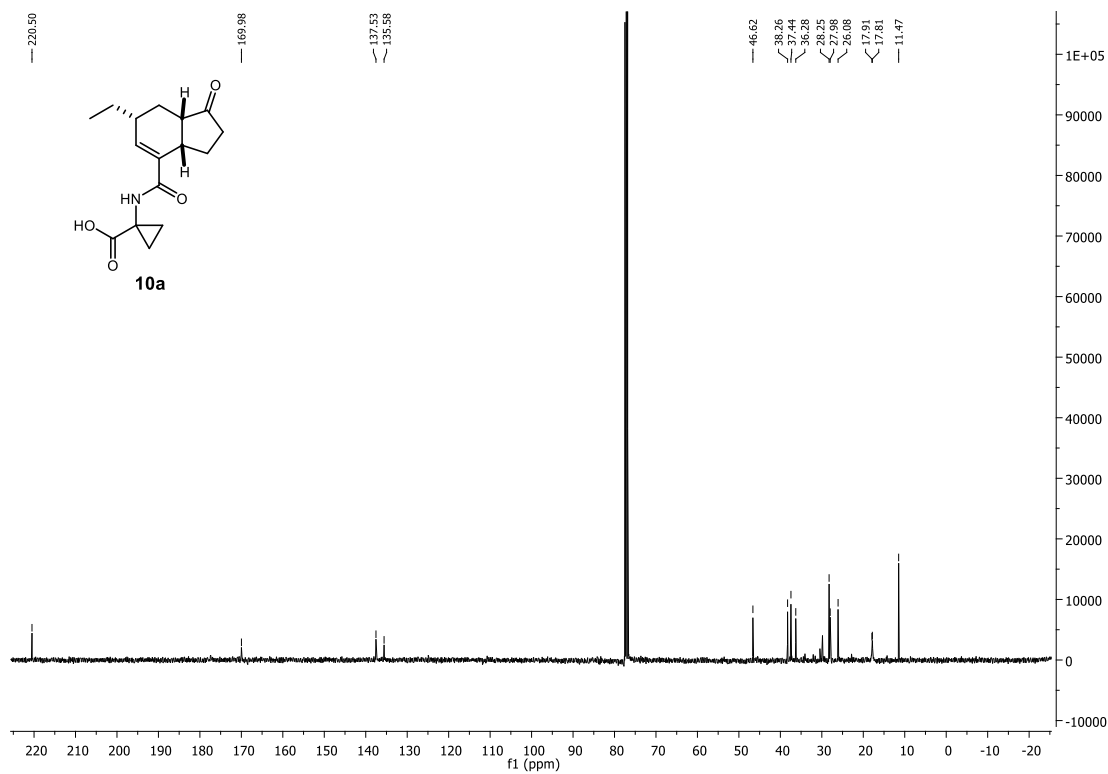
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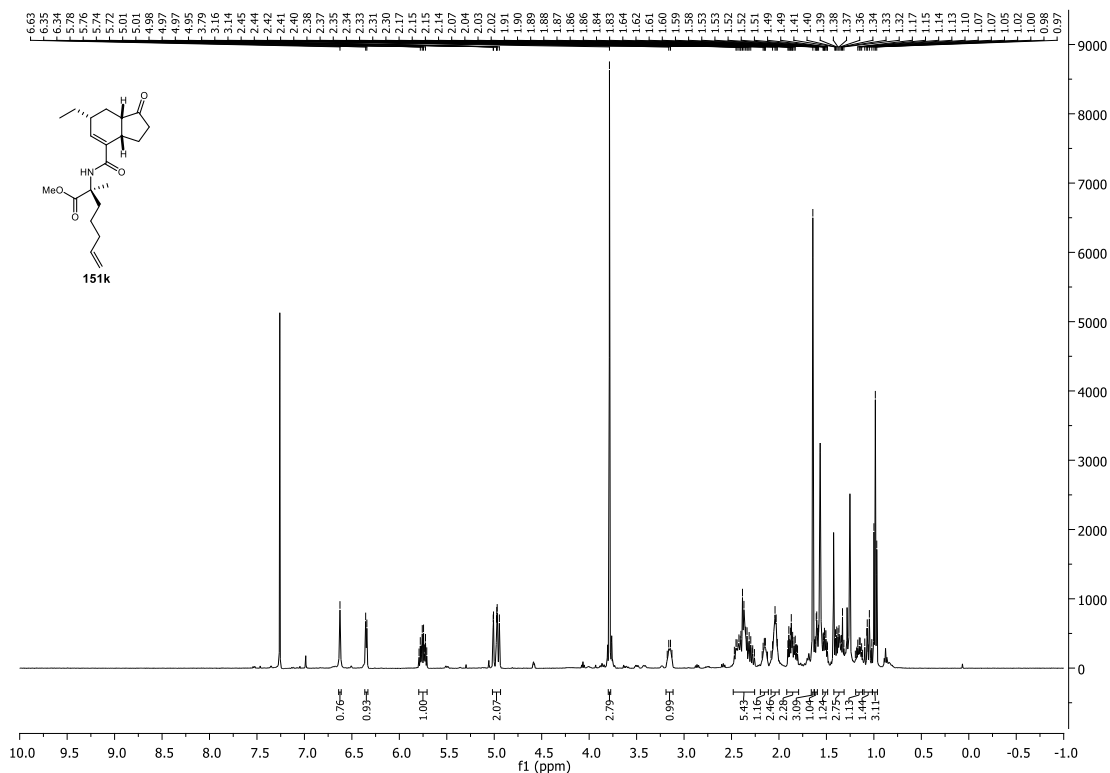
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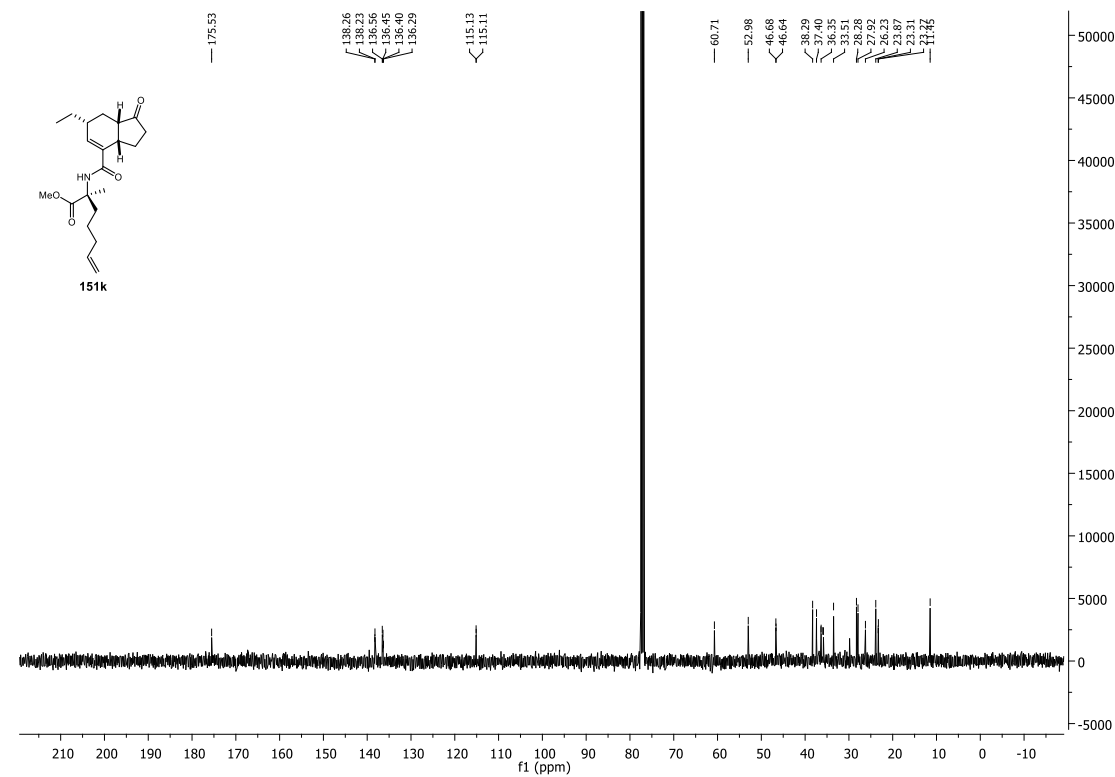
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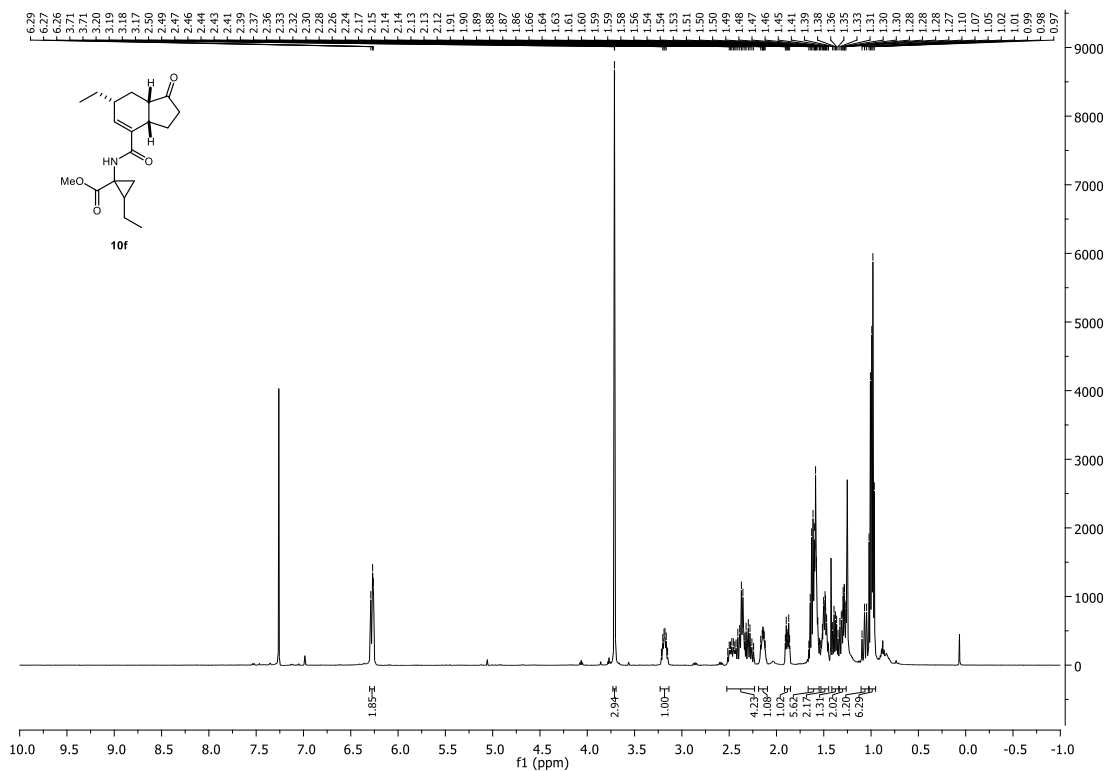
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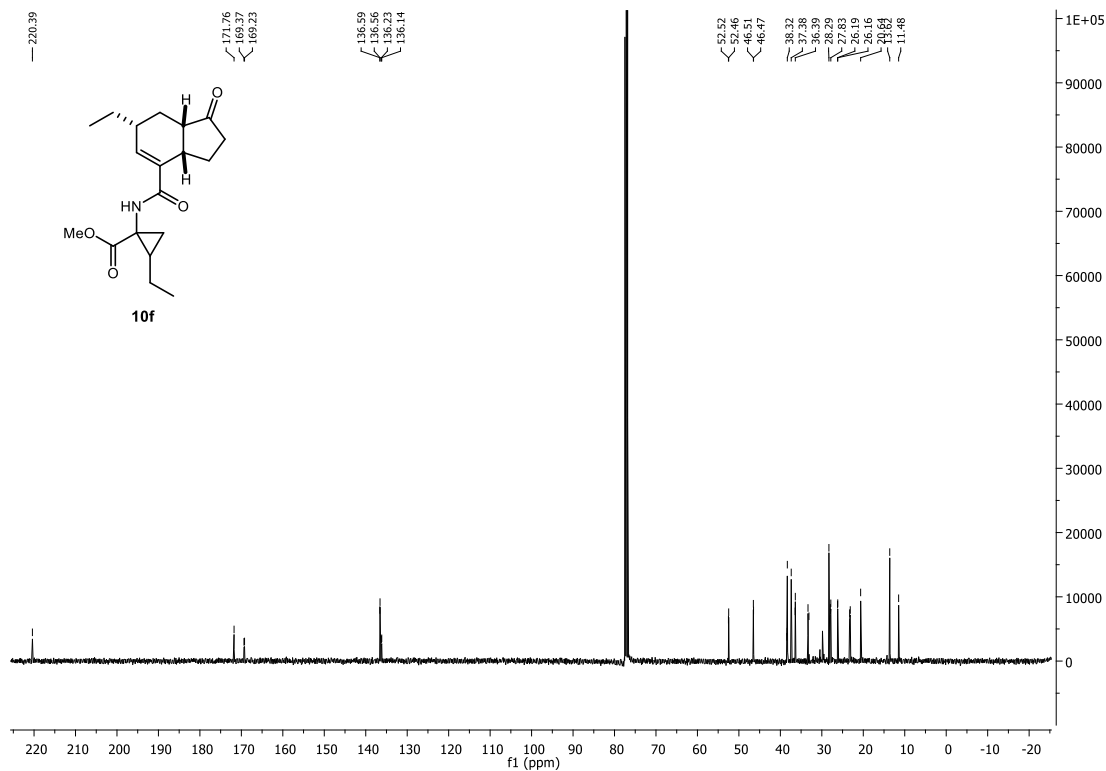
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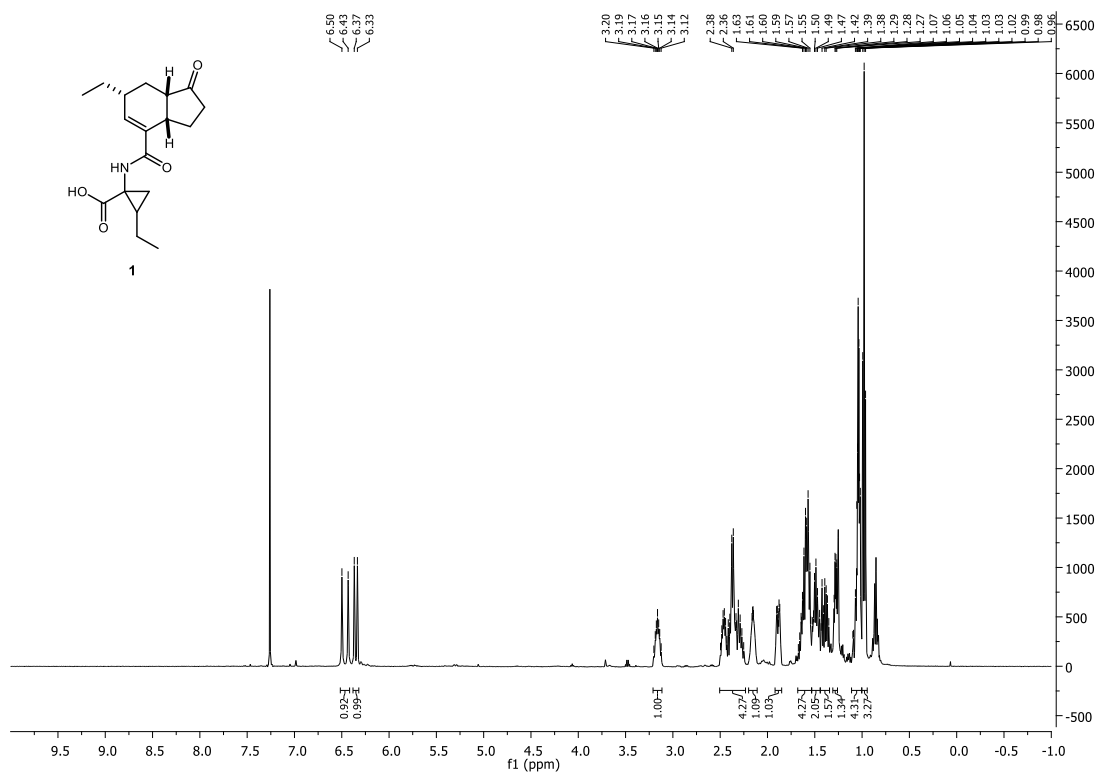
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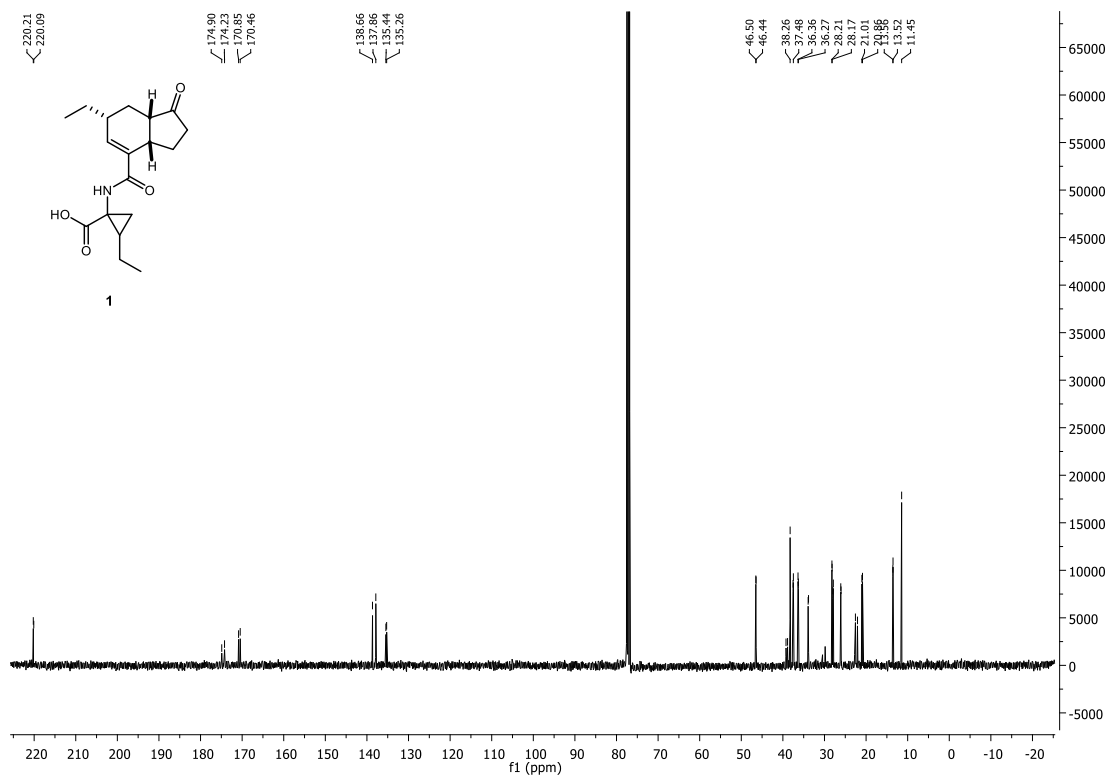
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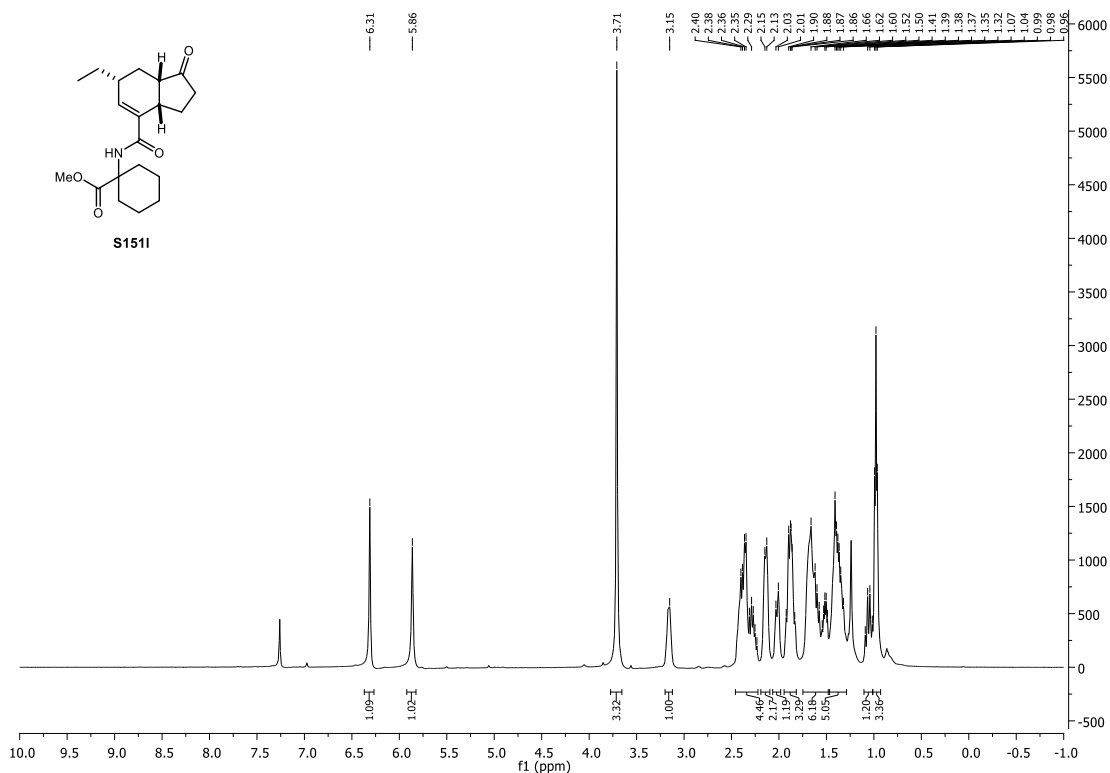
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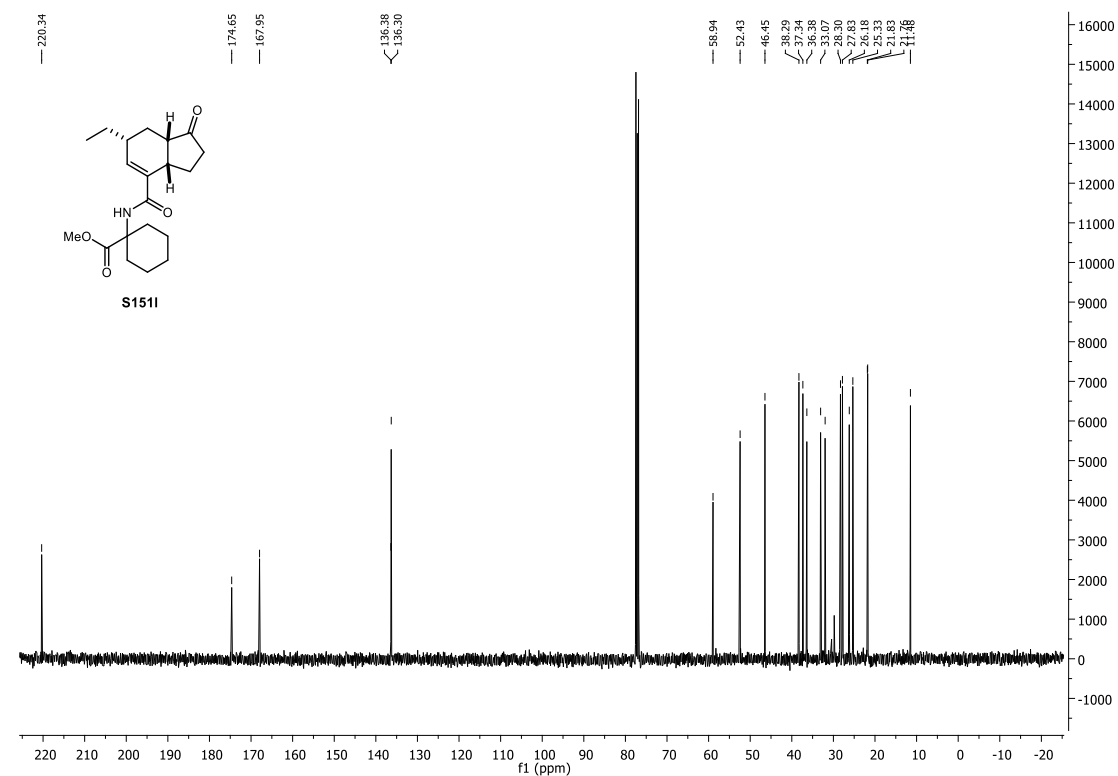
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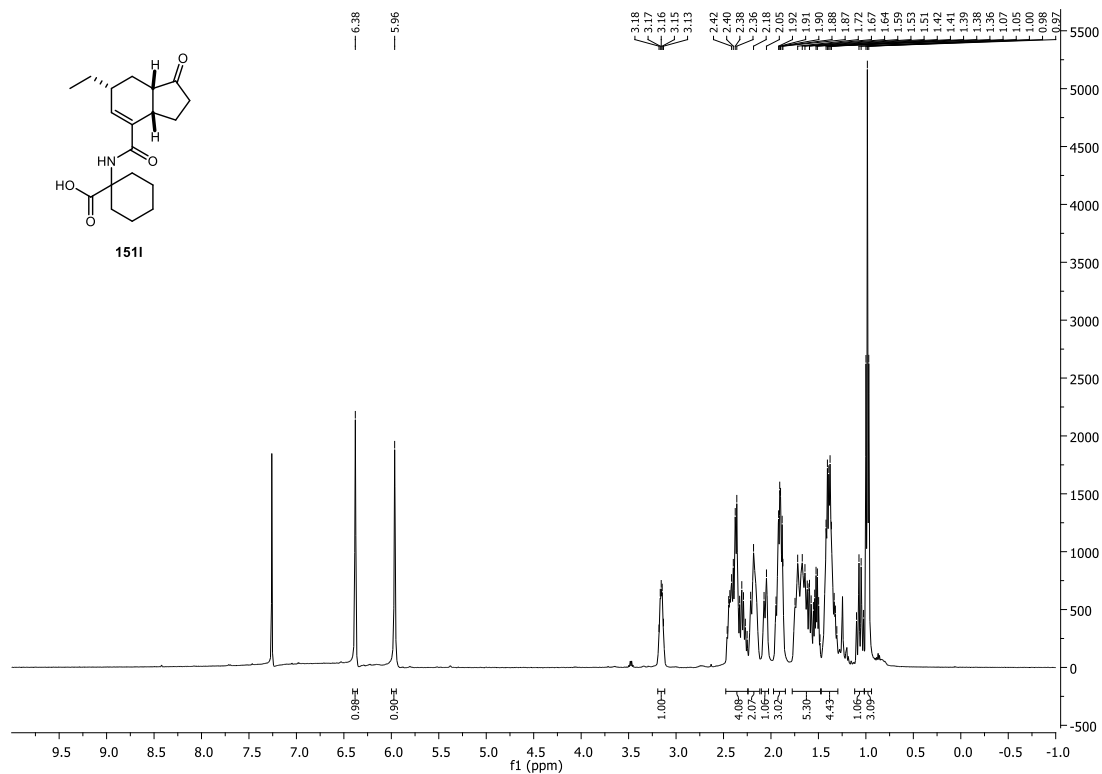
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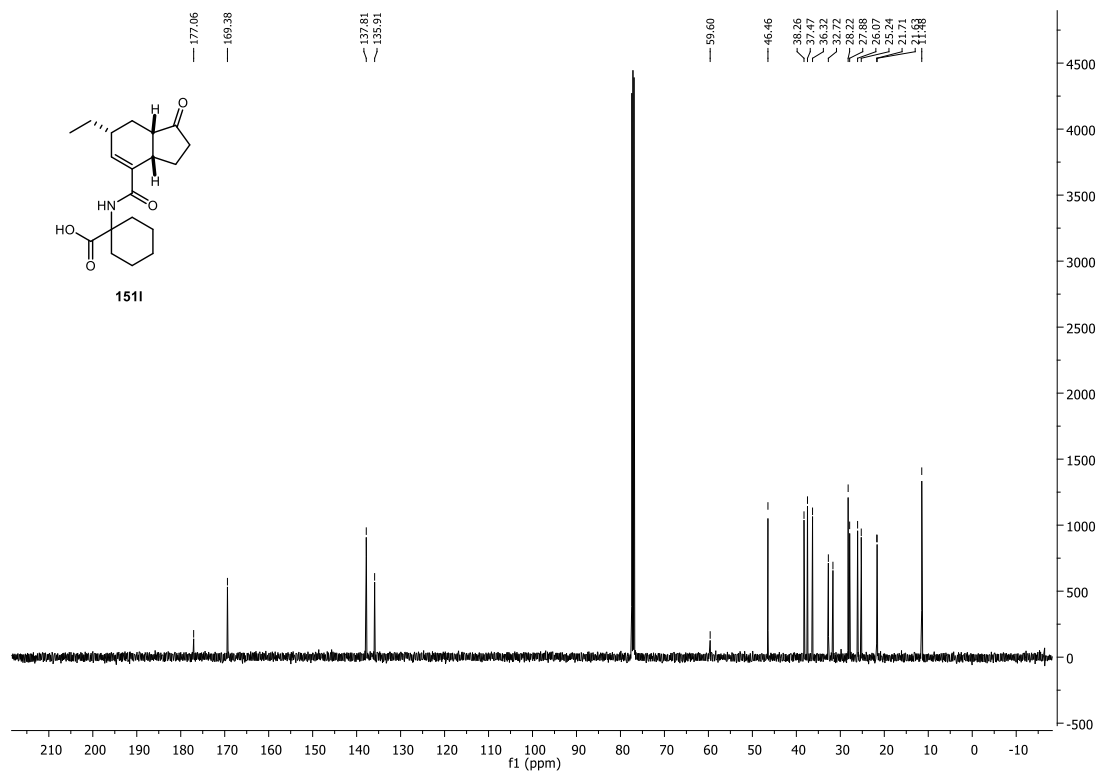
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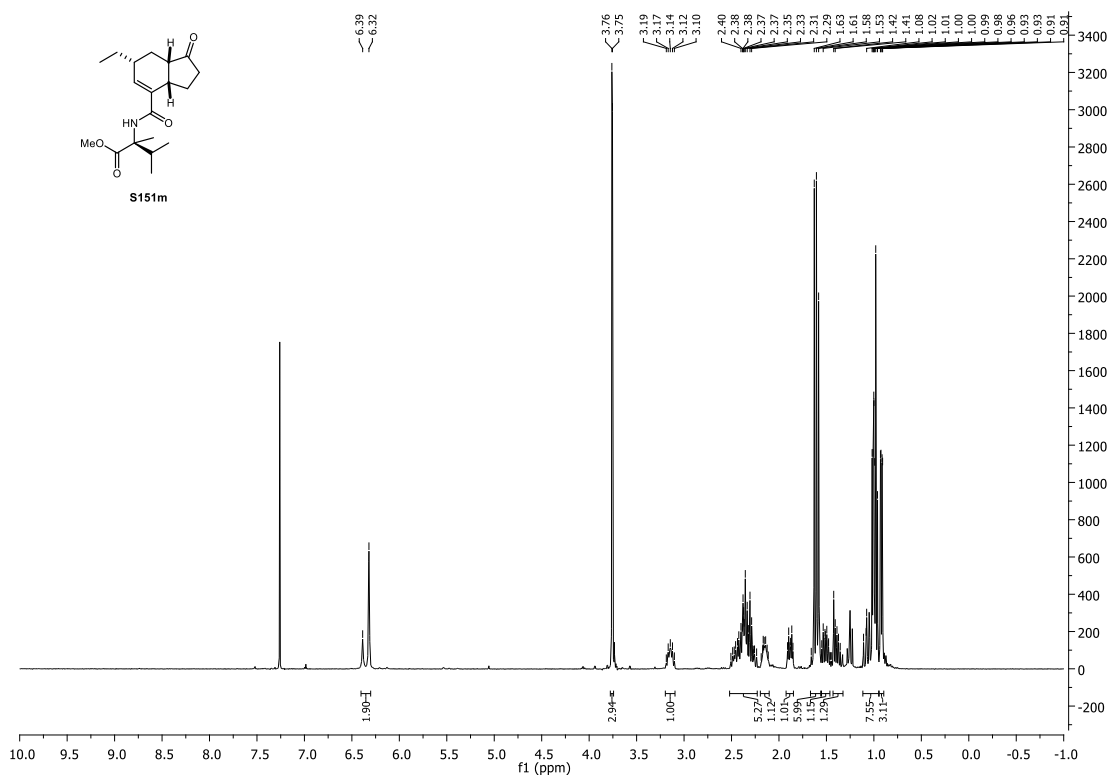
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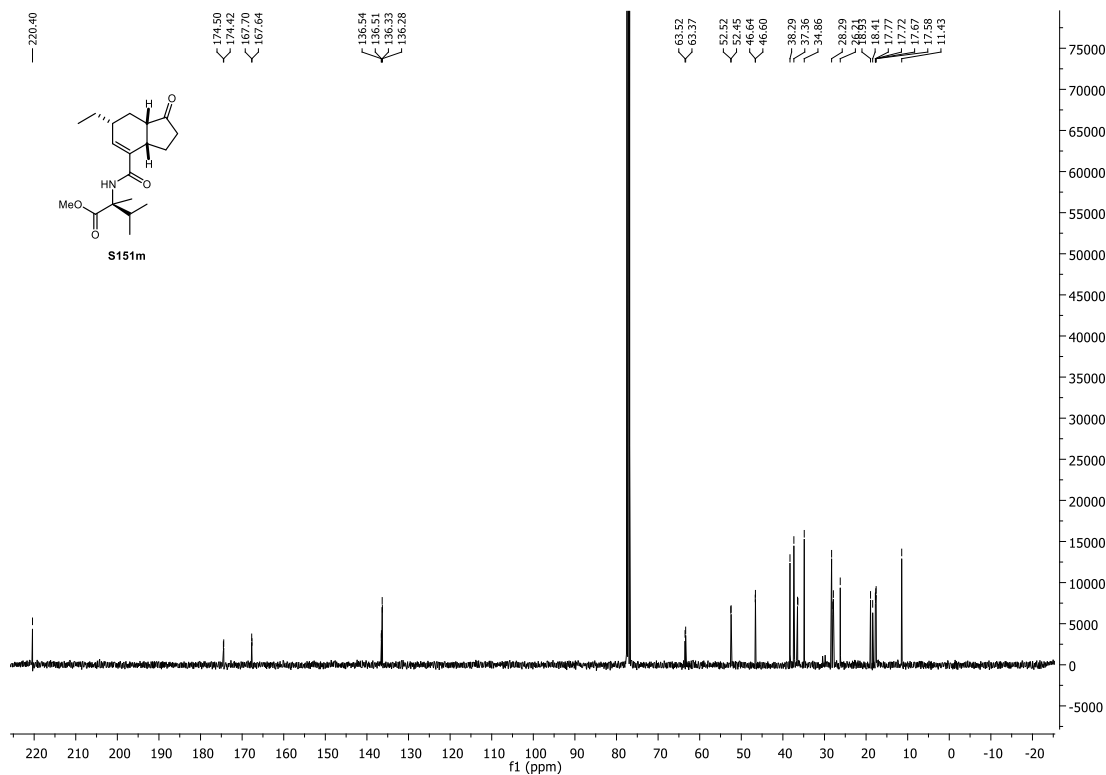
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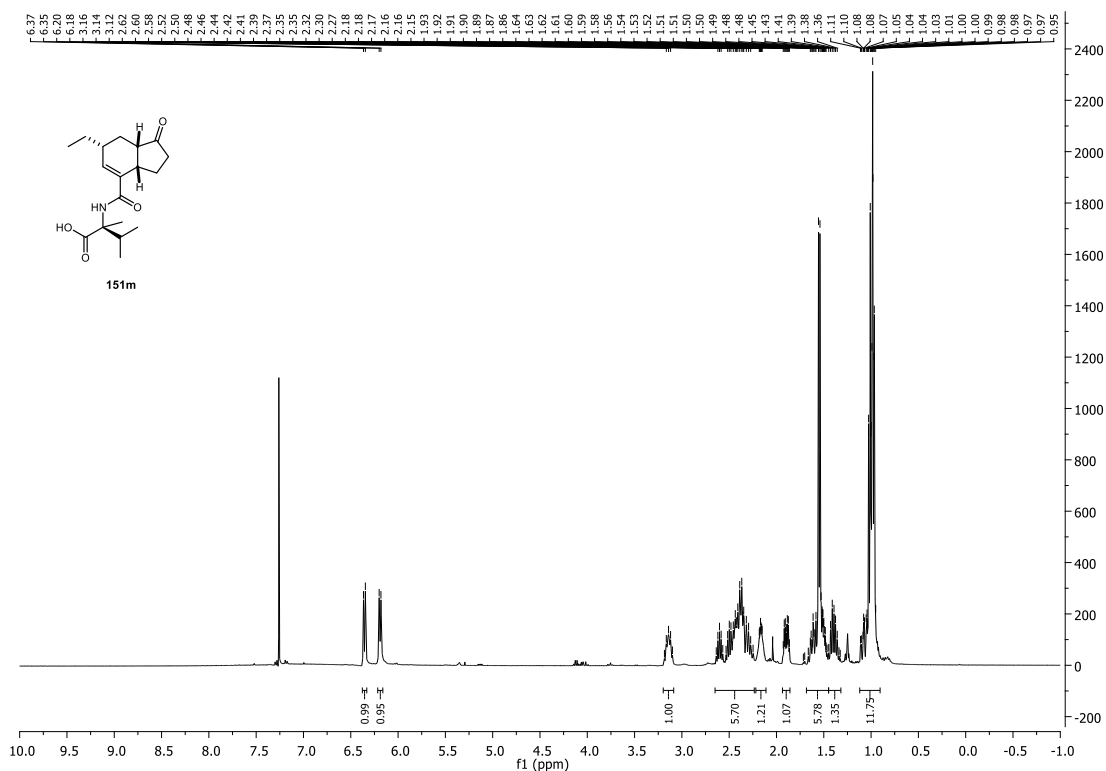
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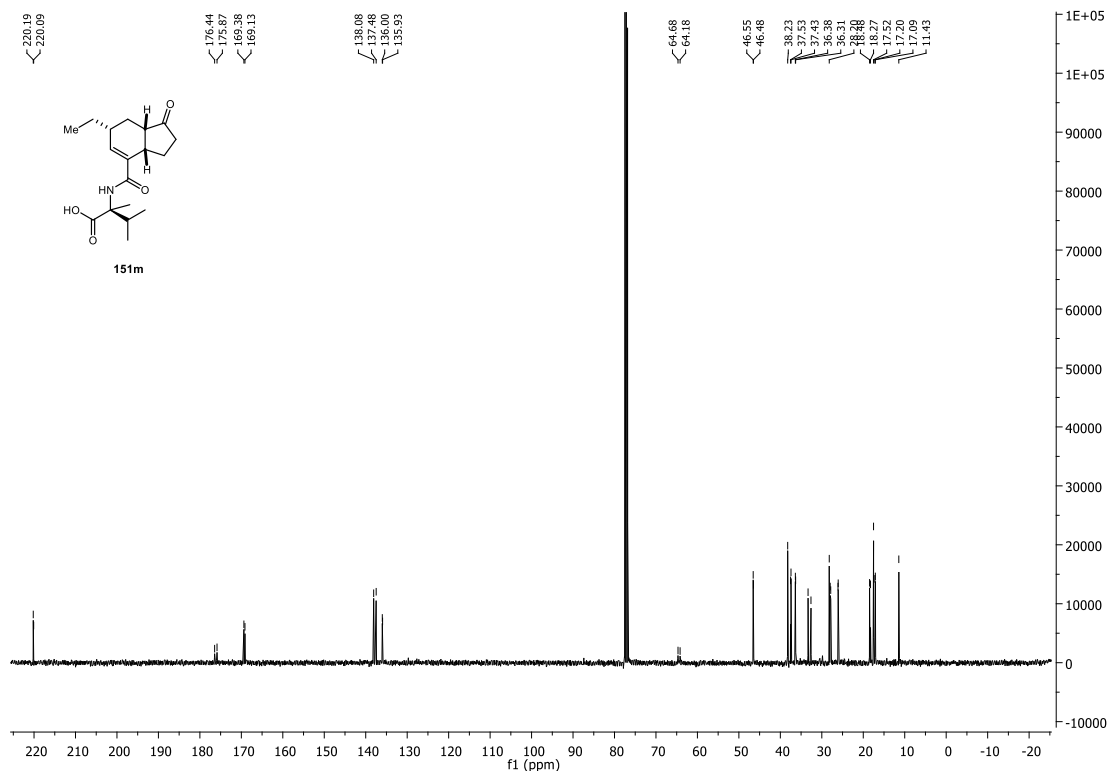
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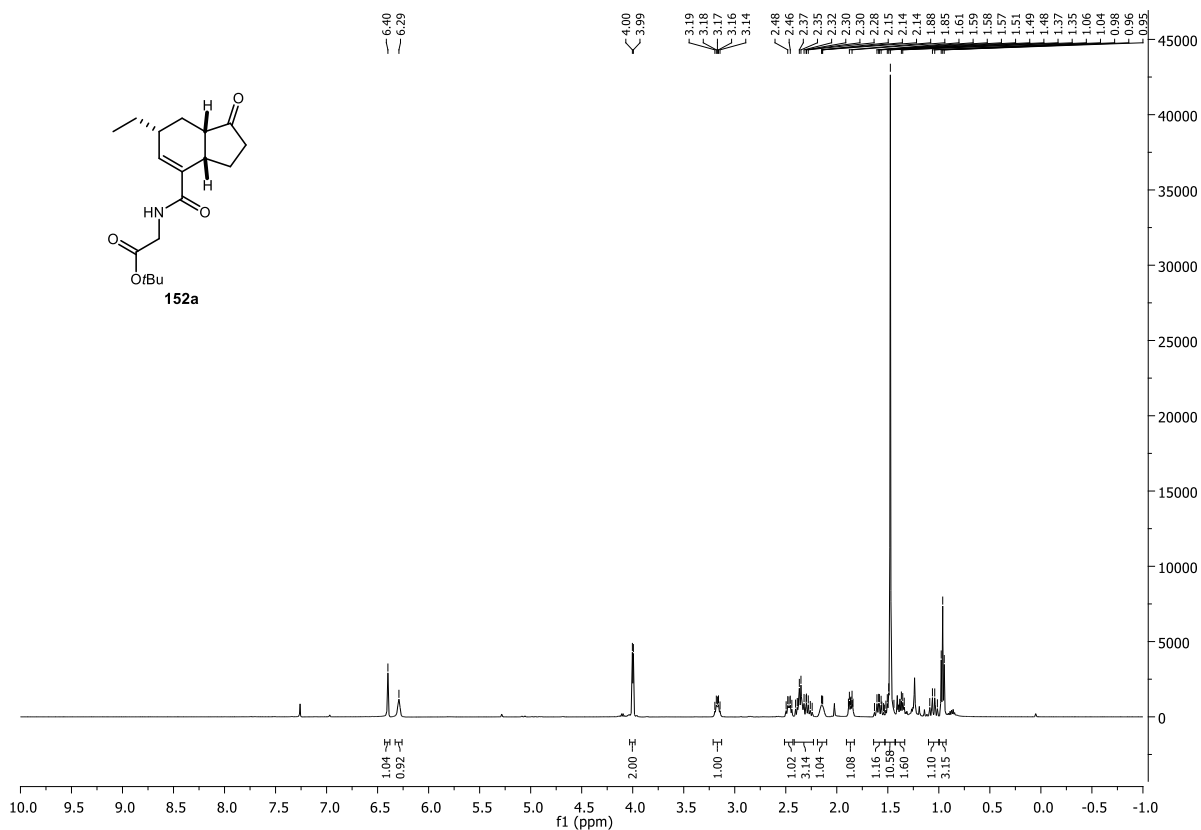
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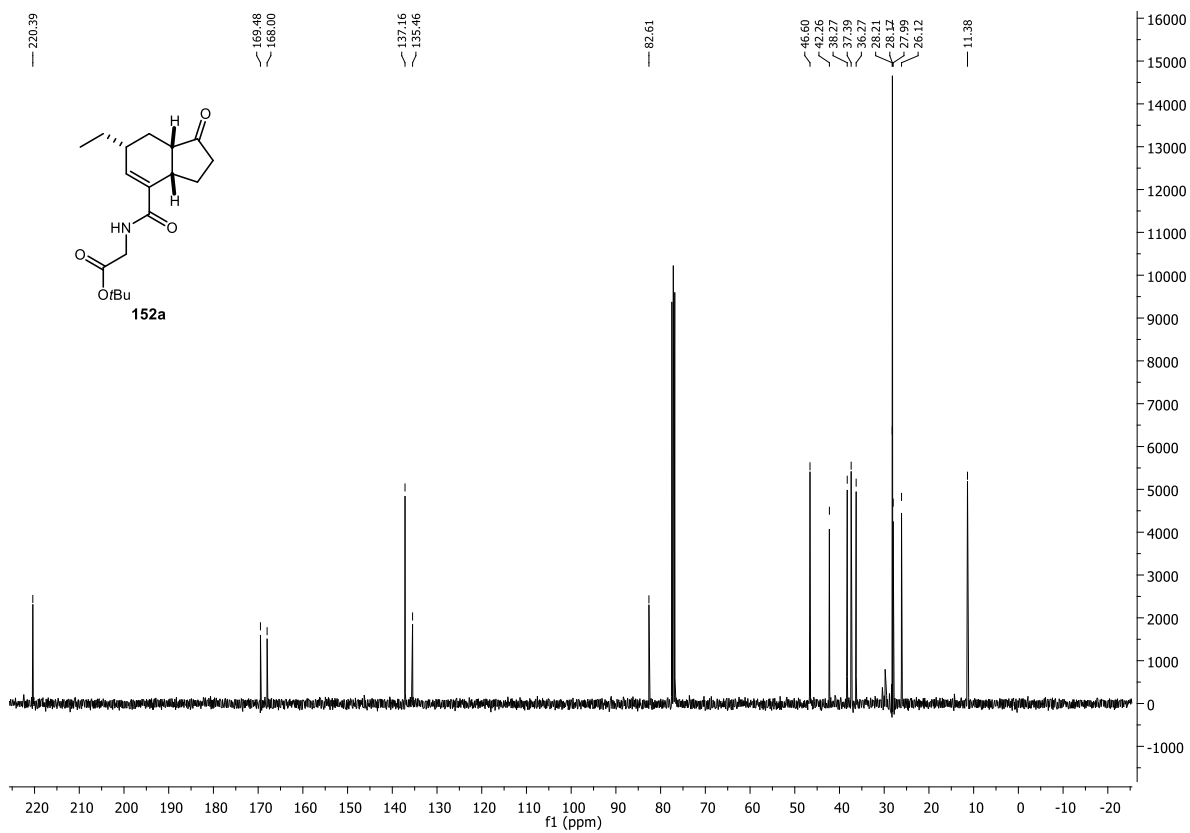
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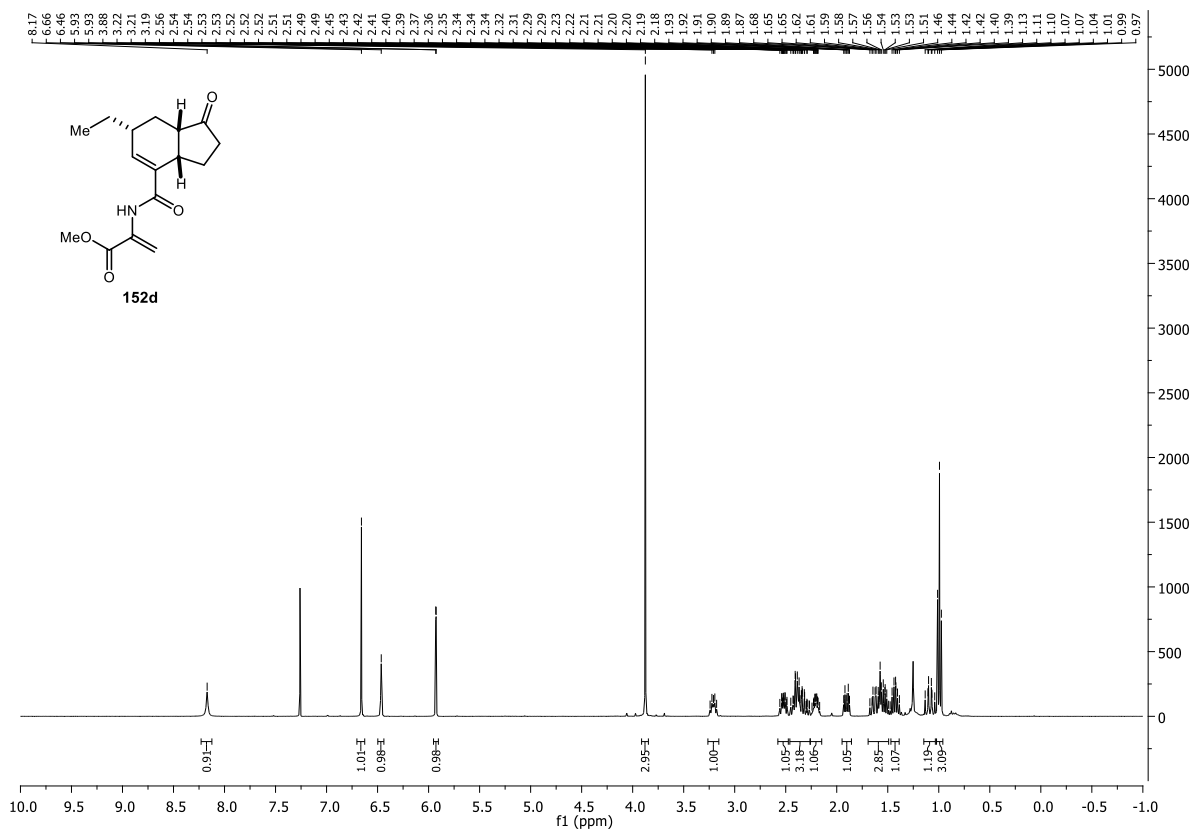
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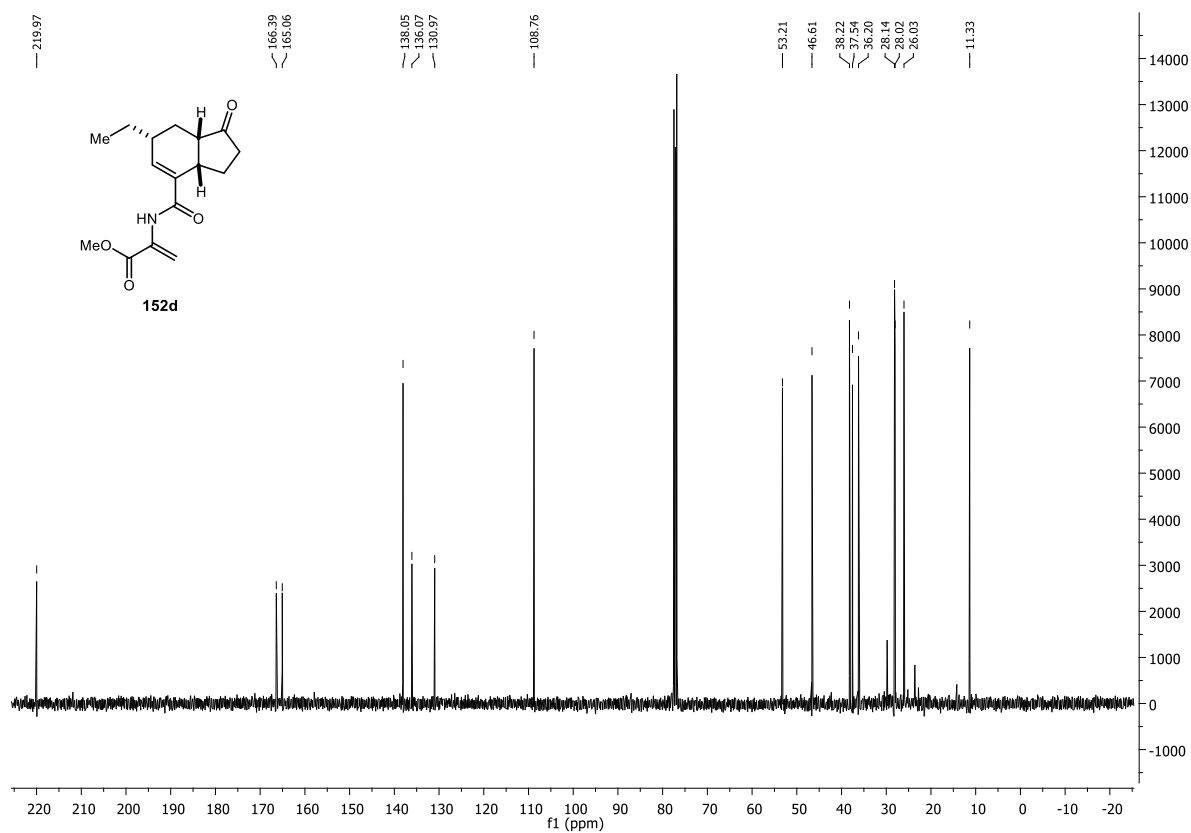
¹³C NMR 152a.



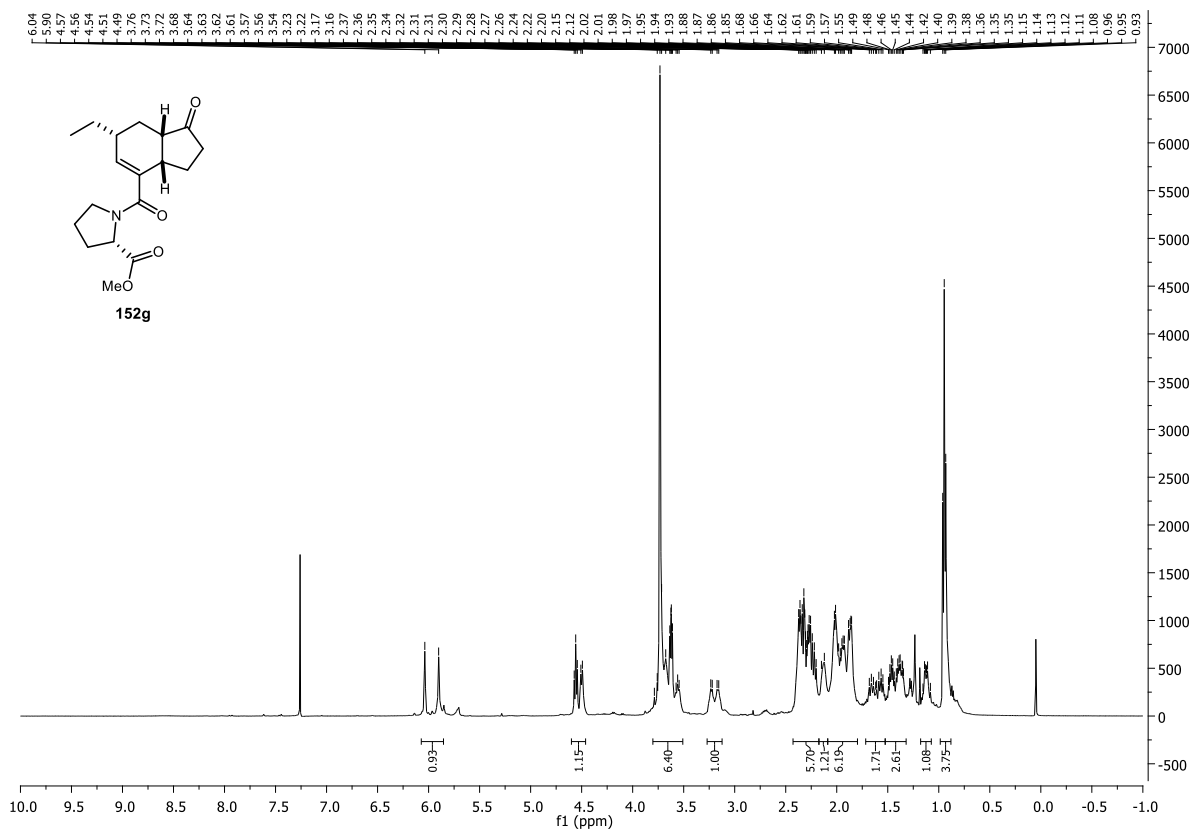
¹H NMR 152d.



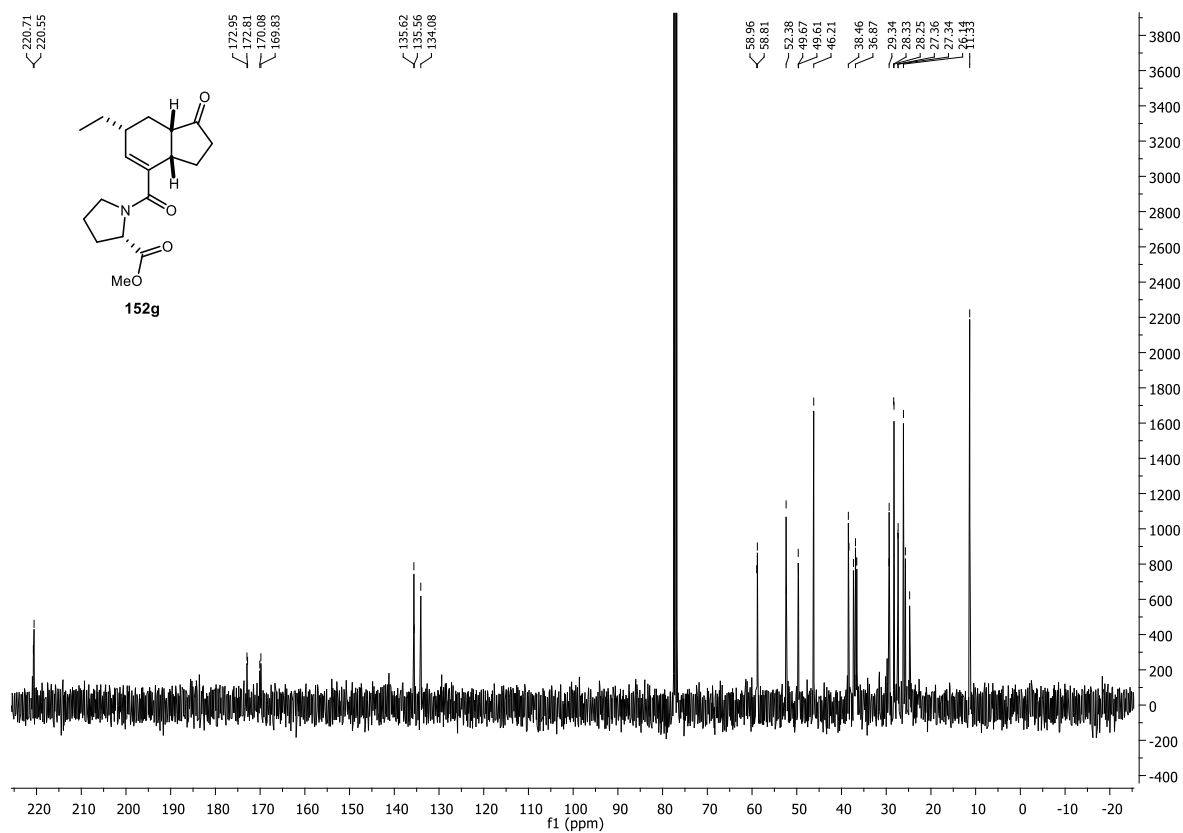
¹³C NMR 152d.



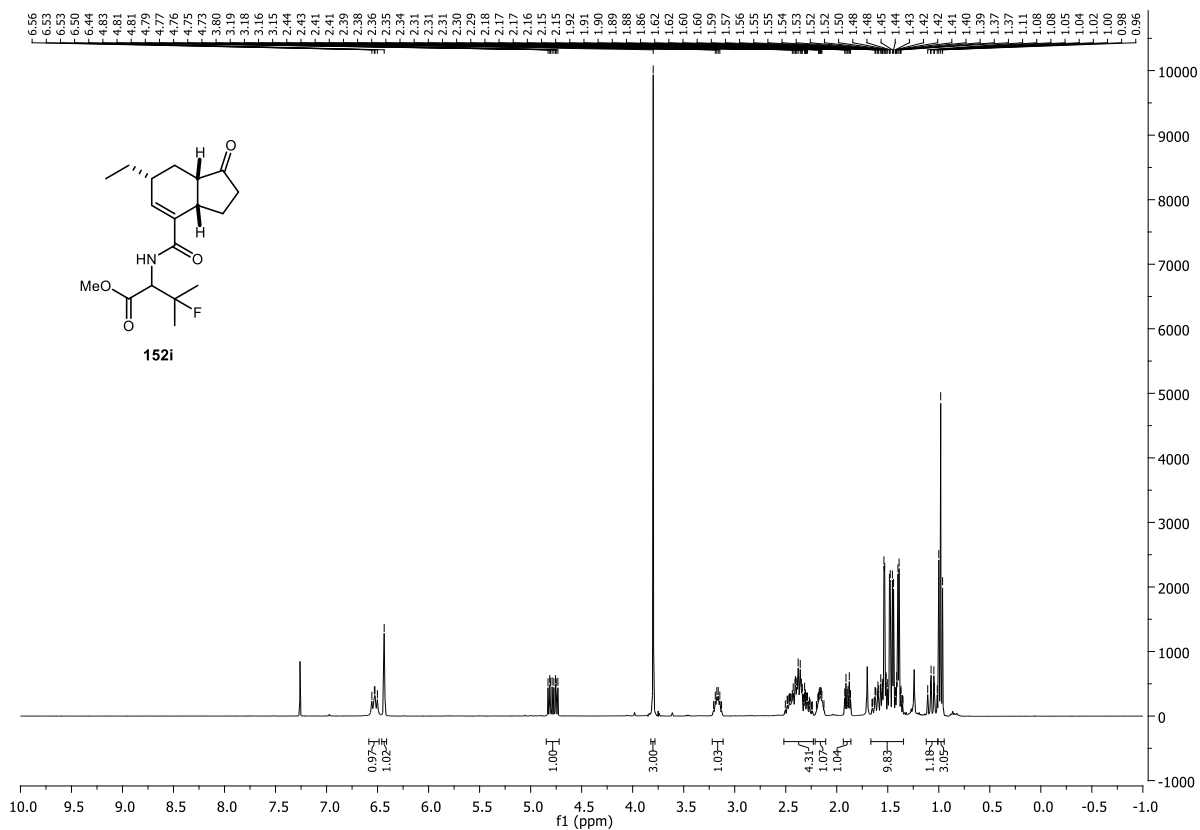
¹H NMR 152g.



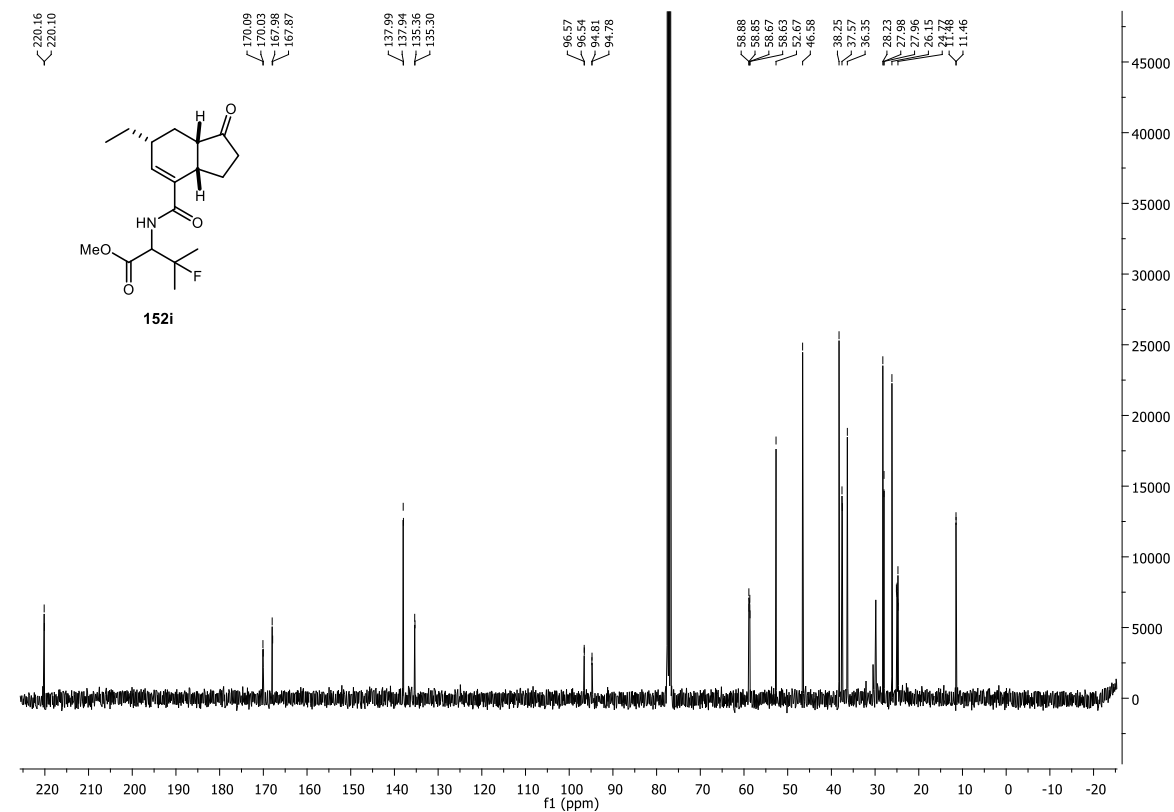
¹³C NMR 152g.



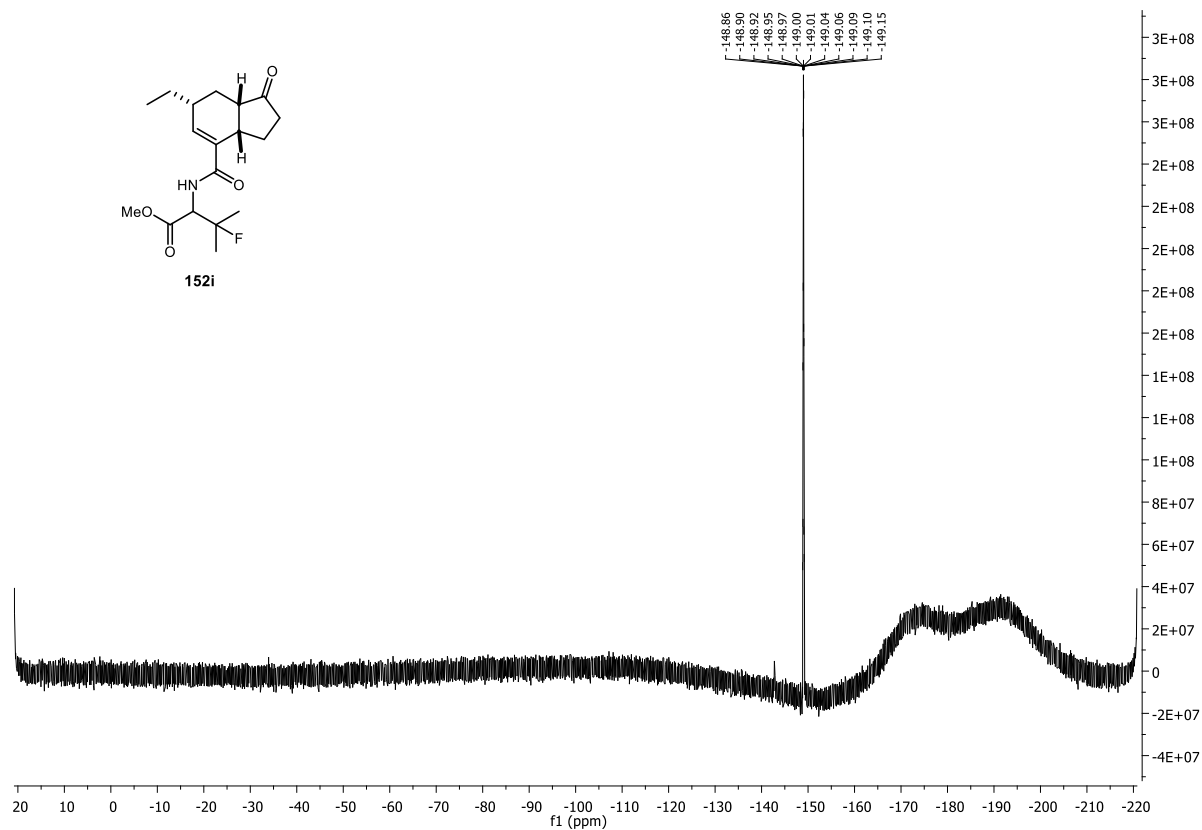
¹H NMR 152i.



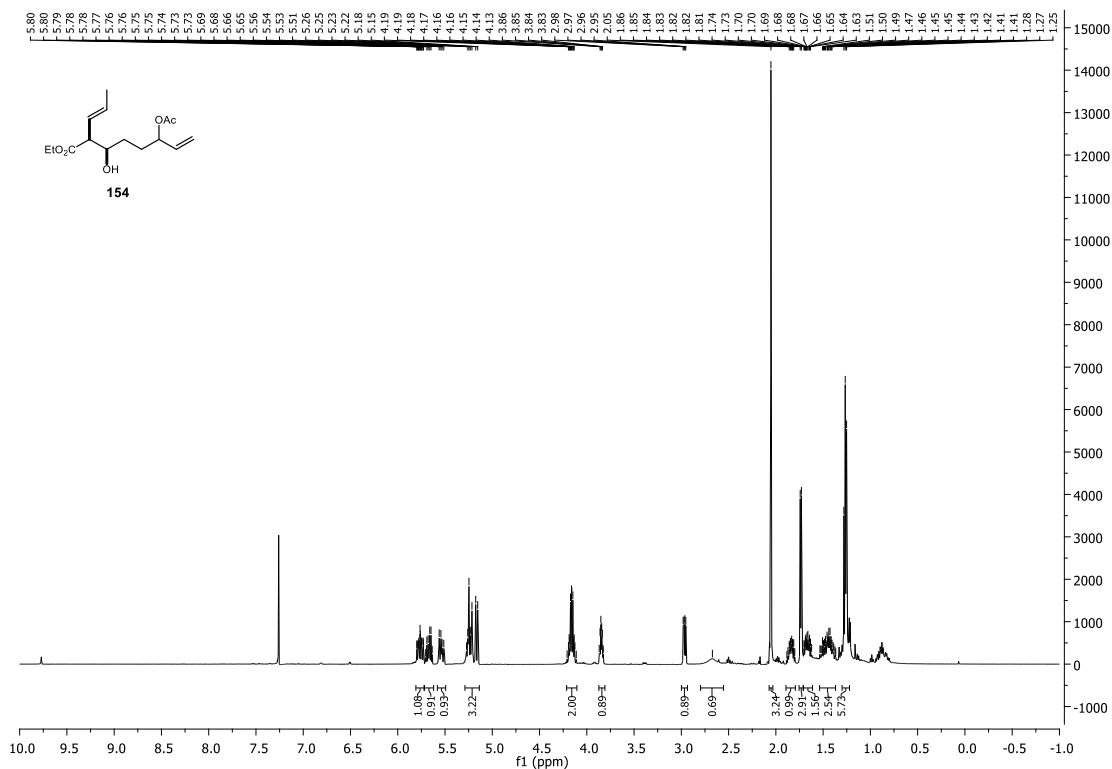
¹³C NMR 152i.



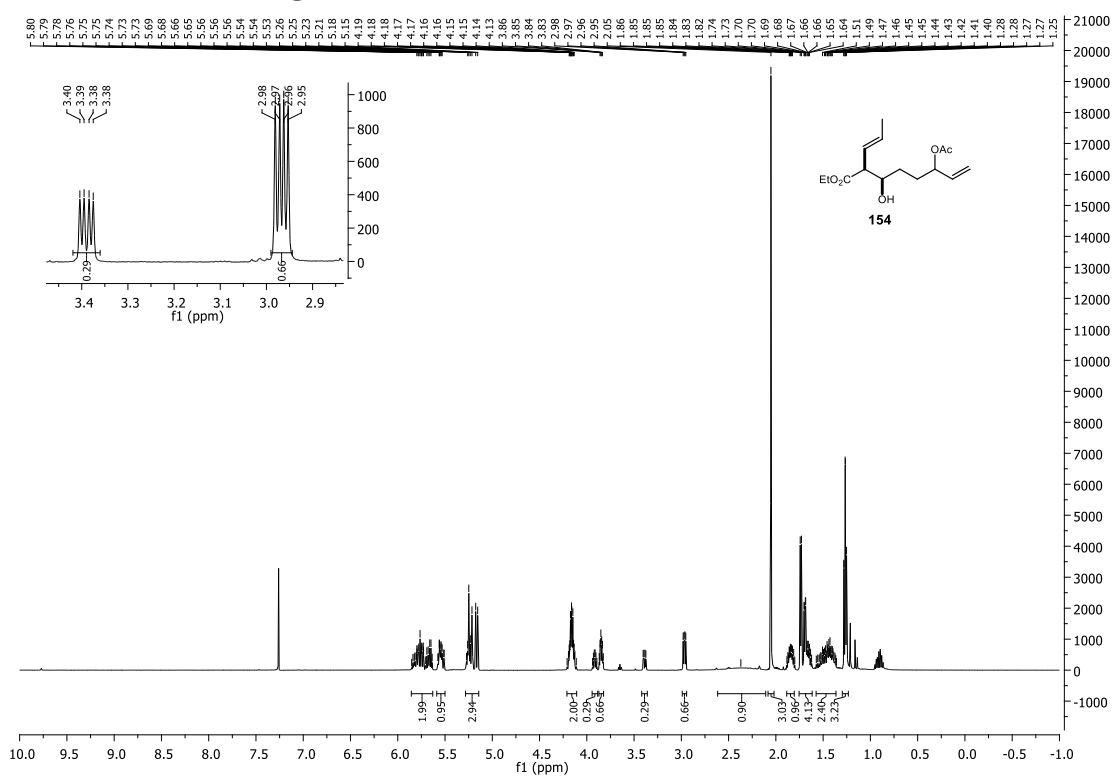
¹⁹F NMR 152i.



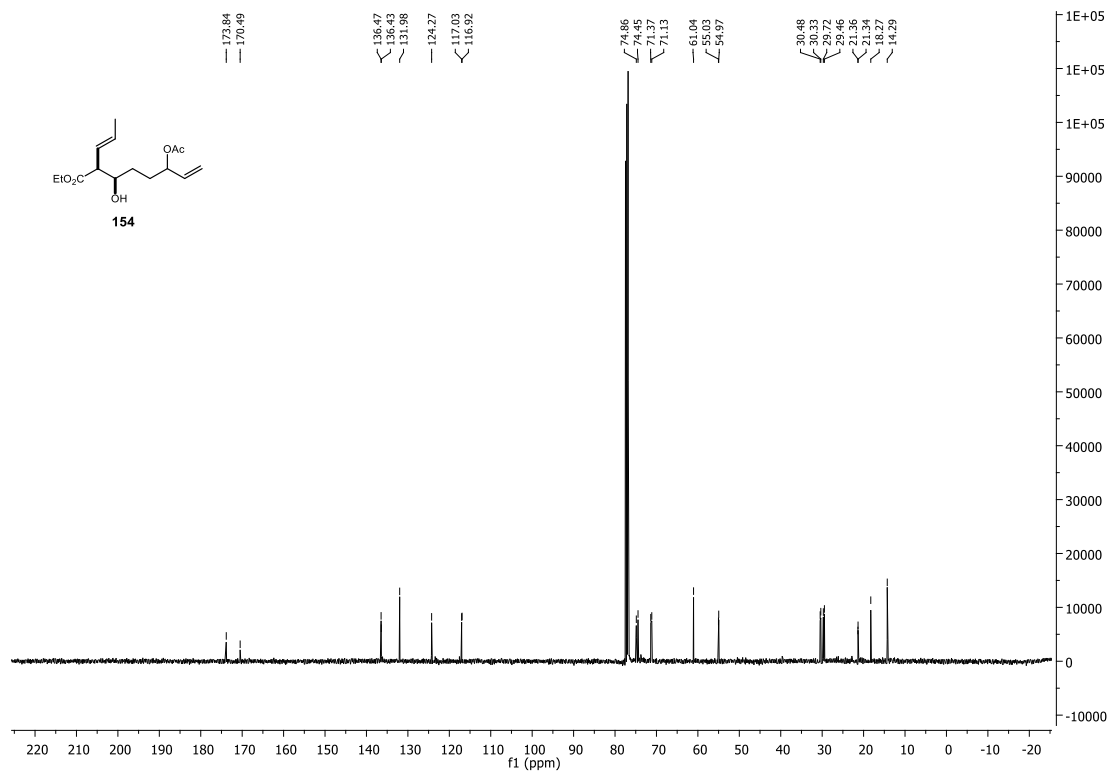
¹H NMR 154.



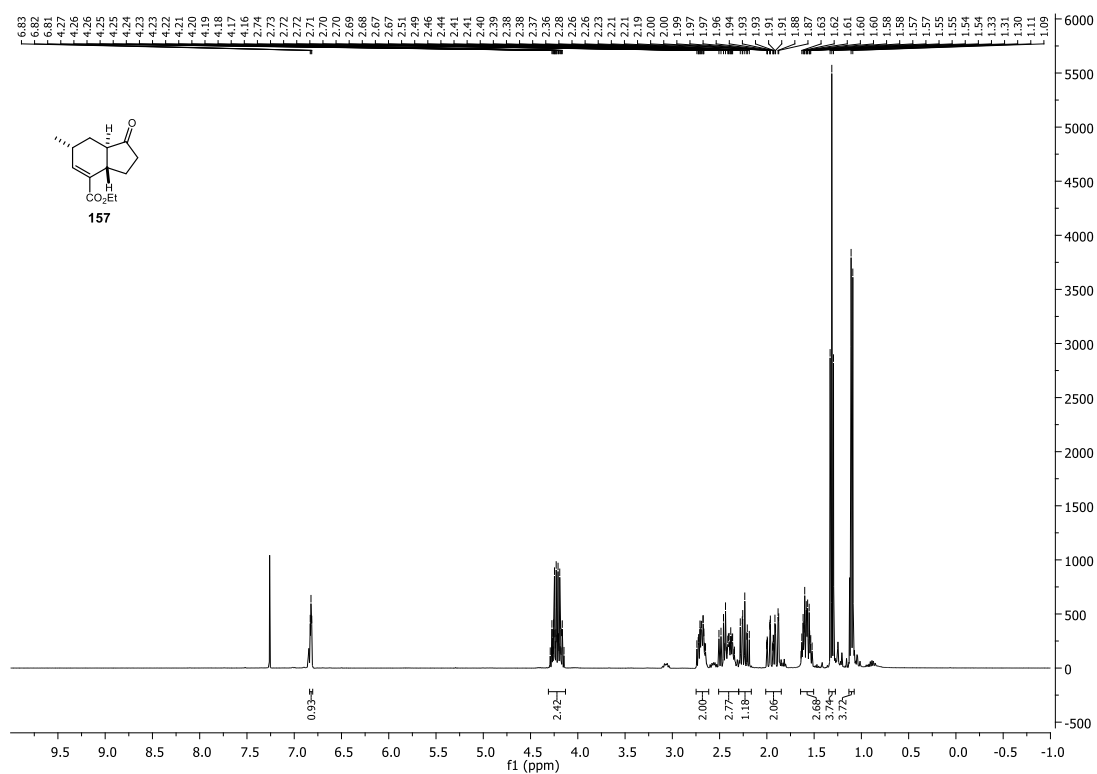
¹H NMR 154 showing alkene isomerization.



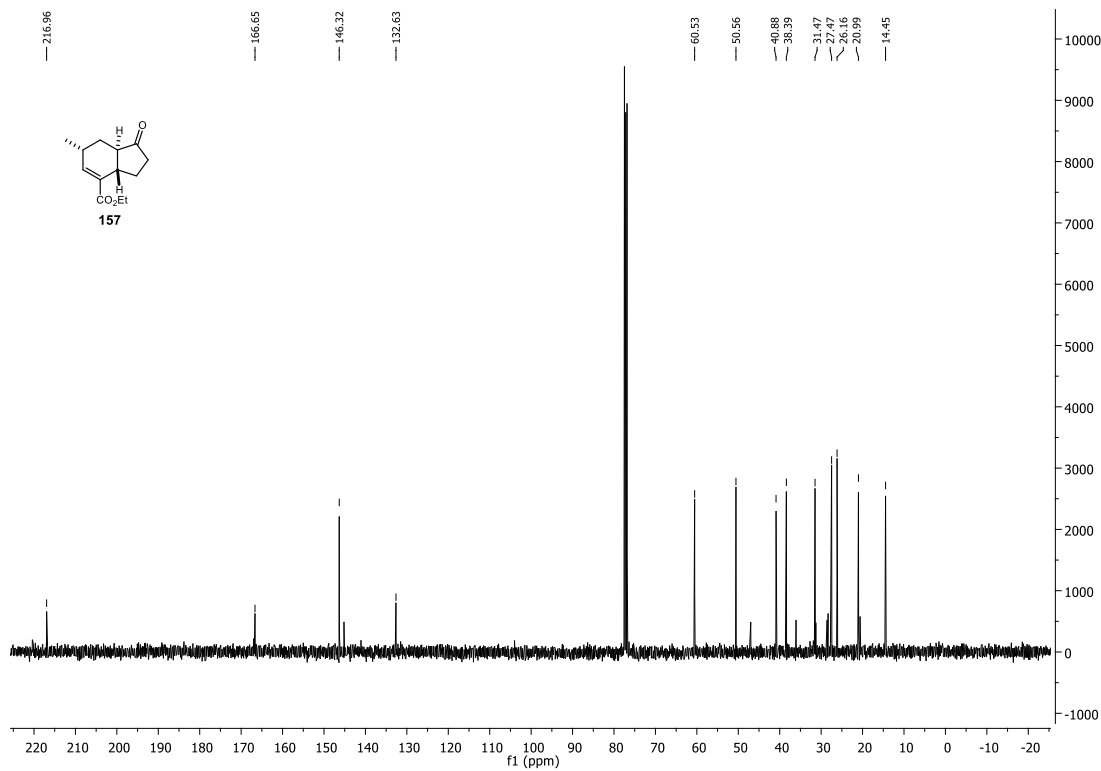
¹³CNMR 154.



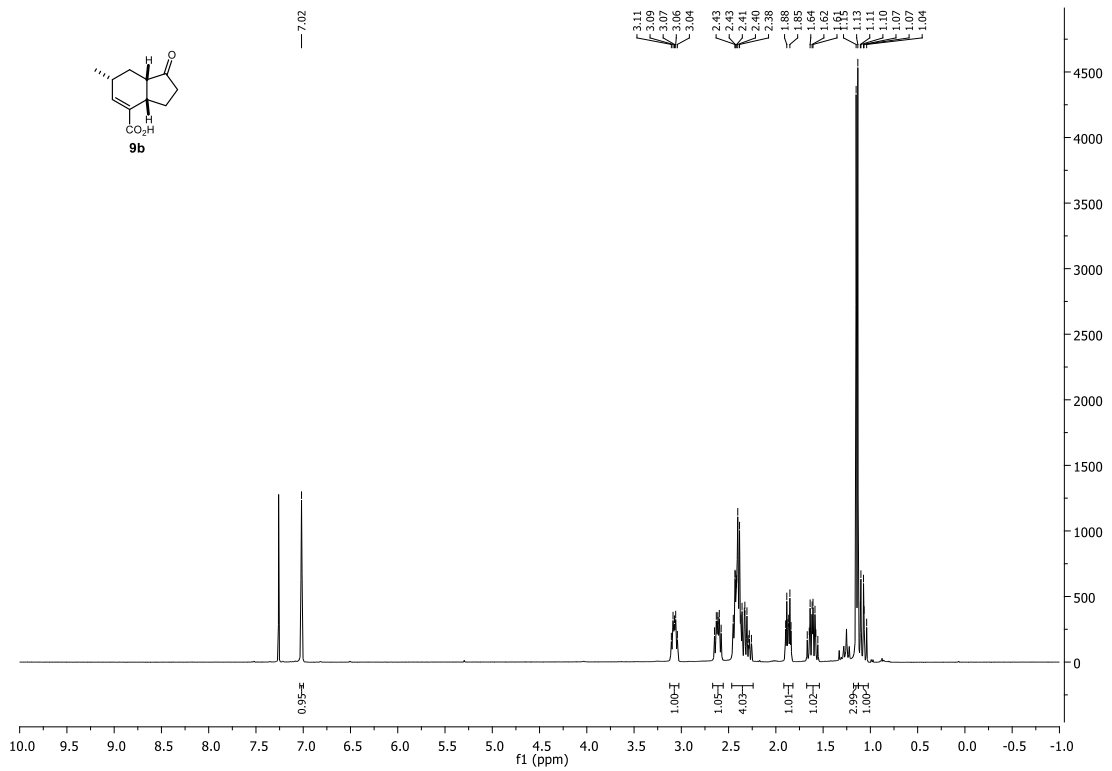
¹H NMR 157.



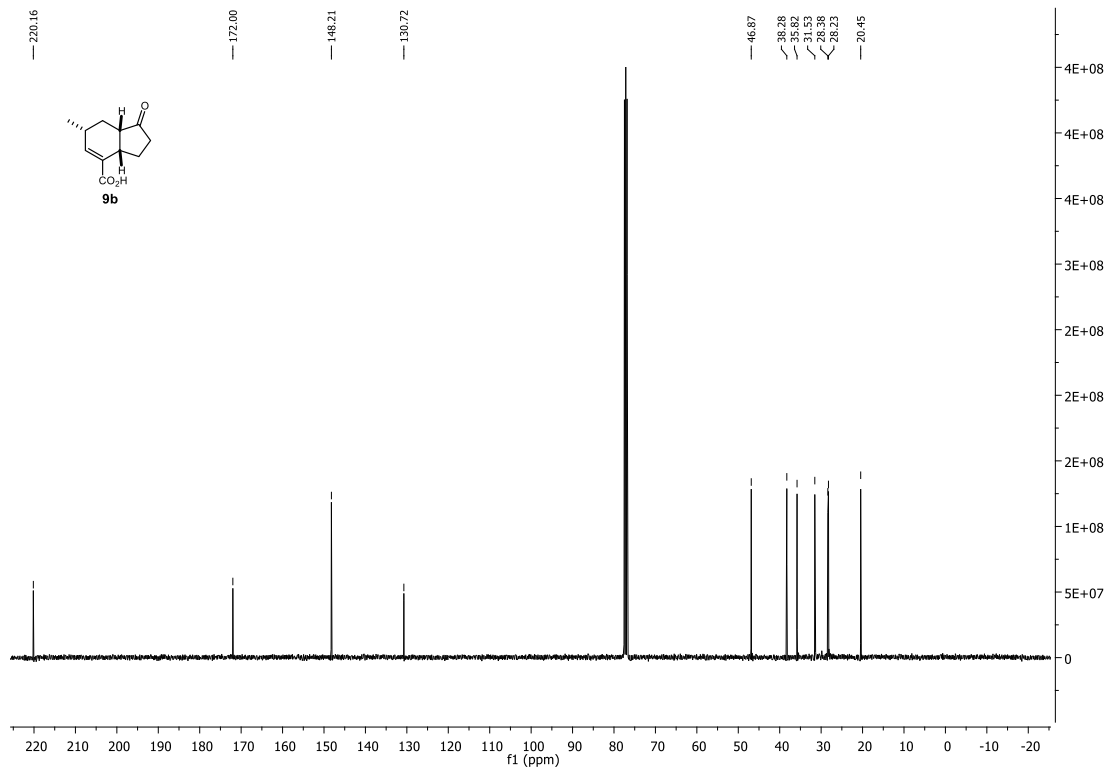
¹³C NMR 157.



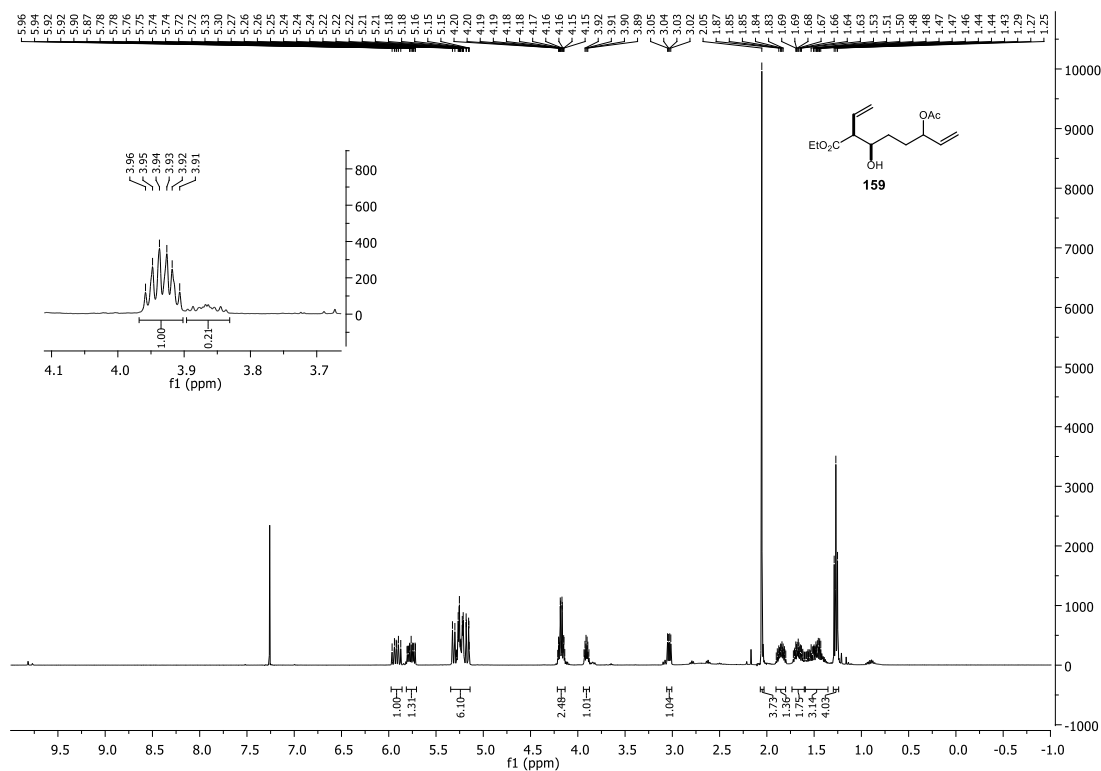
¹H NMR 9b.



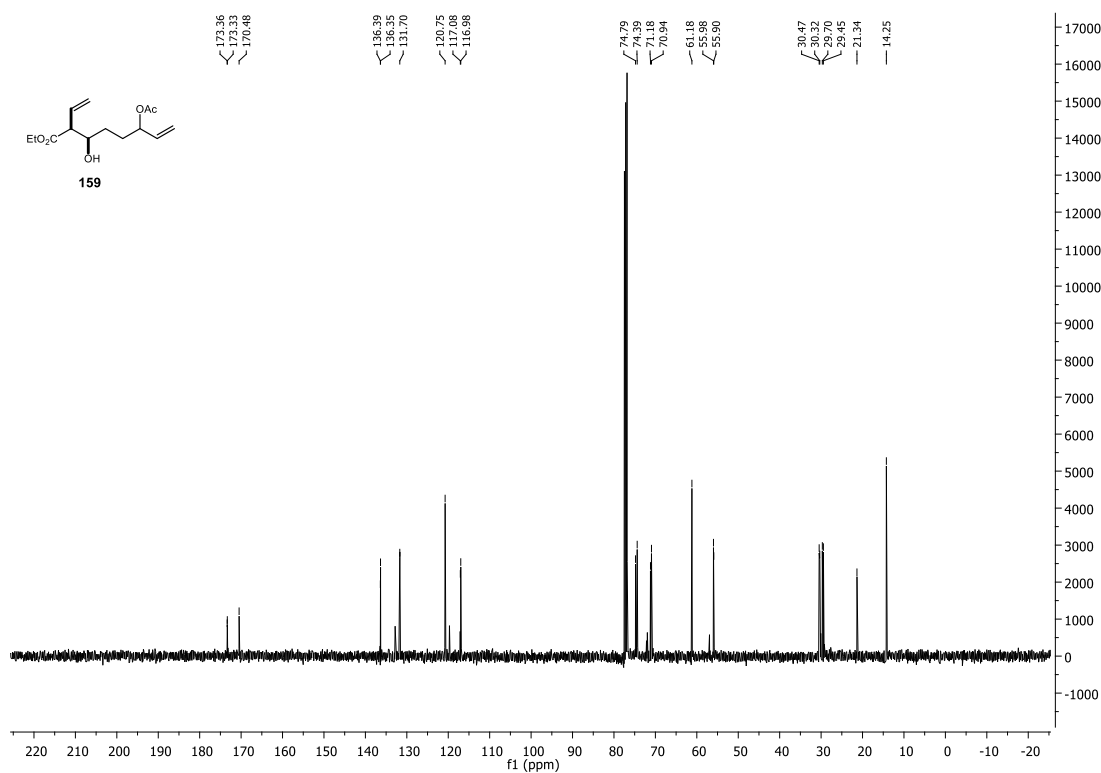
¹³C NMR 9b.



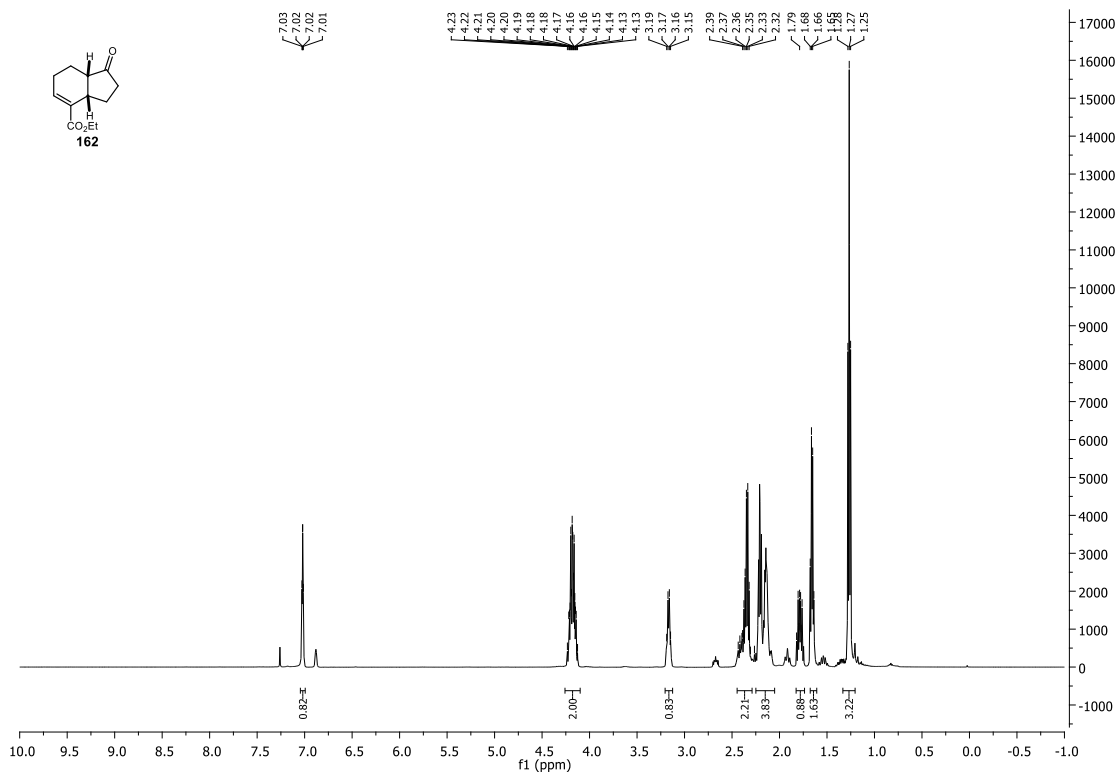
¹H NMR 159.



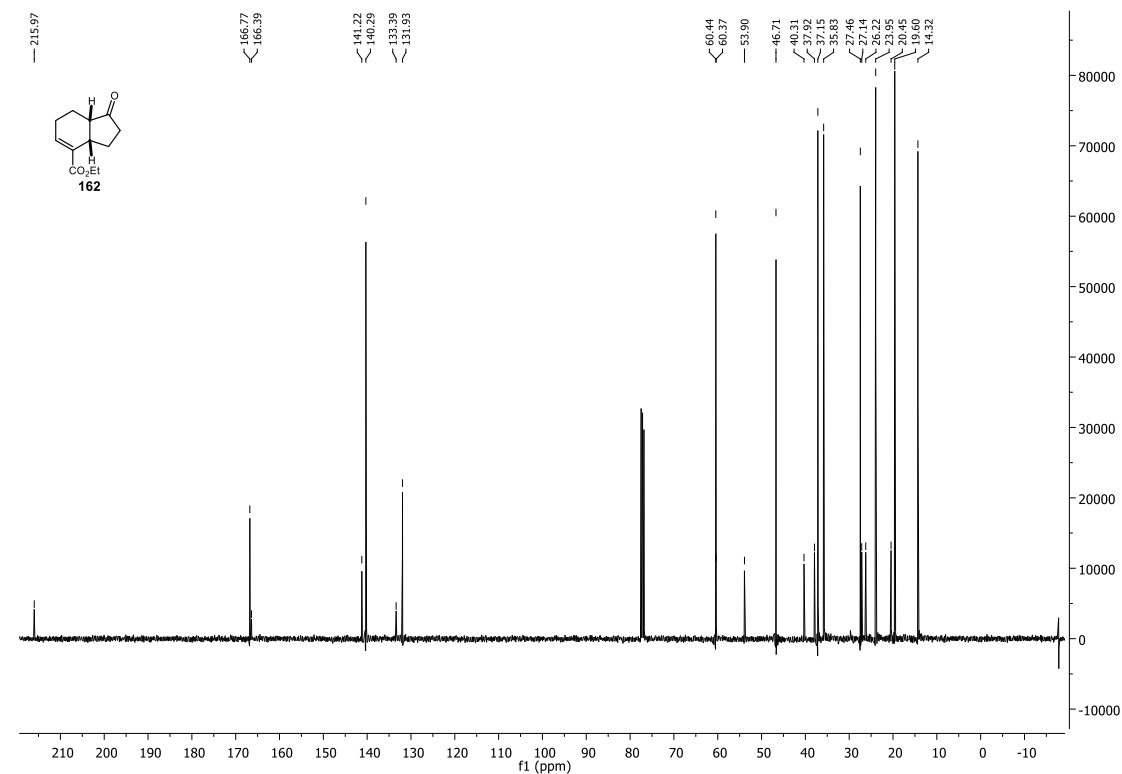
¹³C NMR 159.



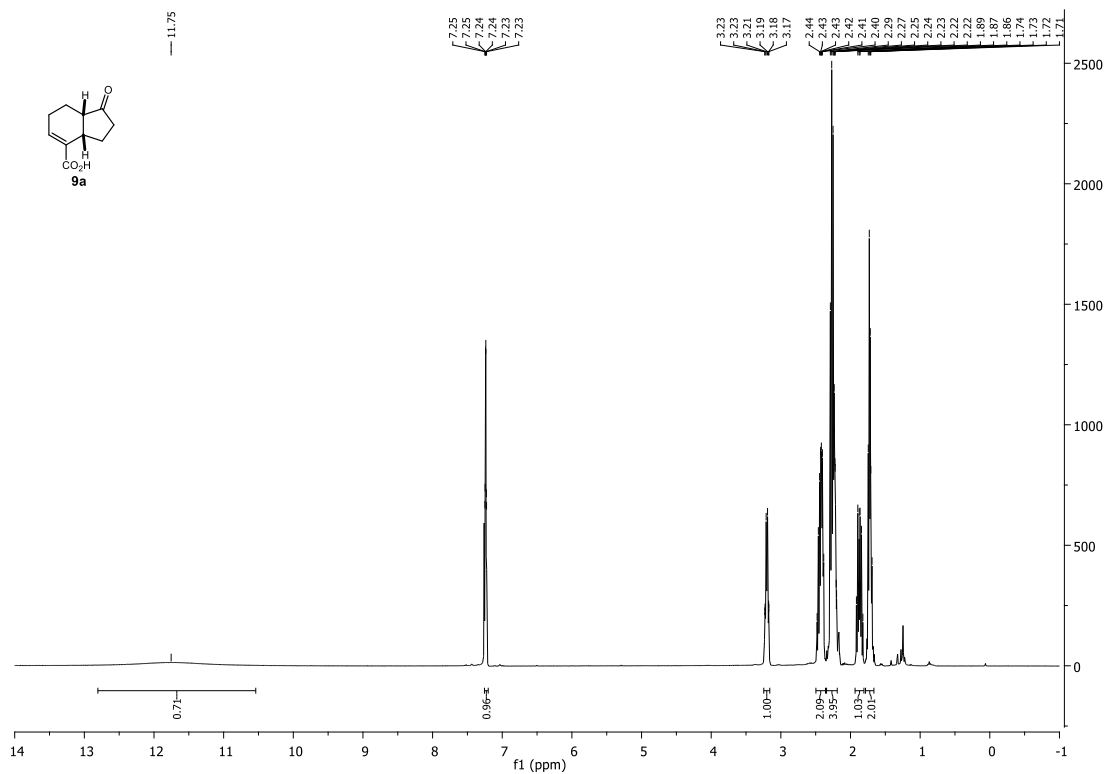
¹H NMR 162.



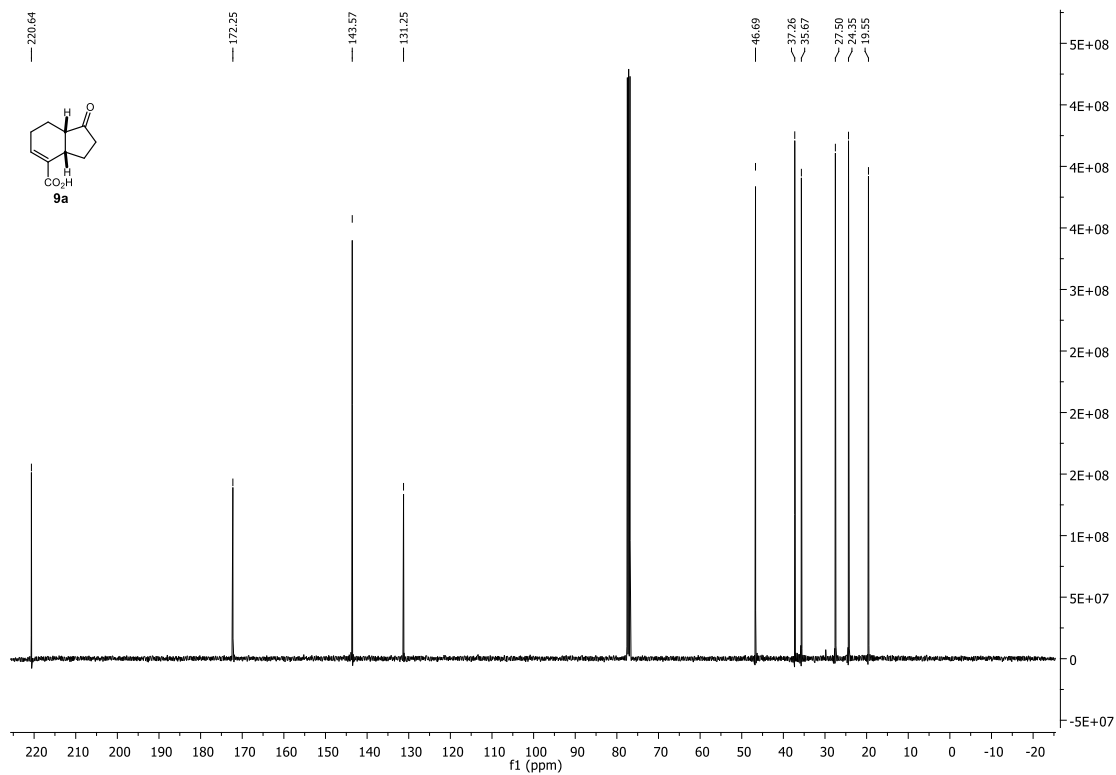
¹³C NMR 162.



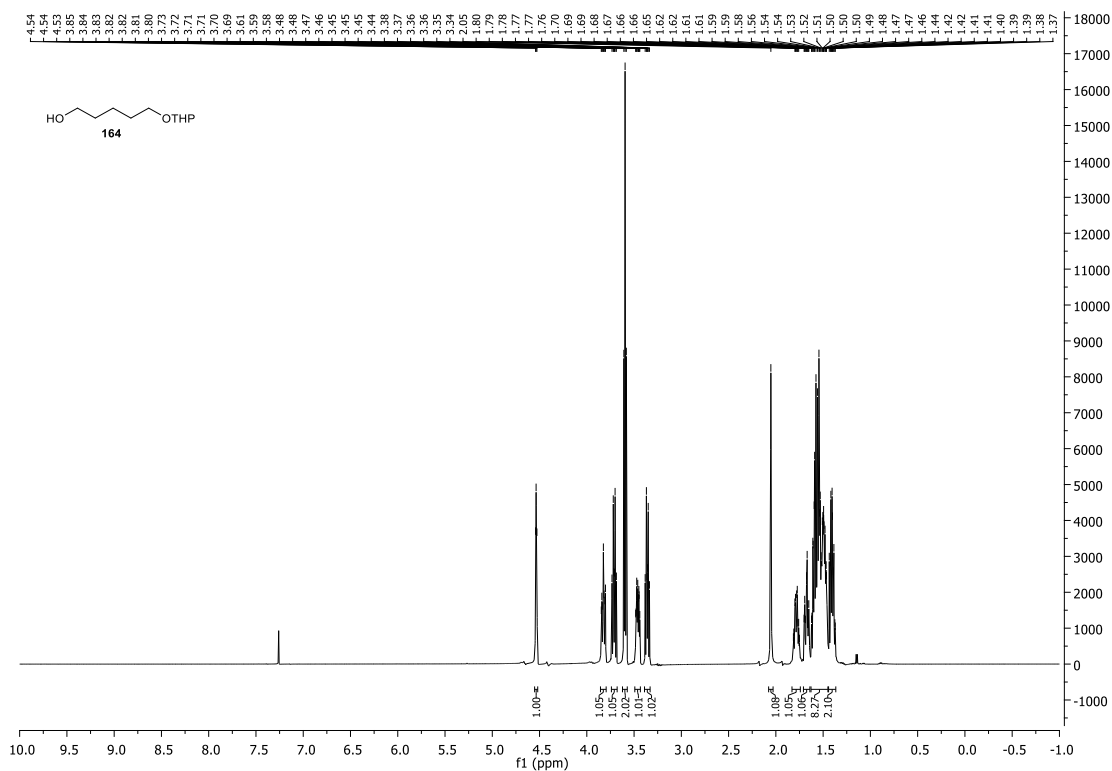
¹H NMR 9a.



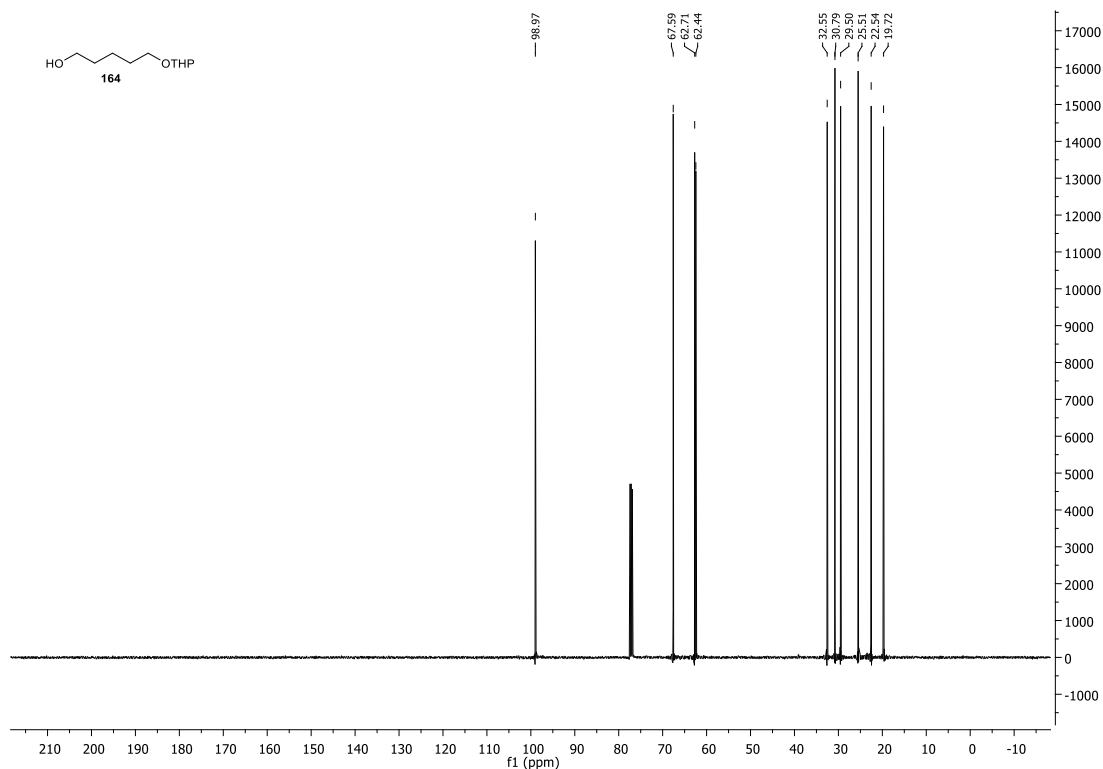
¹³C NMR 9a.



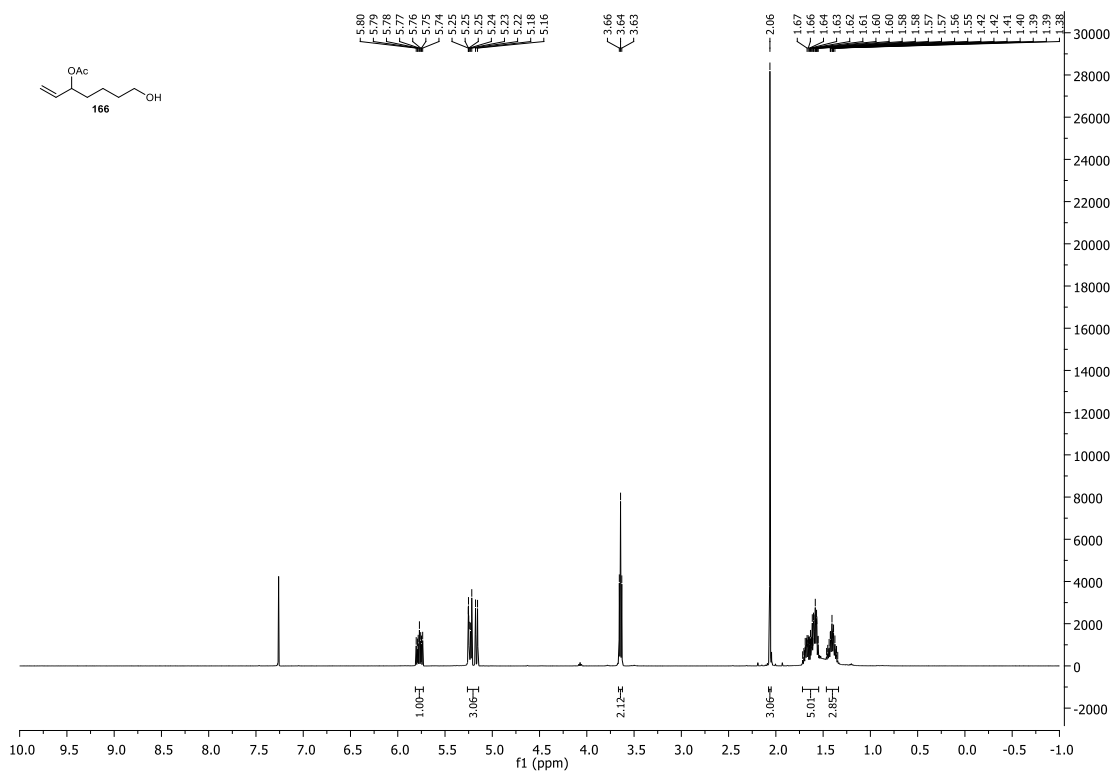
¹H NMR 164.



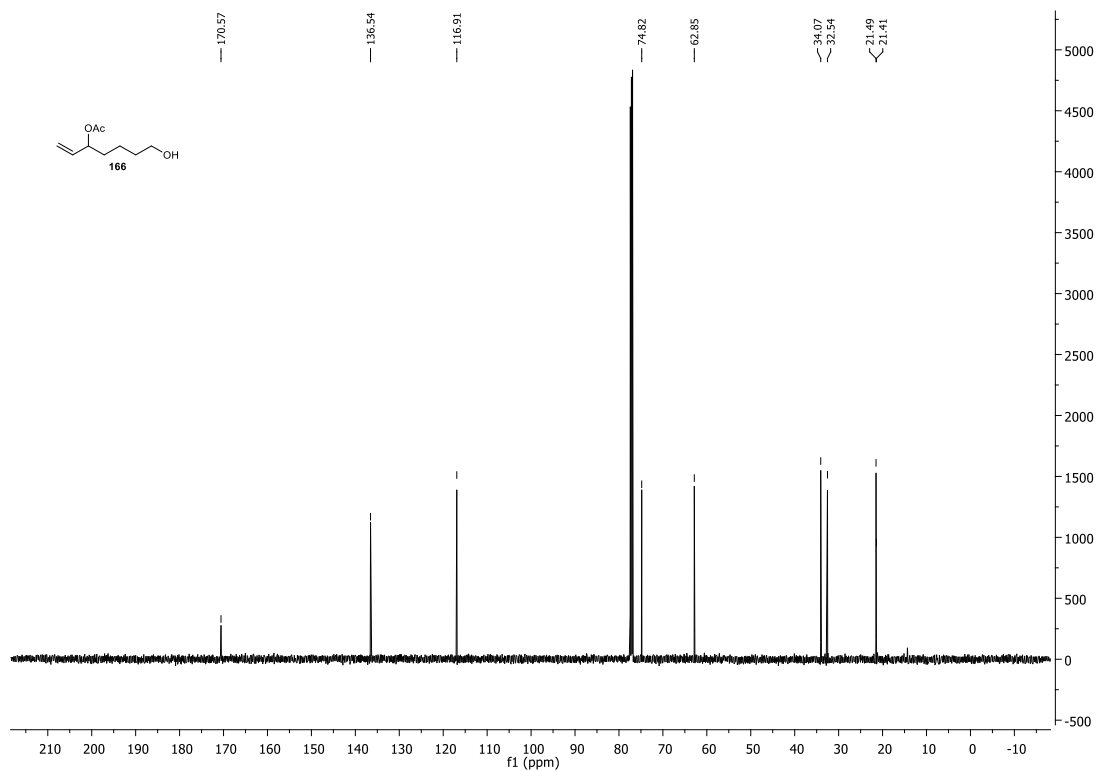
¹³C NMR 164.



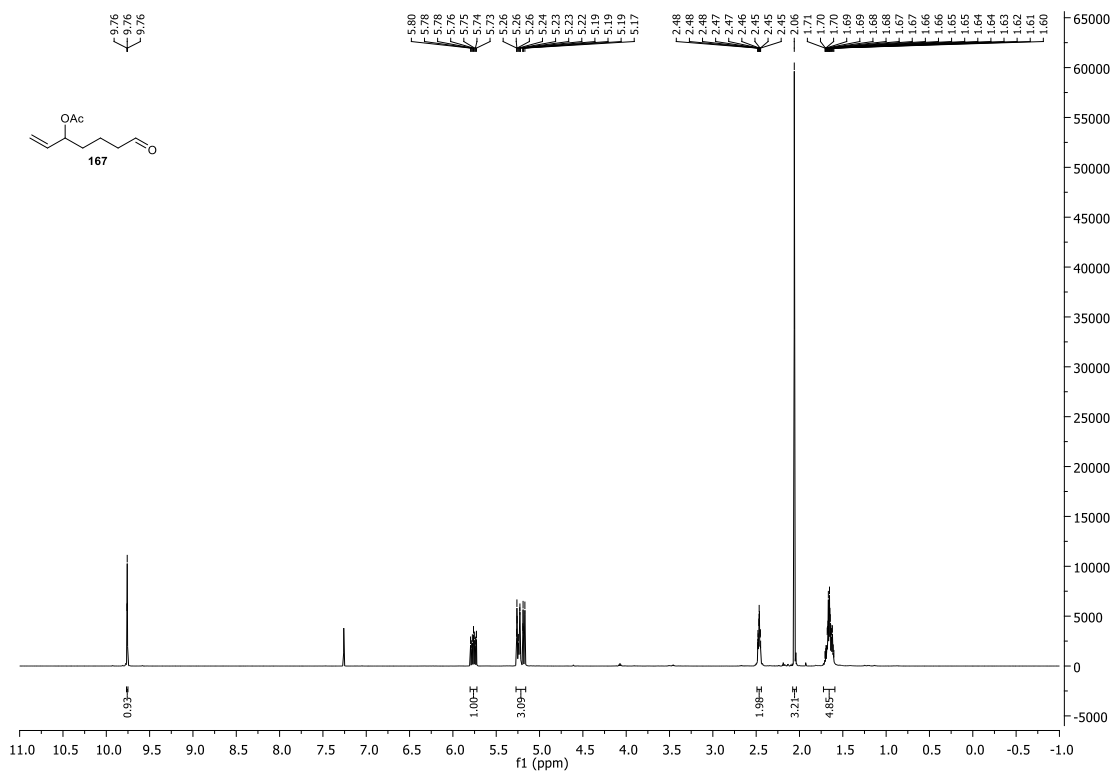
¹H NMR 166.



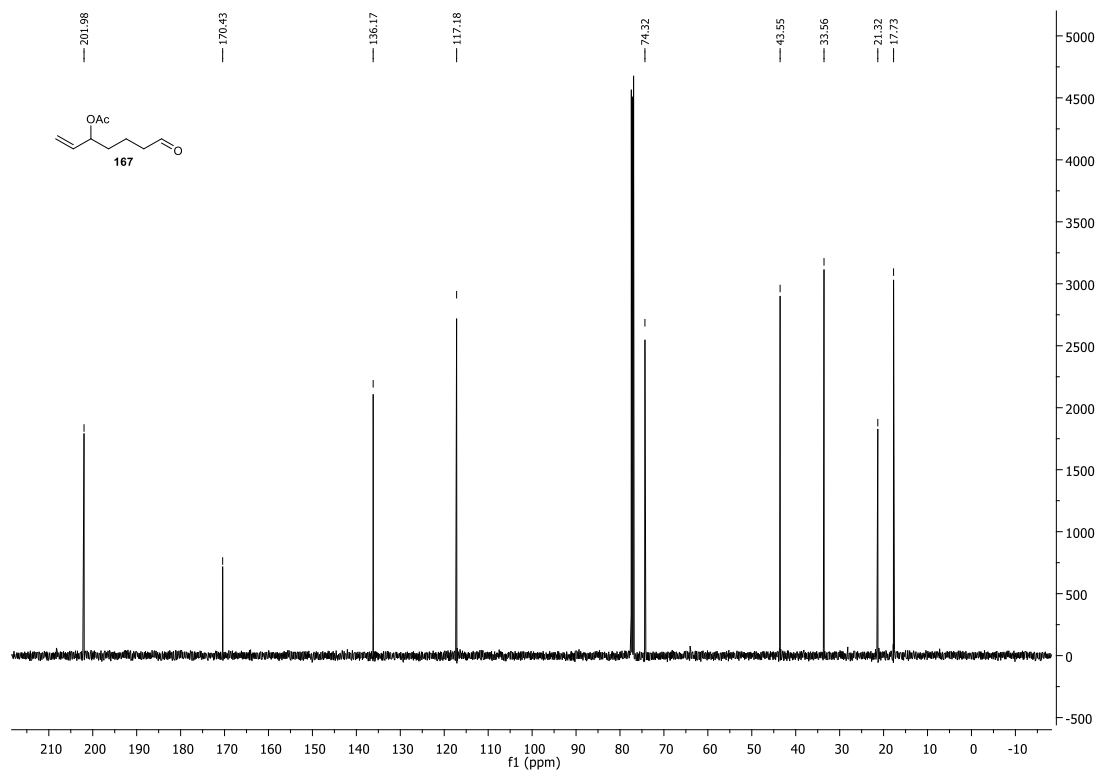
¹³C NMR 166.



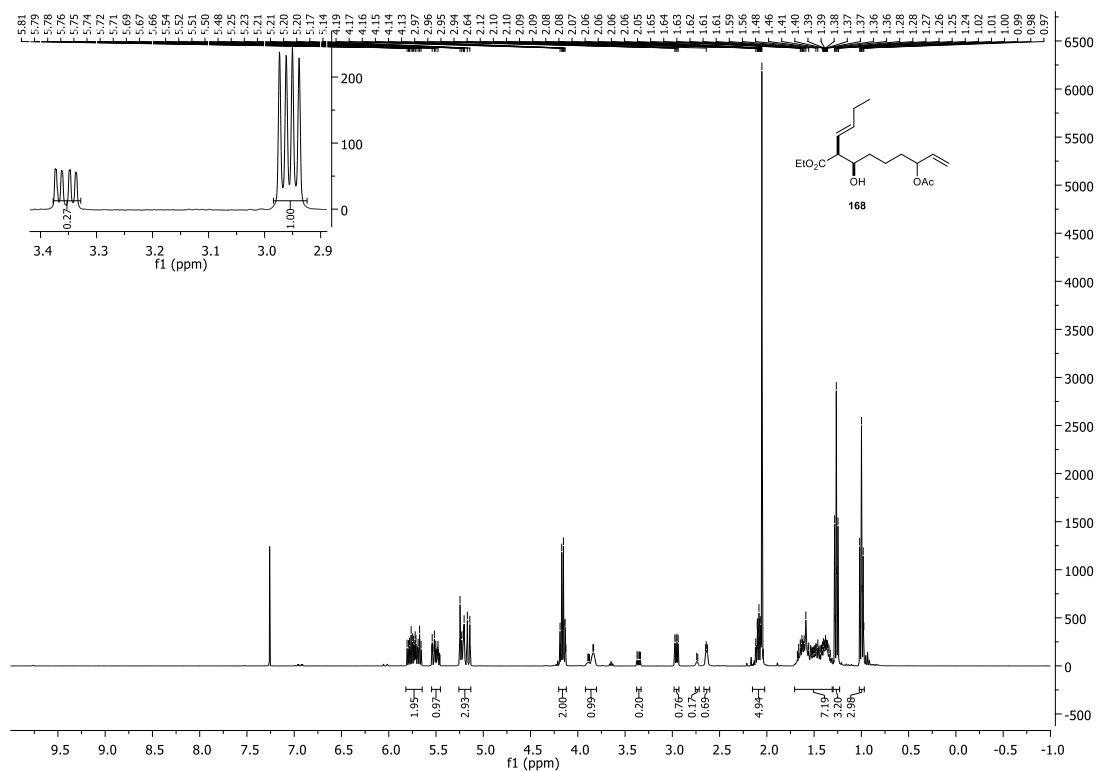
¹H NMR 167.



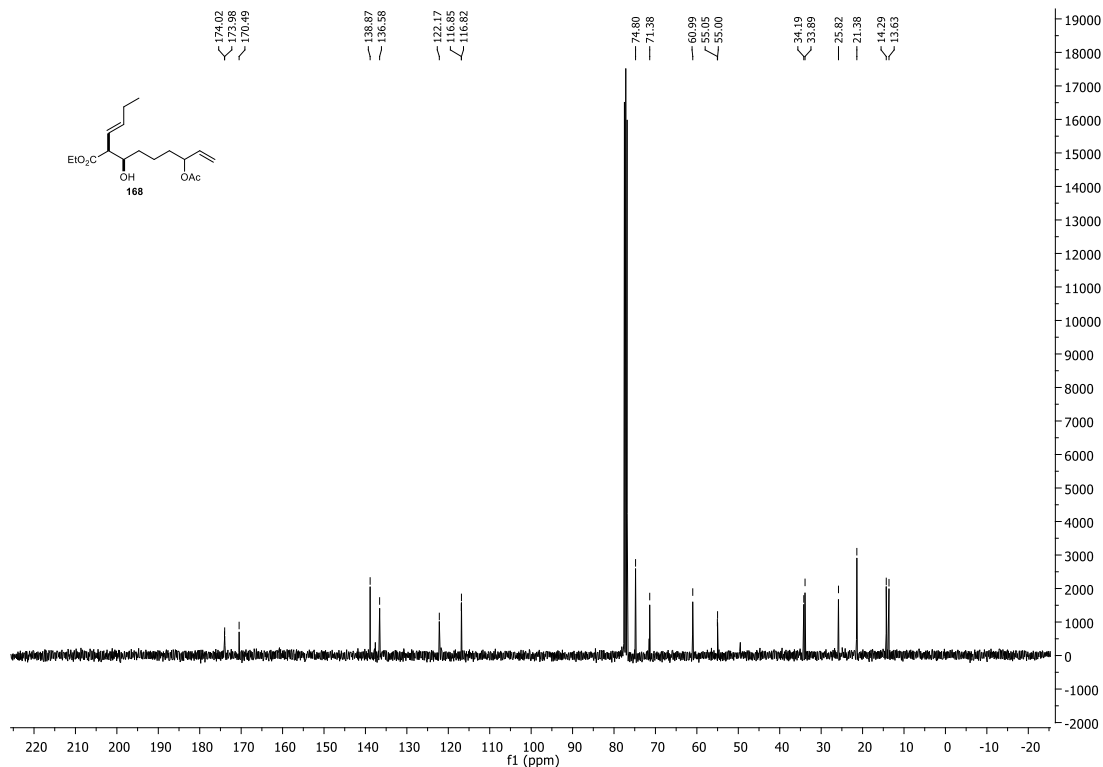
¹³C NMR 167.



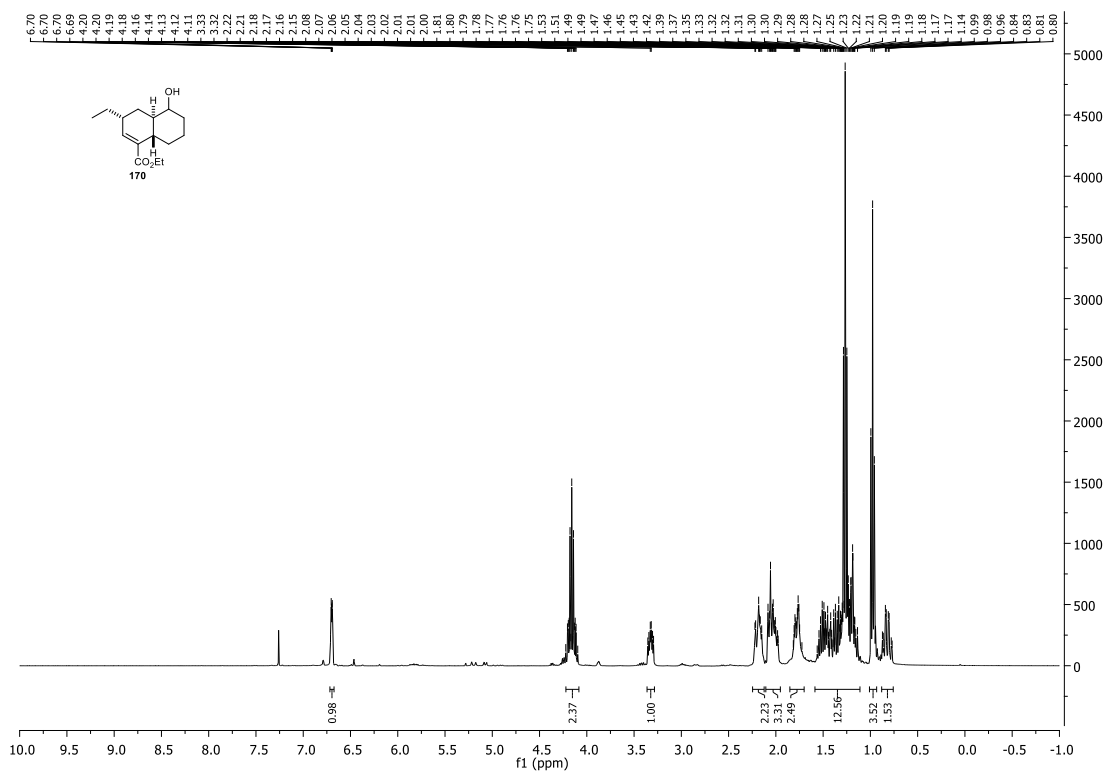
¹H NMR 168.



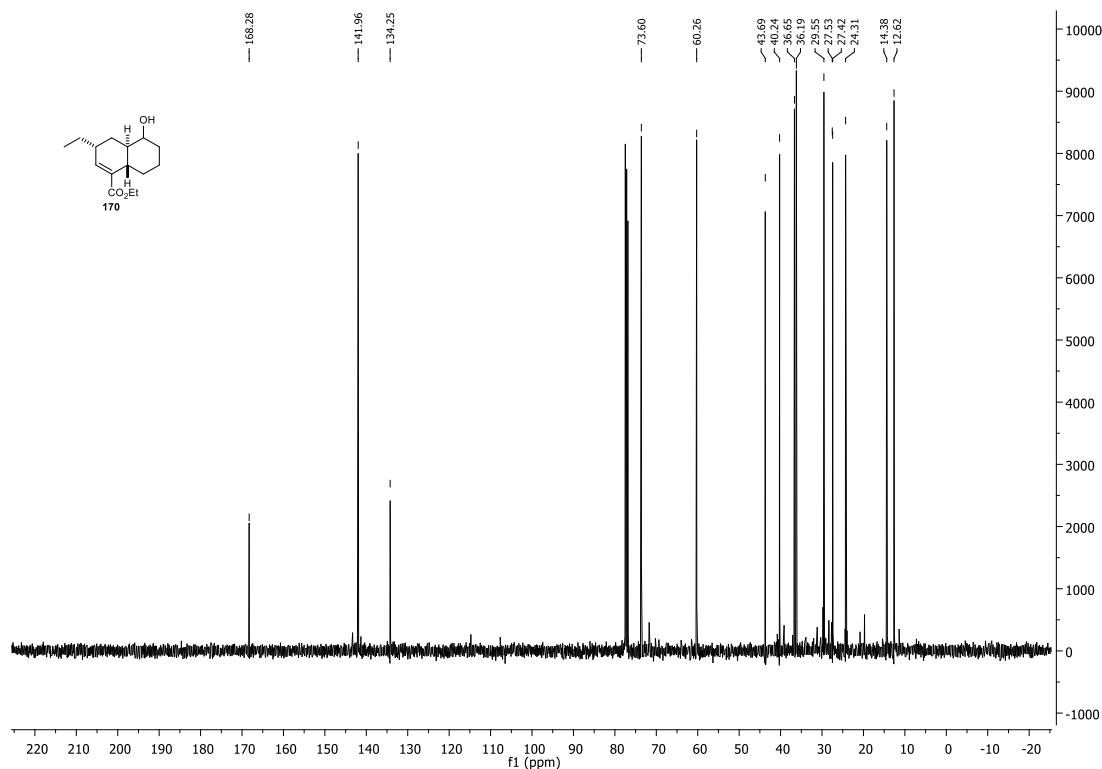
¹³C NMR 168.



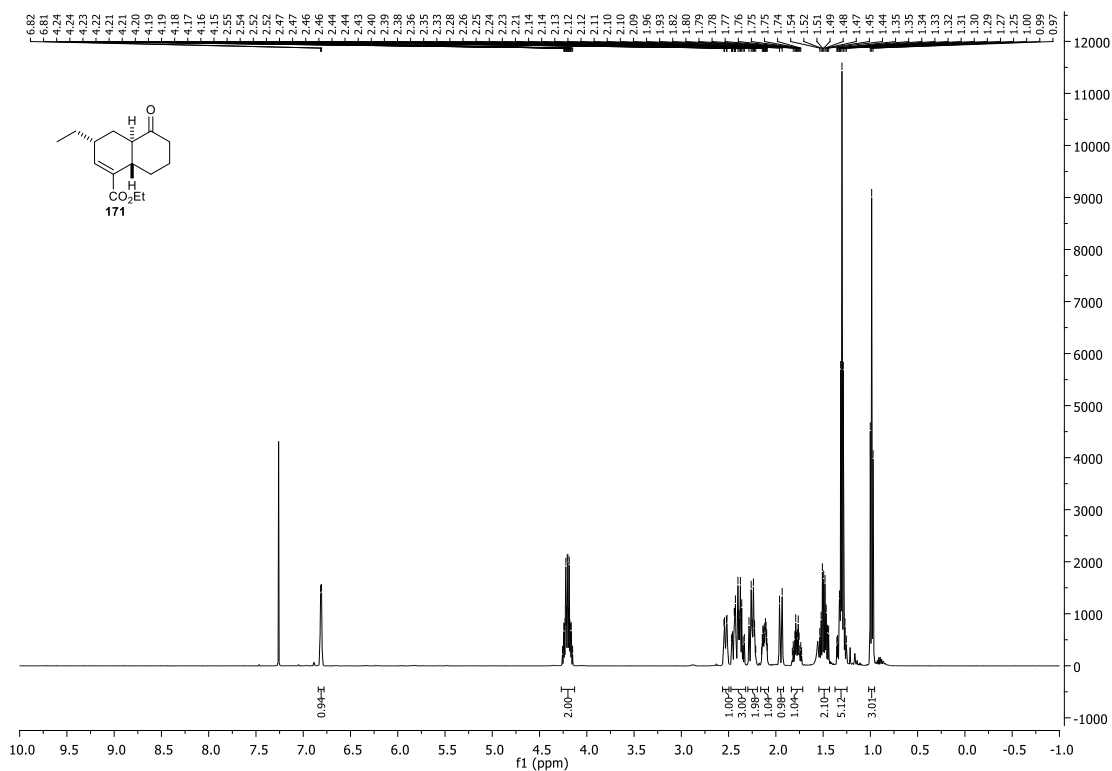
¹H NMR 170.



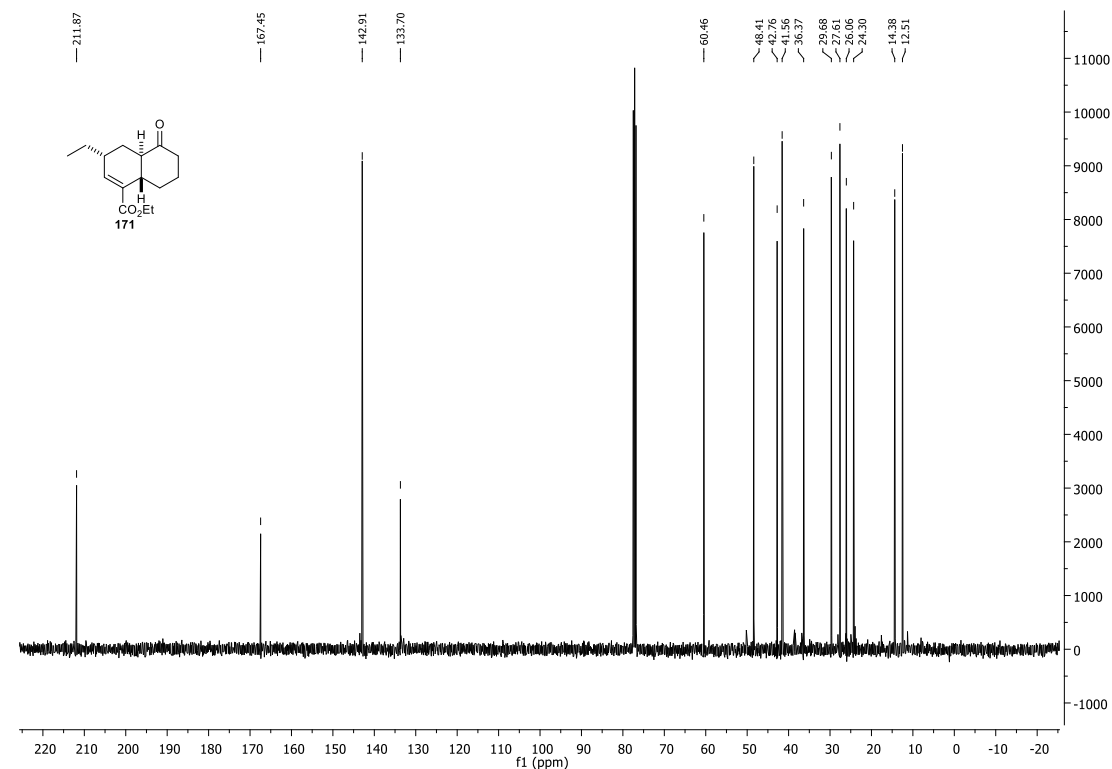
¹³C NMR 170.



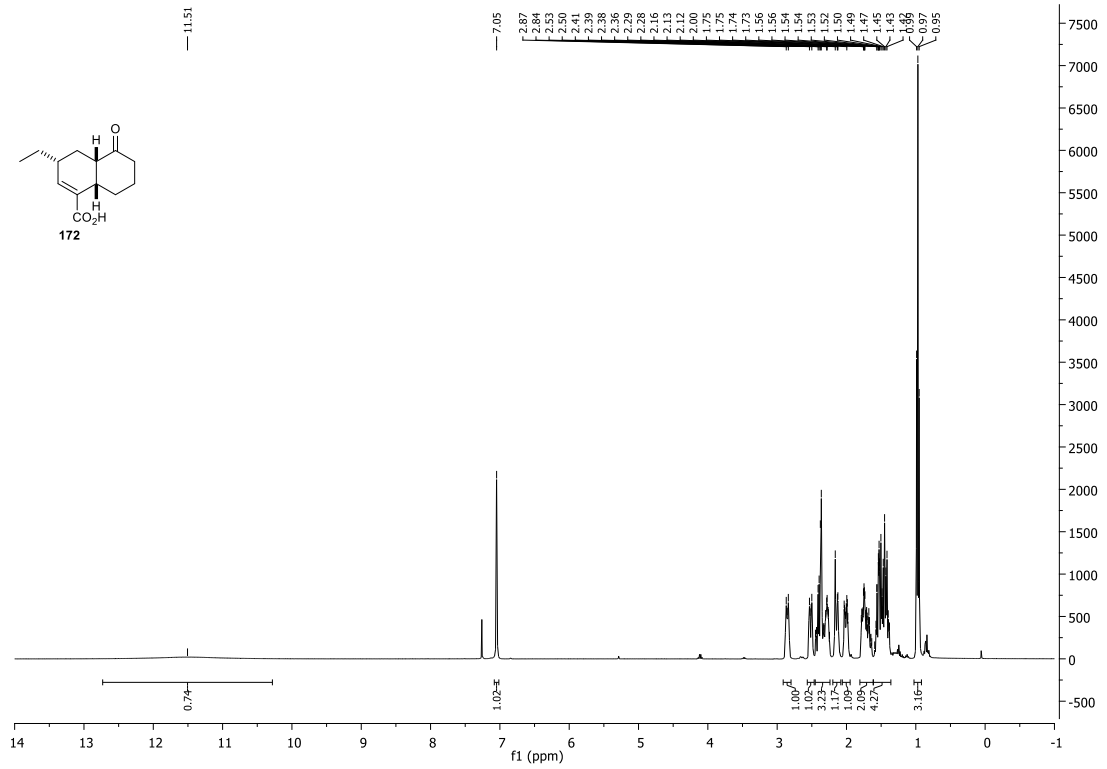
¹H NMR 171.



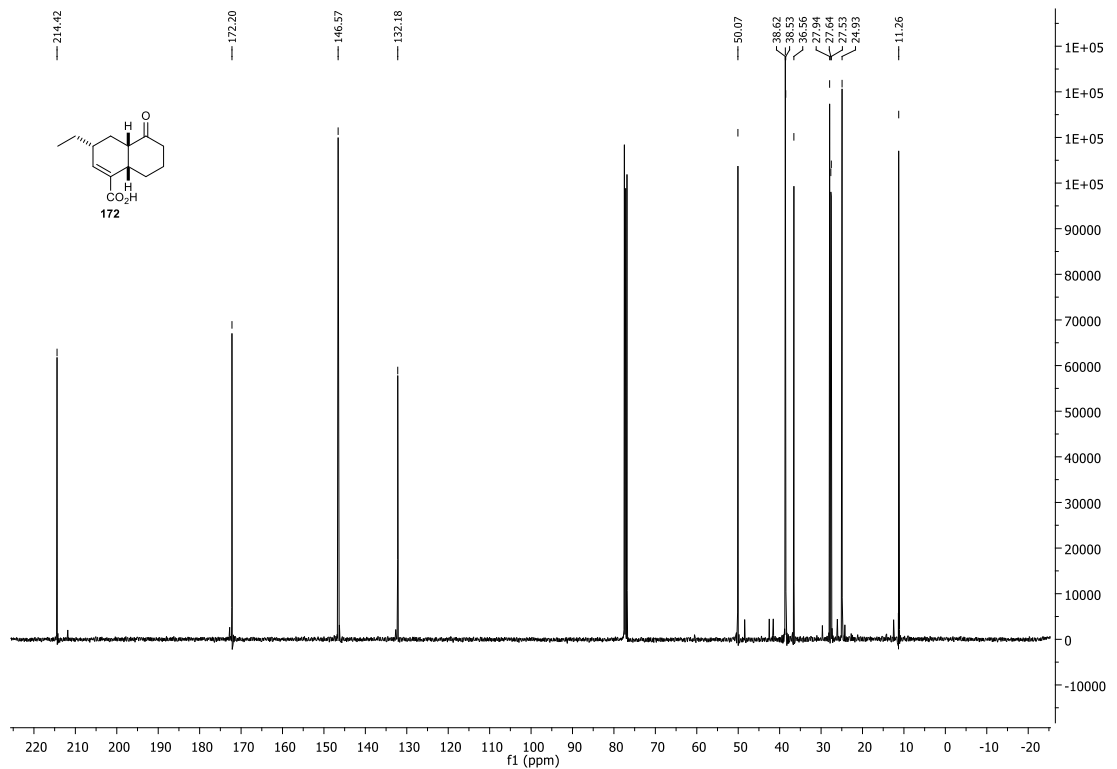
¹³C NMR 171.



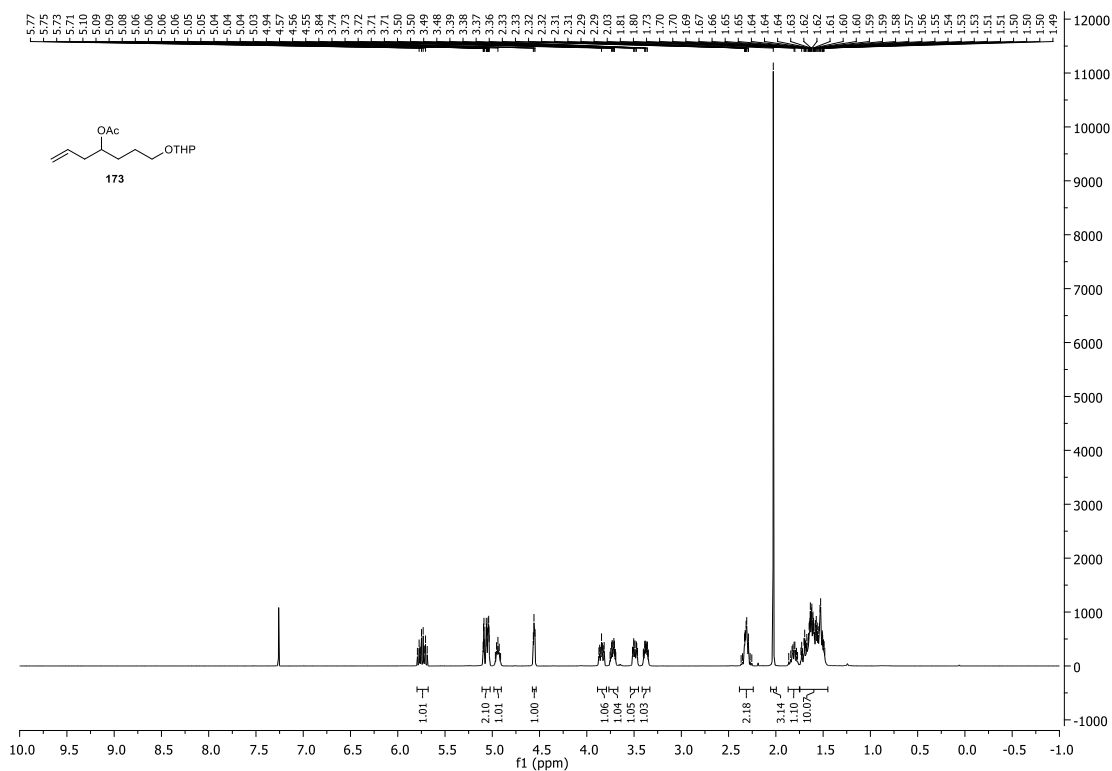
¹H NMR 172.



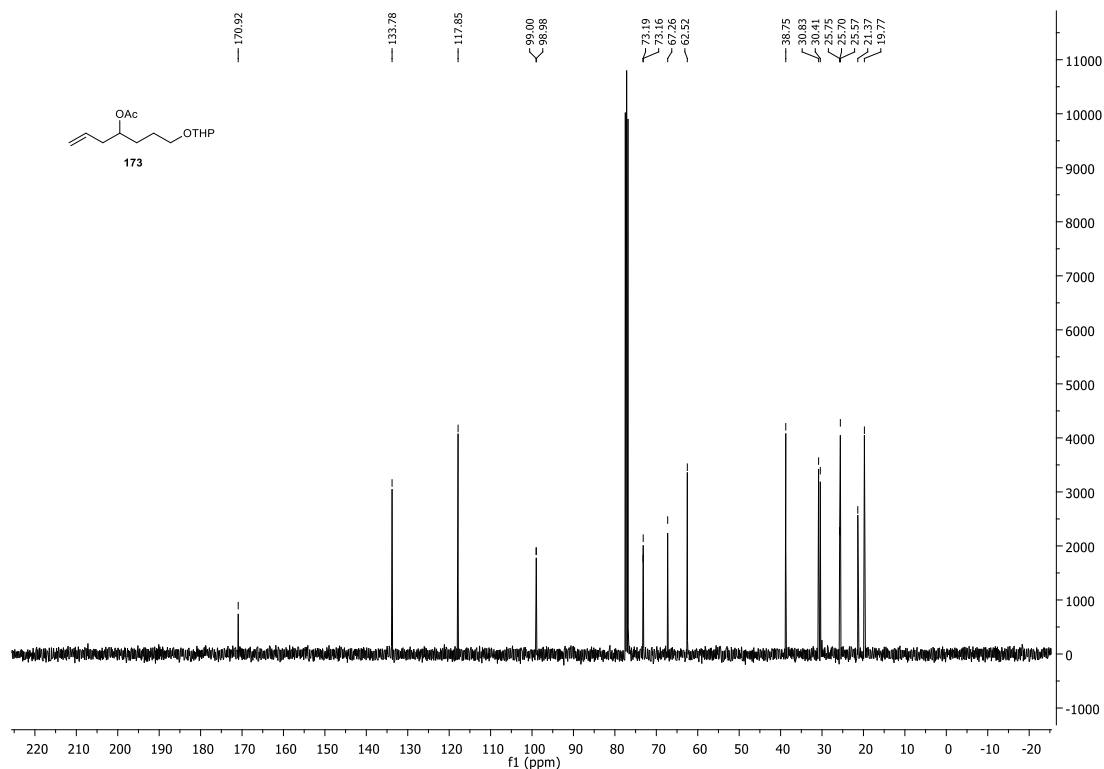
¹³C NMR 172.



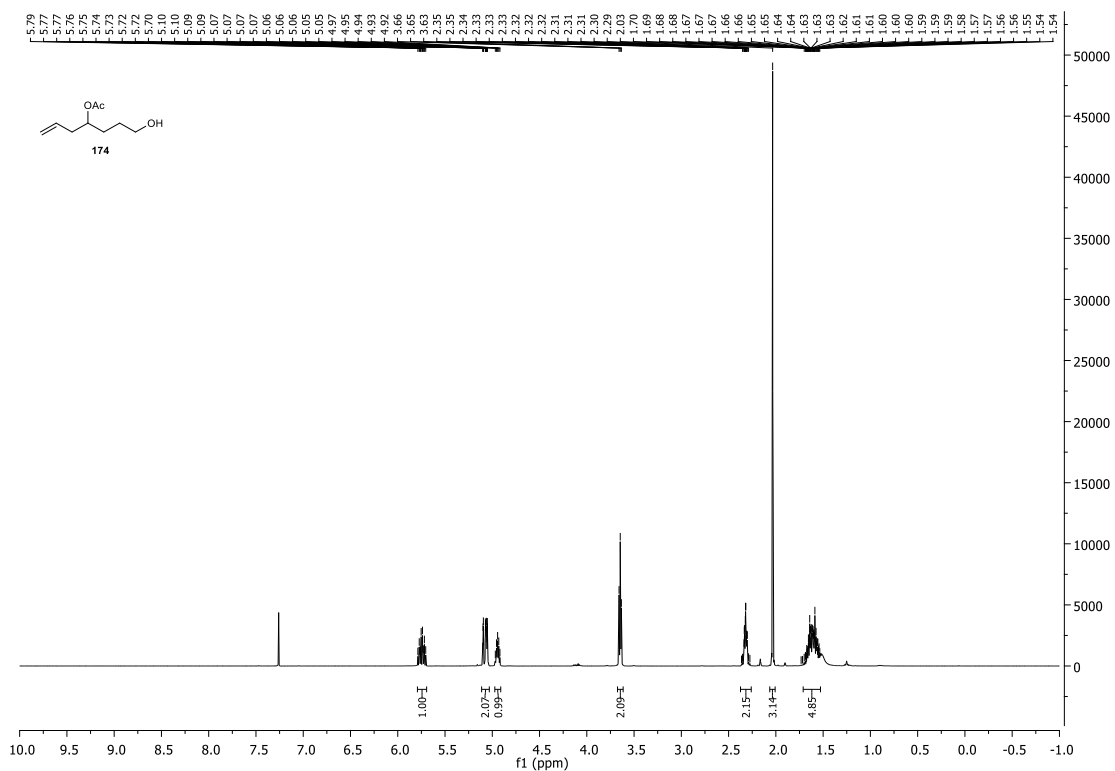
¹H NMR 173.



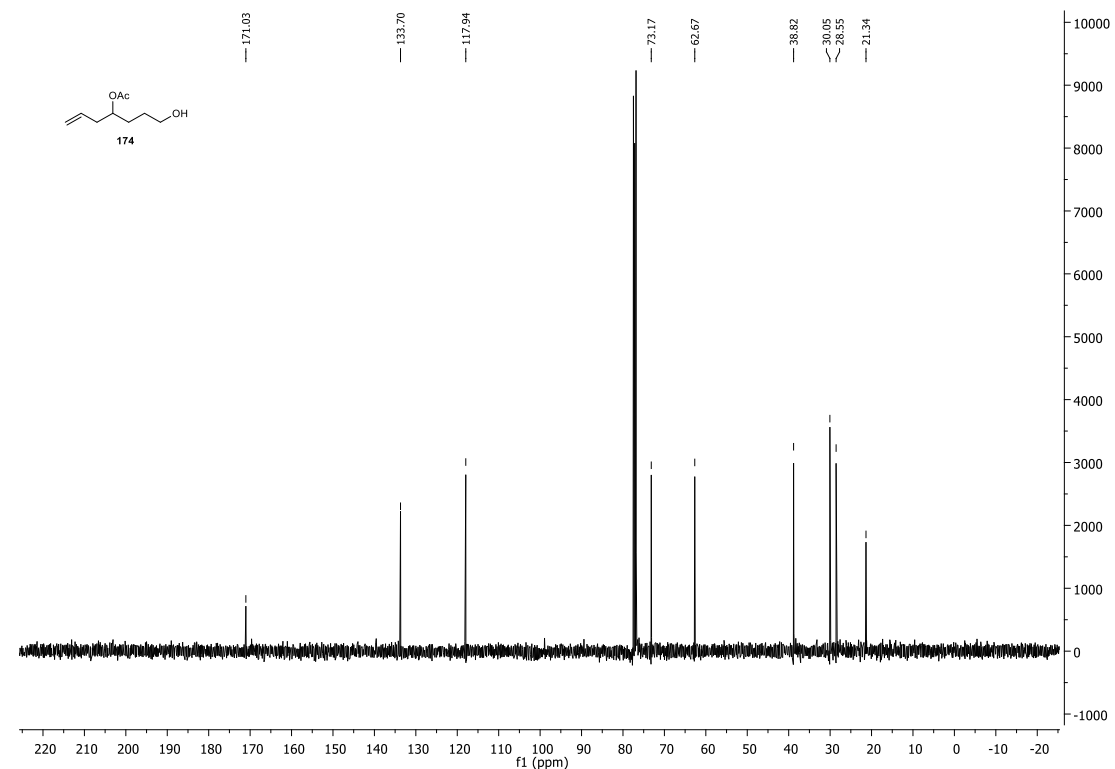
¹³C NMR 173.



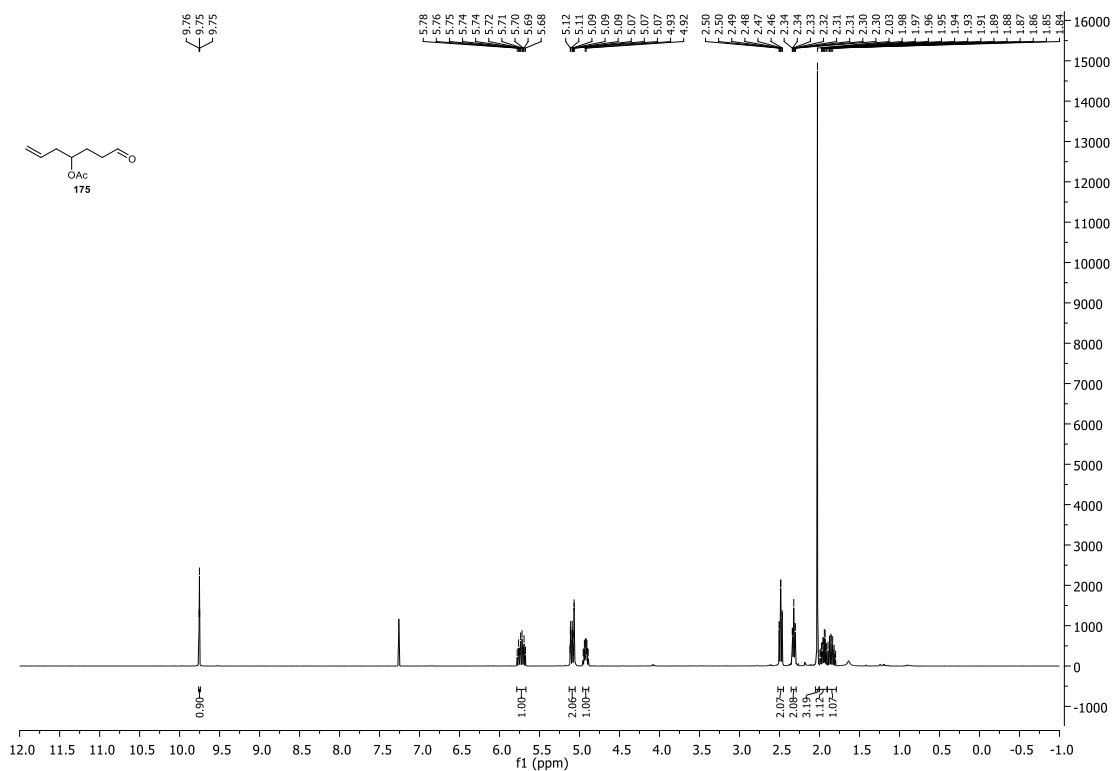
¹H NMR 174.



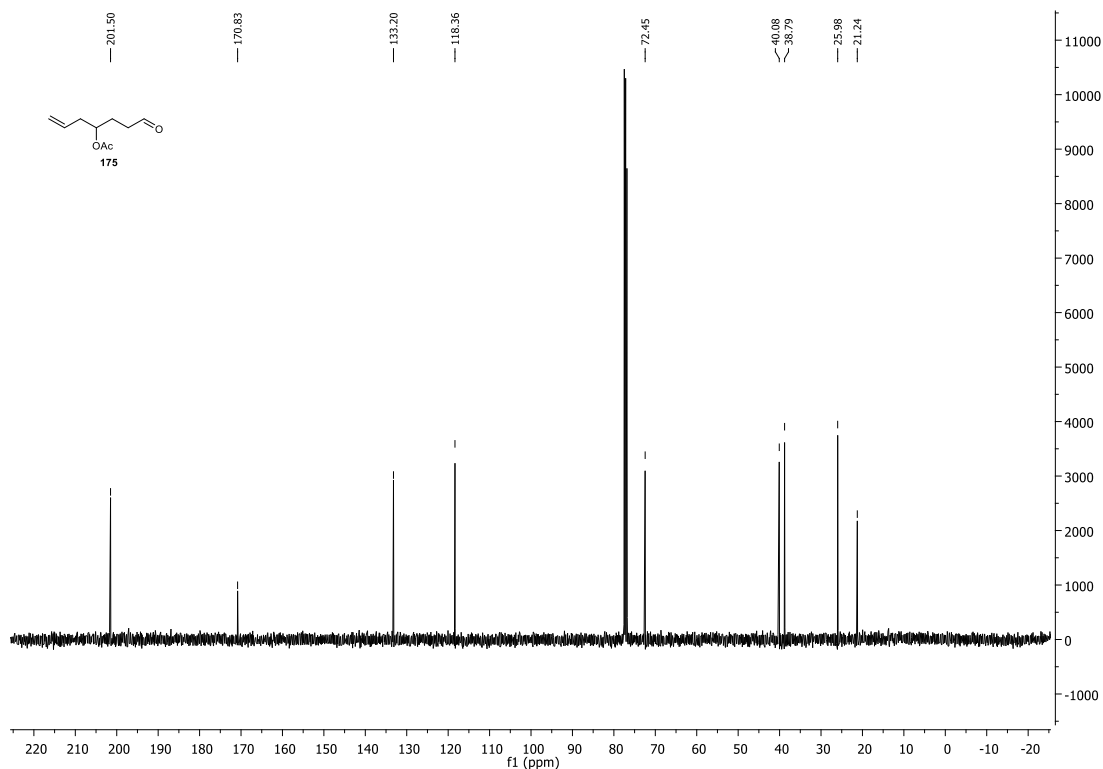
¹³C NMR 174.



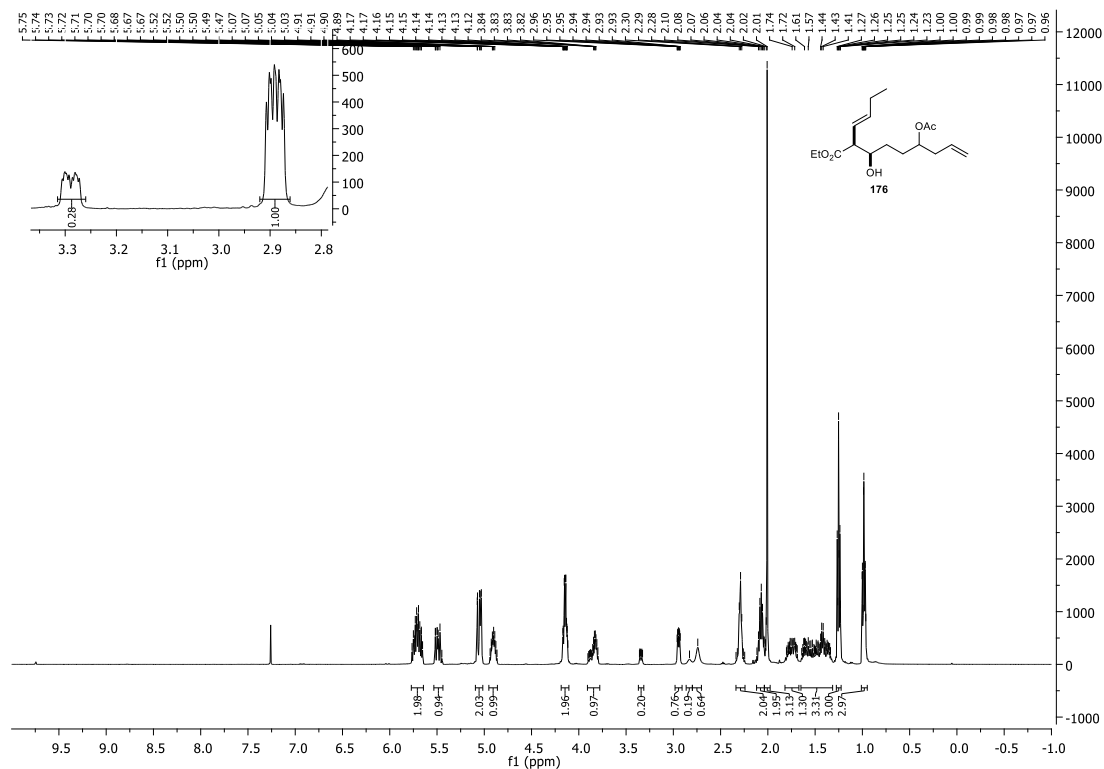
¹H NMR 175.



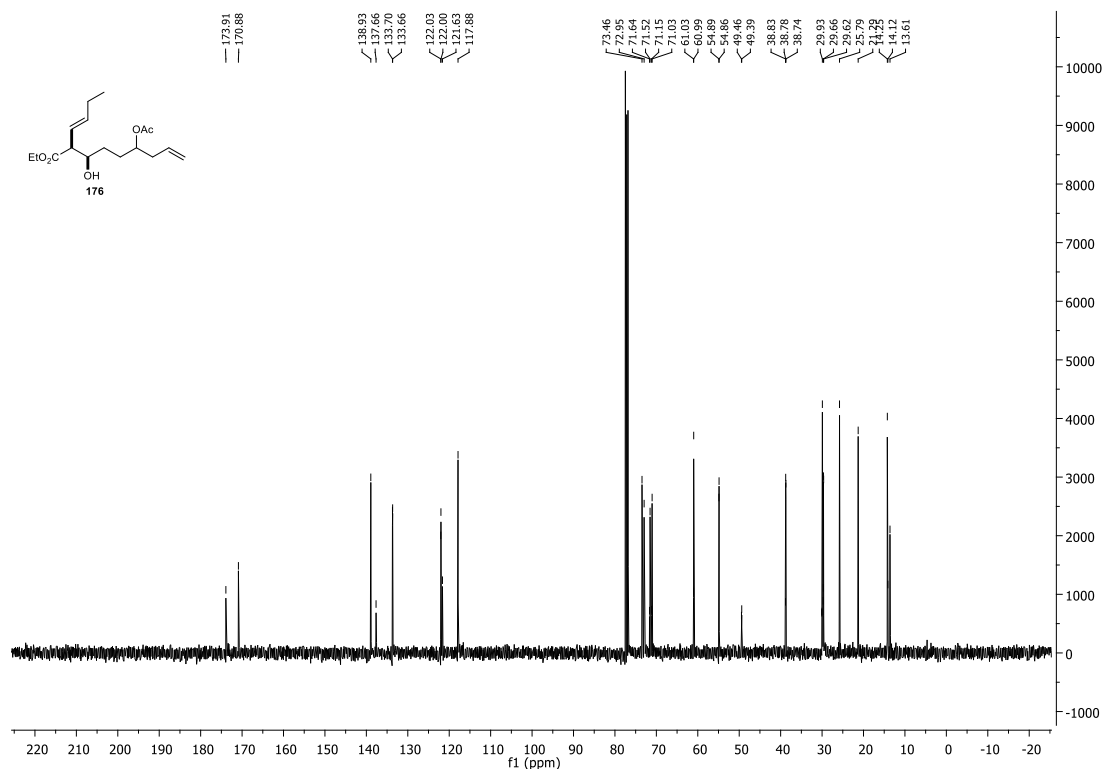
¹³C NMR 175.



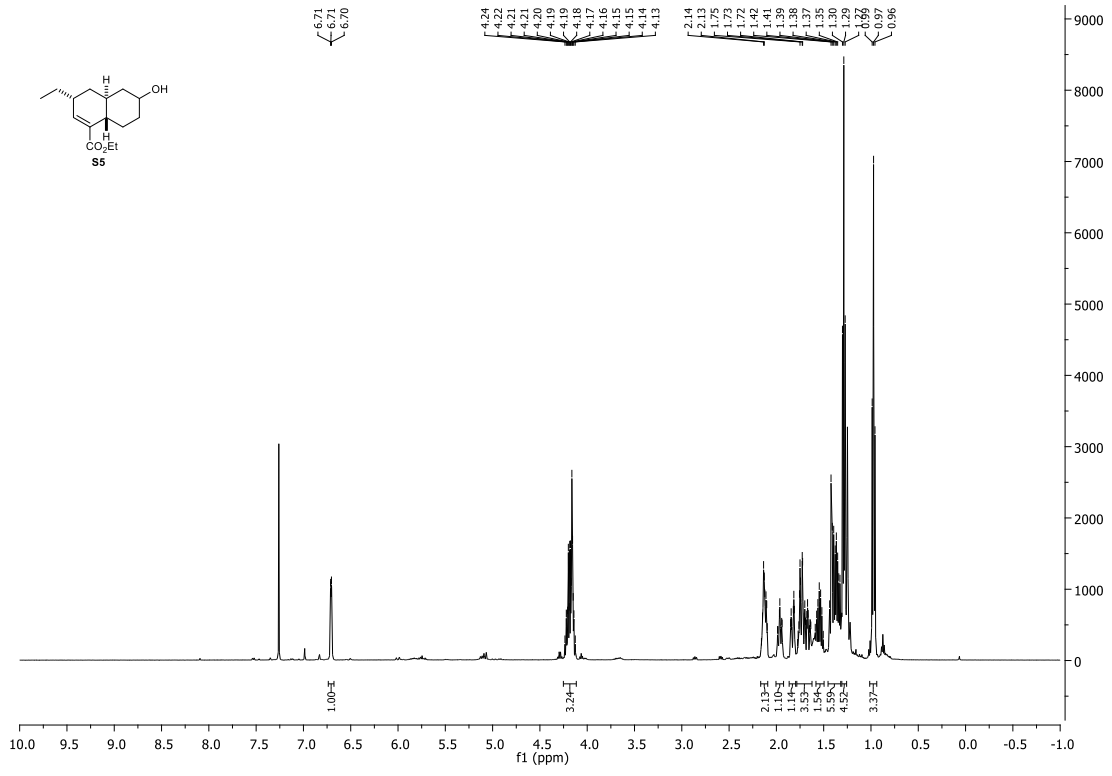
¹H NMR 176.



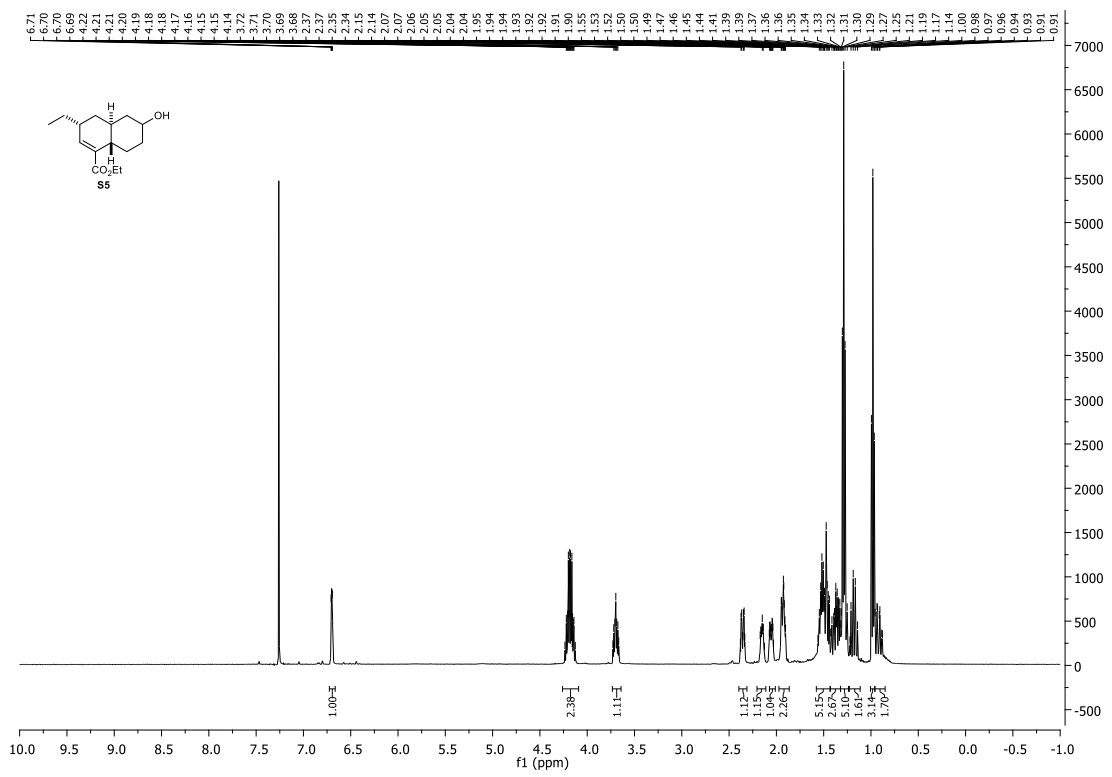
¹³C NMR 176.



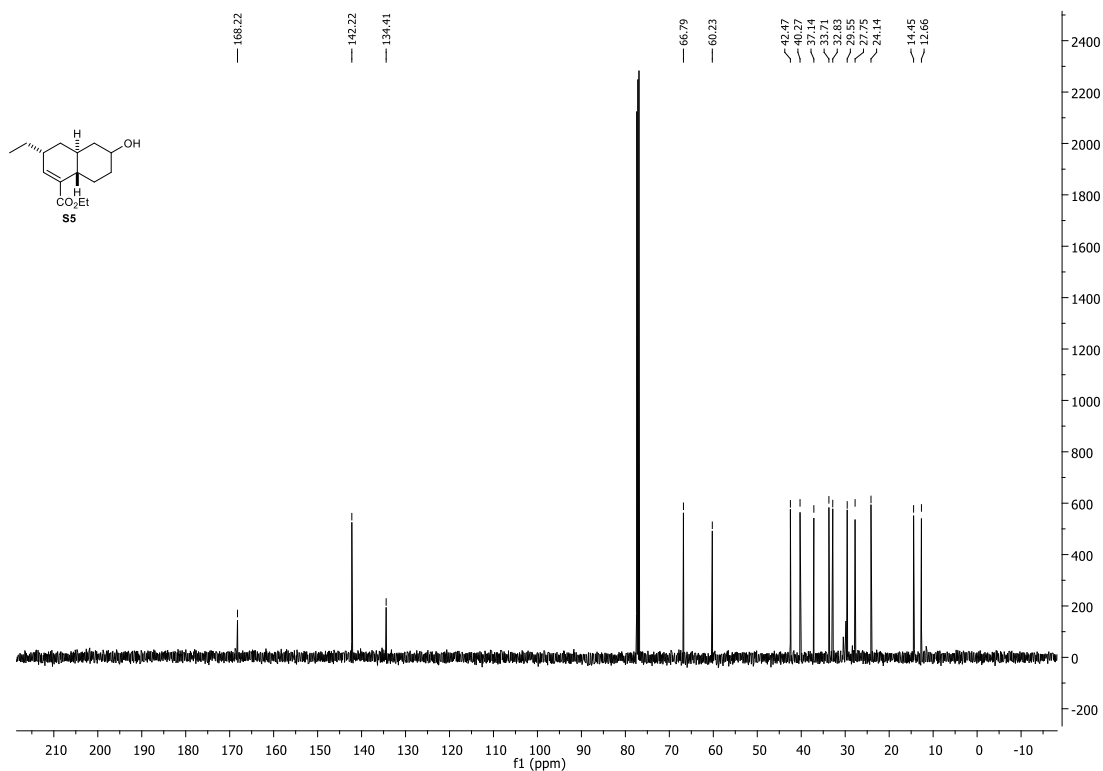
¹H NMR S5.
Isomer 1:



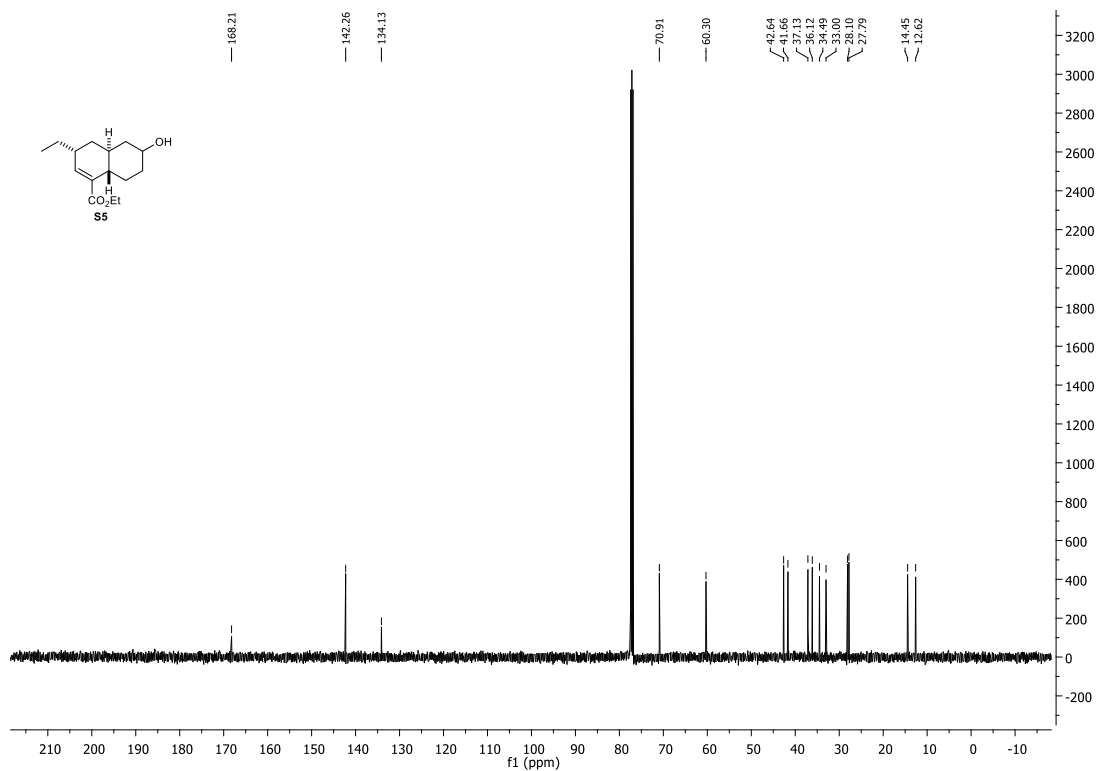
Isomer 2:



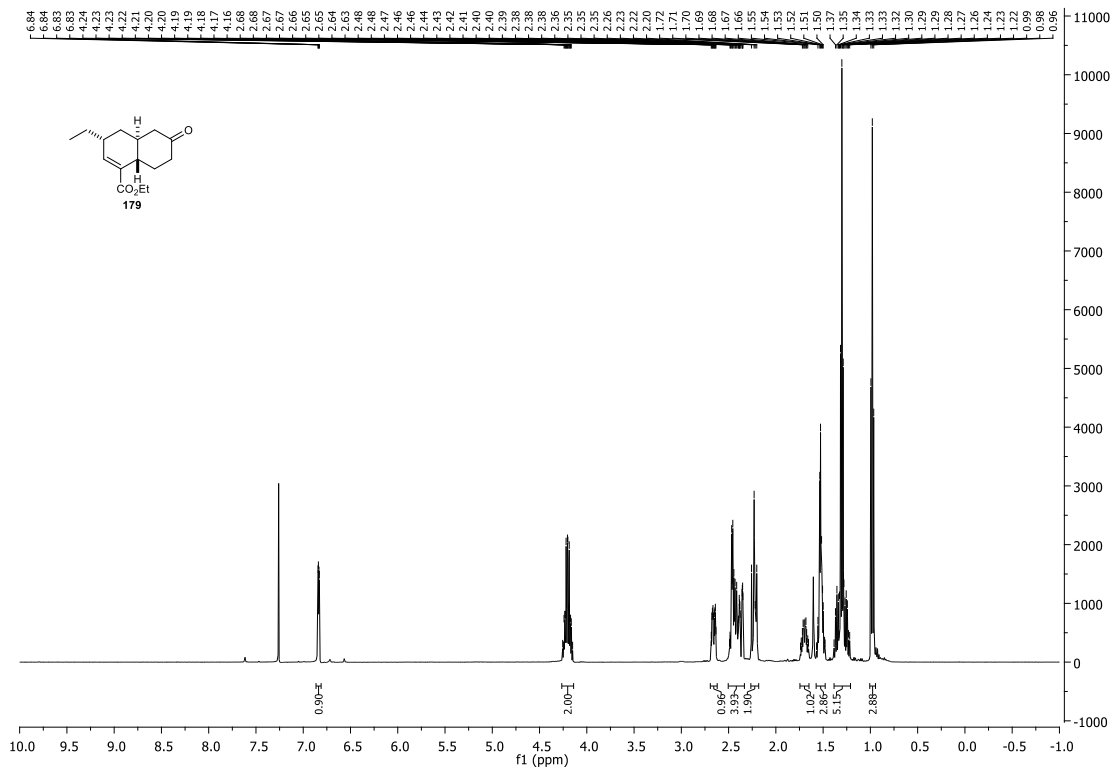
¹³C NMR S5. Isomer 1:



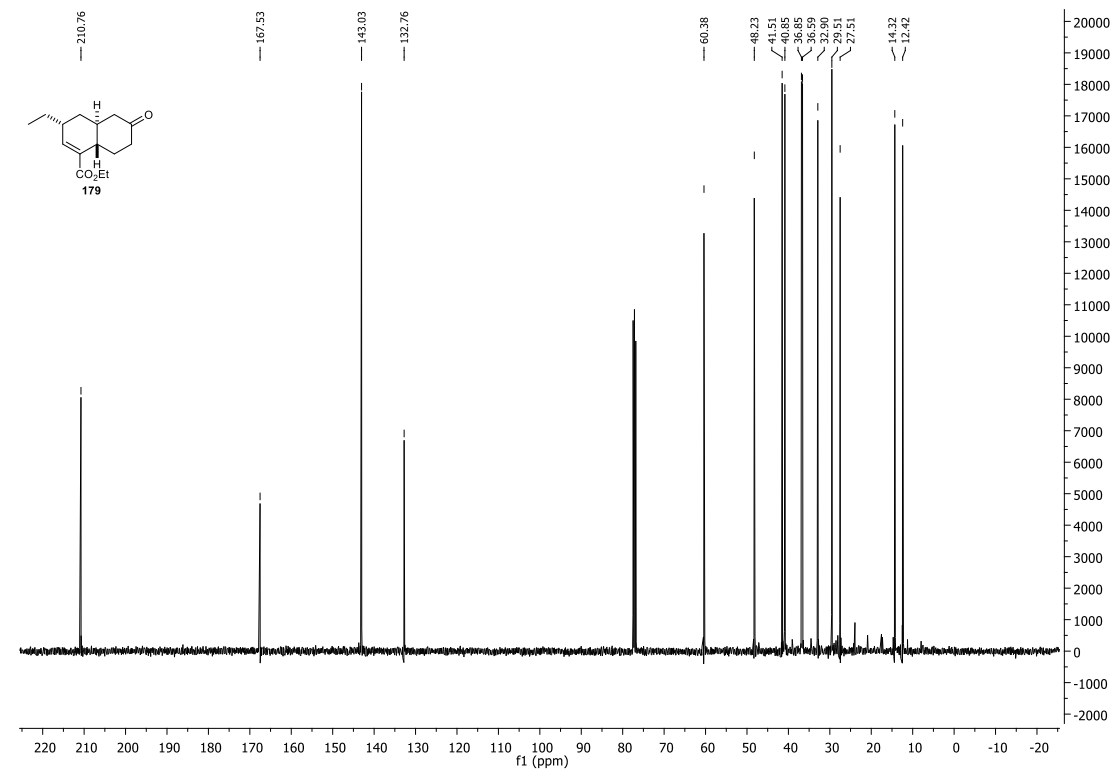
Isomer 2:



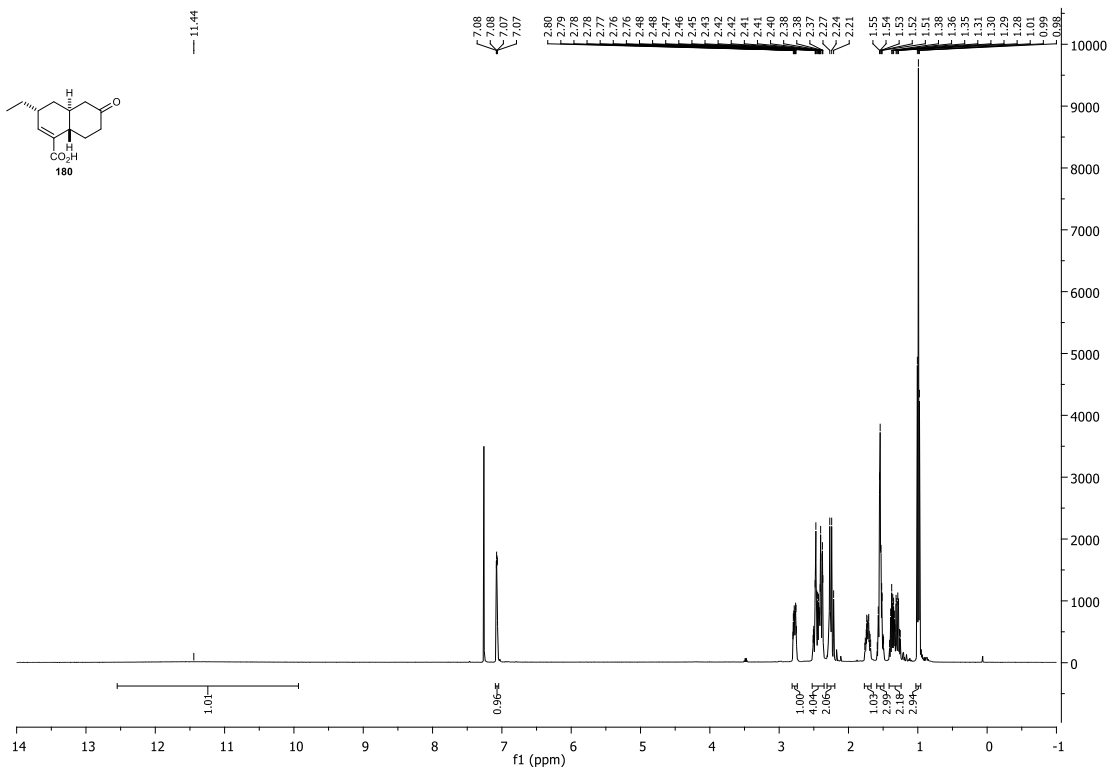
¹H NMR 179.



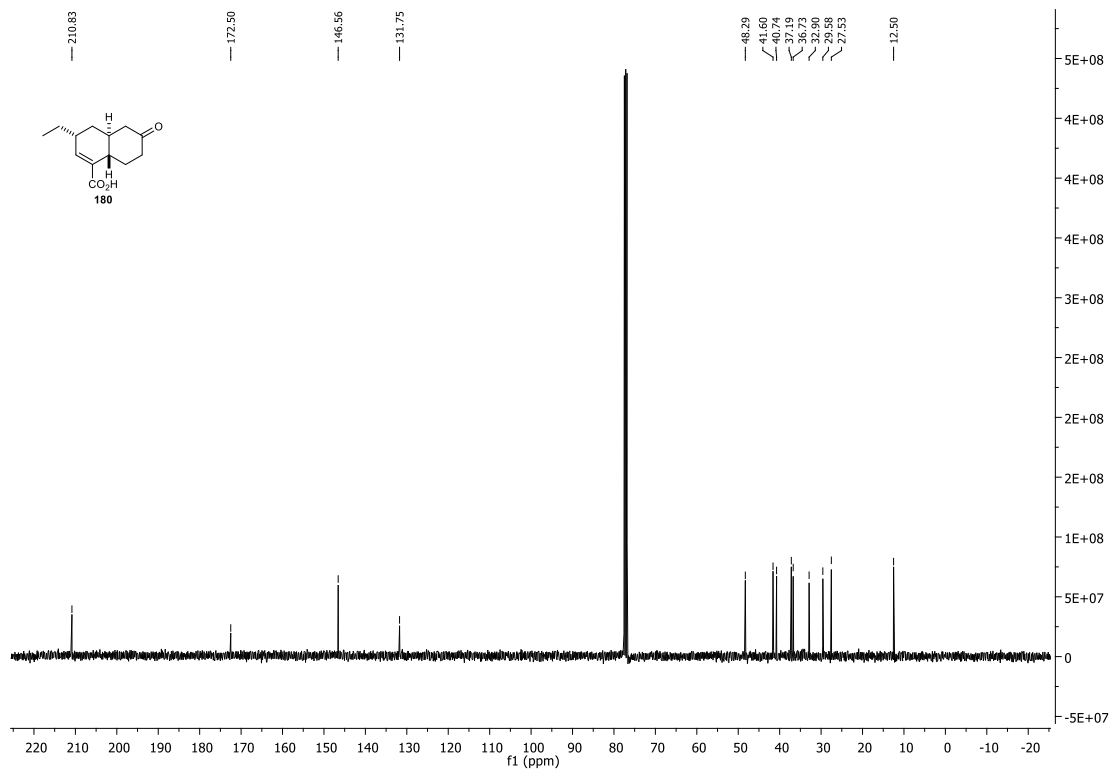
¹³C NMR 179.



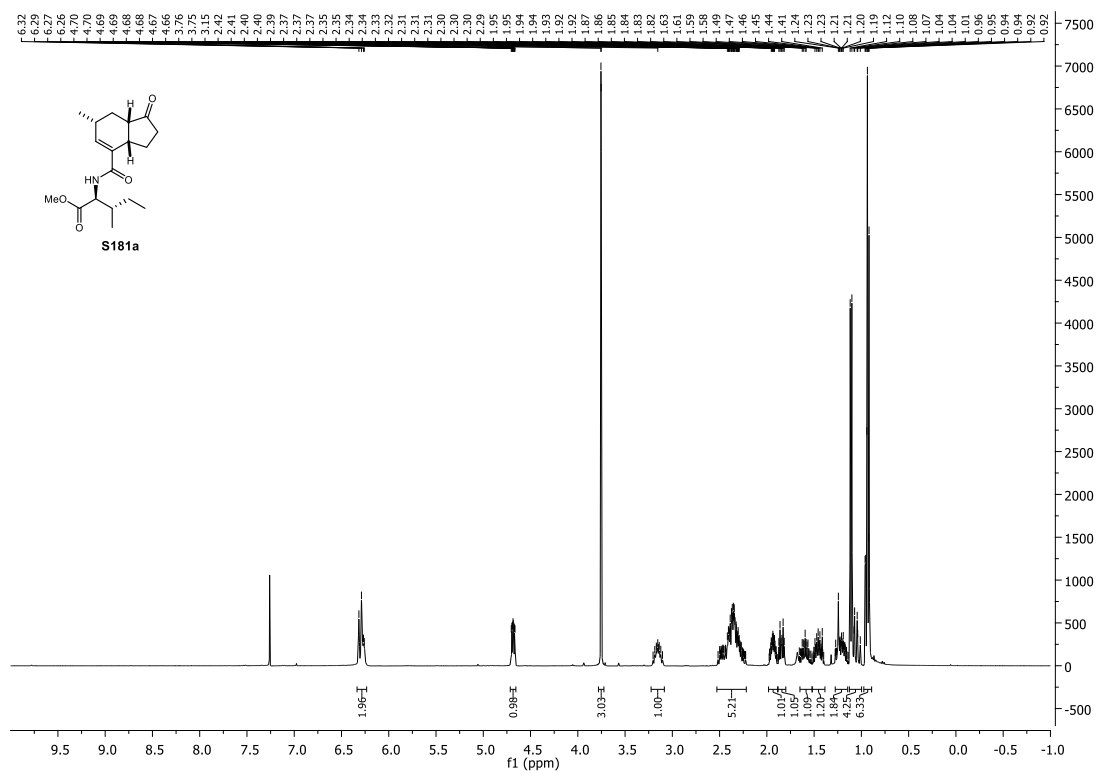
¹H NMR 180.



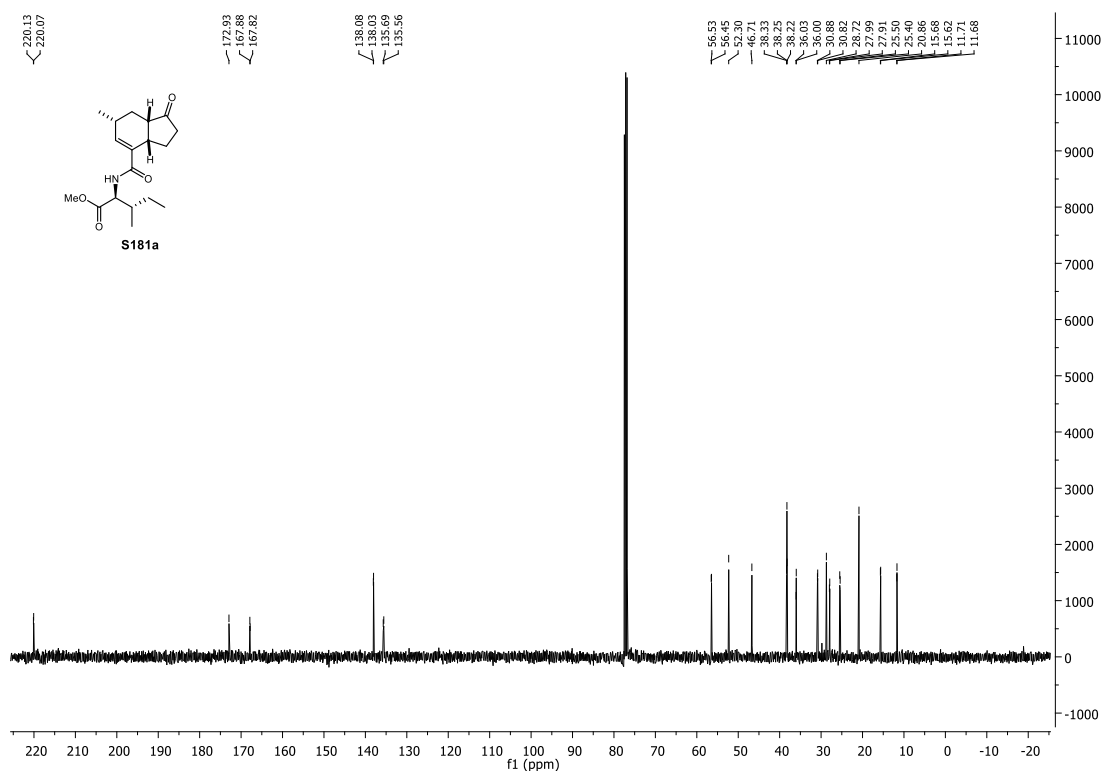
¹³C NMR 180.



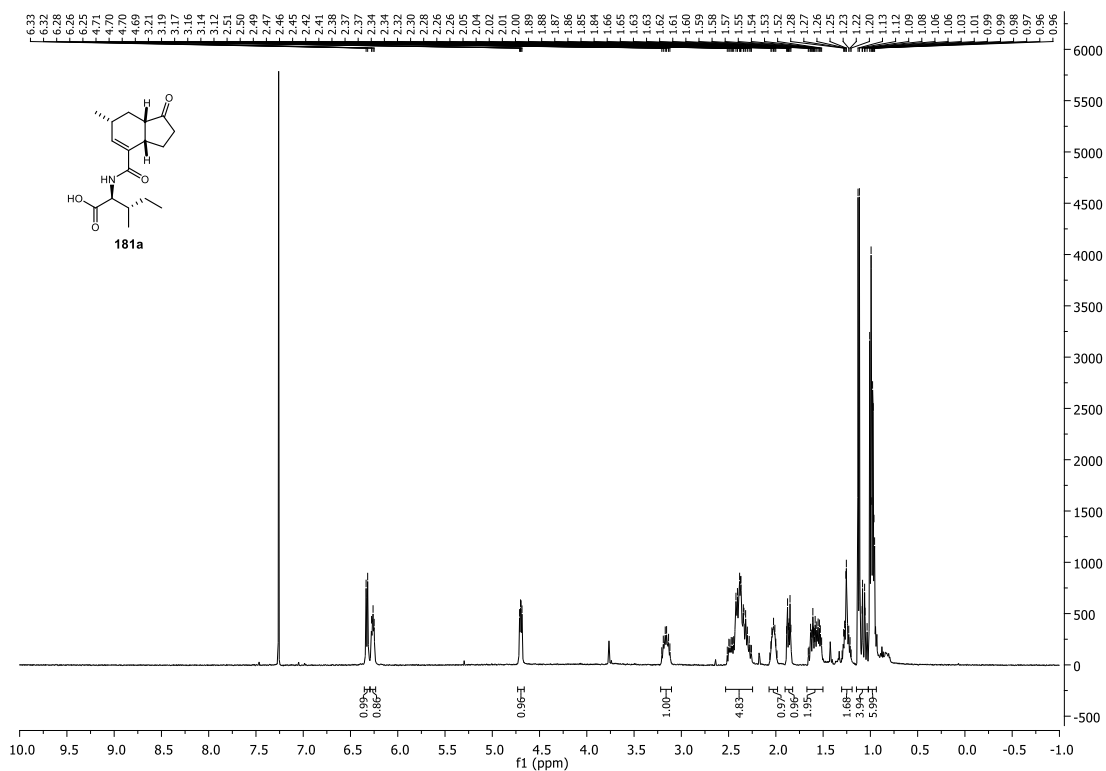
¹H NMR S181a.



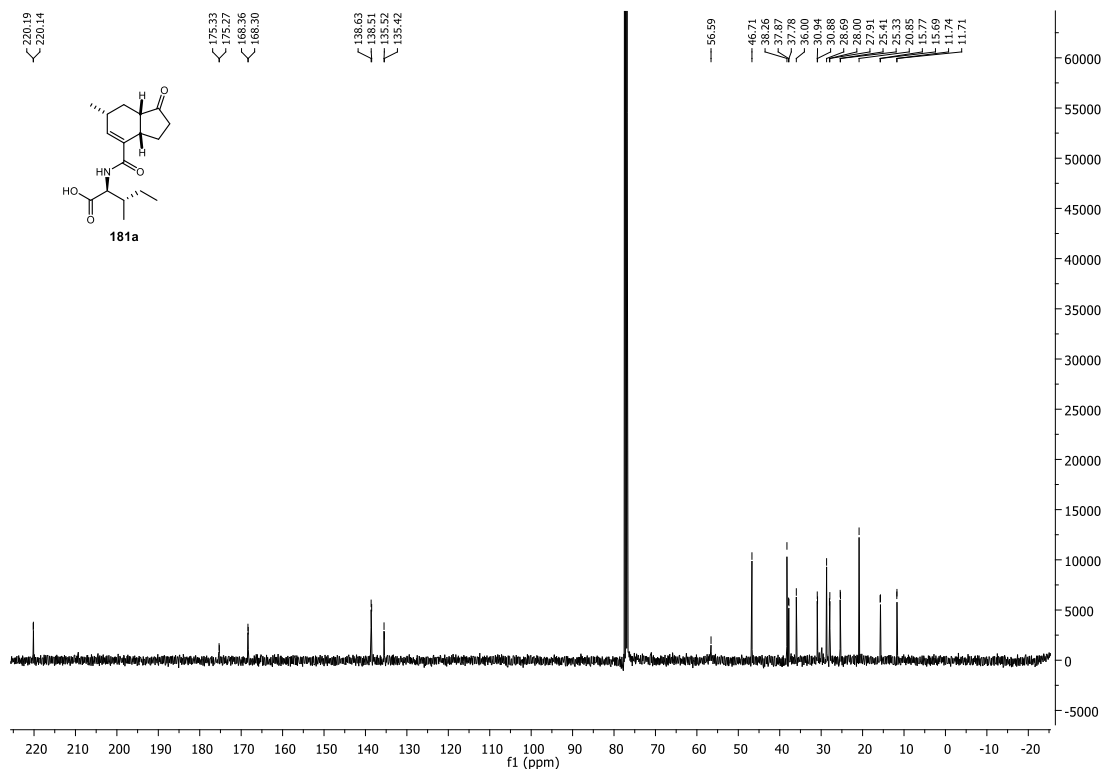
¹³C NMR S181a.



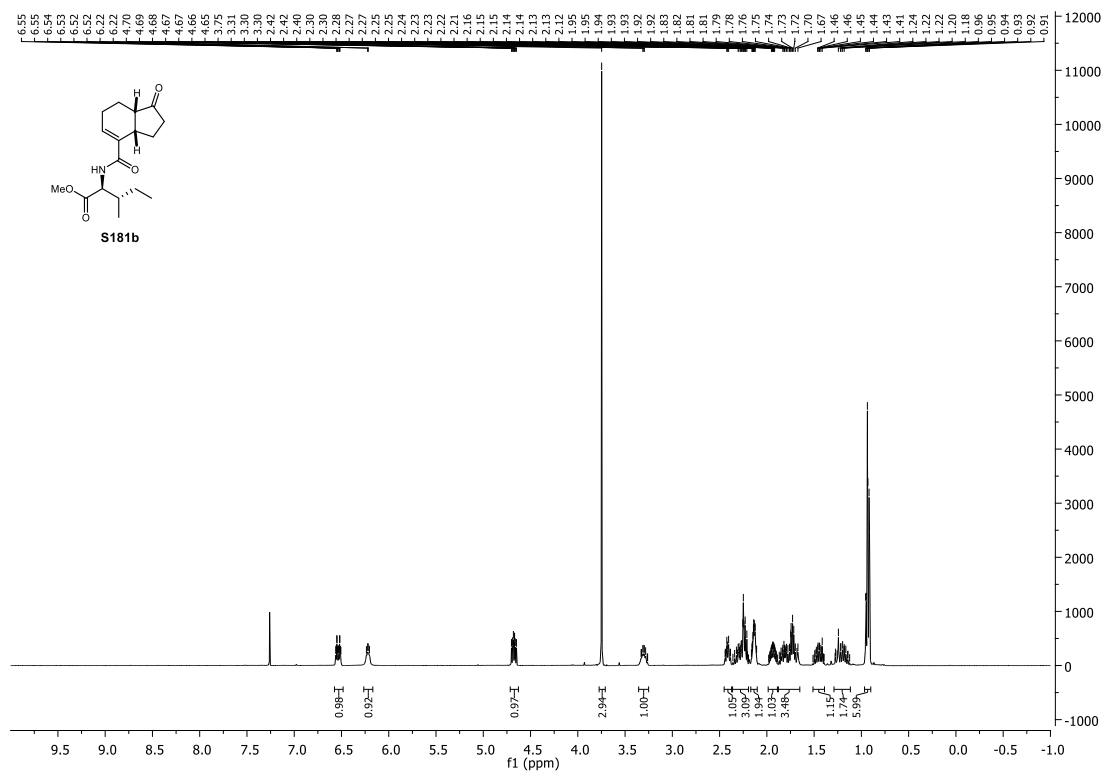
¹H NMR 181a.



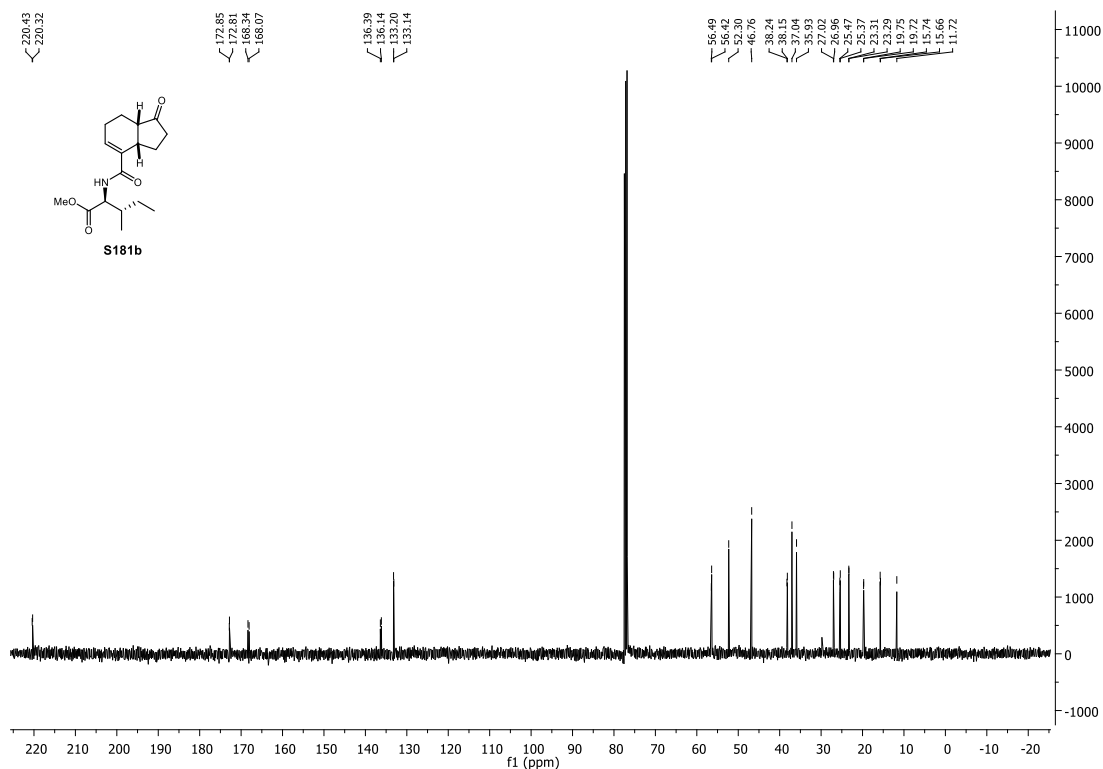
¹³C NMR 181a.



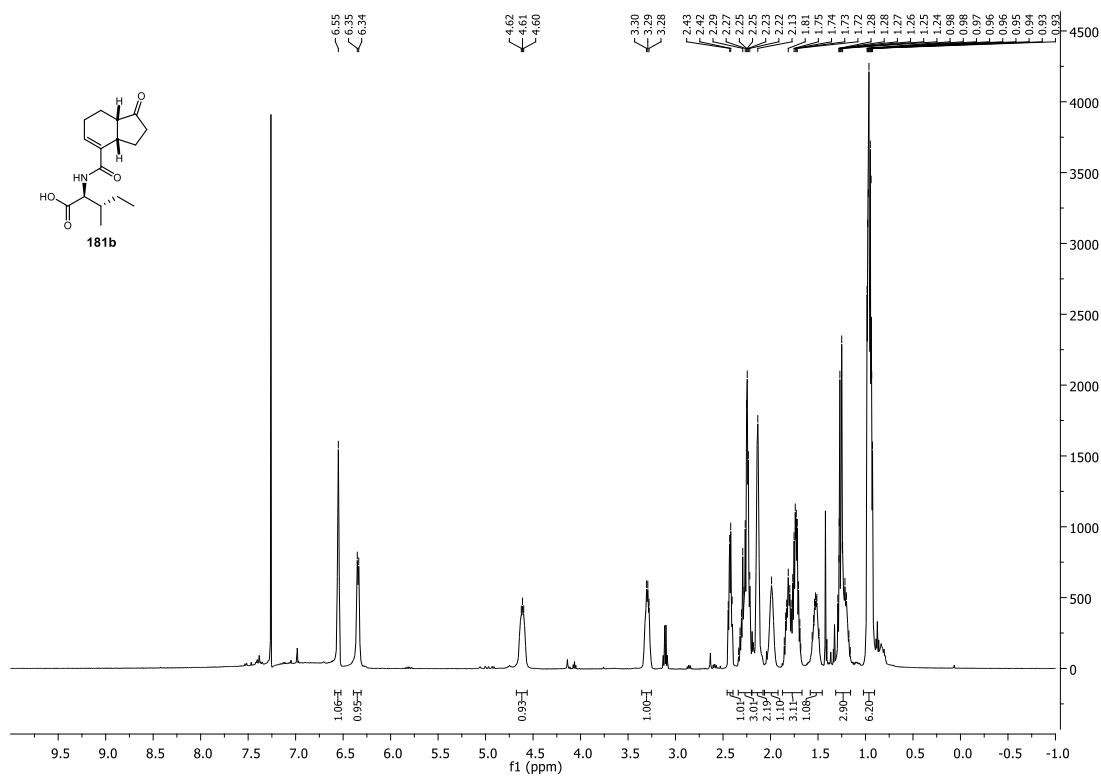
¹H NMR S181b.



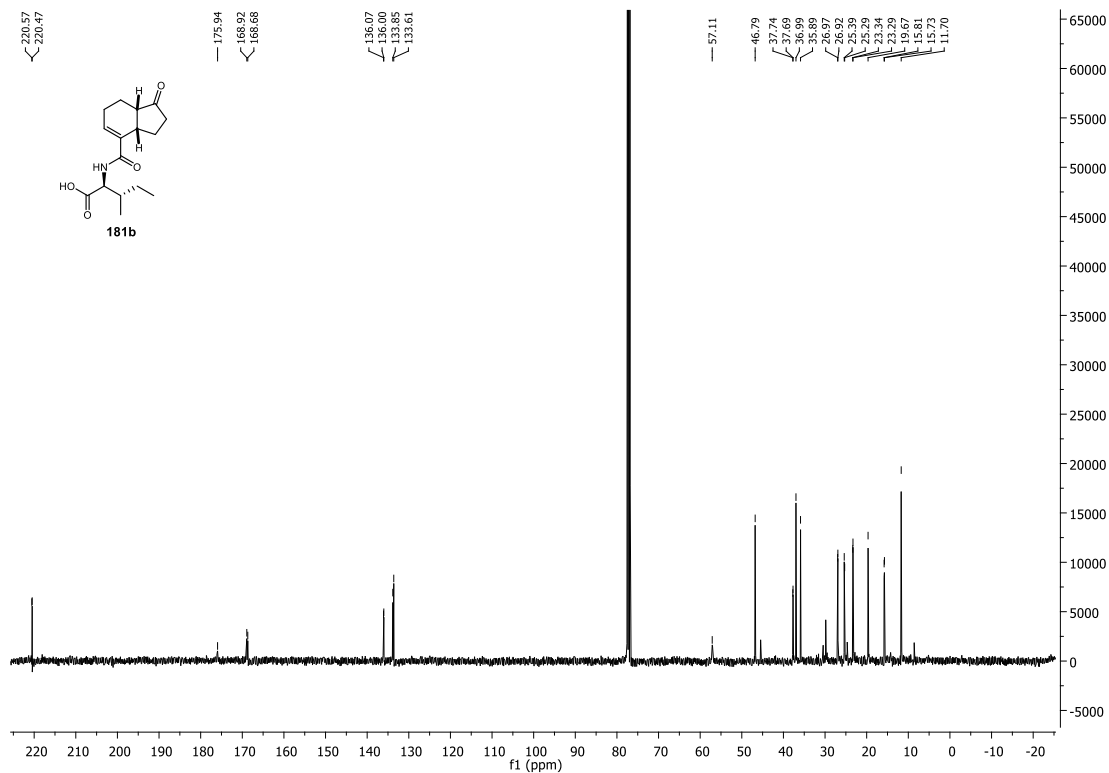
¹³C NMR S181b.



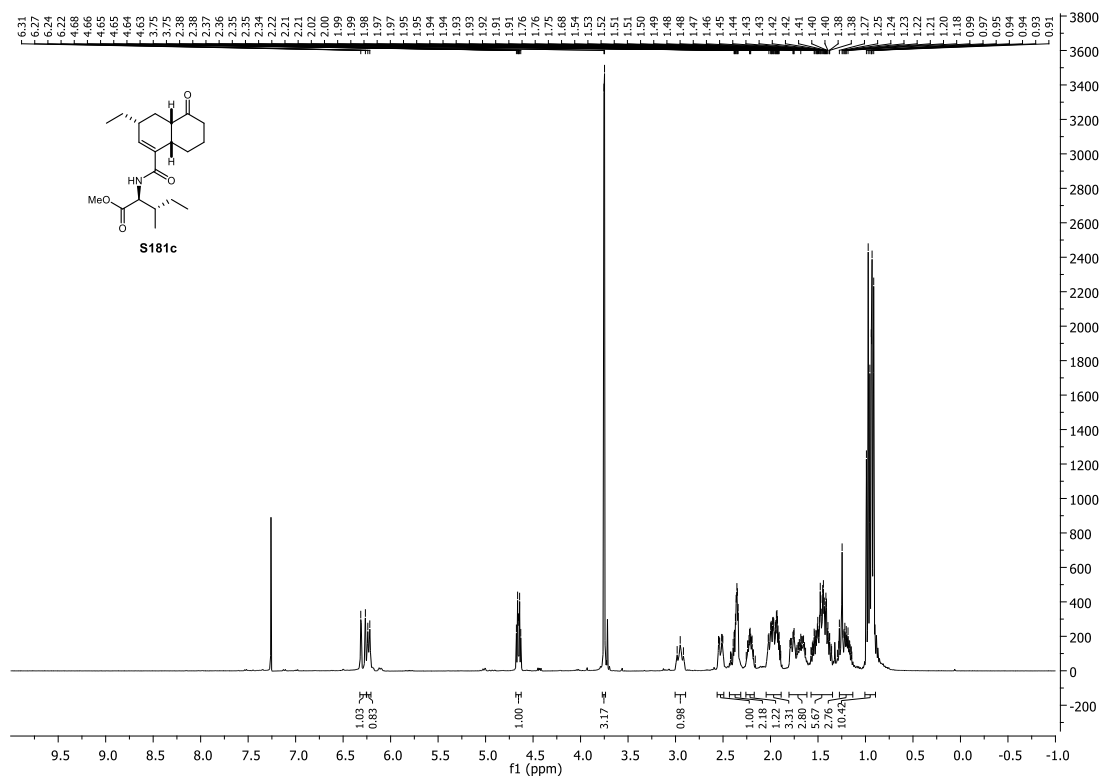
¹H NMR 181b.



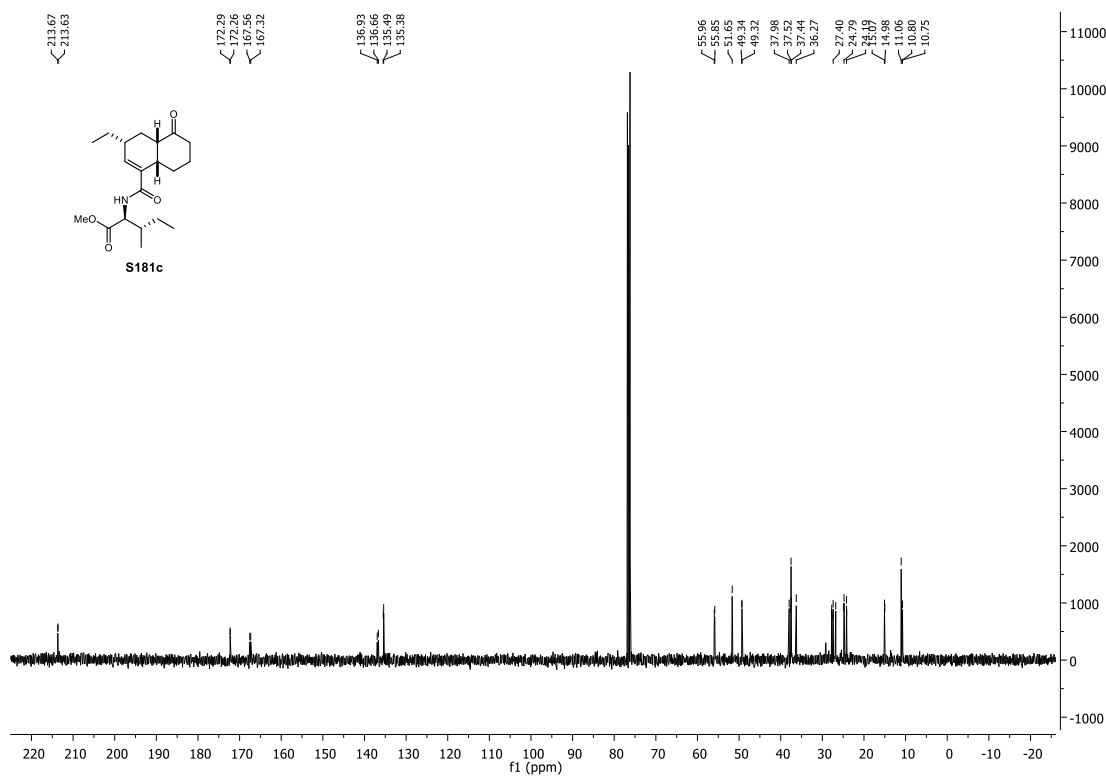
¹³C NMR 181b.



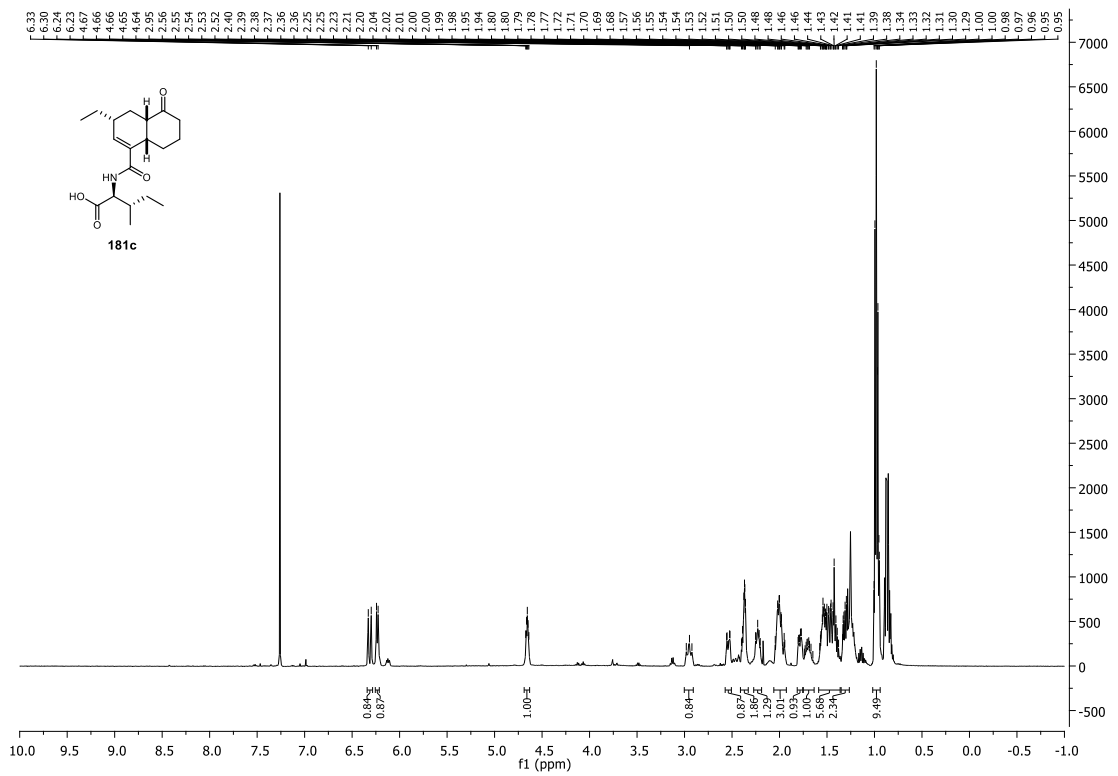
¹H NMR S181c.



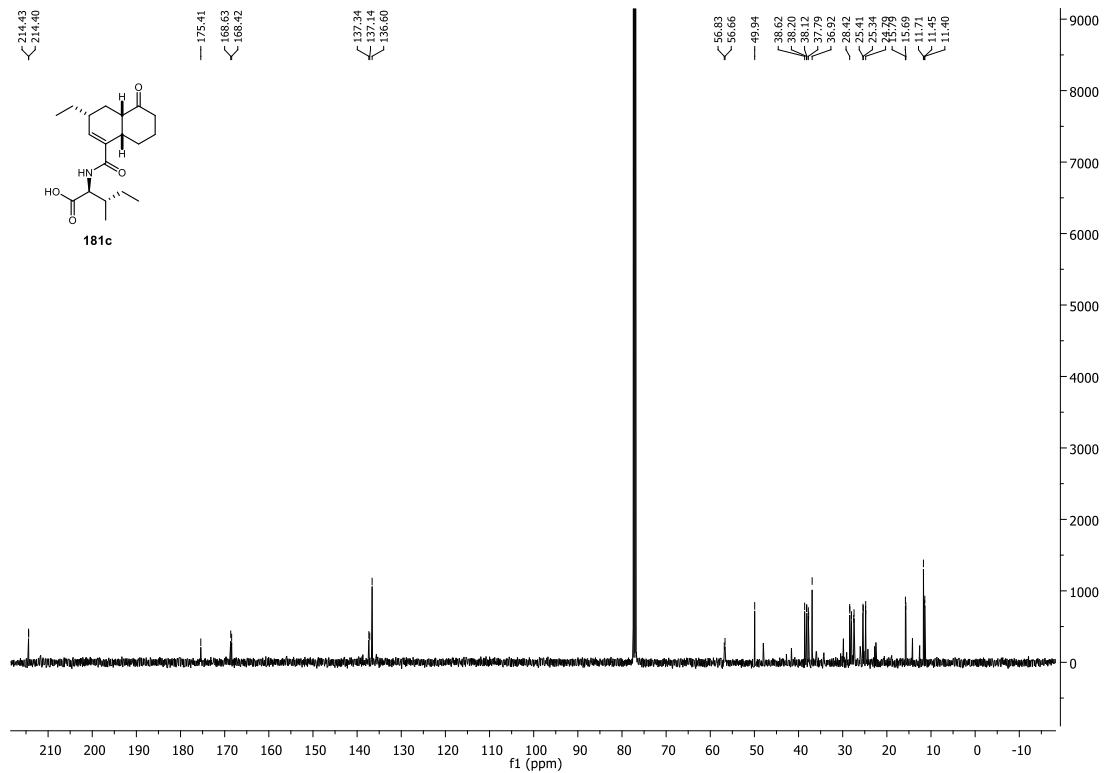
¹³C NMR S181c.



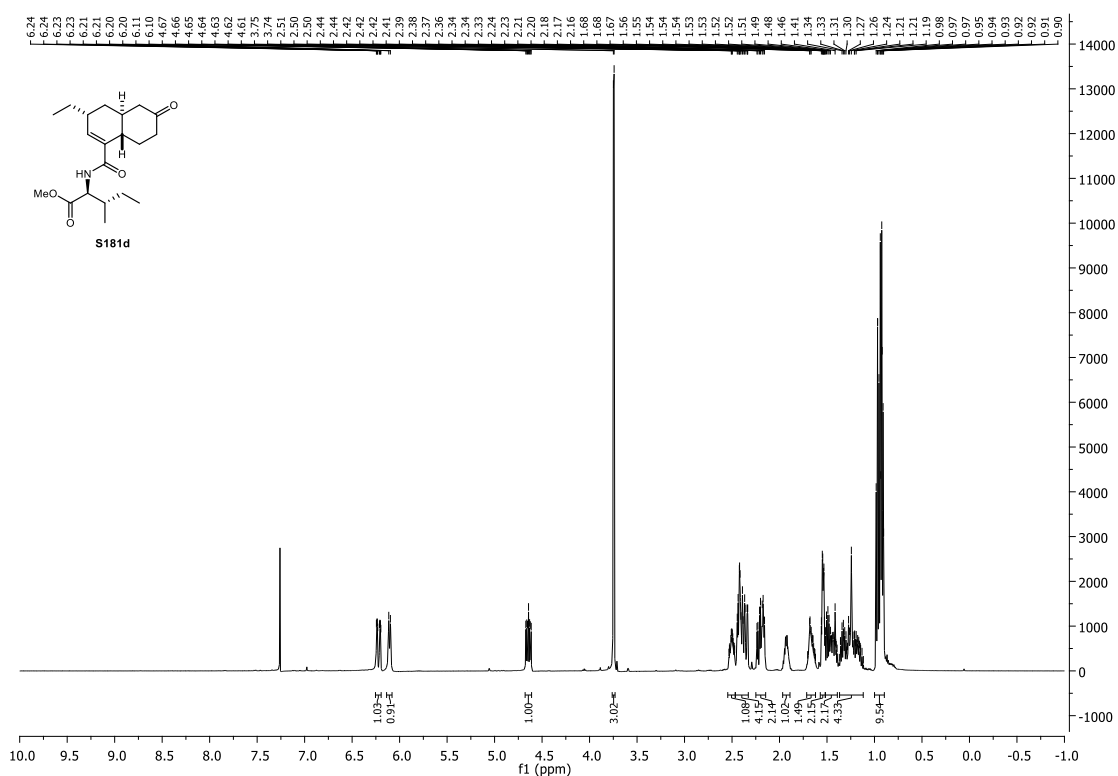
¹H NMR 181c.



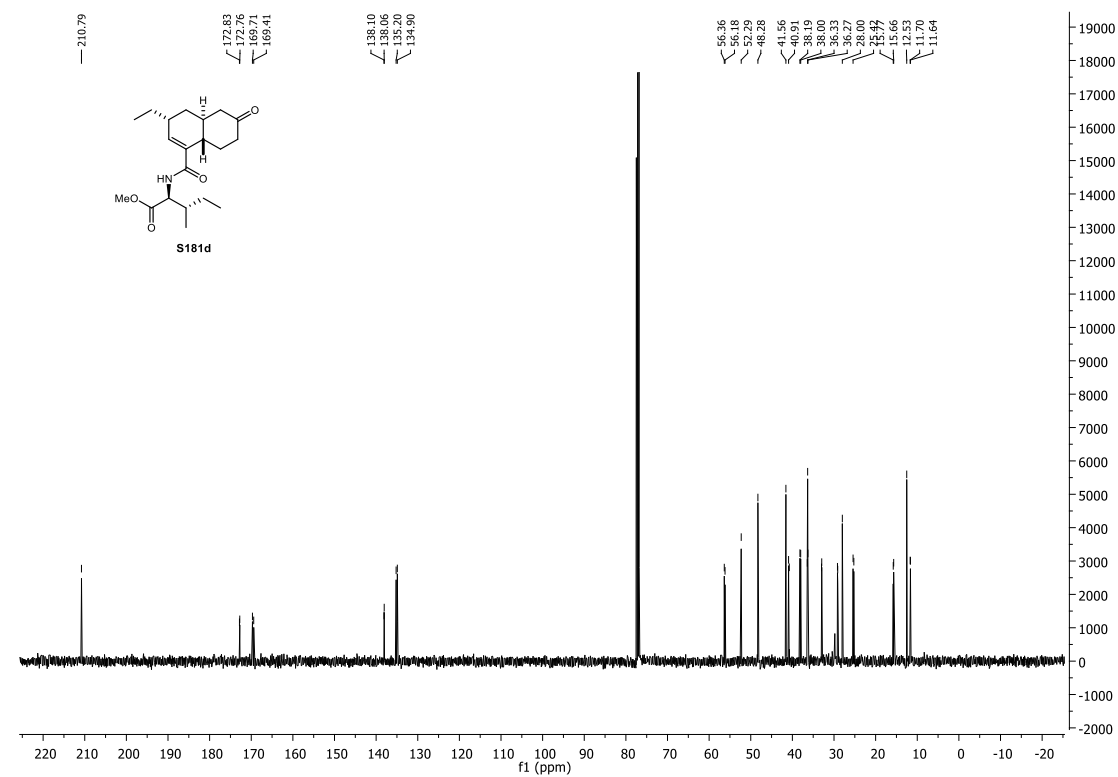
¹³C NMR 181c.



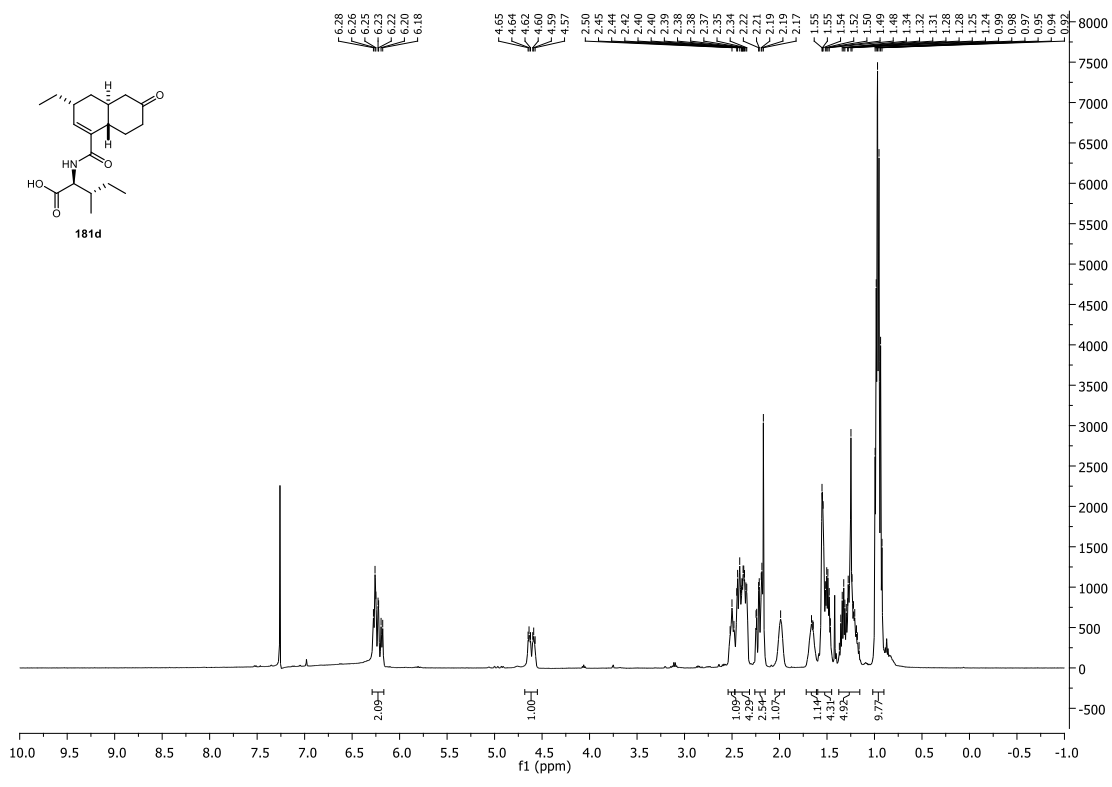
¹H NMR S181d.



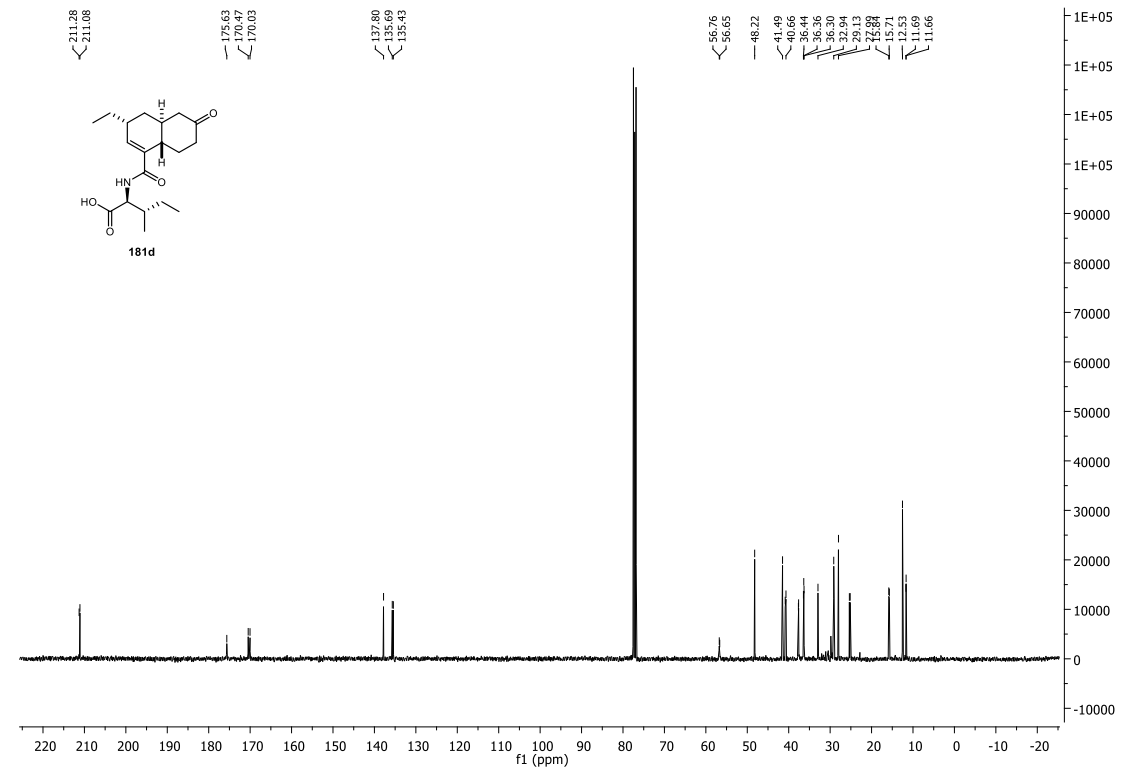
¹³C NMR S181d.



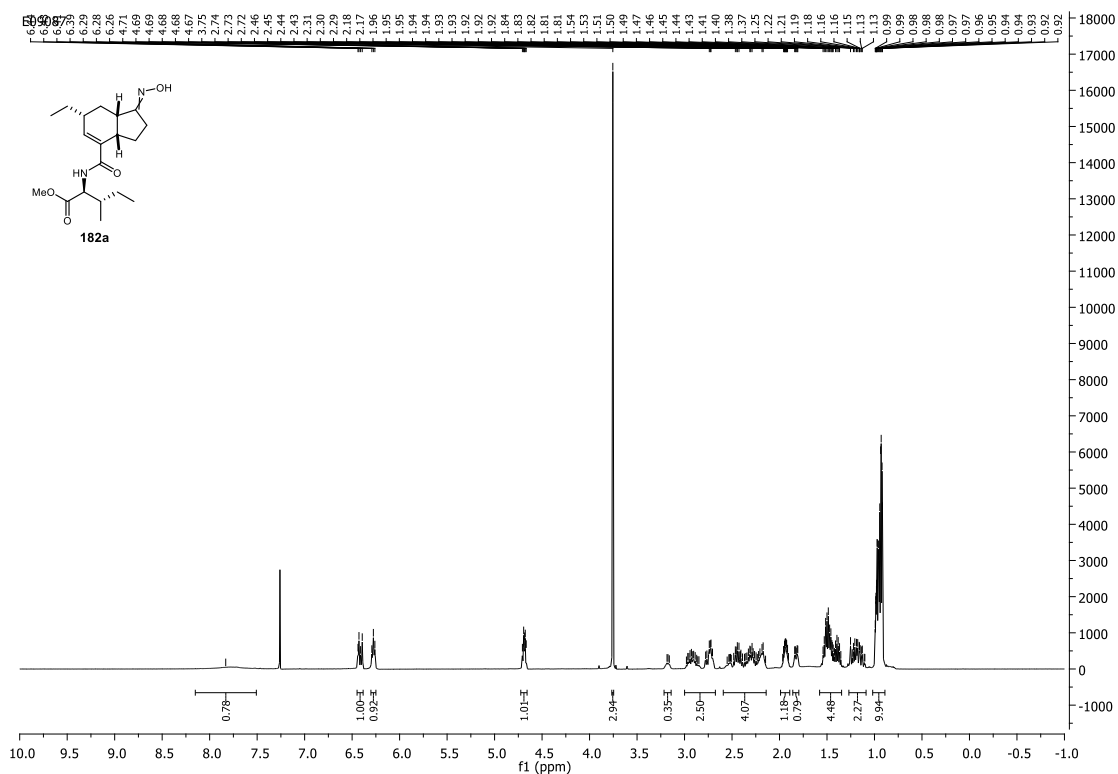
¹H NMR 181d.



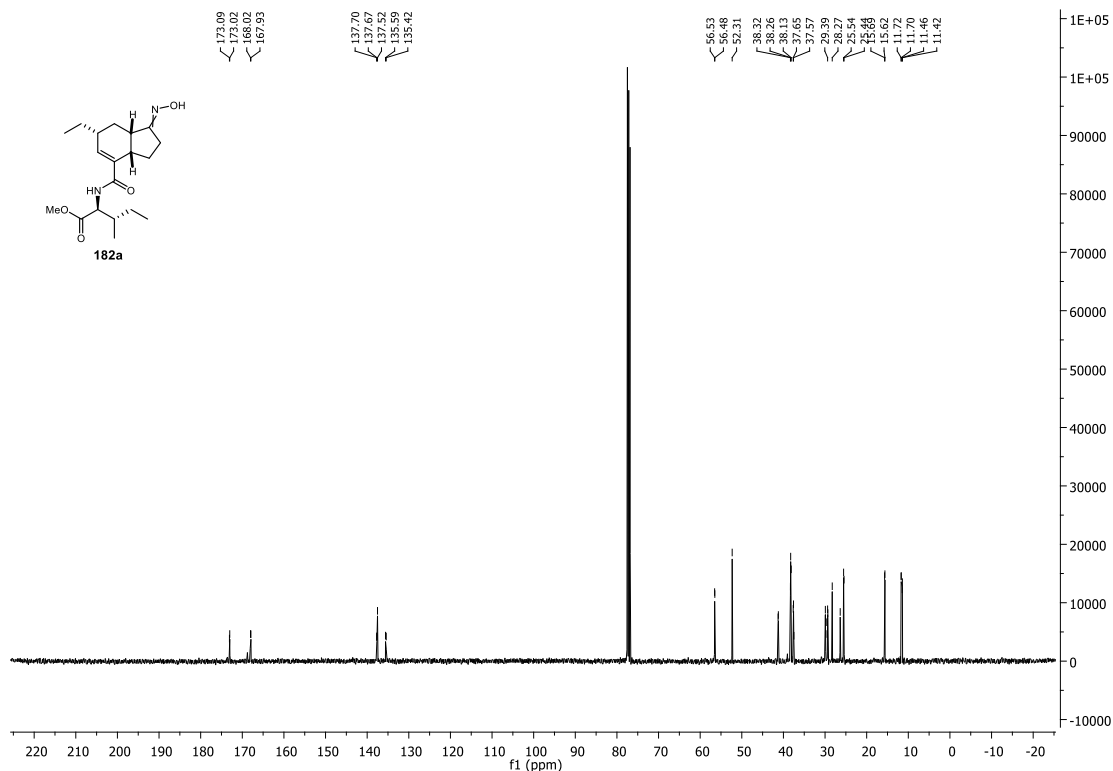
¹³C NMR 181d.



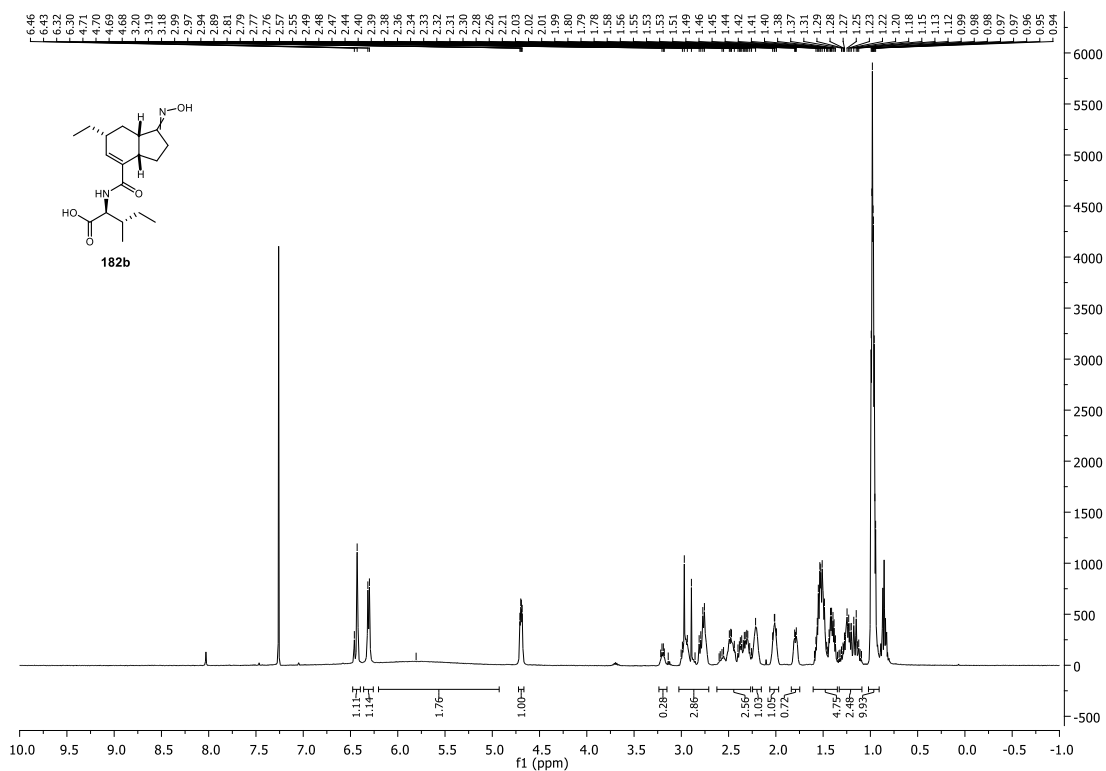
¹H NMR 182a.



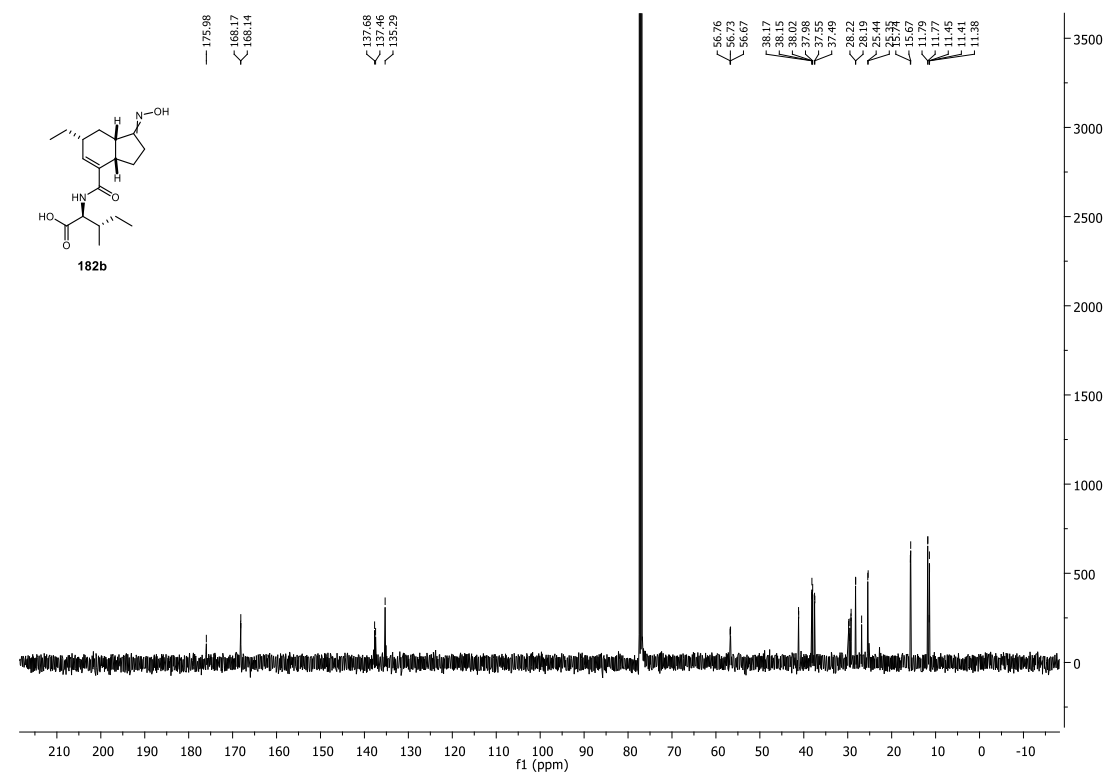
¹³C NMR 182a.



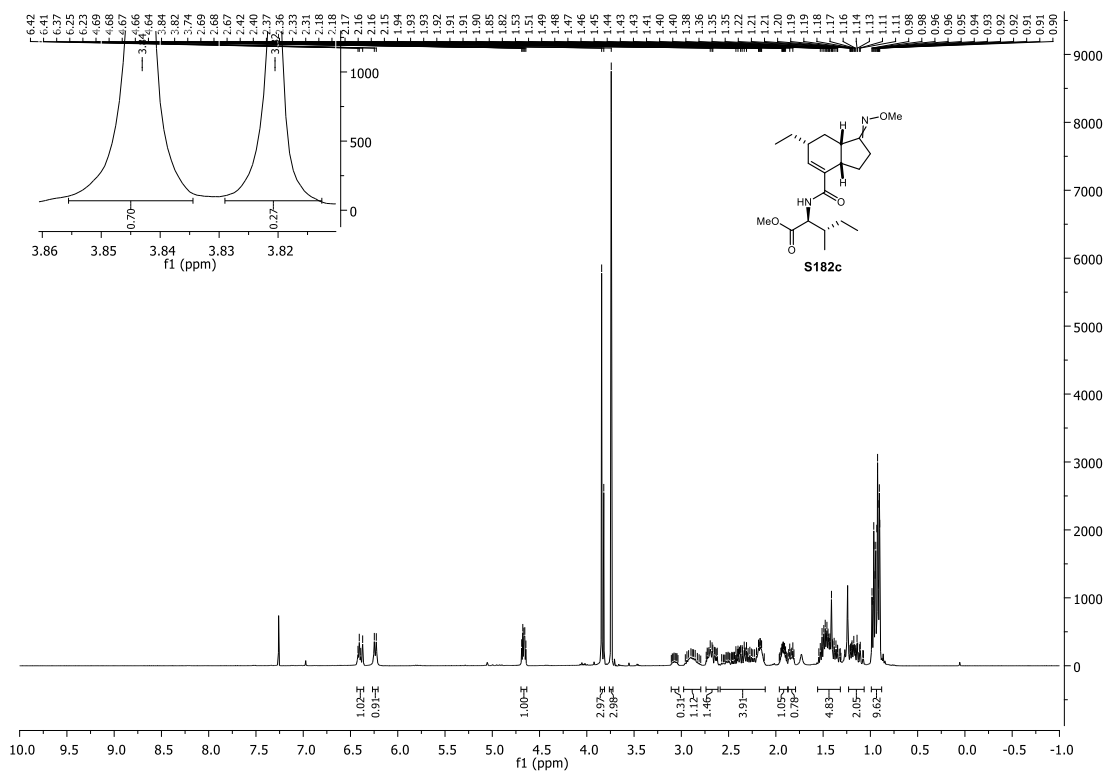
¹H NMR 182b.



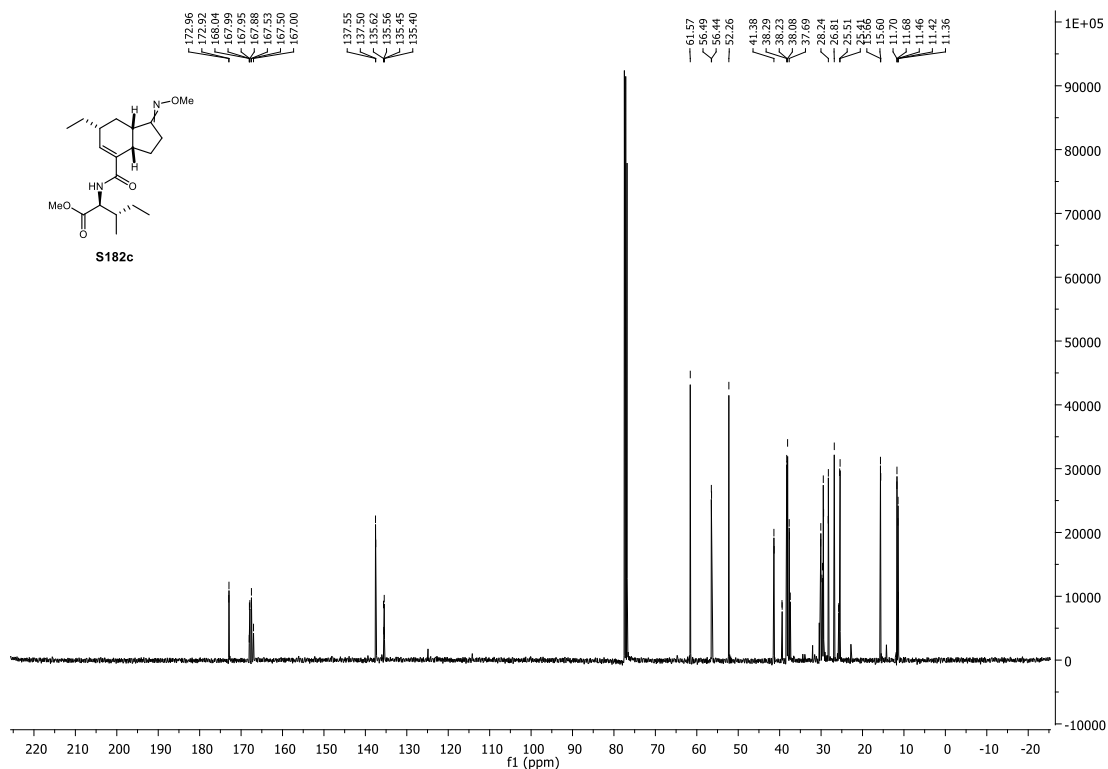
¹³C NMR 182b.



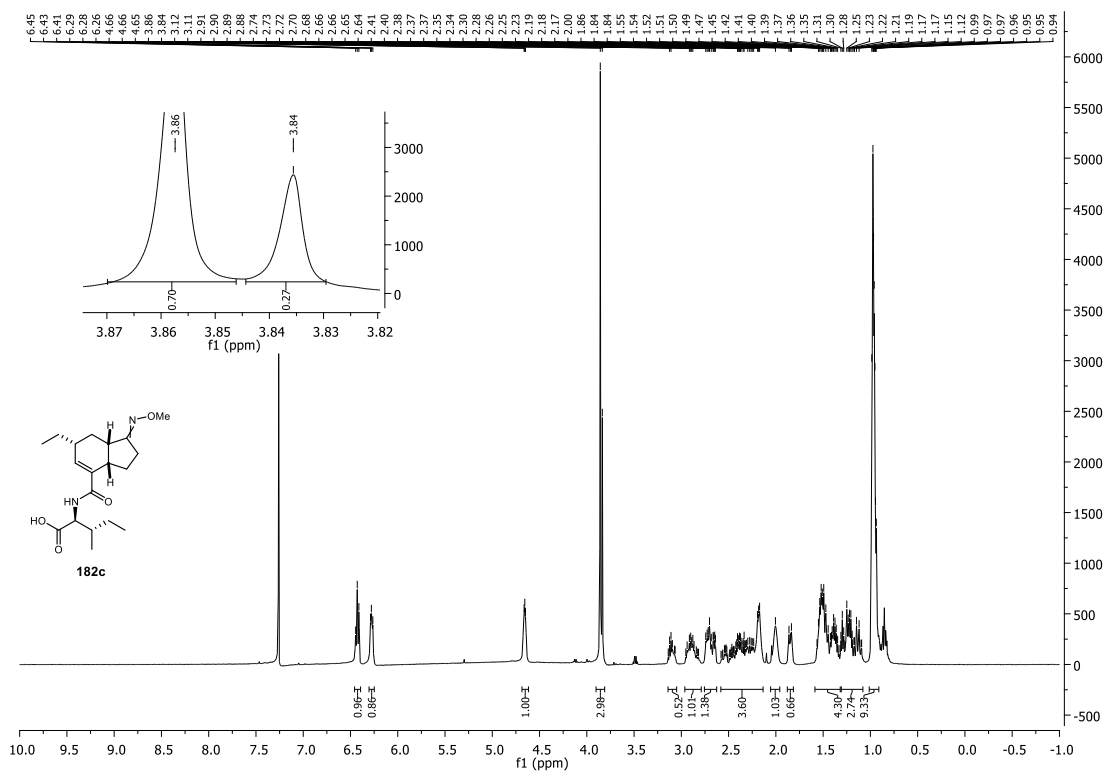
¹H NMR S182c.



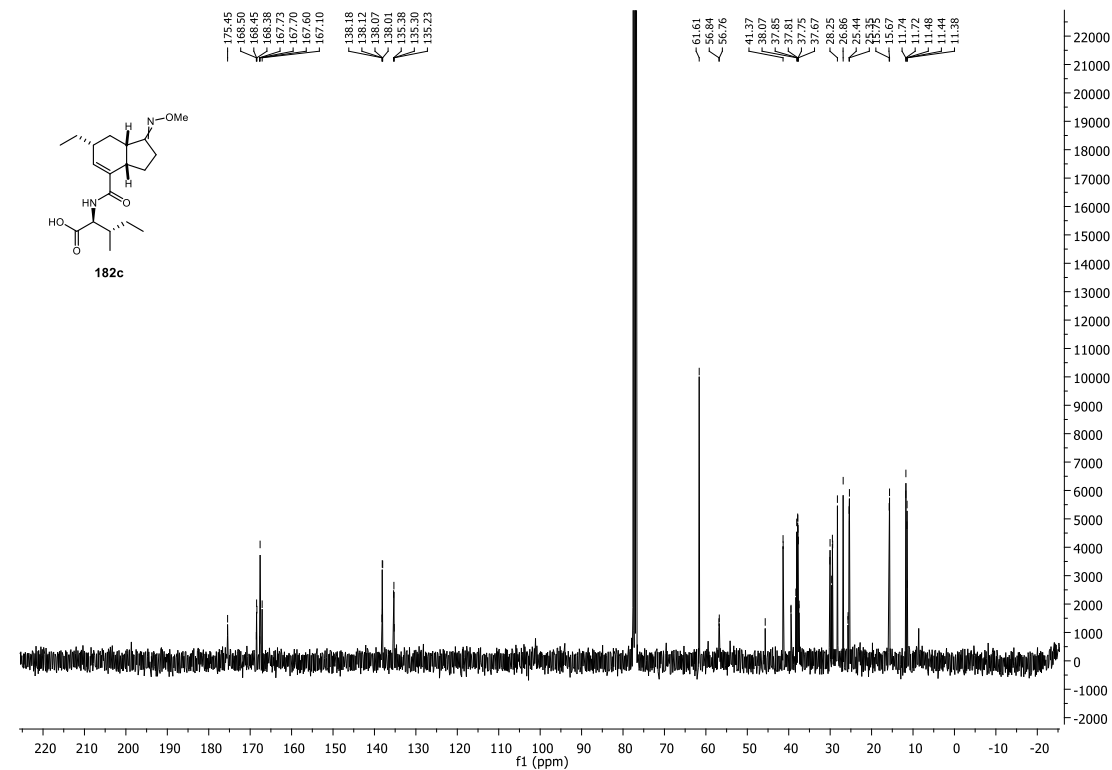
¹³C NMR S182c.



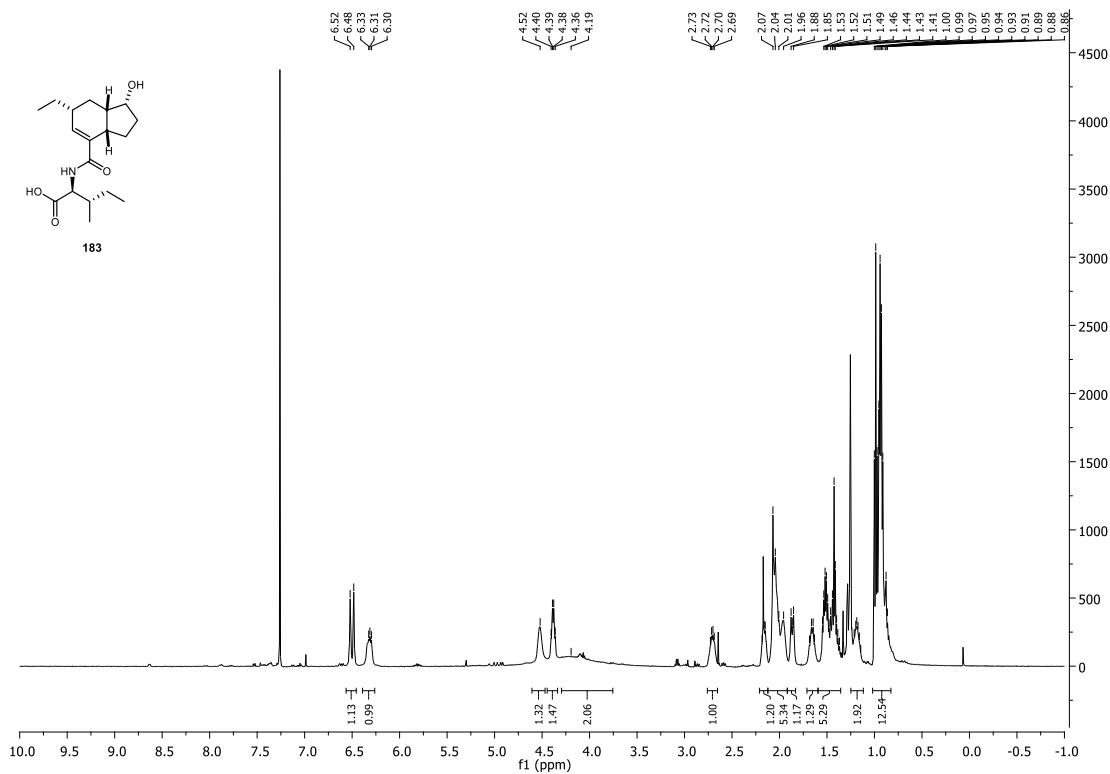
¹H NMR 182c.



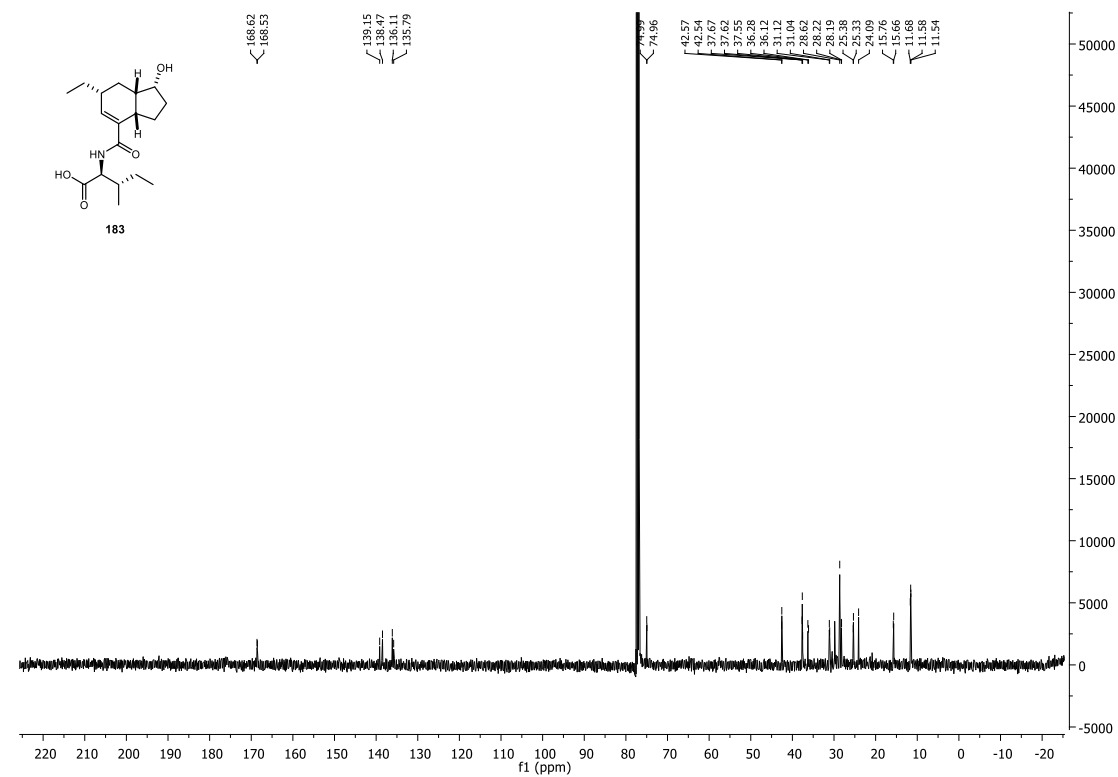
¹³C NMR 182c.



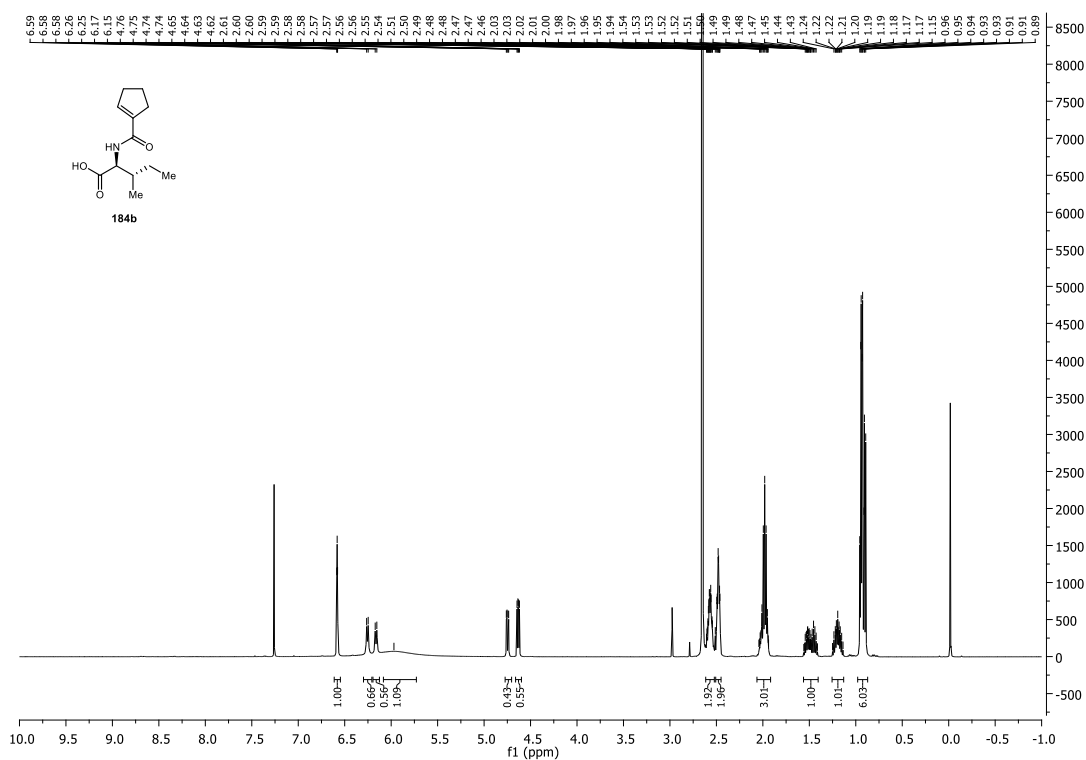
¹H NMR 183.



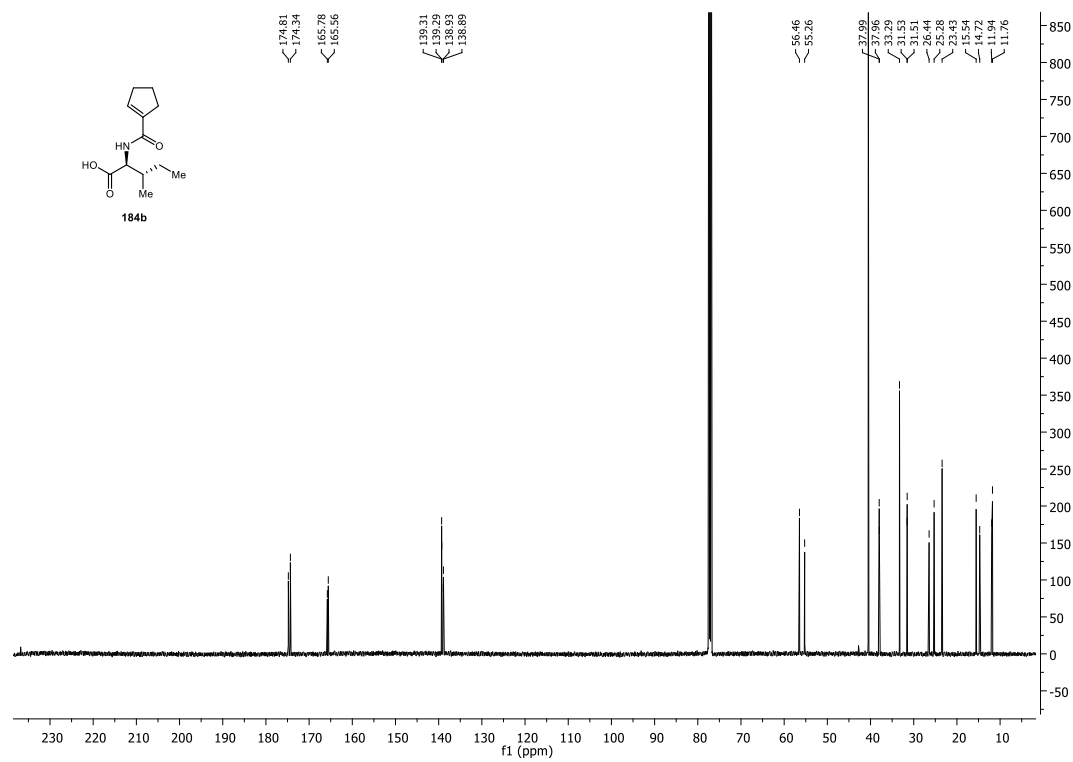
¹³C NMR 183.



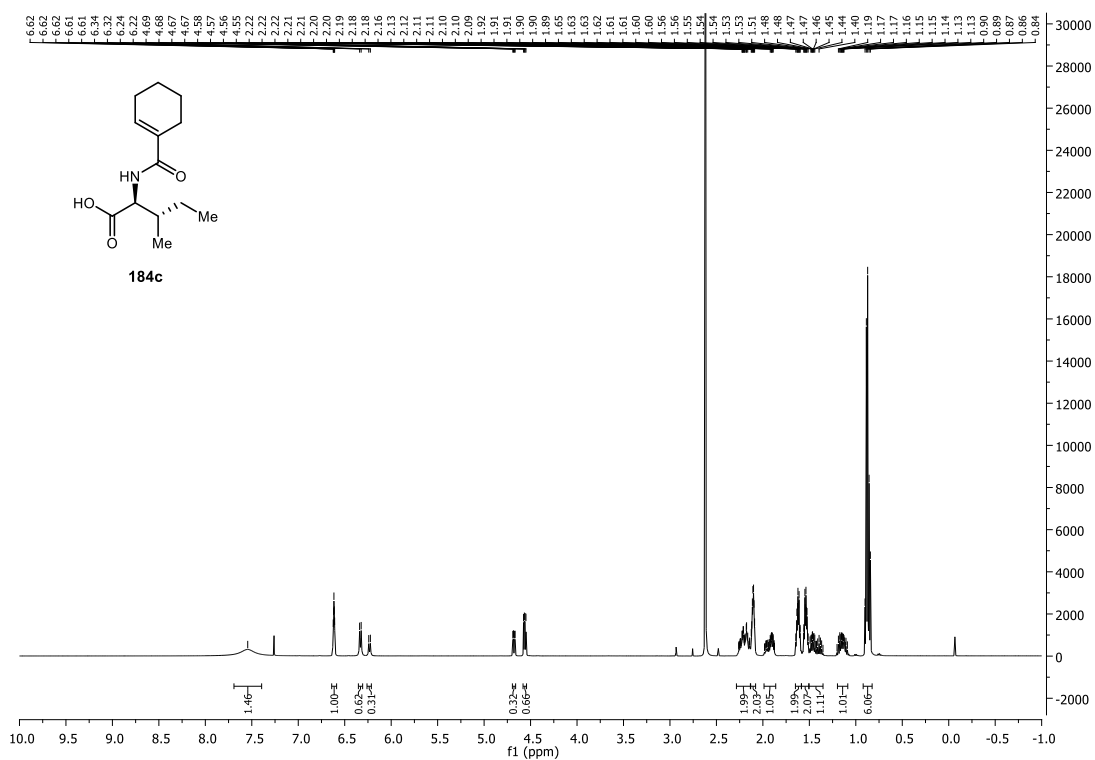
¹H NMR 184b



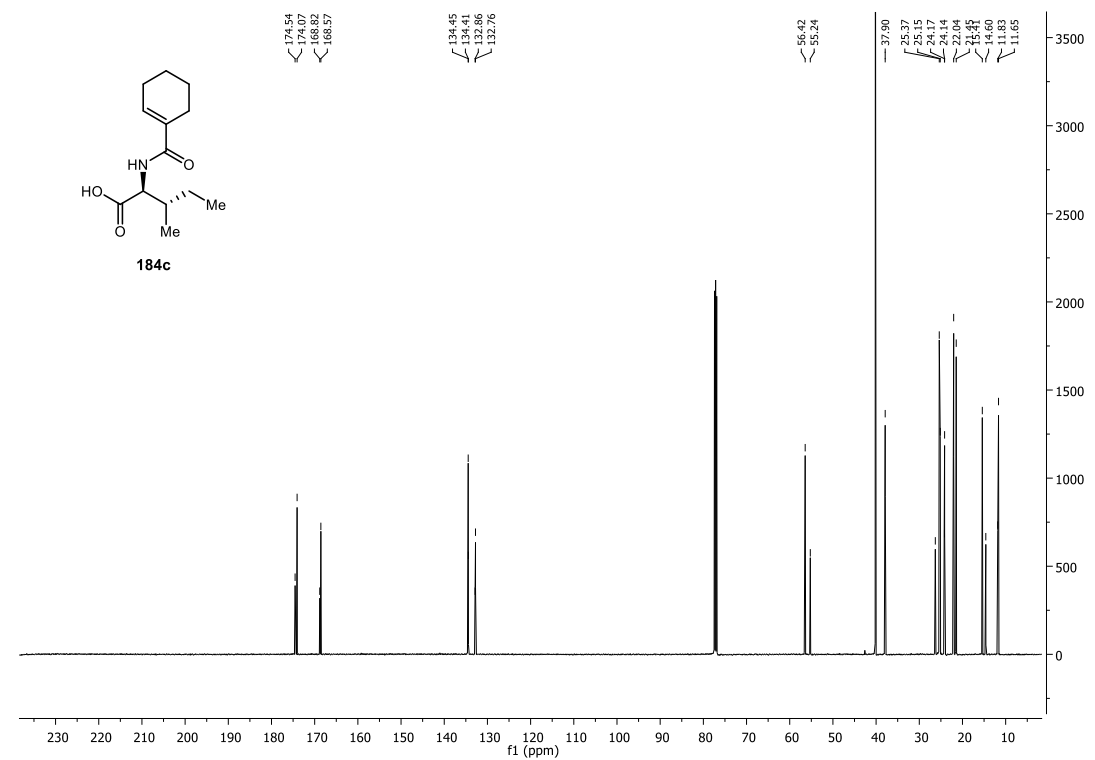
¹³C NMR 184b



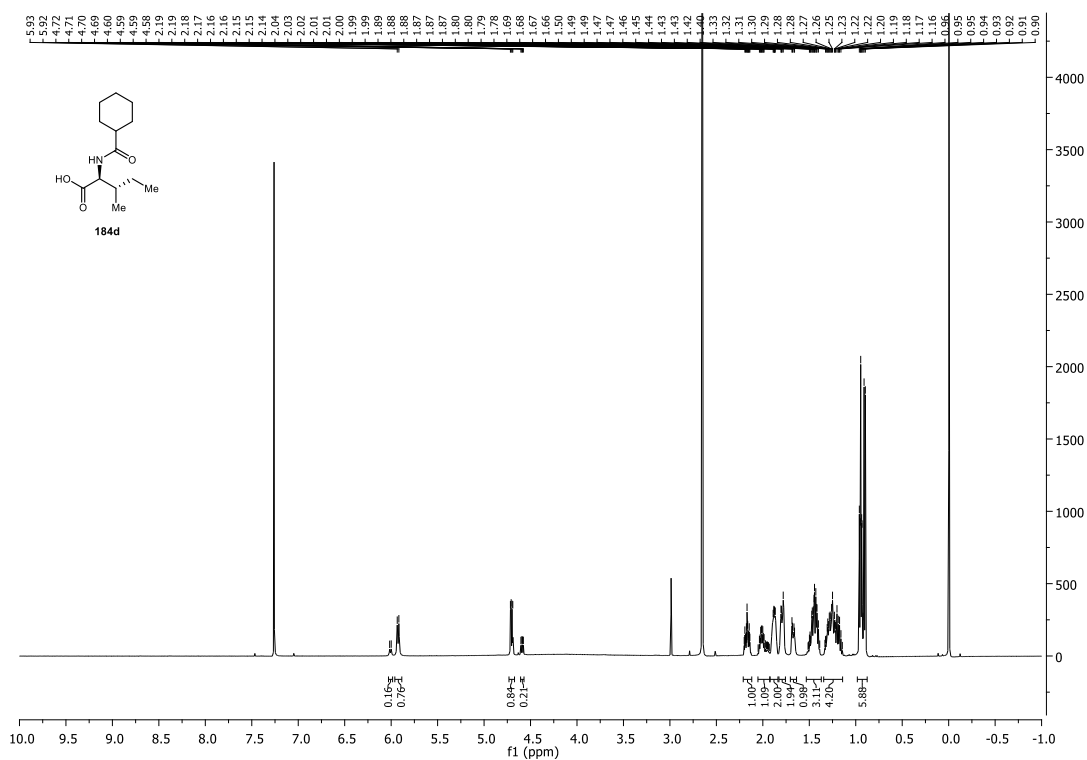
¹H NMR 184c



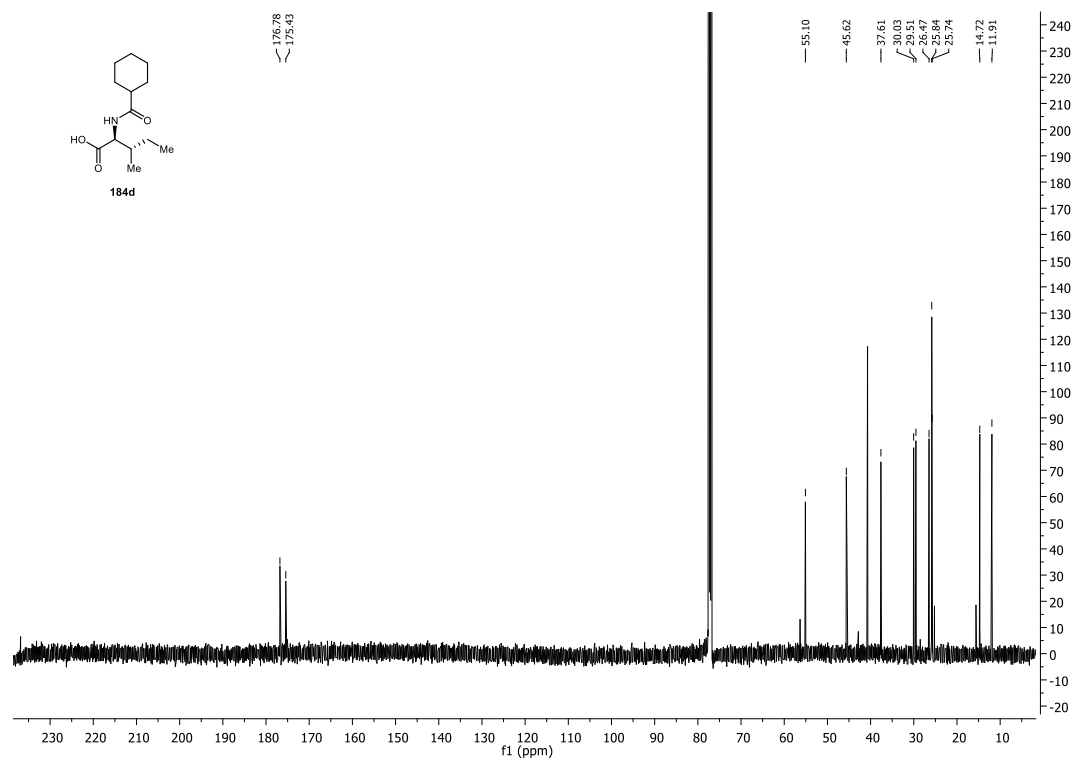
¹³C NMR 184c



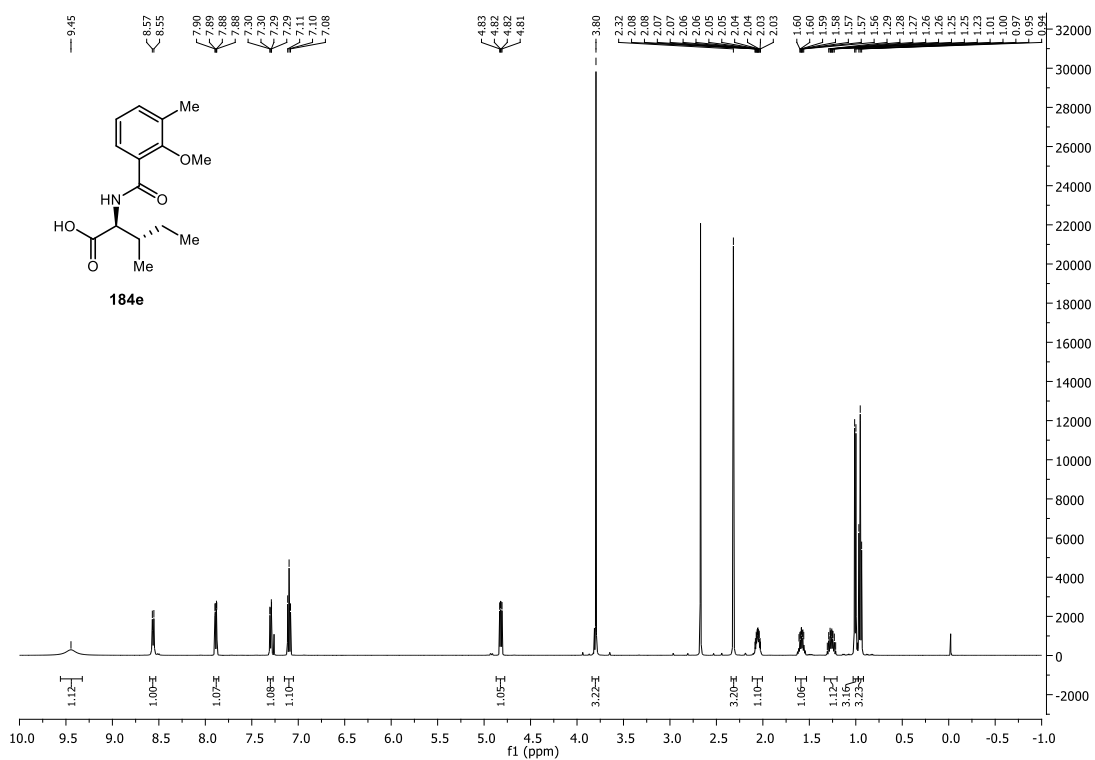
¹H NMR 184d



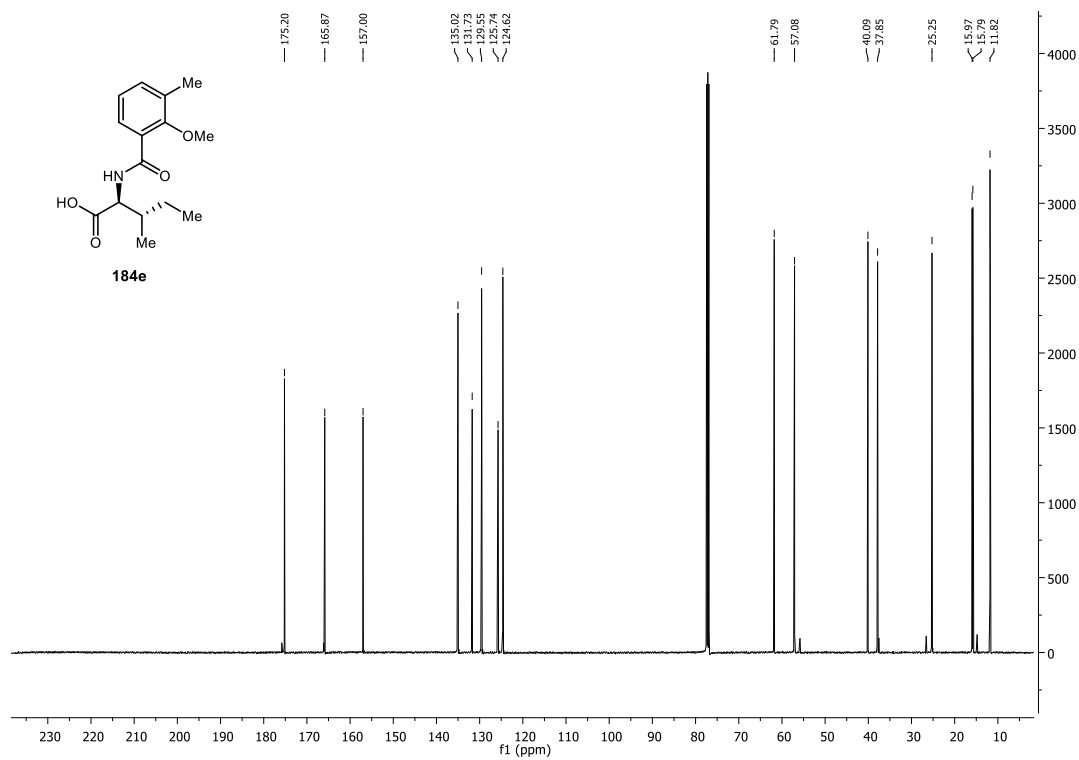
¹³C NMR 184d



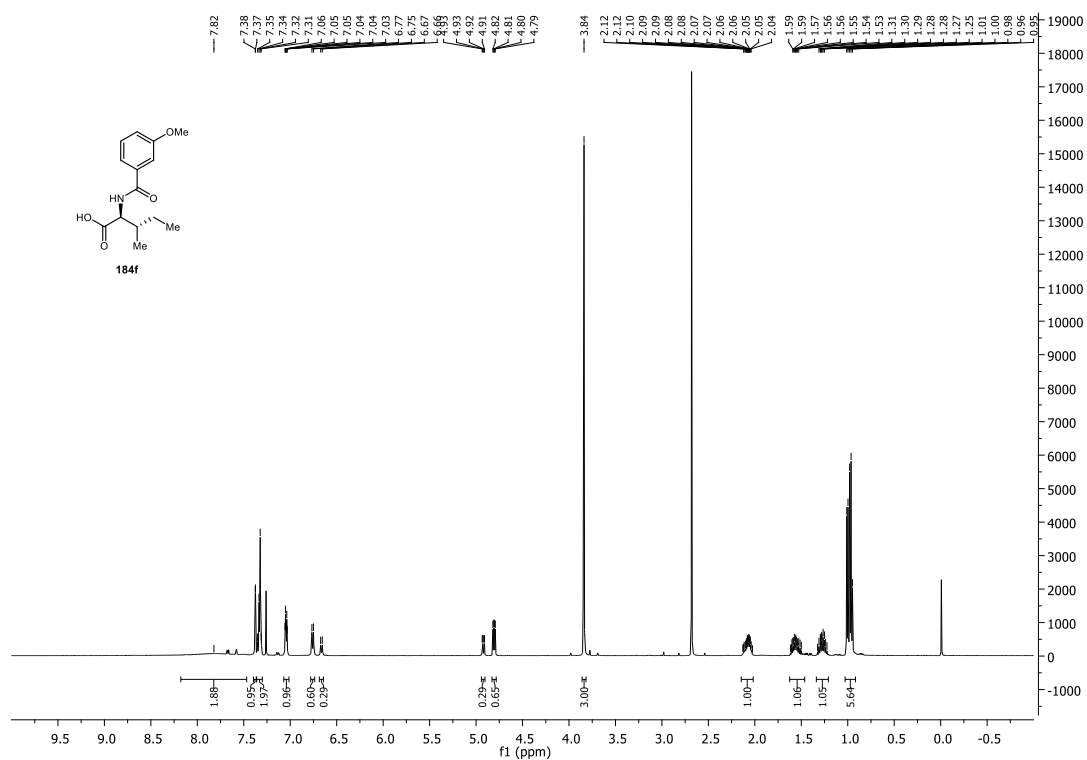
¹H NMR 184e



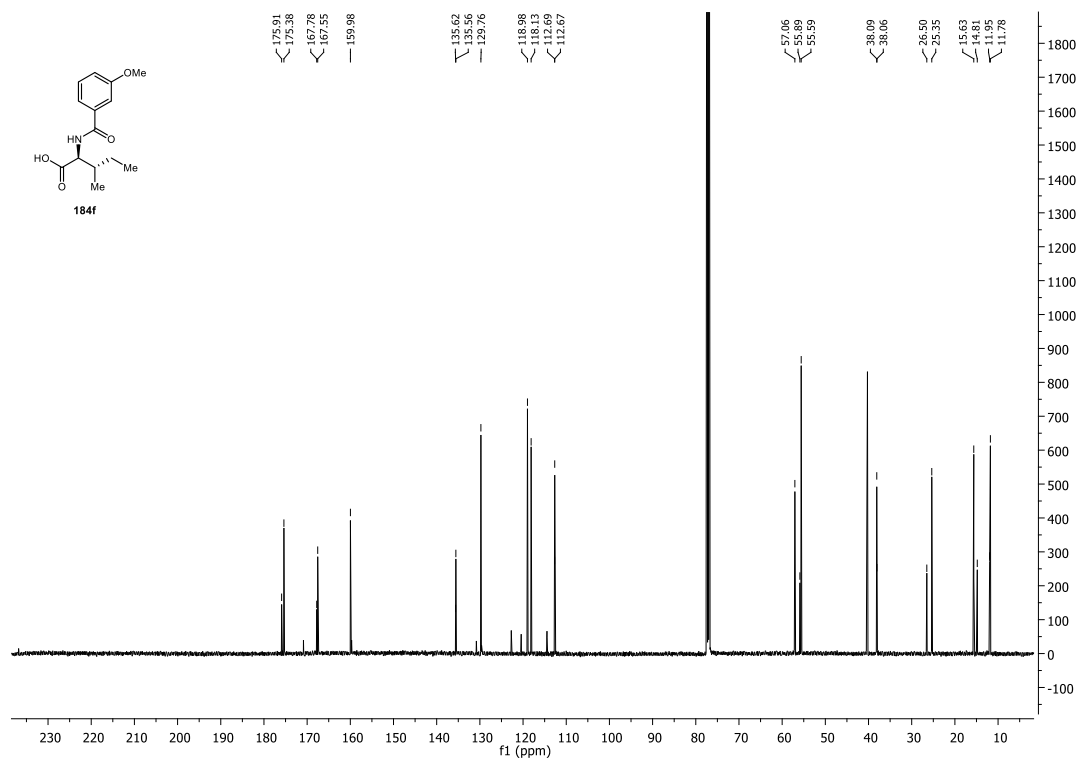
¹³C NMR 184e.



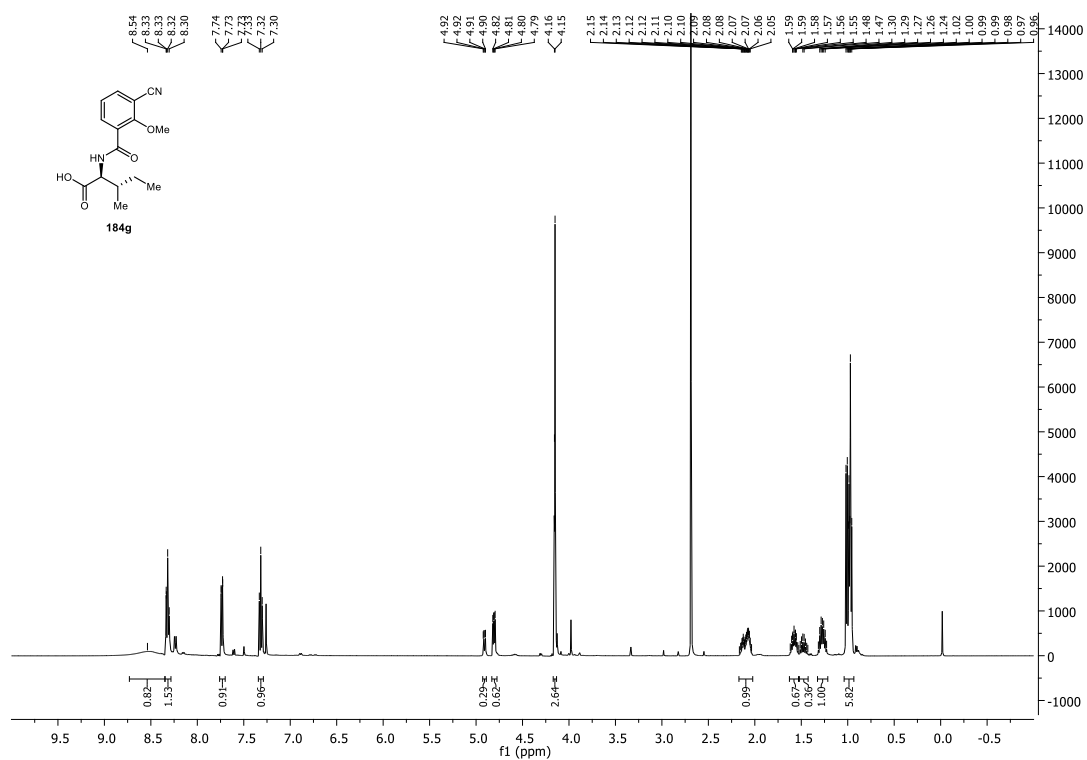
¹H NMR 184f



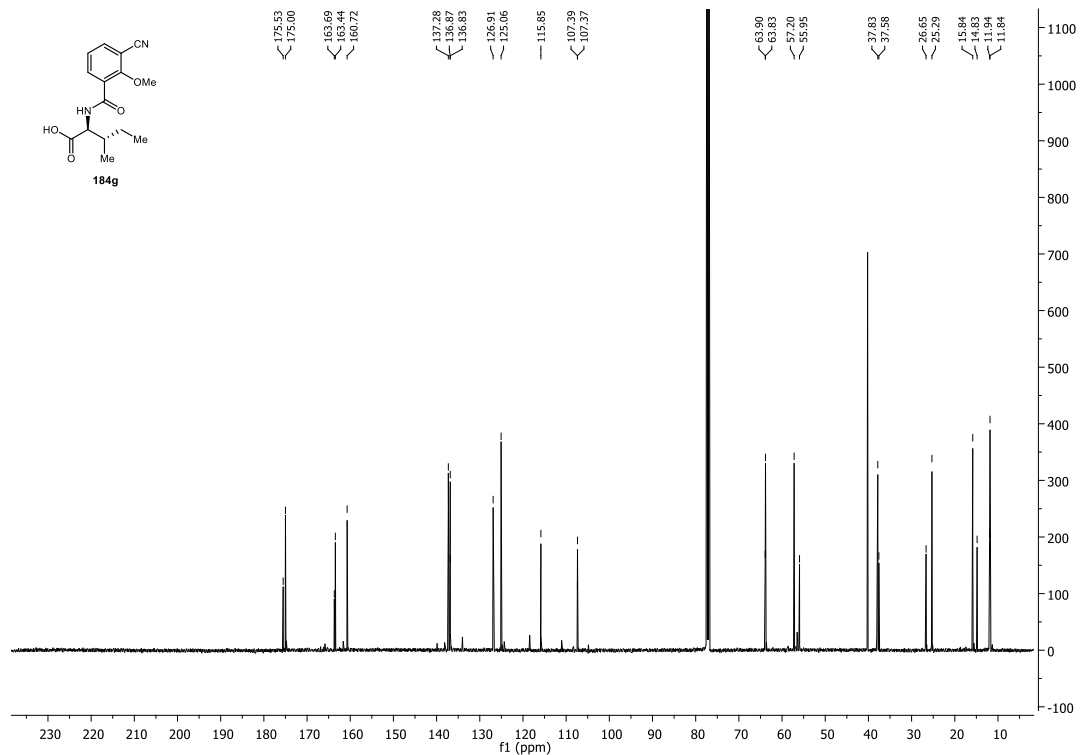
¹³C NMR 184f



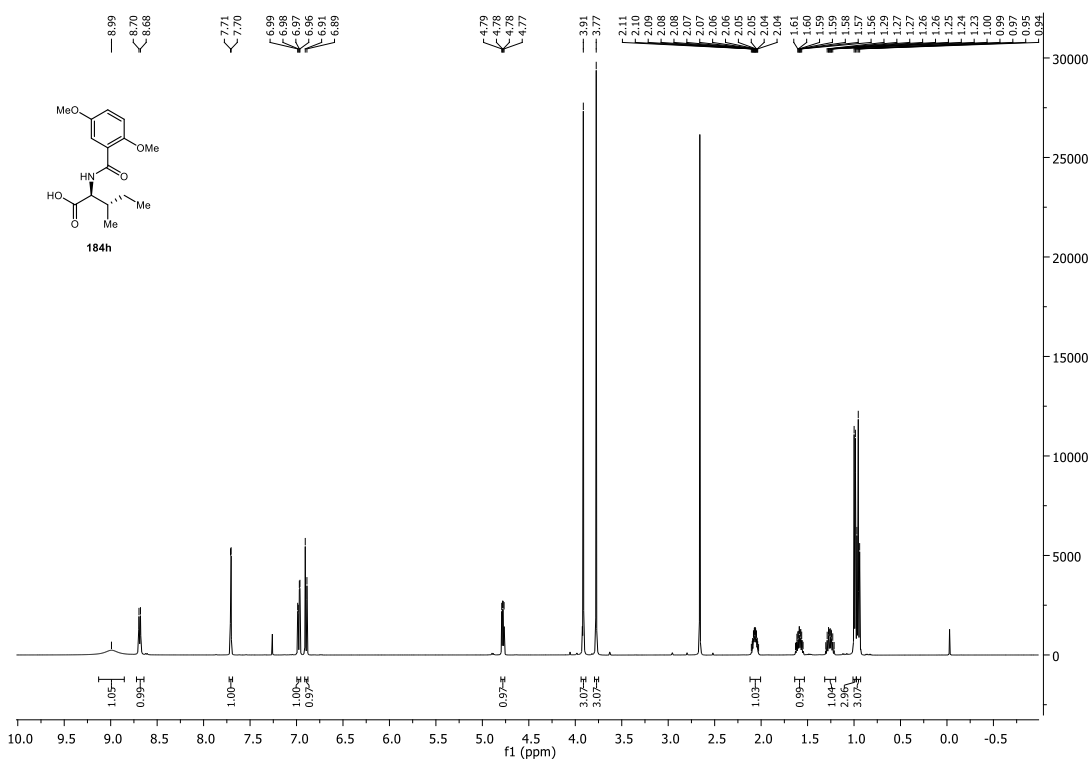
¹H NMR 184g.



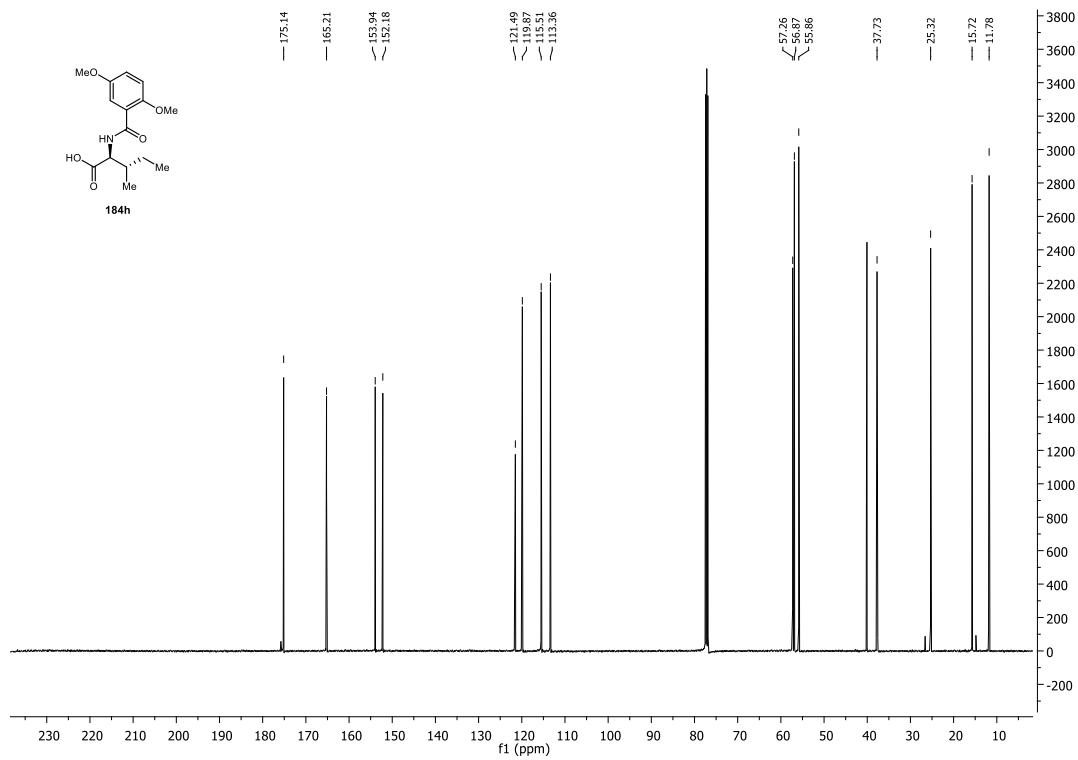
¹³C NMR 184g.



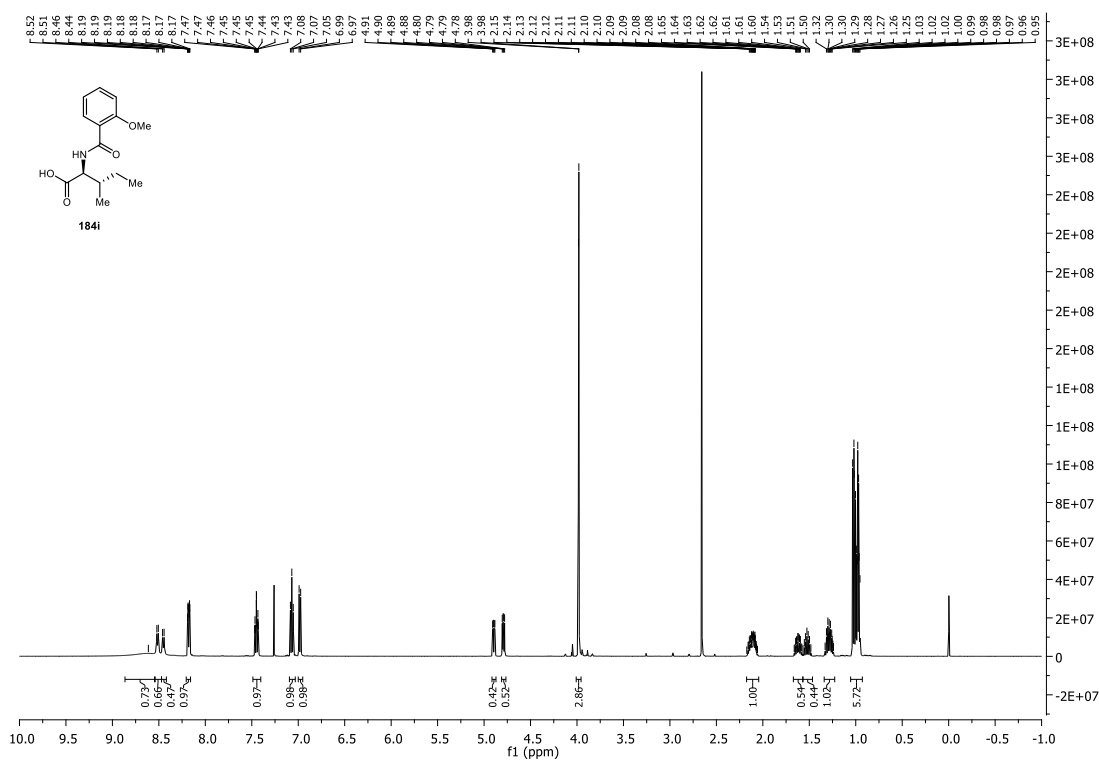
¹H NMR 184h.



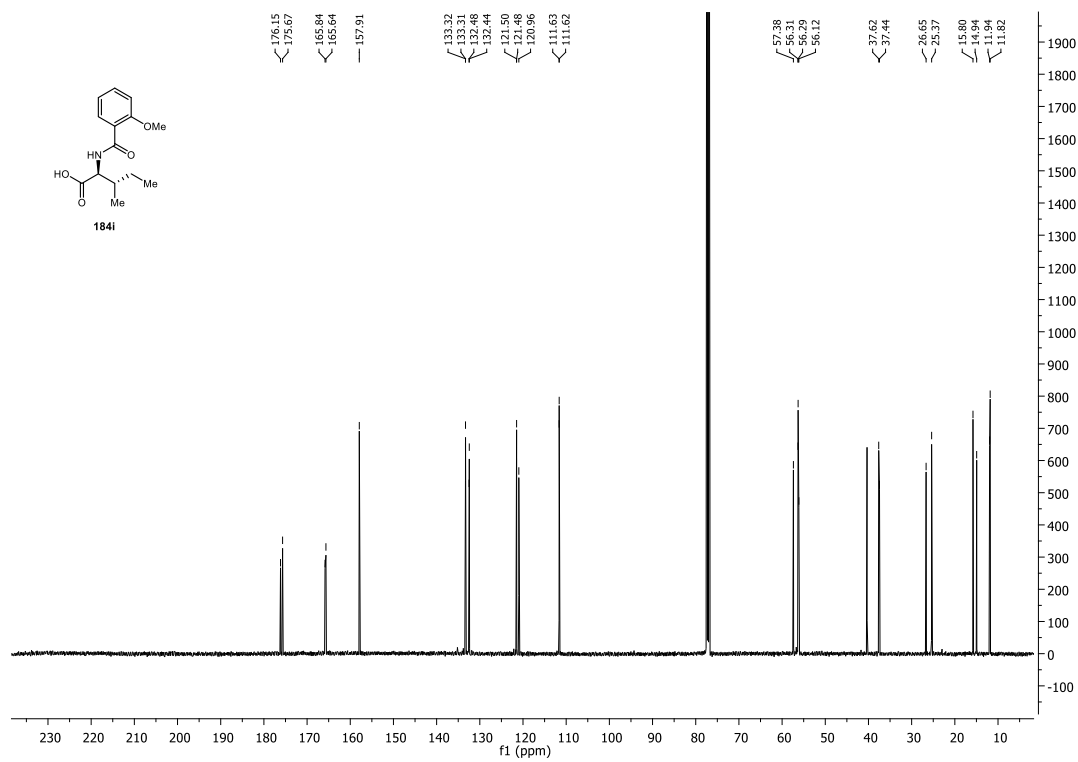
¹³C NMR 184h.



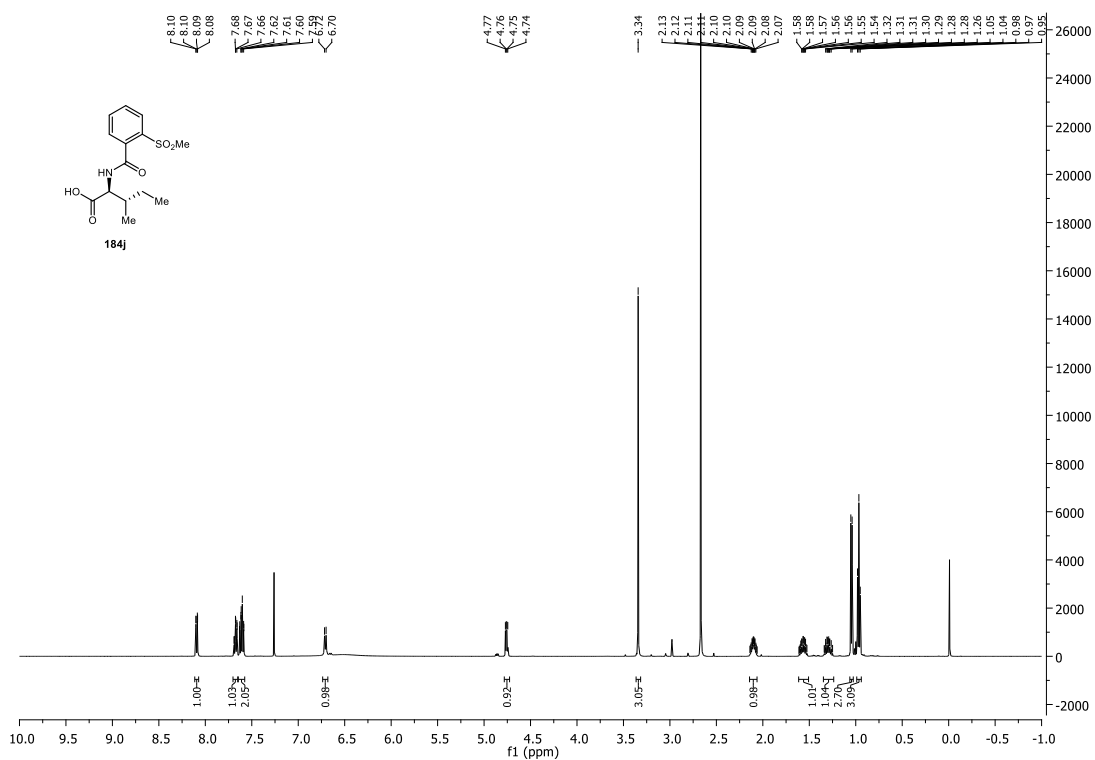
¹H NMR 184i.



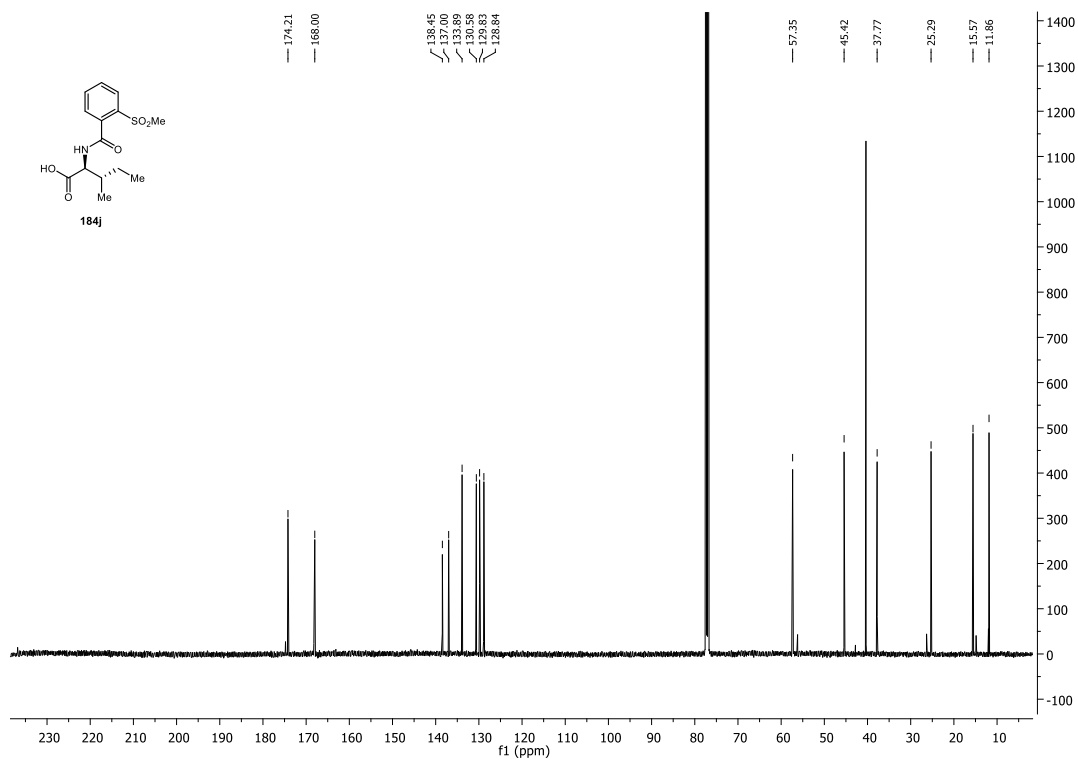
¹³C NMR 184i.



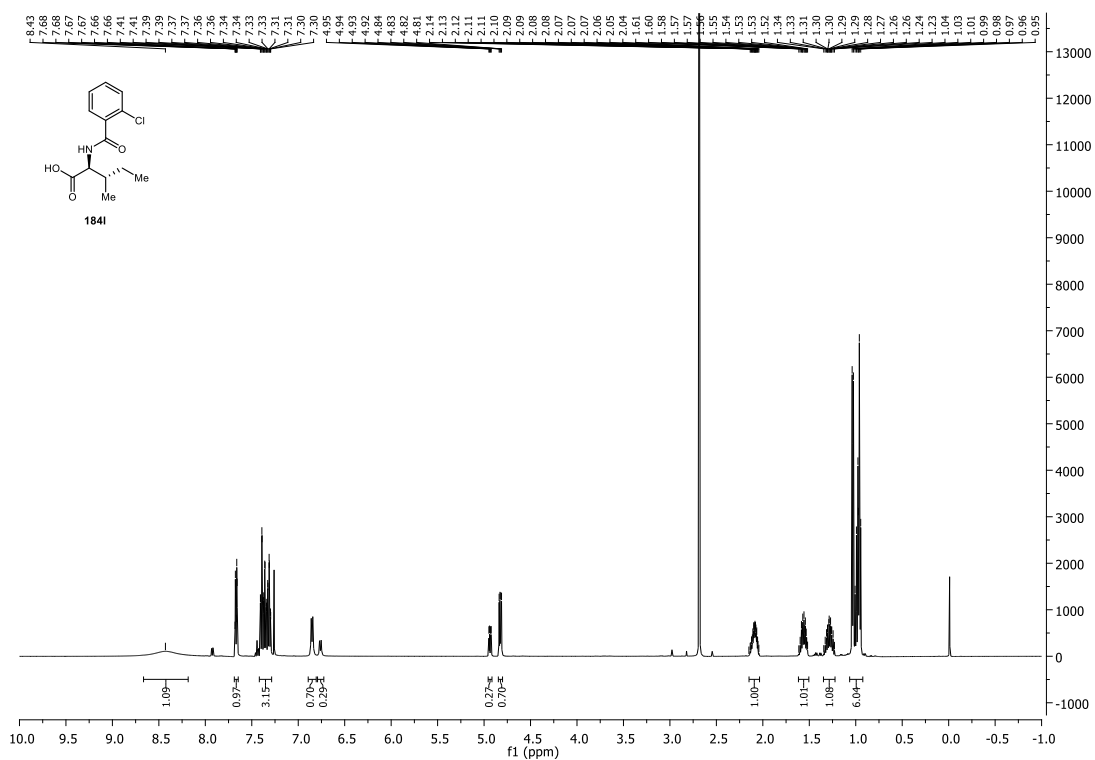
¹H NMR 184j.



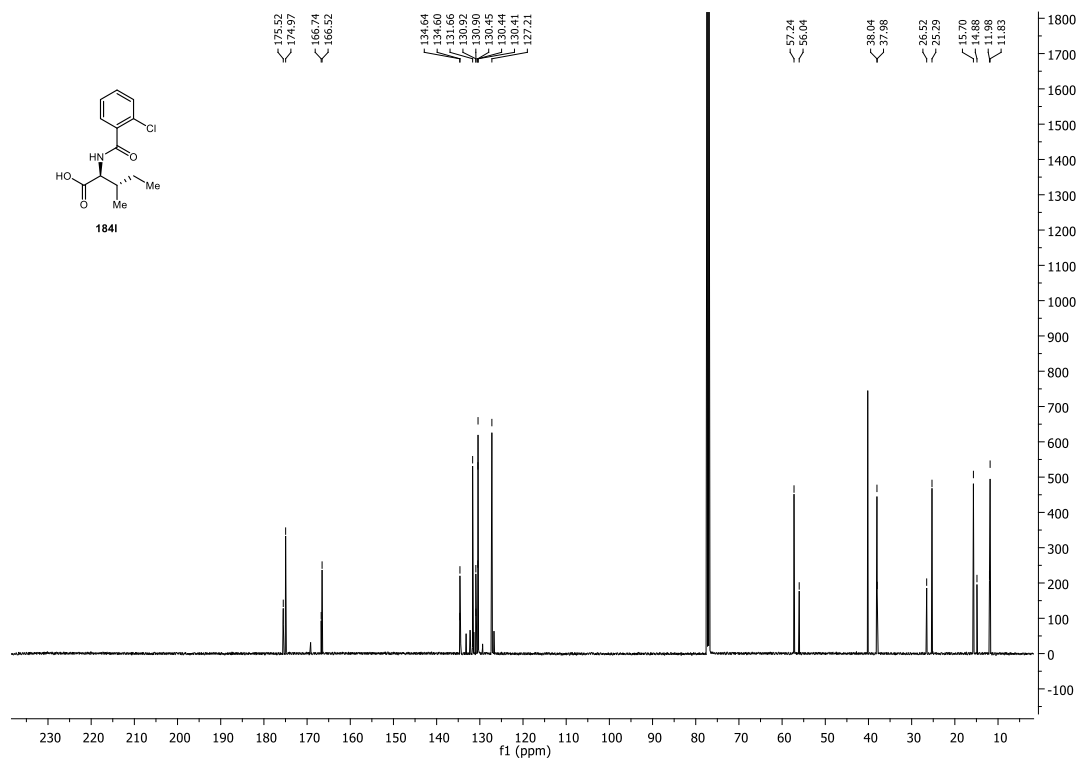
¹³C NMR 184j.



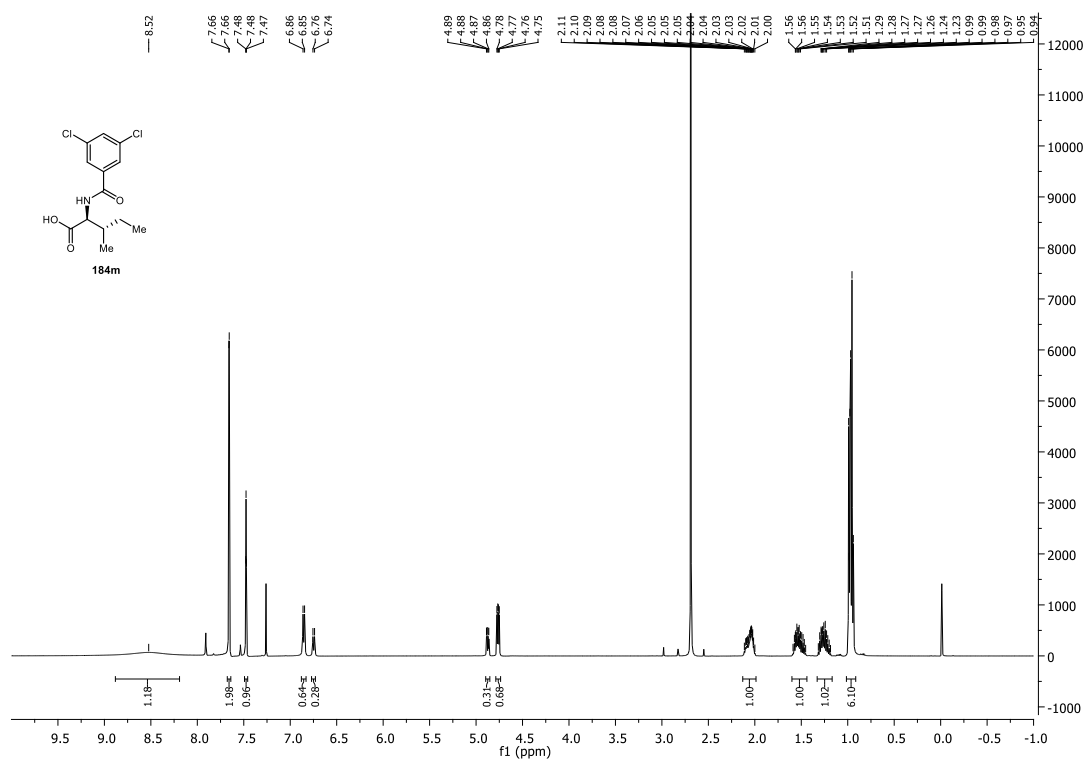
¹H NMR 184I.



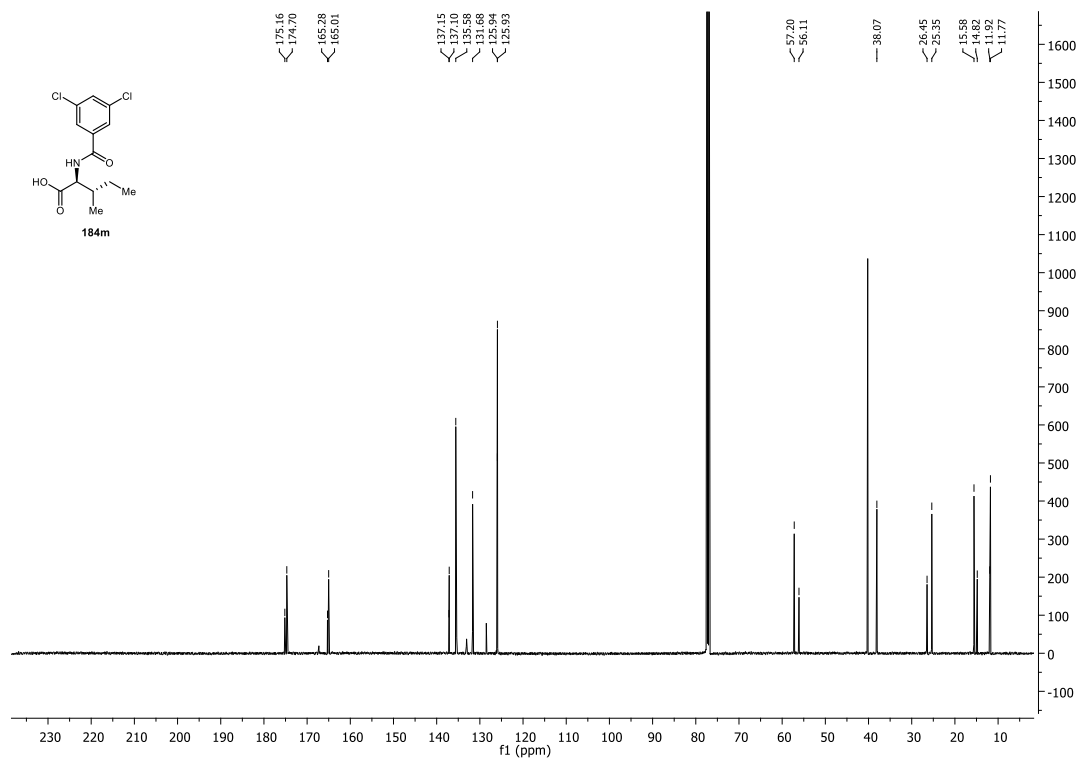
¹³C NMR 184I.



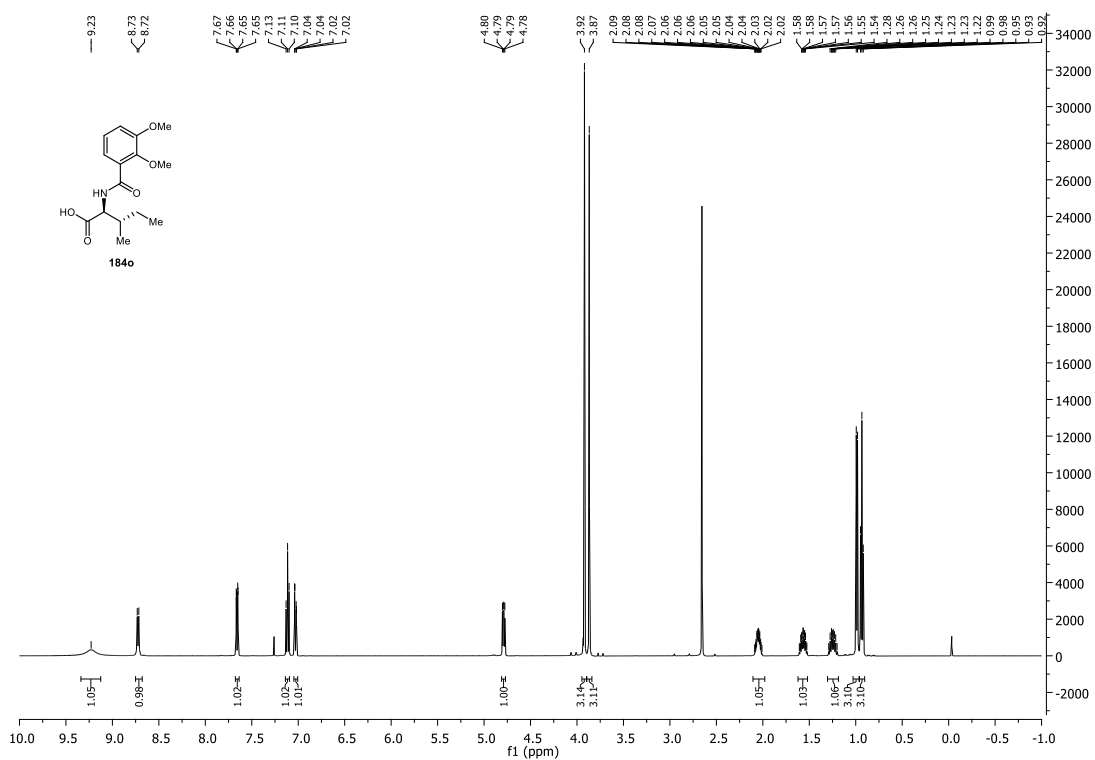
¹H NMR 184m.



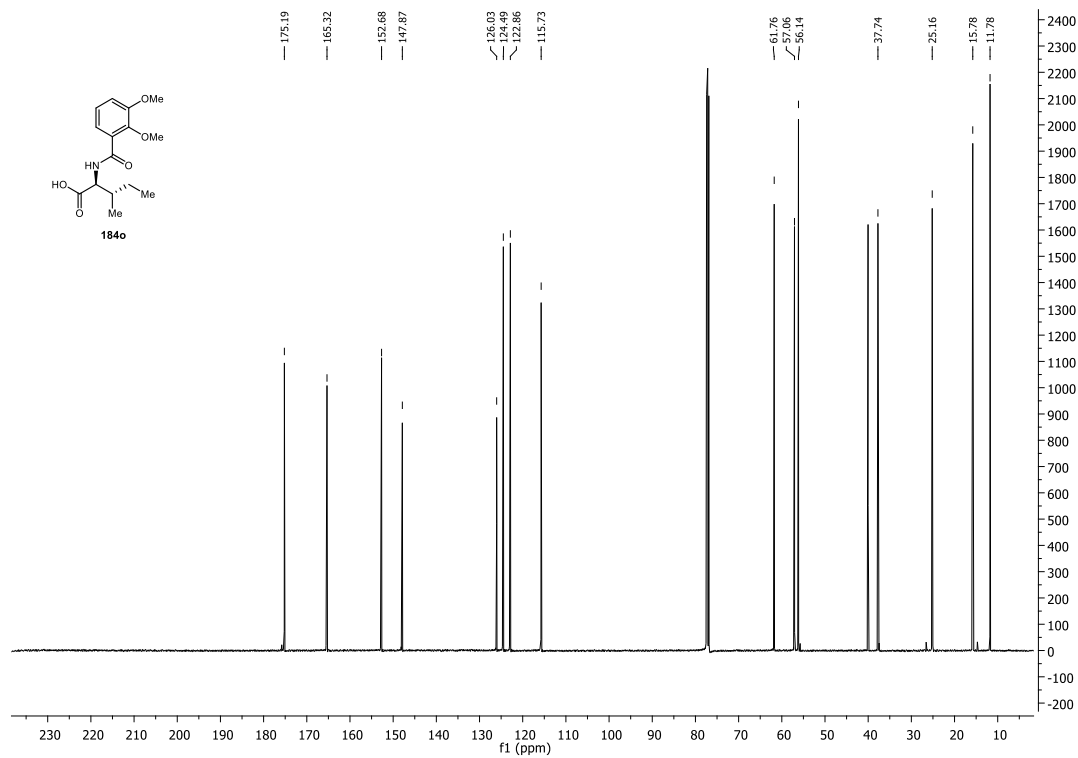
¹³C NMR 184m.



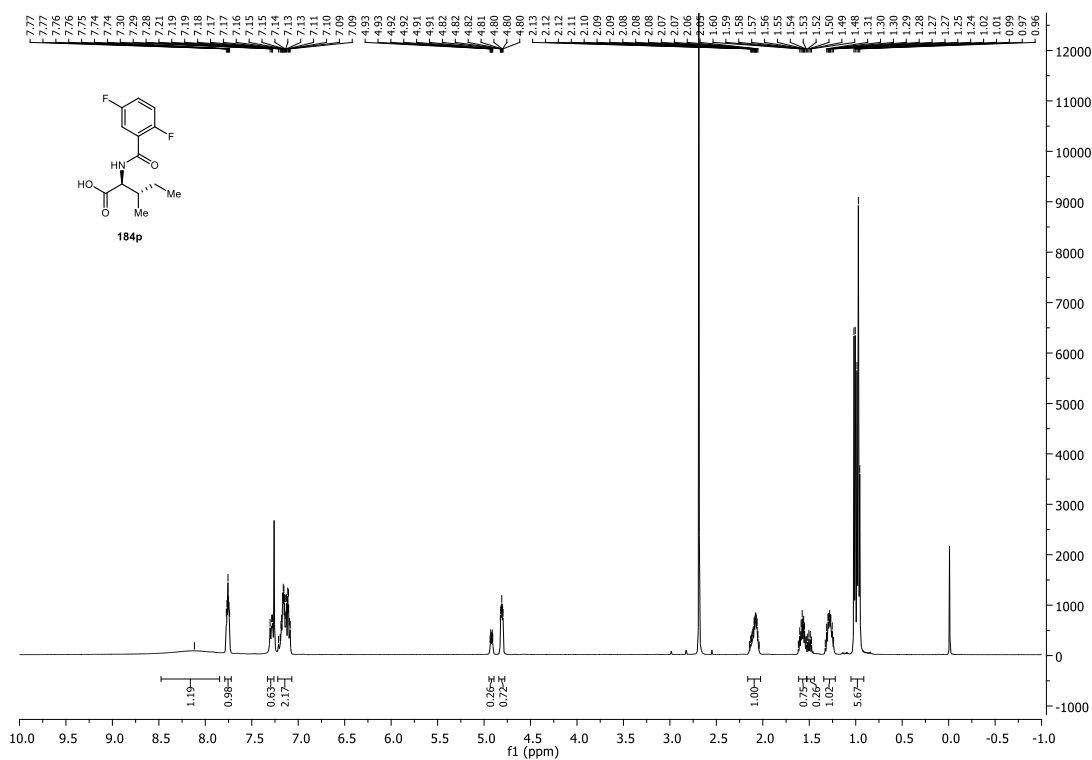
¹H NMR 184o.



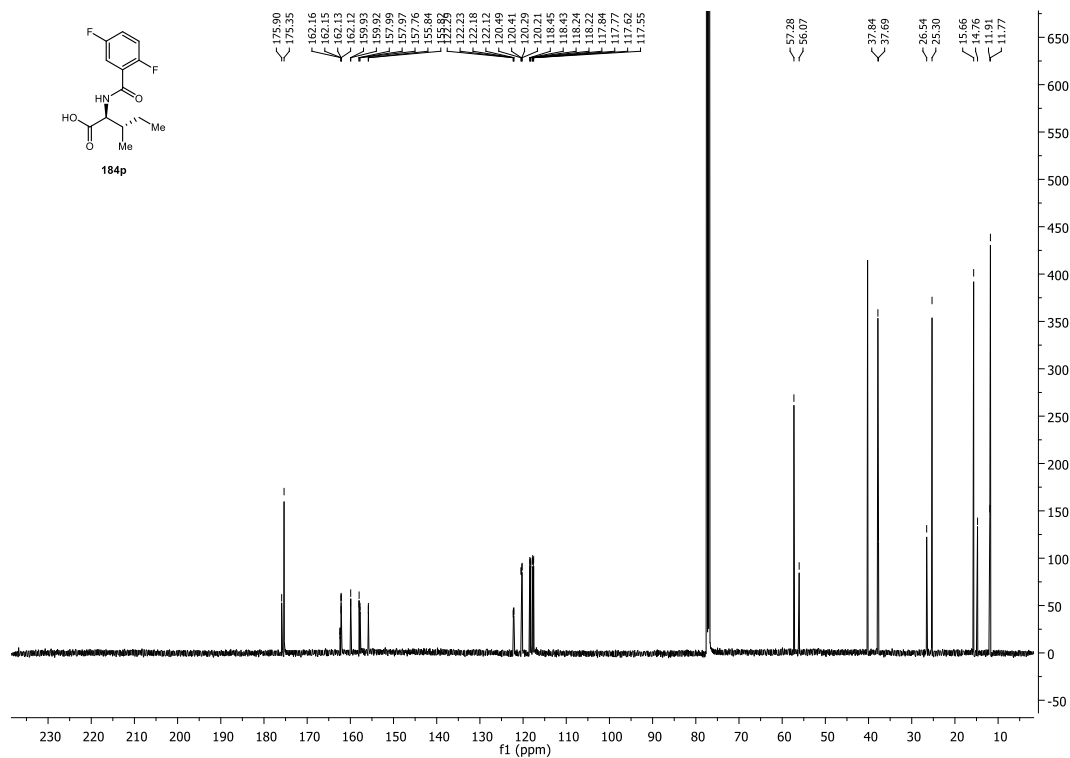
¹³C NMR 184o.



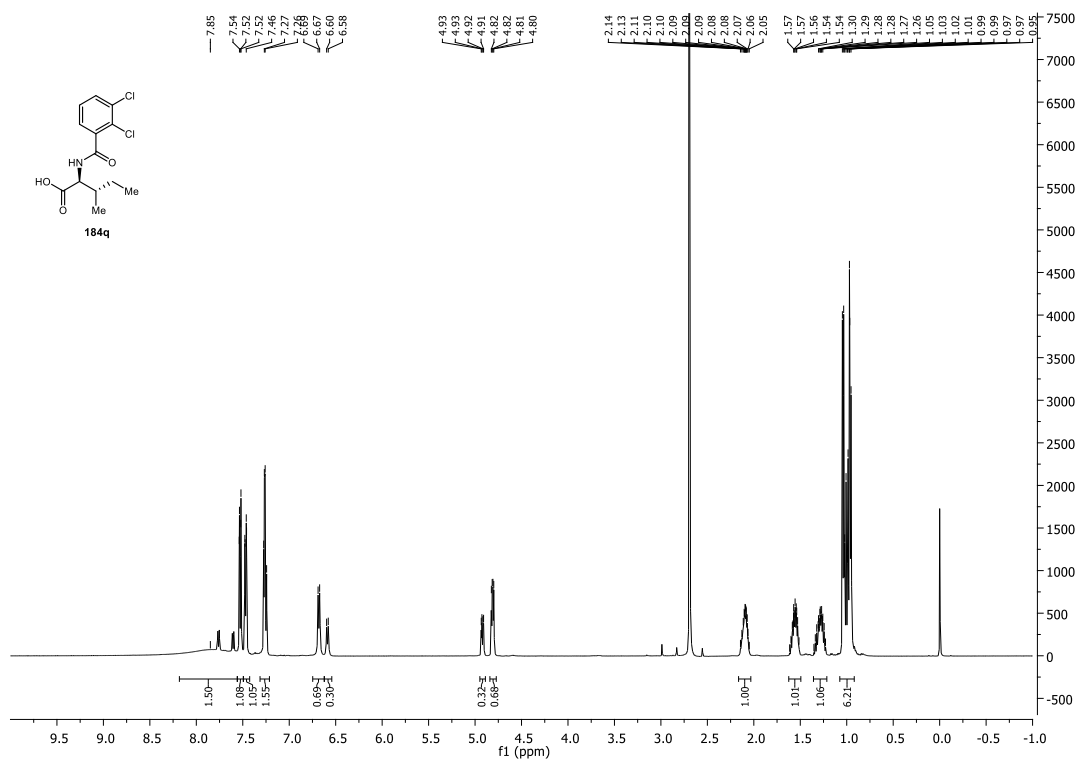
¹H NMR 184p.



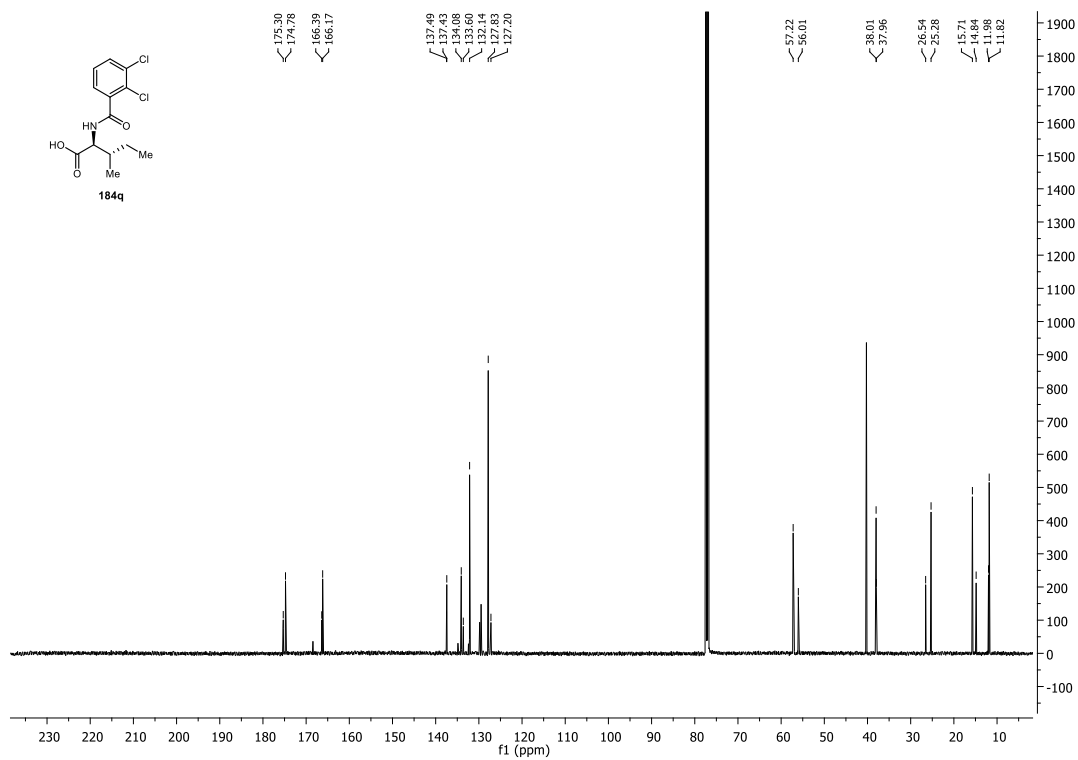
¹³C NMR 184p.



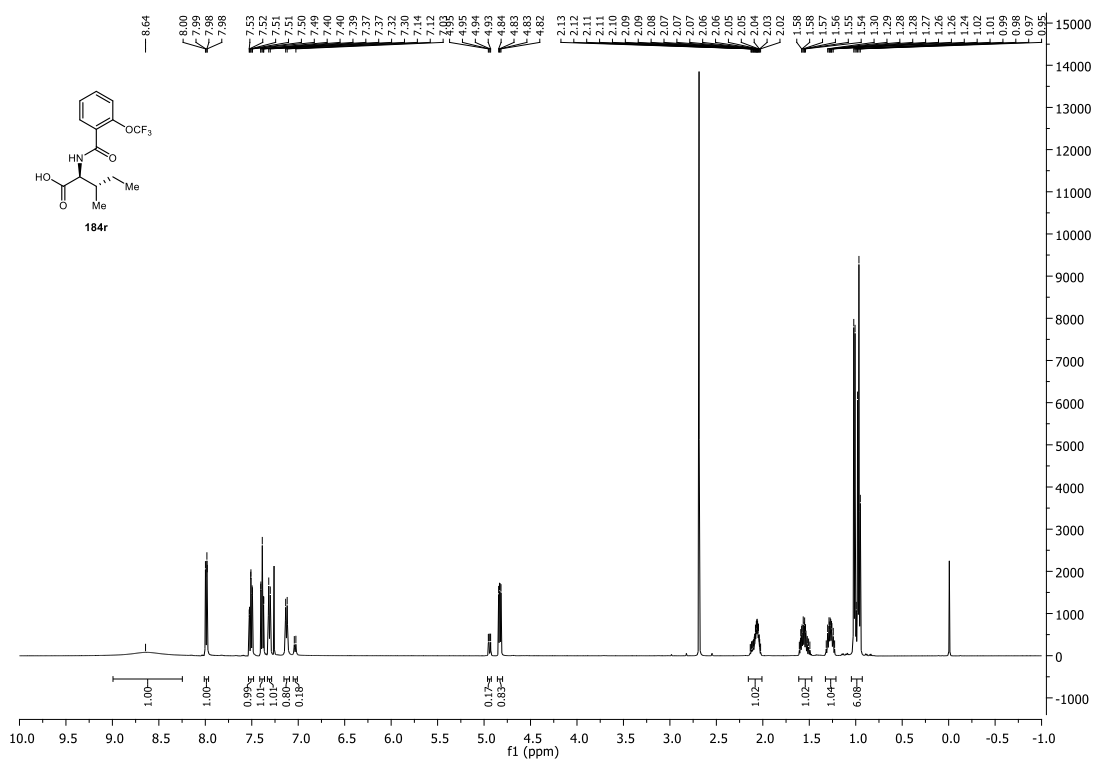
¹H NMR 184q.



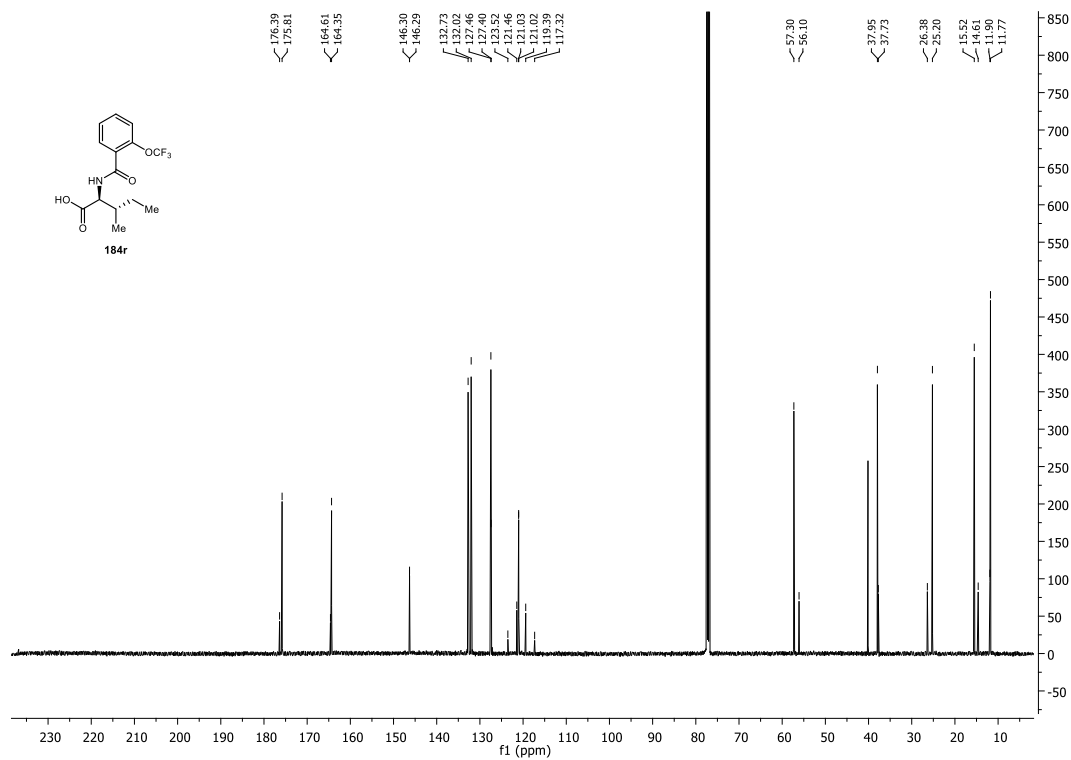
¹³C NMR 184q.



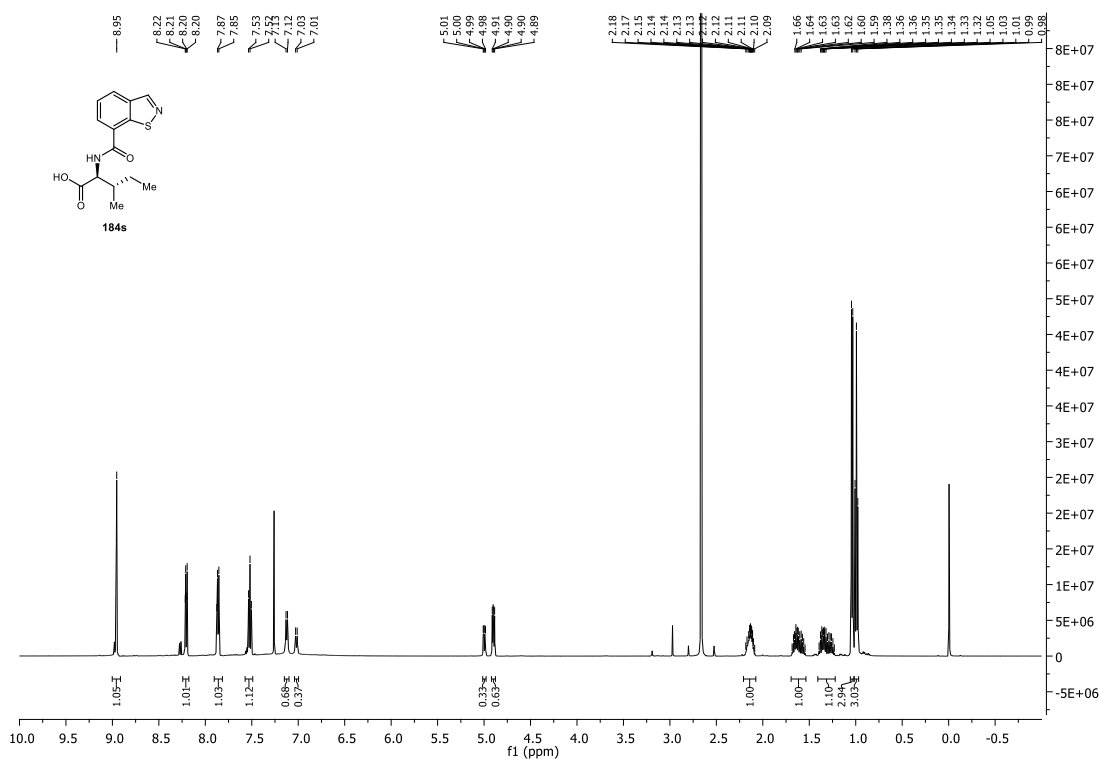
¹H NMR 184r.



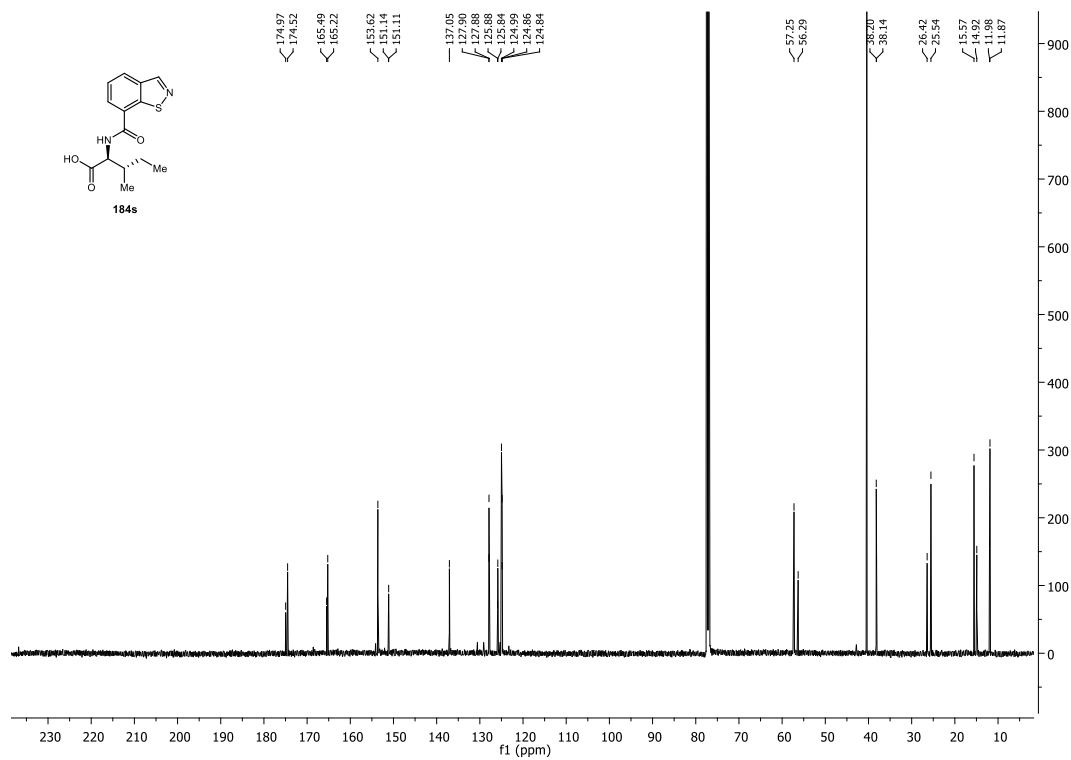
¹³C NMR 184r.



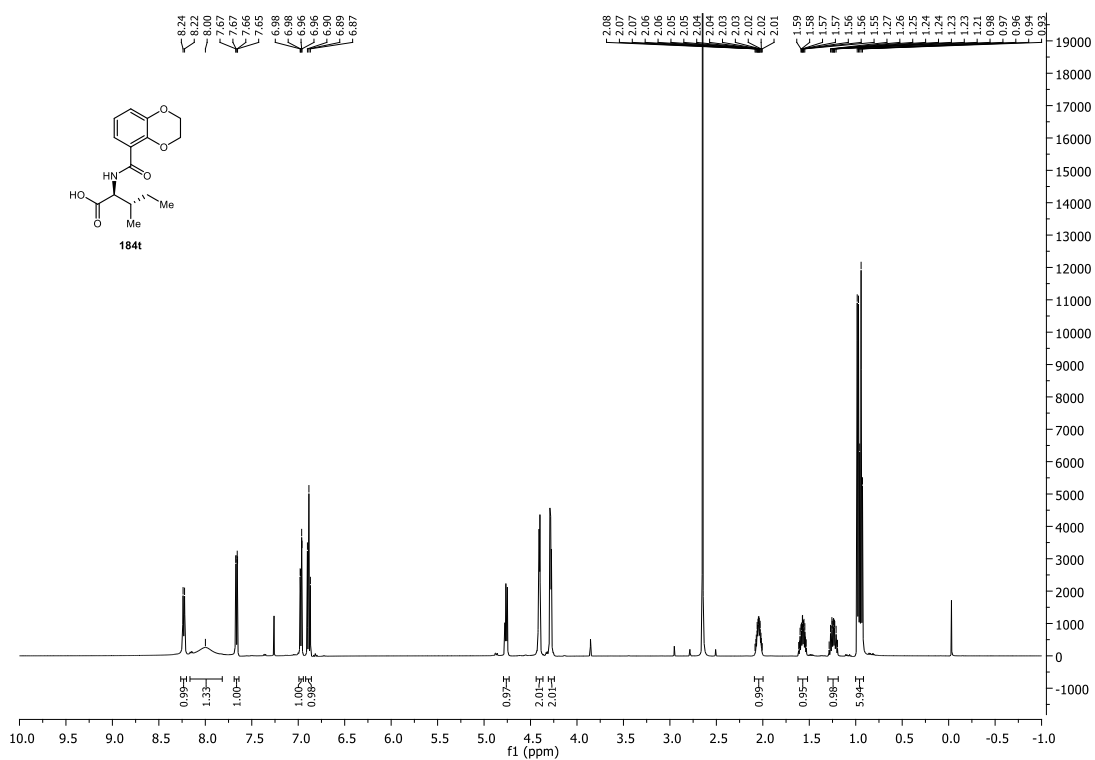
¹H NMR 184s.



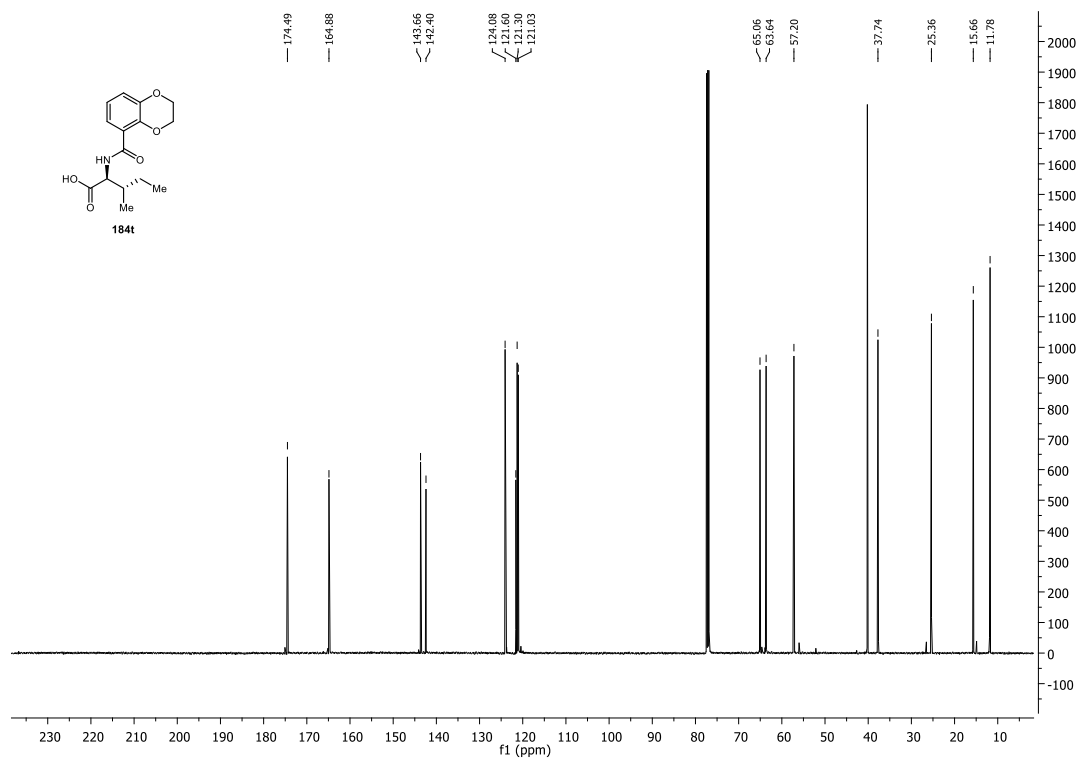
¹³C NMR 184s.



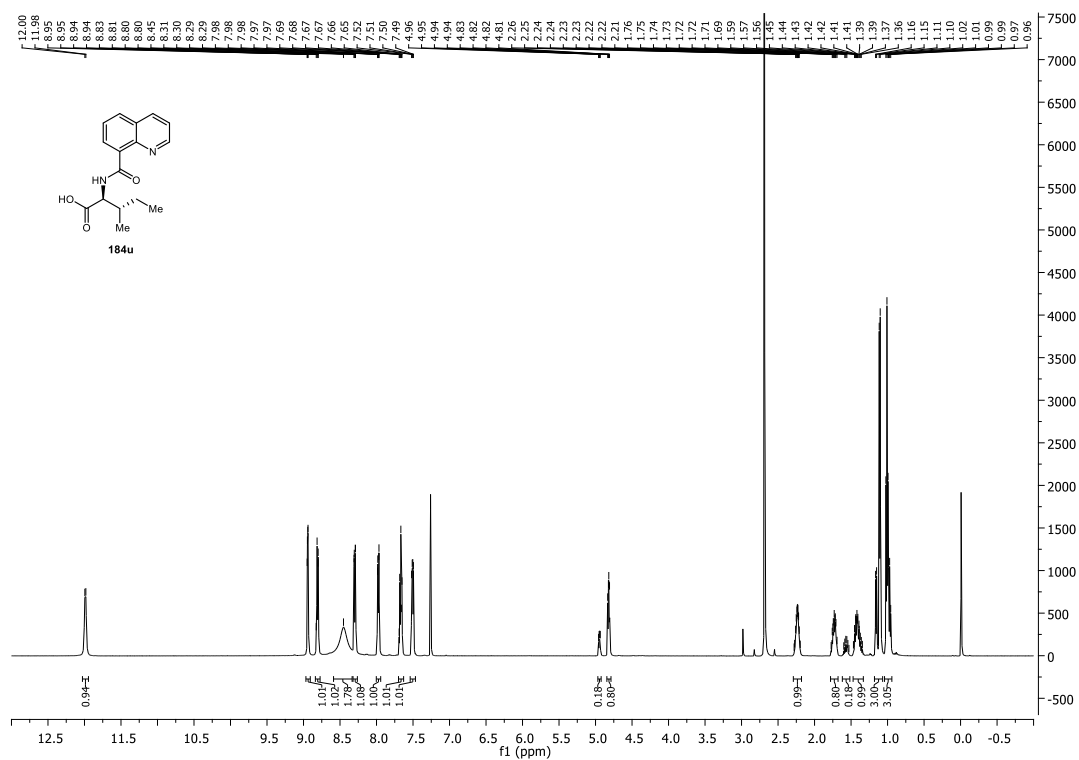
¹H NMR 184t.



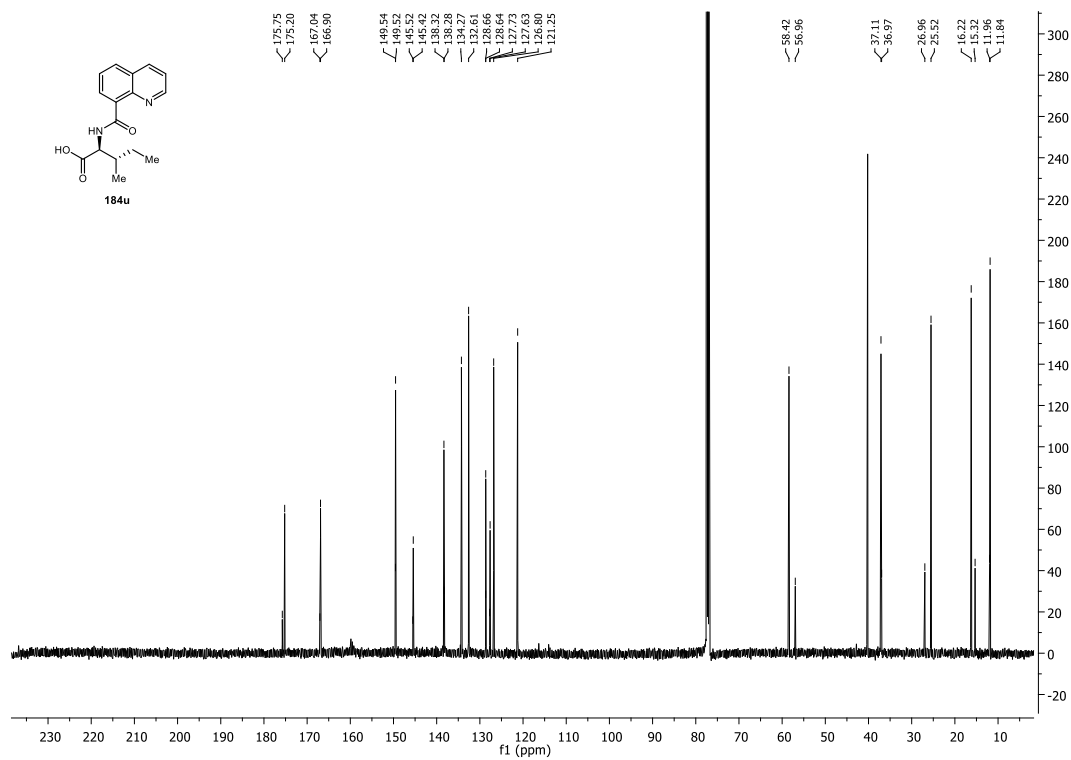
¹³C NMR 184t.



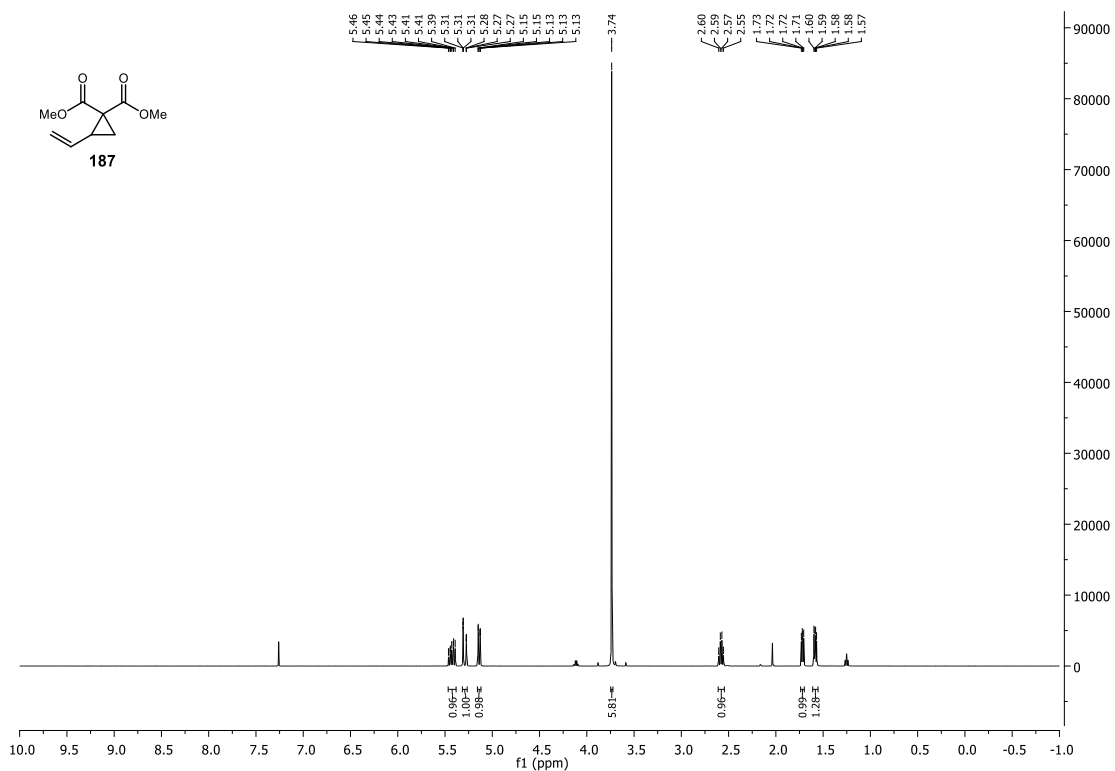
¹H NMR 184u.



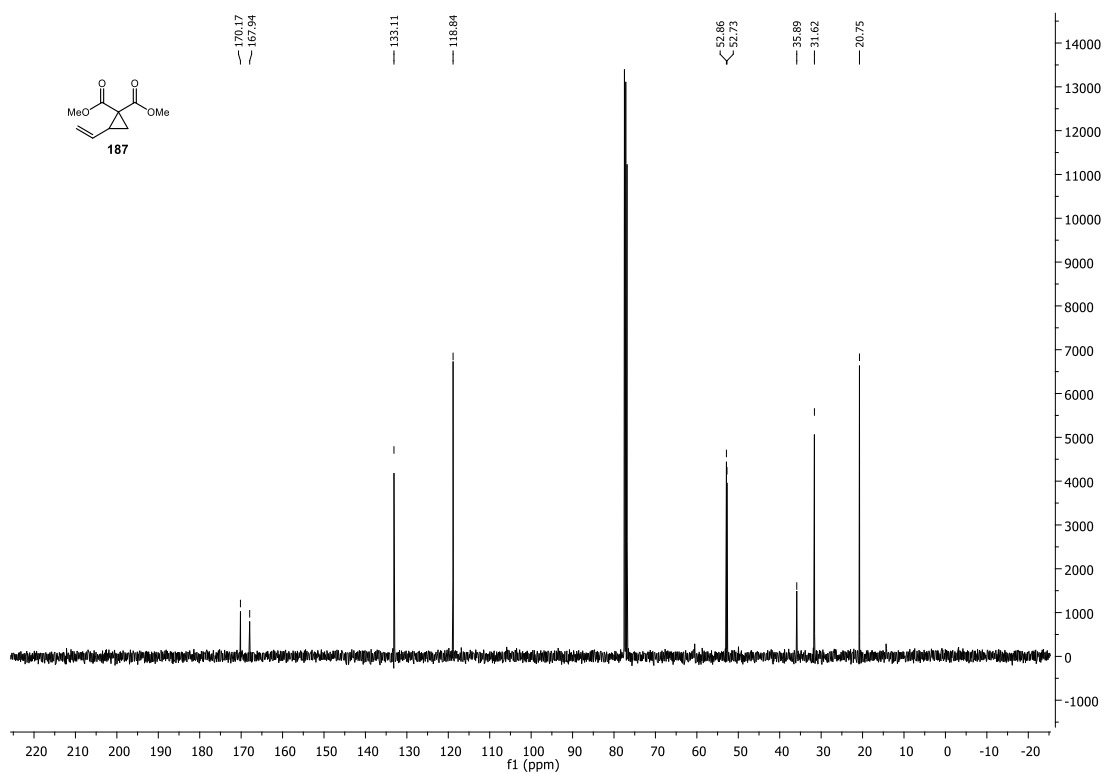
¹³C NMR 184u.



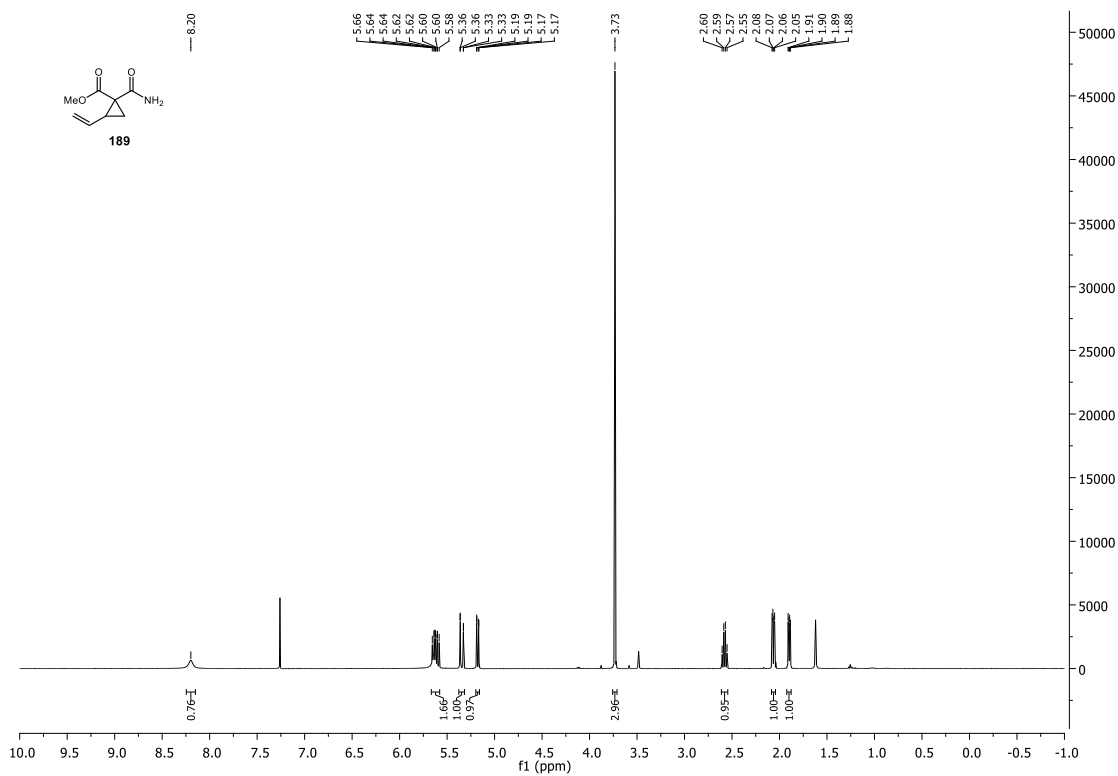
¹H NMR 187.



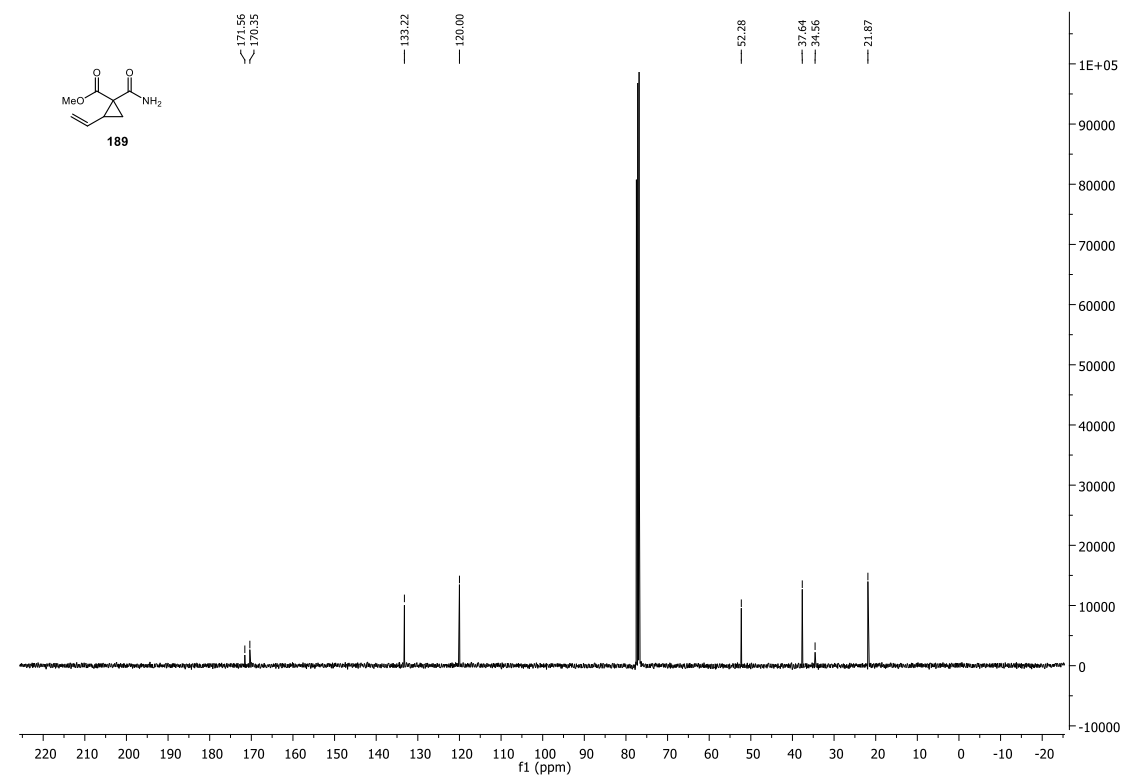
¹³C NMR 187.



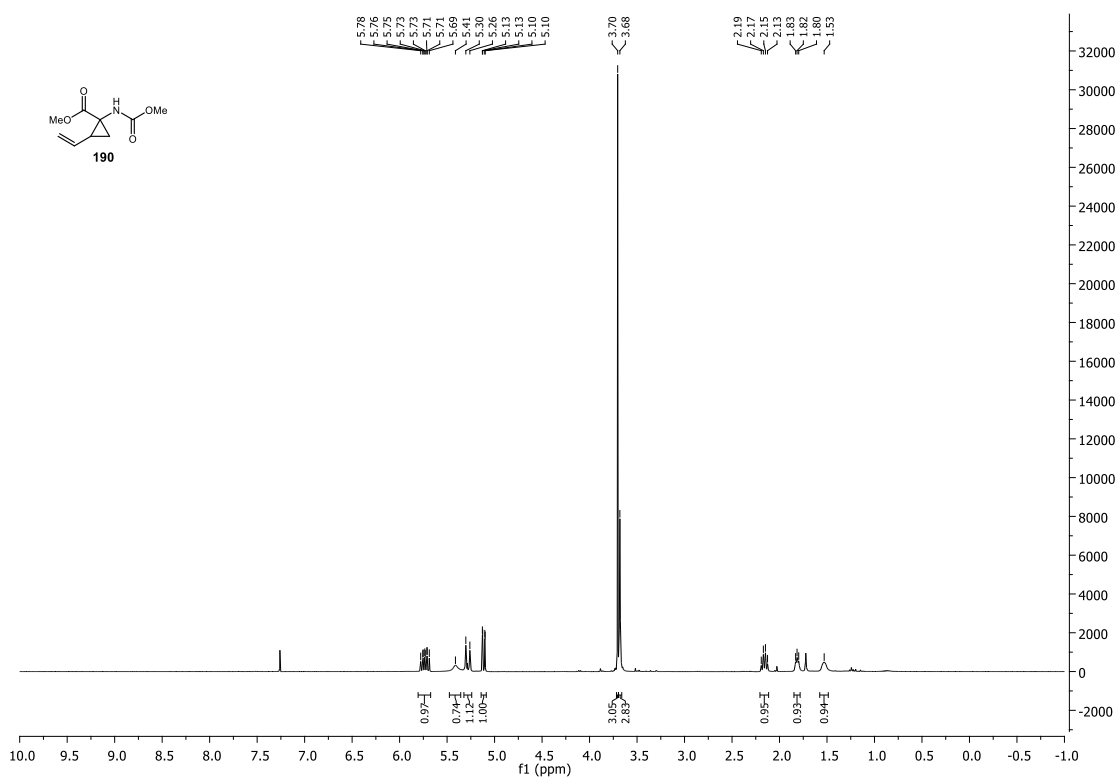
¹H NMR 189.



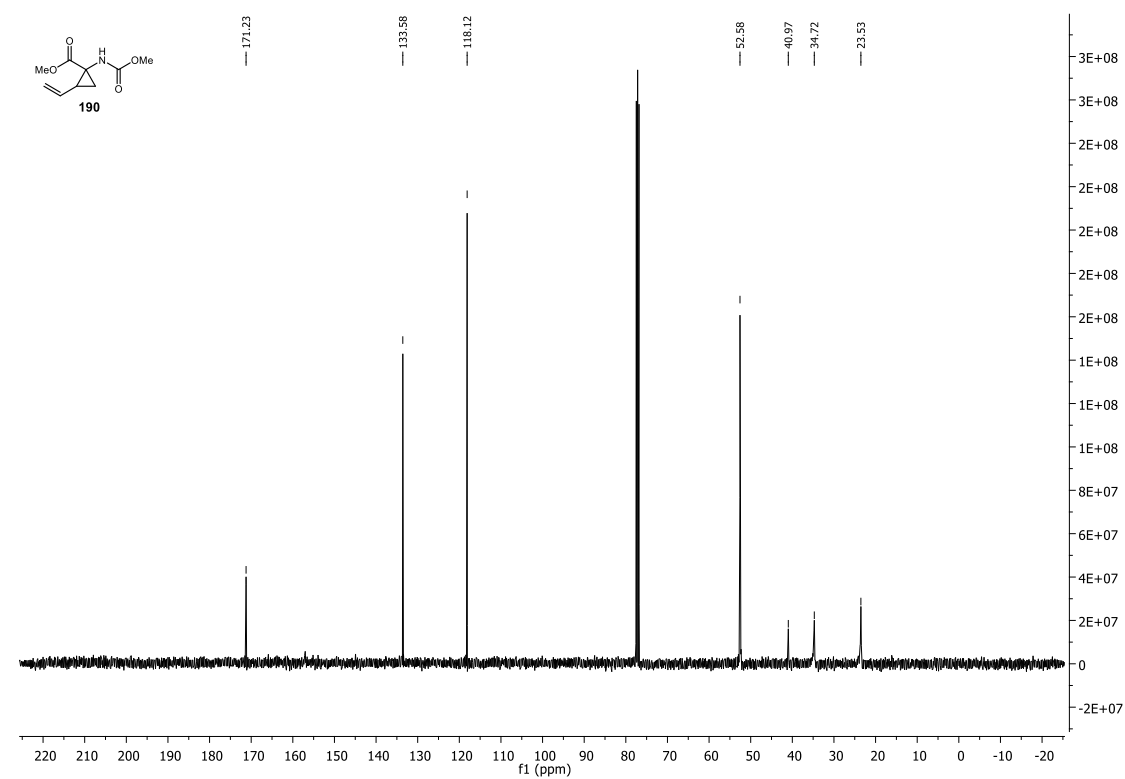
¹³C NMR 189.



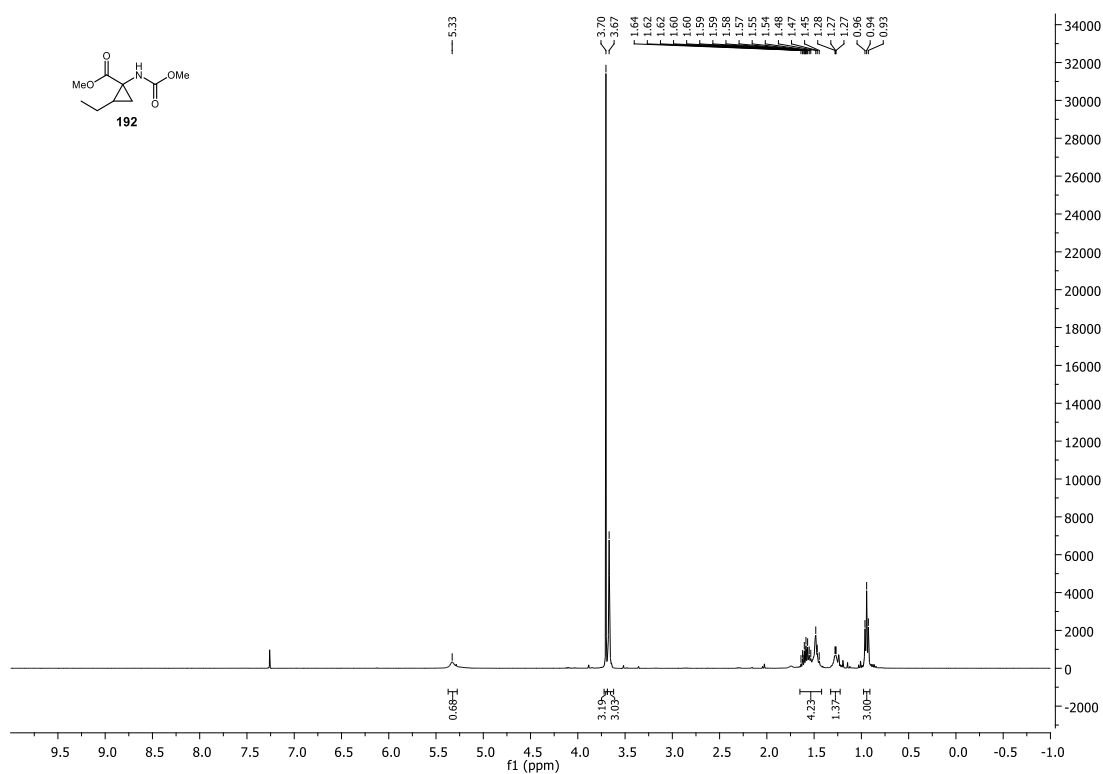
¹H NMR 190.



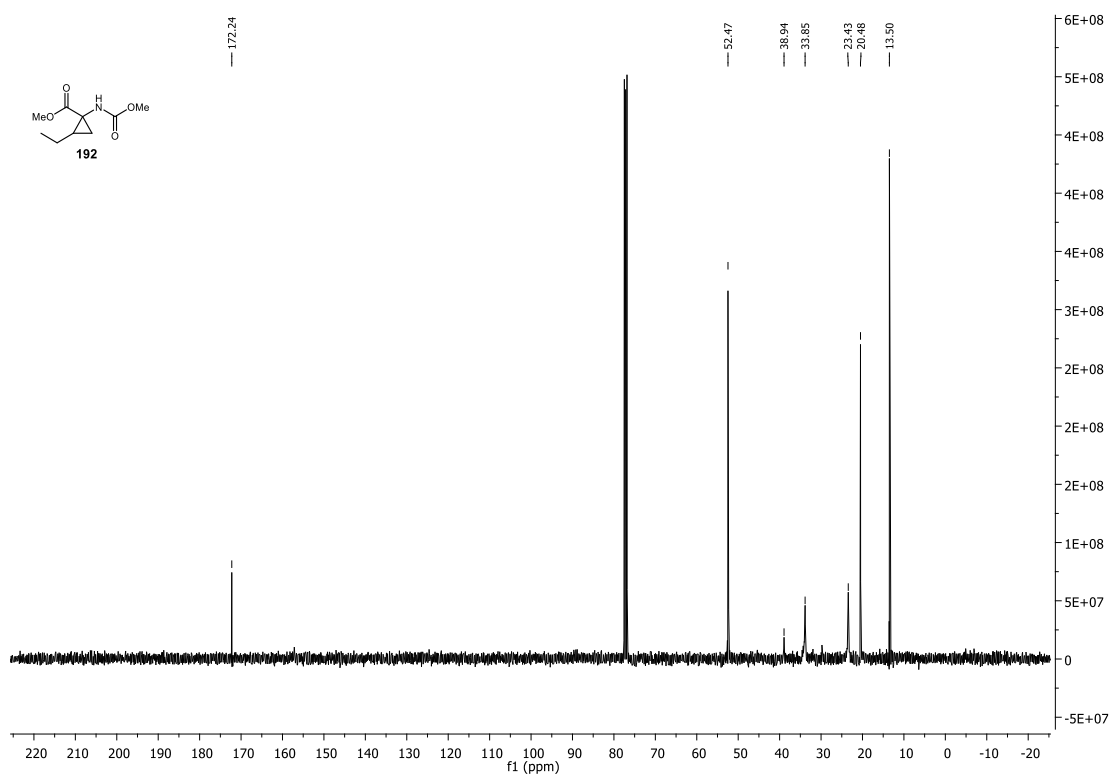
¹³C NMR 190.



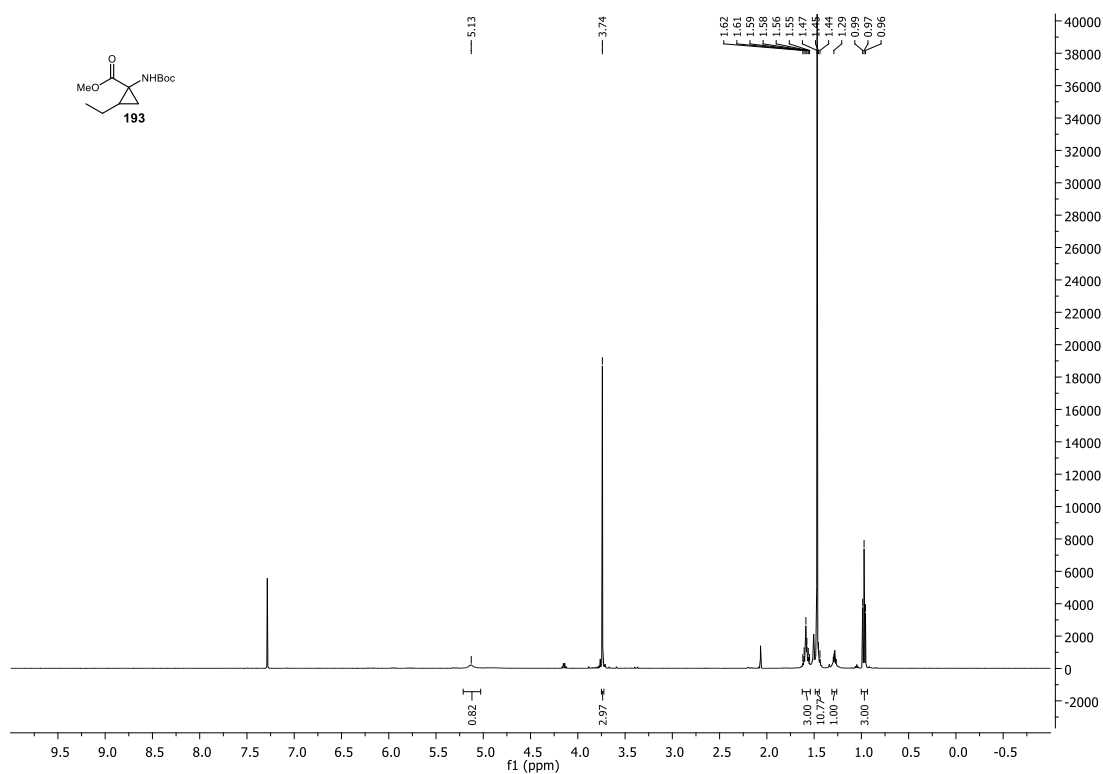
¹H NMR 192.



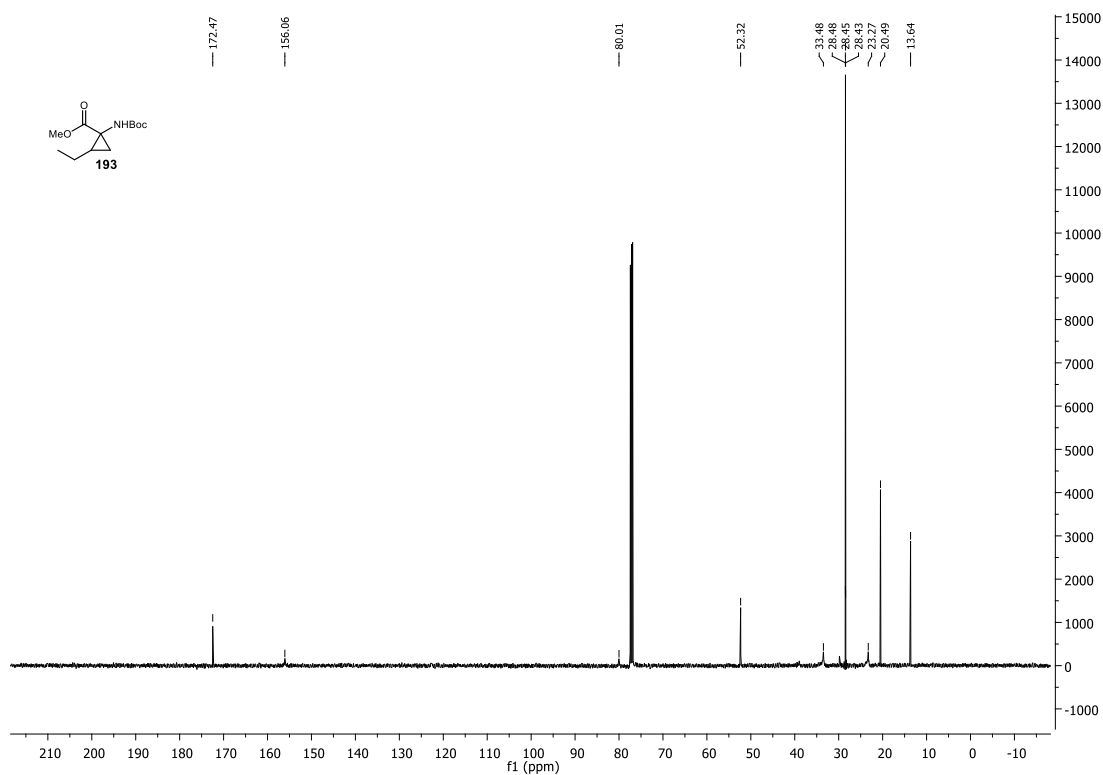
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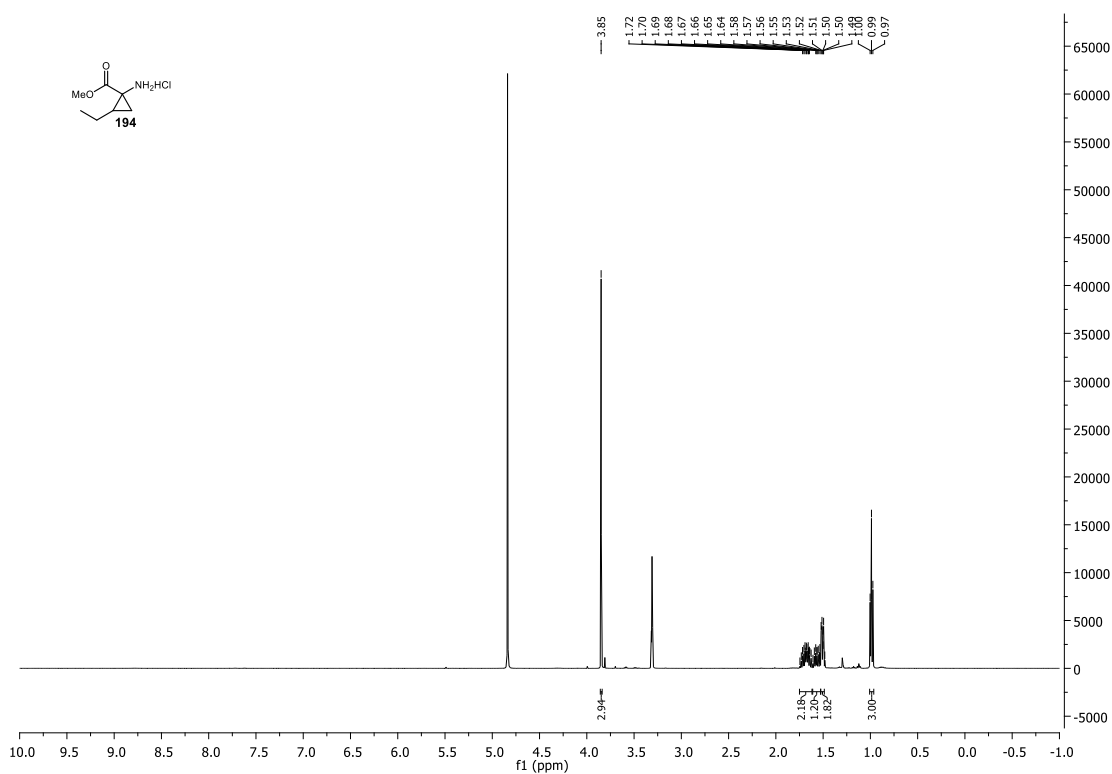
¹H NMR 193.



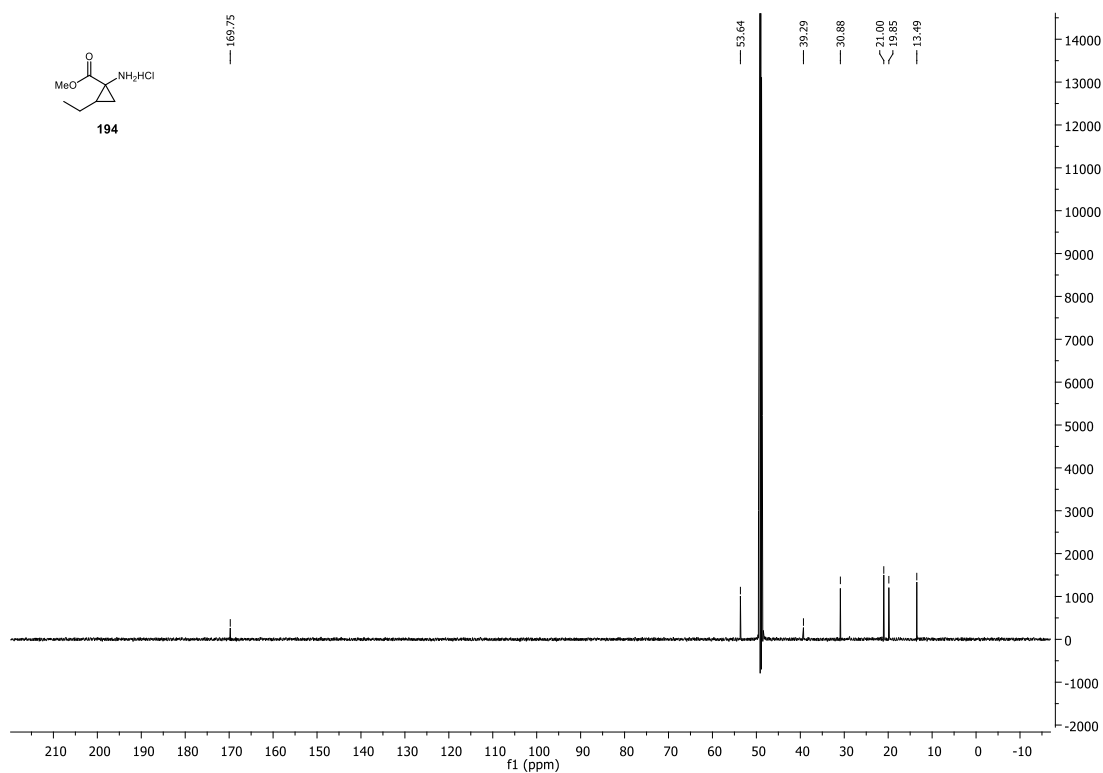
¹³C NMR 193.



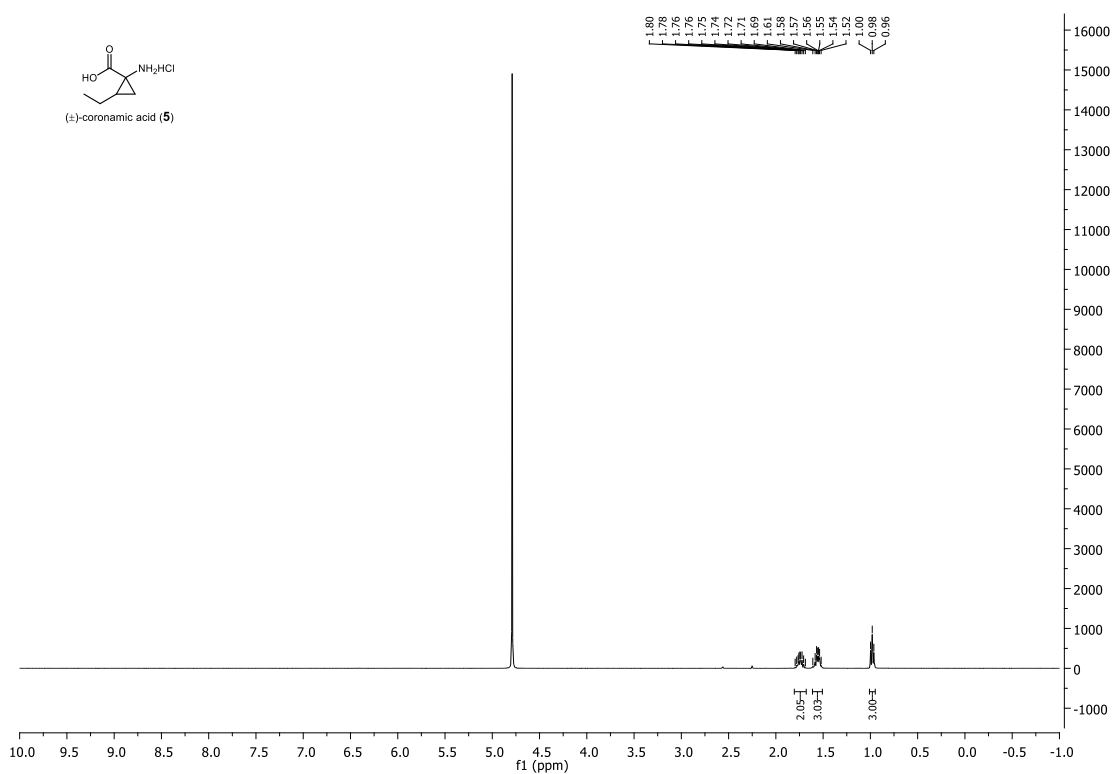
¹H NMR 194.



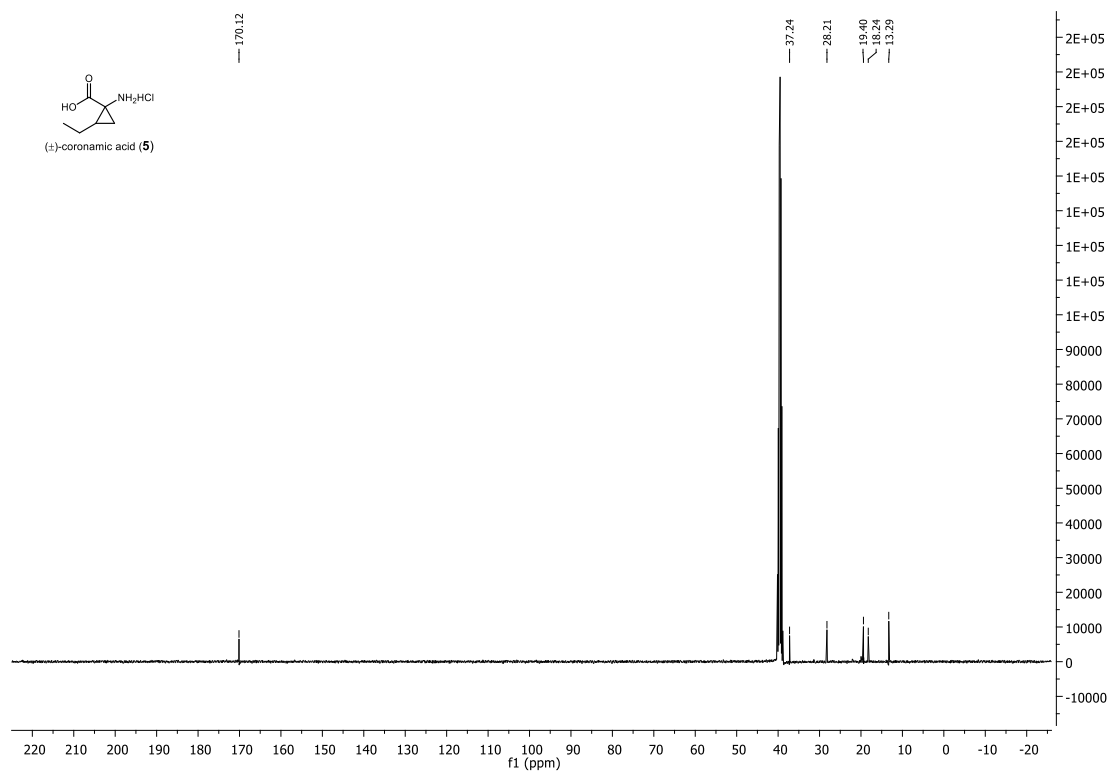
¹³C NMR 194.



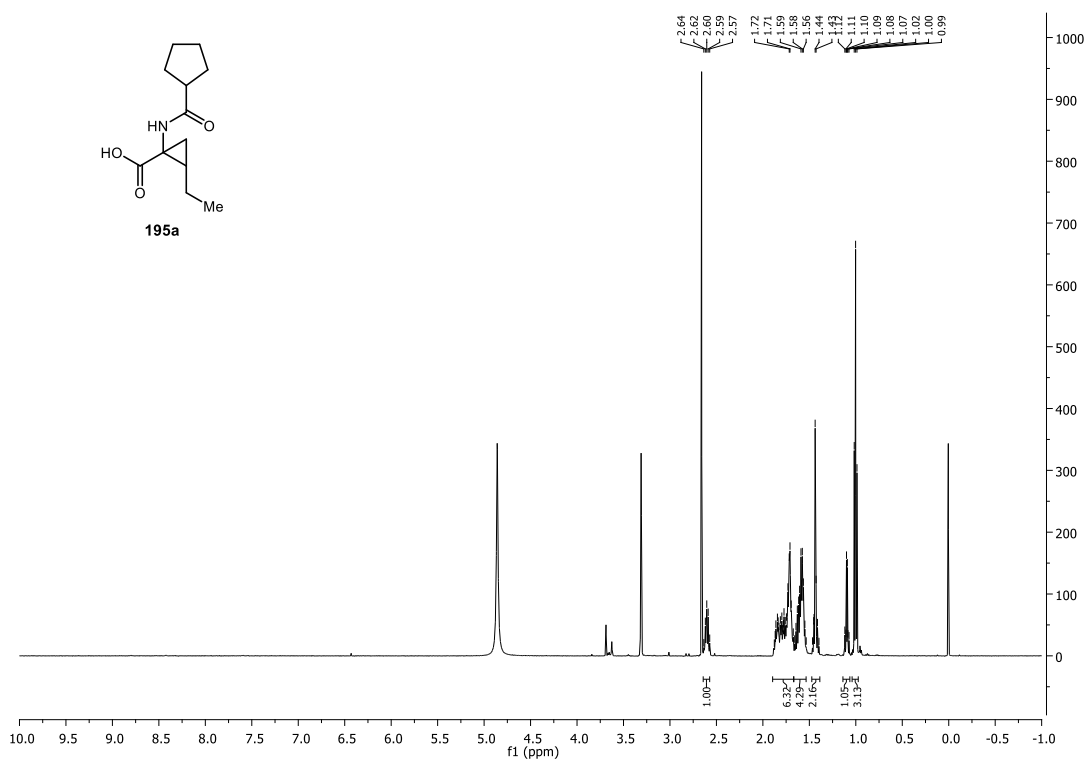
^1H NMR ((±)-CMA) (5).



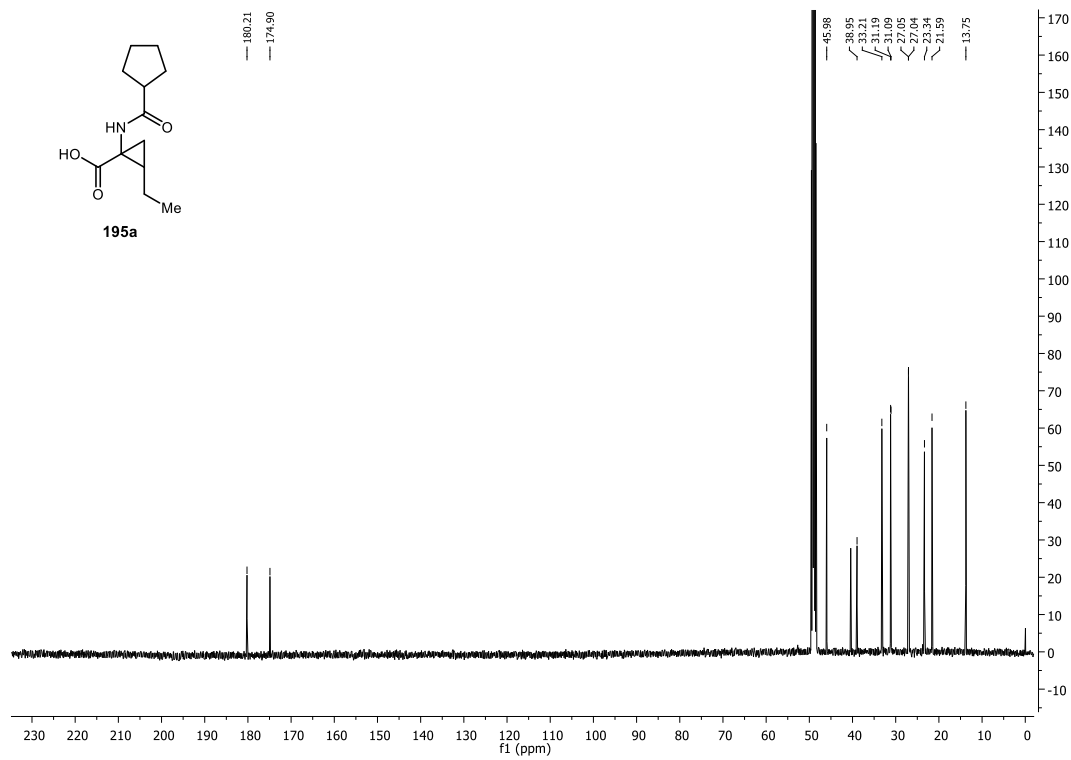
^{13}C NMR ((±)-CMA) (5).



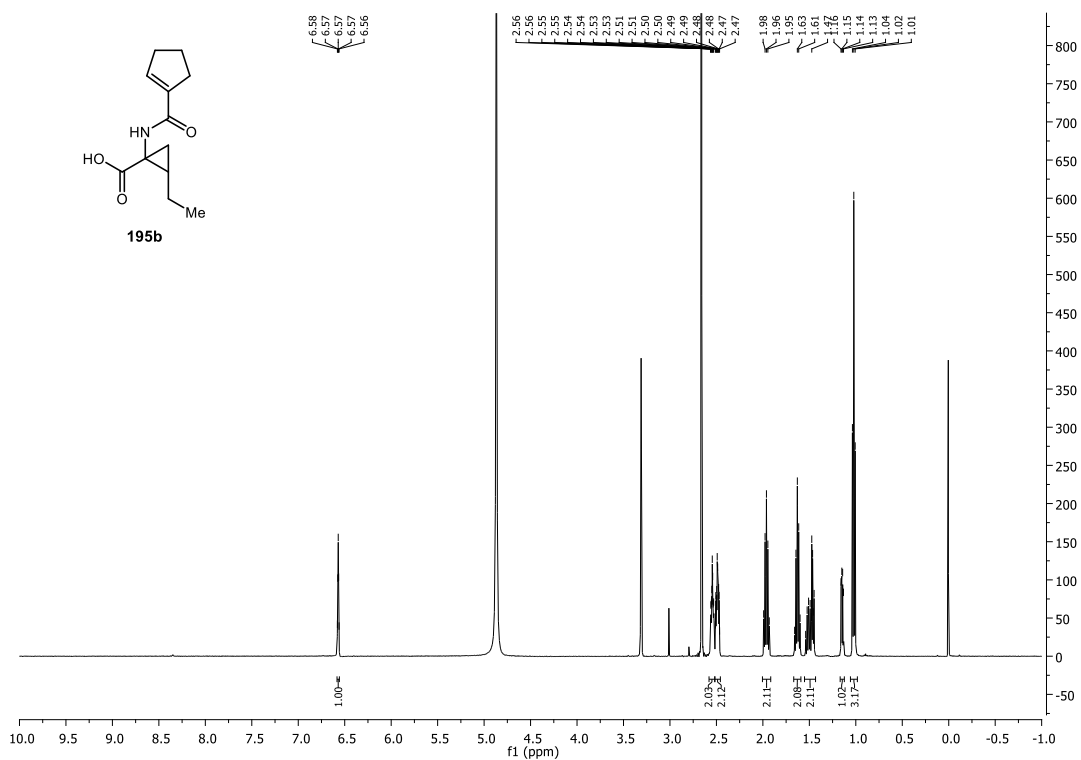
¹H NMR 195a.



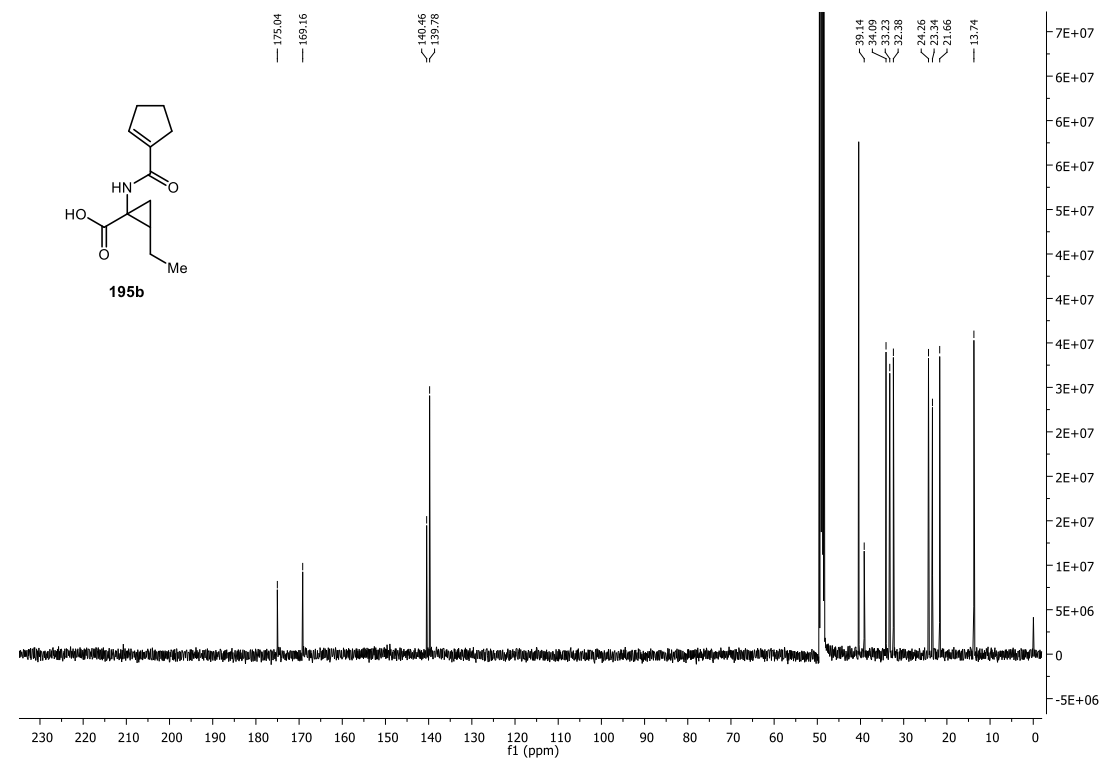
¹³C NMR 195a.



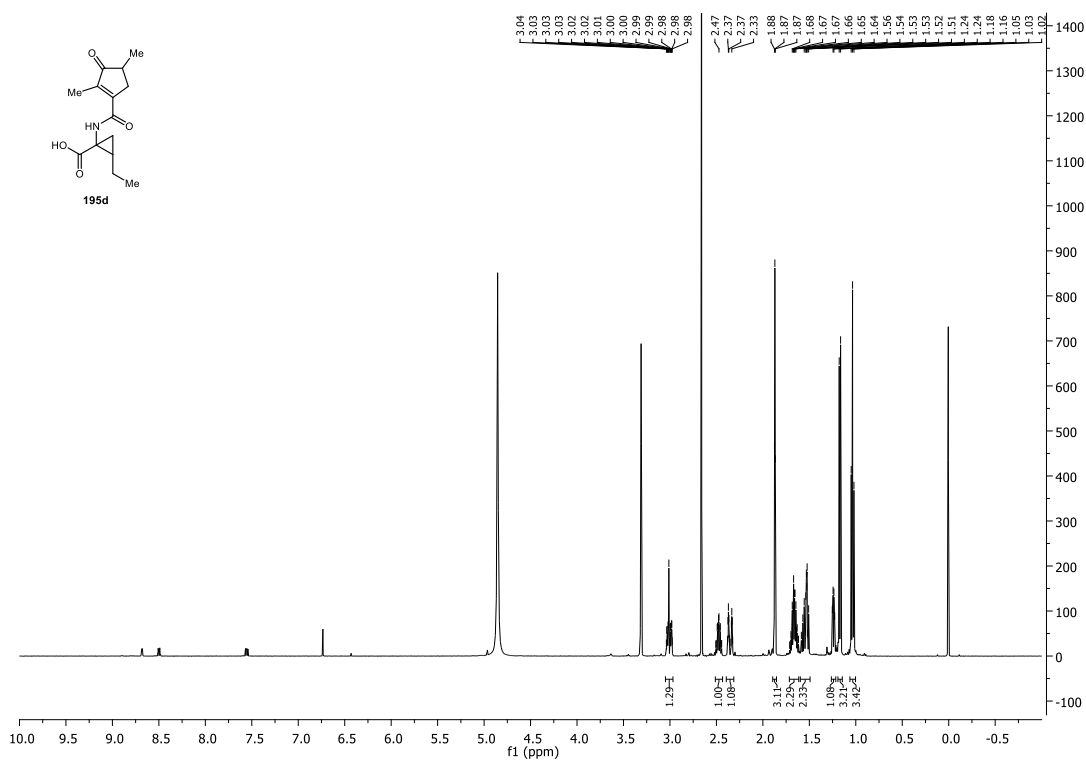
¹H NMR 195b.



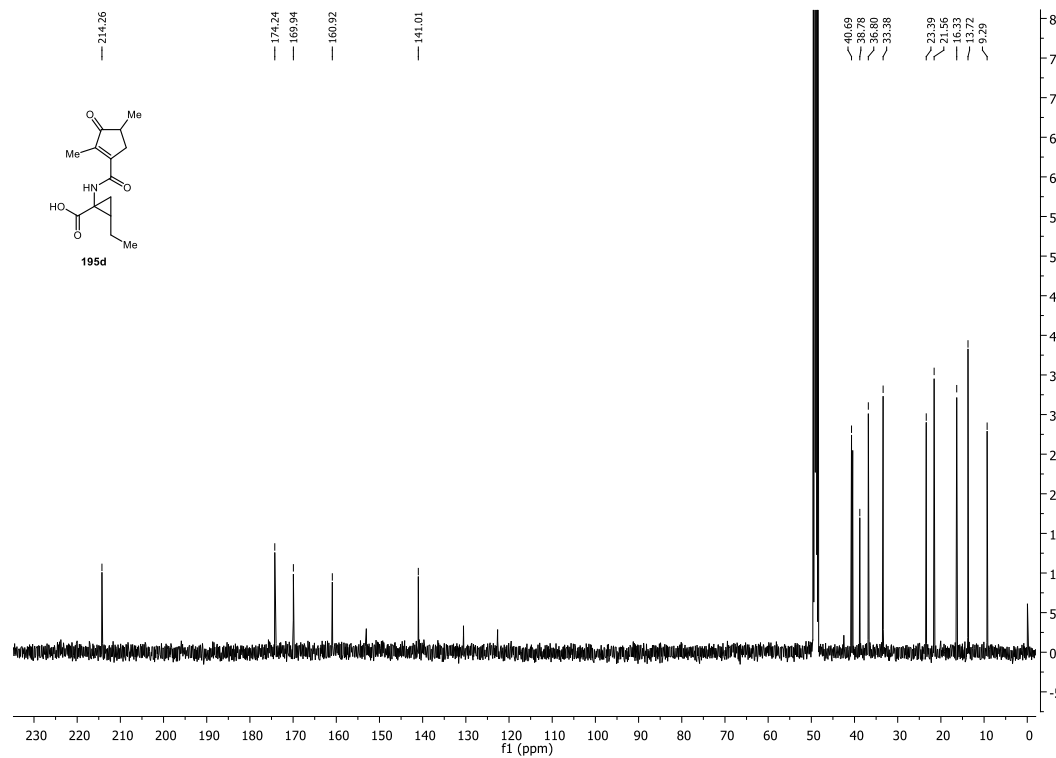
¹³C NMR 195b.



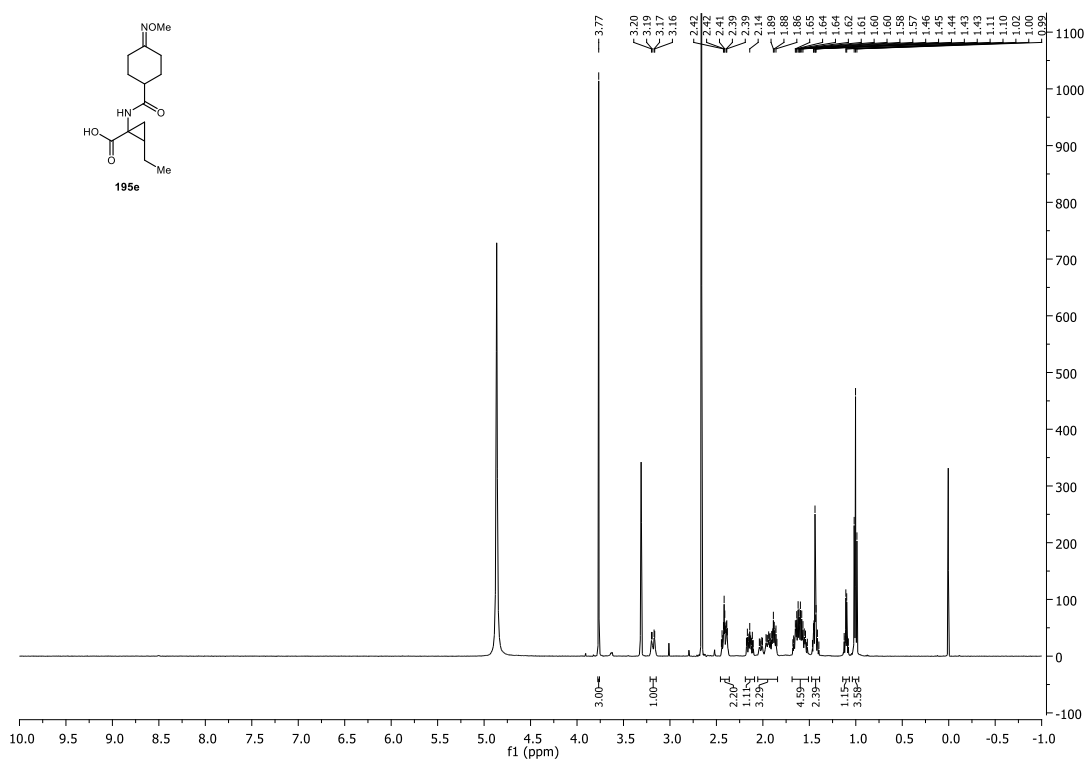
¹H NMR 195d.



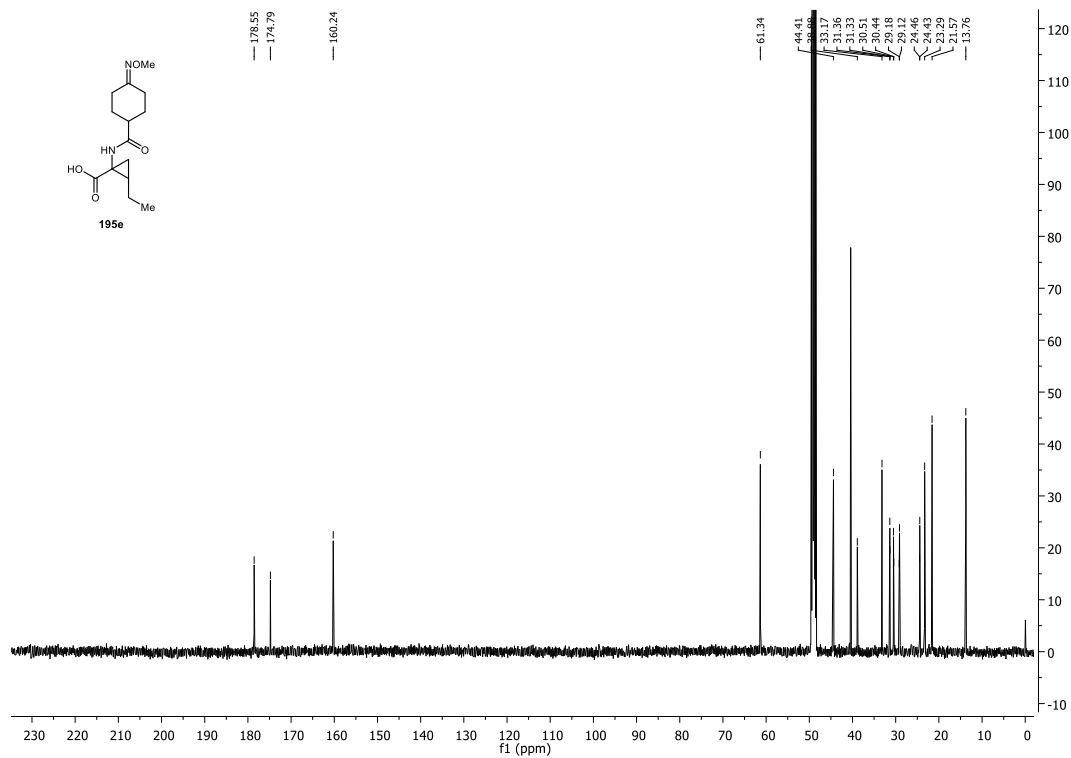
¹³C NMR 195d.



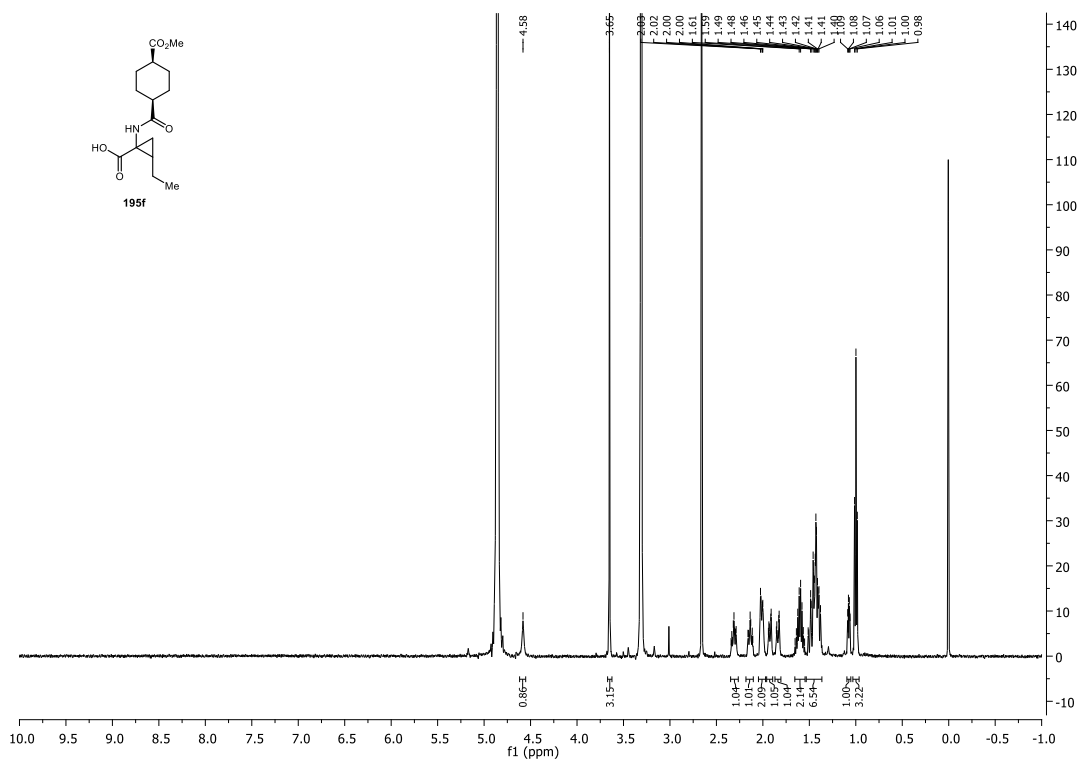
¹H NMR 195e.



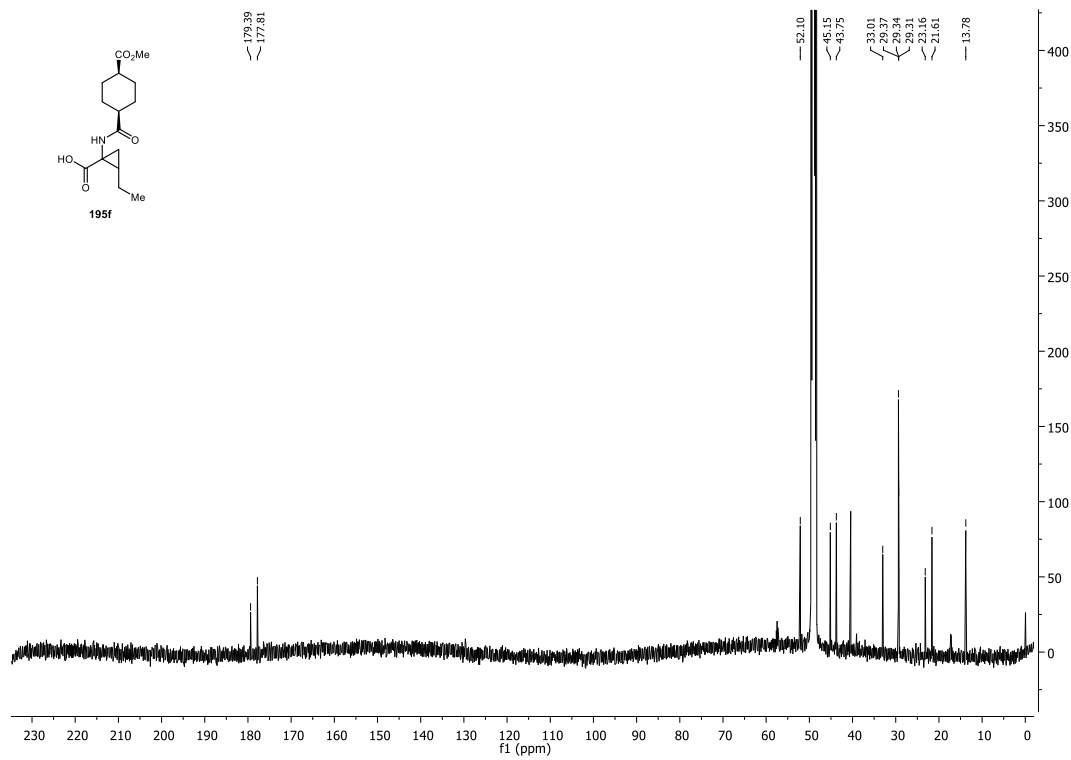
¹³C NMR 195e.



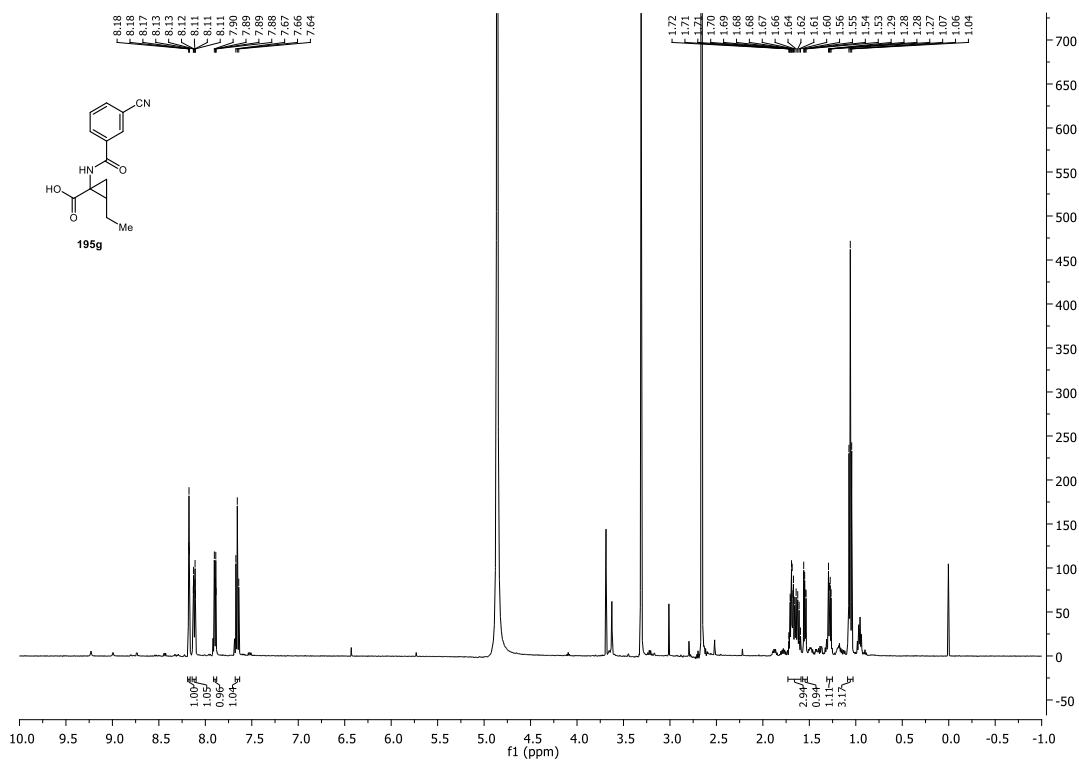
¹H NMR 195f.



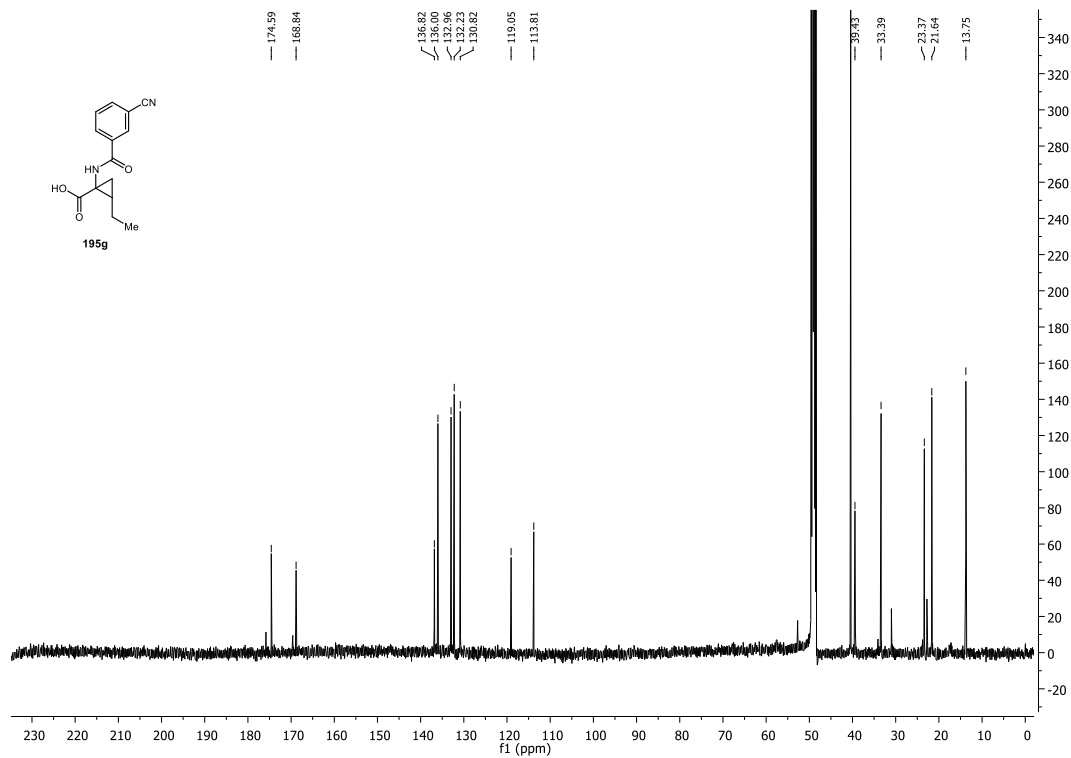
¹³C NMR 195f.



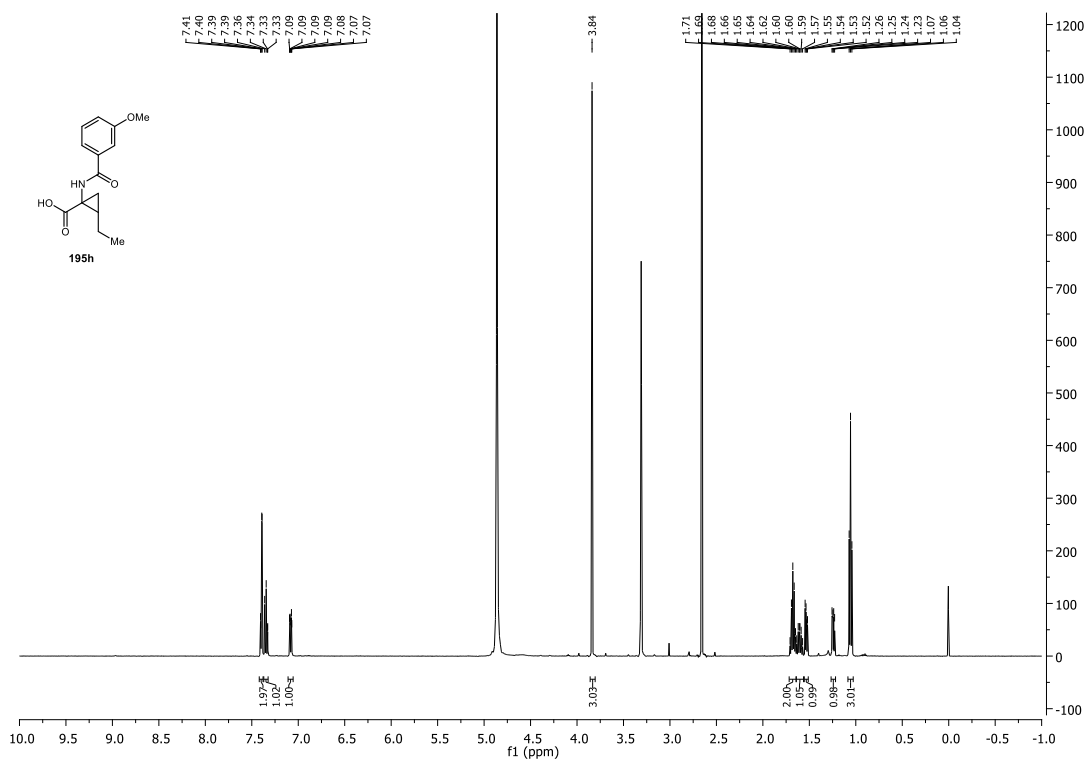
¹H NMR 195g.



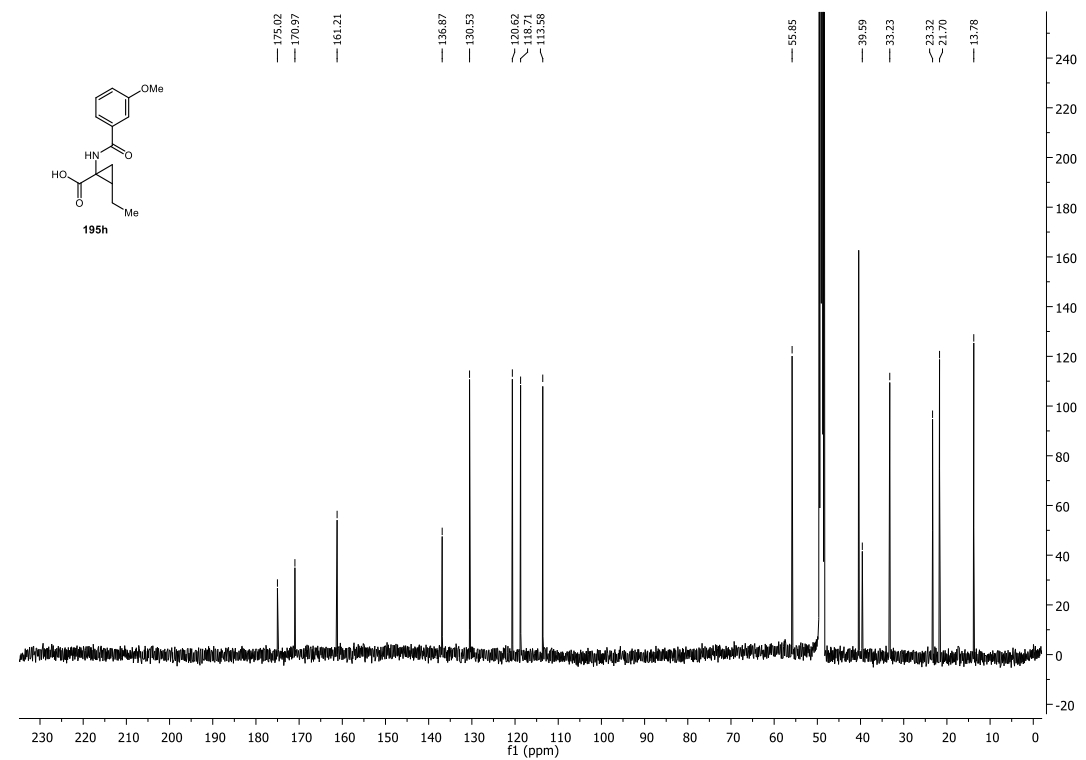
¹³C NMR 195g.



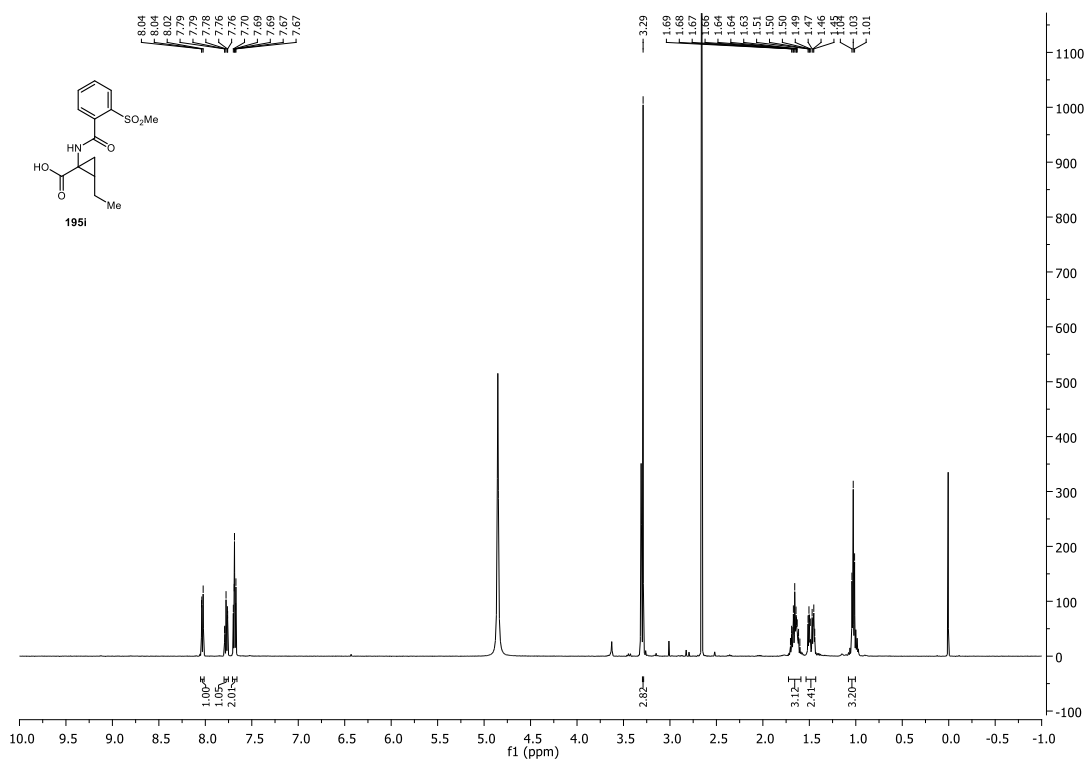
¹H NMR 195h.



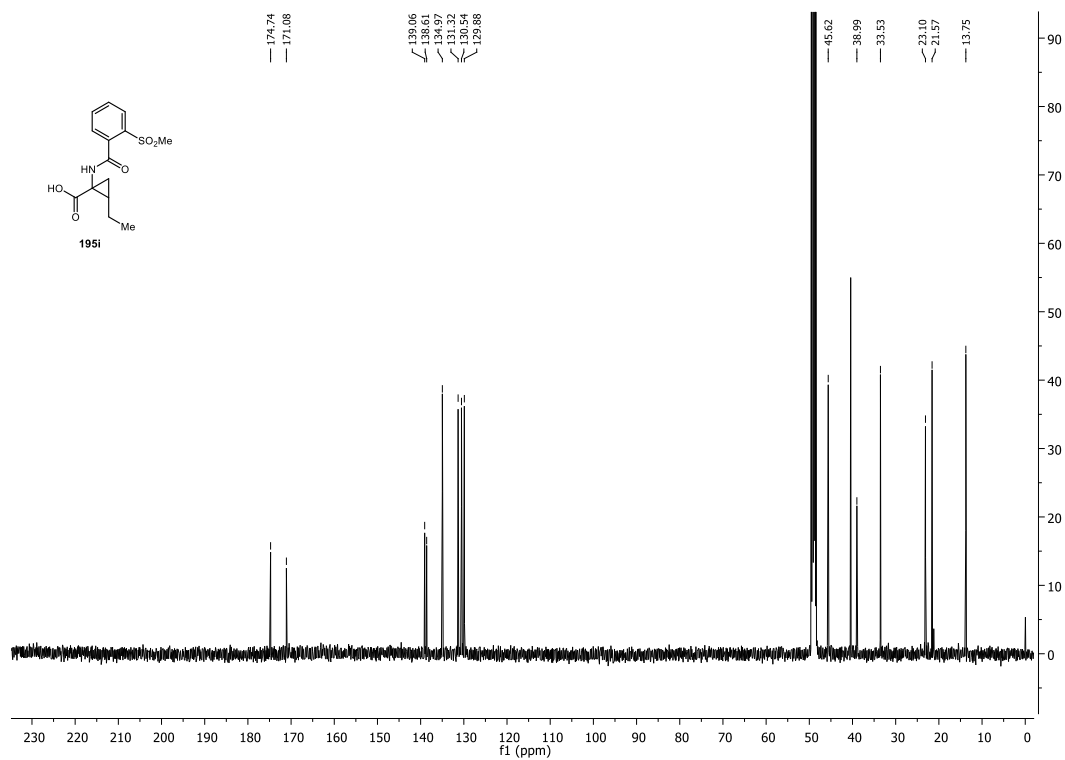
¹³C NMR 195h.



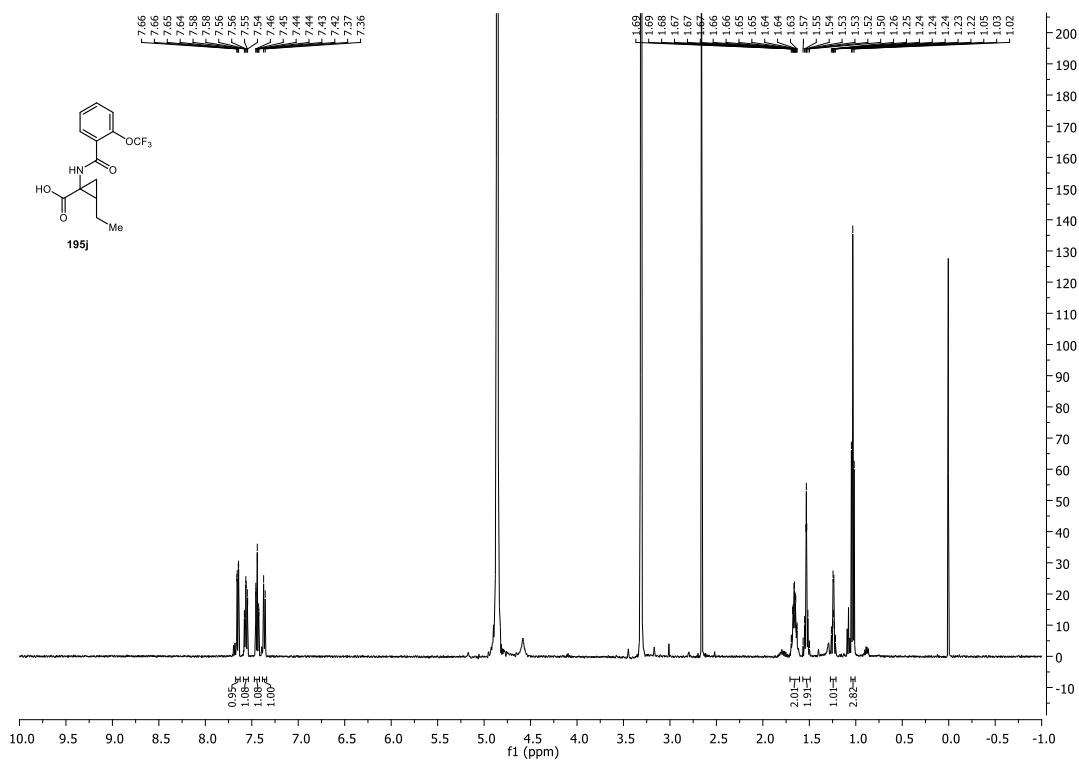
¹H NMR 195i.



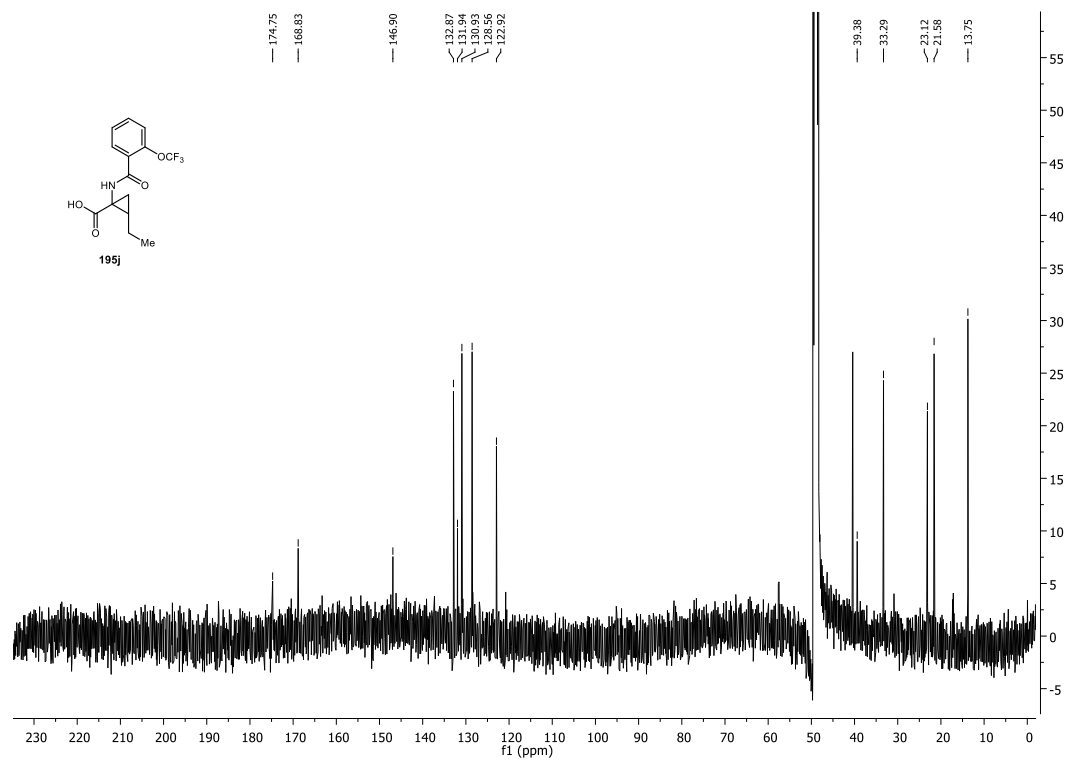
¹³C NMR 195i.



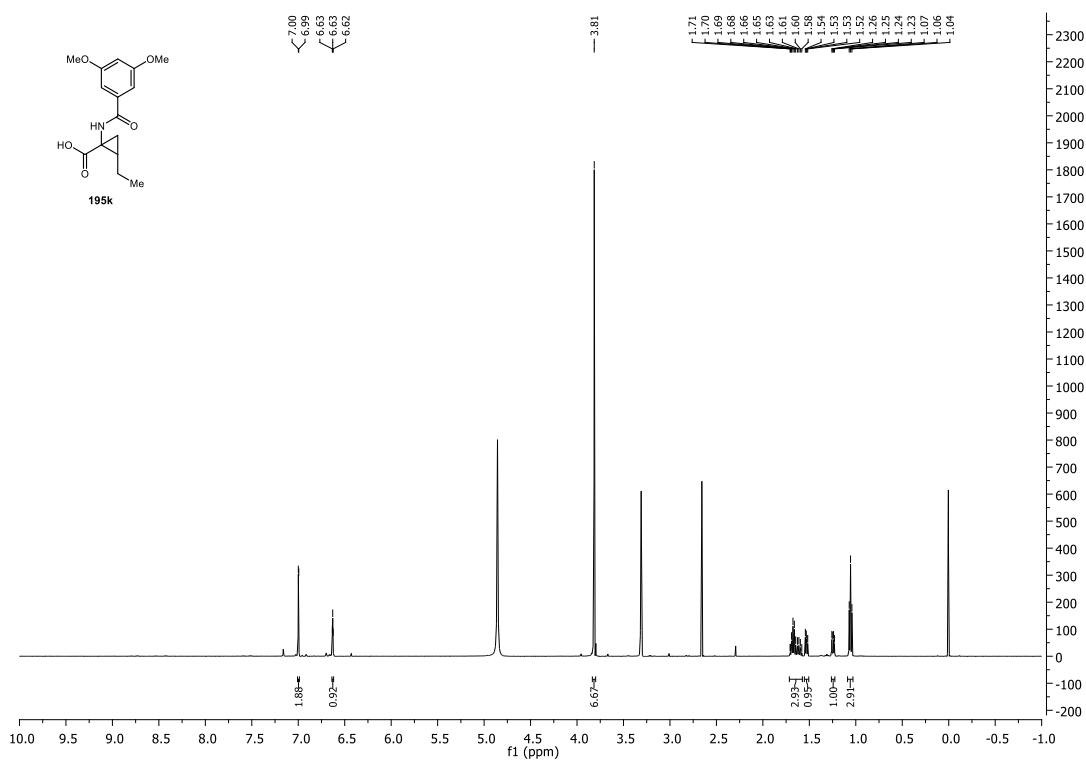
¹H NMR 195j.



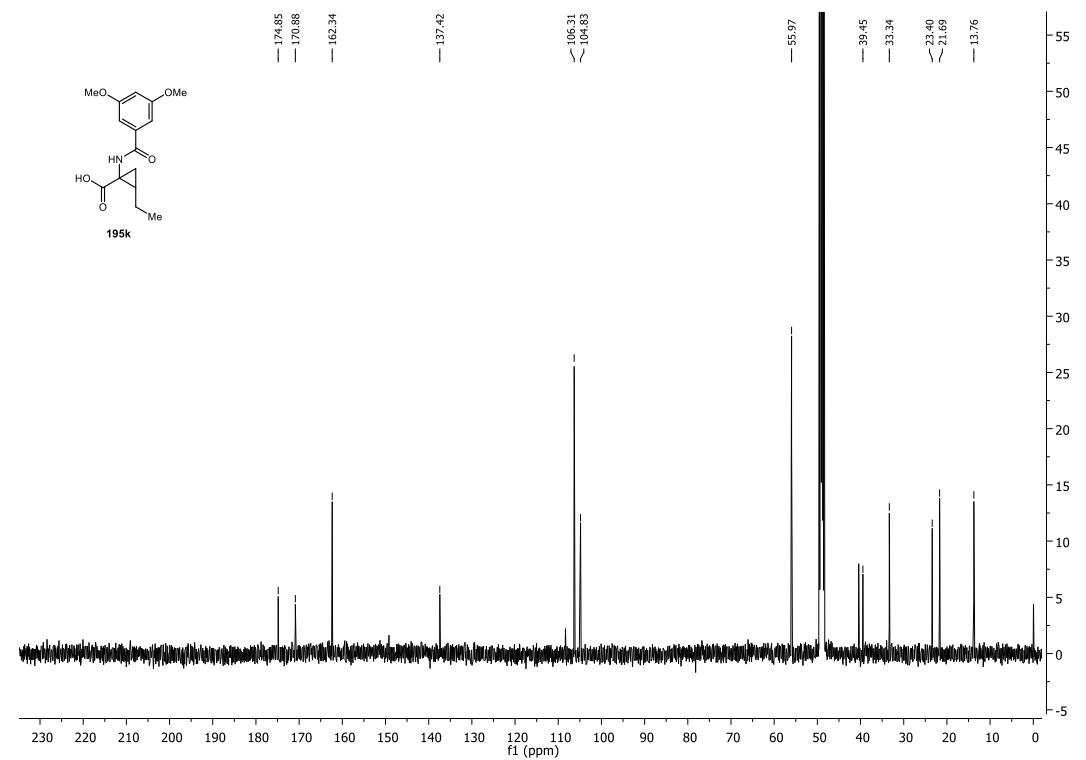
¹³C NMR 195j.



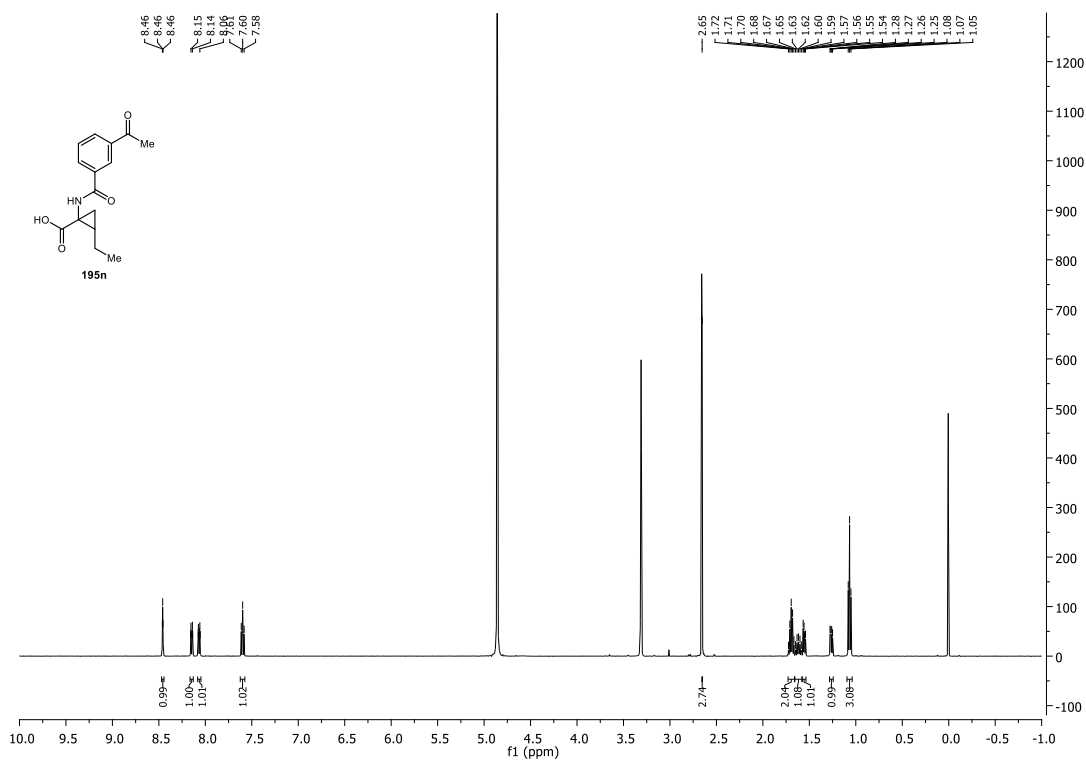
¹H NMR 195k.



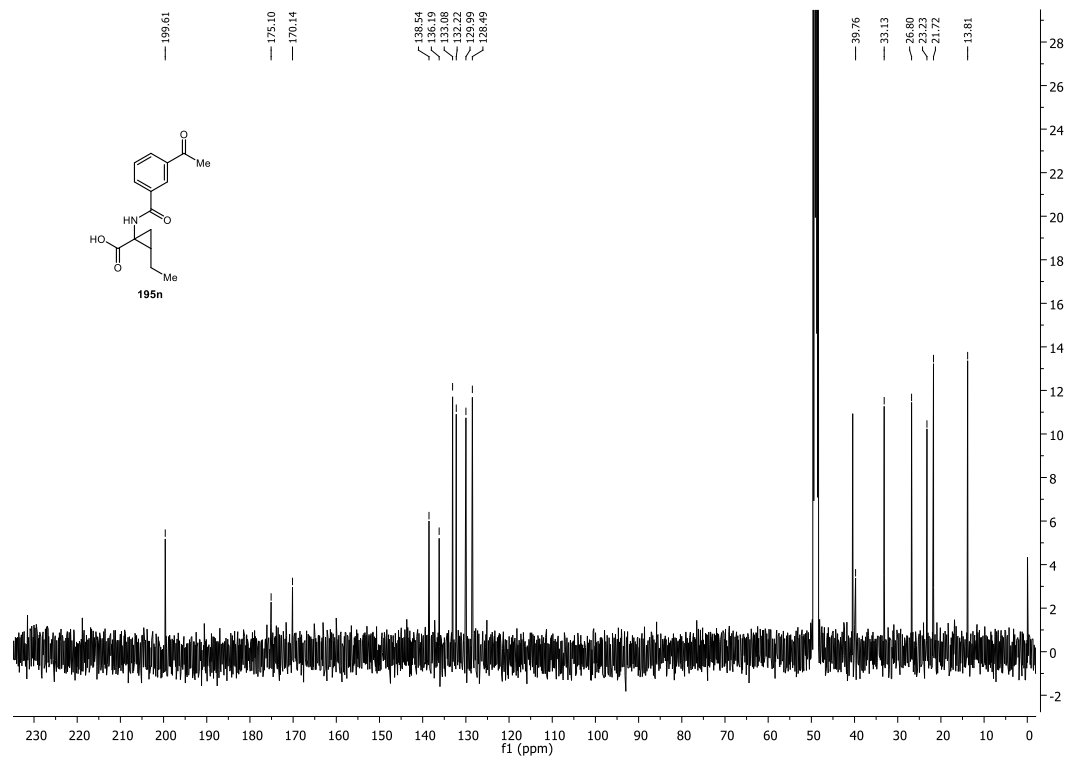
¹³C NMR 195k.



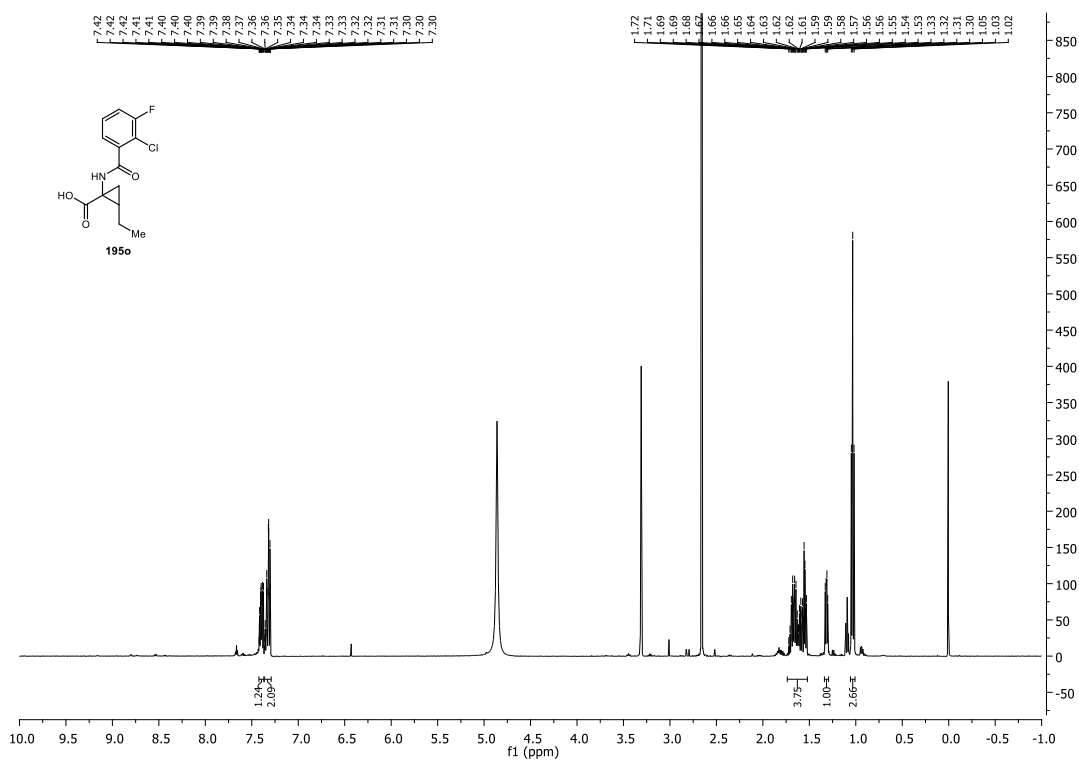
¹H NMR 195n.



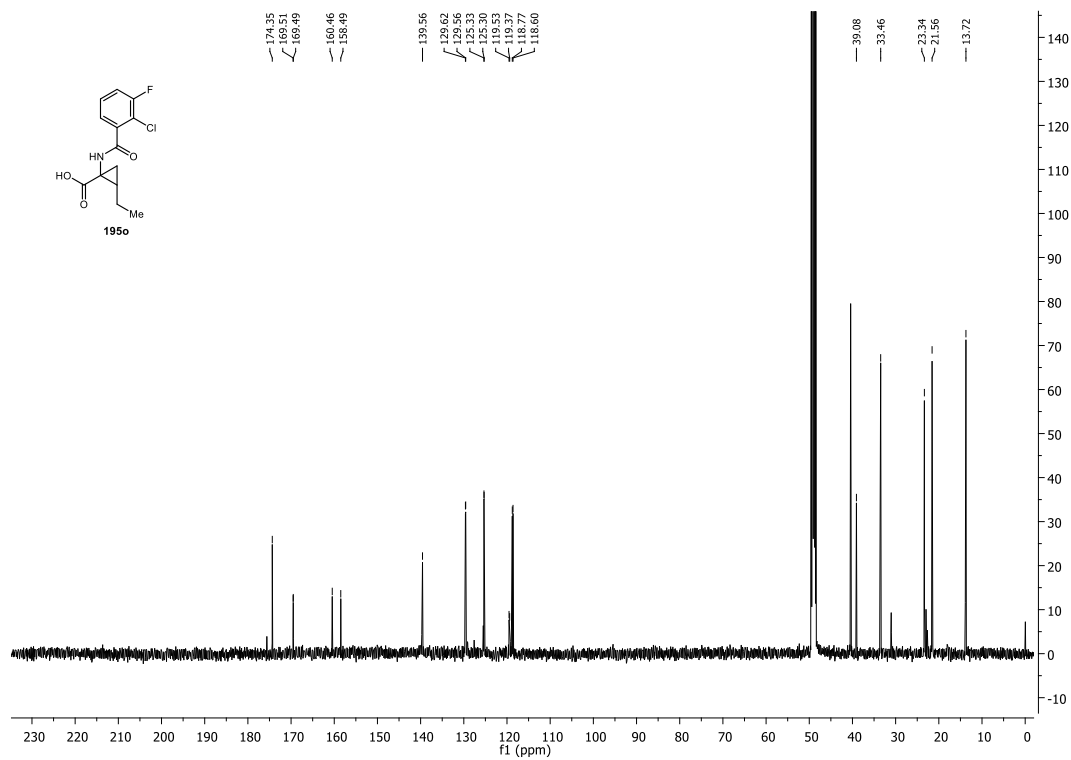
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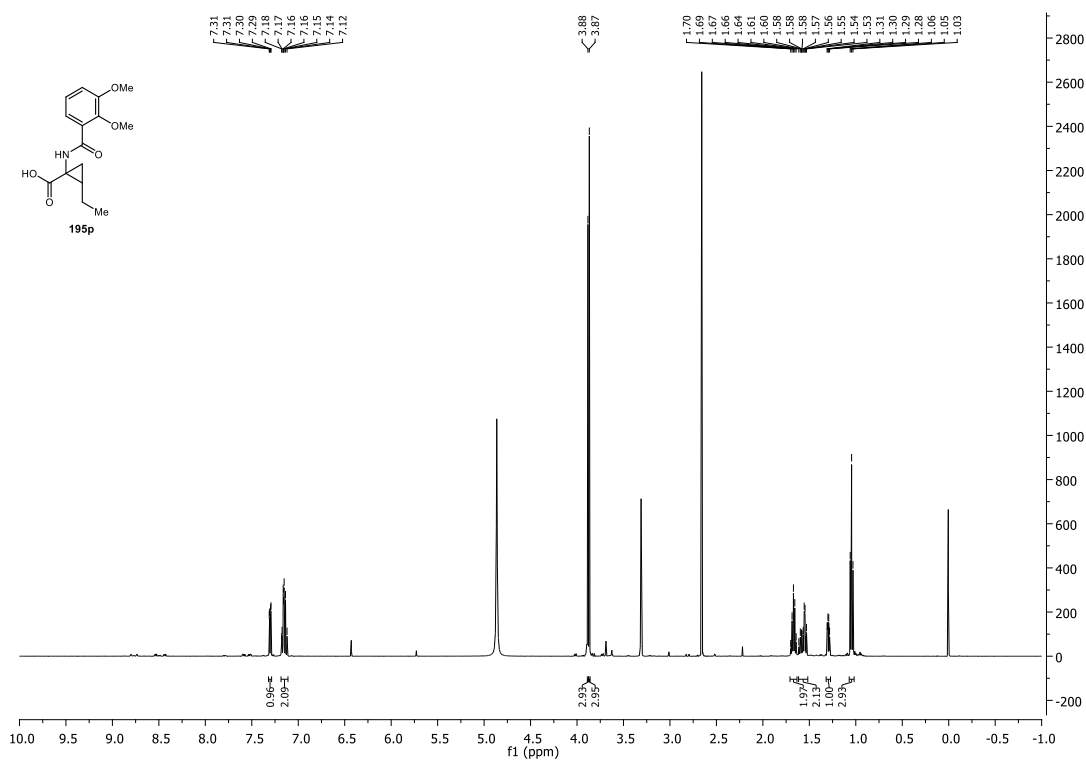
¹H NMR 195o.



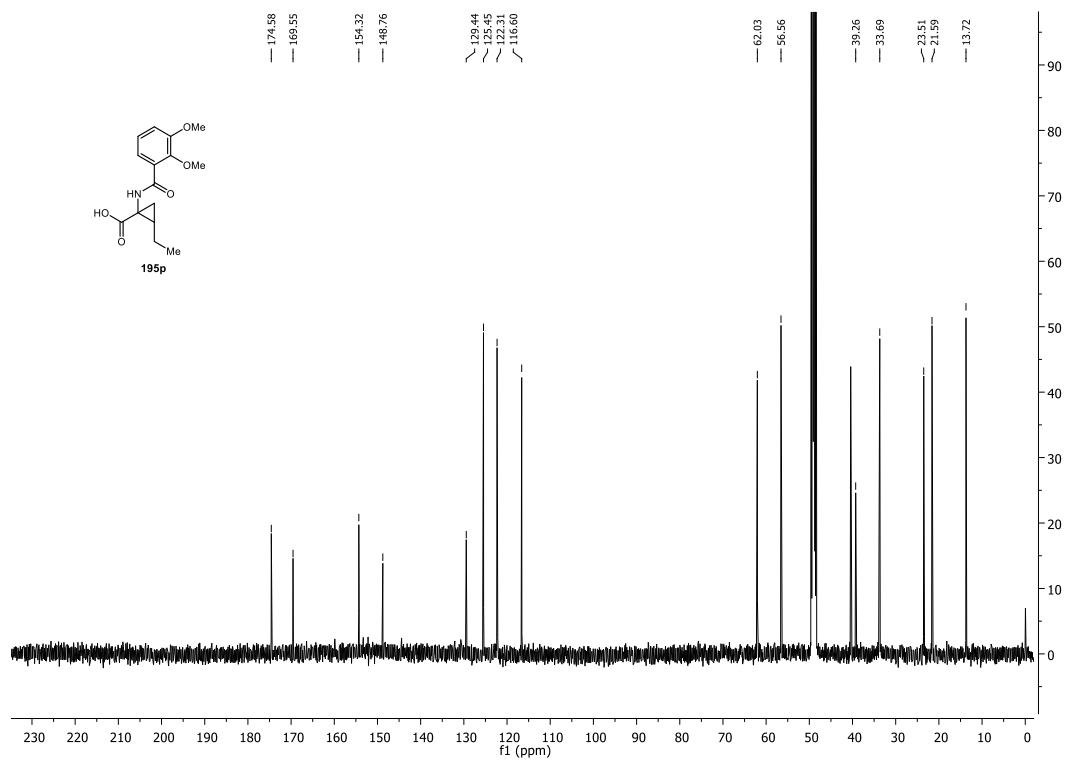
¹³C NMR 195o.



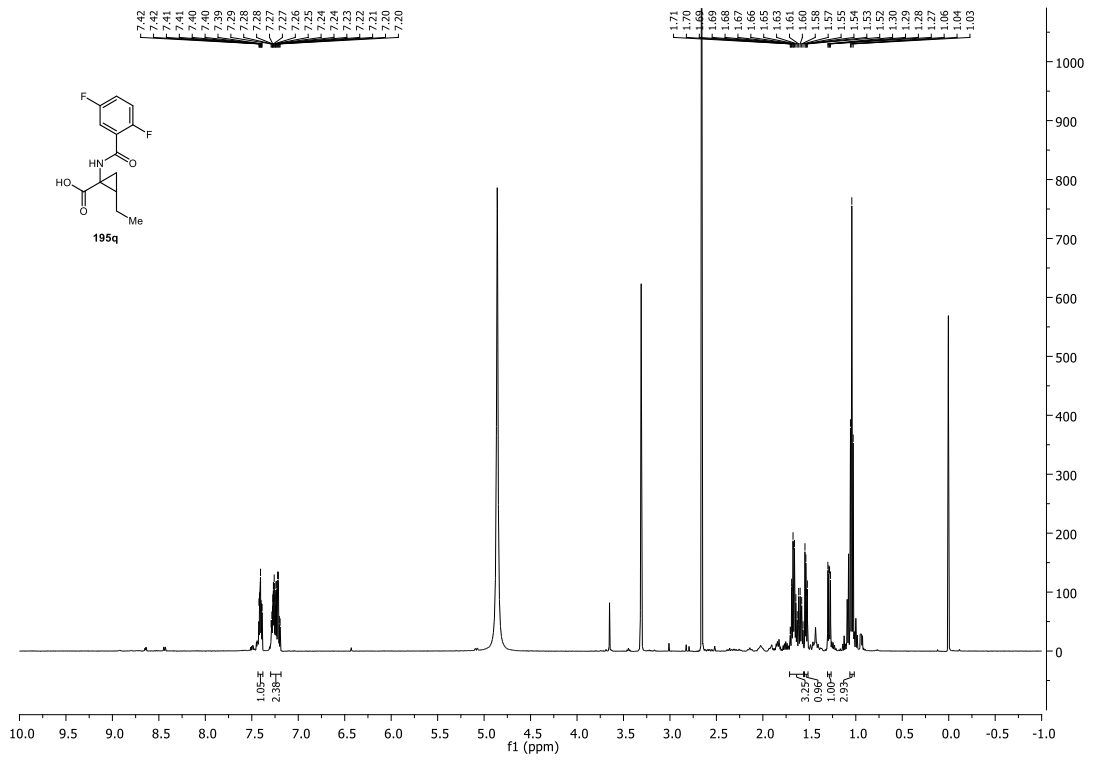
¹H NMR 195p.



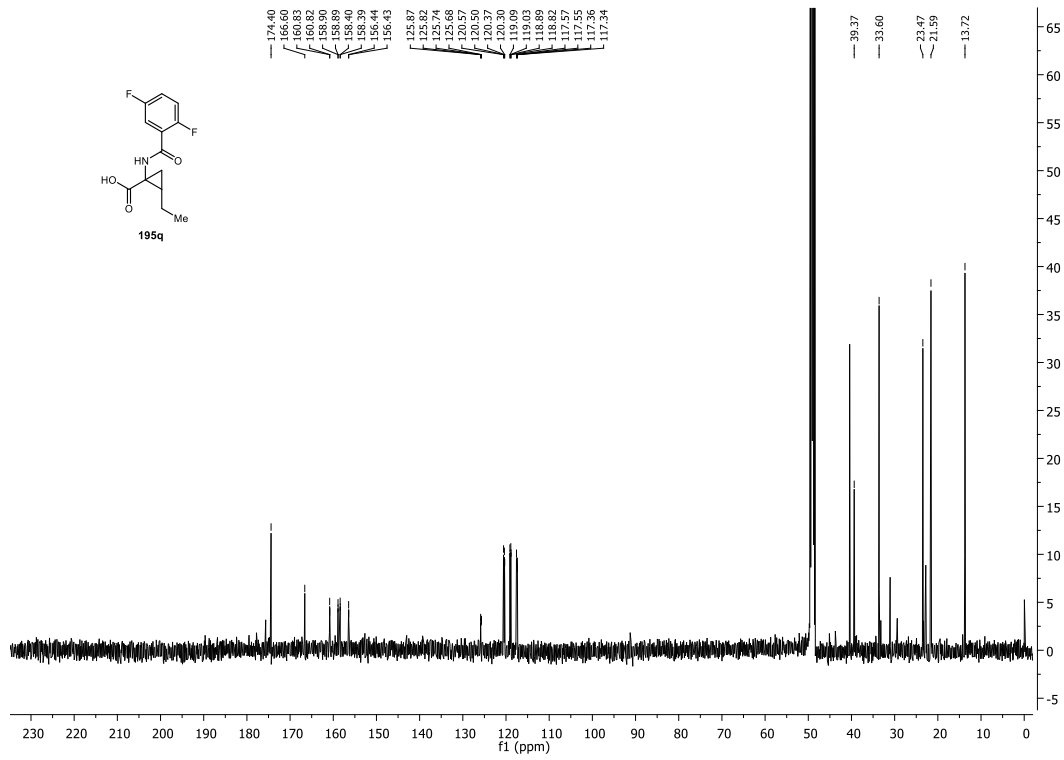
¹³C NMR 195p.



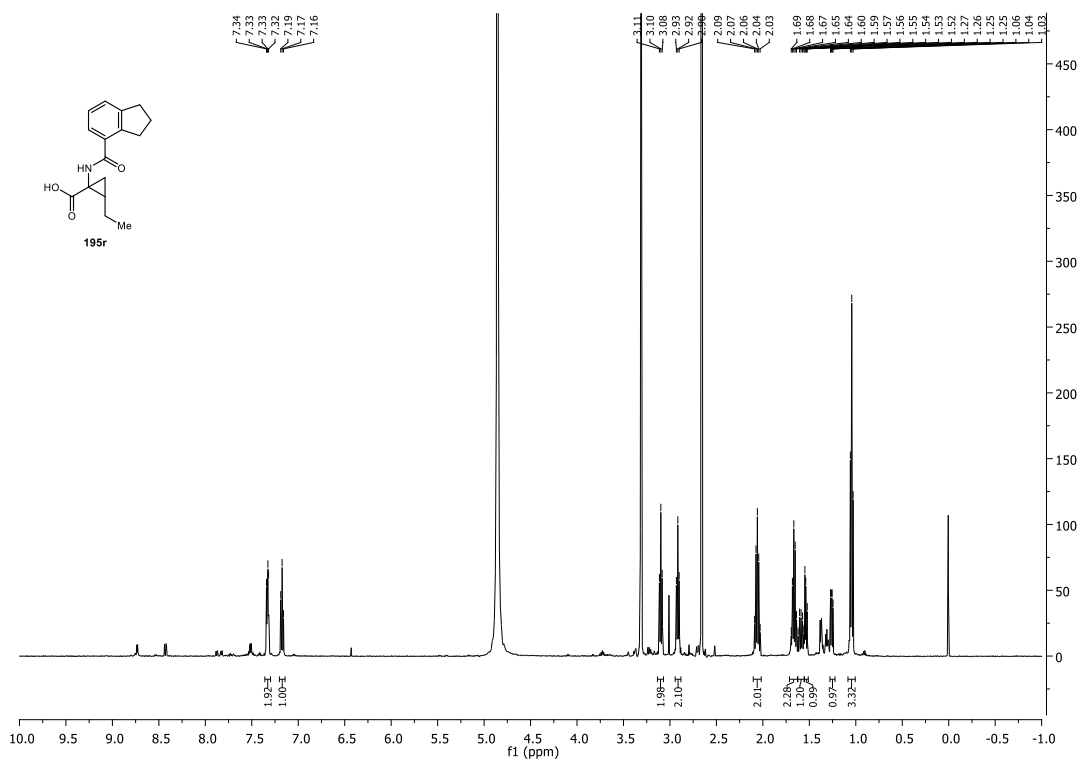
¹H NMR 195q.



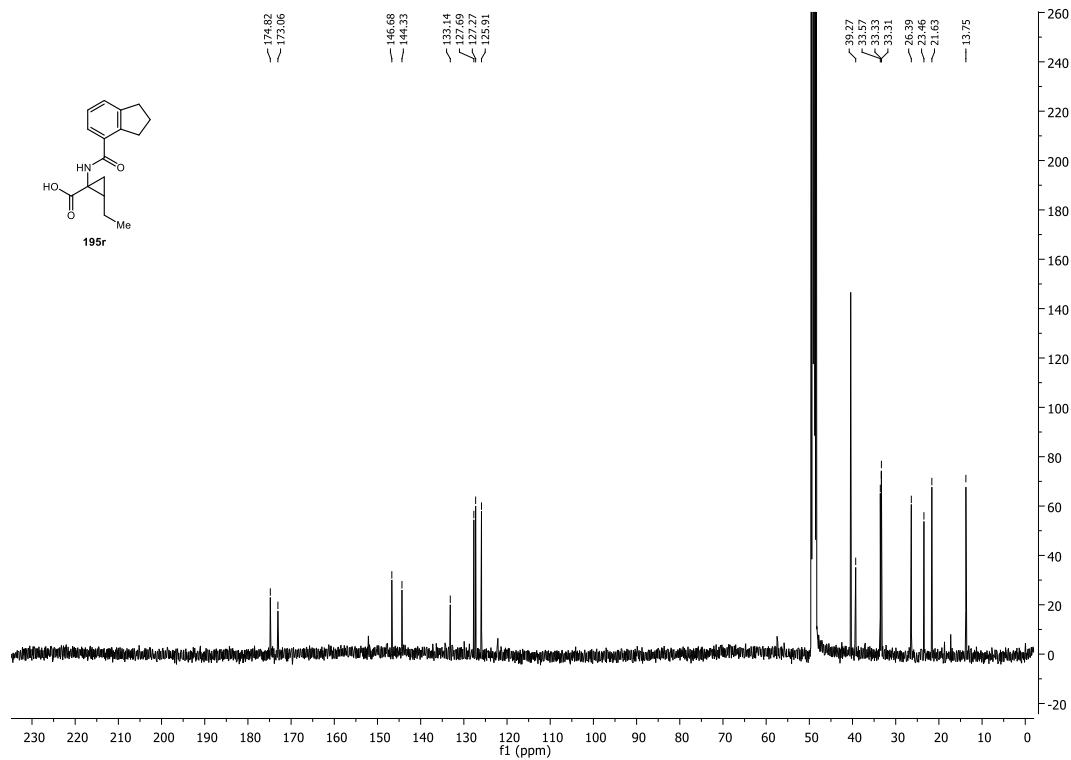
¹³C NMR 195q.



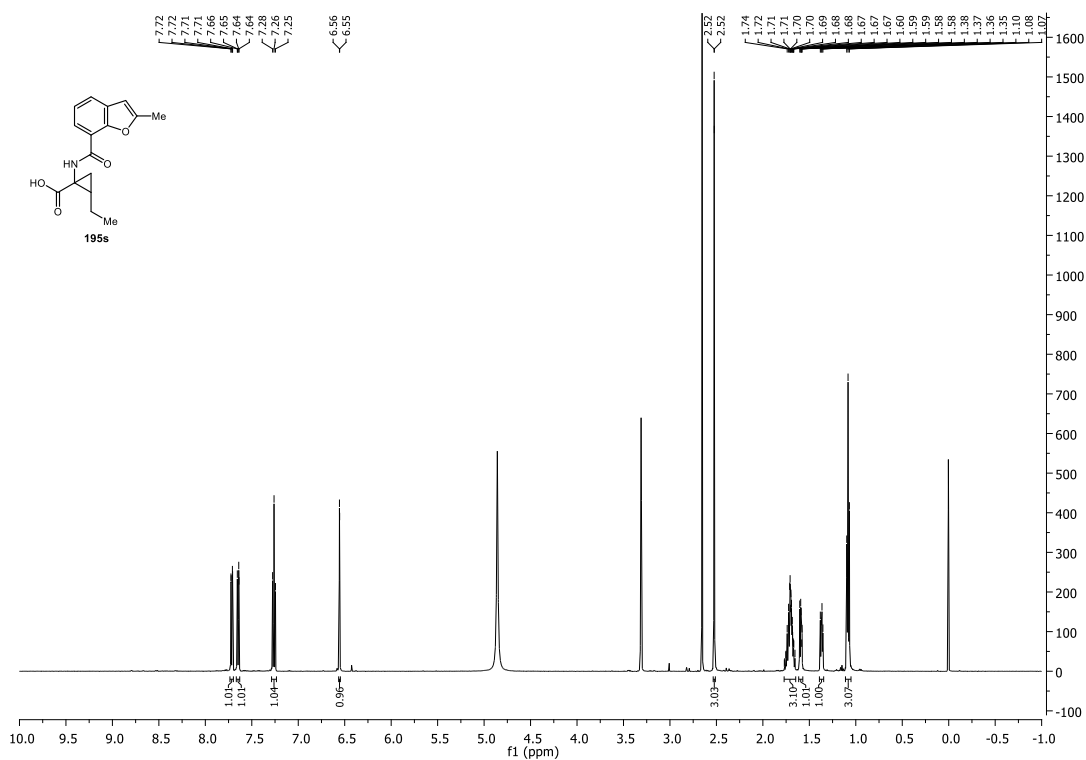
¹H NMR 195r.



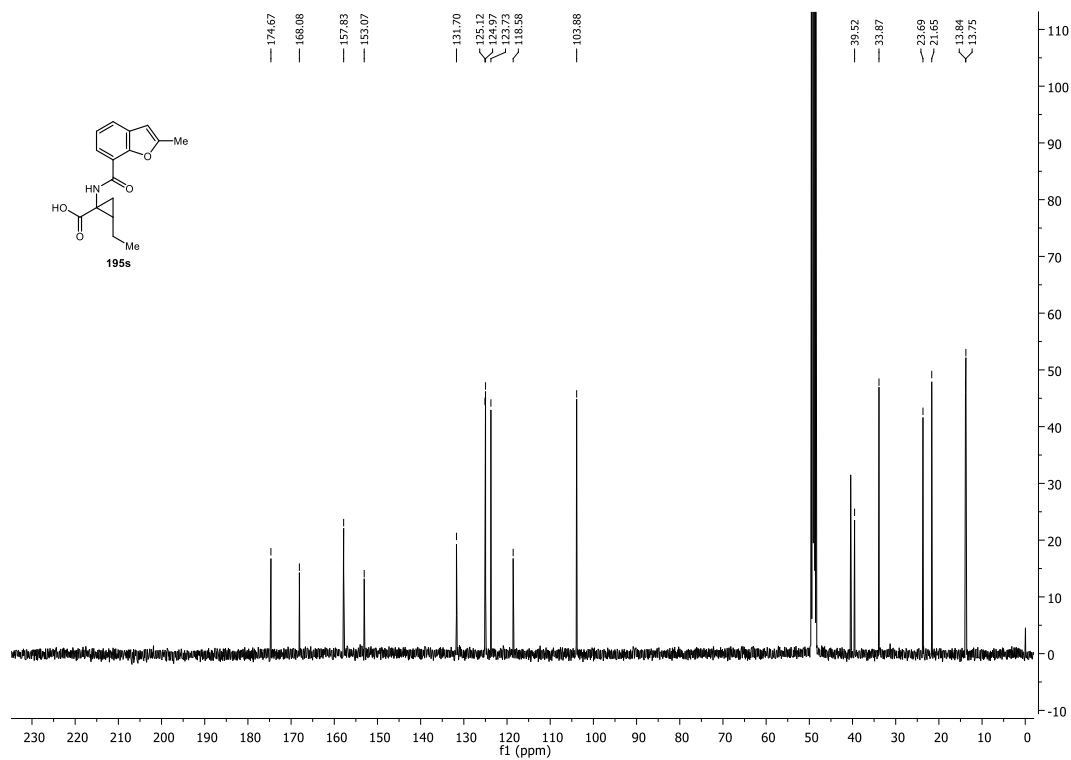
¹³C NMR 195r.



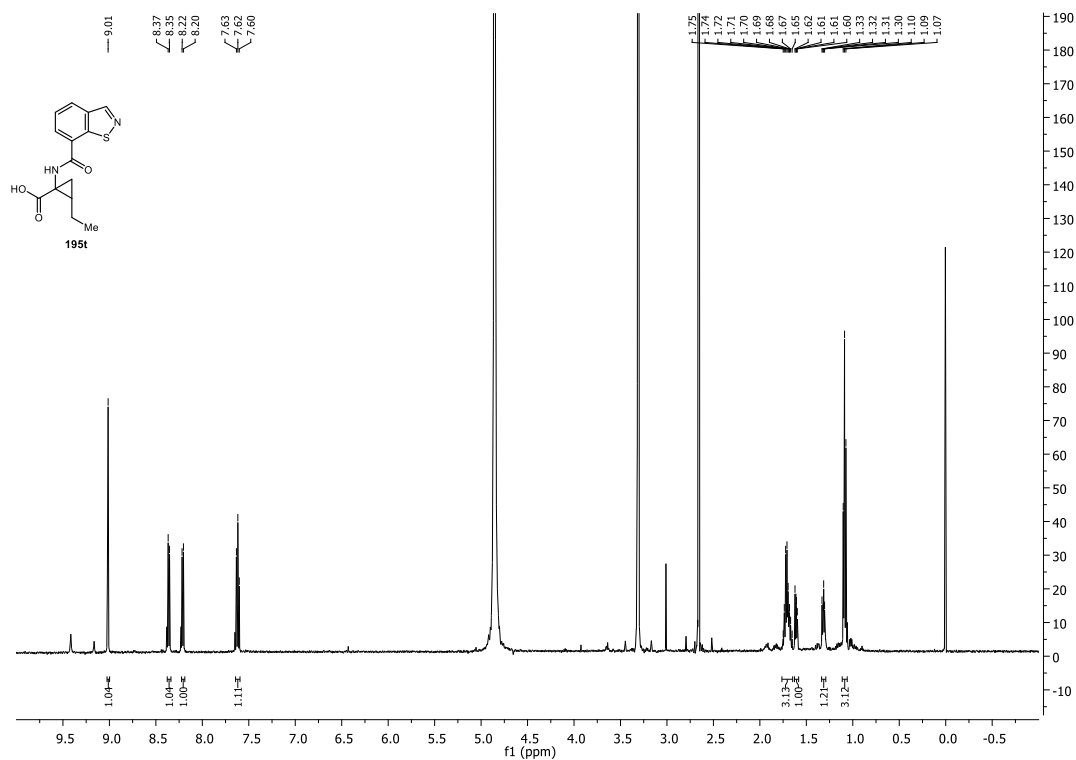
¹H NMR 195s.



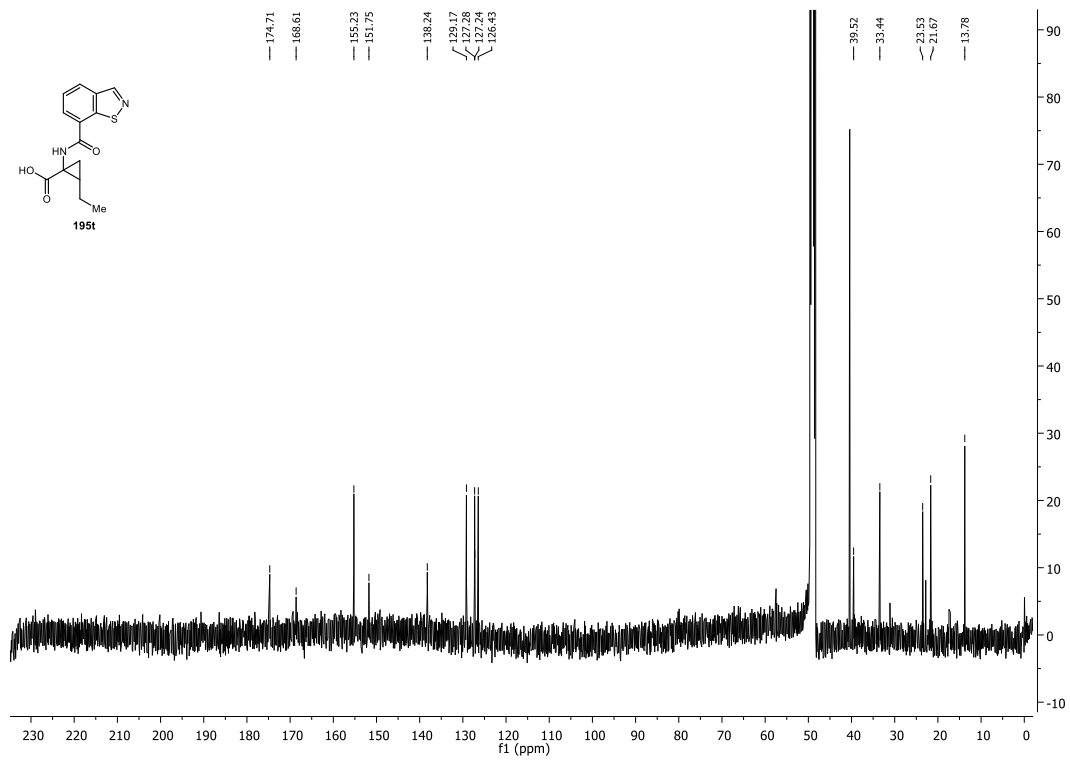
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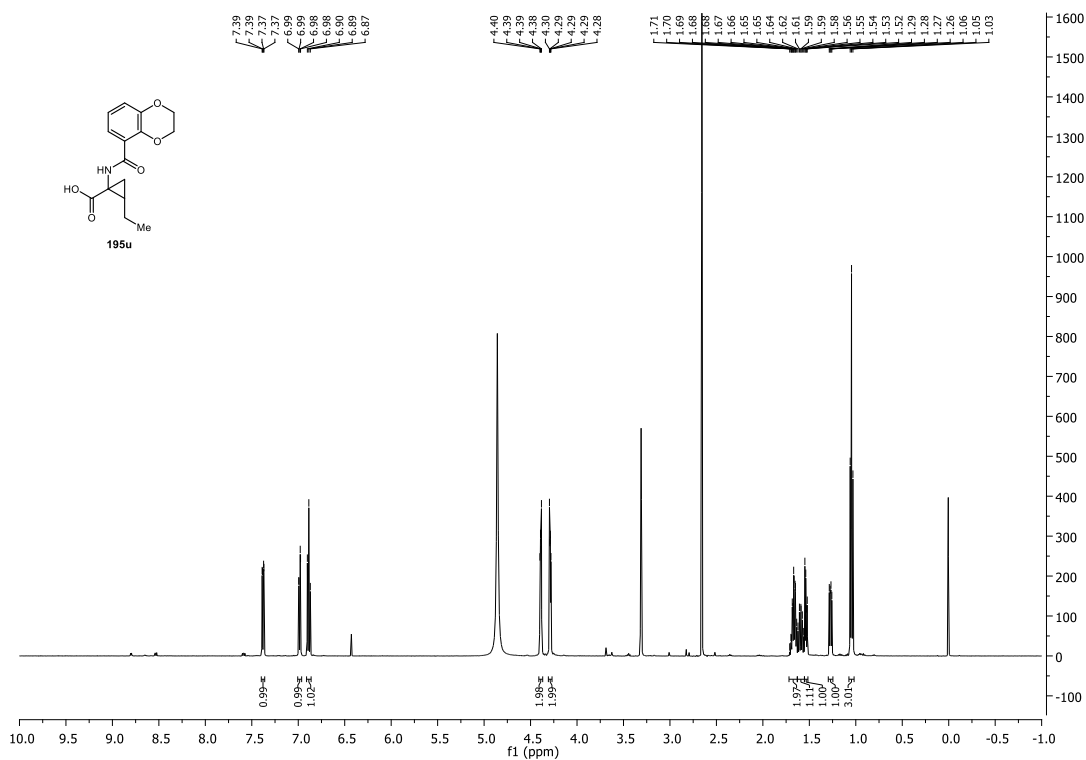
¹H NMR 195t.



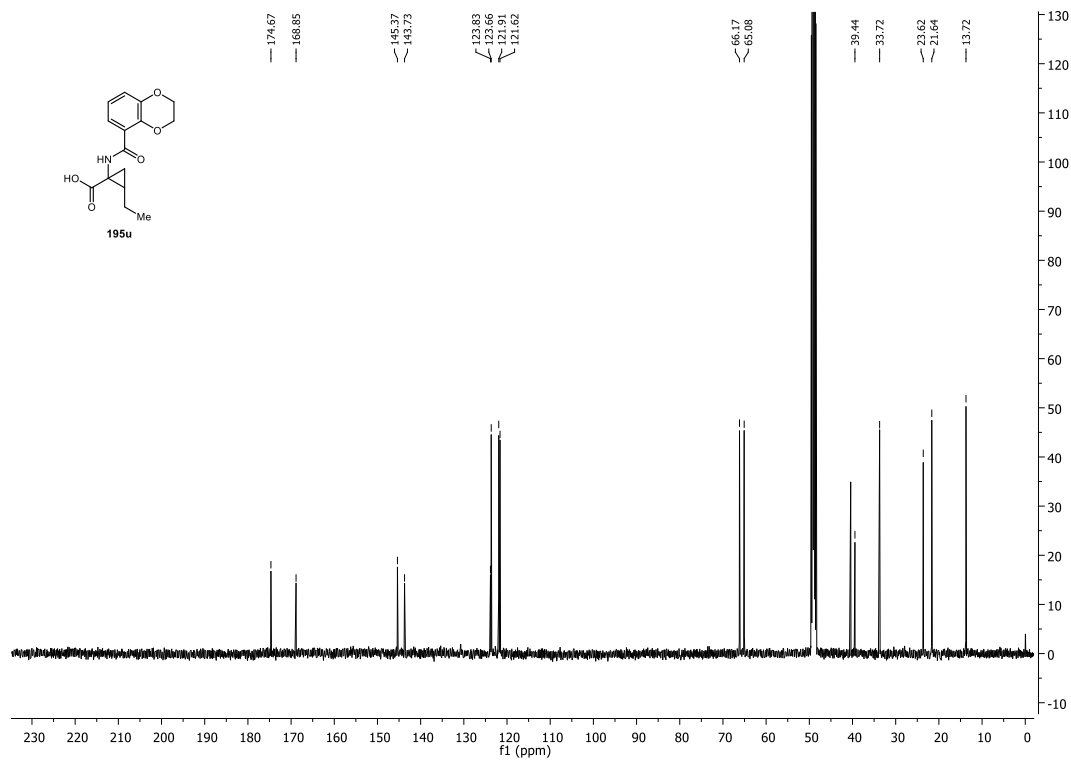
¹³C NMR 195t.



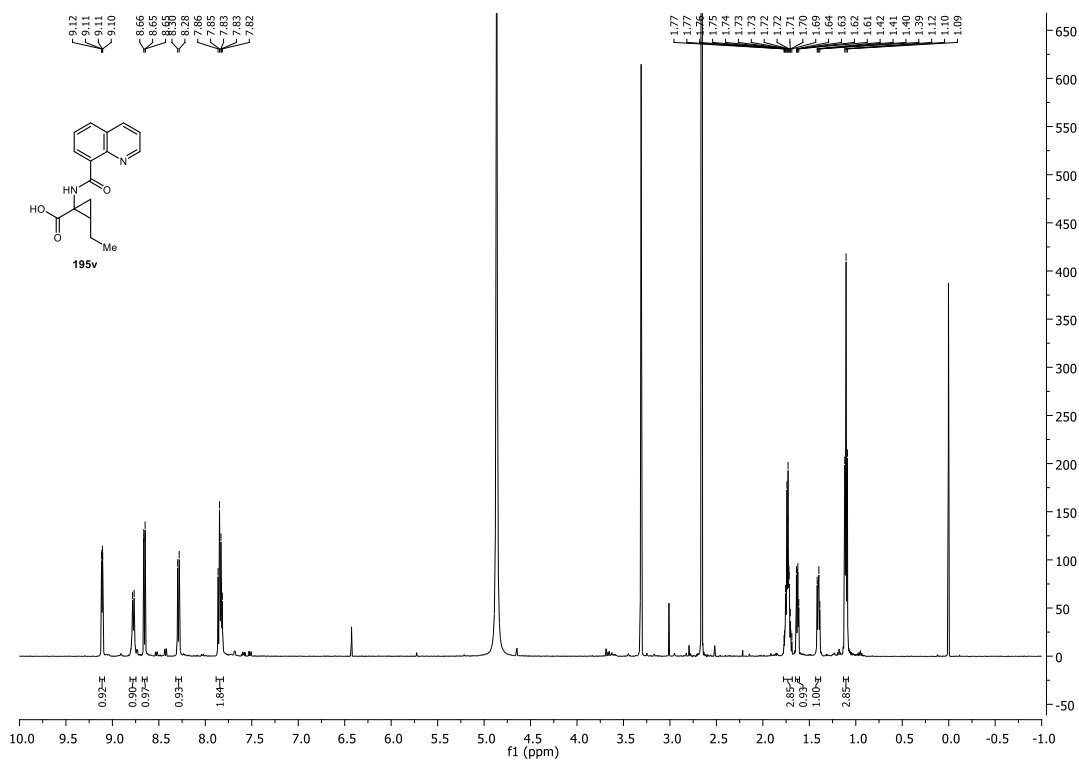
¹H NMR 195u.



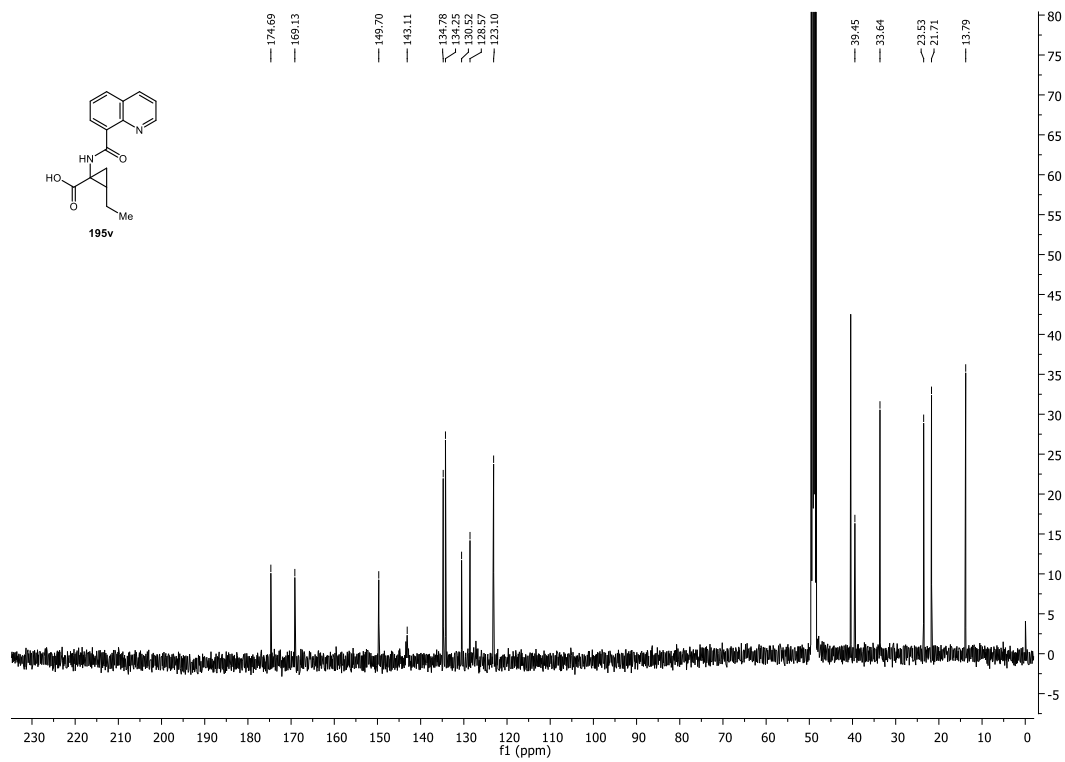
¹³C NMR 195u.



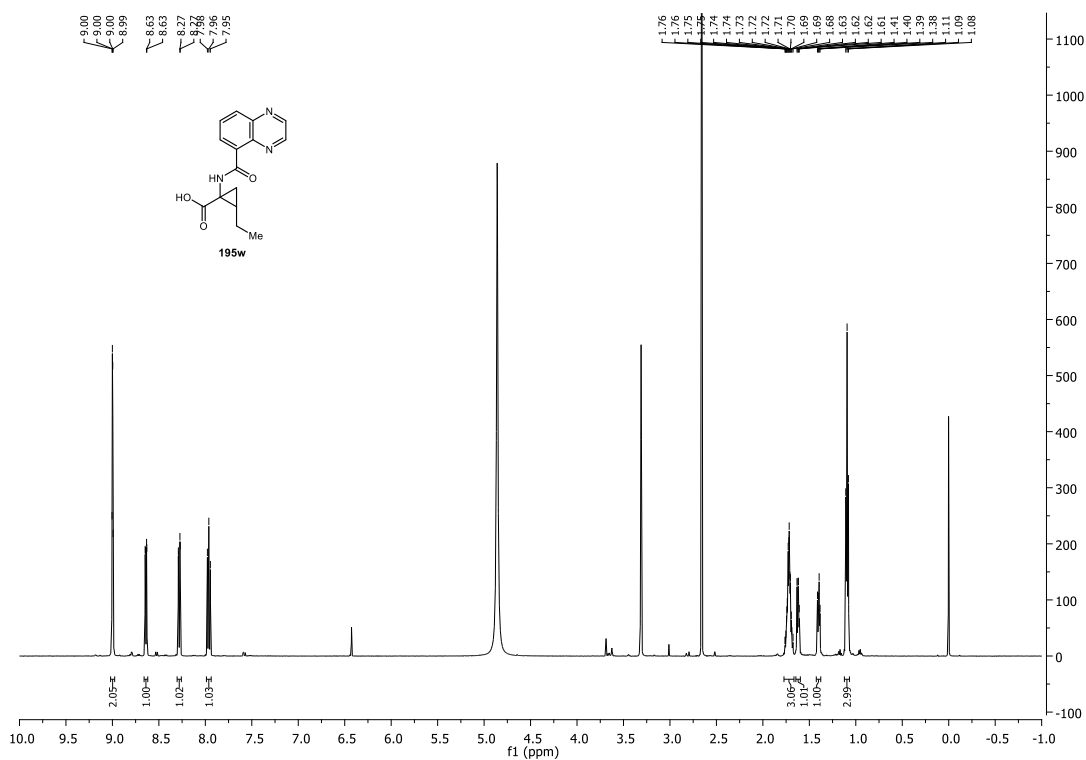
¹H NMR 195v.



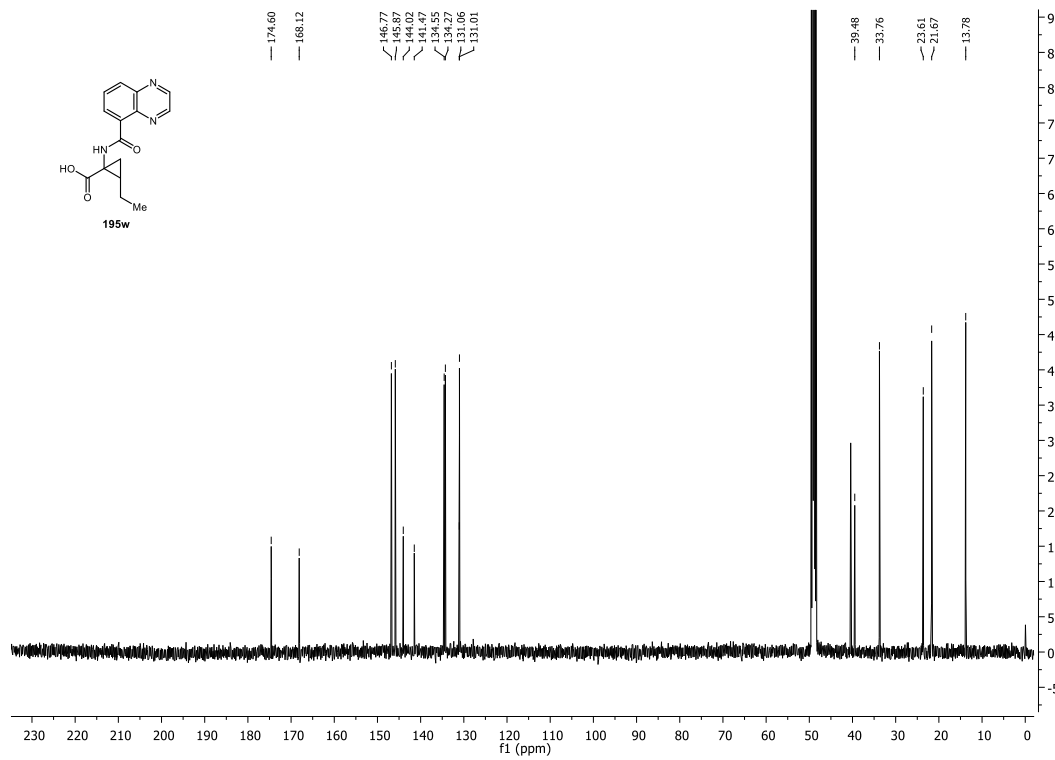
¹³C NMR 195v.



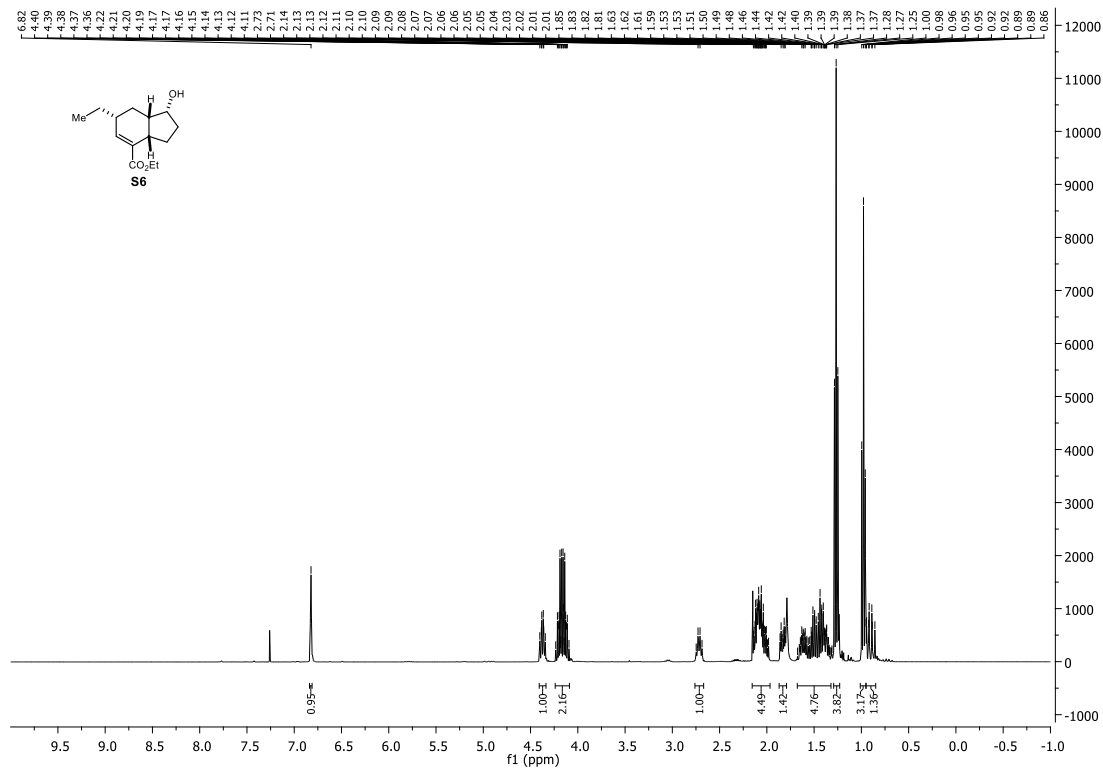
¹H NMR 195w.



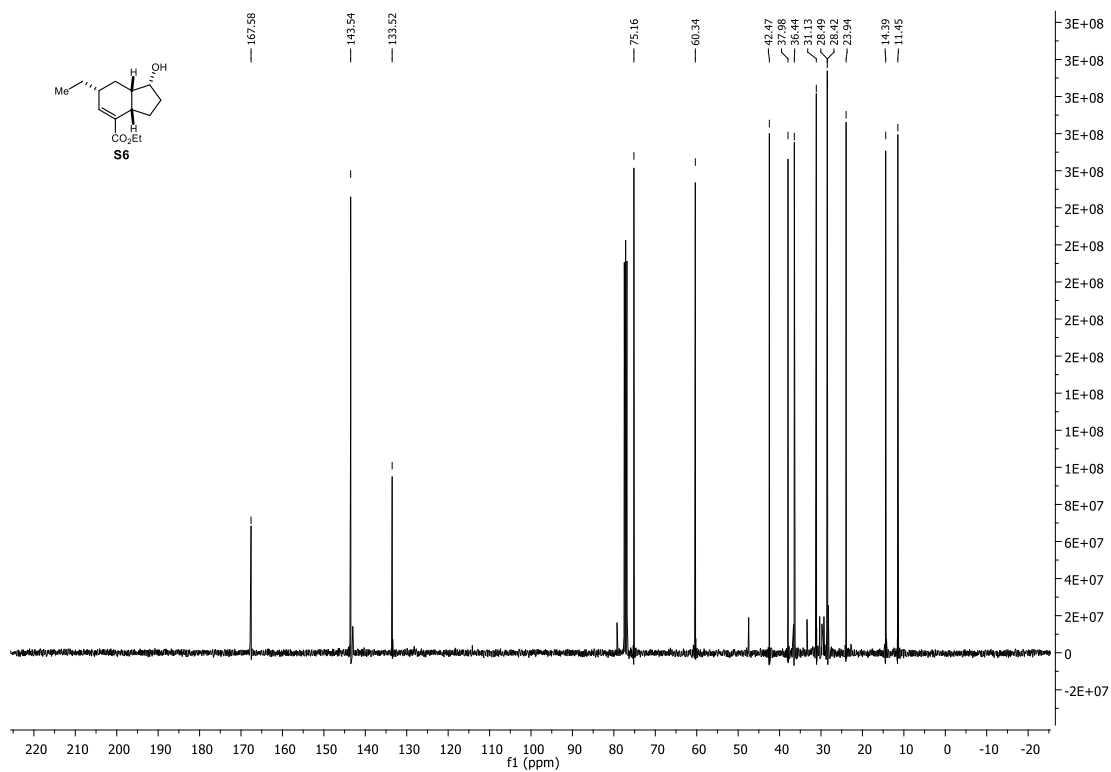
¹³C NMR 195w.



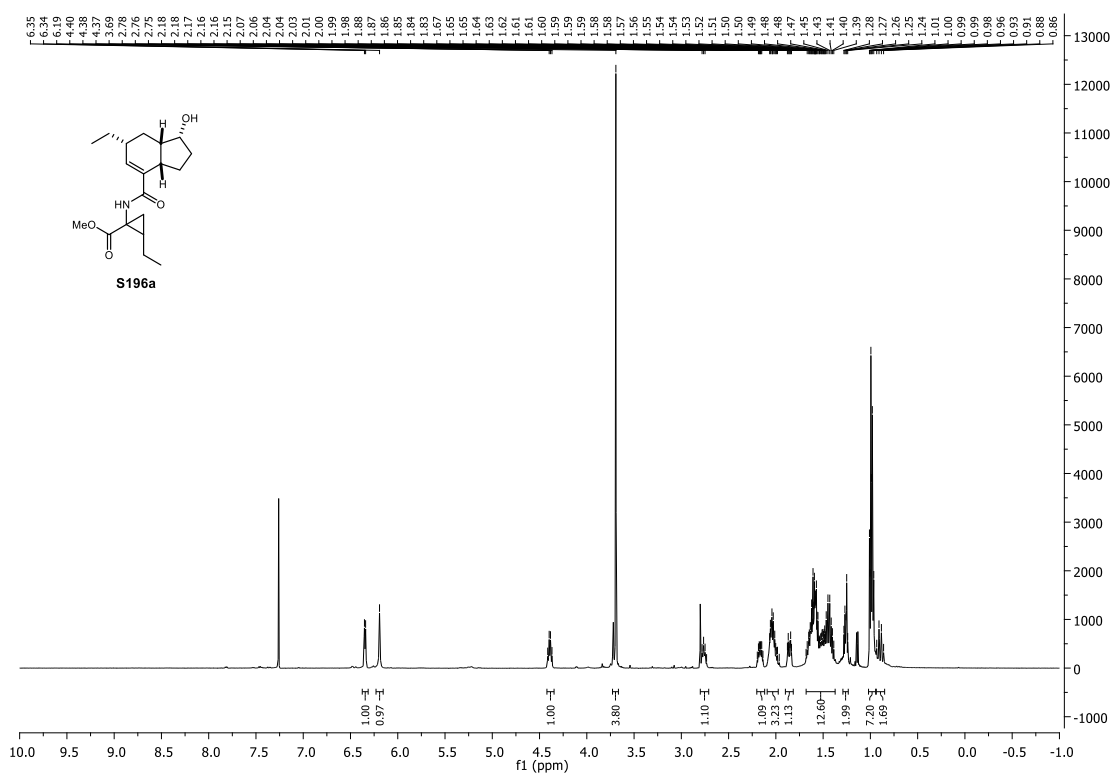
¹H NMR S6.



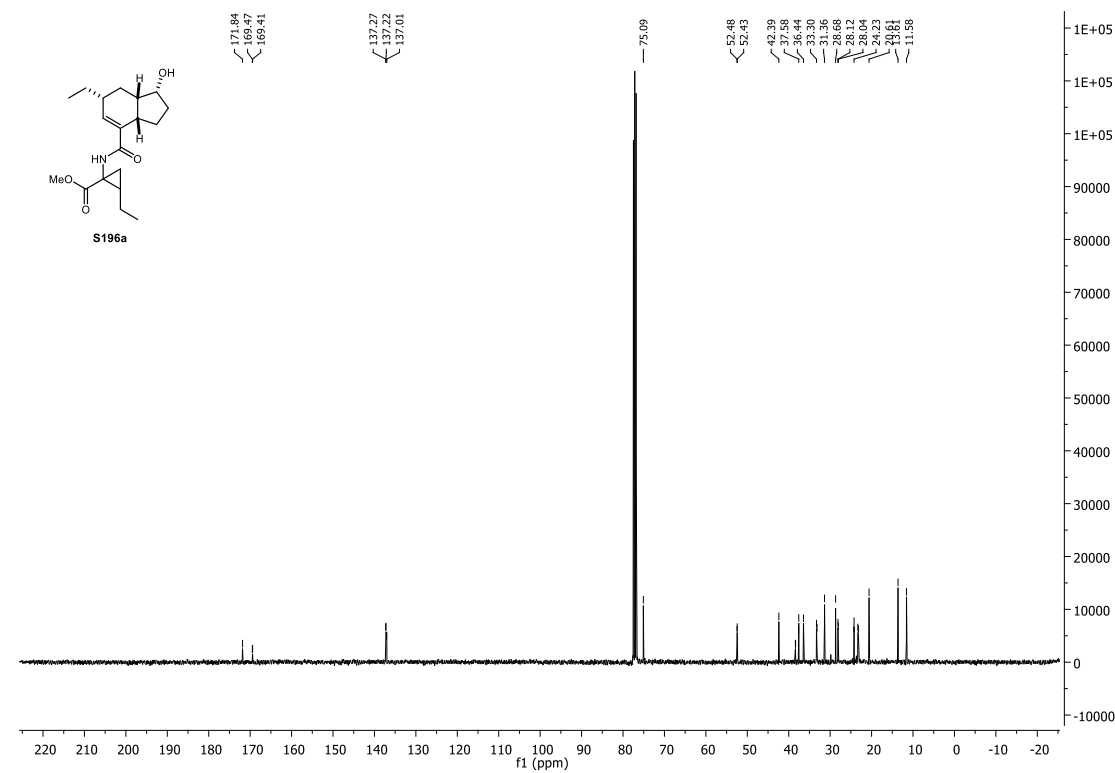
¹³C NMR S6.



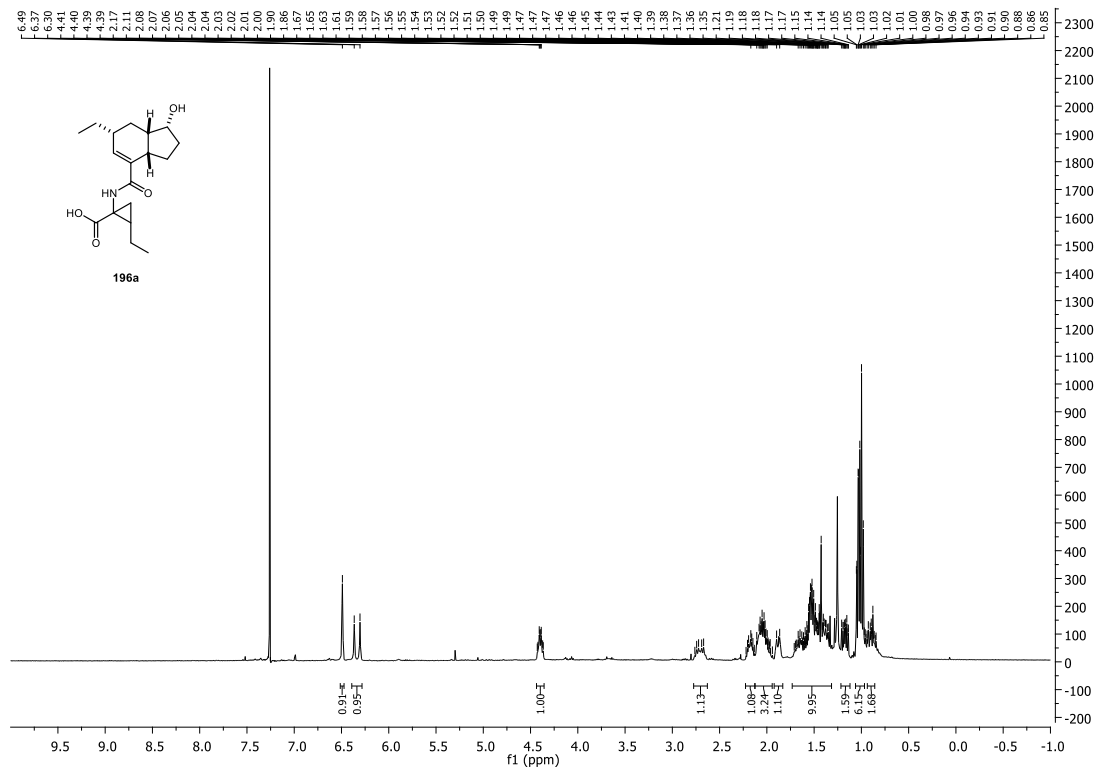
¹H NMR S196a.



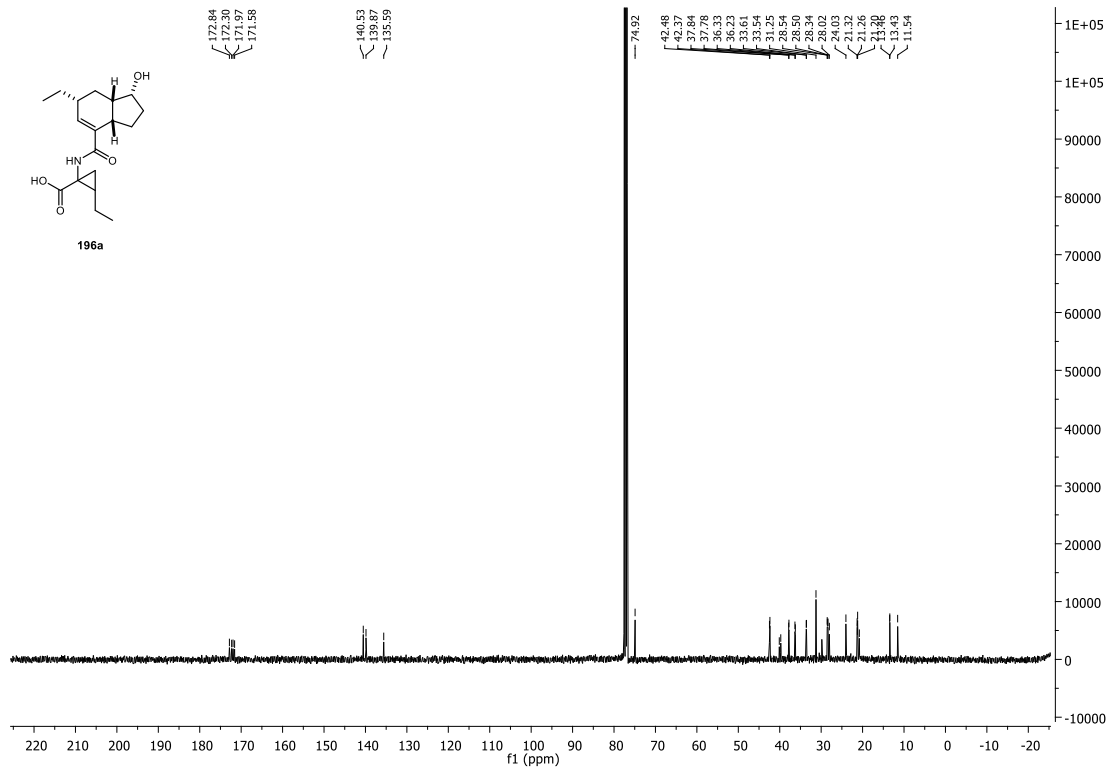
¹³C NMR S196a.



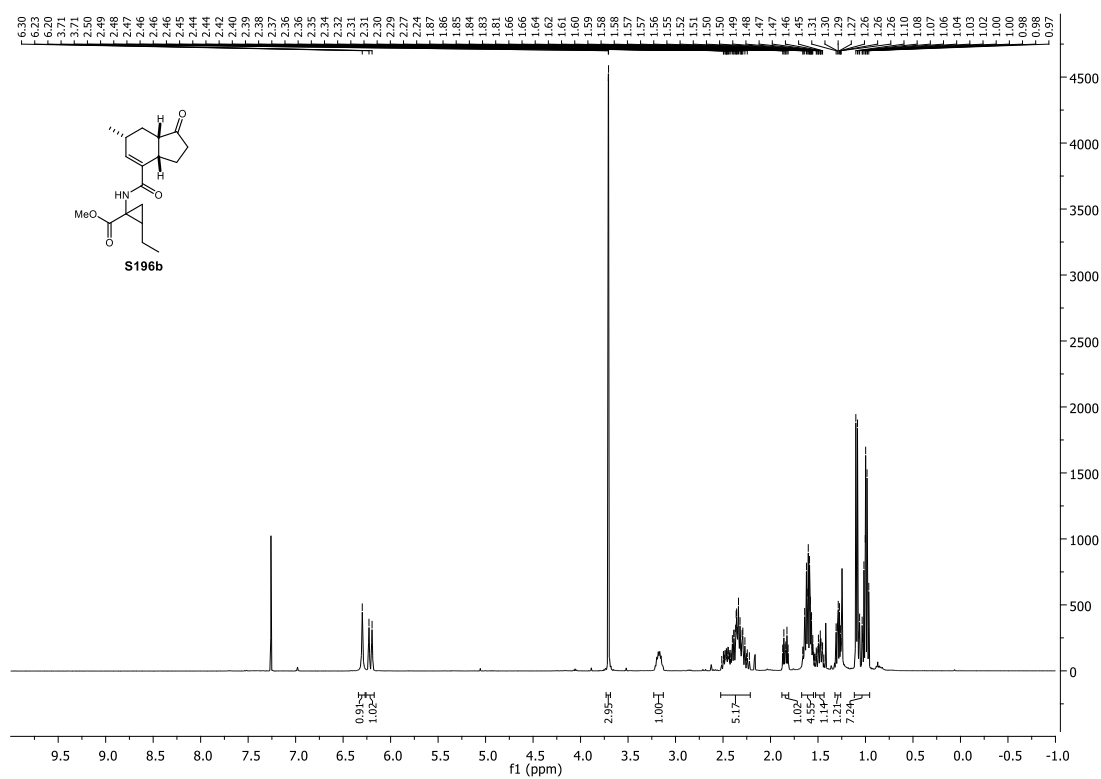
¹H NMR 196a.



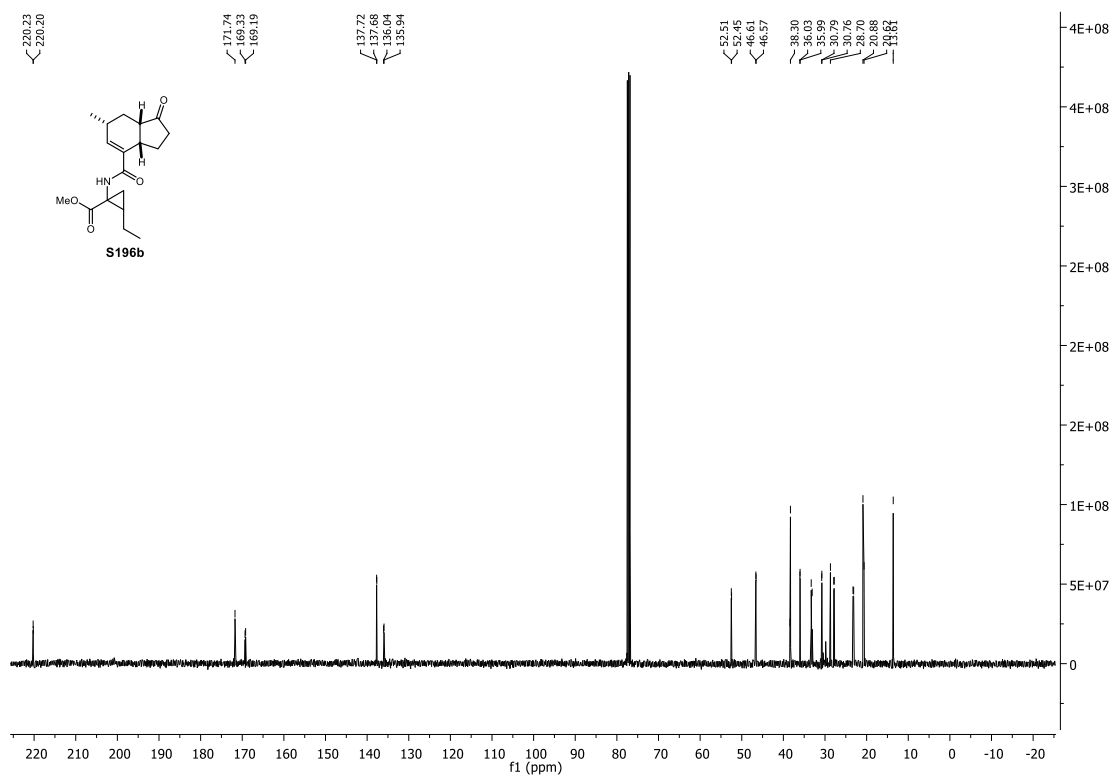
¹³C NMR 196a.



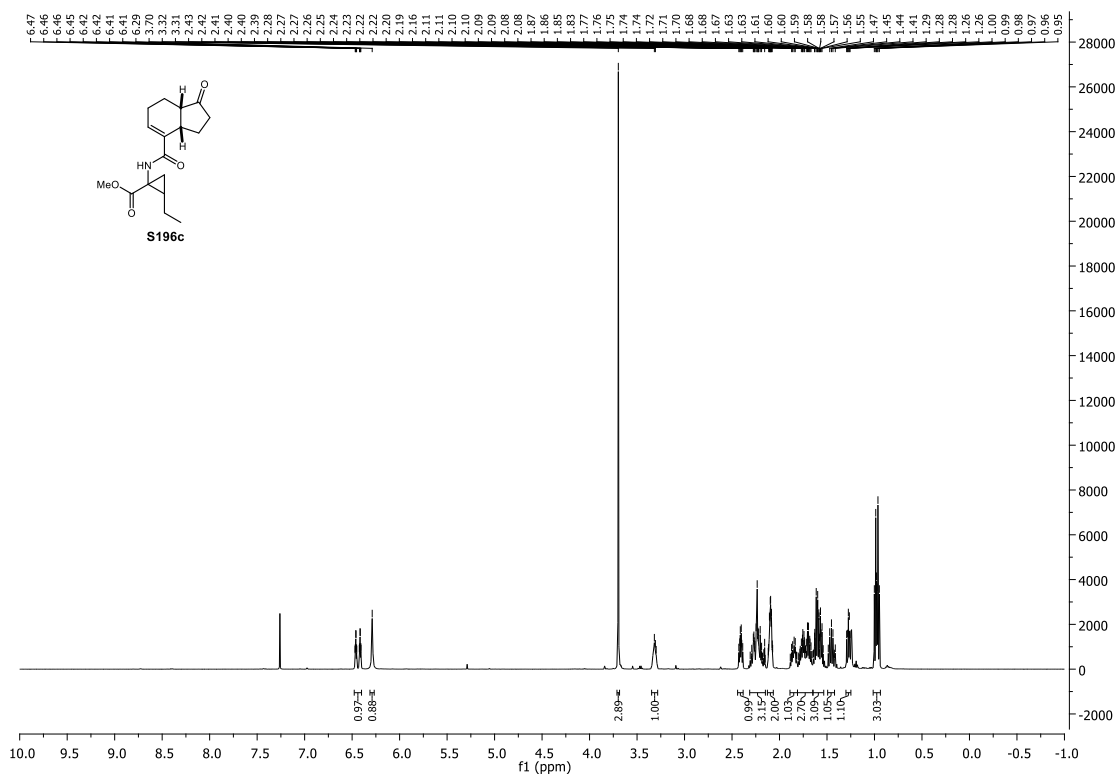
¹H NMR S196b.



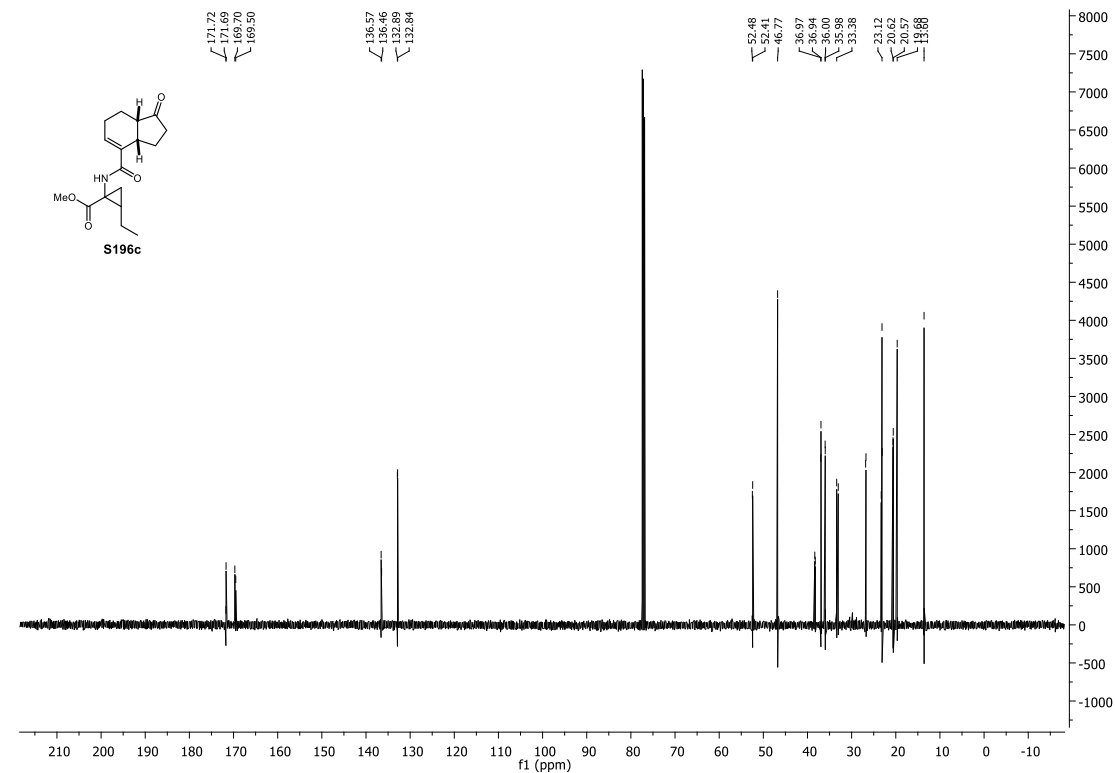
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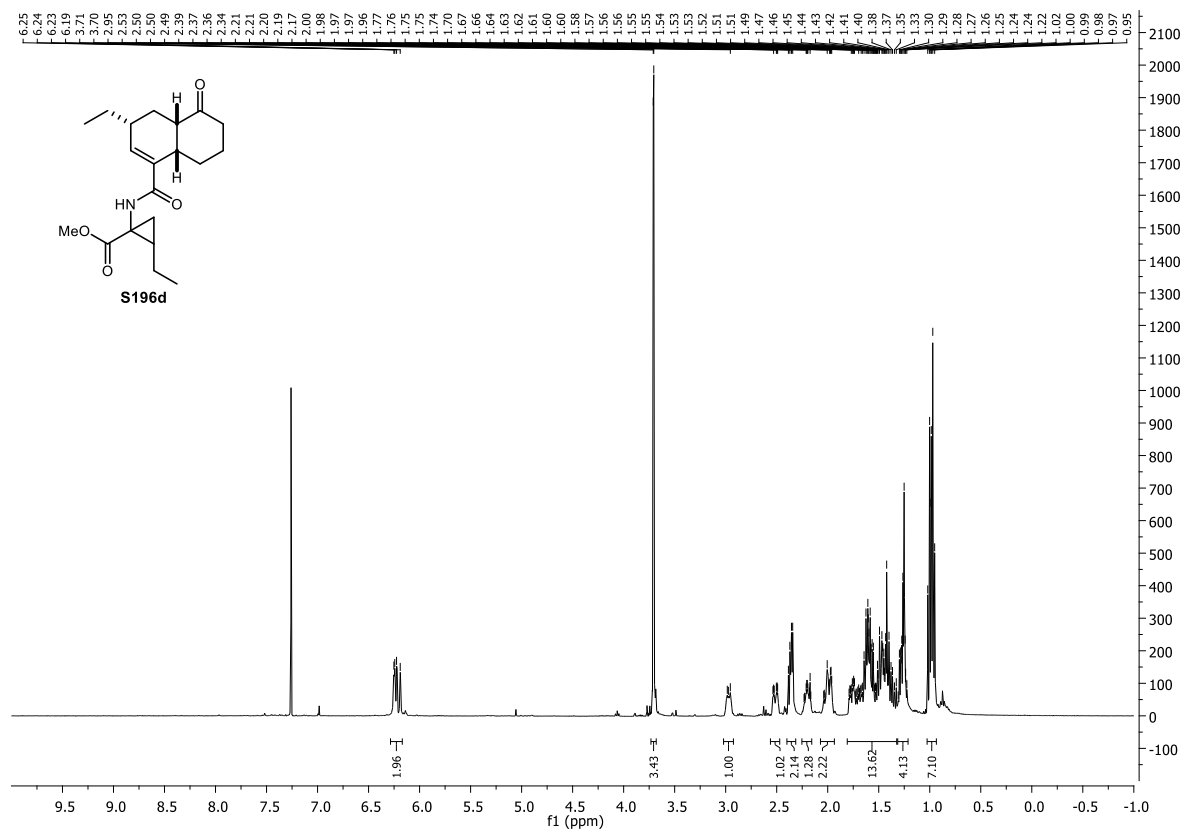
¹H NMR S196c.



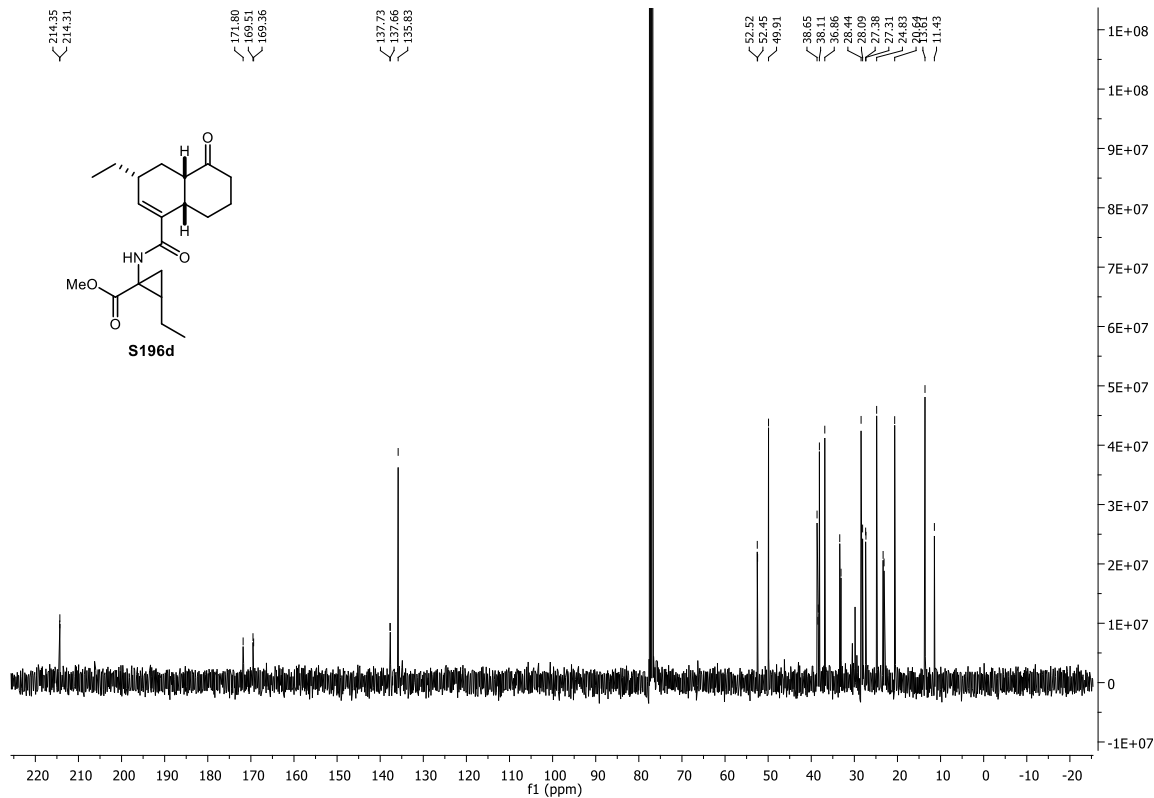
¹³C NMR S196c.



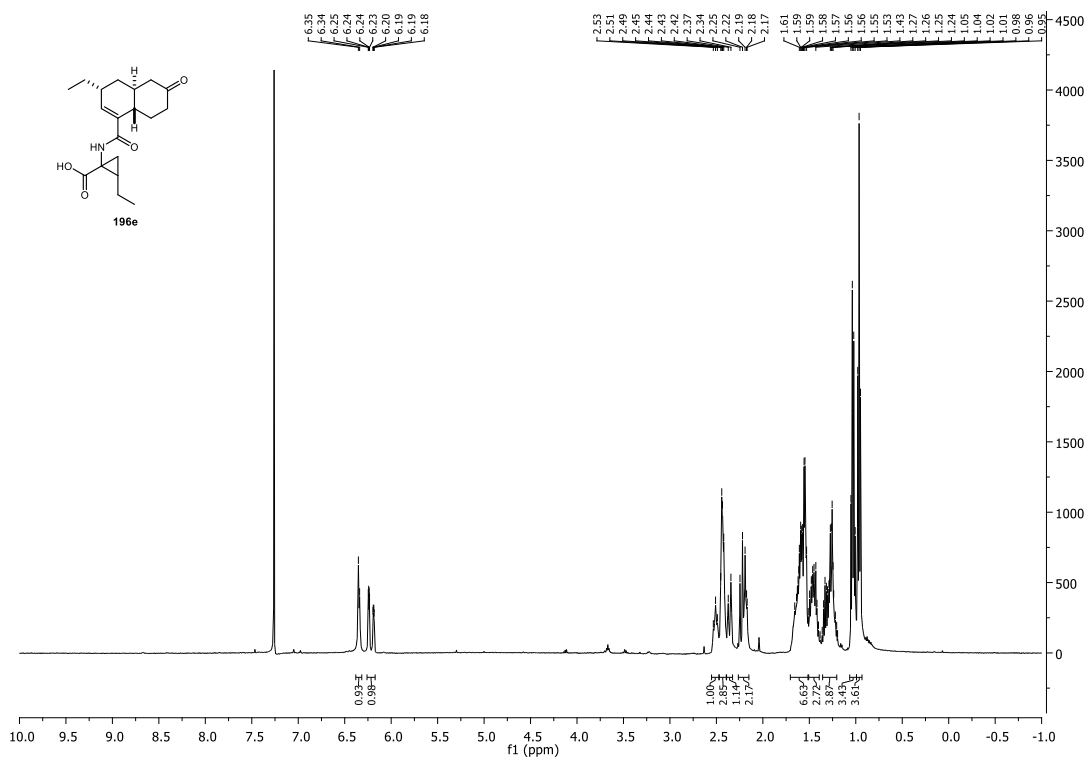
¹H NMR S196d.



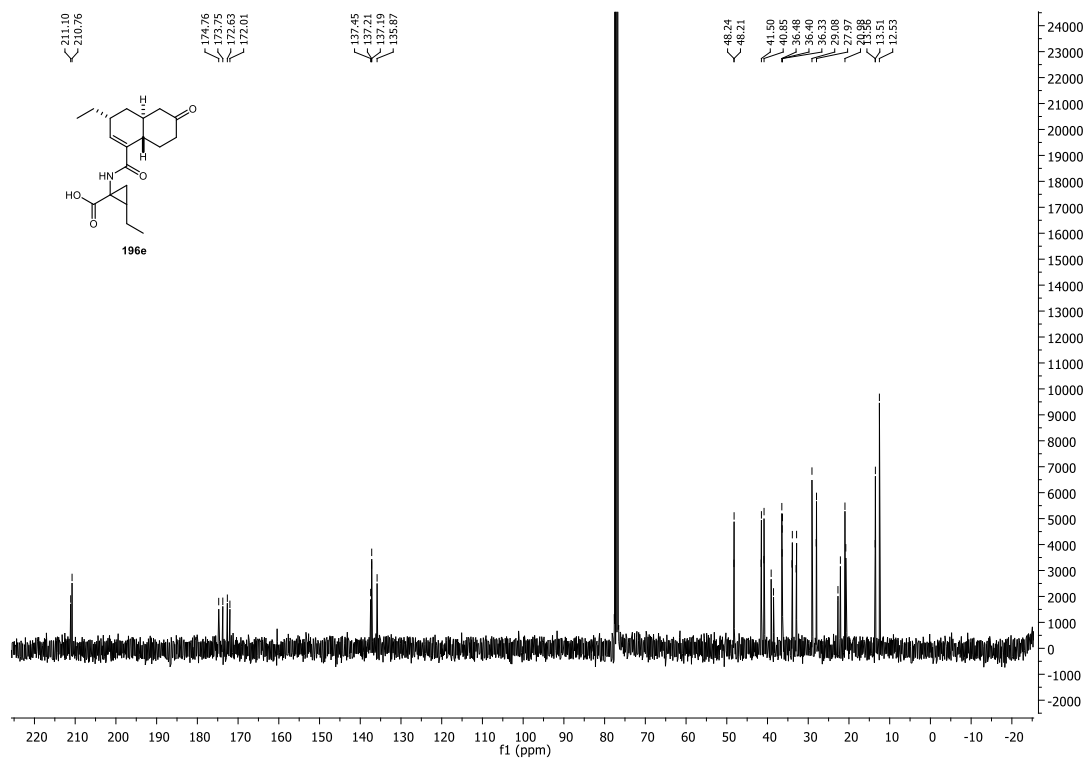
¹³C NMR S196d.



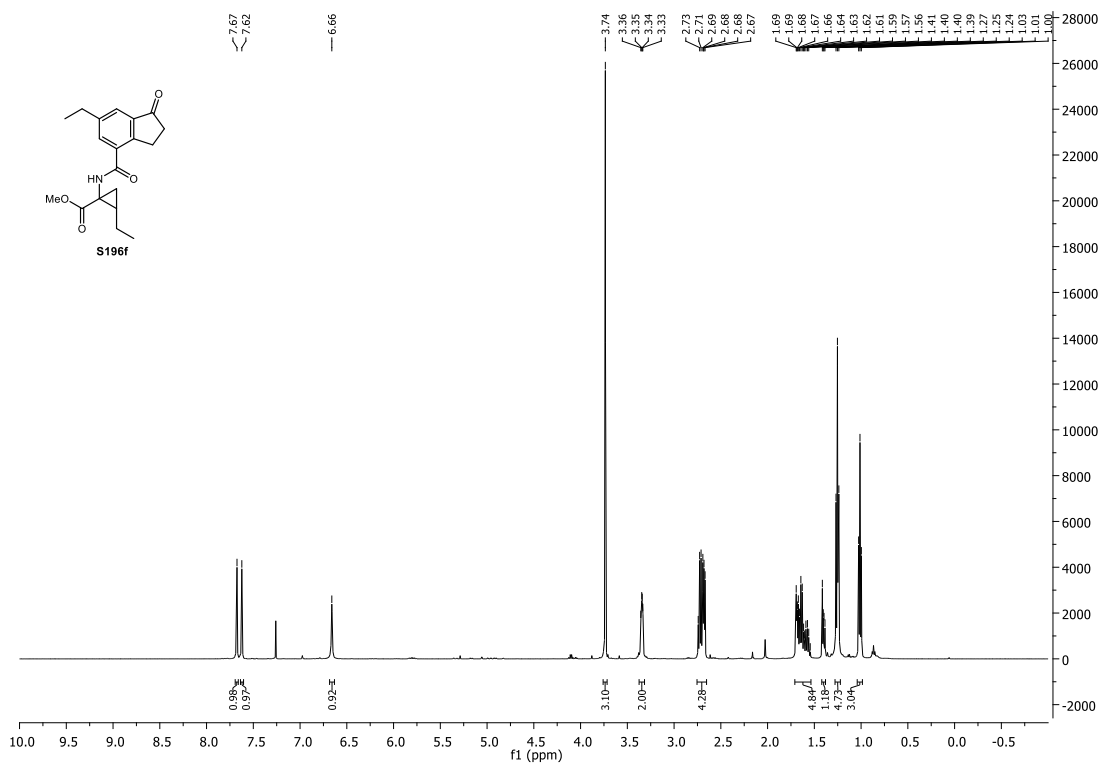
¹H NMR 196e.



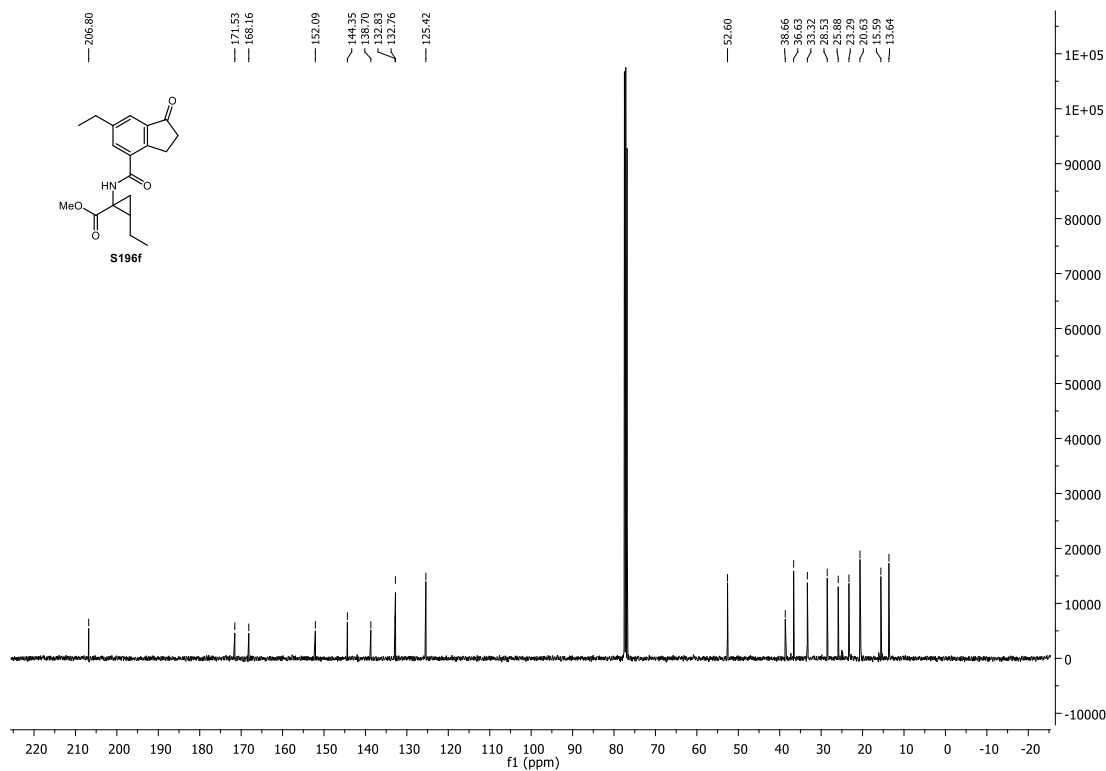
¹³C NMR 196e.



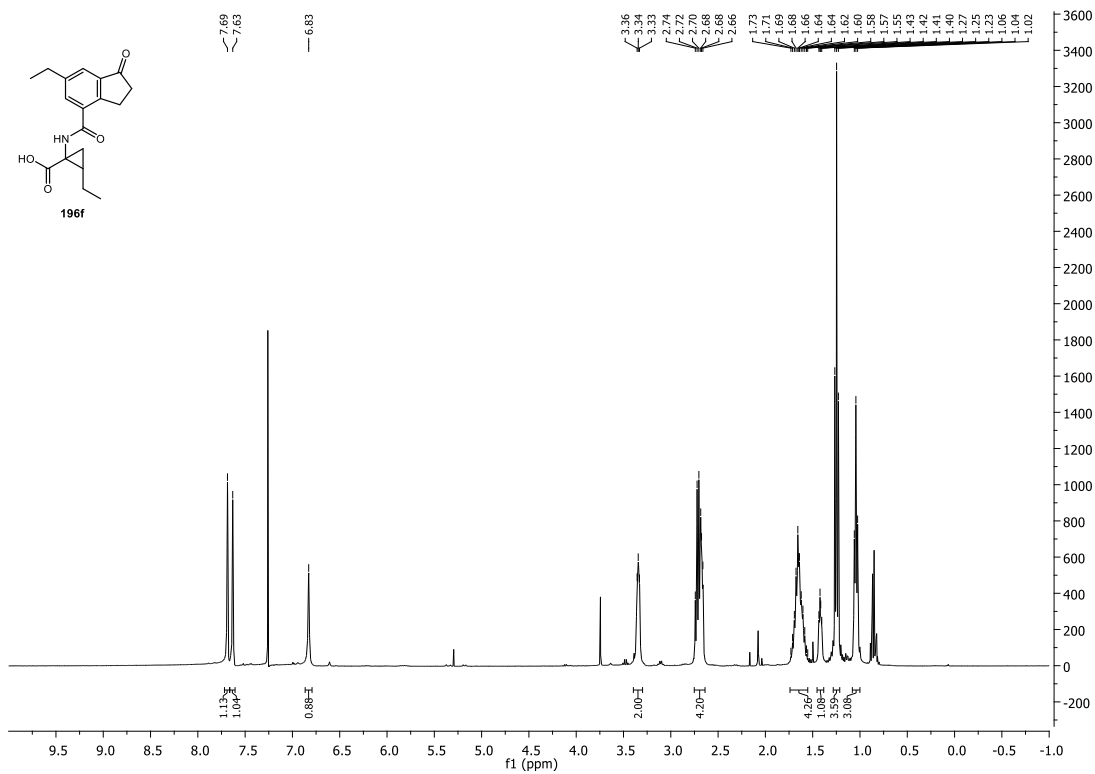
¹H NMR S196f.



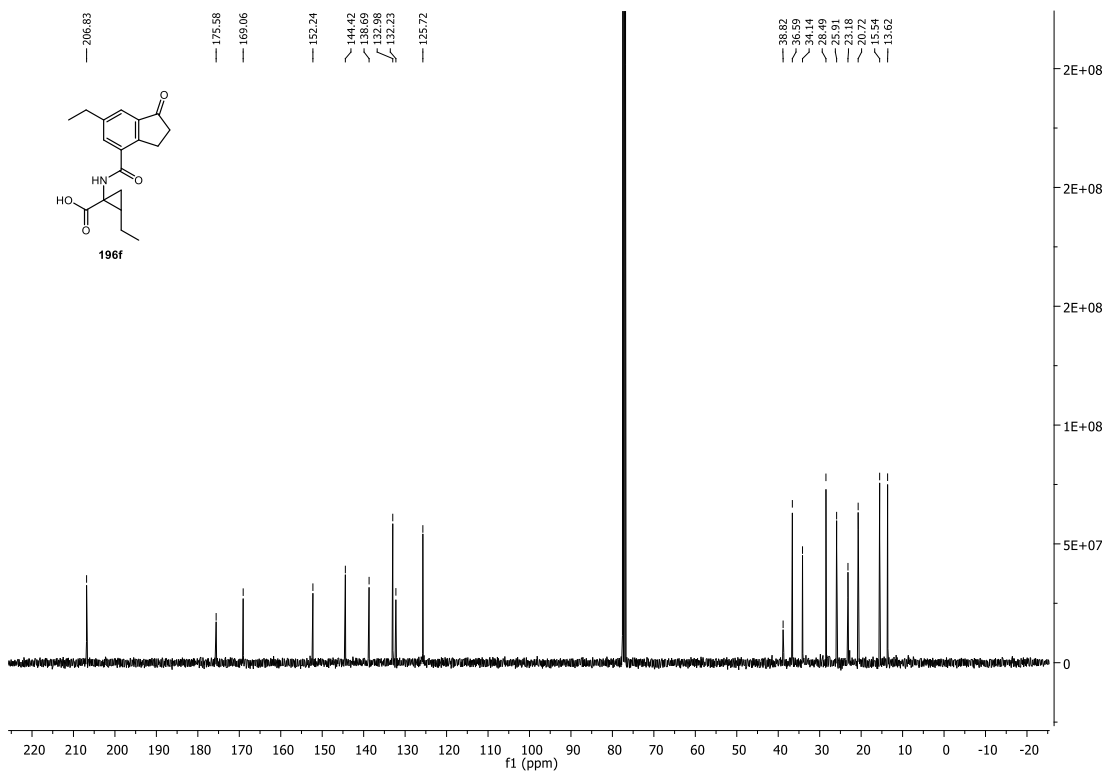
¹³C NMR S196f.



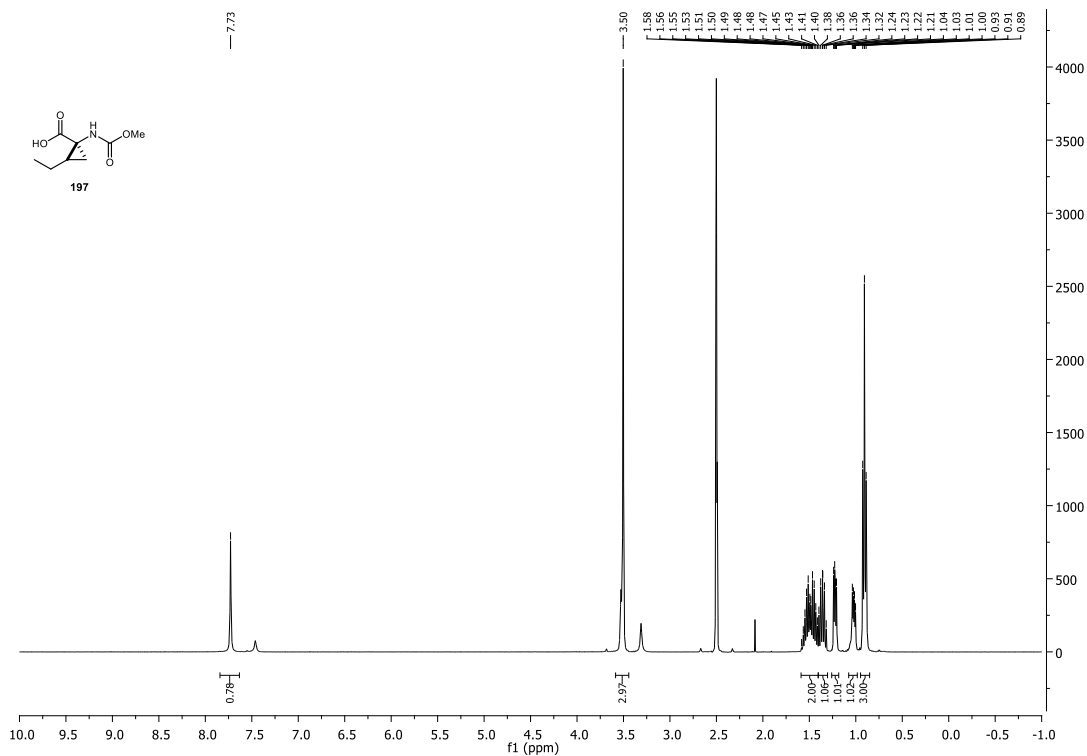
¹H NMR 196f.



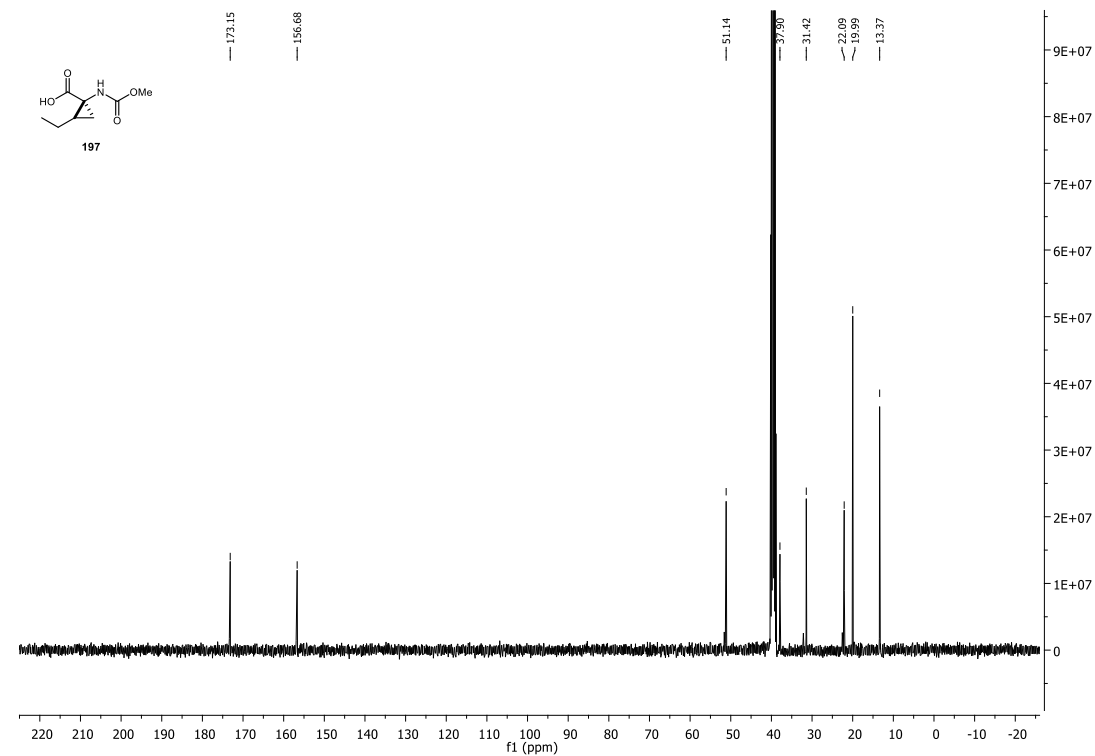
¹³C NMR 196f.



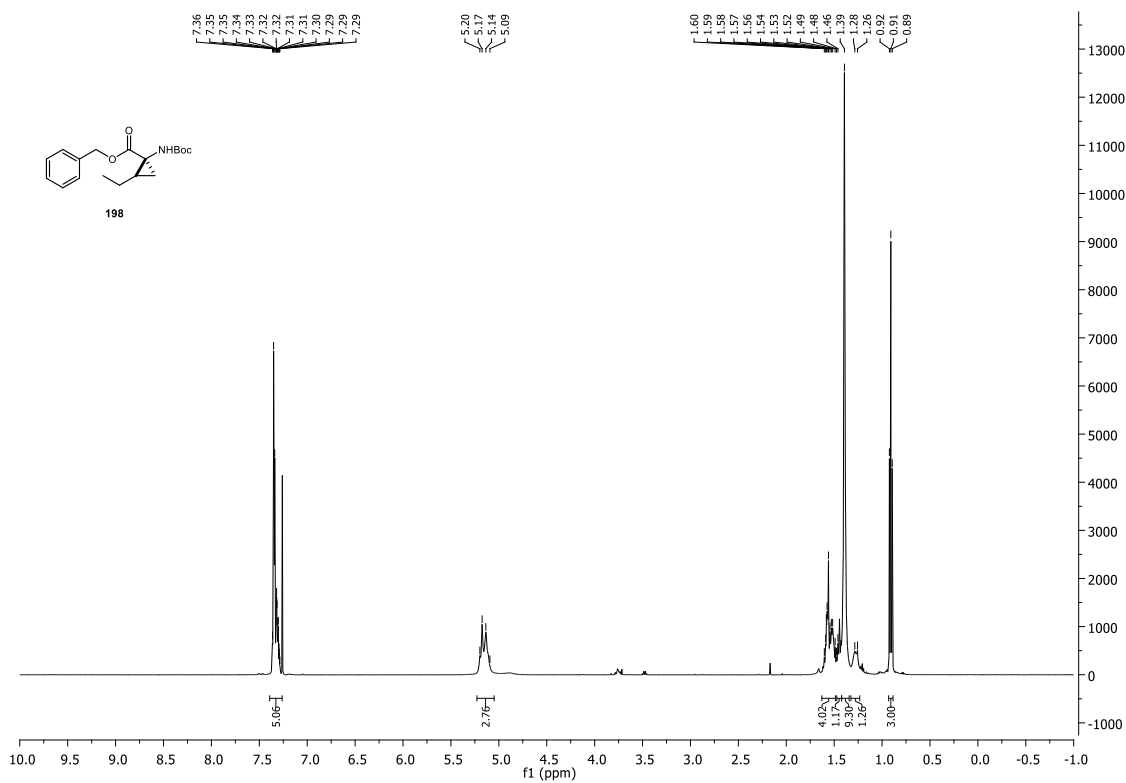
¹H NMR 197.



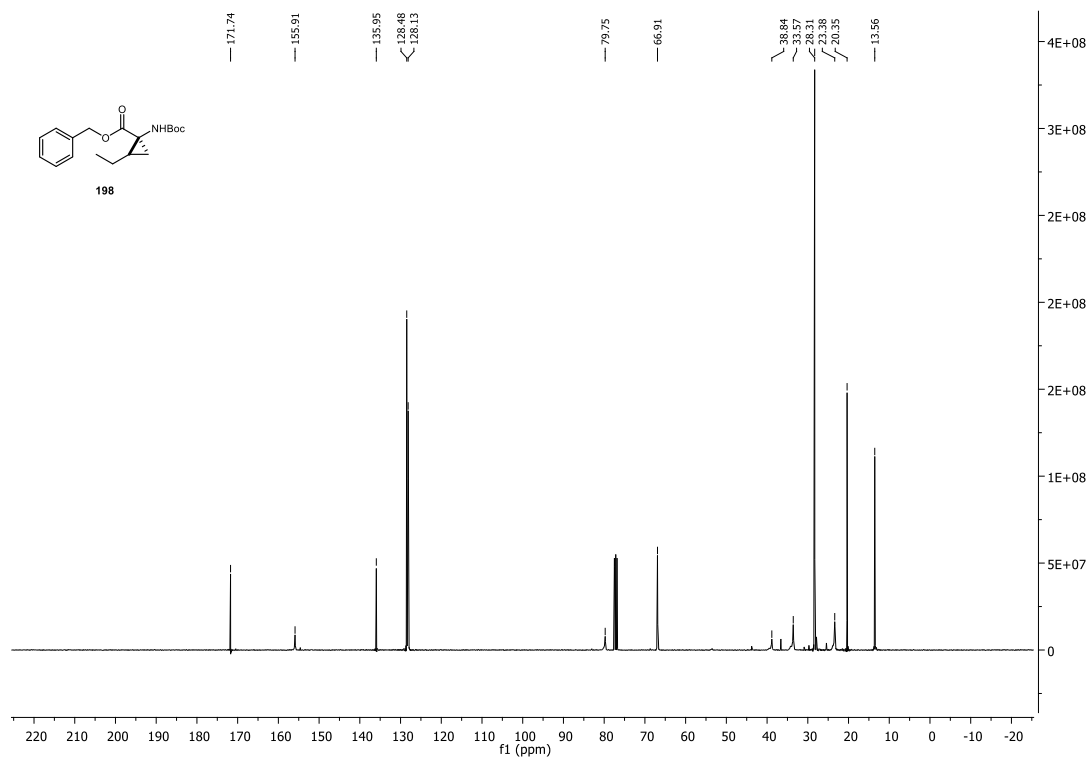
¹³C NMR 197.



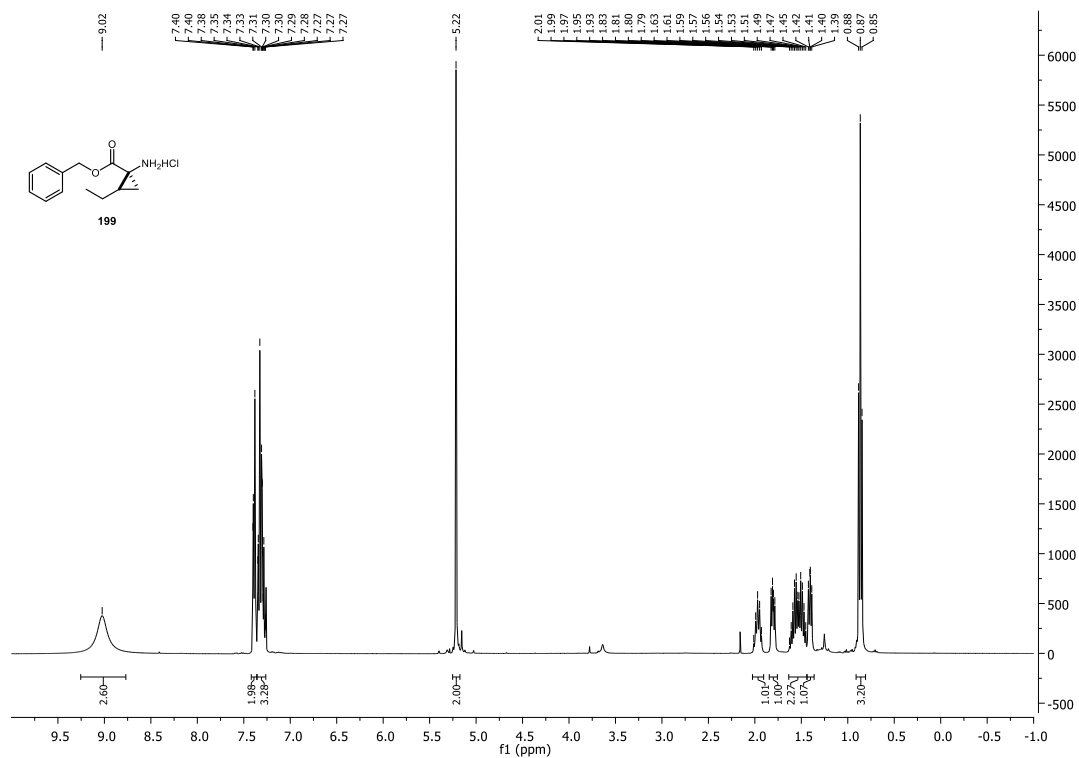
¹H NMR 198.



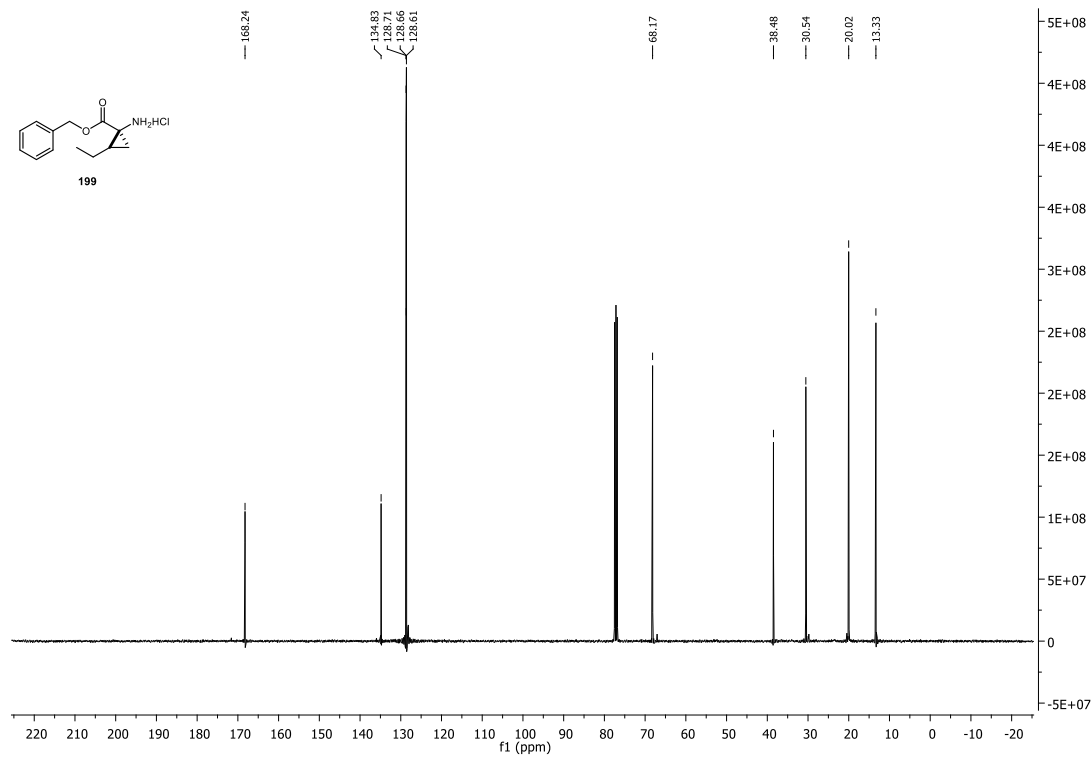
¹³C NMR 198.



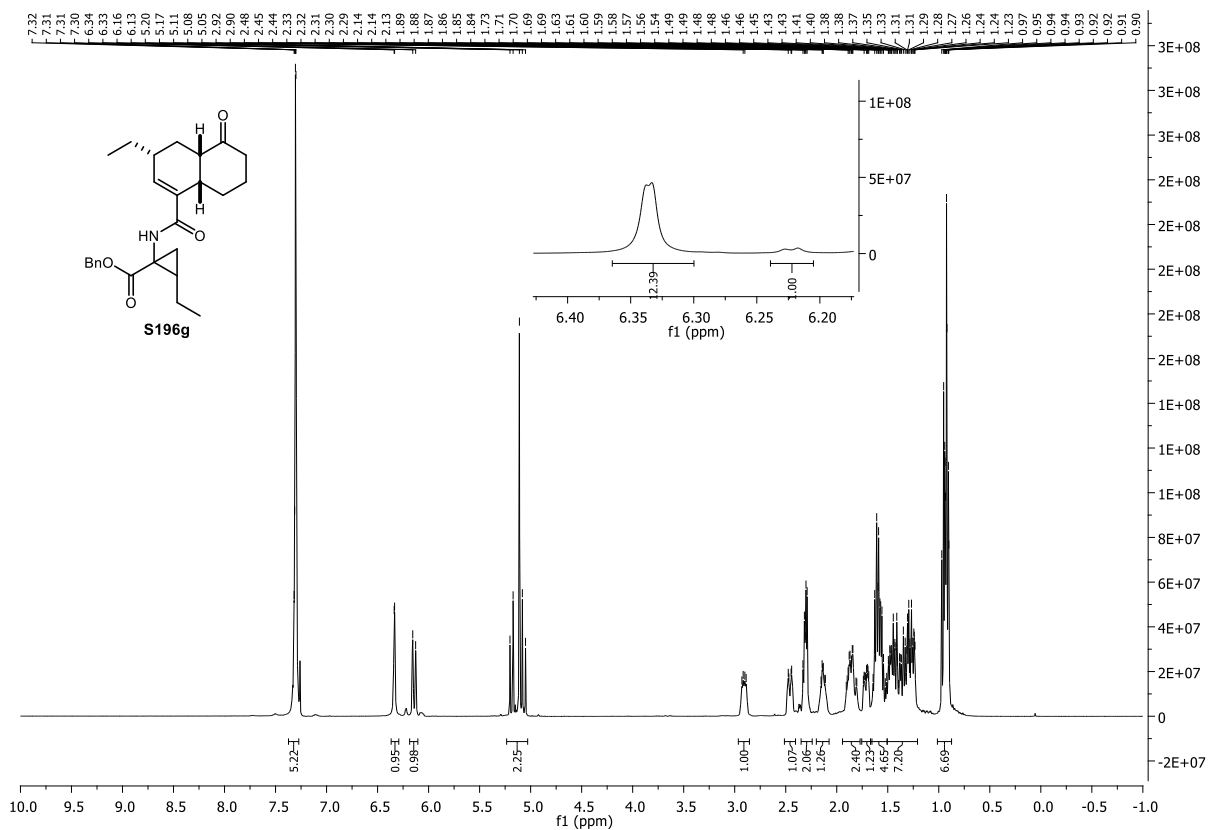
¹H NMR 199.



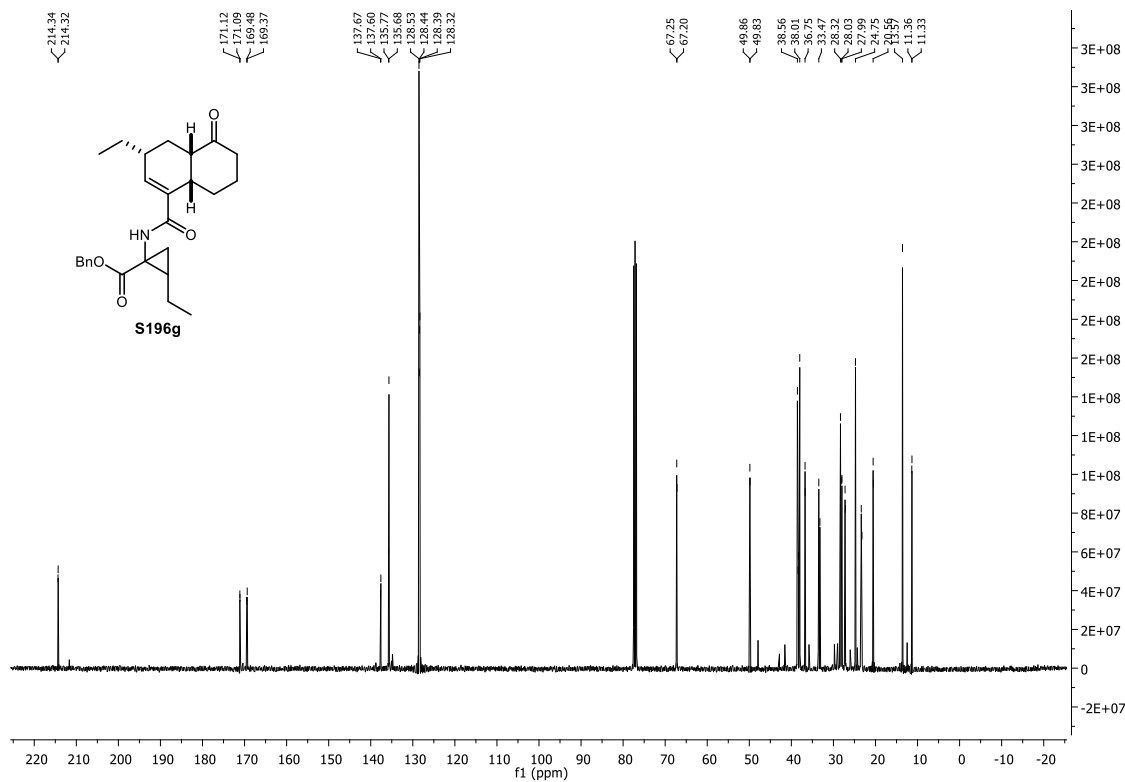
¹³C NMR 199.



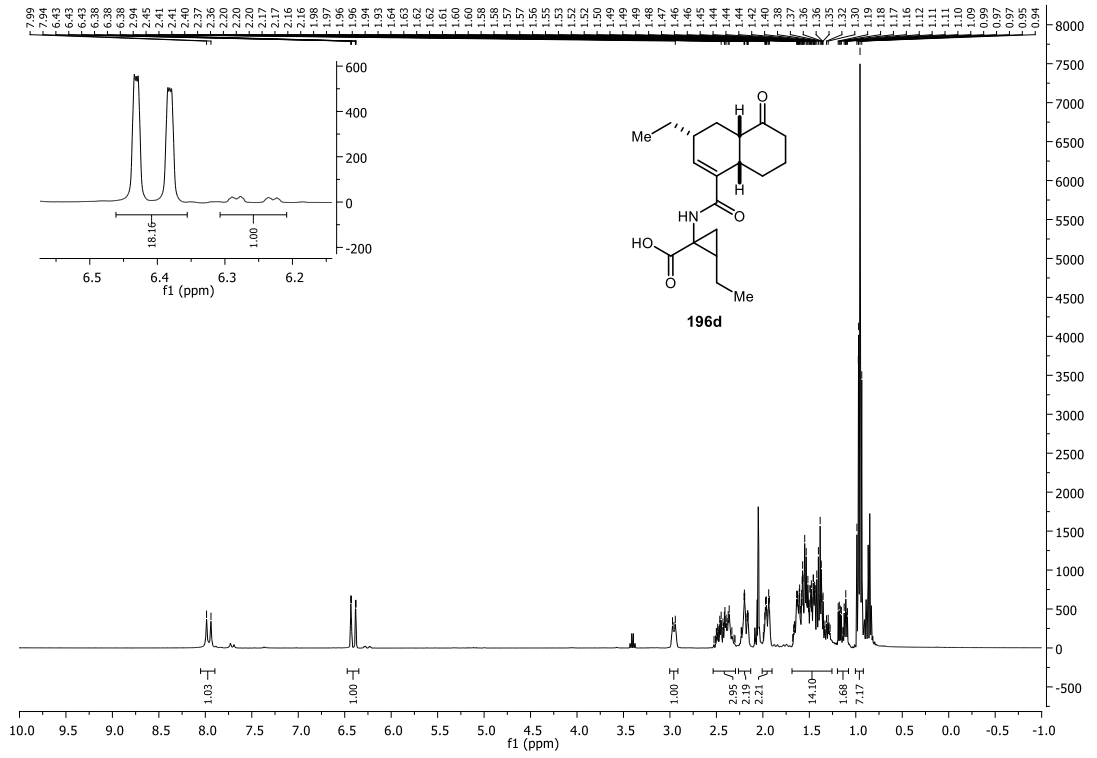
¹H NMR S196g.



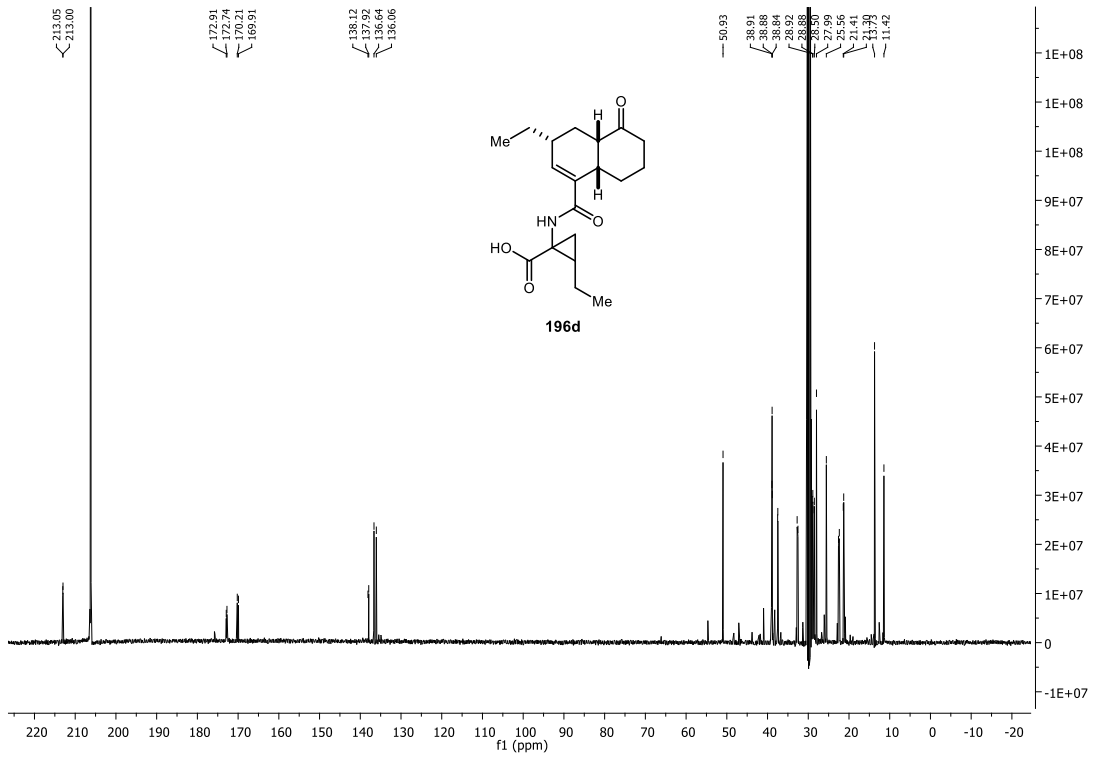
¹³C NMR S196g.



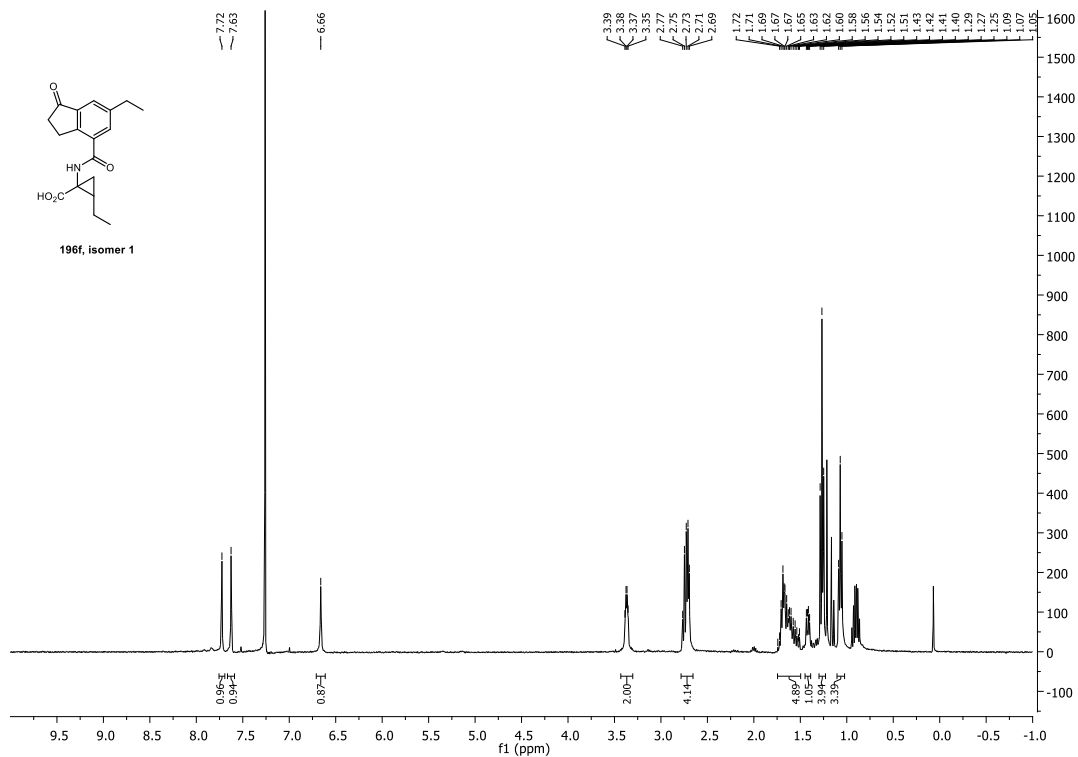
¹H NMR 196d.



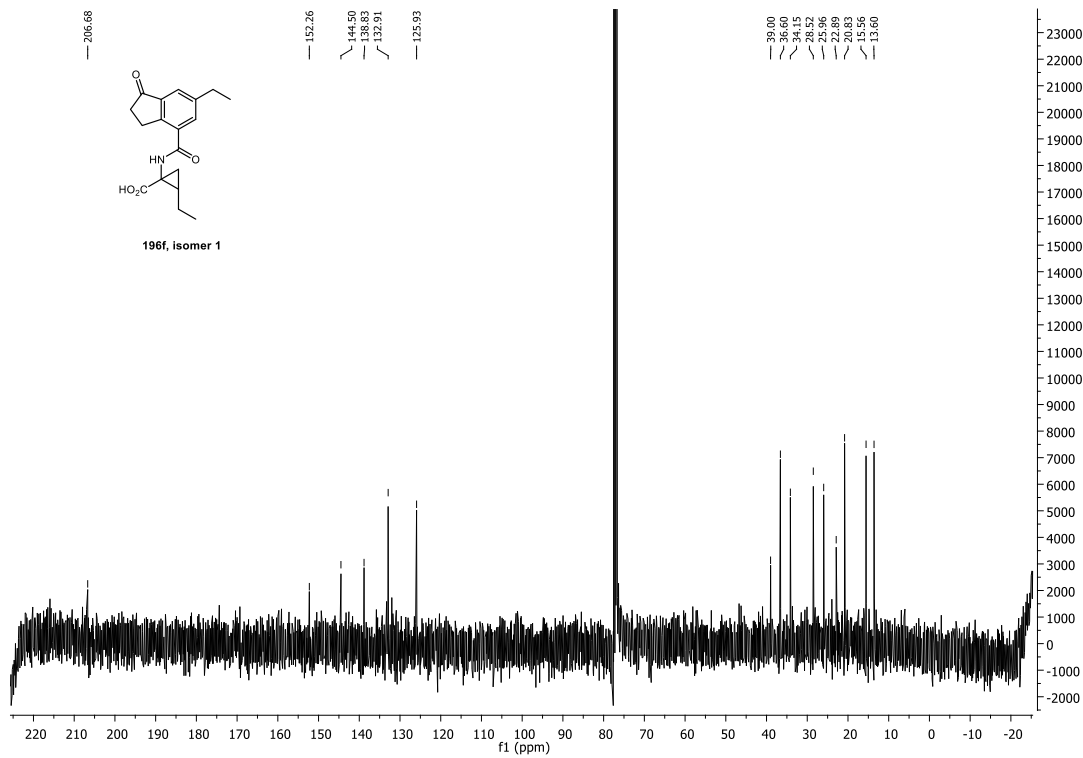
¹³C NMR 196d.



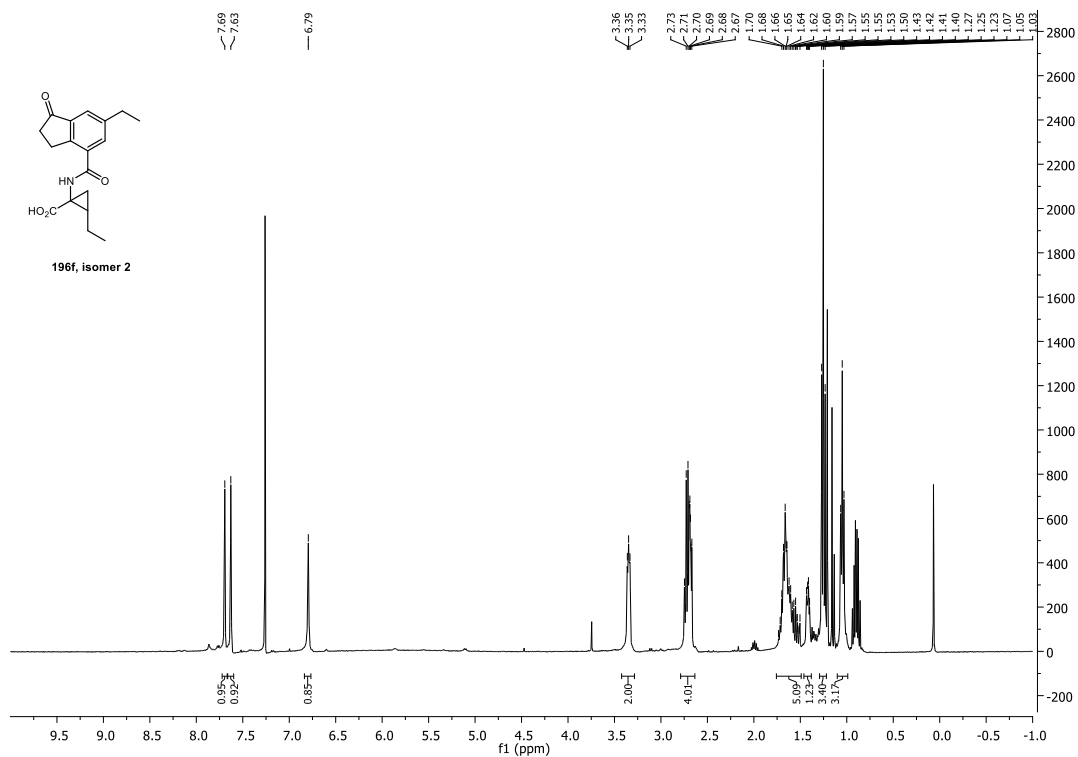
¹H NMR 196f, isomer 1.



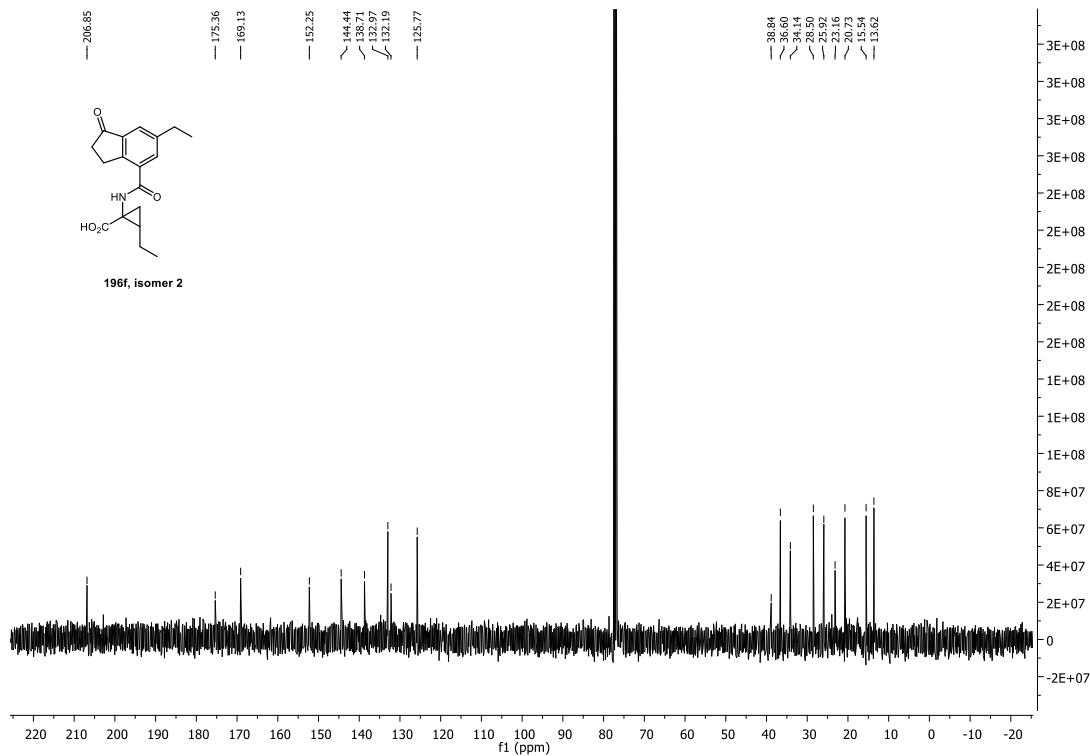
¹³C NMR 196f, isomer 1.



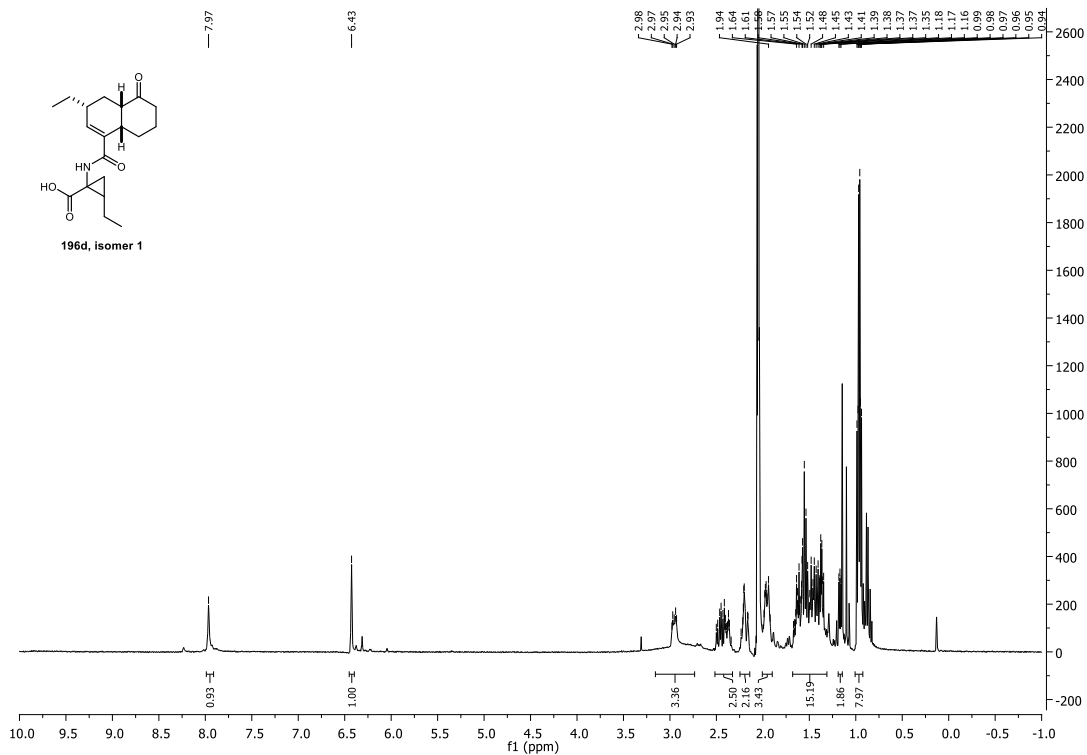
¹H NMR 196f, isomer 2.



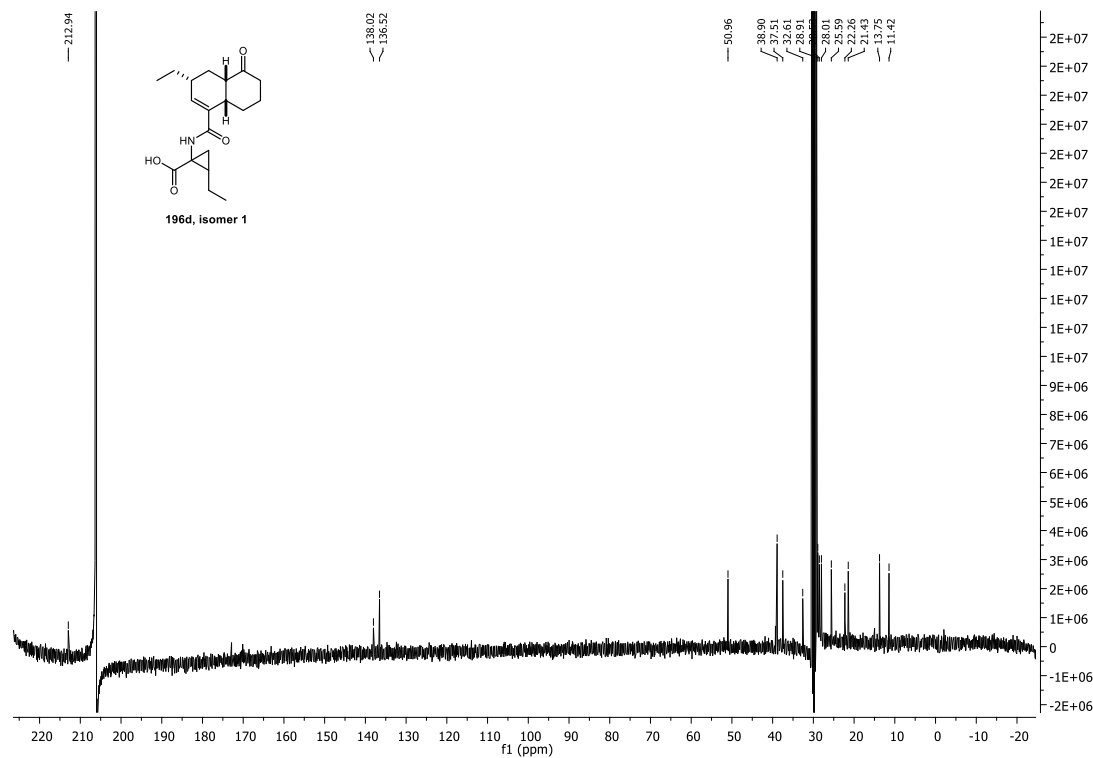
¹³C NMR 196f, isomer 2.



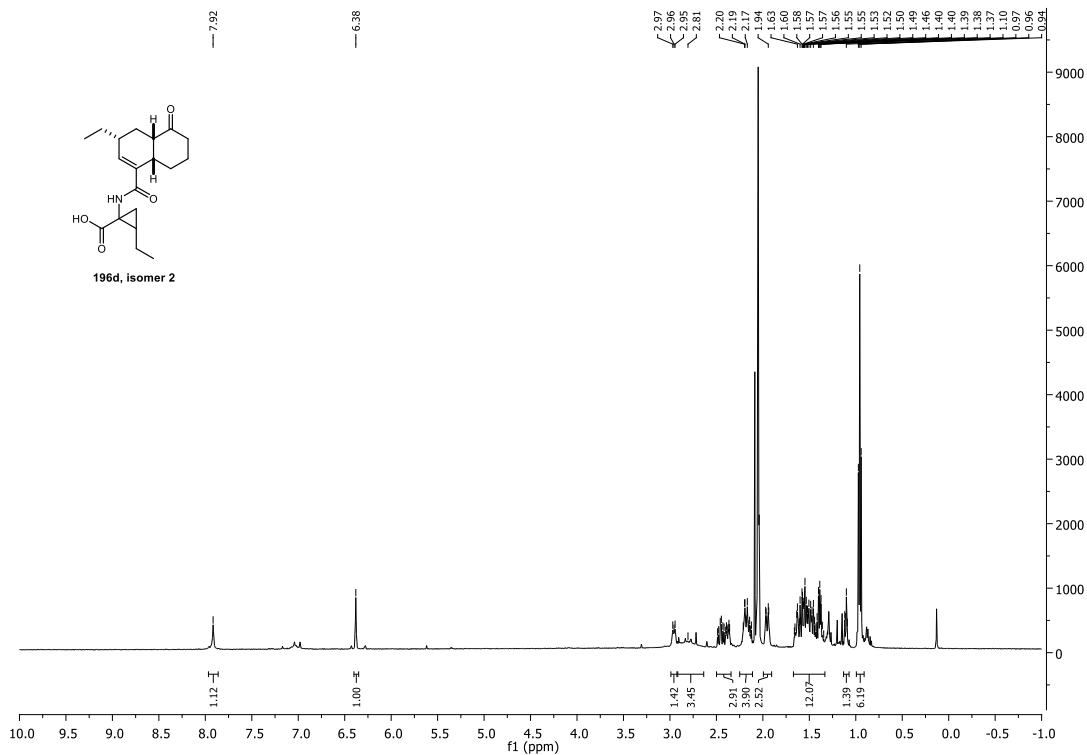
¹H NMR 196d, isomer 1.



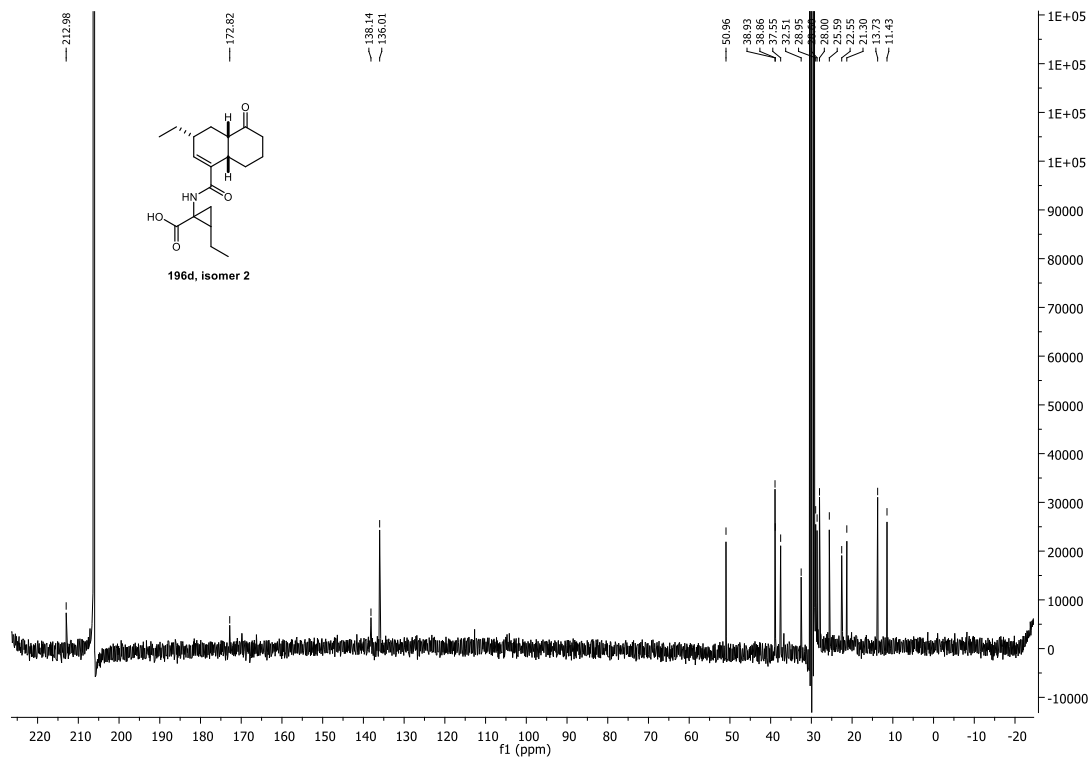
¹³C NMR 196d, isomer 1.



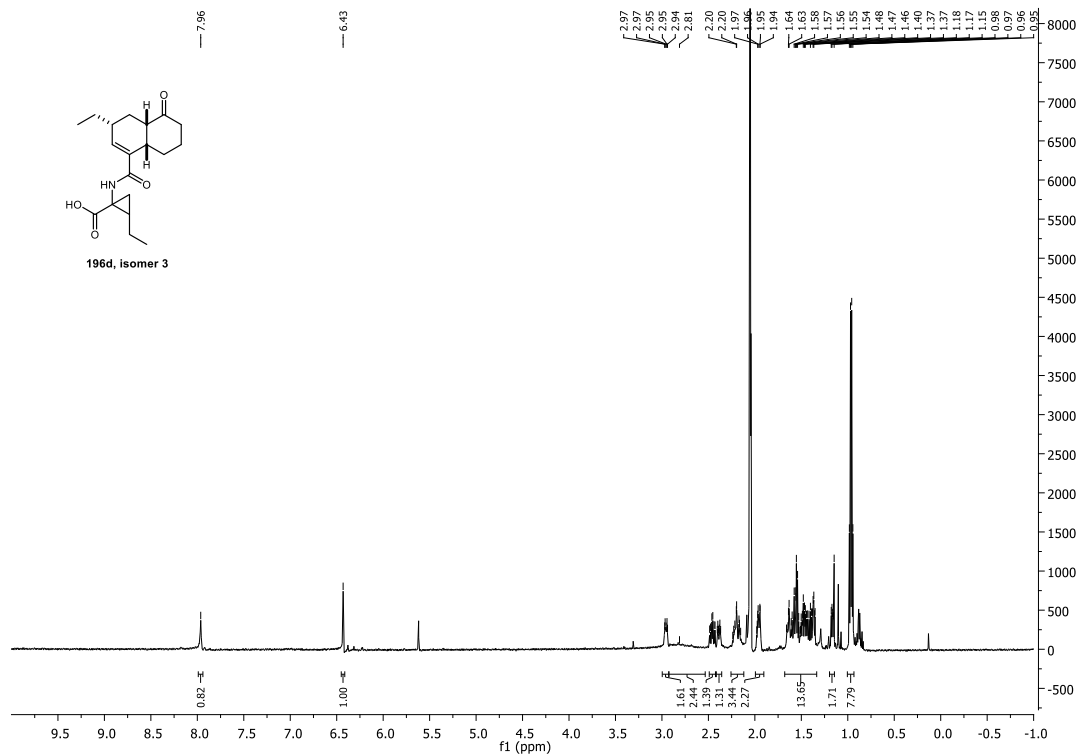
¹H NMR 196d, isomer 2.



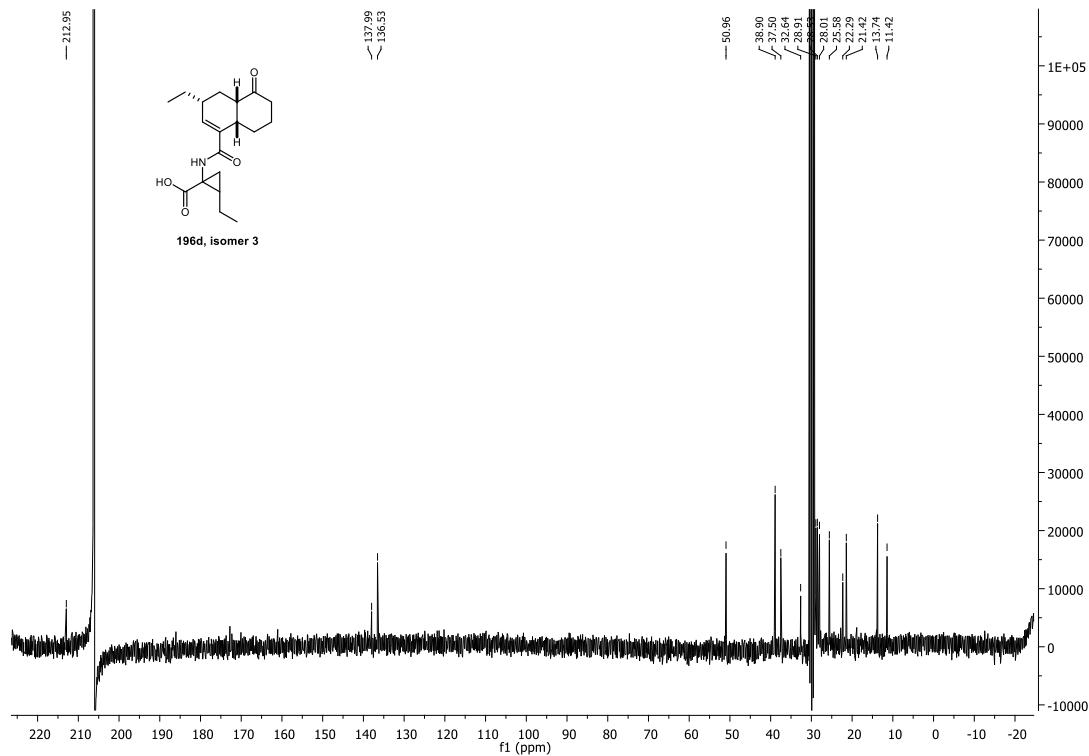
¹³C NMR 196d, isomer 2.



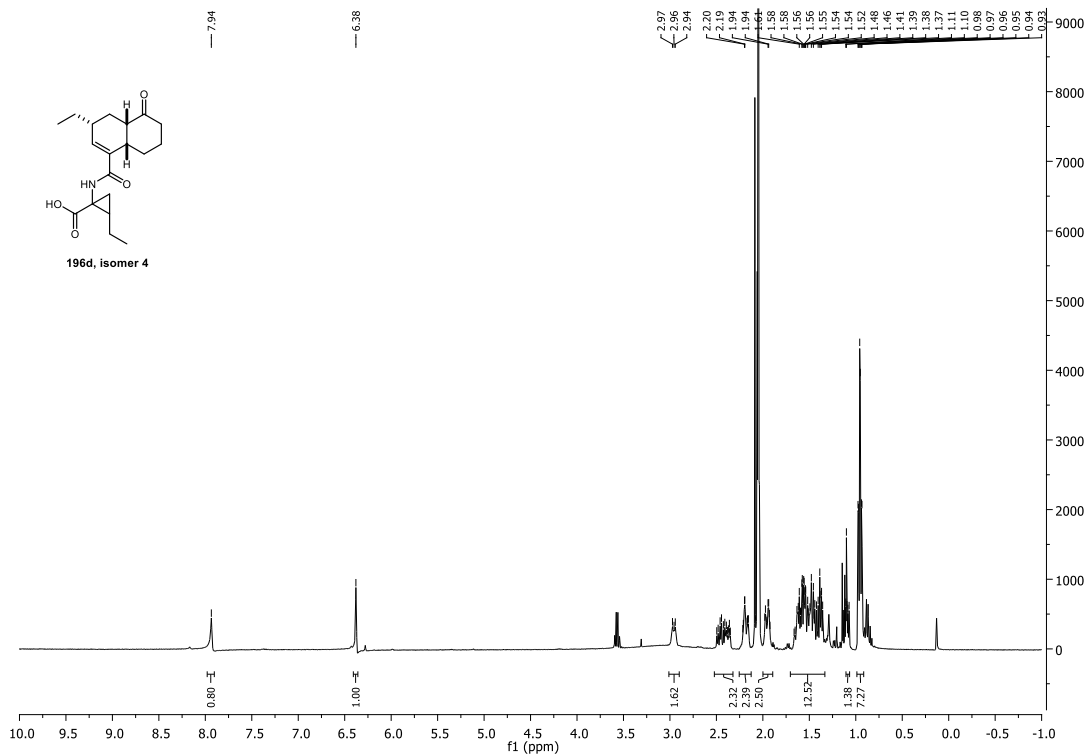
^1H NMR 196d, isomer 3.



^{13}C NMR 196d, isomer 3.



¹H NMR 196d, isomer 4.



¹³C NMR 196d, isomer 4.

