APPENDIX C

RELEVANT SPECTROSCOPIC DATA

Figure C.1. ^{1}H NMR spectrum of **5a** in C_6D_6.

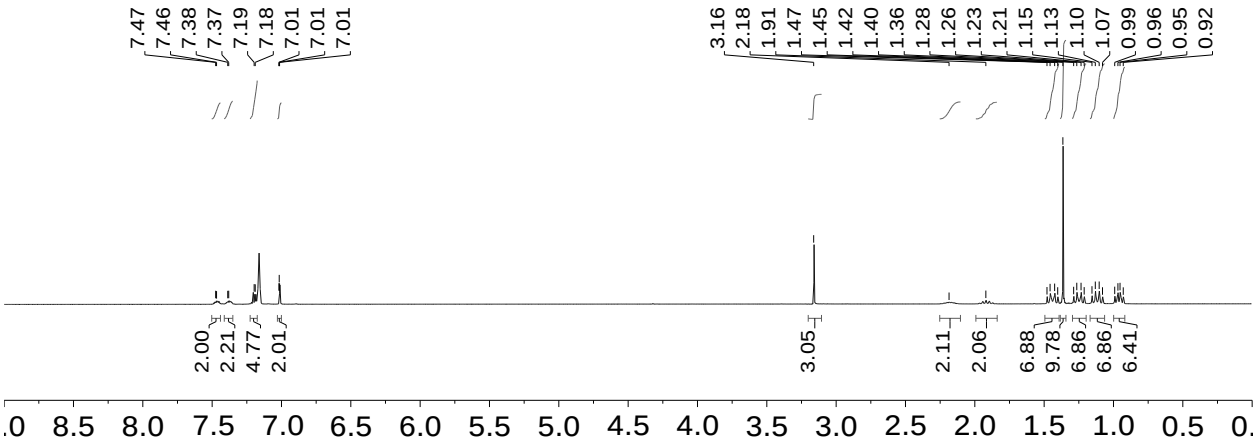


Figure C.2. $^{13}C\{^{1}H\}$ NMR spectrum of **5a** in C_6D_6.

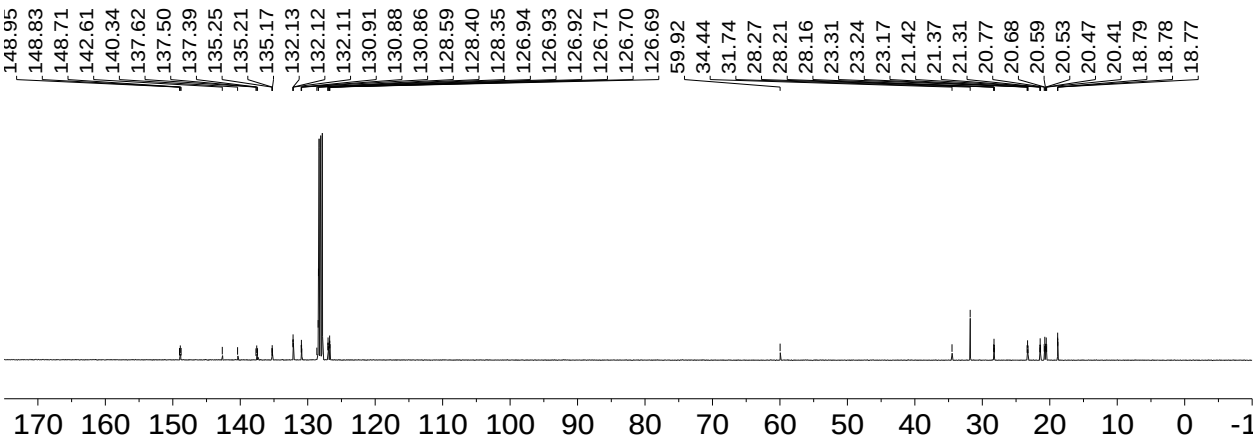


Figure C.3. $^{31}P\{^{1}H\}$ NMR spectrum of **5a** in C_6D_6.

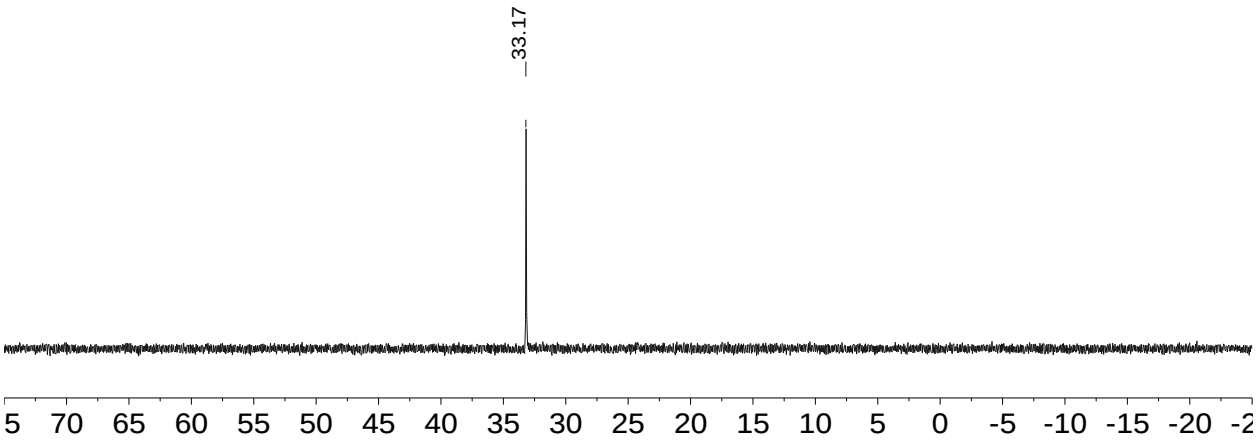


Figure C.4. ^{1}H NMR spectrum of **6a** in C_6D_6.

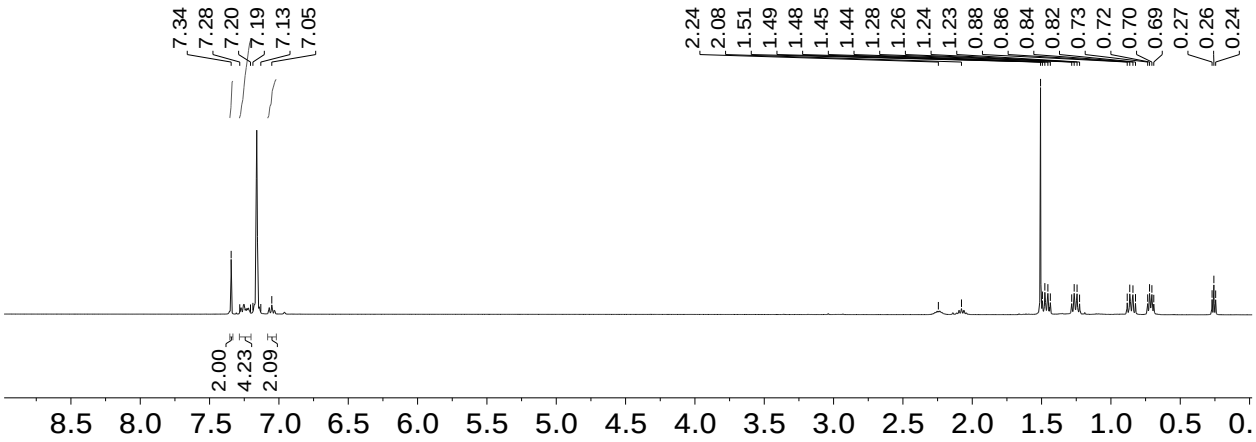


Figure C.5. $^{13}C\{^{1}H\}$ NMR spectrum of **6a** in C_6D_6.

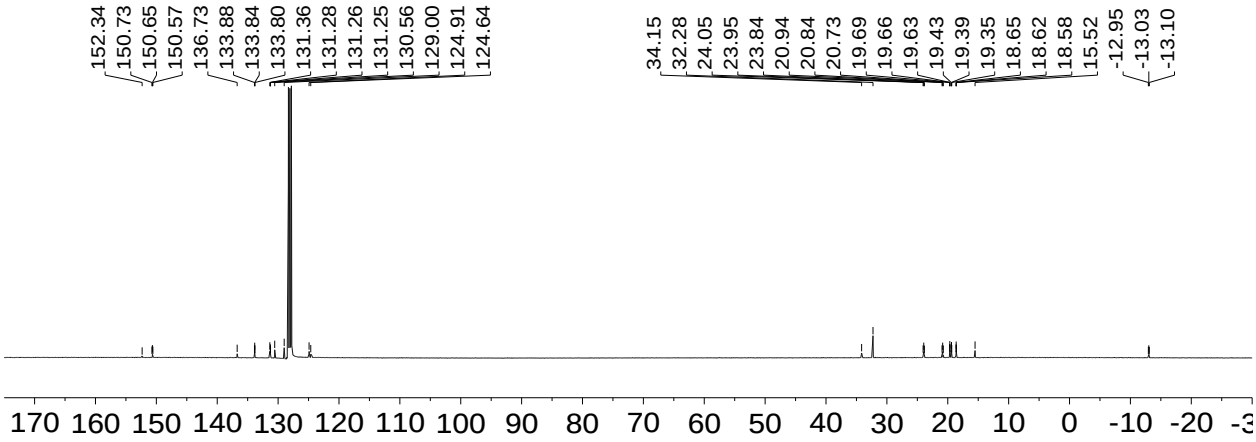


Figure C.6. $^{31}P\{^{1}H\}$ NMR spectrum of **6a** in C_6D_6.

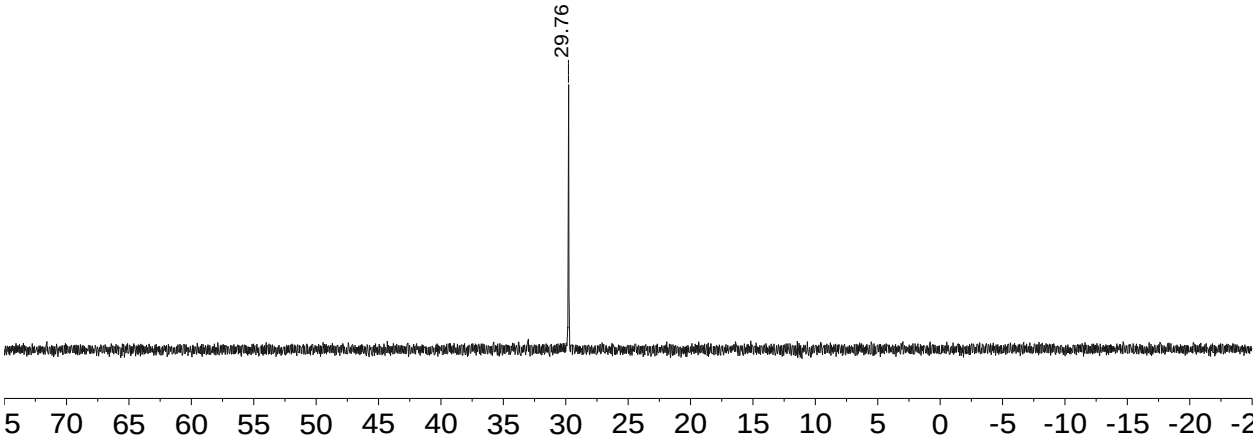


Figure C.7. ^{1}H NMR spectrum of **7a** in C_6D_6.

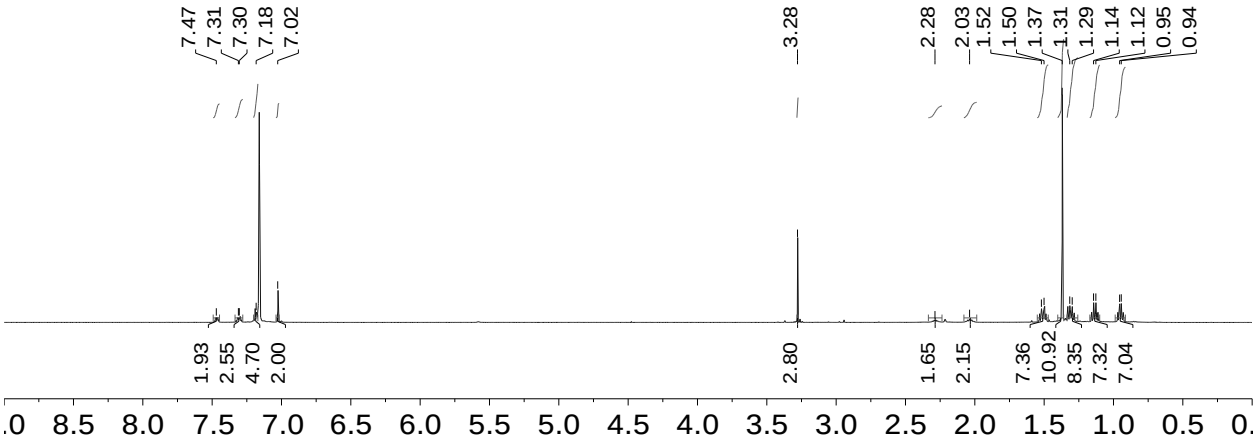


Figure C.8. $^{13}C\{^{1}H\}$ NMR spectrum of **7a** in C_6D_6.

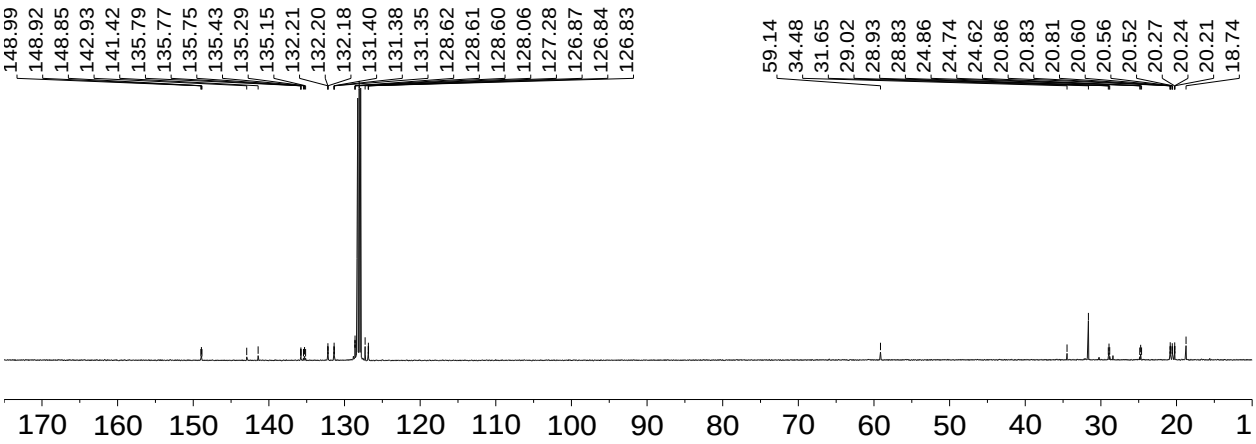


Figure C.9. $^{31}P\{^{1}H\}$ NMR spectrum of **7a** in C_6D_6.

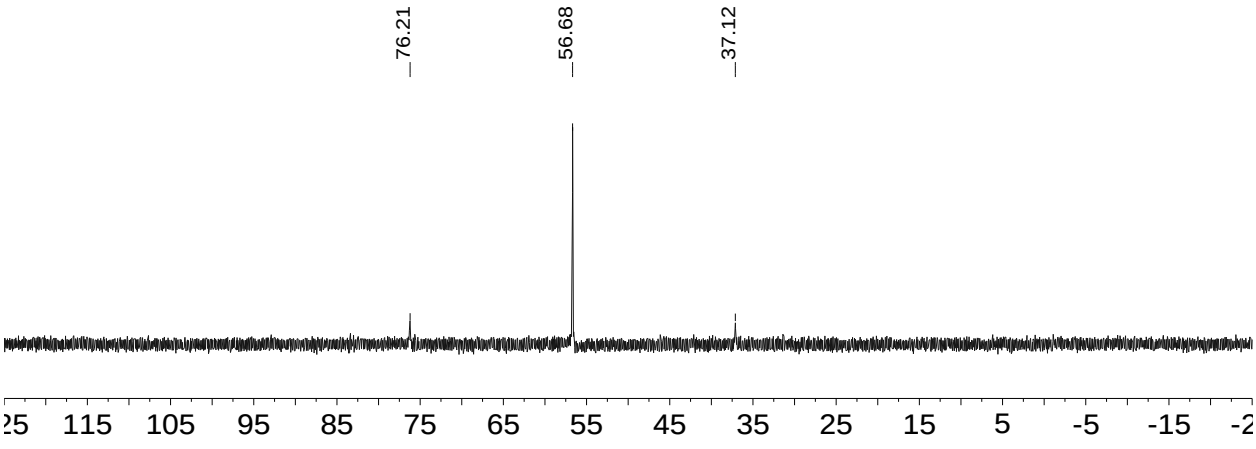


Figure C.10. ^{1}H NMR spectrum of **8a** in C_6D_6.

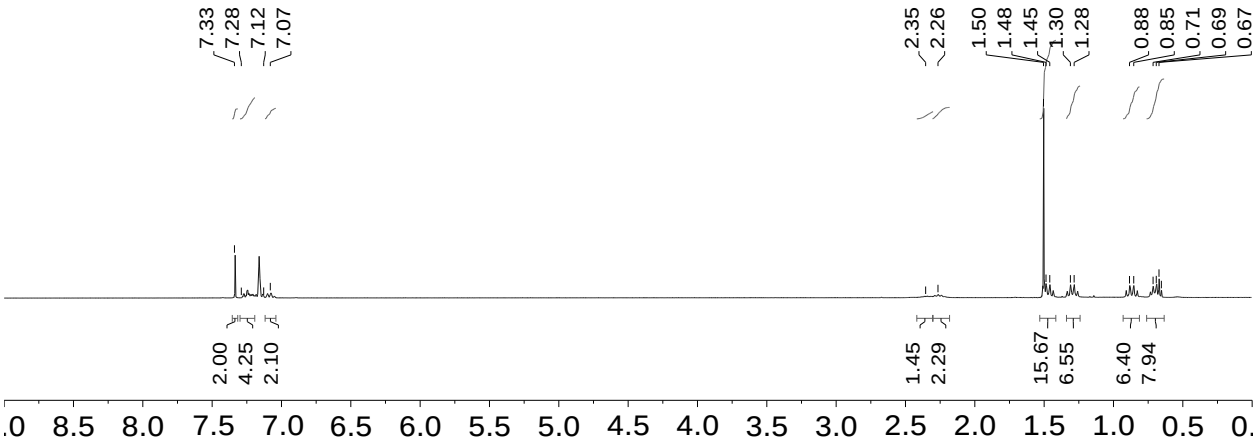


Figure C.11. $^{13}C\{^{1}H\}$ NMR spectrum of **8a** in C_6D_6.

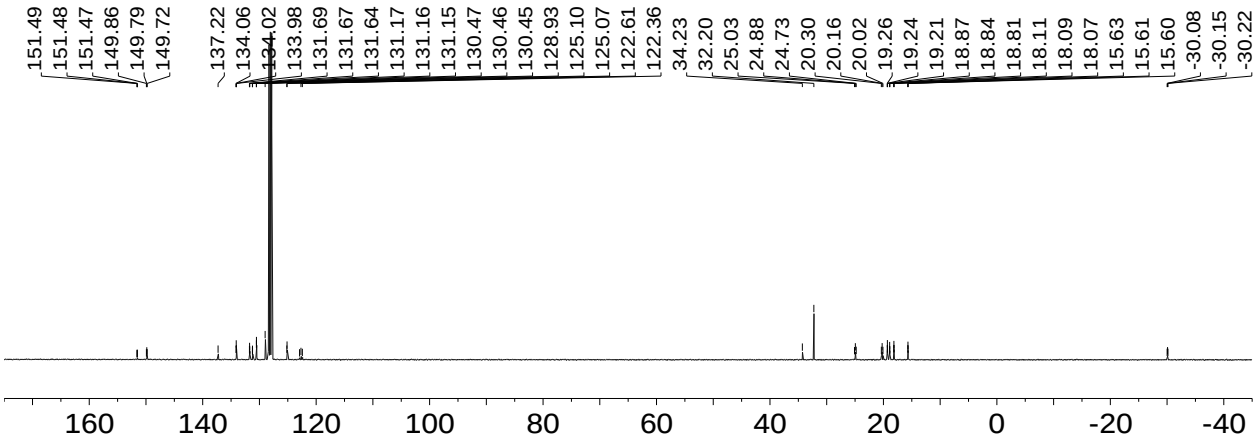


Figure C.12. $^{31}P\{^{1}H\}$ NMR spectrum of **8a** in C_6D_6.

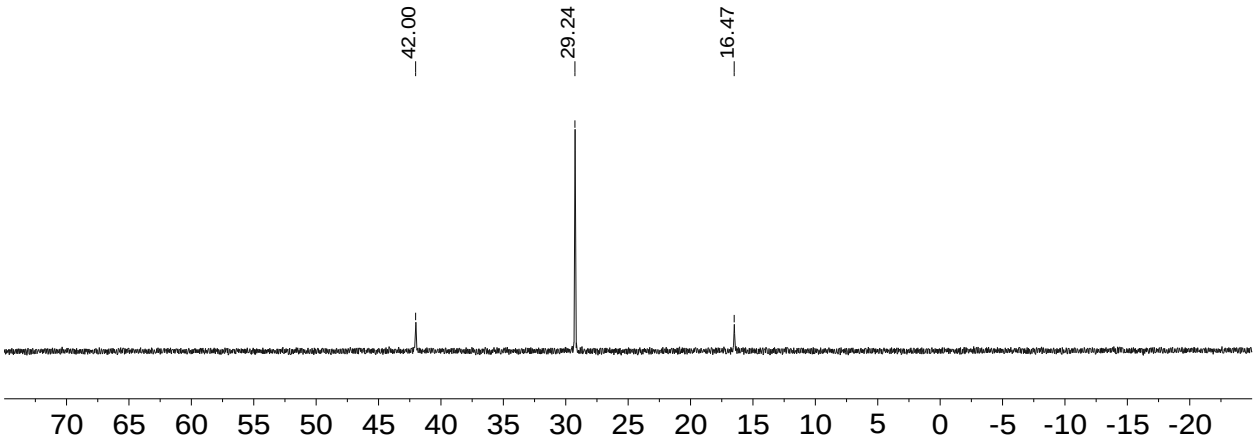


Figure C.13. ^{1}H NMR spectrum of 5-(tert-butyl)-1,3-diiodo-2-(4-nitrophenoxy)-benzene in $CDCl_3$.

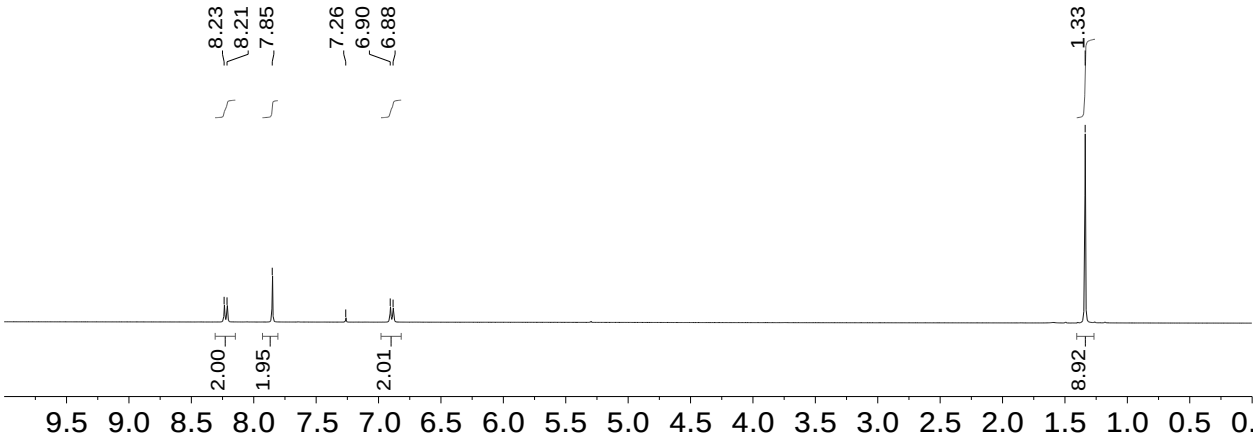


Figure C.14. $^{13}C\{^{1}H\}$ NMR spectrum of 5-(tert-butyl)-1,3-diiodo-2-(4-nitrophenoxy)benzene in $CDCl_3$.

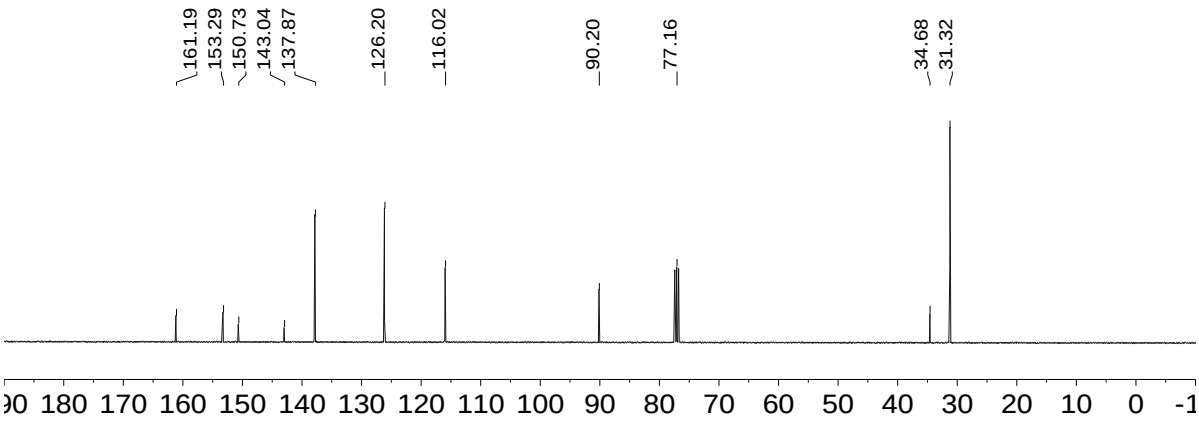


Figure C.15. ^{1}H NMR spectrum of 1,3-bis(2'-bromophenyl)-2-(4'-nitrophenoxy)-5-tert-butyl-benzene in $CDCl_3$. Note: Residual CH_2Cl_2 present.

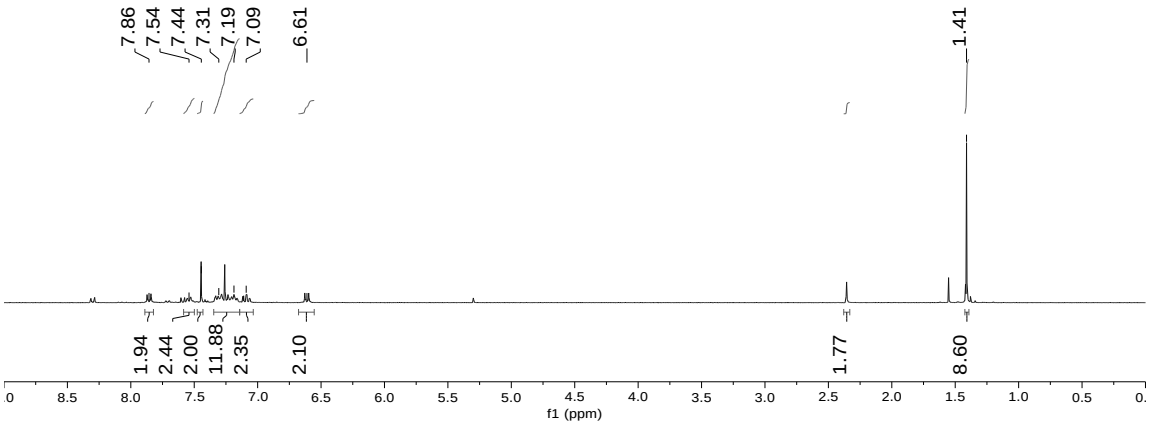


Figure C.16. ^{1}H NMR spectrum of 1,3-bis(2'-bromophenyl)-2-(4'-aminophenoxy)-5-tert-butyl-benzene in $CDCl_3$. Note: Residual CH_2Cl_2 and Et_2O present.

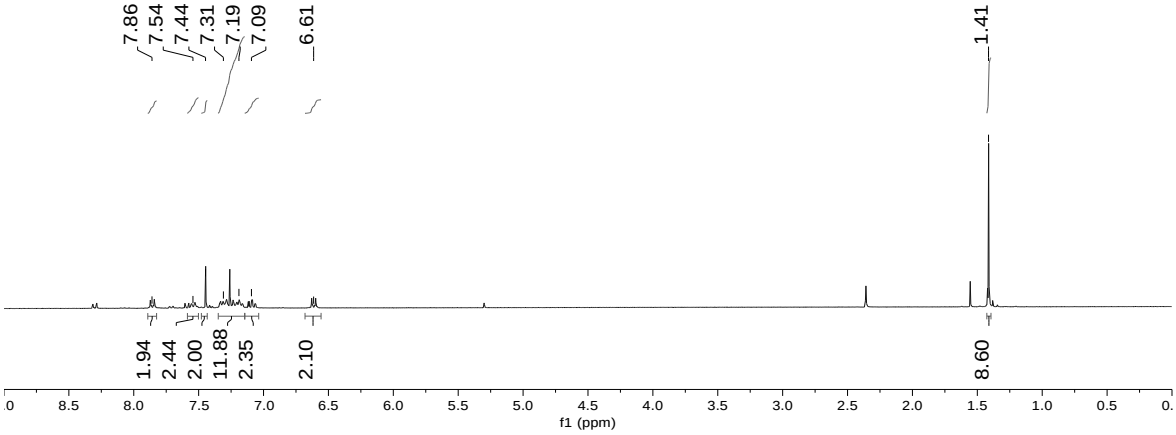


Figure C.17. ^{1}H NMR spectrum of 1,3-bis(2'-bromophenyl)-2-(4'-dimethylamino-phenoxy)-5-tert-butyl-benzene in C_6D_6. Note: Residual Et_2O present.

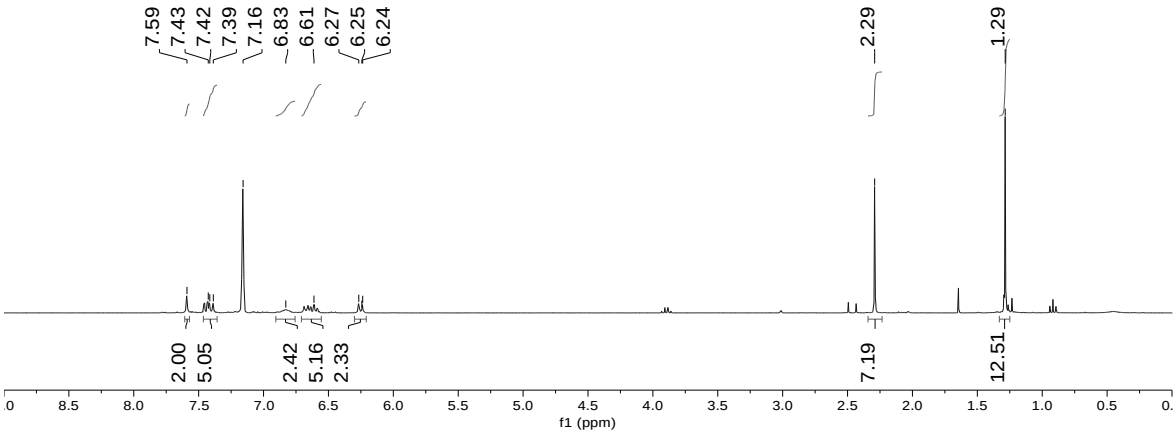


Figure C.18. ^{1}H NMR spectrum of **1c** at 25 °C in C_6D_6.

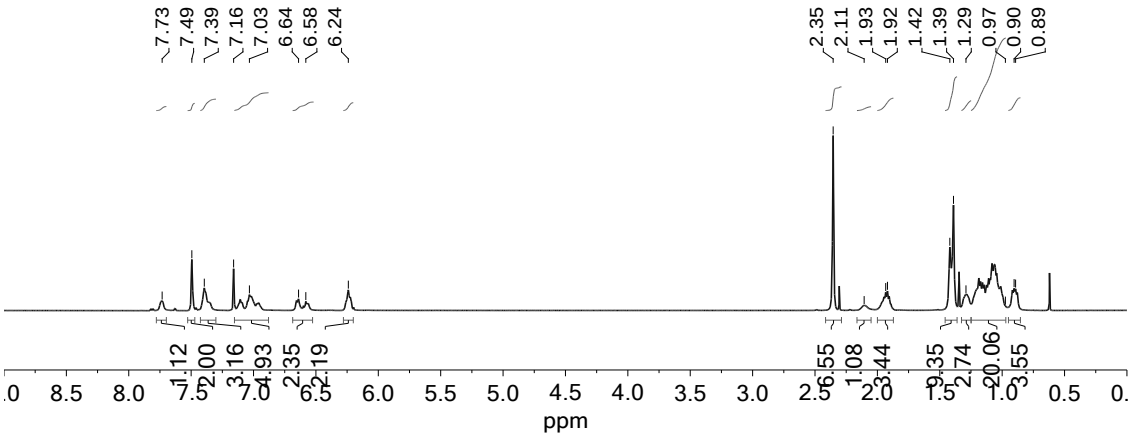


Figure C.19. $^{13}C\{^{1}H\}$ NMR spectrum of **1c** at 25 °C in C_6D_6.

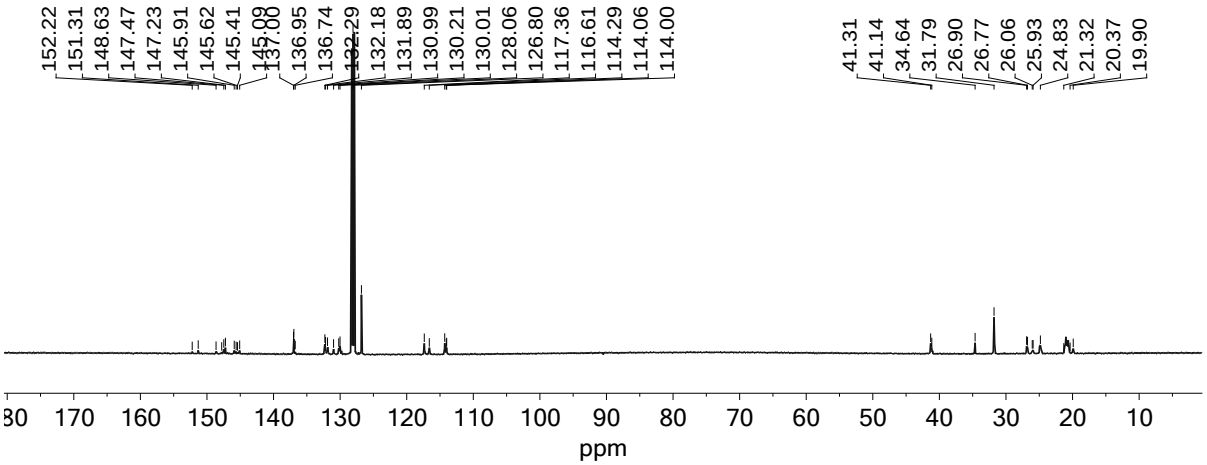


Figure C.20. $^{31}P\{^{1}H\}$ NMR spectrum of **1c** at 25 °C in C_6D_6.

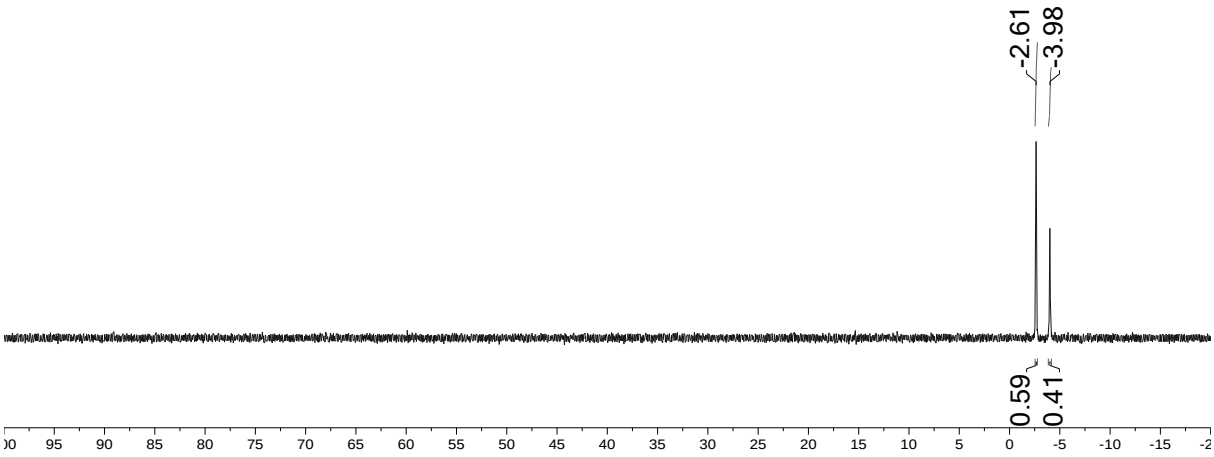


Figure C.21. ^{1}H NMR spectrum of **1c** at 70 °C in C_6D_6.

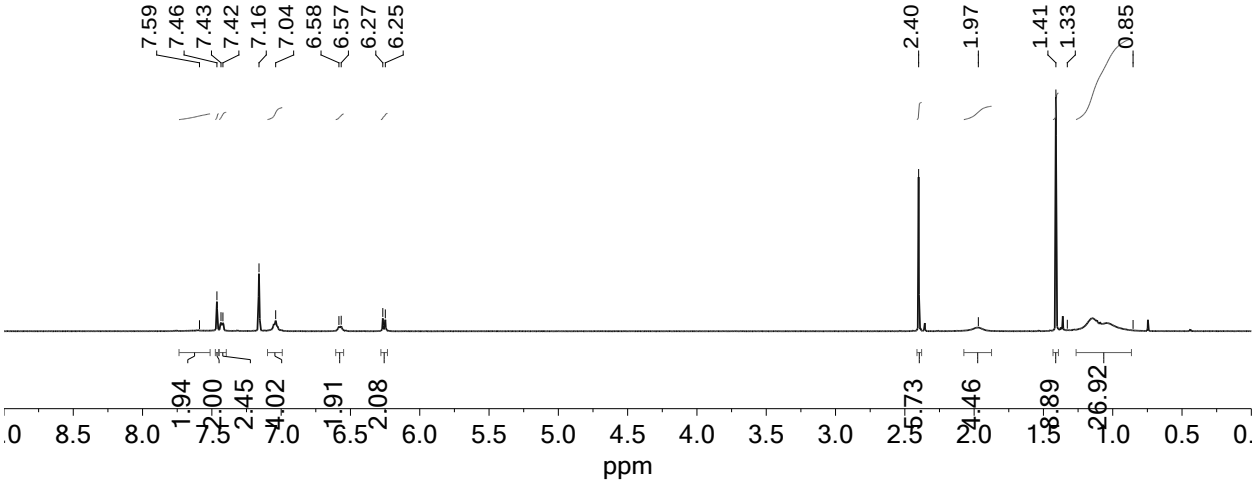


Figure C.22. ^{1}H NMR spectrum of 1,3-bis(2'-bromophenyl)-2-phenoxy-5-tert-butyl-benzene in $CDCl_3$.

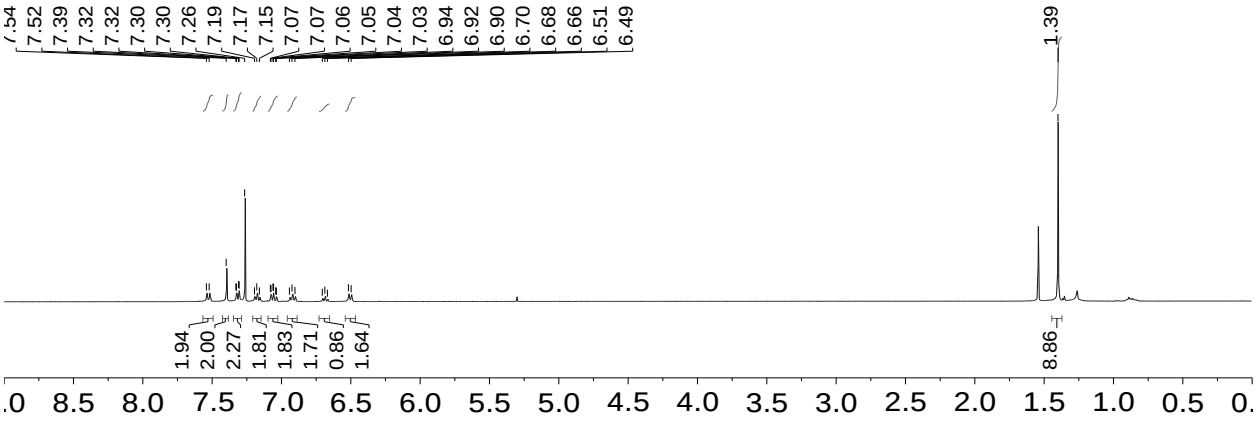


Figure C.23. $^{13}C\{^{1}H\}$ NMR spectrum of 1,3-bis(2'-bromophenyl)-2-phenoxy-5-tert-butyl-benzene in $CDCl_3$.

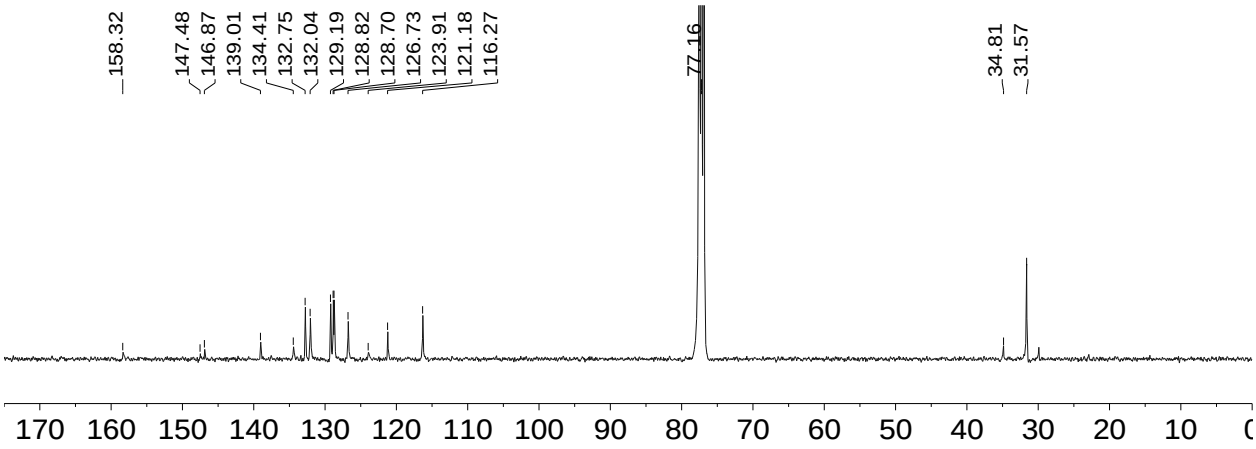


Figure C.24. ^{1}H NMR spectrum of **1d** at 25 °C in $CDCl_3$.

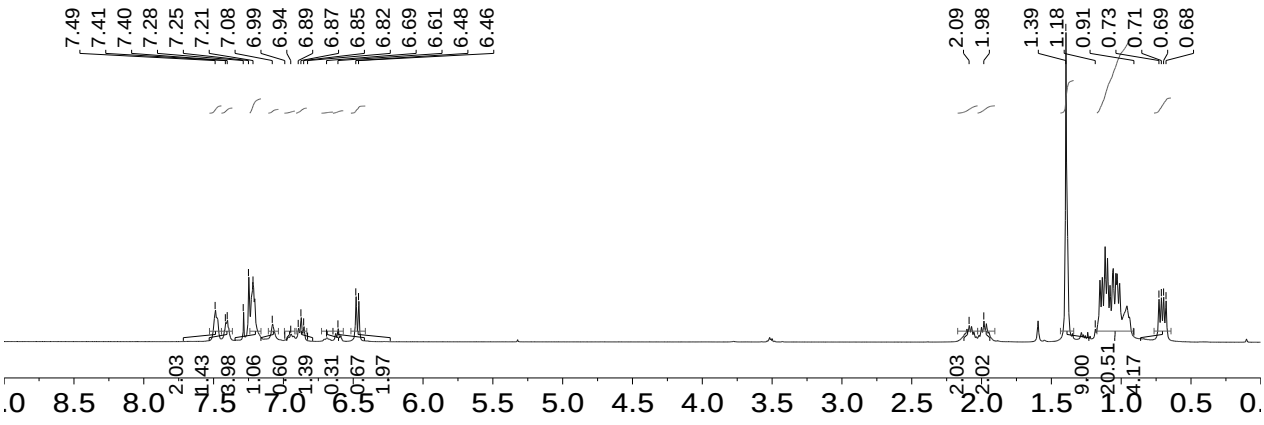


Figure C.25. ^{1}H NMR spectrum of **1d** at 25 °C in C_6D_6.

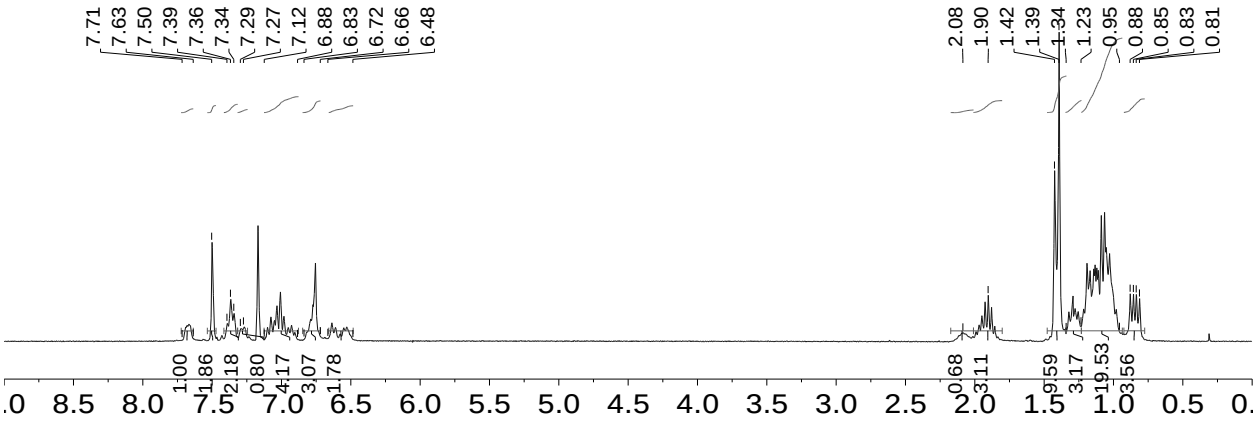


Figure C.26. $^{13}C\{^{1}H\}$ NMR spectrum of **1d** at 25 °C in $CDCl_3$.

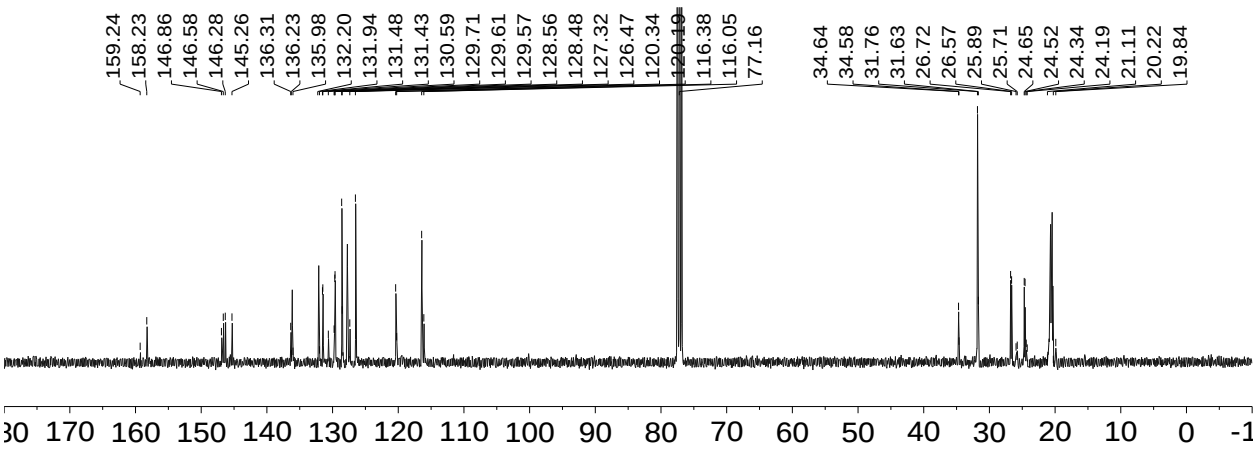


Figure C.27. $^{31}P\{^{1}H\}$ NMR spectrum of **1d** at 25 °C in $CDCl_3$.

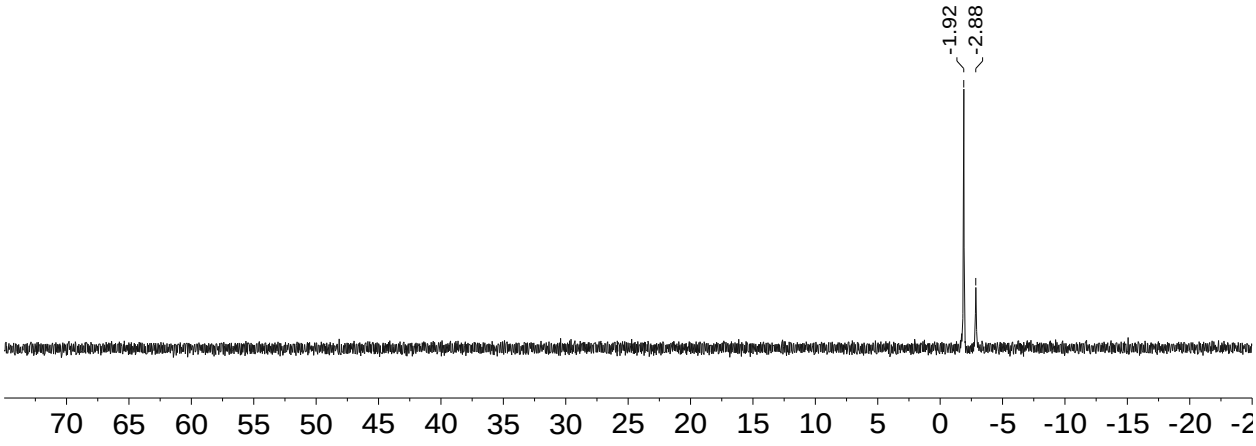


Figure C.28. $^{31}P\{^{1}H\}$ NMR spectrum of **1d** at 25 °C in C_6D_6.

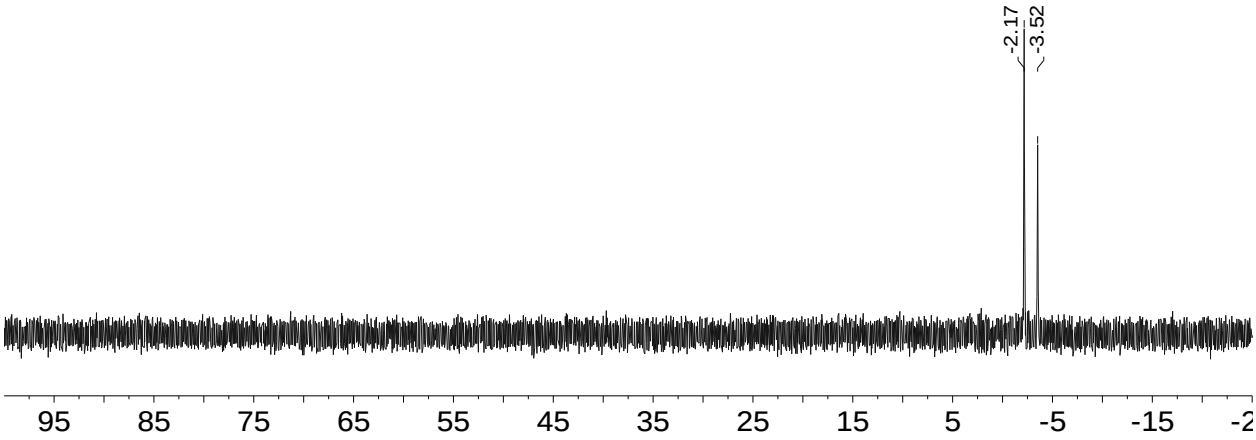


Figure C.29. ^{1}H NMR spectrum of **1d** at 70 °C in C_6D_6.

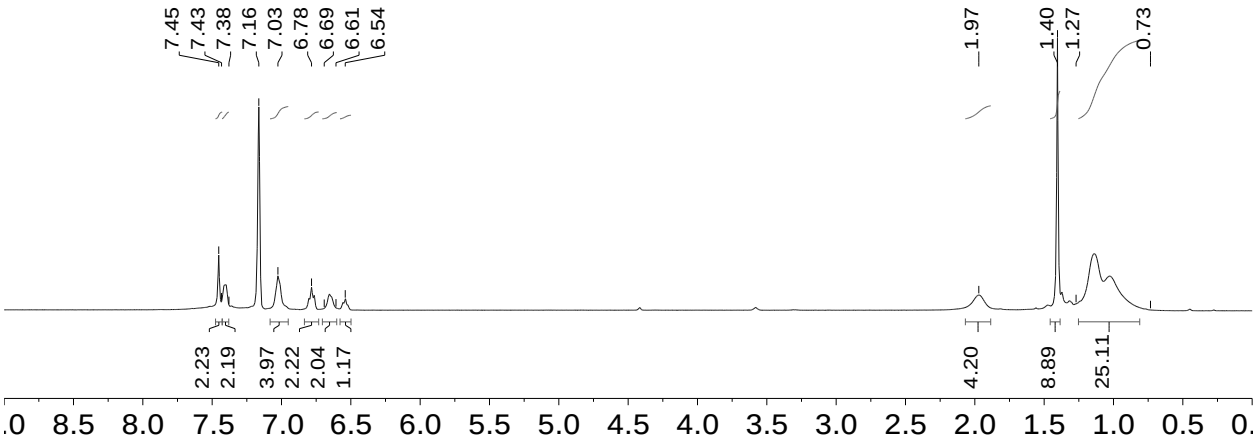


Figure C.30. $^{13}C\{^{1}H\}$ NMR spectrum of **1d** at 70 °C in C_6D_6.

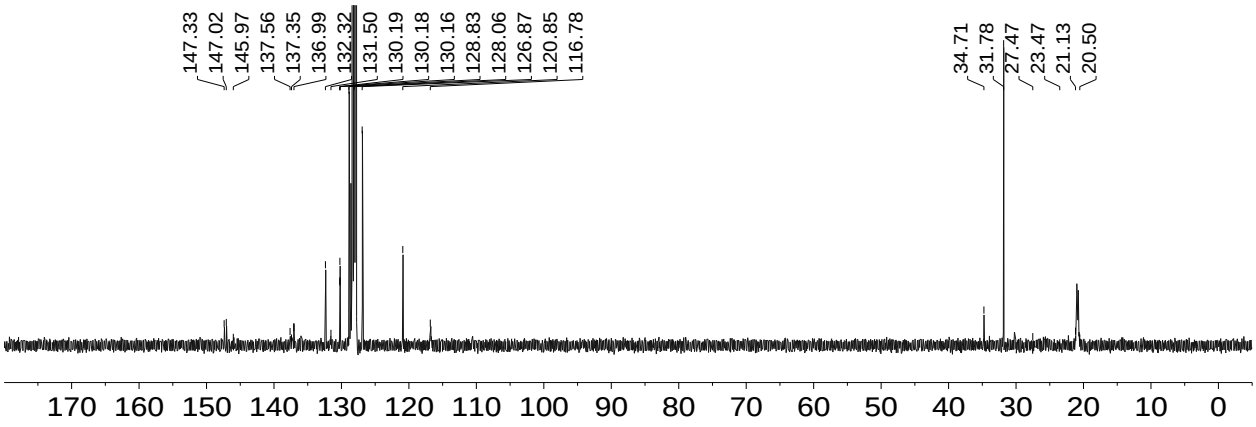


Figure C.31. $^{31}P\{^{1}H\}$ NMR spectrum of **1d** at 70 °C in C_6D_6. (Note: Referenced to solvent lock.)

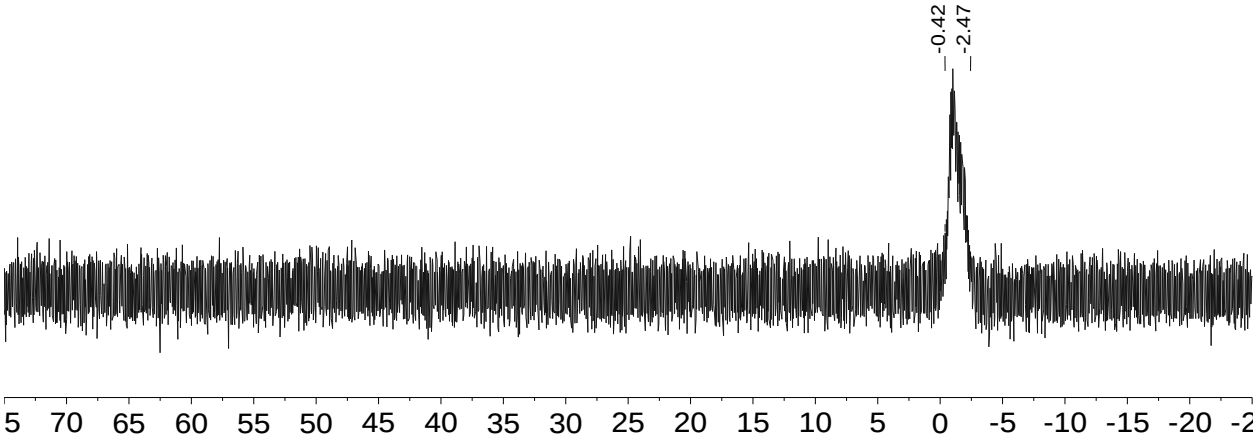


Figure C.32. ^{1}H NMR spectrum of **10d** in C_6D_6.

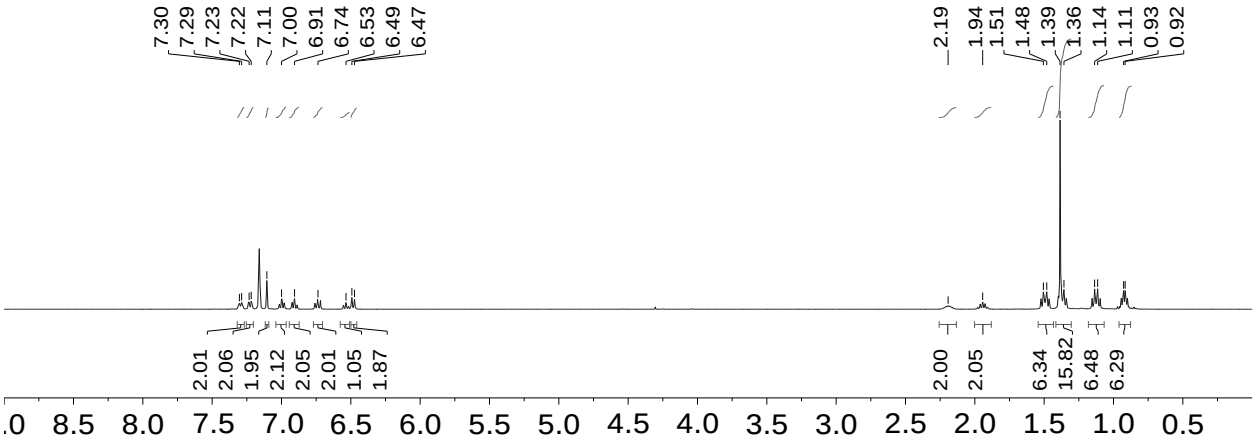


Figure C.33. $^{13}C\{^{1}H\}$ NMR spectrum of **10d** in C_6D_6.

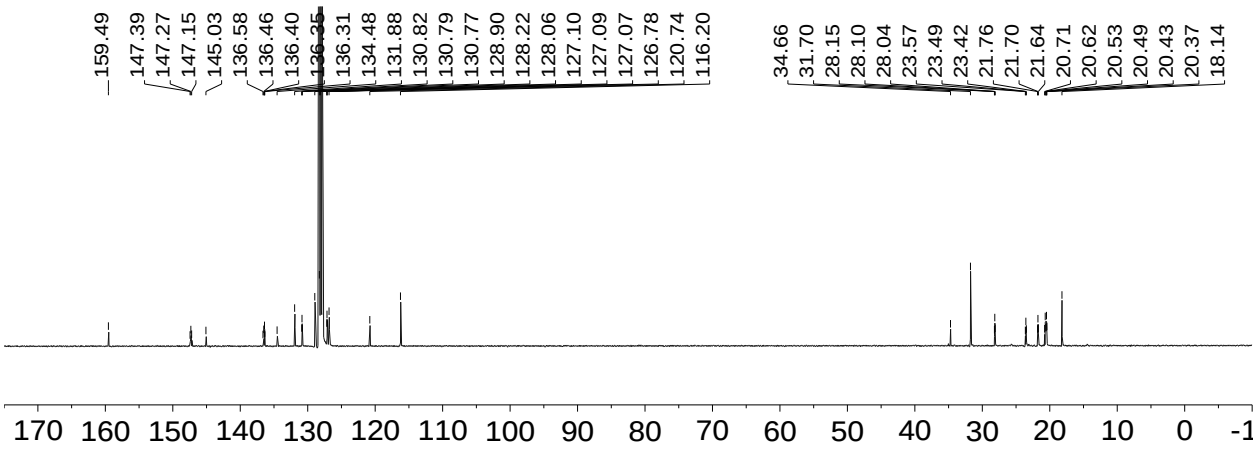


Figure C.34. $^{31}P\{^{1}H\}$ NMR spectrum of **10d** in C_6D_6.

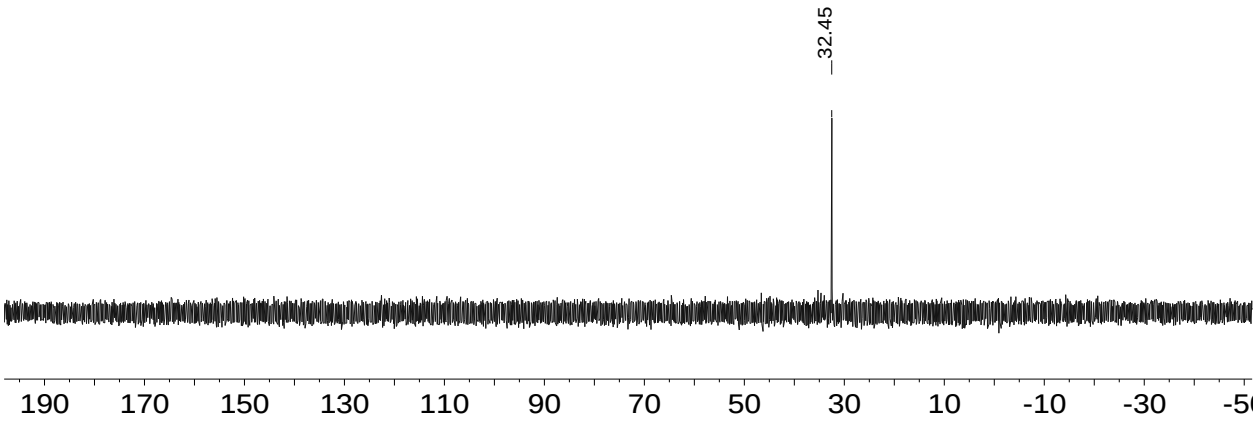


Figure C.35. ^{1}H NMR spectrum of **11d** in C_6D_6.

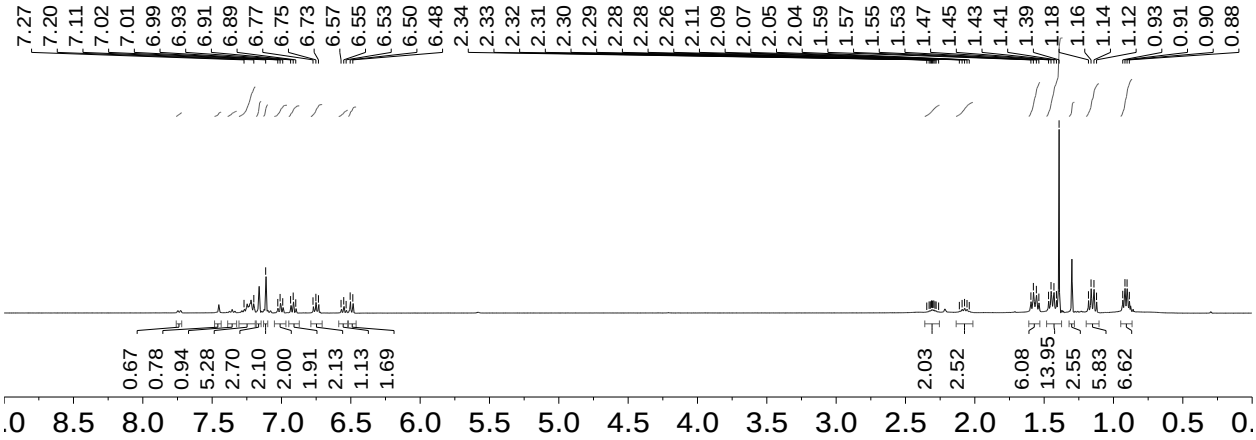


Figure C.36. $^{13}C\{^{1}H\}$ NMR spectrum of **11d** in C_6D_6.

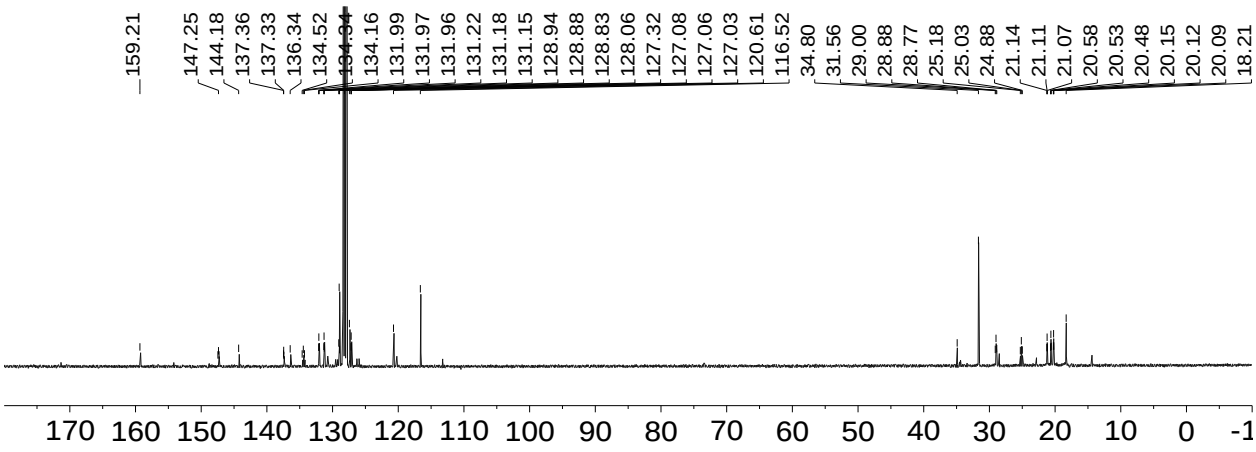


Figure C.37. $^{31}P\{^{1}H\}$ NMR spectrum of **11d** in C_6D_6.

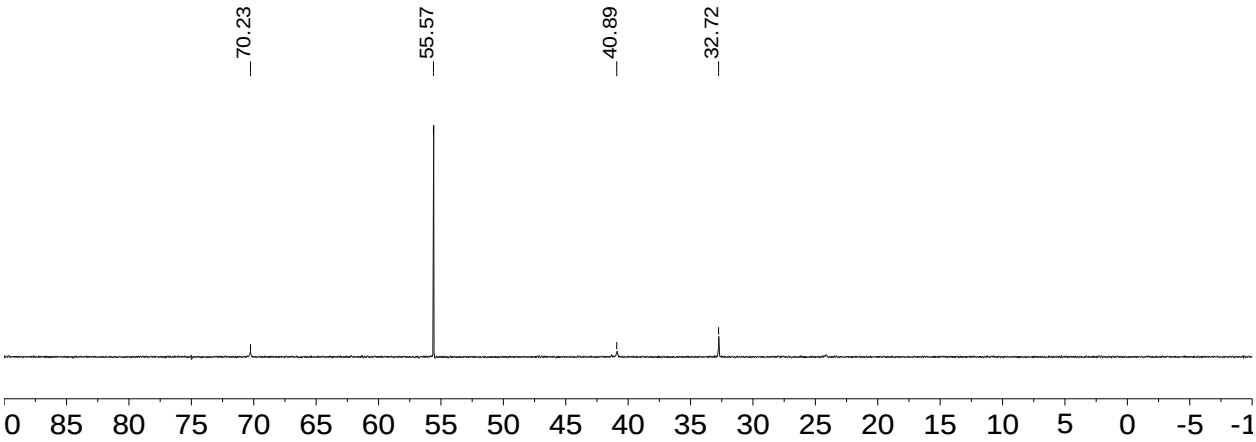


Figure C.38. ^{1}H NMR spectrum of **12c** in C_6D_6.

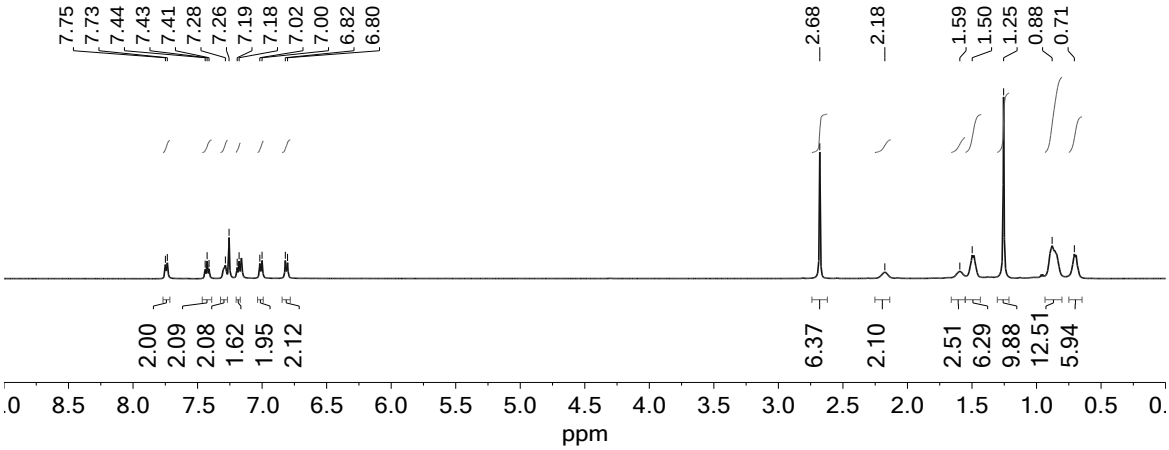


Figure C.39. $^{13}C\{^{1}H\}$ NMR spectrum of **12c** in C_6D_6.

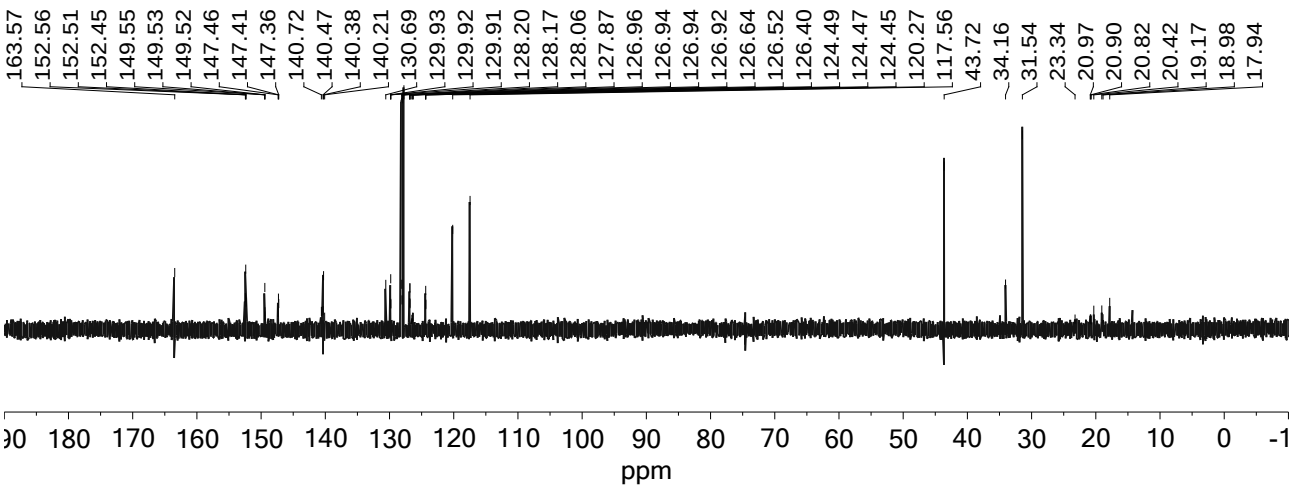


Figure C.40. $^{31}P\{^{1}H\}$ NMR spectrum of **12c** in C_6D_6.

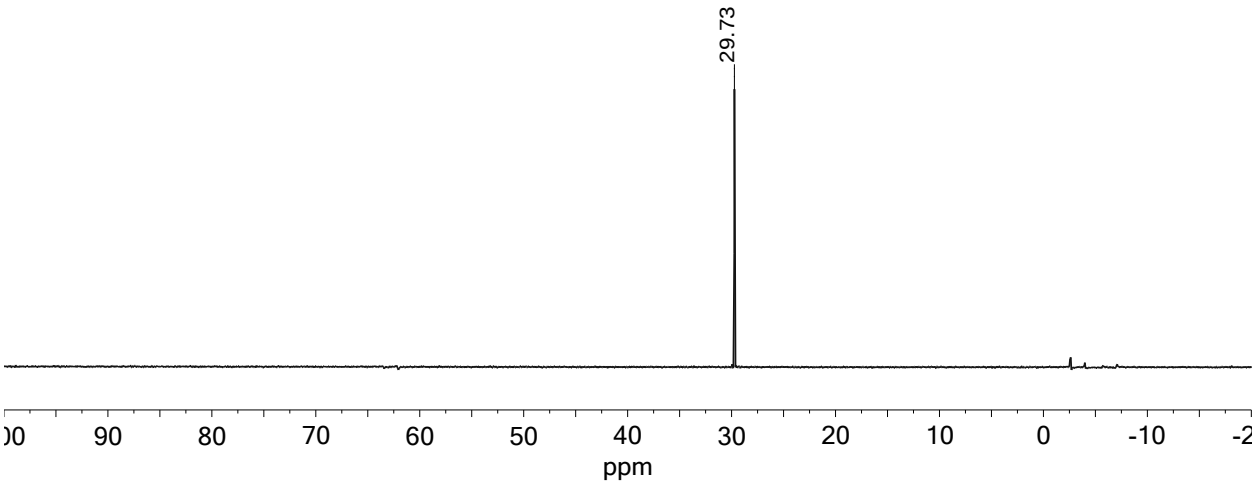


Figure C.41. ^{1}H NMR spectrum of **13d** in C_6D_6.

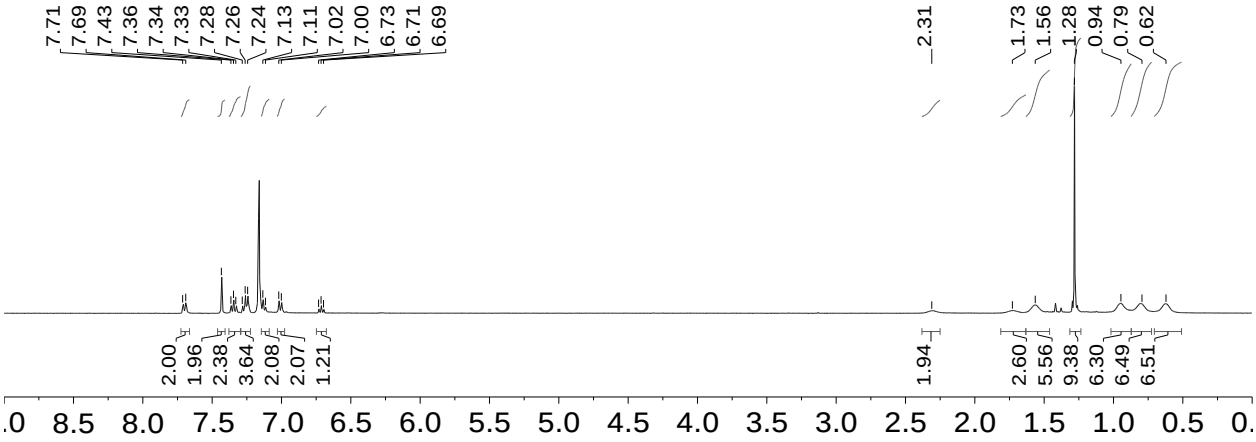


Figure C.42. $^{13}C\{^{1}H\}$ NMR spectrum of **13d** in C_6D_6.

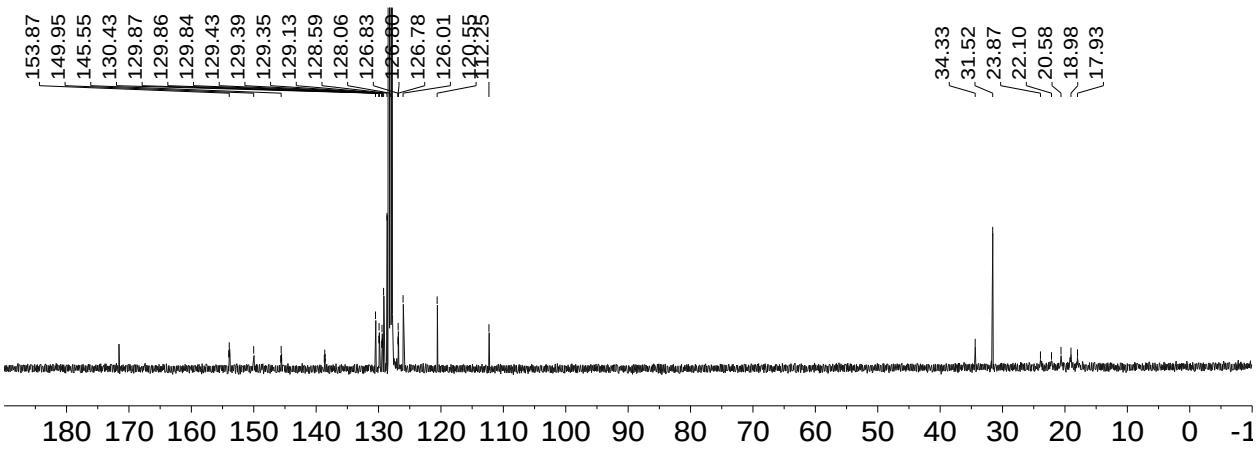


Figure C.43. $^{31}P\{^{1}H\}$ NMR spectrum of **13d** in C_6D_6.

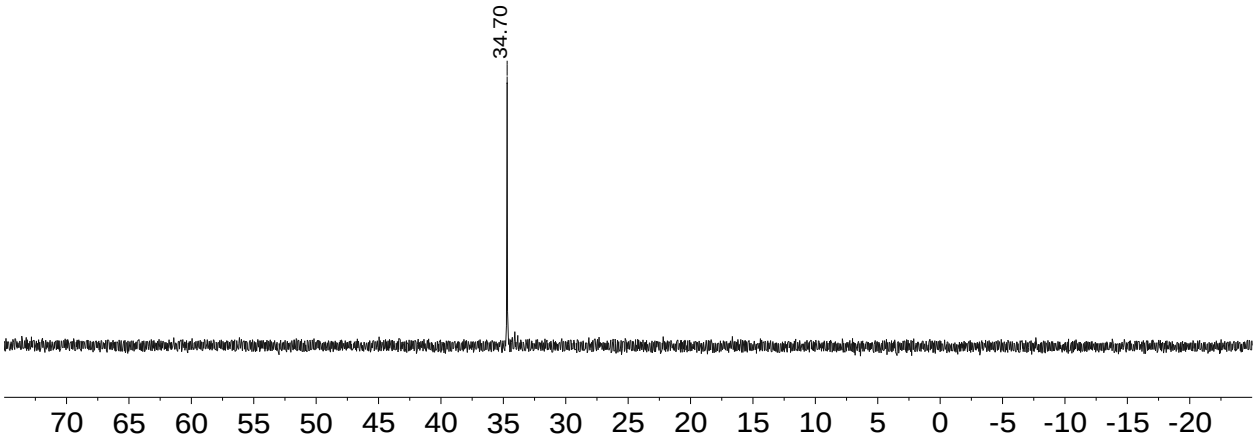


Figure C.44. ^{1}H NMR spectrum of **14d** in C_6D_6.

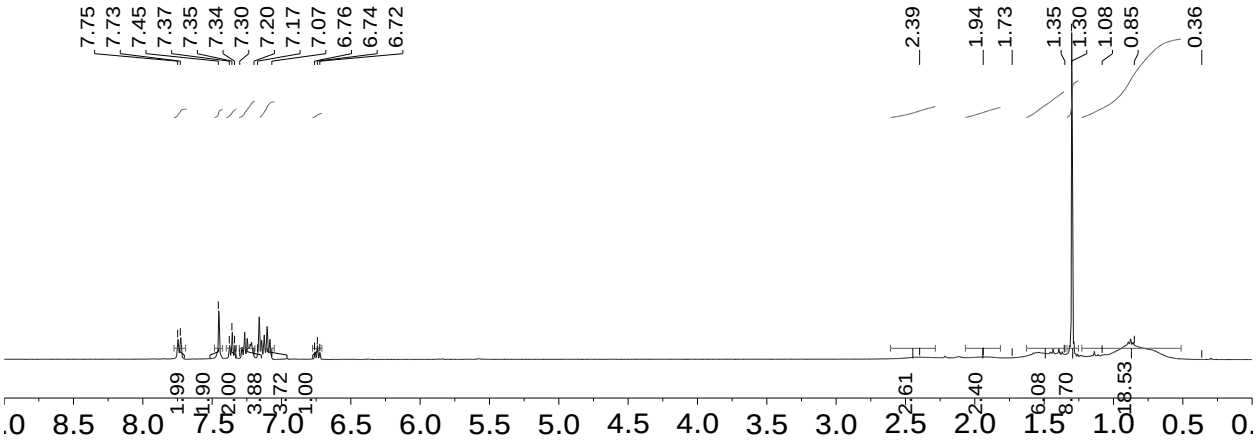


Figure C.45. $^{13}C\{^{1}H\}$ NMR spectrum of **14d** in C_6D_6.

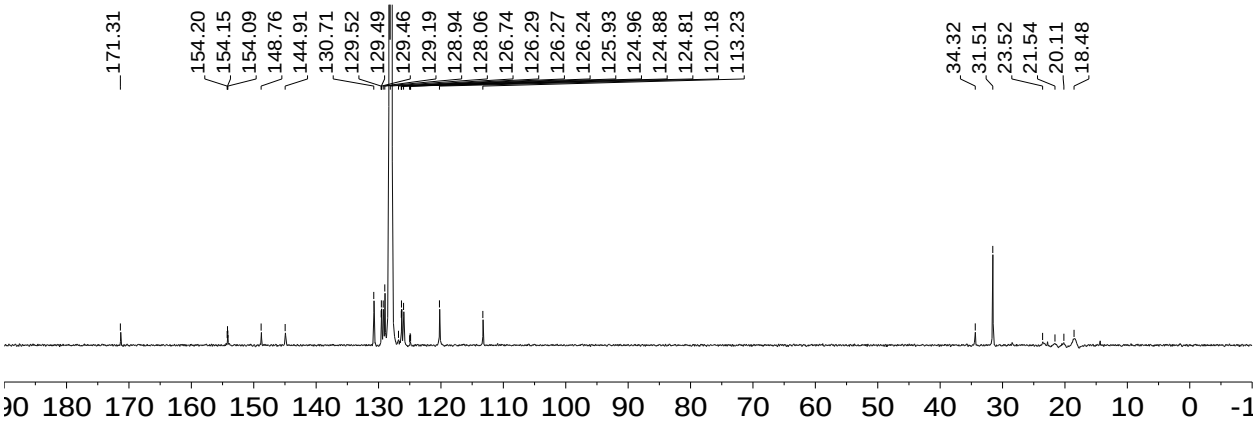


Figure C.46. $^{31}P\{^{1}H\}$ NMR spectrum of **14d** in C_6D_6.

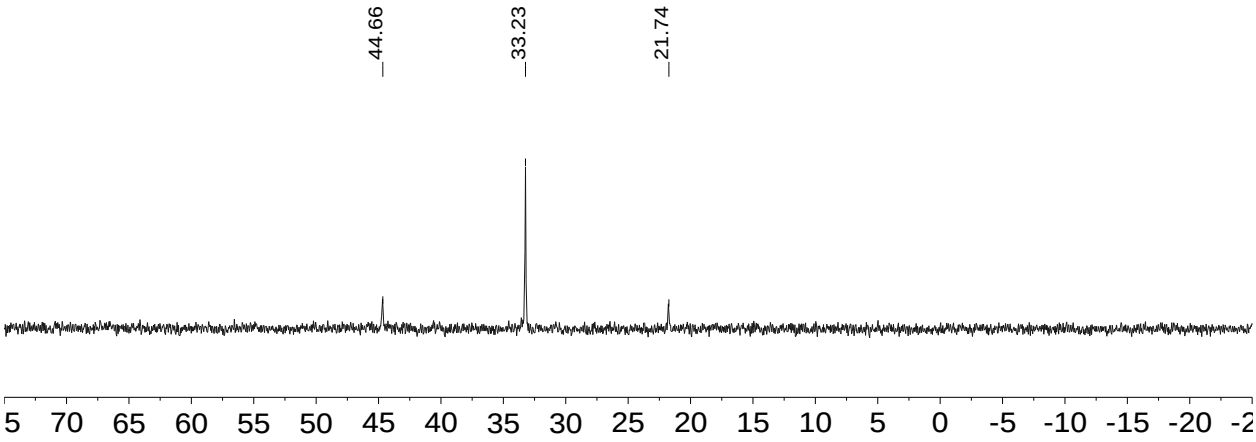


Figure C.47. ^{1}H NMR spectrum of **15a** in C_6D_6.

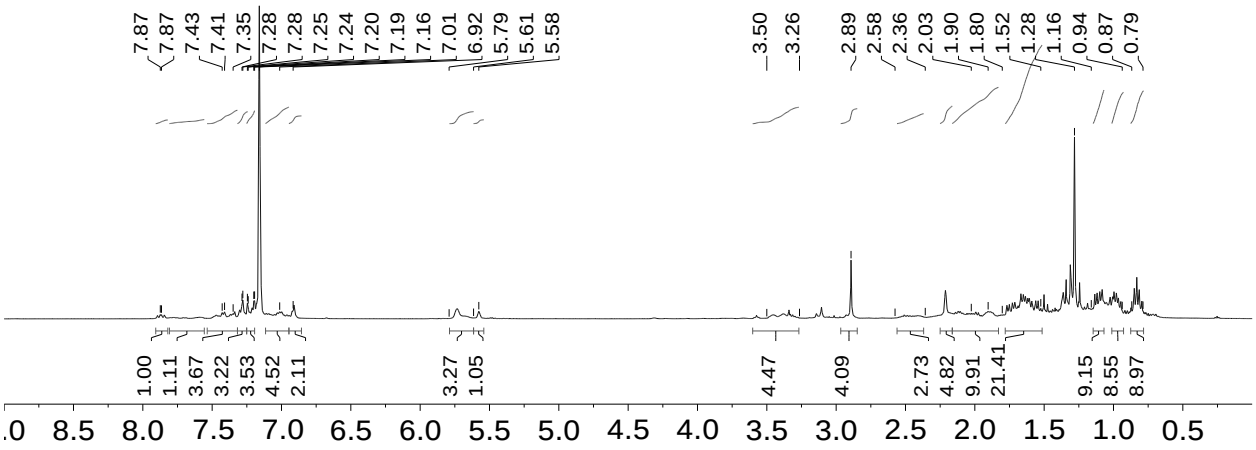


Figure C.48. $^{13}C\{^{1}H\}$ NMR spectrum of **15a** in C_6D_6.

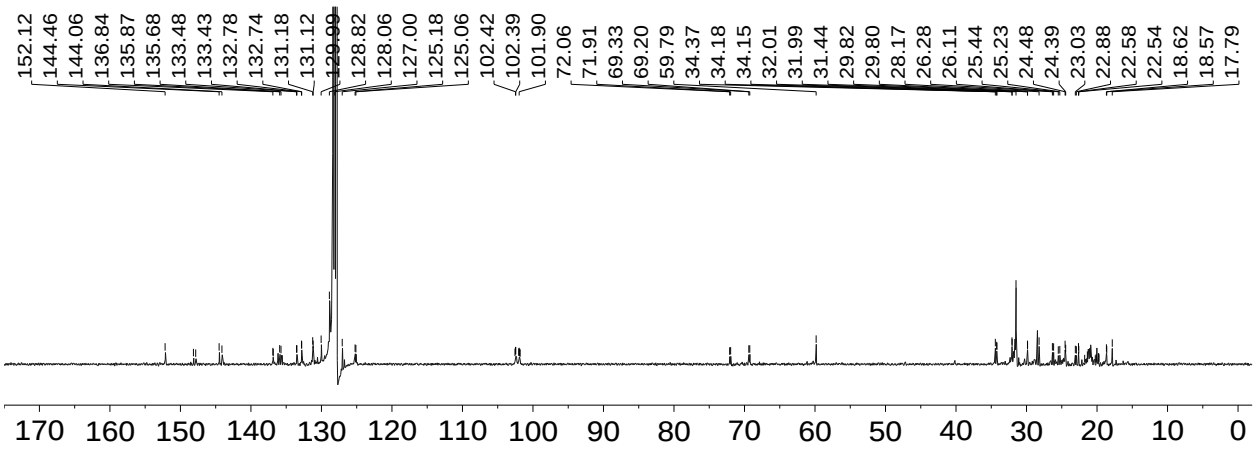


Figure C.49. $^{31}P\{^{1}H\}$ NMR spectrum of **15a** in C_6D_6.

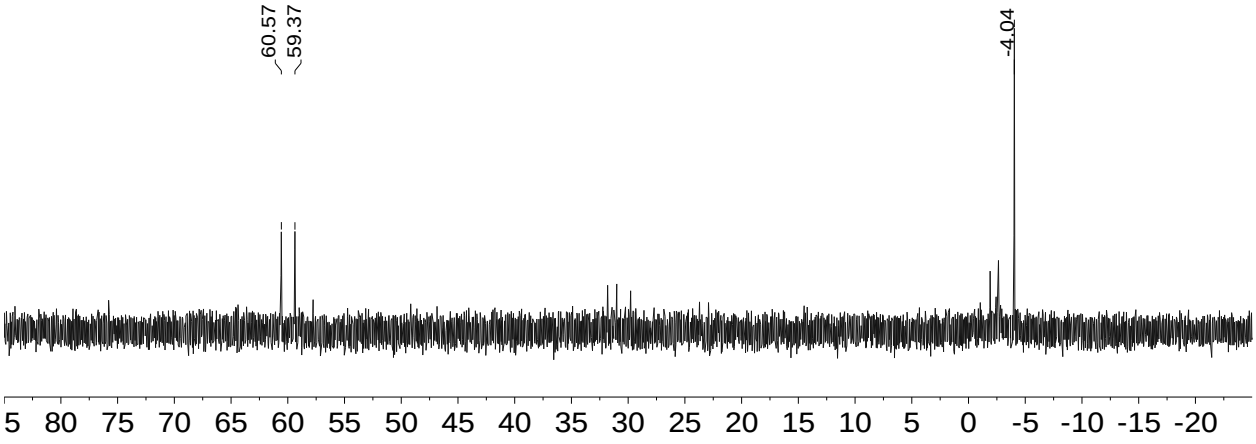


Figure C.50. ^{1}H NMR spectrum of **19a** at 25 °C in C_6D_6.

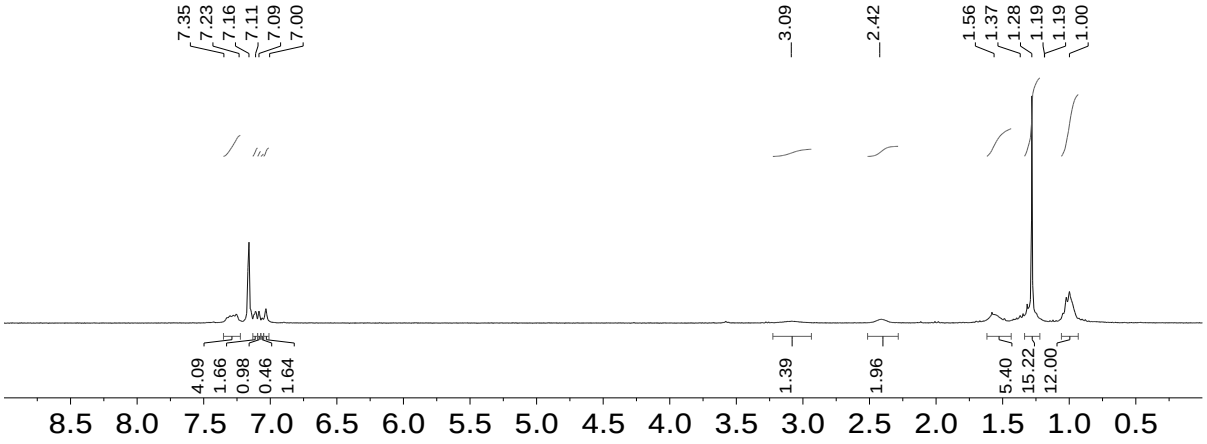


Figure C.51. $^{31}P\{^{1}H\}$ NMR spectrum of **19a** at 25 °C in C_6D_6.

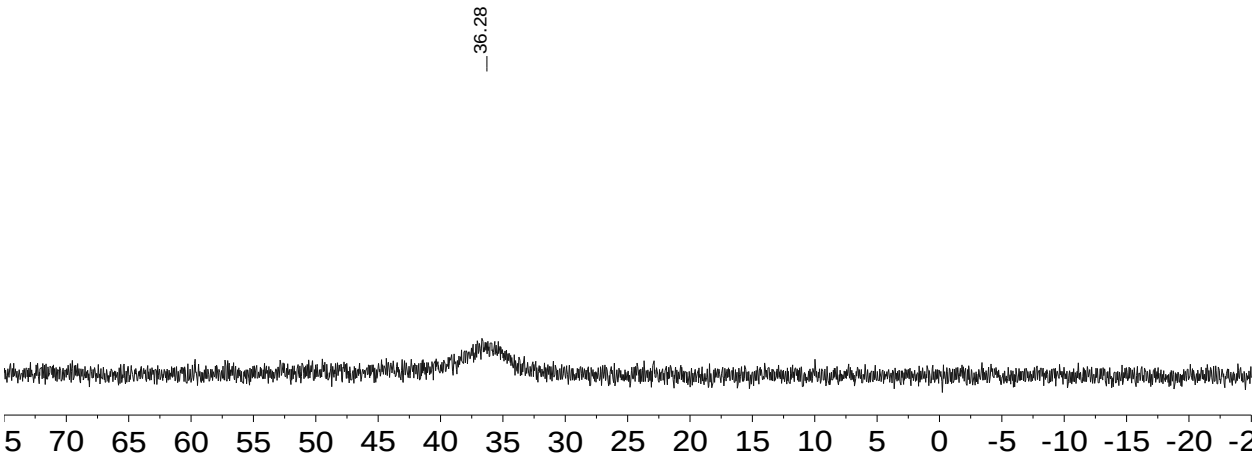


Figure C.52. $^{13}C\{^{1}H\}$ NMR spectrum of **19a** at 70 °C in C_6D_6.

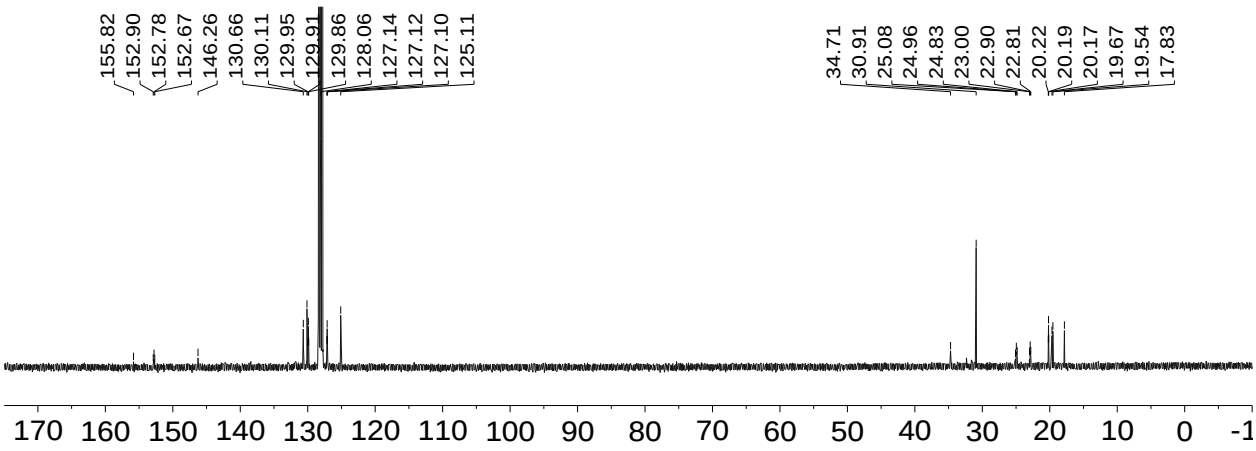


Figure C.53. $^{31}P\{^{1}H\}$ NMR spectrum of **19a** at 70 °C in C_6D_6.

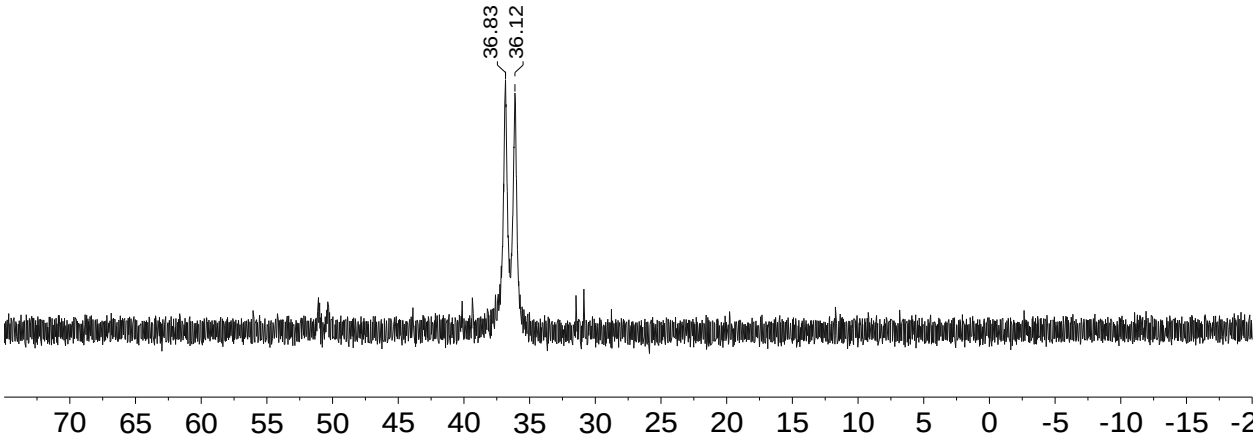


Figure C.54. ^{1}H NMR spectrum of 1,3-bis(2'bromophenyl)-5-tert-butyl-benzene in $CDCl_3$. Note: Residual CH_3OH present.

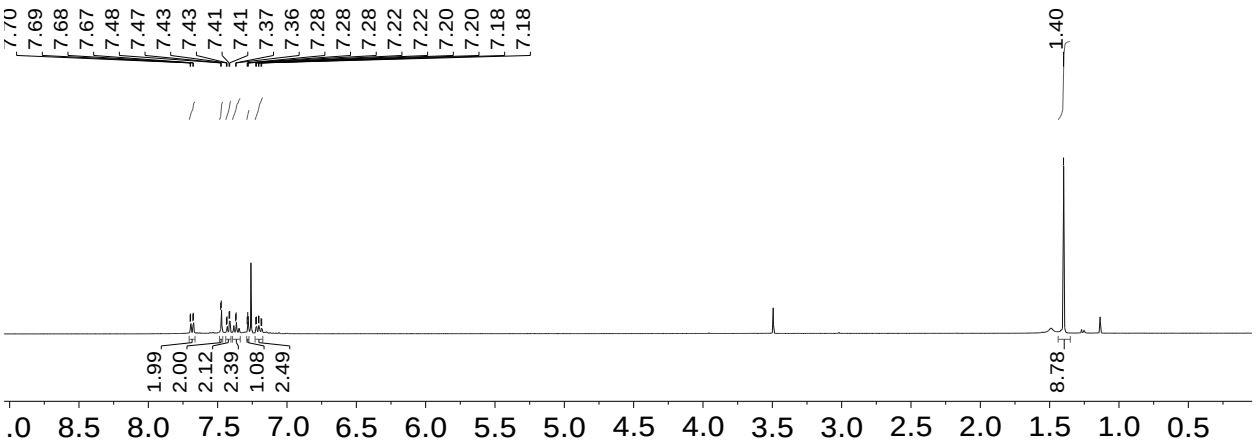


Figure C.55. ^{1}H NMR spectrum of **1e** in C_6D_6.

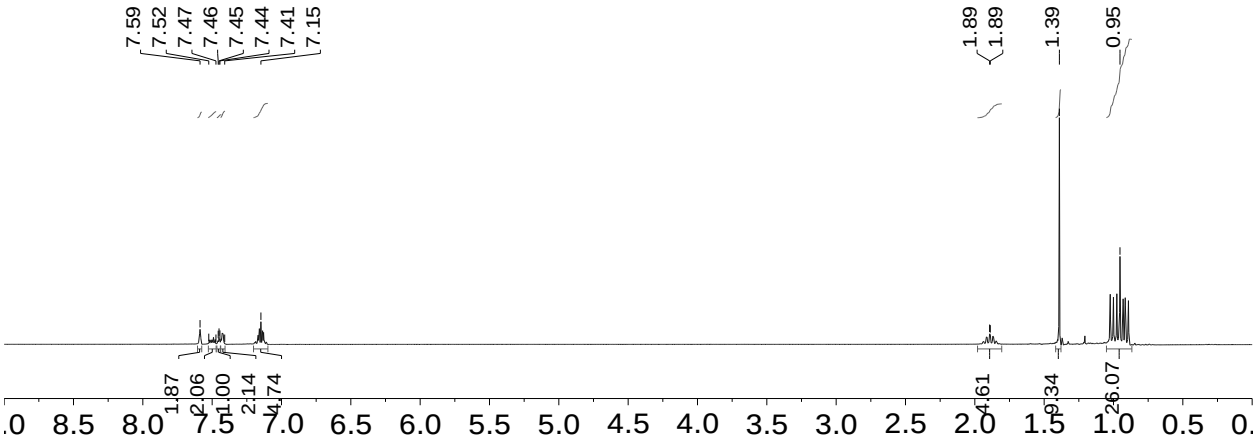


Figure C.56. $^{13}C\{^{1}H\}$ NMR spectrum of **1e** in $CDCl_3$.

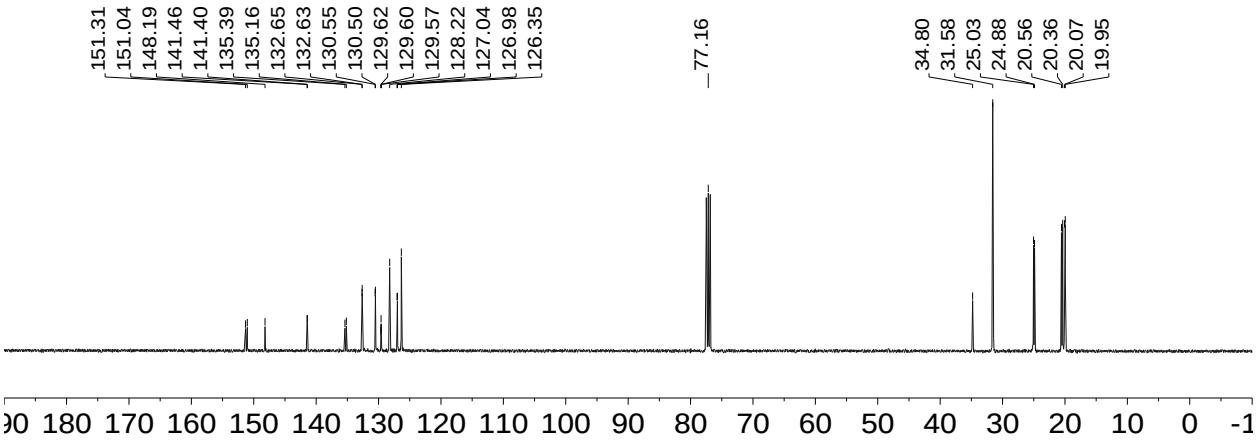


Figure C.57. $^{31}P\{^{1}H\}$ NMR spectrum of **1e** in C_6D_6.

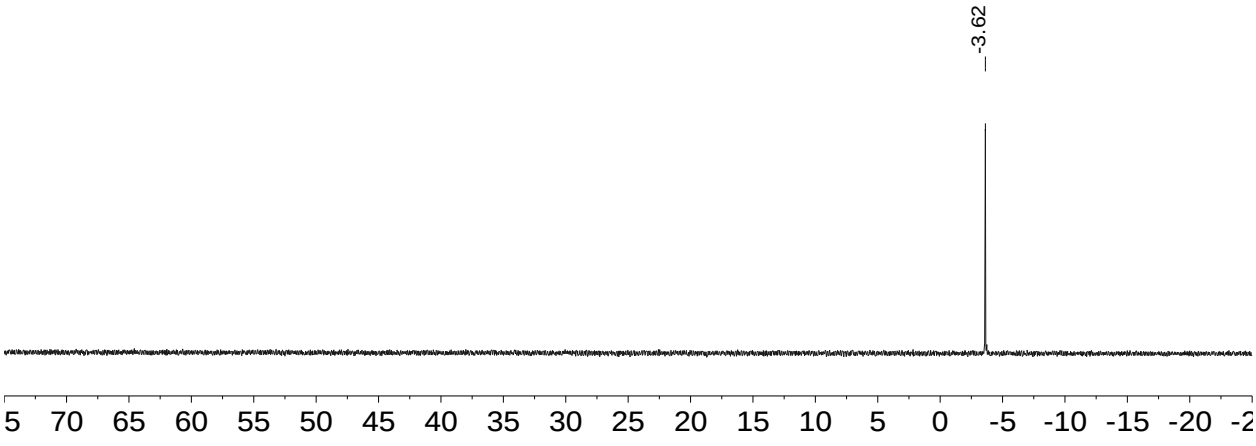


Figure C.58. ^{1}H NMR spectrum of **23a** in C_6D_6.

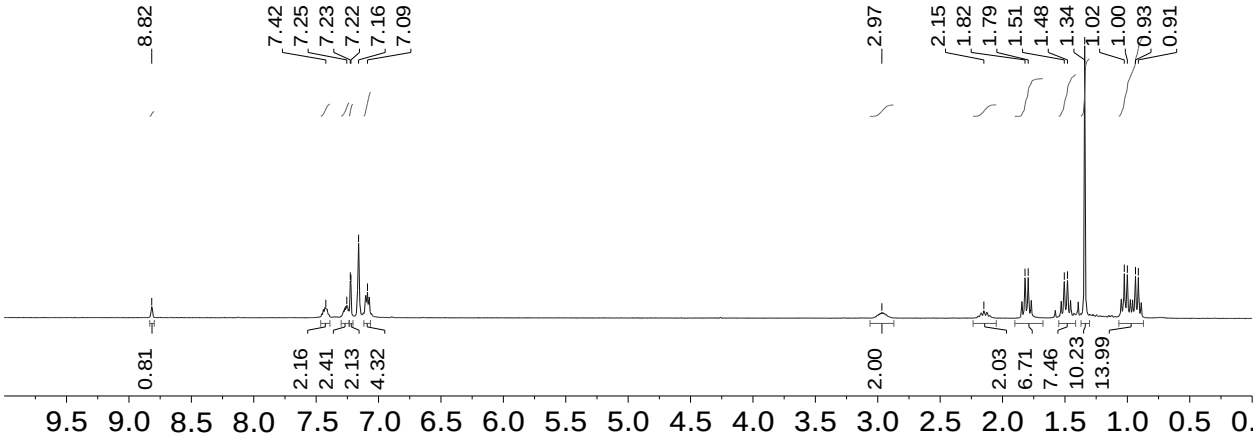


Figure C.59. $^{13}C\{^{1}H\}$ NMR spectrum of **23a** in C_6D_6.

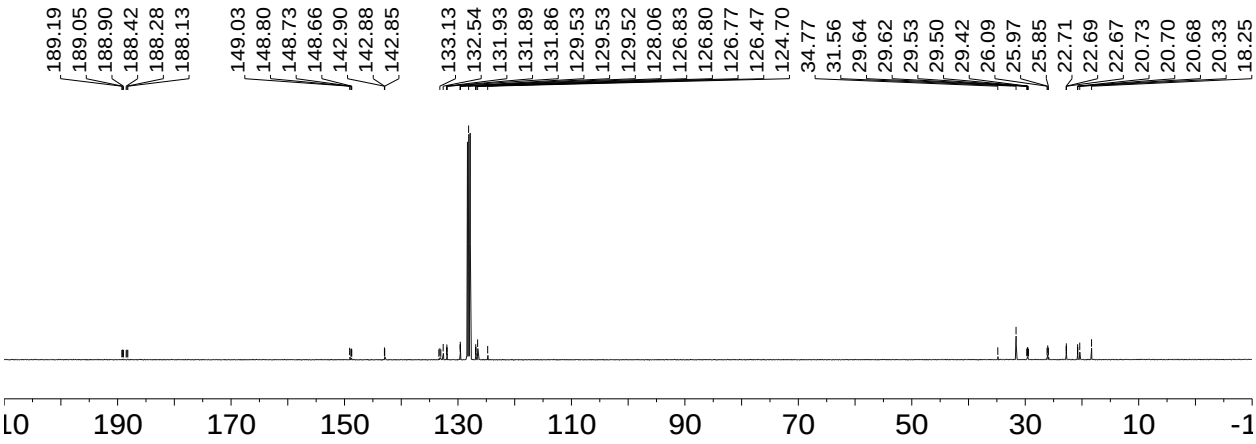


Figure C.60. $^{31}P\{^{1}H\}$ NMR spectrum of **23a** in C_6D_6.

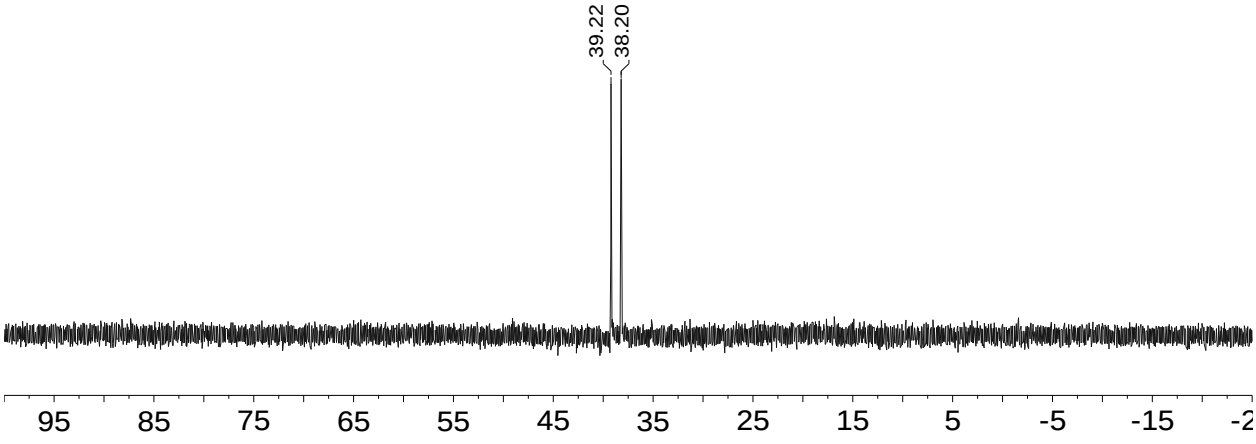


Figure C.61. ^{1}H NMR spectrum of **24a** in C_6D_6.

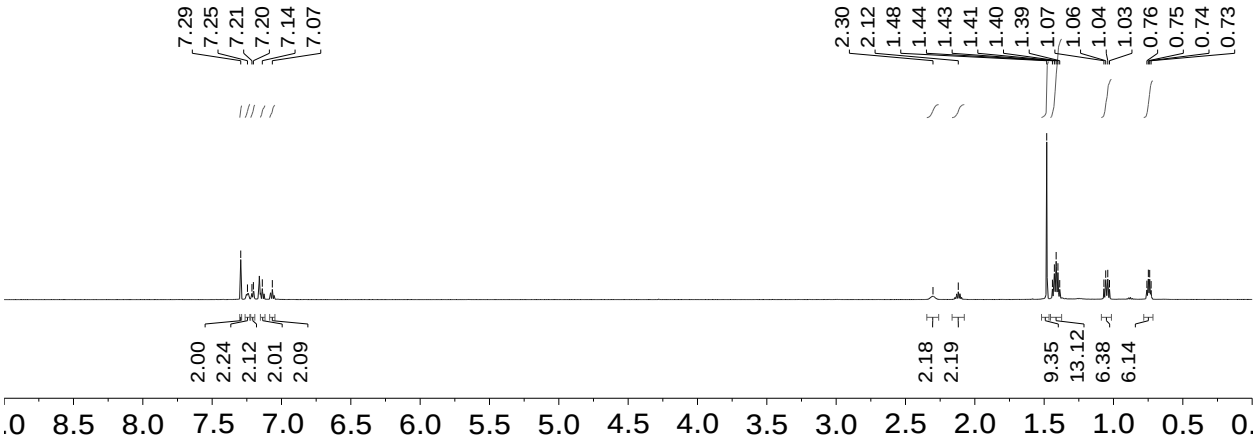


Figure C.62. $^{13}C\{^{1}H\}$ NMR spectrum of **24a** in C_6D_6.

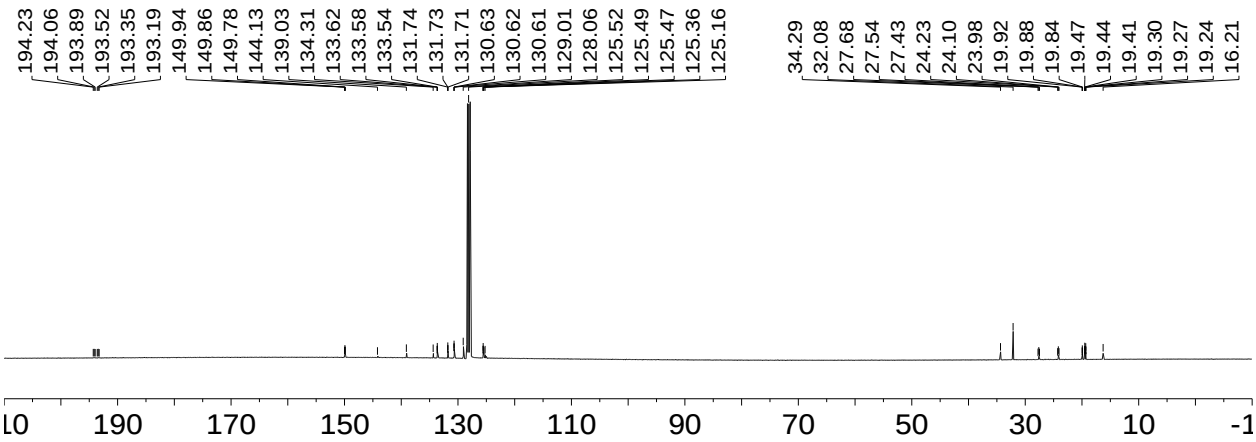


Figure C.63. $^{31}P\{^{1}H\}$ NMR spectrum of **24a** in C_6D_6.

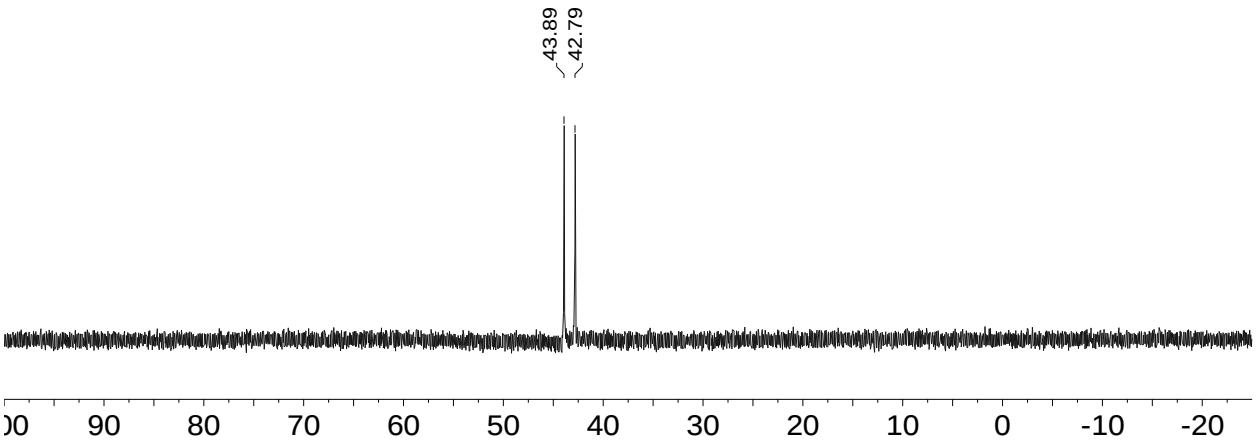


Figure C.64. ^{1}H NMR spectrum of 5-(tert-butyl)-1,3-diiodo-2-(methoxymethoxy)-benzene in $CDCl_3$.

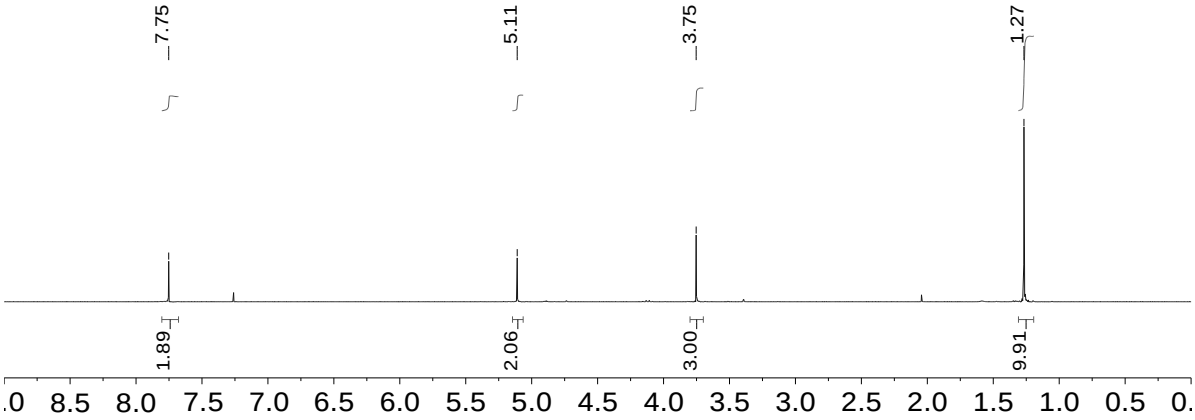


Figure C.65. $^{13}C\{^{1}H\}$ NMR spectrum of 5-(tert-butyl)-1,3-diiodo-2-(methoxy-methoxy)benzene in $CDCl_3$.

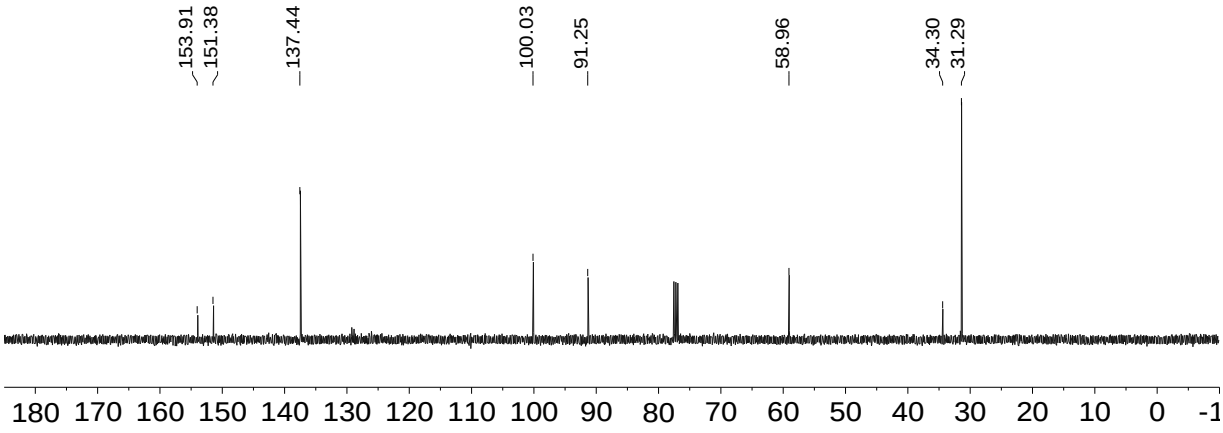


Figure C.66. ^{1}H NMR spectrum of 1,3-bis(2'-bromophenyl)-5-tert-butyl-2-(methoxy-methoxy)benzene in $CDCl_3$.

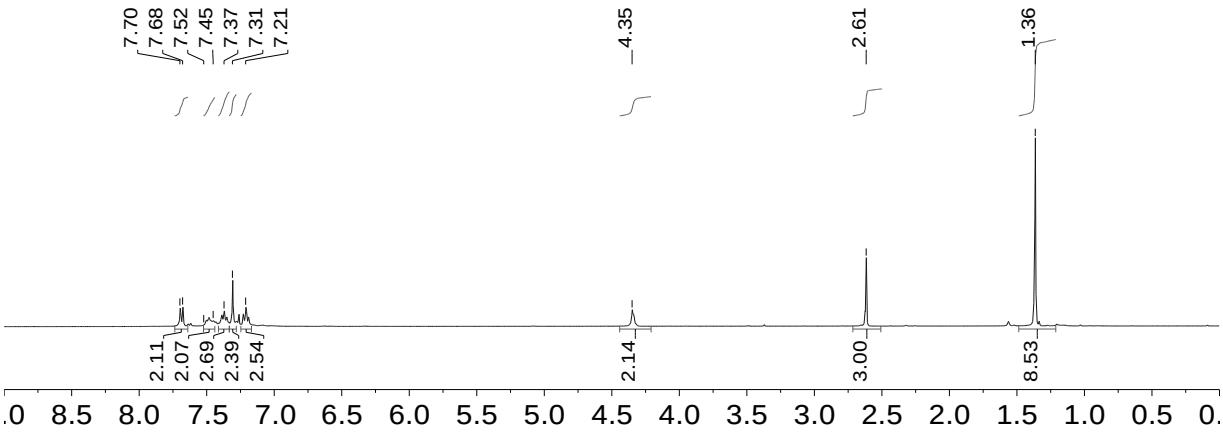


Figure C.67. ^{1}H NMR spectrum of **1f** at 25 °C in C_6D_6.

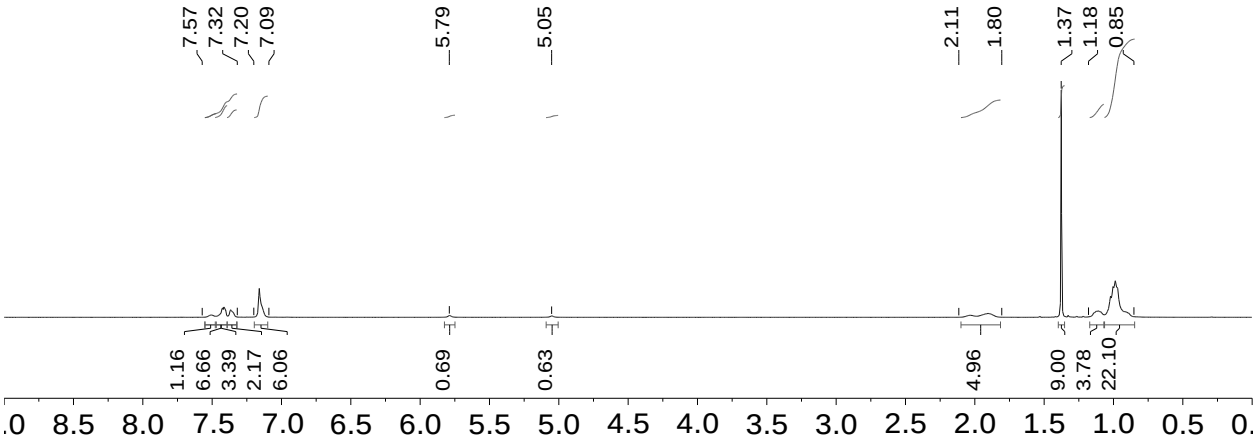


Figure C.68. $^{31}P\{^{1}H\}$ NMR spectrum of **1f** at 25 °C in C_6D_6. Note: Referenced to solvent residual.

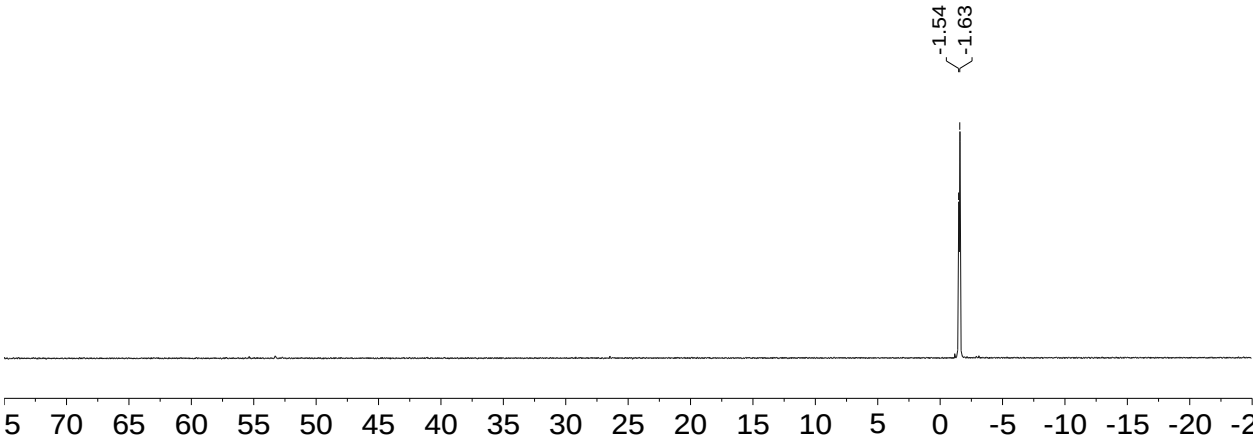


Figure C.69. ^{1}H NMR spectrum of **1f** at 70 °C.

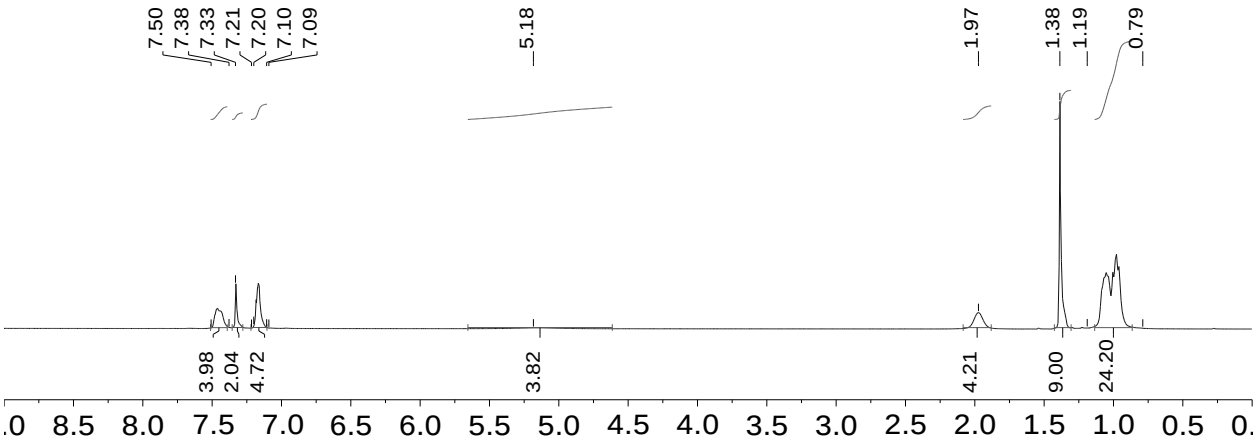


Figure C.70. $^{13}C\{^{1}H\}$ NMR spectrum of **1f** at 70 °C in C_6D_6.

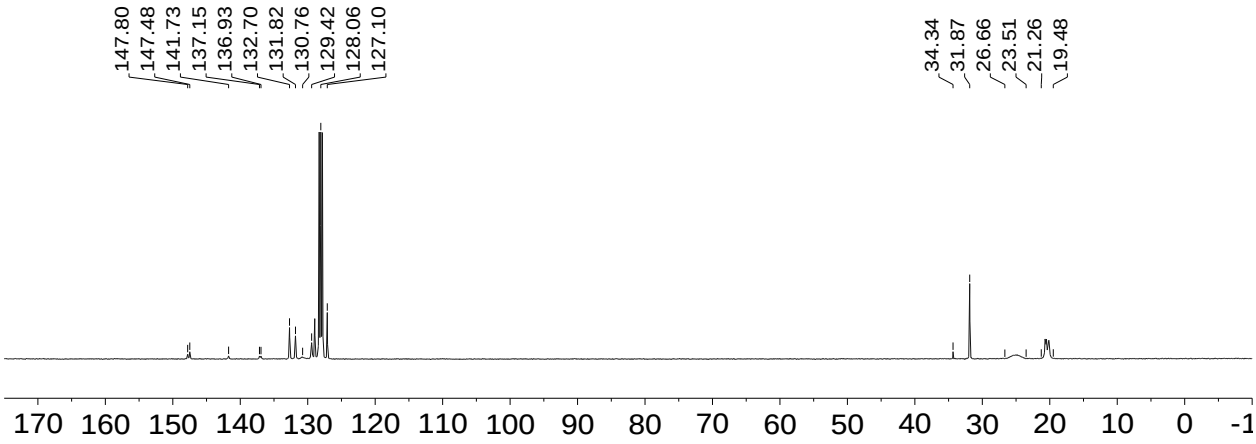


Figure C.71. $^{31}P\{^{1}H\}$ NMR spectrum of **1f** at 70 °C in C_6D_6. Note: Referenced to solvent residual.

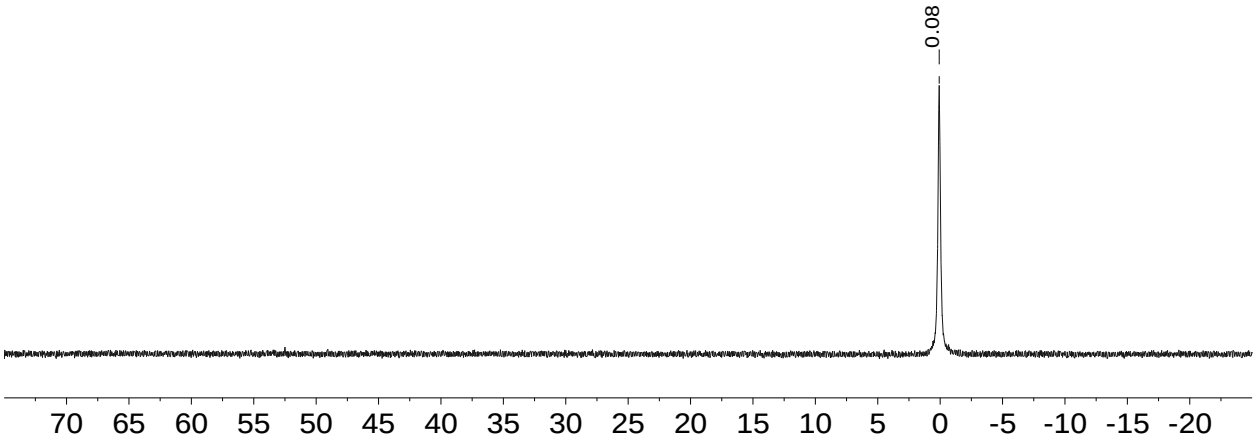


Figure C.72. ^{1}H NMR spectrum of **26a** in C_6D_6.

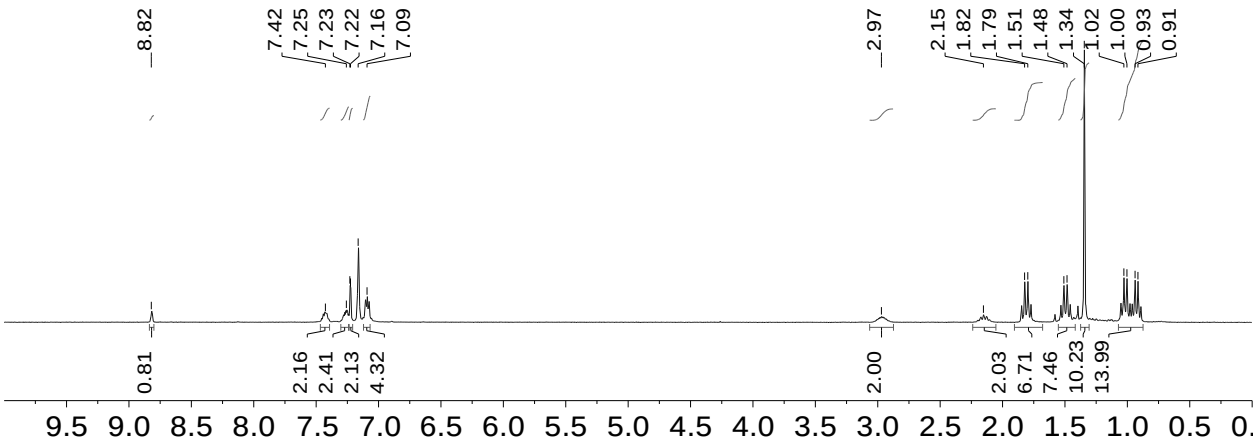


Figure C.73. $^{13}C\{^{1}H\}$ NMR spectrum of **26a** in C_6D_6.

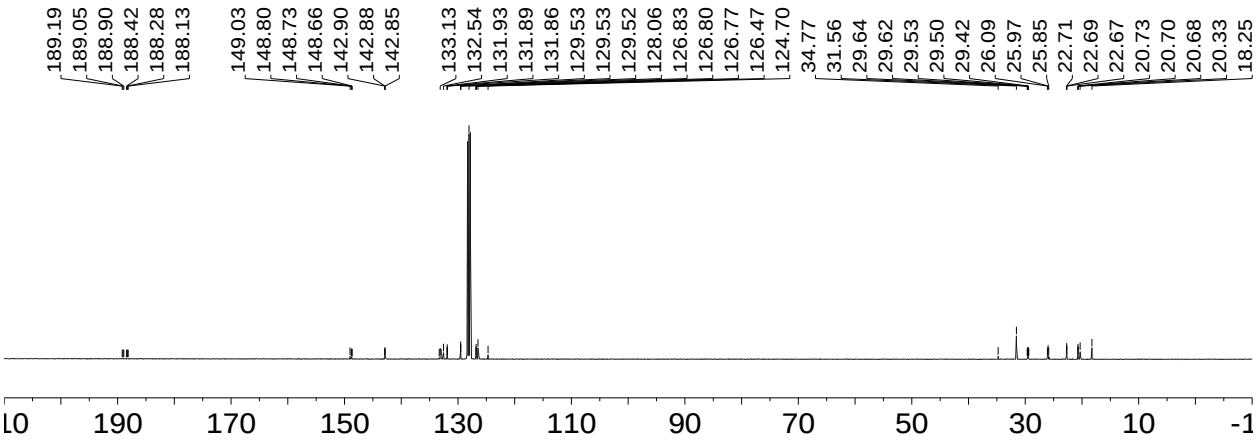


Figure C.74. $^{31}P\{^{1}H\}$ NMR spectrum of **26a** in C_6D_6.

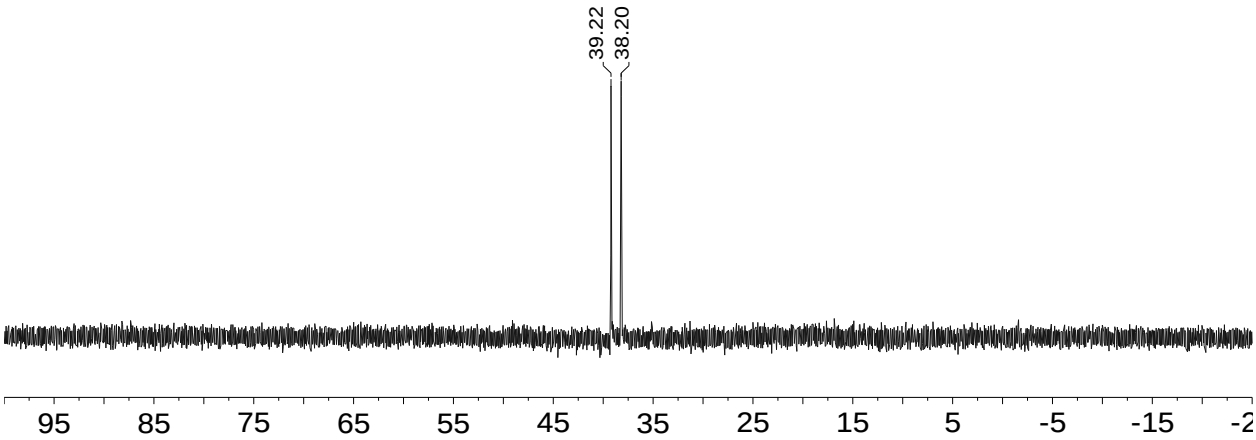


Figure C.75. ^{1}H NMR spectrum of **27a** in C_6D_6.

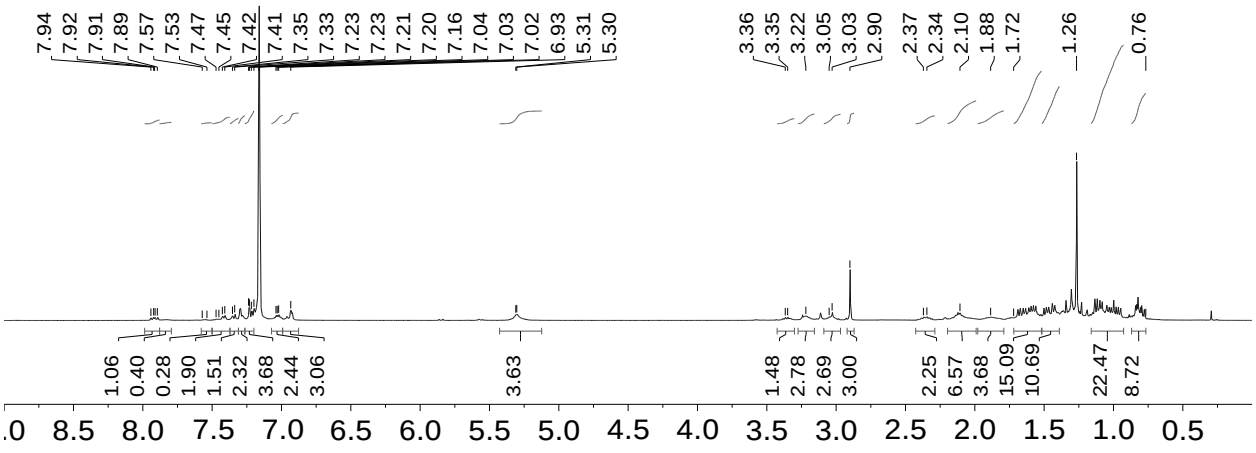


Figure C.76. $^{13}C\{^{1}H\}$ NMR spectrum of **27a** in C_6D_6.

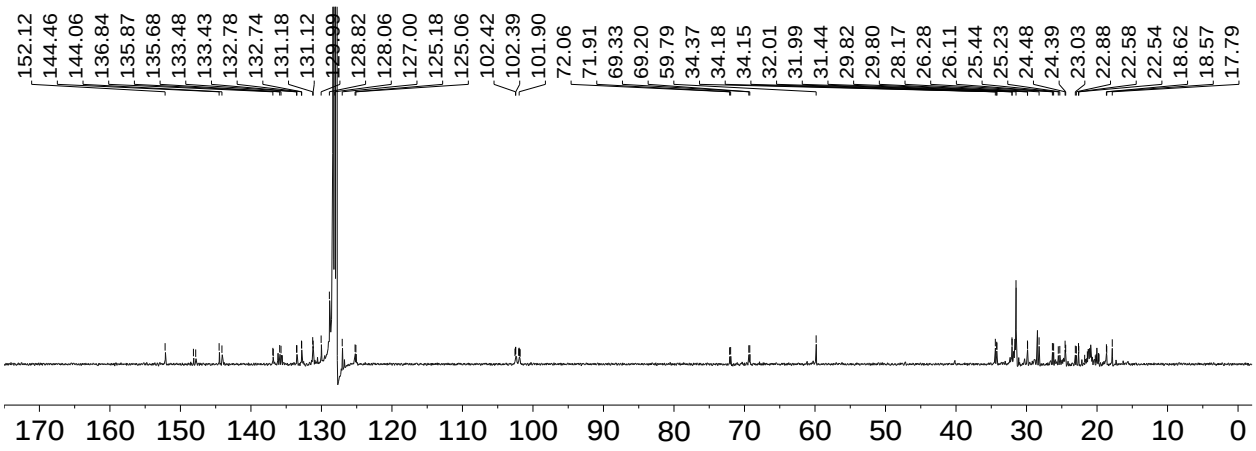


Figure C.77. $^{31}P\{^{1}H\}$ NMR spectrum of **27a** in C_6D_6.

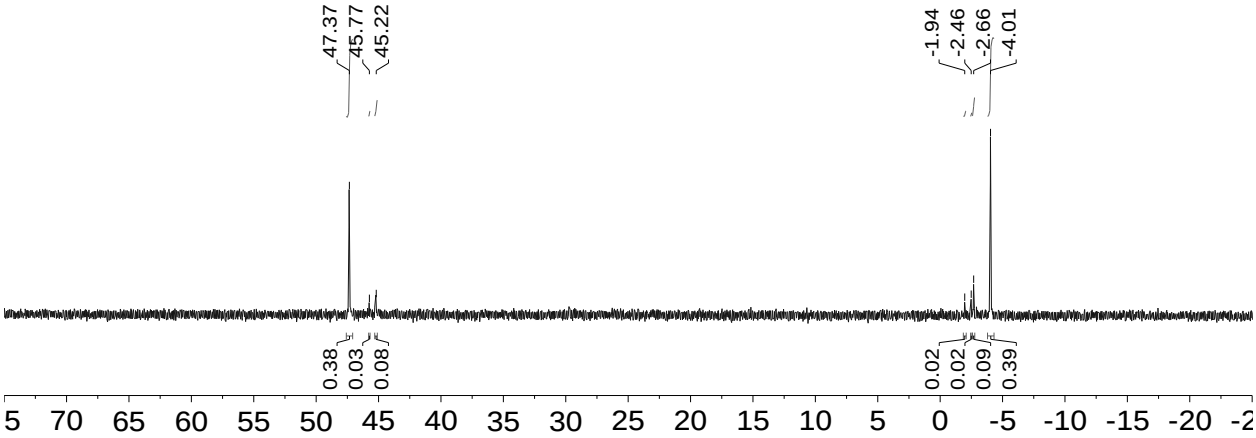


Figure C.78. ^{1}H NMR spectrum of **28a** in C_6D_6.

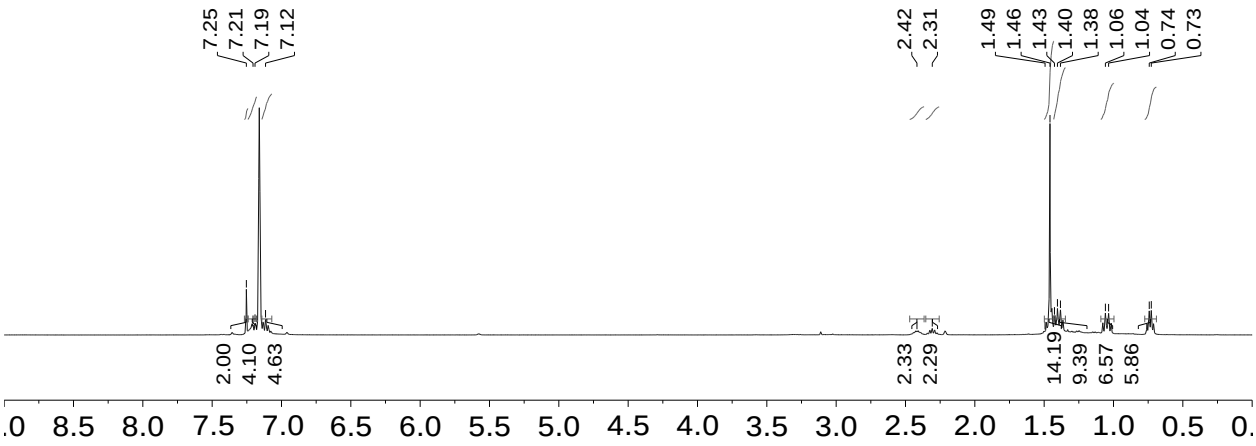


Figure C.79. $^{13}C\{^{1}H\}$ NMR spectrum of **28a** in C_6D_6.

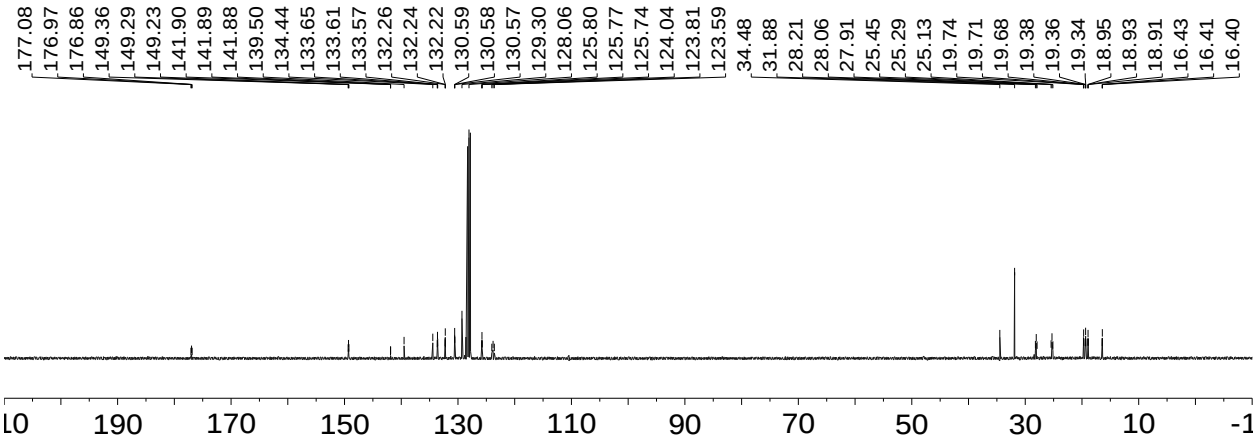


Figure C.80. $^{31}P\{^{1}H\}$ NMR spectrum of **28a** in C_6D_6.

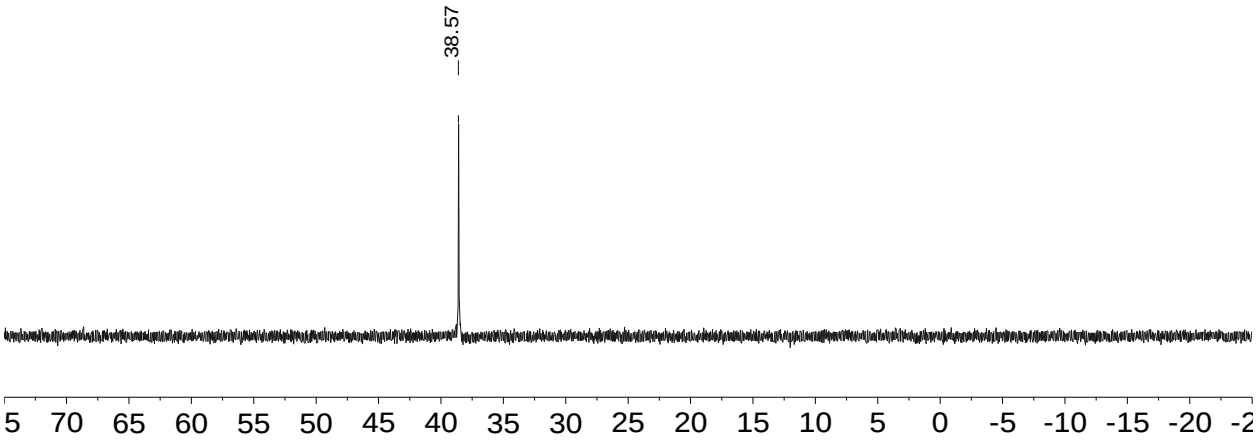


Figure C.81. ^{1}H NMR spectrum of **29a** in C_6D_6. Note: Residual 1,5-cyclooctadiene present.

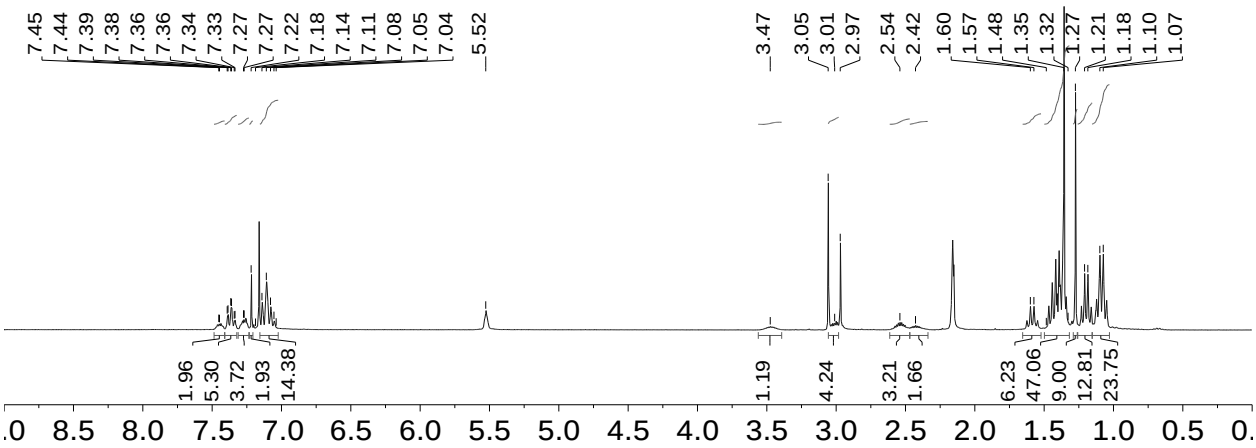


Figure C.82. $^{13}C\{^{1}H\}$ NMR spectrum of **29a** in C_6D_6. Note: Residual 1,5-cycloocta-diene present.

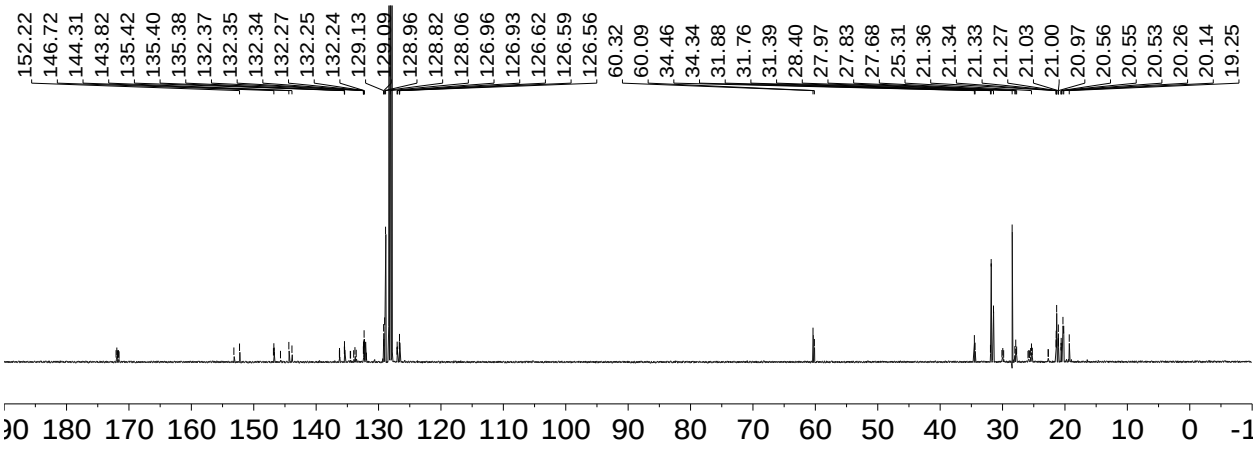


Figure C.83. $^{31}P\{^{1}H\}$ NMR spectrum of **29a** in C_6D_6.

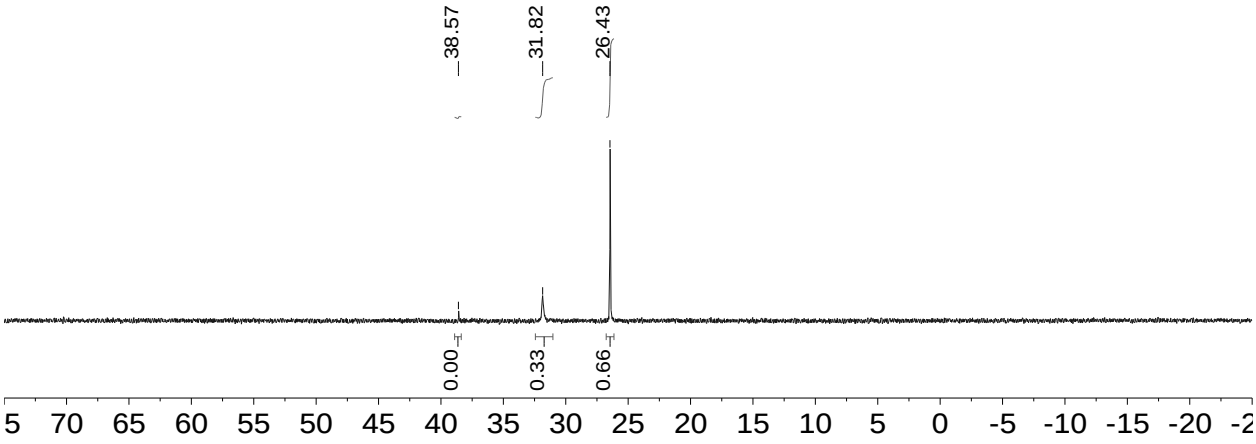


Figure C.84. ^{1}H NMR spectrum of **32a** in C_6D_6. Note: Residual toluene present.

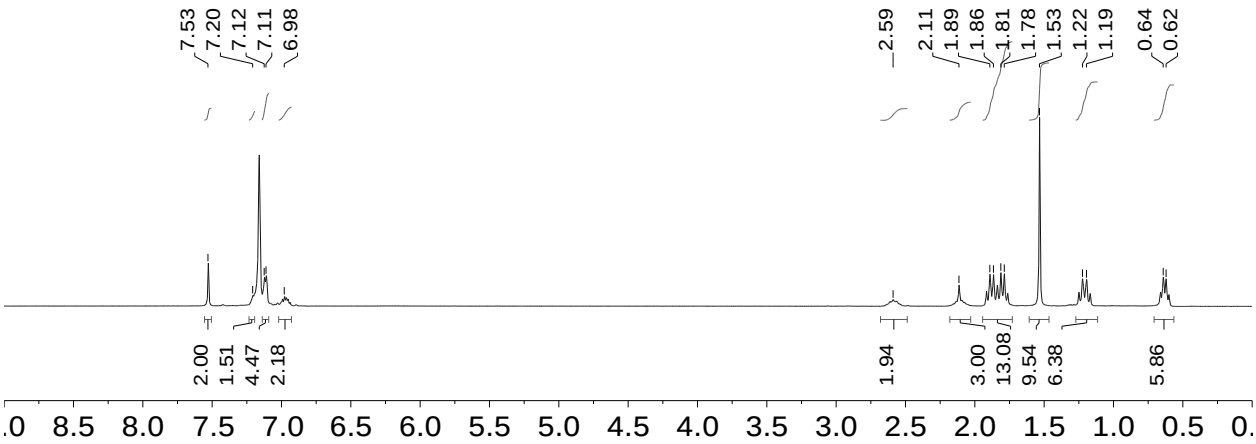


Figure C.85. $^{13}C\{^{1}H\}$ NMR spectrum of **32a** in C_6D_6. Note: Residual toluene present.

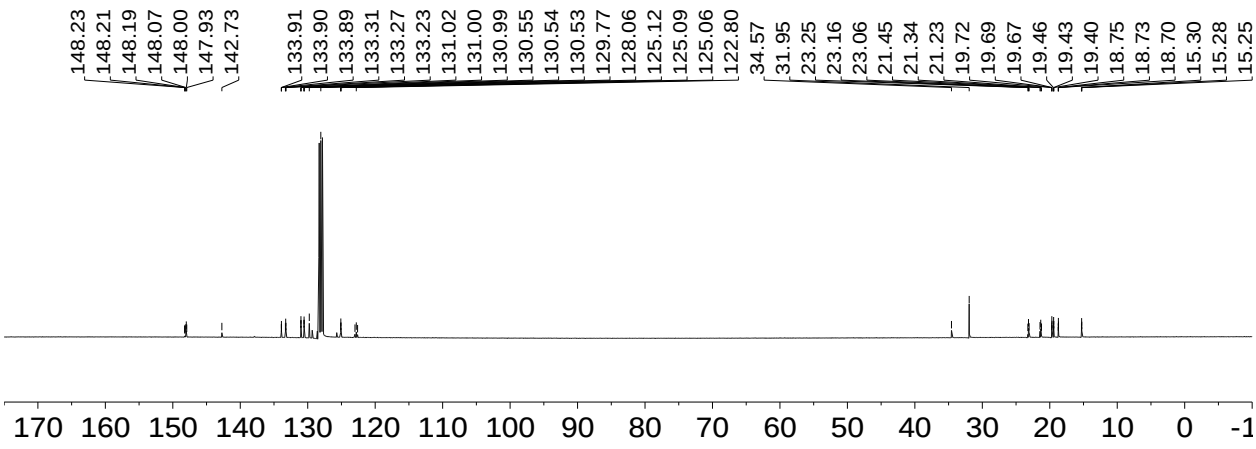


Figure C.86. $^{31}P\{^{1}H\}$ NMR spectrum of **32a** in C_6D_6.

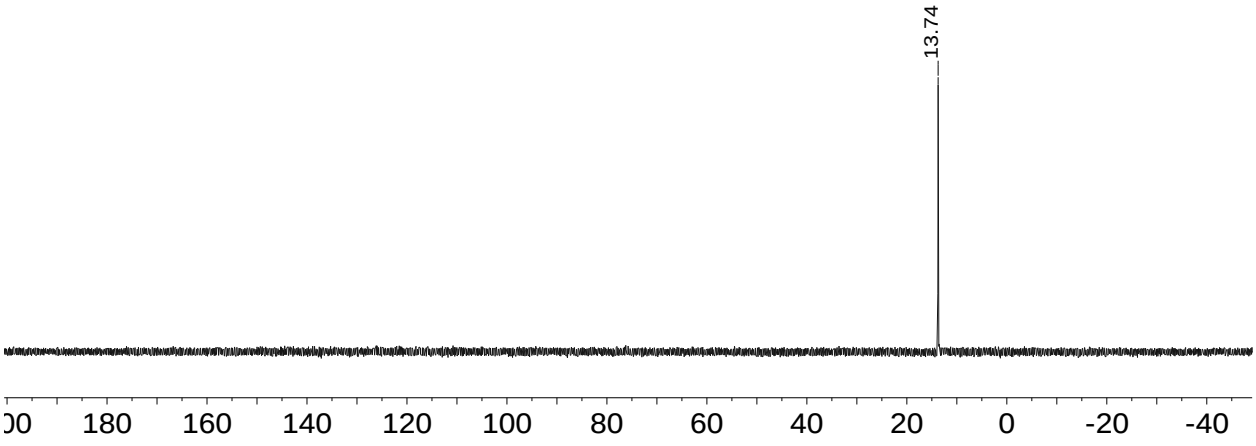


Figure C.87. ^{1}H NMR spectrum of **32b** in C_6D_6.

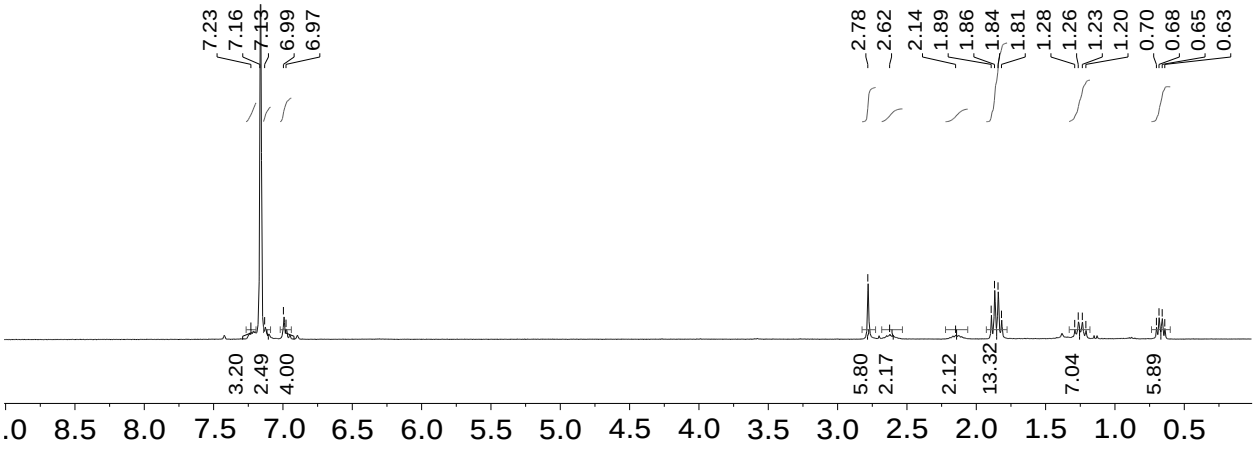


Figure C.88. $^{13}C\{^{1}H\}$ NMR spectrum of **32b** in C_6D_6.

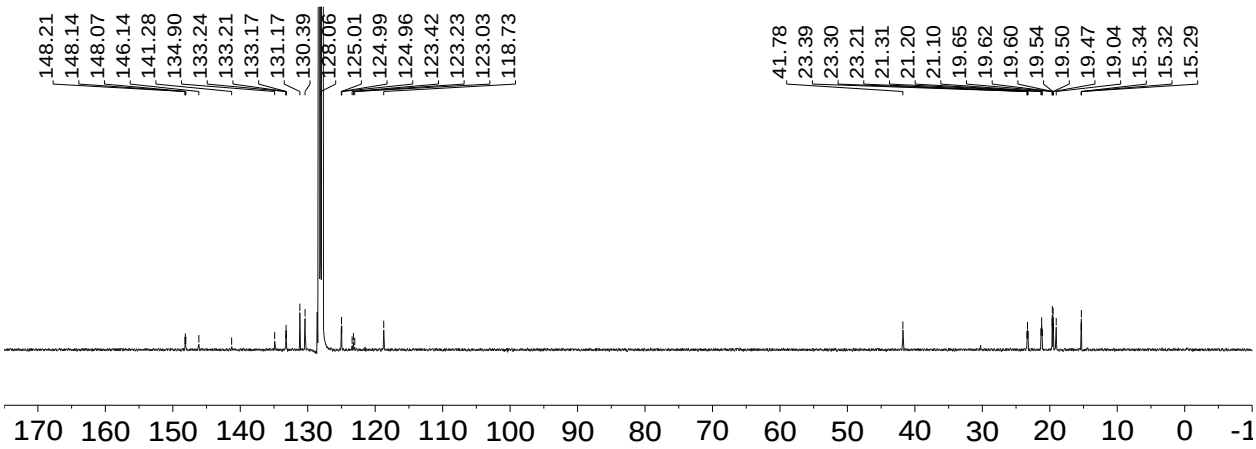


Figure C.89. $^{31}P\{^{1}H\}$ NMR spectrum of **32b** in C_6D_6.

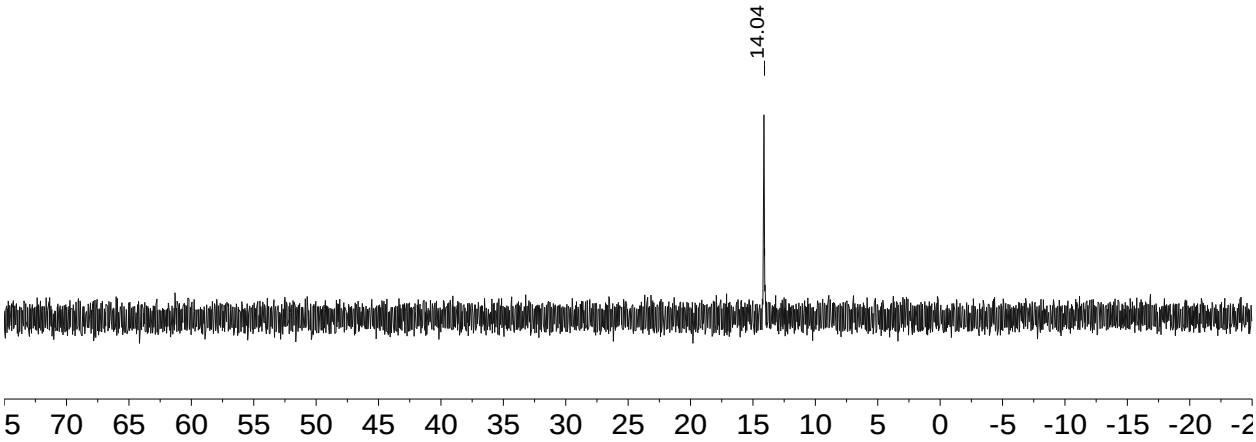


Figure C.90. ^{1}H NMR spectrum of **33a** in C_6D_6.

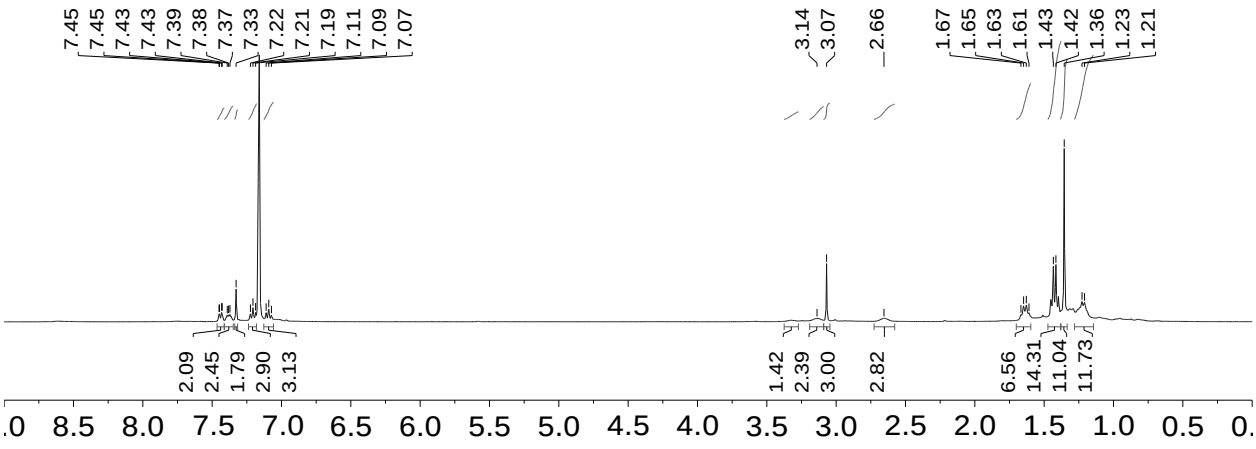


Figure C.91. $^{13}C\{^{1}H\}$ NMR spectrum of **33a** in C_6D_6.

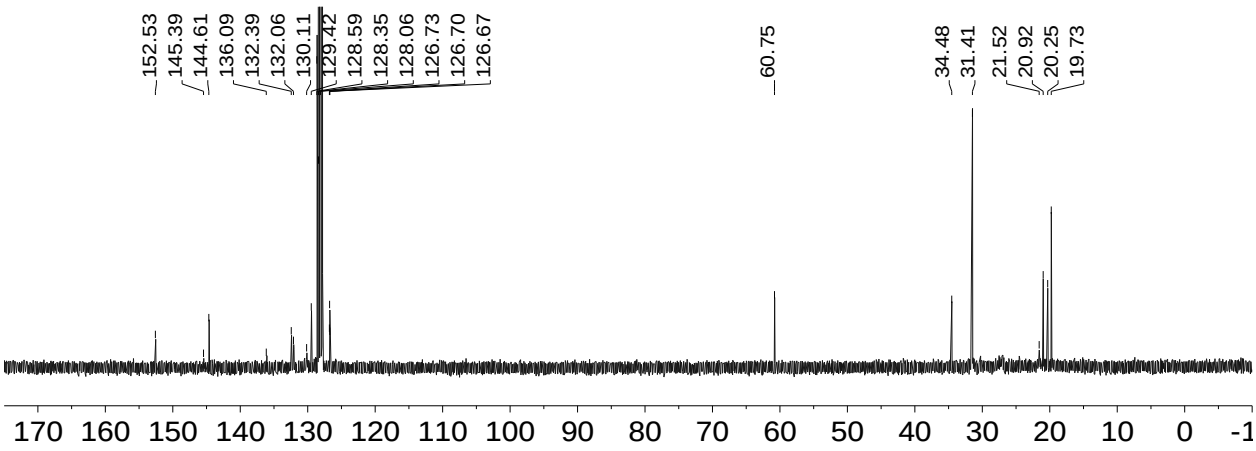


Figure C.92. $^{31}P\{^{1}H\}$ NMR spectrum of **33a** in C_6D_6.

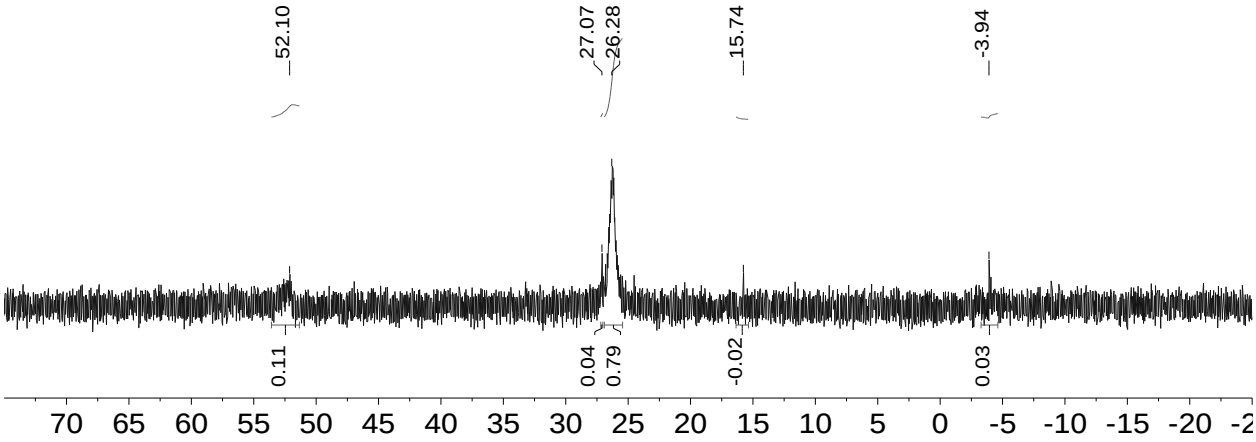


Figure C.93. ^{1}H NMR spectrum of **34a** in CD_3CN.

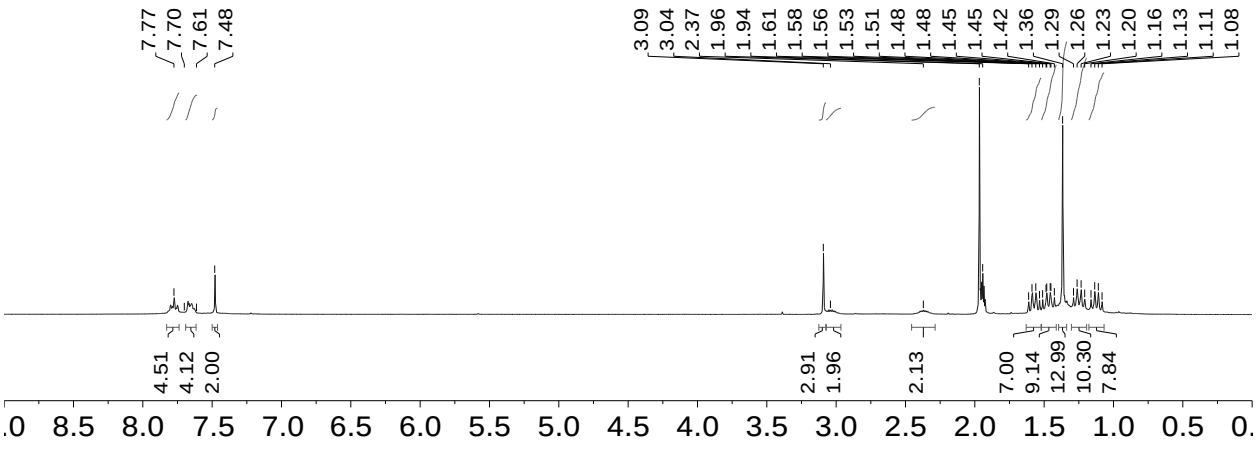


Figure C.94. $^{13}C\{^{1}H\}$ NMR spectrum of **34a** in CD_3CN.

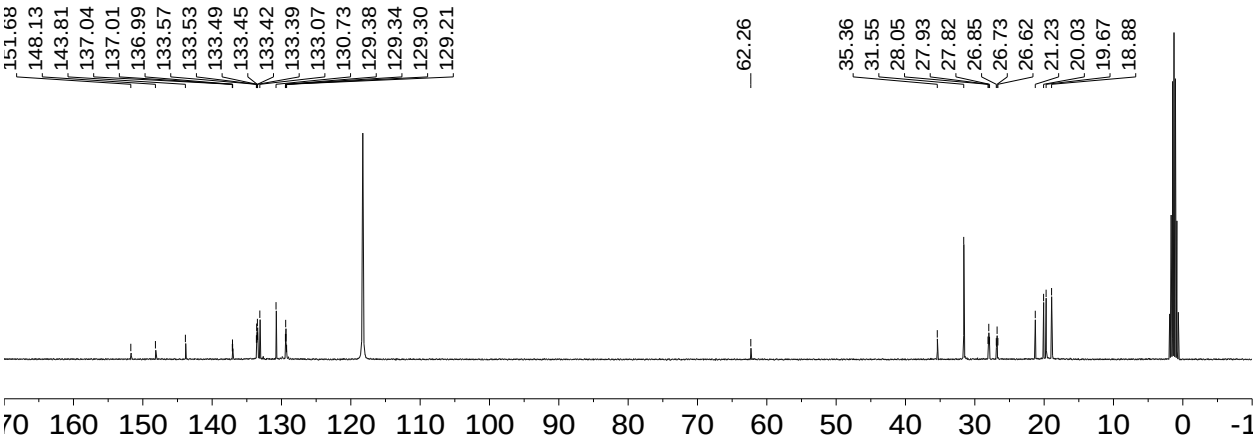


Figure C.95. ^{19}F NMR spectrum of **34a** in CD_3CN.

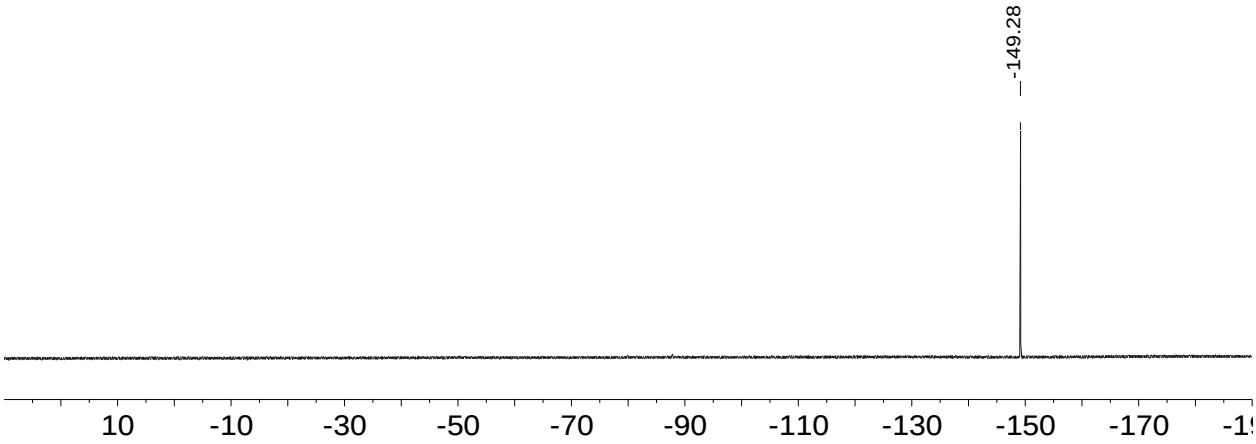


Figure C.96. $^{31}P\{^{1}H\}$ NMR spectrum of **34a** in CD_3CN.

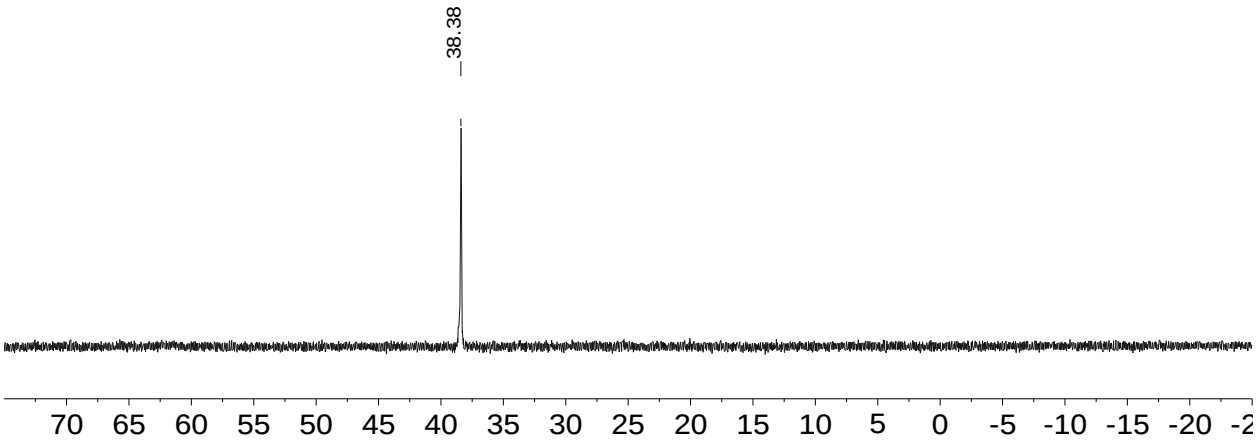


Figure C.97. ^{1}H NMR spectrum of **35a** in C_6D_6.

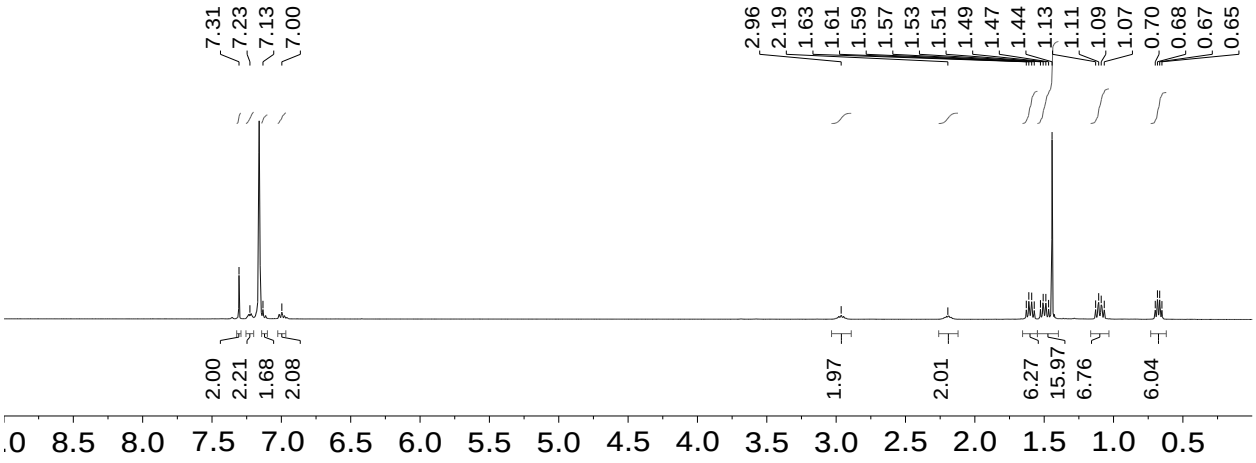


Figure C.98. $^{13}C\{^{1}H\}$ NMR spectrum of **35a** in C_6D_6.

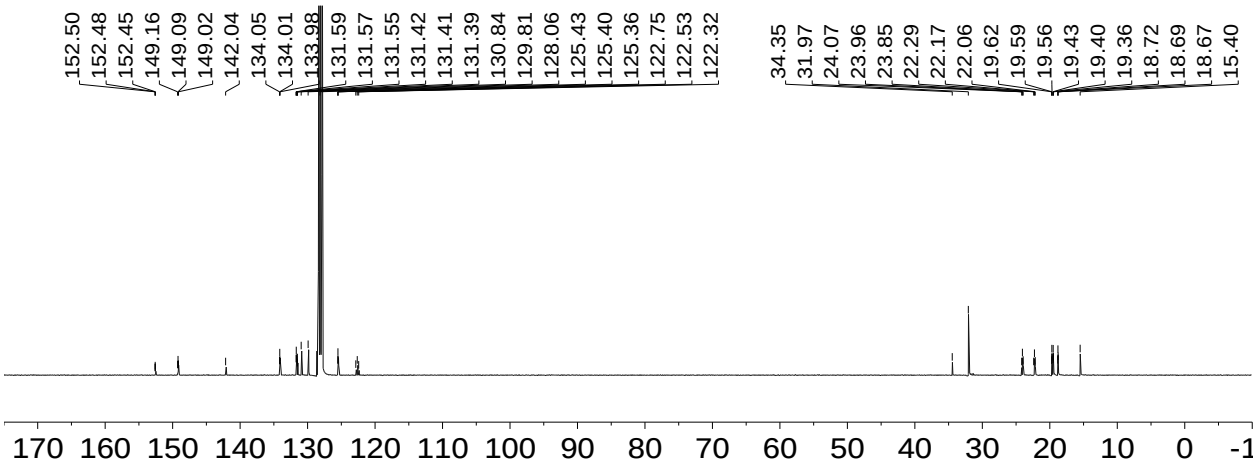


Figure C.99. $^{31}P\{^{1}H\}$ NMR spectrum of **35a** in C_6D_6.

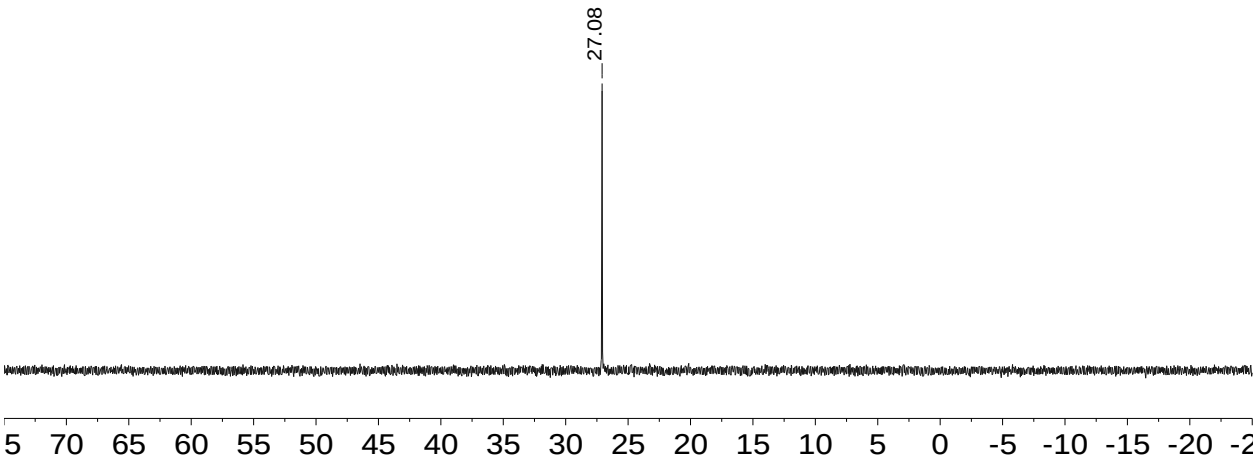


Figure C.100. ^{1}H NMR spectrum of **36a** in C_6D_6.

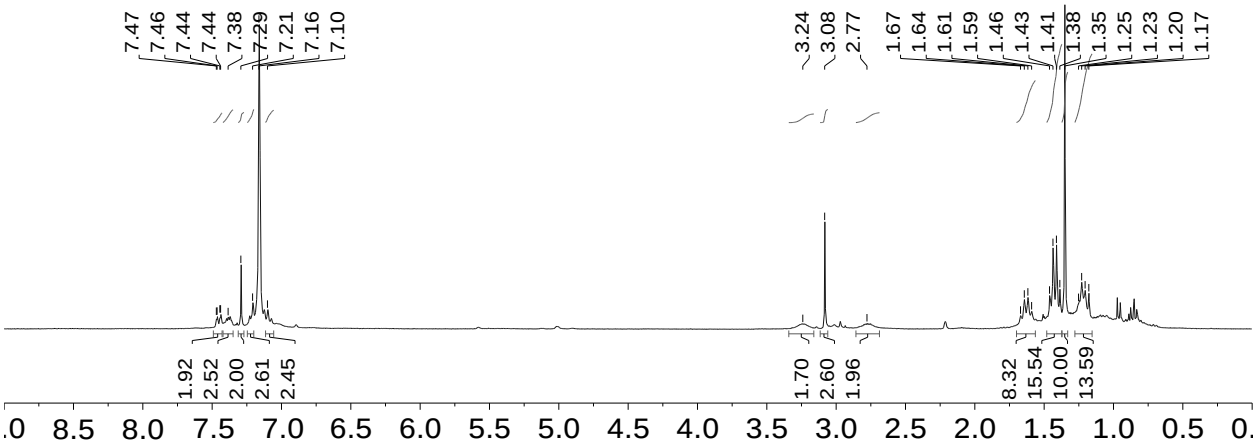


Figure C.101. $^{13}C\{^{1}H\}$ NMR spectrum of **36a** in C_6D_6.

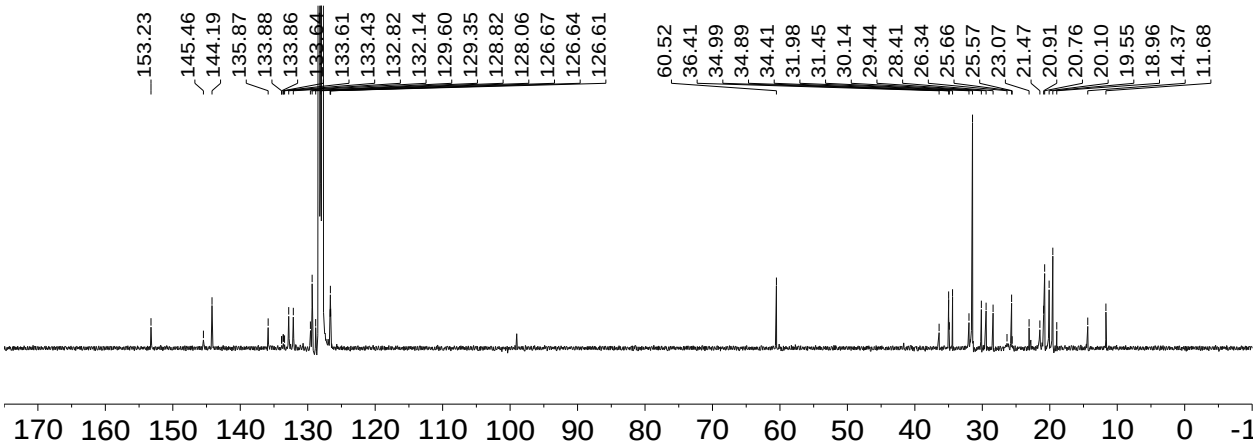


Figure C.102. $^{31}P\{^{1}H\}$ NMR spectrum of **36a** in C_6D_6.

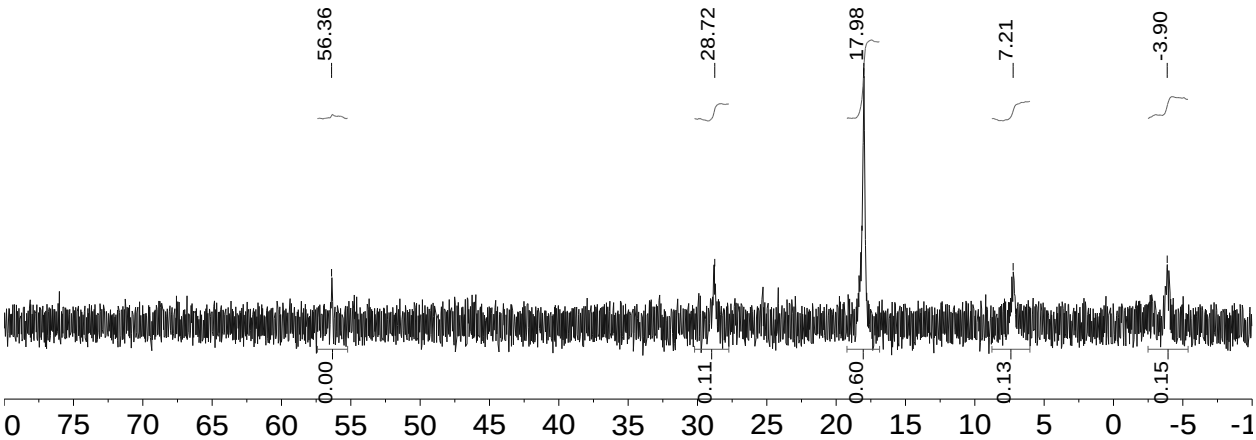


Figure C.103. ^{1}H NMR spectrum of **37a** in C_6D_6.

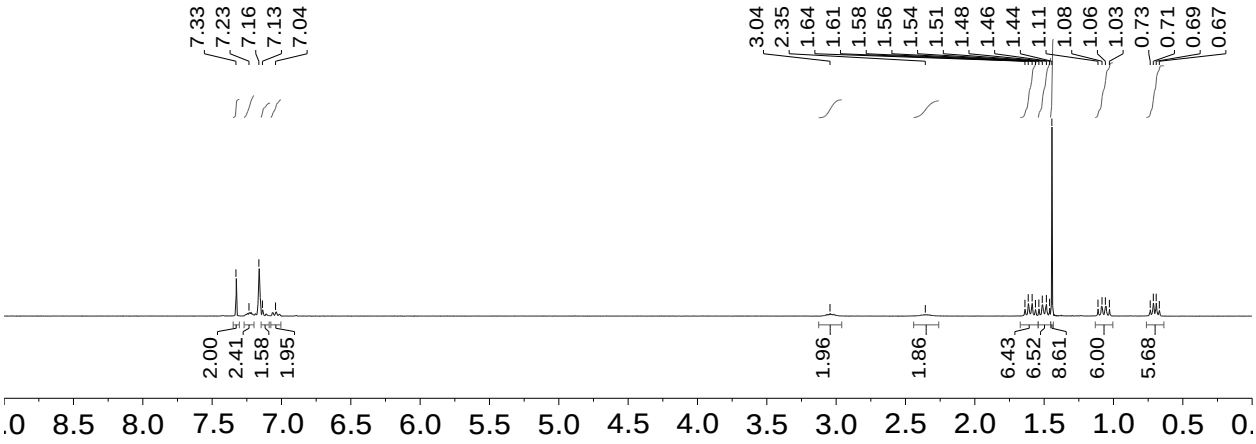


Figure C.104. $^{13}C\{^{1}H\}$ NMR spectrum of **37a** in C_6D_6.

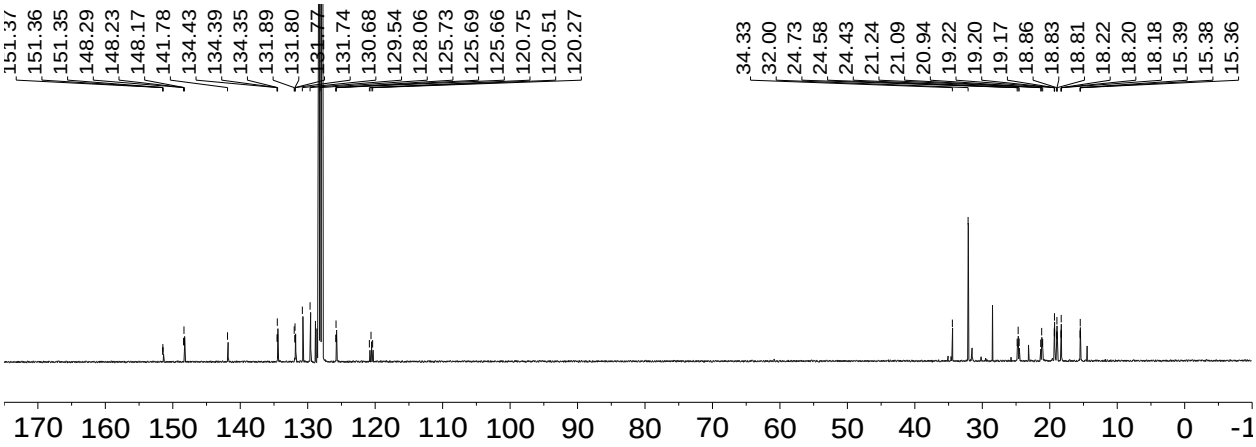


Figure C.105. $^{31}P\{^{1}H\}$ NMR spectrum of **37a** in C_6D_6.

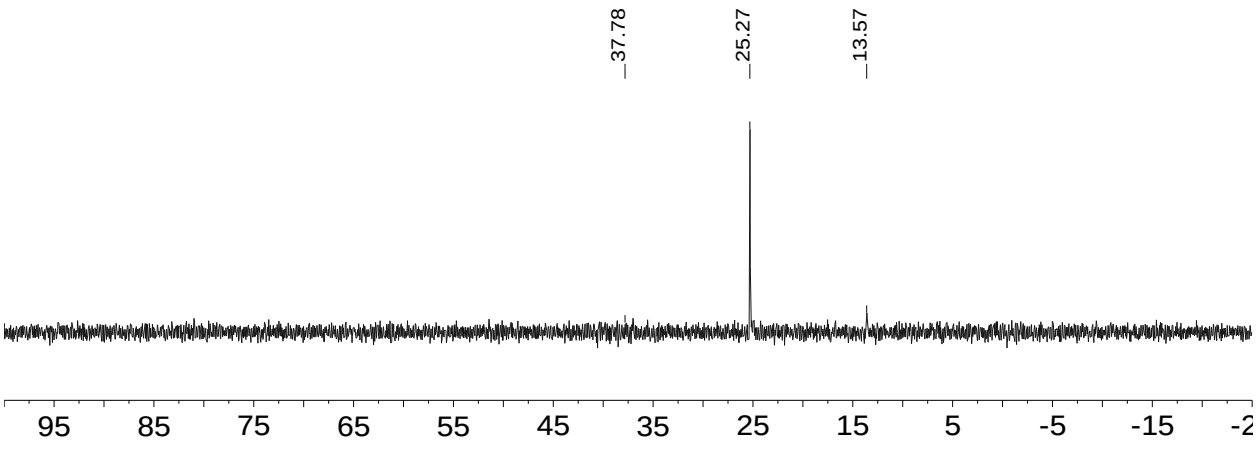


Figure C.106. ^{1}H NMR spectrum of **38a** in C_6D_6.

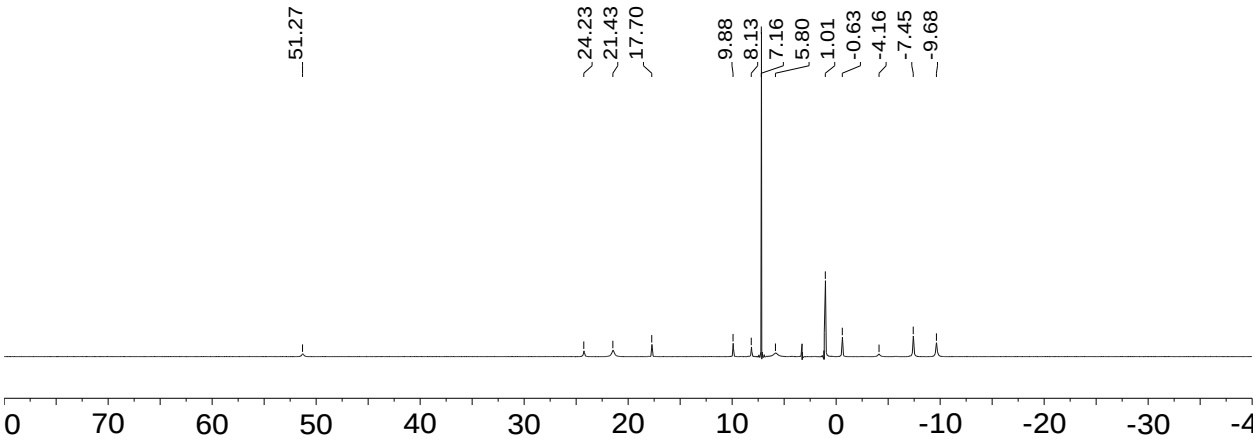


Figure C.107. ^{1}H NMR spectrum of **46** in $CDCl_3$.

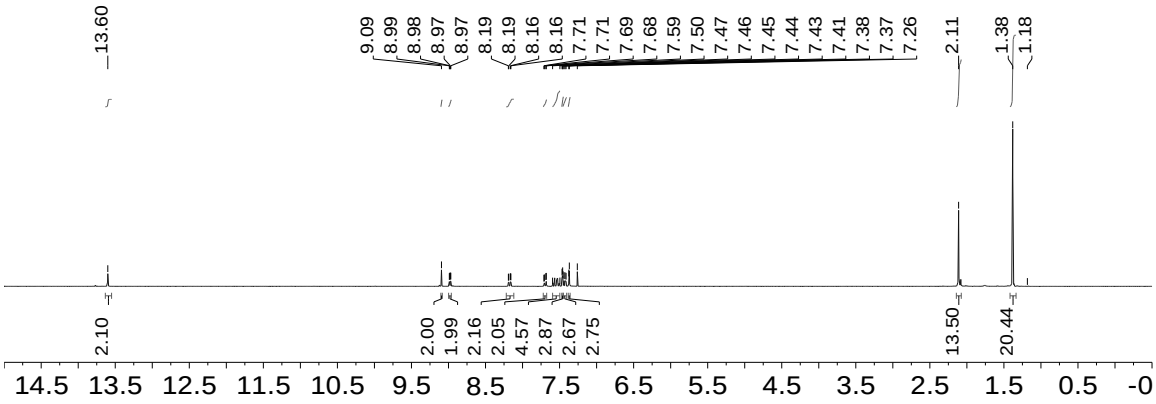


Figure C.108. ^{1}H NMR spectrum of **46** in C_6D_6.

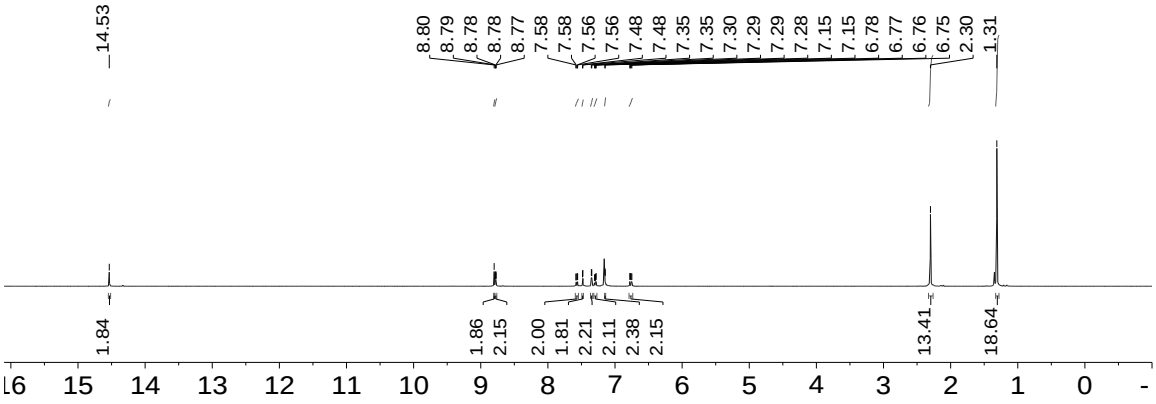


Figure C.109. $^{13}C\{^{1}H\}$ NMR spectrum of **46** in C_6D_6.

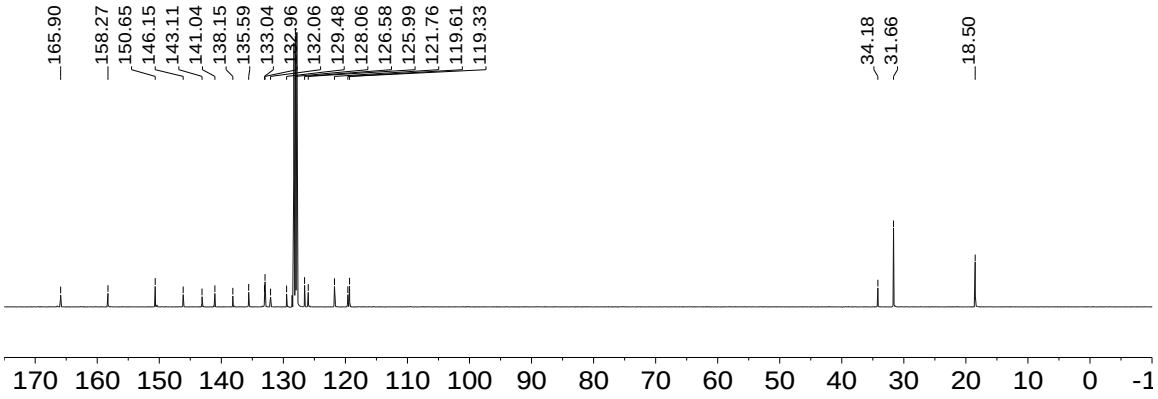


Figure C.110. ^{1}H NMR spectrum of **44** in $CDCl_3$.

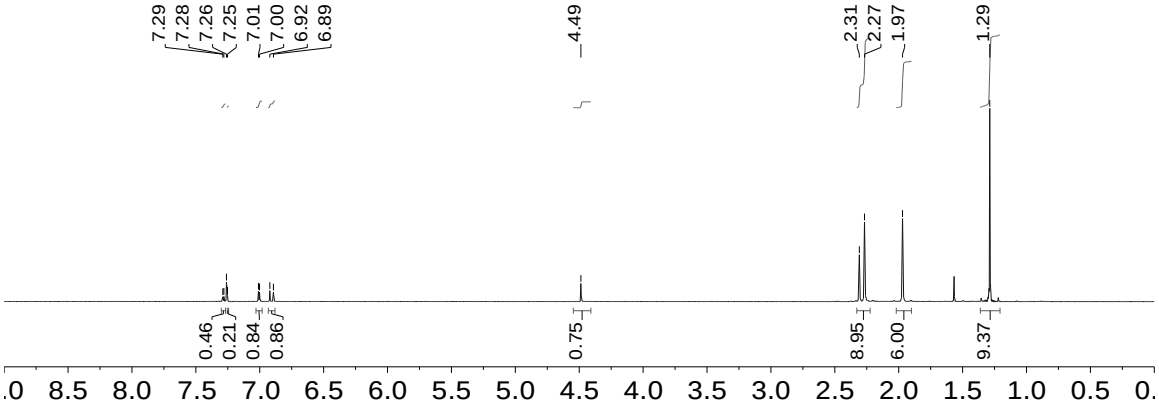


Figure C.111. ^{1}H NMR spectrum of **45** in $CDCl_3$.

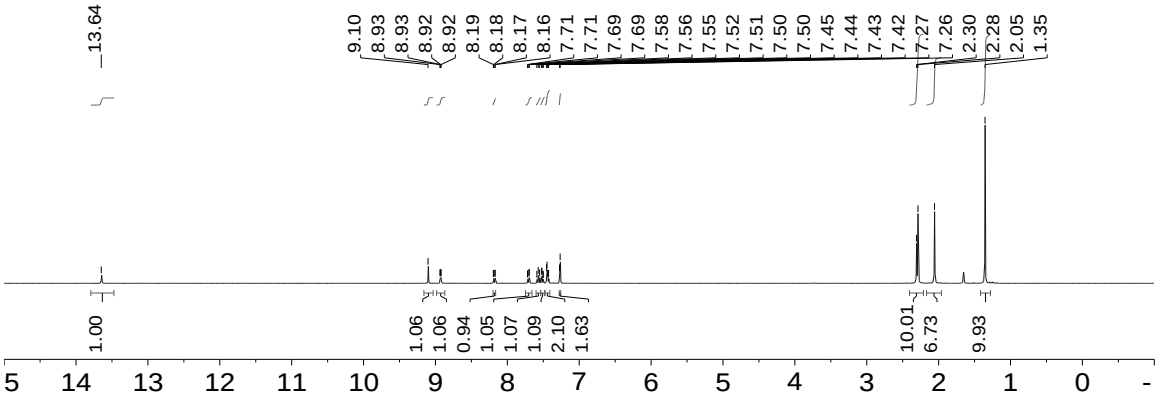


Figure C.112. $^{13}C\{^{1}H\}$ NMR spectrum of **45** in $CDCl_3$.

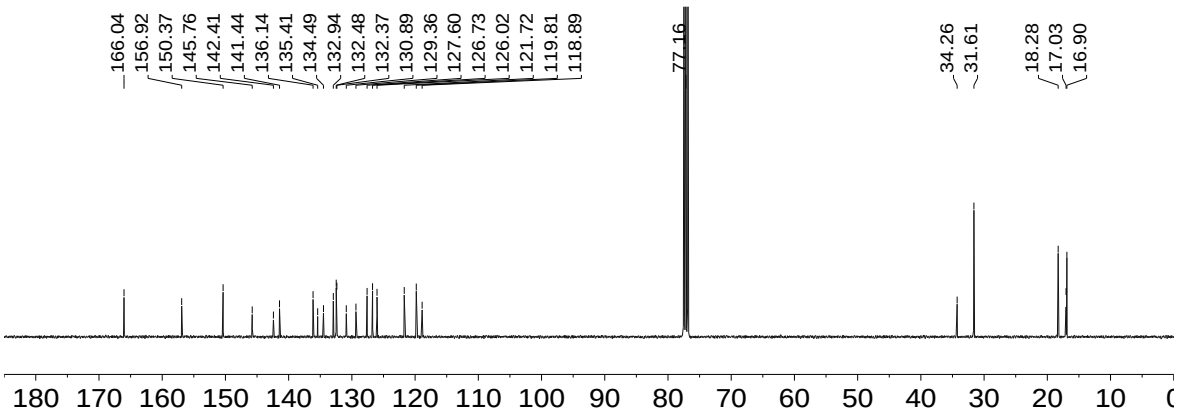


Figure C.113. ^{1}H NMR spectrum of **57** in CD_2Cl_2.

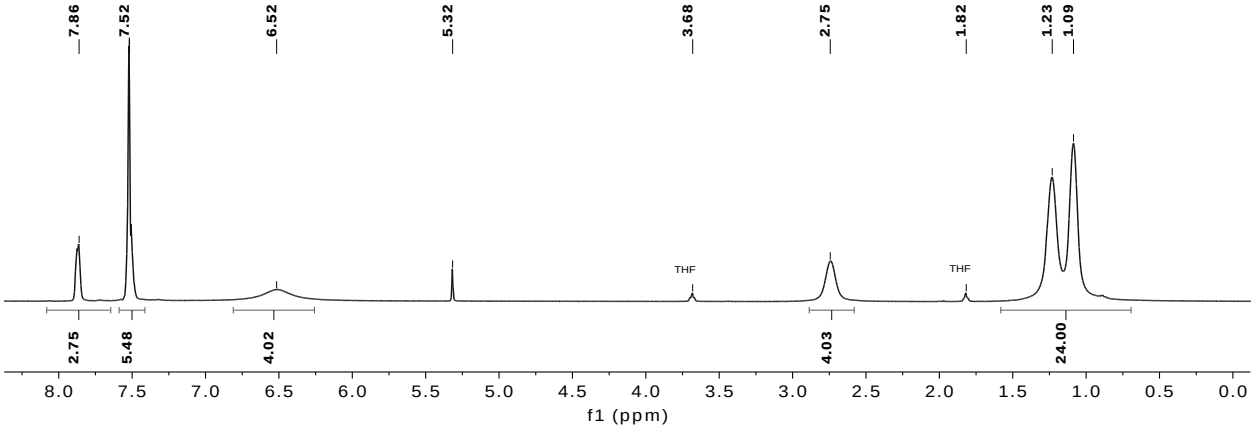


Figure C.114. $^{31}P\{^{1}H\}$ NMR spectrum of **57** in CD_2Cl_2.

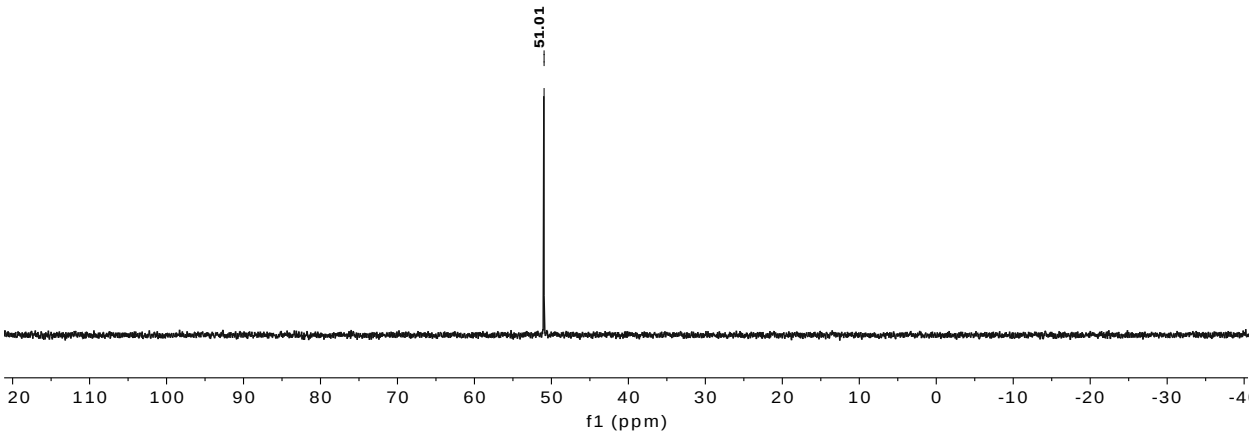


Figure C.115. $^{13}C\{^{1}H\}$ NMR spectrum of **57** in CD_2Cl_2.

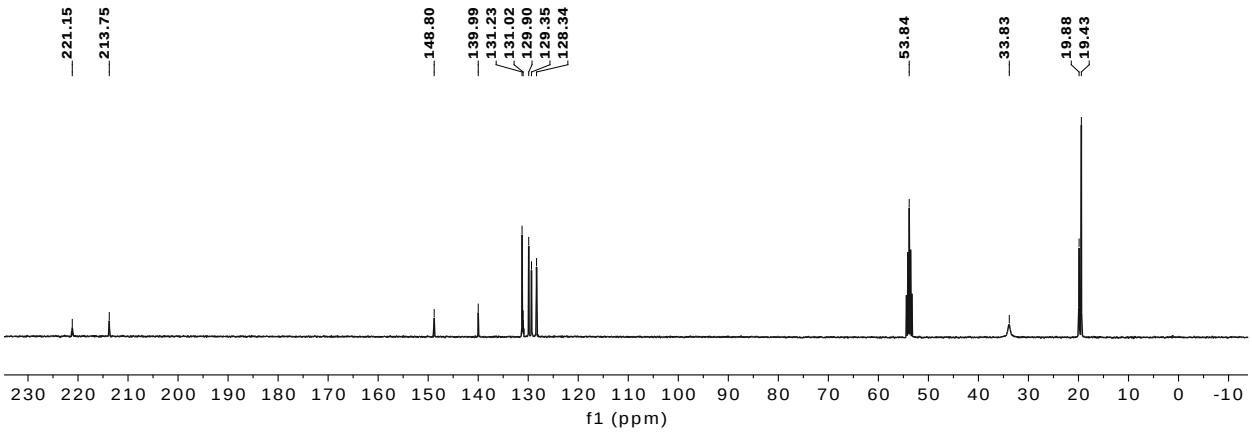


Figure C.116. ^{1}H NMR spectrum of **58** in CD_3CN.

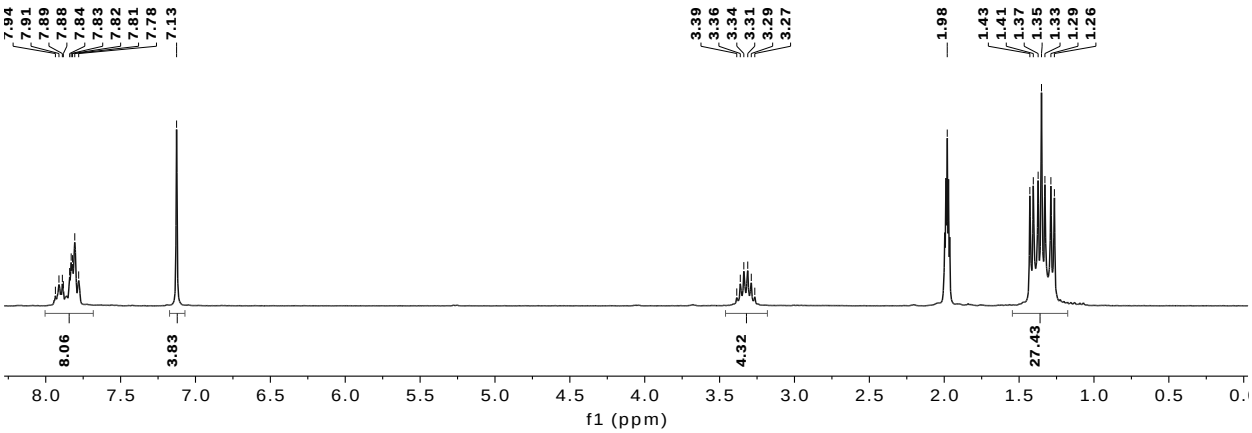


Figure C.117. $^{31}P\{^{1}H\}$ NMR spectrum of **58** in CD_3CN.

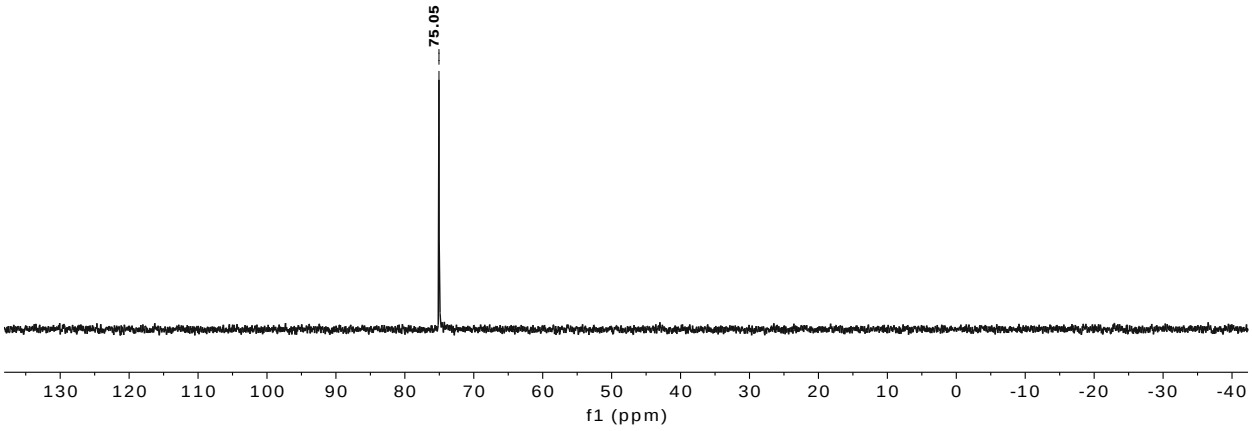


Figure C.118. $^{13}C\{^{1}H\}$ NMR spectrum of **58** in CD_3CN.

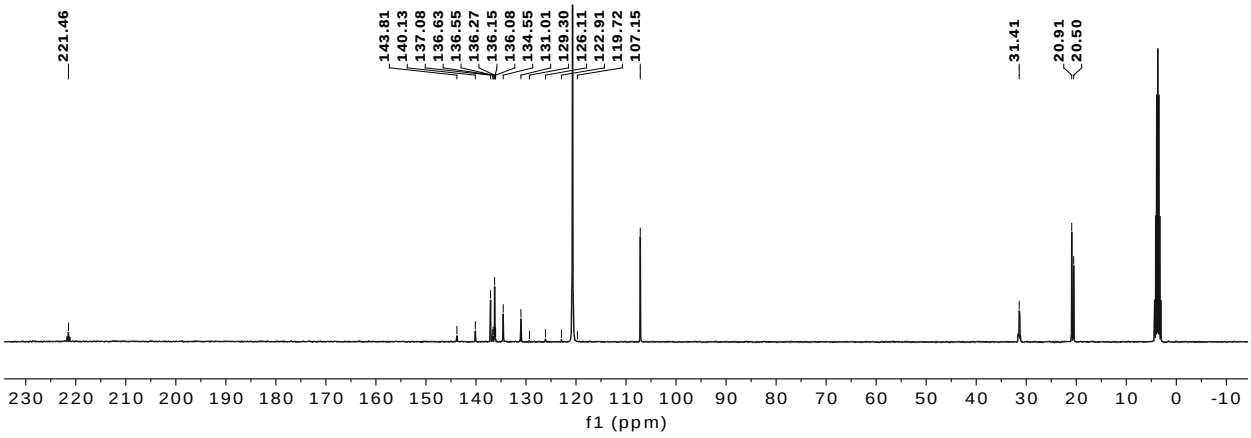


Figure C.119. ^{1}H NMR spectrum of **59** in CD_3CN.

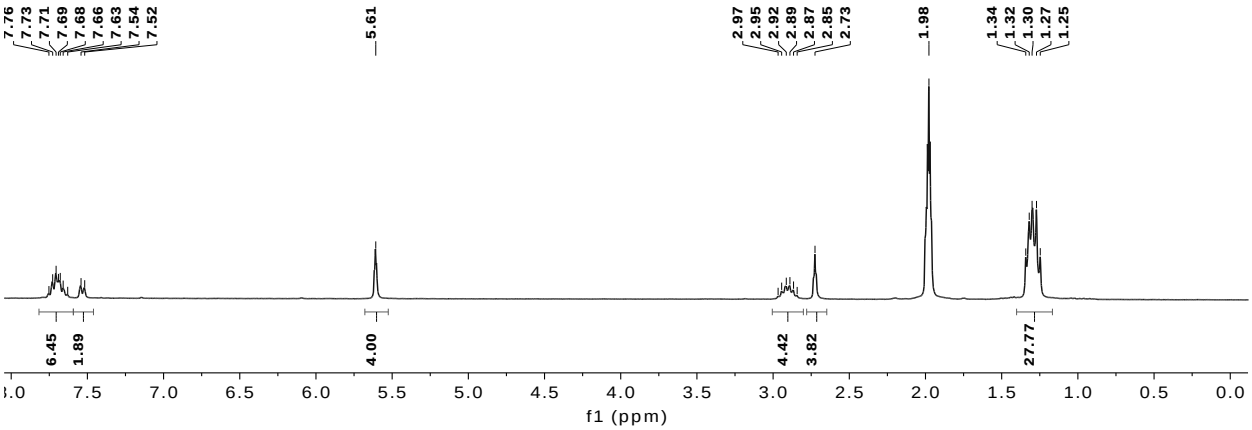


Figure C.120. $^{31}P\{^{1}H\}$ NMR spectrum of **59** in CD_3CN.

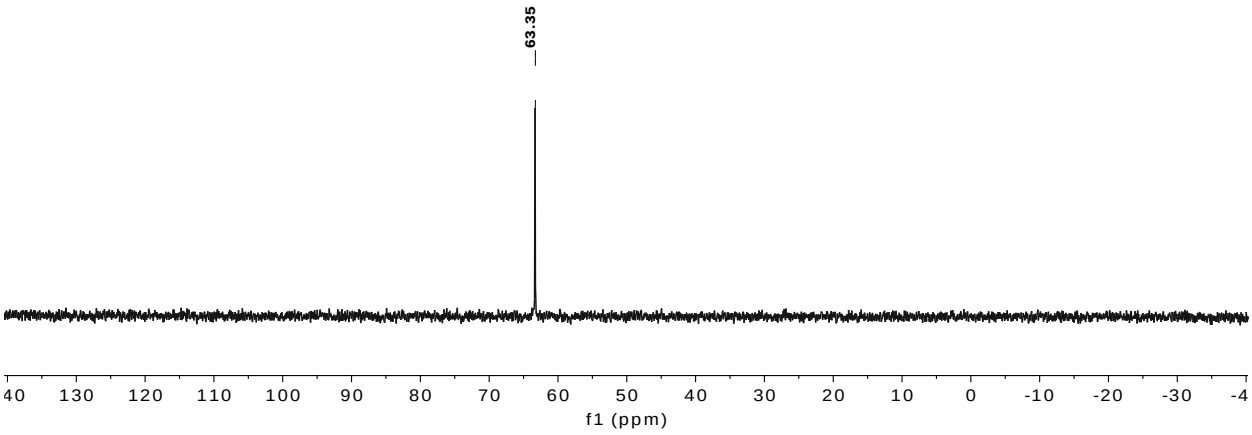


Figure C.121. $^{13}C\{^{1}H\}$ NMR spectrum of **59** in CD_3CN.

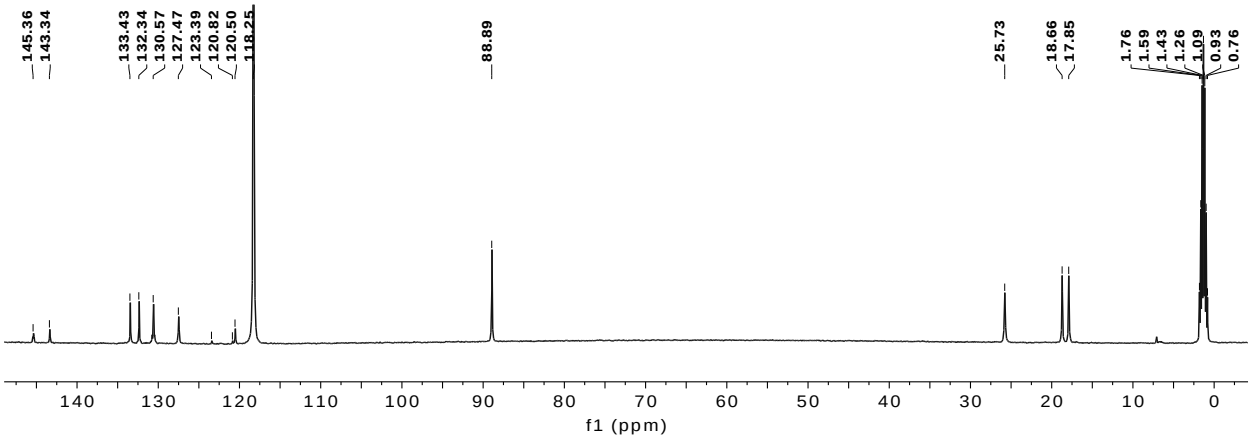


Figure C.122. ^{1}H NMR spectrum of **60** in C_6D_6.

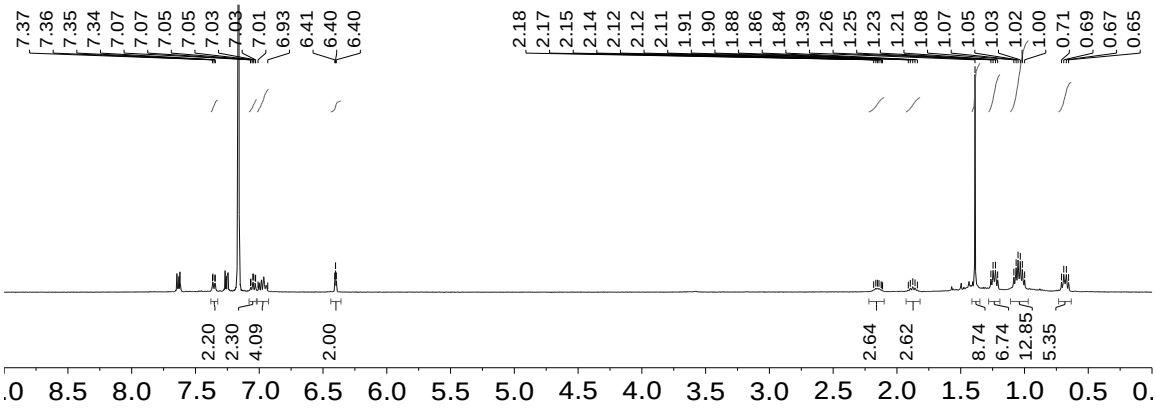


Figure C.123. $^{13}C\{^{1}H\}$ NMR spectrum of **60** in C_6D_6.

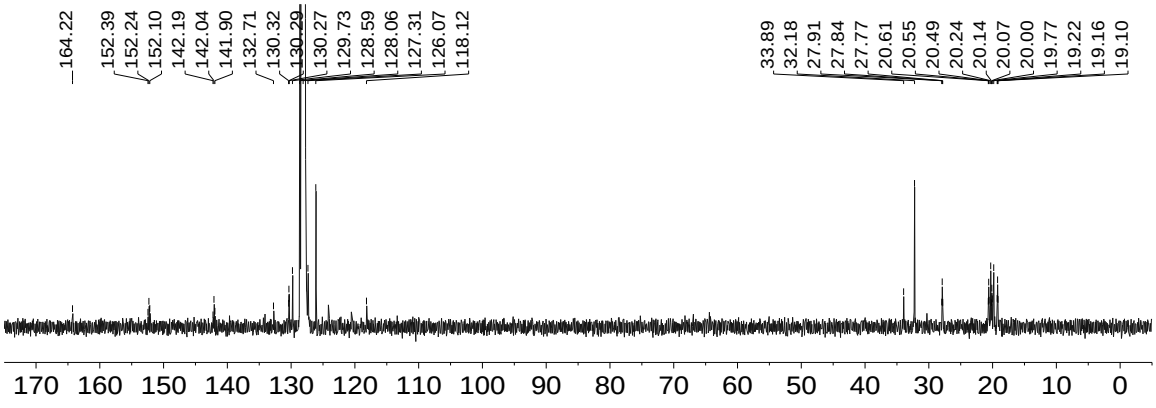


Figure C.124. $^{31}P\{^{1}H\}$ NMR spectrum of **60** in C_6D_6.

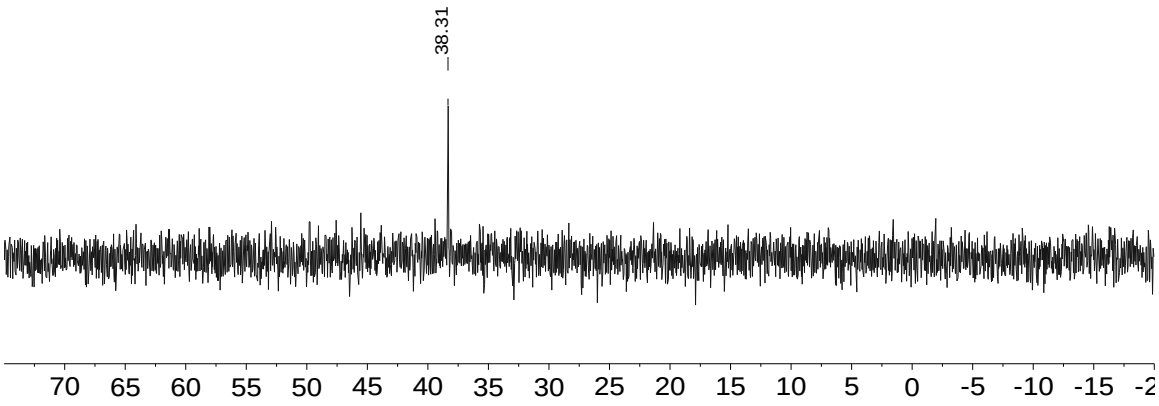


Figure C.125. ^{1}H NMR spectrum of **62** in C_6D_6.

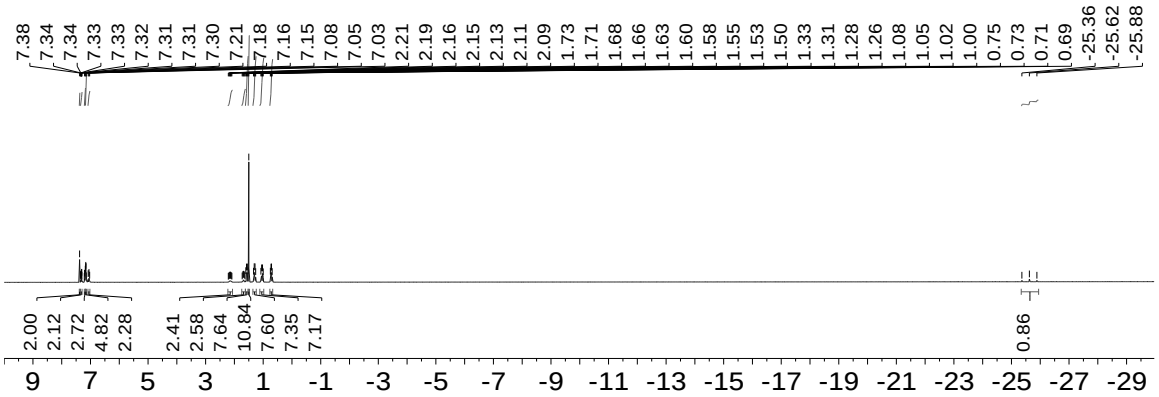


Figure C.126. $^{13}C\{^{1}H\}$ NMR spectrum of **62** in C_6D_6.

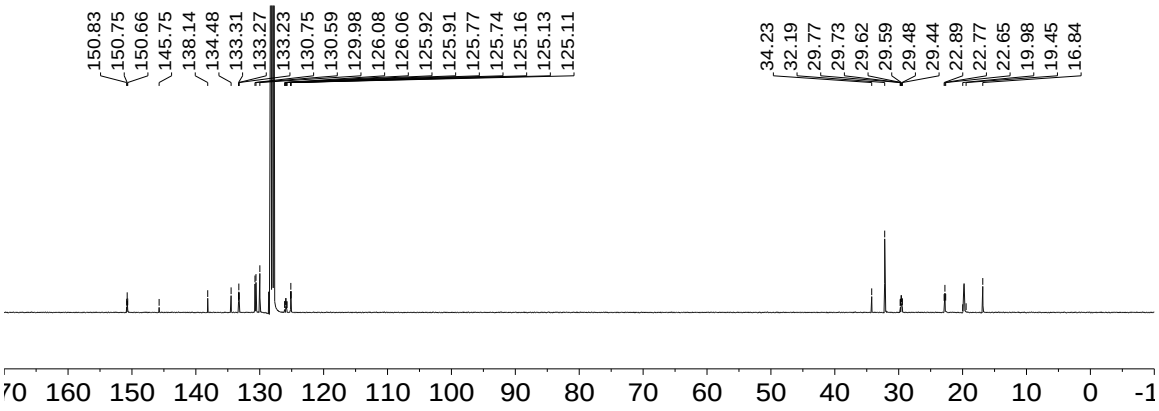


Figure C.127. $^{31}P\{^{1}H\}$ NMR spectrum of **62** in C_6D_6.

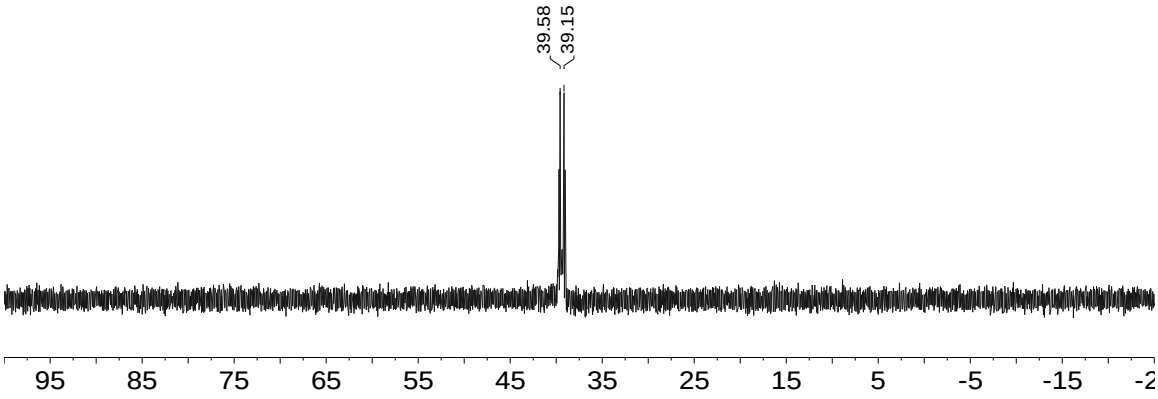


Figure C.128. ^{1}H NMR spectrum of 1-(2'-diisopropylphosphino)phenyl-2-methoxymethoxy-3,5-di-tert-butylbenzene in C_6D_6.

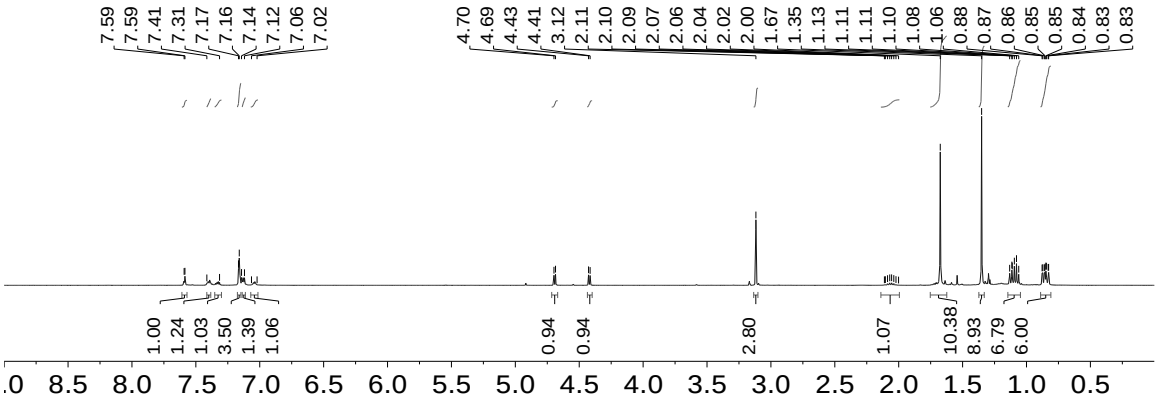


Figure C.129. $^{13}C\{^{1}H\}$ NMR spectrum of 1-(2'-diisopropylphosphino)phenyl-2-methoxymethoxy-3,5-di-tert-butylbenzene in C_6D_6.

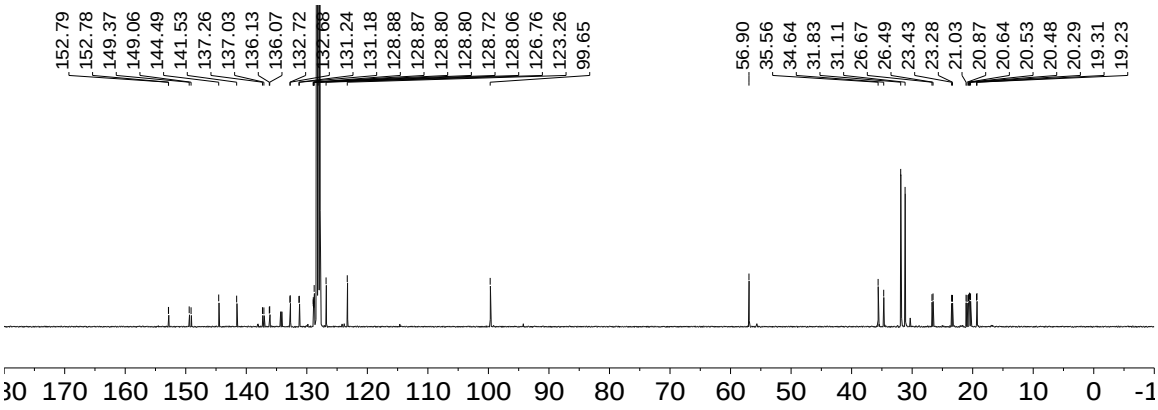


Figure C.130. $^{31}P\{^{1}H\}$ NMR spectrum of 1-(2'-diisopropylphosphino)phenyl-2-methoxymethoxy-3,5-di-tert-butylbenzene in C_6D_6.

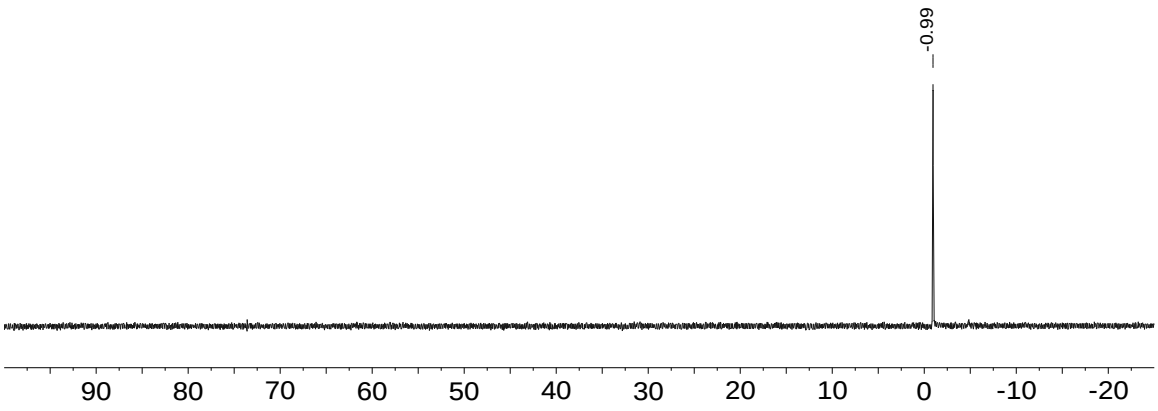


Figure C.131. ^{1}H NMR spectrum of **65** in C_6D_6.

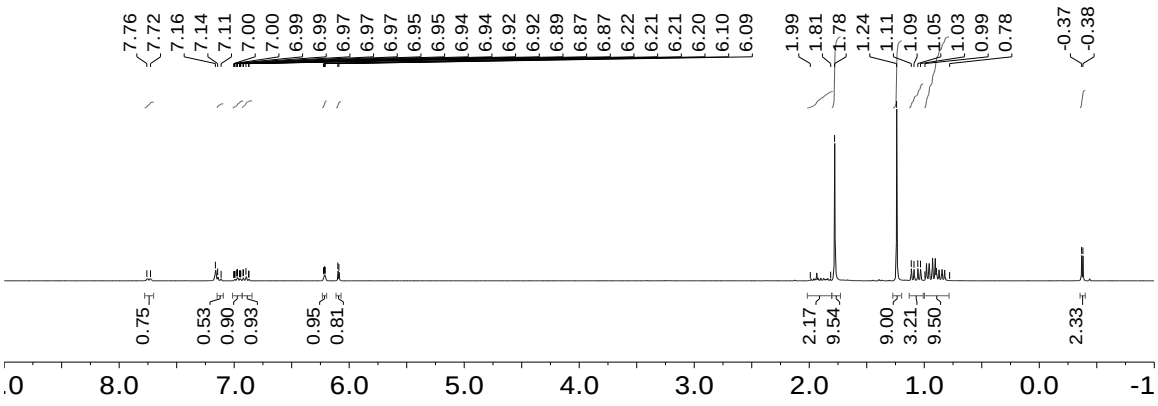


Figure C.132. $^{13}C\{^{1}H\}$ NMR spectrum of **65** in C_6D_6.

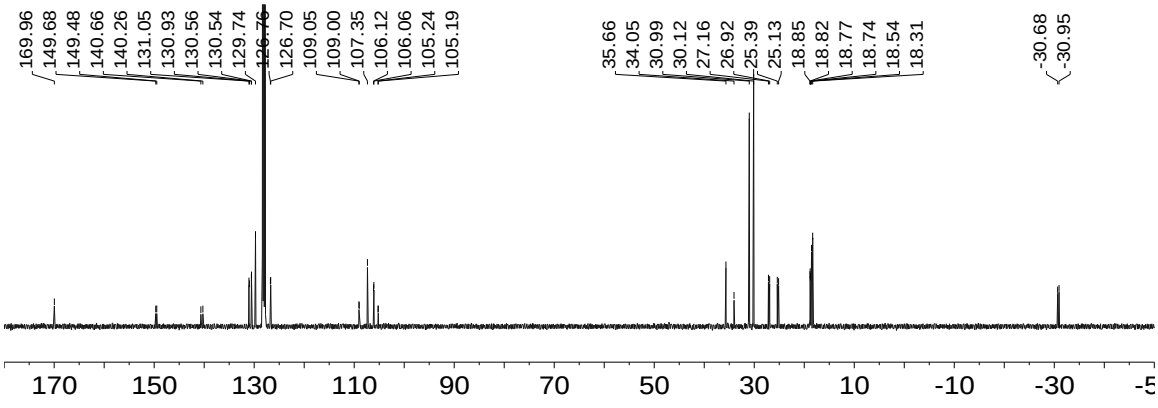


Figure C.133. $^{31}P\{^{1}H\}$ NMR spectrum of **65** in C_6D_6.

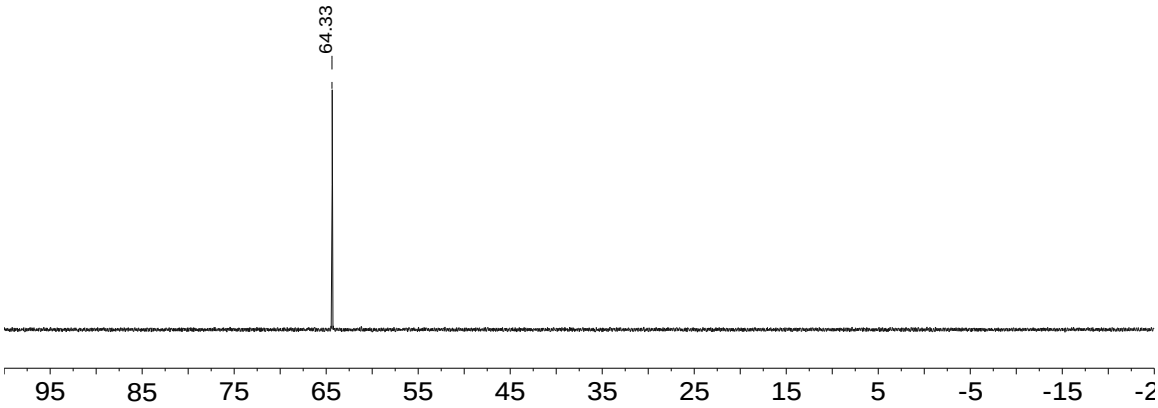


Figure C.134. ^{1}H NMR spectrum of **66** in C_6D_6. Note: Residual tetrahydrofuran present.

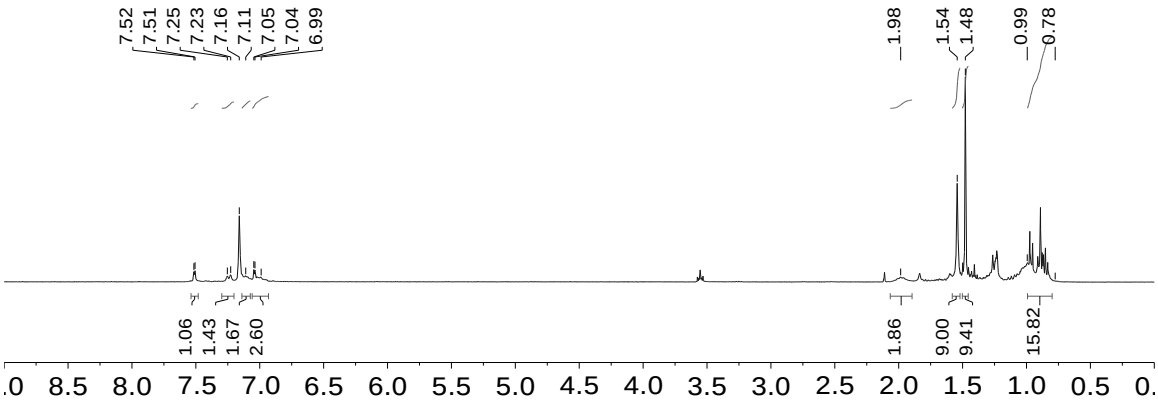


Figure C.135. $^{31}P\{^{1}H\}$ NMR spectrum of **66** in C_6D_6.

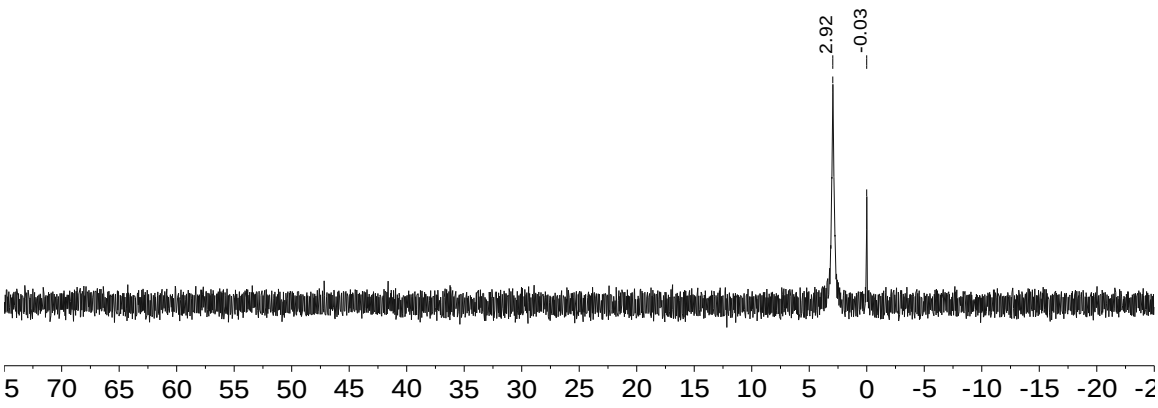


Figure C.136. ^{1}H NMR spectrum of **68** in $CDCl_3$. Note: Residual Et_2O and acetone present.

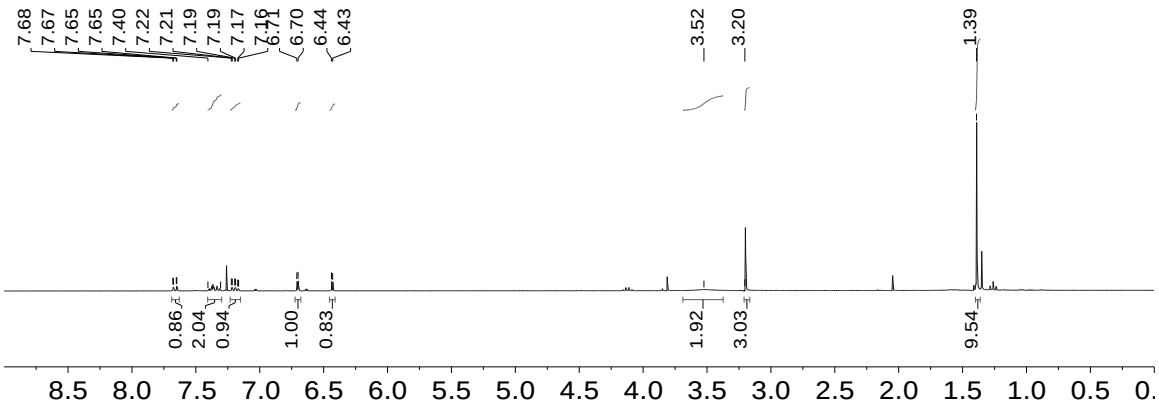


Figure C.137. ^{1}H NMR spectrum of **69** in $CDCl_3$.

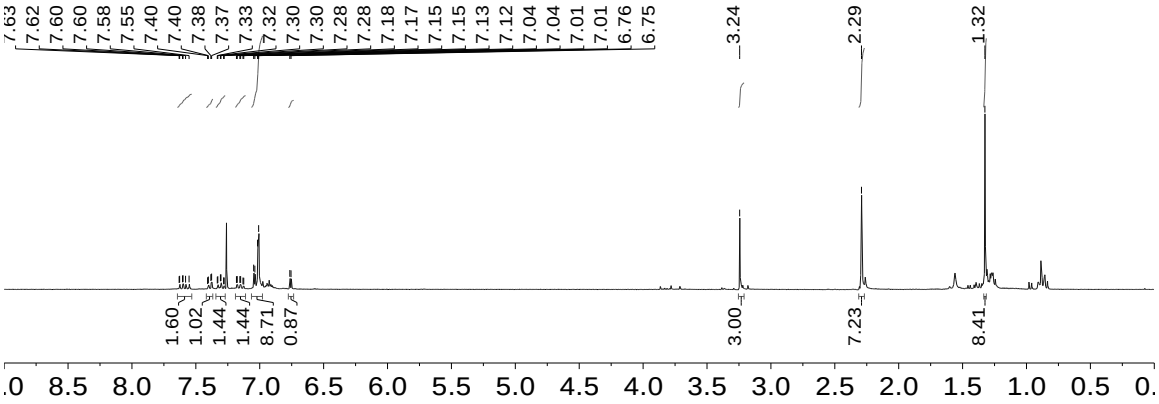


Figure C.138. ^{1}H NMR spectrum of **69** in C_6D_6.

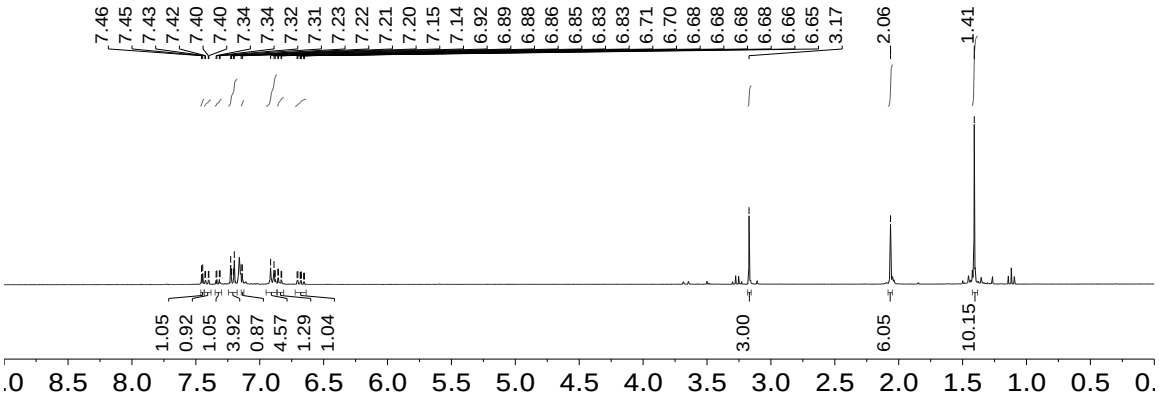


Figure C.139. ^{1}H NMR spectrum of **70** in C_6D_6. Note: Residual $(^{i}Pr)_2PCl$ present.

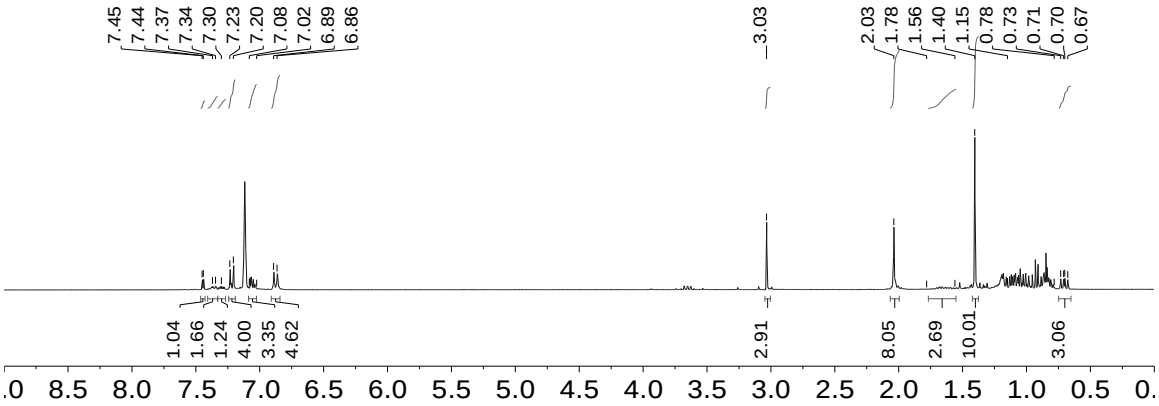


Figure C.140. $^{31}P\{^{1}H\}$ NMR spectrum of **70** in C_6D_6. Note: Residual $(^{i}Pr)_2PCl$ present.

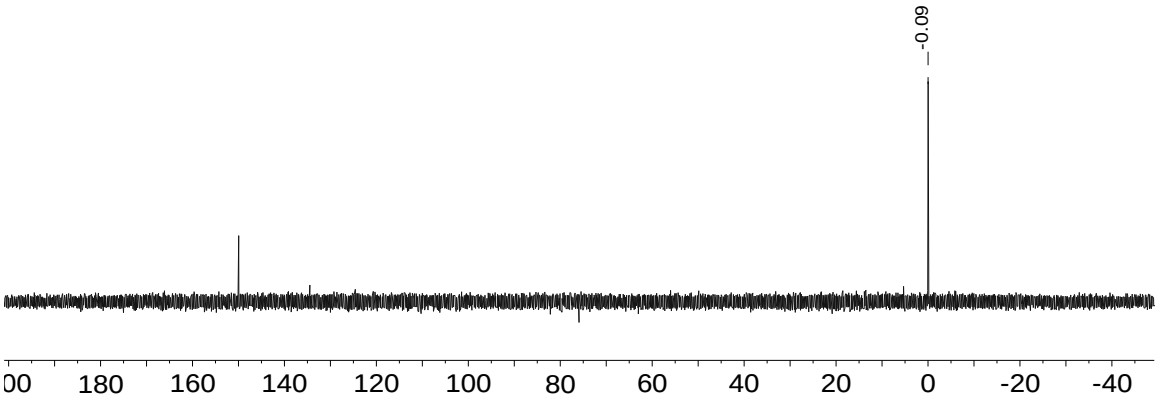


Figure C.141. ^{1}H NMR spectrum of **71** in $CDCl_3$.

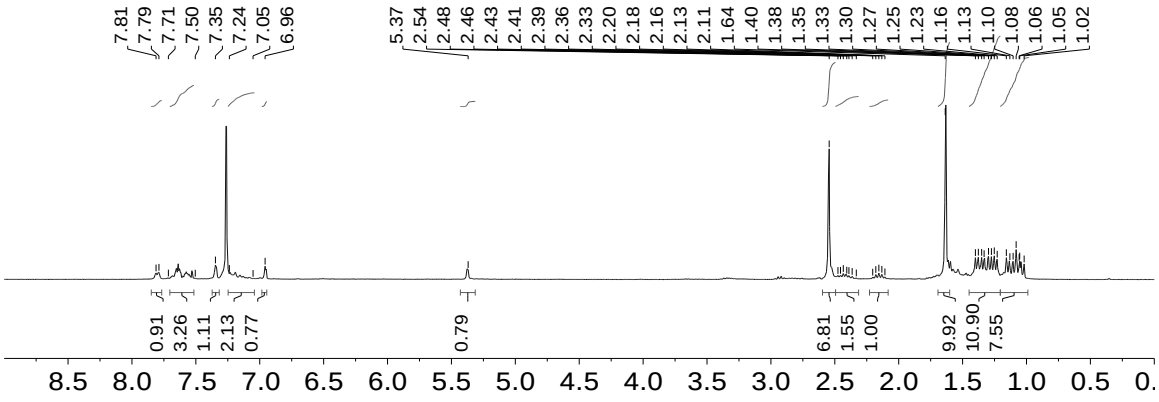


Figure C.142. $^{31}P\{^{1}H\}$ NMR spectrum of **71** in $CDCl_3$.

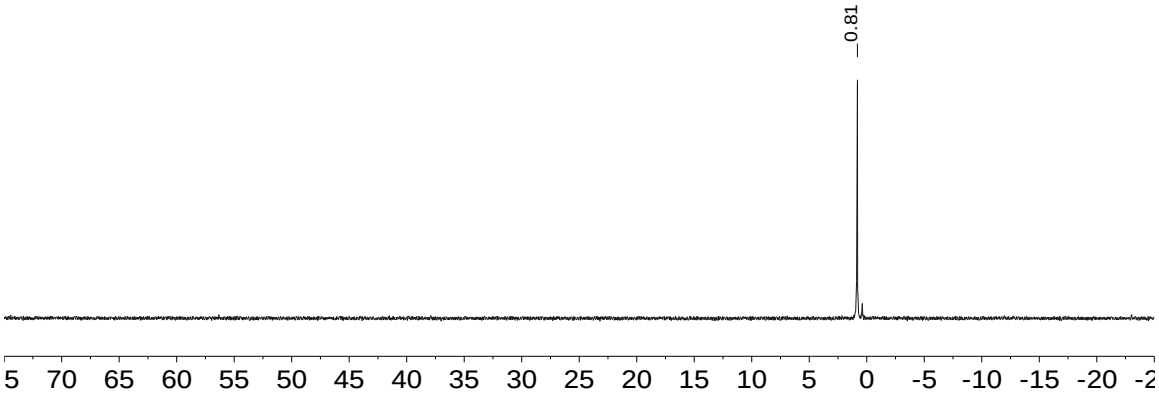


Figure C.143. ^{1}H NMR spectrum of **71** in C_6D_6.

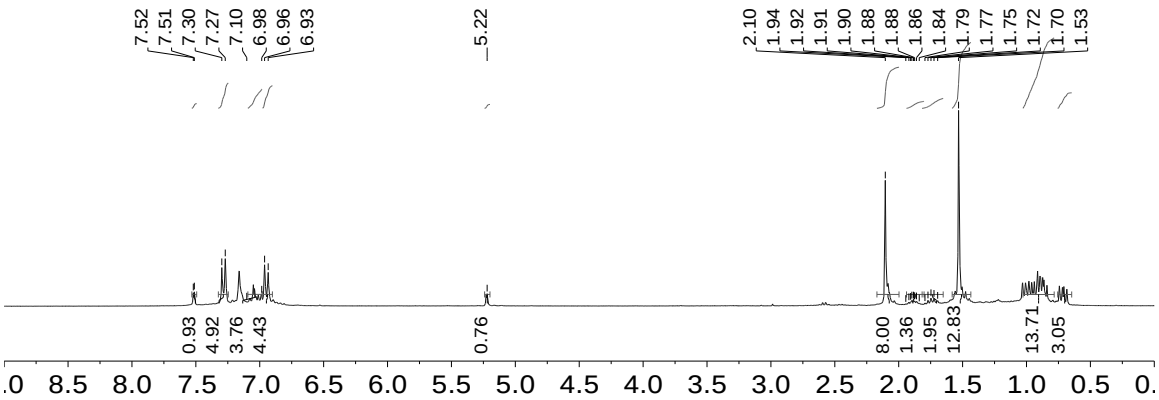


Figure C.144. $^{31}P\{^{1}H\}$ NMR spectrum of **71** in C_6D_6.

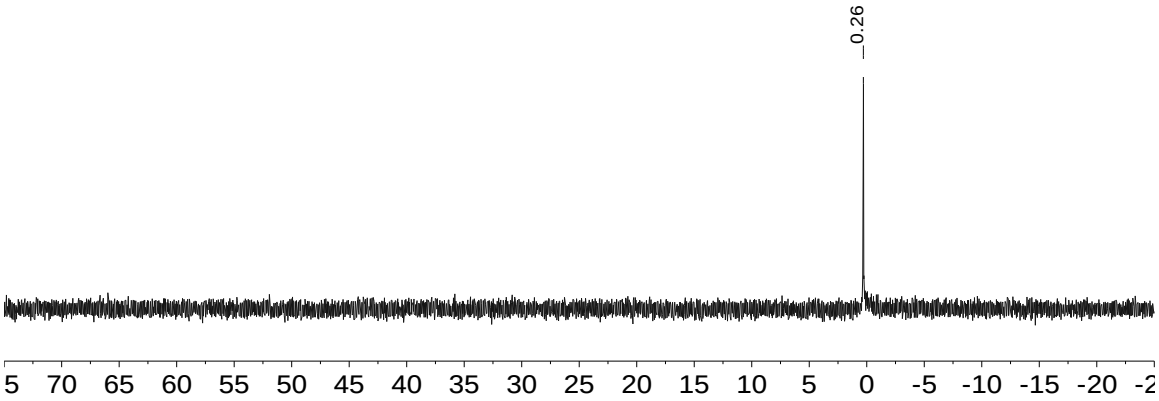


Figure C.145. ^{1}H NMR spectrum of **72** in C_6D_6. Note: Residual toluene and tetrahydrofuran present.

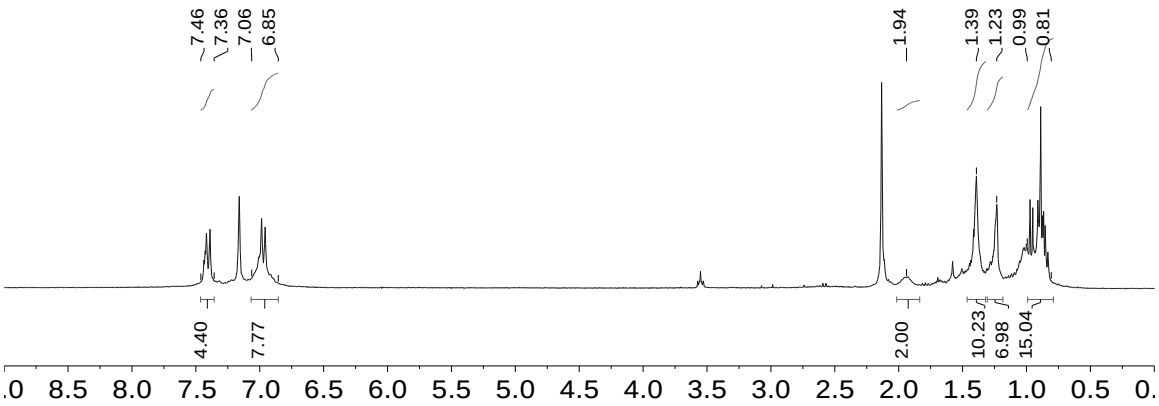
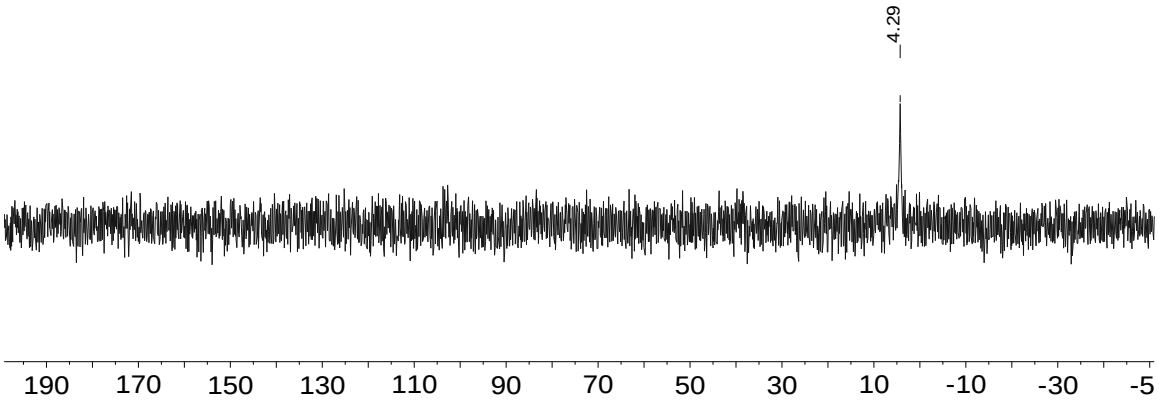


Figure C.146. $^{31}P\{^{1}H\}$ NMR spectrum of **72** in C_6D_6.



ABOUT THE AUTHOR

Guy Anthony Edouard was born in Boston, MA, on August 28, 1987, son of Marise Valbrun Edouard and Guy Milhaud Edouard, who met in their hometown of Cap Haïtien, Haiti. He was raised in Brockton, MA, with his two brothers, Rudy and Alan. In Brockton, he attended St. Edward's School and Cardinal Spellman High School. After high school, he graduated from Harvard College with a B. A. in Chemical and Physical Biology in 2010, where he performed research in the laboratory of Prof. Ted Betley. His Ph. D. studies were completed in the laboratory of Prof. Theo Agapie at the California Institute of Technology. In 2016, he left Pasadena to begin work as an engineer with Intel at their research and development facility in Hillsboro, OR. Guy's interests have long included but are not limited to: high school and college Mock Trial competitions and trial advocacy, Haitian food, standup comedy, playing basketball, and rooting for the Celtics and Patriots.

"When I picture him heading south in his own car with the top down, it always makes me laugh. Andy Dufresne... who crawled through a river of ---- and came out clean on the other side. Andy Dufresne... headed for the Pacific."

Red, *The Shawshank Redemption* (1994)