

Base Mediated 1,3-Dipolar Cycloaddition of α -Substituted Vinyl Phosphonates with Diazo Compounds for Synthesis of 3-Pyrazolylphosphonates and 5- Pyrazolcarboxylates

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^b Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Leninsky Pr. 31, 119071 Moscow, Russian Federation

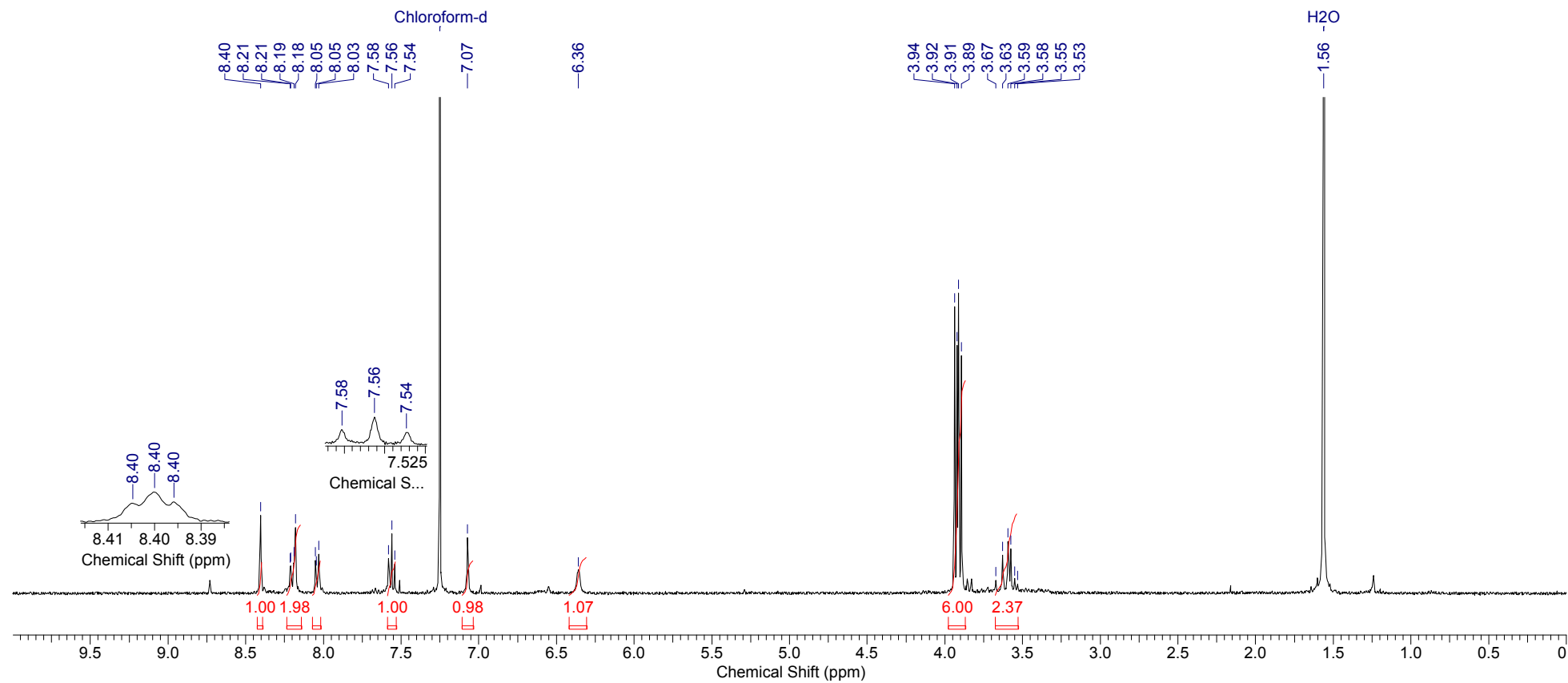
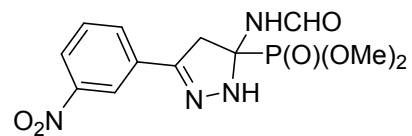
E-mail: goulioukina@org.chem.msu.ru

Supporting Information

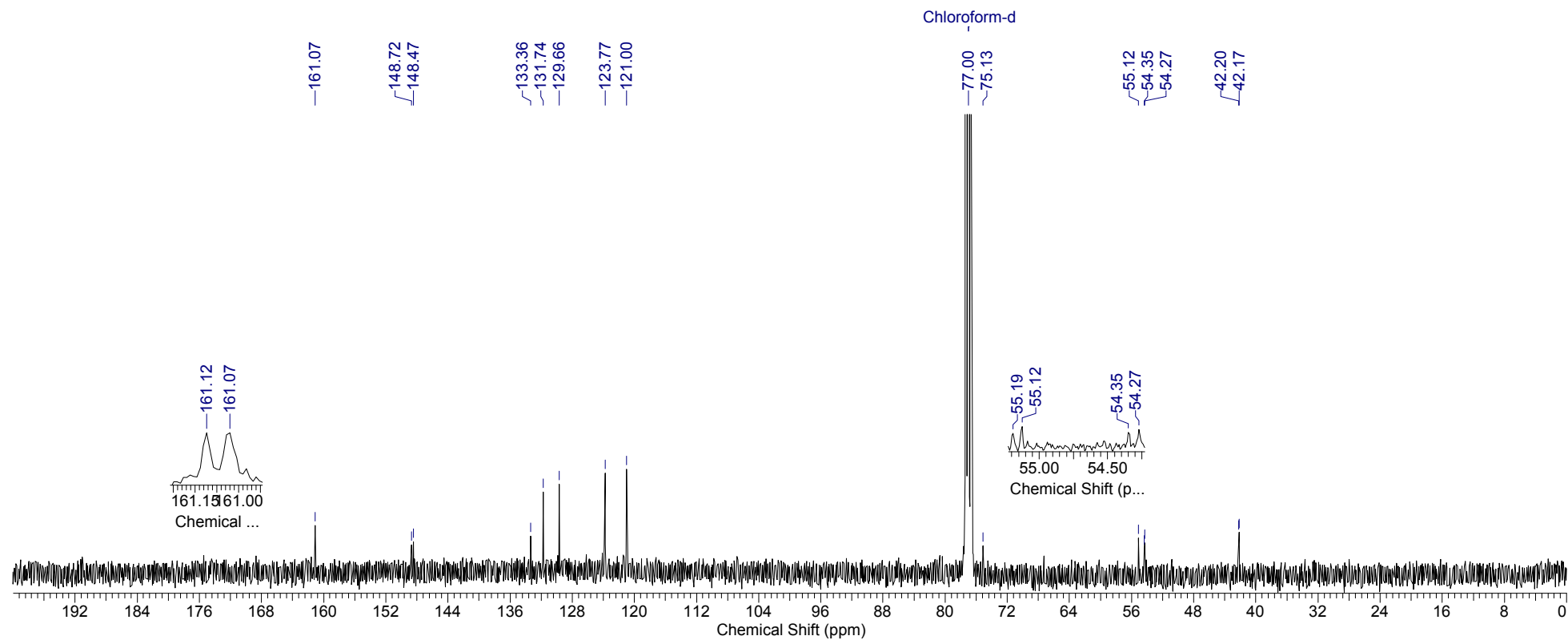
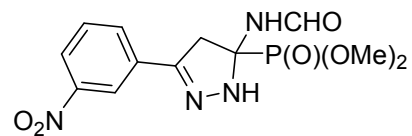
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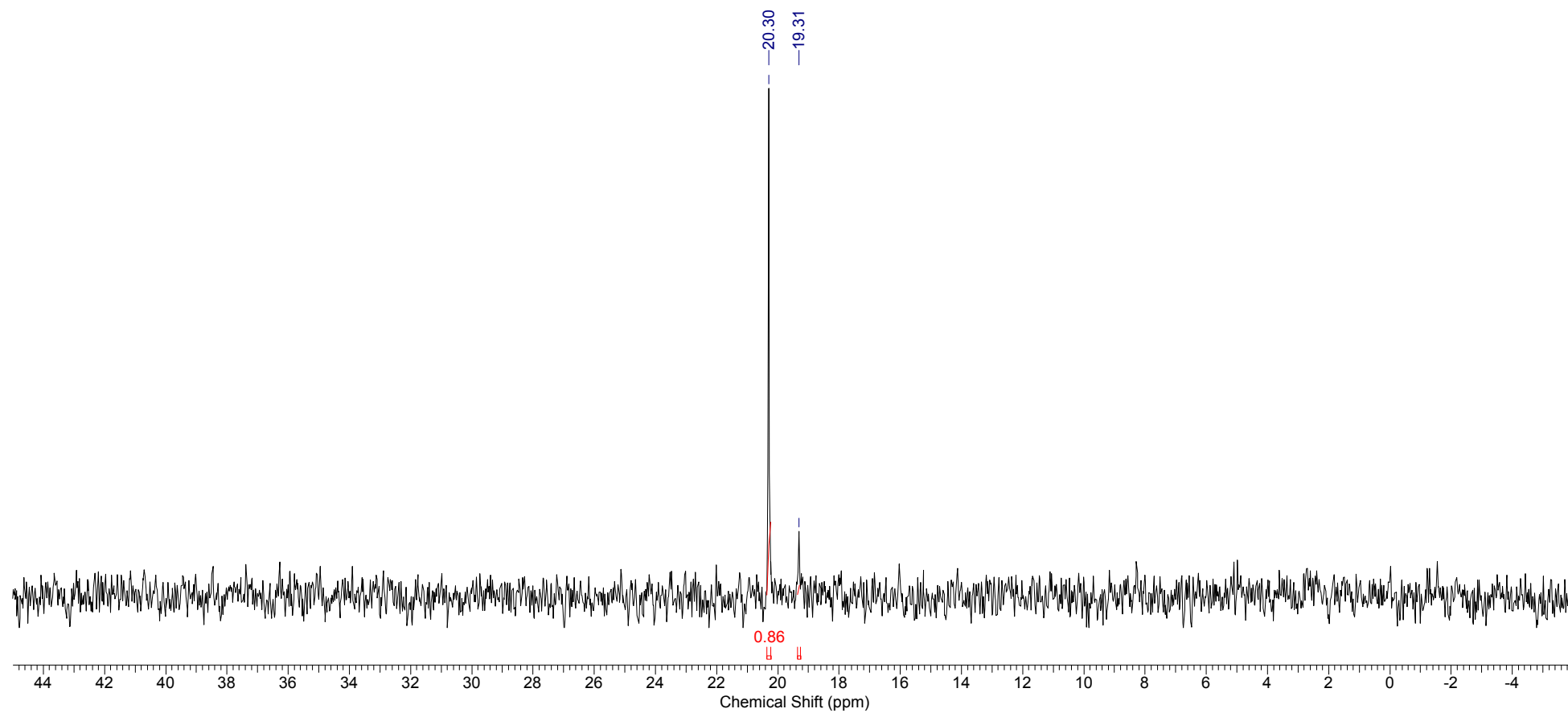
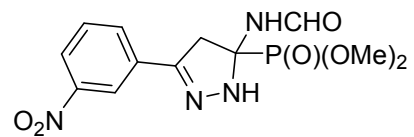
^1H NMR spectrum (CDCl_3) of **3** (mixture of rotamers)



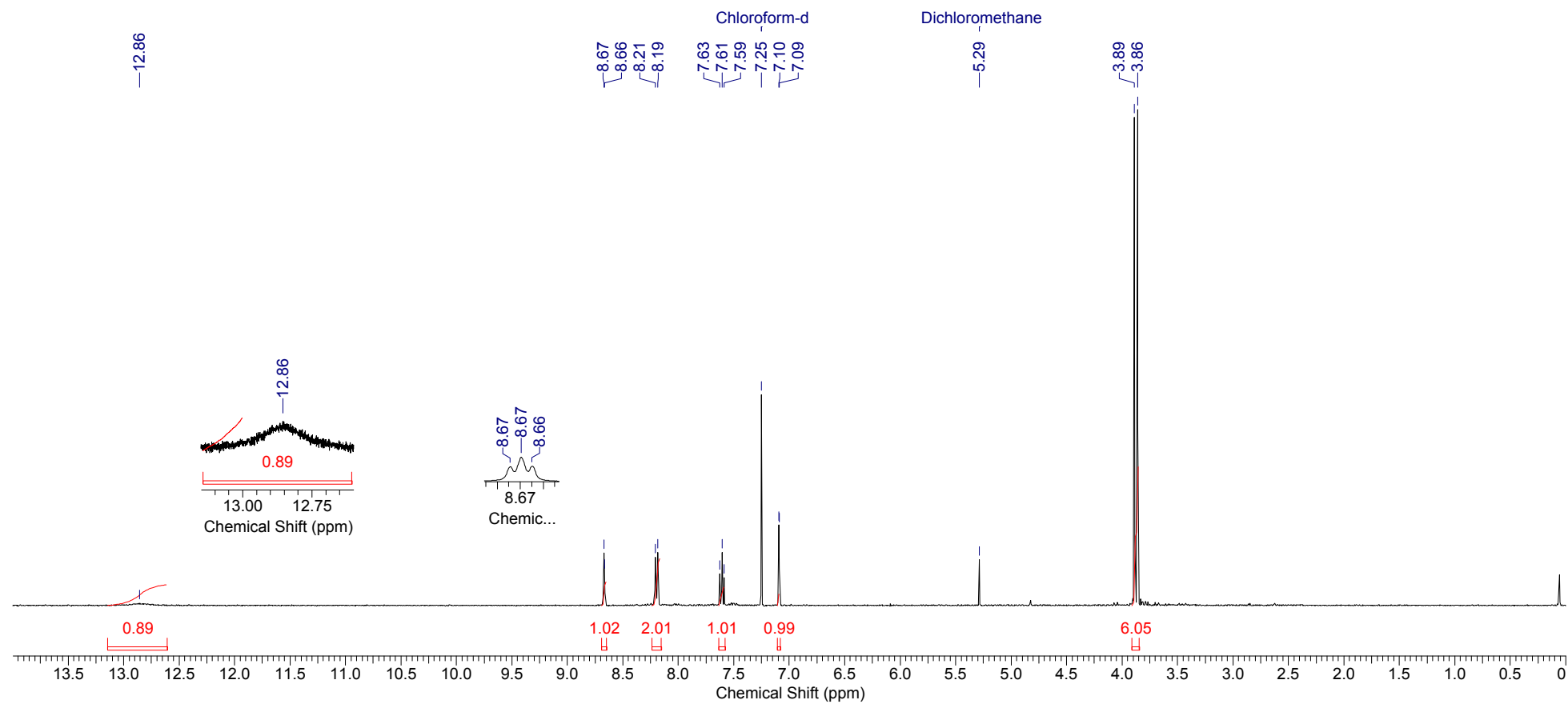
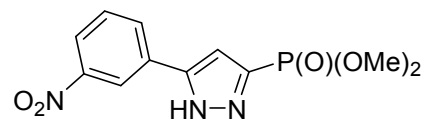
^{13}C NMR spectrum (CDCl_3) of **3** (mixture of rotamers)



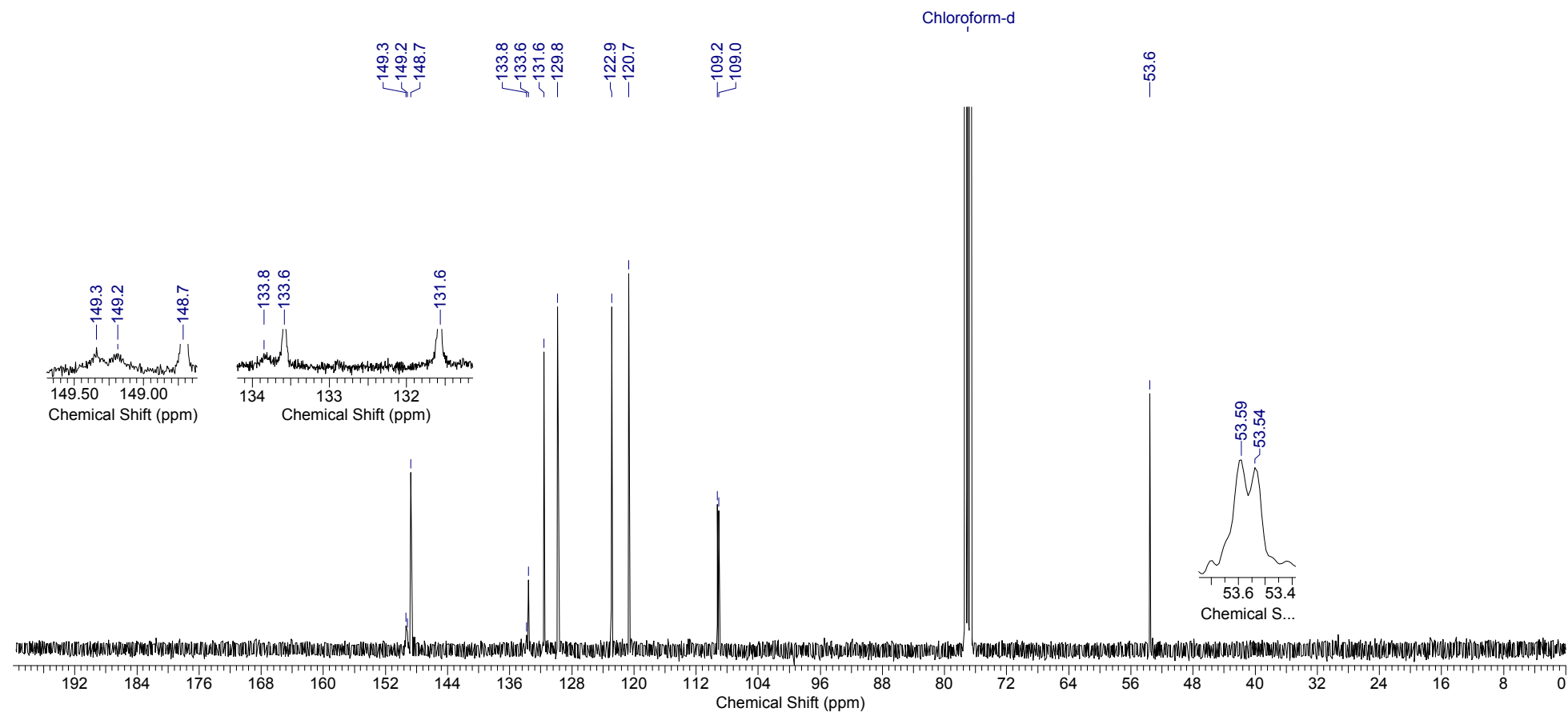
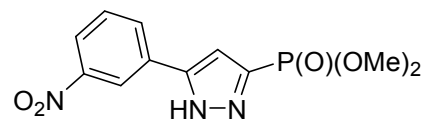
^{31}P NMR spectrum (CDCl_3) of **3** (mixture of rotamers)



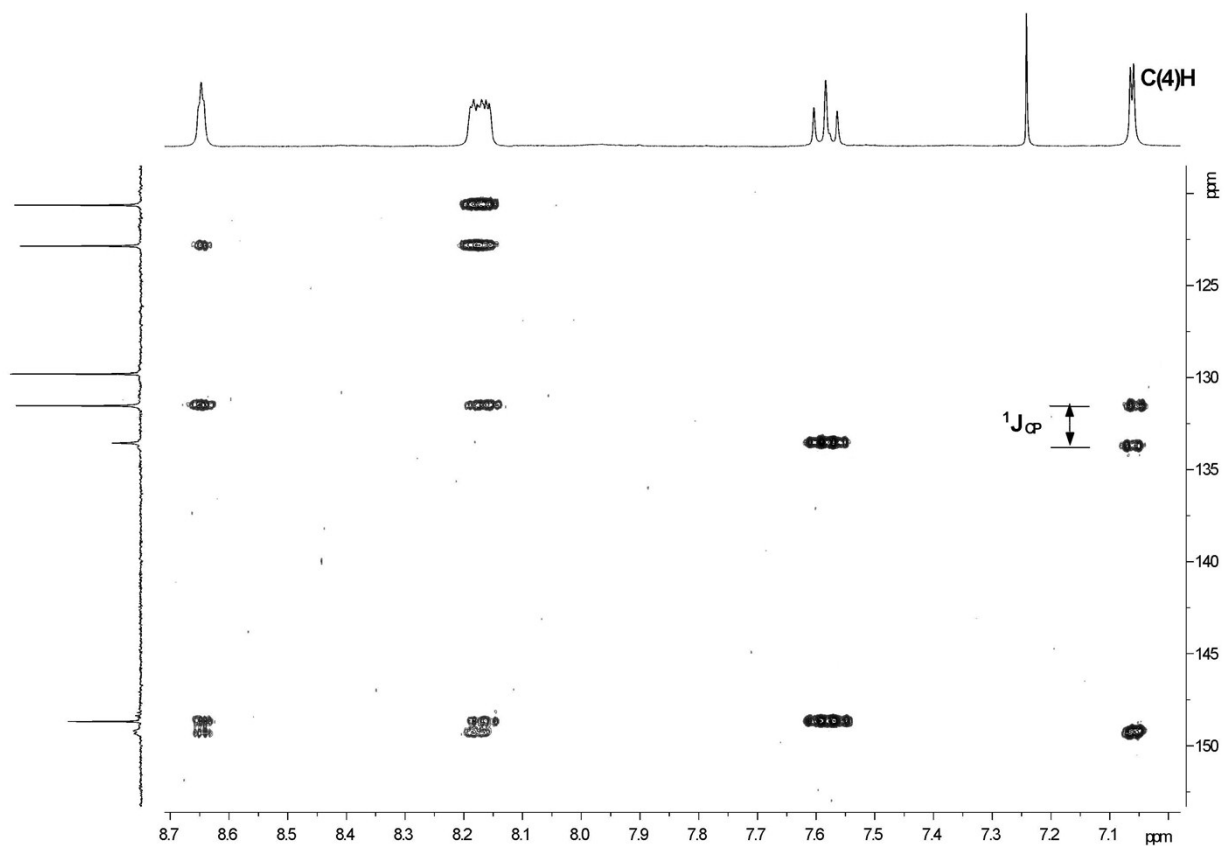
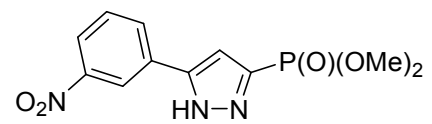
^1H NMR spectrum (CDCl_3) of **4a**



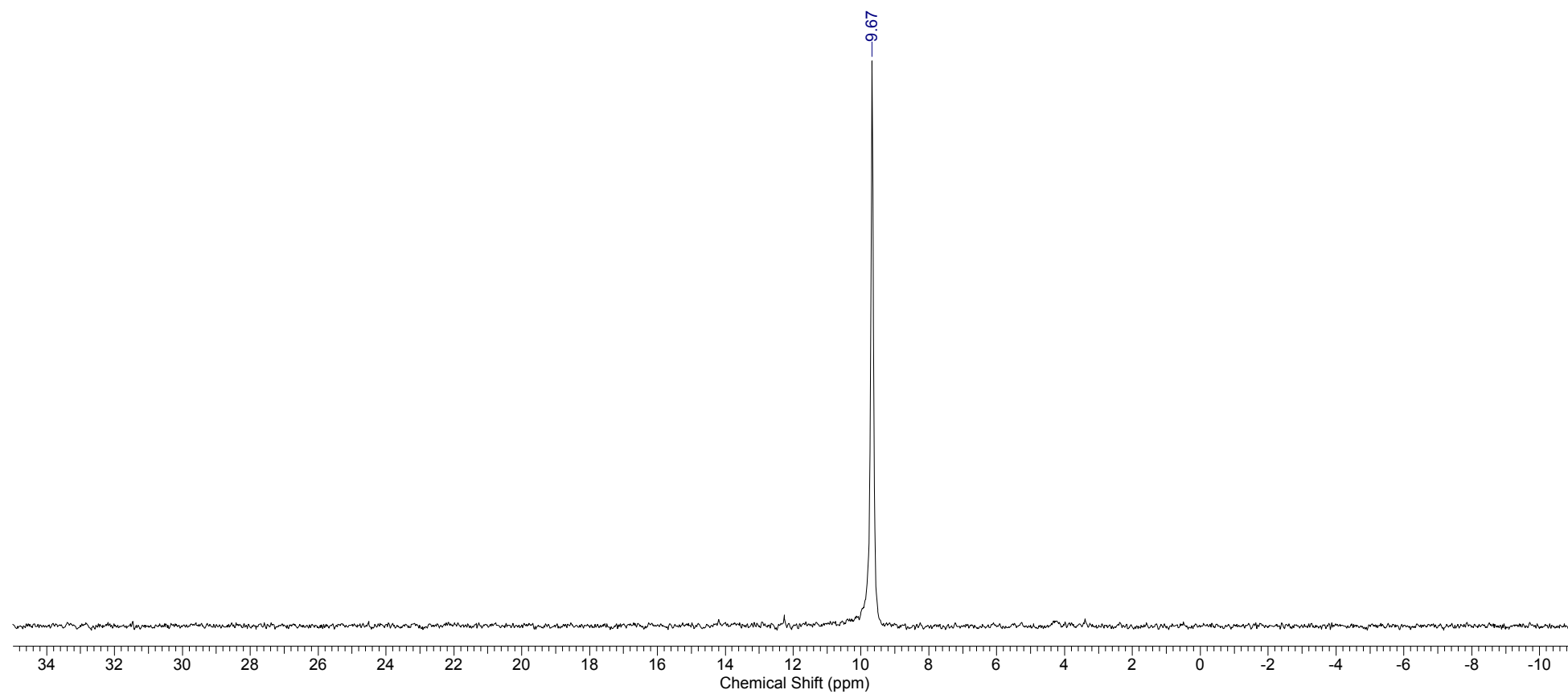
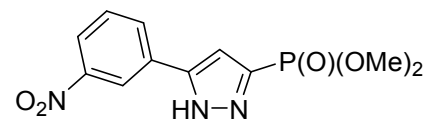
^{13}C NMR spectrum (CDCl_3) of **4a**



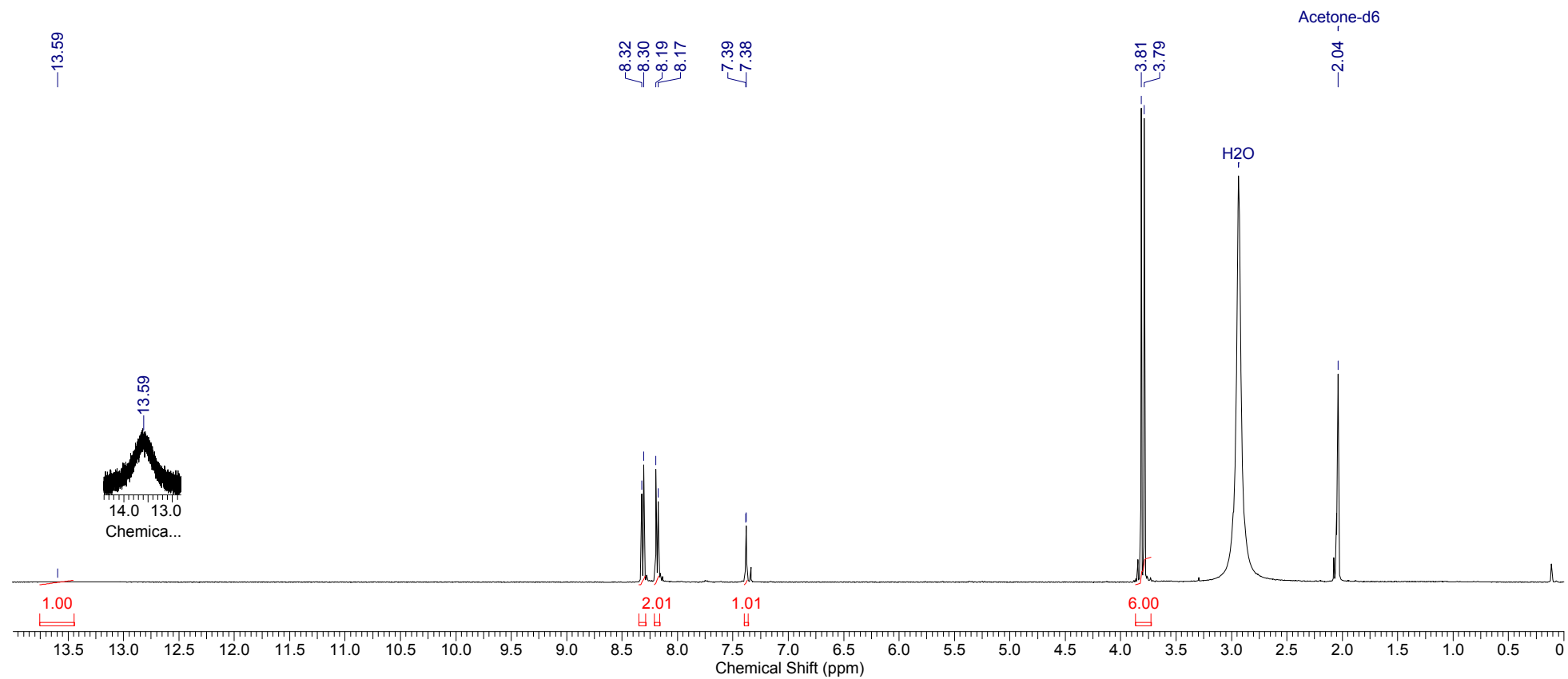
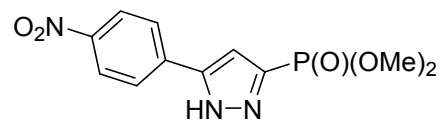
HMBC spectrum (CDCl₃) of **4a**



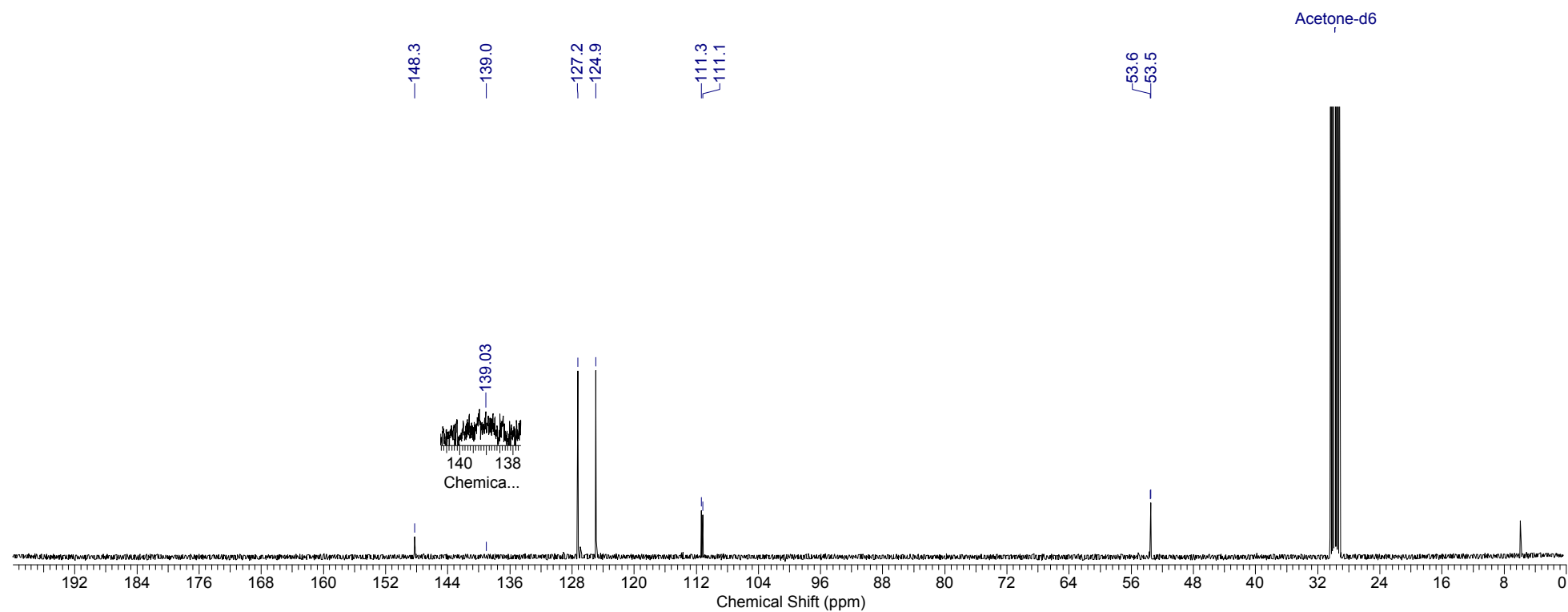
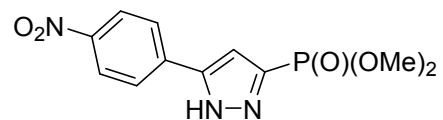
^{31}P NMR spectrum (CDCl_3) of **4a**



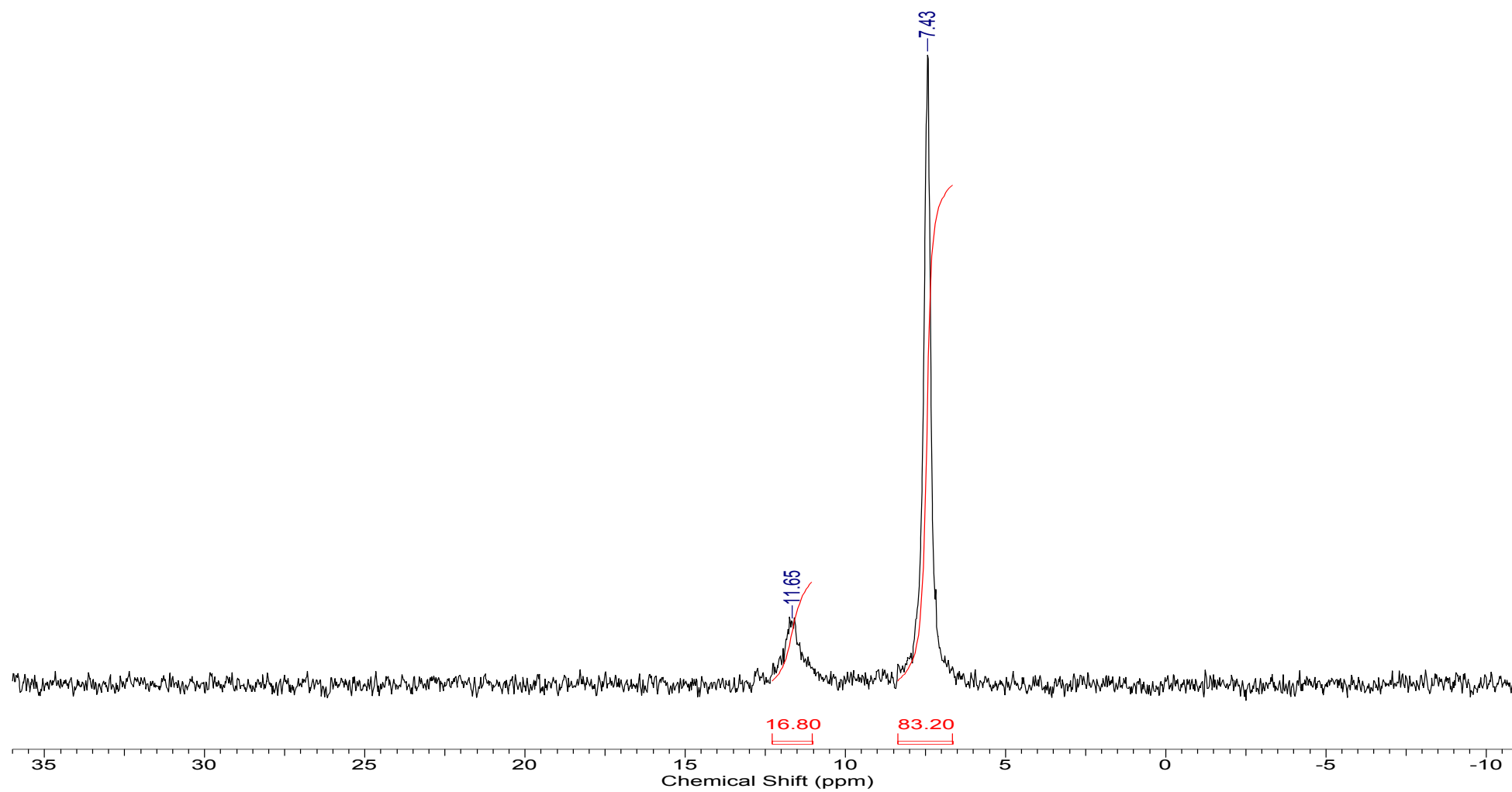
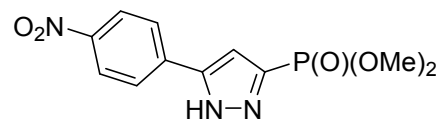
^1H NMR spectrum (Acetone- d_6) of **4b** (mixture of tautomers)



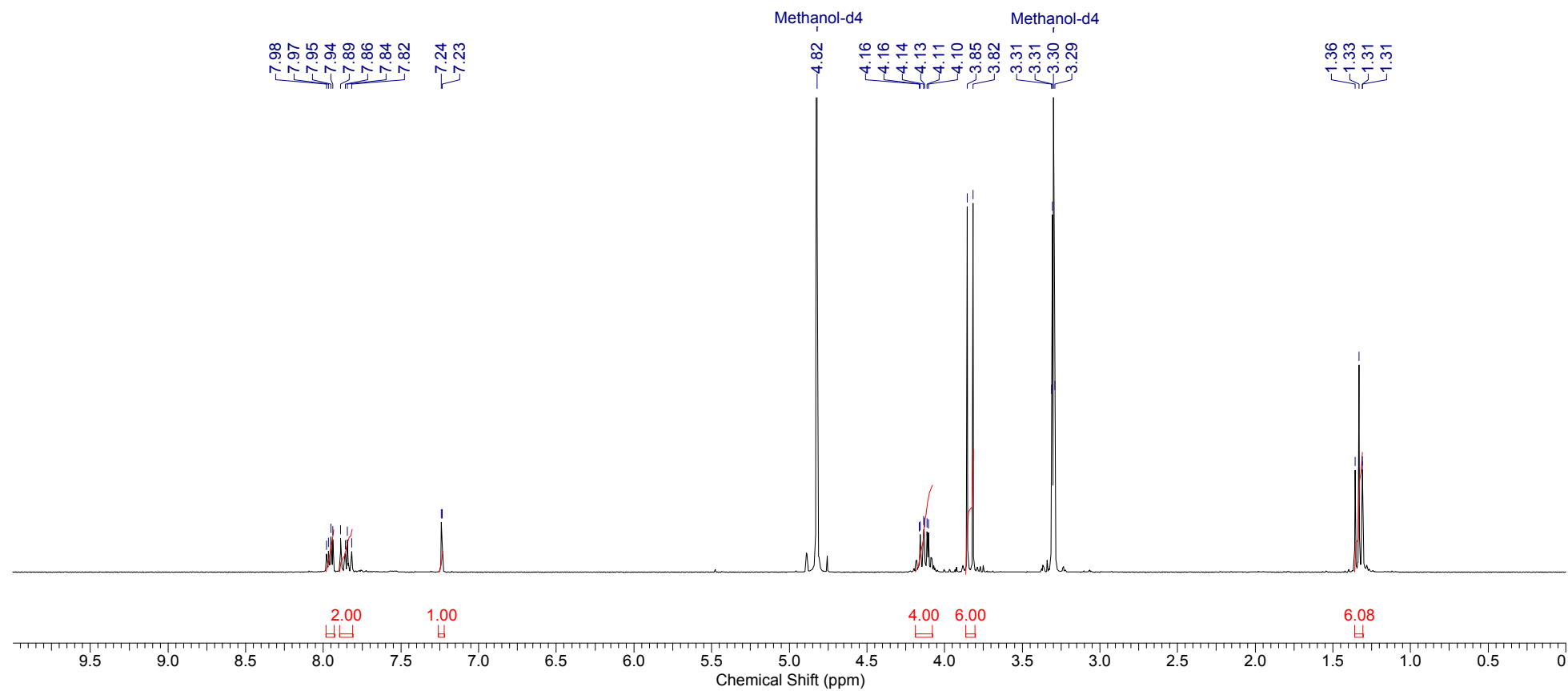
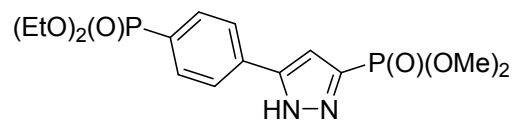
^{13}C NMR spectrum (Acetone- d_6) of **4b** (mixture of tautomers)



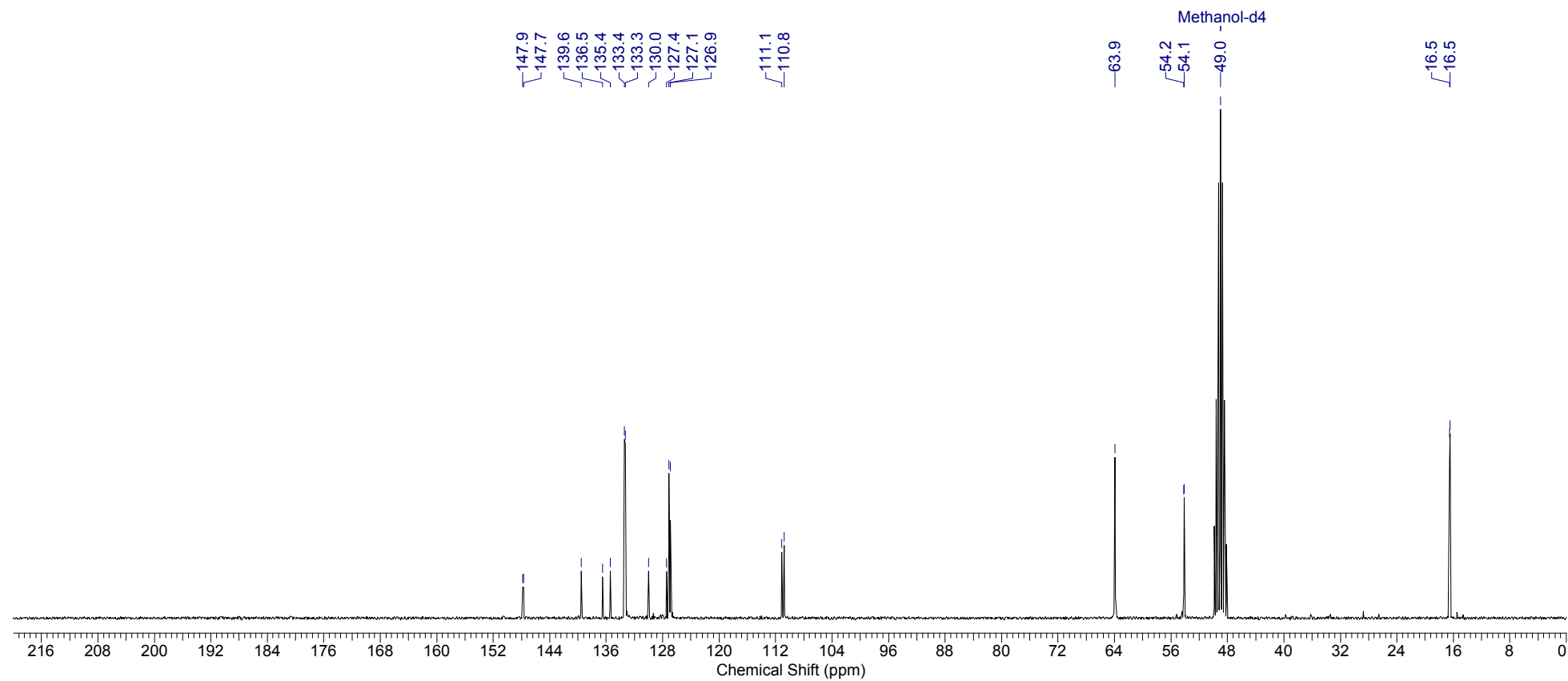
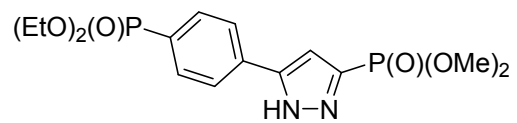
^{31}P NMR spectrum (Acetone- d_6) of **4b** (mixture of tautomers)



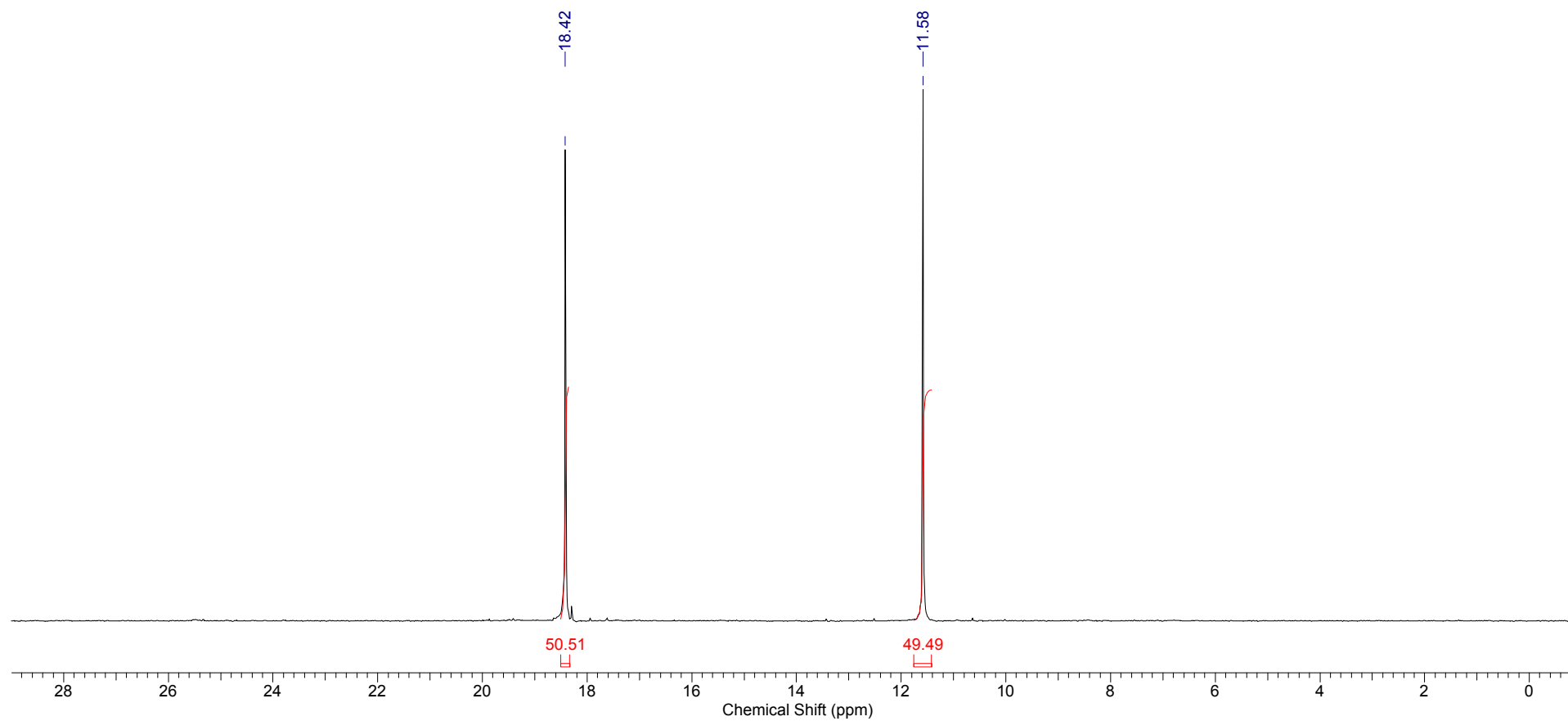
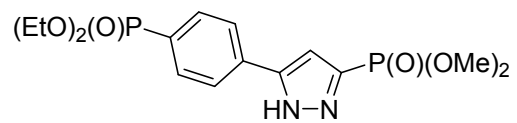
^1H NMR spectrum (CD_3OD) of **4c**



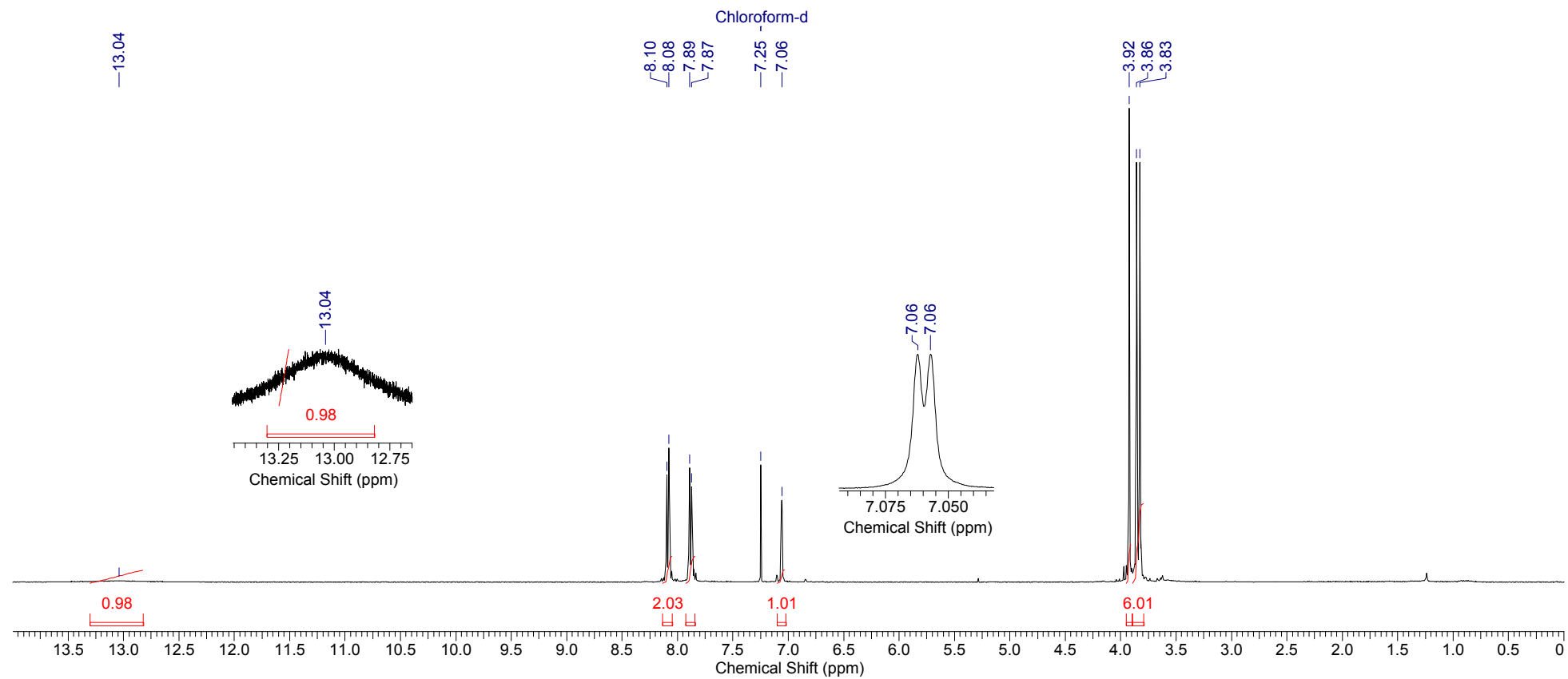
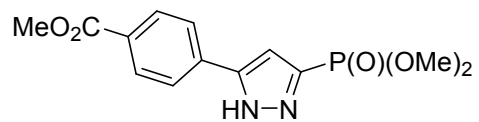
^{13}C NMR spectrum (CD_3OD) of **4c**



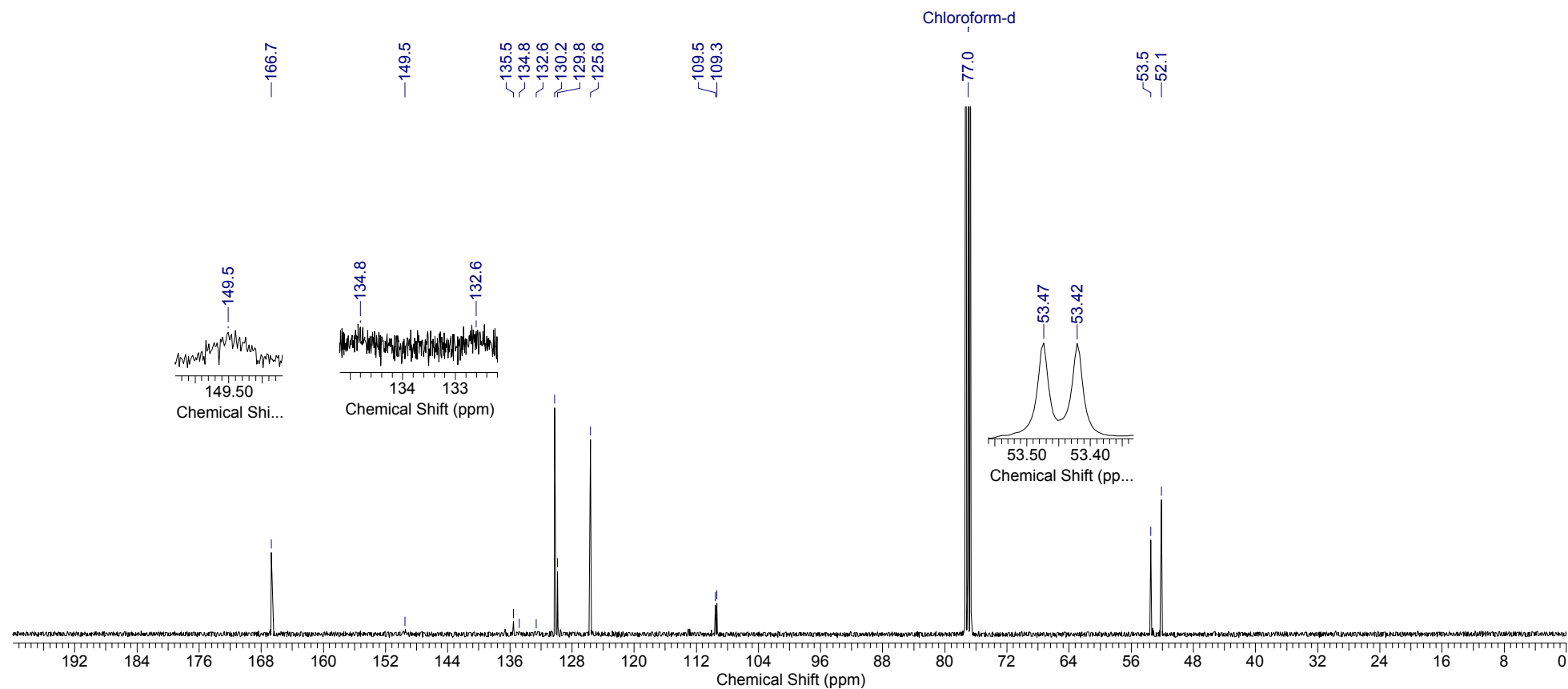
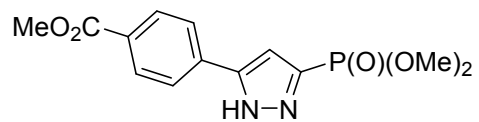
^{31}P NMR spectrum (CD_3OD) of **4c**



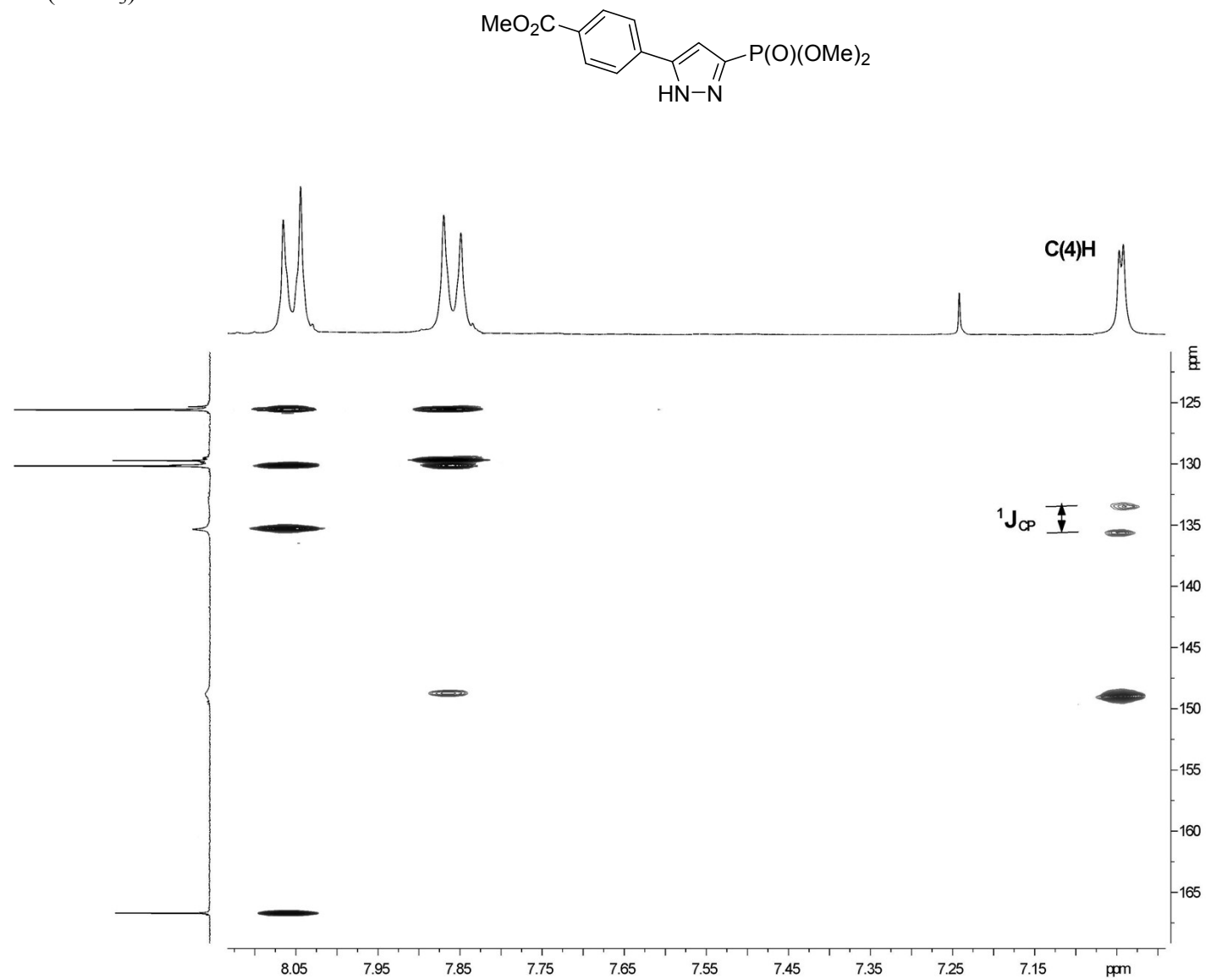
^1H NMR spectrum (CDCl_3) of **4d**



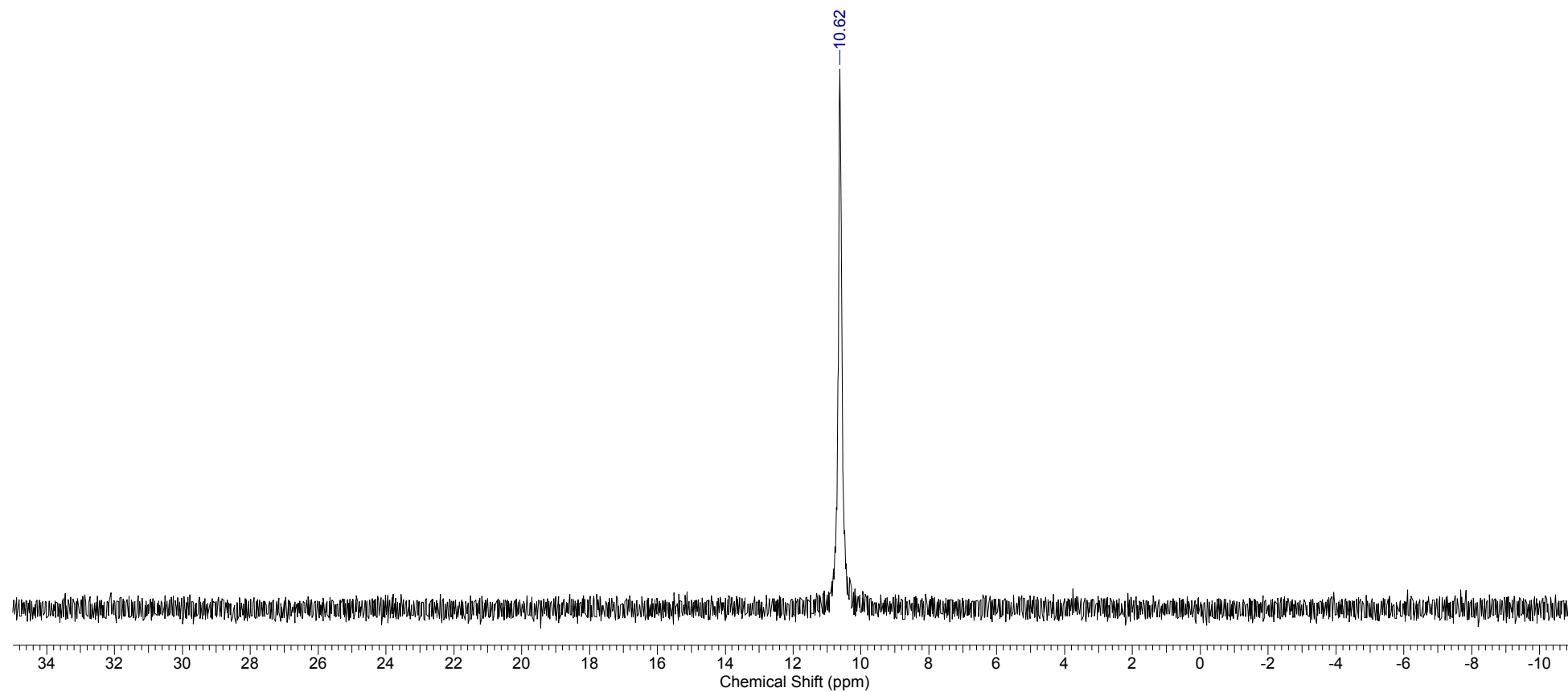
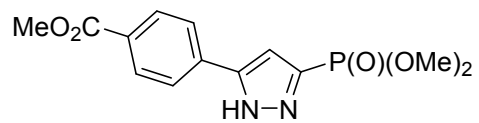
^{13}C NMR spectrum (CDCl_3) of **4d**

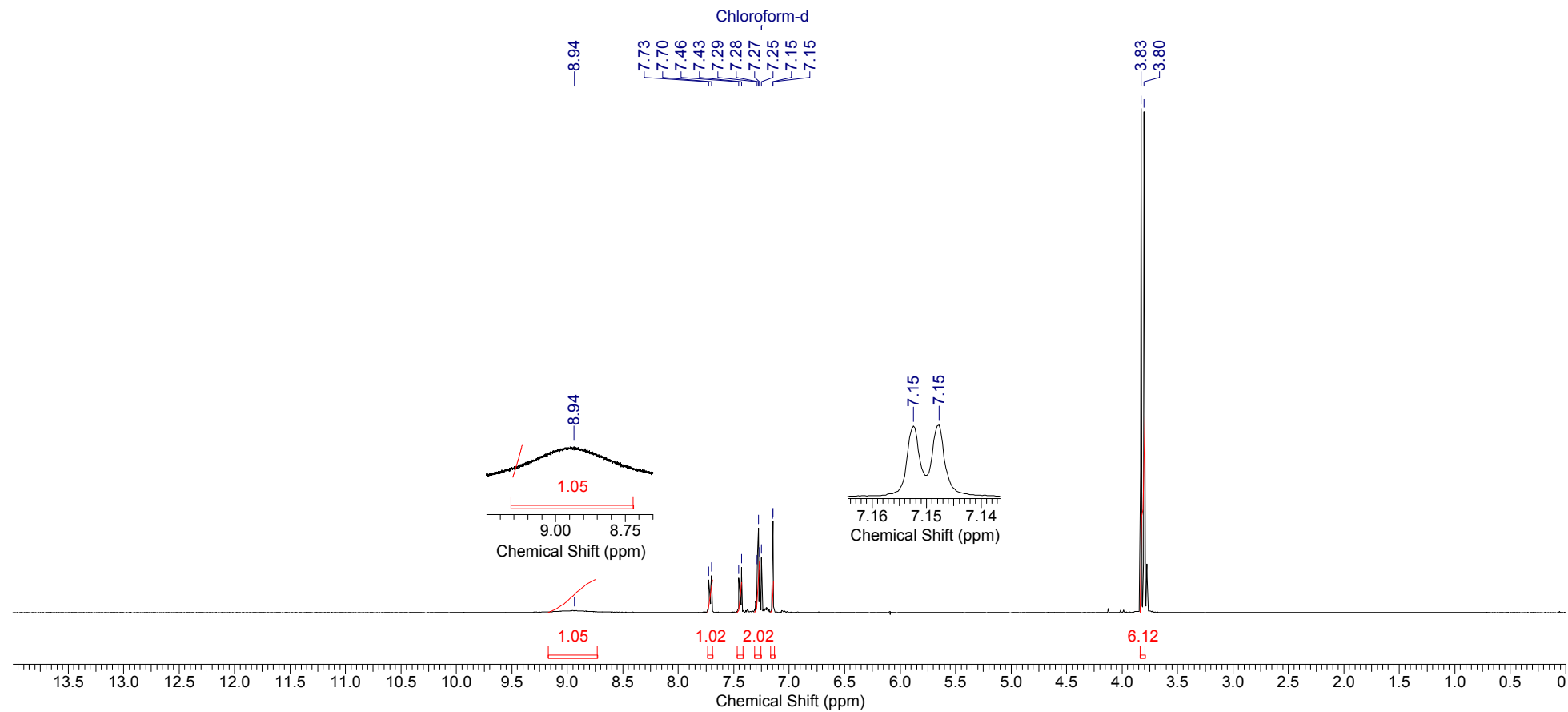
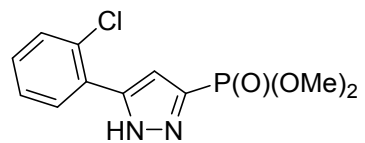


HMBC spectrum (CDCl₃) of **4d**

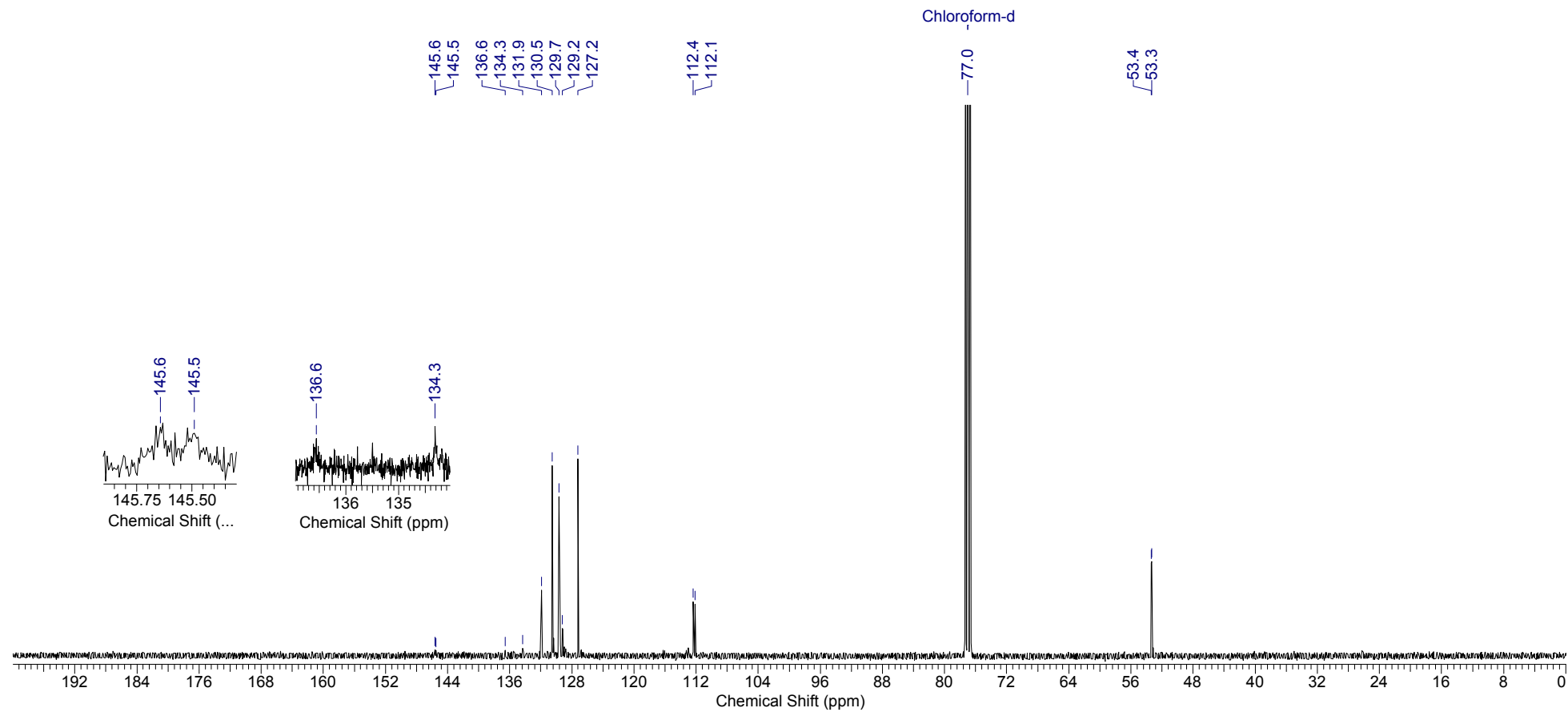
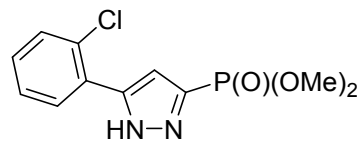


^{31}P NMR spectrum (CDCl_3) of **4d**

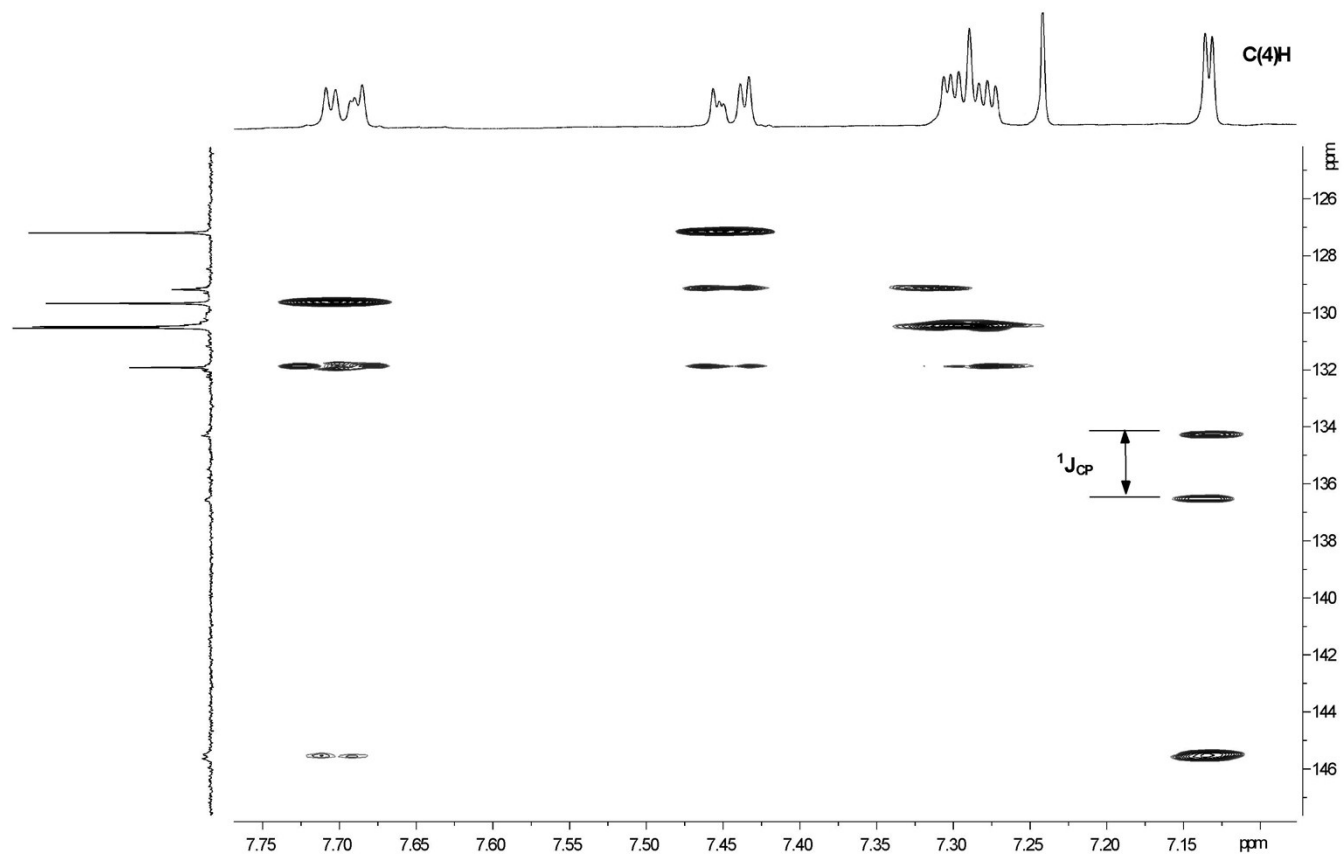
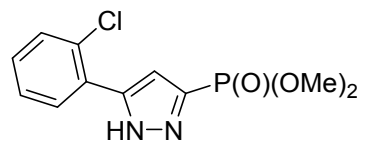


¹H NMR spectrum (CDCl₃) of **4e**

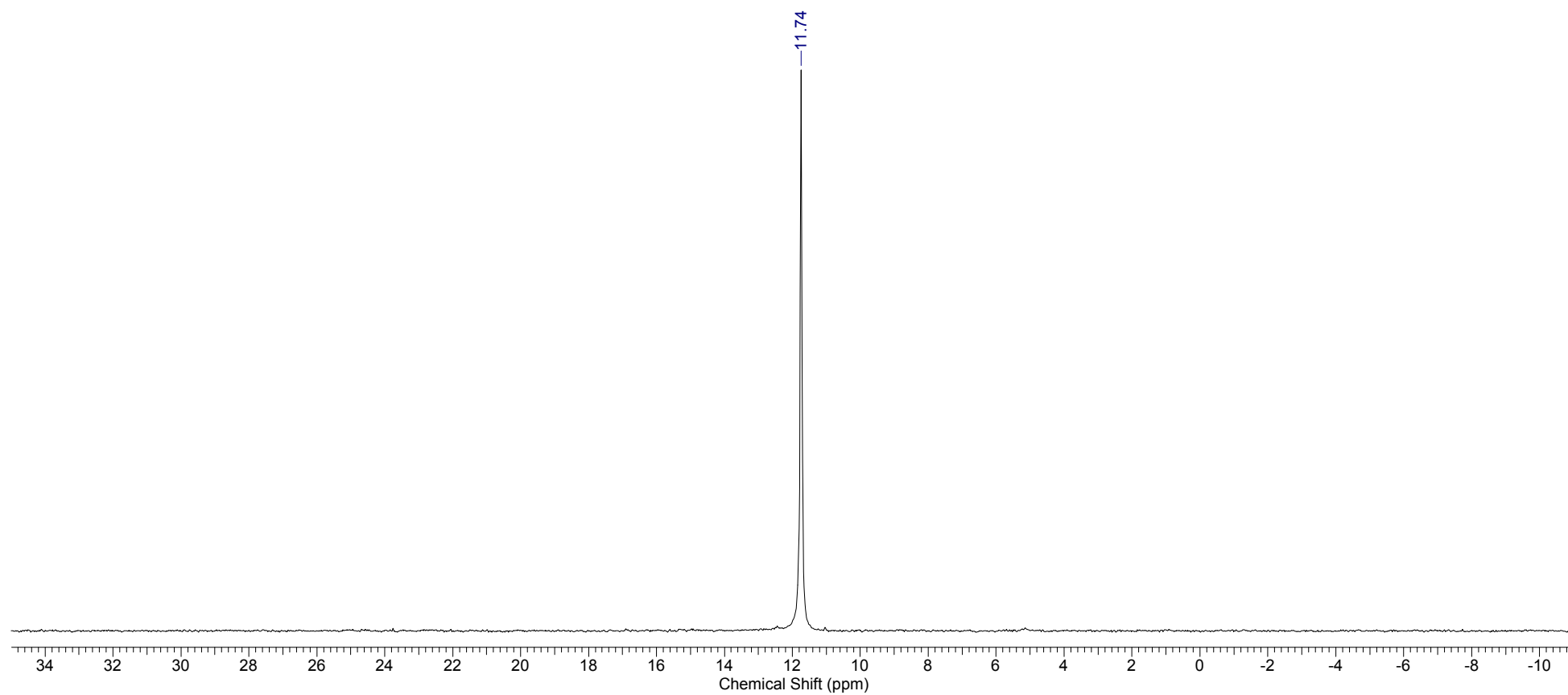
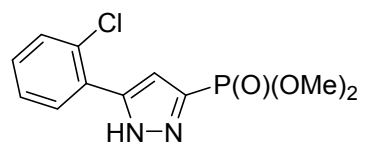
^{13}C NMR spectrum (CDCl_3) of **4e**

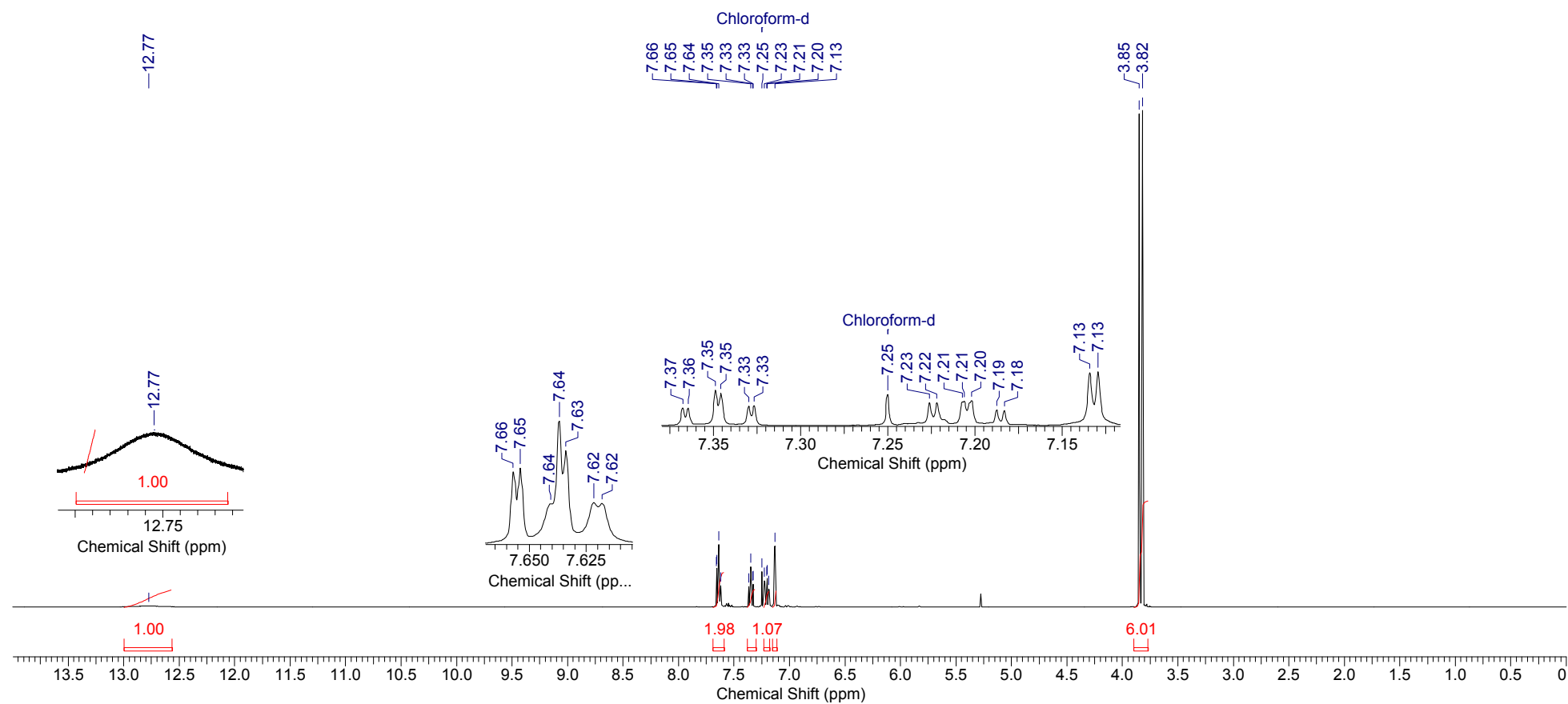
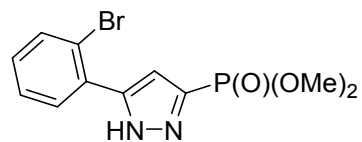


HMBC spectrum (CDCl₃) of **4e**

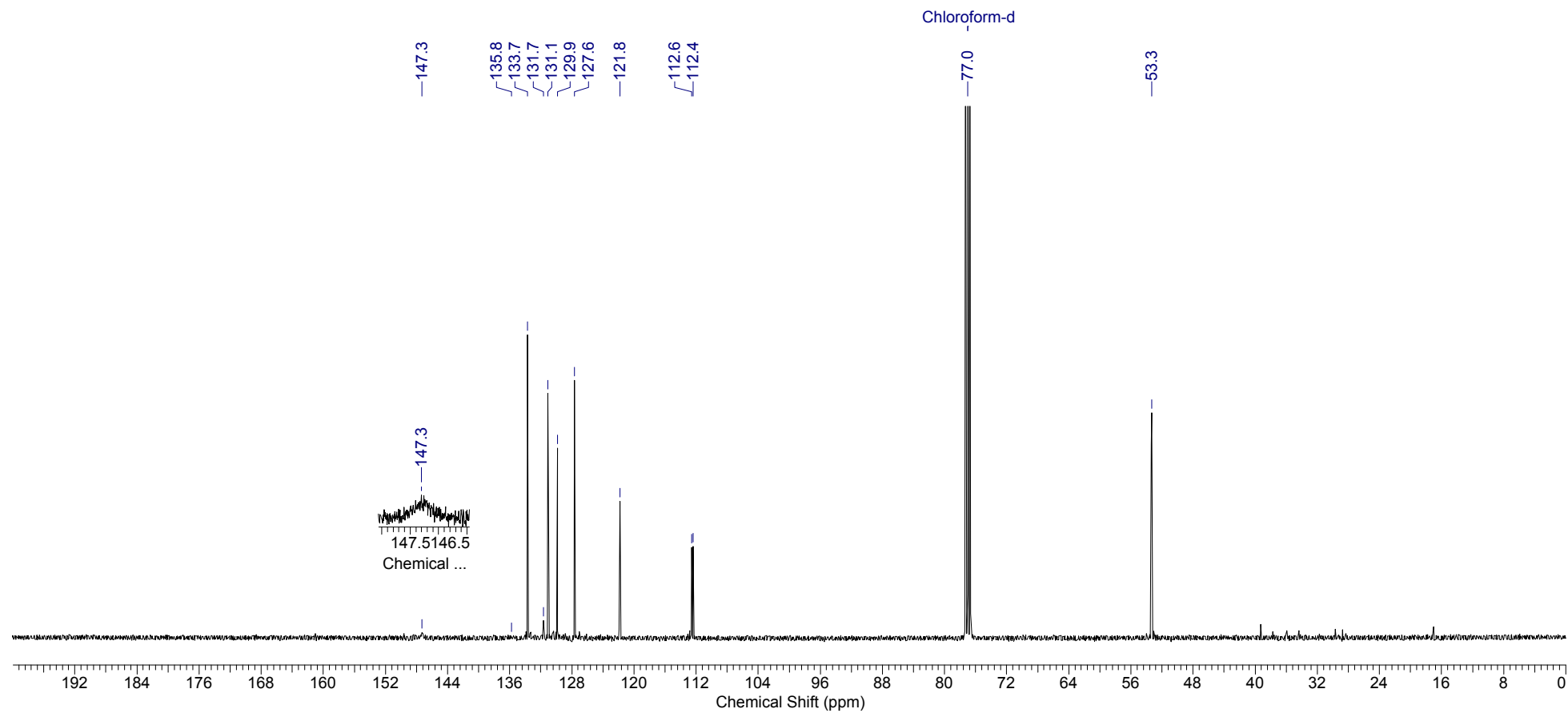
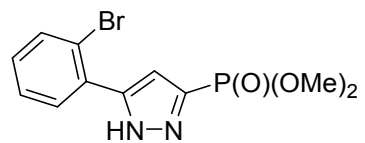


^{31}P NMR spectrum (CDCl_3) of **4e**

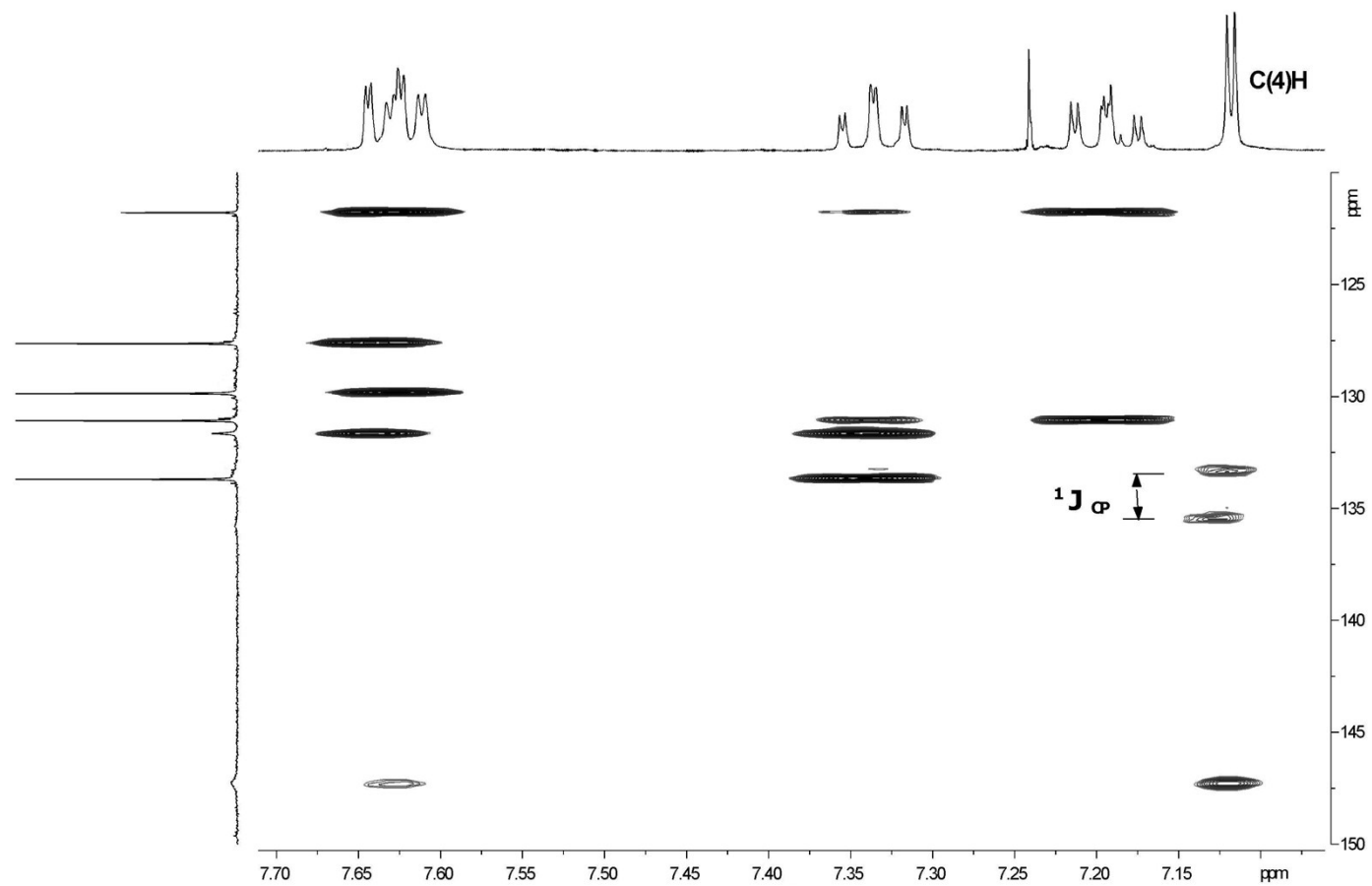
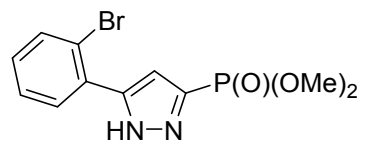


¹H NMR spectrum (CDCl₃) of **4f**

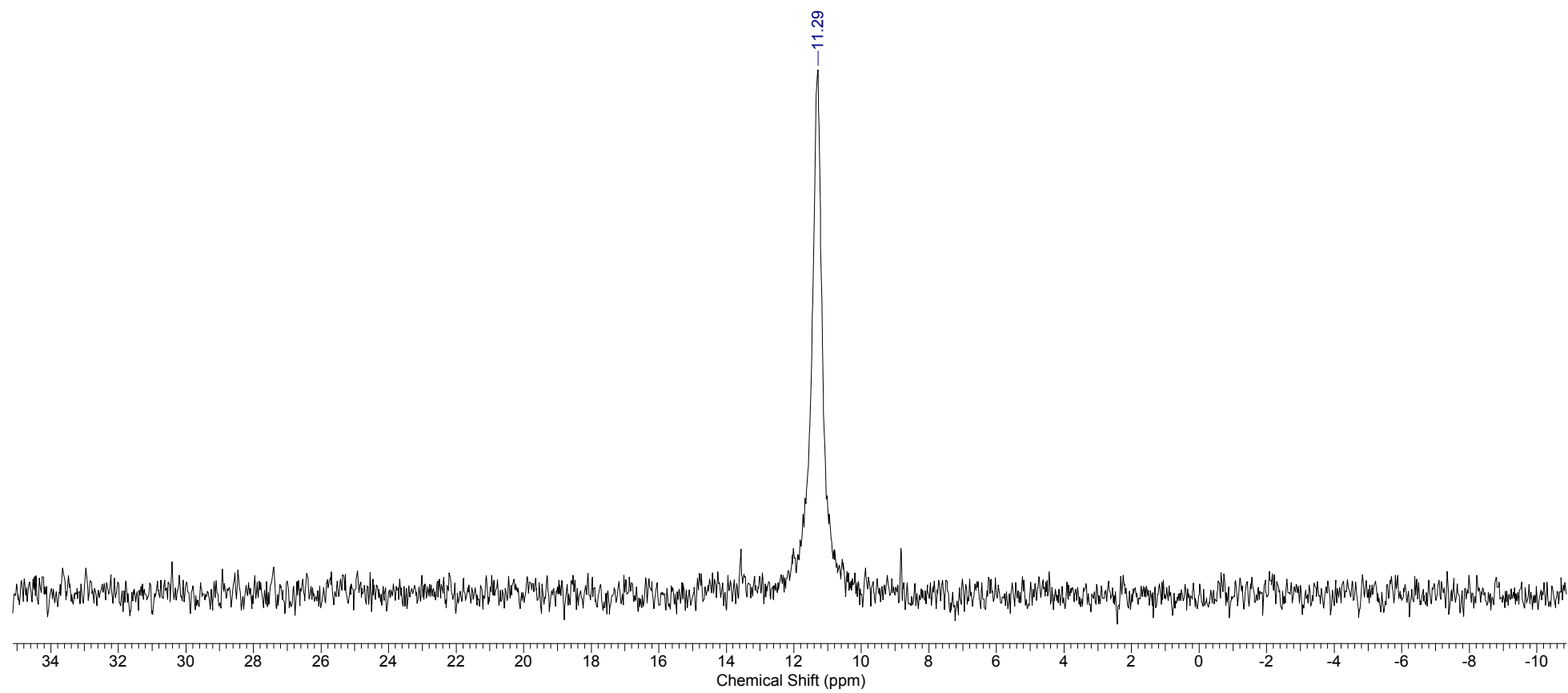
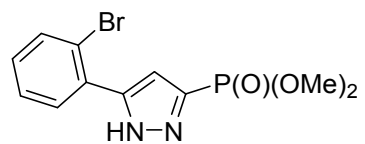
^{13}C NMR spectrum (CDCl_3) of **4f**



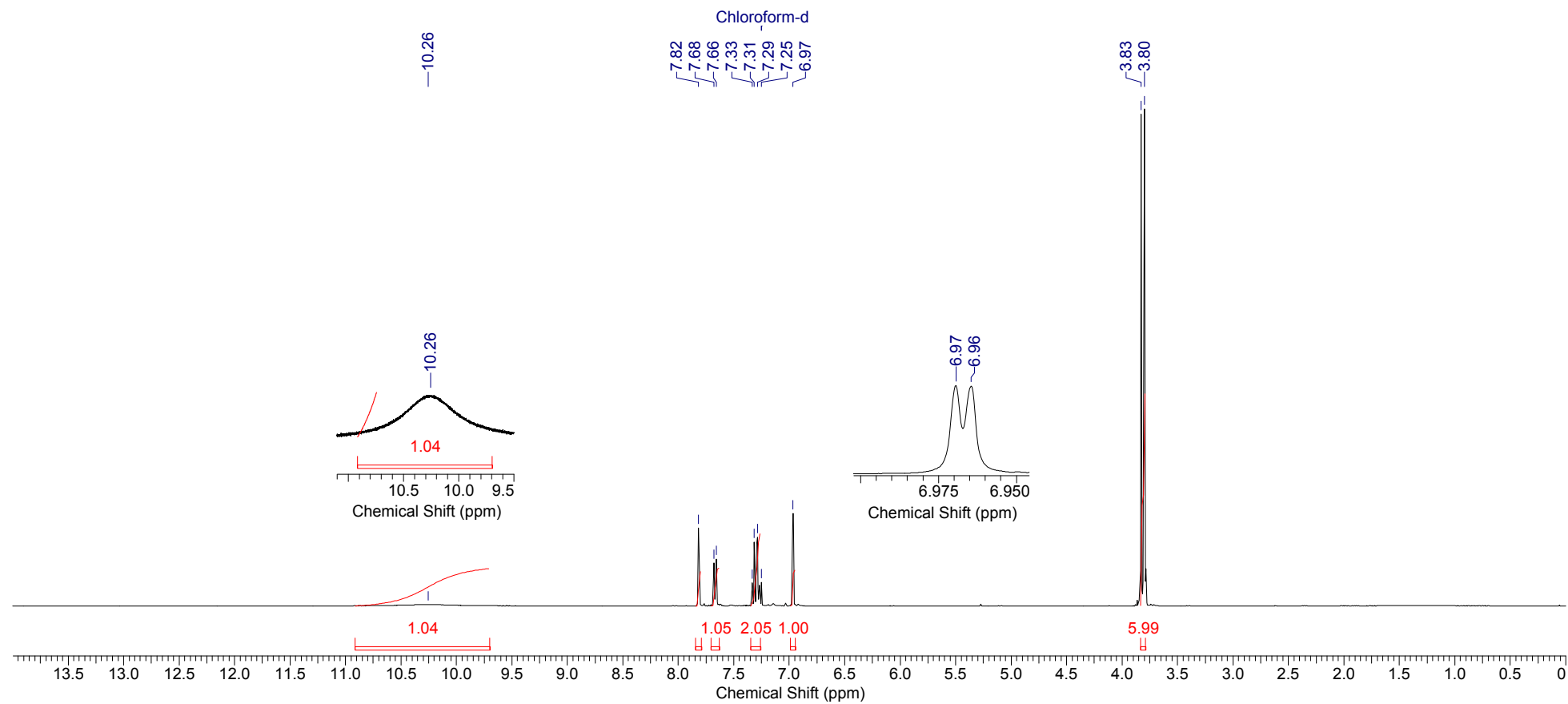
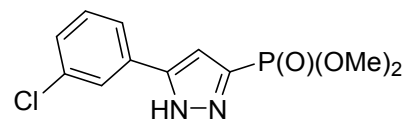
HMBC spectrum (CDCl₃) of **4f**



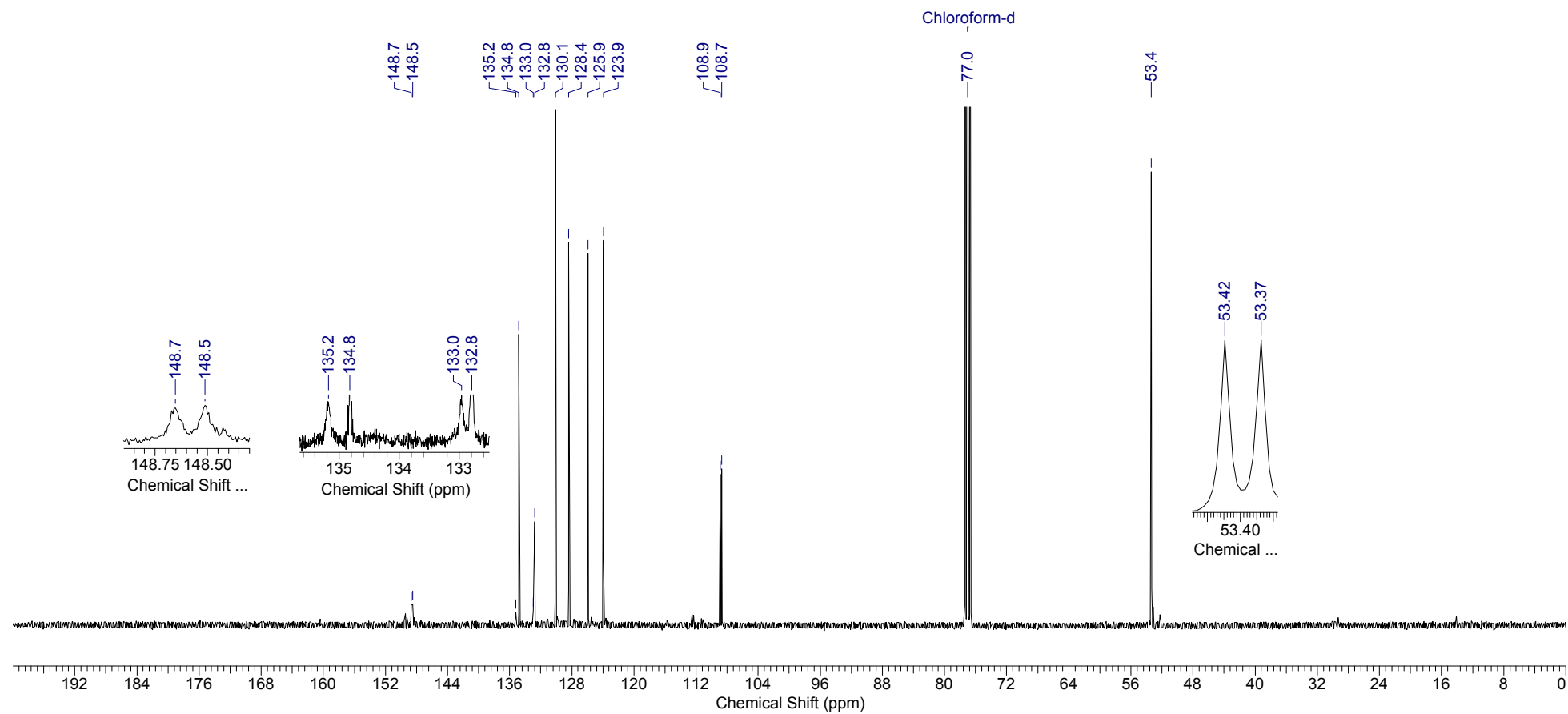
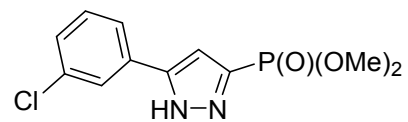
^{31}P NMR spectrum (CDCl_3) of **4f**



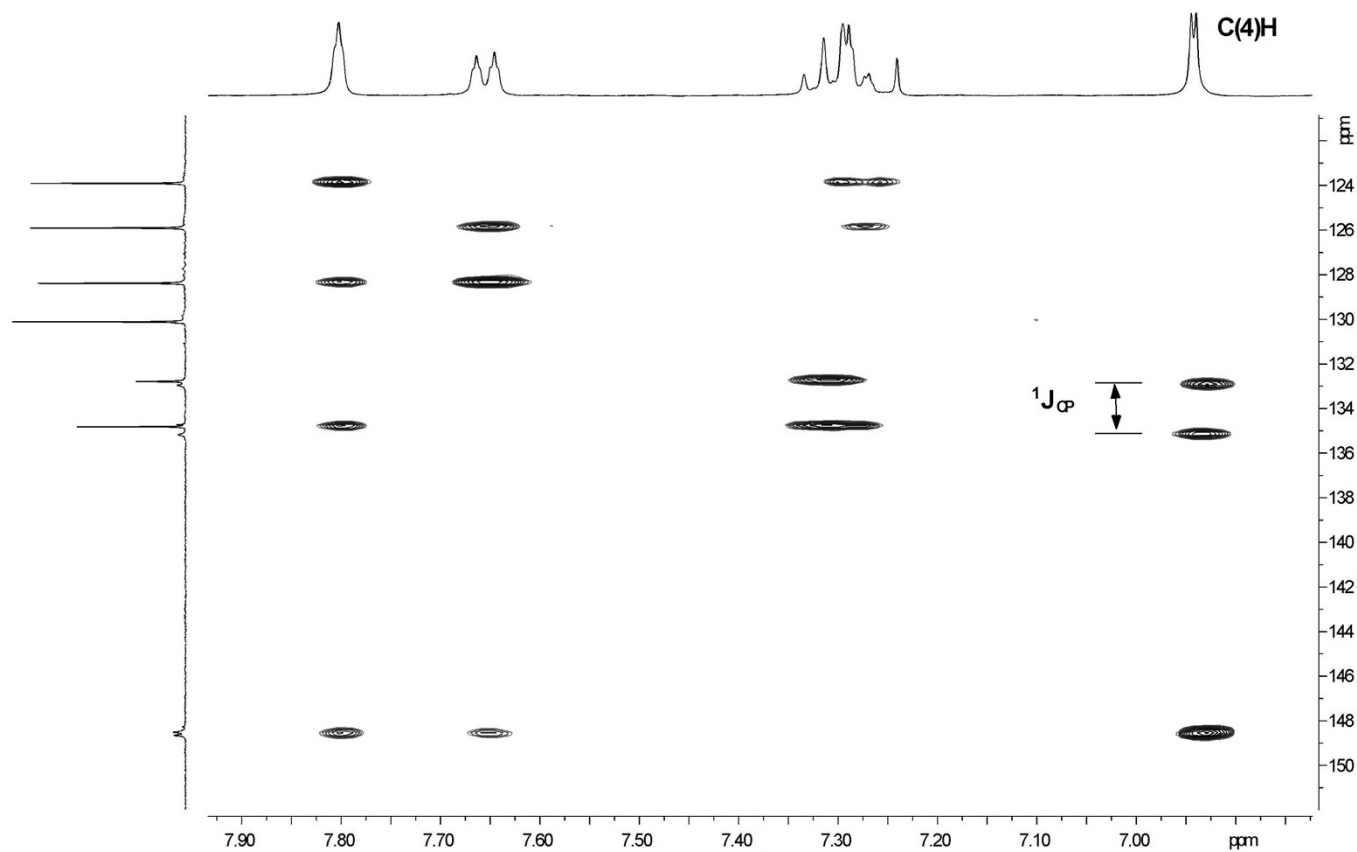
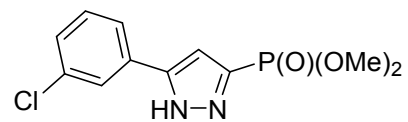
^1H NMR spectrum (CDCl_3) of **4g**



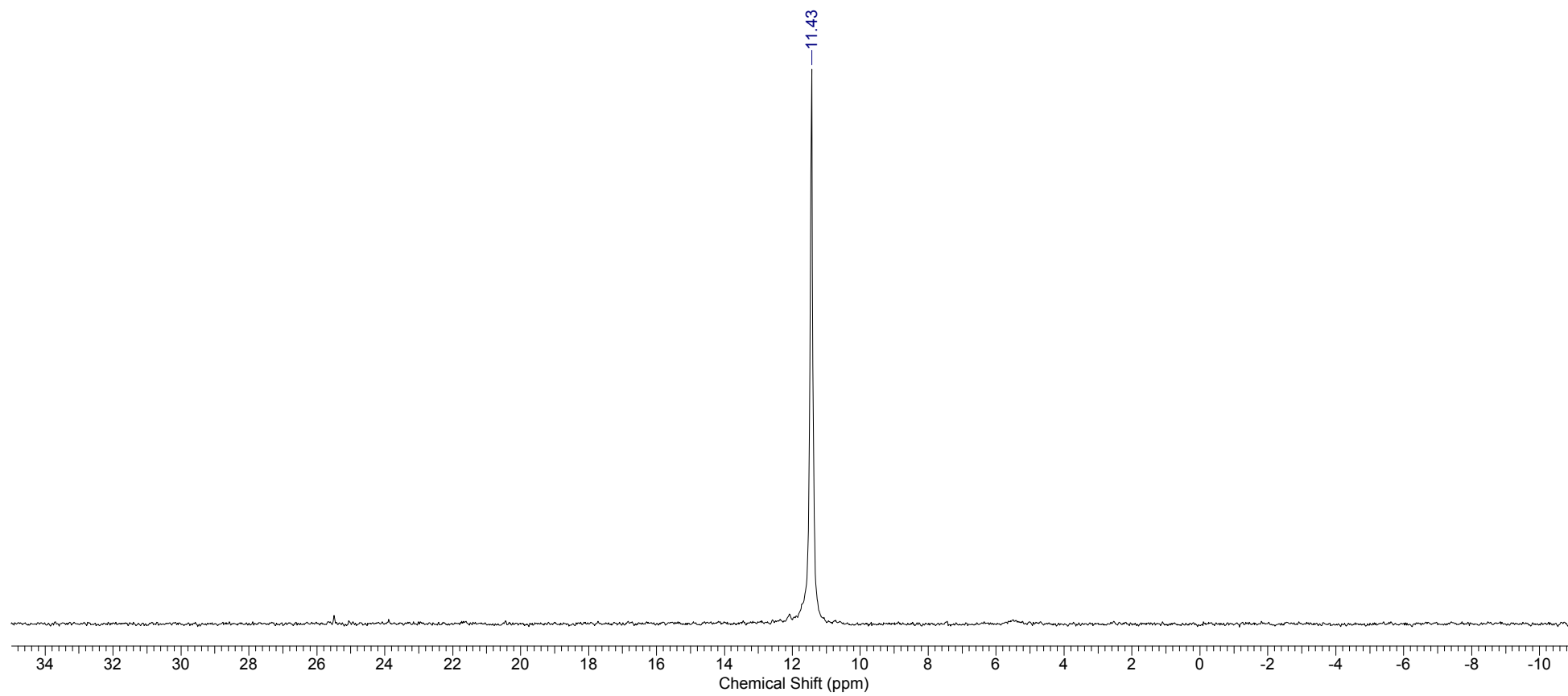
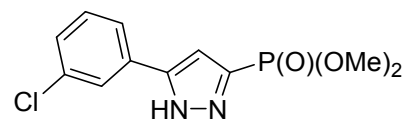
^{13}C NMR spectrum (CDCl_3) of **4g**



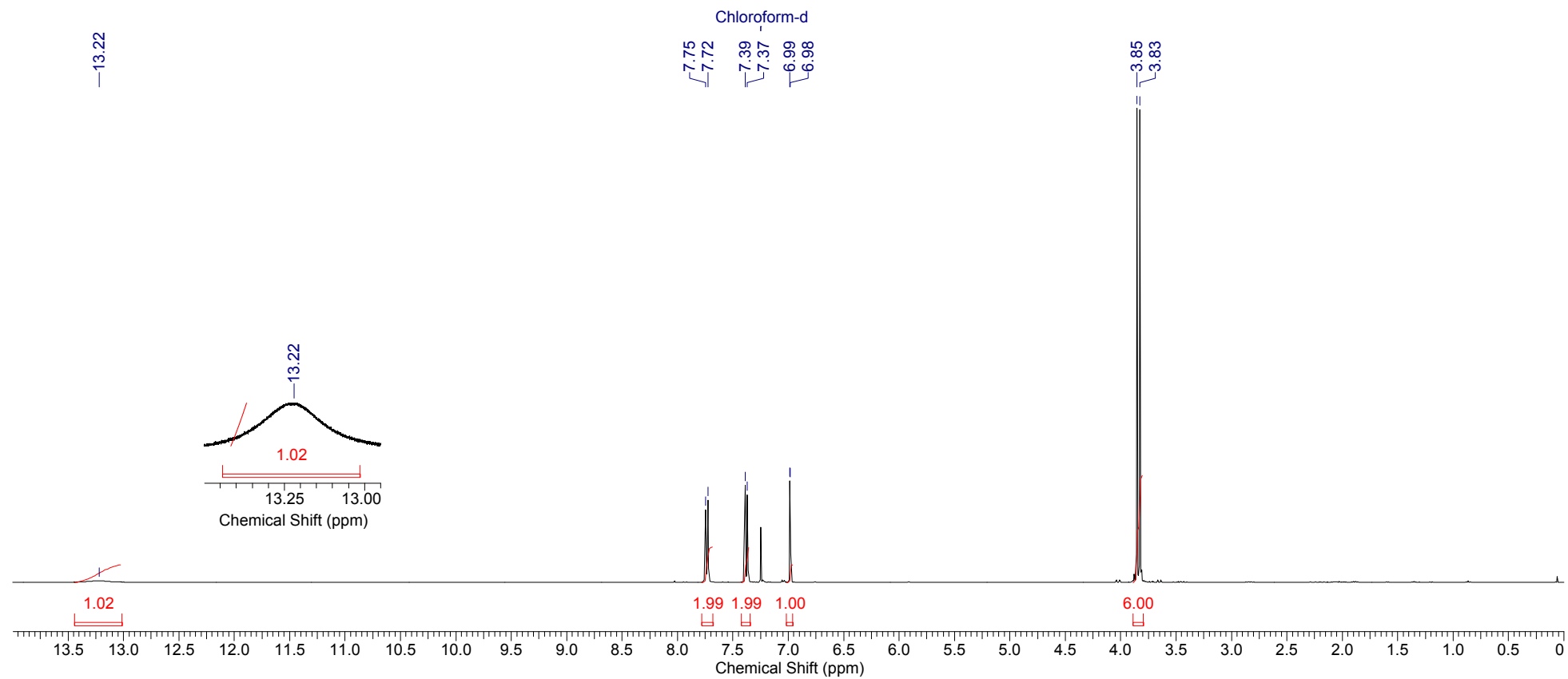
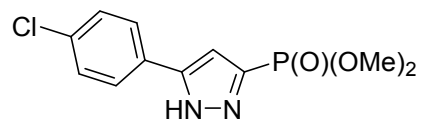
HMBC spectrum (CDCl₃) of **4g**



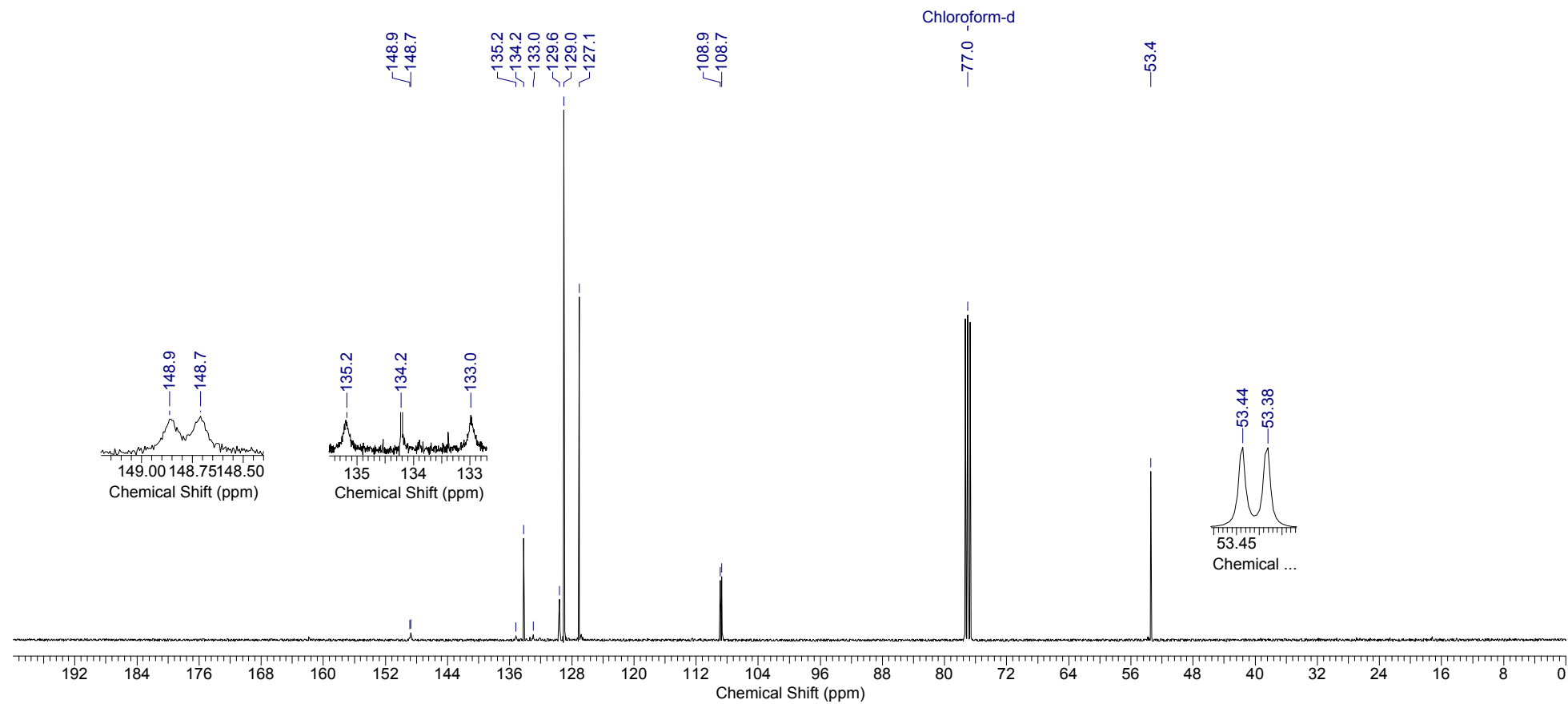
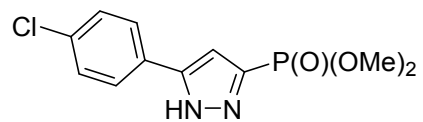
^{31}P NMR spectrum (CDCl_3) of **4g**



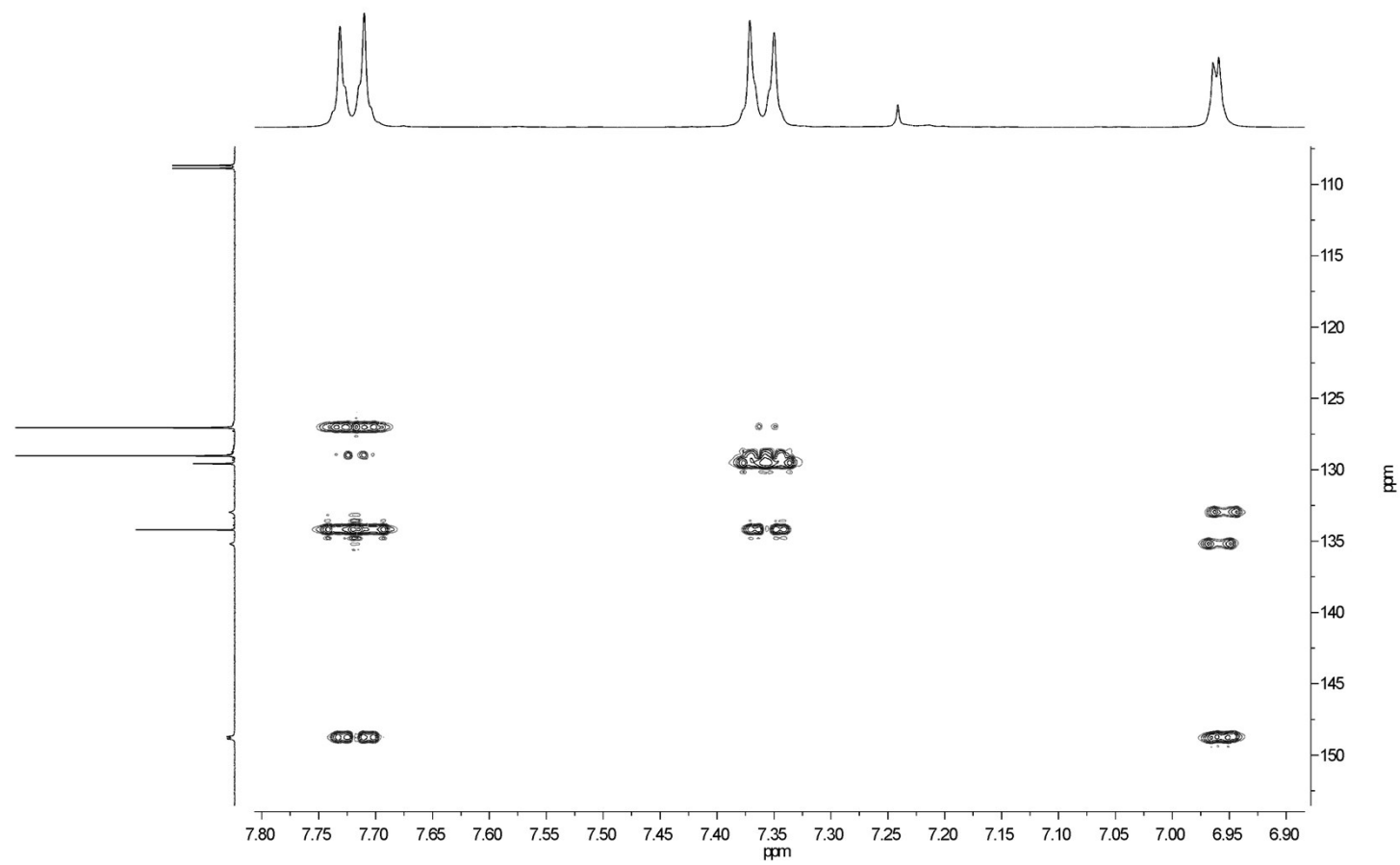
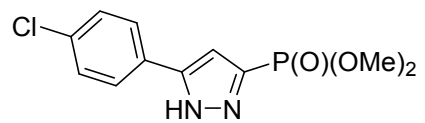
^1H NMR spectrum (CDCl_3) of **4h**



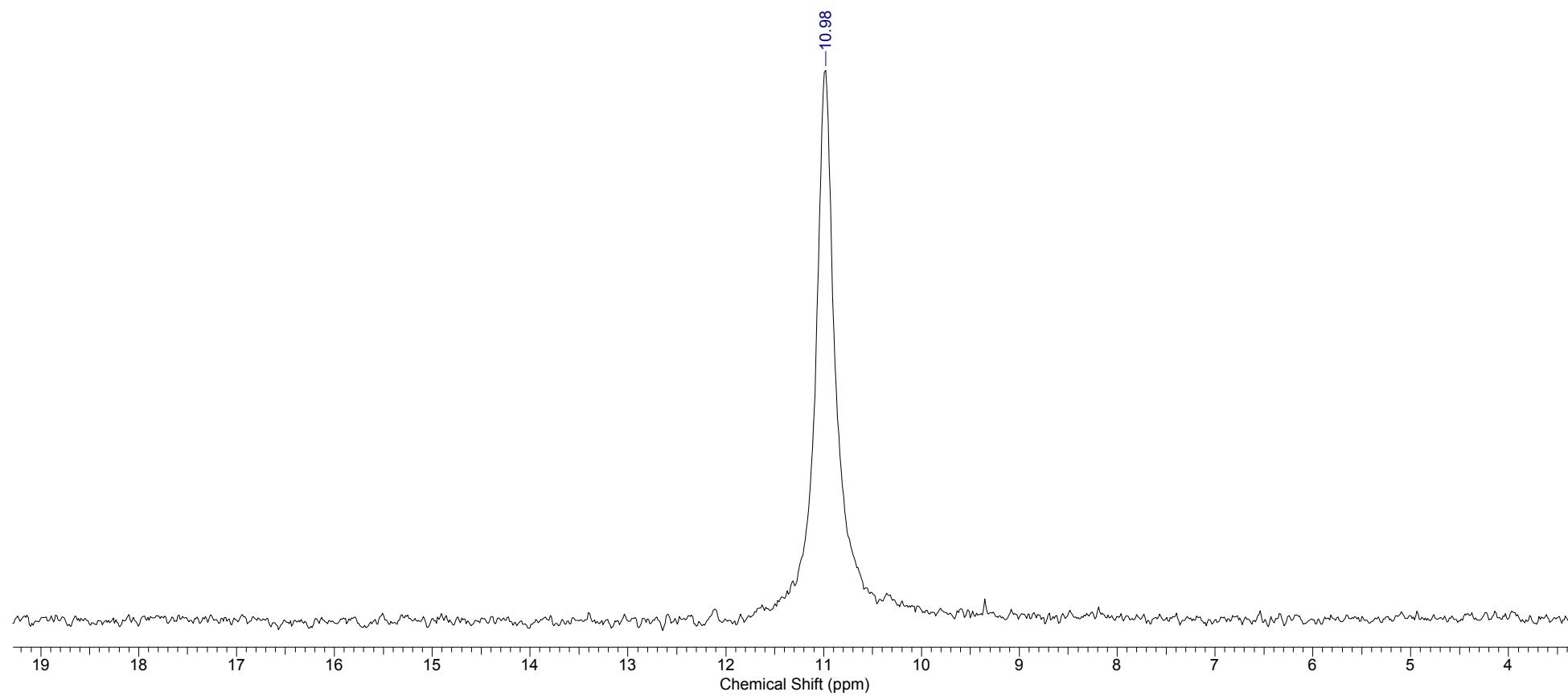
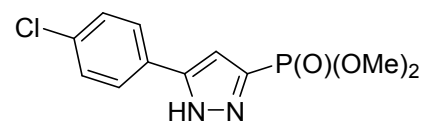
^{13}C NMR spectrum (CDCl_3) of **4h**



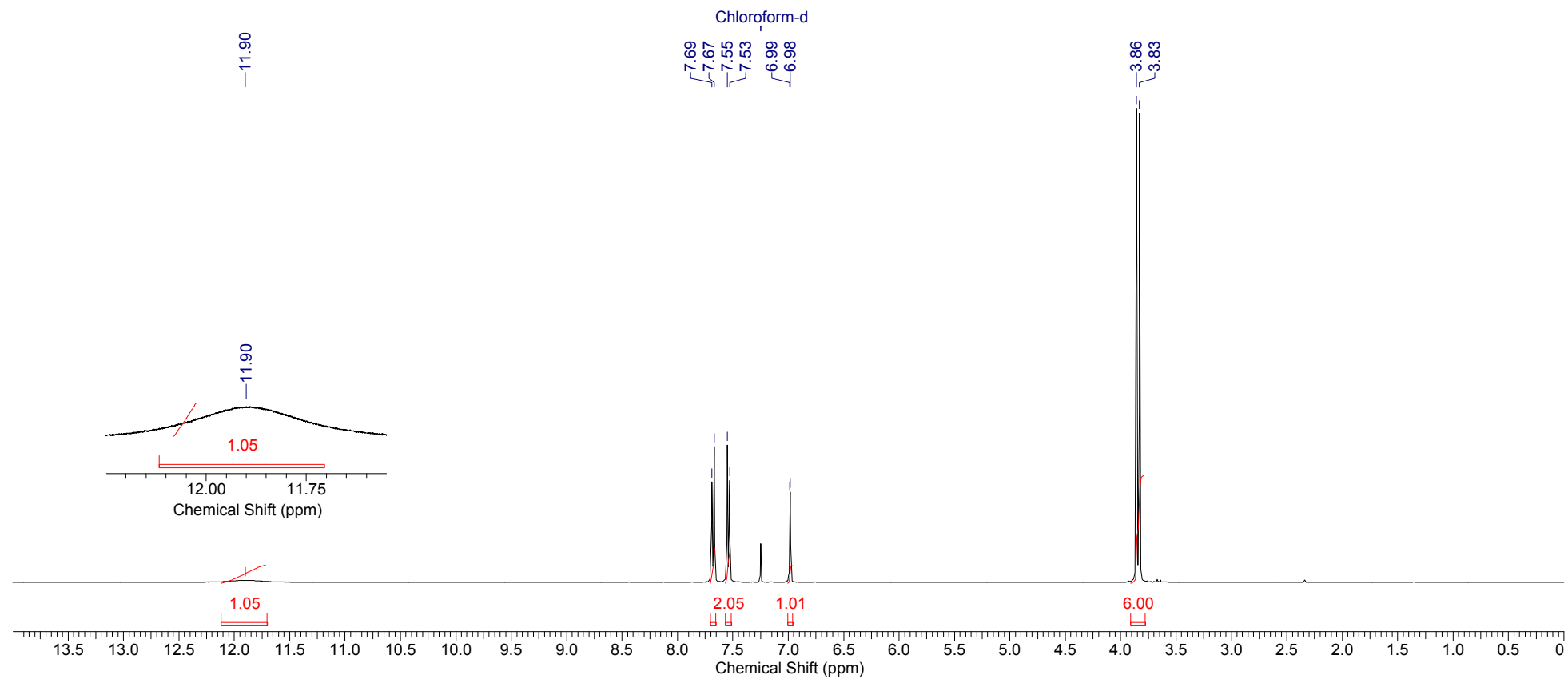
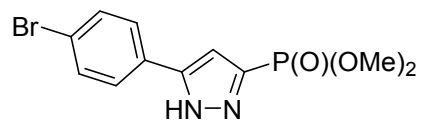
HMBC spectrum (CDCl₃) of **4h**



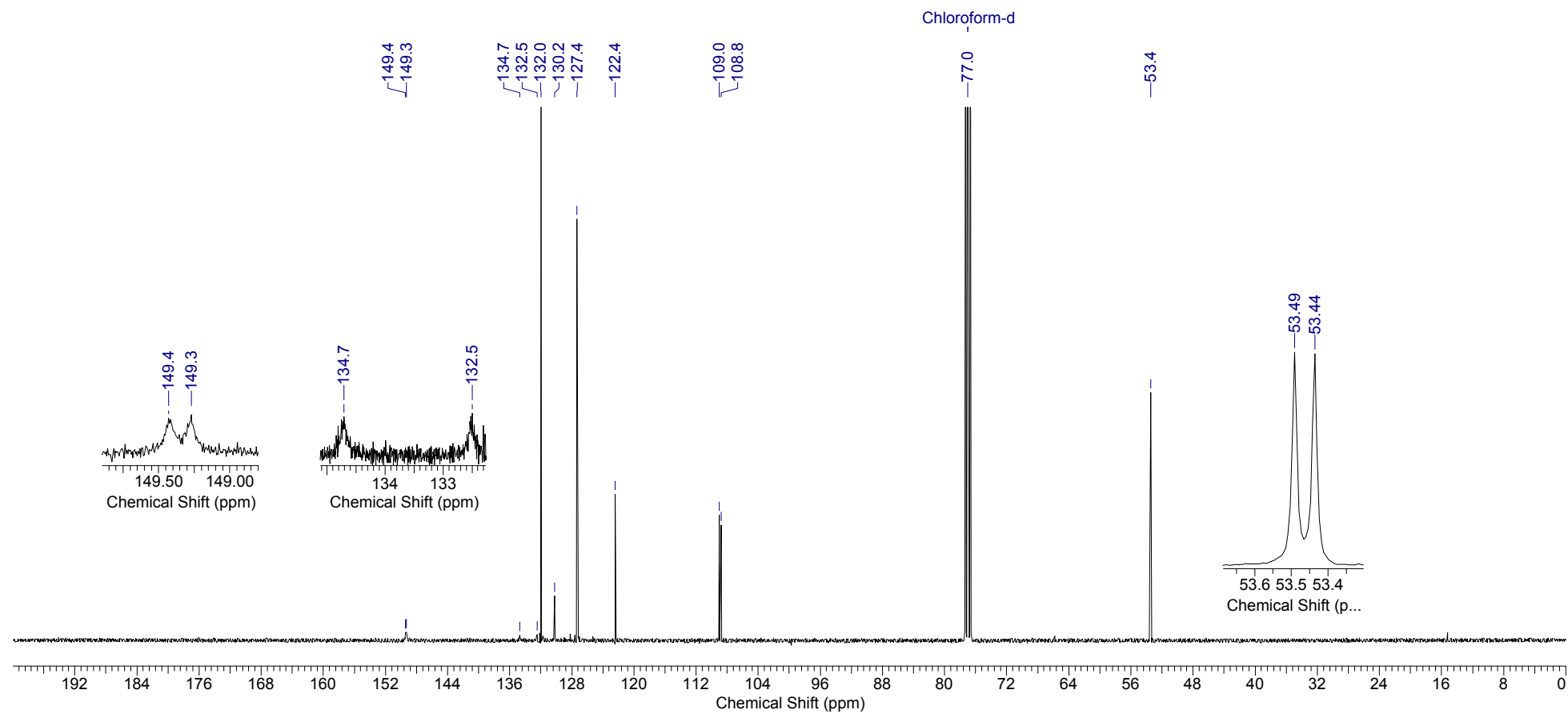
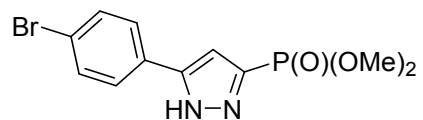
^{31}P NMR spectrum (CDCl_3) of **4h**



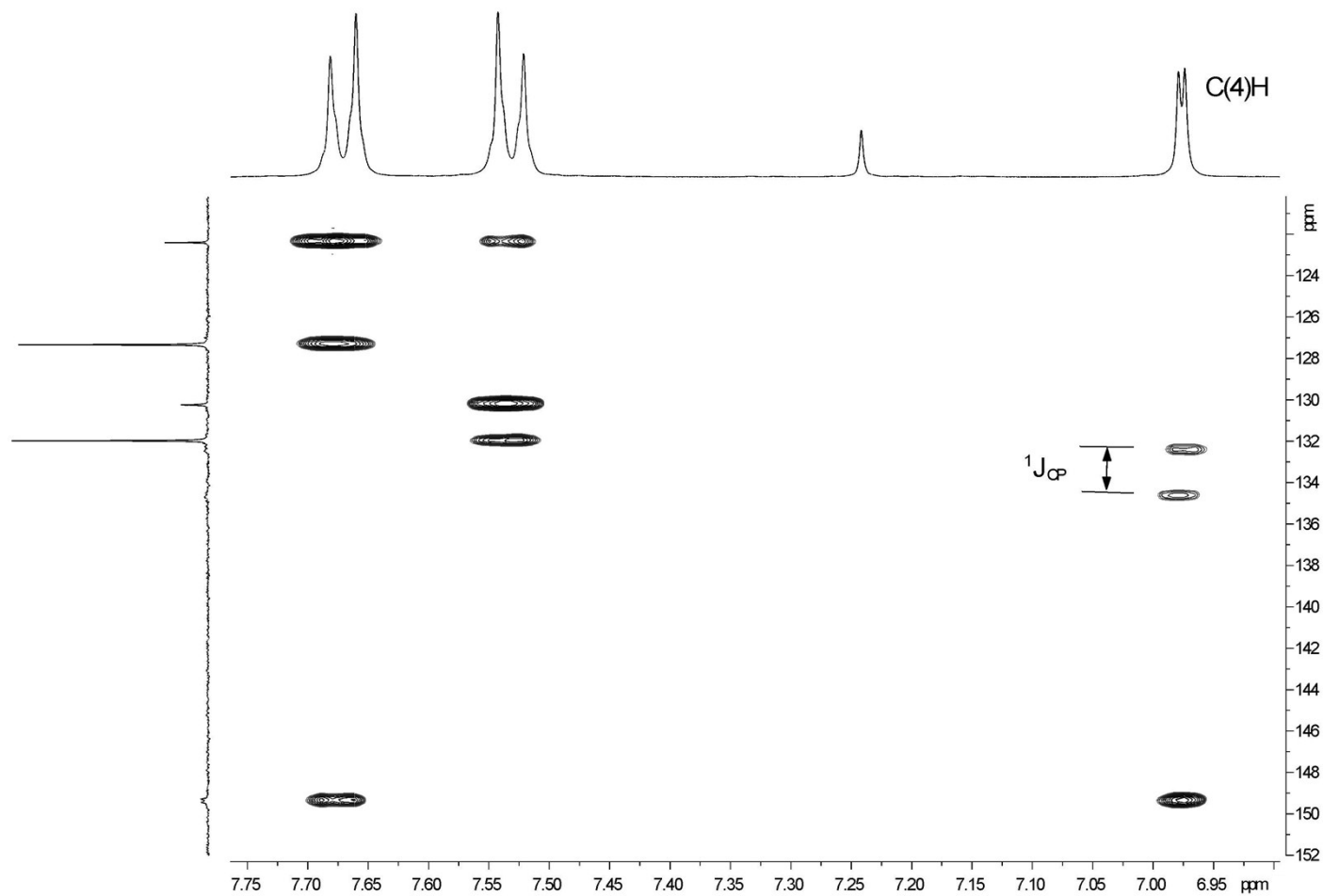
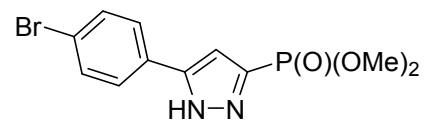
^1H NMR spectrum (CDCl_3) of **4i**



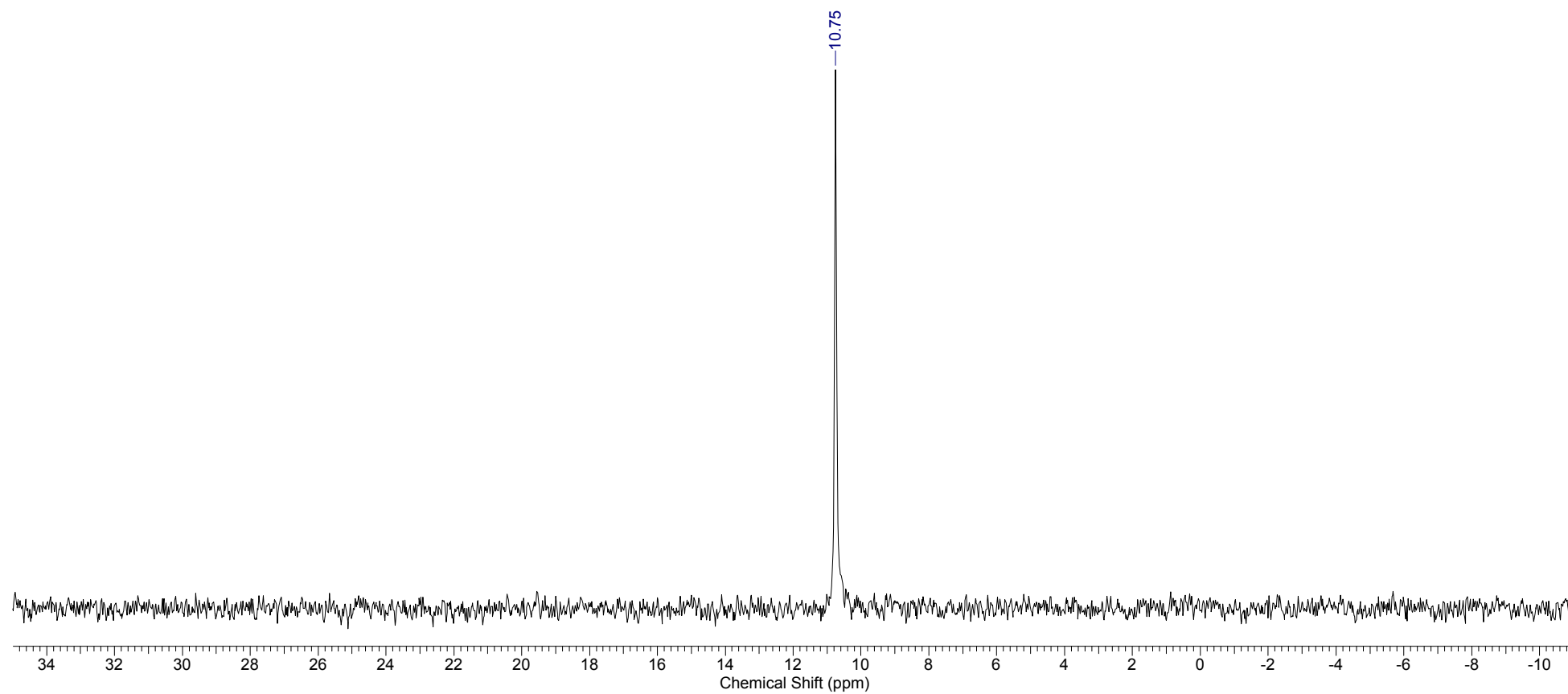
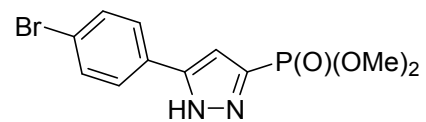
^{13}C NMR spectrum (CDCl_3) of **4i**



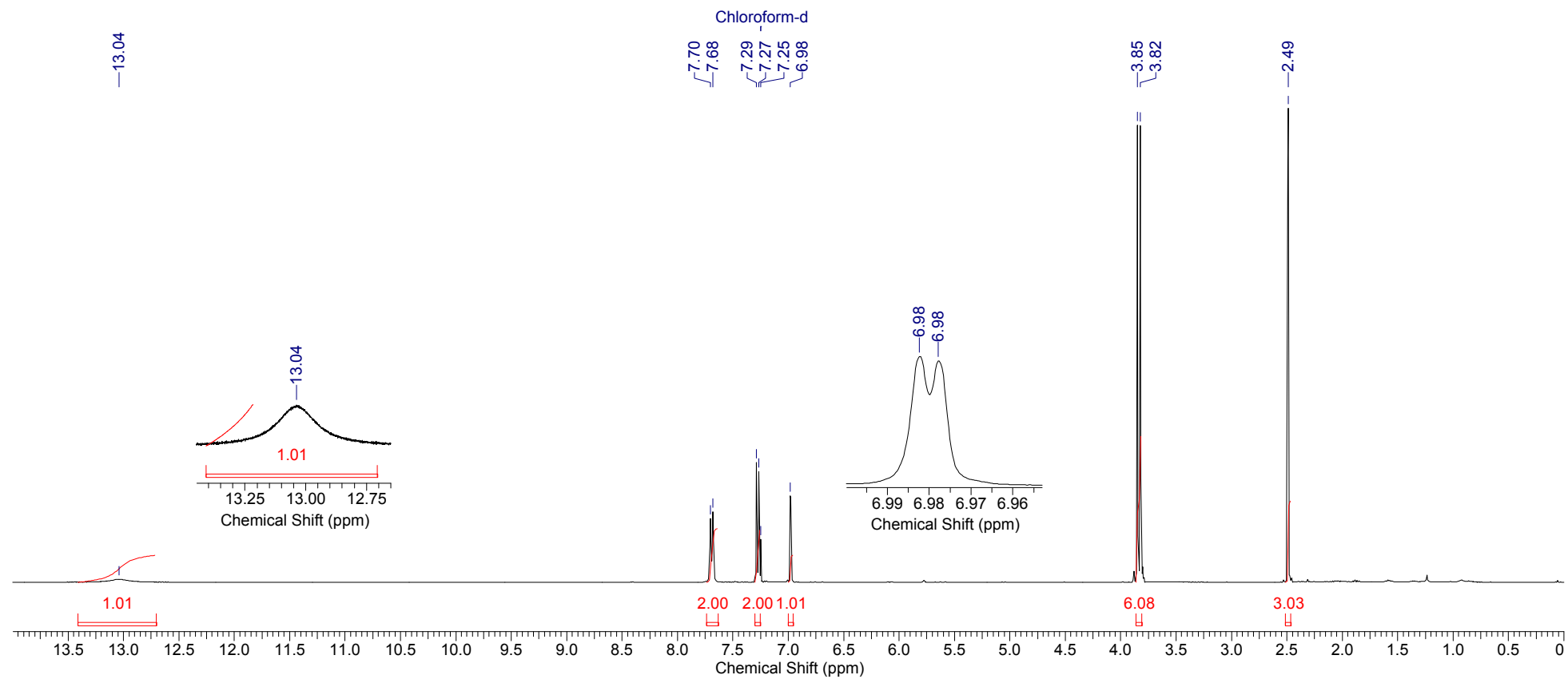
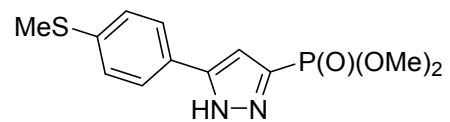
HMBC spectrum (CDCl₃) of **4i**



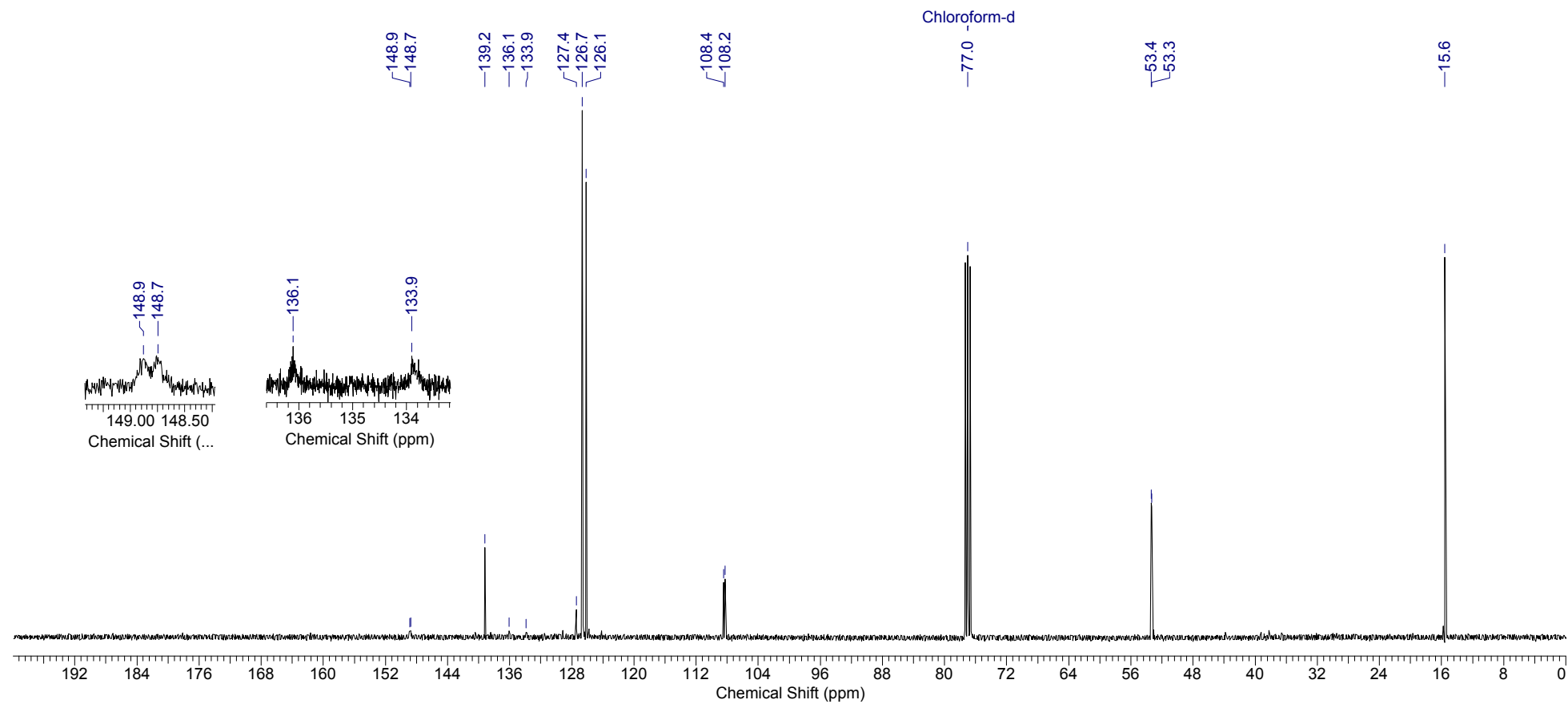
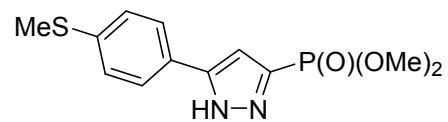
^{31}P NMR spectrum (CDCl_3) of **4i**



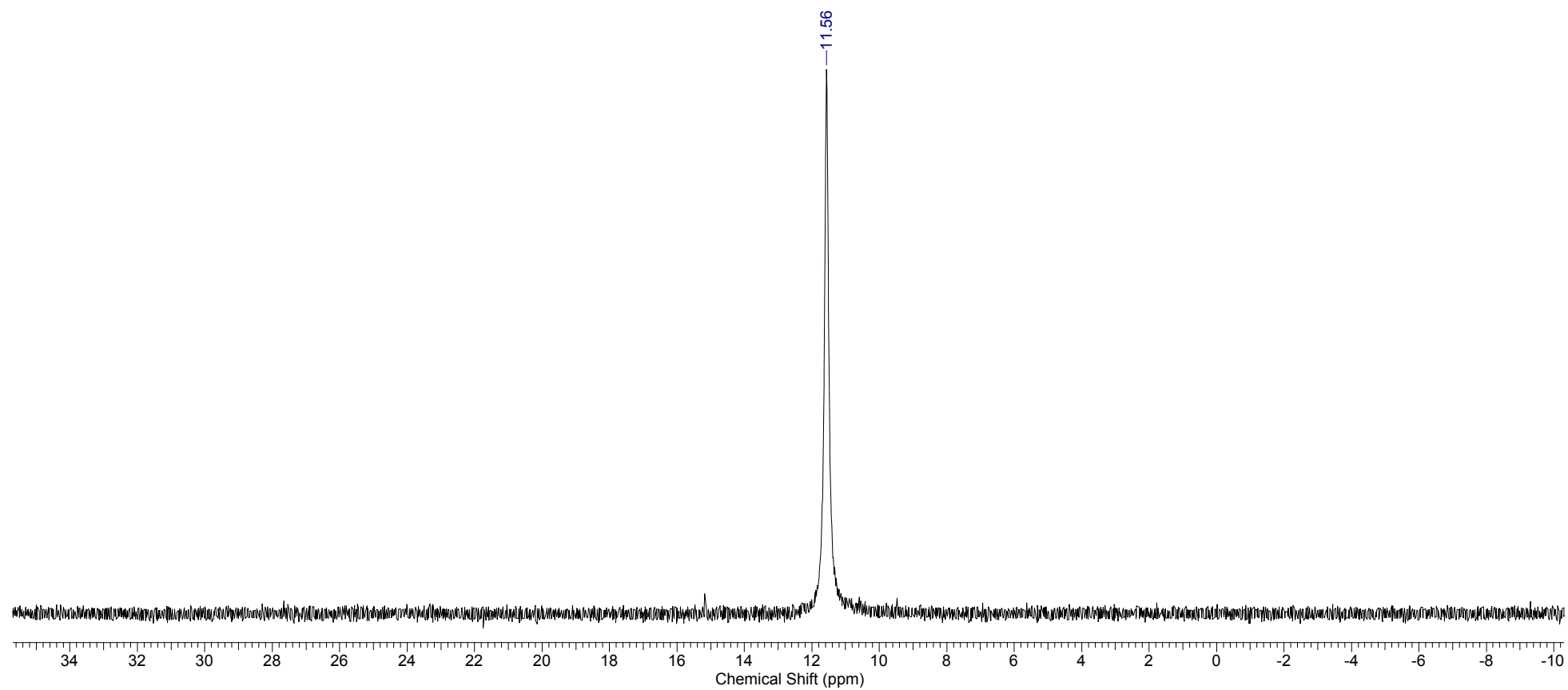
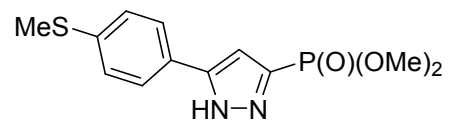
^1H NMR spectrum (CDCl_3) of **4j**



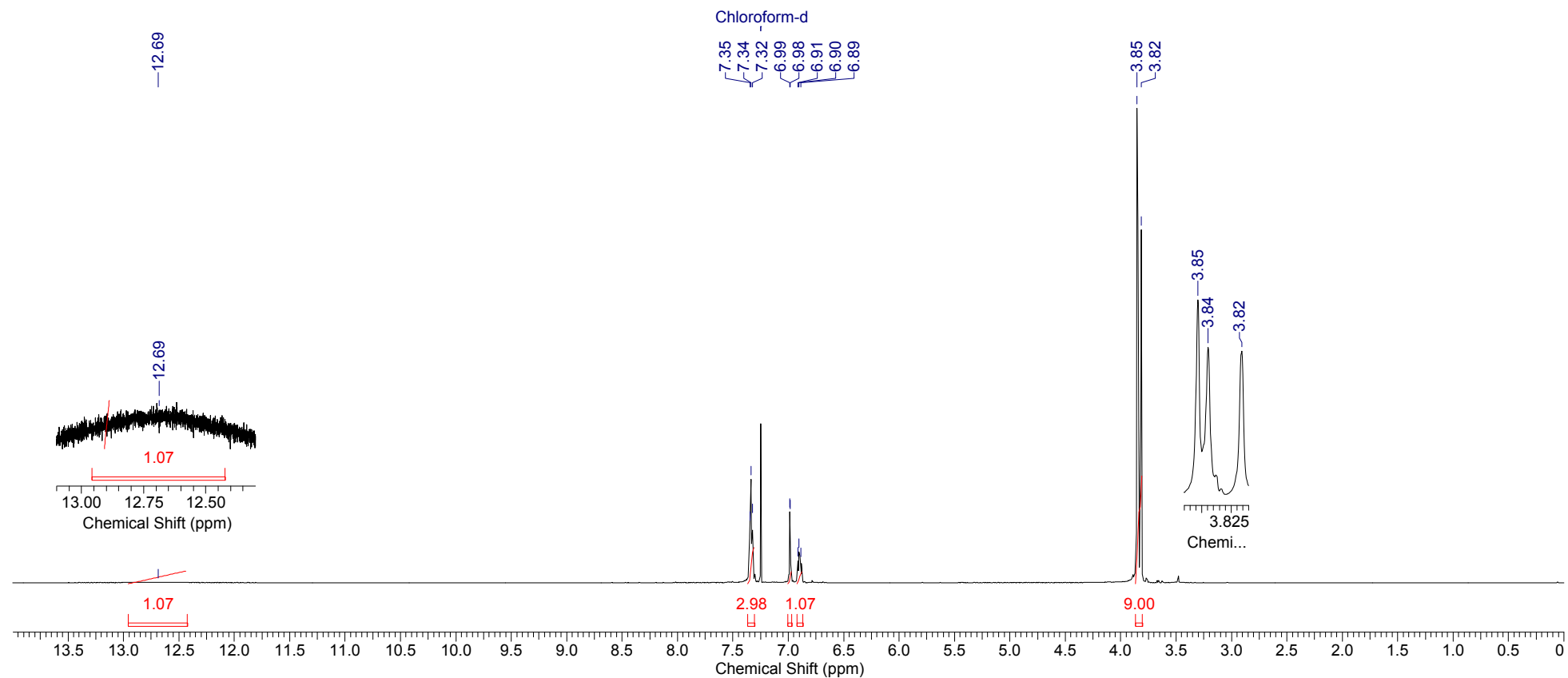
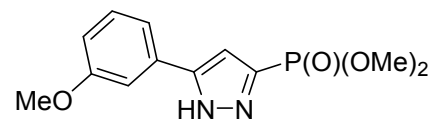
^{13}C NMR spectrum (CDCl_3) of **4j**



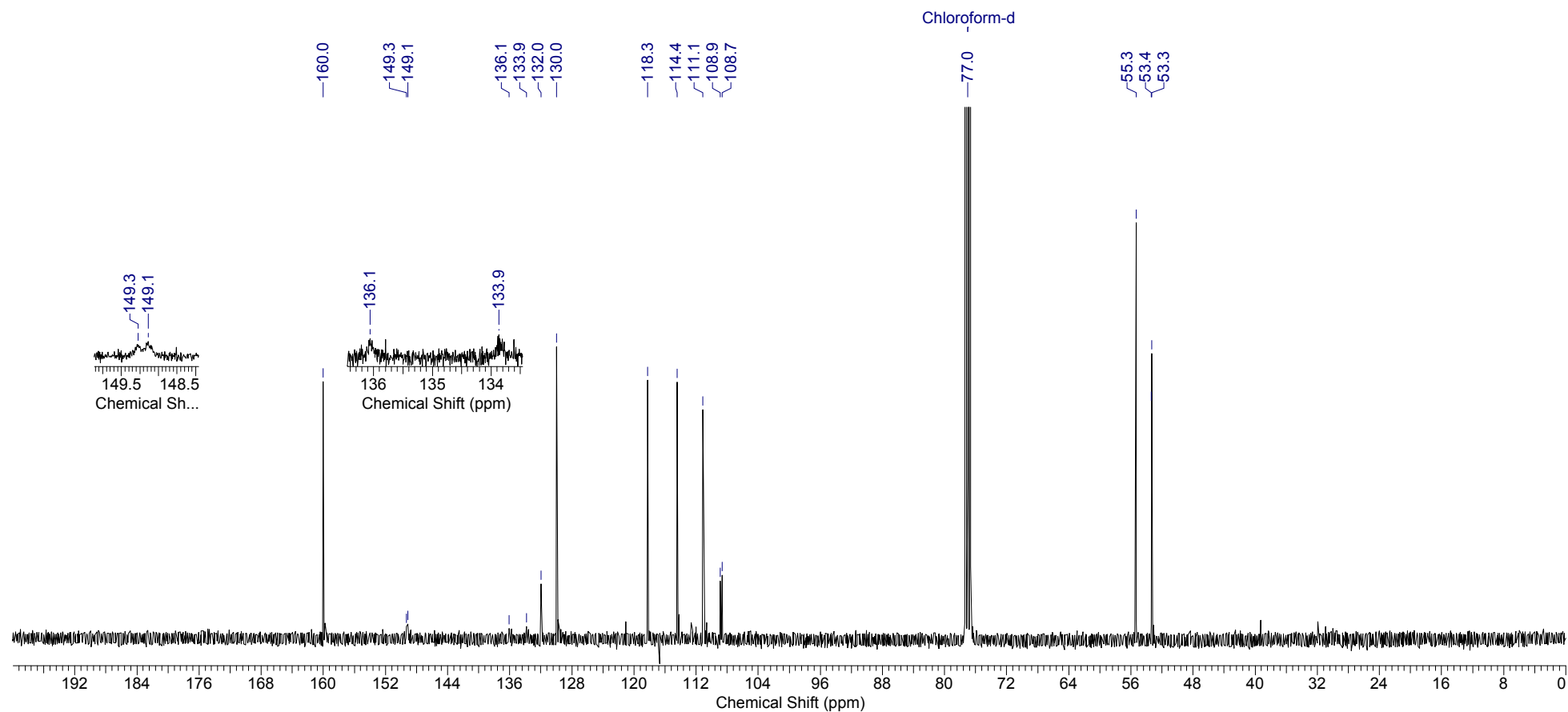
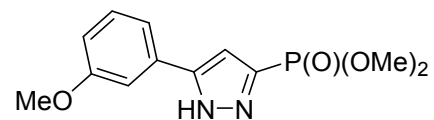
^{31}P NMR spectrum (CDCl_3) of **4j**



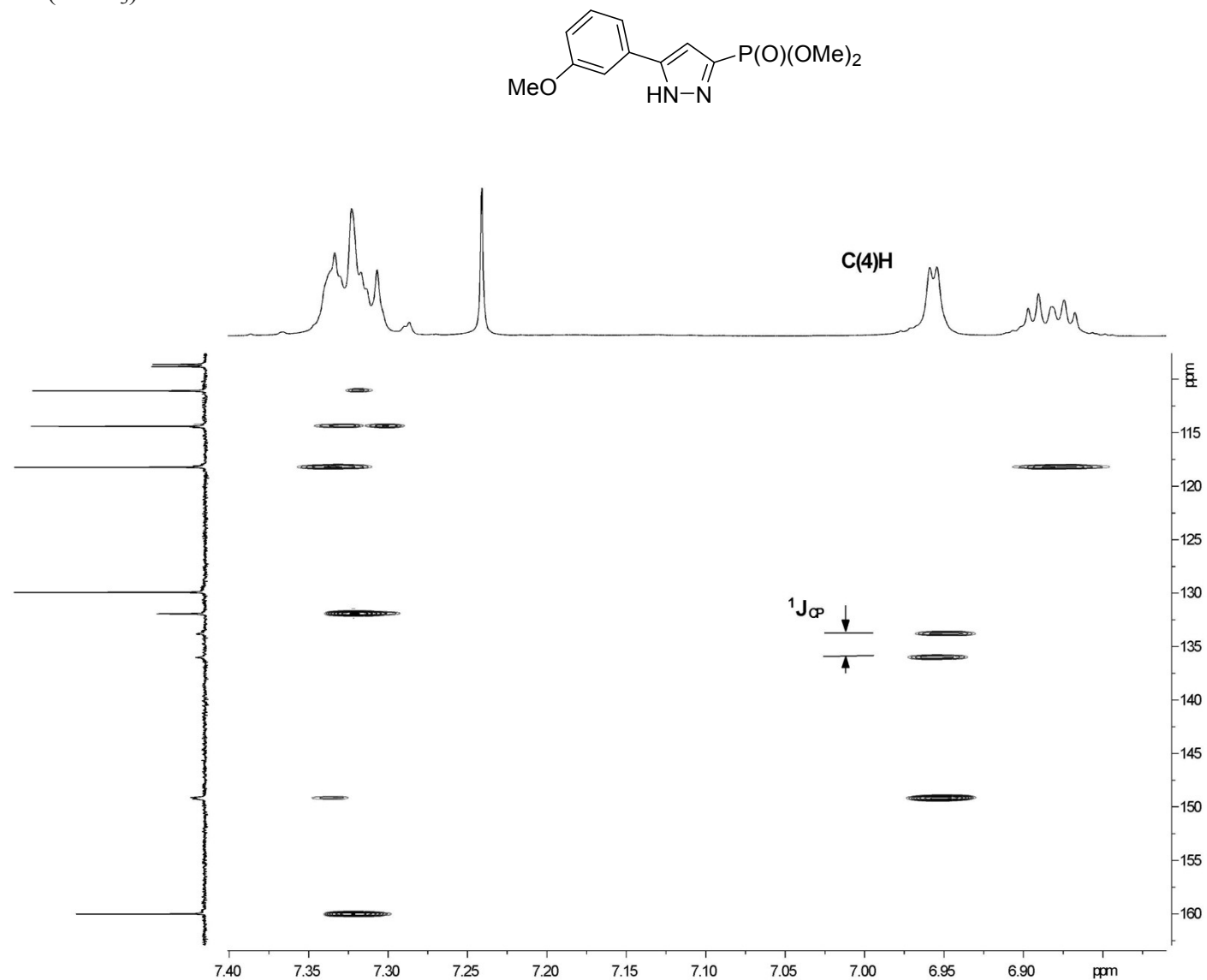
^1H NMR spectrum (CDCl_3) of **4k**



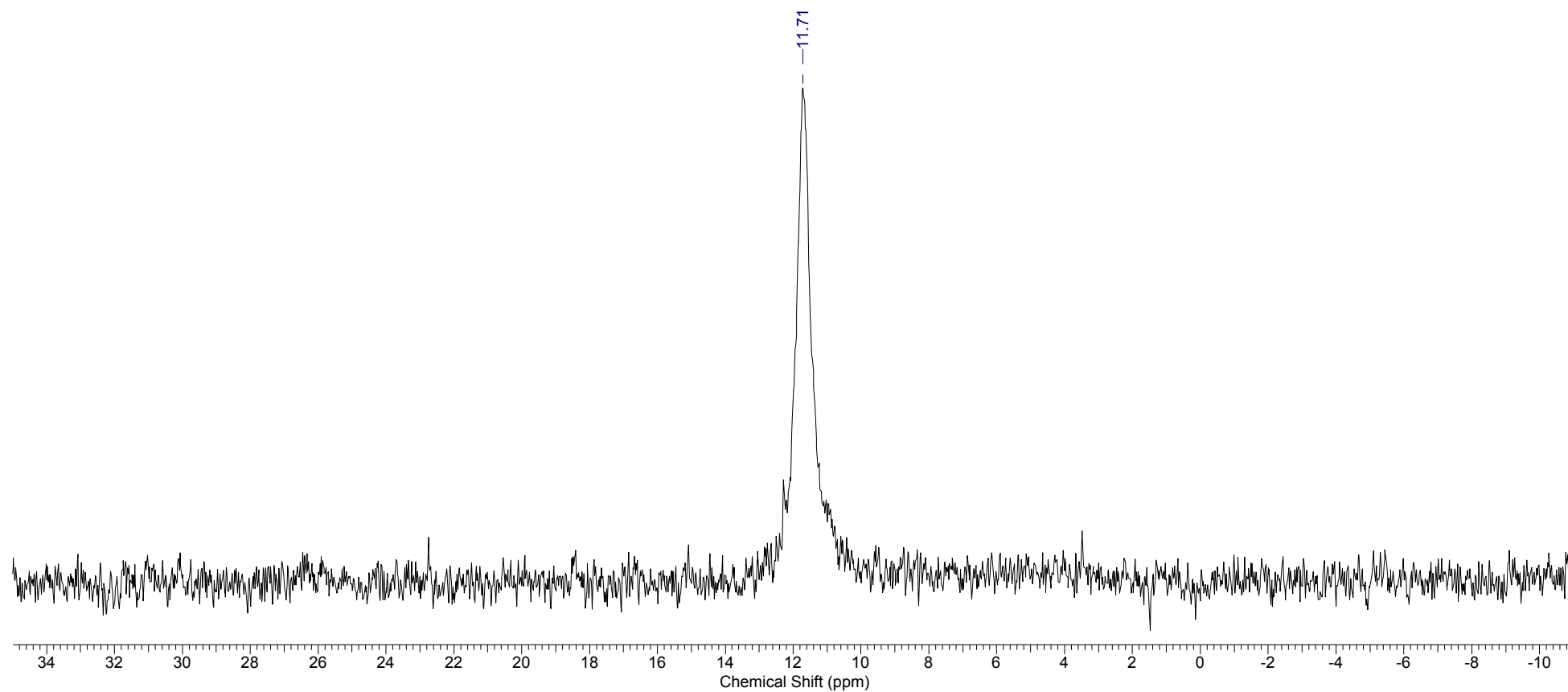
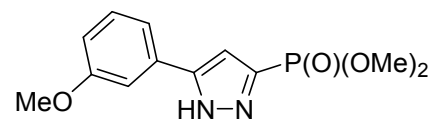
^{13}C NMR spectrum (CDCl_3) of **4k**



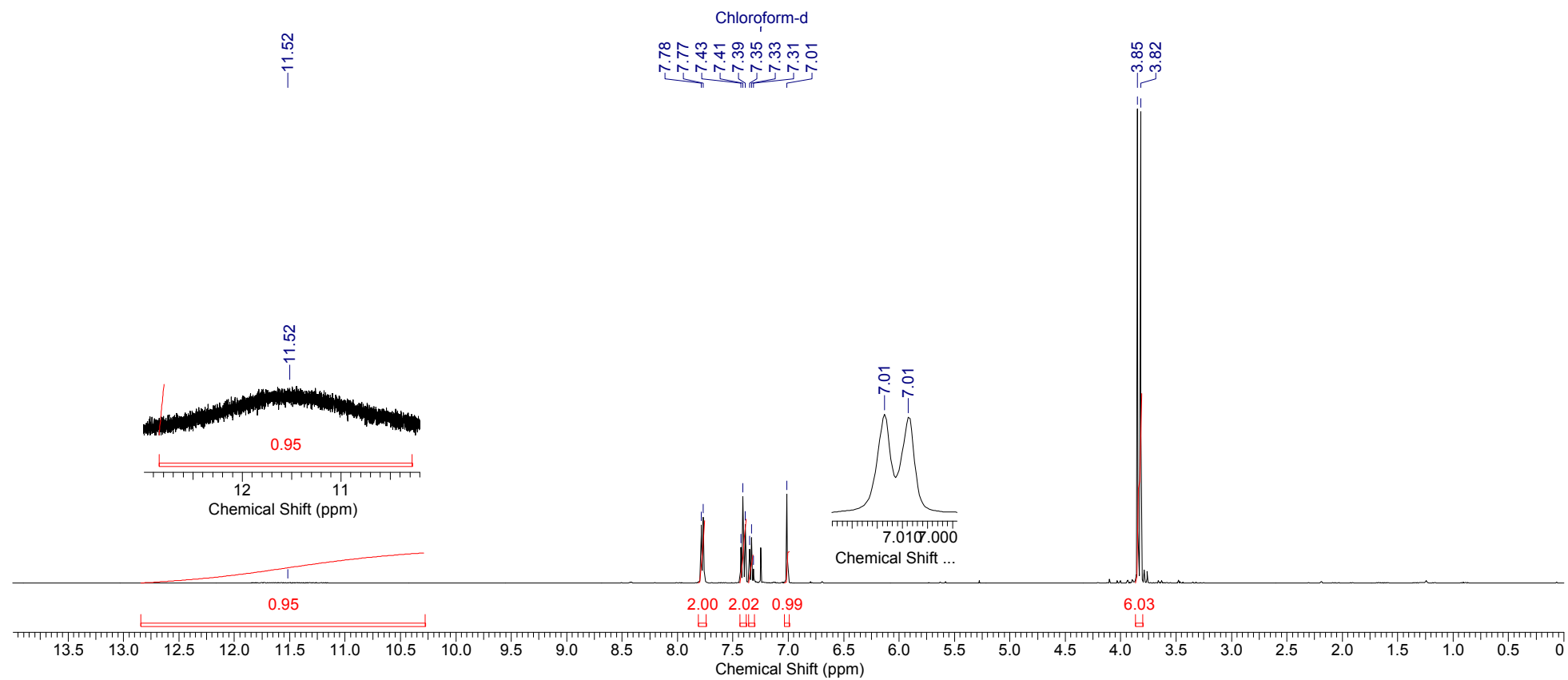
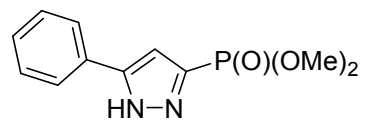
HMBC spectrum (CDCl₃) of **4k**



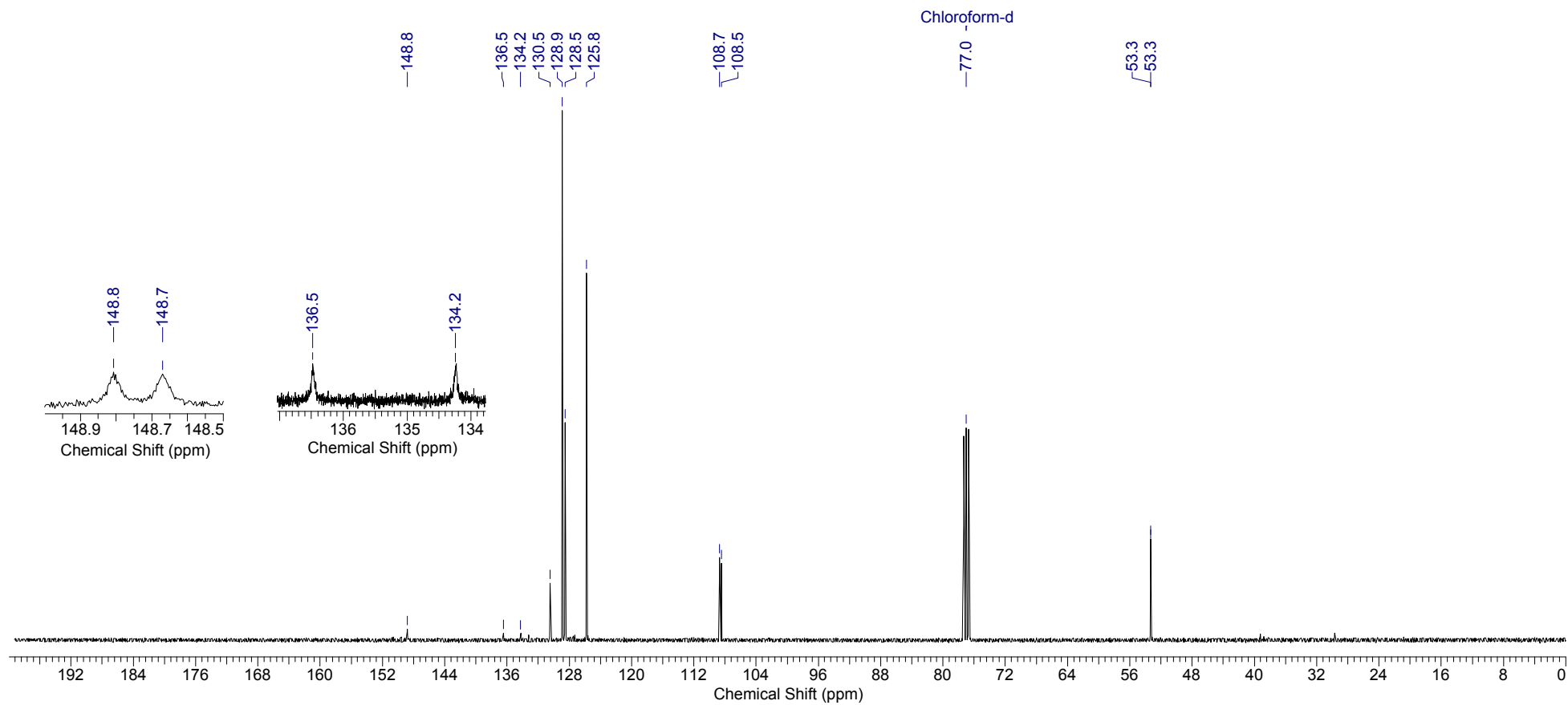
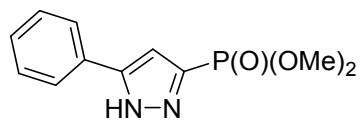
^{31}P NMR spectrum (CDCl_3) of **4k**



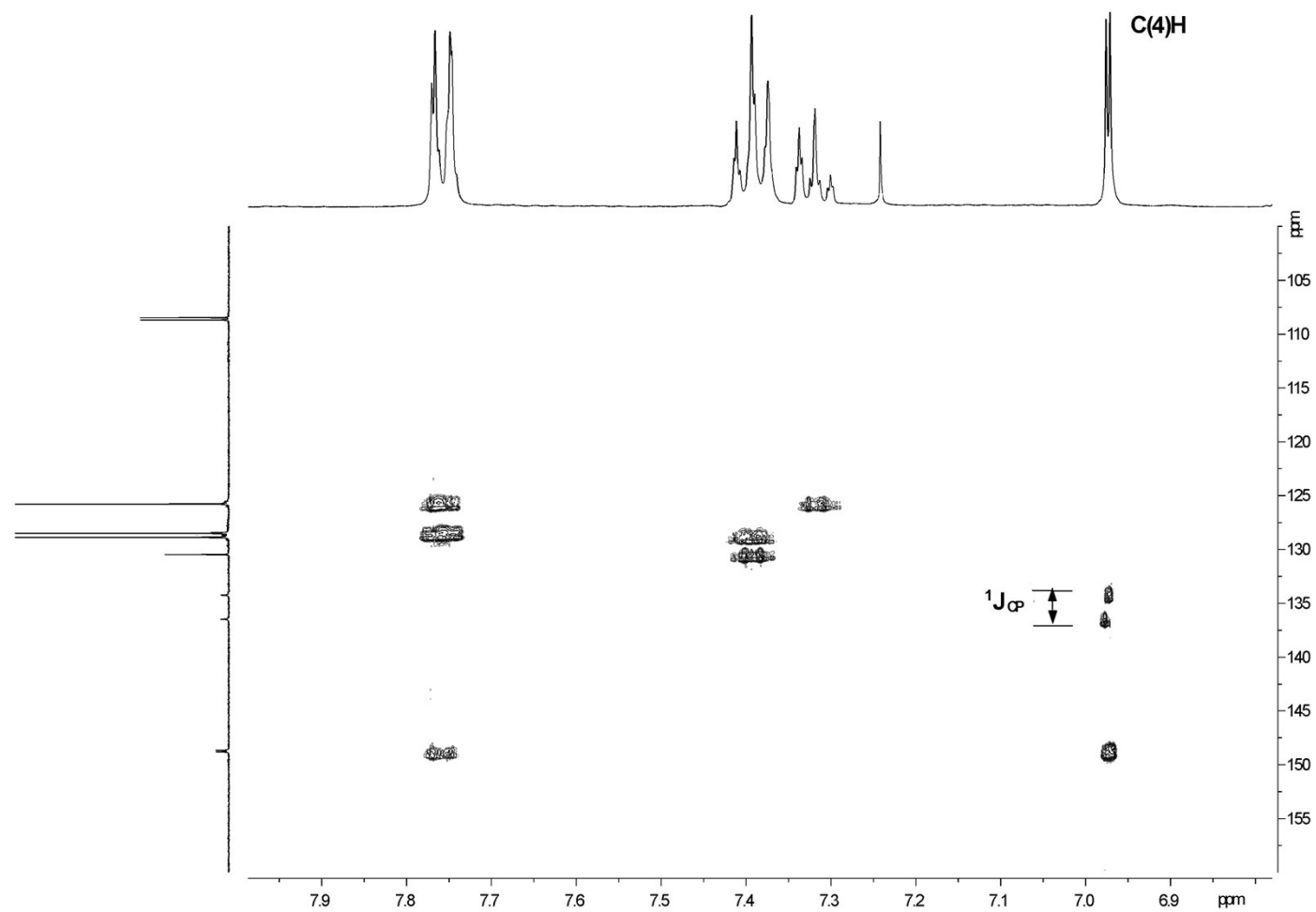
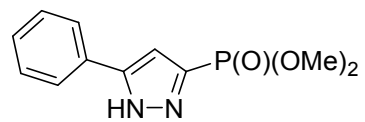
^1H NMR spectrum (CDCl_3) of **4l**



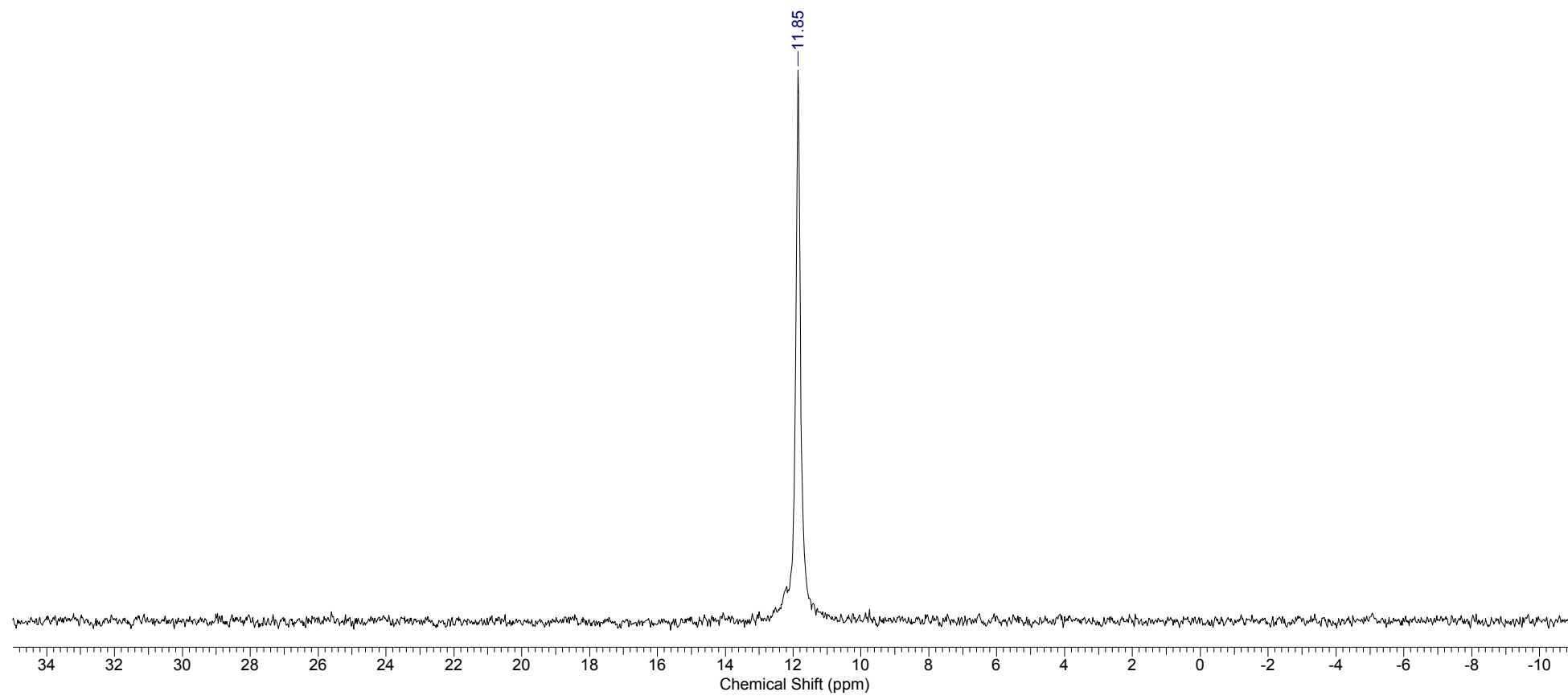
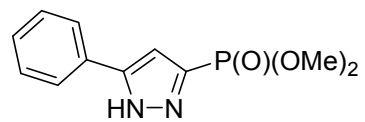
^{13}C NMR spectrum (CDCl_3) of **4l**



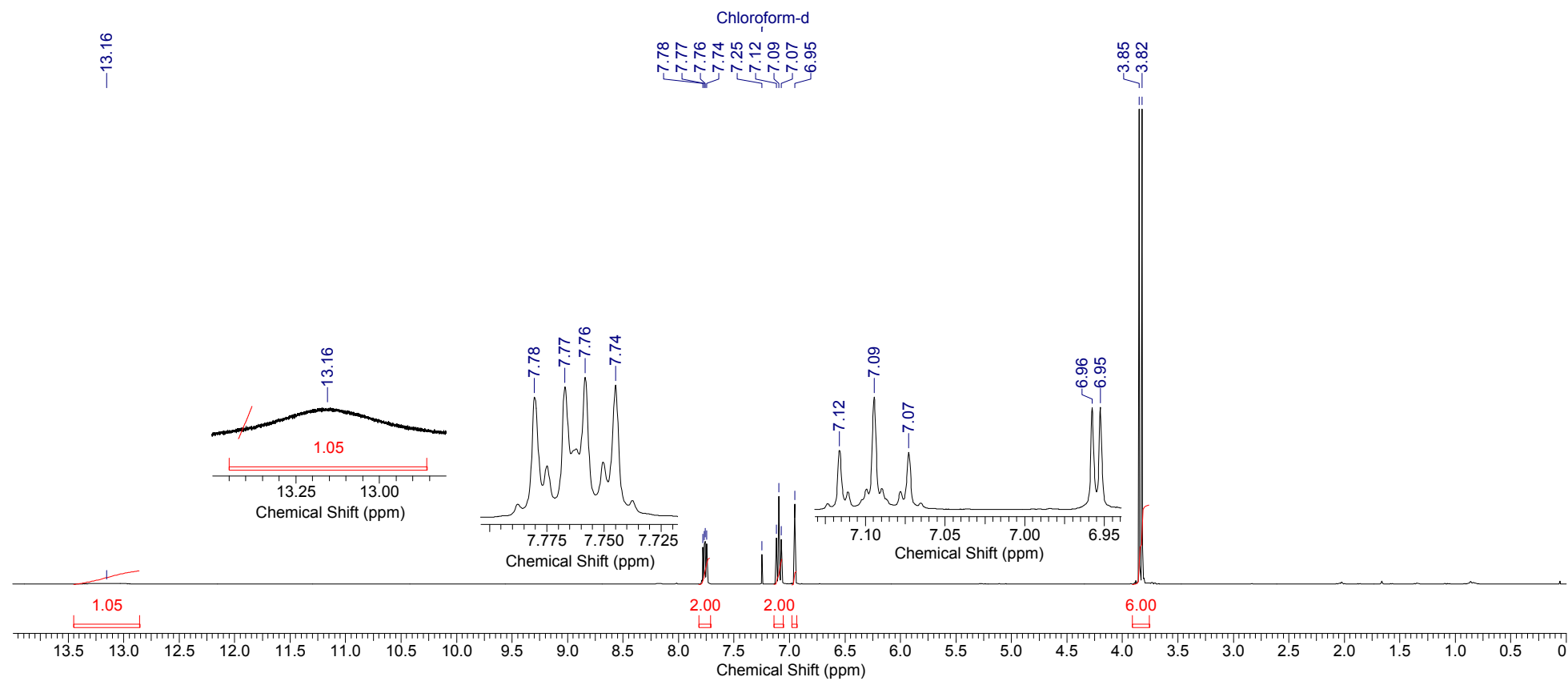
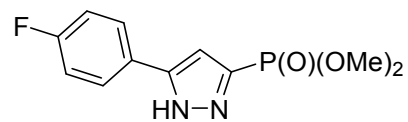
HMBC spectrum (CDCl₃) of **4l**



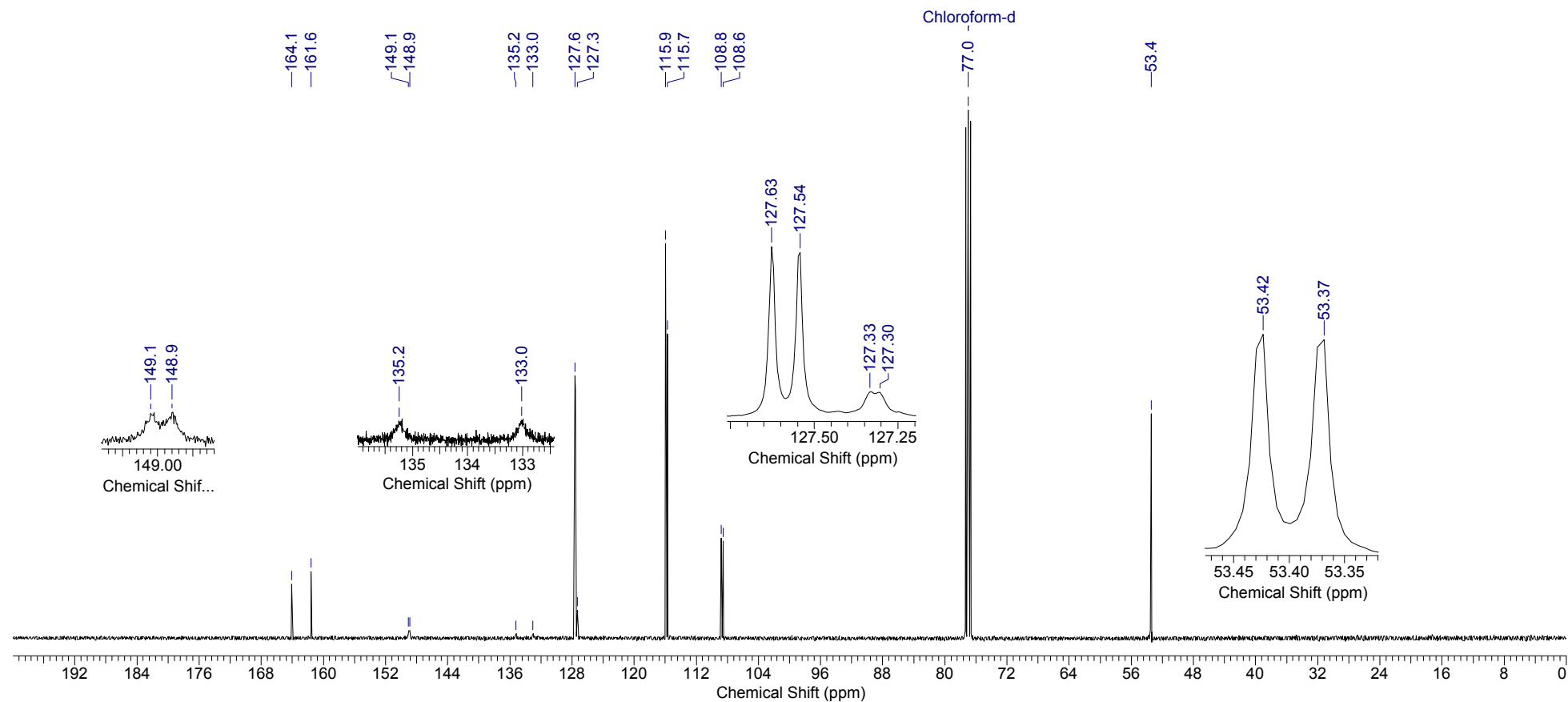
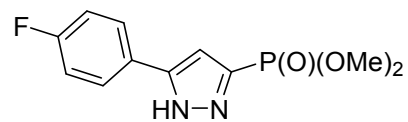
^{31}P NMR spectrum (CDCl_3) of **4l**



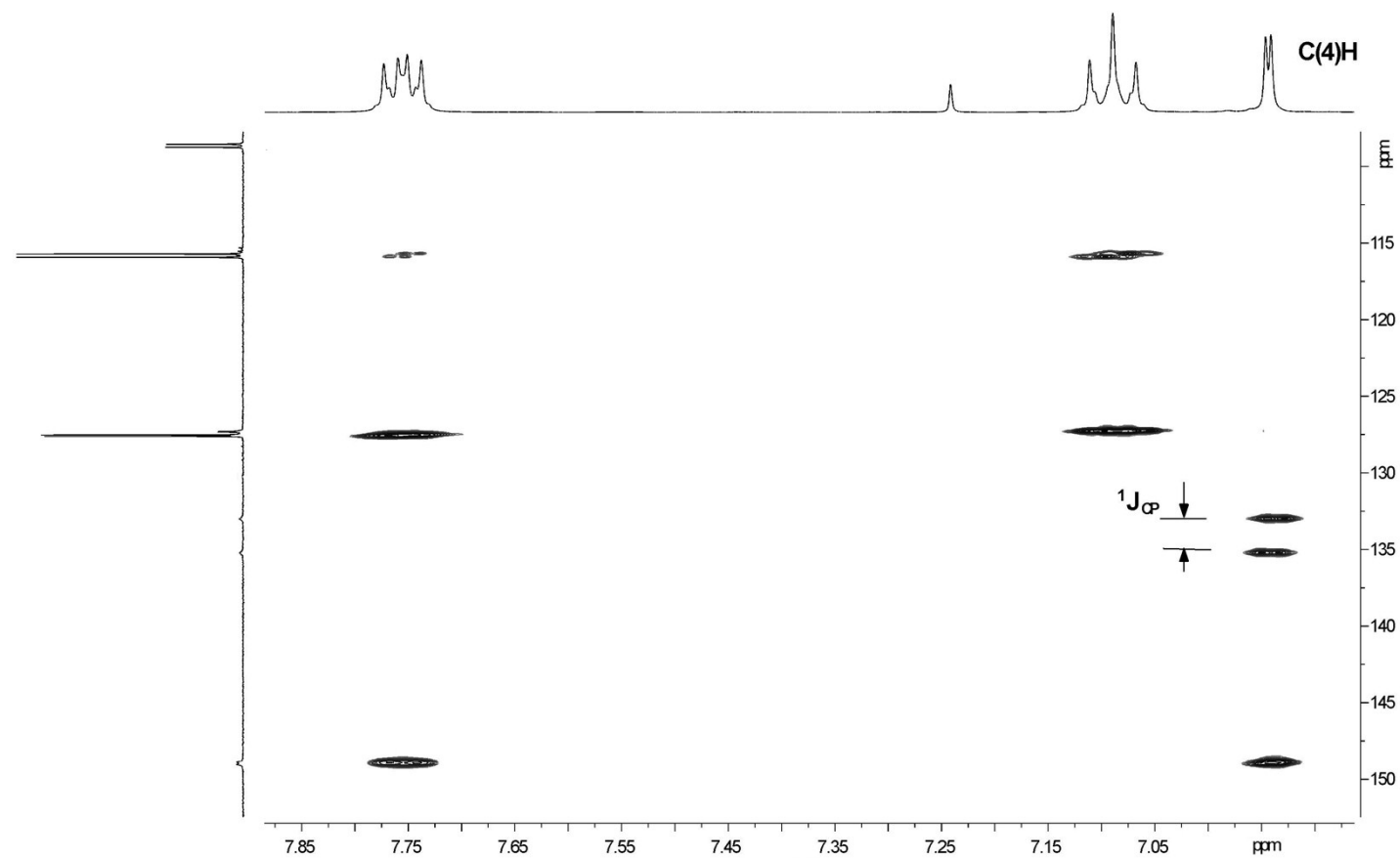
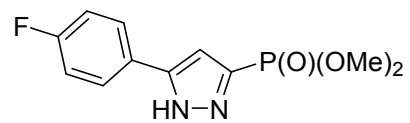
^1H NMR spectrum (CDCl_3) of **4m**



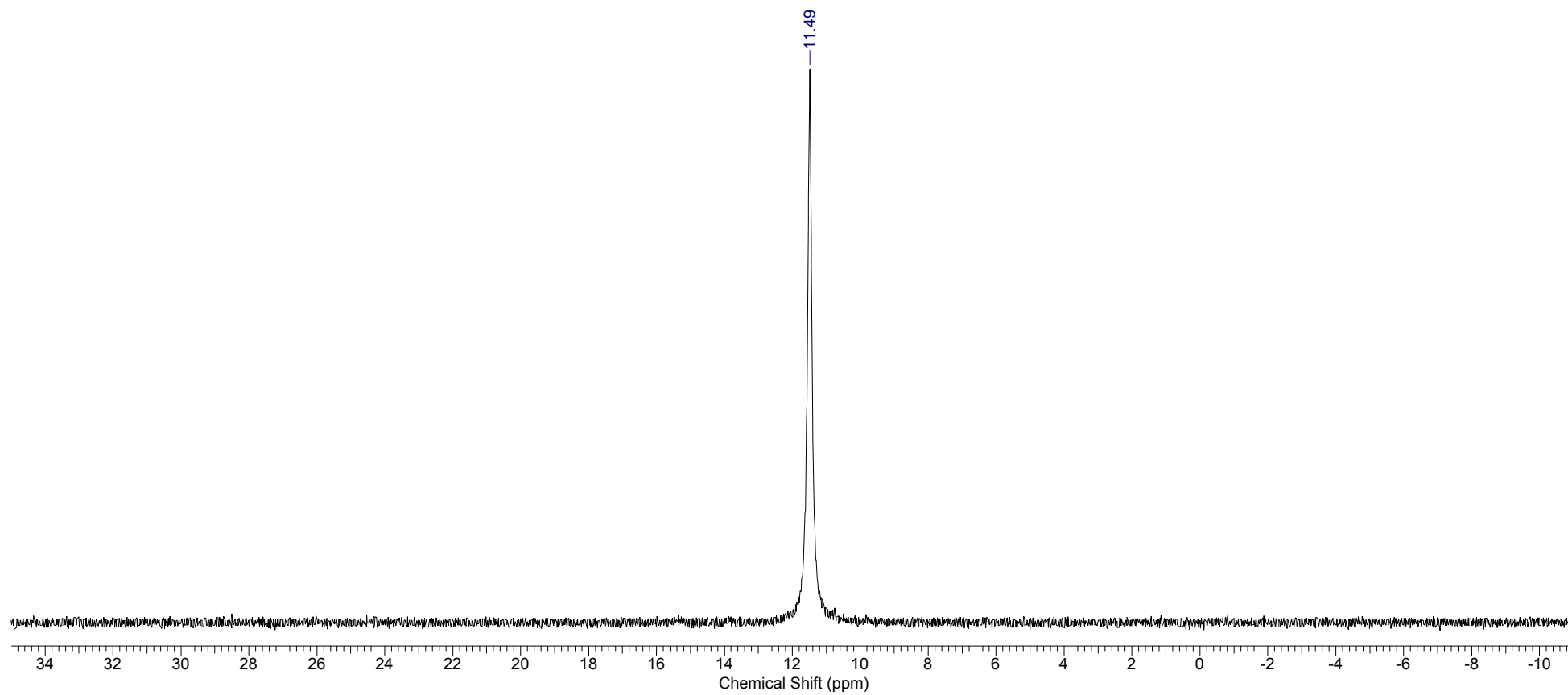
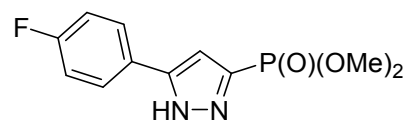
^{13}C NMR spectrum (CDCl_3) of **4m**



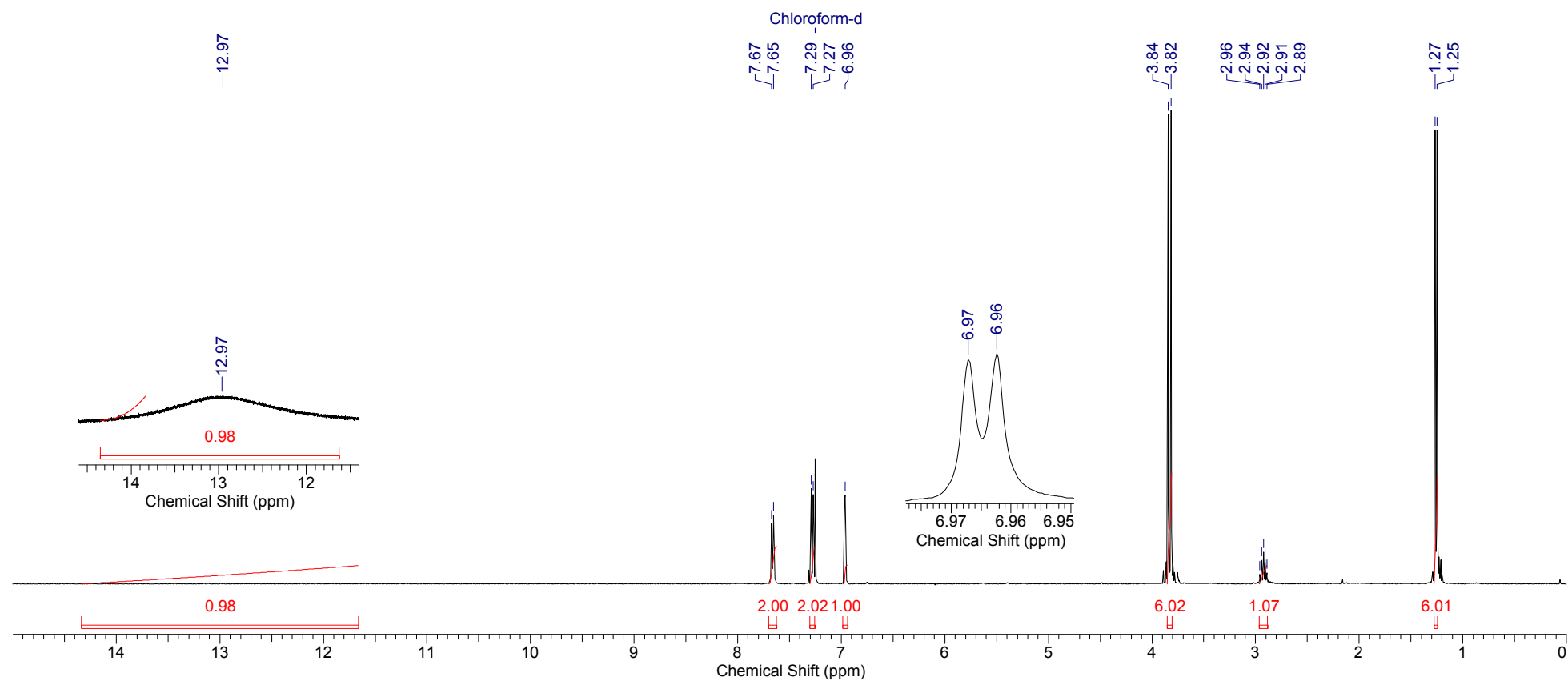
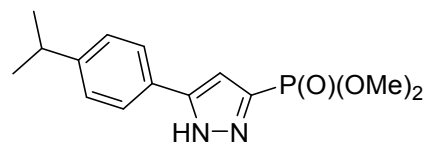
HMBC spectrum (CDCl₃) of **4m**



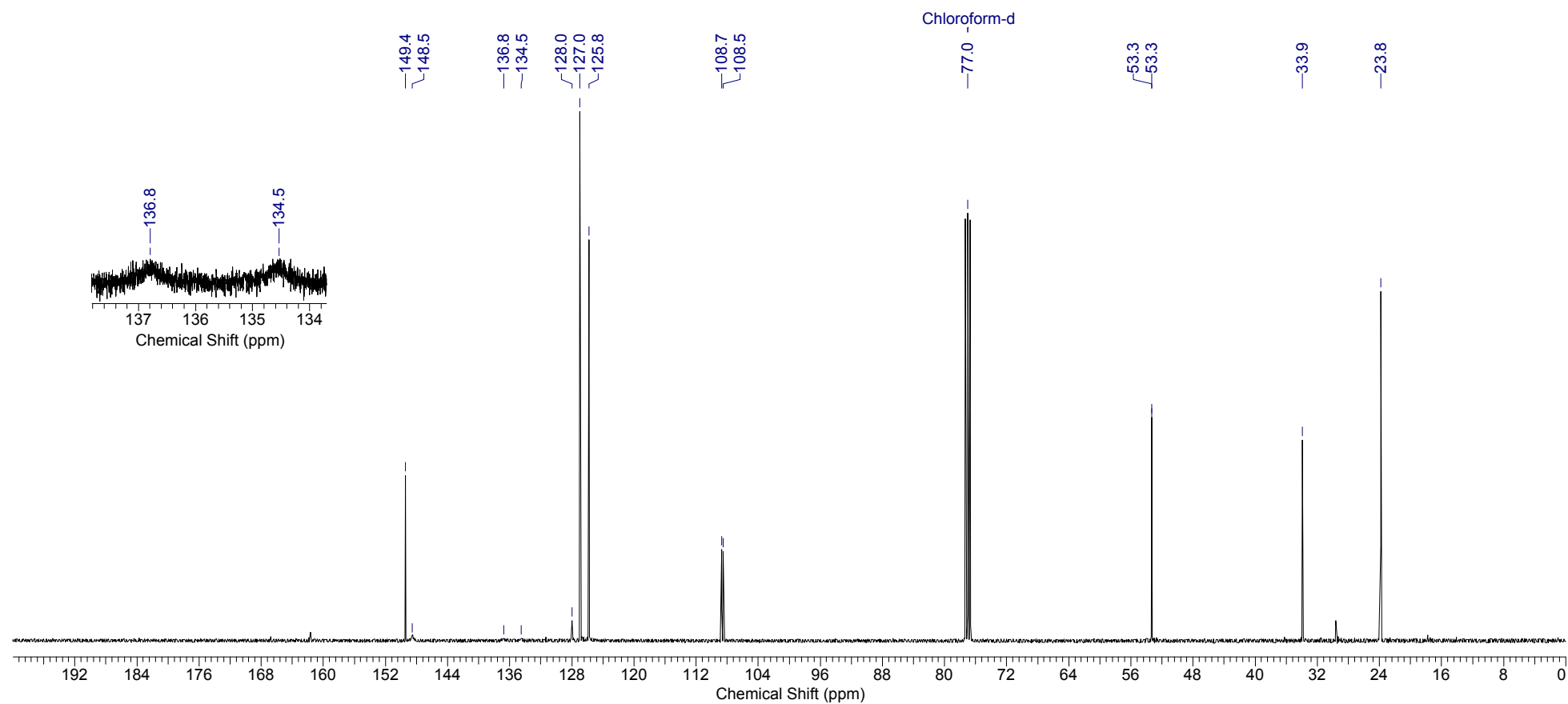
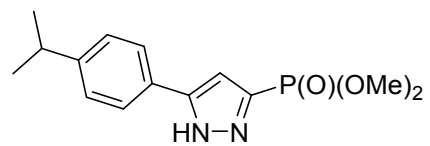
^{31}P NMR spectrum (CDCl_3) of **4m**



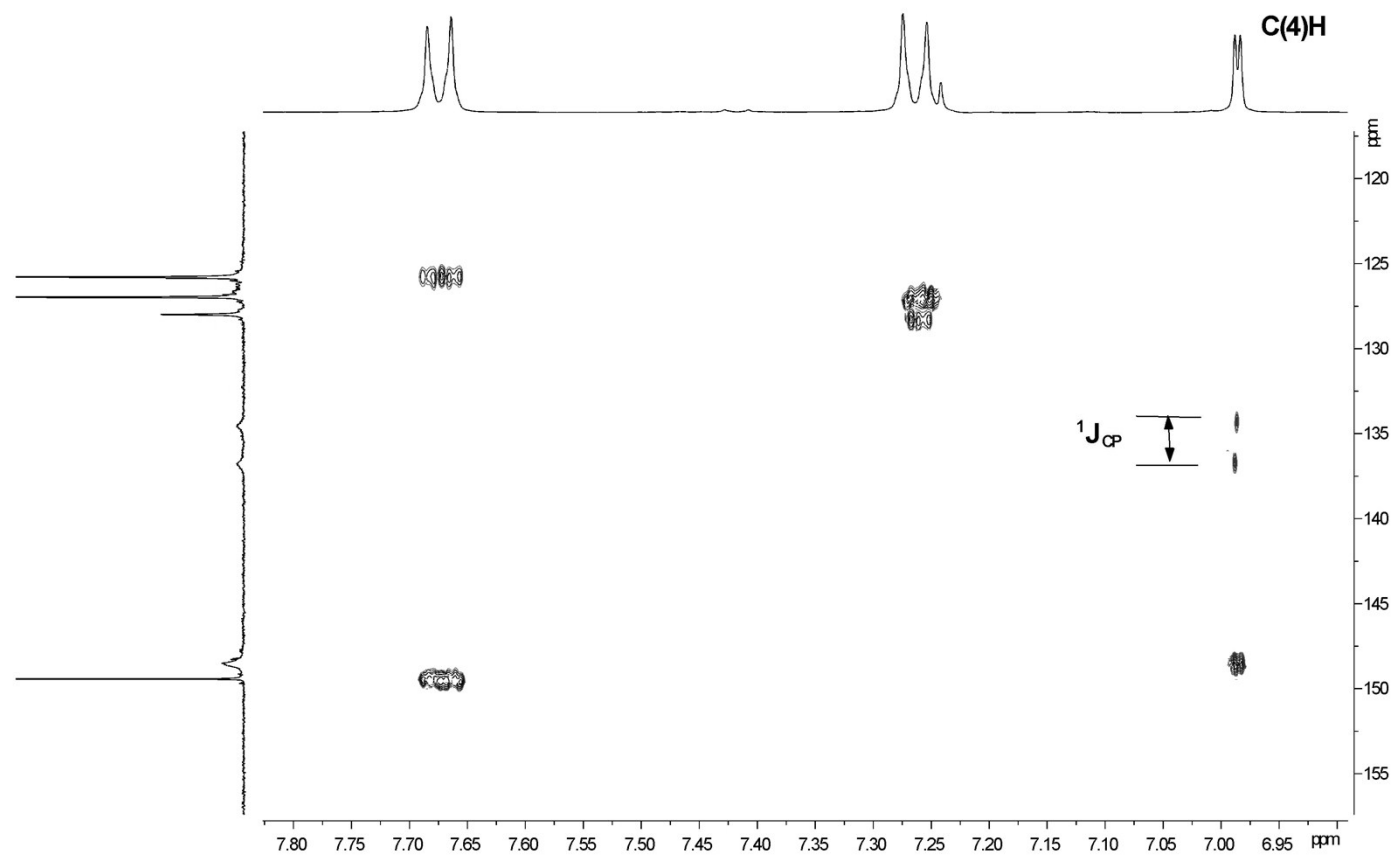
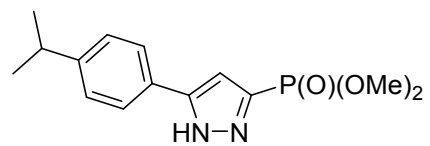
^1H NMR spectrum (CDCl_3) of **4n**



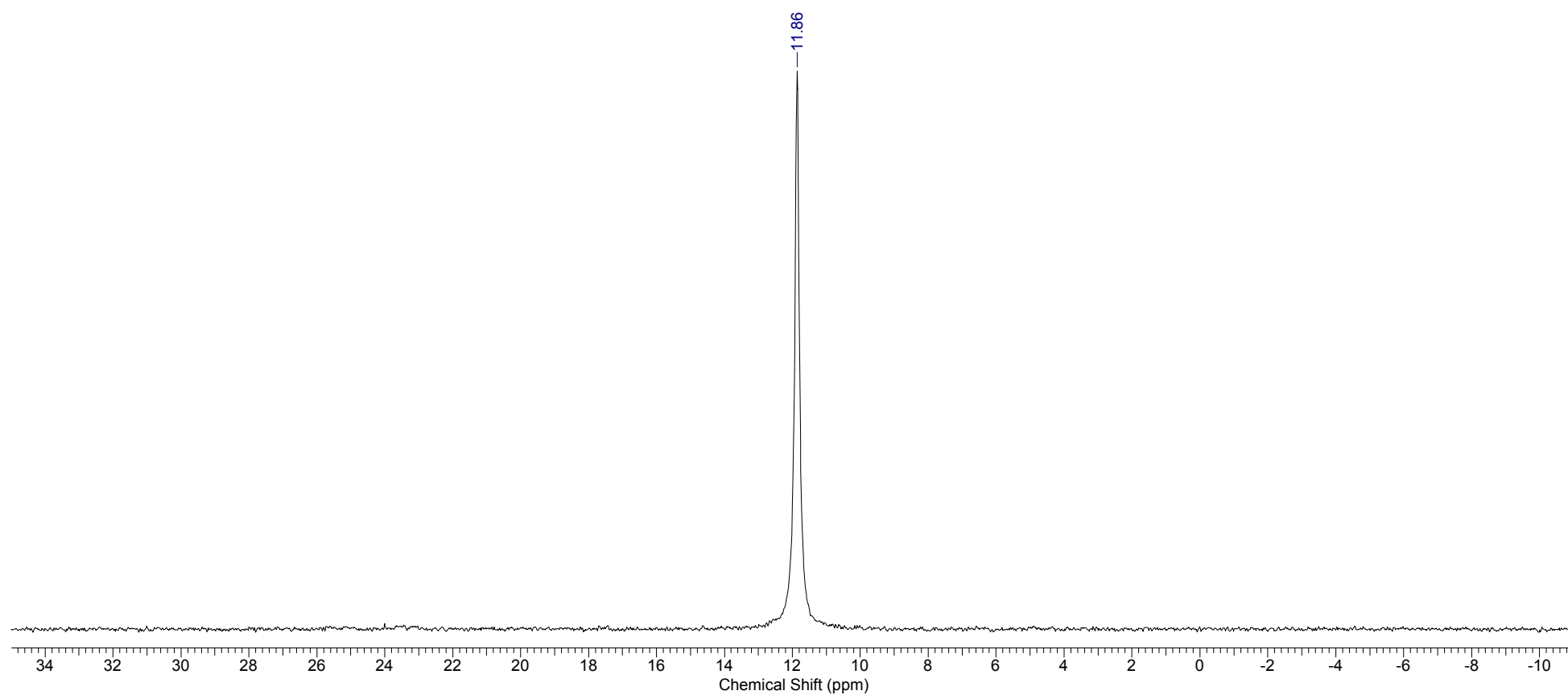
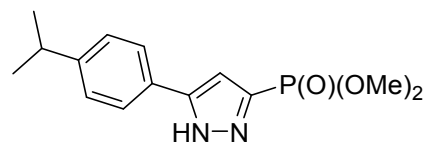
^{13}C NMR spectrum (CDCl_3) of **4n**



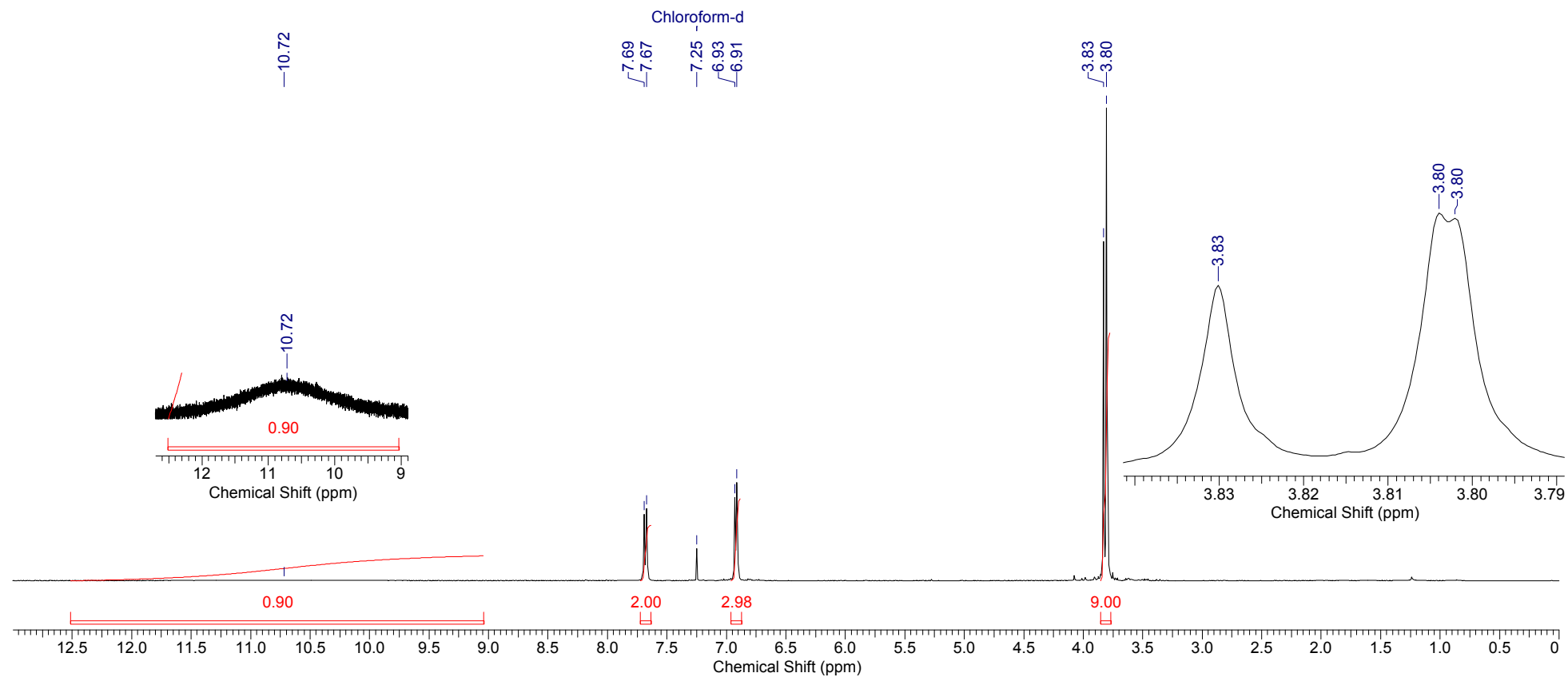
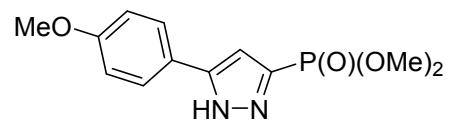
HMBC spectrum (CDCl₃) of **4n**



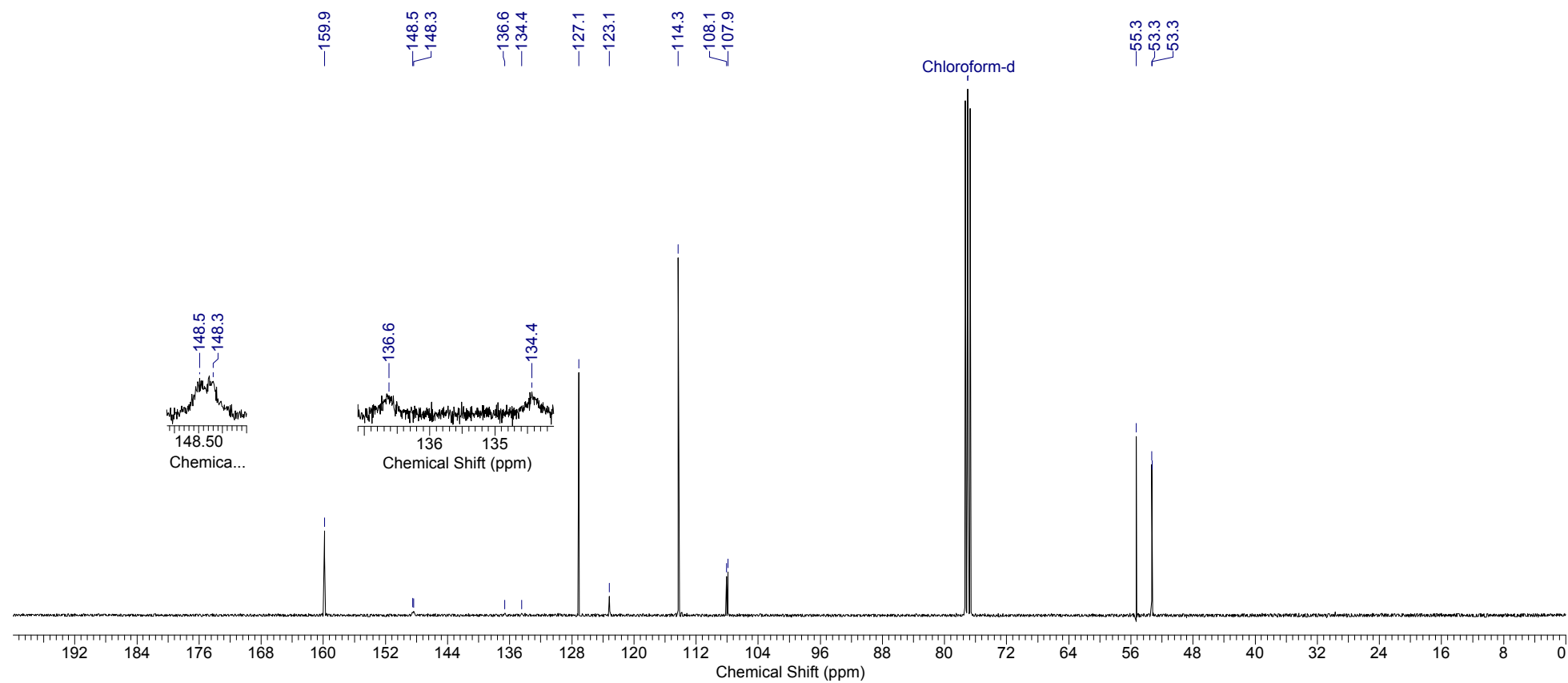
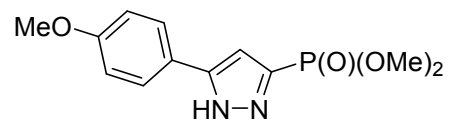
^{31}P NMR spectrum (CDCl_3) of **4n**



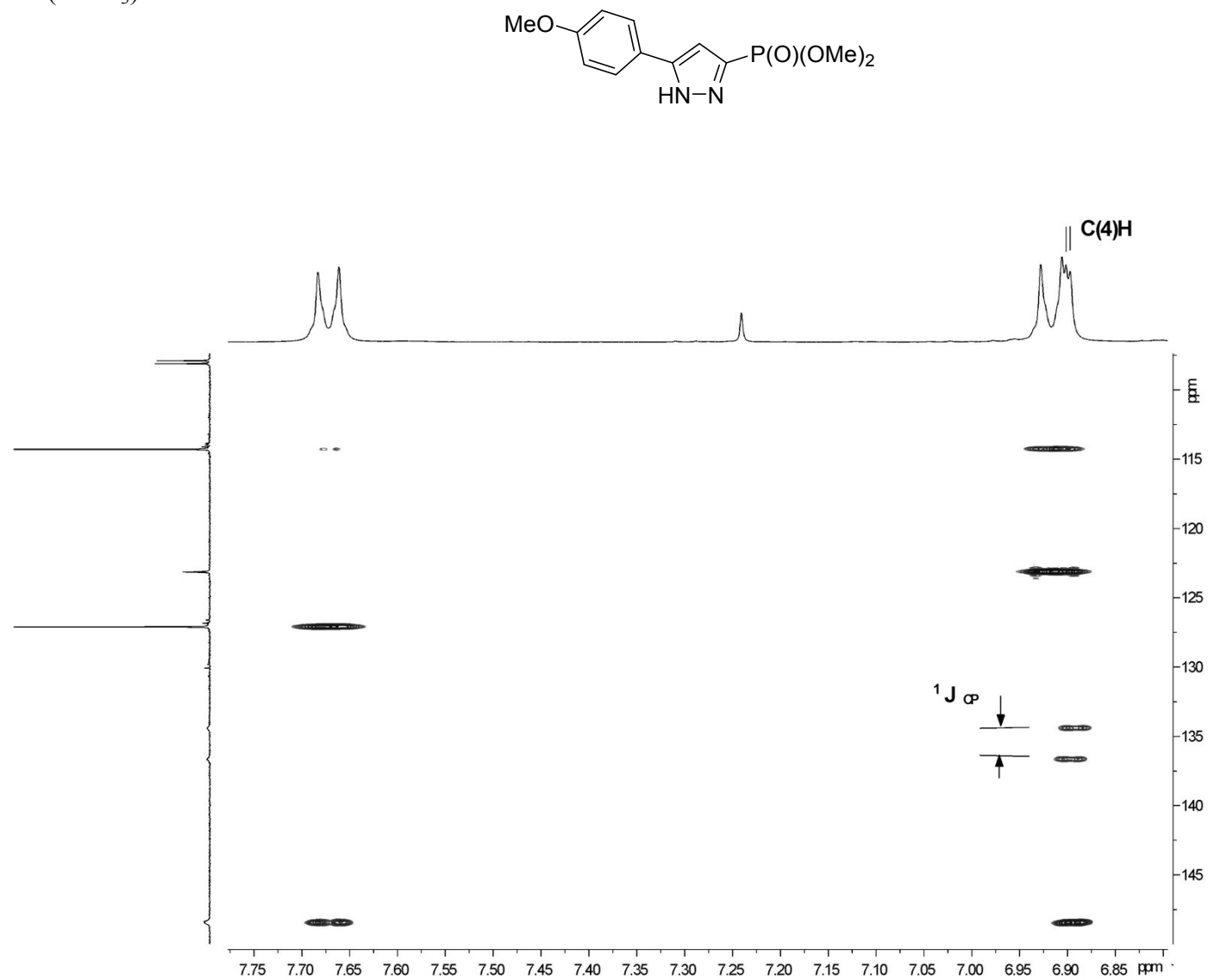
^1H NMR spectrum (CDCl_3) of **4o**



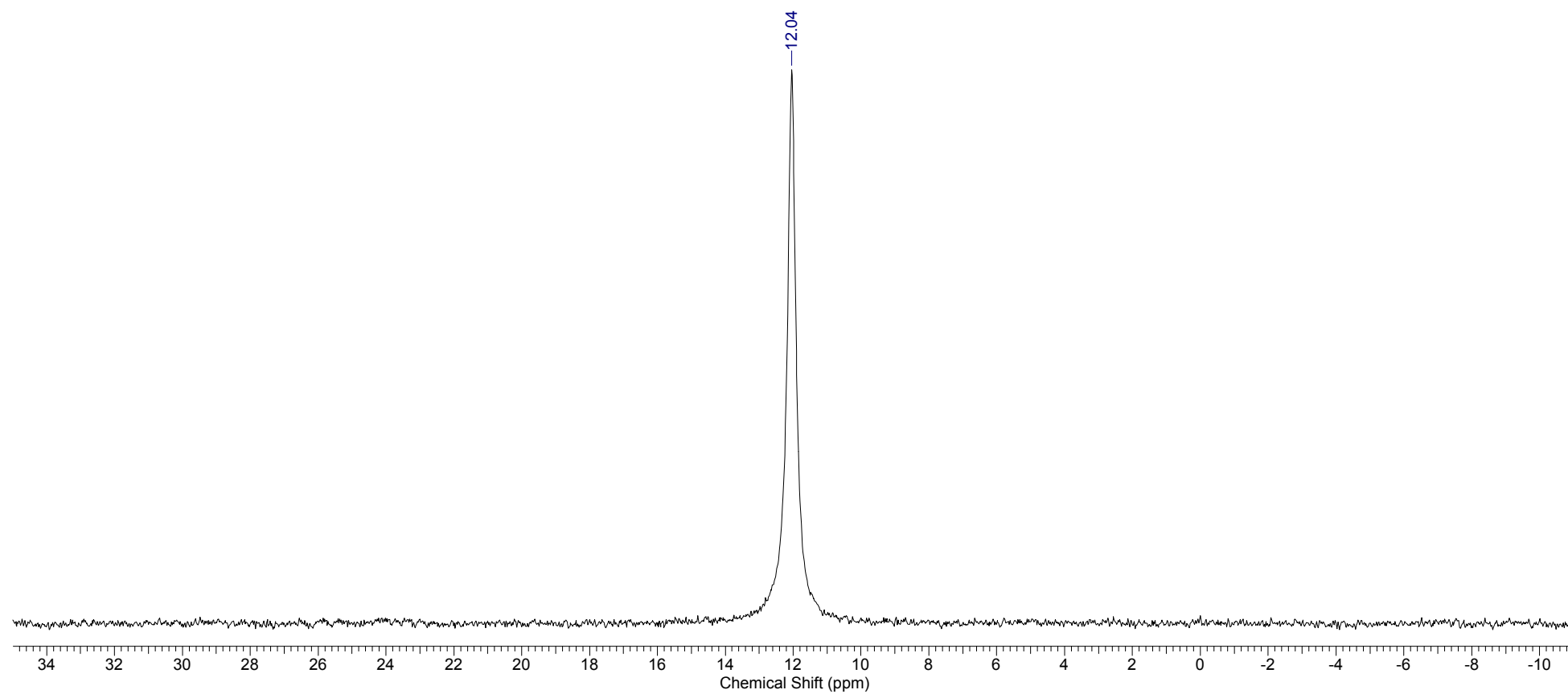
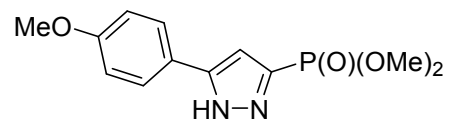
^{13}C NMR spectrum (CDCl_3) of **4o**



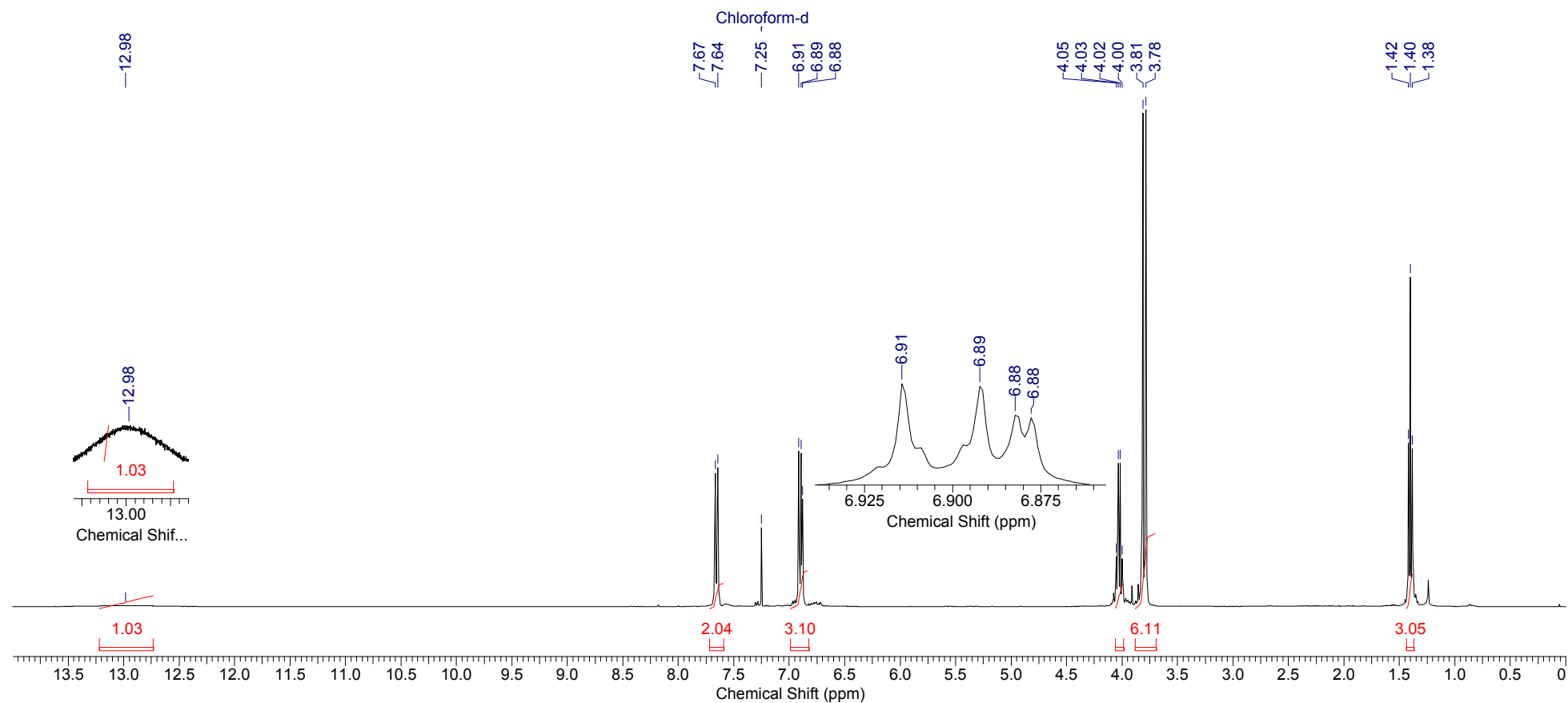
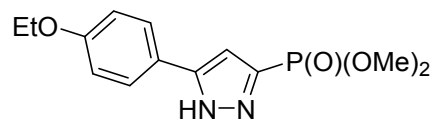
HMBC spectrum (CDCl₃) of **4o**



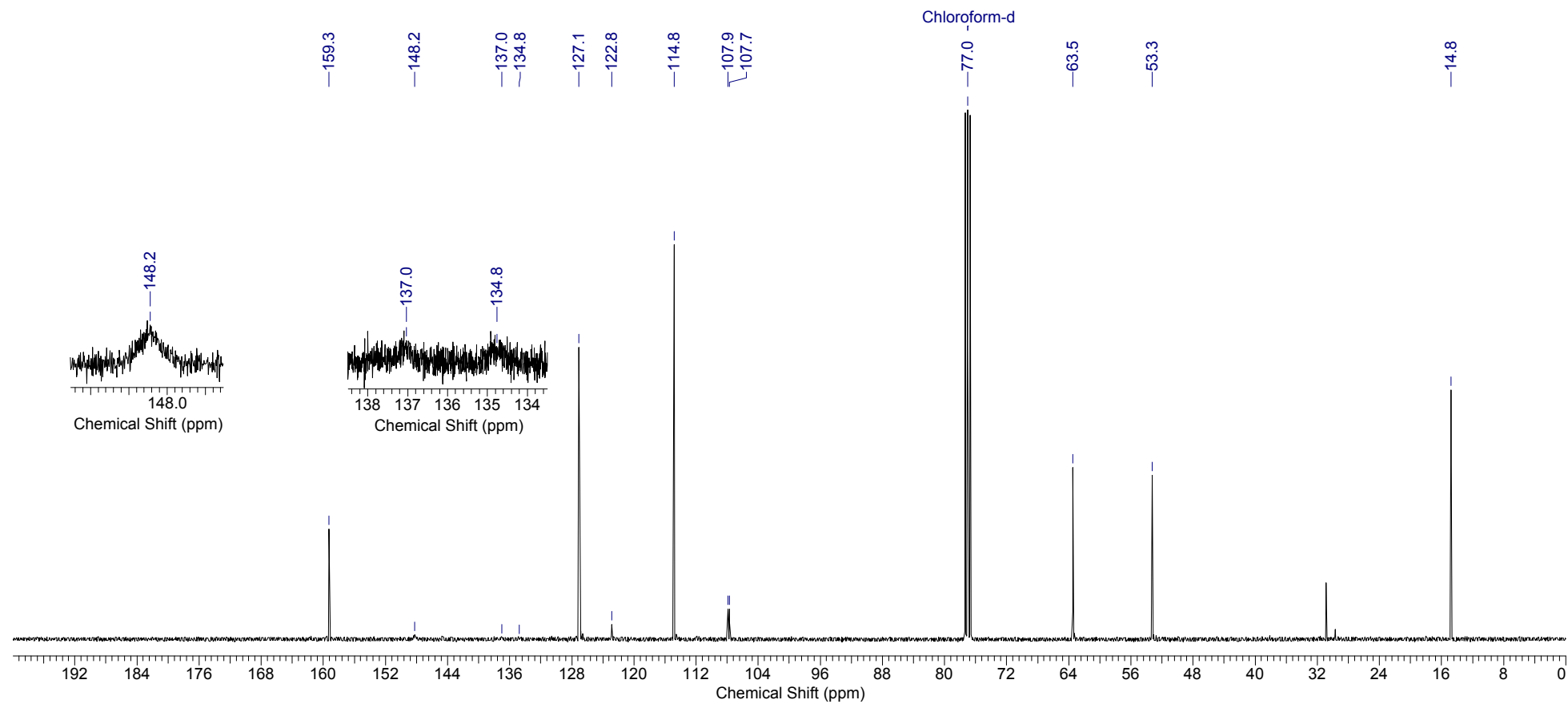
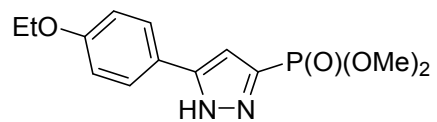
^{31}P NMR spectrum (CDCl_3) of **4o**



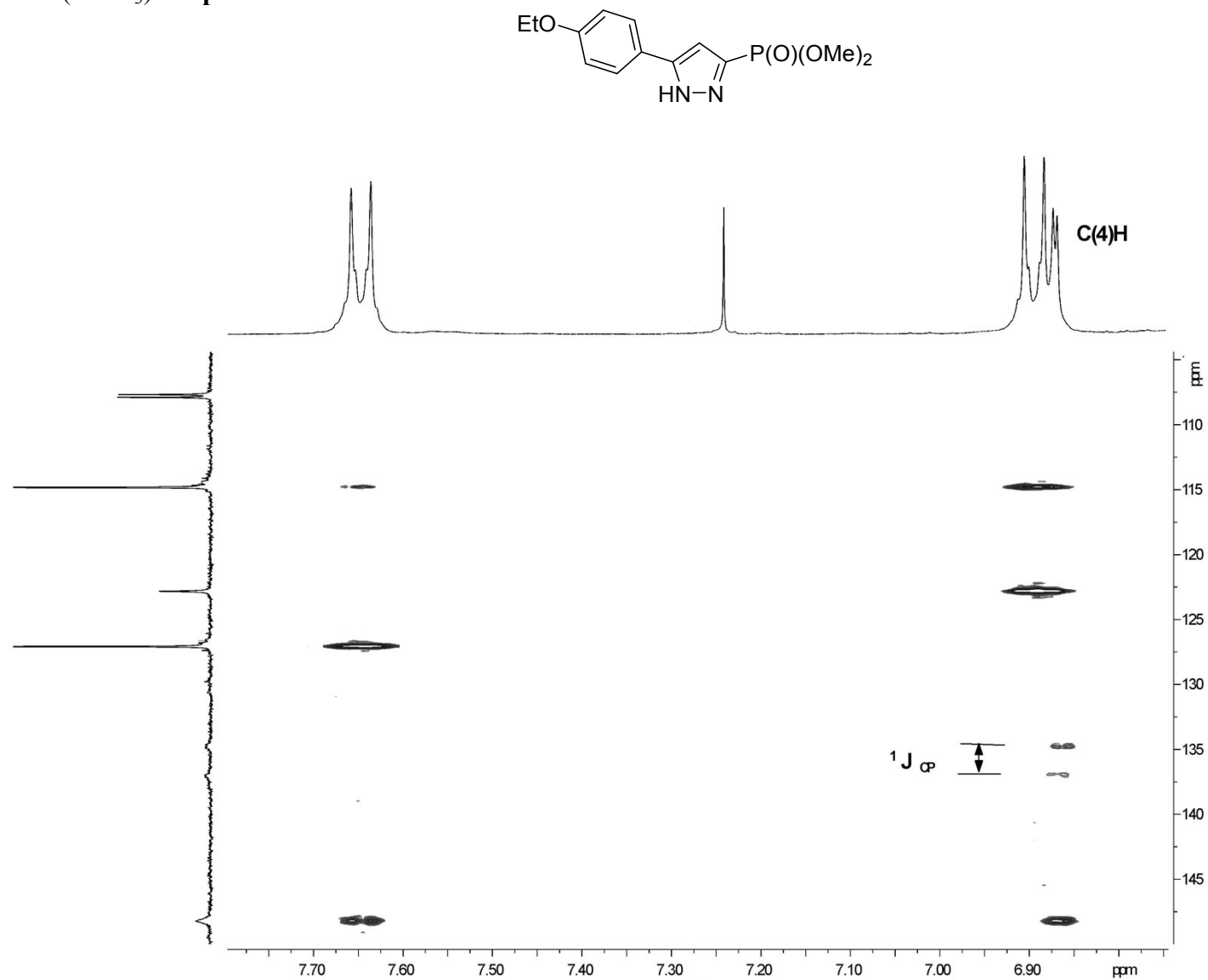
^1H NMR spectrum (CDCl_3) of **4p**



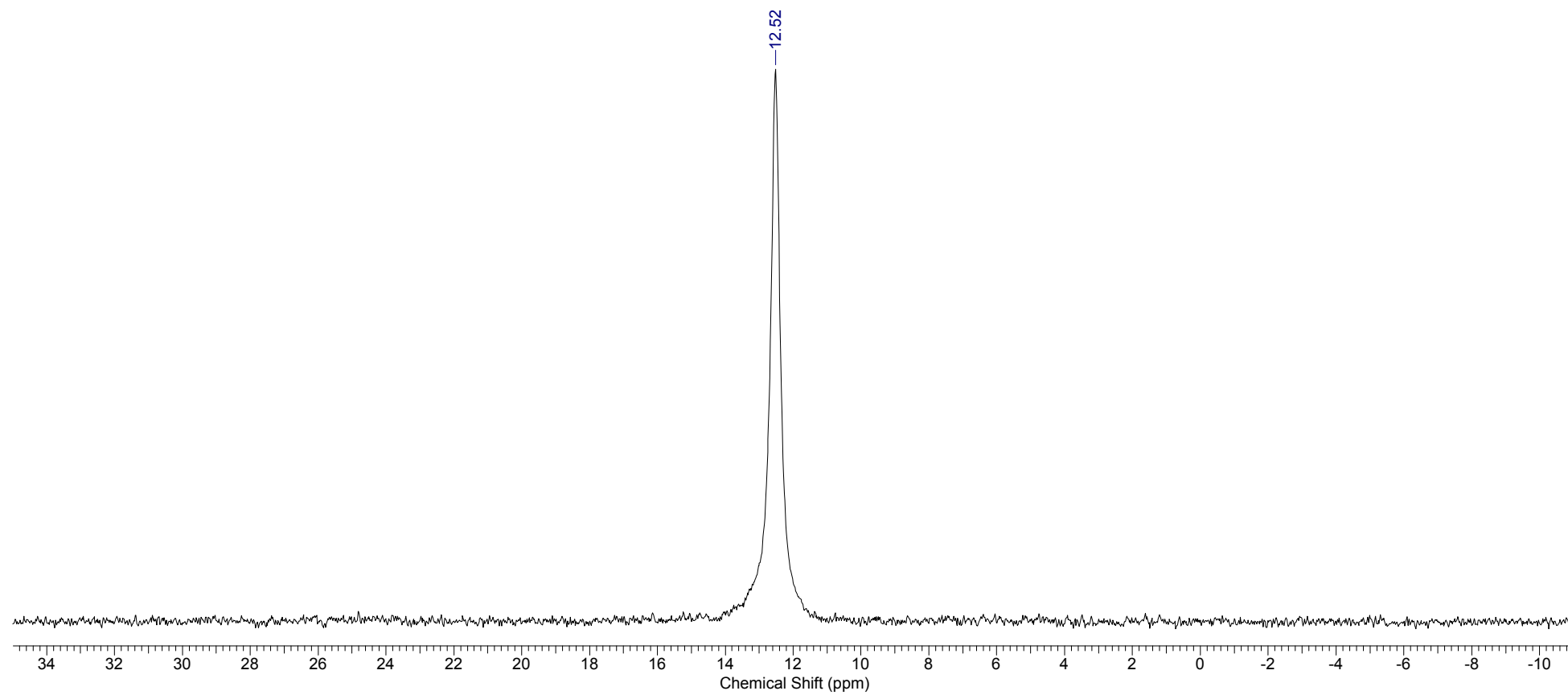
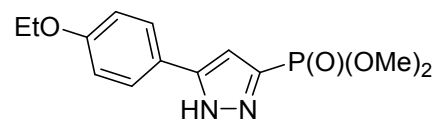
^{13}C NMR spectrum (CDCl_3) of **4p**



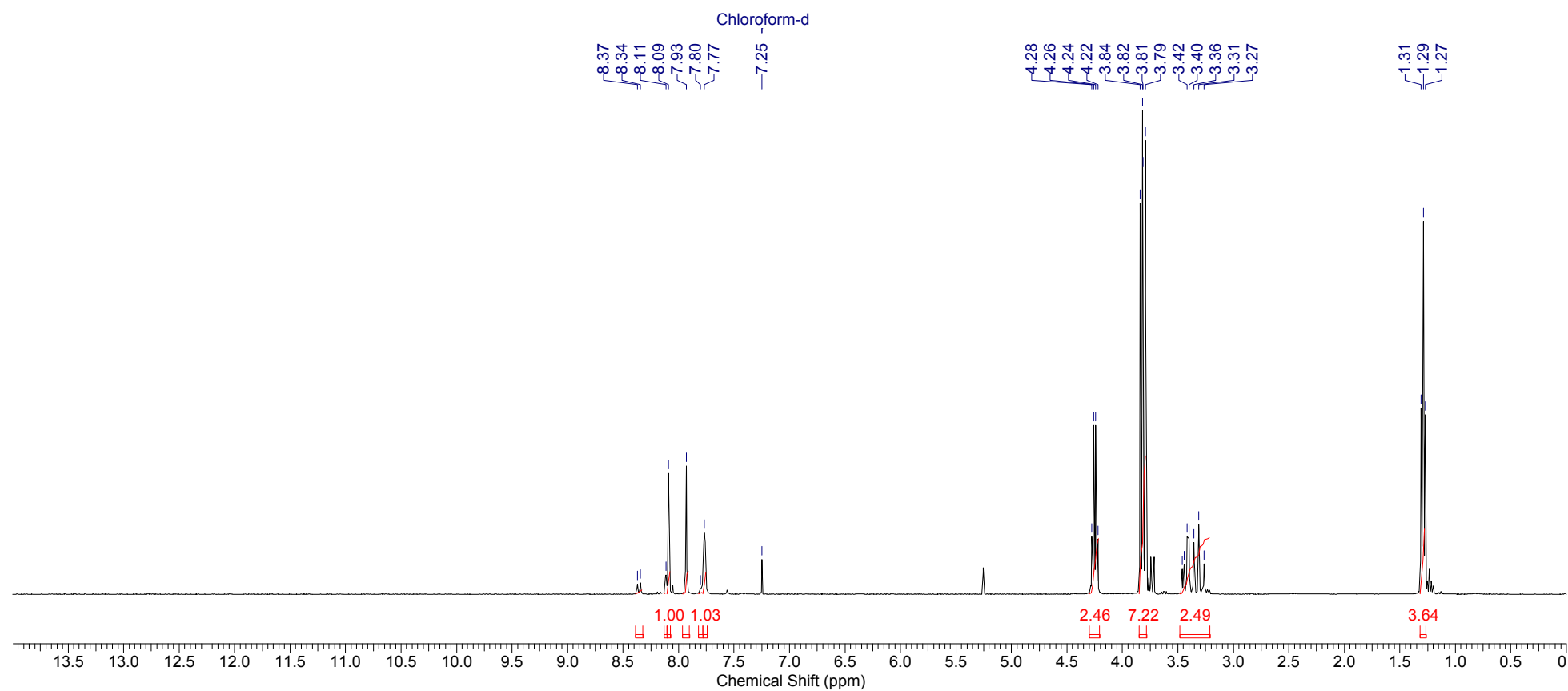
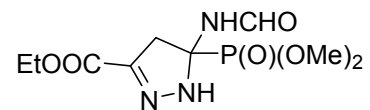
HMBC spectrum (CDCl₃) of **4p**



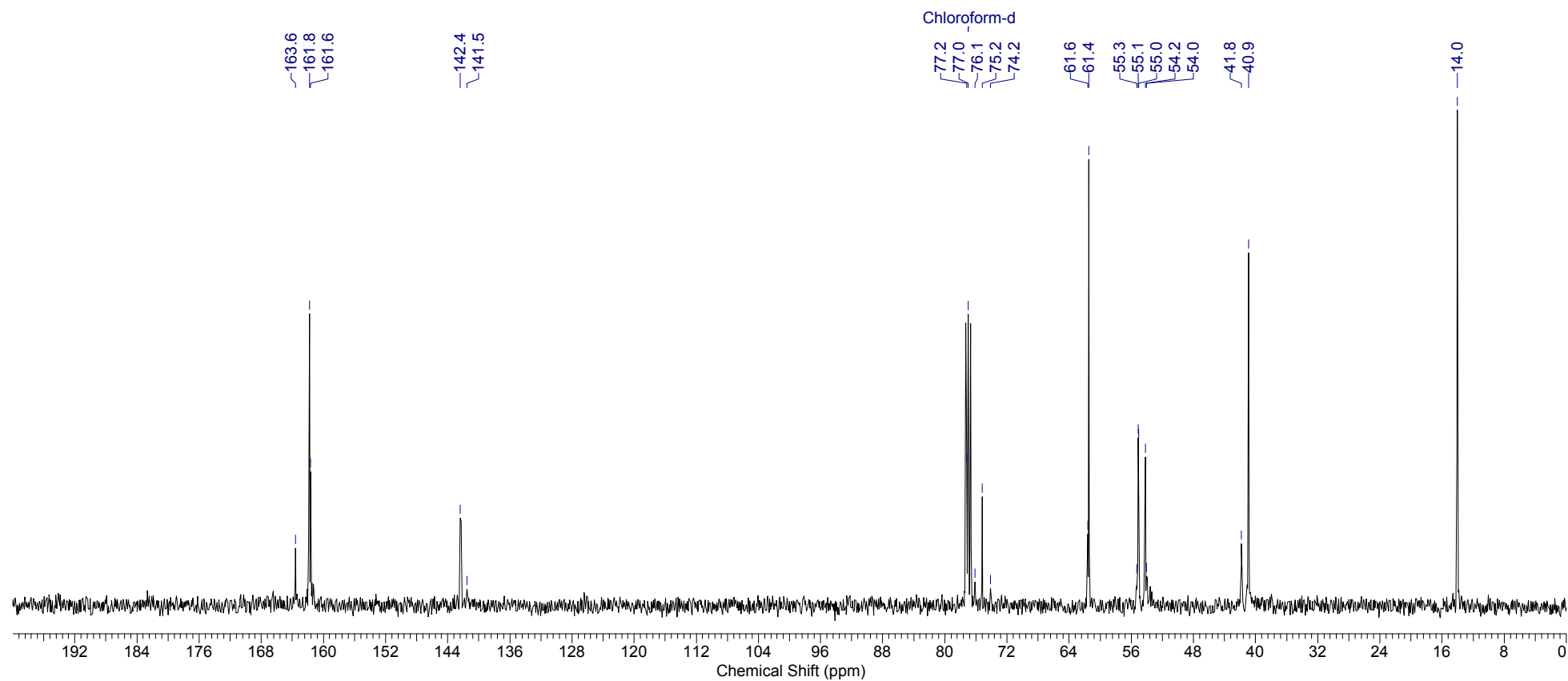
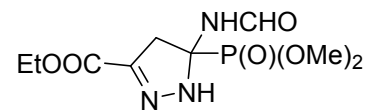
^{31}P NMR spectrum (CDCl_3) of **4p**



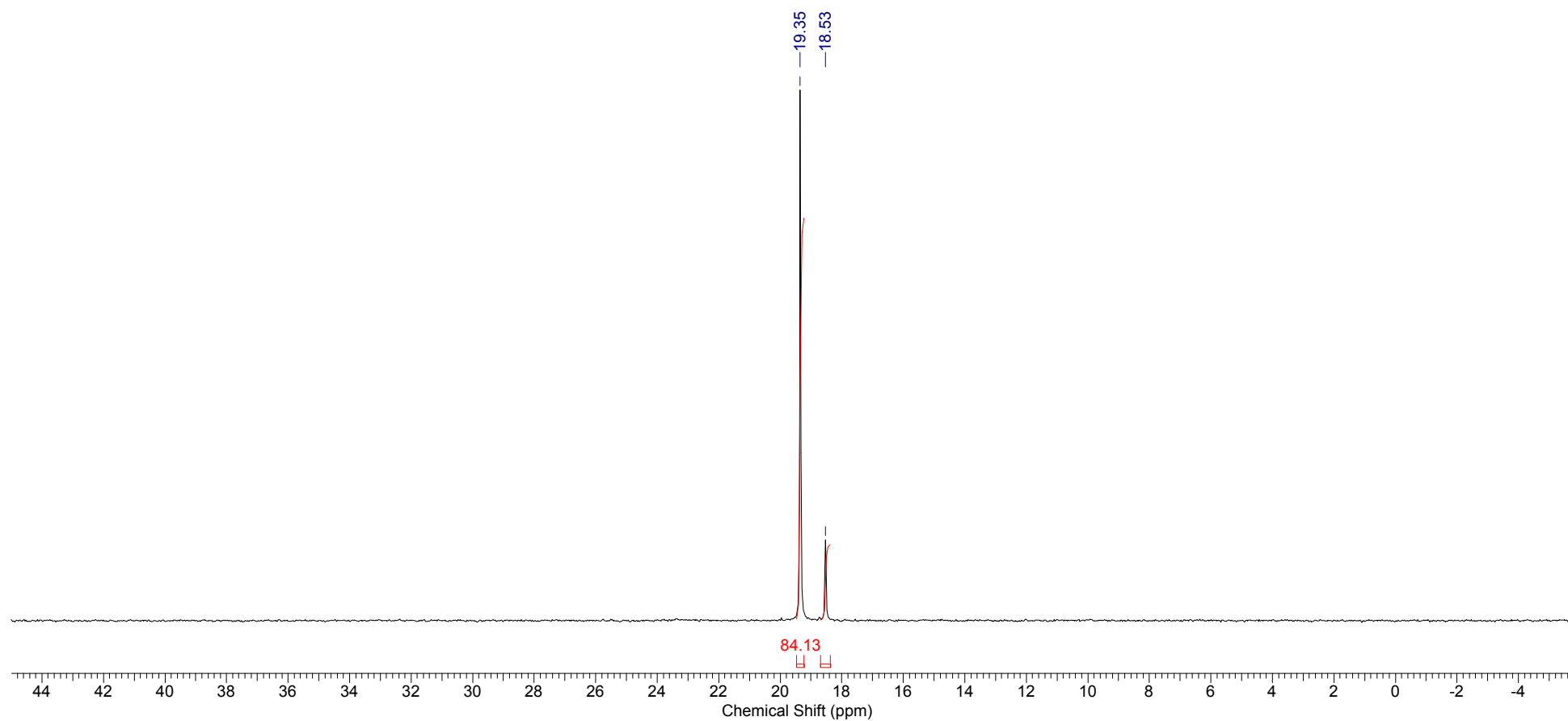
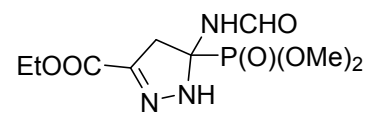
^1H NMR spectrum (CDCl_3) of **5** (mixture of rotamers)



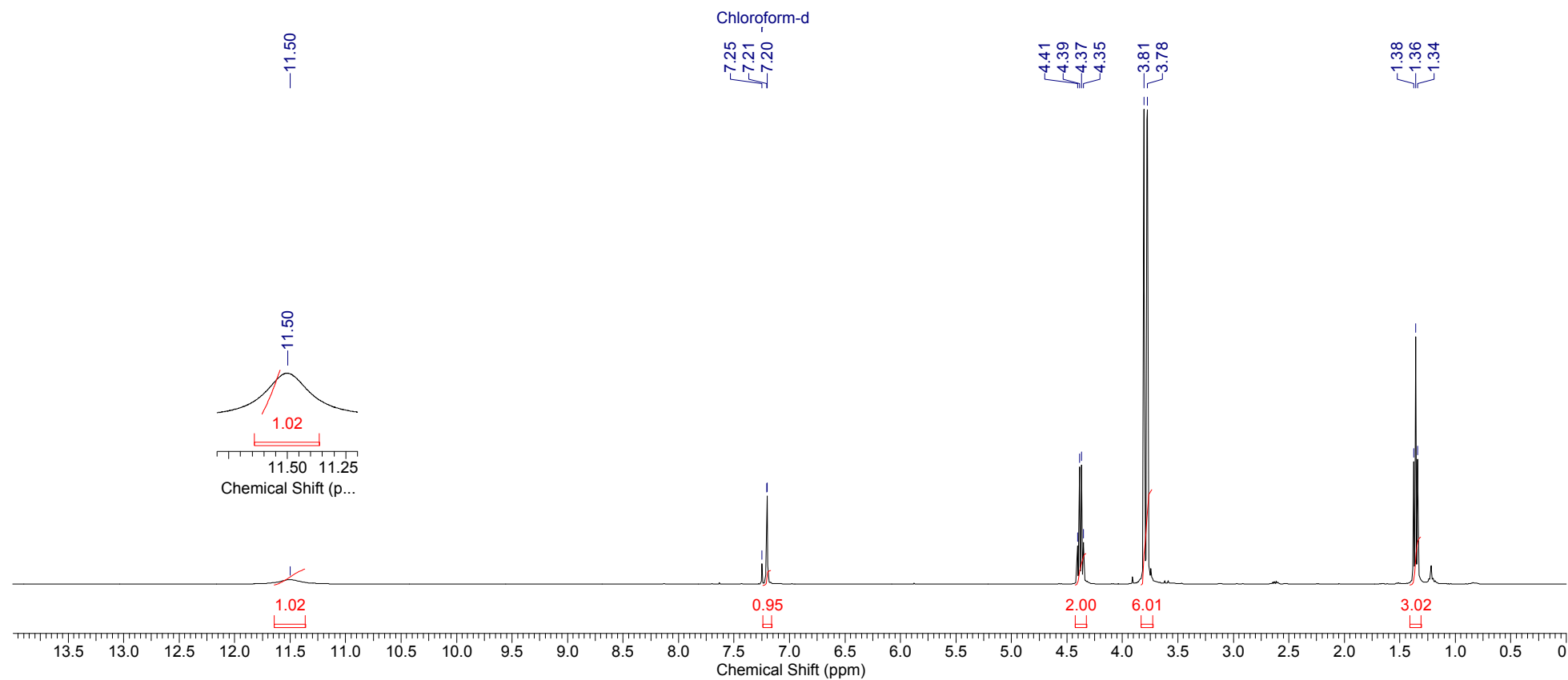
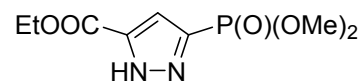
^{13}C NMR spectrum (CDCl_3) of **5** (mixture of rotamers)



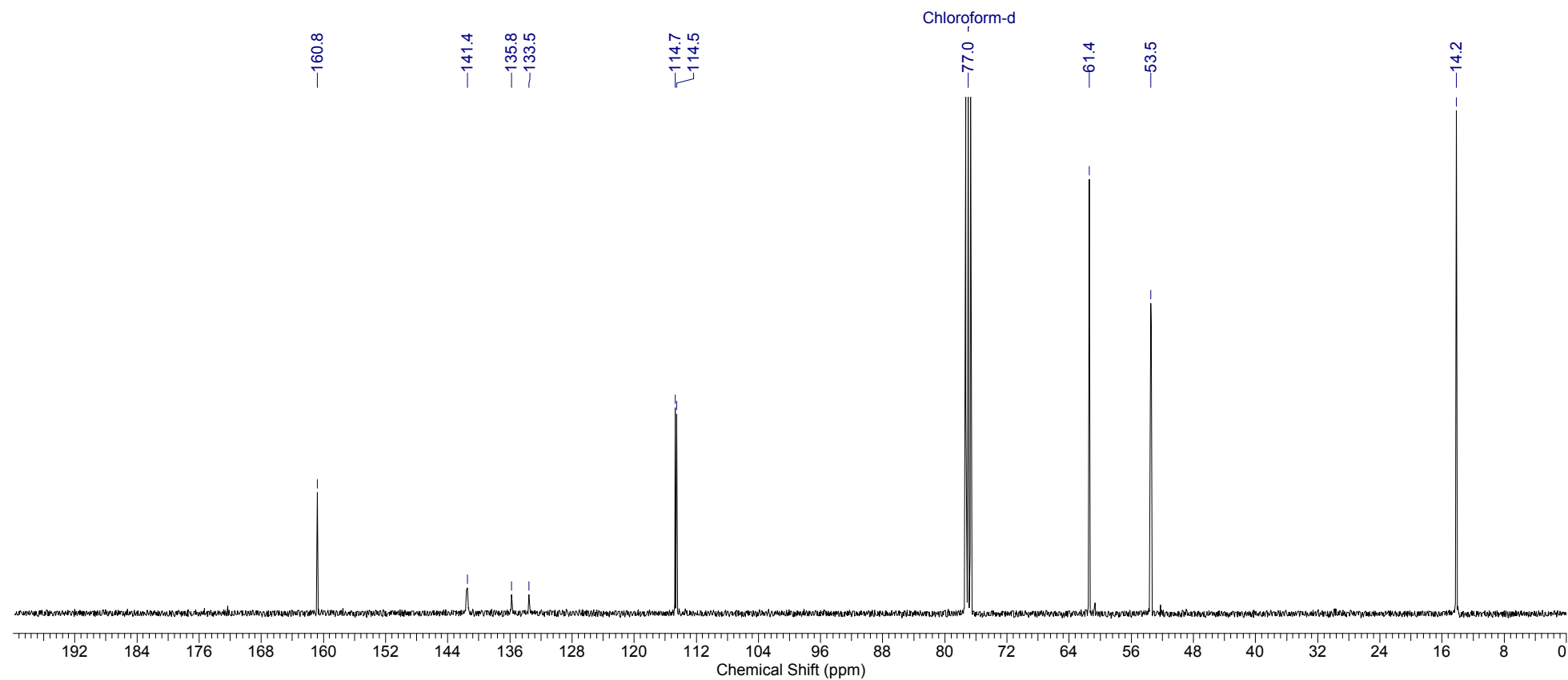
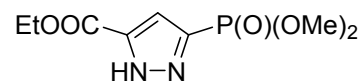
^{31}P NMR spectrum (CDCl_3) of **5** (mixture of rotamers)



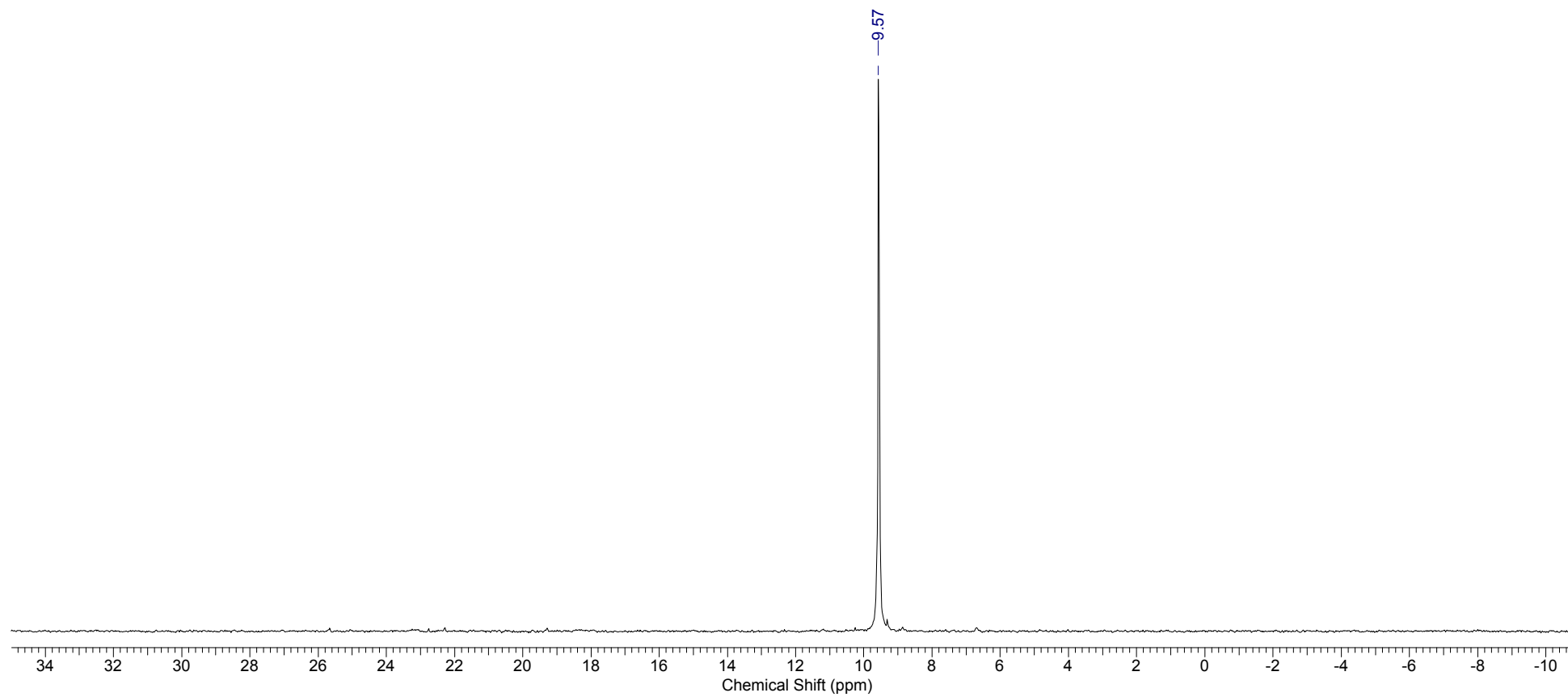
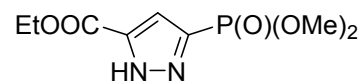
^1H NMR spectrum (CDCl_3) of **6**



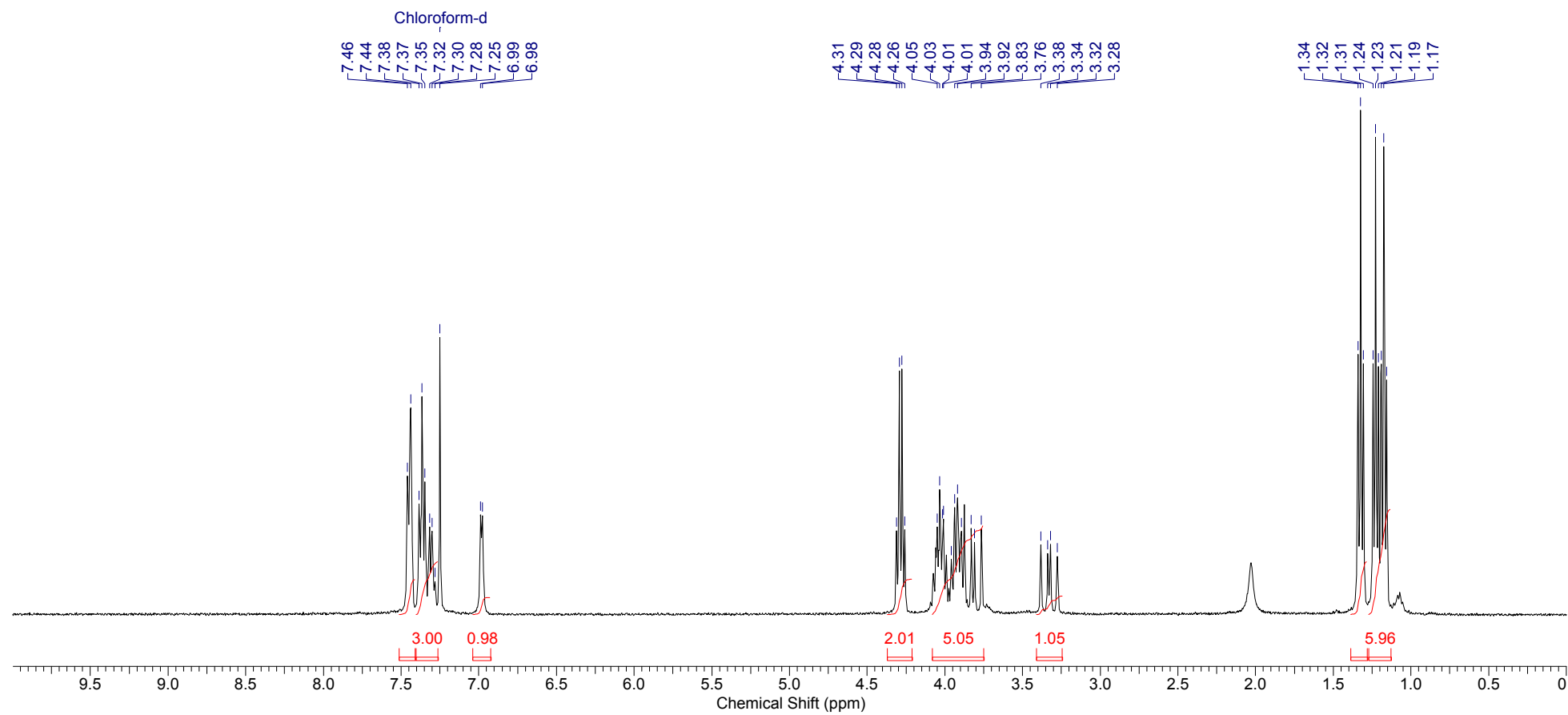
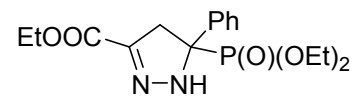
^{13}C NMR spectrum (CDCl_3) of 6



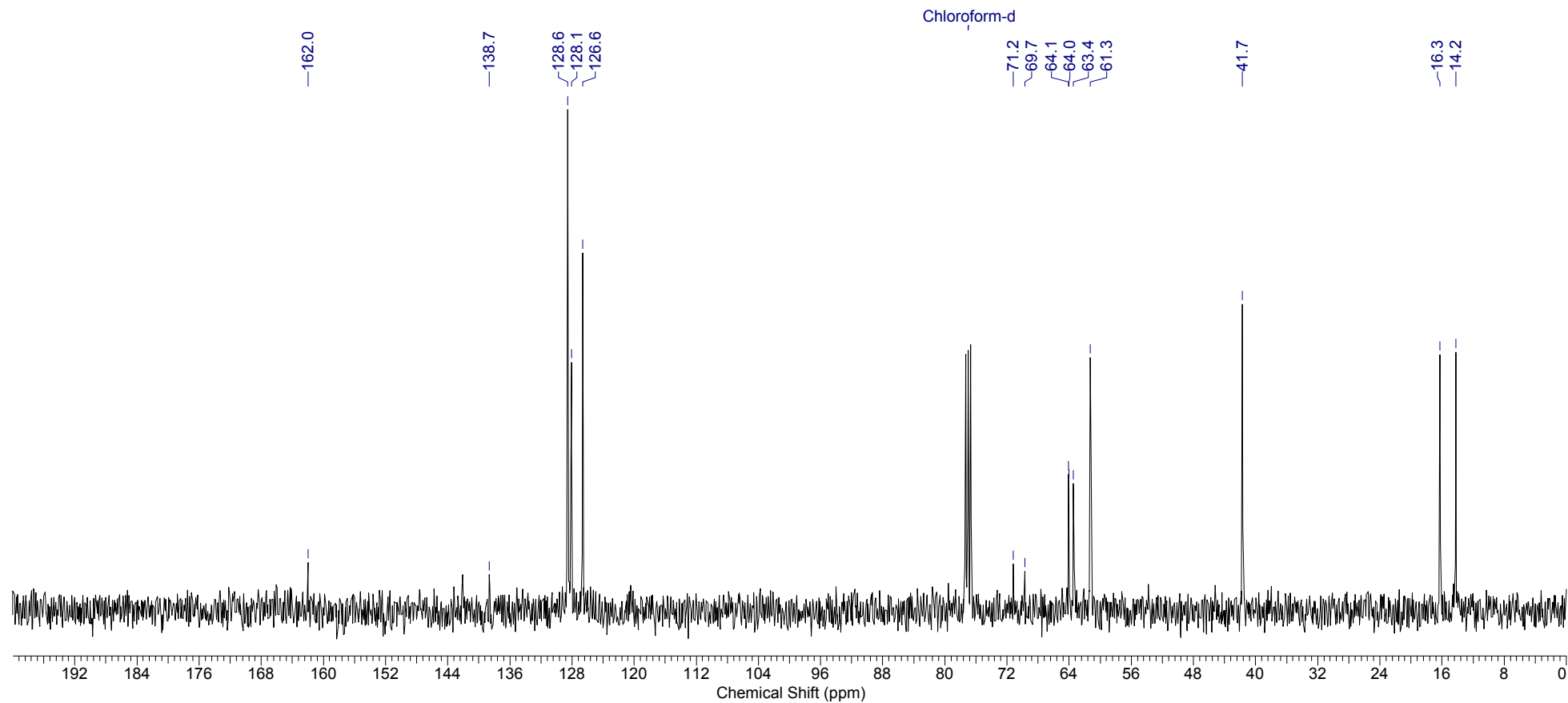
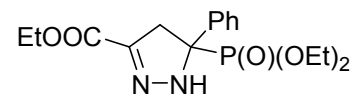
^{31}P NMR spectrum (CDCl_3) of **6**



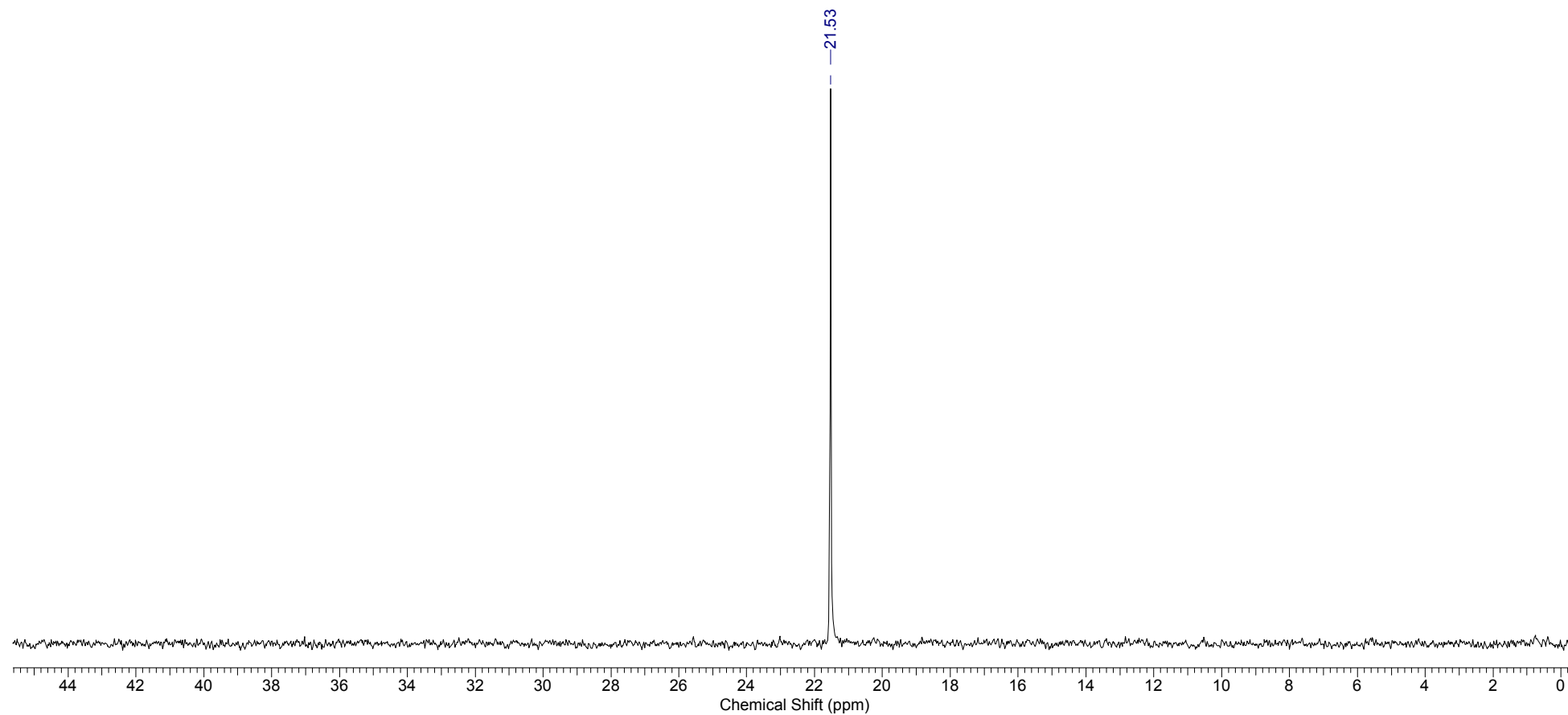
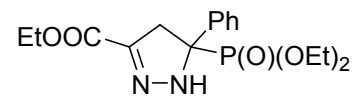
^1H NMR spectrum (CDCl_3) of **8**



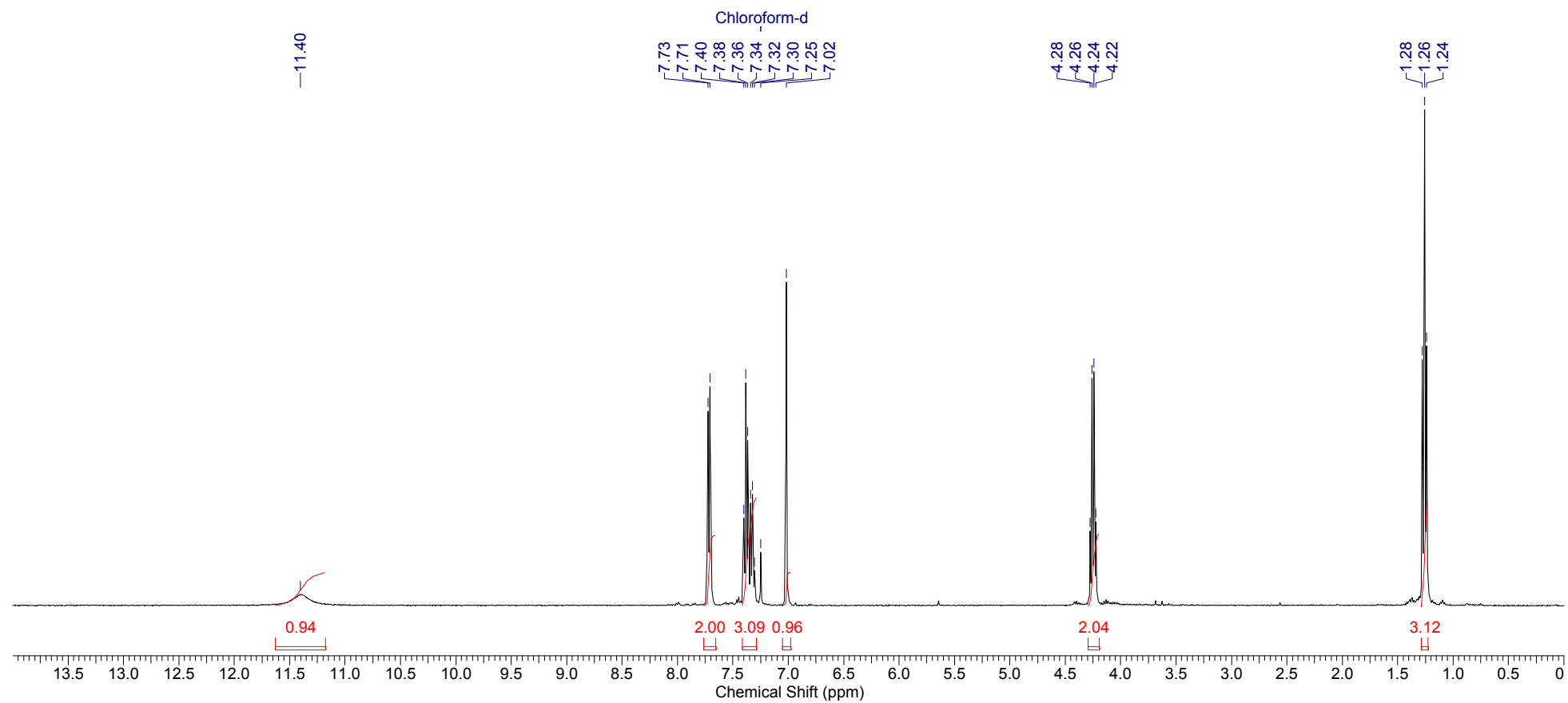
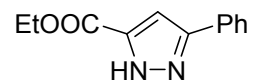
^{13}C NMR spectrum (CDCl_3) of **8**



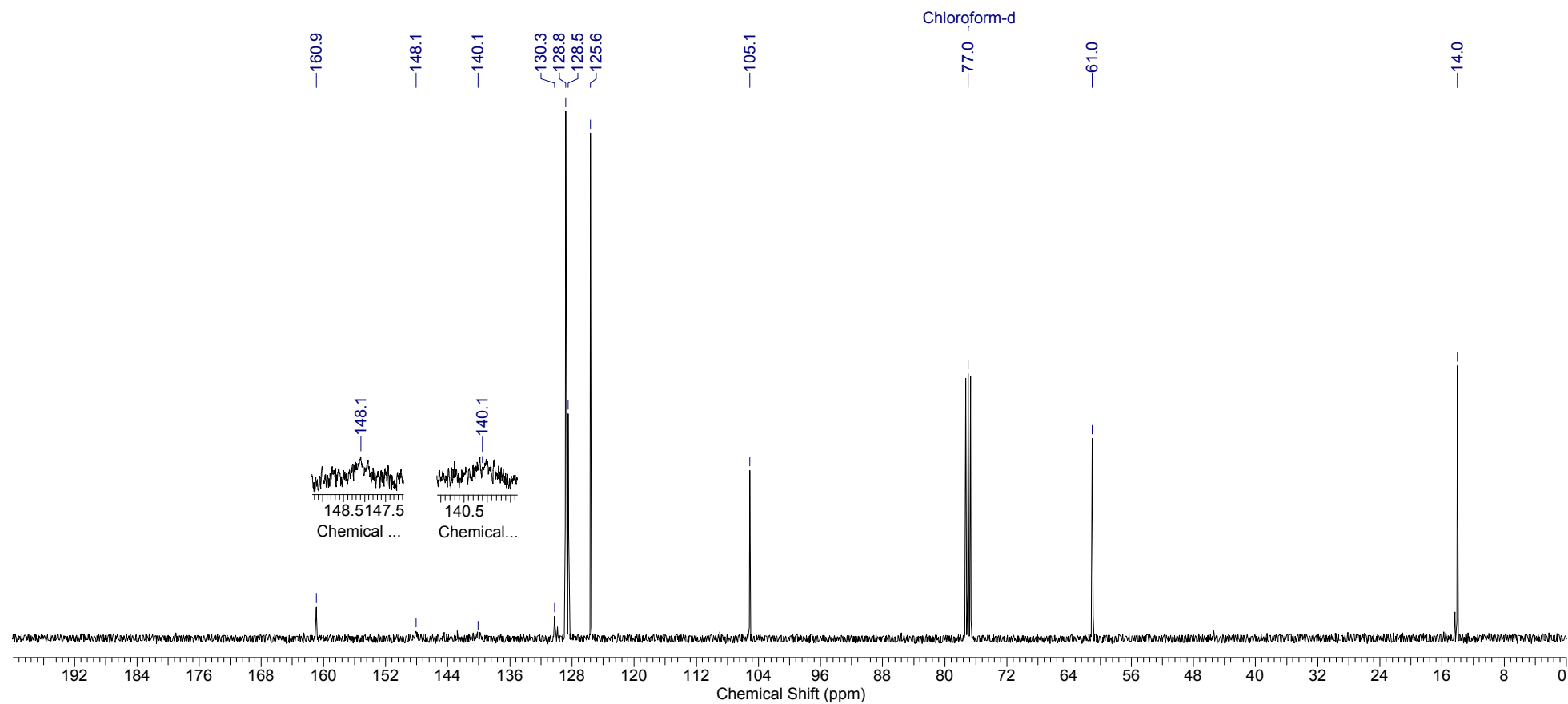
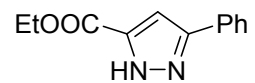
^{31}P NMR spectrum (CDCl_3) of **8**



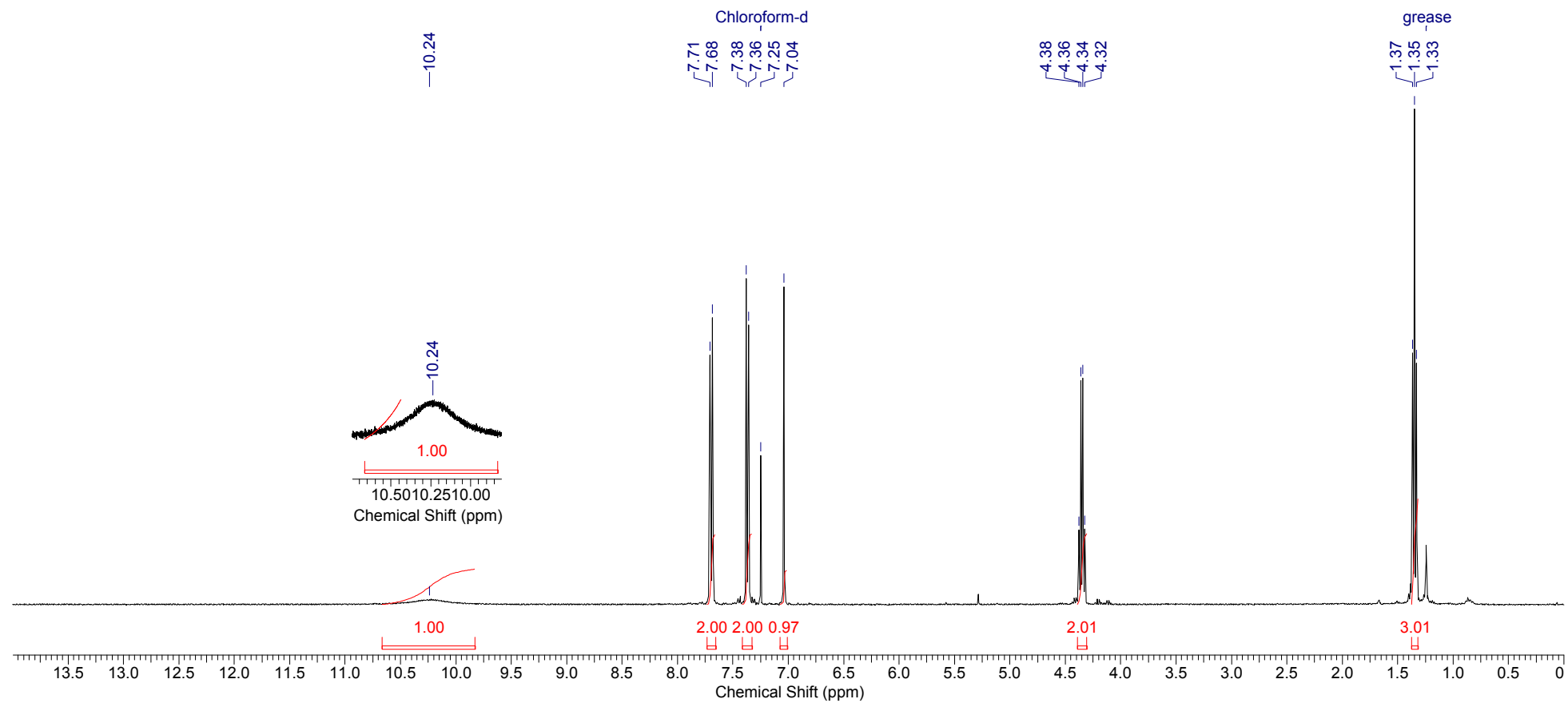
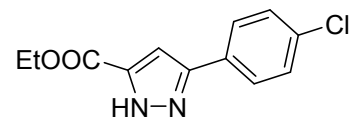
^1H NMR spectrum (CDCl_3) of **9a**



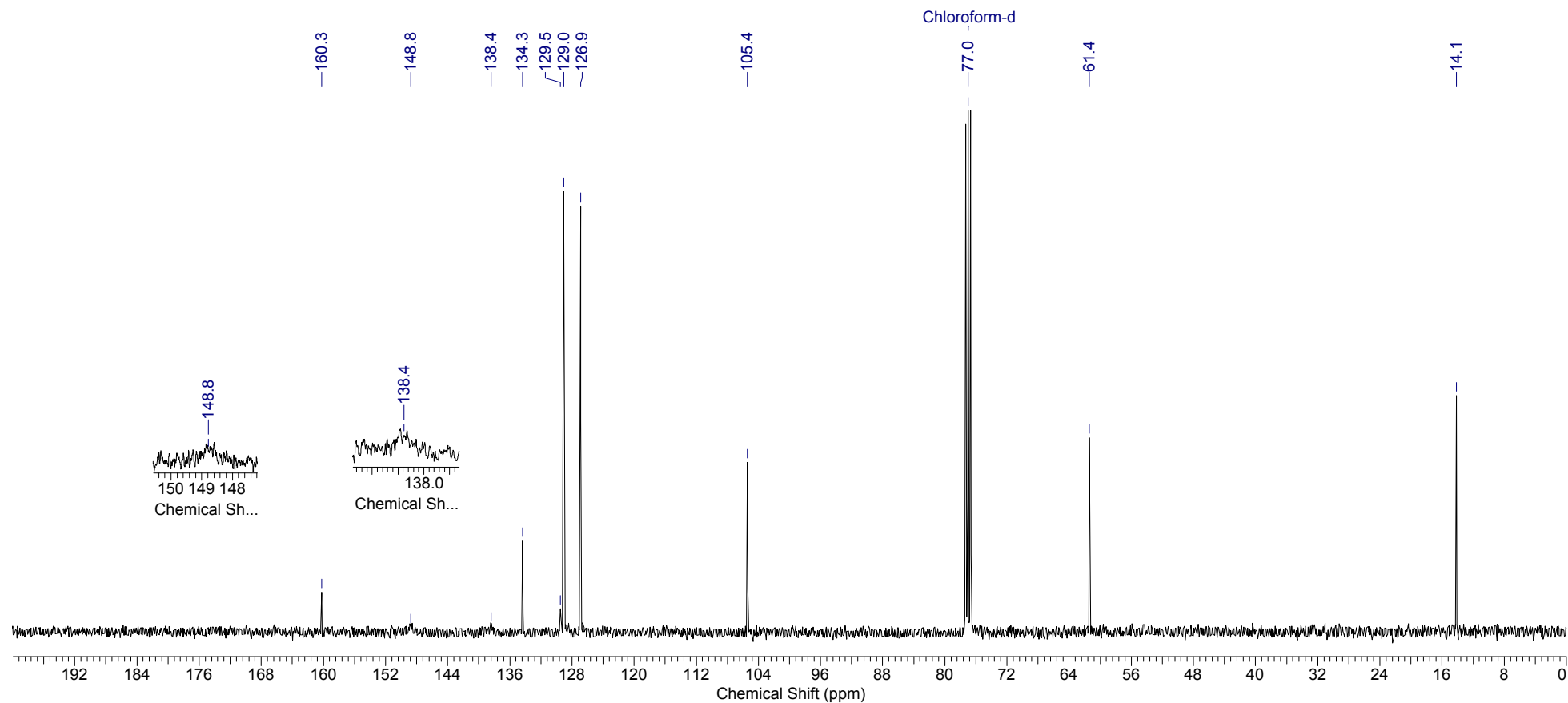
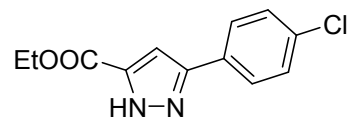
^{13}C NMR spectrum (CDCl_3) of **9a**



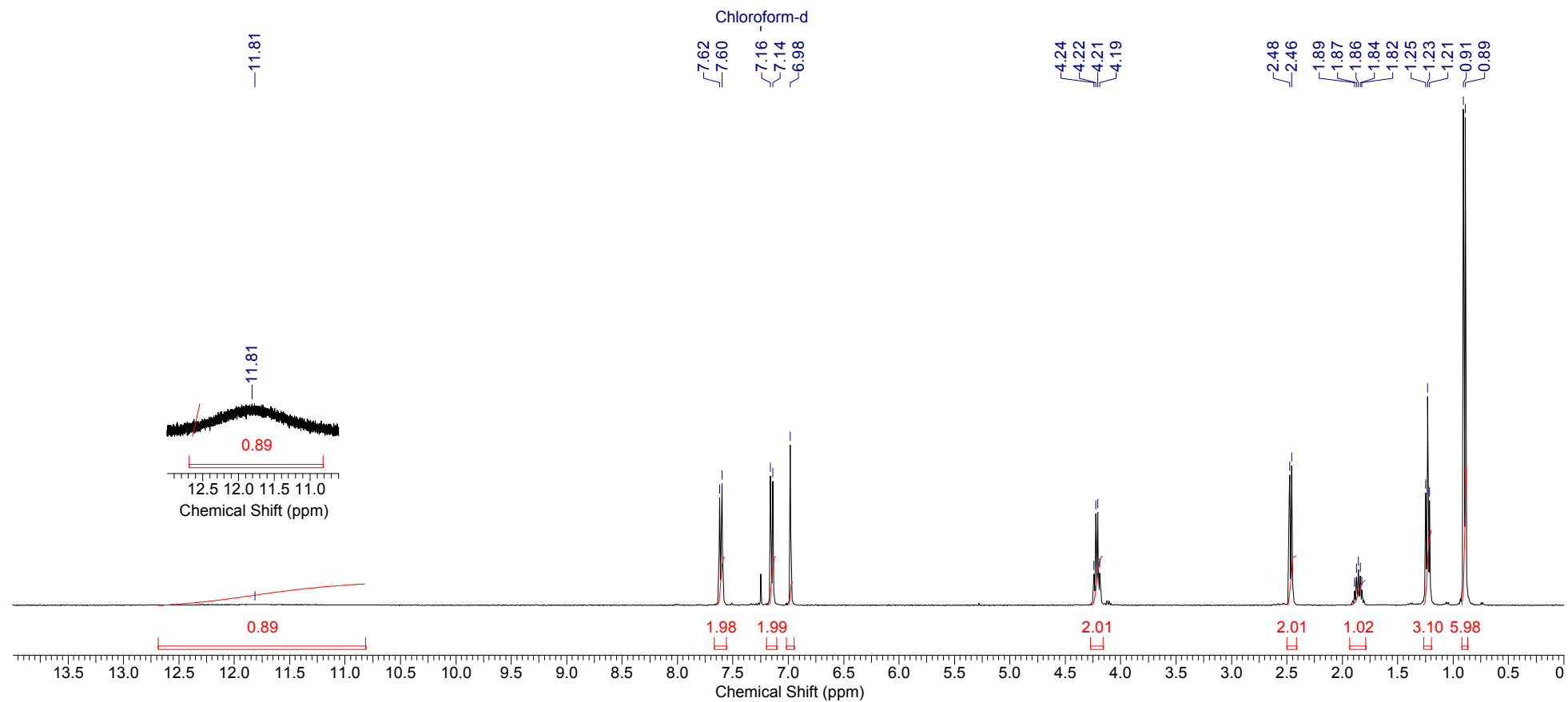
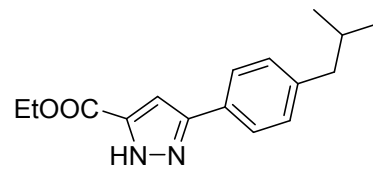
^1H NMR spectrum (CDCl_3) of **9b**



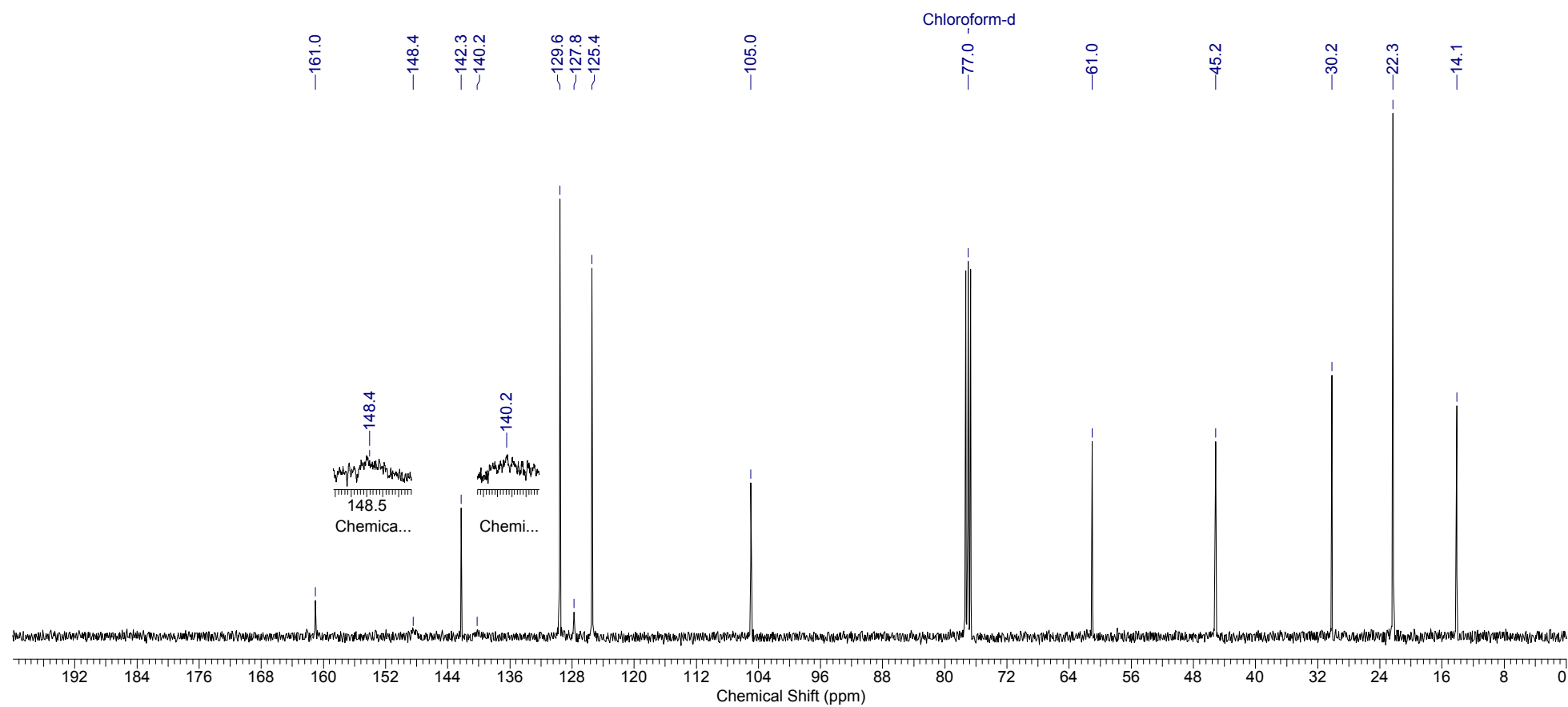
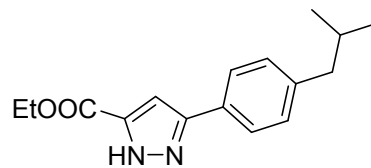
^{13}C NMR spectrum (CDCl_3) of **9b**



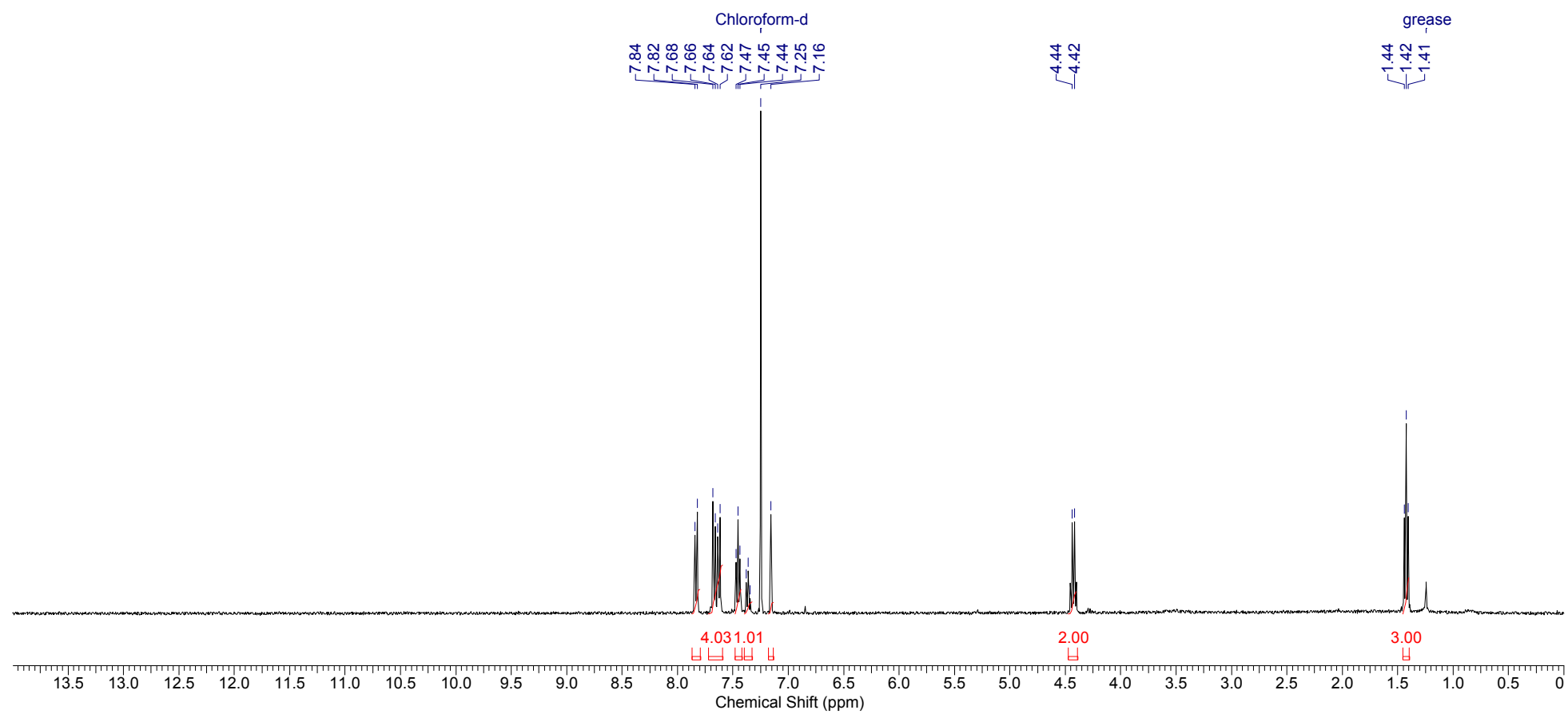
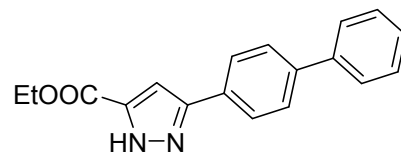
^1H NMR (CDCl_3) of **9c**



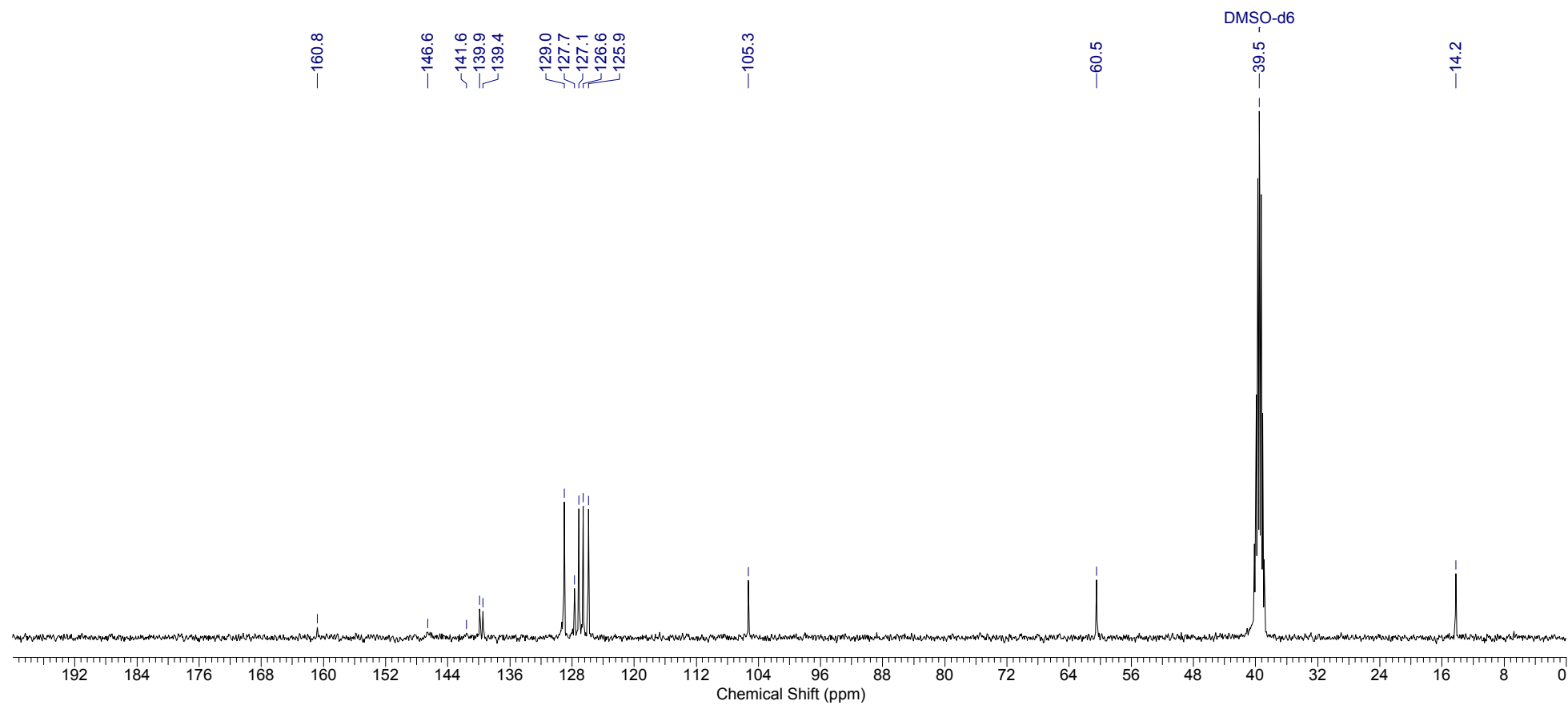
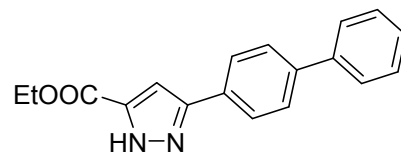
^{13}C NMR spectrum (CDCl_3) of **9c**



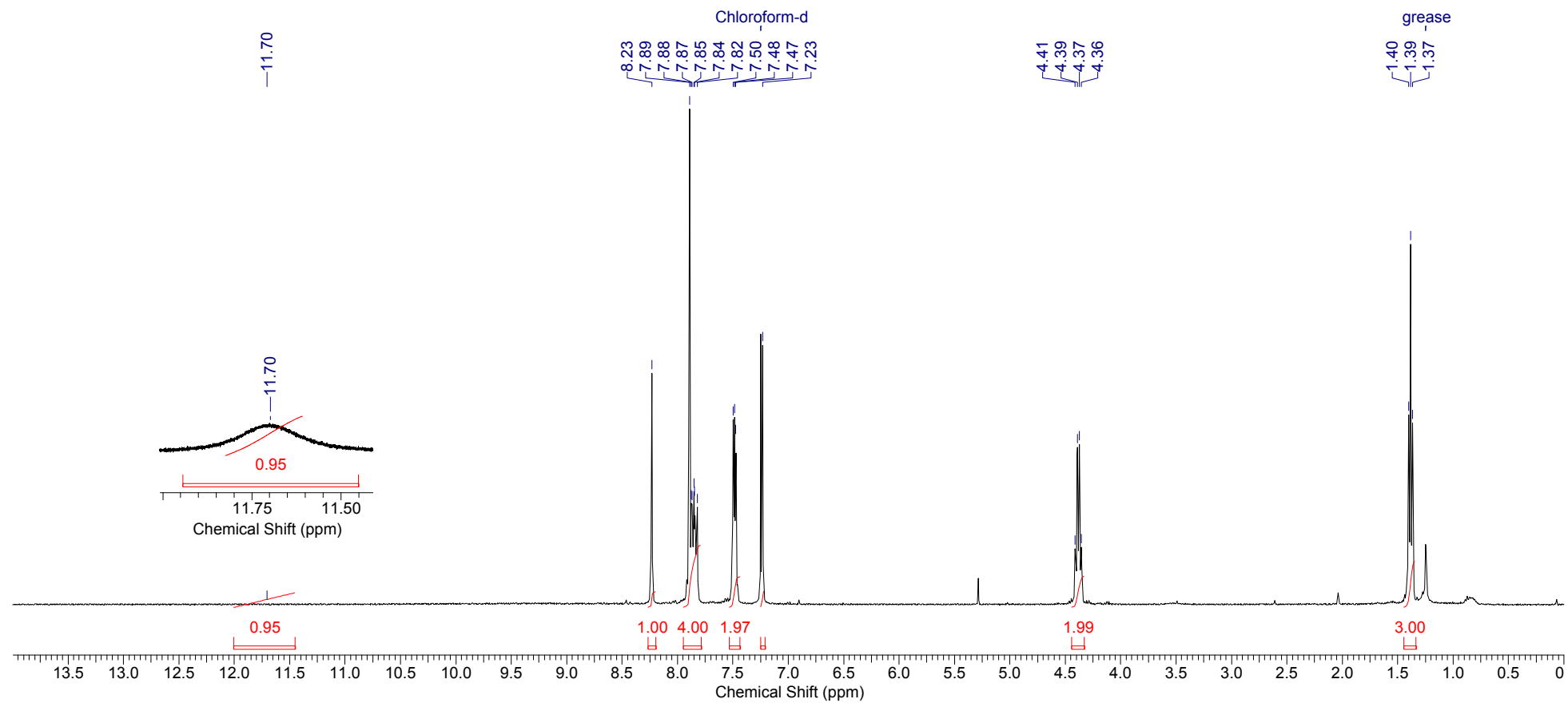
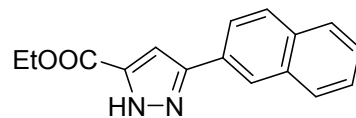
^1H NMR spectrum (CDCl_3) of **9d**



^{13}C NMR spectrum (DMSO- d_6) of **9d**



^1H NMR spectrum (CDCl_3) of **9e**



^{13}C NMR spectrum (CDCl_3) of **9e**

