

APPENDIX 1

Spectra Relevant to Chapter 1:

*Ir-Catalyzed Asymmetric Allylic Alkylation of Dialkyl Malonates
Enabling the Construction of Enantioenriched All-Carbon Quaternary
Centers*

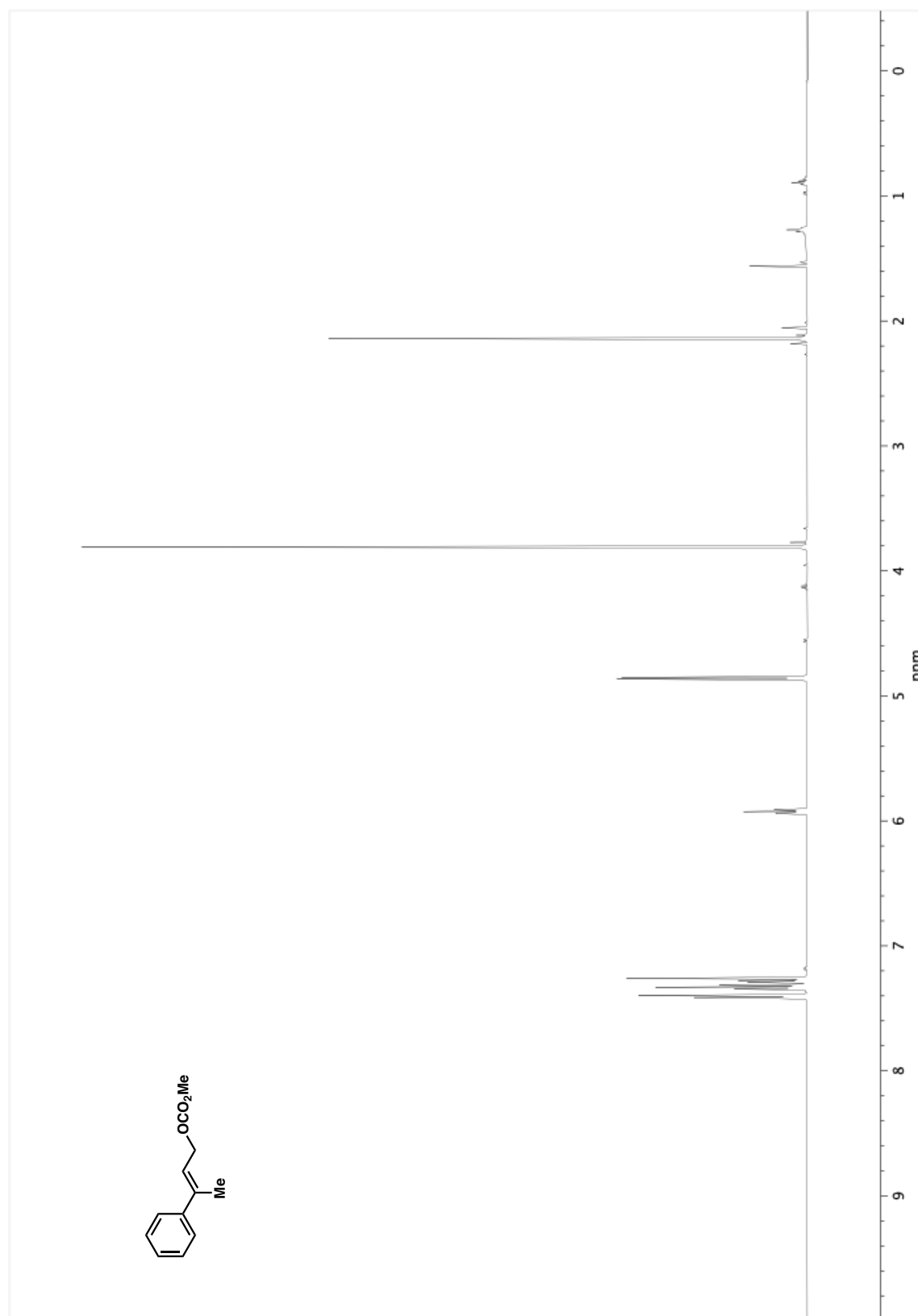


Figure A1.1.1. ¹H NMR (500 MHz, CDCl₃) of compound **2a**.



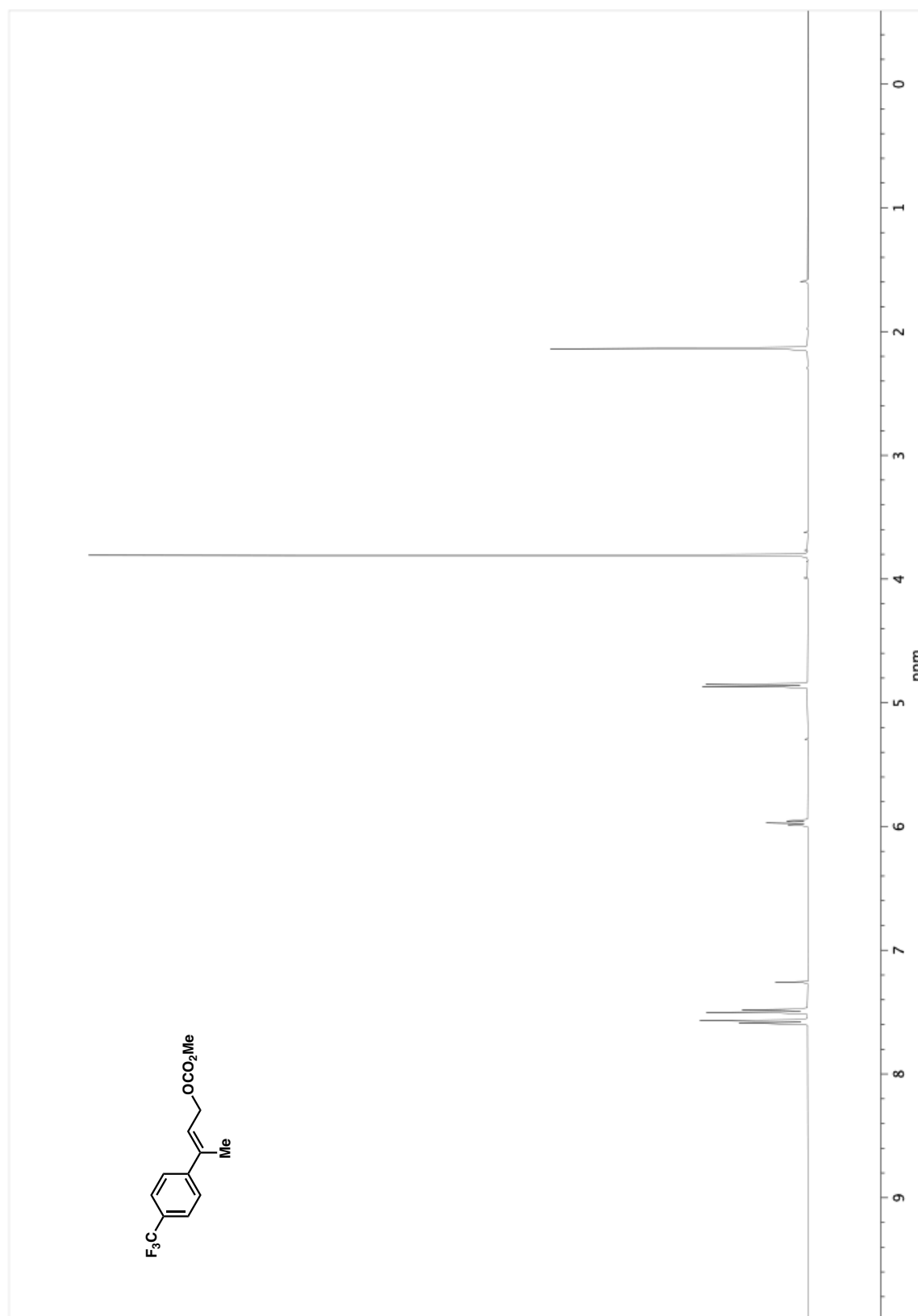


Figure A1.3. ^1H NMR (400 MHz, CDCl_3) of compound **2c**.

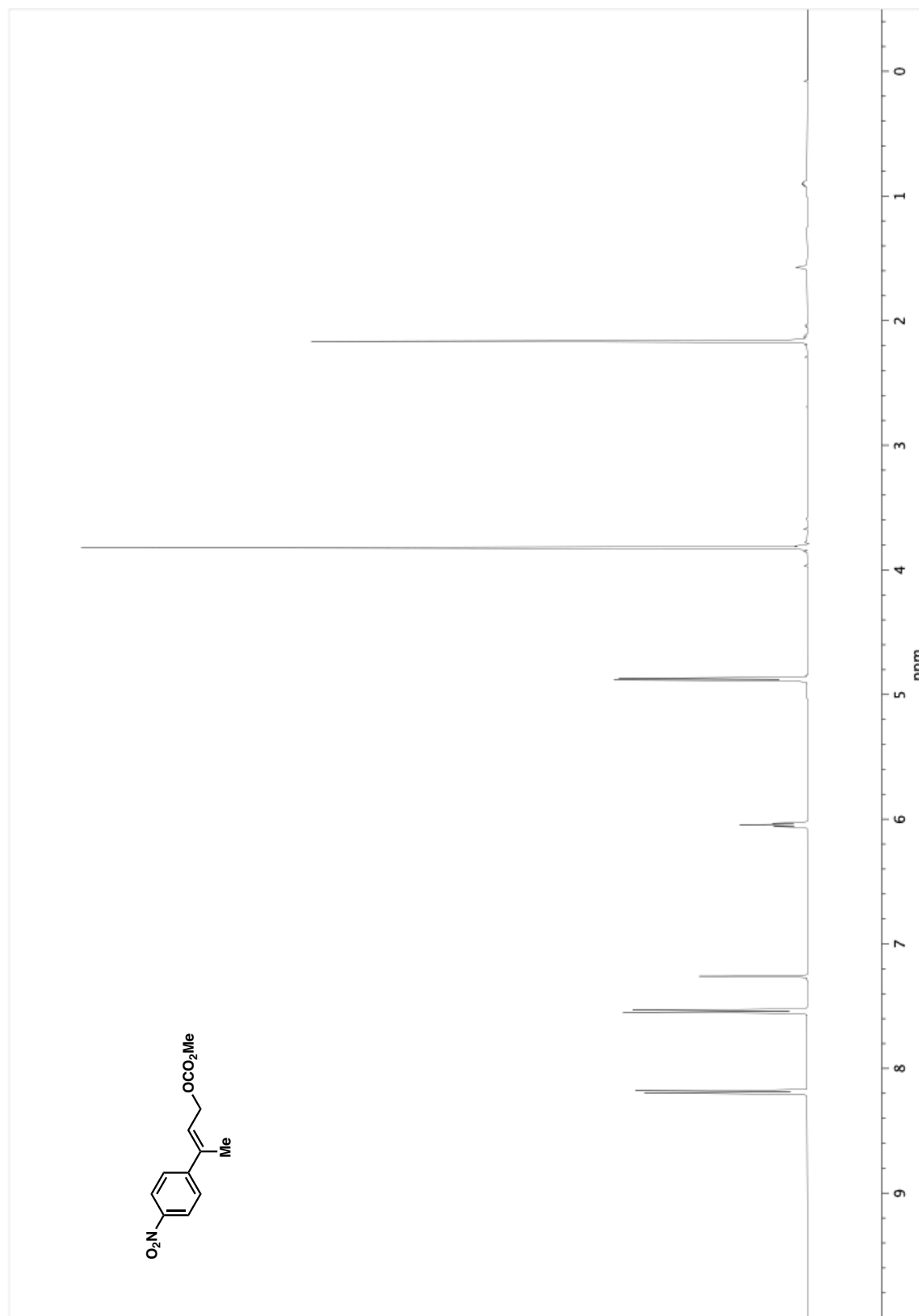


Figure A1.4. ¹H NMR (500 MHz, CDCl₃) of compound **2d**.

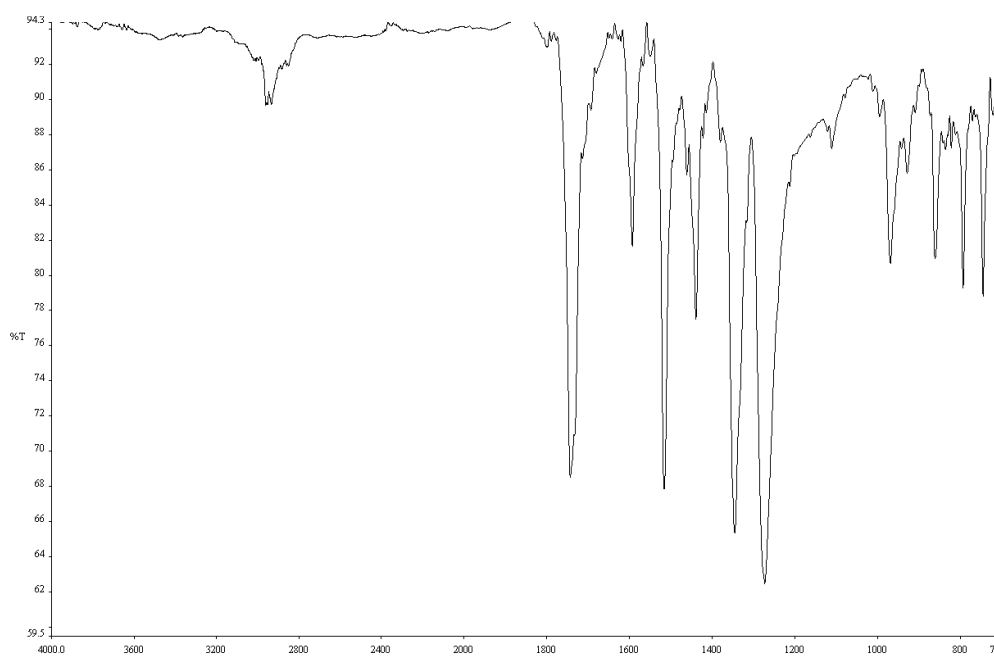


Figure A1.5. Infrared spectrum (Thin Film, NaCl) of compound **2d**.

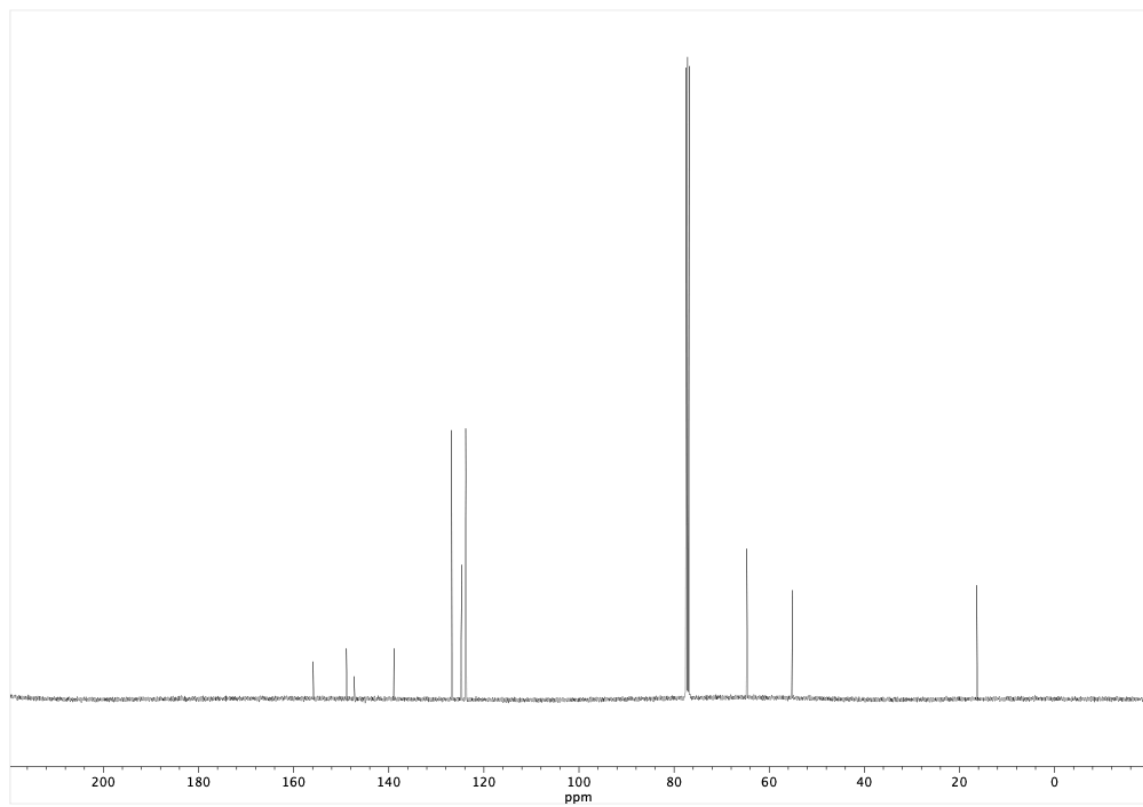


Figure A1.6. ¹³C NMR (100 MHz, CDCl₃) of compound **2d**.

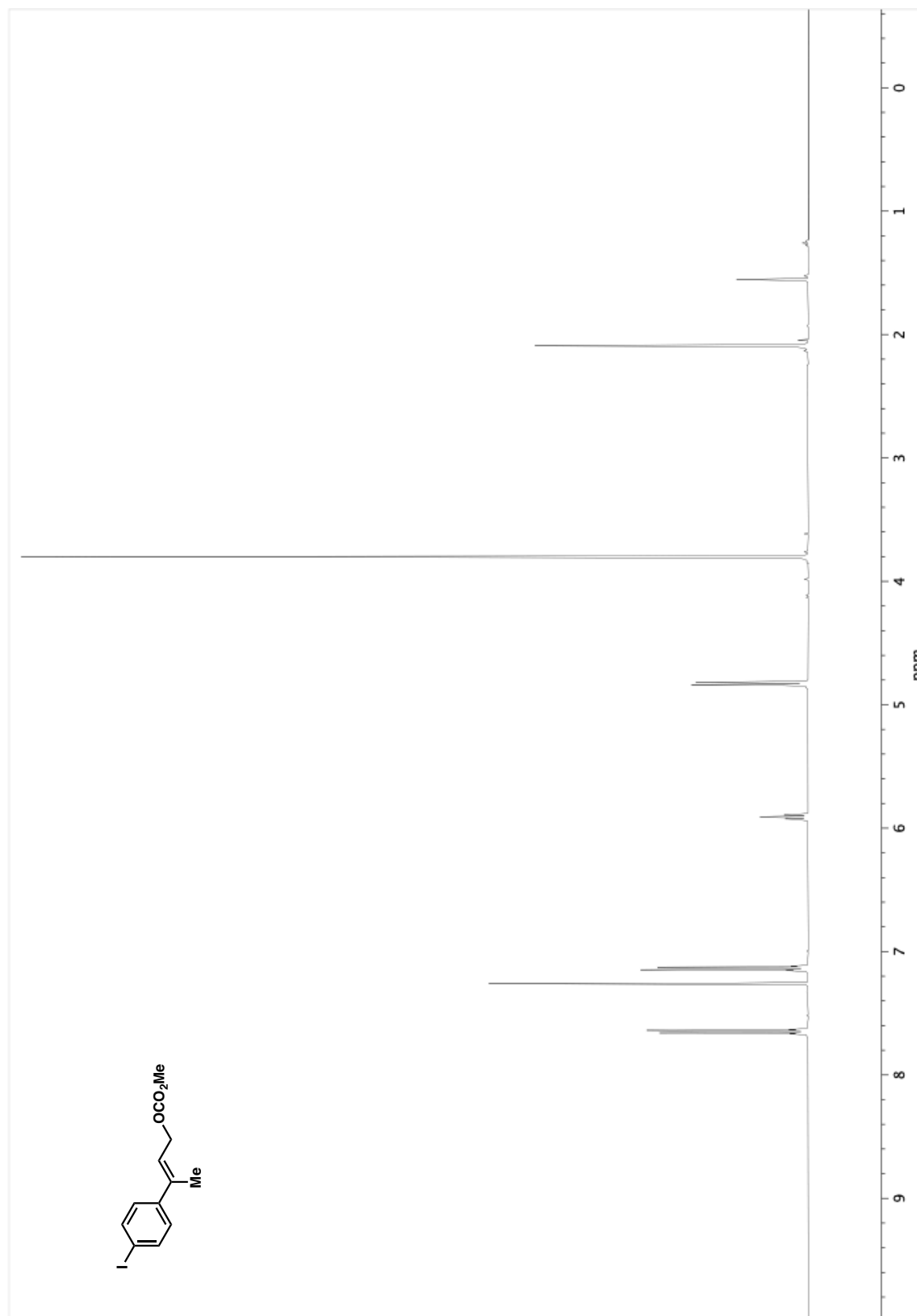


Figure A1.7. ¹H NMR (400 MHz, CDCl₃) of compound **2e**.

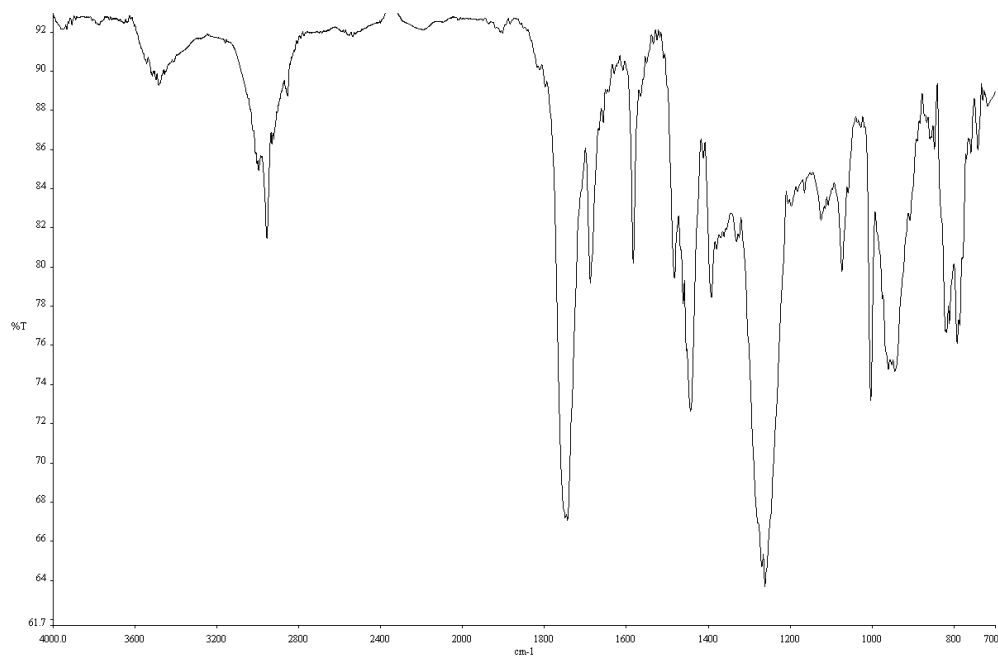


Figure A1.8. Infrared spectrum (Thin Film, NaCl) of compound **2e**.

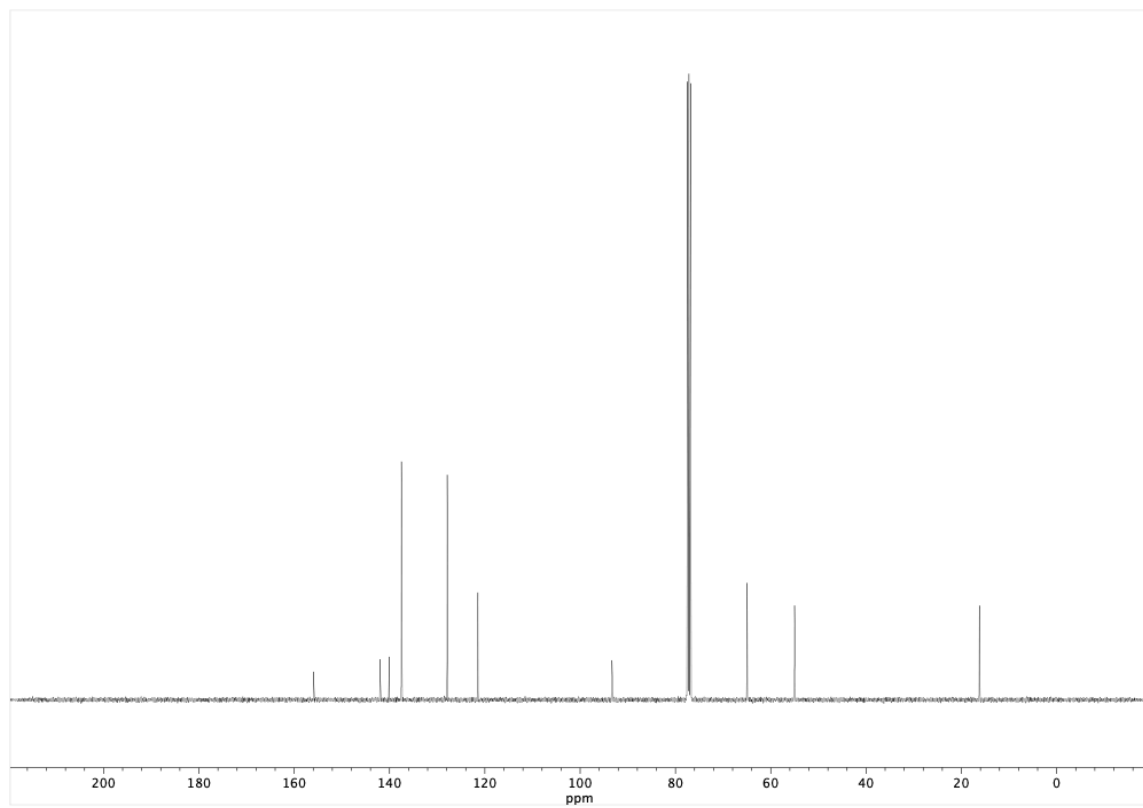


Figure A1.9. ¹³C NMR (100 MHz, CDCl₃) of compound **2e**.

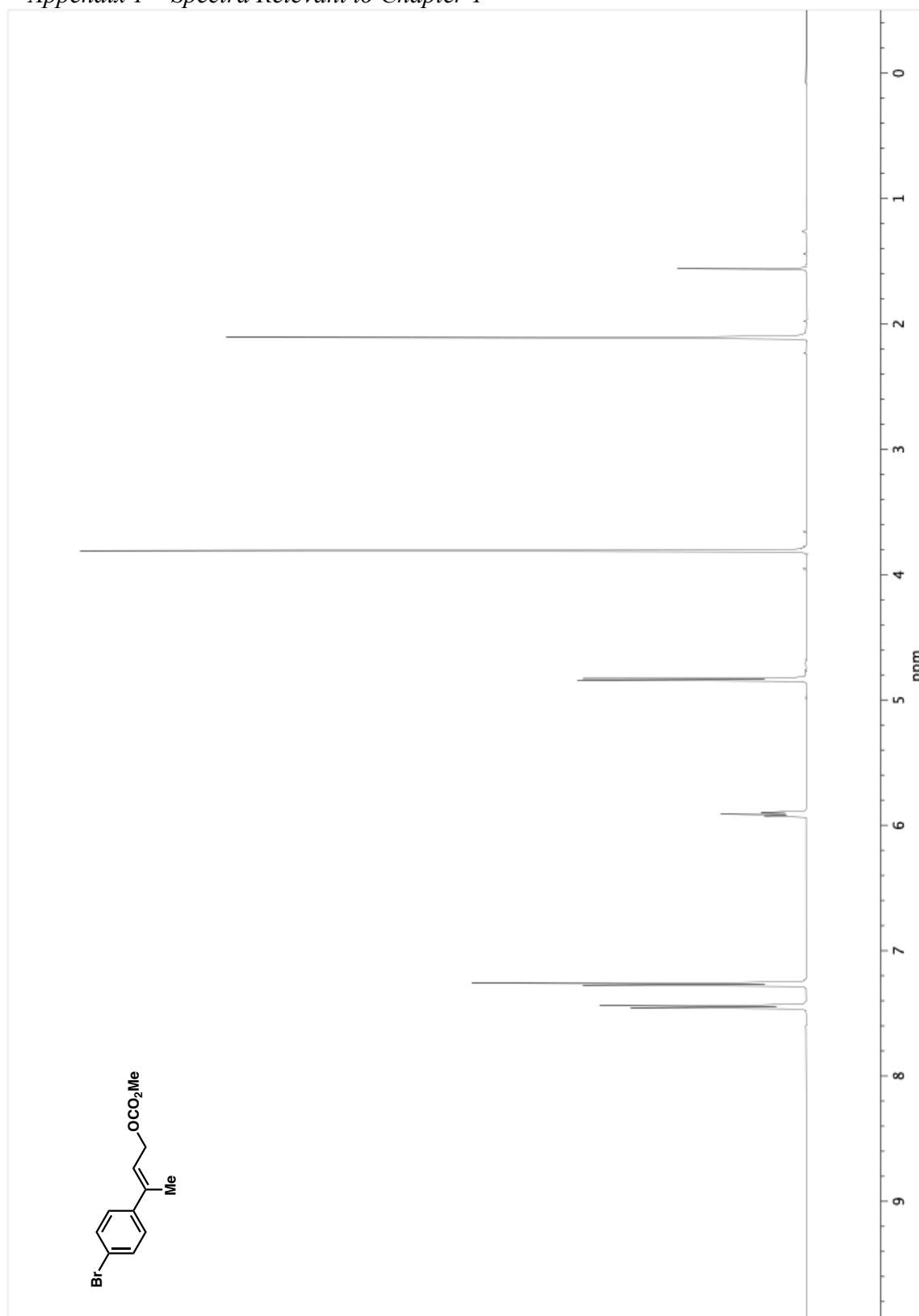


Figure A1.10. ^1H NMR (500 MHz, CDCl_3) of compound **2f**.

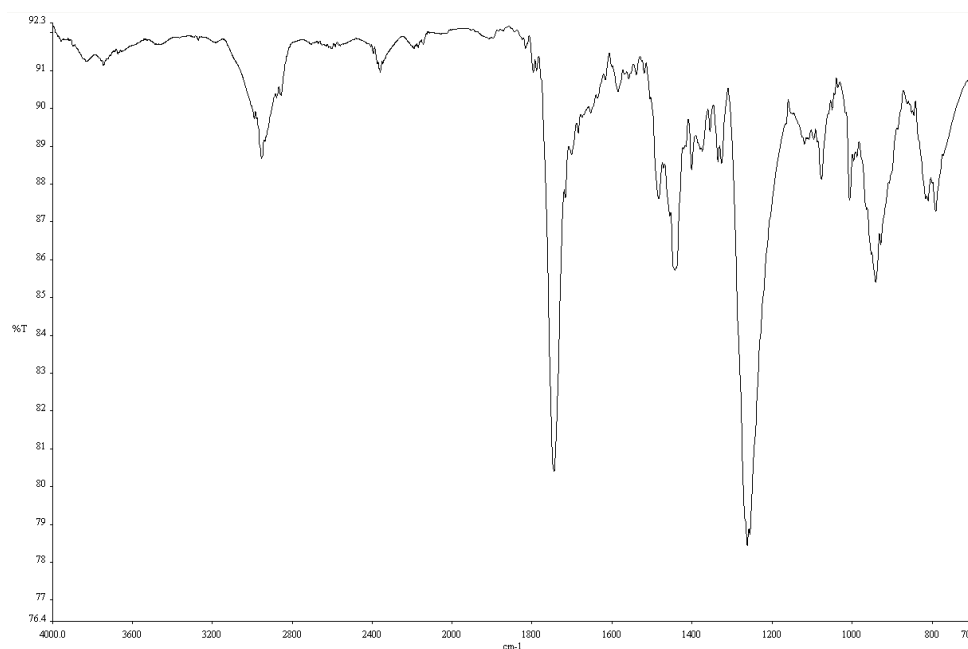


Figure A1.11. Infrared spectrum (Thin Film, NaCl) of compound **2f**.

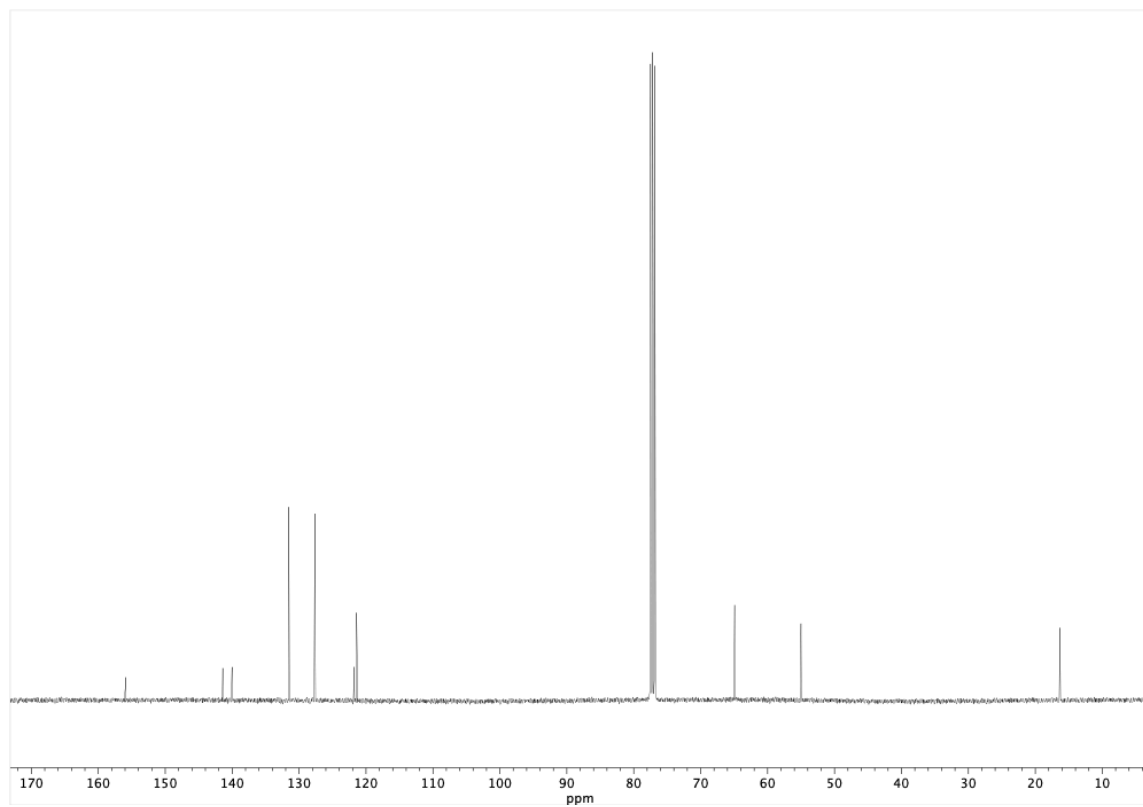


Figure A1.12. ¹³C NMR (100 MHz, CDCl₃) of compound **2f**.

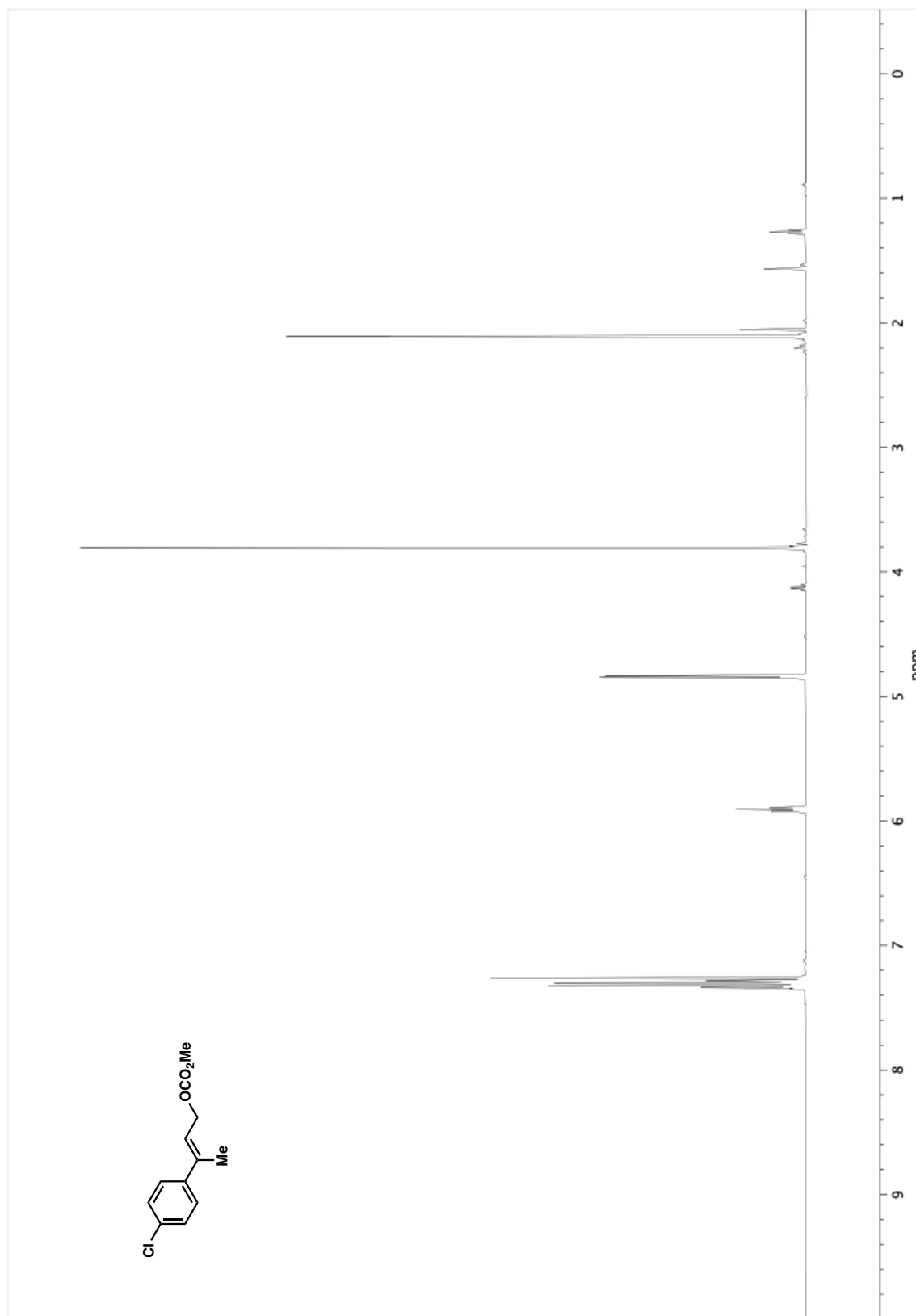


Figure A1.13. ^1H NMR (500 MHz, CDCl_3) of compound **2g**.

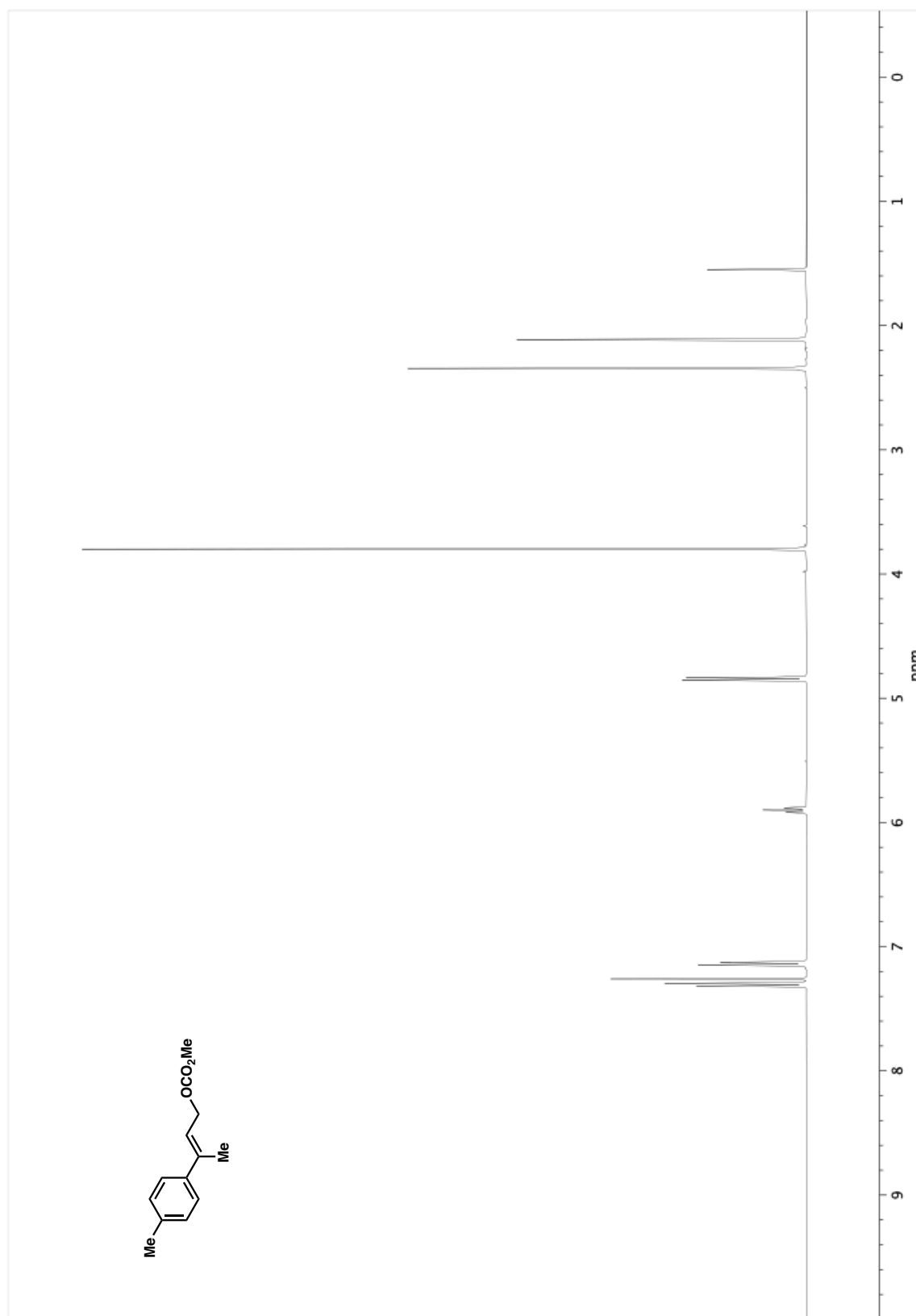


Figure A1.14. ¹H NMR (400 MHz, CDCl₃) of compound **2h**.

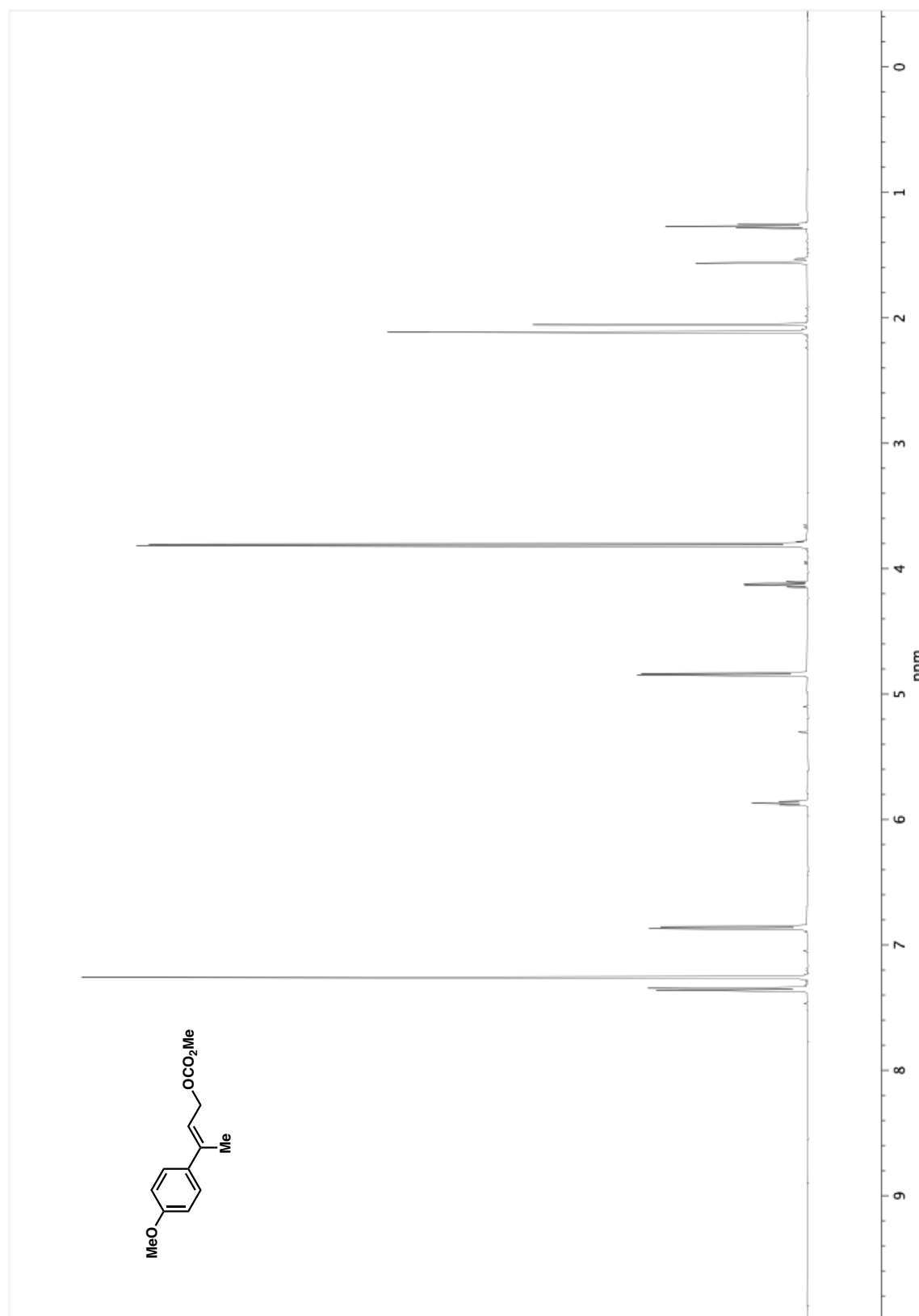


Figure A1.15. ^1H NMR (500 MHz, CDCl_3) of compound **2i**.

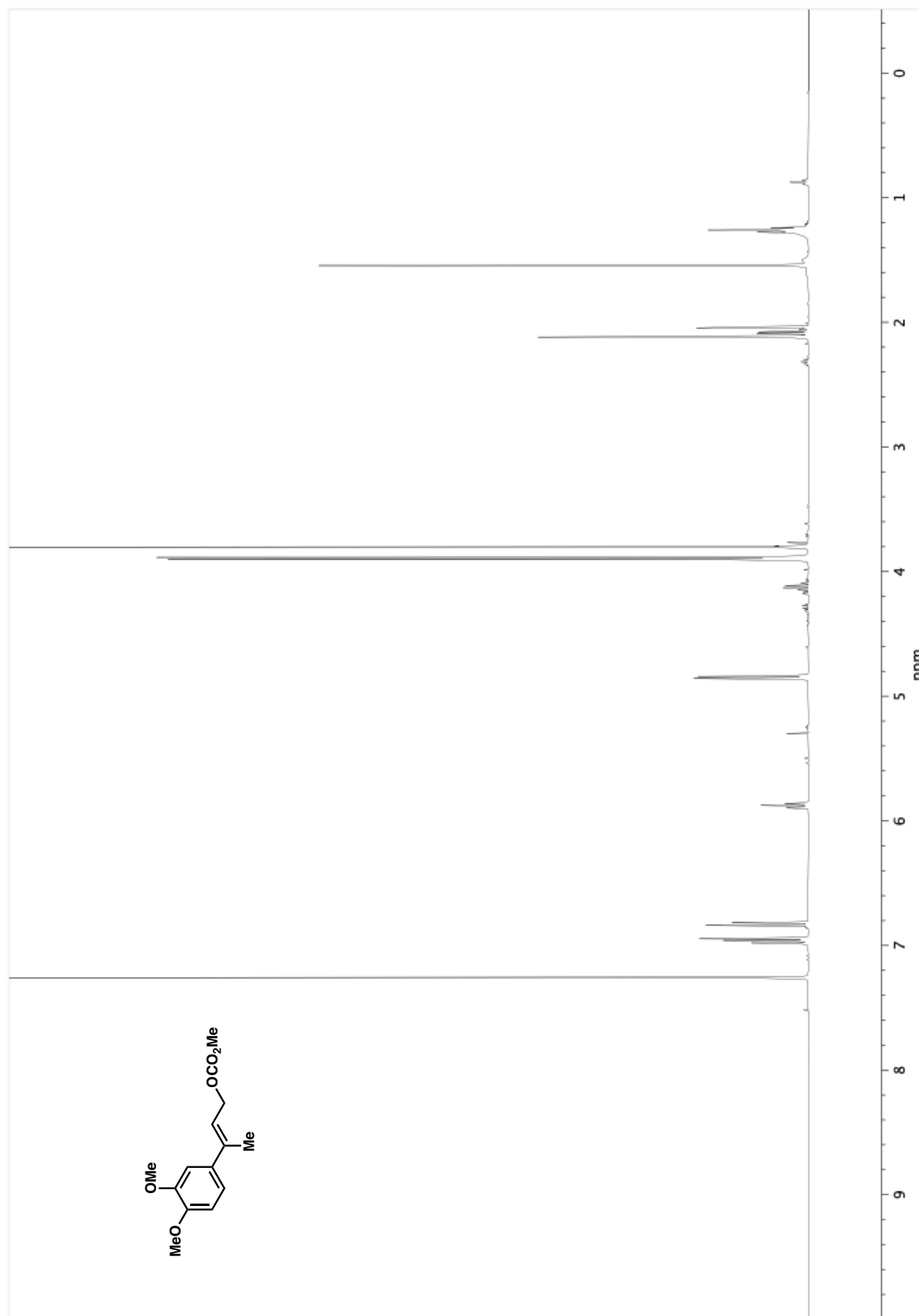


Figure A1.16. ¹H NMR (400 MHz, CDCl₃) of compound **2j**.

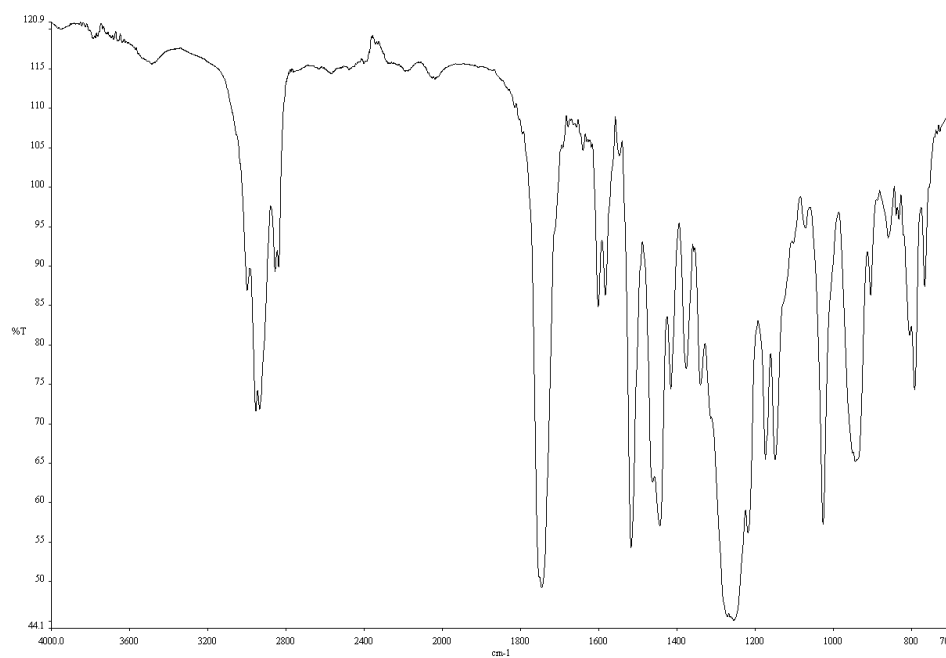


Figure A1.17. Infrared spectrum (Thin Film, NaCl) of compound **2j**.

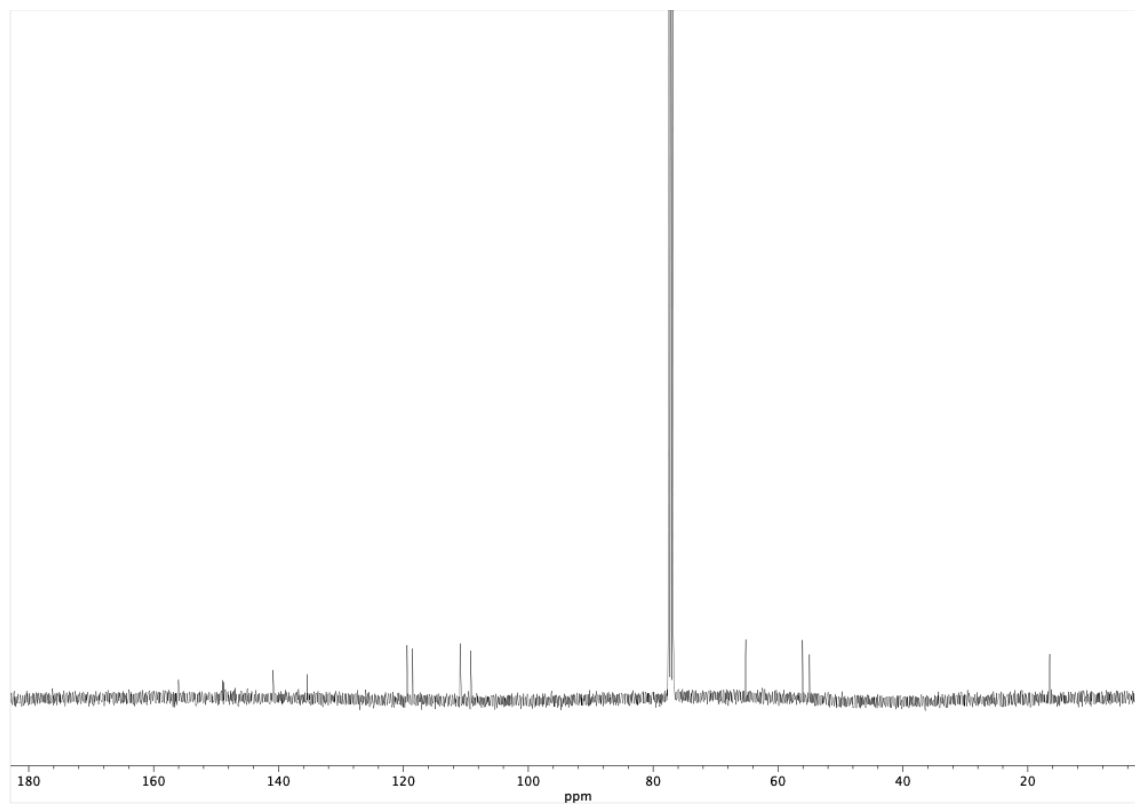


Figure A1.18. ¹³C NMR (100 MHz, CDCl₃) of compound **2j**.

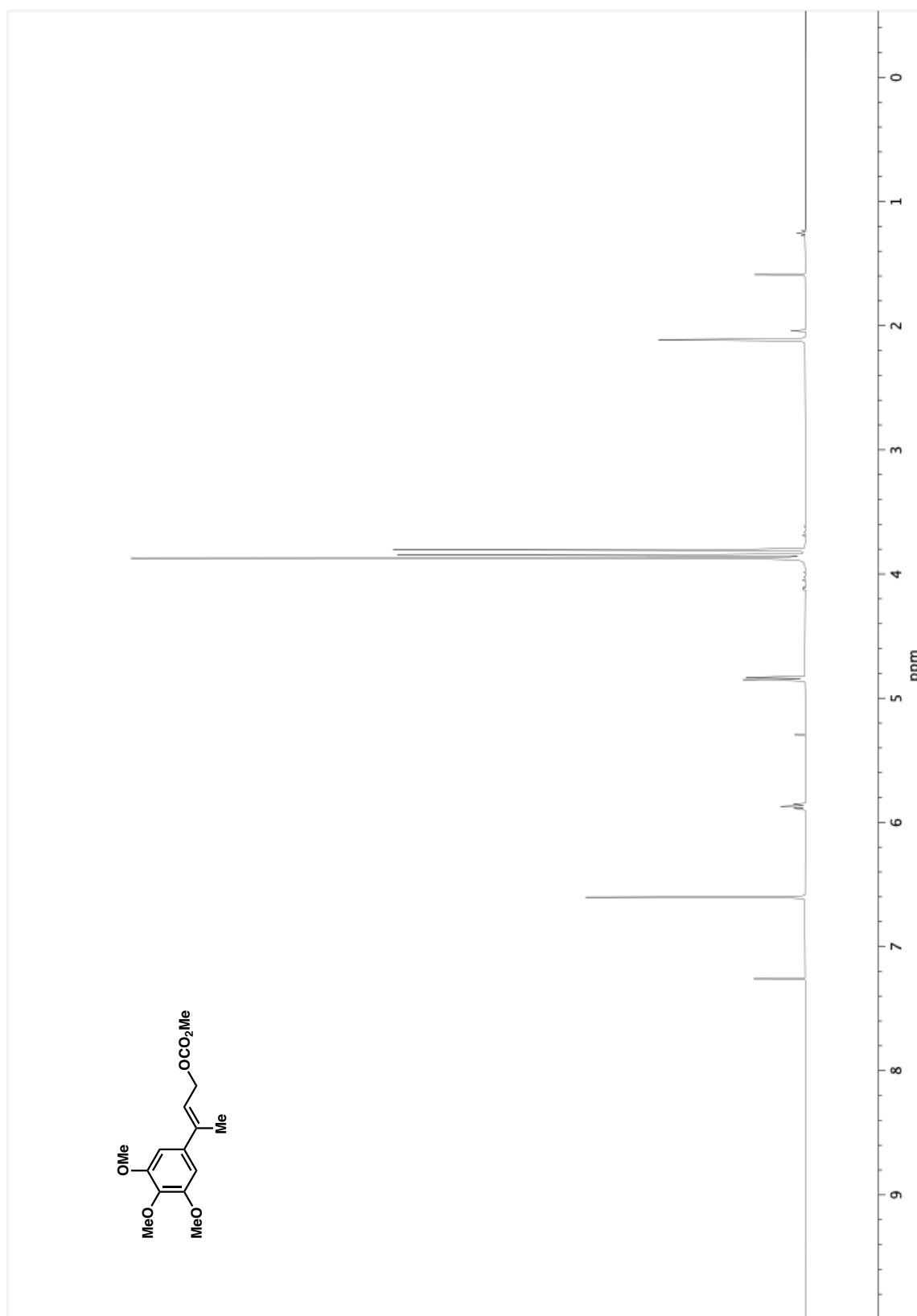


Figure A1.19. ¹H NMR (400 MHz, CDCl₃) of compound **2k**.

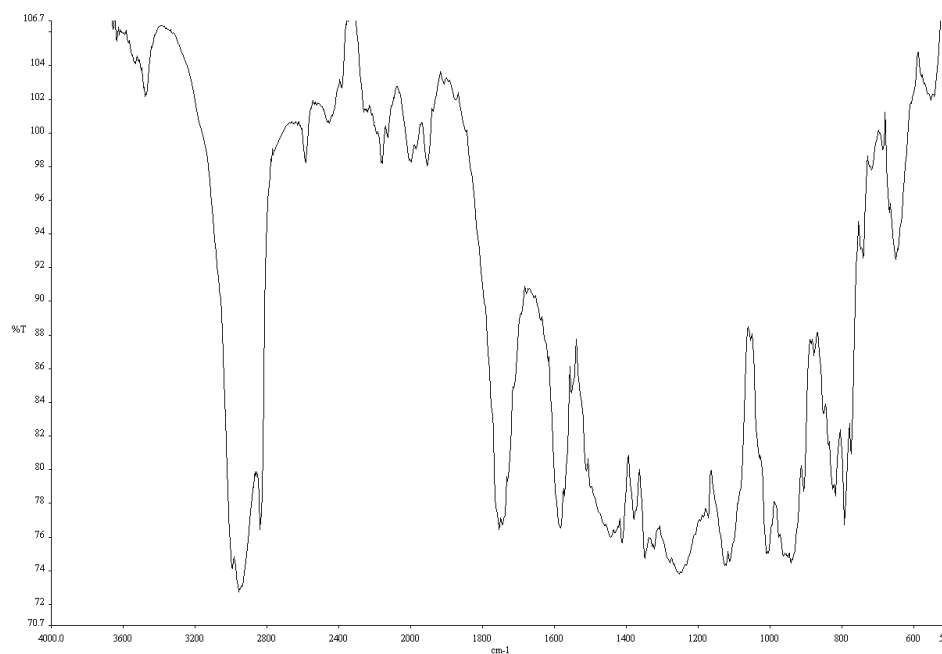


Figure A1.20. Infrared spectrum (Thin Film, NaCl) of compound **2k**.

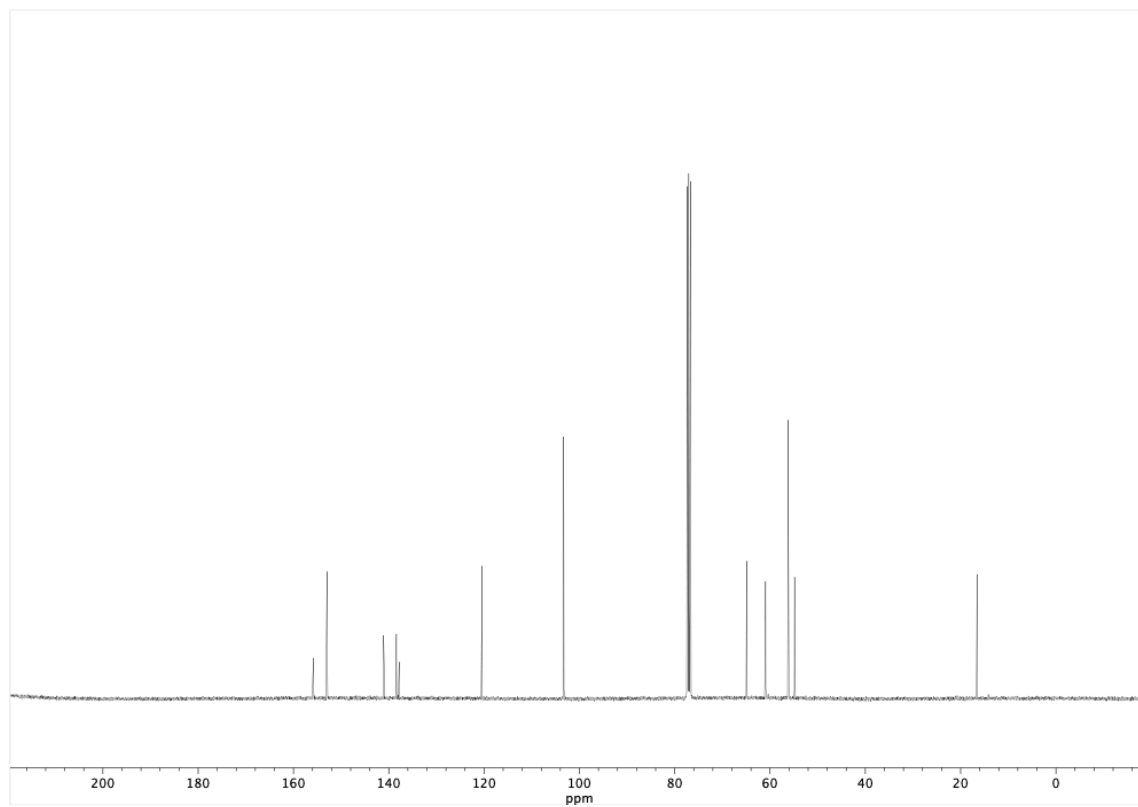


Figure A1.21. ^{13}C NMR (100 MHz, CDCl_3) of compound **2k**.

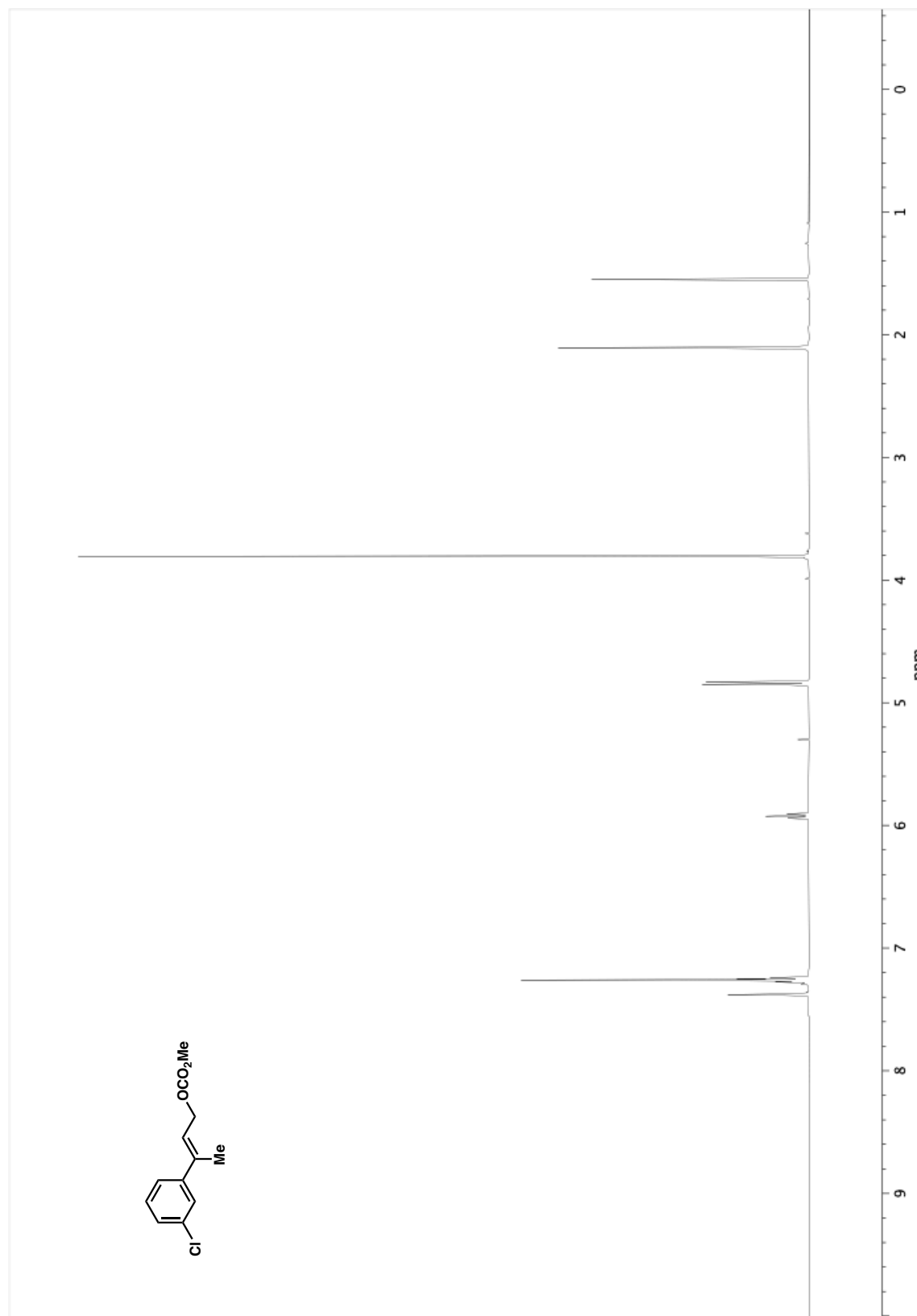


Figure A1.22. ^1H NMR (400 MHz, CDCl_3) of compound **2l**.

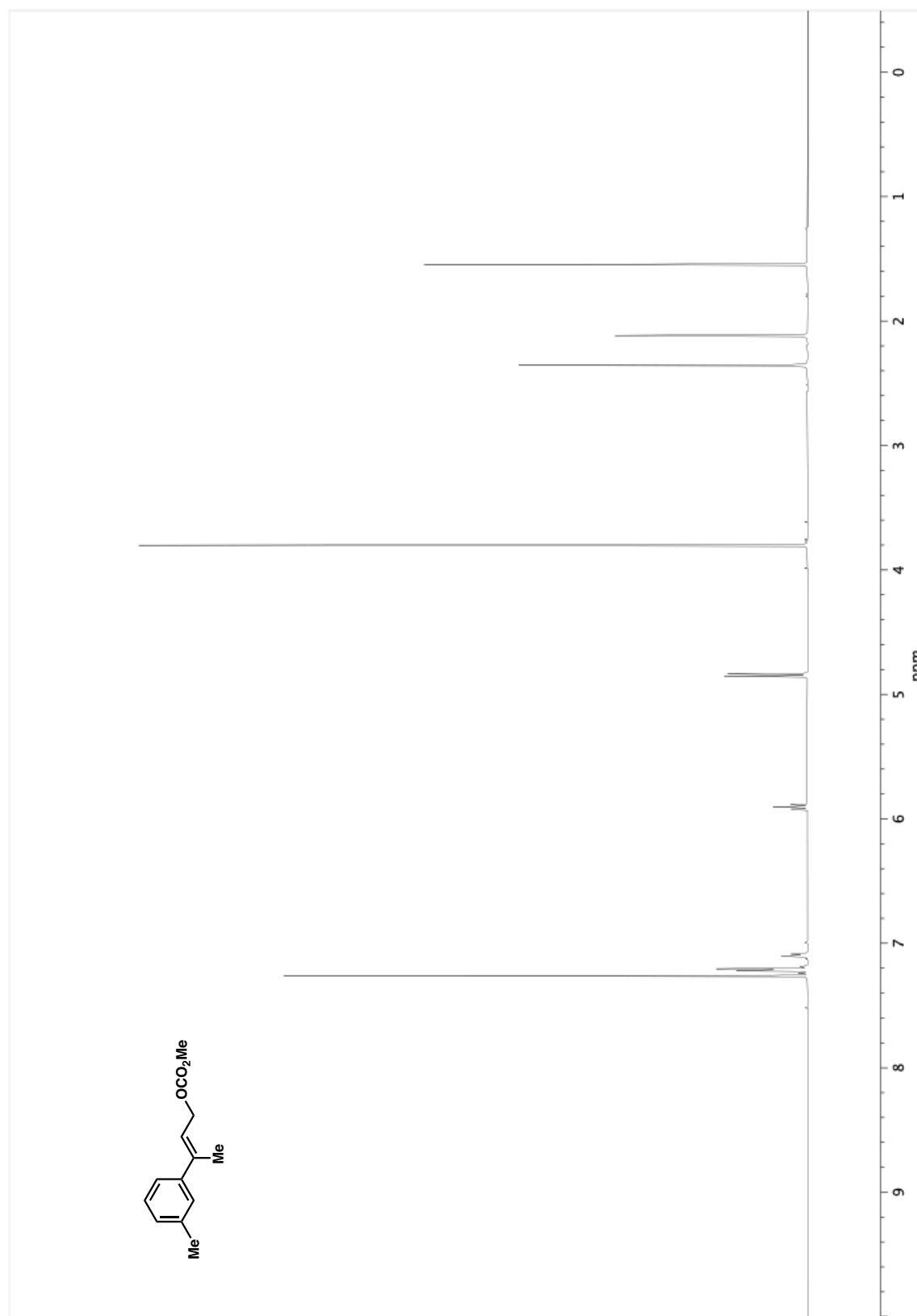


Figure A1.23. ¹H NMR (400 MHz, CDCl₃) of compound **2m**.

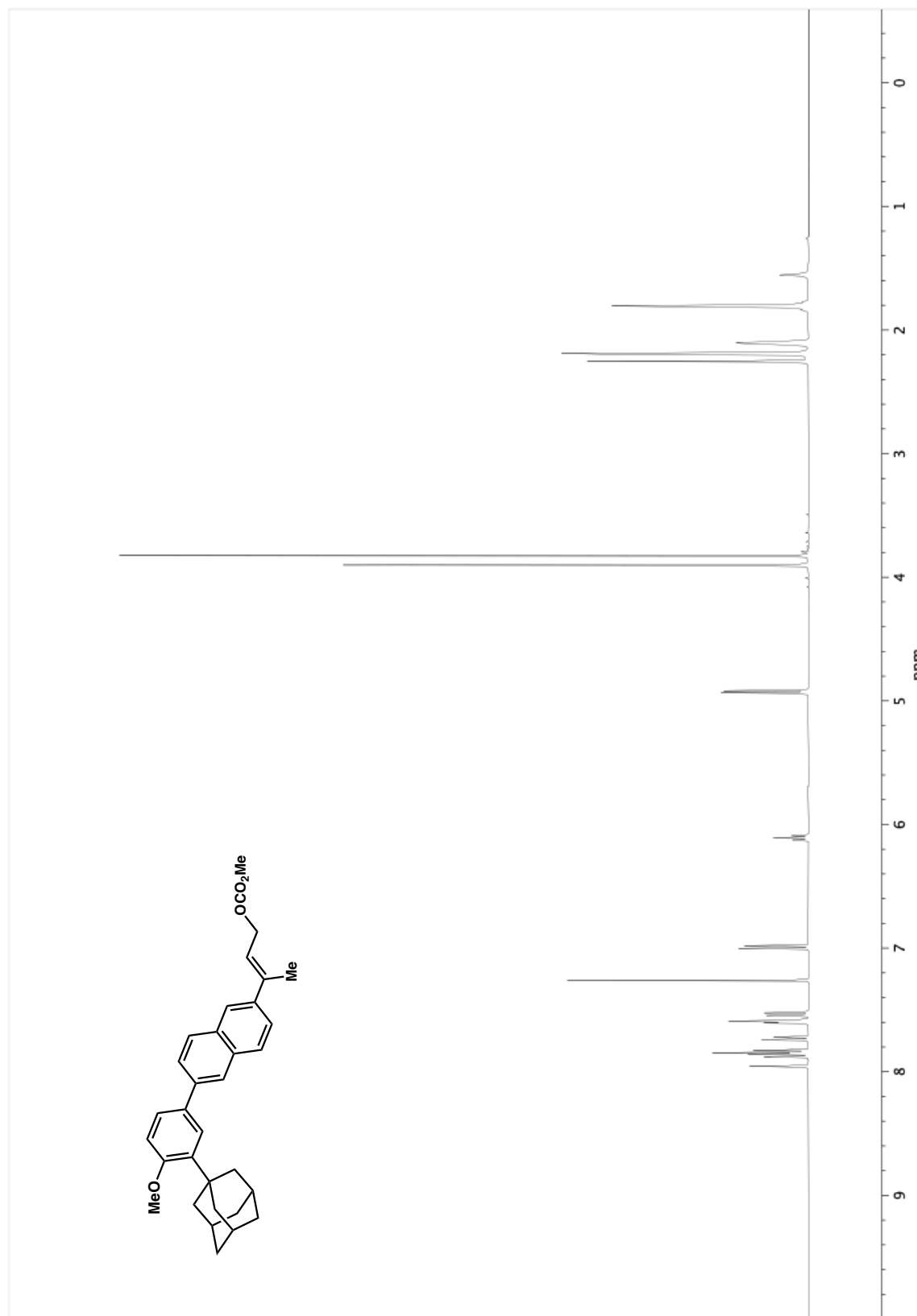


Figure A1.24. ¹H NMR (400 MHz, CDCl₃) of compound **2n**.

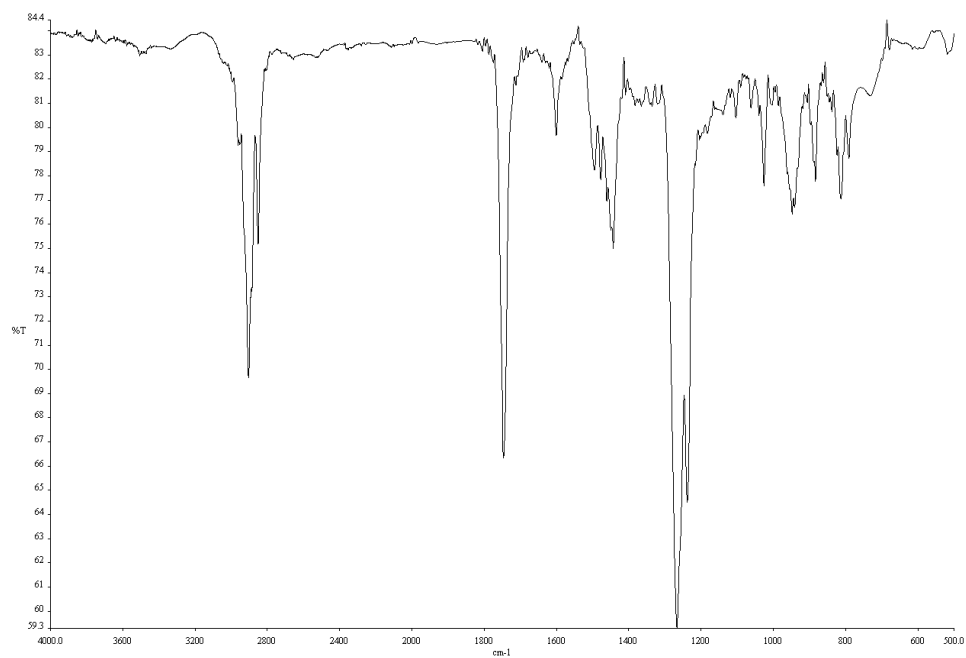


Figure A1.25. Infrared spectrum (Thin Film, NaCl) of compound **2n**.

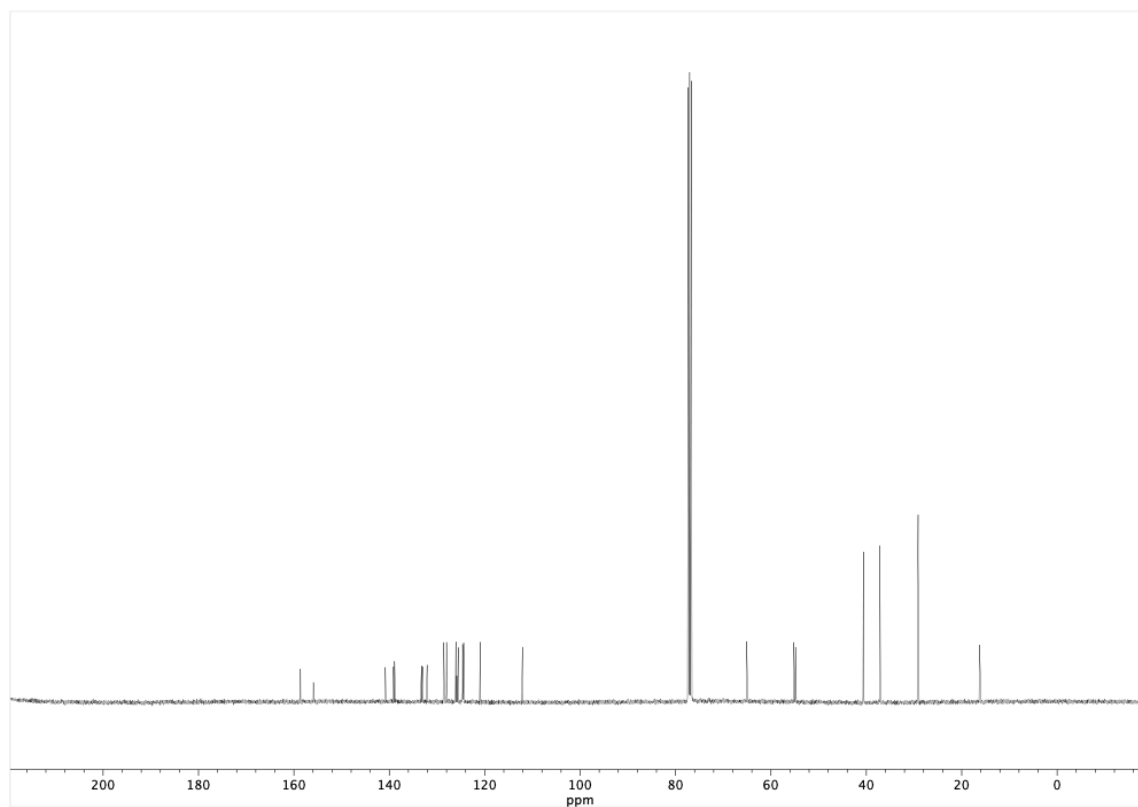


Figure A1.26. ¹³C NMR (100 MHz, CDCl₃) of compound **2n**.

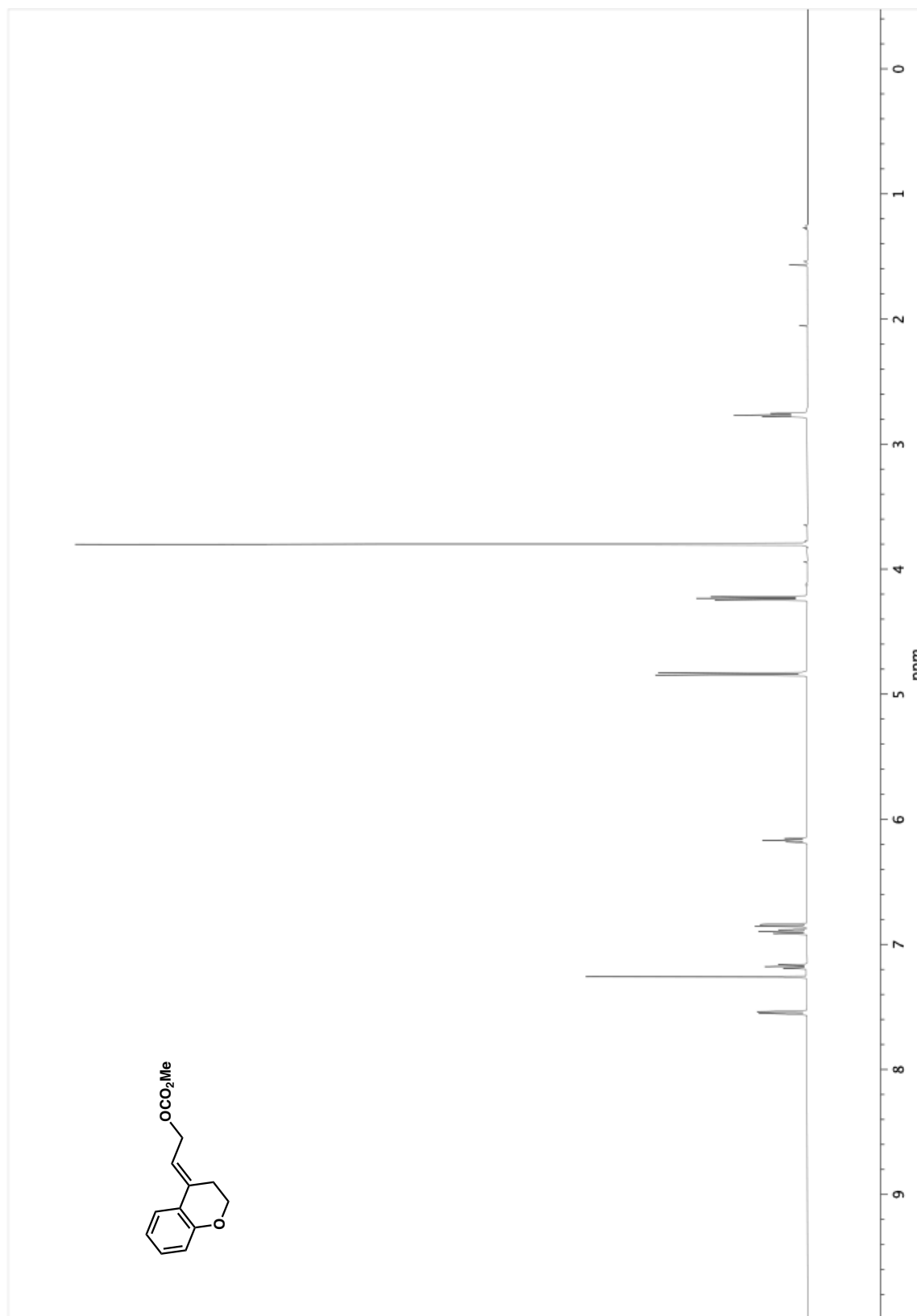


Figure A1.27. ¹H NMR (500 MHz, CDCl₃) of compound **2o**.

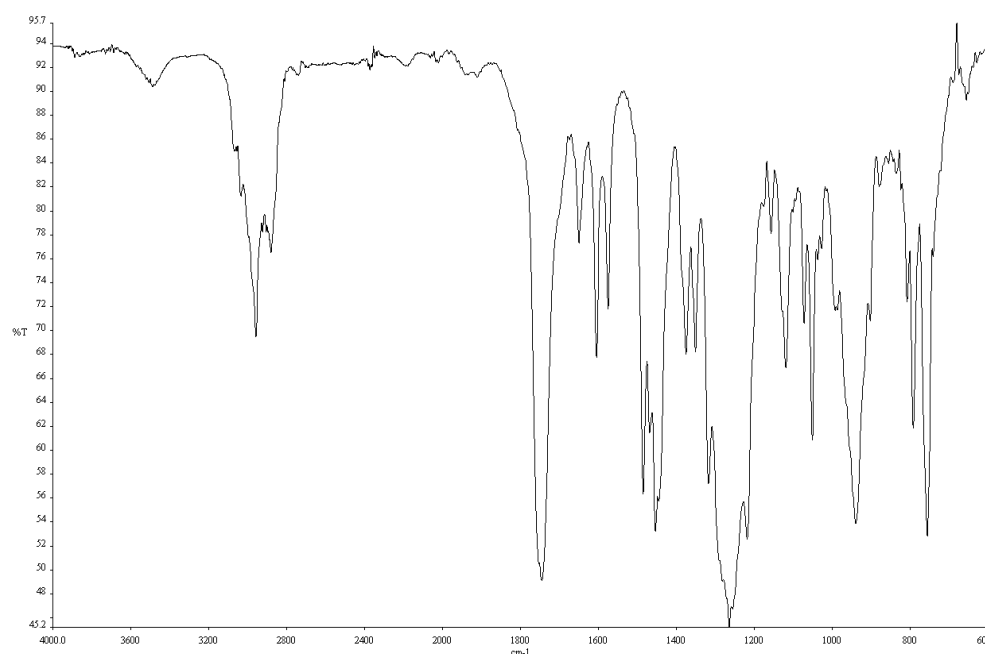


Figure A1.28. Infrared spectrum (Thin Film, NaCl) of compound **2o**.

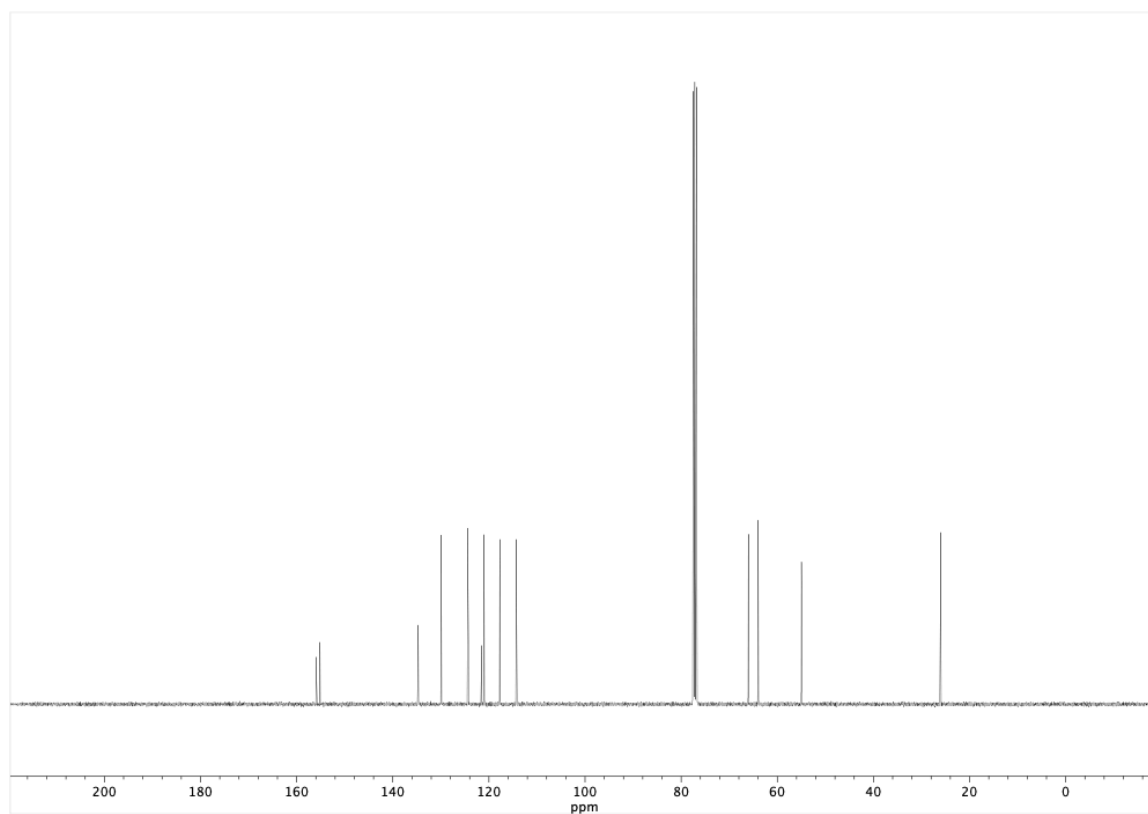


Figure A1.29. ^{13}C NMR (100 MHz, CDCl_3) of compound **2o**.

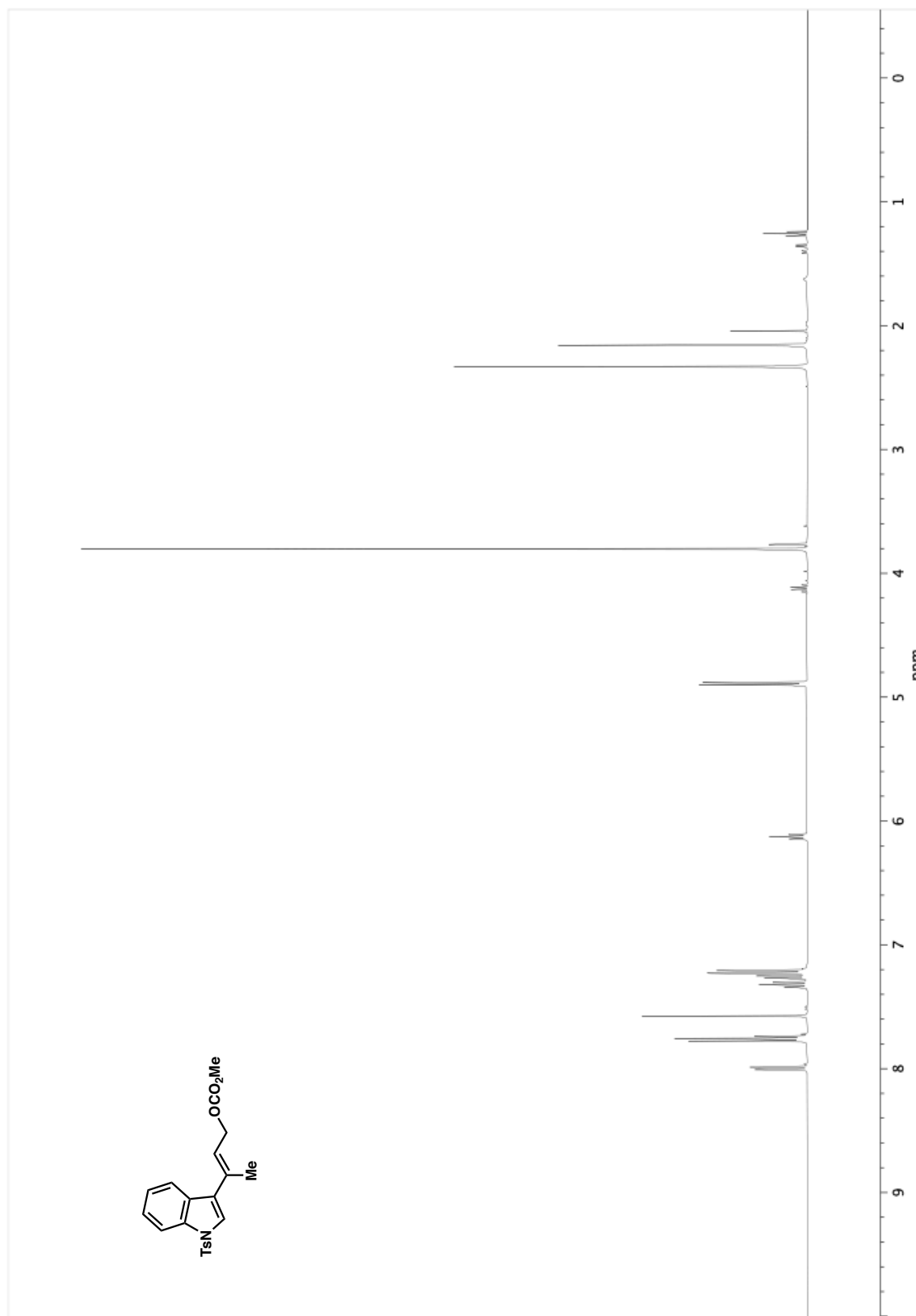


Figure A1.30. ¹H NMR (400 MHz, CDCl₃) of compound **2p**.

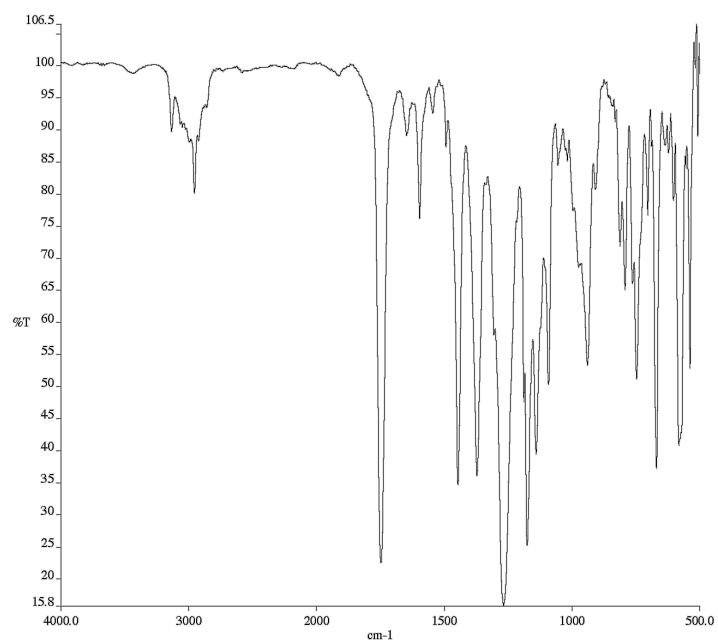


Figure A1.31. Infrared spectrum (Thin Film, NaCl) of compound **2p**.

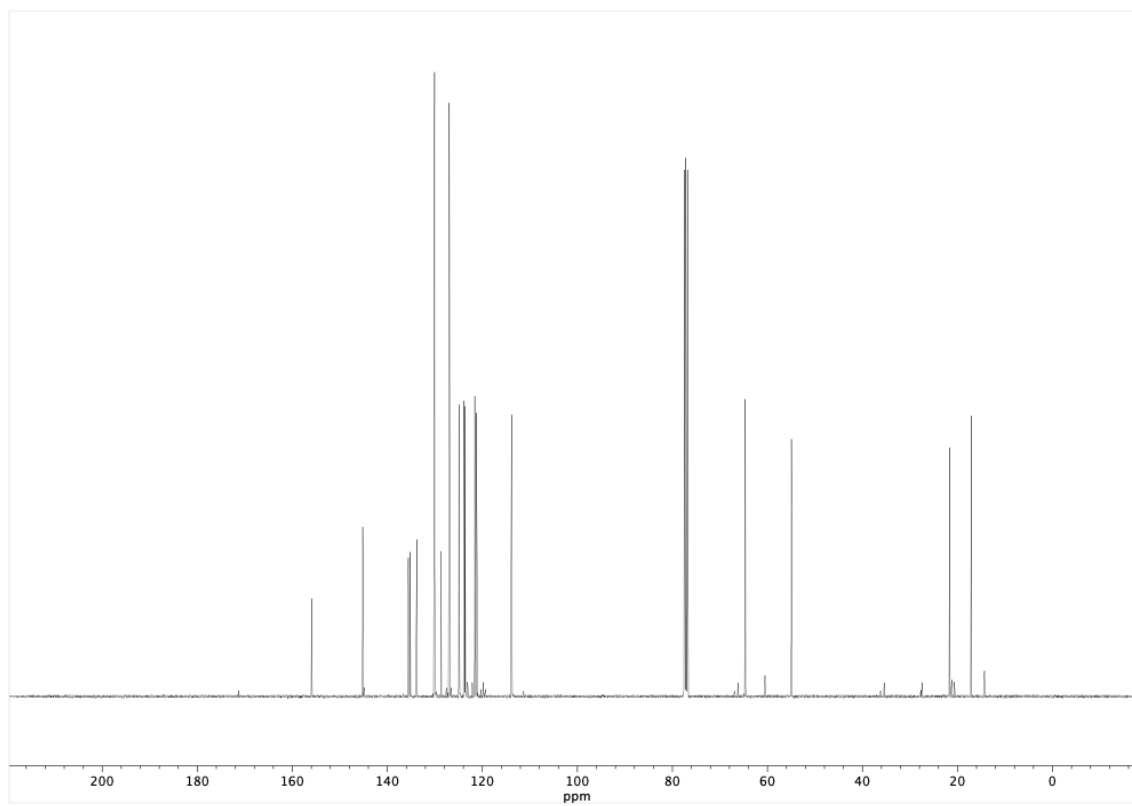


Figure A1.32. ¹³C NMR (100 MHz, CDCl₃) of compound **2p**.

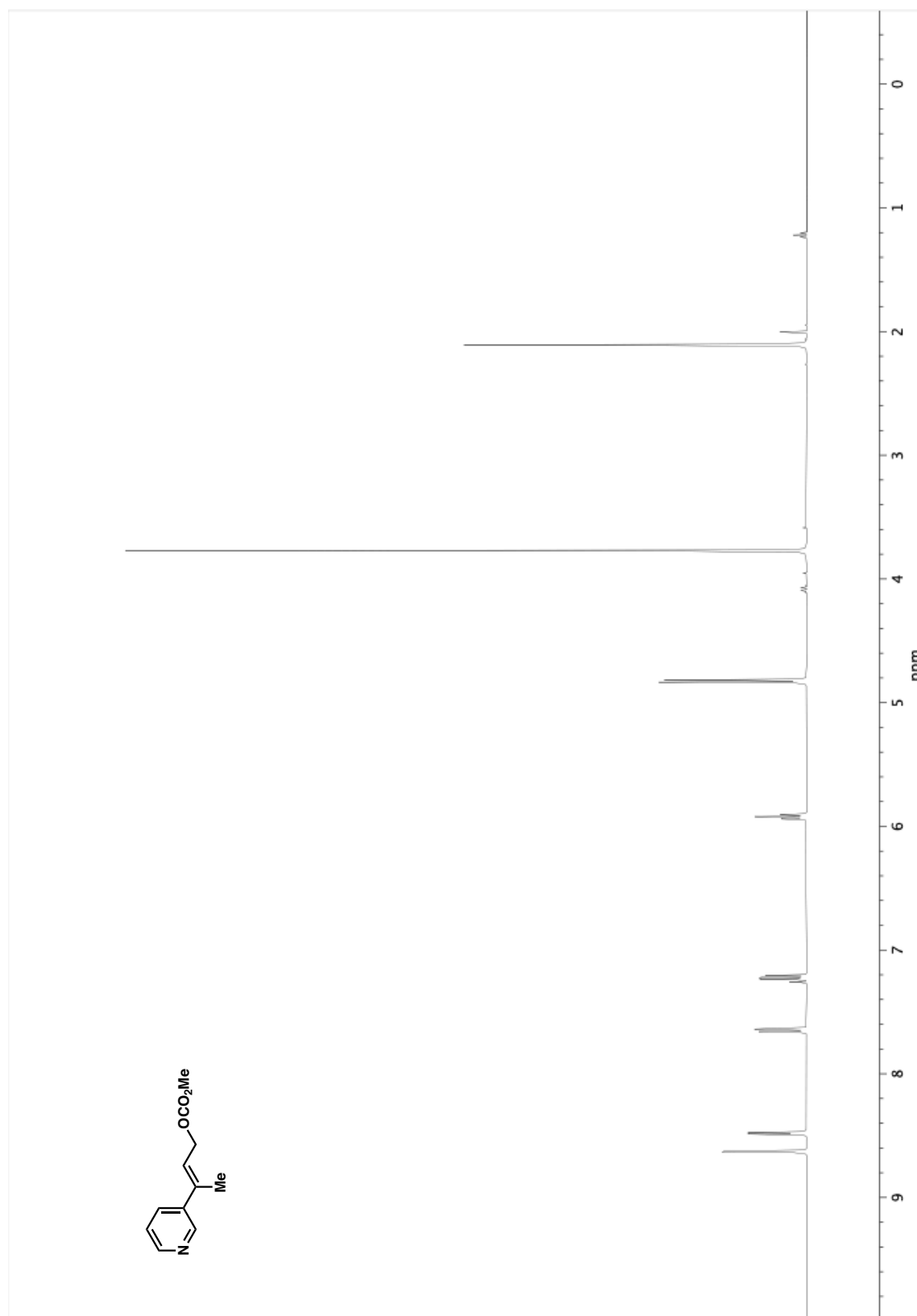


Figure A1.33. ¹H NMR (400 MHz, CDCl₃) of compound **2q**.

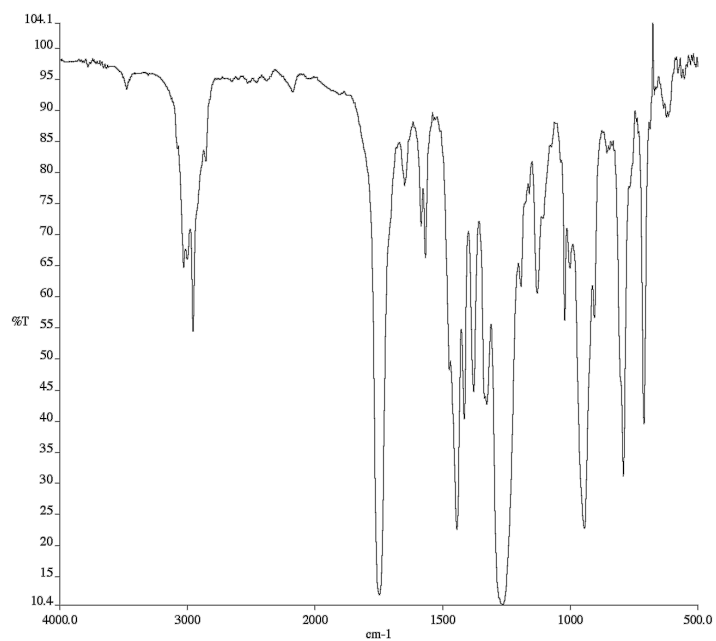


Figure A1.34. Infrared spectrum (Thin Film, NaCl) of compound **2q**.

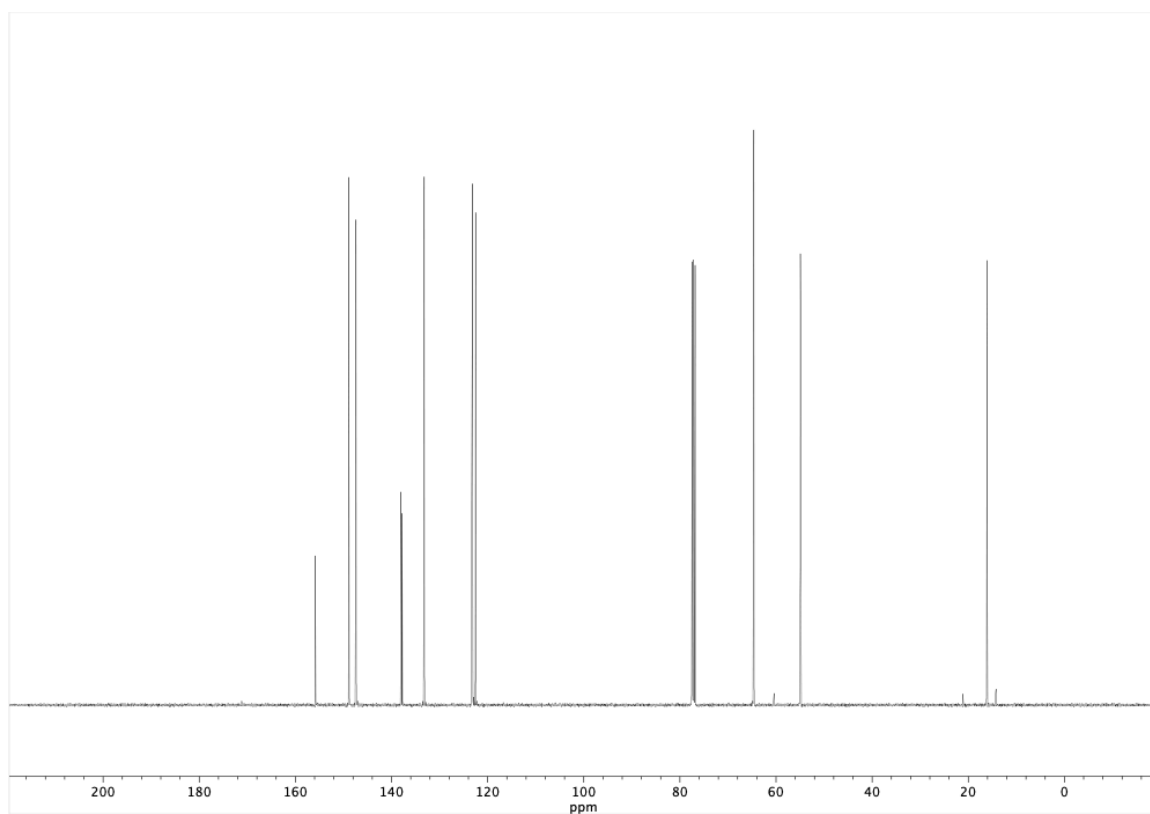


Figure A1.35. ¹³C NMR (100 MHz, CDCl₃) of compound **2q**.

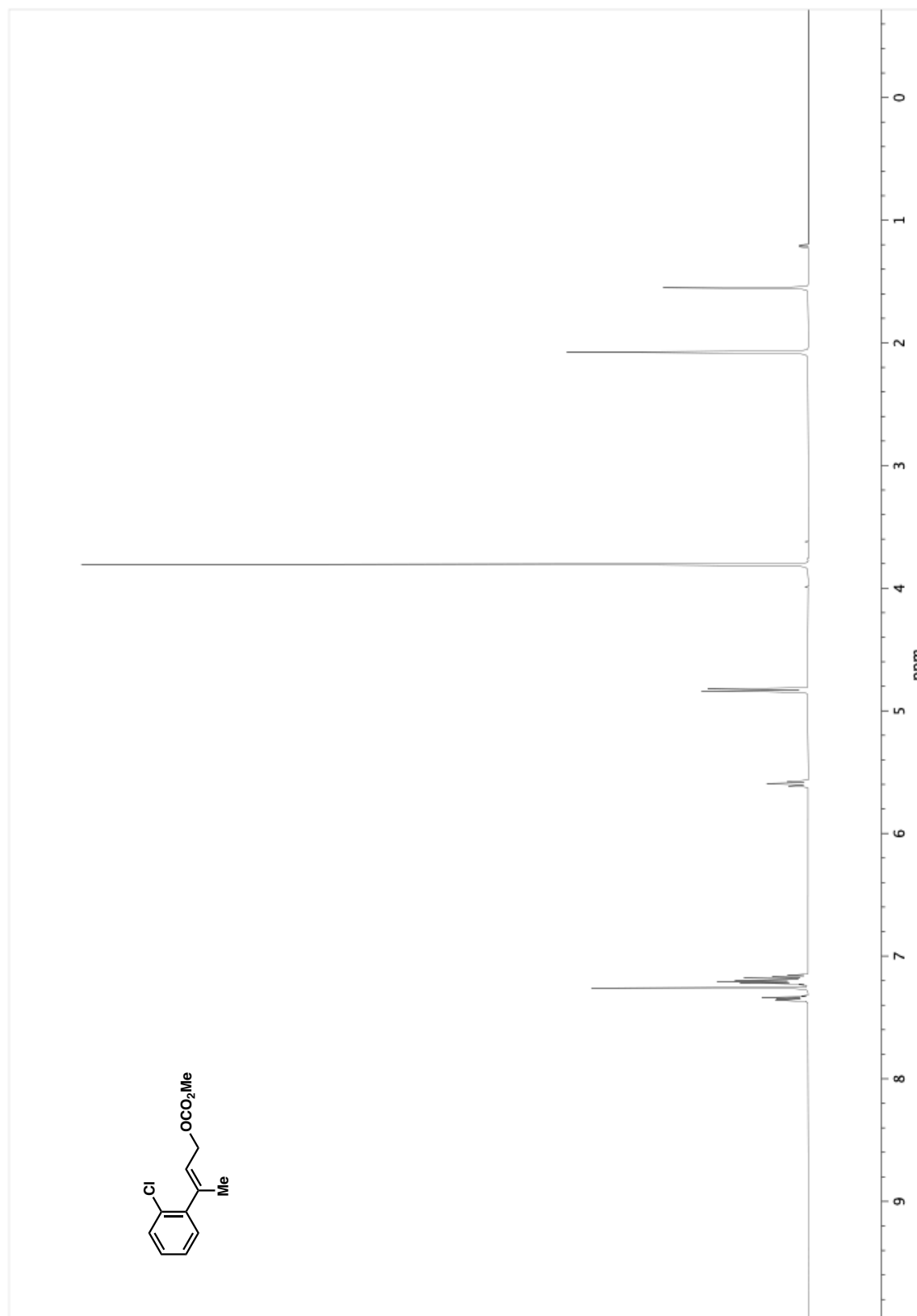
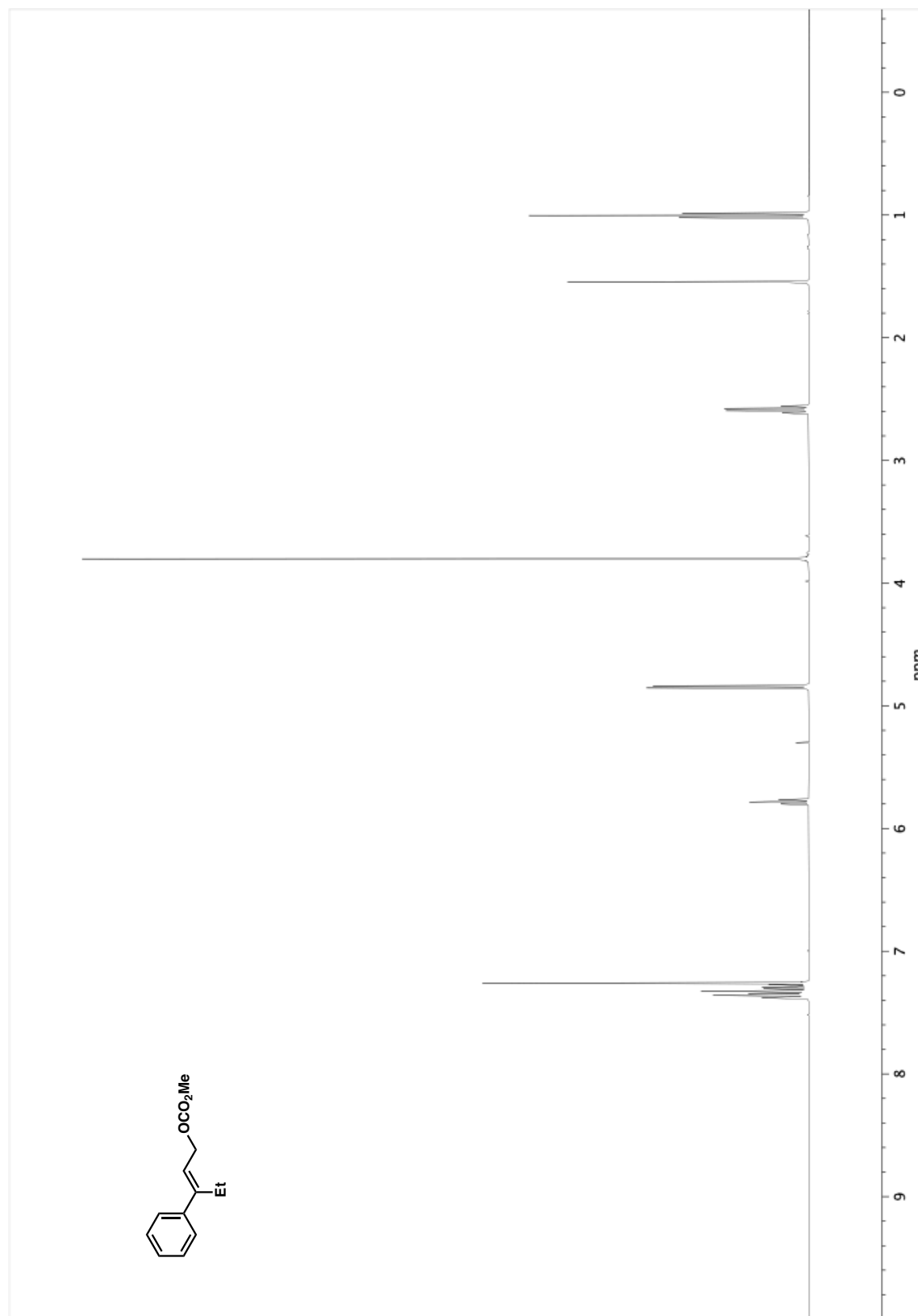


Figure A1.36. ¹H NMR (400 MHz, CDCl₃) of compound **2r**.

**Figure A1.37.** ¹H NMR (400 MHz, CDCl₃) of compound **2s**.

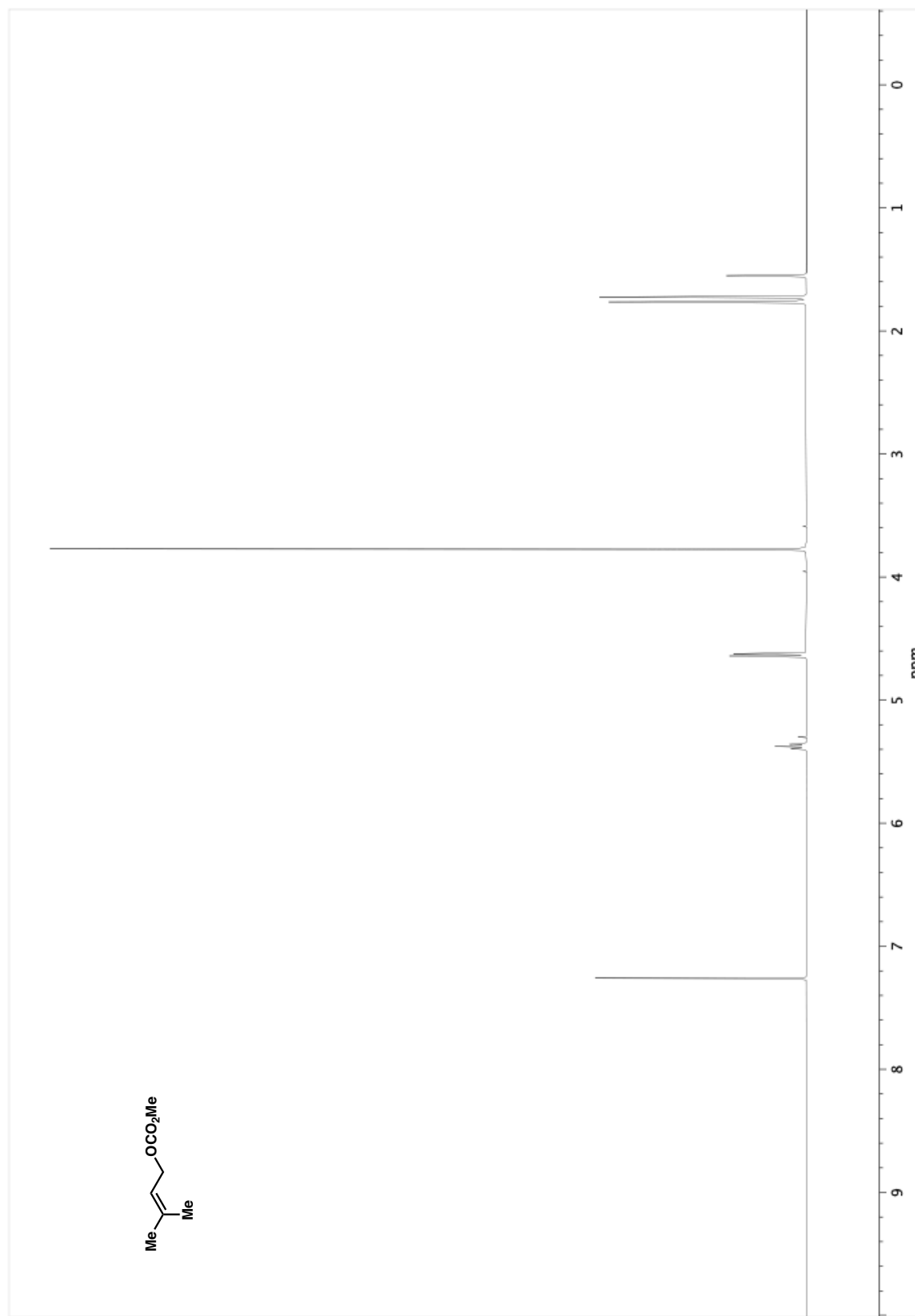


Figure A1.38. ¹H NMR (400 MHz, CDCl₃) of compound **2t**.

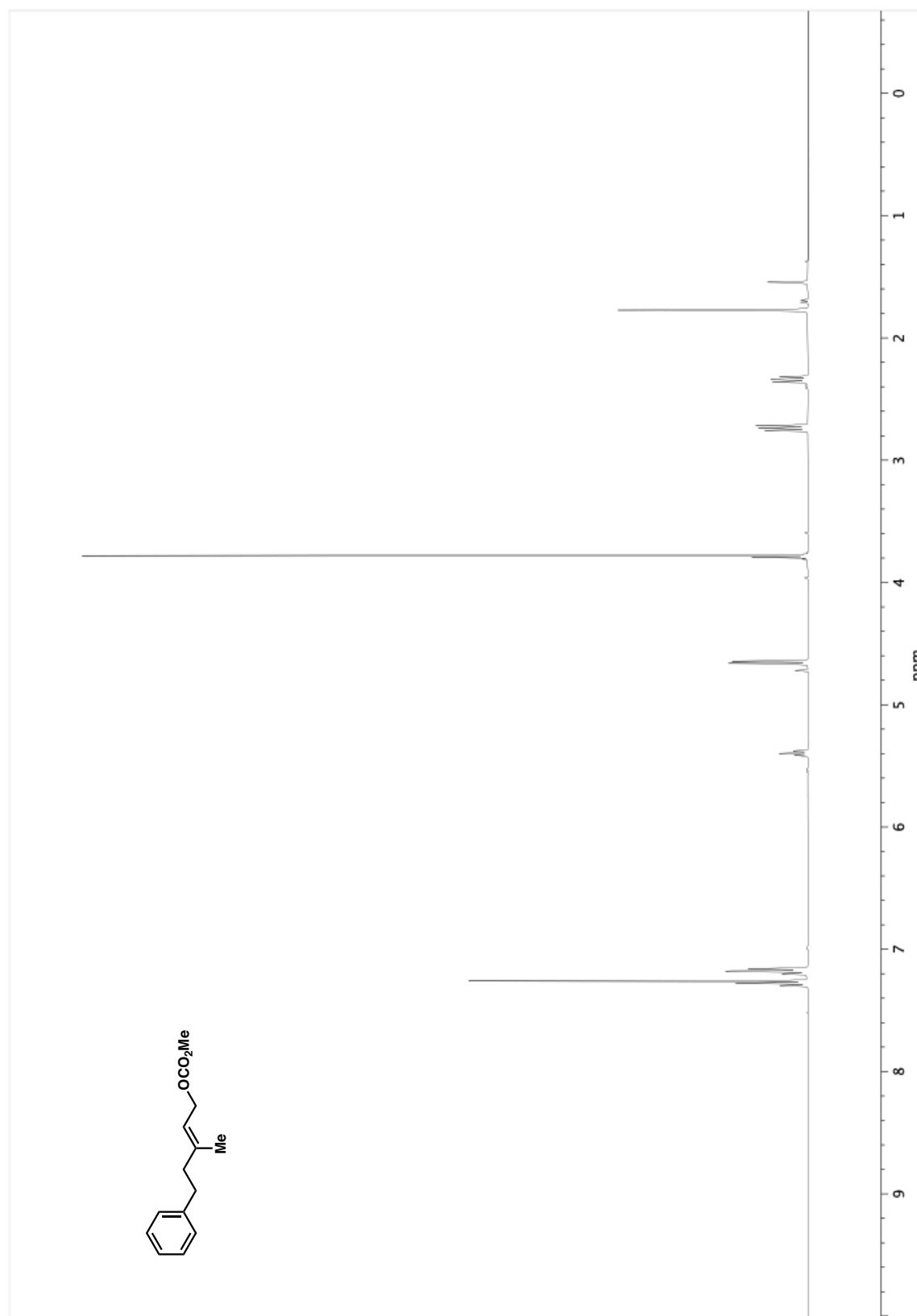


Figure A1.39. ¹H NMR (400 MHz, CDCl₃) of compound **2u**.

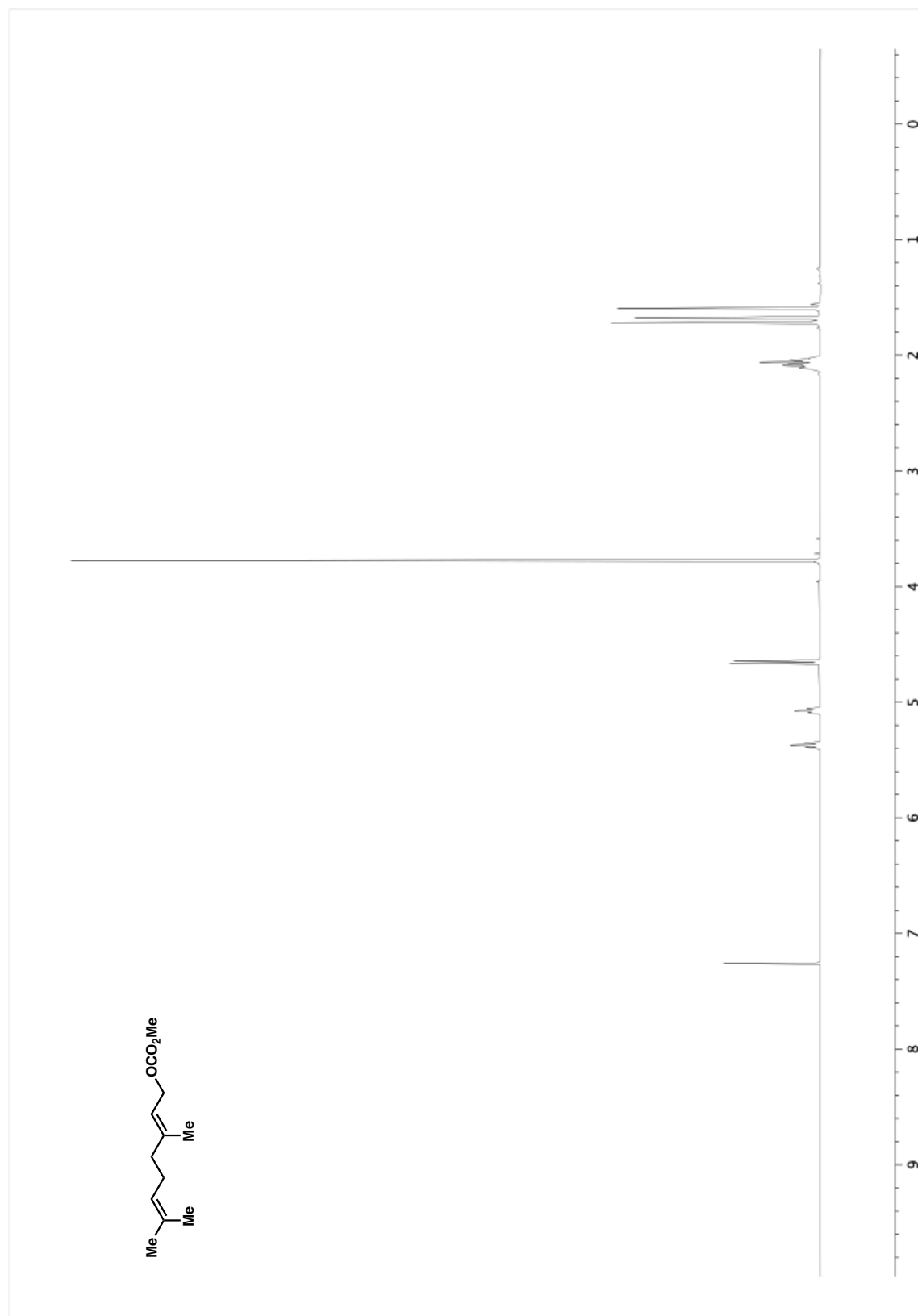


Figure A1.40. ¹H NMR (400 MHz, CDCl₃) of compound **2v**.

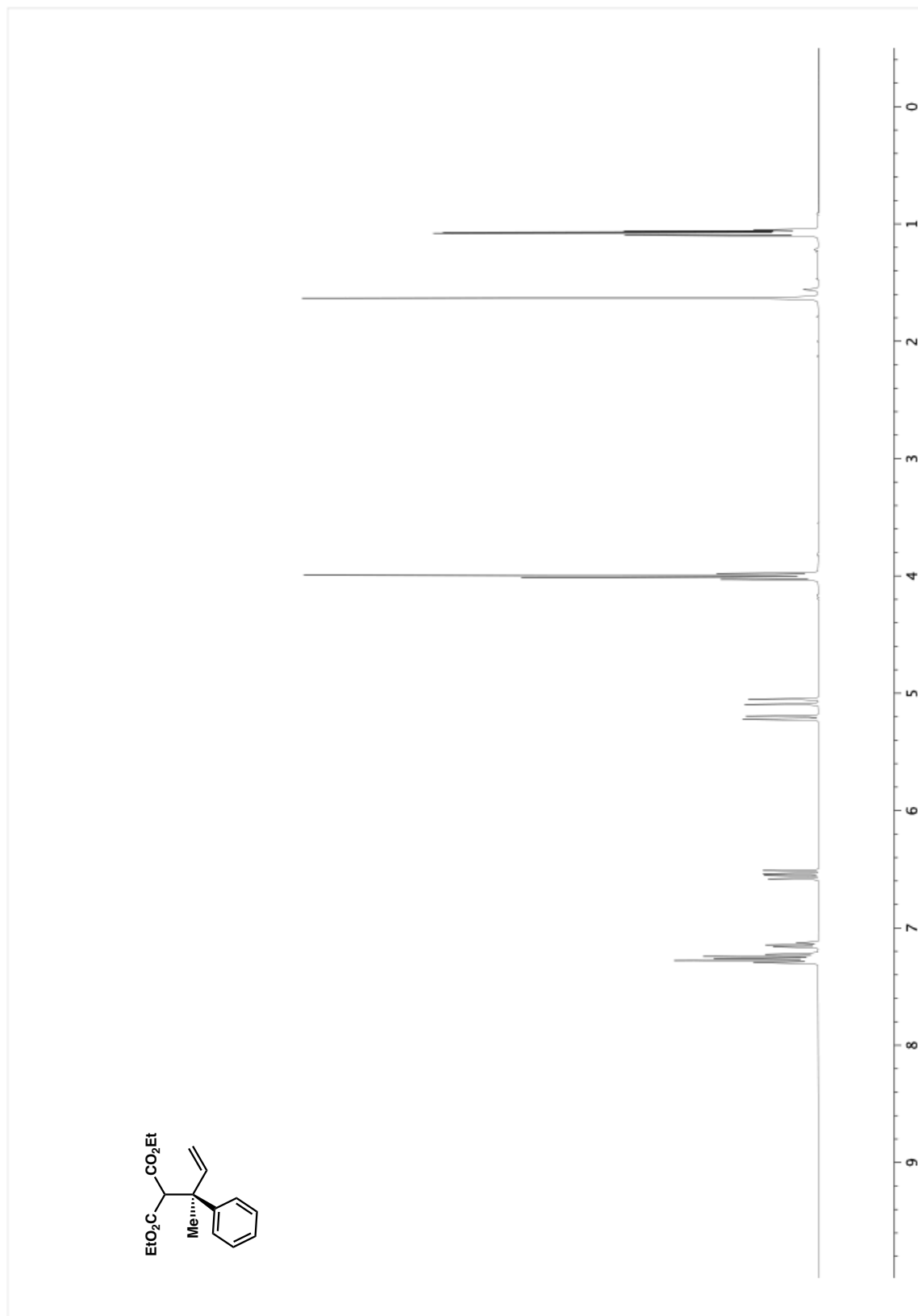


Figure A1.41. ¹H NMR (500 MHz, CDCl₃) of compound **3a**.

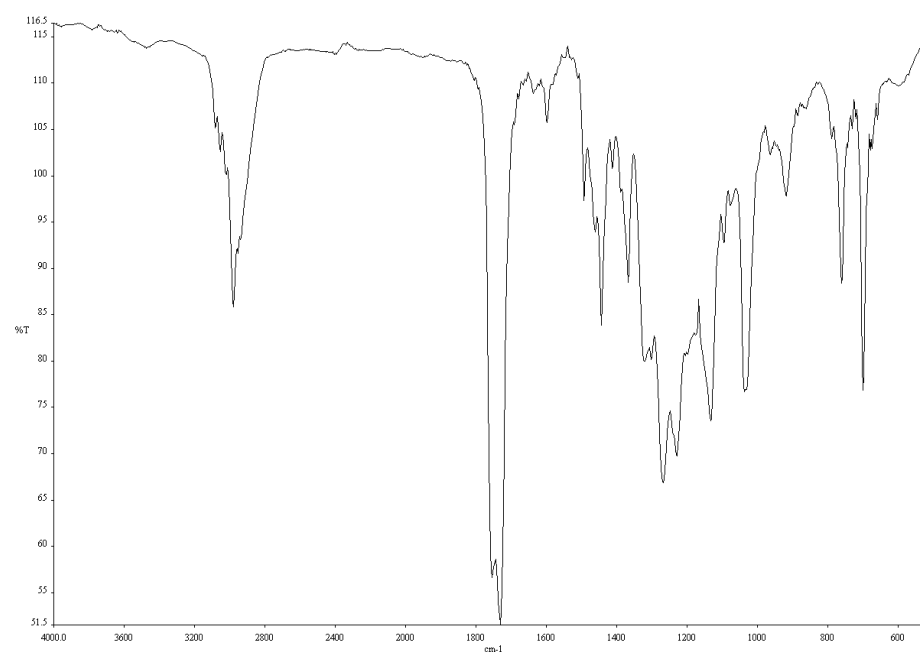


Figure A1.42. Infrared spectrum (Thin Film, NaCl) of compound **3a**.

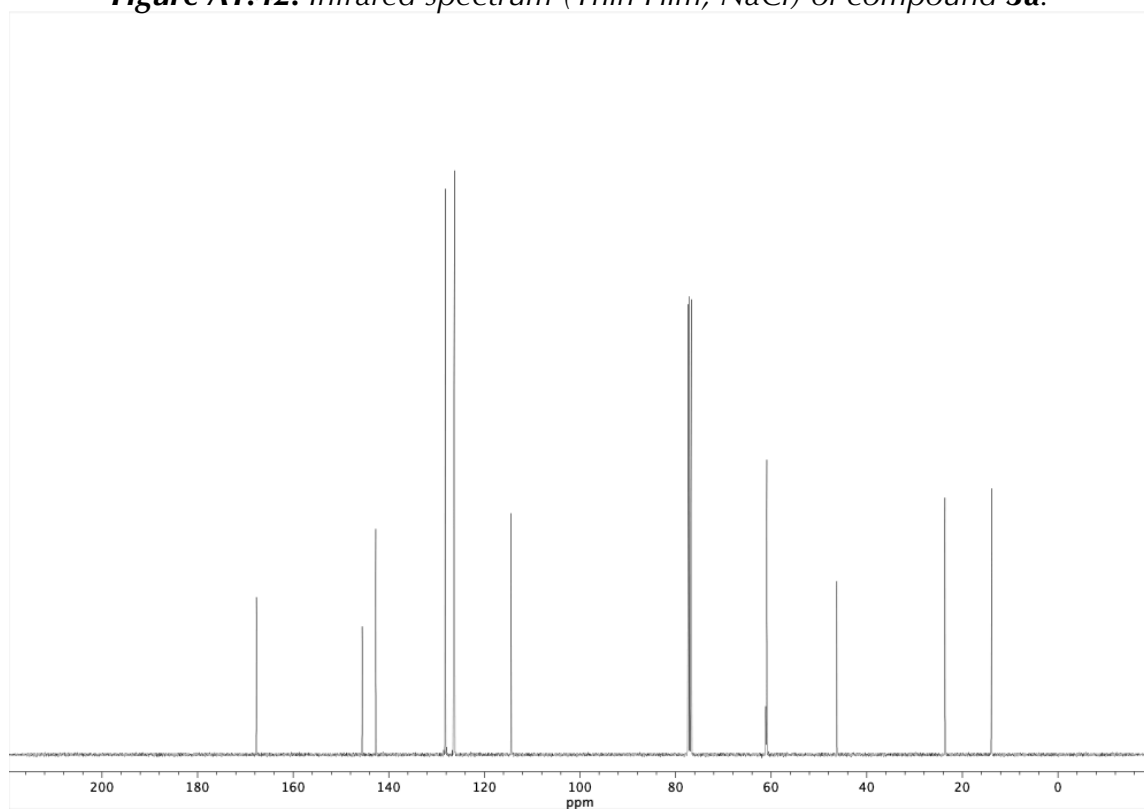


Figure A1.43. ^{13}C NMR (100 MHz, CDCl_3) of compound **3a**.

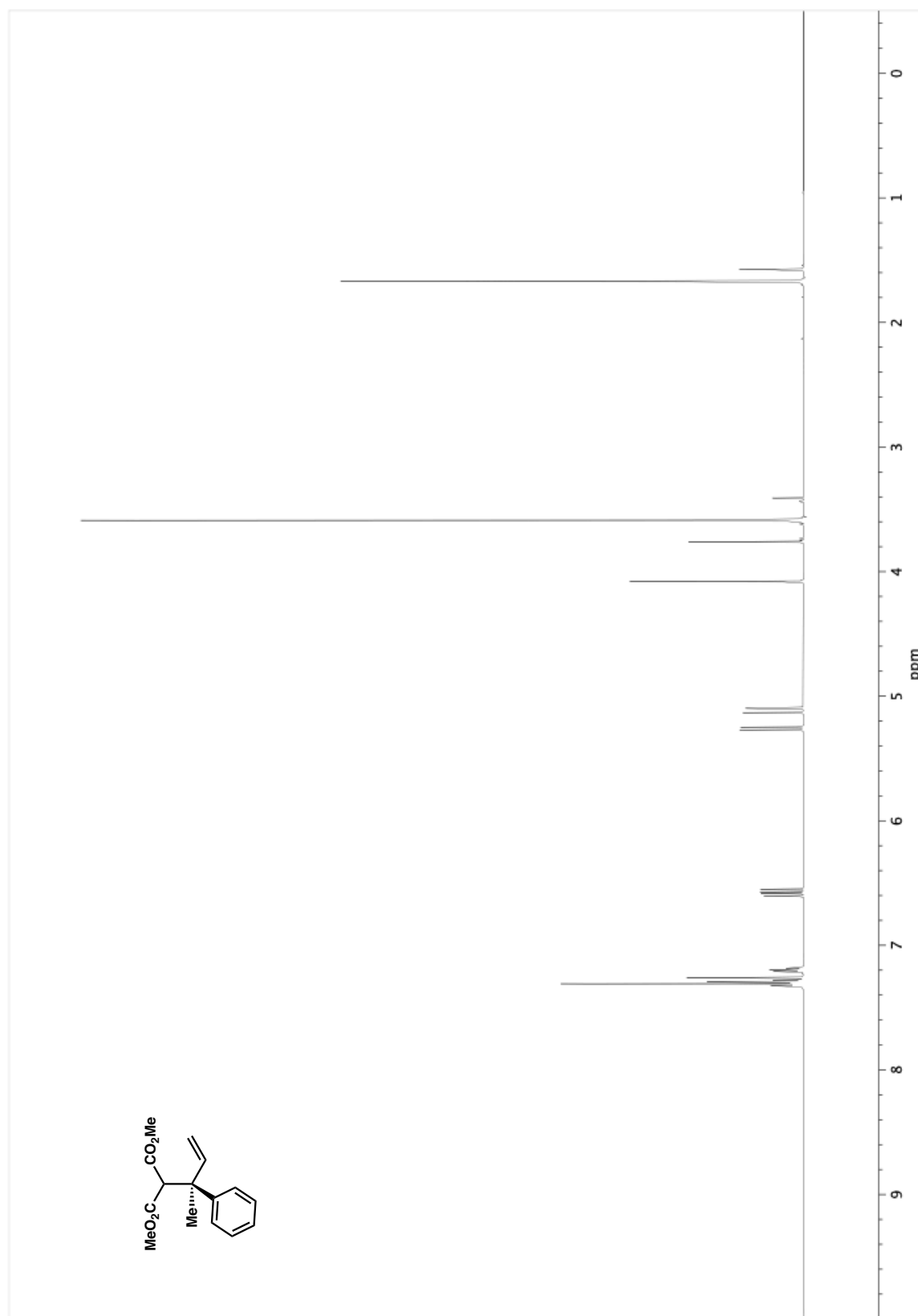


Figure A1.44. ¹H NMR (500 MHz, CDCl₃) of compound 3b.

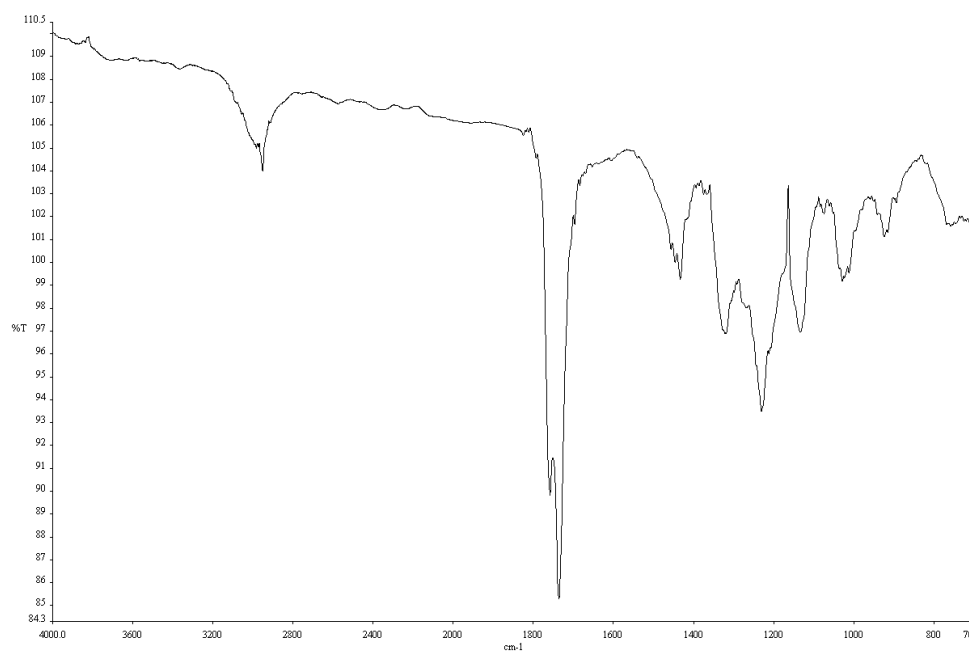


Figure A1.45. Infrared spectrum (Thin Film, NaCl) of compound **3b**.

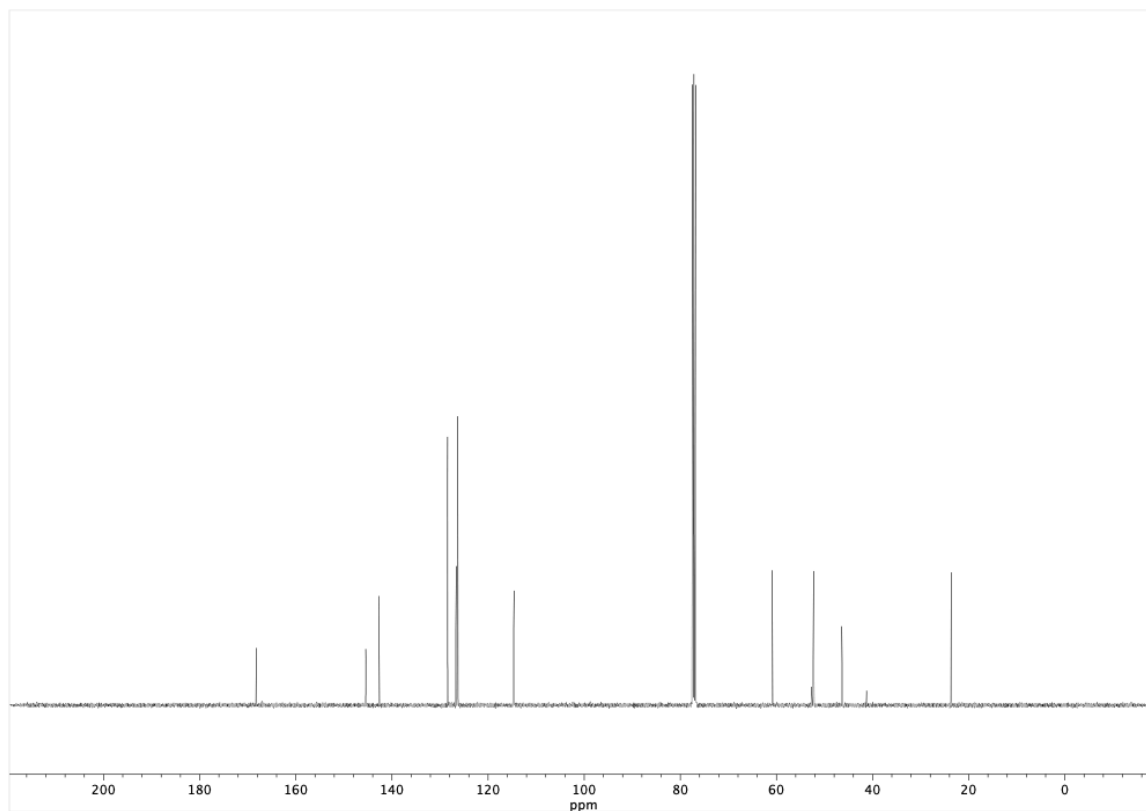


Figure A1.46. ¹³C NMR (100 MHz, CDCl₃) of compound **3b**.

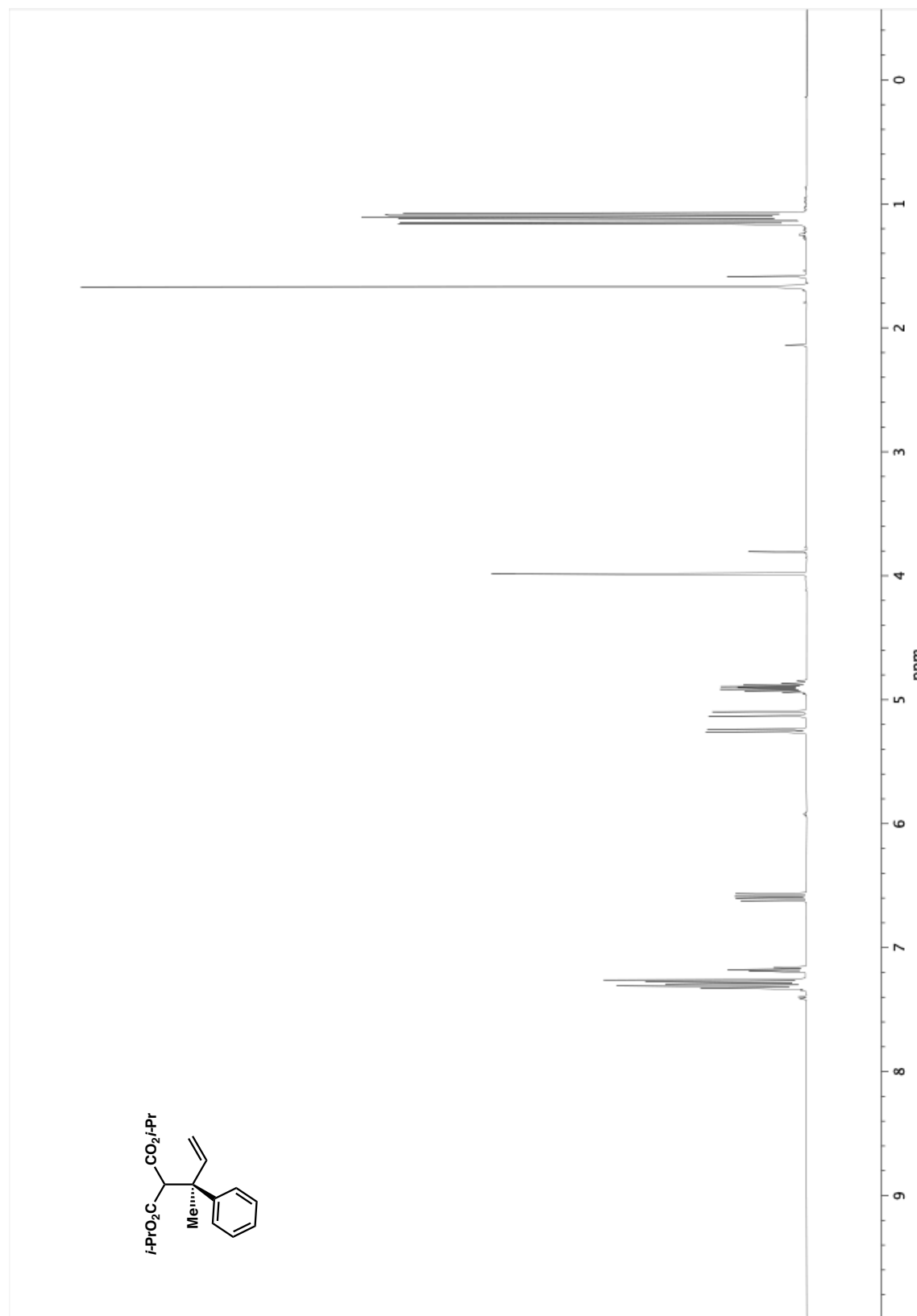


Figure A1.47. ¹H NMR (500 MHz, CDCl₃) of compound **3c**.

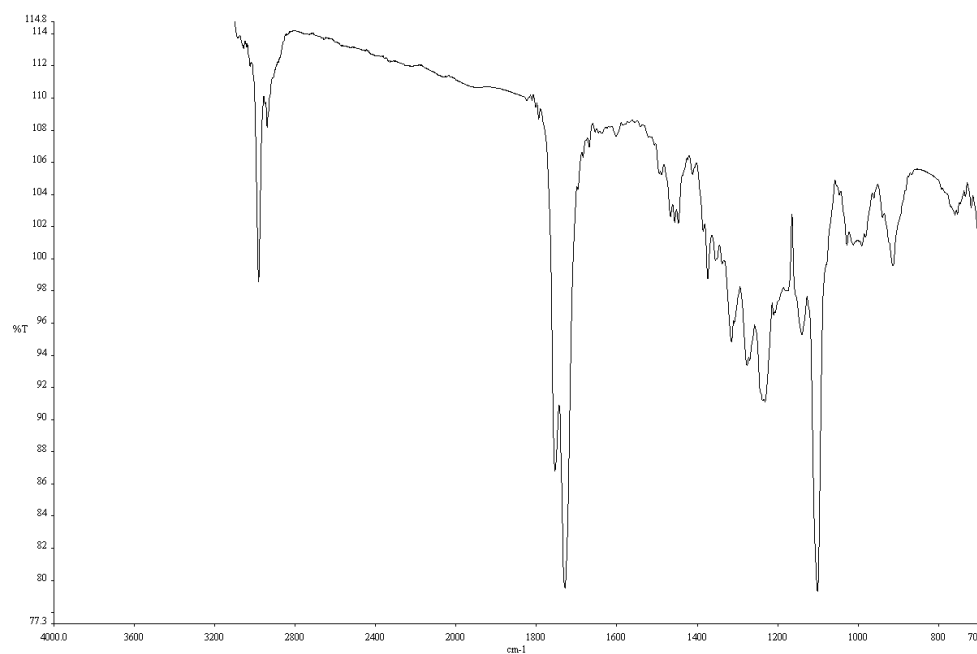


Figure A1.48. Infrared spectrum (Thin Film, NaCl) of compound **3c**.

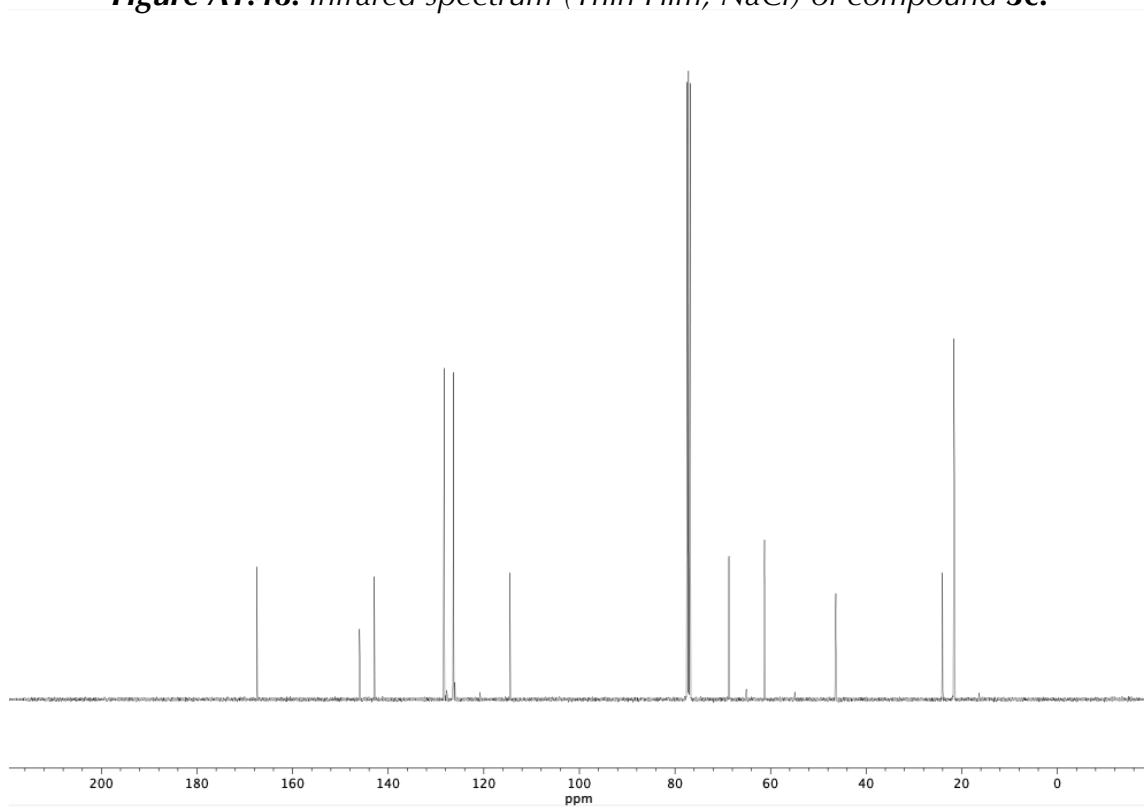


Figure A1.49. ¹³C NMR (100 MHz, CDCl₃) of compound **3c**.

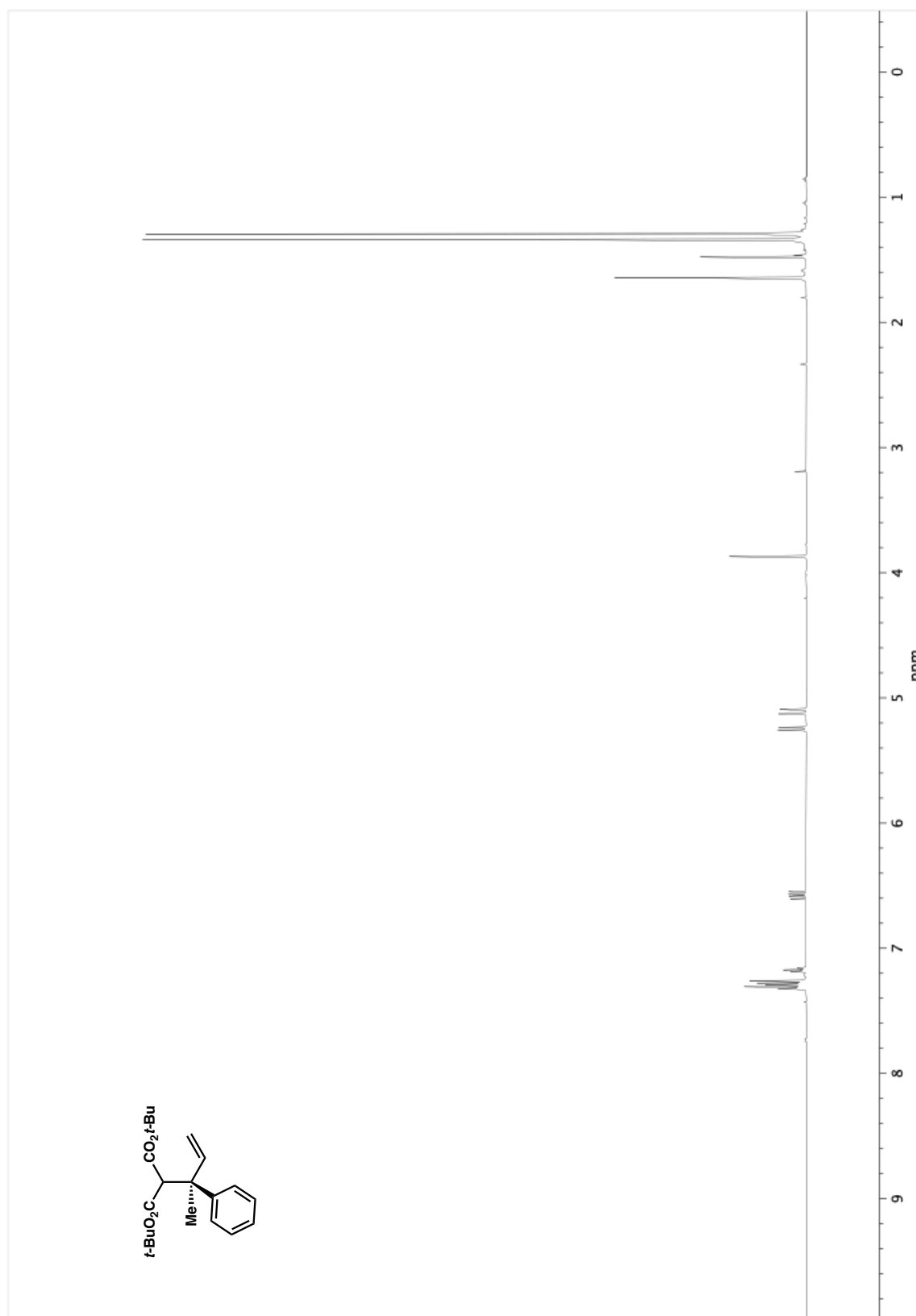


Figure A1.50. ¹H NMR (500 MHz, CDCl₃) of compound **3d**.

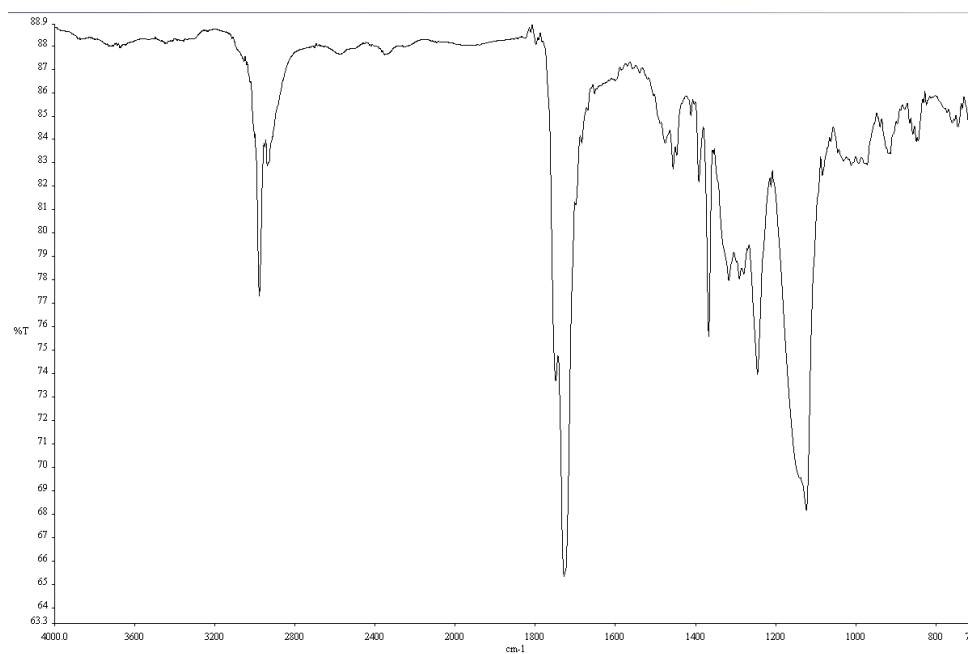


Figure A1.51. Infrared spectrum (Thin Film, NaCl) of compound **3d**.

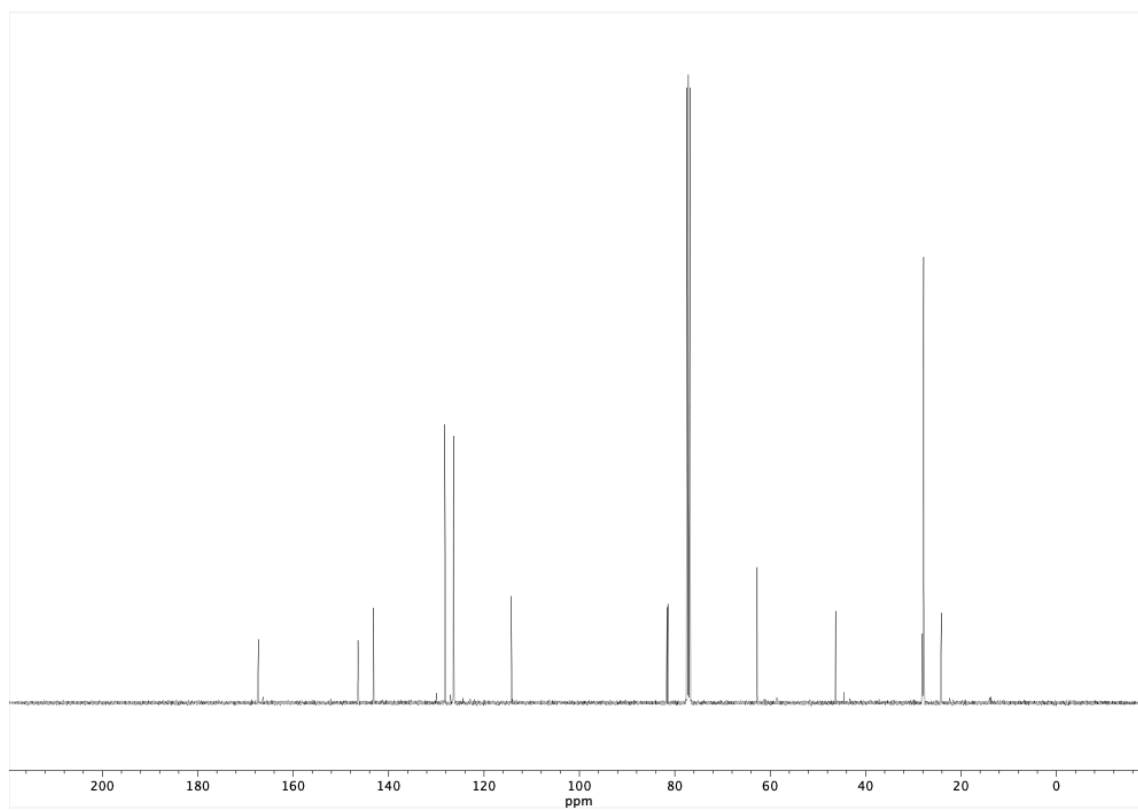


Figure A1.52. ¹³C NMR (100 MHz, CDCl₃) of compound **3d**.

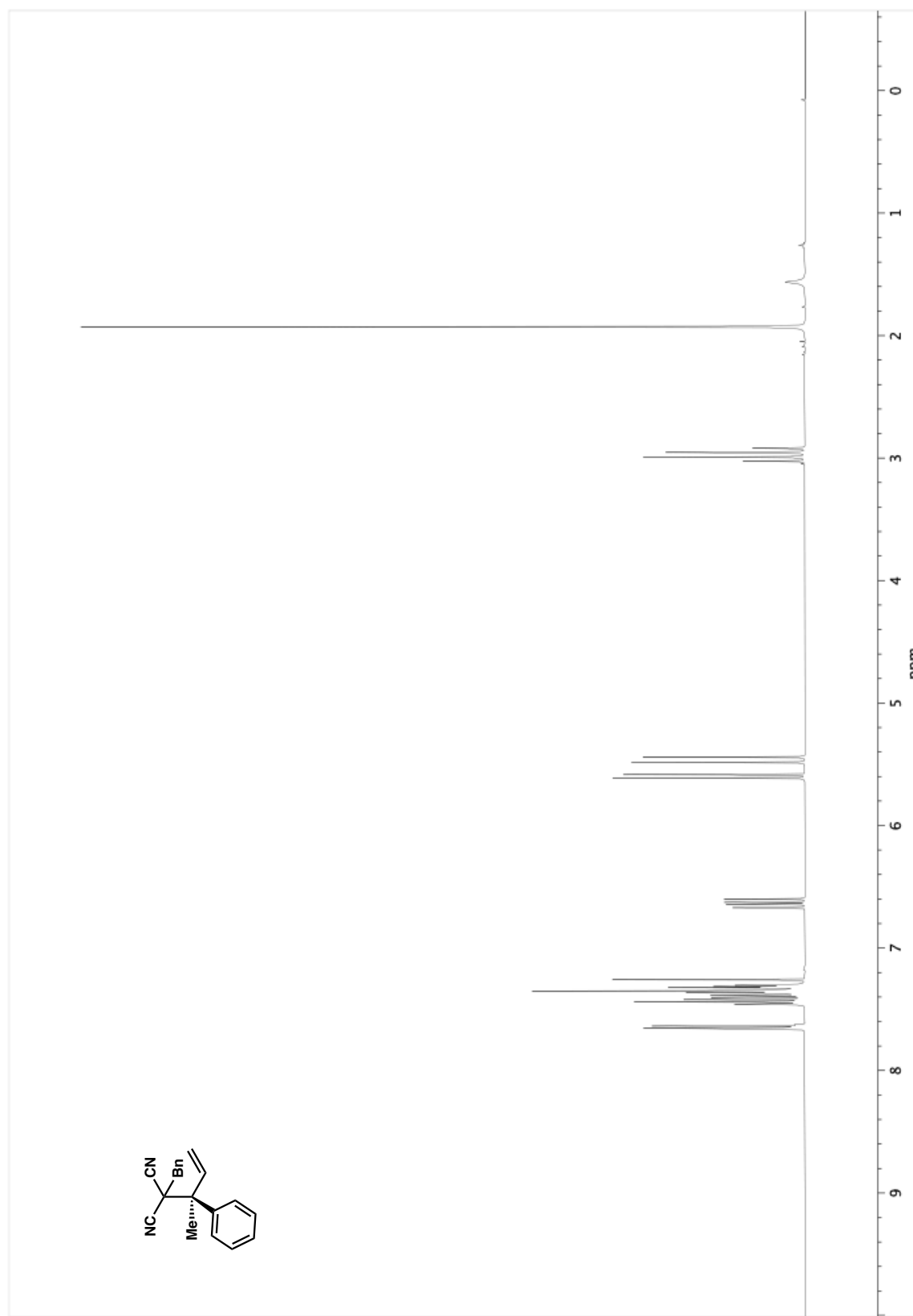


Figure A1.53. ¹H NMR (400 MHz, CDCl₃) of compound **4d**.

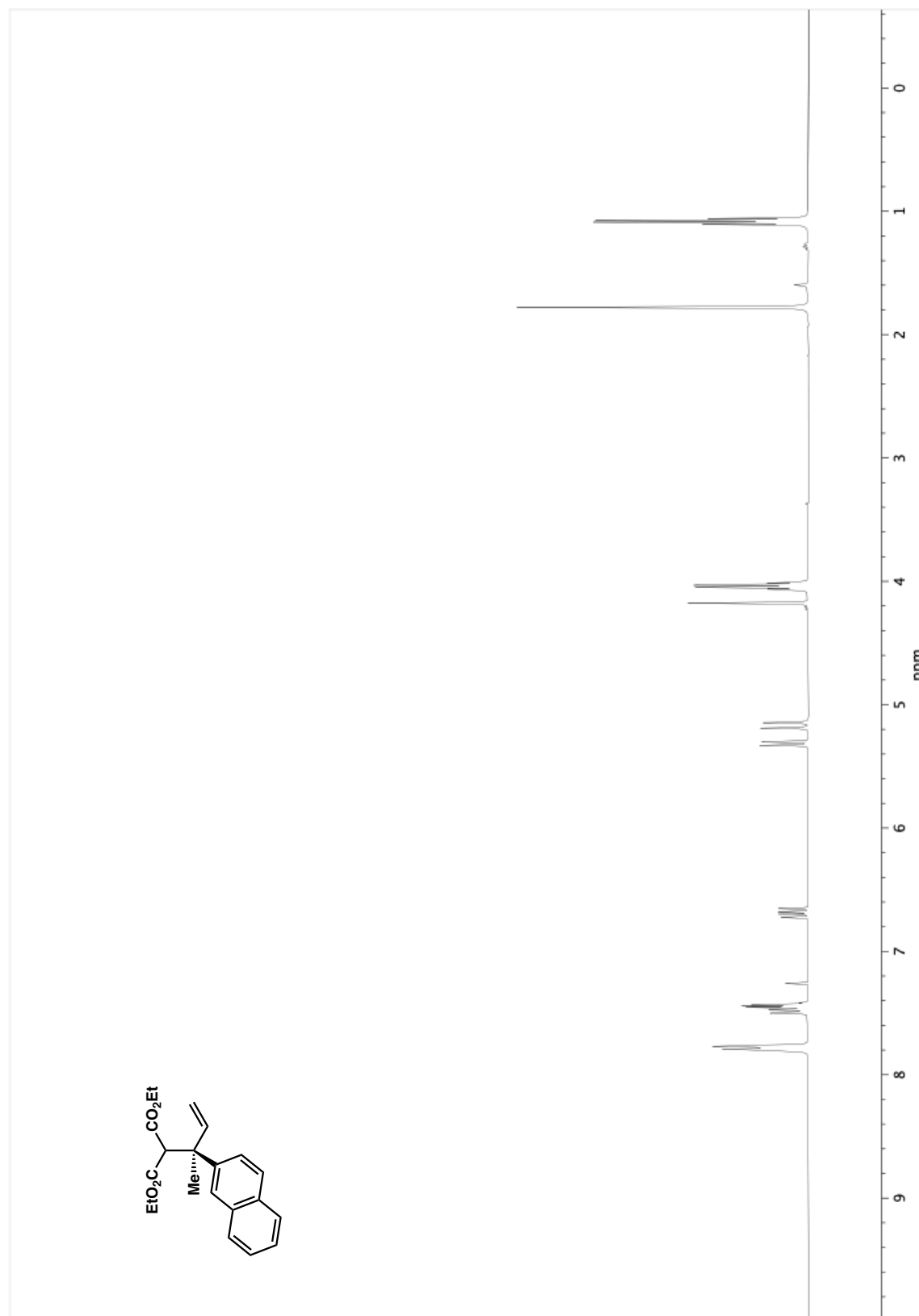


Figure A1.54. ¹H NMR (400 MHz, CDCl₃) of compound 5.

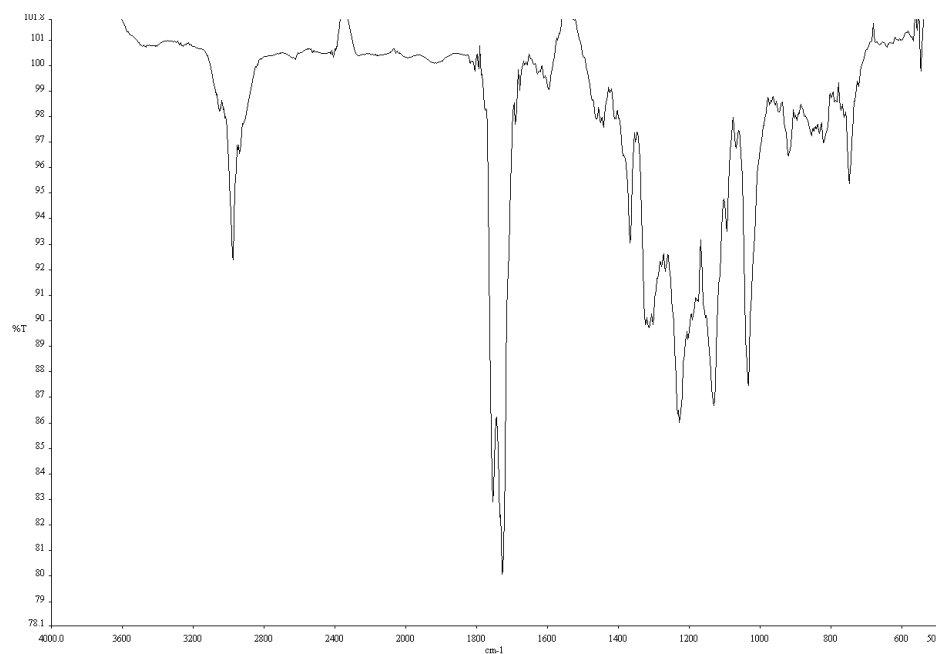


Figure A1.55. Infrared spectrum (Thin Film, NaCl) of compound **5**.

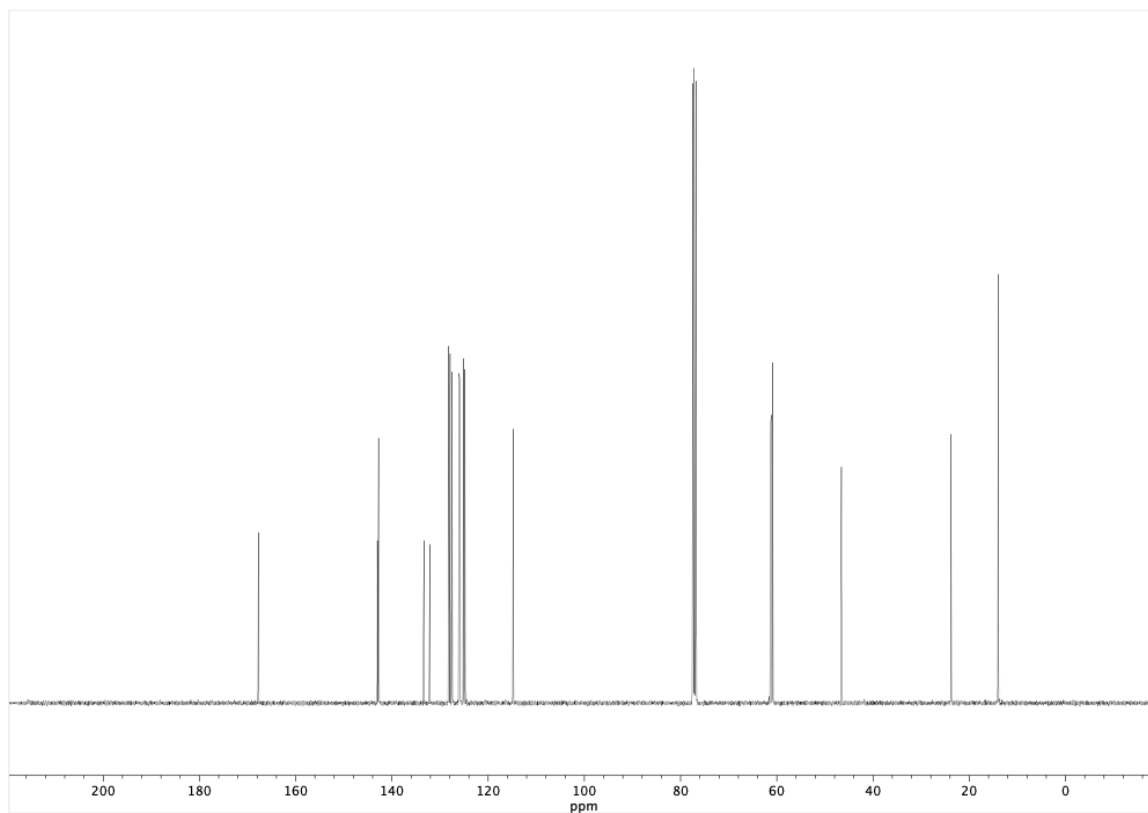


Figure A1.56. ¹³C NMR (100 MHz, CDCl₃) of compound **5**.

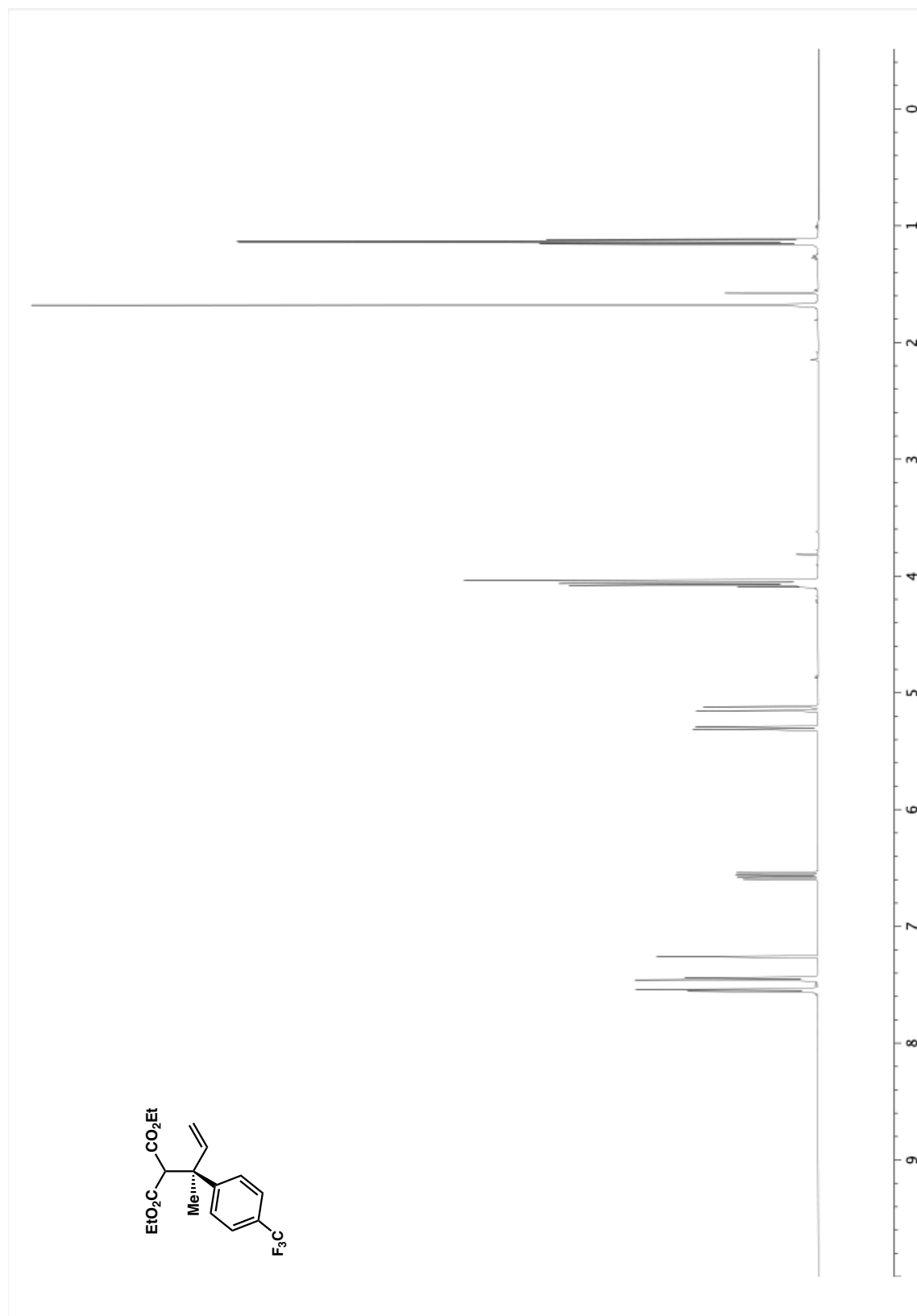


Figure A1.57. ¹H NMR (500 MHz, CDCl₃) of compound **6a**.

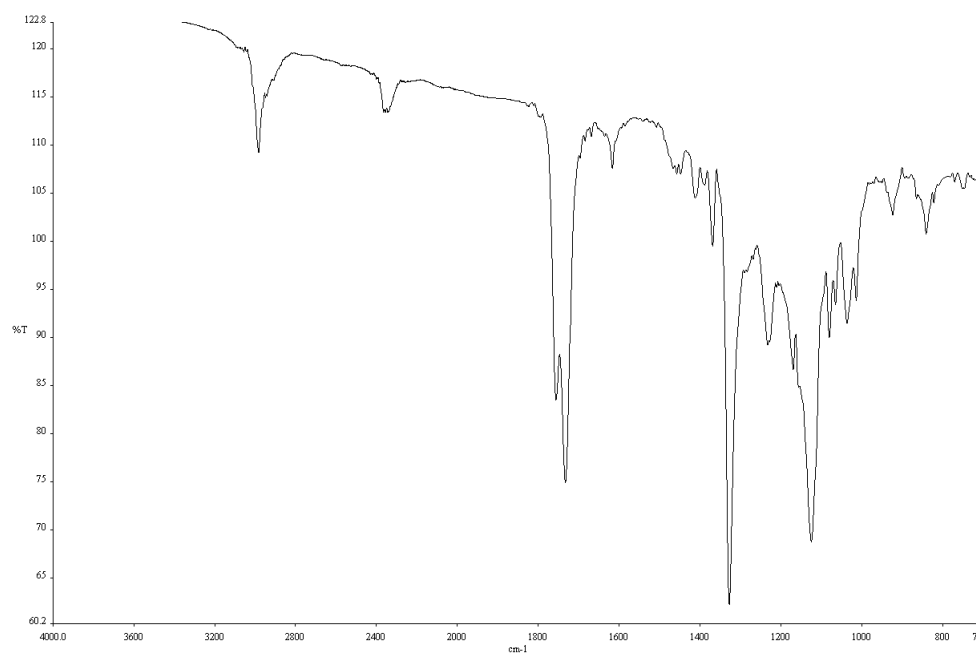


Figure A1.58. Infrared spectrum (Thin Film, NaCl) of compound **6a**.

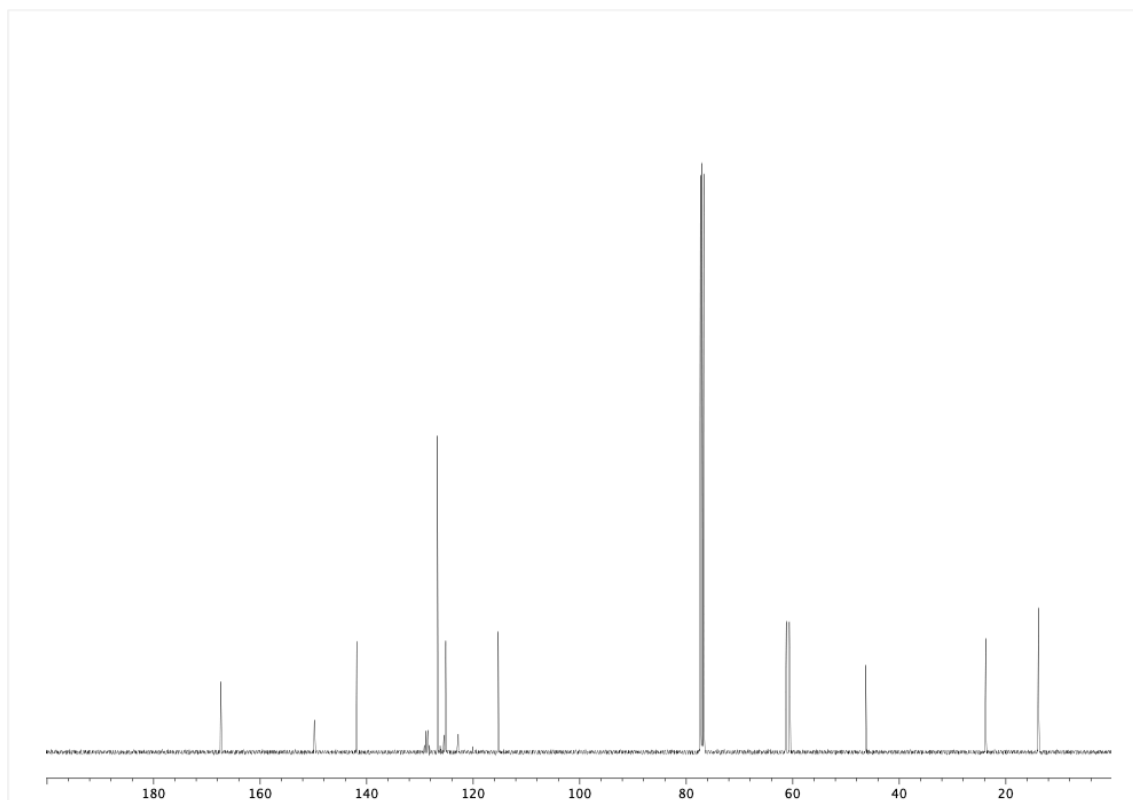


Figure A1.59. ^{13}C NMR (100 MHz, CDCl_3) of compound **6a**.

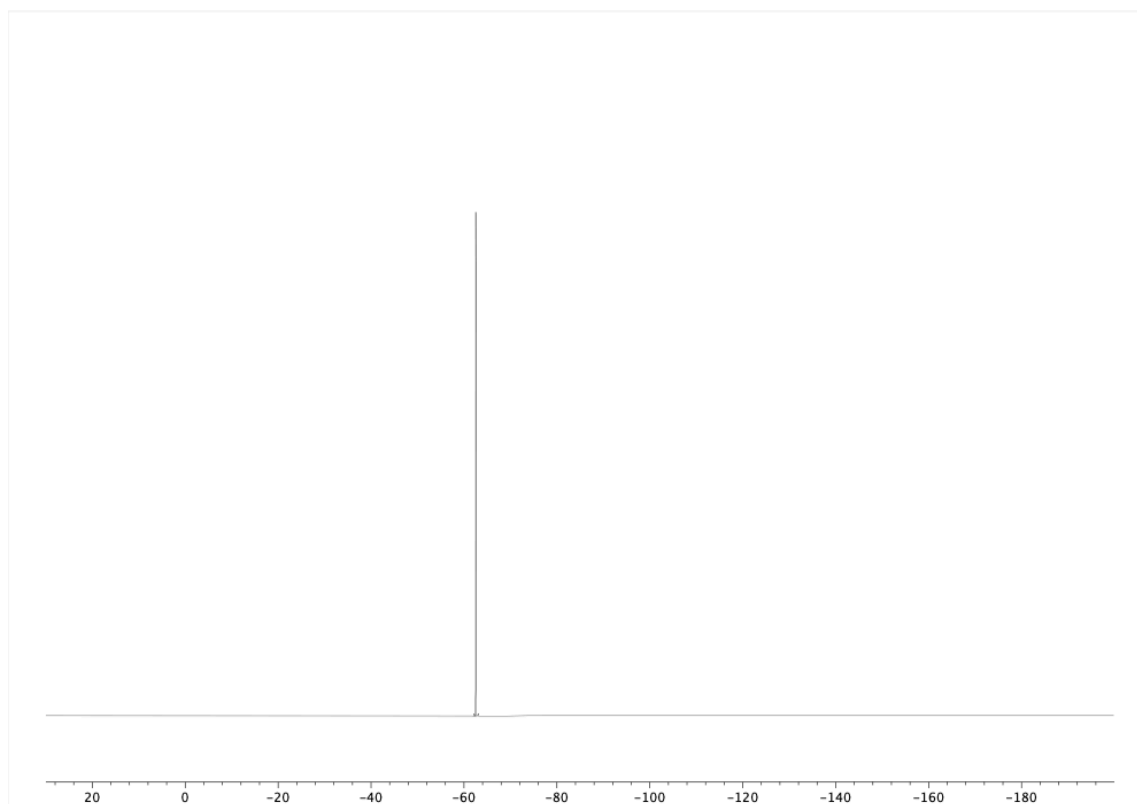


Figure A1.60. ^{19}F NMR (377 MHz, CDCl_3) of compound **6a**

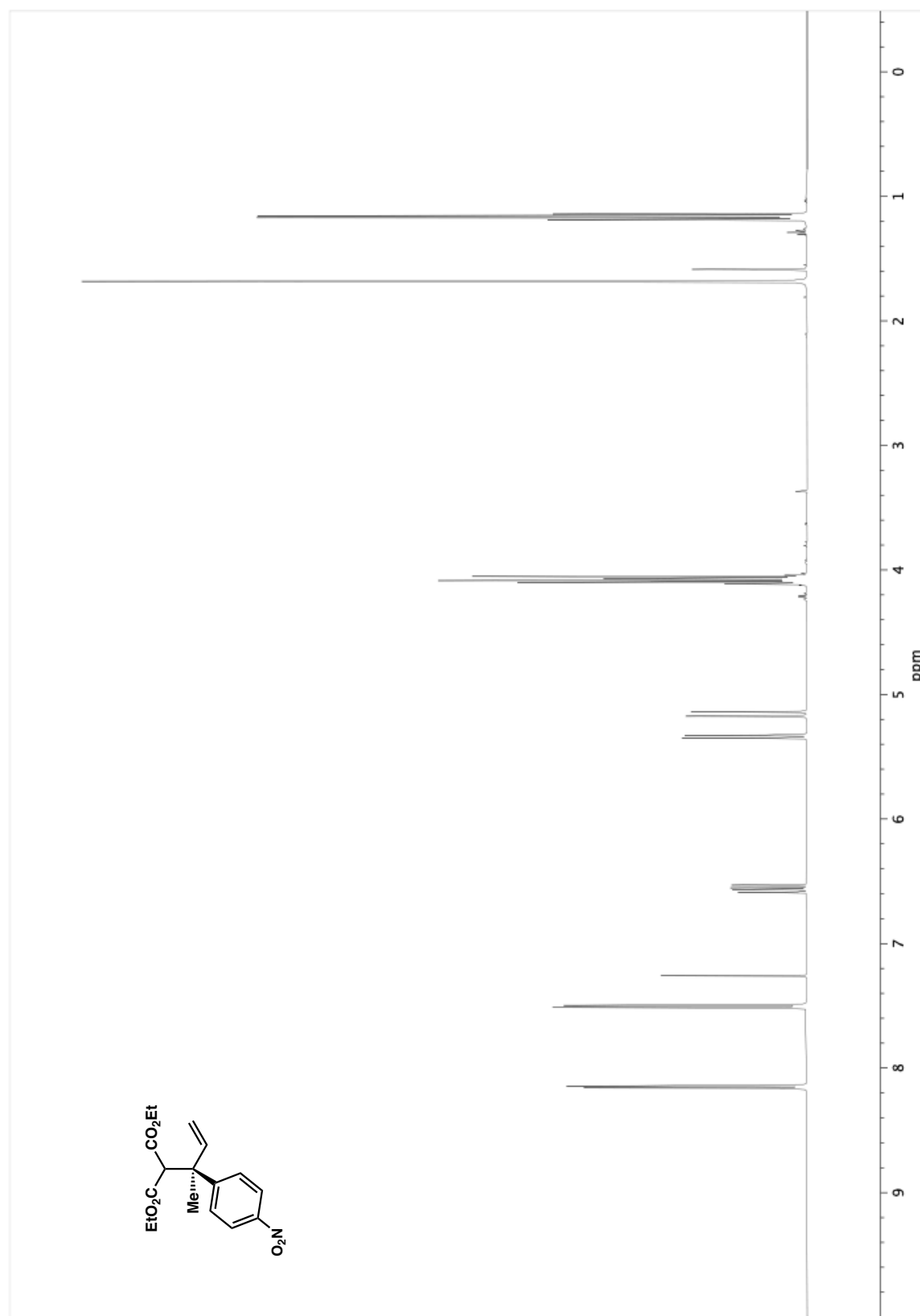


Figure A1.61. ¹H NMR (500 MHz, CDCl₃) of compound **6b**.

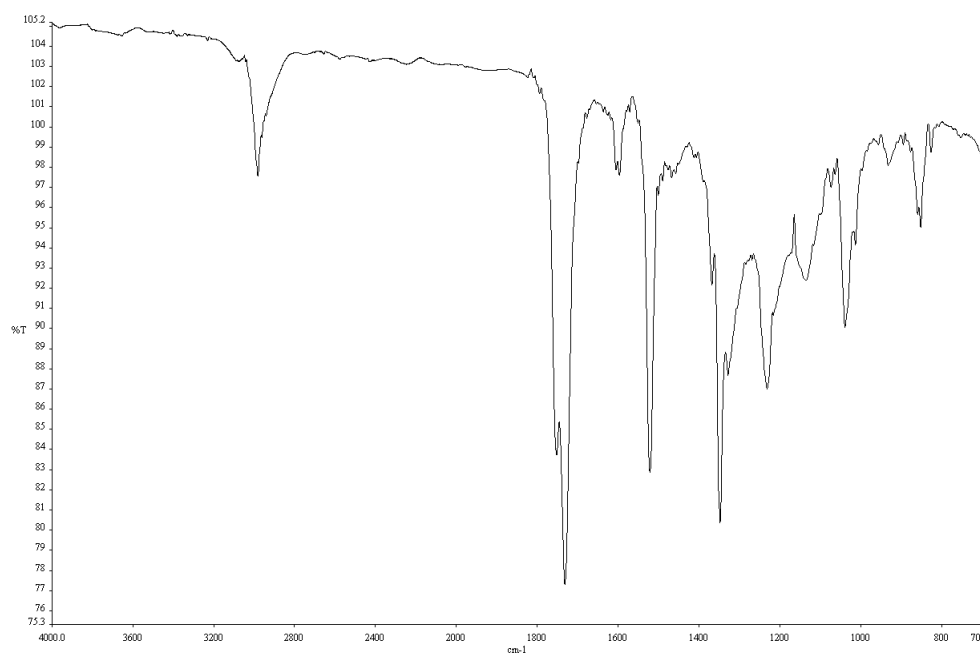


Figure A1.62. Infrared spectrum (Thin Film, NaCl) of compound **6b**.

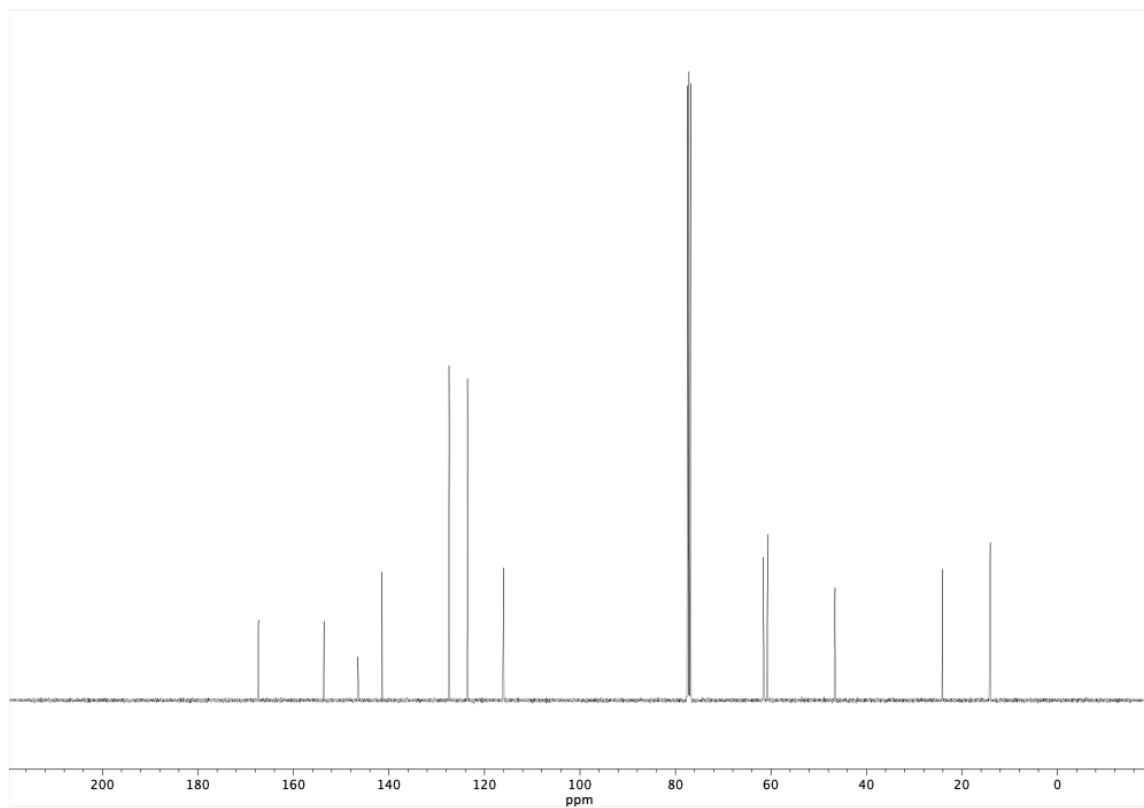


Figure A1.63. ^{13}C NMR (100 MHz, CDCl_3) of compound **6b**.

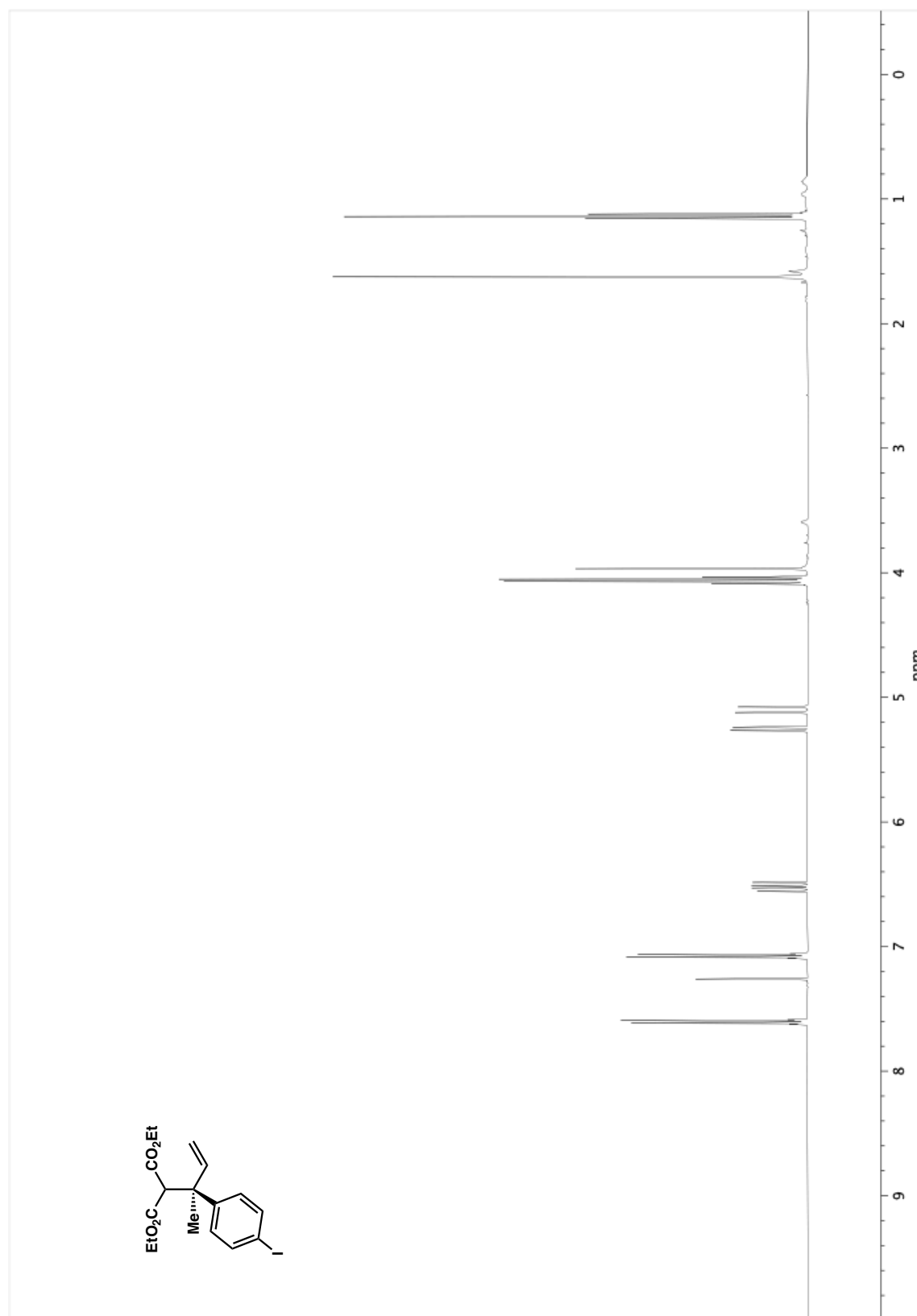


Figure A1.64. ¹H NMR (400 MHz, CDCl₃) of compound 7a.

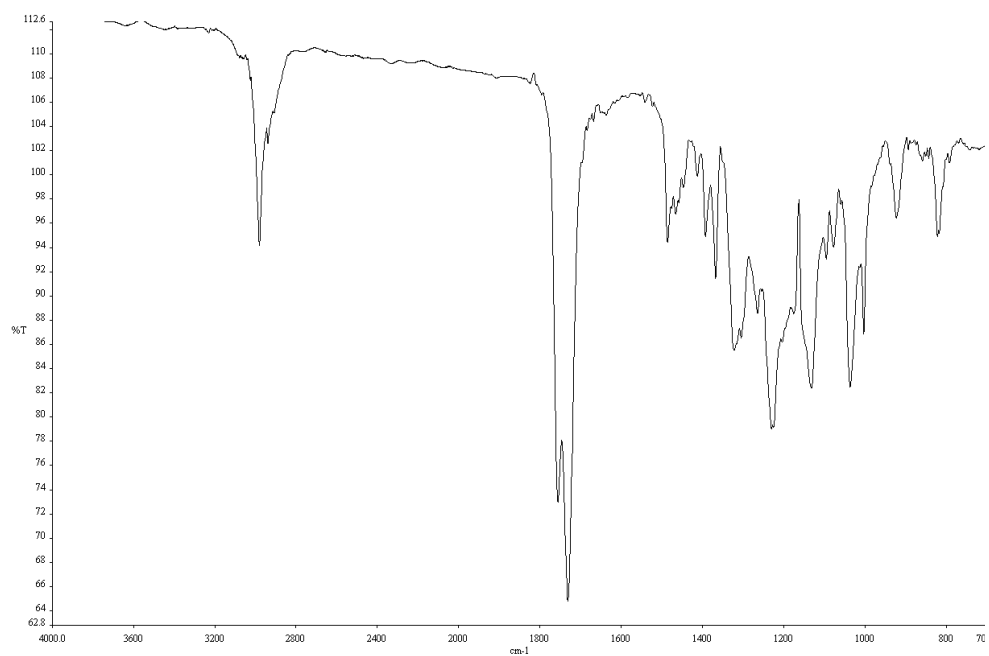


Figure A1.65. Infrared spectrum (Thin Film, NaCl) of compound **7a**.

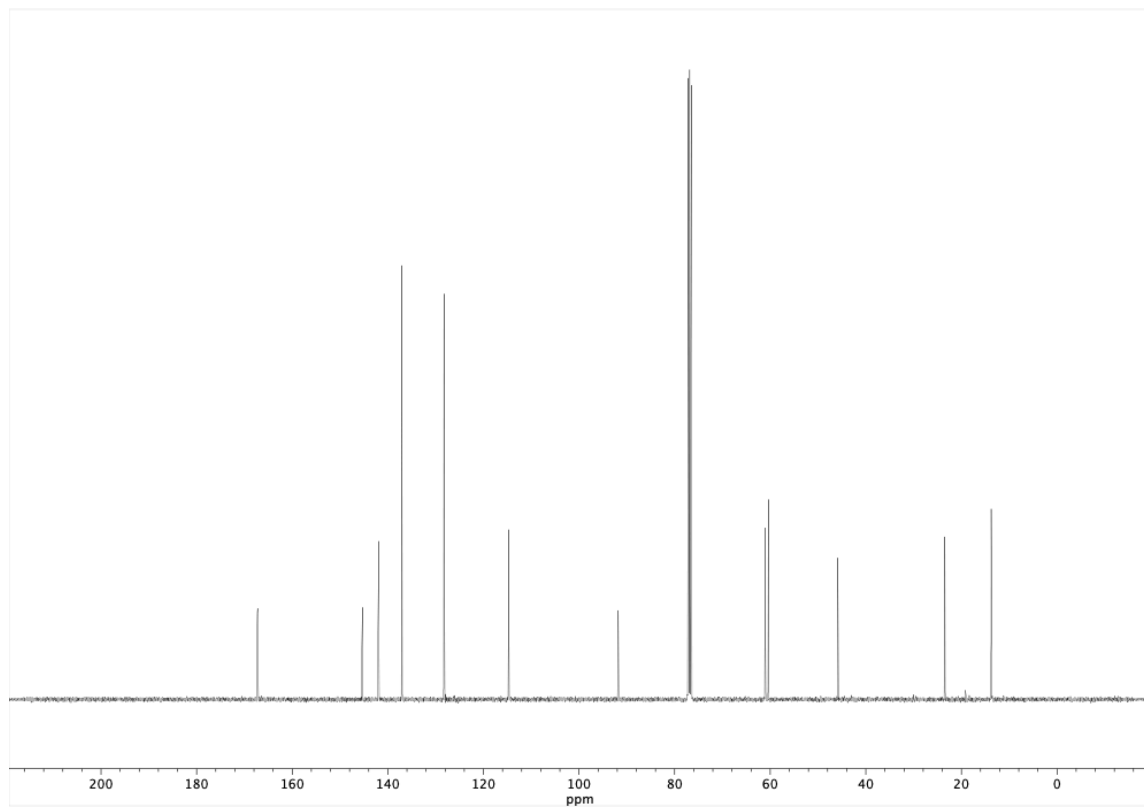


Figure A1.66. ^{13}C NMR (100 MHz, CDCl_3) of compound **7a**.

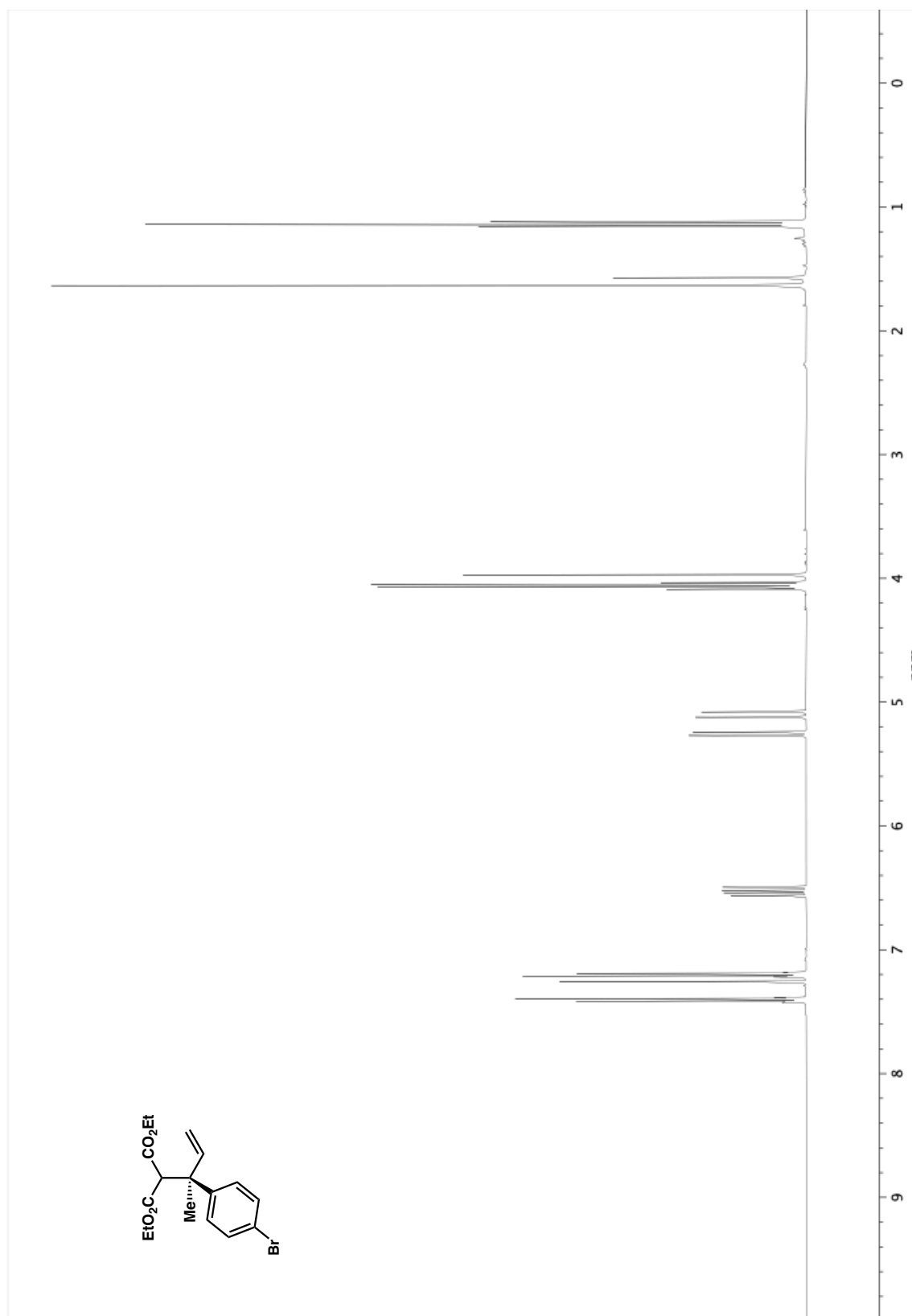


Figure A1.67. ¹H NMR (400 MHz, CDCl₃) of compound **7b**.

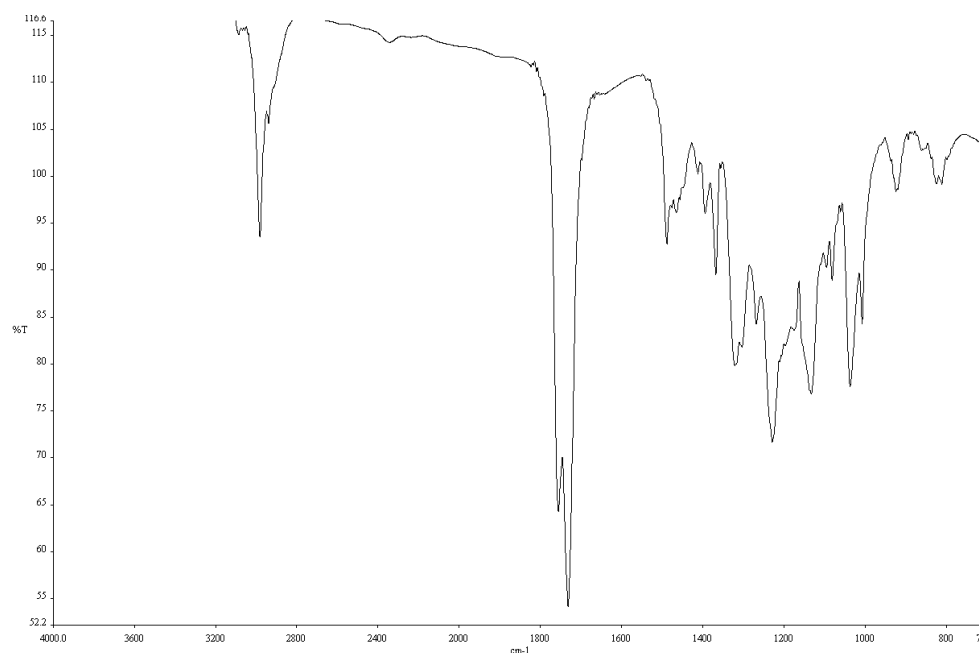


Figure A1.68. Infrared spectrum (Thin Film, NaCl) of compound **7b**.

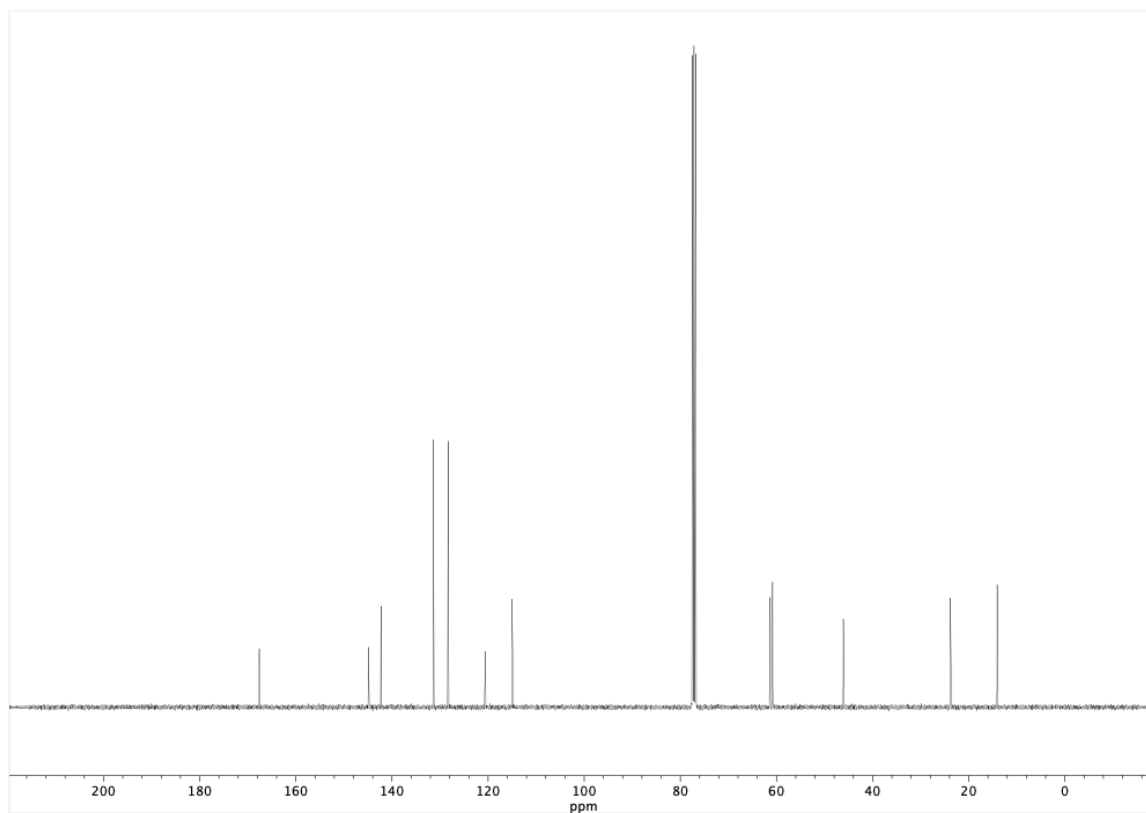


Figure A1.69. ^{13}C NMR (100 MHz, CDCl_3) of compound **7b**.

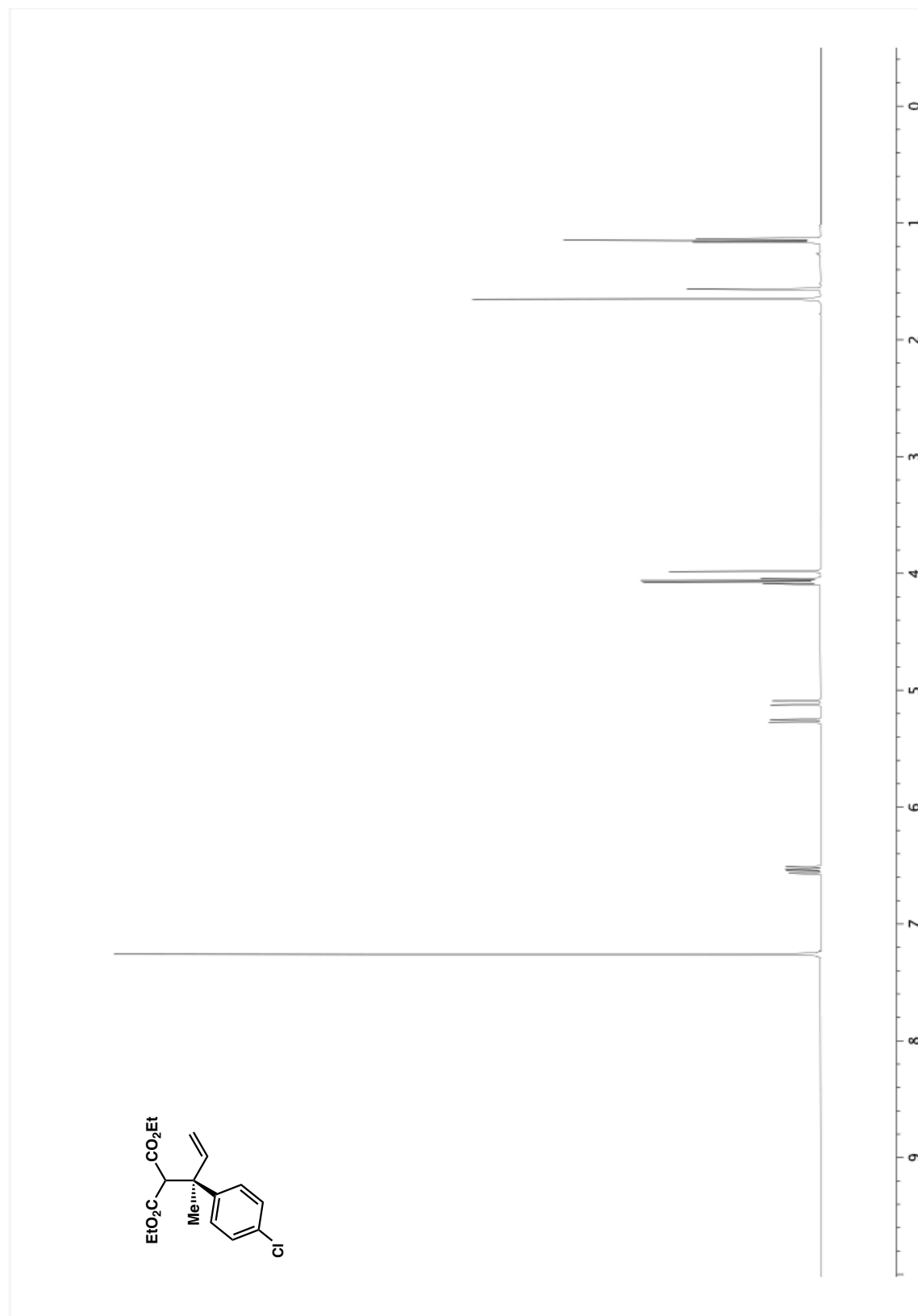


Figure A1.70. ¹H NMR (500 MHz, CDCl₃) of compound 7c.

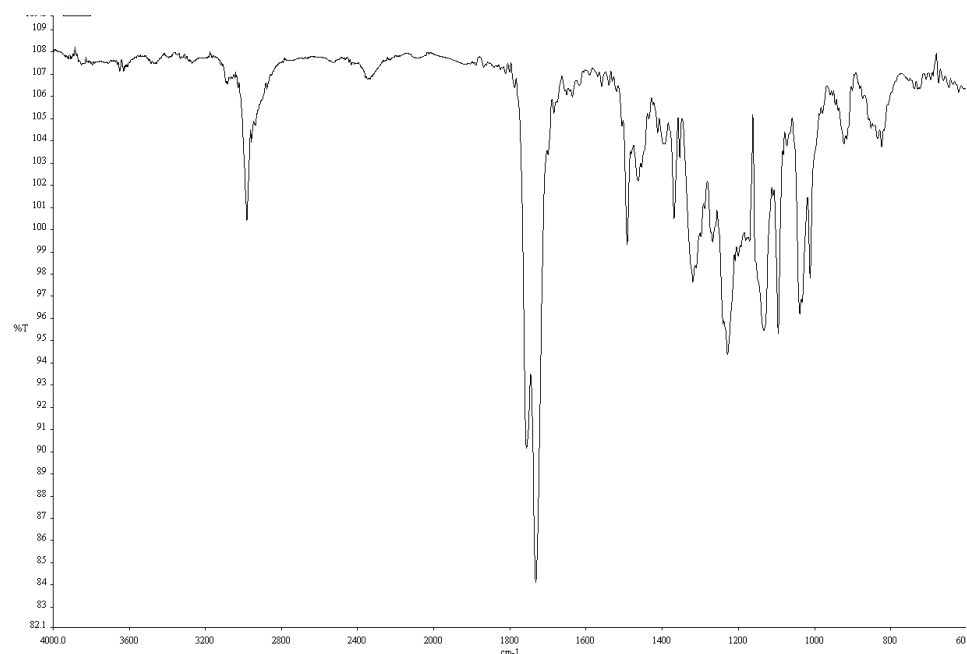


Figure A1.71. Infrared spectrum (Thin Film, NaCl) of compound **7c**.

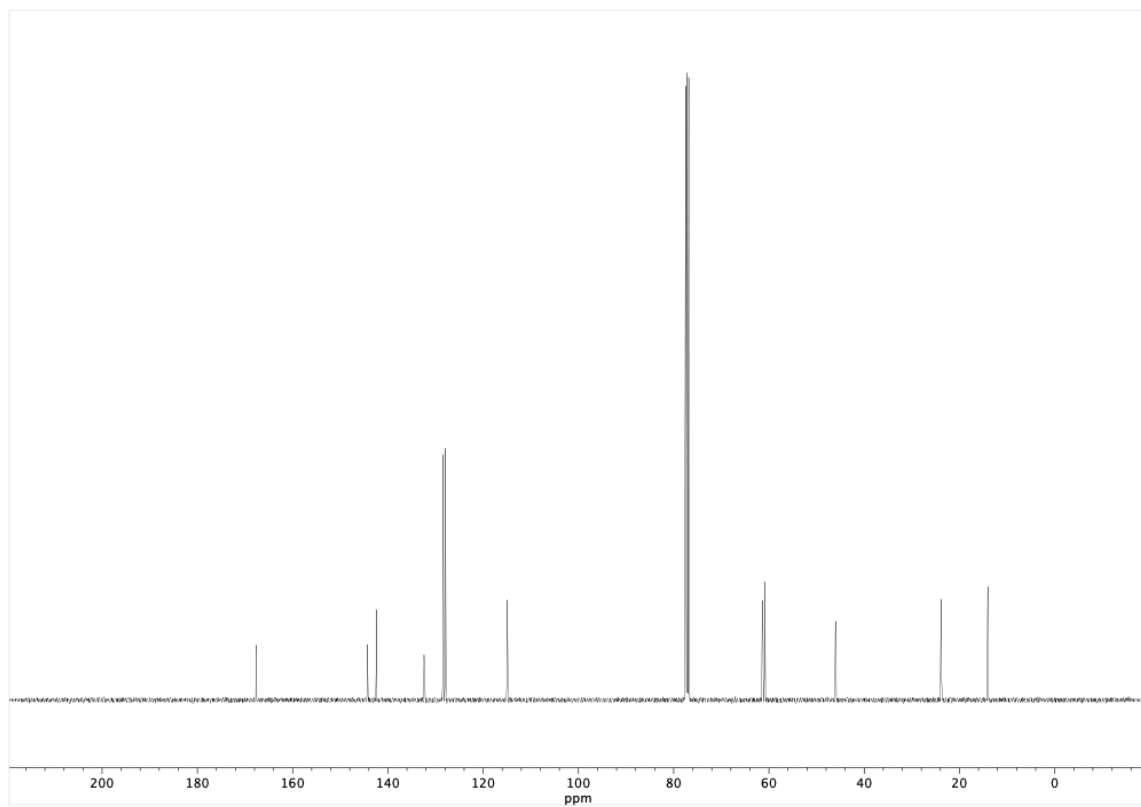


Figure A1.72. ^{13}C NMR (100 MHz, CDCl_3) of compound **7c**.

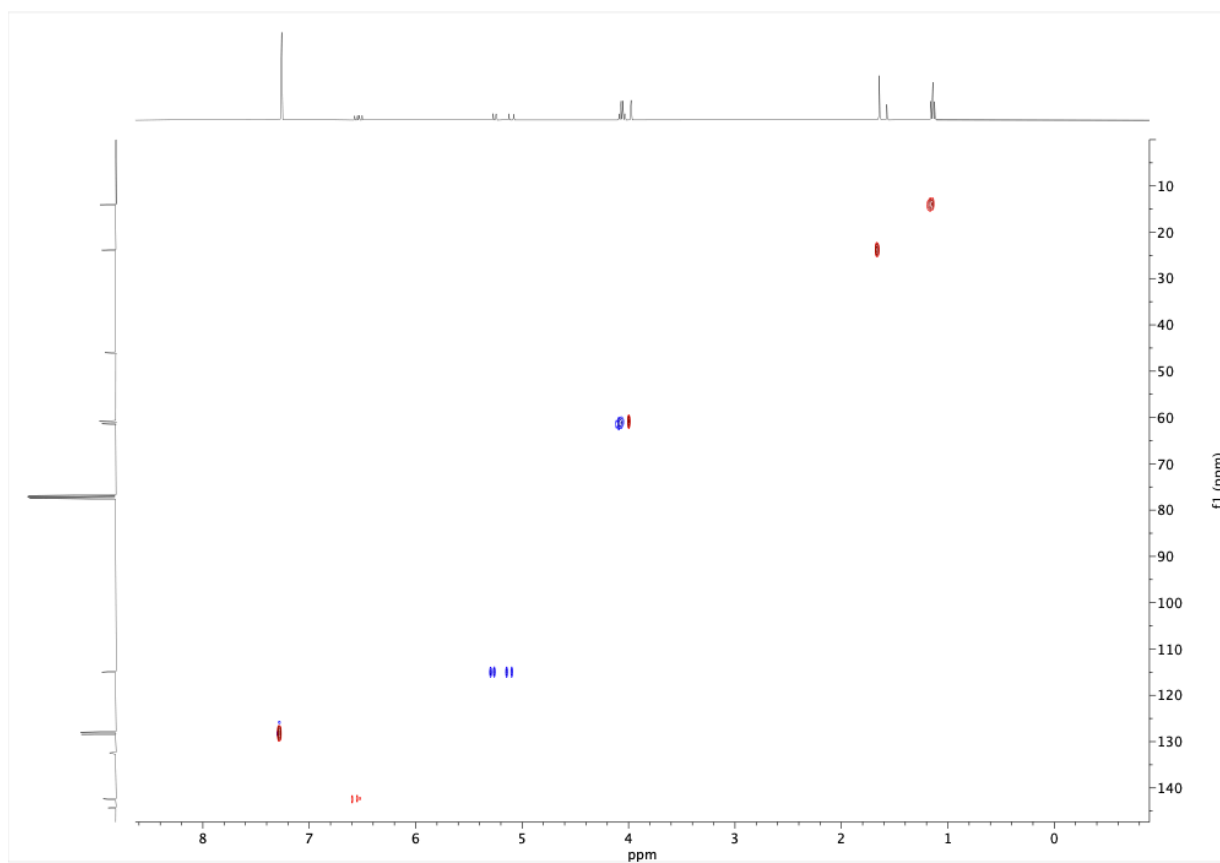


Figure A1.73. ^1H - ^{13}C HSQC (CDCl_3) of compound **7c**.

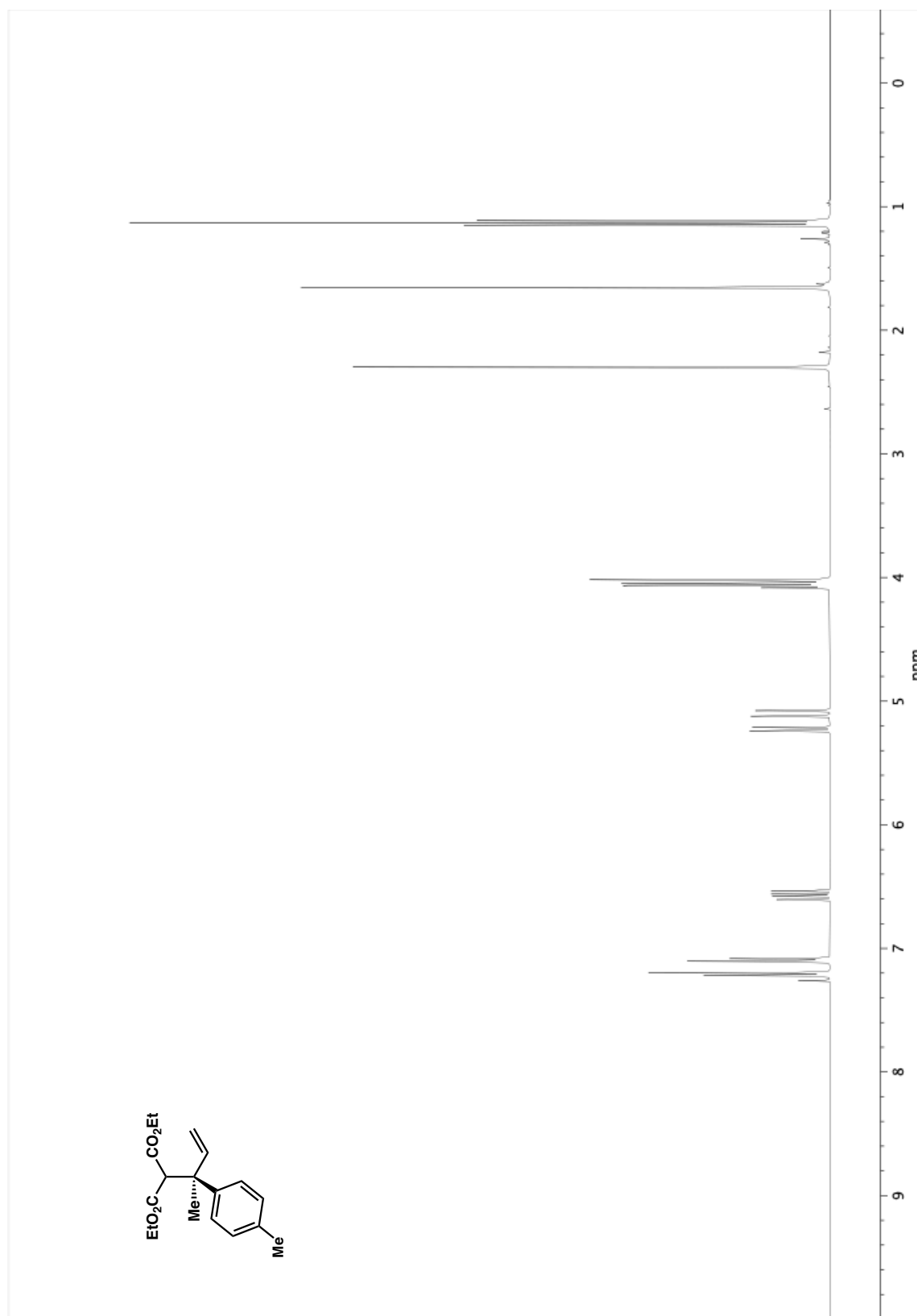


Figure A1.74. ¹H NMR (400 MHz, CDCl₃) of compound 8a.

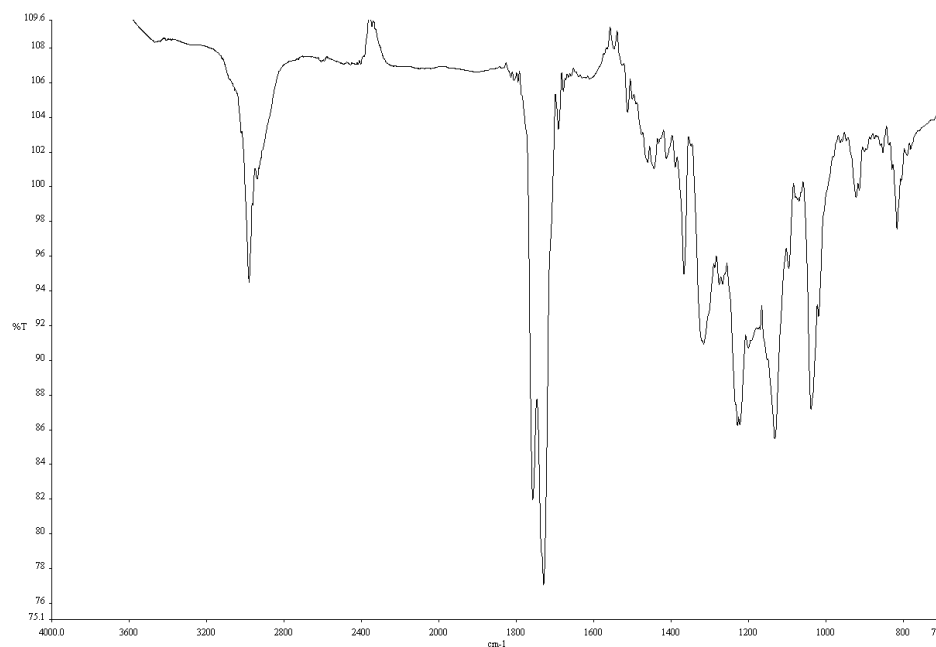


Figure A1.75. Infrared spectrum (Thin Film, NaCl) of compound **8a**.

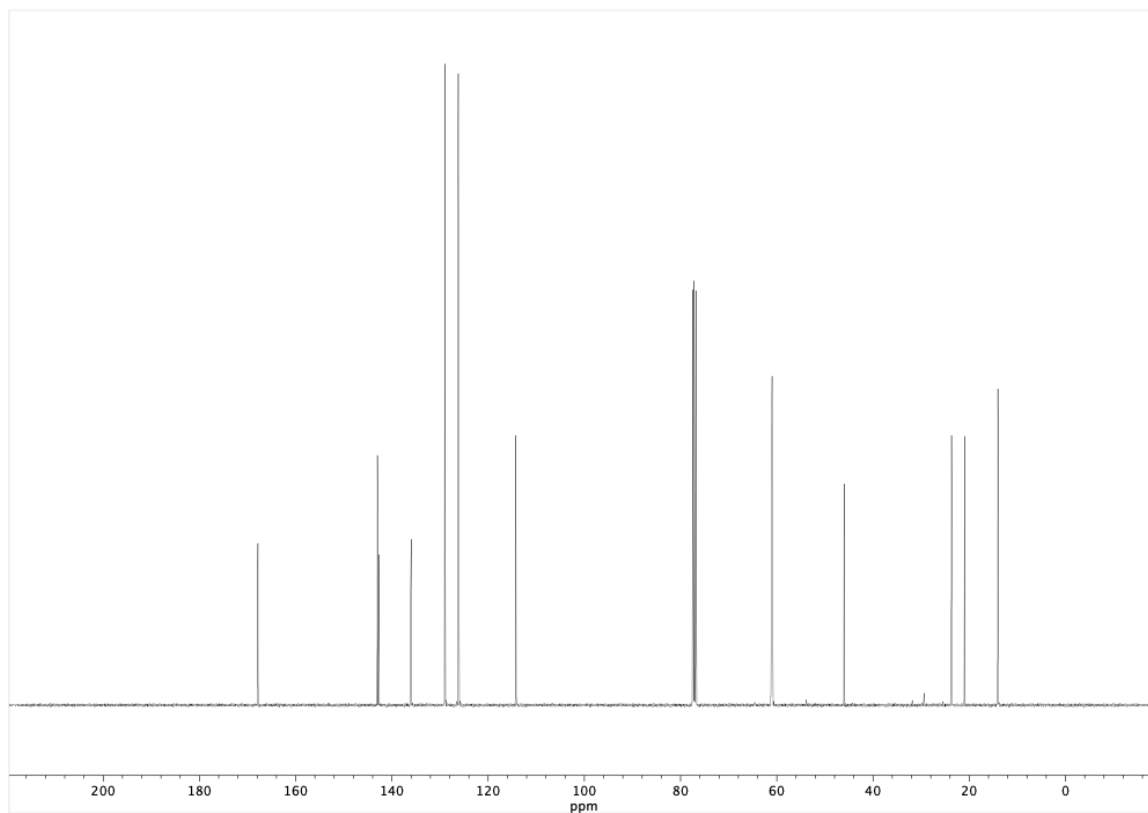


Figure A1.76. ¹³C NMR (100 MHz, CDCl₃) of compound **8a**.

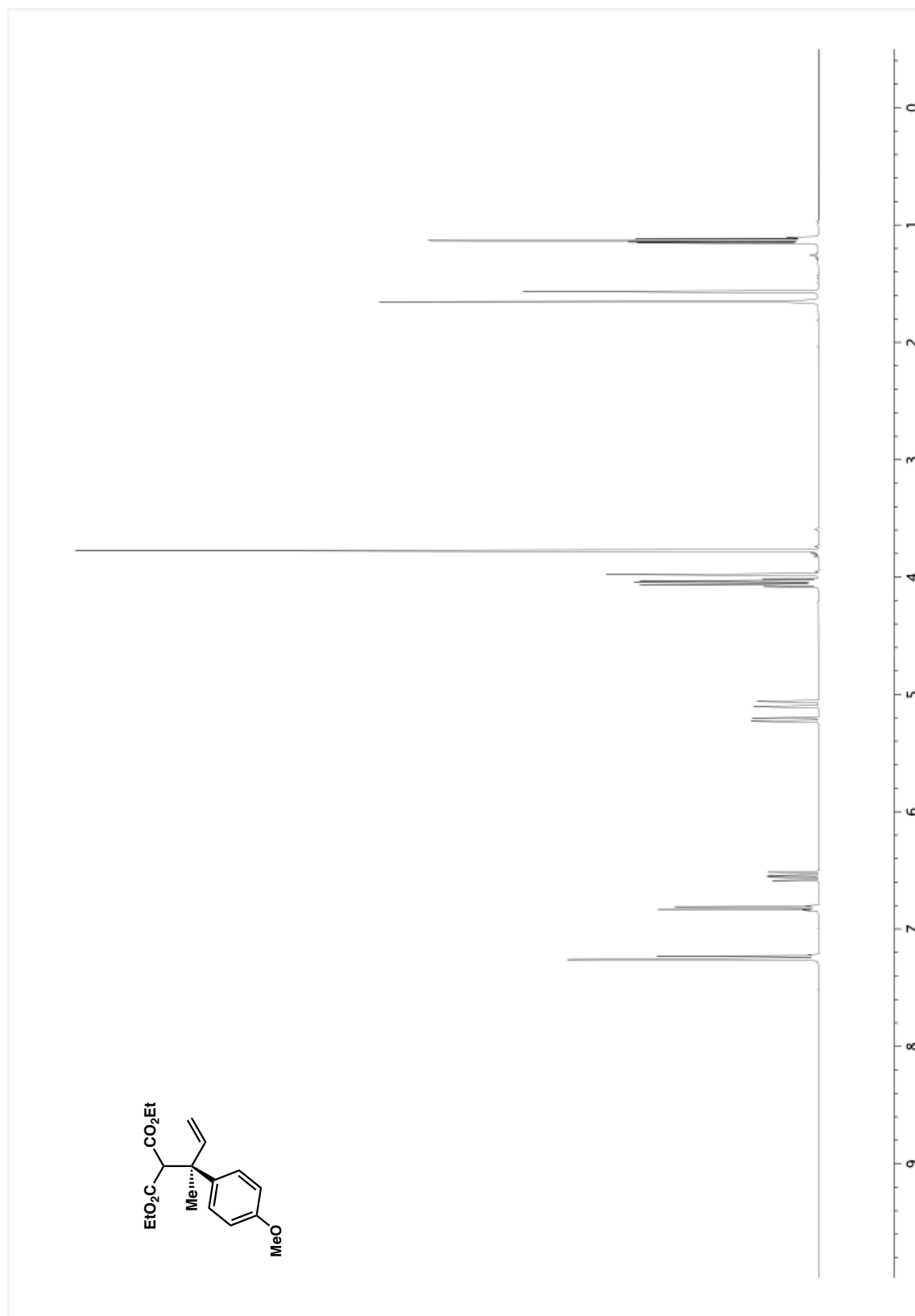


Figure A1.77. ¹H NMR (400 MHz, CDCl₃) of compound **8b**.

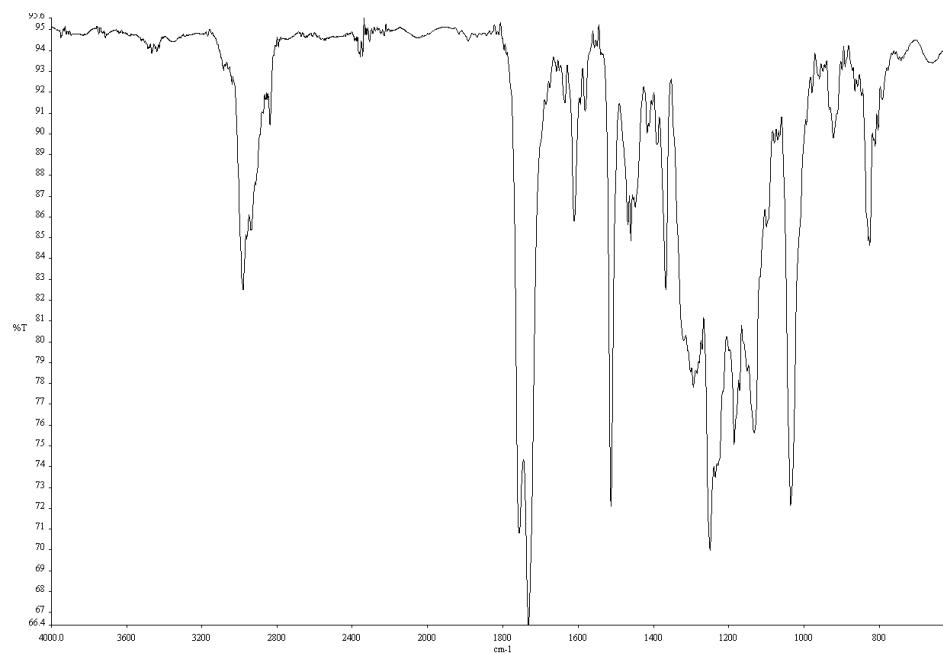


Figure A1.78. Infrared spectrum (Thin Film, NaCl) of compound **8b**.

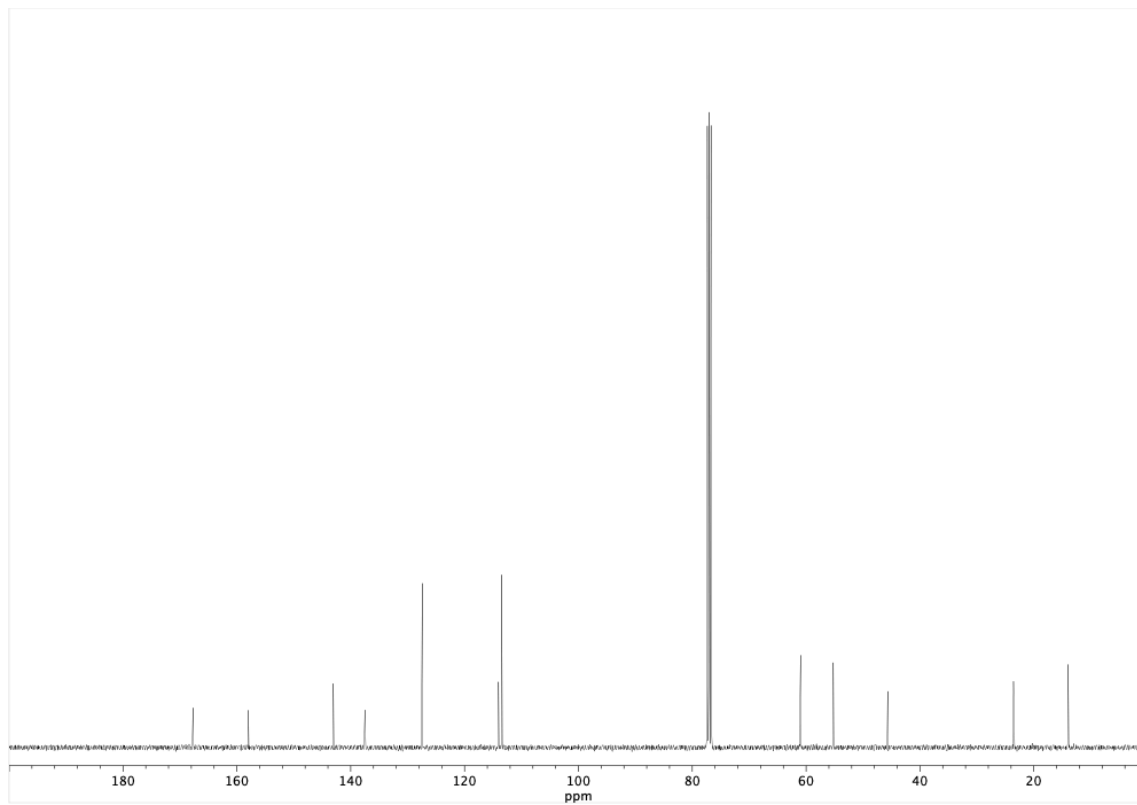


Figure A1.79. ¹³C NMR (100 MHz, CDCl₃) of compound **8b**.

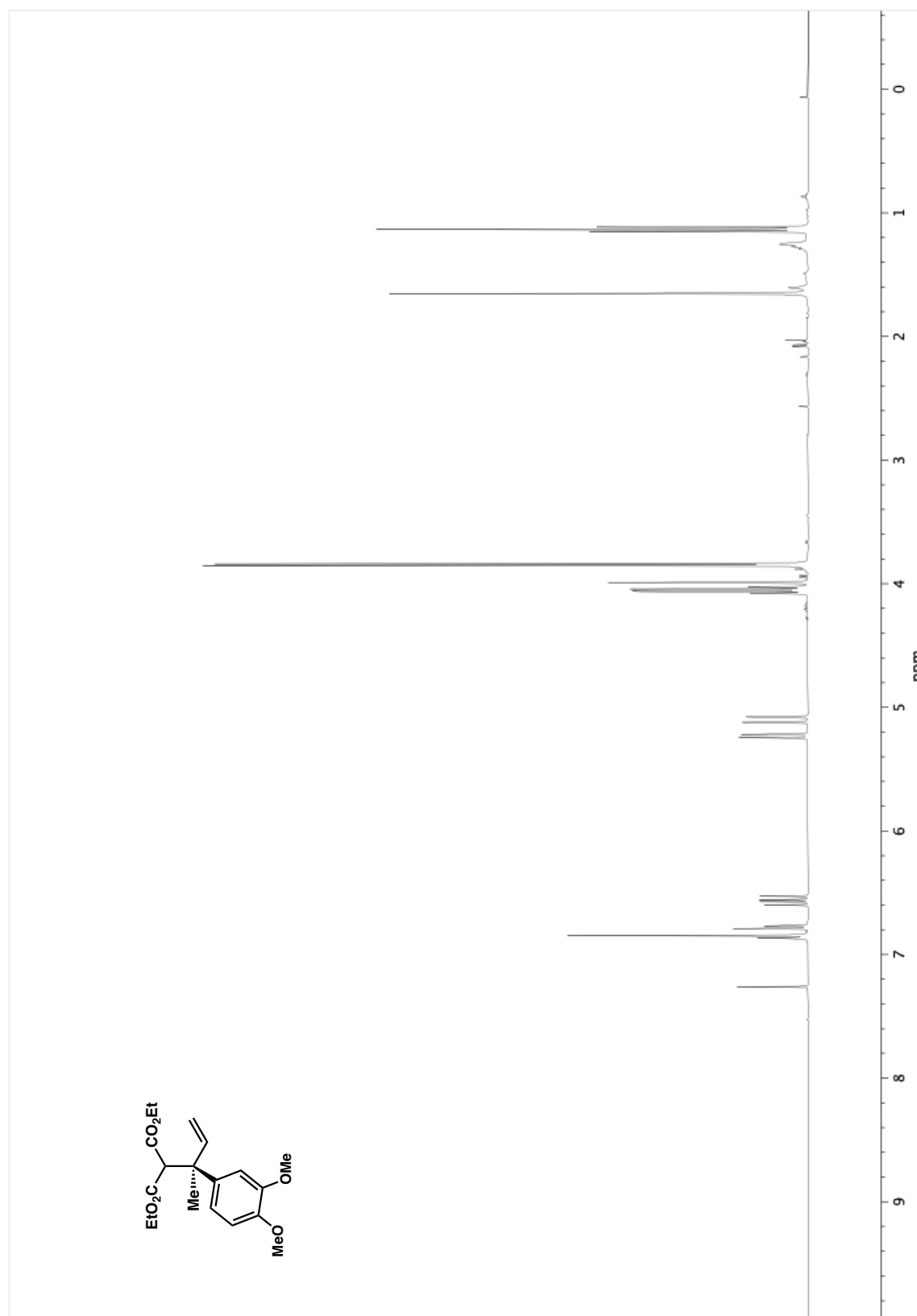


Figure A1.80. ¹H NMR (400 MHz, CDCl₃) of compound 8c.

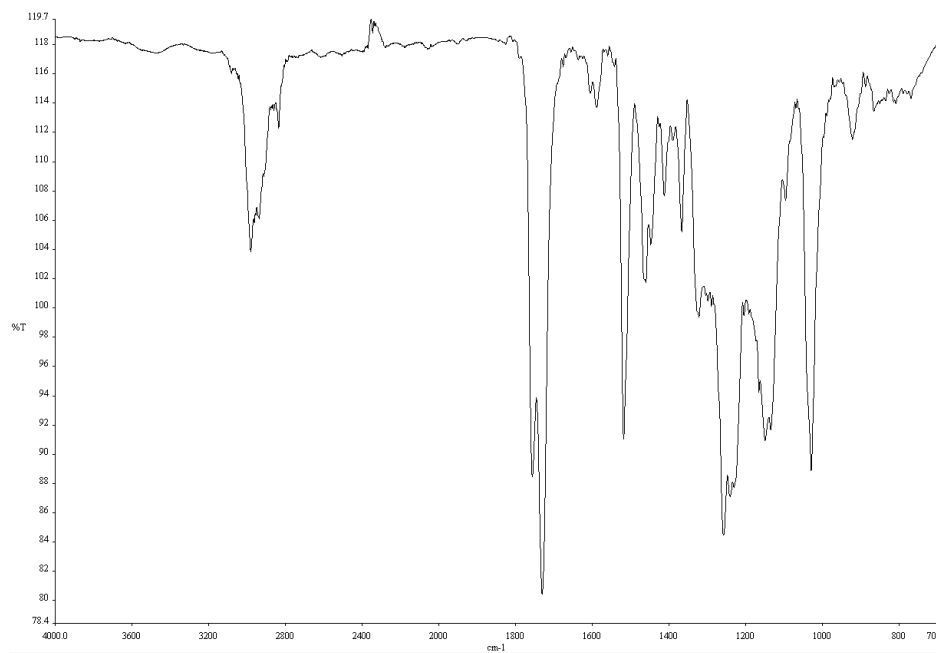


Figure A1.81. Infrared spectrum (Thin Film, NaCl) of compound **8c**.

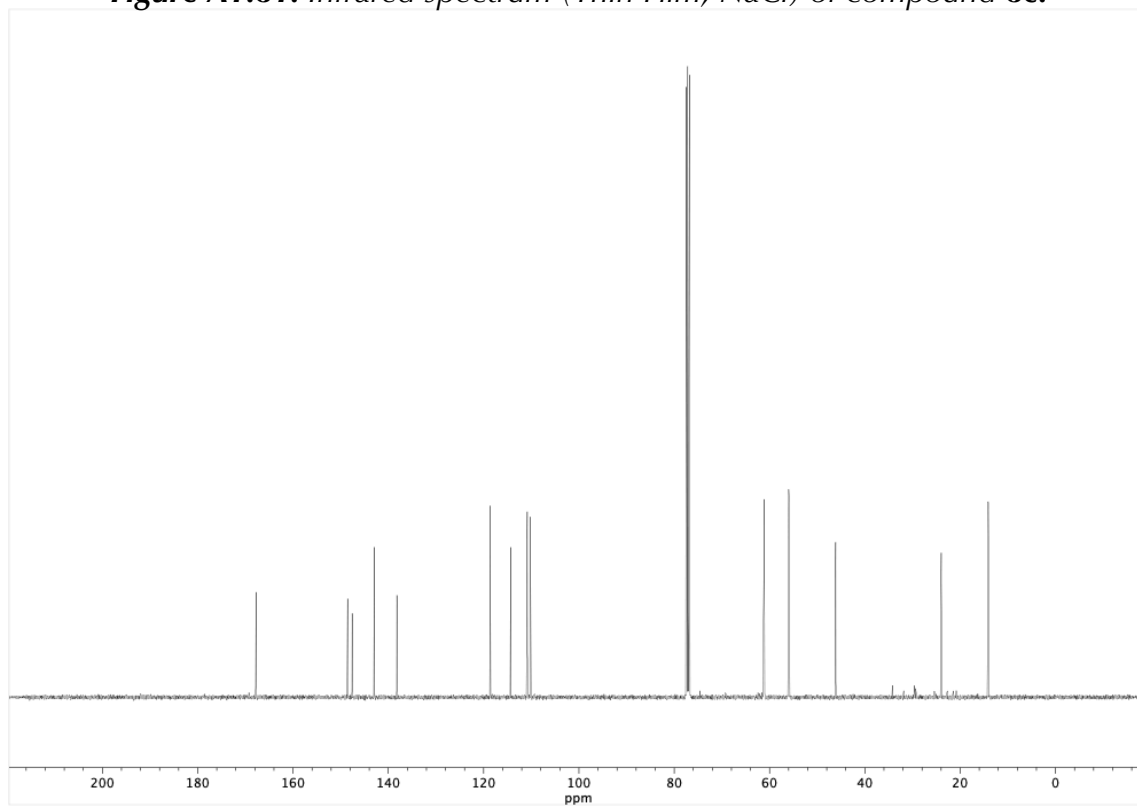


Figure A1.82. ¹³C NMR (100 MHz, CDCl₃) of compound **8c**.

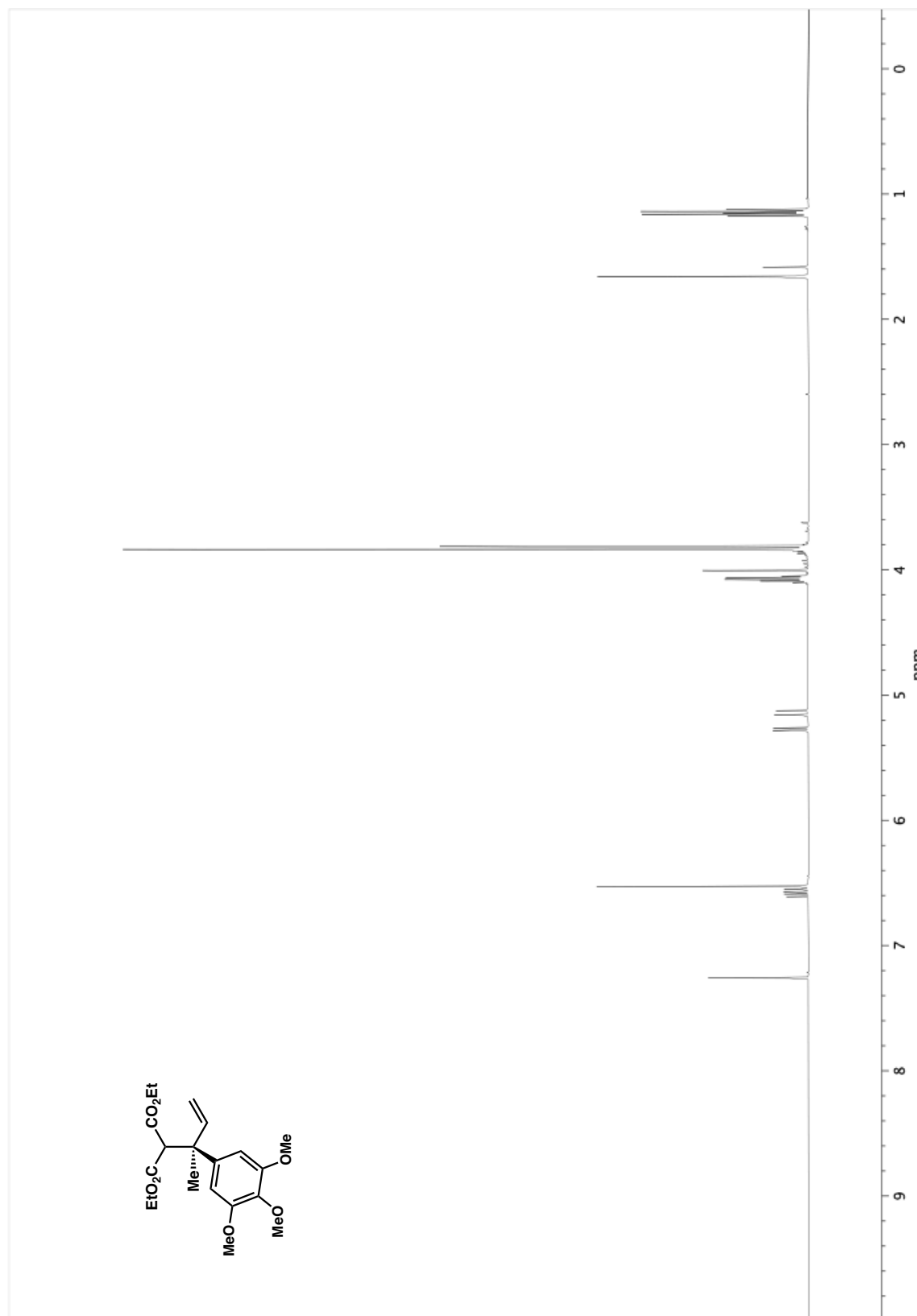


Figure A1.83. ¹H NMR (500 MHz, CDCl₃) of compound **8d**.

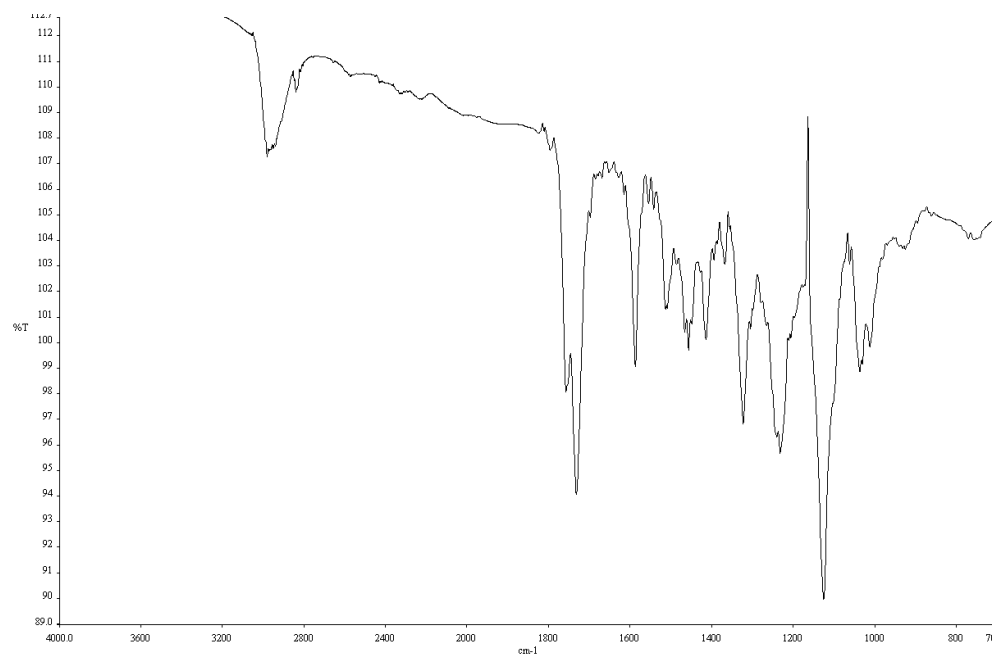


Figure A1.84. Infrared spectrum (Thin Film, NaCl) of compound **8d**.

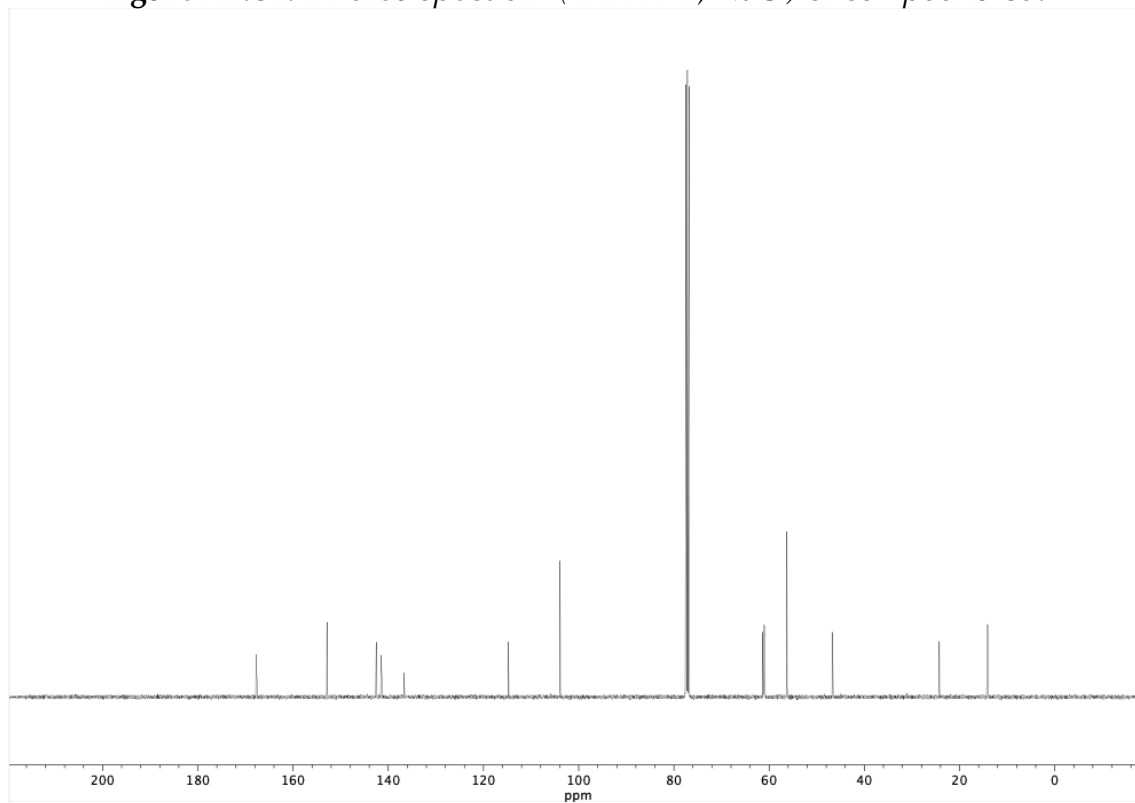


Figure A1.85. ^{13}C NMR (100 MHz, CDCl_3) of compound **8d**.

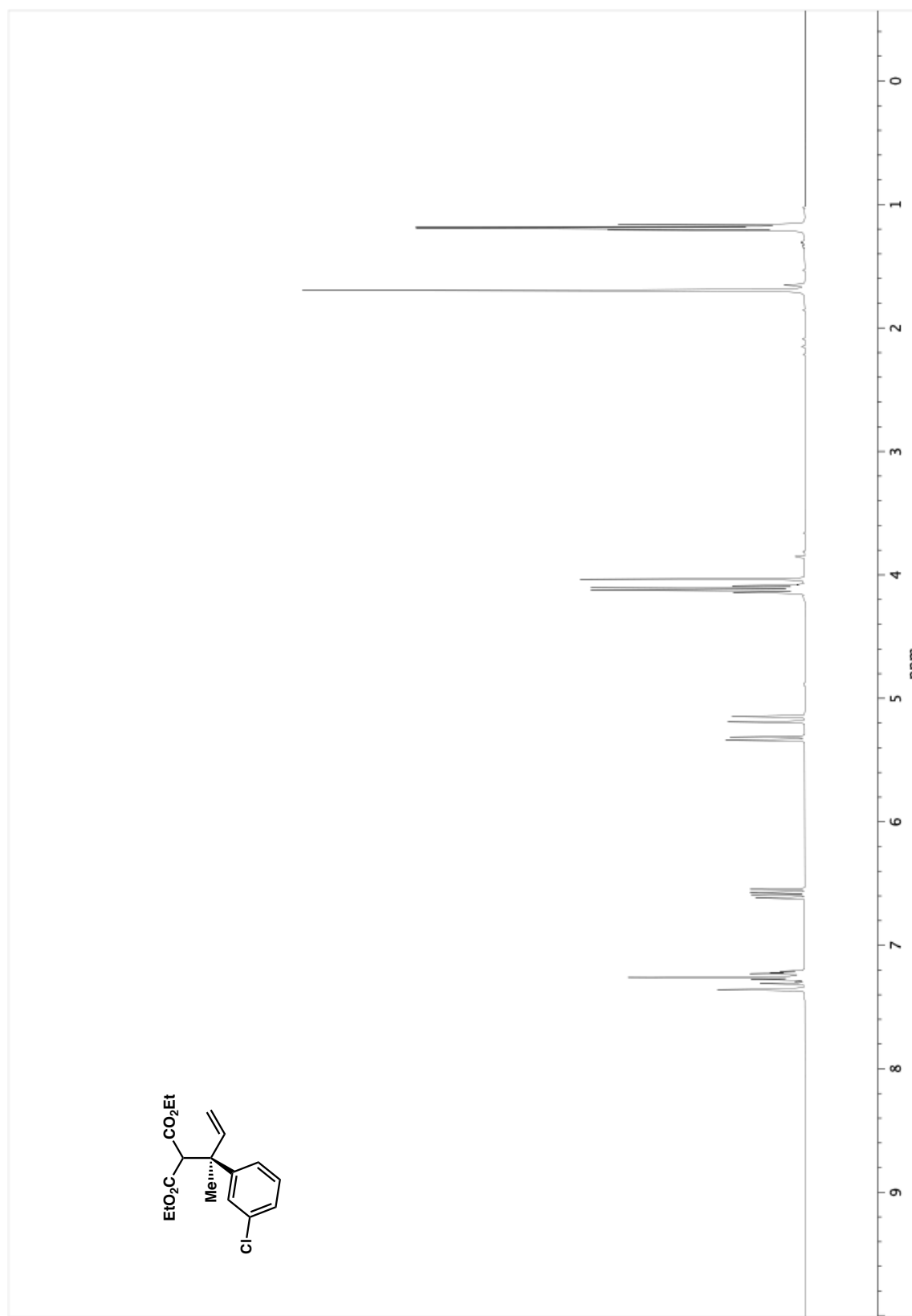


Figure A1.86. ¹H NMR (400 MHz, CDCl₃) of compound **9a**.

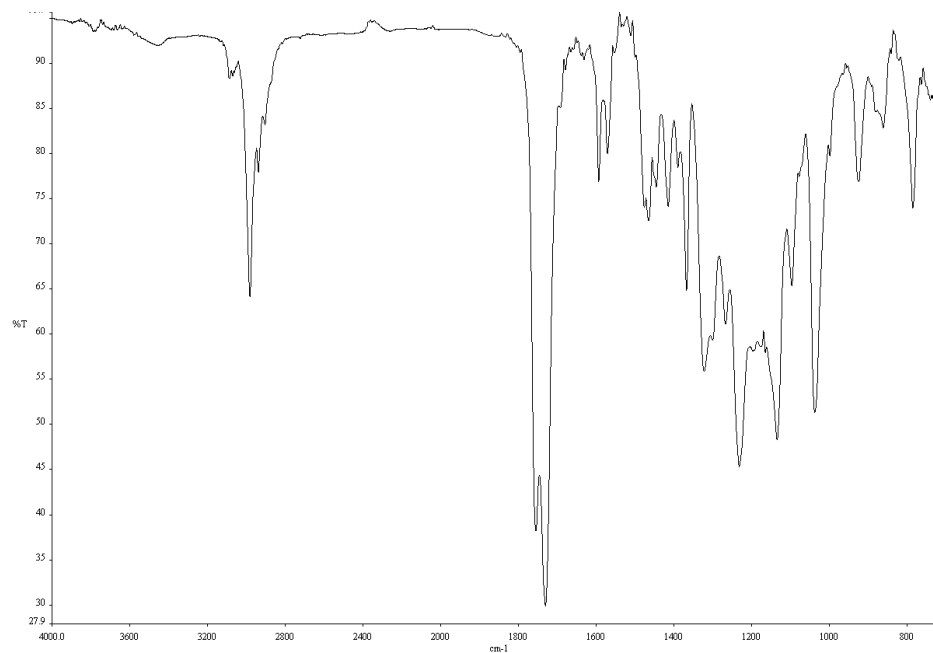


Figure A1.87. Infrared spectrum (Thin Film, NaCl) of compound **9a**.

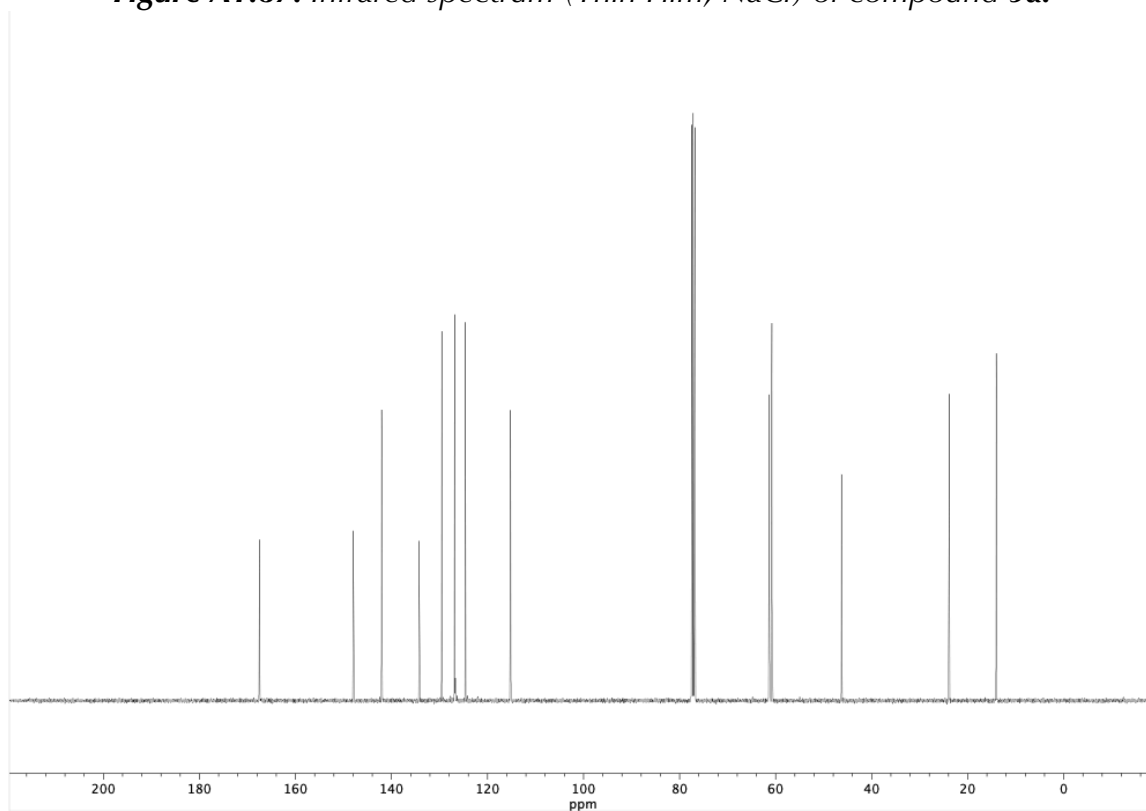


Figure A1.88. ^{13}C NMR (100 MHz, CDCl_3) of compound **9a**.

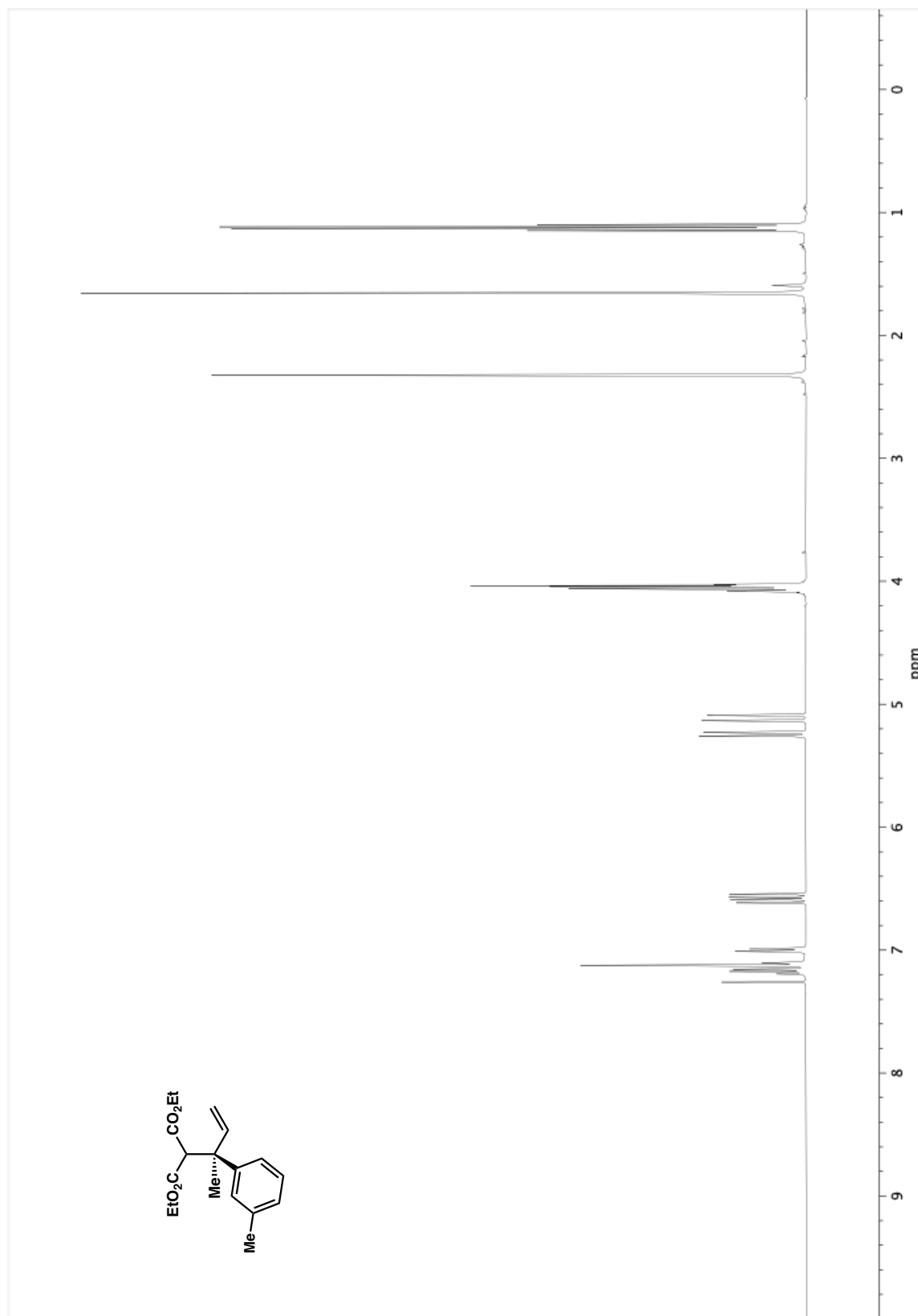


Figure A1.89. ¹H NMR (400 MHz, CDCl₃) of compound **9b**.

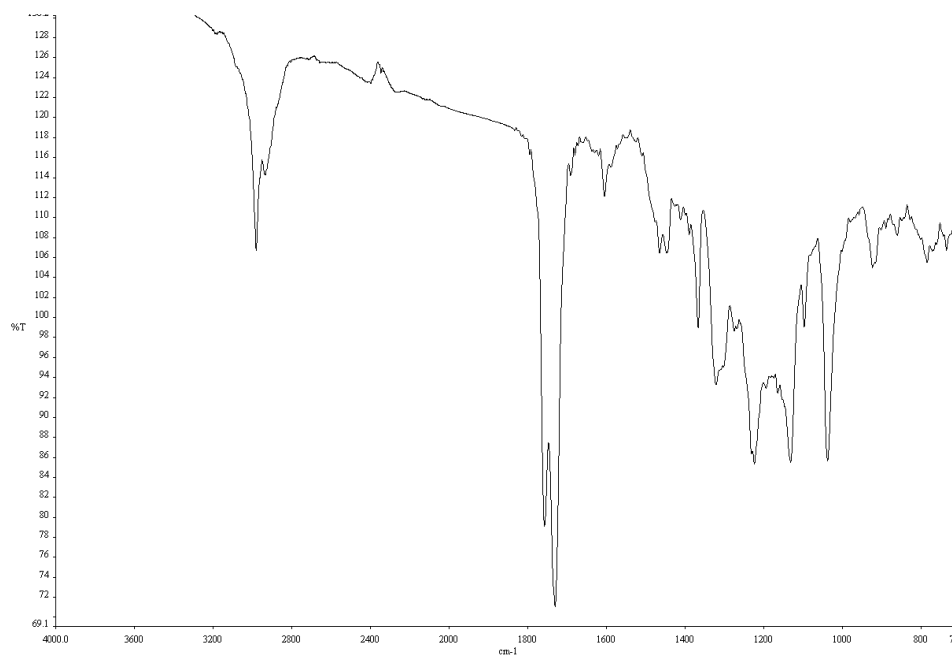


Figure A1.90. Infrared spectrum (Thin Film, NaCl) of compound **9b**.

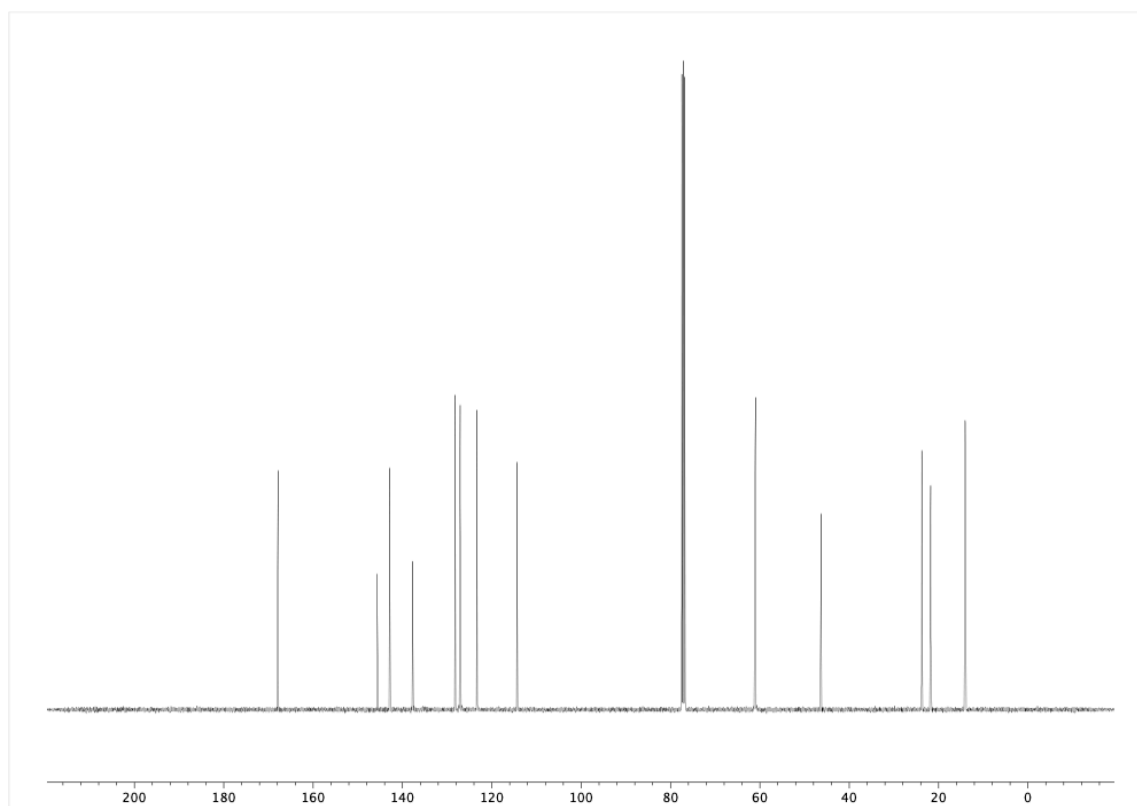


Figure A1.91. ¹³C NMR (100 MHz, CDCl₃) of compound **9b**.

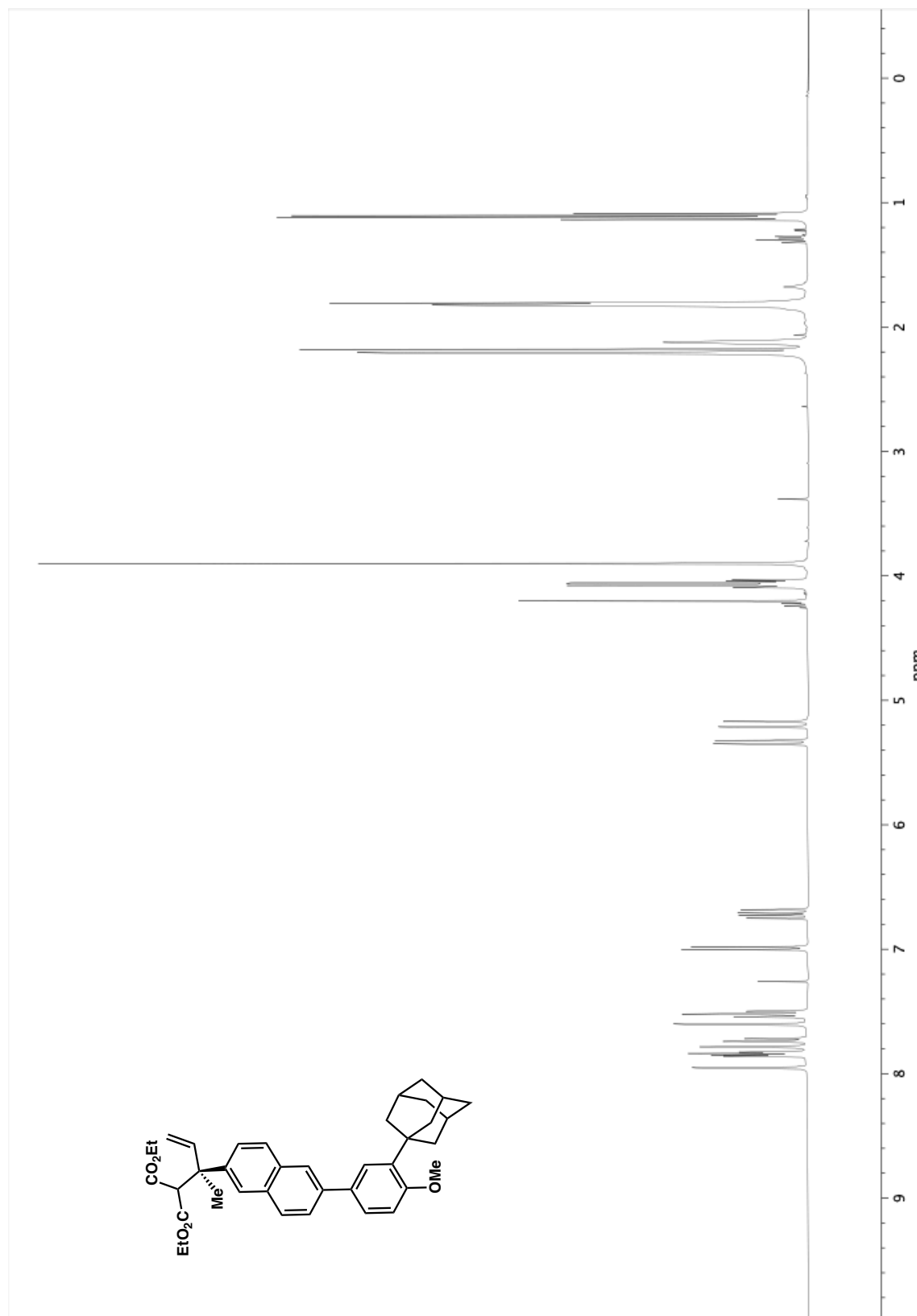


Figure A1.92. ^1H NMR (400 MHz, CDCl_3) of compound **10**.

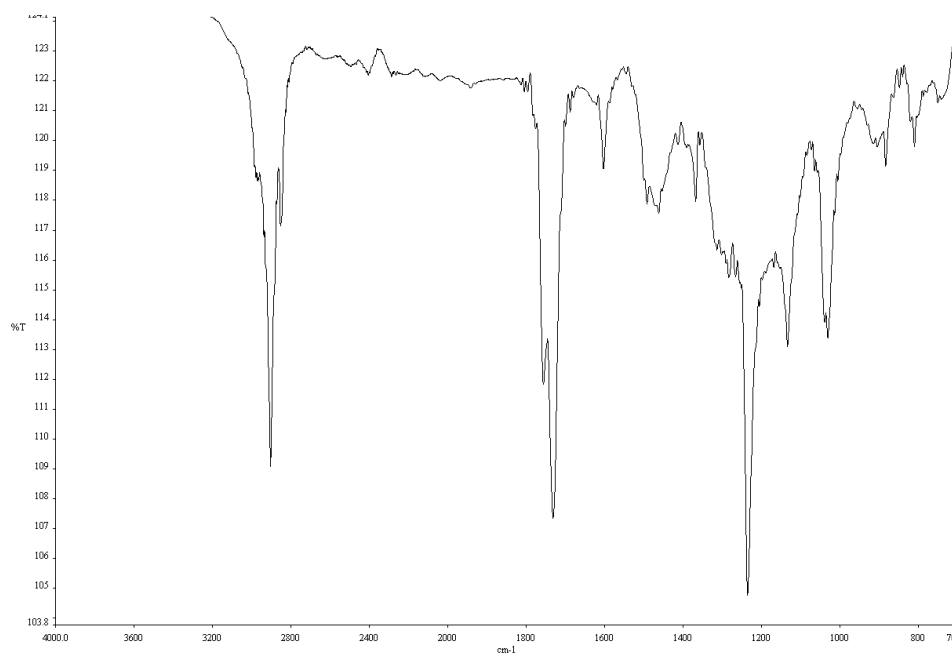


Figure A1.93. Infrared spectrum (Thin Film, NaCl) of compound **10**.

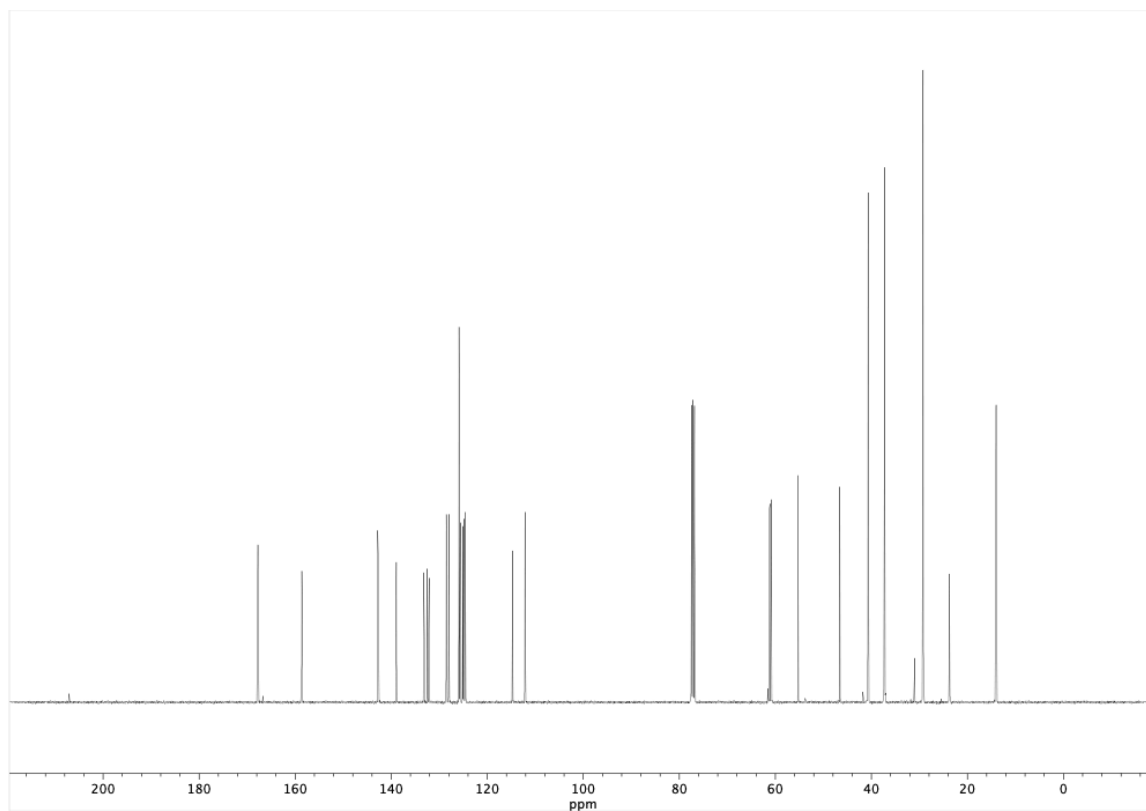


Figure A1.94. ¹³C NMR (100 MHz, CDCl₃) of compound **10**.

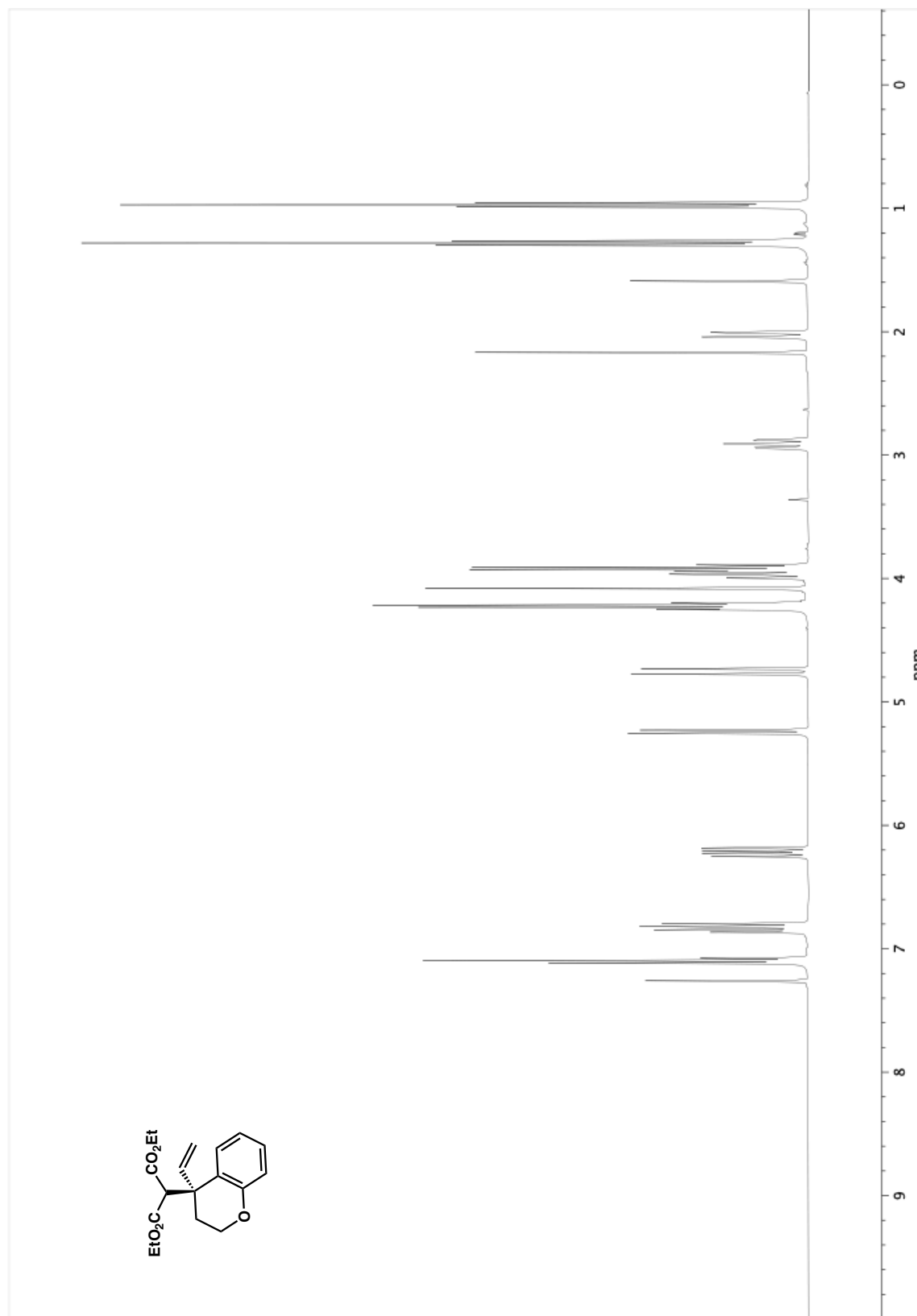


Figure A1.95. ^1H NMR (400 MHz, CDCl_3) of compound **11a**.

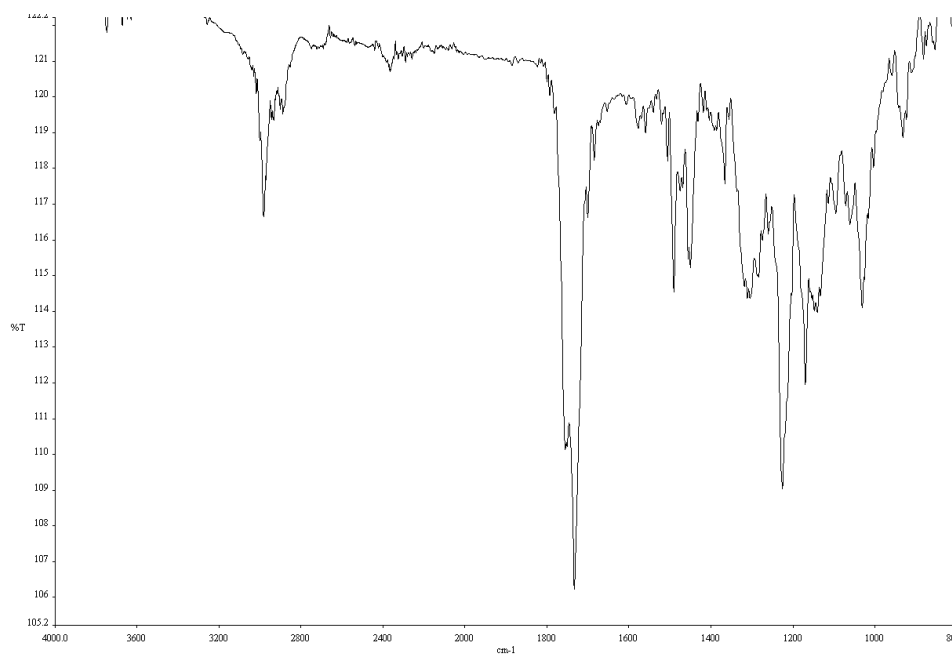


Figure A1.96. Infrared spectrum (Thin Film, NaCl) of compound **11a**.

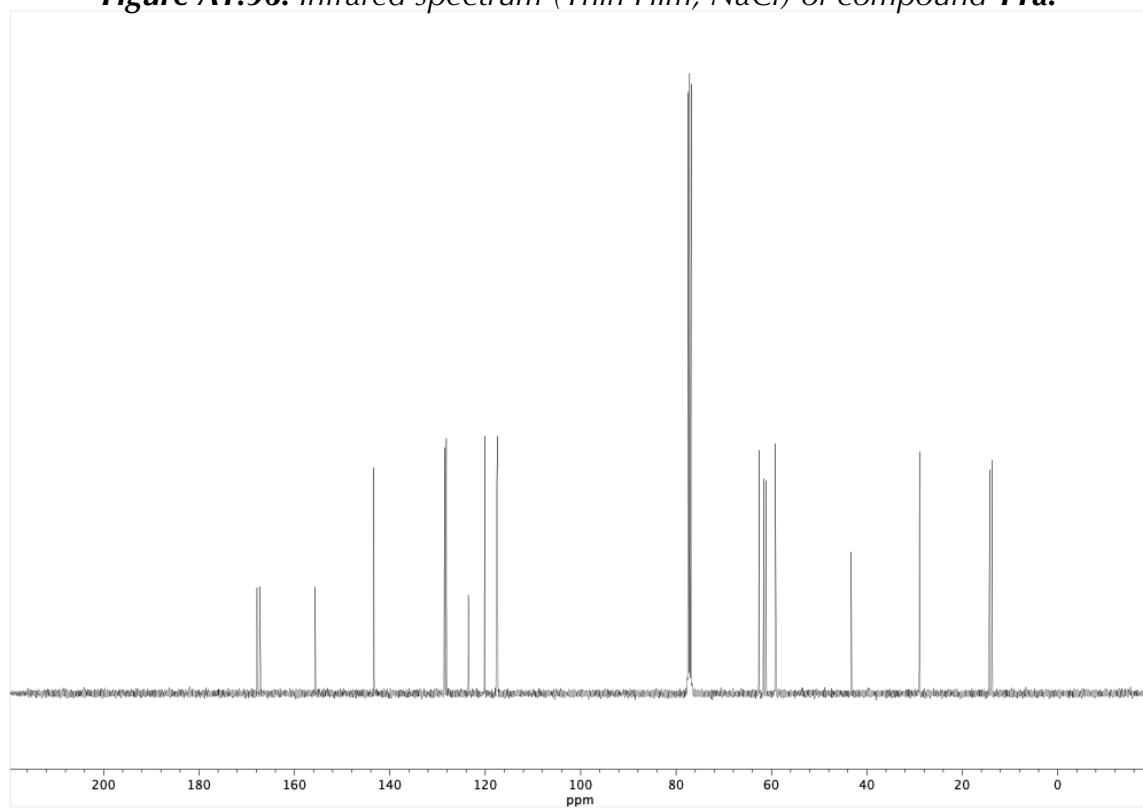


Figure A1.97. ^{13}C NMR (100 MHz, CDCl_3) of compound **11a**.

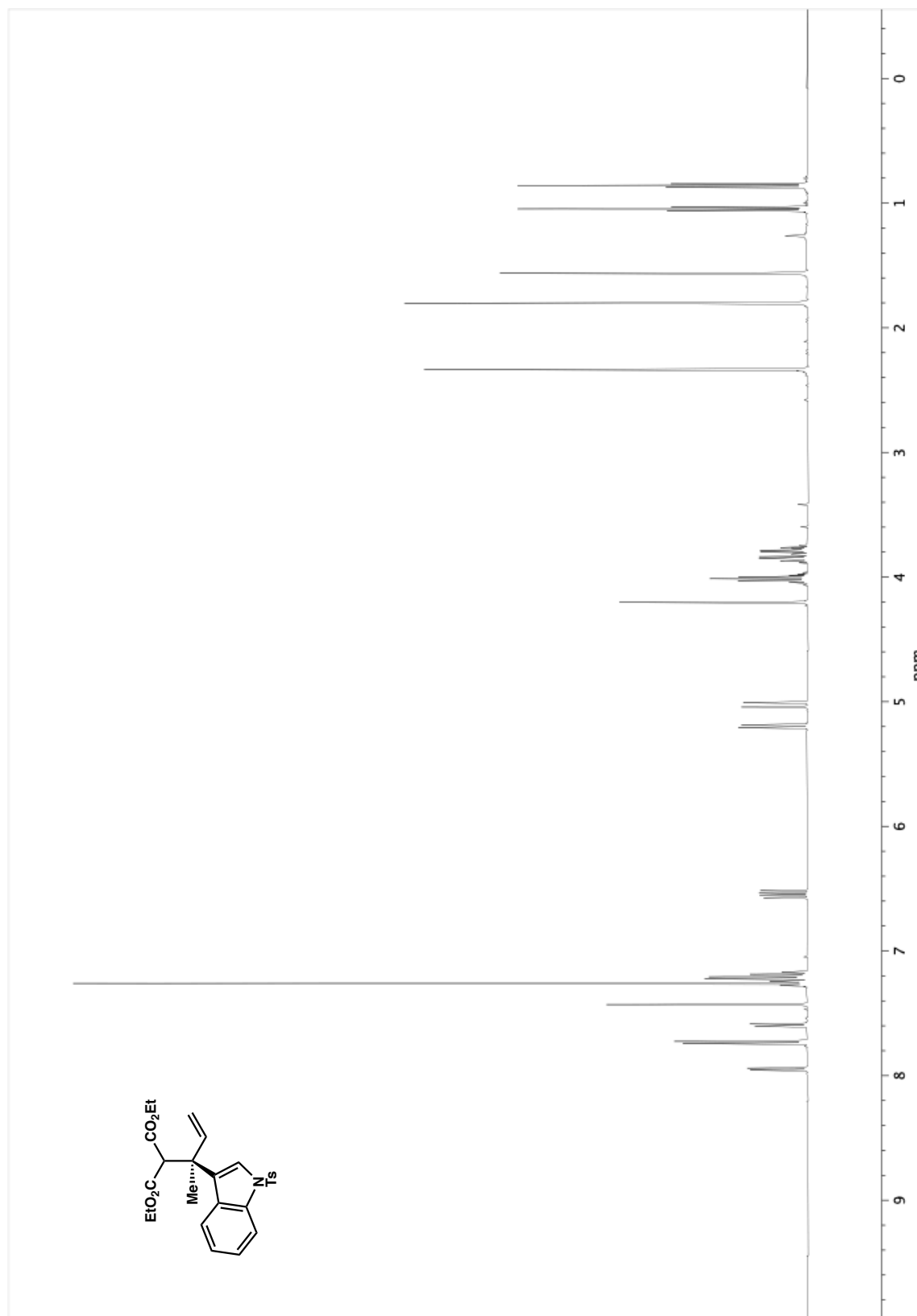


Figure A1.98. ¹H NMR (500 MHz, CDCl₃) of compound **11b**.

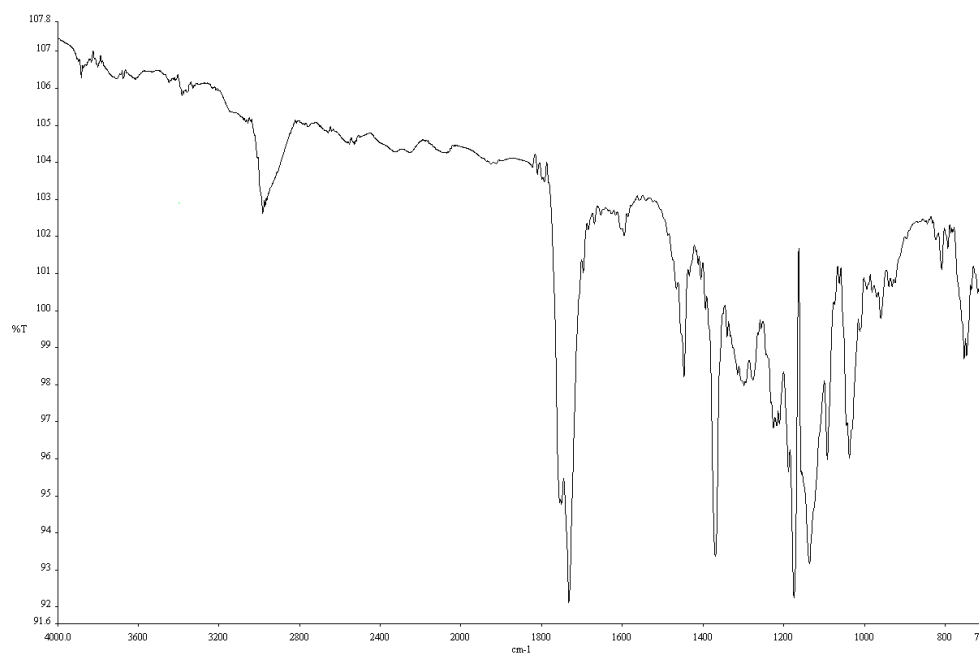


Figure A1.99. Infrared spectrum (Thin Film, NaCl) of compound **11b**.

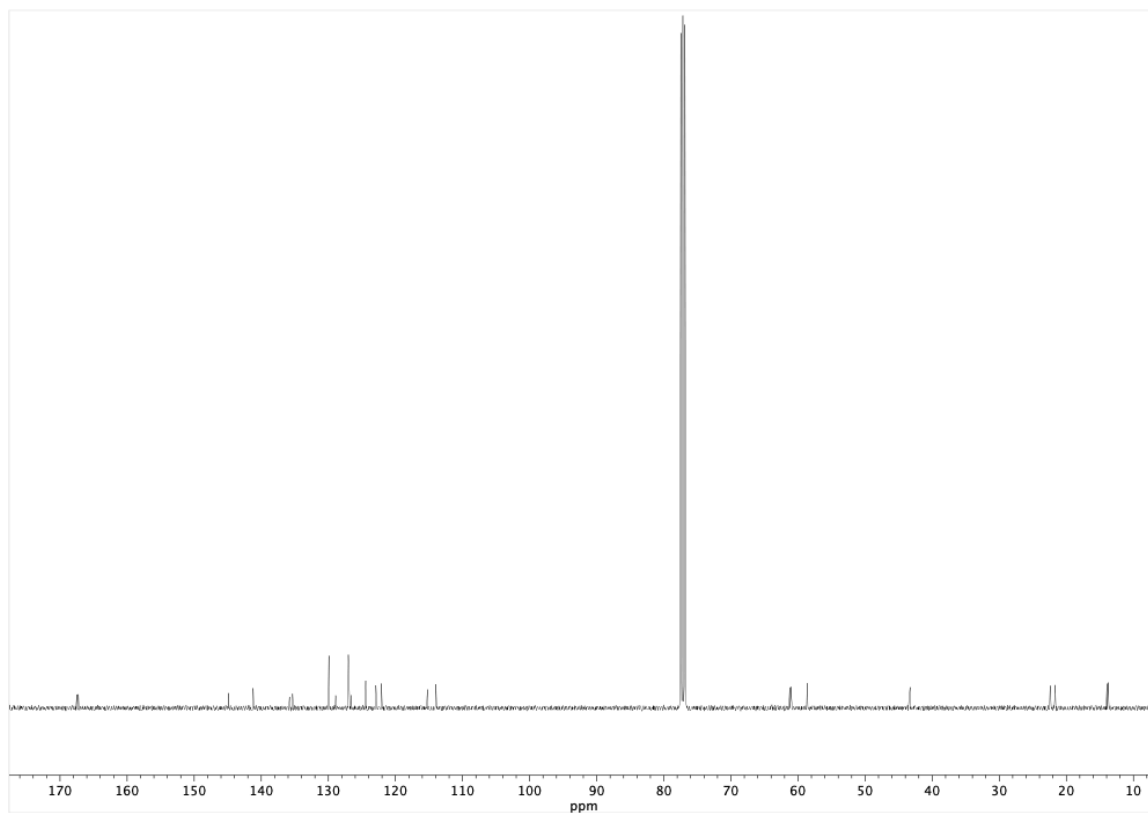


Figure A1.100. ¹³C NMR (100 MHz, CDCl₃) of compound **11b**.

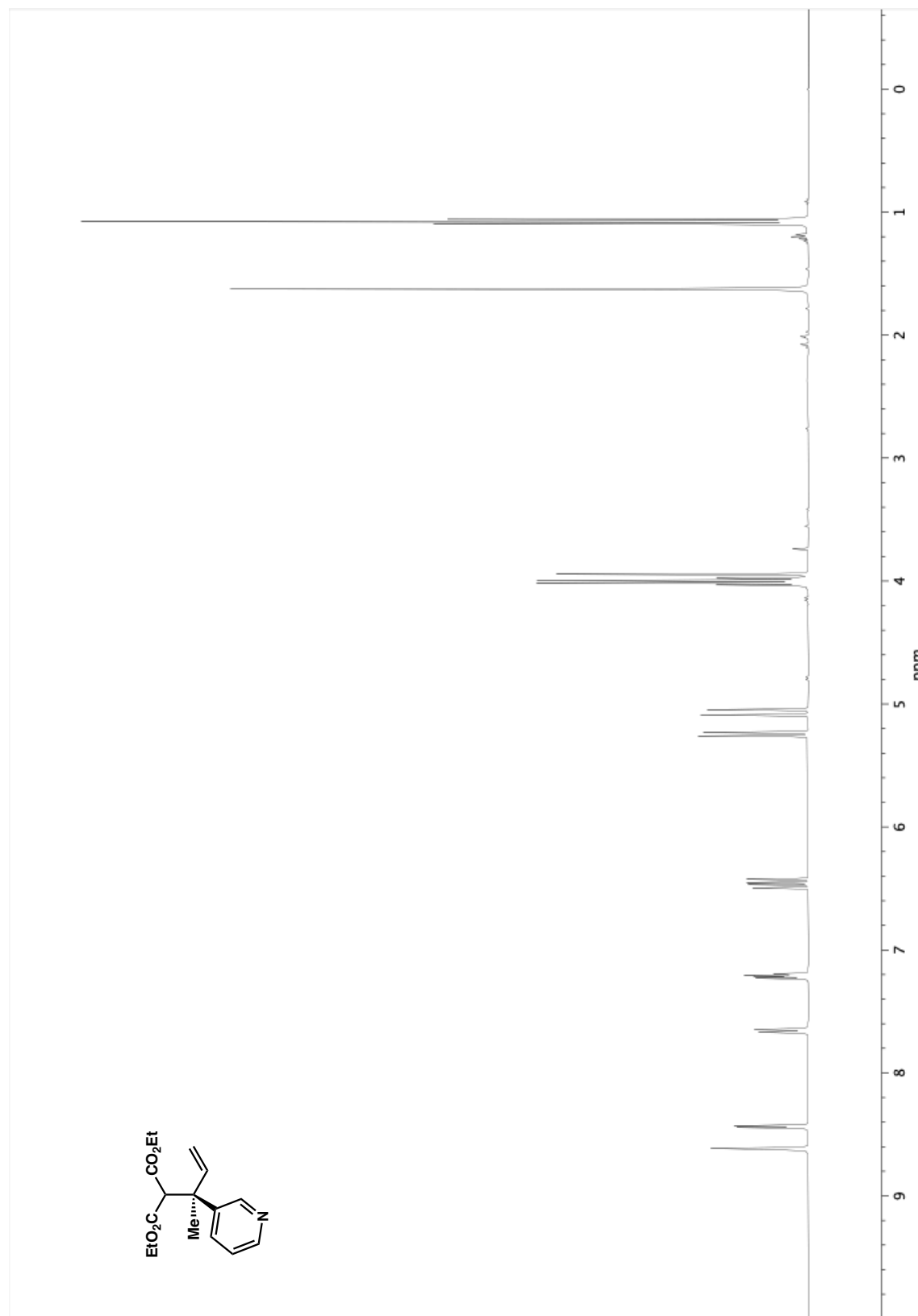


Figure A1.101. ¹H NMR (400 MHz, CDCl₃) of compound **11c**.

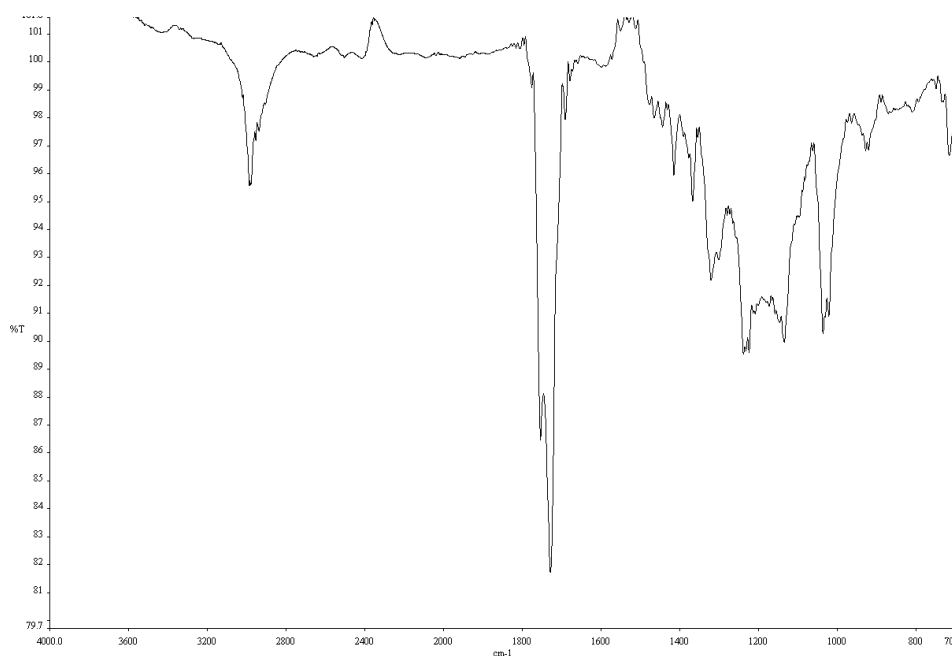


Figure A1.102. Infrared spectrum (Thin Film, NaCl) of compound **11c**.

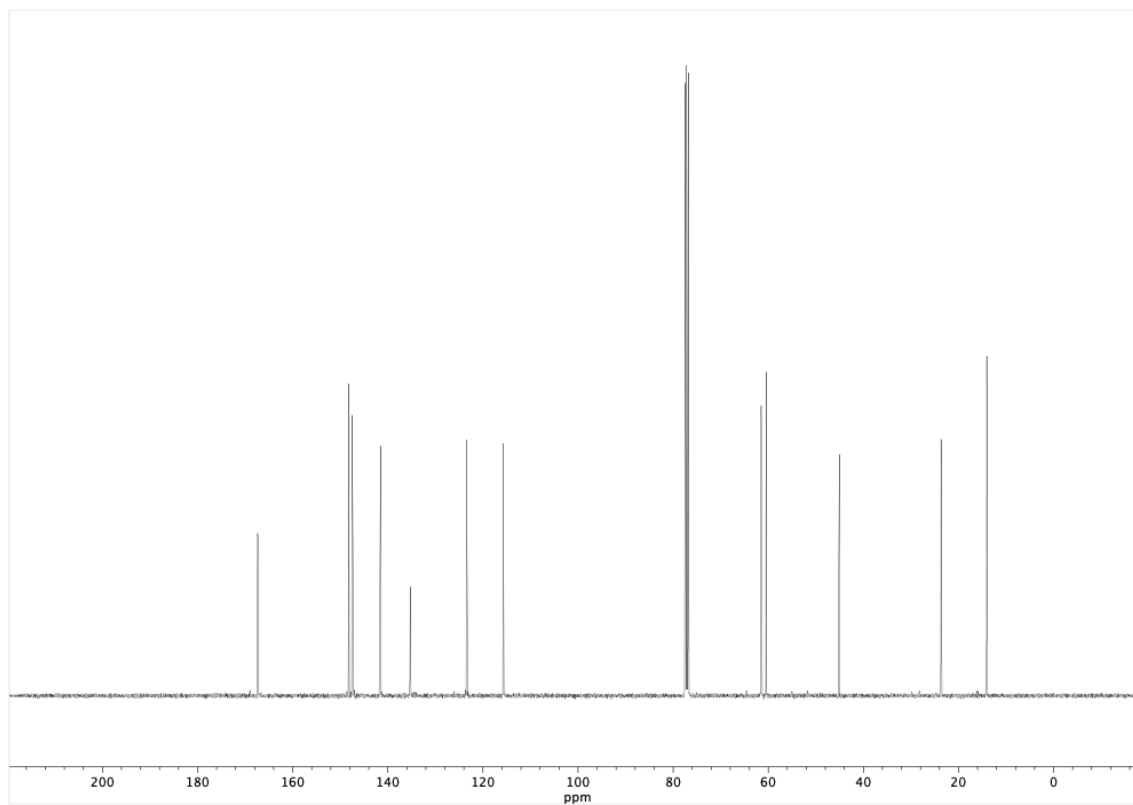


Figure A1.103. ¹³C NMR (100 MHz, CDCl₃) of compound **11c**.

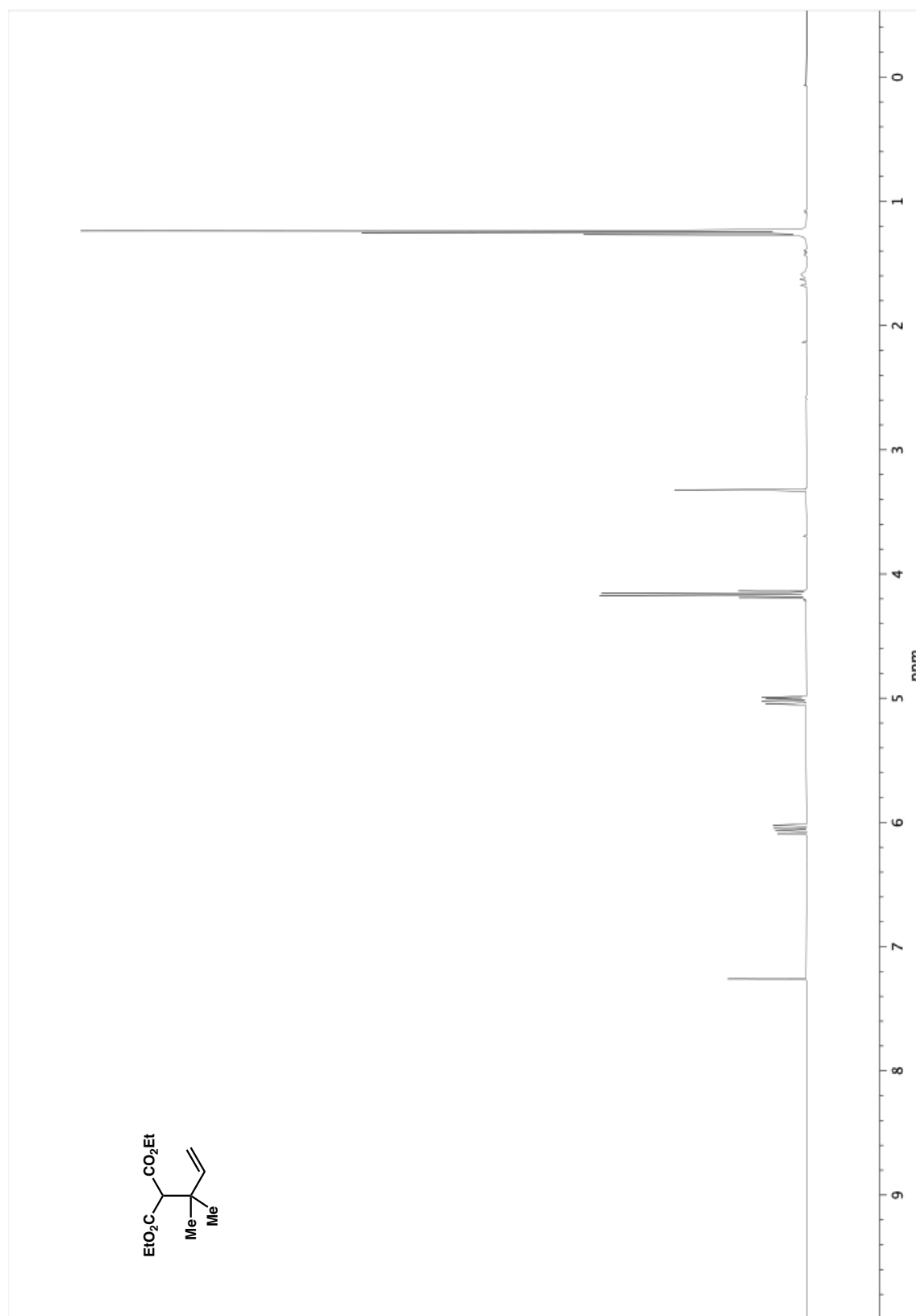


Figure A1.104. ^1H NMR (400 MHz, CDCl_3) of compound **14a**.

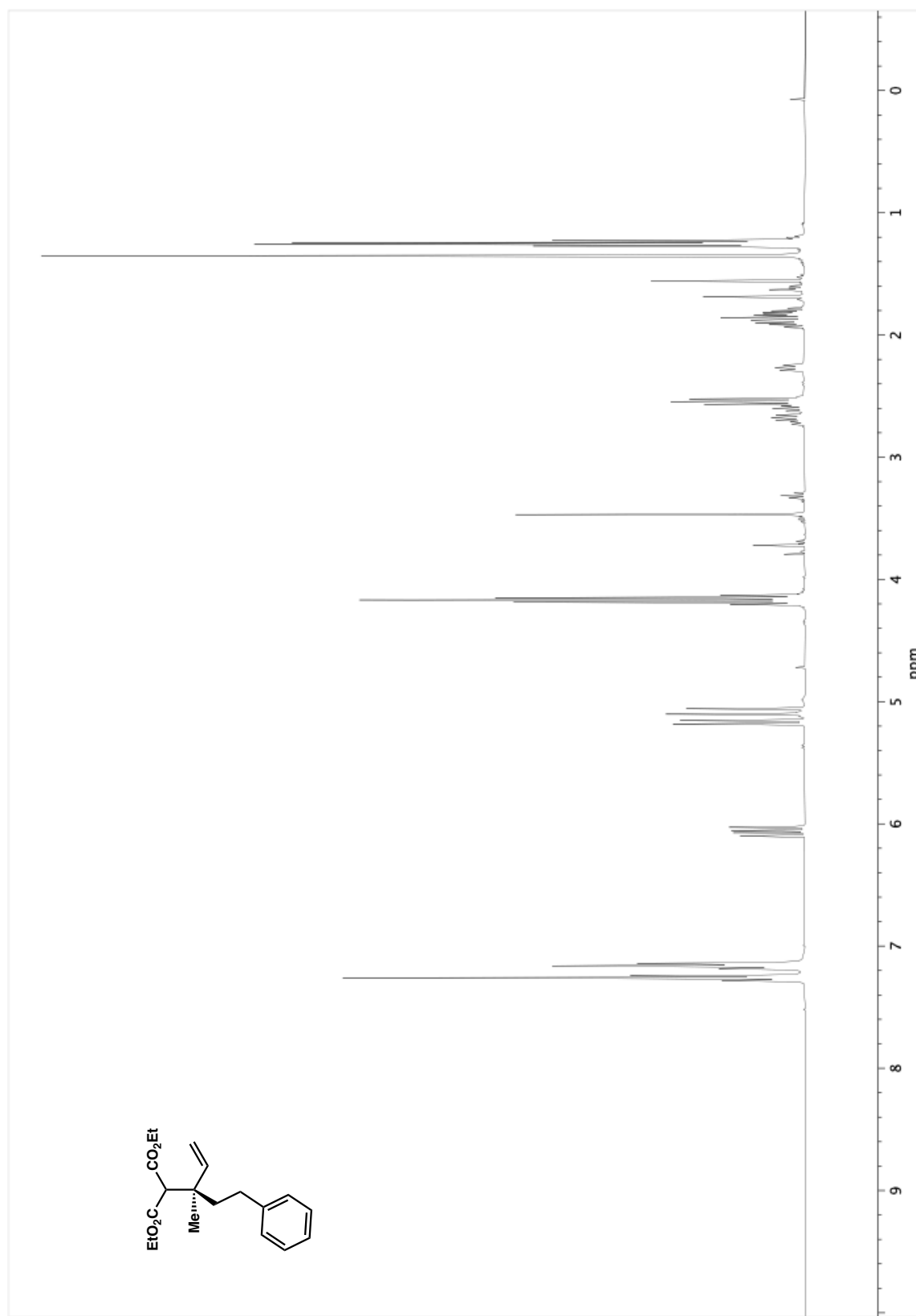


Figure A1.105. ¹H NMR (400 MHz, CDCl₃) of compound **14b**.

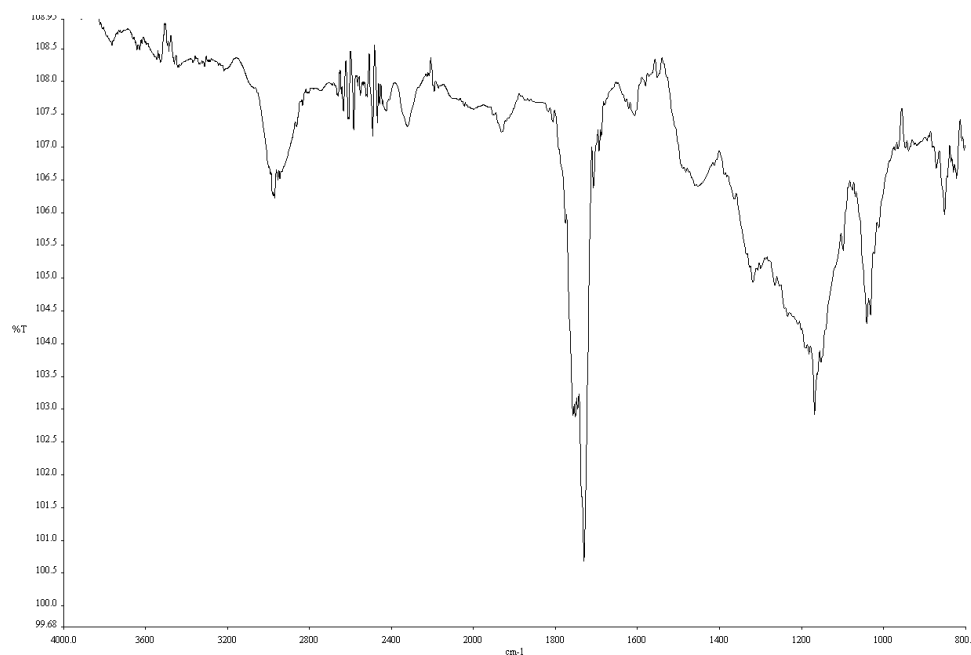


Figure A1.106. Infrared spectrum (Thin Film, NaCl) of compound **14b**.

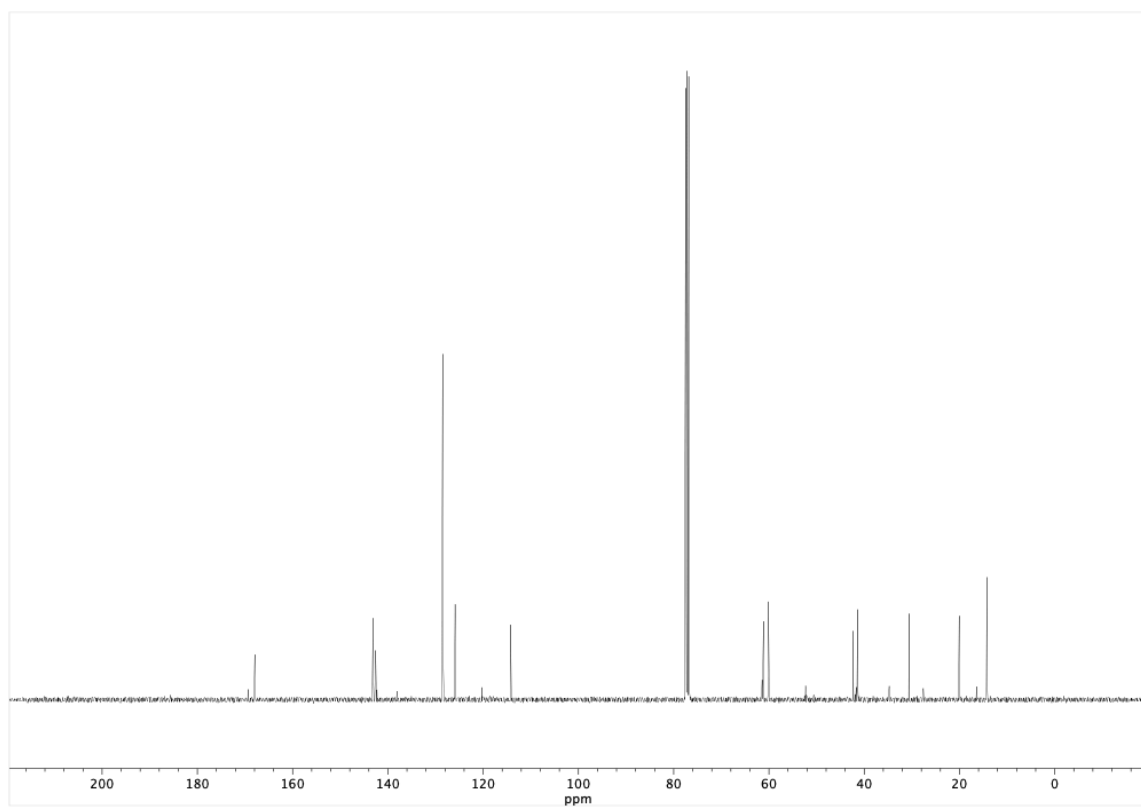


Figure A1.107. ^{13}C NMR (100 MHz, CDCl_3) of compound **14b**.

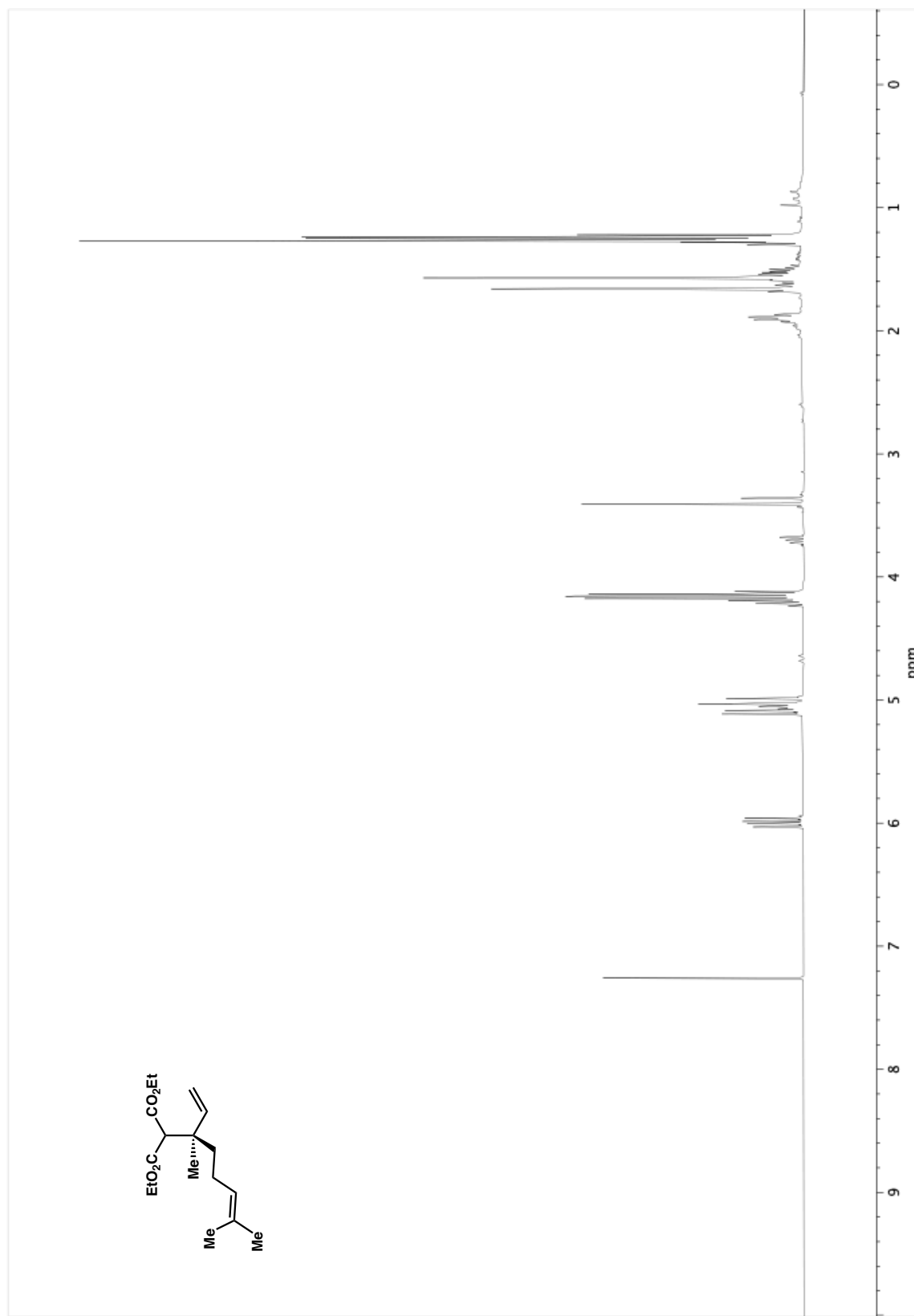


Figure A1.108. ¹H NMR (400 MHz, CDCl₃) of compound **14c**.



Figure A1.109. Infrared spectrum (Thin Film, NaCl) of compound **14c**.

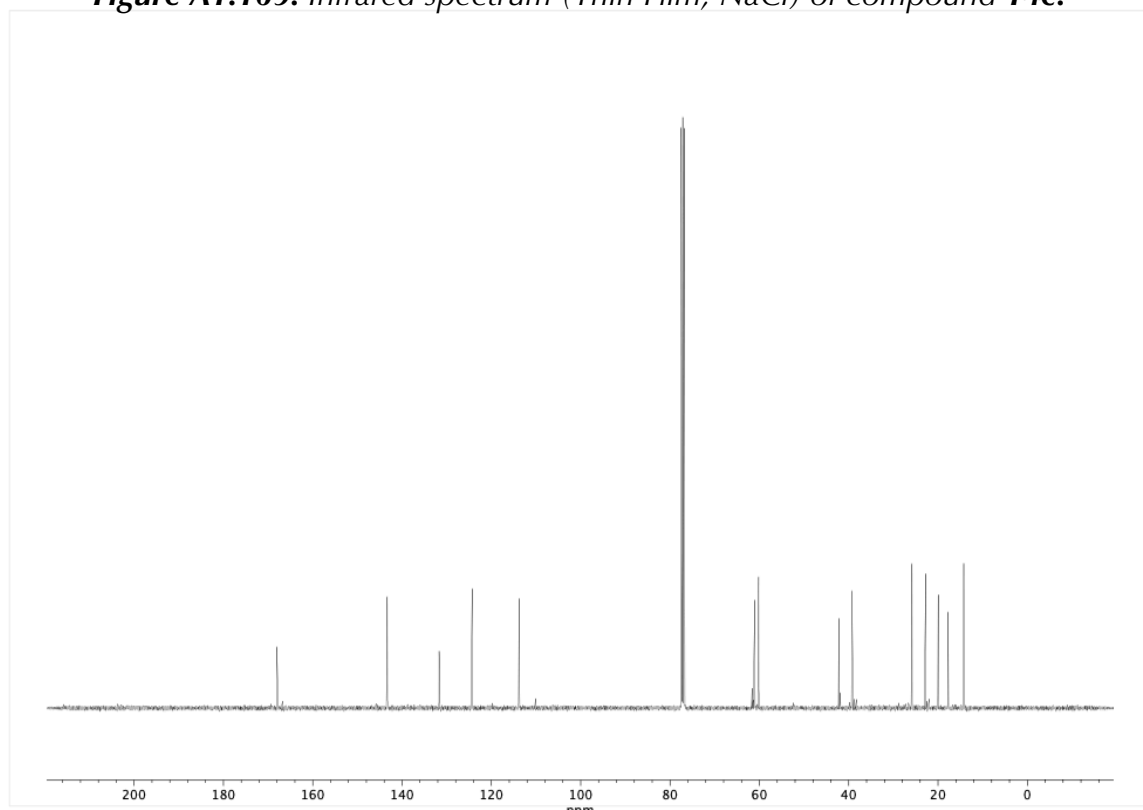


Figure A1.110. ^{13}C NMR (100 MHz, CDCl_3) of compound **14c**.

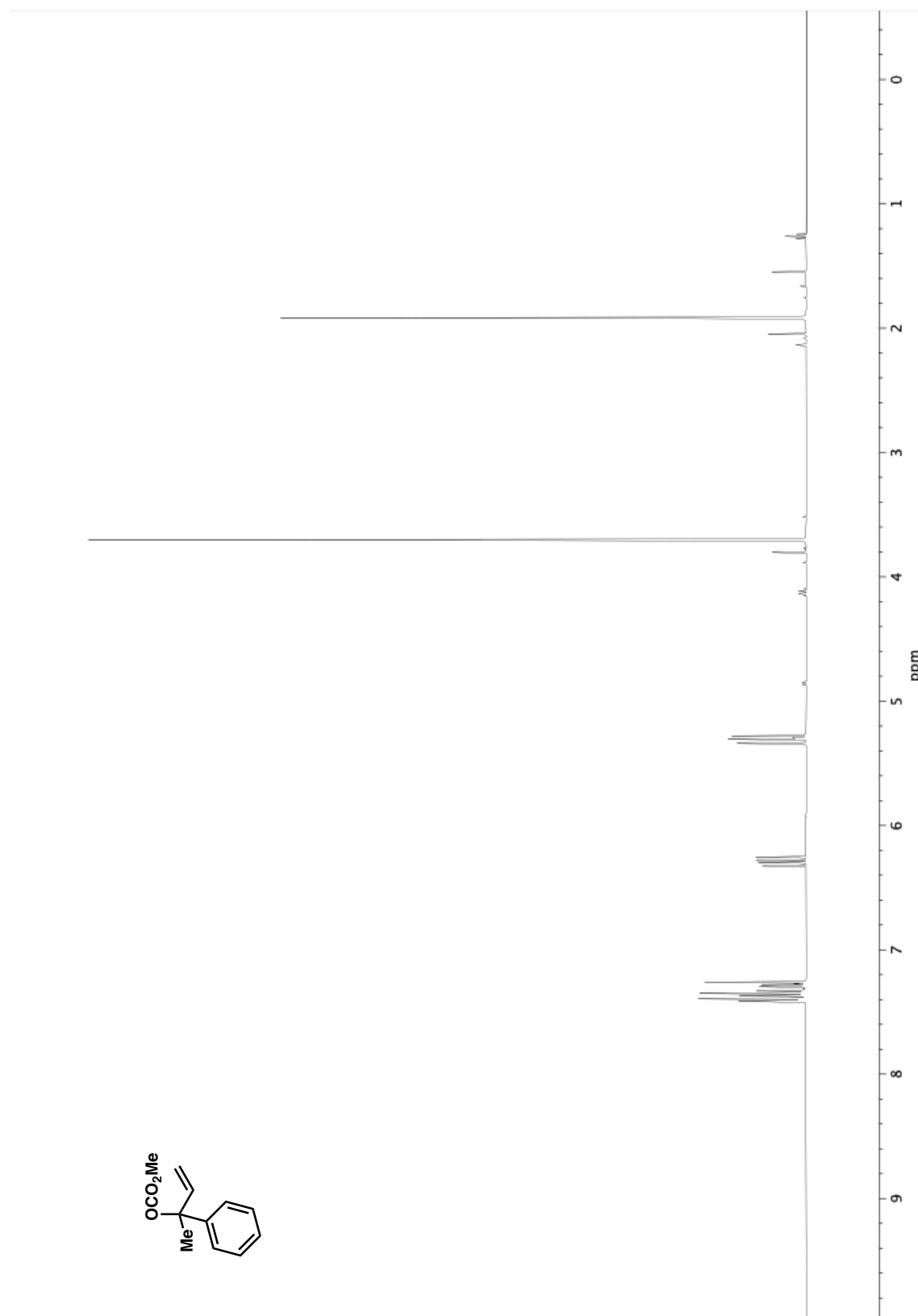


Figure A1.111. ¹H NMR (400 MHz, CDCl₃) of compound **17a**.

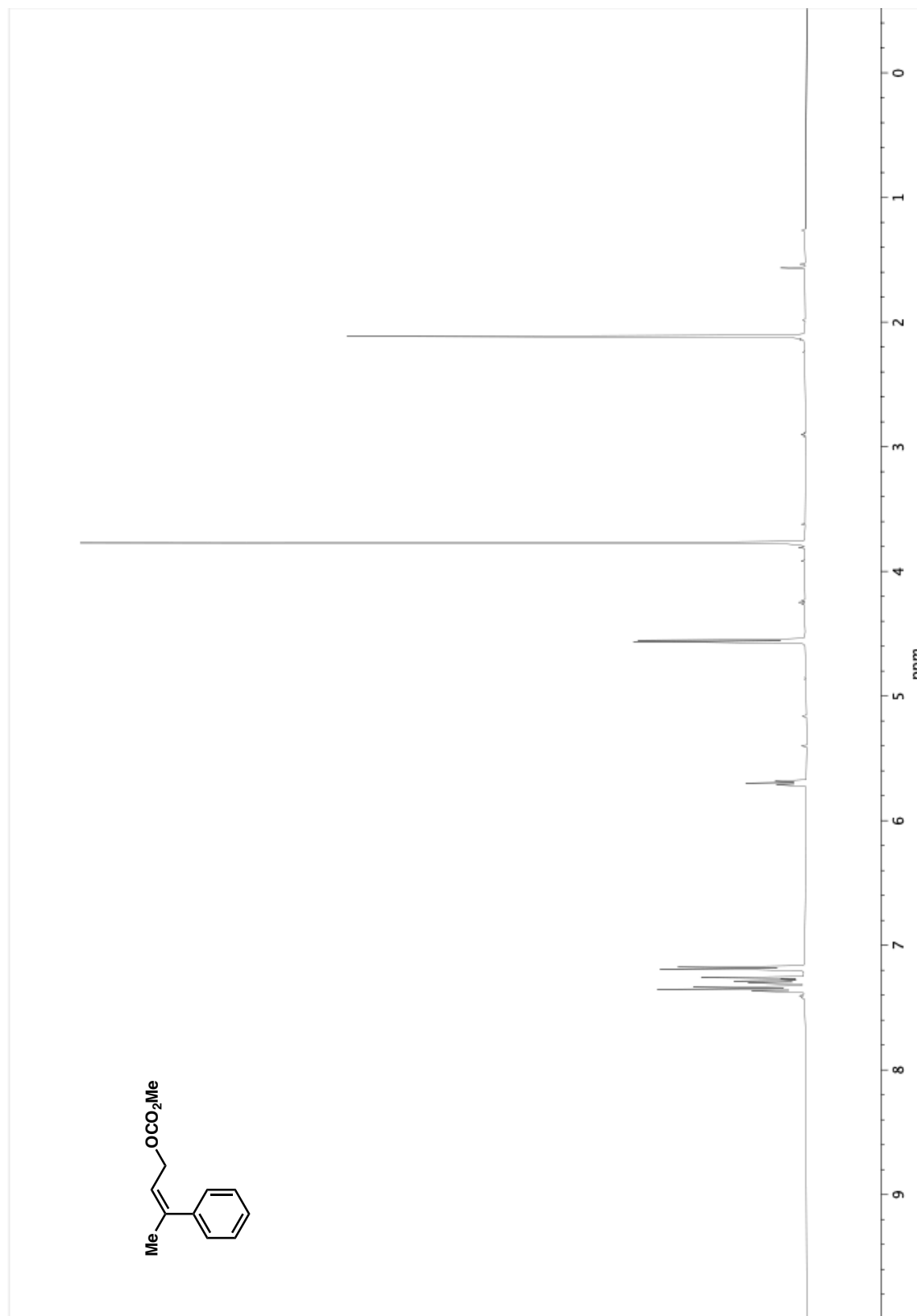


Figure A1.112. ^1H NMR (500 MHz, CDCl_3) of compound **17b**.

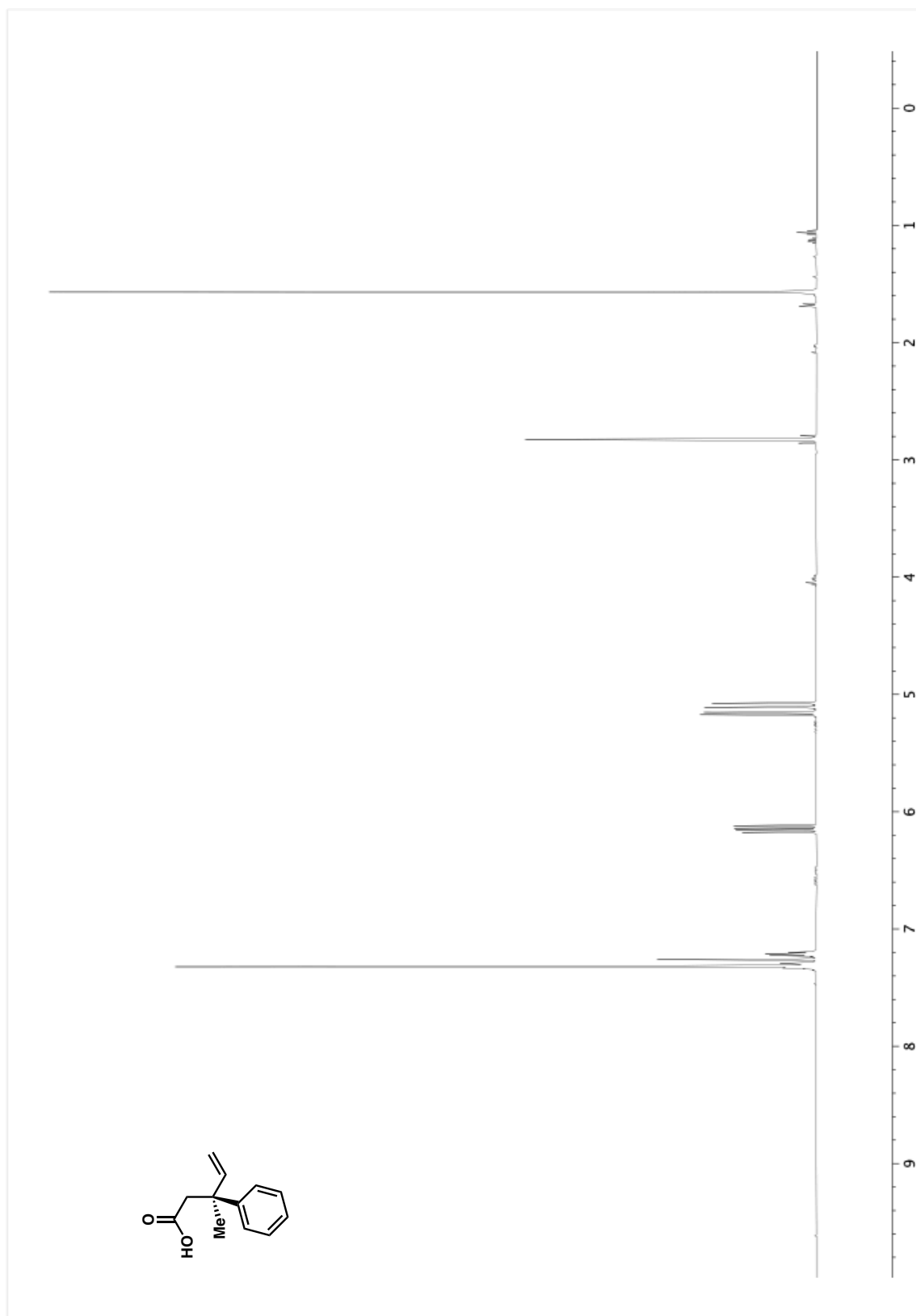


Figure A1.113. ¹H NMR (500 MHz, CDCl₃) of compound **18**.

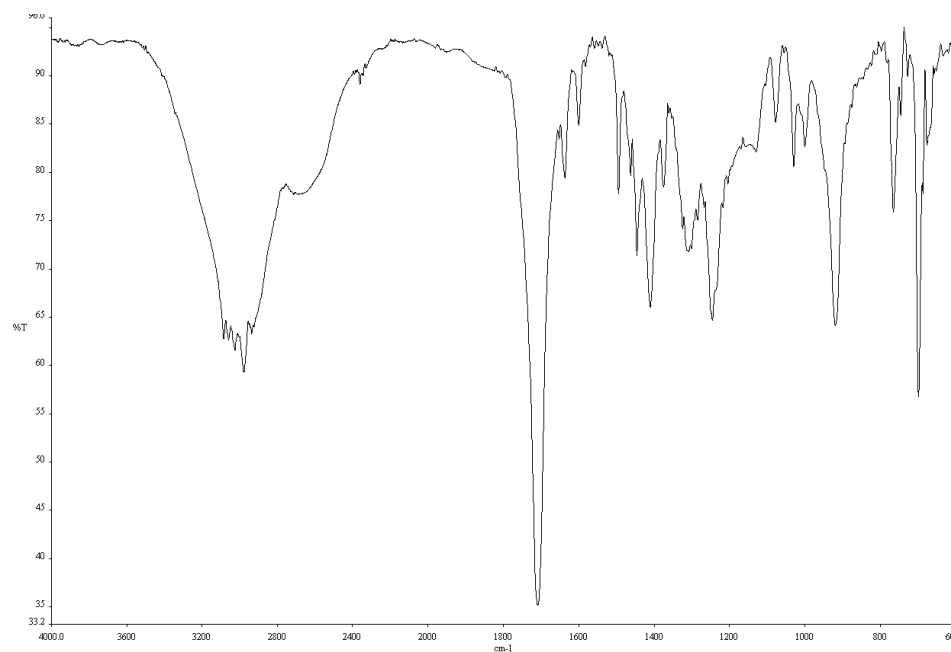


Figure A1.114. Infrared spectrum (Thin Film, NaCl) of compound **18**.

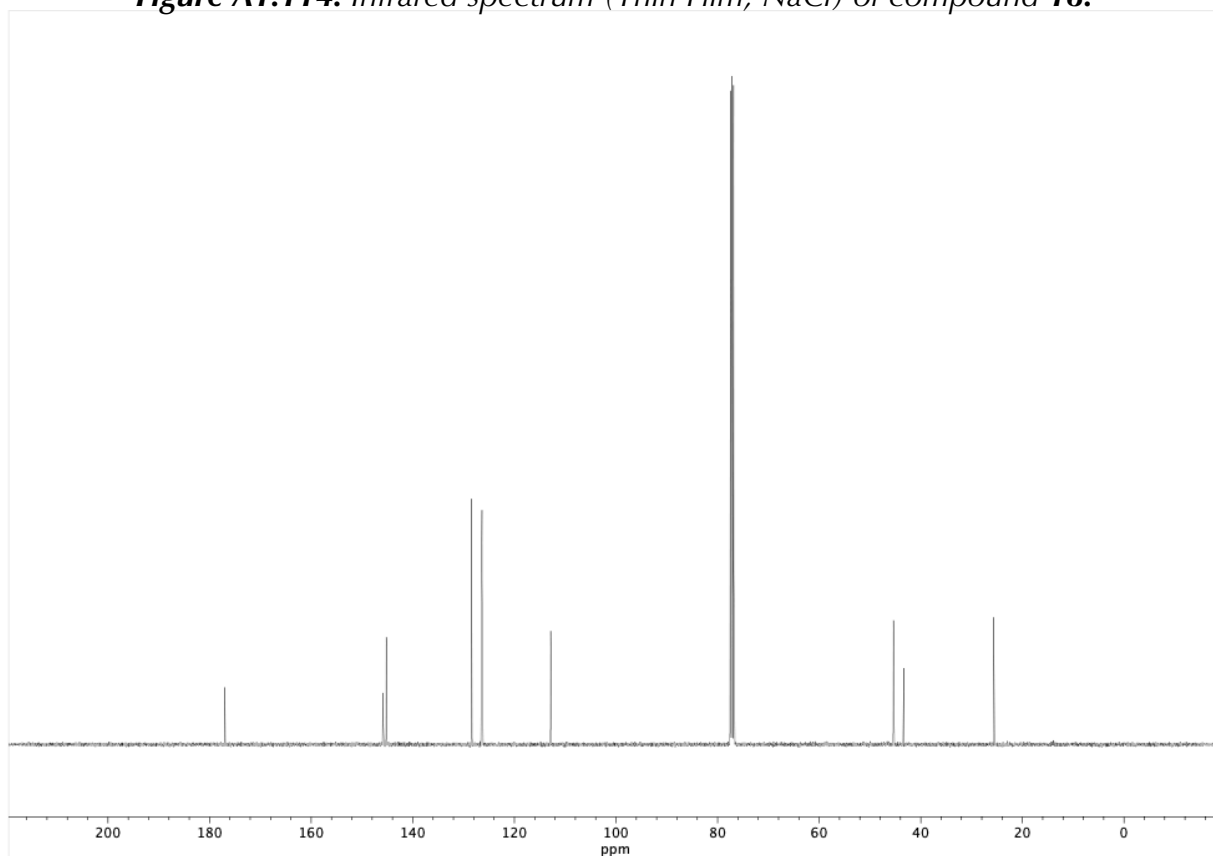


Figure A1.115. ¹³C NMR (100 MHz, CDCl₃) of compound **18**.

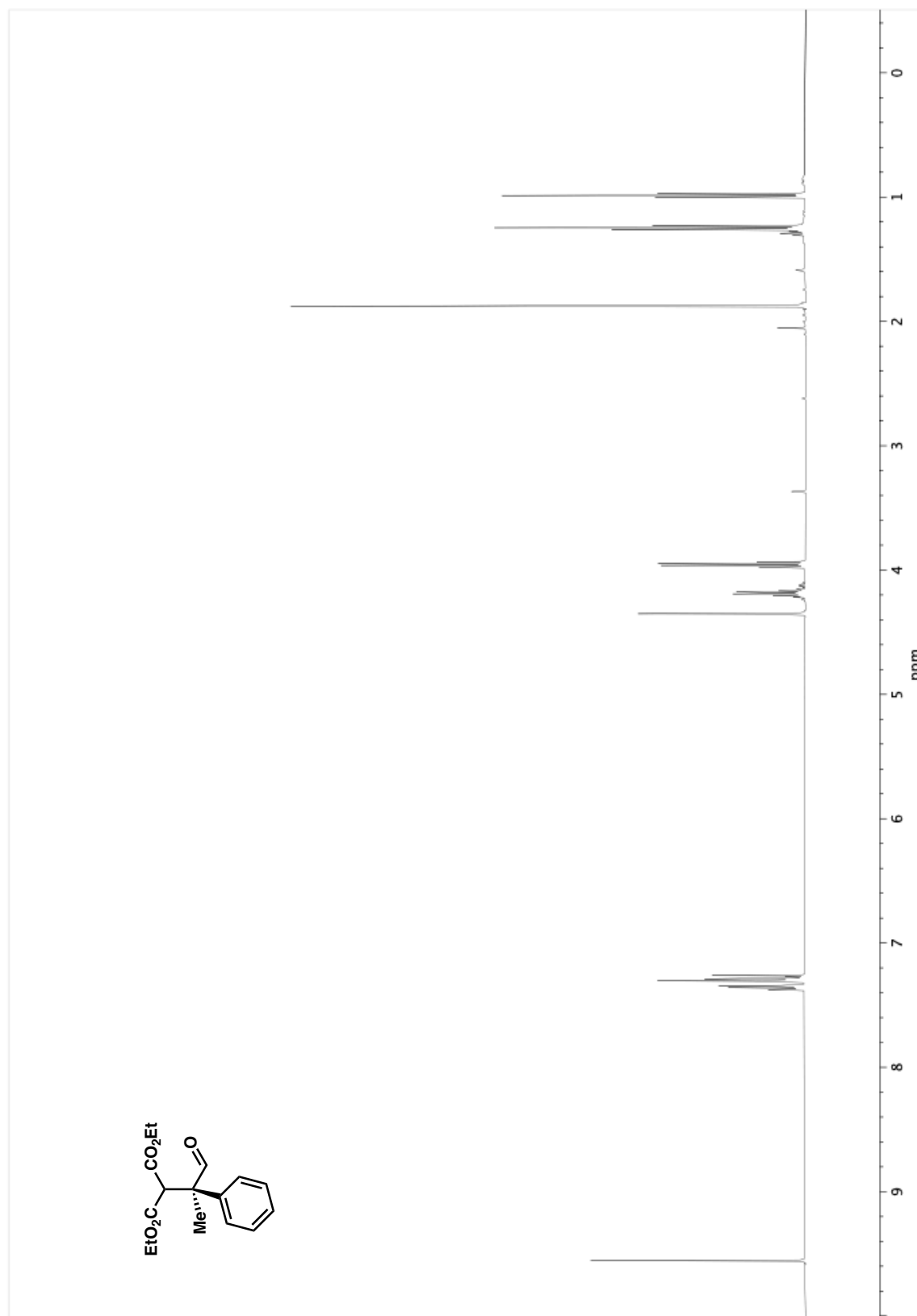


Figure A1.116. ¹H NMR (500 MHz, CDCl₃) of compound **19**.

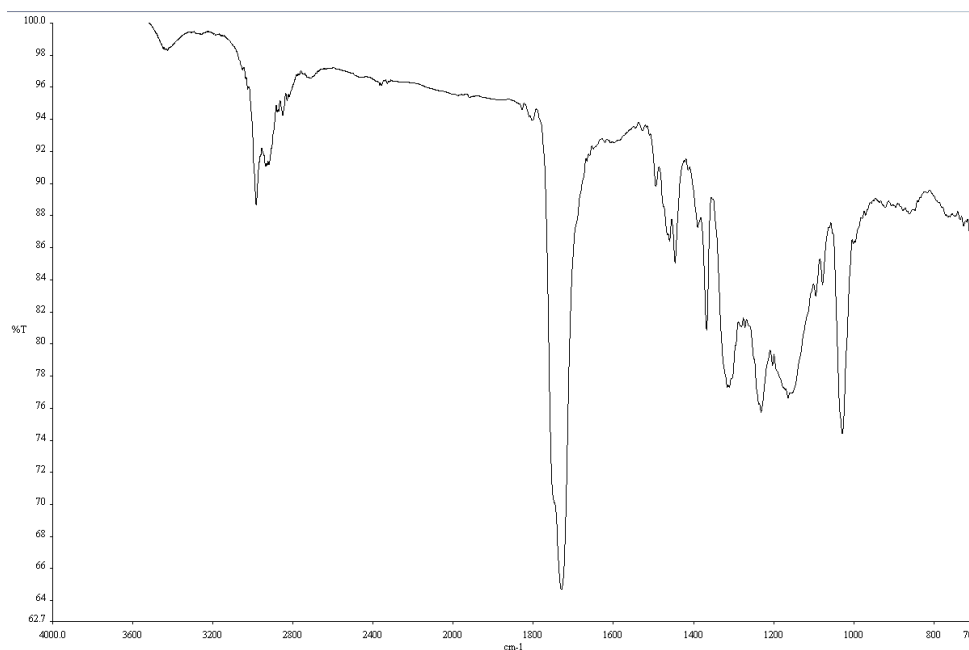


Figure A1.117. Infrared spectrum (Thin Film, NaCl) of compound **19**.

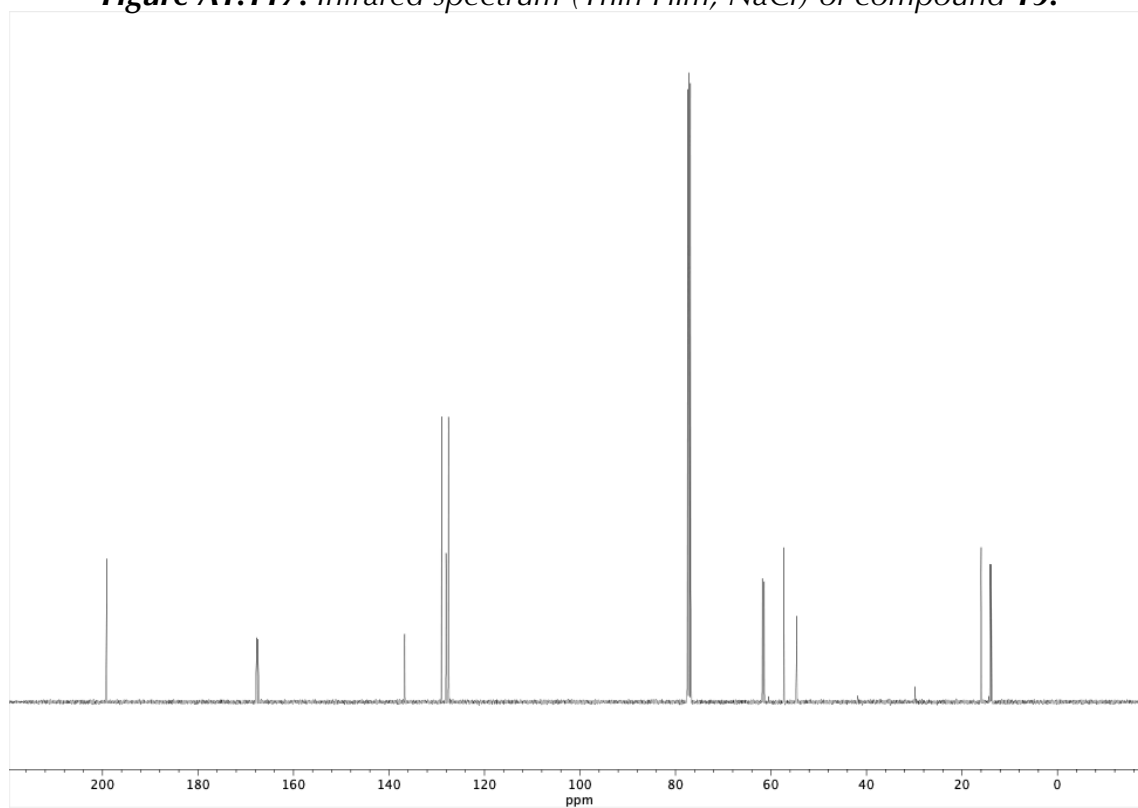


Figure A1.118. ¹³C NMR (100 MHz, CDCl₃) of compound **19**.

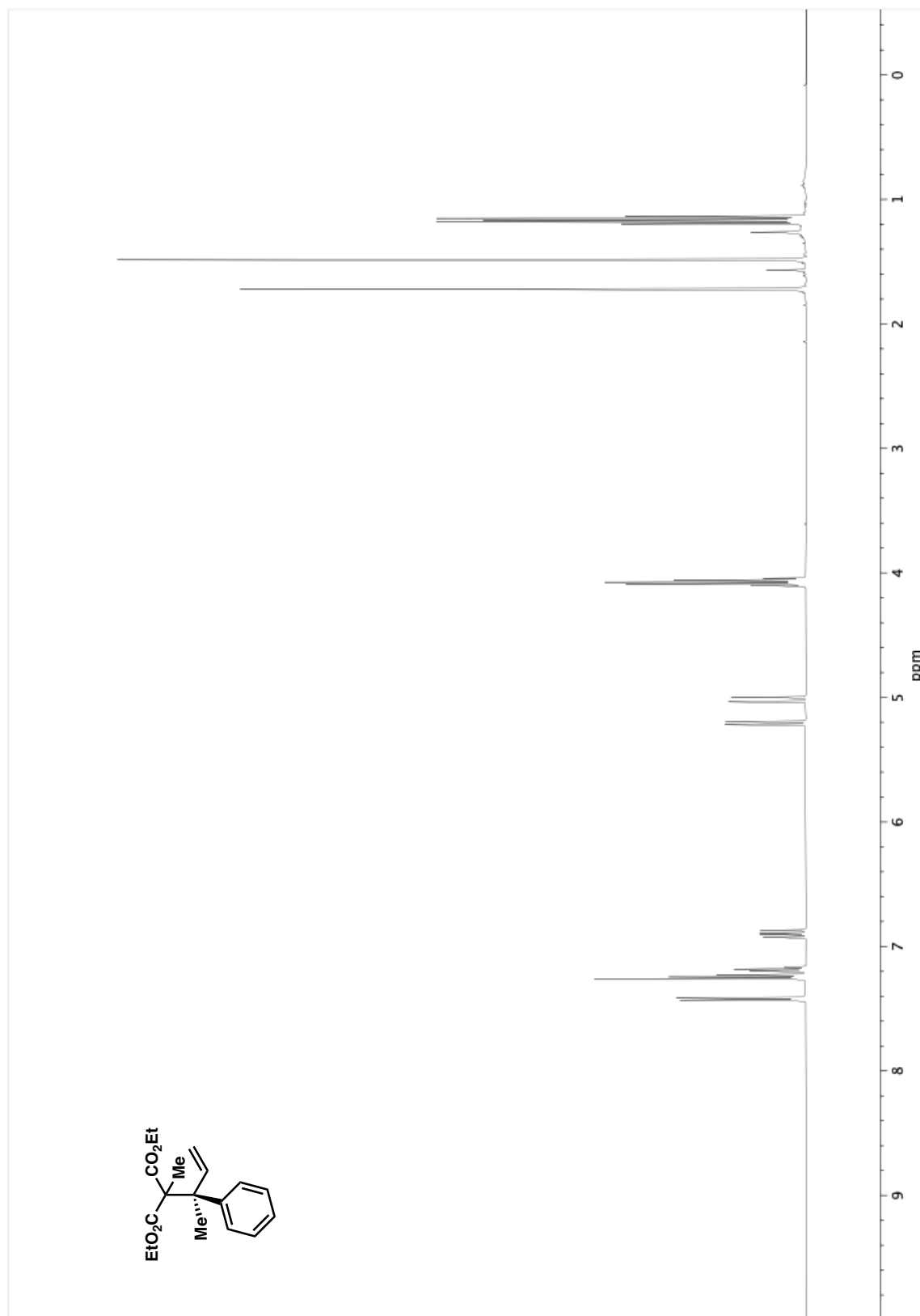


Figure A1.119. ¹H NMR (500 MHz, CDCl₃) of compound **20**.

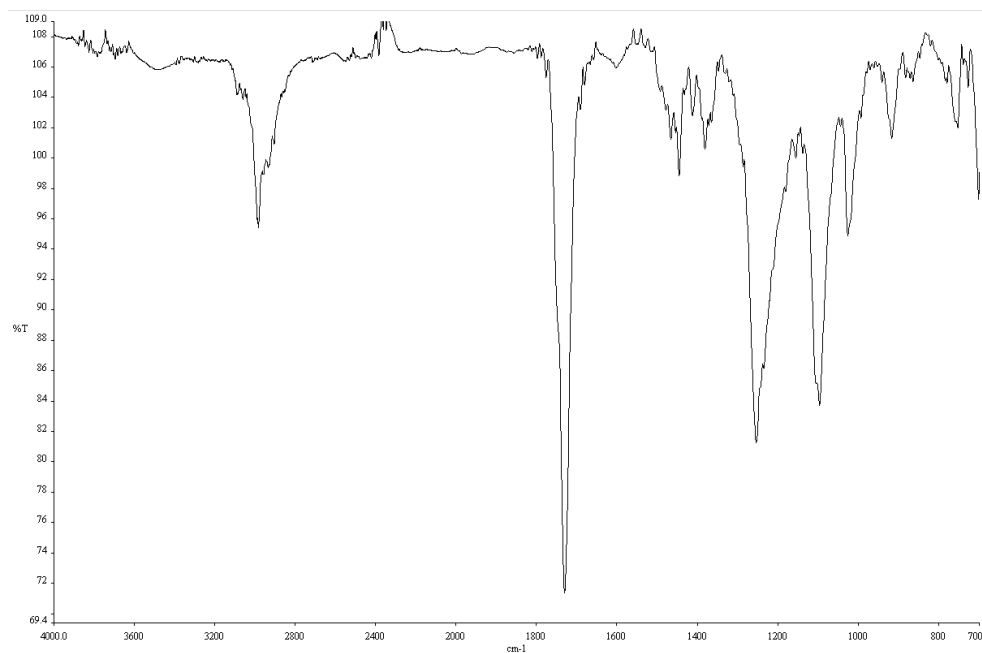


Figure A1.120. Infrared spectrum (Thin Film, NaCl) of compound **20**.

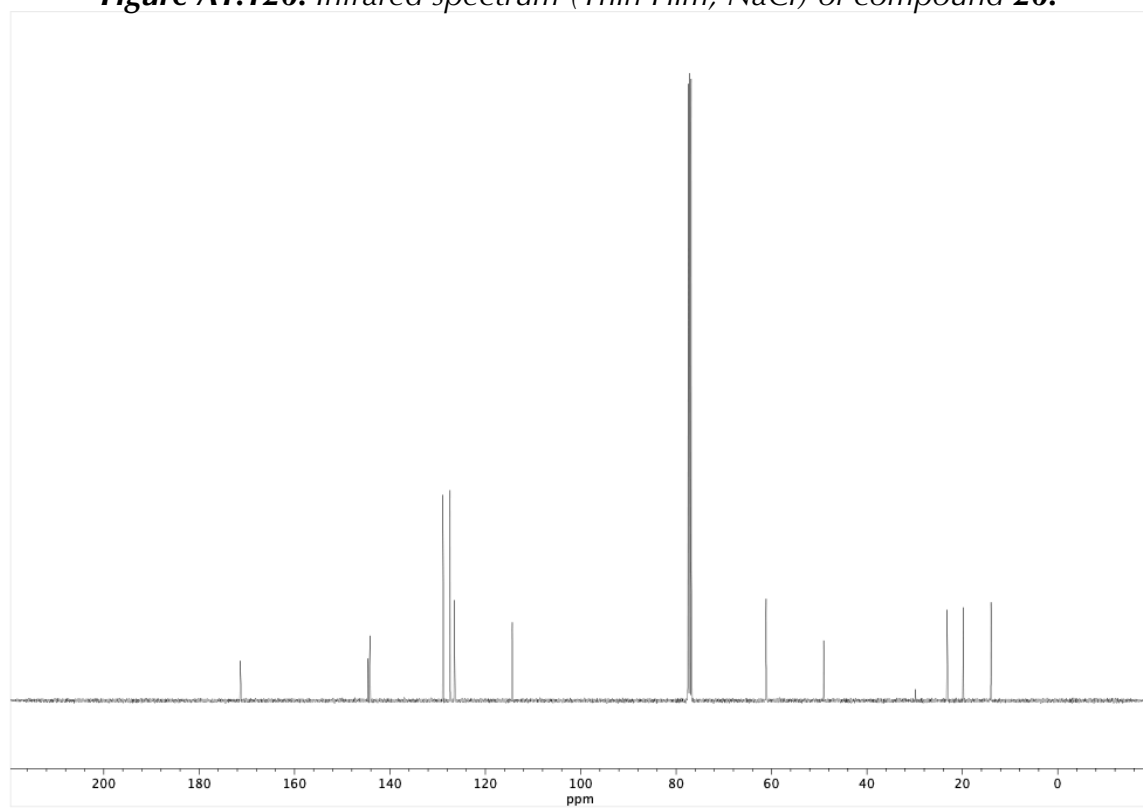


Figure A1.121. ¹³C NMR (100 MHz, CDCl₃) of compound **20**.

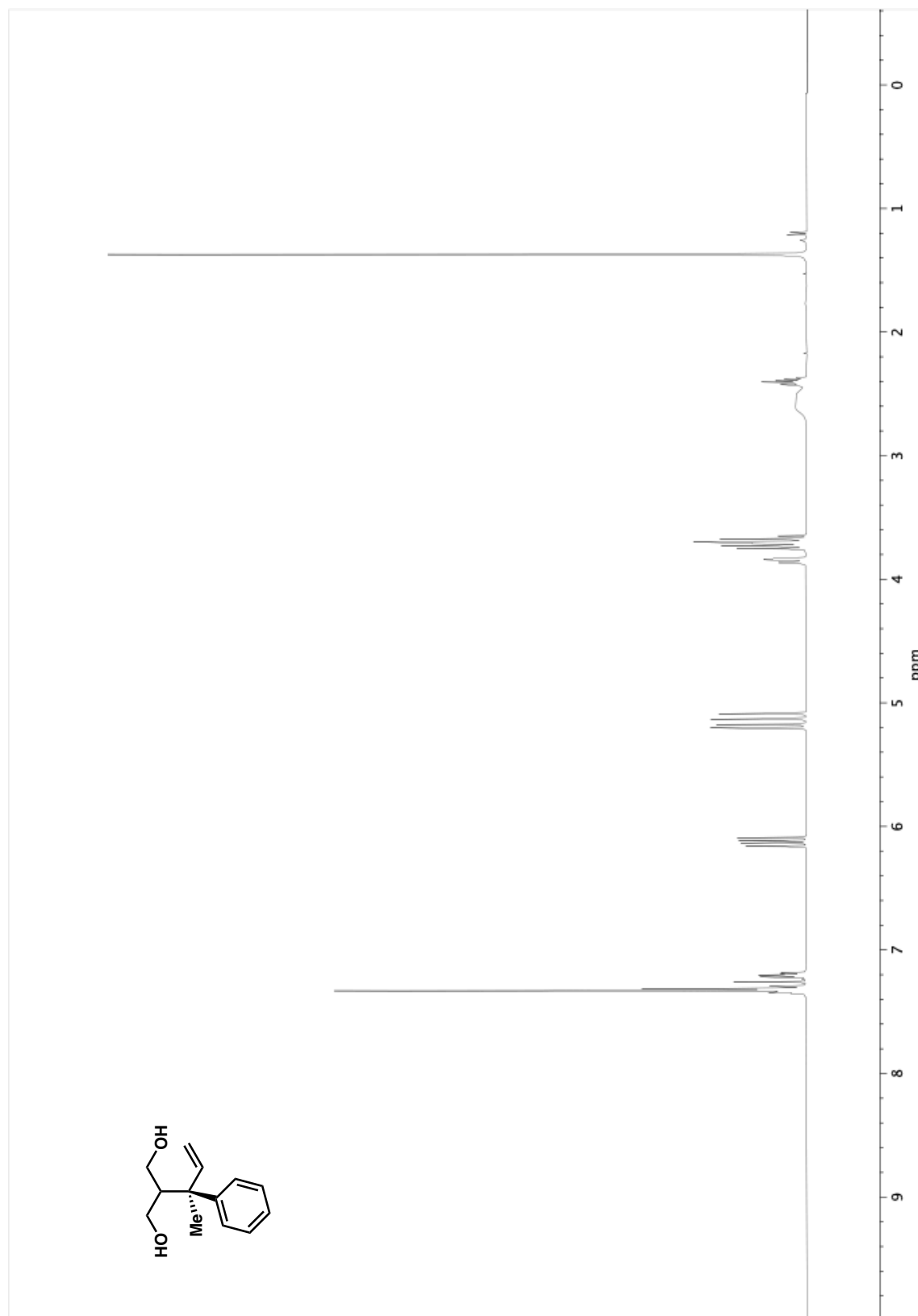


Figure A1.122. ¹H NMR (400 MHz, CDCl₃) of compound **21**.

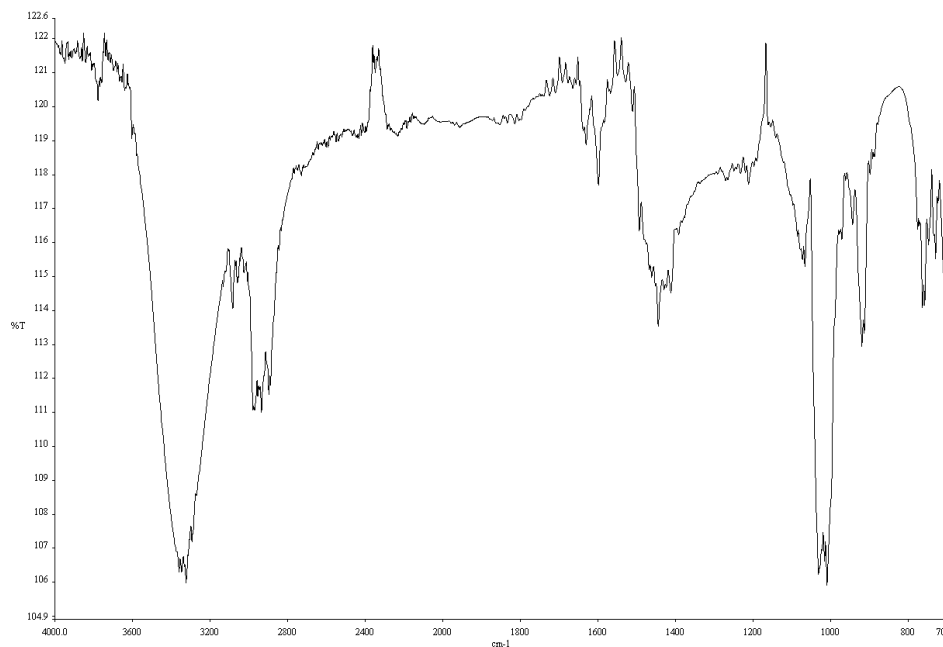


Figure A1.123. Infrared spectrum (Thin Film, NaCl) of compound **21**.

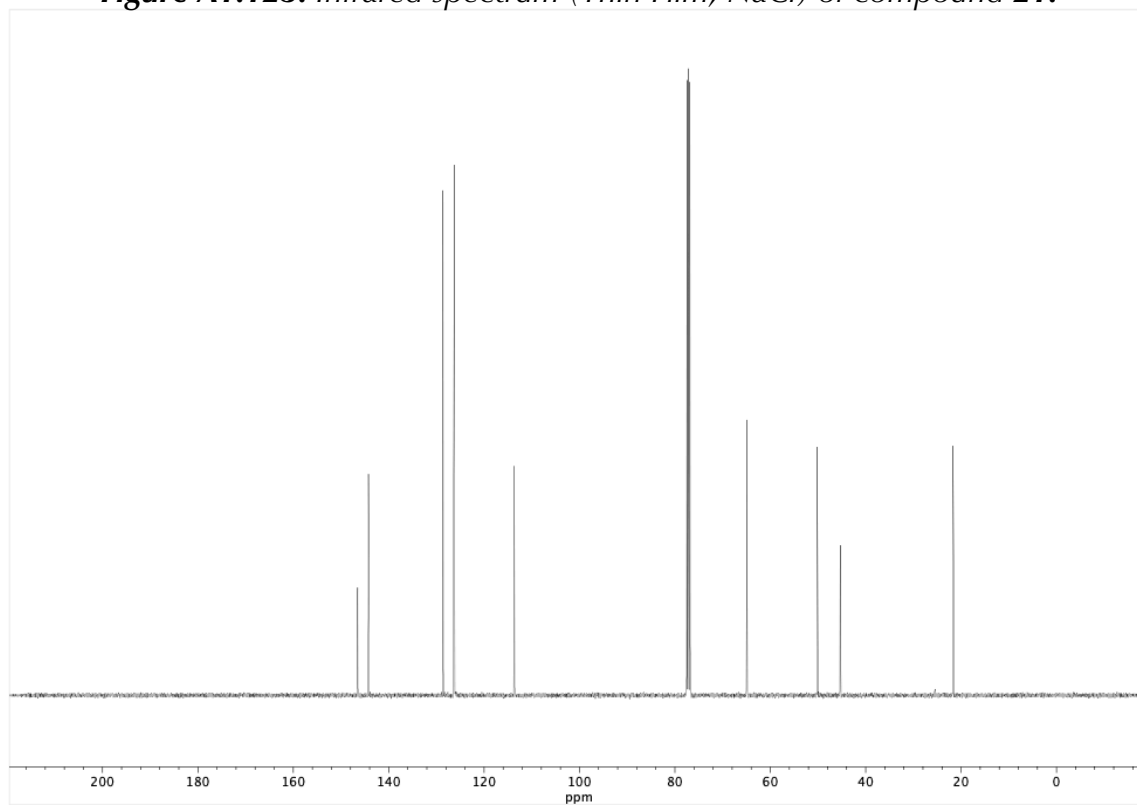


Figure A1.124. ¹³C NMR (100 MHz, CDCl₃) of compound **21**.

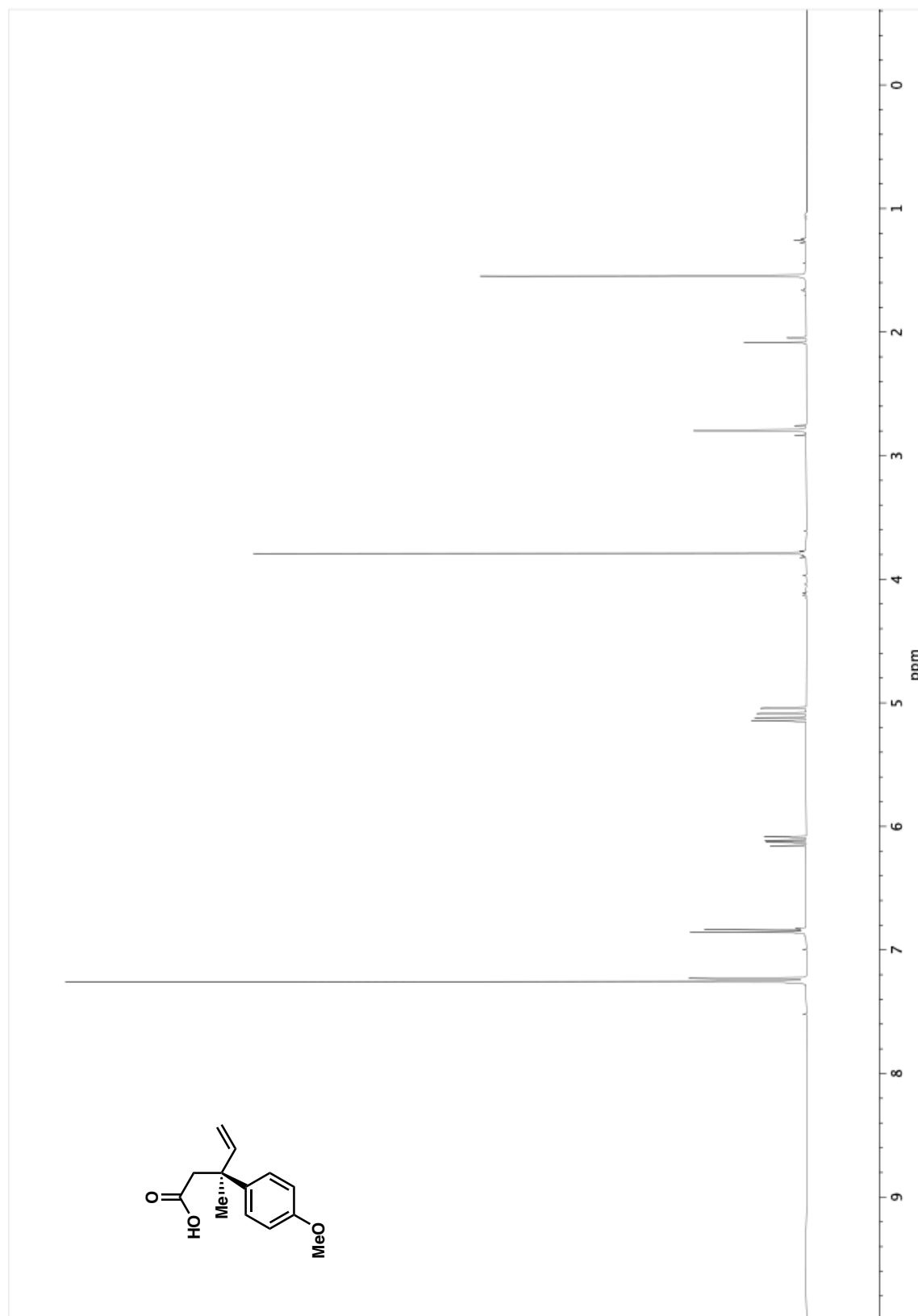


Figure A1.125. ¹H NMR (400 MHz, CDCl₃) of compound 22a.

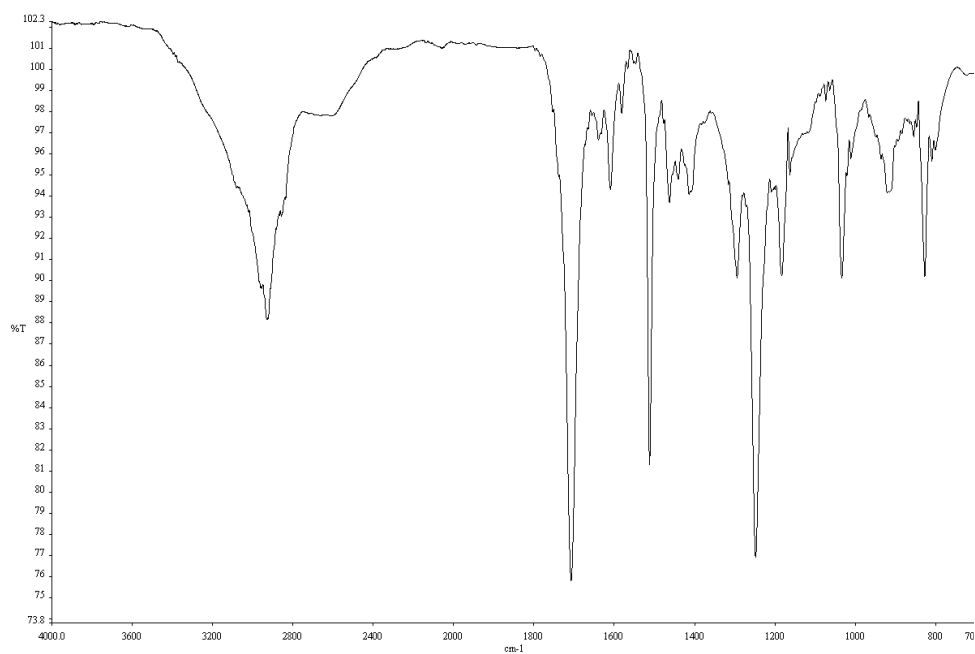


Figure A1.126. Infrared spectrum (Thin Film, NaCl) of compound **22a**.

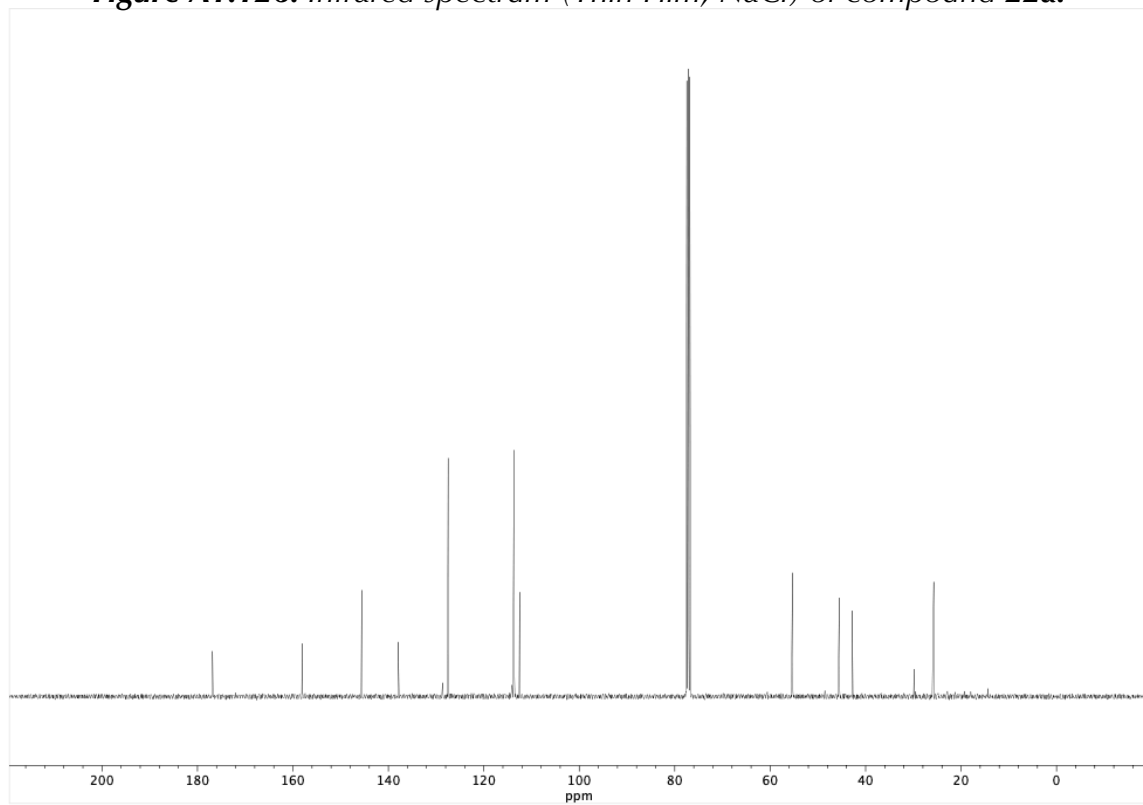


Figure A1.127. ^{13}C NMR (100 MHz, CDCl_3) of compound **22a**.

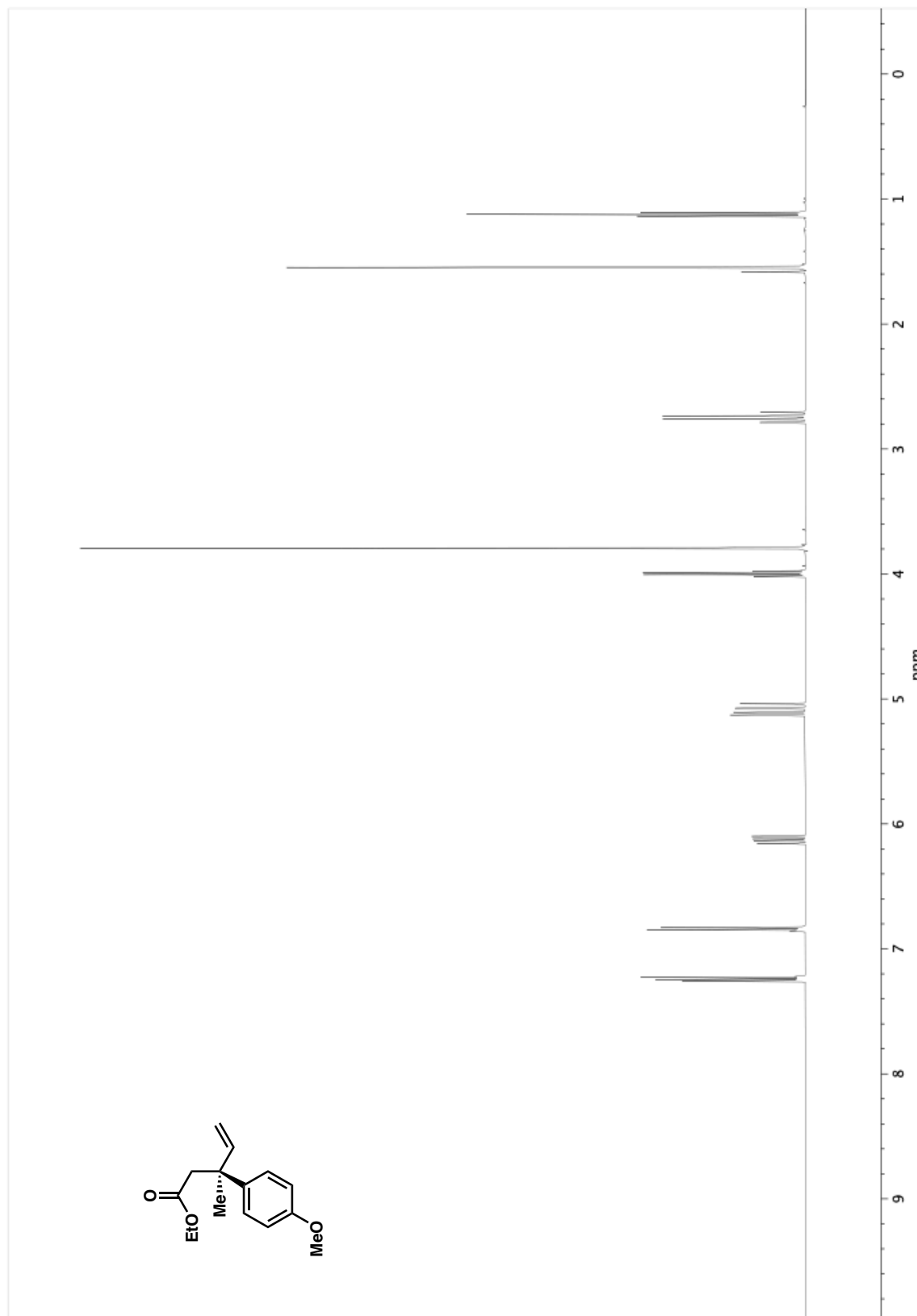


Figure A1.128. ¹H NMR (500 MHz, CDCl₃) of compound **22b**.

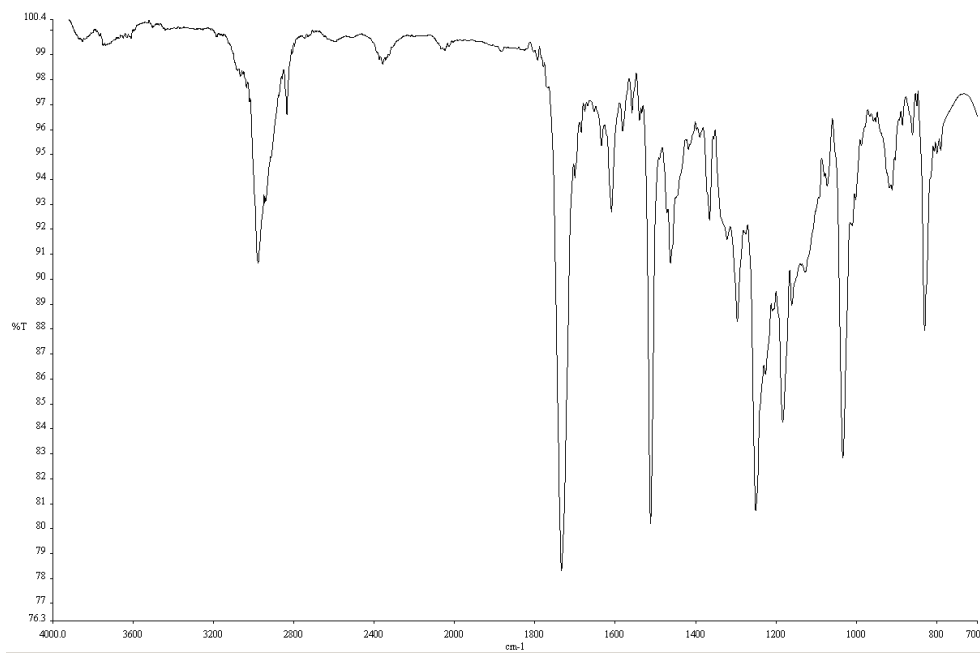


Figure A1.129. Infrared spectrum (Thin Film, NaCl) of compound **22b**.

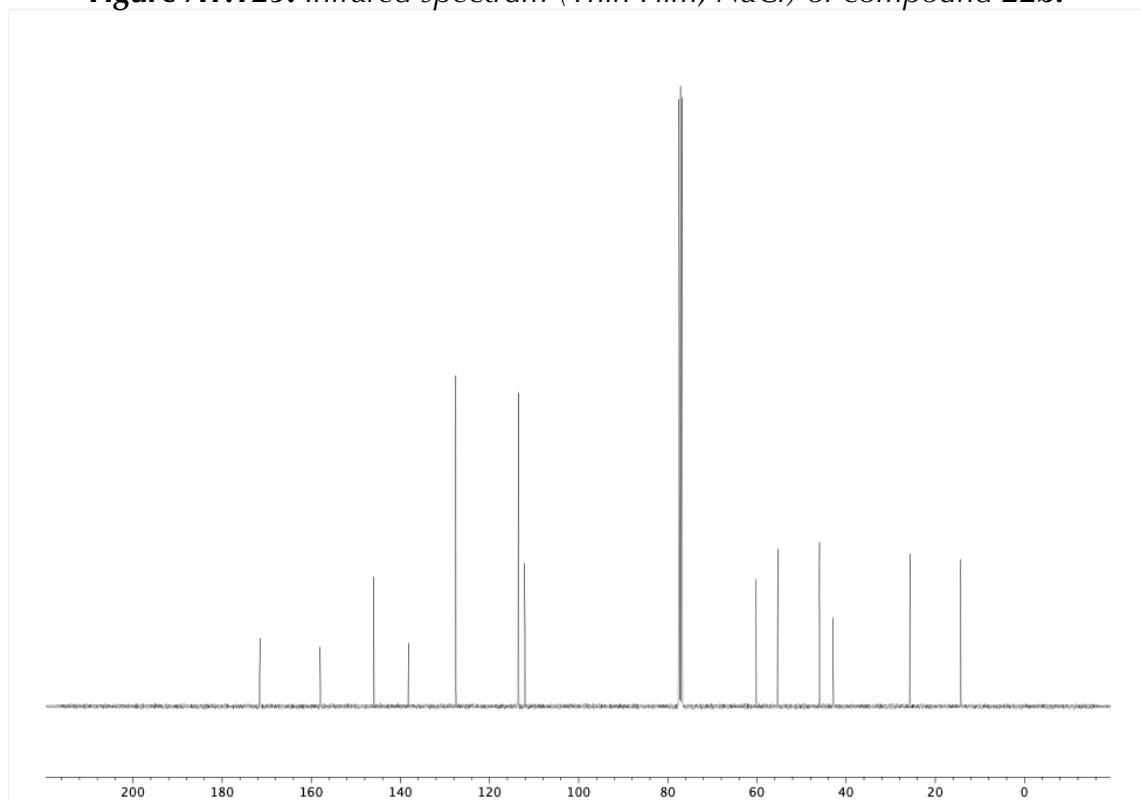


Figure A1.130. ¹³C NMR (100 MHz, CDCl₃) of compound **22b**.

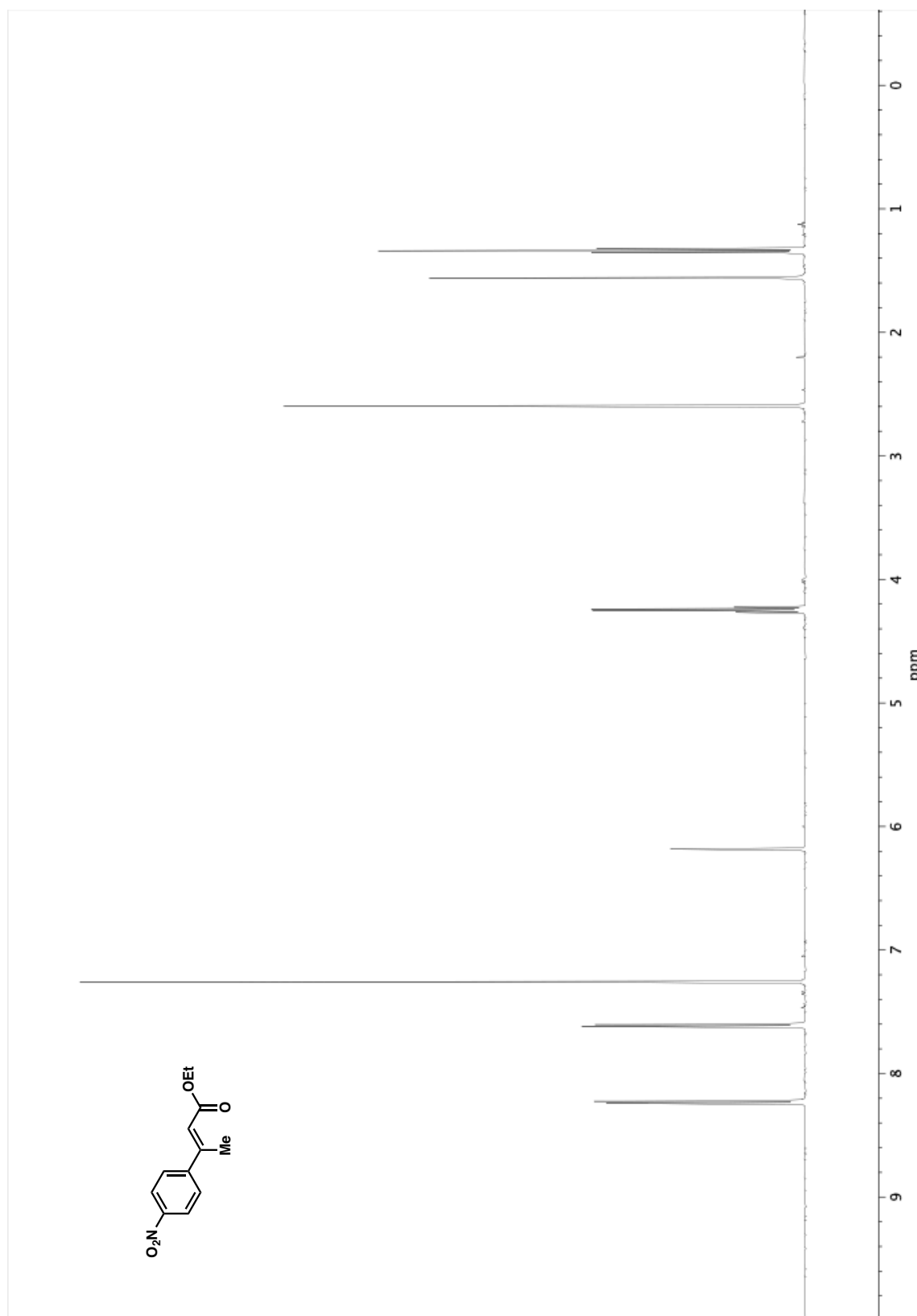


Figure A1.131. ^1H NMR (500 MHz, CDCl_3) of compound **2da**.

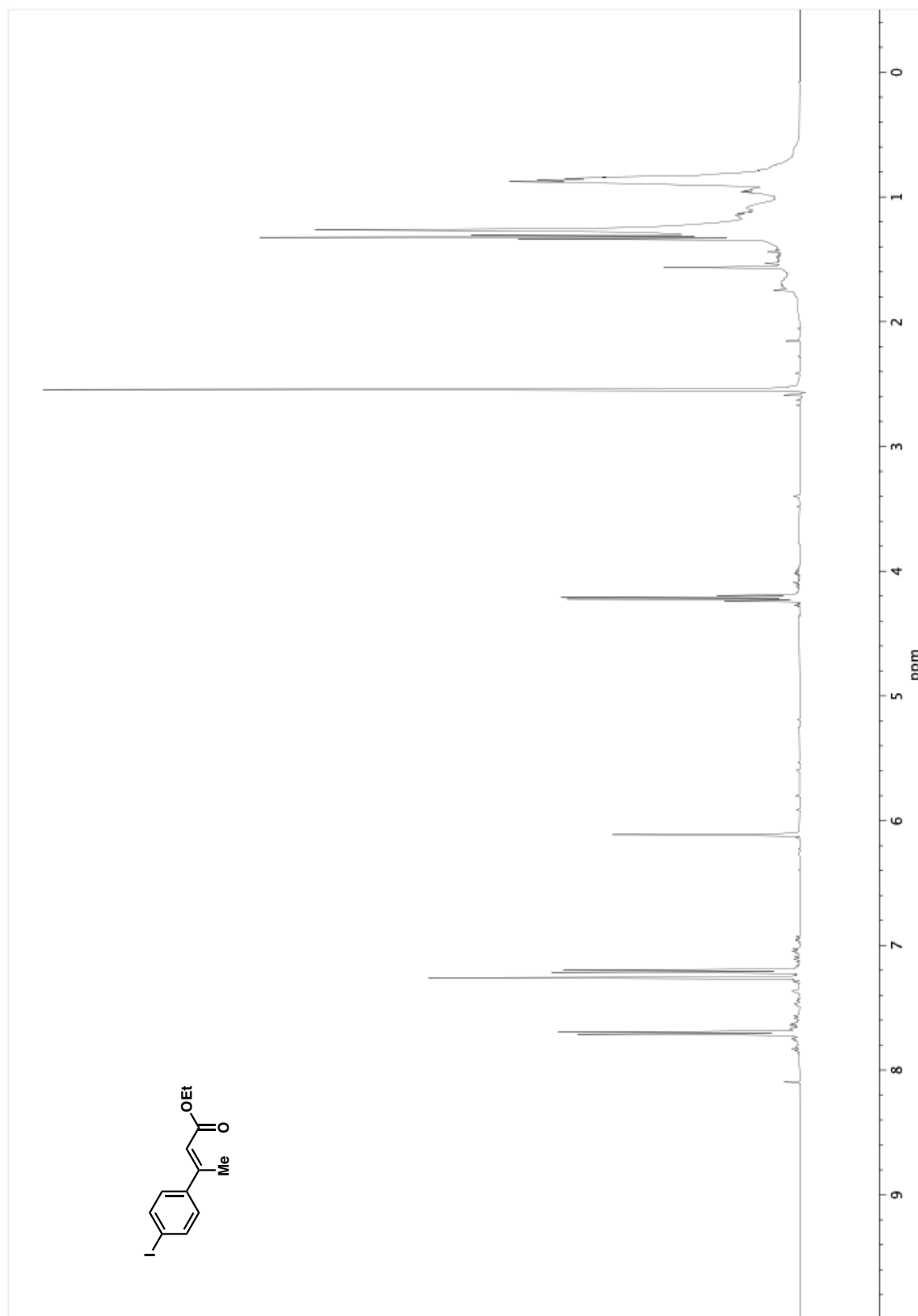


Figure A1.132. ¹H NMR (500 MHz, CDCl₃) of compound **2ea**.

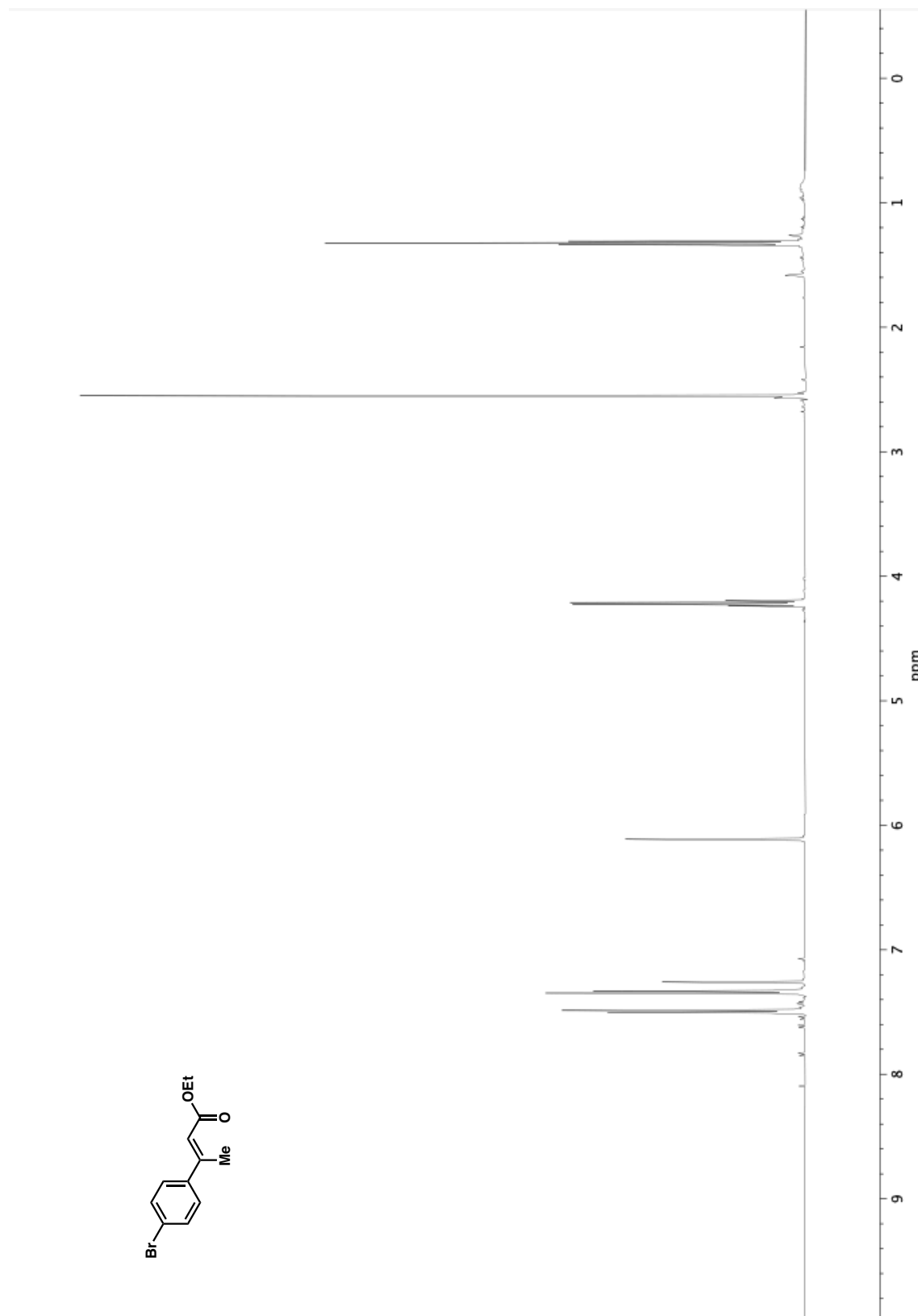


Figure A1.133. ¹H NMR (500 MHz, CDCl₃) of compound **2fa**.

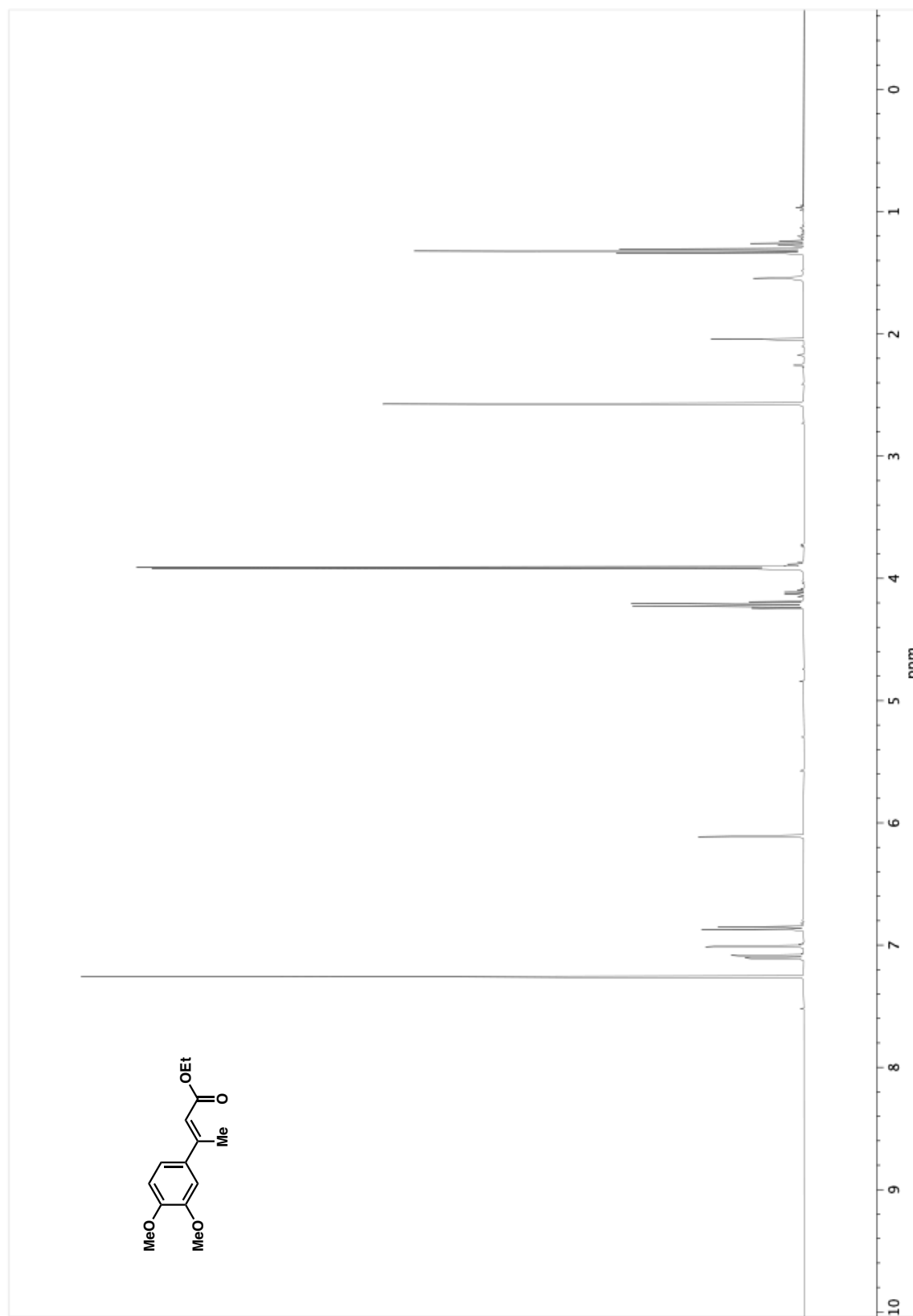


Figure A1.134. ¹H NMR (400 MHz, CDCl₃) of compound 2ja.

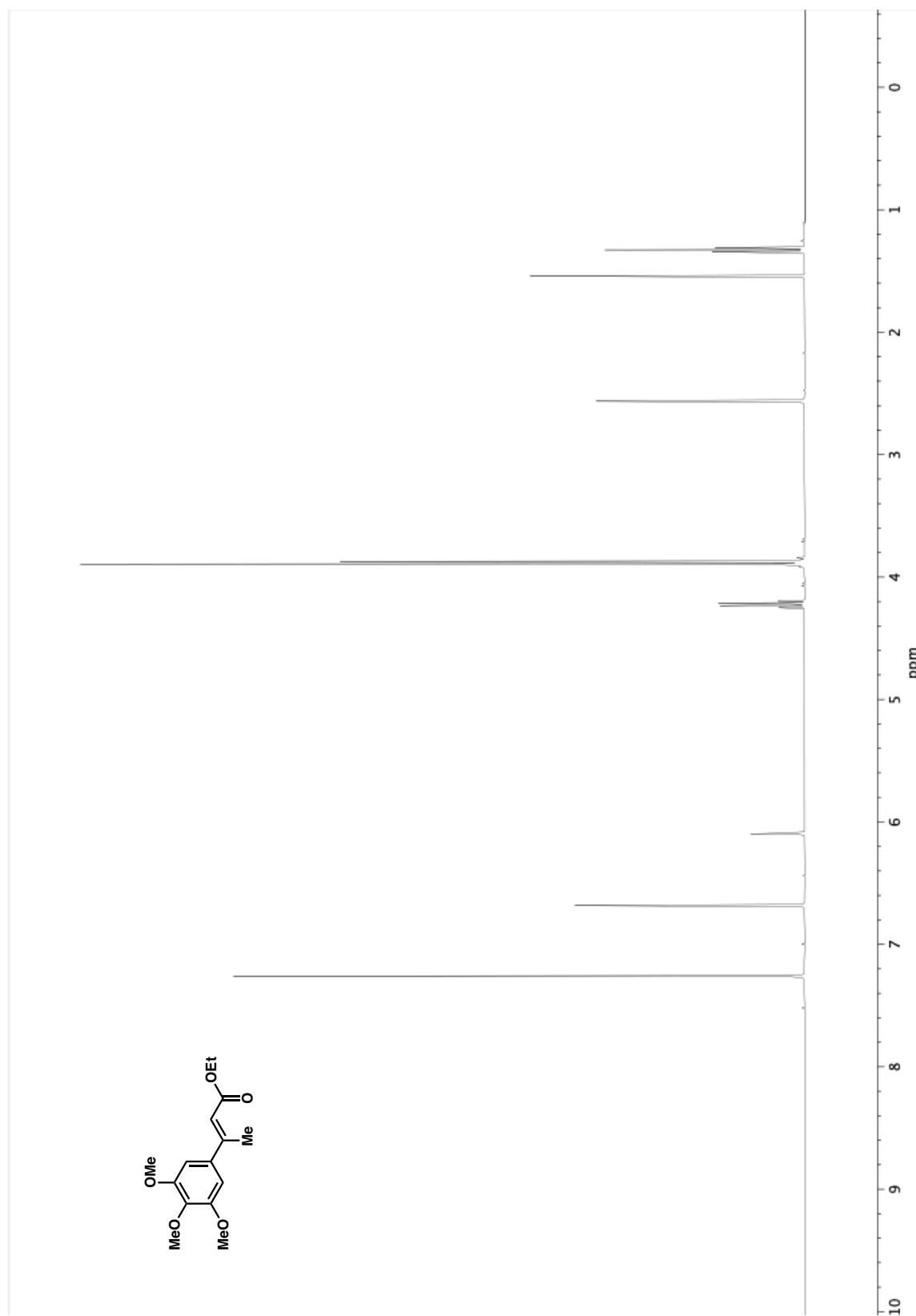


Figure A1.135. ¹H NMR (400 MHz, CDCl₃) of compound **2ka**.

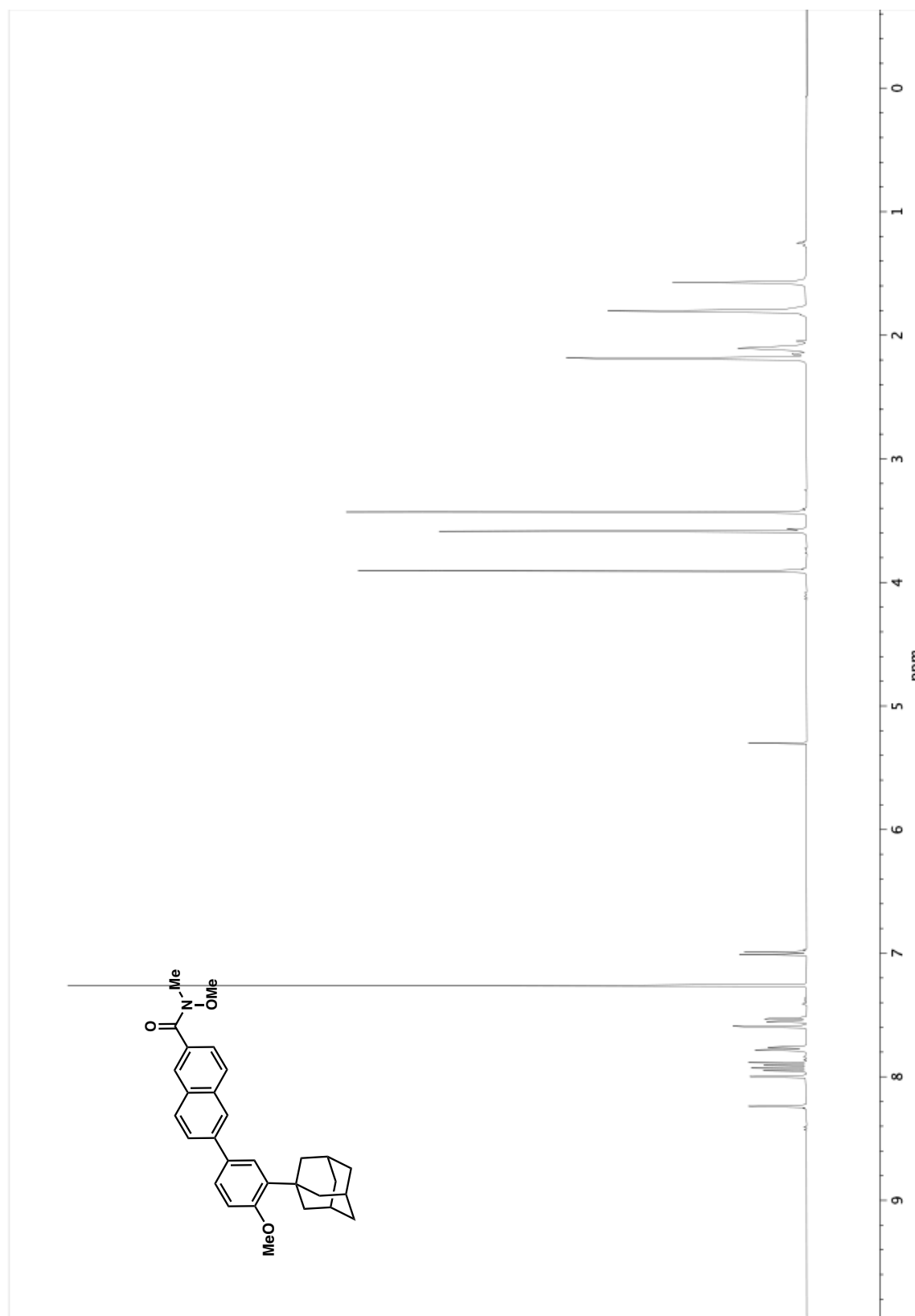


Figure A1.136. ¹H NMR (400 MHz, CDCl₃) of compound **10a**.

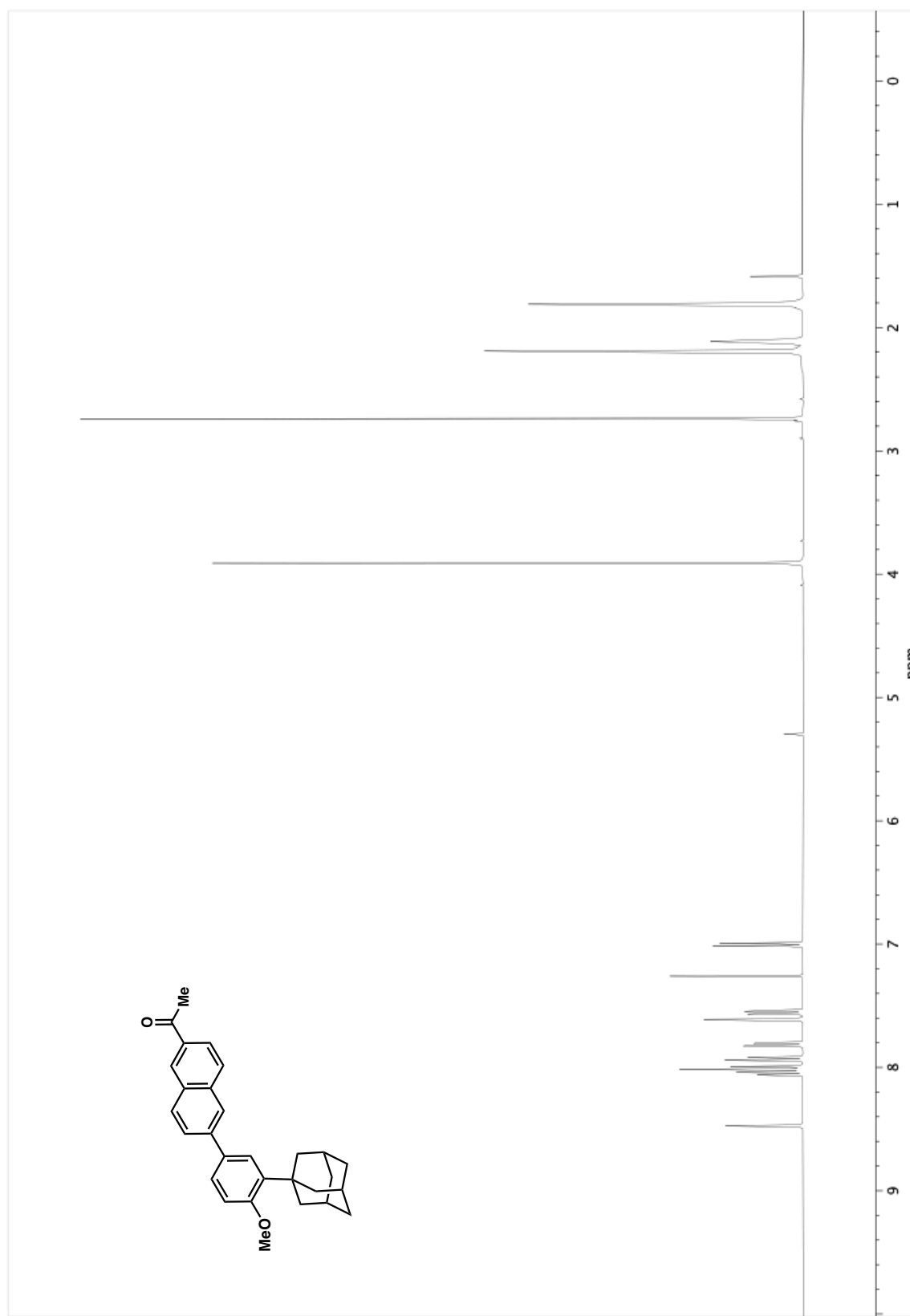


Figure A1.137. ¹H NMR (400 MHz, CDCl₃) of compound **10b**.

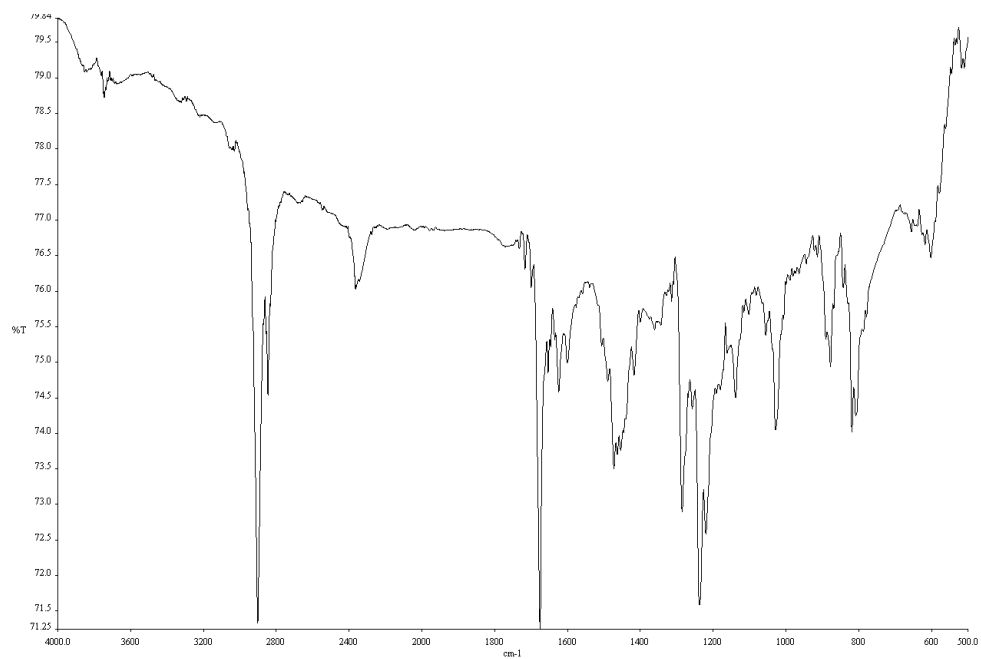


Figure A1.138. Infrared spectrum (Thin Film, NaCl) of compound **10b**.

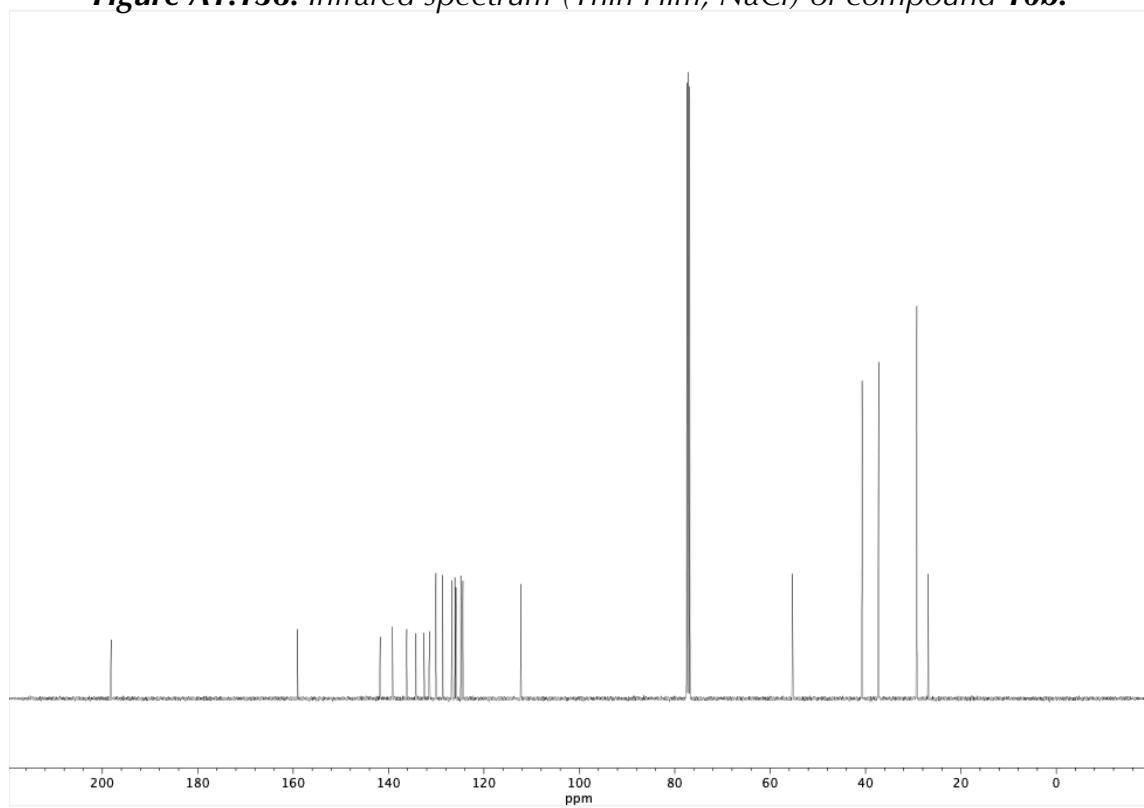


Figure A1.139. ¹³C NMR (100 MHz, CDCl₃) of compound **10b**.

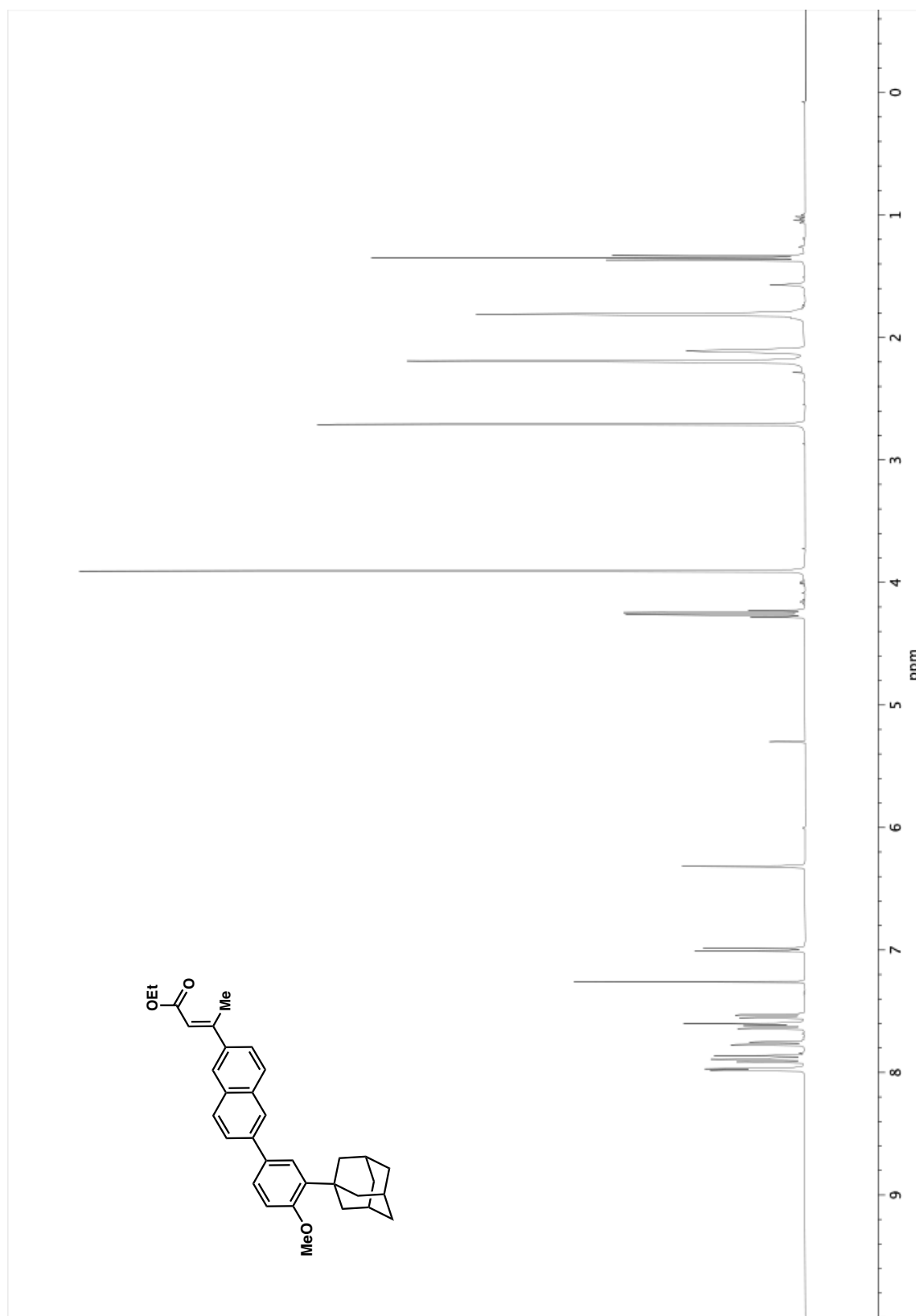


Figure A1.140. ^1H NMR (400 MHz, CDCl_3) of compound **10c**.

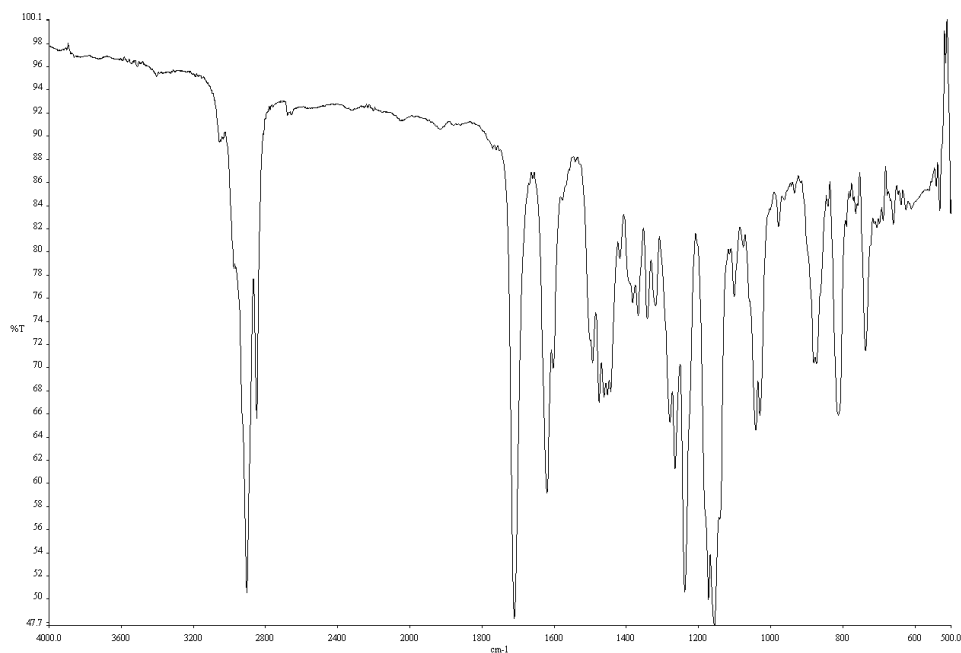


Figure A1.141. Infrared spectrum (Thin Film, NaCl) of compound **10c**.

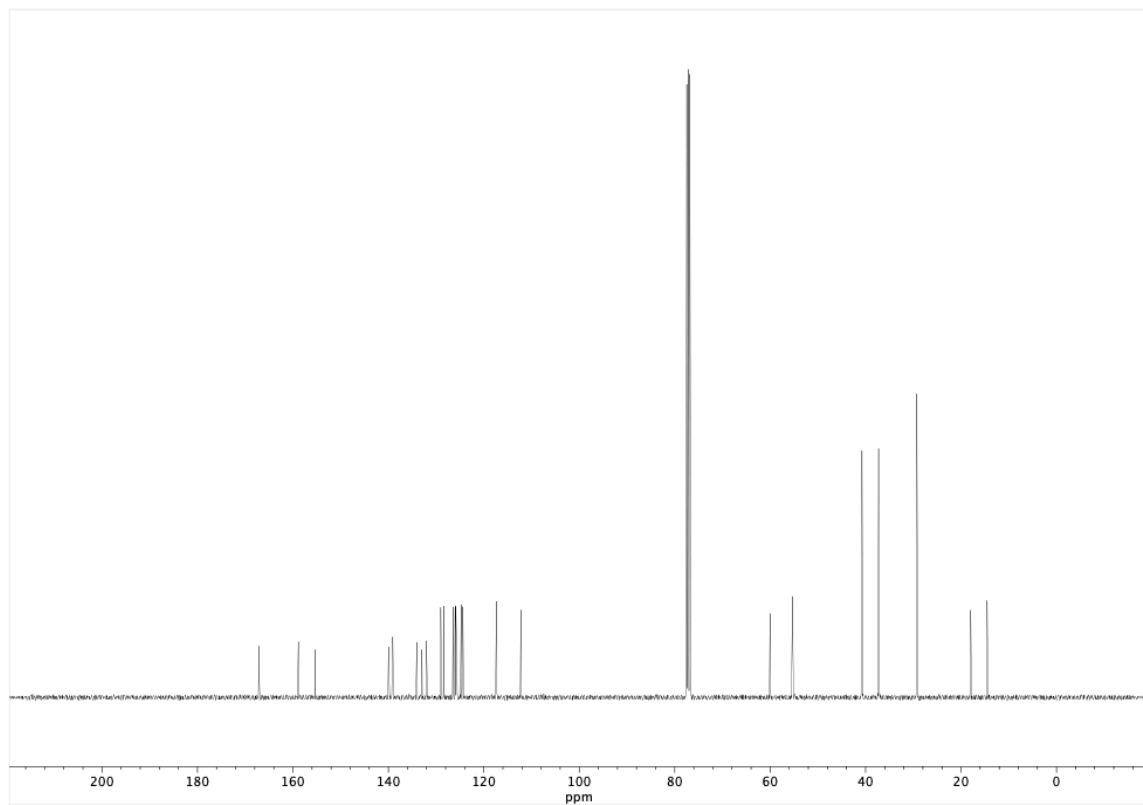


Figure A1.142. ¹³C NMR (100 MHz, CDCl₃) of compound **10c**.

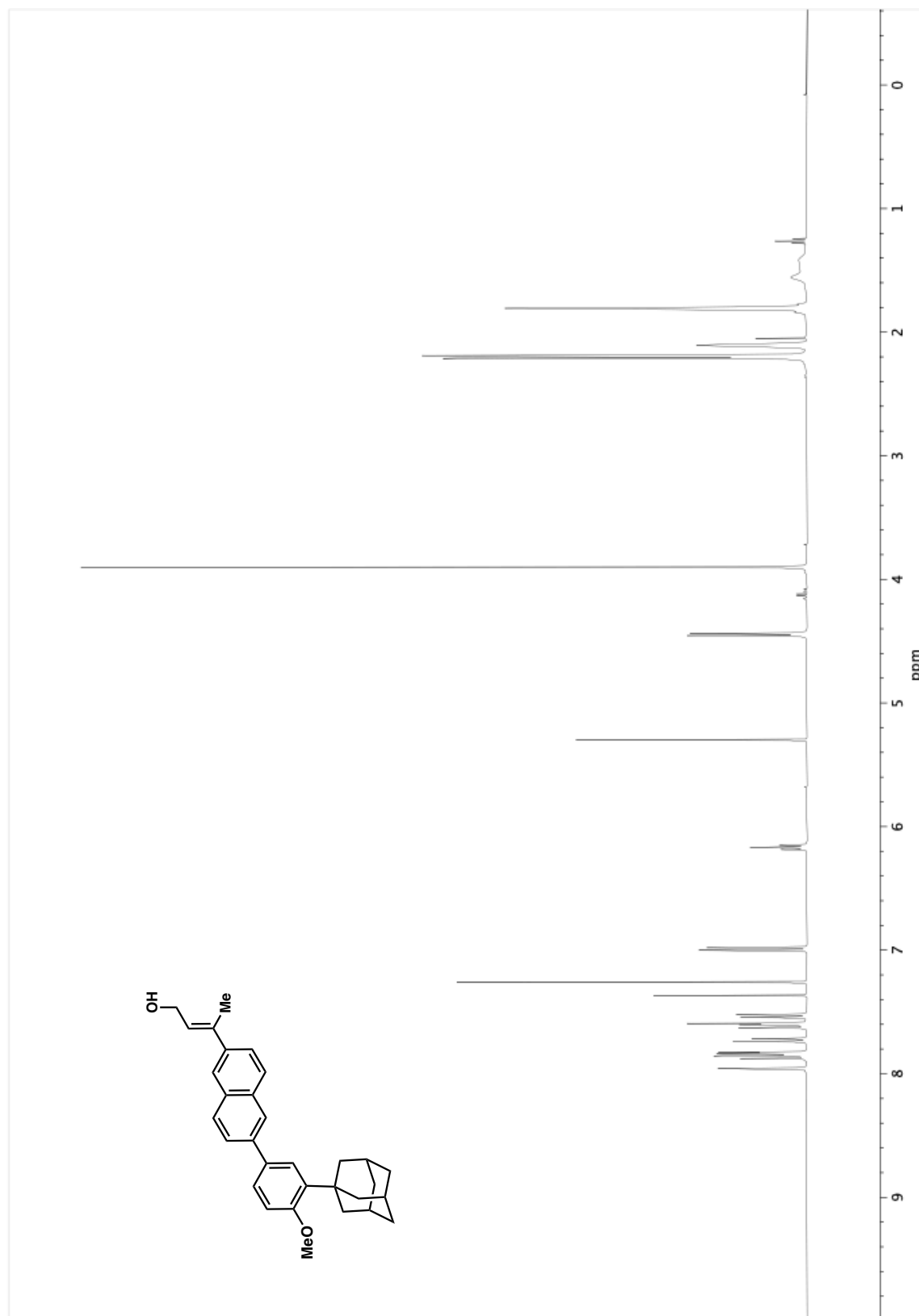


Figure A1.143. ^1H NMR (400 MHz, CDCl_3) of compound **10d**.

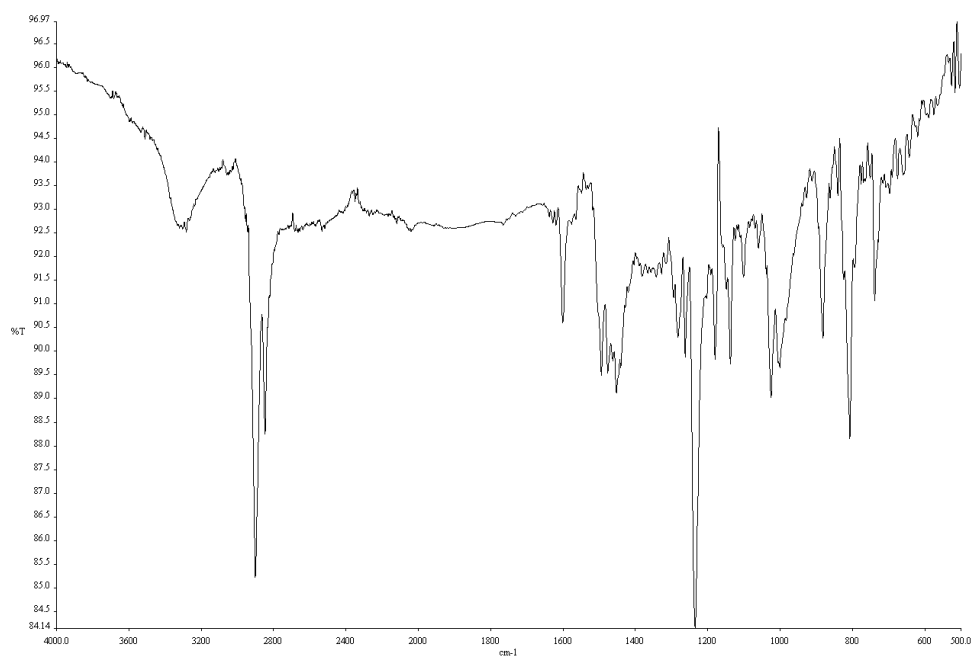


Figure A1.144. Infrared spectrum (Thin Film, NaCl) of compound **10d**.

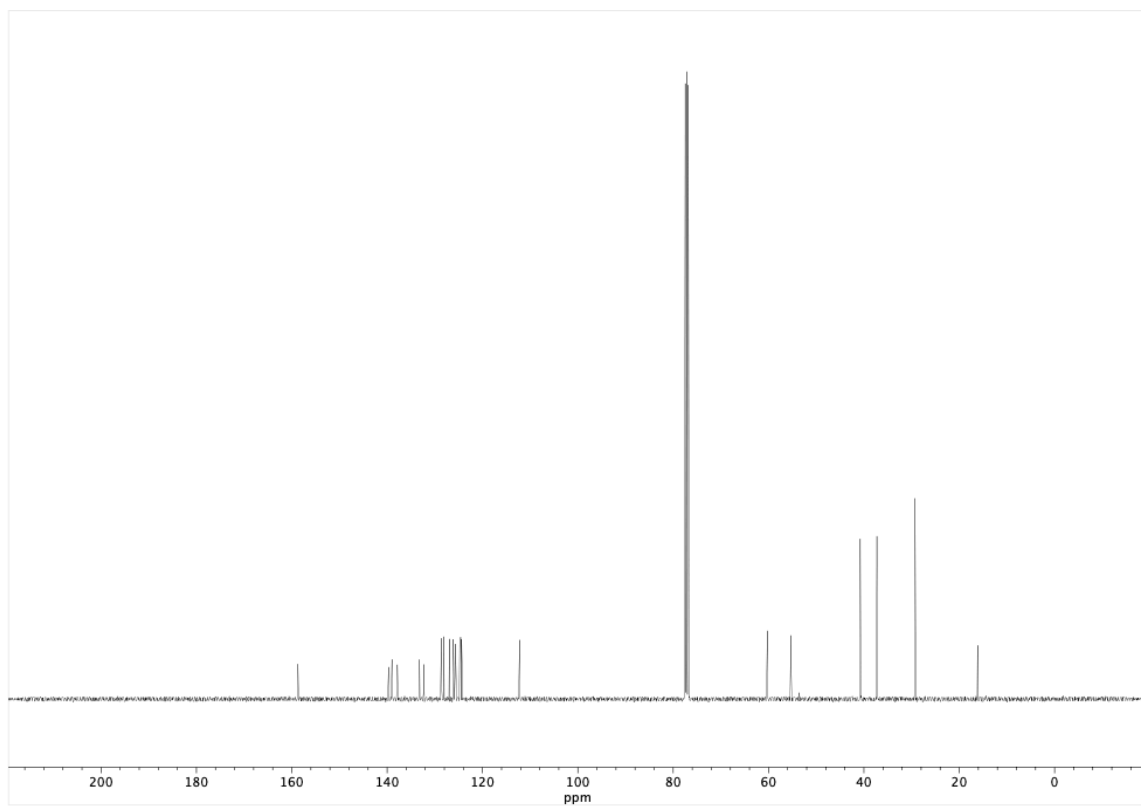


Figure A1.145. ¹³C NMR (100 MHz, CDCl₃) of compound **10d**.

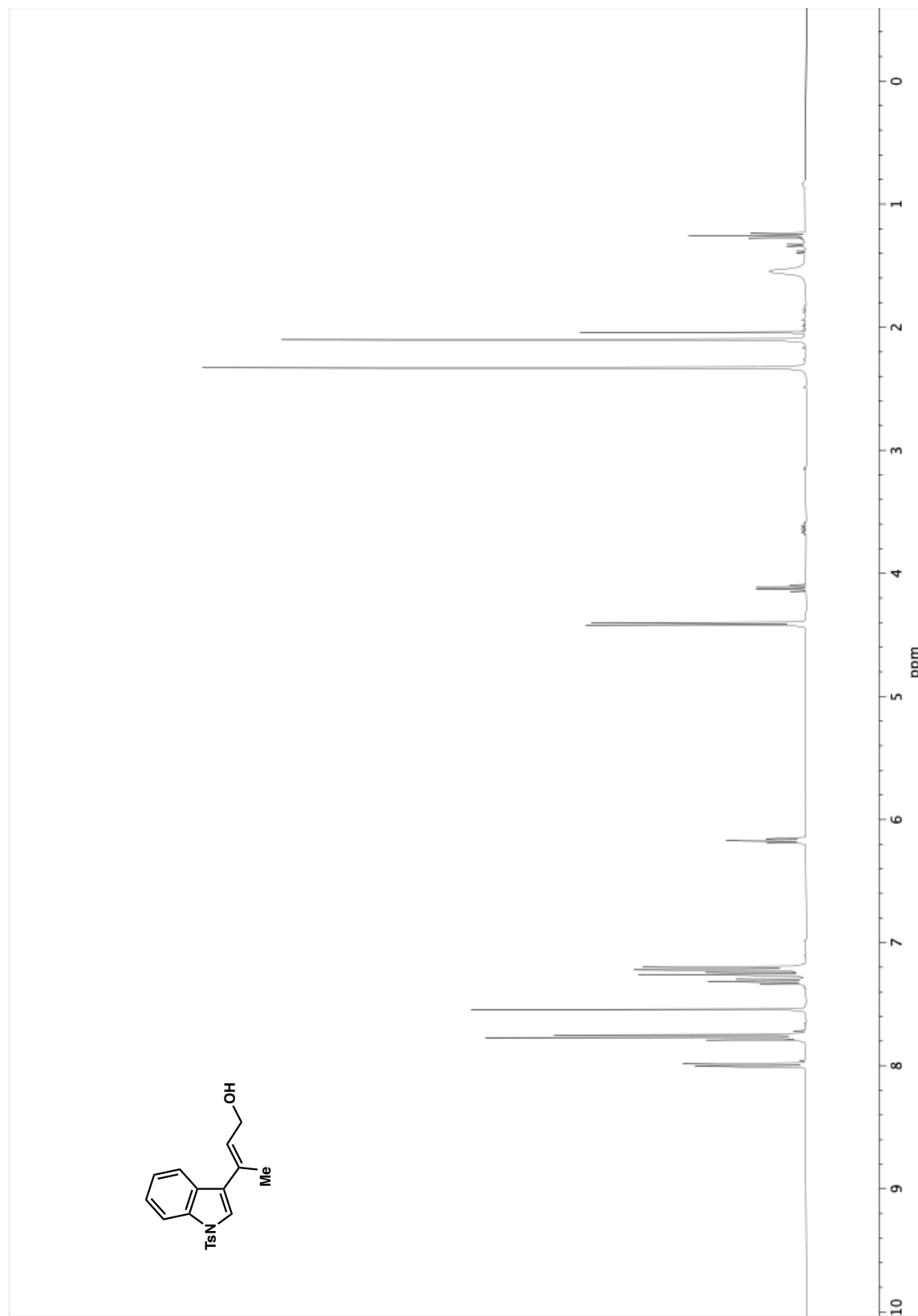


Figure A1.146. ¹H NMR (500 MHz, CDCl₃) of compound **2pb**.

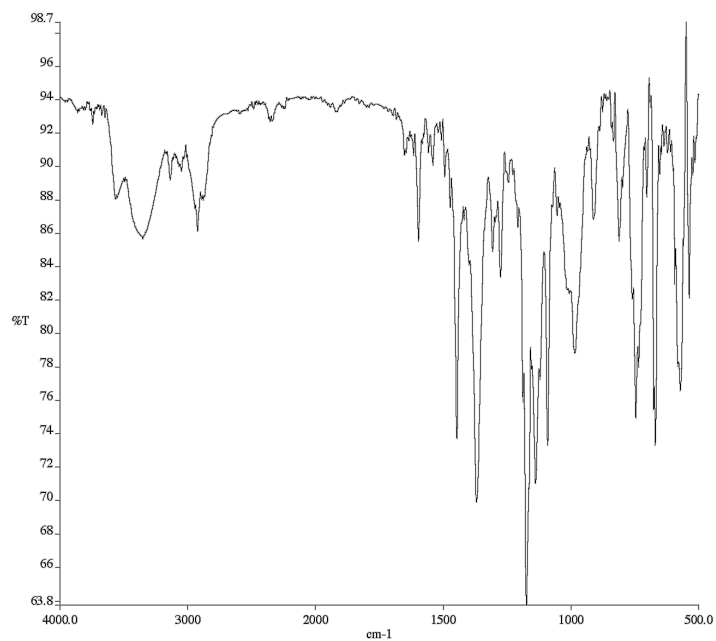


Figure A1.147. Infrared spectrum (Thin Film, NaCl) of compound **2pb**.

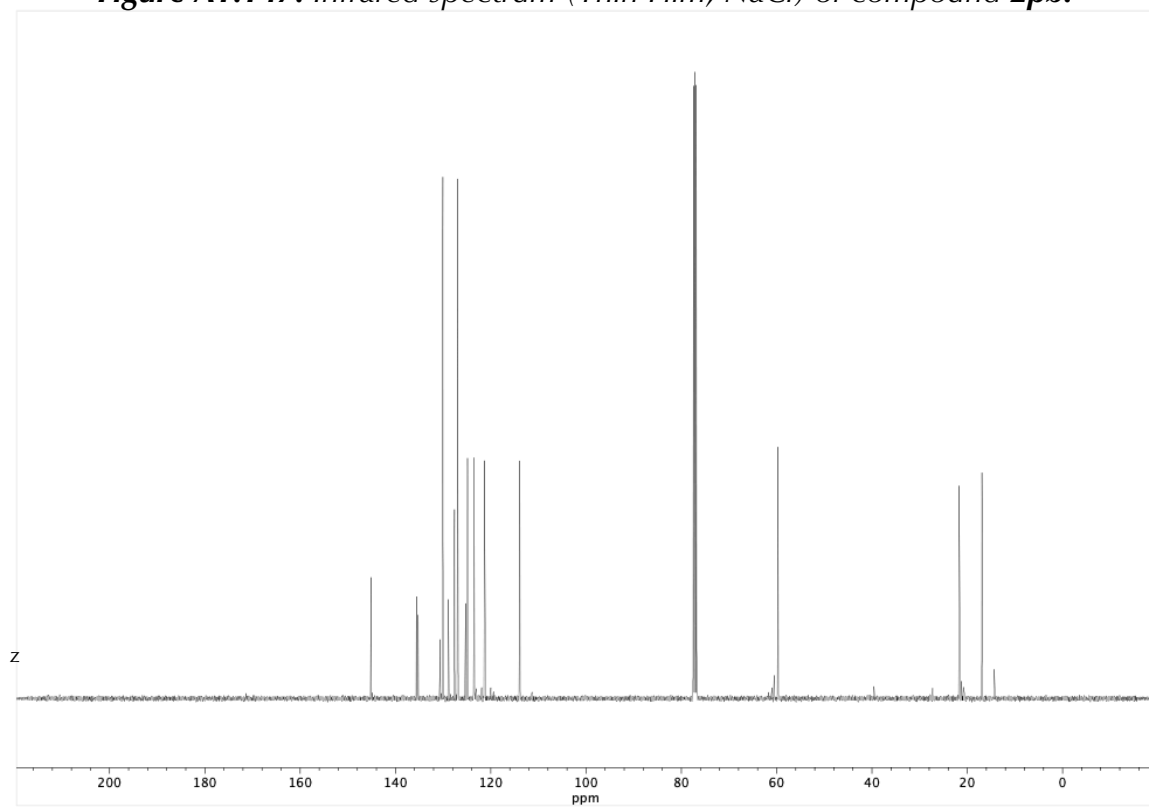


Figure A1.148. ¹³C NMR (100 MHz, CDCl₃) of compound **2pb**.

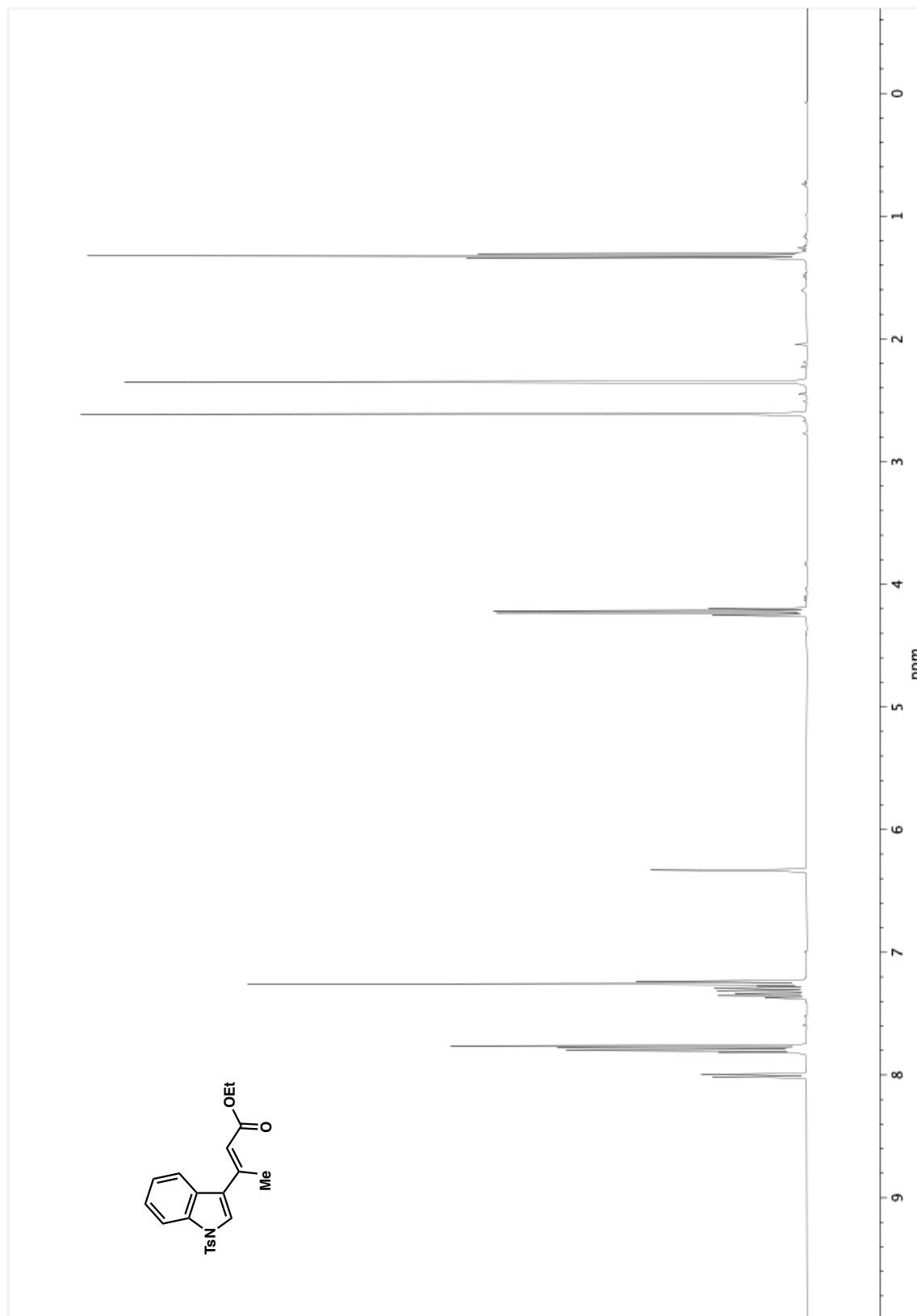


Figure A1.149. ^1H NMR (400 MHz, CDCl_3) of compound **2pa**.

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