

Base-free direct synthesis of alkynylphosphonates from alkynes and H-phosphonates catalyzed by Cu₂O.

Yanina Moglie,^{a,*} Evangelina Mascaró^a, Victoria Gutierrez^a, Francisco Alonso^b, and Gabriel Radivoy^{a,*}

^a *Instituto de Química del Sur, INQUISUR (CONICET-UNS), Departamento de Química, Universidad Nacional del Sur, Av. Alem 1253, 8000 Bahía Blanca, Argentina.*

^b *Departamento de Química Orgánica, Facultad de Ciencias and Instituto de Síntesis Orgánica (ISO), Universidad de Alicante, Apdo. 99, E-03080, Alicante, Spain.*

Supporting Information

Table of Contents

¹ H-, ¹³C- and ³¹P-NMR spectra of alkynylphosphonates 2a-2t.....S2-S34

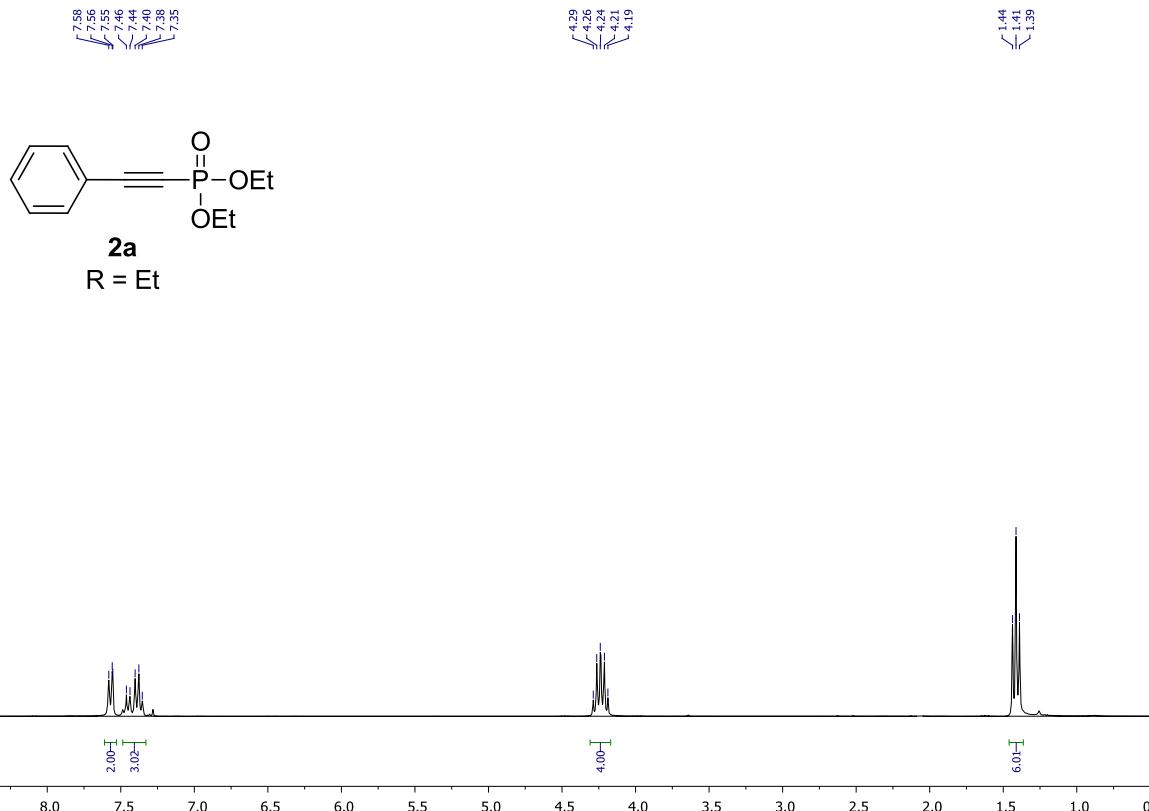


Figure 1. ^1H -NMR (300 MHz, CDCl_3).

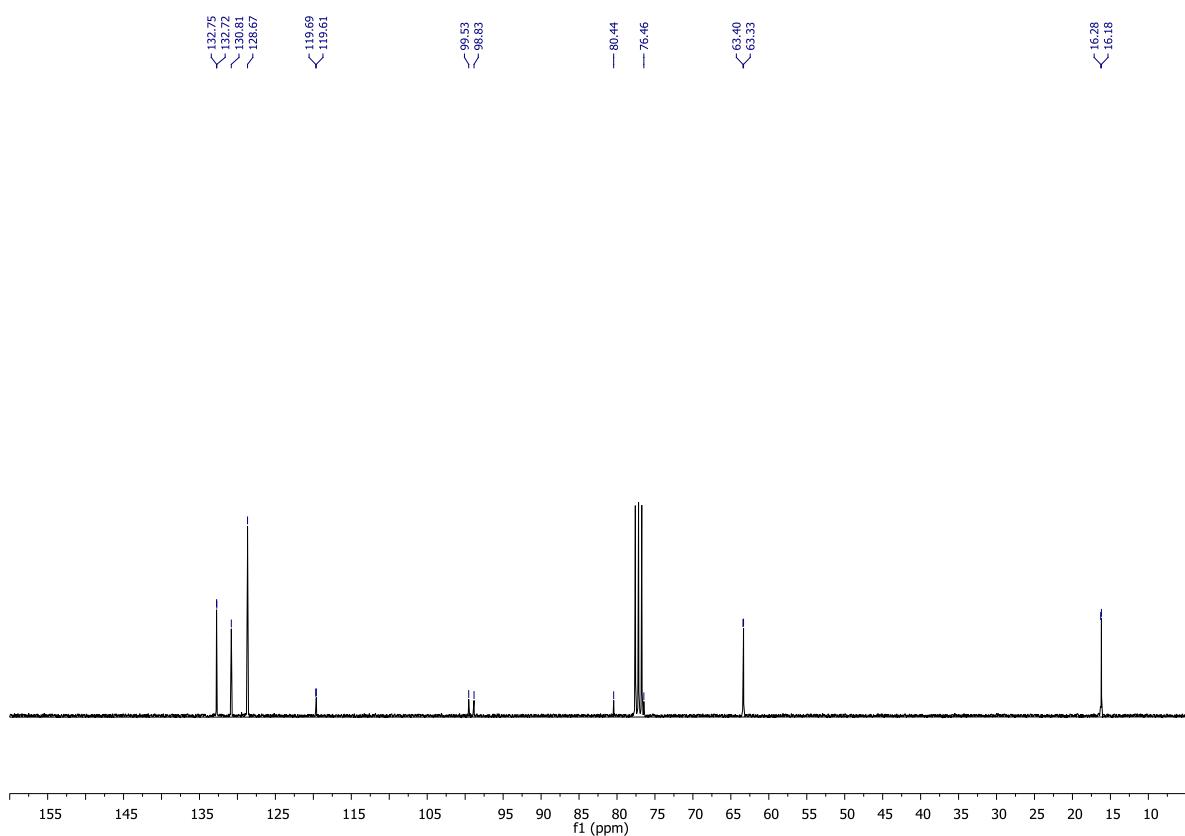


Figure 2. ^{13}C -NMR (75 MHz, CDCl_3).

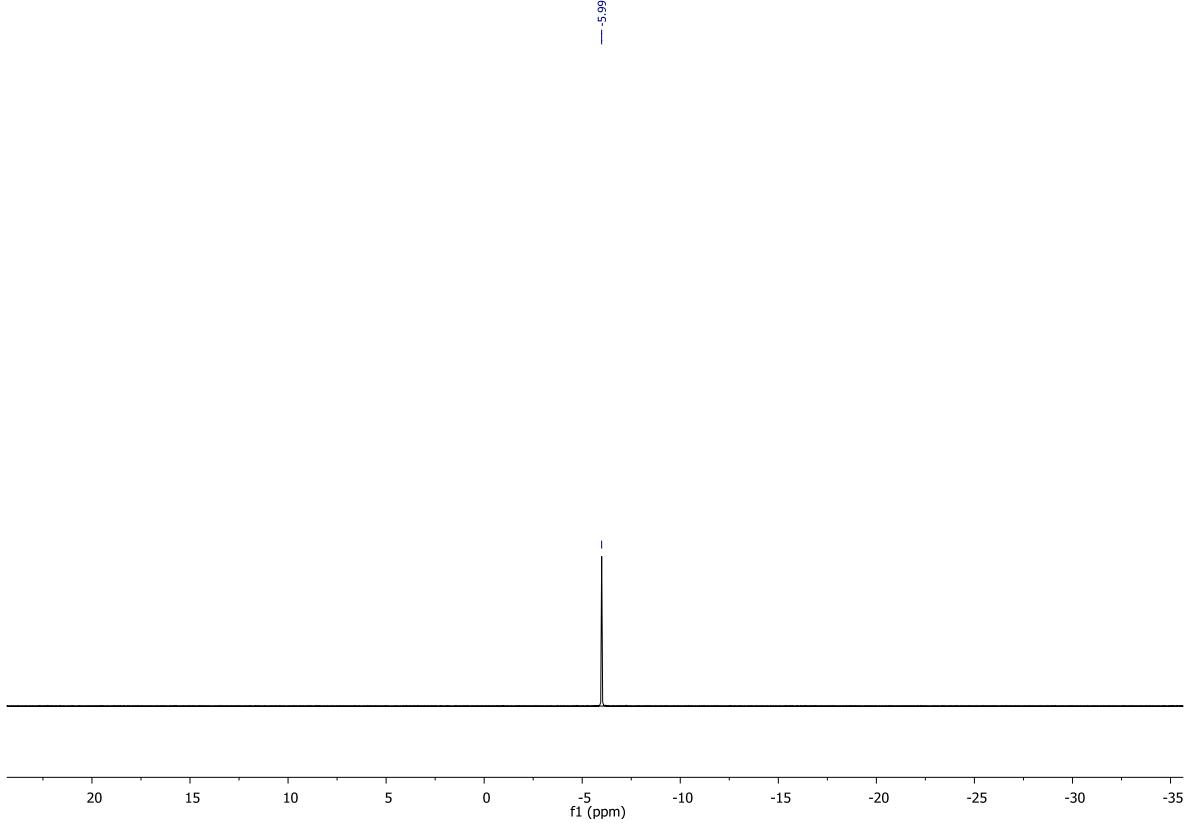


Figure 3. ^{31}P -NMR (121 MHz, CDCl_3).

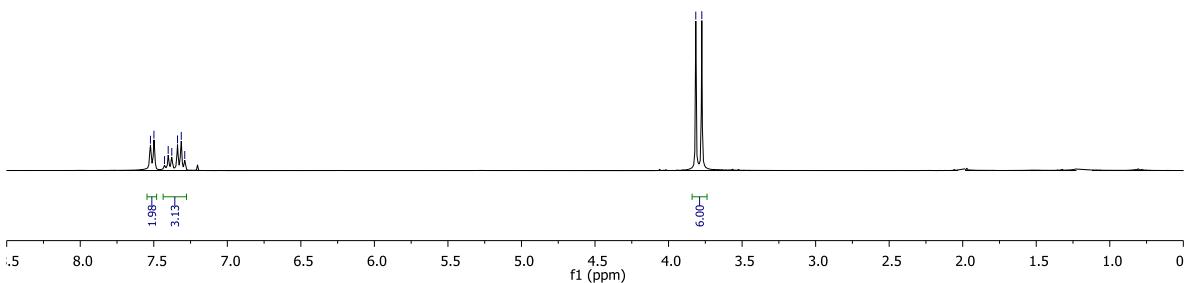
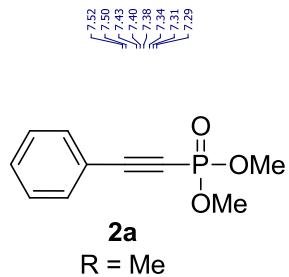


Figure 4. ^1H -NMR (300 MHz, CDCl_3).

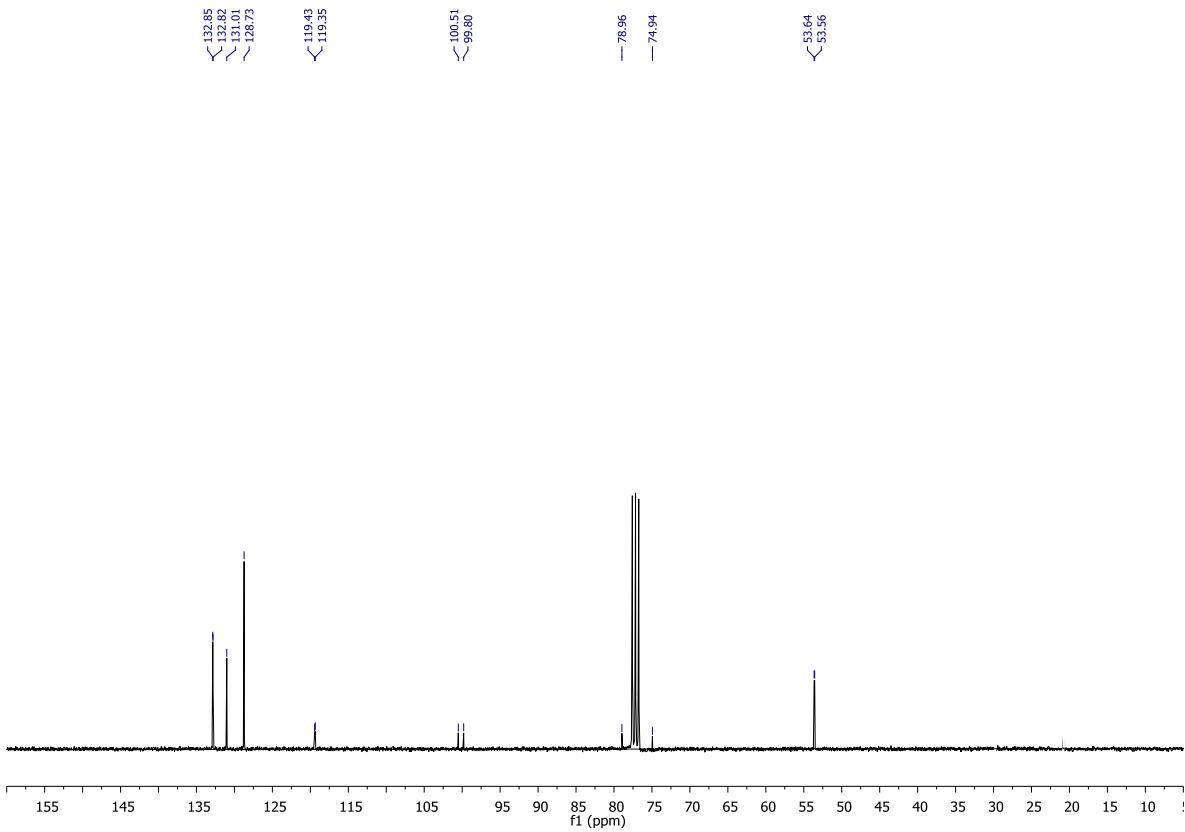


Figure 5. ^{13}C -NMR (75 MHz, CDCl_3).

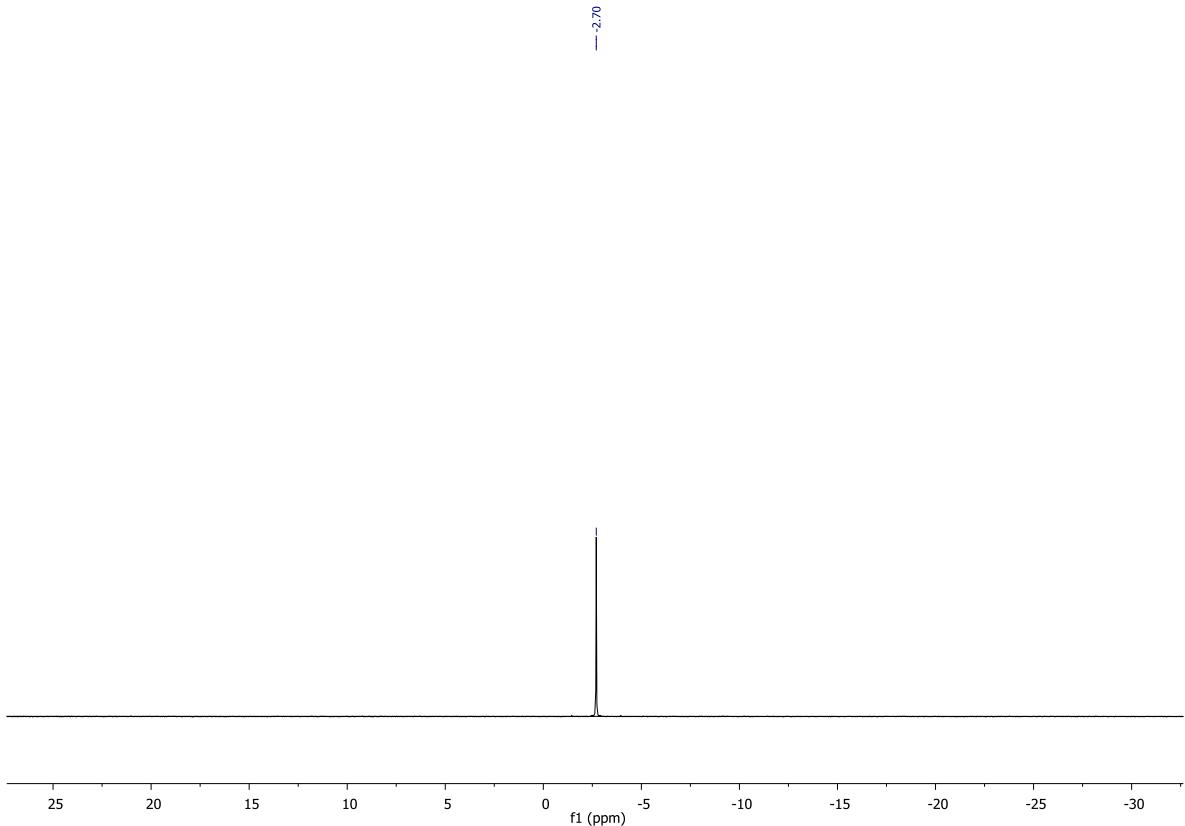


Figure 6. ^{31}P -NMR (121 MHz, CDCl_3).

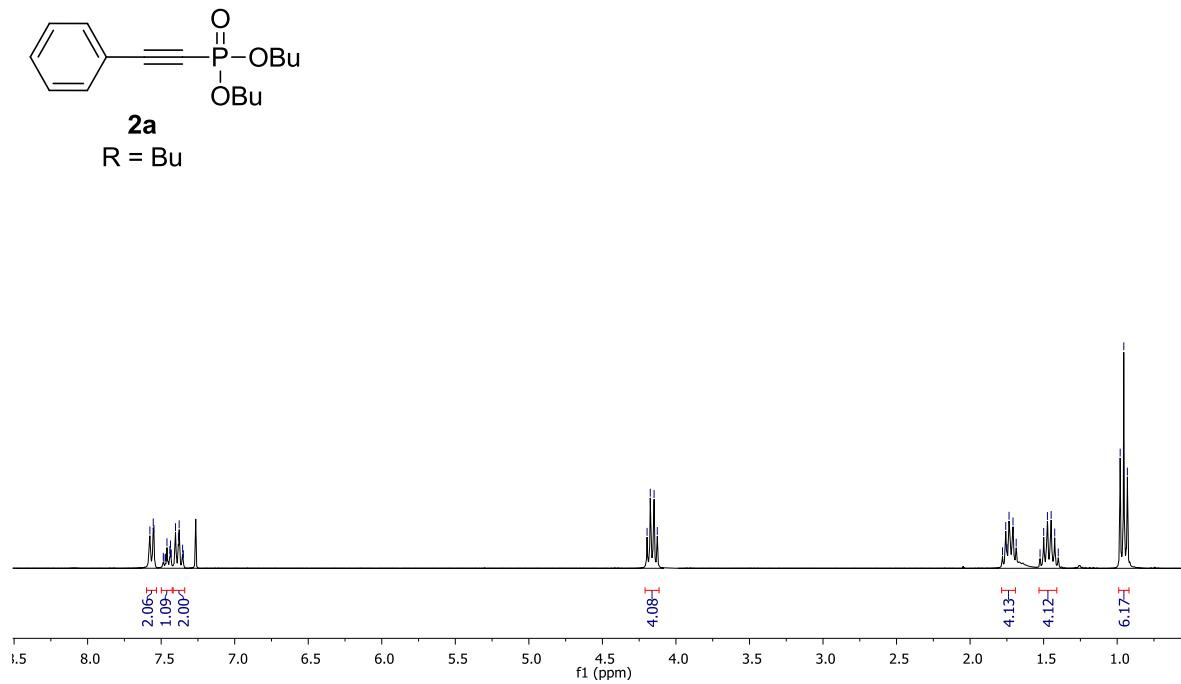


Figure 7. ¹H-NMR (300 MHz, CDCl₃).

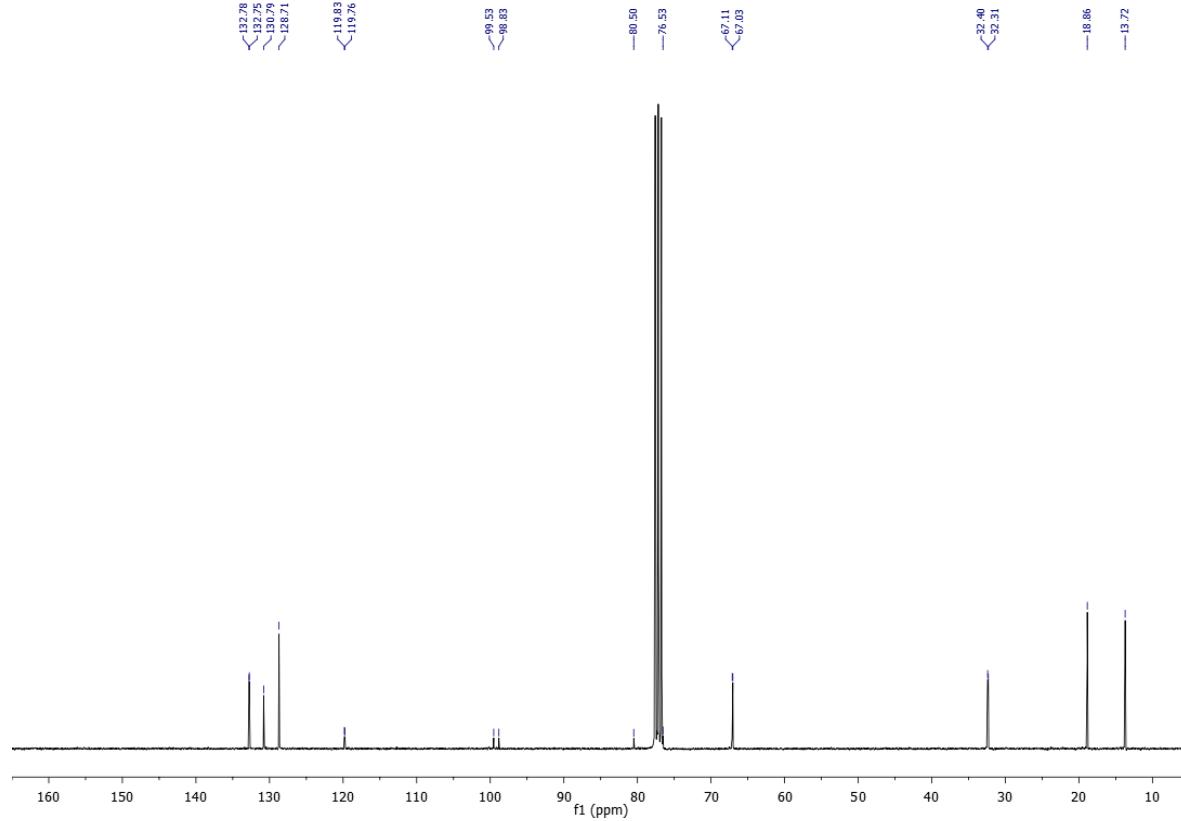


Figure 8. ¹³C-NMR (75 MHz, CDCl₃).

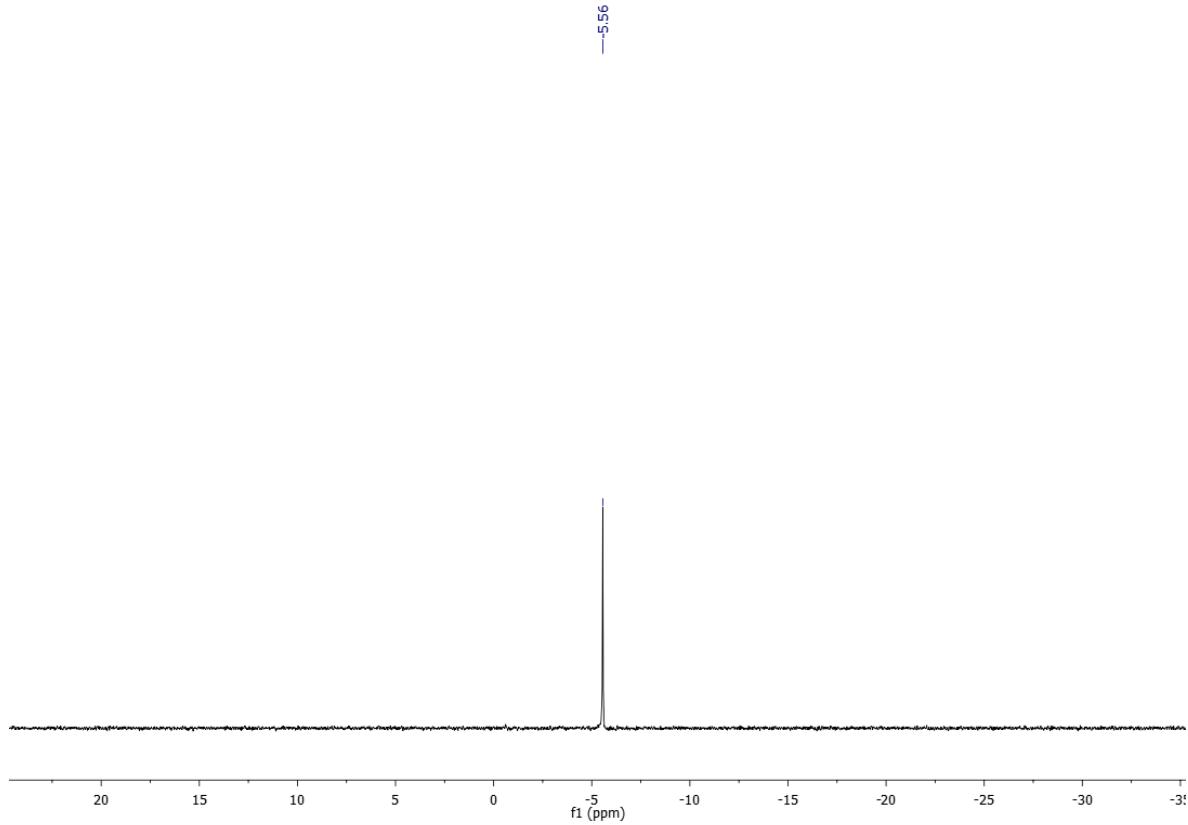


Figure 9. ^{31}P -NMR (121 MHz, CDCl_3).

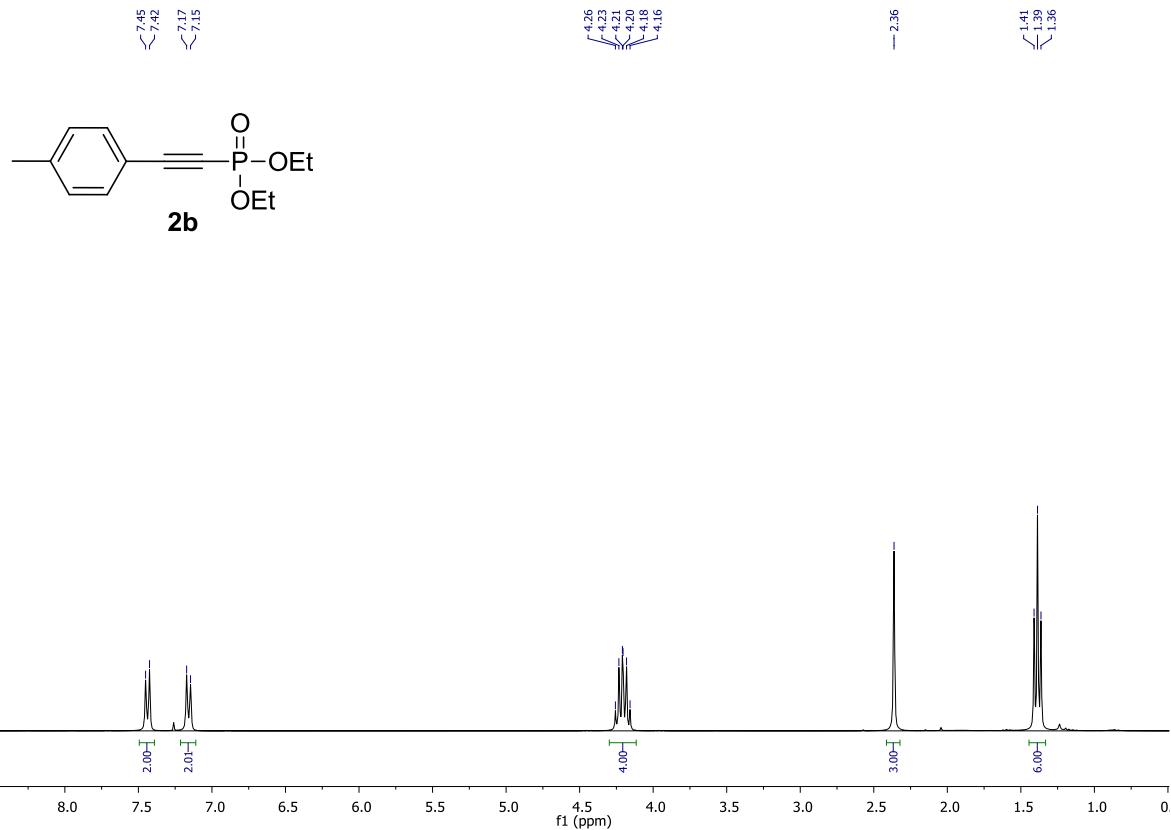


Figure 10. ^1H -NMR (300 MHz, CDCl_3).

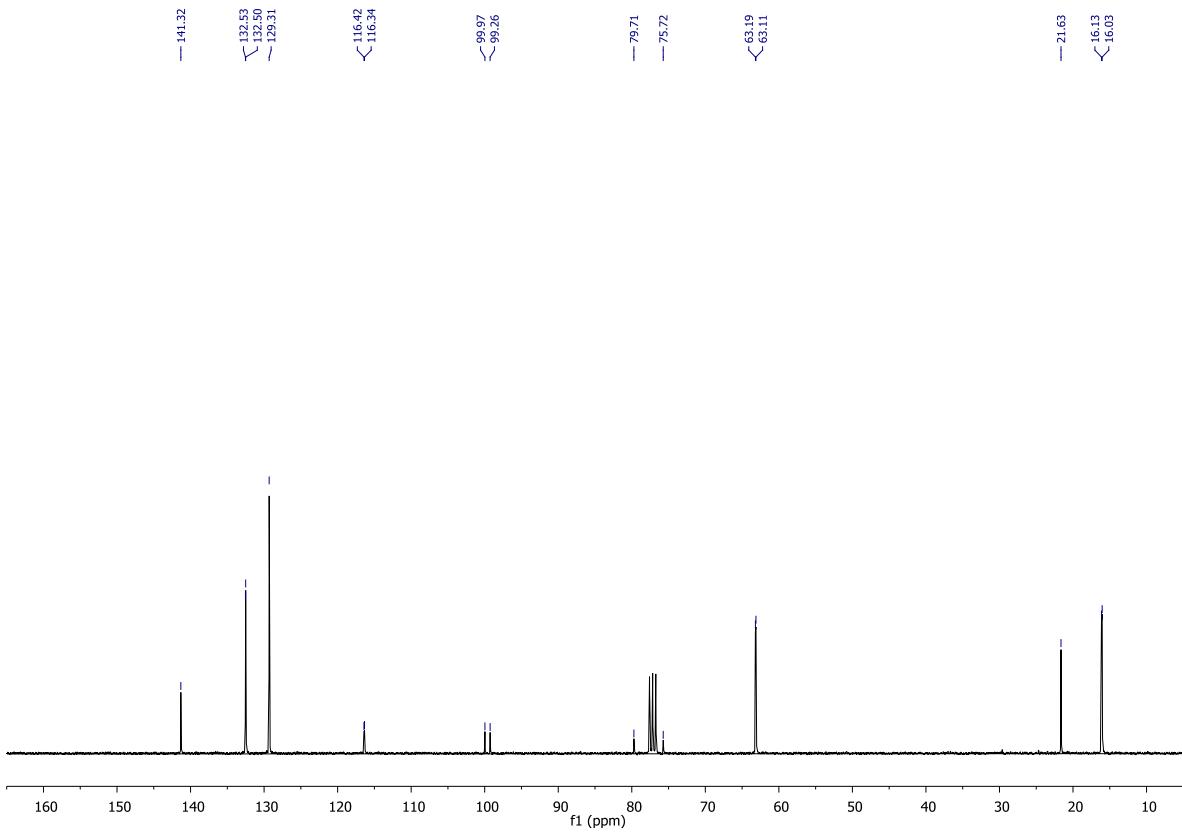


Figure 11. ^{13}C -NMR (75 MHz, CDCl_3).

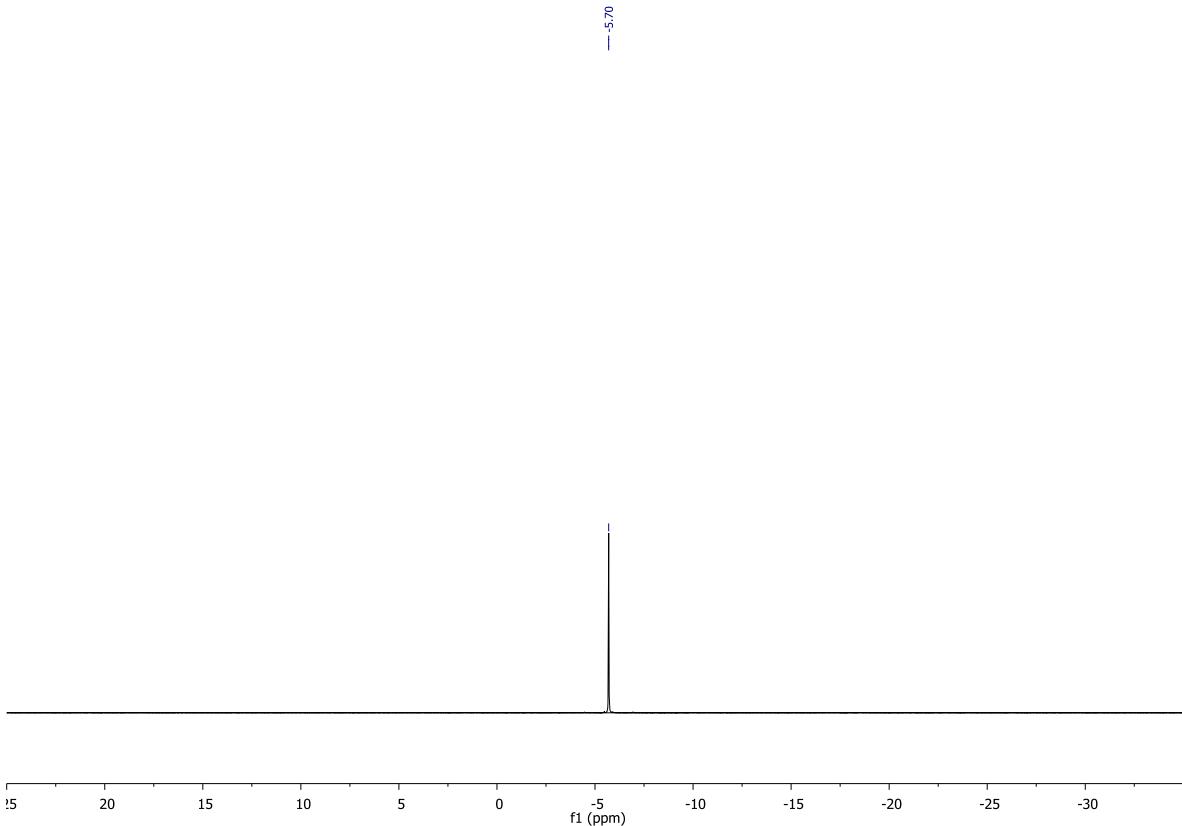


Figure 12. ^{31}P -NMR (121 MHz, CDCl_3).

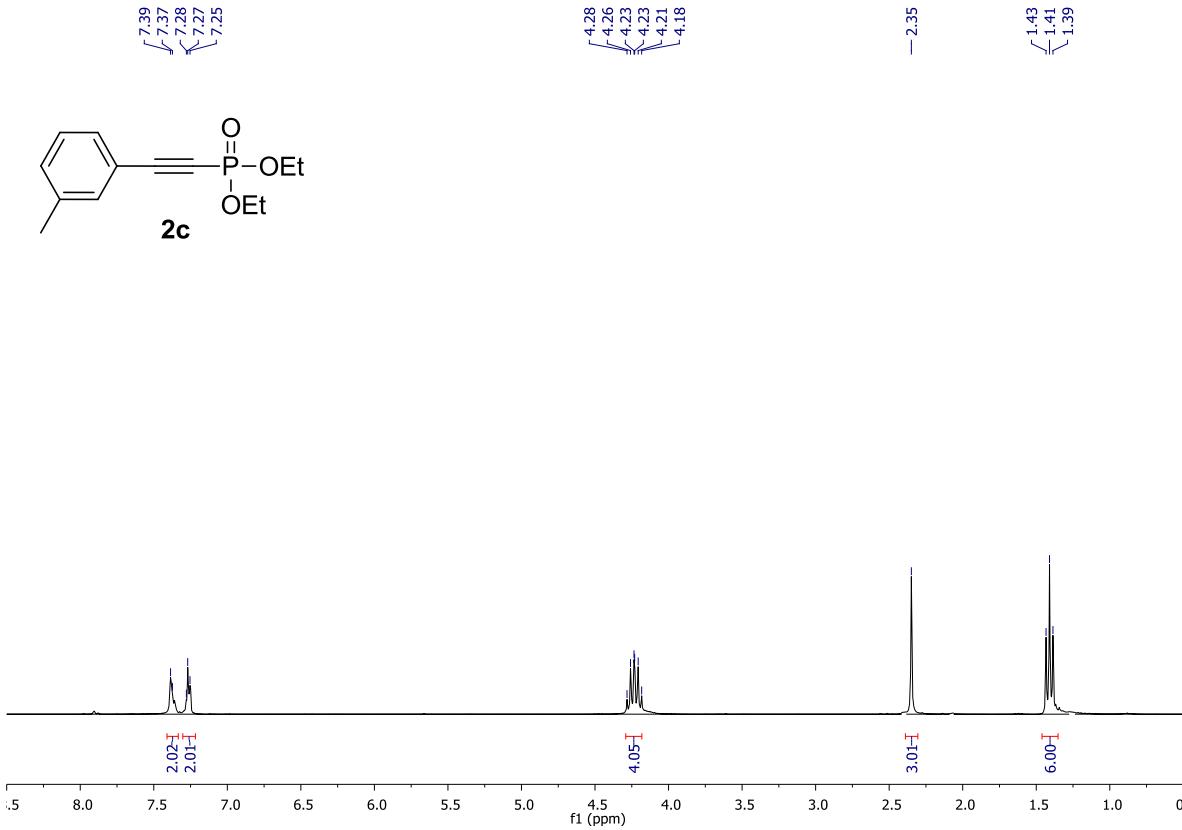


Figure 13. ¹H-NMR (300 MHz, CDCl₃).

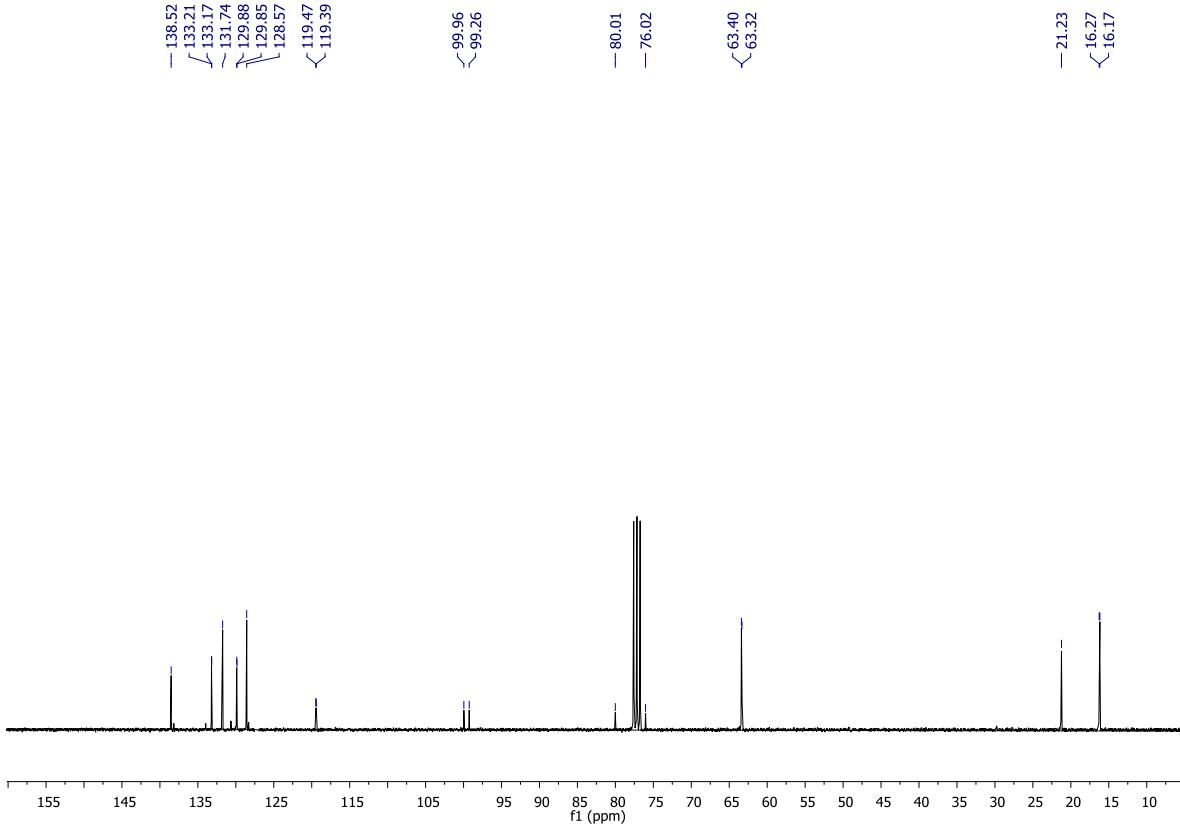


Figure 14. ¹³C-NMR (75 MHz, CDCl₃).

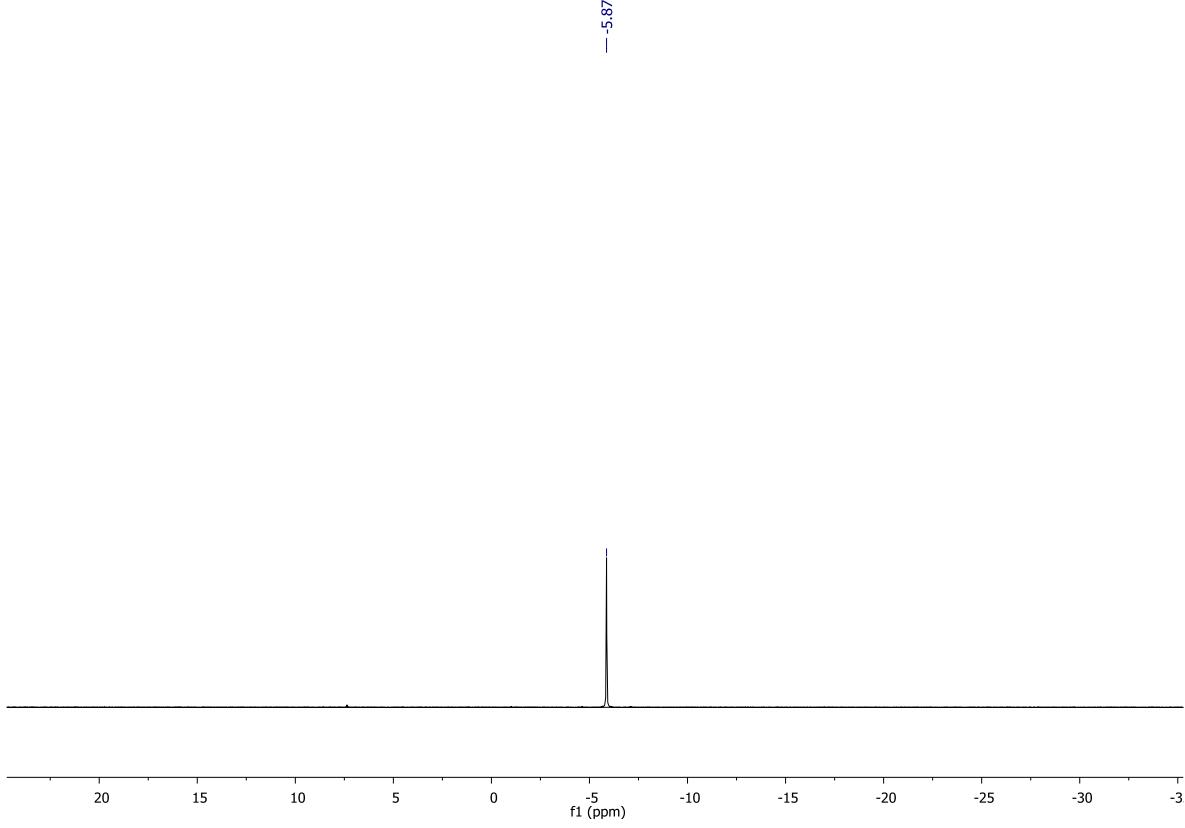


Figure 15. ^{31}P -NMR (121 MHz, CDCl_3).

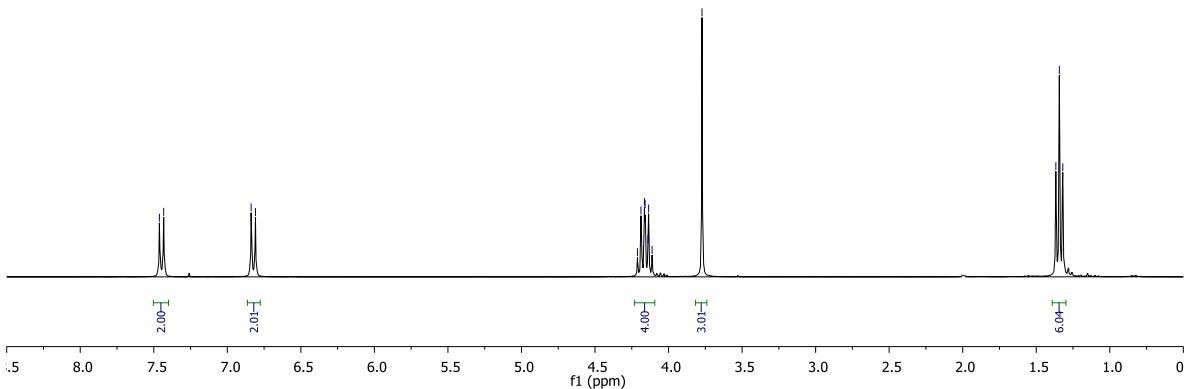
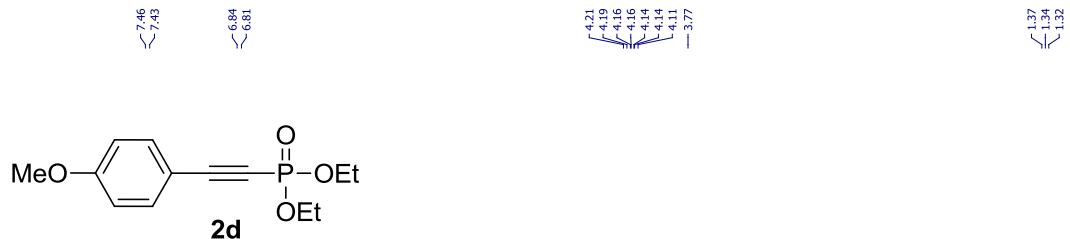


Figure 16. ^1H -NMR (300 MHz, CDCl_3).

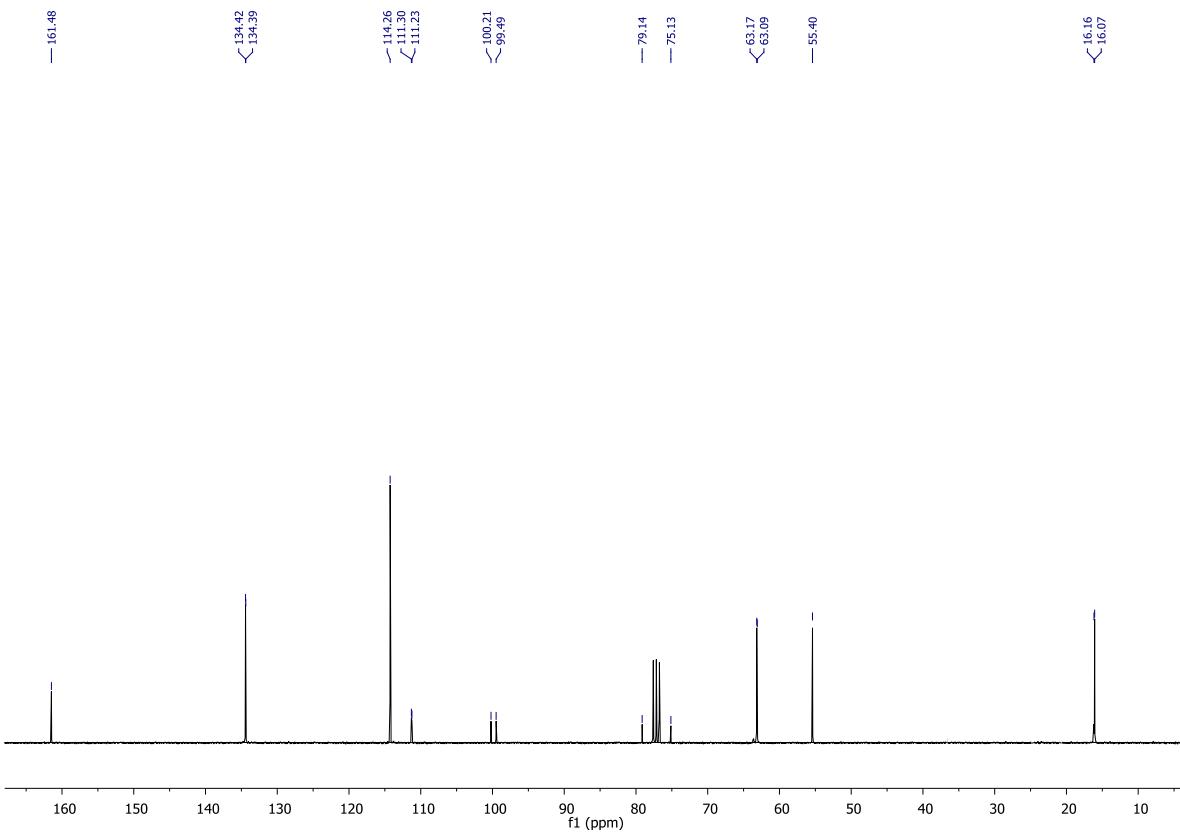


Figure 17. ^{13}C -NMR (75 MHz, CDCl_3).

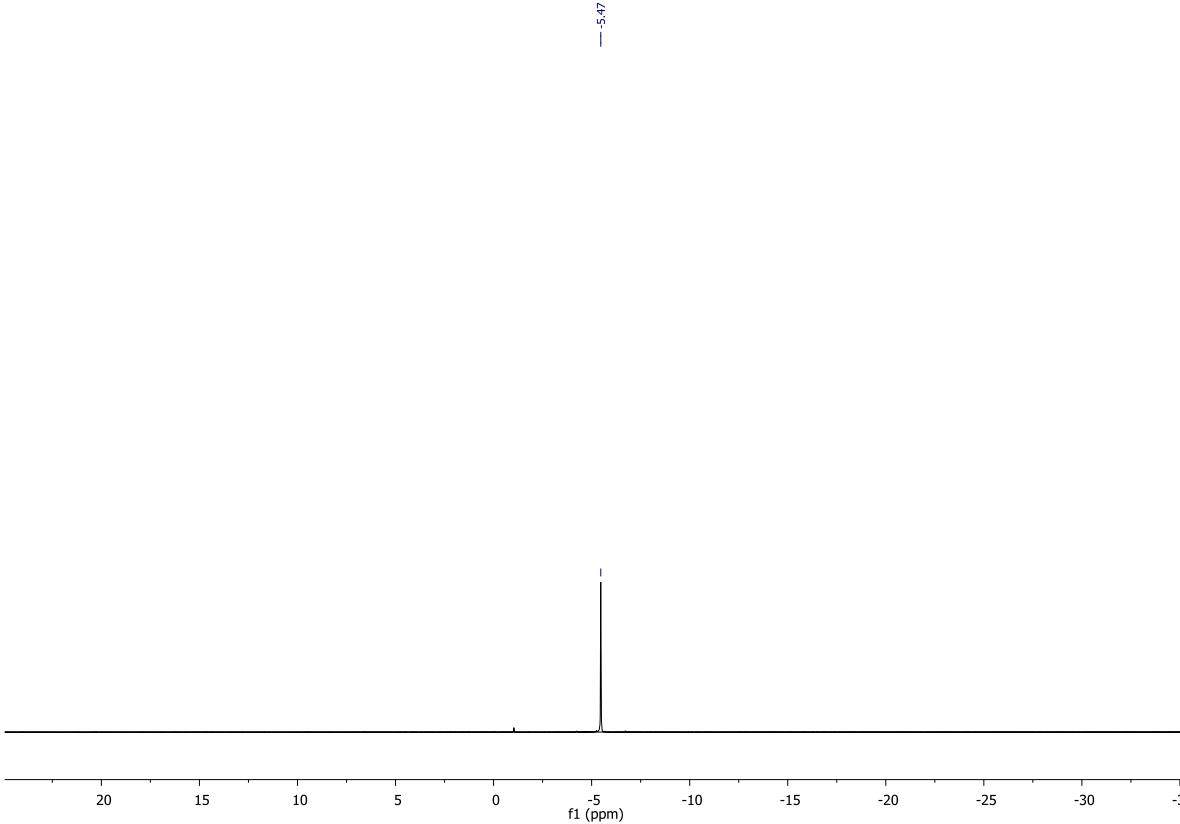


Figure 18. ^{31}P -NMR (121 MHz, CDCl_3).

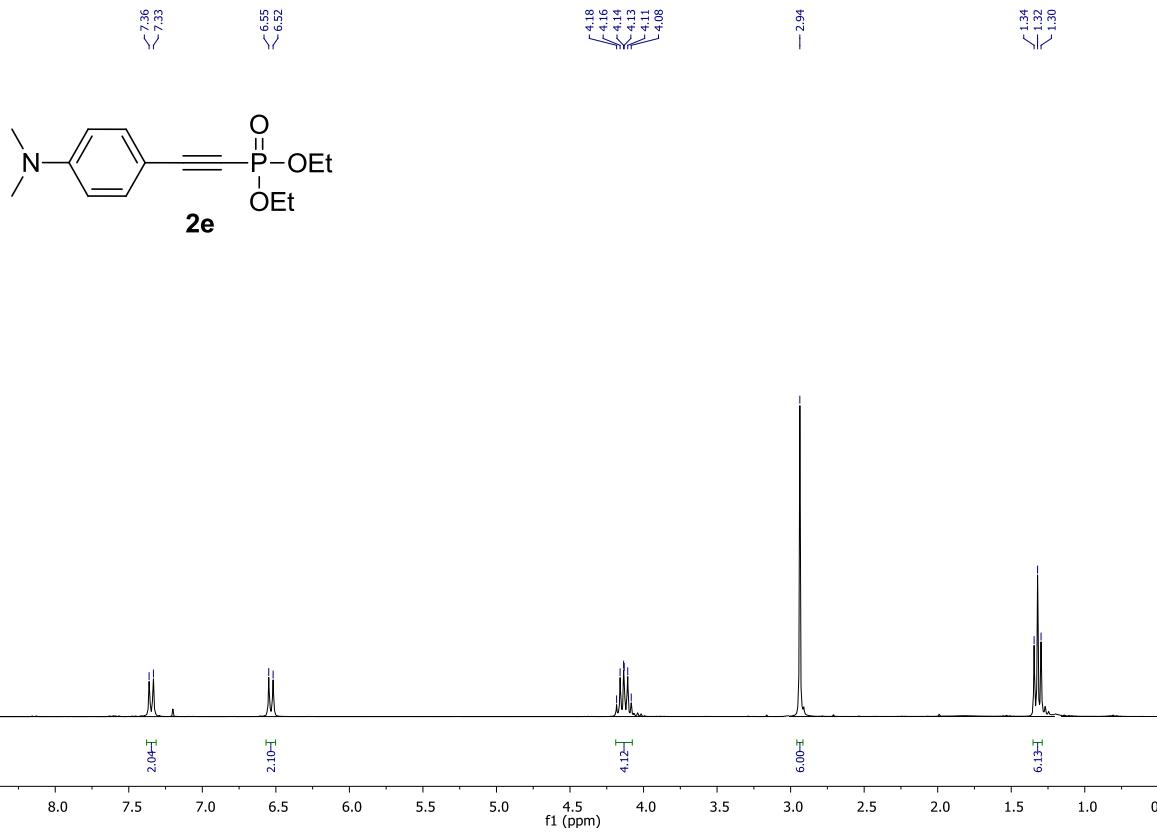


Figure 19. ^1H -NMR (300 MHz, CDCl_3).

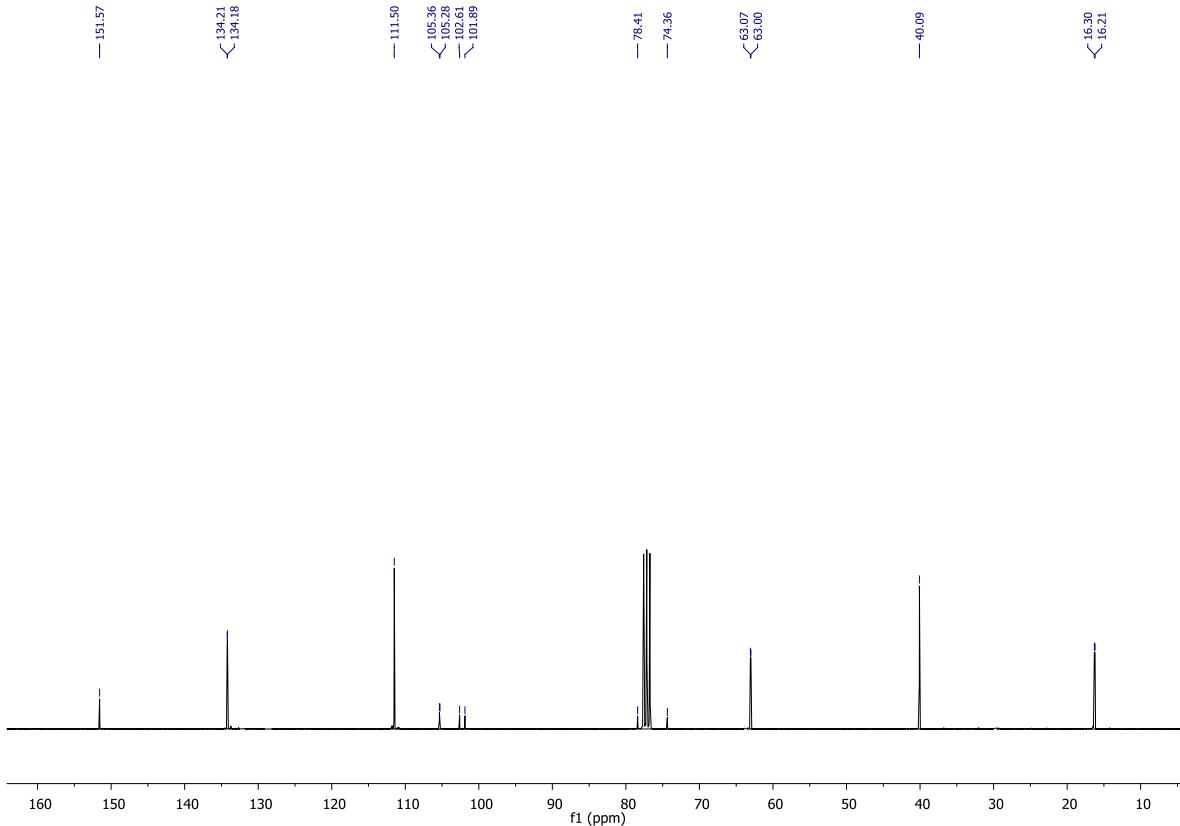


Figure 20. ^{13}C -NMR (75 MHz, CDCl_3).

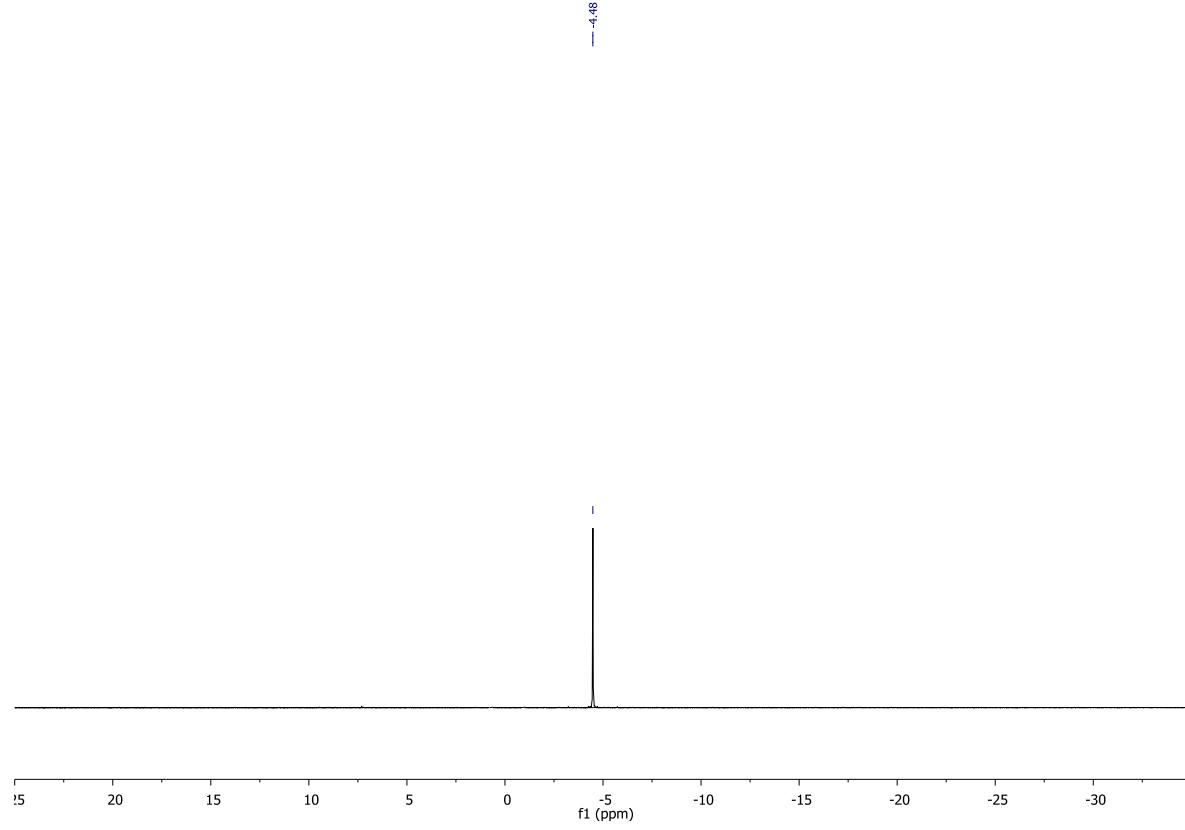


Figure 21. ^{31}P -NMR (121 MHz, CDCl_3).

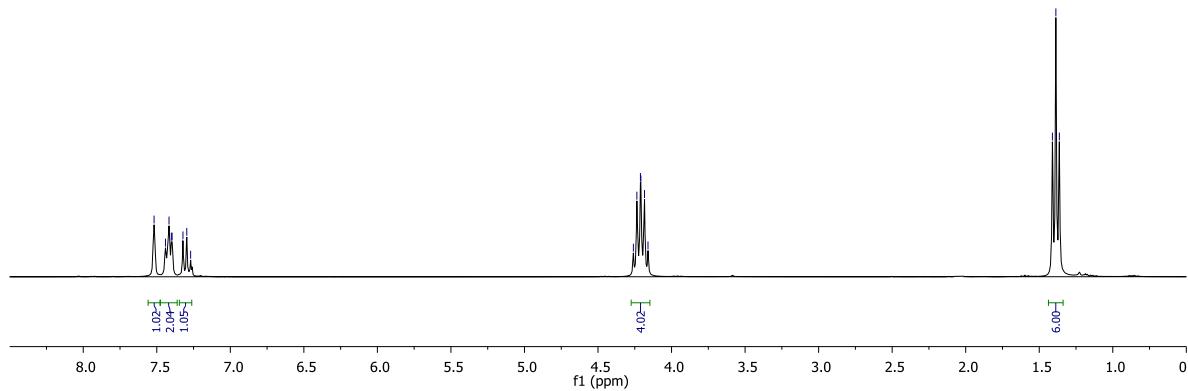
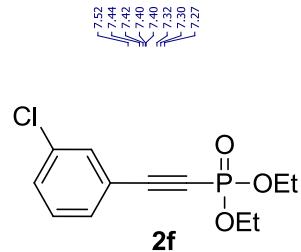


Figure 22. ^1H -NMR (300 MHz, CDCl_3).

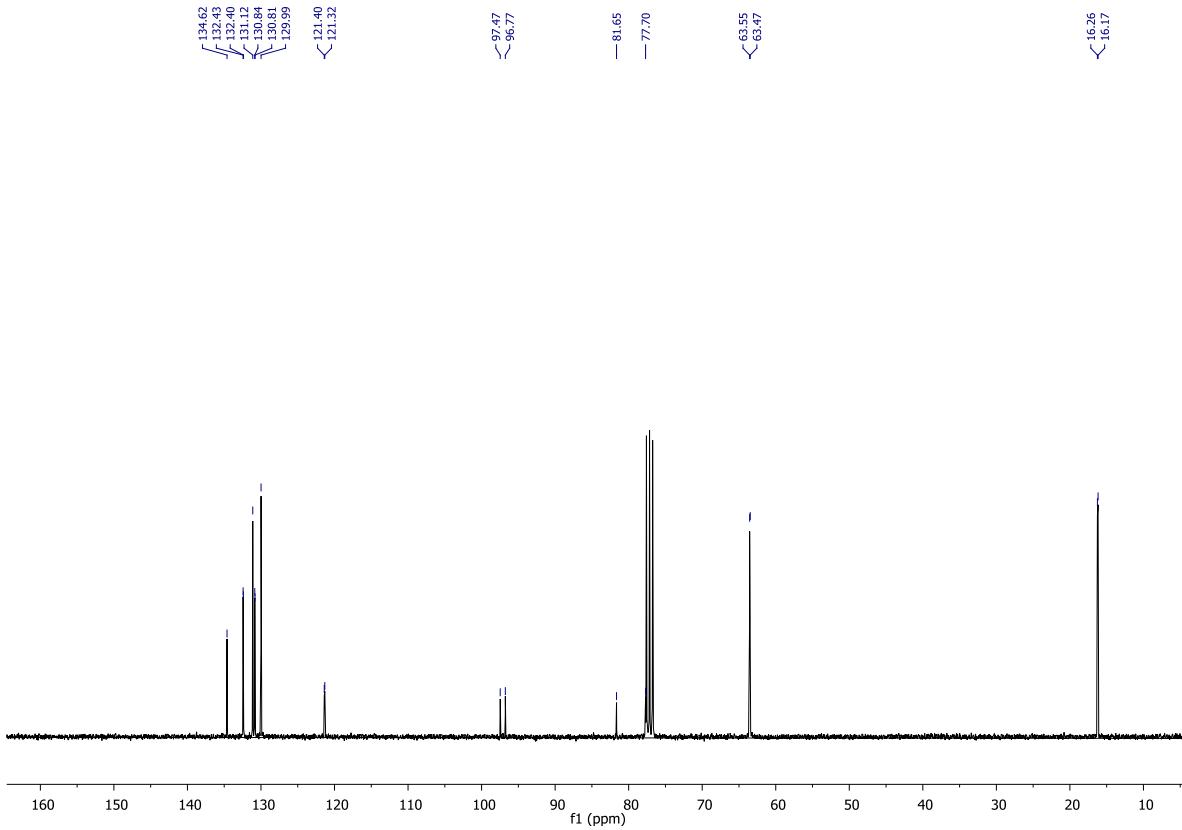


Figure 23. ^{13}C -NMR (75 MHz, CDCl_3).

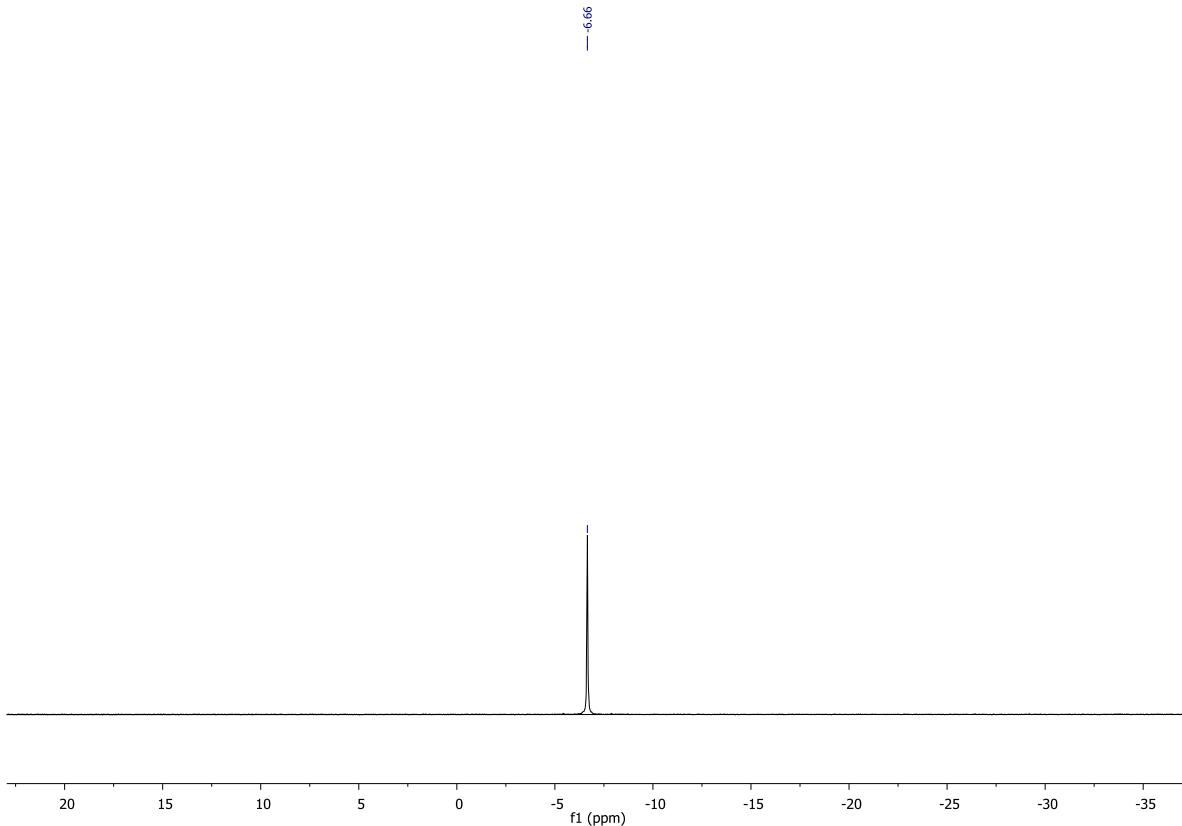


Figure 24. ^{31}P -NMR (121 MHz, CDCl_3).

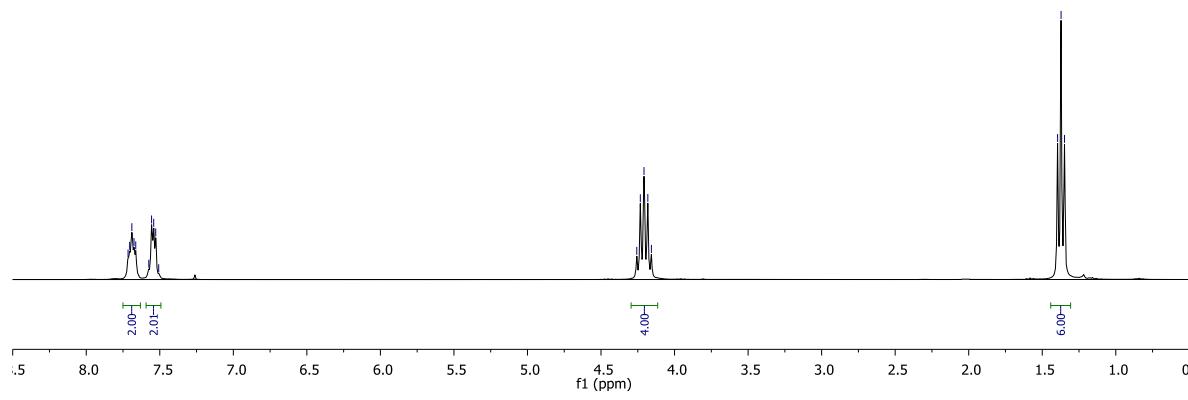
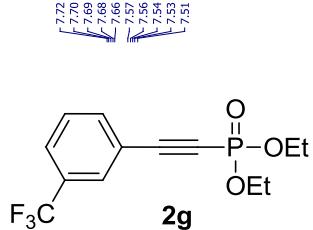


Figure 25. ^1H -NMR (300 MHz, CDCl_3).

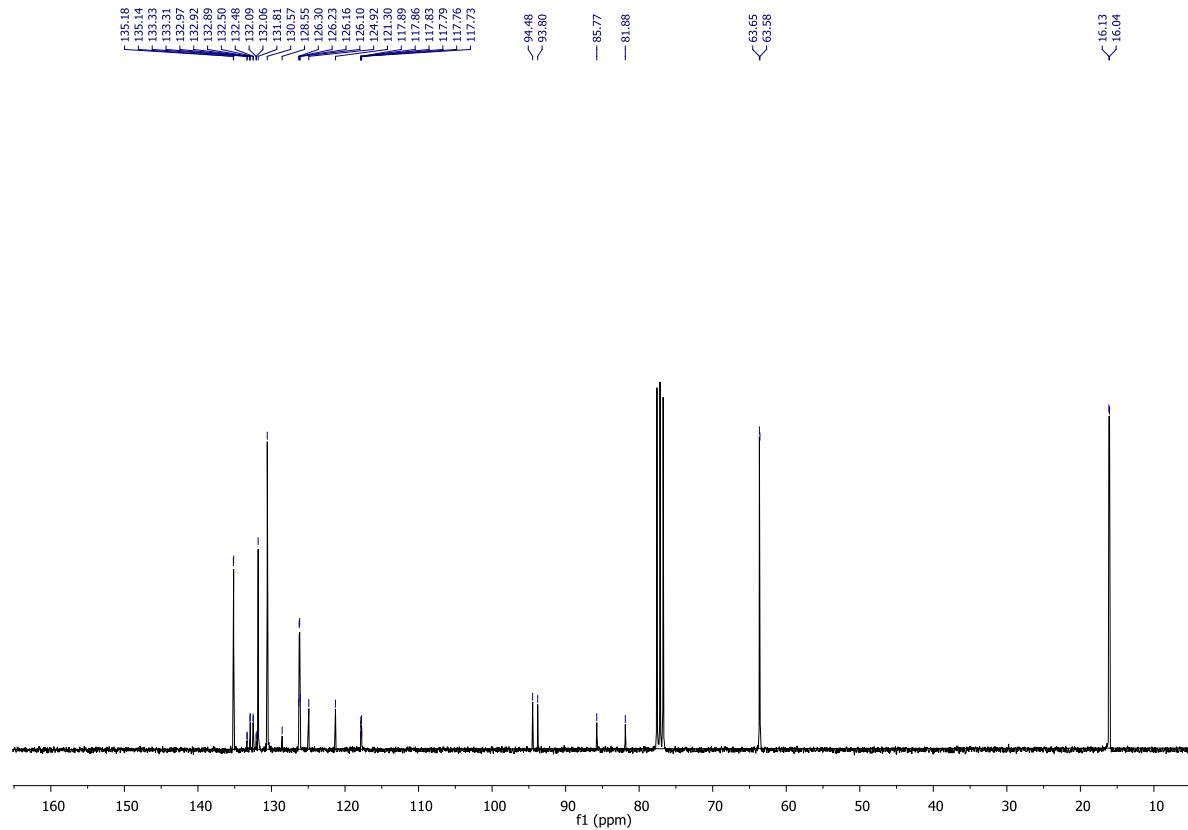


Figure 26. ^{13}C -NMR (75 MHz, CDCl_3).

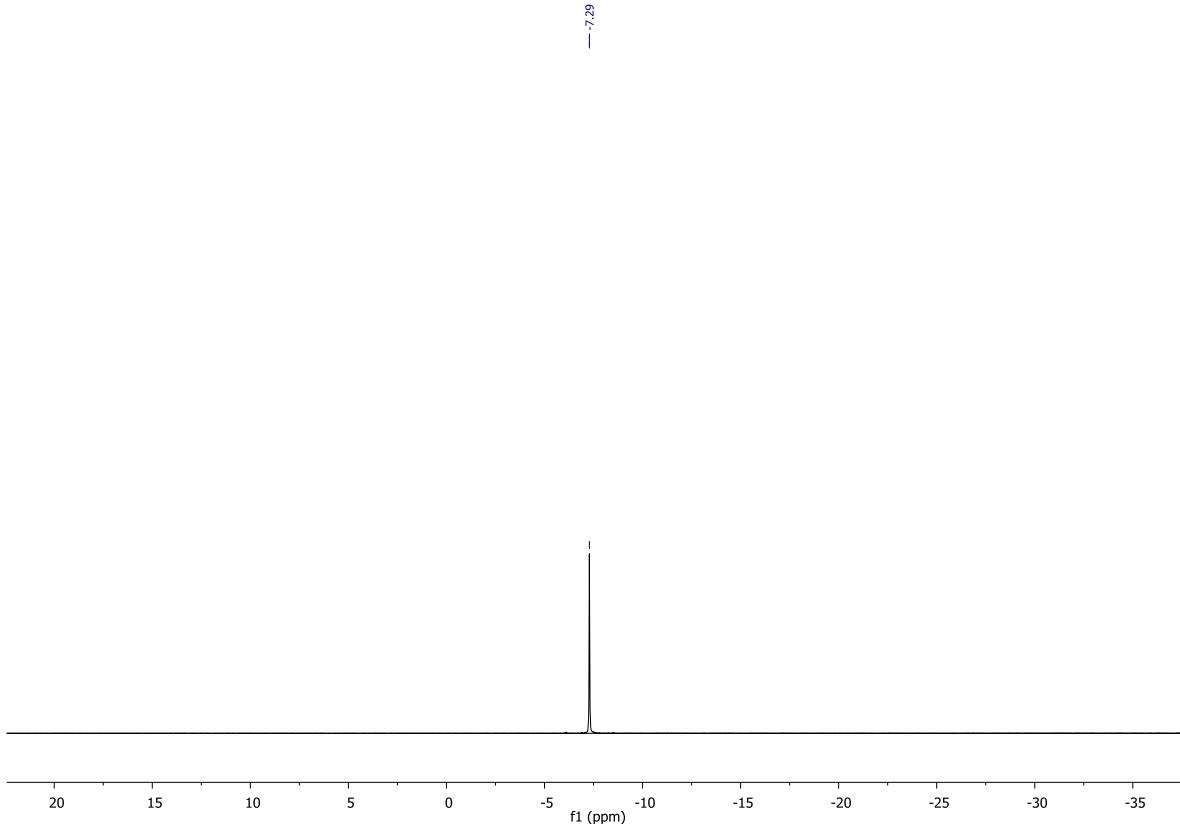


Figure 27. ^{31}P -NMR (121 MHz, CDCl_3).

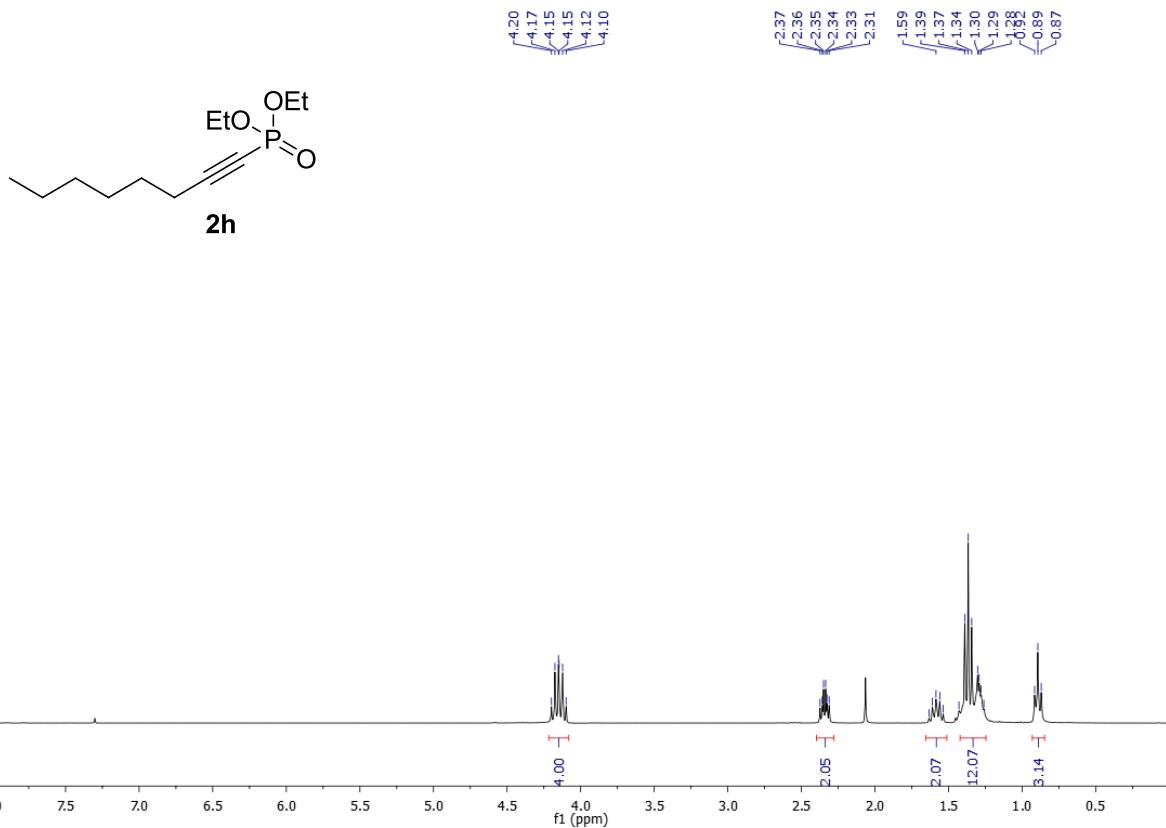


Figure 28. ^1H -NMR (300 MHz, CDCl_3).

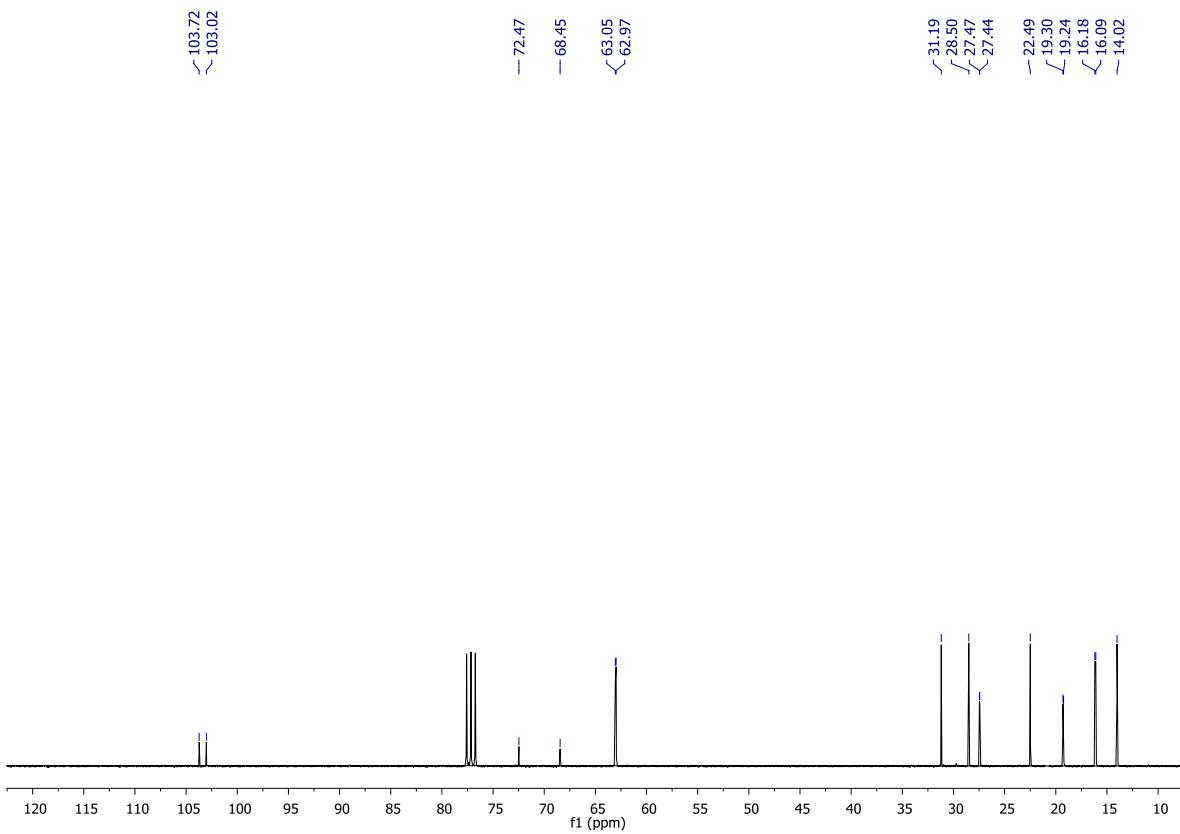


Figure 29. ^{13}C -NMR (75 MHz, CDCl_3).

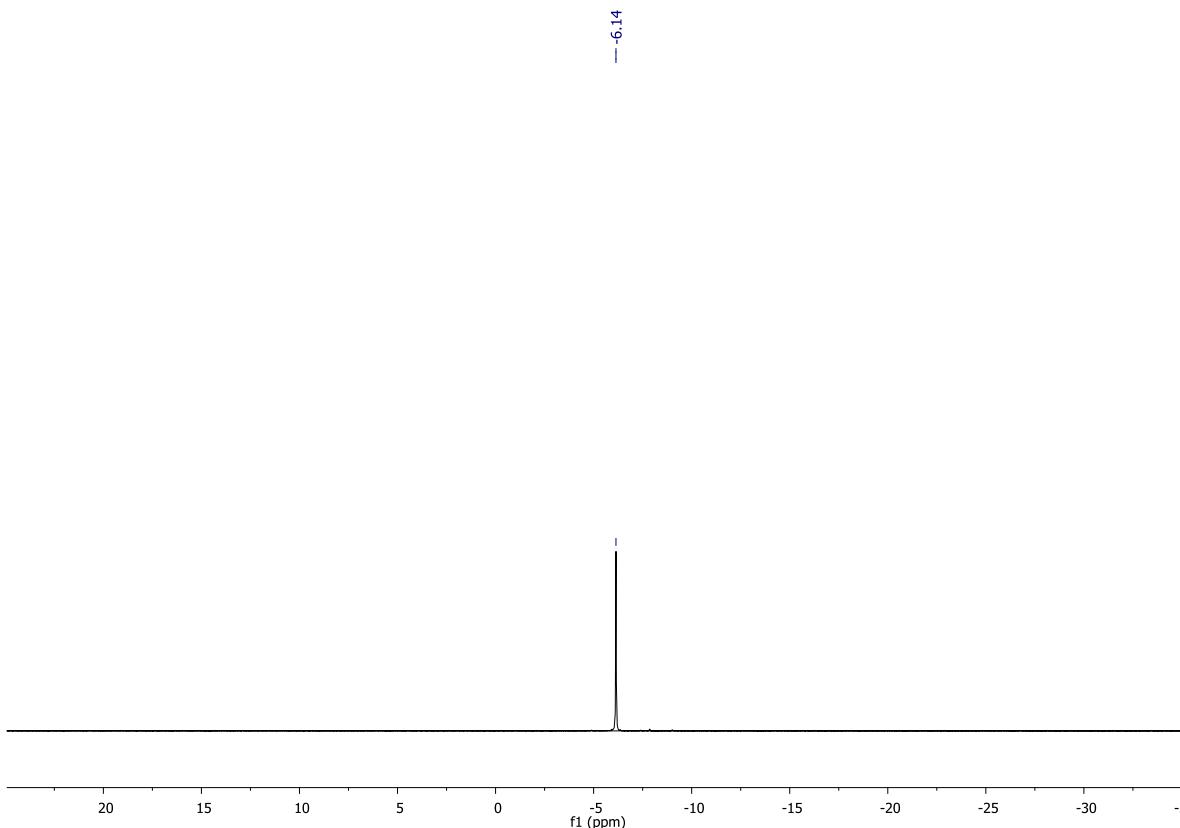


Figure 30. ^{31}P -NMR (121 MHz, CDCl_3).

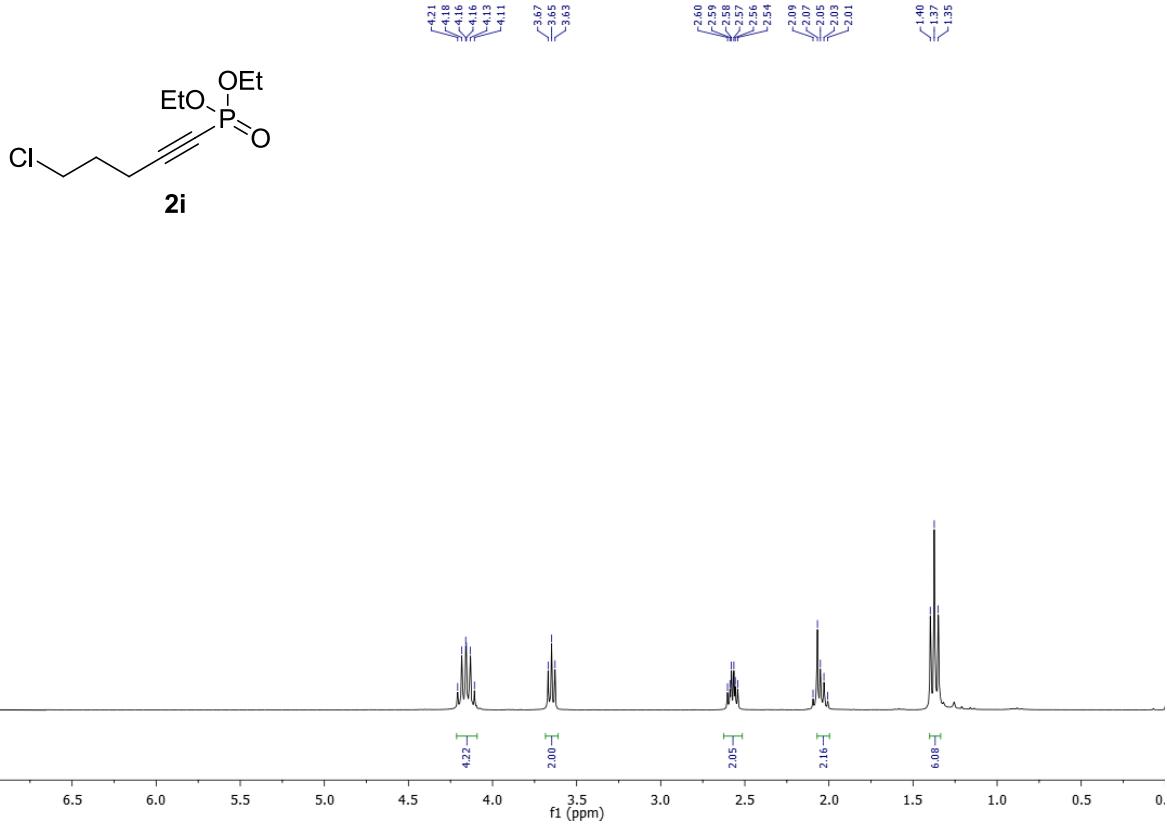


Figure 31. ^1H -NMR (300 MHz, CDCl_3).

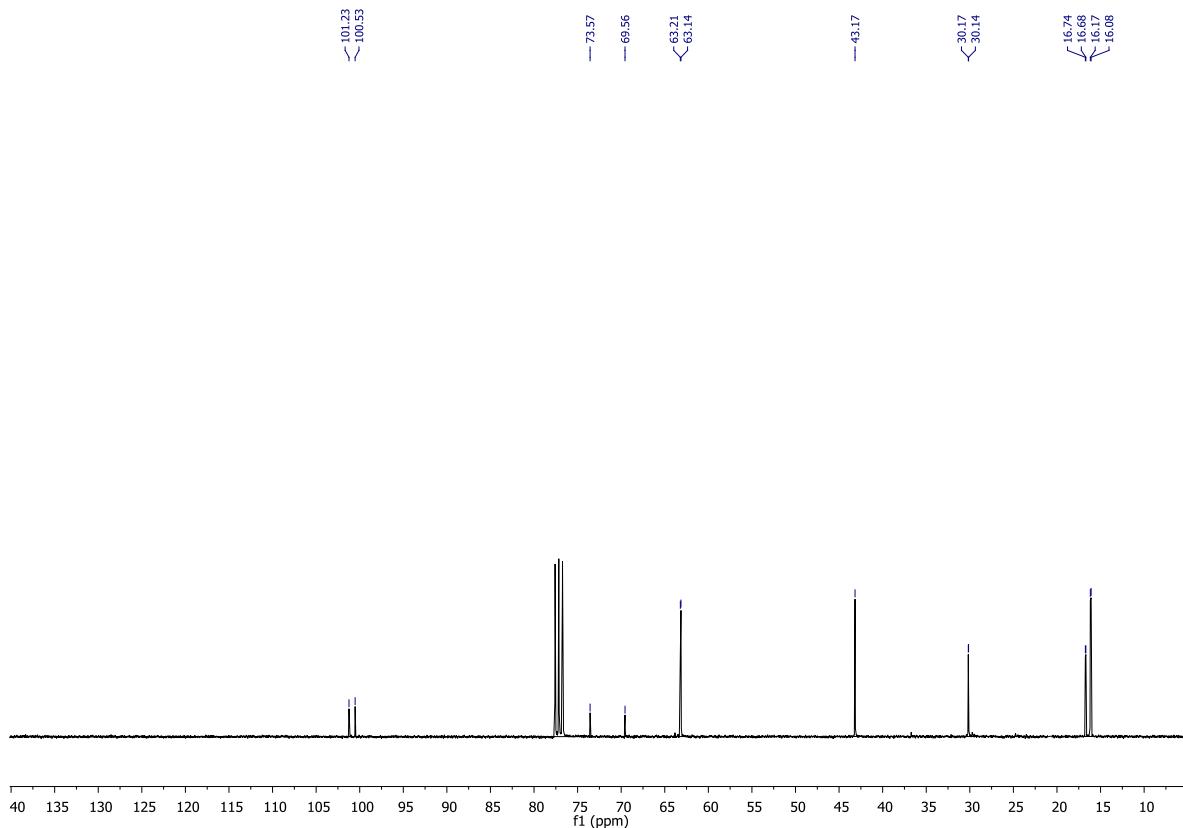


Figure 32. ^{13}C -NMR (75 MHz, CDCl_3).

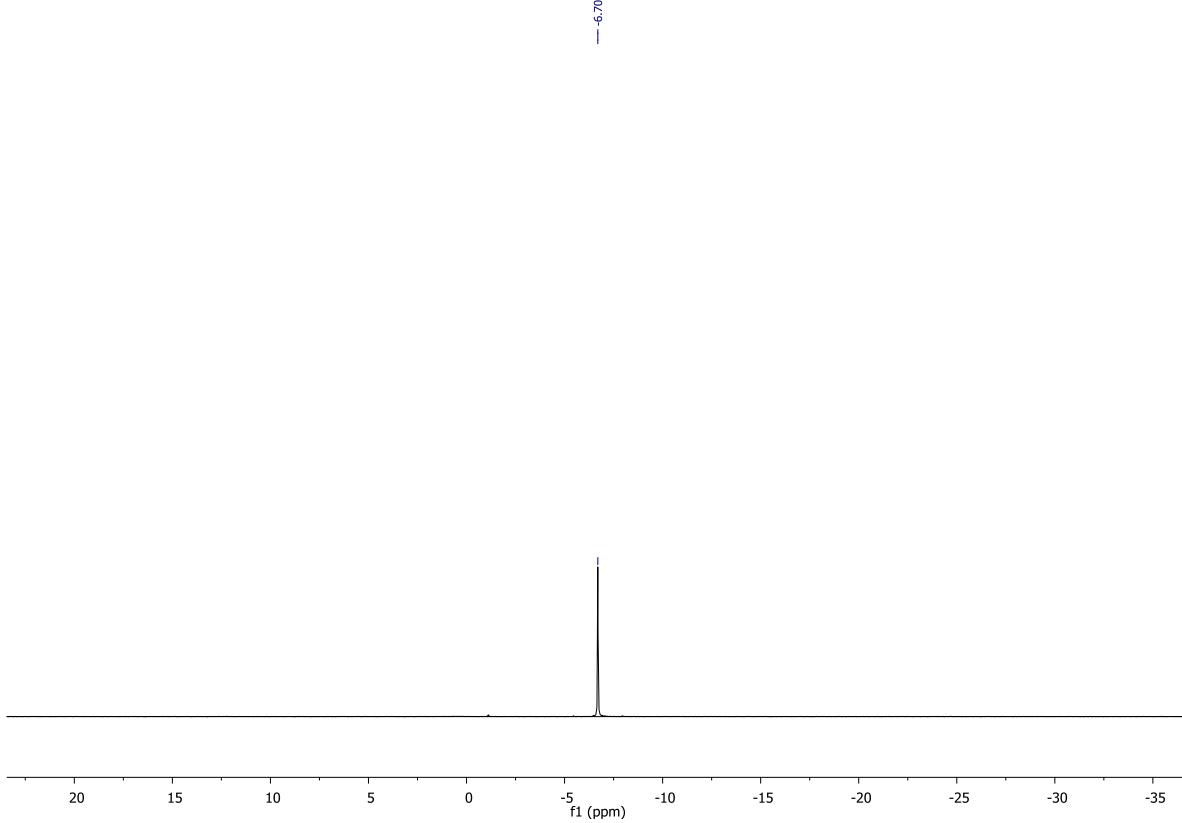


Figure 33. ^{31}P -NMR (121 MHz, CDCl_3).

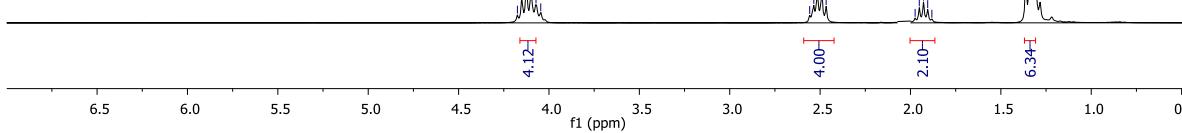
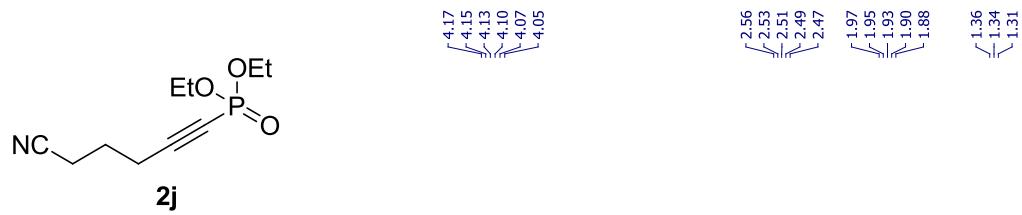


Figure 34. ^1H -NMR (300 MHz, CDCl_3).

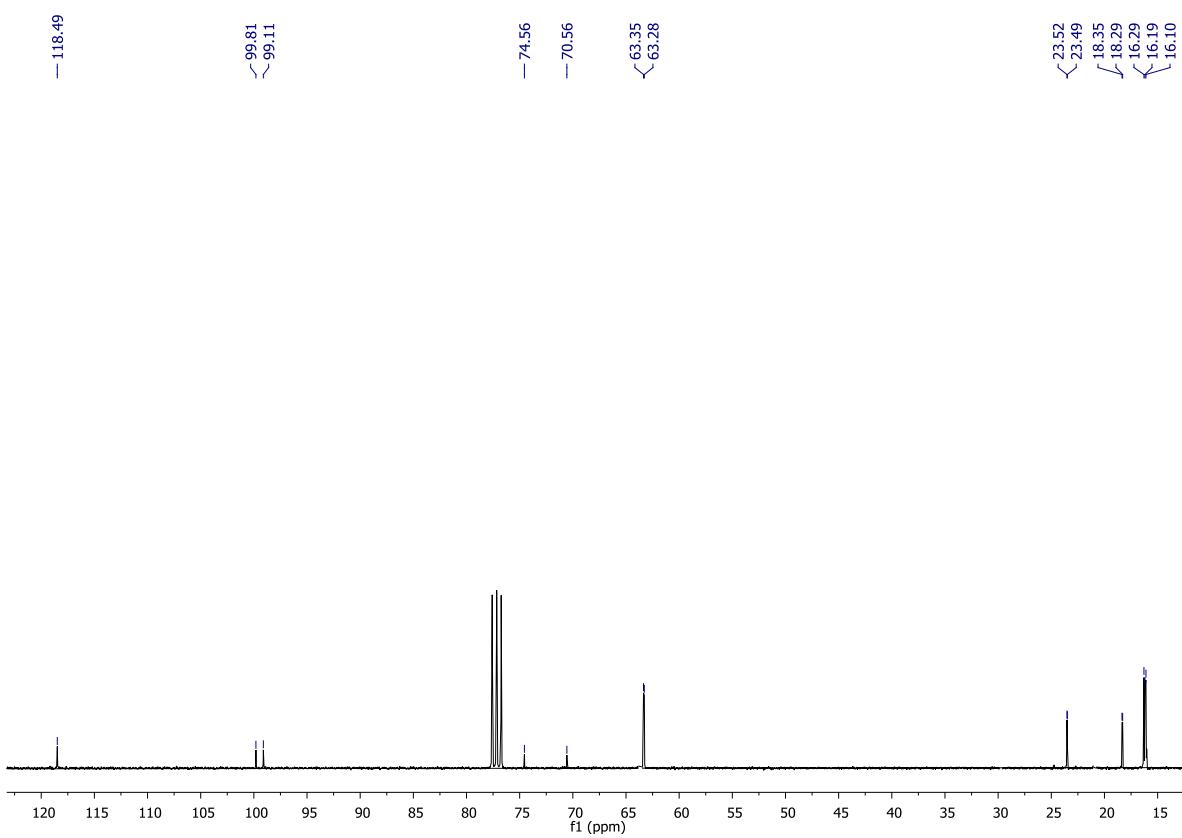


Figure 35. ^{13}C -NMR (75 MHz, CDCl_3).

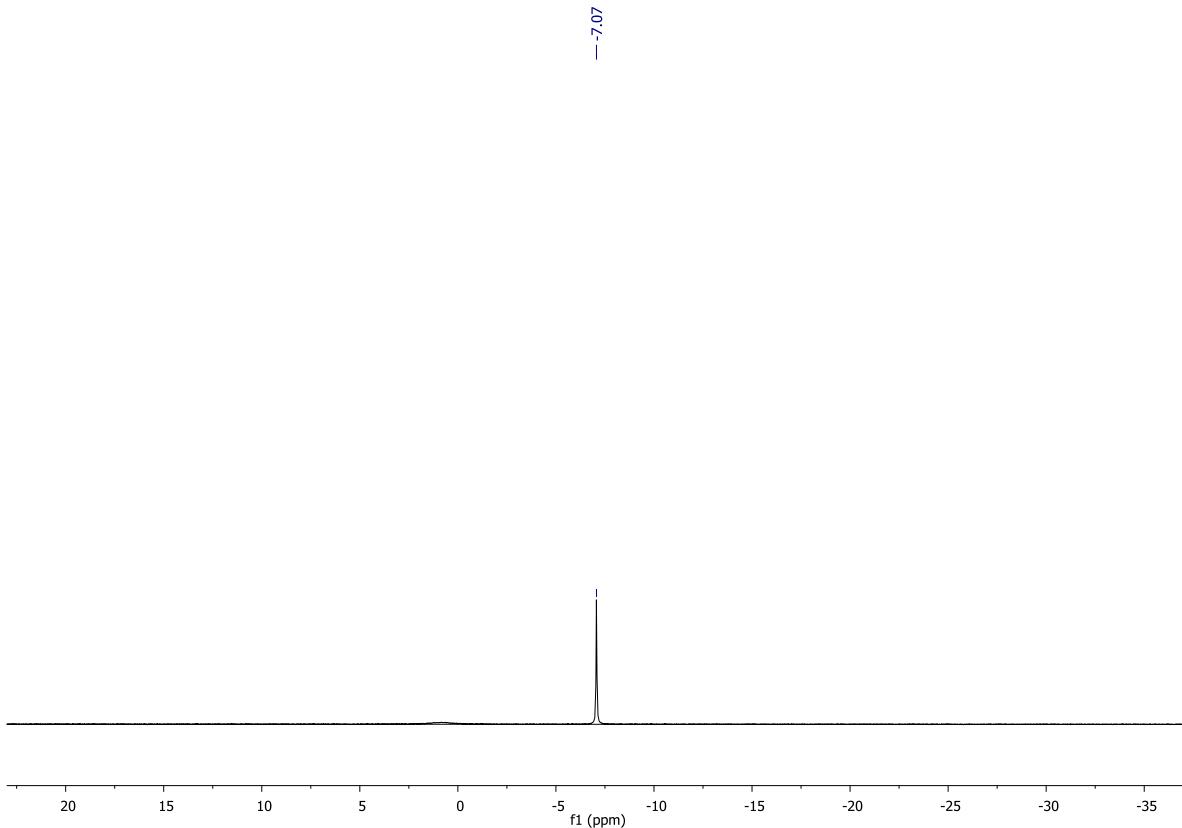


Figure 36. ^{31}P -NMR (121 MHz, CDCl_3).

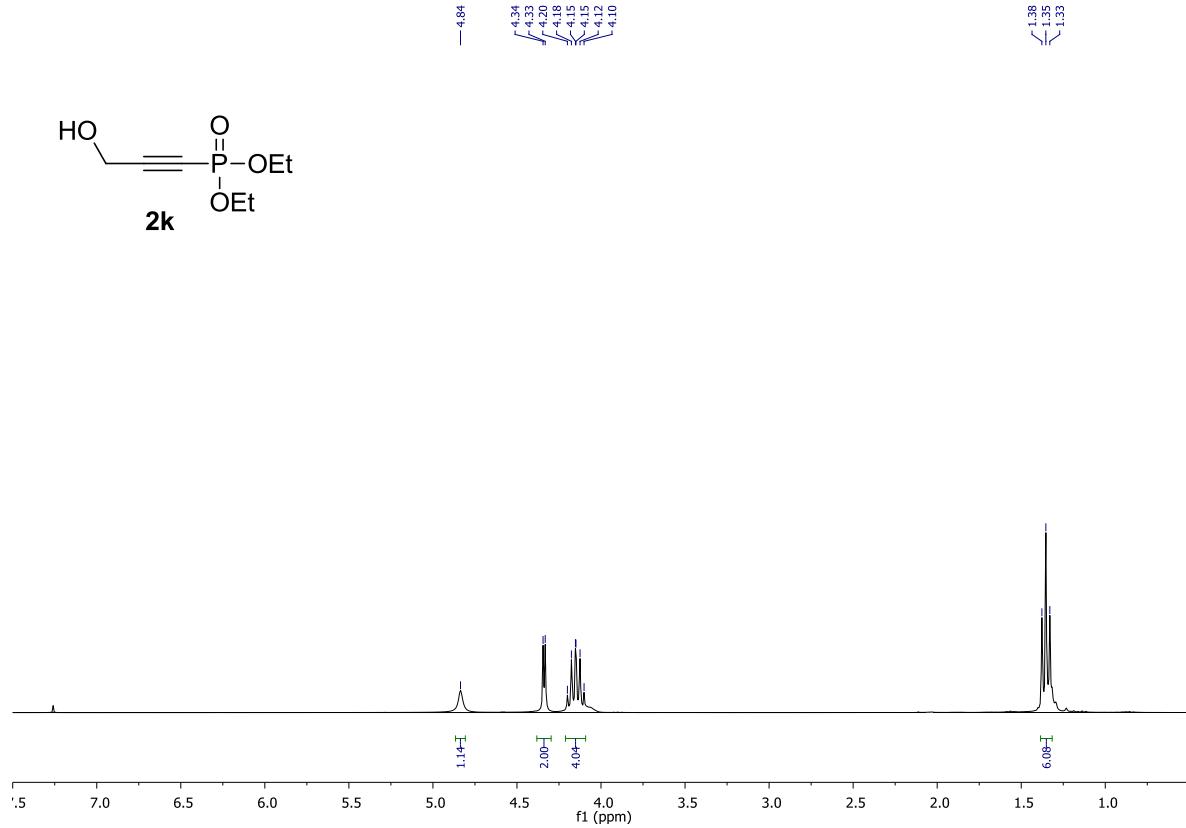
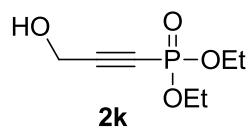


Figure 37. ^1H -NMR (300 MHz, CDCl_3).

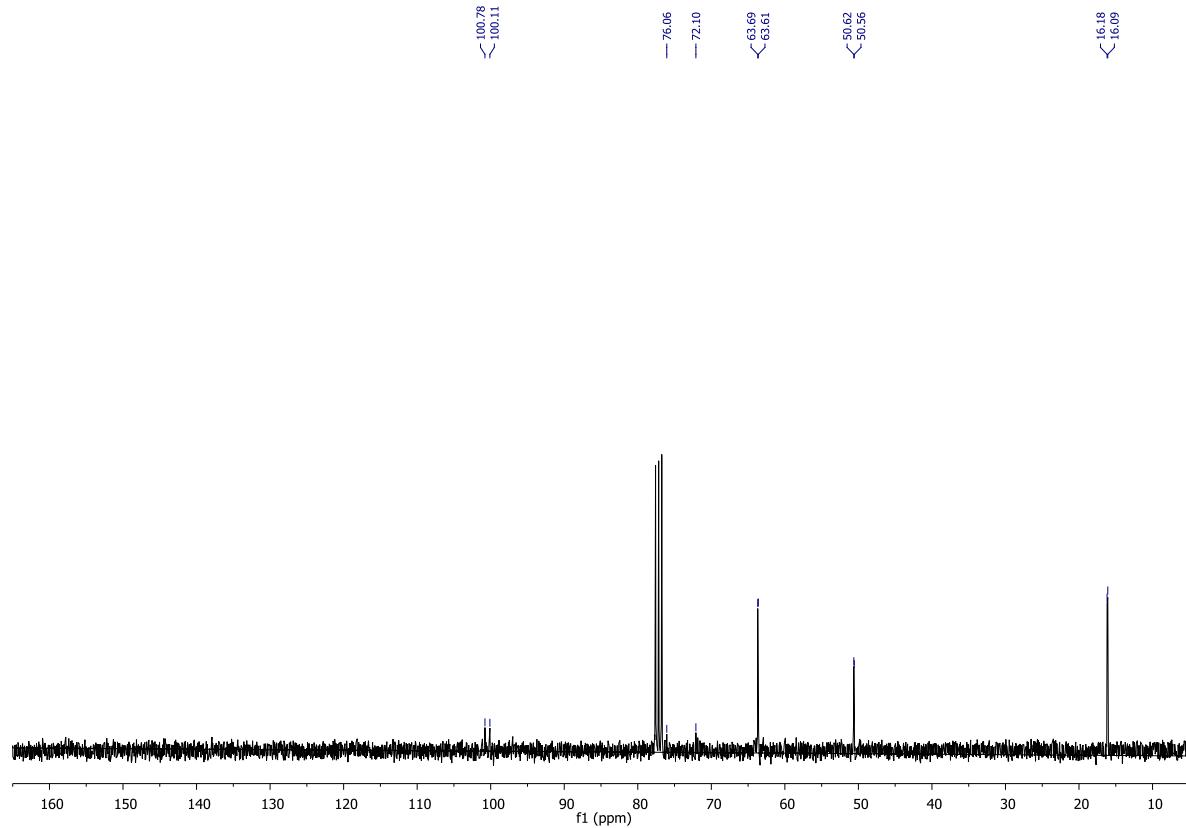


Figure 38. ^{13}C -NMR (75 MHz, CDCl_3).

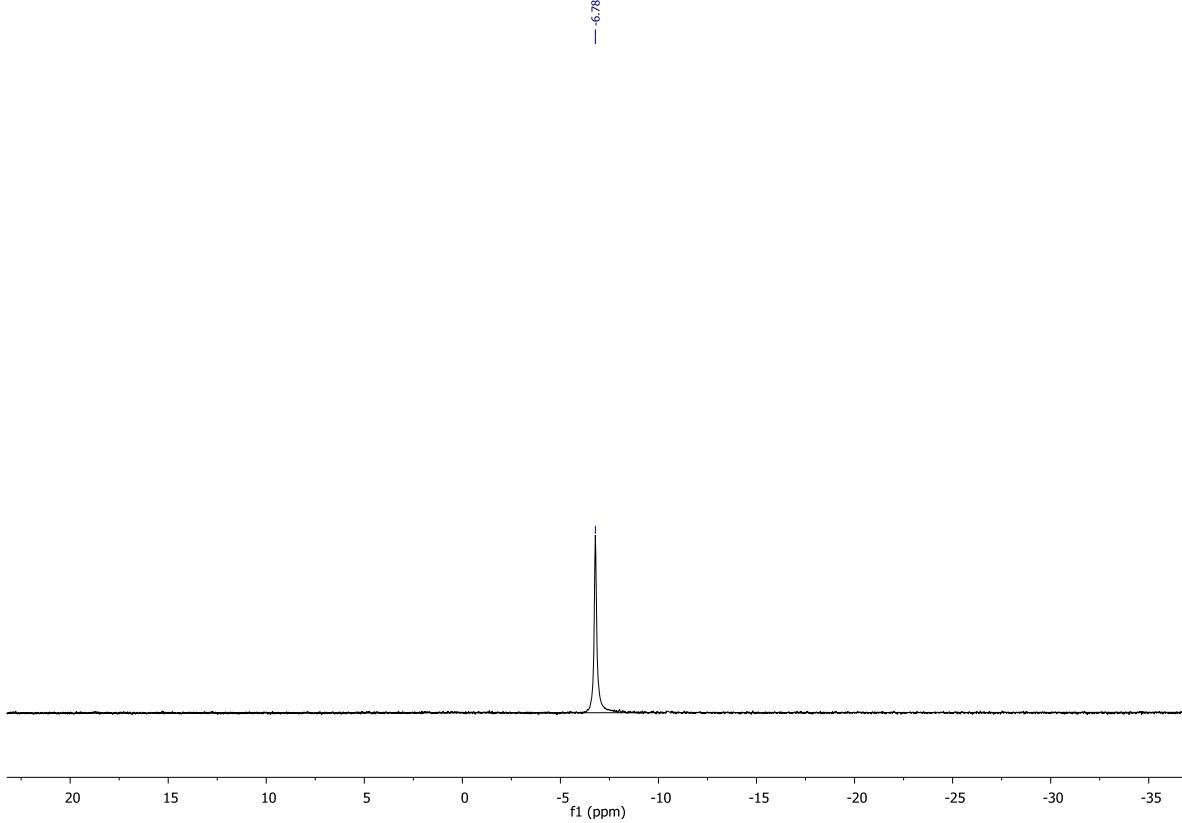


Figure 39. ^{31}P -NMR (121 MHz, CDCl_3).

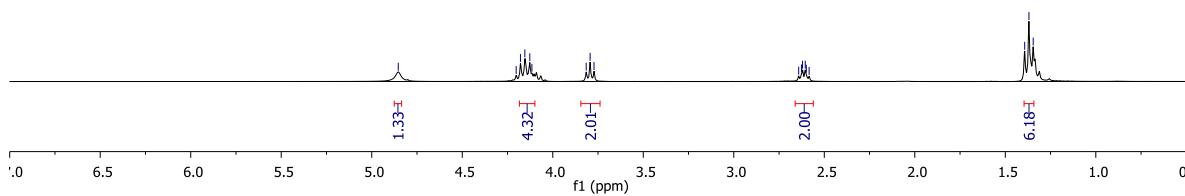
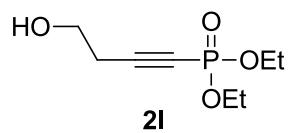


Figure 40. ^1H -NMR (300 MHz, CDCl_3).

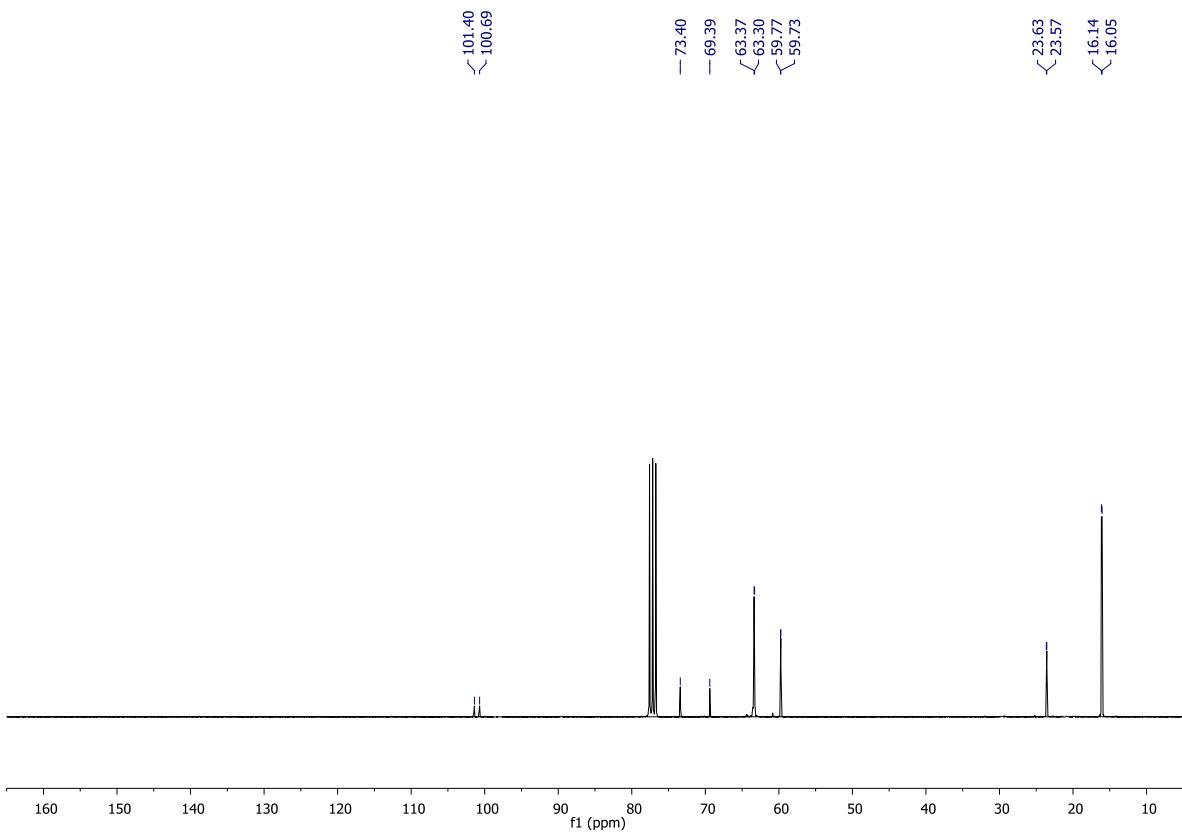


Figure 41. ^{13}C -NMR (75 MHz, CDCl_3).

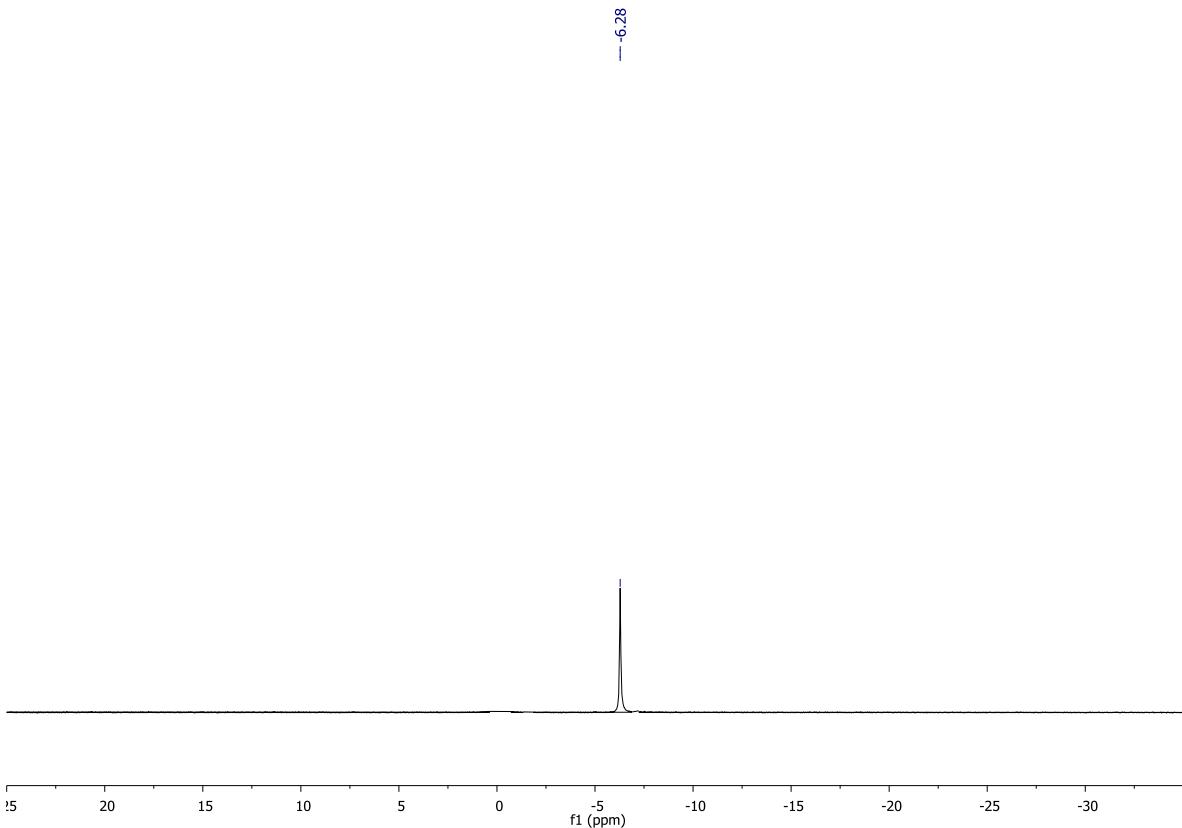


Figure 42. ^{31}P -NMR (121 MHz, CDCl_3).

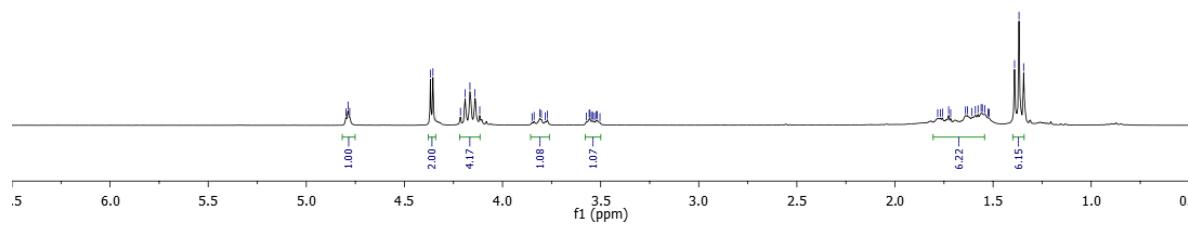
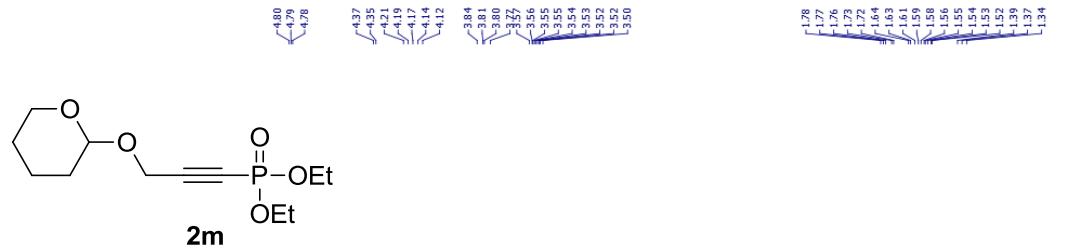


Figure 43. ^1H -NMR (300 MHz, CDCl_3).

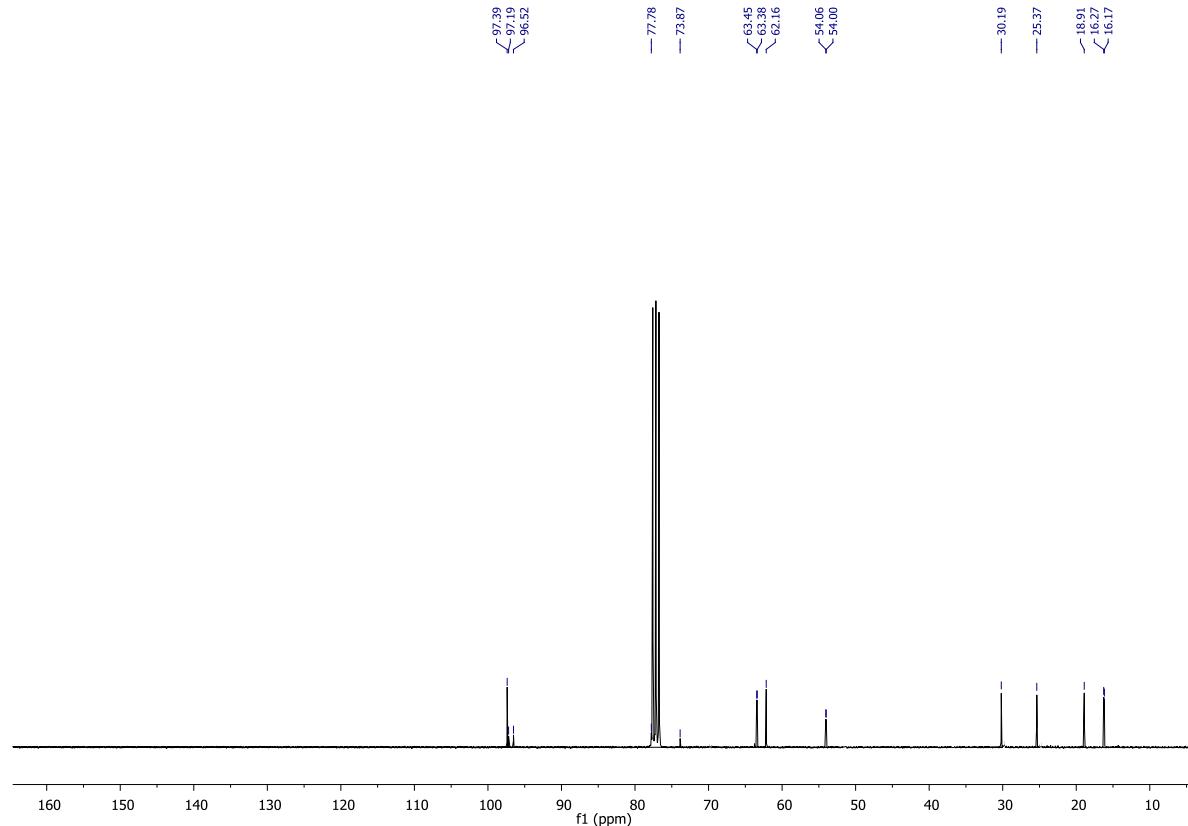


Figure 44. ^{13}C -NMR (75 MHz, CDCl_3).

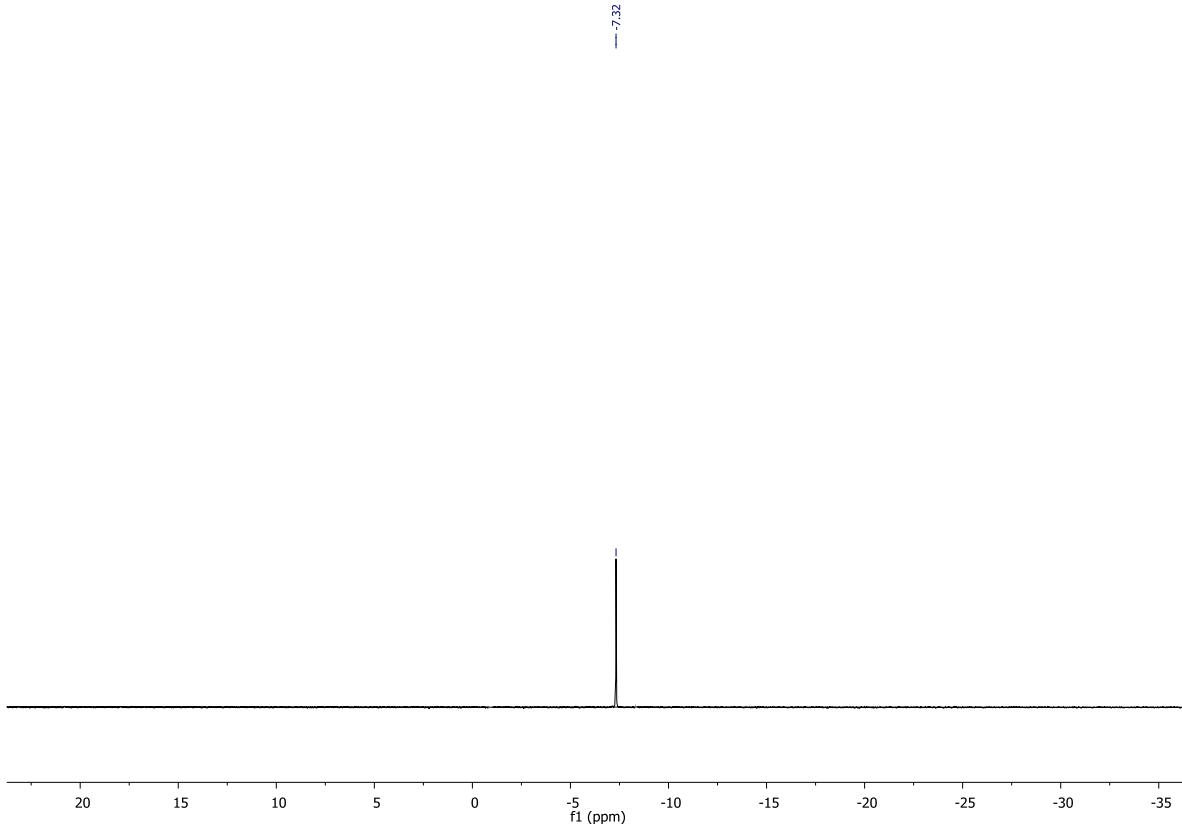


Figure 45. ^{31}P -NMR (121 MHz, CDCl_3).

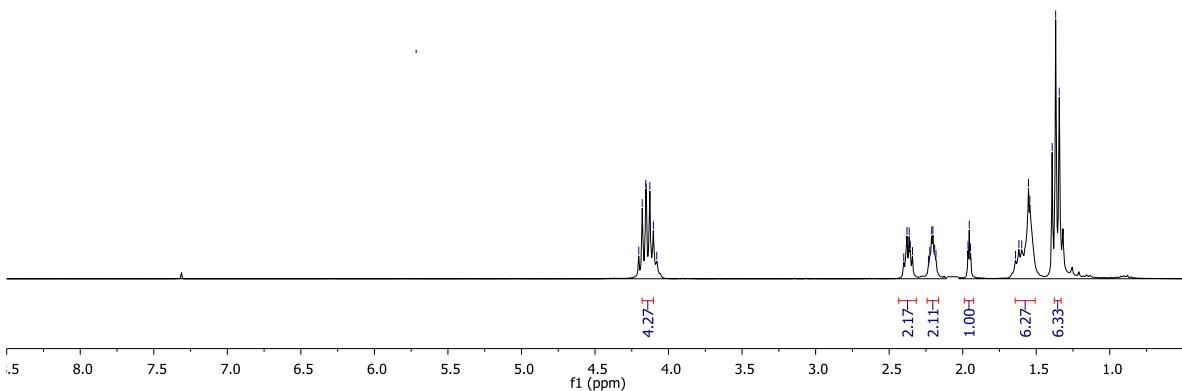
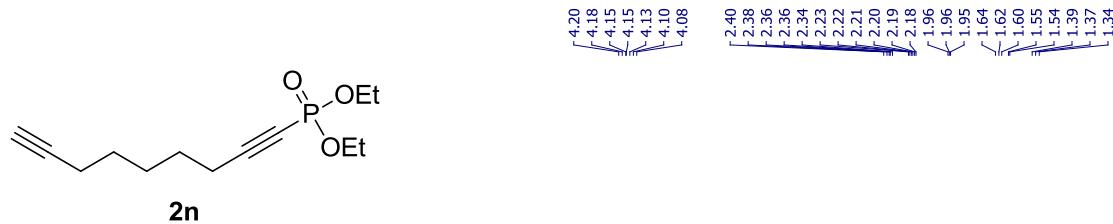


Figure 46. ^1H -NMR (300 MHz, CDCl_3).

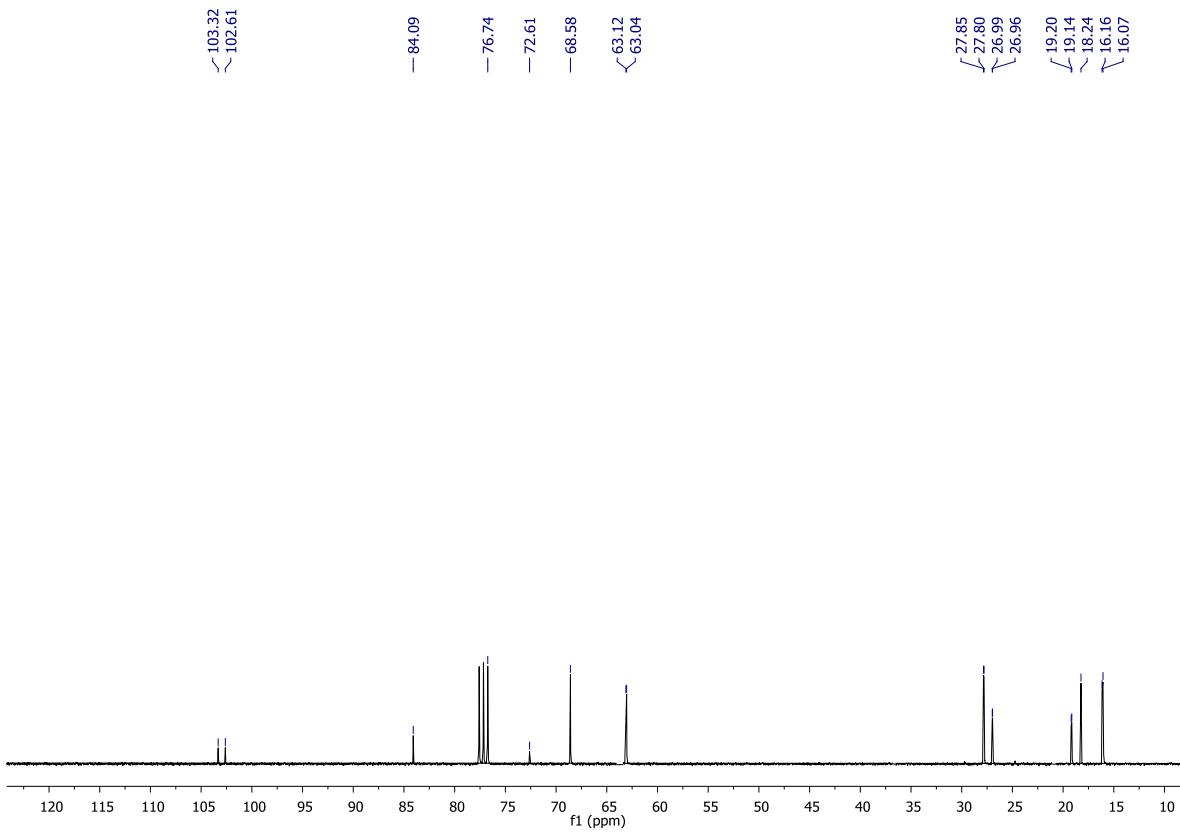


Figure 47. ^{13}C -NMR (75 MHz, CDCl_3).

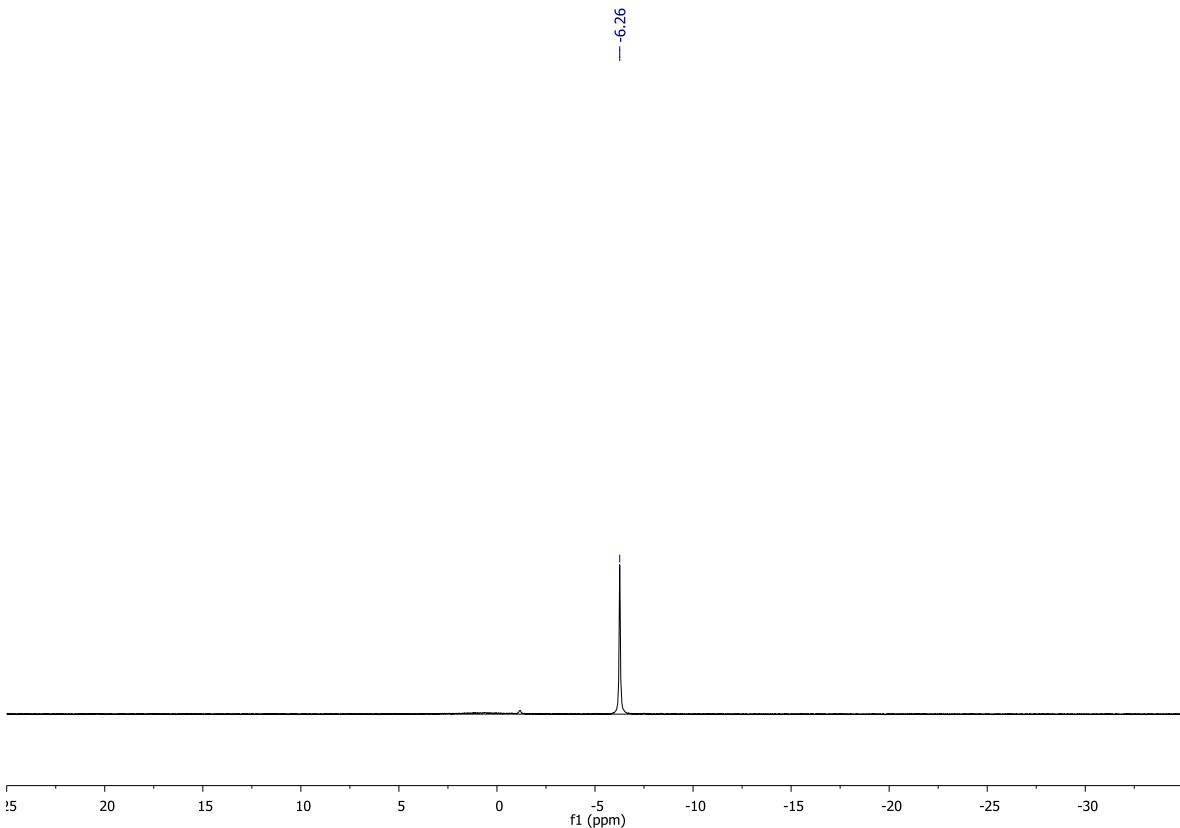


Figure 48. ^{31}P -NMR (121 MHz, CDCl_3).

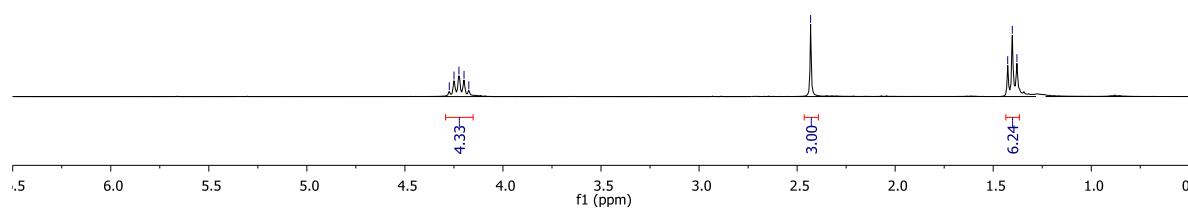
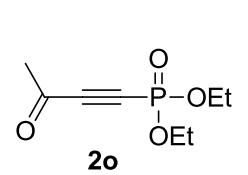


Figure 49. ^1H -NMR (300 MHz, CDCl_3).

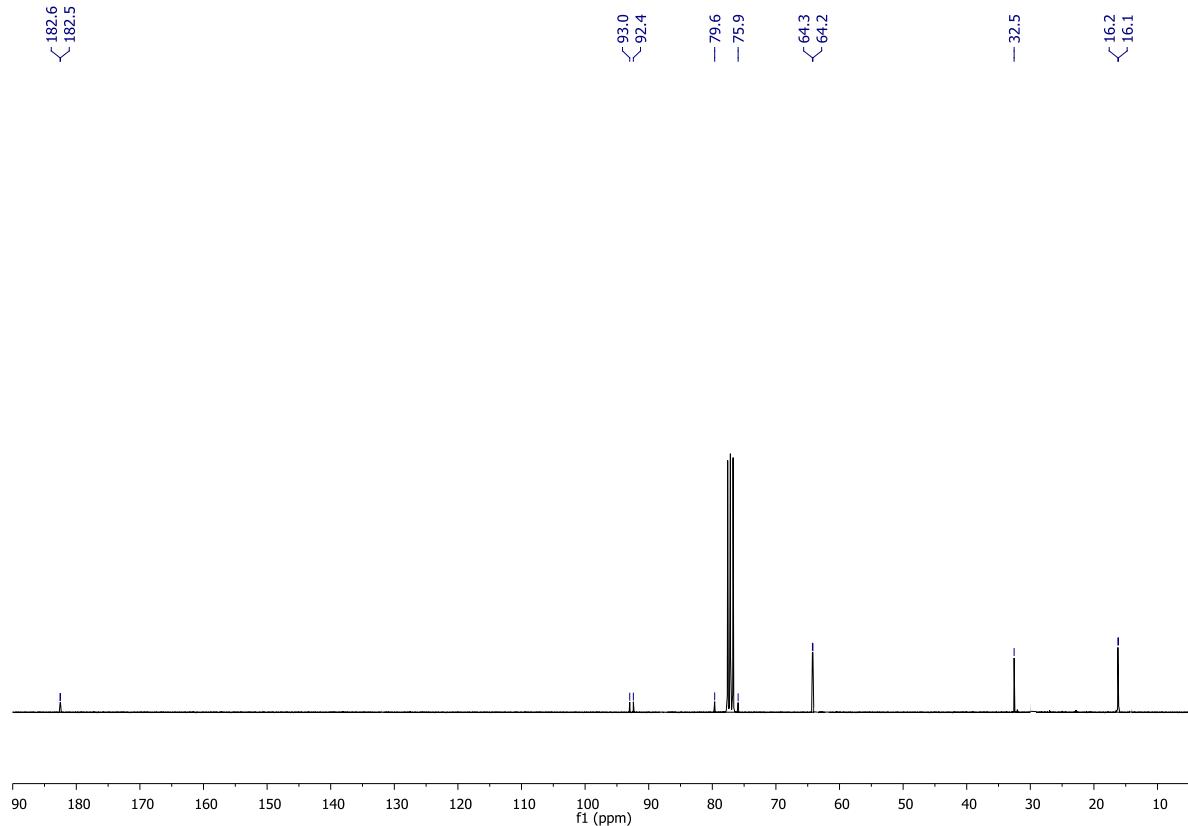


Figure 50. ^{13}C -NMR (75 MHz, CDCl_3).

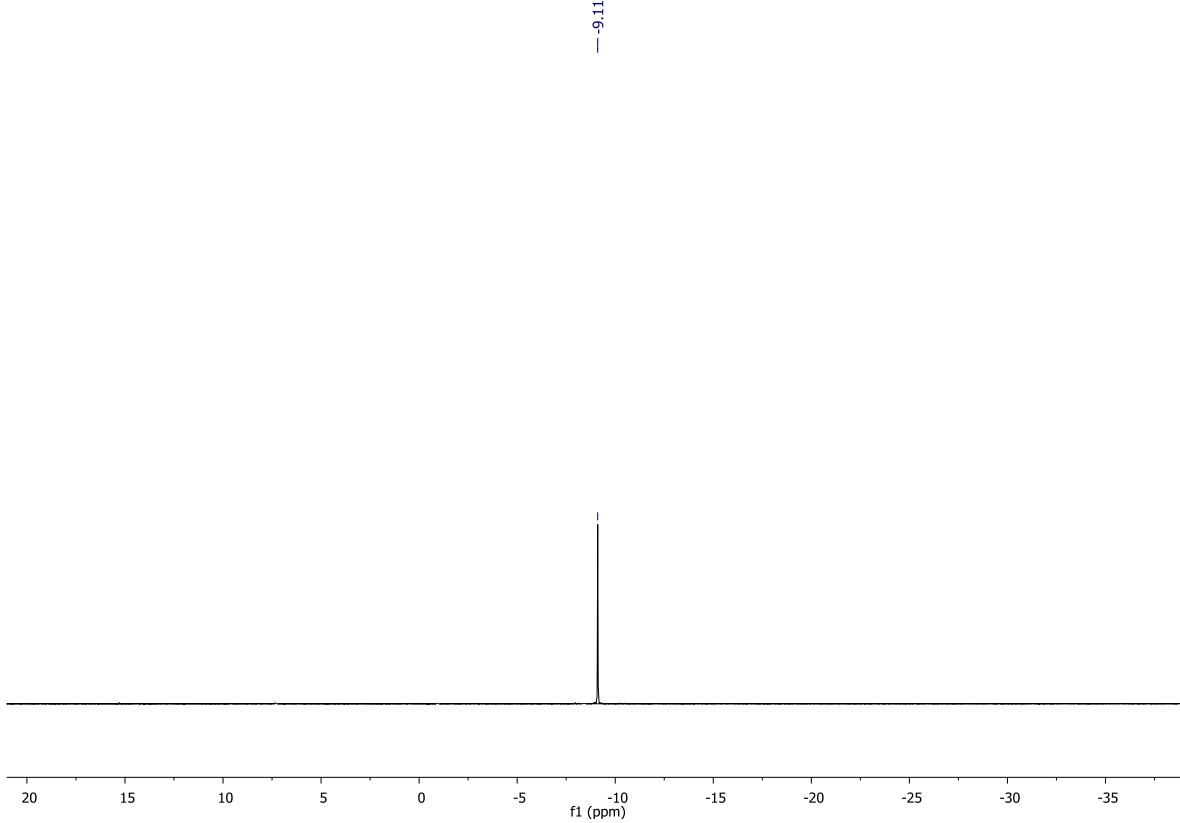
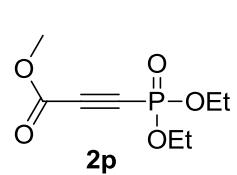


Figure 51. ^{31}P -NMR (121 MHz, CDCl_3).



4.28
4.24
4.21
4.18
4.16
— 3.83
— 1.41
— 1.38
— 1.36

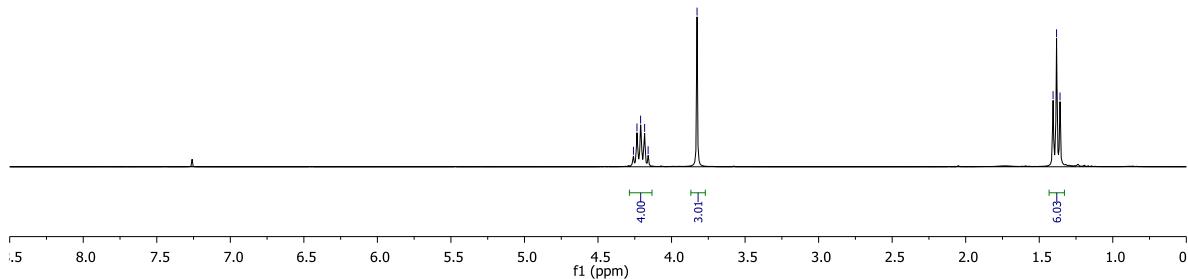


Figure 52. ^1H -NMR (300 MHz, CDCl_3).

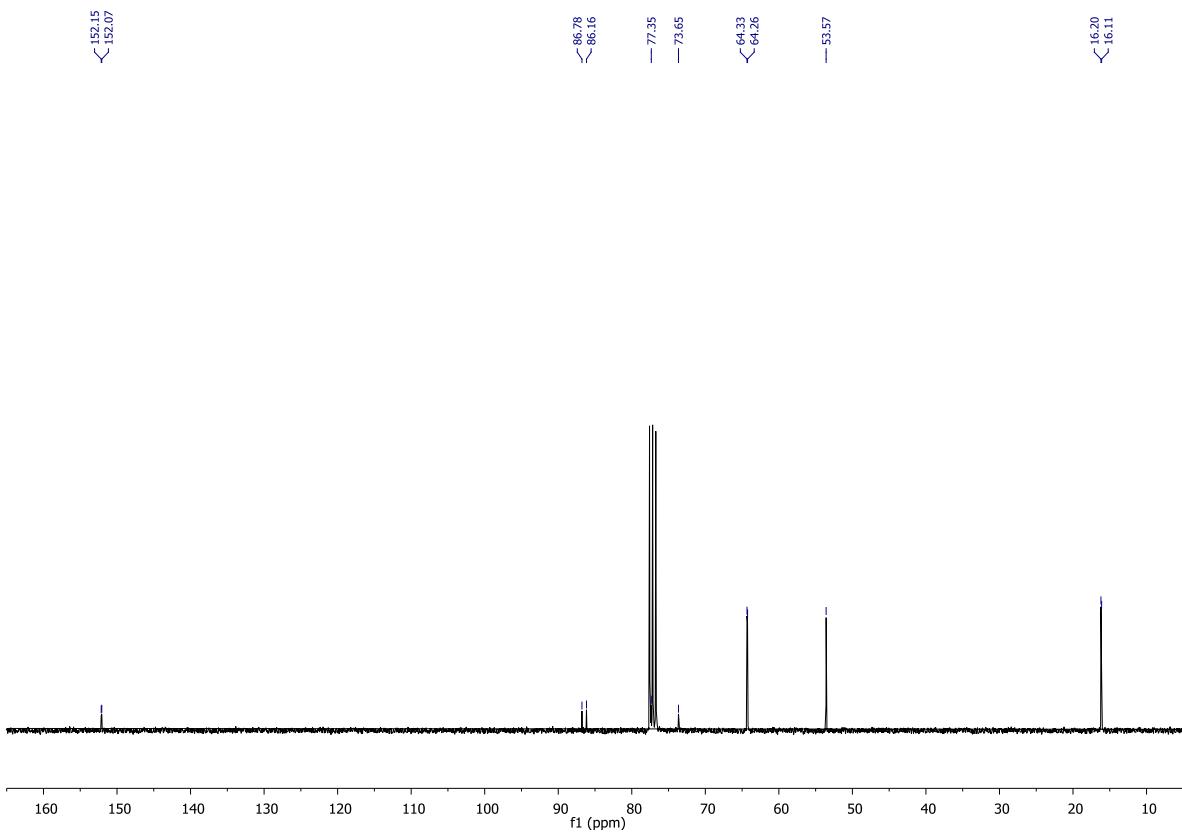


Figure 53. ^{13}C -NMR (75 MHz, CDCl_3).

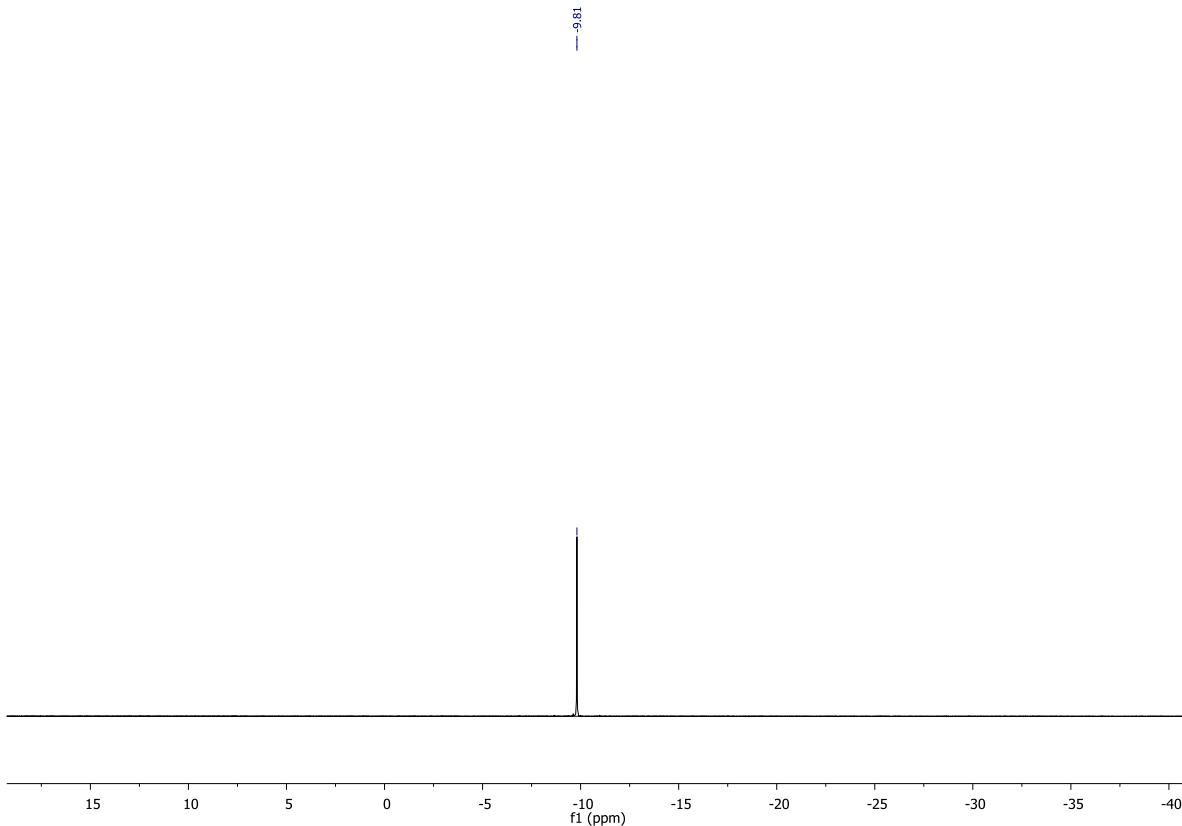


Figure 54. ^{31}P -NMR (121 MHz, CDCl_3).

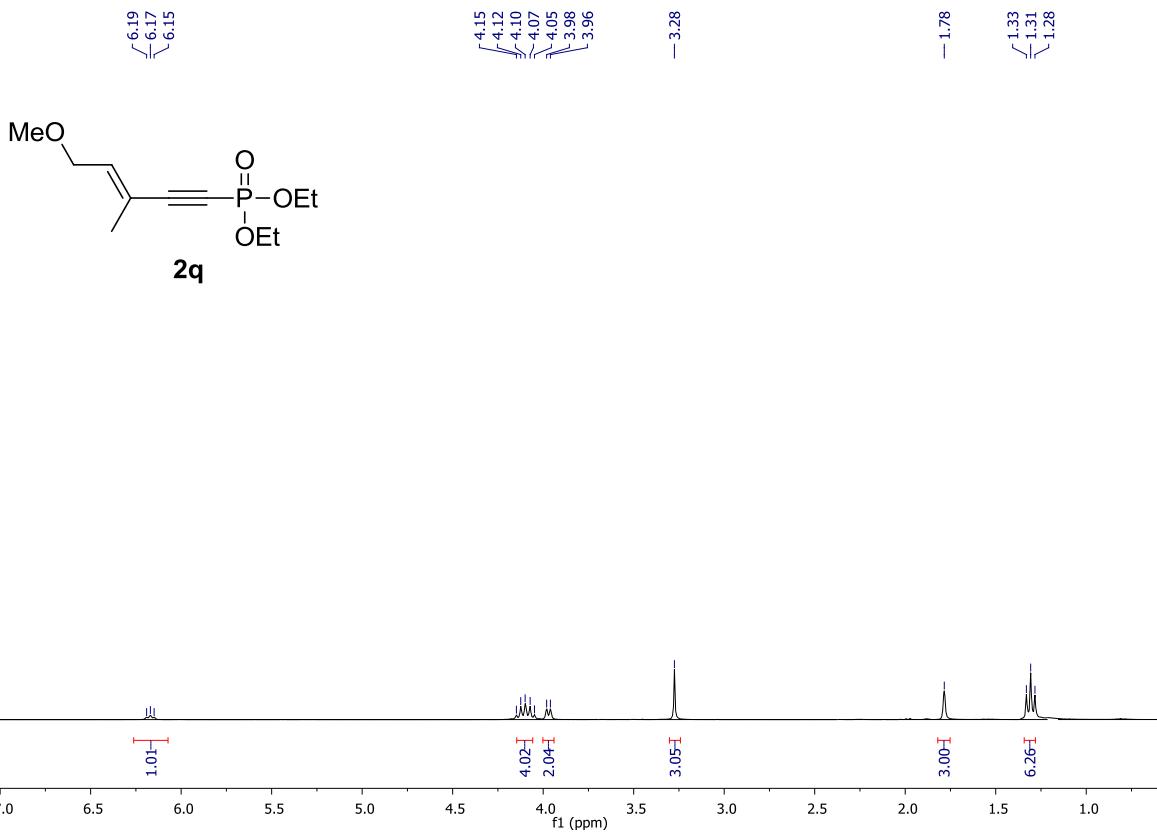


Figure 55. ^1H -NMR (300 MHz, CDCl_3).

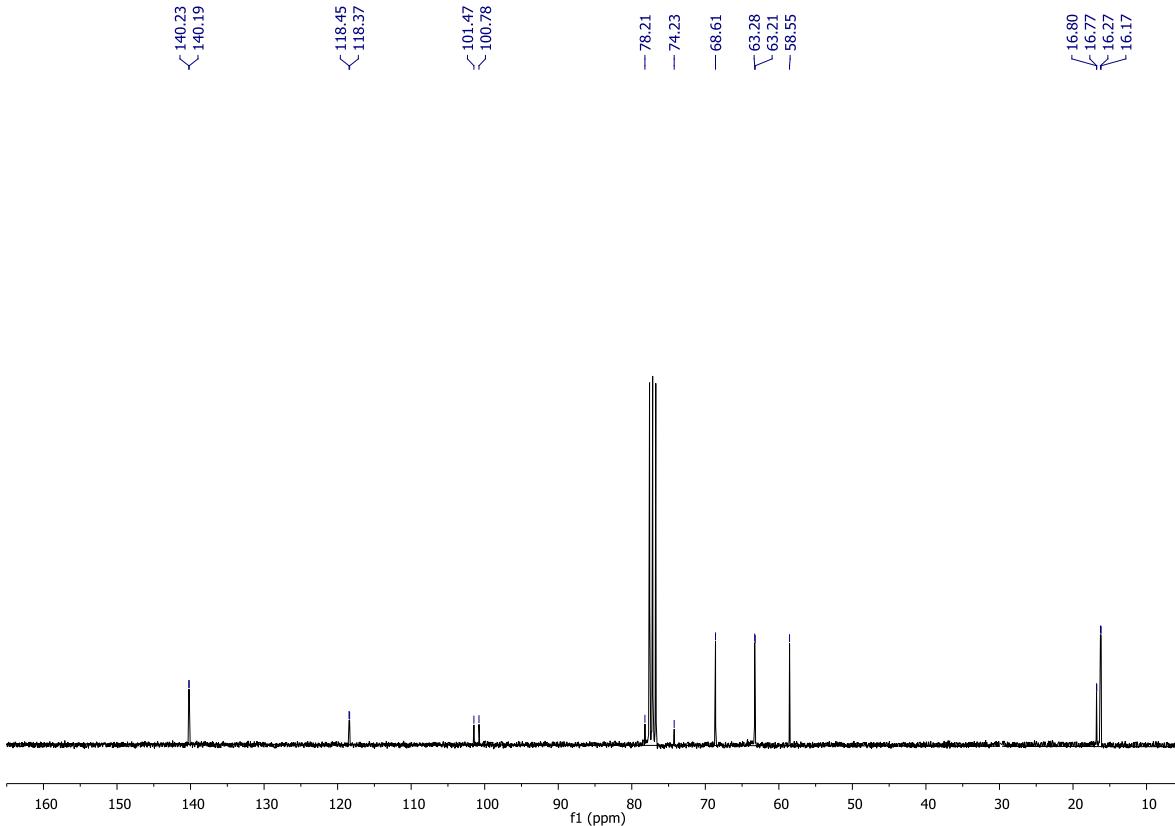


Figure 56. ^{13}C -NMR (75 MHz, CDCl_3).

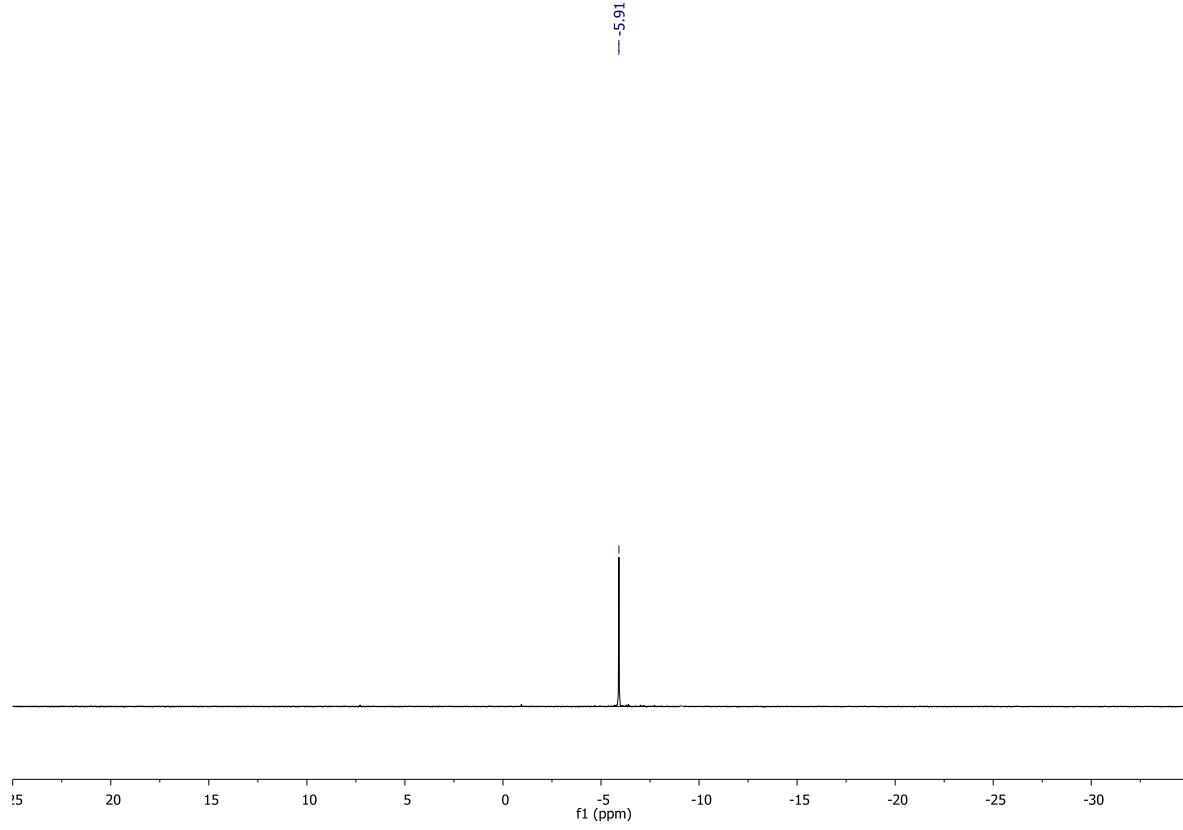
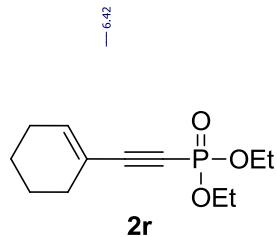


Figure 57. ^{31}P -NMR (121 MHz, CDCl_3).



$\swarrow^{4.19}$ $\swarrow^{4.17}$ $\swarrow^{4.14}$ $\swarrow^{4.11}$ $\swarrow^{4.09}$

$\swarrow^{2.13}$ $\swarrow^{1.61}$ $\swarrow^{1.60}$

$\swarrow^{1.37}$ $\swarrow^{1.35}$ $\swarrow^{1.33}$

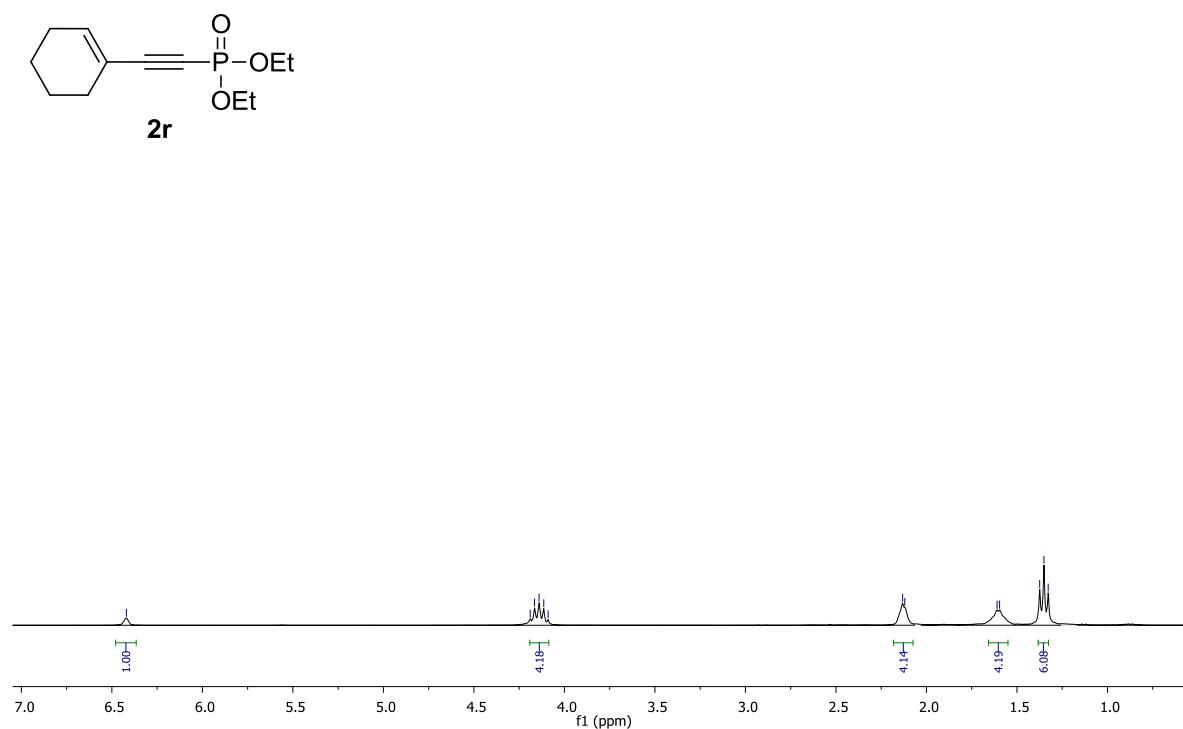


Figure 58. ^1H -NMR (300 MHz, CDCl_3).

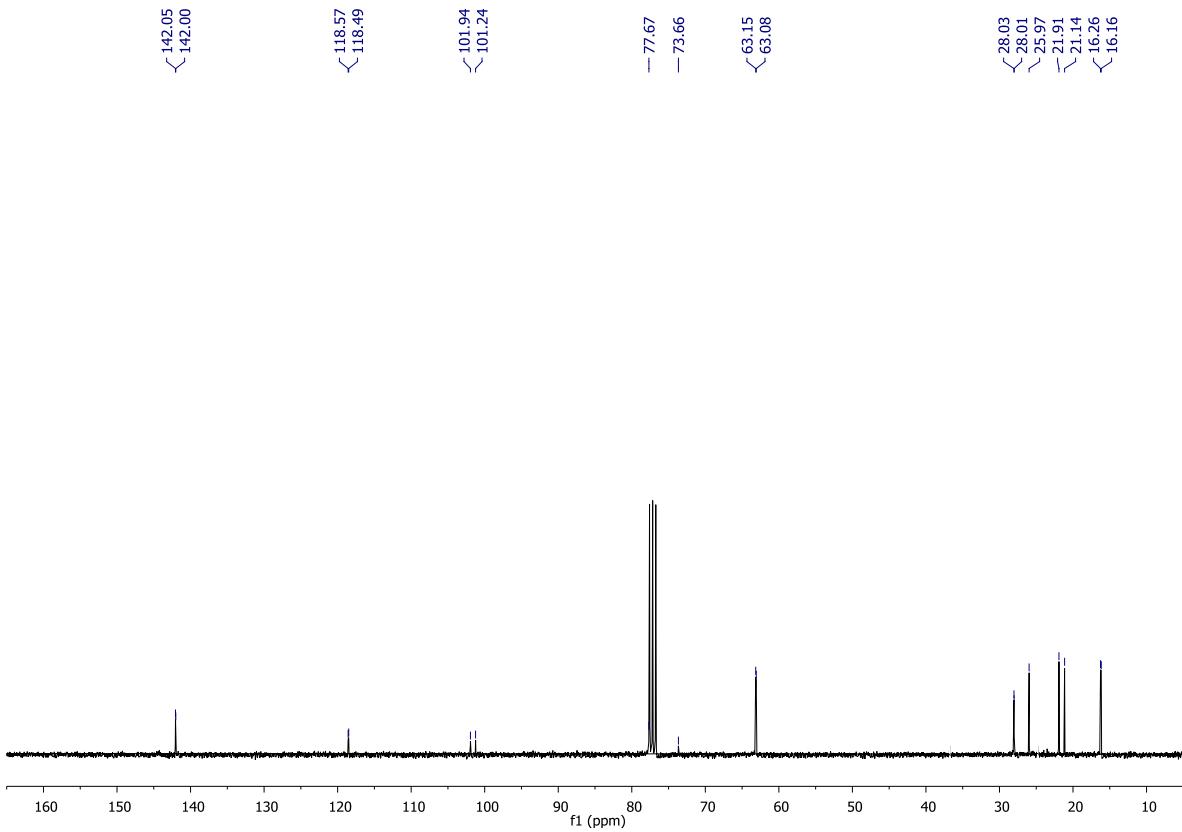


Figure 59. ^{13}C -NMR (75 MHz, CDCl_3).

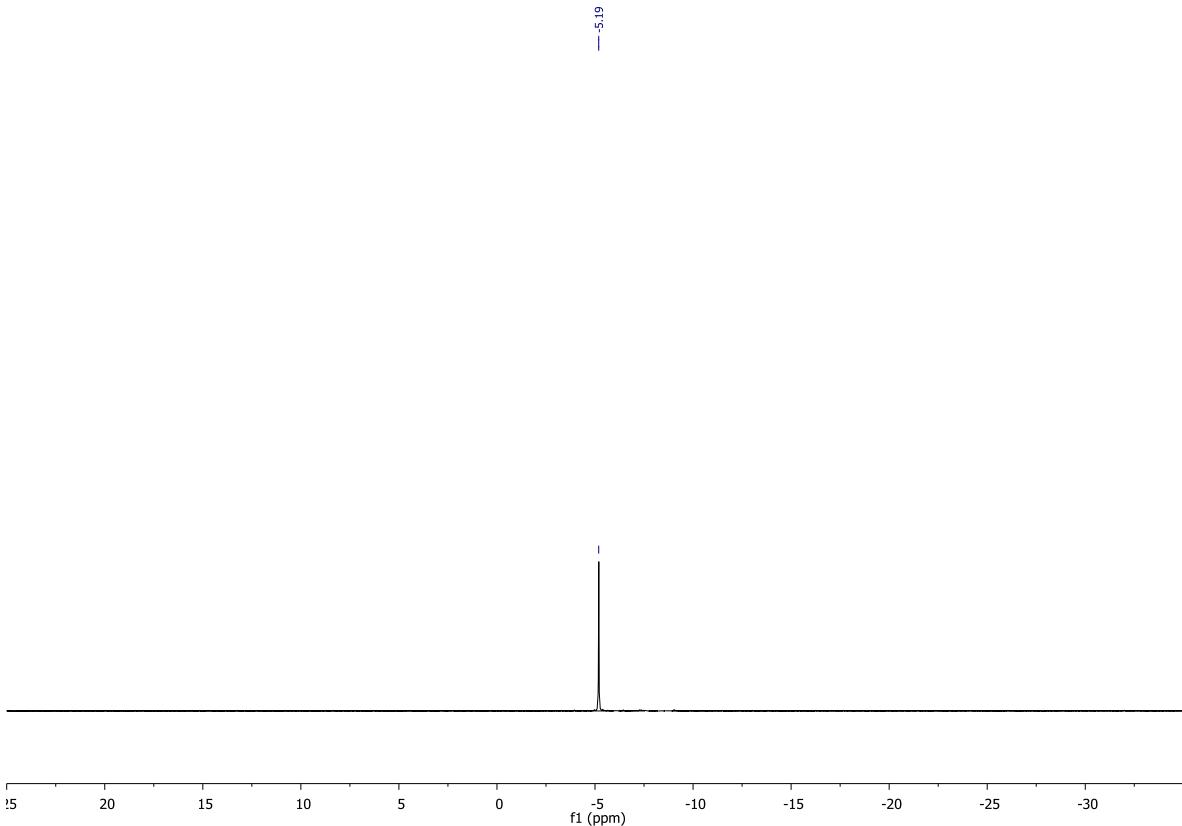


Figure 60. ^{31}P -NMR (121 MHz, CDCl_3).

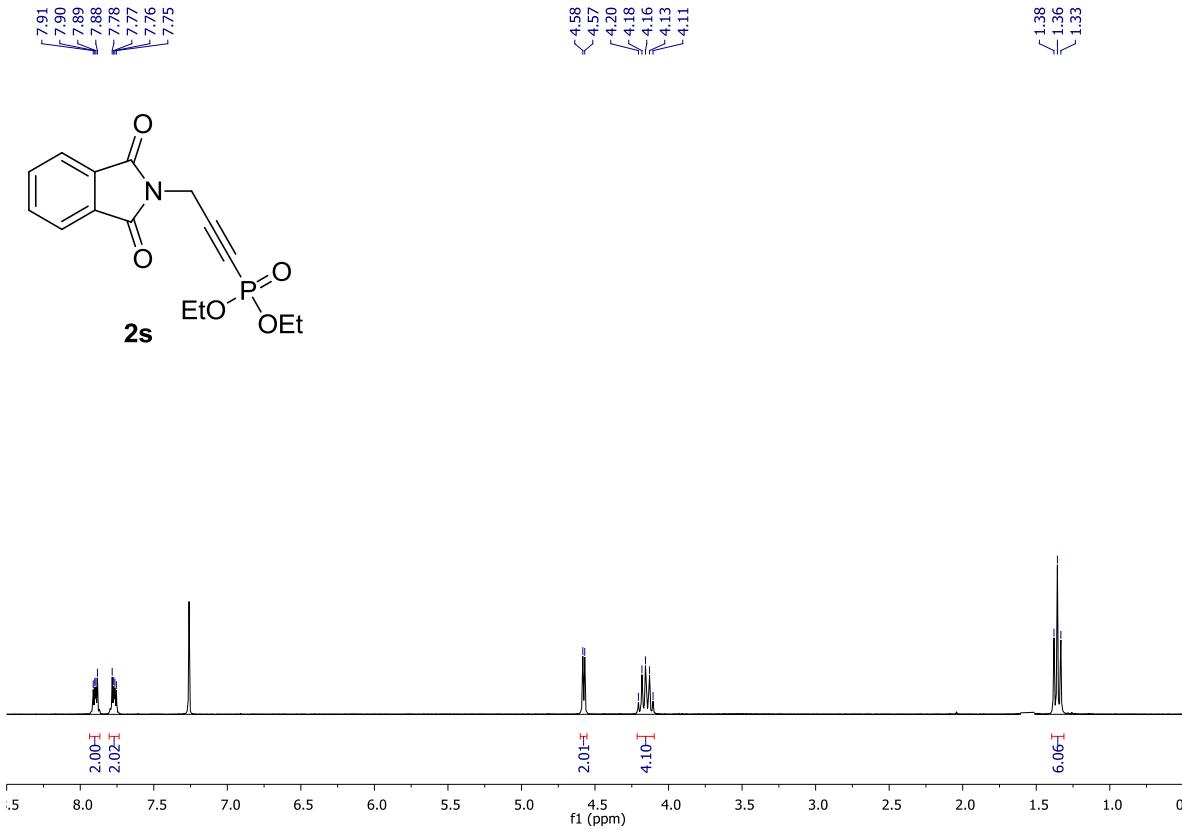


Figure 61. ^1H -NMR (300 MHz, CDCl_3).

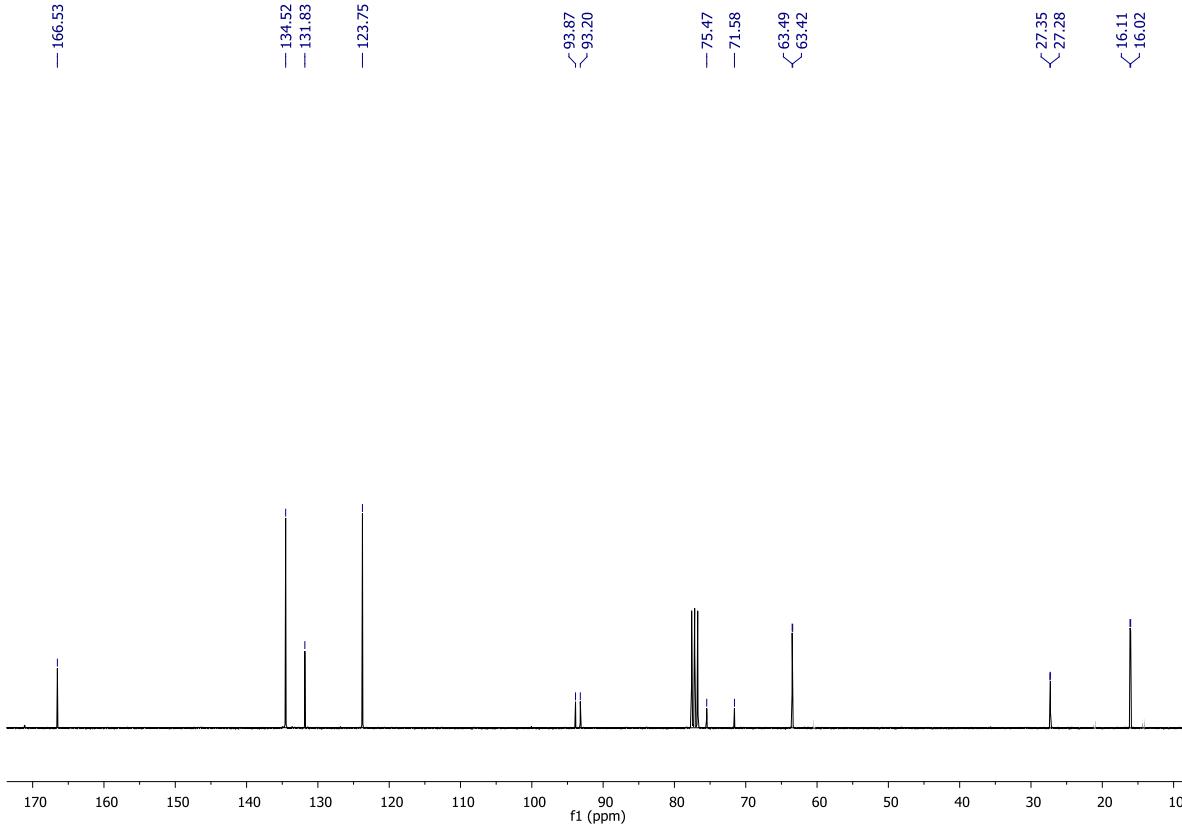


Figure 62. ^{13}C -NMR (75 MHz, CDCl_3).

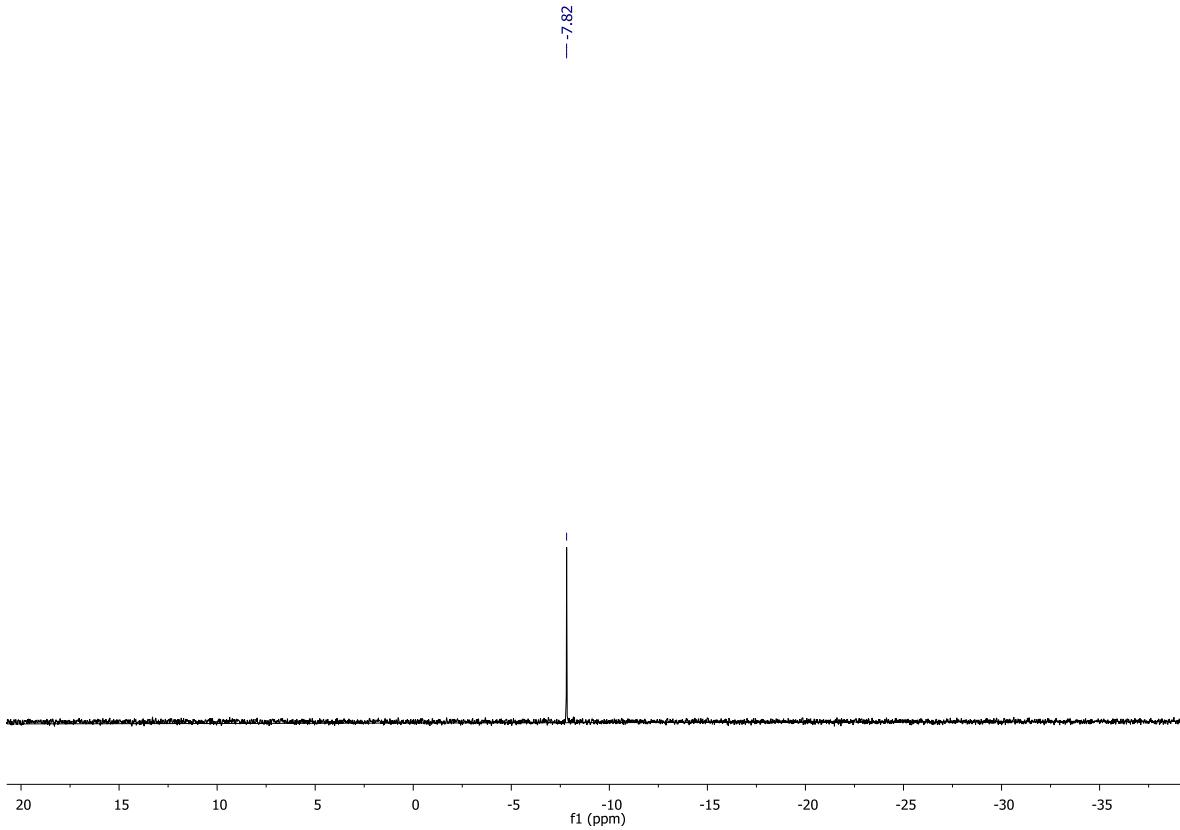


Figure 63. ^{31}P -NMR (121 MHz, CDCl_3).

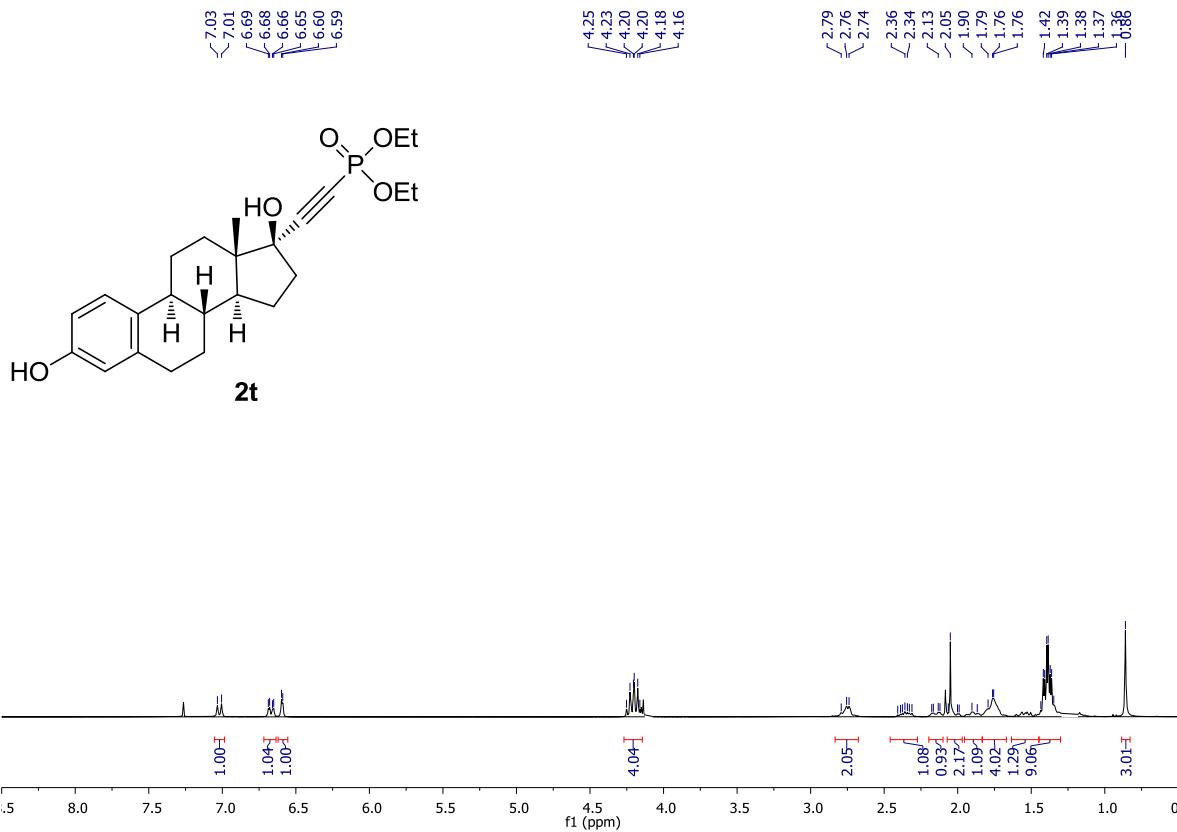


Figure 64. ^1H -NMR (300 MHz, CDCl_3).

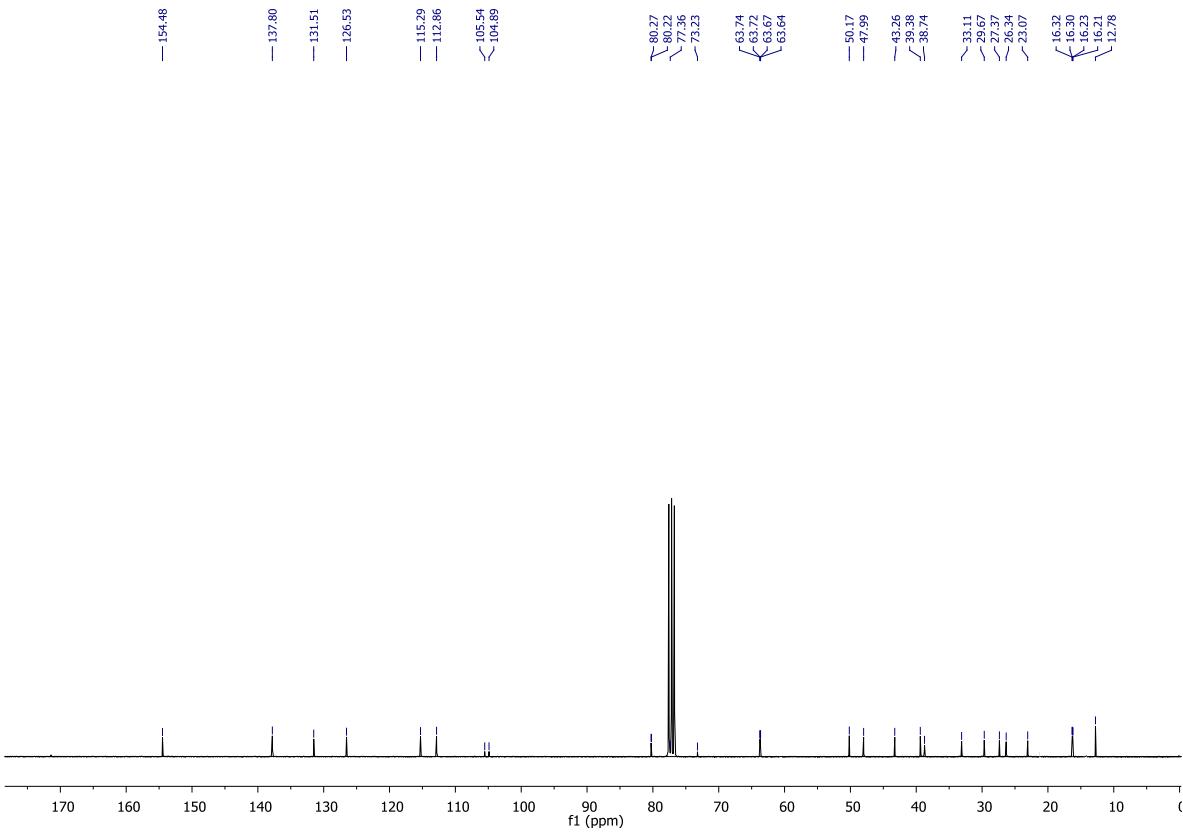


Figure 65. ^{13}C -NMR (75 MHz, CDCl_3).

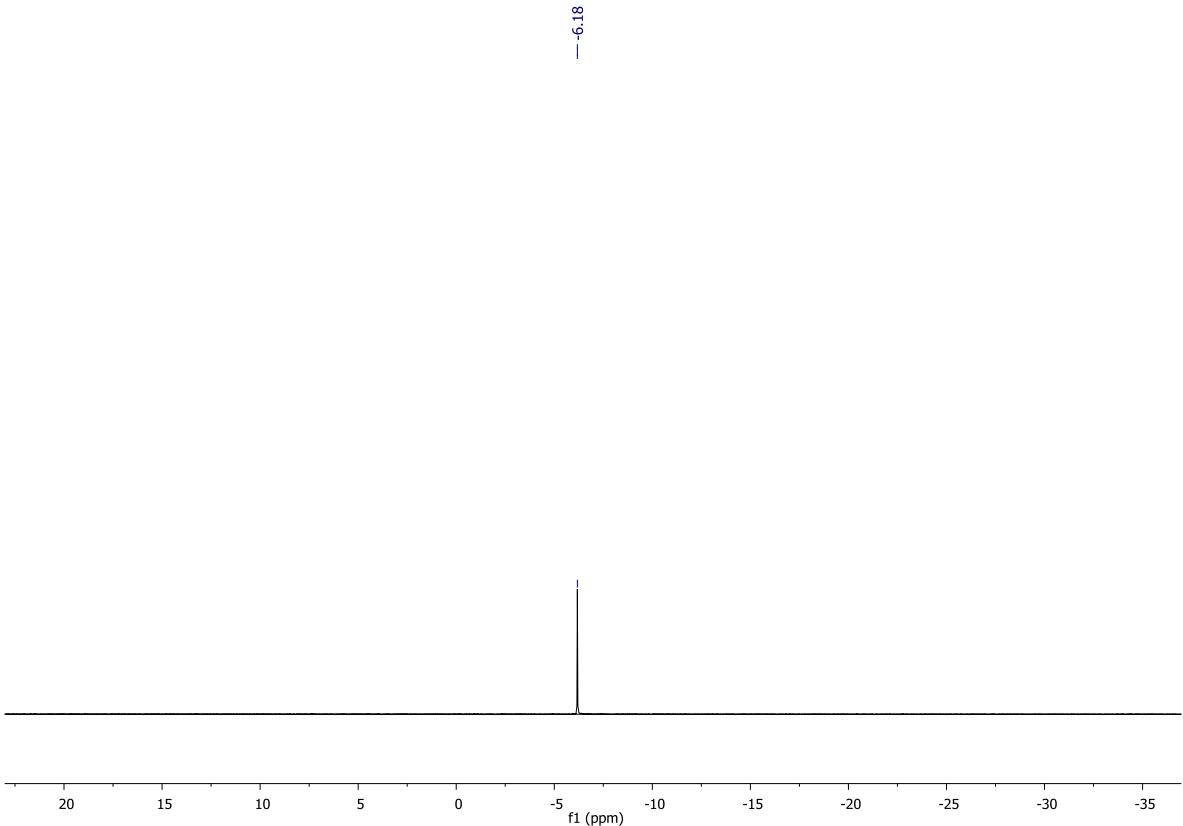


Figure 66. ^{31}P -NMR (121 MHz, CDCl_3).