

Reduction of functionalized tertiary phosphine oxides with BH₃

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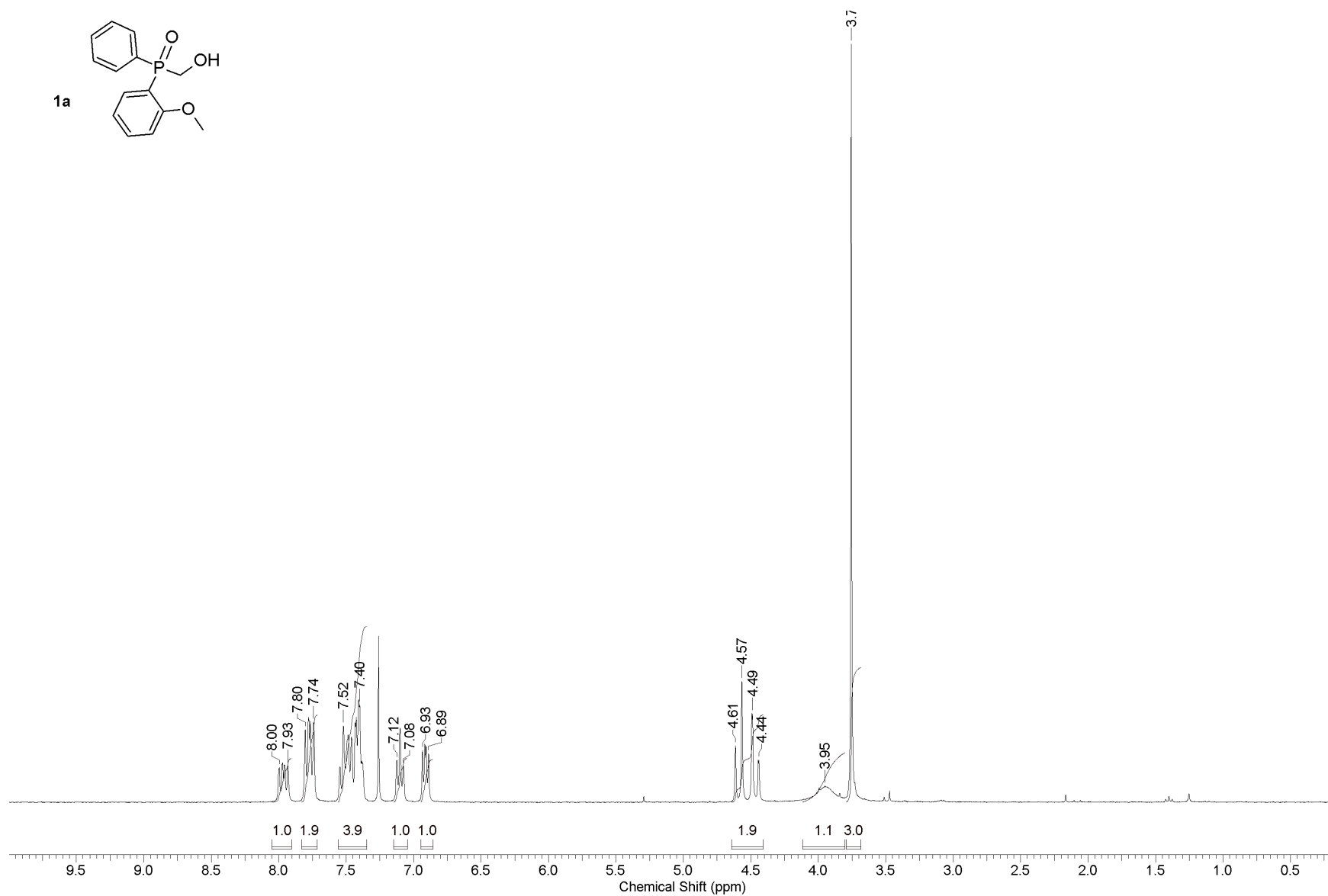
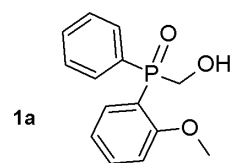
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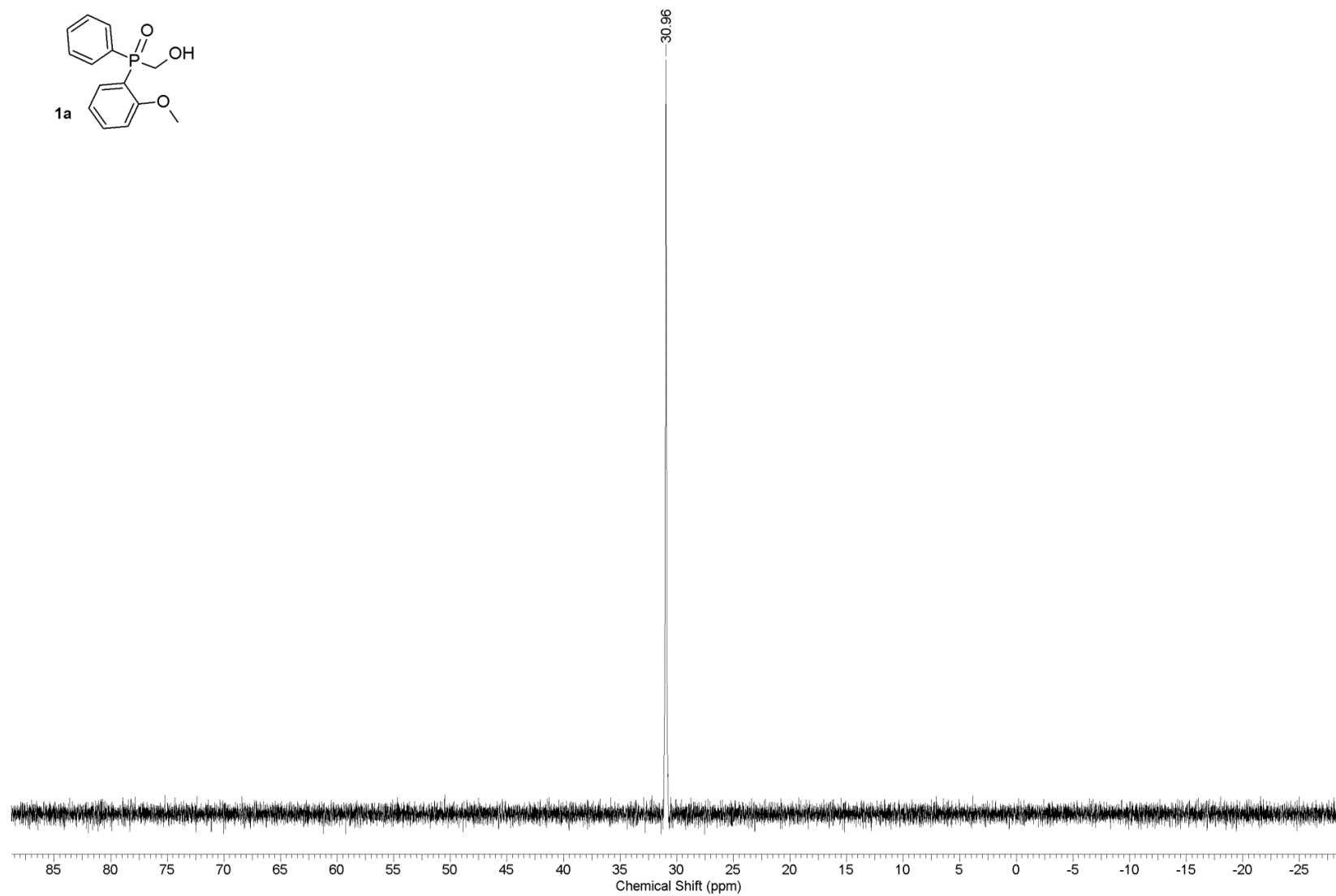
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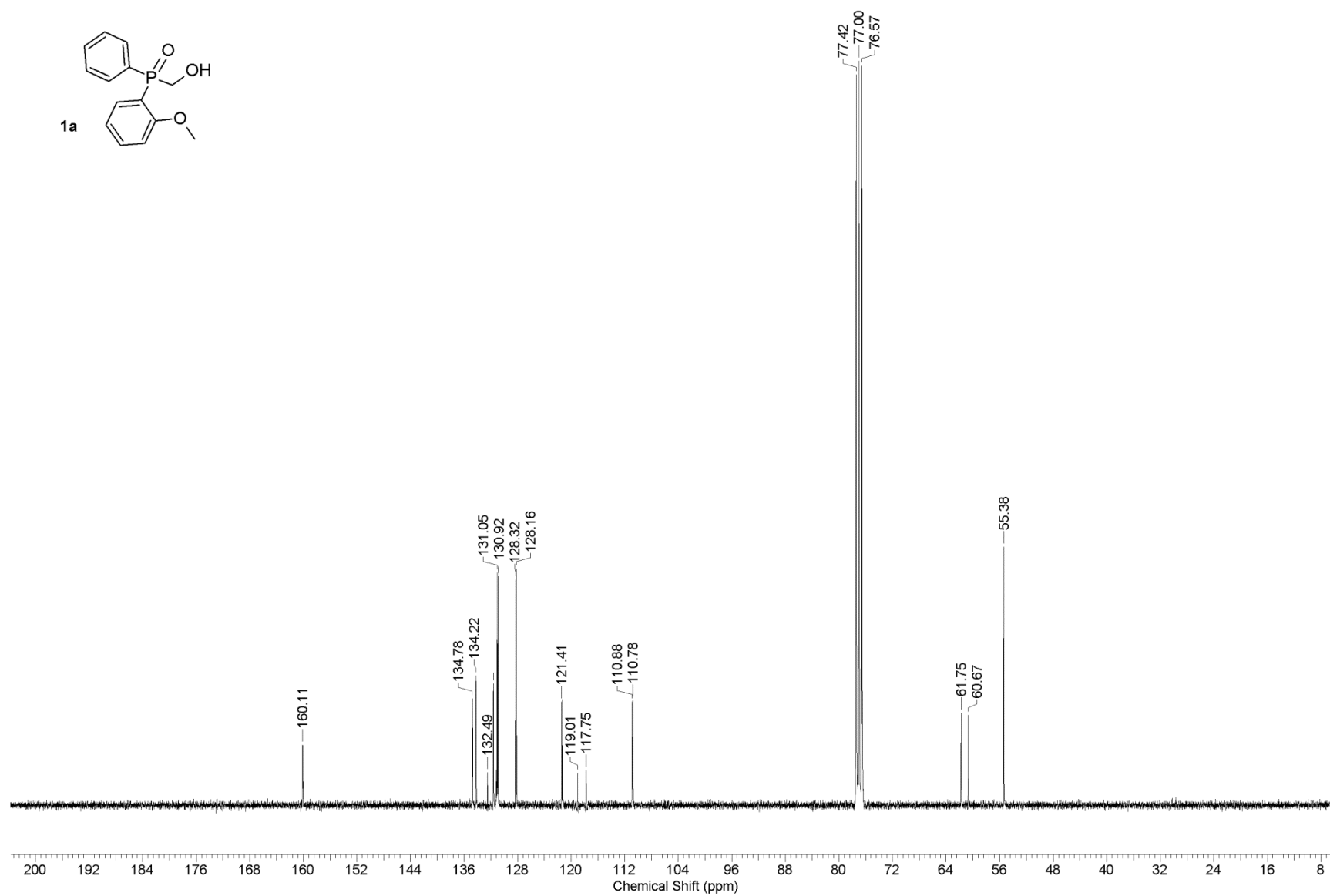
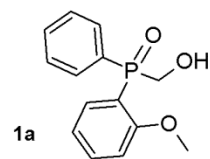
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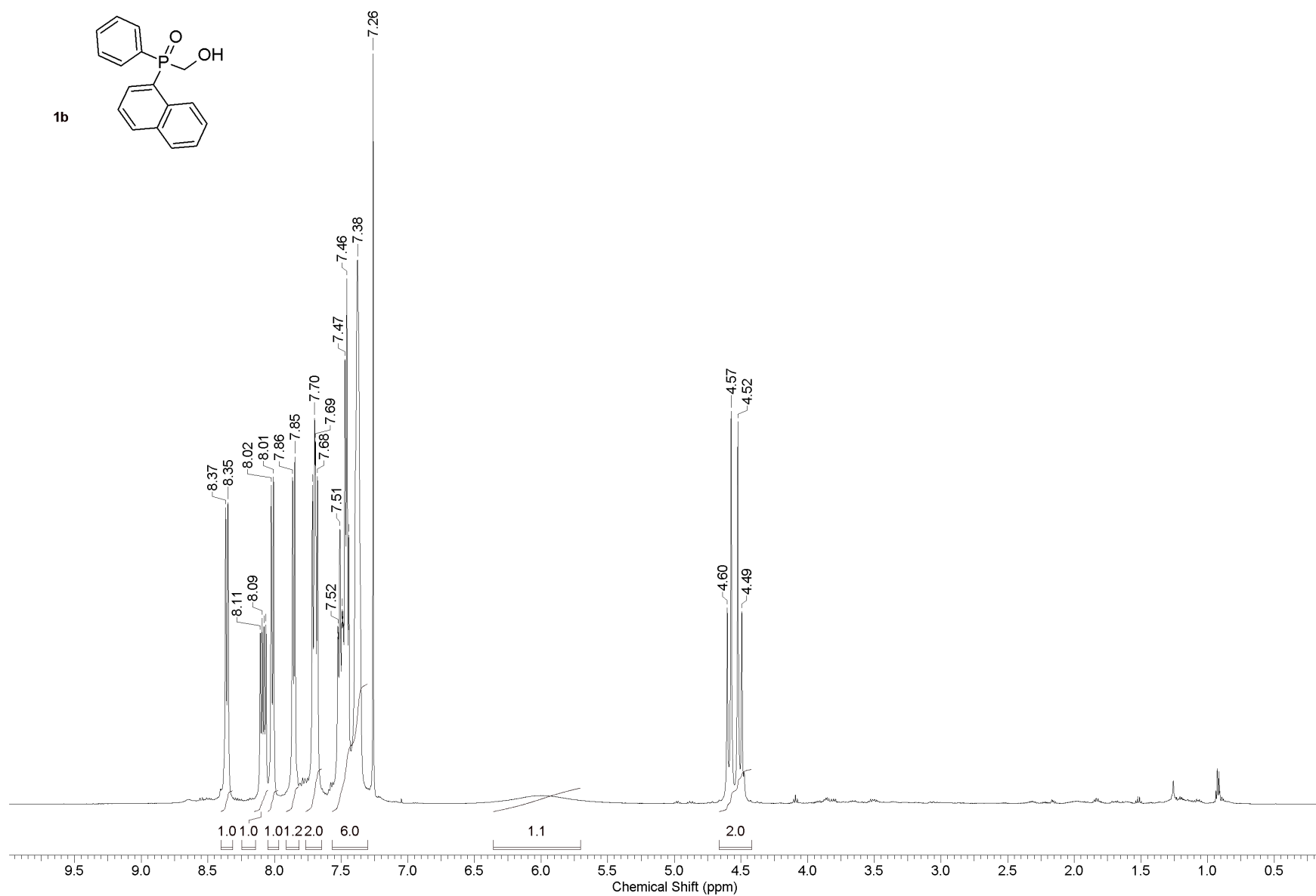
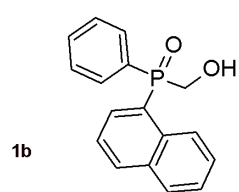
^1H NMR spectrum of *o*-anisyl(hydroxymethyl)phenylphosphine oxide (**1a**) (300 MHz, CDCl_3)



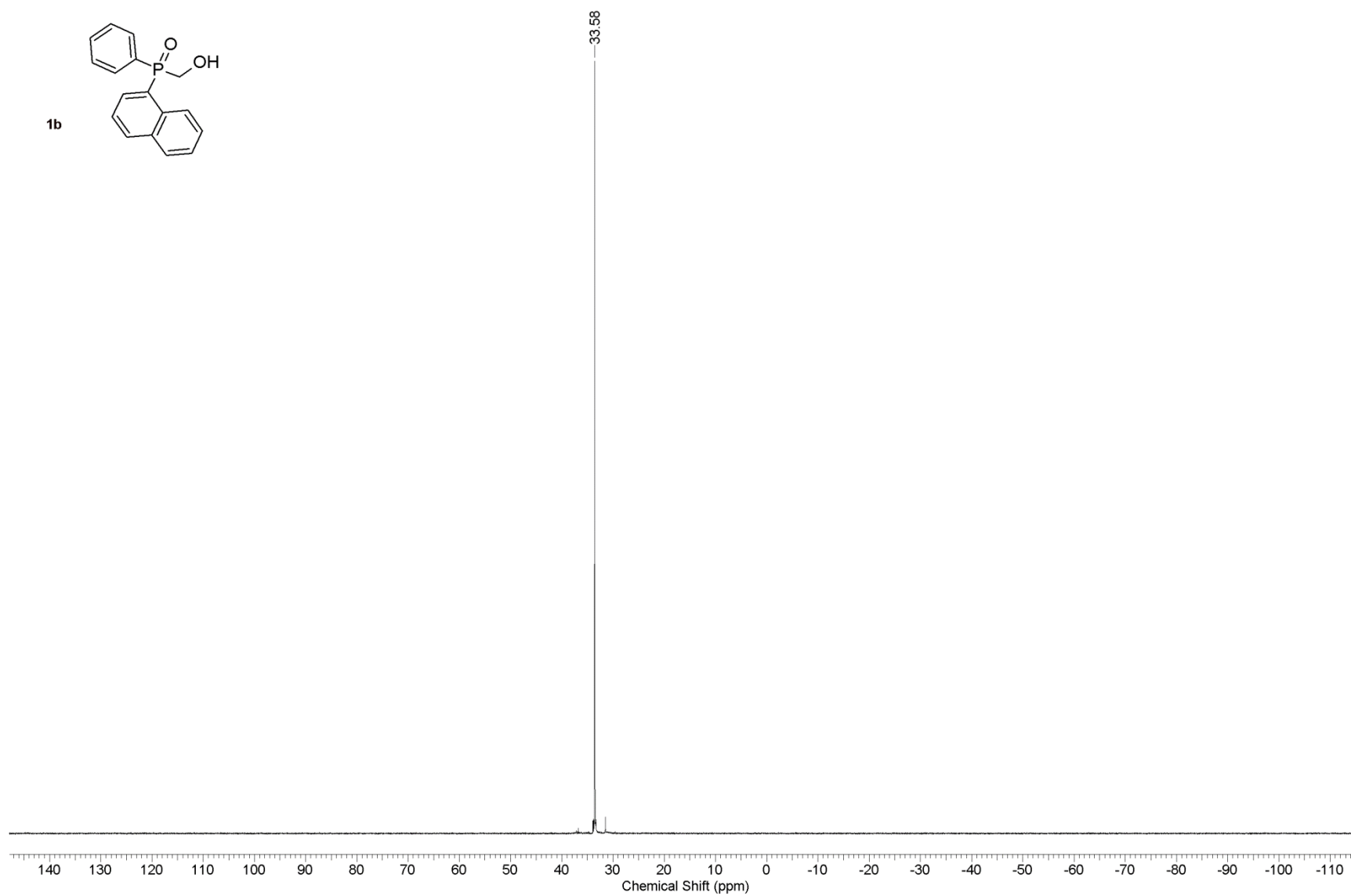
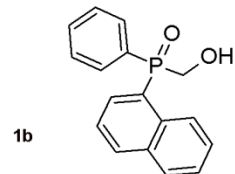
^{31}P NMR spectrum of *o*-anisyl(hydroxymethyl)phenylphosphine oxide (**1a**) (121 MHz, CDCl_3)



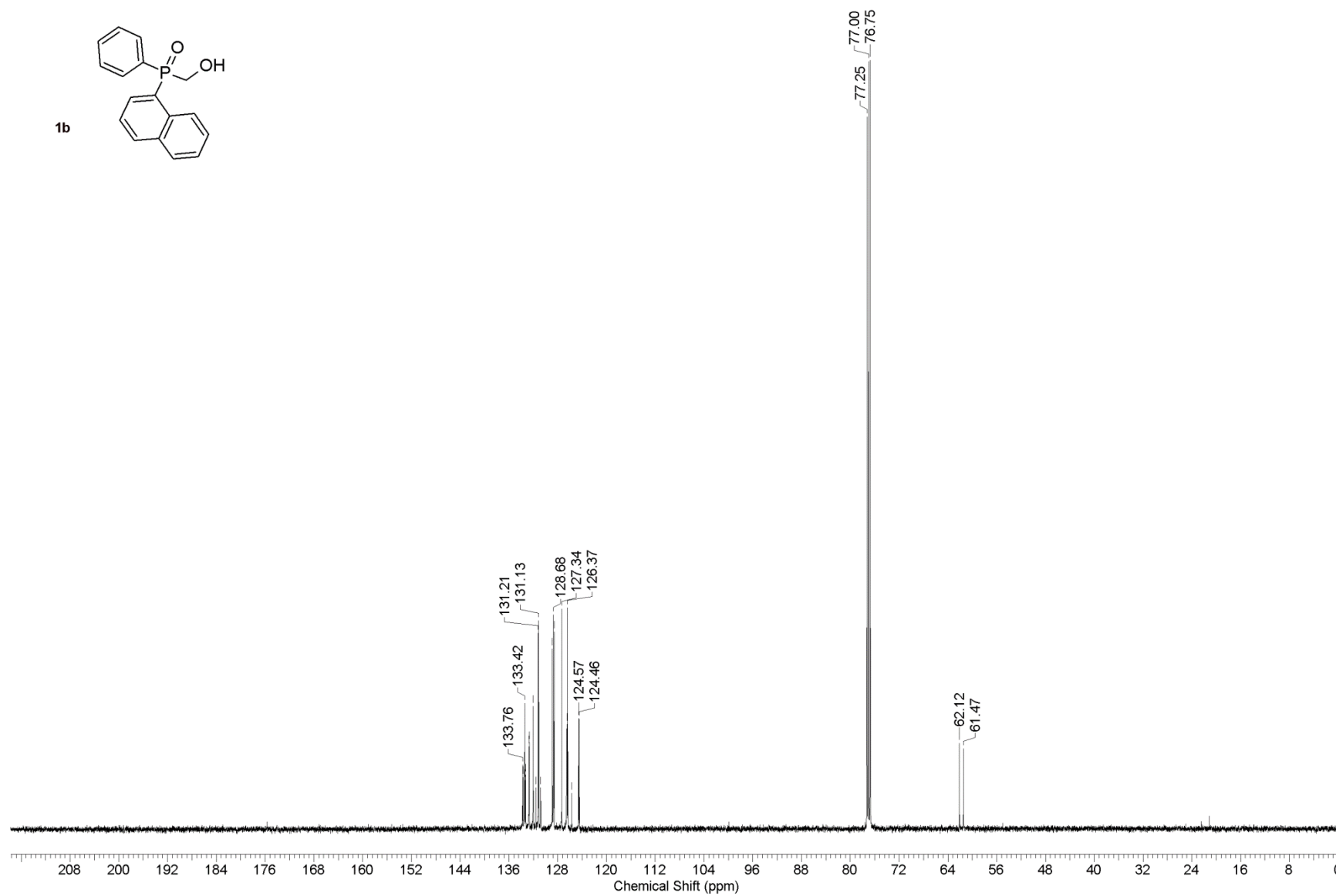
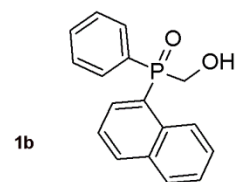
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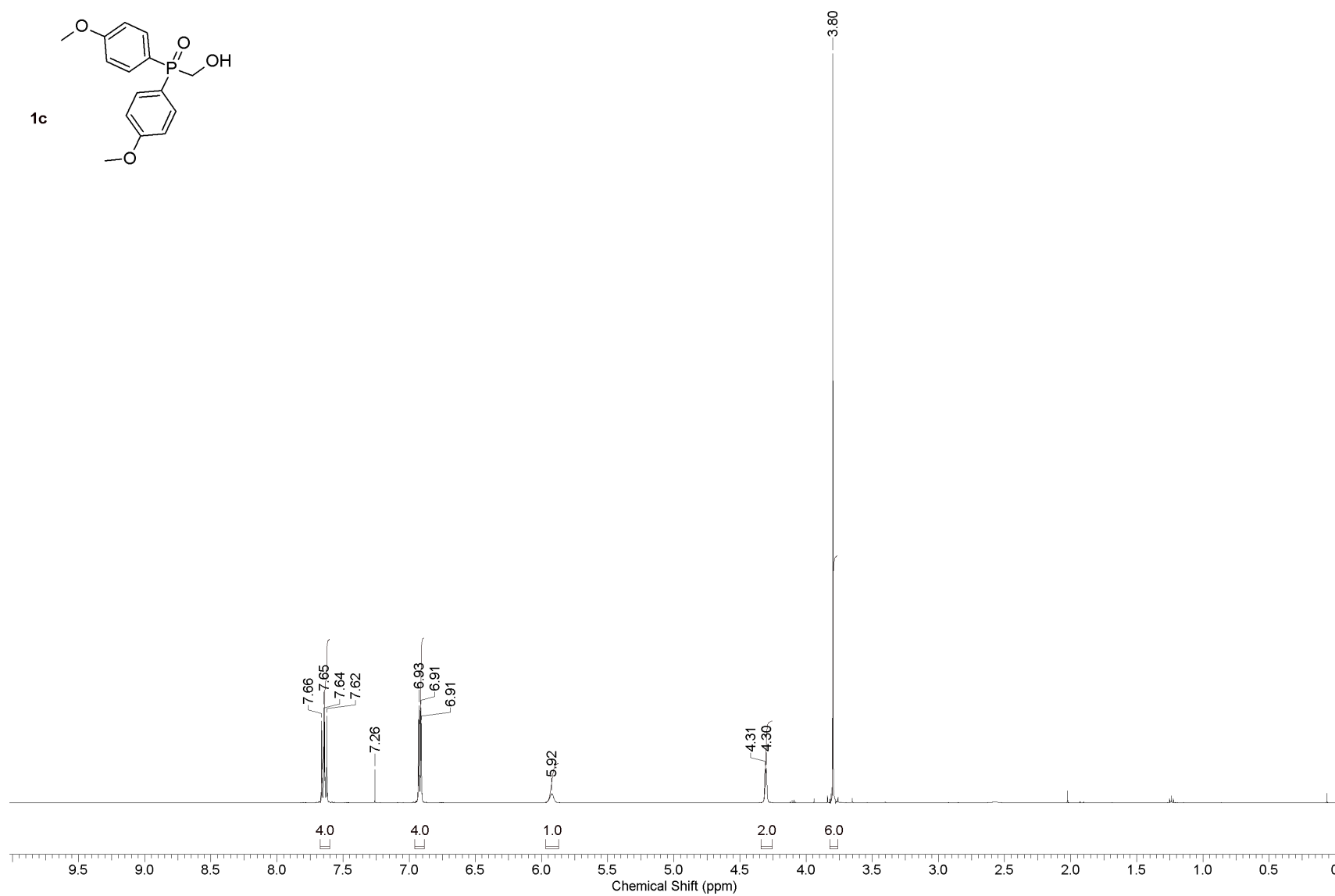
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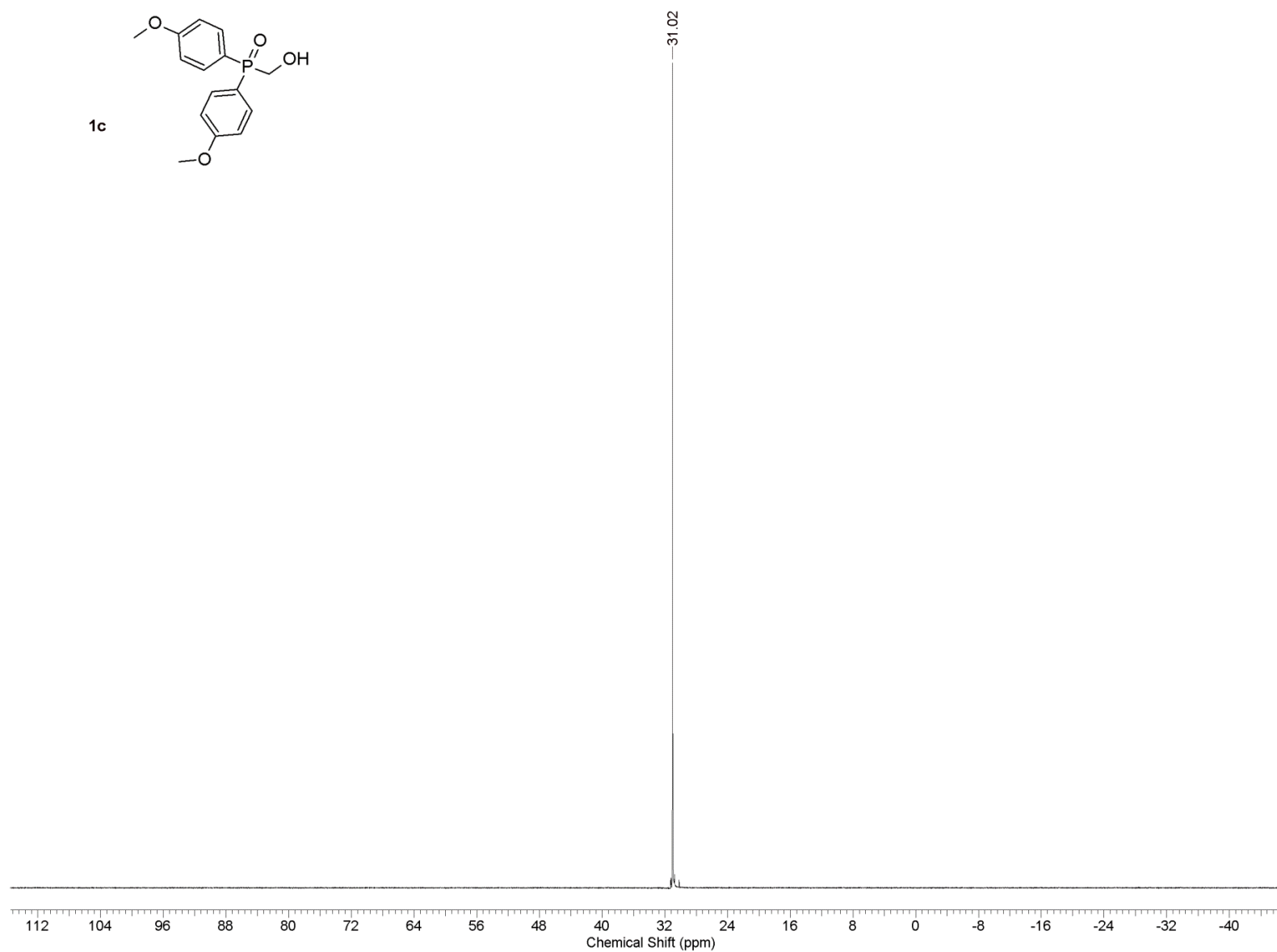
^{31}P NMR spectrum of hydroxymethyl(1-naphthyl)phenylphosphine oxide (**1b**) (202 MHz, CDCl_3)



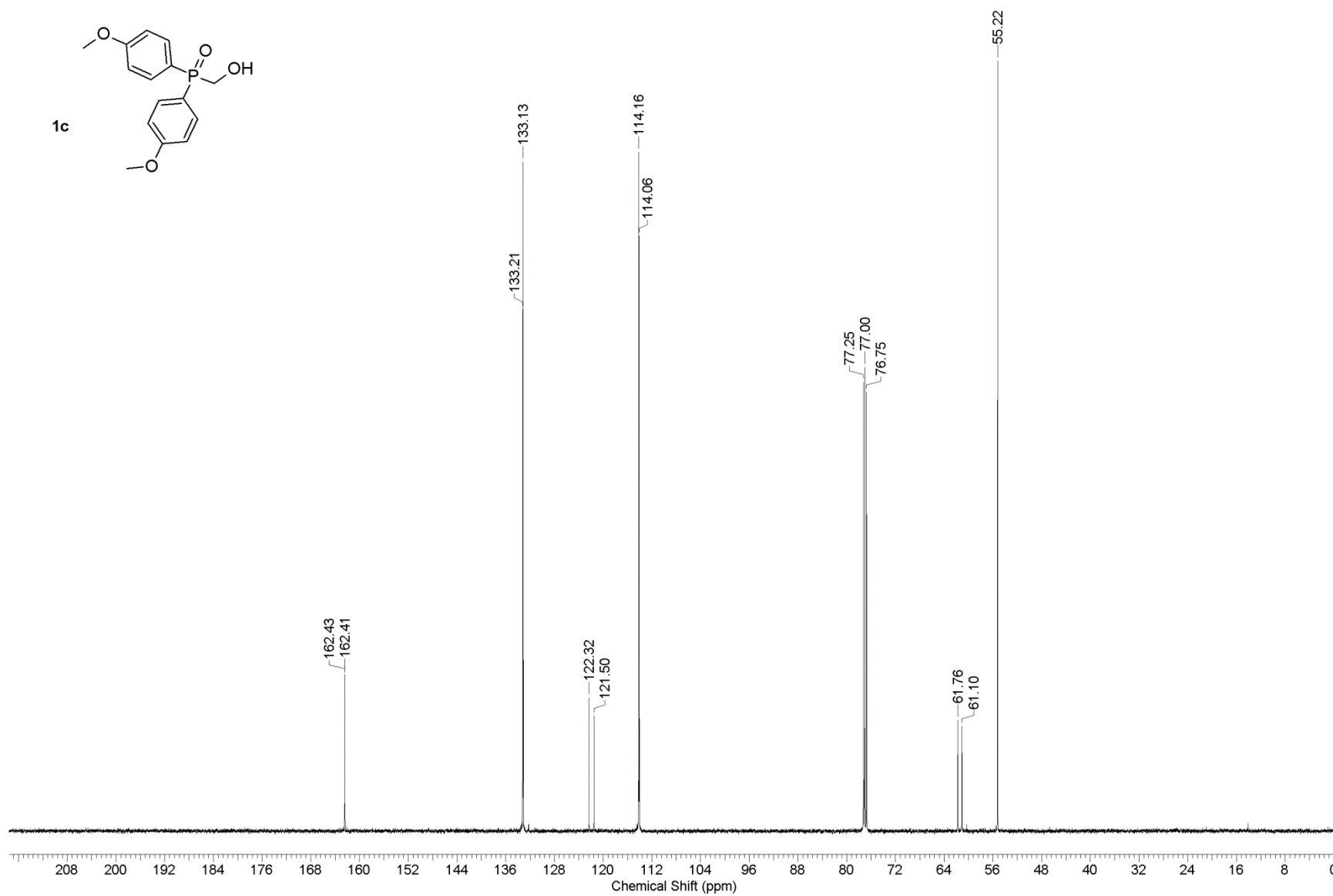
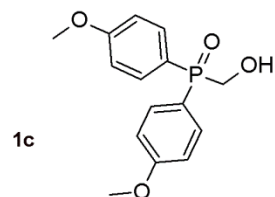
^{13}C NMR spectrum of hydroxymethyl(1-naphthyl)phenylphosphine oxide (**1b**) (125 MHz, CDCl_3)



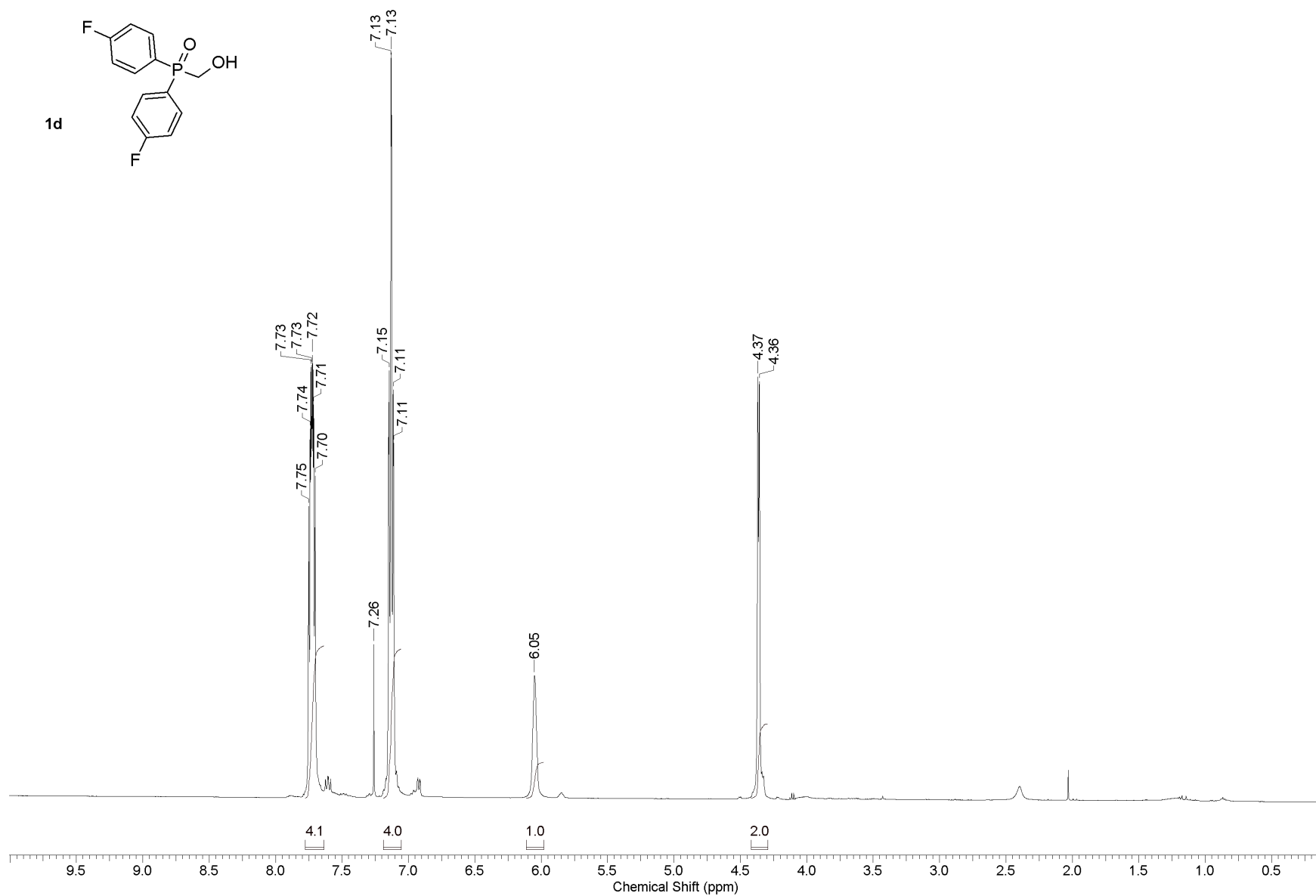
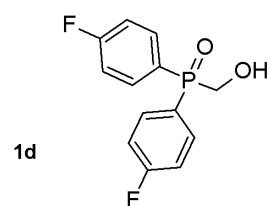
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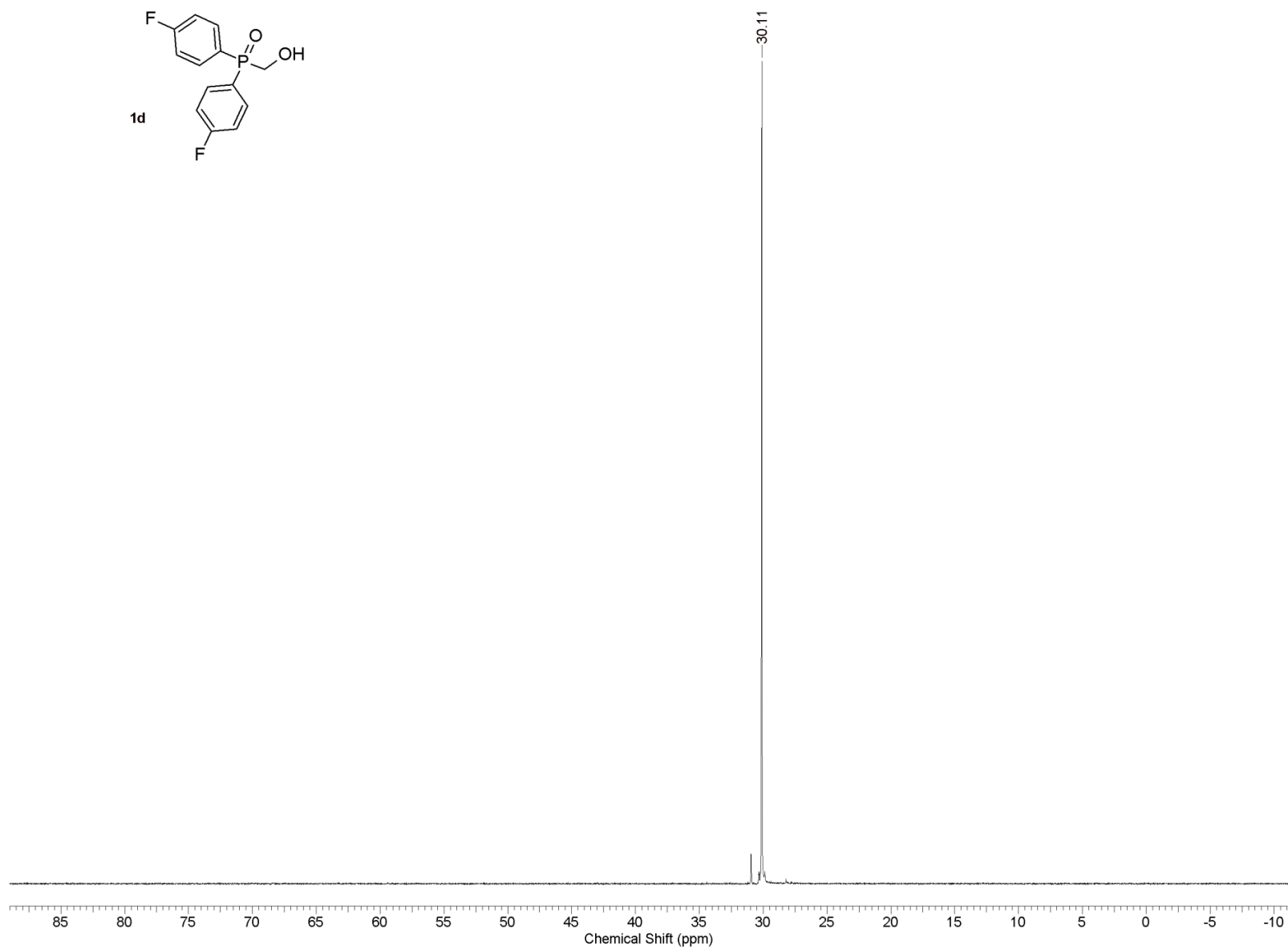
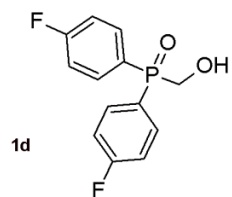
^{31}P NMR spectrum of (hydroxymethyl)-di-*p*-methoxyphenylphosphine oxide (**1c**) (202 MHz, CDCl_3)



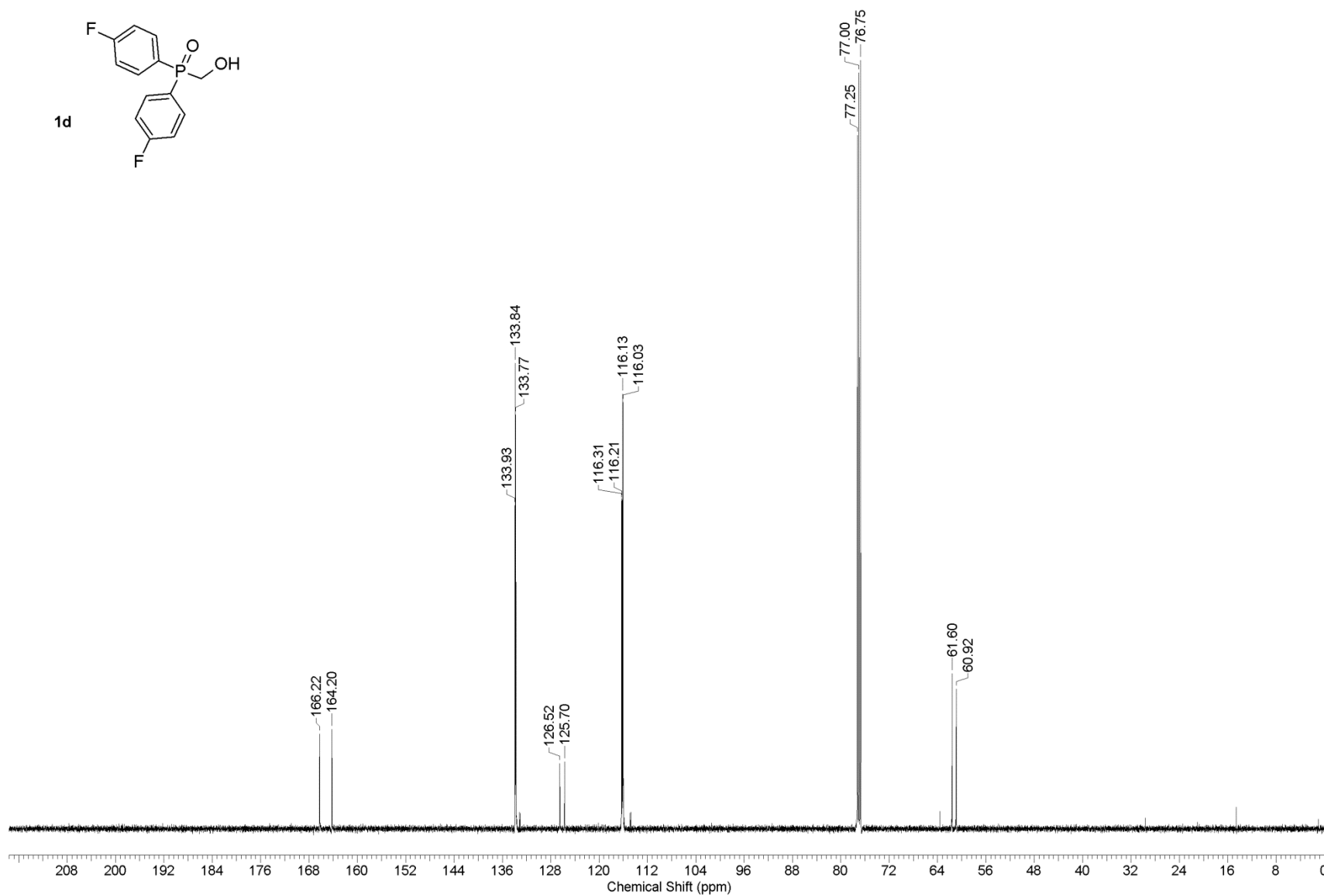
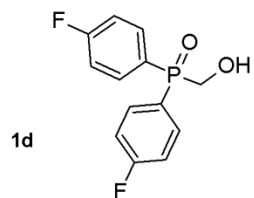
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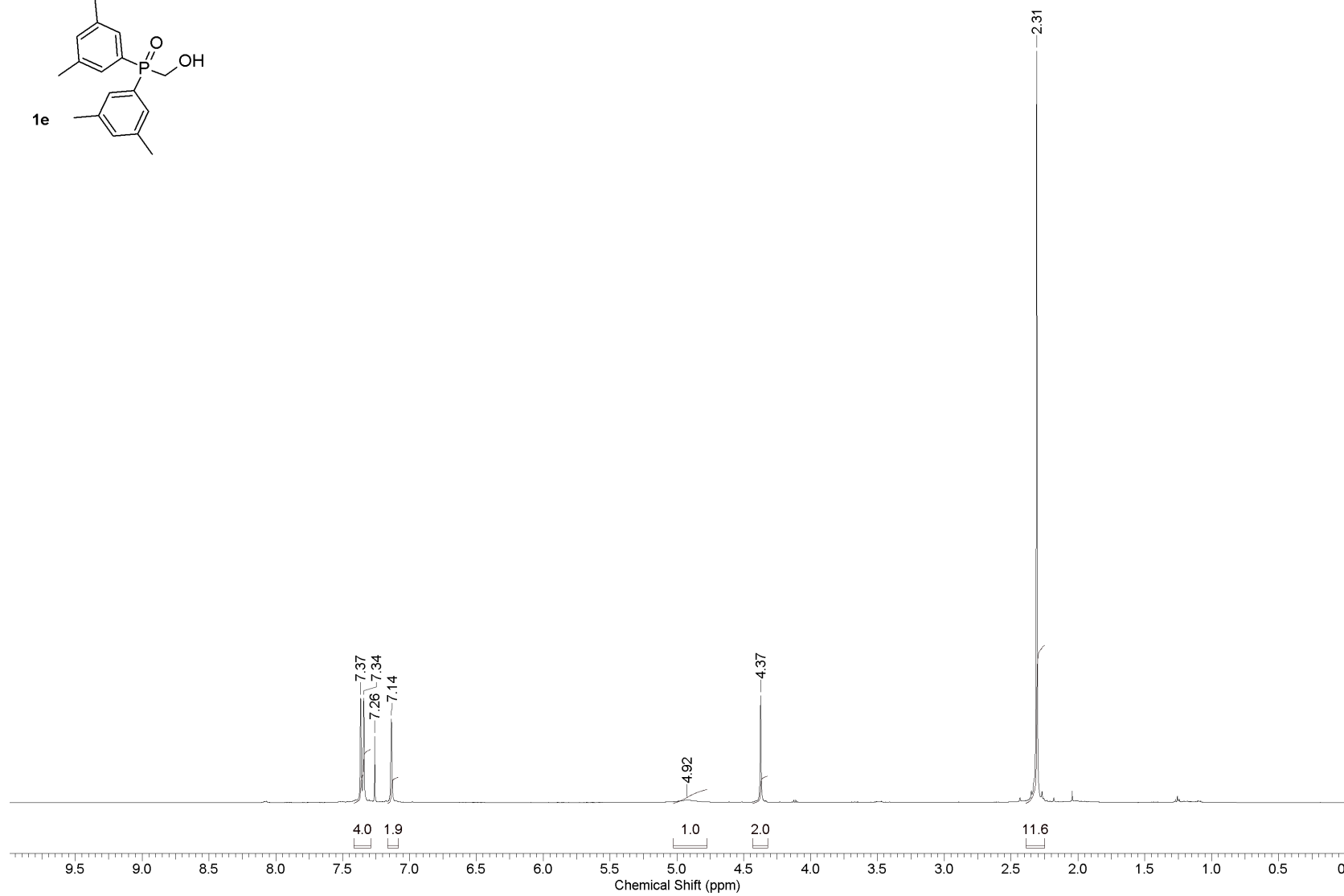
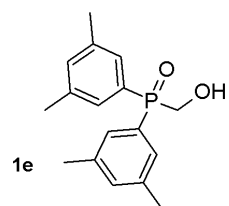
^1H NMR spectrum of di-*p*-fluorophenyl(hydroxymethyl)phosphine oxide (**1d**) (500 MHz, CDCl_3)



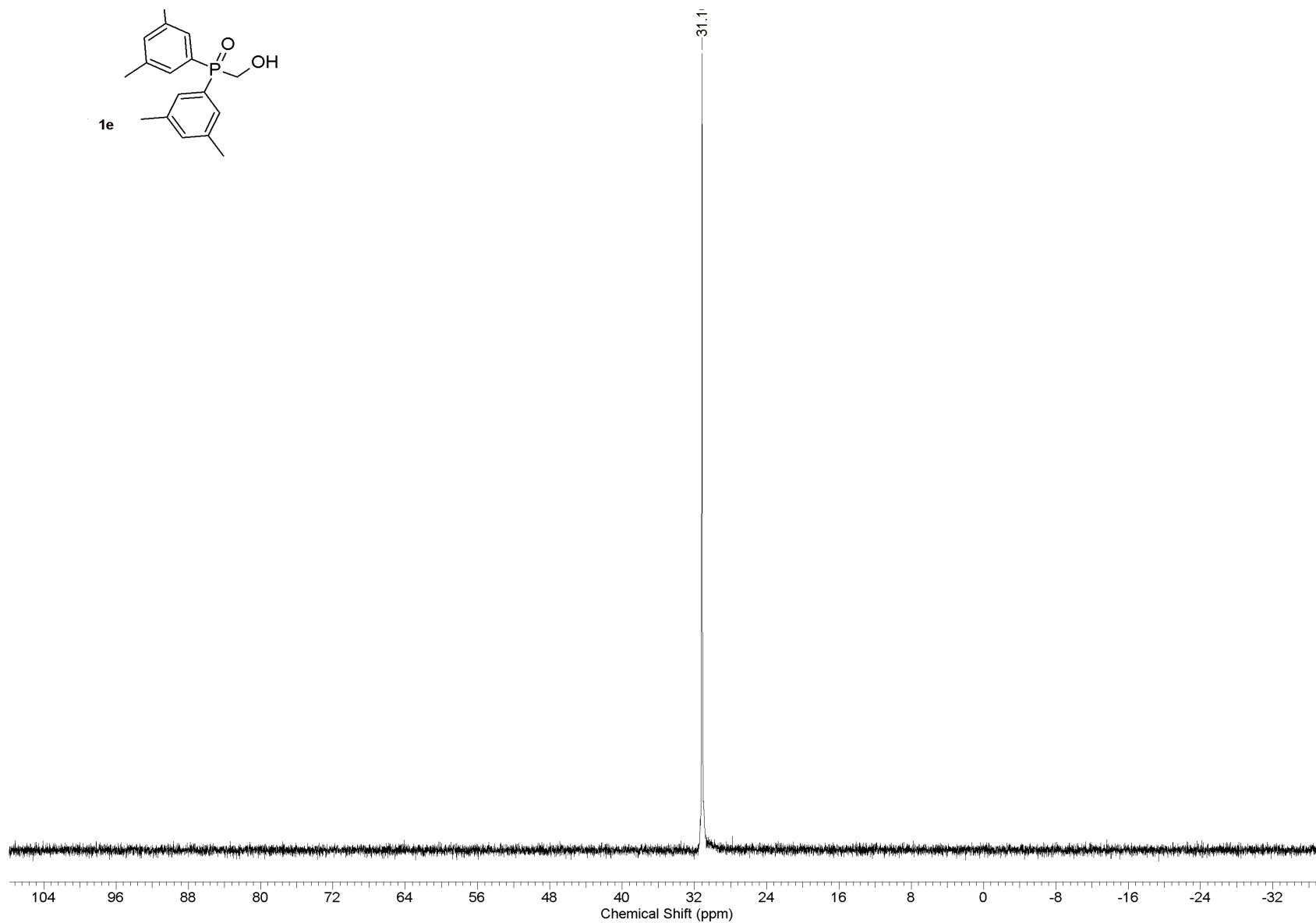
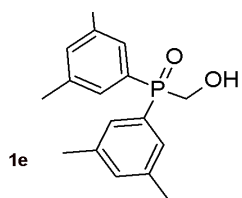
^{31}P NMR spectrum of di-*p*-fluorophenyl(hydroxymethyl)phosphine oxide (**1d**) (202 MHz, CDCl_3)



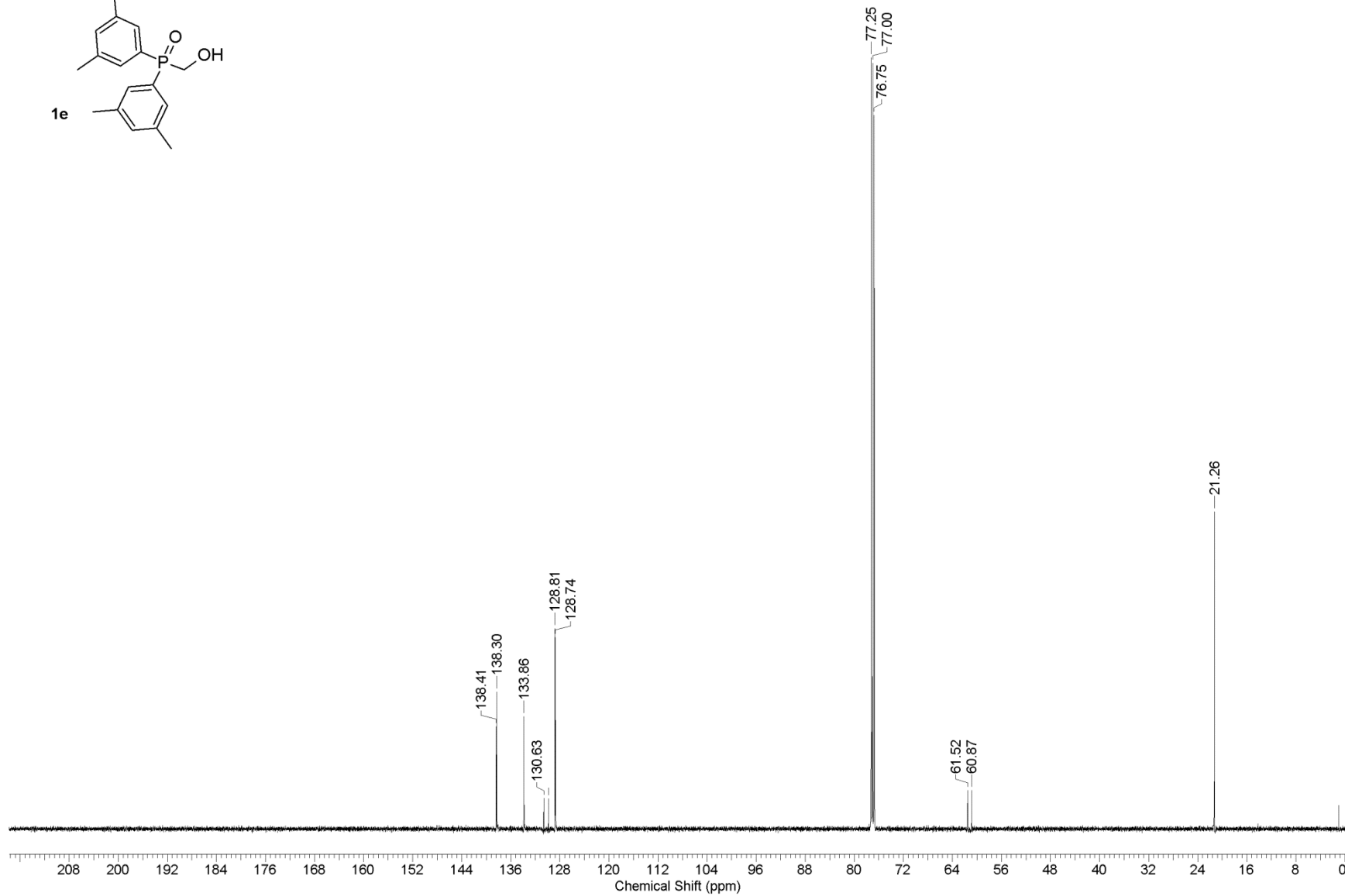
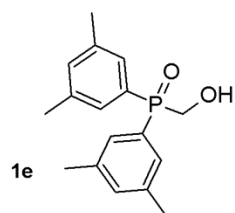
^{13}C NMR spectrum of di-*p*-fluorophenyl(hydroxymethyl)phosphine oxide (**1d**) (125 MHz, CDCl_3)



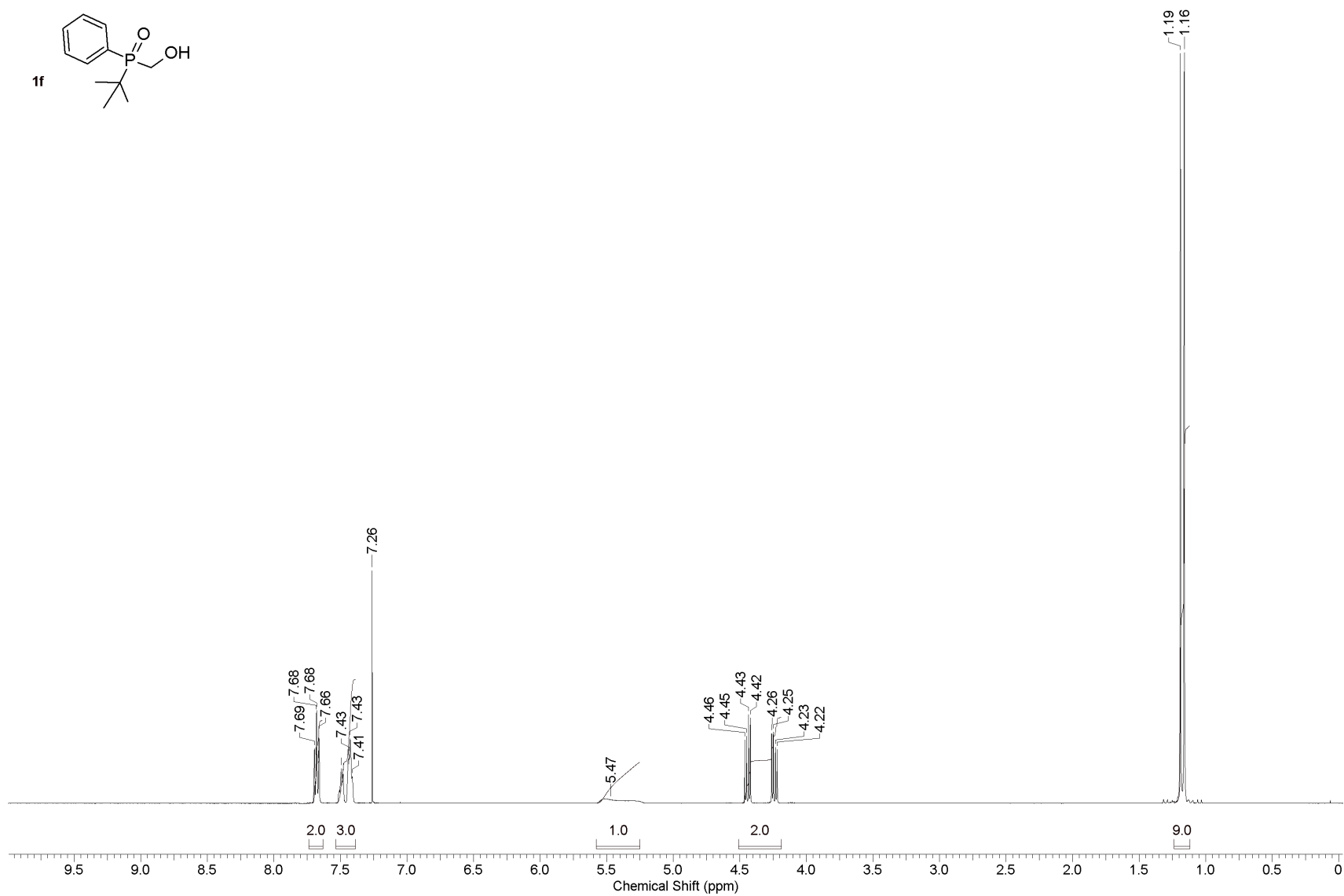
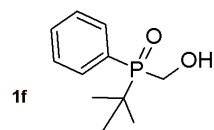
^1H NMR spectrum of di-(3,5-dimethylphenyl)hydroxymethylphosphine oxide (**1e**) (500 MHz, CDCl_3)



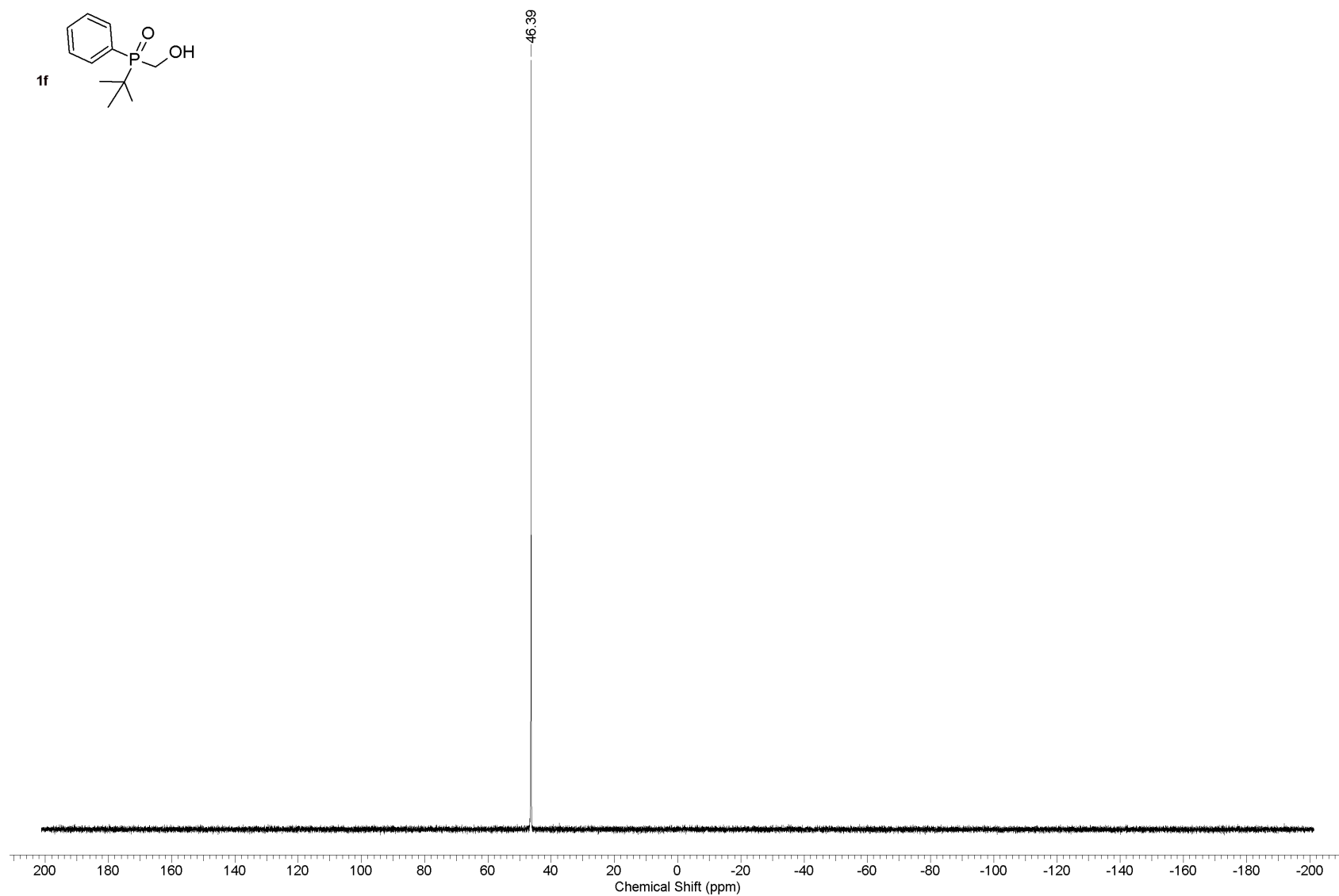
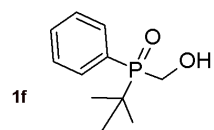
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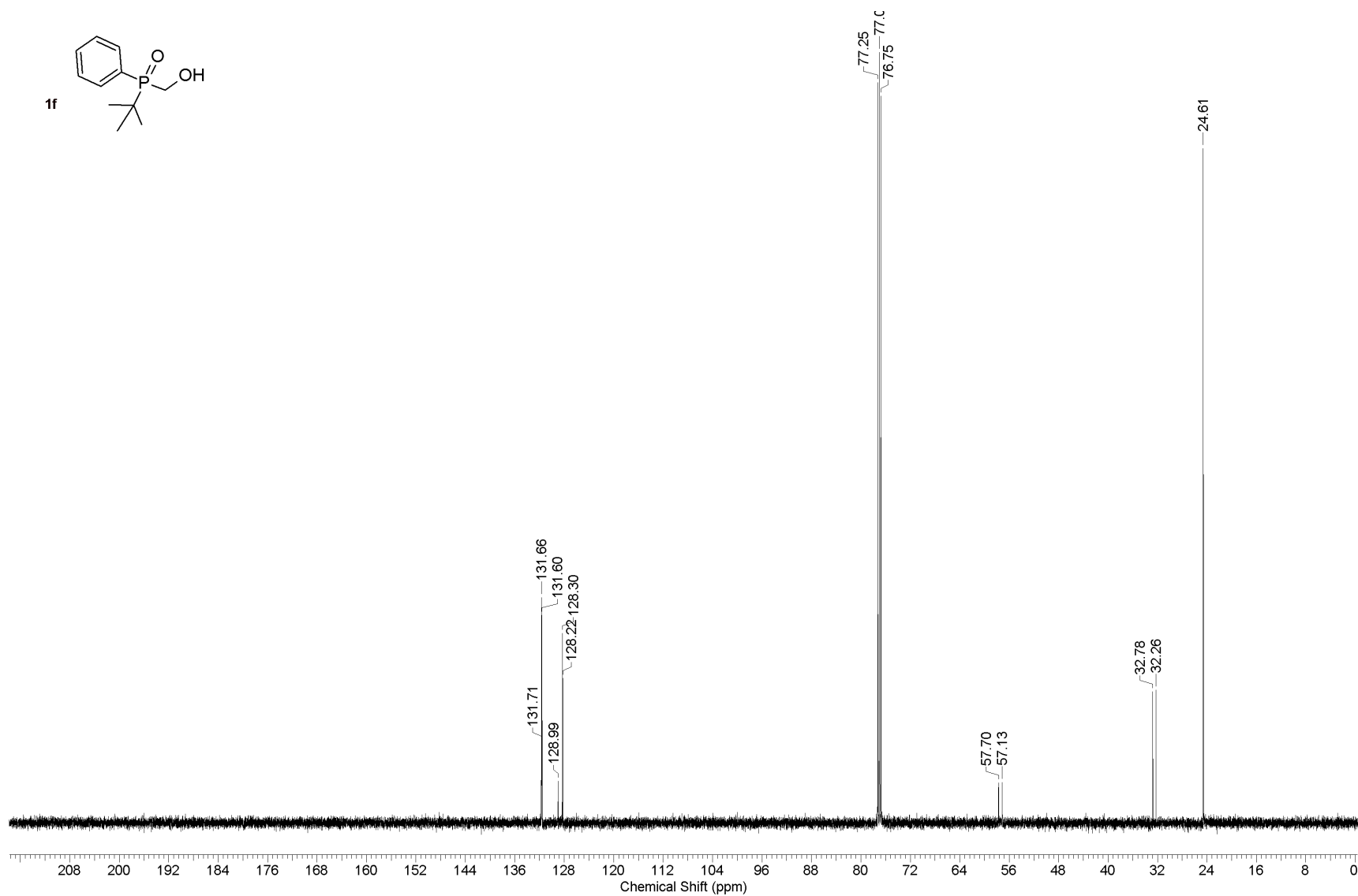
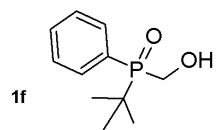
^{13}C NMR spectrum of di-(3,5-dimethylphenyl)hydroxymethylphosphine oxide (**1e**) (125 MHz, CDCl_3)



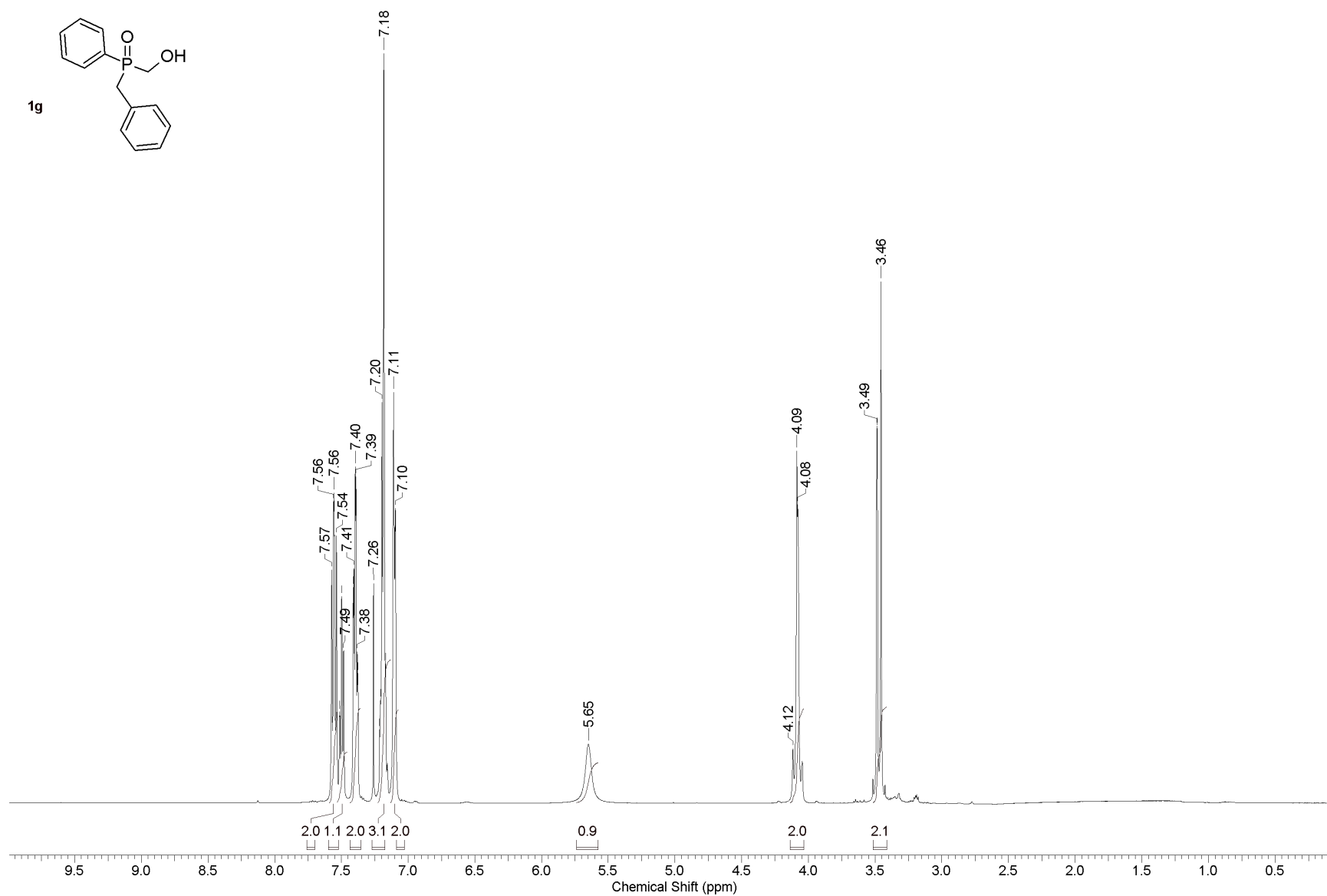
^1H NMR spectrum of *t*-butyl(hydroxymethyl)phenylphosphine oxide (**1f**) (500 MHz, CDCl_3)



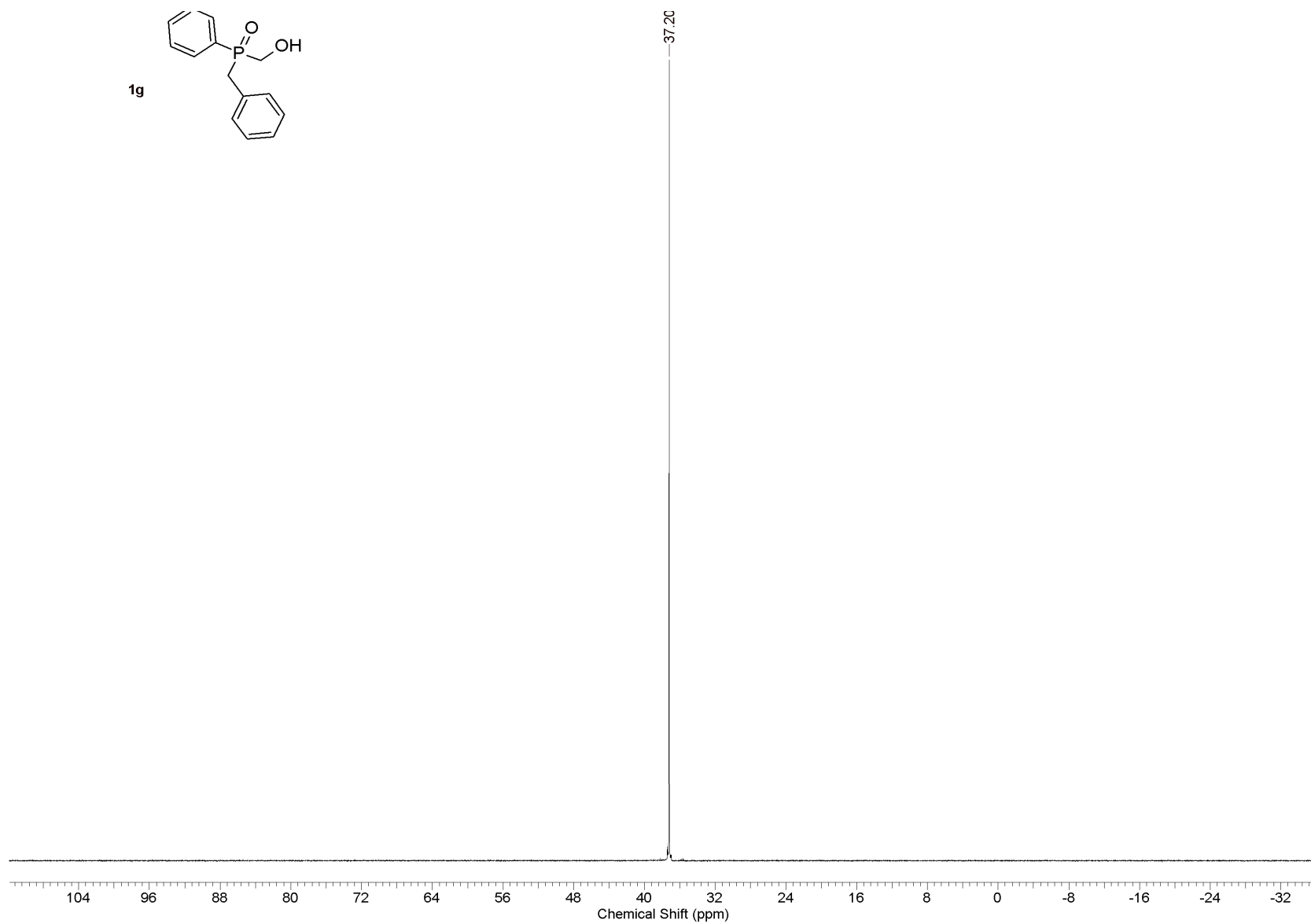
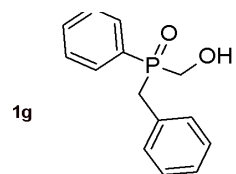
^{31}P NMR spectrum of *t*-butyl(hydroxymethyl)phenylphosphine oxide (**1f**) (202 MHz, CDCl_3)



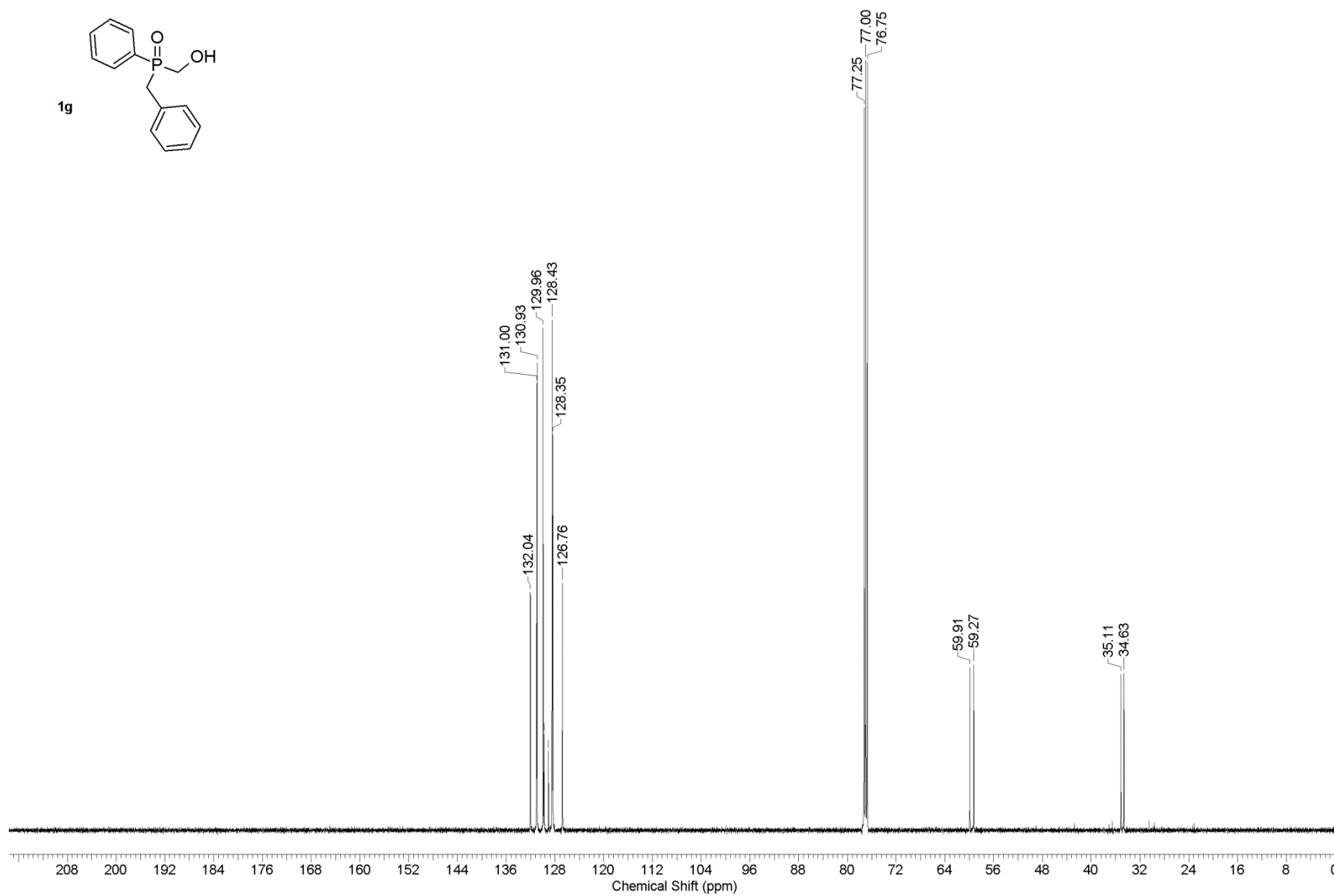
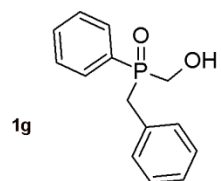
^{13}C NMR spectrum of *t*-butyl(hydroxymethyl)phenylphosphine oxide (**1f**) (125 MHz, CDCl_3)



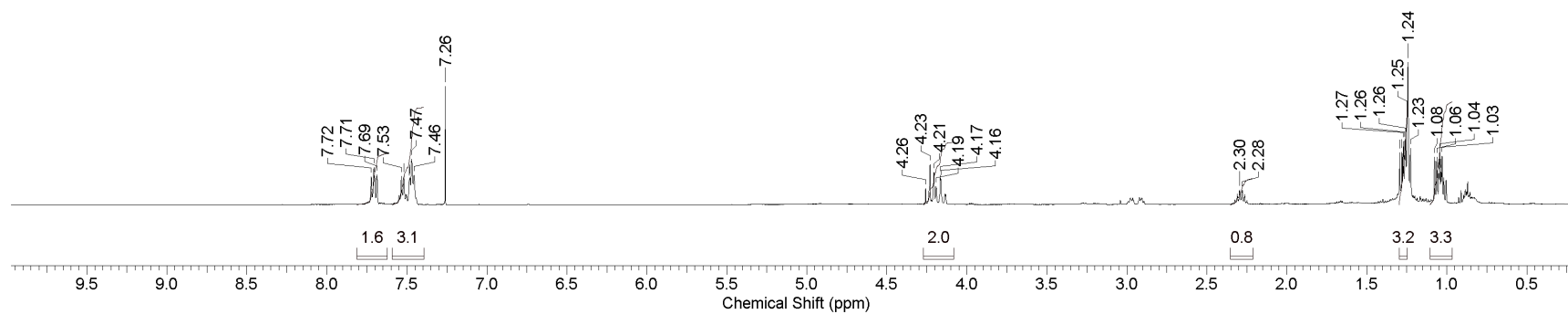
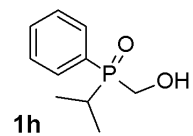
^1H NMR spectrum of benzyl(hydroxymethyl)phenylphosphine oxide (**1g**) (500 MHz, CDCl_3)



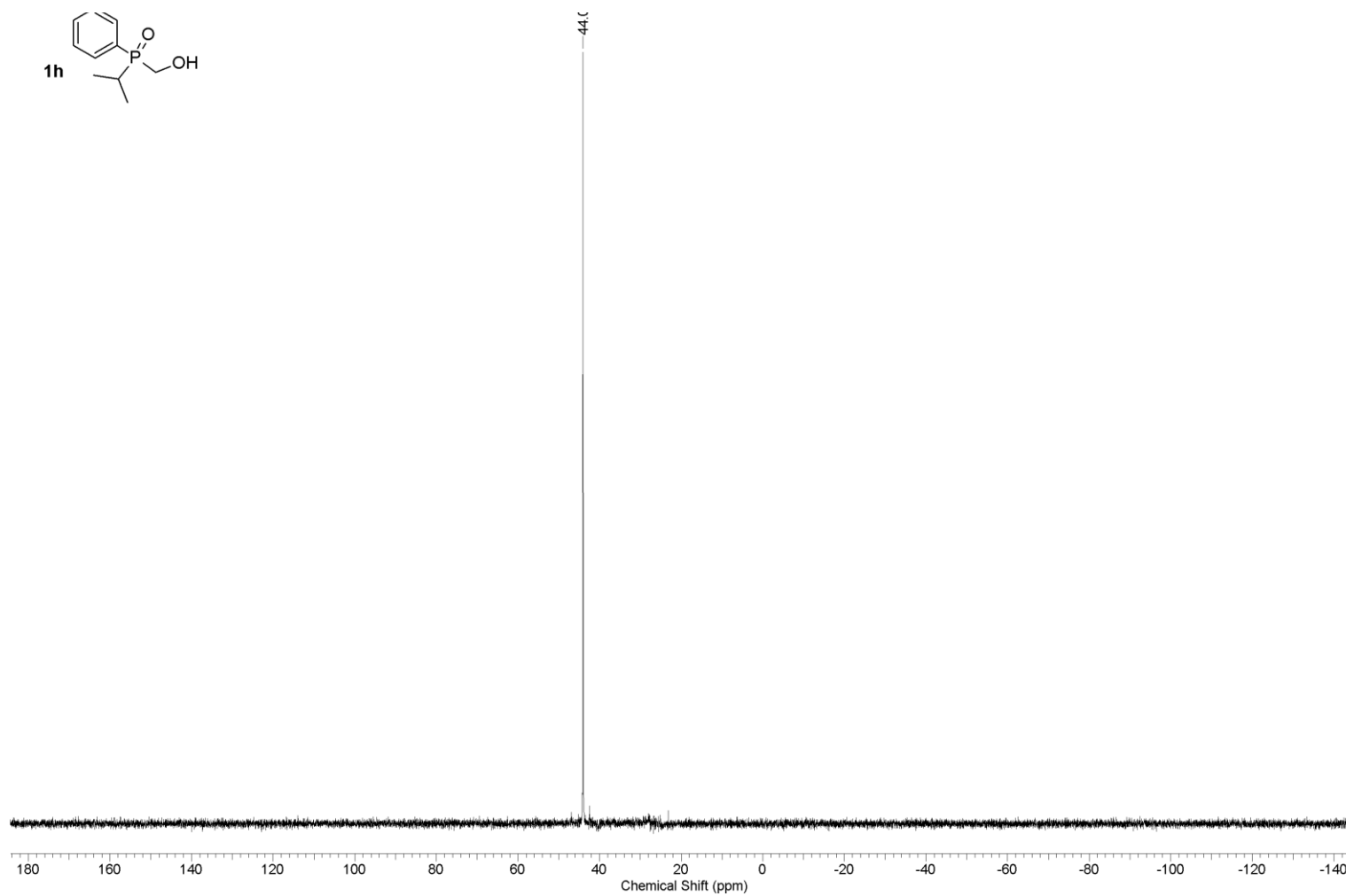
^{31}P NMR spectrum of benzyl(hydroxymethyl)phenylphosphine oxide (**1g**) (202 MHz, CDCl_3)



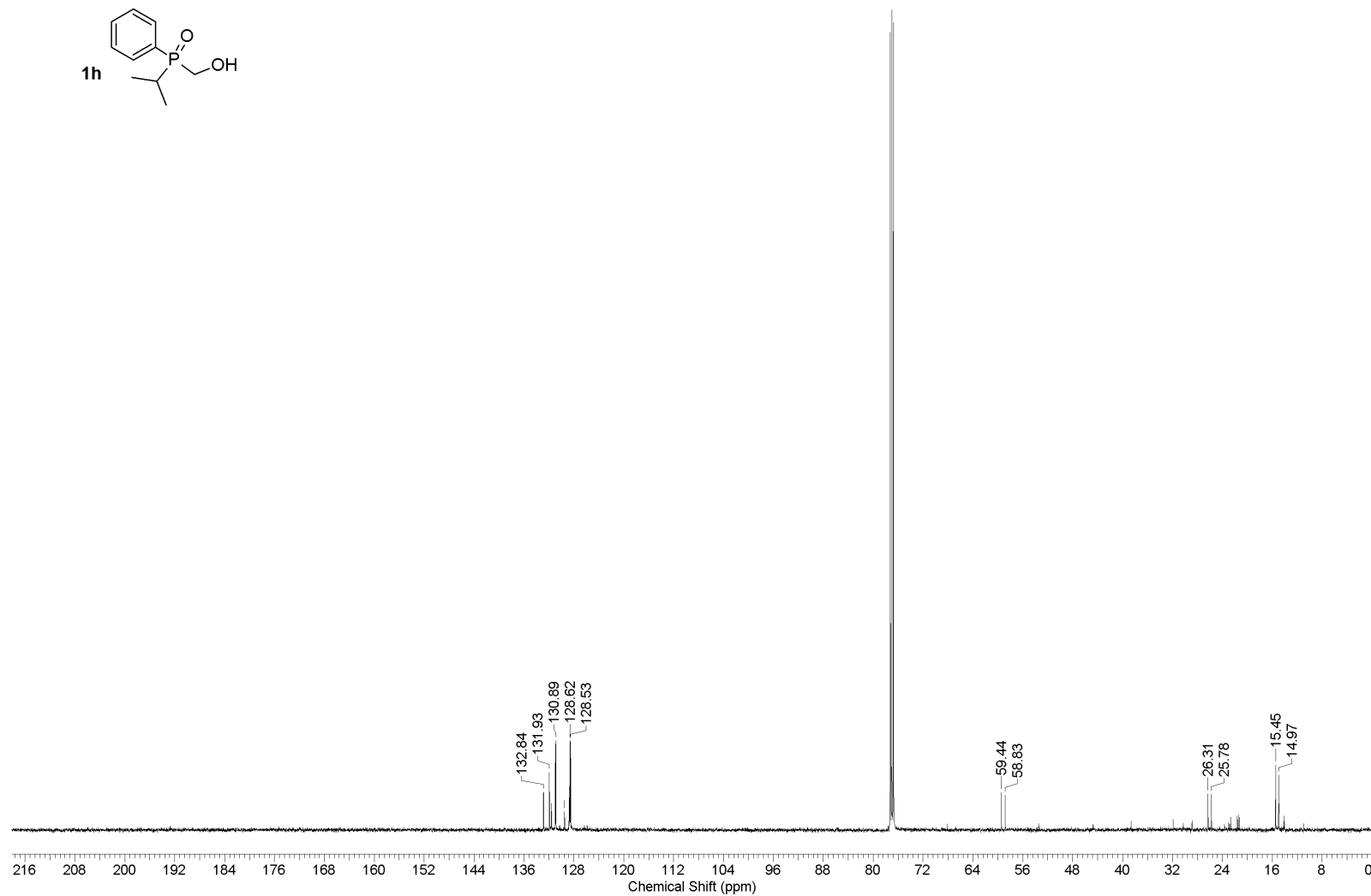
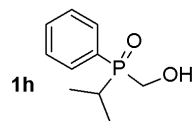
^{13}C NMR spectrum of benzyl(hydroxymethyl)phenylphosphine oxide (**1g**) (125 MHz, CDCl_3)



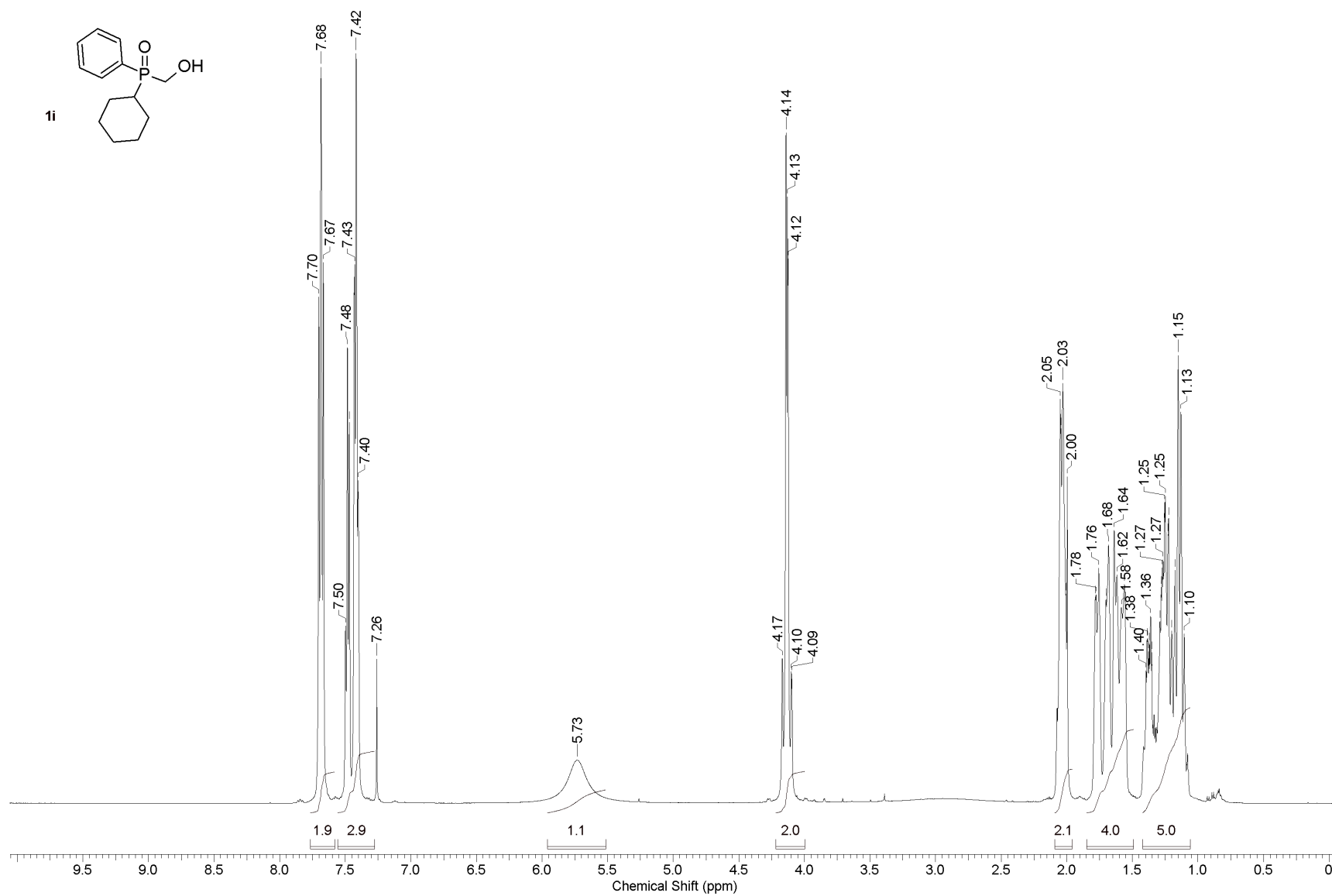
^1H NMR spectrum of (hydroxymethyl)phenyl(*i*-propyl)phosphine oxide (**1h**) (500 MHz, CDCl_3)



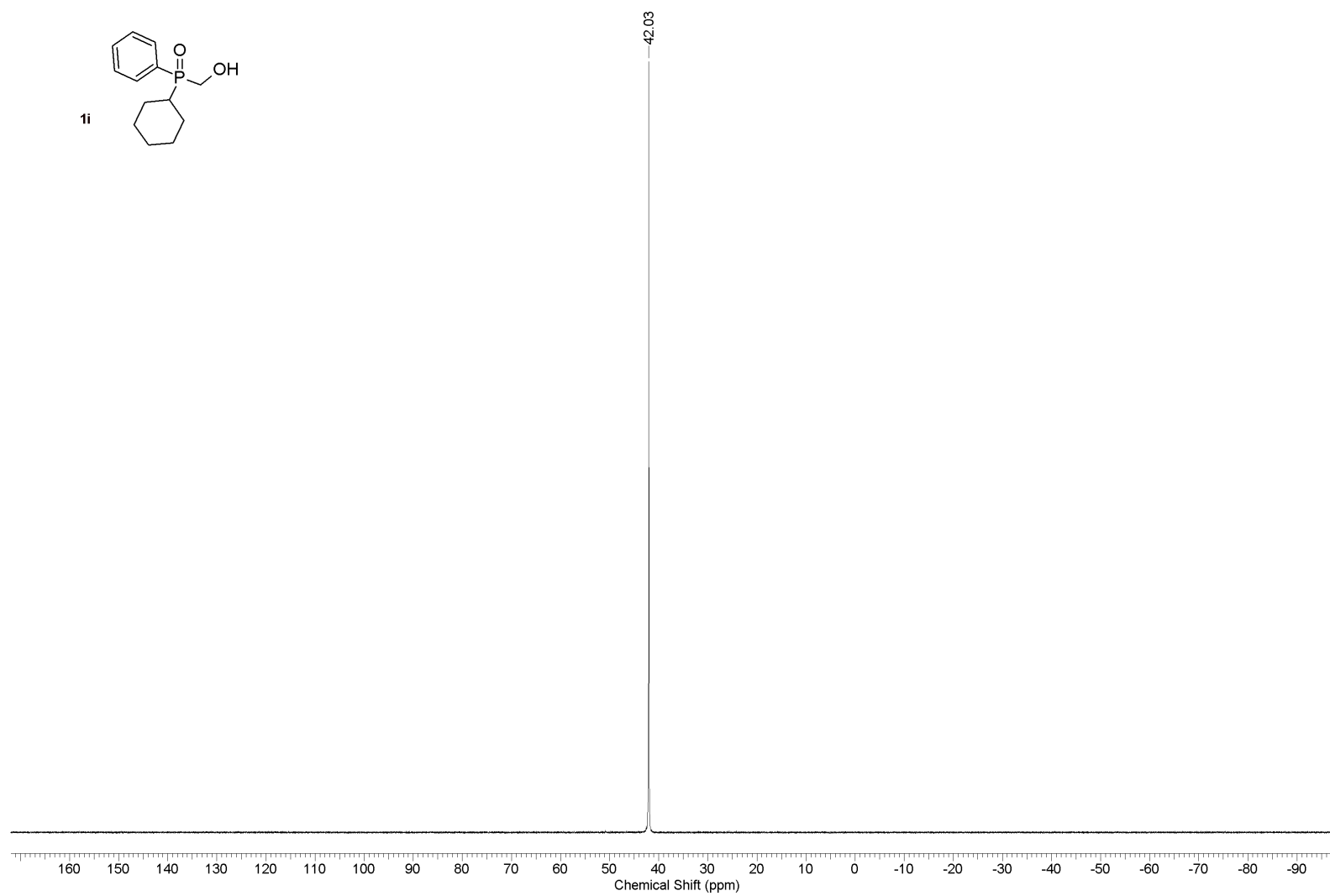
^{31}P NMR spectrum of (hydroxymethyl)phenyl(*i*-propyl)phosphine oxide (**1h**) (202 MHz, CDCl_3)



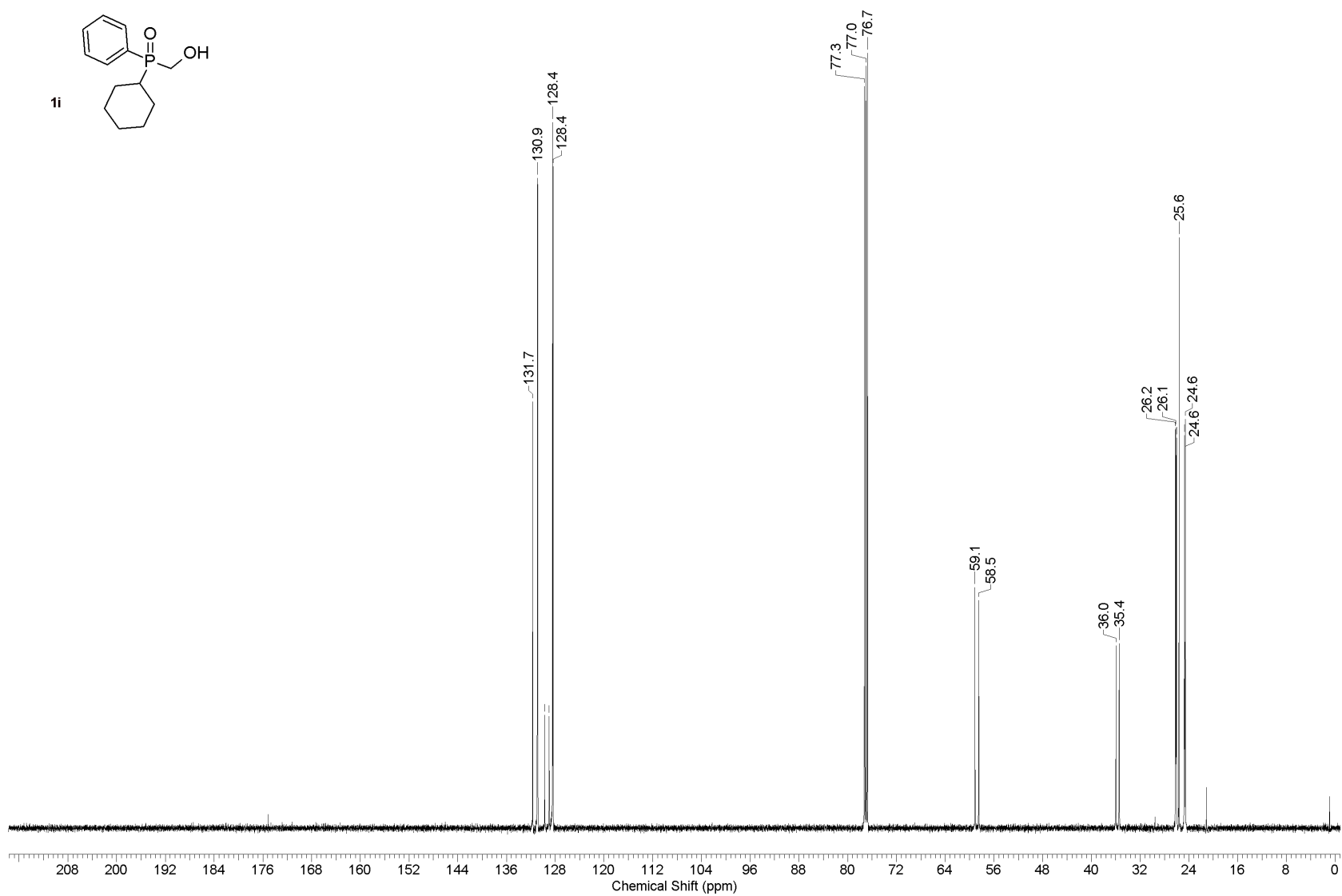
^{13}C NMR spectrum of (hydroxymethyl)phenyl(*i*-propyl)phosphine oxide (**1h**) (125 MHz, CDCl_3)



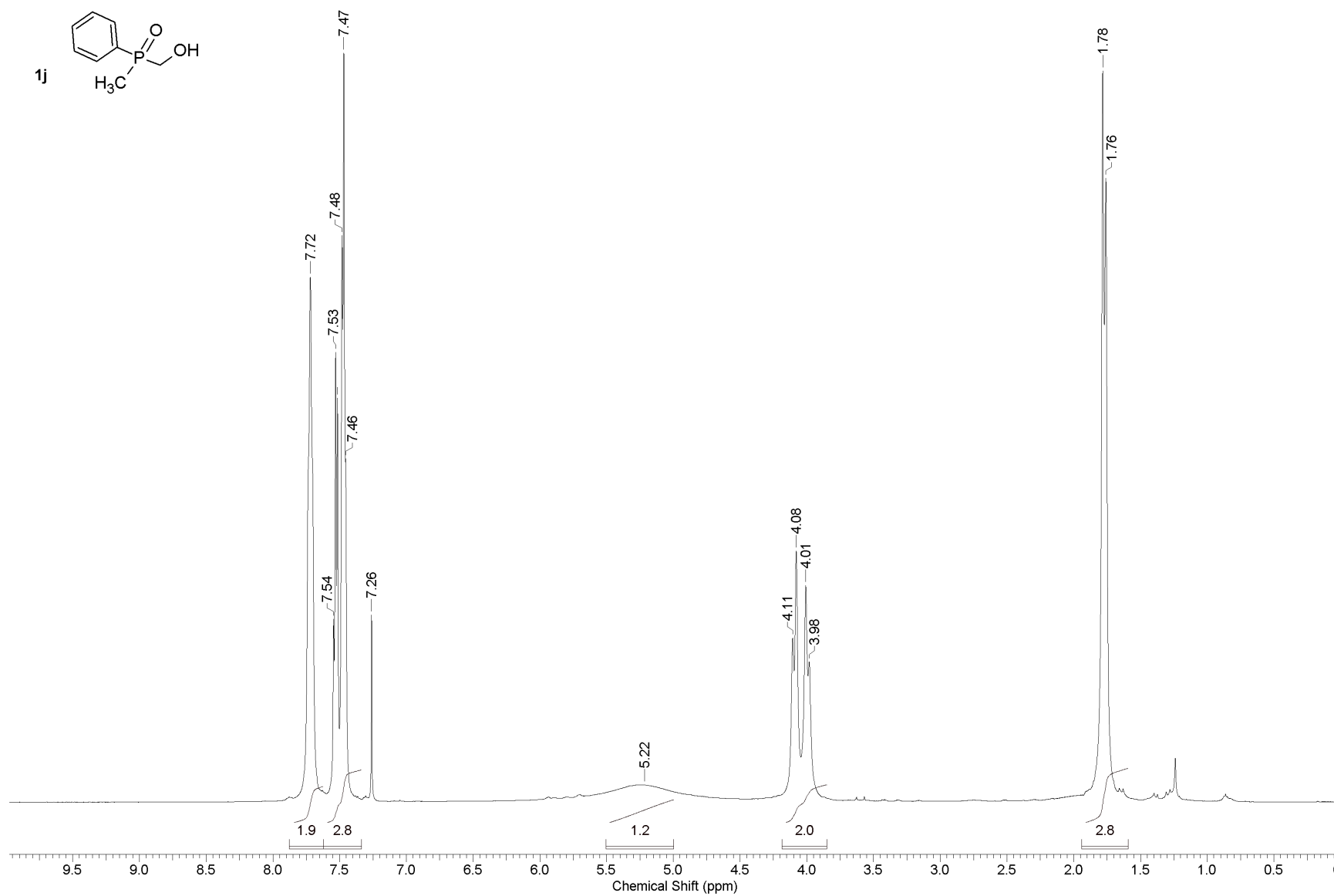
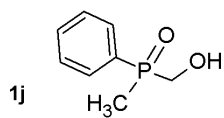
^1H NMR spectrum of cyclohexyl(hydroxymethyl)phenylphosphine oxide (**1i**) (500 MHz, CDCl_3)



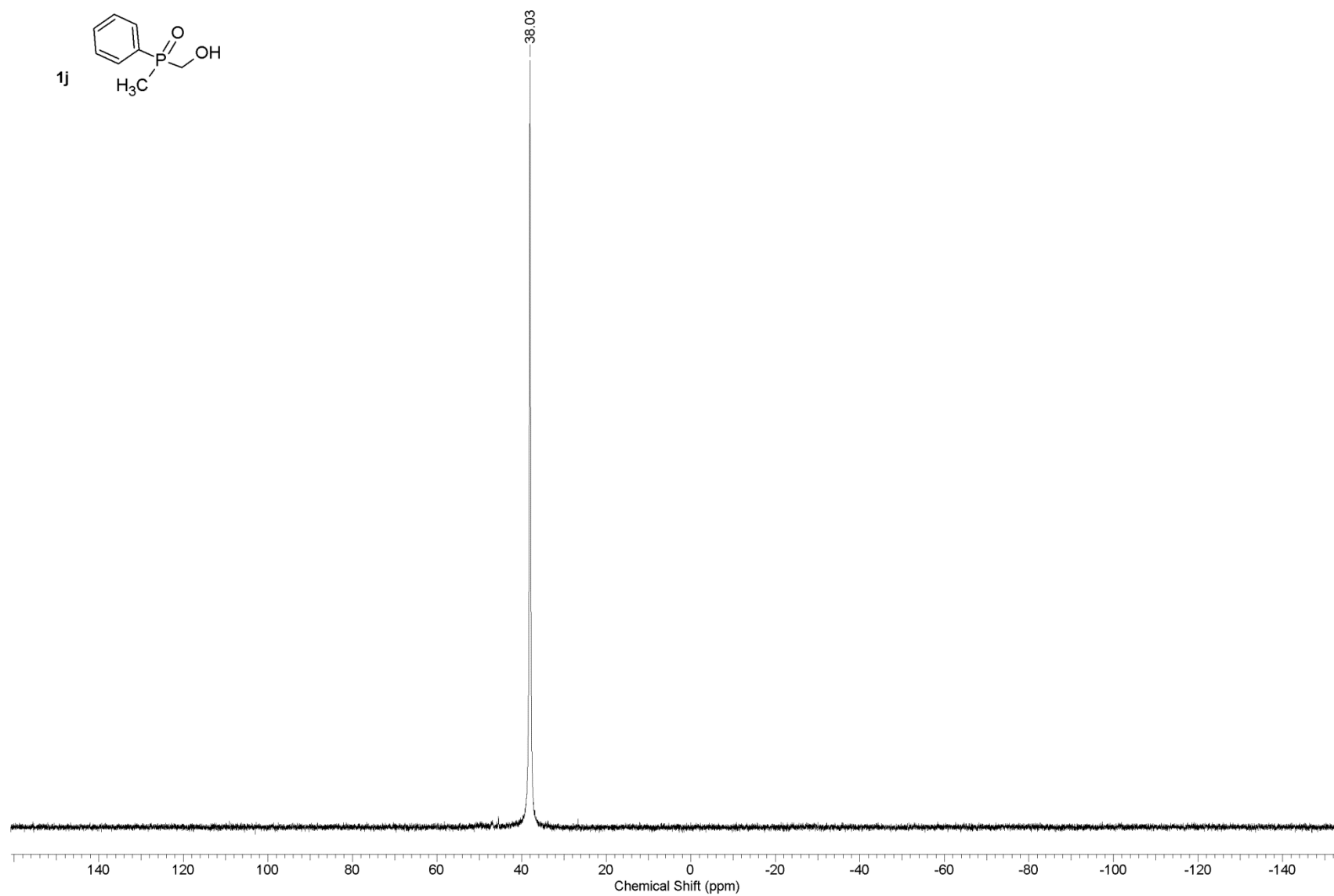
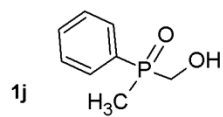
^{31}P NMR spectrum of cyclohexyl(hydroxymethyl)phenylphosphine oxide (**1i**) (202 MHz, CDCl_3)



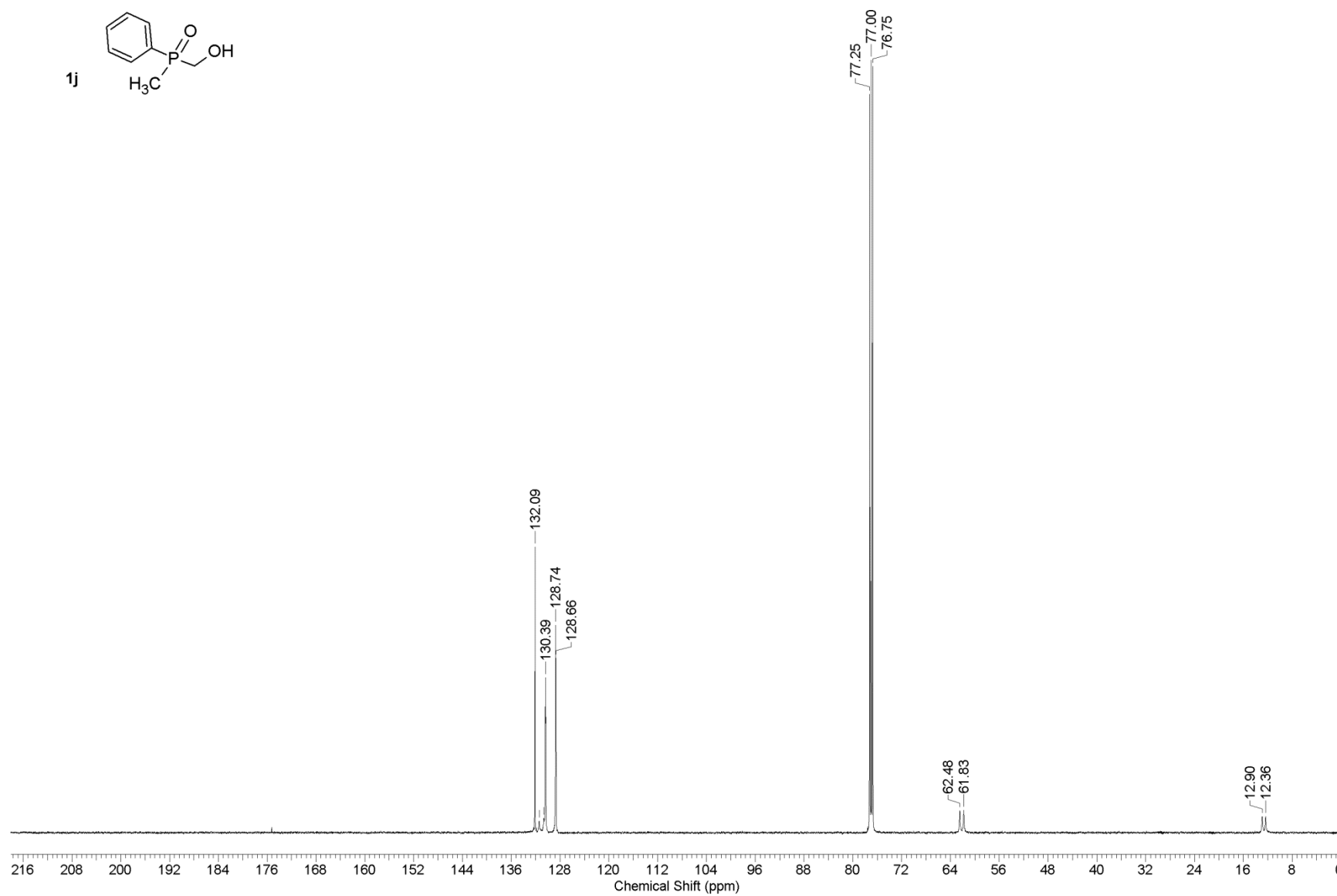
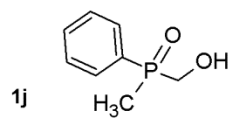
¹³C NMR spectrum of cyclohexyl(hydroxymethyl)phenylphosphine oxide (**1i**) (125 MHz, CDCl₃)



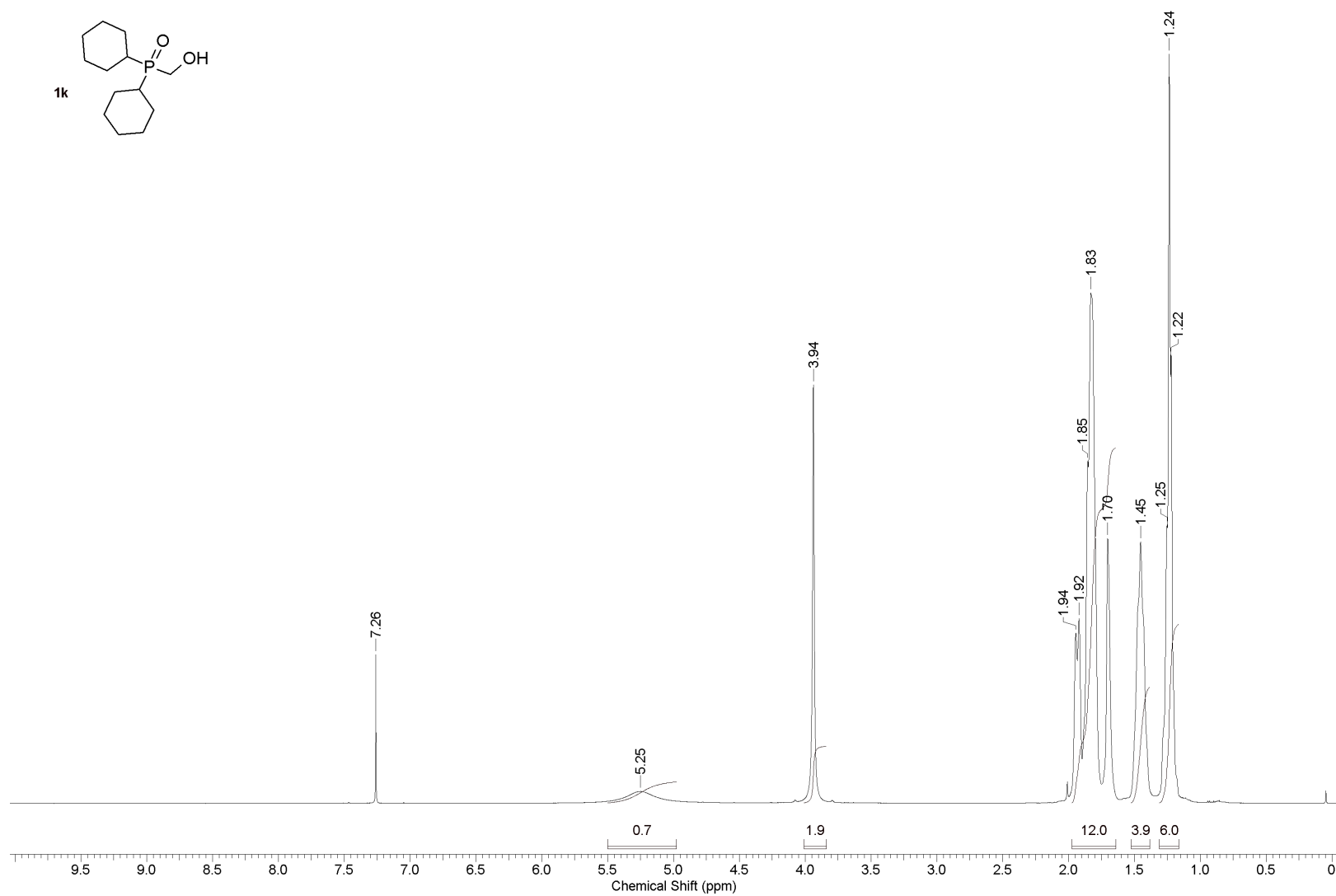
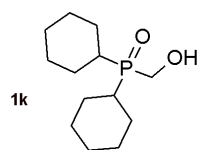
¹H NMR spectrum of hydroxymethyl(methyl)phenylphosphine oxide (**1j**) (500 MHz, CDCl₃)



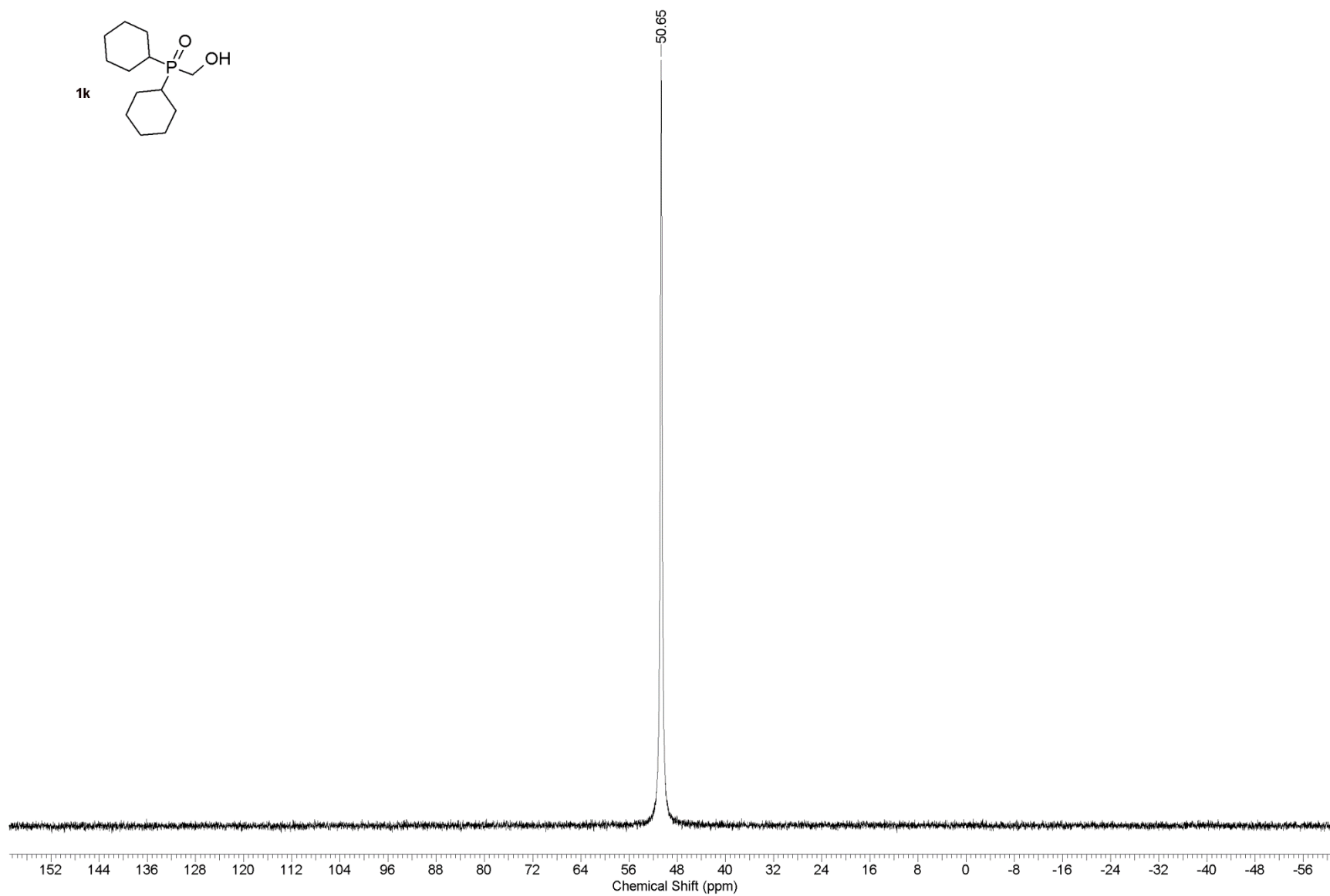
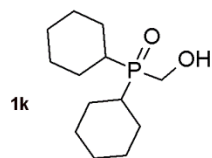
^{31}P NMR spectrum of hydroxymethyl(methyl)phenylphosphine oxide (**1j**) (202 MHz, CDCl_3)



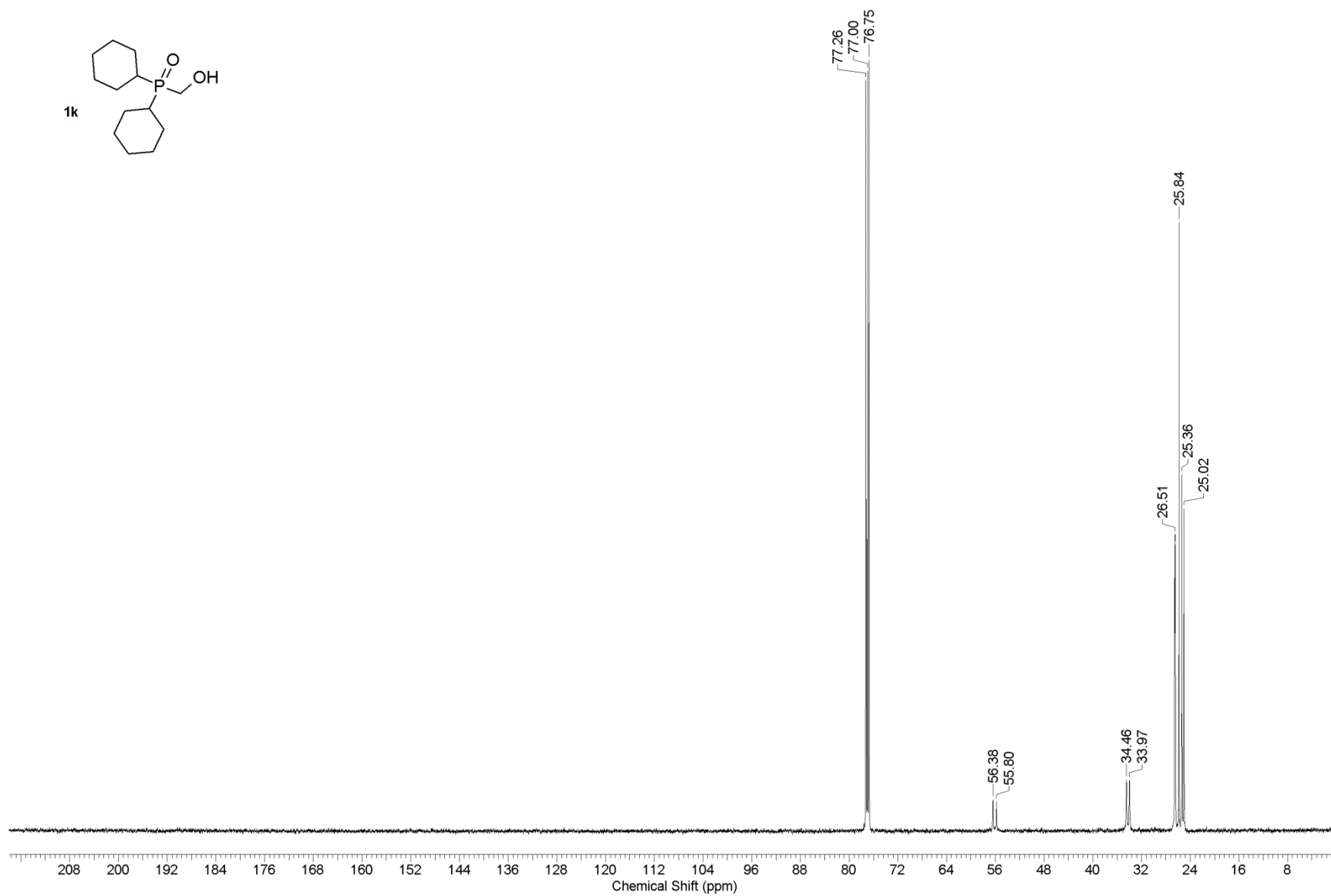
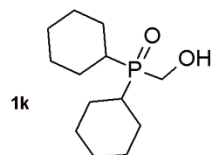
^{13}C NMR spectrum of hydroxymethyl(methyl)phenylphosphine oxide (**1j**) (125 MHz, CDCl_3)



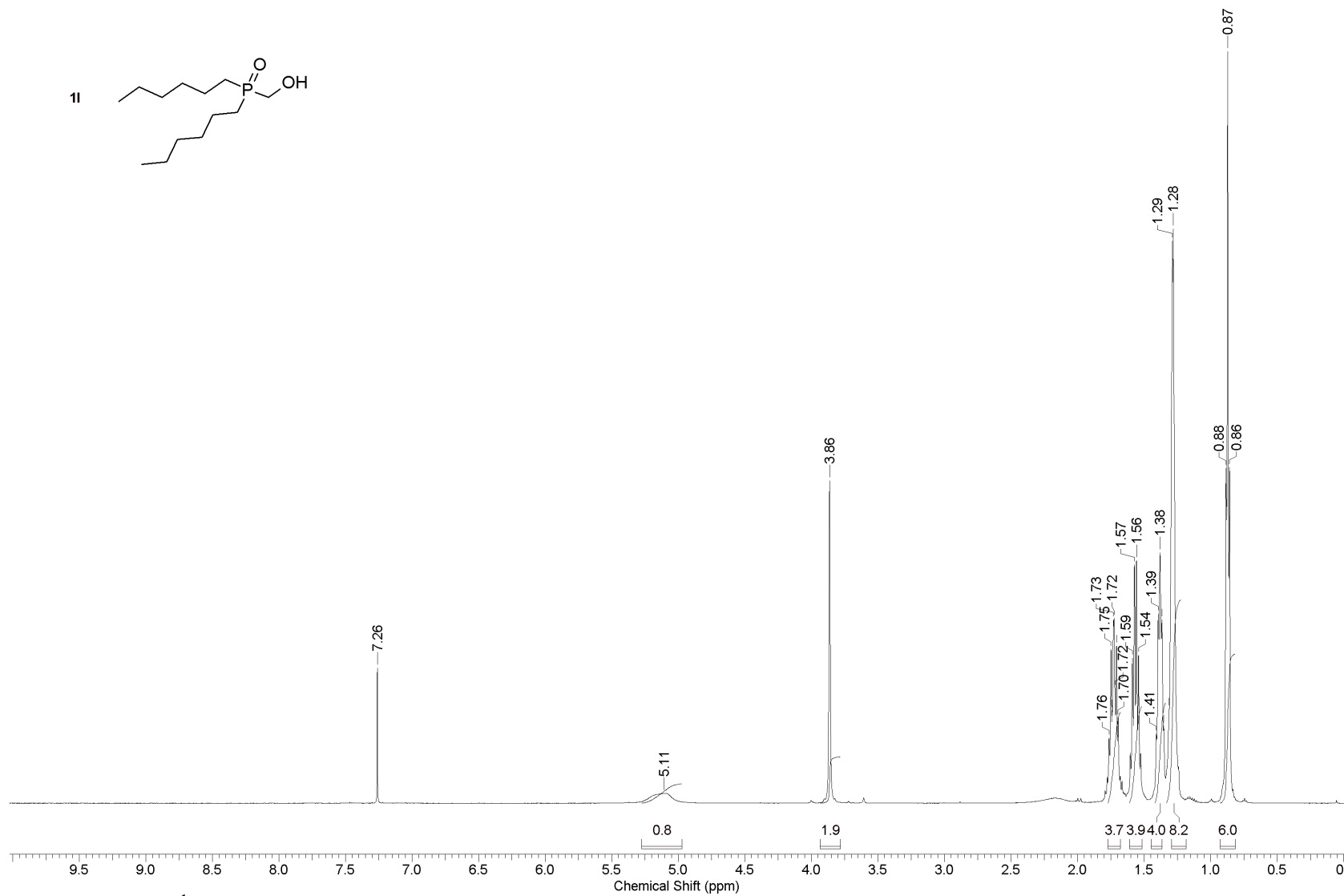
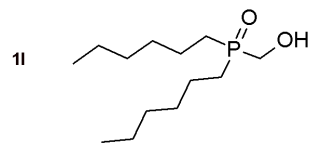
^1H NMR spectrum of dicyclohexyl(hydroxymethyl)phosphine oxide (**1k**) (500 MHz, CDCl_3)



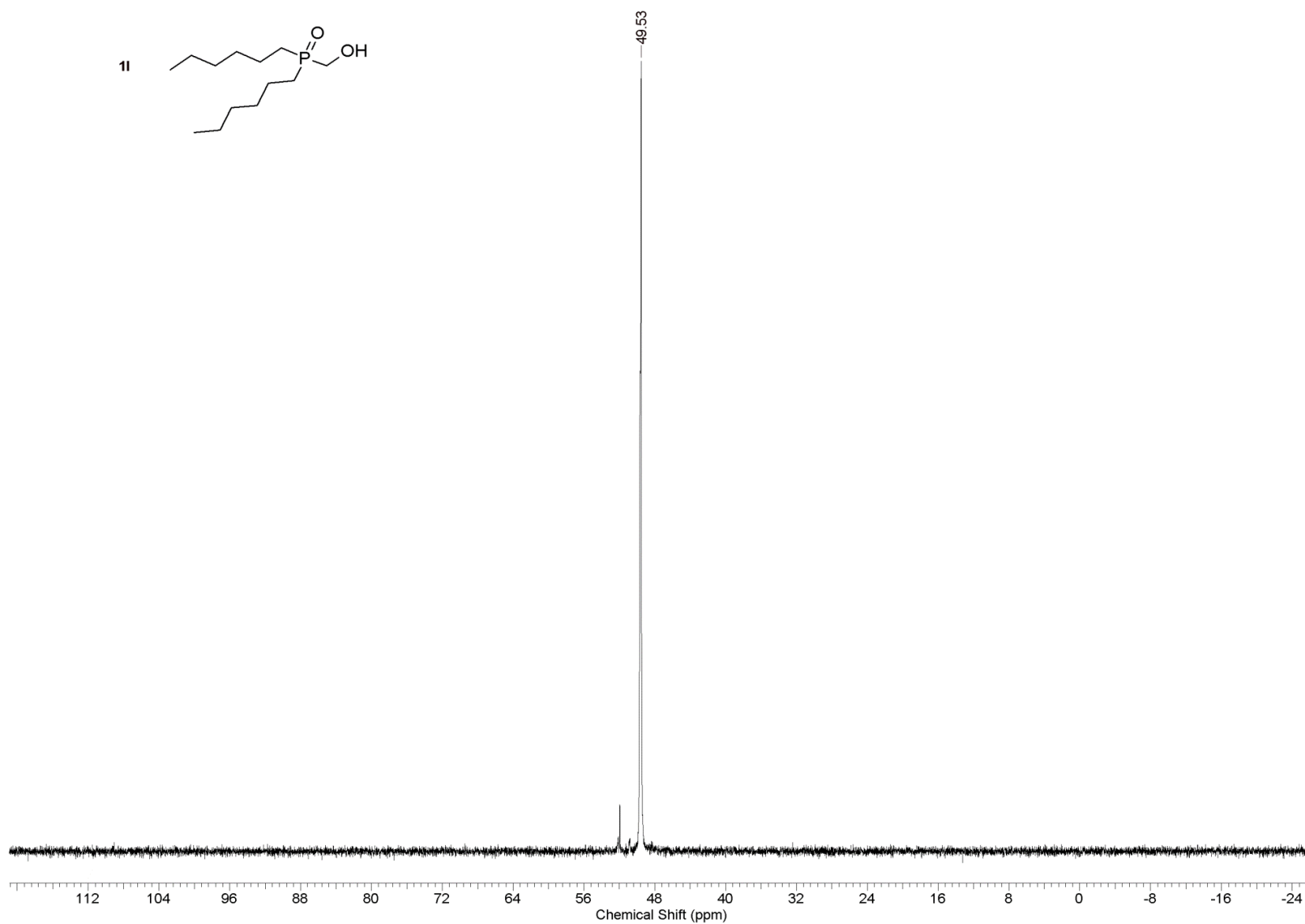
^{31}P NMR spectrum of dicyclohexyl(hydroxymethyl)phosphine oxide (**1k**) (202 MHz, CDCl_3)



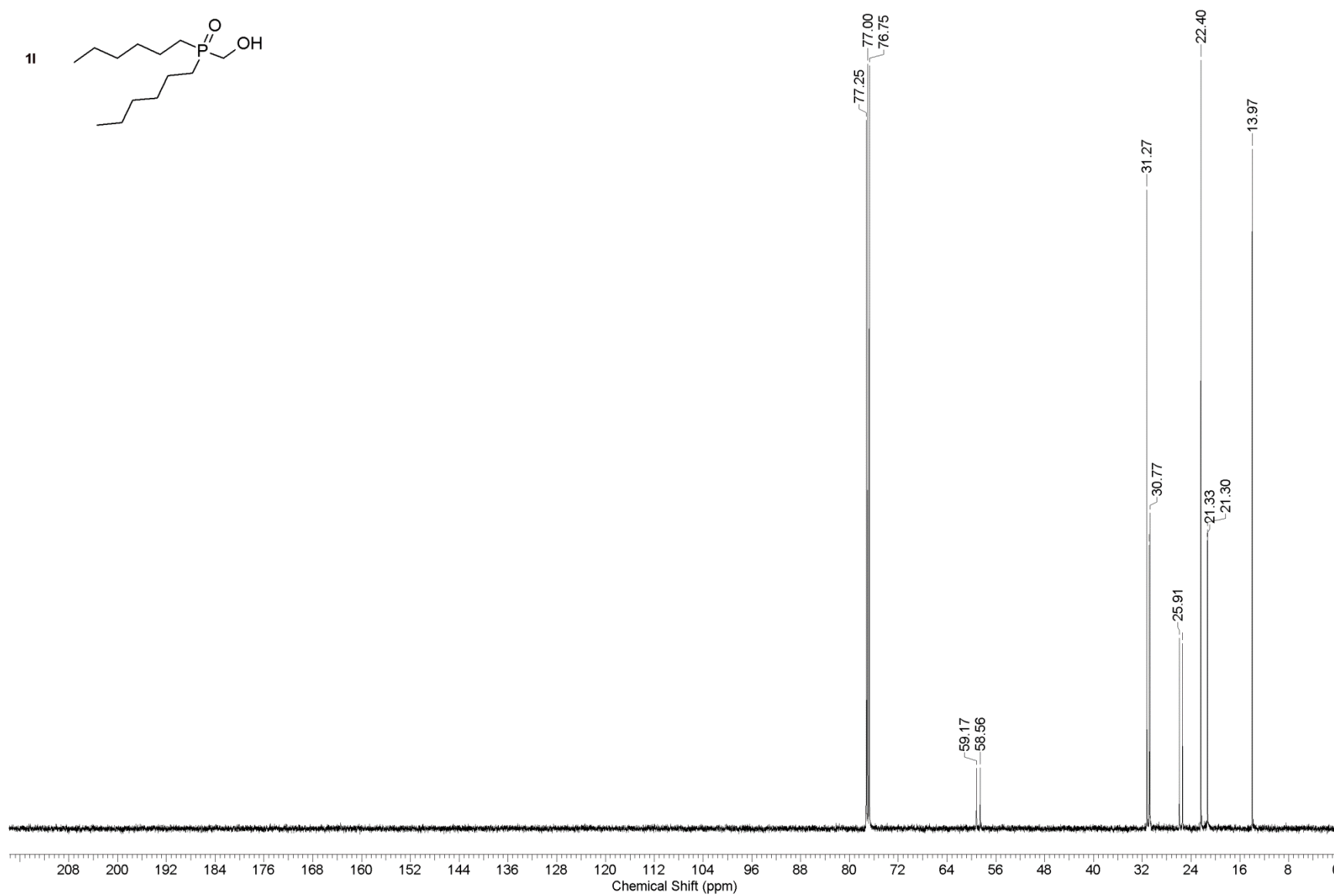
^{13}C NMR spectrum of dicyclohexyl(hydroxymethyl)phosphine oxide (**1k**) (125 MHz, CDCl_3)



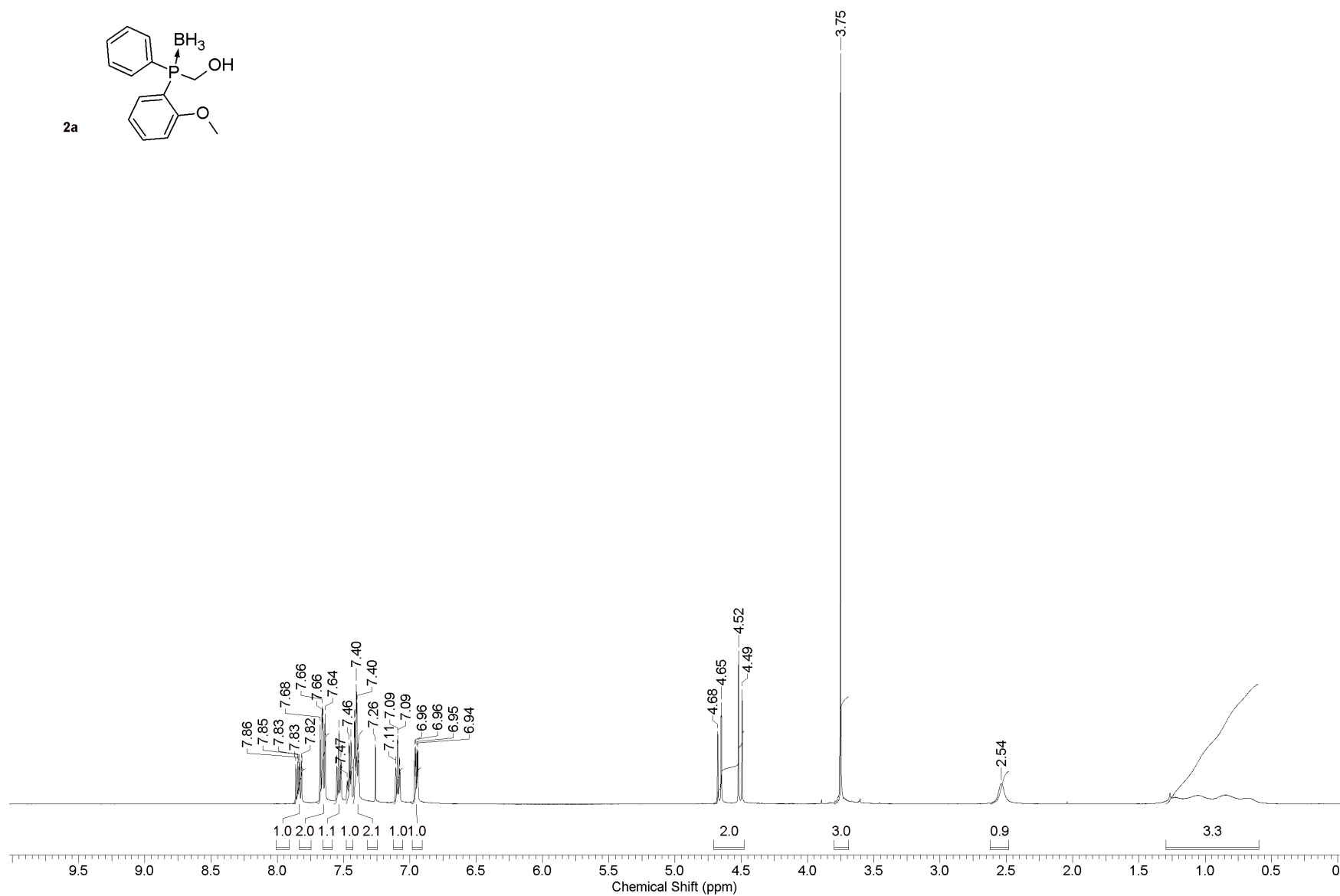
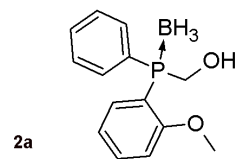
^1H NMR spectrum of di-*n*-hexyl(hydroxymethyl)phosphine oxide (**11**) (500 MHz, CDCl_3)



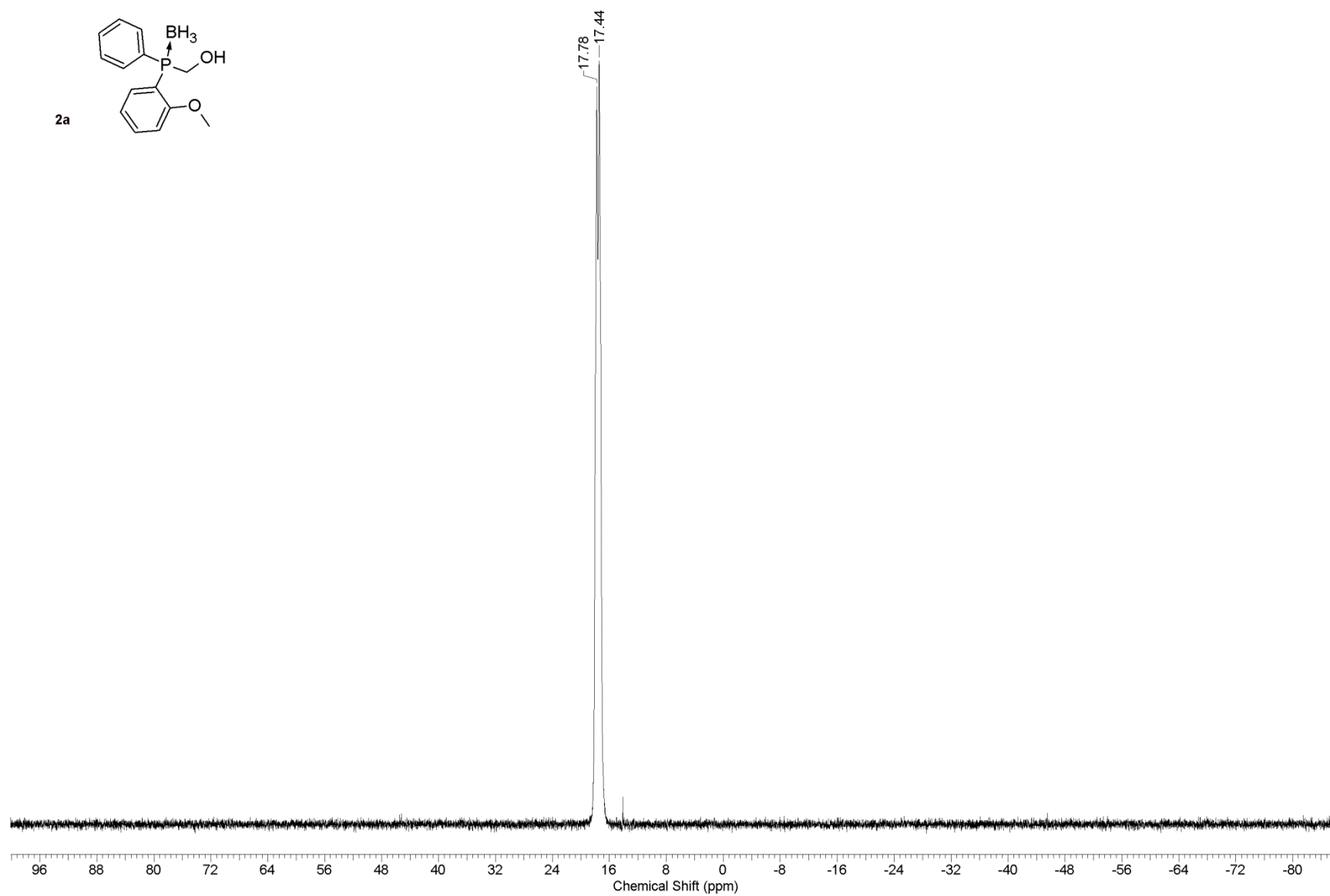
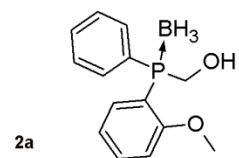
^{31}P NMR spectrum of di-*n*-hexyl(hydroxymethyl)phosphine oxide (**11**) (202 MHz, CDCl_3)



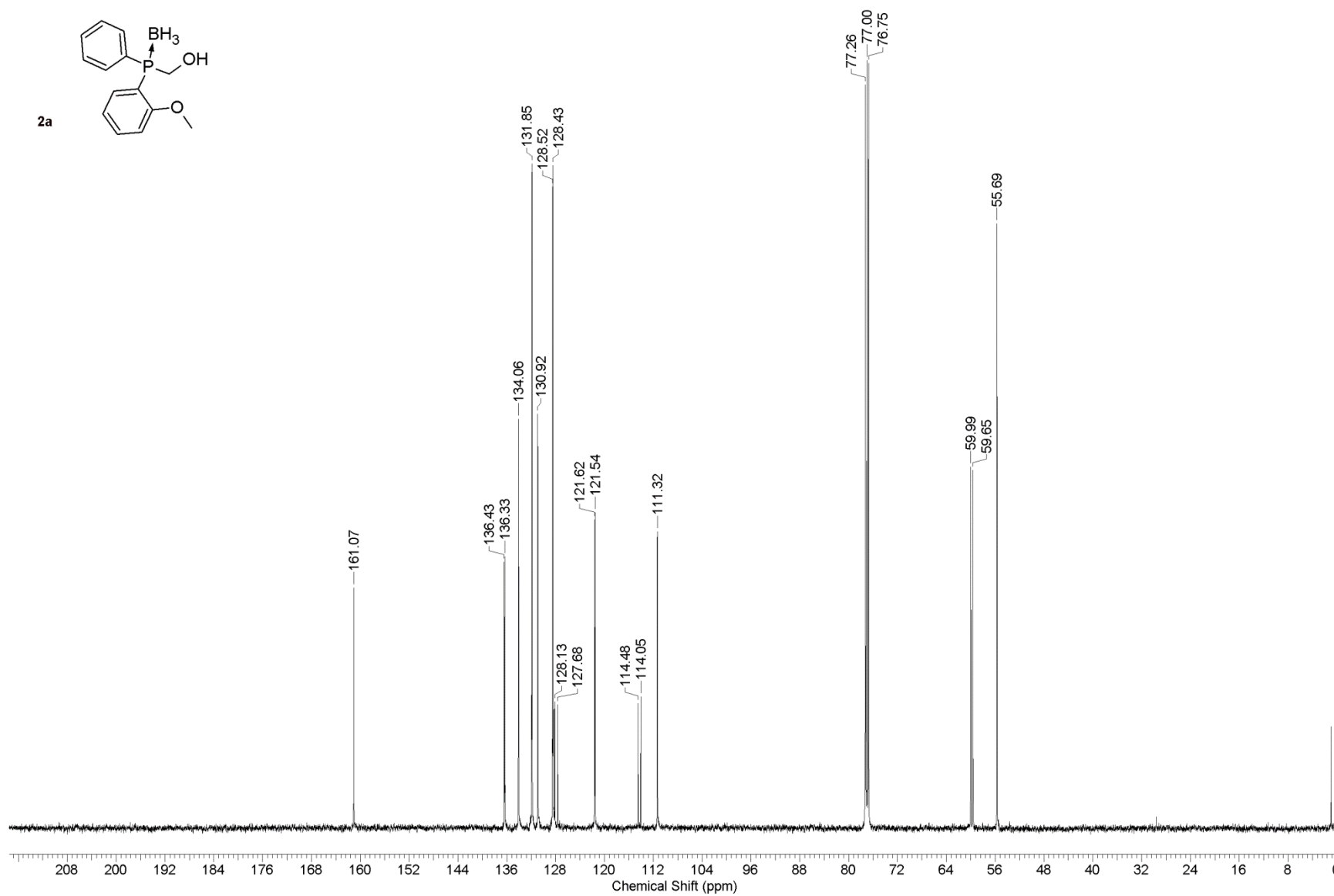
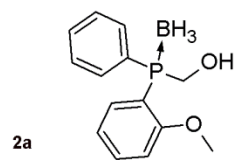
^{13}C NMR spectrum of di-*n*-hexyl(hydroxymethyl)phosphine oxide (**11**) (125 MHz, CDCl_3)



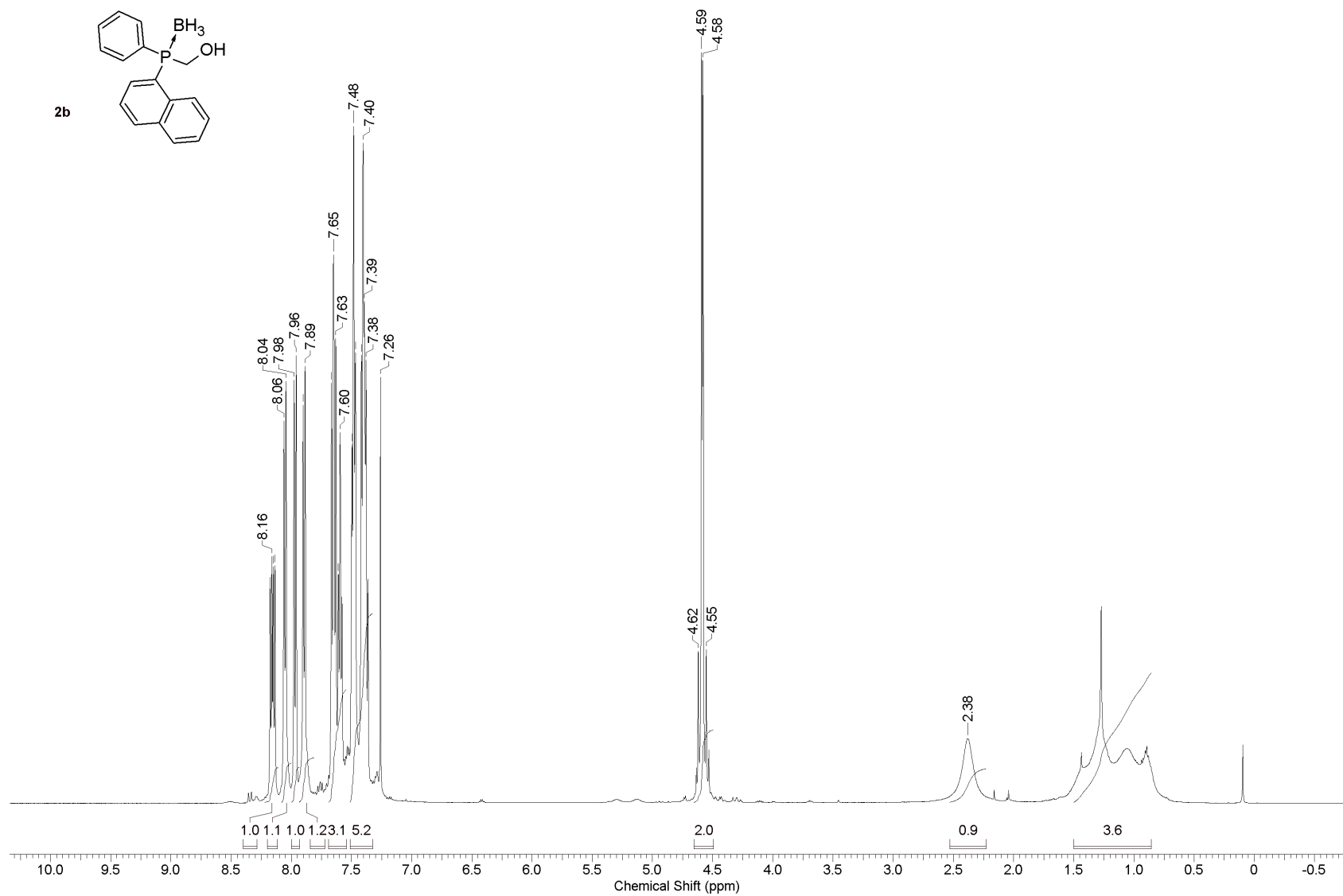
^1H NMR spectrum of *o*-anisyl(hydroxymethyl)phenylphosphine-borane (**2a**) (500 MHz, CDCl_3)



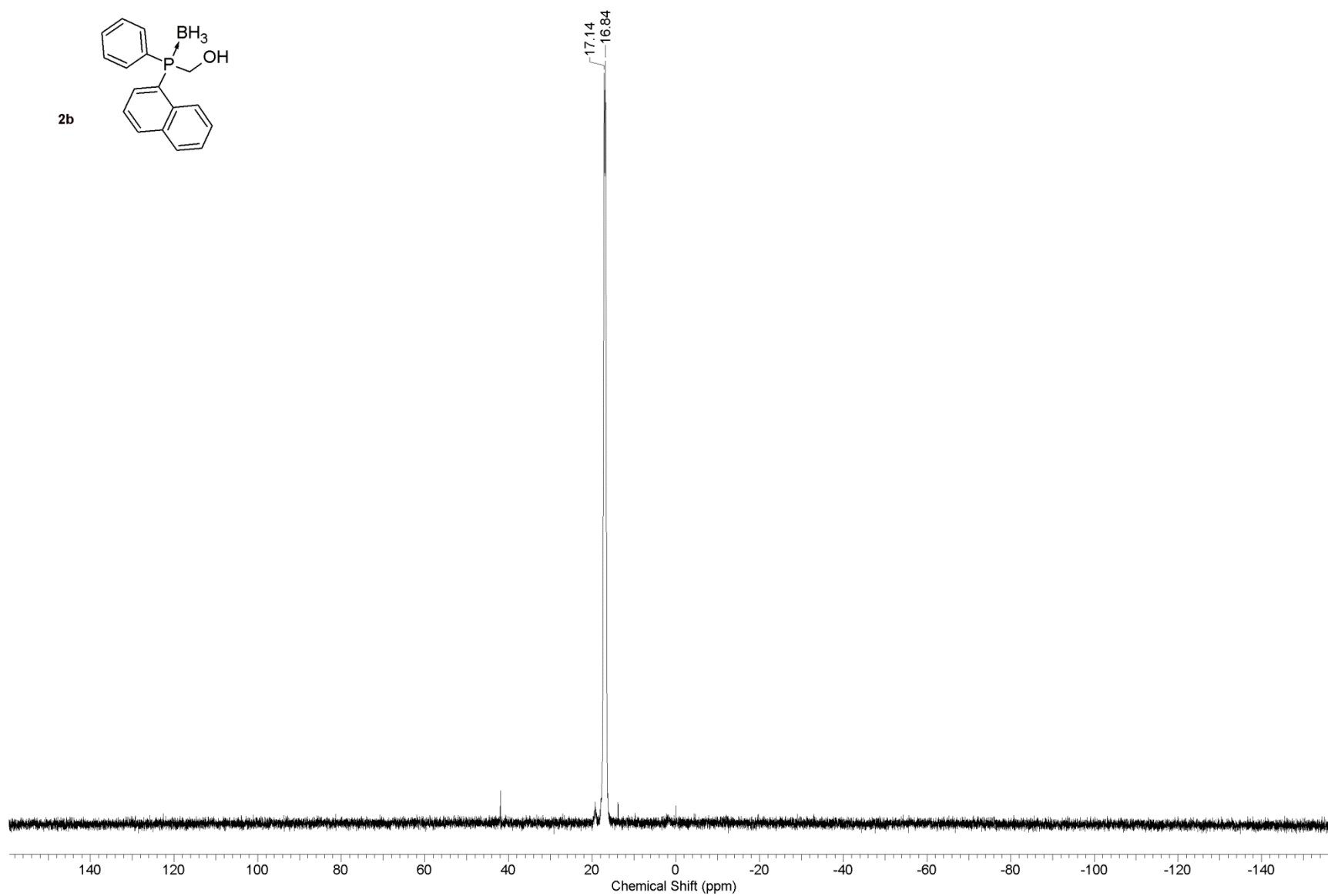
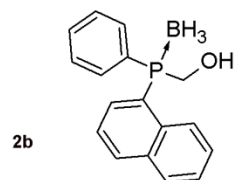
^{31}P NMR spectrum of *o*-anisyl(hydroxymethyl)phenylphosphine-borane (**2a**) (202 MHz, CDCl_3)



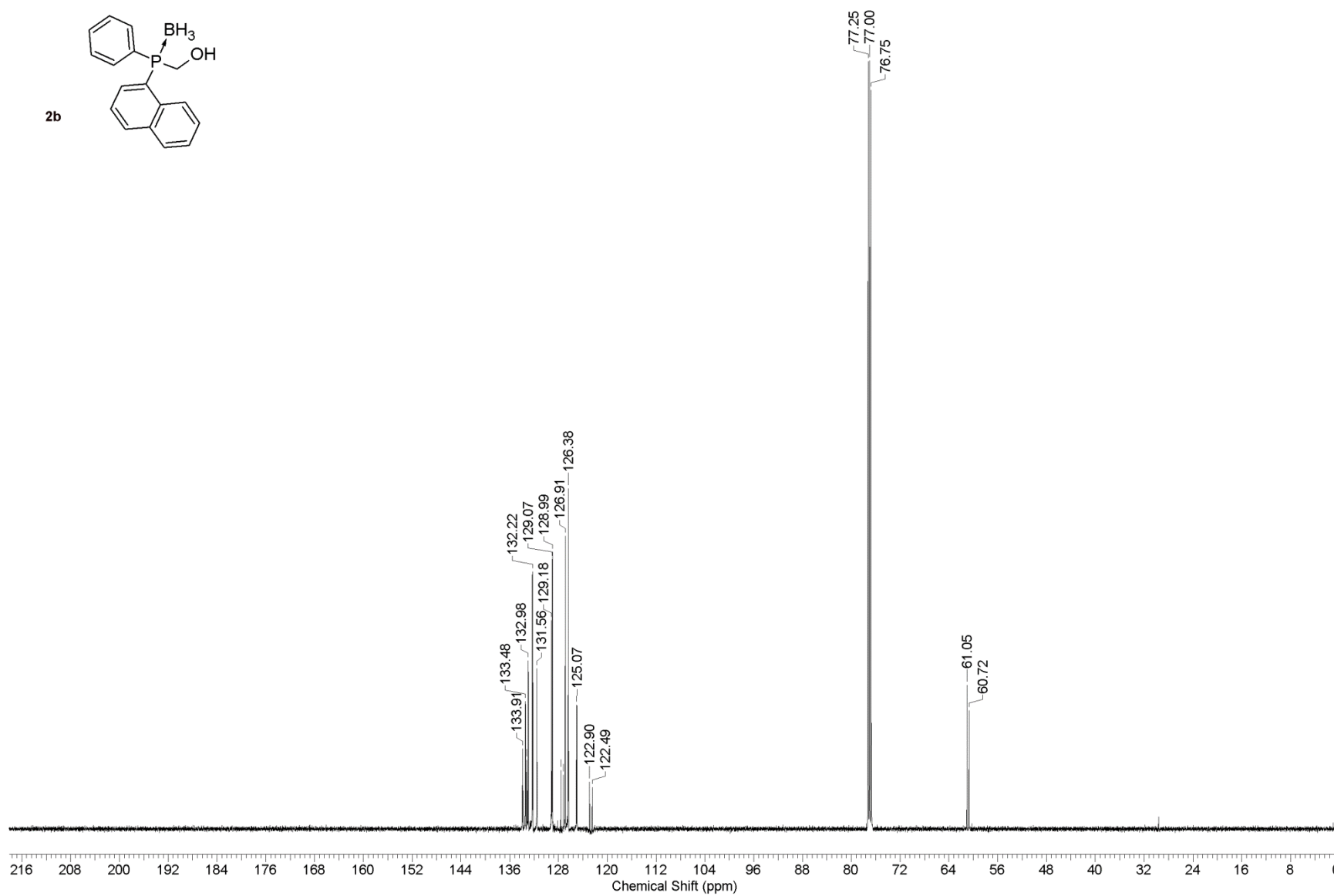
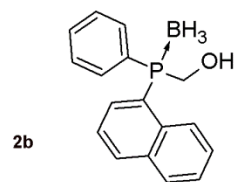
^{13}C NMR spectrum of *o*-anisyl(hydroxymethyl)phenylphosphine-borane (**2a**) (125 MHz, CDCl_3)



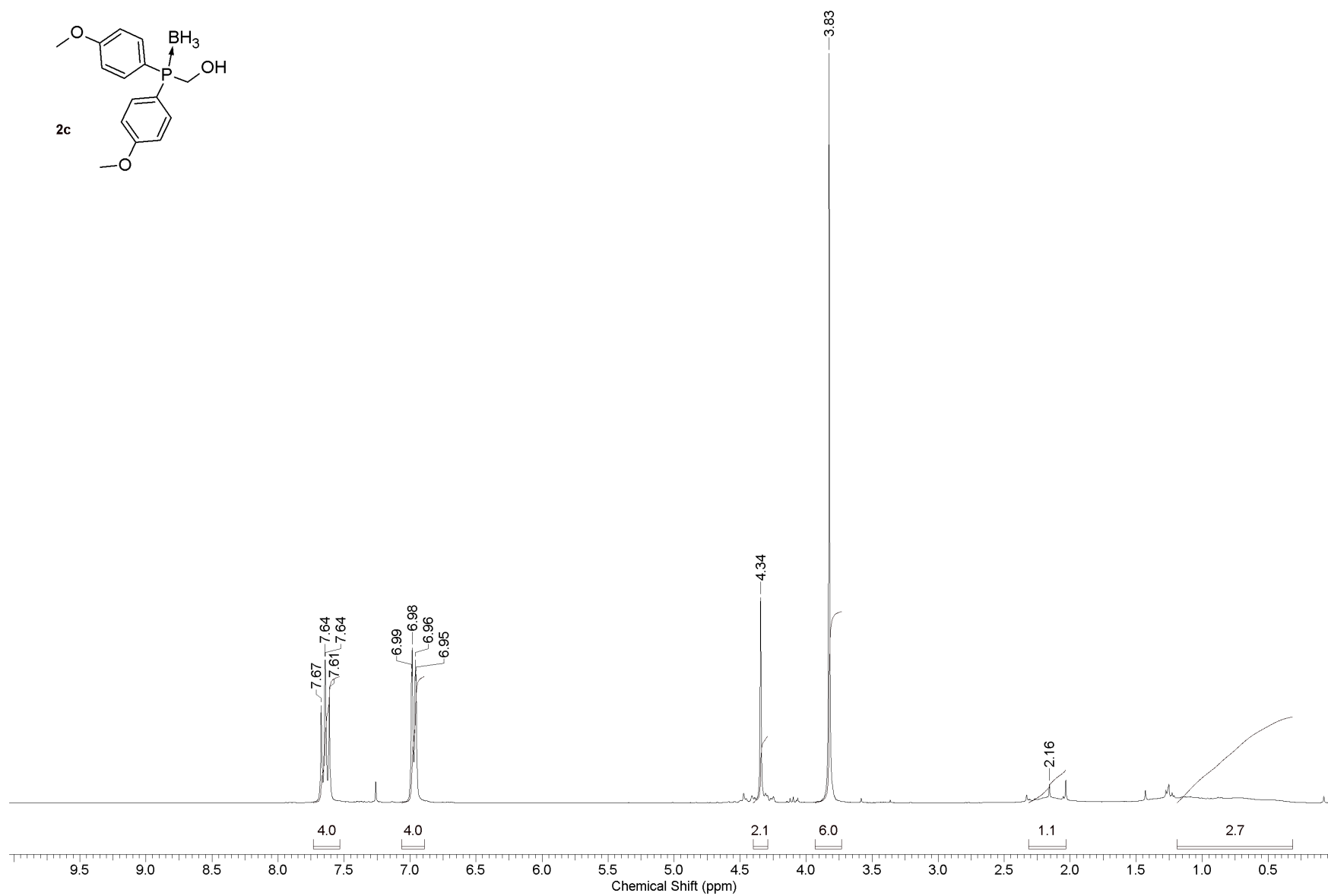
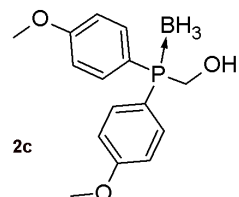
^1H NMR spectrum of hydroxymethyl(1-naphthyl)phenylphosphine-borane (**2b**) (500 MHz, CDCl_3)



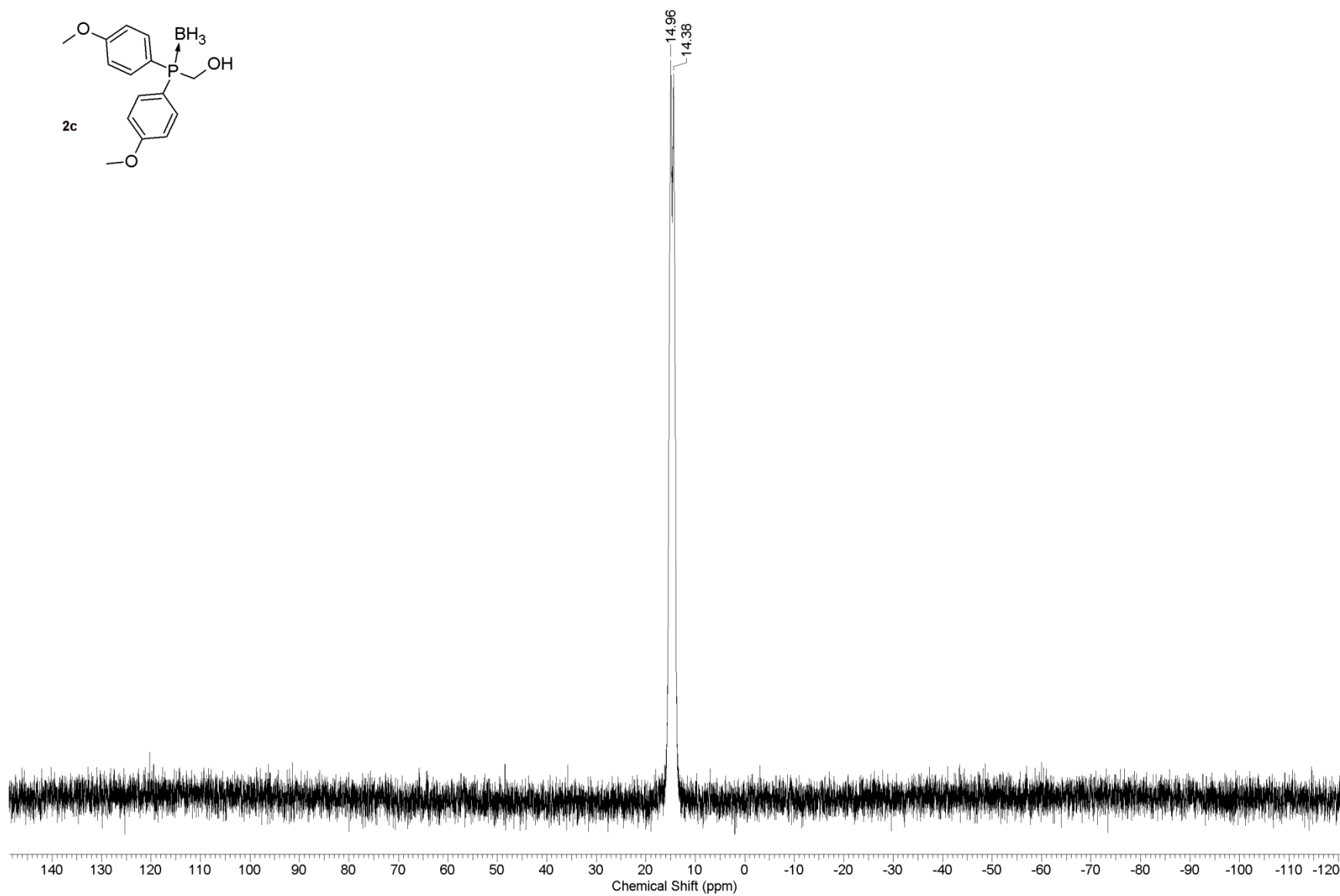
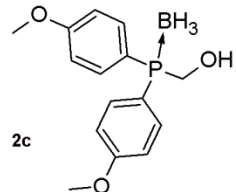
^{31}P NMR spectrum of hydroxymethyl(1-naphthyl)phenylphosphine-borane (**2b**) (202 MHz, CDCl_3)



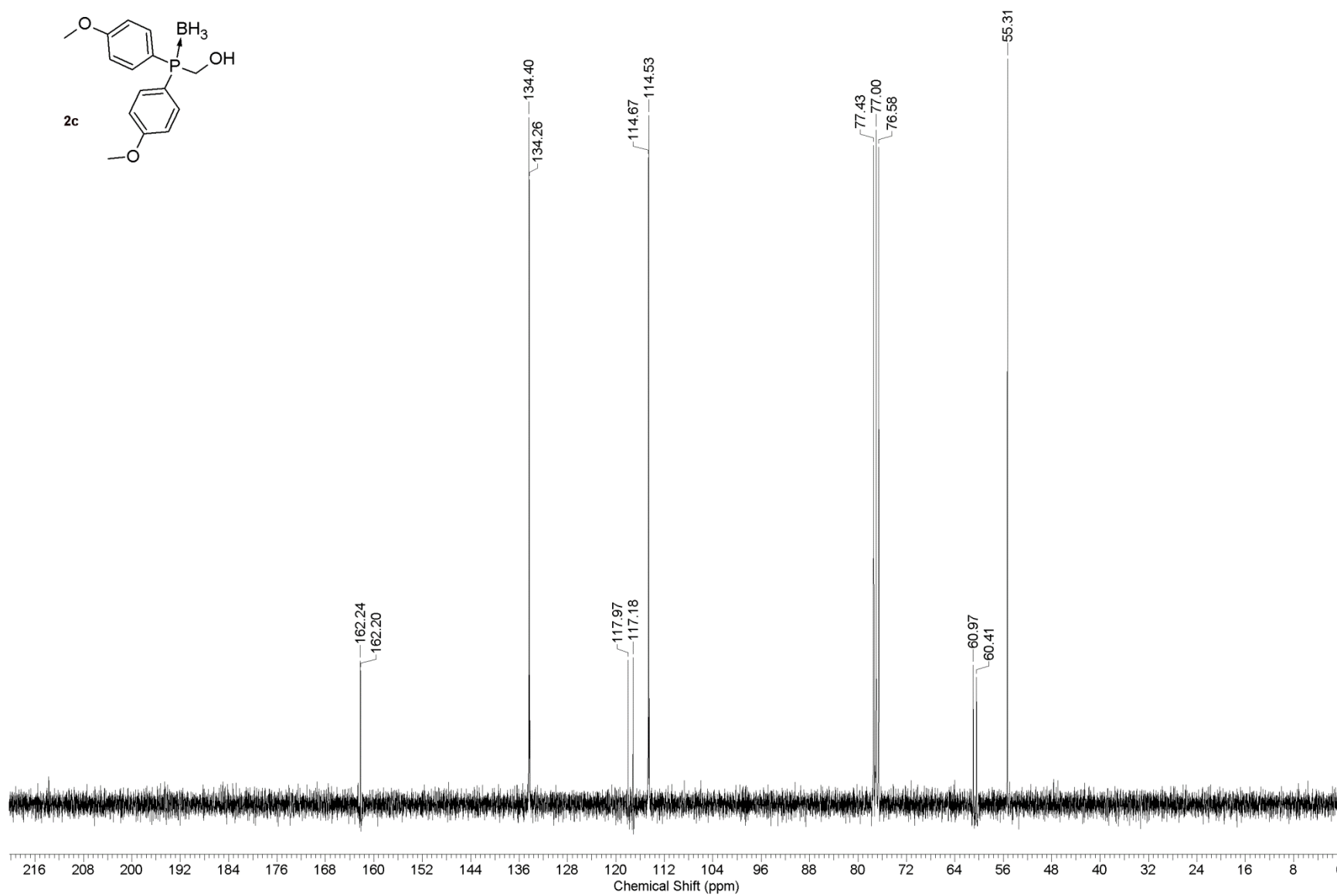
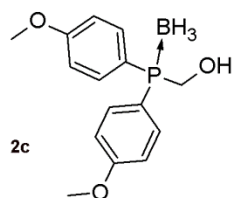
^{13}C NMR spectrum of hydroxymethyl(1-naphthyl)phenylphosphine-borane (**2b**) (125 MHz, CDCl_3)



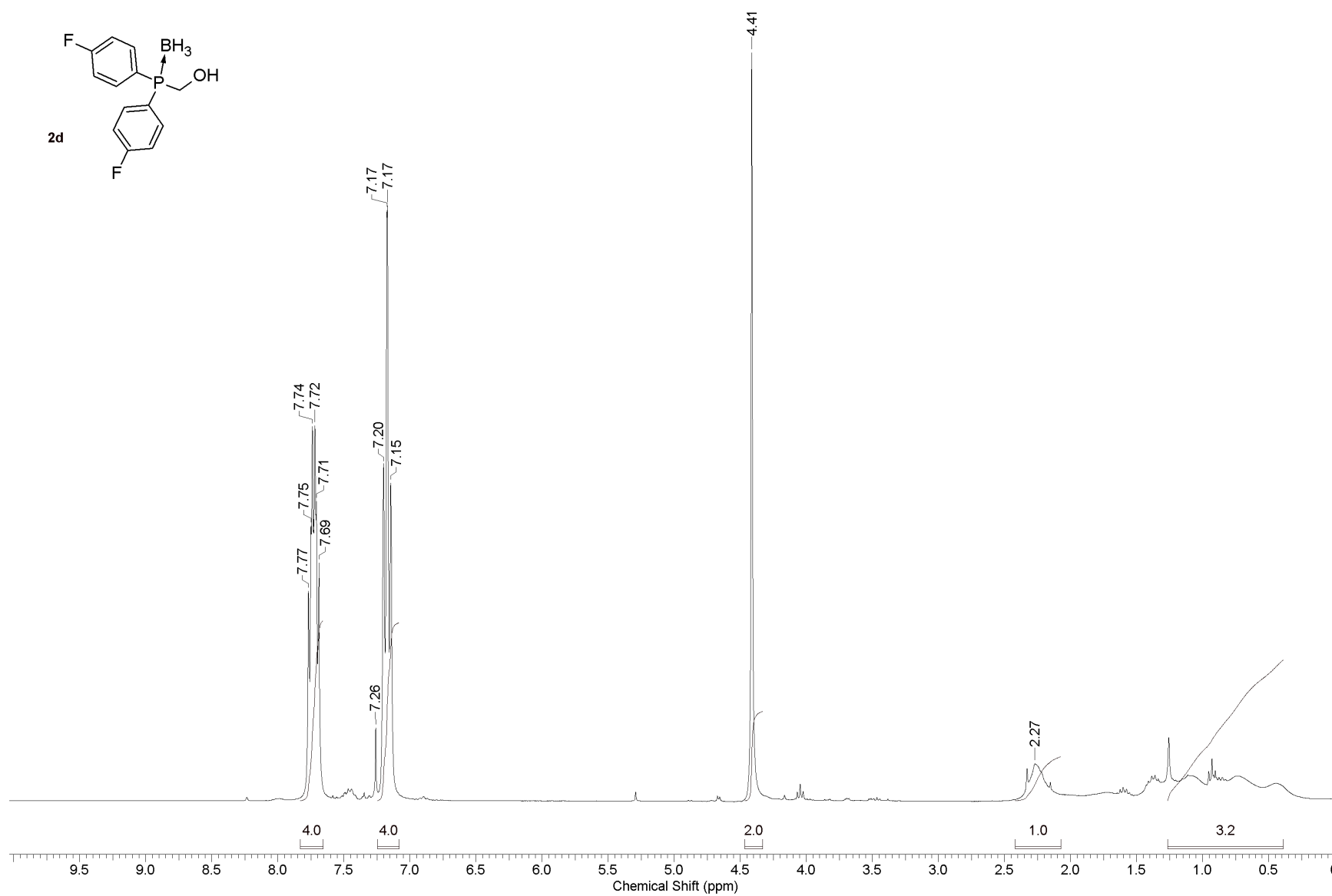
¹H NMR spectrum of (hydroxymethyl)-di-*p*-anisylphosphine-borane (**2c**) (300 MHz, CDCl₃)



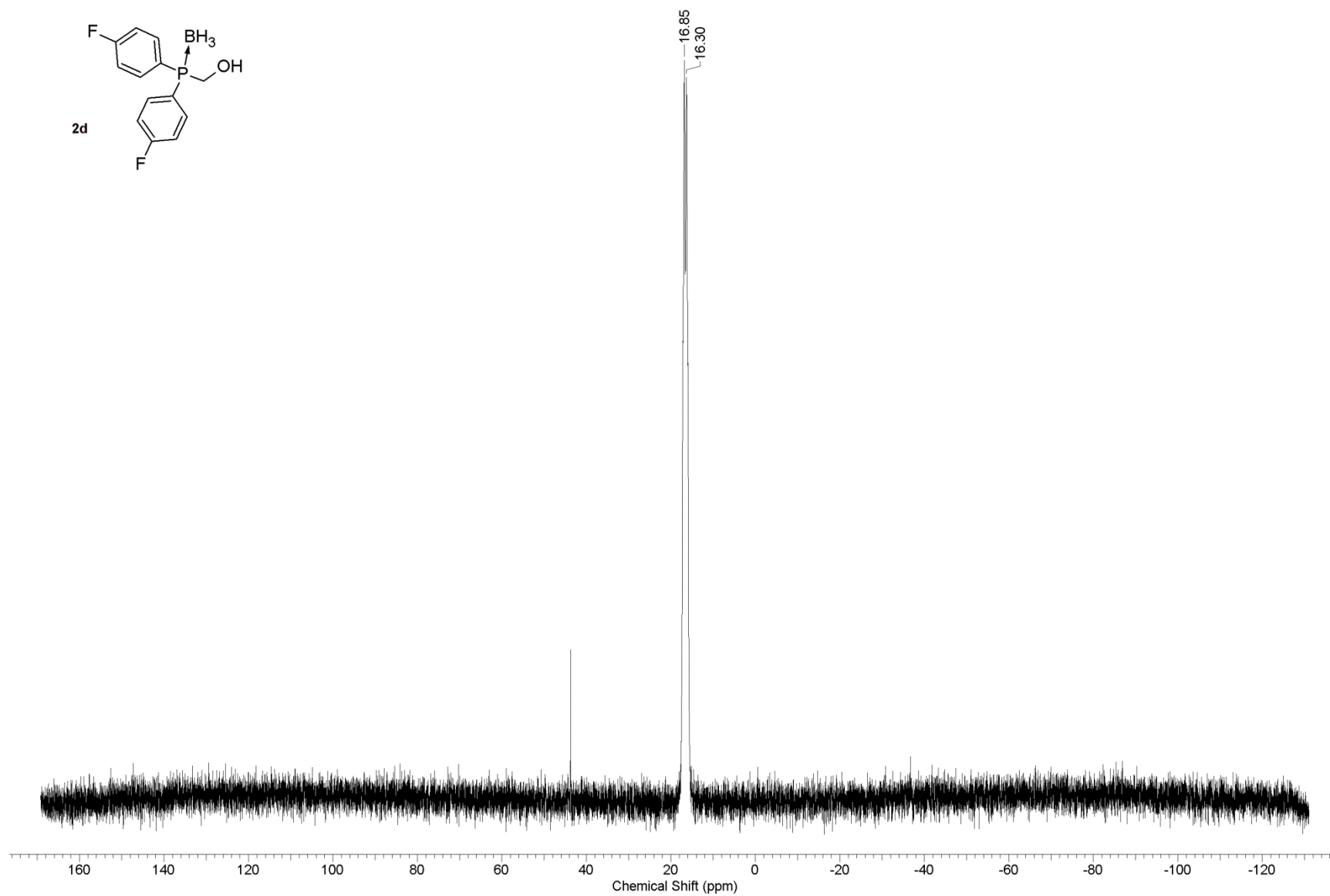
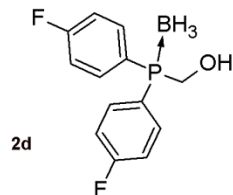
³¹P NMR spectrum of (hydroxymethyl)-di-*p*-anisylphosphine-borane (**2c**) (122 MHz, CDCl₃)



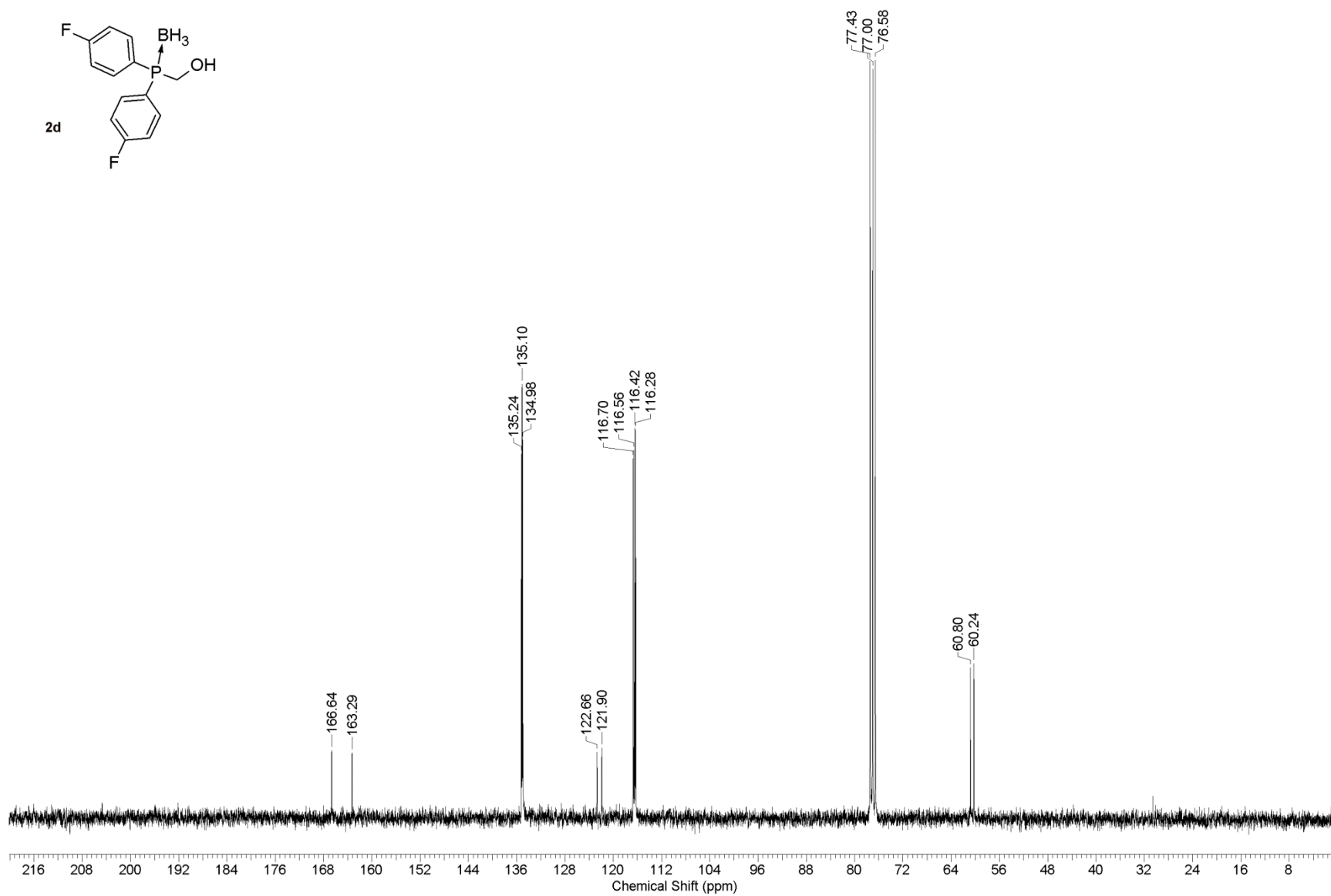
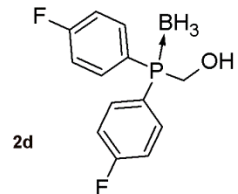
¹³C NMR spectrum of (hydroxymethyl)-di-*p*-anisylphosphine-borane (**2c**) (75 MHz, CDCl₃)



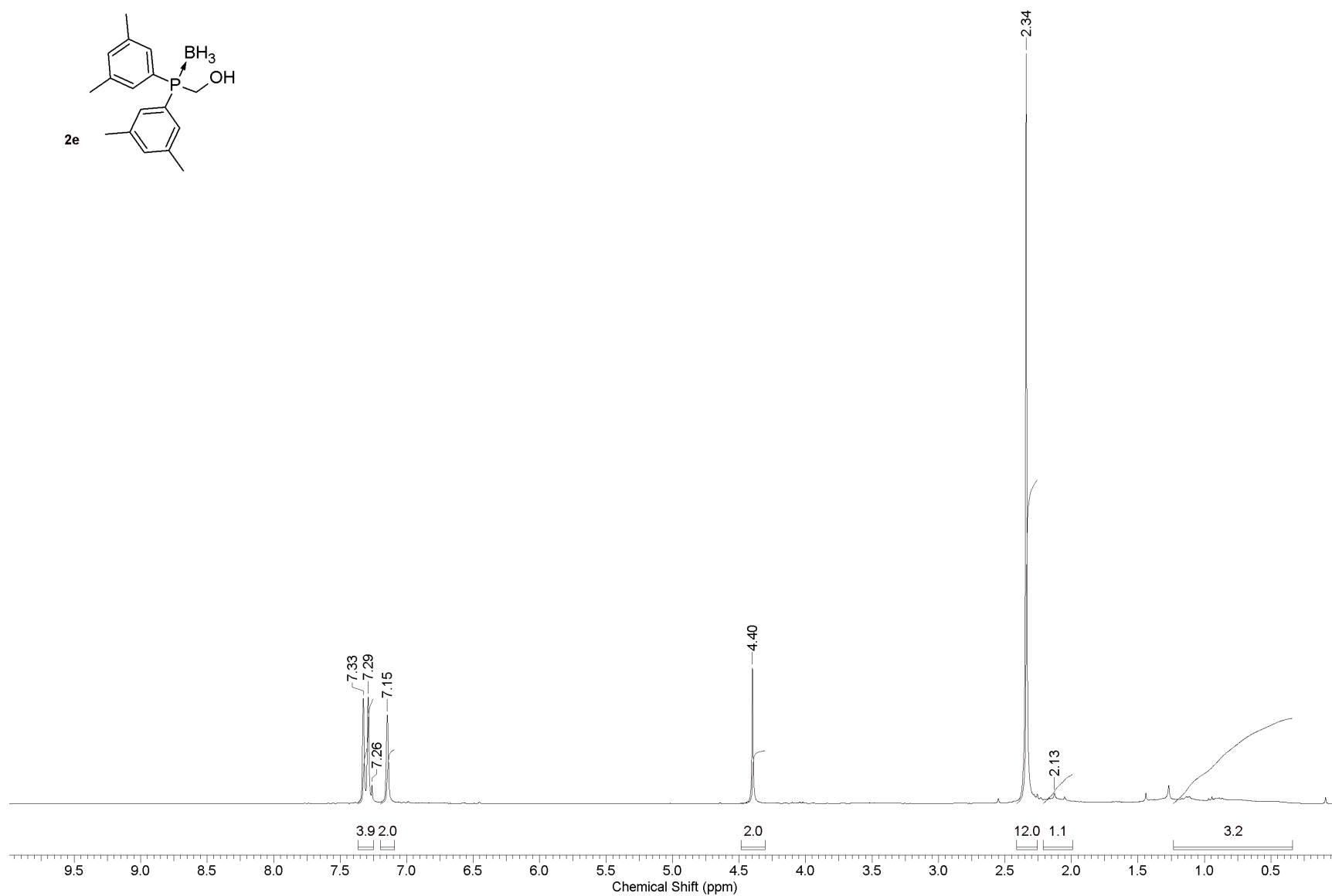
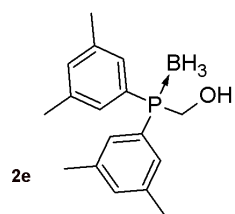
^1H NMR spectrum of di-*p*-fluorophenyl(hydroxymethyl)phosphine-borane (**2d**) (300 MHz, CDCl_3)



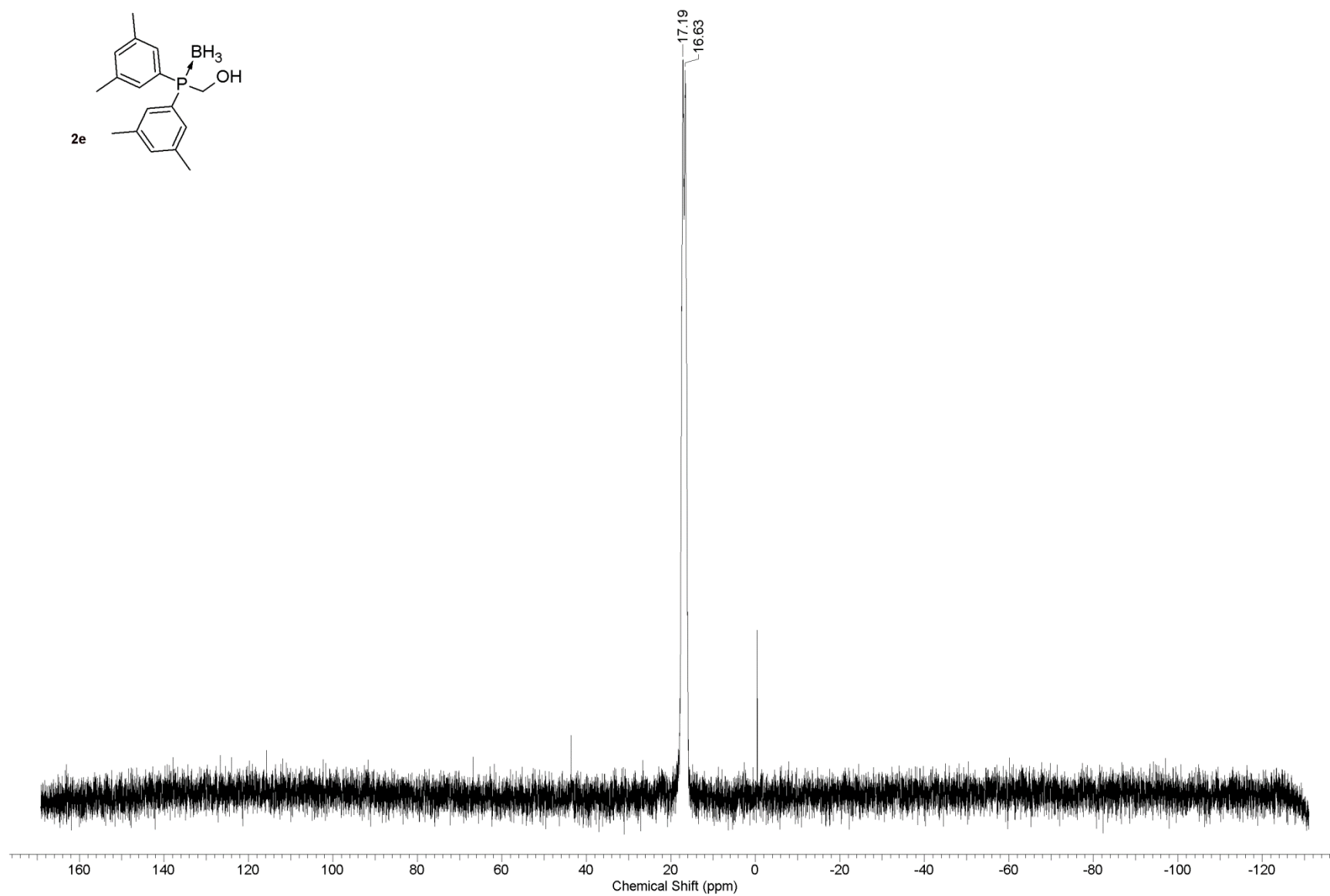
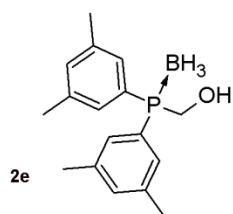
^{31}P NMR spectrum of di-*p*-fluorophenyl(hydroxymethyl)phosphine-borane (**2d**) (122 MHz, CDCl_3)



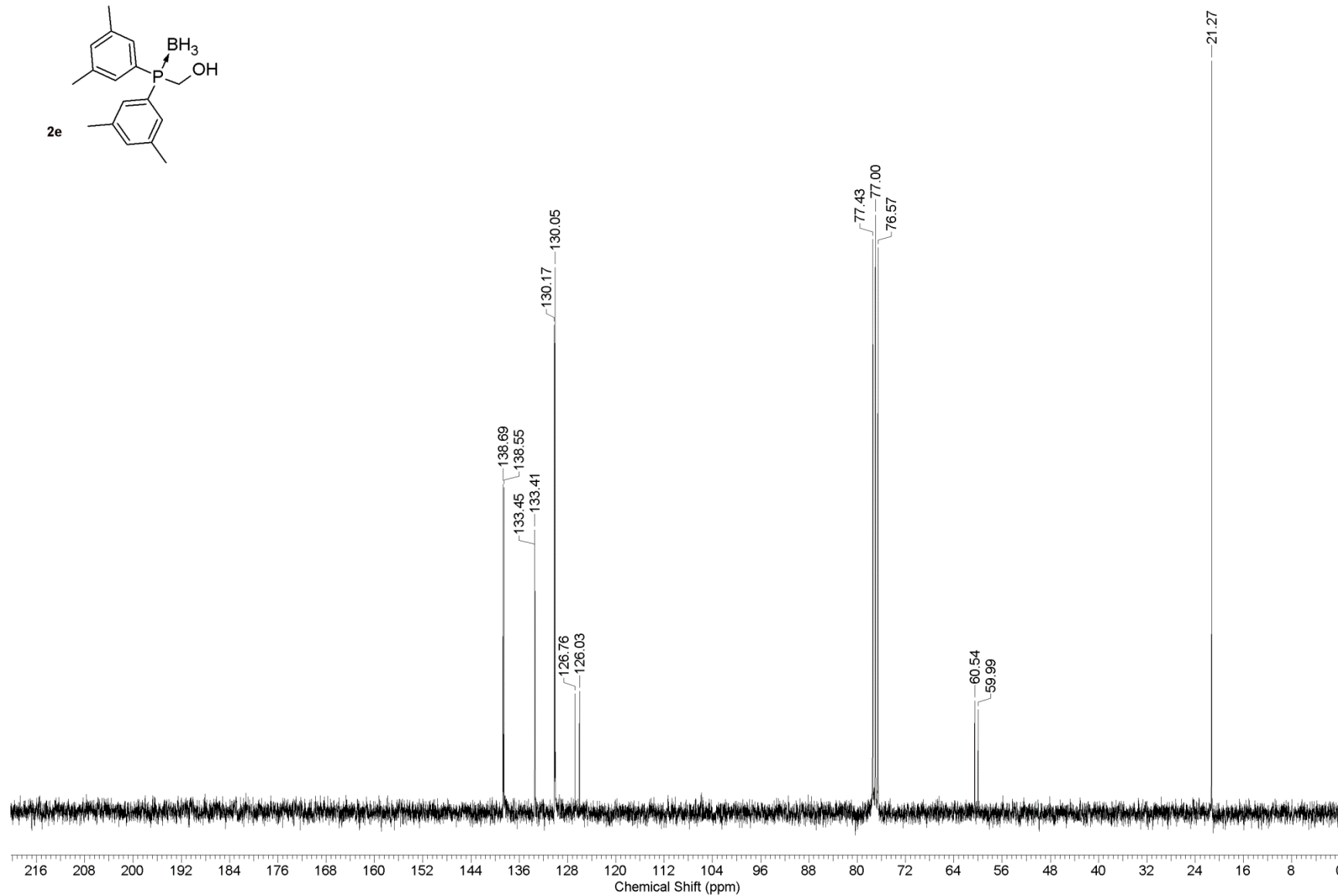
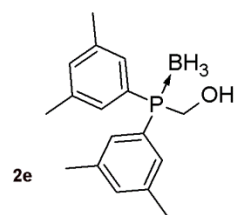
¹³C NMR spectrum of di-*p*-fluorophenyl(hydroxymethyl)phosphine-borane (**2d**) (75 MHz, CDCl₃)



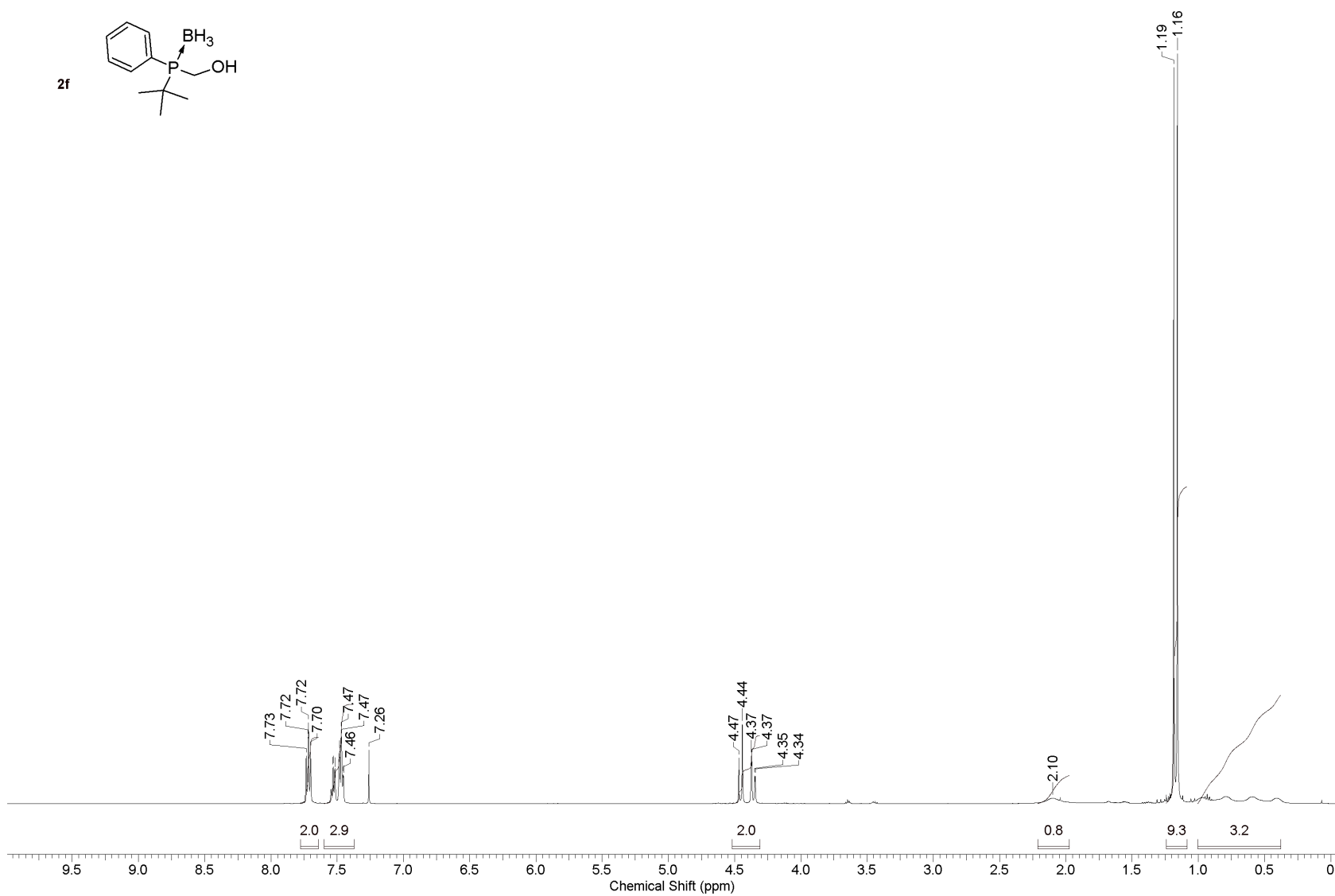
¹H NMR spectrum of di-(3,5-dimethylphenyl)hydroxymethylphosphine-borane (**2e**) (300 MHz, CDCl₃)



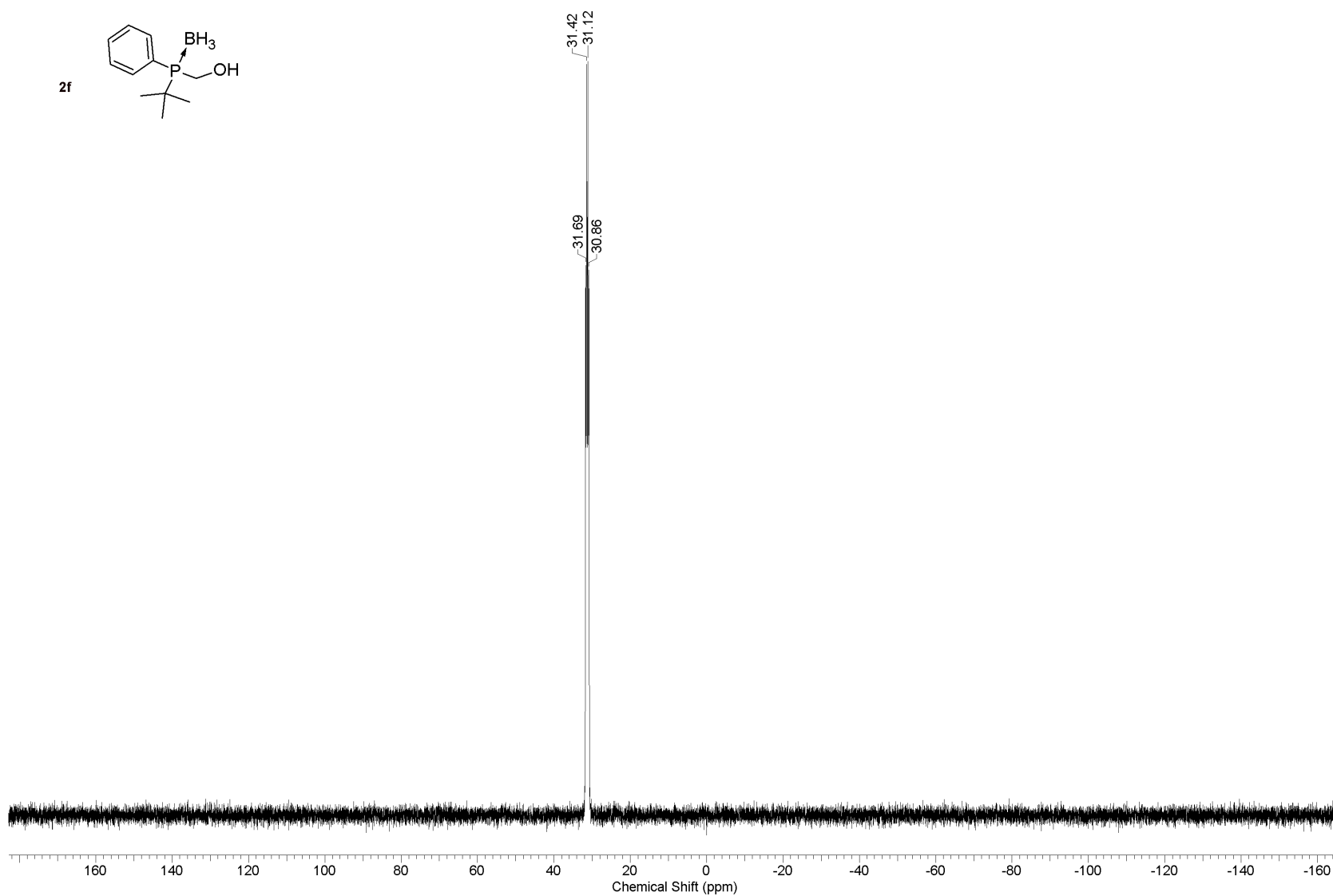
³¹P NMR spectrum of di-(3,5-dimethylphenyl)hydroxymethylphosphine-borane (**2e**) (122 MHz, CDCl₃)



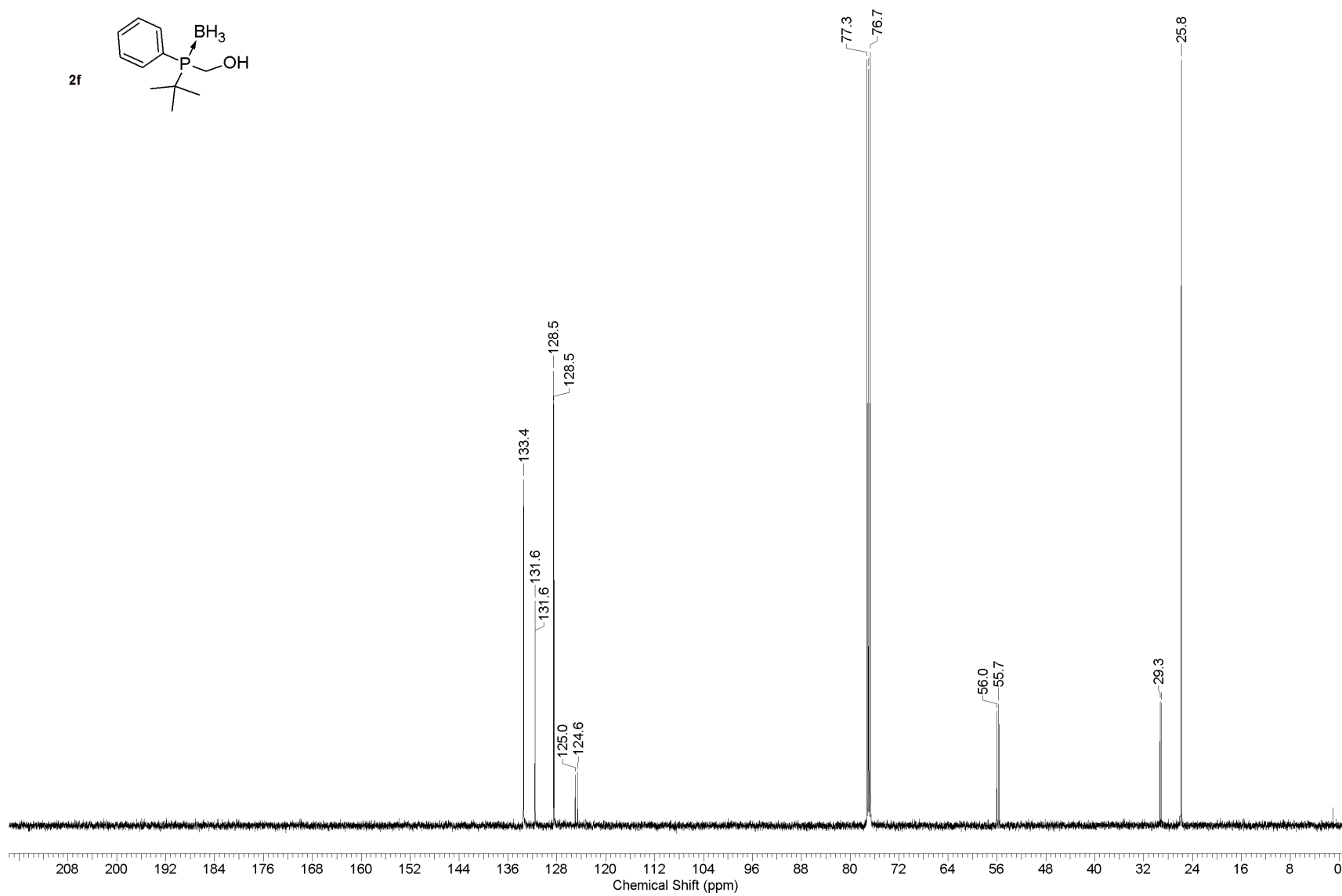
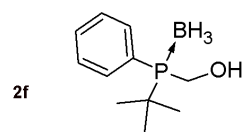
^{13}C NMR spectrum of di-(3,5-dimethylphenyl)hydroxymethylphosphine-borane (**2e**) (75 MHz, CDCl_3)



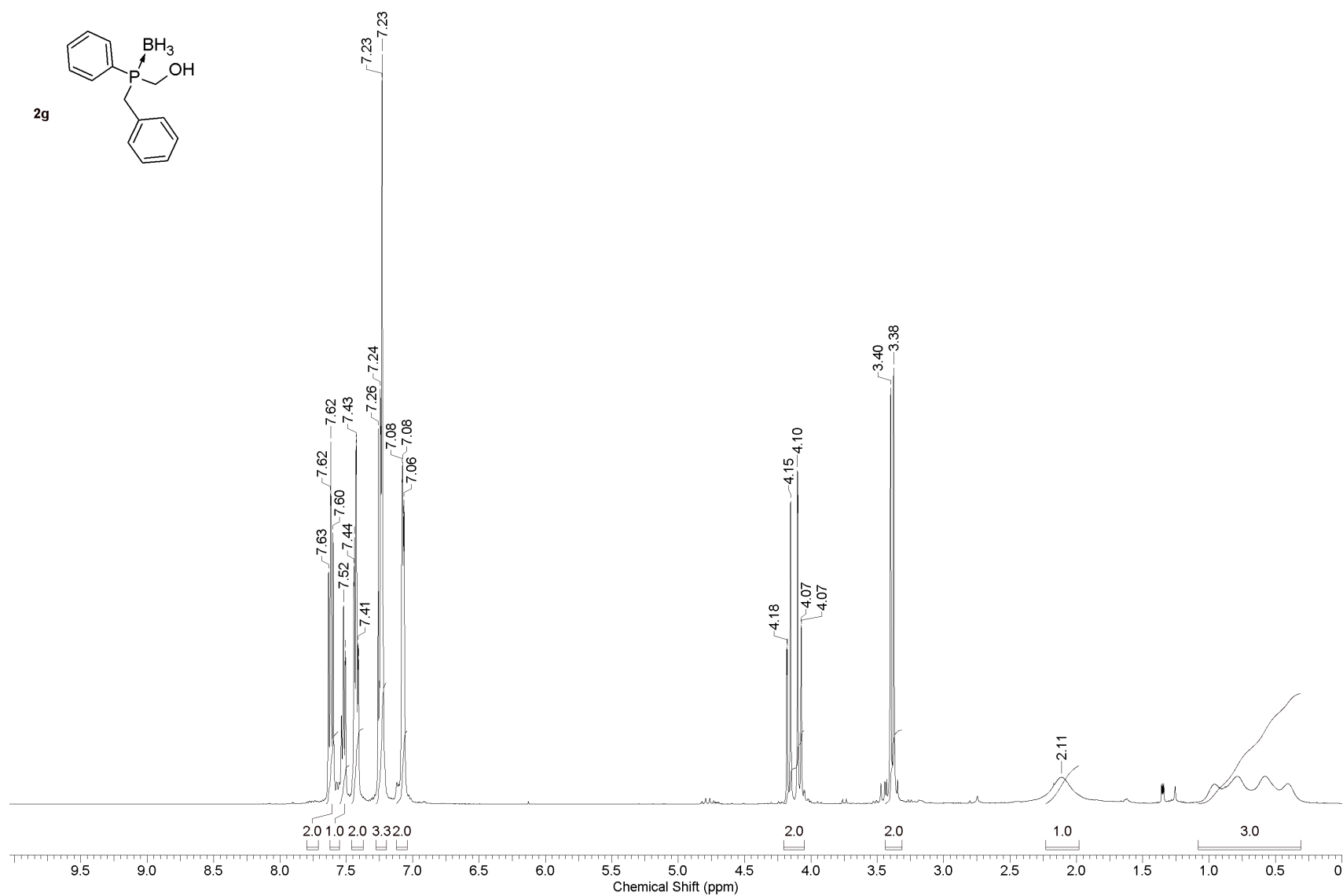
¹H NMR spectrum of *t*-butyl(hydroxymethyl)phenylphosphine-borane (**2f**) (500 MHz, CDCl₃)



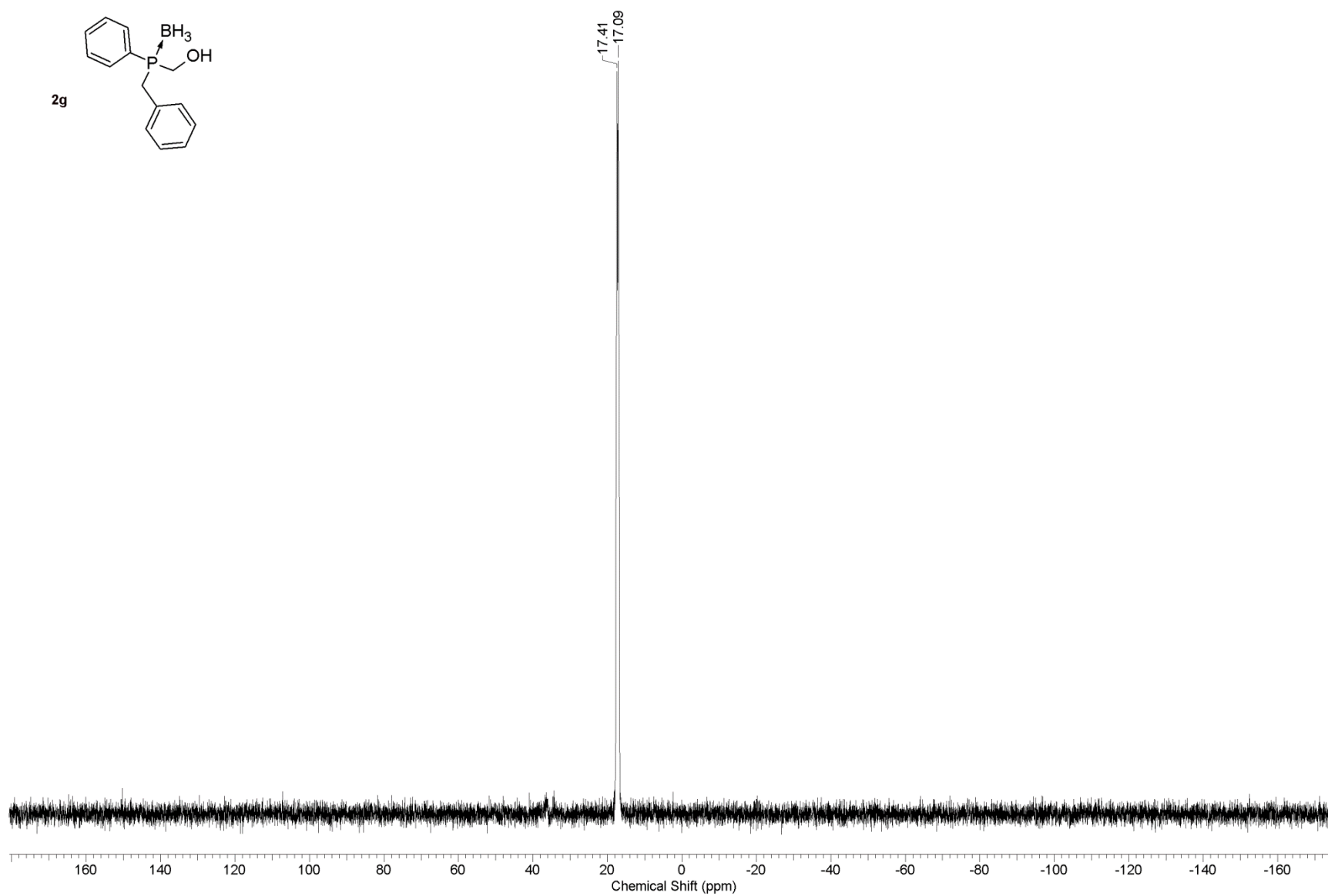
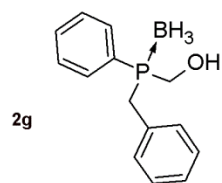
^{31}P NMR spectrum of *t*-butyl(hydroxymethyl)phenylphosphine-borane (**2f**) (202 MHz, CDCl_3)



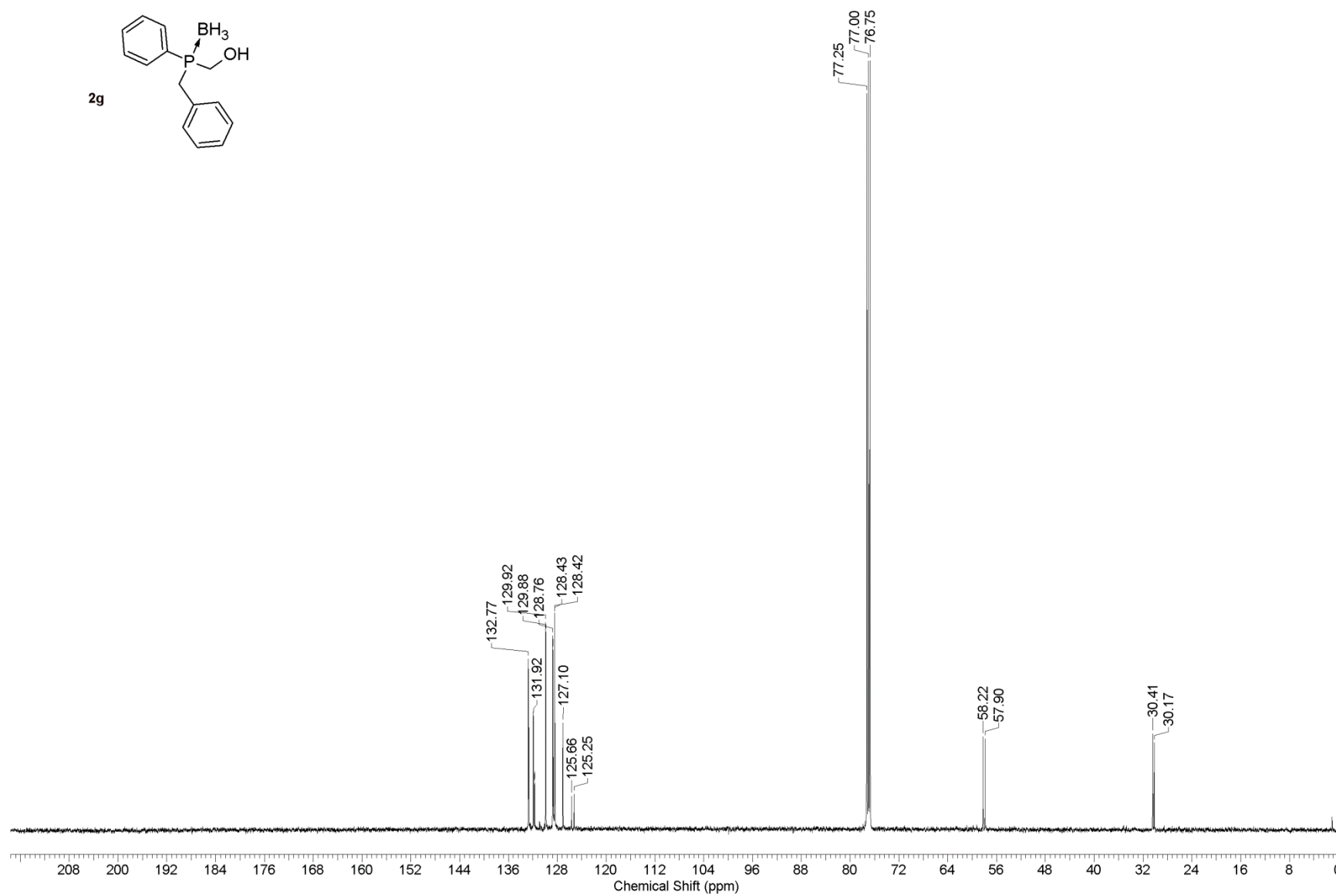
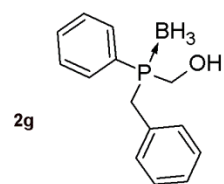
^{13}C NMR spectrum of *t*-butyl(hydroxymethyl)phenylphosphine-borane (**2f**) (125 MHz, CDCl_3)



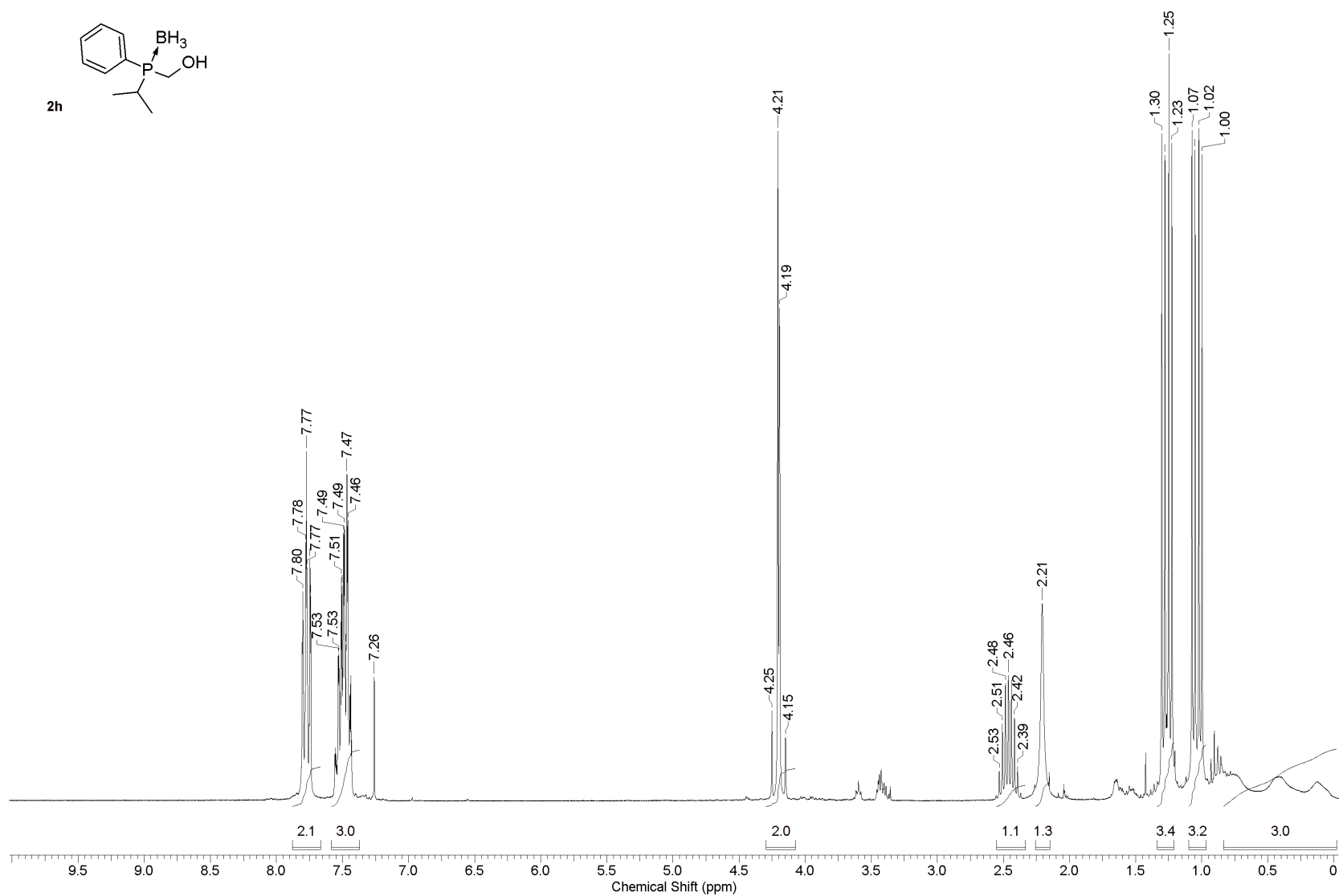
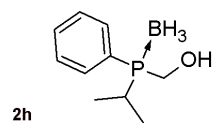
^1H NMR spectrum of benzyl(hydroxymethyl)phenylphosphine-borane (**2g**) (500 MHz, CDCl_3)



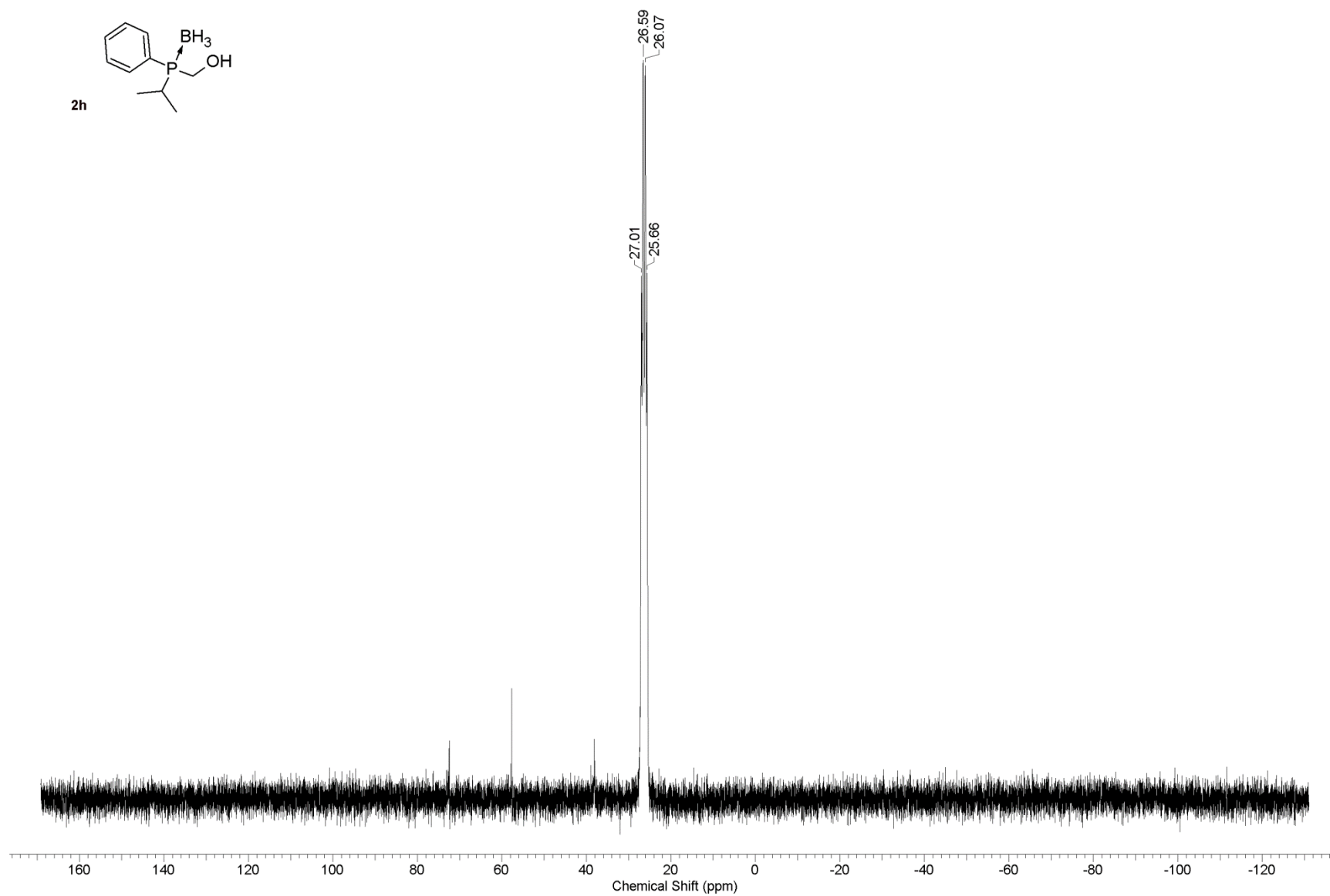
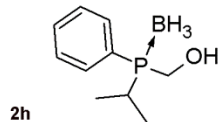
^{31}P NMR spectrum of benzyl(hydroxymethyl)phenylphosphine-borane (**2g**) (202 MHz, CDCl_3)



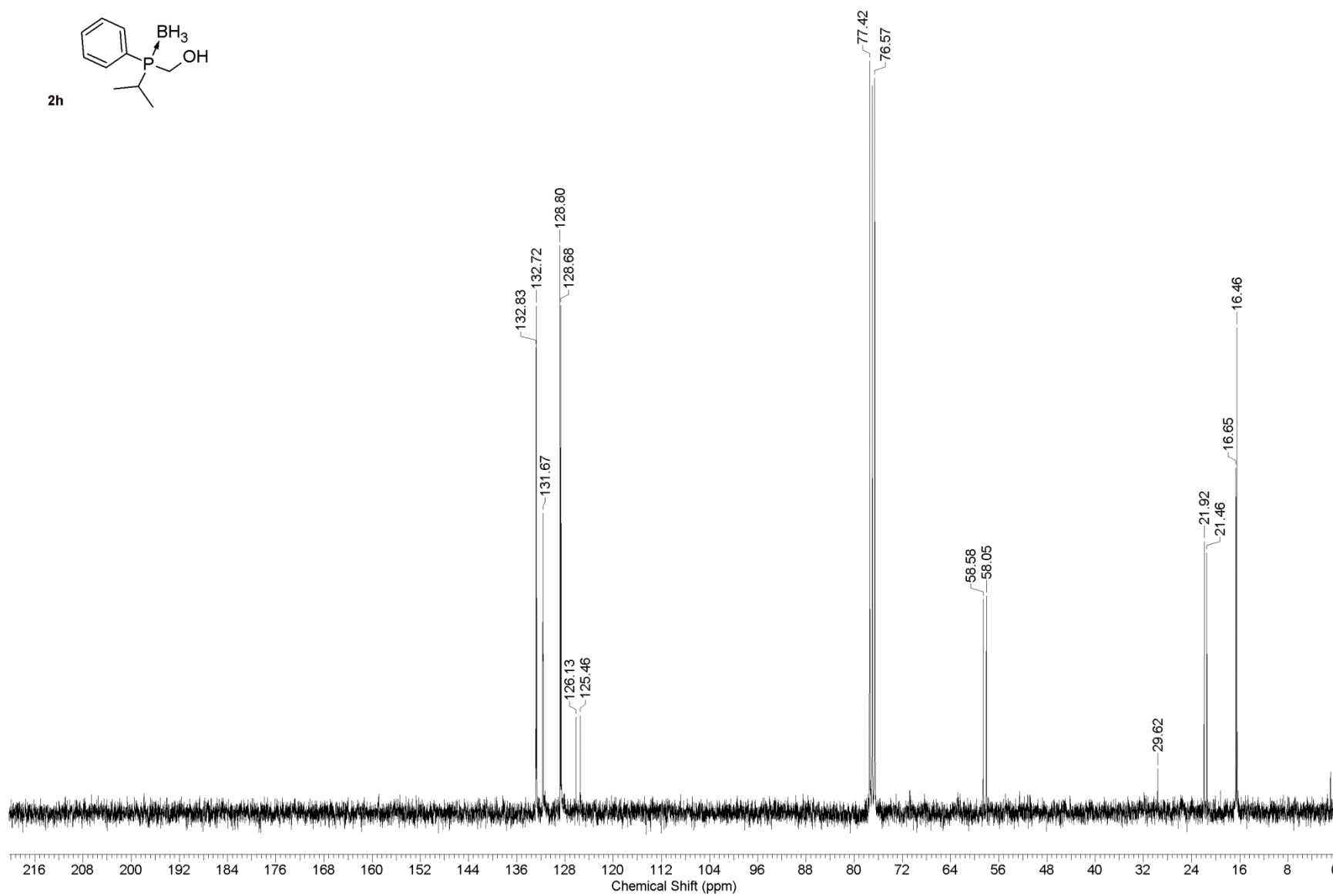
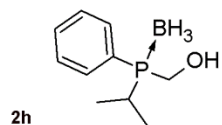
^{13}C NMR spectrum of benzyl(hydroxymethyl)phenylphosphine-borane (**2g**) (125 MHz, CDCl_3)



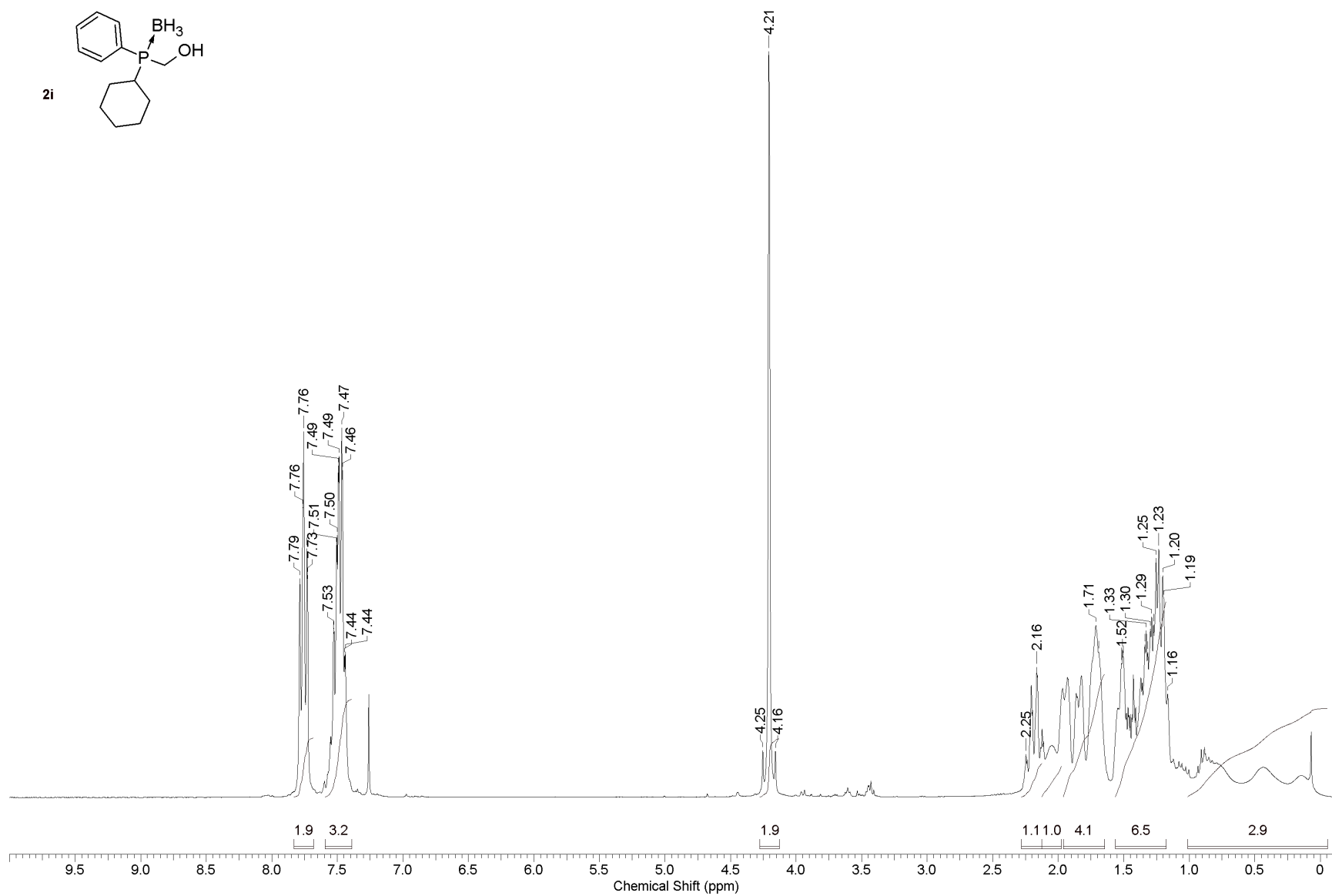
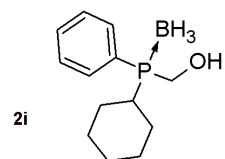
^1H NMR spectrum of hydroxymethyl(*i*-propyl)phenylphosphine-borane (**2h**) (300 MHz, CDCl_3)



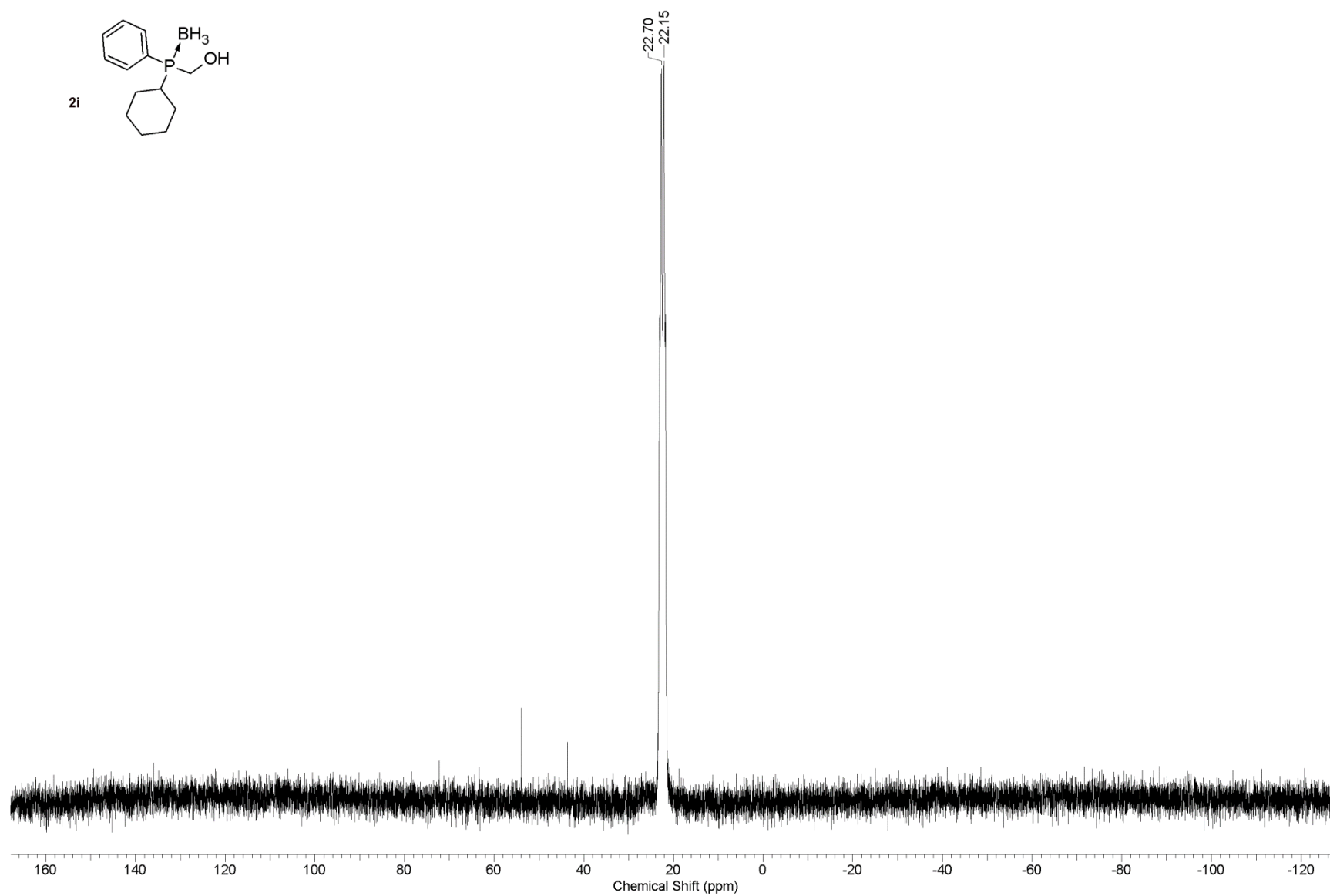
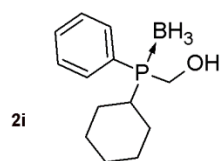
^{31}P NMR spectrum of hydroxymethyl(*i*-propyl)phenylphosphine-borane (**2h**) (122 MHz, CDCl_3)



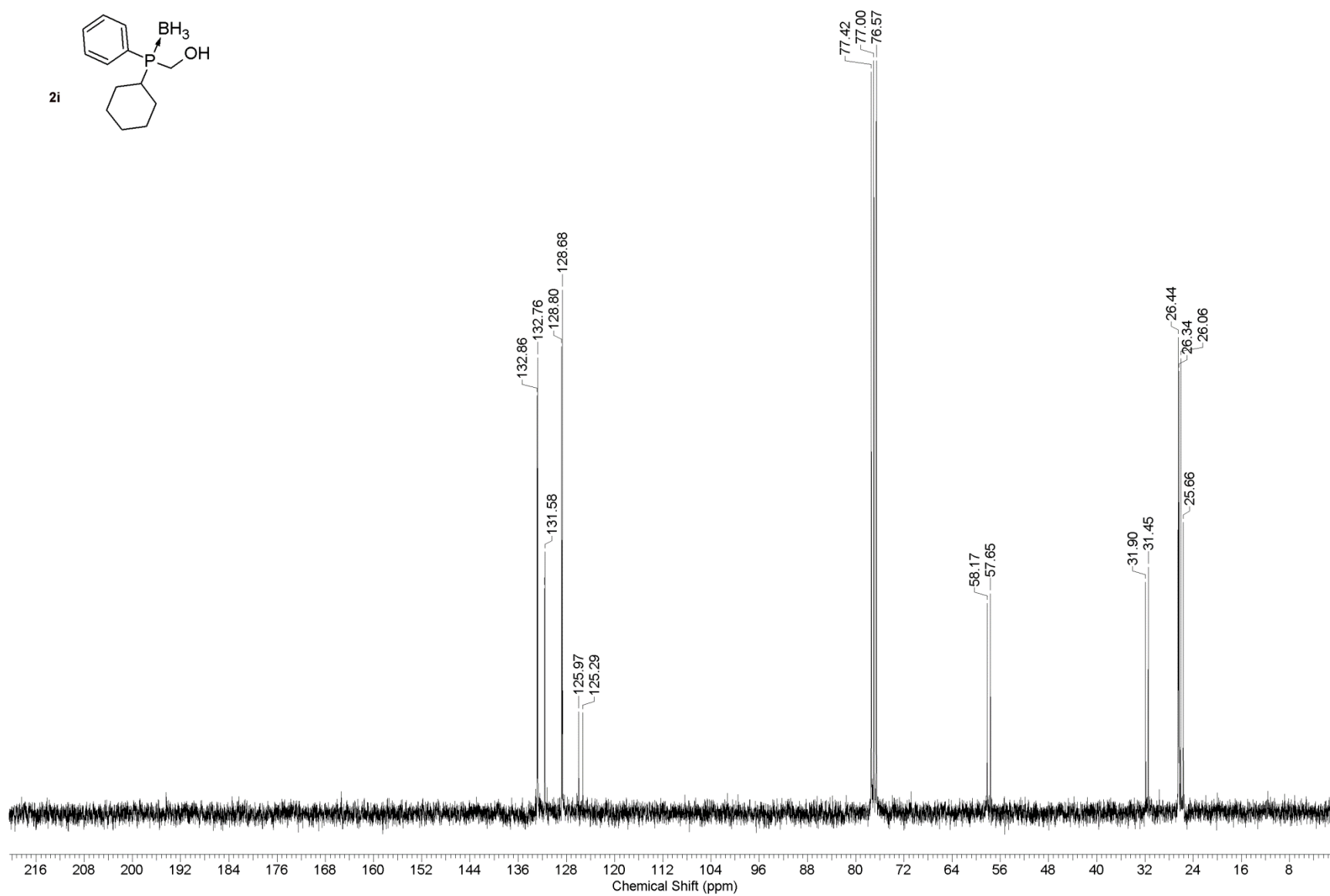
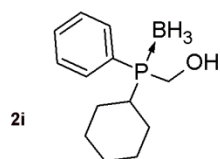
^{13}C NMR spectrum of hydroxymethyl(*i*-propyl)phenylphosphine-borane (**2h**) (75 MHz, CDCl_3)



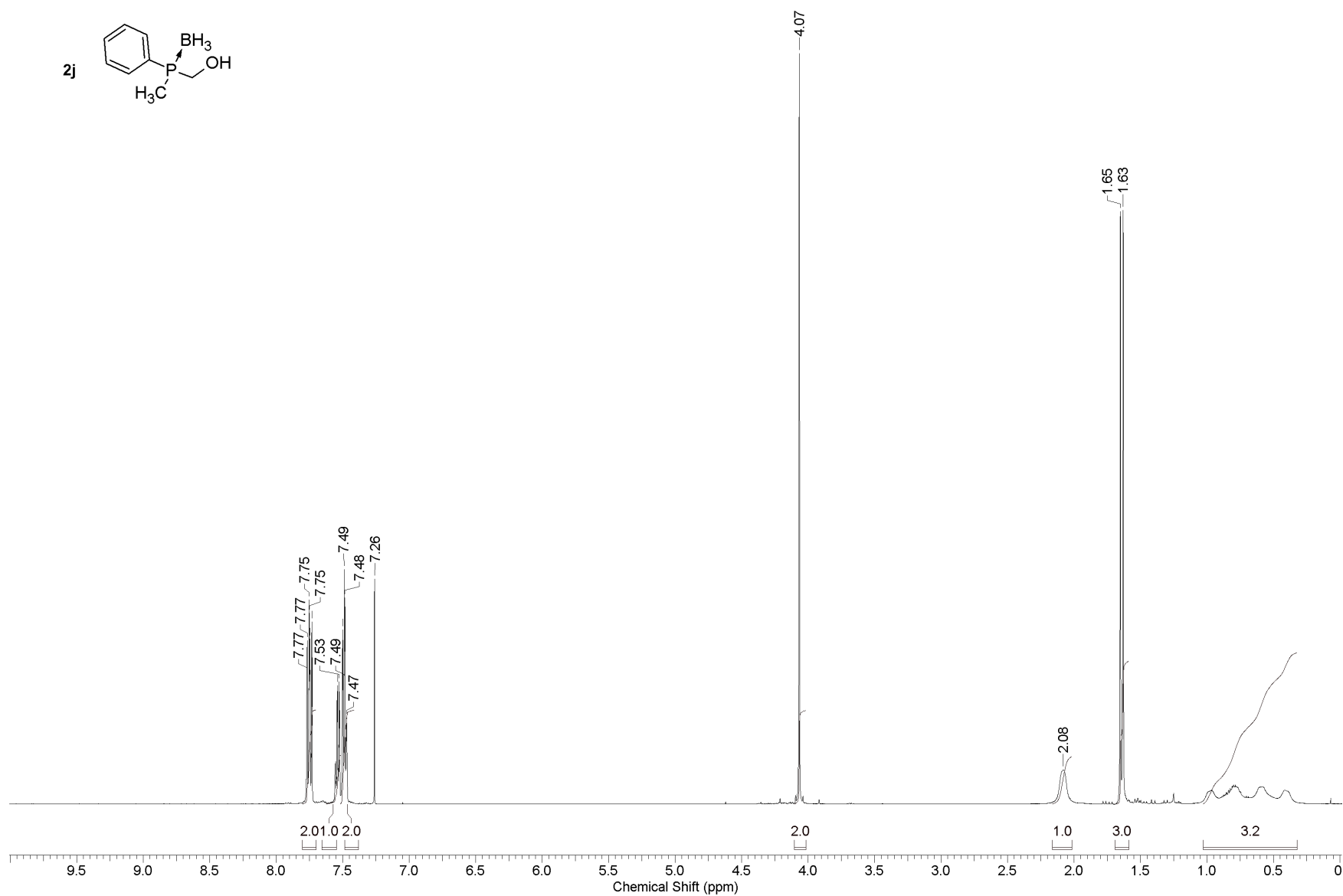
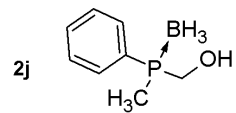
^1H NMR spectrum of cyclohexyl(hydroxymethyl)phenylphosphine-borane (**2i**) (300 MHz, CDCl_3)



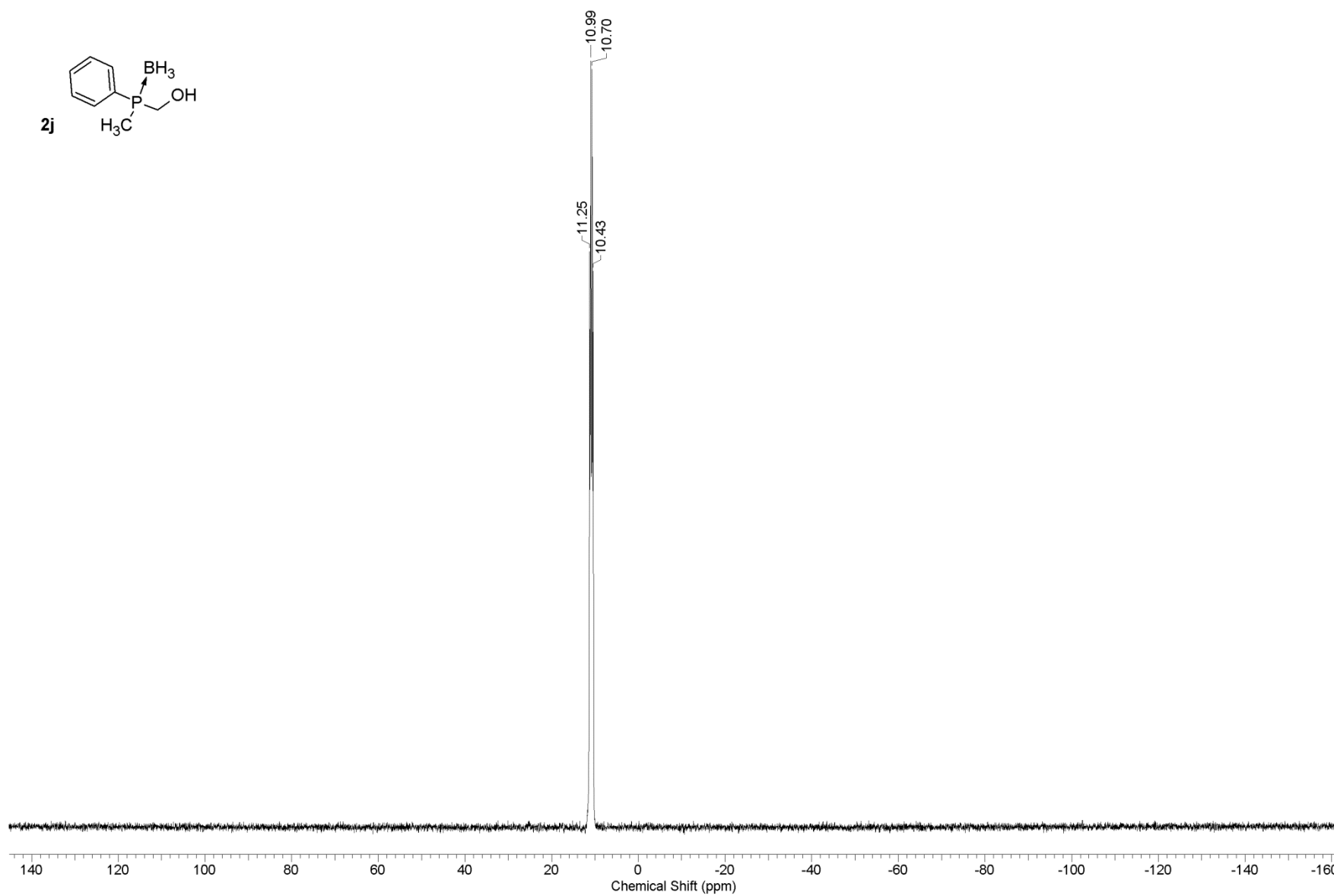
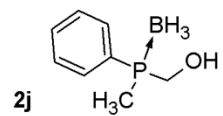
^{31}P NMR spectrum of cyclohexyl(hydroxymethyl)phosphine-borane (**2i**) (122 MHz, CDCl_3)



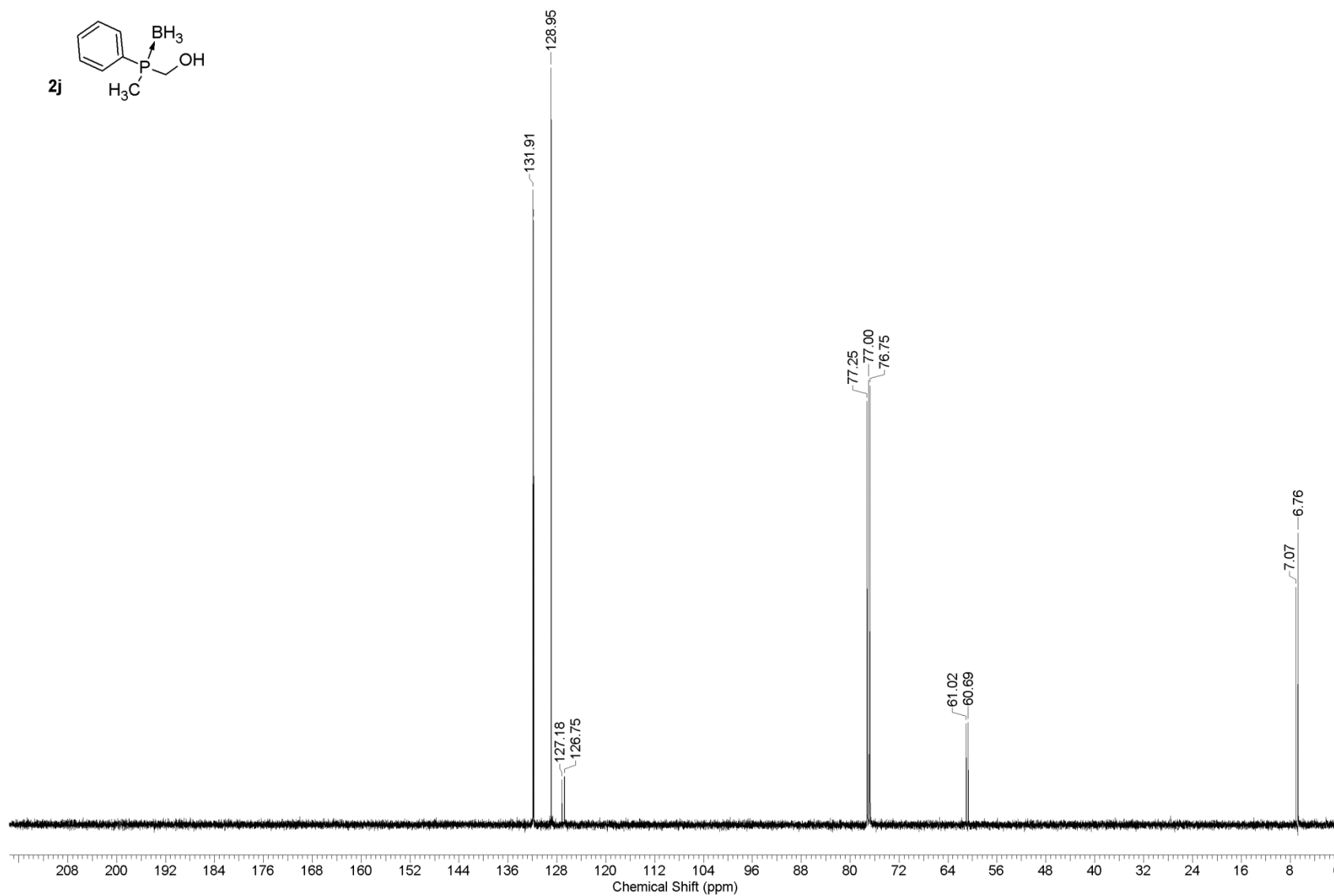
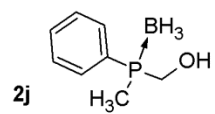
^{13}C NMR spectrum of cyclohexyl(hydroxymethyl)phenylphosphine-borane (**2i**) (75 MHz, CDCl_3)



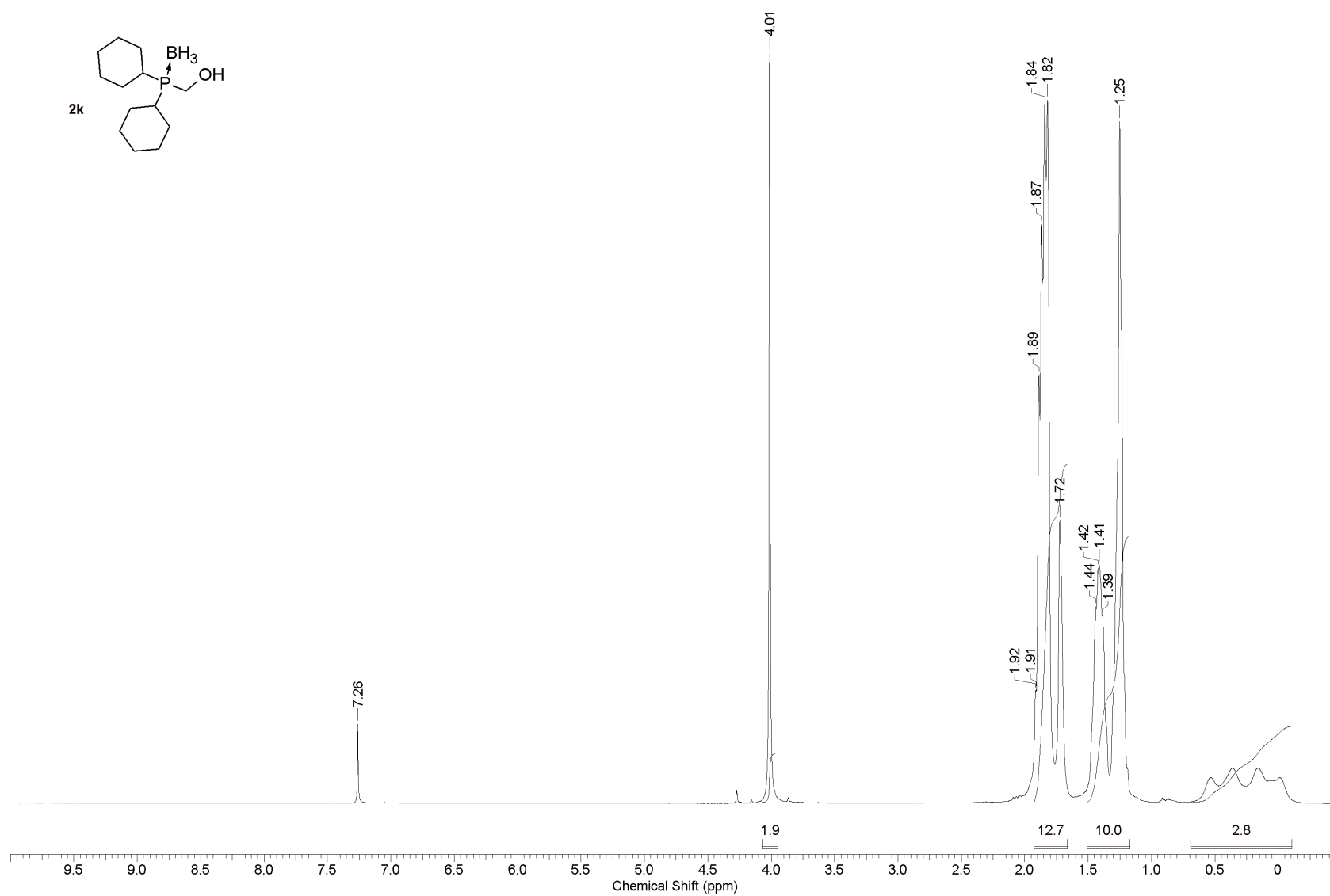
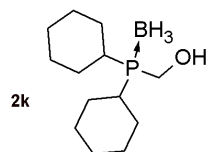
^1H NMR spectrum of hydroxymethyl(methyl)phenylphosphine-borane (**2j**) (500 MHz, CDCl_3)



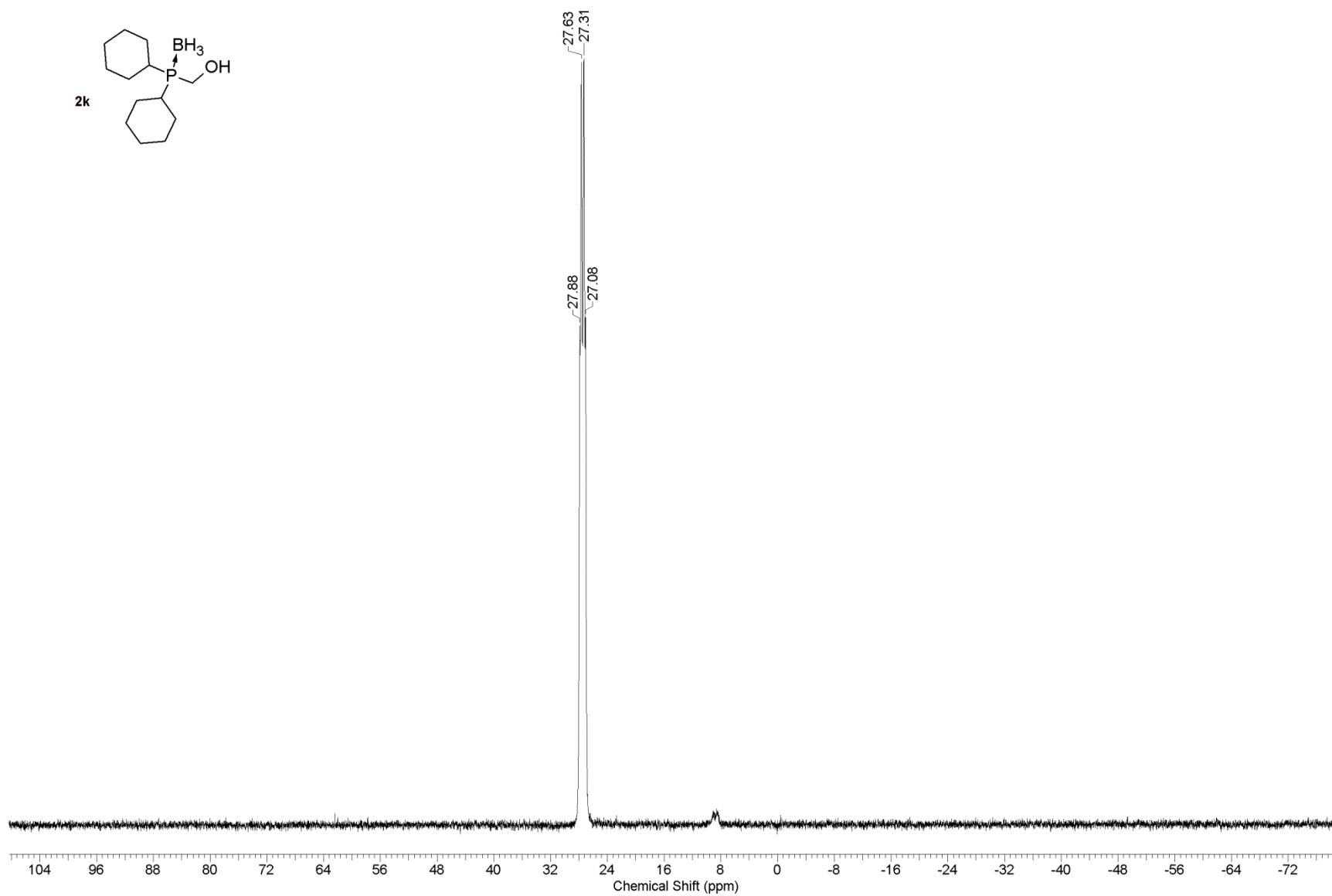
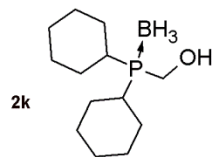
^{31}P NMR spectrum of hydroxymethyl(methyl)phenylphosphine-borane (**2j**) (202 MHz, CDCl_3)



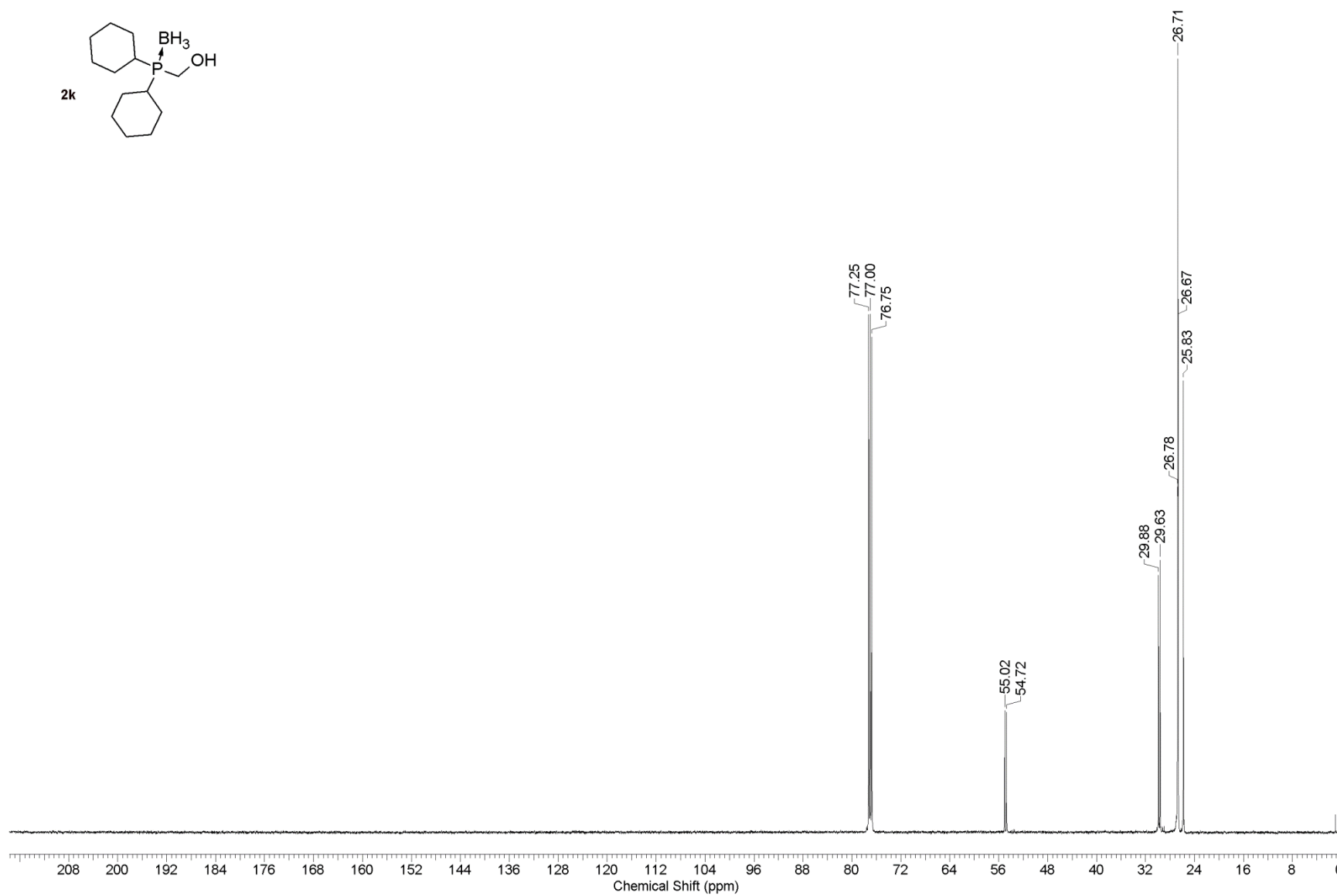
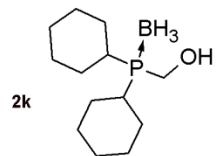
¹³C NMR spectrum of hydroxymethyl(methyl)phenylphosphine-borane (**2j**) (125 MHz, CDCl₃)



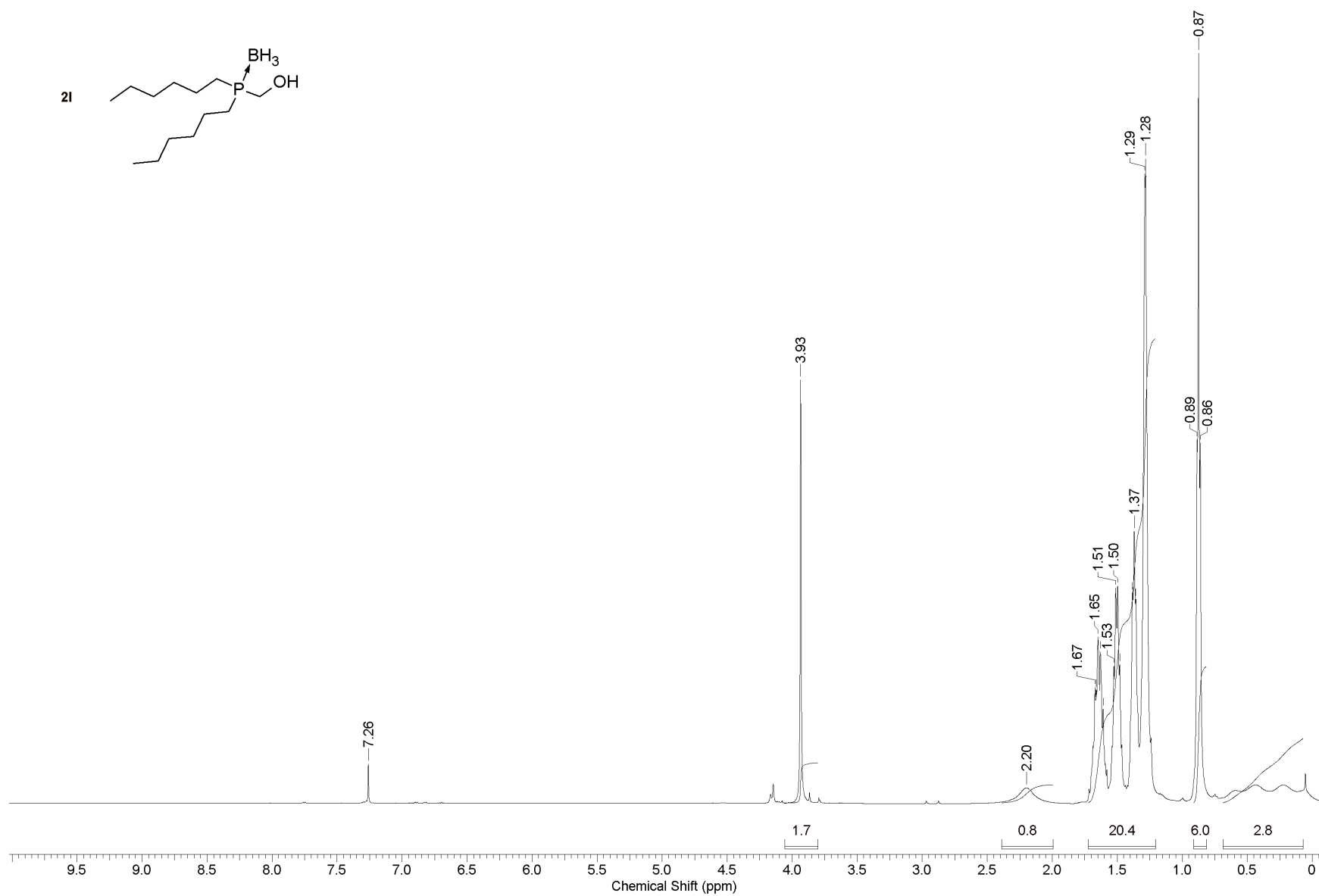
¹H NMR spectrum of di-*c*-hexyl(hydroxymethyl)phosphine-borane (**2k**) (500 MHz, CDCl₃)



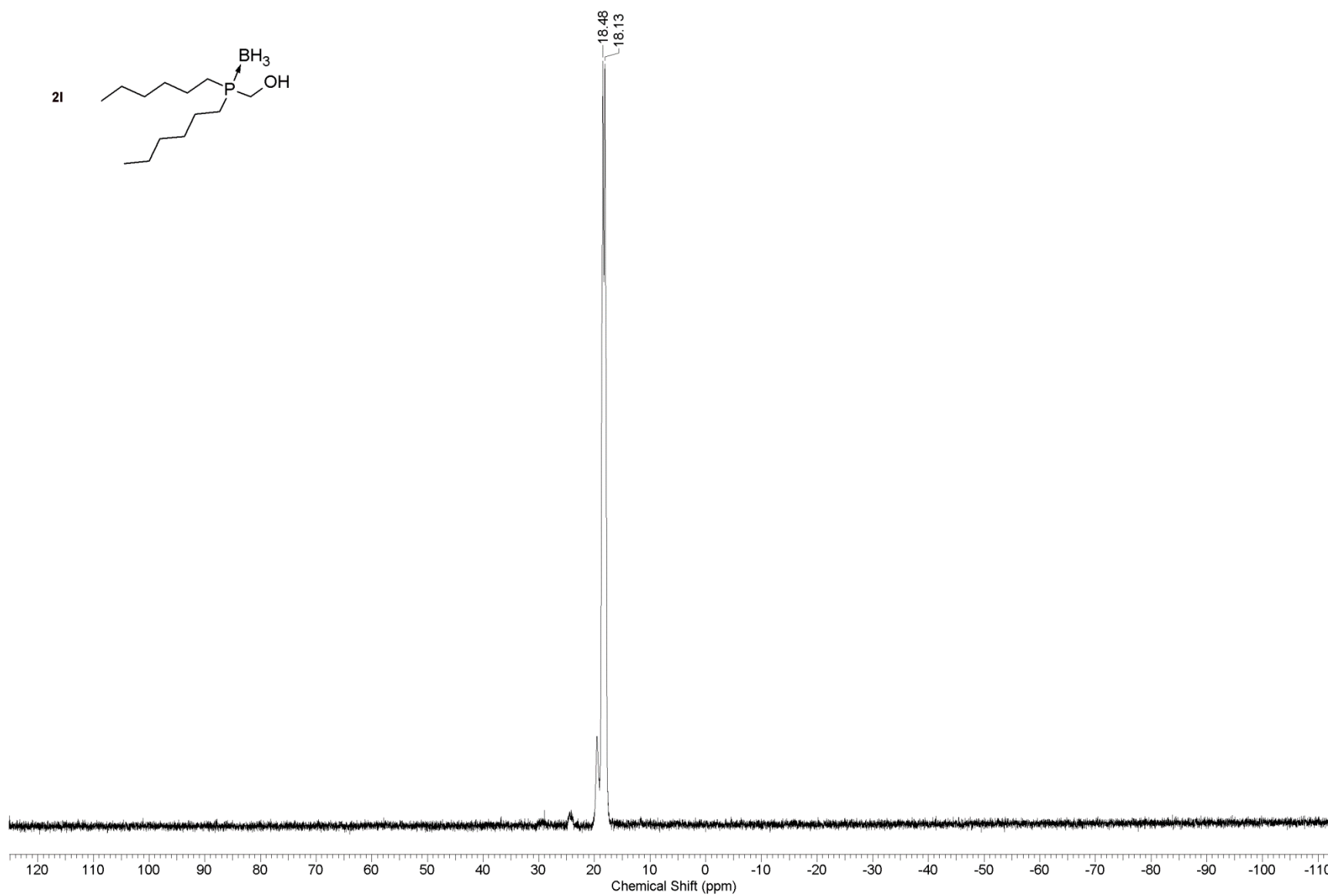
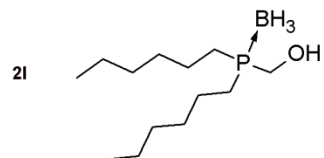
^{31}P NMR spectrum of di-*c*-hexyl(hydroxymethyl)phosphine-borane (**2k**) (202 MHz, CDCl_3)



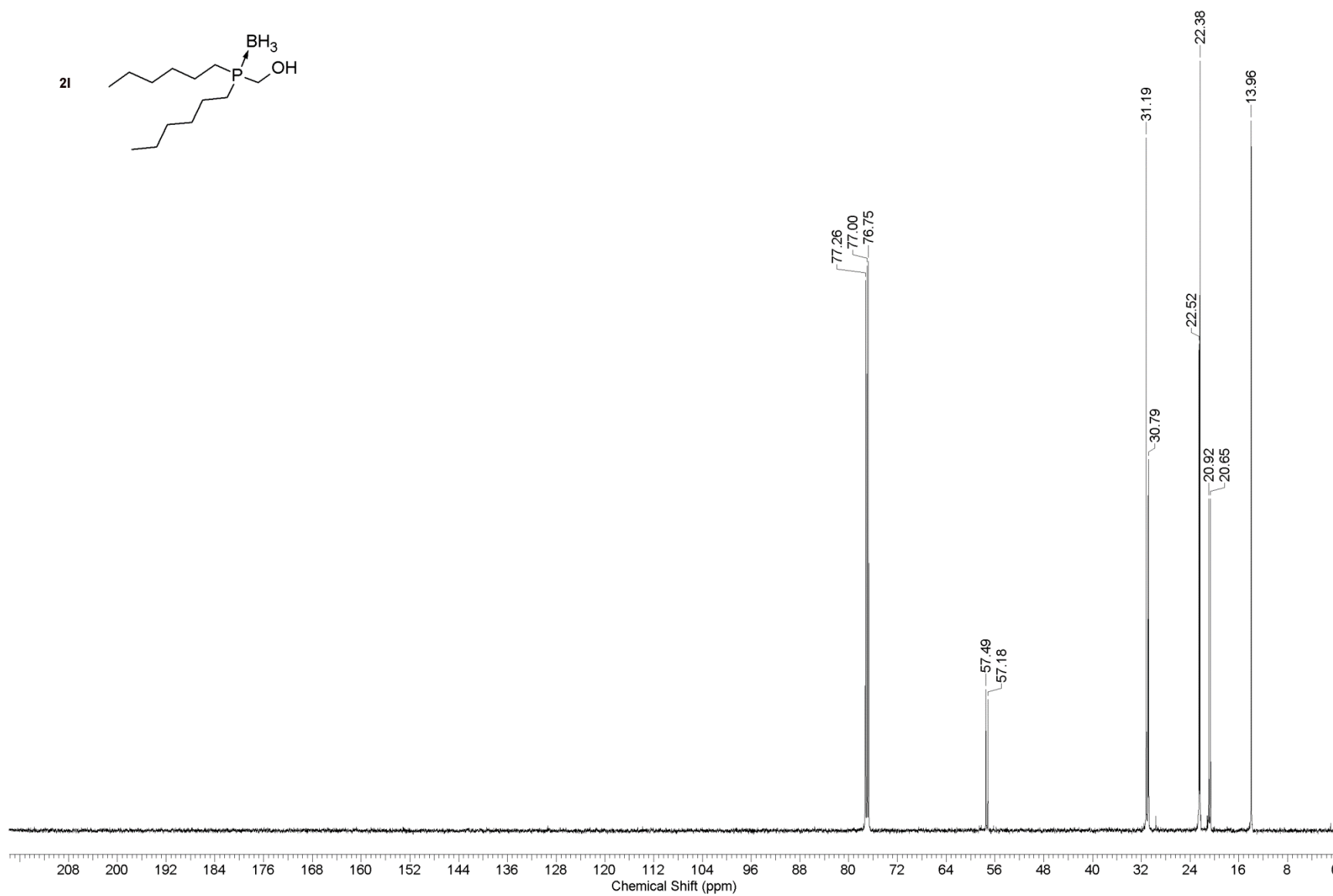
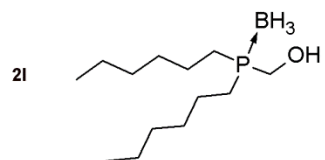
^{13}C NMR spectrum of di-*c*-hexyl(hydroxymethyl)phosphine-borane (**2k**) (125 MHz, CDCl_3)



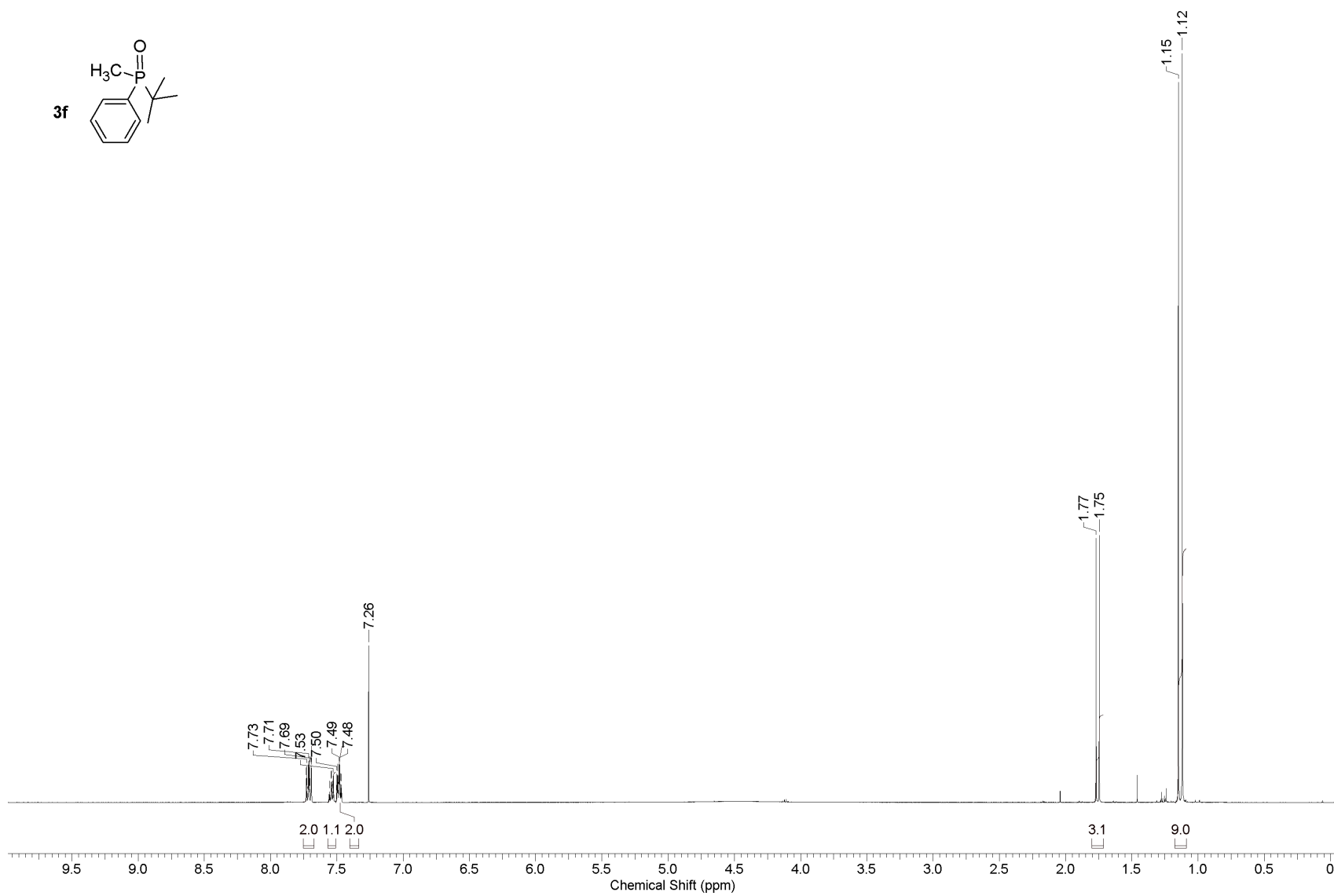
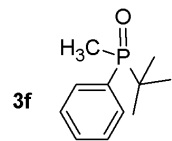
¹H NMR spectrum of di-*n*-hexyl(hydroxymethyl)phosphine-borane (**2l**) (500 MHz, CDCl₃)



^{31}P NMR spectrum of di-*n*-hexyl(hydroxymethyl)phosphine-borane (**21**) (202 MHz, CDCl_3)

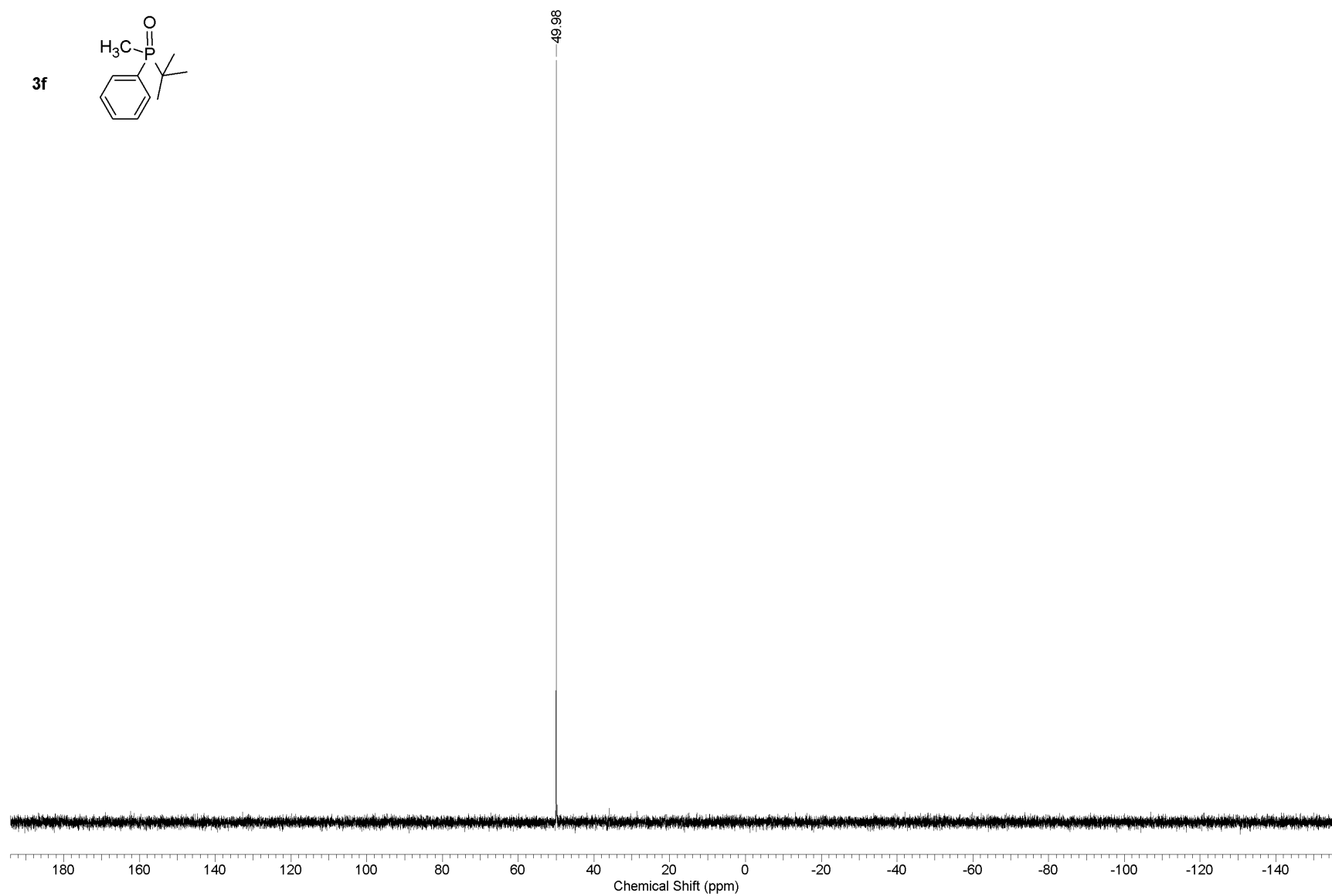
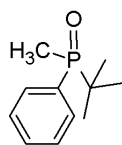


¹³C NMR spectrum of di-*n*-hexyl(hydroxymethyl)phosphine-borane (**2I**) (125 MHz, CDCl₃)

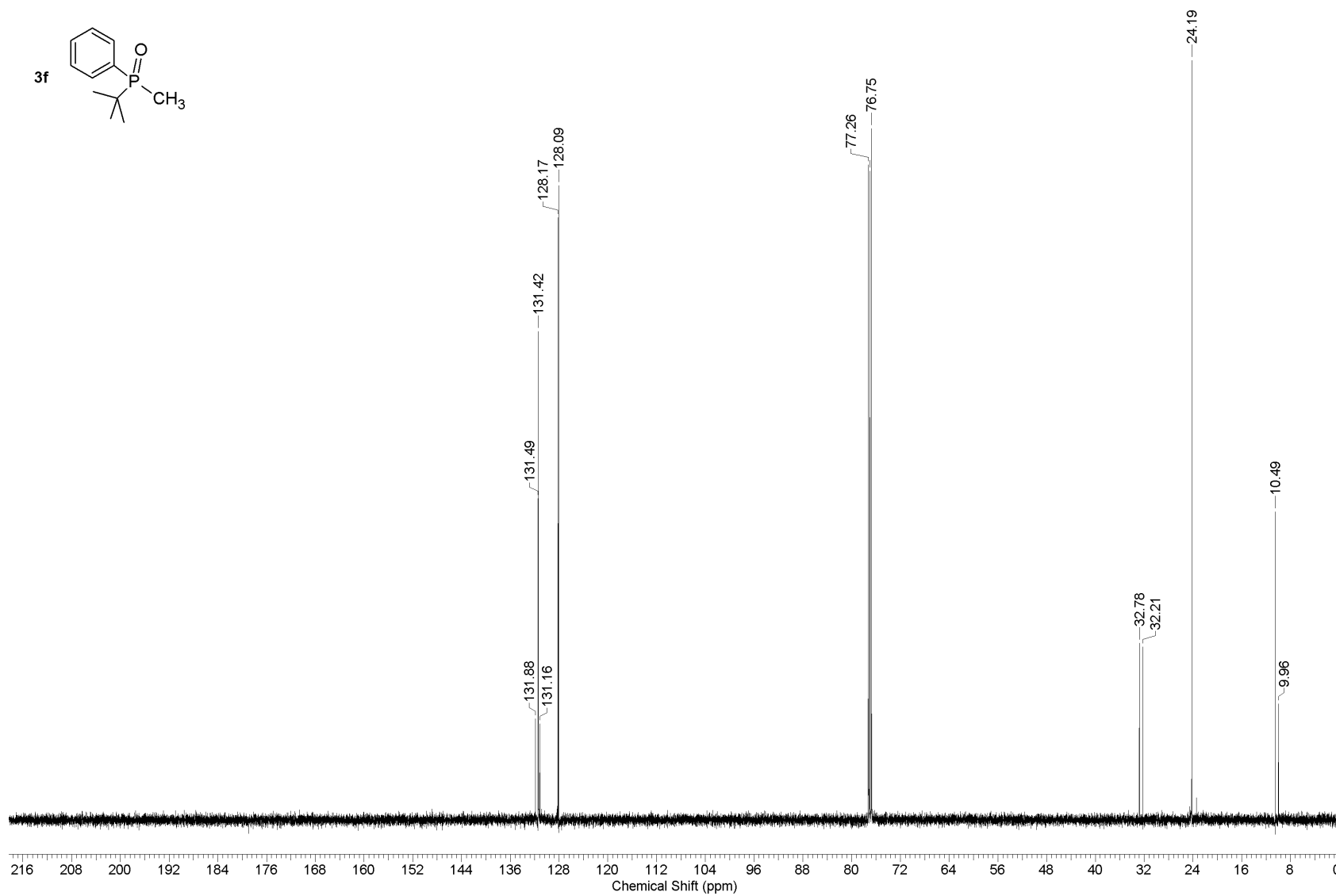
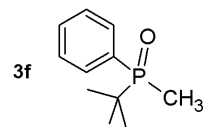


^1H NMR spectrum of *t*-butyl(methyl)phenylphosphine oxide (**3f**) (500 MHz, CDCl_3)

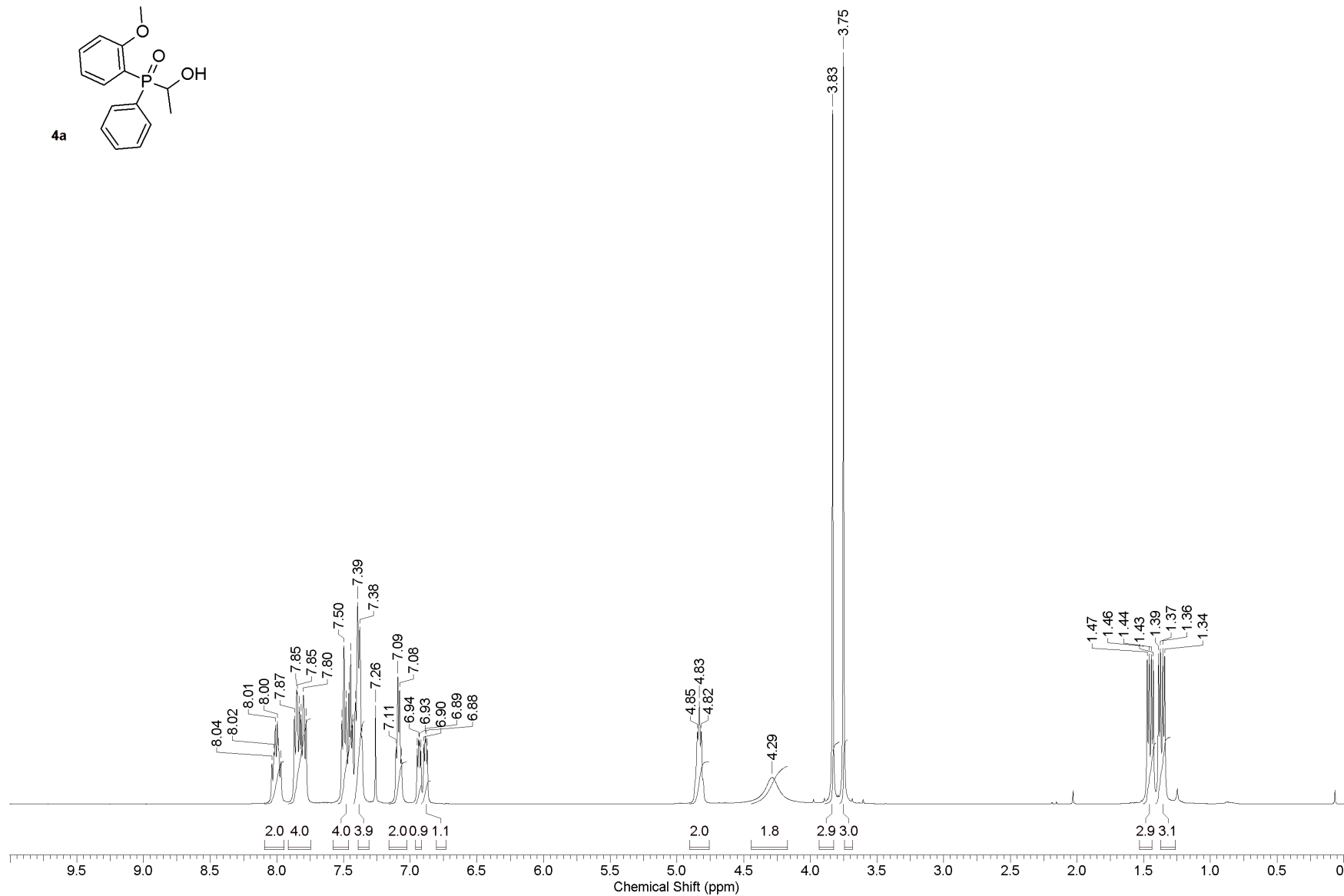
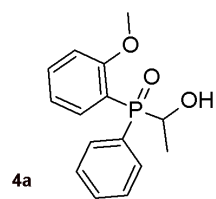
3f



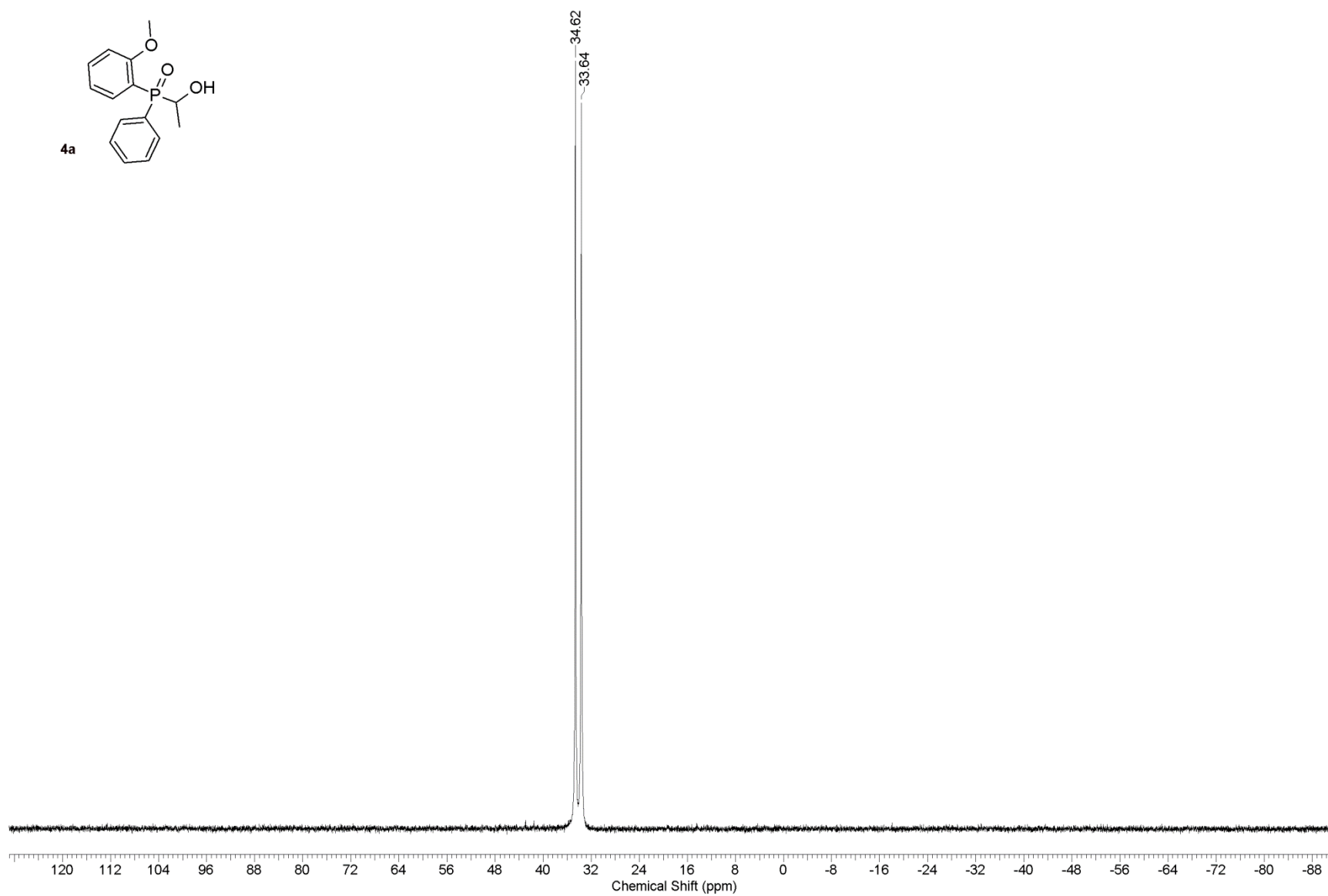
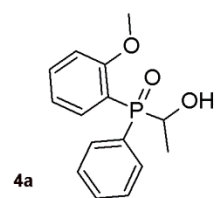
^{31}P NMR spectrum of *t*-butyl(methyl)phenylphosphine oxide (**3f**) (202 MHz, CDCl_3)



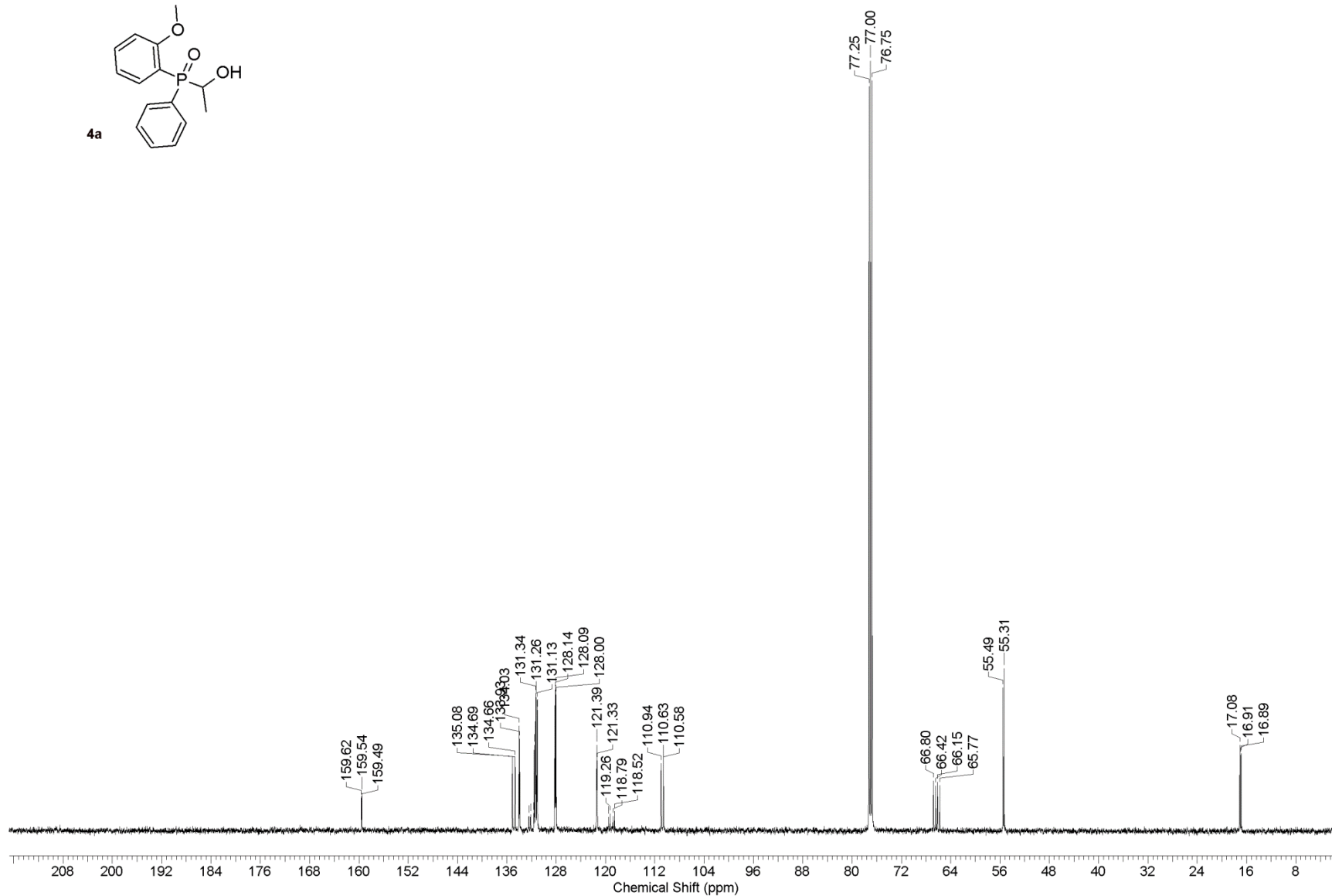
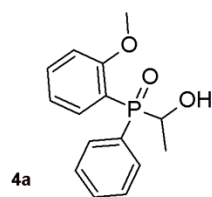
^{13}C NMR spectrum of *t*-butyl(methyl)phenylphosphine oxide (**3f**) (125 MHz, CDCl_3)



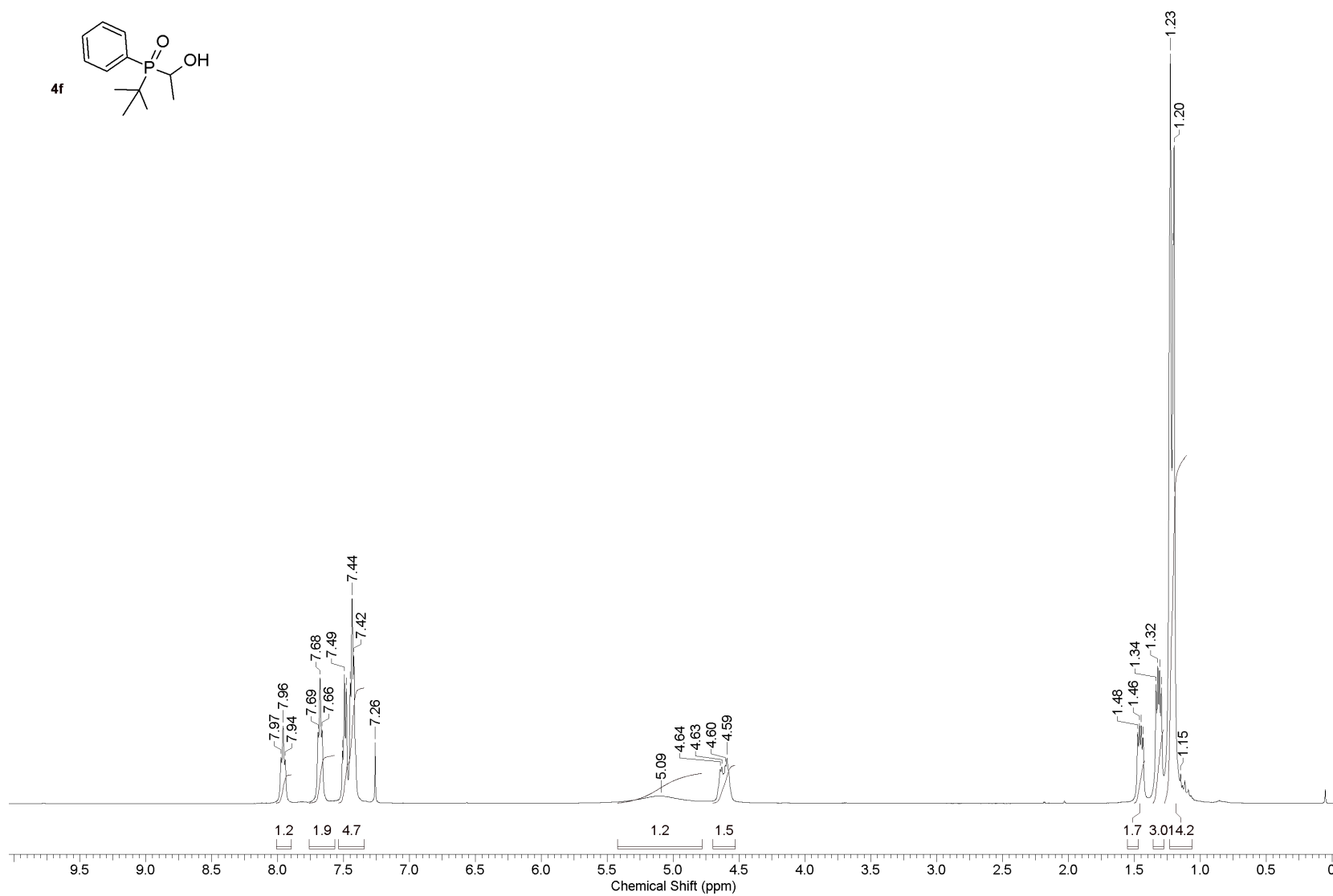
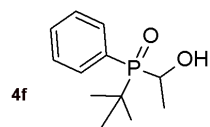
^1H NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine oxide (**4a**) (500 MHz, CDCl_3)



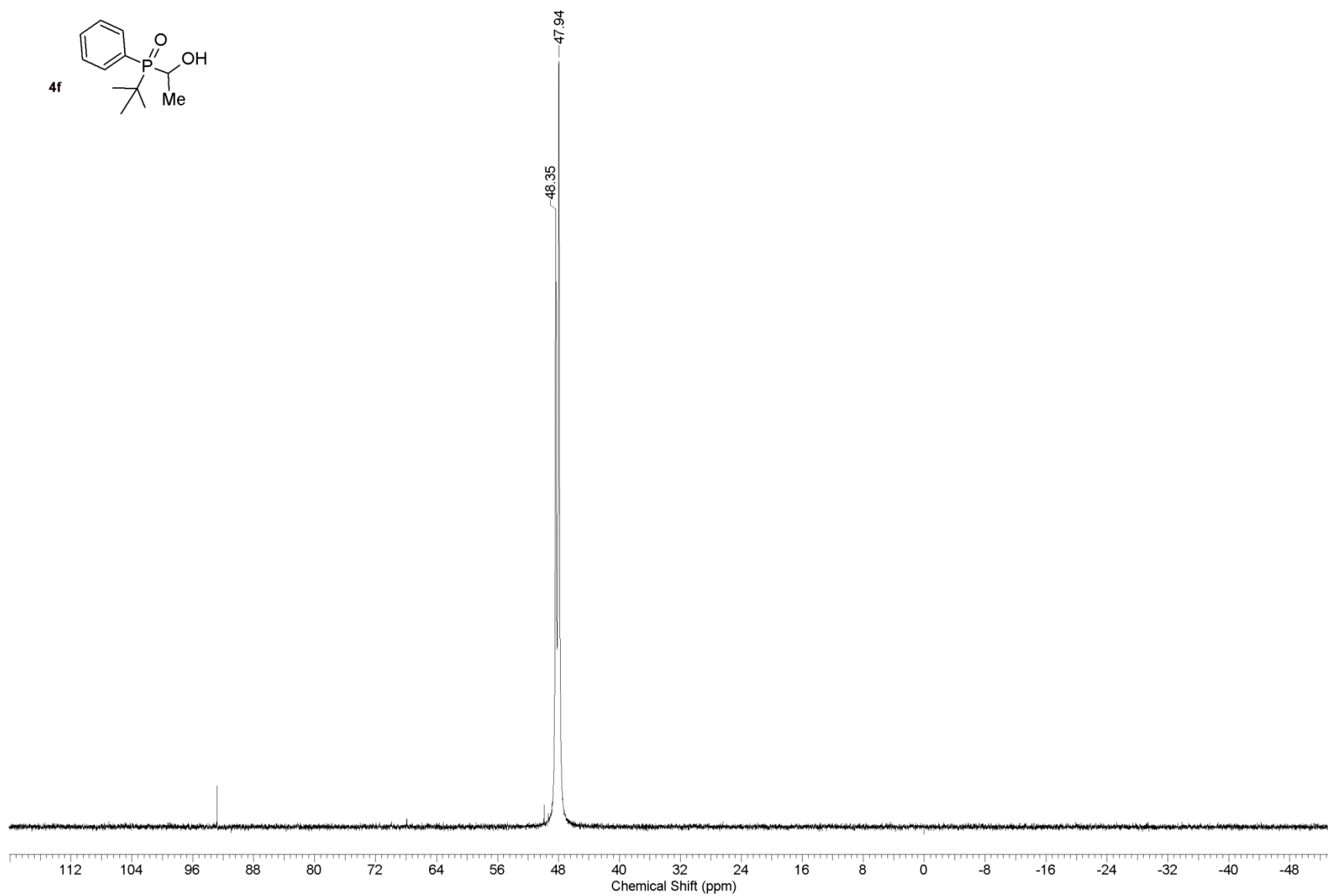
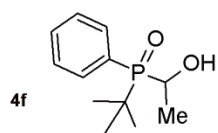
^{31}P NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine oxide (**4a**) (202 MHz, CDCl_3)



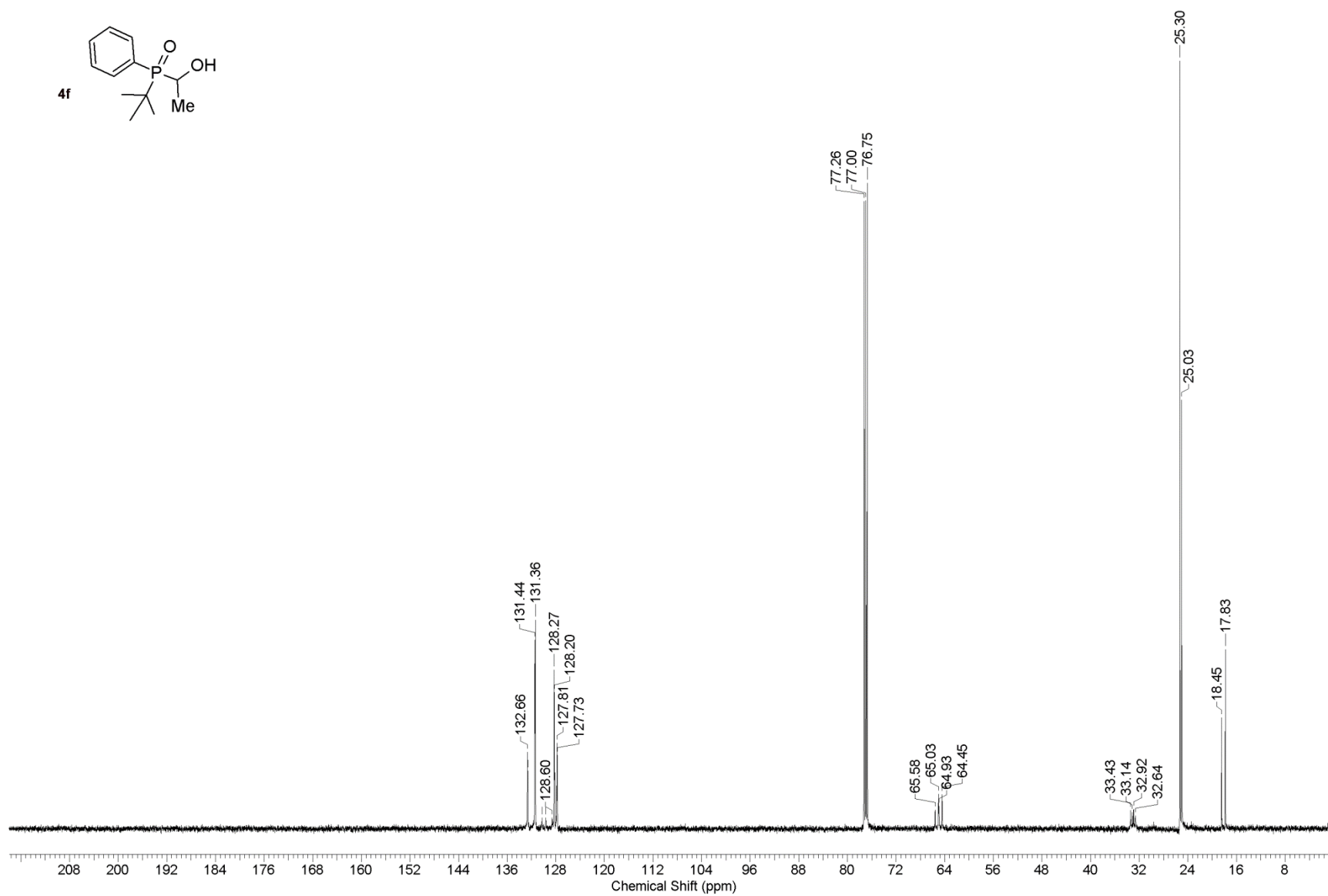
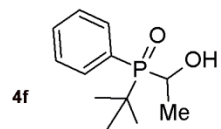
^{13}C NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine oxide (**4a**) (125 MHz, CDCl_3)



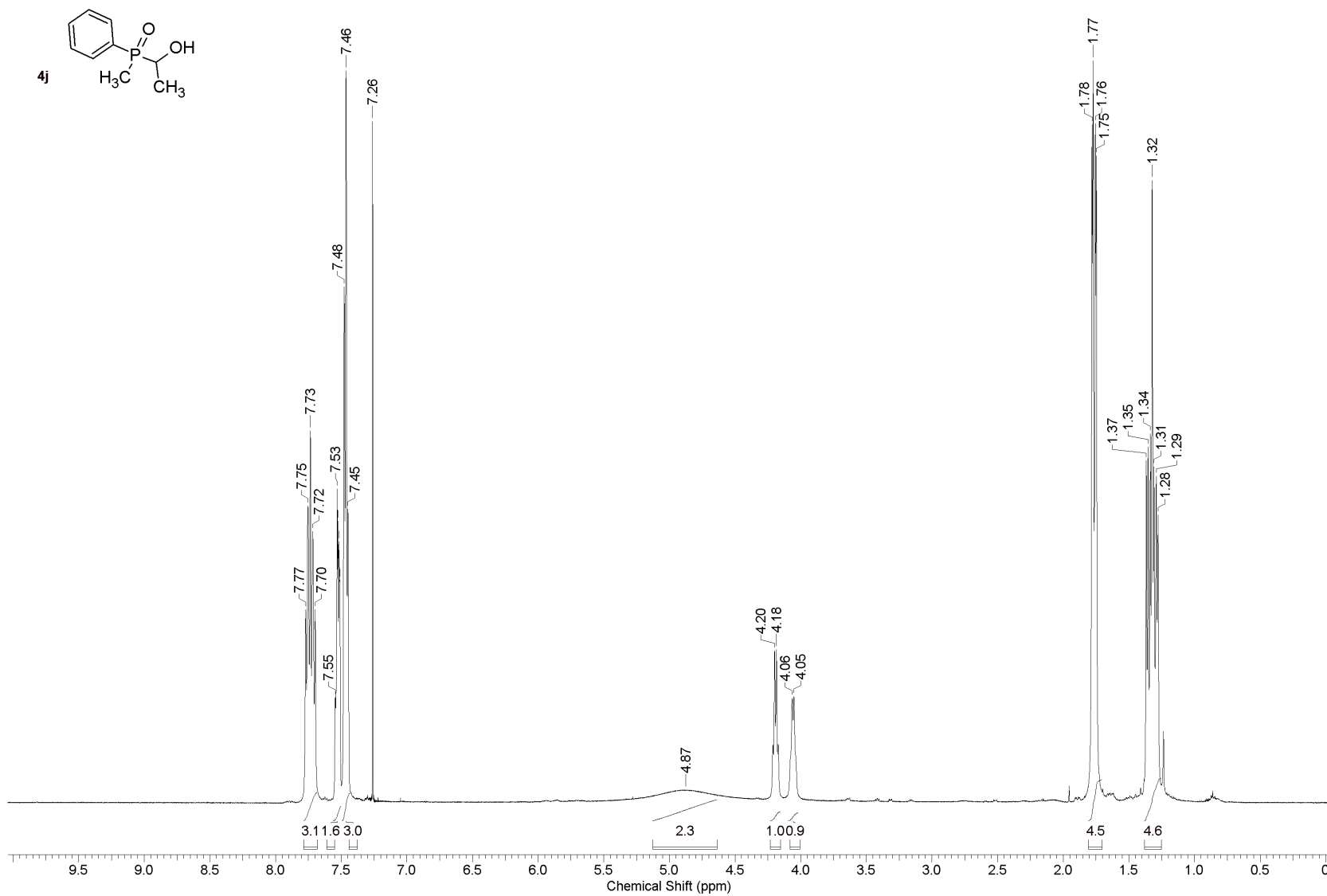
^1H NMR spectrum of *t*-butyl(1-hydroxyethyl)phenylphosphine oxide (**4f**) (500 MHz, CDCl_3)



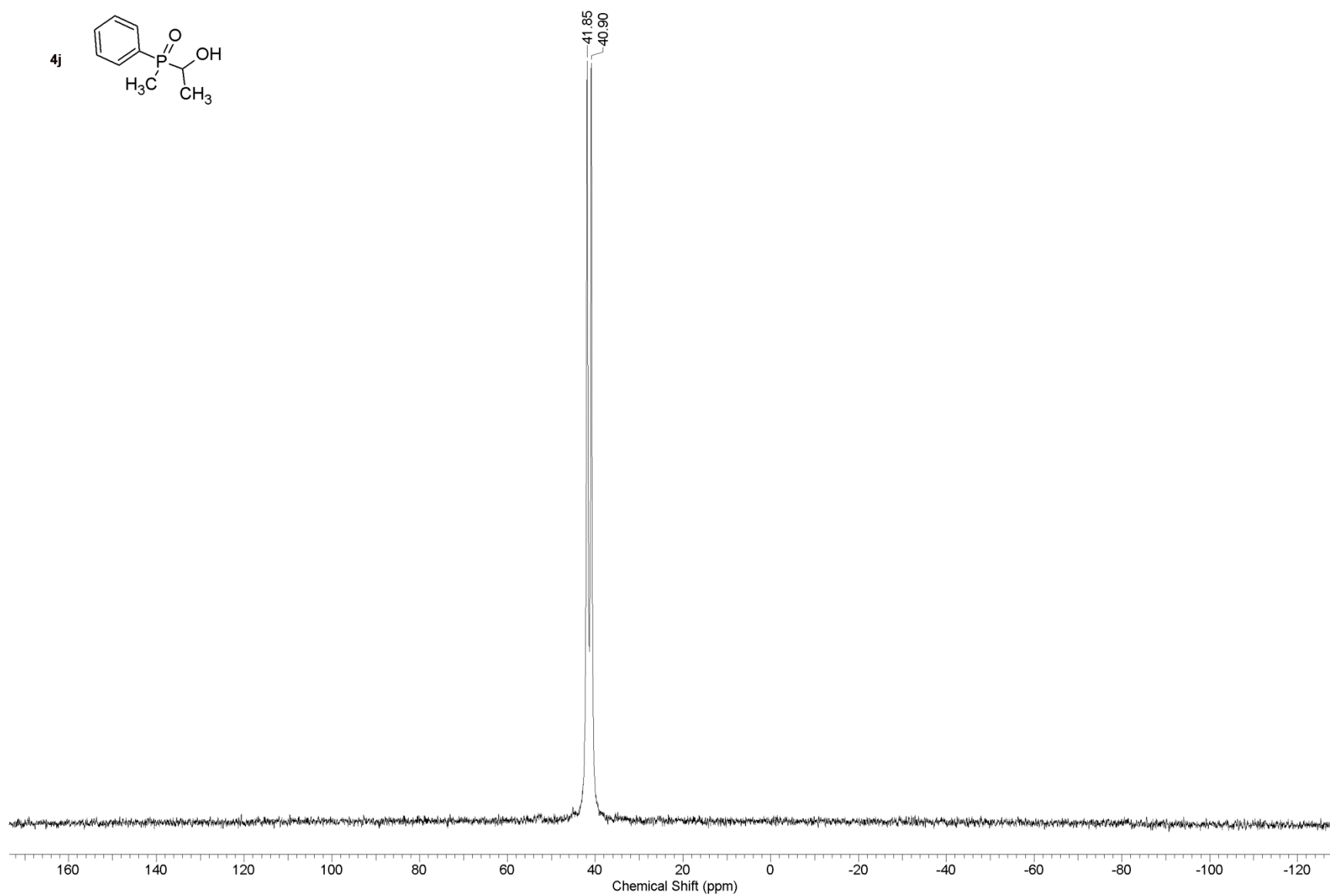
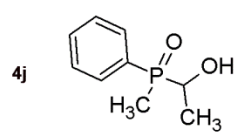
^{31}P NMR spectrum of *t*-butyl(1-hydroxyethyl)phenylphosphine oxide (**4f**) (202 MHz, CDCl_3)



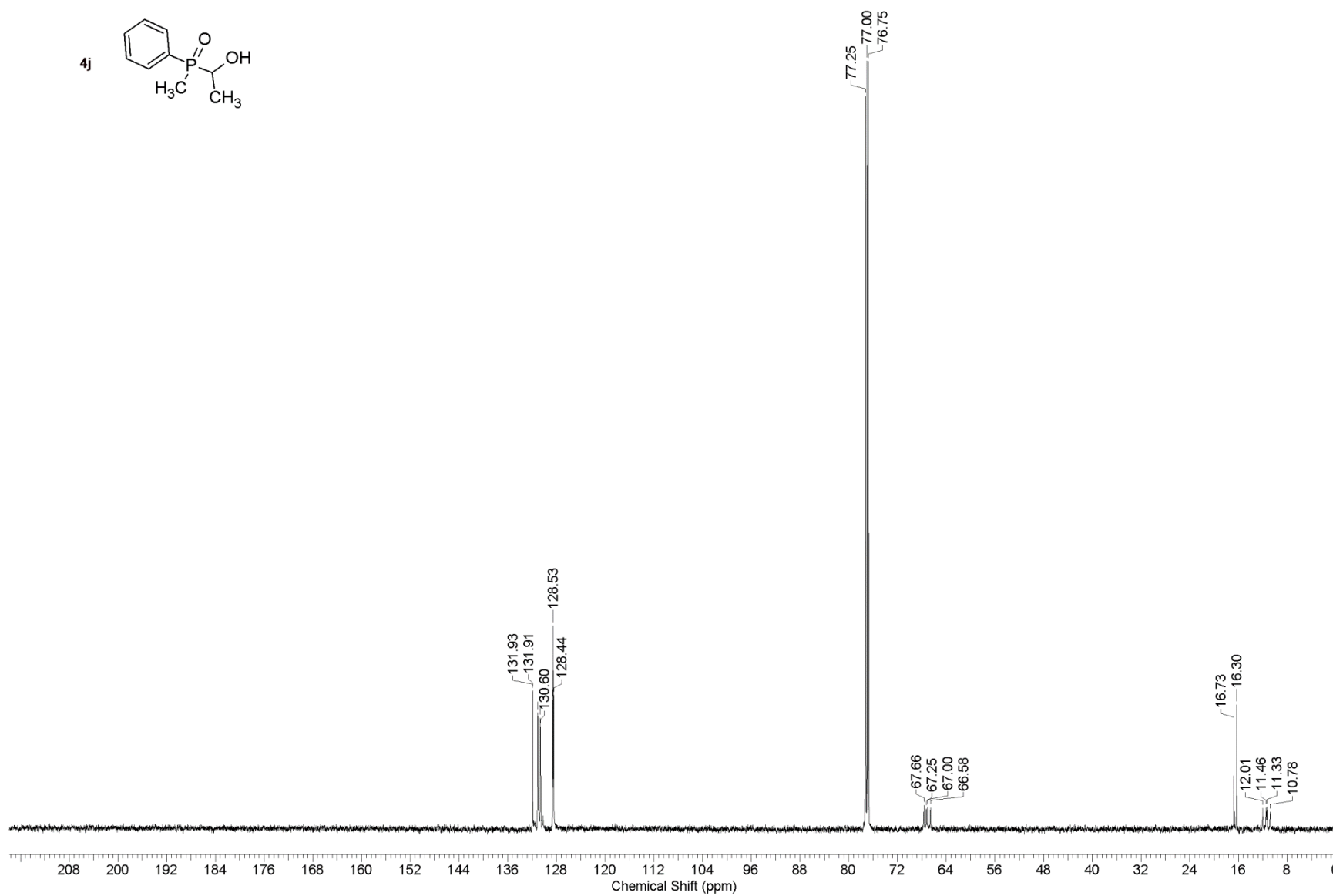
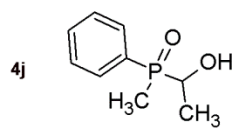
^{13}C NMR spectrum of *t*-butyl(1-hydroxyethyl)phenylphosphine oxide (**4f**) (125 MHz, CDCl_3)



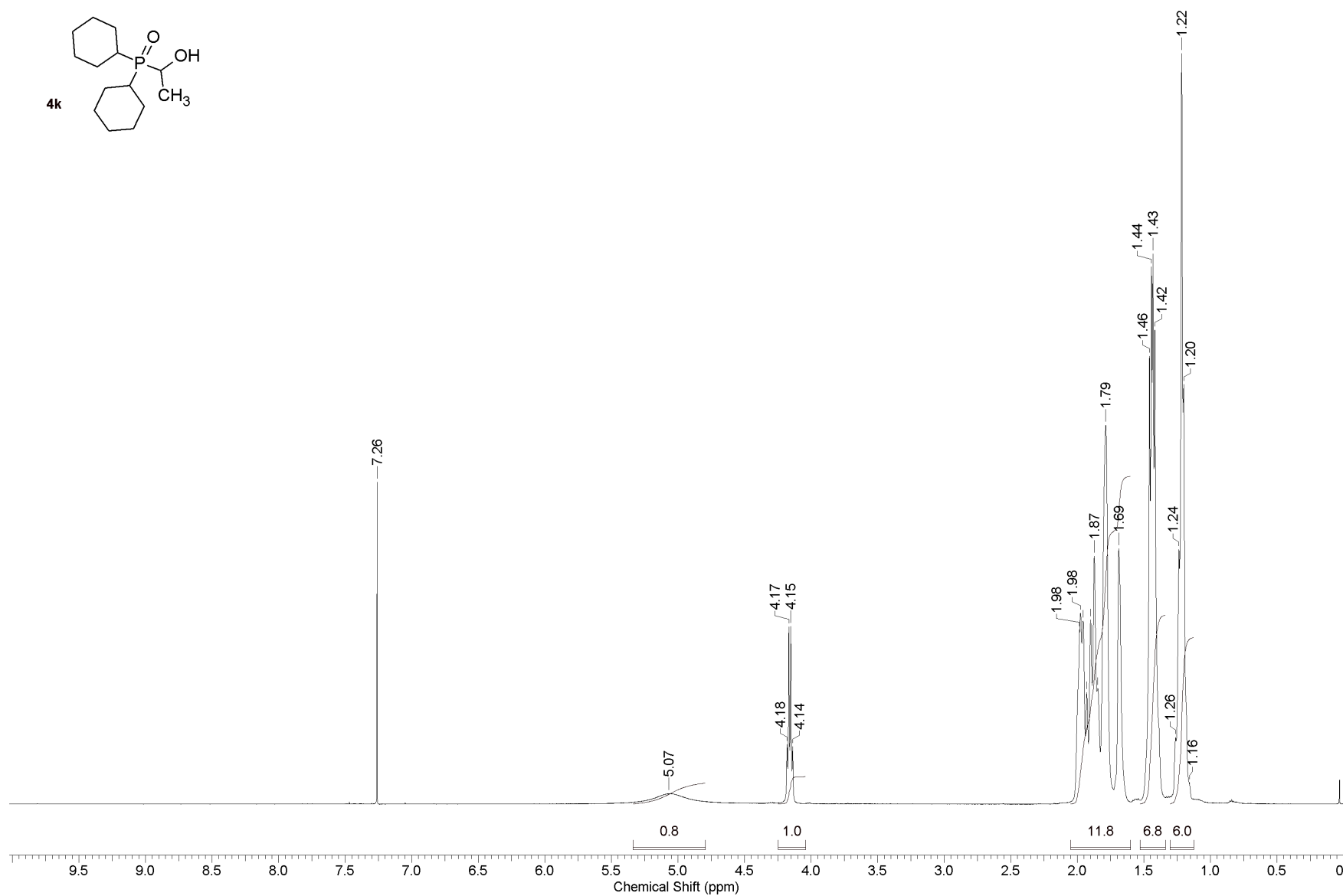
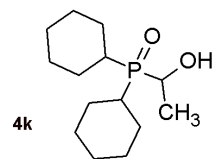
^1H NMR spectrum of (1-hydroxyethyl)(methyl)phenylphosphine oxide (**4j**) (500 MHz, CDCl_3)



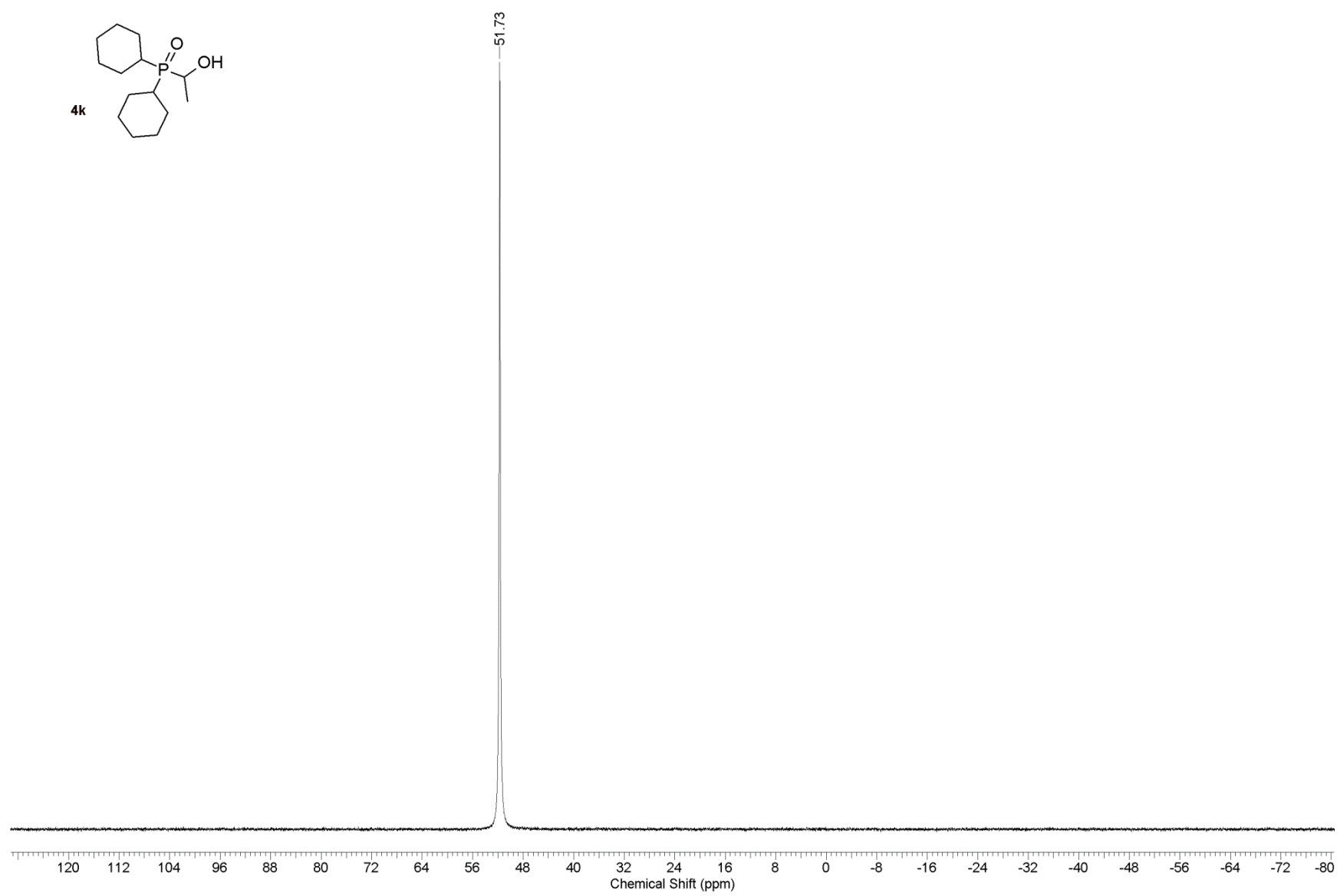
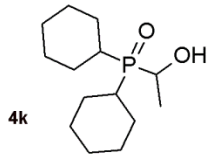
^{31}P NMR spectrum of (1-hydroxyethyl)(methyl)phenylphosphine oxide (**4j**) (202 MHz, CDCl_3)



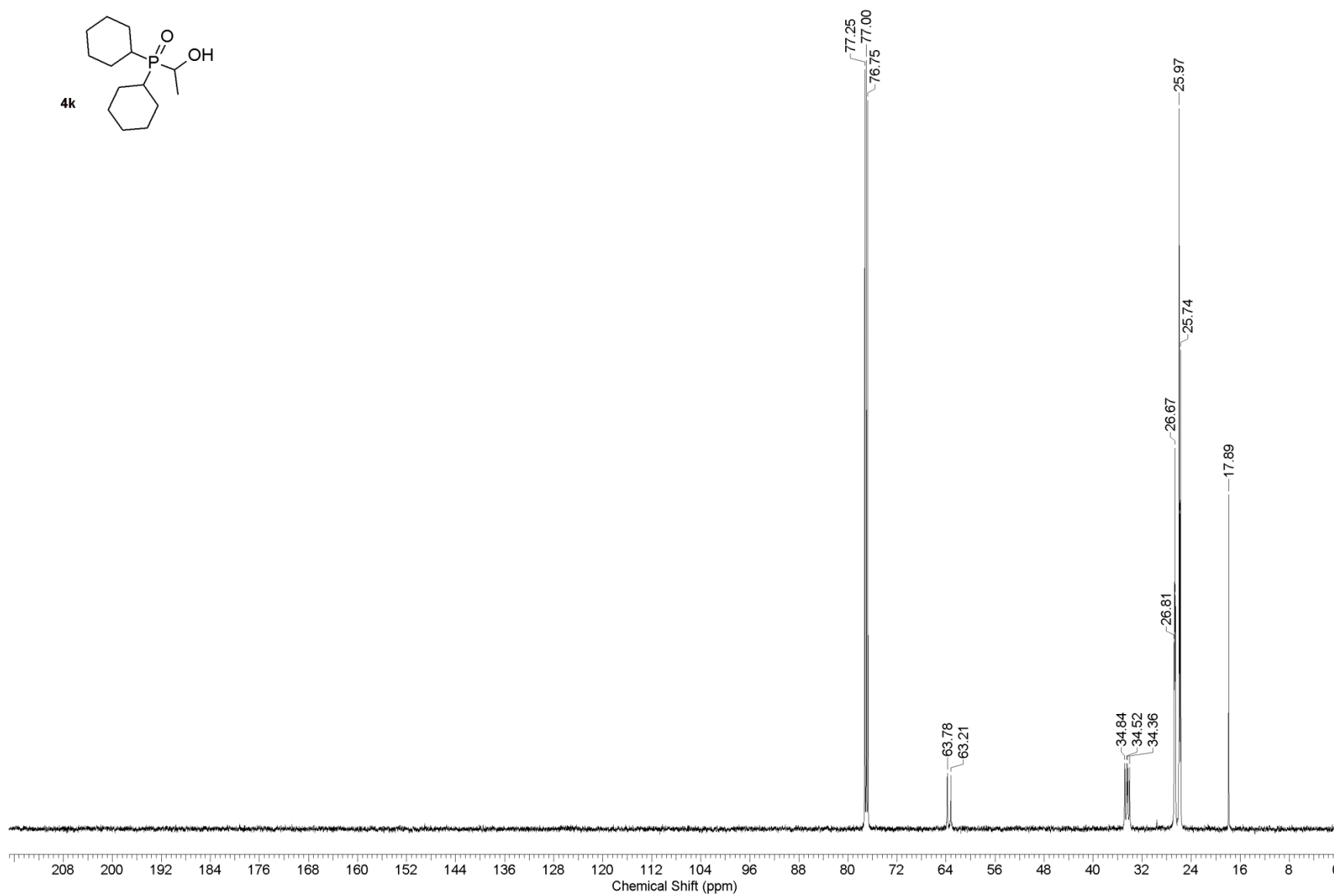
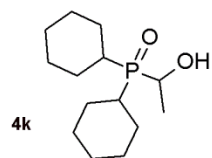
^{13}C NMR spectrum of (1-hydroxyethyl)(methyl)phenylphosphine oxide (**4j**) (125 MHz, CDCl_3)



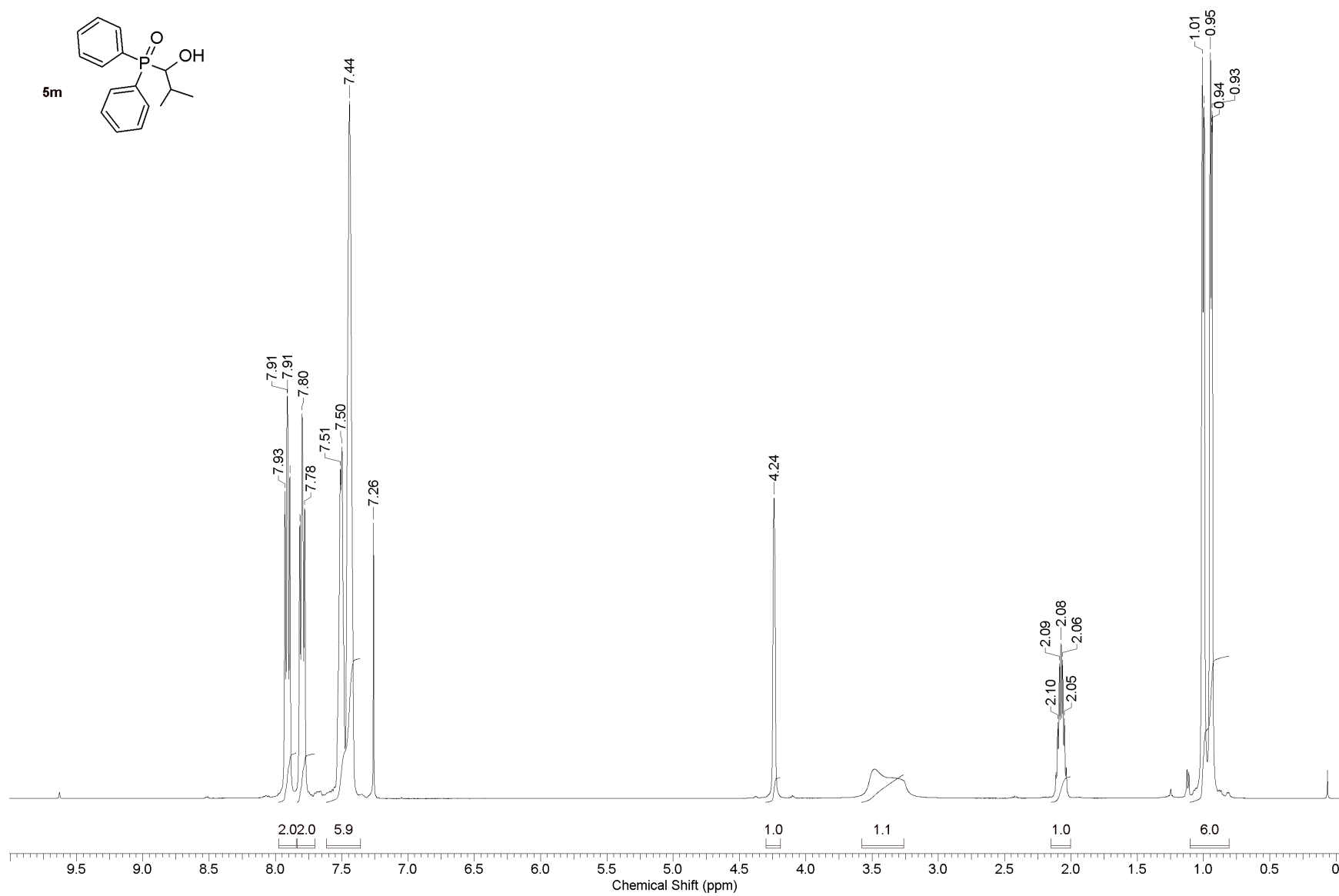
^1H NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine oxide (**4k**) (500 MHz, CDCl_3)



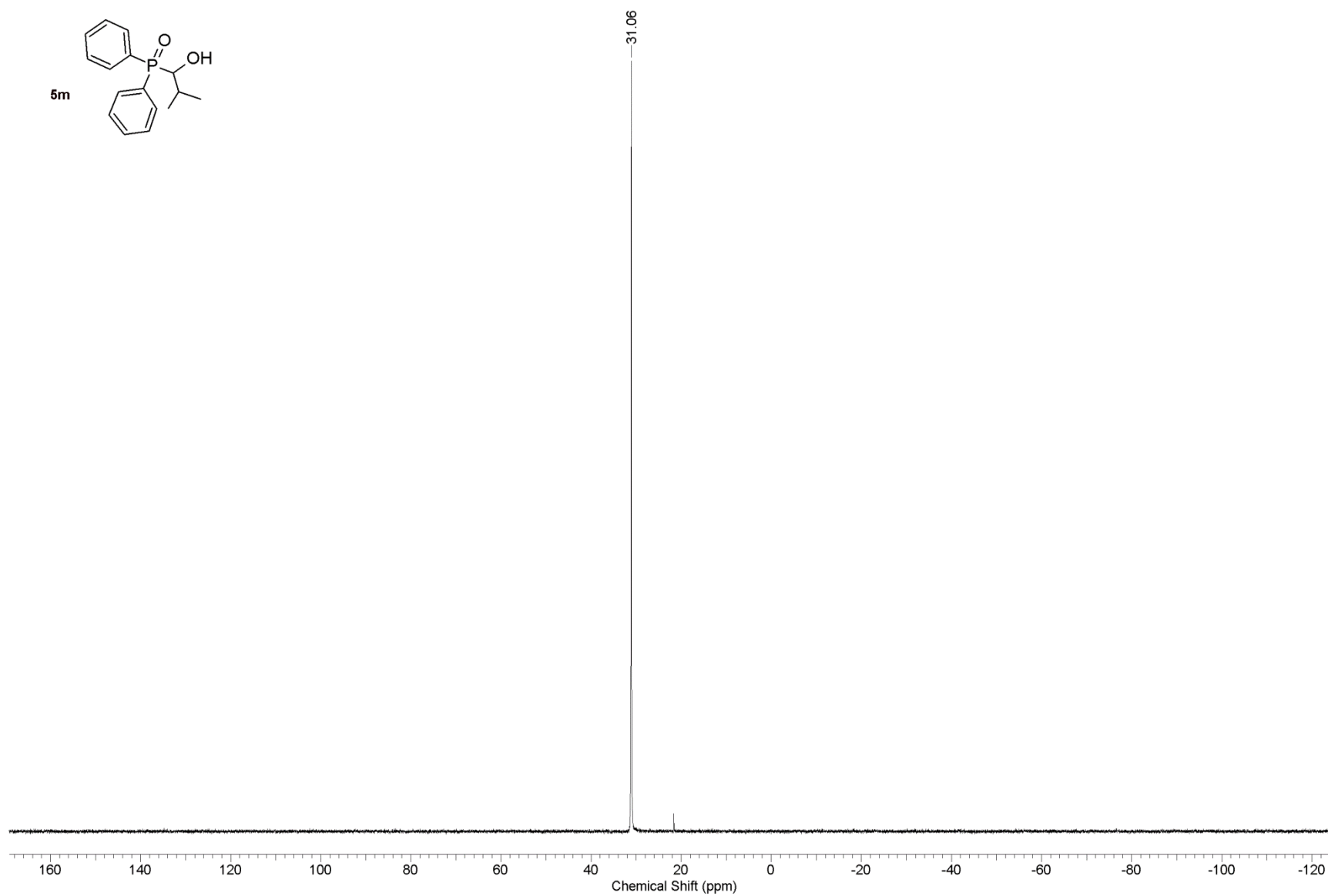
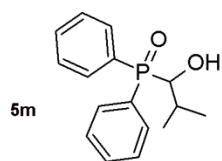
^{31}P NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine oxide(**4k**) (202 MHz, CDCl_3)



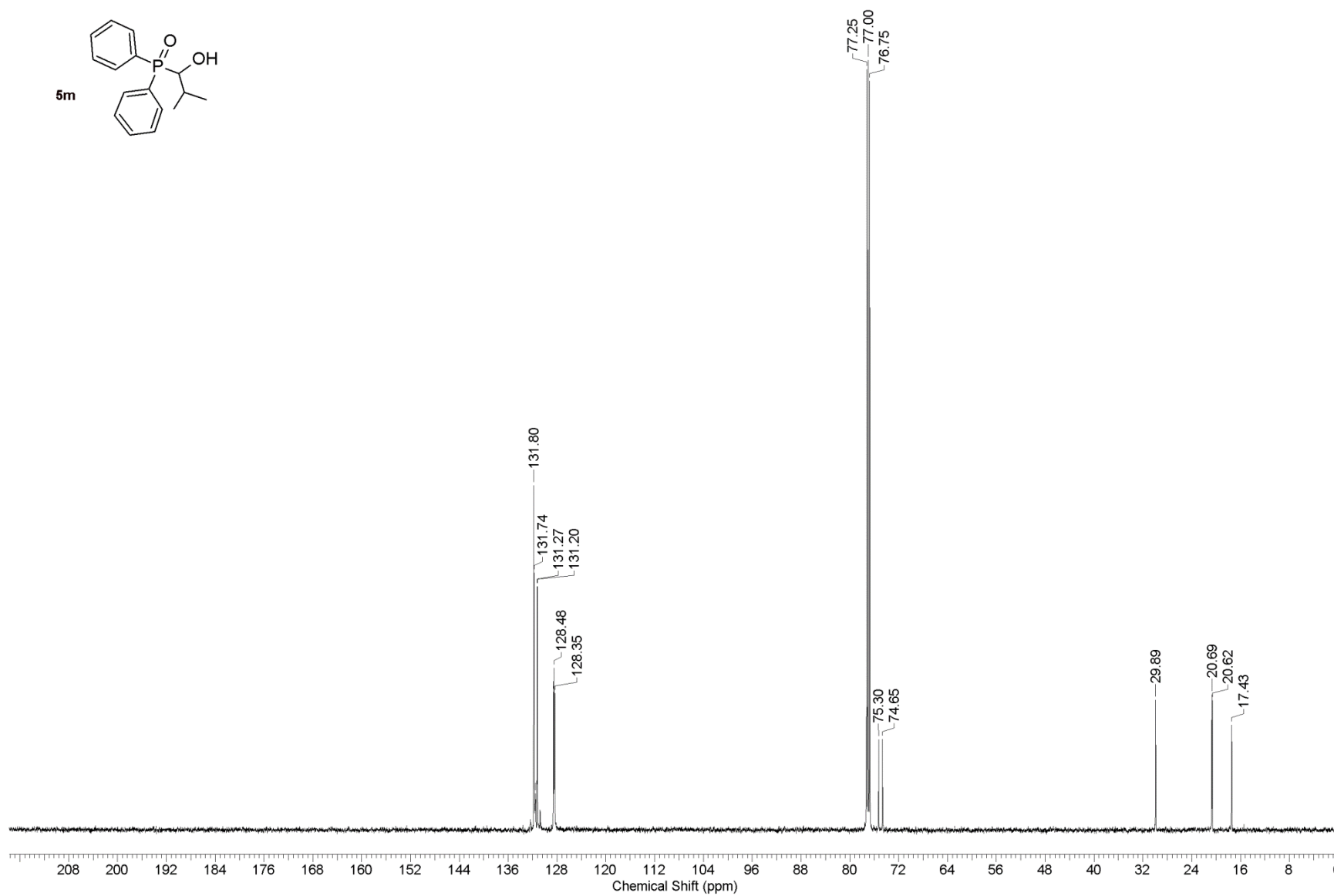
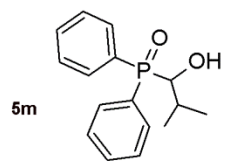
^{13}C NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine oxide (**4k**) (125 MHz, CDCl_3)



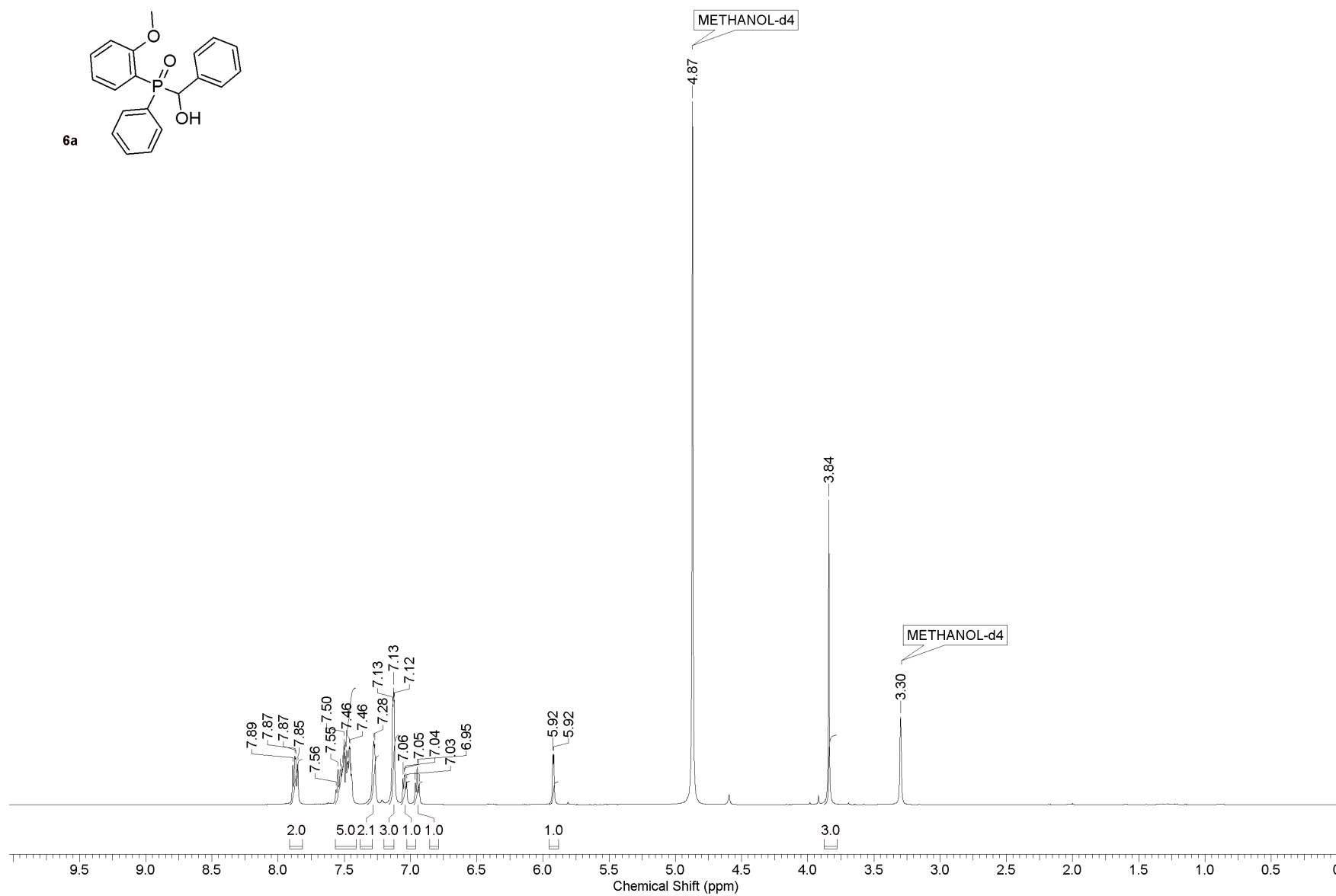
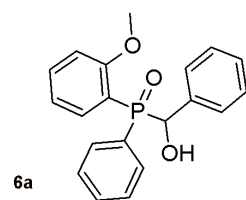
¹H NMR spectrum of (1-hydroxy-2-methylpropyl)diphenylphosphine oxide (**5m**) (500 MHz, CDCl₃)



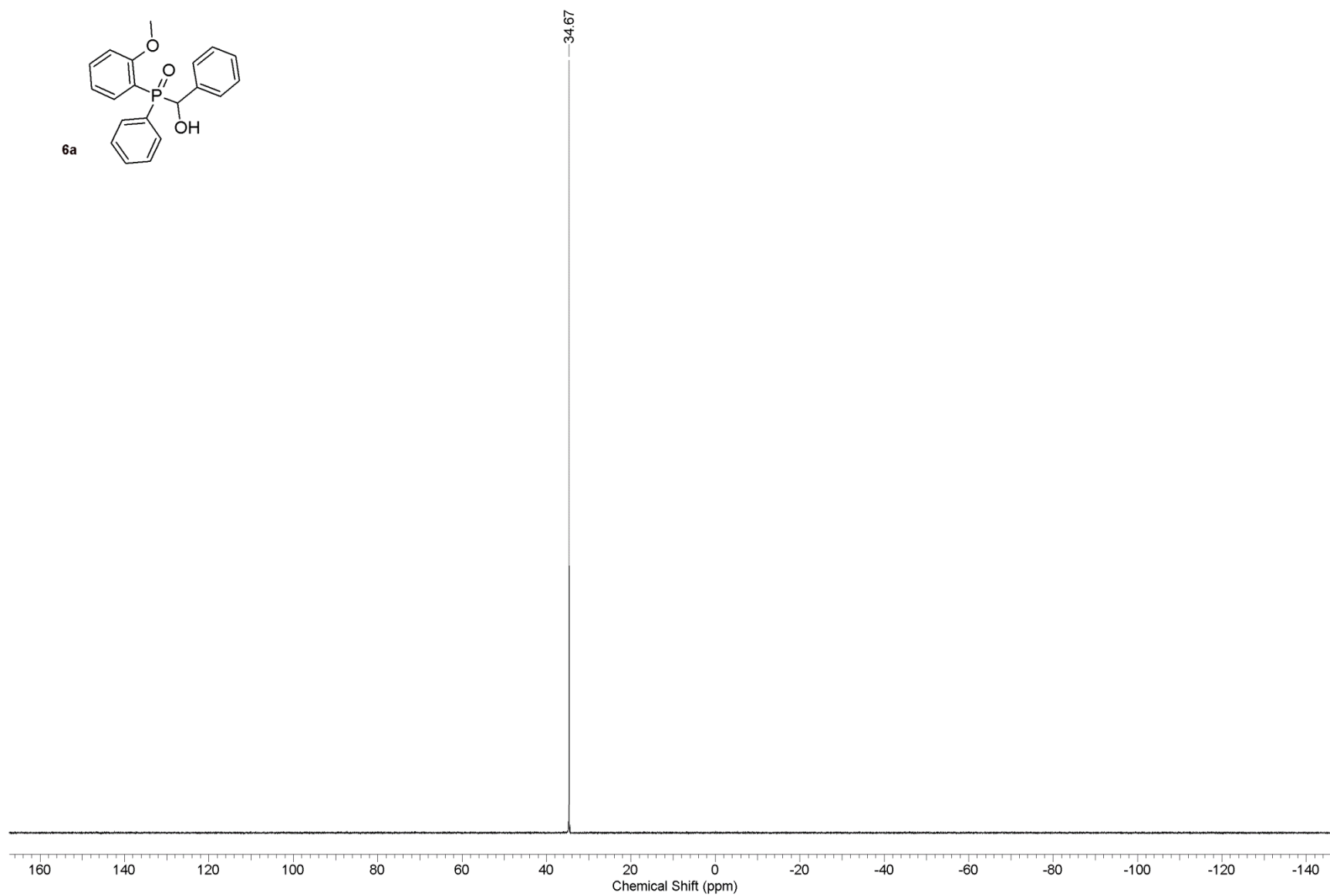
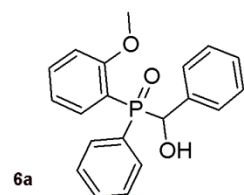
^{31}P NMR spectrum of (1-hydroxy-2-methylpropyl)diphenylphosphine oxide (**5m**) (202 MHz, CDCl_3)



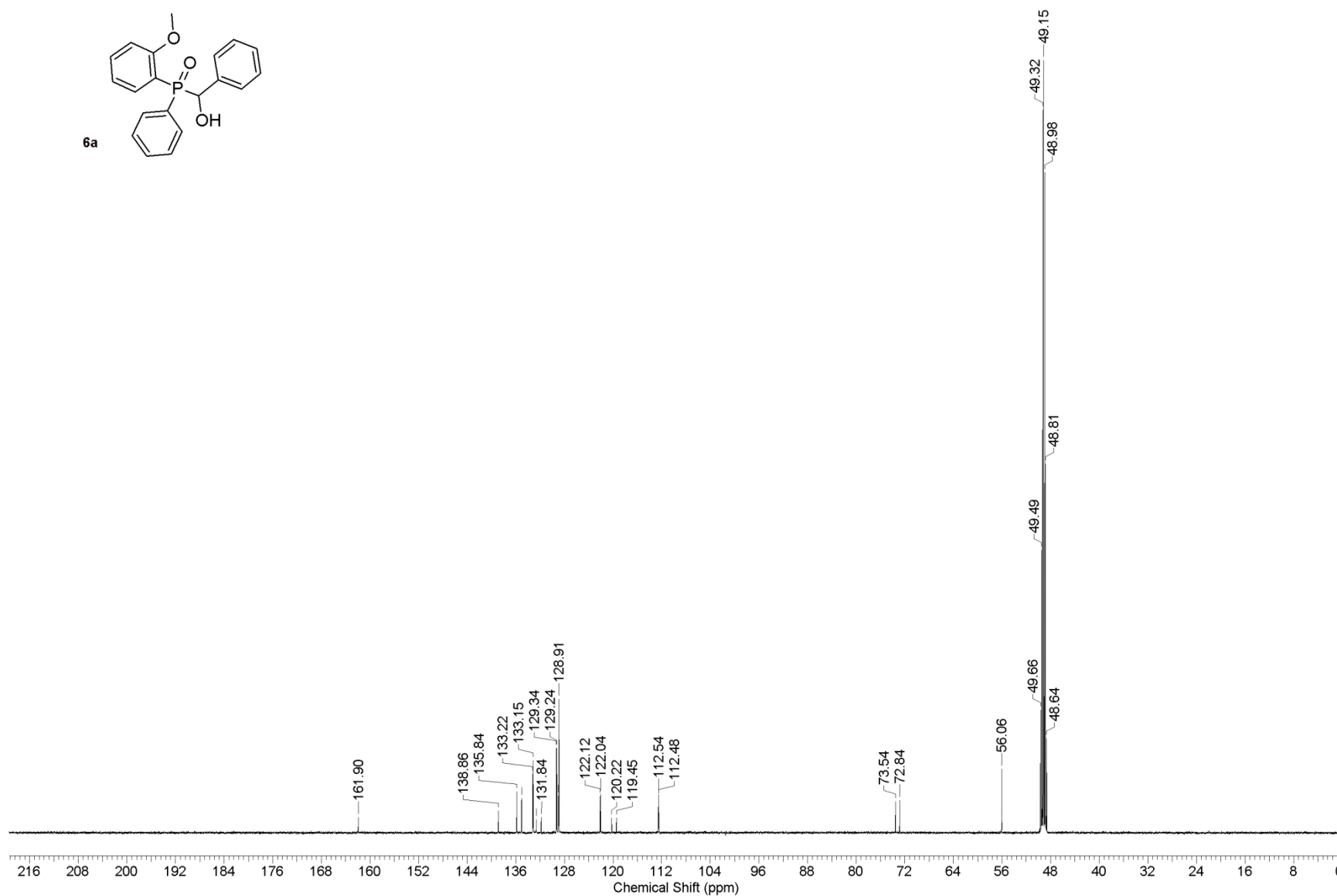
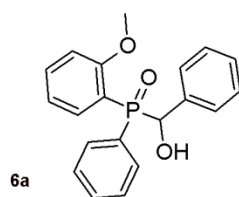
^{13}C NMR spectrum of (1-hydroxy-2-methylpropyl)diphenylphosphine oxide (**5m**) (125 MHz, CDCl_3)



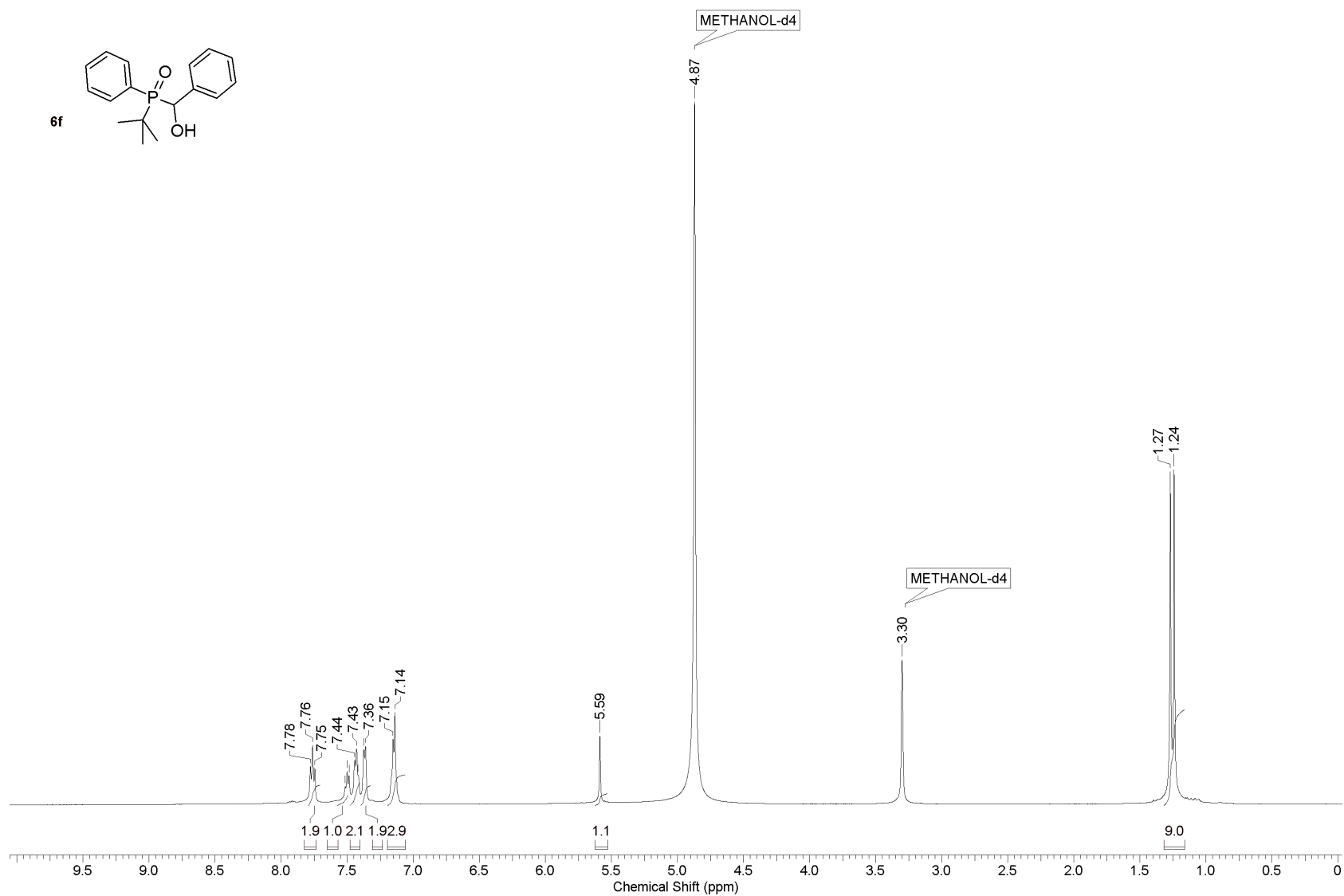
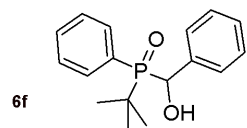
^1H NMR spectrum of *o*-anisyl((1-hydroxy)phenylmethyl)phenylphosphine oxide (**6a**) (500 MHz, CD_3OD)



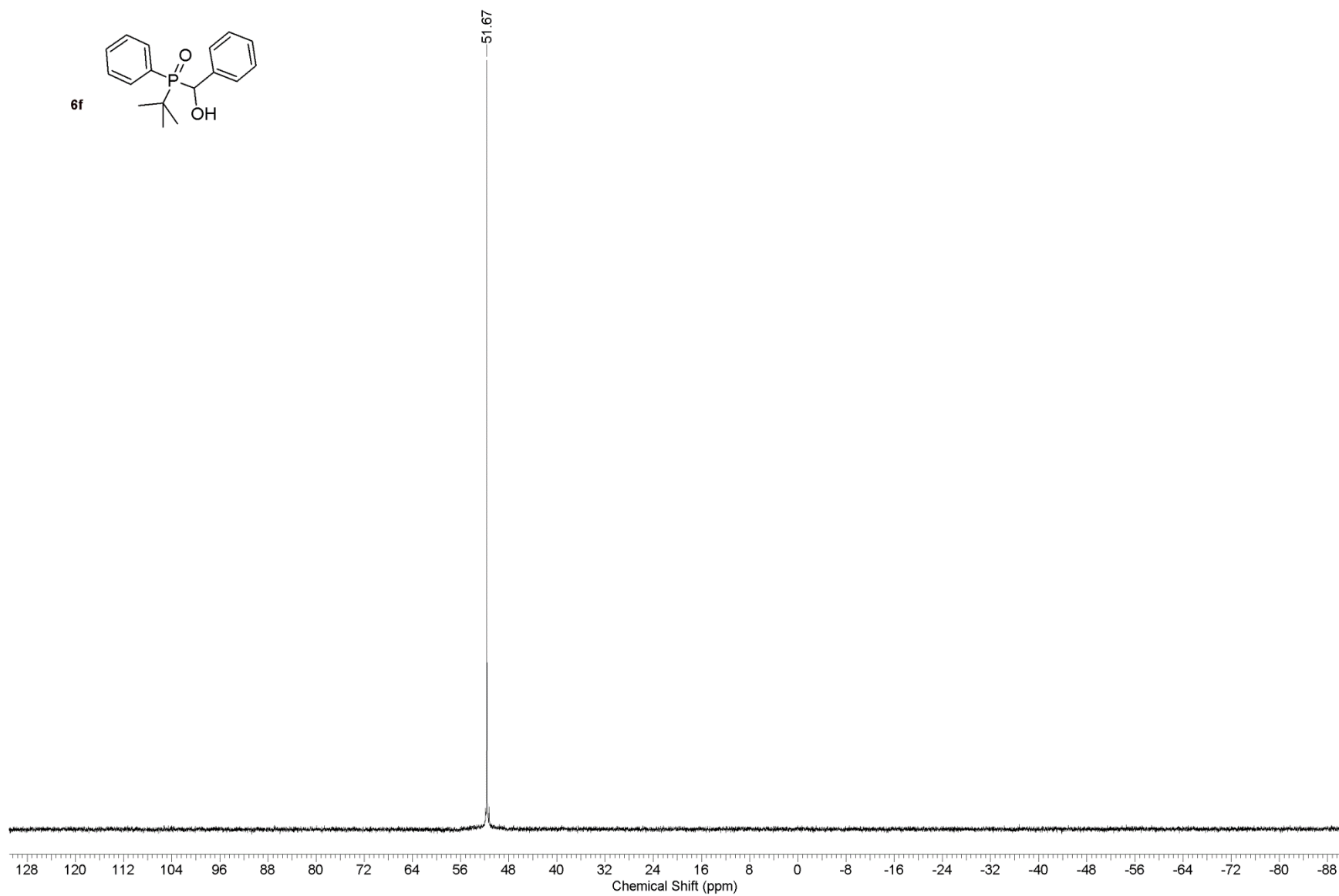
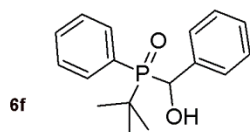
^{31}P NMR spectrum of *o*-anisyl((1-hydroxy)phenylmethyl)phenylphosphine oxide (**6a**) (202 MHz, CD_3OD)



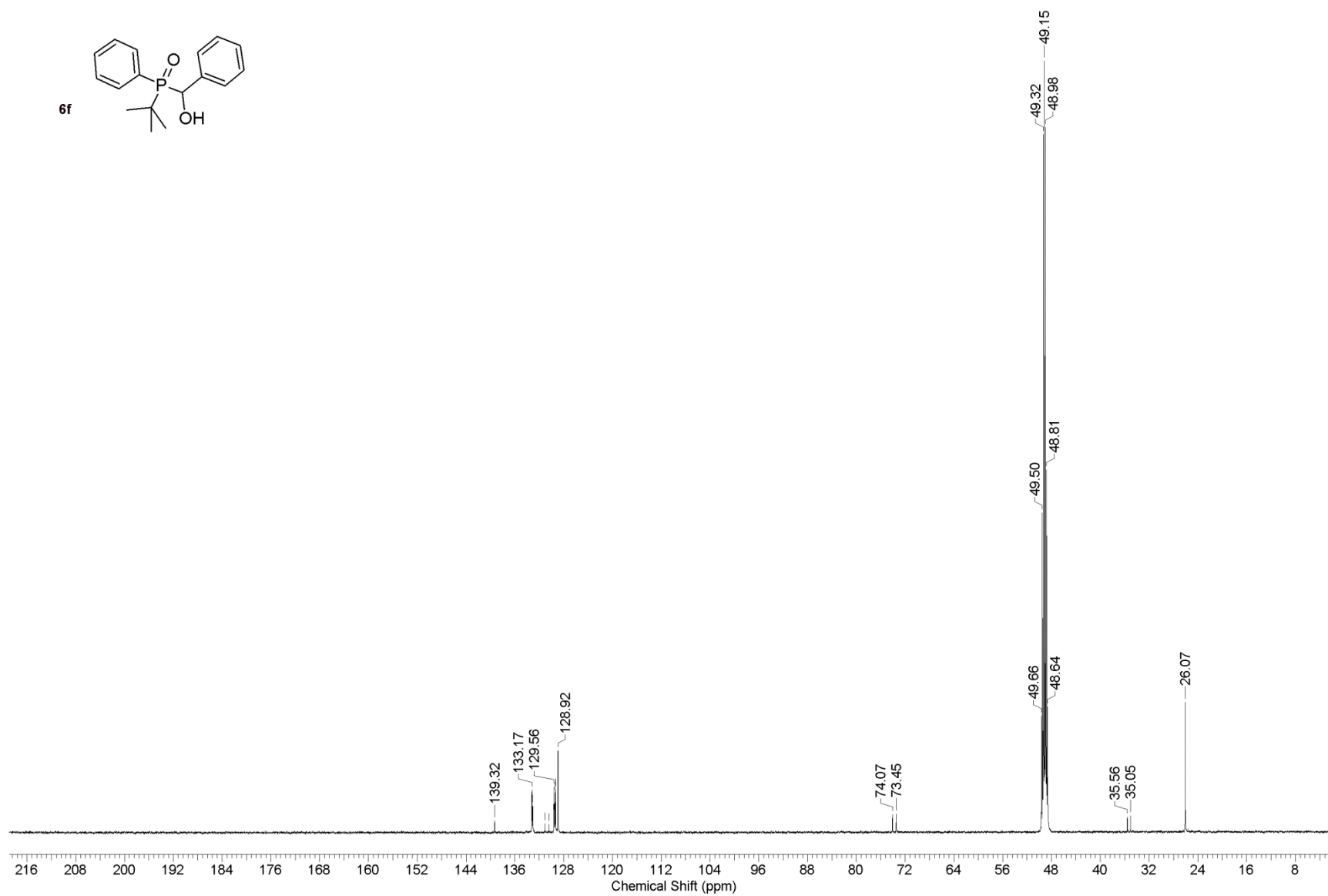
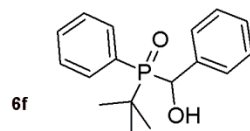
^{13}C NMR spectrum of *o*-anisyl((1-hydroxy)phenylmethyl)phenylphosphine oxide (**6a**) (125 MHz, CD_3OD)



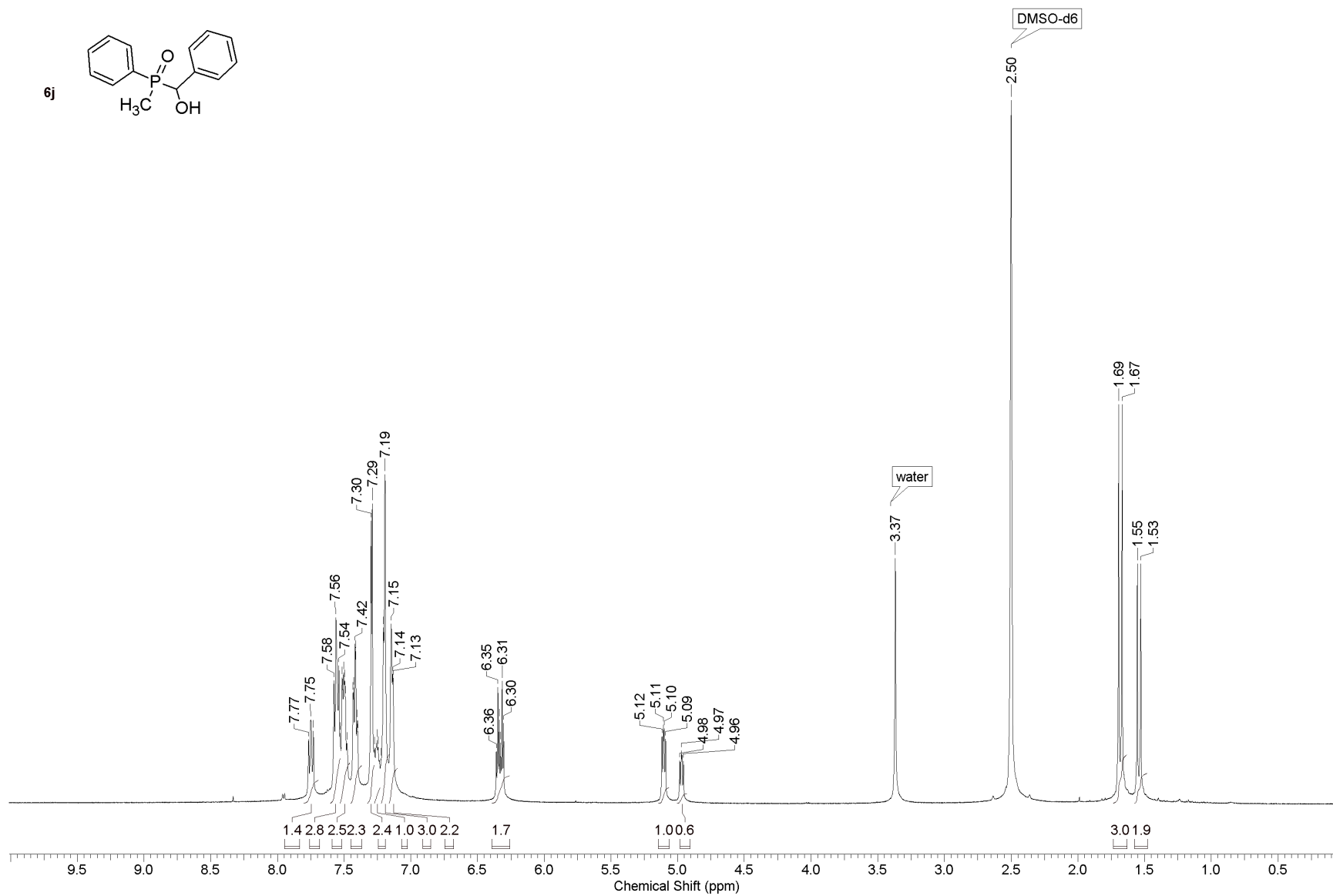
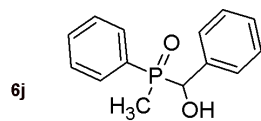
^1H NMR spectrum of *t*-butyl((1-hydroxy)phenylmethyl)phenylphosphine oxide (**6f**) (500 MHz, CD_3OD)



^{31}P NMR spectrum of *t*-butyl((1-hydroxy)phenylmethyl)phenylphosphine oxide (**6f**) (202 MHz, CD_3OD)

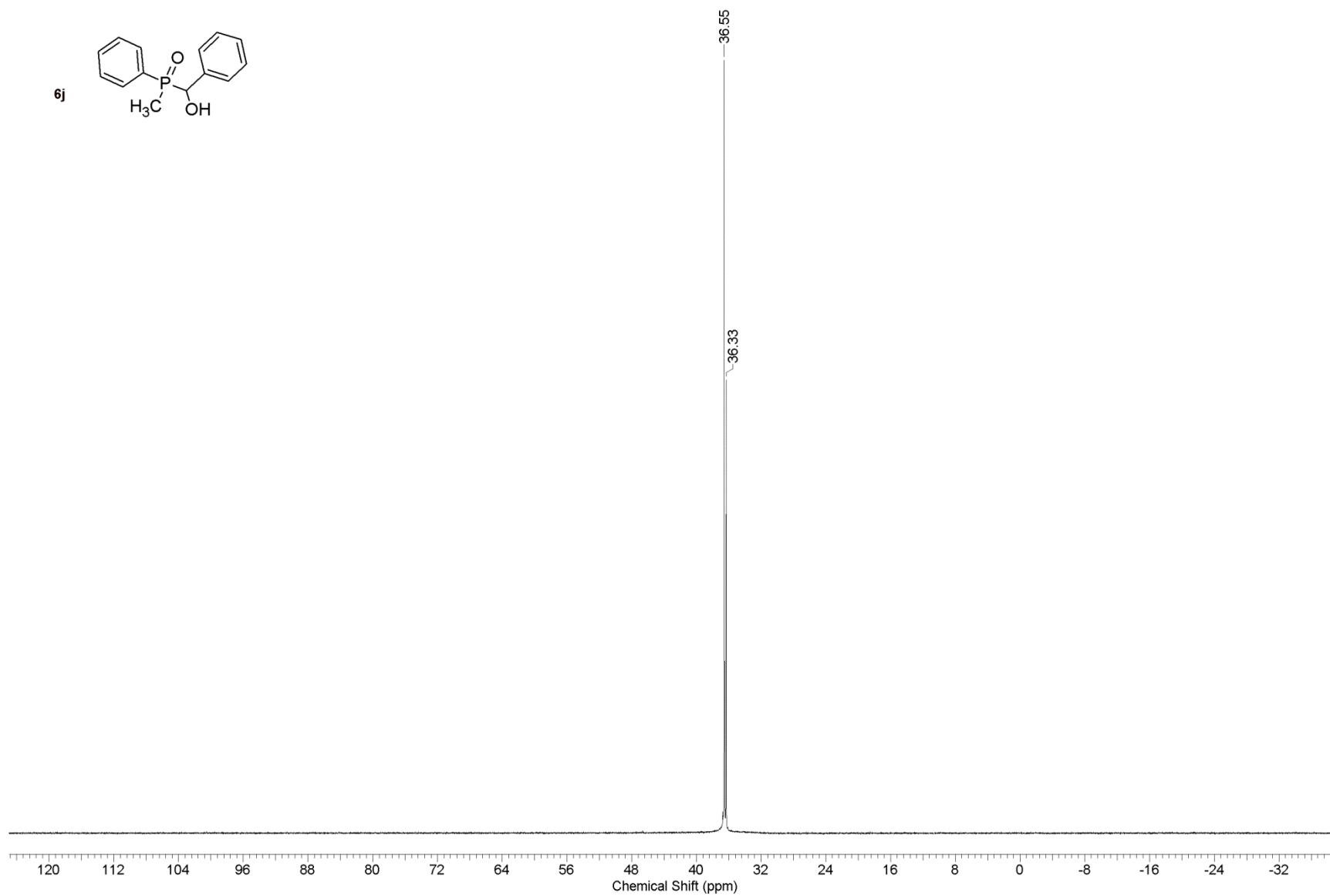
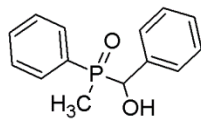


^{13}C NMR spectrum of *t*-butyl((1-hydroxy)phenylmethyl)phenylphosphine oxide (**6f**) (125 MHz, CD_3OD)

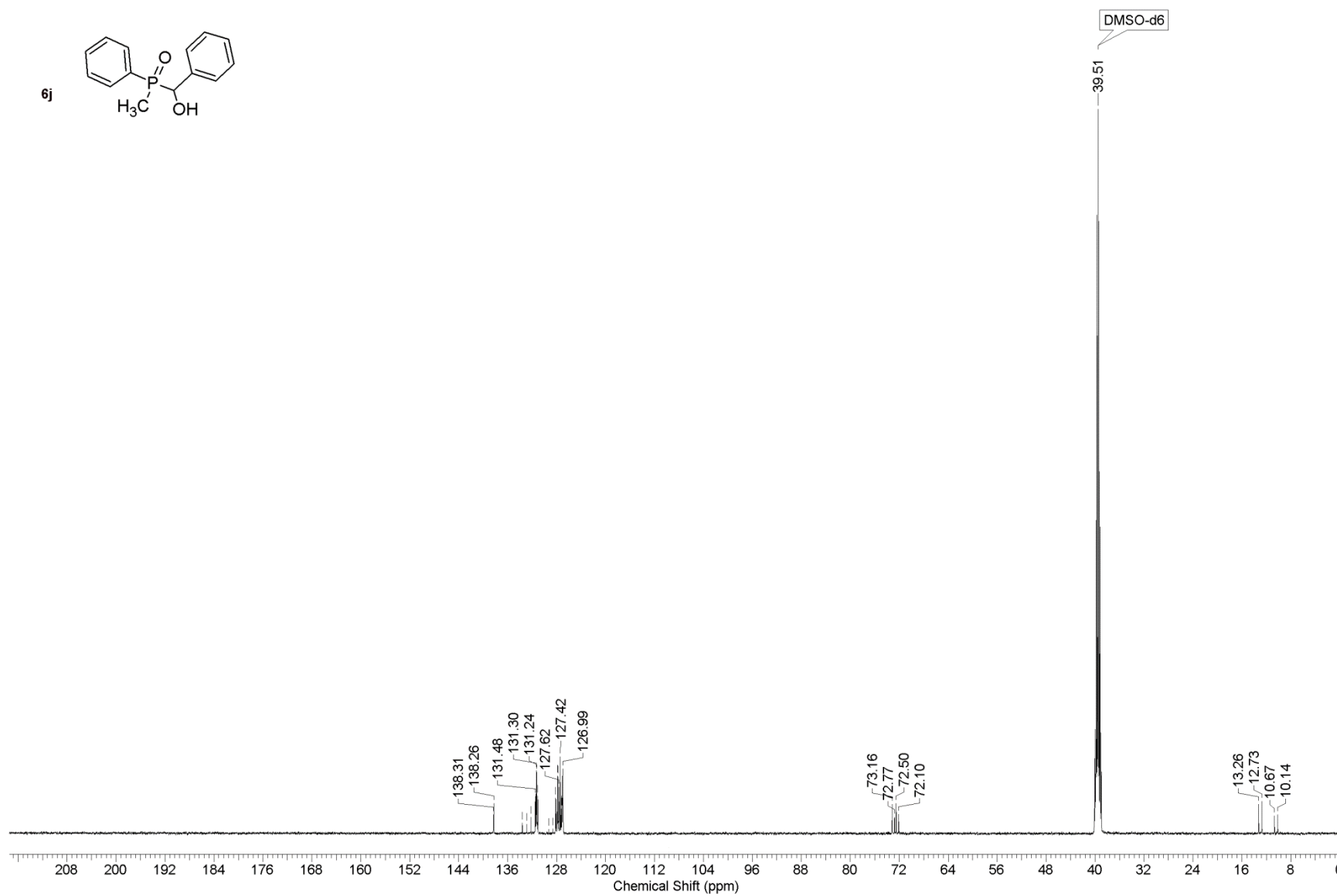
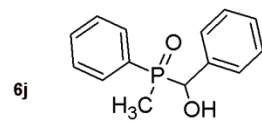


^1H NMR spectrum of ((1-hydroxy)phenylmethyl)(methyl)phenylphosphine (**6j**) (500 MHz, DMSO- d_6), water comes from DMSO- d_6

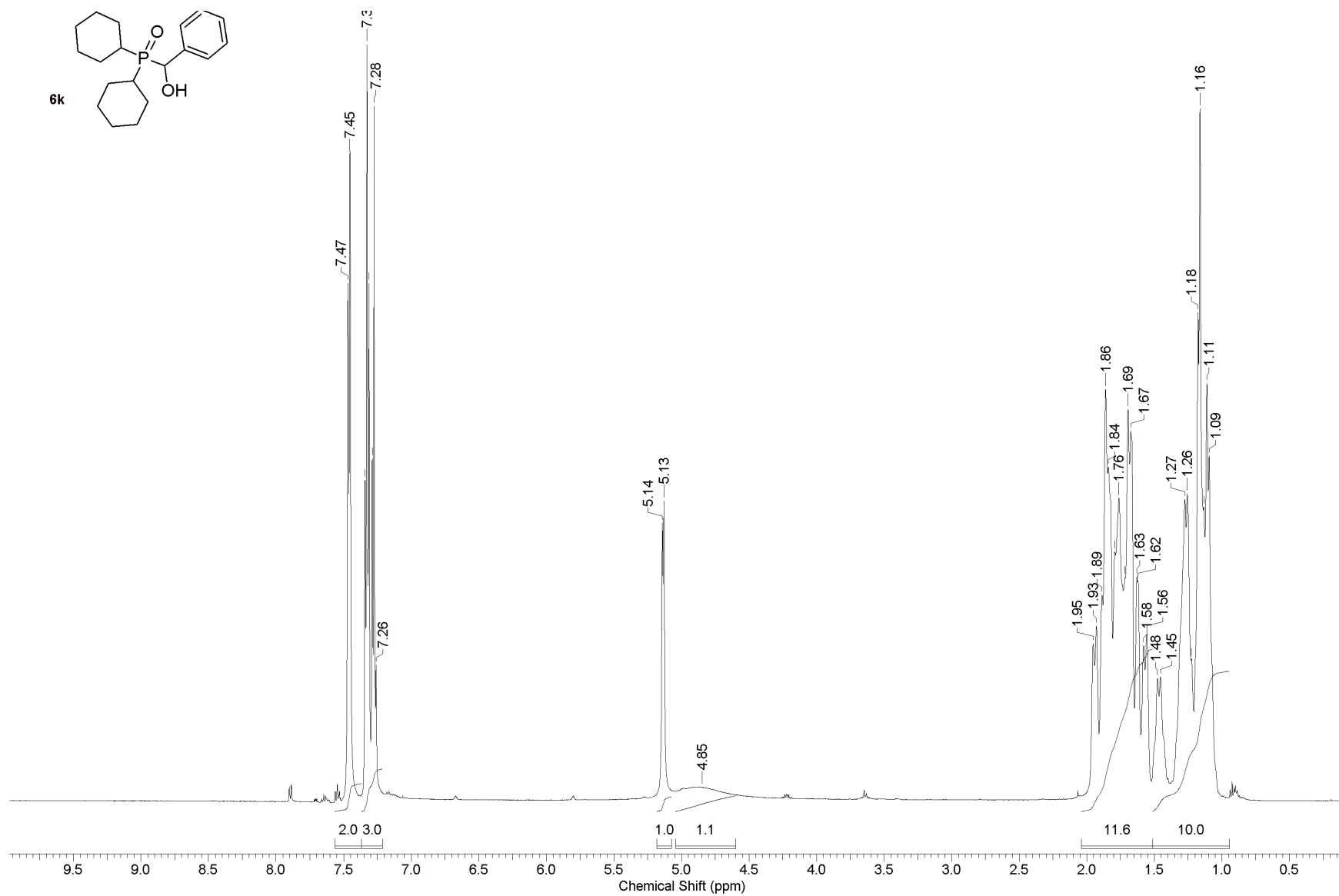
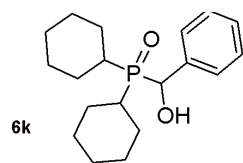
6j



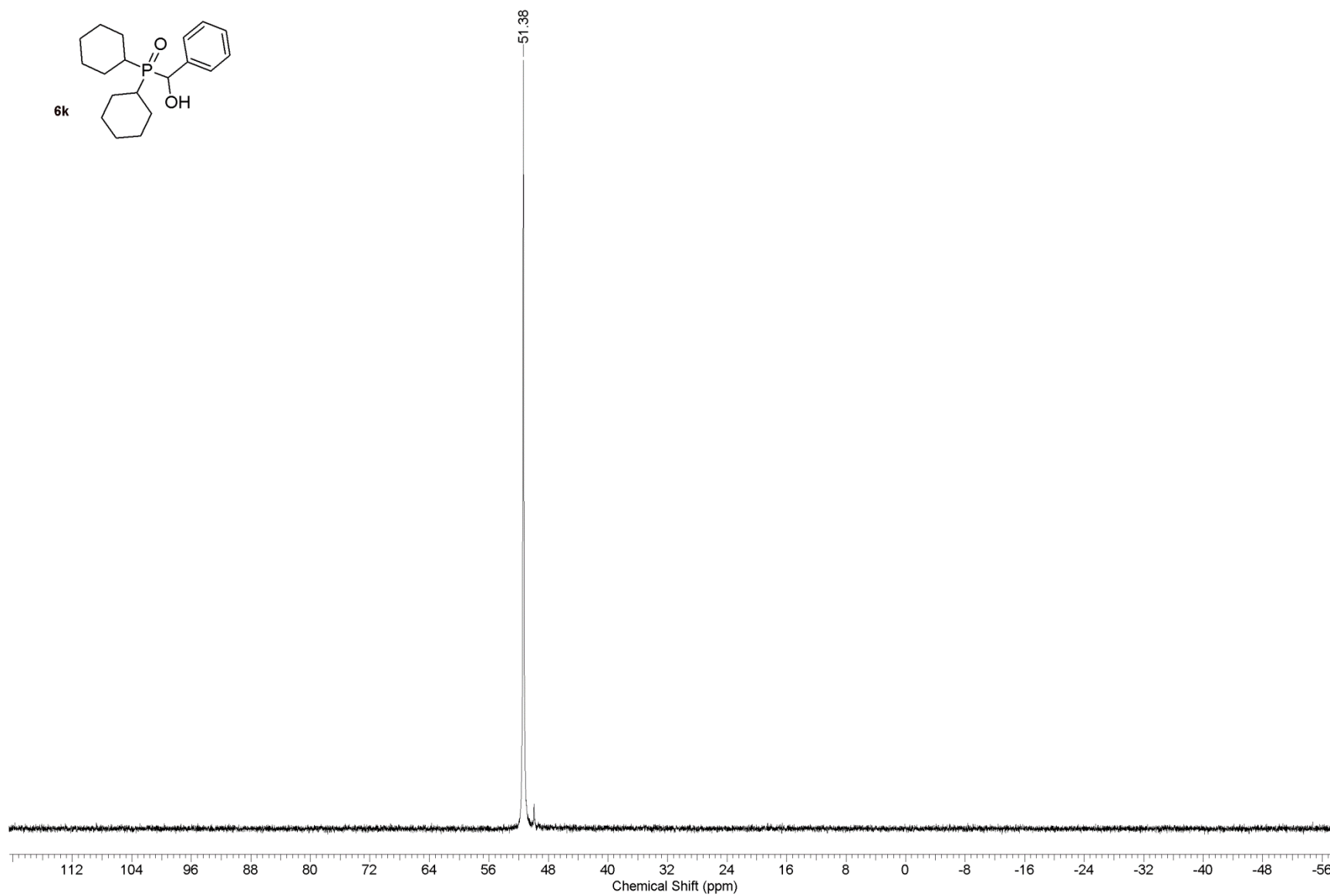
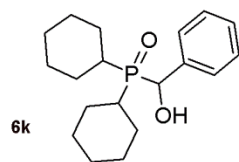
^{31}P NMR spectrum of ((1-hydroxy)phenylmethyl)(methyl)phenylphosphine (**6j**) (202 MHz, DMSO- d_6)



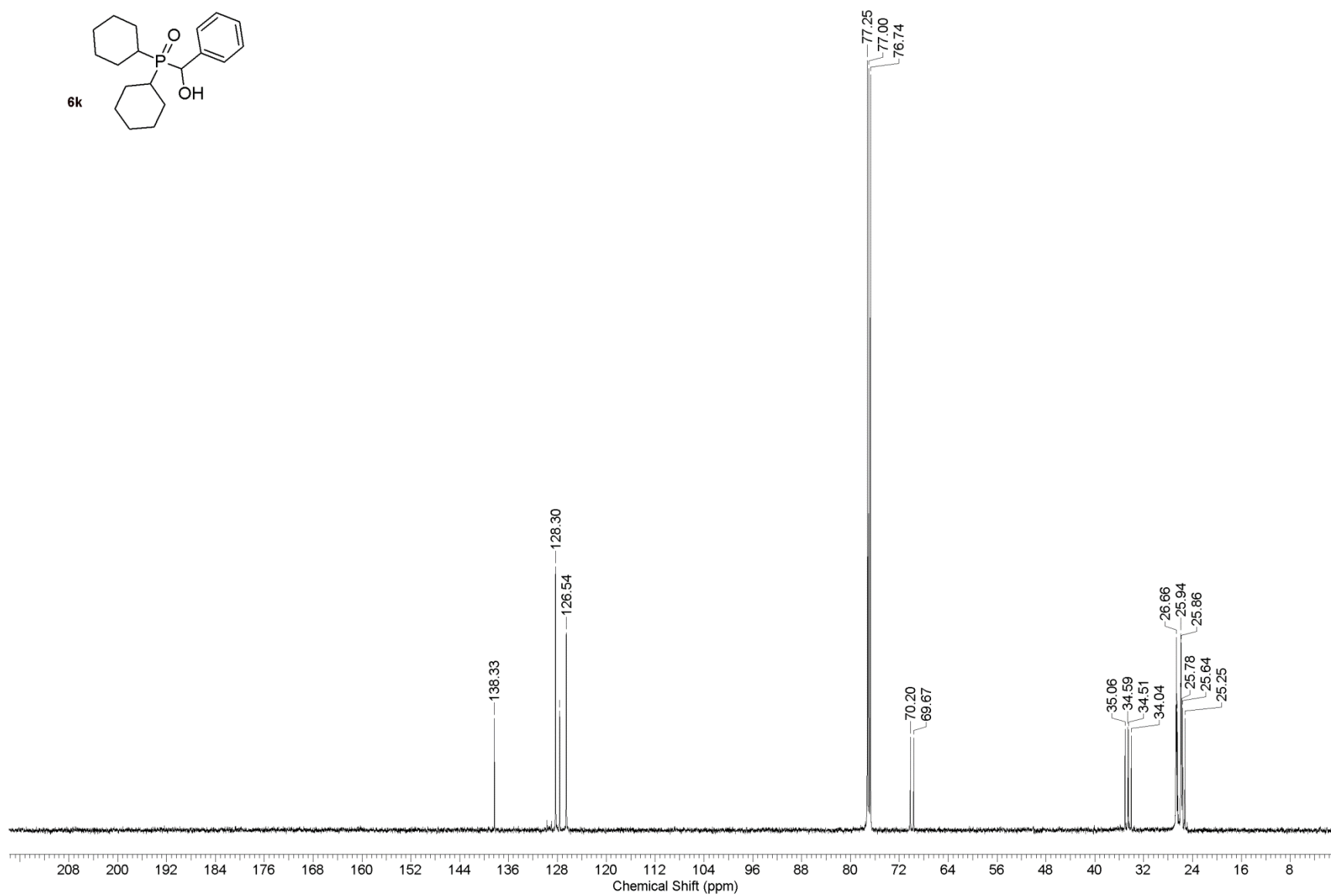
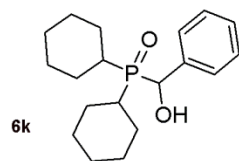
^{13}C NMR spectrum of ((1-hydroxy)phenylmethyl)(methyl)phenylphosphine (**6j**) (125 MHz, DMSO- d_6)



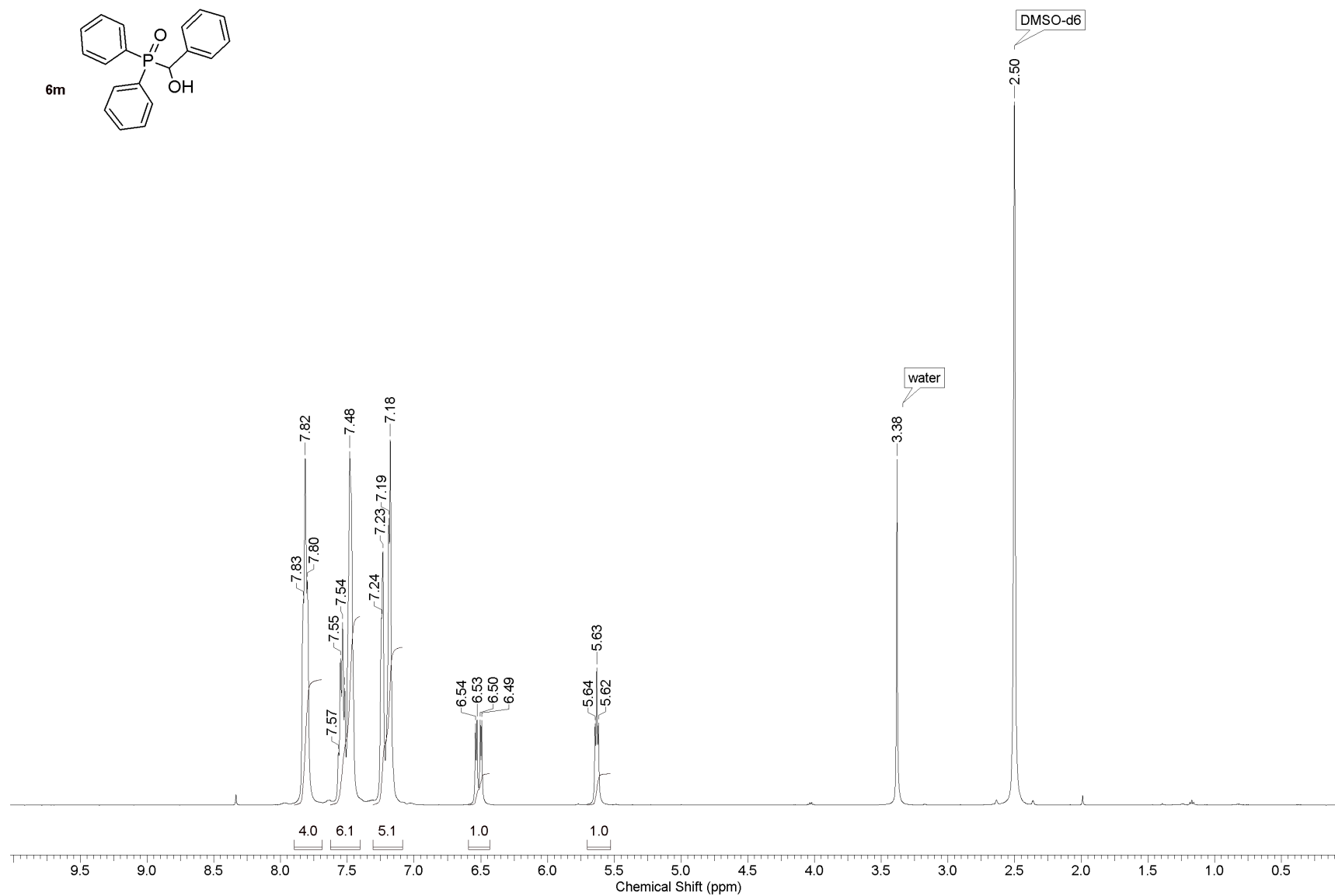
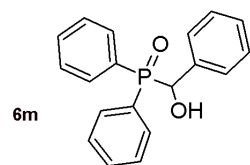
^1H NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine oxide (**6k**) (500 MHz, CDCl_3)



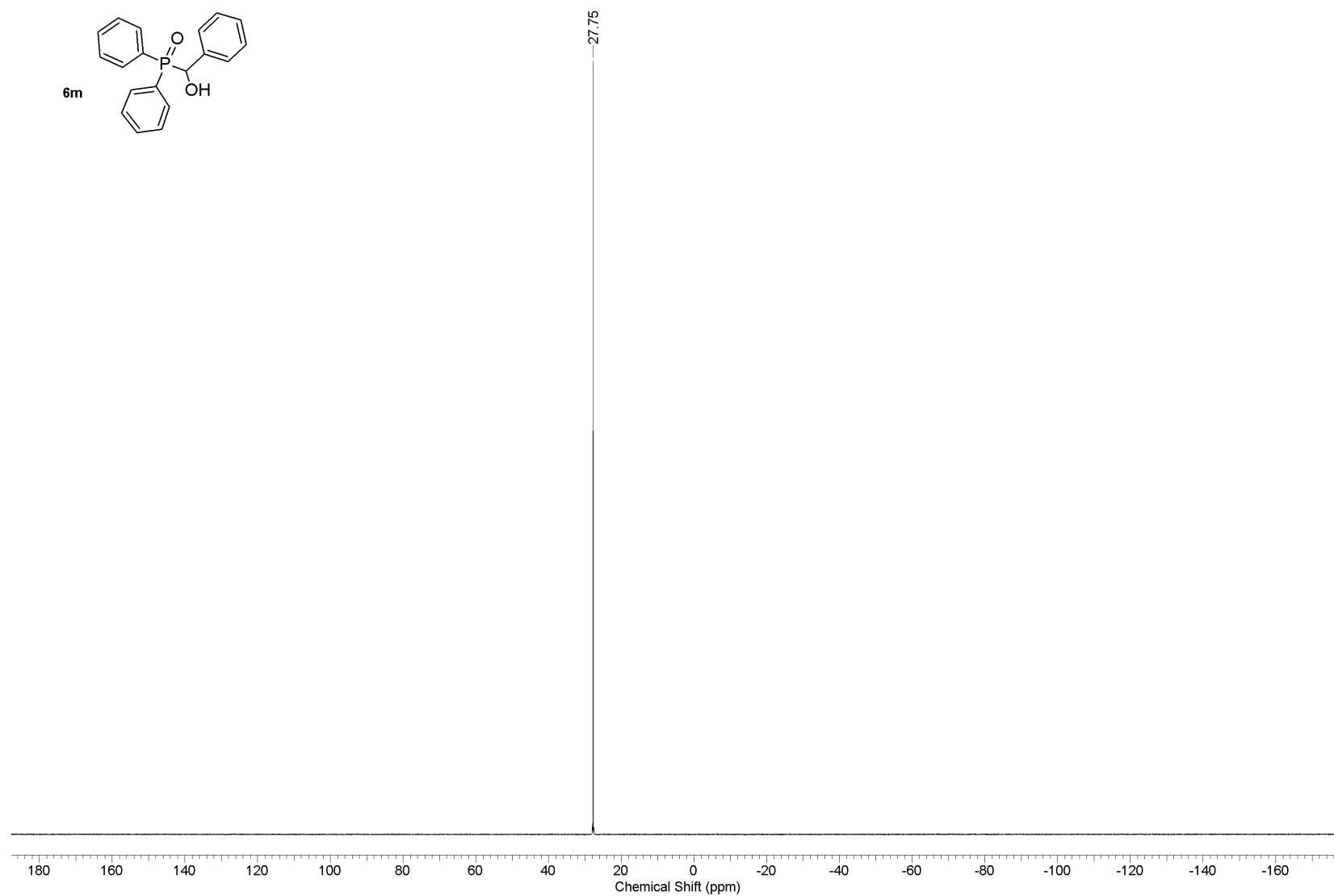
^{31}P NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine oxide (**6k**) (202 MHz, CDCl_3)



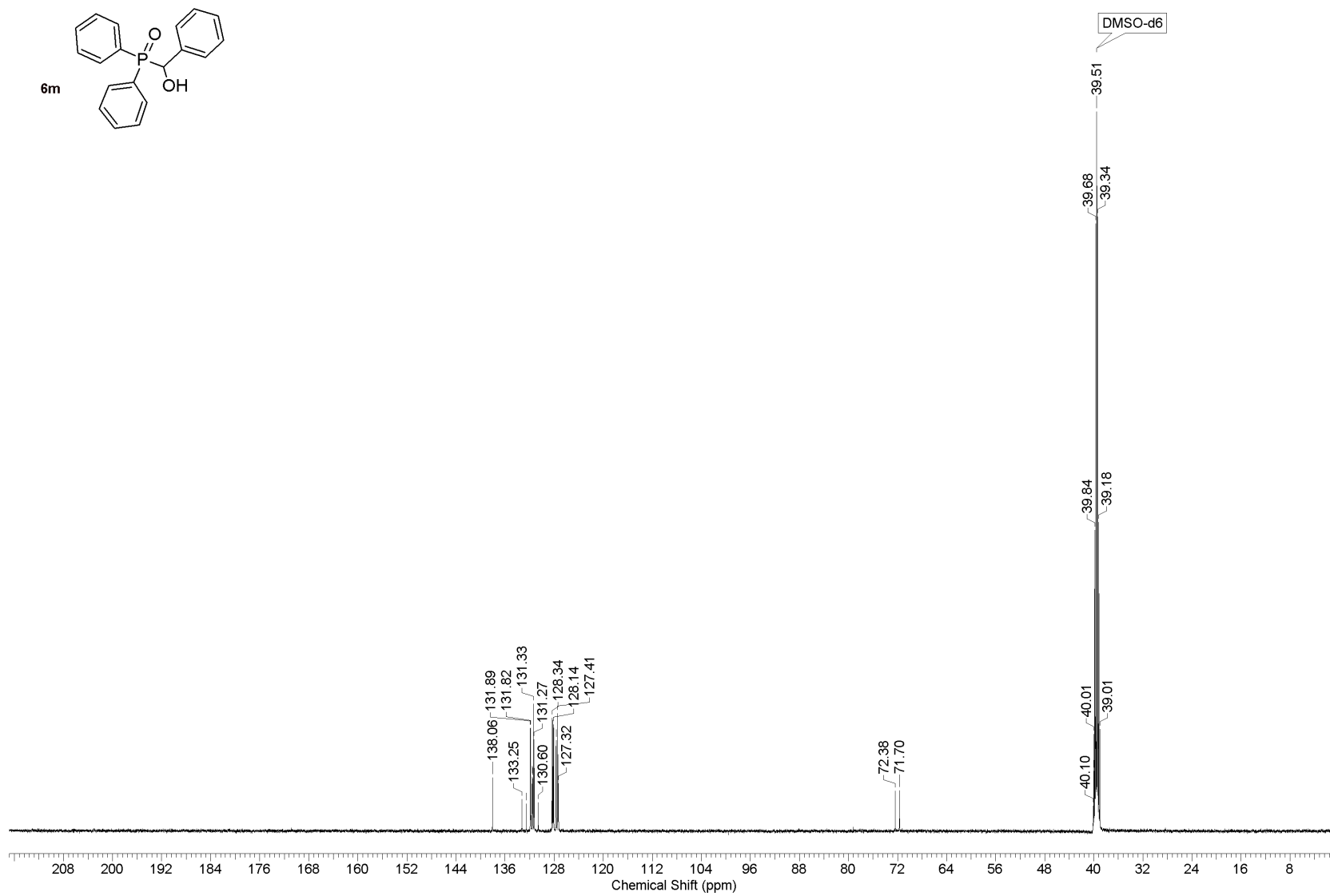
^{13}C NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine oxide (**6k**) (125 MHz, CDCl_3)



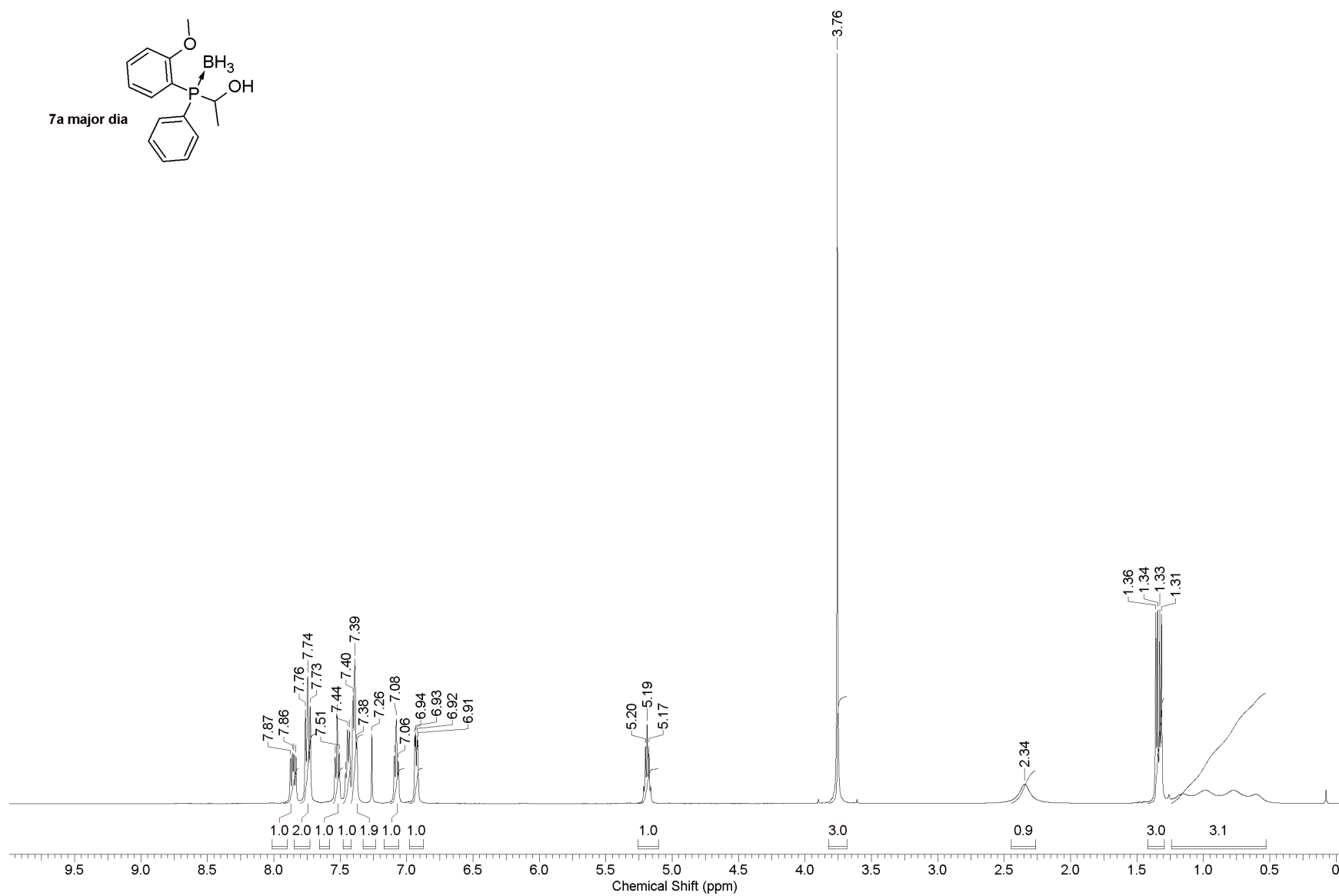
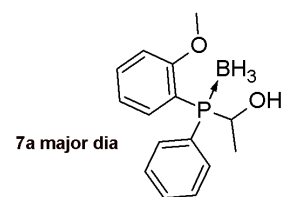
^1H NMR spectrum of diphenyl(1-hydroxyethyl)phosphine oxide (**6m**) (500 MHz, DMSO- d_6), water comes from the solvent



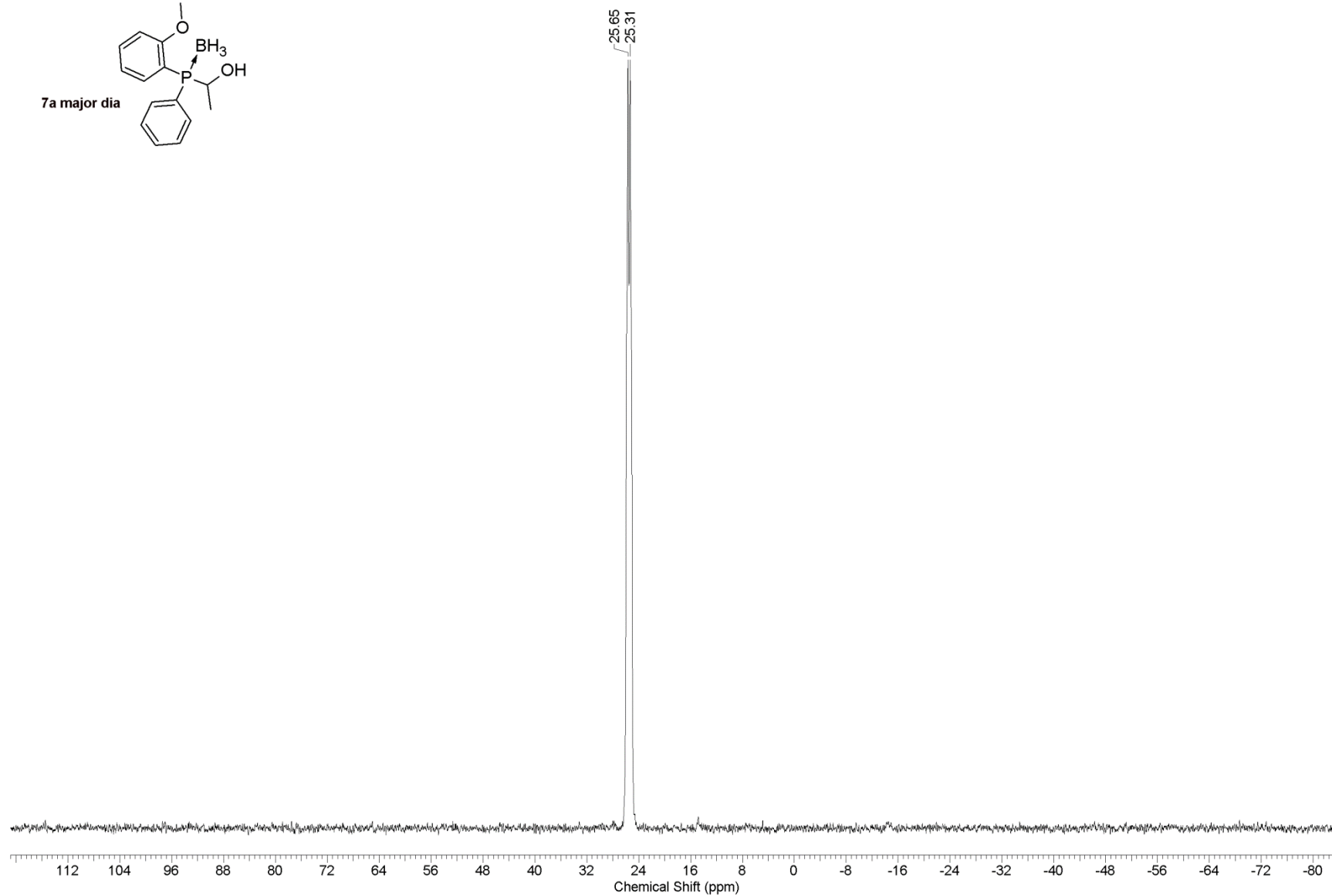
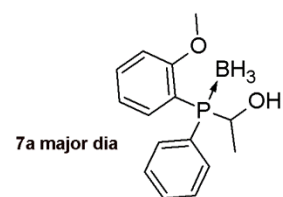
^{31}P NMR spectrum of diphenyl(1-hydroxyethyl)phosphine oxide (**6m**) (202 MHz, $\text{DMSO-}d_6$)



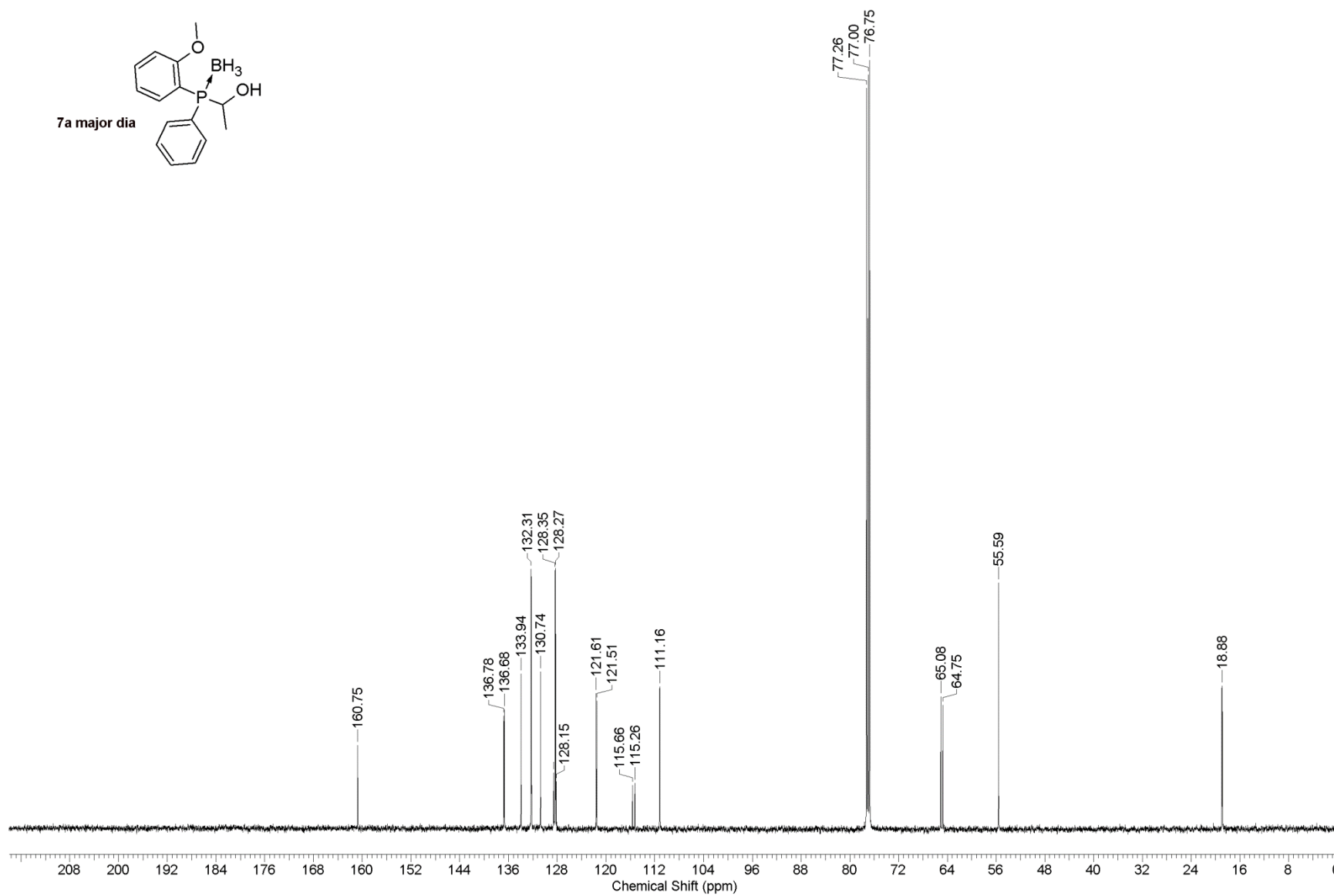
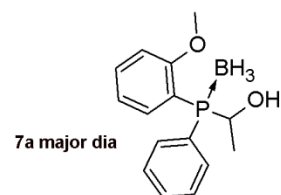
¹³C NMR spectrum of diphenyl(1-hydroxyethyl)phosphine oxide (**6m**) (125 MHz, DMSO-d₆)



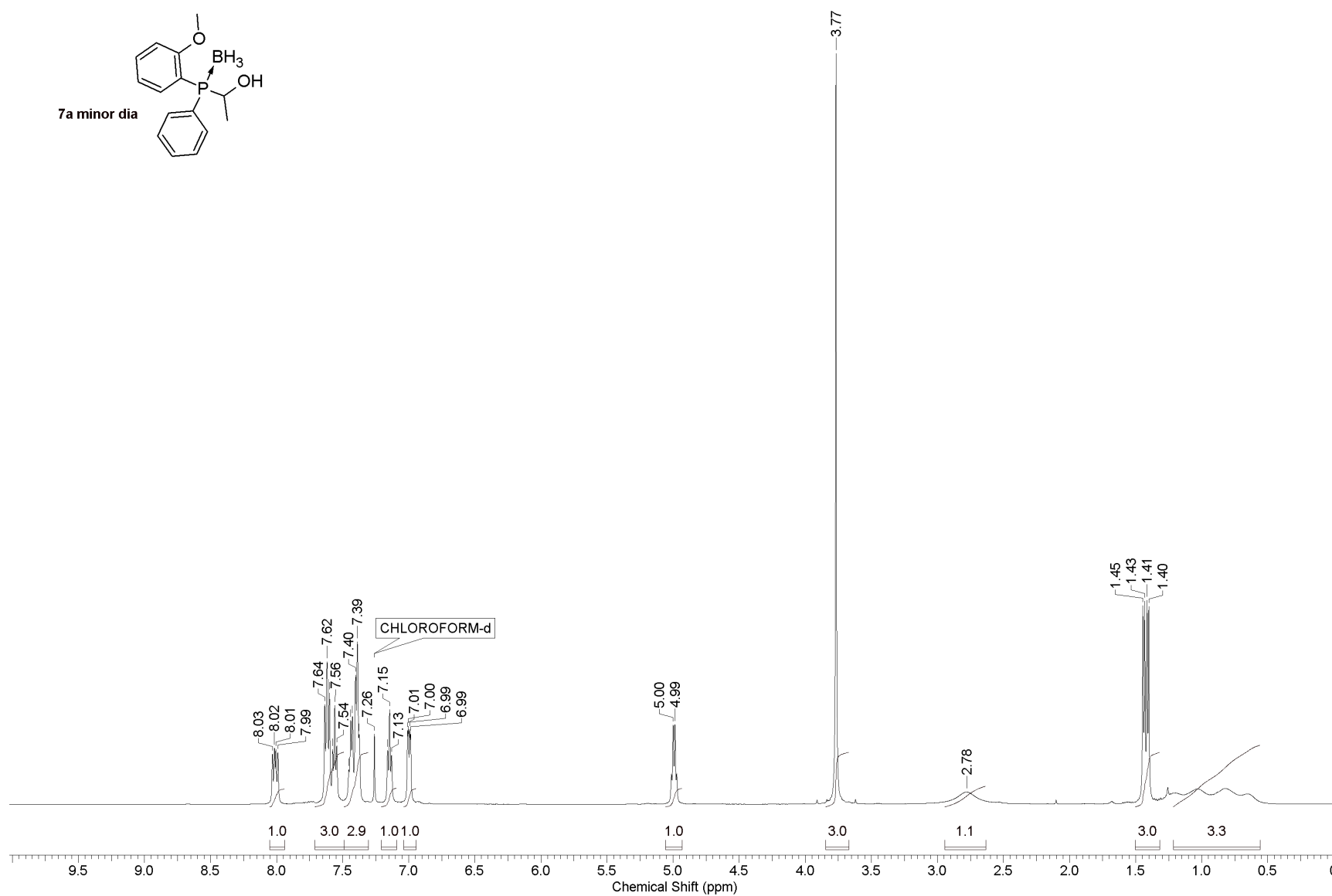
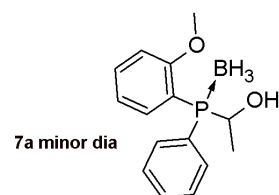
¹H NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine-borane (**7a-major**) (500 MHz, CDCl₃)



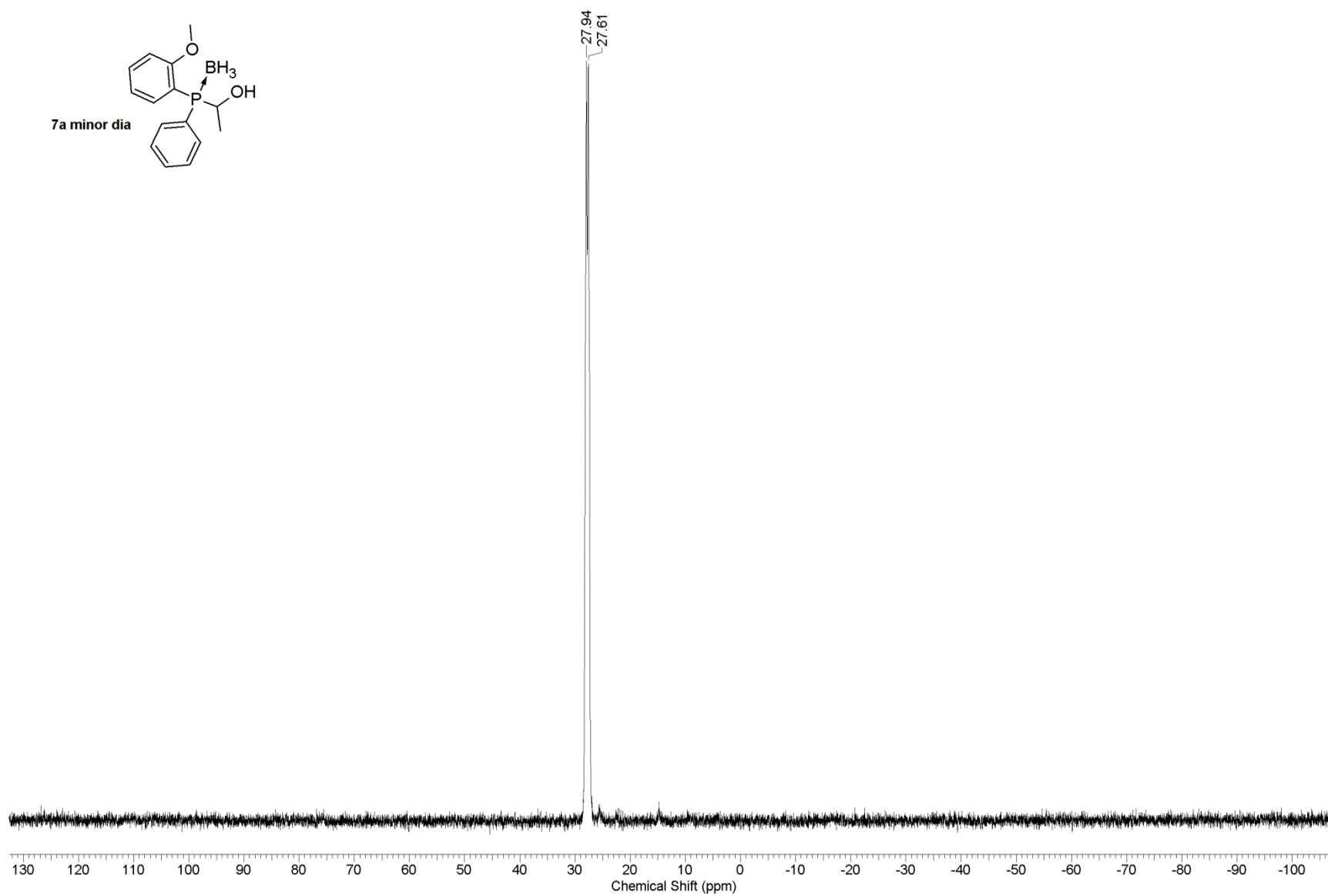
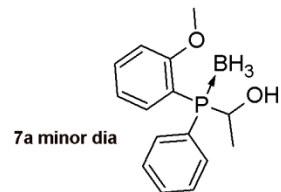
^{31}P NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine-borane (**7a**-major) (202 MHz, CDCl_3)



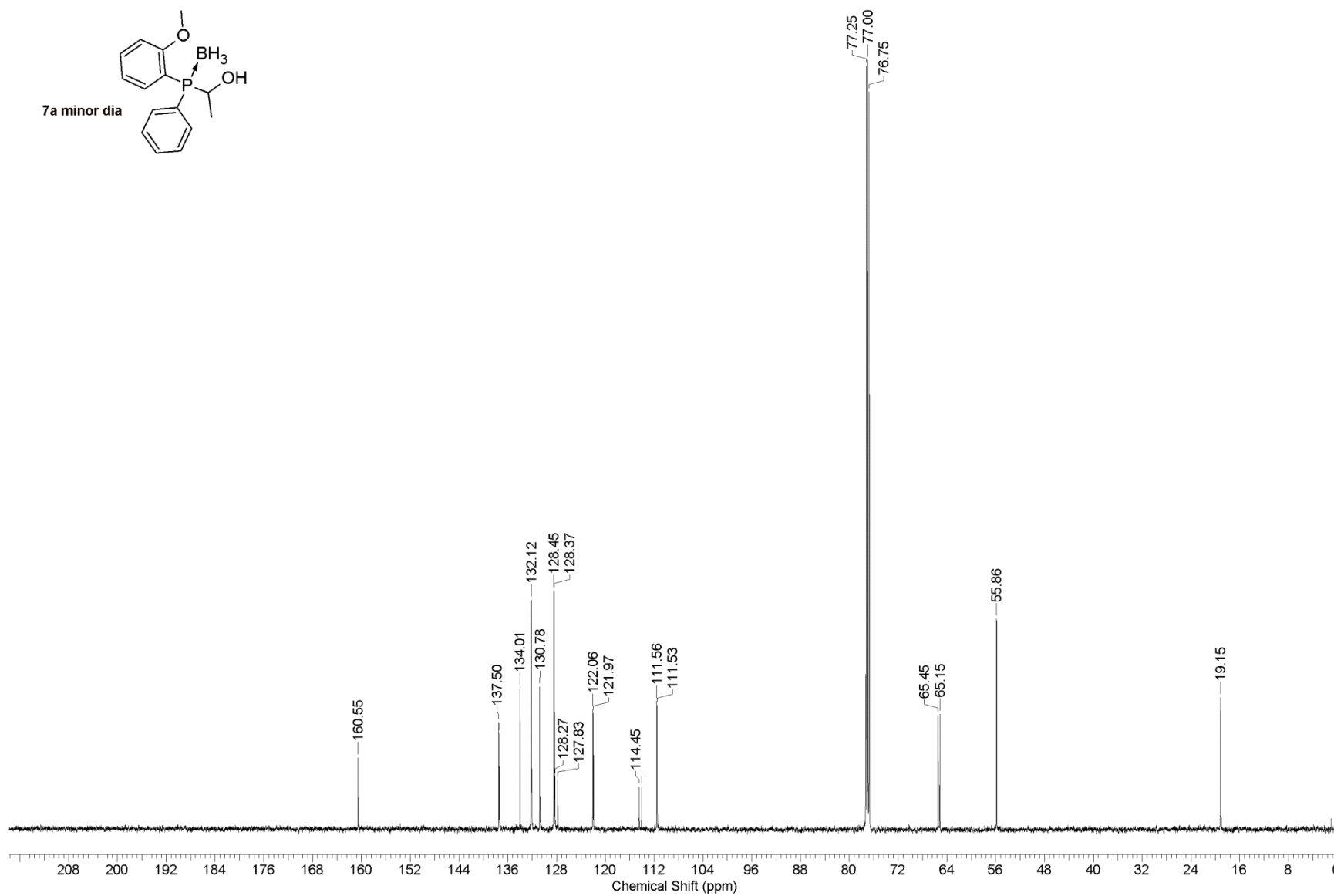
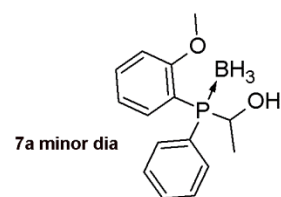
^{13}C NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine-borane (**7a-major**) (125 MHz, CDCl_3)



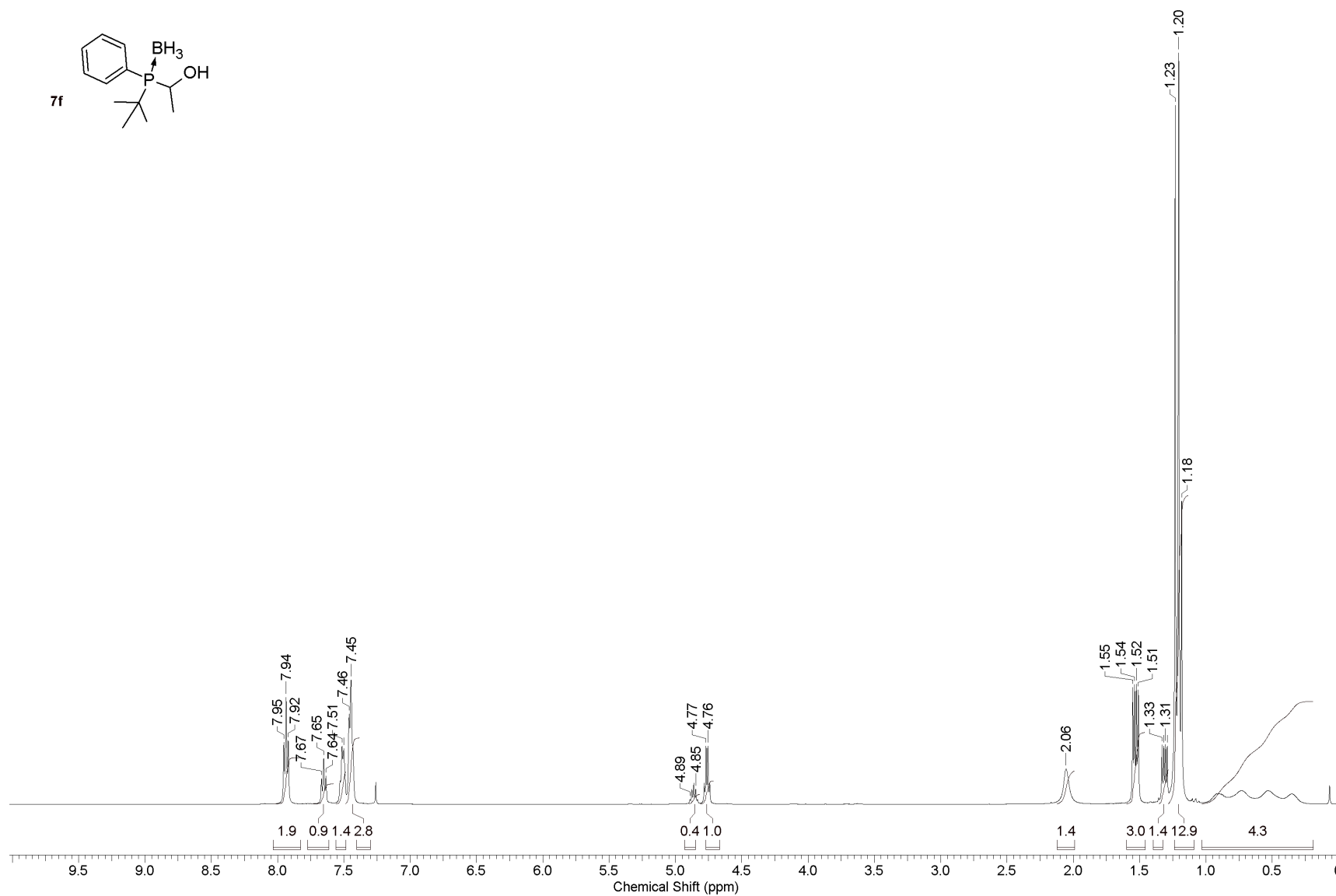
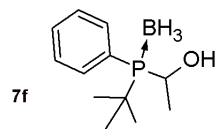
^1H NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine-borane (**7a-minor**) (500 MHz, CDCl_3)



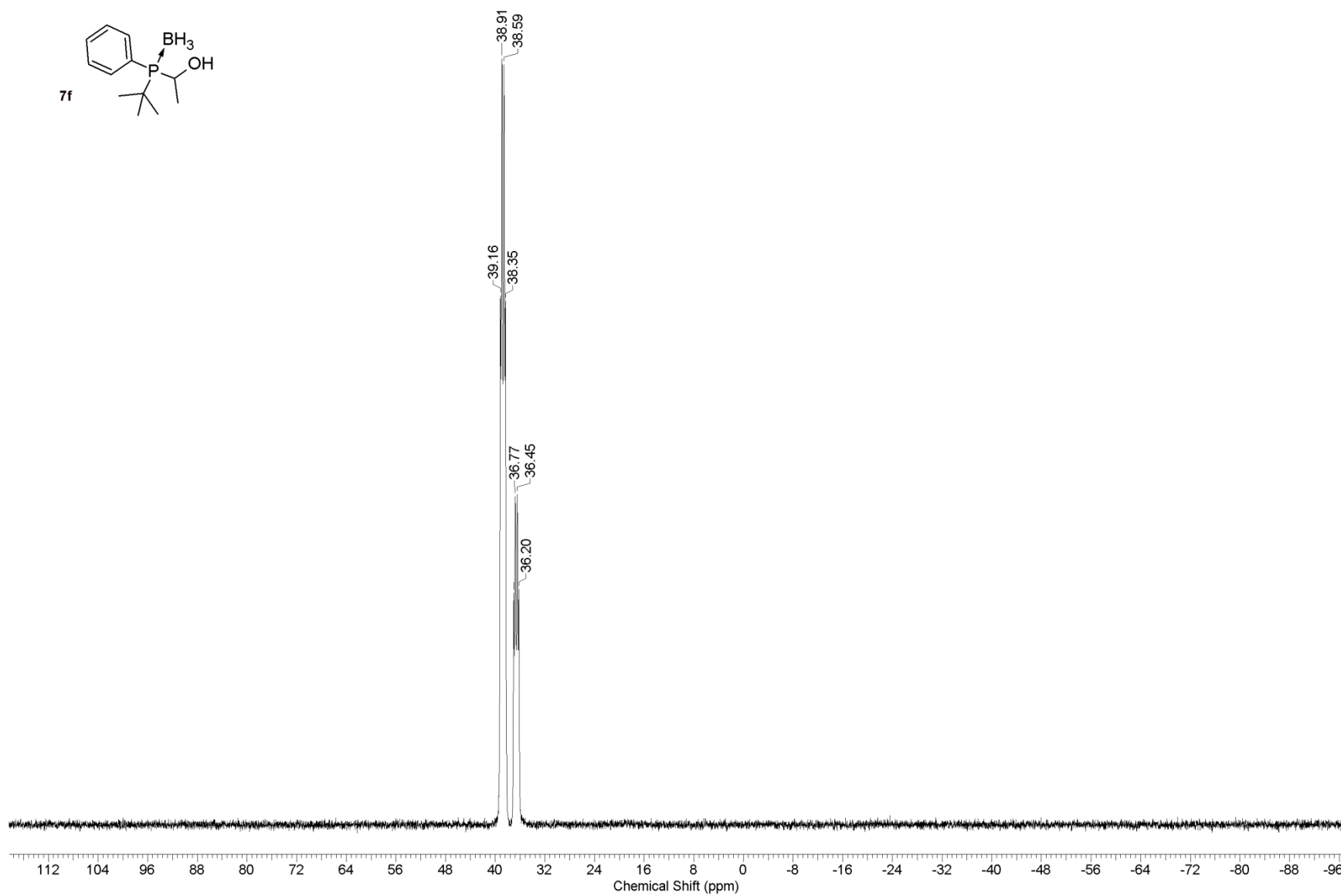
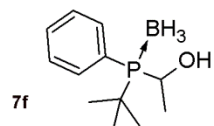
^{31}P NMR spectrum of *o*-anisyl(1-hydroxyethyl)phenylphosphine-borane (**7a-minor**) (202 MHz, CDCl_3)



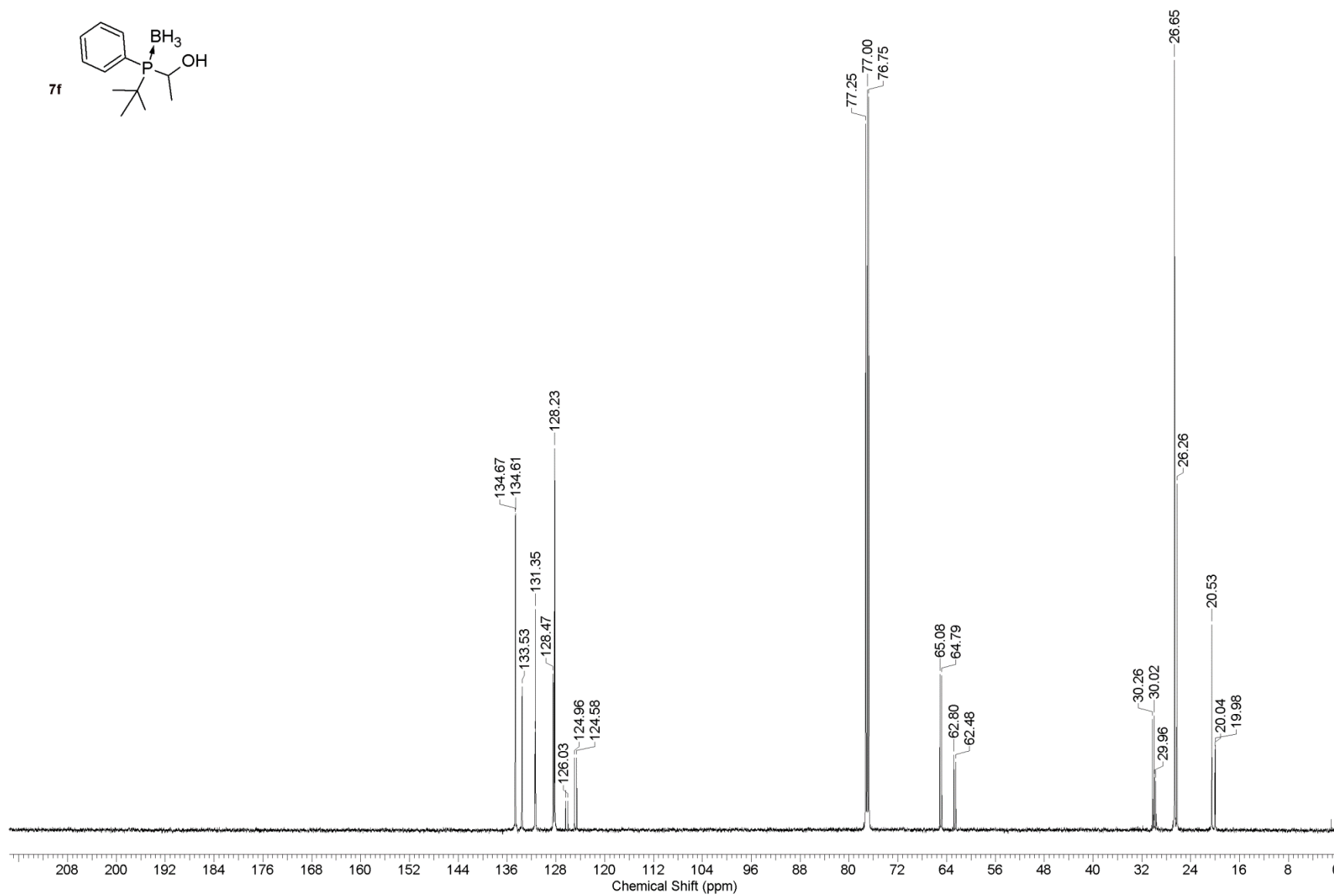
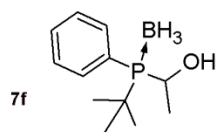
^{13}C NMR spectrum of *o*-anisyl (1-hydroxyethyl)phenylphosphine-borane (**7a**-minor) (125 MHz, CDCl_3)



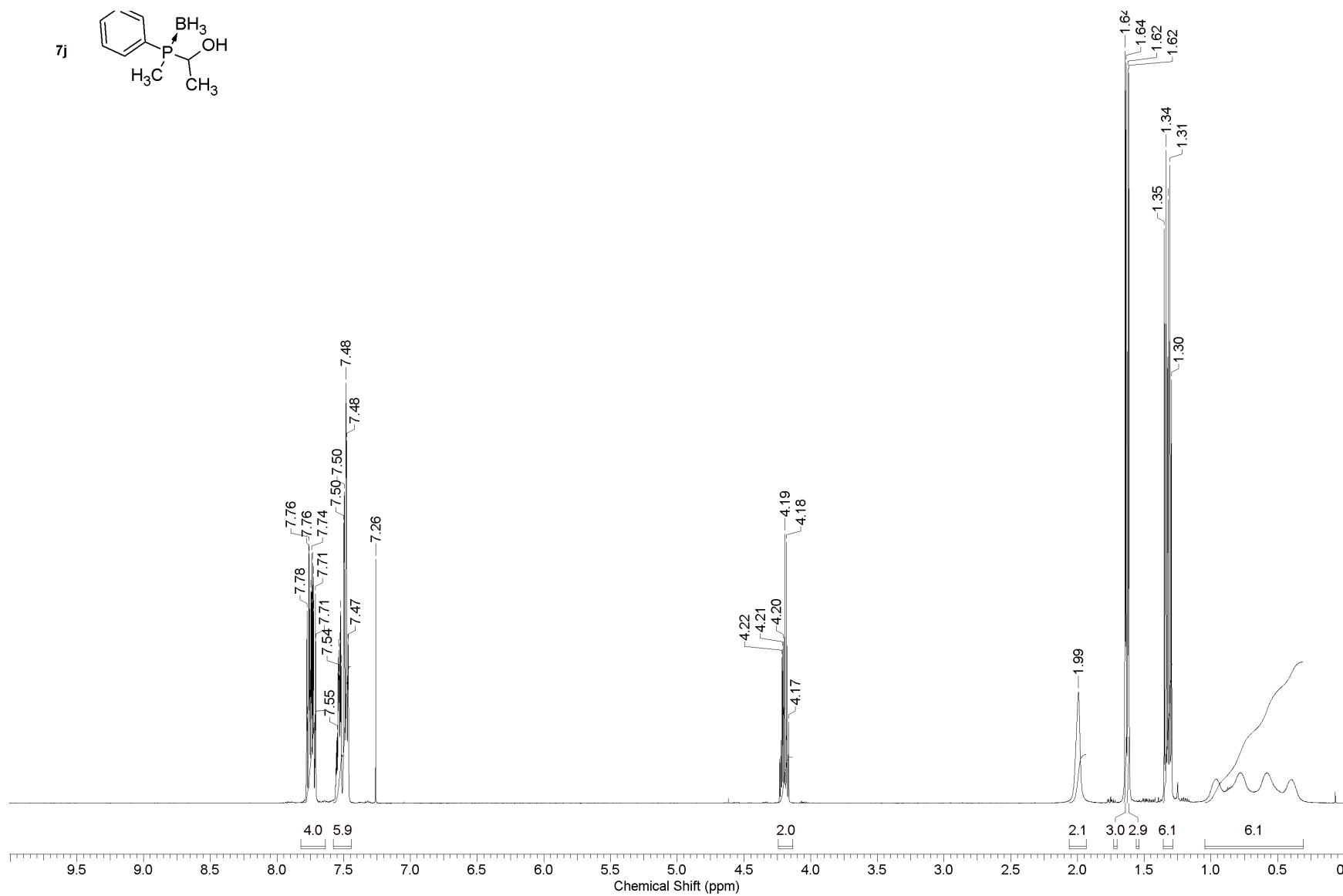
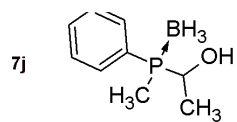
^1H NMR spectrum of *t*-butyl(1-hydroxyethyl)phenylphosphine-borane (**7f**) (500 MHz, CDCl_3)



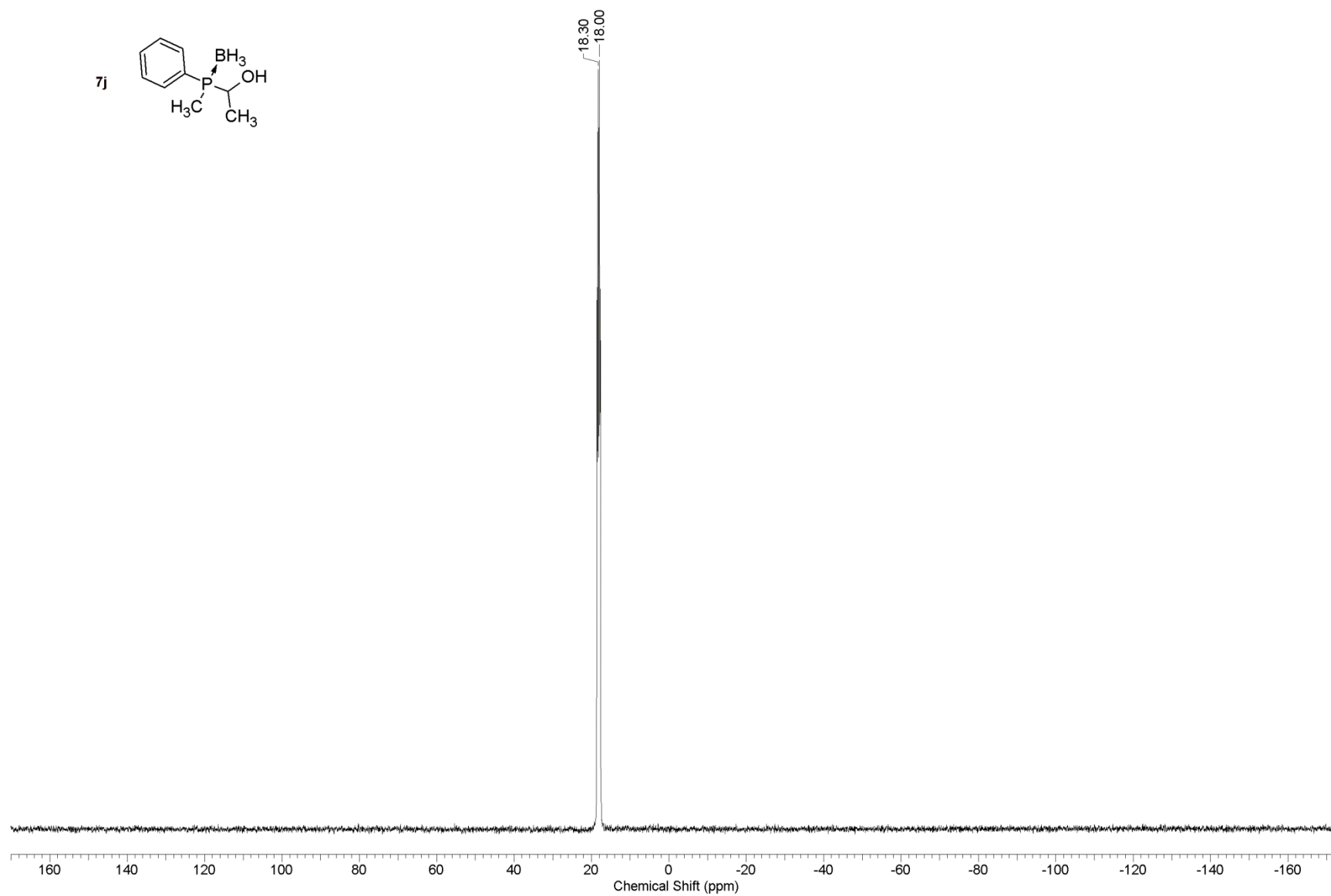
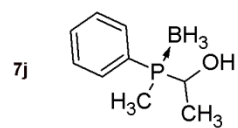
^{31}P NMR spectrum of *t*-butyl(1-hydroxyethyl)phenylphosphine-borane (**7f**) (202 MHz, CDCl_3)



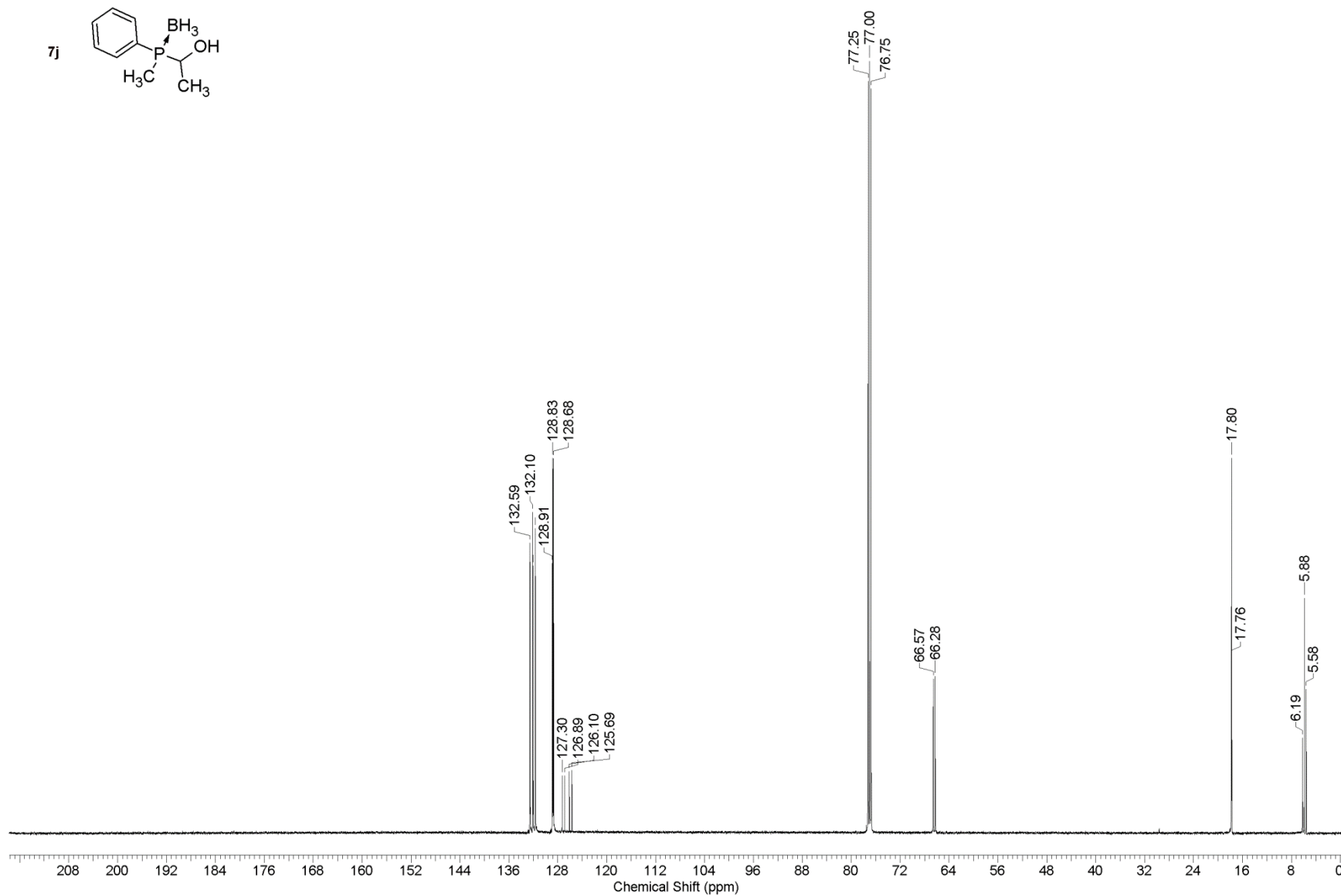
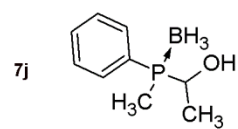
^{13}C NMR spectrum of *t*-butyl (1-hydroxyethyl)phenylphosphine-borane (**7f**) (125 MHz, CDCl_3)



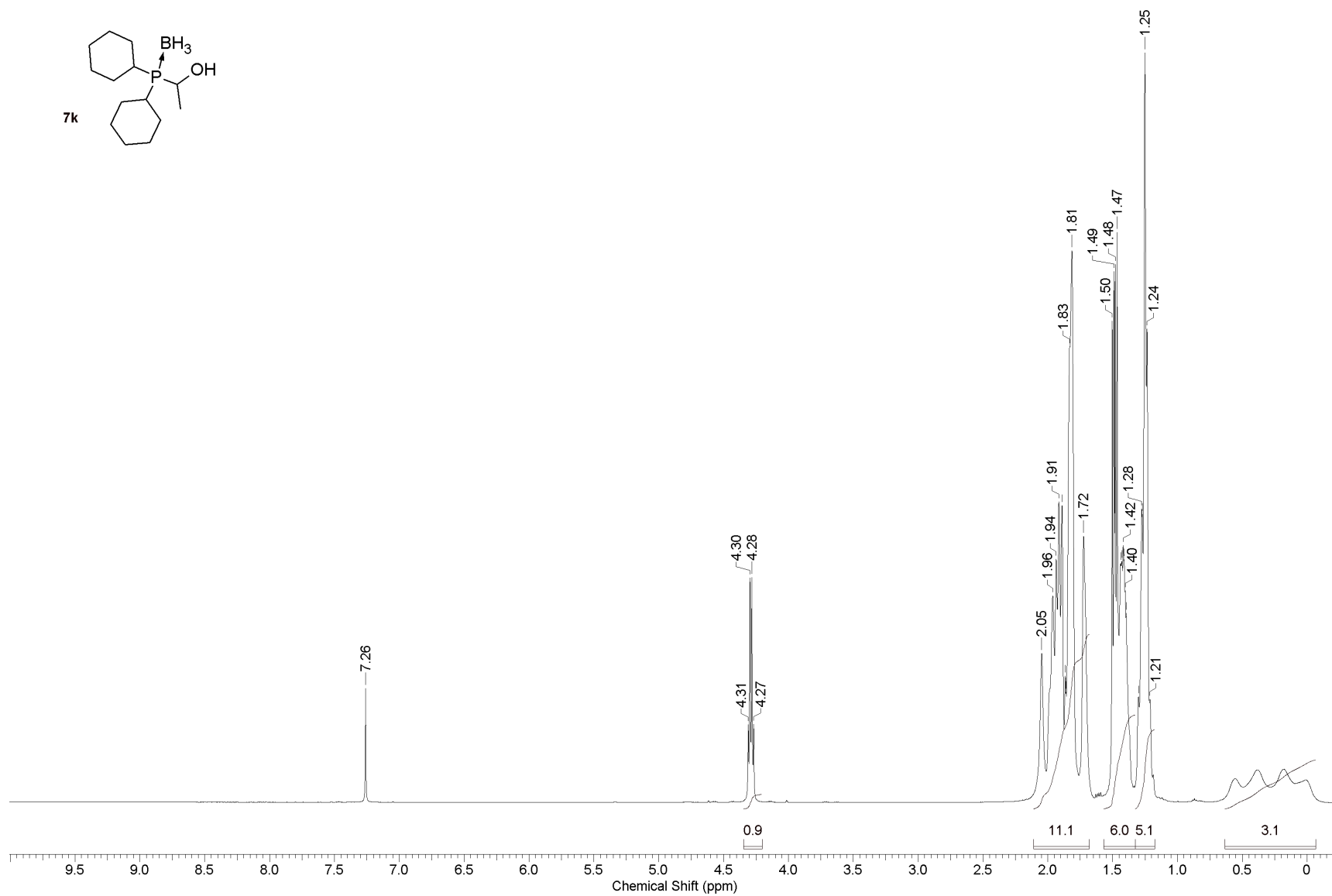
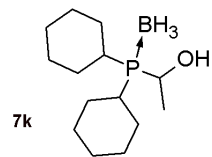
^1H NMR spectrum of (1-hydroxyethyl)(methyl)phenylphosphine-borane (**7j**) (500 MHz, CDCl_3)



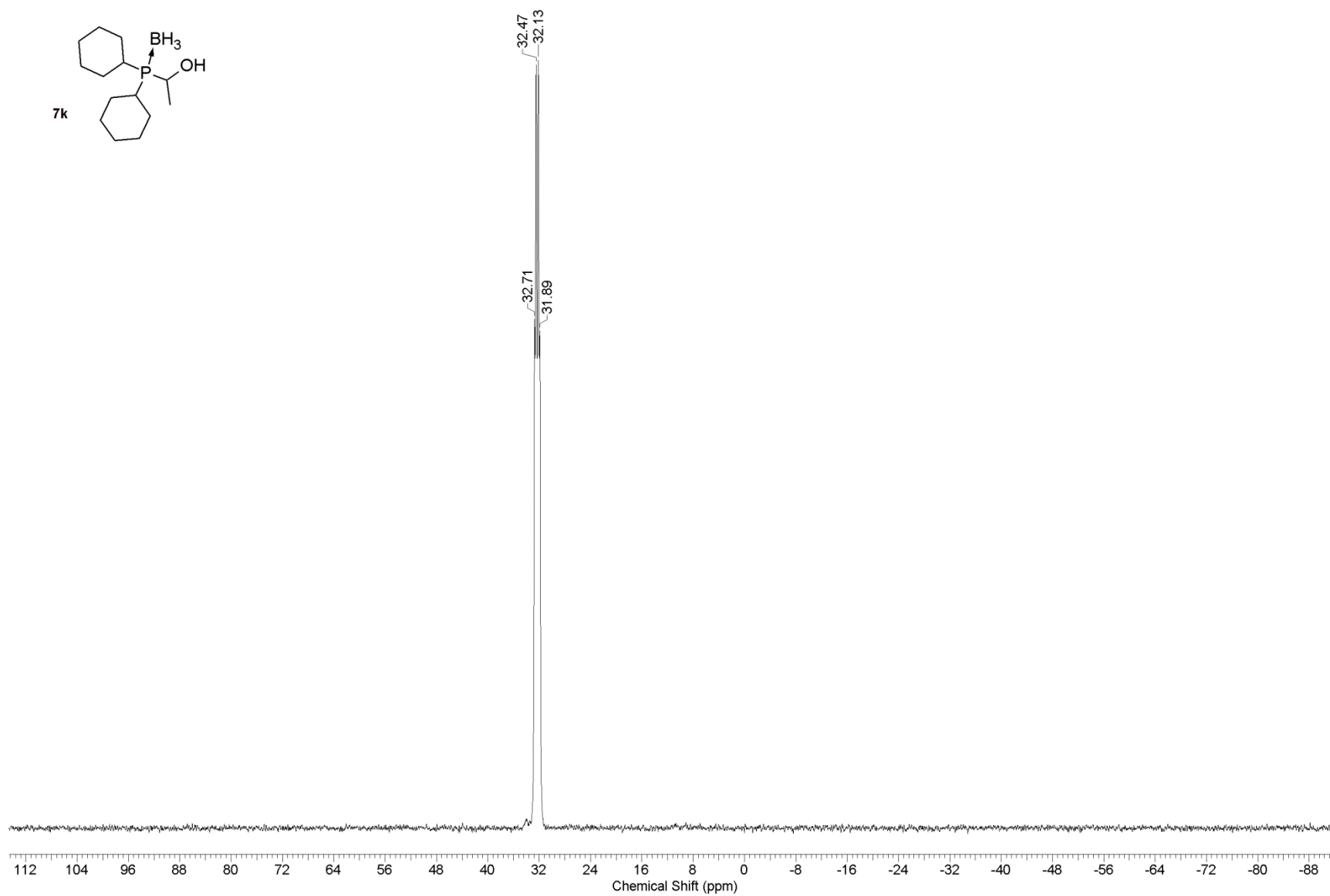
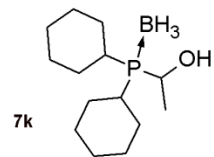
^{31}P NMR spectrum of (1-hydroxyethyl)(methyl)phenylphosphine-borane (**7j**) (202 MHz, CDCl_3)



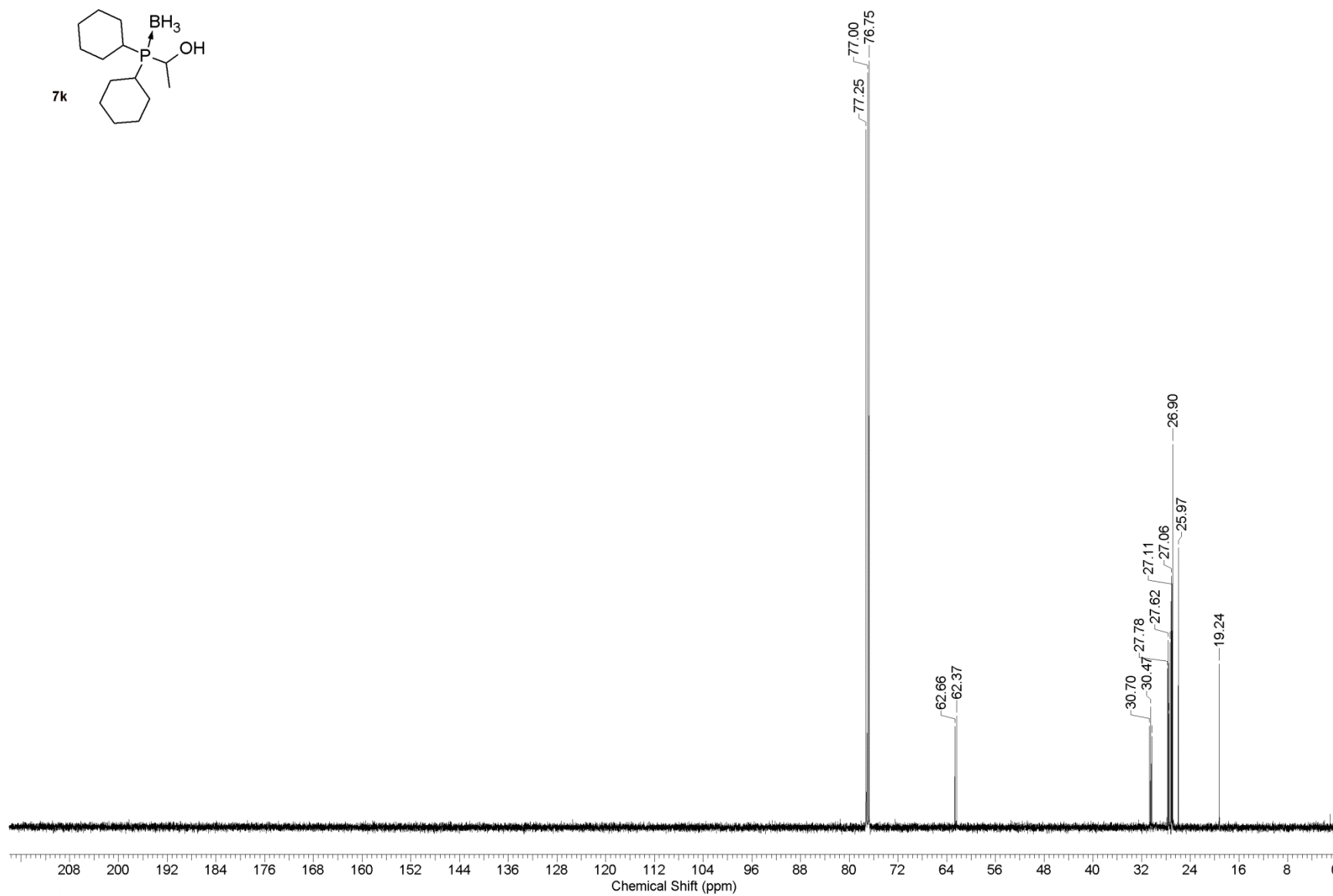
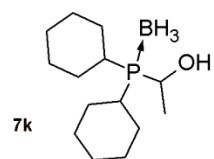
^{13}C NMR spectrum of (1-hydroxyethyl)(methyl)phenylphosphine-borane (**7j**) (125 MHz, CDCl_3)



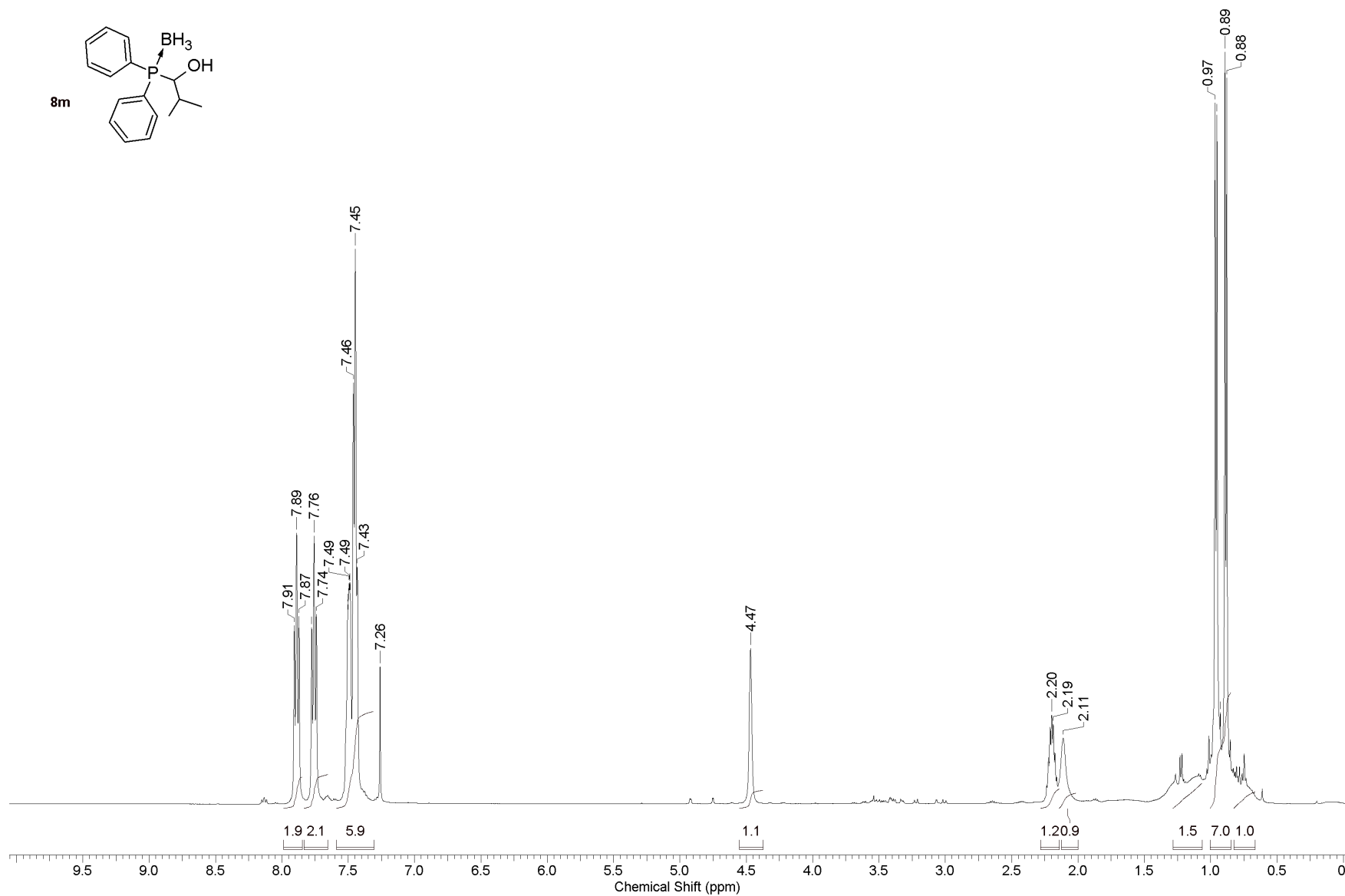
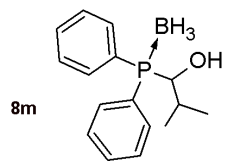
^1H NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine-borane (**7k**) (500 MHz, CDCl_3)



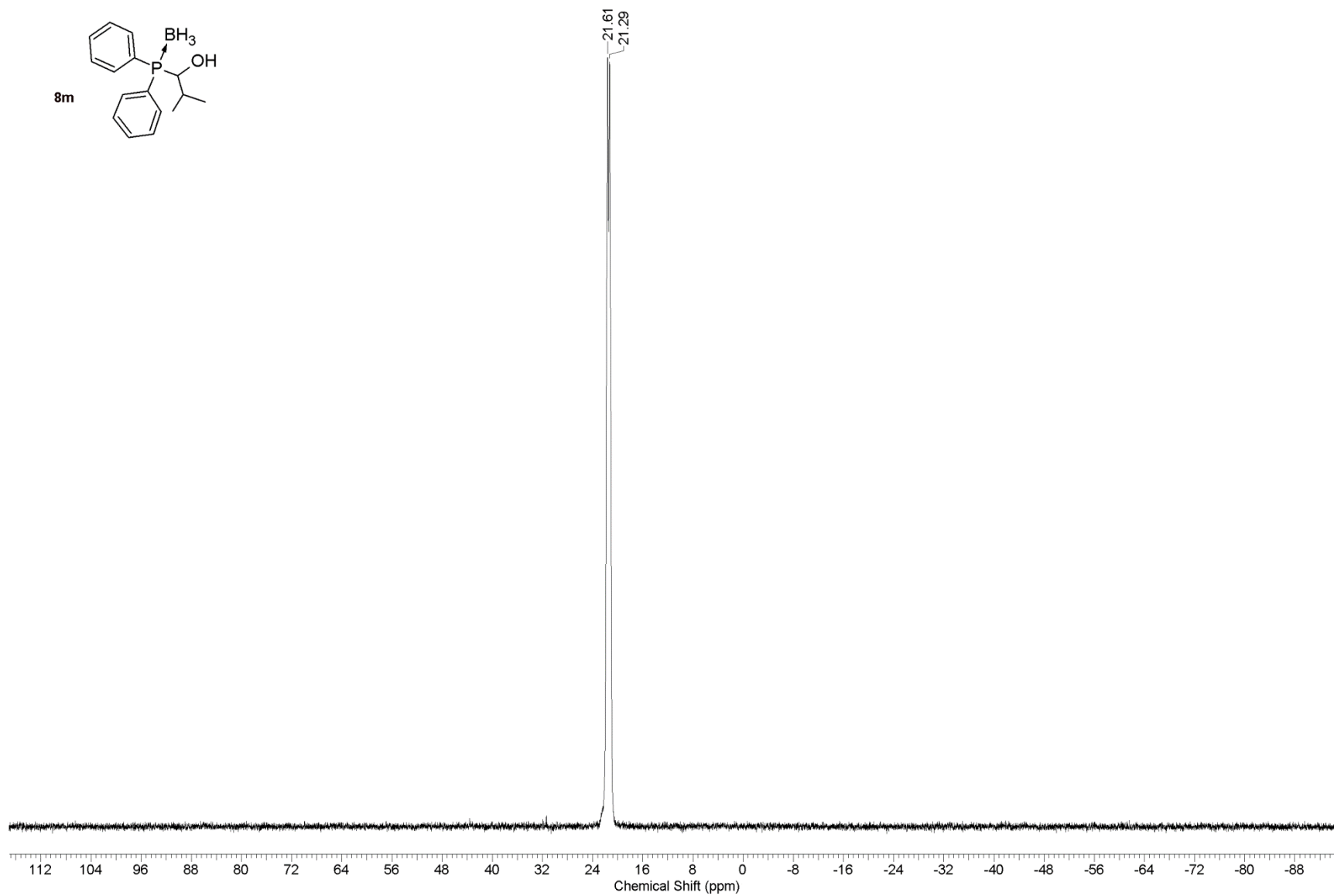
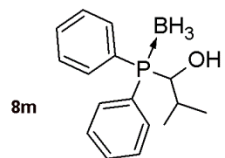
^{31}P NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine-borane (**7k**) (202 MHz, CDCl_3)



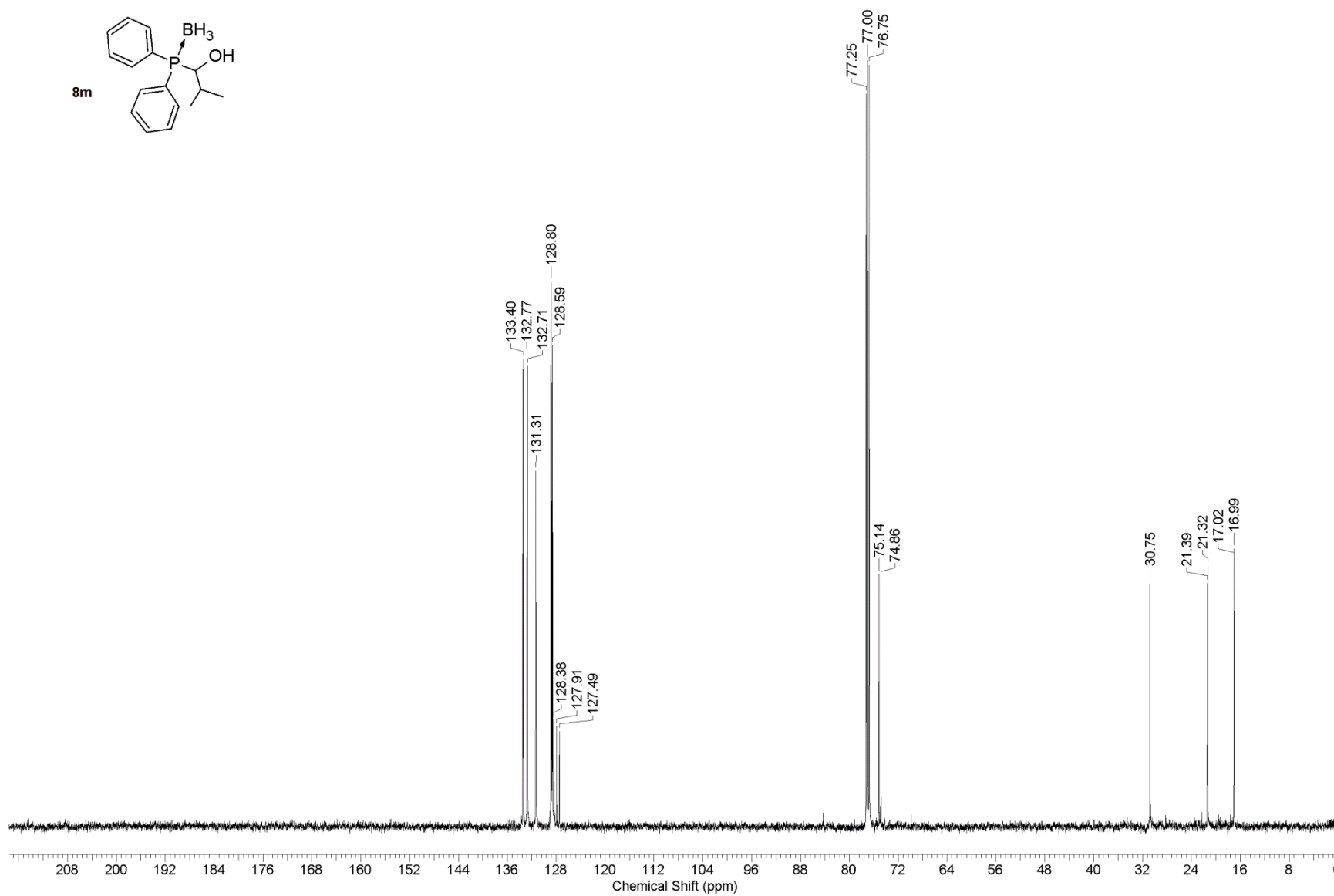
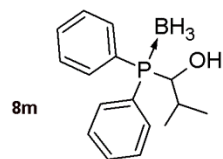
^{13}C NMR spectrum of di-*c*-hexyl(1-hydroxyethyl)phosphine-borane (**7k**) (125 MHz, CDCl_3)



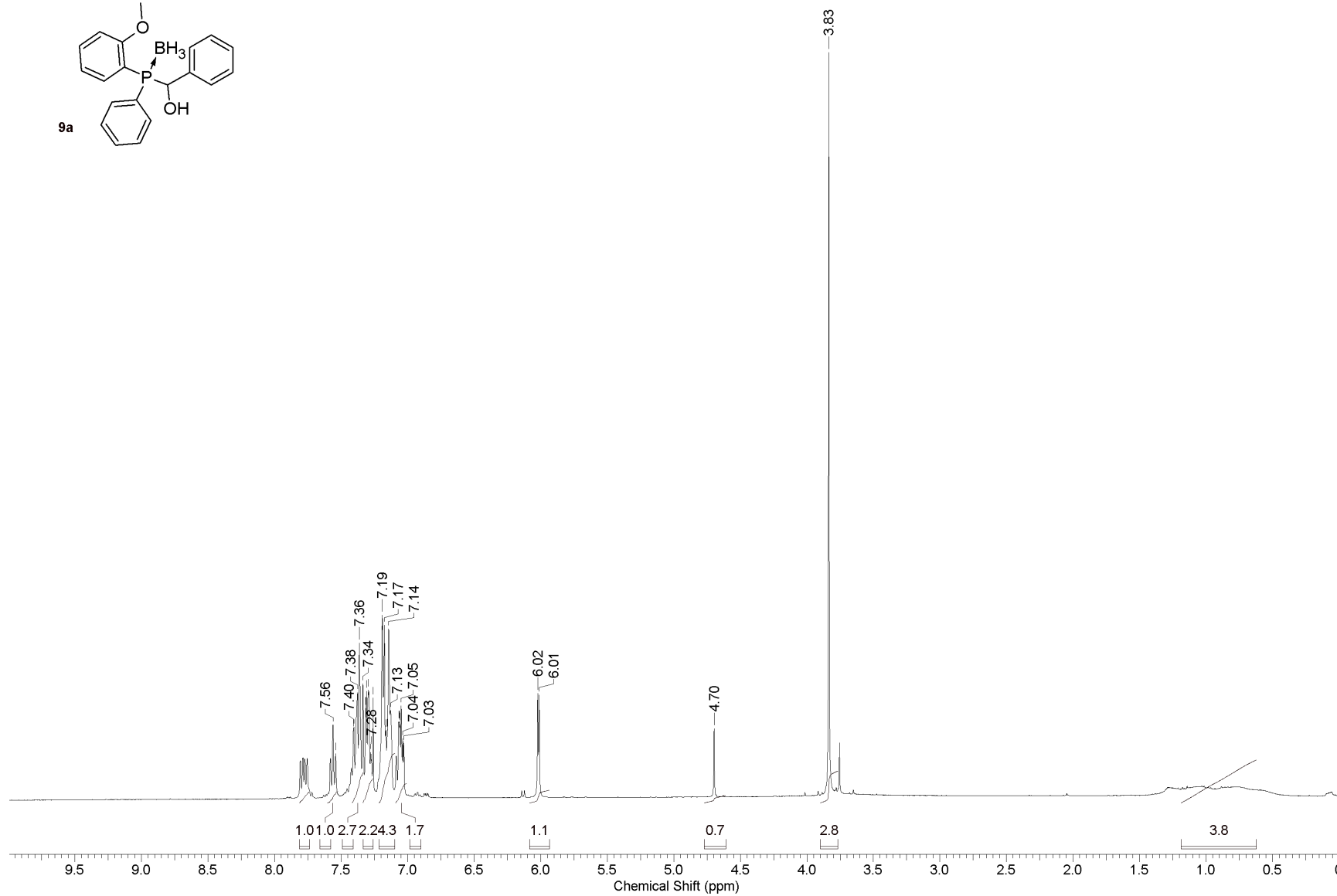
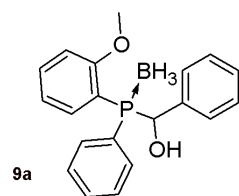
^1H NMR spectrum of (1-hydroxy-2-methylpropyl)diphenylphosphine-borane (**8m**) (500 MHz, CDCl_3)



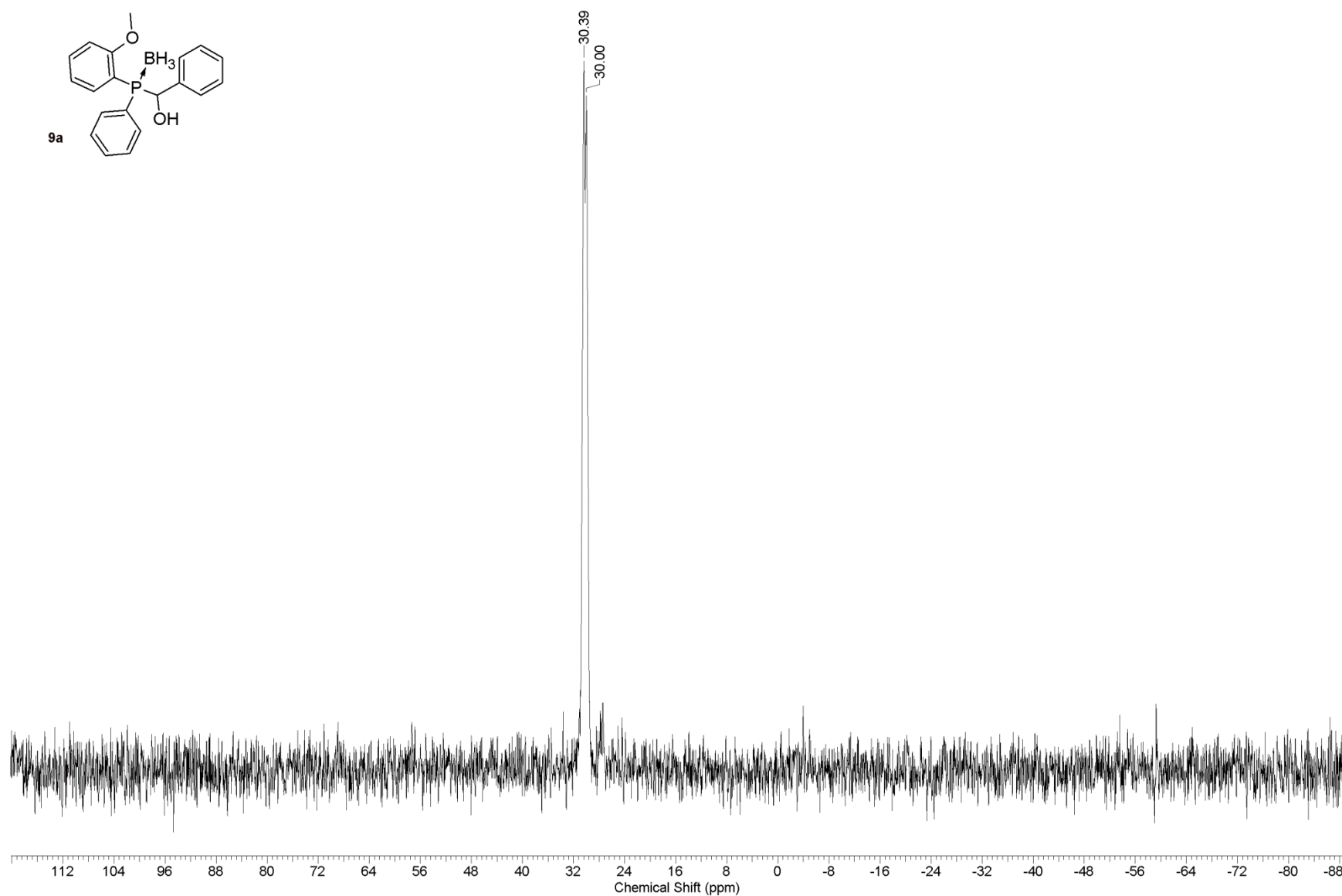
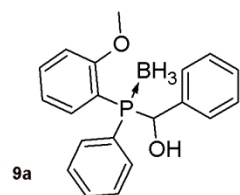
^{31}P NMR spectrum of (1-hydroxy-2-methylpropyl)diphenylphosphine-borane (**8m**) (202 MHz, CDCl_3)



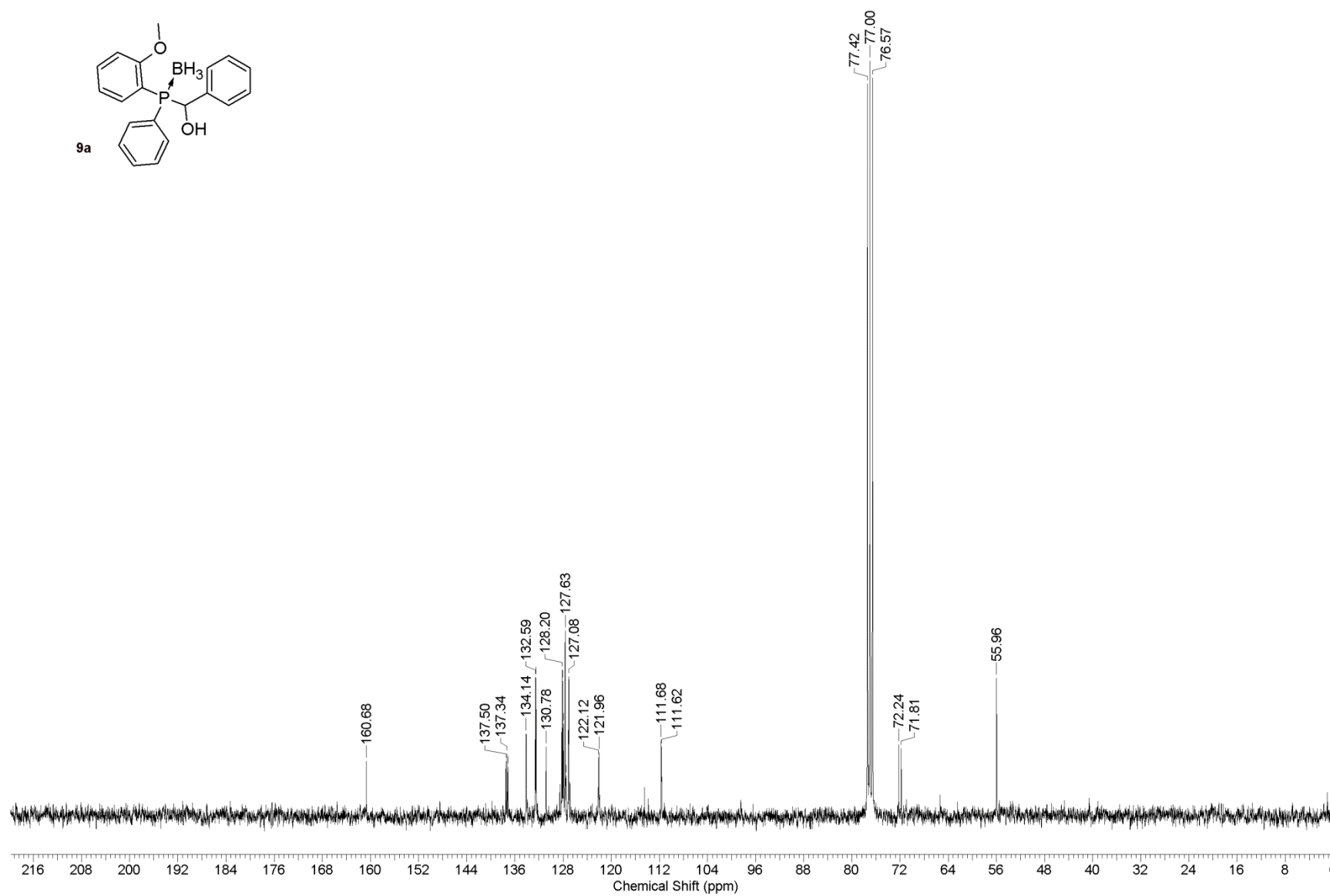
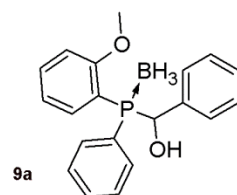
^{13}C NMR spectrum of (1-hydroxy-2-methylpropyl)diphenylphosphine-borane (**8m**) (125 MHz, CDCl_3)



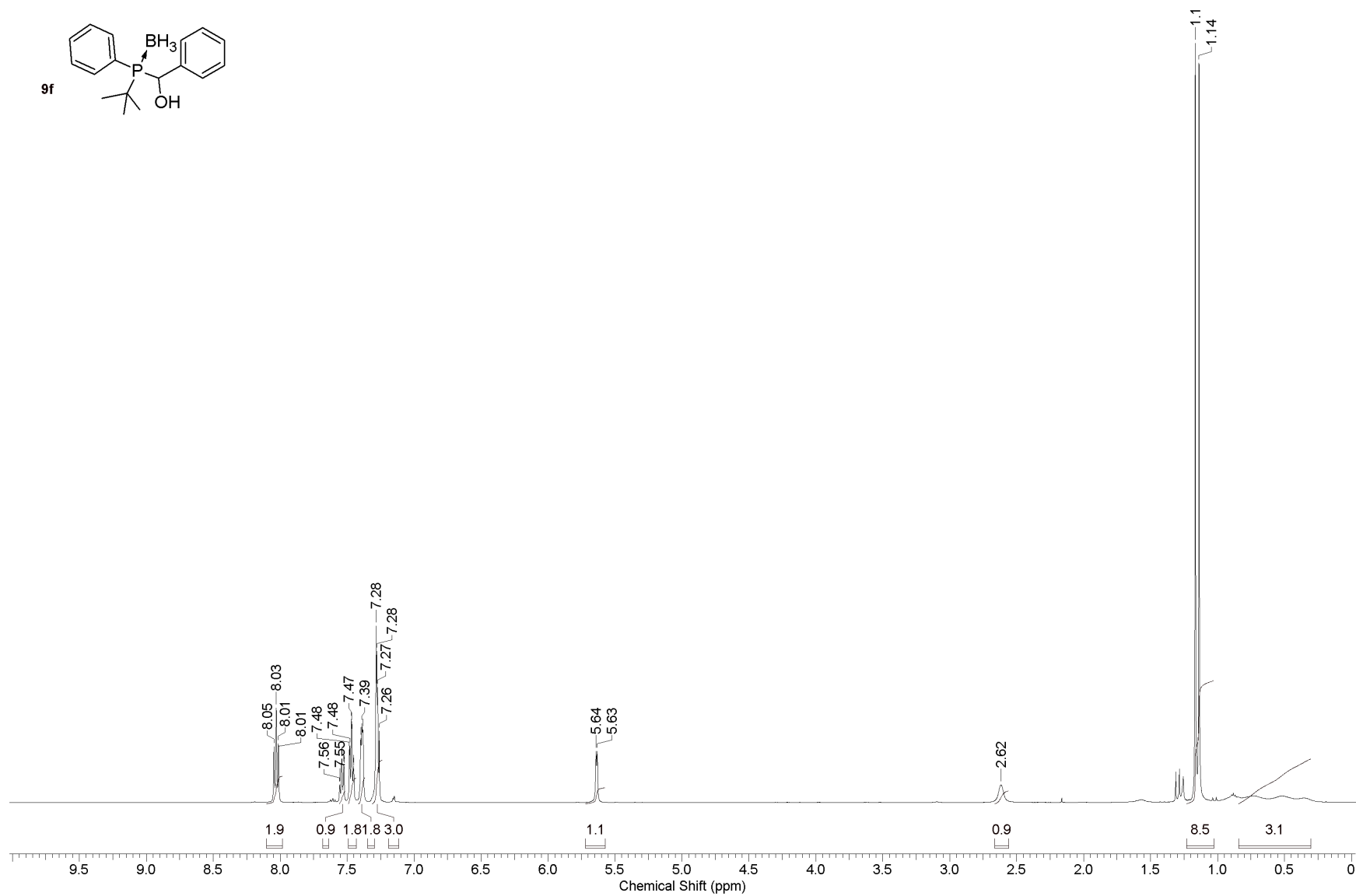
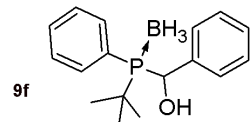
^1H NMR spectrum of *o*-anisyl((1-hydroxy)phenylmethyl)phenylphosphine-borane (**9a**) (400 MHz, CDCl_3)



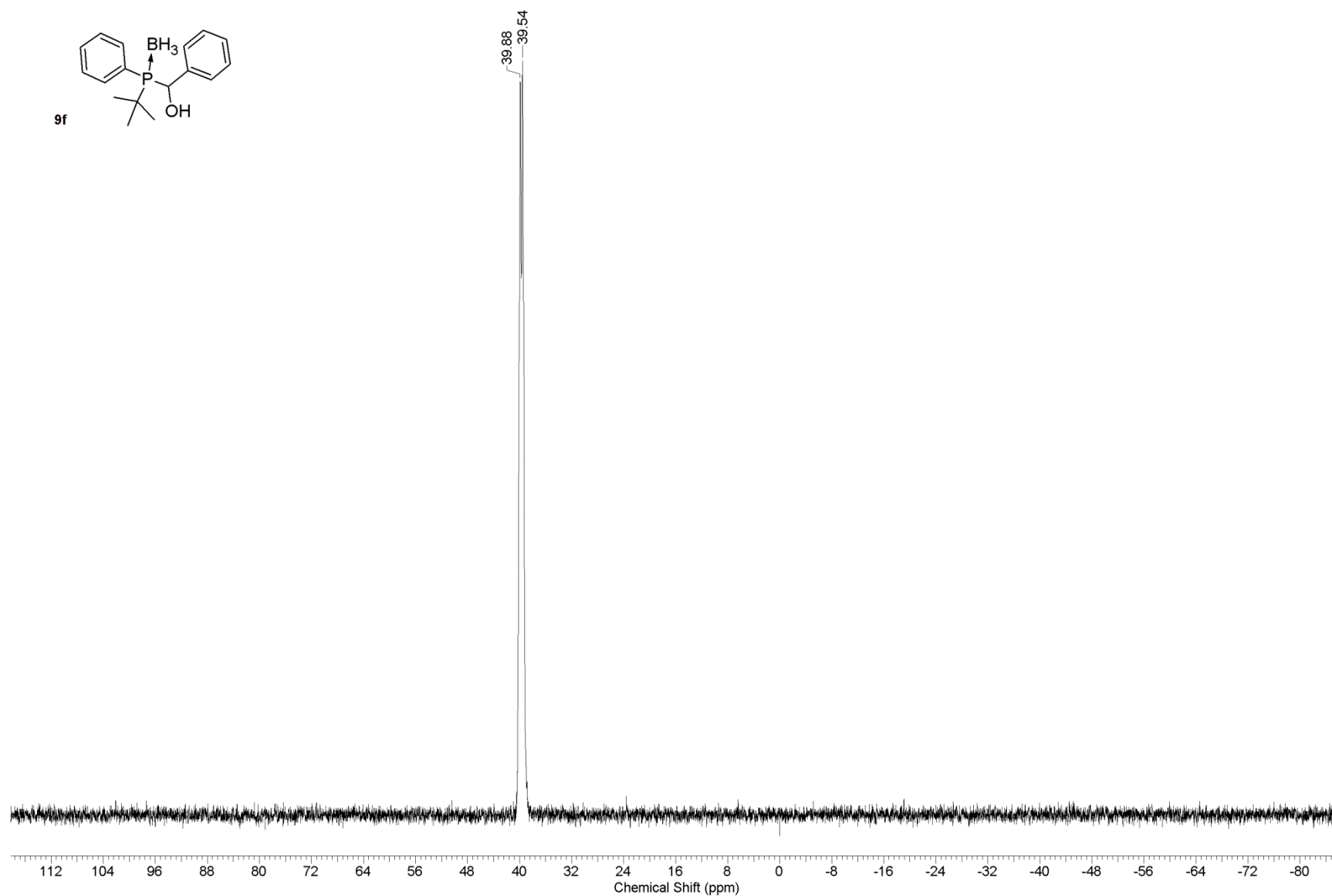
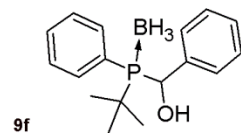
^{31}P NMR spectrum of *o*-anisyl((1-hydroxy)phenylmethyl)phenylphosphine-borane (**9a**) (162 MHz, CDCl_3)



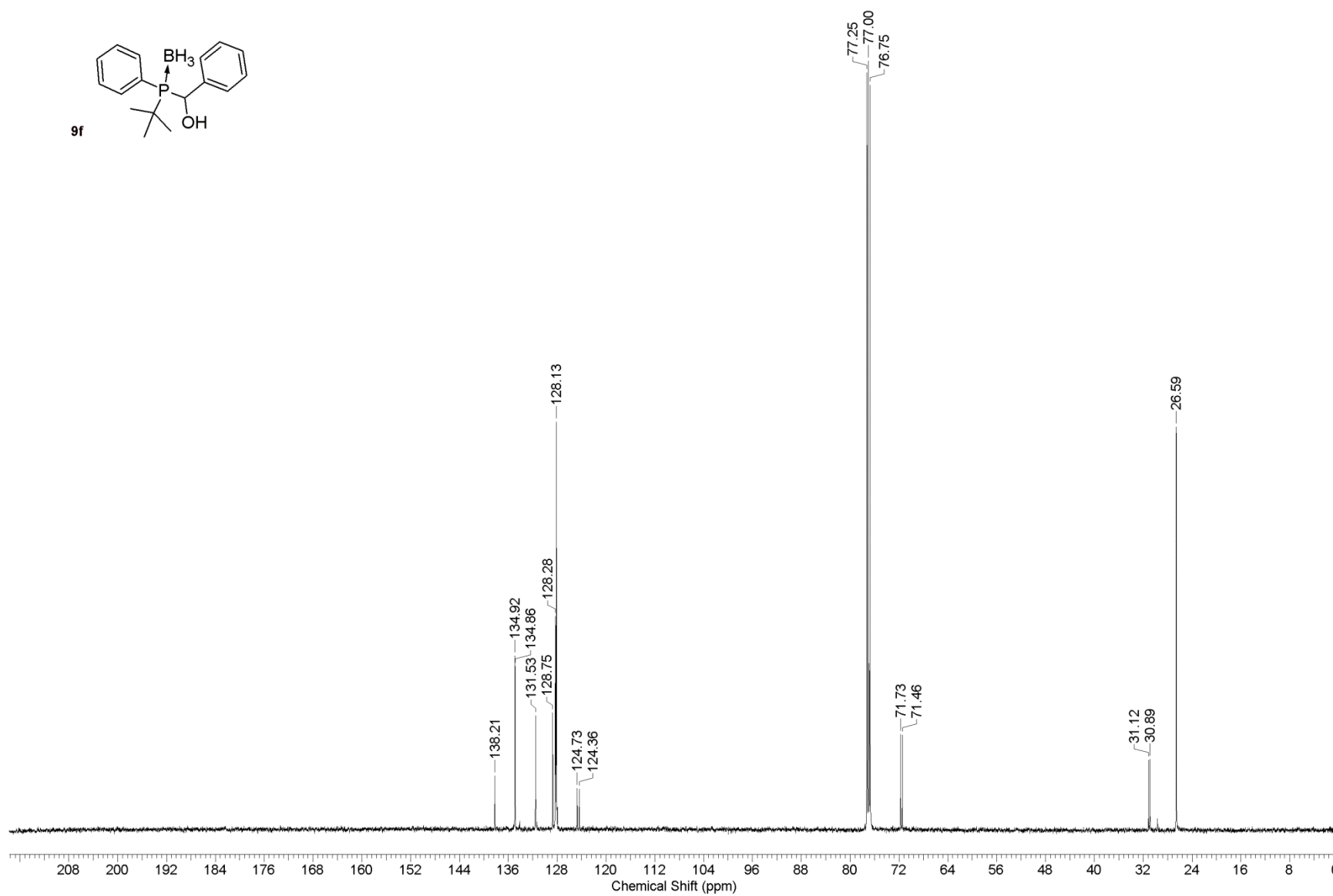
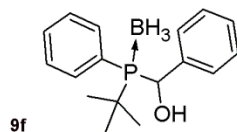
^{13}C NMR spectrum of *o*-anisyl((1-hydroxy)phenylmethyl)phenylphosphine-borane (**9a**) (75 MHz, CDCl_3)



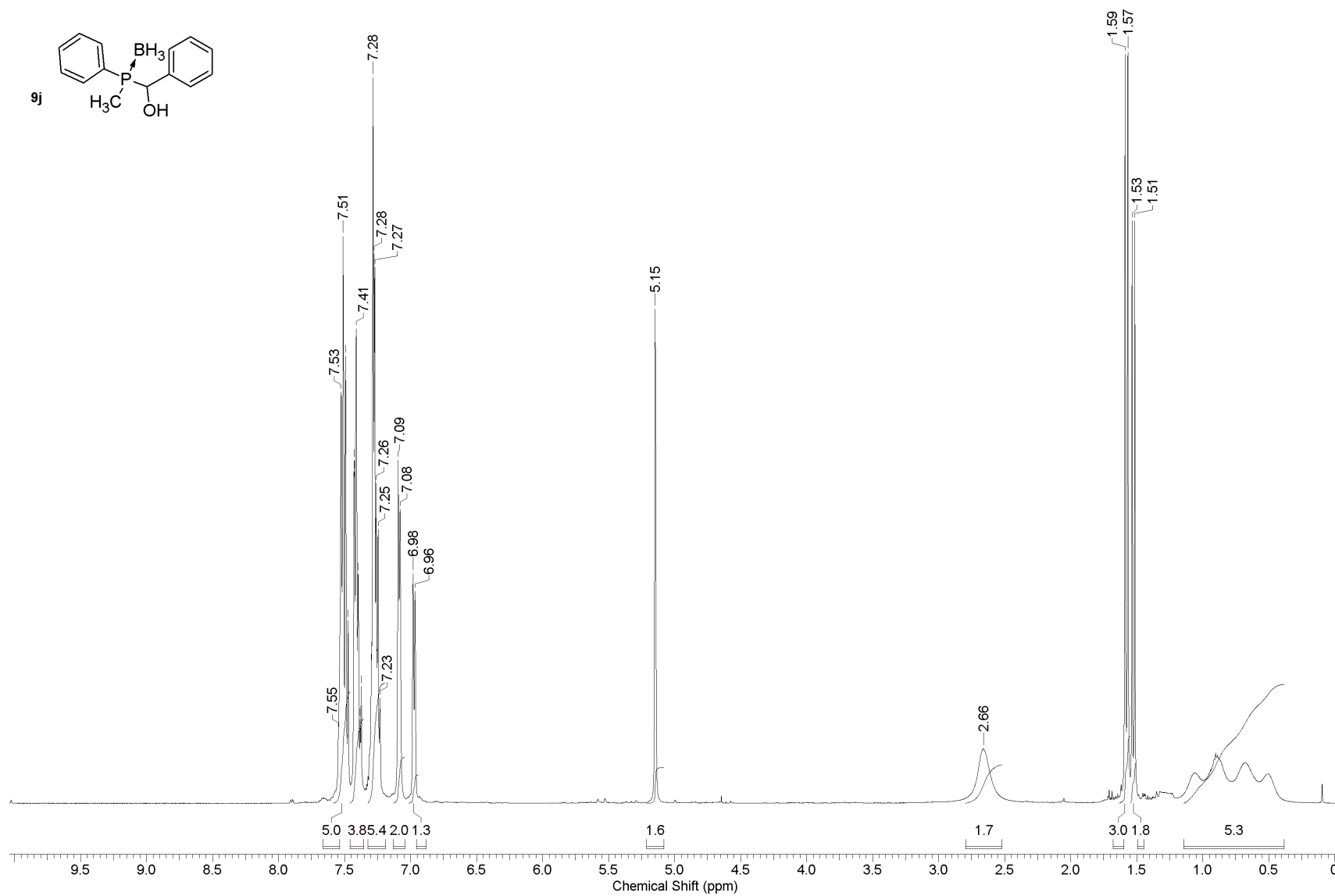
^1H NMR spectrum of *t*-butyl((1-hydroxy)phenylmethyl)phenylphosphine-borane (**9f**) (500 MHz, CDCl_3)



^{31}P NMR spectrum of *t*-butyl((1-hydroxy)phenylmethyl)phenylphosphine-borane (**9f**) (202 MHz, CDCl_3)

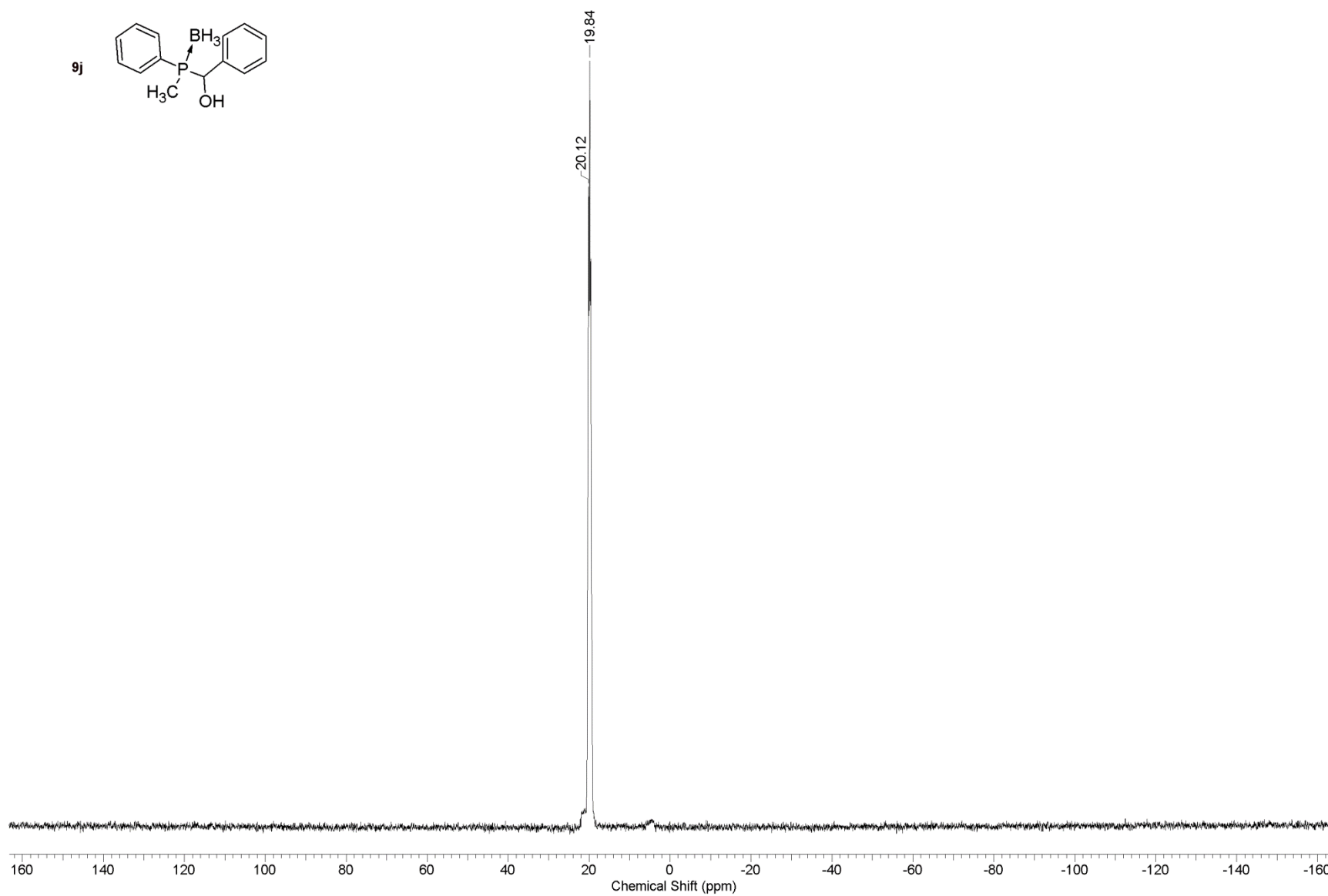
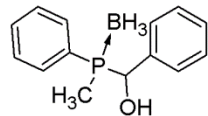


^{13}C NMR spectrum of *t*-butyl((1-hydroxy)phenylmethyl)phenylphosphine-borane (**9f**) (125 MHz, CDCl_3)

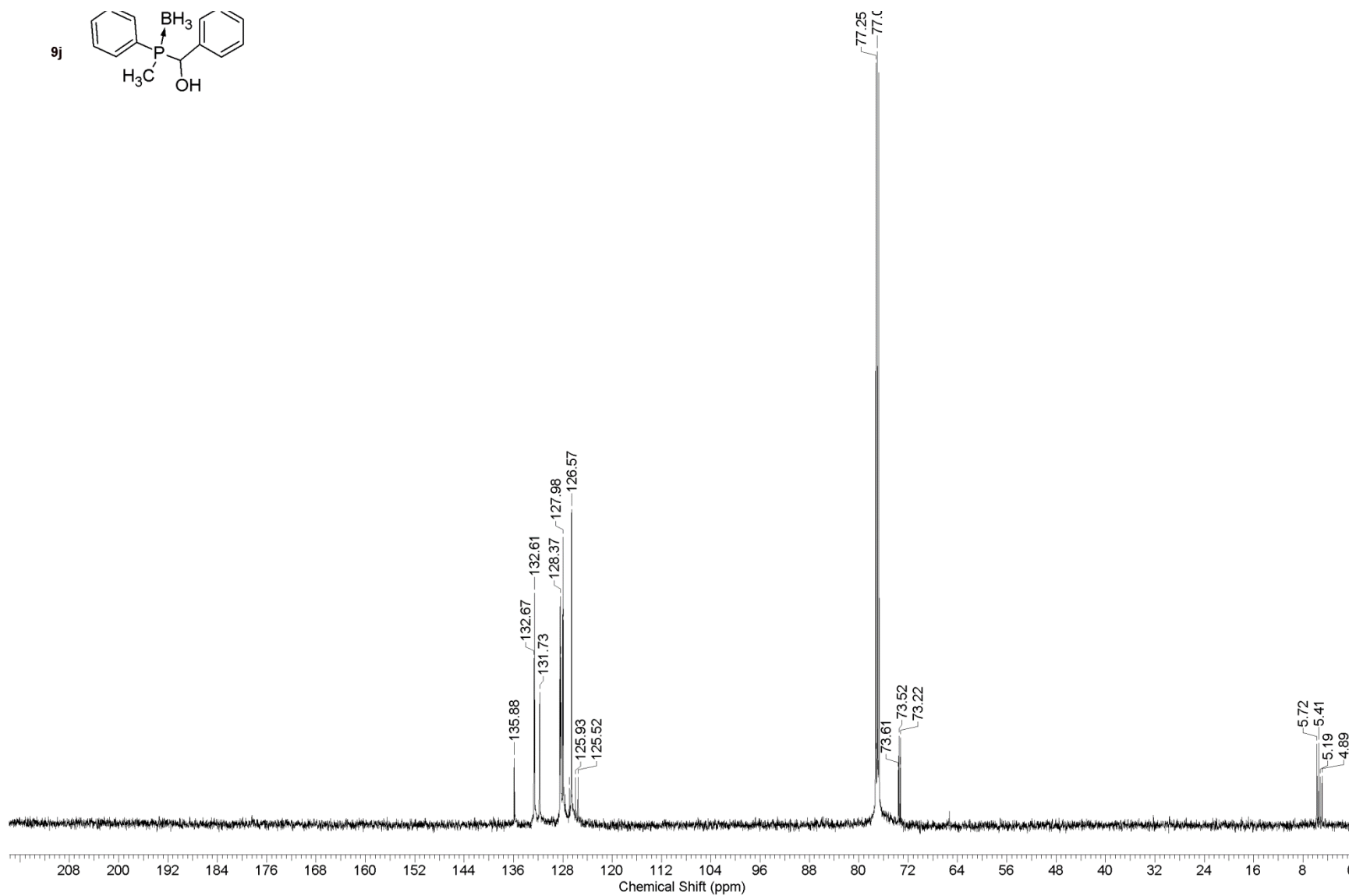
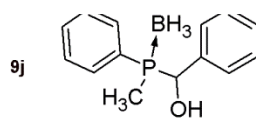


¹H NMR spectrum of ((1-hydroxy)phenylmethyl)(methyl)phenylphosphine-borane (**9j**) (500 MHz, CDCl₃)

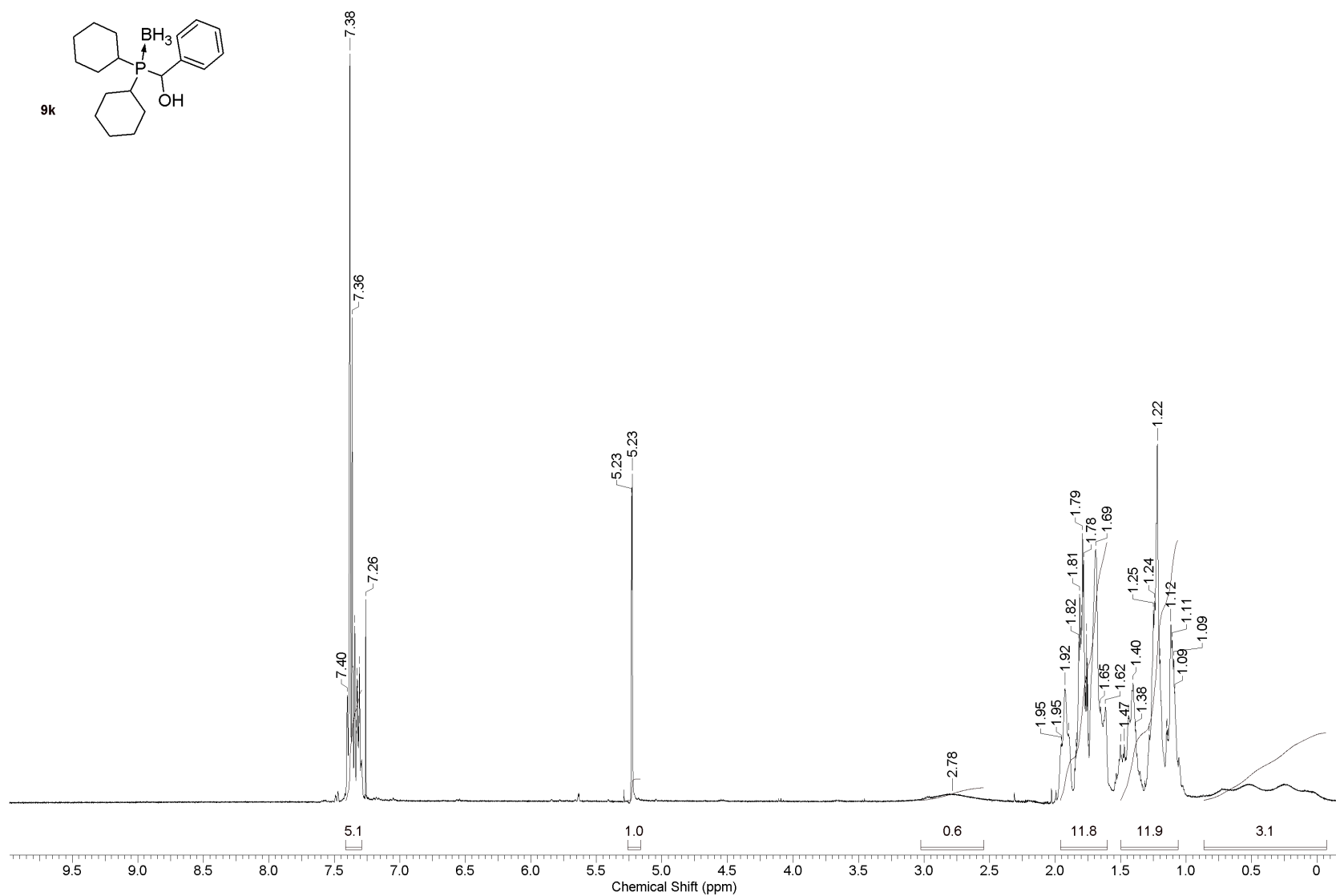
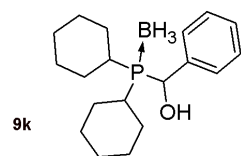
9j



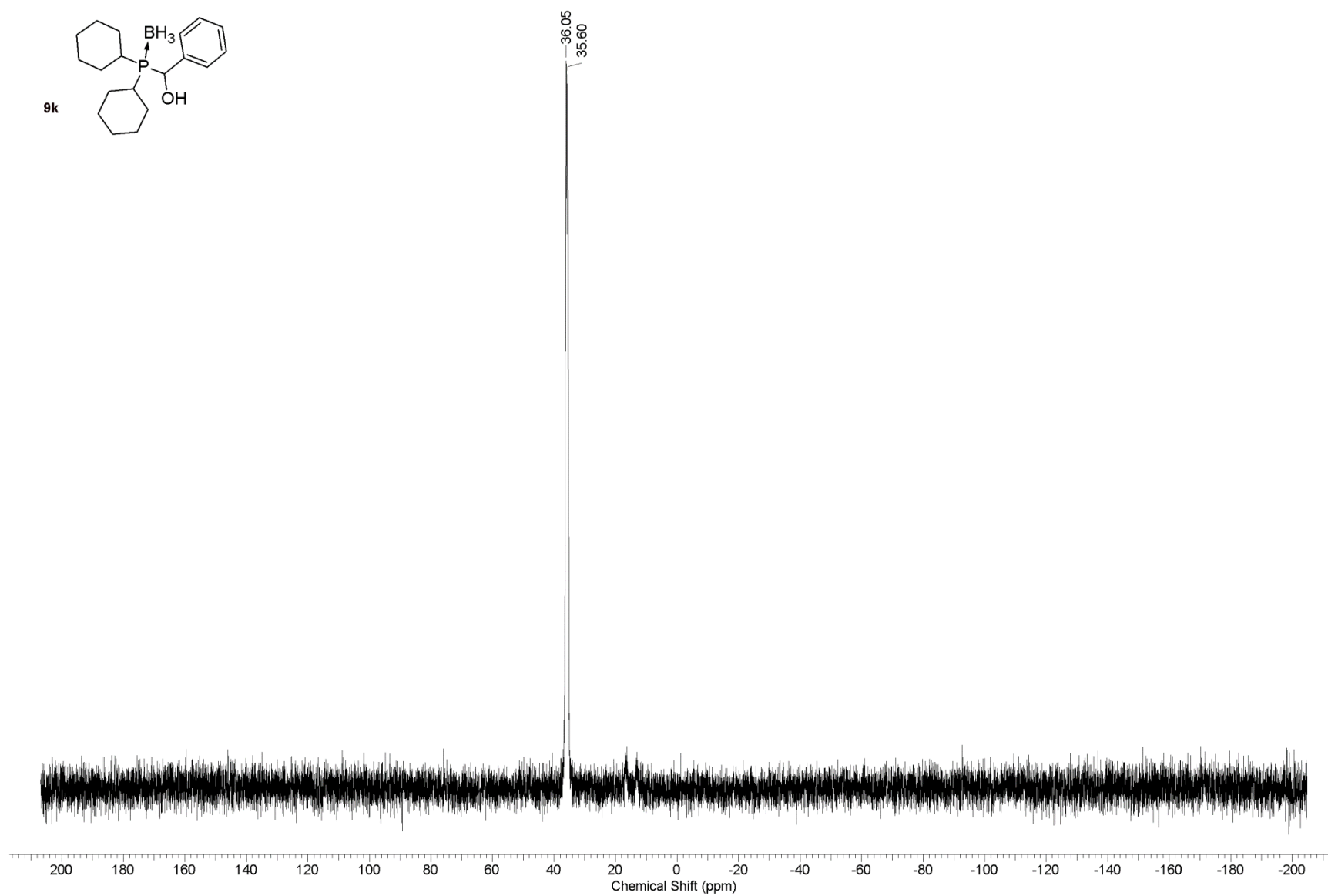
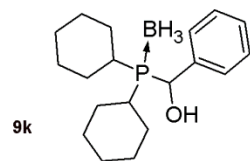
^{31}P NMR spectrum of ((1-hydroxy)phenylmethyl)(methyl)phenylphosphine-borane (**9j**) (202 MHz, CDCl_3)



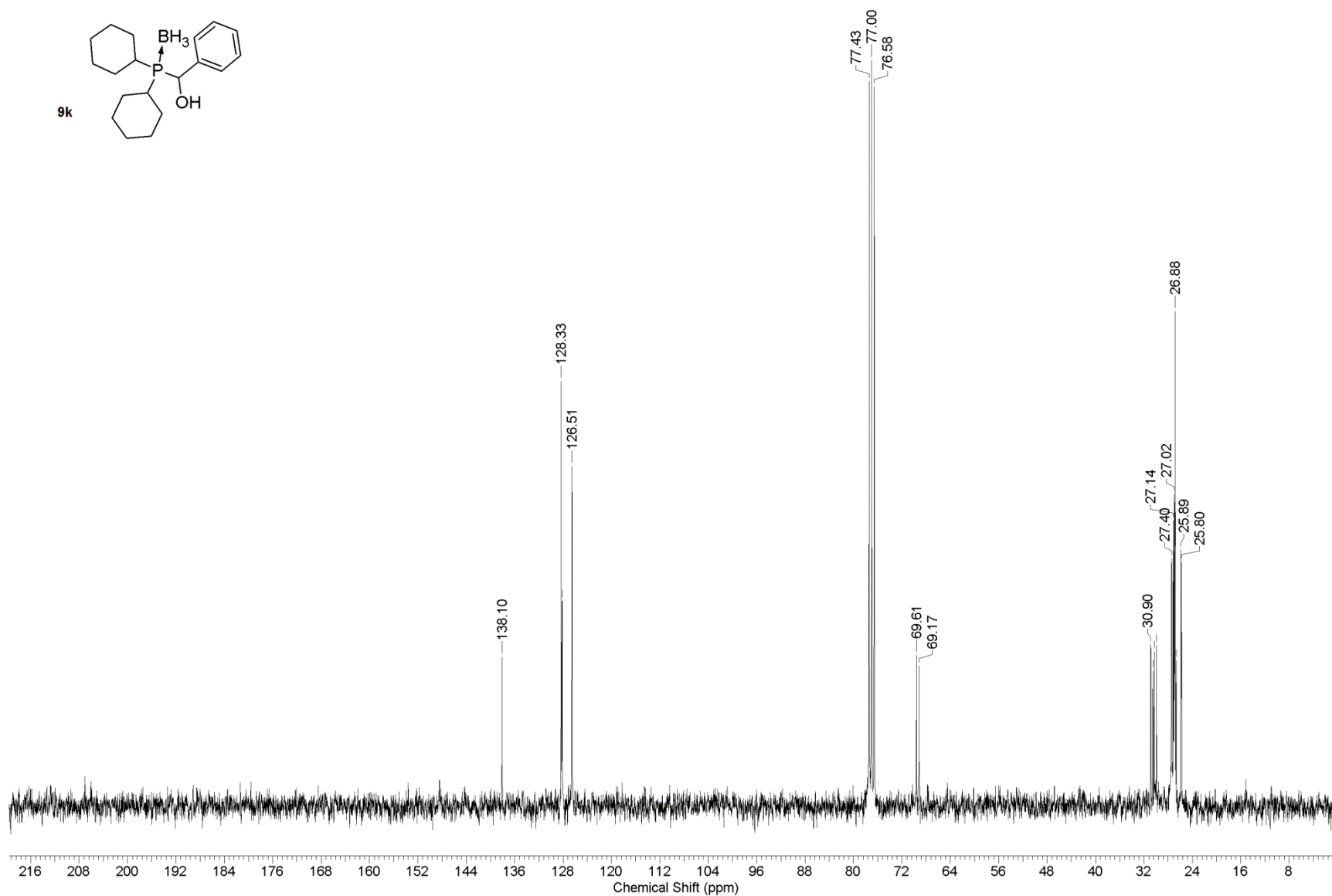
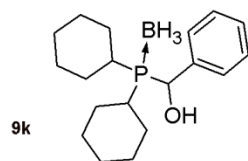
^{13}C NMR spectrum of ((1-hydroxy)phenylmethyl)(methyl)phenylphosphine-borane (**9j**) (125 MHz, CDCl_3)



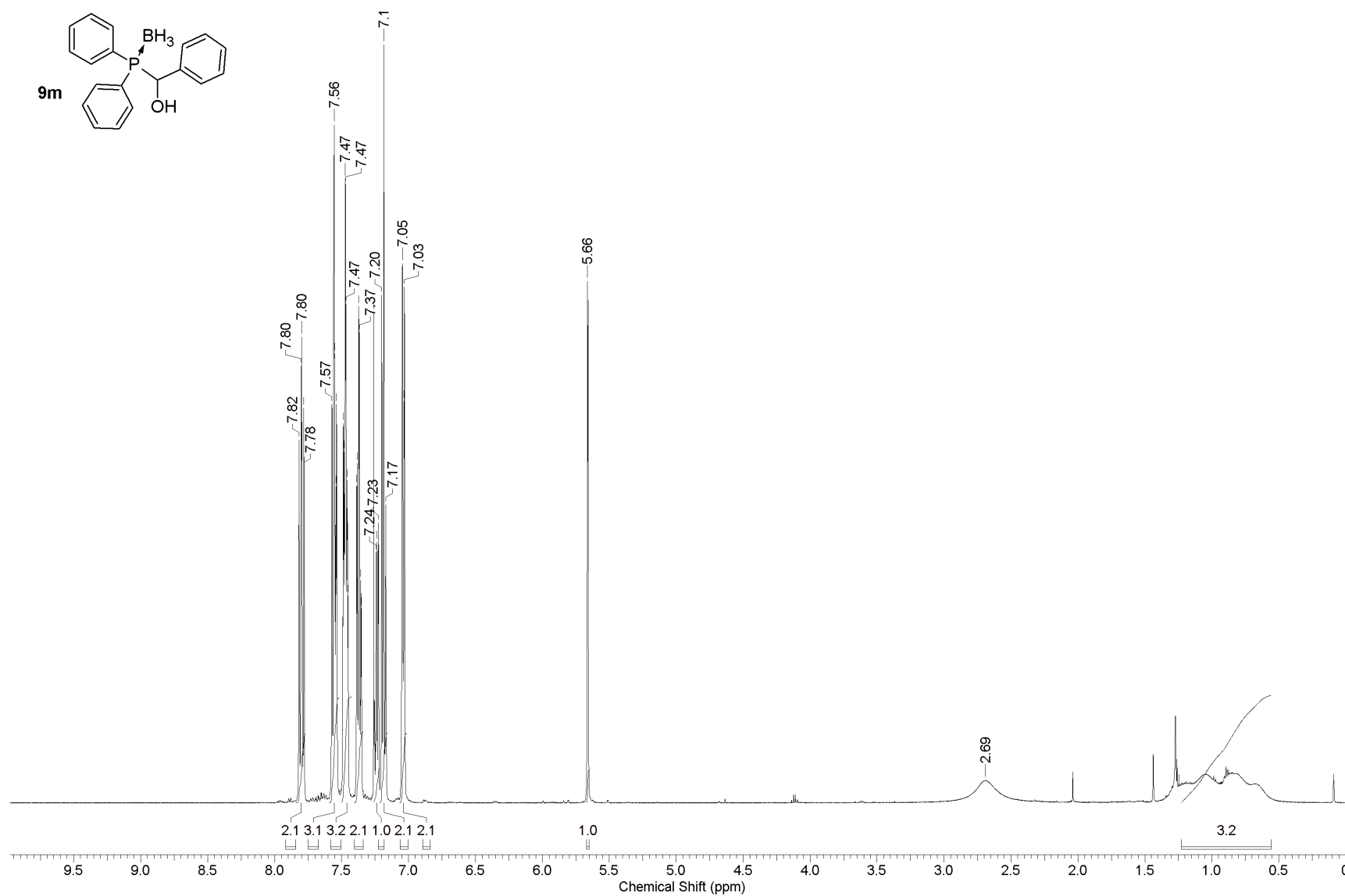
^1H NMR spectrum of di-*c*-hexyl((1-hydroxy)phenylmethyl)phosphine-borane (**9k**) (400 MHz, CDCl_3)



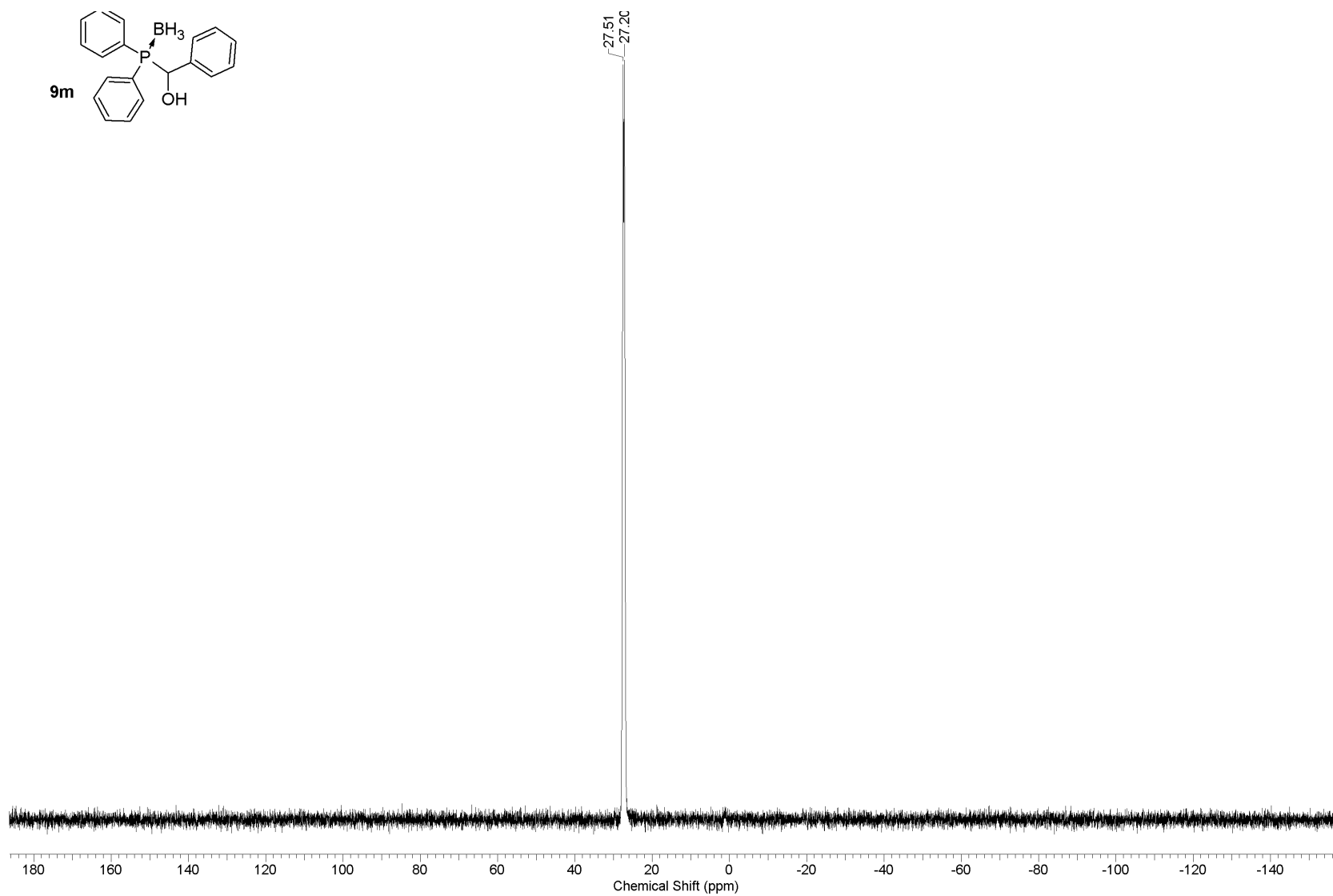
^{31}P NMR spectrum of di-*c*-hexyl((1-hydroxy)phenylmethyl)phosphine-borane (**9k**) (162 MHz, CDCl_3)



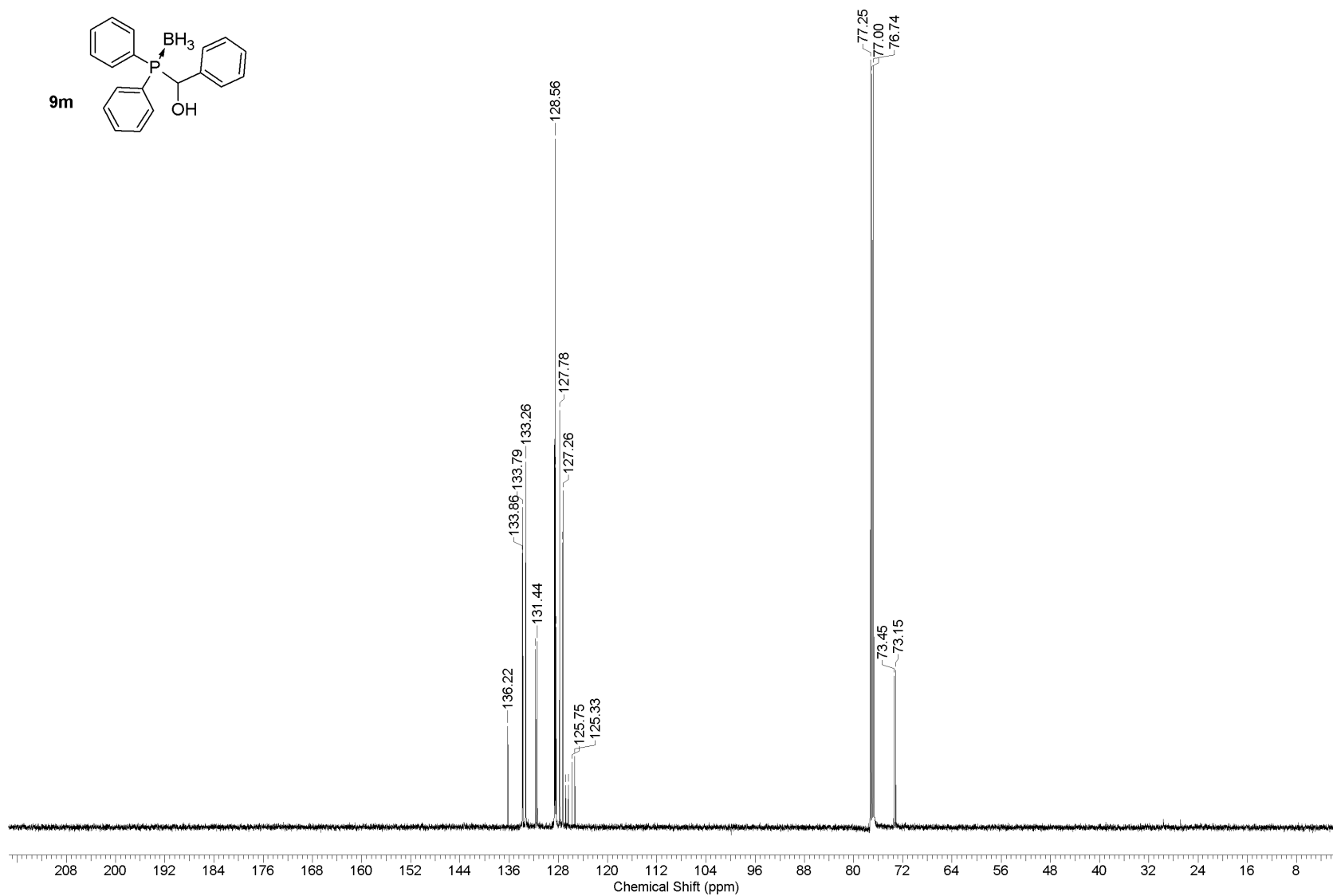
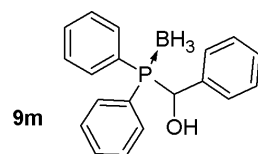
^{13}C NMR spectrum of di-*c*-hexyl((1-hydroxy)phenylmethyl)phosphine-borane (**9k**) (75 MHz, CDCl_3)



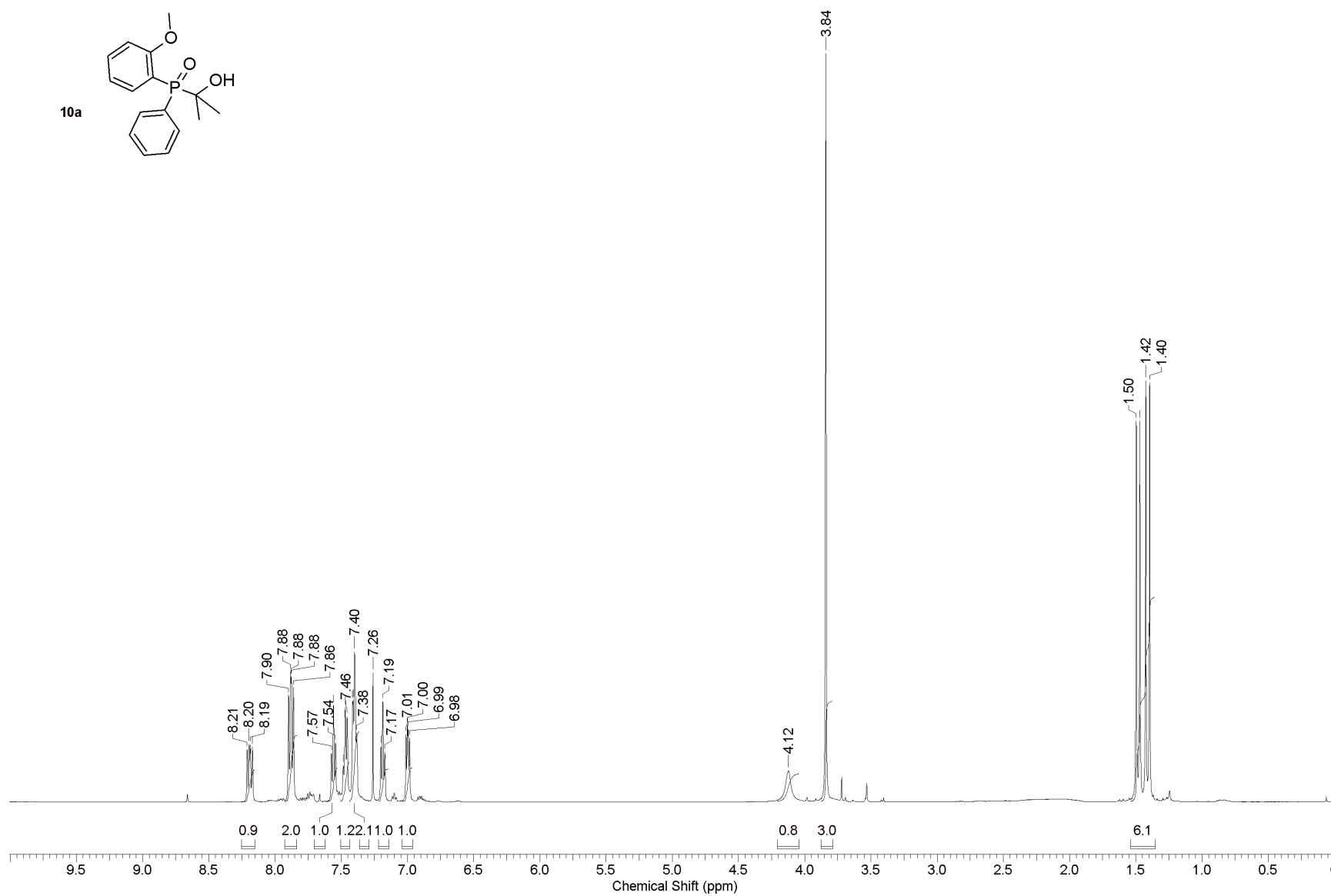
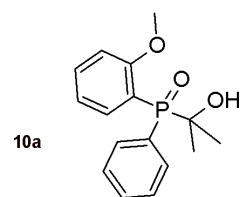
¹H NMR spectrum of diphenyl((1-hydroxy)phenylmethyl)phosphine-borane (**9m**) (500 MHz, CDCl₃)



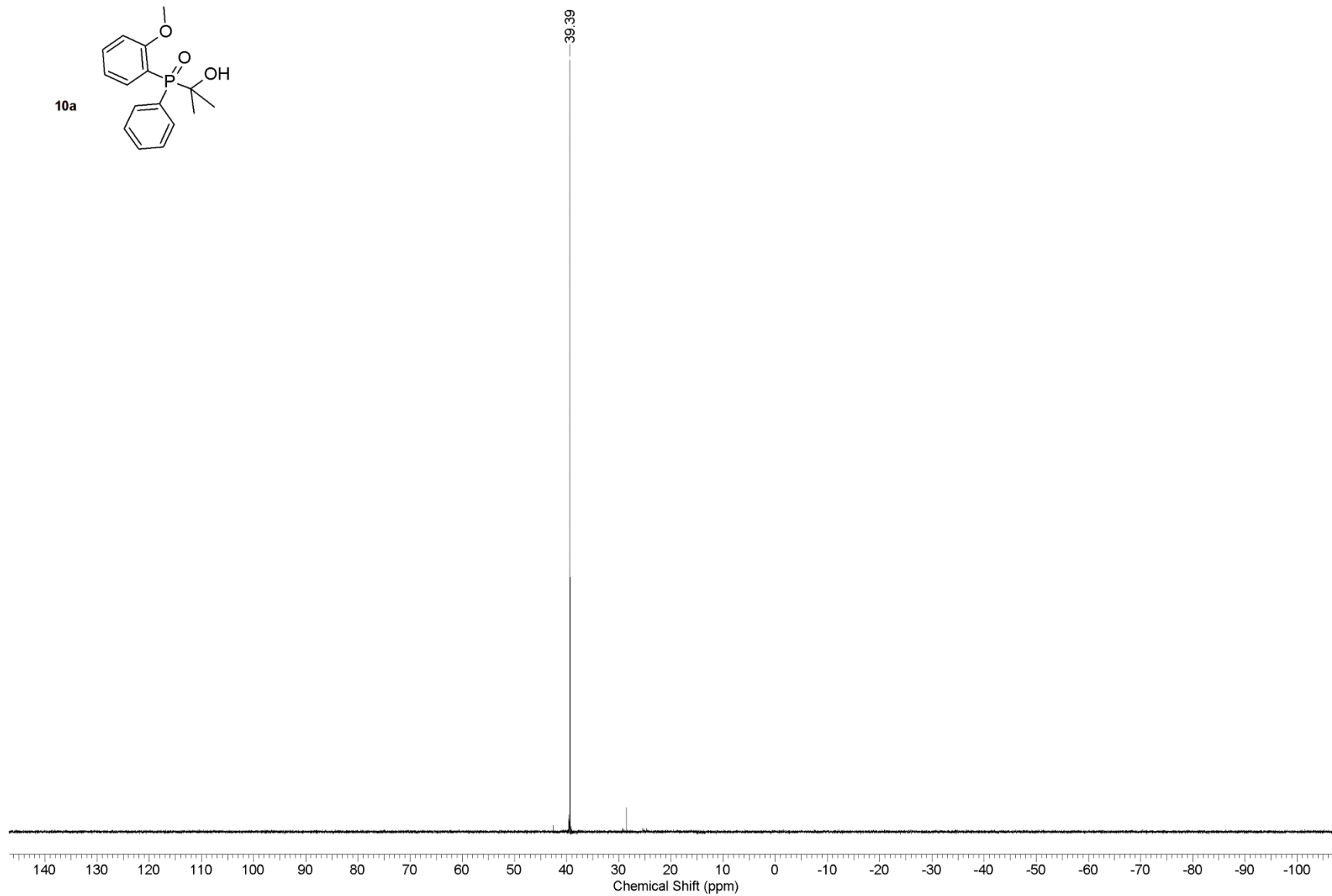
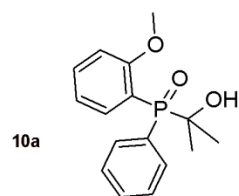
^{31}P NMR spectrum of diphenyl((1-hydroxy)phenylmethyl)phosphine-borane (**9m**) (202 MHz, CDCl_3)



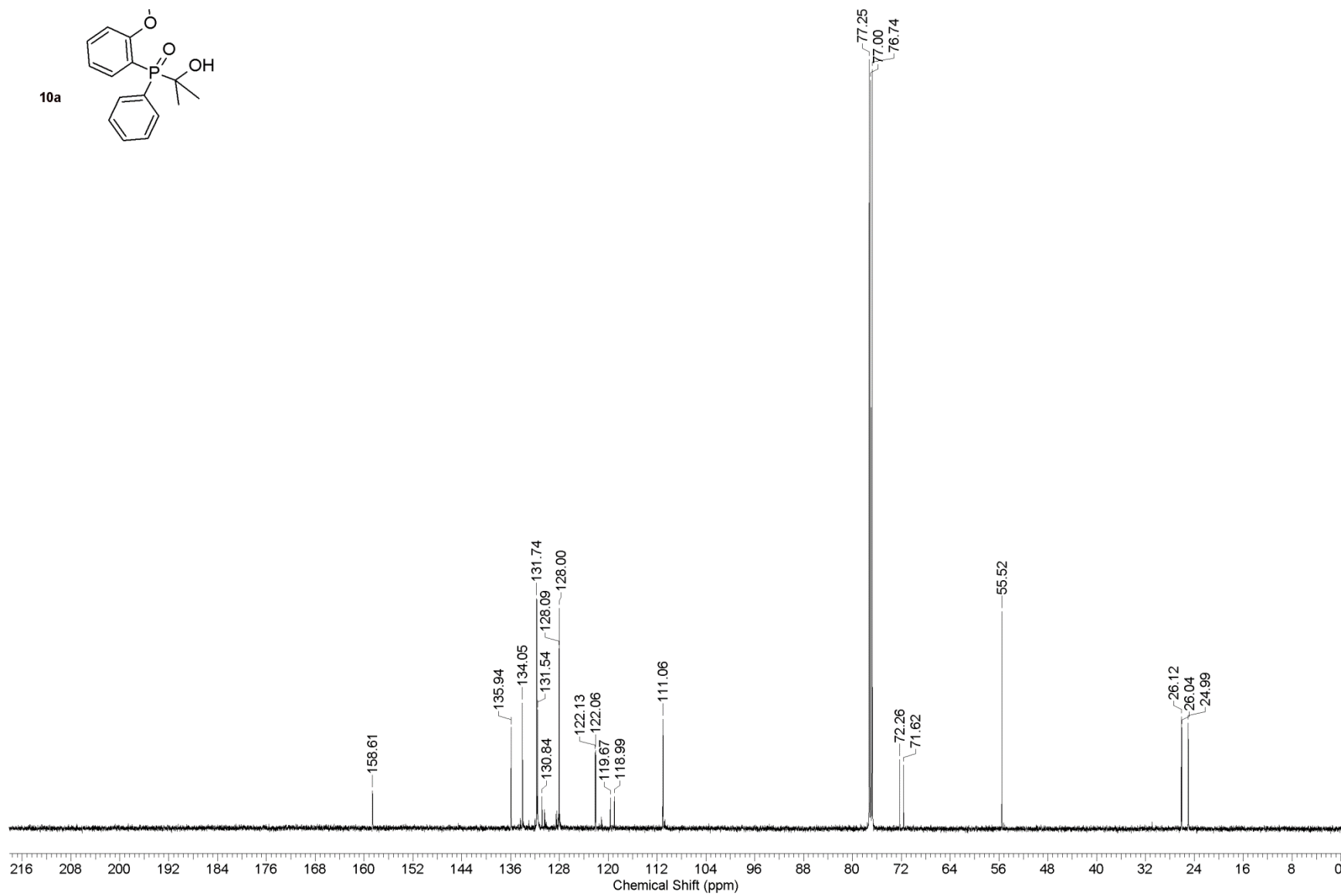
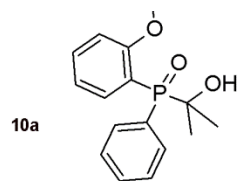
^{13}C NMR spectrum of diphenyl((1-hydroxy)phenylmethyl)phosphine-borane (**9m**) (125 MHz, CDCl_3)



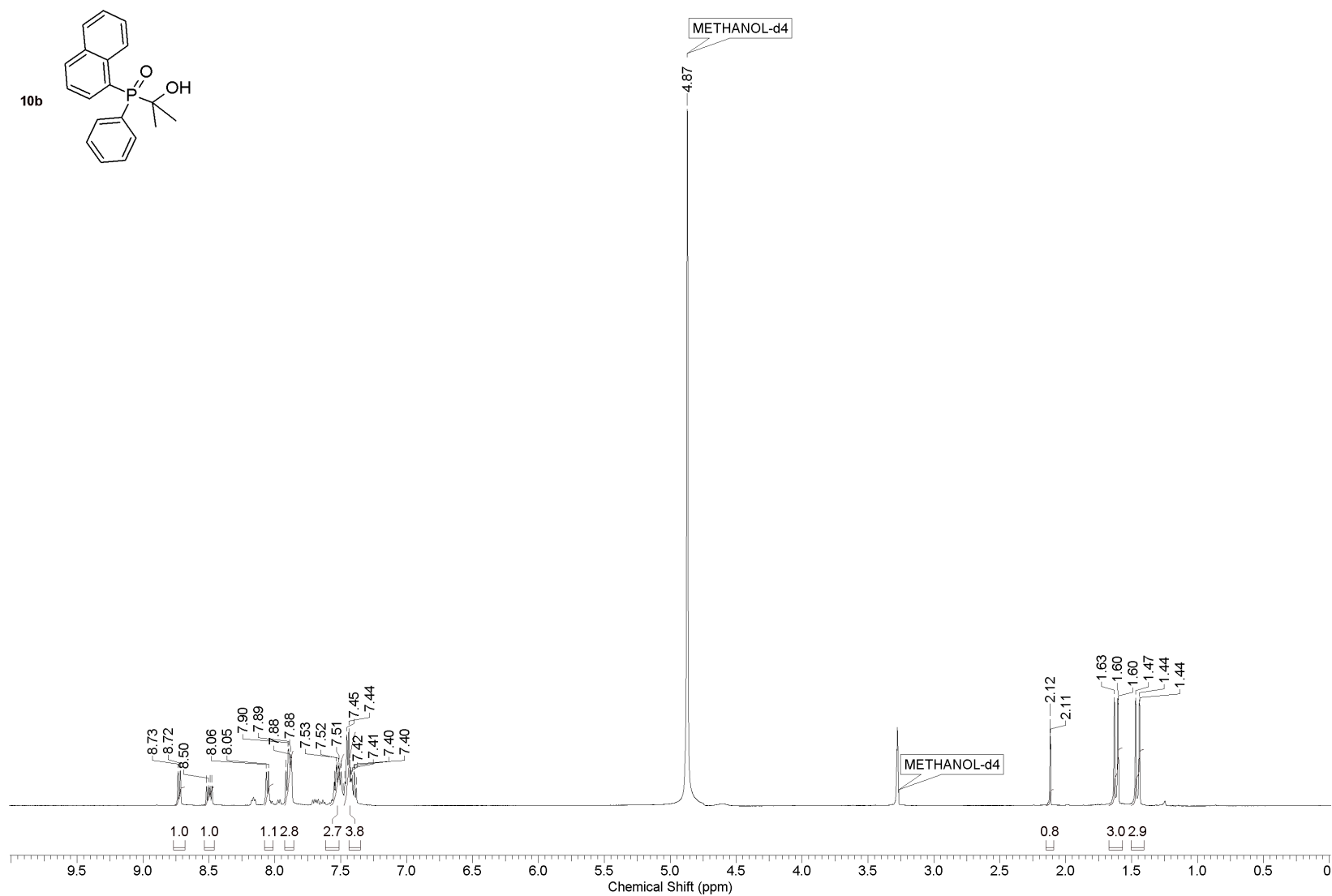
^1H NMR spectrum of *o*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10a**) (500 MHz, CDCl_3)



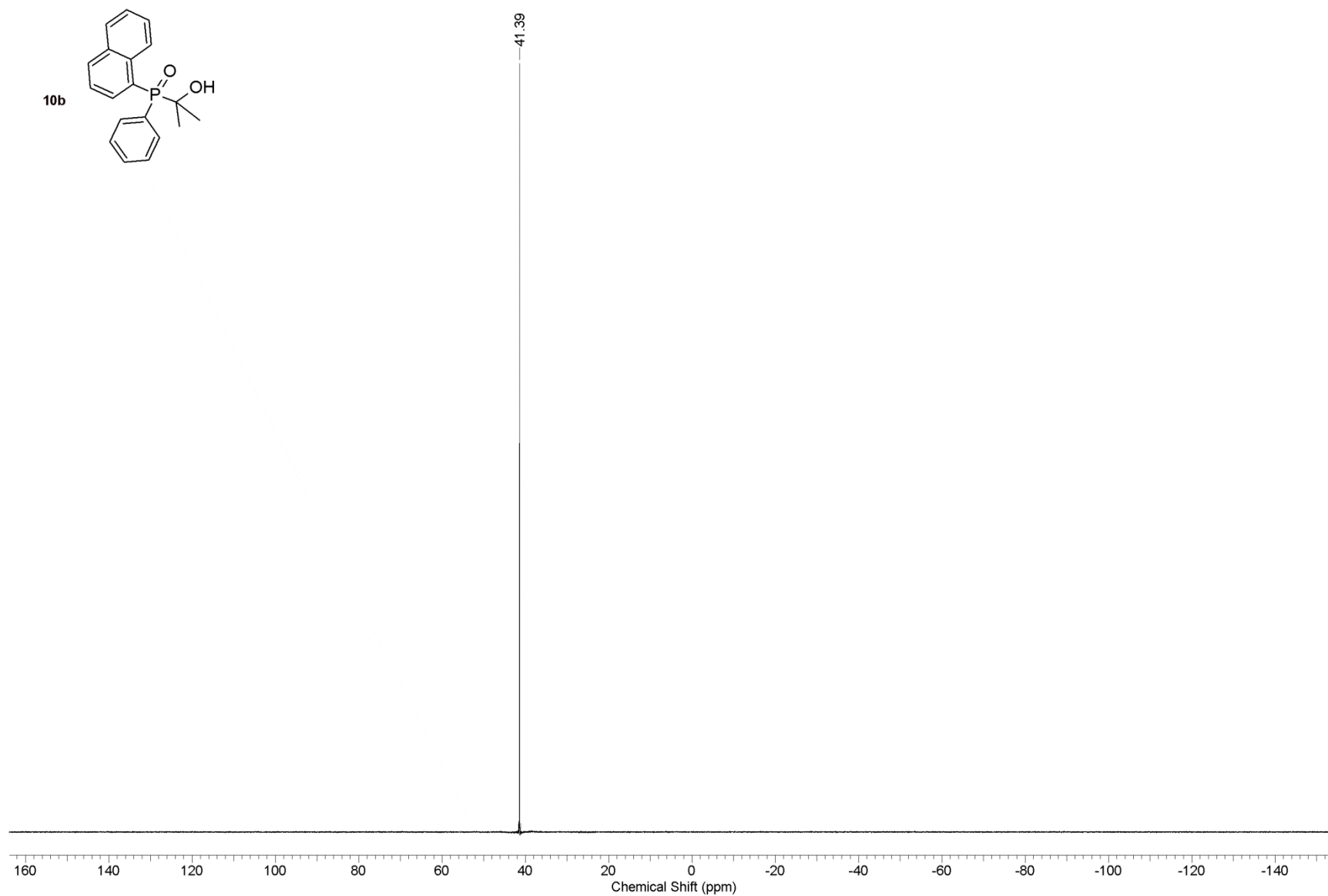
^{31}P NMR spectrum of *o*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10a**) (202 MHz, CDCl_3)



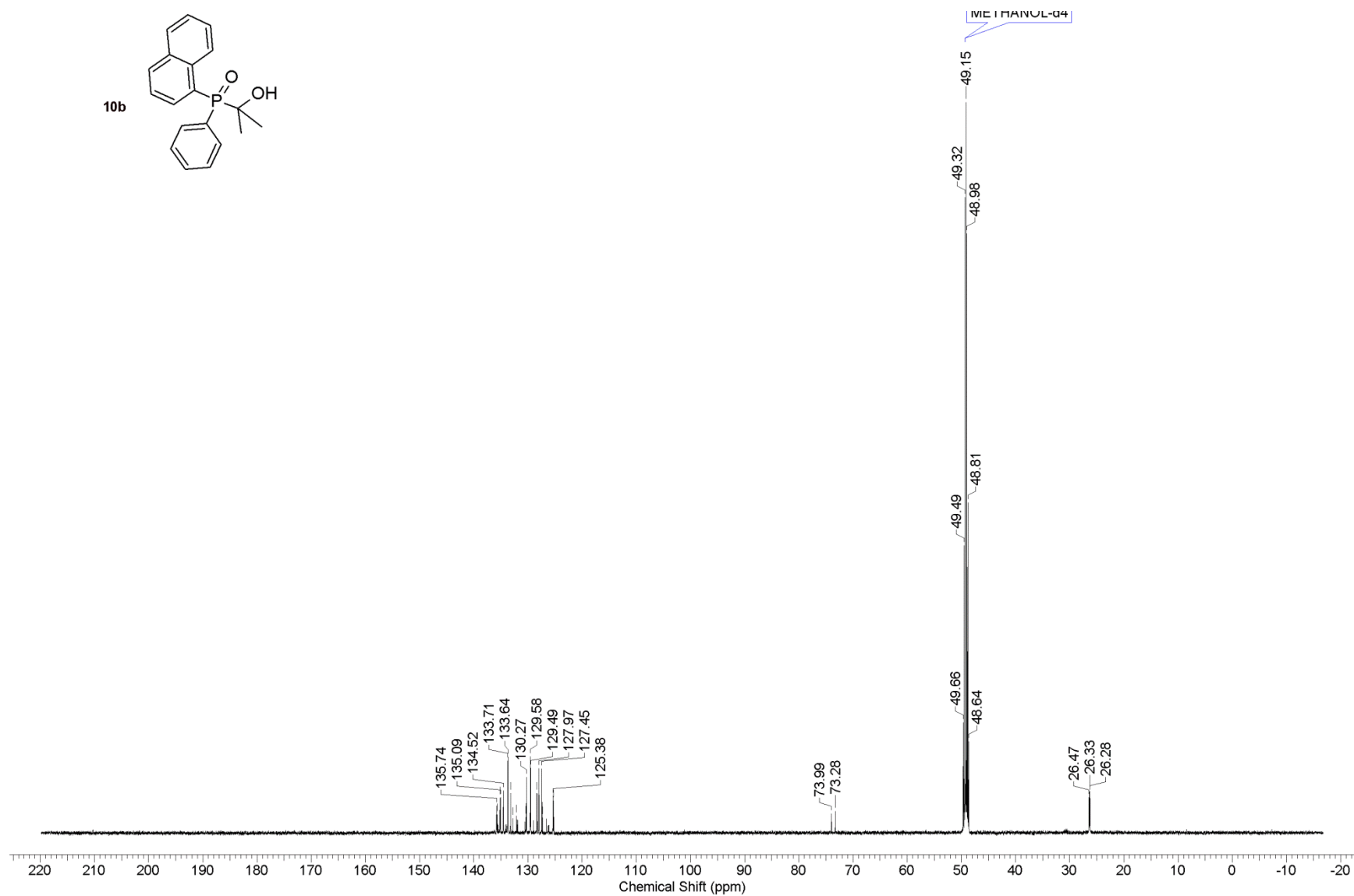
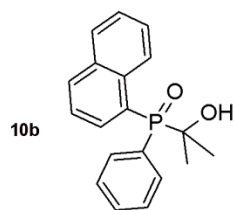
^{13}C NMR spectrum of *o*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10a**) (125 MHz, CDCl_3)



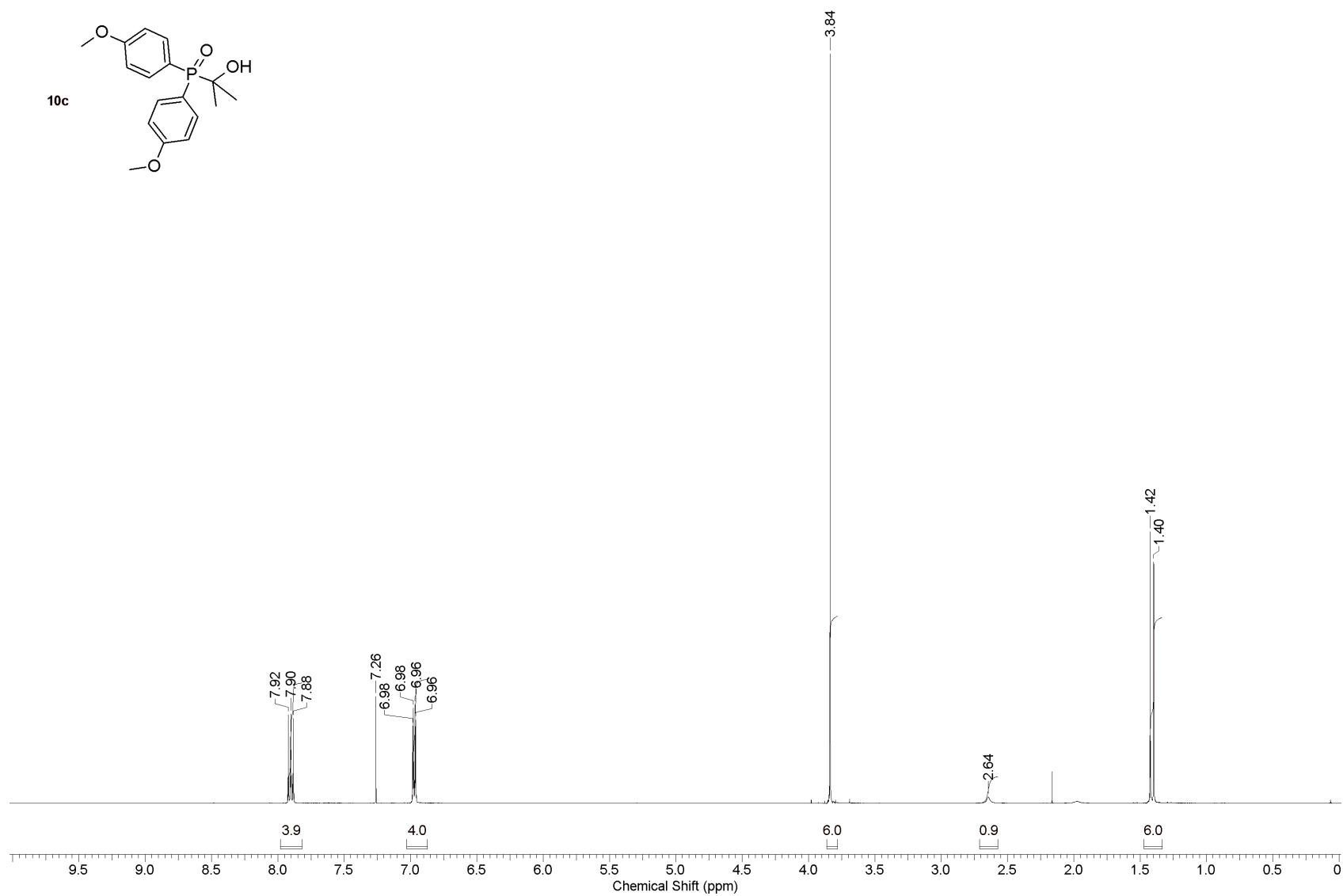
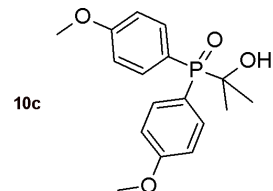
¹H NMR spectrum of 1-naphthyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10b**) (500 MHz, CD₃OD)



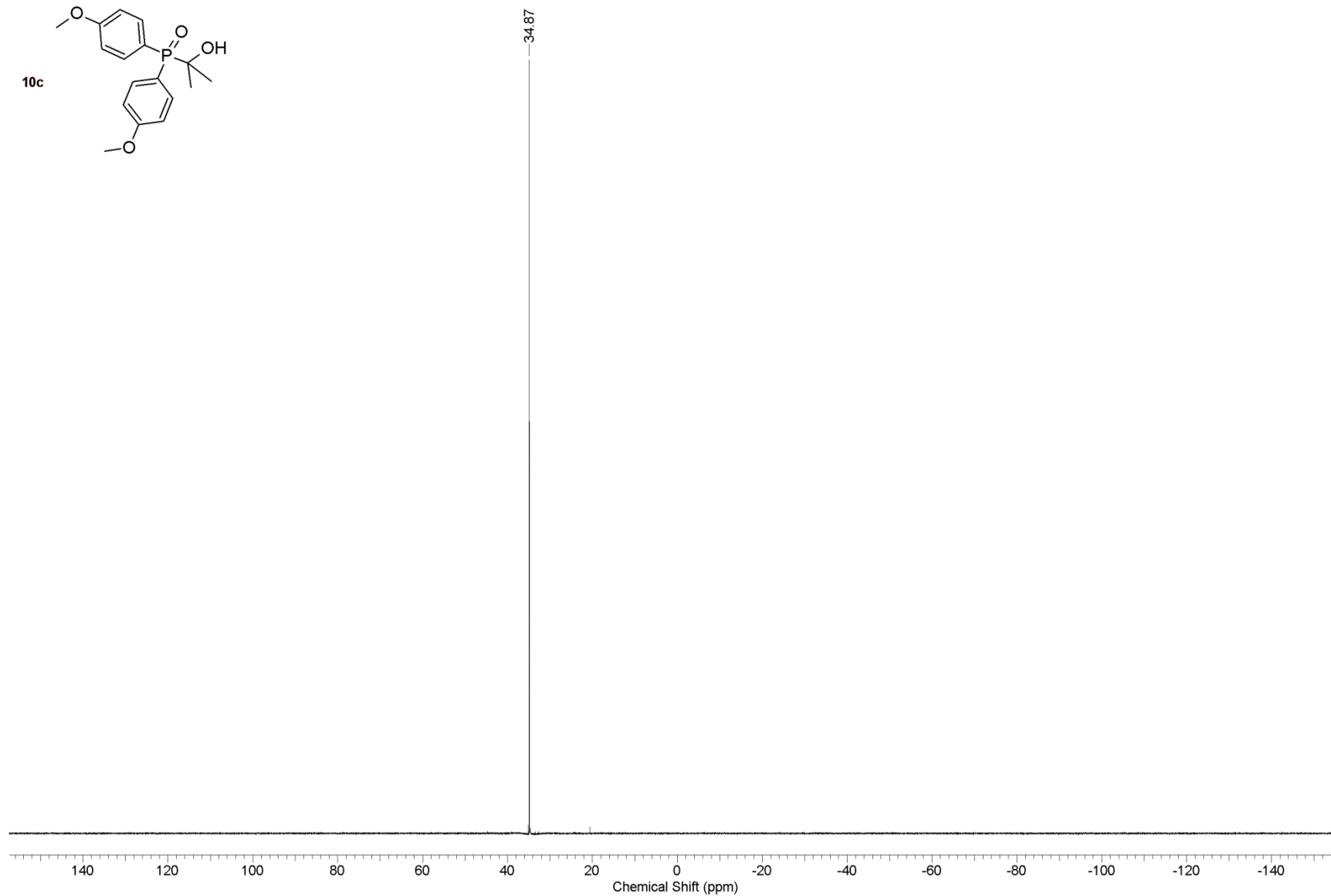
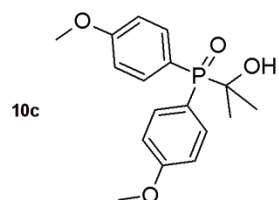
^{31}P NMR spectrum of 1-naphthyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10b**) (202 MHz, CD_3OD)



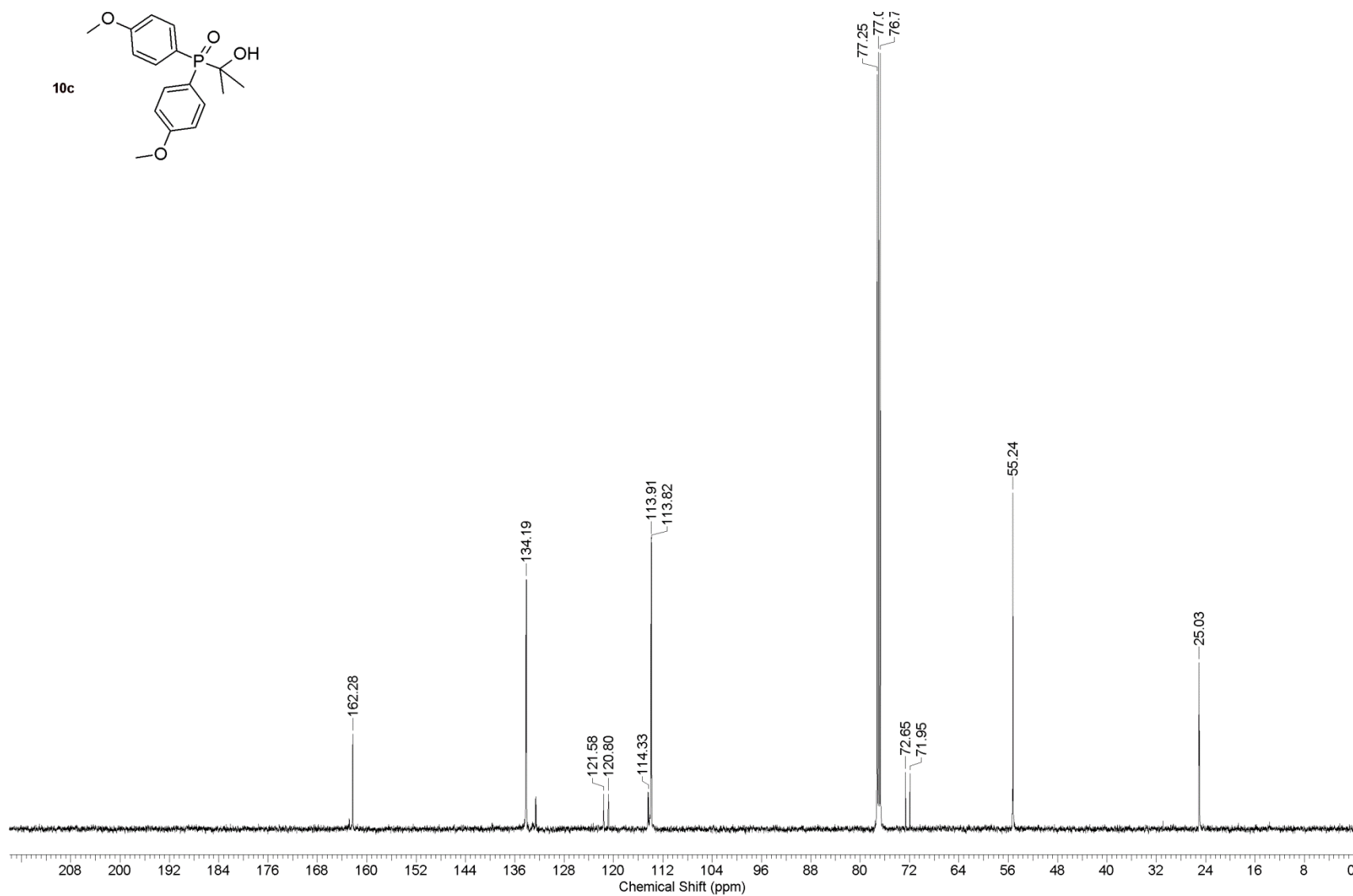
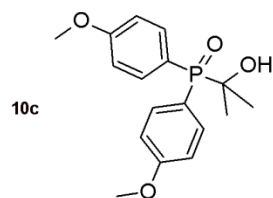
^{13}C NMR spectrum of 1-naphthyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10b**) (125 MHz, CD_3OD)



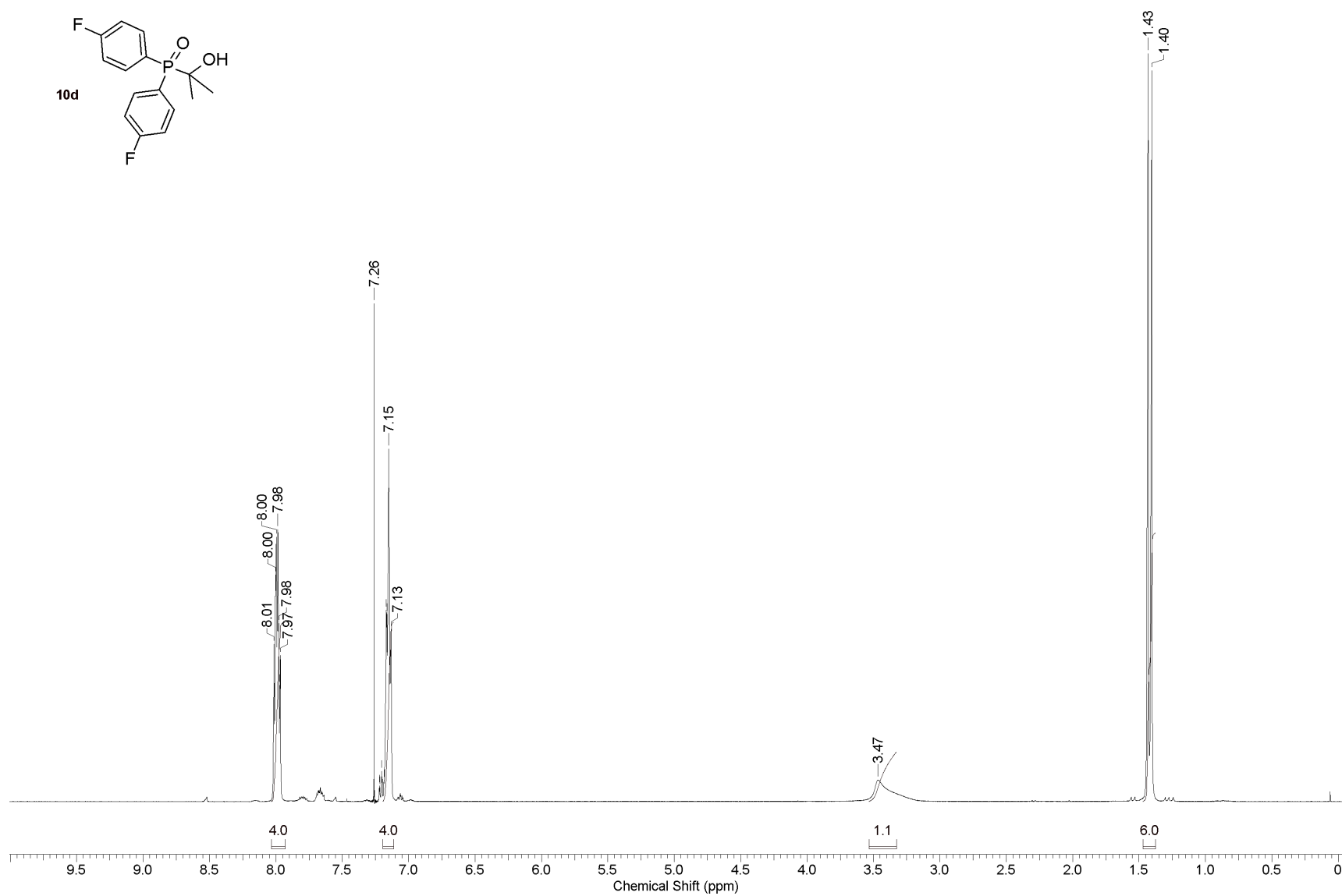
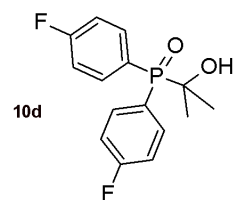
^1H NMR spectrum of di-*p*-anisyl(1-hydroxy-1-methylethyl)phosphine oxide (**10c**) (500 MHz, CDCl_3)



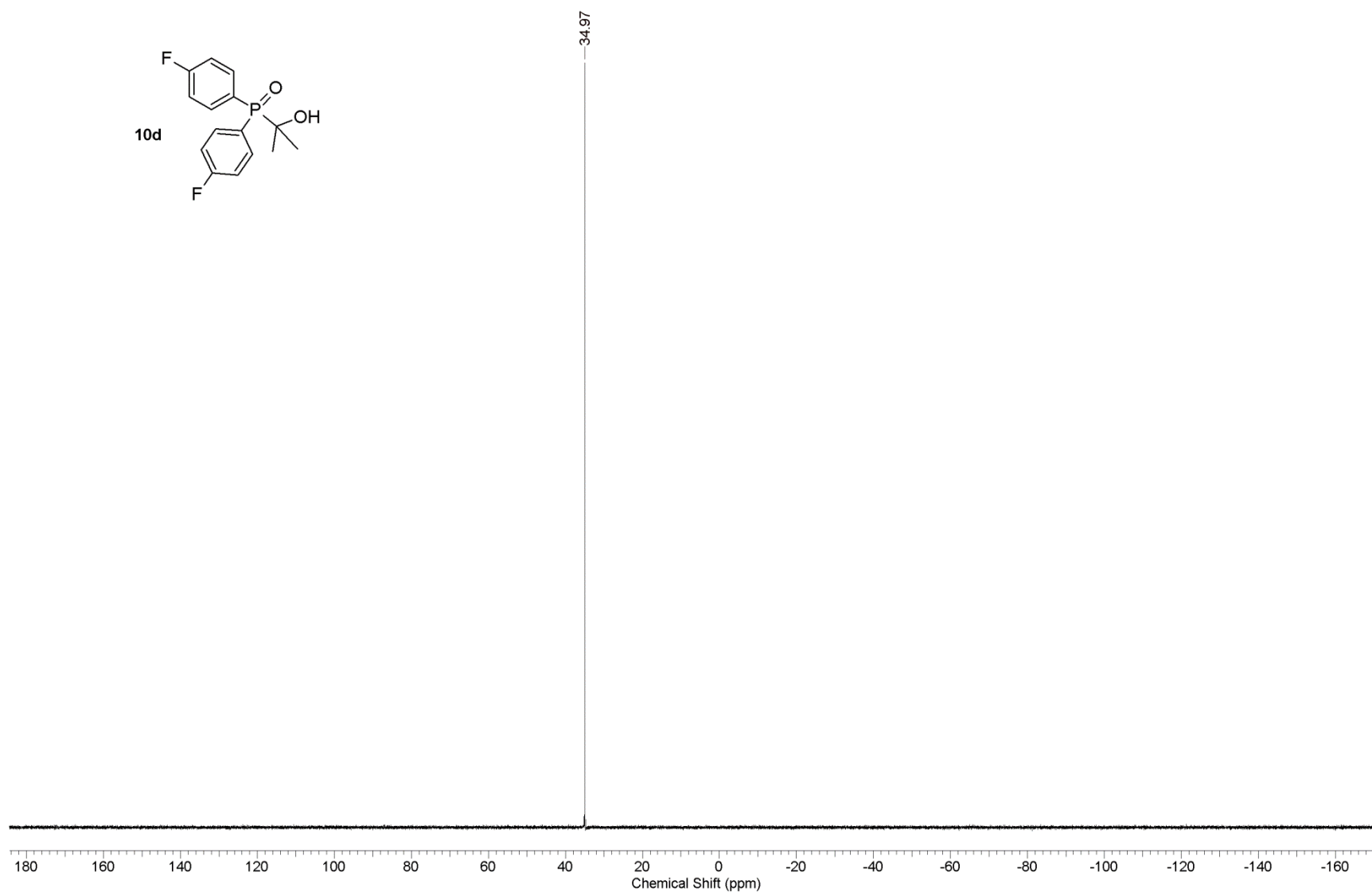
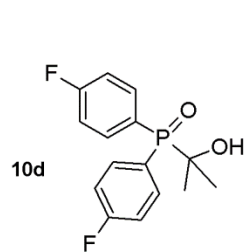
^{31}P NMR spectrum of di-*p*-anisyl(1-hydroxy-1-methylethyl)phosphine oxide (**10c**) (202 MHz, CDCl_3)



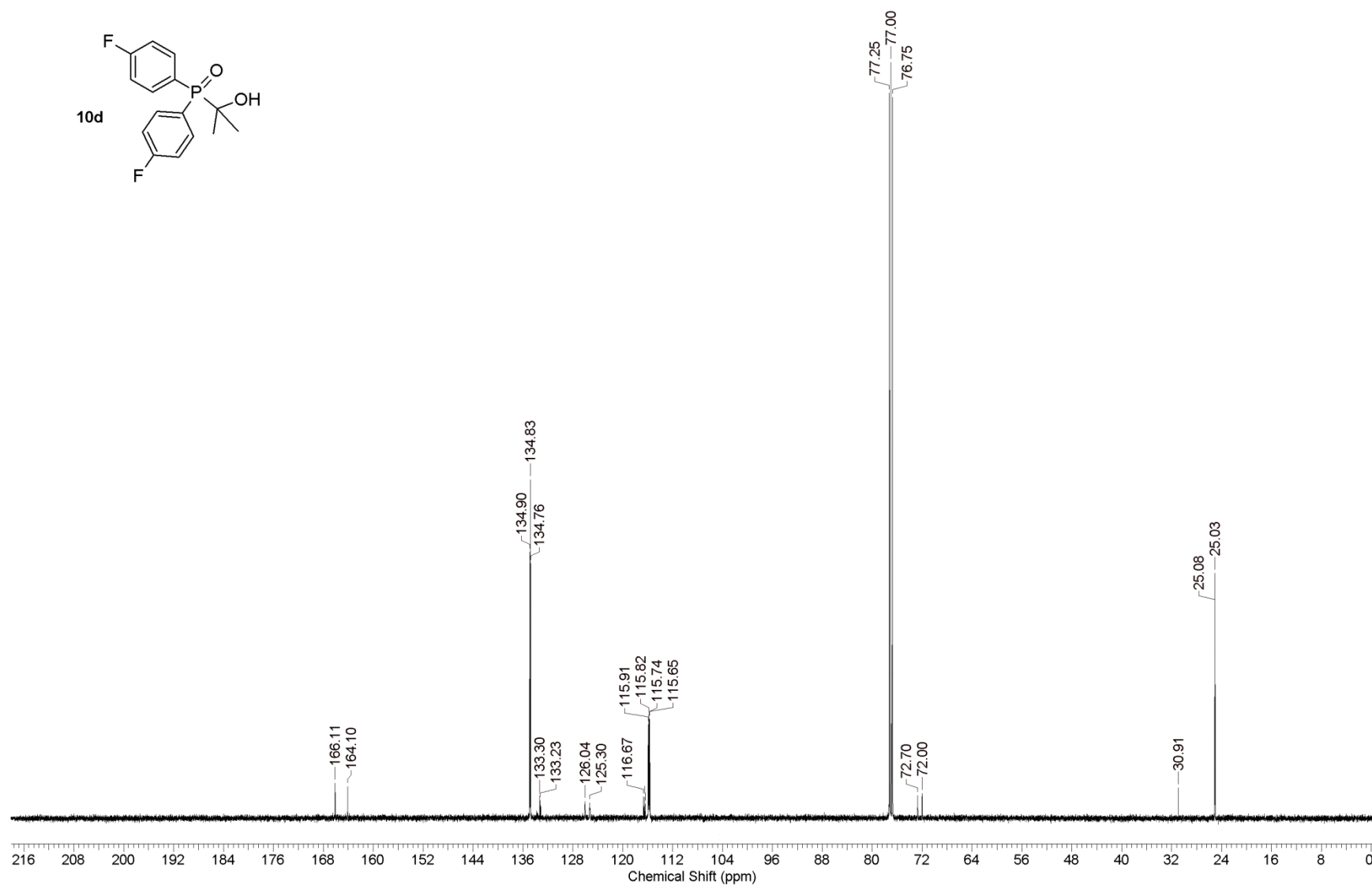
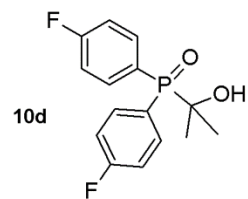
^{13}C NMR spectrum of di-*p*-anisyl(1-hydroxy-1-methylethyl)phosphine oxide (**10c**) (125 MHz, CDCl_3)



^1H NMR spectrum of di-*p*-fluorophenyl(1-hydroxy-1-methylethyl)phosphine oxide (**10d**) (500 MHz, CDCl_3)

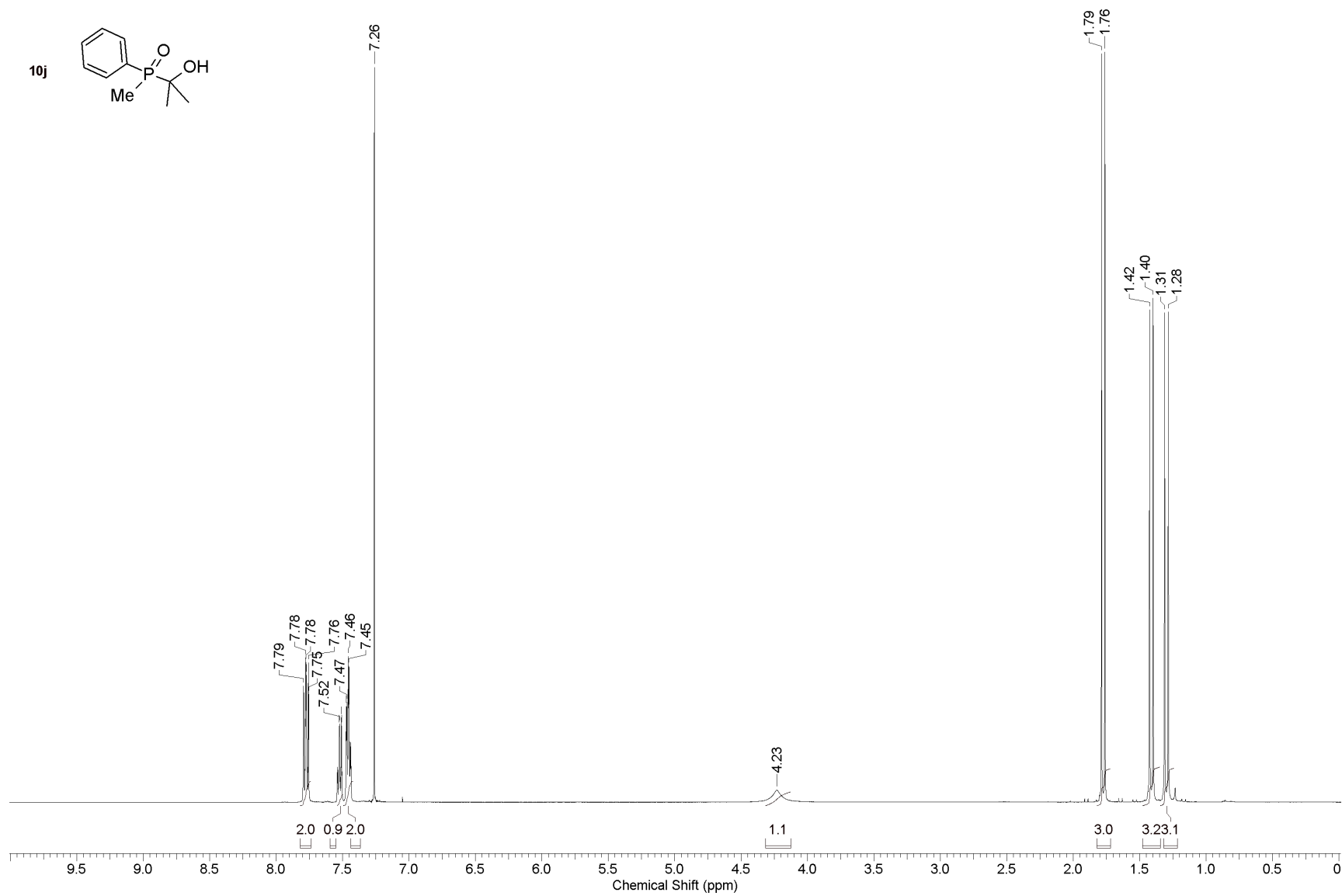
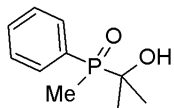


^{31}P NMR spectrum of di-*p*-fluorophenyl(1-hydroxy-1-methylethyl)phosphine oxide (**10d**) (202 MHz, CDCl_3)



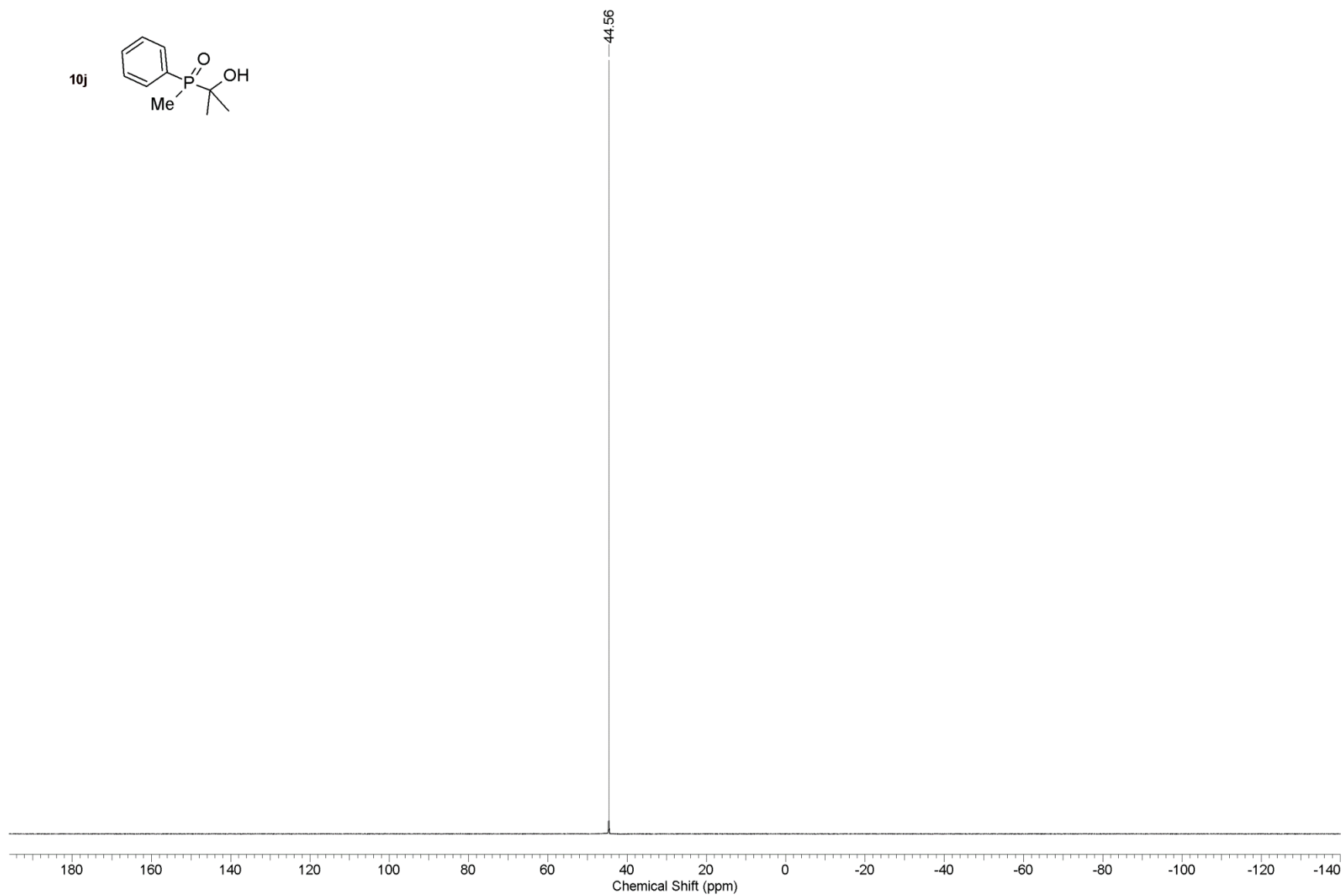
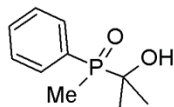
^{13}C NMR spectrum of di-*p*-fluorophenyl(1-hydroxy-1-methylethyl)phosphine oxide (**10d**) (125 MHz, CDCl_3)

10j



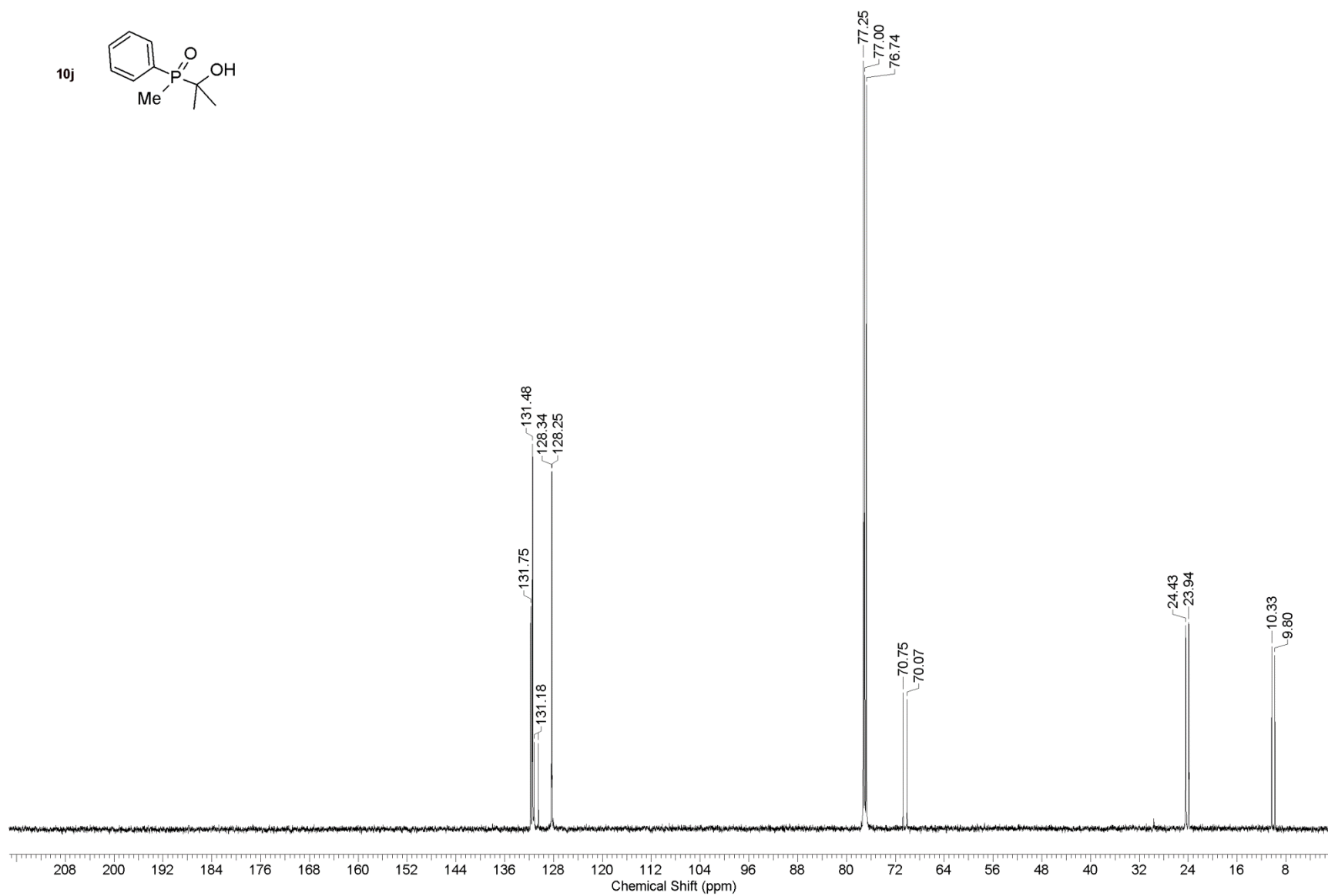
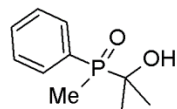
^1H NMR spectrum of (1-hydroxy-1-methylethyl)(methyl)phenylphosphine oxide (**10j**) (125 MHz, CDCl_3)

10j

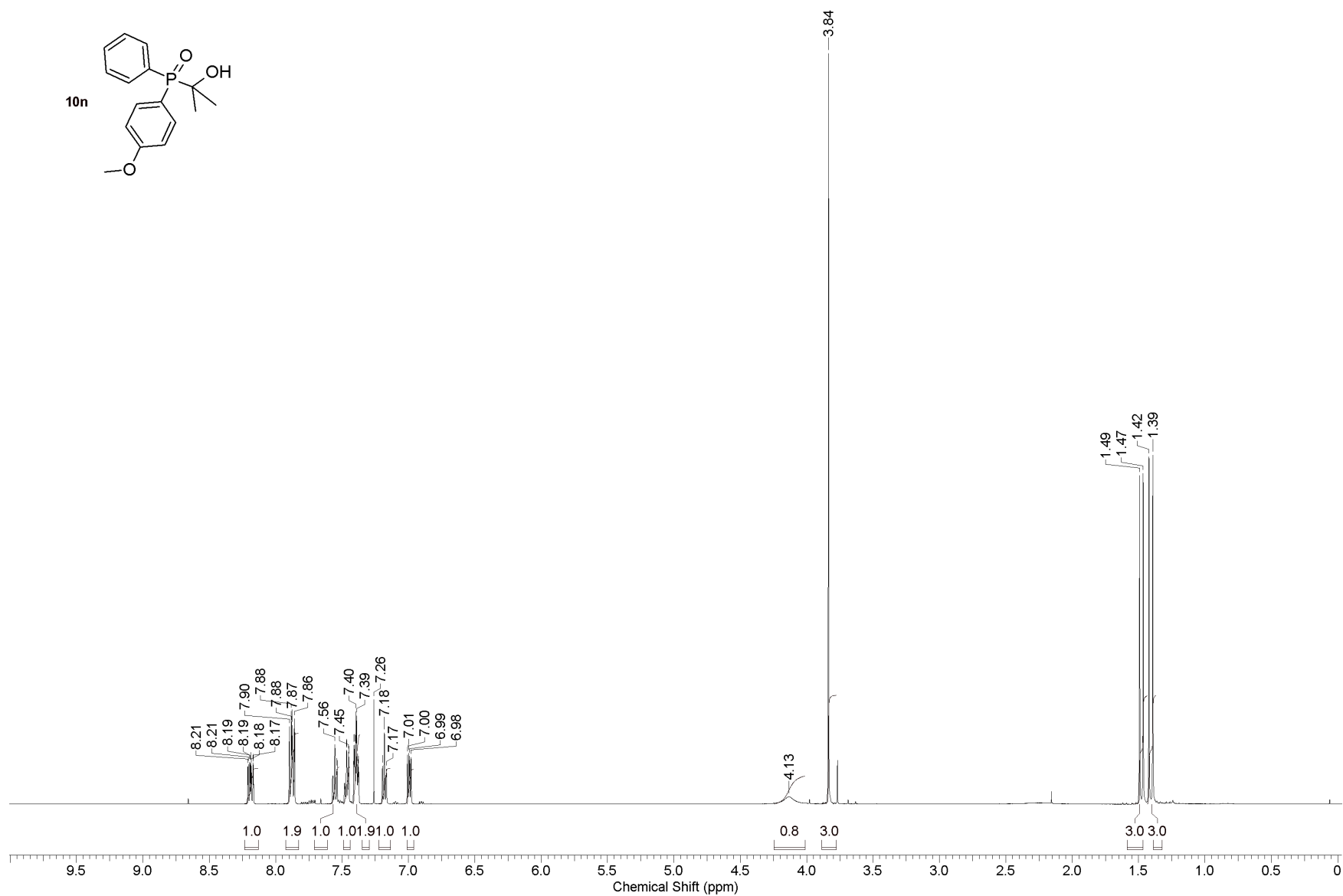
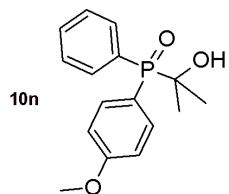


^{31}P NMR spectrum of (1-hydroxy-1-methylethyl)(methyl)phenylphosphine oxide (**10j**) (202 MHz, CDCl_3)

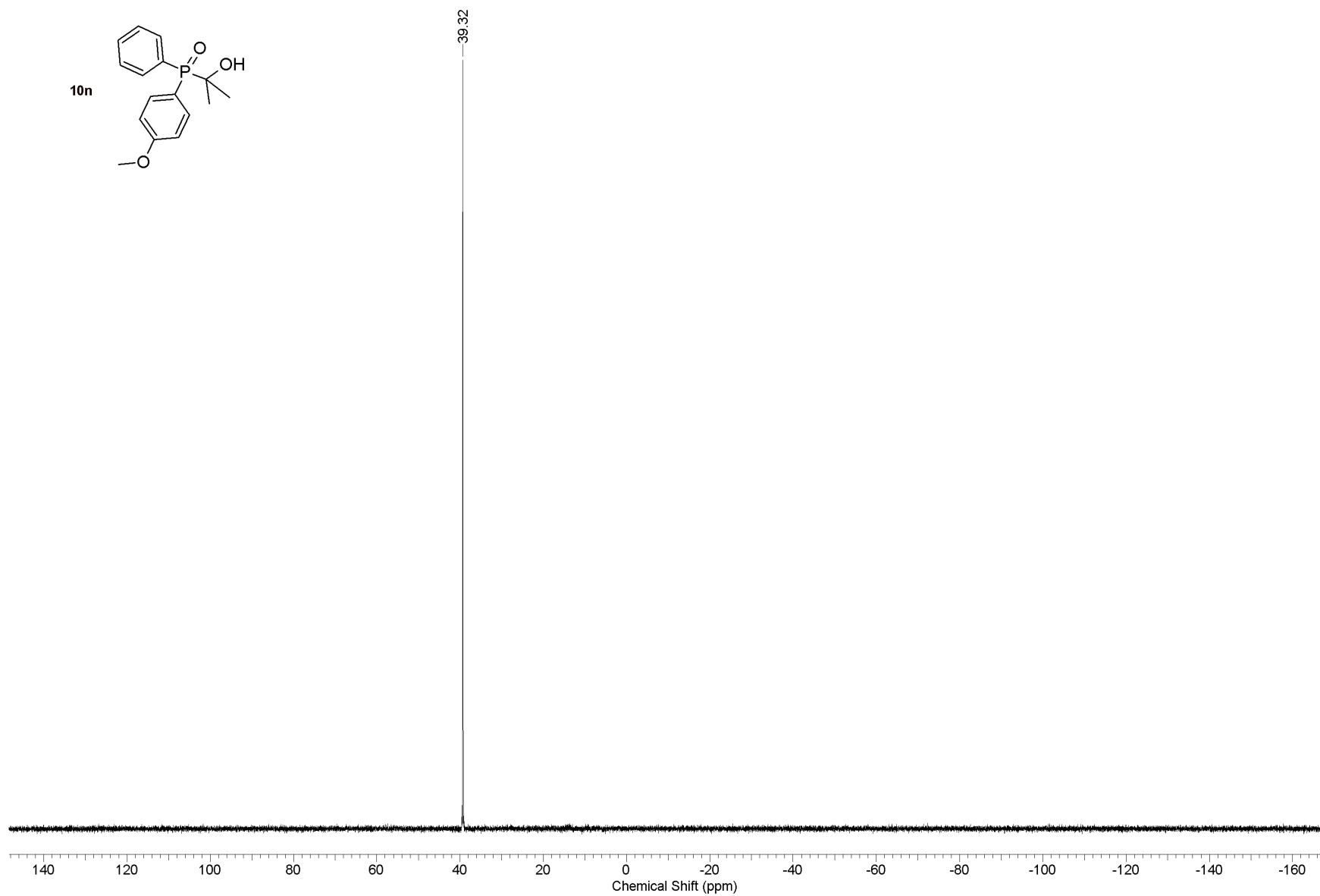
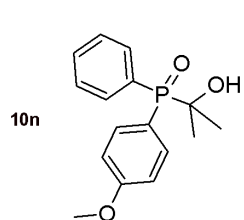
10j



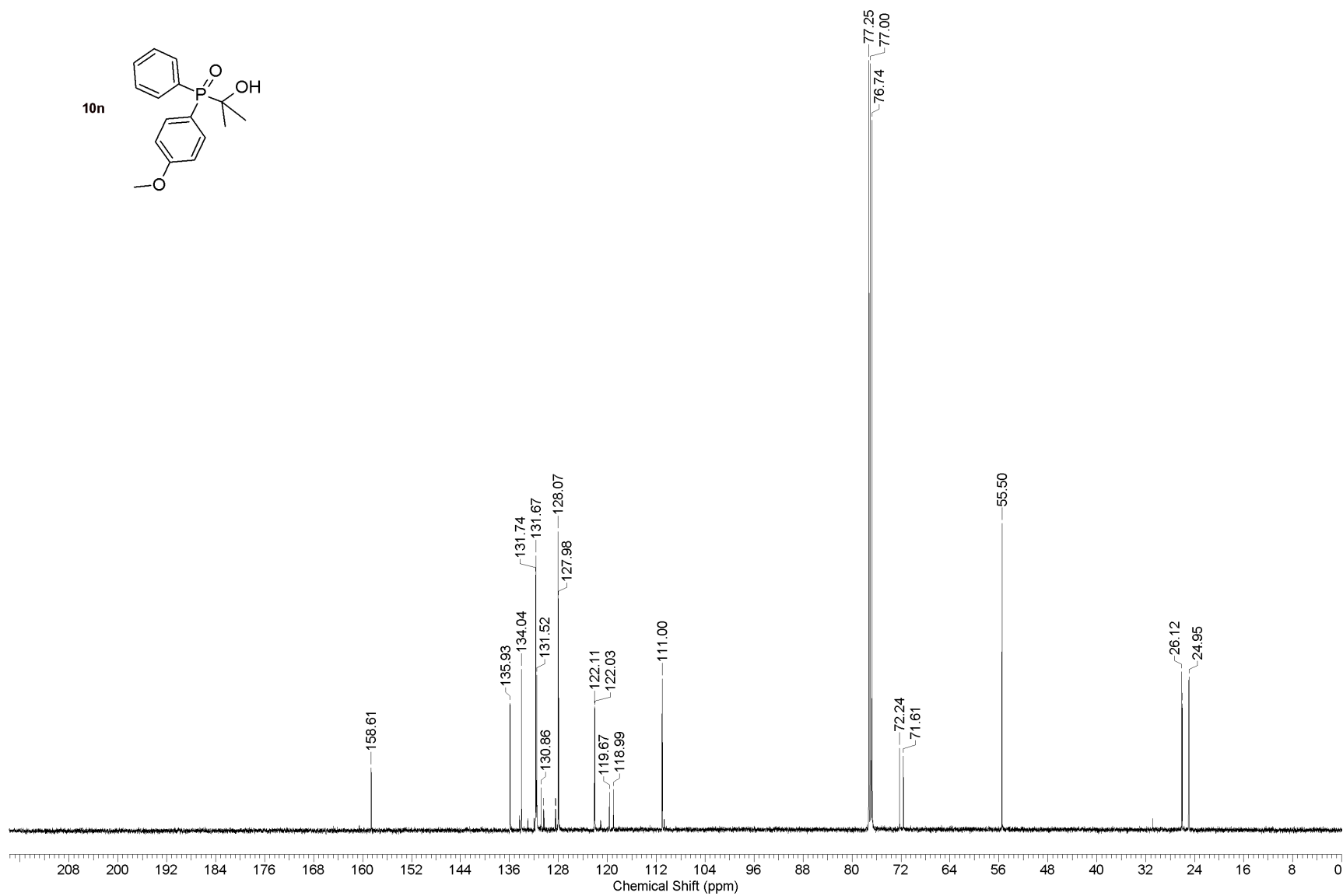
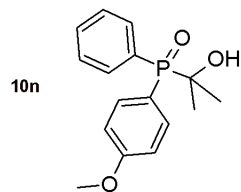
^{13}C NMR spectrum of (1-hydroxy-1-methylethyl)(methyl)phenylphosphine oxide (**10j**) (125 MHz, CDCl_3)



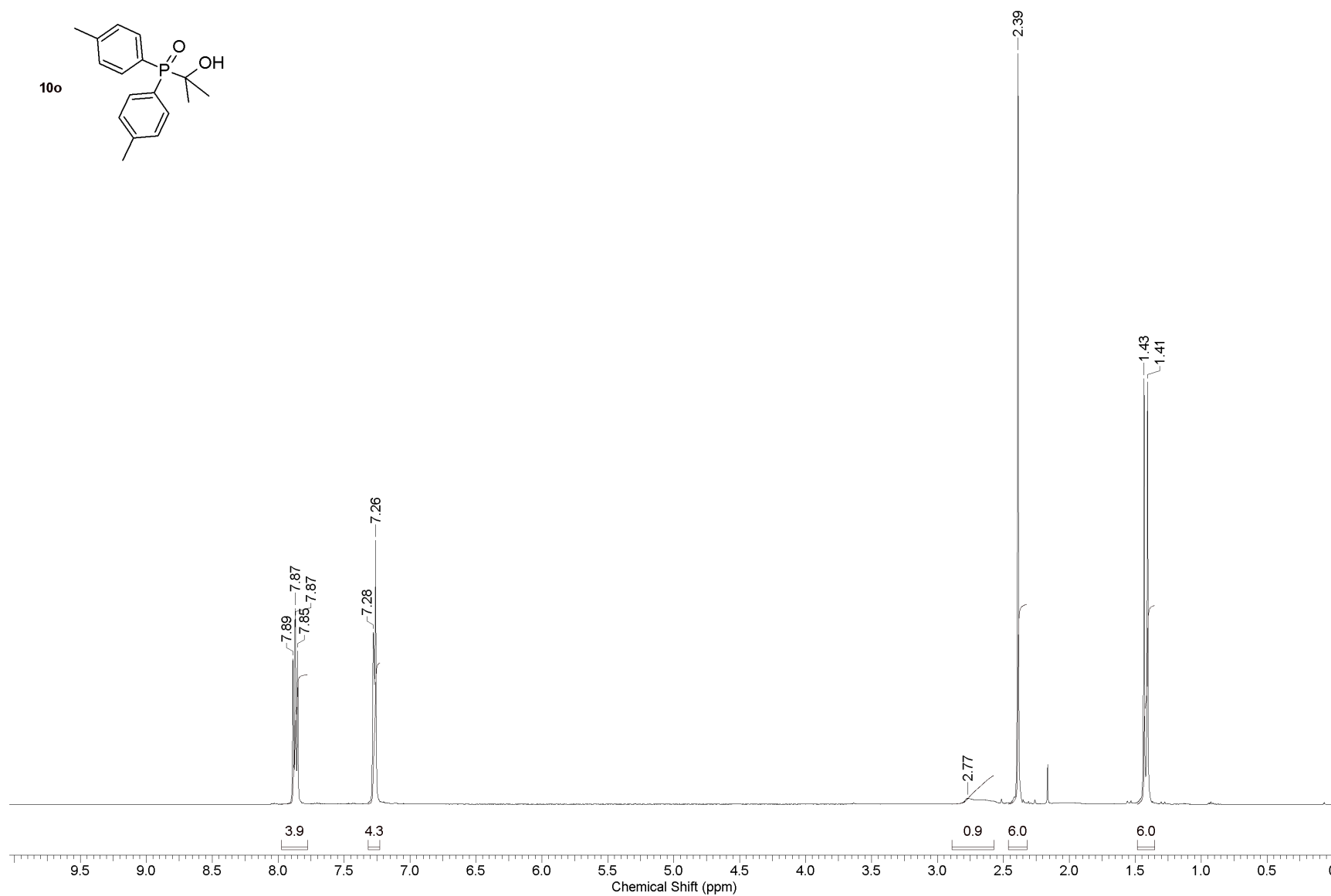
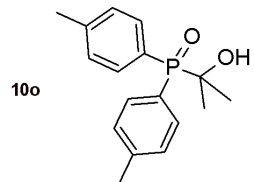
^1H NMR spectrum of *p*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10n**) (500 MHz, CDCl_3)



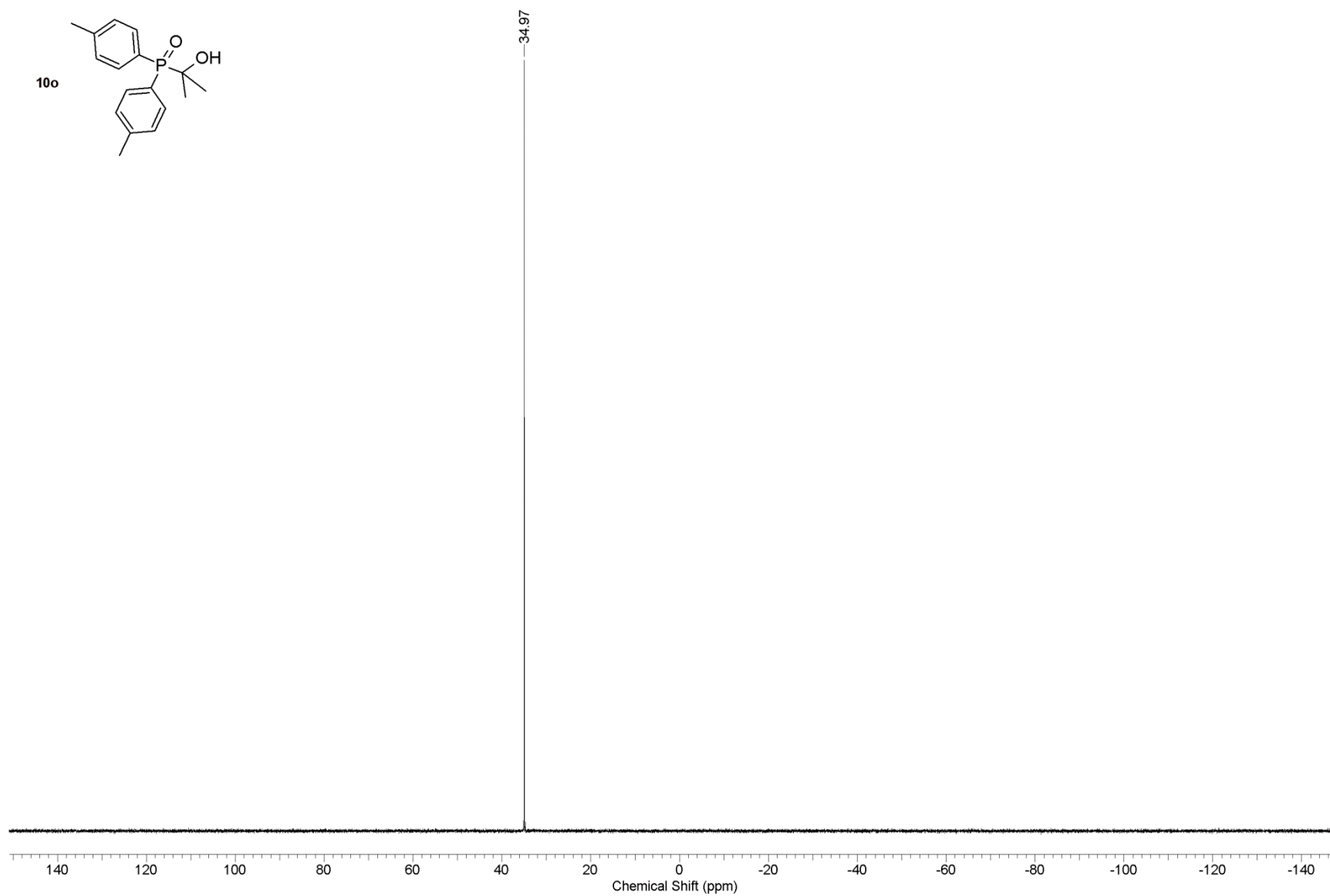
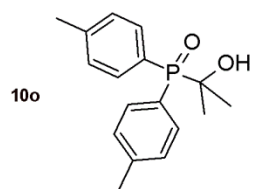
^{31}P NMR spectrum of *p*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10n**) (202 MHz, CDCl_3)



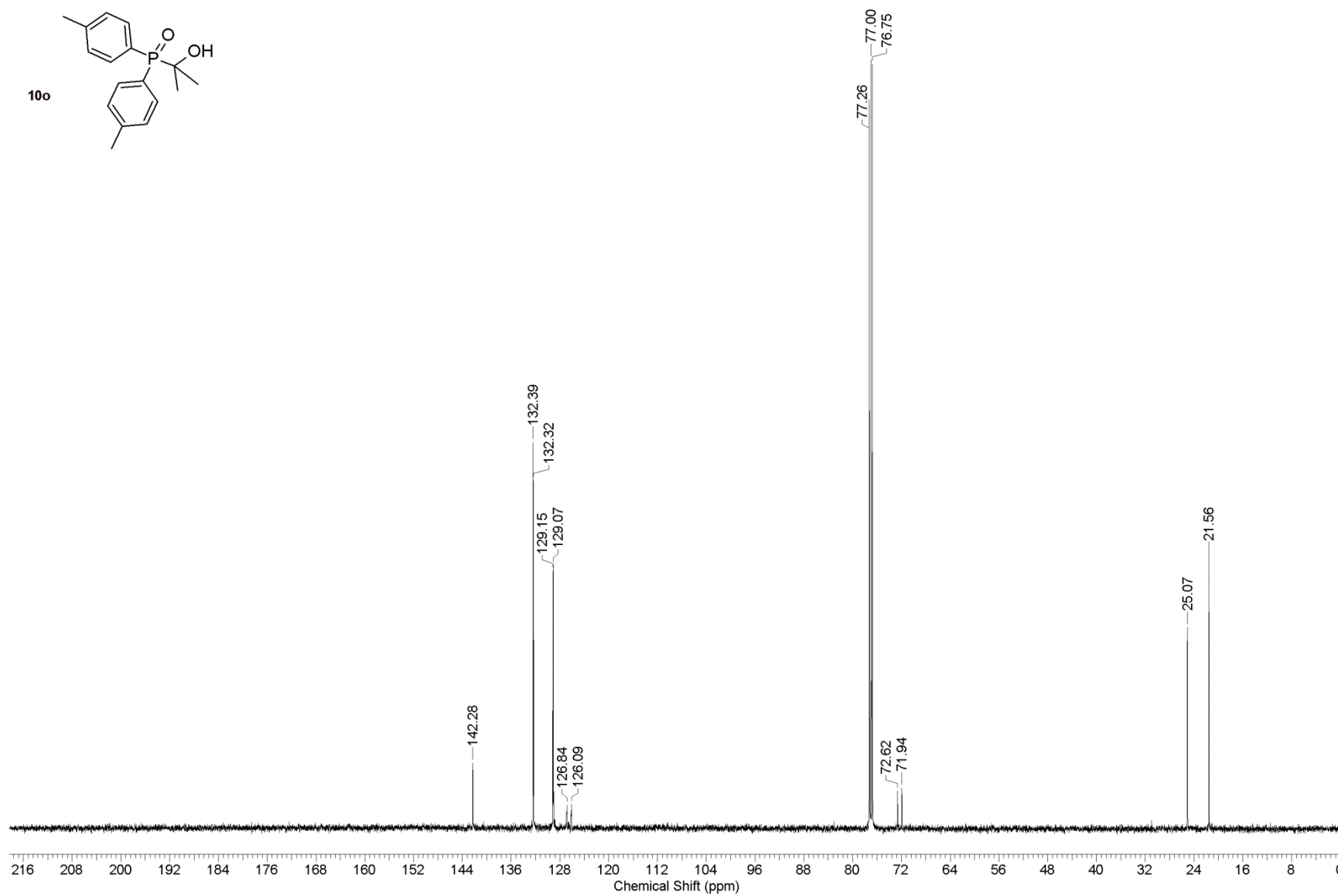
^{13}C NMR spectrum of *p*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine oxide (**10n**) (125 MHz, CDCl_3)



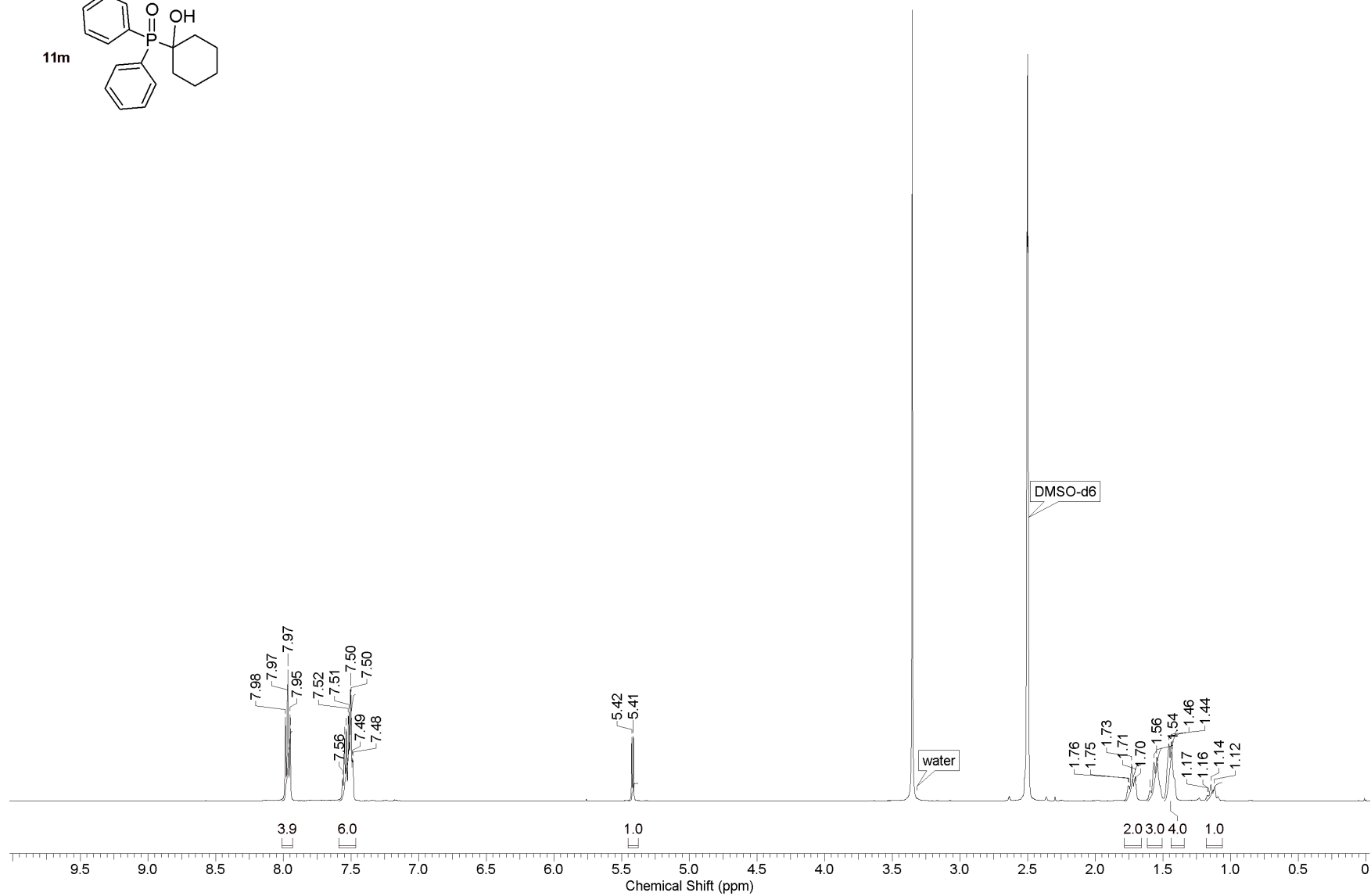
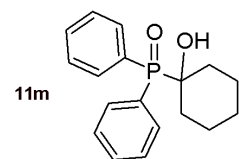
^1H NMR spectrum of di-*p*-tolyl(1-hydroxy-1-methylethyl)phosphine oxide (**10o**) (500 MHz, CDCl_3)



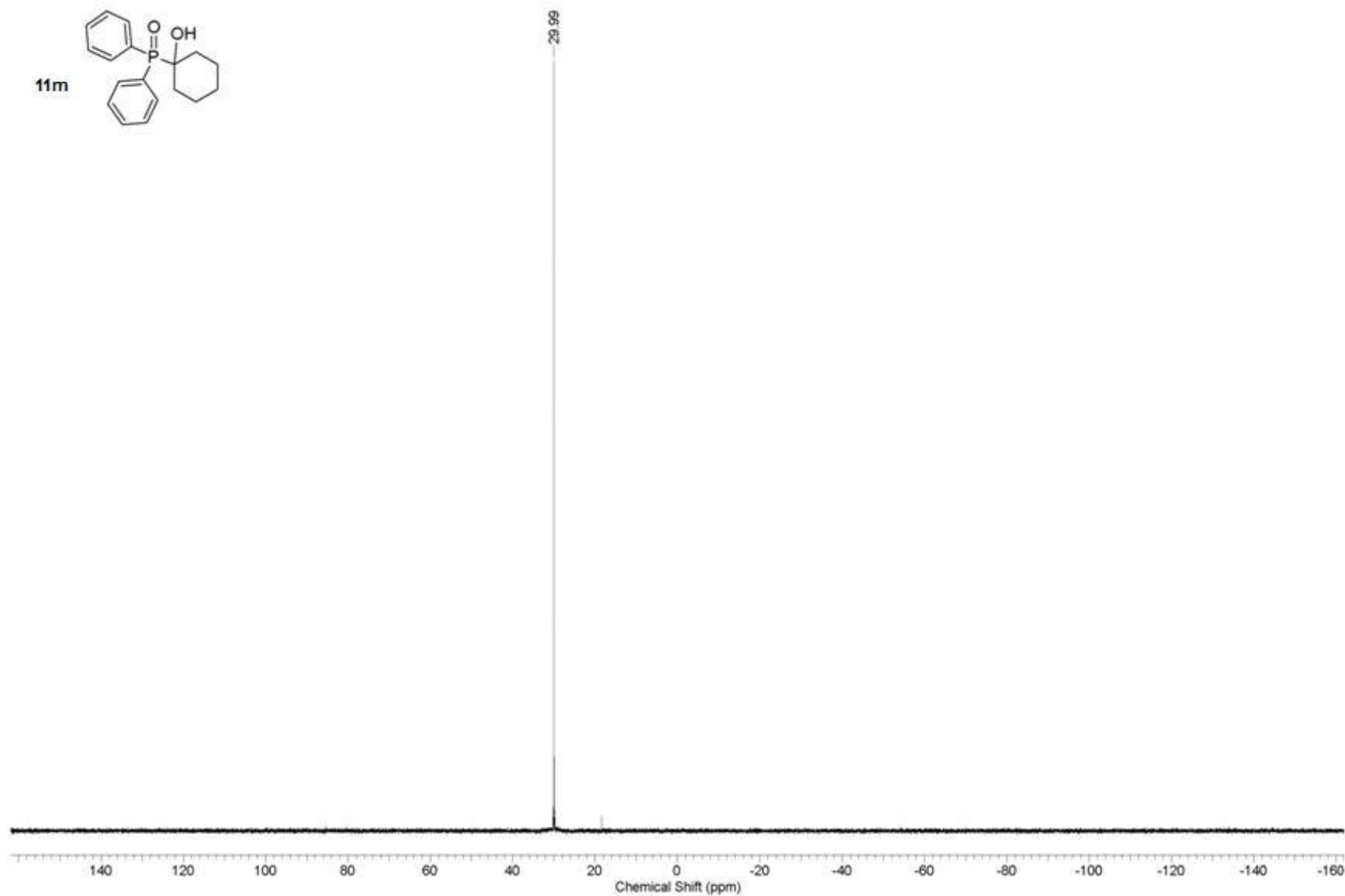
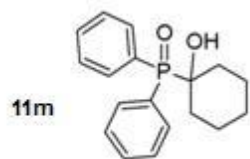
^{31}P NMR spectrum of di-*p*-tolyl(1-hydroxy-1-methylethyl)phosphine oxide (**10o**) (202 MHz, CDCl_3)



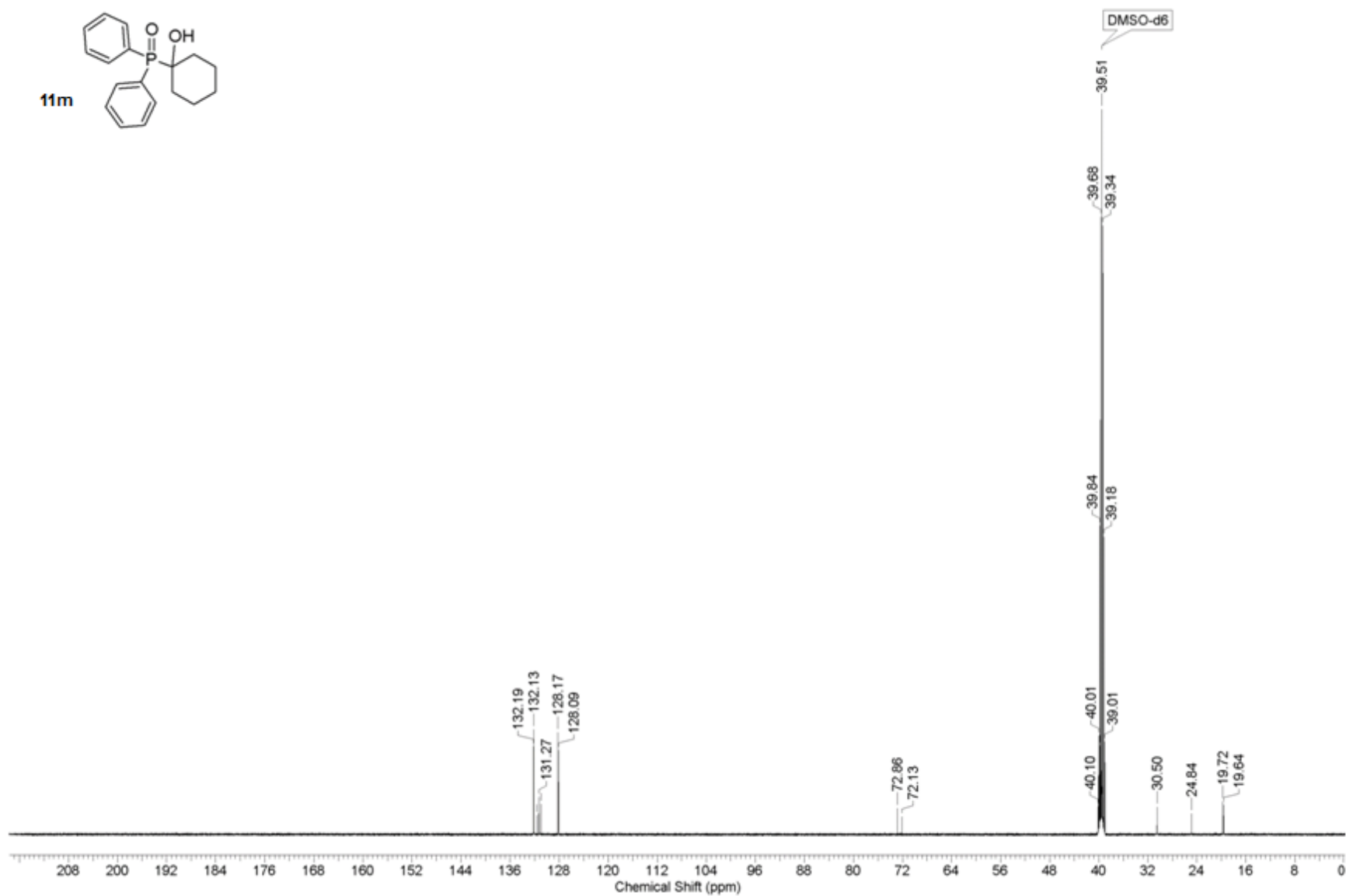
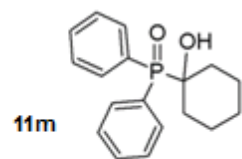
^{13}C NMR spectrum of di-*p*-tolyl(1-hydroxy-1-methylethyl)phosphine oxide (**10o**) (125 MHz, CDCl_3)



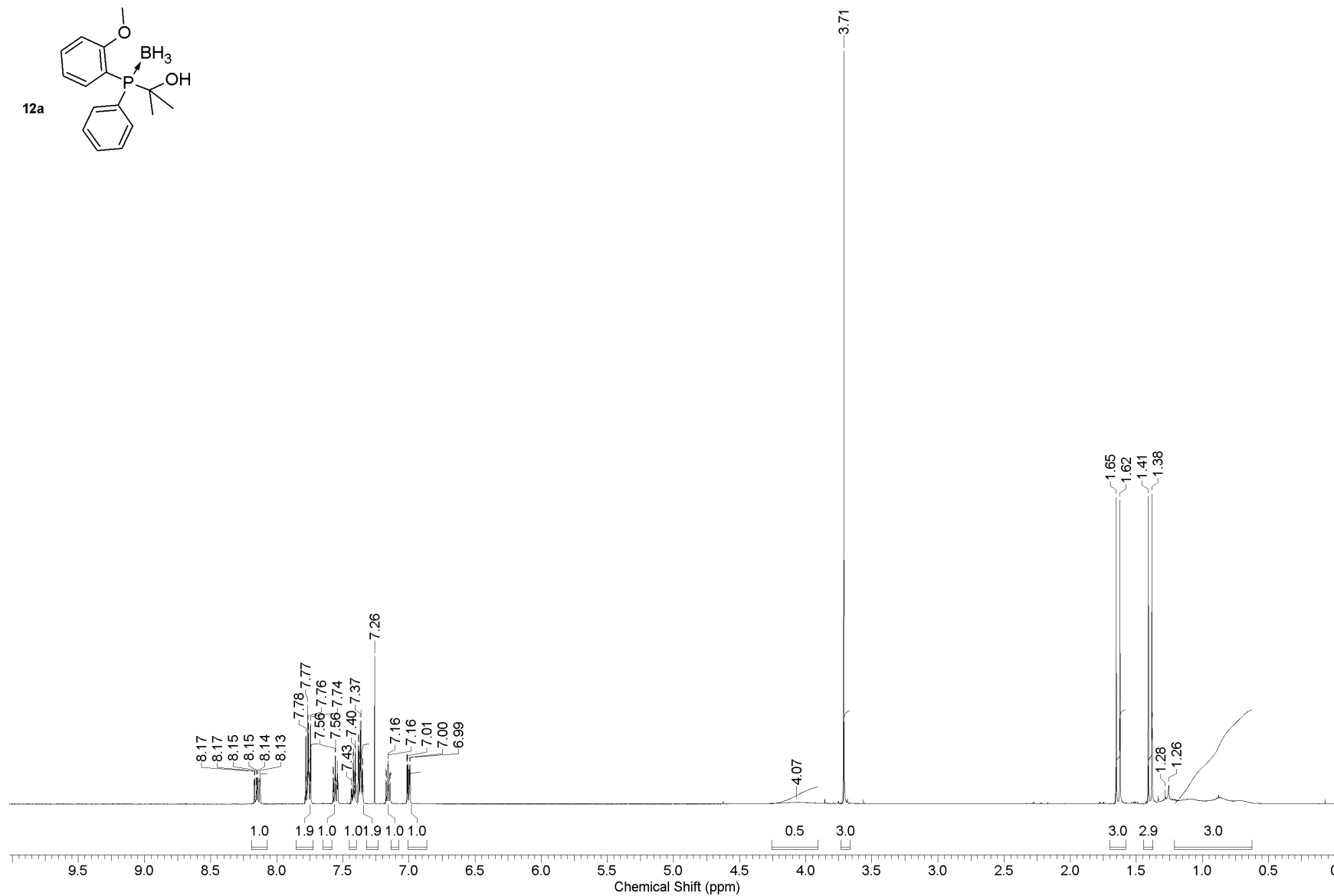
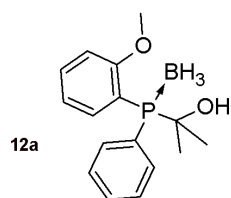
^1H NMR spectrum of (1-hydroxy-1-cyclohexyl)diphenylphosphine oxide (**11m**) (500 MHz, DMSO- d_6), water comes from DMSO- d_6



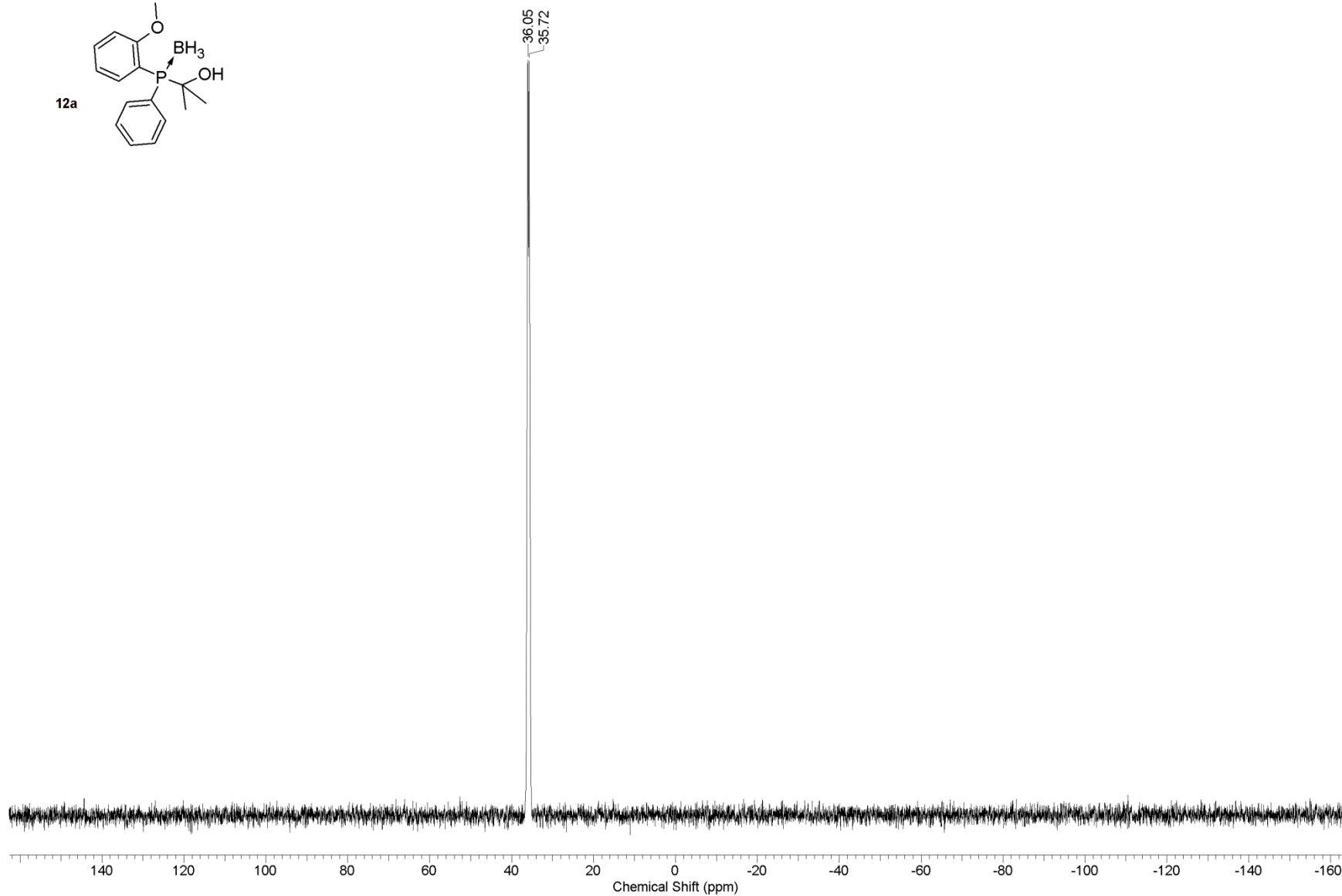
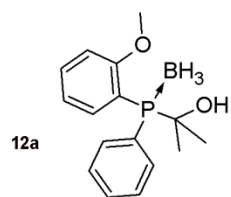
^{31}P NMR spectrum of (1-hydroxy-1-cyclohexyl)diphenylphosphine oxide (**11m**) (202 MHz, DMSO- d_6)



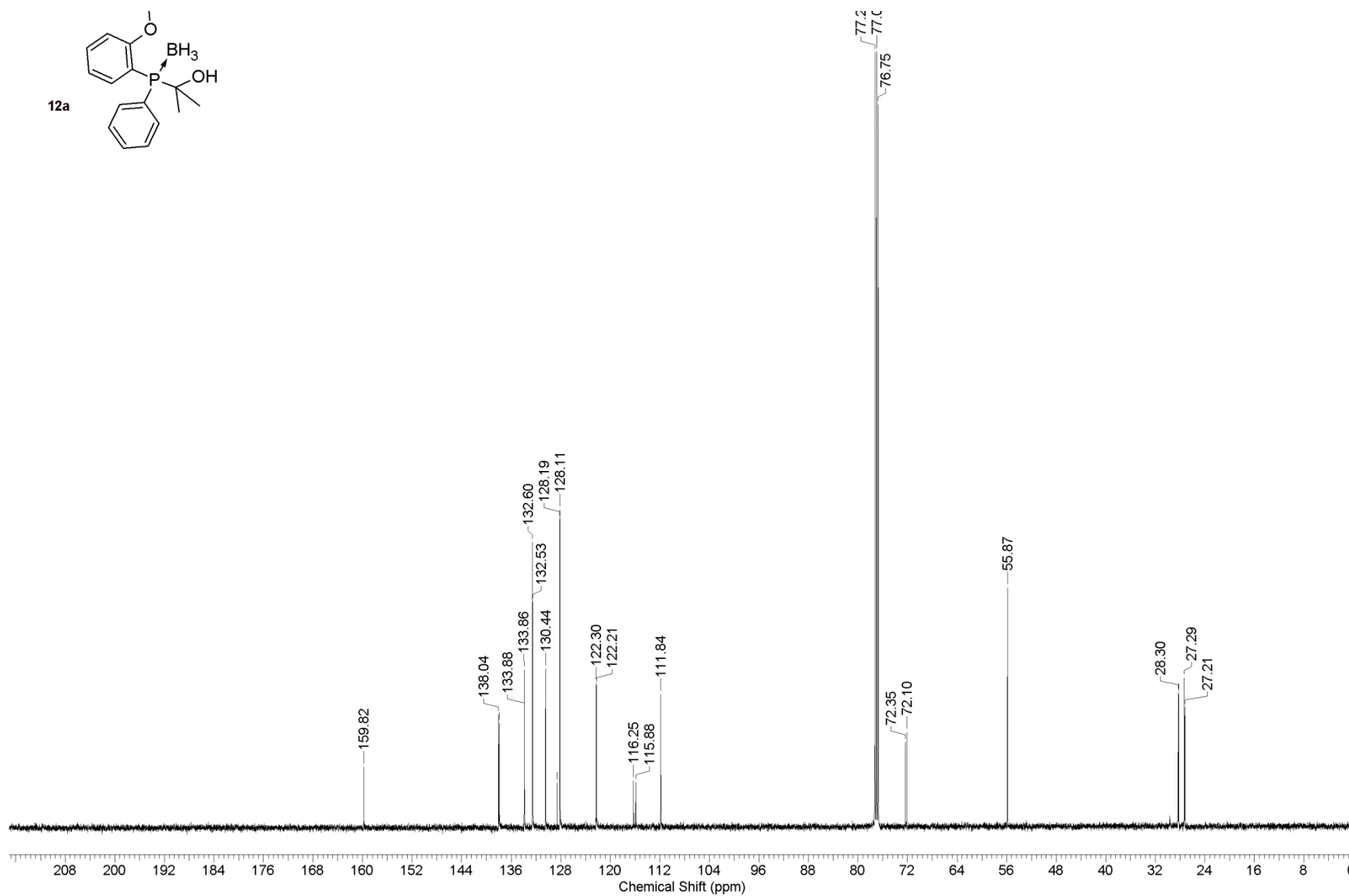
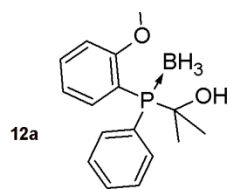
^{13}C NMR spectrum of (1-hydroxy-1-cyclohexyl)diphenylphosphine oxide (**11m**) (125 MHz, DMSO- d_6)



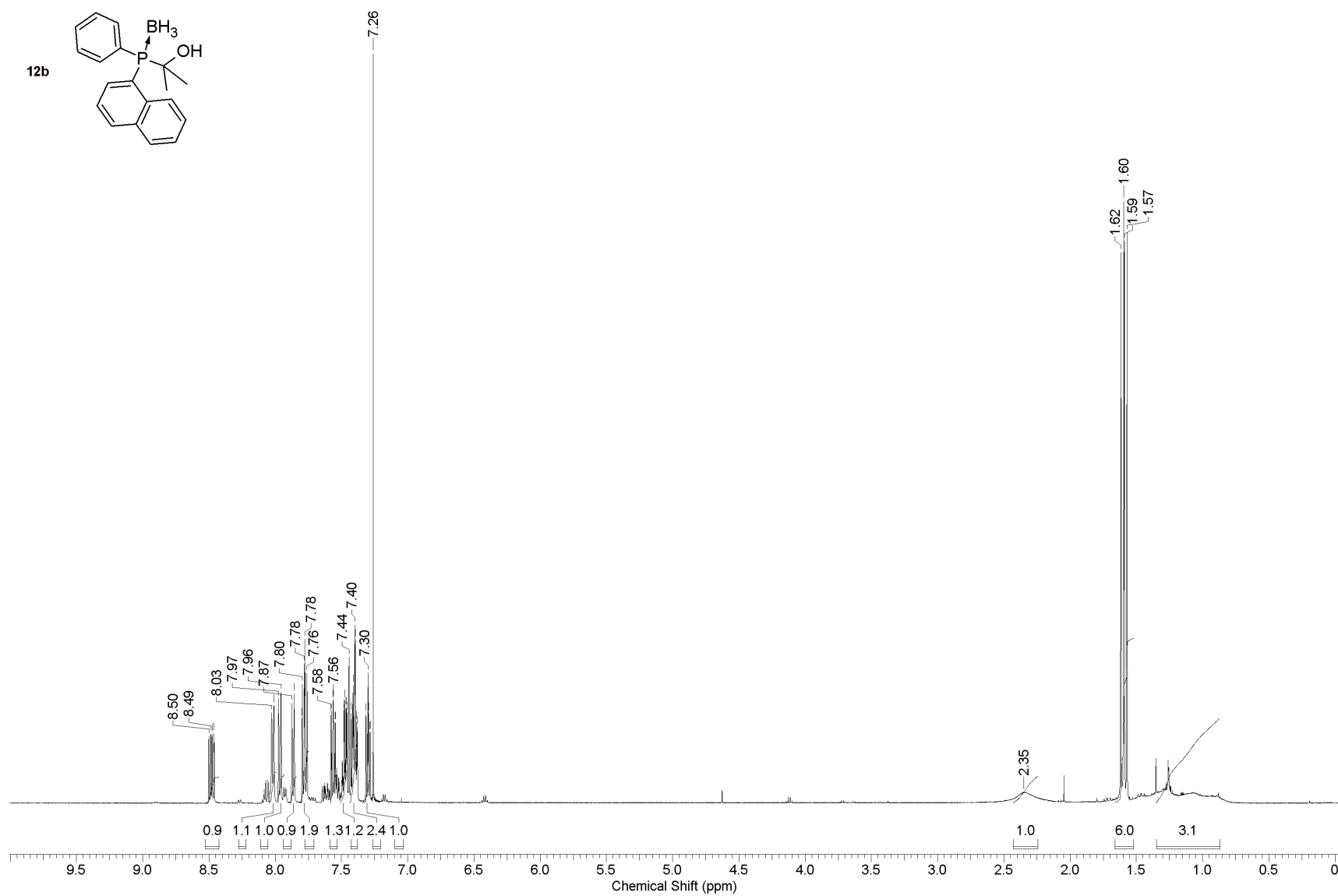
^1H NMR spectrum of *o*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12a**) (500 MHz, CDCl_3)



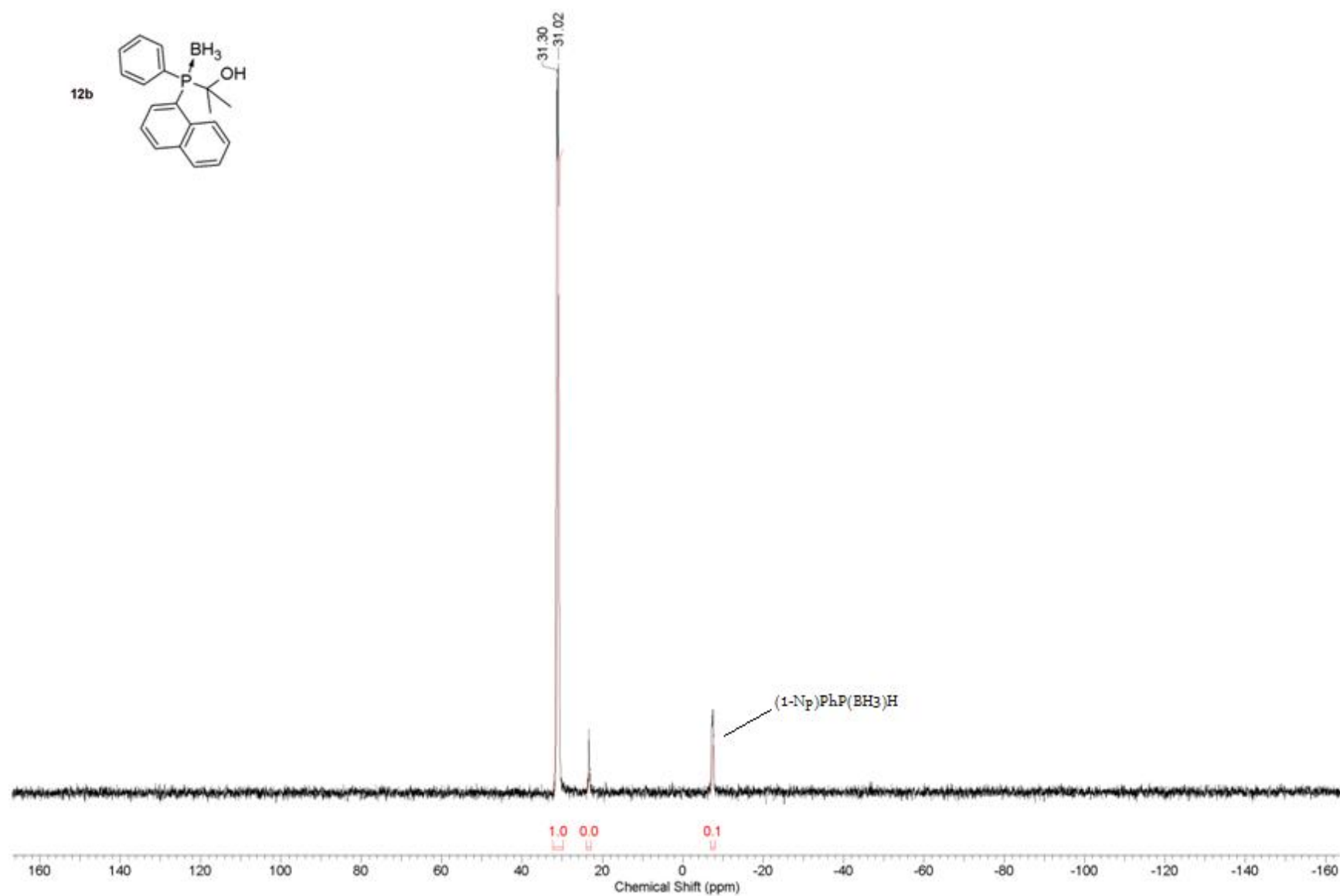
^{31}P NMR spectrum of *o*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12a**) (202 MHz, CDCl_3)



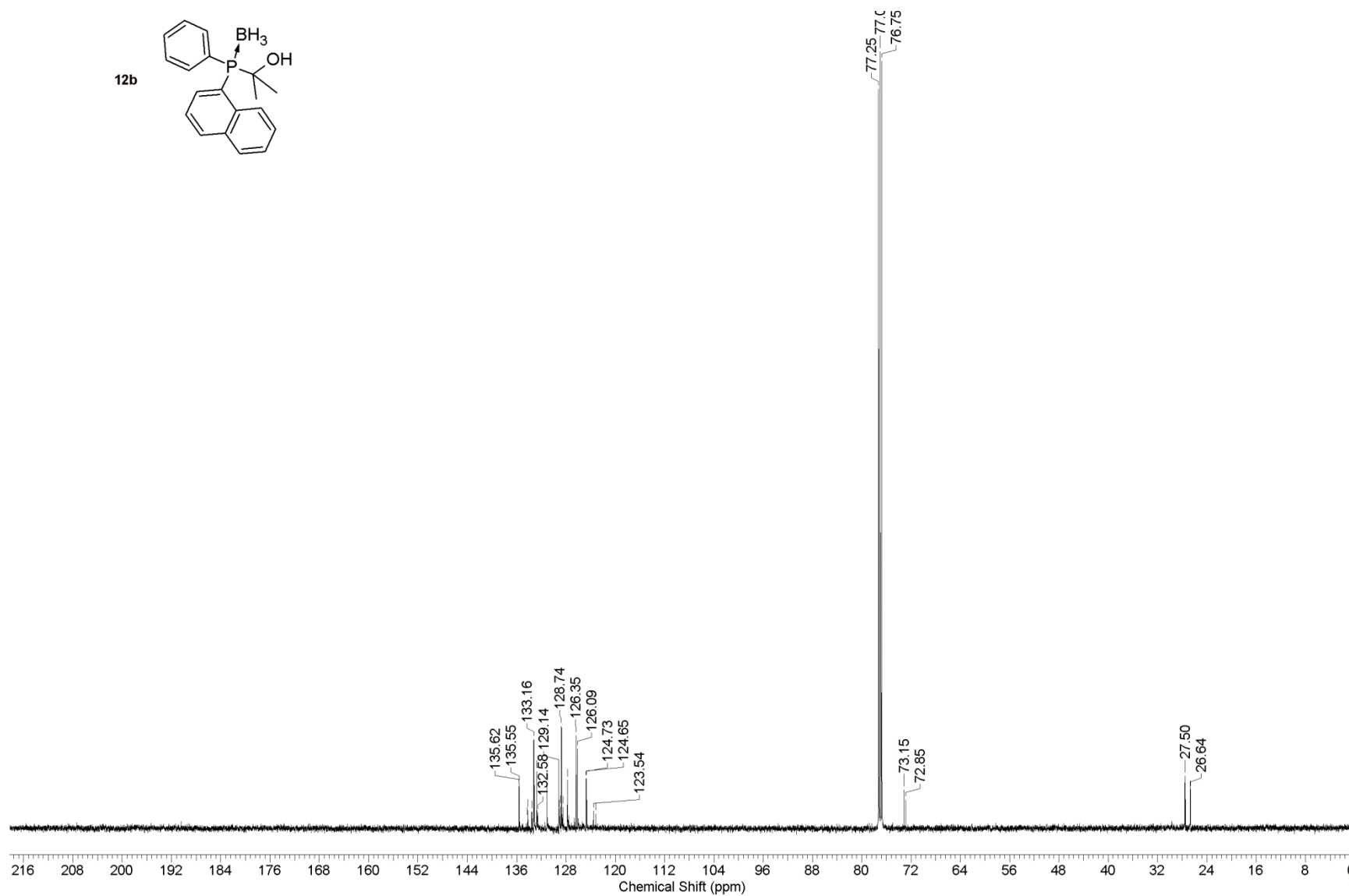
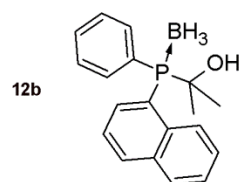
¹³C NMR spectrum of *o*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12a**) (125 MHz, CDCl₃)



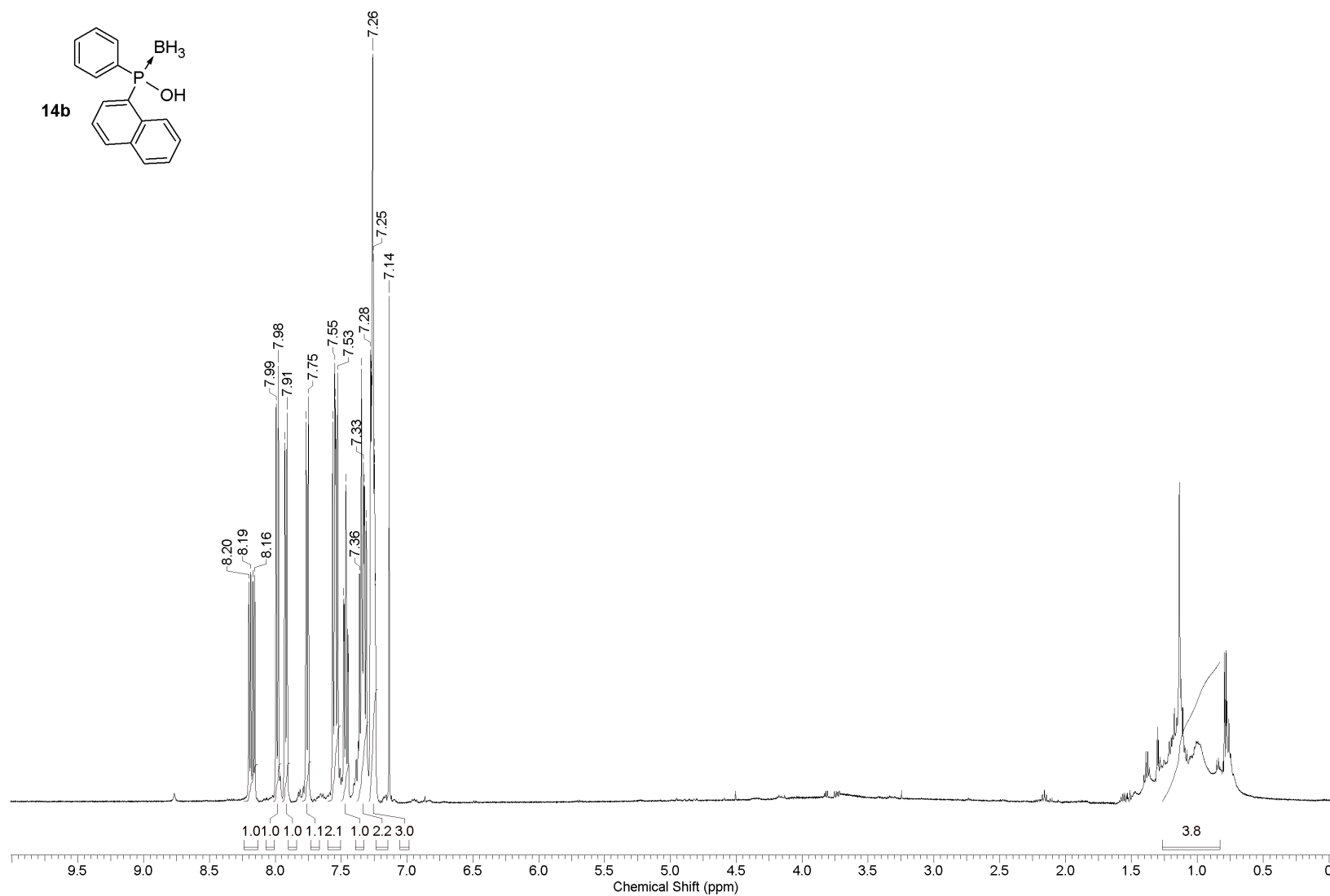
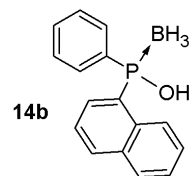
^1H NMR spectrum of 1-naphthyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12b**) (500 MHz, CDCl_3)



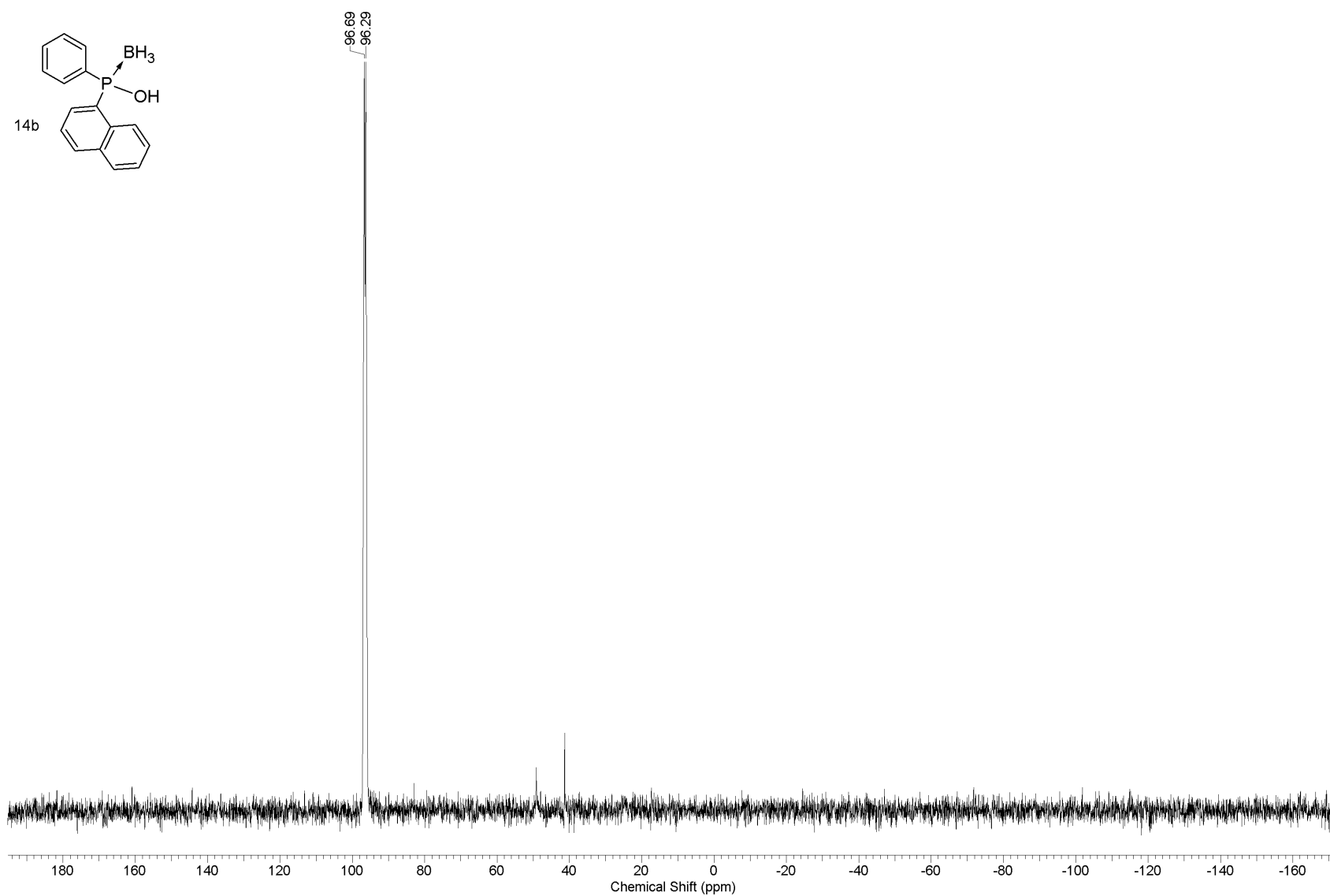
^{31}P NMR spectrum of 1-naphthyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12b**) (202 MHz, CDCl_3)



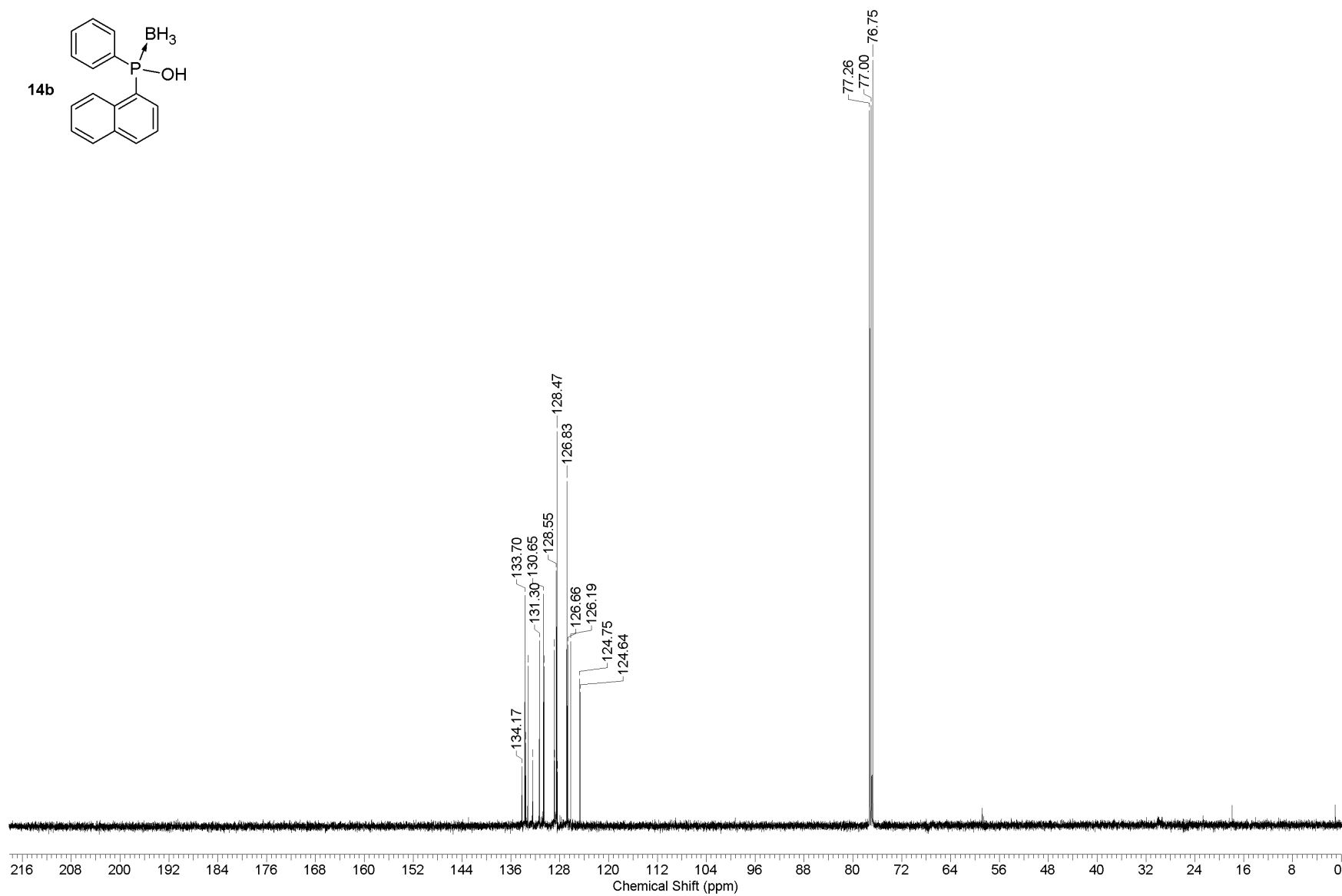
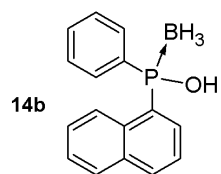
^{13}C NMR spectrum of 1-naphthyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12b**) (125 MHz, CDCl_3)



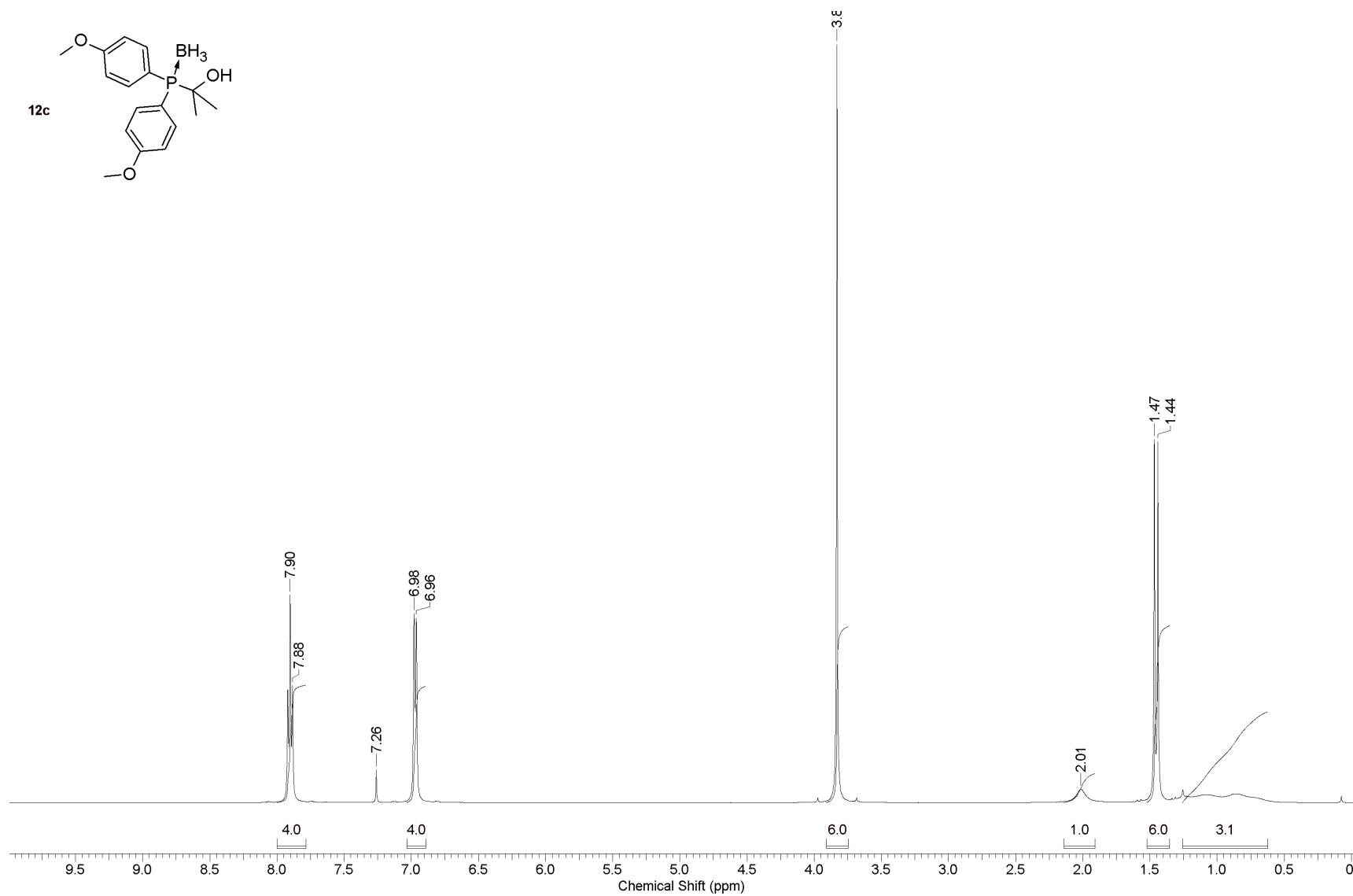
^1H NMR spectrum of 1-naphthylphenylphosphinous acid-borane (**14b**) (500 MHz, CDCl_3)



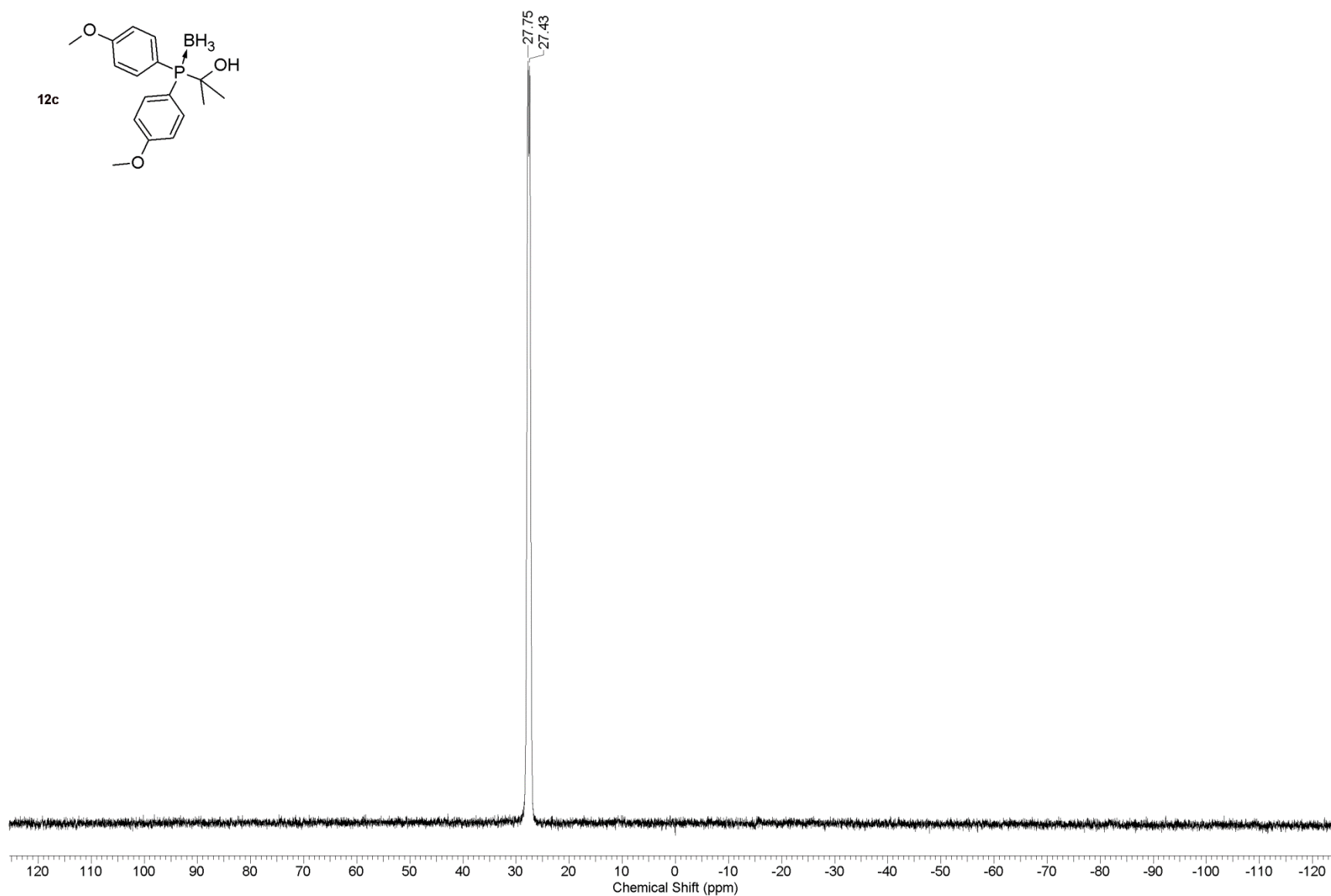
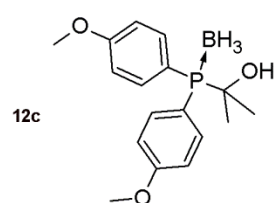
³¹P NMR spectrum of 1-naphthylphenylphosphinous acid-borane (**14b**) (202 MHz, CDCl₃)



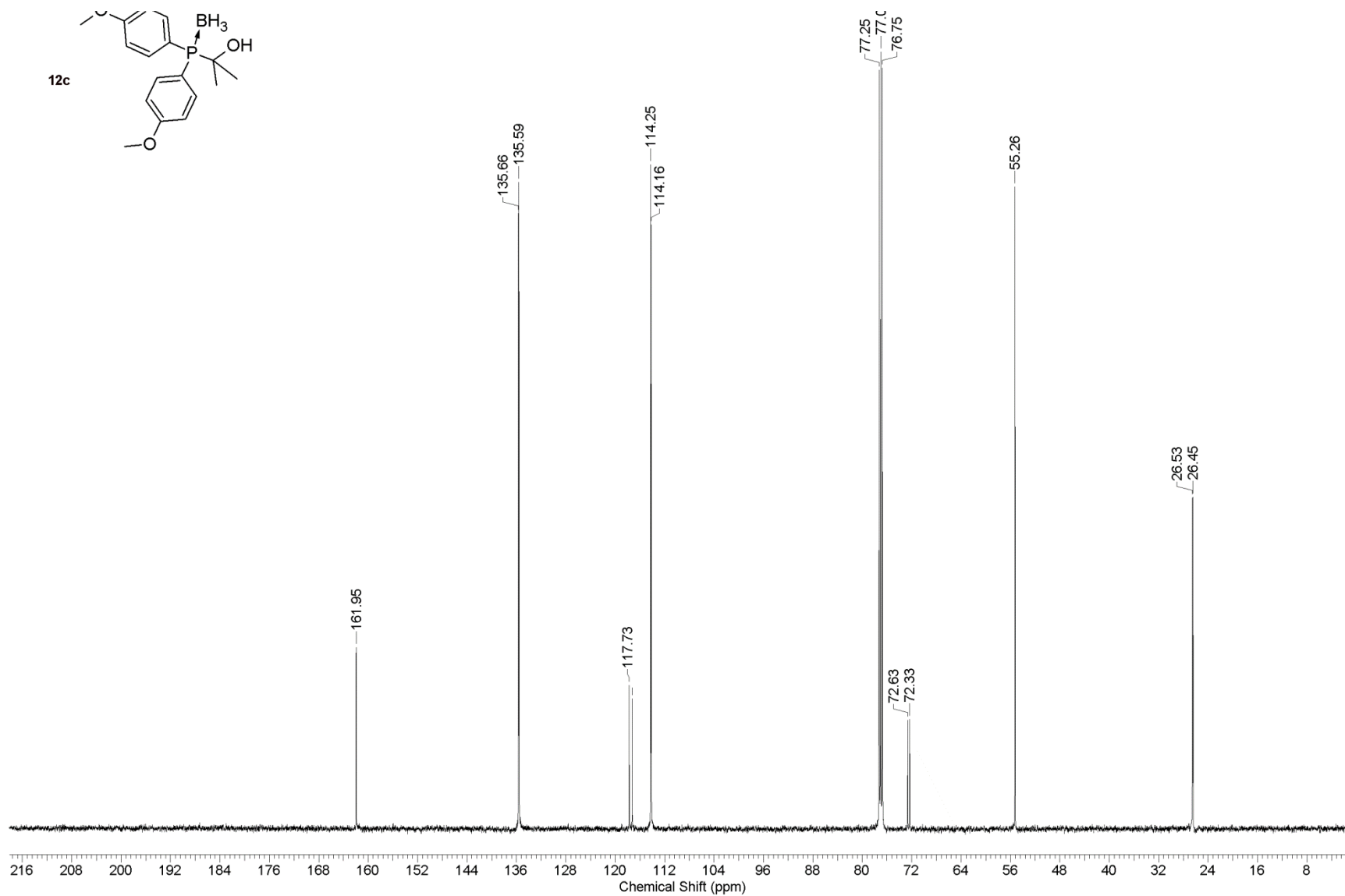
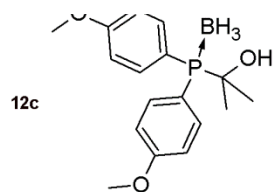
^{13}C NMR spectrum of 1-naphthylphenylphosphinous acid-borane (**14b**) (125 MHz, CDCl_3)



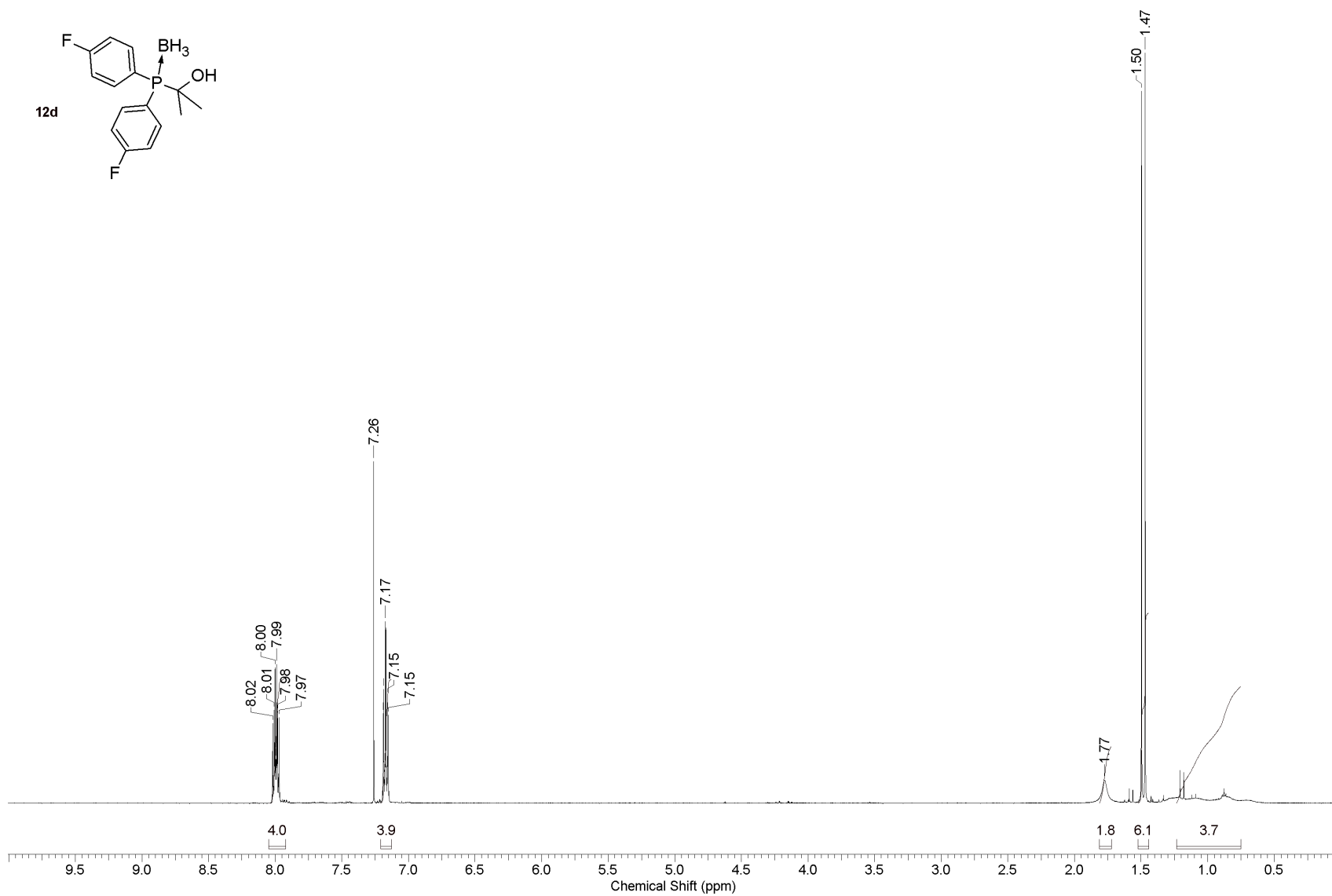
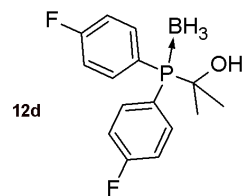
^1H NMR spectrum of di-*p*-anisyl(1-hydroxy-1-methylethyl)phosphine-borane (**12c**) (500 MHz, CDCl_3)



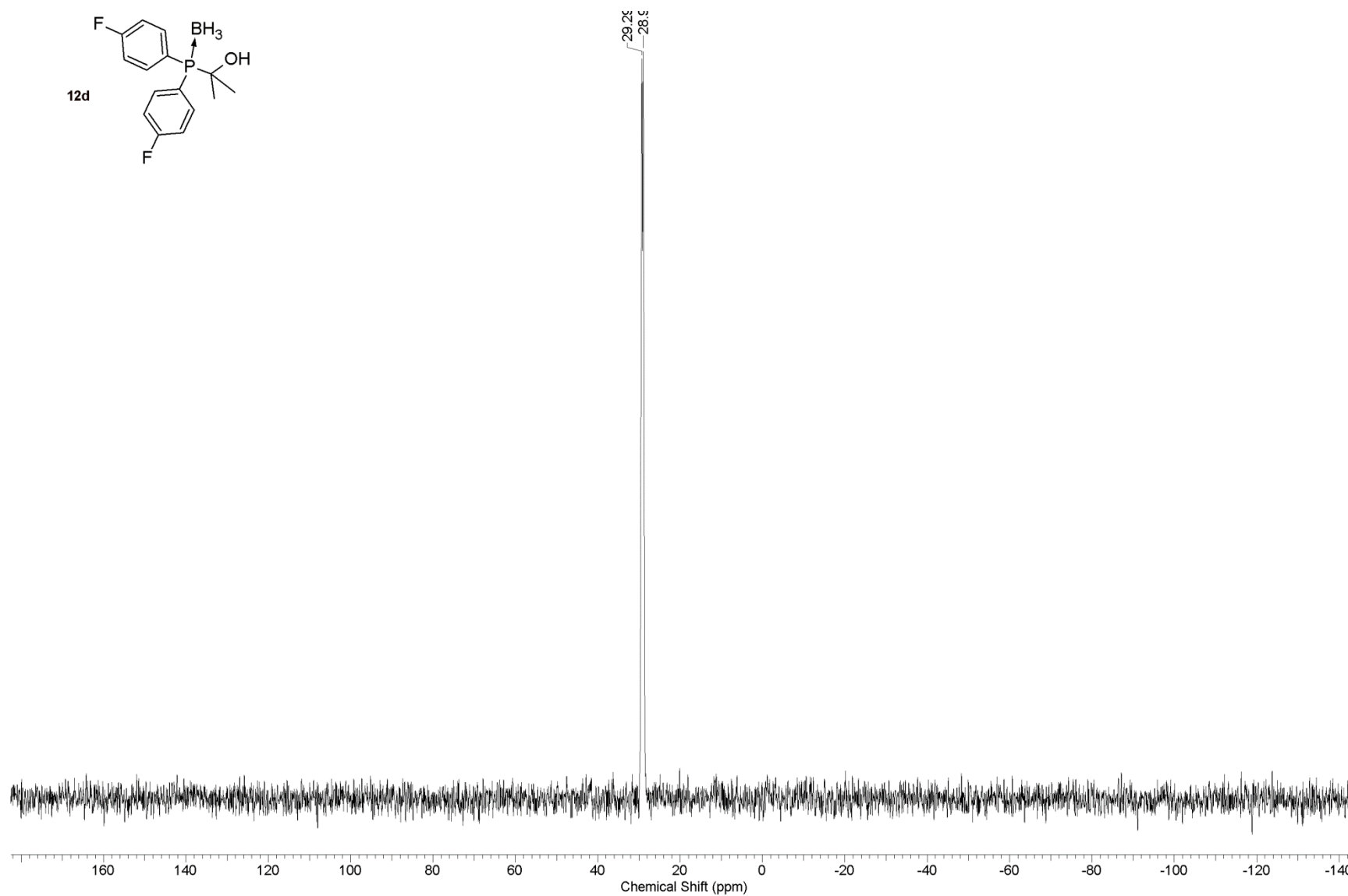
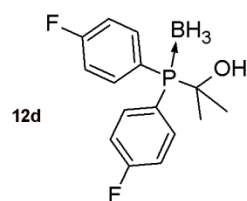
^{31}P NMR spectrum of di-*p*-anisyl(1-hydroxy-1-methylethyl)phosphine-borane (**12c**) (202 MHz, CDCl_3)



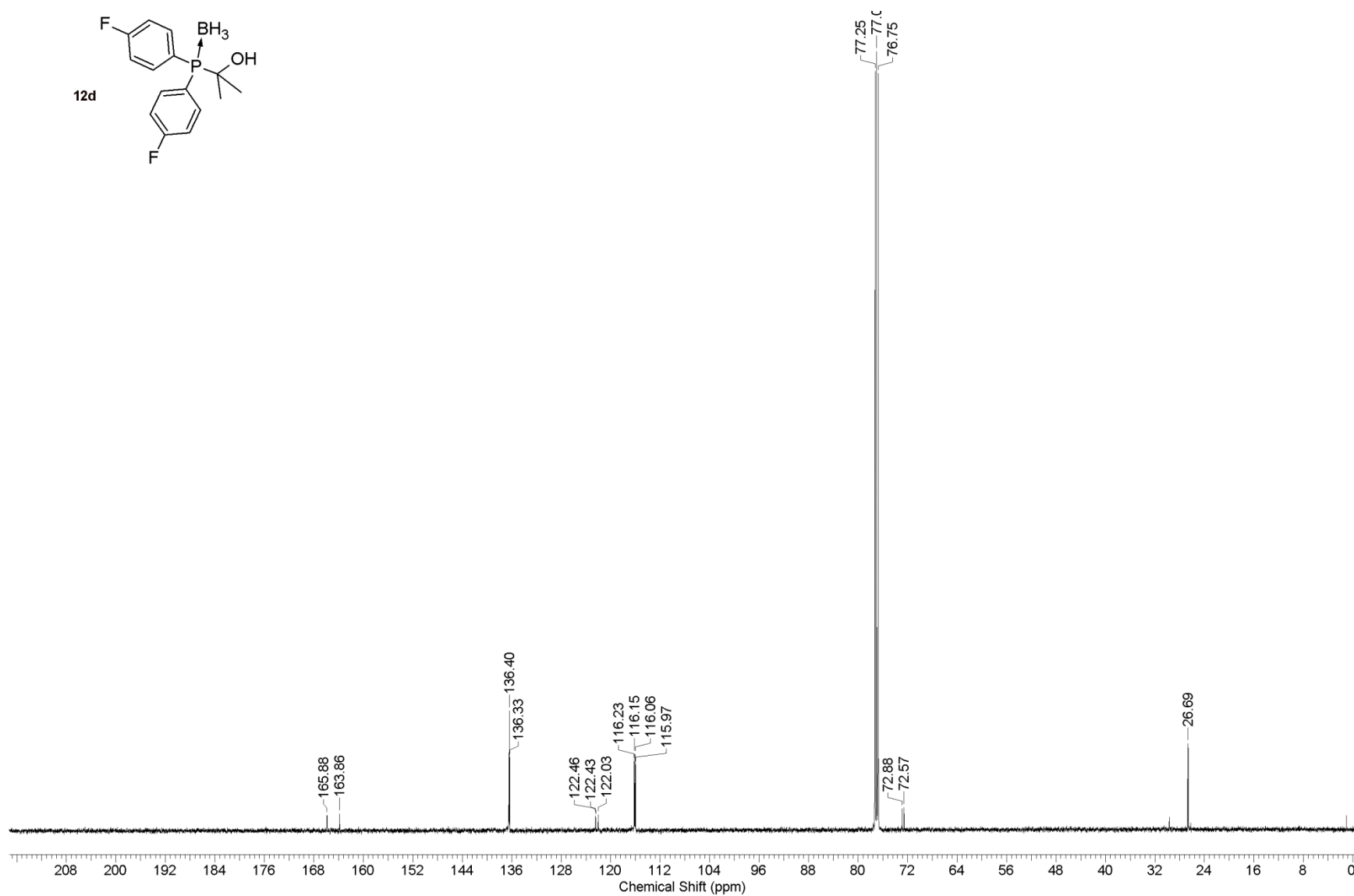
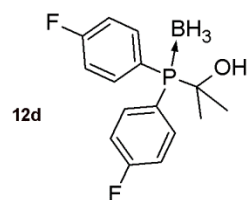
^{13}C NMR spectrum of di-*p*-anisyl(1-hydroxy-1-methylethyl)phosphine-borane (**12c**) (125 MHz, CDCl_3)



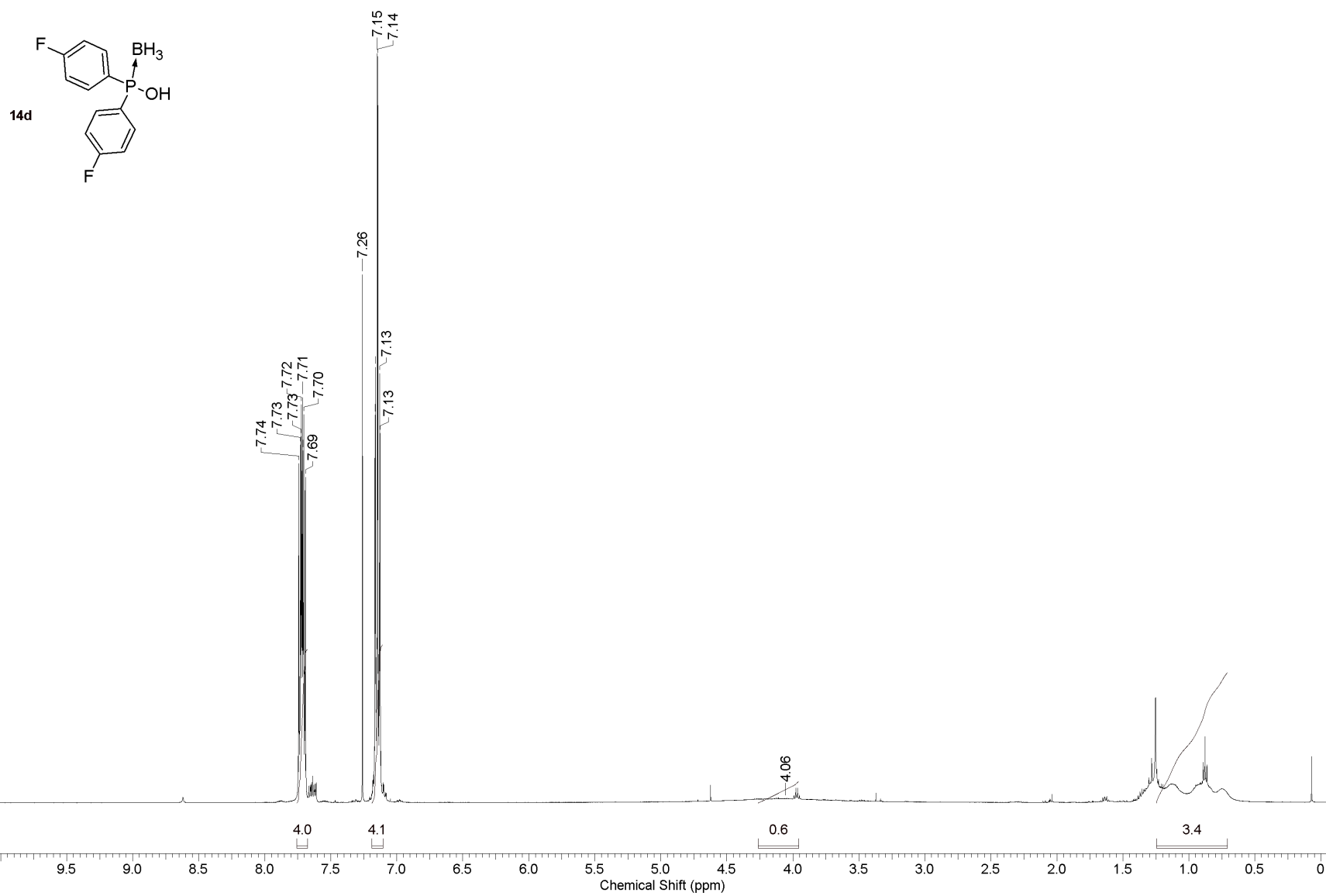
^1H NMR spectrum of di-*p*-fluorophenyl-(1-hydroxy-1-methylethyl)phosphine-borane (**12d**) (500 MHz, CDCl_3)



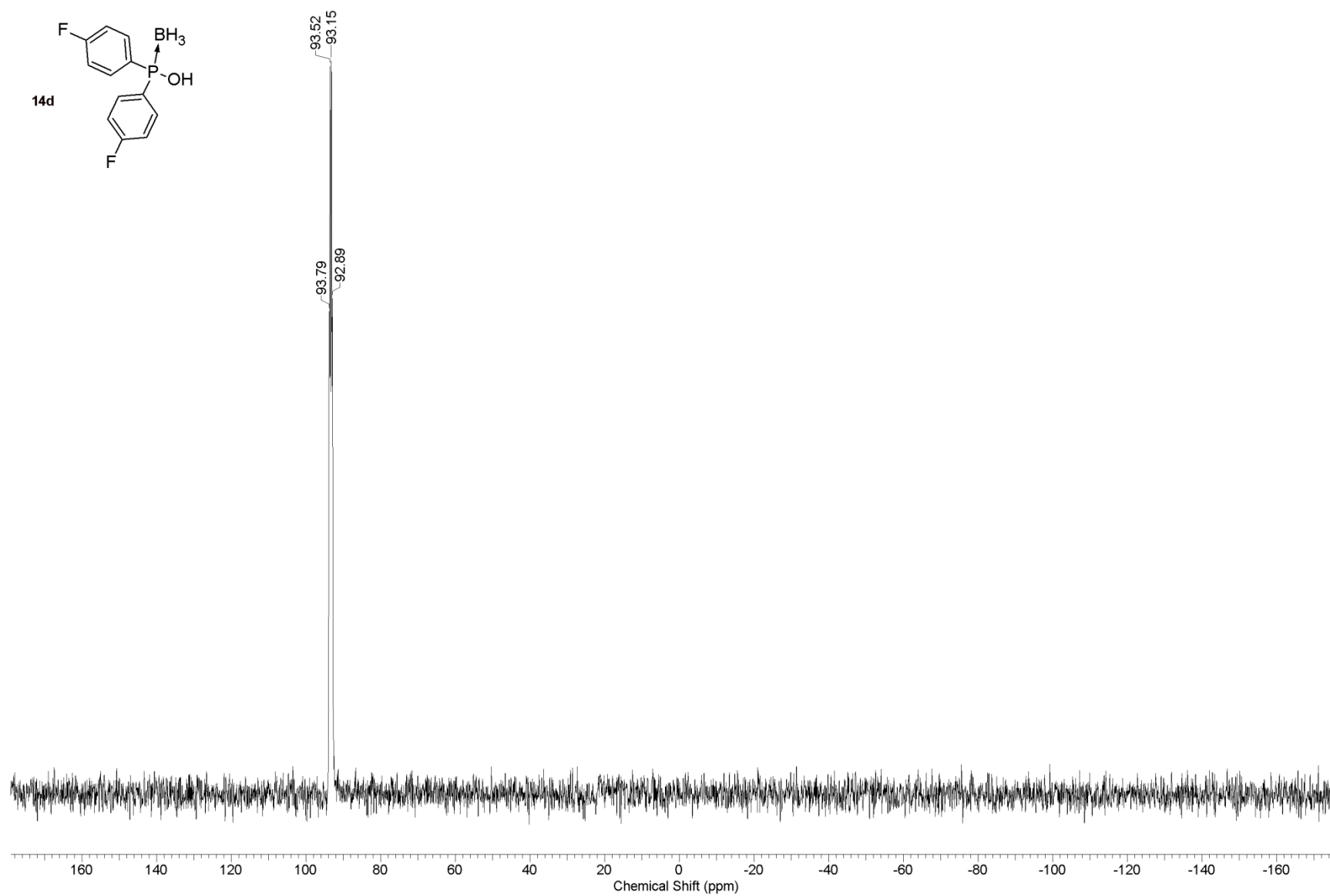
^{31}P NMR spectrum of di-*p*-fluorophenyl-(1-hydroxy-1-methylethyl)phosphine-borane (**12d**) (202 MHz, CDCl_3)



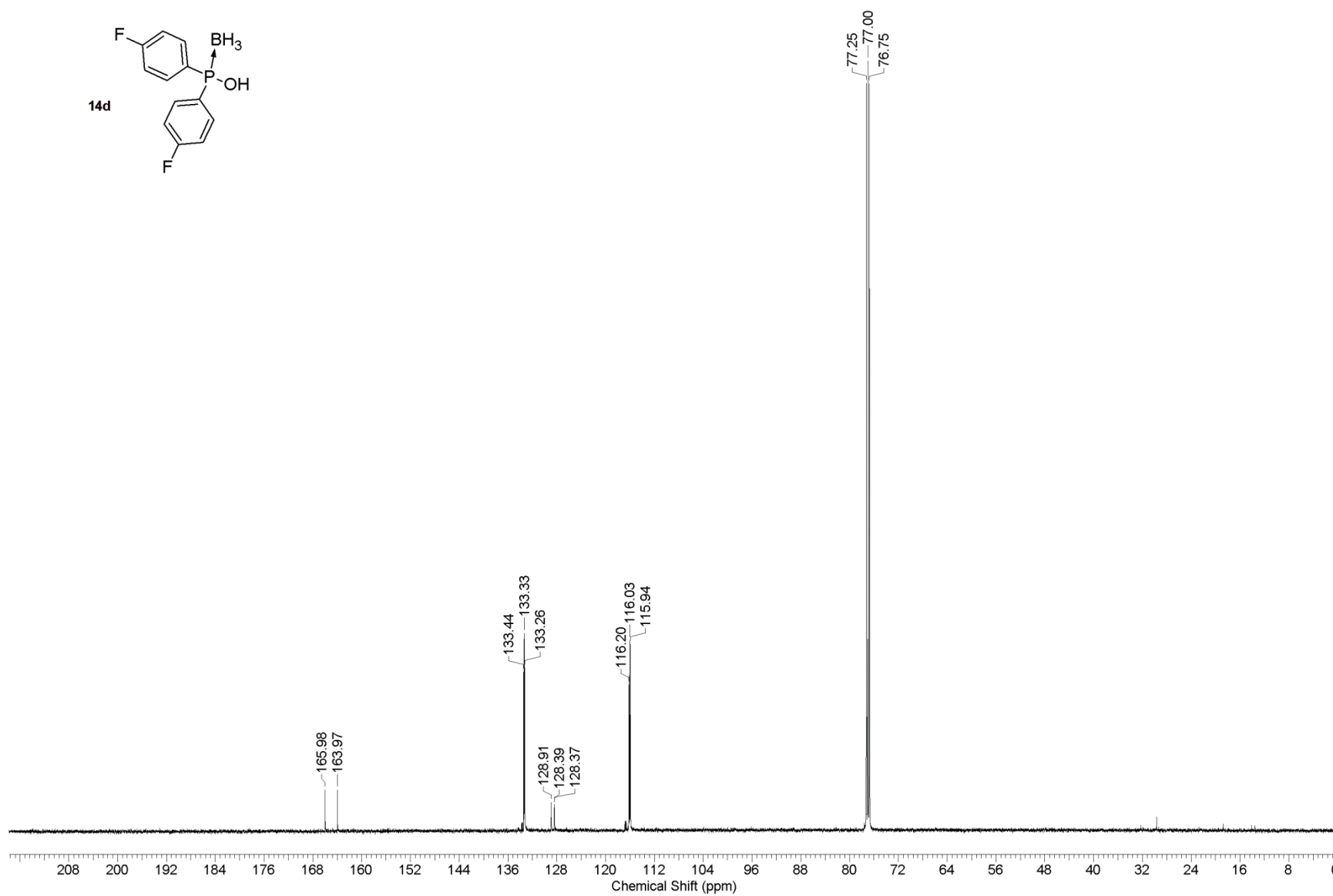
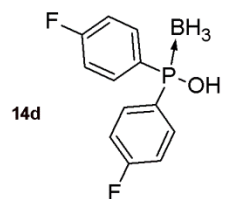
^{13}C NMR spectrum of di-*p*-fluorophenyl-(1-hydroxy-1-methylethyl)phosphine-borane (**12d**) (125 MHz, CDCl_3)



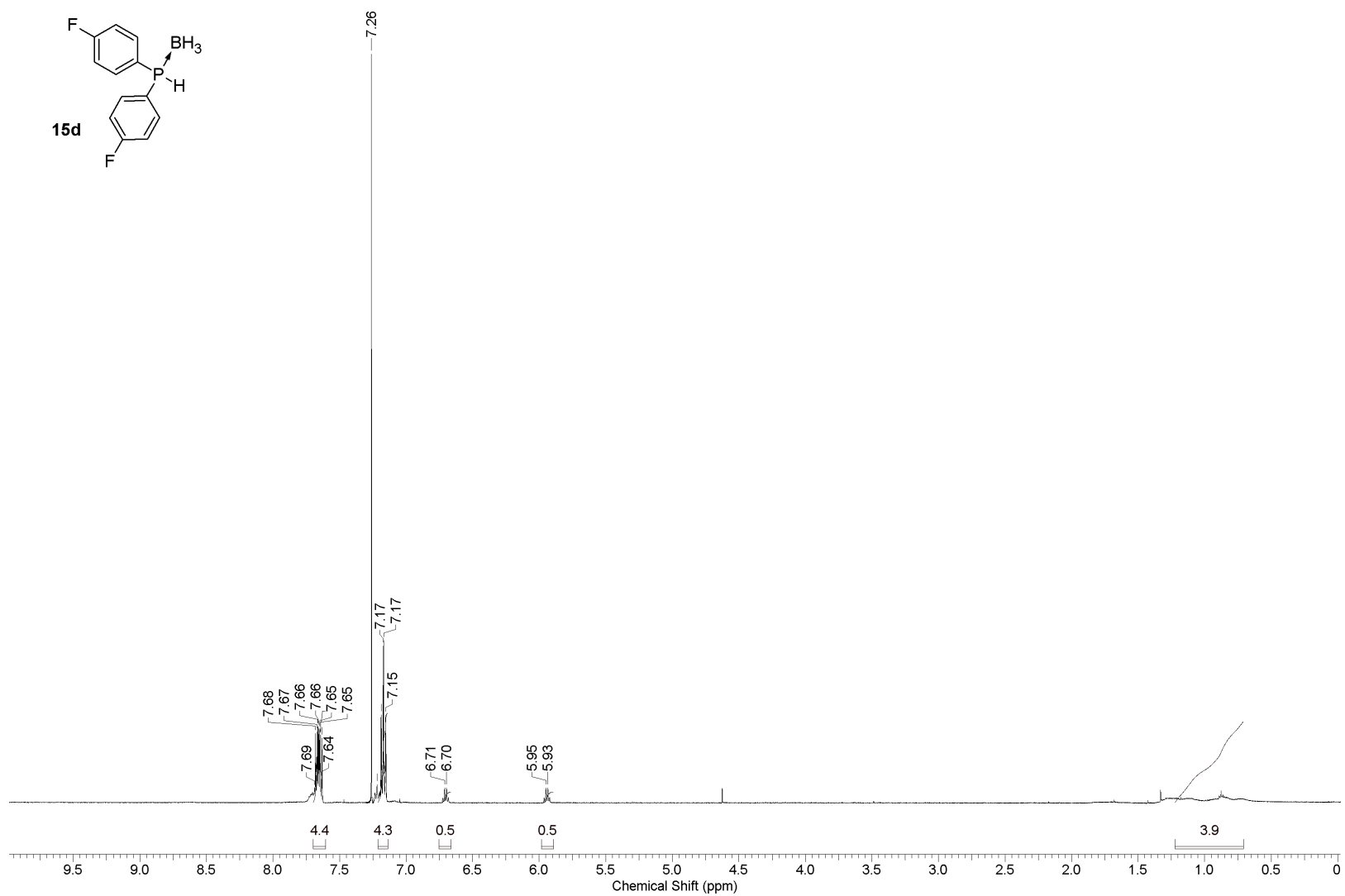
^1H NMR spectrum of di-*p*-fluorophenylphosphinous acid-borane (**14d**) (500 MHz, CDCl_3)



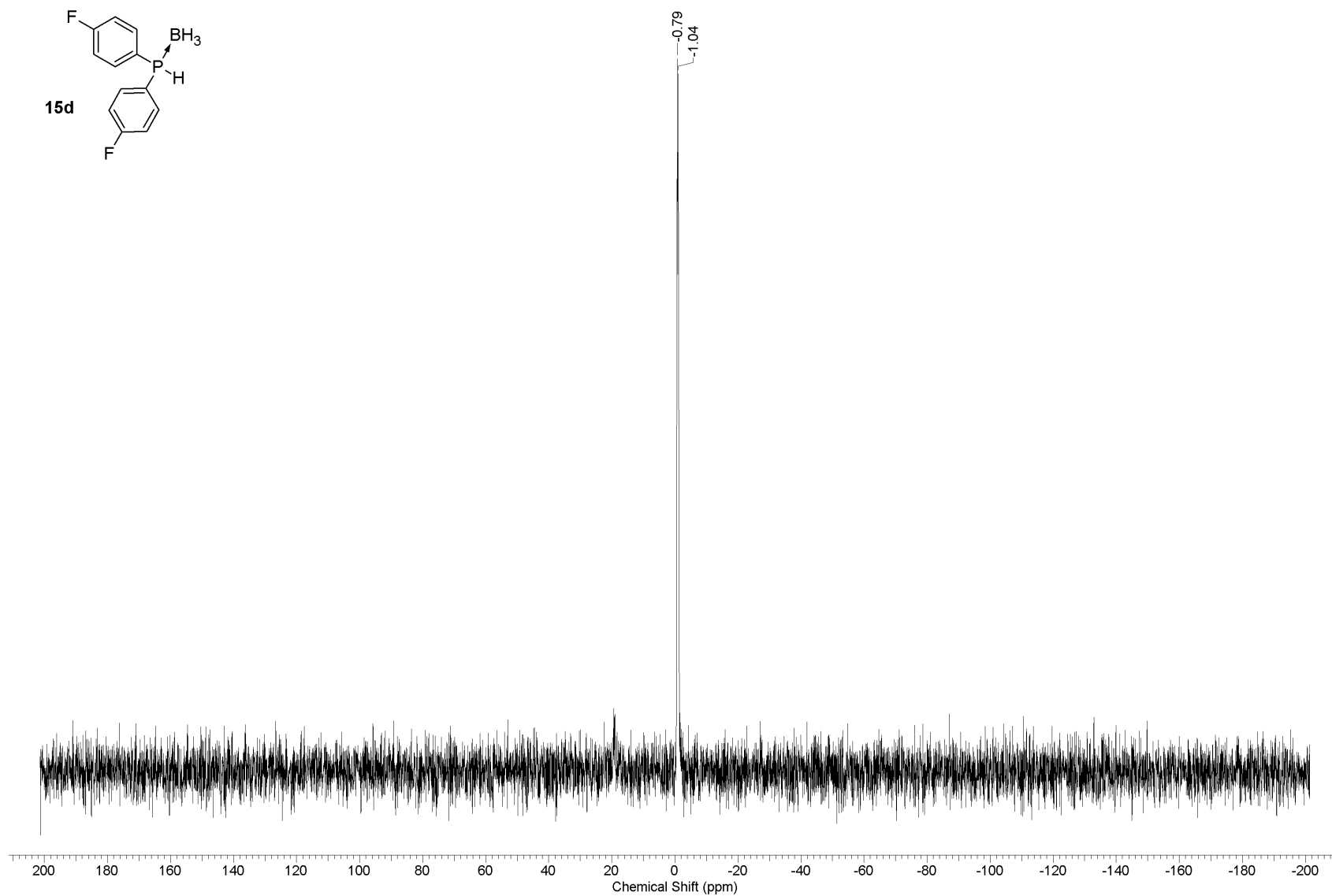
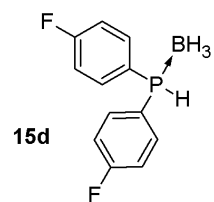
^{31}P NMR spectrum of di-*p*-fluorophenylphosphinous acid-borane (**14d**) (202 MHz, CDCl_3)



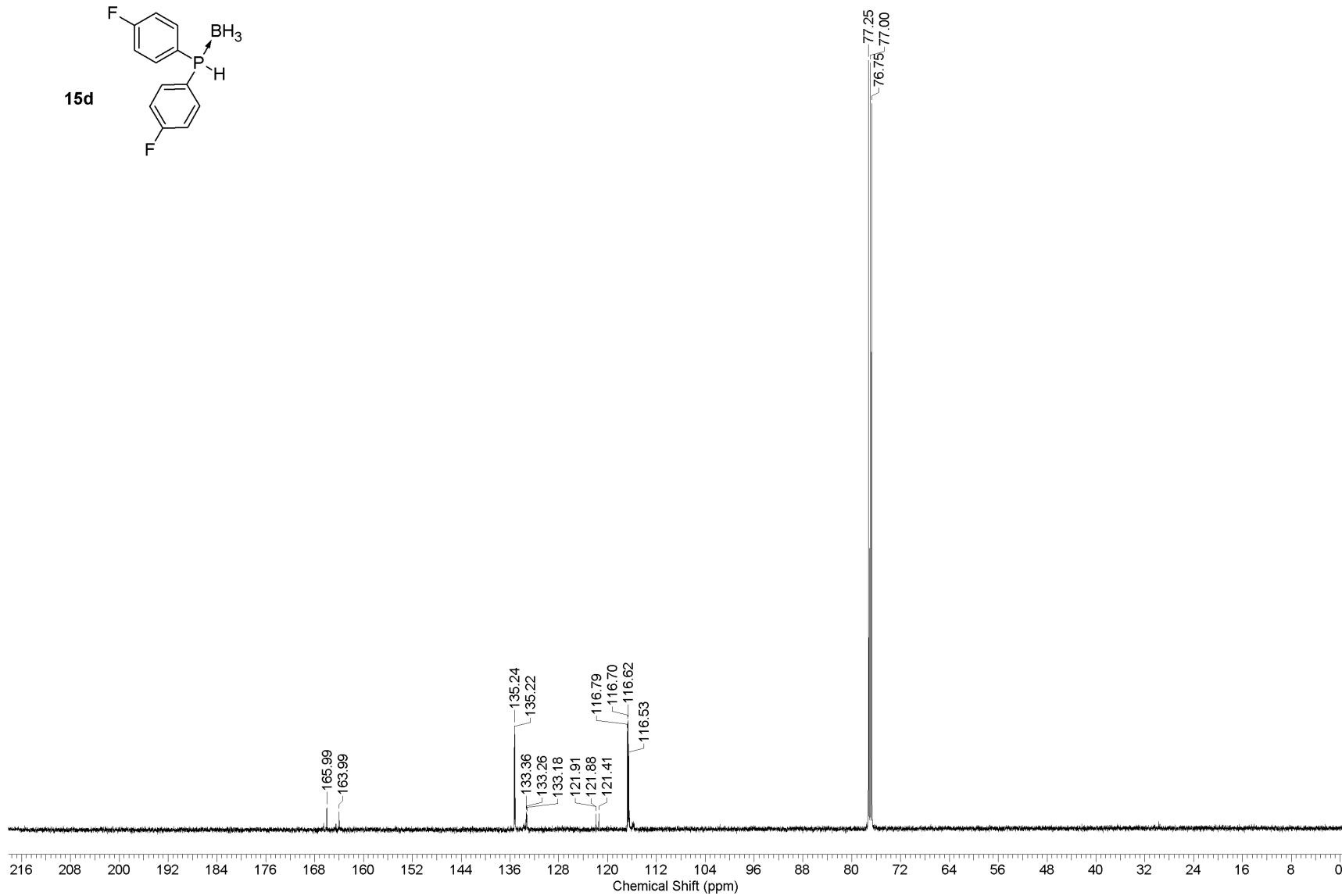
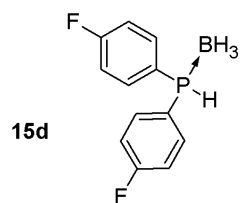
^{13}C NMR spectrum of di-*p*-fluorophenylphosphinous acid-borane (**14d**) (125 MHz, CDCl_3)



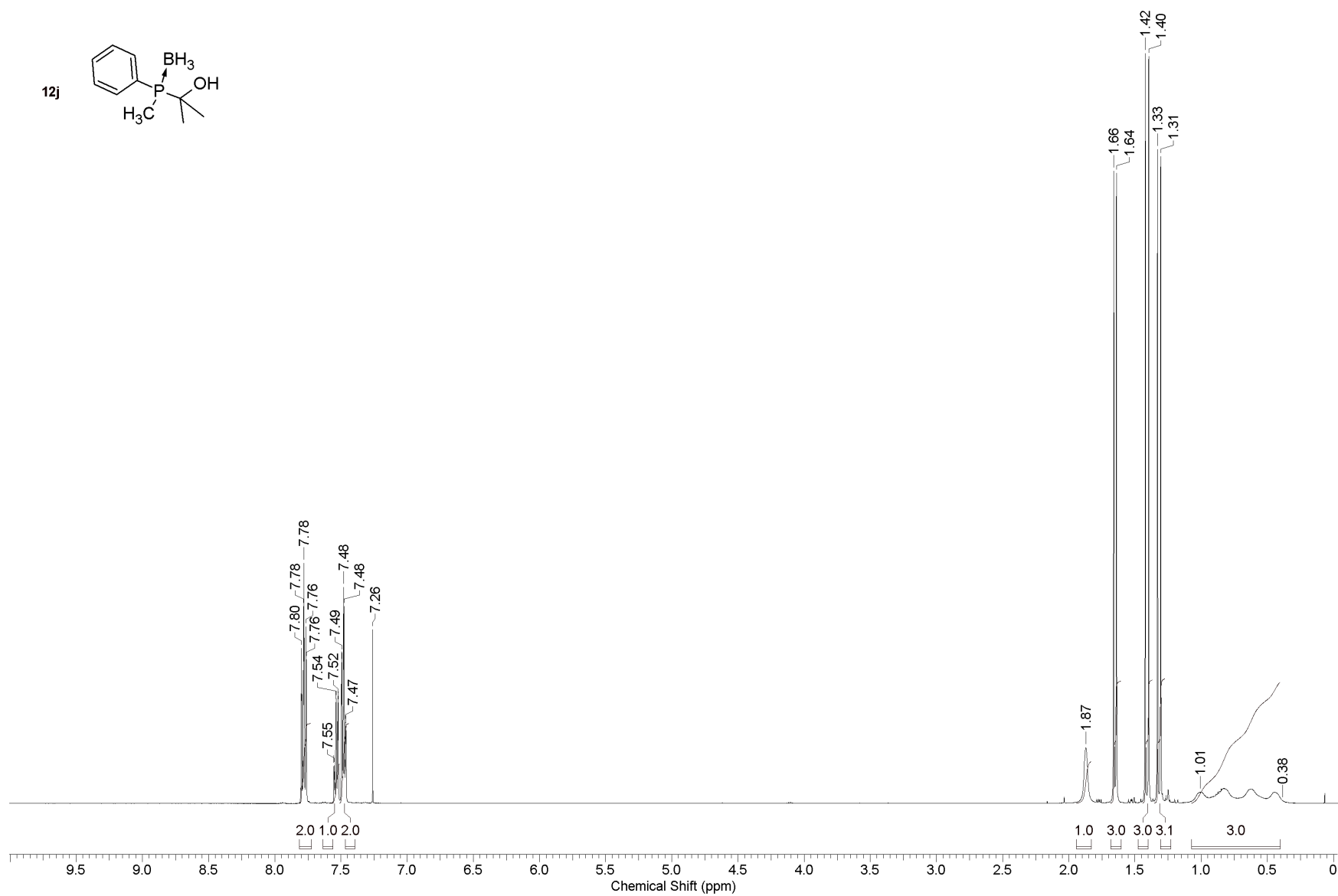
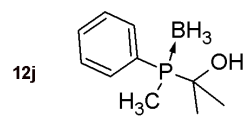
^1H NMR spectrum of di-*p*-fluorophenylphosphine-borane (**15d**) (500 MHz, CDCl_3)



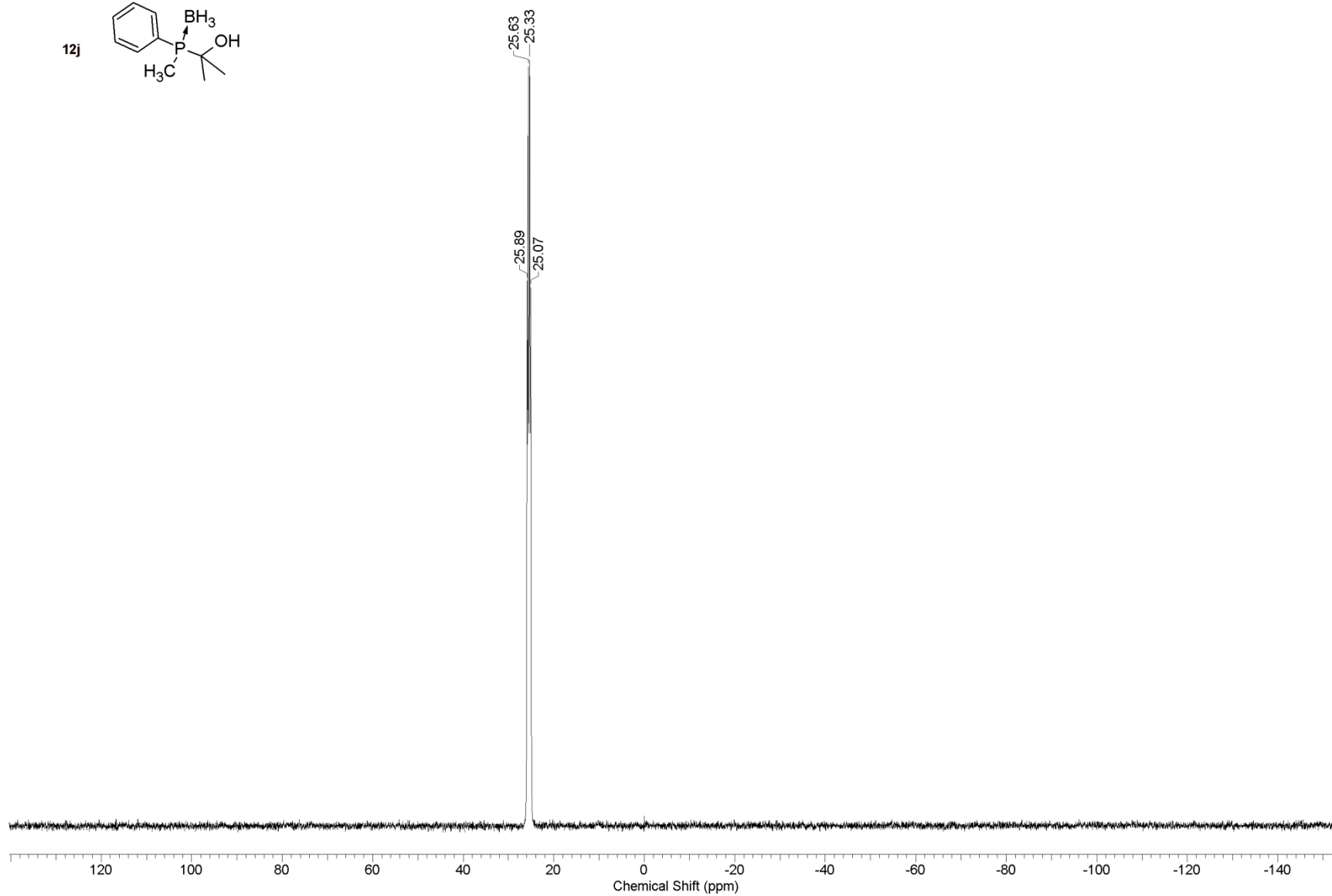
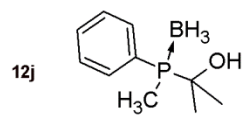
^{31}P NMR spectrum of di-*p*-fluorophenylphosphine-borane (**15d**) (202 MHz, CDCl_3)



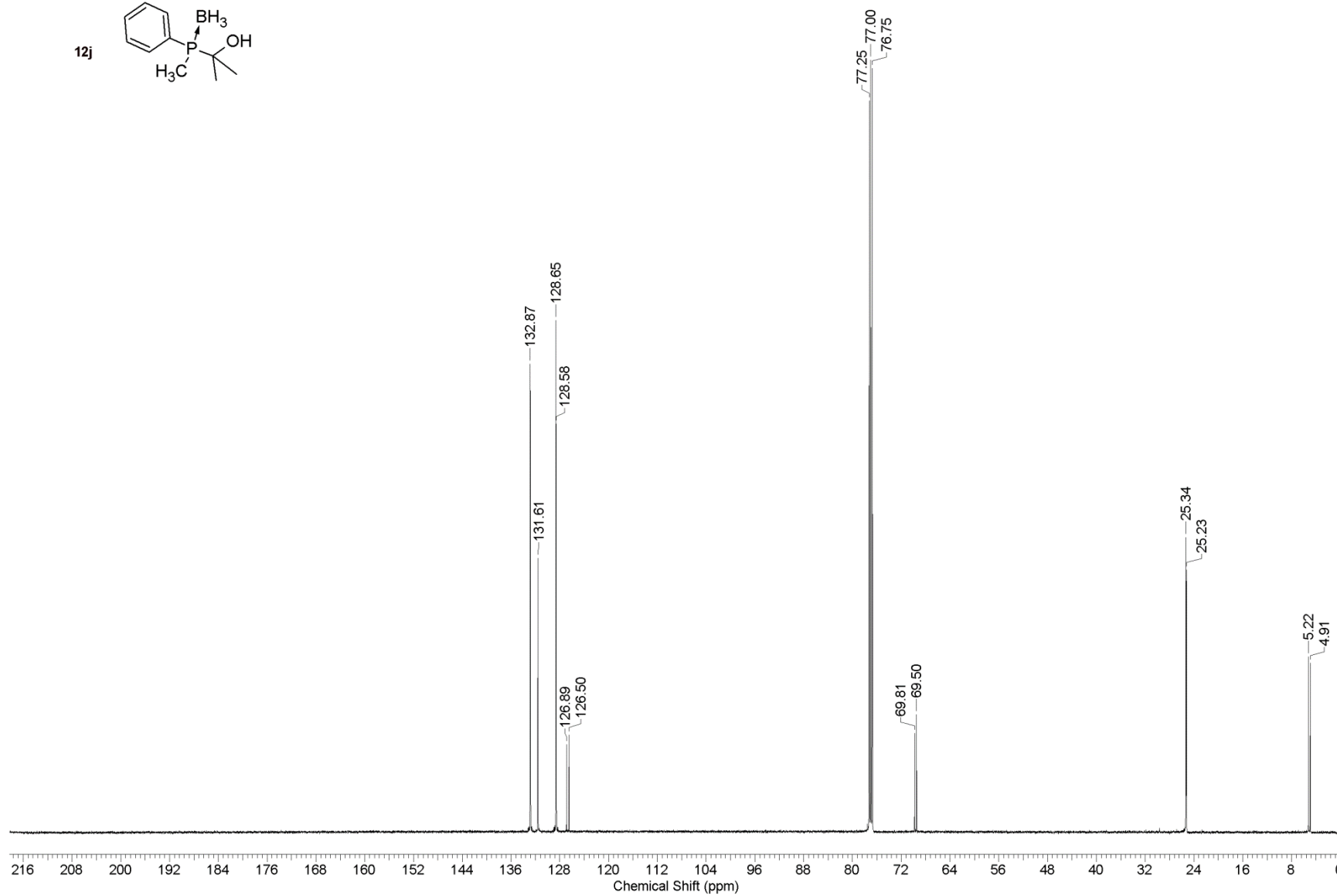
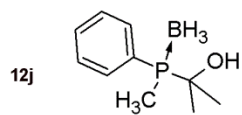
^{13}C NMR spectrum of di-*p*-fluorophenylphosphine-borane (**15d**) (125 MHz, CDCl_3)



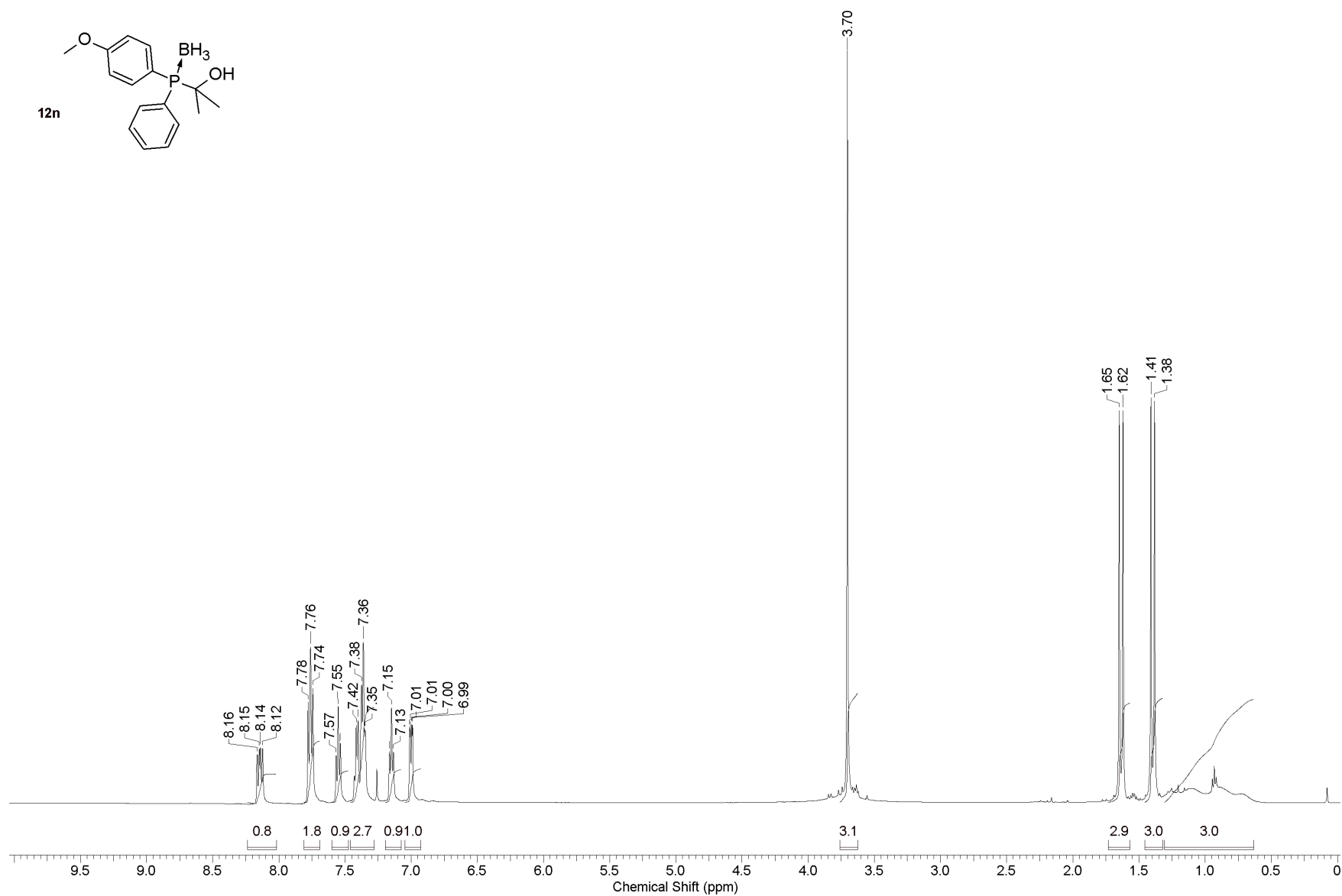
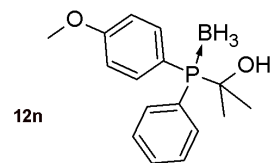
¹H NMR spectrum of (1-hydroxy-1-methylethyl)methylphenylphosphine-borane (**12j**) (500 MHz, CDCl₃)



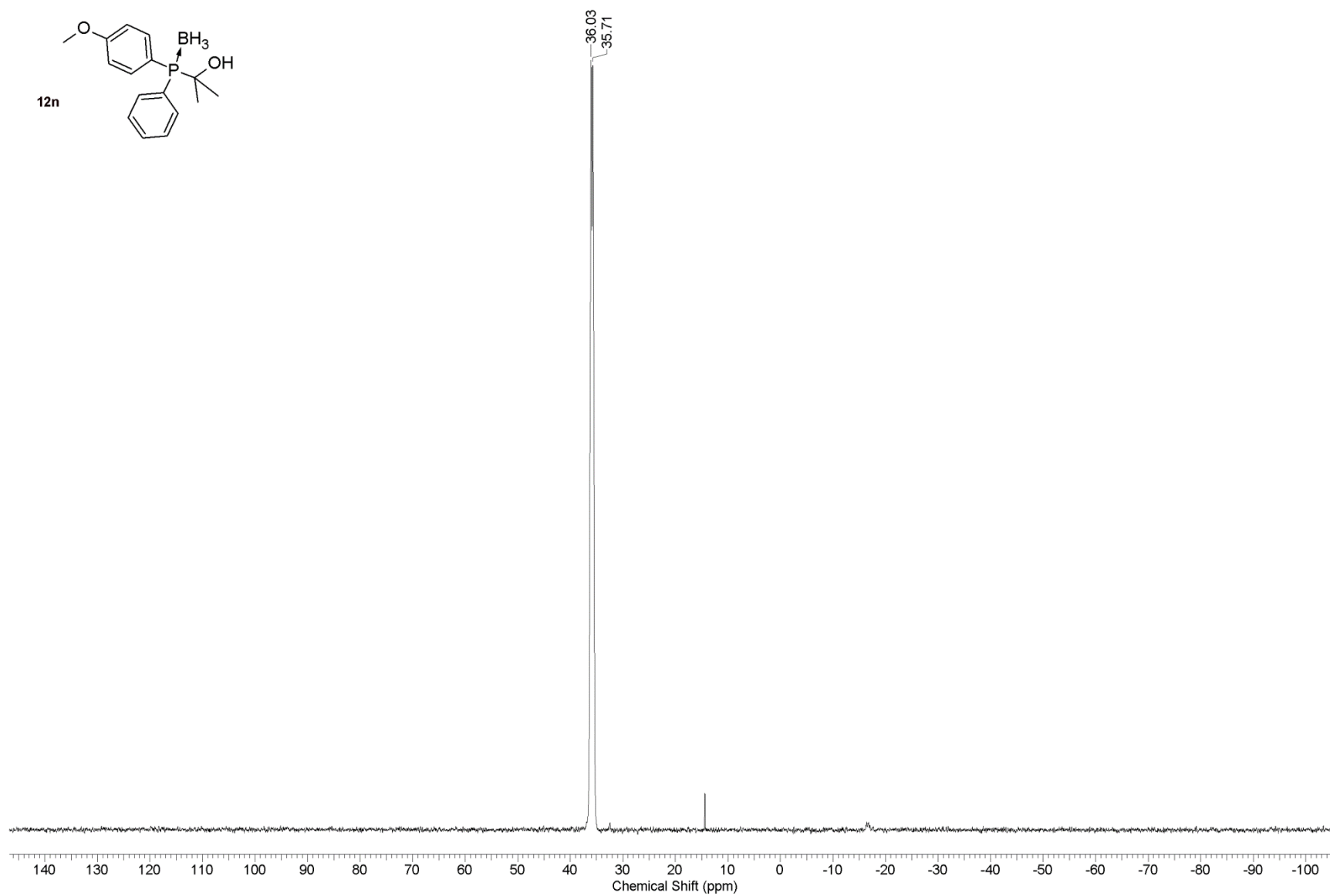
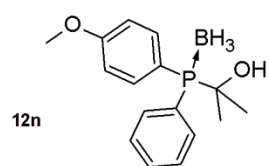
^{31}P NMR of spectrum (1-hydroxy-1-methylethyl)methylphenylphosphine-borane (**12j**) (202 MHz, CDCl_3)



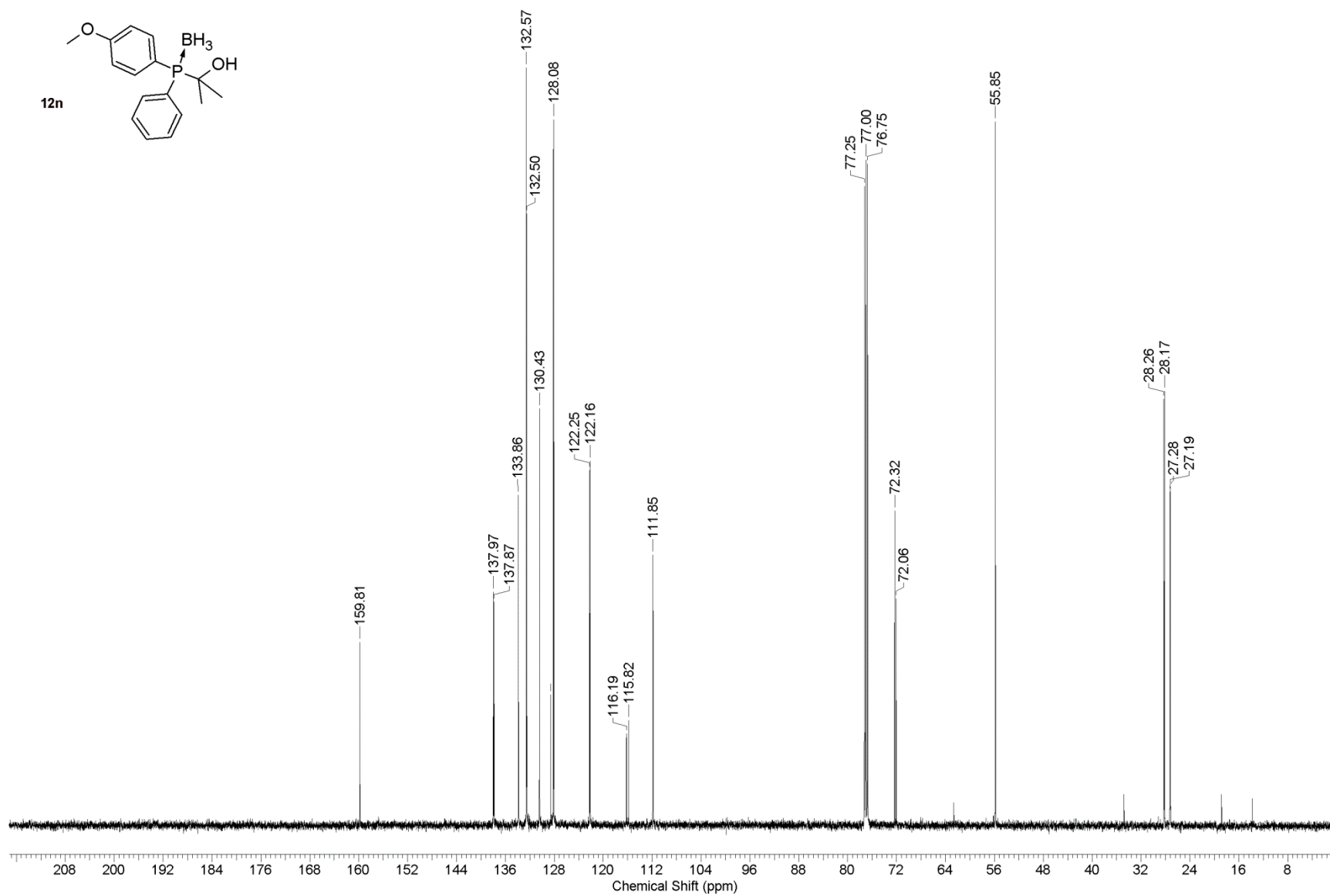
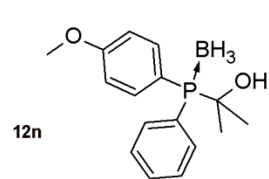
^{13}C NMR of spectrum (1-hydroxy-1-methylethyl)methylphenylphosphine-borane (**12j**) (125 MHz, CDCl_3)



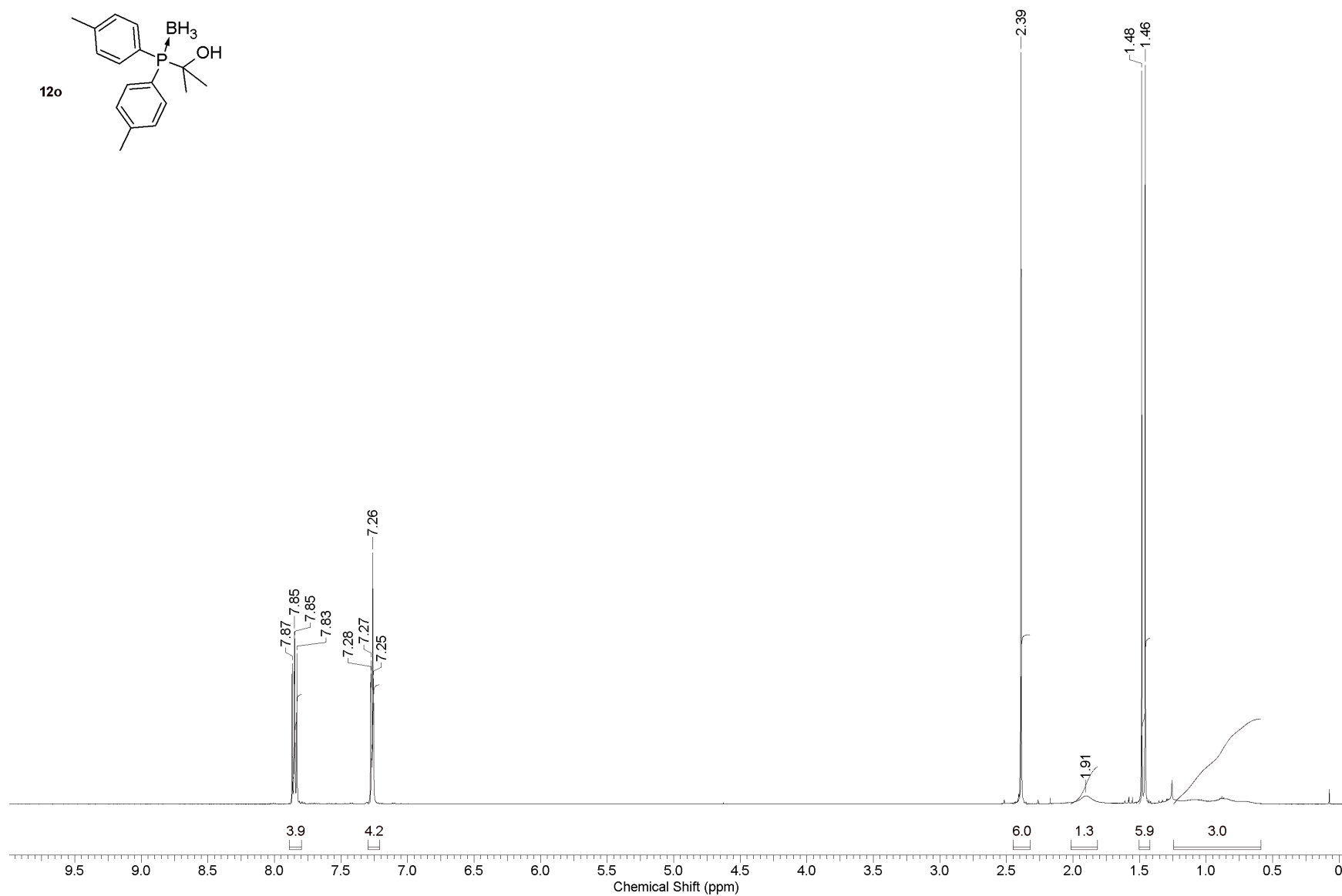
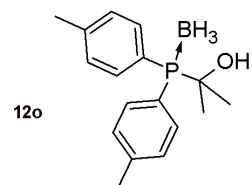
^1H NMR spectrum of *p*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12n**) (500 MHz, CDCl_3)



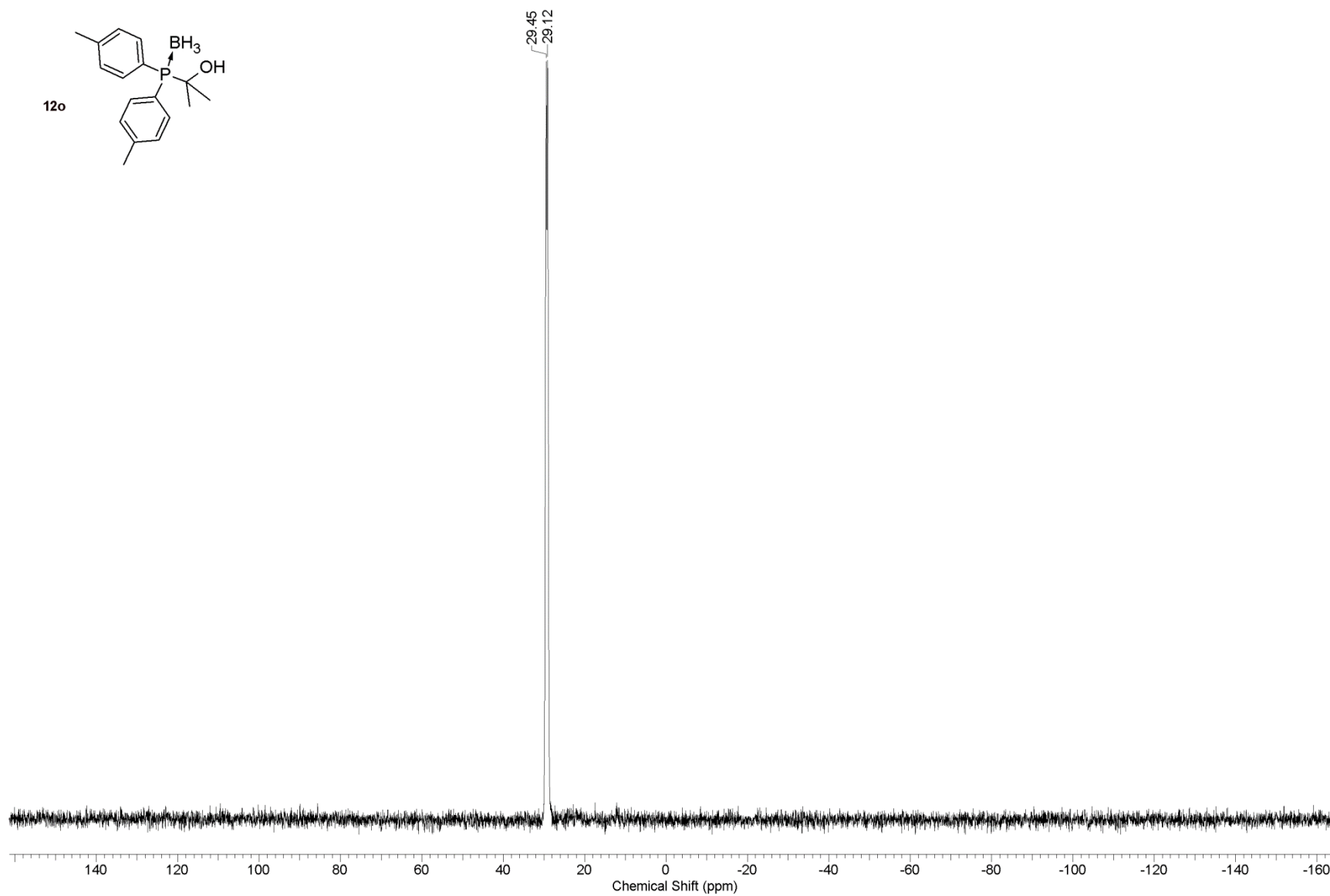
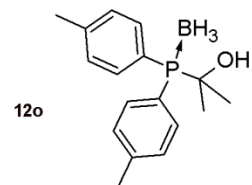
^{31}P NMR of spectrum *p*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12n**) (202 MHz, CDCl_3)



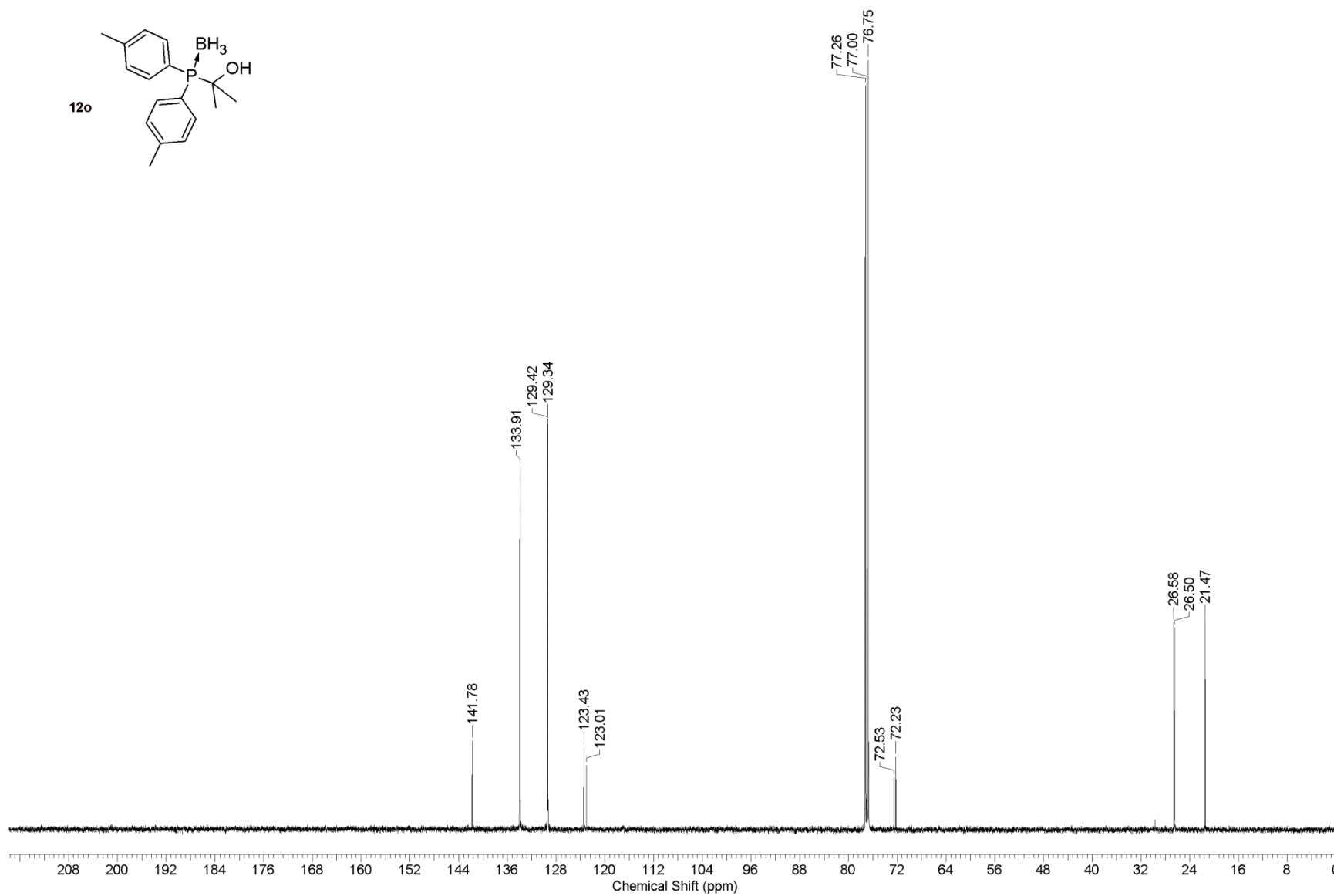
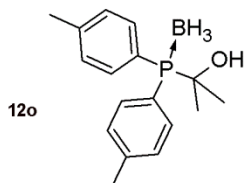
^{13}C NMR of spectrum *p*-anisyl(1-hydroxy-1-methylethyl)phenylphosphine-borane (**12n**) (125 MHz, CDCl_3)



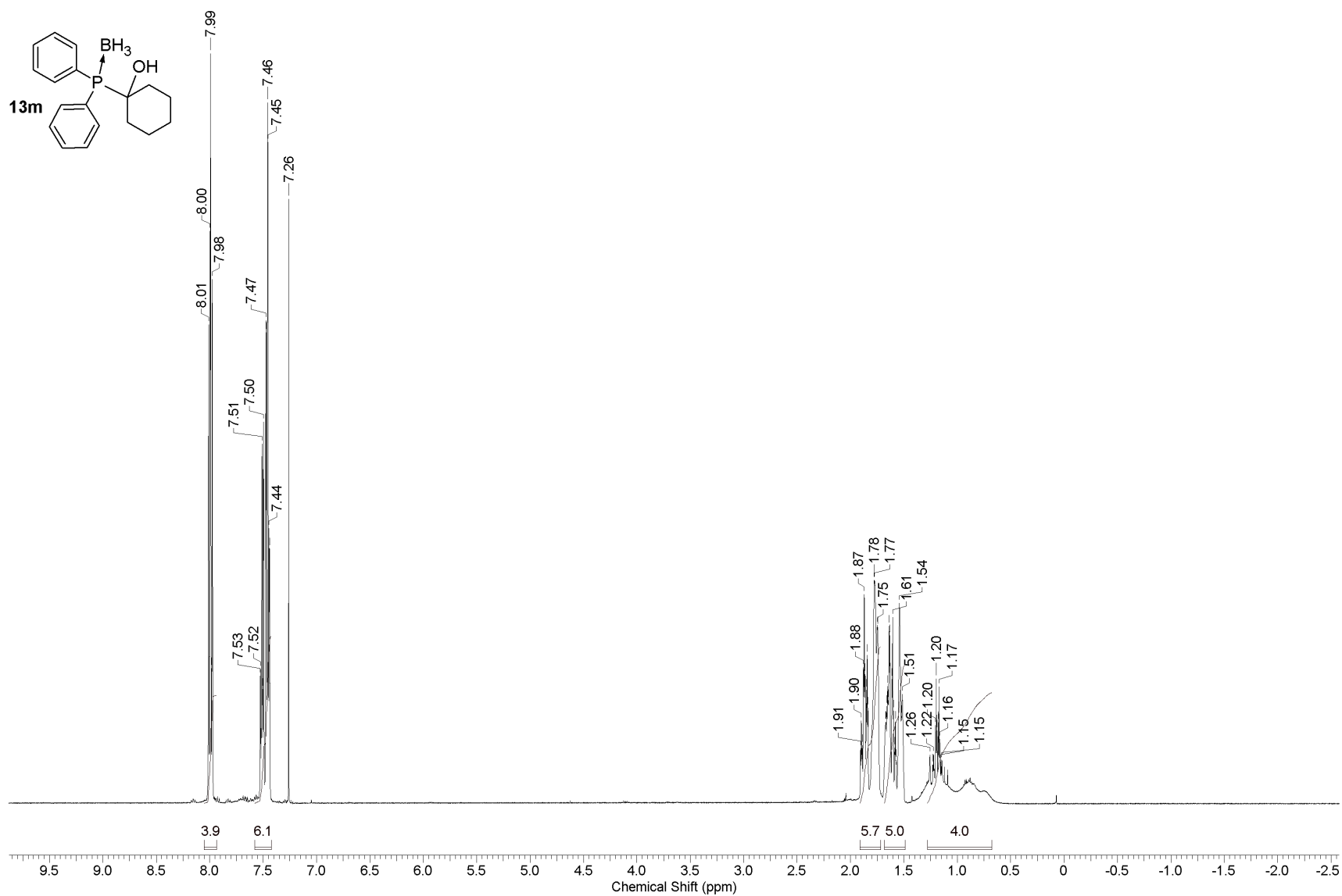
¹H NMR of spectrum di-*p*-tolyl(1-hydroxy-1-methylethyl)phosphine-borane (**12o**) (500 MHz, CDCl₃)



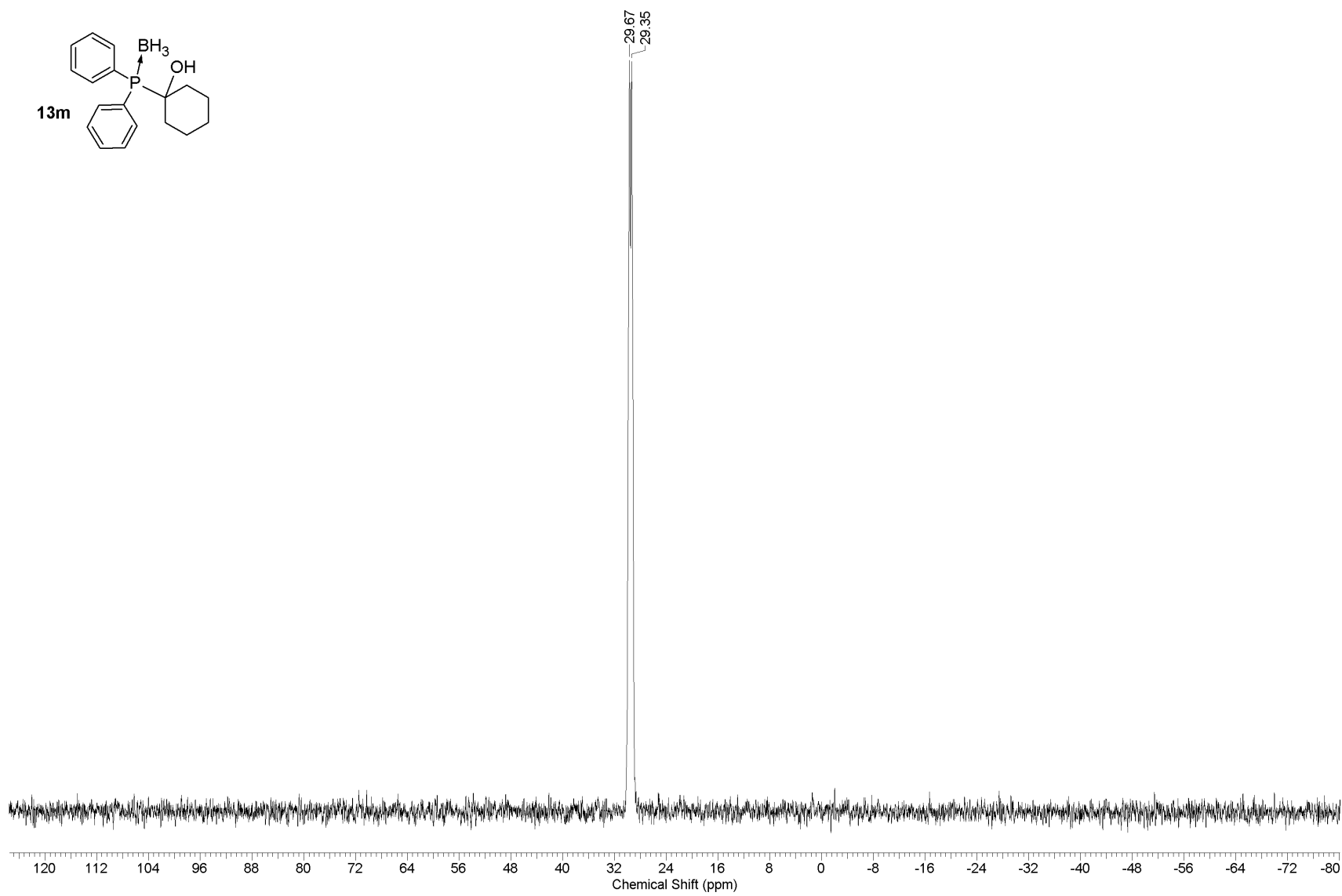
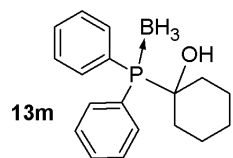
^{31}P NMR of spectrum di-*p*-tolyl(1-hydroxy-1-methylethyl)phosphine-borane (**12o**) (202 MHz, CDCl_3)



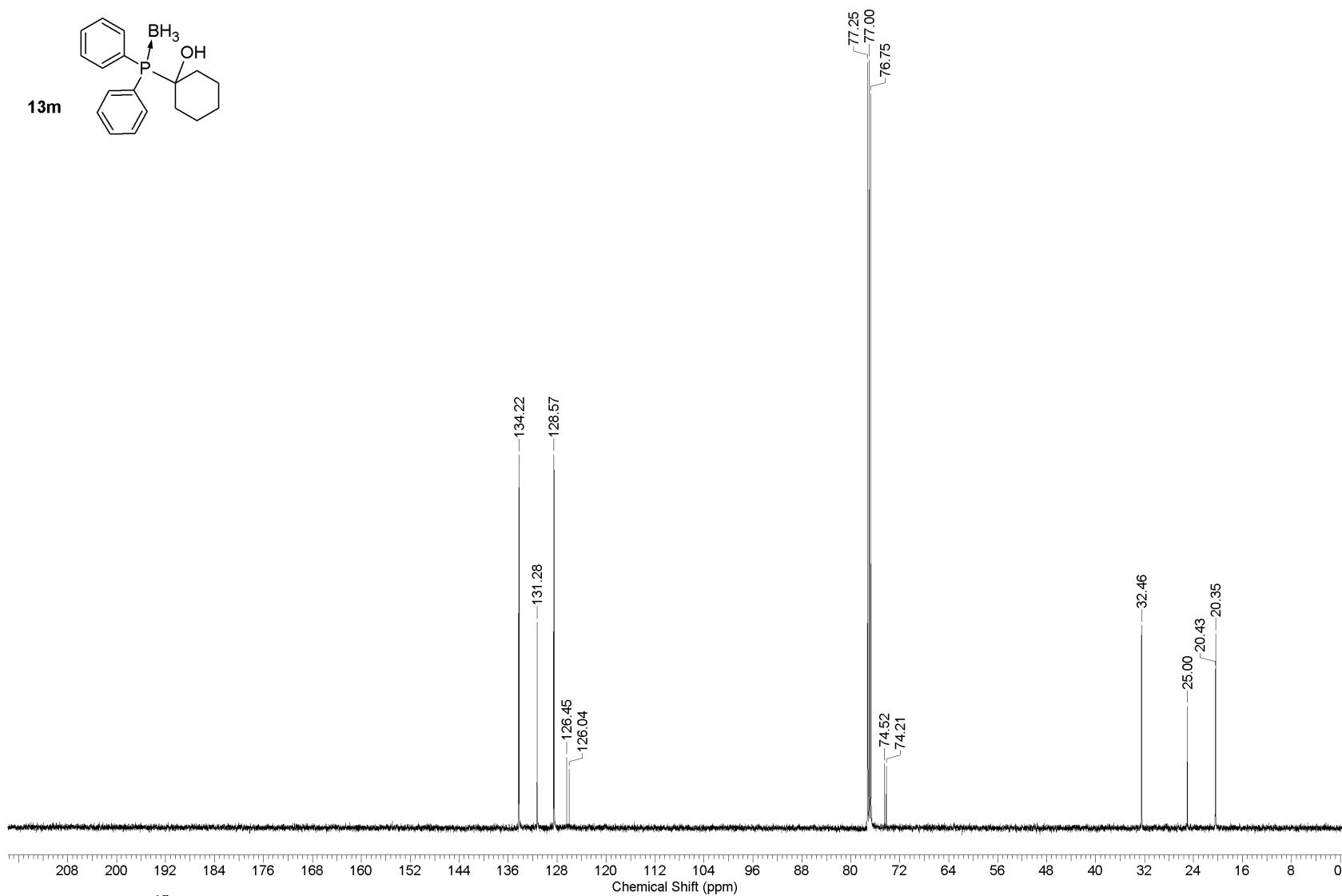
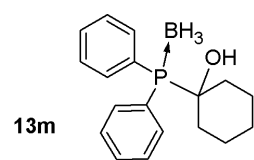
^{13}C NMR of spectrum di-*p*-tolyl(1-hydroxy-1-methylethyl)phosphine-borane (**12o**) (125 MHz, CDCl_3)



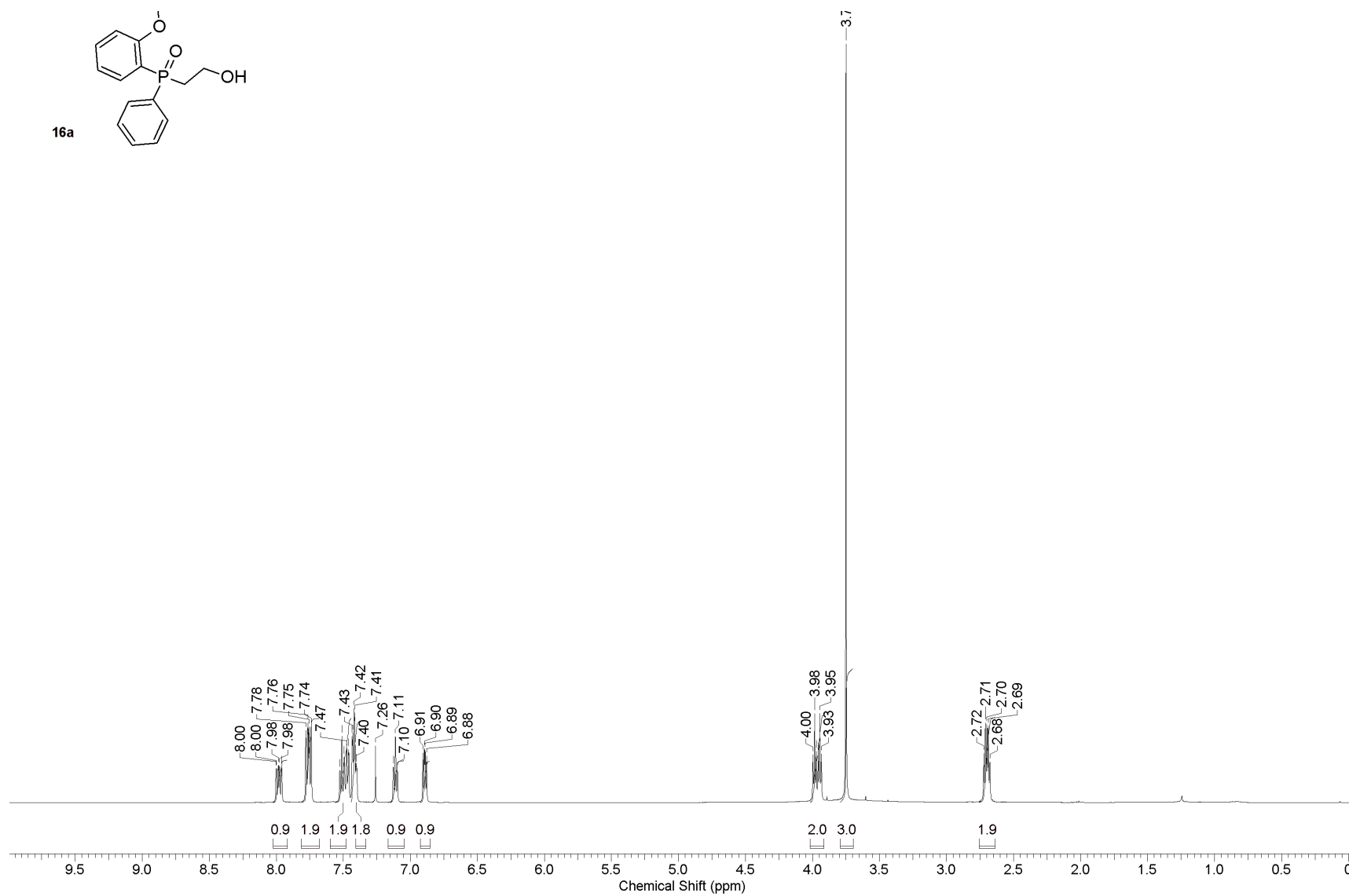
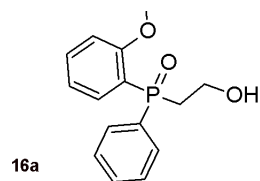
¹H NMR of spectrum diphenyl(1-hydroxycyclohexanyl) phosphine-borane (**13m**) (500 MHz, CDCl₃)



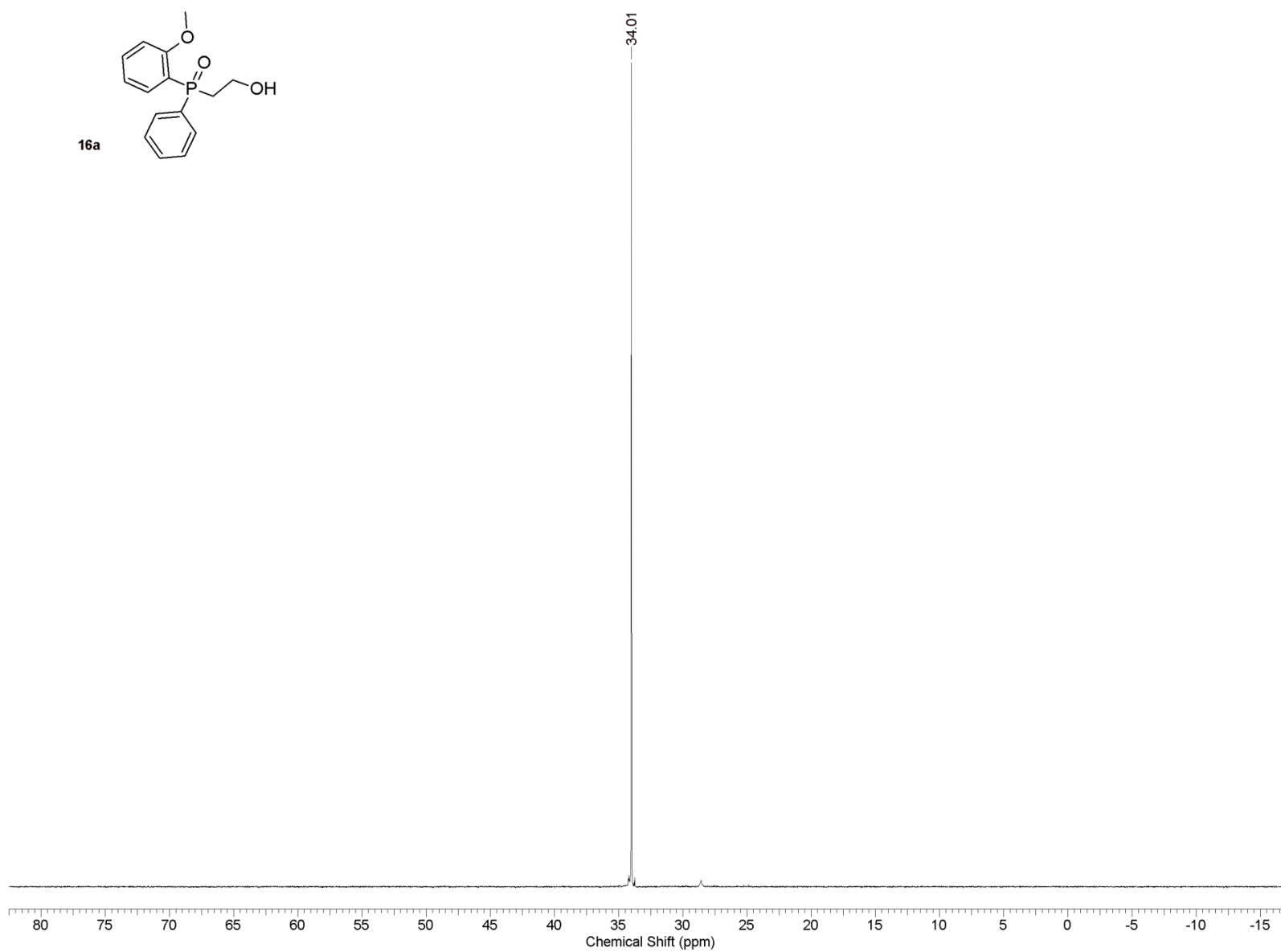
^{31}P NMR of spectrum diphenyl(1-hydroxycyclohexanyl) phosphine-borane (**13m**) (202 MHz, CDCl_3)



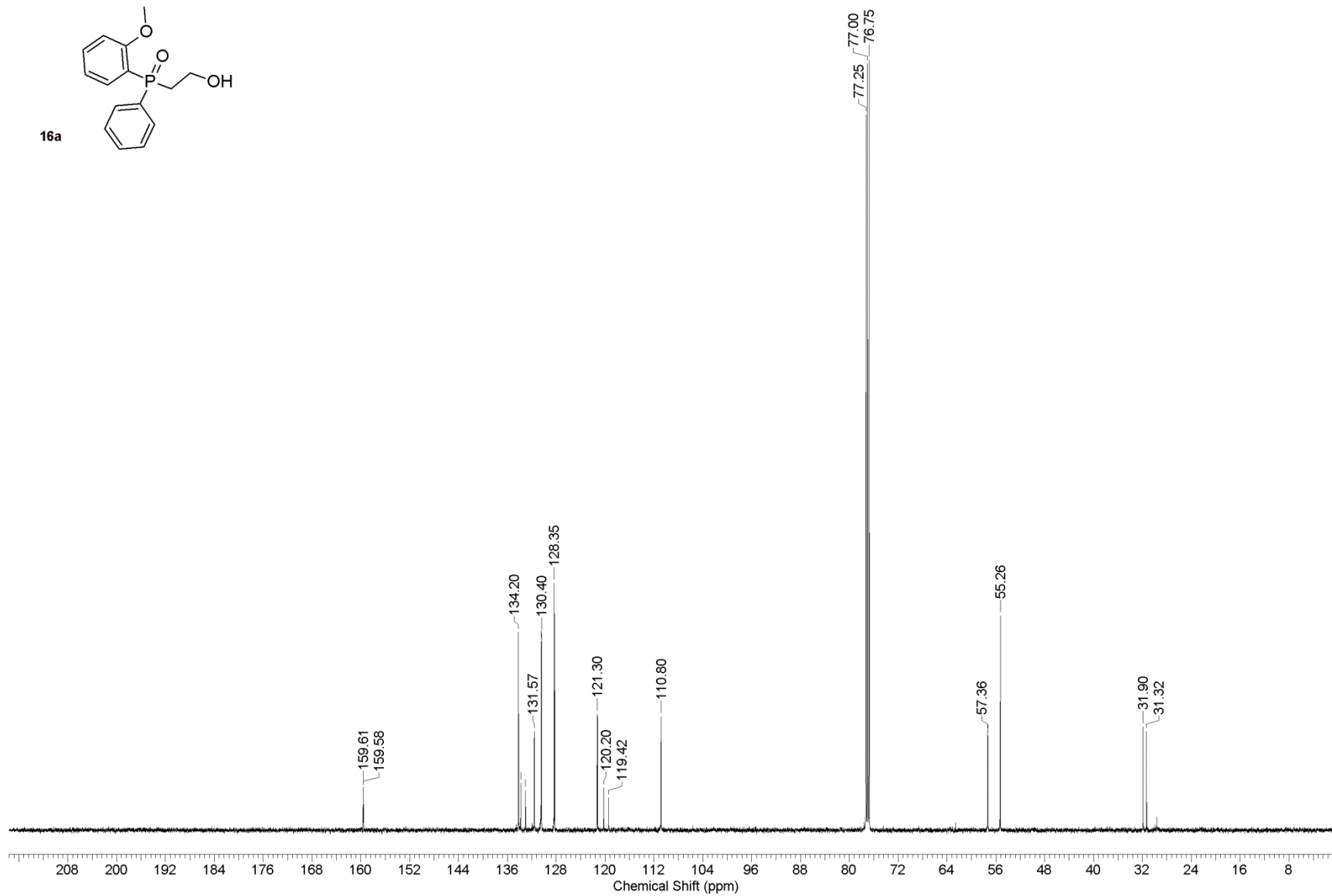
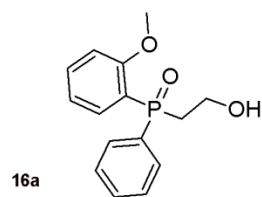
^{13}C NMR of spectrum diphenyl(1-hydroxycyclohexyl) phosphine-borane (**13m**) (125 MHz, CDCl_3)



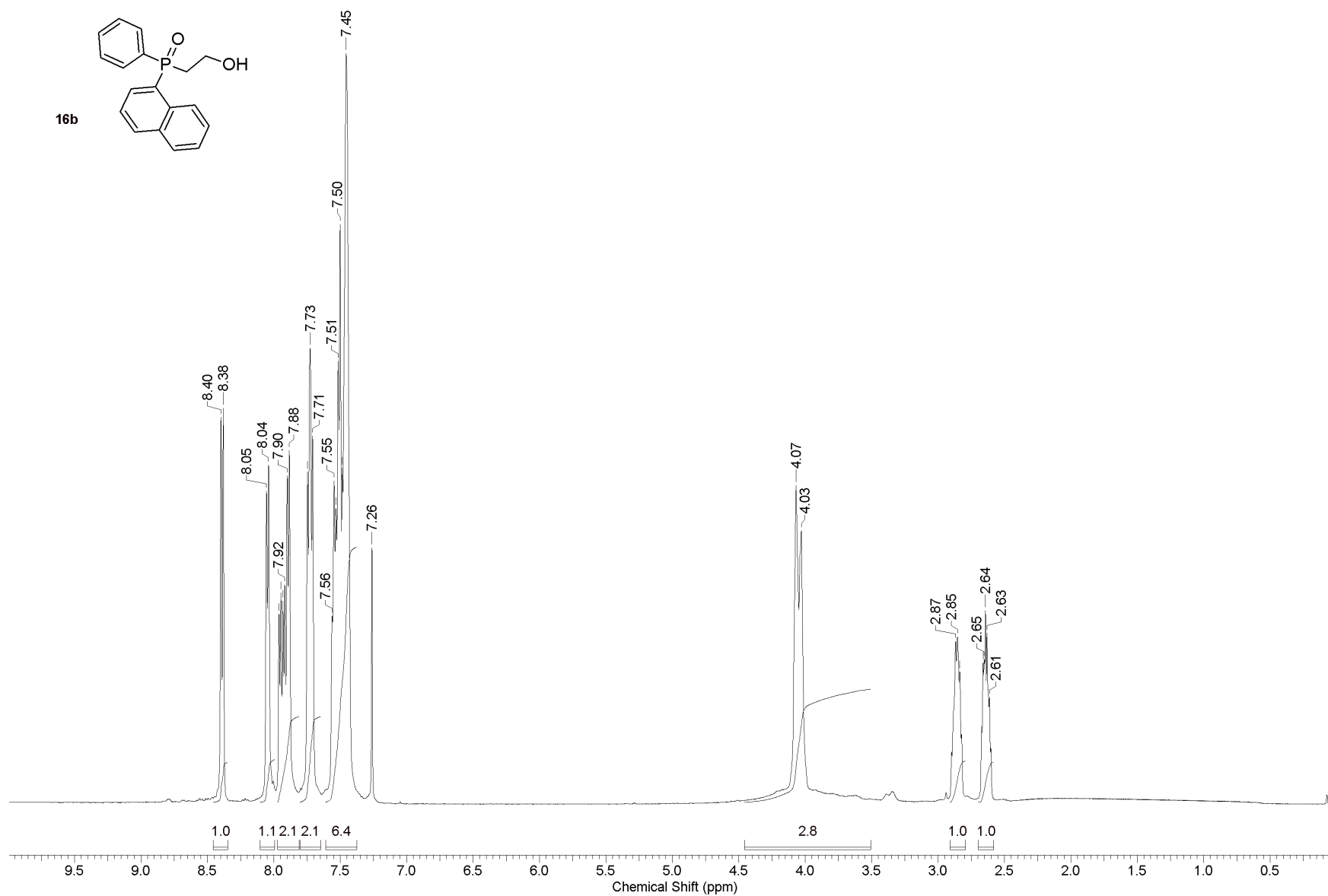
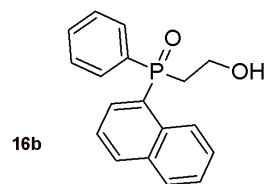
^1H NMR spectrum of *o*-anisyl(2-hydroxyethyl)phenylphosphine oxide (**16a**) (500 MHz, CDCl_3)



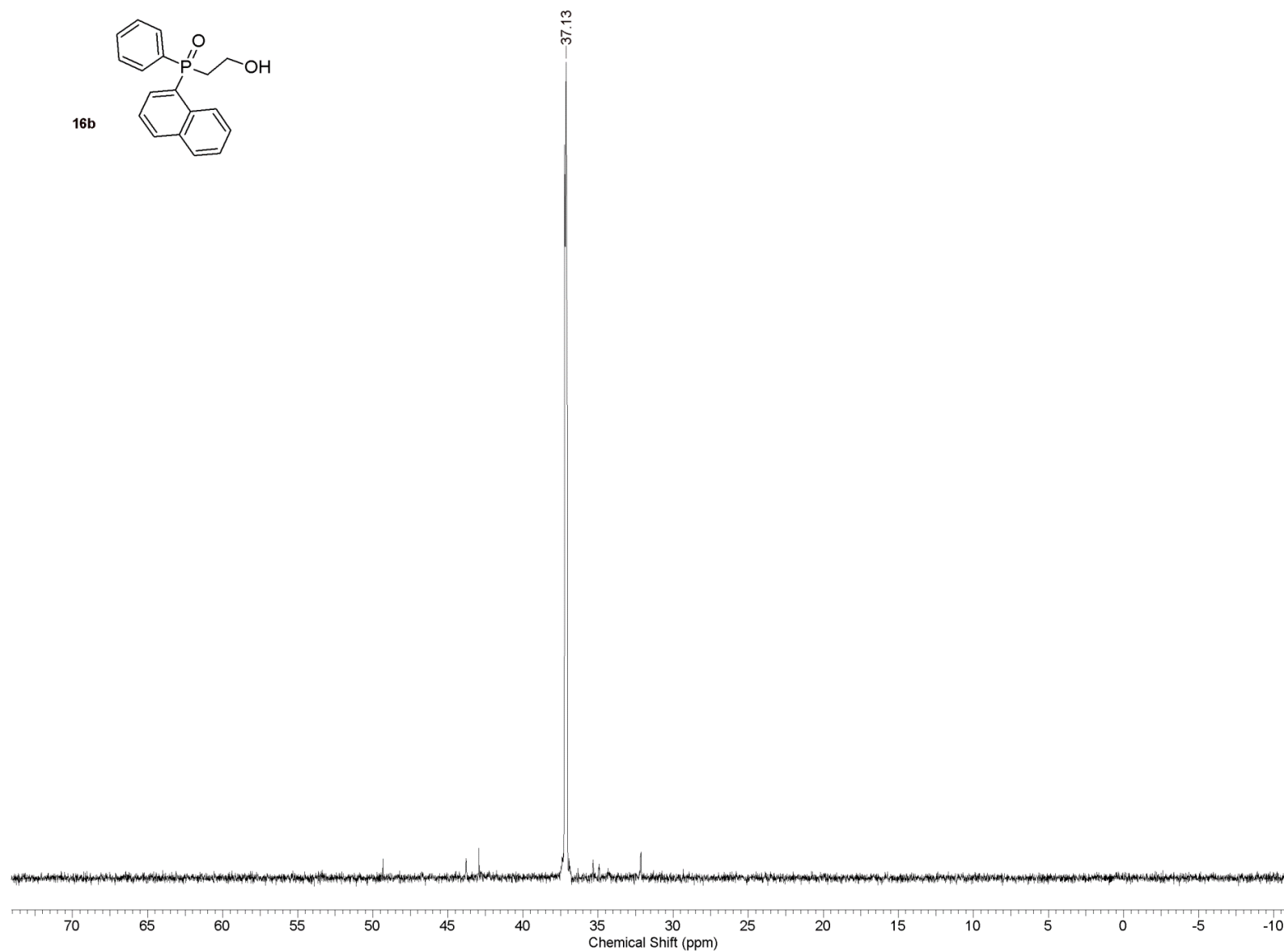
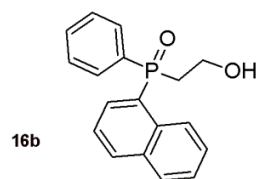
³¹P NMR spectrum of o-anisyl(2-hydroxyethyl)phenylphosphine oxide (**16a**) (202 MHz, CDCl₃)



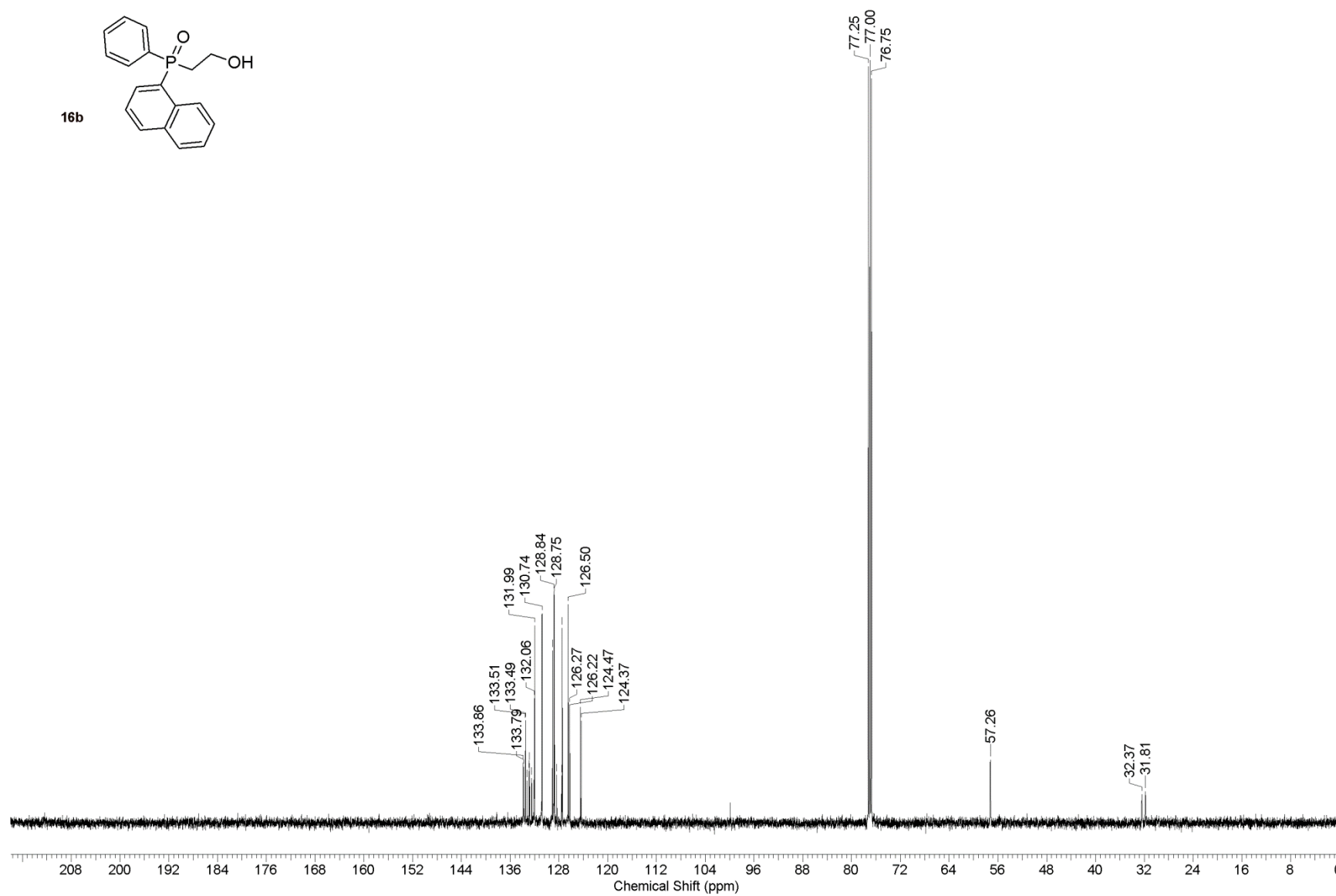
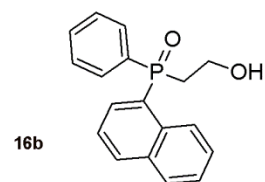
^{13}C NMR spectrum of *o*-anisyl(2-hydroxyethyl)phenylphosphine oxide (**16a**) (125 MHz, CDCl_3)



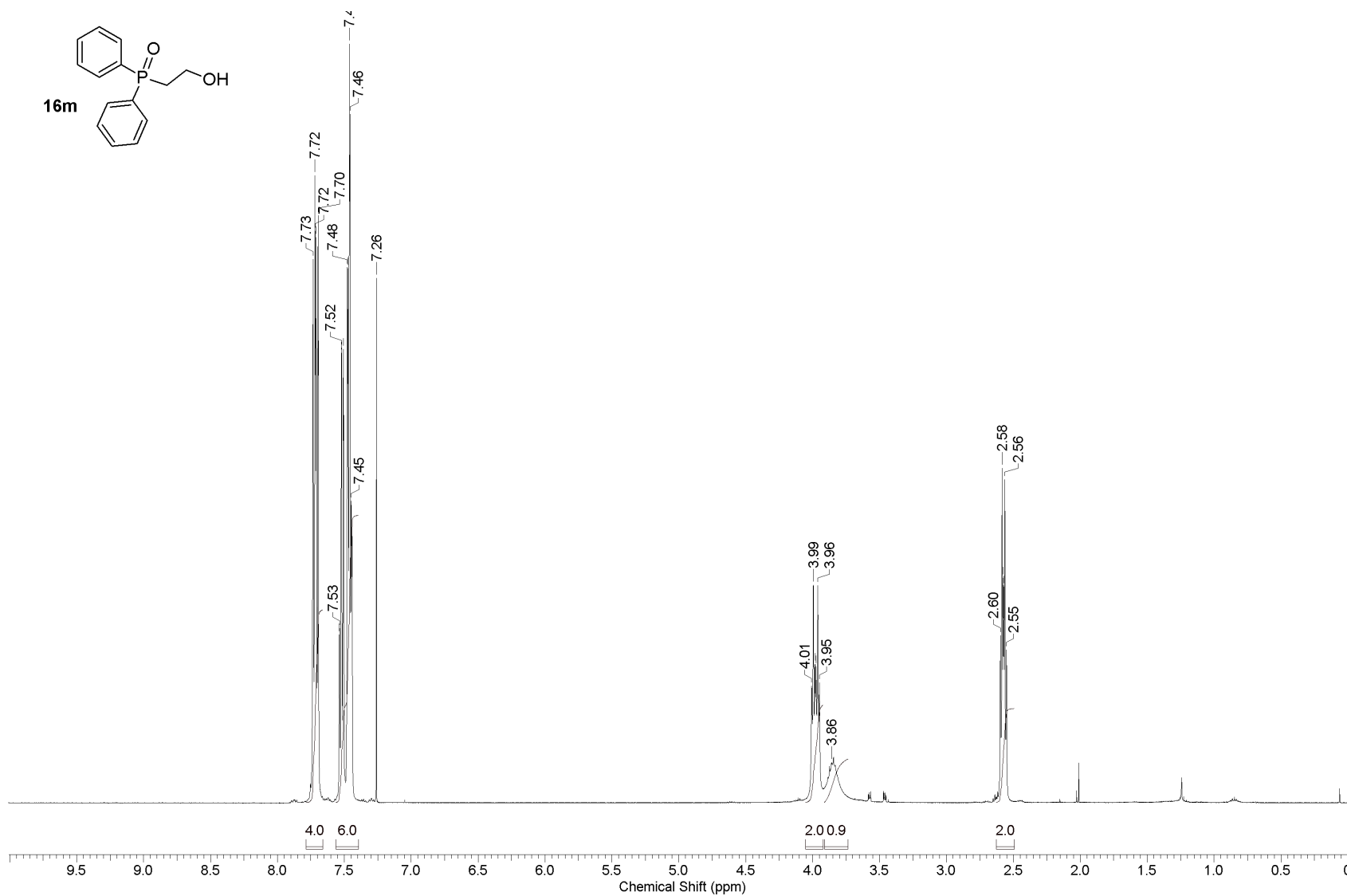
^1H NMR spectrum of (2-hydroxyethyl)(1-naphthyl)phenylphosphine oxide (**16b**) (500 MHz, CDCl_3)



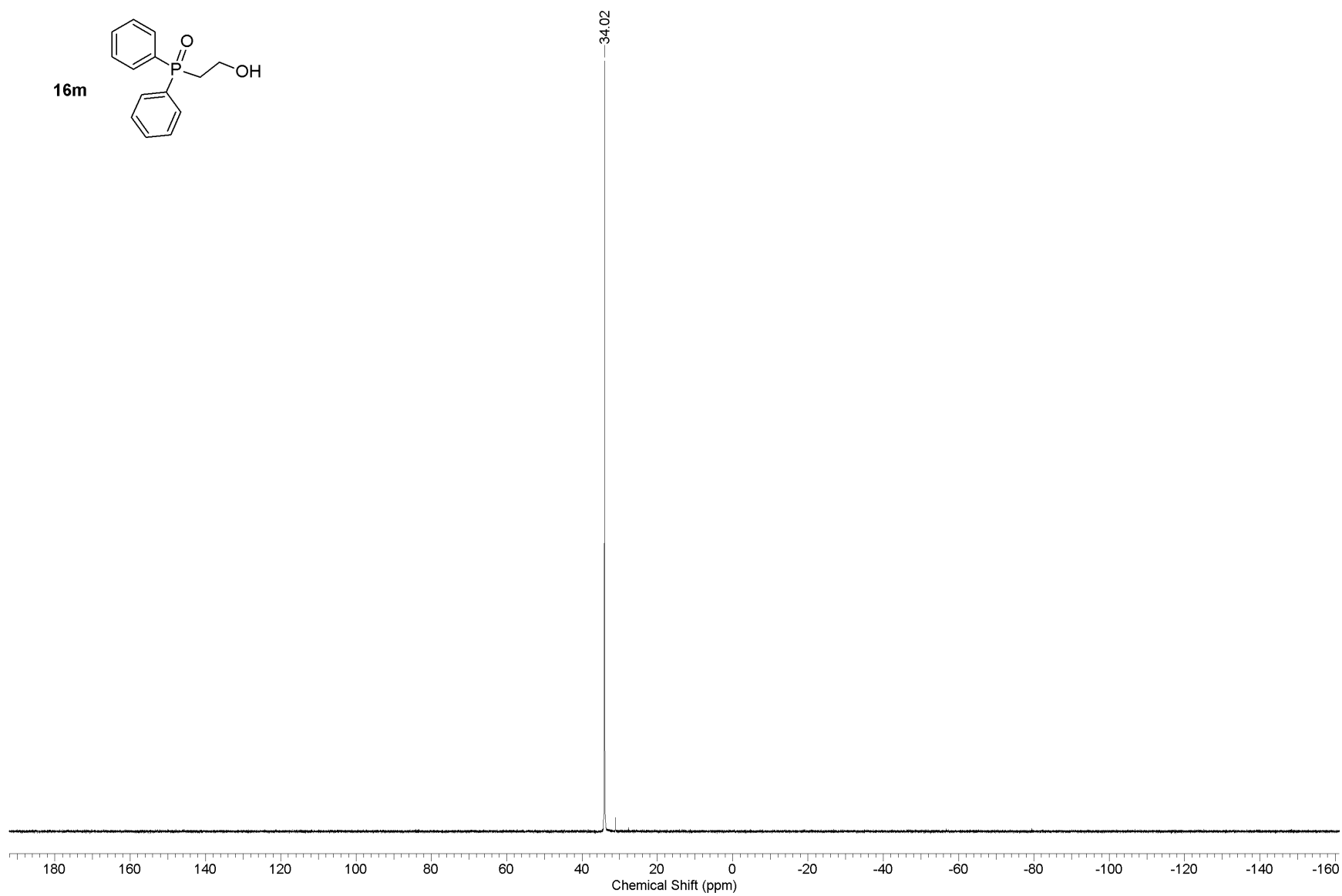
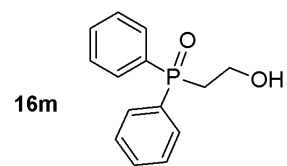
^{31}P NMR spectrum of (2-hydroxyethyl)(1-naphthyl)phenylphosphine oxide (**16b**) (202 MHz, CDCl_3)



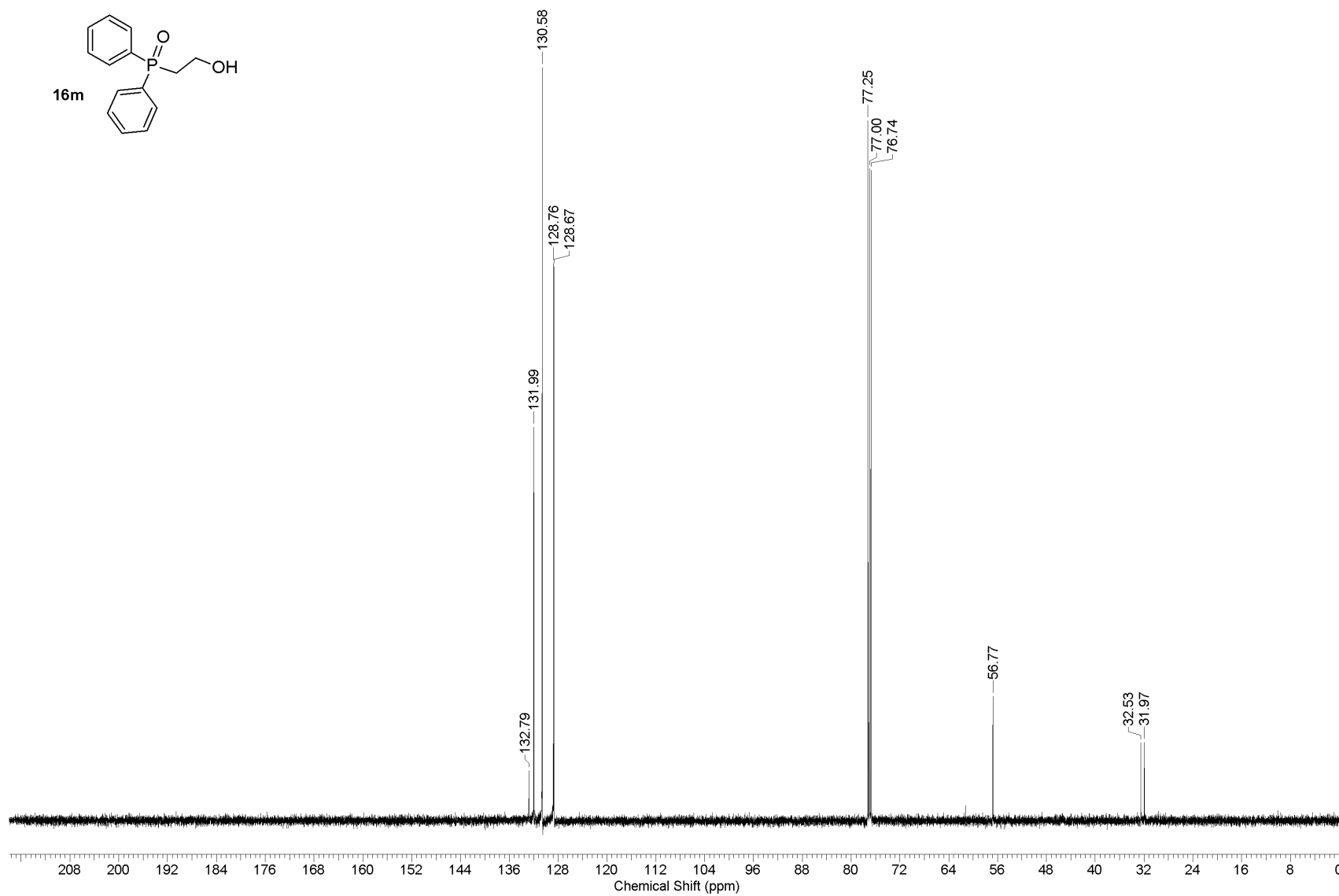
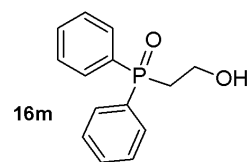
^{13}C NMR spectrum of (2-hydroxyethyl)(1-naphthyl)phenylphosphine oxide (**16b**) (125 MHz, CDCl_3)



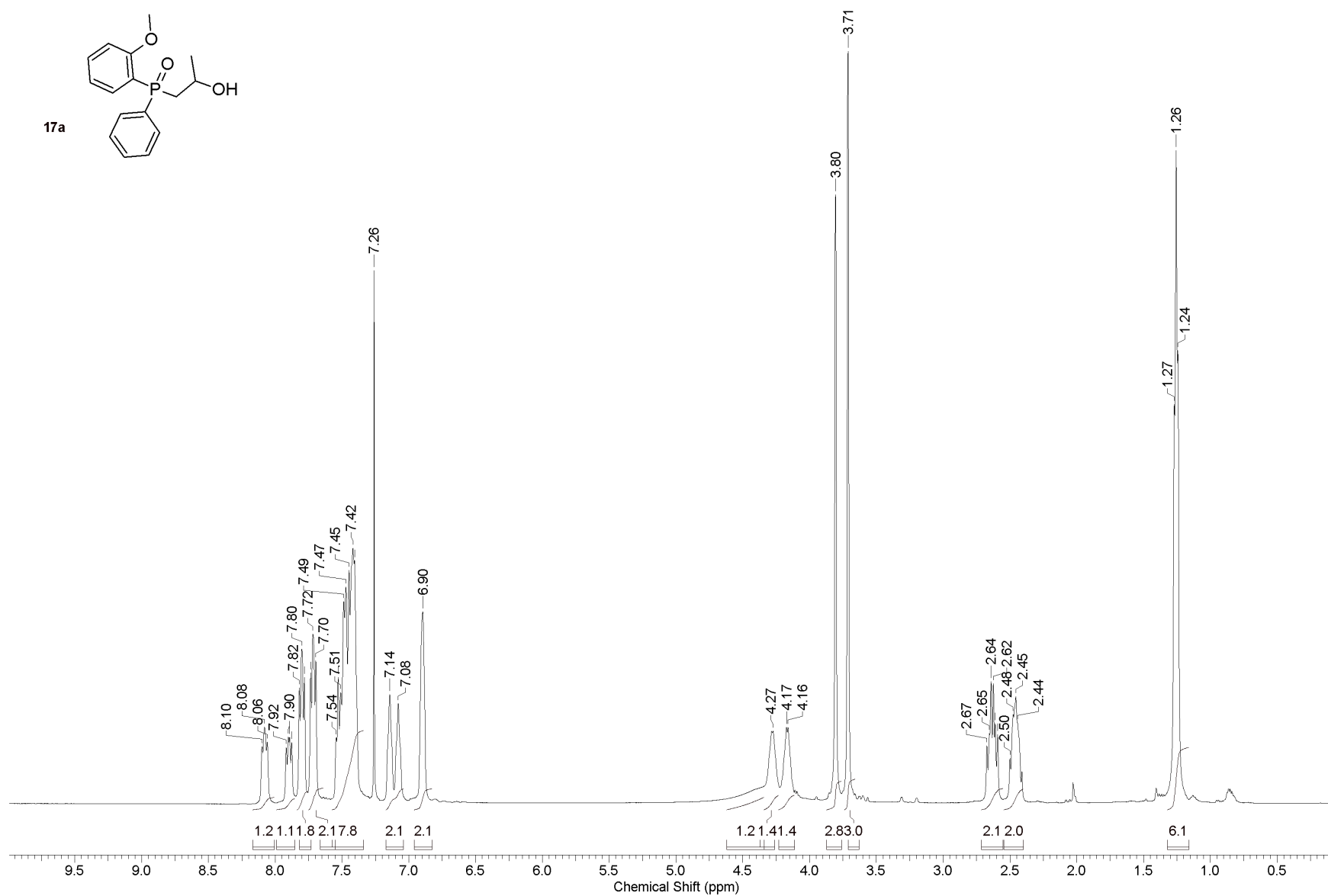
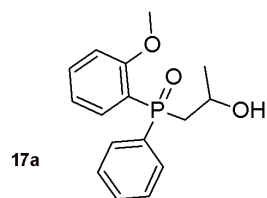
^1H NMR spectrum of (2-hydroxyethyl)diphenylphosphine oxide (**16m**) (500 MHz, CDCl_3)



^{31}P NMR spectrum of (2-hydroxyethyl)diphenylphosphine oxide (**16m**) (202 MHz, CDCl_3)

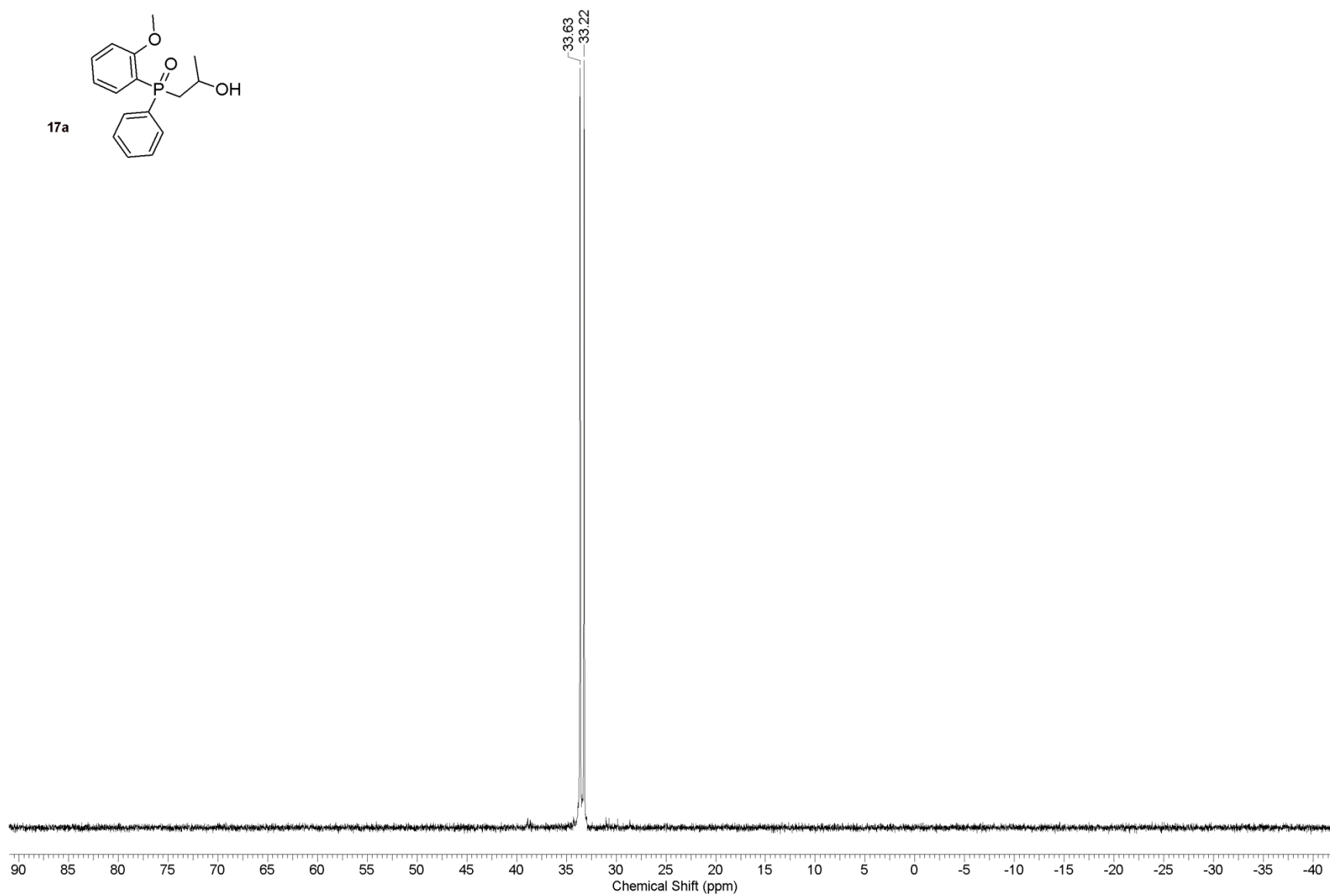
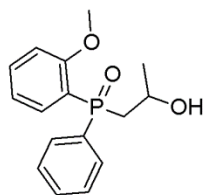


^{13}C NMR spectrum of (2-hydroxyethyl)diphenylphosphine oxide (**16m**) (125 MHz, CDCl_3)

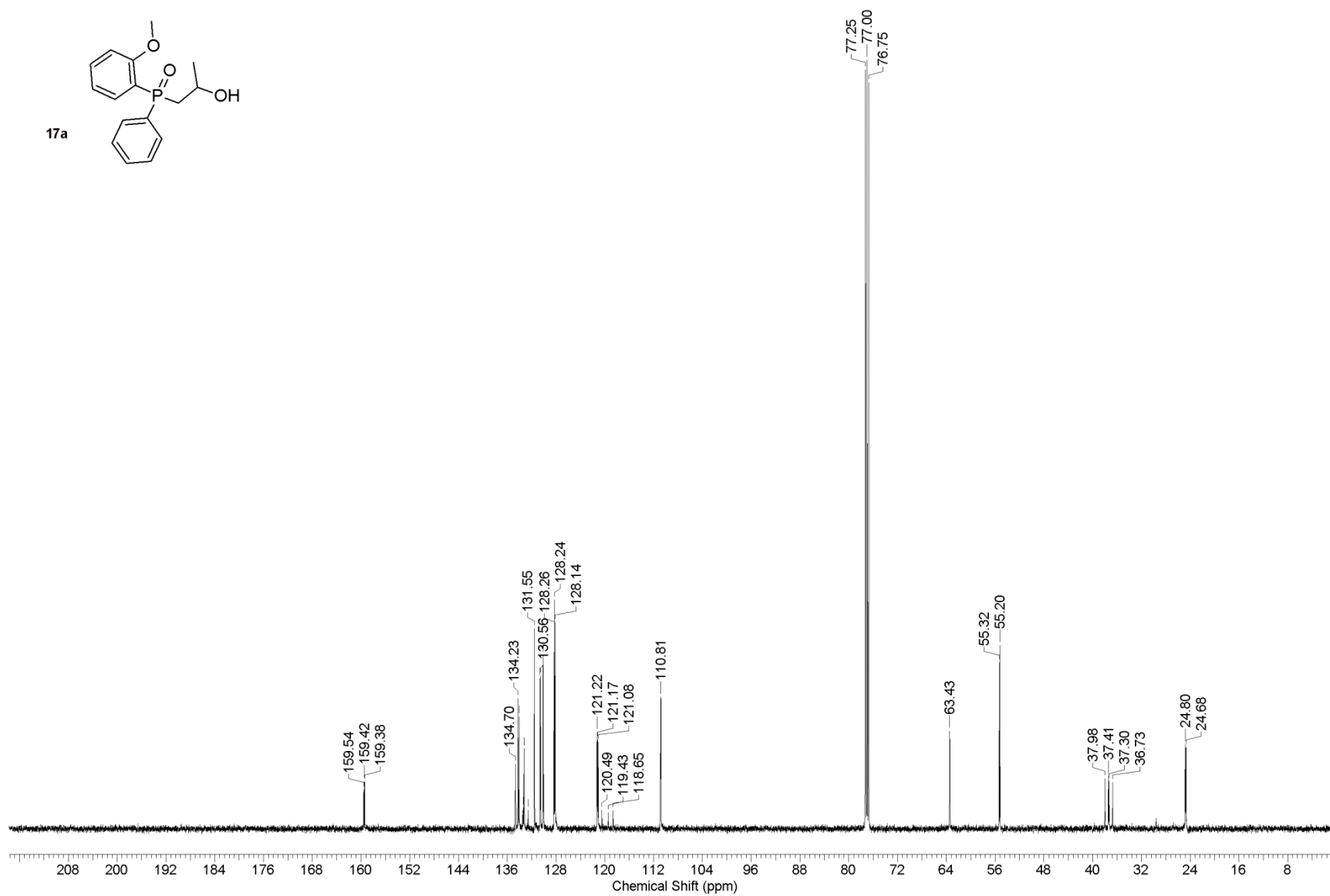
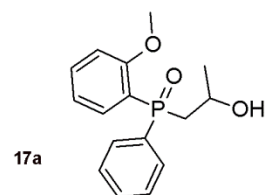


^1H NMR spectrum of *o*-anisyl(2-hydroxypropyl)phenylphosphine oxide (**17a**) (500 MHz, CDCl_3)

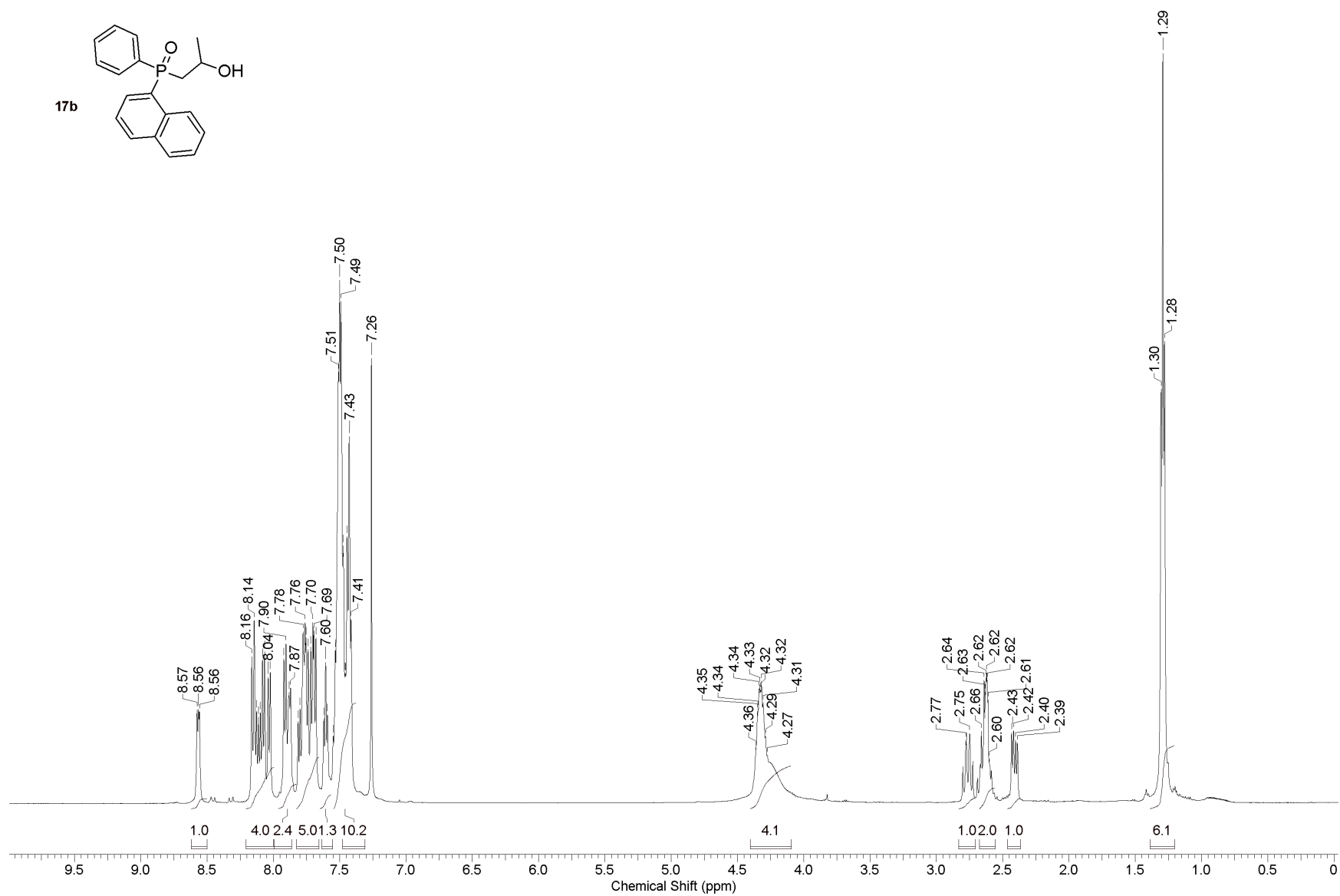
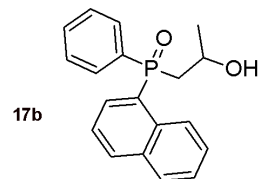
17a



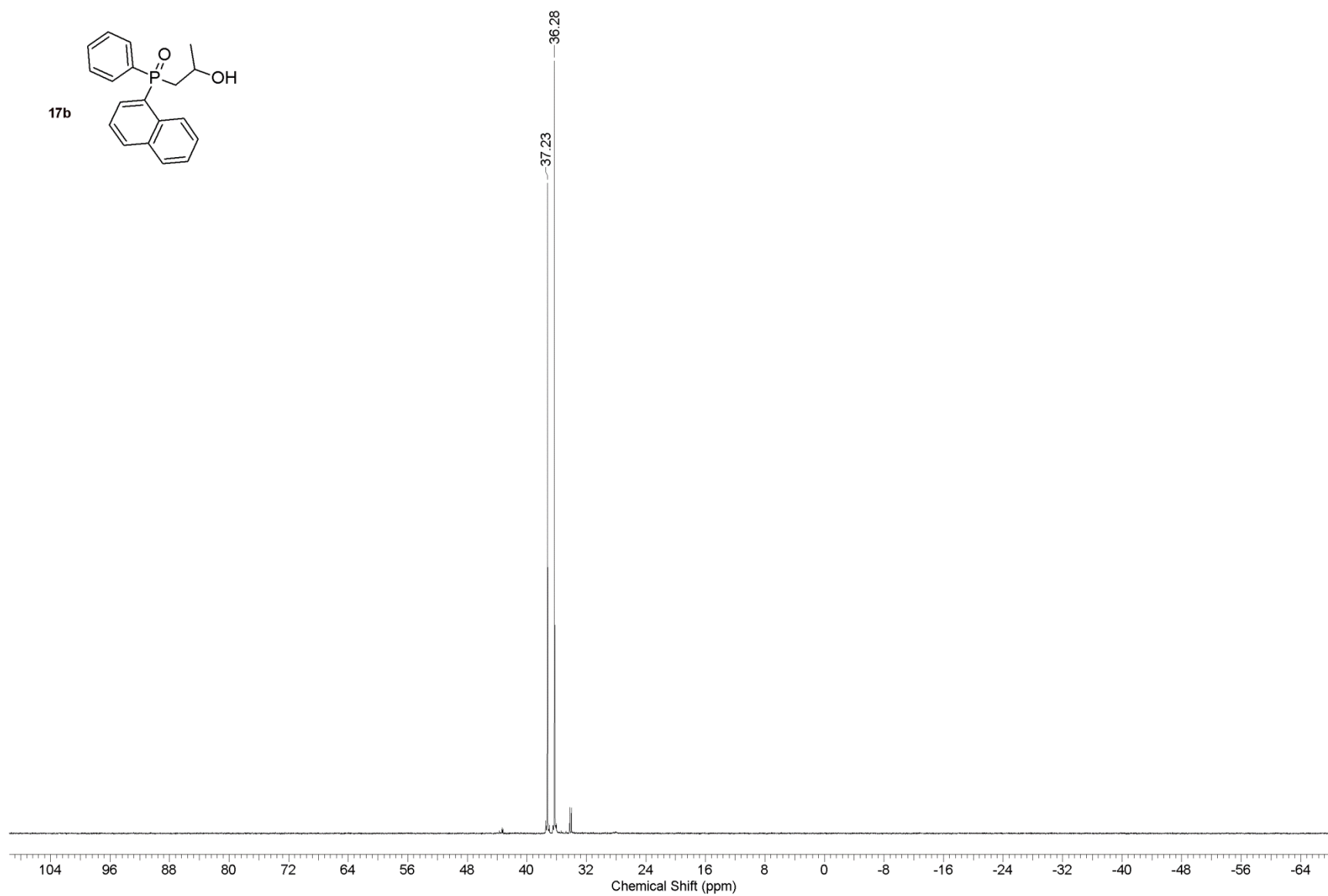
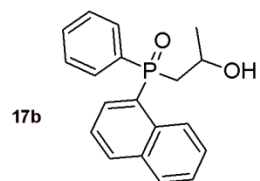
^{31}P NMR spectrum of *o*-anisyl(2-hydroxypropyl)phenylphosphine oxide (**17a**) (202 MHz, CDCl_3)



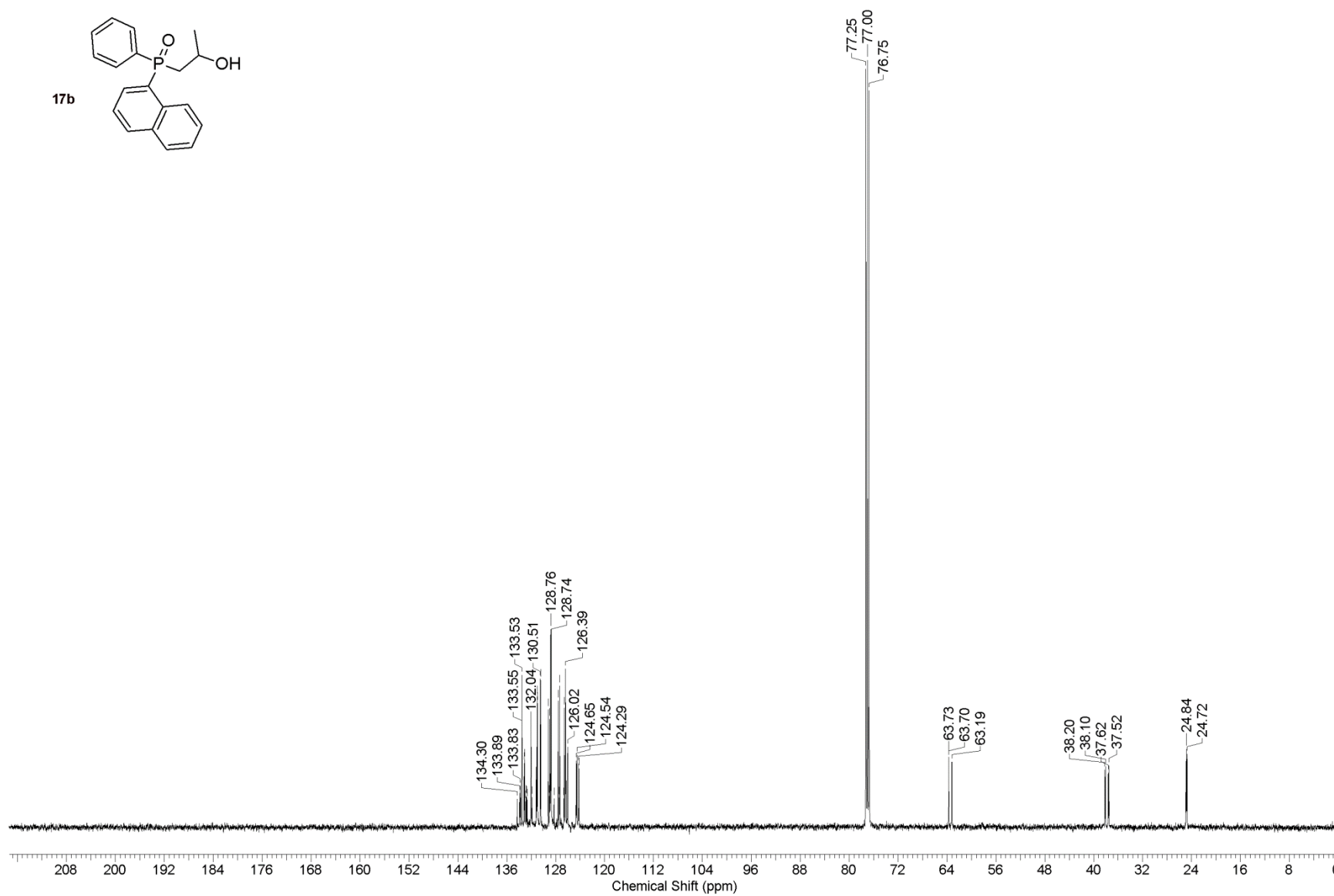
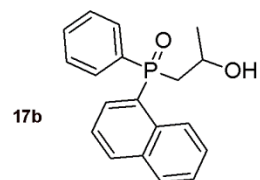
^{13}C NMR spectrum of *o*-anisyl(2-hydroxypropyl)phenylphosphine oxide (**17a**) (125 MHz, CDCl_3)



¹H NMR spectrum of (2-hydroxypropyl)(1-naphthyl)phenylphosphine oxide (**17b**) (500 MHz, CDCl₃)

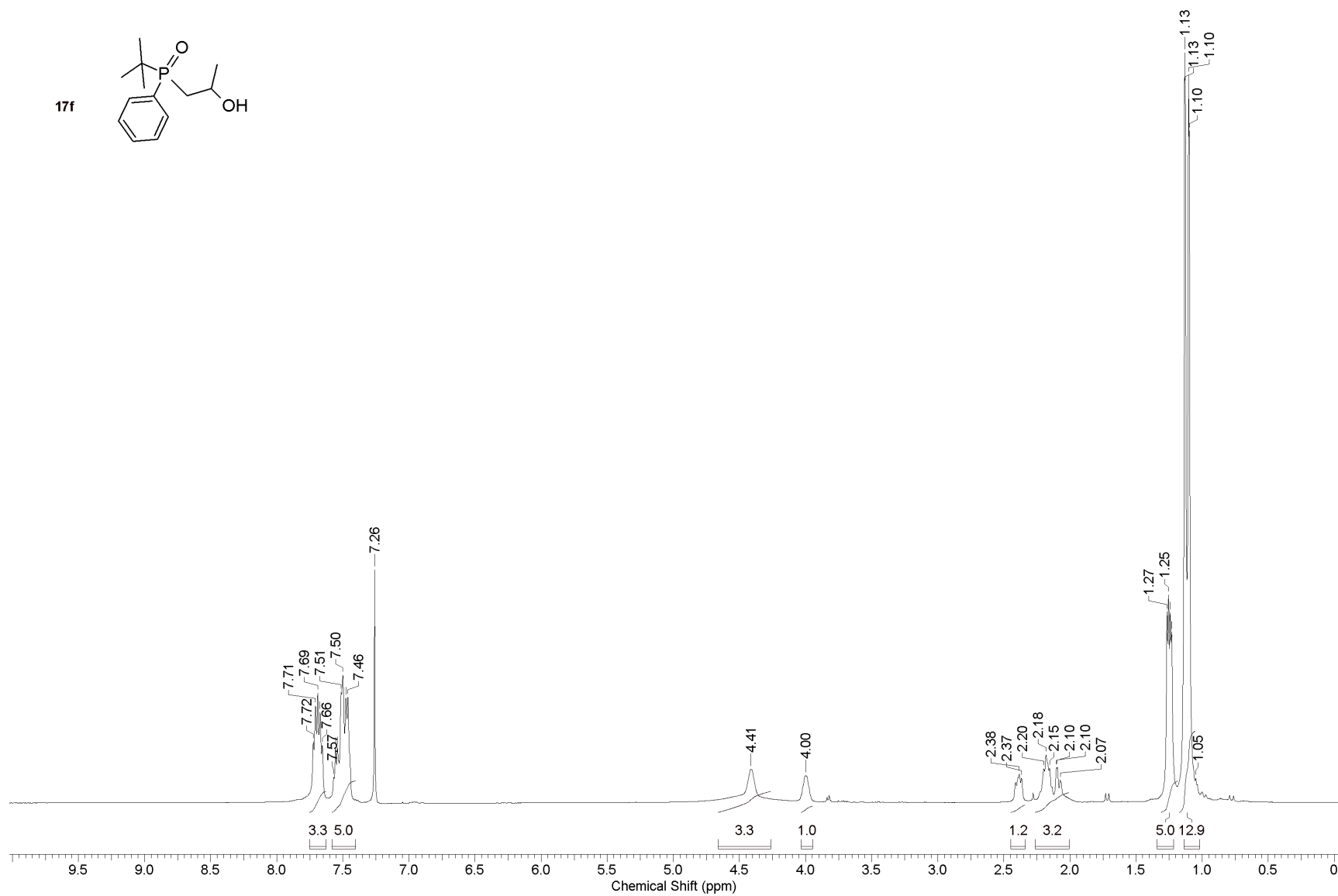
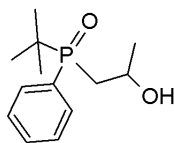


^{31}P NMR spectrum of (2-hydroxypropyl)(1-naphthyl)phenylphosphine oxide (**17b**) (202 MHz, CDCl_3)



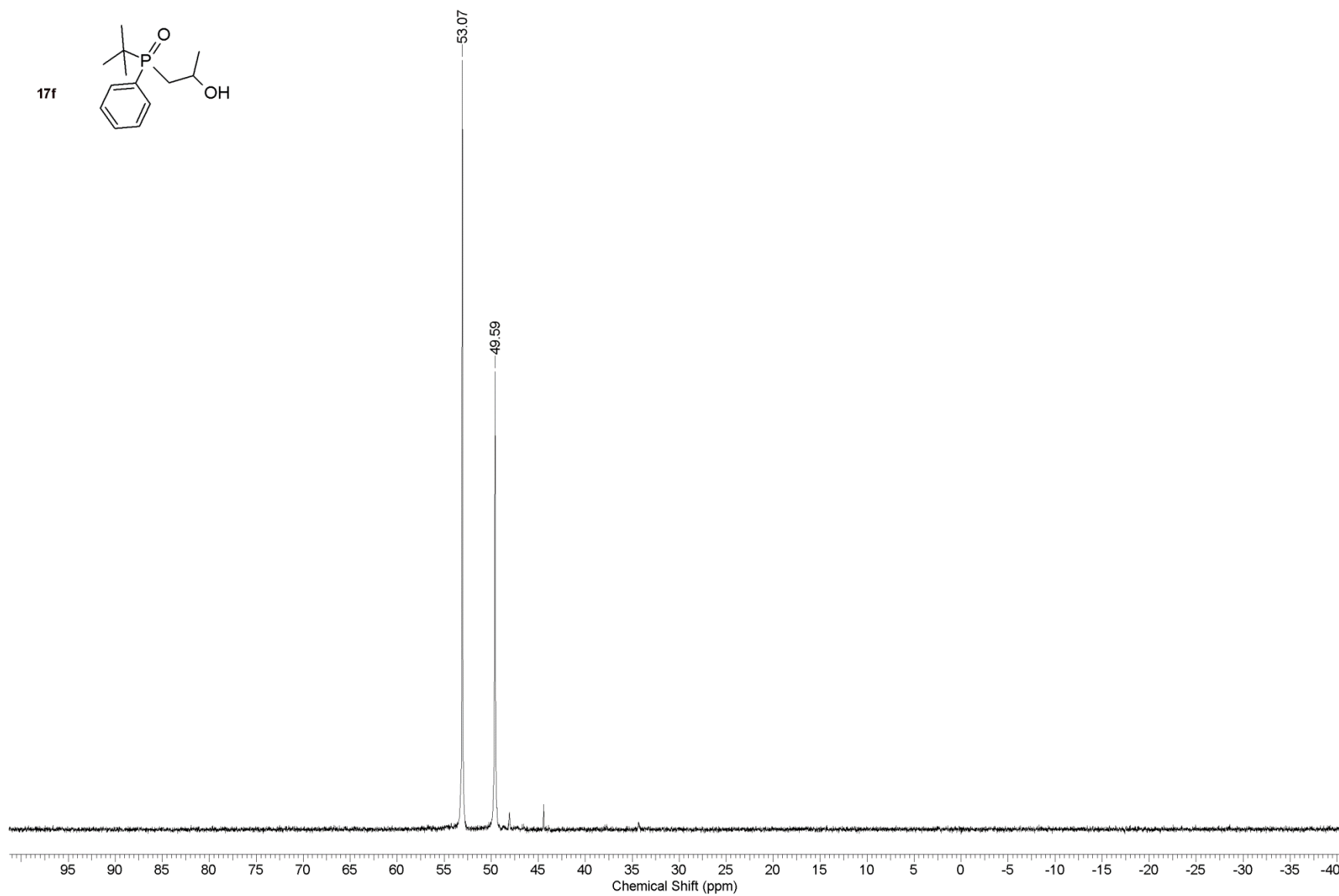
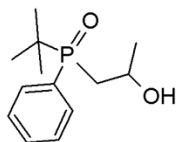
^{13}C NMR spectrum of (2-hydroxypropyl)(1-naphthyl)phenylphosphine oxide (**17b**) (125 MHz, CDCl_3)

17f



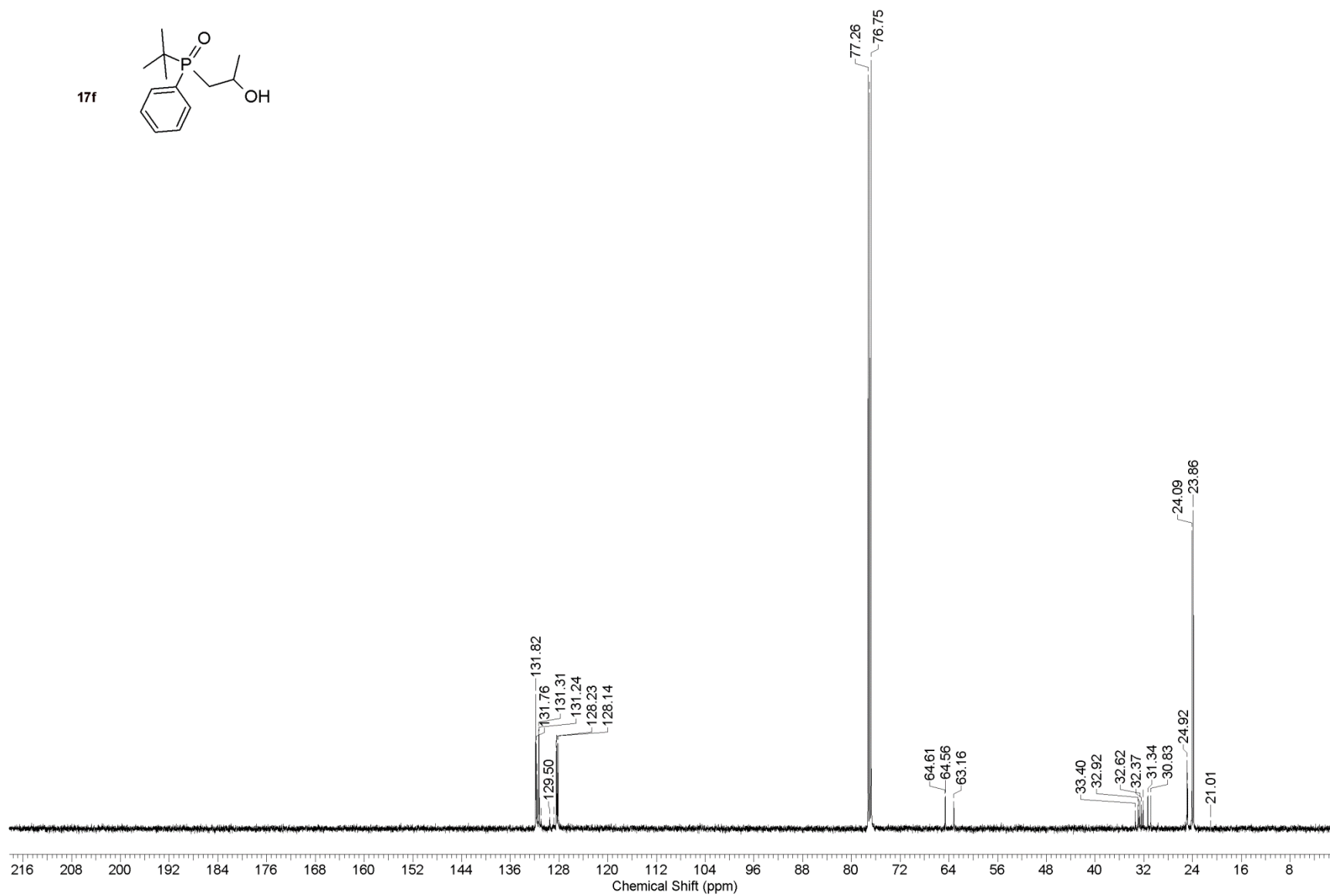
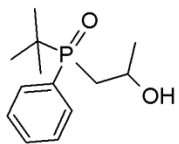
^1H NMR spectrum of *t*-butyl(2-hydroxypropyl)phenylphosphine oxide (**17f**) (500 MHz, CDCl_3)

17f

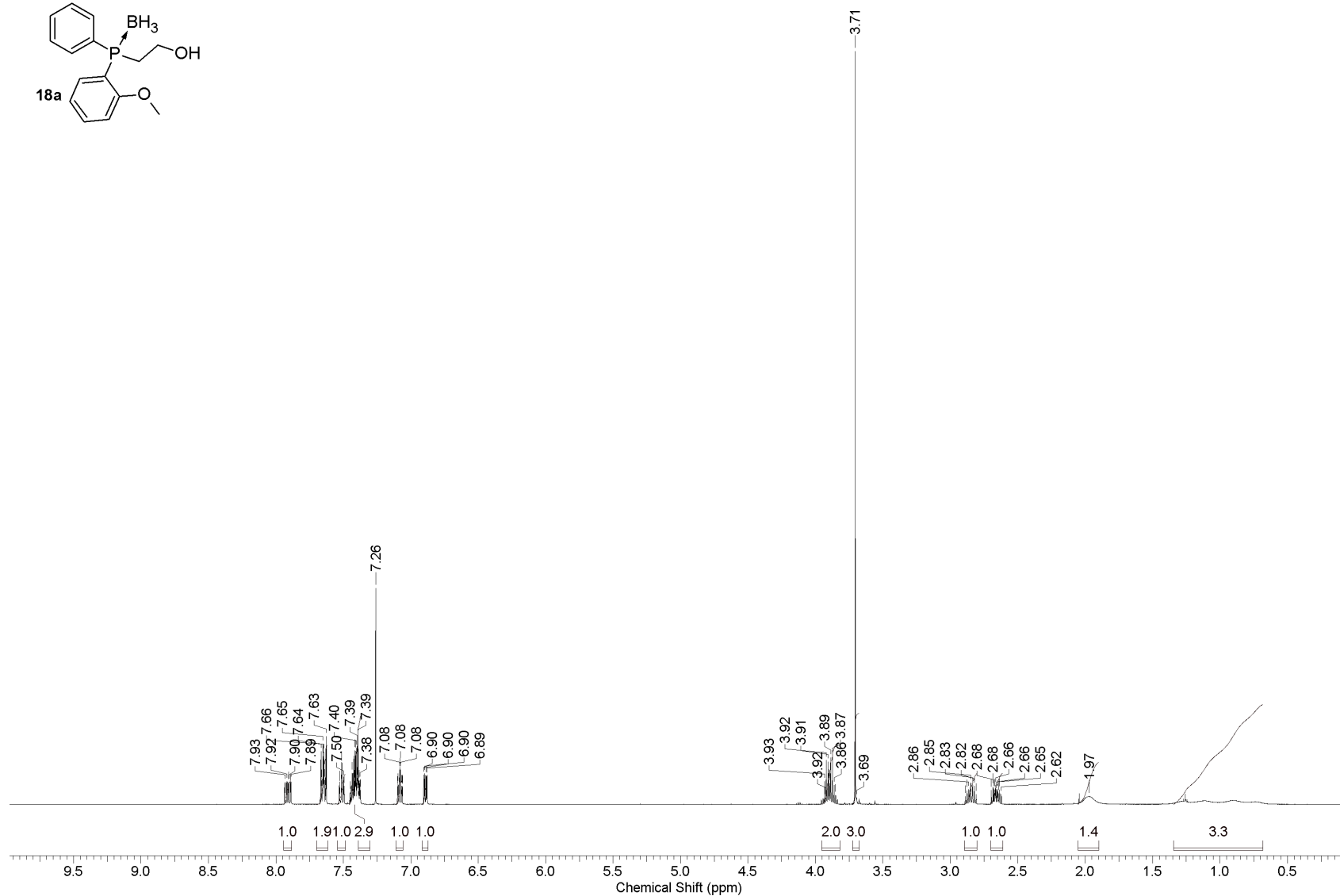
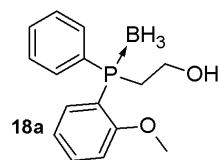


^{31}P NMR spectrum of *t*-butyl(2-hydroxypropyl)phenylphosphine oxide (**17f**) (202 MHz, CDCl_3)

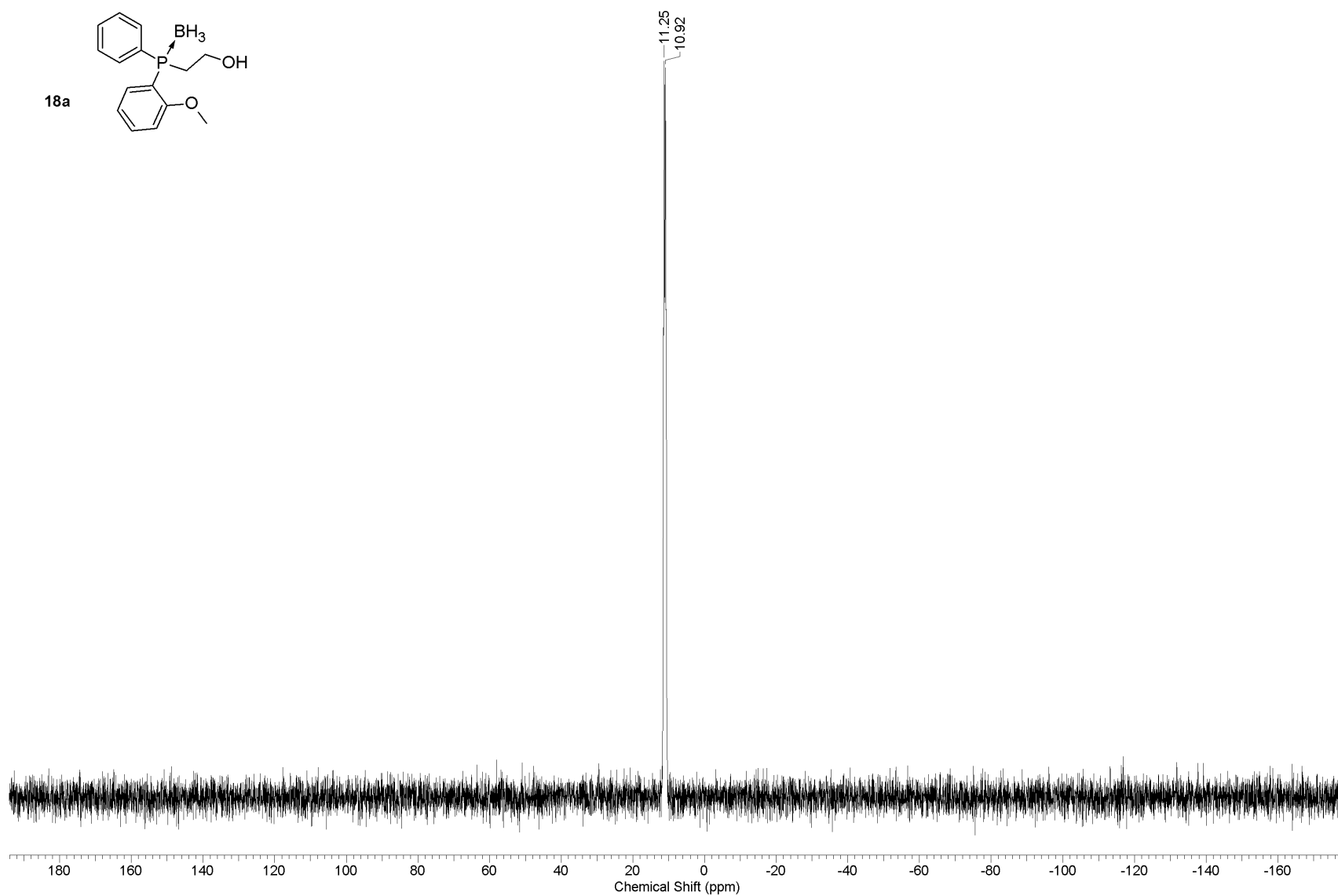
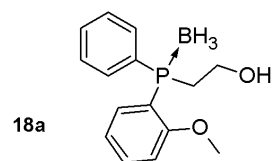
17f



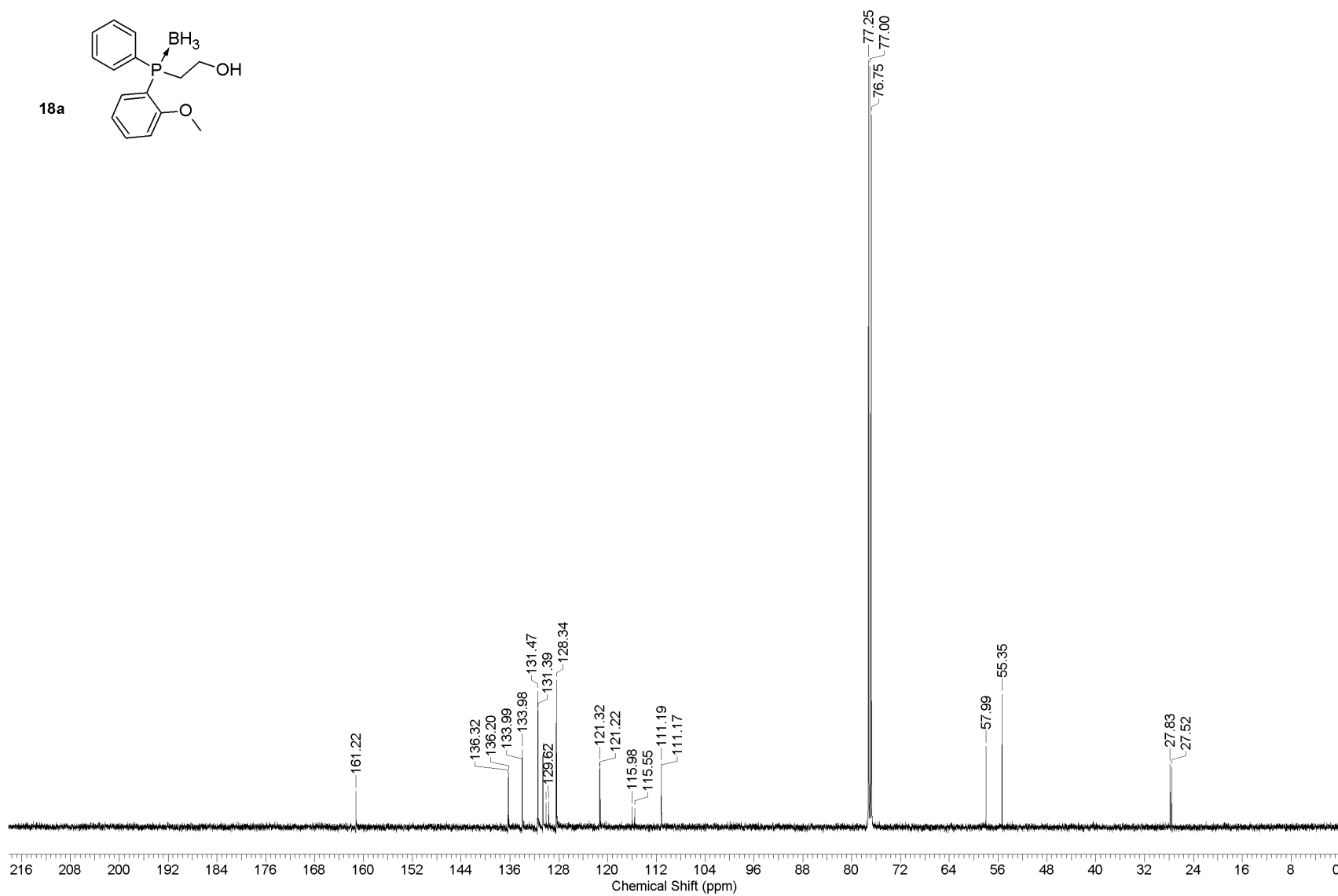
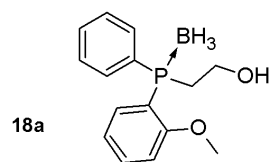
^{13}C NMR spectrum of *t*-butyl(2-hydroxypropyl)phenylphosphine oxide (**17f**) (125 MHz, CDCl_3)



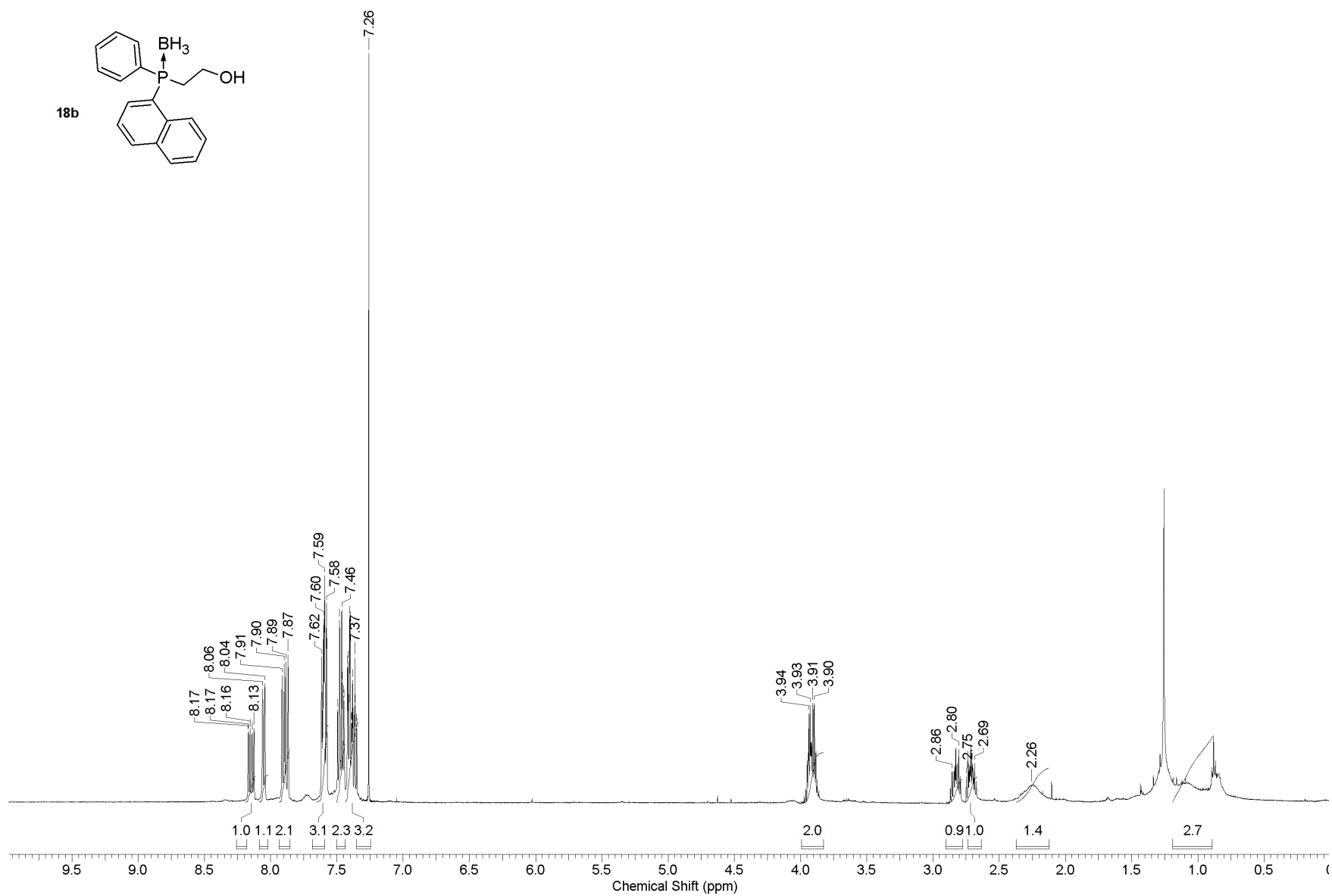
^1H NMR spectrum of *o*-anisyl(hydroxyethyl)phenylphosphine-borane (**18a**) (500 MHz, CDCl_3)



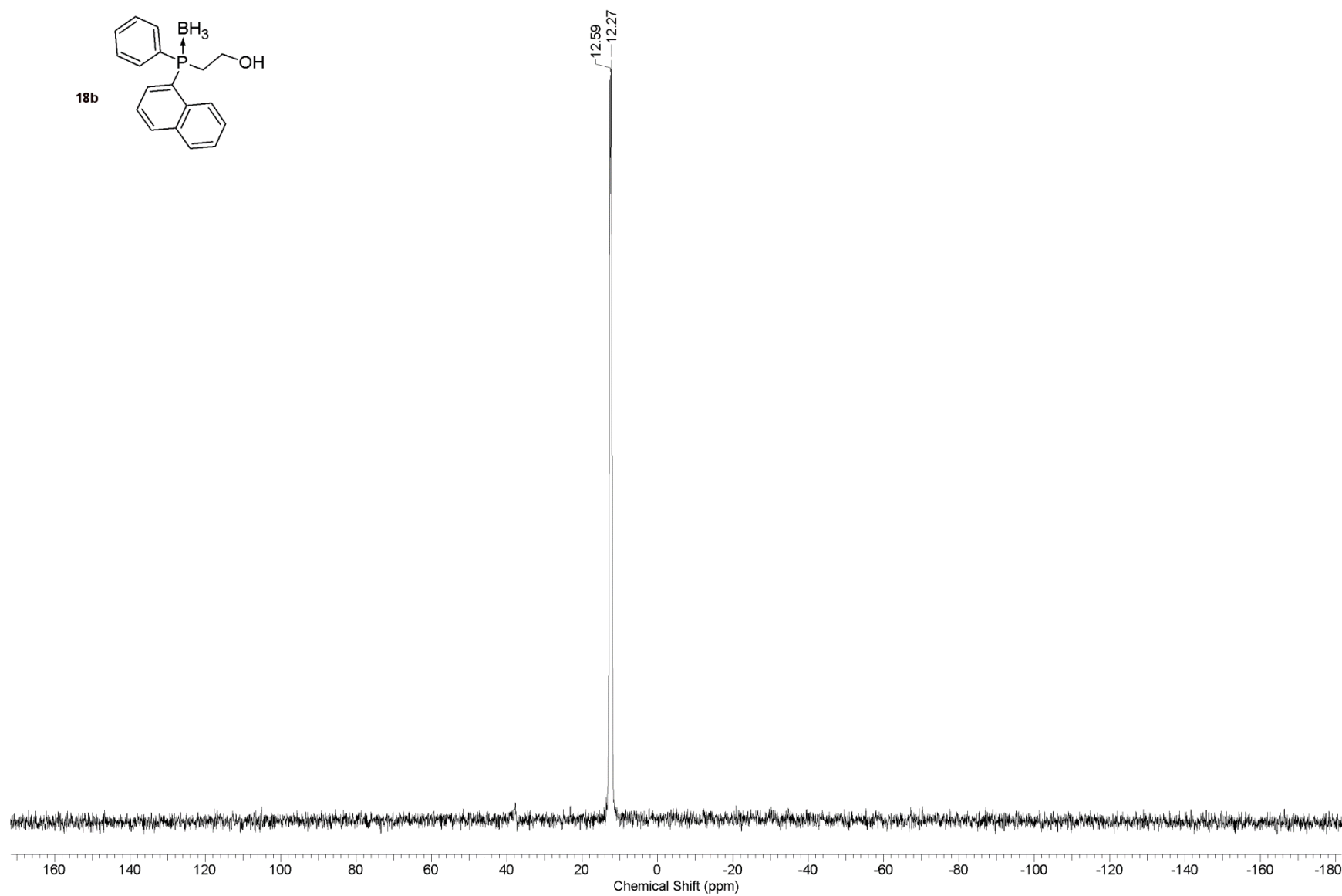
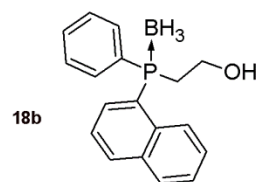
³¹P NMR spectrum of *o*-anisyl(hydroxyethyl)phenylphosphine-borane (**18a**) (202 MHz, CDCl₃)



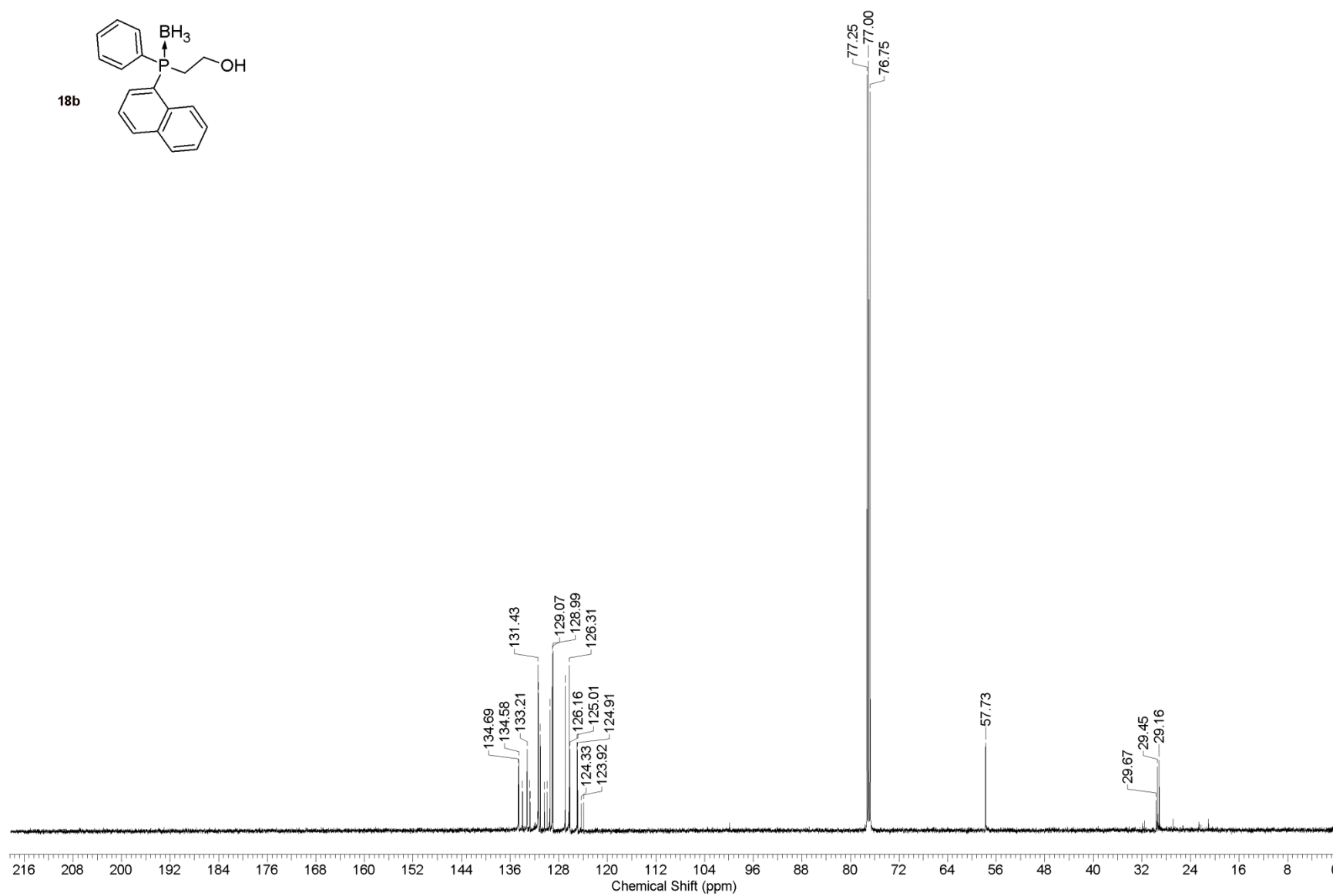
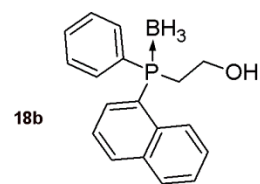
^{13}C NMR spectrum of *o*-anisyl(hydroxyethyl)phenylphosphine-borane (**18a**) (125 MHz, CDCl_3)



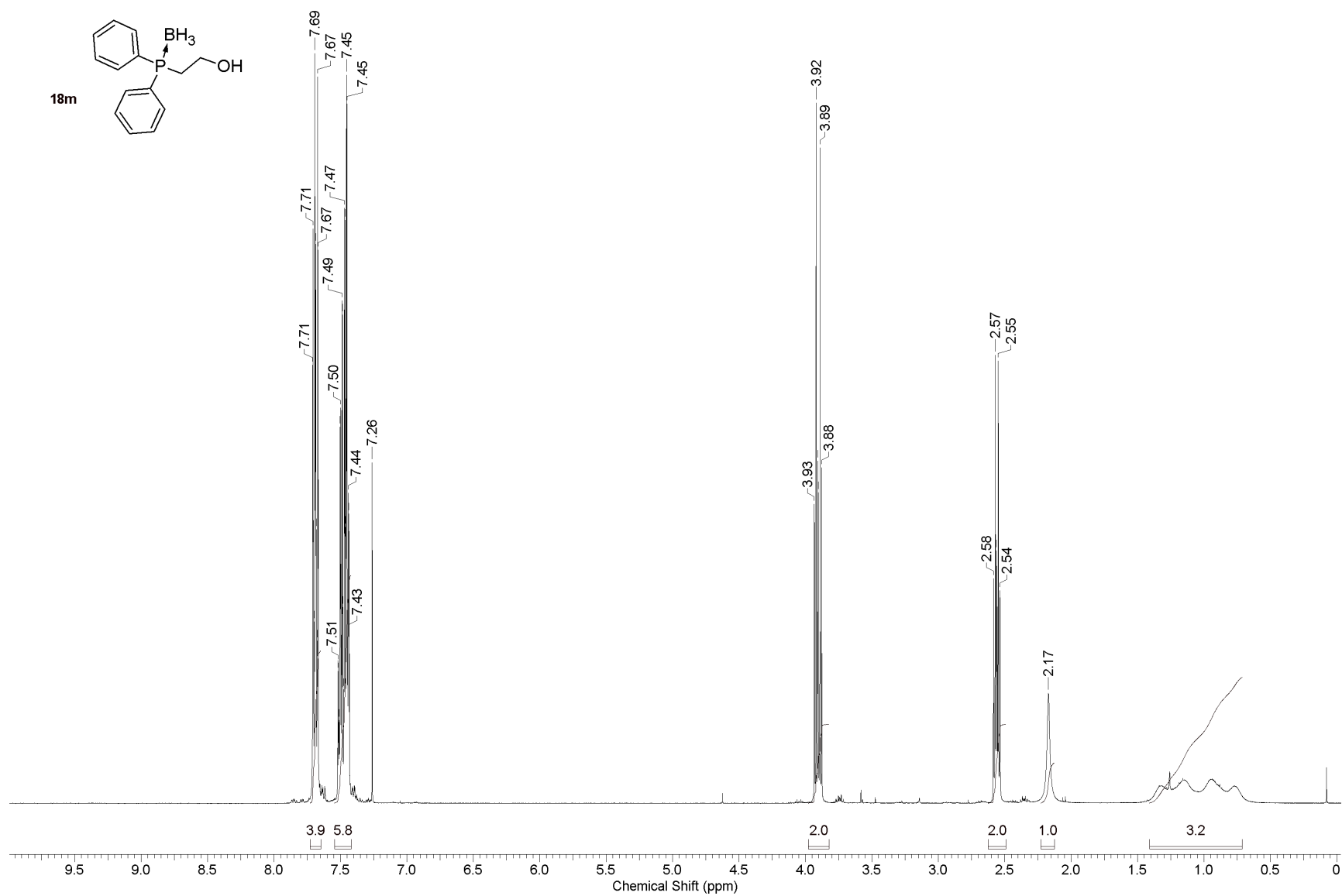
^1H NMR spectrum of (2-hydroxyethyl)(1-naphthyl)phenylphosphine-borane (**18b**) (500 MHz, CDCl_3)



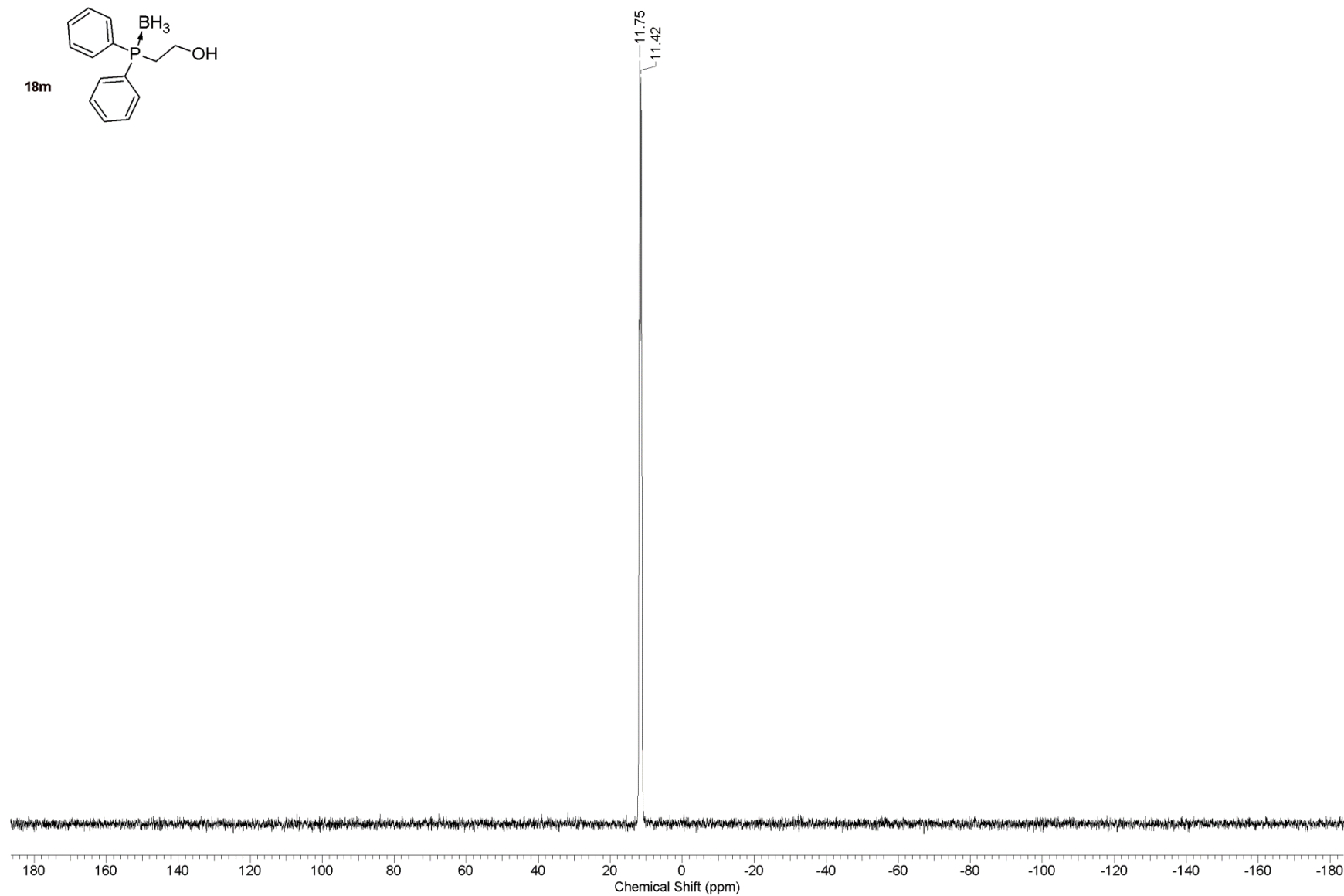
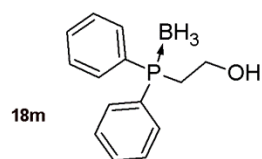
^{31}P NMR spectrum of (2-hydroxyethyl)(1-naphthyl)phenylphosphine-borane (**18b**) (202 MHz, CDCl_3)



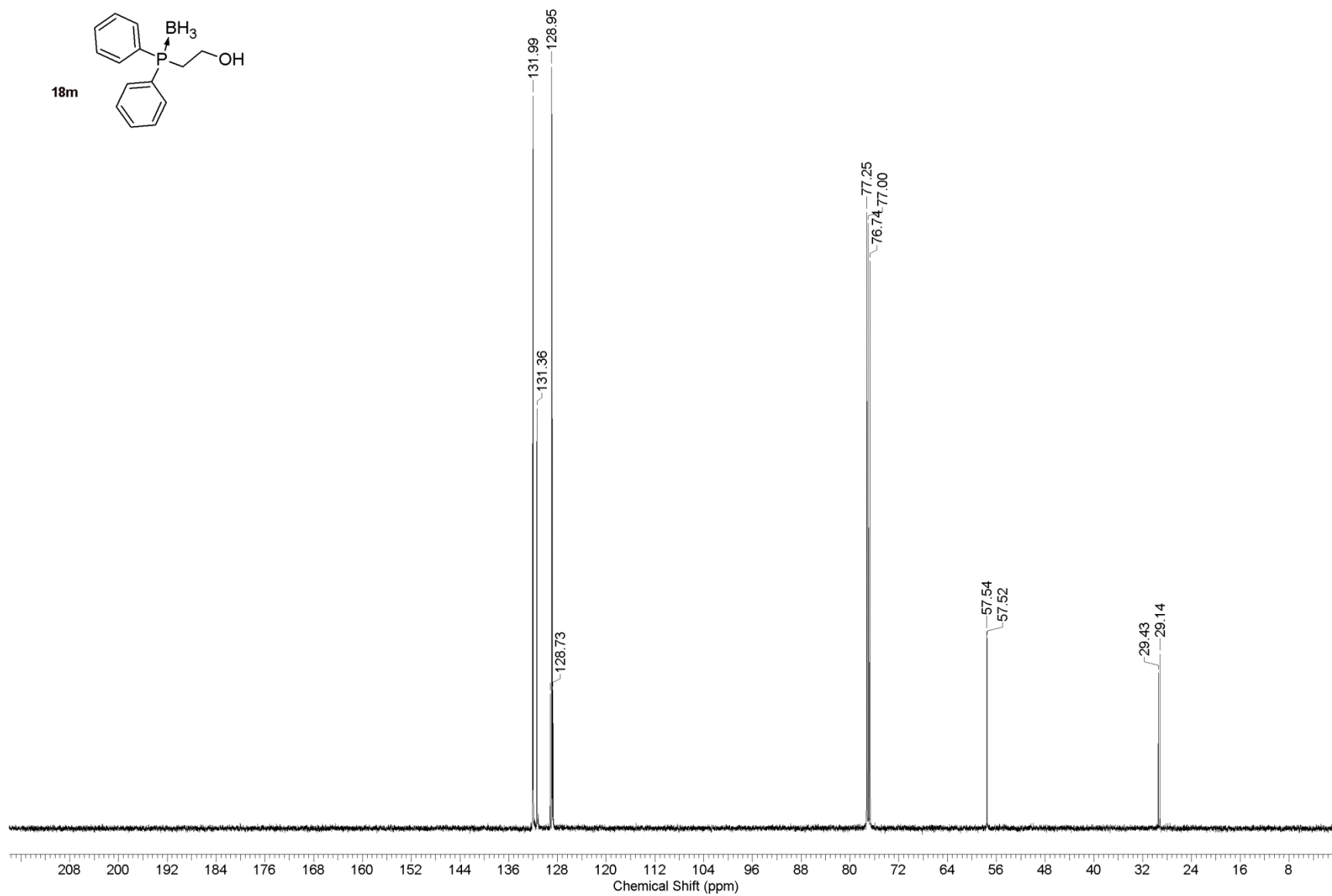
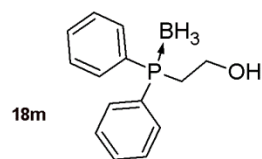
^{13}C NMR spectrum of (2-hydroxyethyl)(1-naphthyl)phenylphosphine-borane (**18b**) (125 MHz, CDCl_3)



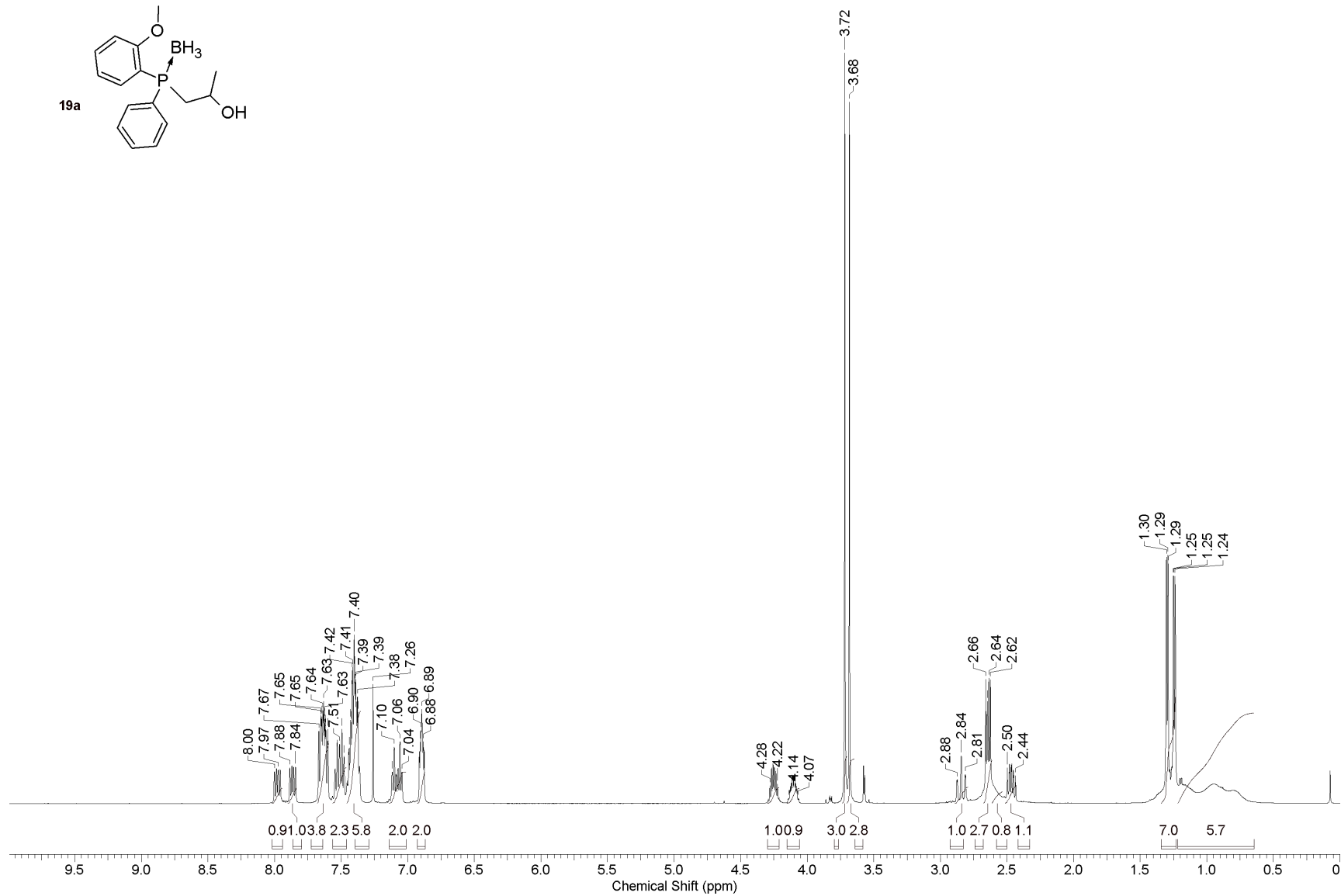
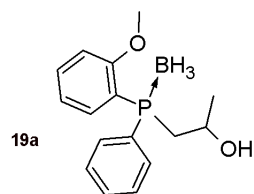
^1H NMR spectrum of (2-hydroxyethyl)diphenylphosphine-borane (**18m**) (500 MHz, CDCl_3)



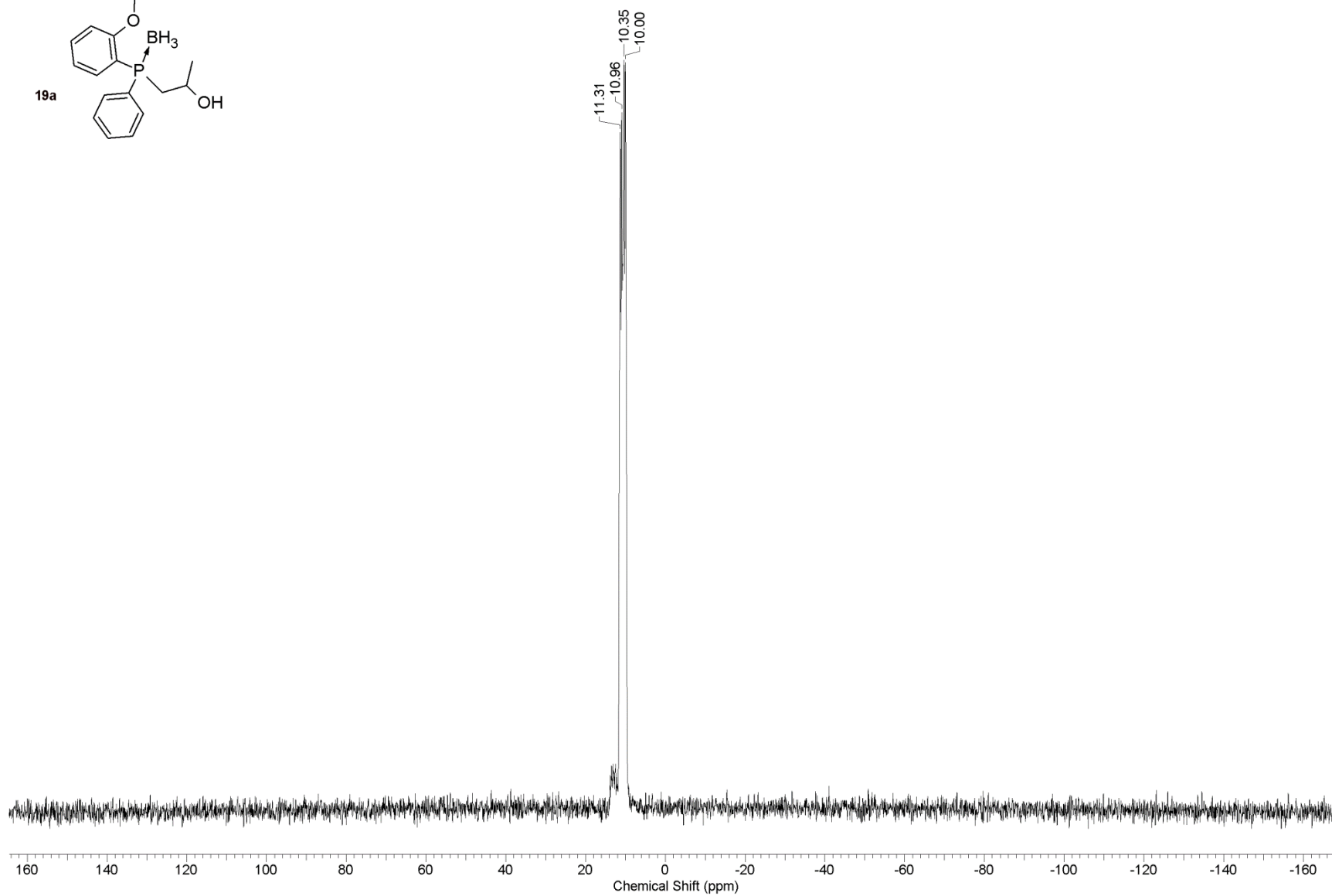
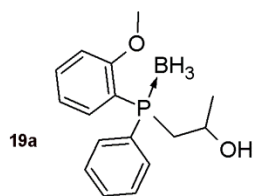
^{31}P NMR spectrum of (2-hydroxyethyl)diphenylphosphine-borane (**18m**) (202 MHz, CDCl_3)



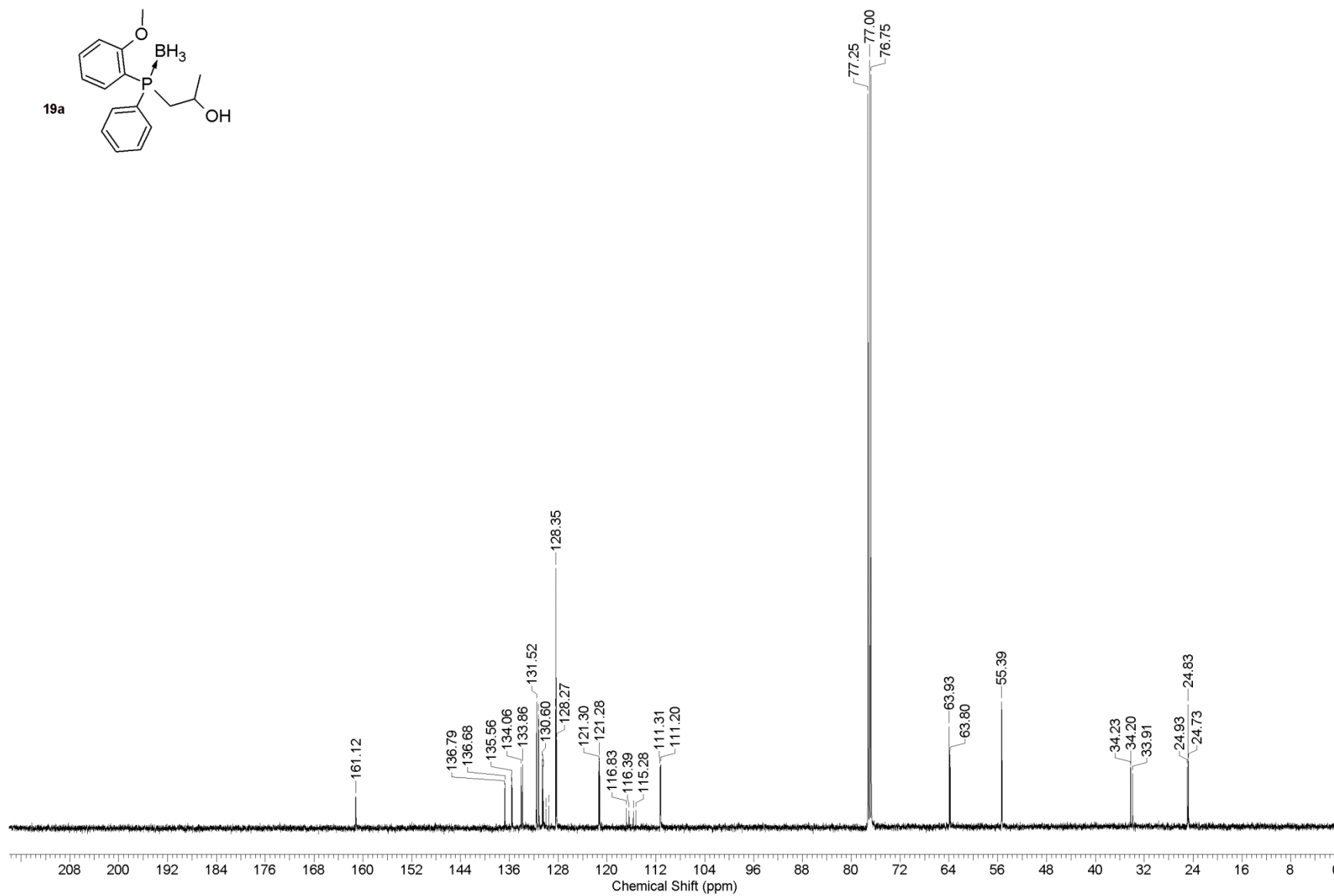
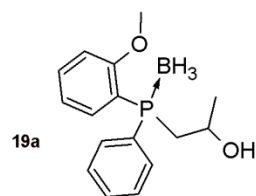
^{13}C NMR spectrum of (2-hydroxyethyl)diphenylphosphine-borane (**18m**) (125 MHz, CDCl_3)



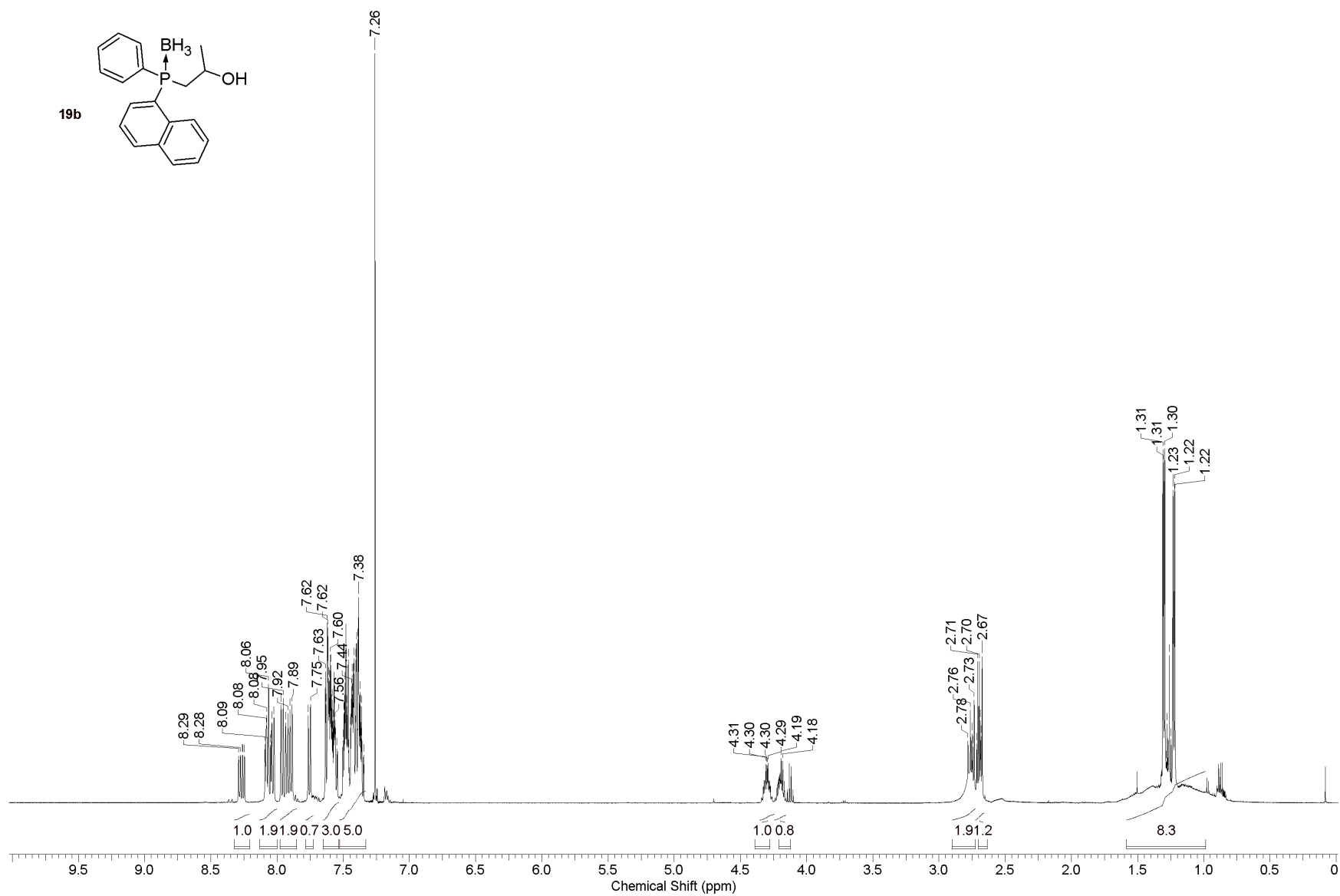
^1H NMR spectrum of *o*-anisyl(2-hydroxypropyl)phenylphosphine-borane (**19a**) (500 MHz, CDCl_3)



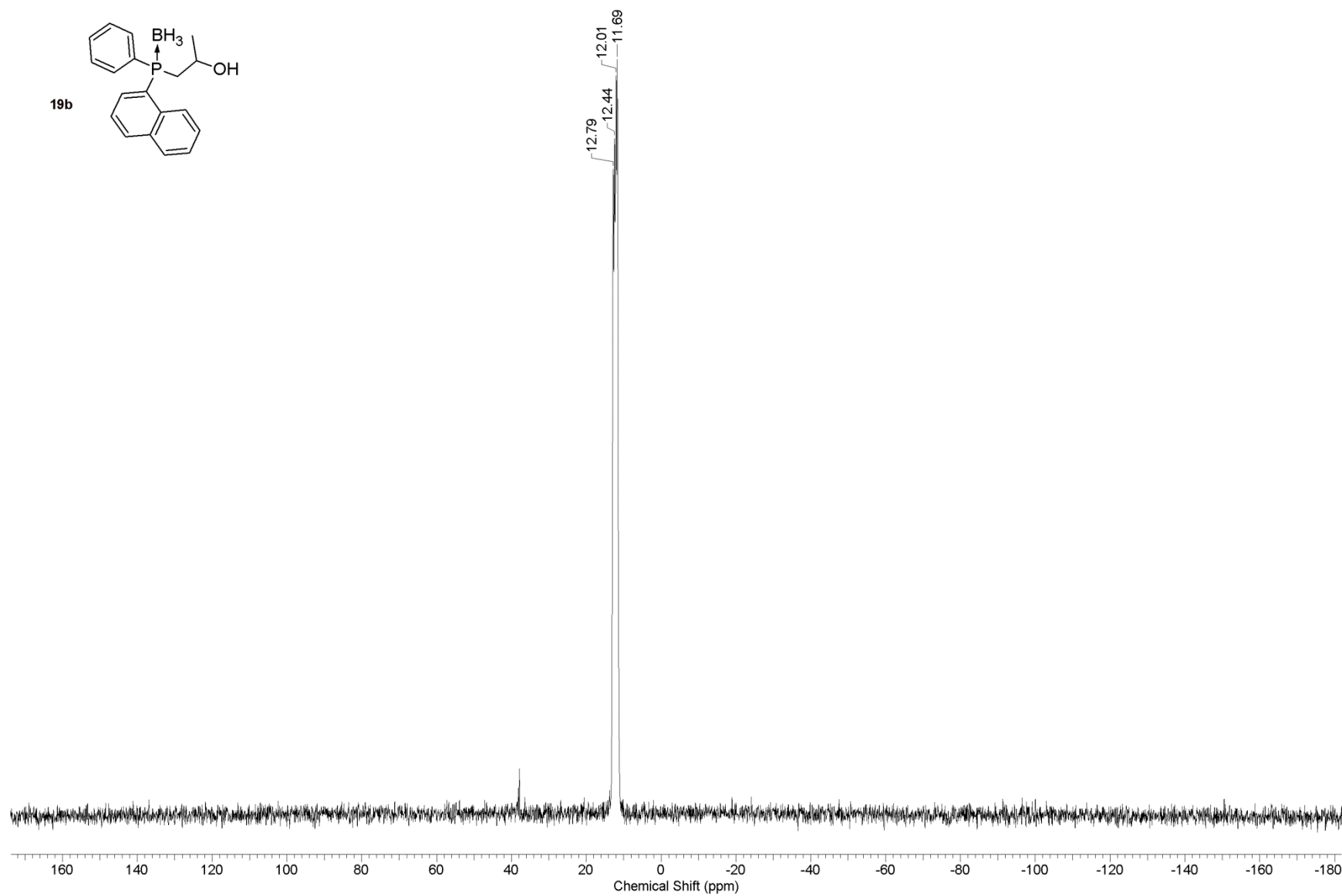
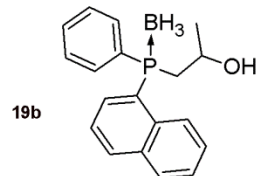
³¹P NMR spectrum of *o*-anisyl(2-hydroxypropyl)phenylphosphine-borane (**19a**) (202 MHz, CDCl₃)



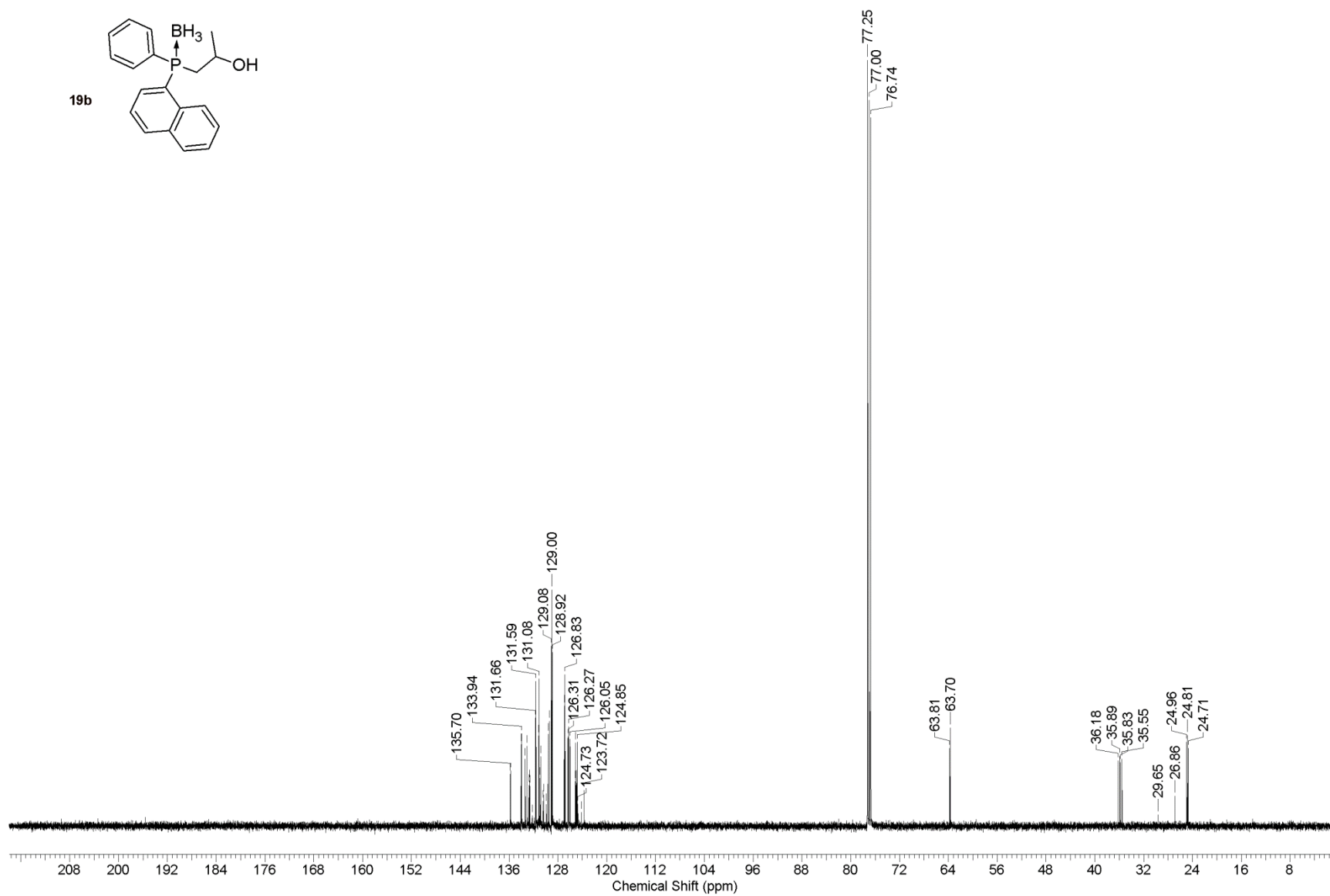
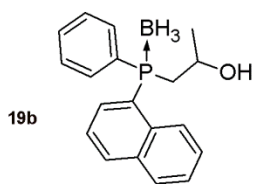
^{13}C NMR spectrum of *o*-anisyl(2-hydroxypropyl)phenylphosphine-borane (**19a**) (125 MHz, CDCl_3)



^1H NMR spectrum of (2-hydroxypropyl)(1-naphthyl)phenylphosphine-borane (**19b**) (500 MHz, CDCl_3)

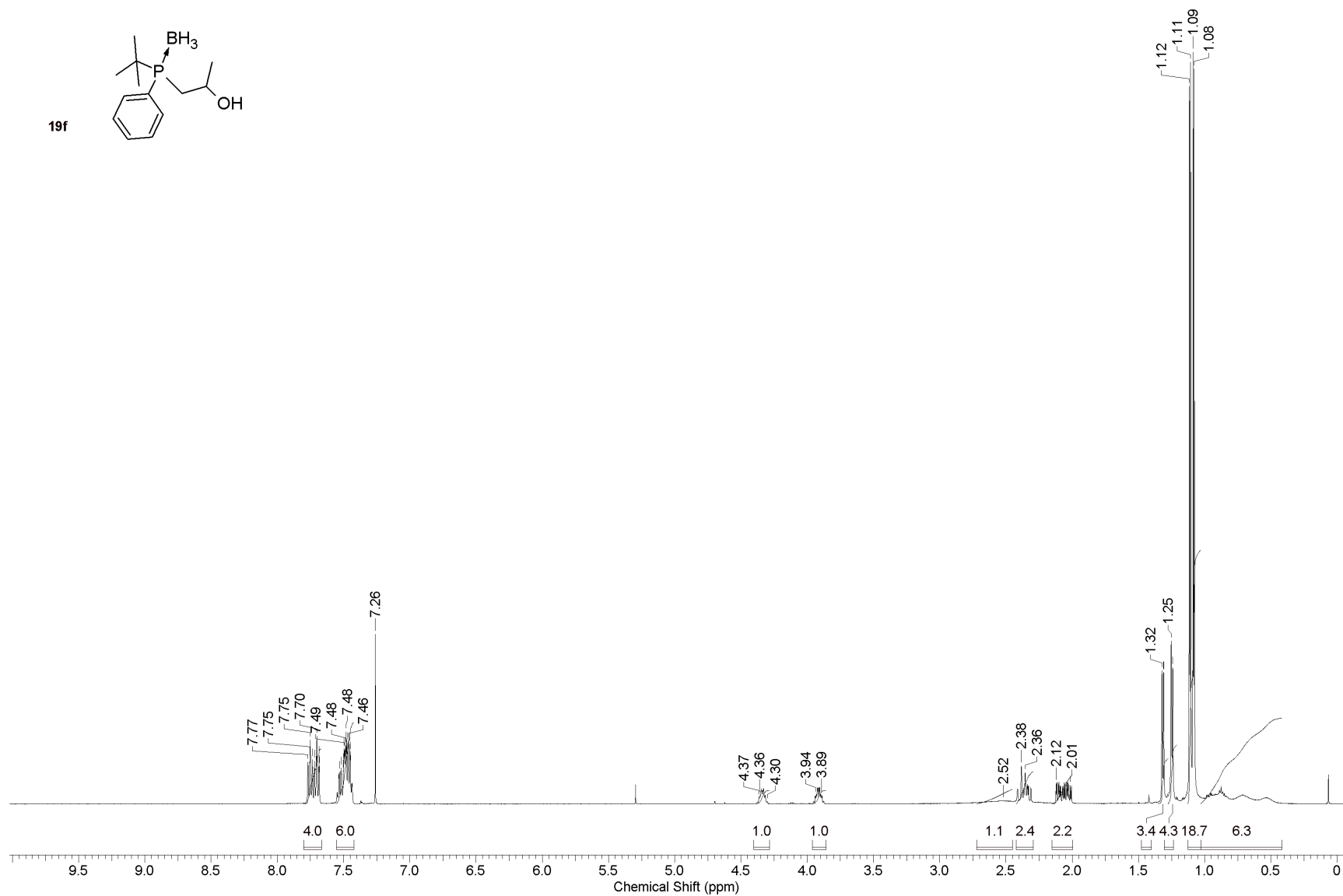
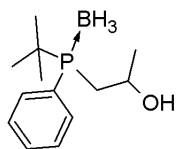


³¹P NMR spectrum of (2-hydroxypropyl)(1-naphthyl)phenylphosphine-borane (**19b**) (202 MHz, CDCl₃)

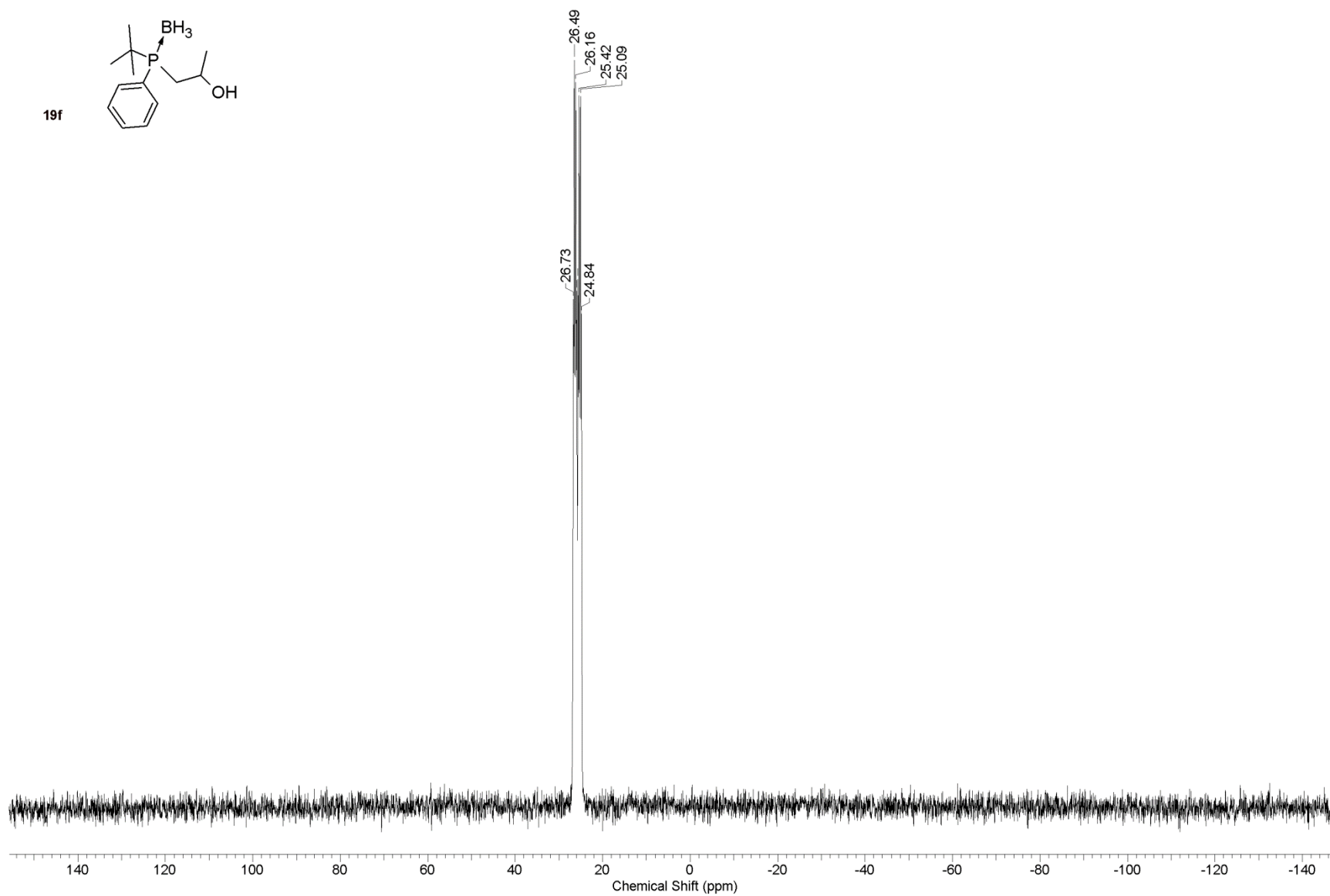
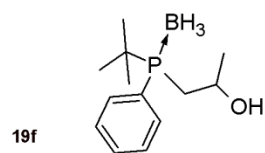


^{13}C NMR spectrum of (2-hydroxypropyl)(1-naphthyl)phenylphosphine-borane (**19b**) (125 MHz, CDCl_3)

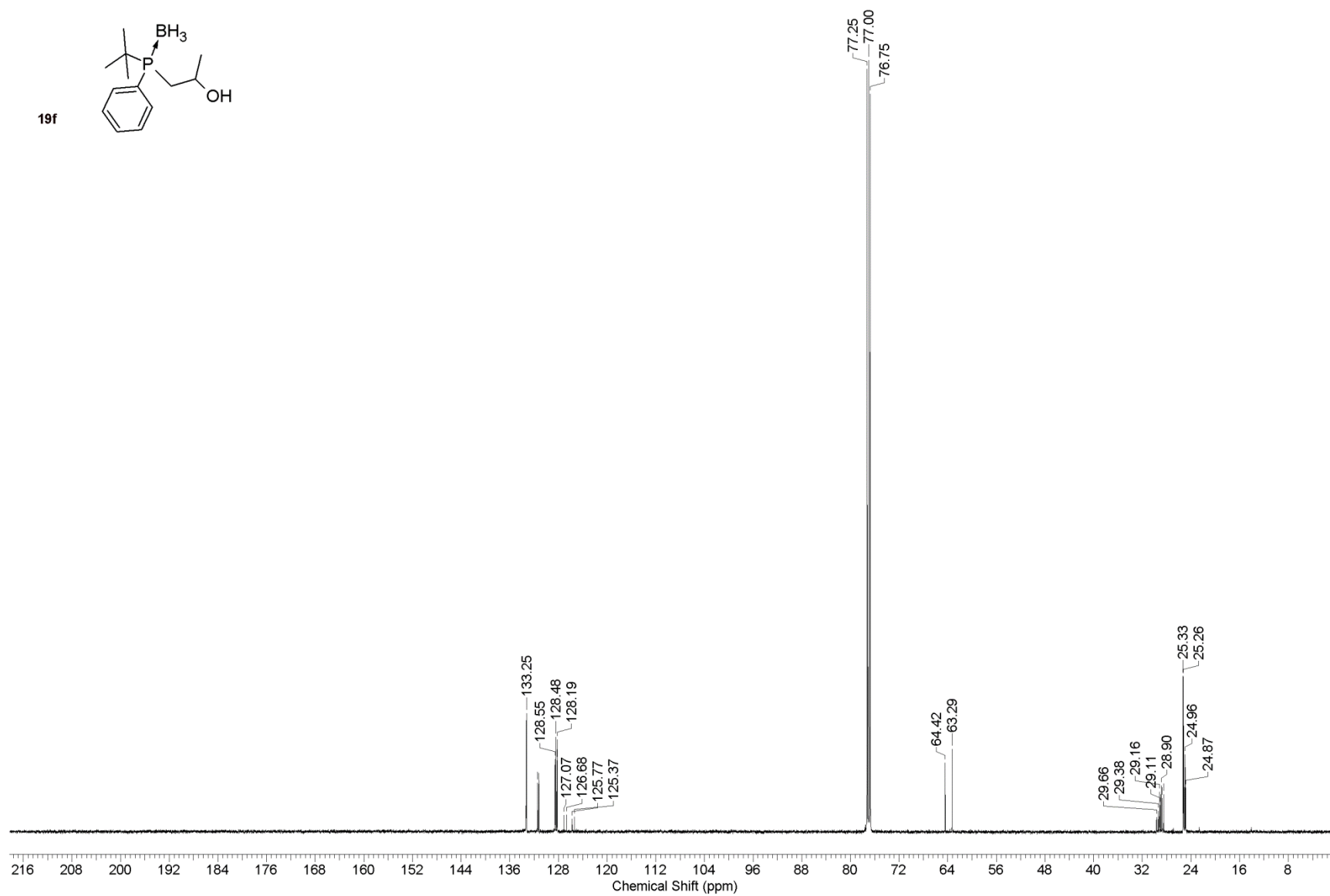
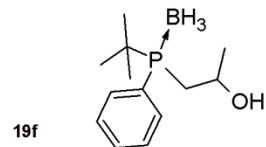
19f



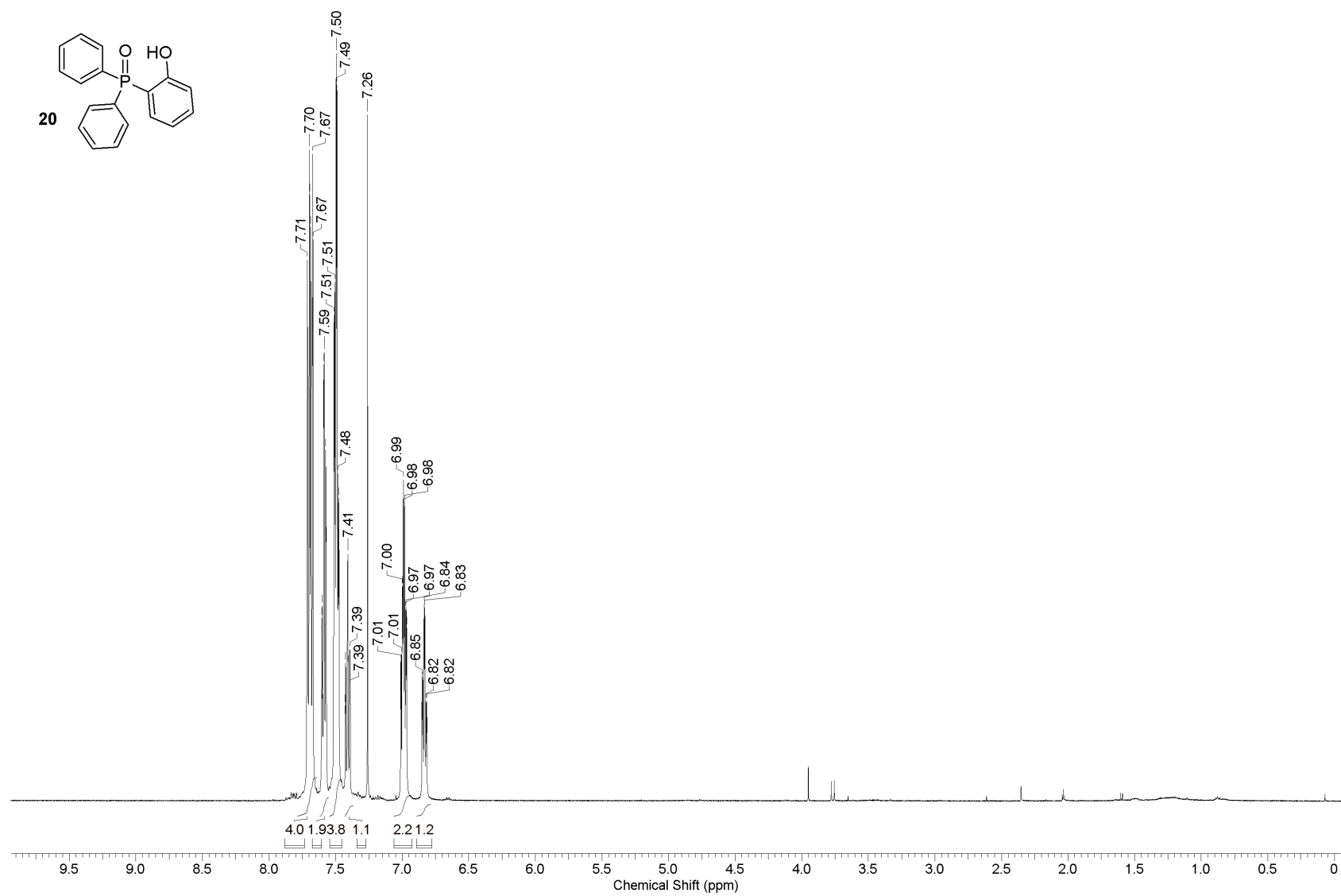
^1H NMR spectrum of *o* *t*-butyl(hydroxypropyl)phenylphosphine-borane (**19f**) (500 MHz, CDCl_3)



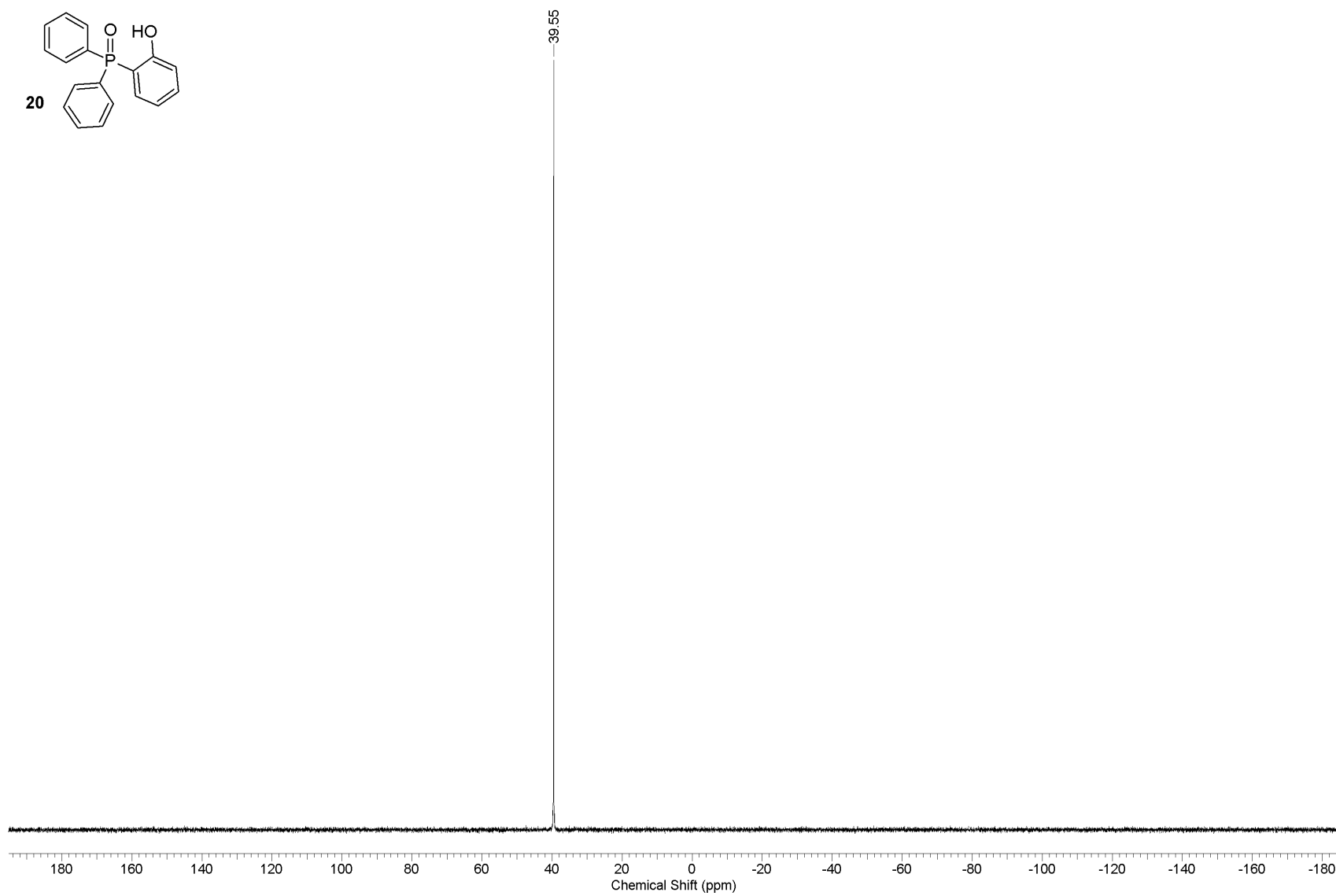
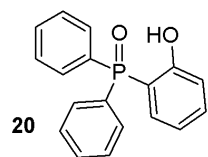
³¹P NMR spectrum of *t*-butyl(hydroxypropyl)phenylphosphine-borane (**19f**) (202 MHz, CDCl₃)



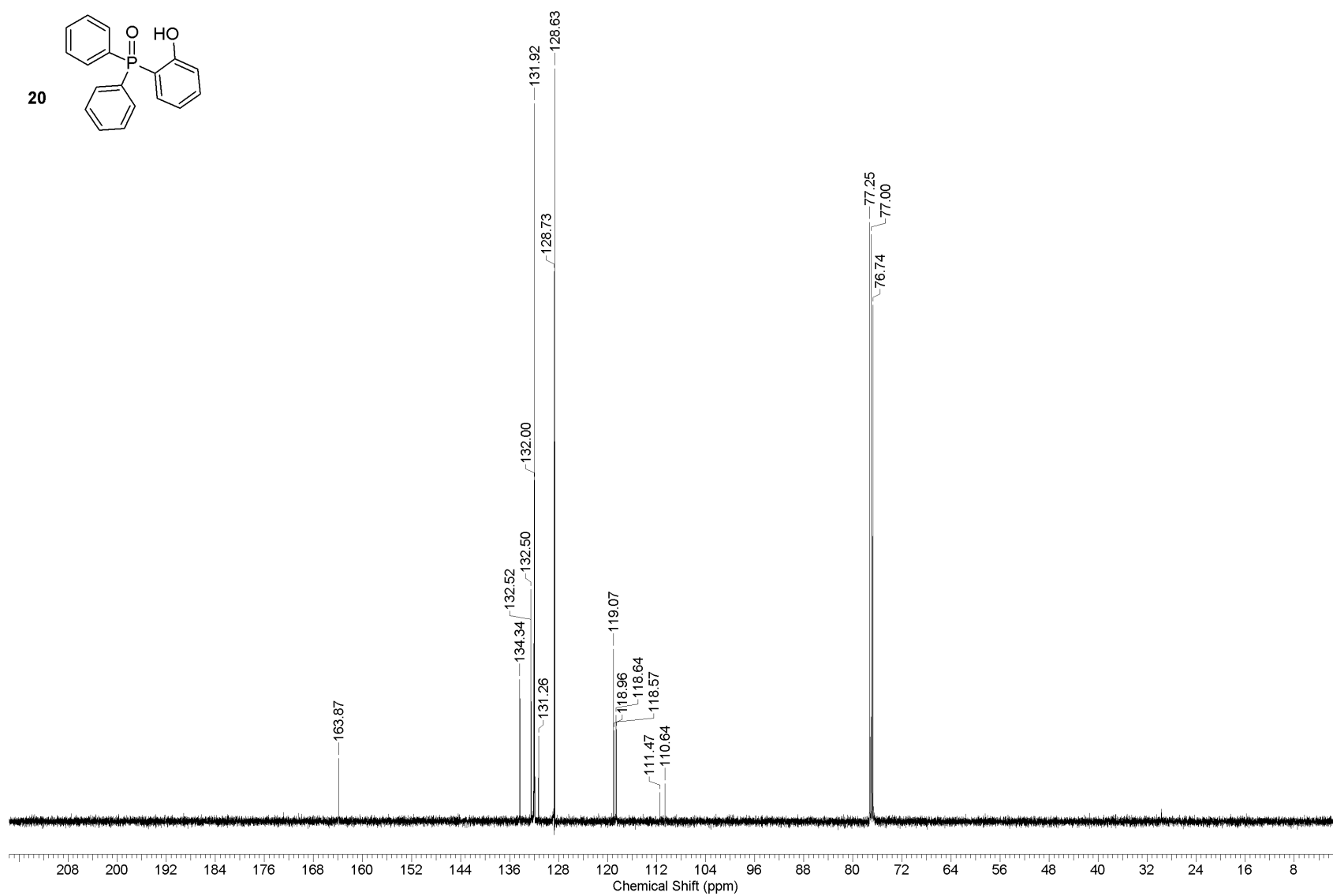
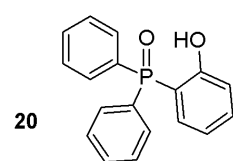
^{13}C NMR spectrum of *t*-butyl(hydroxypropyl)phenylphosphine-borane (**19f**) (125 MHz, CDCl_3)



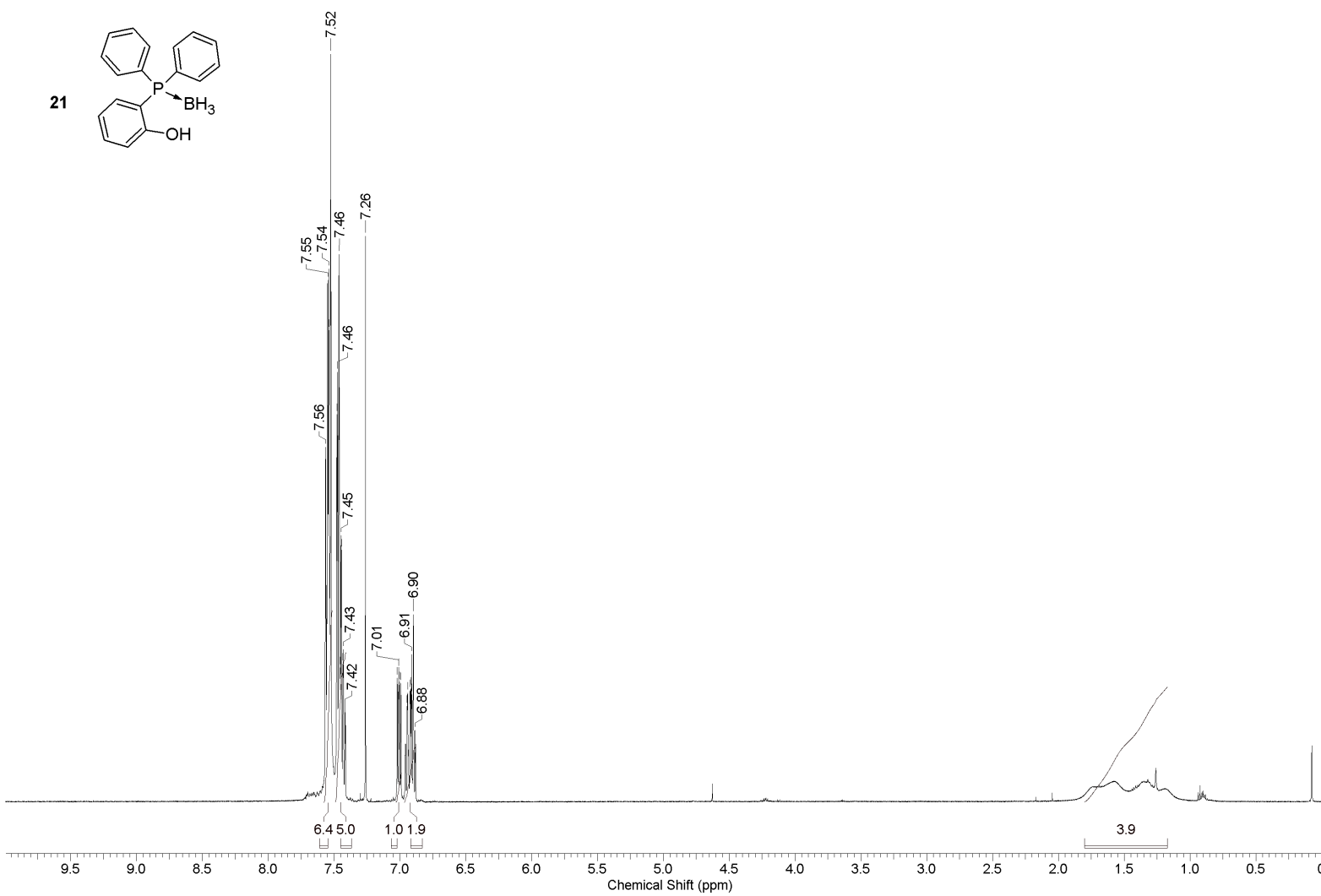
^1H NMR spectrum of diphenyl(*ortho*-hydroxyphenyl)phosphine oxide (**20**) (500 MHz, CDCl_3)



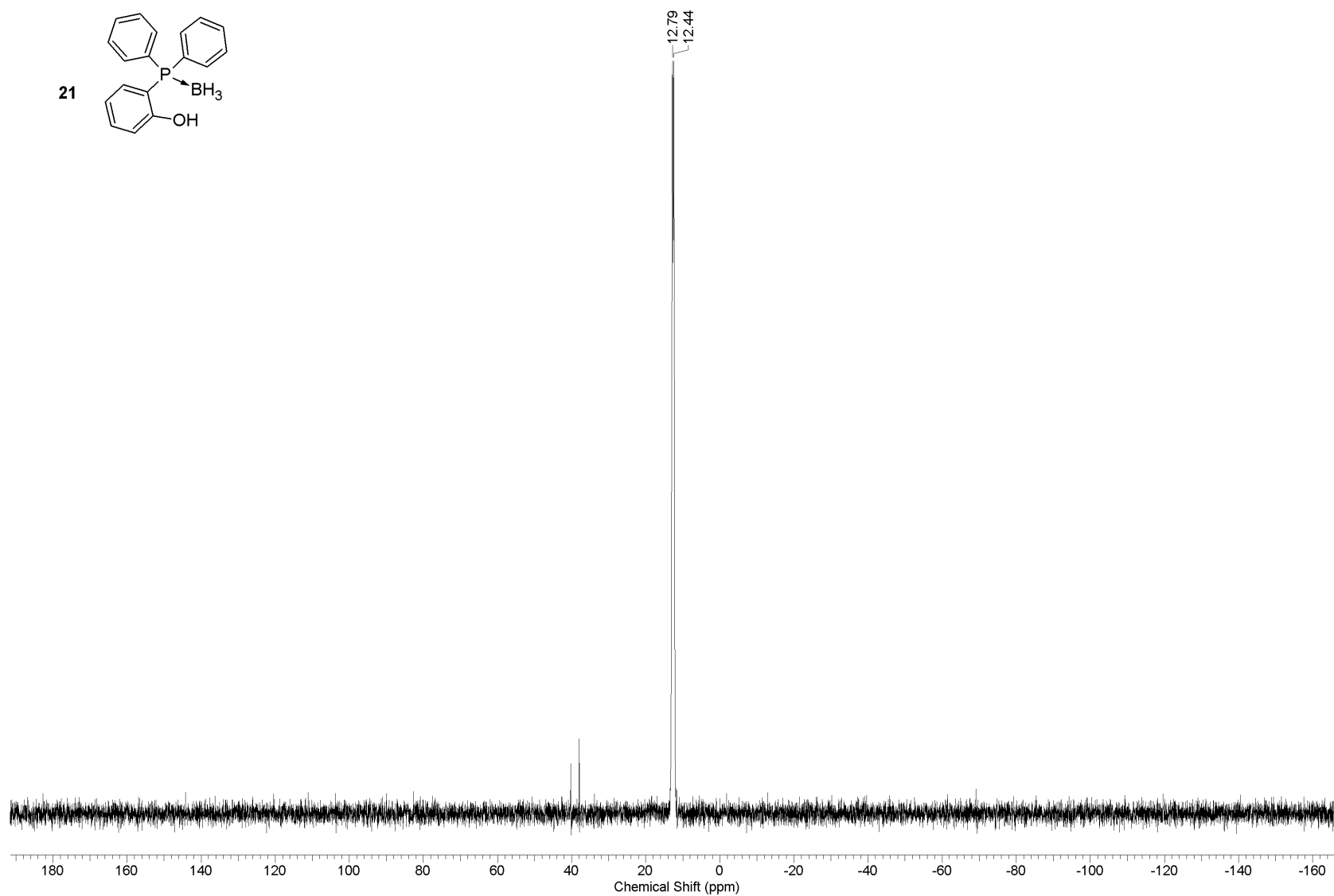
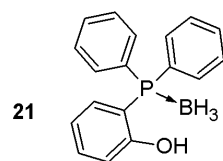
^{31}P NMR spectrum of diphenyl(*ortho*-hydroxyphenyl)phosphine oxide (**20**) (202 MHz, CDCl_3)



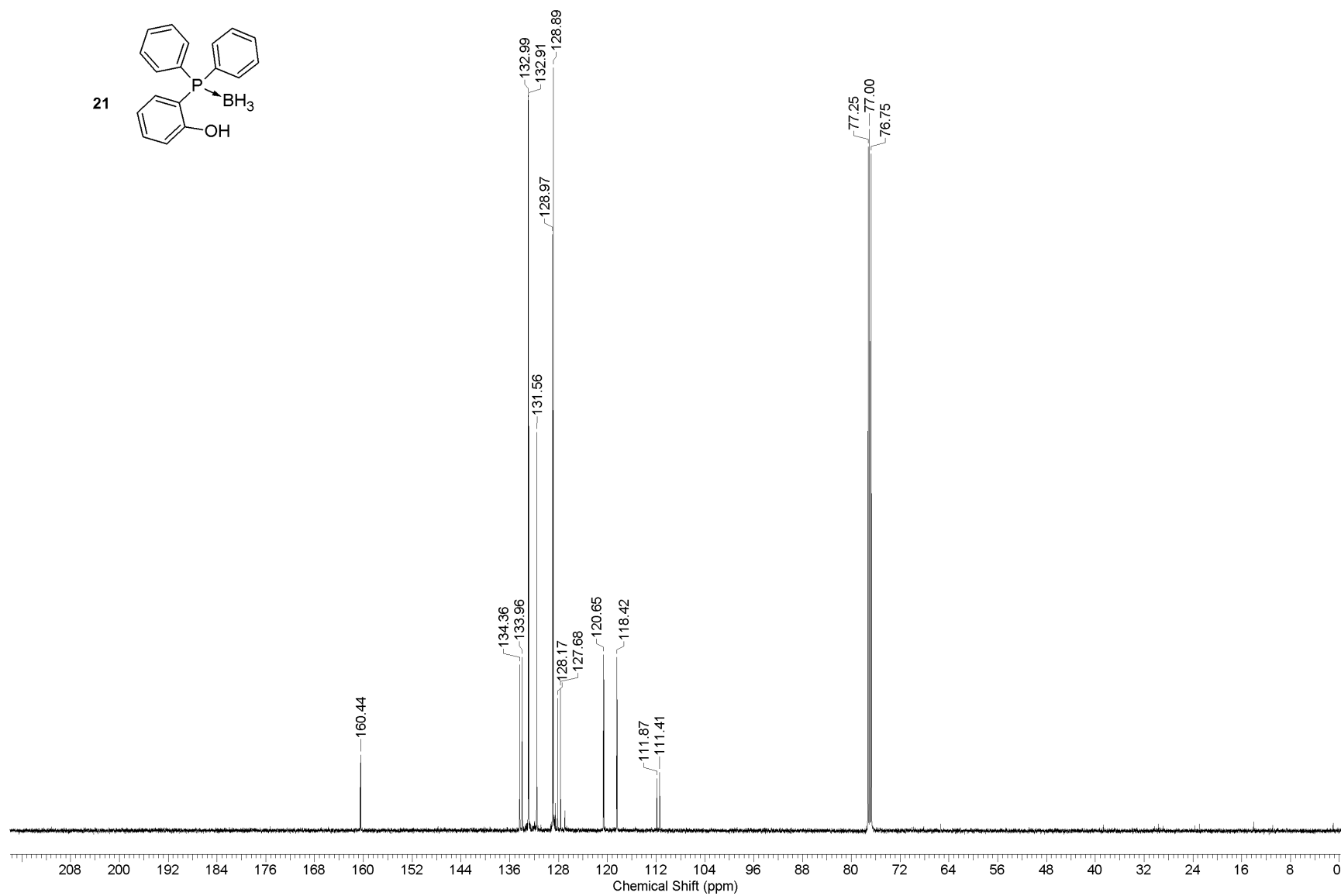
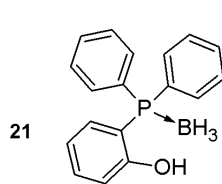
^{13}C NMR spectrum of diphenyl(*ortho*-hydroxyphenyl)phosphine oxide (**20**) (125 MHz, CDCl_3)



¹H NMR spectrum of diphenyl(*ortho*-hydroxyphenyl)phosphine-borane (**21**) (500 MHz, CDCl₃)

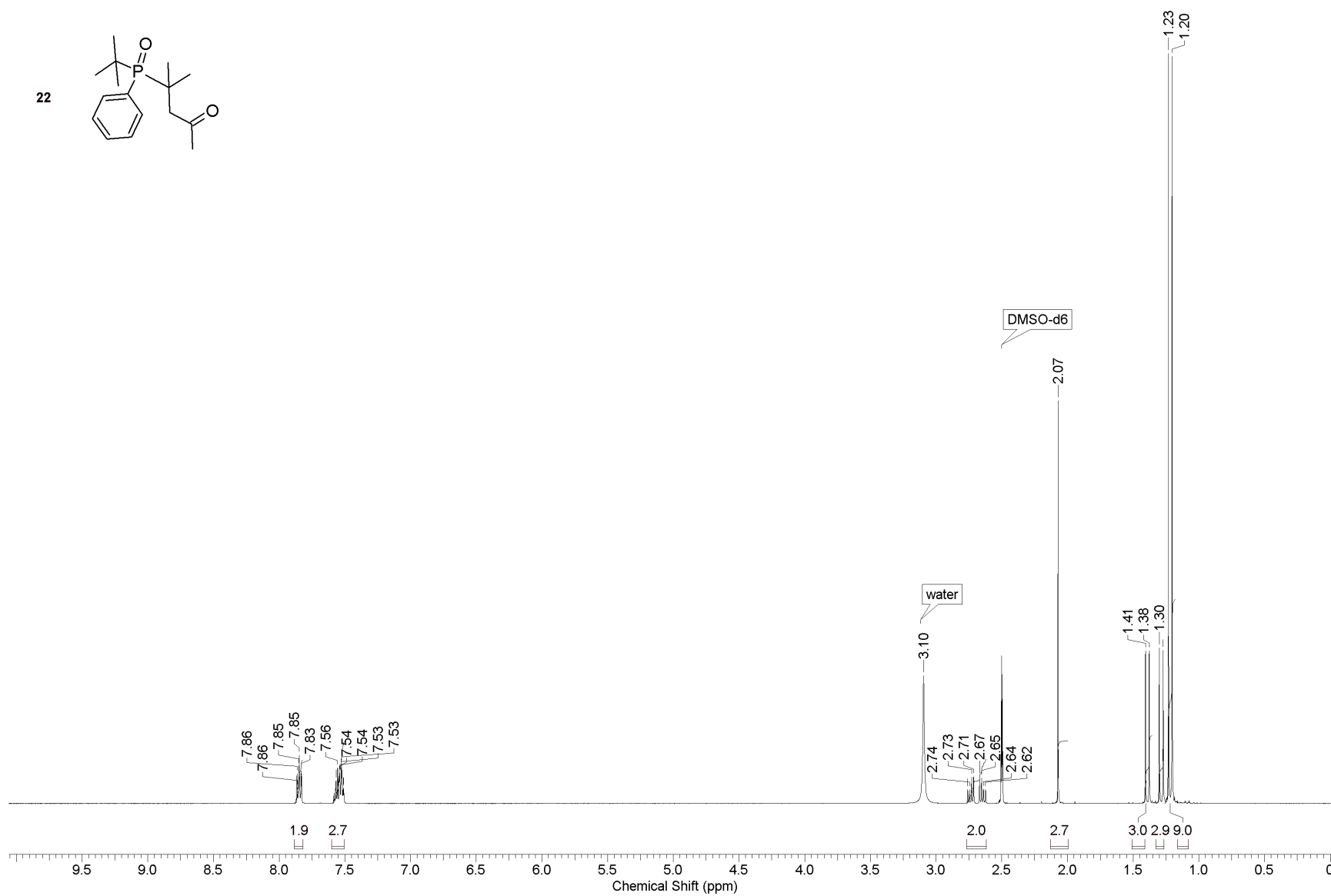
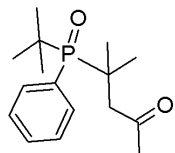


^{31}P NMR spectrum of diphenyl(*ortho*-hydroxyphenyl)phosphine-borane (**21**) (202 MHz, CDCl_3)



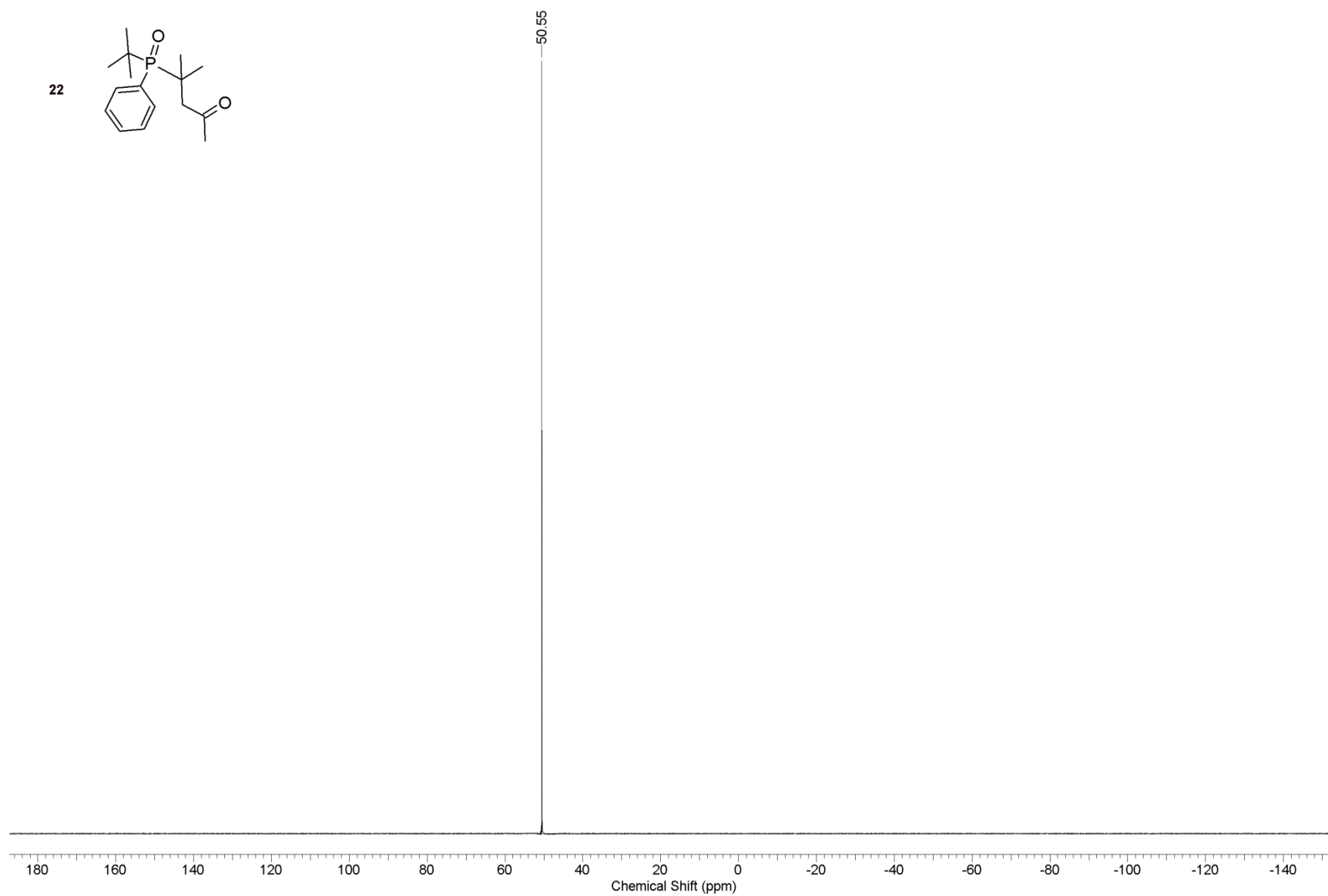
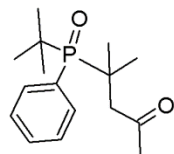
^{13}C NMR spectrum of diphenyl(*ortho*-hydroxyphenyl)phosphine-borane (**21**) (125 MHz, CDCl_3)

22



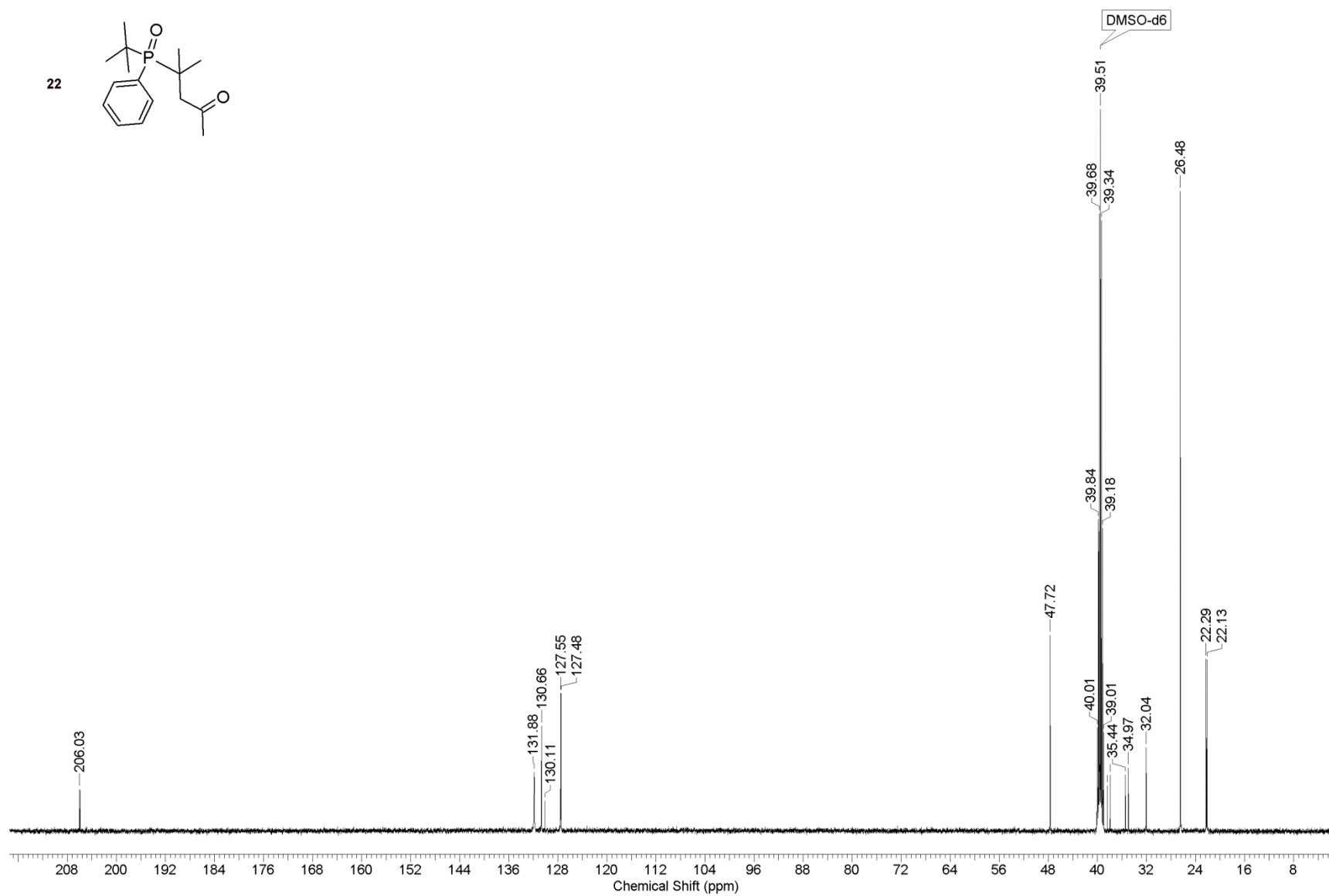
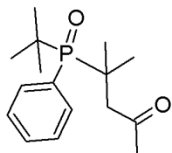
¹H NMR spectrum of *t*-butylphenyl(2-(2-methyl-3-oxopentyl))phosphine oxide (22) (500 MHz, DMSO-*d*₆, 80 °C), water comes from DMSO-*d*₆

22



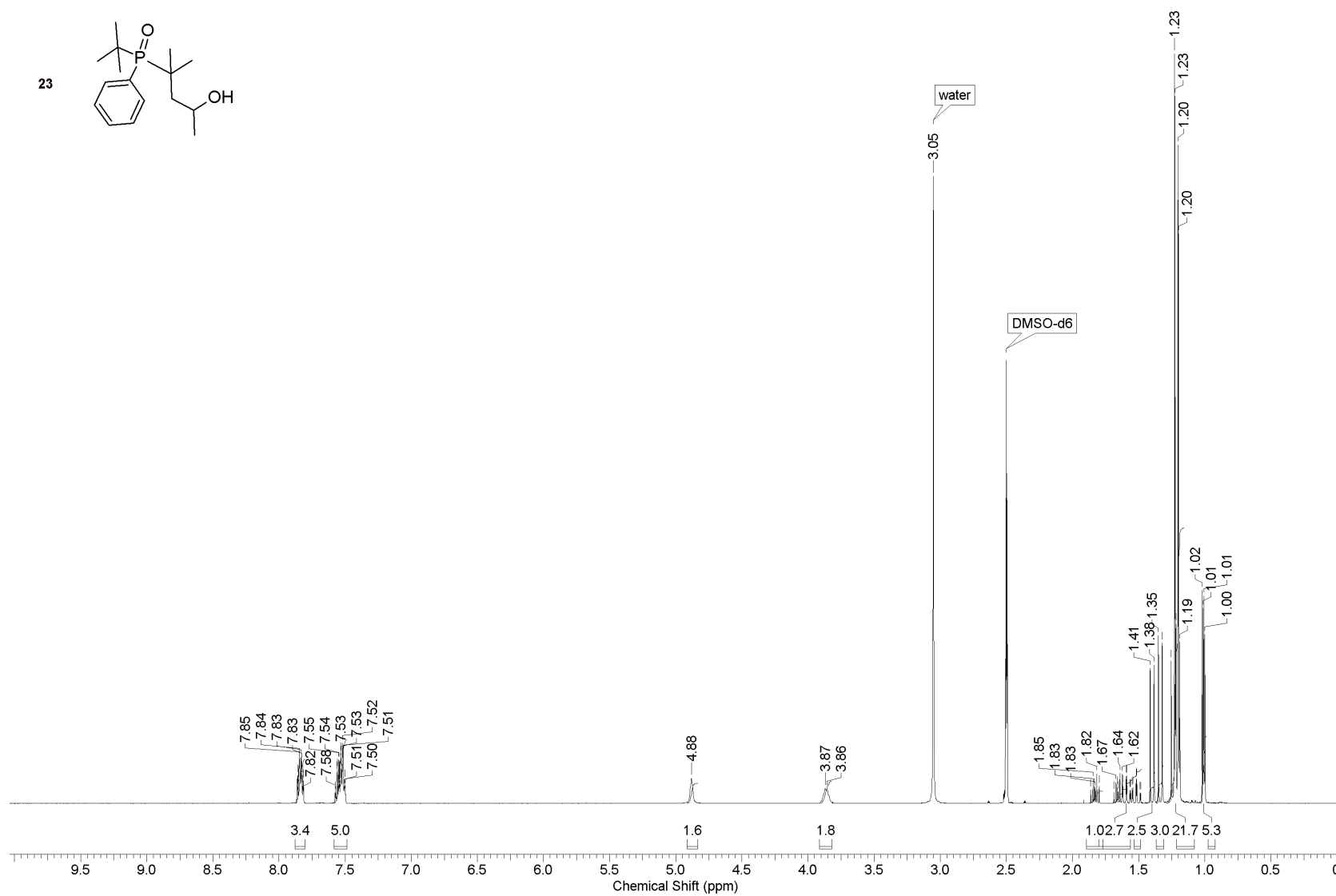
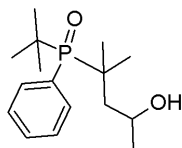
^{31}P NMR spectrum of *t*-butylphenyl(2-(2-methyl-3-oxopentyl))phosphine oxide (**22**) (202 MHz, DMSO-*d*₆)

22



¹³C NMR spectrum of (t-butylphenyl(2-(2-methyl-3-oxopentyl)))phosphine oxide (22) (125 MHz, DMSO-d₆, 80 °C)

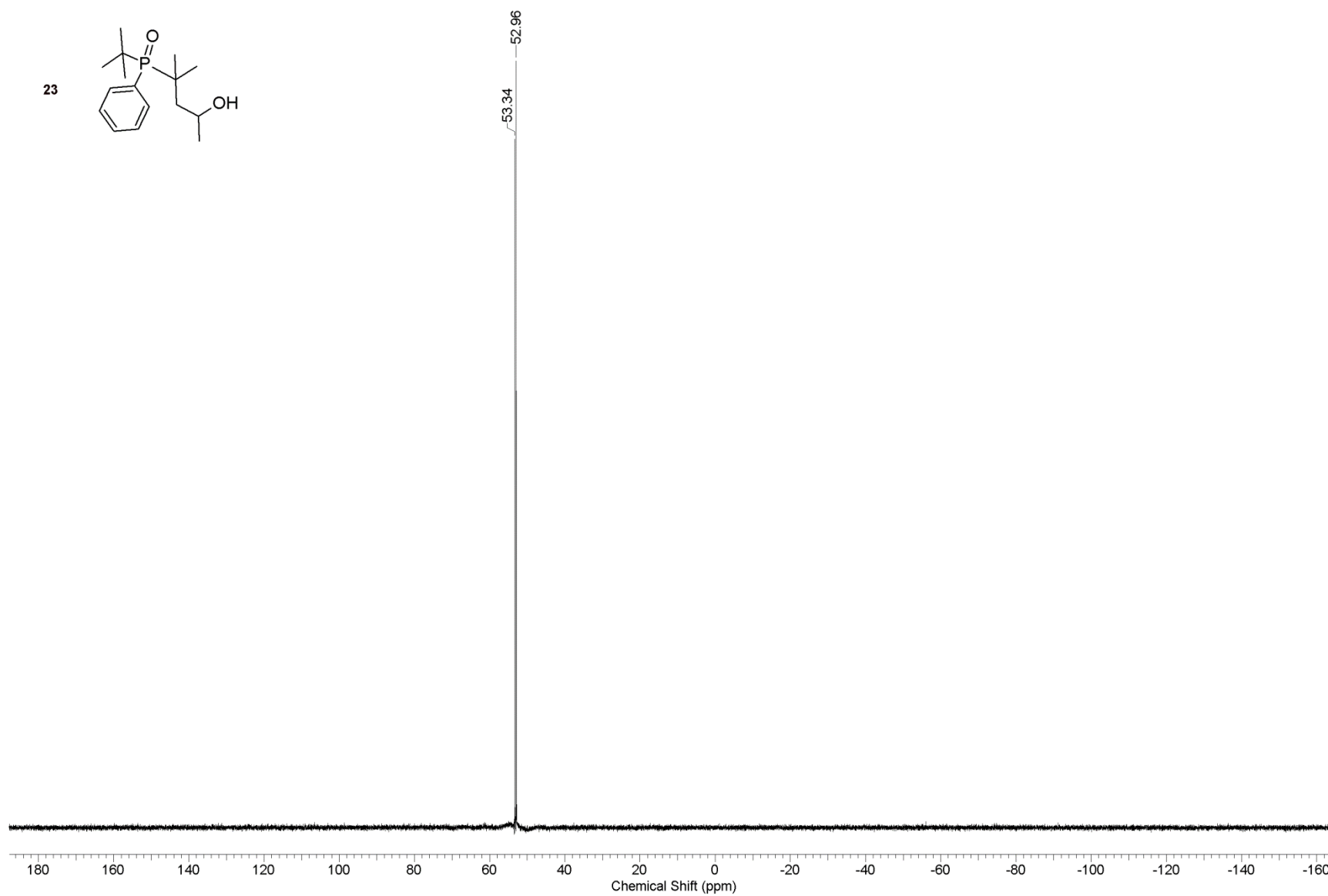
23



¹H NMR spectrum of *t*-butylphenyl(2-(2-methyl-3-hydroxypentyl))phosphine oxide (23) (500 MHz, DMSO-*d*₆, 80 °C), water comes from DMSO-

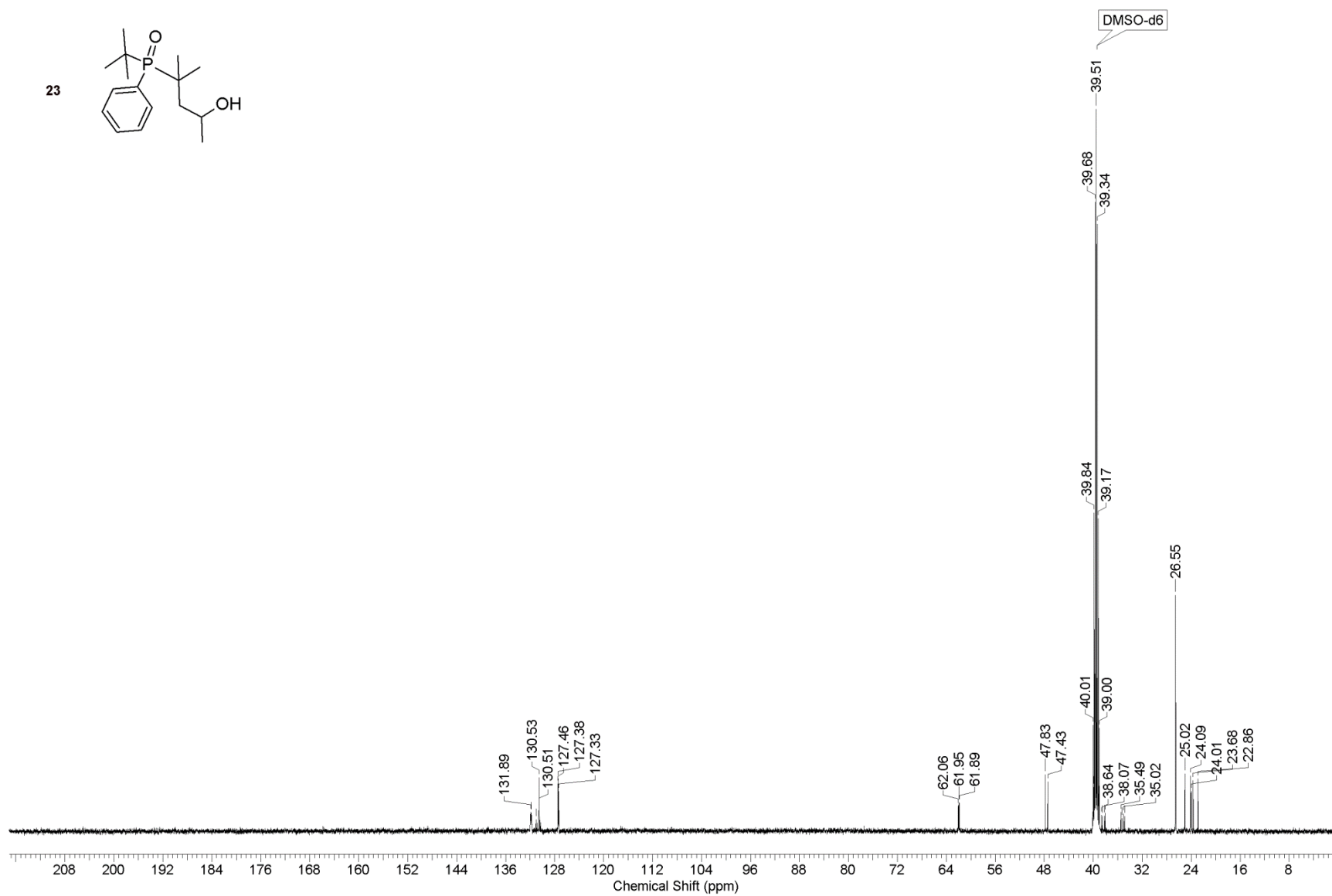
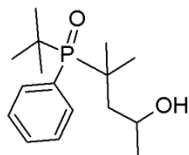
*d*₆

S247

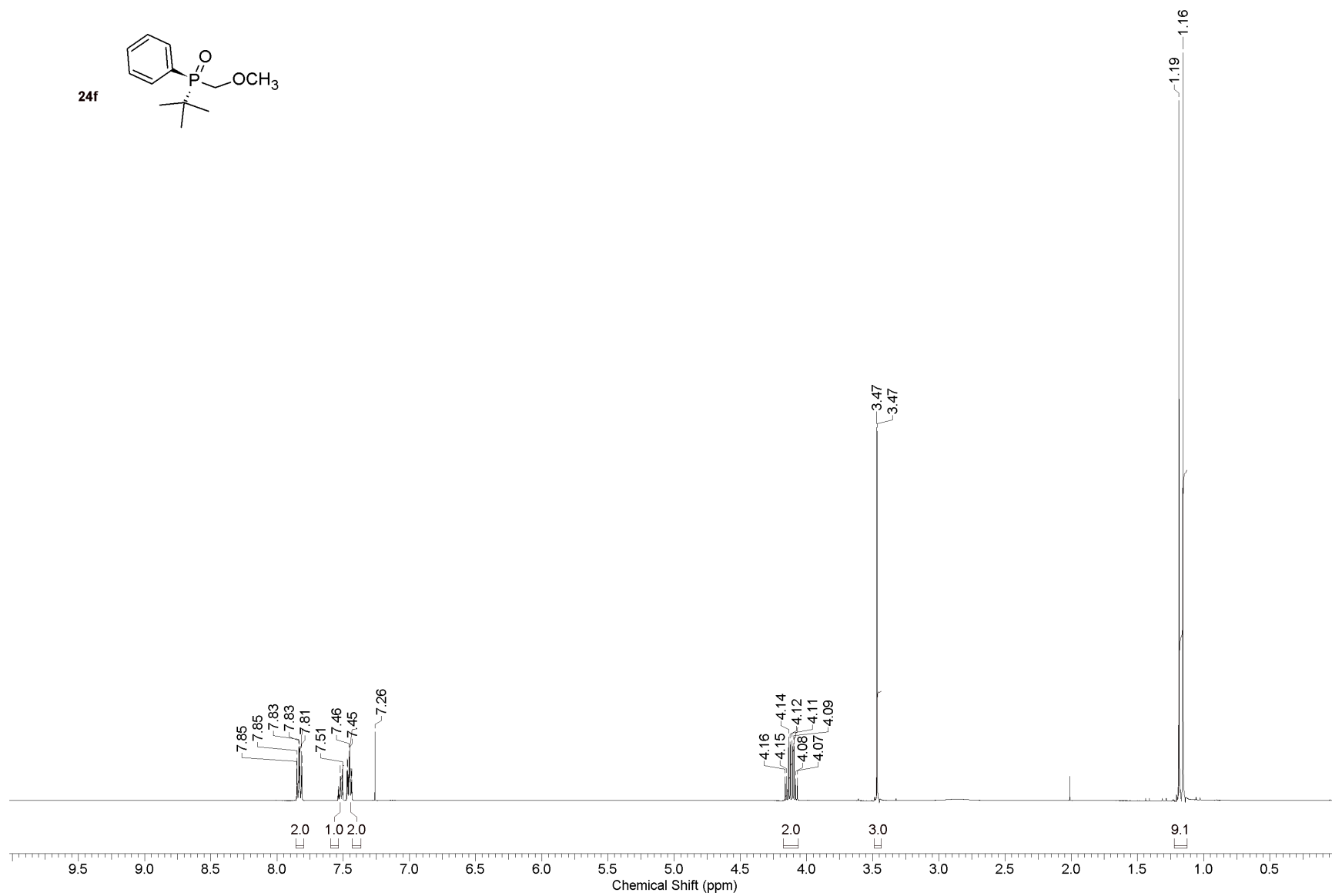
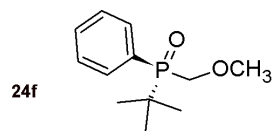


^{31}P NMR spectrum of *t*-butylphenyl(2-(2-methyl-3-hydroxypentyl))phosphine oxide (**23**) (202 MHz, DMSO-*d*₆, 80 °C)

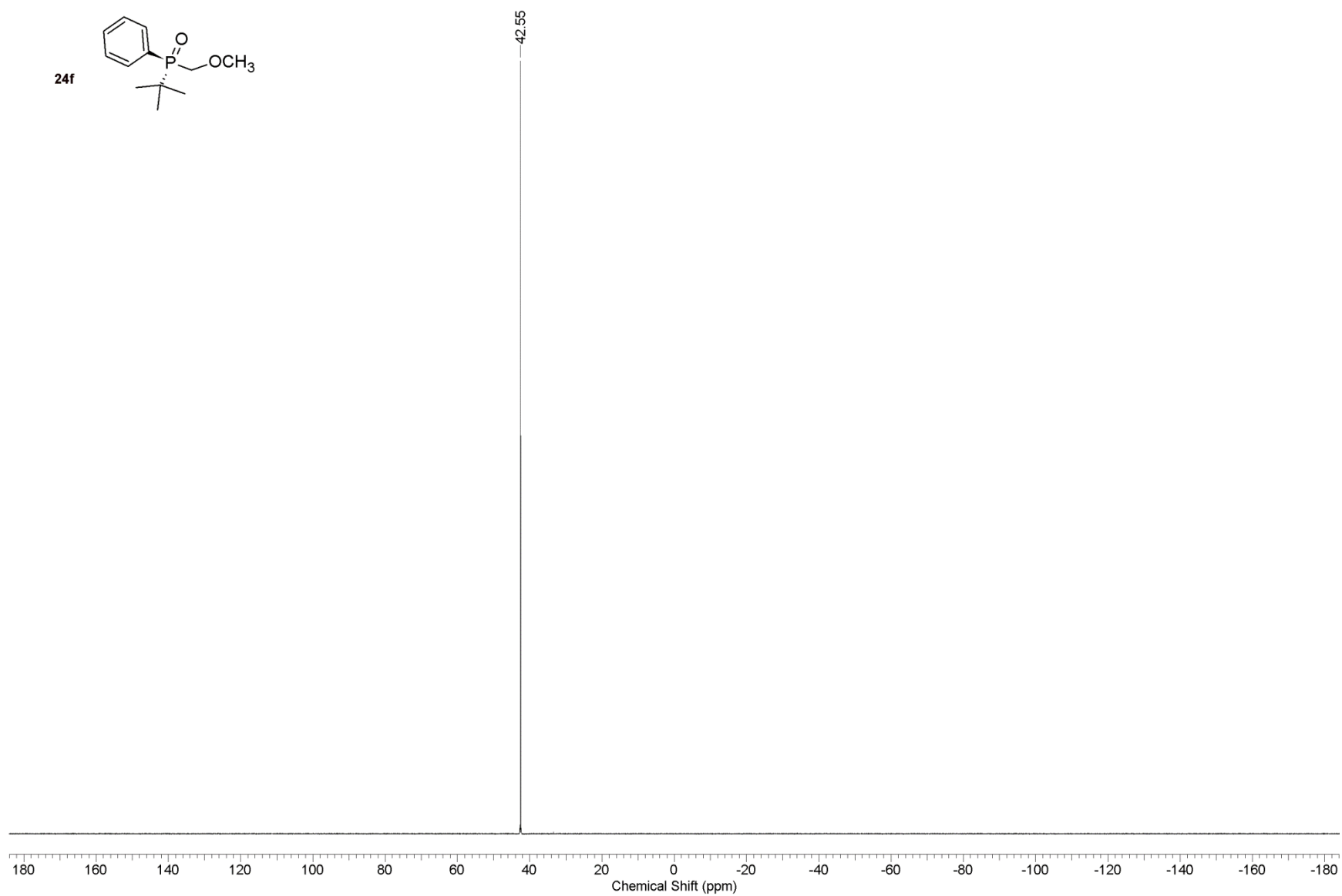
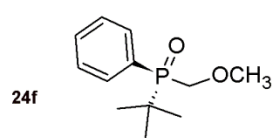
23



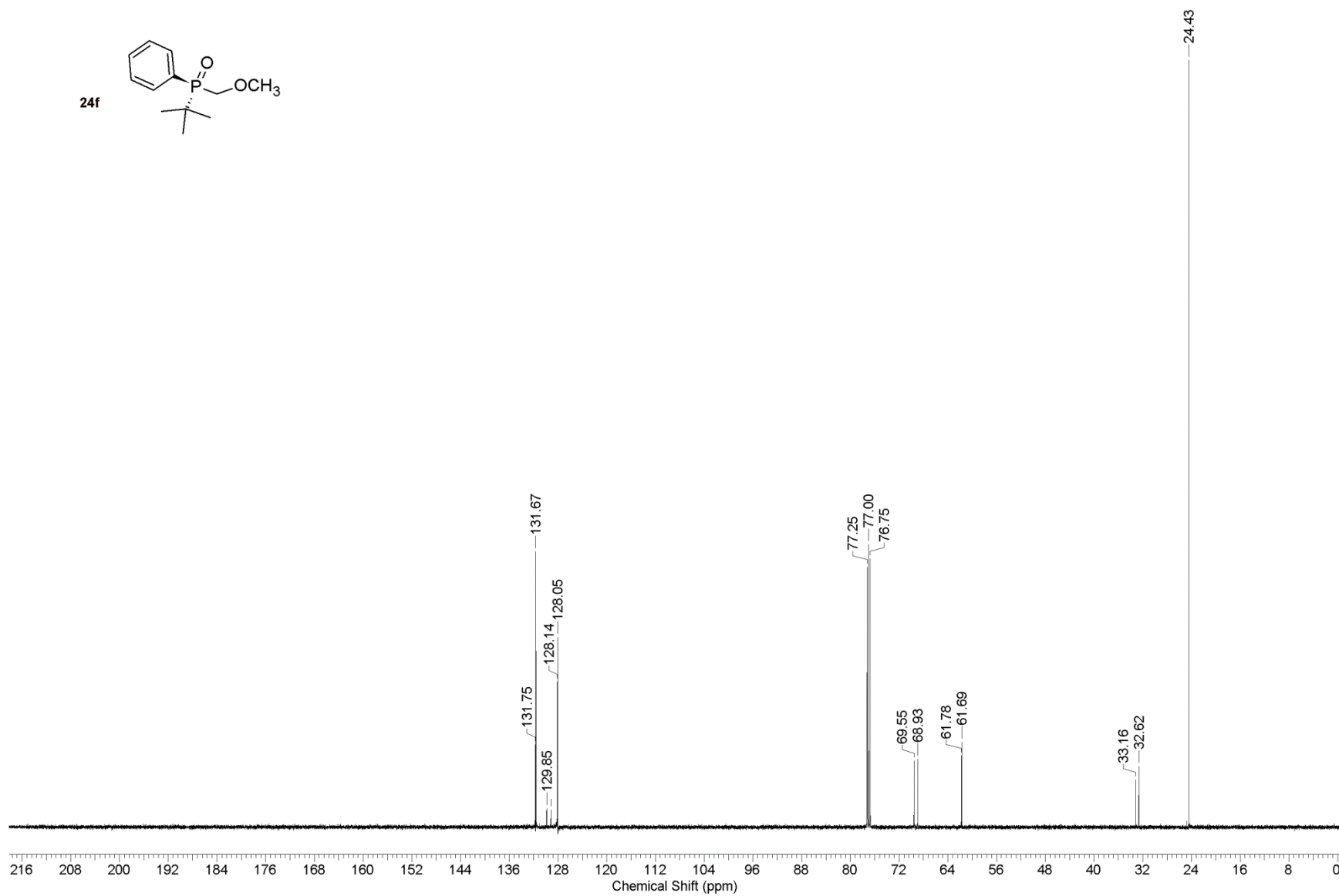
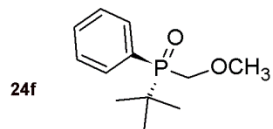
¹³C NMR spectrum of *t*-butylphenyl(2-(2-methyl-3-hydroxypentyl))phosphine oxide (23) (125 MHz, DMSO-*d*₆, 80 °C)



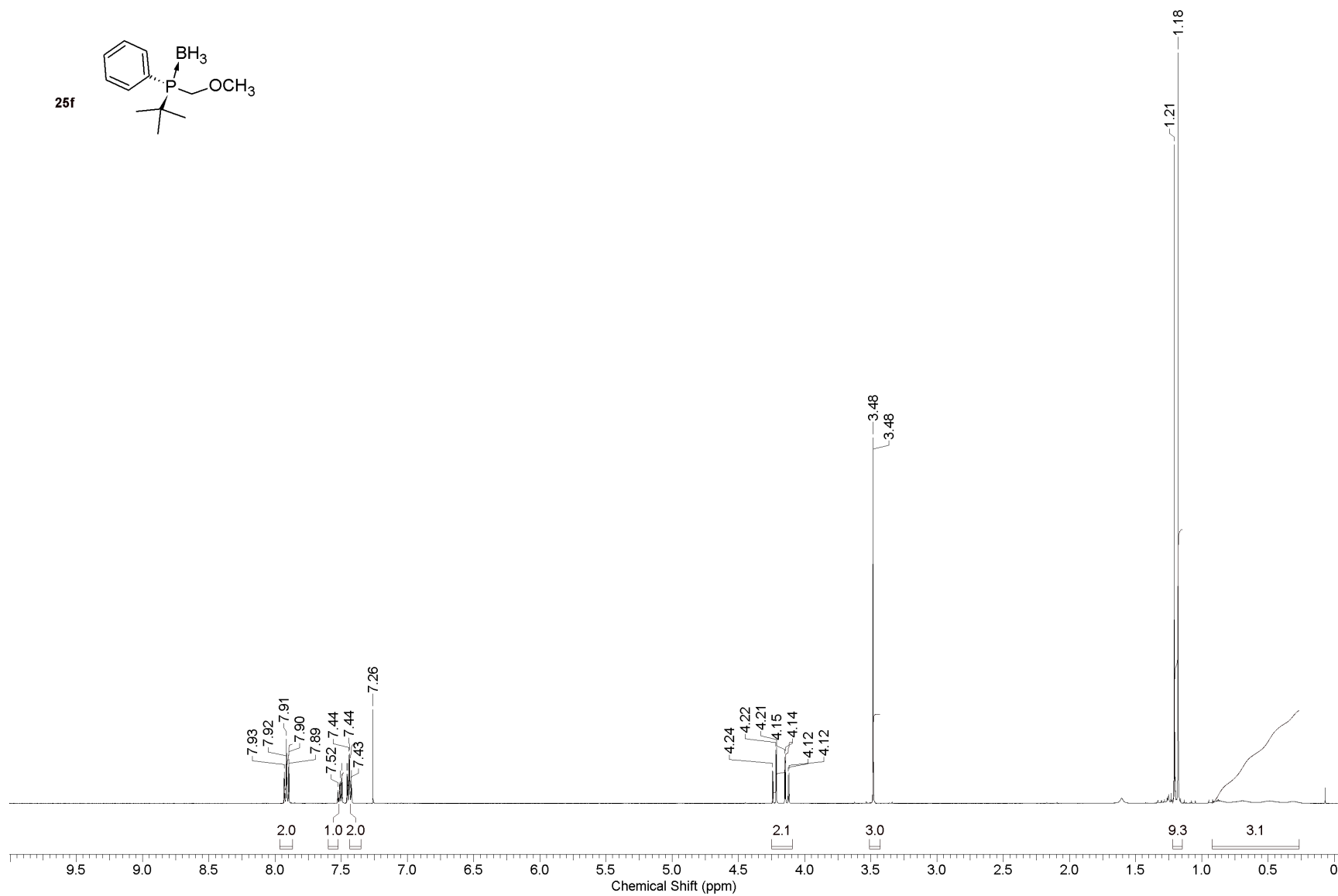
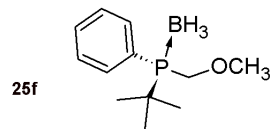
^1H NMR spectrum of (*R*)-*t*-butyl(methoxymethyl)phenylphosphine oxide (*R*)-(24f) (500 MHz, CDCl_3)



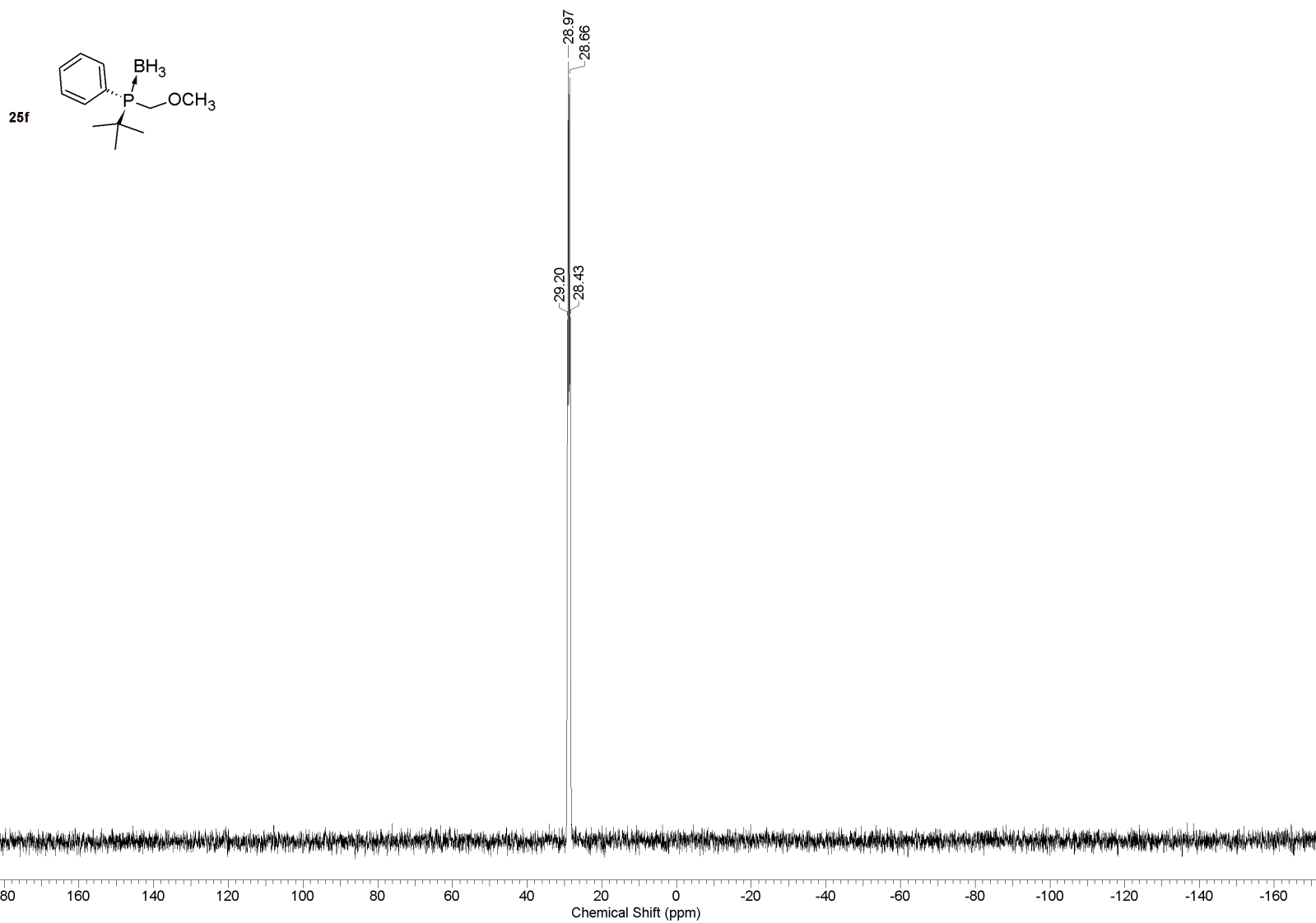
^{31}P NMR spectrum of (*R*)-*t*-butyl(methoxymethyl)phenylphosphine oxide (*R*)-(24f) (202 MHz, CDCl_3)



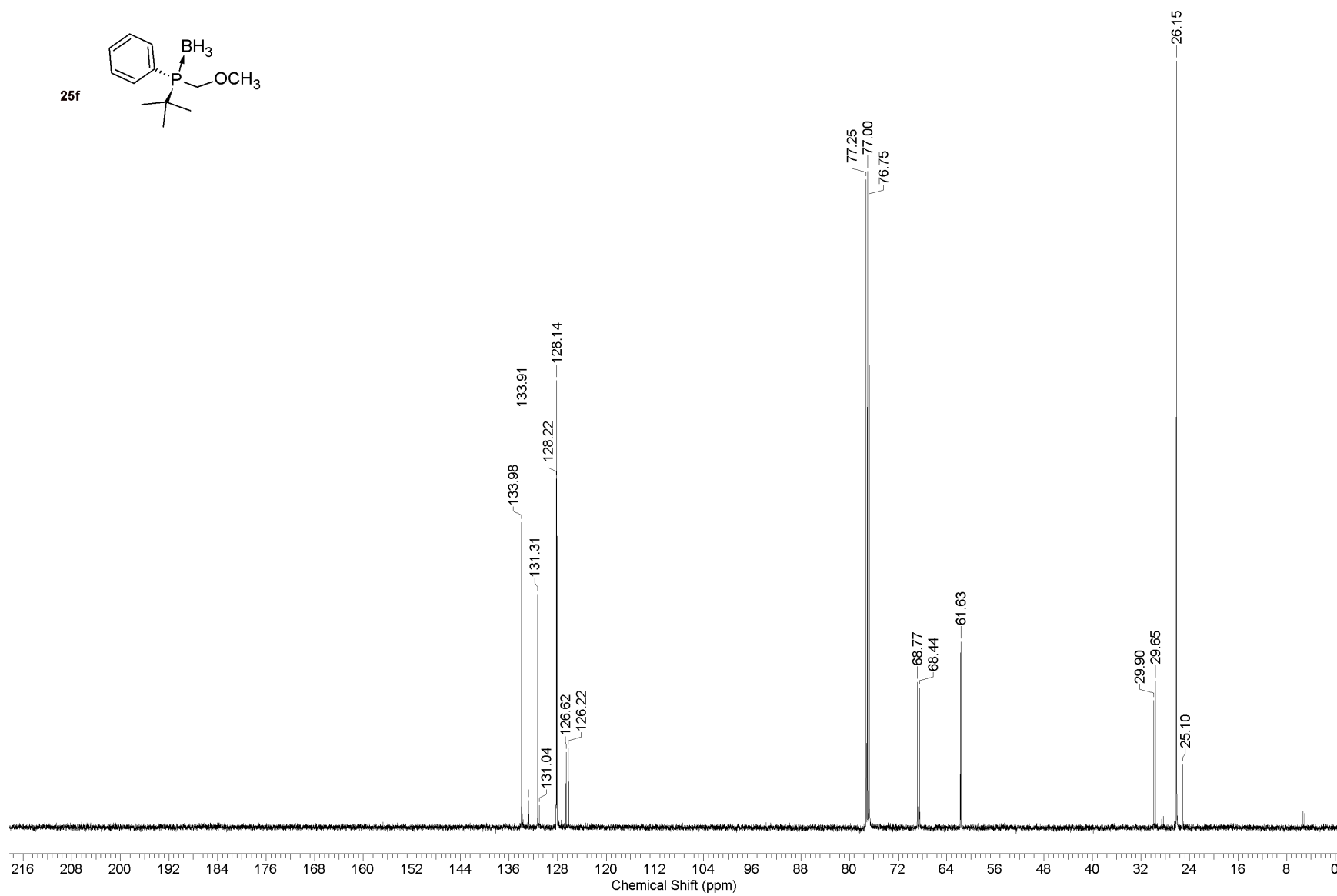
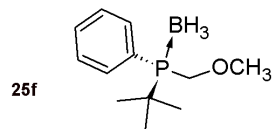
^{13}C NMR spectrum of (*R*)-*t*-butyl(methoxymethyl)phenylphosphine oxide (*R*)-(24f) (125 MHz, CDCl_3)



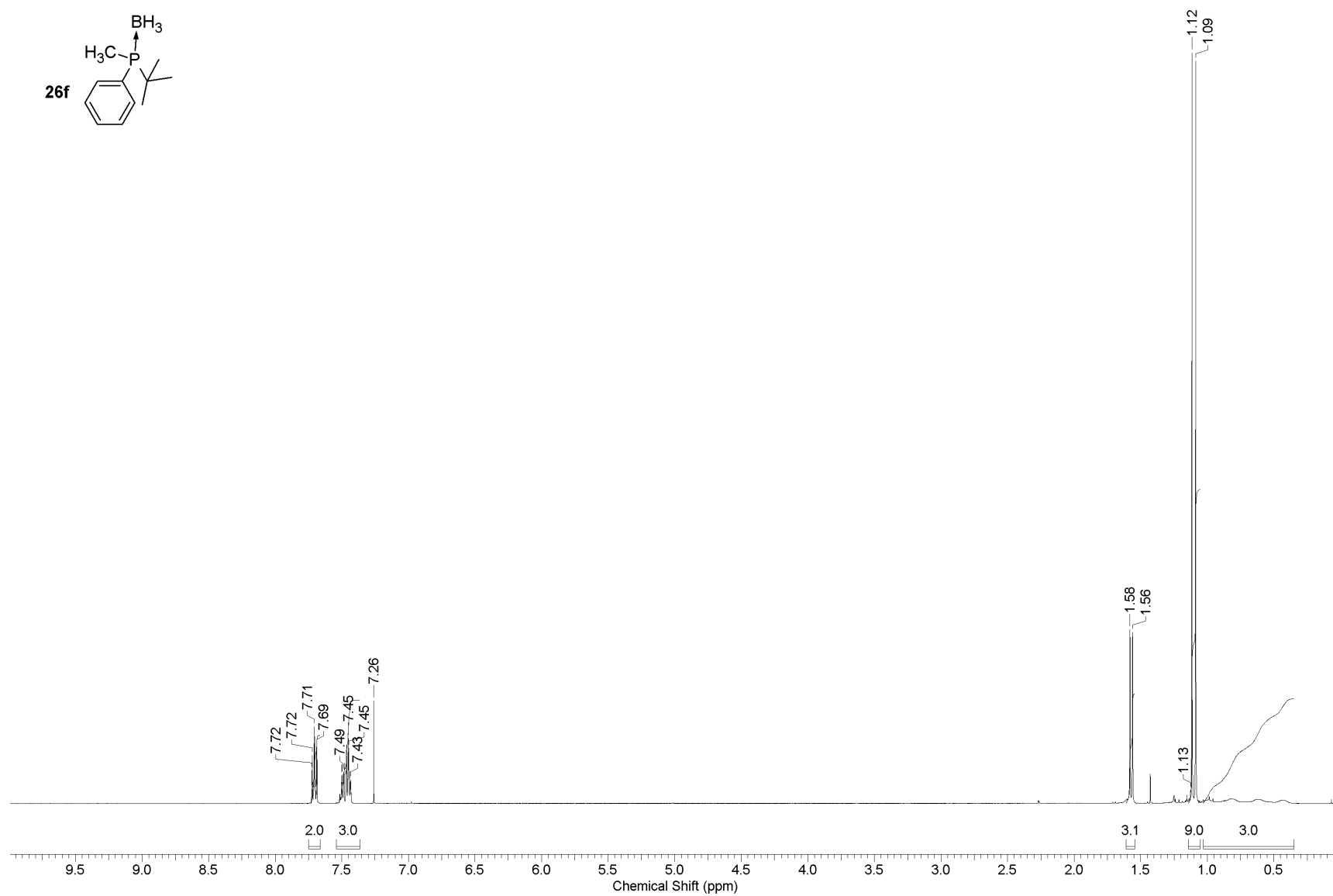
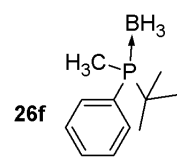
^1H NMR spectrum of (*R*)-*t*-butyl(methoxymethyl)phenylphosphine-borane (*R*)-(25f) (500 MHz, CDCl_3)



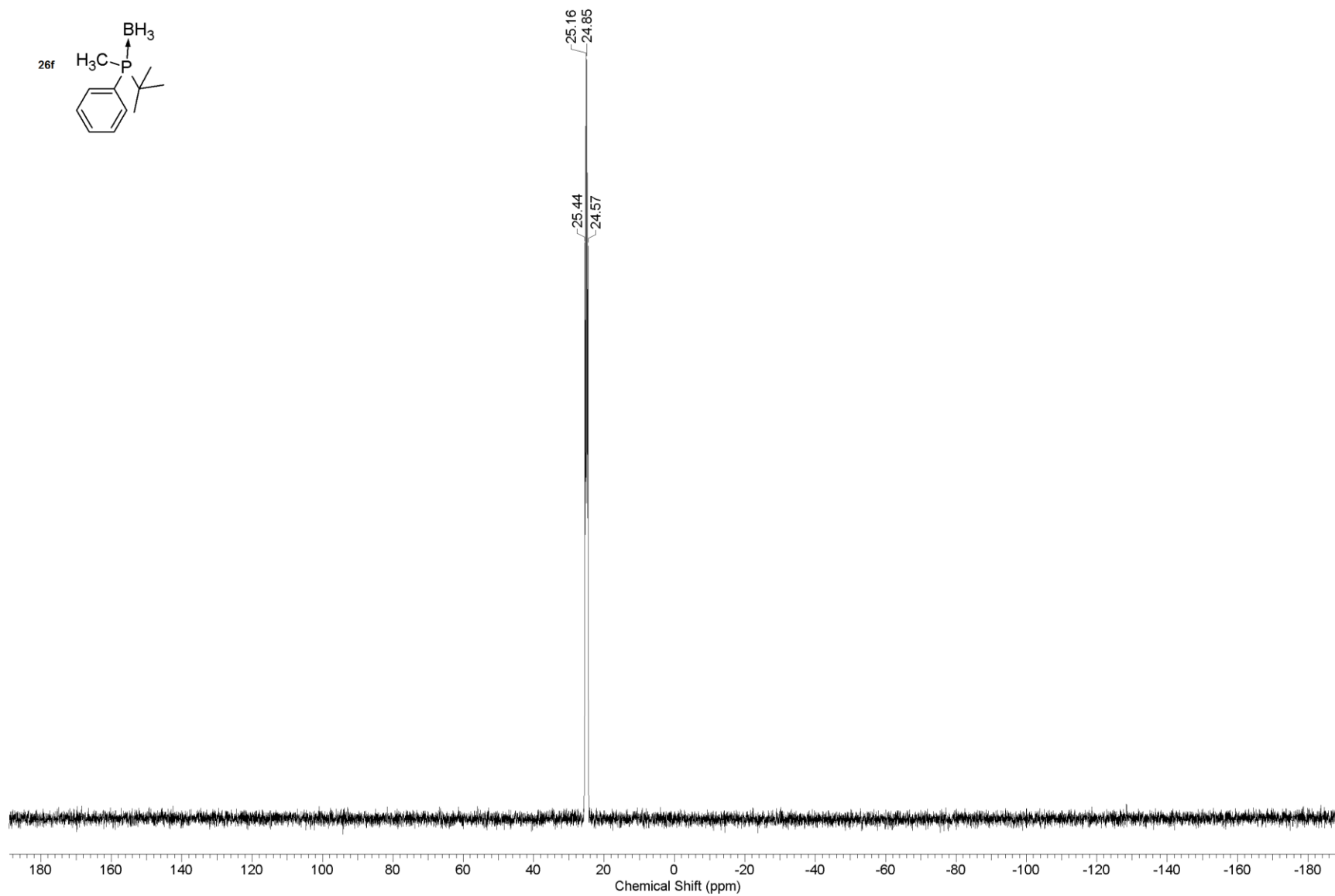
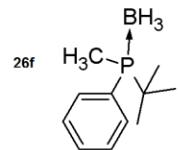
^{31}P NMR spectrum of *(R)*-*t*-butyl(methoxymethyl)phenylphosphine-borane *(R)*-(**25f**) (202 MHz, CDCl_3)



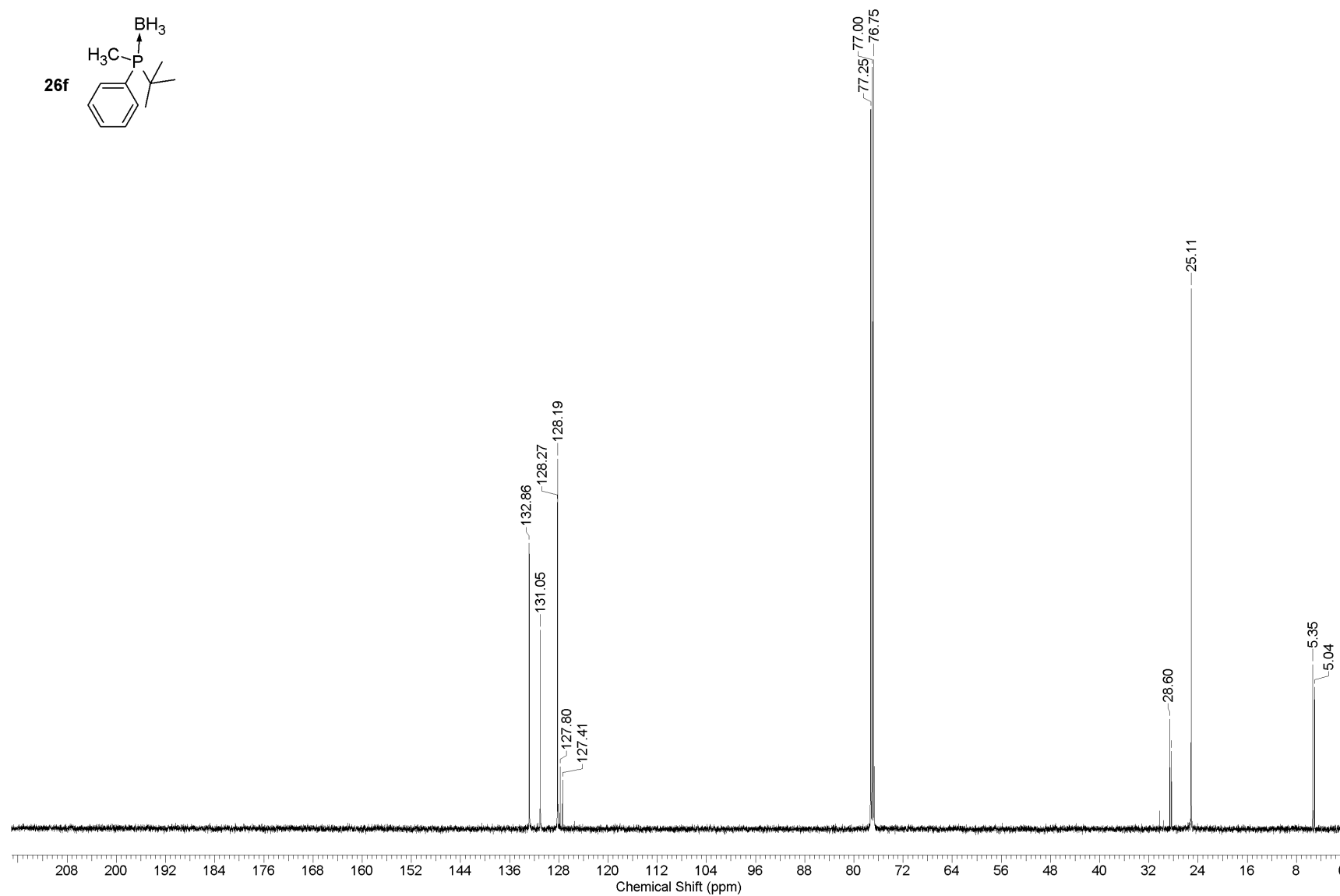
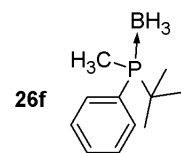
^{13}C NMR spectrum of (*R*)-*t*-butyl(methoxymethyl)phenylphosphine-borane (**25f**) (125 MHz, CDCl_3)



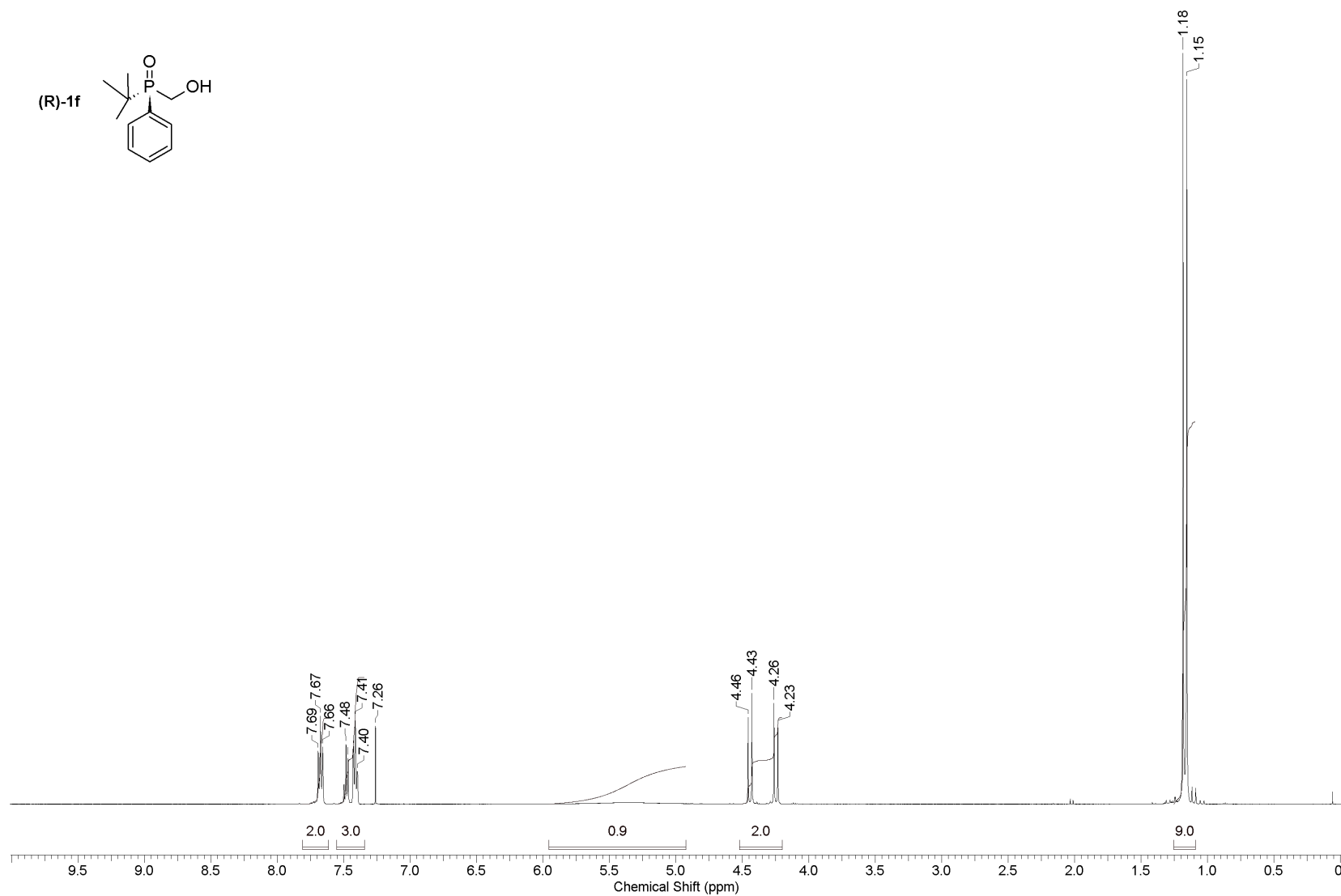
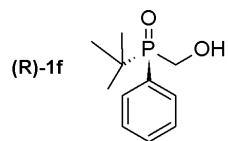
^1H NMR spectrum of *t*-butyl(methyl)phenylphosphine-borane (**26f**) (500 MHz, CDCl_3)



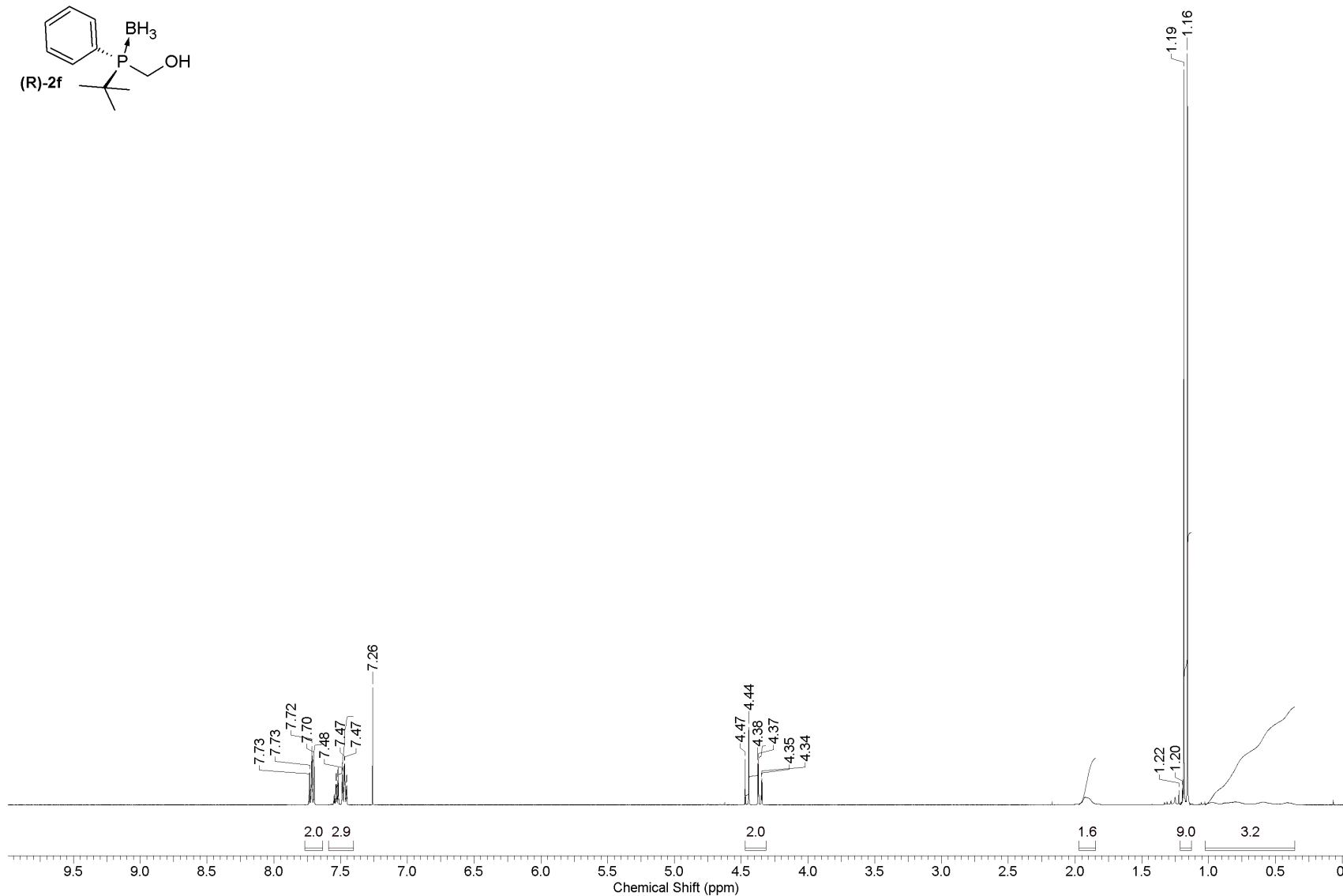
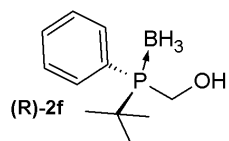
^{31}P NMR spectrum of *t*-butyl(methyl)phenylphosphine-borane (**26f**) (202 MHz, CDCl_3)



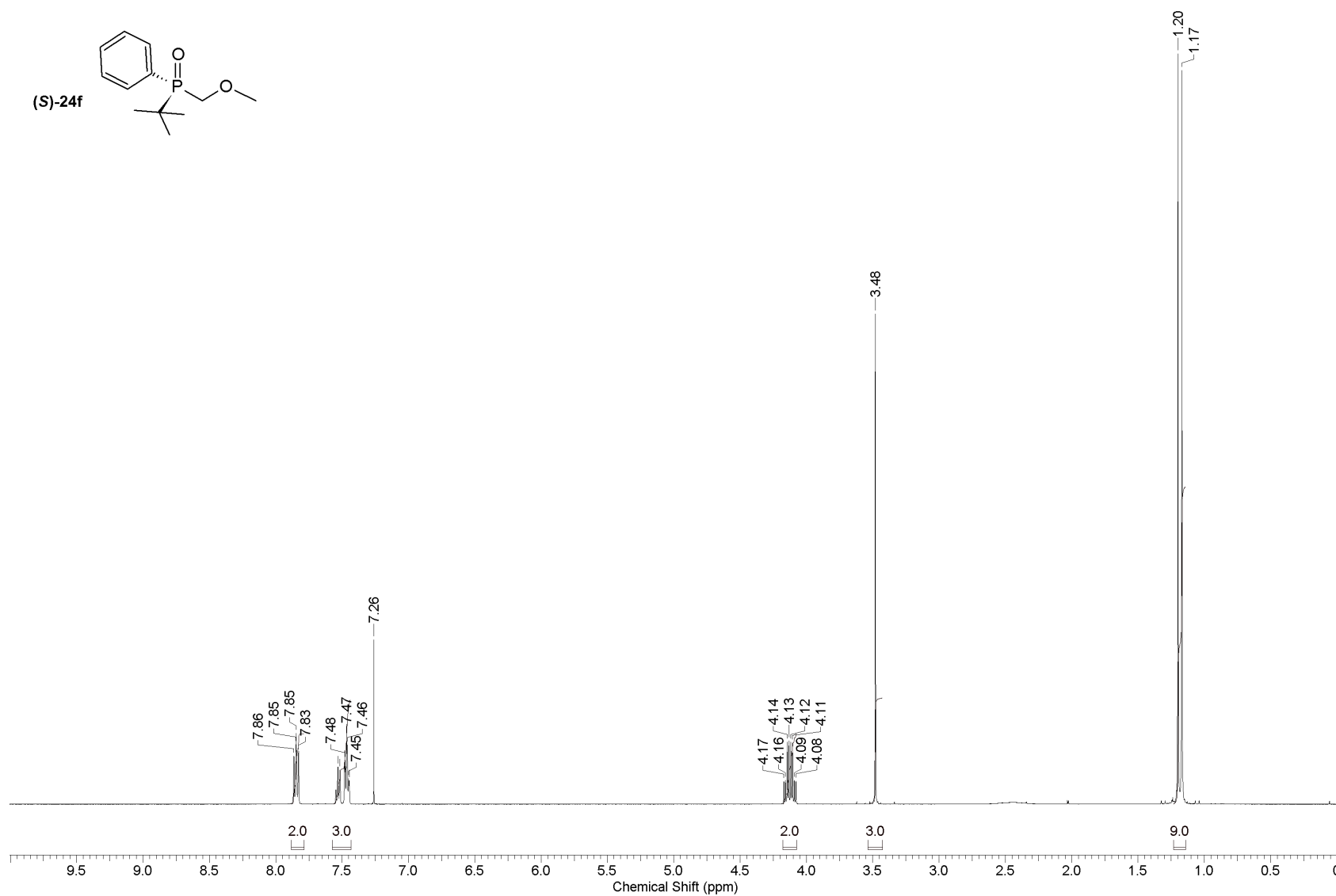
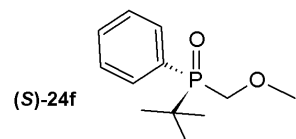
¹³C NMR spectrum of *t*-butyl(methyl)phenylphosphine-borane (**26f**) (125 MHz, CDCl₃)



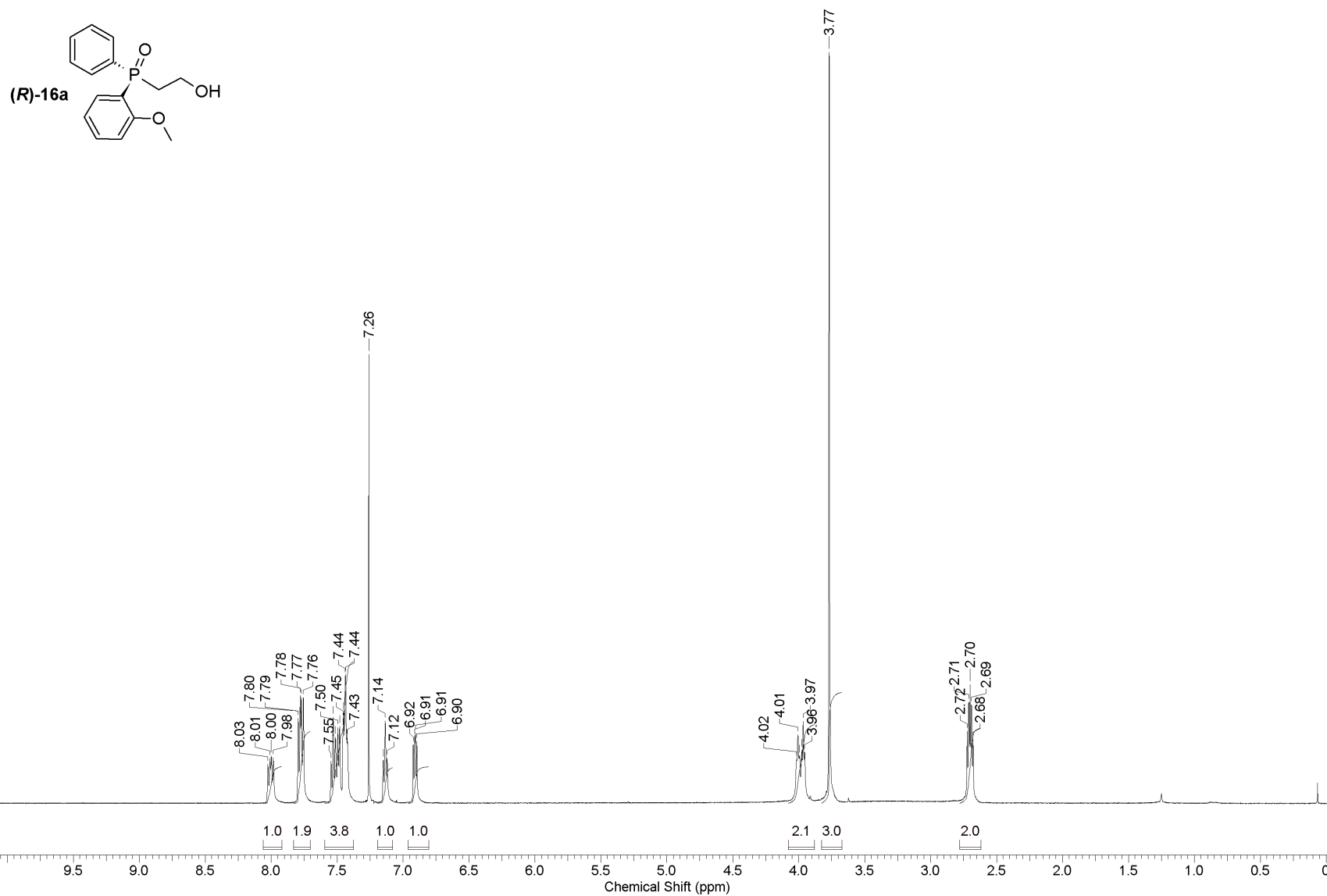
¹H NMR spectrum of (R)-*t*-butyl(hydroxymethyl)phenylphosphine oxide (R)-1f (500 MHz, CDCl₃)



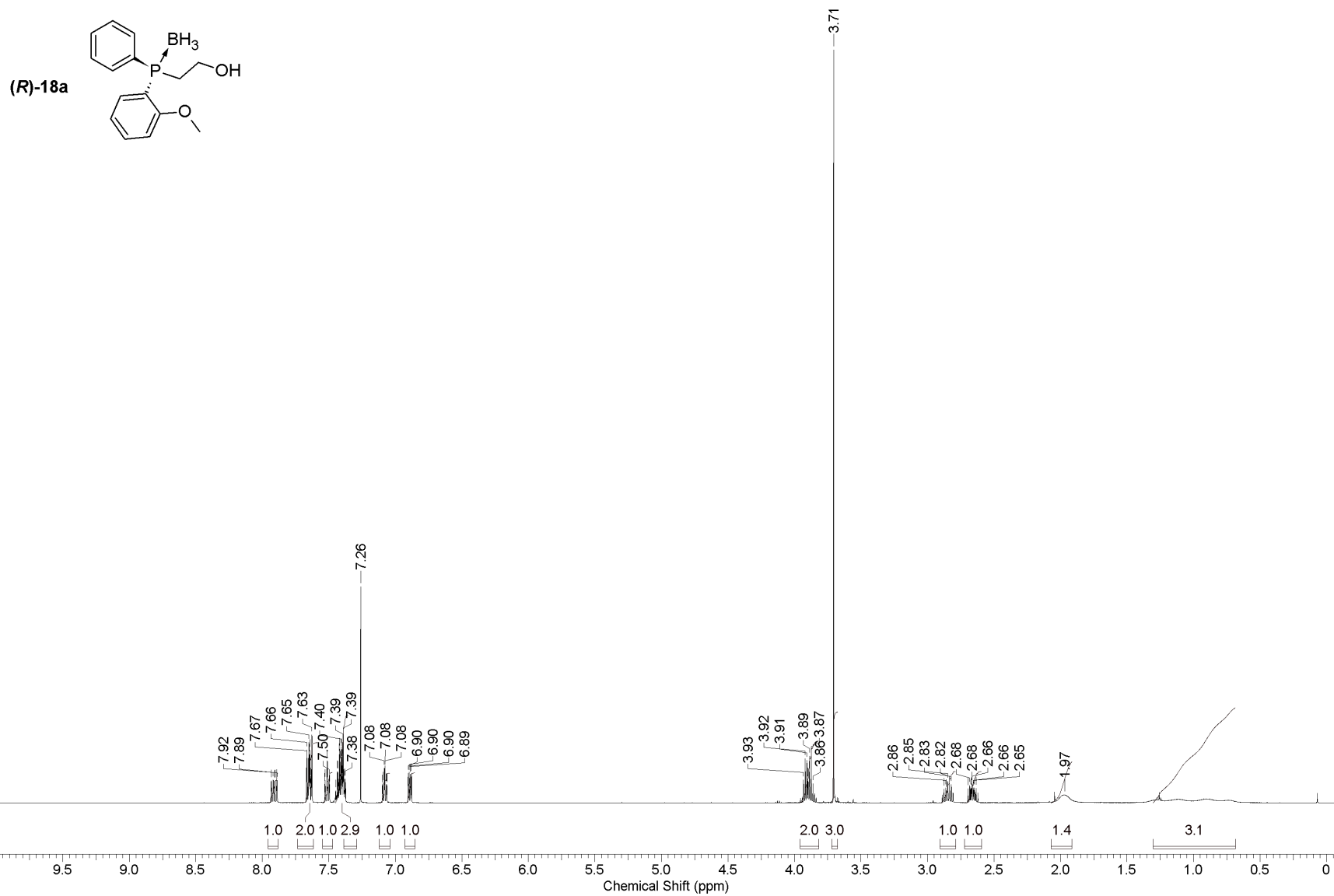
¹H NMR spectrum of (R)-*t*-butyl(hydroxymethyl)phenylphosphine-borane (R)-(2f) (500 MHz, CDCl₃)



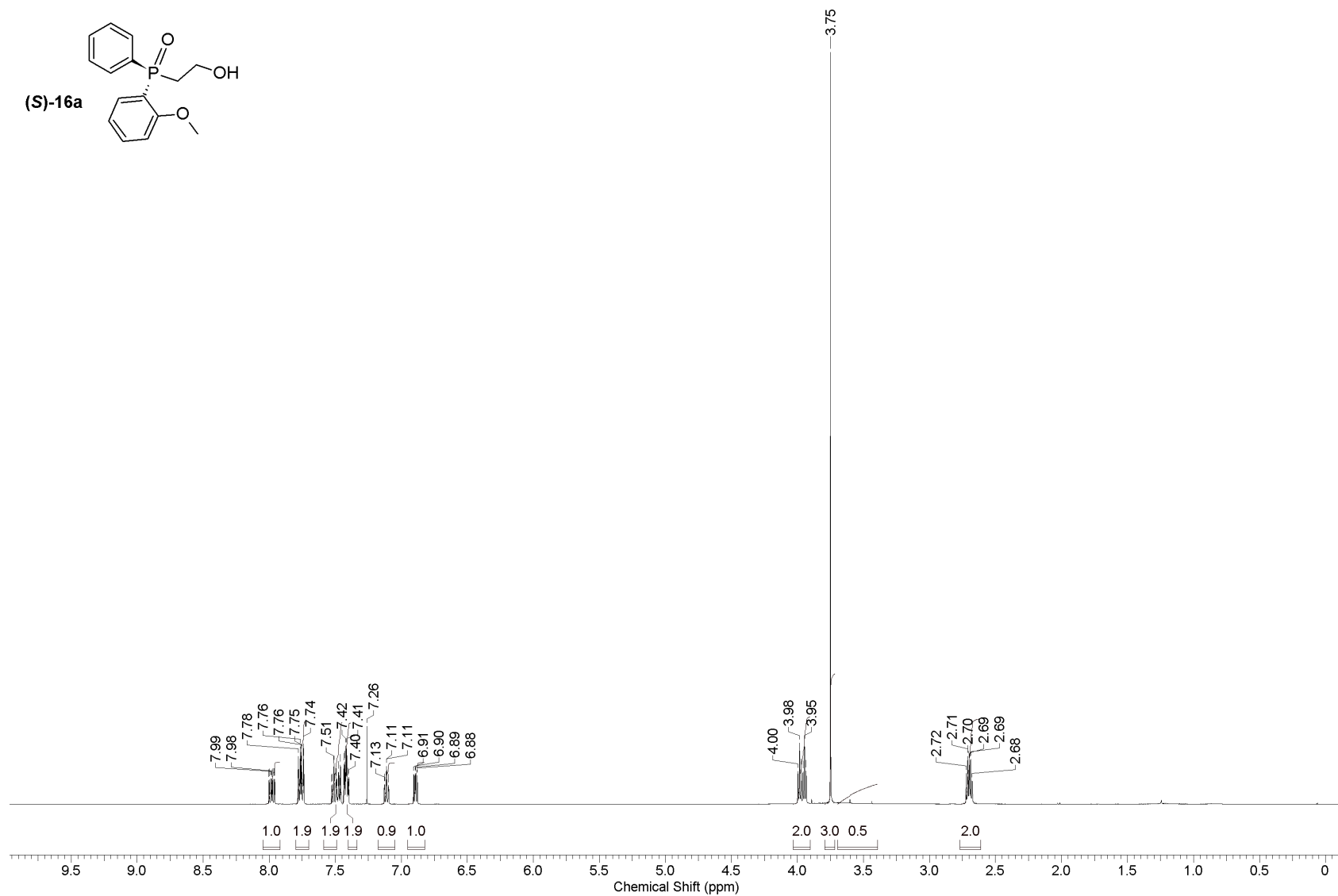
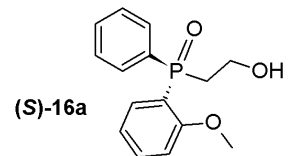
^1H NMR spectrum of (S)-*t*-butyl(methoxymethyl)phenylphosphine-borane (S)-(24f) (500 MHz, CDCl_3)



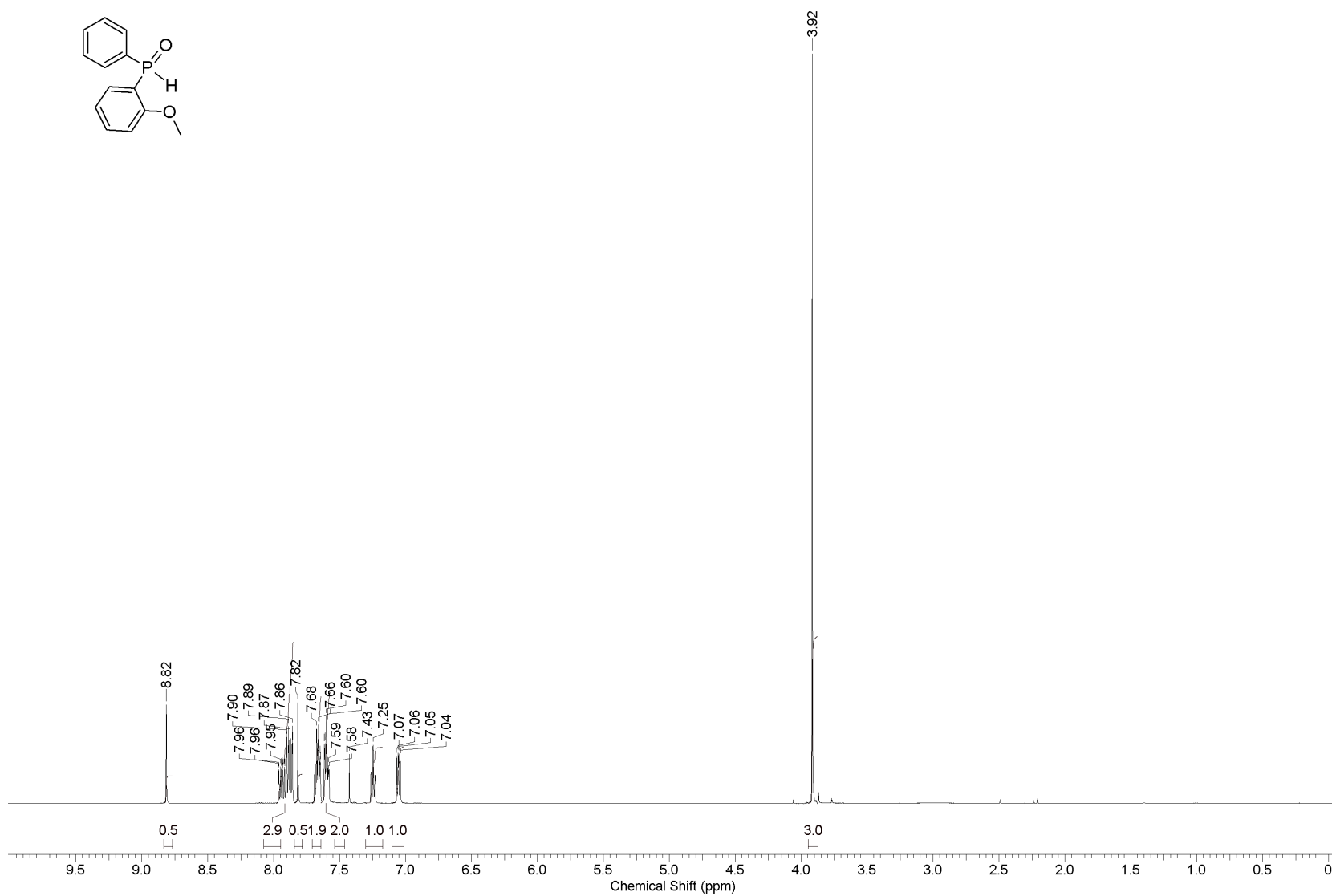
^1H NMR spectrum of (*R*)-*o*-anisyl(2-hydroxyethyl)phenylphosphine oxide (*R*)-(**16a**) (500 MHz, CDCl_3)



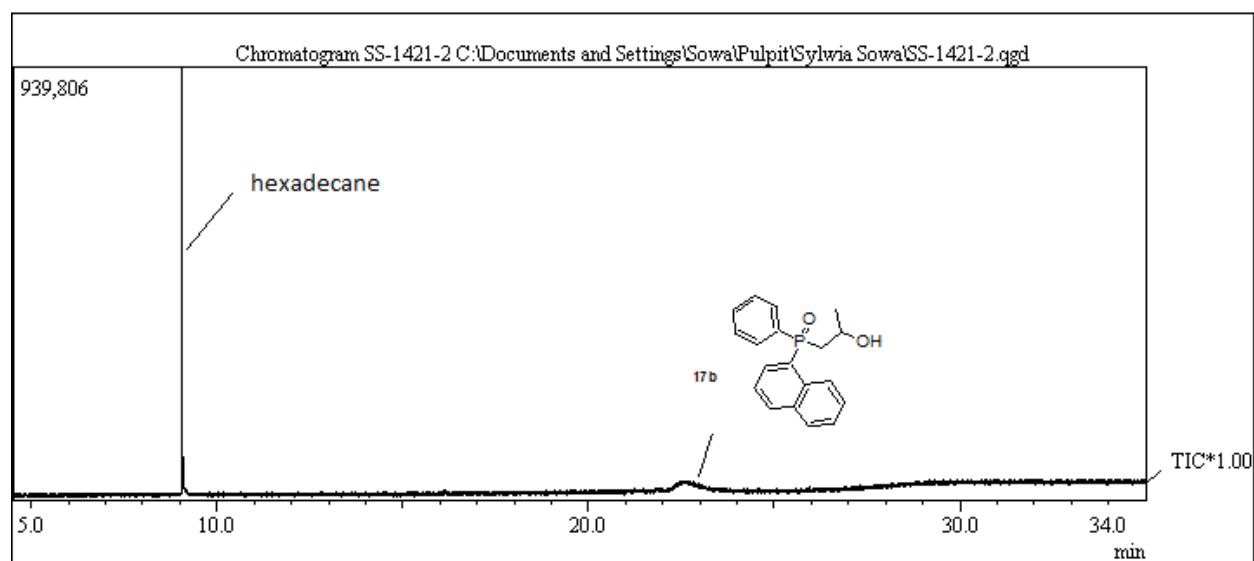
^1H NMR spectrum of (*R*)-*o*-anisyl(hydroxyethyl)phenylphosphine-borane (*R*)-(**18a**) (500 MHz, CDCl_3)



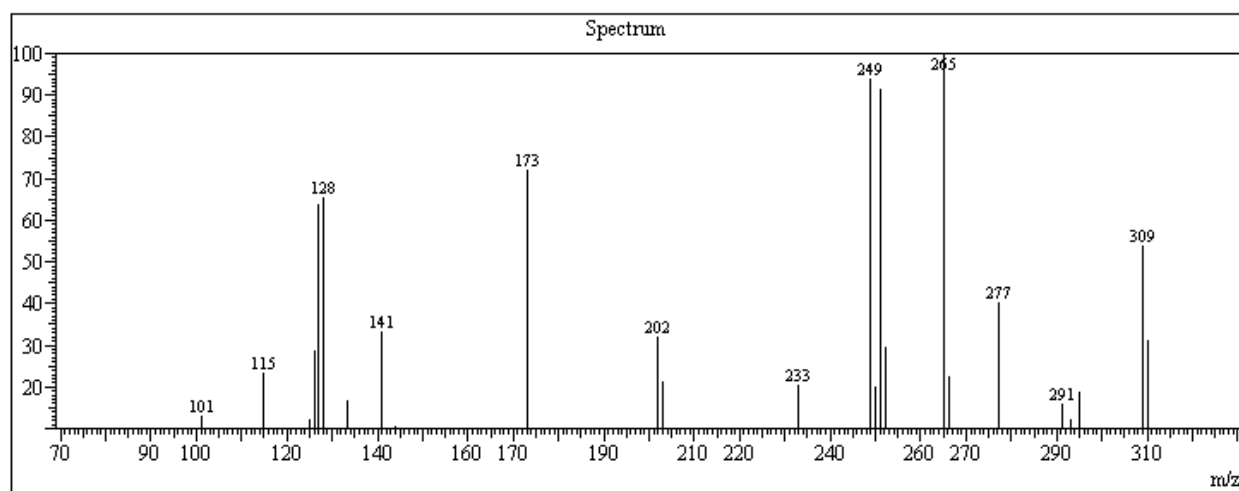
^1H NMR spectrum of (S)-*o*-anisyl(2-hydroxyethyl)phenylphosphine oxide (S)-(**16a**) (500 MHz, CDCl_3)



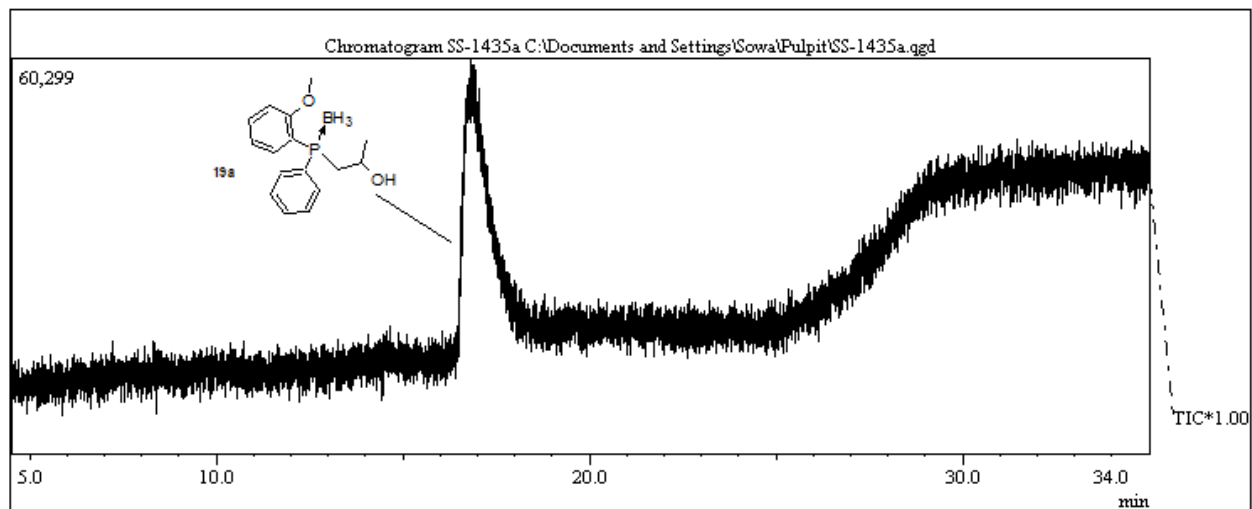
¹H NMR spectrum of *o*-anisylphenylphosphine oxide (500 MHz, CDCl₃)



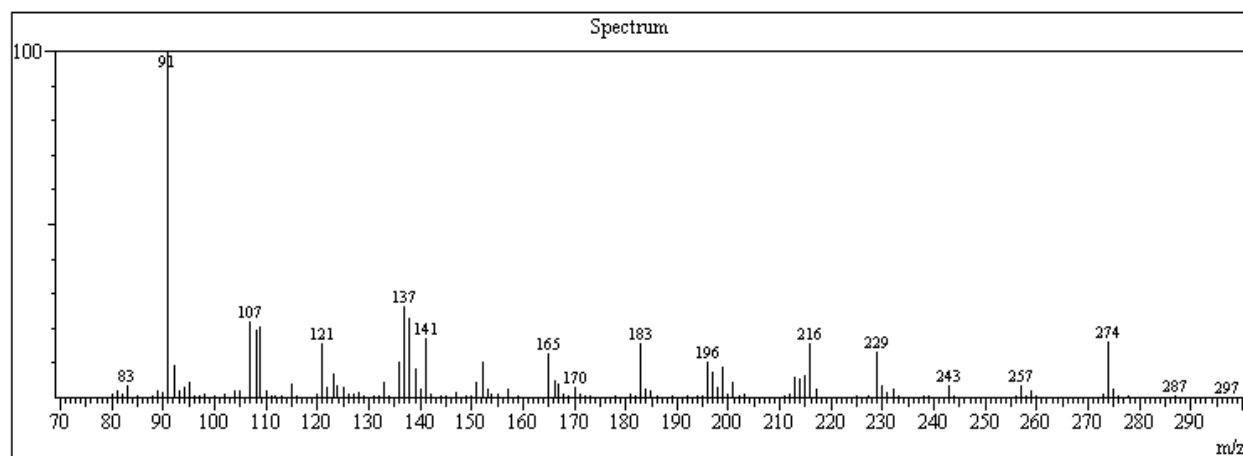
GC chromatogram of (2-hydroxypropyl)(1-naphthyl)phenylphosphine oxide (**17b**) (method 35 min with internal standard hexadecane)



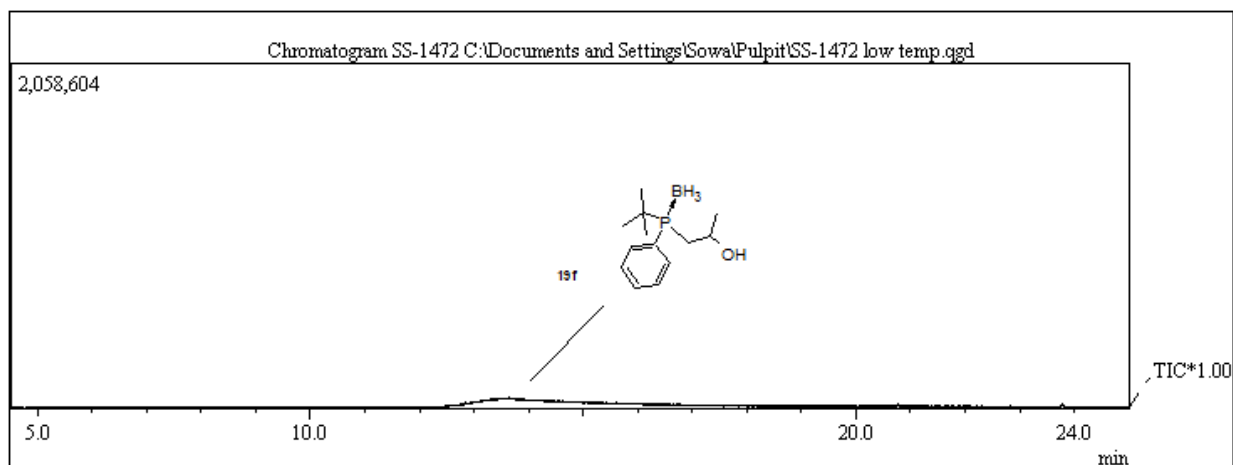
MS spectrum of (2-hydroxypropyl)(1-naphthyl)phenylphosphine oxide (**17b**)



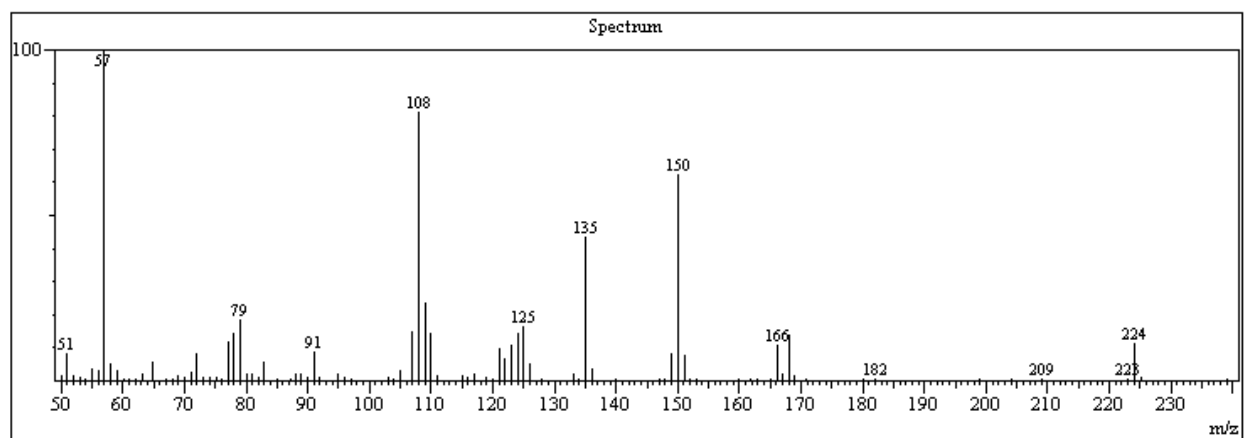
GC chromatogram of *o*-anisyl(2-hydroxypropyl)phenylphosphine-borane (**19a**) (method 35 min)



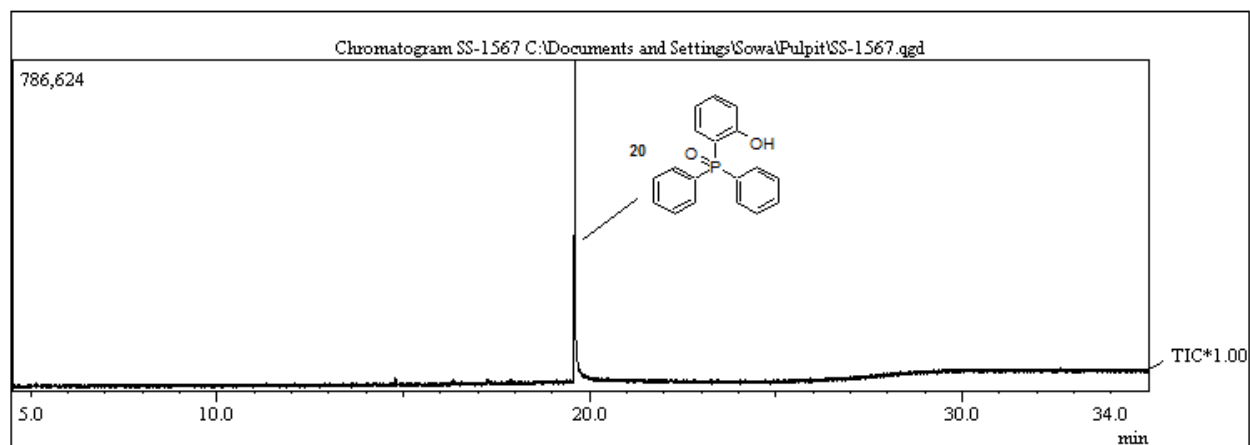
MS spectrum of *o*-anisyl(2-hydroxypropyl)phenylphosphine-borane (**19a**)



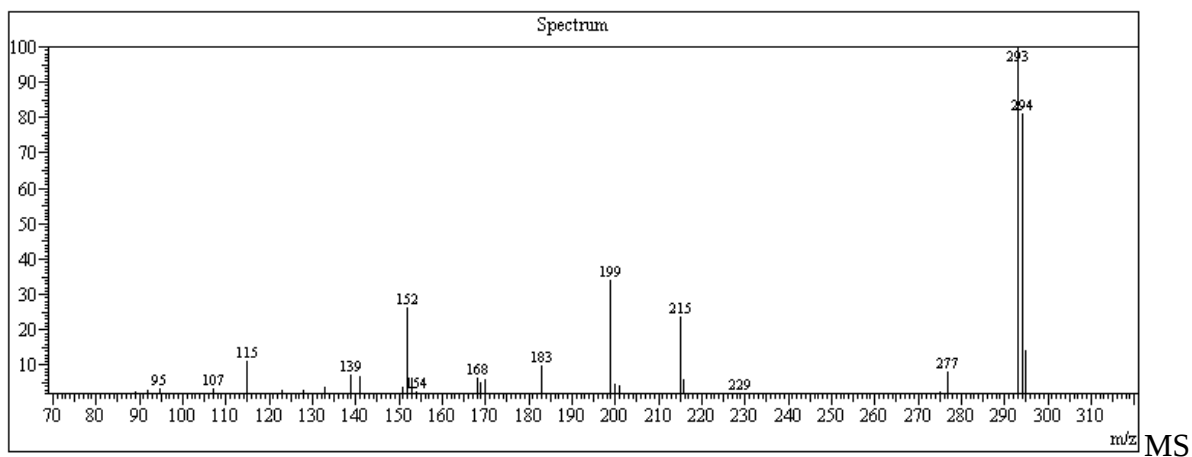
GC chromatogram of *t*-butyl(2-hydroxypropyl)phenylphosphine-borane (**19f**) (method 25 min)



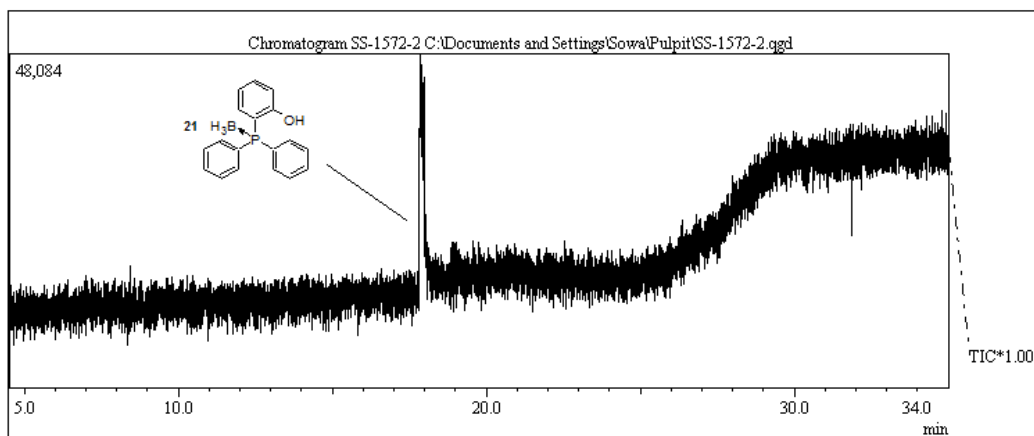
MS spectrum of *t*-butyl(2-hydroxypropyl)phenylphosphine-borane (**19f**)



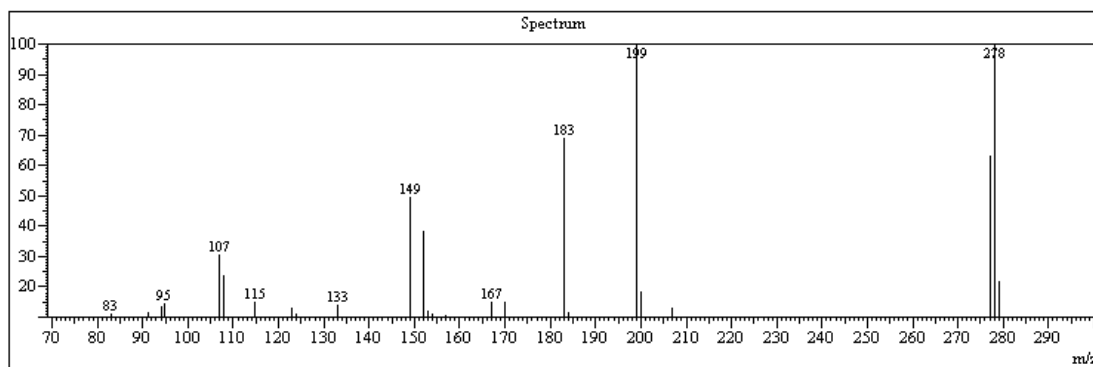
GC chromatogram of (*ortho*-hydroxyphenyl)diphenyl phosphine oxide (**20**) (method 35 min)



spectrum of (*ortho*-hydroxyphenyl)diphenyl phosphine oxide (20)

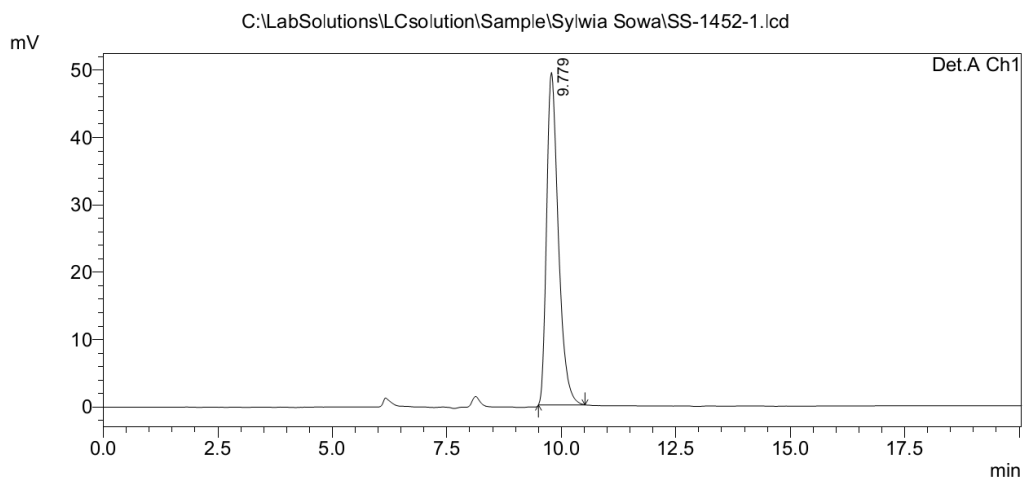


GC chromatogram of (*ortho*-hydroxyphenyl)diphenyl phosphine-borane (21) (method 35 min)



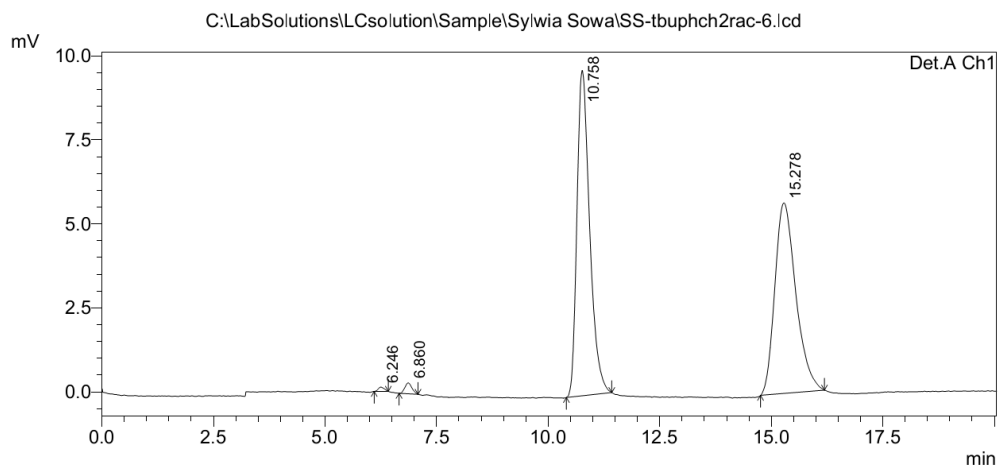
MS spectrum of (*ortho*-hydroxyphenyl)diphenyl phosphine-borane (21)

<Chromatogram>



Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.779	879720	49350	100.000	100.000
Total		879720	49350	100.000	100.000

HPLC chromatogram of (*R*)-**1f** (eluent: 90:10 hexane-isopropanol; flow rate: 1mL; method 20 min) (Daicel Chiralpack AS-H column)

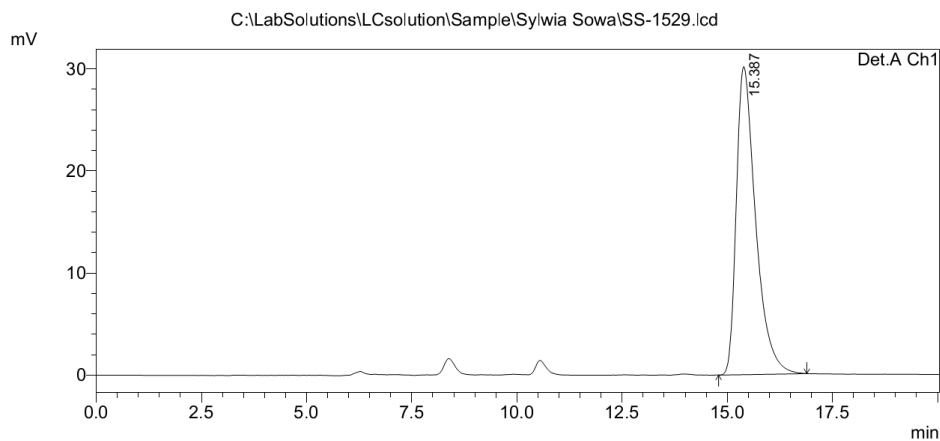


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.246	1171	129	0.307	0.817
2	6.860	3556	323	0.932	2.046
3	10.758	191541	9680	50.204	61.245
4	15.278	185258	5673	48.557	35.892
Total		381525	15806	100.000	100.000

HPLC chromatogram of rac-**1f** (eluent: 90:10 hexane-*i*-PrOH; flow rate: 1mL; method 20 min) (Daicel Chiralpack AS-H column)

<Chromatogram>

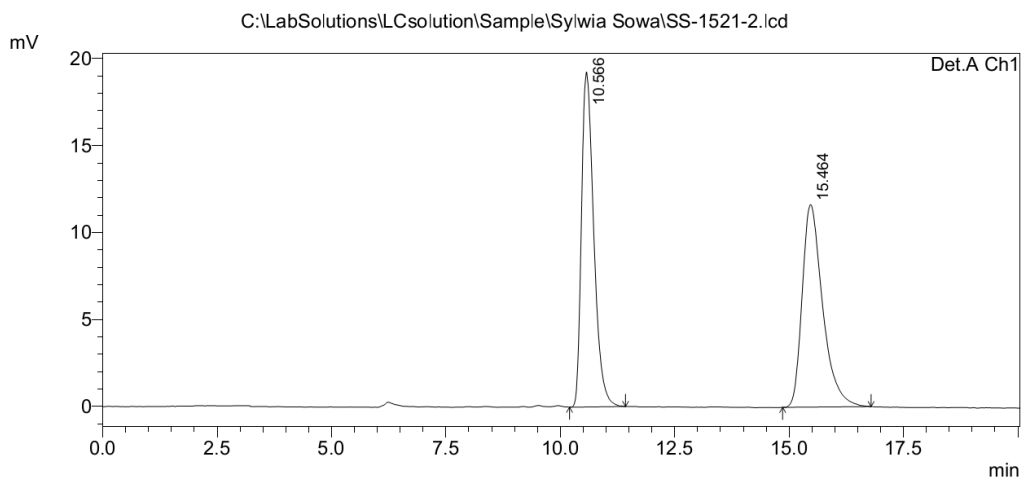


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.387	963916	30189	100.000	100.000
Total		963916	30189	100.000	100.000

HPLC chromatogram of (*R*)-**24f** (eluent: 90:10 hexane- *i*-PrOH; flow rate: 1 mL; method 20 min) (Daicel Chiralpack AS-H column)

<Chromatogram>

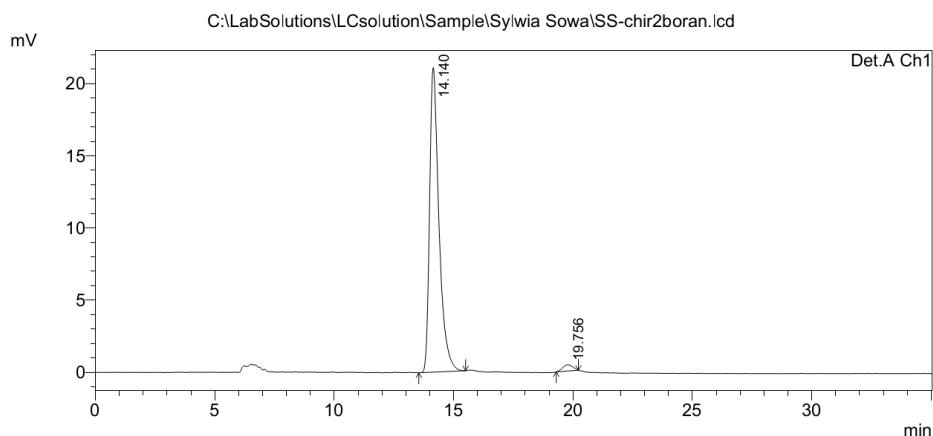


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.566	360004	19256	49.845	62.316
2	15.464	362241	11644	50.155	37.684
Total		722245	30900	100.000	100.000

HPLC chromatogram of rac-**24f** (eluent: 90:10 hexane- *i*-PrOH; flow rate: 1 mL; method 20 min) (Daicel Chiralpack AS-H column)

<Chromatogram>



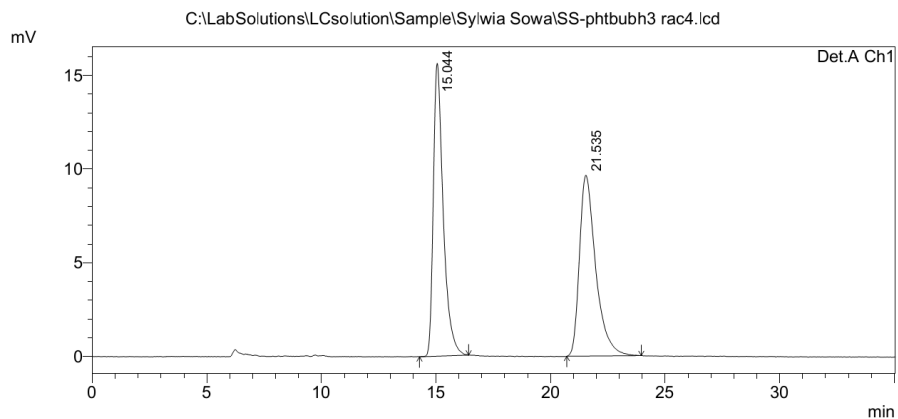
PeakTable

Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.140	574631	21106	100.000	100.000
Total		574631	21106	100.000	100.000

HPLC chromatogram of (R)-(2f) (eluent: 90:10 hexane *i*-PrOH; flow rate: 1 mL; method 35 min) (Daicel Chiralpack AS-H column)

<Chromatogram>

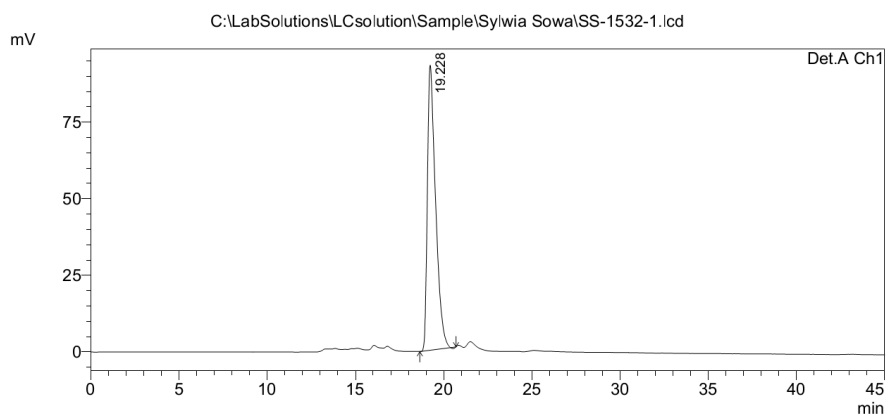


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.044	469658	15637	49.703	61.833
2	21.535	475264	9652	50.297	38.167
Total		944922	25289	100.000	100.000

HPLC chromatogram of rac-(2f) (eluent: 90:10 hexane-*i*-PrOH; flow rate: 1 mL; method 35 min) (Daicel Chiralpack AS-H column)

<Chromatogram>



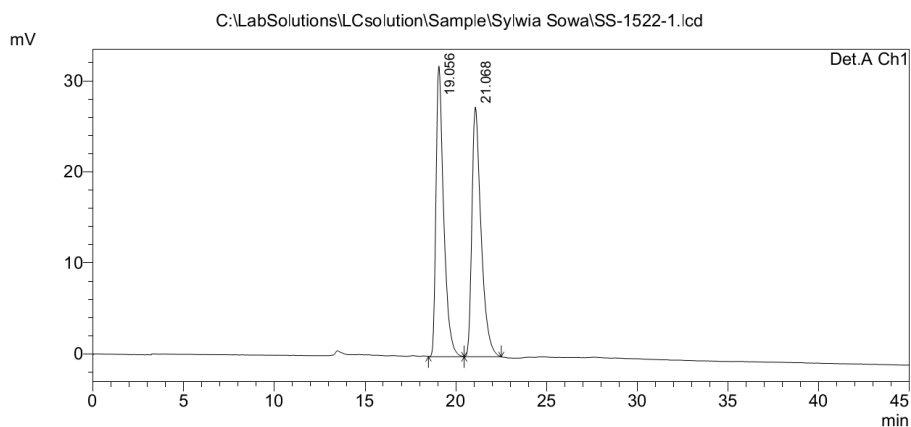
PeakTable

Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.228	2984143	93092	100.000	100.000
Total		2984143	93092	100.000	100.000

HPLC chromatogram of (*R*)-**25f** (eluent: 90:10 hexane-*i*-PrOH; flow rate: 0.5 mL; method 45 min) (Daicel Chiralpack AS-H column)

<Chromatogram>



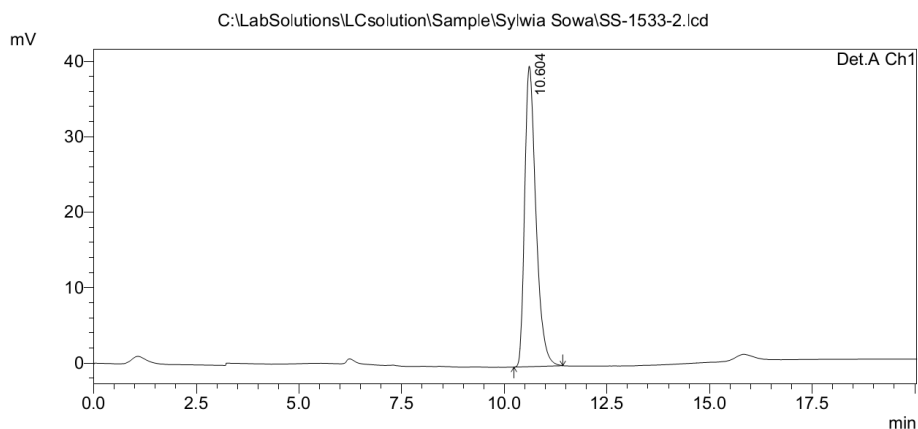
PeakTable

Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.056	940969	31932	49.390	53.793
2	21.068	964207	27429	50.610	46.207
Total		1905175	59361	100.000	100.000

HPLC chromatogram of rac-**25f** (eluent: 90:10 hexane-*i*-PrOH; flow rate: 0.5 mL; method 45 min) (Daicel Chiralpack AS-H column)

<Chromatogram>

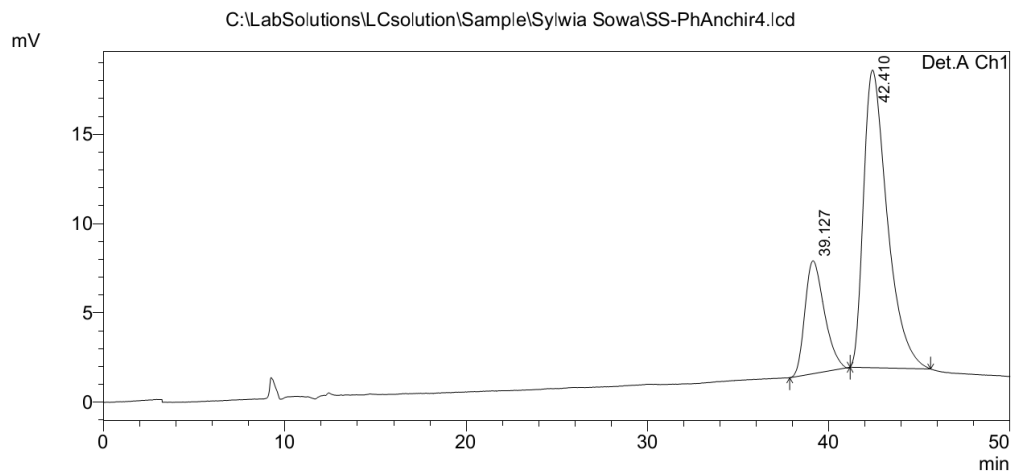


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.604	756454	39848	100.000	100.000
Total		756454	39848	100.000	100.000

HPLC chromatogram of (S)-**24f** (eluent: 90:10 hexane-*i*-PrOH; flow rate: 1 mL; method 20 min)
(Daicel Chiralpack AS-H column)

<Chromatogram>

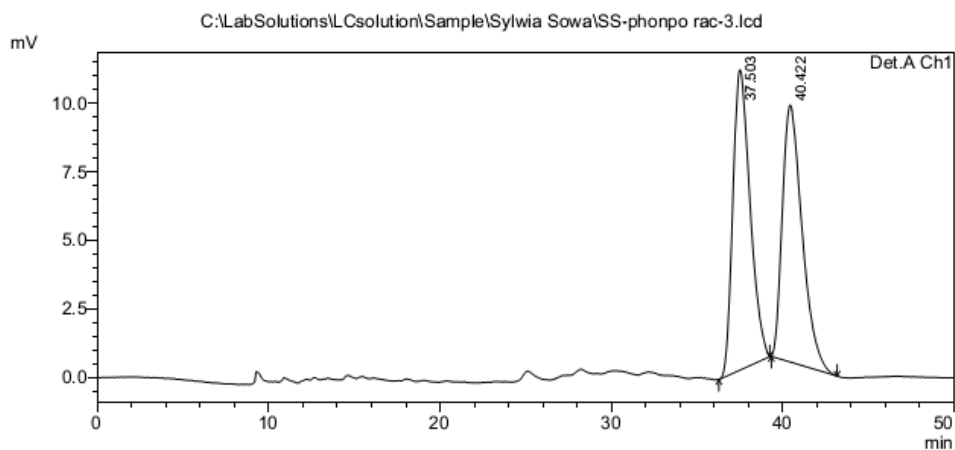


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	39.127	470555	6320	23.693	27.510
2	42.410	1515475	16655	76.307	72.490
Total		1986029	22975	100.000	100.000

HPLC chromatogram of (R)-**16a** (eluent: 90:5:5 hexane-*i*-PrOH-EtOH; flow rate: 0.5 mL;
method 50 min) (Daicel Chiralpack AS-H column)

<Chromatogram>

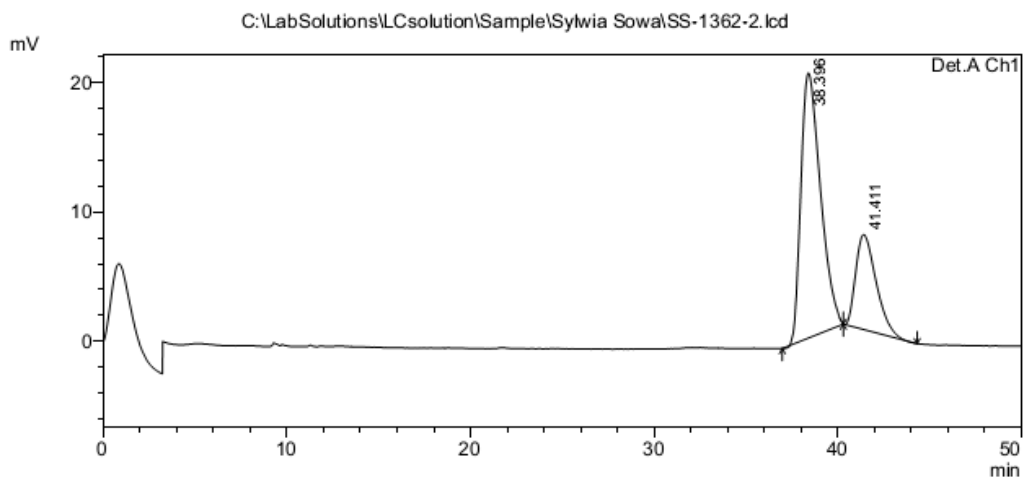


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	37.503	765206	10954	50.481	53.885
2	40.422	750628	9374	49.519	46.115
Total		1515834	20328	100.000	100.000

HPLC chromatogram of rac-**16a** (eluent: 90:5:5 hexane-*i*-PrOH-EtOH; flow rate: 0.5 mL; method 50 min) (Daicel Chiralpack AS-H column)

<Chromatogram>

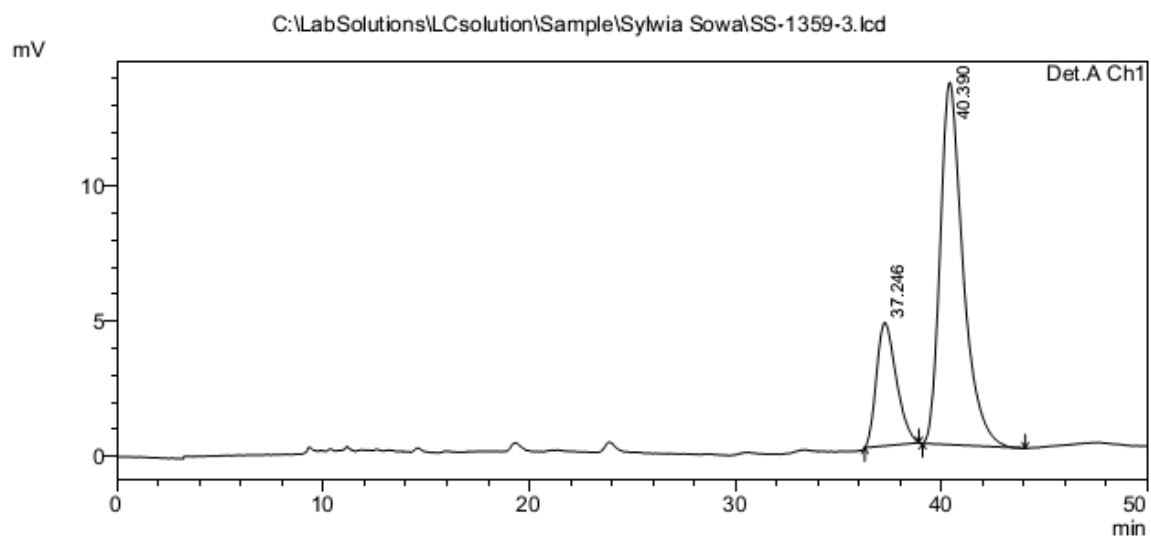


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	38.396	1512640	20493	72.691	73.604
2	41.411	568278	7349	27.309	26.396
Total		2080918	27842	100.000	100.000

HPLC chromatogram of (*S*)-**16a** (eluent: 90:10 hexane-*i*-PrOH-EtOH; flow rate: 0.5 mL; method 50 min) (Daicel Chiralpack AS-H column)

<Chromatogram>

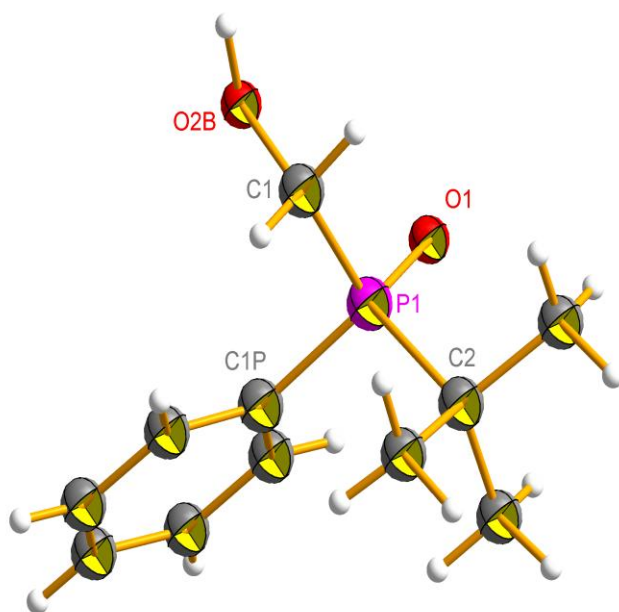
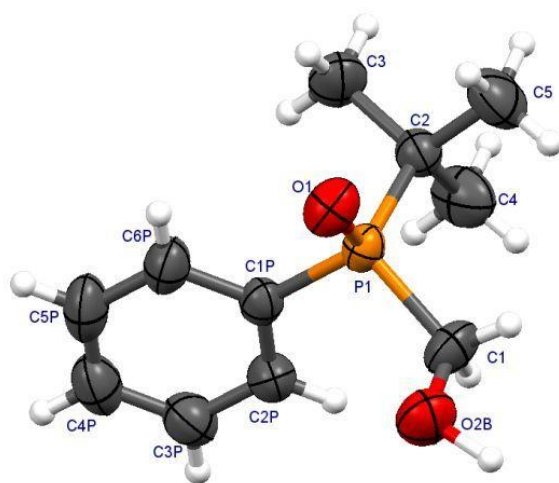


Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	37.246	306089	4568	22.866	25.412
2	40.390	1032520	13409	77.134	74.588
Total		1338609	17977	100.000	100.000

HPLC chromatogram of (*R*)-**(18a)** (eluent: 90:5:5 hexane-*i*-PrOH-EtOH; flow rate: 0.5 mL; method 50 min) (Daicel Chiralpack AS-H column)

Structure 1. X-Ray structure of (*R*)-**1f** Compound **CCDC 967625**. The absolute configuration of (*R*)-**1f** (CH_3OH) determined by a single crystal X-ray structural analysis. The absolute configuration at the phosphorus atom is *R*. (*R*)-(**1f**) crystallizes in the orthorhombic system, in the non-centrosymmetric space group $P2_12_12_1$, with unit cell dimensions $a = 6.195(1) \text{ \AA}$, $b = 9.733(1) \text{ \AA}$, $c = 19.016(2) \text{ \AA}$.



Structure 2. The crystal structure of (*R*)-*t*-butyl(hydroxymethyl)phenylphosphine oxide (*R*)-**1f**
(Compound CCDC 967625).

In the crystal structure the hydroxyl group is disordered over two positions as a result of the CH₂OH fragment rotation around the P1-O1 bond. The catemeric association of molecules is stabilized by the intermolecular hydrogen bonds (P=O...H-O).

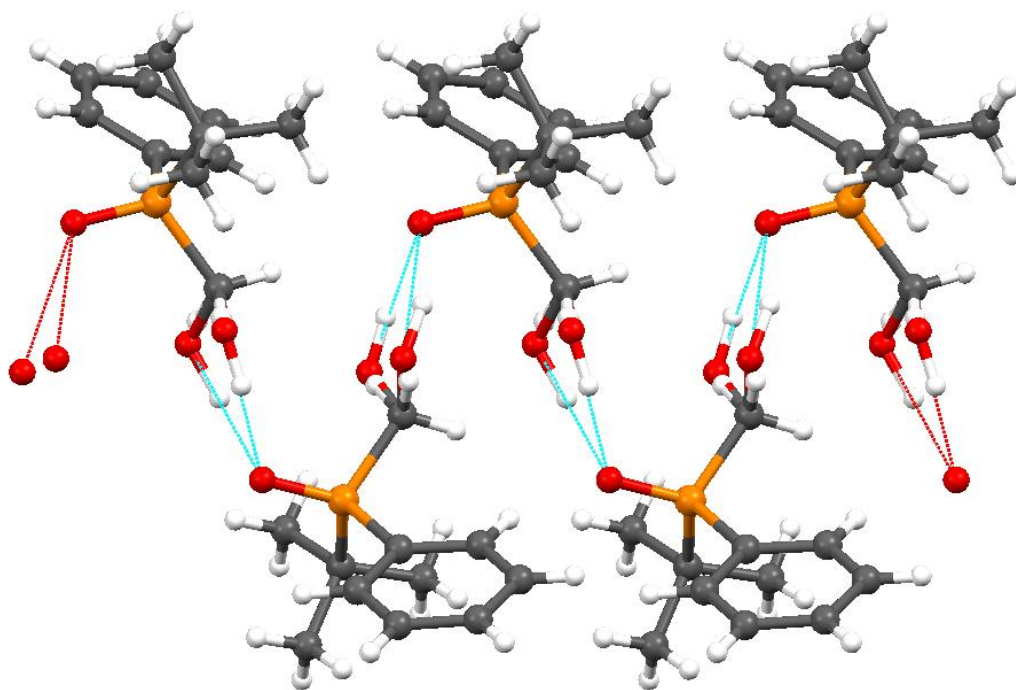


Table 1. Crystal data and structure refinement for (R)-**1f**.

Identification code	(R)- 1f	
Empirical formula	C ₁₁ H ₁₇ O ₂ P	
Formula weight	212.22	
Temperature	294(2) K	
Wavelength	1.54184 Å	
Crystal system	orthorhombic	
Space group	P 2 ₁ 2 ₁ 2 ₁	
Unit cell dimensions	a = 6.195(1) Å	a = 90°.
	b = 9.737(1) Å	b = 90°.
	c = 19.016(2) Å	g = 90°.
Volume	1147.1(2) Å ³	
Z	4	
Density (calculated)	1.229 g/cm ³	
Absorption coefficient	1.914 mm ⁻¹	
F(000)	456	
Crystal size	0.2 x 0.05 x 0.05 mm ³	
Theta range for data collection	4.65 to 68.20°.	
Index ranges	-7 ≤ h ≤ 7, -11 ≤ k ≤ 11, -22 ≤ l ≤ 22	
Reflections collected	17294	
Independent reflections	2083 [R(int) = 0.0442]	
Completeness to theta = 68.20°	99.6 %	

Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	1.00 and 0.6734
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	2083 / 0 / 139
Goodness-of-fit on F^2	1.063
Final R indices [$I > 2\sigma(I)$]	$R_1 = 0.0297$, $wR_2 = 0.0795$
R indices (all data)	$R_1 = 0.0313$, $wR_2 = 0.0814$
Absolute structure parameter	0.00(3)
Largest diff. peak and hole	0.24 and -0.19 e. Å ⁻³