

APPENDIX 2

Spectra Relevant to Chapter 2:

Catalytic Asymmetric Synthesis of Cyclopentanoid and Cycloheptanoid

Core Structures Using Pd-Catalyzed Asymmetric Alkylation

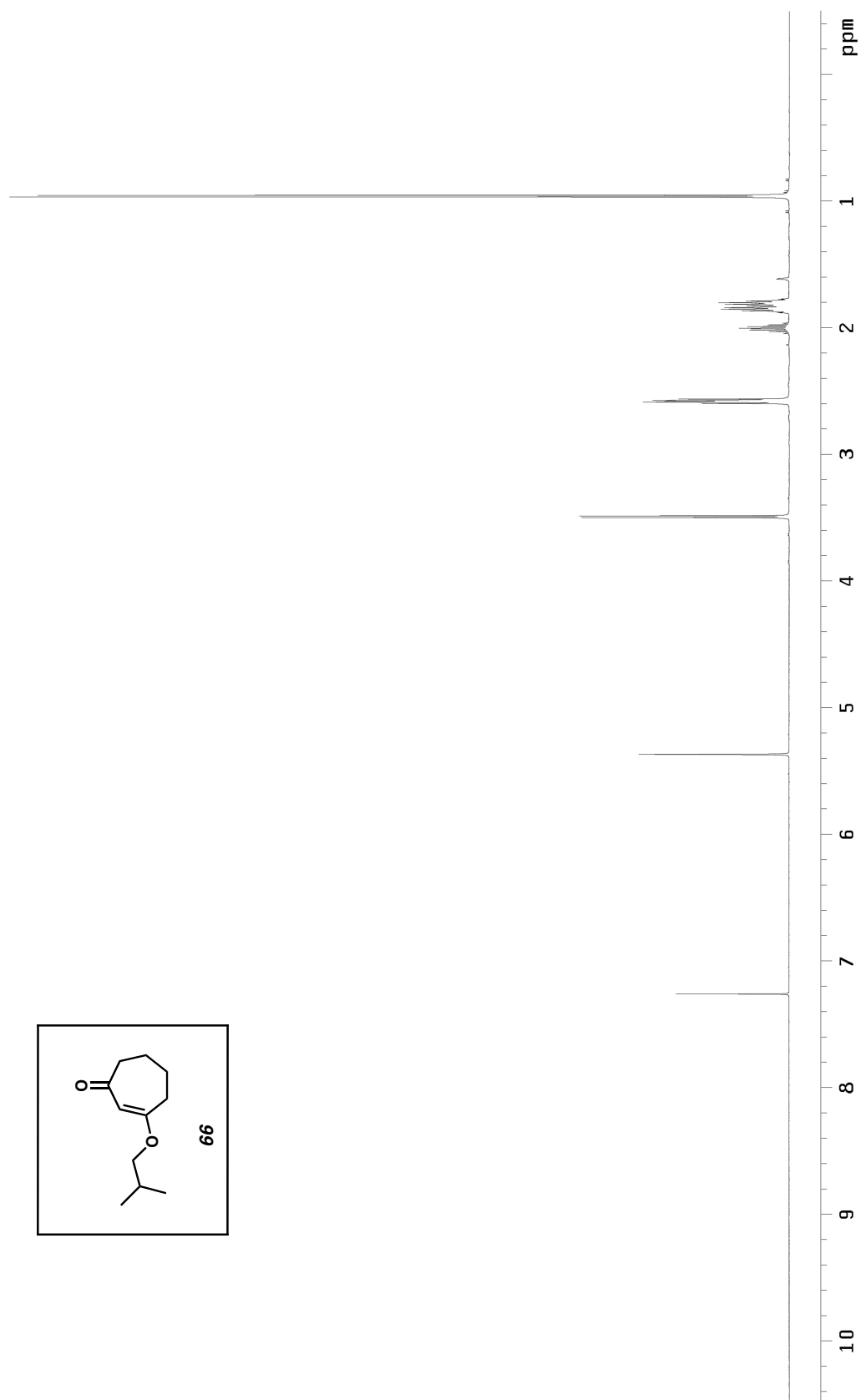


Figure A2.1.1. ^1H NMR (500 MHz, CDCl_3) of compound **66**.

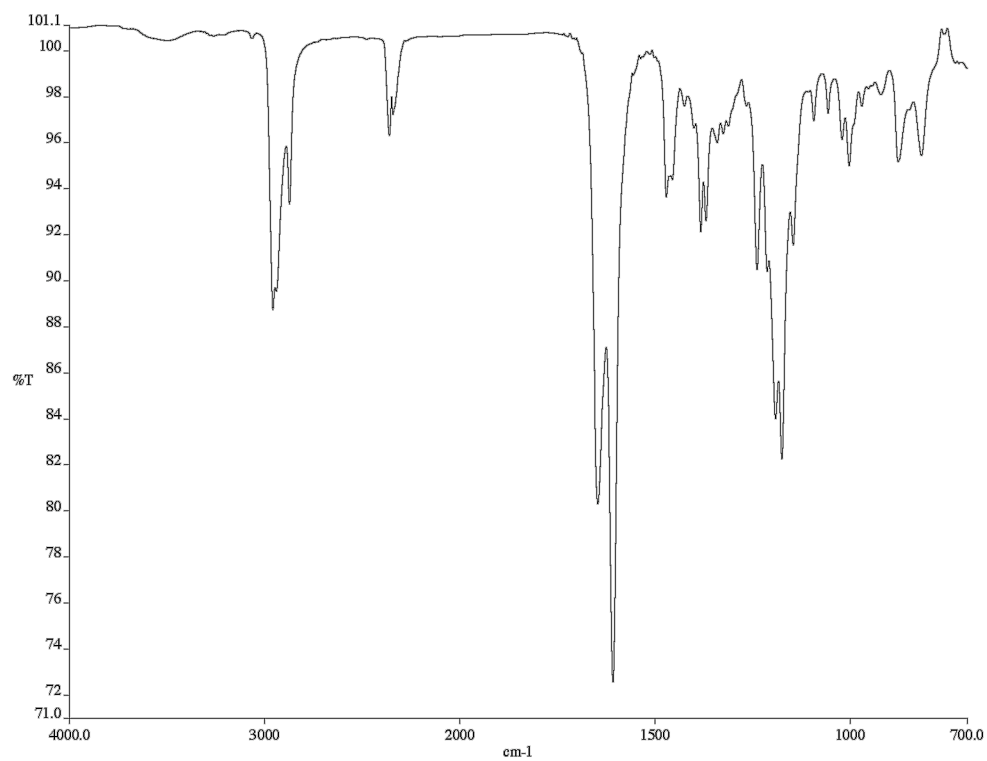


Figure A2.1.2. Infrared spectrum (thin film/NaCl) of compound **66**.

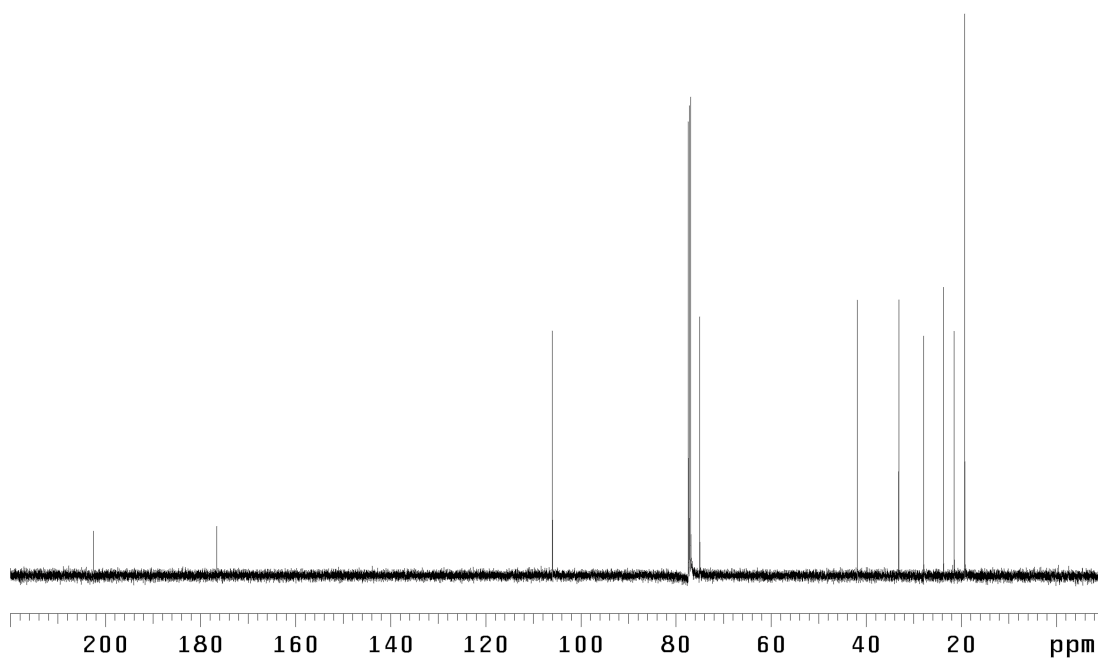
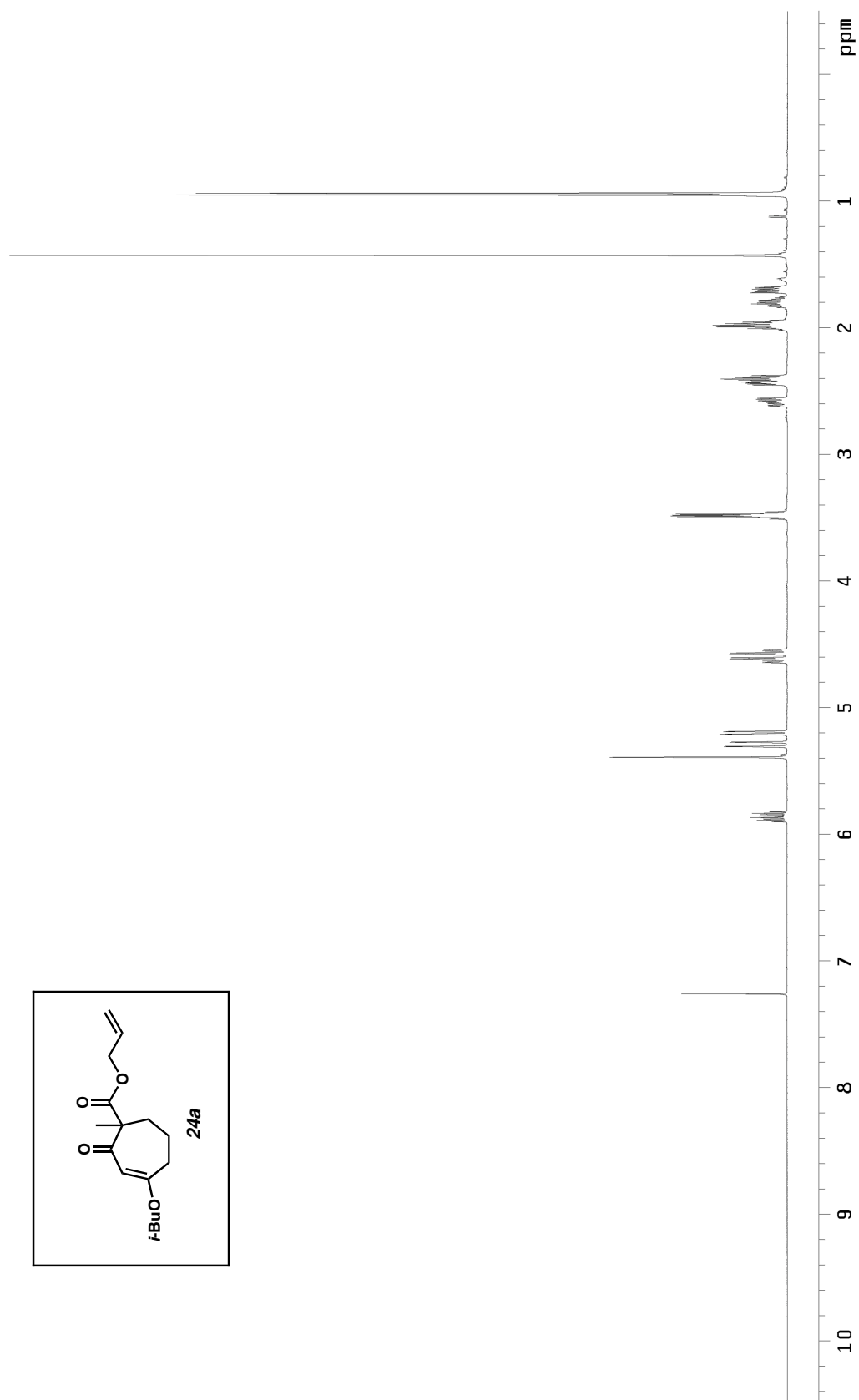


Figure A2.1.3. ¹³C NMR (125 MHz, CDCl₃) of compound **66**.

Figure A2.2.1. ^1H NMR (500 MHz, CDCl_3) of compound **24a**.

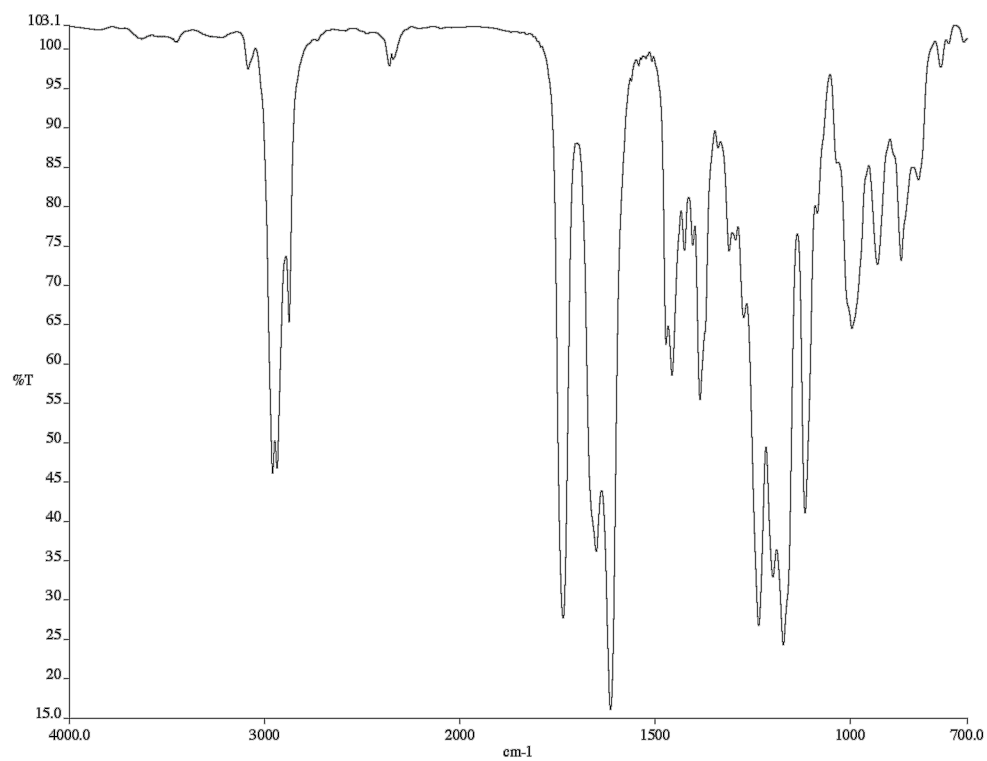


Figure A2.2.2. Infrared spectrum (thin film/NaCl) of compound **24a**.

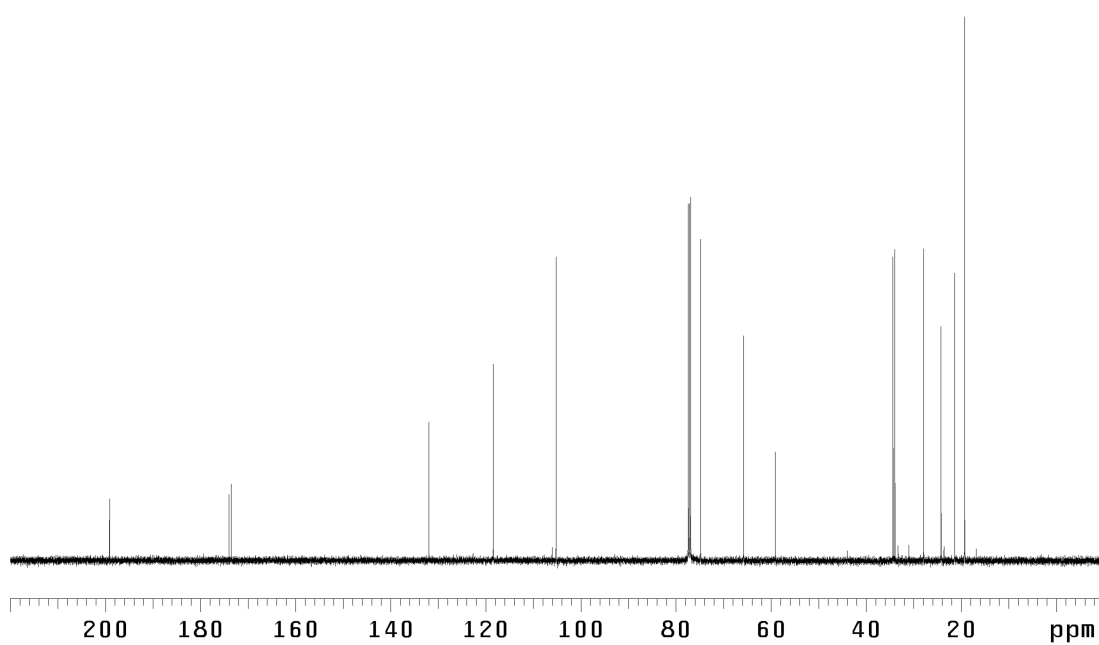


Figure A2.2.3. ¹³C NMR (125 MHz, CDCl₃) of compound **24a**.

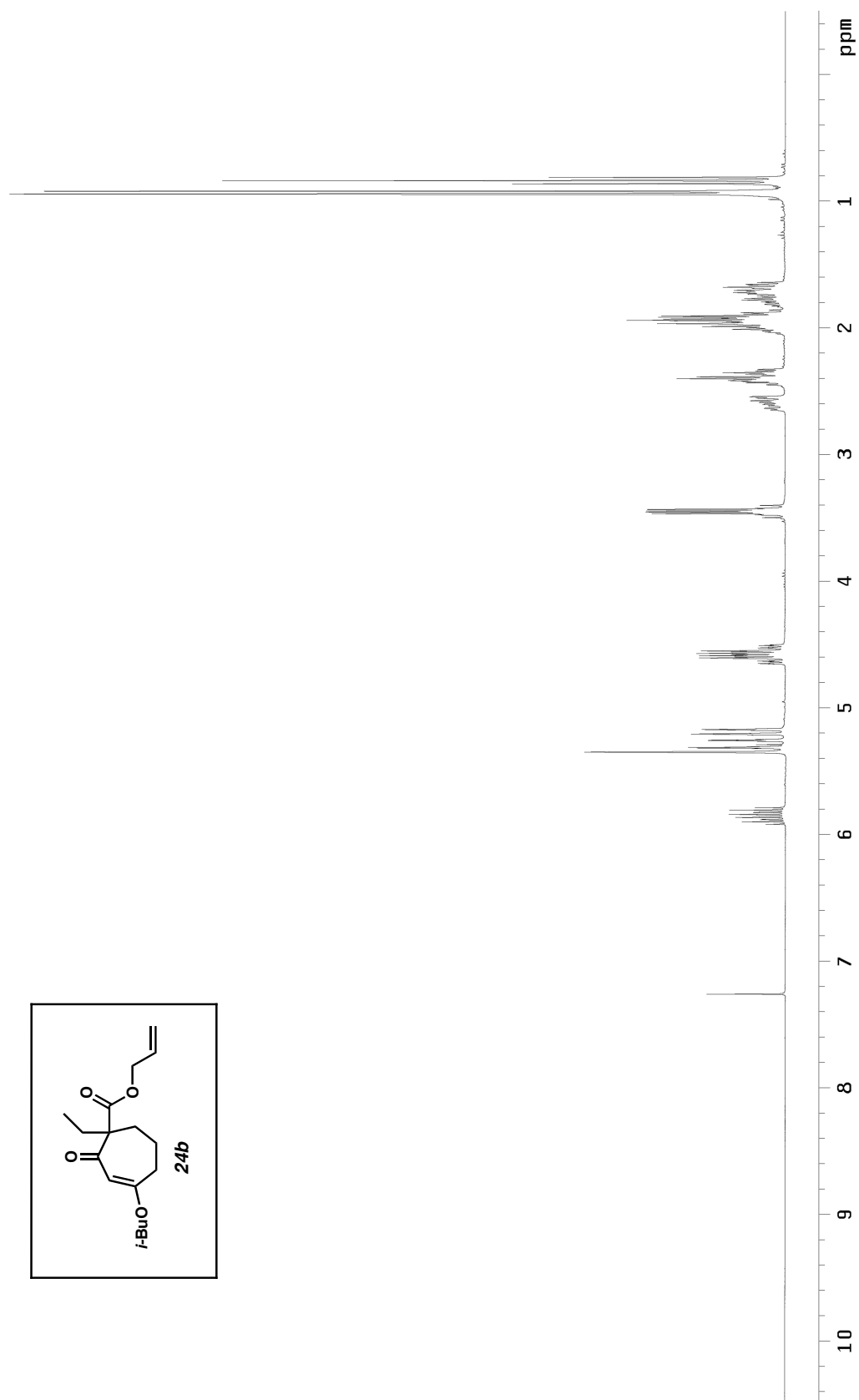


Figure A2.3.1. ^1H NMR (300 MHz, CDCl_3) of compound **24b**.

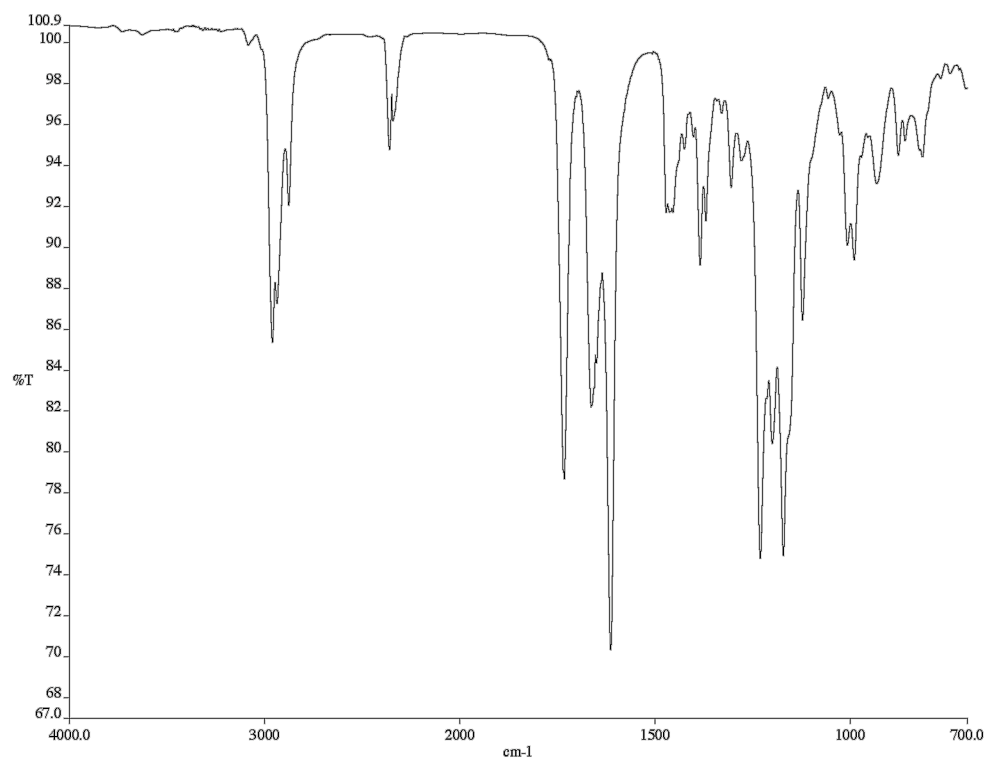


Figure A2.3.2. Infrared spectrum (thin film/NaCl) of compound **24b**.

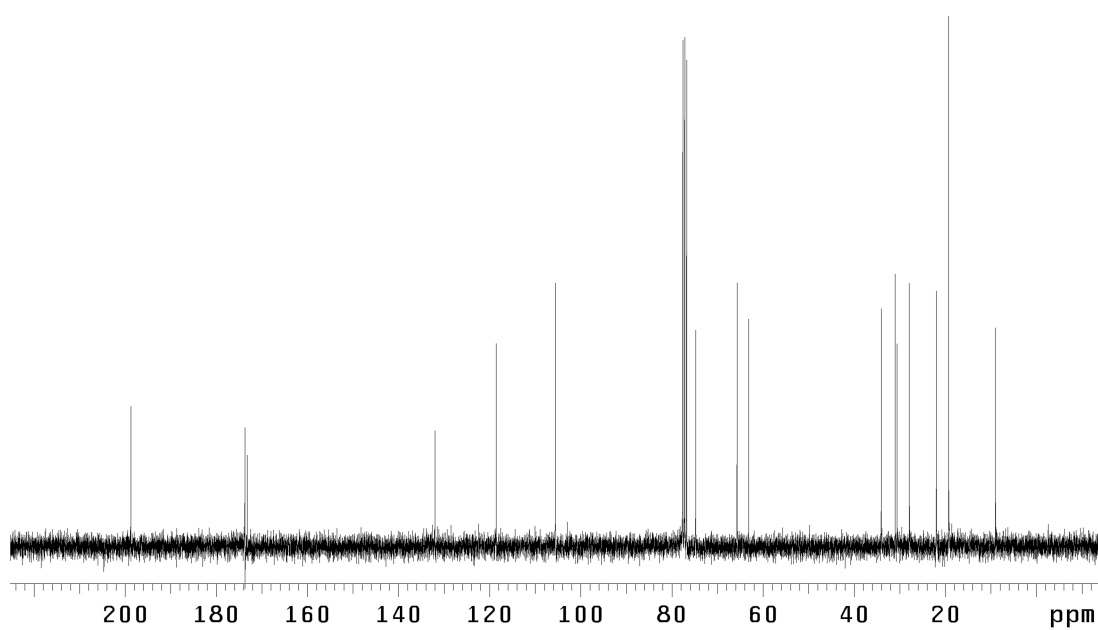
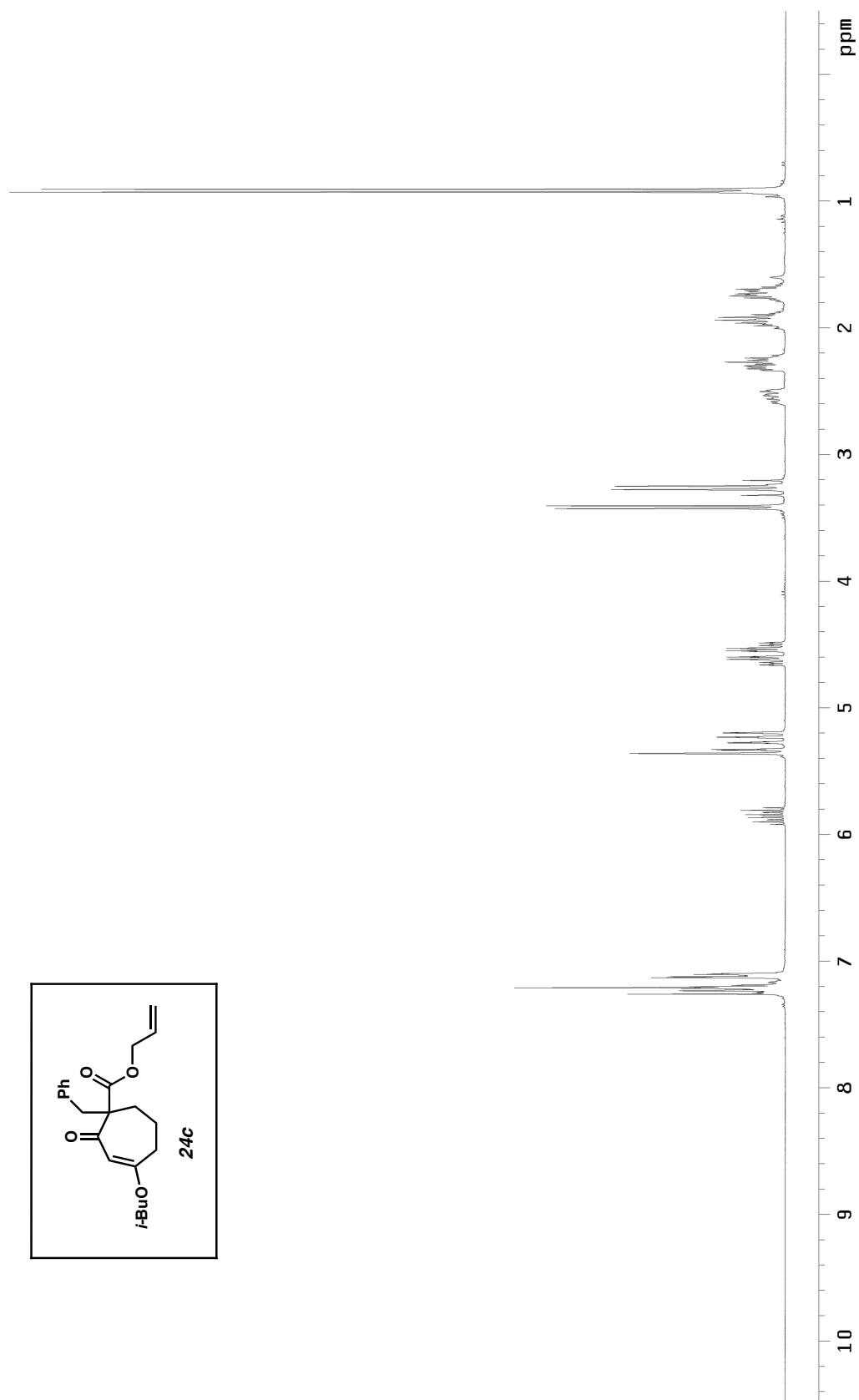


Figure A2.3.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24b**.

Figure A2.4.1. ^1H NMR (300 MHz, CDCl_3) of compound **24c**.

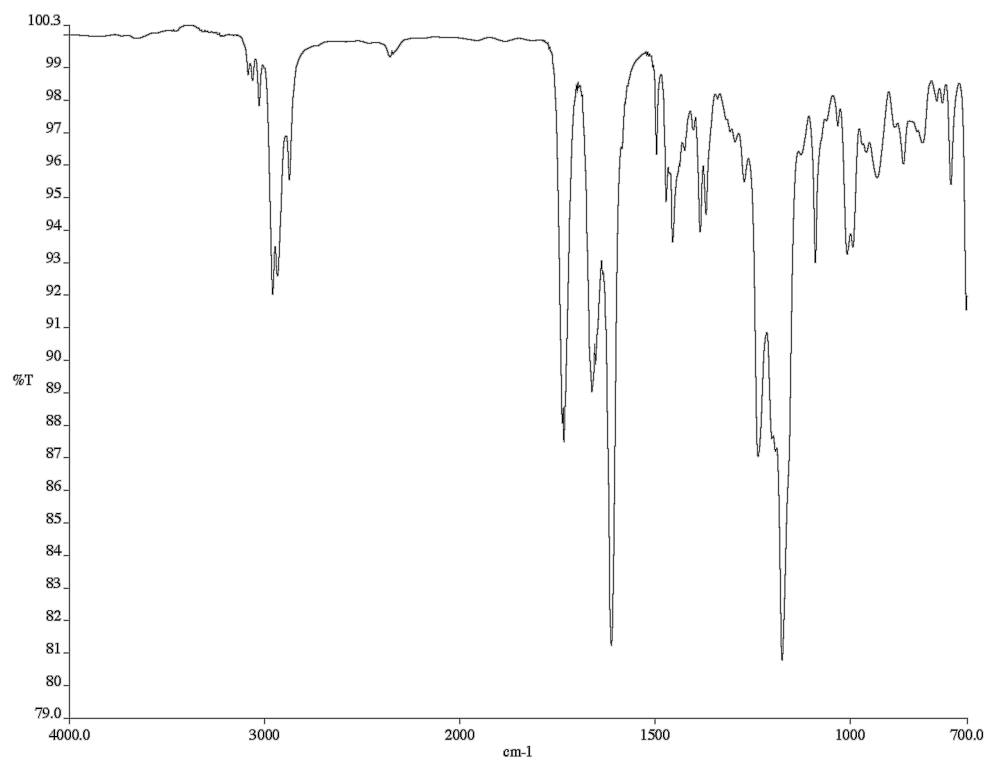


Figure A2.4.2. Infrared spectrum (thin film/NaCl) of compound **24c**.

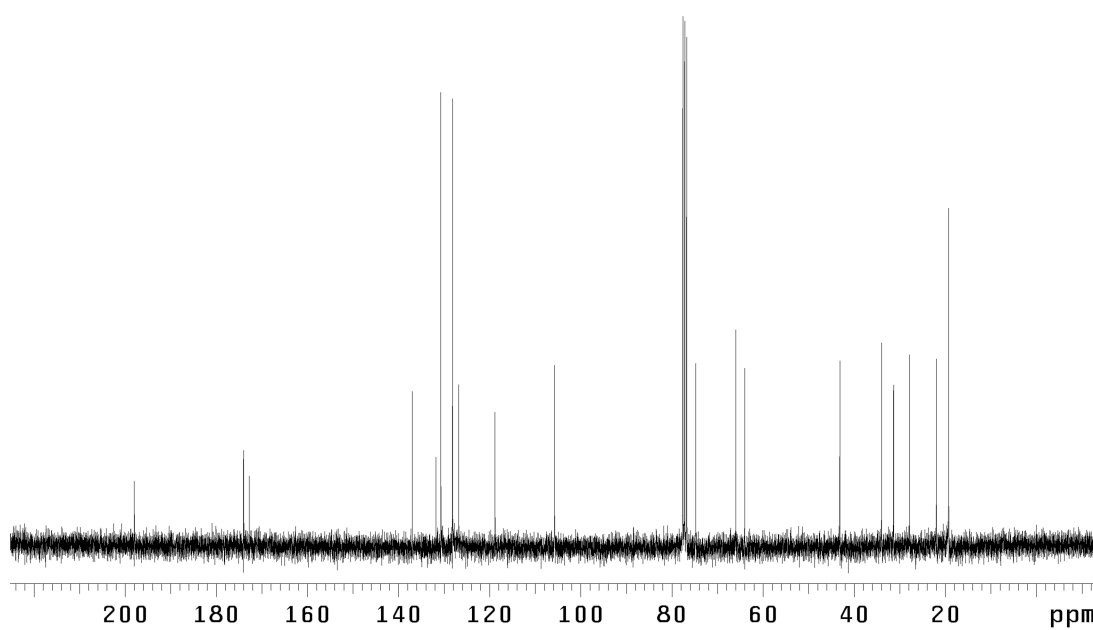


Figure A2.4.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **24c**.

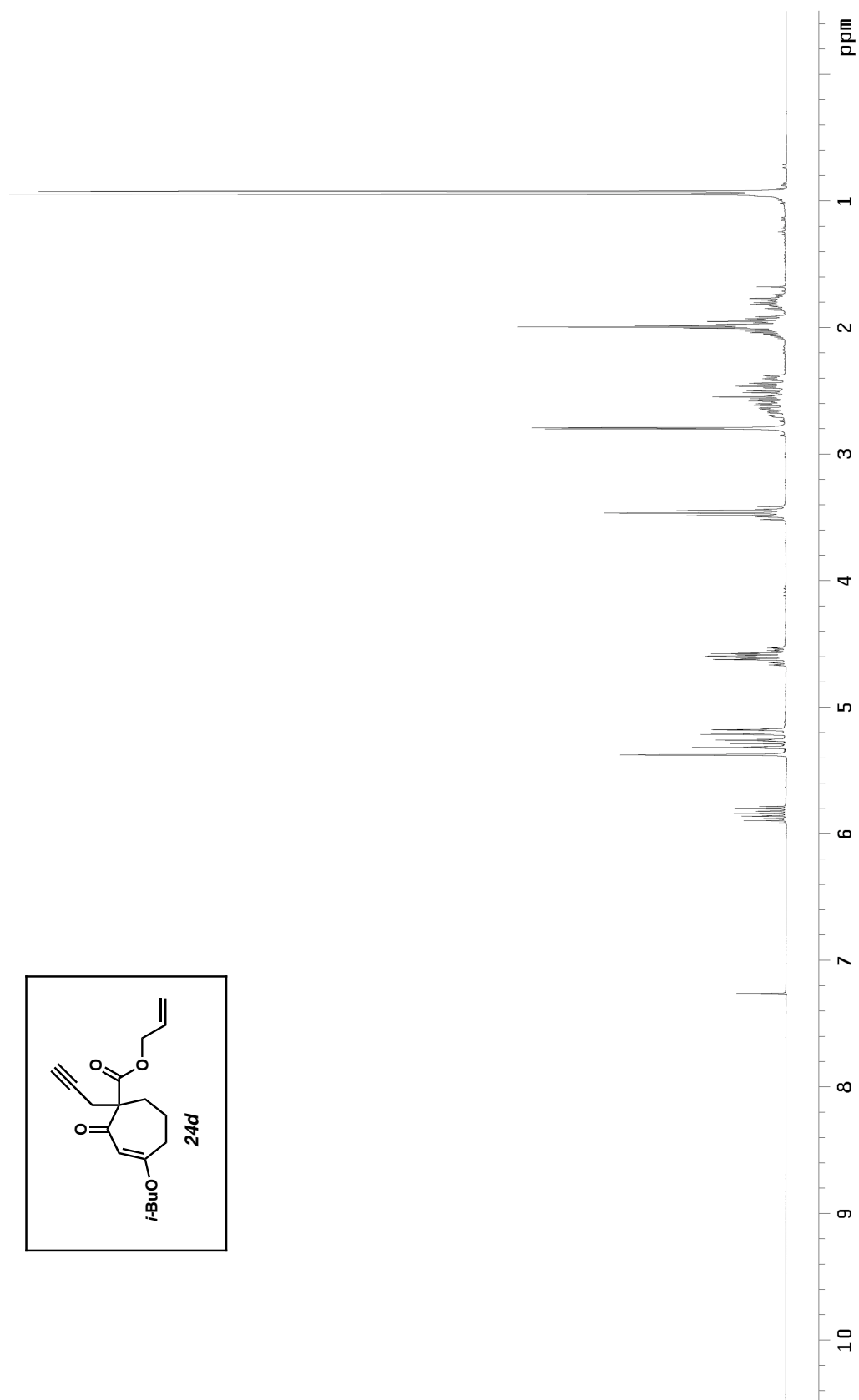


Figure A2.5.1. ^1H NMR (300 MHz, CDCl_3) of compound **24d**.

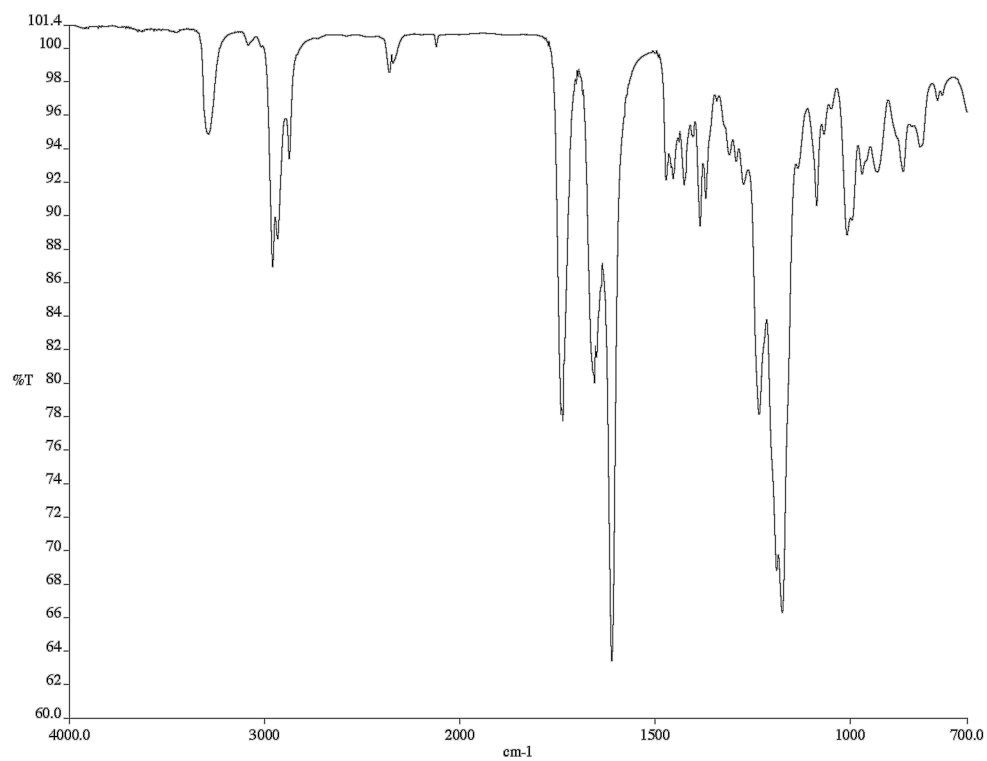


Figure A2.5.2. Infrared spectrum (thin film/NaCl) of compound **24d**.

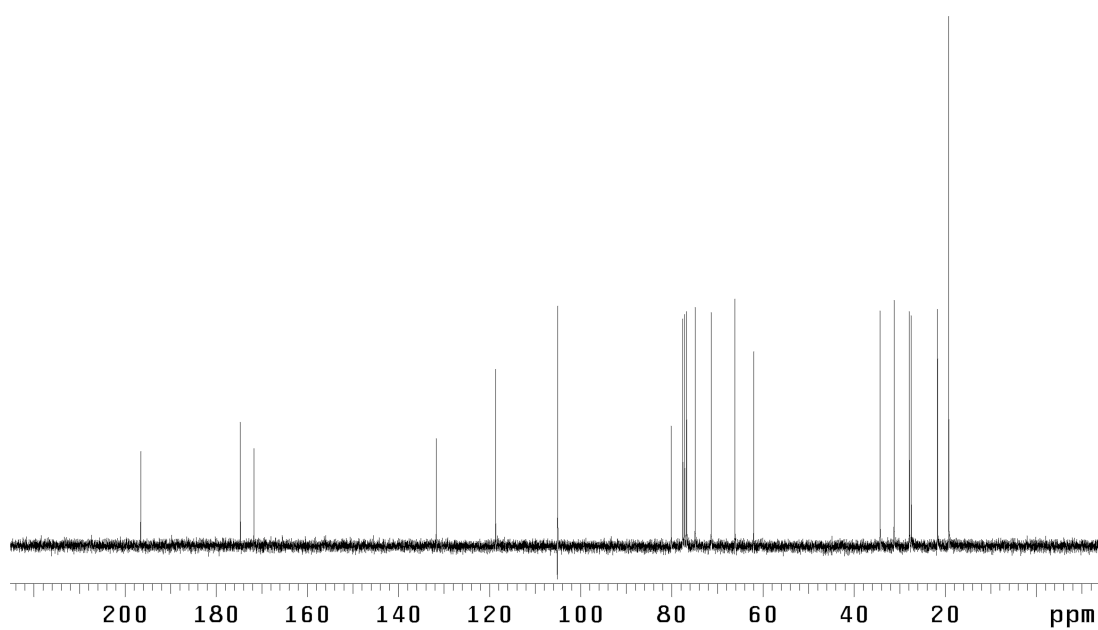
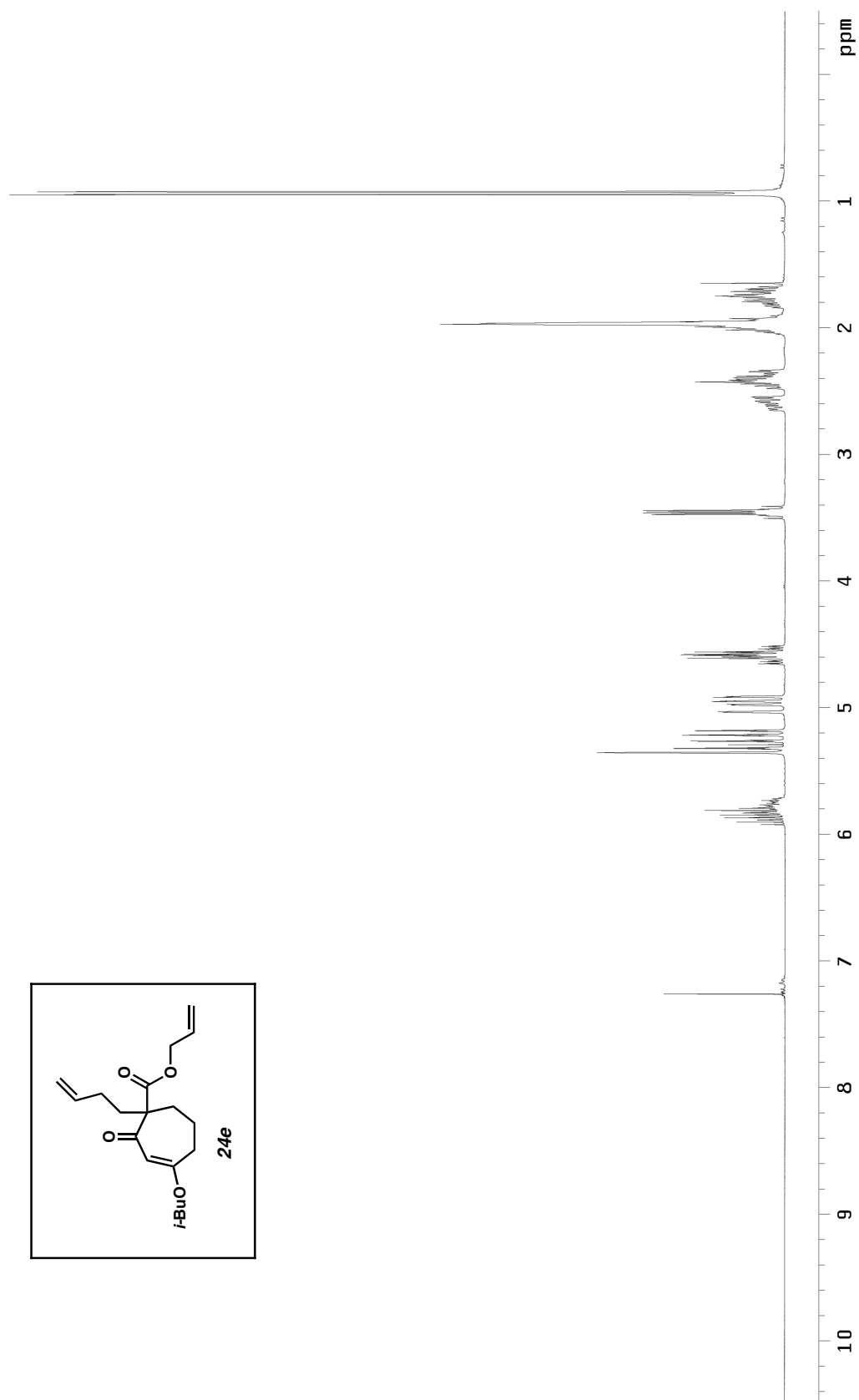


Figure A2.5.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24d**.

Figure A2.6.1. ^1H NMR (300 MHz, CDCl_3) of compound **24e**.

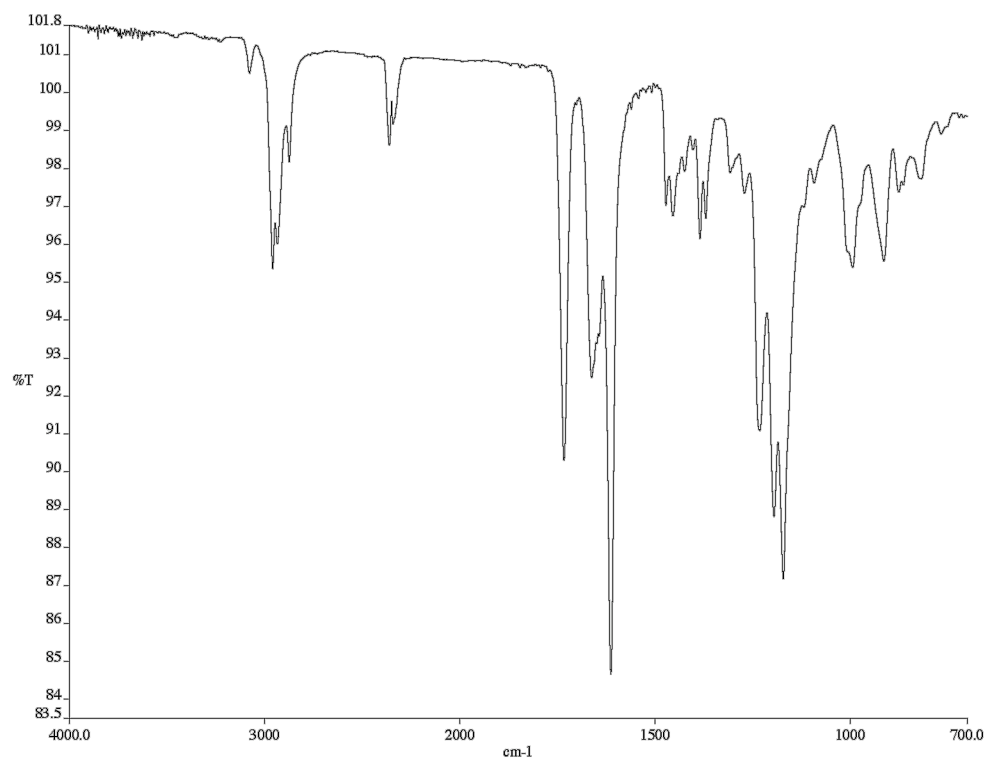


Figure A2.6.2. Infrared spectrum (thin film/NaCl) of compound **24e**.

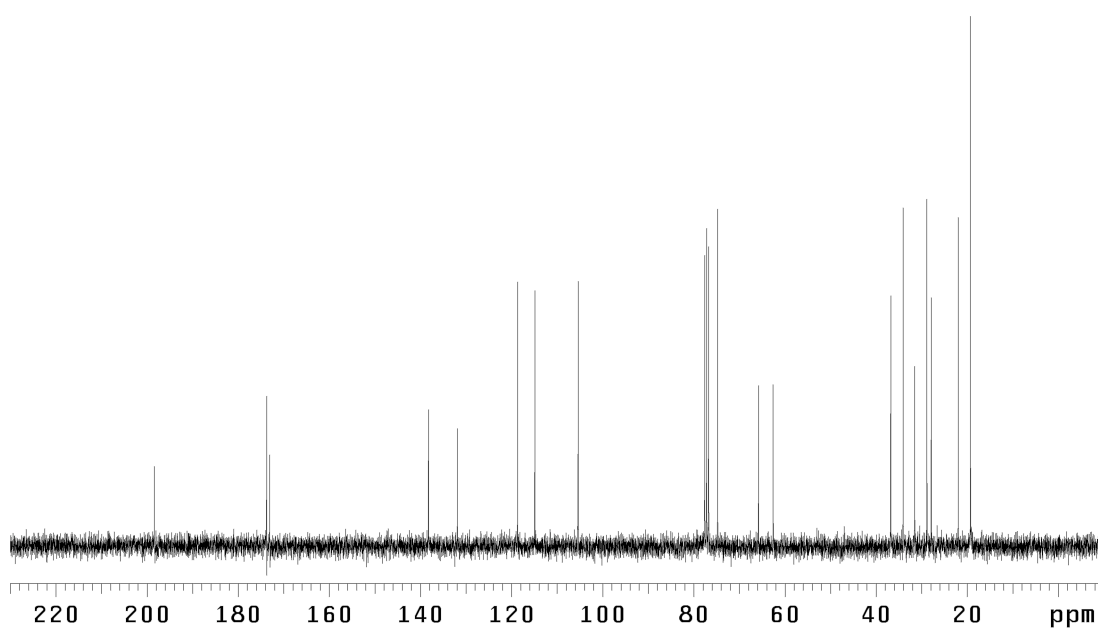
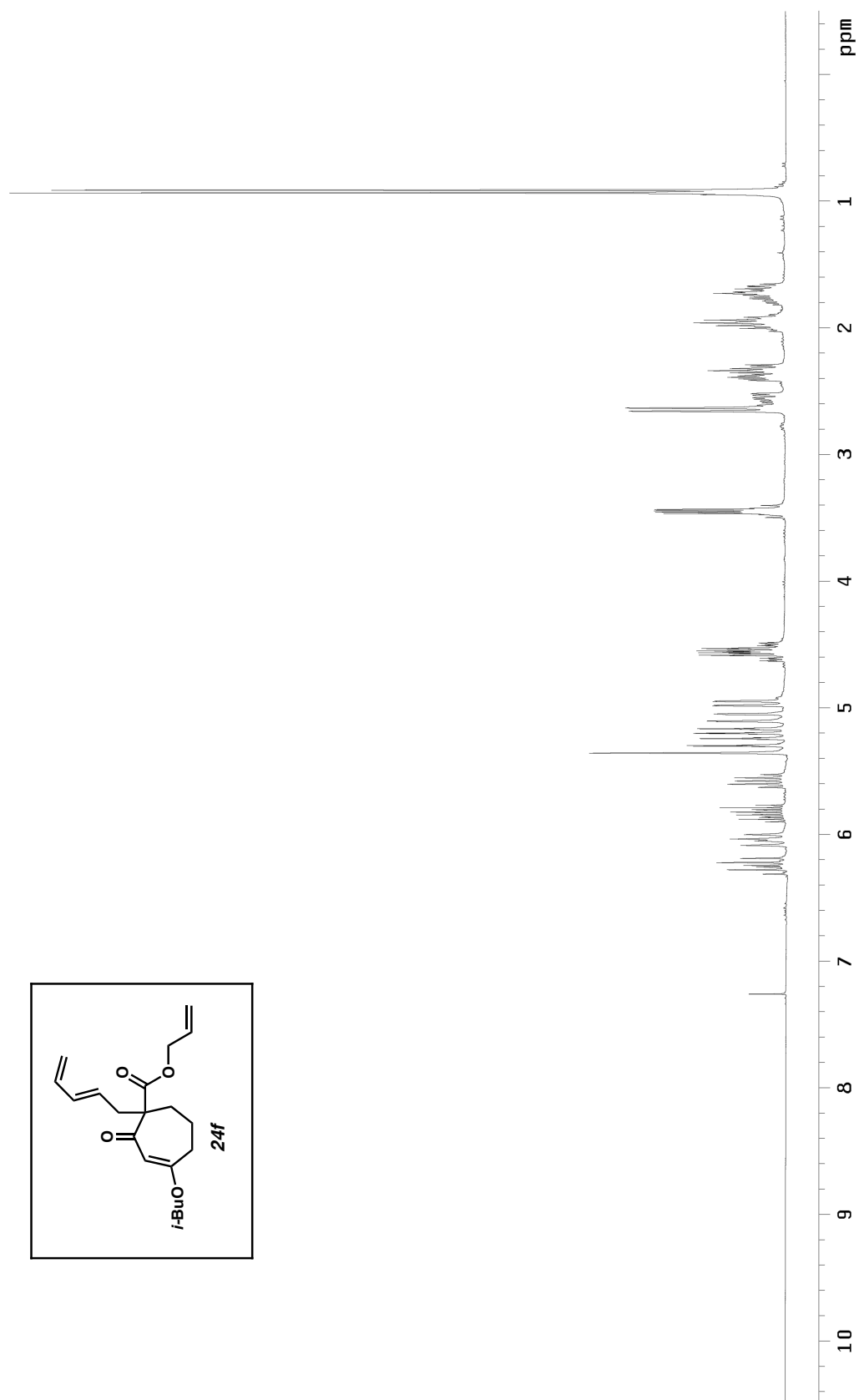


Figure A2.6.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **24e**.



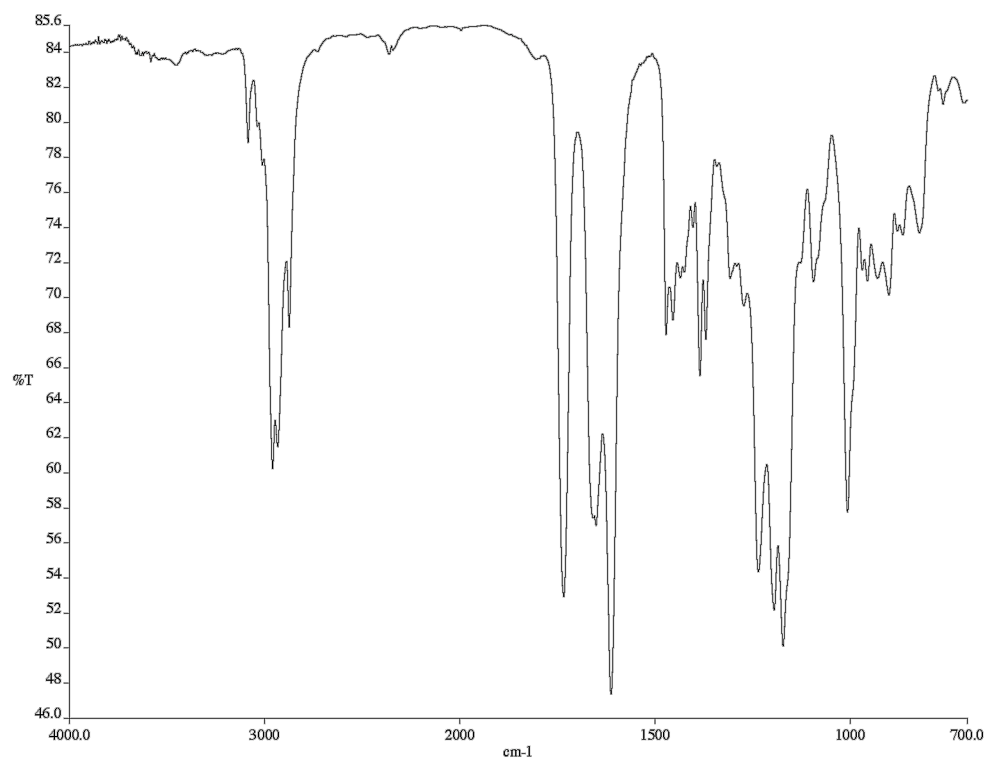


Figure A2.7.2. Infrared spectrum (thin film/NaCl) of compound **24f**.

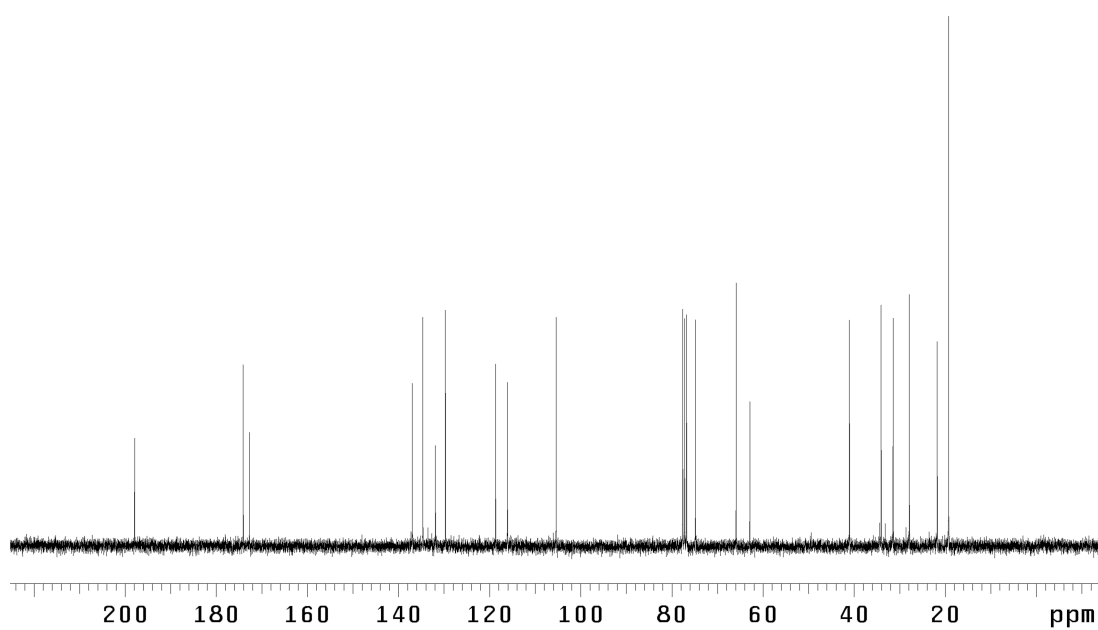
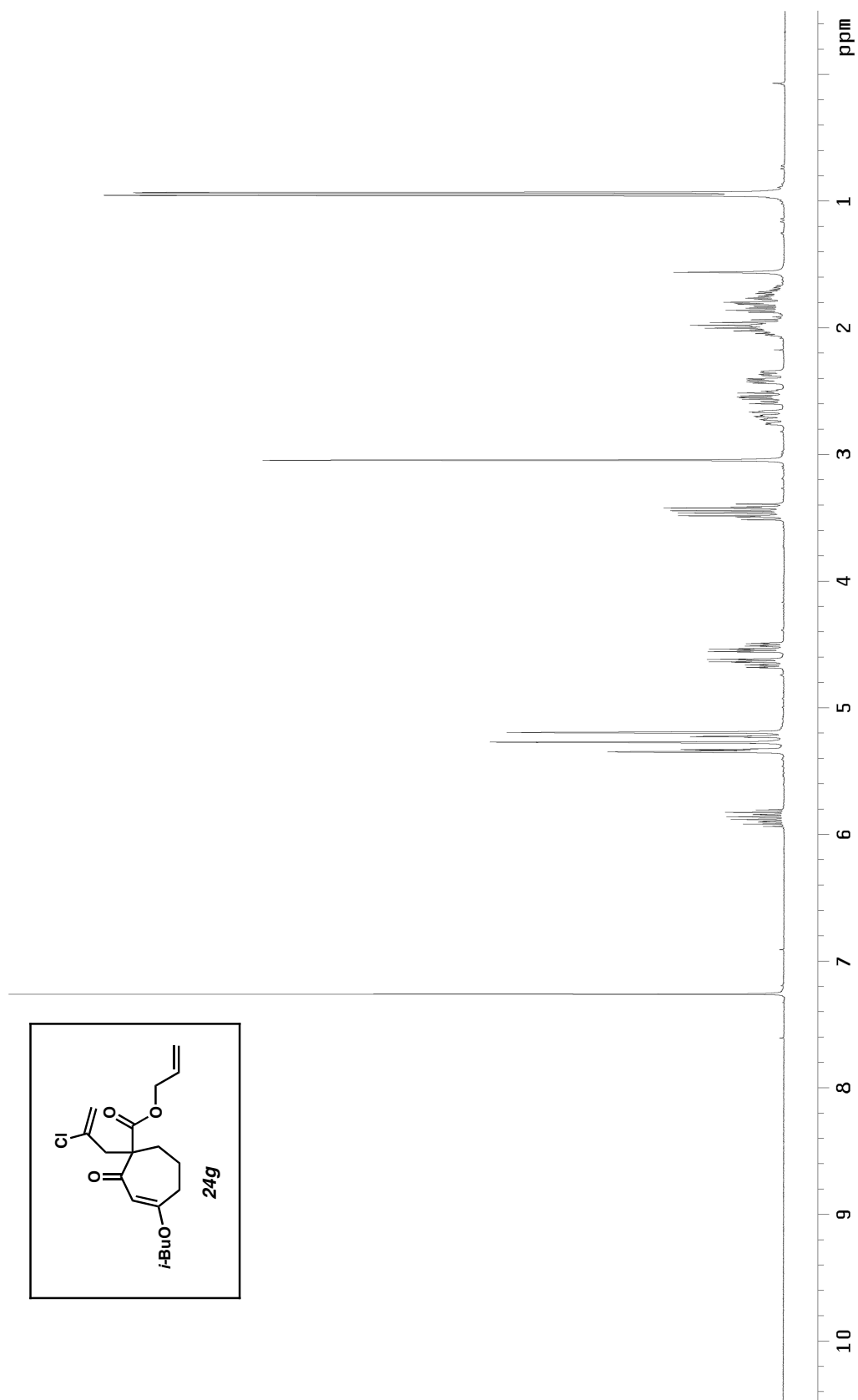


Figure A2.7.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24f**.

Figure A2.8.1. ¹H NMR (300 MHz, CDCl₃) of compound **24g**.

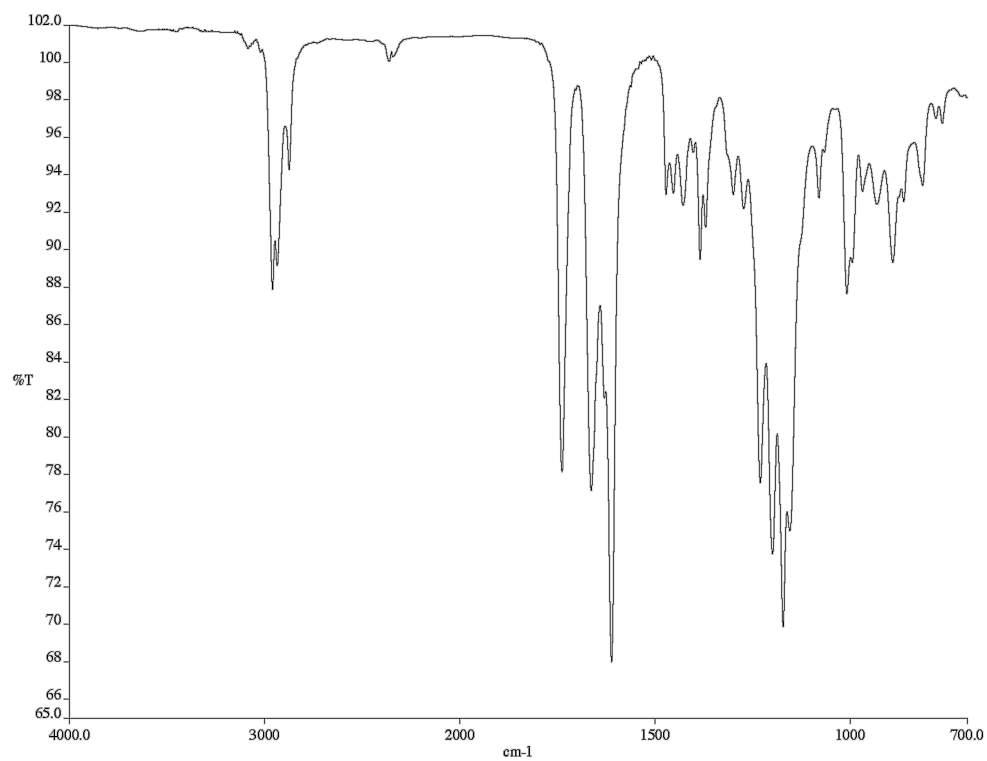


Figure A2.8.2. Infrared spectrum (thin film/NaCl) of compound **24g**.

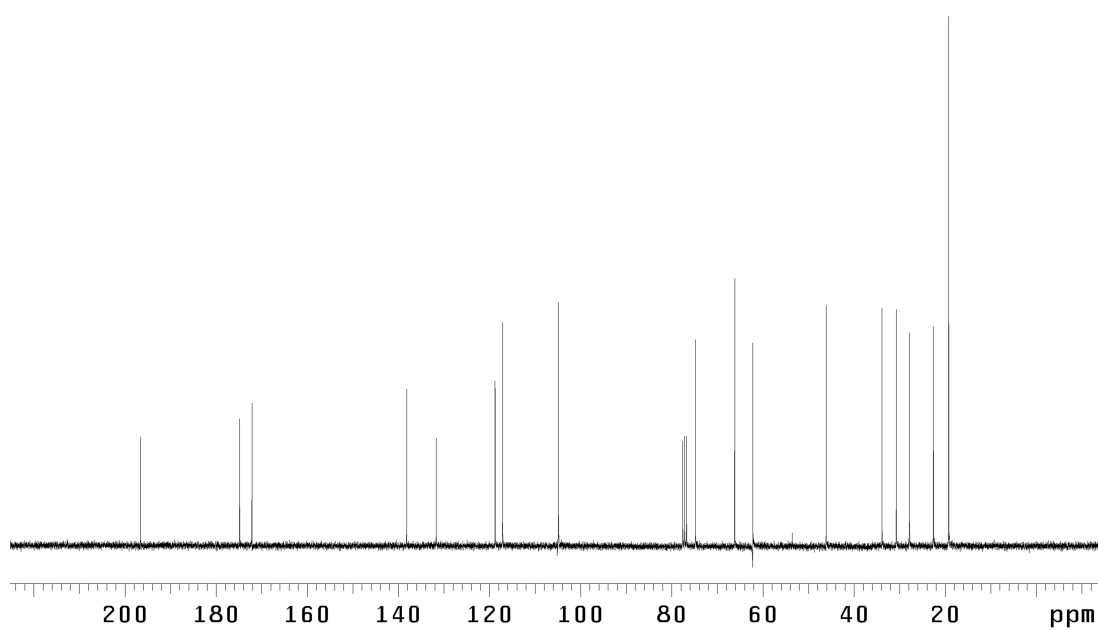
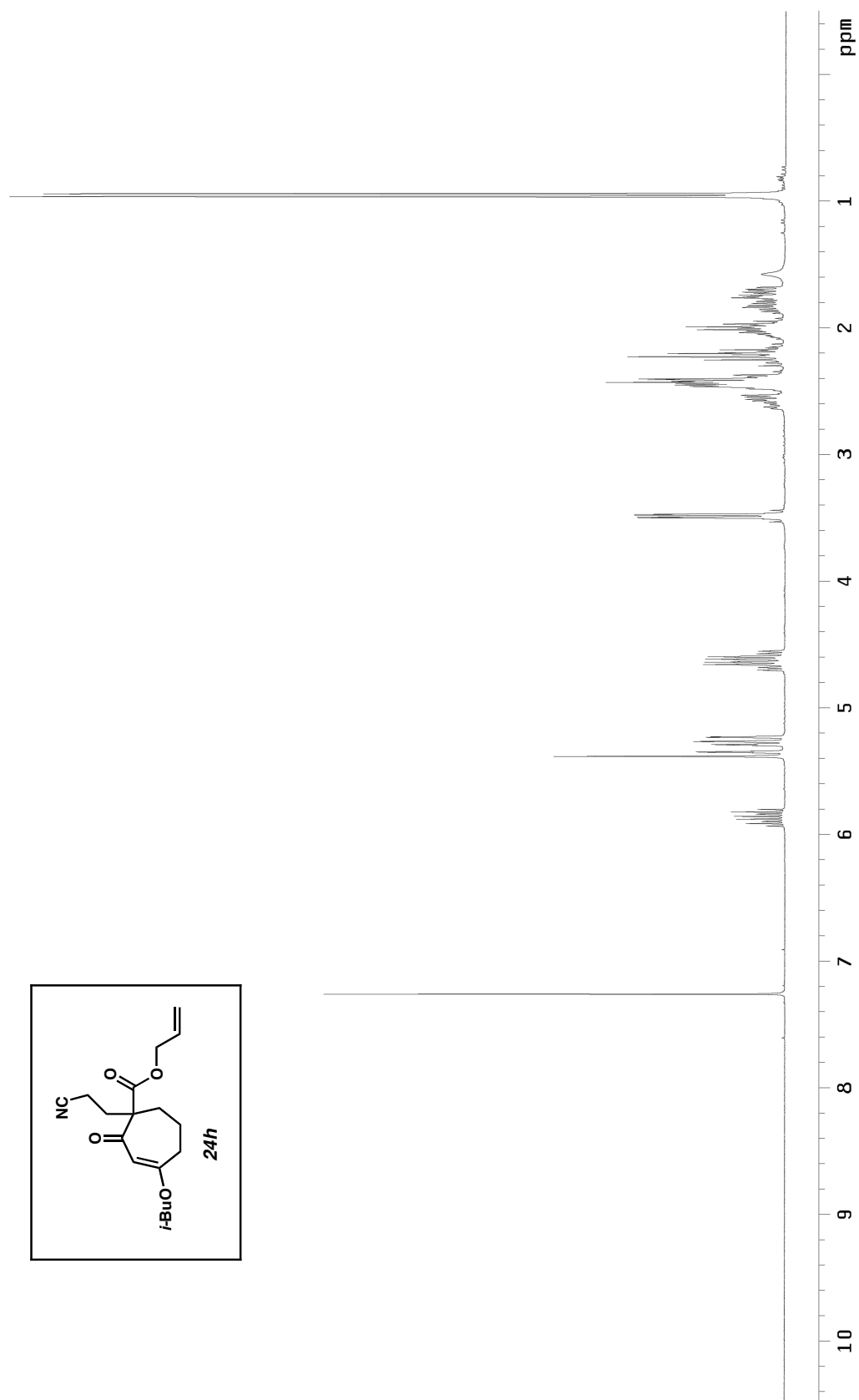


Figure A2.8.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **24g**.

Figure A2.9.1. ^1H NMR (300 MHz, CDCl_3) of compound **24h**.

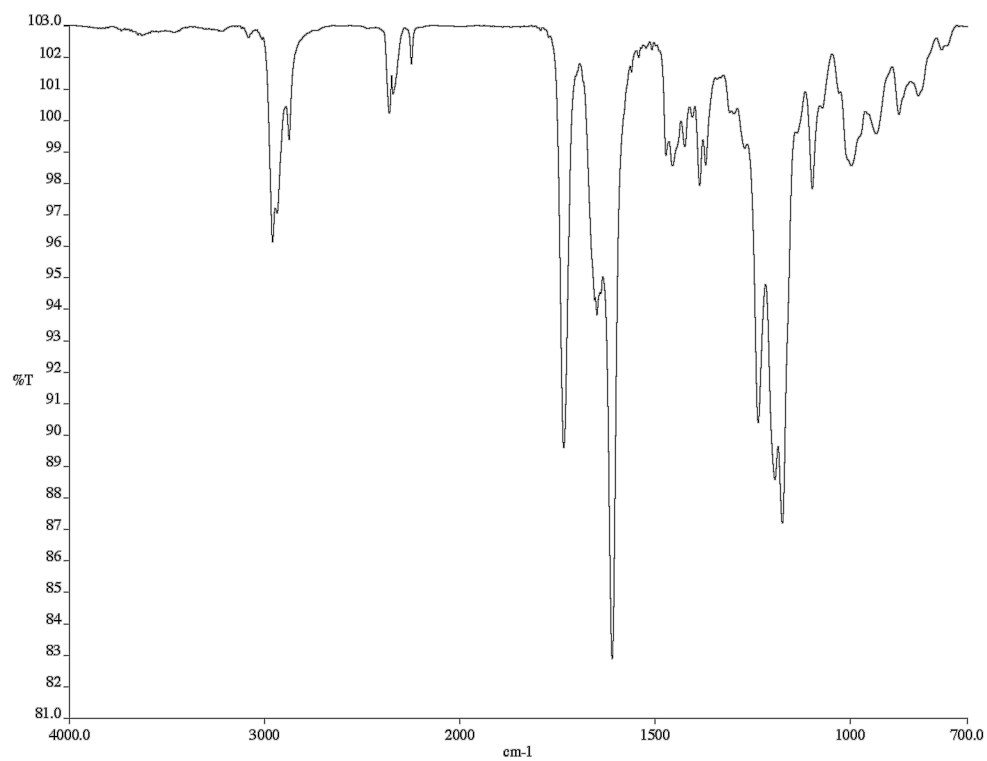


Figure A2.9.2. Infrared spectrum (thin film/NaCl) of compound **24h**.

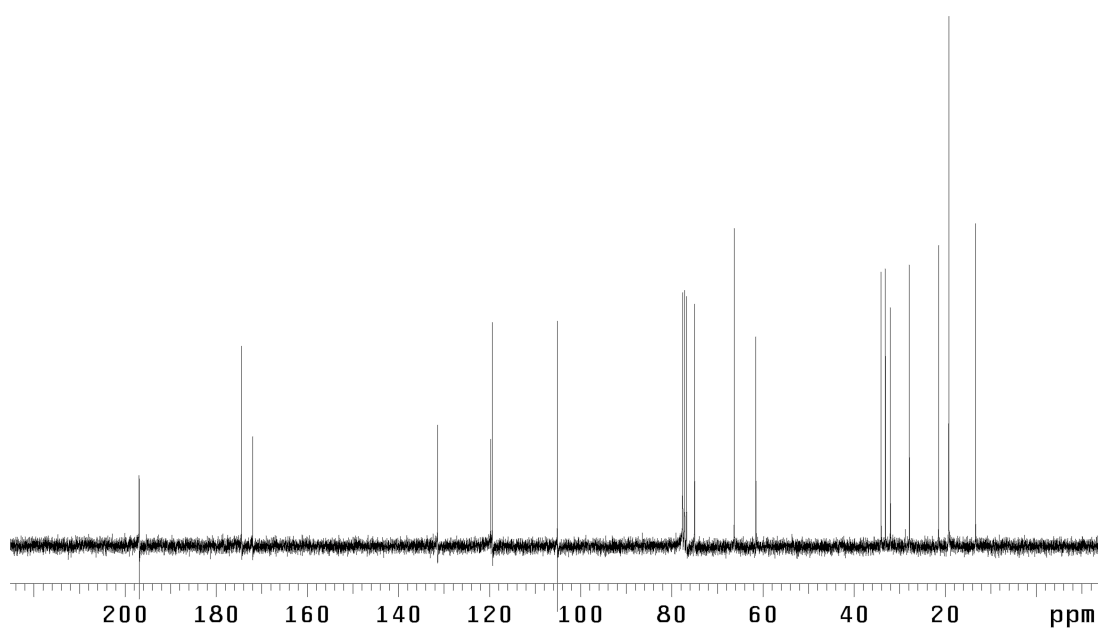
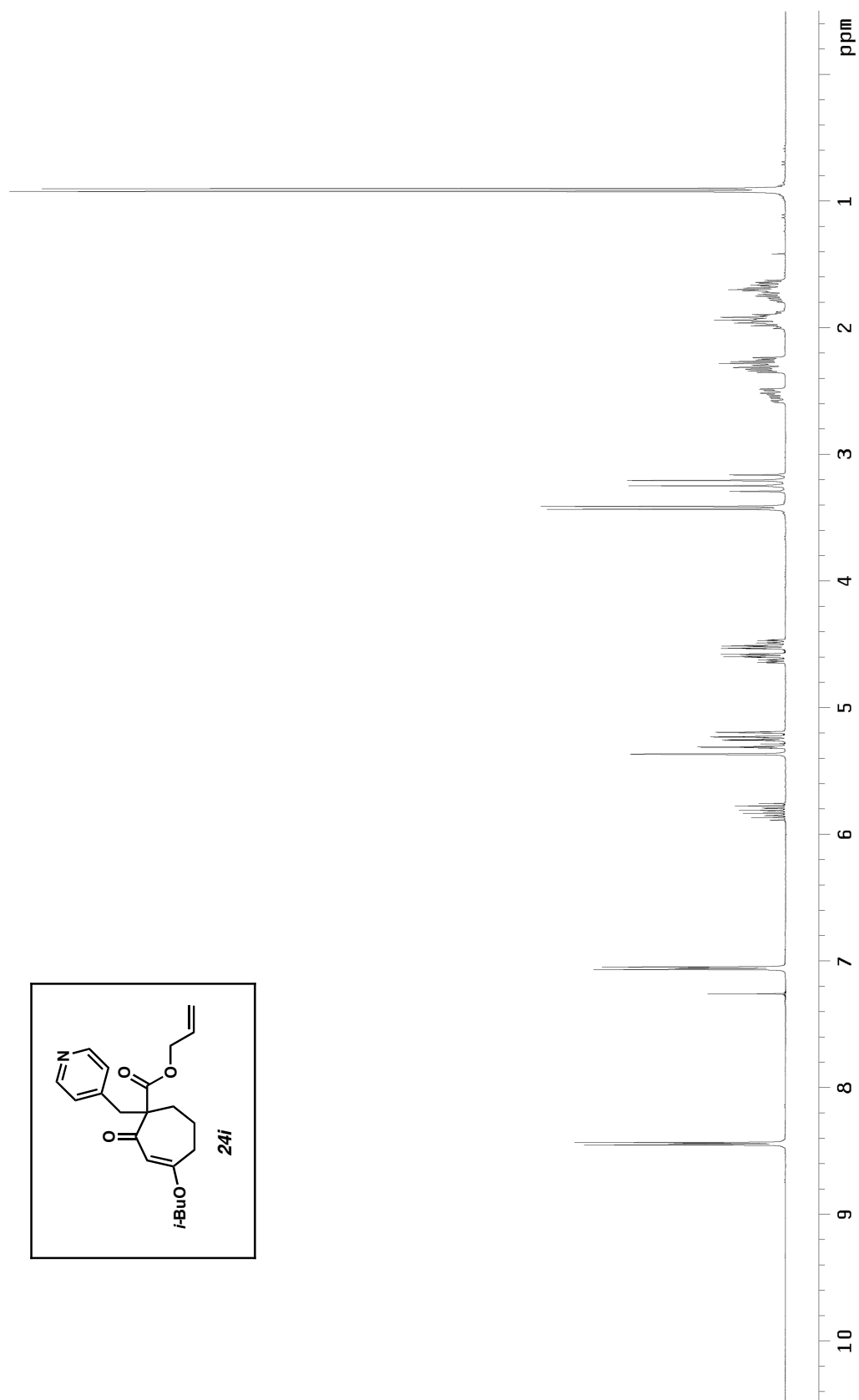


Figure A2.9.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24h**.

Figure A2.10.1. ^1H NMR (300 MHz, CDCl_3) of compound **24i**.

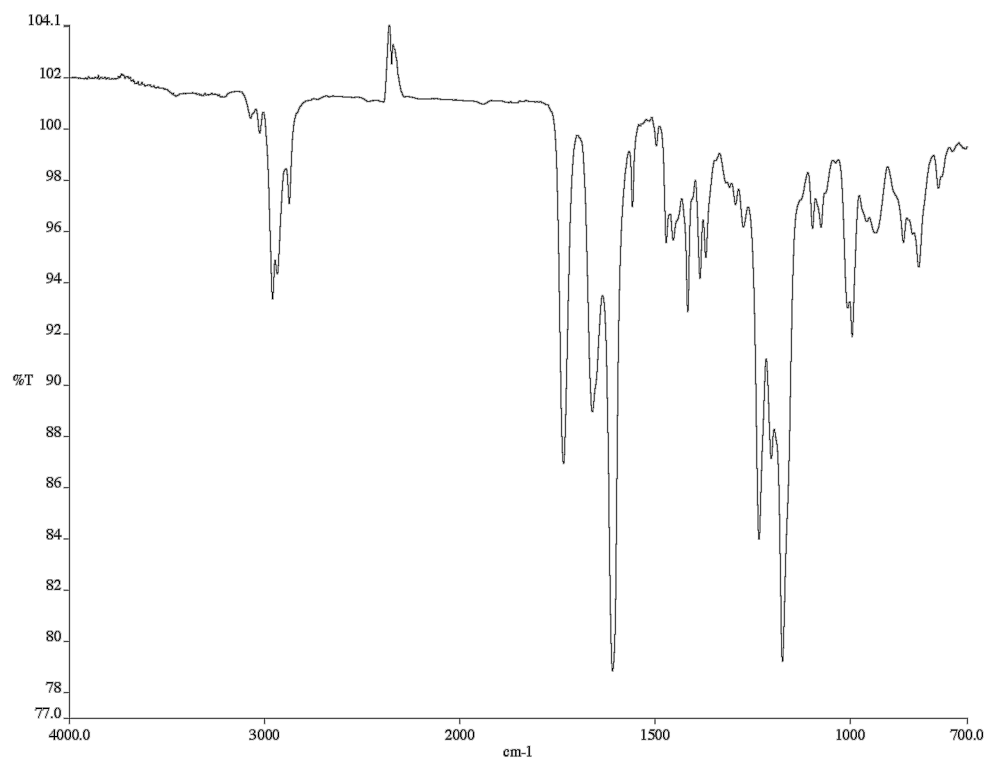


Figure A2.10.2. Infrared spectrum (thin film/NaCl) of compound **24i**.

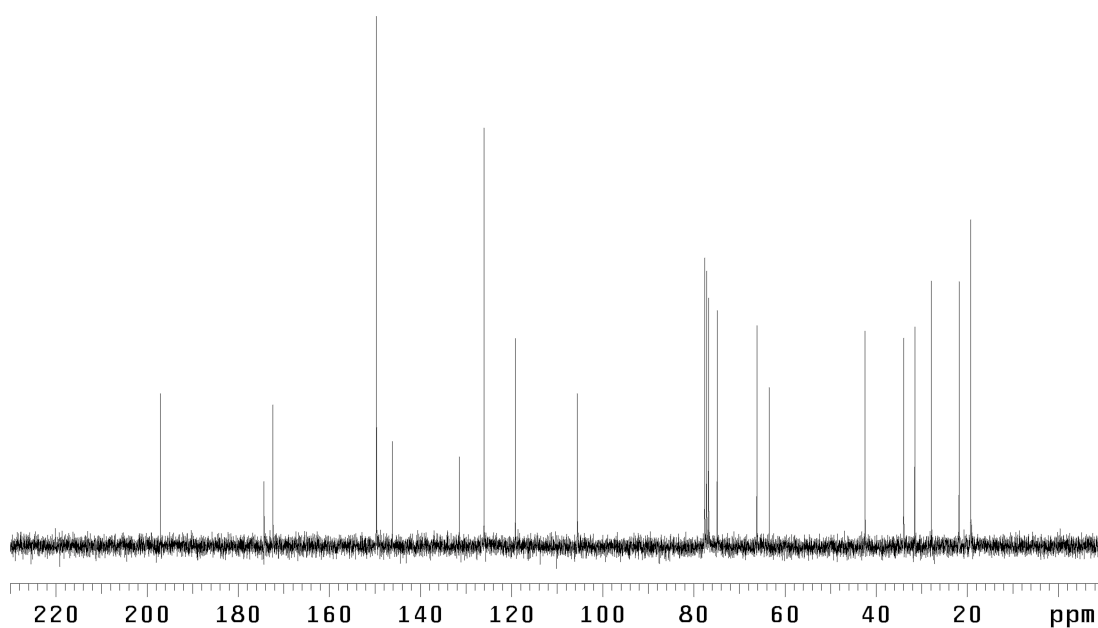
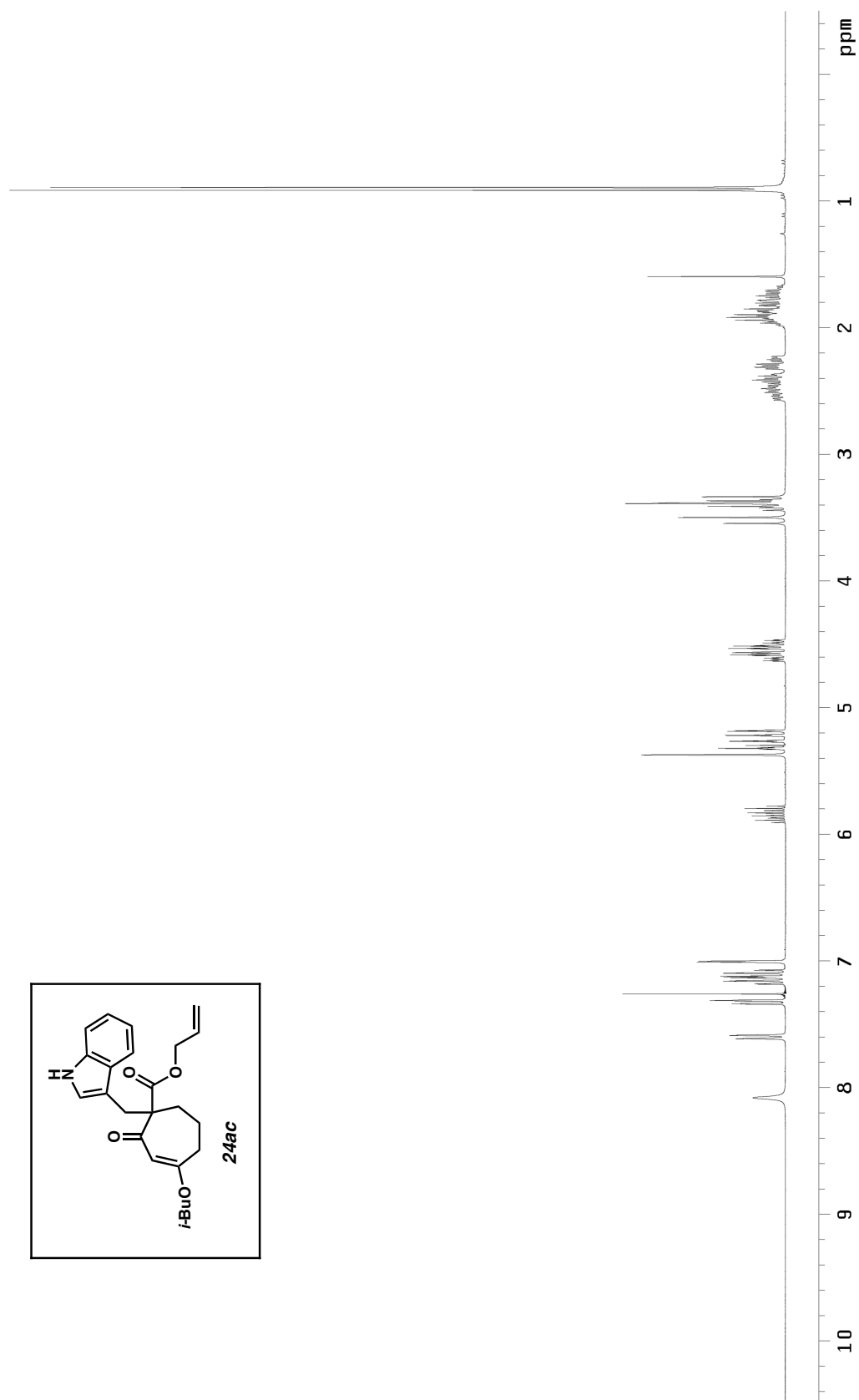


Figure A2.10.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24i**.

Figure A2.11.1. ^1H NMR (300 MHz, CDCl_3) of compound **24ac**.

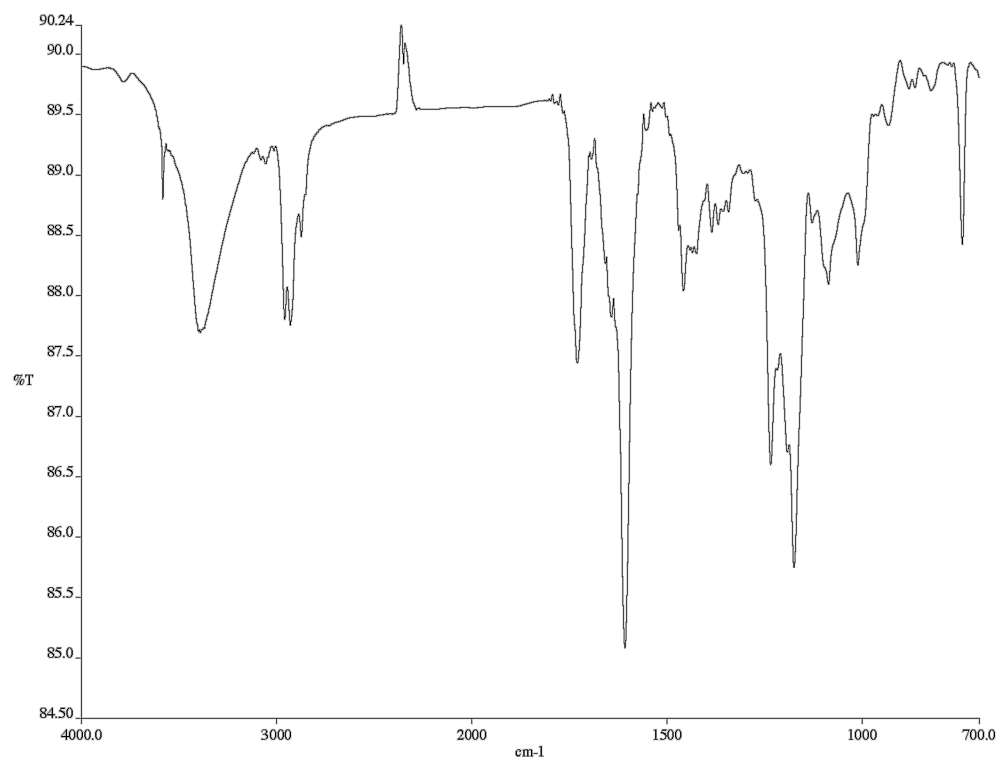


Figure A2.11.2. Infrared spectrum (thin film/NaCl) of compound **24ac**.

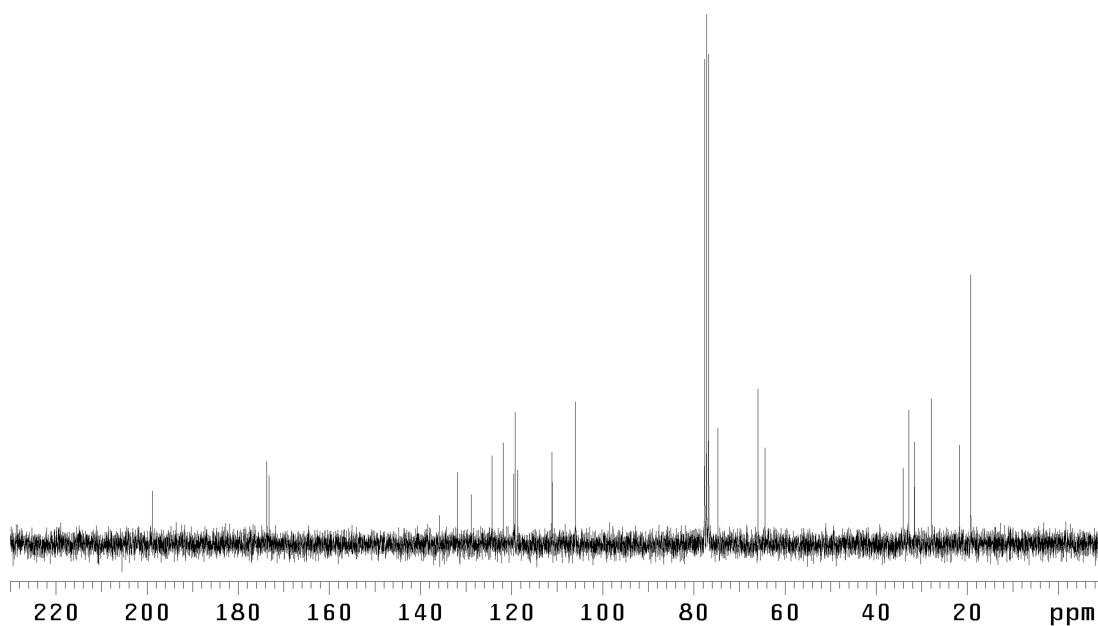
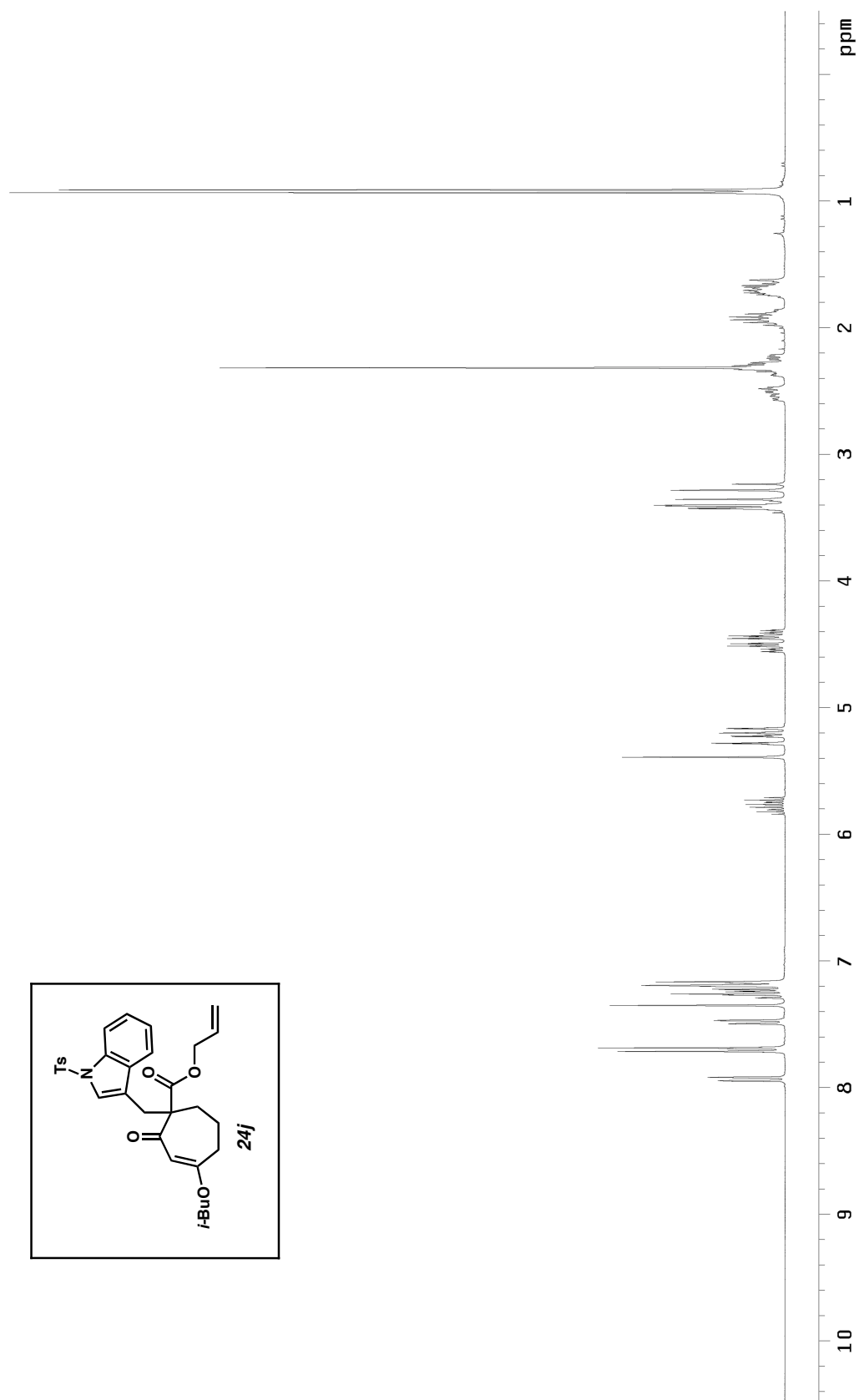


Figure A2.11.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24ac**.



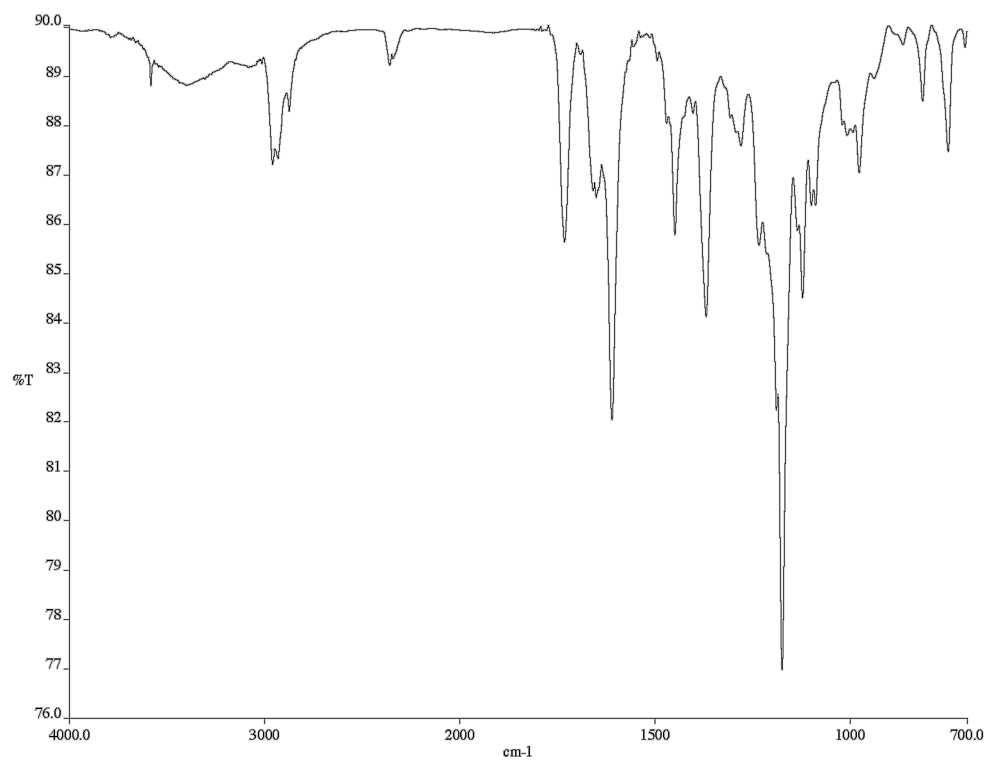


Figure A2.12.2. Infrared spectrum (thin film/NaCl) of compound **24j**.

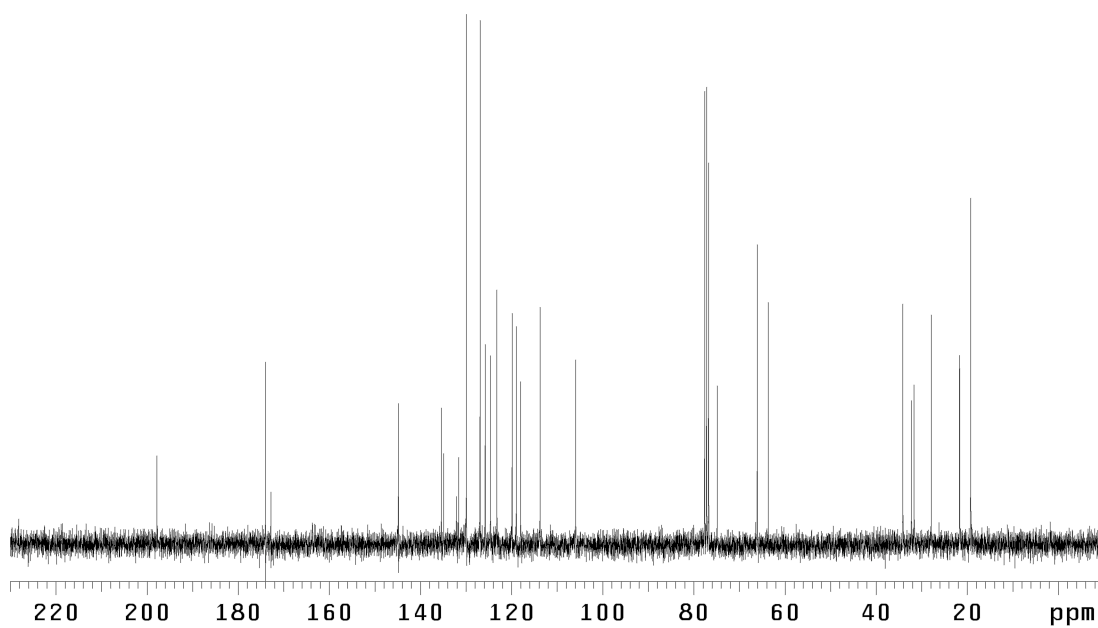


Figure A2.12.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24j**.

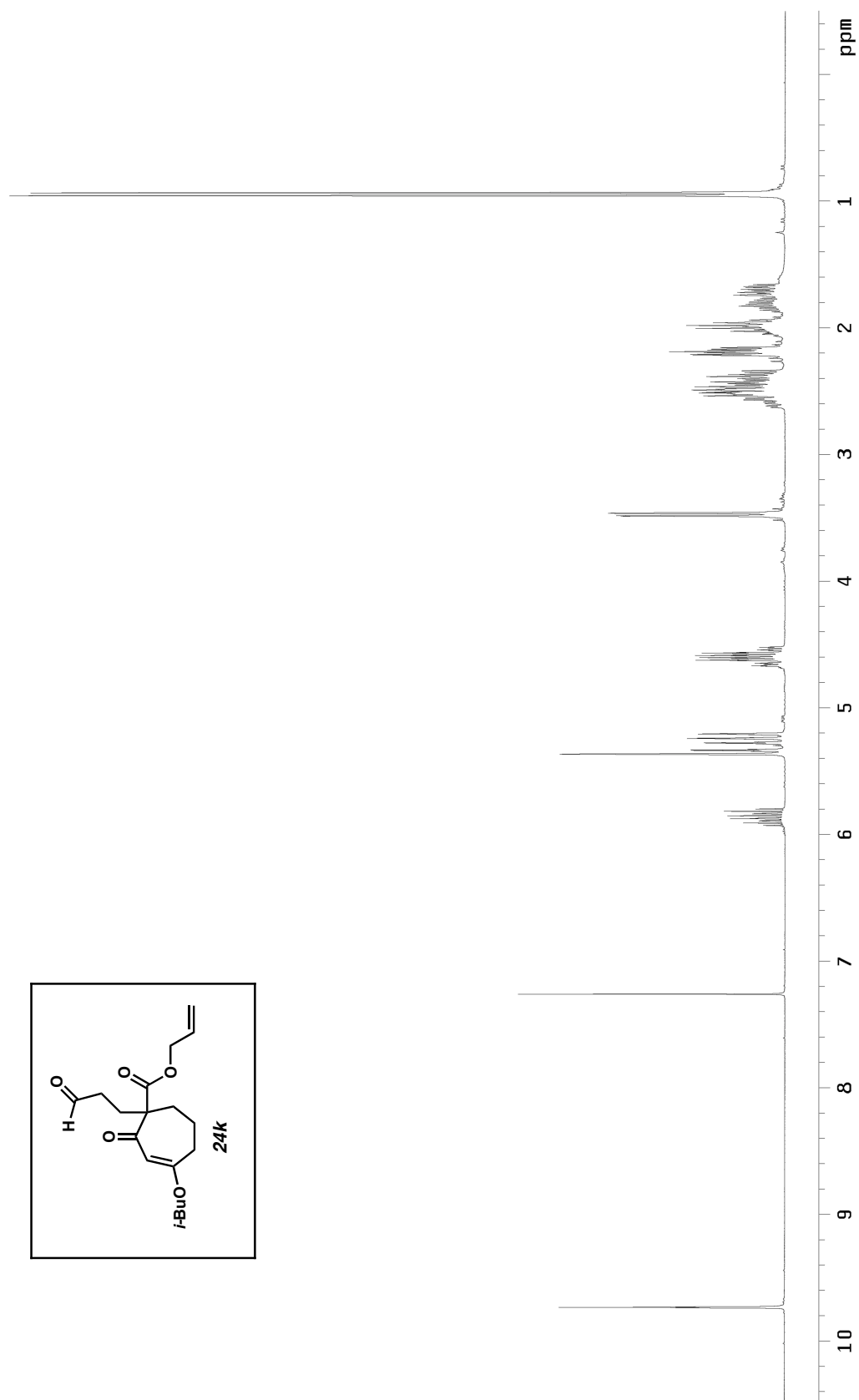


Figure A2.13.1. ^1H NMR (300 MHz, CDCl_3) of compound **24k**.

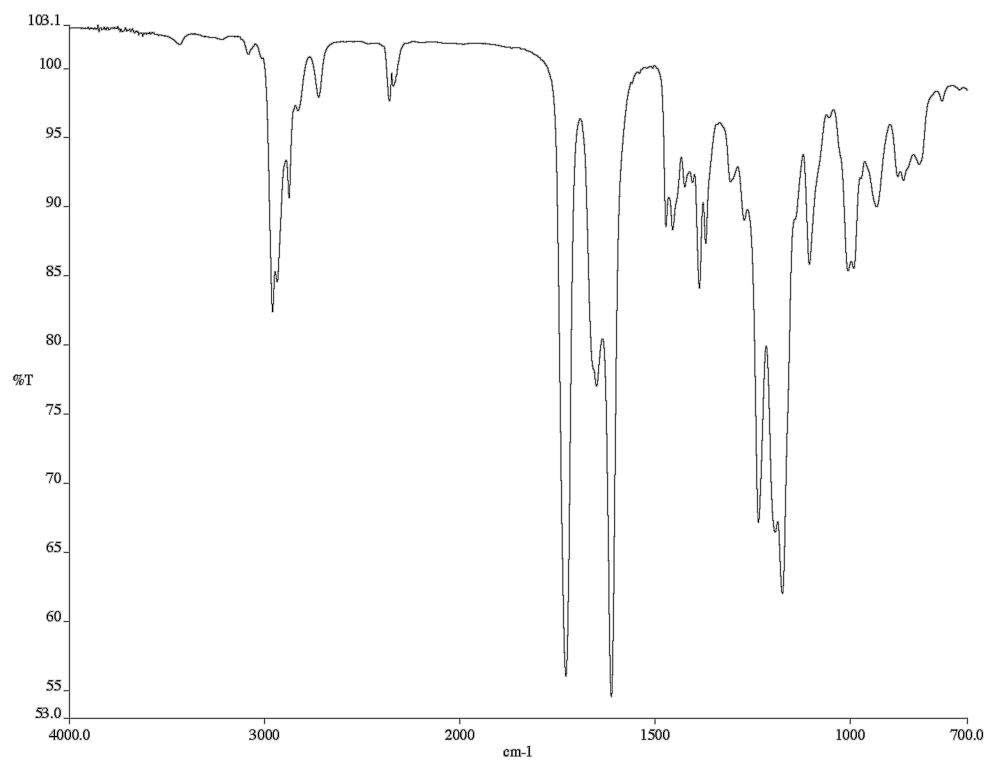


Figure A2.13.2. Infrared spectrum (thin film/NaCl) of compound **24k**.

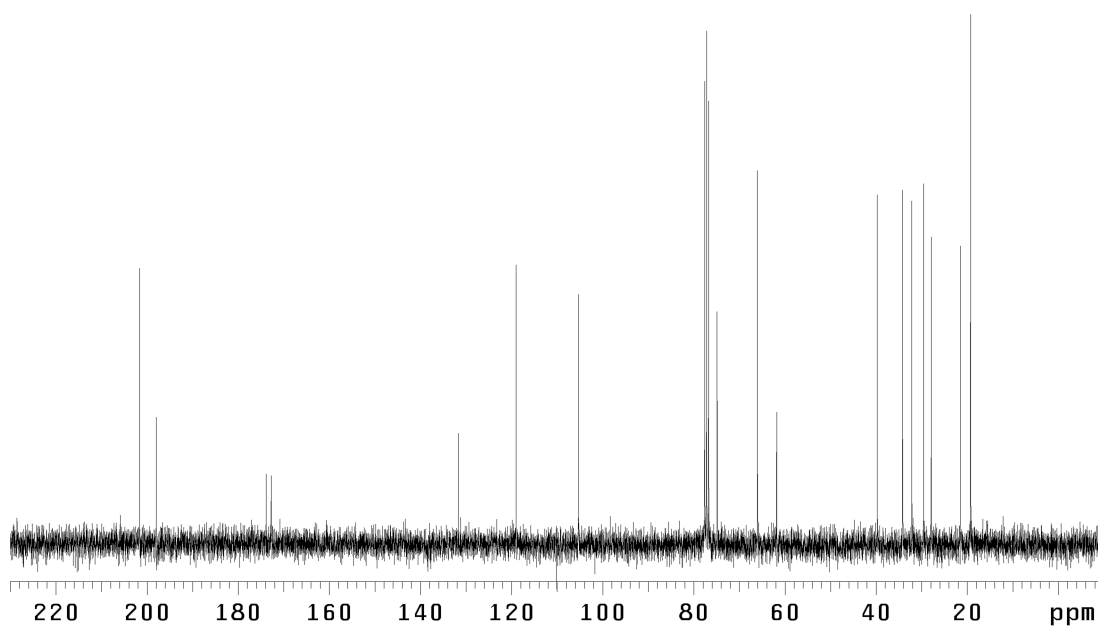
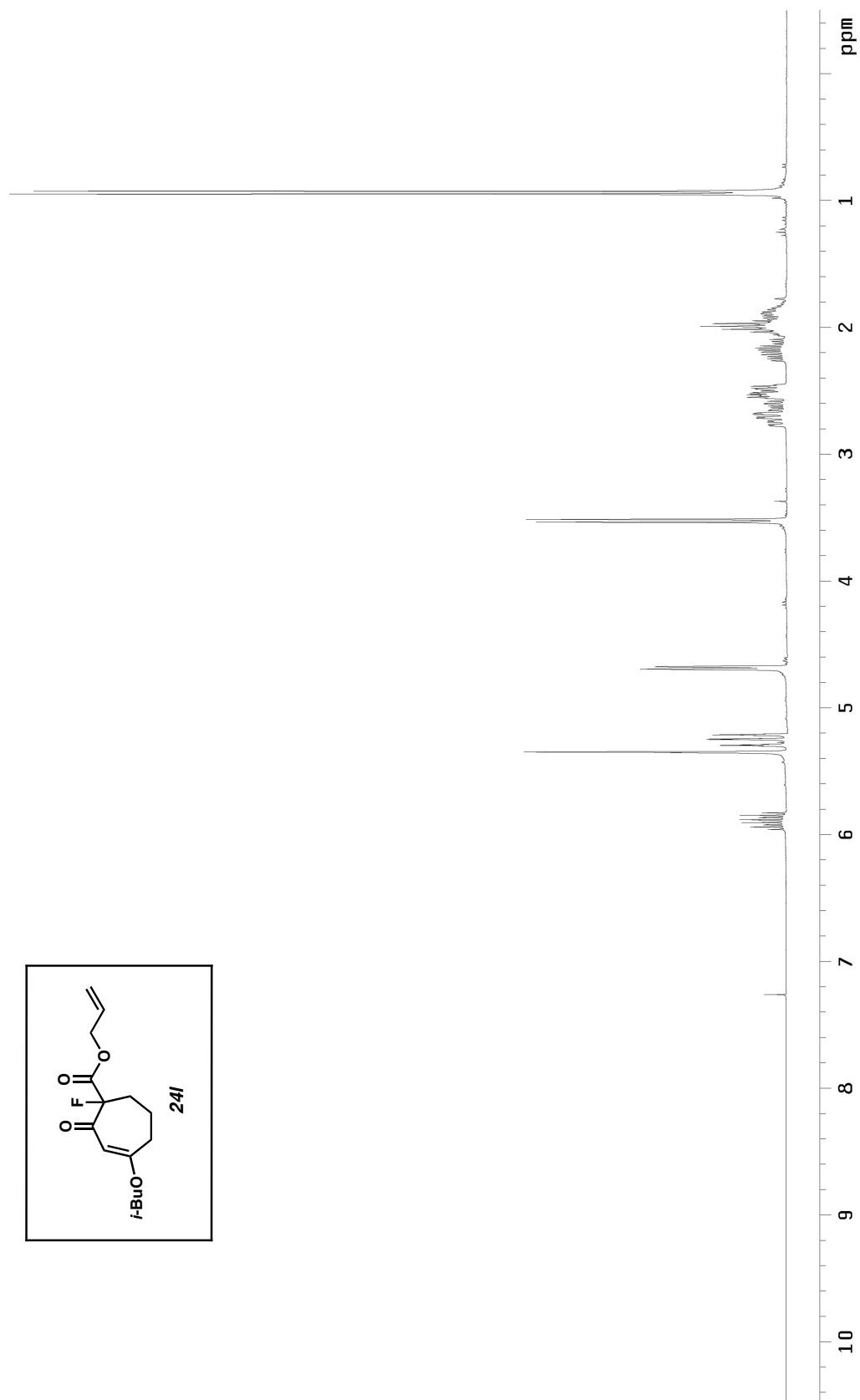
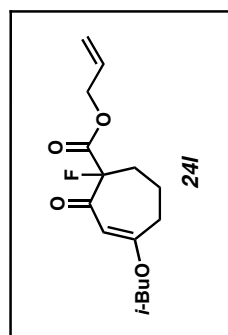


Figure A2.13.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24k**.

Figure A2.14.1. ¹H NMR (300 MHz, CDCl₃) of compound **24I**.

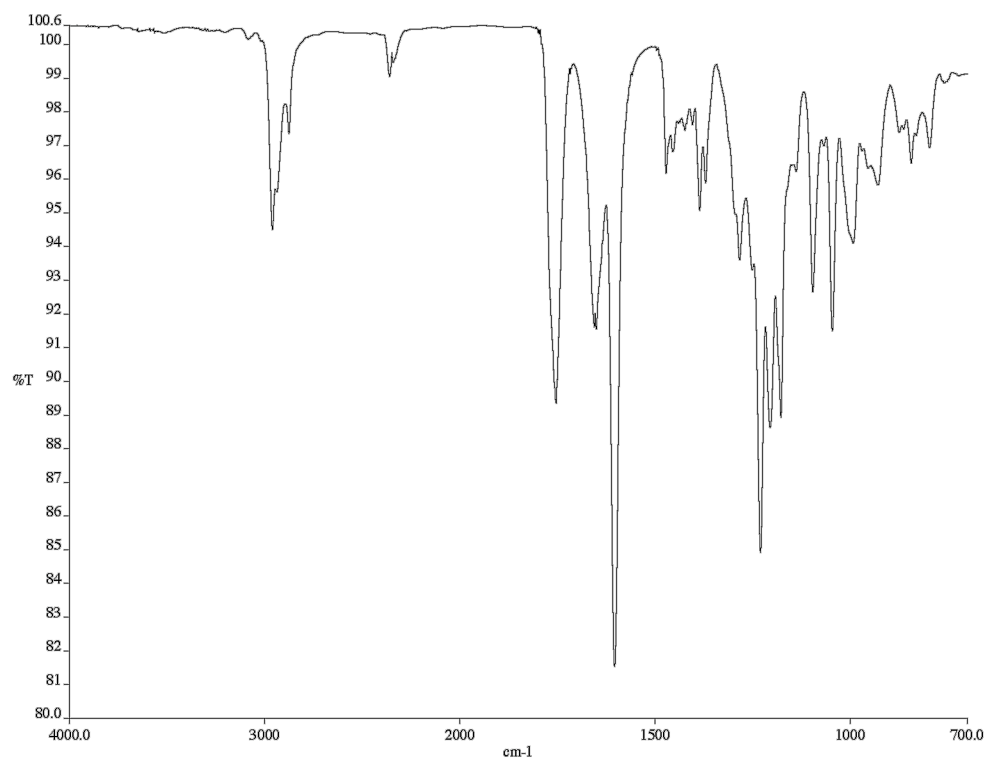


Figure A2.14.2. Infrared spectrum (thin film/NaCl) of compound **24I**.

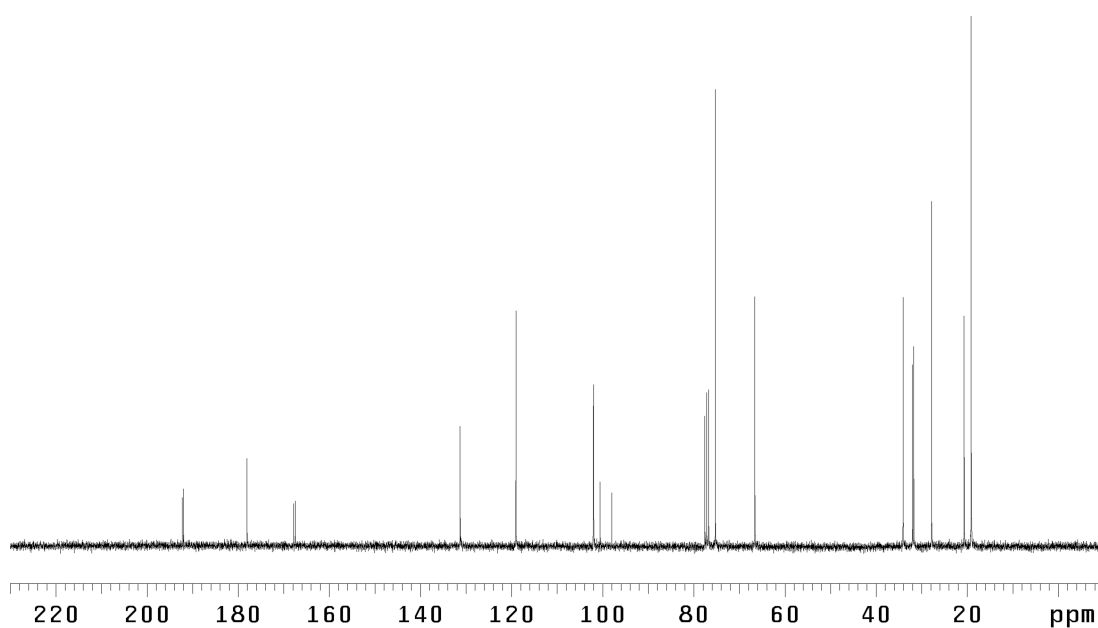
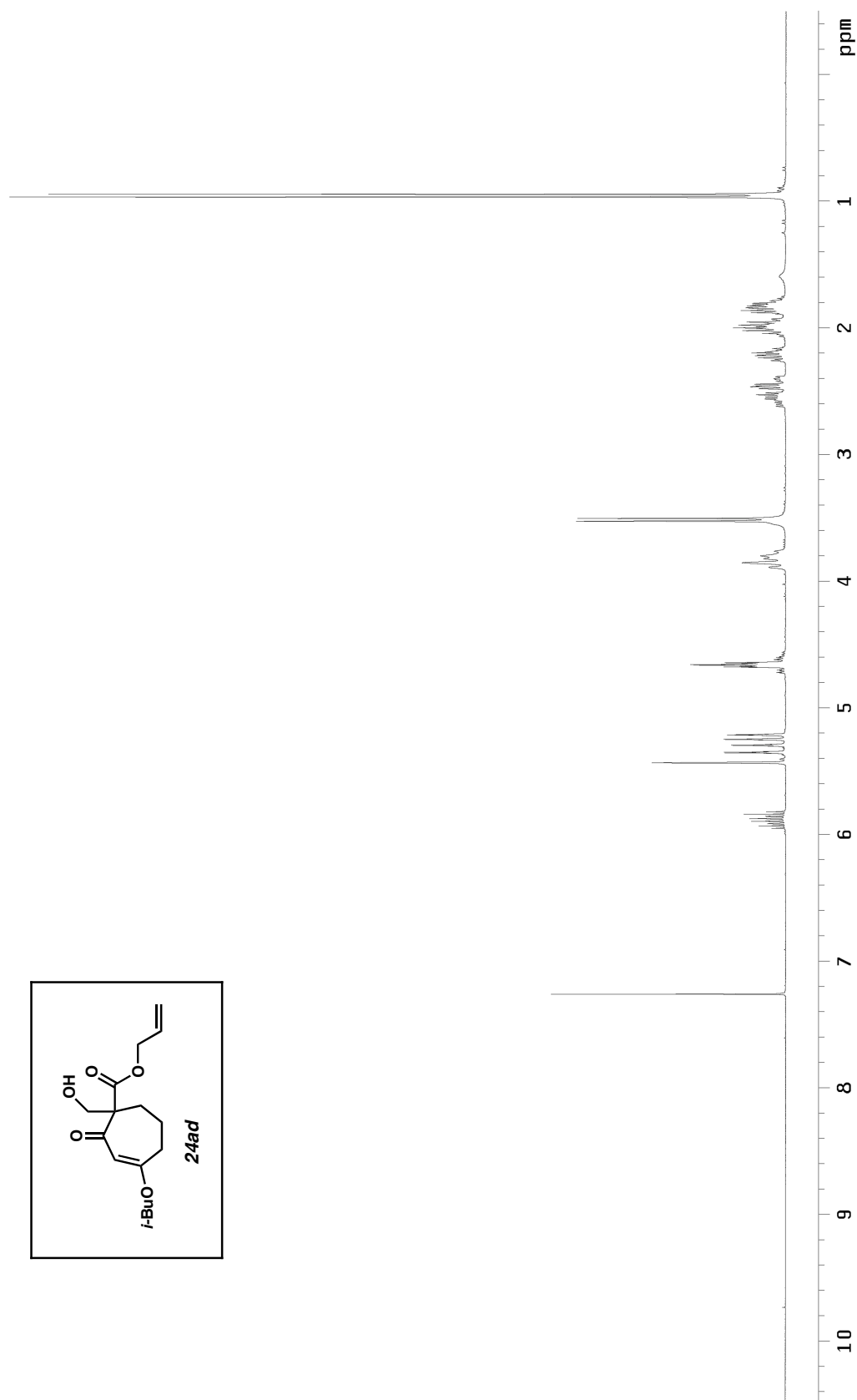


Figure A2.14.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24I**.

Figure A2.15.1. ^1H NMR (300 MHz, CDCl_3) of compound **24ad**.

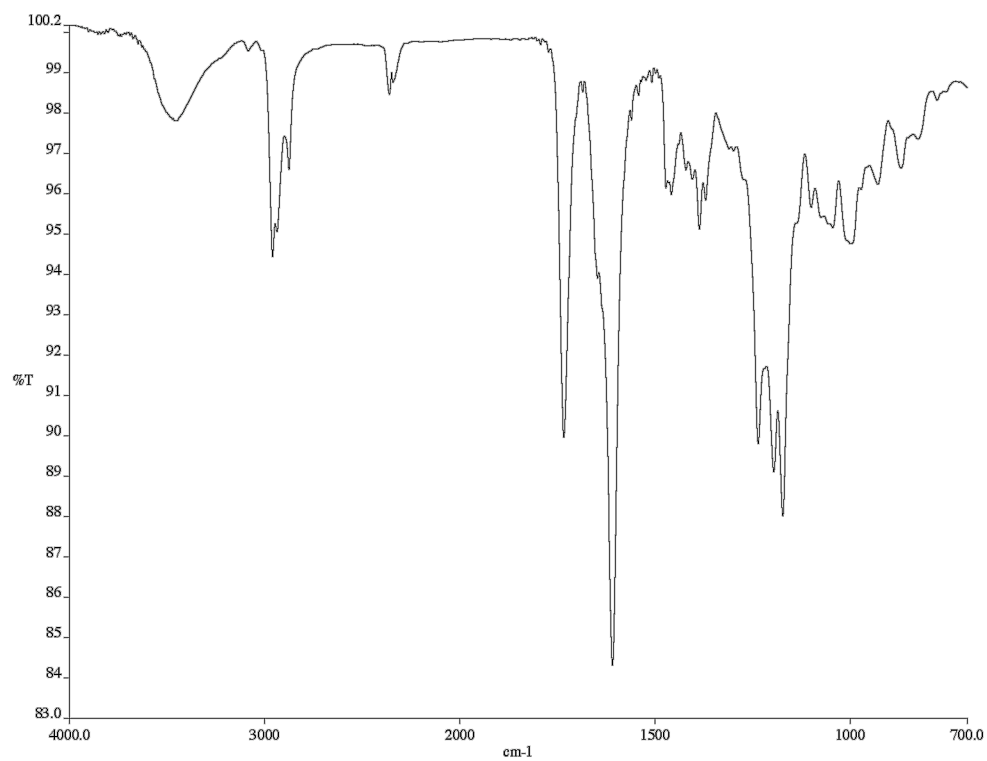


Figure A2.15.2. Infrared spectrum (thin film/NaCl) of compound **24ad**.

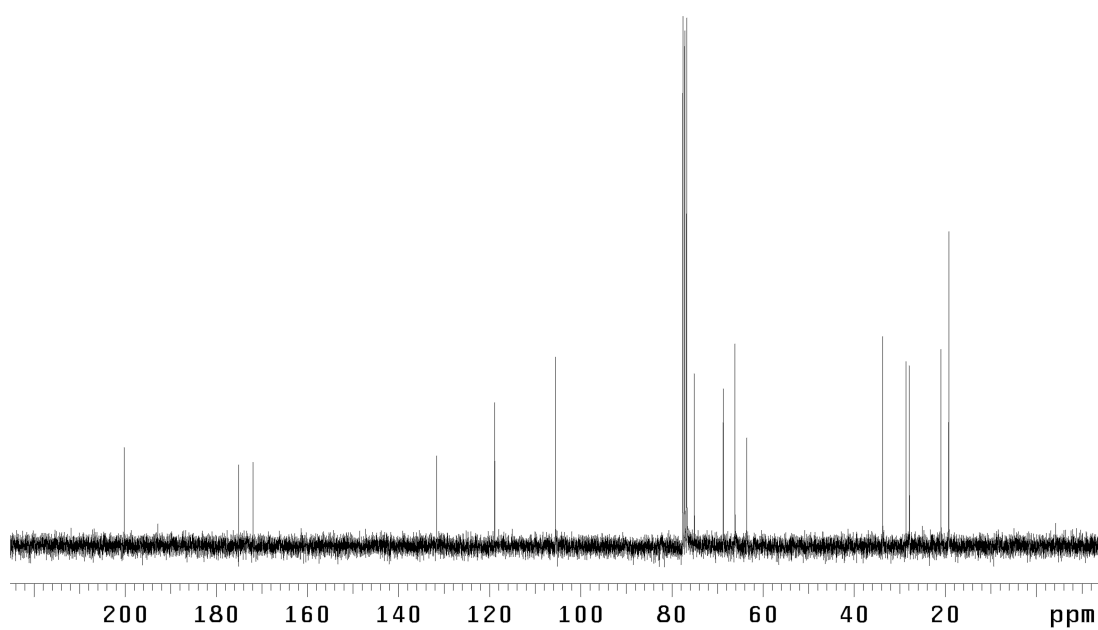
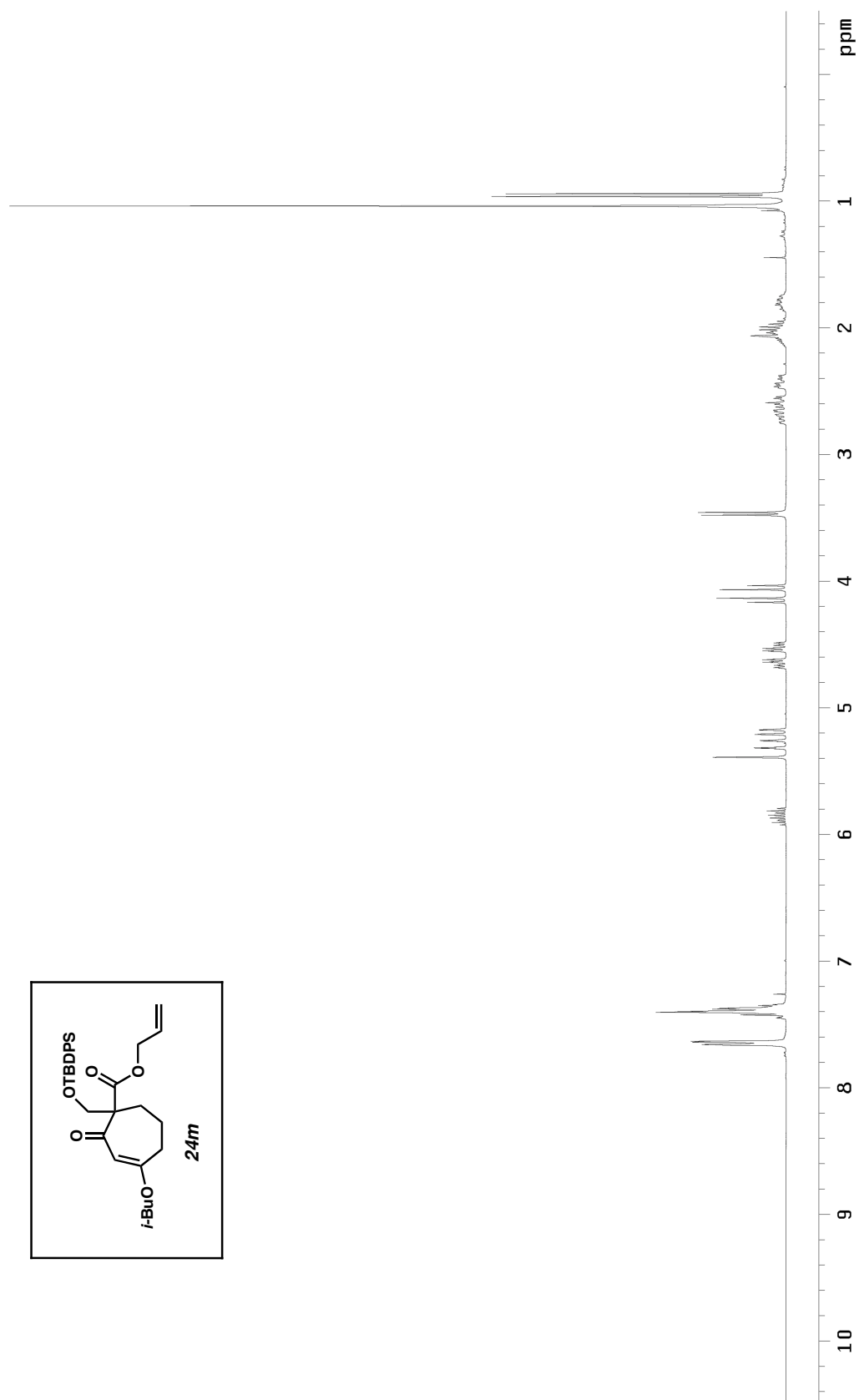


Figure A2.15.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24ad**.

Figure A2.16.1. ^1H NMR (300 MHz, CDCl_3) of compound **24m**.

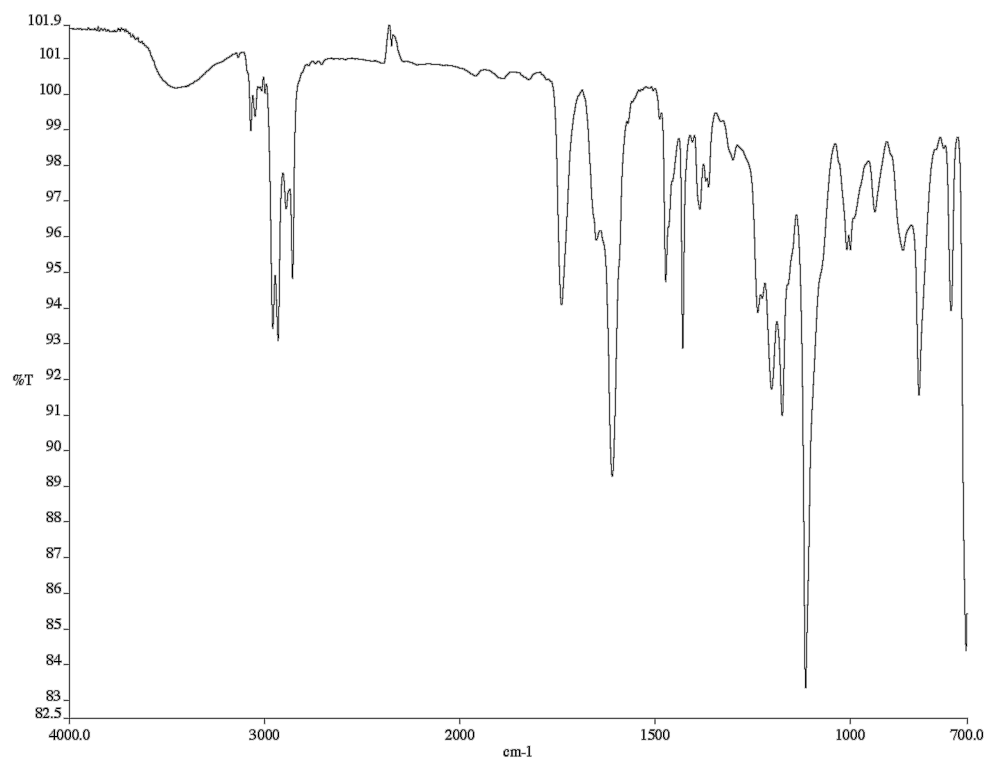


Figure A2.16.2. Infrared spectrum (thin film/NaCl) of compound **24m**.

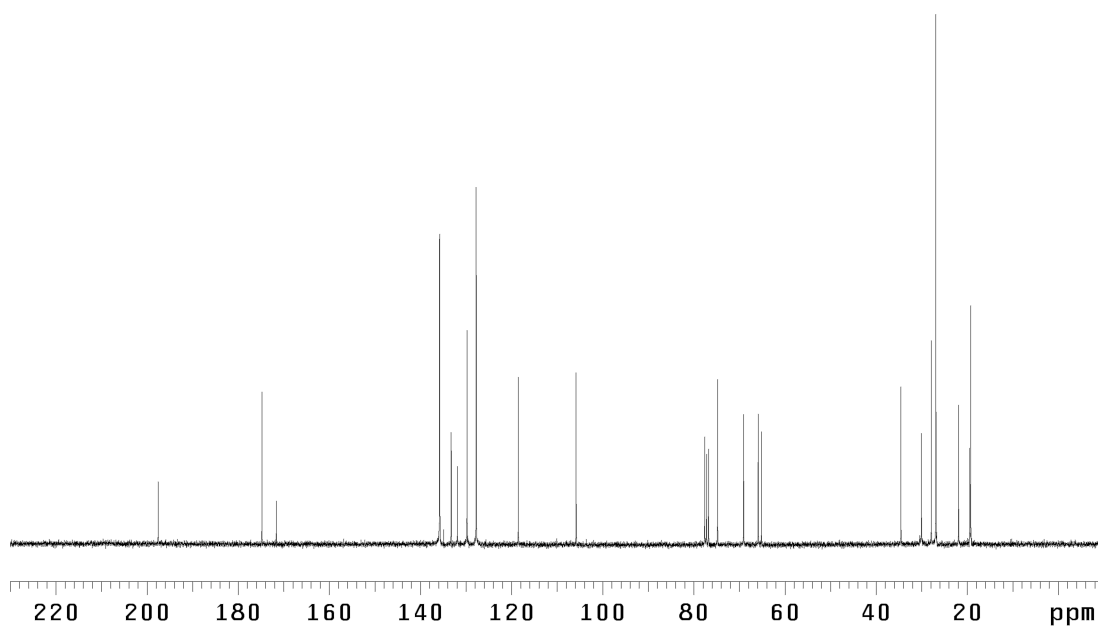
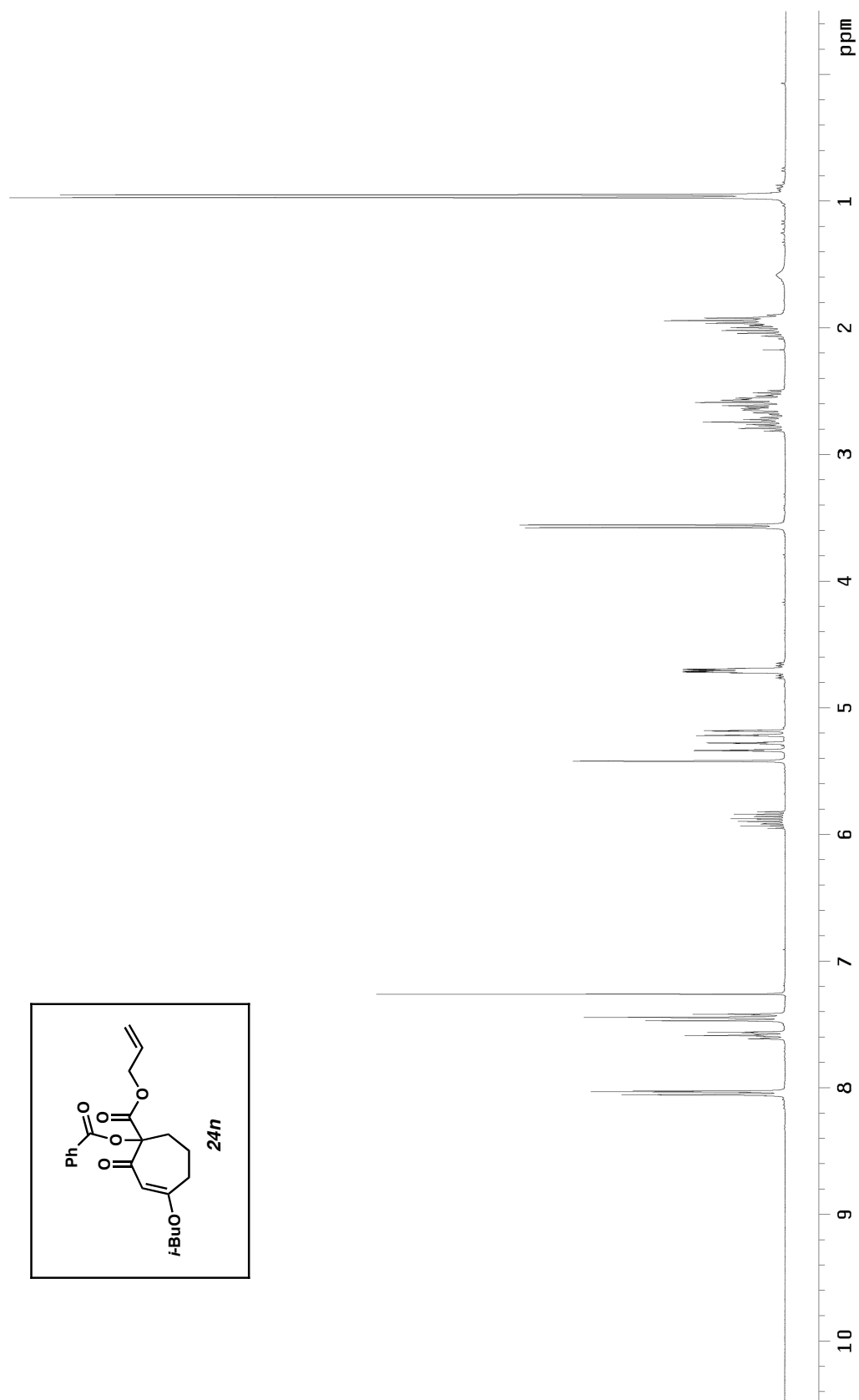


Figure A2.16.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24m**.

Figure A2.17.1. ^1H NMR (300 MHz, CDCl_3) of compound **24n**.

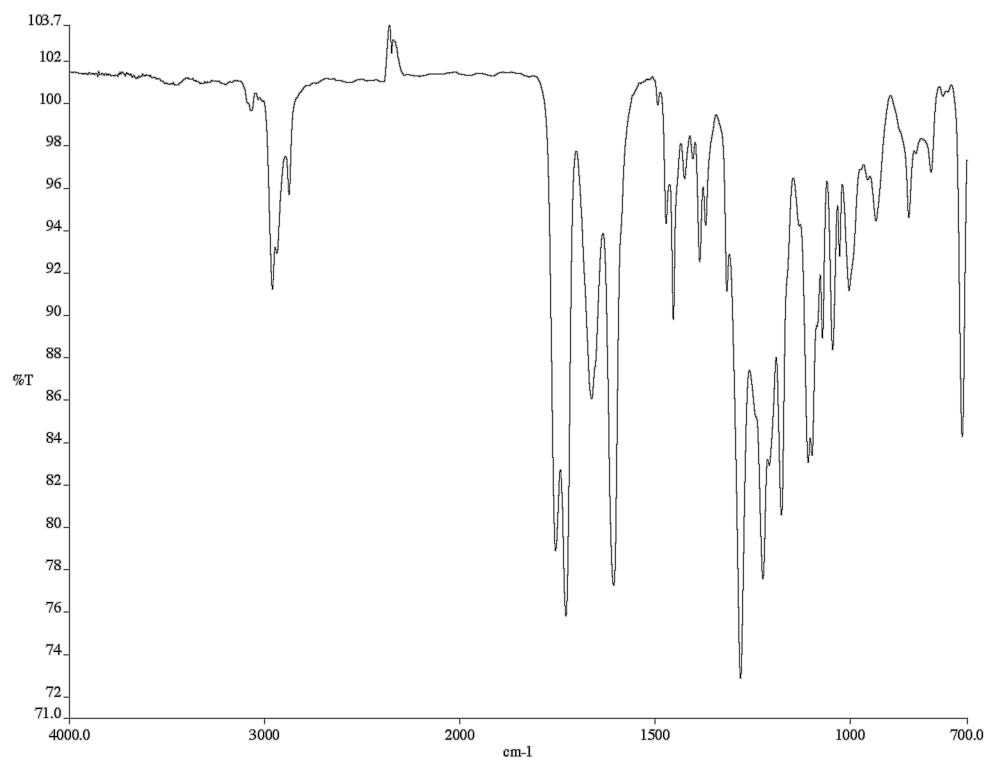


Figure A2.17.2. Infrared spectrum (thin film/NaCl) of compound **24n**.

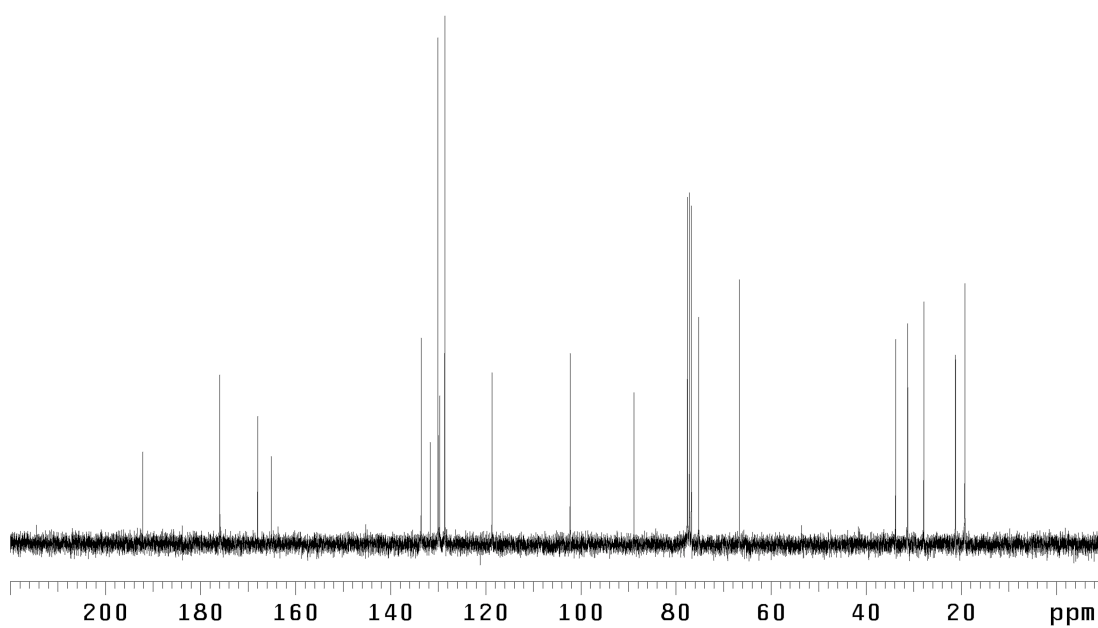
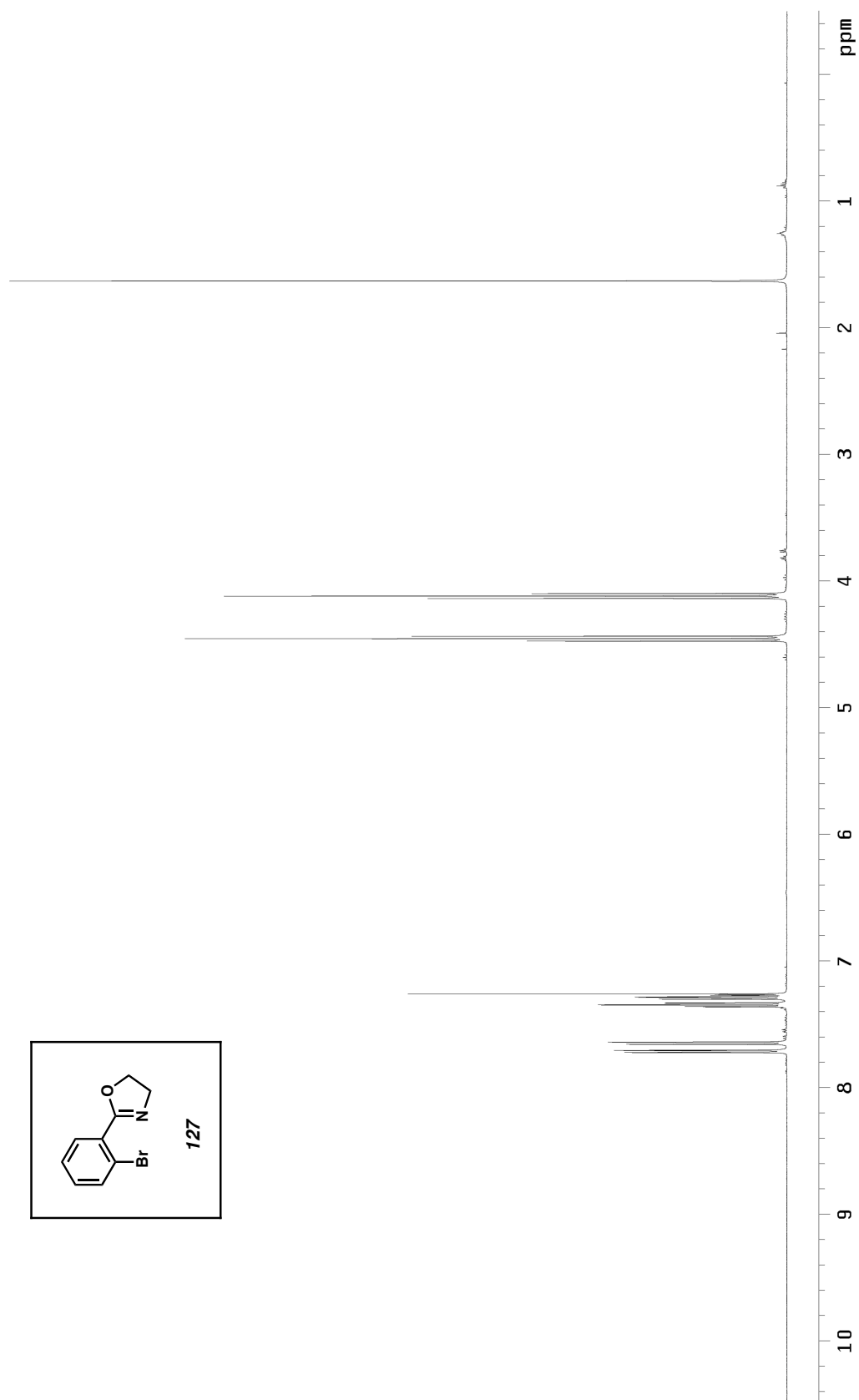


Figure A2.17.3. ¹³C NMR (75 MHz, CDCl₃) of compound **24n**.

Figure A2.18.1. ^1H NMR (500 MHz, CDCl_3) of compound **127**.

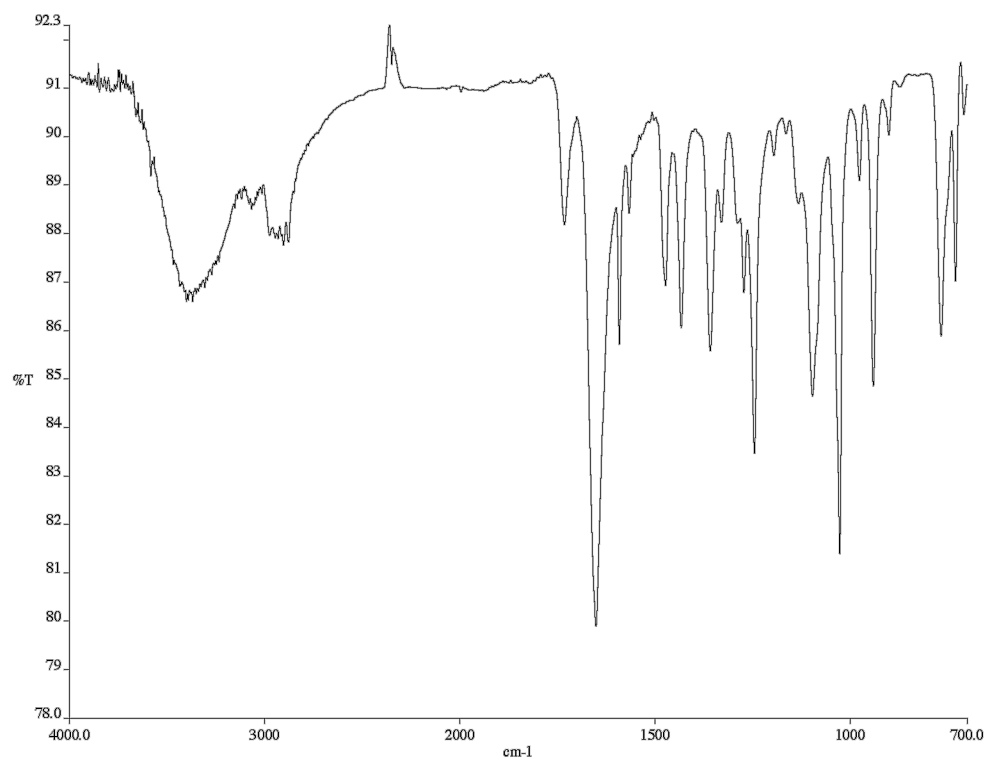


Figure A2.18.2. Infrared spectrum (thin film/NaCl) of compound **127**.

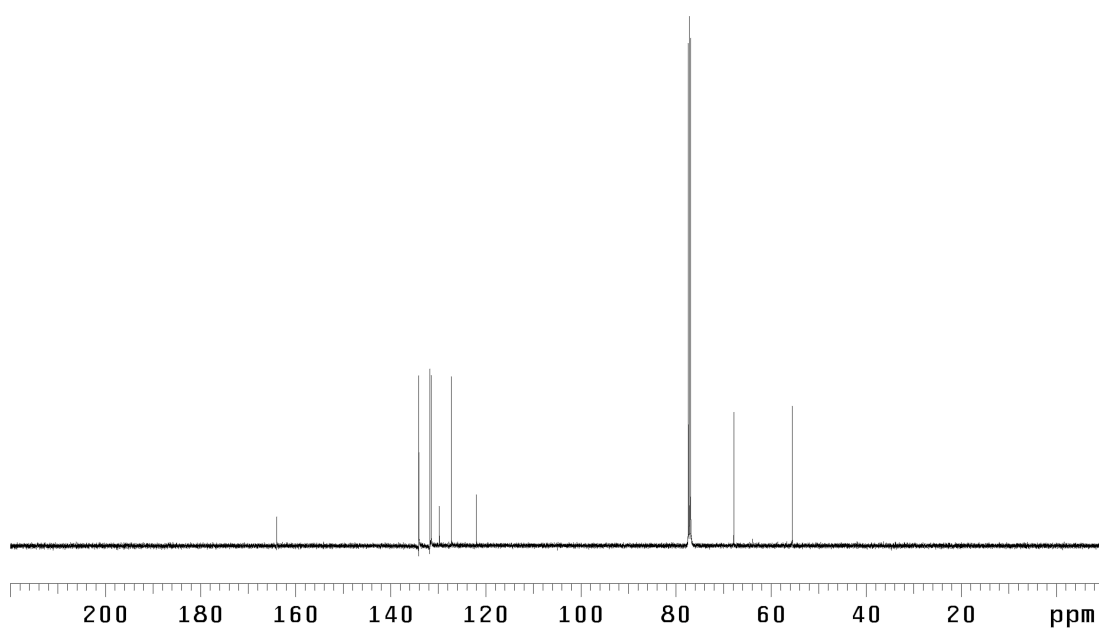


Figure A2.18.3. ¹³C NMR (125 MHz, CDCl₃) of compound **127**.

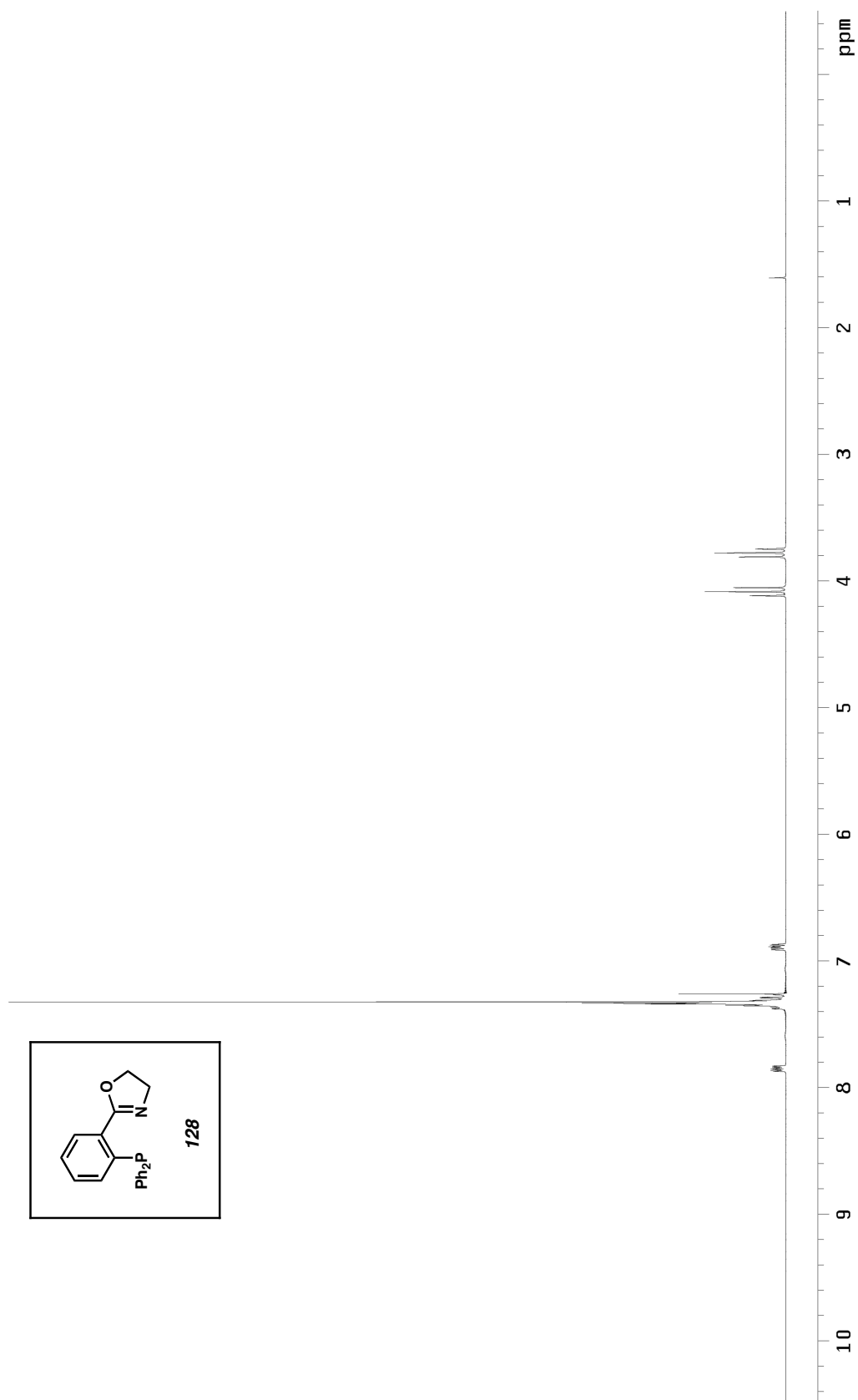


Figure A2.19.1. ^1H NMR (500 MHz, CDCl_3) of compound **128**.

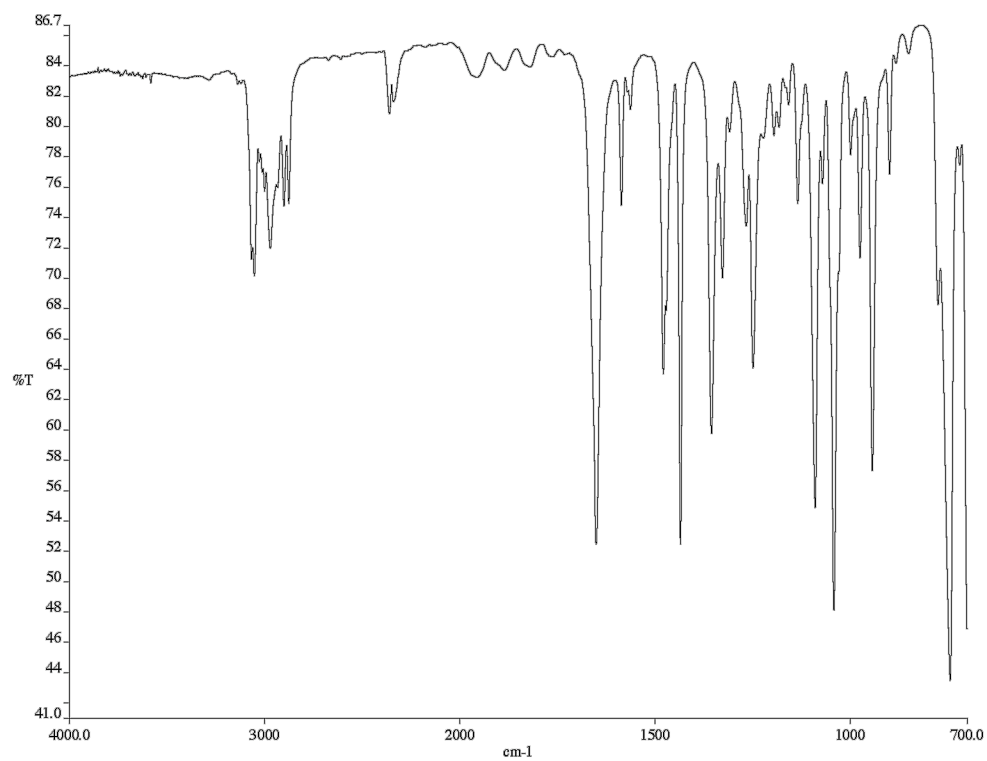


Figure A2.19.2. Infrared spectrum (thin film/NaCl) of compound **128**.

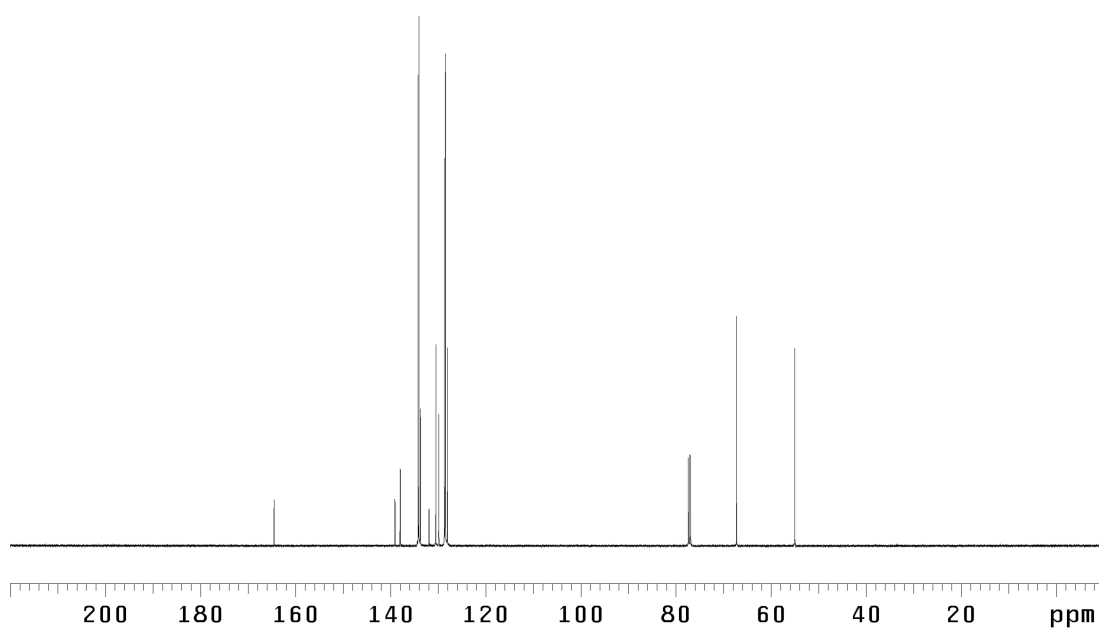


Figure A2.19.3. ¹³C NMR (125 MHz, CDCl₃) of compound **128**.

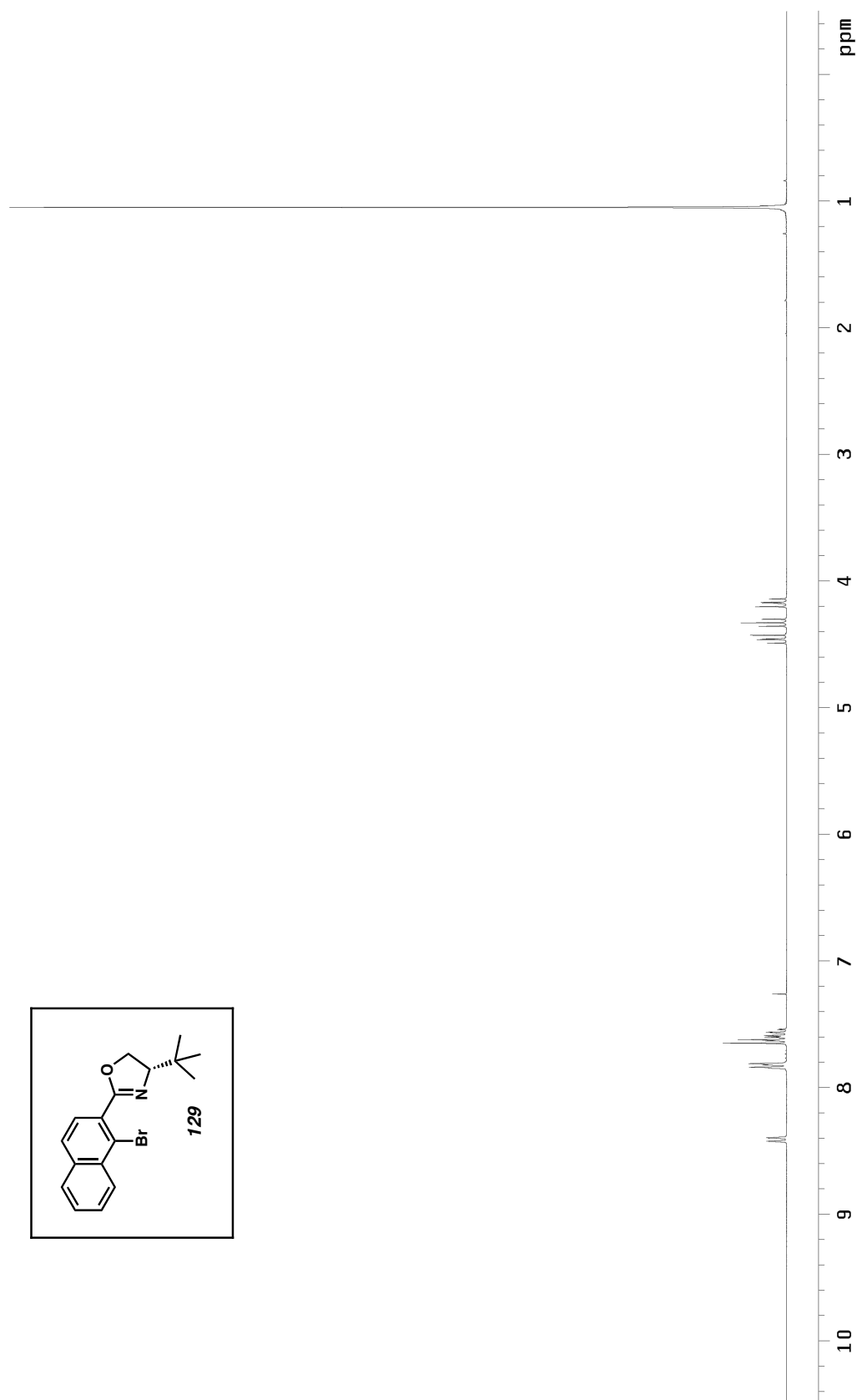


Figure A2.20.1. ^1H NMR (300 MHz, CDCl_3) of compound **129**.

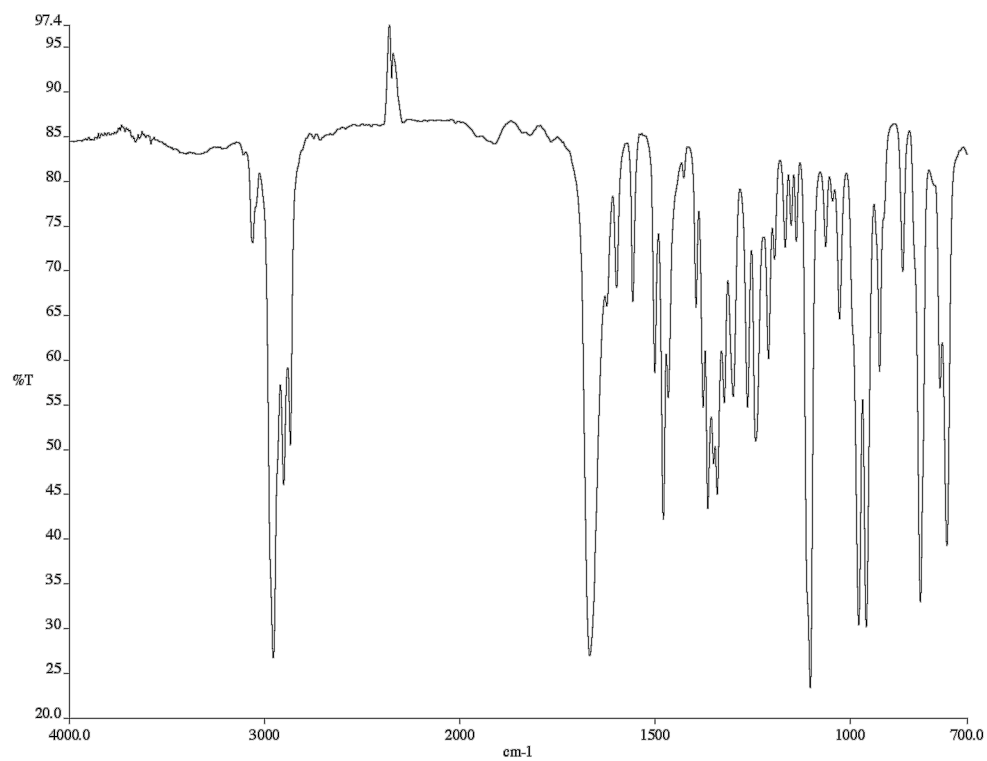


Figure A2.20.2. Infrared spectrum (thin film/NaCl) of compound **129**.

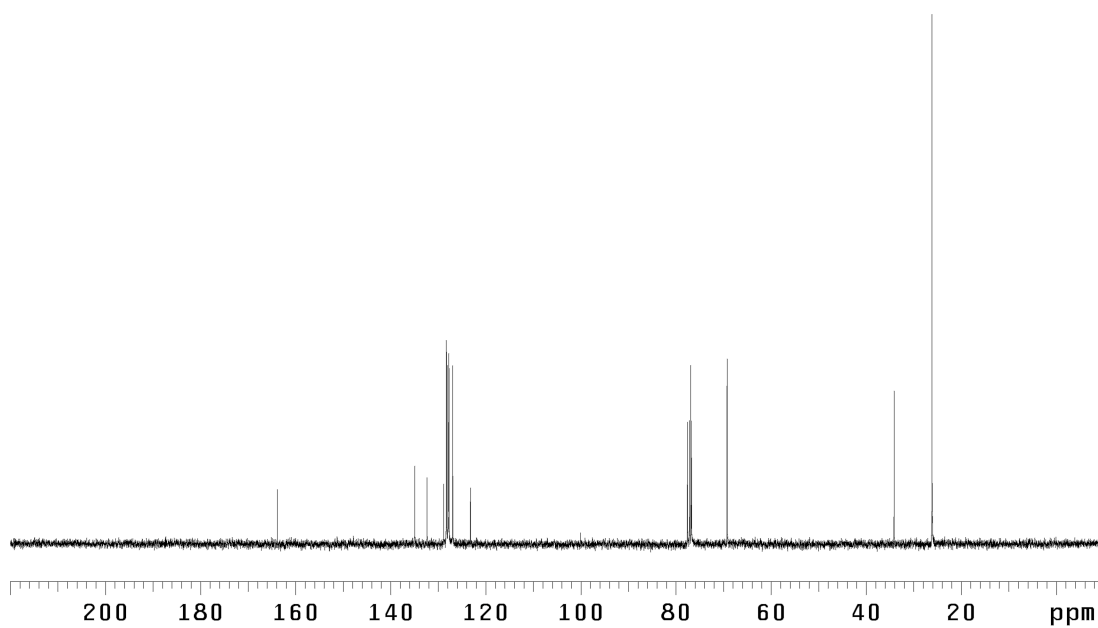
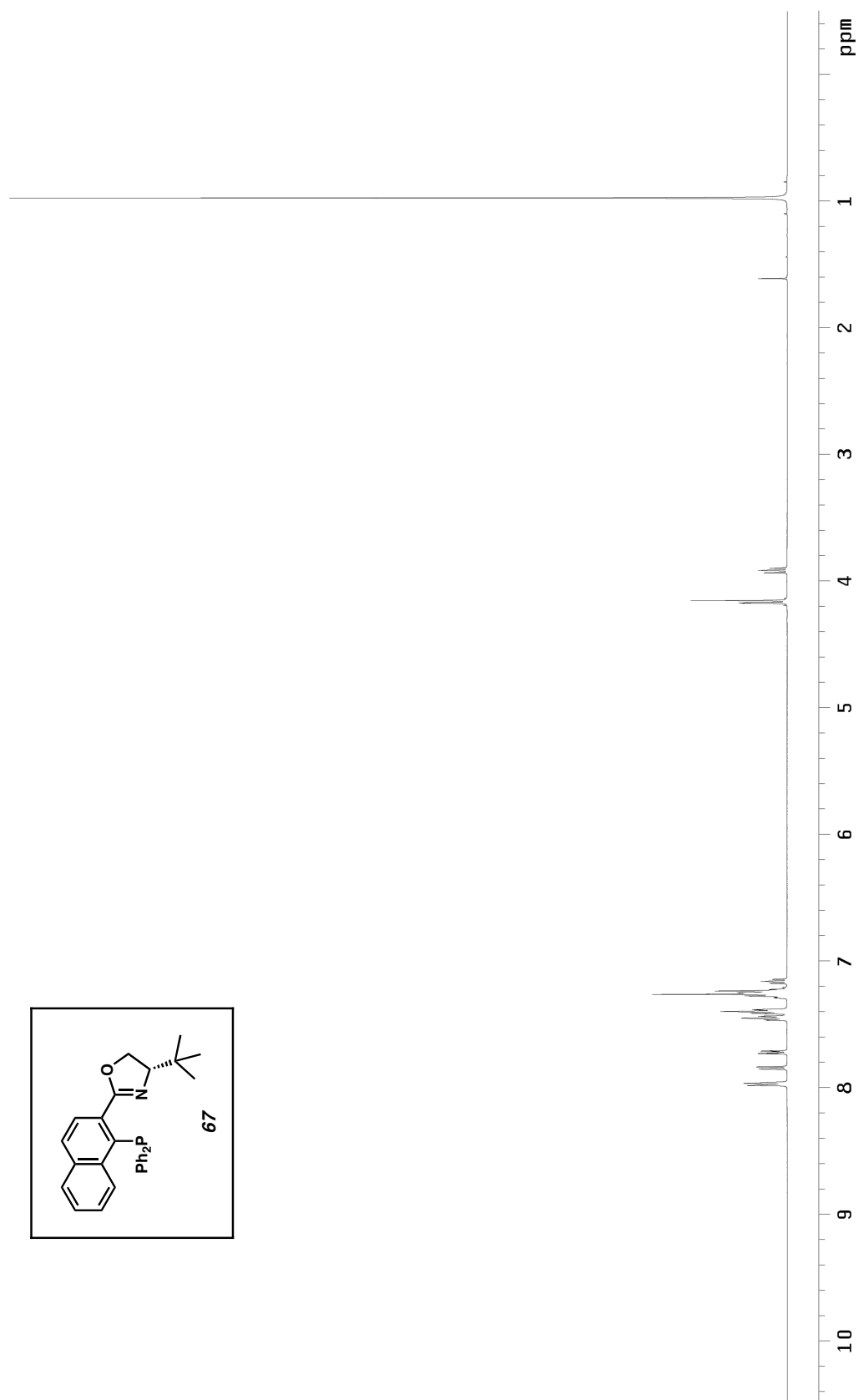


Figure A2.20.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **129**.

Figure A2.21.1. ^1H NMR (500 MHz, CDCl_3) of compound **67**.

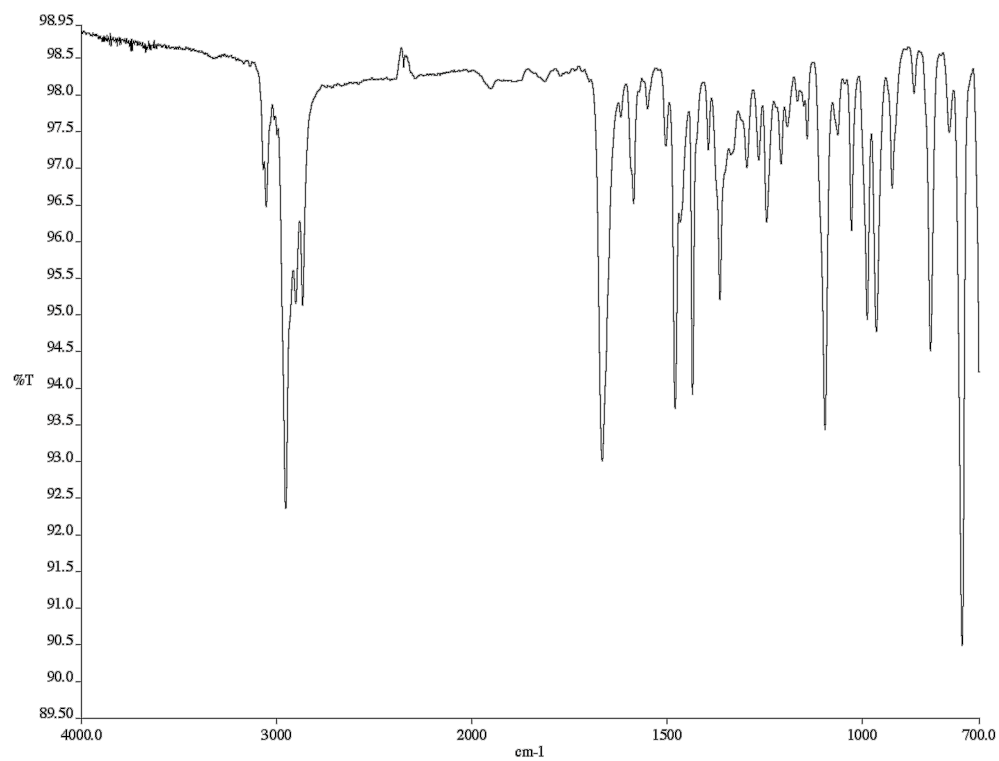


Figure A2.21.2. Infrared spectrum (thin film/NaCl) of compound **67**.

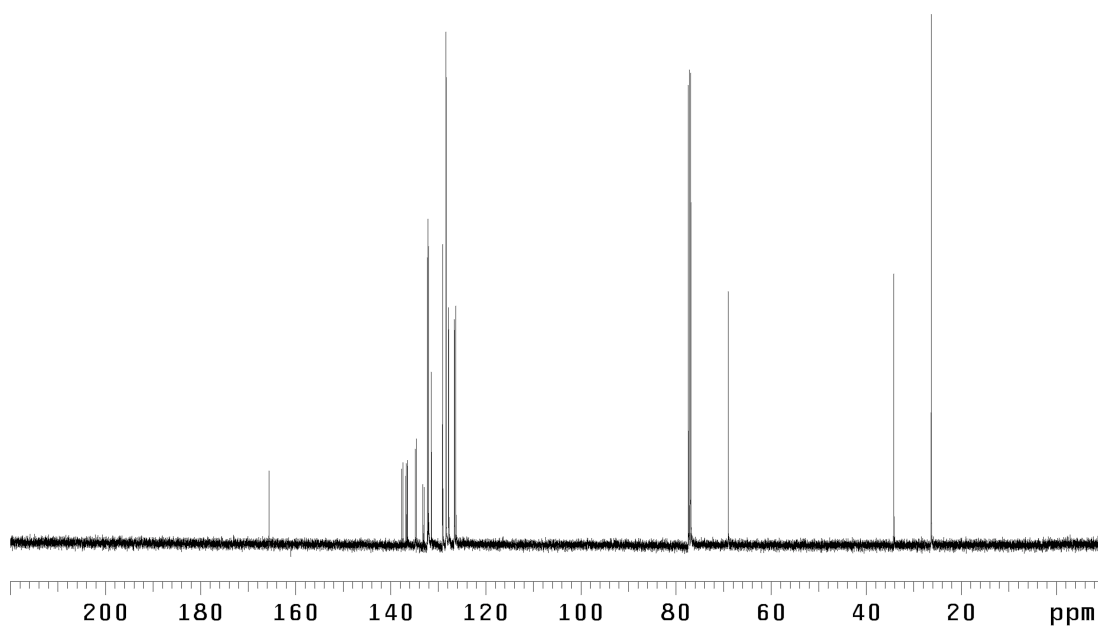
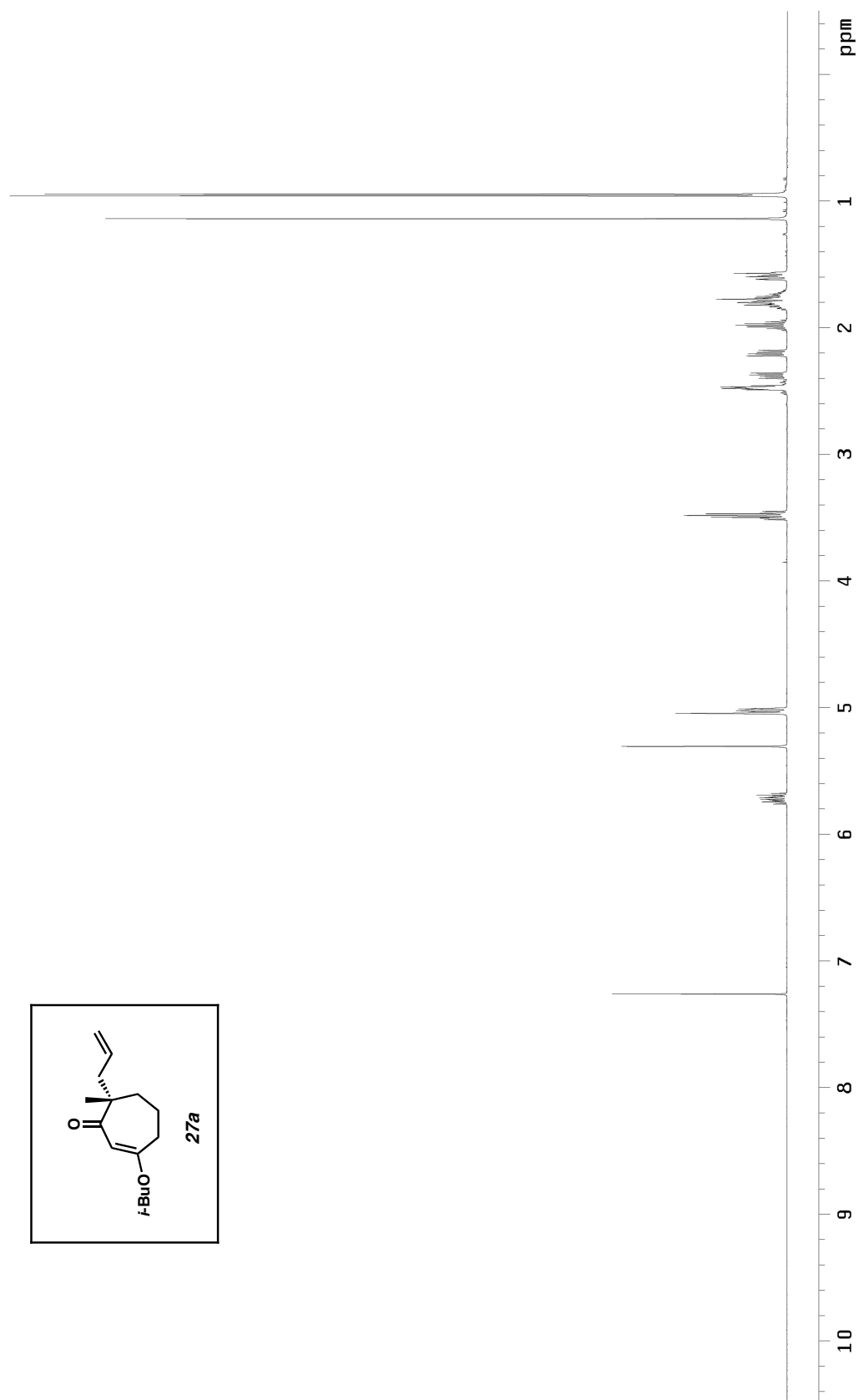


Figure A2.21.3. ¹³C NMR (125 MHz, CDCl₃) of compound **67**.

Figure A2.22.1. ^1H NMR (500 MHz, CDCl_3) of compound **27a**.

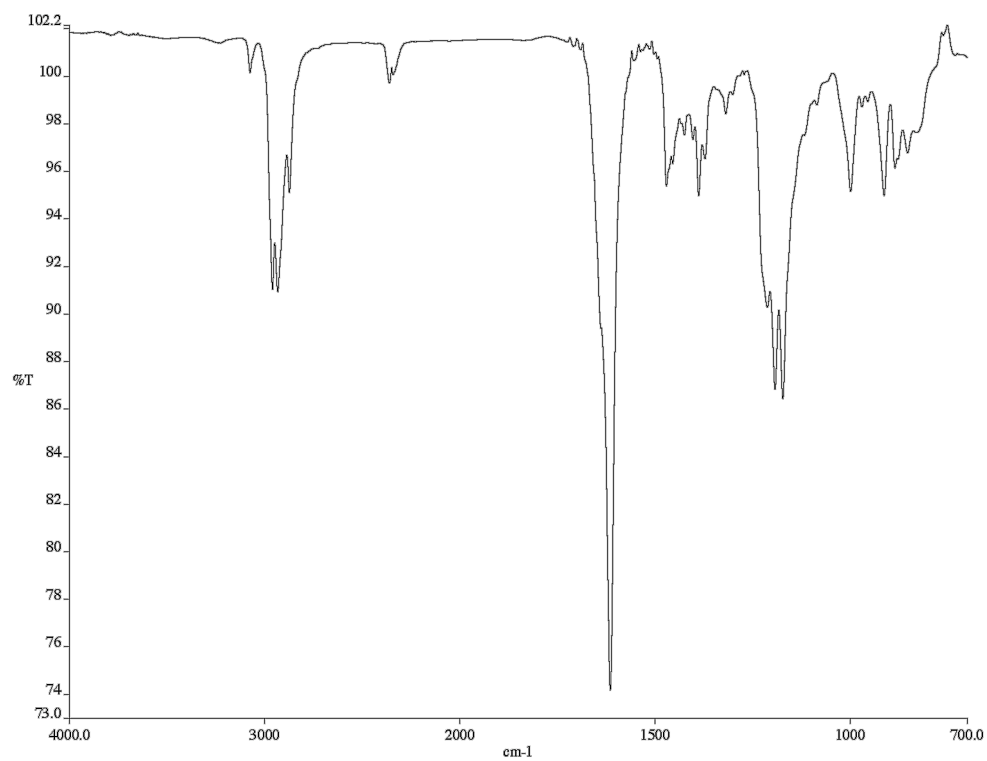


Figure A2.22.2. Infrared spectrum (thin film/NaCl) of compound **27a**.

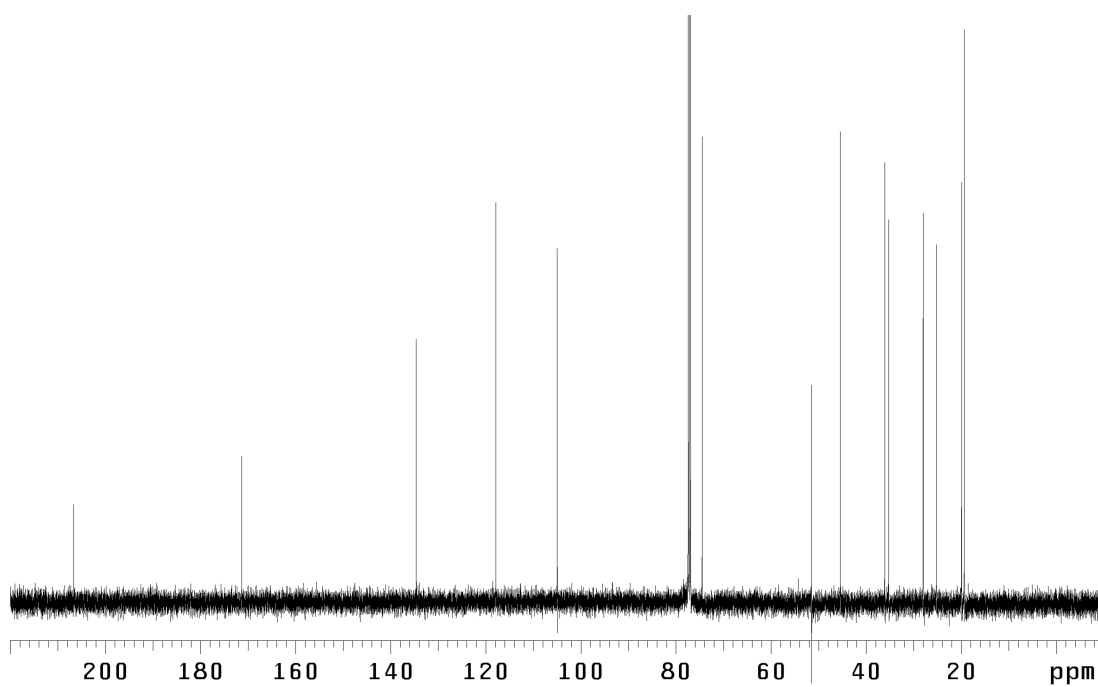


Figure A2.22.3. ¹³C NMR (125 MHz, CDCl₃) of compound **27a**.

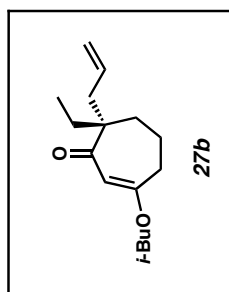
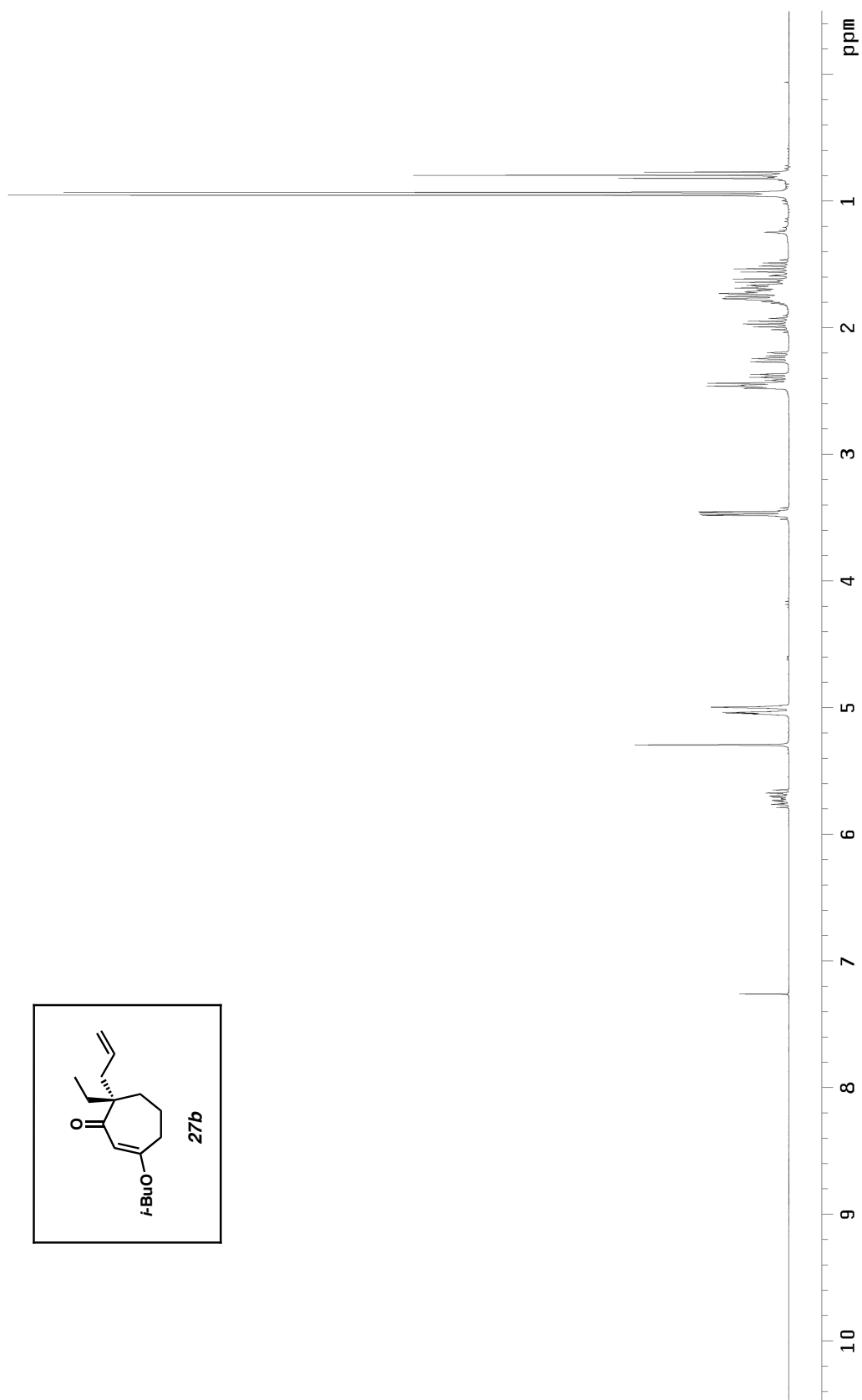


Figure A2.23.1. ¹H NMR (300 MHz, CDCl₃) of compound **27b**.

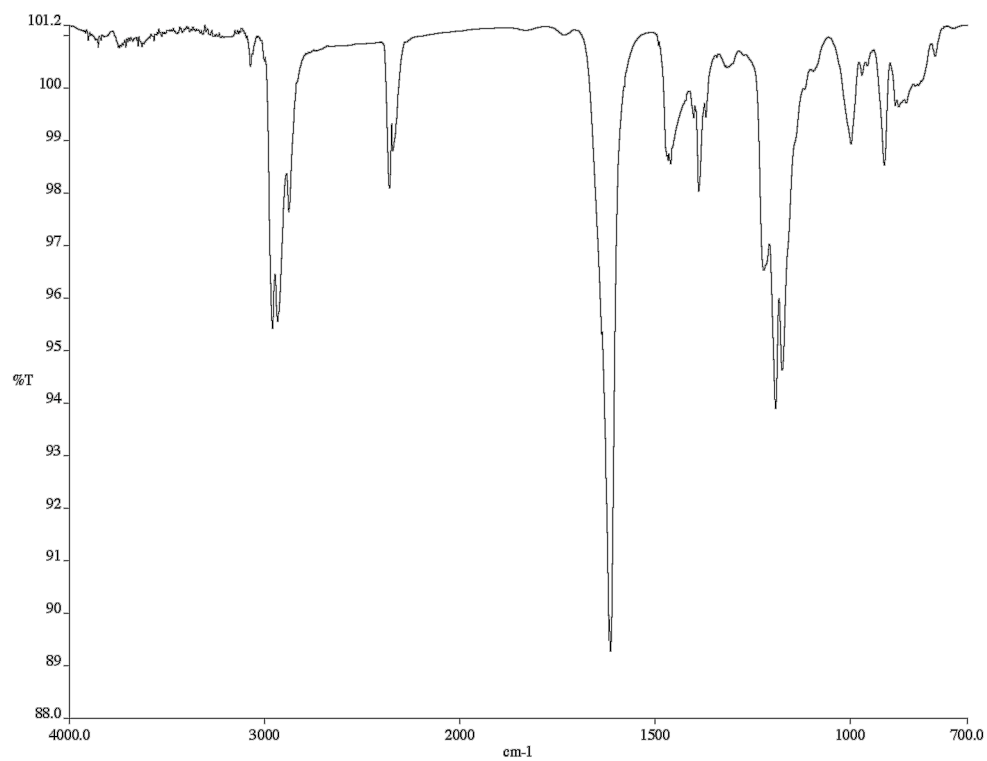


Figure A2.23.2. Infrared spectrum (thin film/NaCl) of compound **27b**.

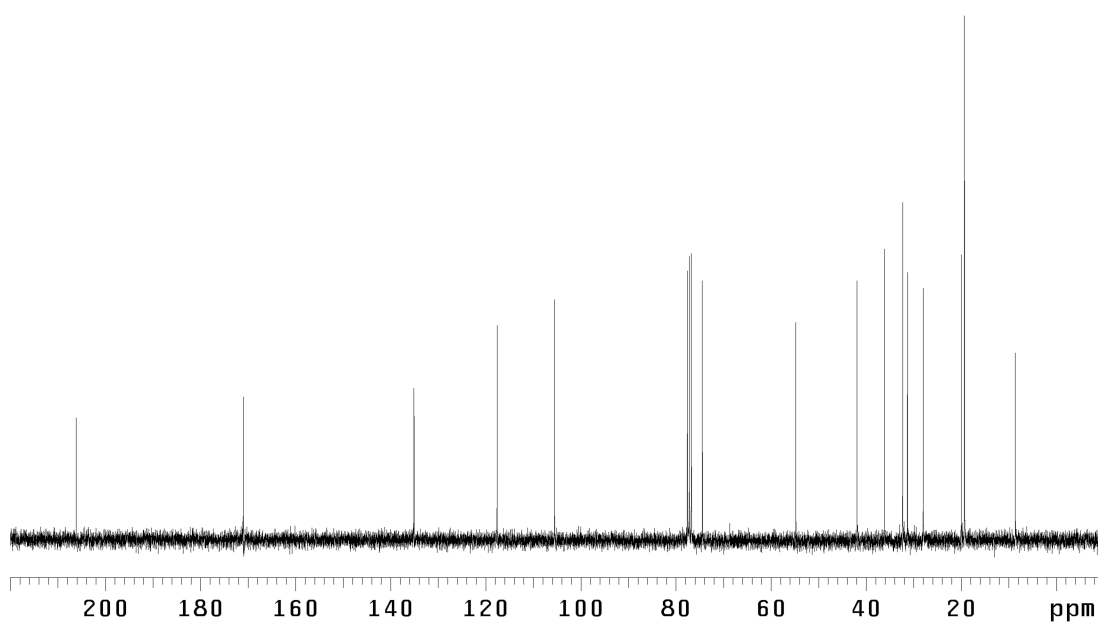
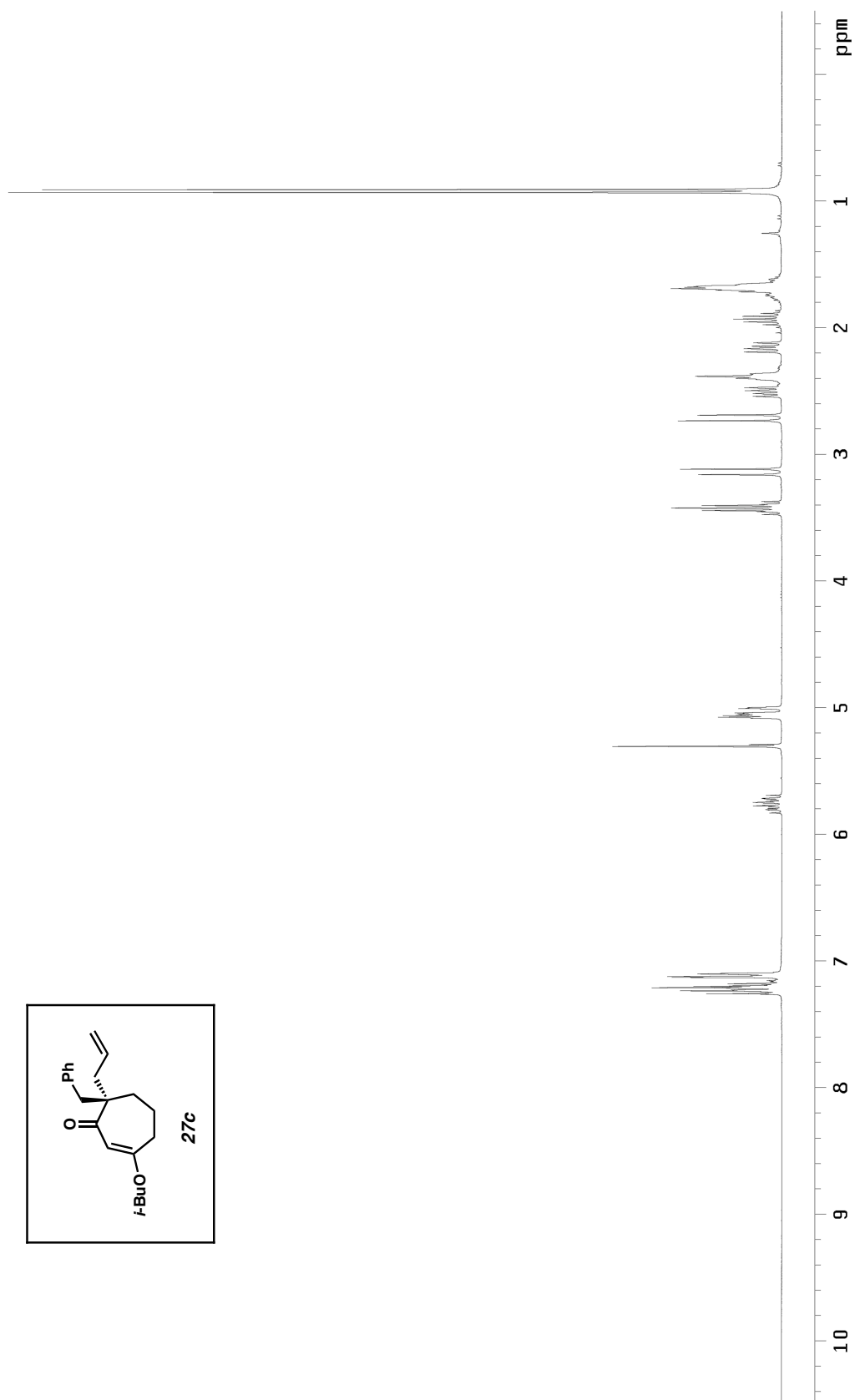


Figure A2.23.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27b**.

Figure A2.24.1. ^1H NMR (300 MHz, CDCl_3) of compound **27c**.

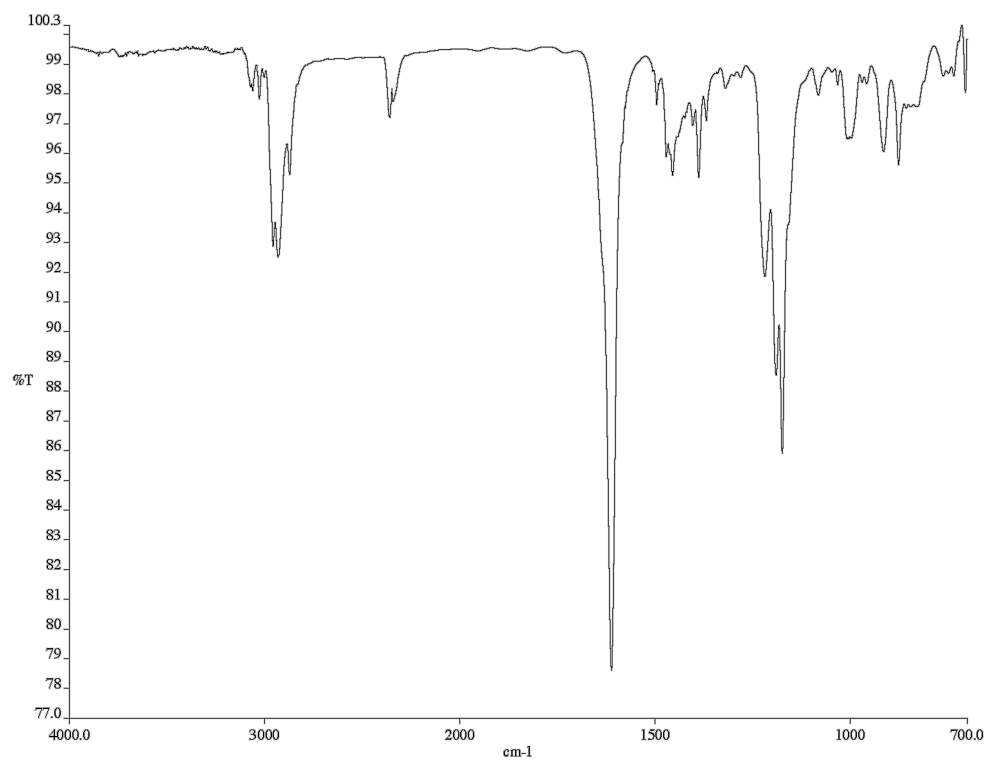


Figure A2.24.2. Infrared spectrum (thin film/NaCl) of compound **27c**.

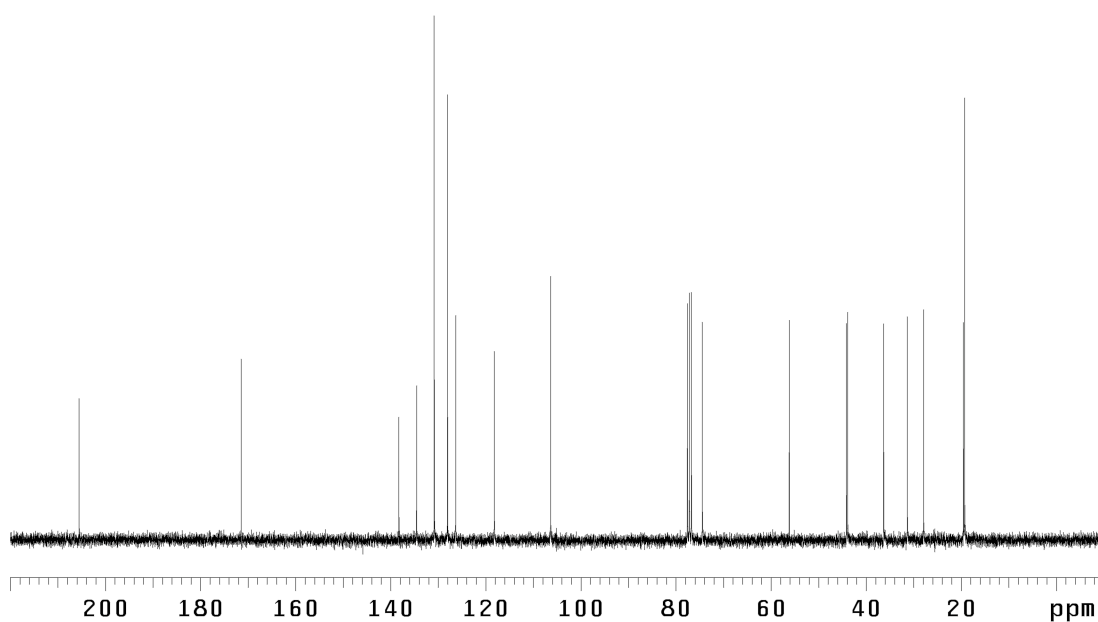


Figure A2.24.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27c**.

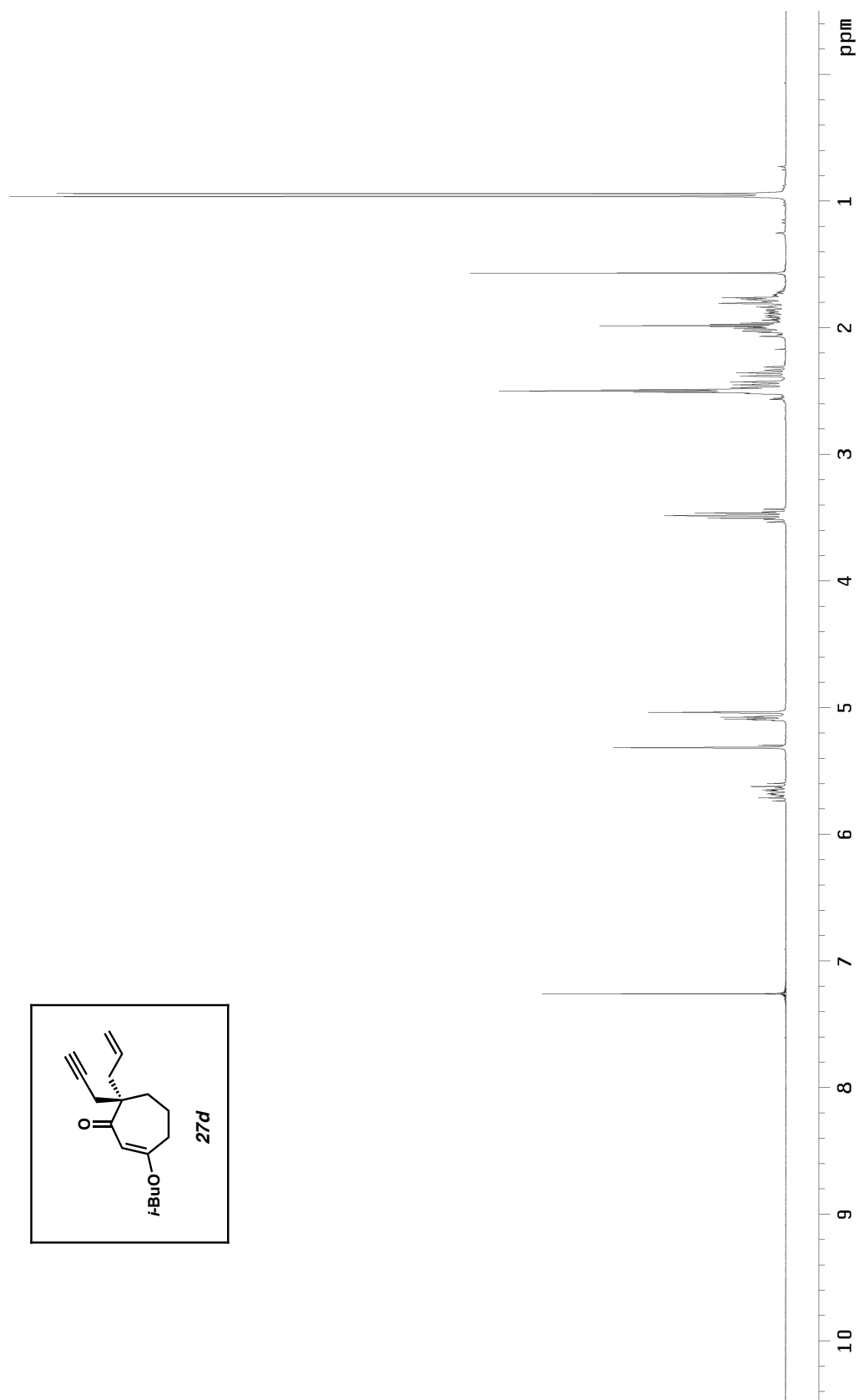


Figure A2.25.1. ^1H NMR (300 MHz, CDCl_3) of compound **27d**.

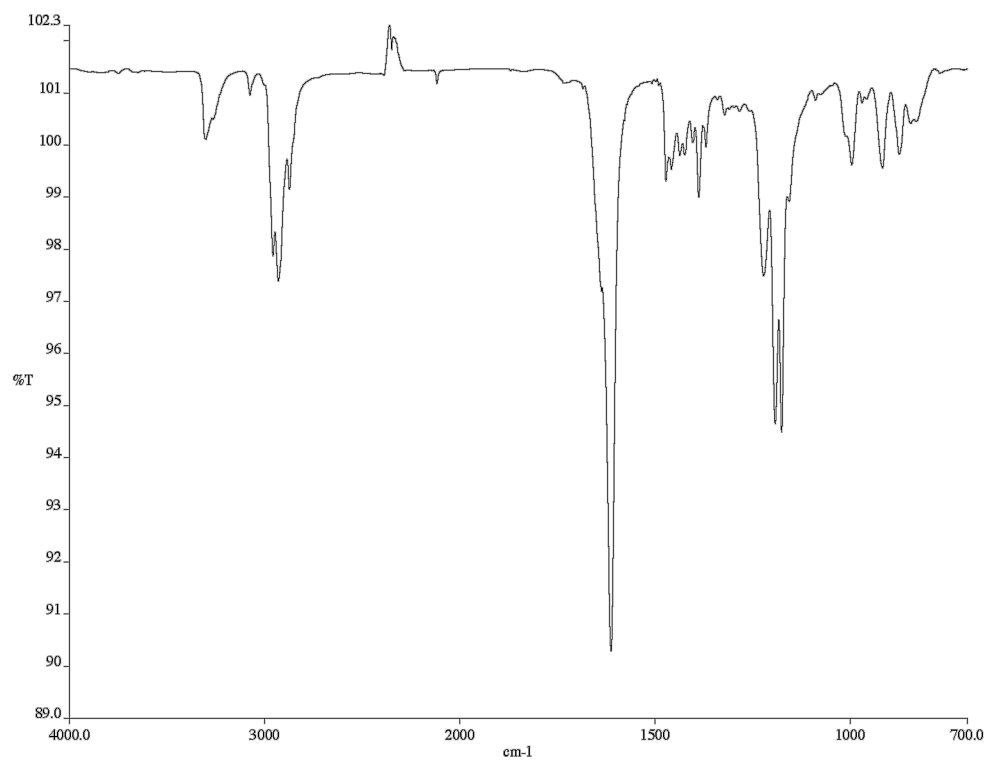


Figure A2.25.2. Infrared spectrum (thin film/NaCl) of compound **27d**.

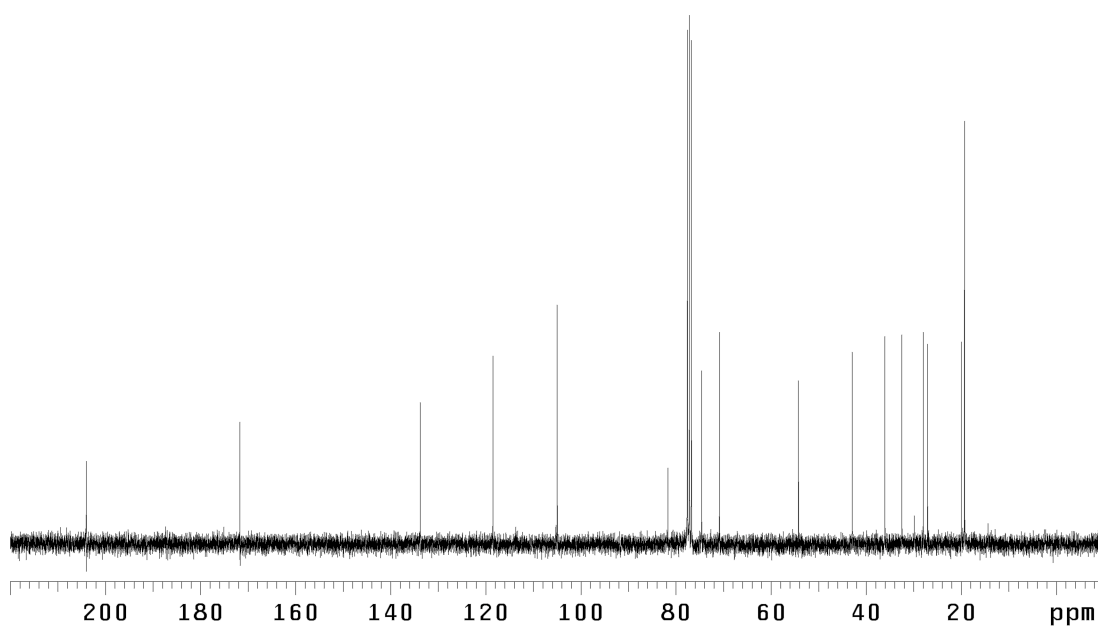


Figure A2.25.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27d**.

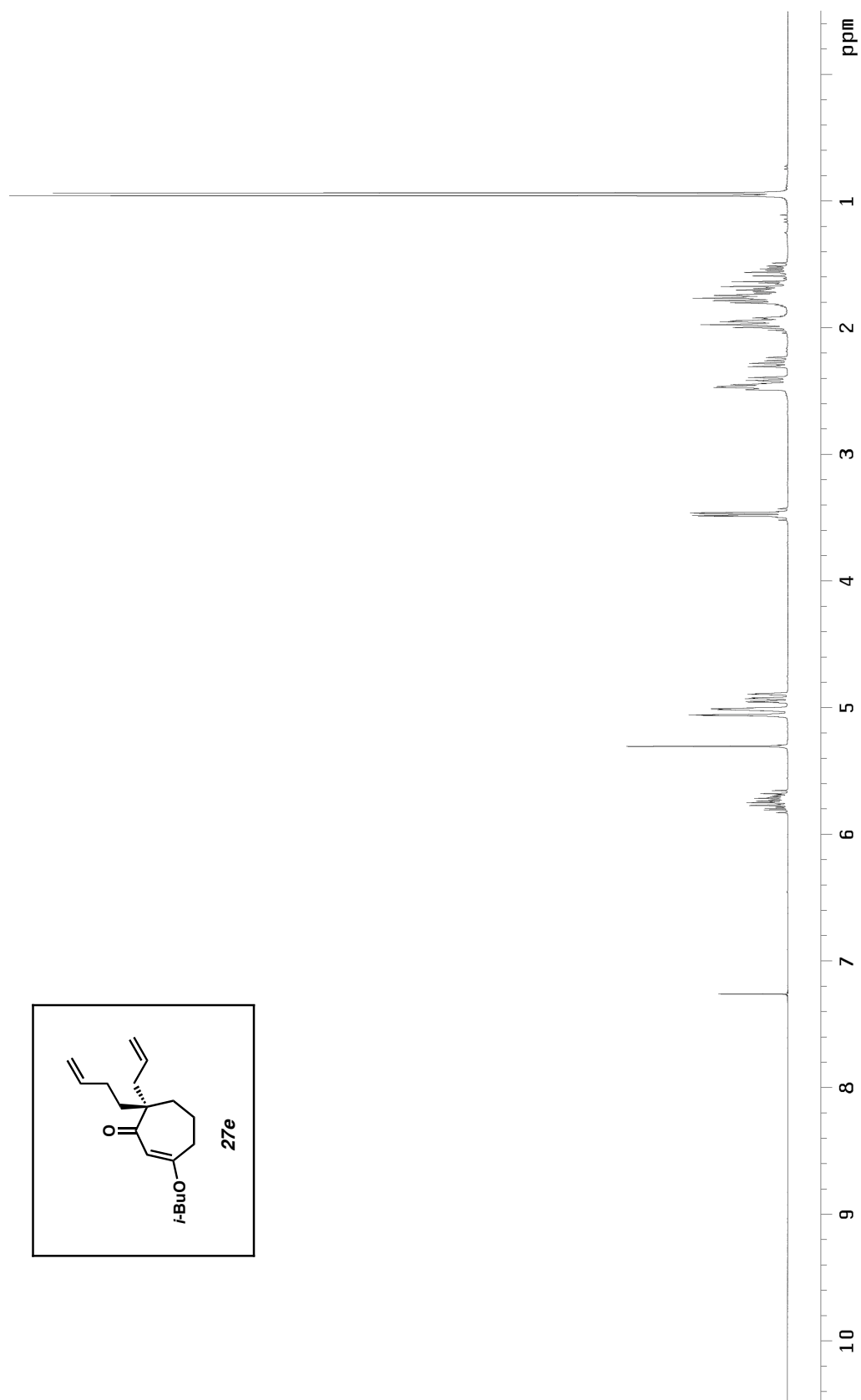


Figure A2.26.1. ^1H NMR (300 MHz, CDCl_3) of compound **27e**.

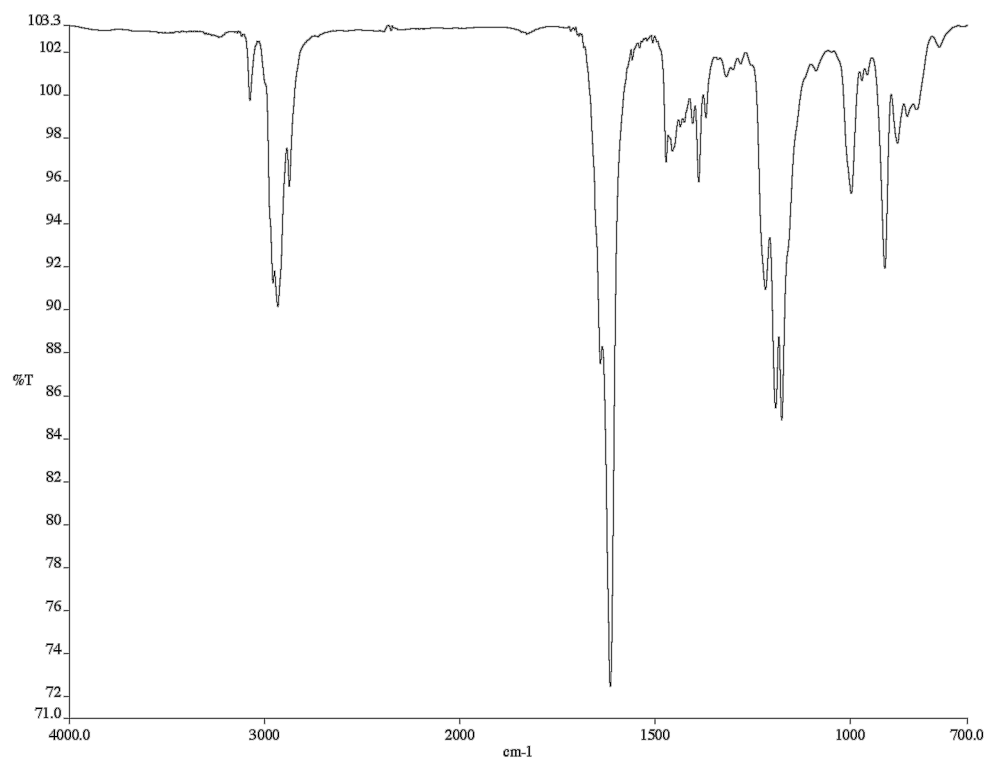


Figure A2.26.2. Infrared spectrum (thin film/NaCl) of compound **27e**.

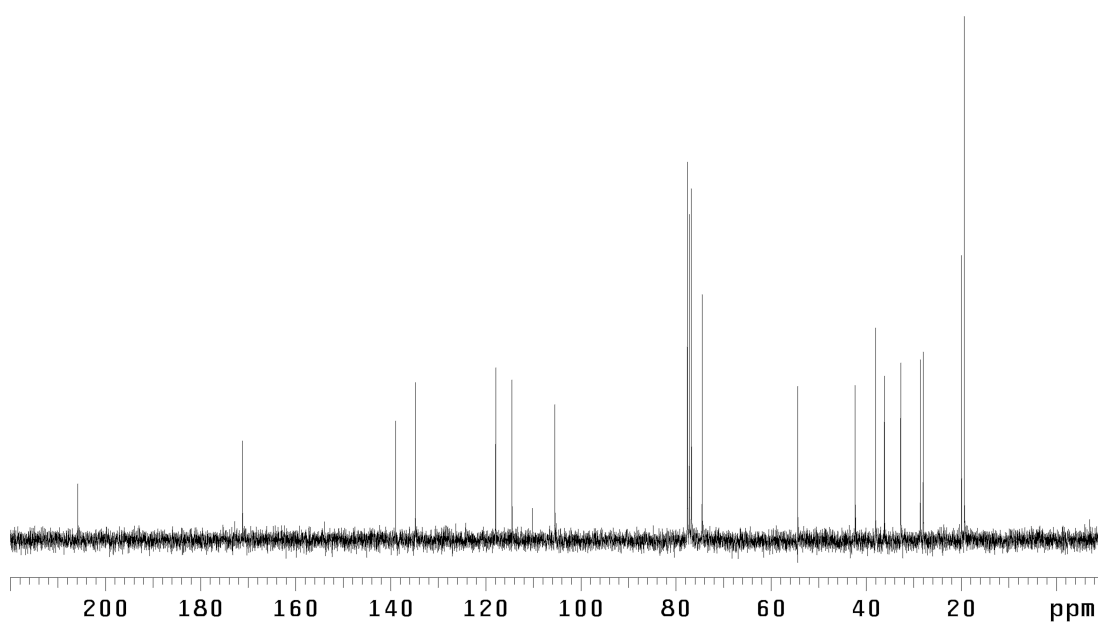
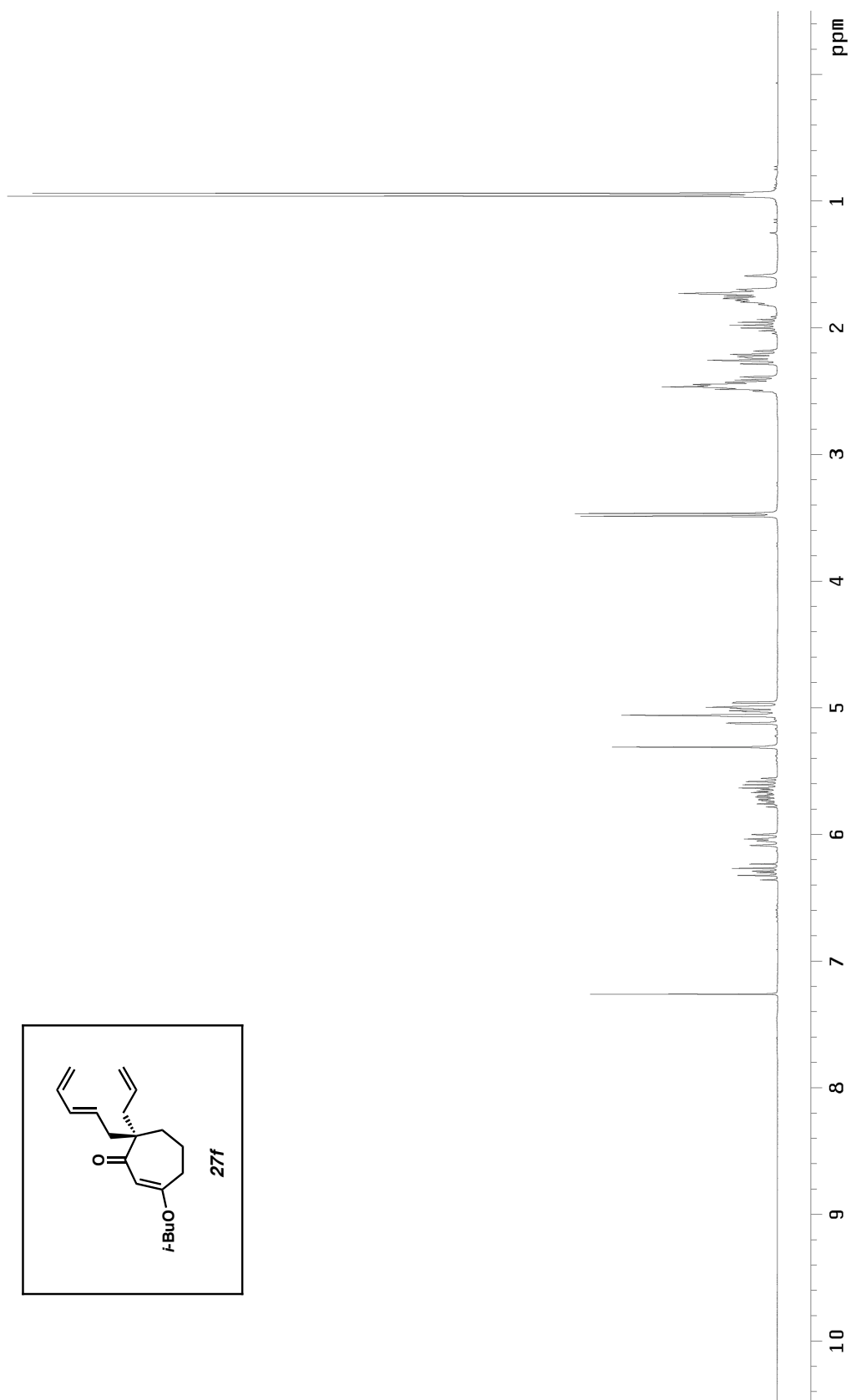


Figure A2.26.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27e**.

Figure A2.27.1. ^1H NMR (300 MHz, CDCl_3) of compound **27f**.

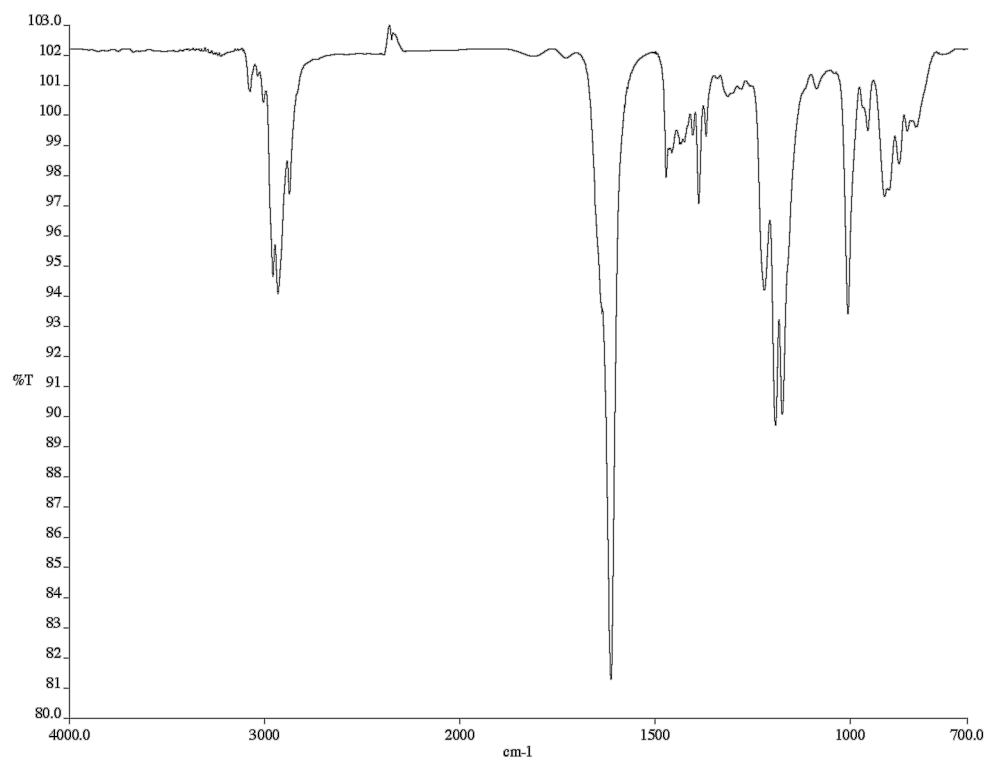


Figure A2.27.2. Infrared spectrum (thin film/NaCl) of compound **27f**.

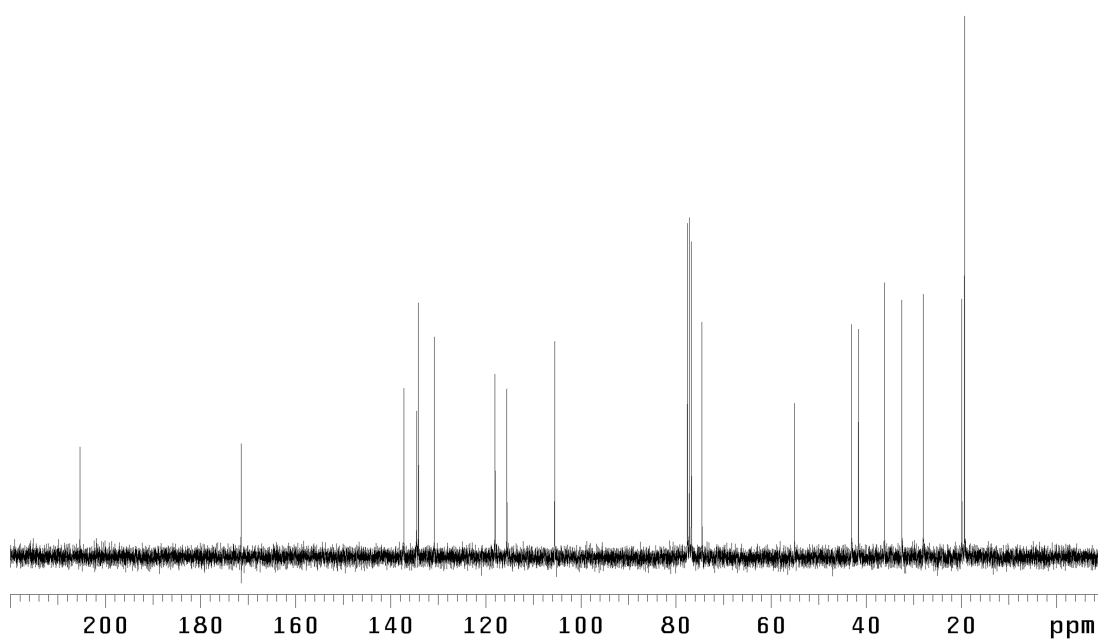
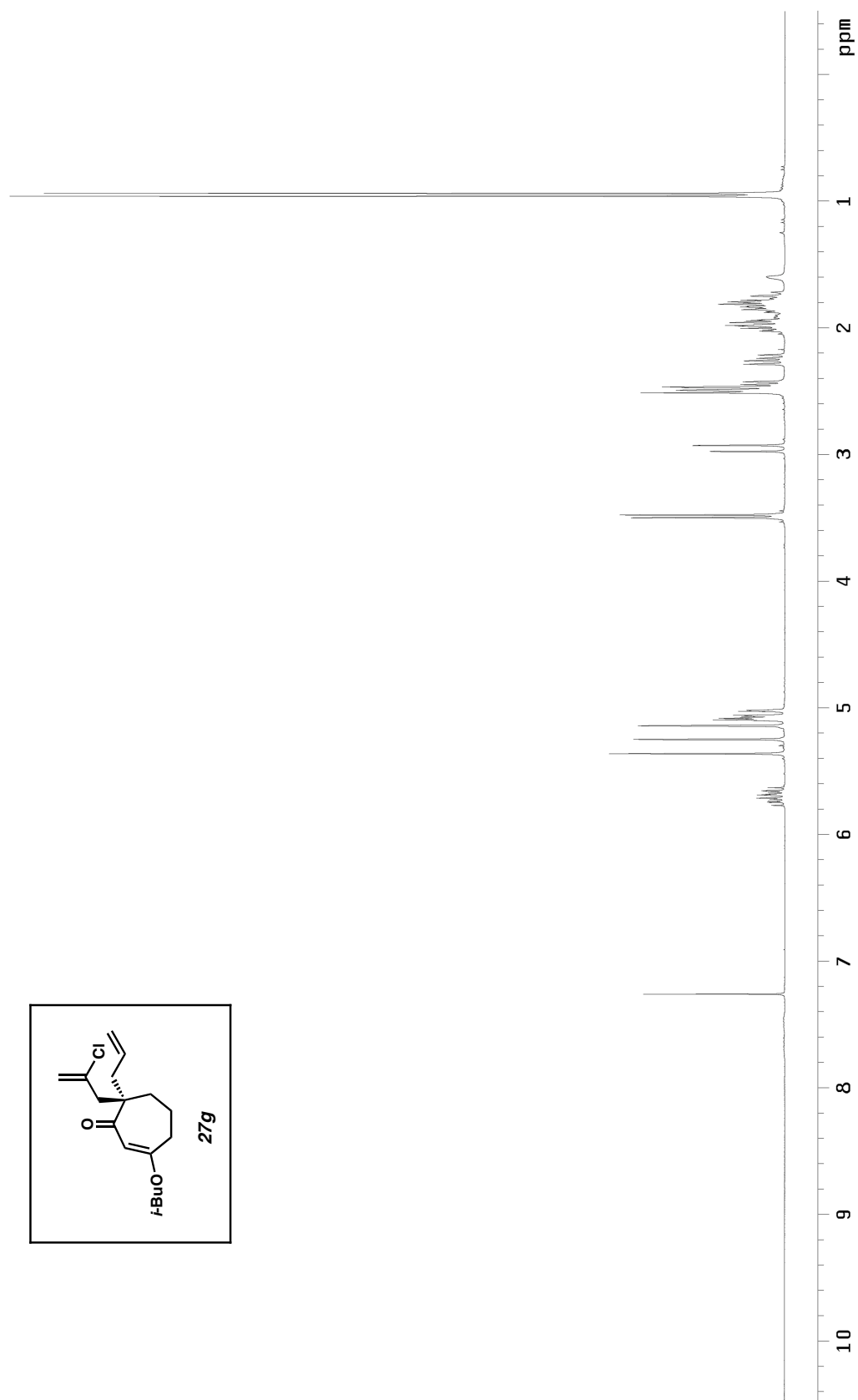


Figure A2.27.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **27f**.

Figure A2.28.1. ^1H NMR (300 MHz, CDCl_3) of compound **27g**.

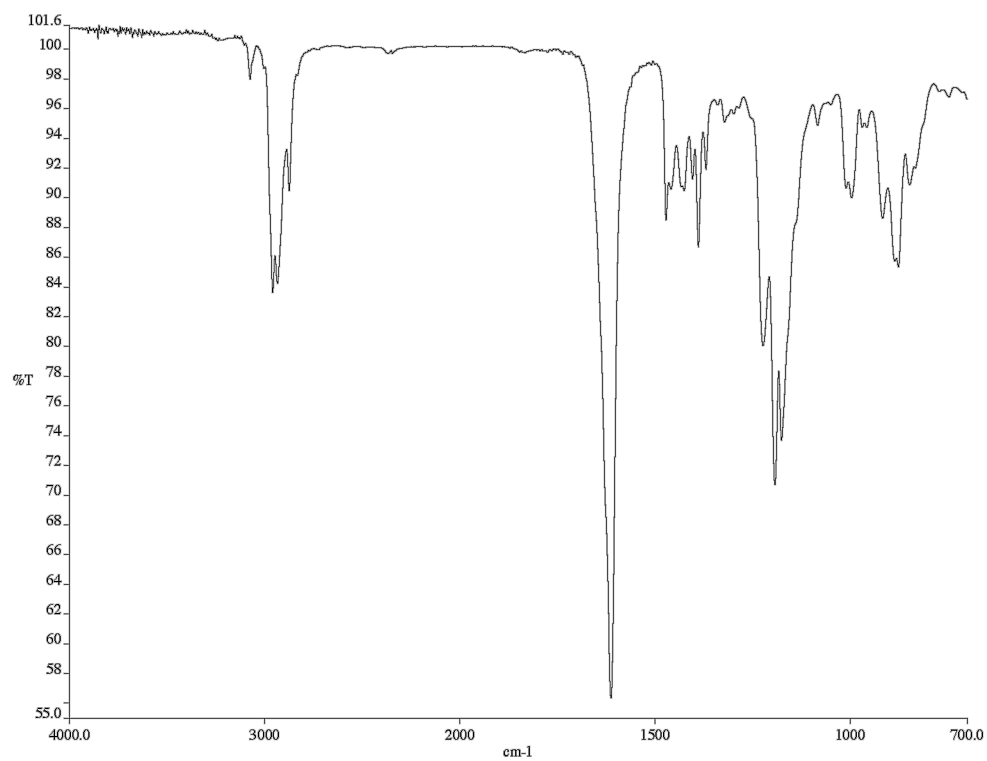


Figure A2.28.2. Infrared spectrum (thin film/NaCl) of compound **27g**.

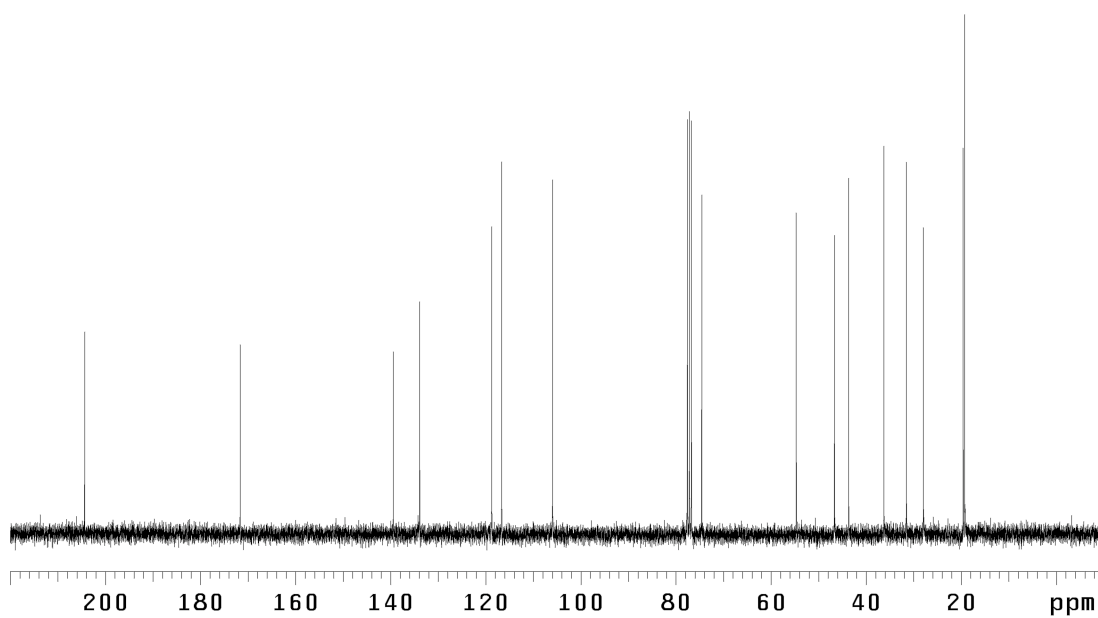
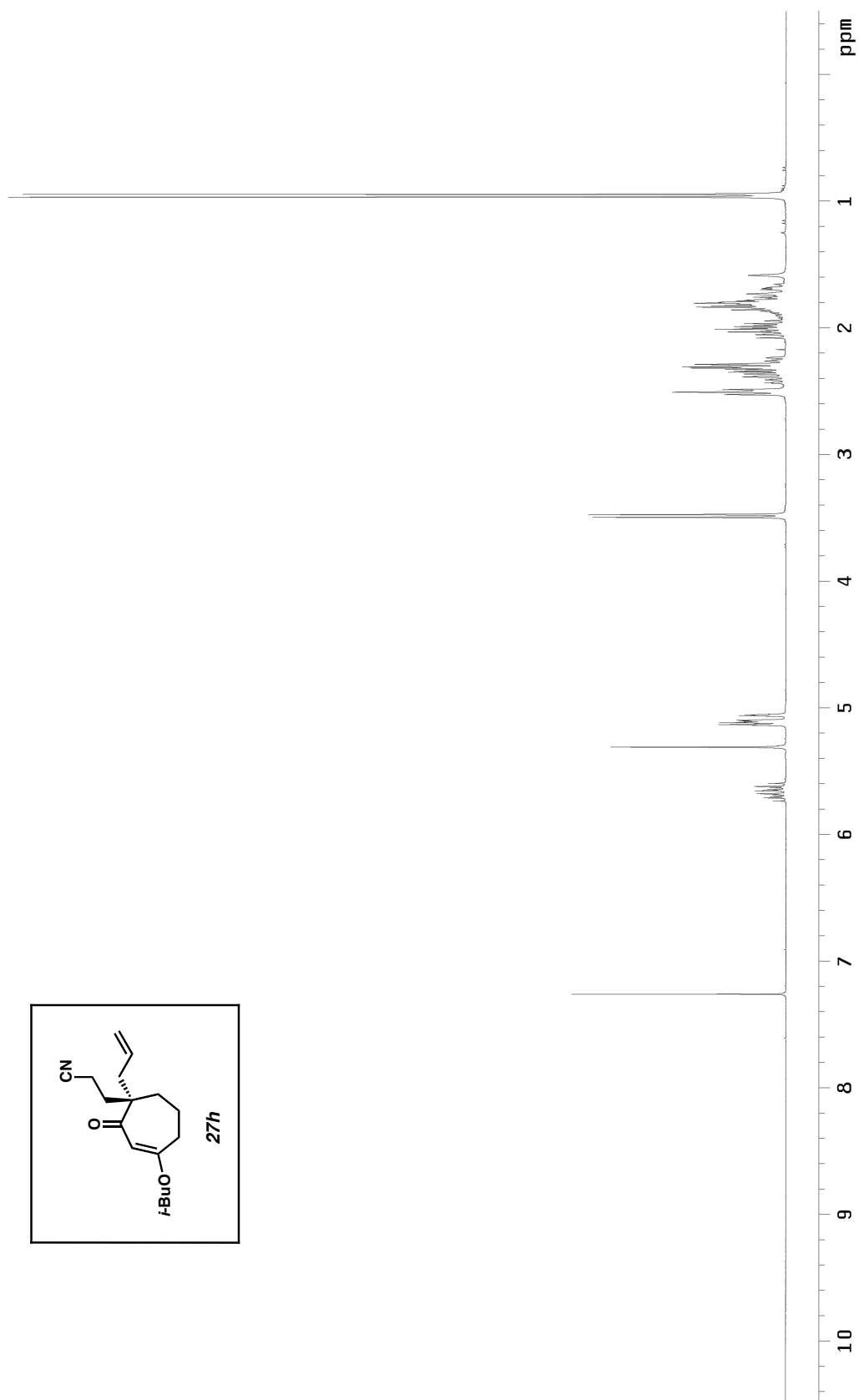


Figure A2.28.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27g**.

Figure A2.29.1. ^1H NMR (300 MHz, CDCl_3) of compound **27h**.

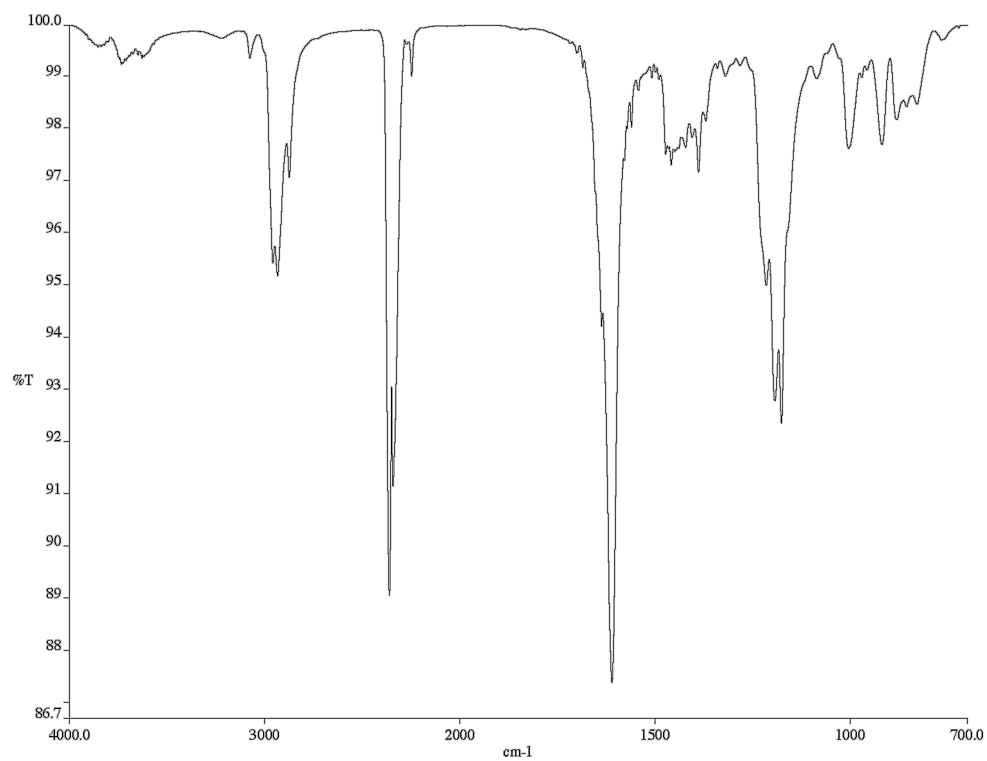


Figure A2.29.2. Infrared spectrum (thin film/NaCl) of compound **27h**.

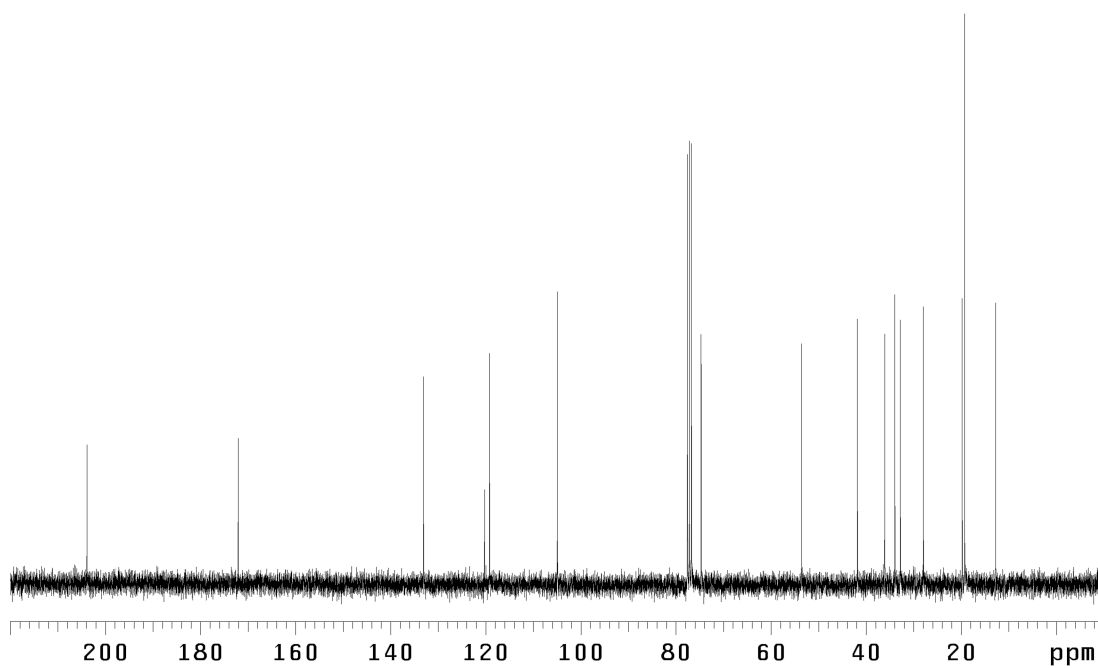
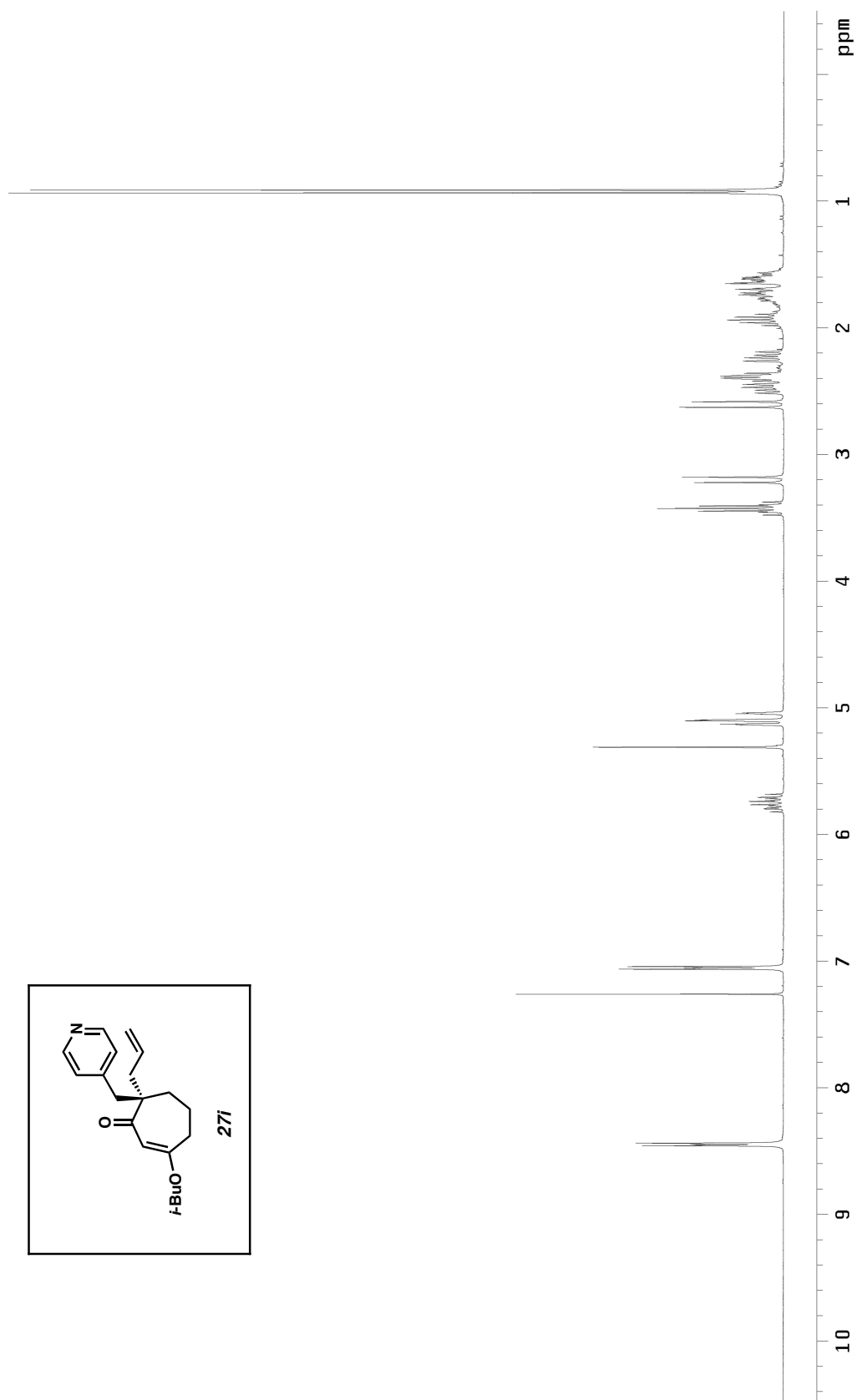


Figure A2.29.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27h**.

Figure A2.30.1. ^1H NMR (300 MHz, CDCl_3) of compound **27i**.

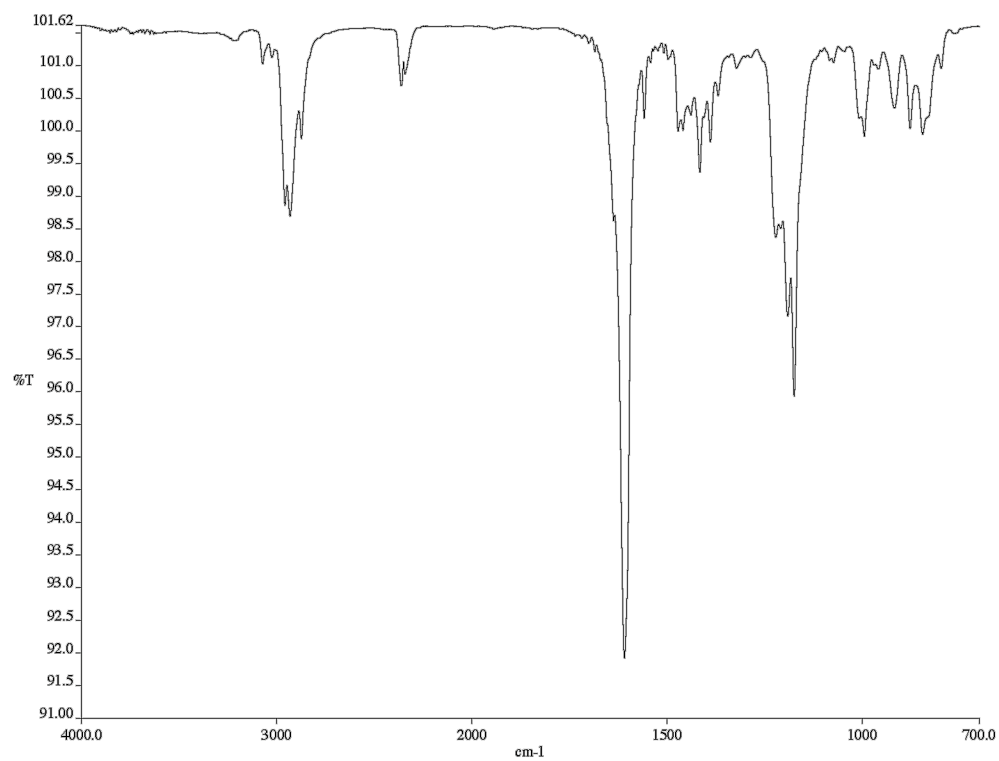


Figure A2.30.2. Infrared spectrum (thin film/NaCl) of compound **27i**.

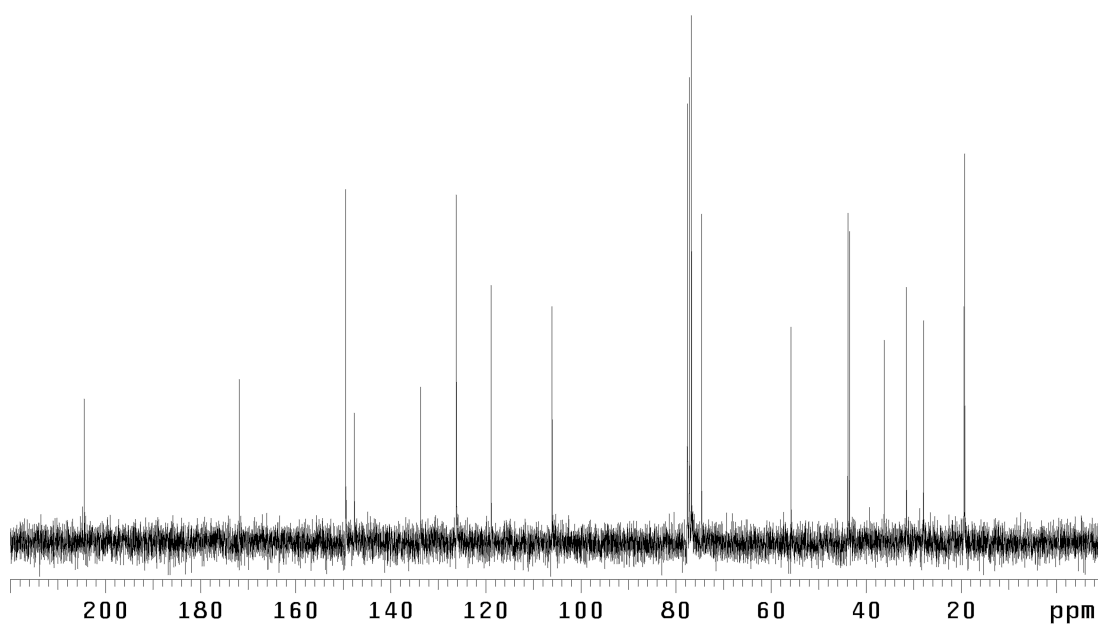
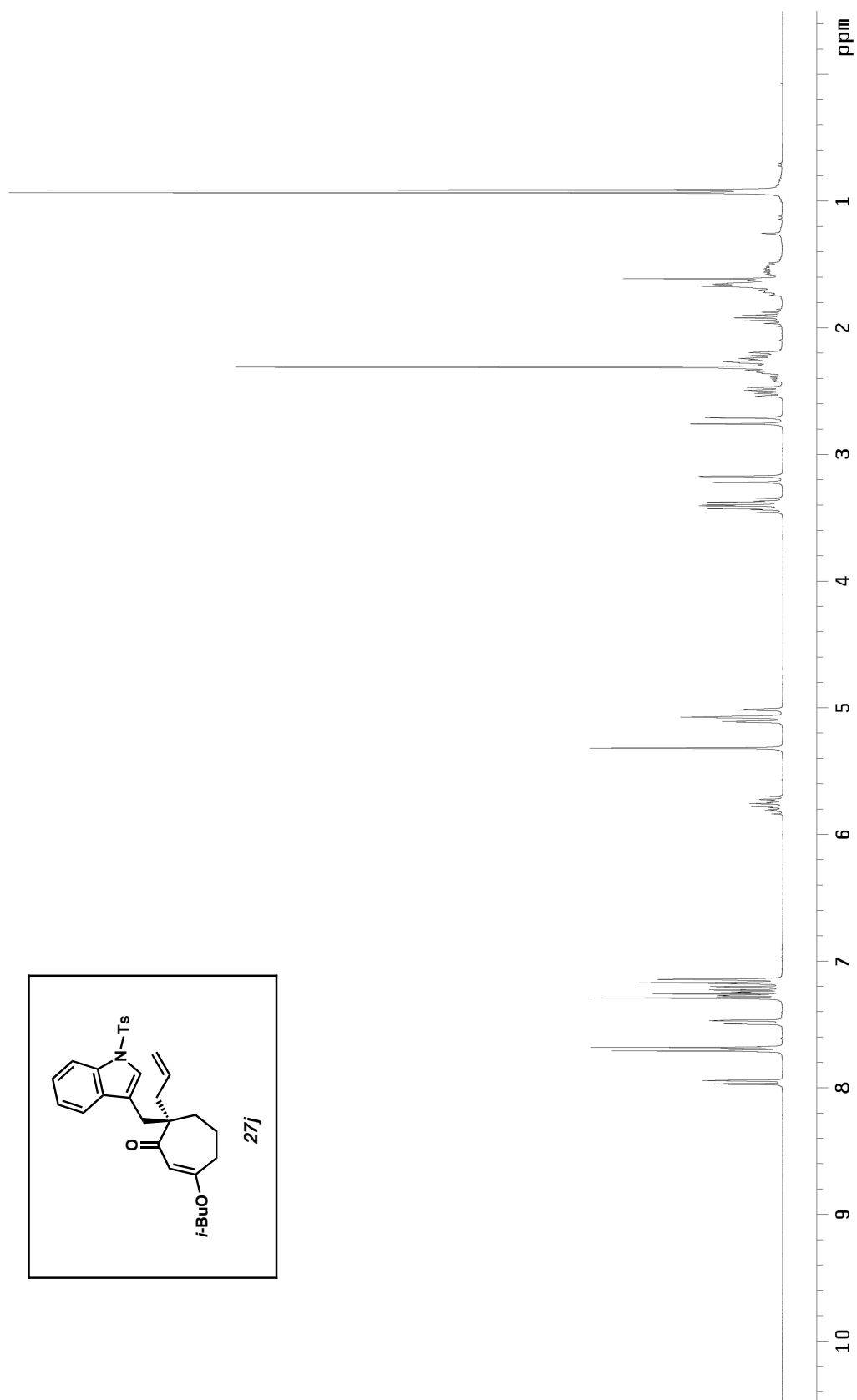


Figure A2.30.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27i**.



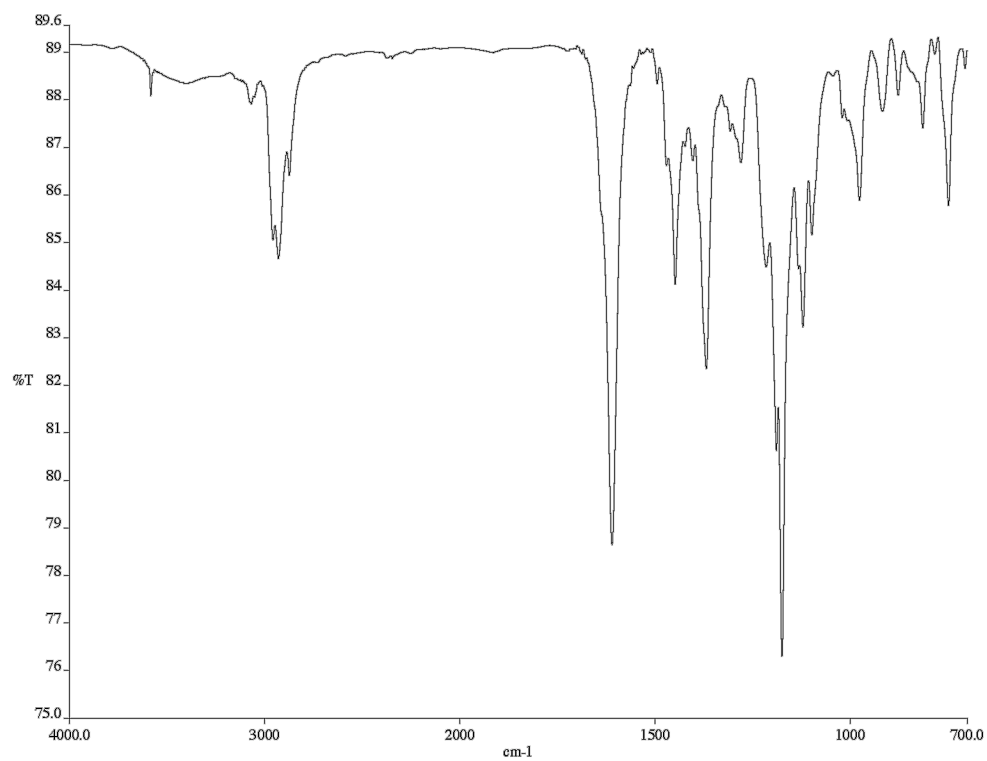


Figure A2.31.2. Infrared spectrum (thin film/NaCl) of compound **27j**.

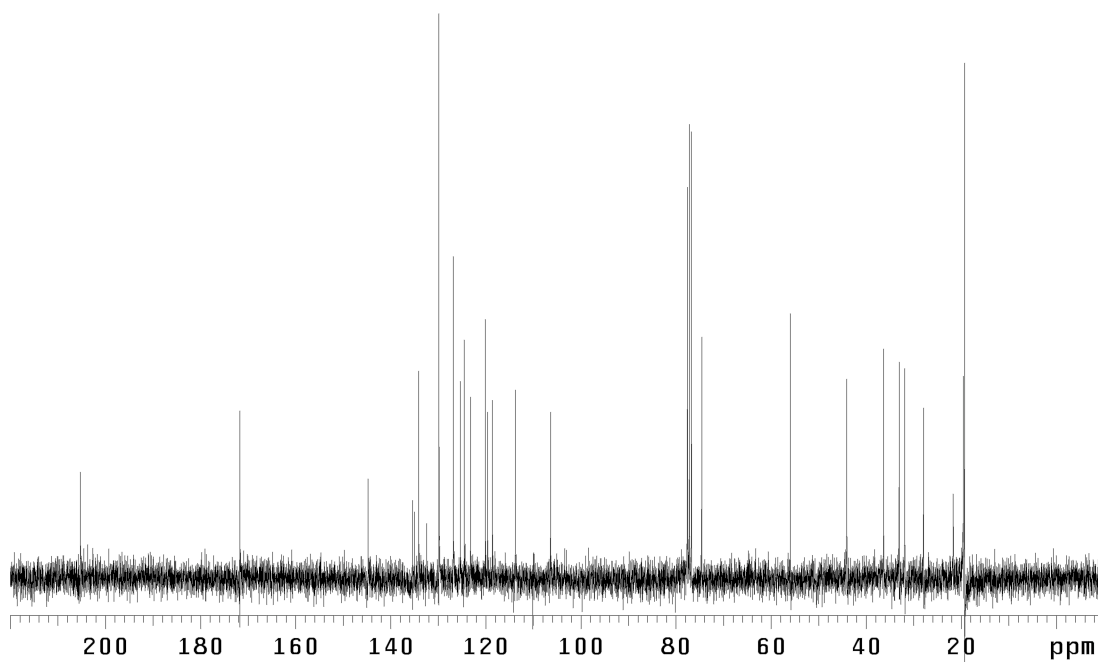
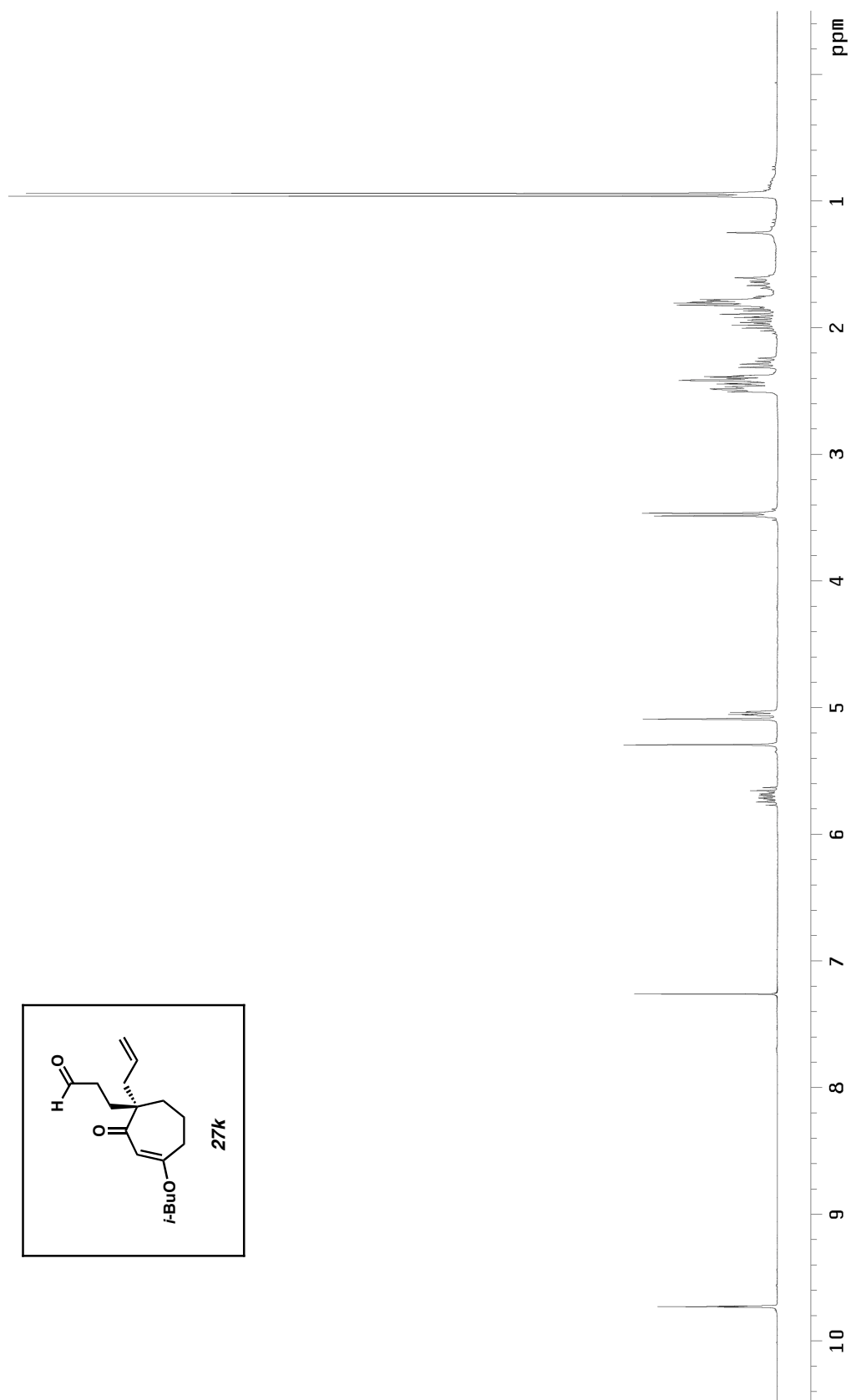


Figure A2.31.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27j**.

Figure A2.32.1. ^1H NMR (300 MHz, CDCl_3) of compound **27k**.

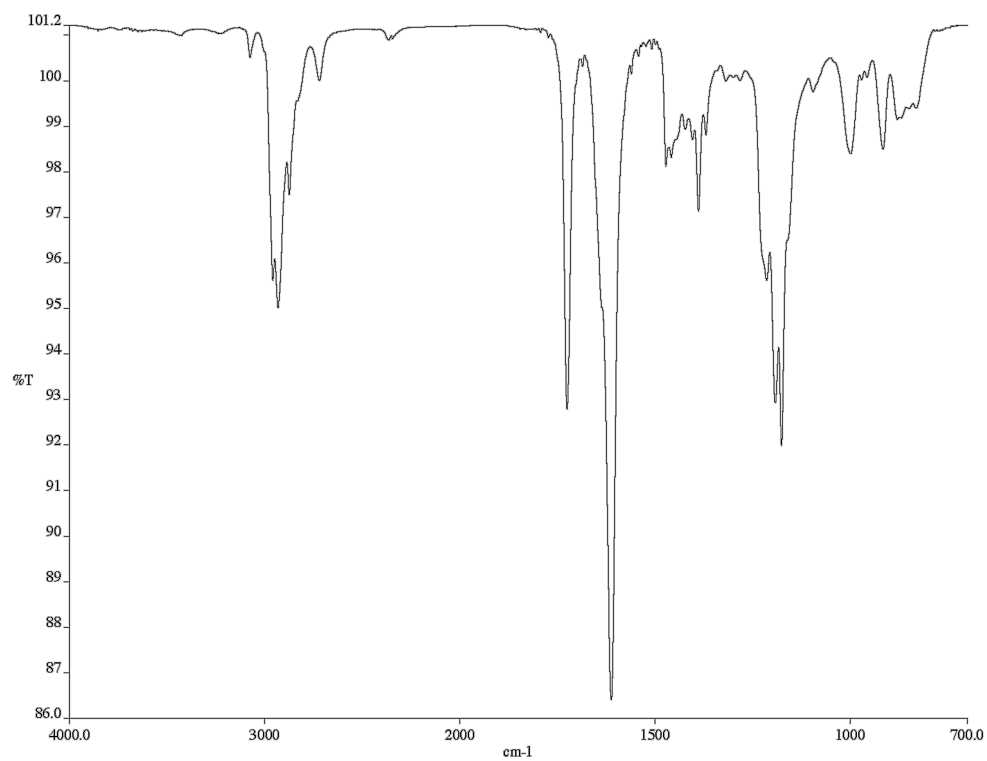


Figure A2.32.2. Infrared spectrum (thin film/NaCl) of compound **27k**.

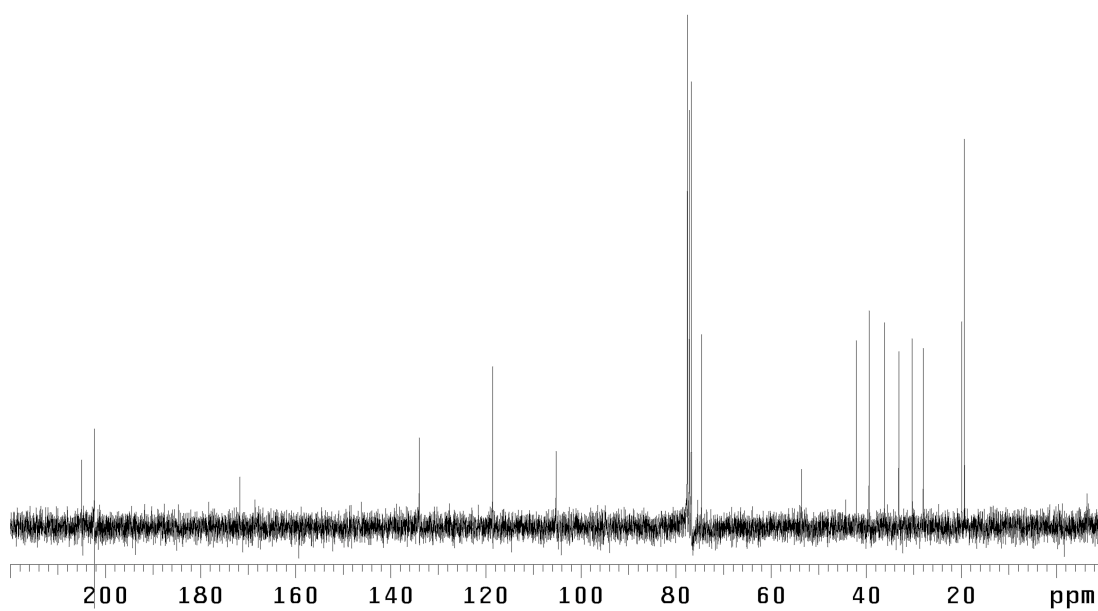


Figure A2.32.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27k**.

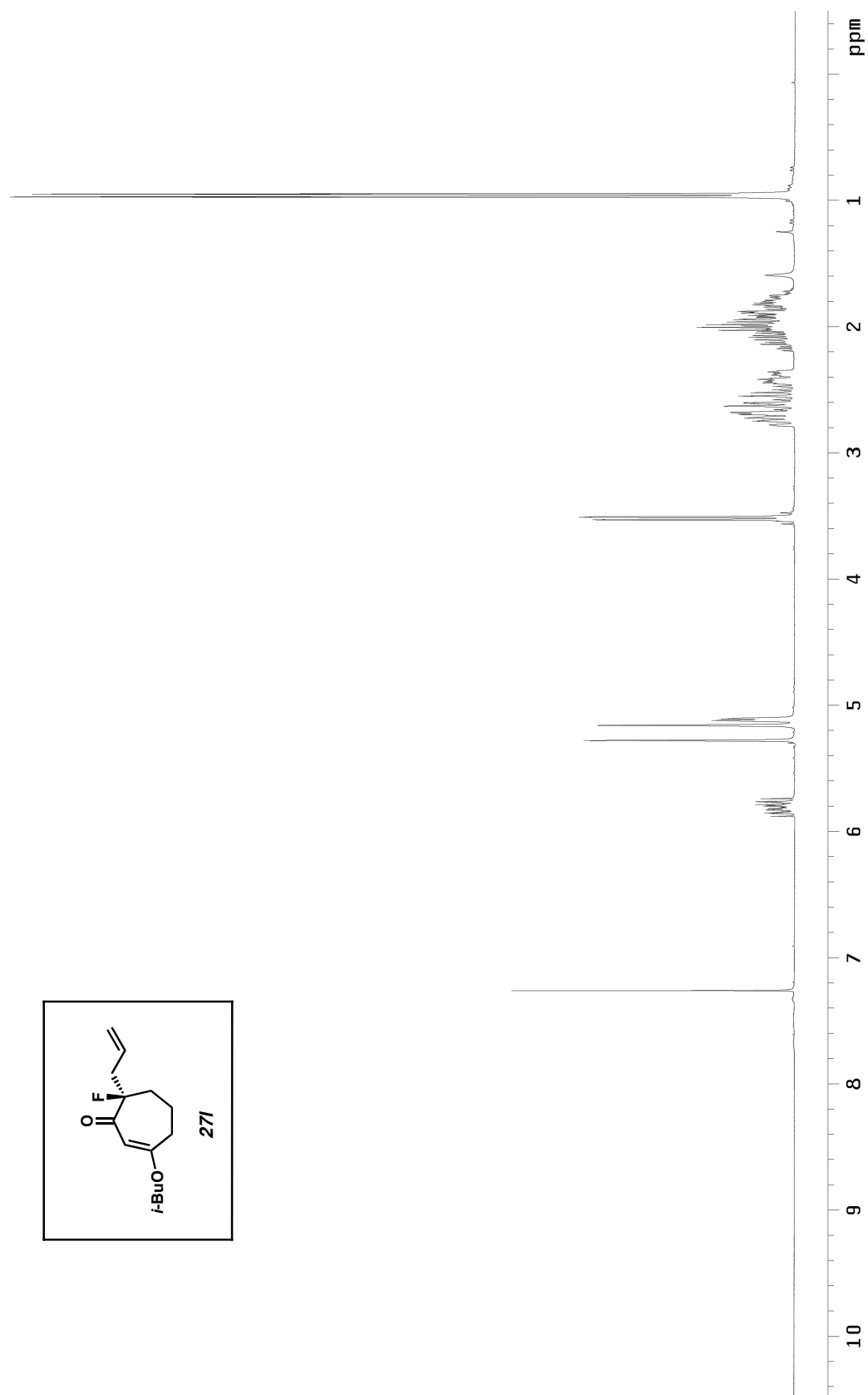


Figure A2.33.1. ^1H NMR (300 MHz, CDCl_3) of compound **271**.

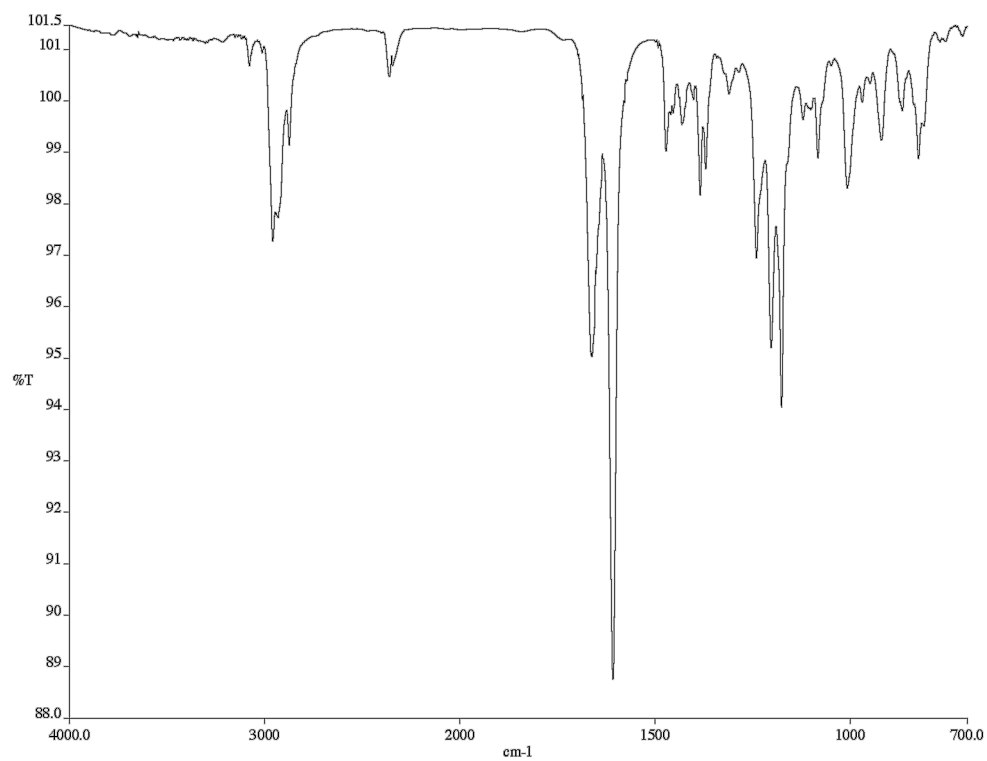


Figure A2.33.2. Infrared spectrum (thin film/NaCl) of compound **271**.

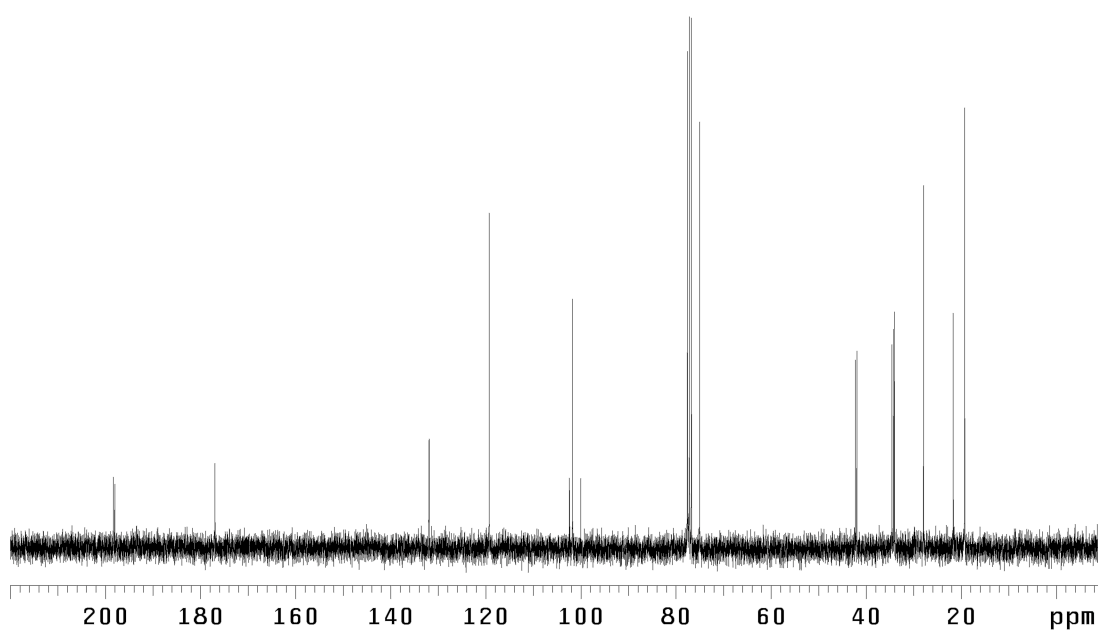


Figure A2.33.3. ¹³C NMR (75 MHz, CDCl₃) of compound **271**.

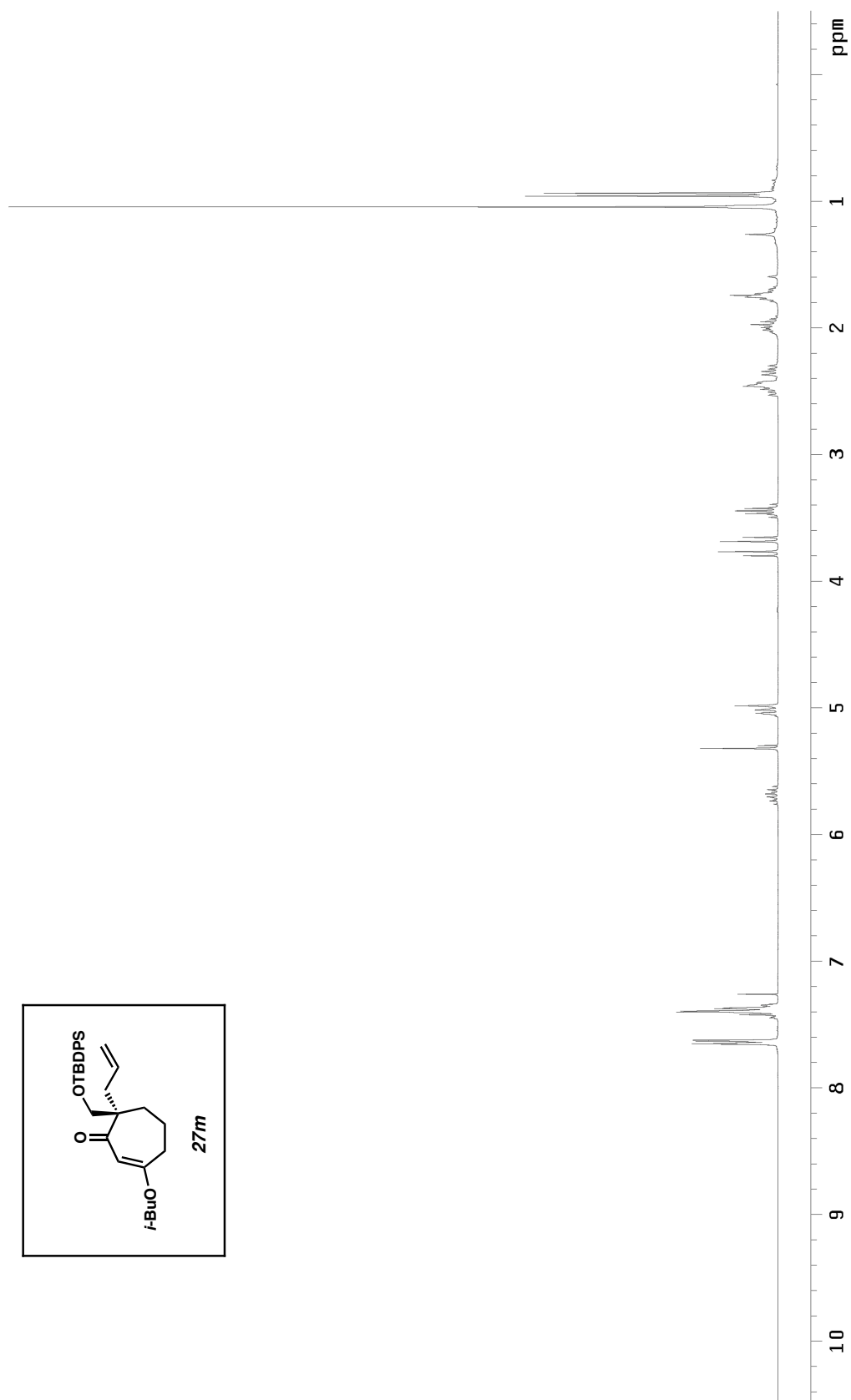


Figure A2.34.1. ^1H NMR (300 MHz, CDCl_3) of compound **27m**.

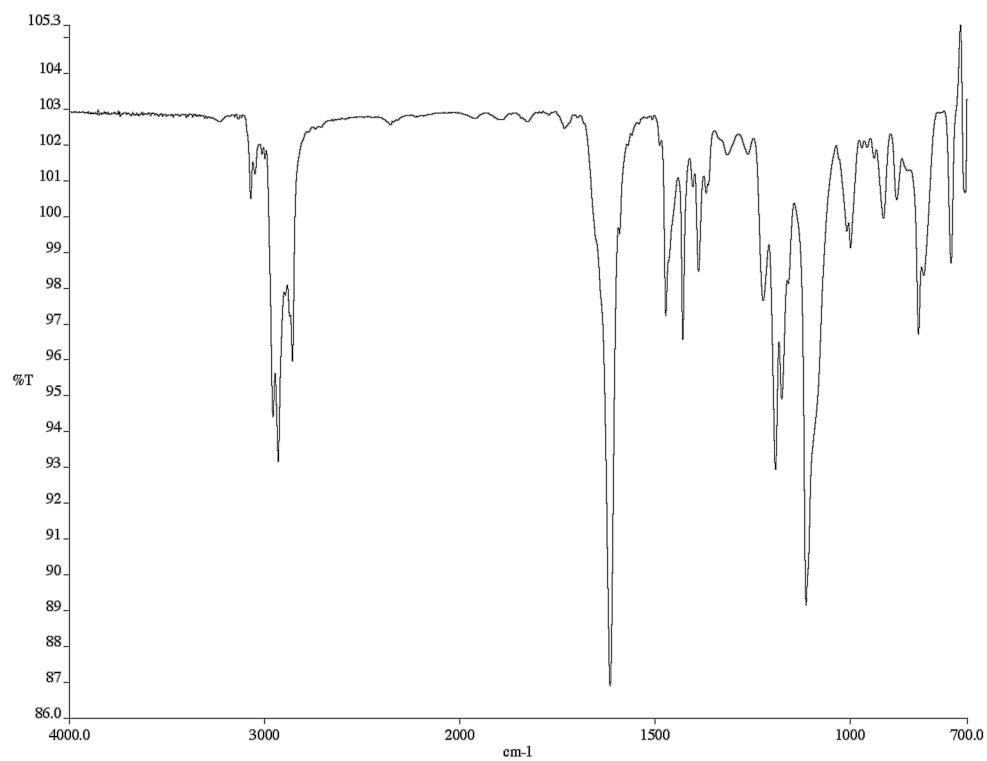


Figure A2.34.2. Infrared spectrum (thin film/NaCl) of compound **27m**.

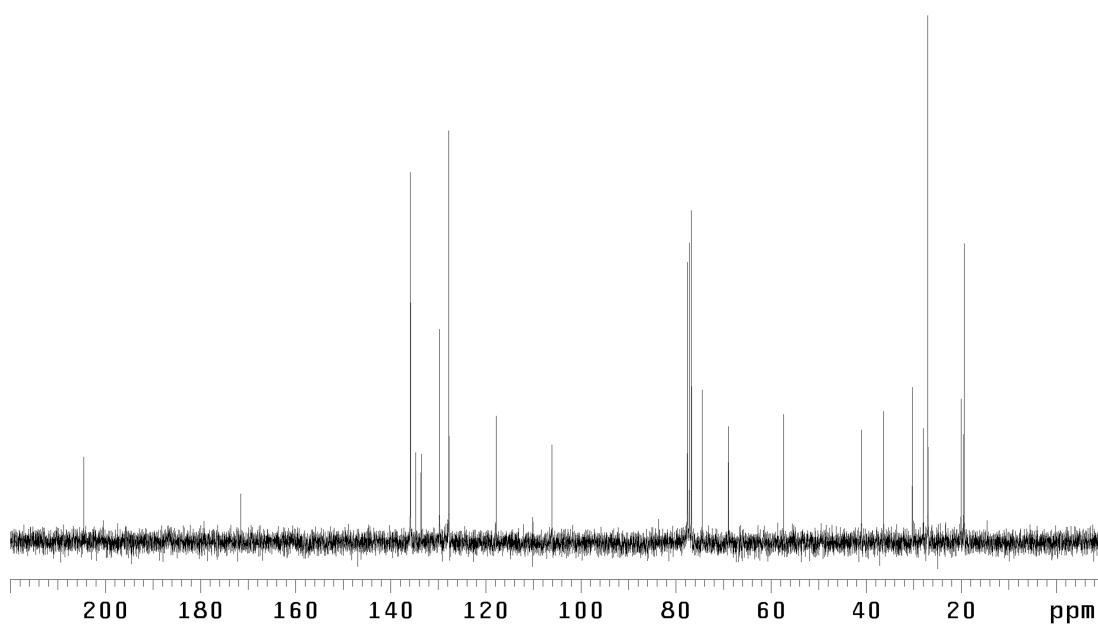


Figure A2.34.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27m**.

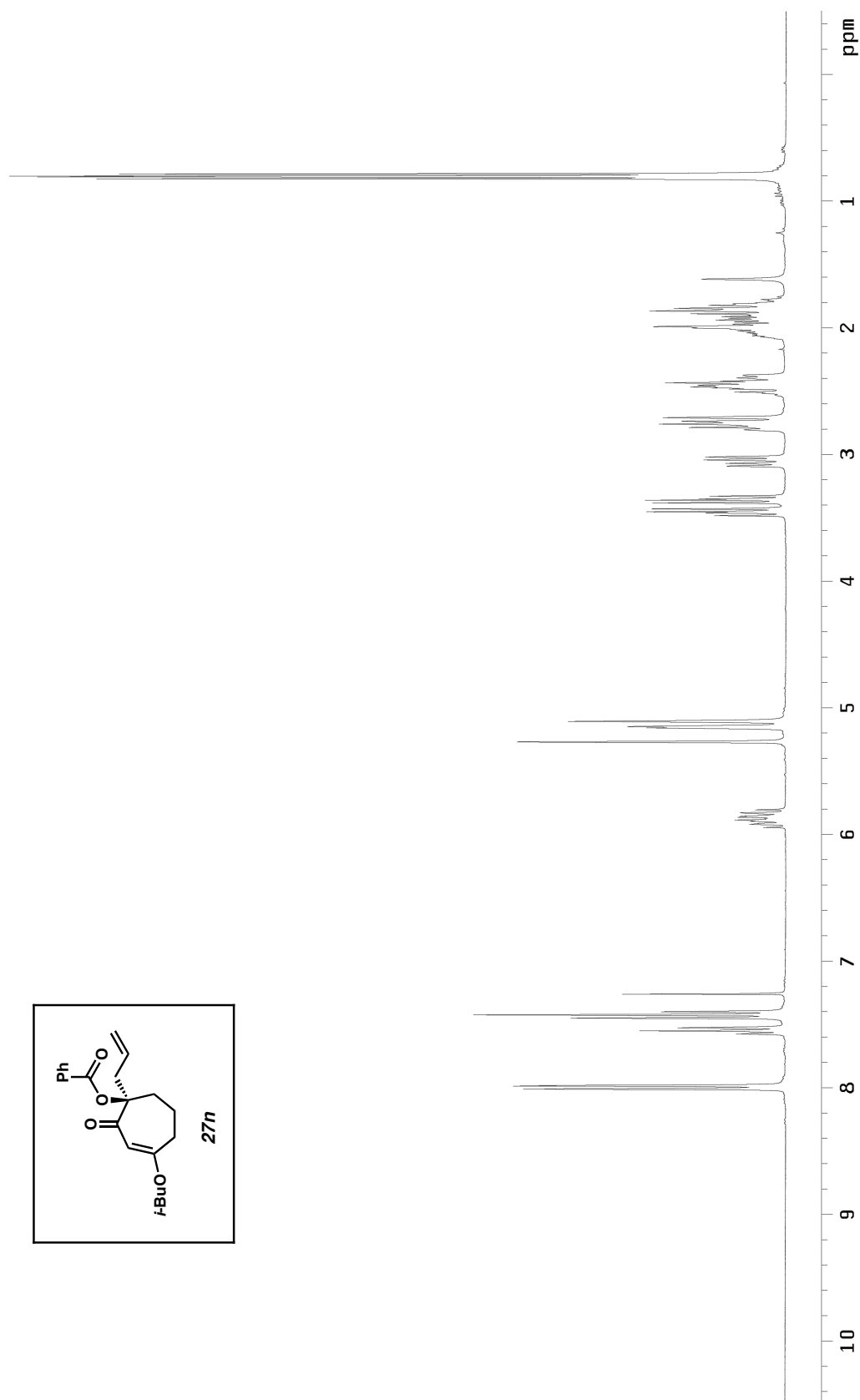


Figure A2.35.1. ¹H NMR (300 MHz, CDCl₃) of compound **27n**.

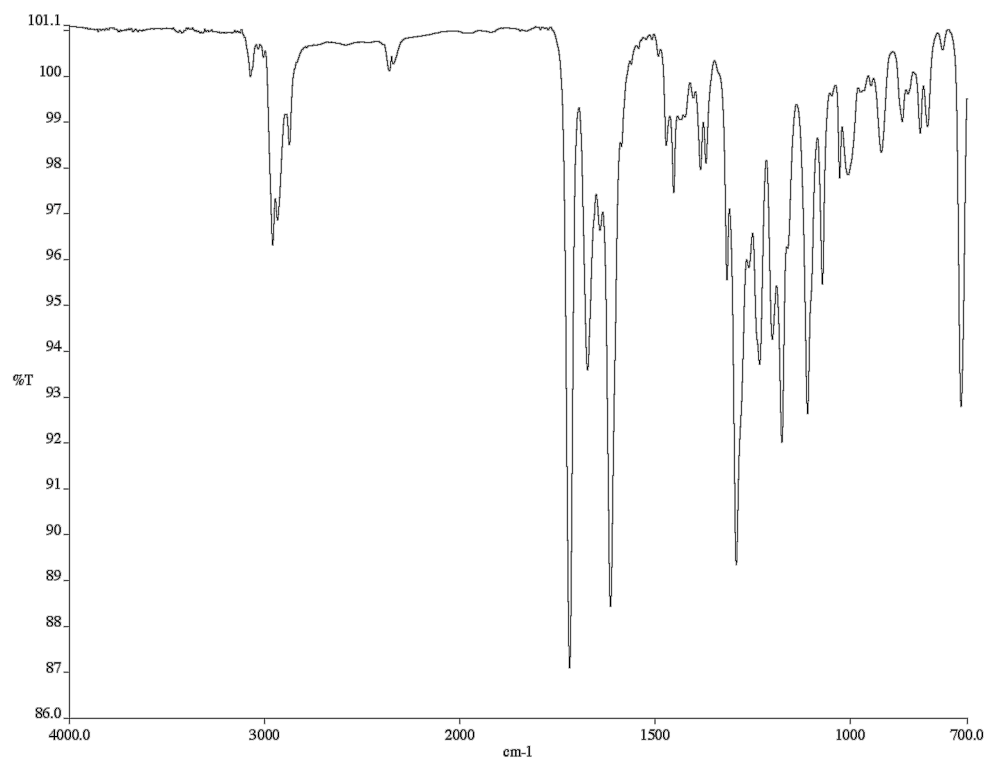


Figure A2.35.2. Infrared spectrum (thin film/NaCl) of compound **27n**.

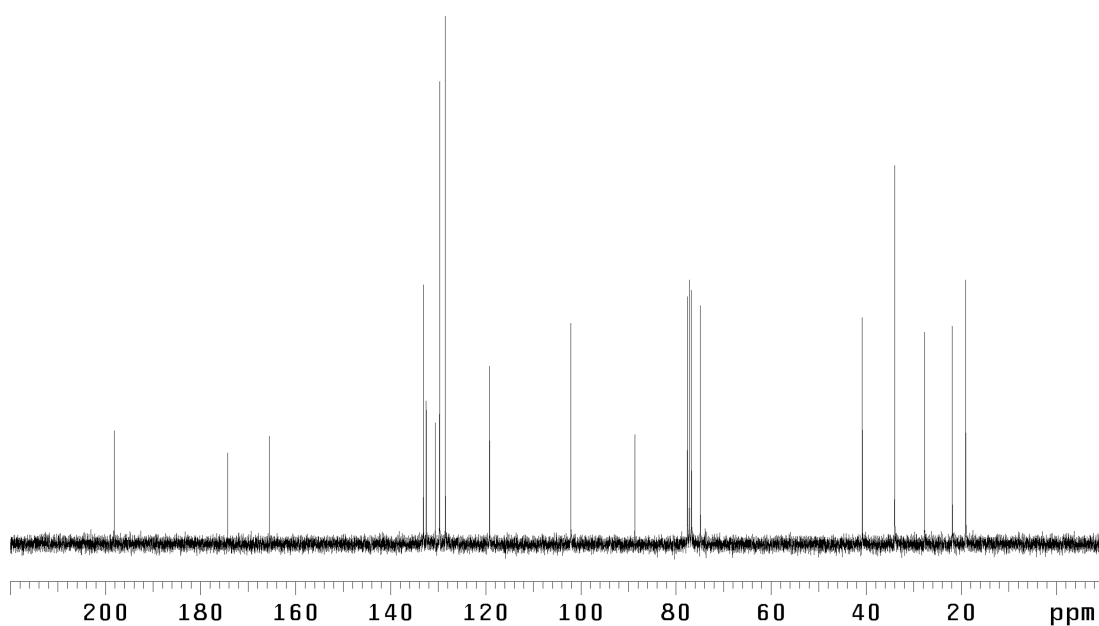
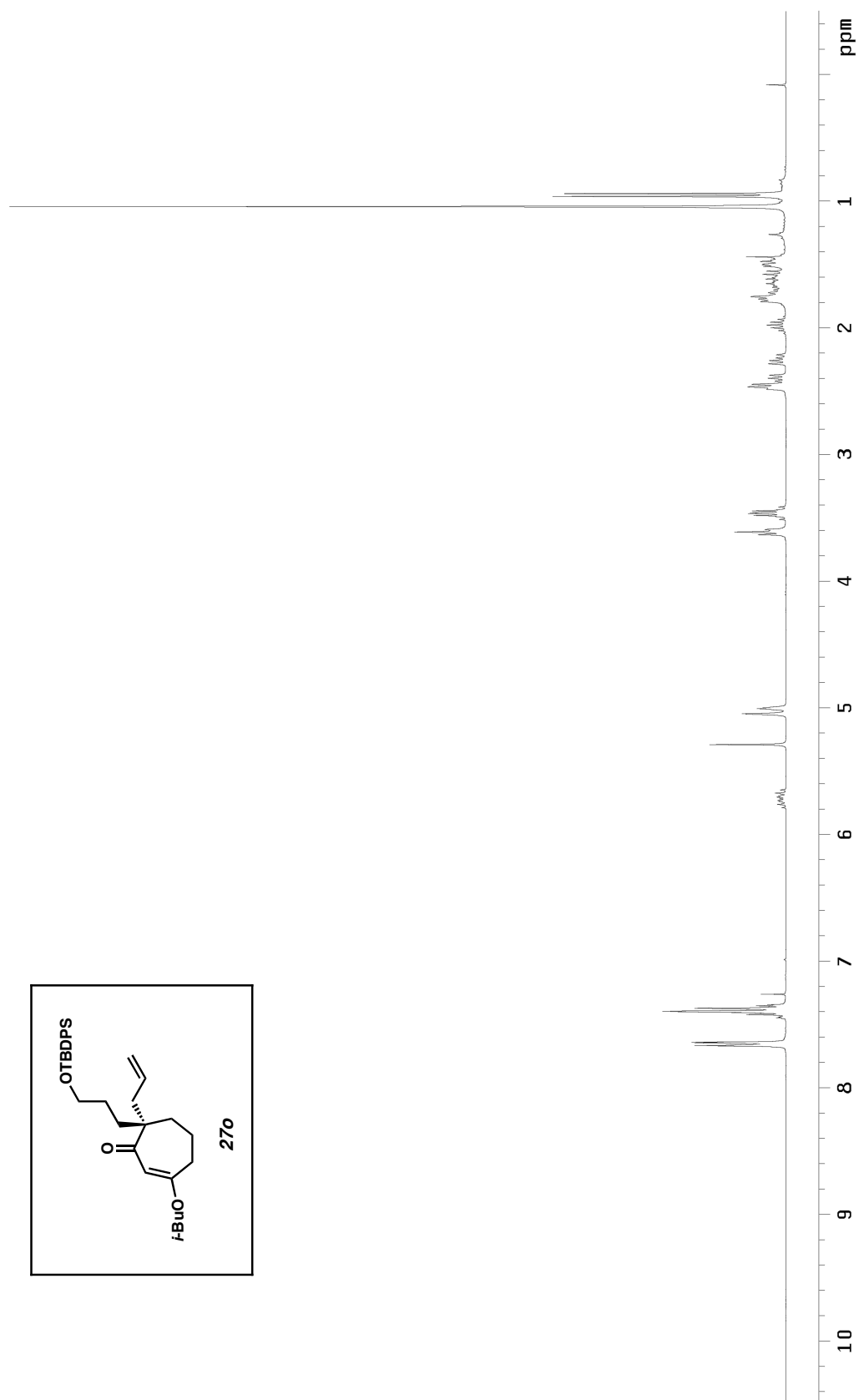


Figure A2.35.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27n**.

Figure A2.36.1. ^1H NMR (300 MHz, CDCl_3) of compound **27o**.

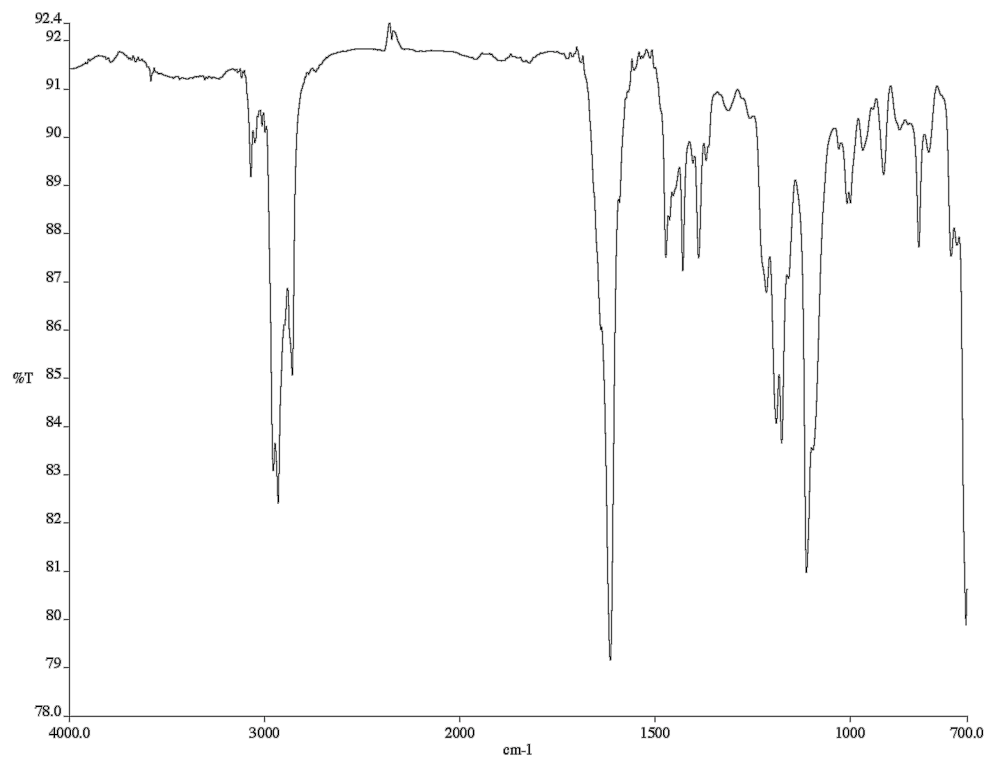


Figure A2.36.2. Infrared spectrum (thin film/NaCl) of compound **27o**.

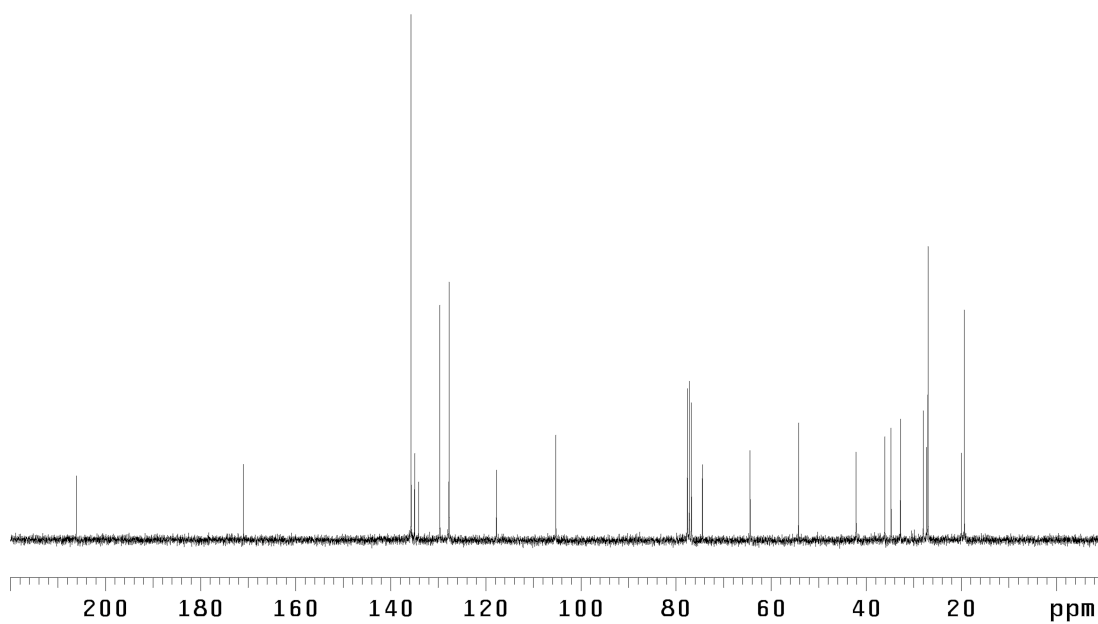
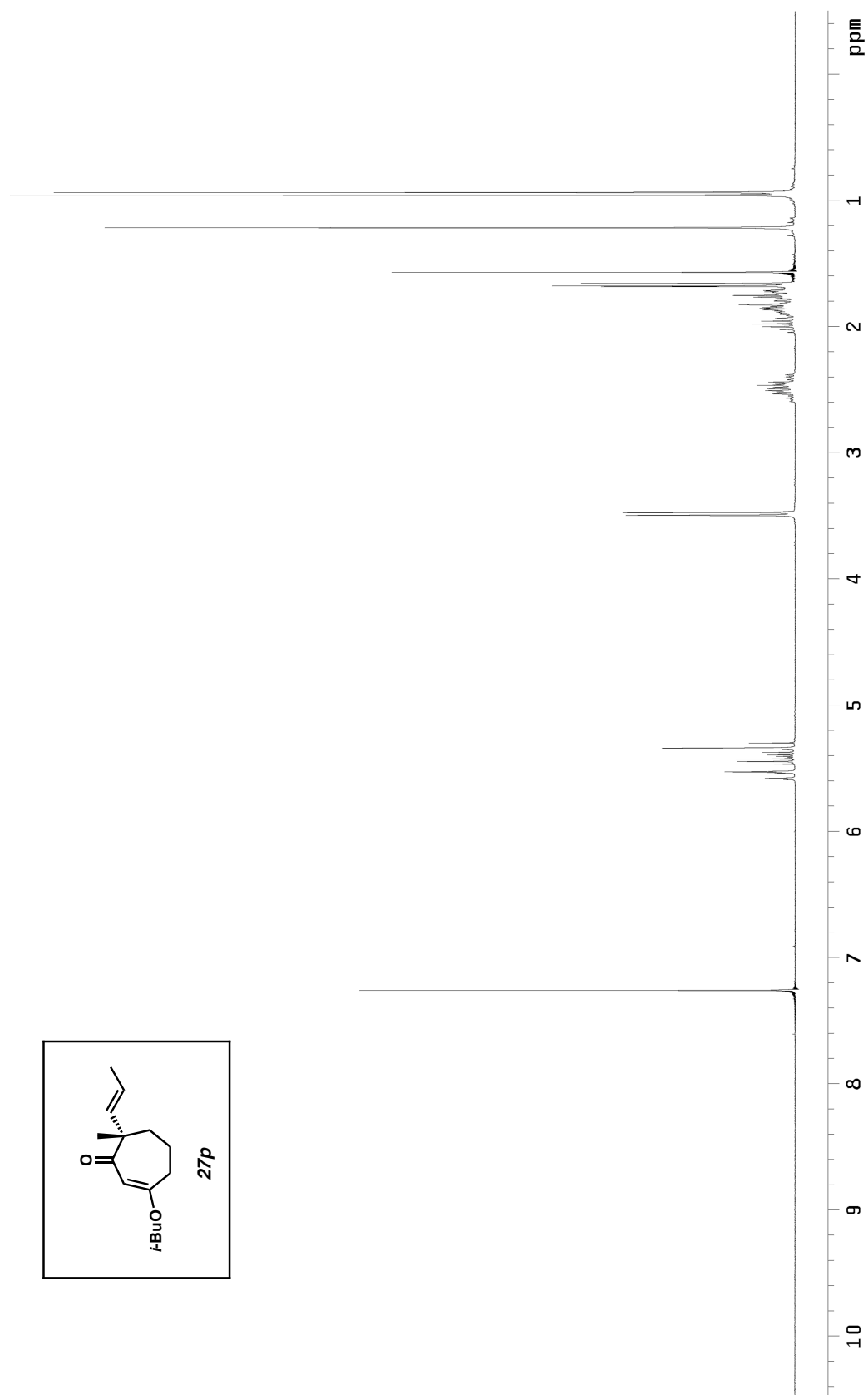


Figure A2.36.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27o**.

Figure A2.37.1. ¹H NMR (300 MHz, CDCl₃) of compound 27p.

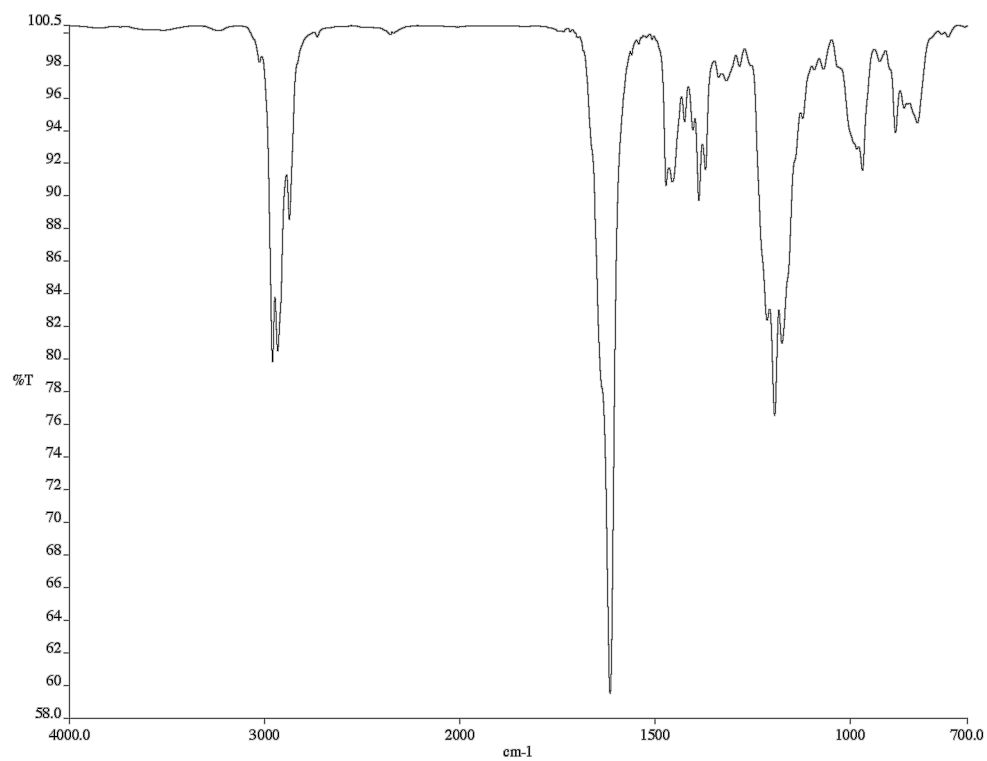


Figure A2.37.2. Infrared spectrum (thin film/NaCl) of compound **27p**.

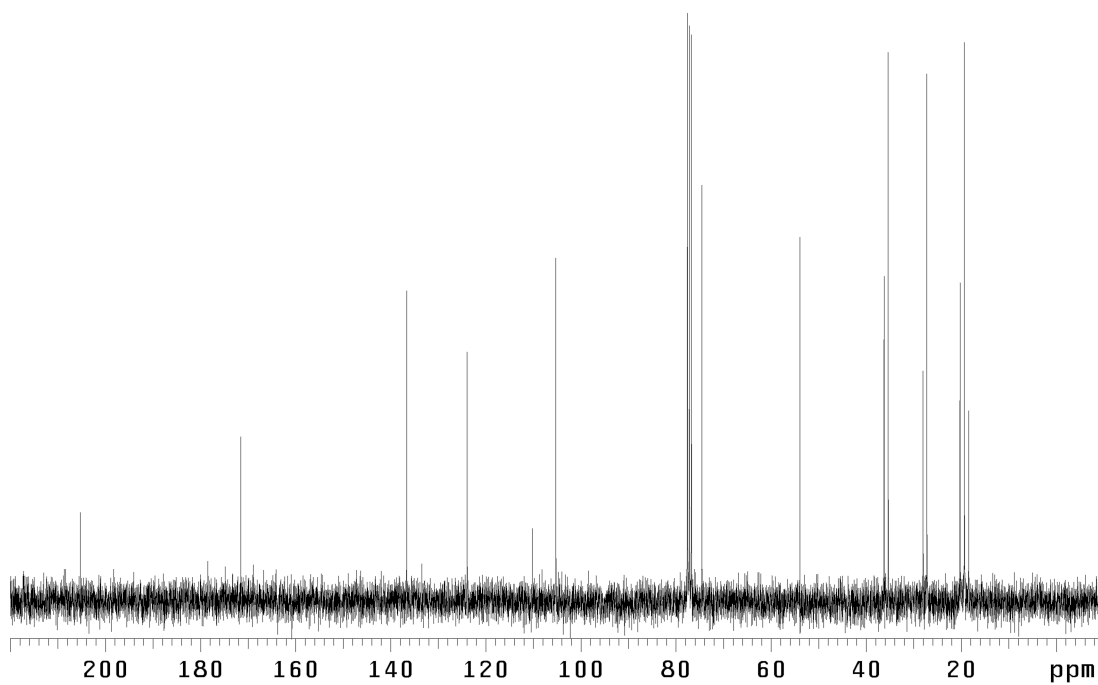
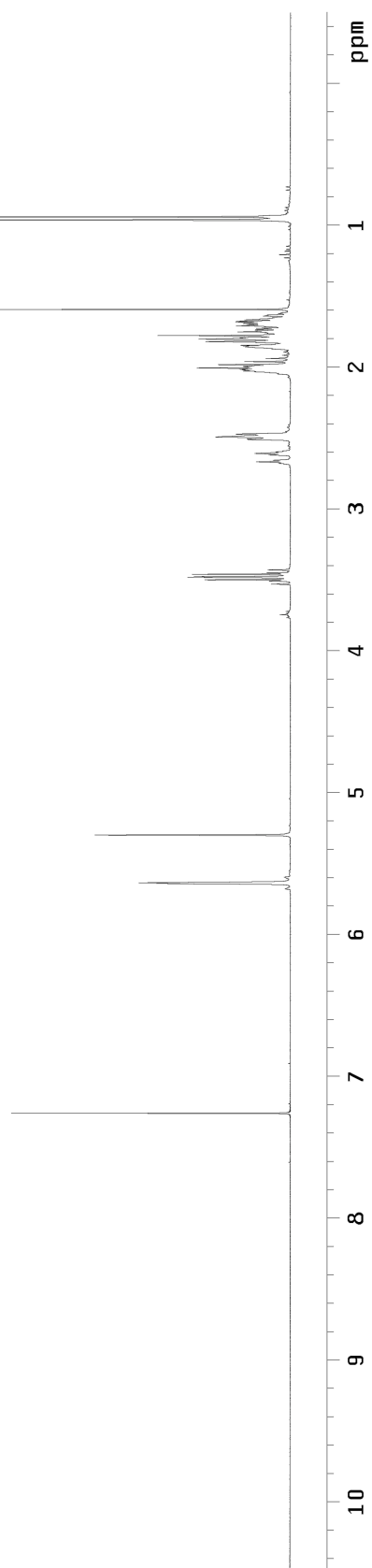
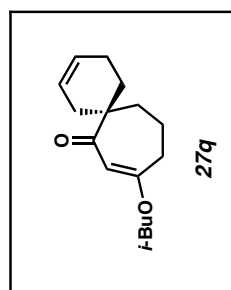


Figure A2.37.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27p**.

Figure A2.38. 1. ¹H NMR (300 MHz, CDCl₃) of compound **27q**.

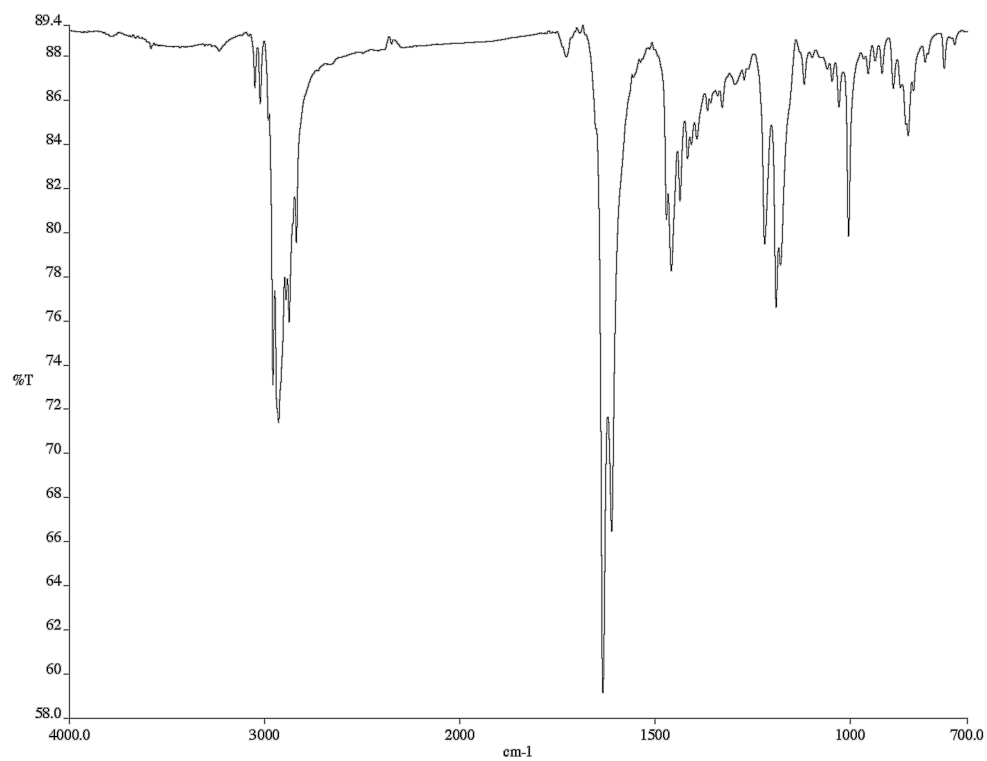


Figure A2.38.2. Infrared spectrum (thin film/NaCl) of compound **27q**.

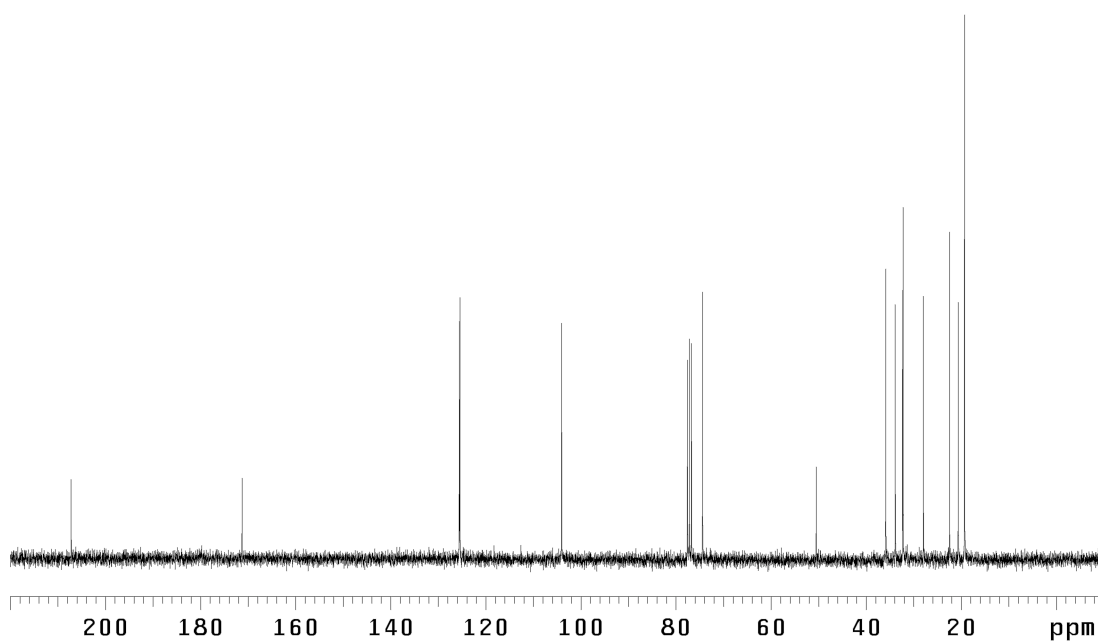
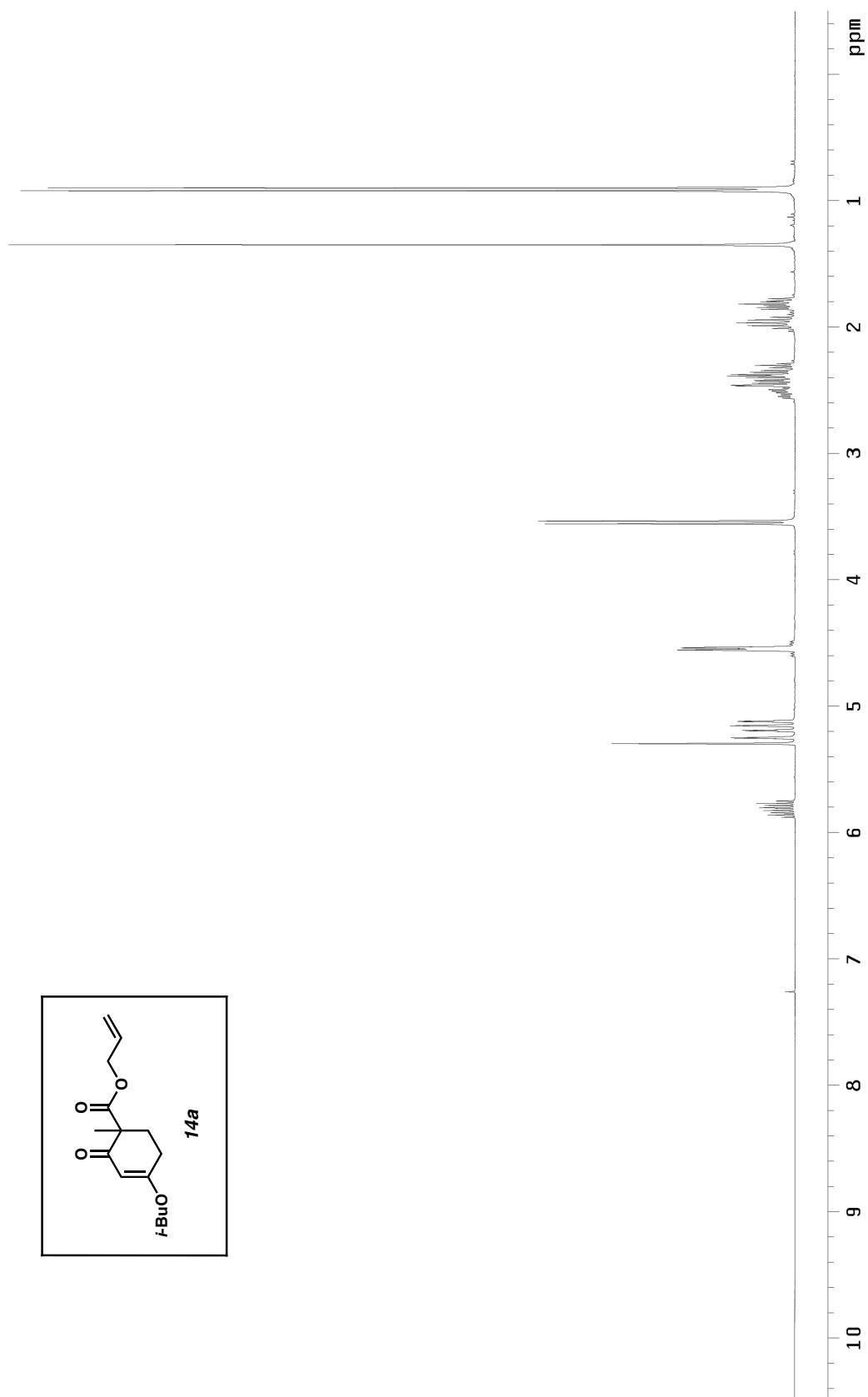


Figure A2.38.3. ¹³C NMR (75 MHz, CDCl₃) of compound **27q**.



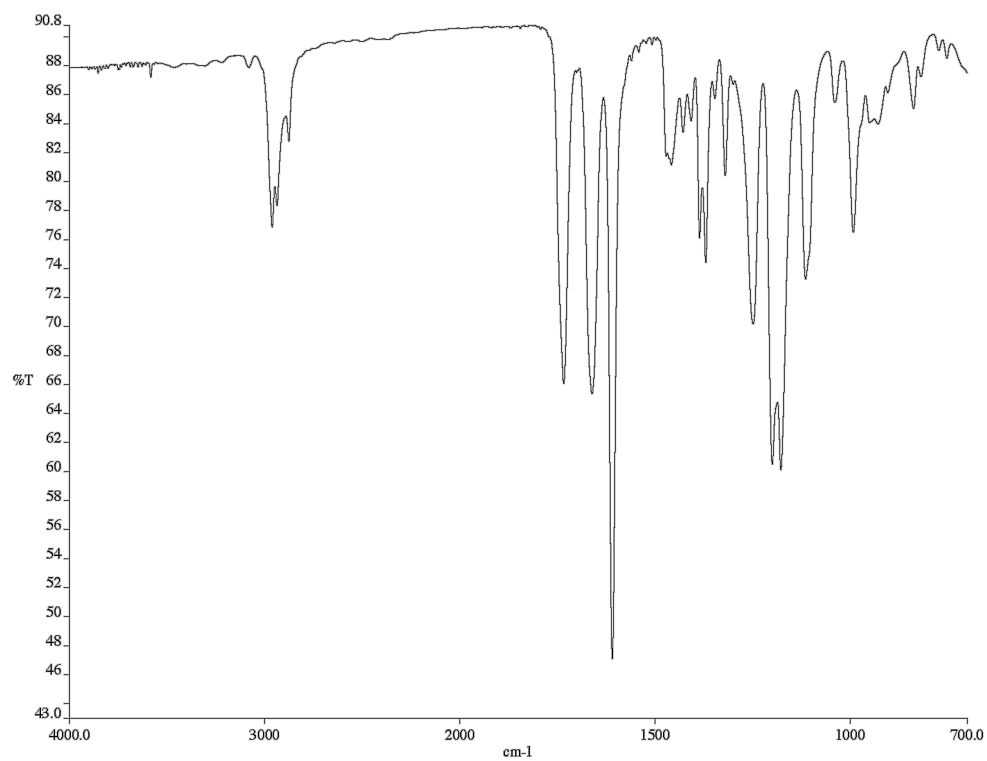


Figure A2.39.2. Infrared spectrum (thin film/NaCl) of compound **14a**.

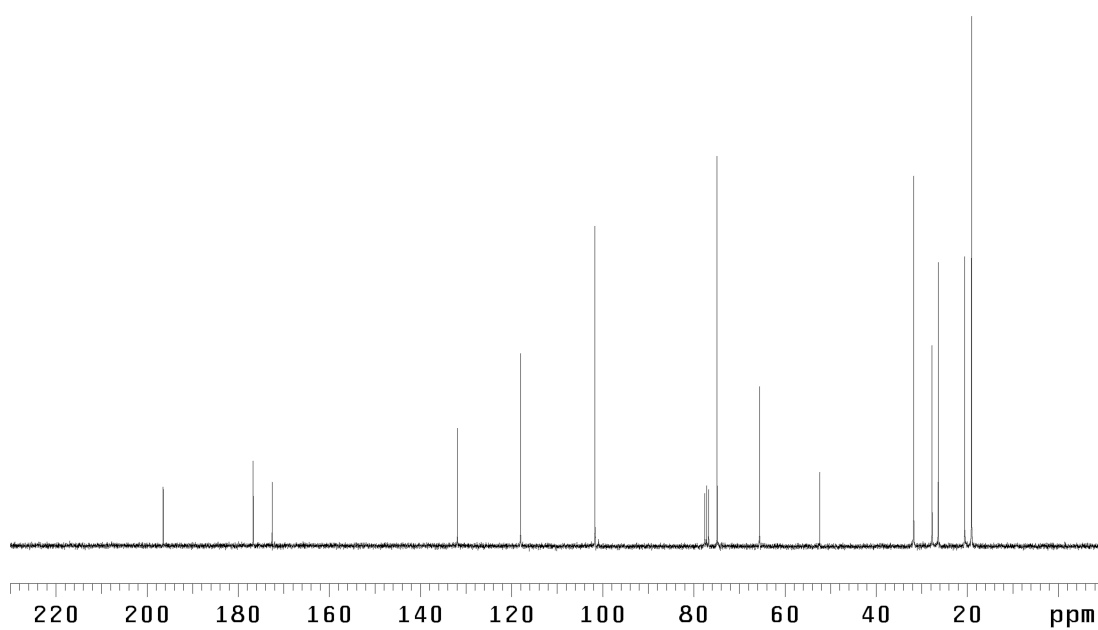
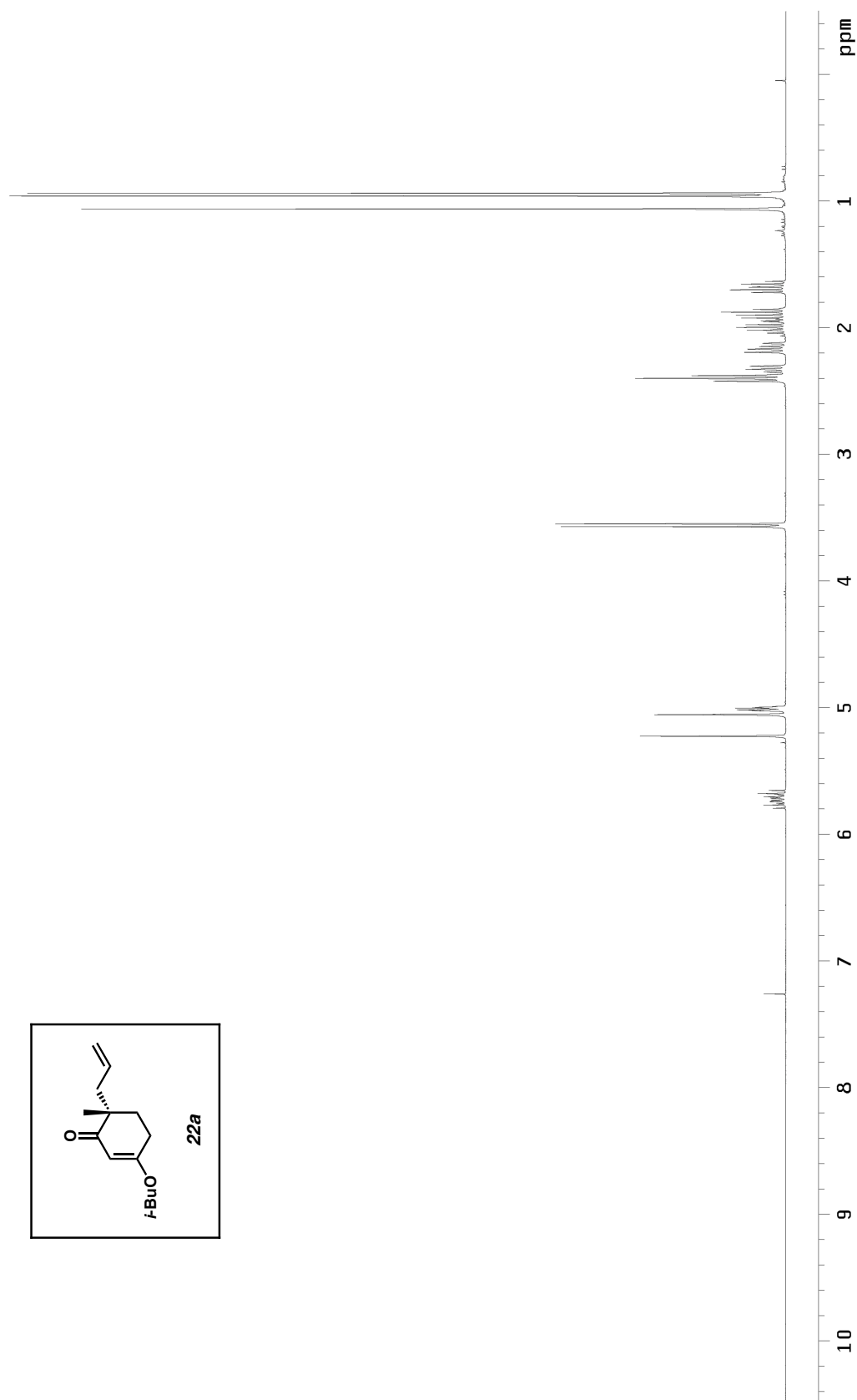


Figure A2.39.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **14a**.

Figure A2.40.1. ¹H NMR (300 MHz, CDCl₃) of compound **22a**.

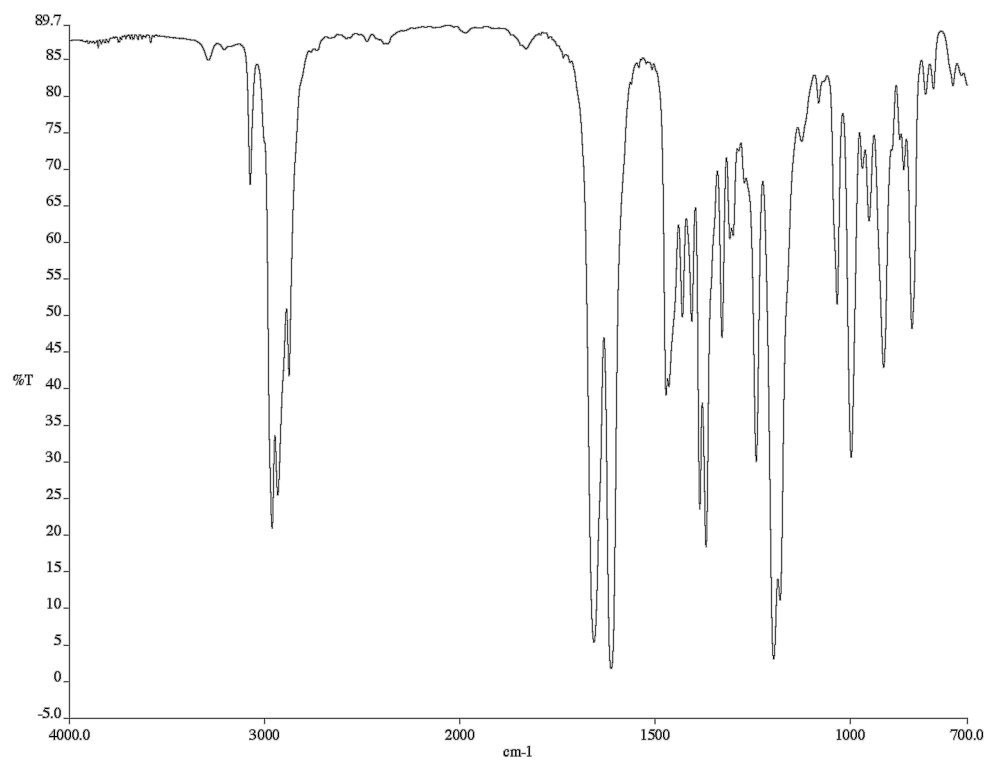


Figure A2.40.2. Infrared spectrum (thin film/NaCl) of compound **22a**.

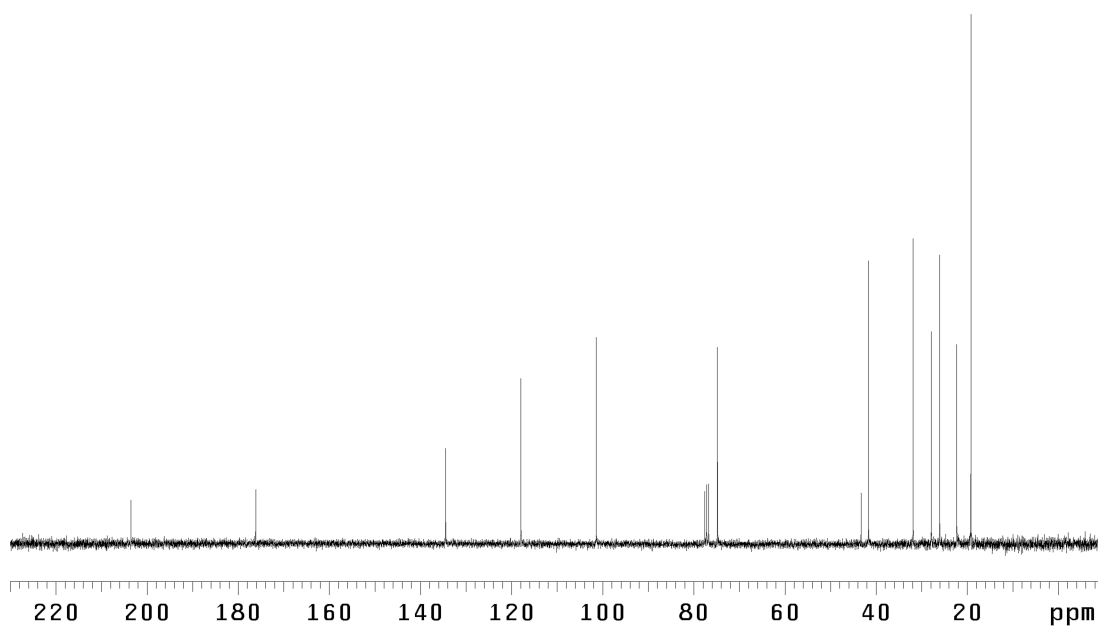


Figure A2.40.3. ¹³C NMR (75 MHz, CDCl₃) of compound **22a**.

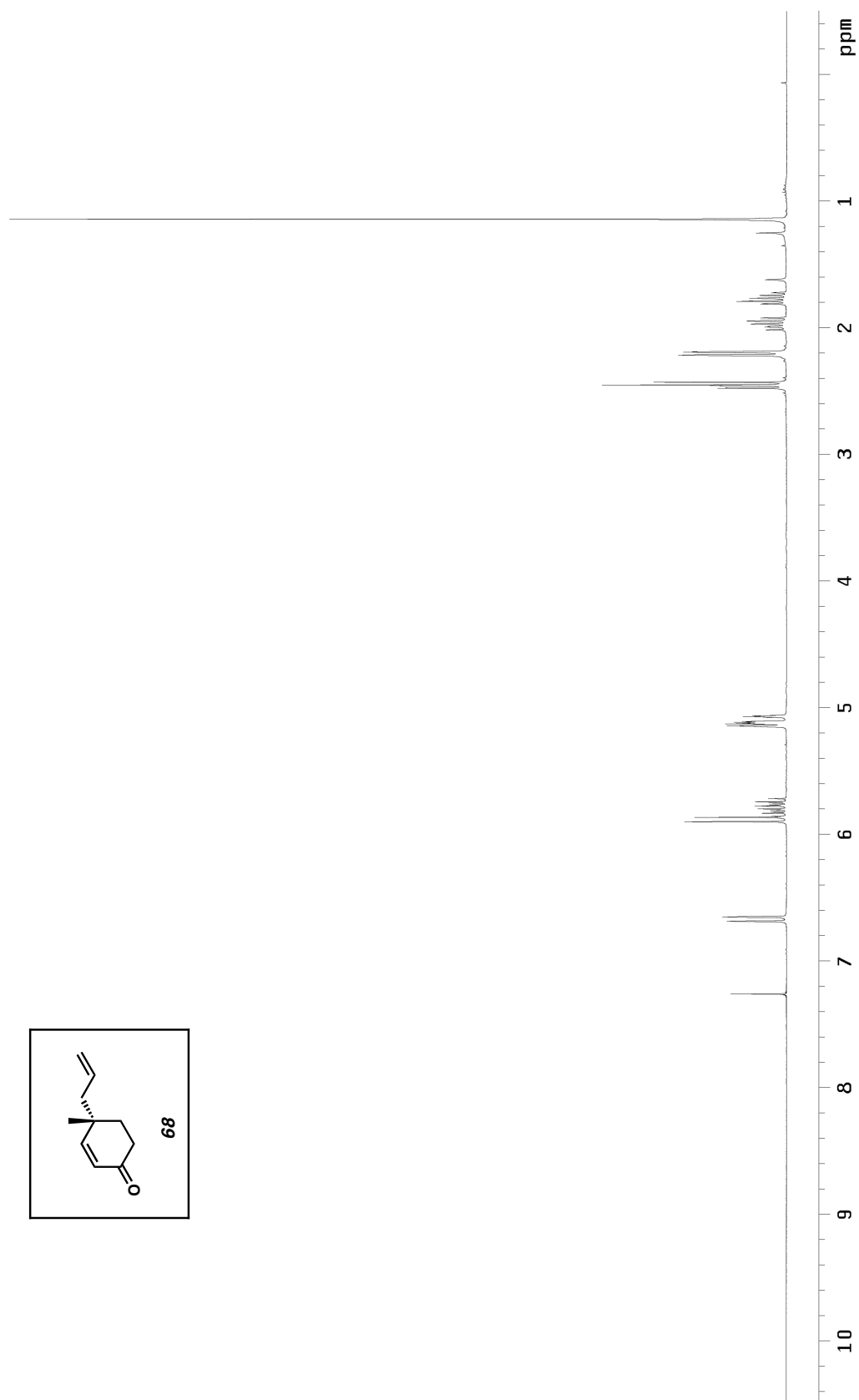


Figure A2.41.1. ¹H NMR (300 MHz, CDCl₃) of compound **68**.

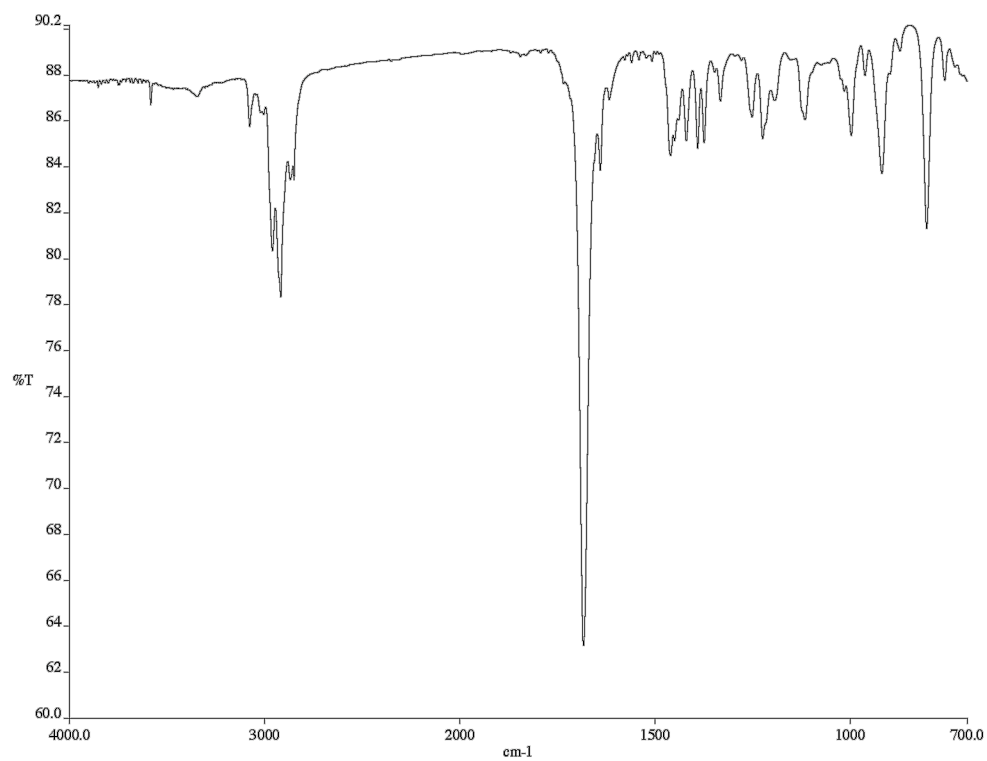


Figure A2.41.2. Infrared spectrum (thin film/NaCl) of compound **68**.

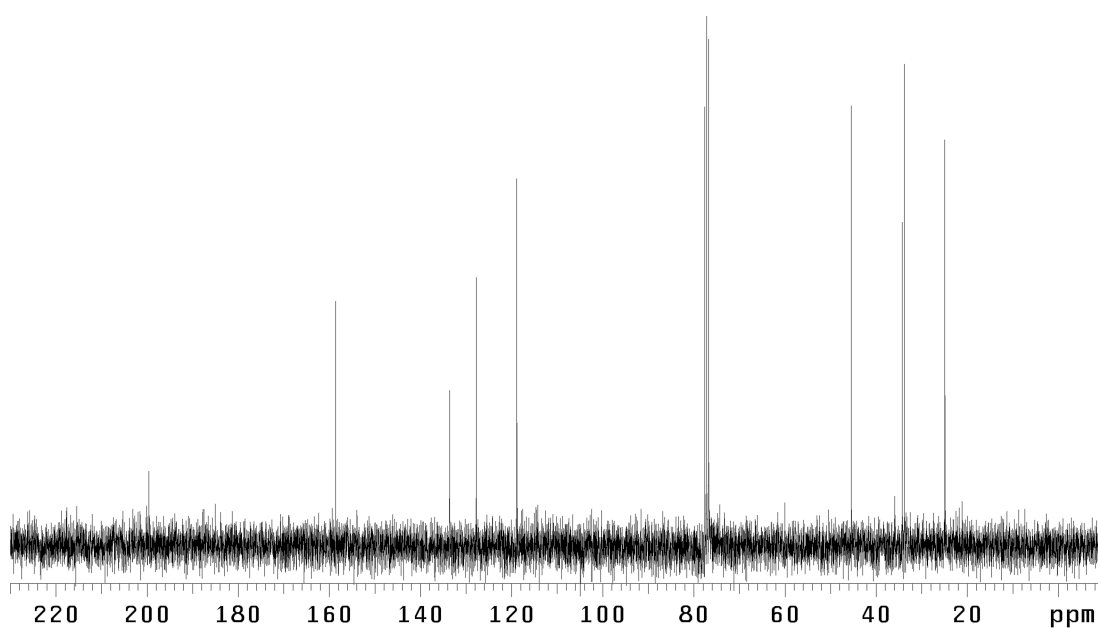


Figure A2.41.3. ¹³C NMR (75 MHz, CDCl₃) of compound **68**.

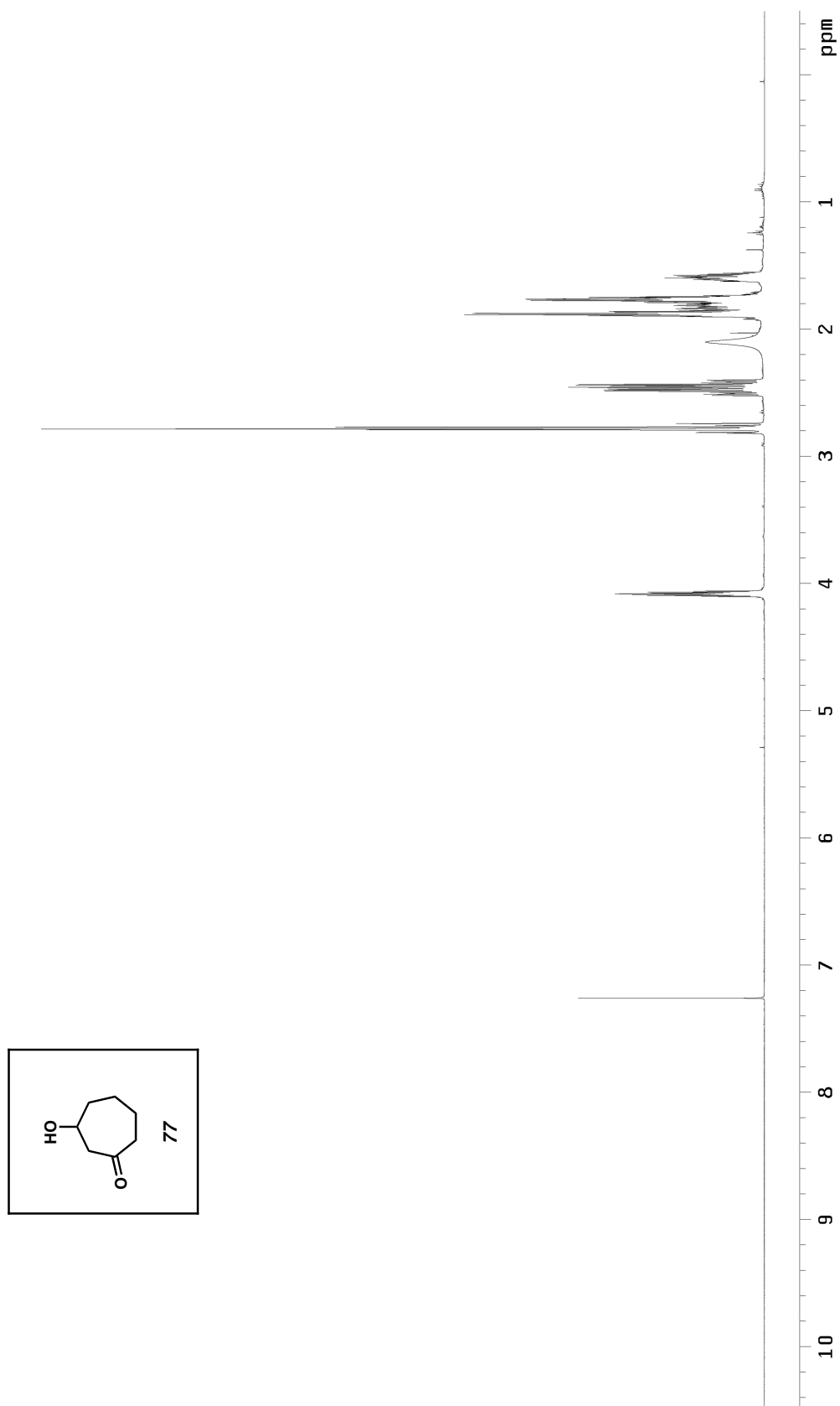


Figure A2.42.1. ^1H NMR (500 MHz, CDCl_3) of compound 77.

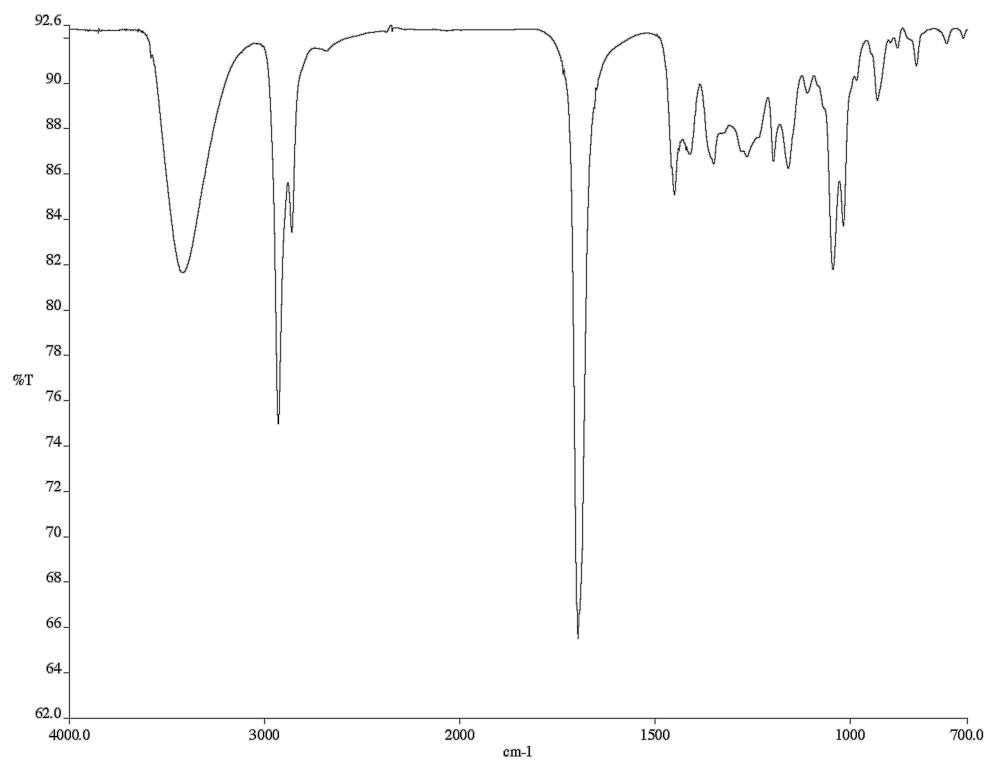


Figure A2.42.2. Infrared spectrum (thin film/NaCl) of compound **77**.

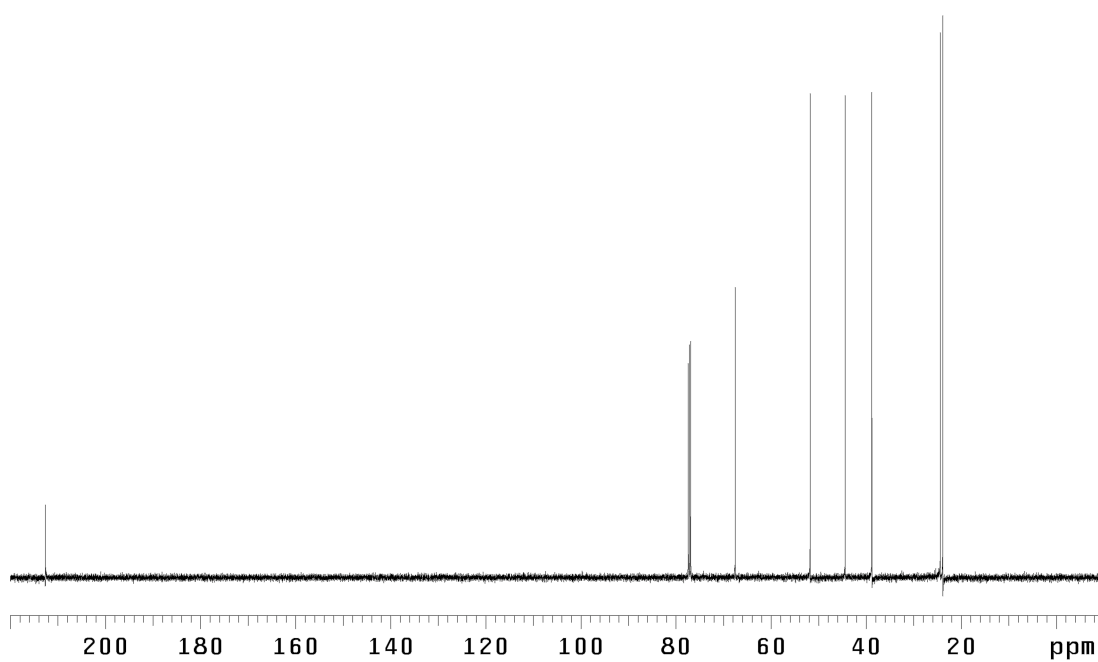


Figure A2.42.3. ¹³C NMR (125 MHz, CDCl₃) of compound **77**.

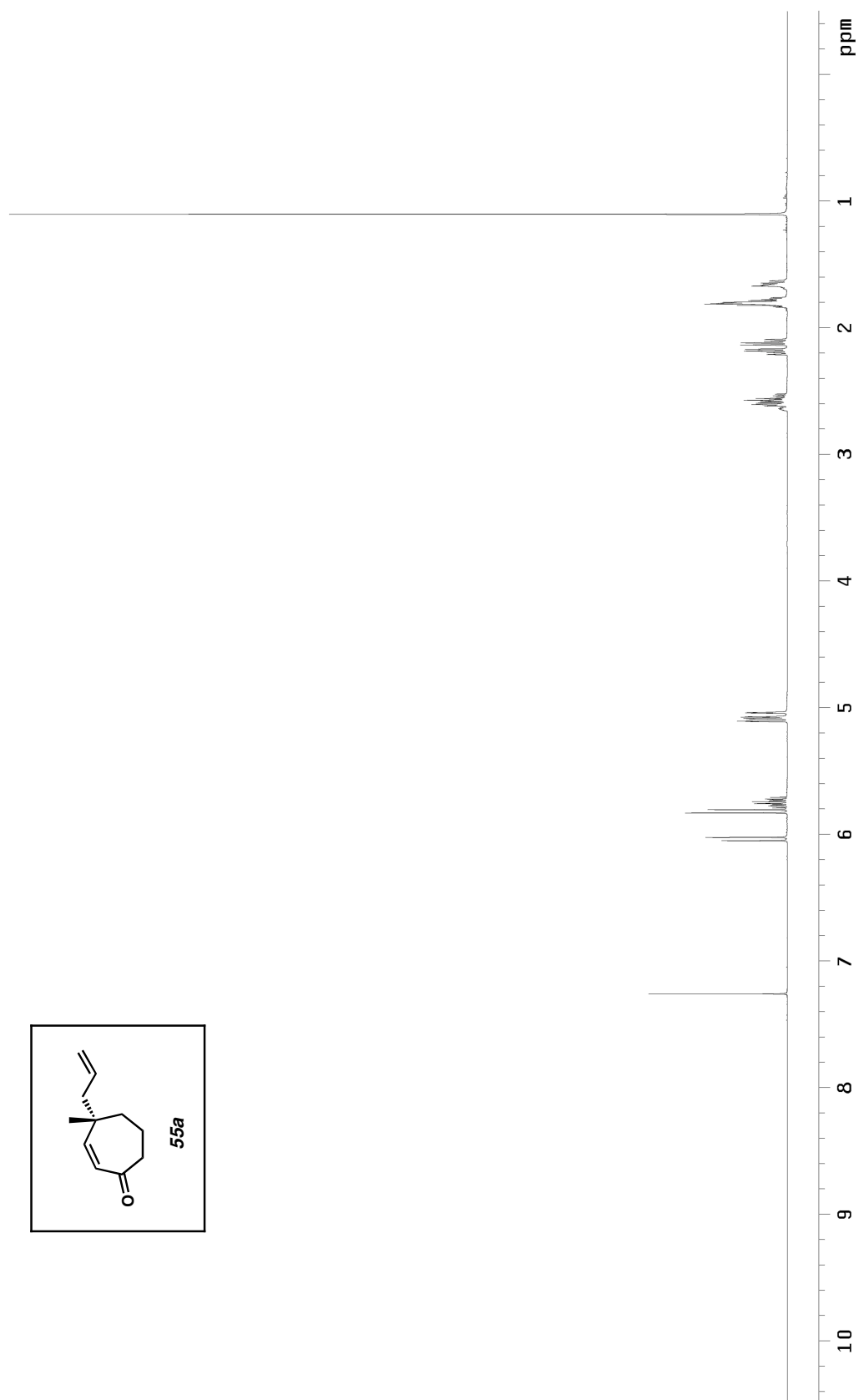


Figure A2.43. 1. ^1H NMR (500 MHz, CDCl_3) of compound **55a**.

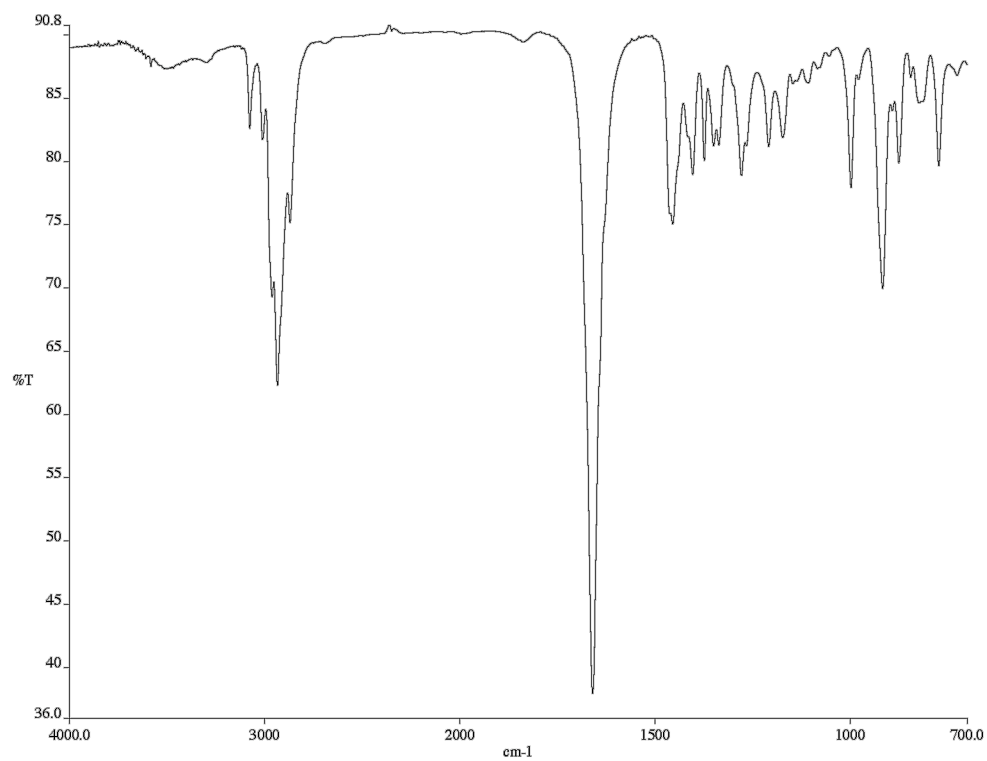


Figure A2.43.2. Infrared spectrum (thin film/NaCl) of compound **55a**.

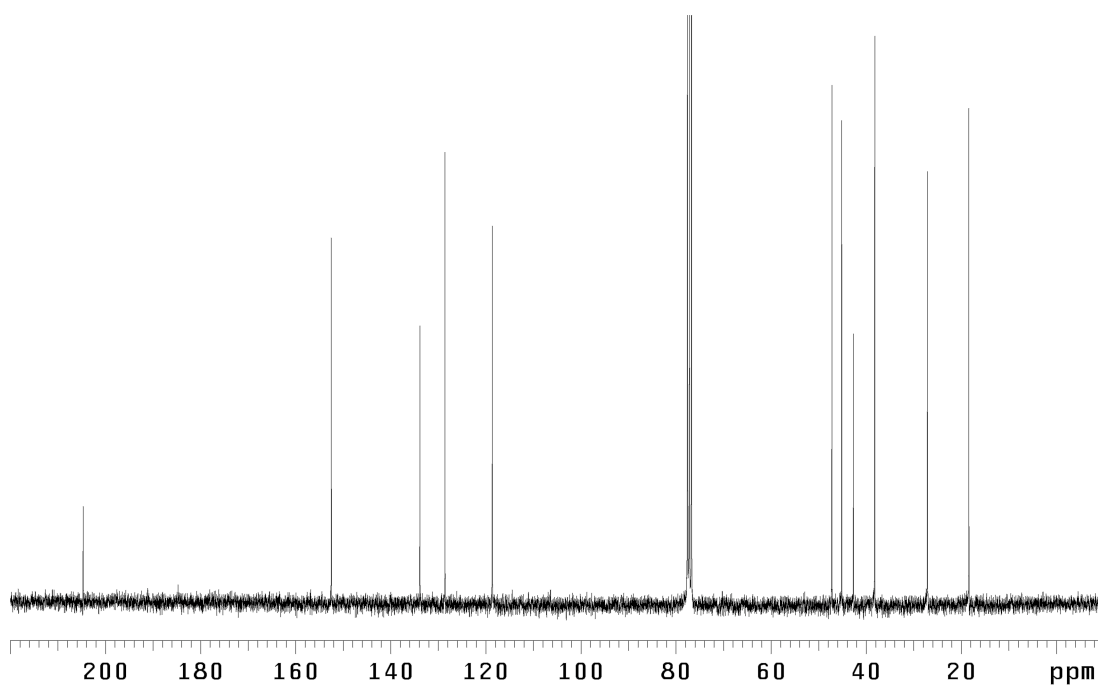


Figure A2.43.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55a**.

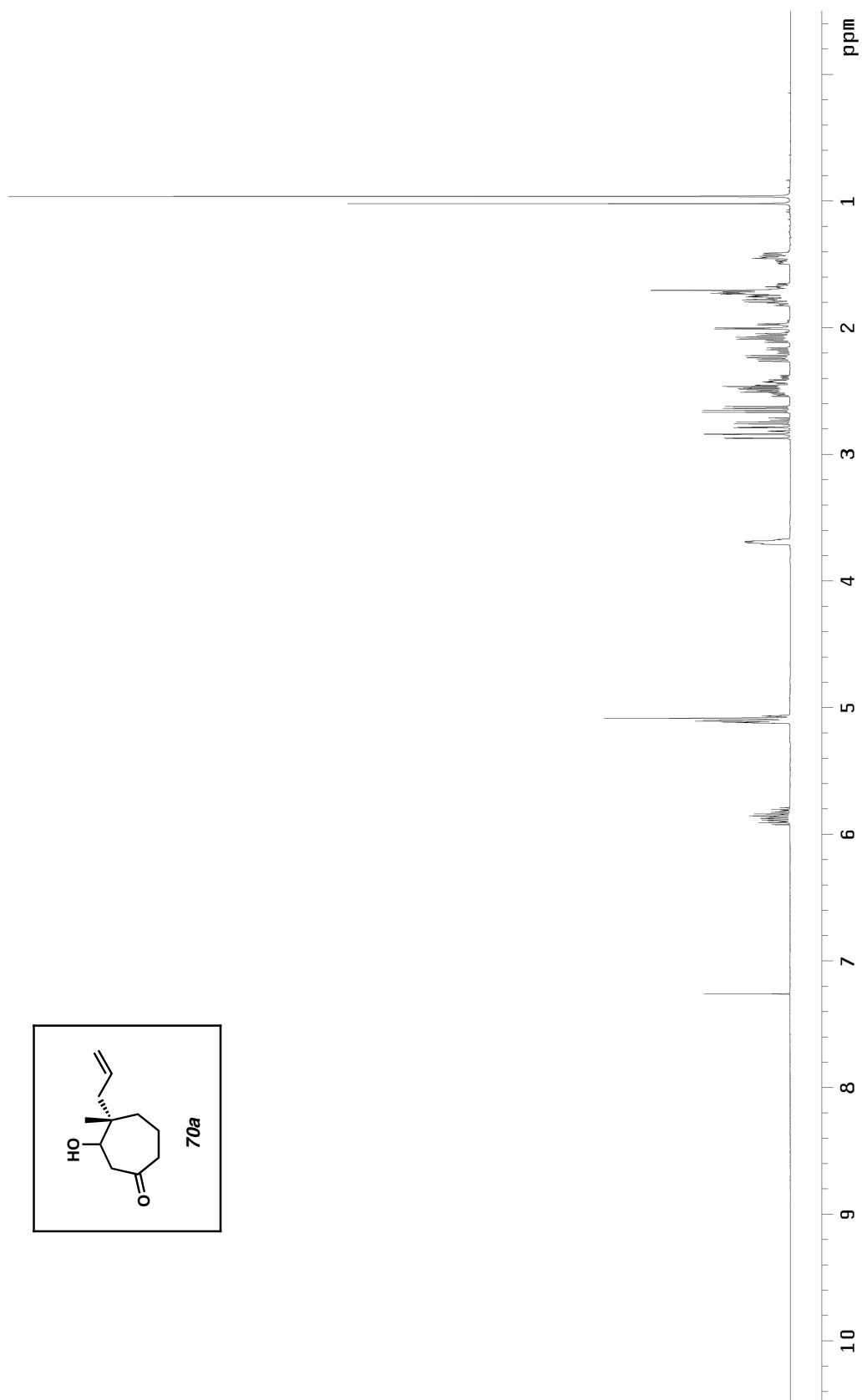


Figure A2.44. 1. ¹H NMR (500 MHz, CDCl₃) of compound **70a**.

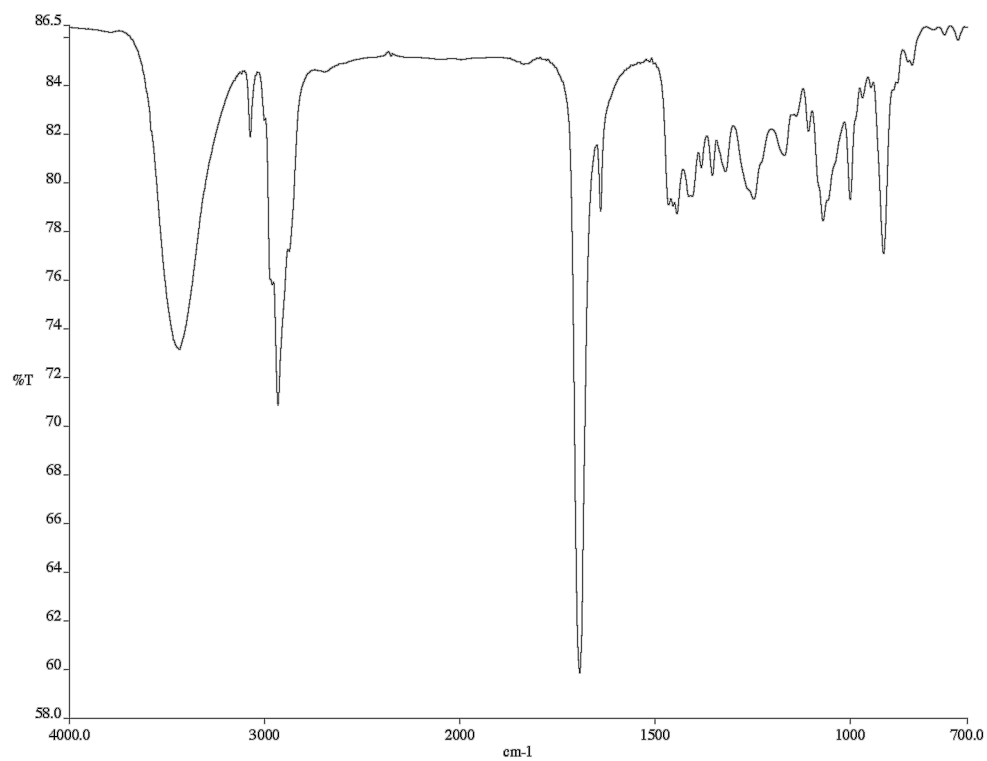


Figure A2.44.2. Infrared spectrum (thin film/NaCl) of compound **70a**.

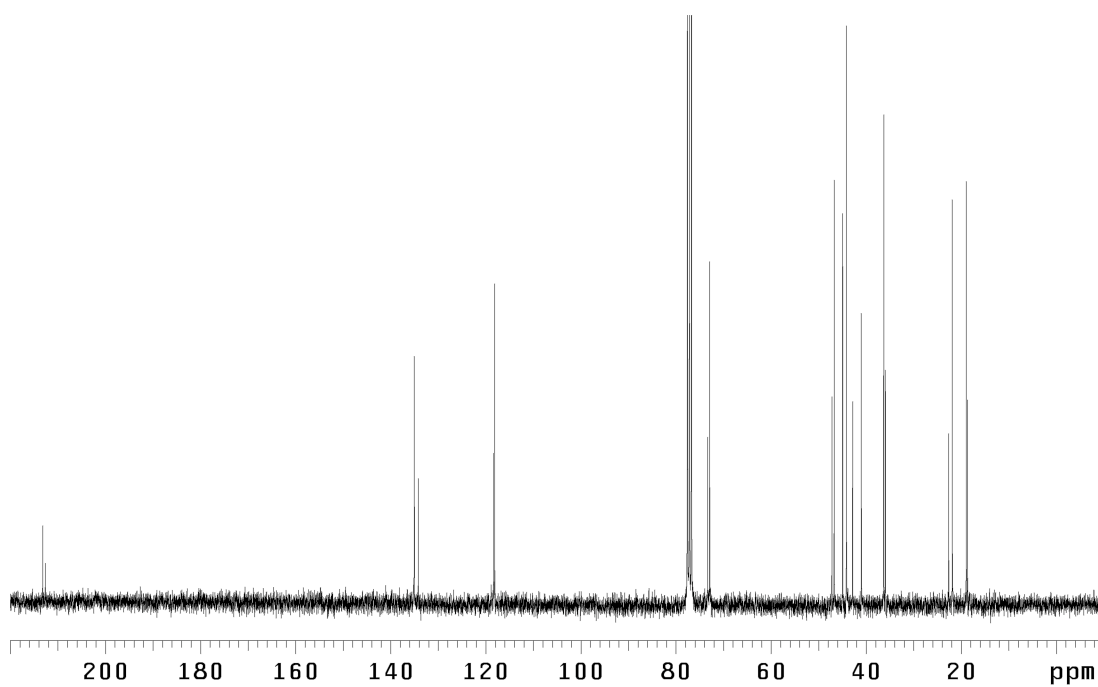


Figure A2.44.3. ¹³C NMR (125 MHz, CDCl₃) of compound **70a**.

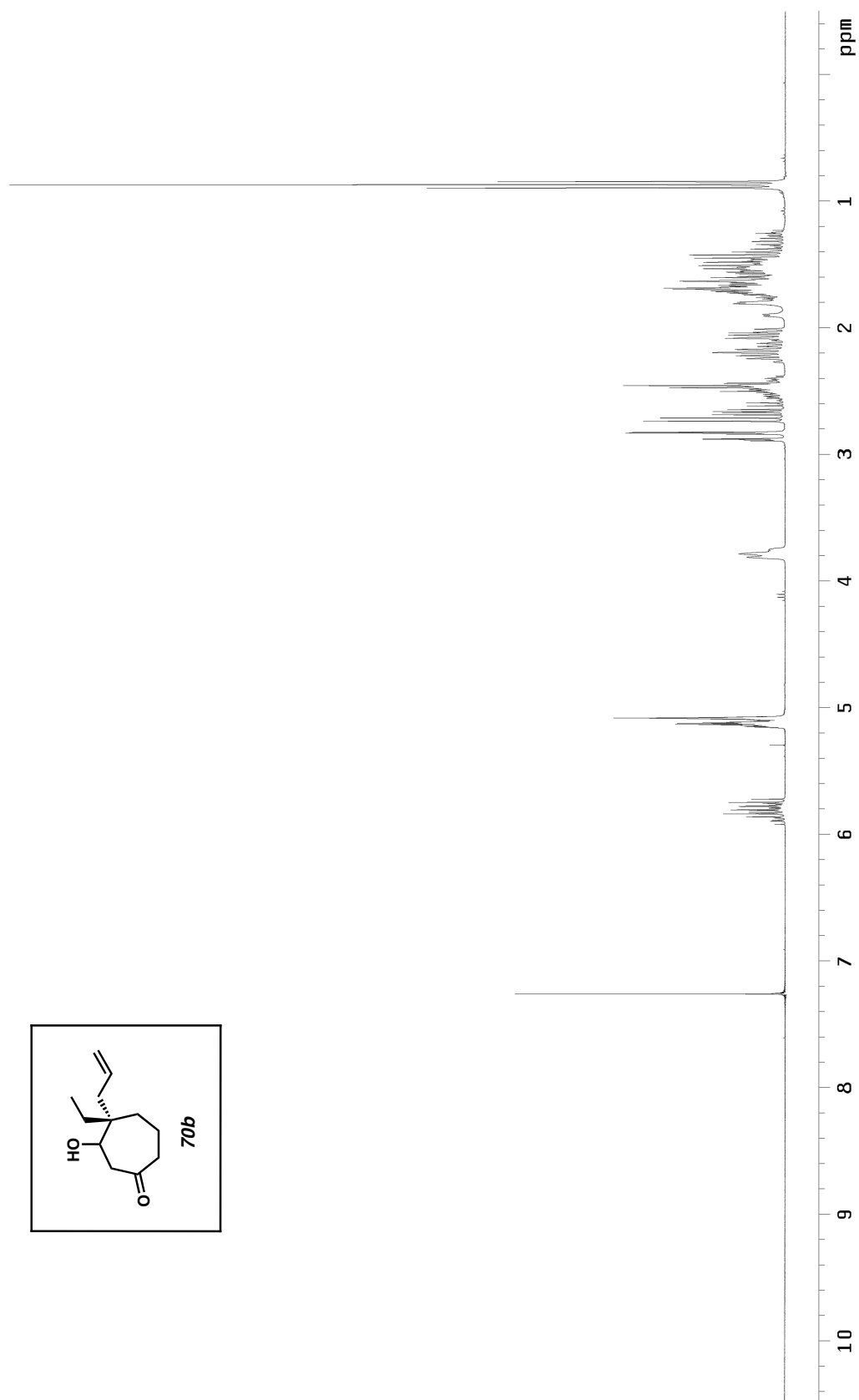


Figure A2.45.1. ¹H NMR (300 MHz, CDCl₃) of compound **70b**.

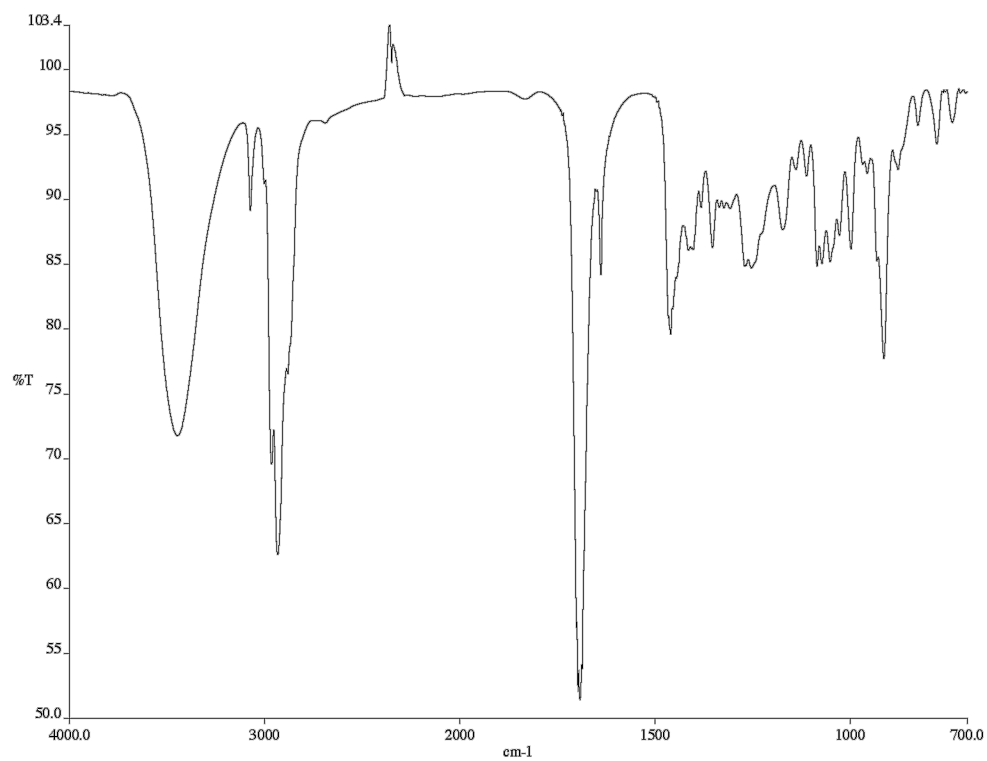


Figure A2.45.2. Infrared spectrum (thin film/NaCl) of compound **70b**.

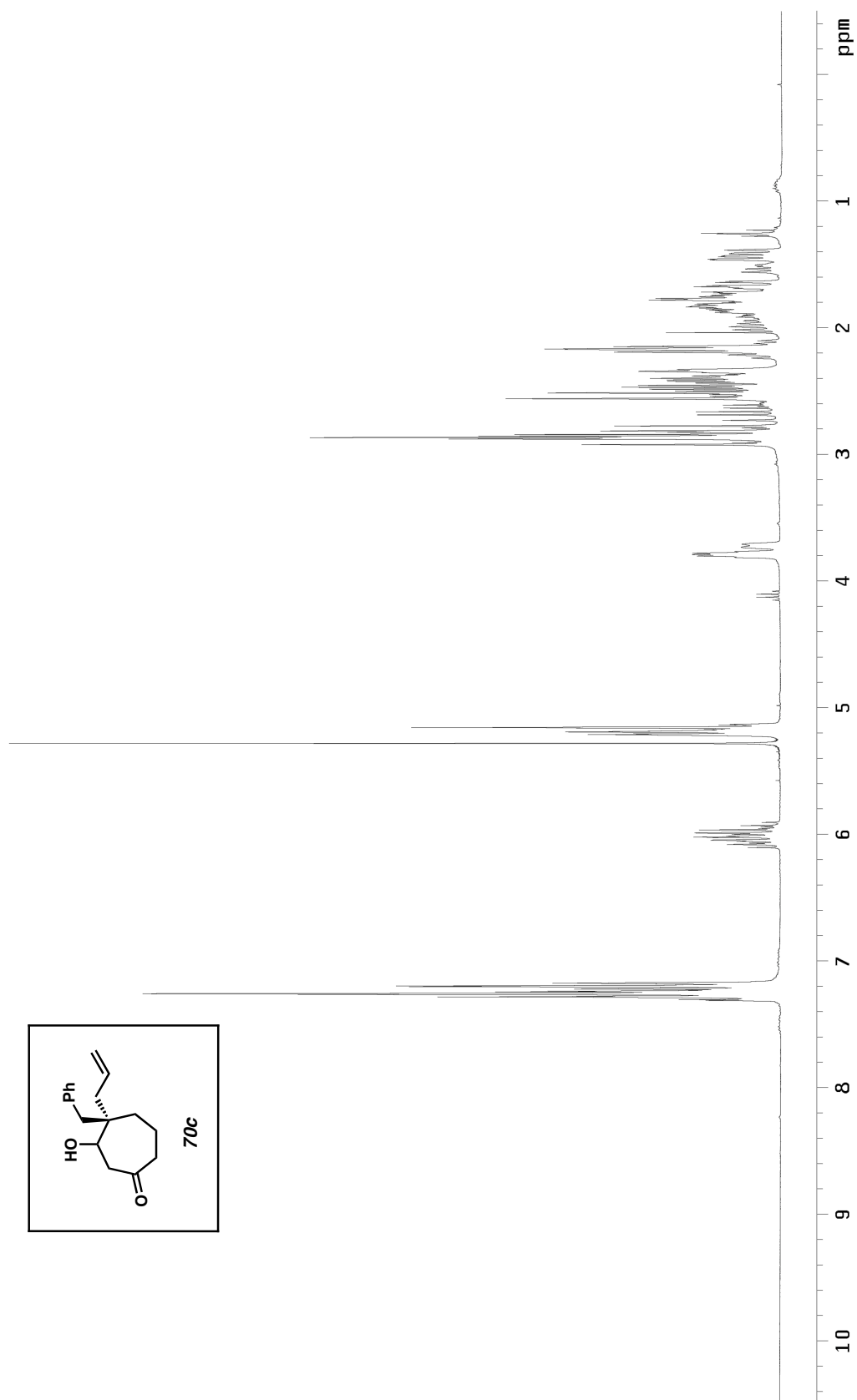


Figure A2.46. 1. ^1H NMR (300 MHz, CDCl_3) of compound **70c**.

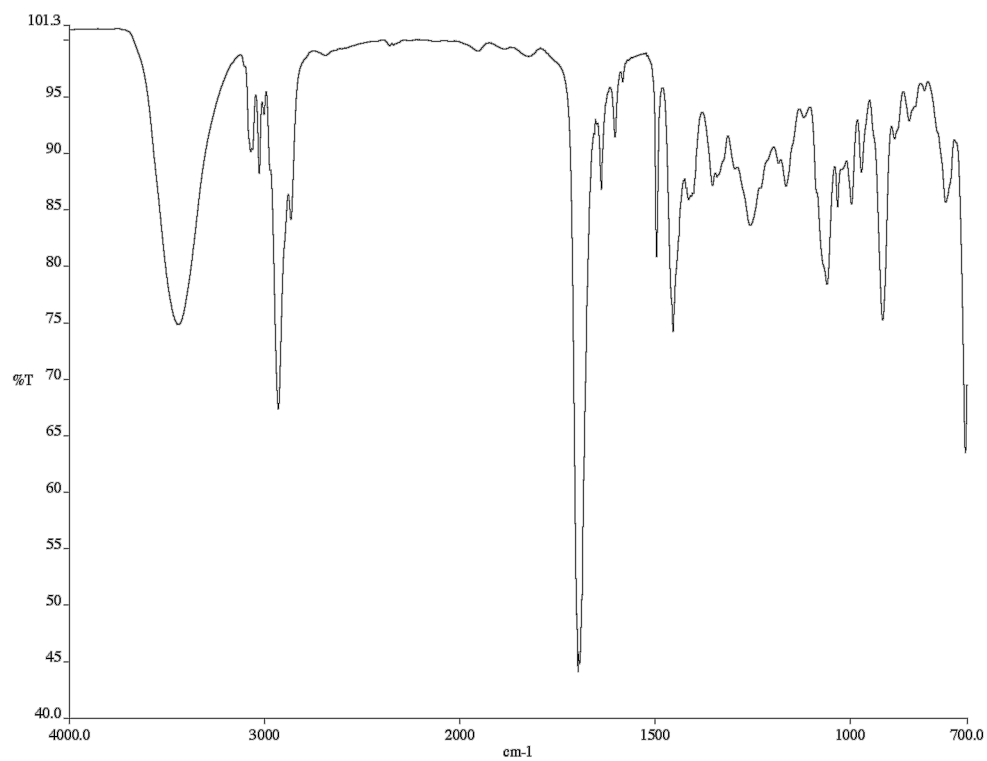
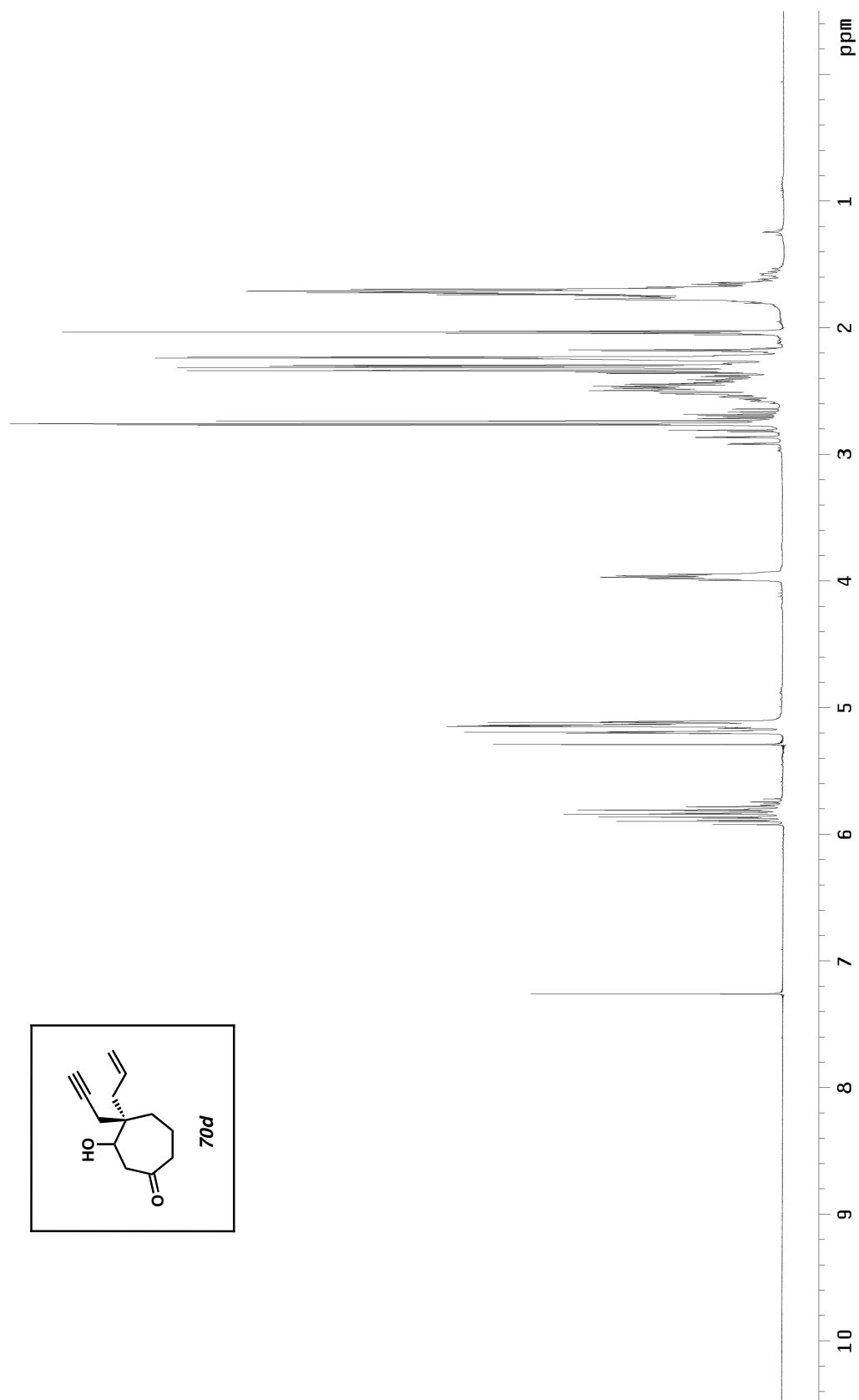


Figure A2.46.2. Infrared spectrum (thin film/NaCl) of compound **70c**.



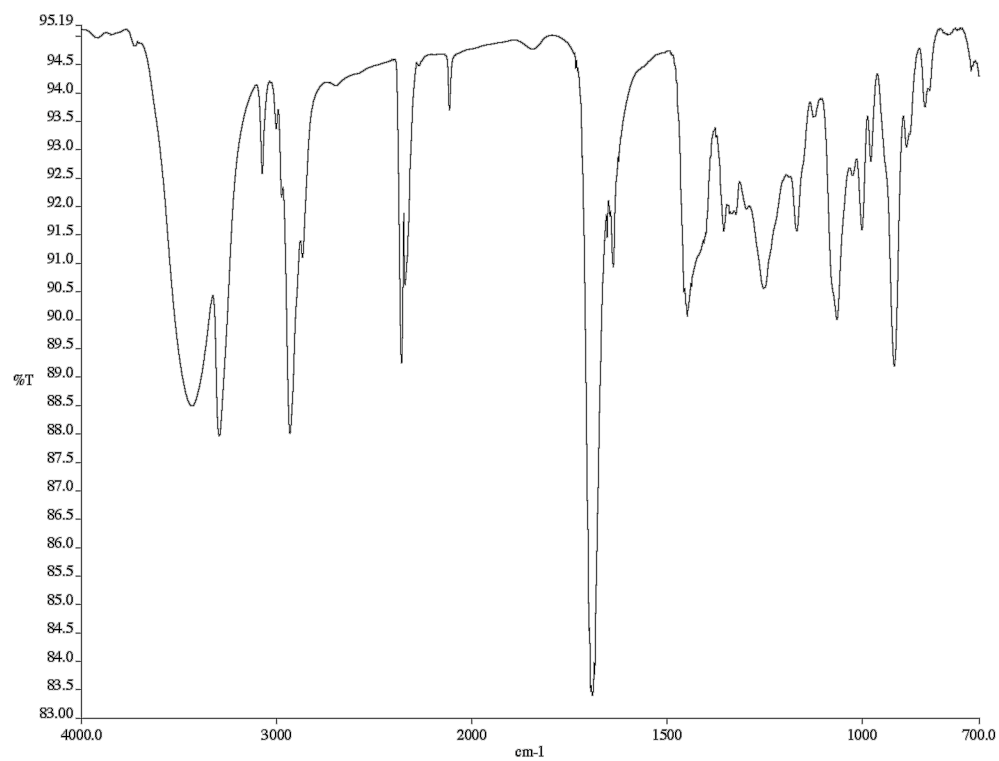


Figure A2.47.2. Infrared spectrum (thin film/NaCl) of compound **70d**.

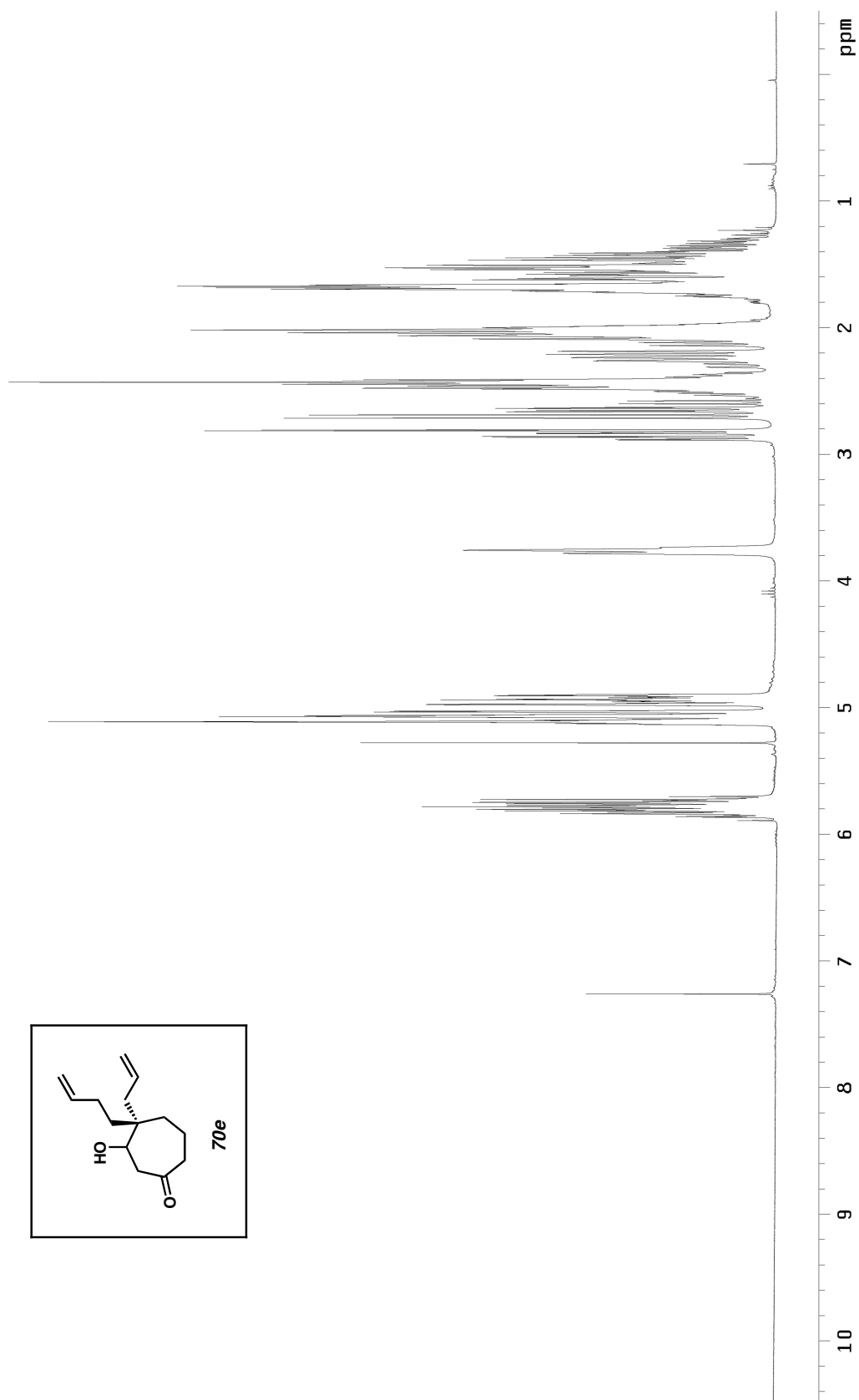


Figure A2.48.1. ^1H NMR (300 MHz, CDCl_3) of compound **70e**.

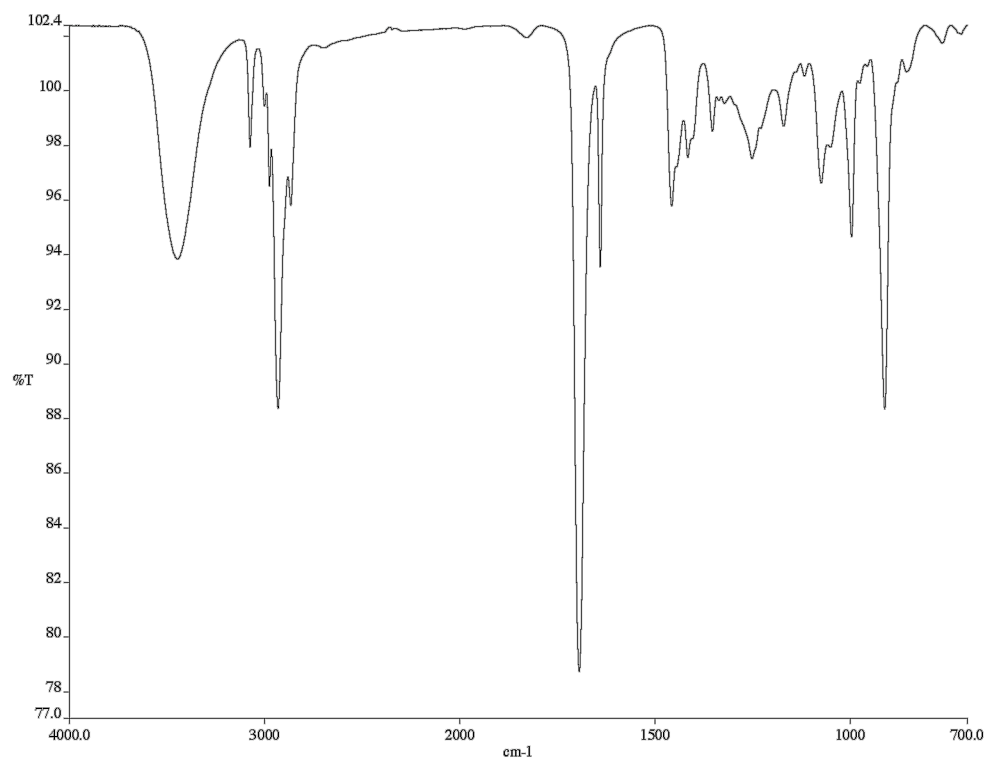
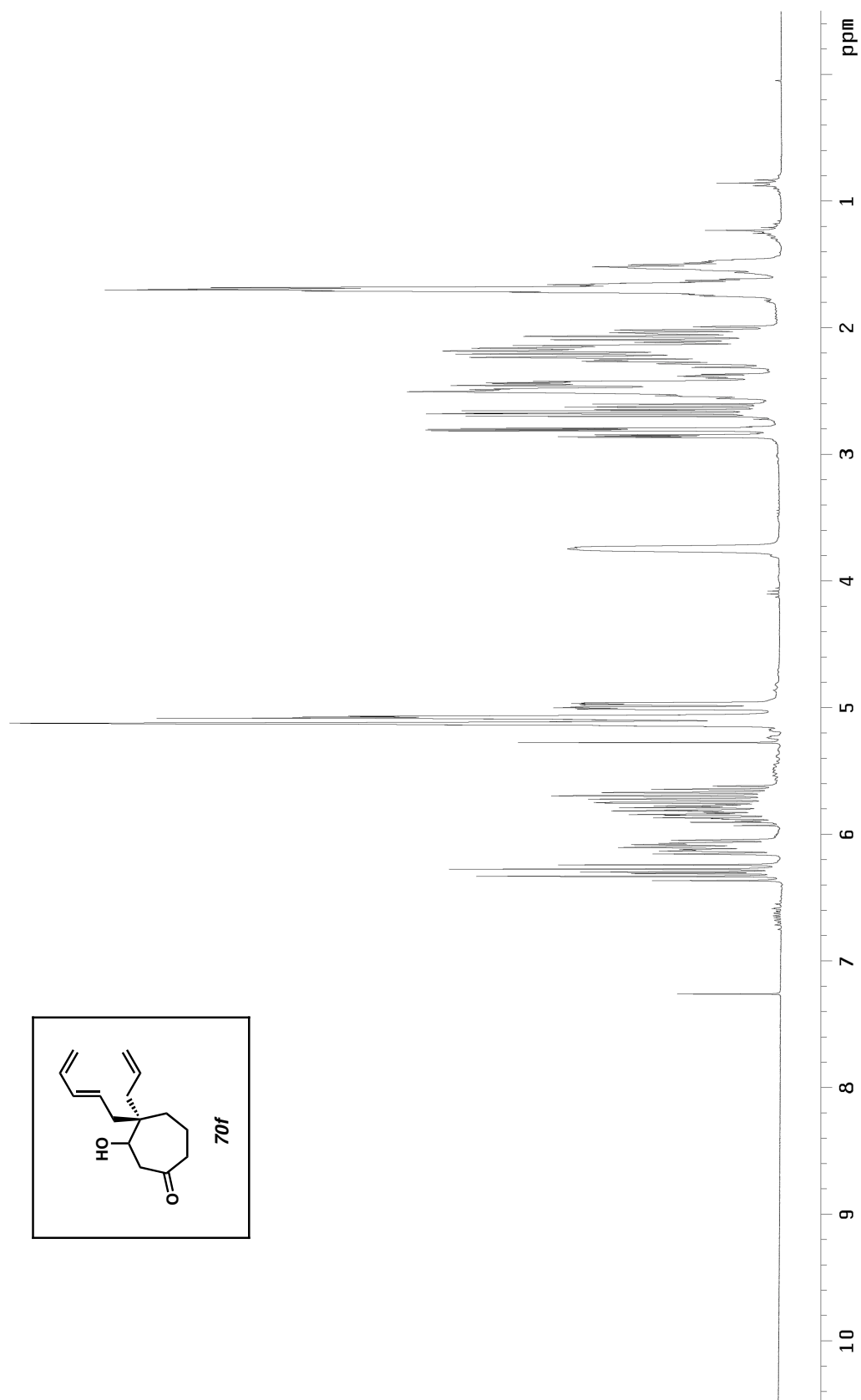


Figure A2.48.2. Infrared spectrum (thin film/NaCl) of compound **70e**.

Figure A2.49.1. ^1H NMR (300 MHz, CDCl_3) of compound **70f**.

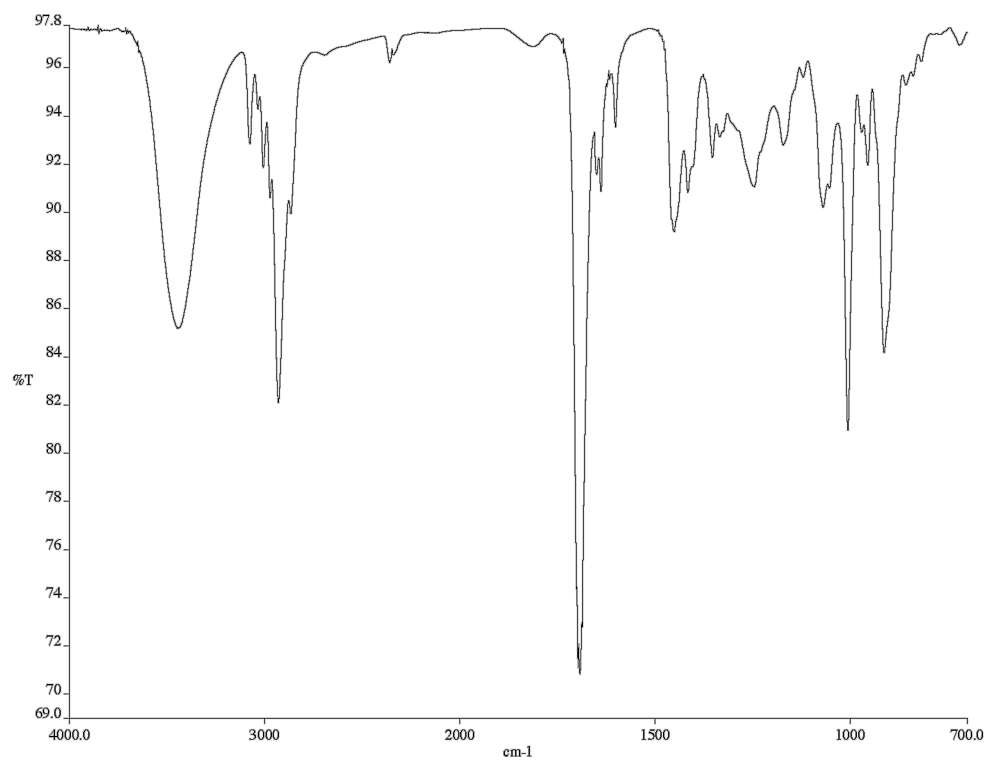
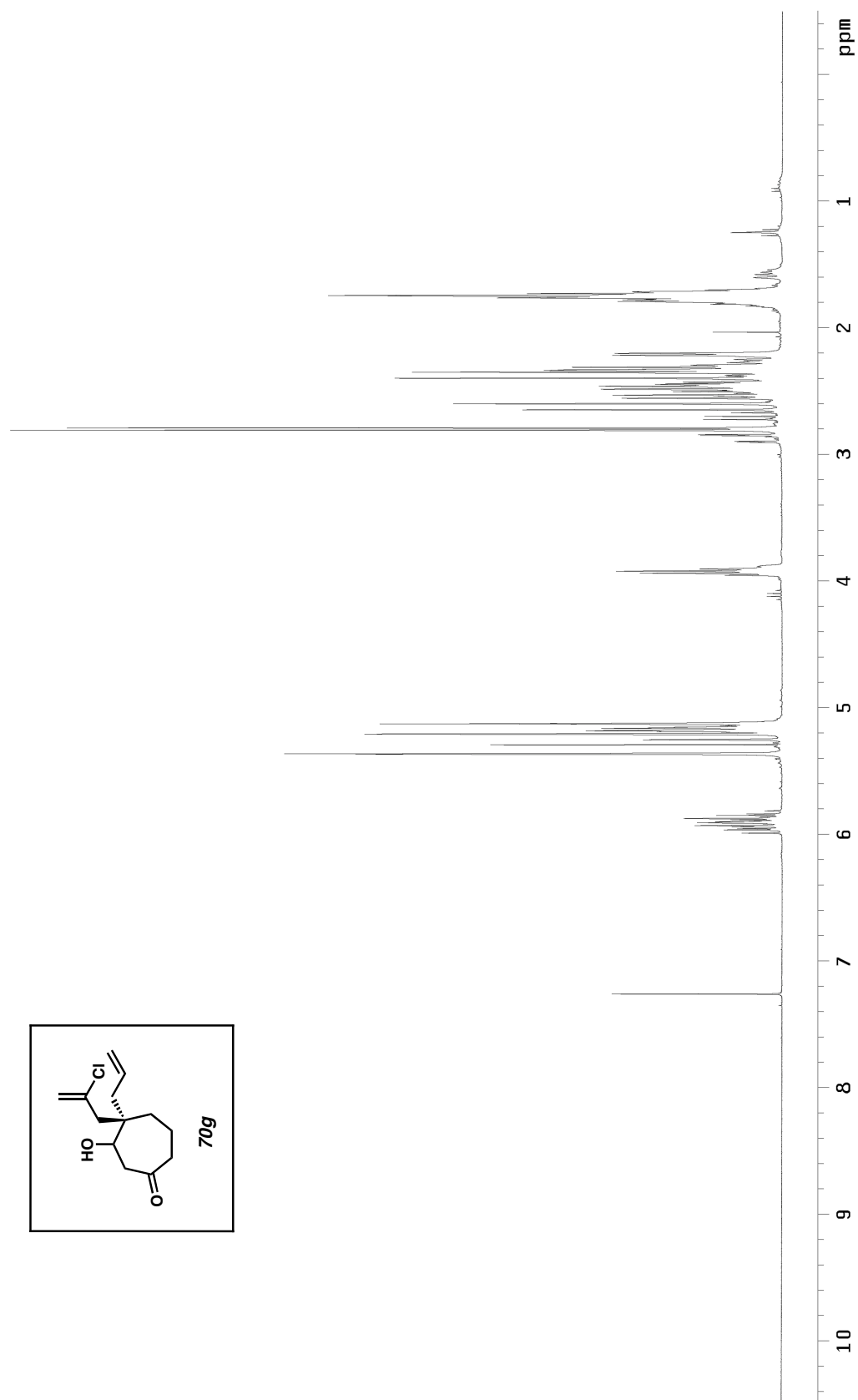


Figure A2.49.2. Infrared spectrum (thin film/NaCl) of compound **70f**.

Figure A2.50.1. ^1H NMR (300 MHz, CDCl_3) of compound **70g**.

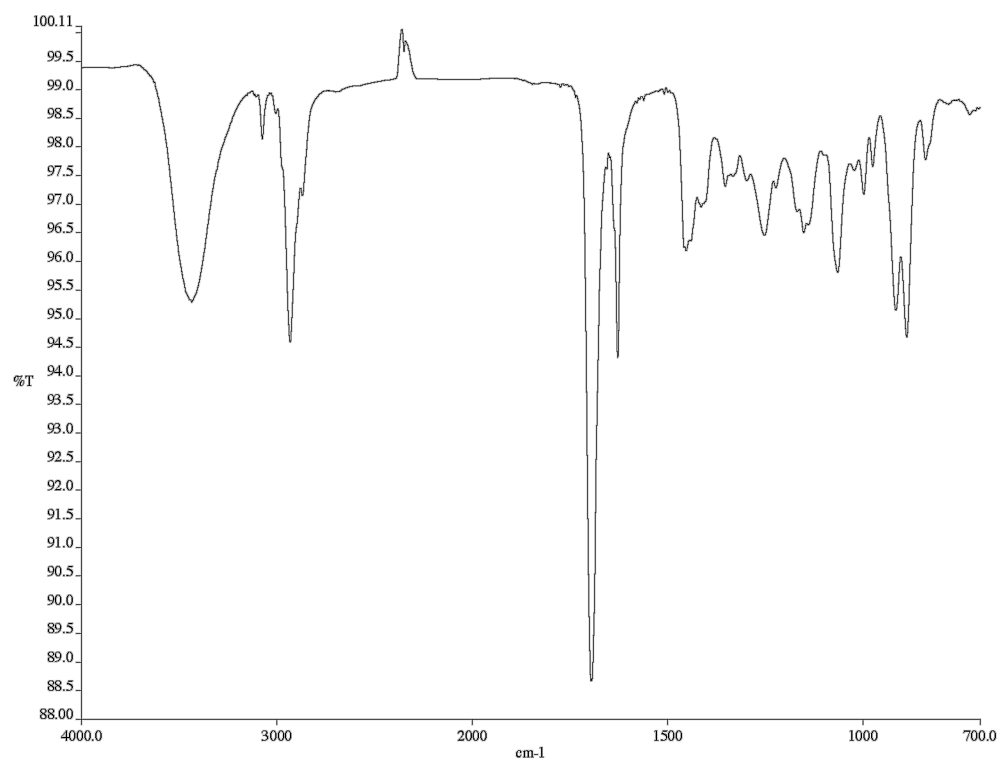
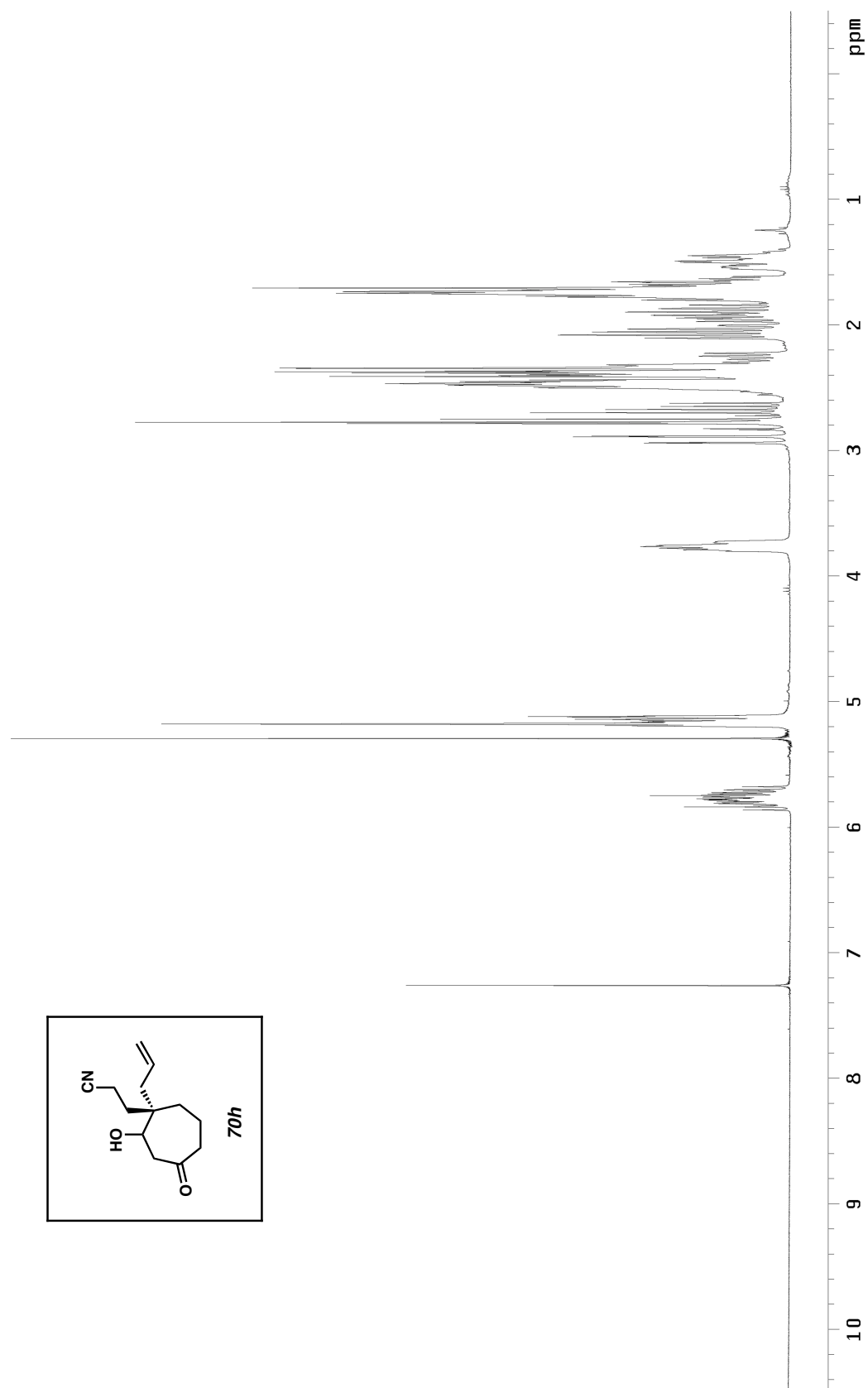


Figure A2.50.2. Infrared spectrum (thin film/NaCl) of compound **70g**.

Figure A2.51.1. ¹H NMR (300 MHz, CDCl₃) of compound **70h**.

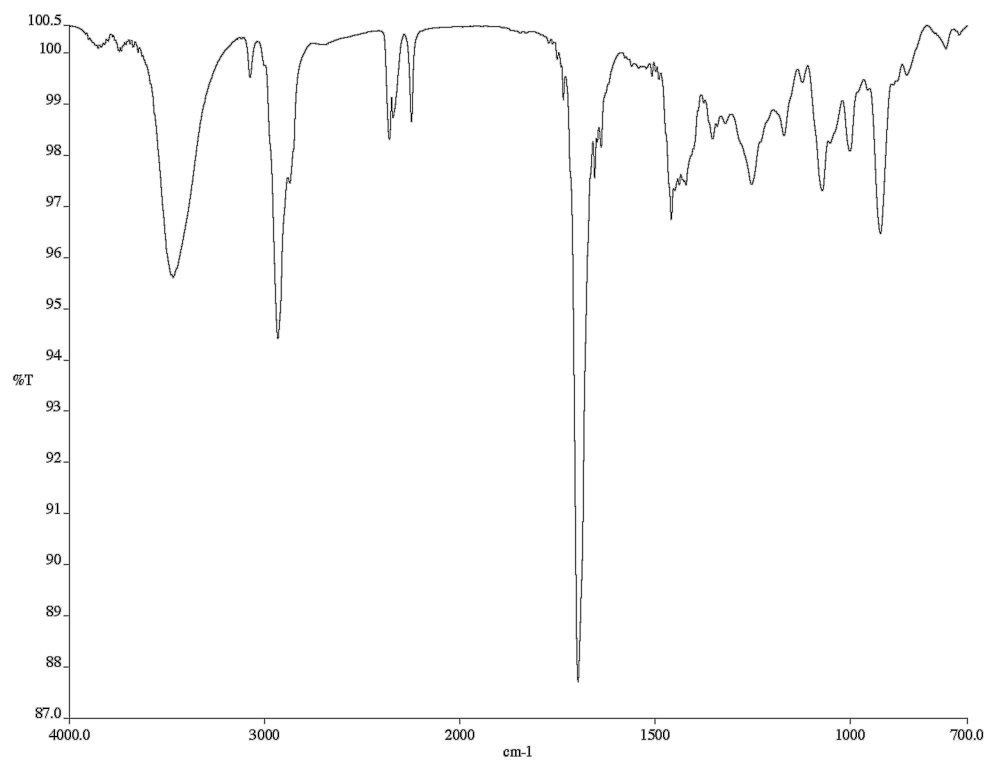
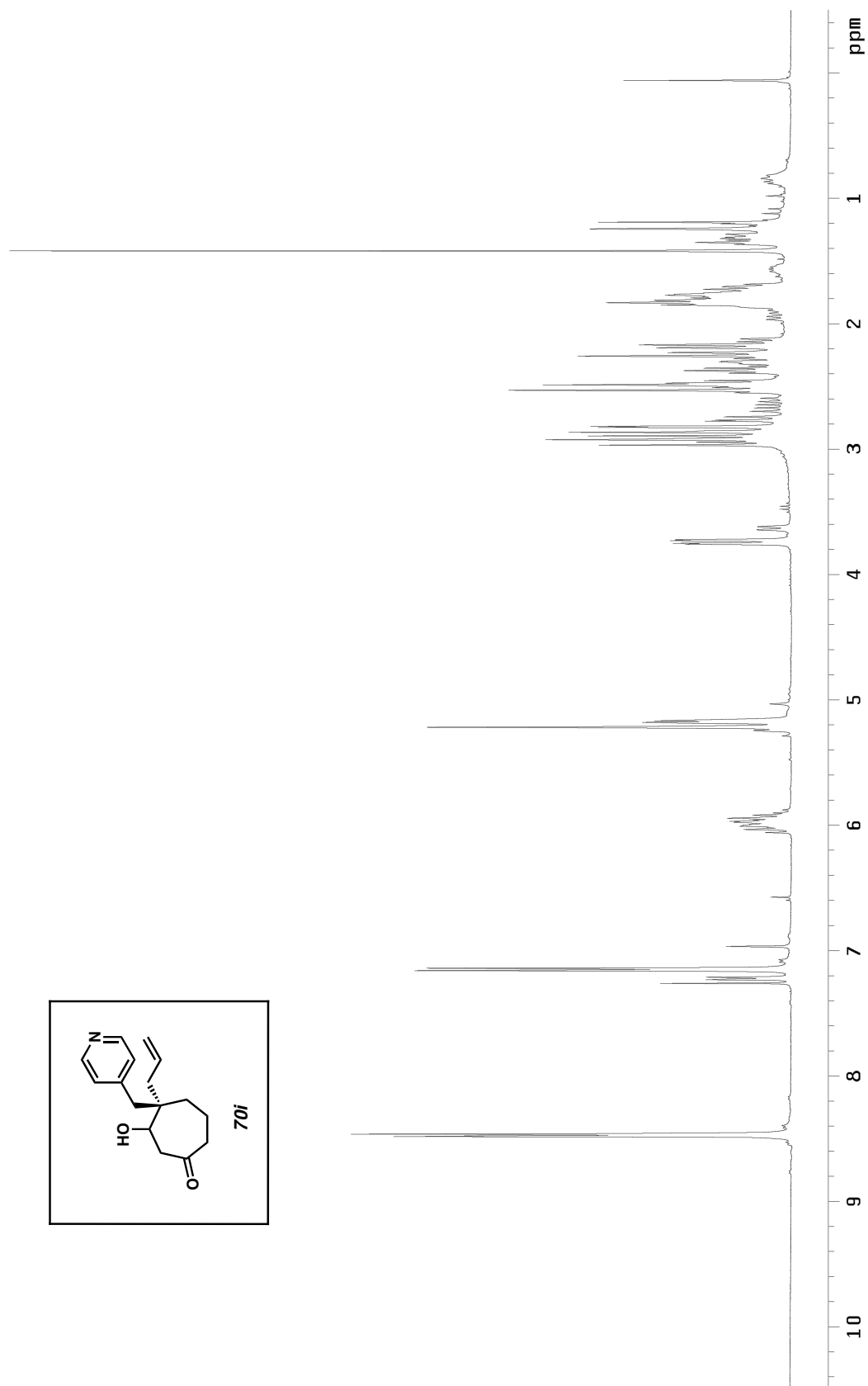


Figure A2.51.2. Infrared spectrum (thin film/NaCl) of compound **70h**.

Figure A2.52.1. ^1H NMR (300 MHz, CDCl_3) of compound **70i**.

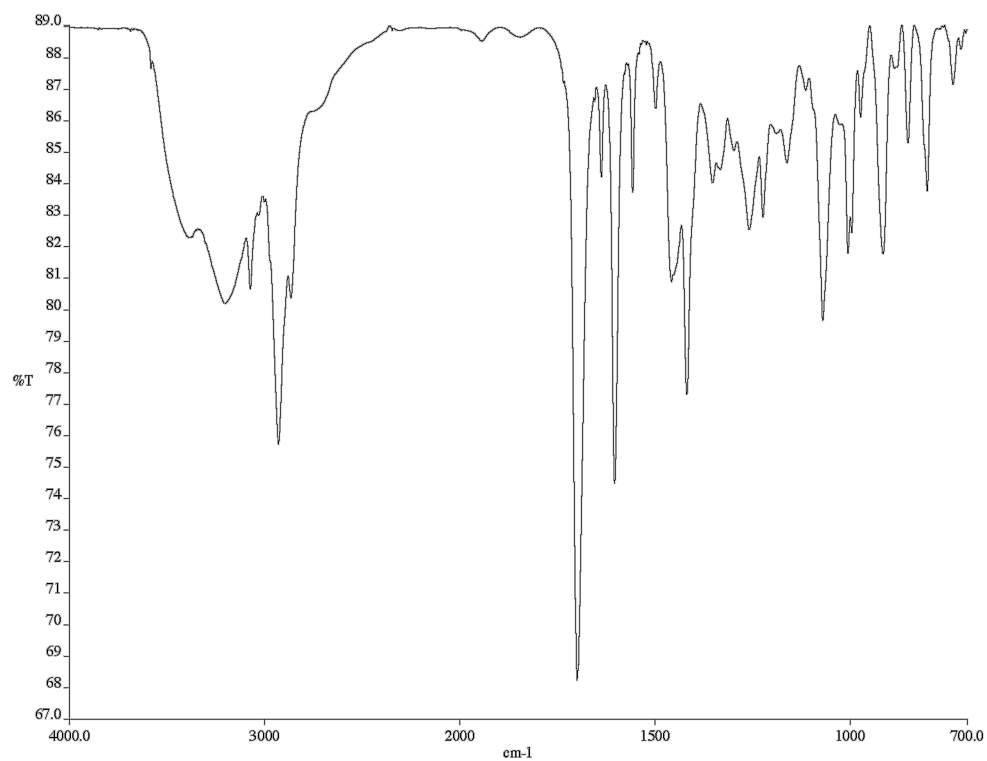
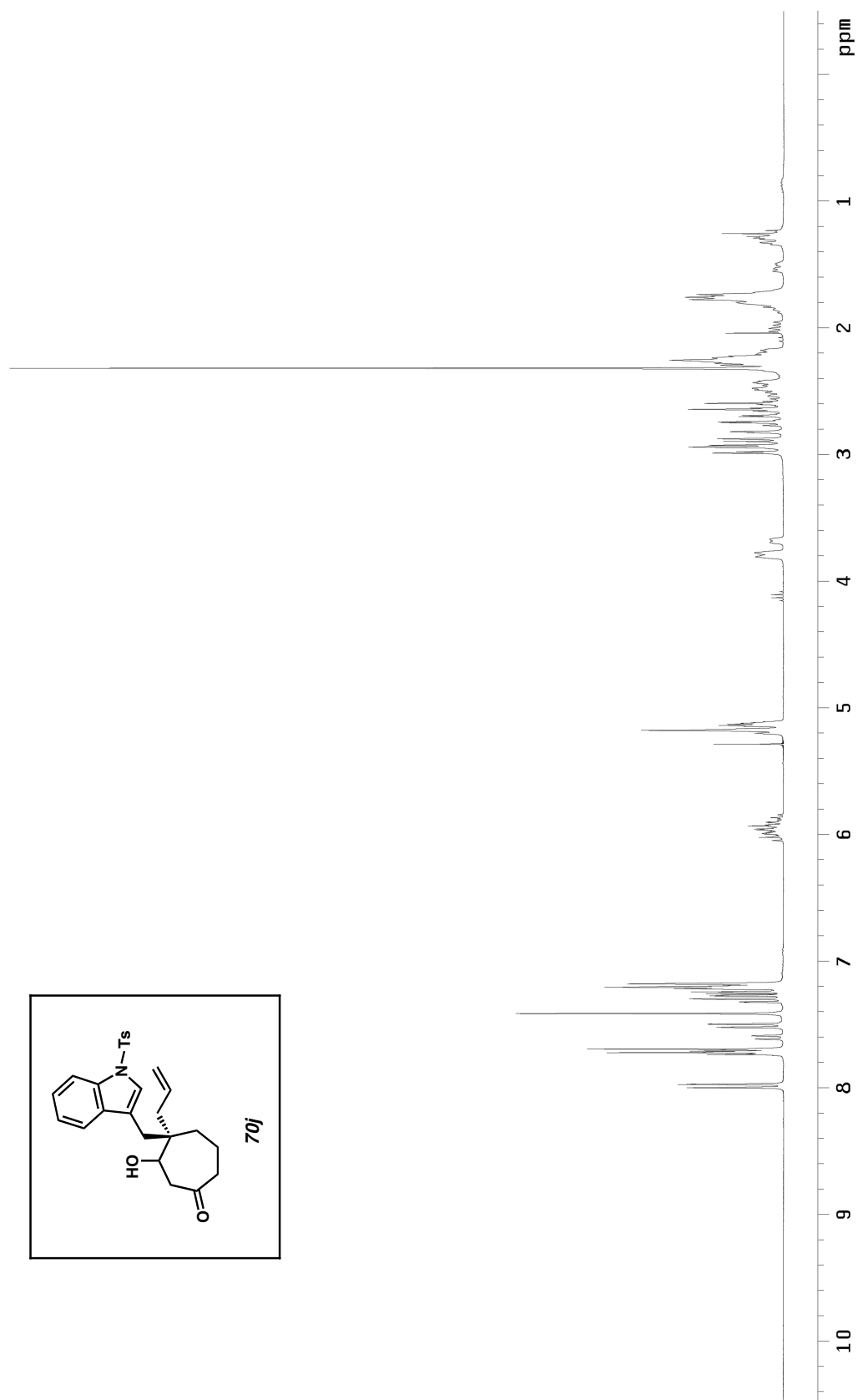


Figure A2.52.2. Infrared spectrum (thin film/NaCl) of compound **70i**.

Figure A2.53.1. ^1H NMR (300 MHz, CDCl_3) of compound **70j**.

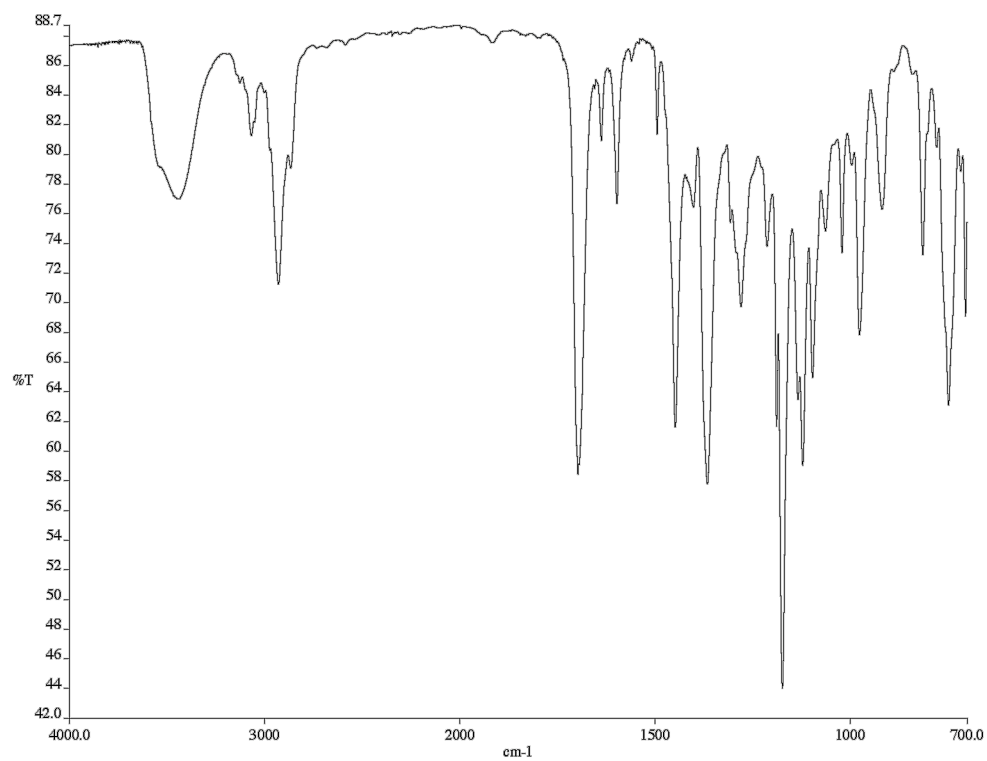


Figure A2.53.2. Infrared spectrum (thin film/NaCl) of compound **70j**.

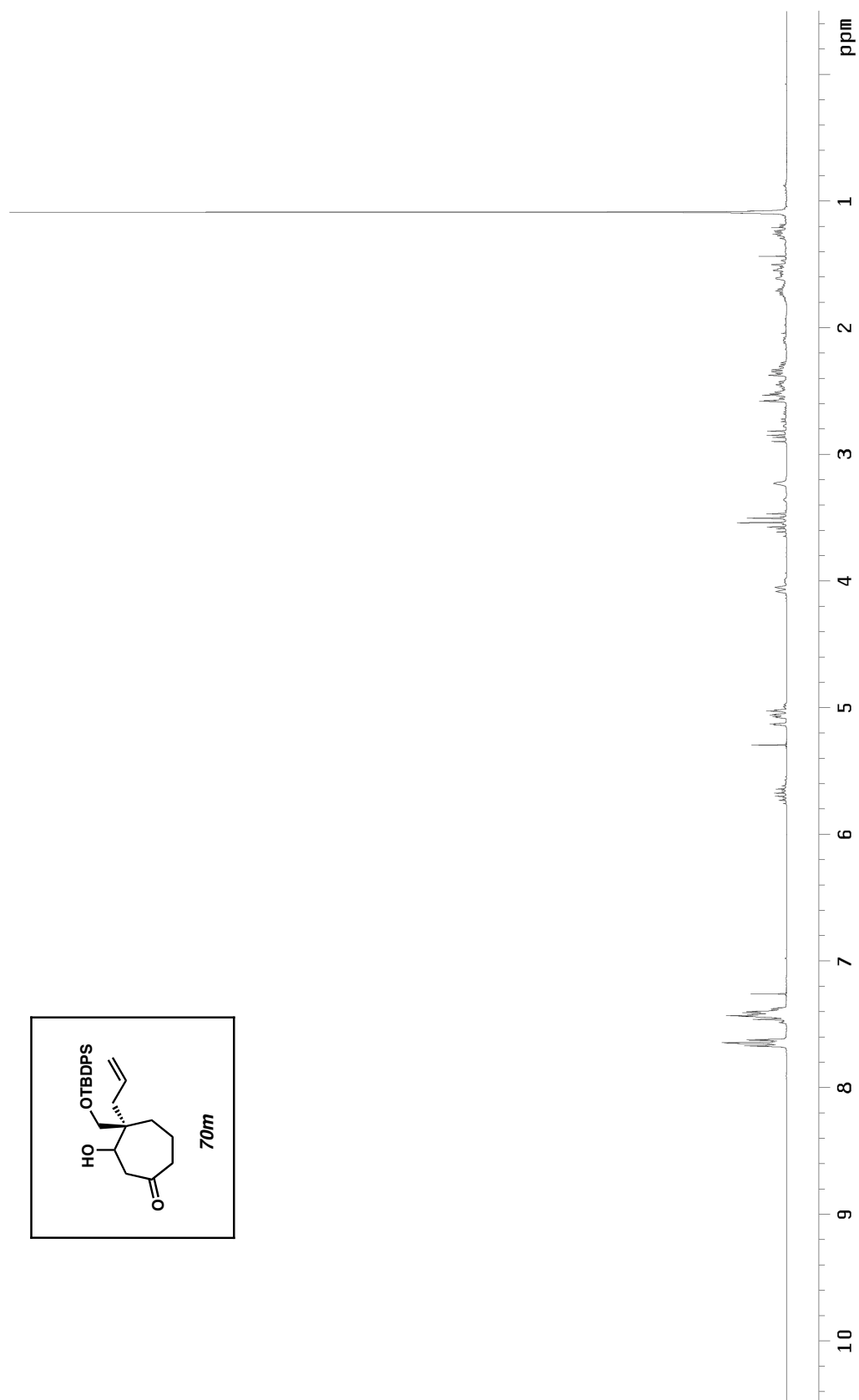


Figure A2.54.1. ^1H NMR (300 MHz, CDCl_3) of compound **70m**.

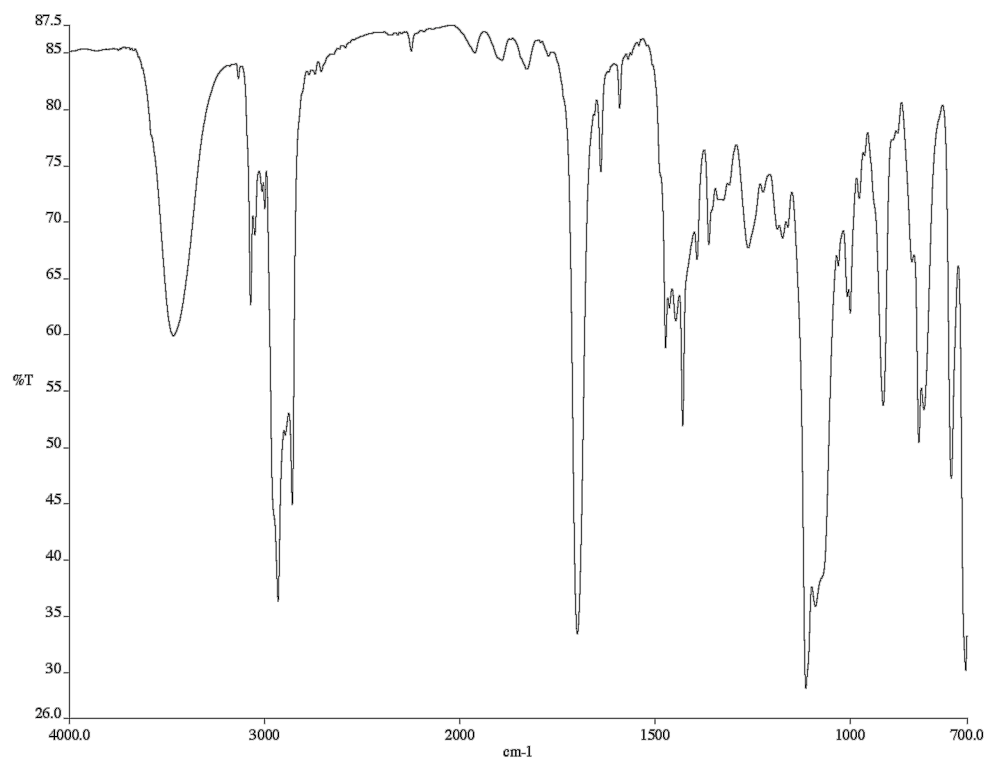
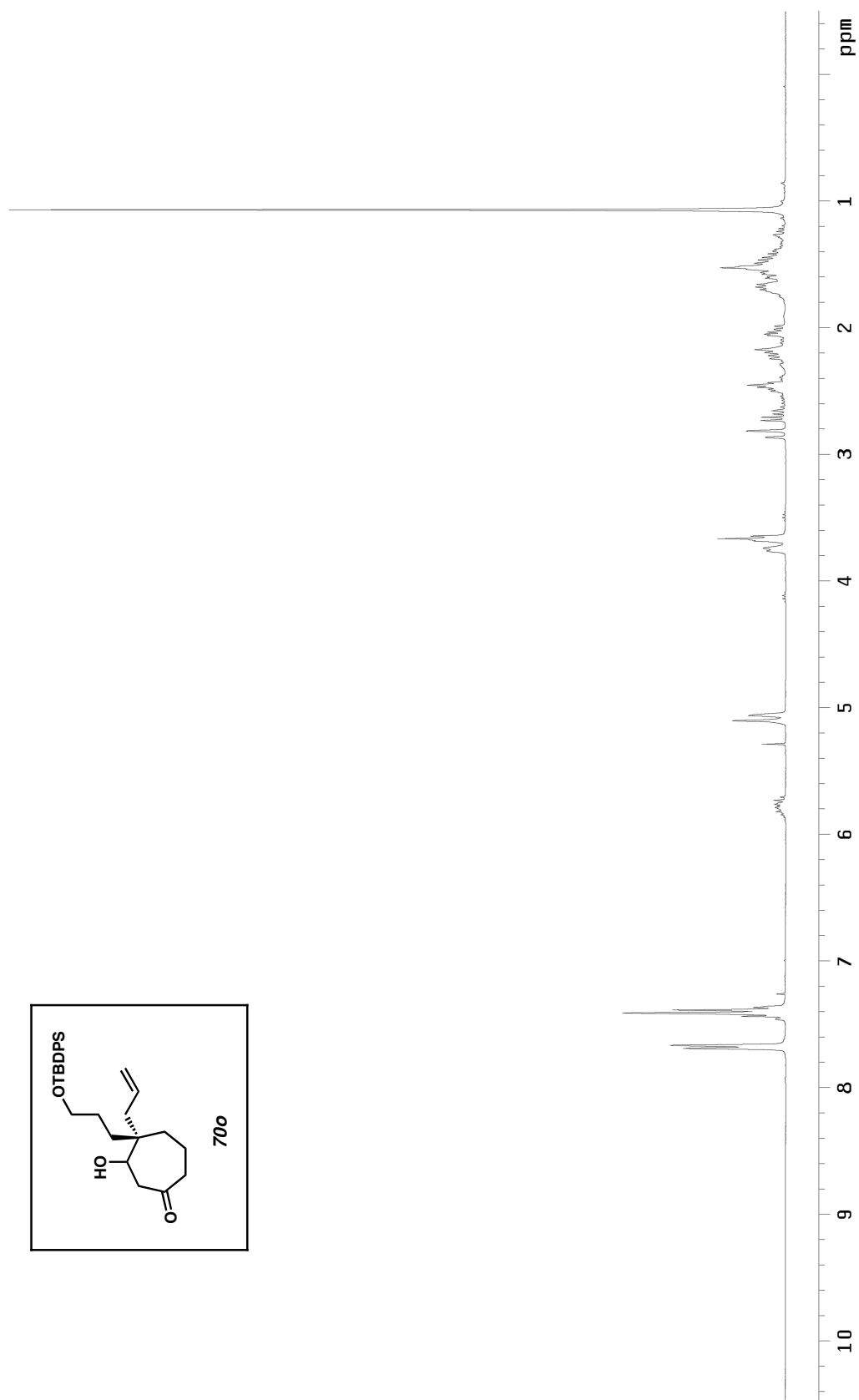


Figure A2.54.2. Infrared spectrum (thin film/NaCl) of compound **70m**.

Figure A2.55.1. ¹H NMR (300 MHz, CDCl₃) of compound **70o**.

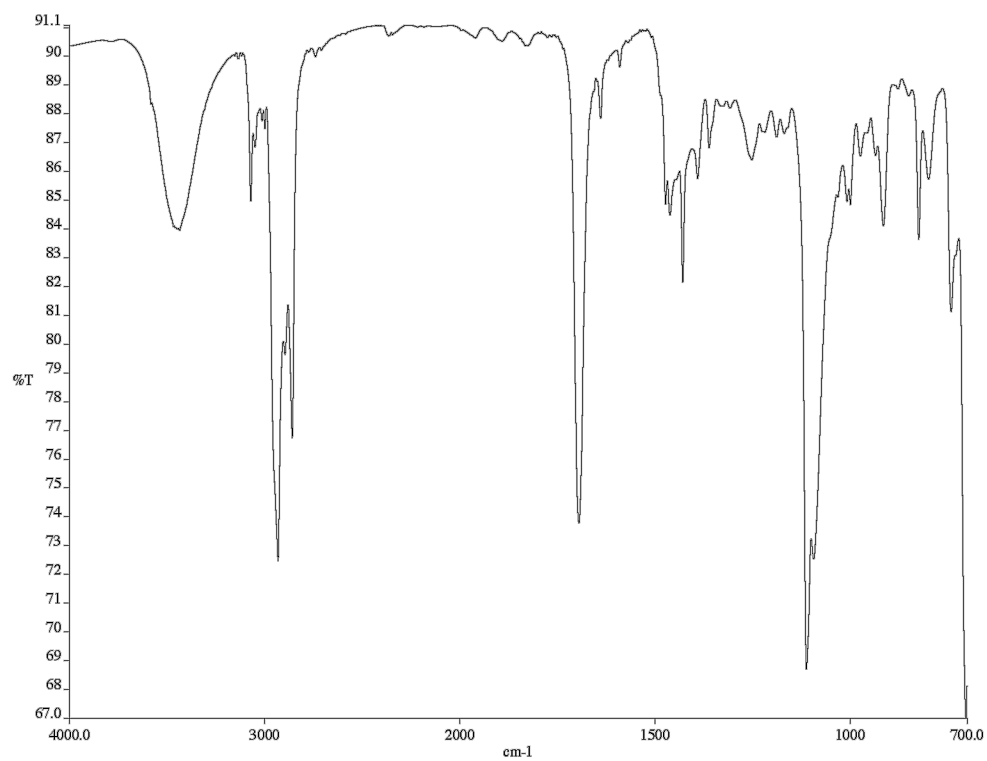


Figure A2.55.2. Infrared spectrum (thin film/NaCl) of compound **70o**.

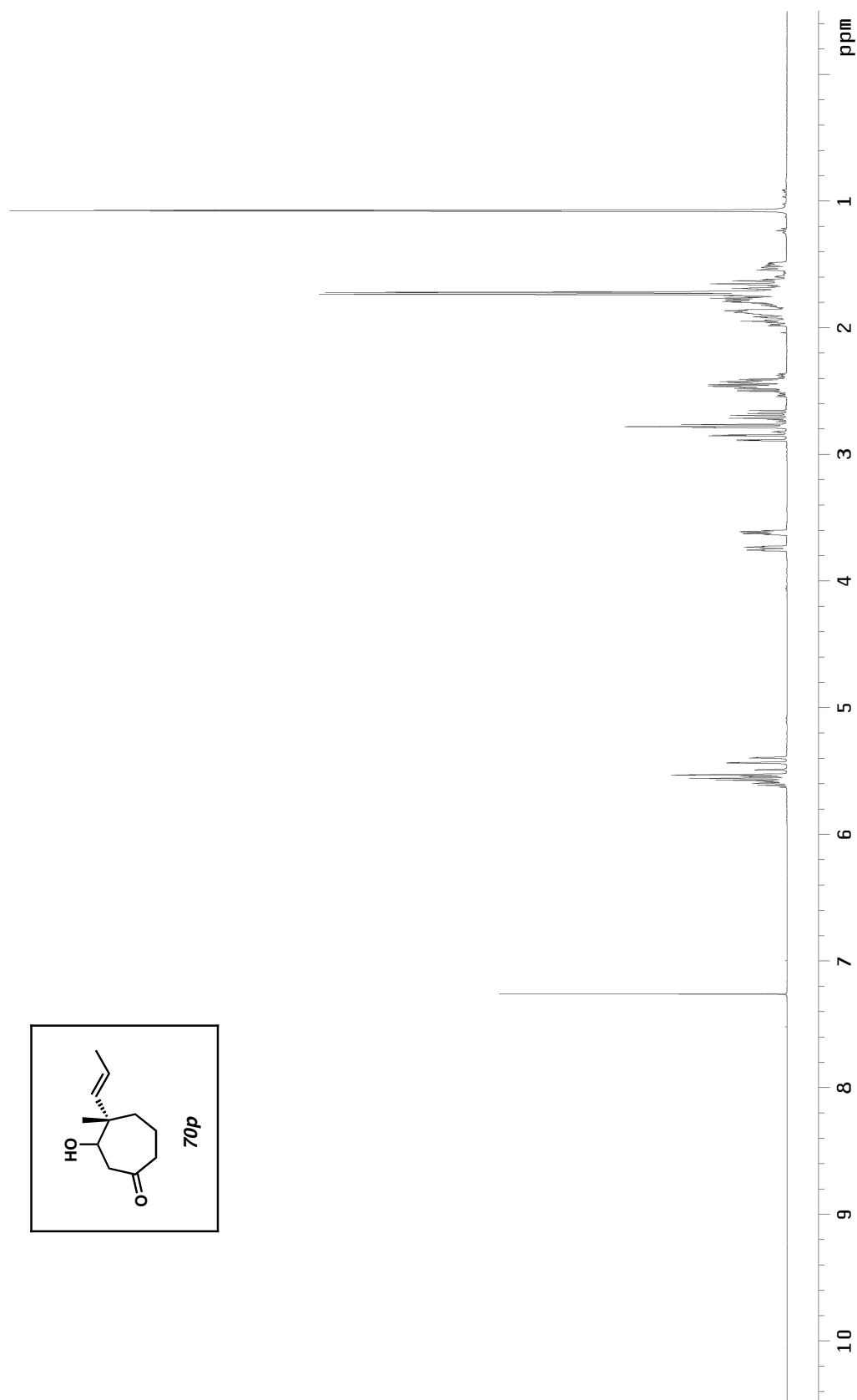


Figure A2.56.1. ¹H NMR (400 MHz, CDCl₃) of compound **70p**.

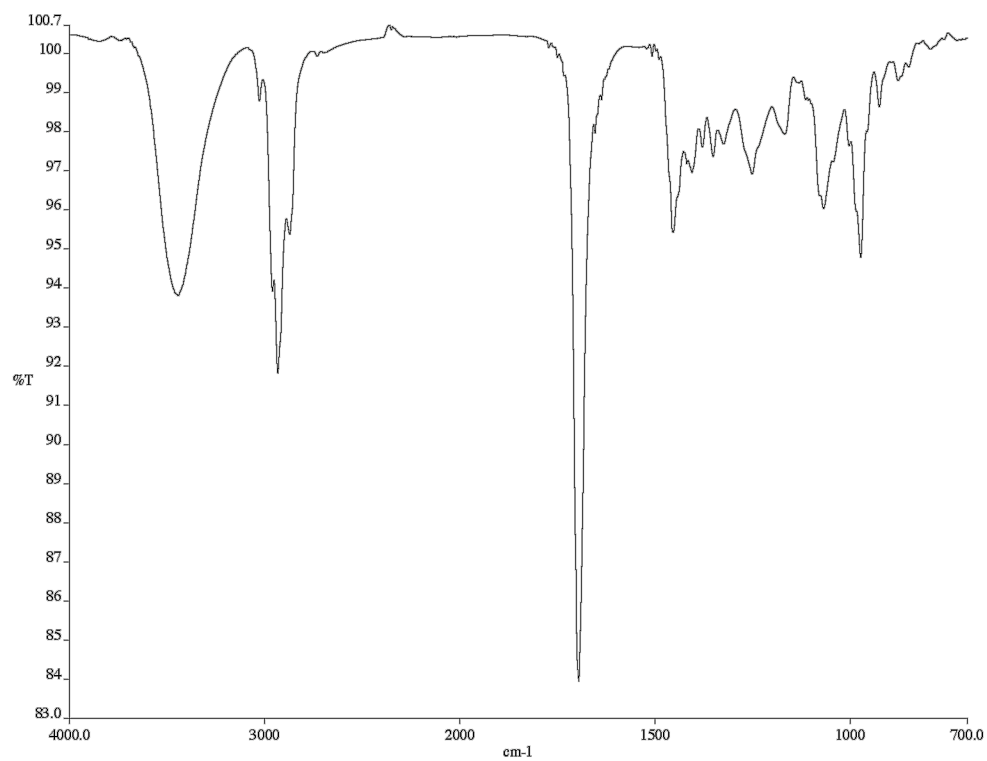


Figure A2.56.2. Infrared spectrum (thin film/NaCl) of compound **70p**.

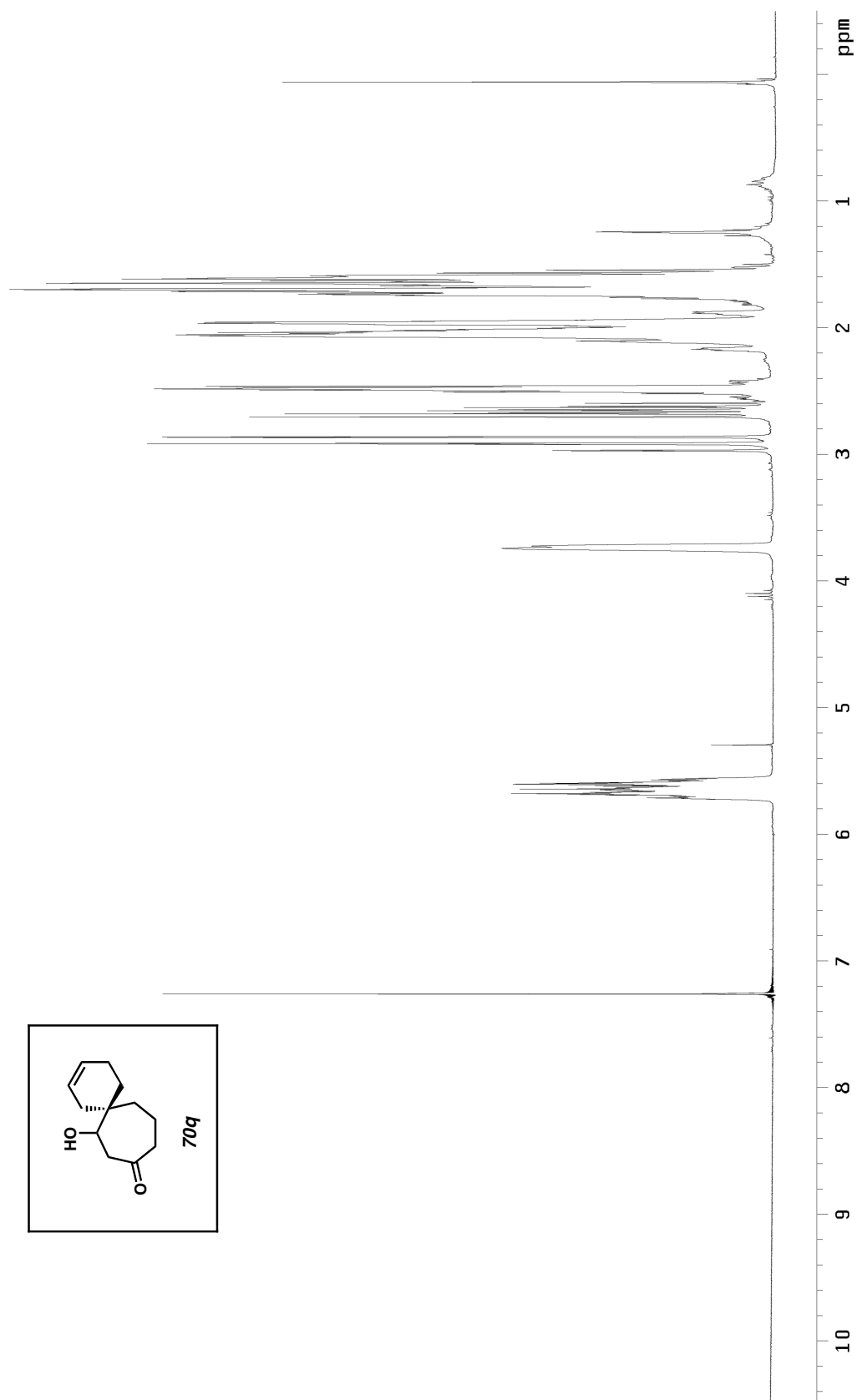


Figure A2.57.1. ^1H NMR (300 MHz, CDCl_3) of compound **70q**.

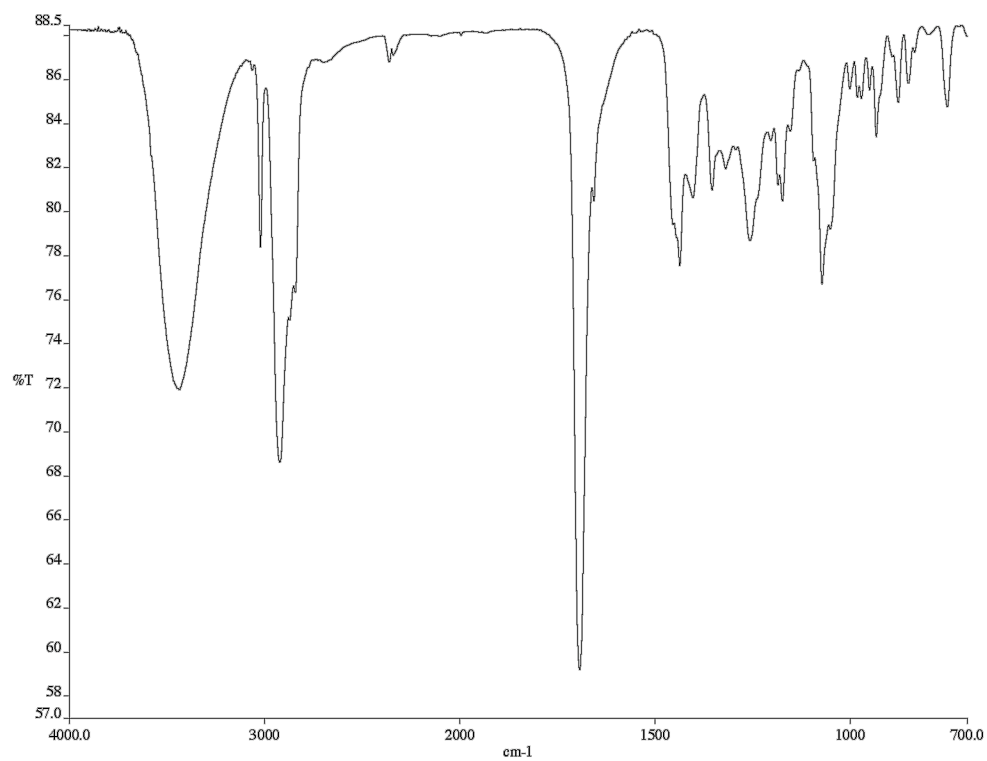


Figure A2.57.2. Infrared spectrum (thin film/NaCl) of compound **70q**.

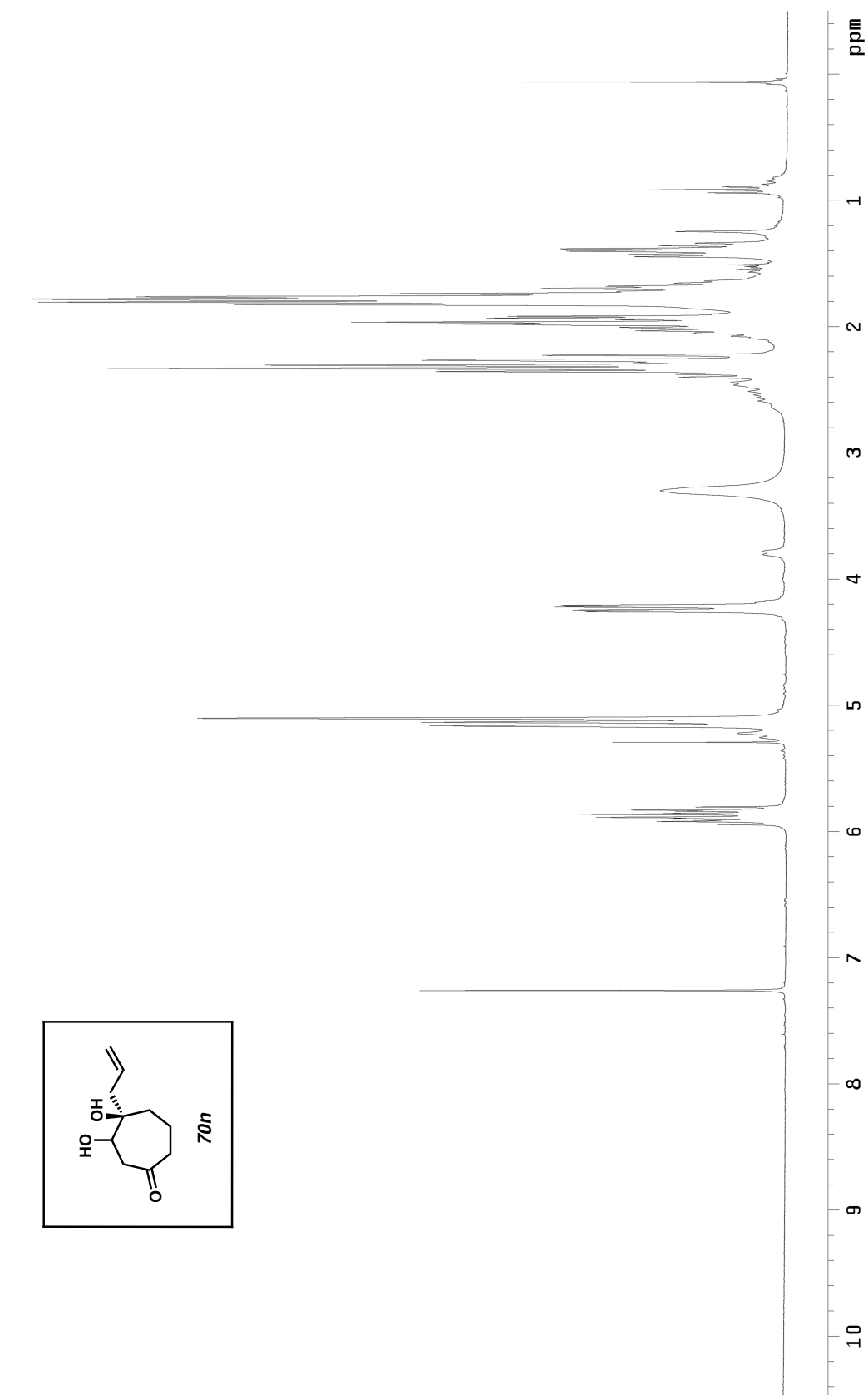


Figure A2.58.1. ^1H NMR (300 MHz, CDCl_3) of compound **70n**.

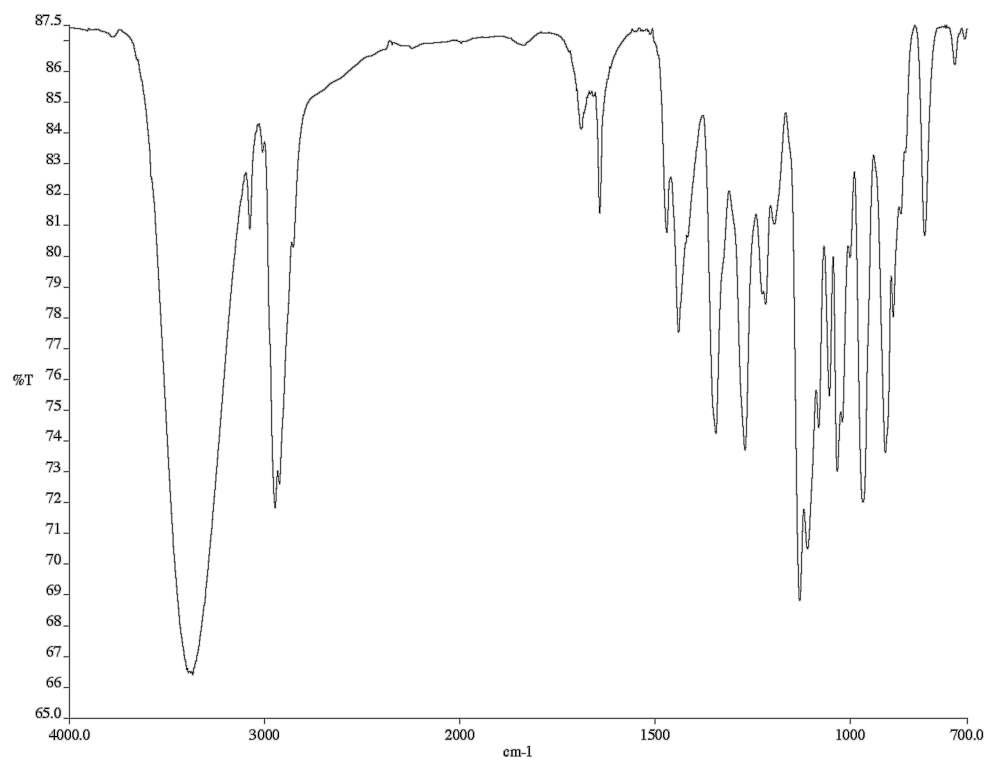


Figure A2.58.2. Infrared spectrum (thin film/NaCl) of compound **70n**.

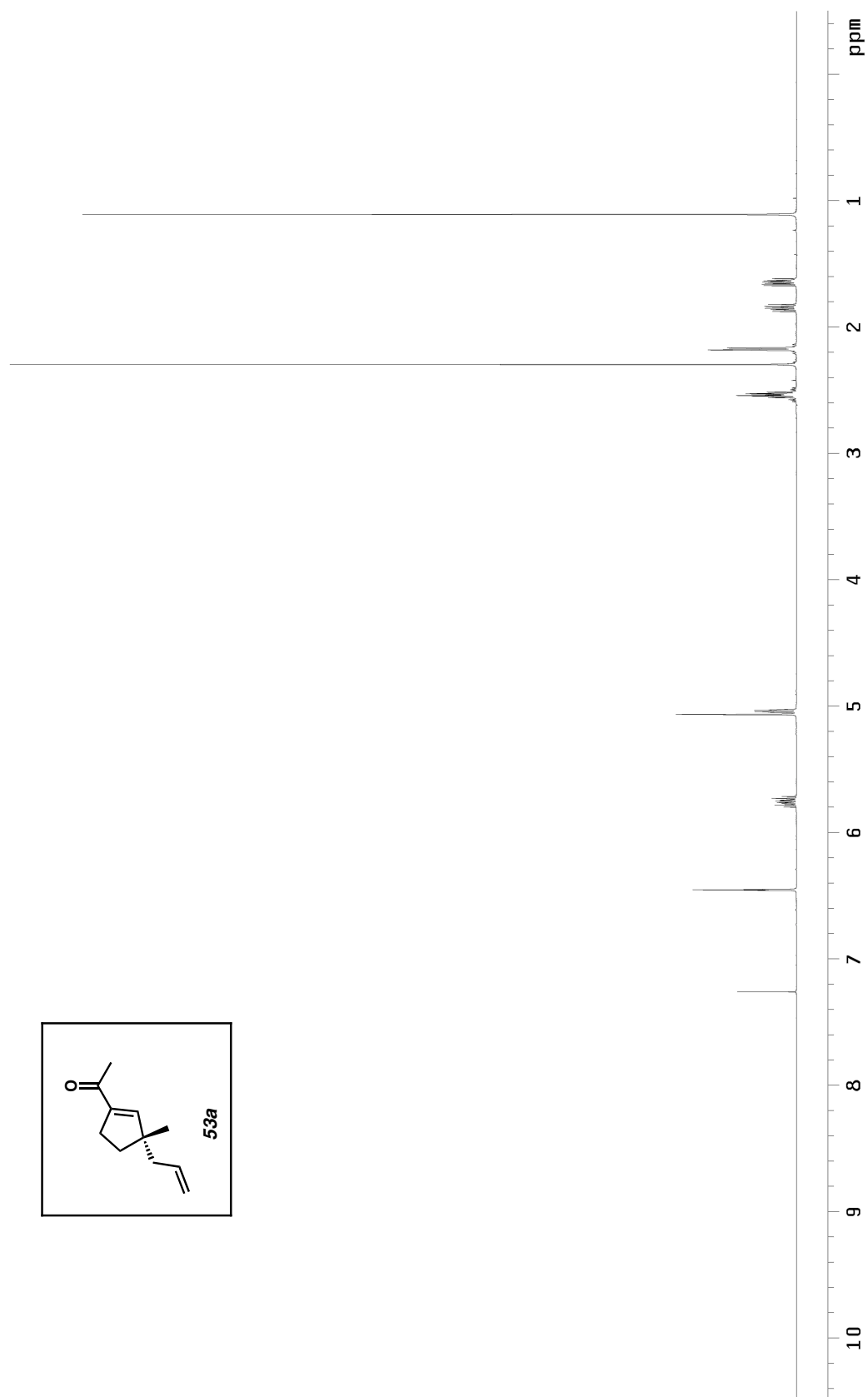


Figure A2.59.1. ^1H NMR (500 MHz, CDCl_3) of compound **53a**.

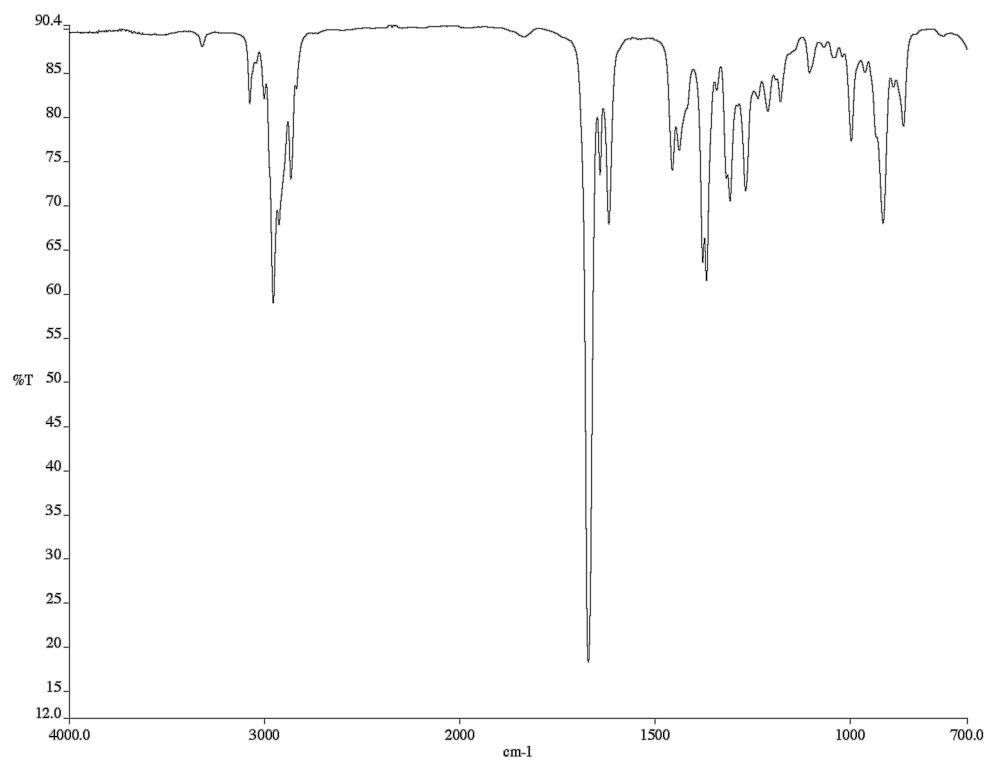


Figure A2.59.2. Infrared spectrum (thin film/NaCl) of compound **53a**.

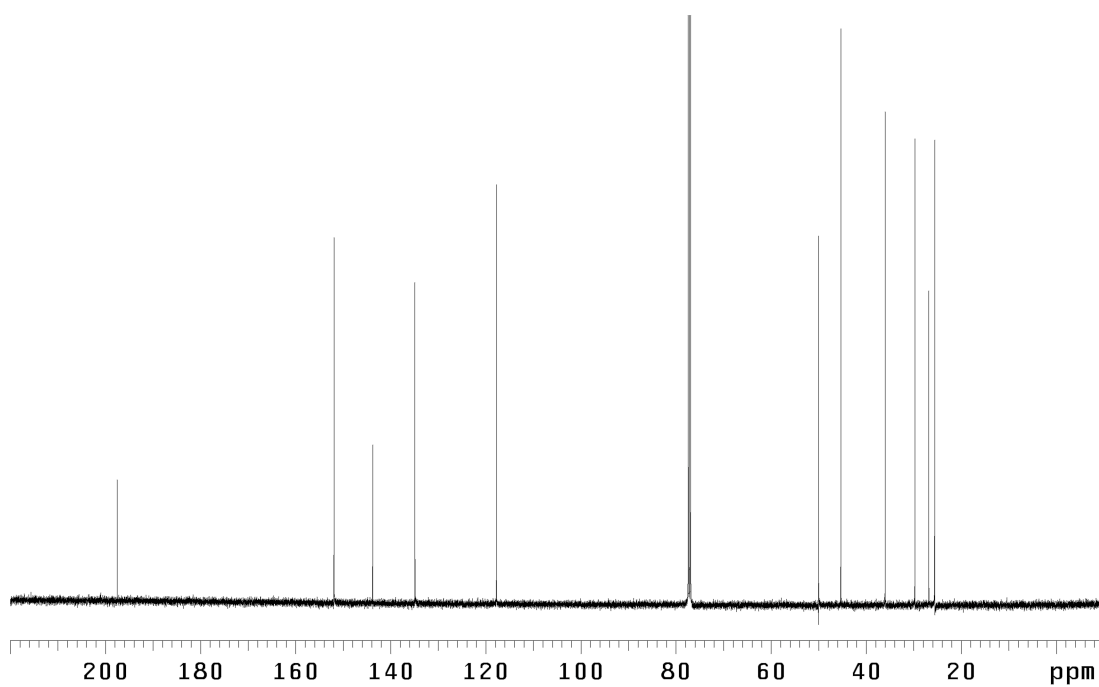


Figure A2.59.3. ¹³C NMR (125 MHz, CDCl₃) of compound **53a**.

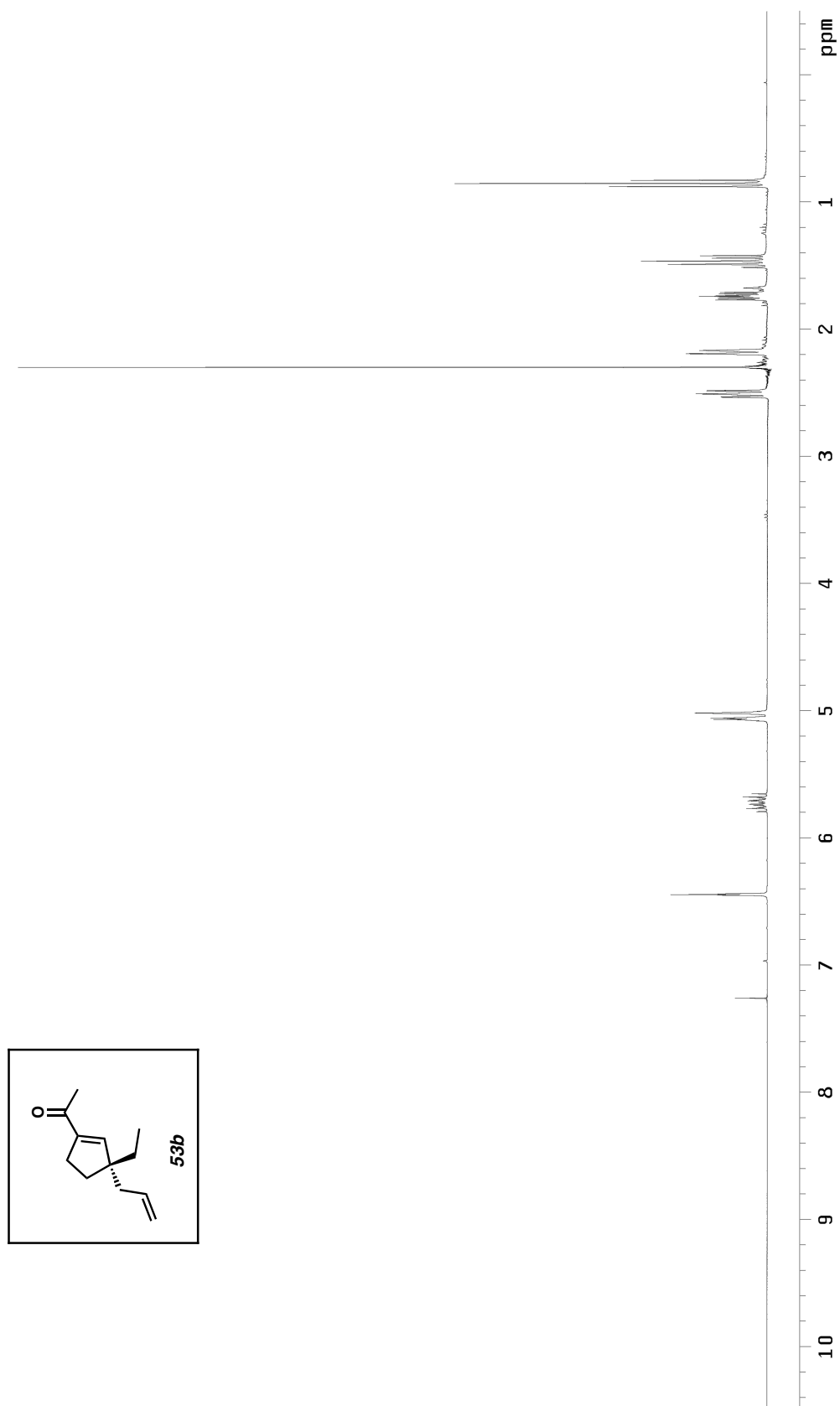


Figure A2.60.1. ^1H NMR (300 MHz, CDCl_3) of compound **53b**.

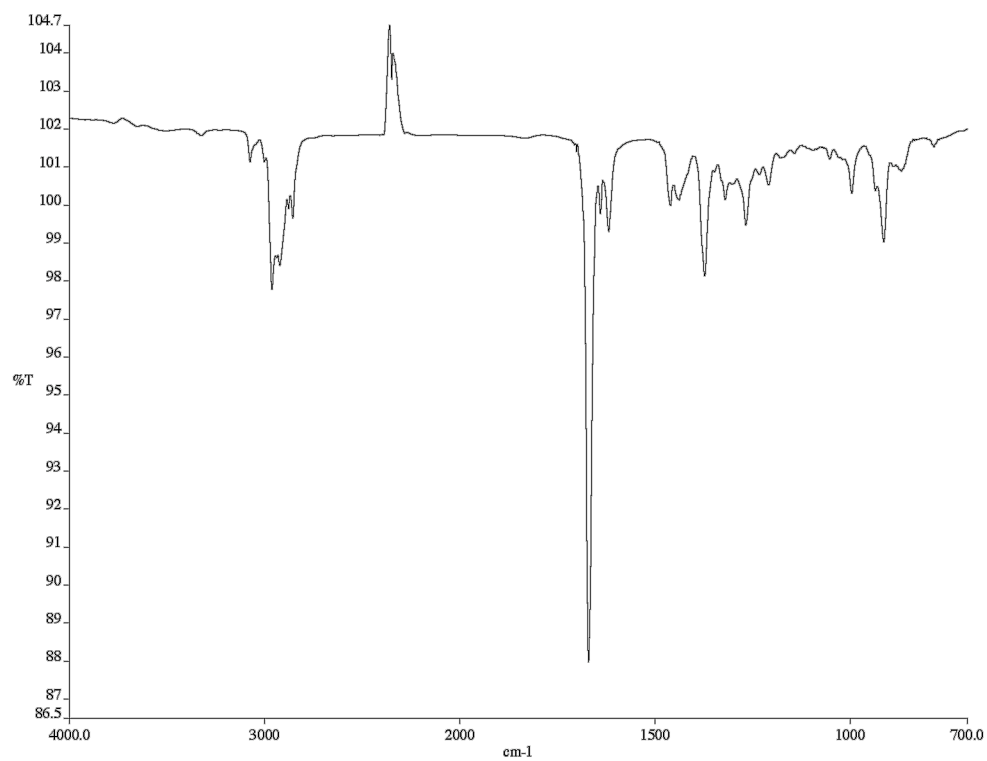


Figure A2.60.2. Infrared spectrum (thin film/NaCl) of compound **53b**.

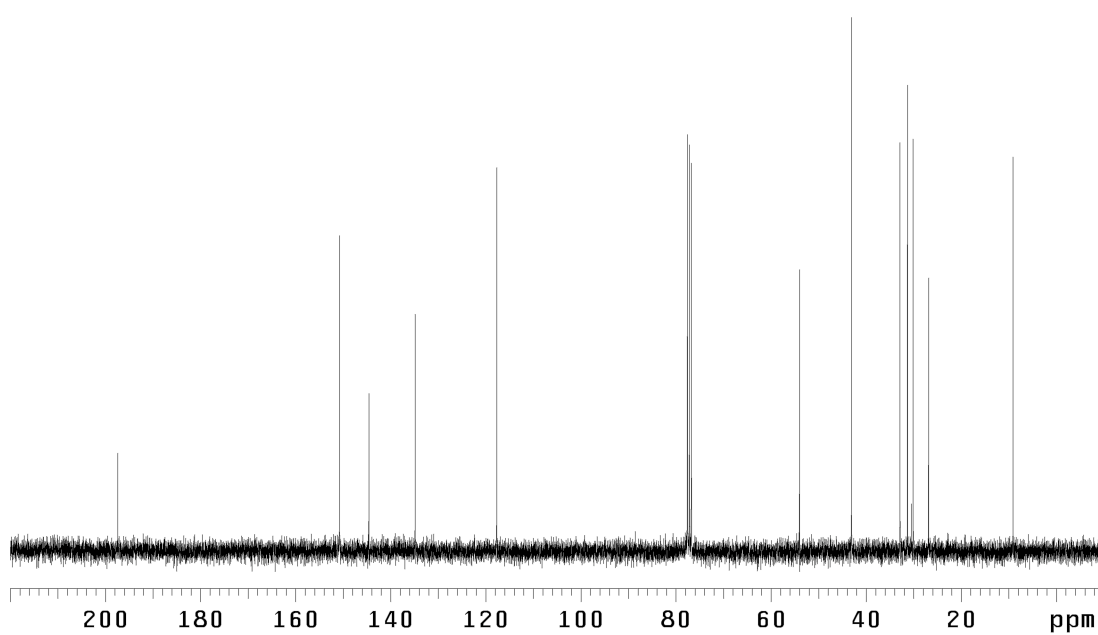
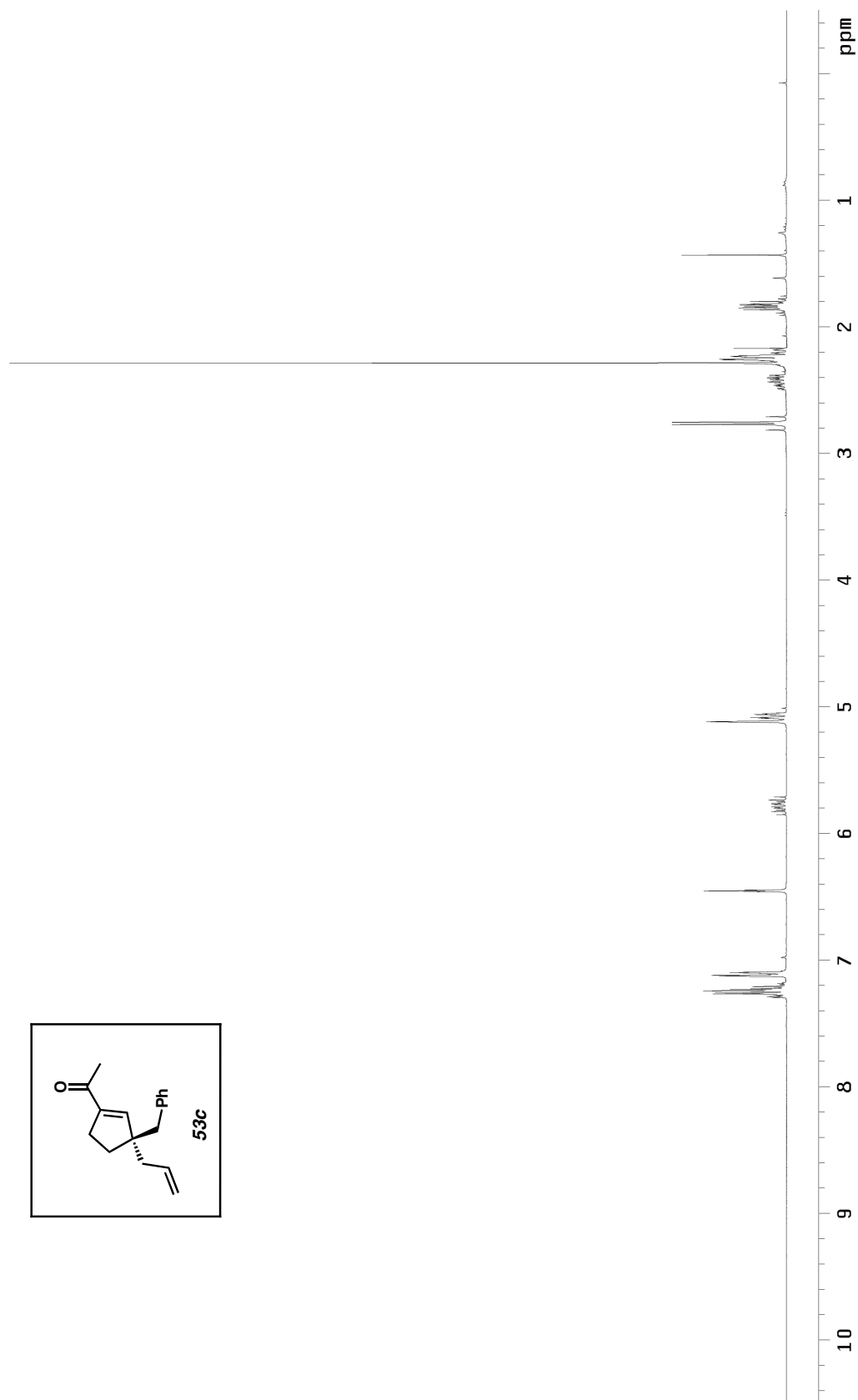


Figure A2.60.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **53b**.

Figure A2.61.1. ^1H NMR (300 MHz, CDCl_3) of compound **53c**.

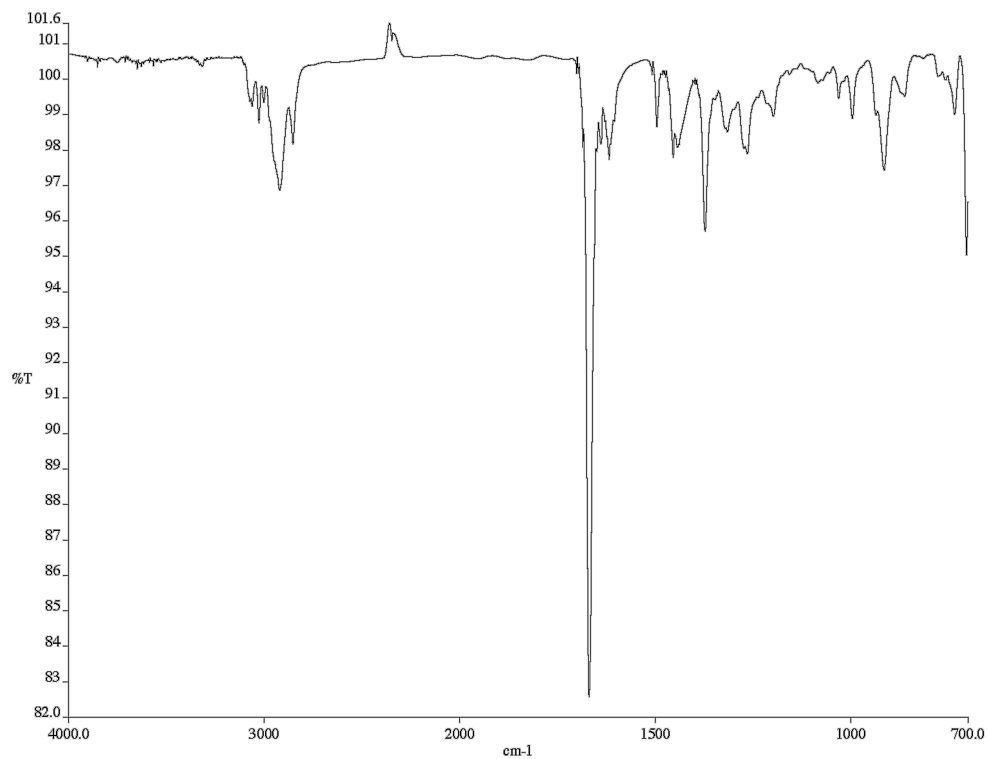


Figure A2.61.2. Infrared spectrum (thin film/NaCl) of compound **53c**.

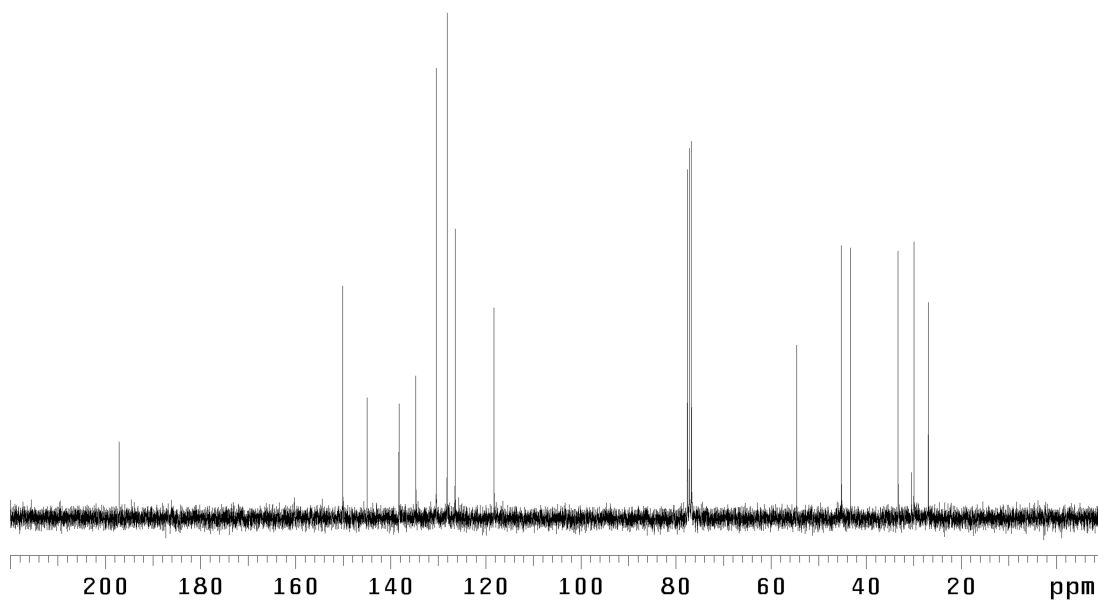
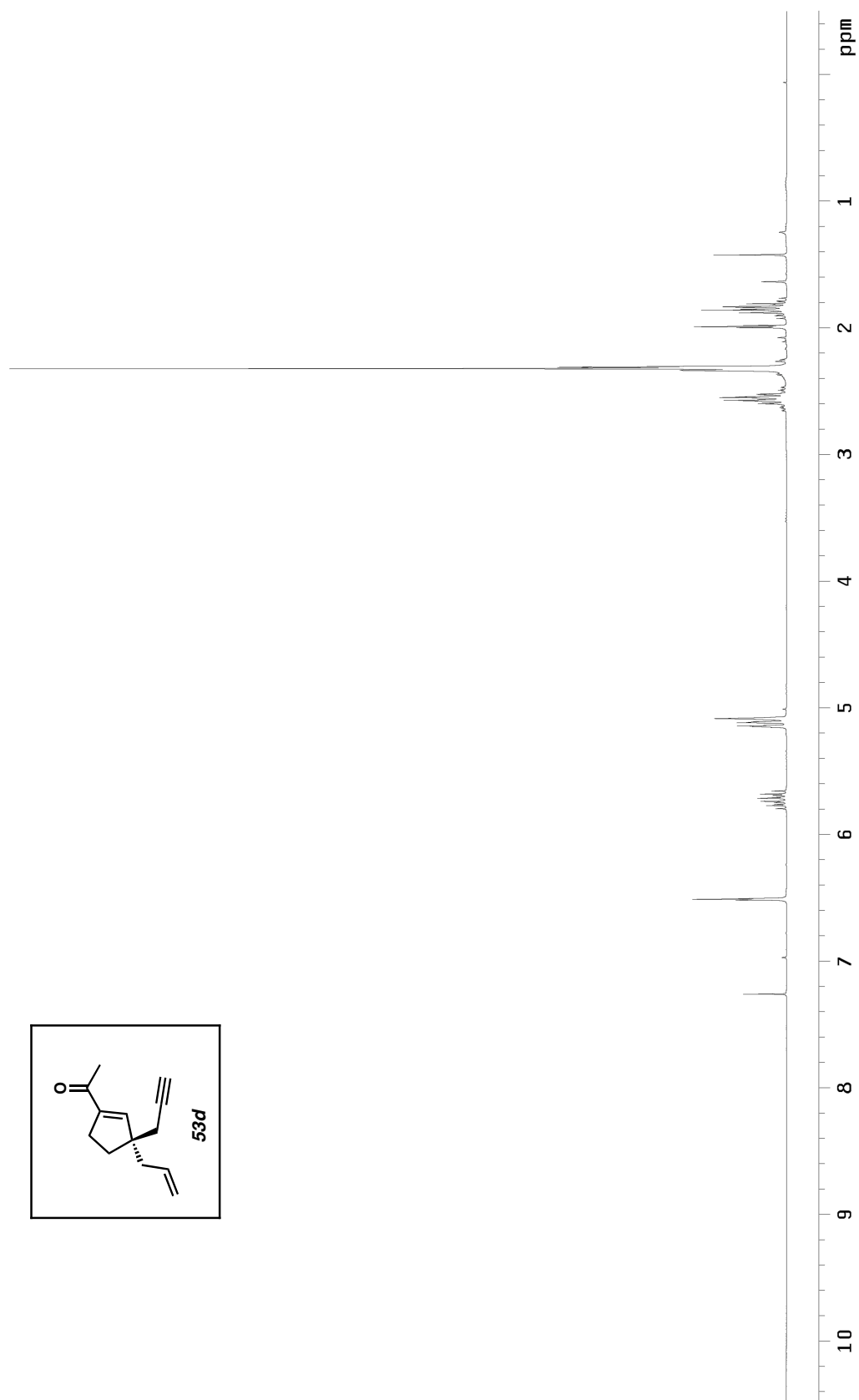


Figure A2.61.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53c**.

Figure A2.62.1. ¹H NMR (300 MHz, CDCl₃) of compound **53d**.

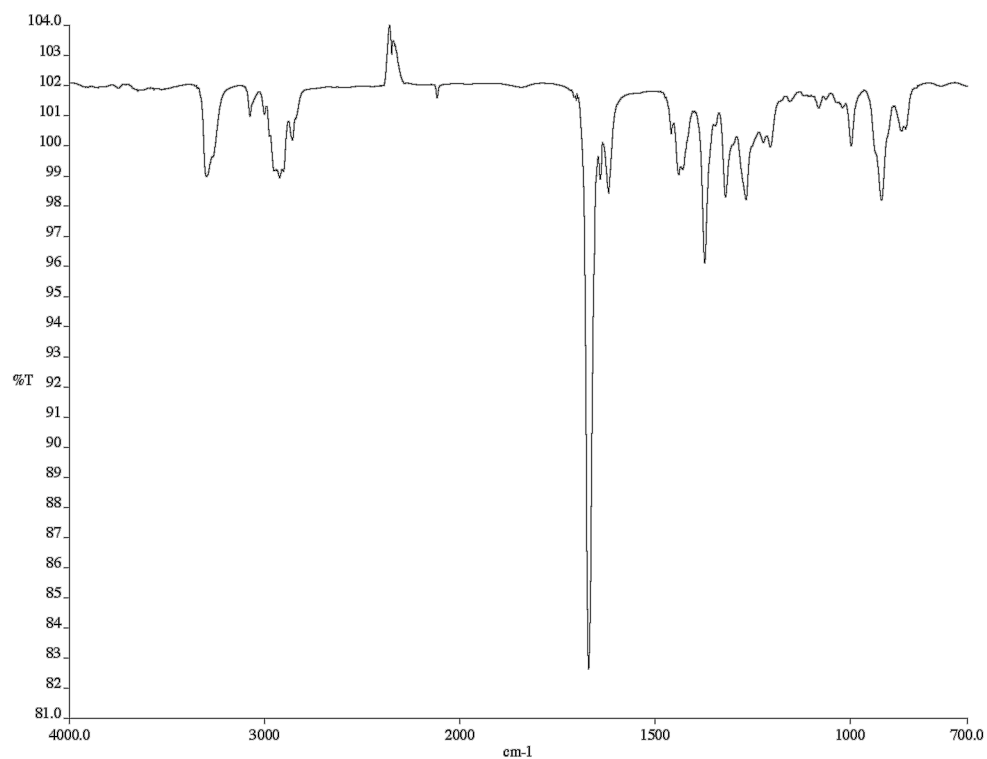


Figure A2.62.2. Infrared spectrum (thin film/NaCl) of compound **53d**.

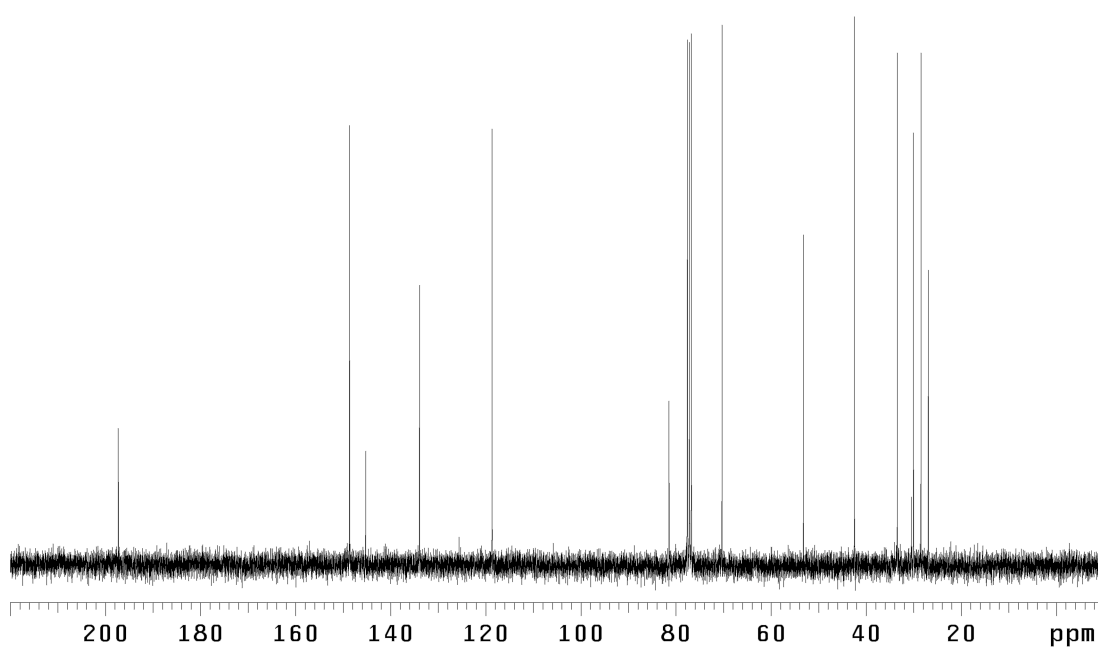


Figure A2.62.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53d**.

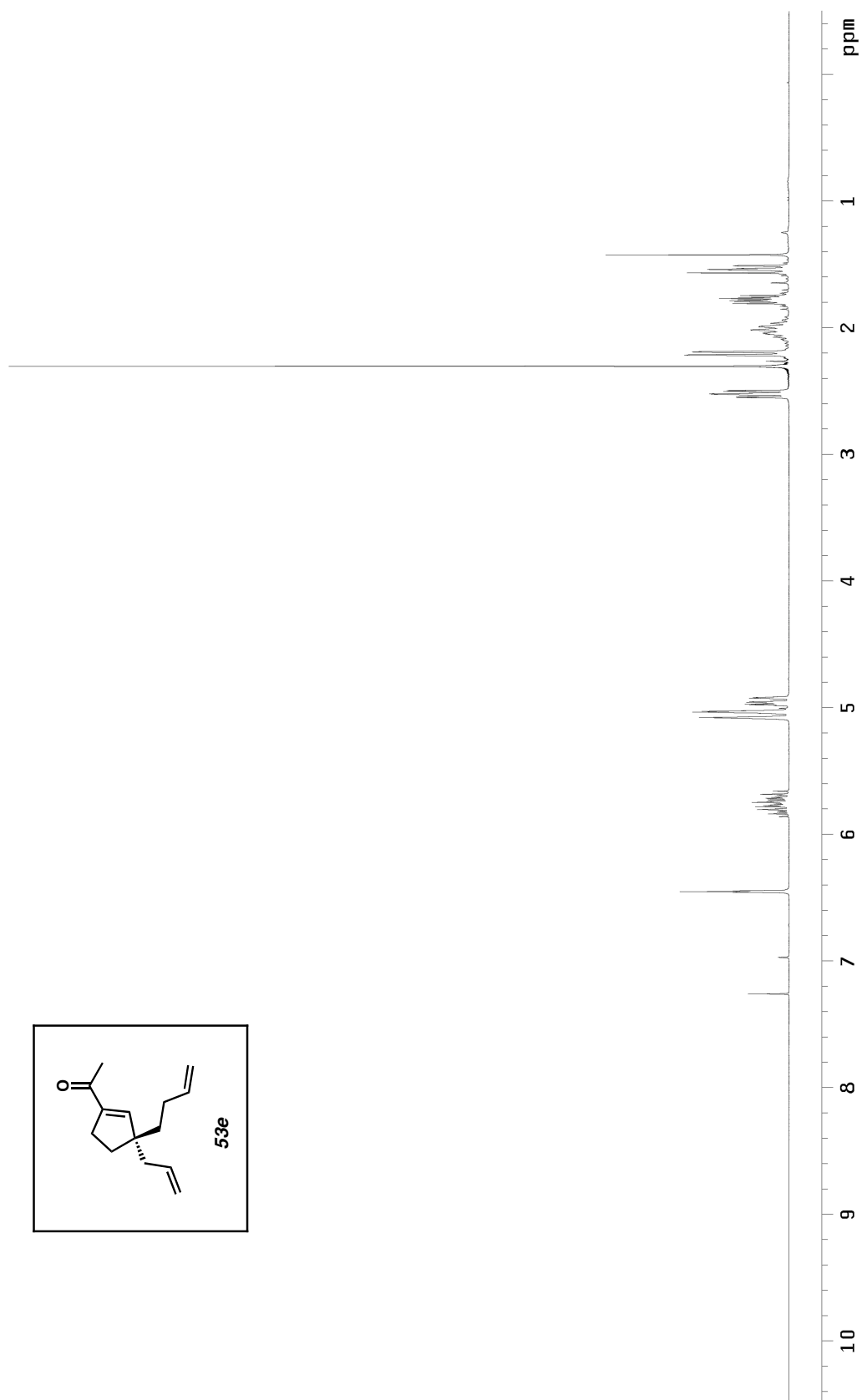


Figure A2.63. 1. ^1H NMR (300 MHz, CDCl_3) of compound **53e**.

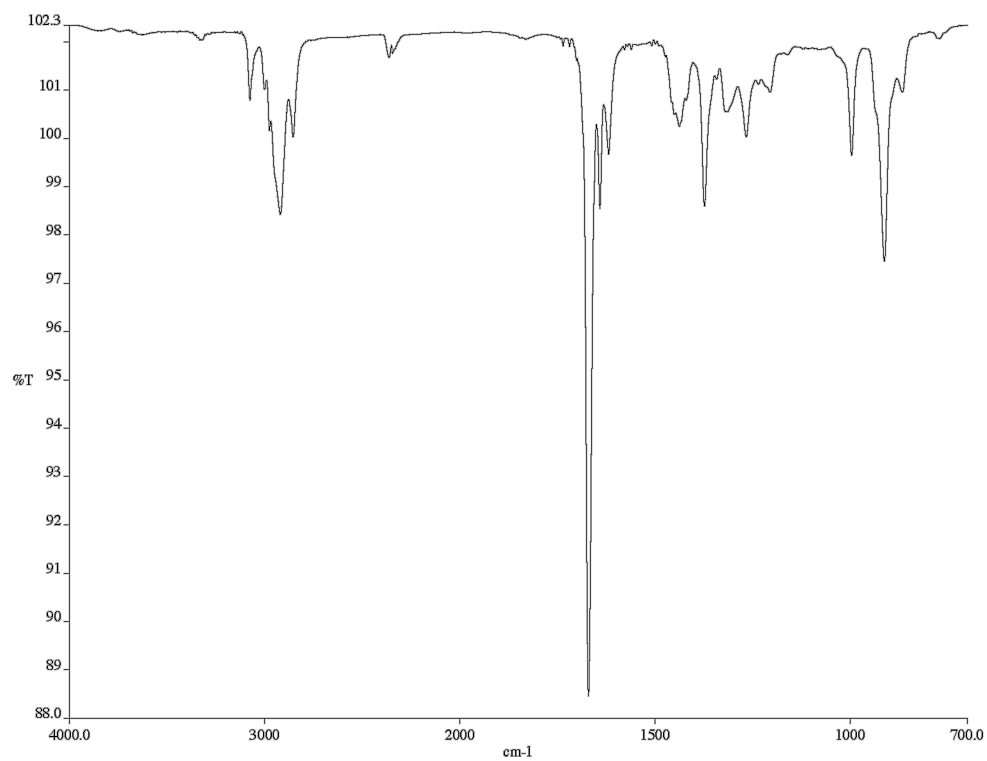


Figure A2.63.2. Infrared spectrum (thin film/NaCl) of compound **53e**.

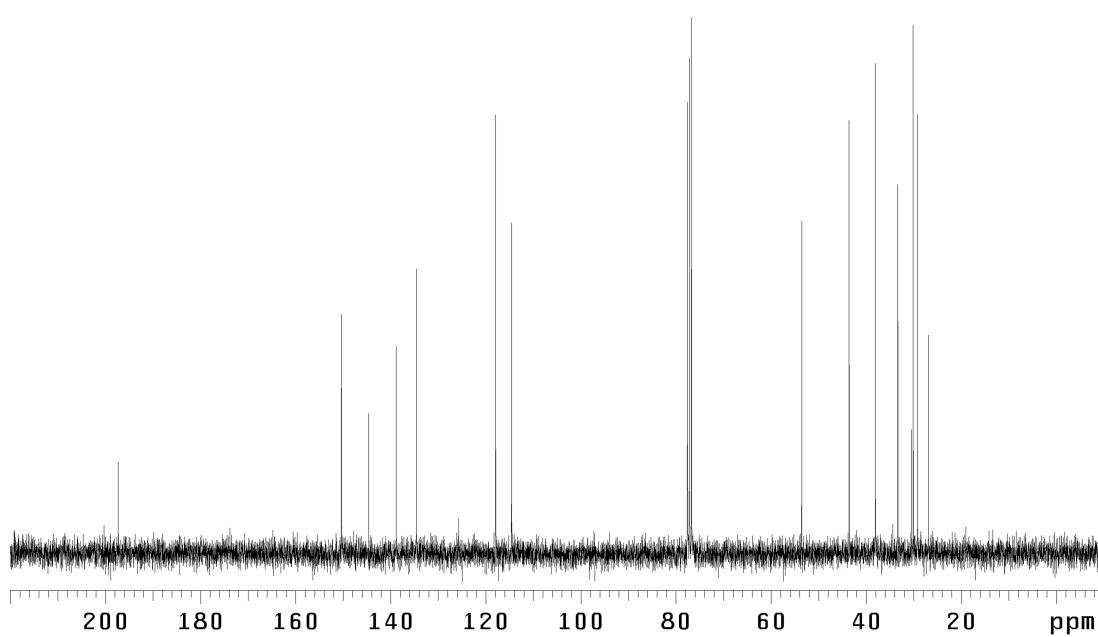


Figure A2.63.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53e**.

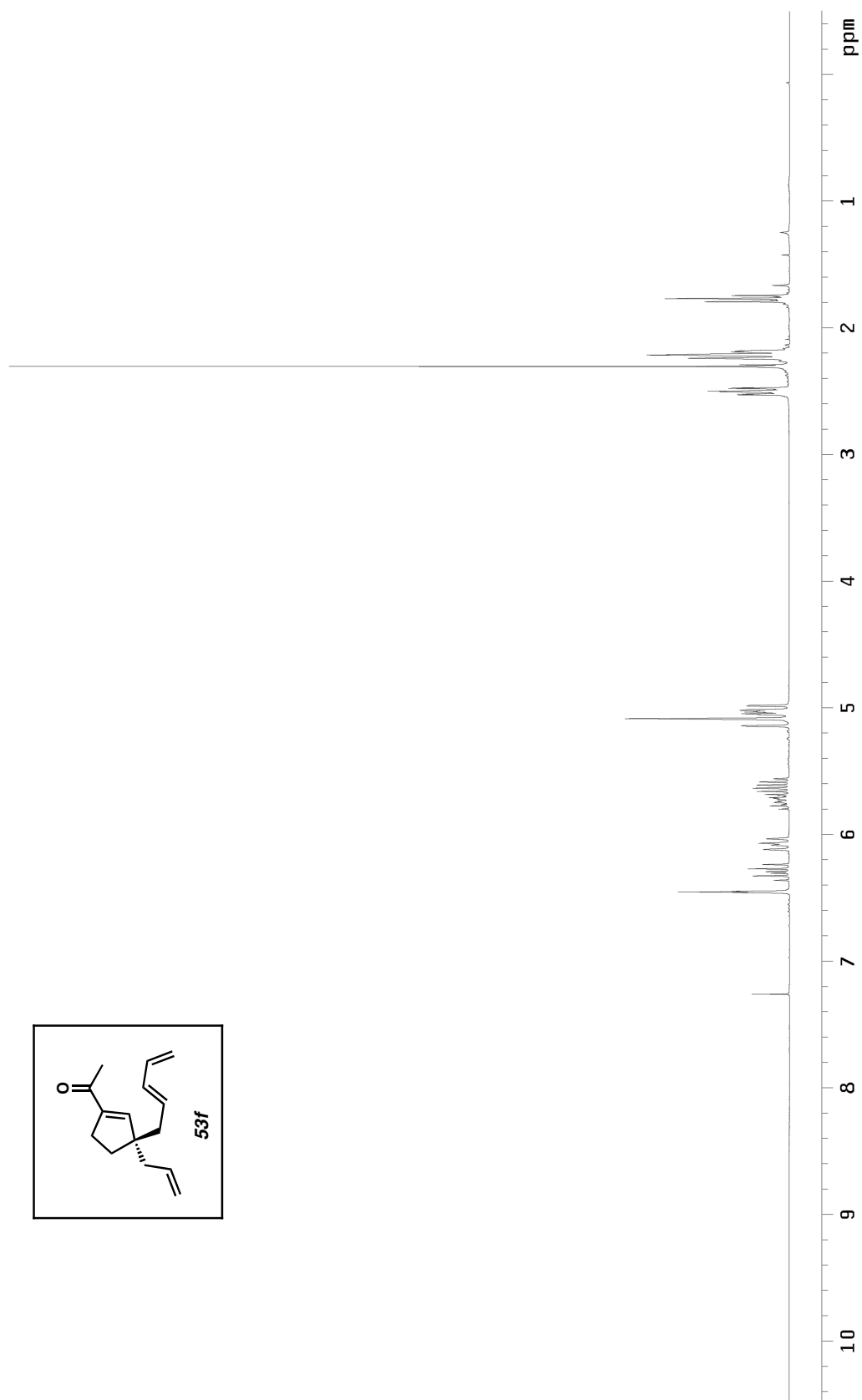


Figure A2.64.1. ^1H NMR (300 MHz, CDCl_3) of compound **53f**.

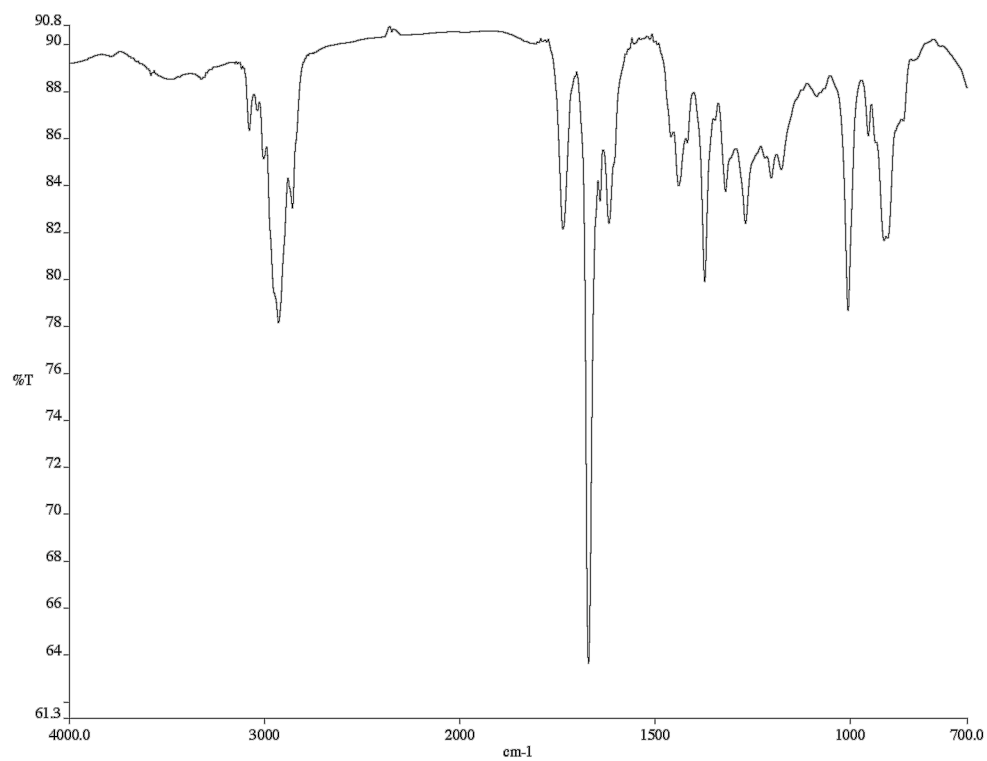


Figure A2.64.2. Infrared spectrum (thin film/NaCl) of compound **53f**.

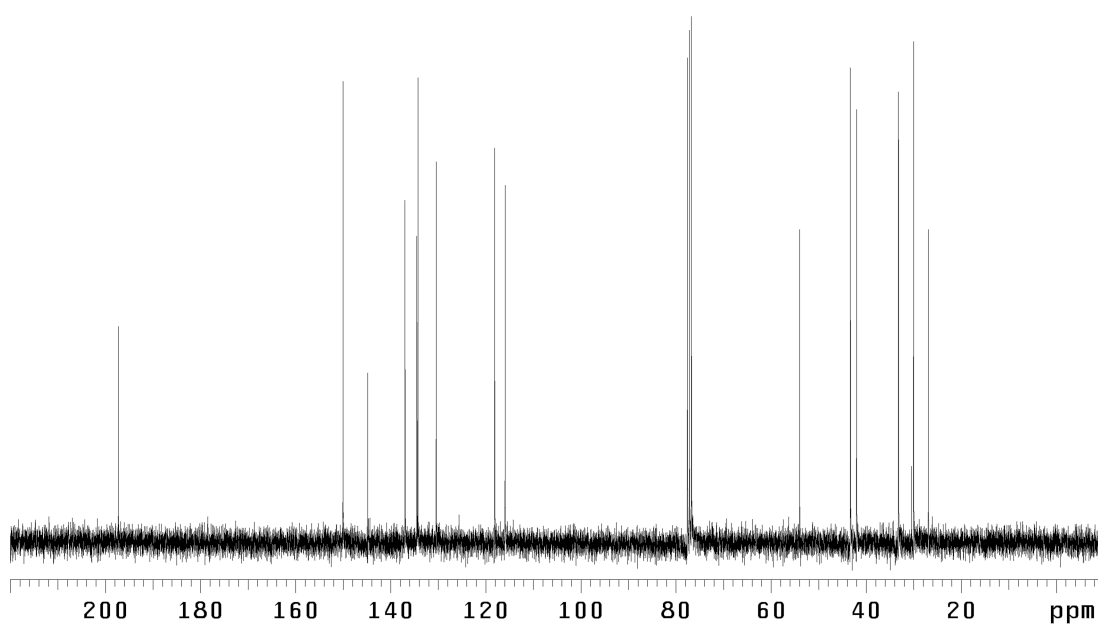


Figure A2.64.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53f**.

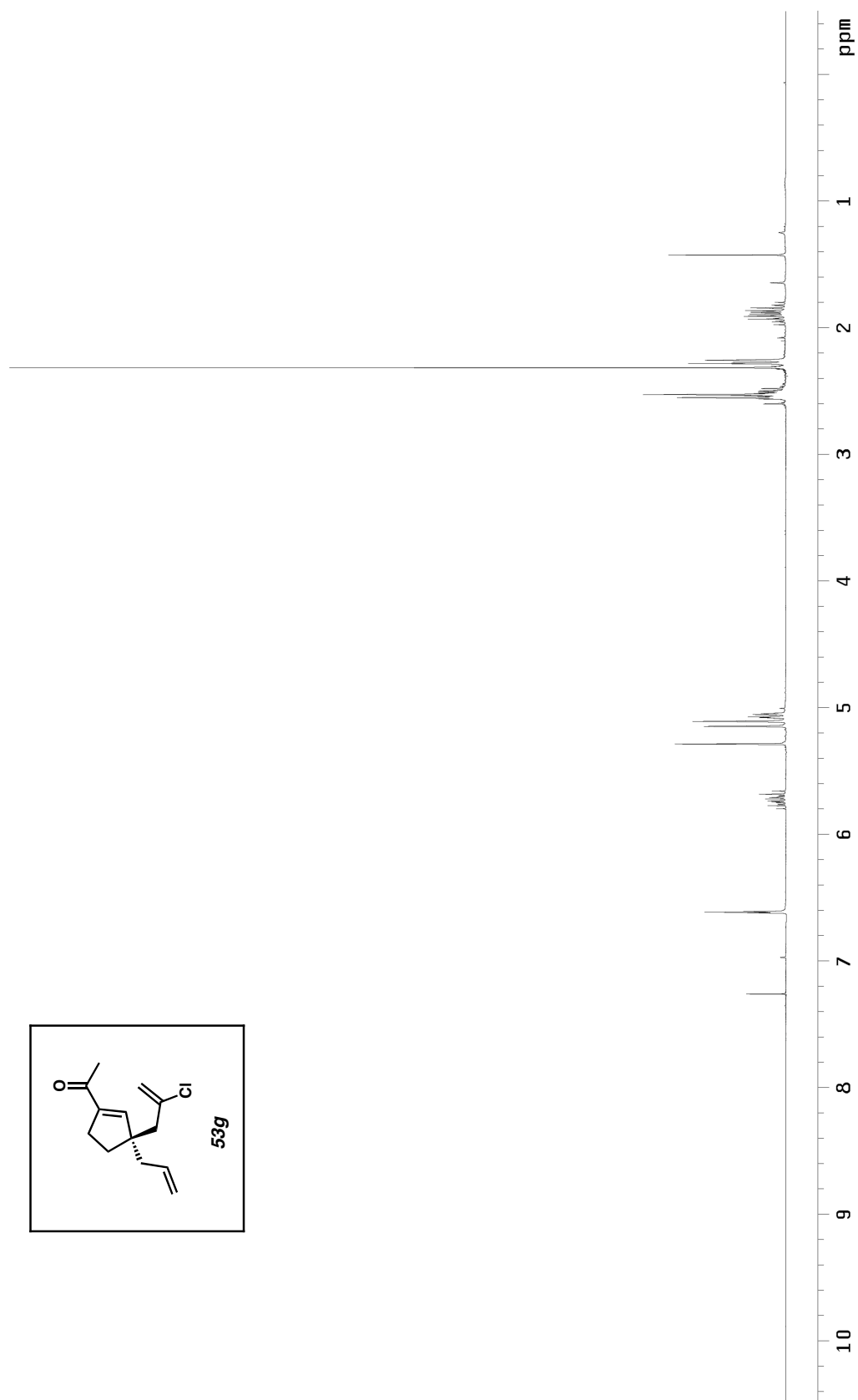


Figure A2.65. 1. ¹H NMR (300 MHz, CDCl₃) of compound **53g**.

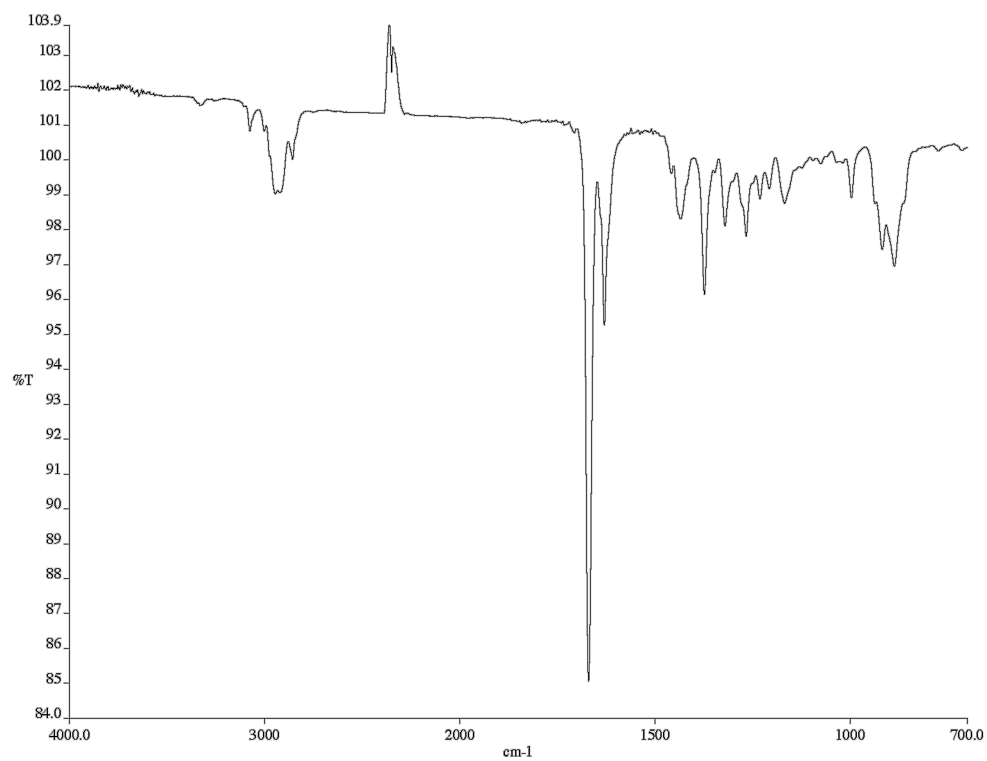


Figure A2.65.2. Infrared spectrum (thin film/NaCl) of compound **53g**.

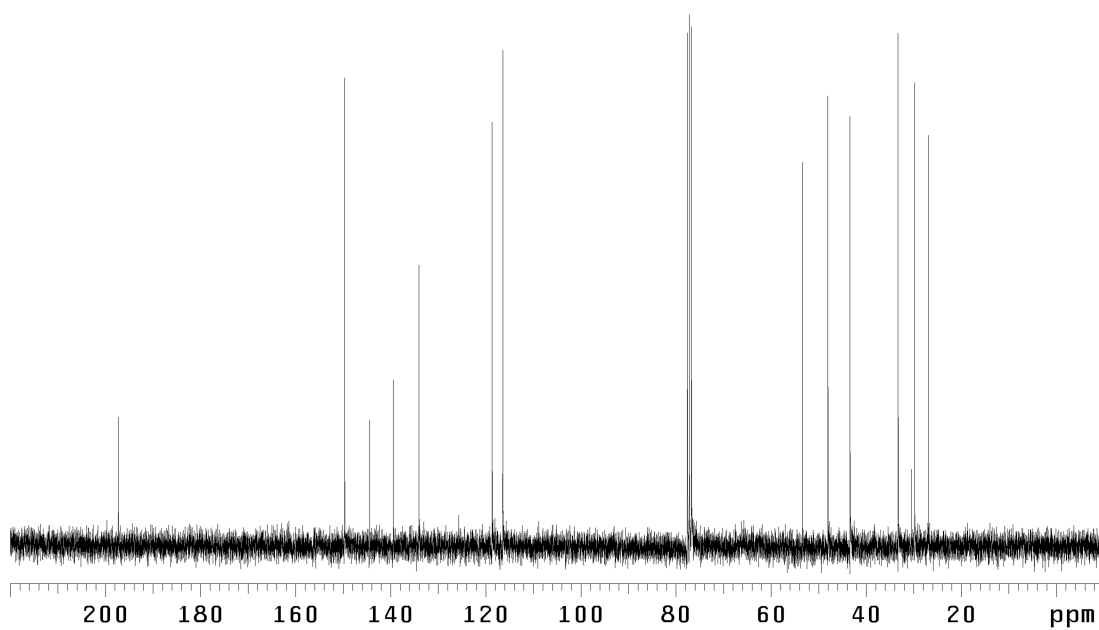


Figure A2.65.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53g**.

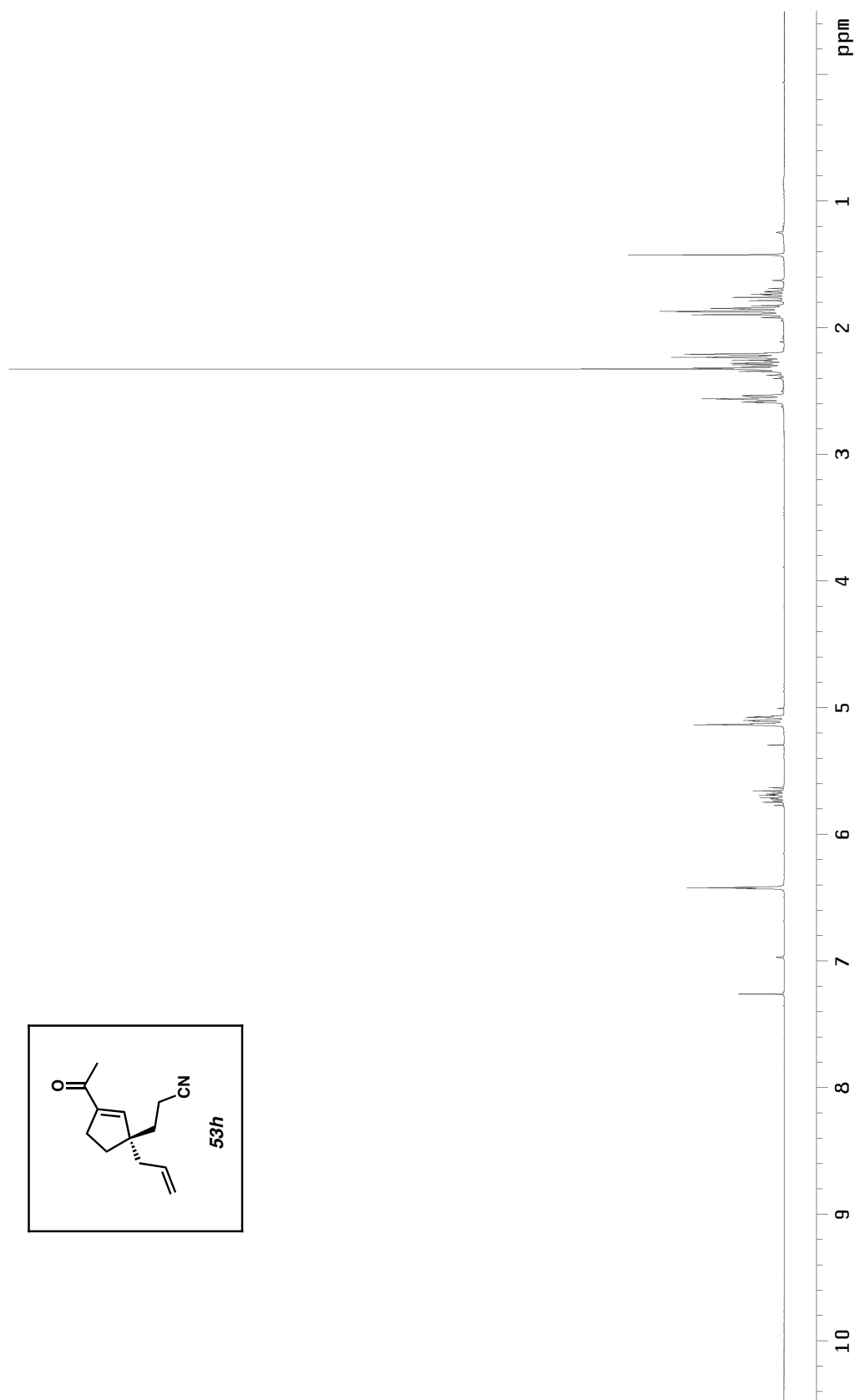


Figure A2.66.1. ^1H NMR (300 MHz, CDCl_3) of compound **53h**.

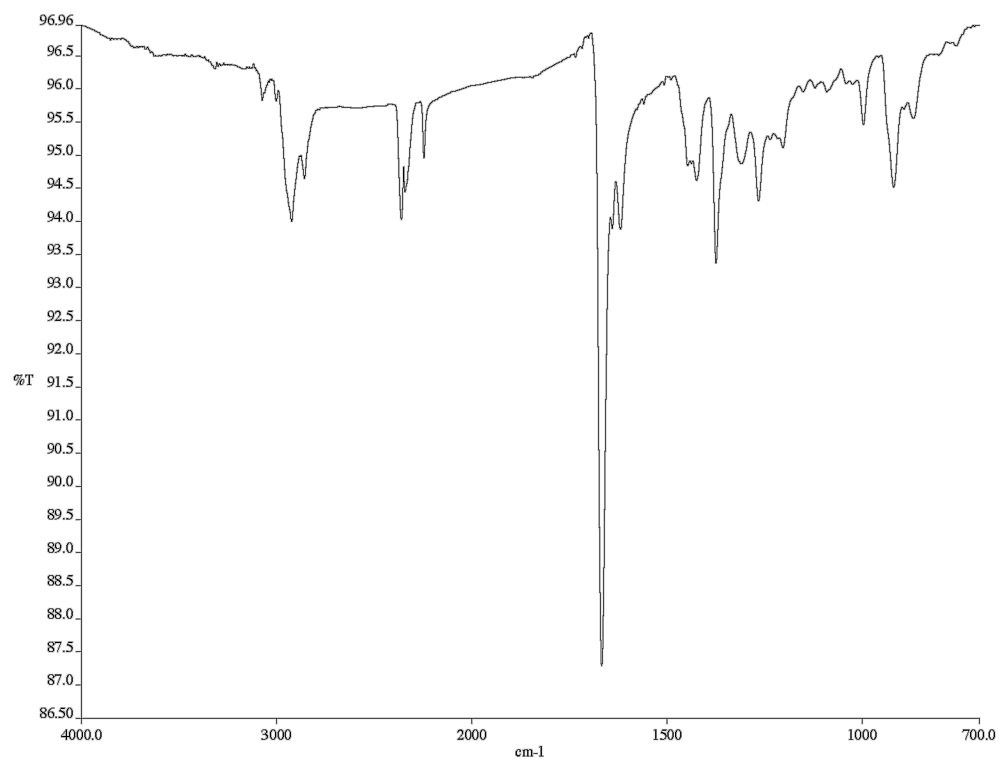


Figure A2.66.2. Infrared spectrum (thin film/NaCl) of compound **53h**.

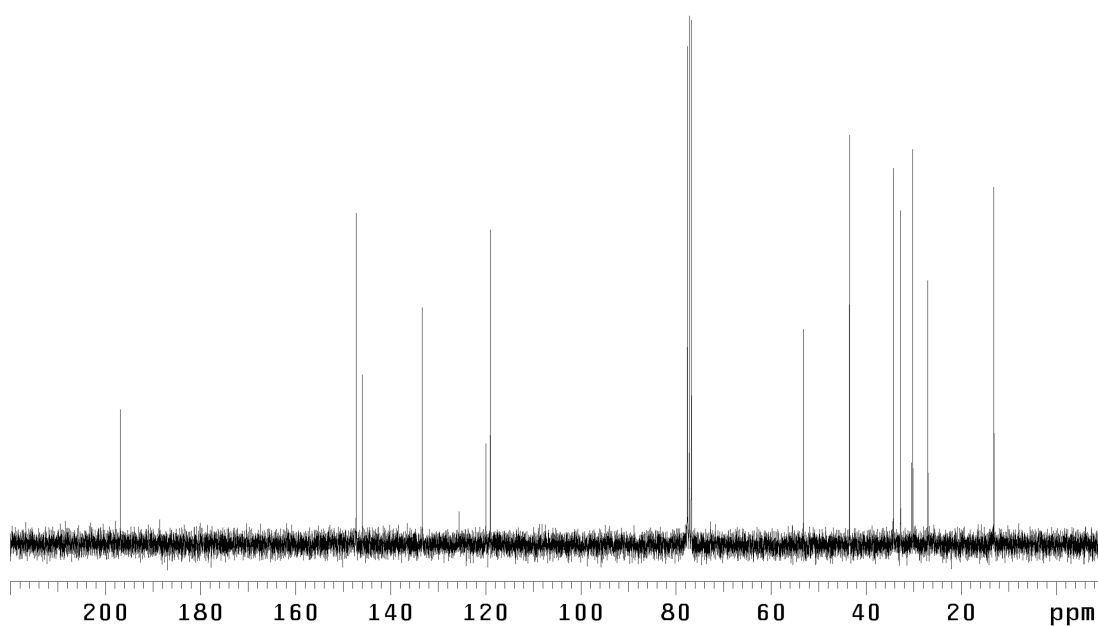


Figure A2.66.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53h**.

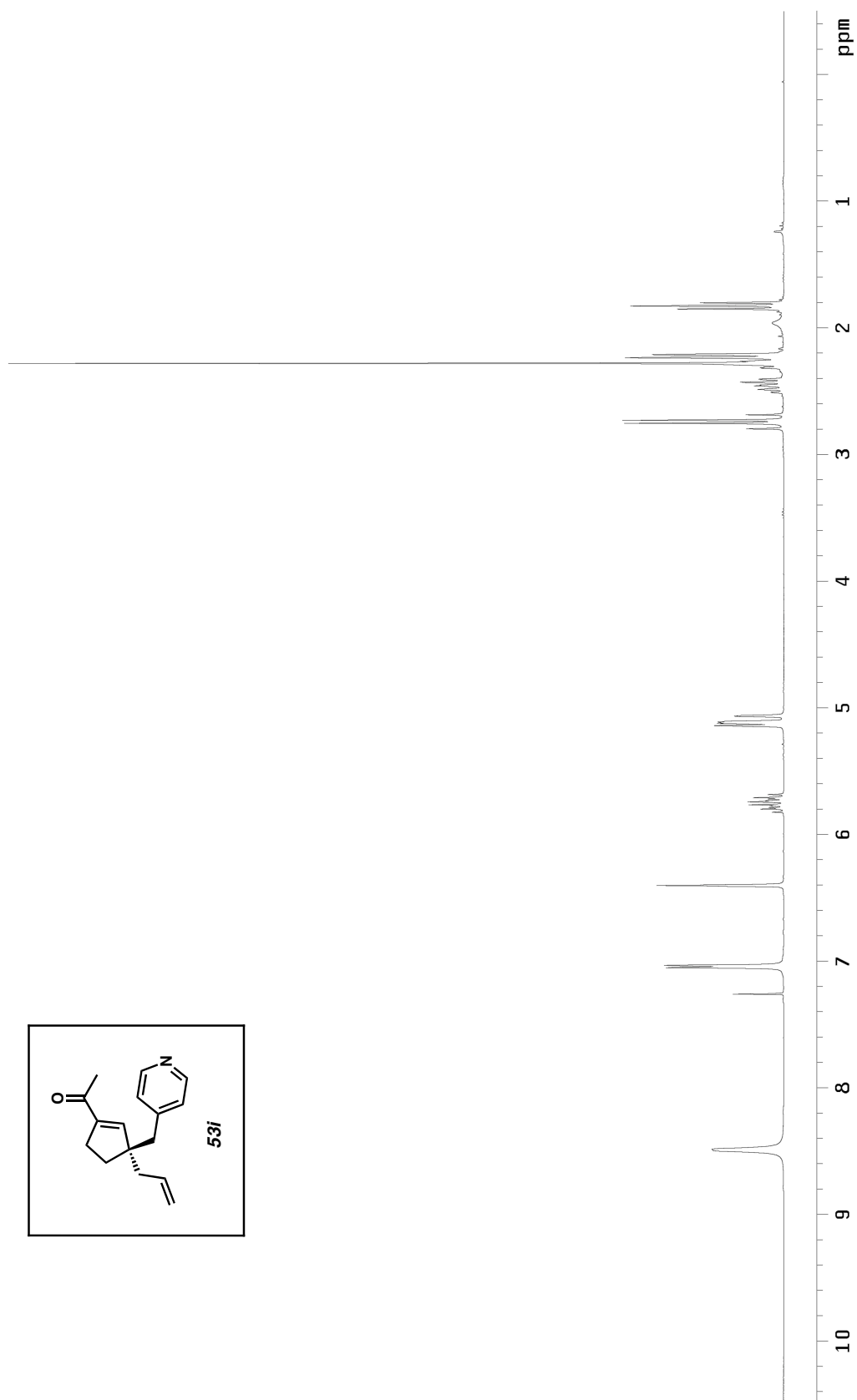


Figure A2.67.1. ^1H NMR (300 MHz, CDCl_3) of compound **53i**.

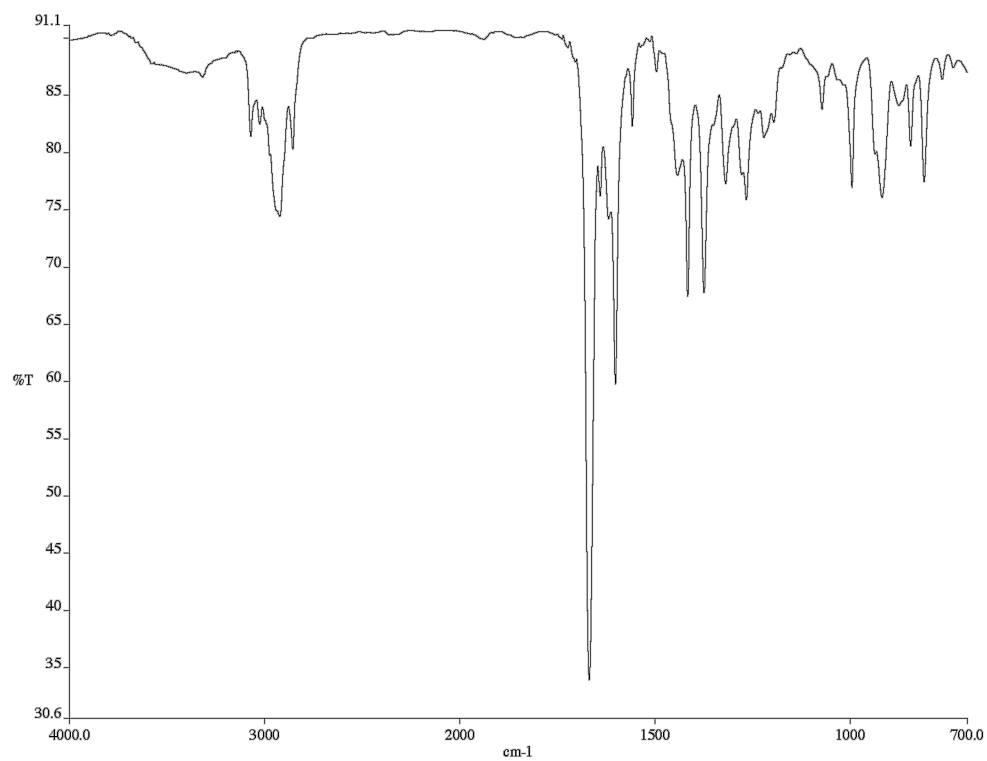


Figure A2.67.2. Infrared spectrum (thin film/NaCl) of compound **53i**.

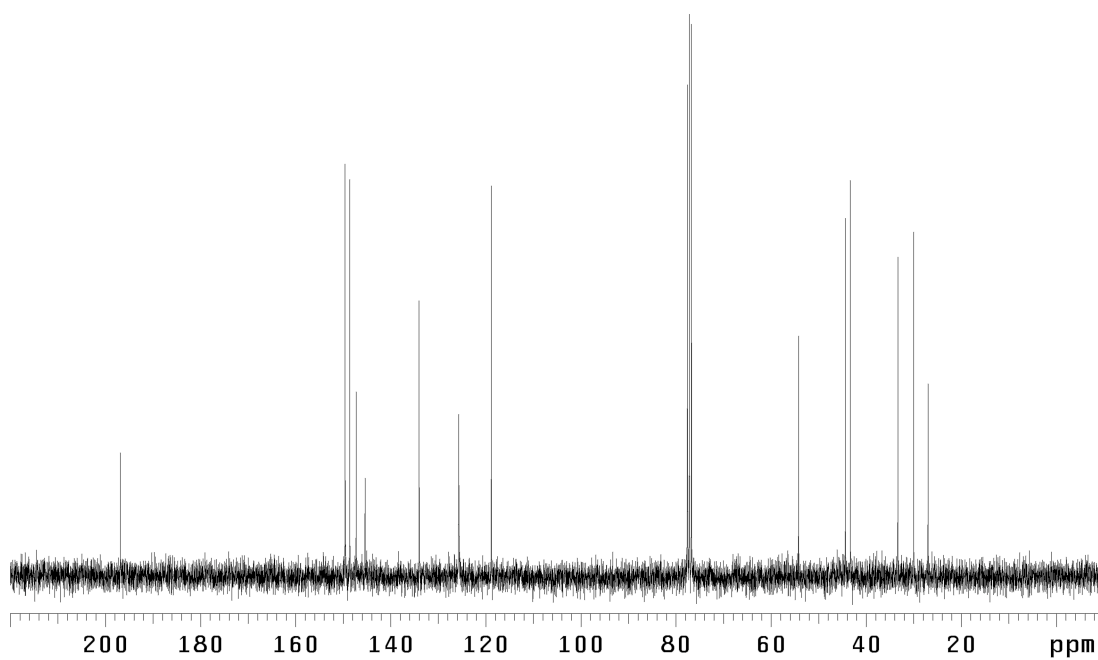


Figure A2.67.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53i**.

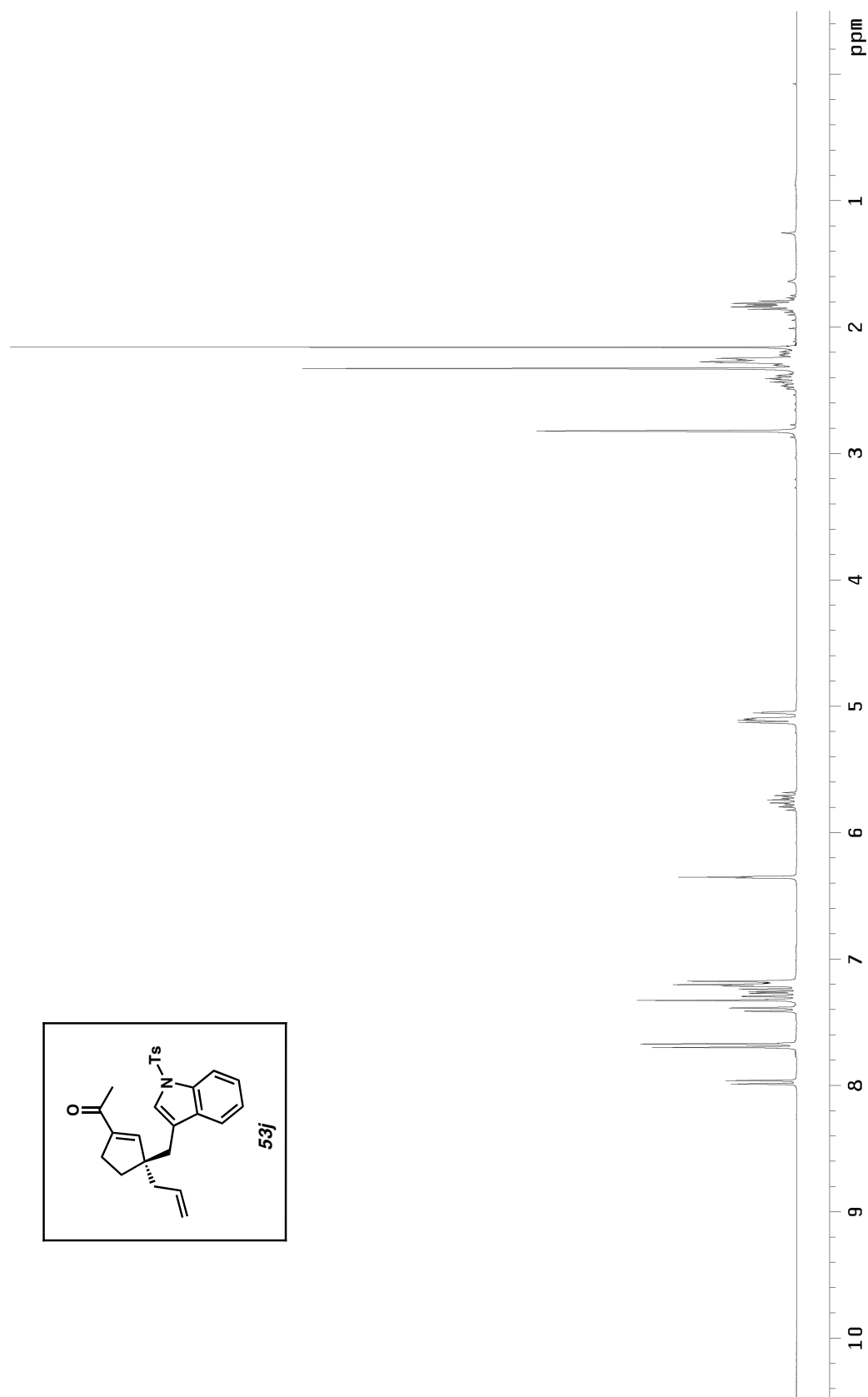


Figure A2.68.1. ^1H NMR (300 MHz, CDCl_3) of compound **53j**.

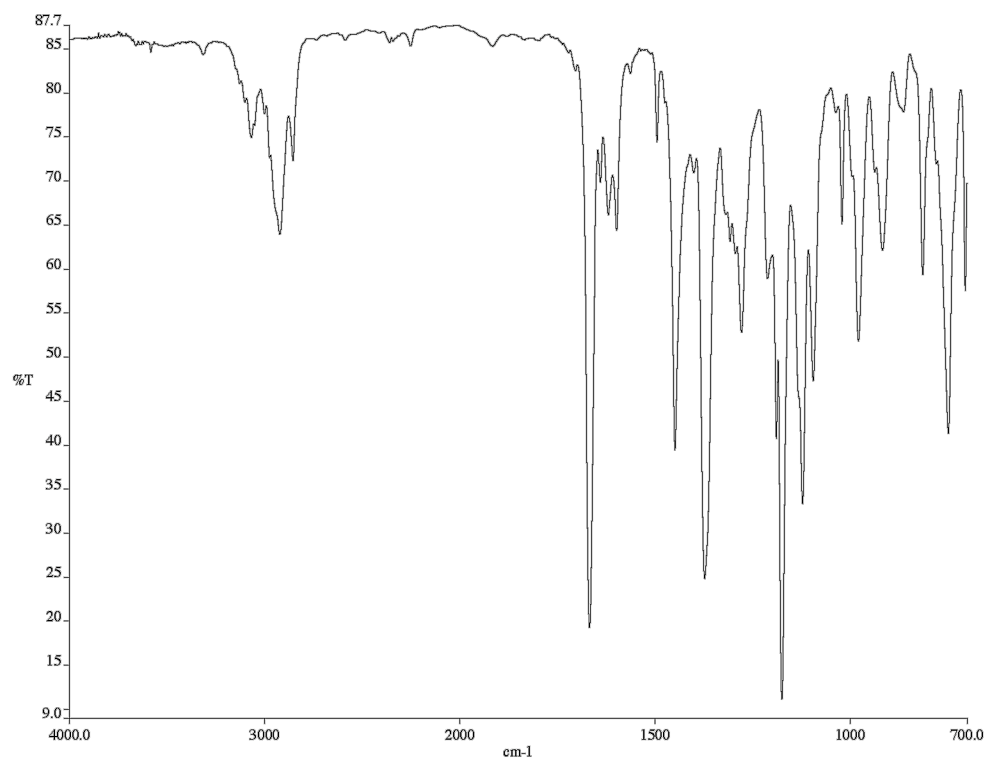


Figure A2.68.2. Infrared spectrum (thin film/NaCl) of compound **53j**.

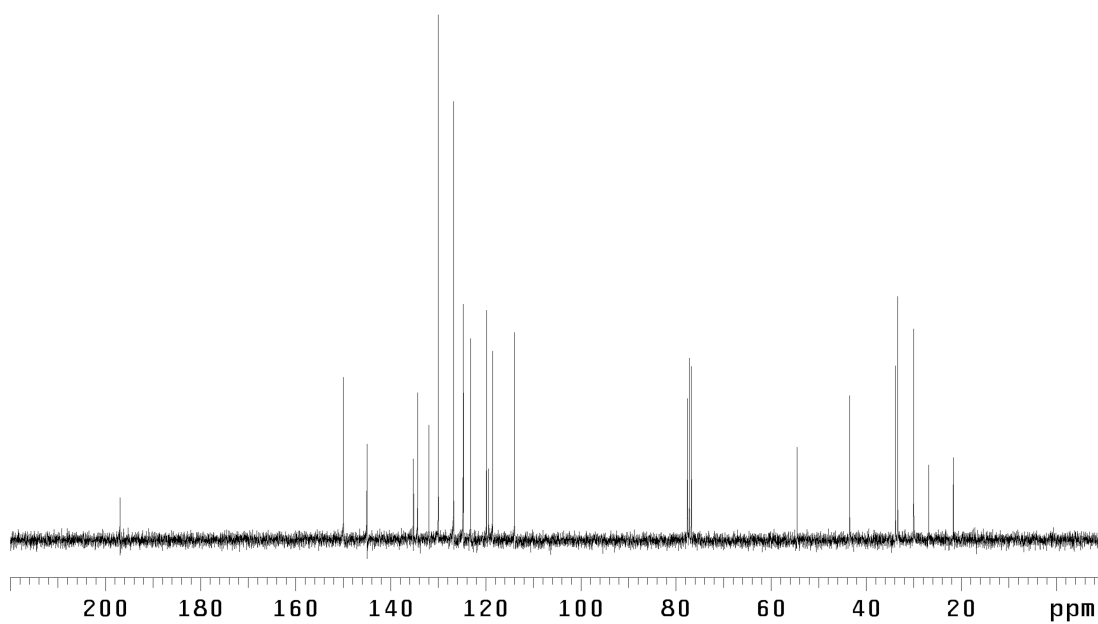


Figure A2.68.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53j**.

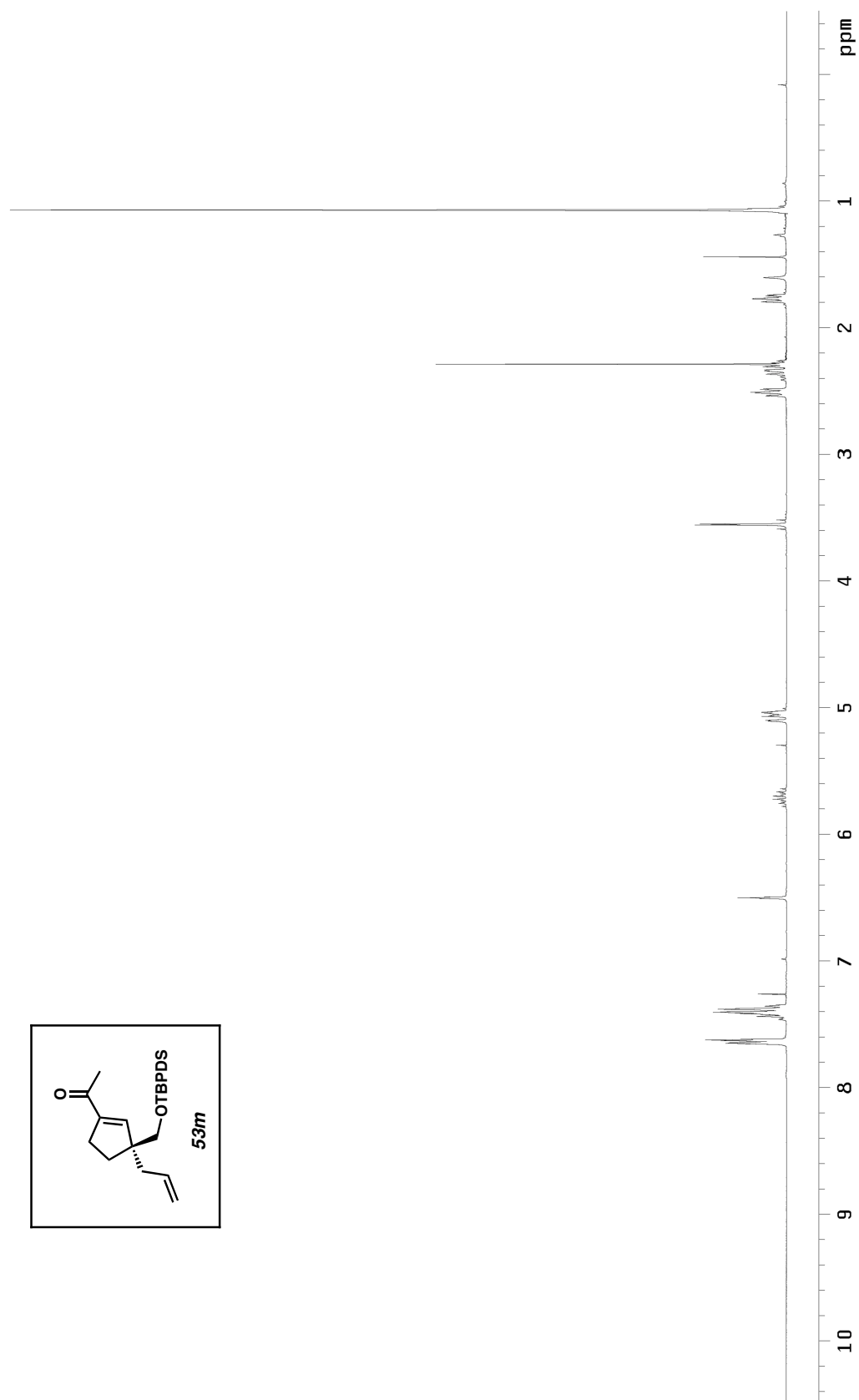


Figure A2.69.1. ¹H NMR (300 MHz, CDCl₃) of compound **53m**.

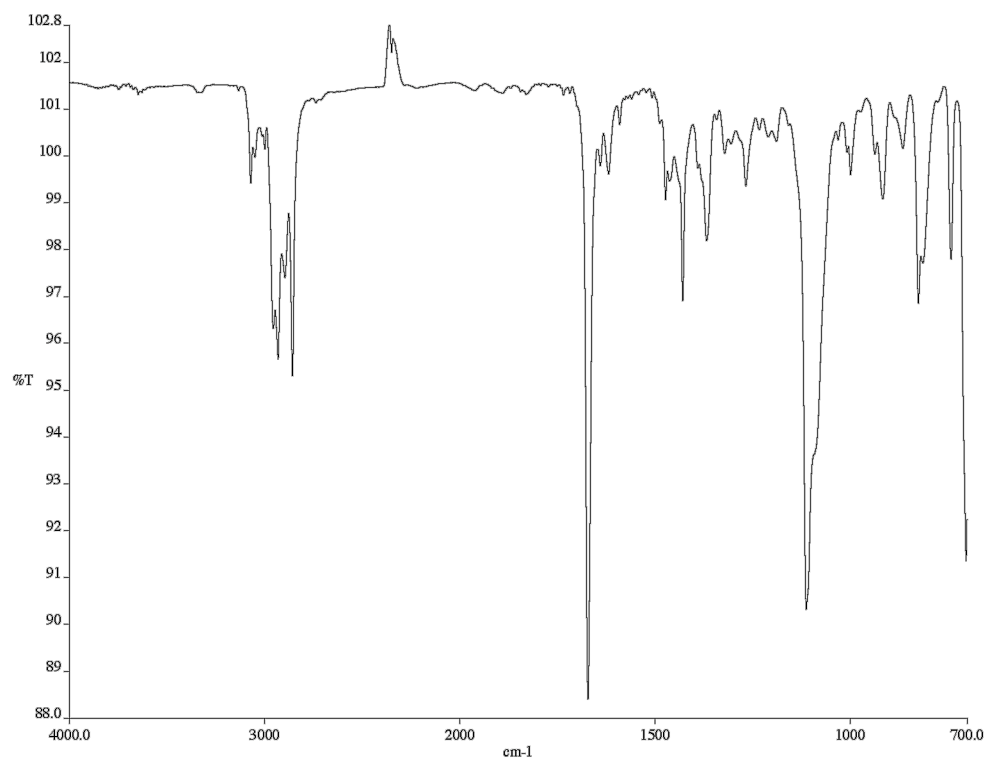


Figure A2.69.2. Infrared spectrum (thin film/NaCl) of compound **53m**.

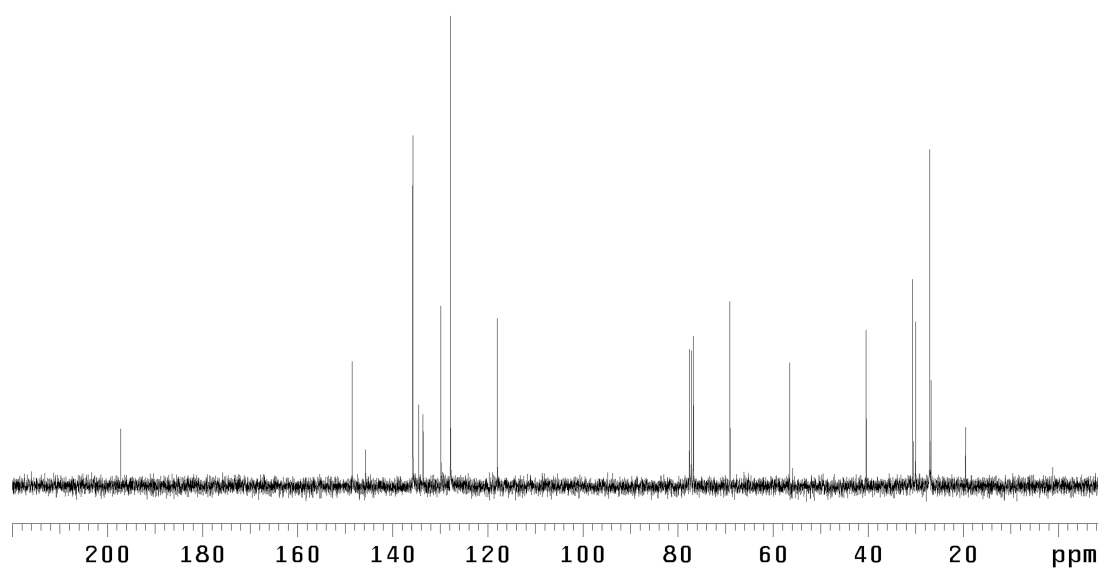
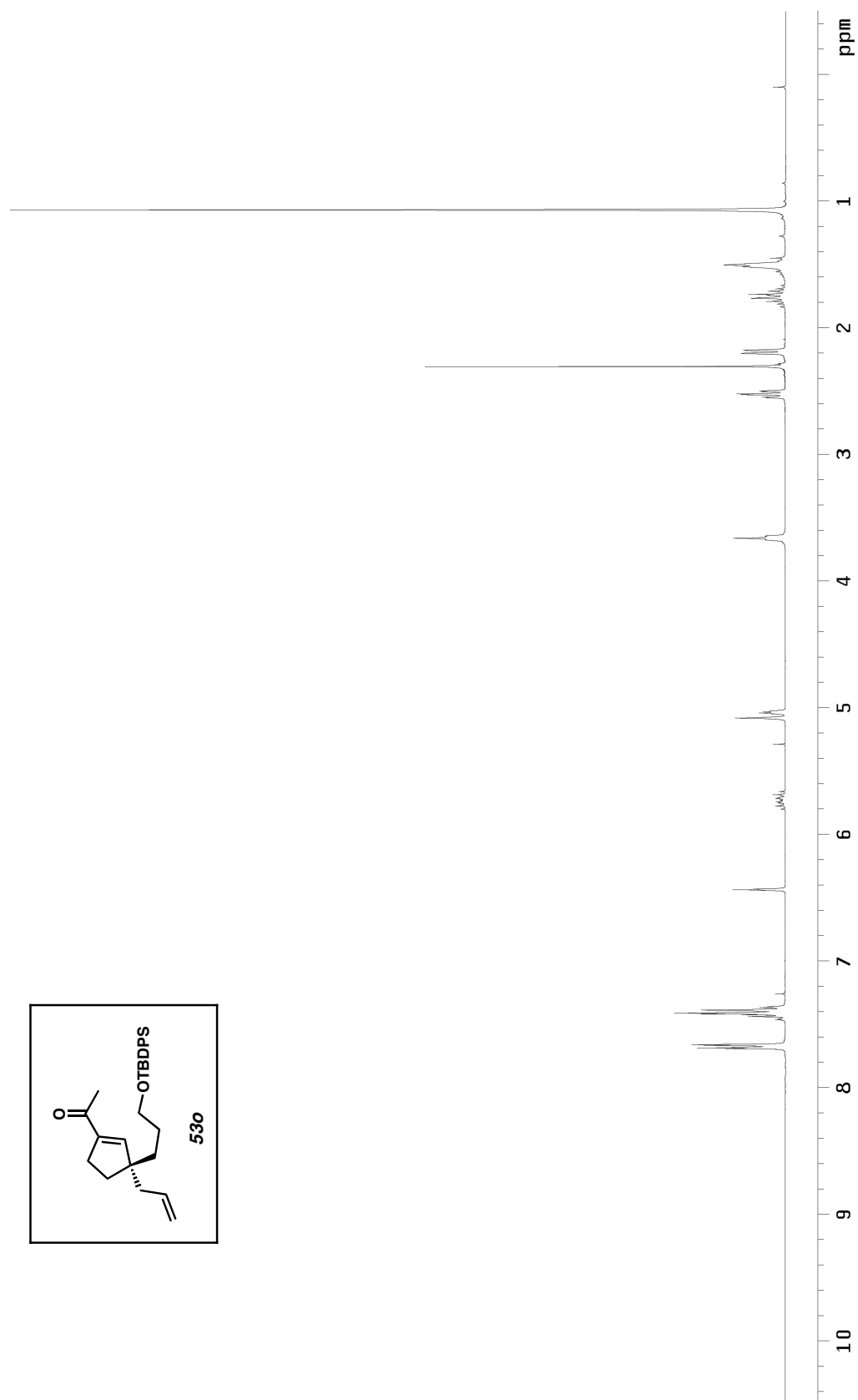


Figure A2.69.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53m**.

Figure A2.70.1. ^1H NMR (300 MHz, CDCl_3) of compound **53o**.

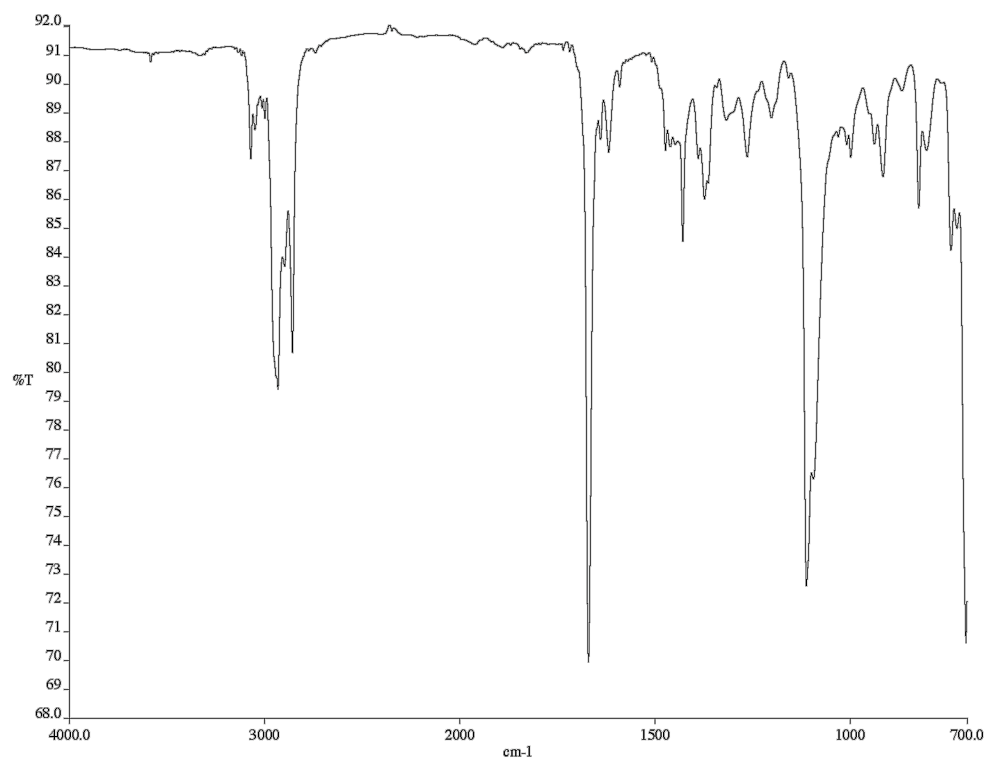


Figure A2.70.2. Infrared spectrum (thin film/NaCl) of compound **53o**.

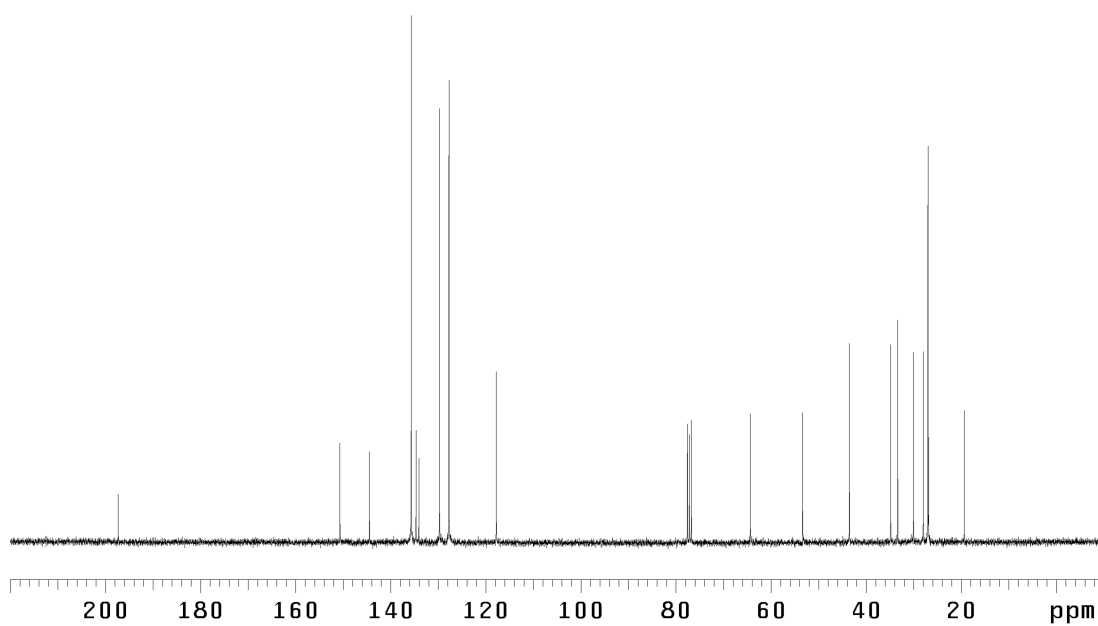


Figure A2.70.3. ¹³C NMR (75 MHz, CDCl₃) of compound **53o**.

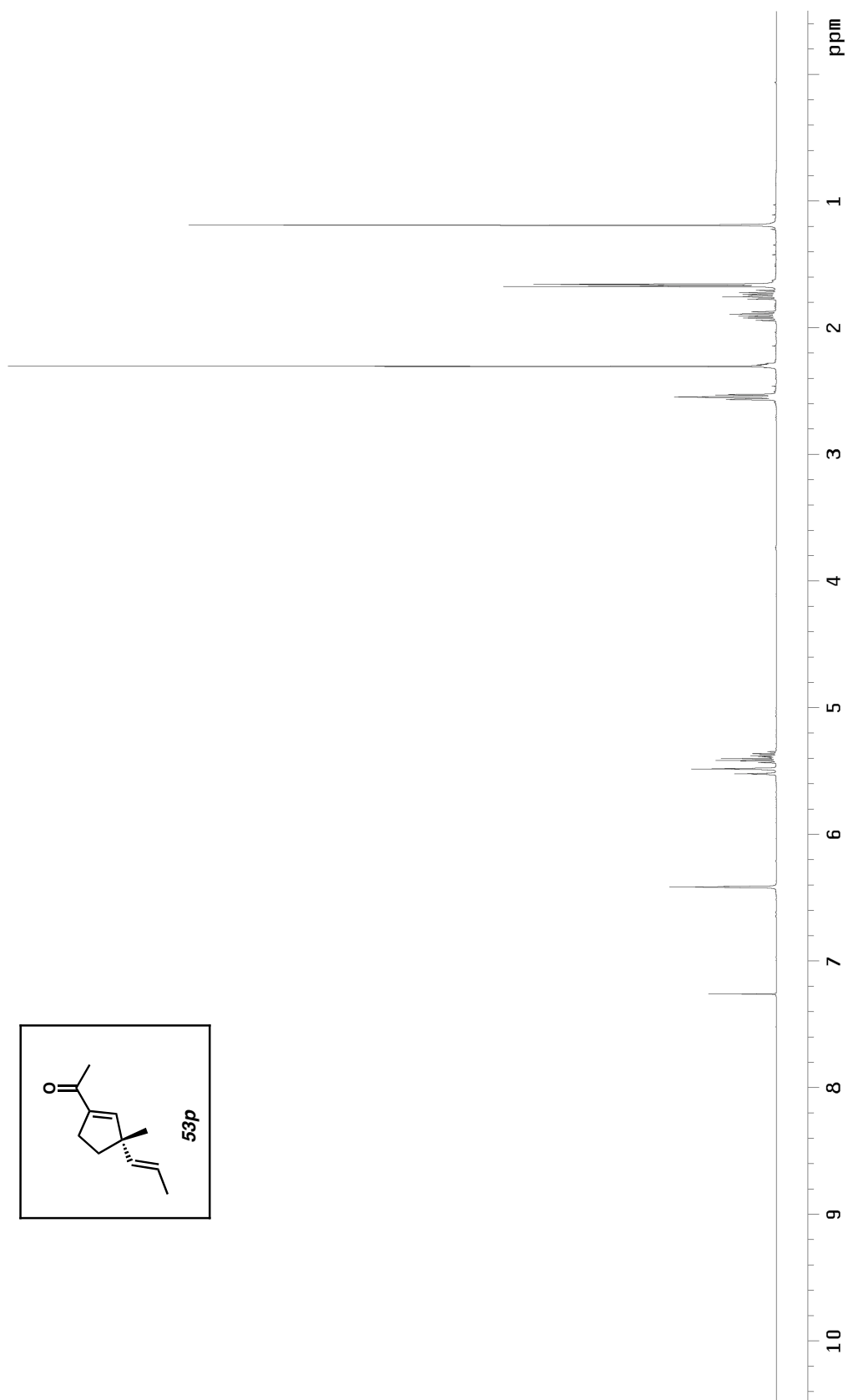


Figure A2.71.1. ^1H NMR (400 MHz, CDCl_3) of compound **53p**.

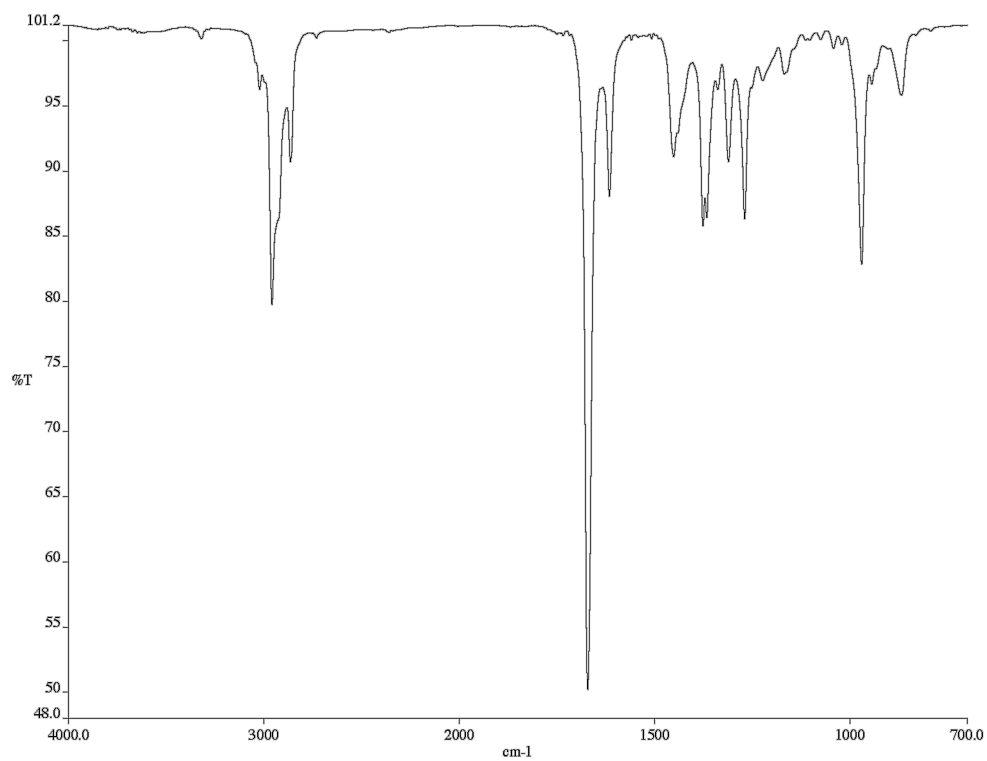


Figure A2.71.2. Infrared spectrum (thin film/NaCl) of compound **53p**.

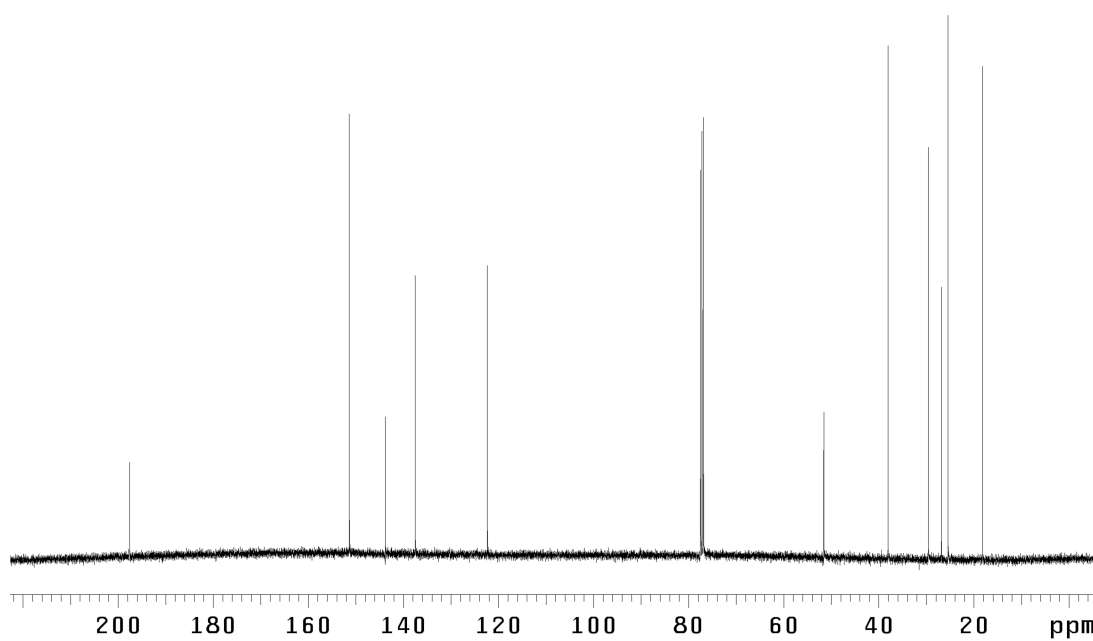


Figure A2.71.3. ¹³C NMR (100 MHz, CDCl₃) of compound **53p**.

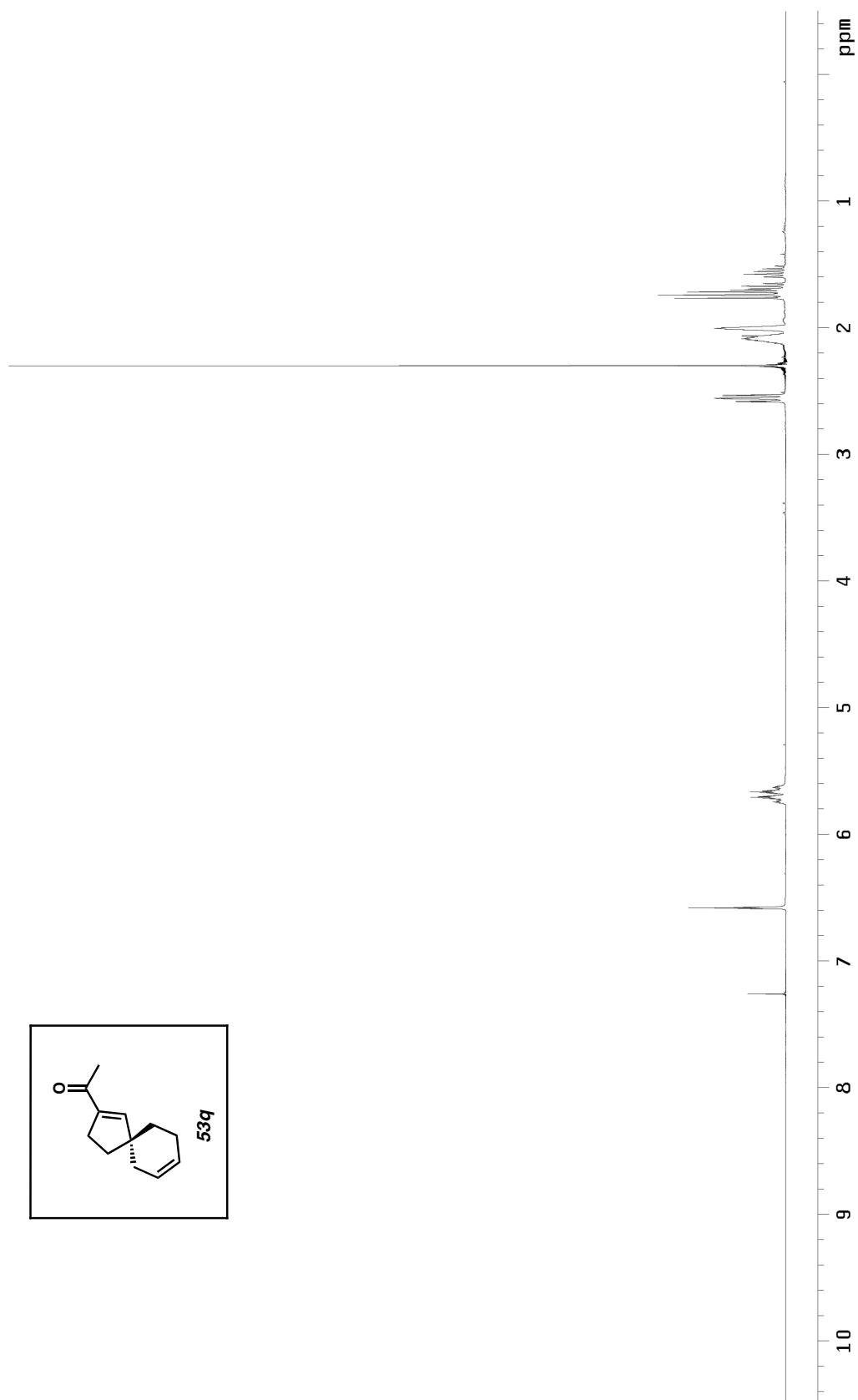


Figure A2.72.1. ^1H NMR (300 MHz, CDCl_3) of compound **53q**.

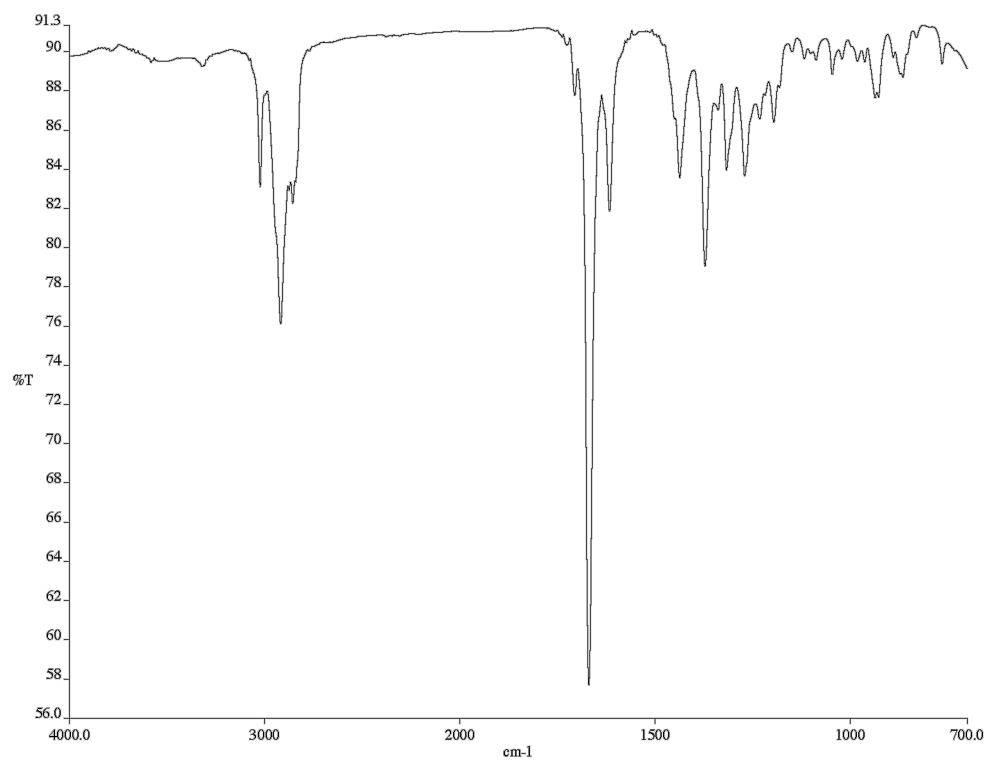


Figure A2.72.2. Infrared spectrum (thin film/NaCl) of compound **53q**.

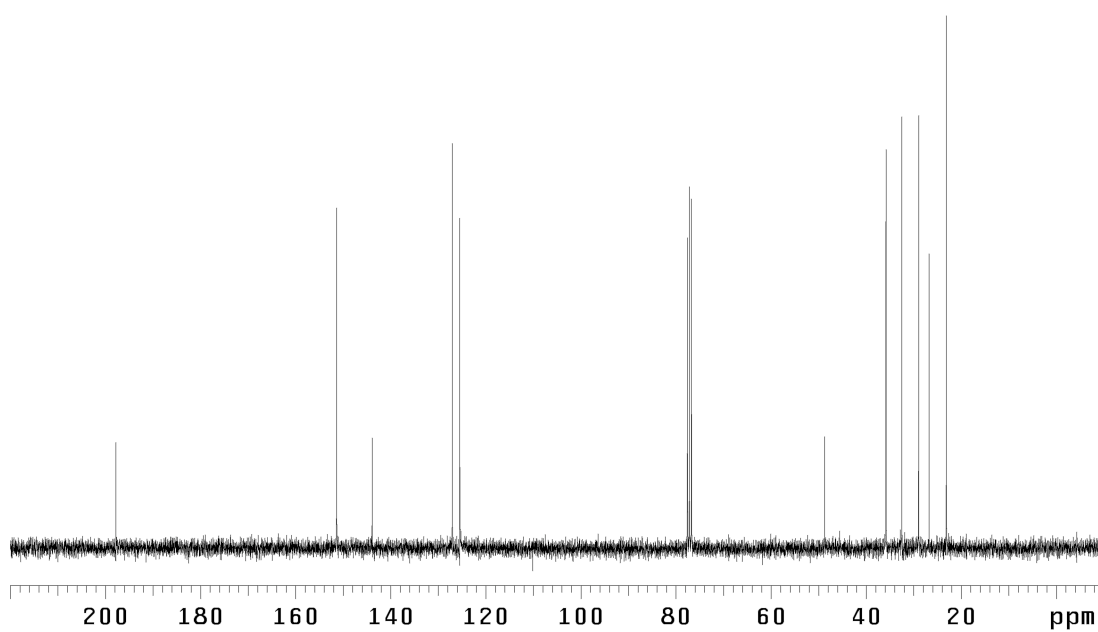


Figure A2.72.3. ^{13}C NMR (75 MHz, CDCl_3) of compound **53q**.

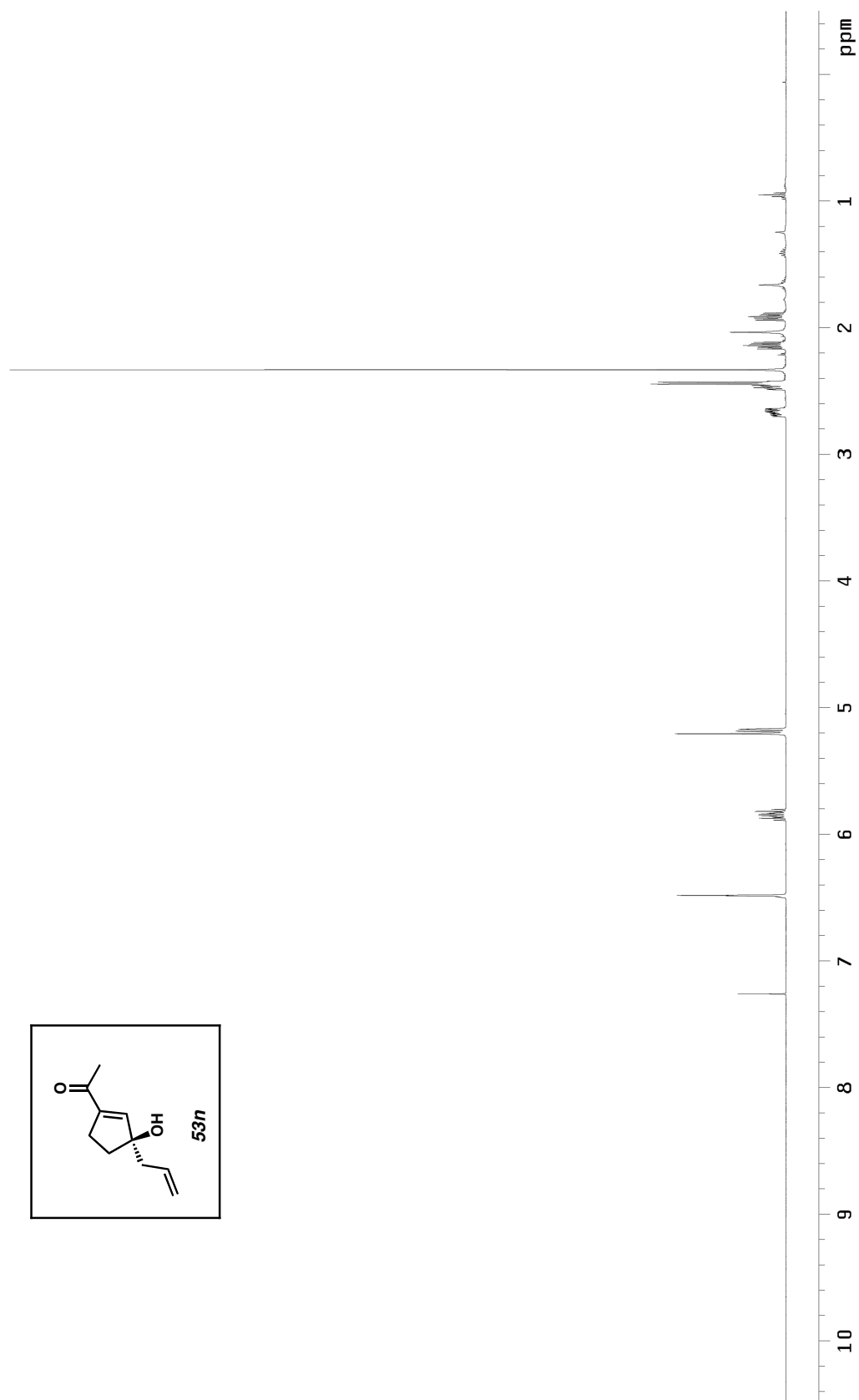


Figure A2.73.1. ^1H NMR (500 MHz, CDCl_3) of compound **53n**.

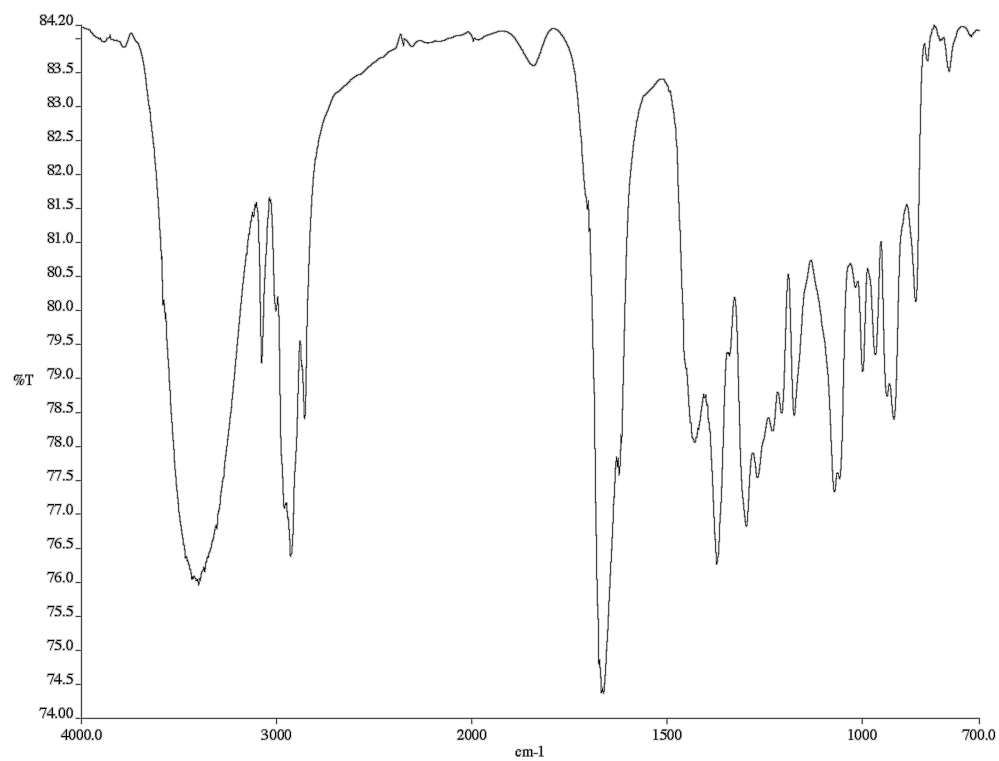


Figure A2.73.2. Infrared spectrum (thin film/NaCl) of compound **53n**.

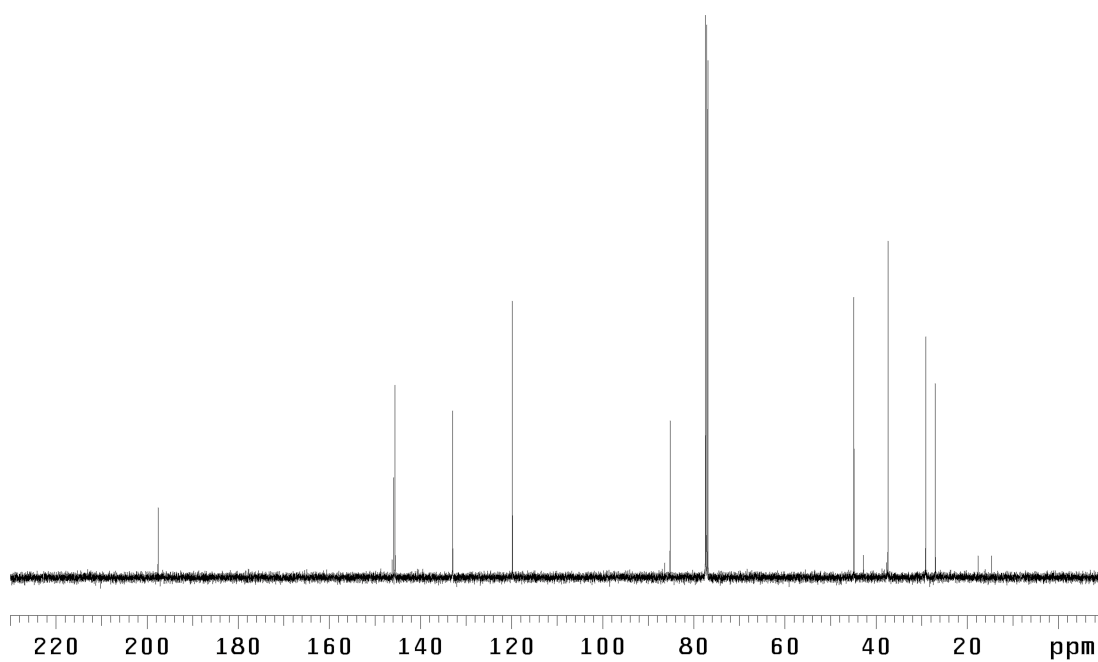


Figure A2.73.3. ¹³C NMR (125 MHz, CDCl₃) of compound **53n**.

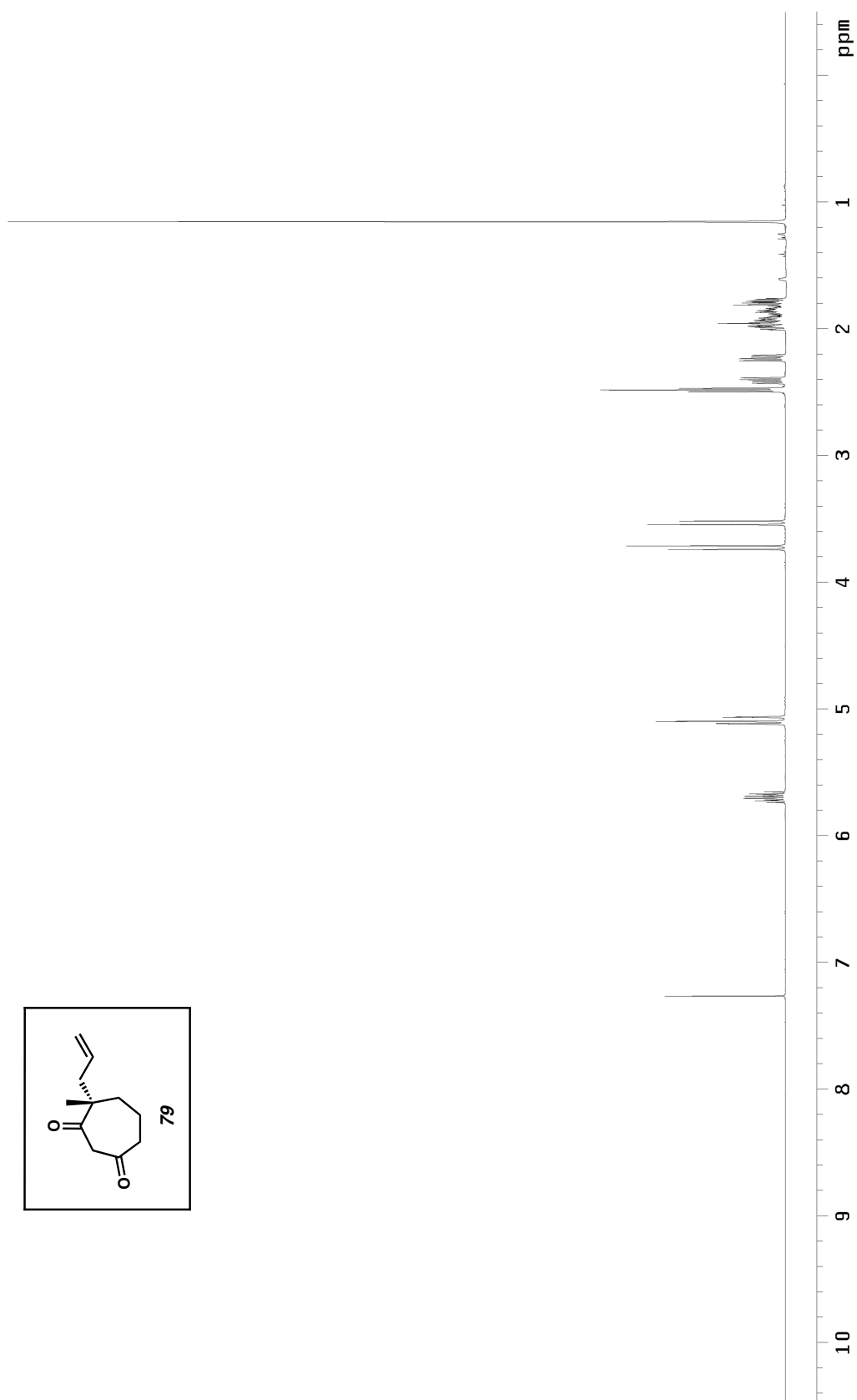


Figure A2.74.1. ^1H NMR (500 MHz, CDCl_3) of compound **79**.

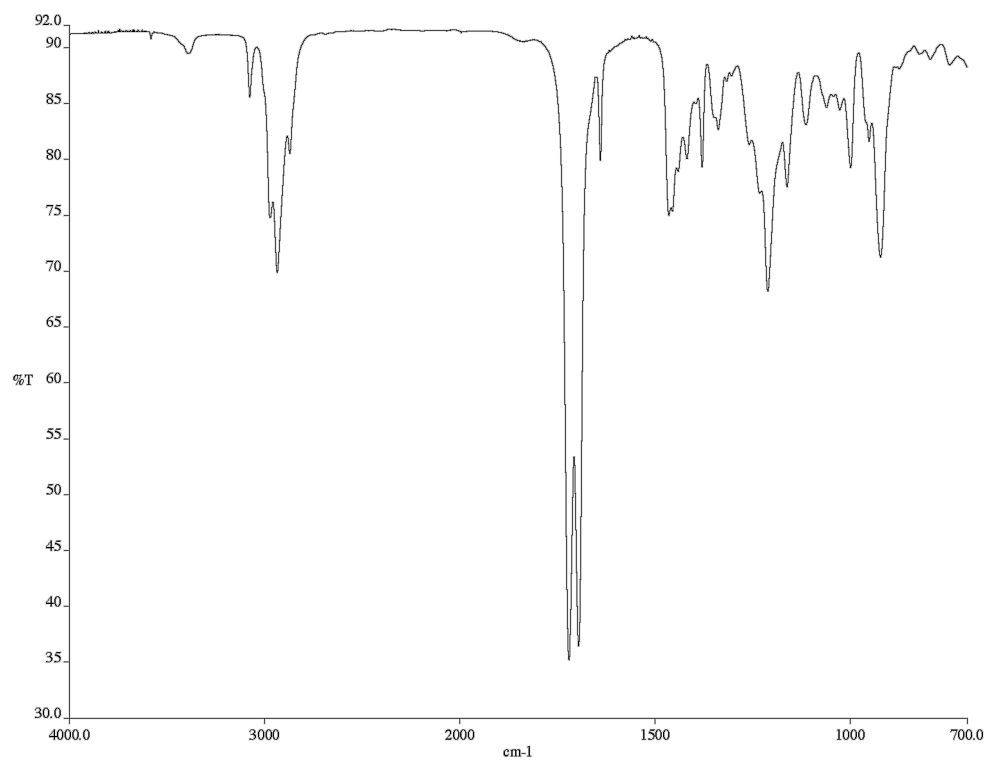


Figure A2.74.2. Infrared spectrum (thin film/NaCl) of compound **79**.

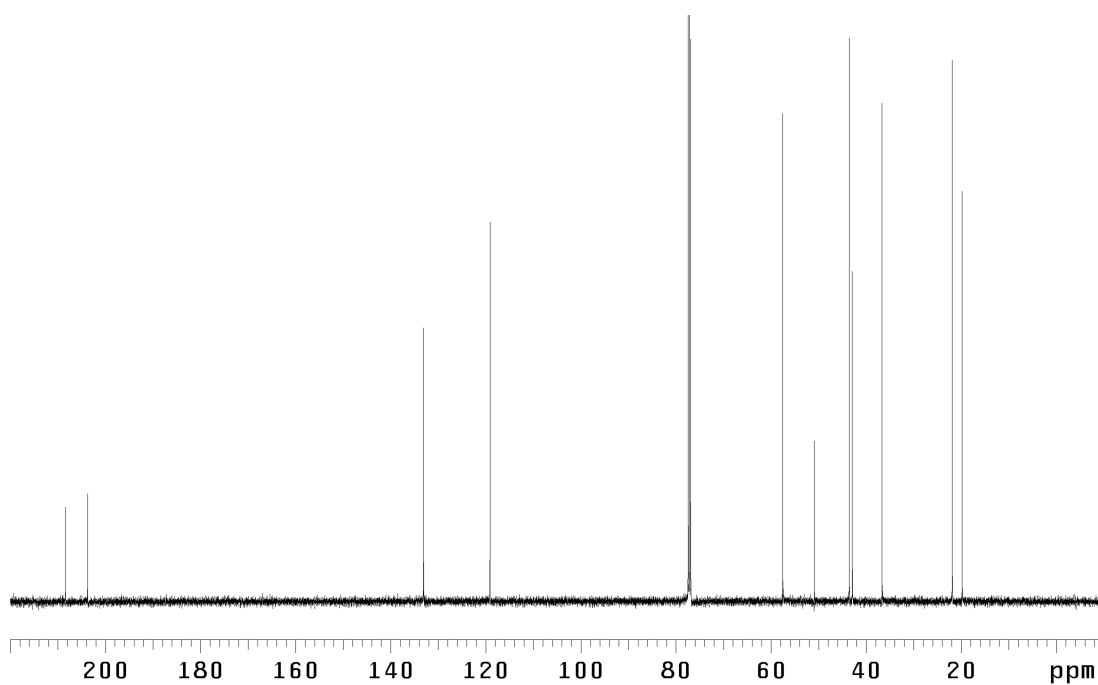
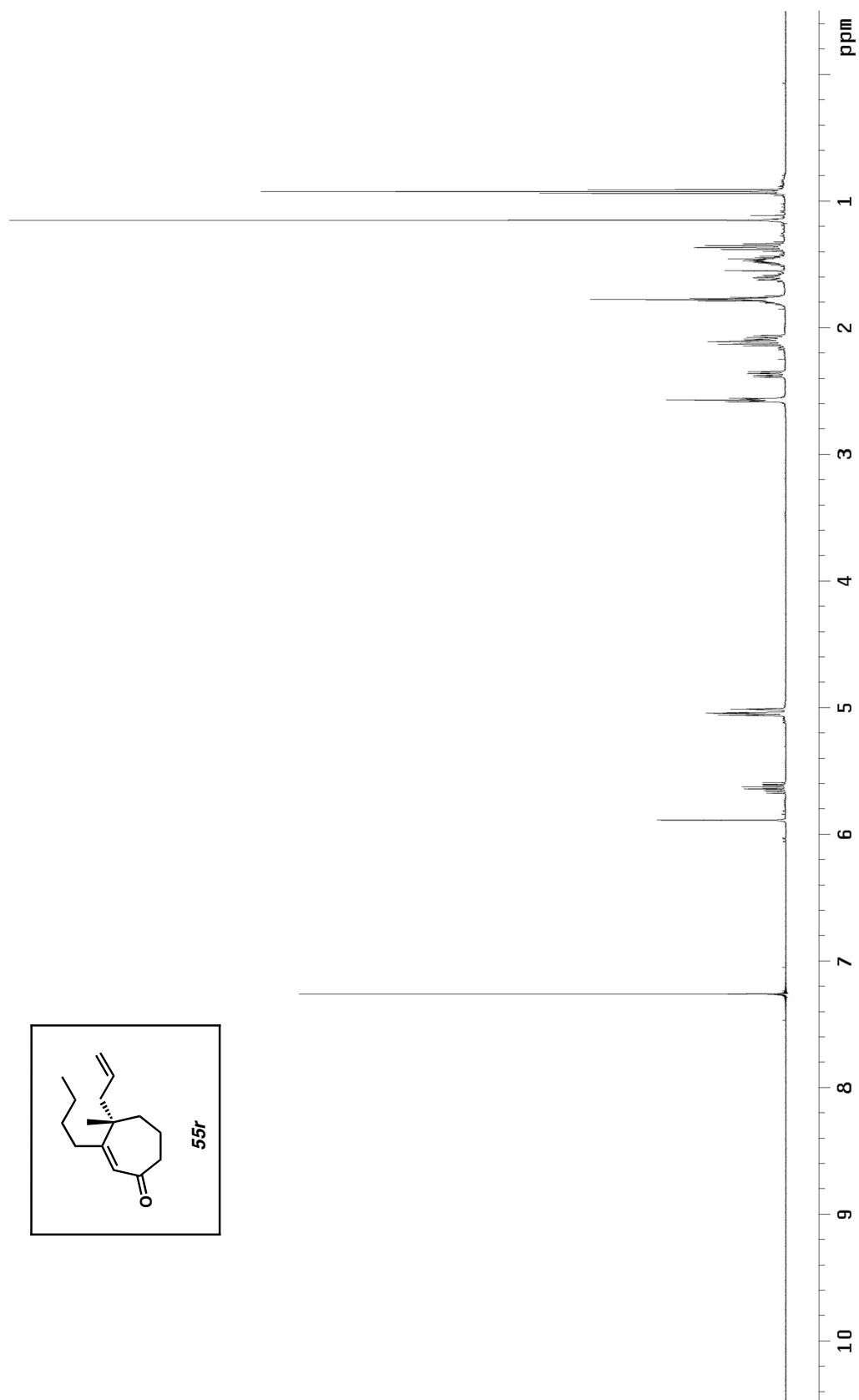


Figure A2.74.3. ^{13}C NMR (125 MHz, CDCl_3) of compound **79**.

Figure A2.75. 1. ^1H NMR (500 MHz, CDCl_3) of compound **55r**.

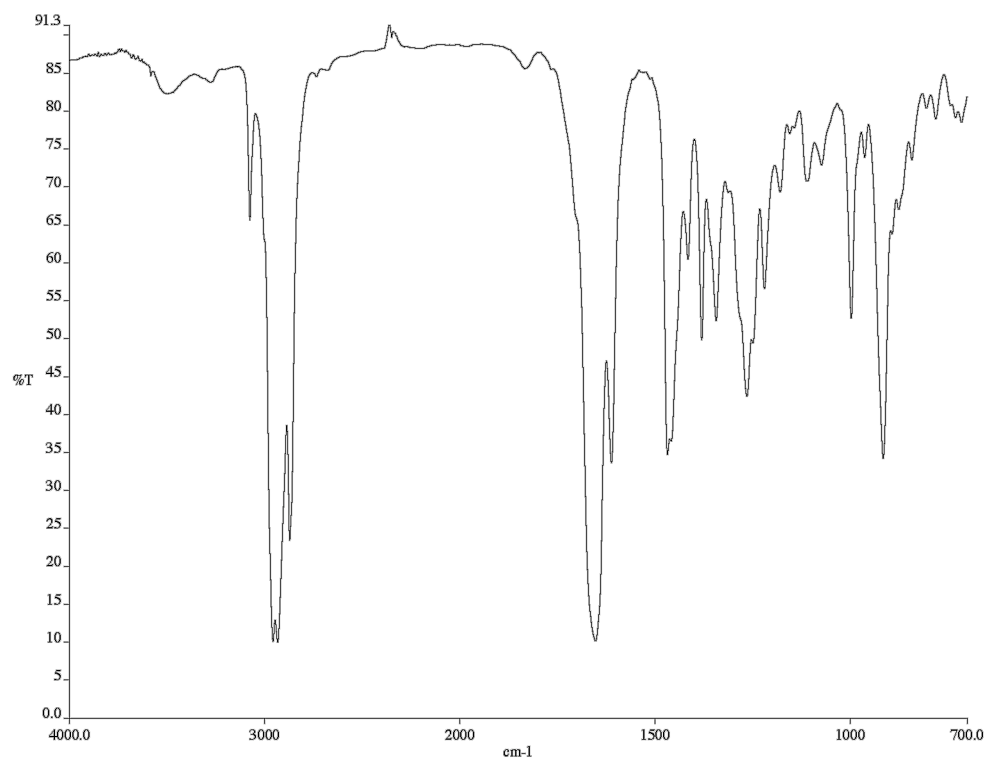


Figure A2.75.2. Infrared spectrum (thin film/NaCl) of compound **55r**.

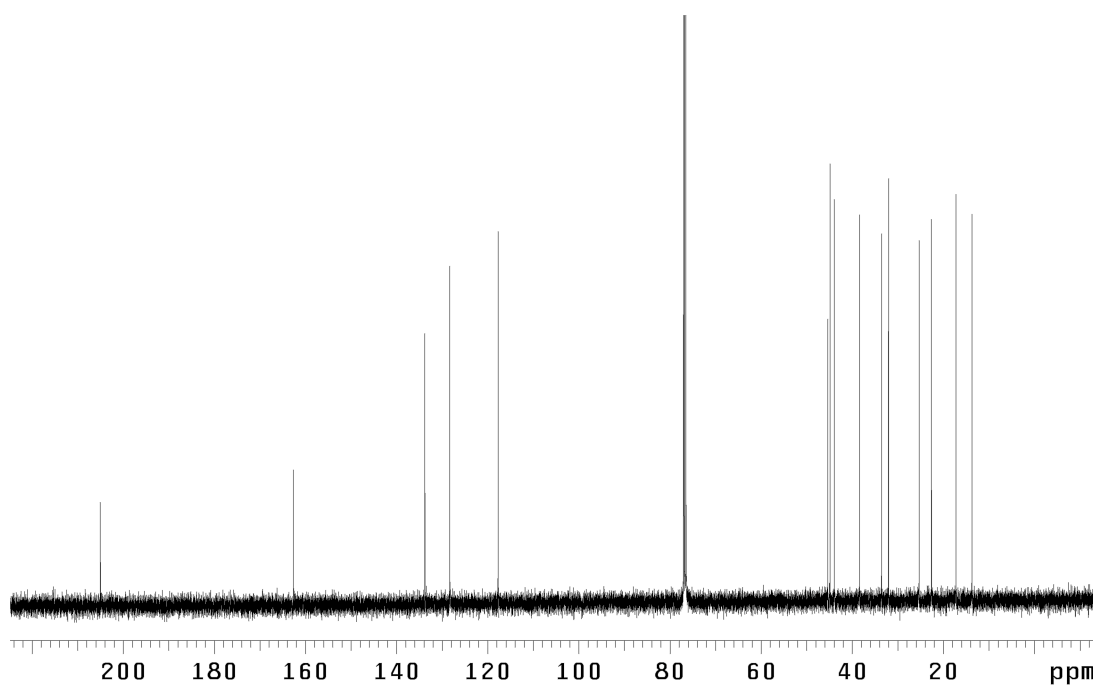


Figure A2.75.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55r**.

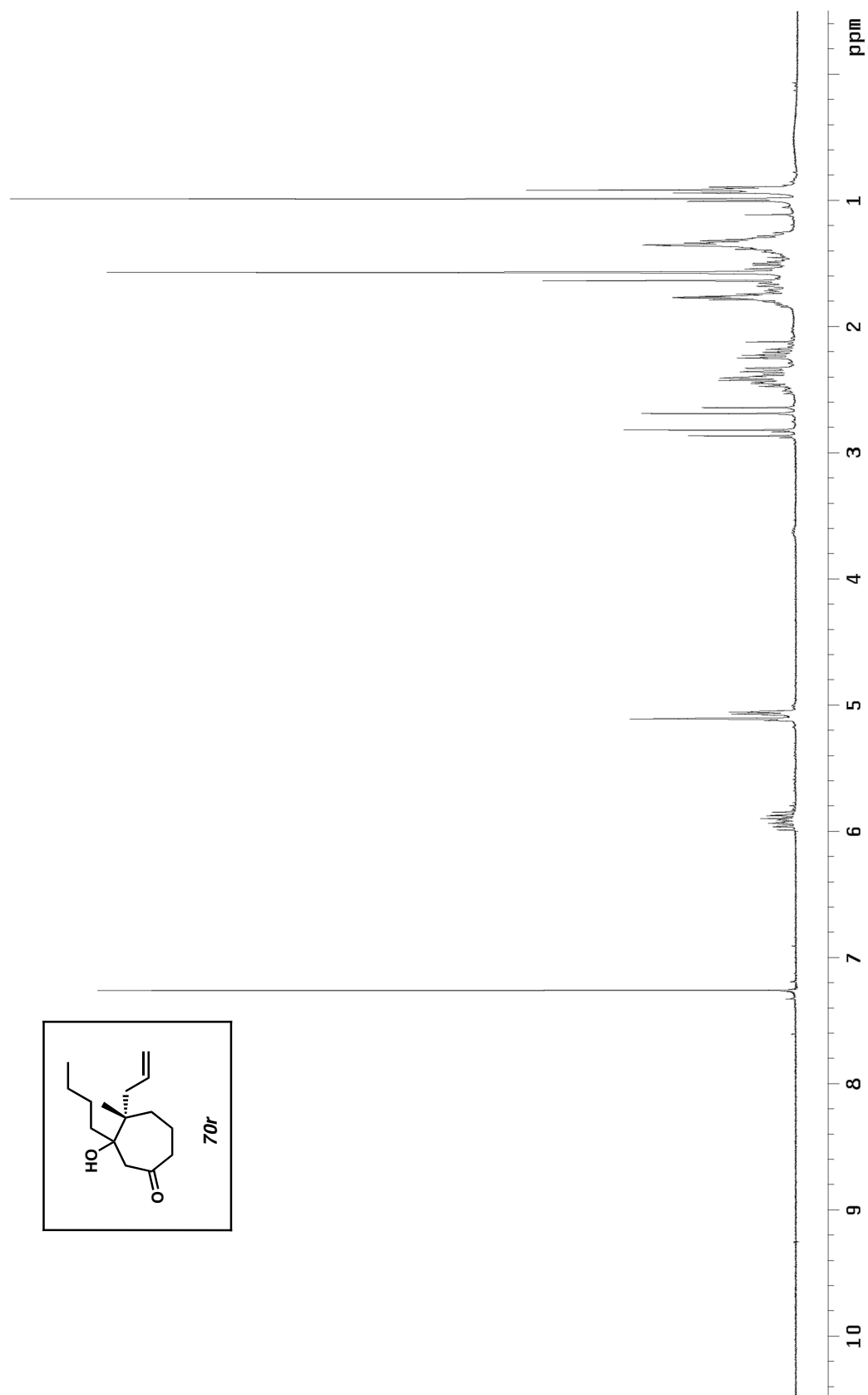


Figure A2.76. 1. ^1H NMR (500 MHz, CDCl_3) of compound **70r**.

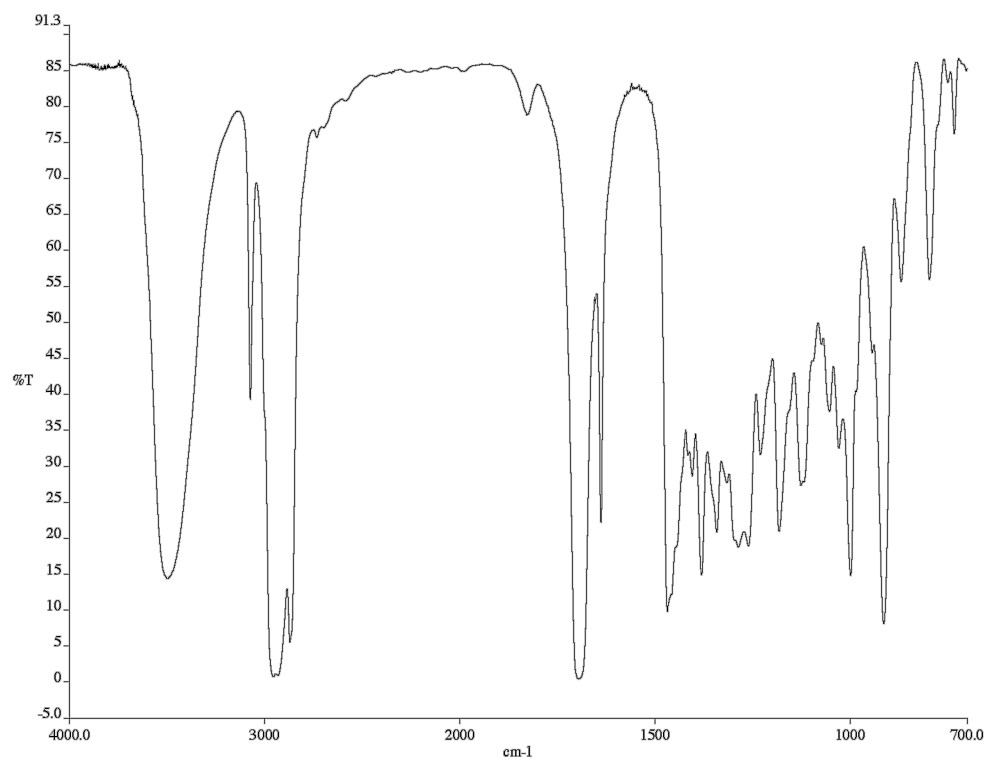


Figure A2.76.2. Infrared spectrum (thin film/NaCl) of compound **70r**.

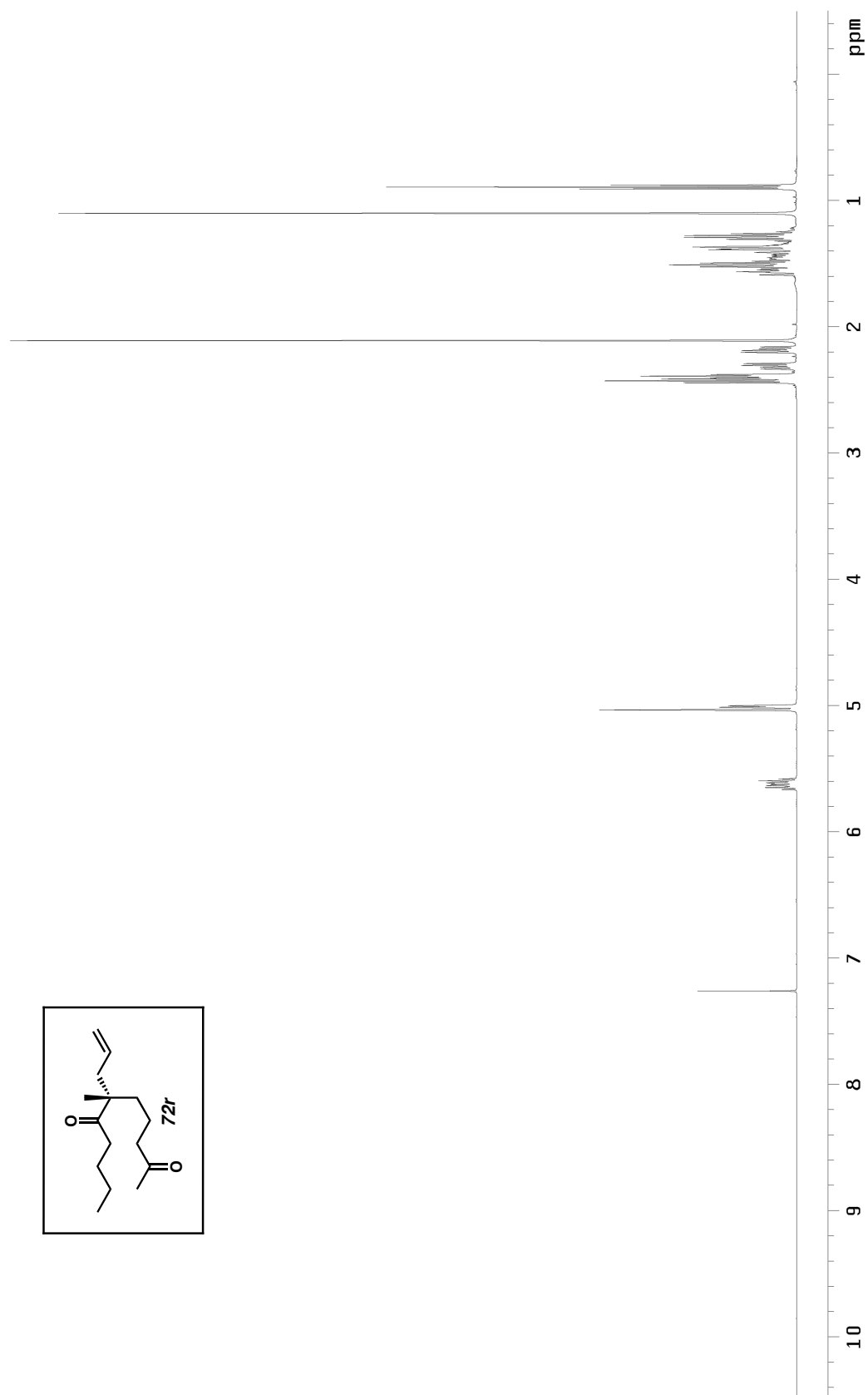


Figure A2.77.1. ^1H NMR (500 MHz, CDCl_3) of compound **72r**.

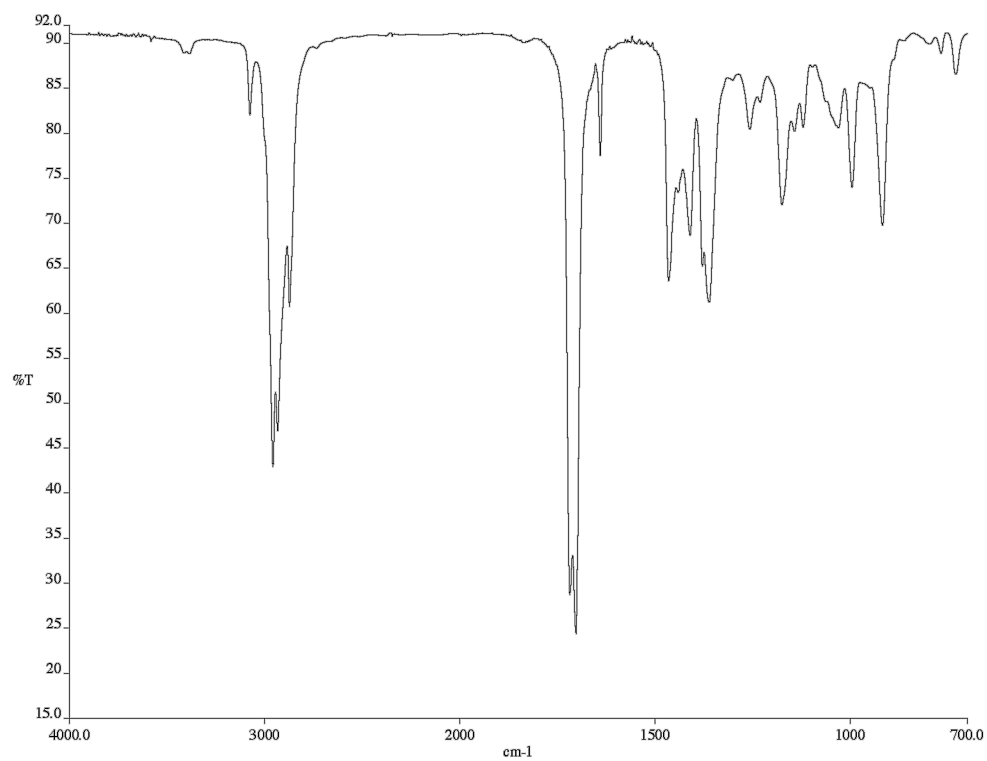


Figure A2.77.2. Infrared spectrum (thin film/NaCl) of compound **72r**.

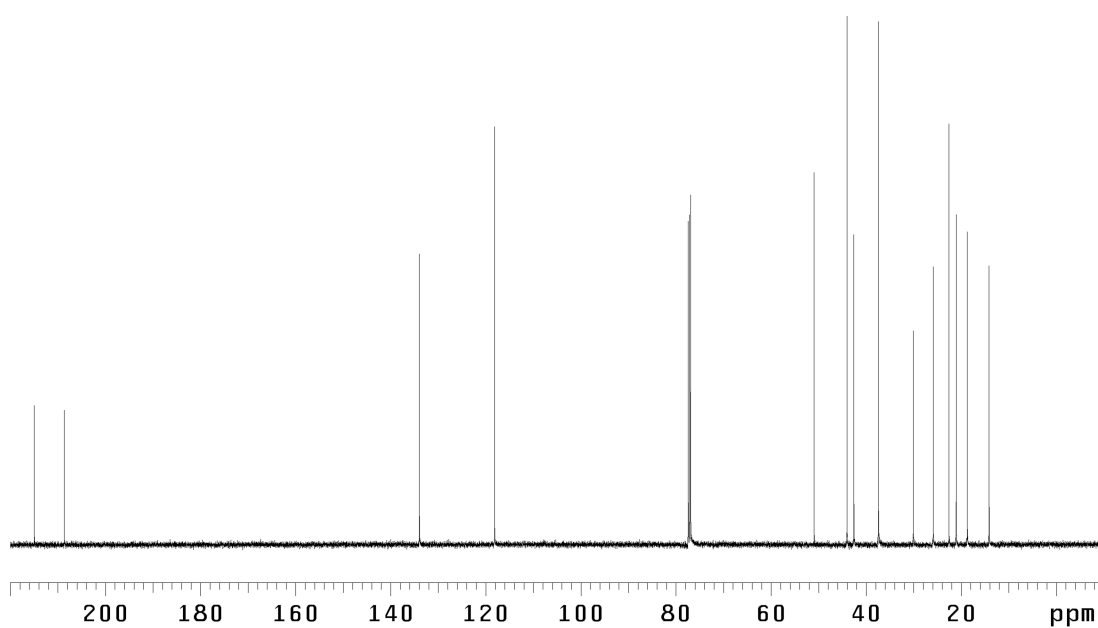
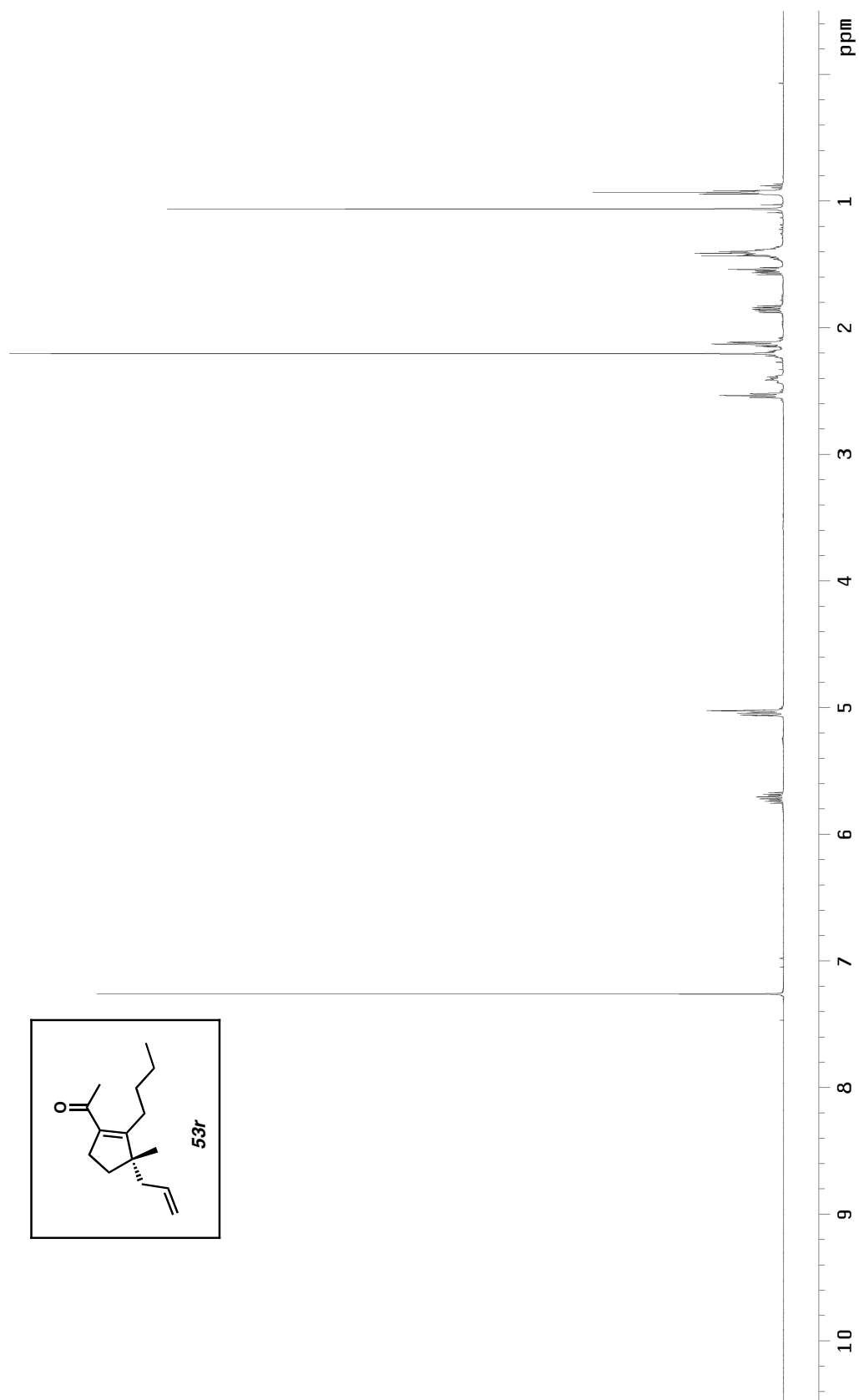


Figure A2.77.3. ¹³C NMR (125 MHz, CDCl₃) of compound **72r**.

Figure A2.78. 1. ^1H NMR (500 MHz, CDCl_3) of compound **53r**.

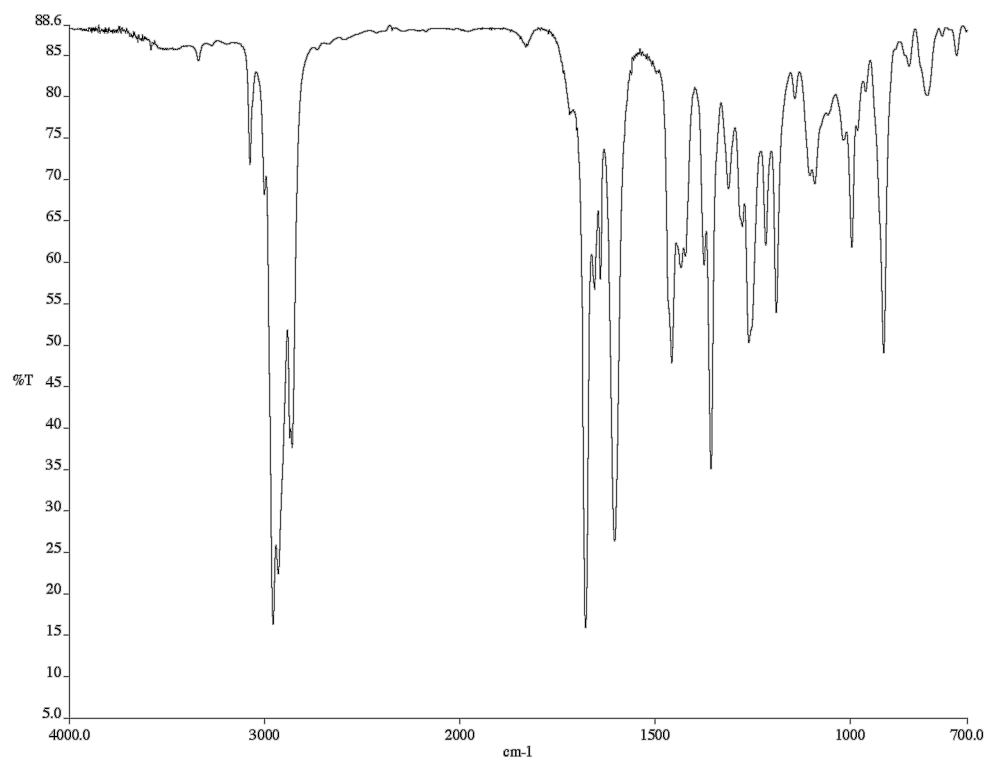


Figure A2.78.2. Infrared spectrum (thin film/NaCl) of compound **53r**.

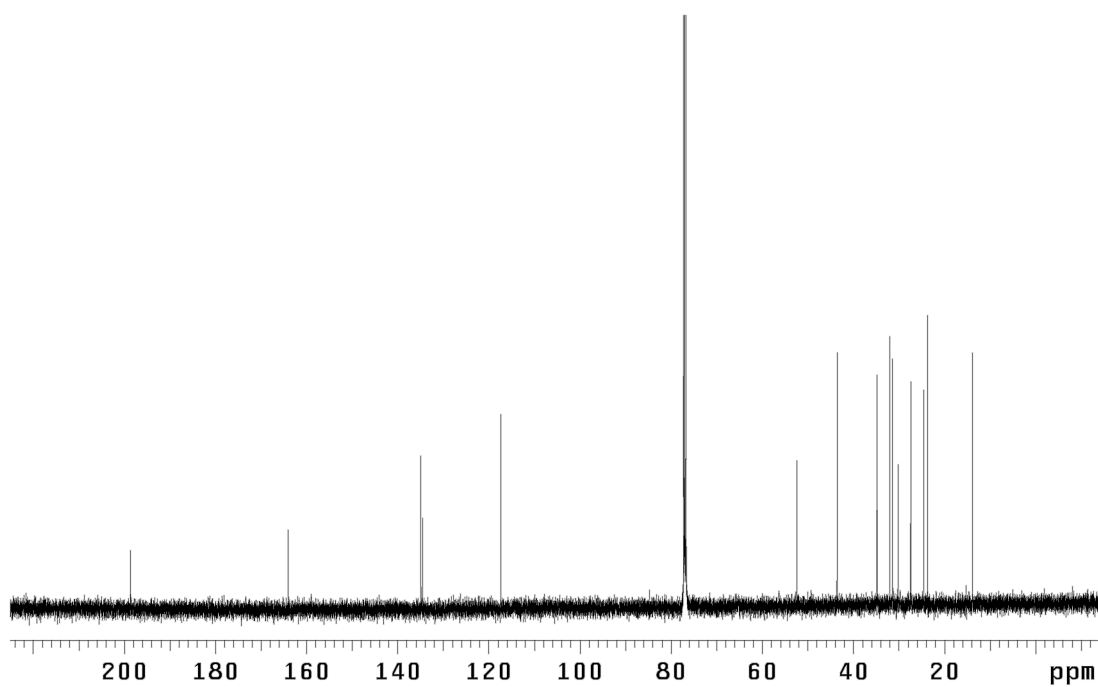
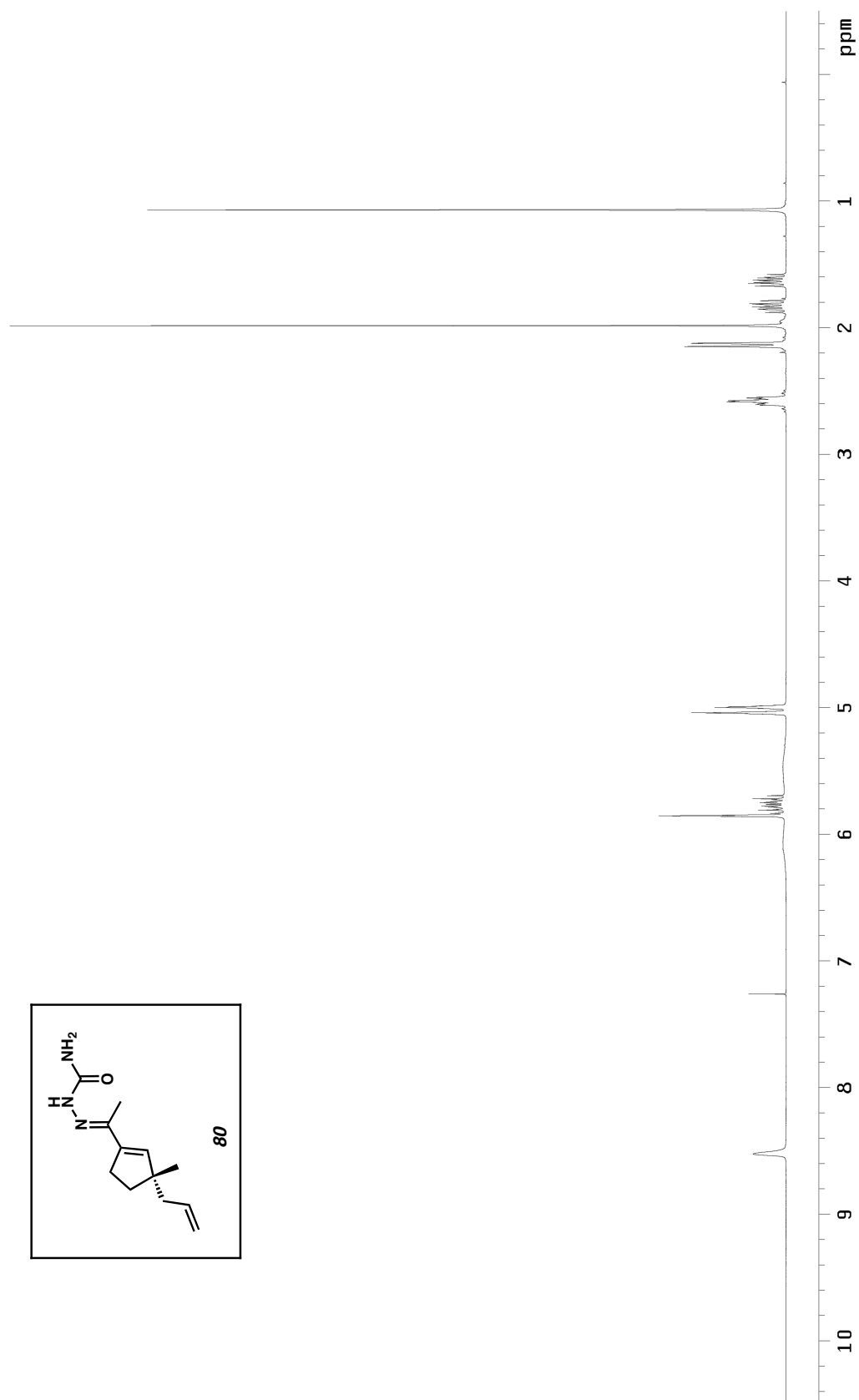


Figure A2.78.3. ¹³C NMR (125 MHz, CDCl₃) of compound **53r**.

Figure A2.79.1. ^1H NMR (300 MHz, CDCl_3) of compound **80**.

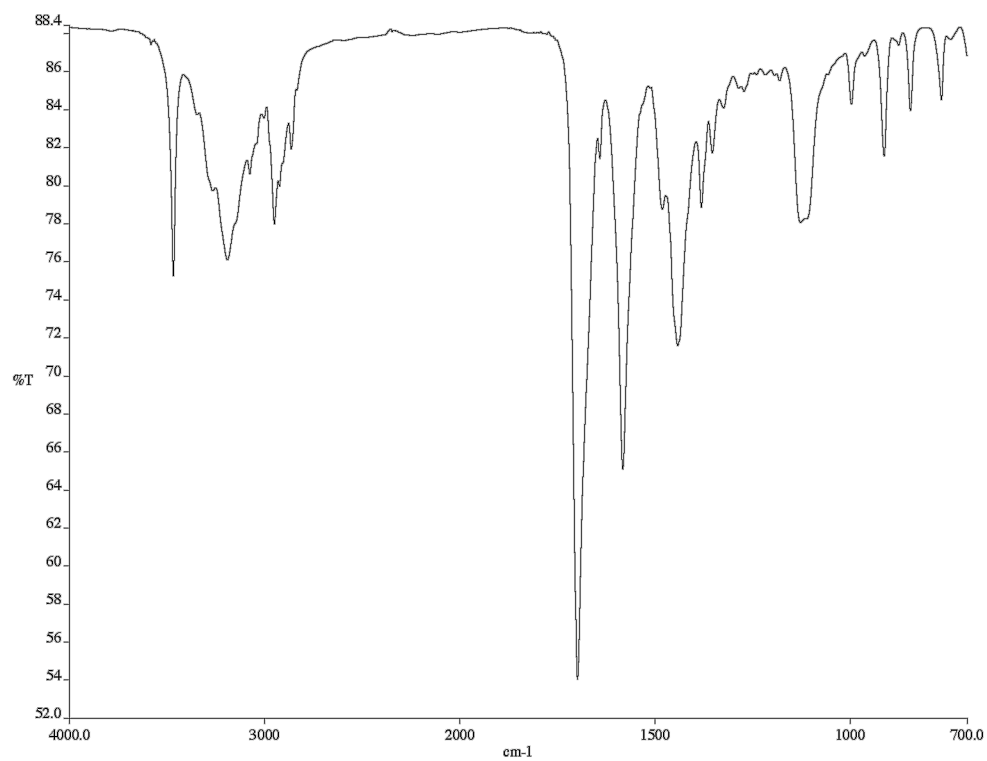


Figure A2.79.2. Infrared spectrum (thin film/NaCl) of compound **80**.

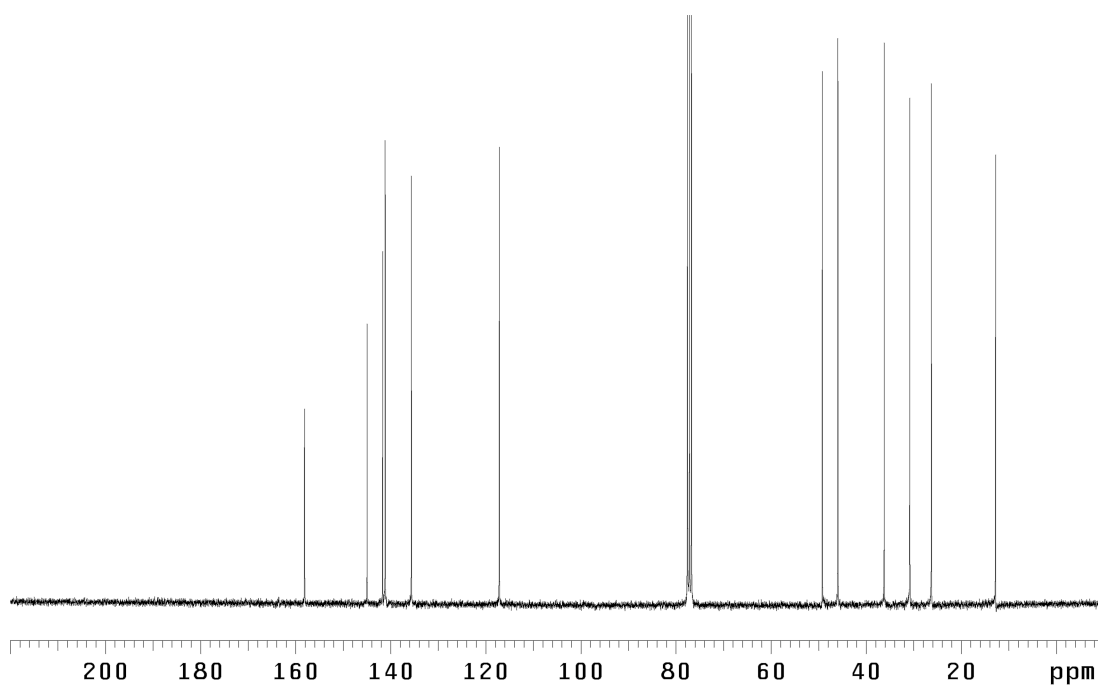
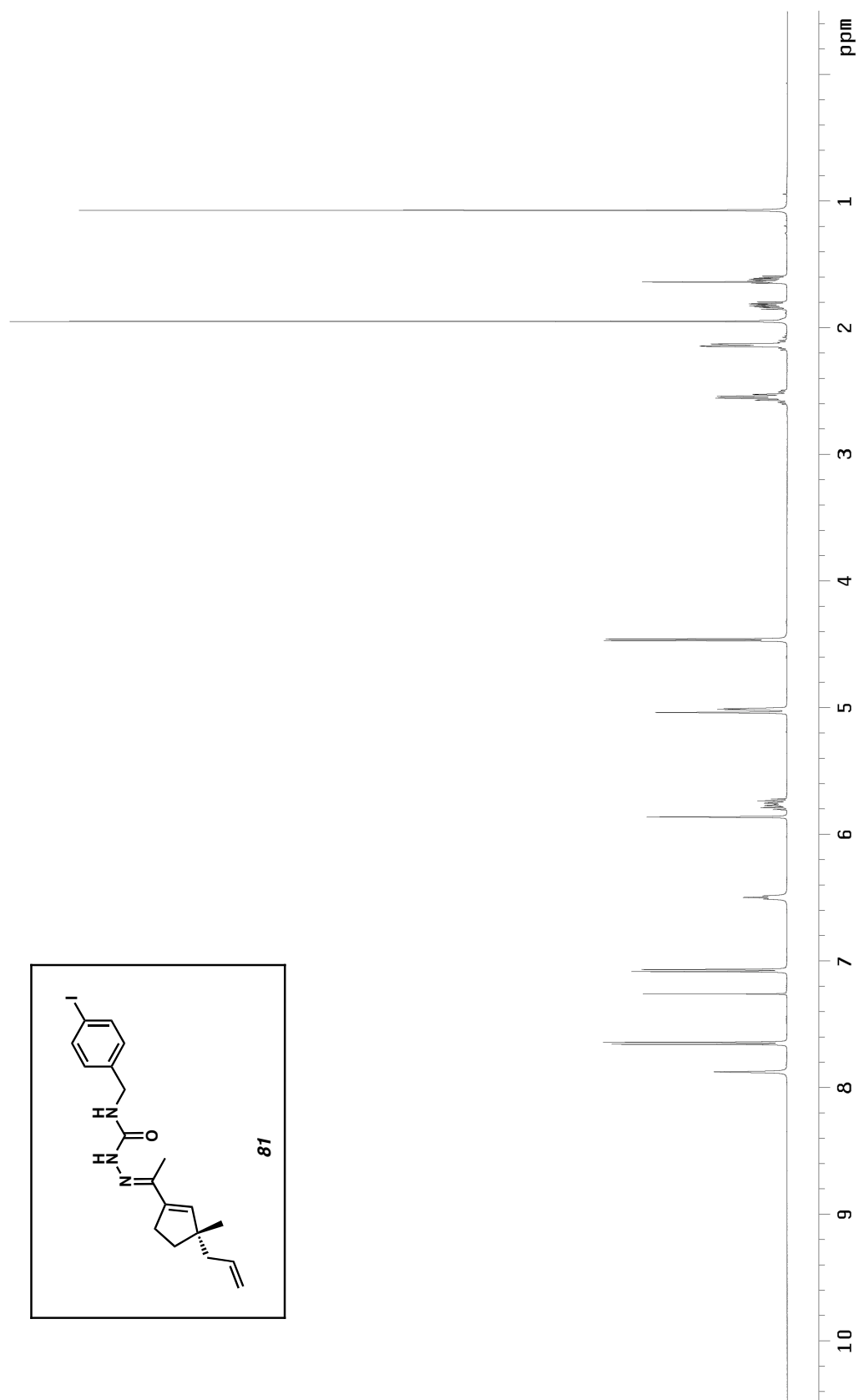


Figure A2.79.3. ¹³C NMR (75 MHz, CDCl₃) of compound **80**.

Figure A2.80.1. ^1H NMR (500 MHz, CDCl_3) of compound **81**.

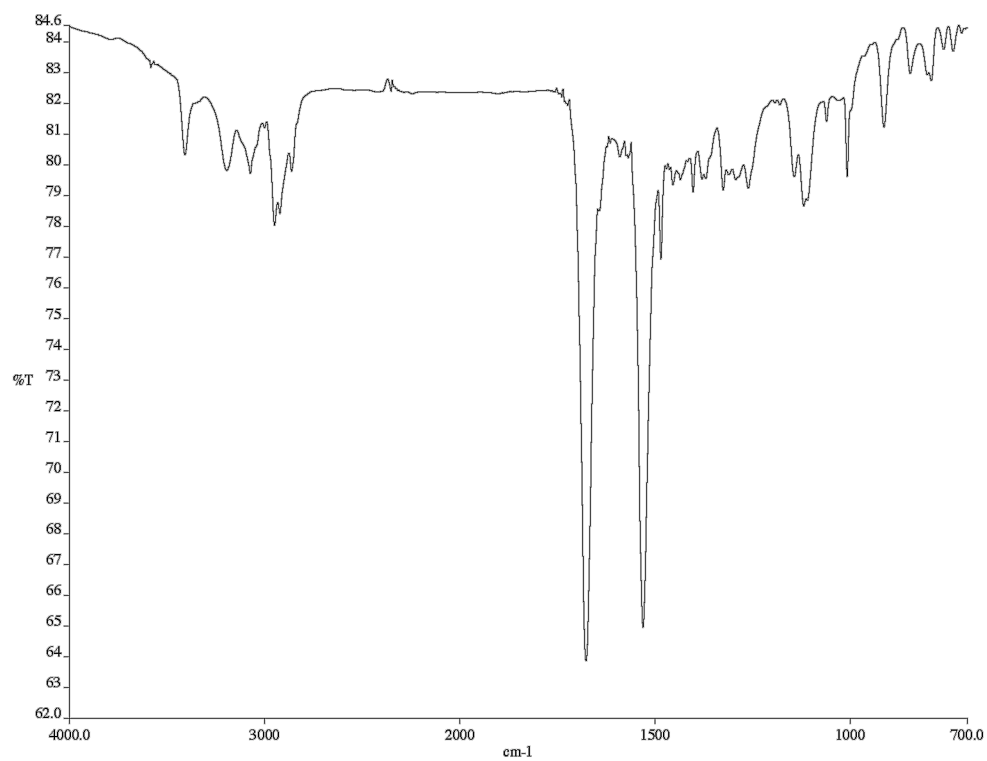


Figure A2.80.2. Infrared spectrum (thin film/NaCl) of compound **81**.

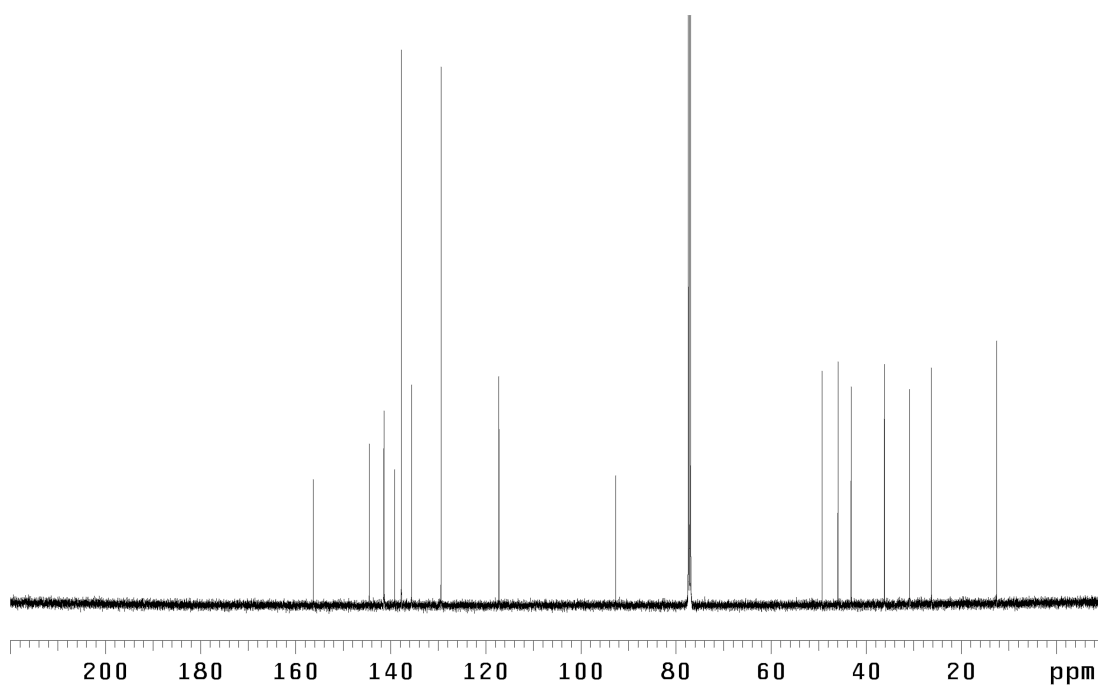


Figure A2.80.3. ¹³C NMR (125 MHz, CDCl₃) of compound **81**.

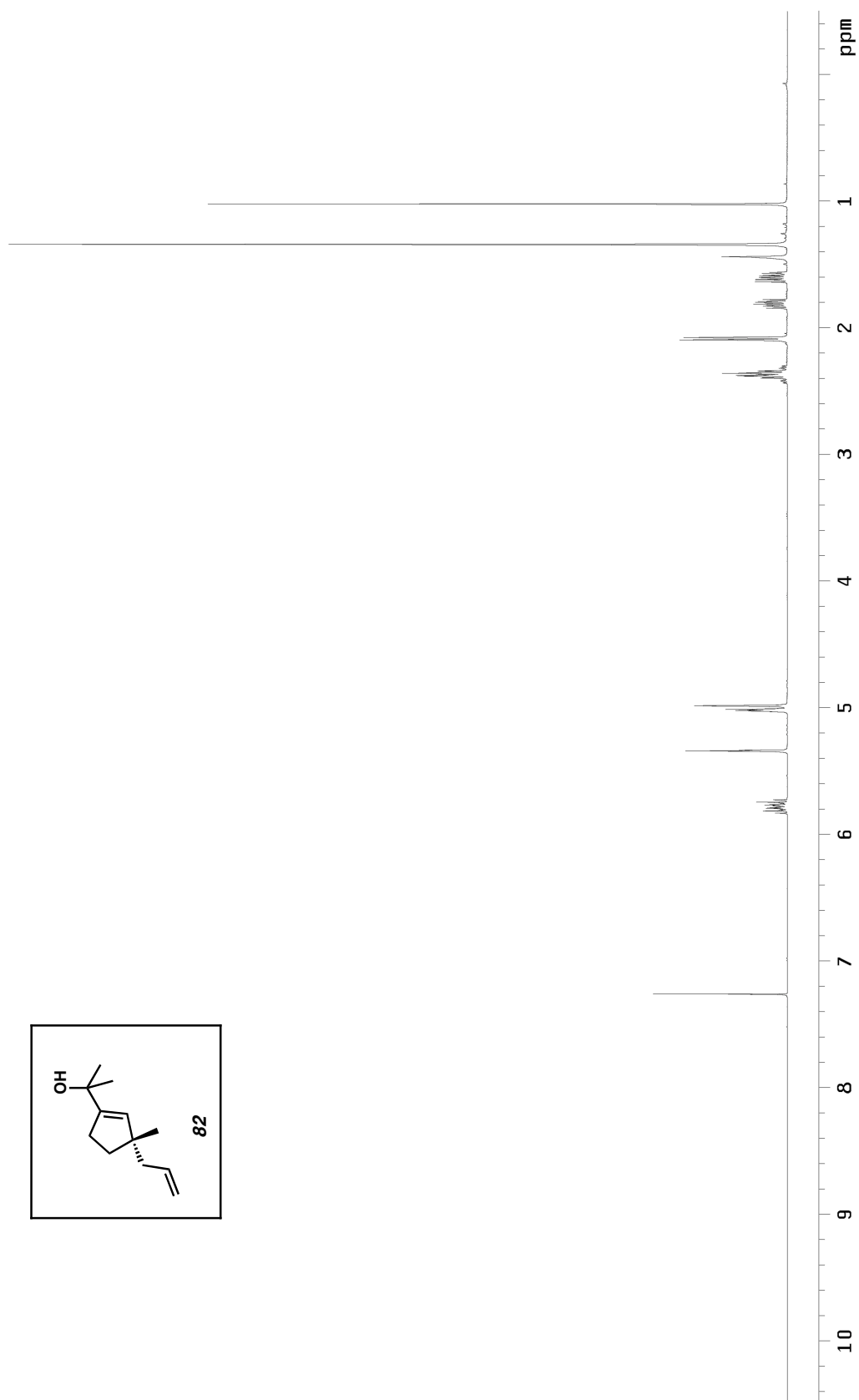


Figure A2.81.1. ^1H NMR (400 MHz, CDCl_3) of compound **82**.

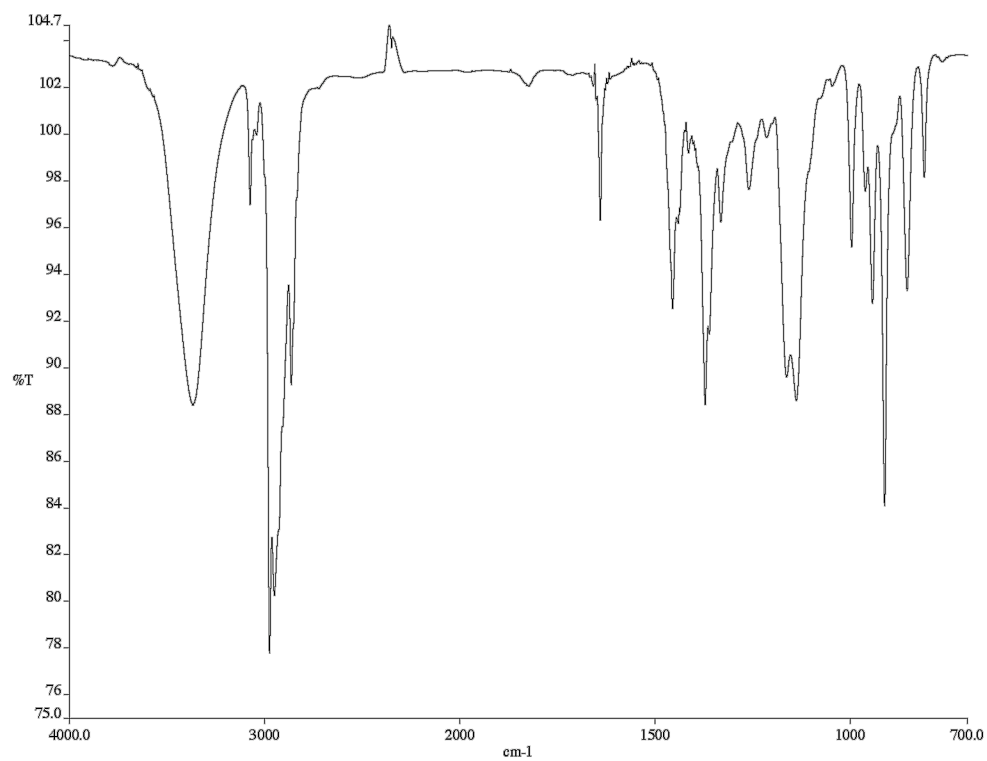


Figure A2.81.2. Infrared spectrum (thin film/NaCl) of compound **82**.

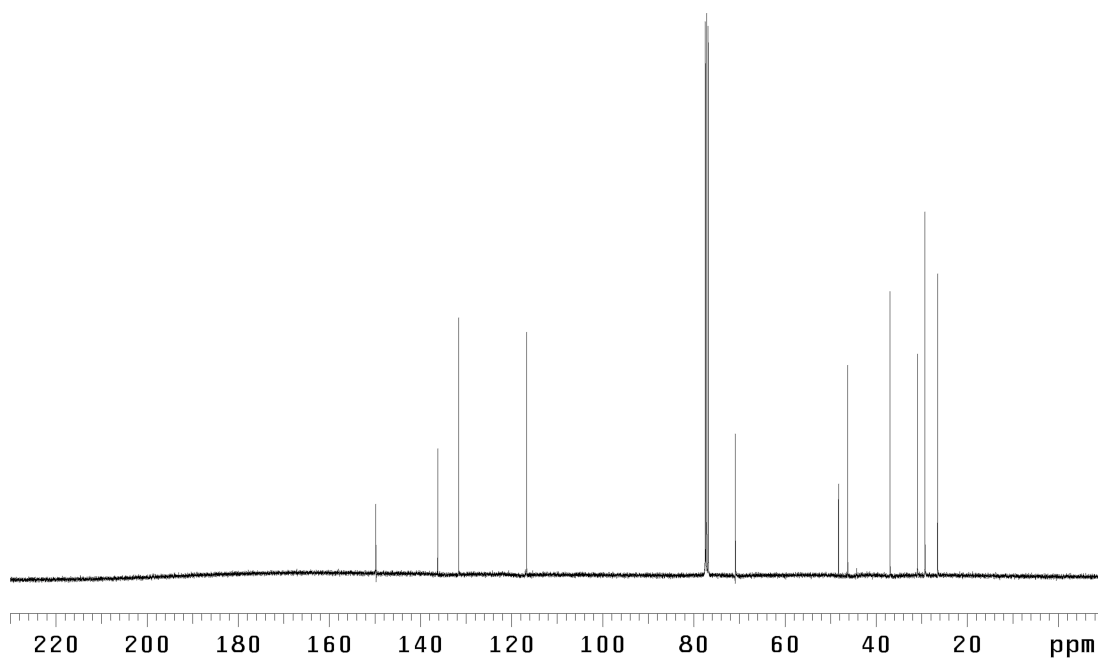
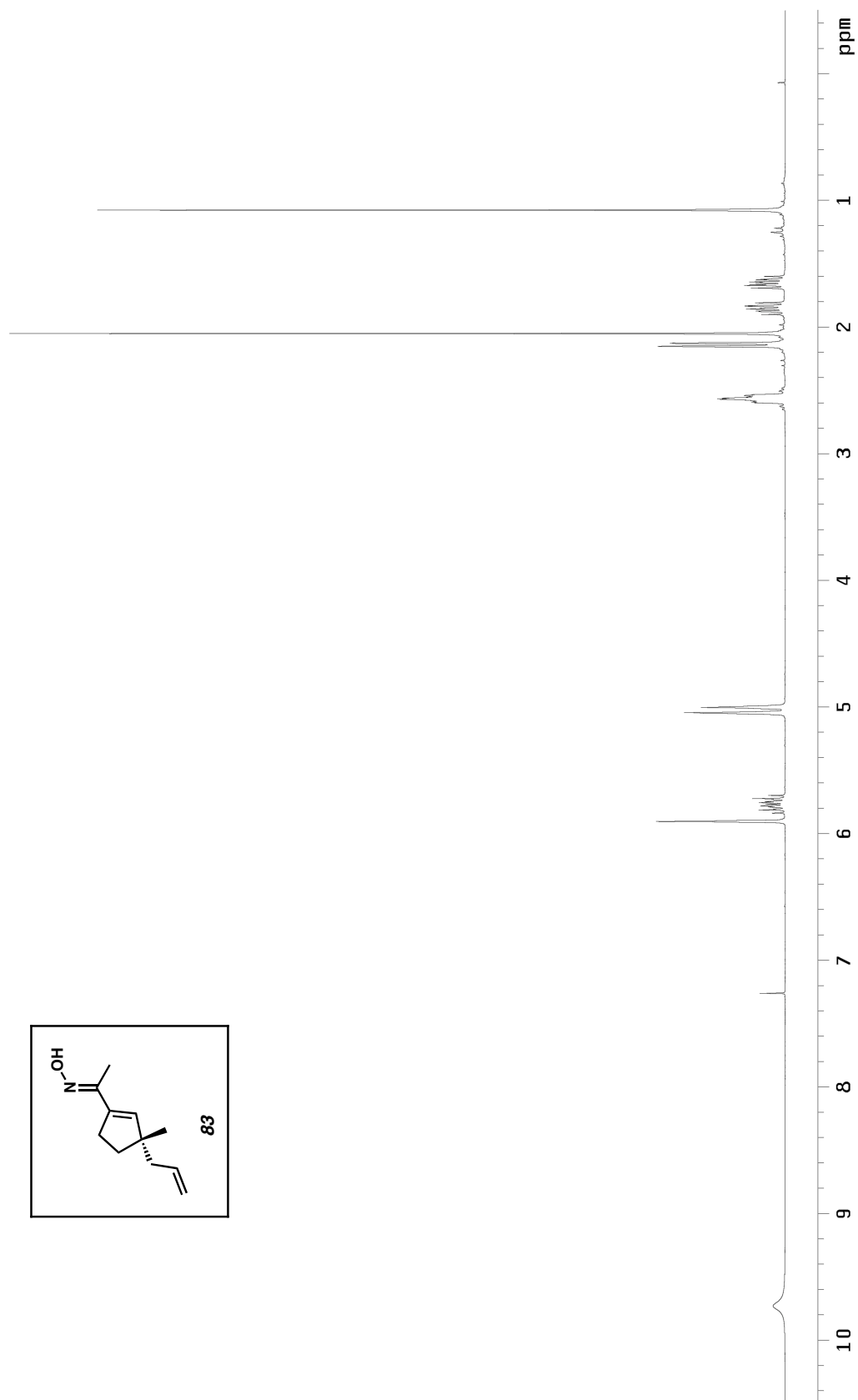


Figure A2.81.3. ¹³C NMR (100 MHz, CDCl₃) of compound **82**.

Figure A2.82.1. ^1H NMR (300 MHz, CDCl_3) of compound **83**.

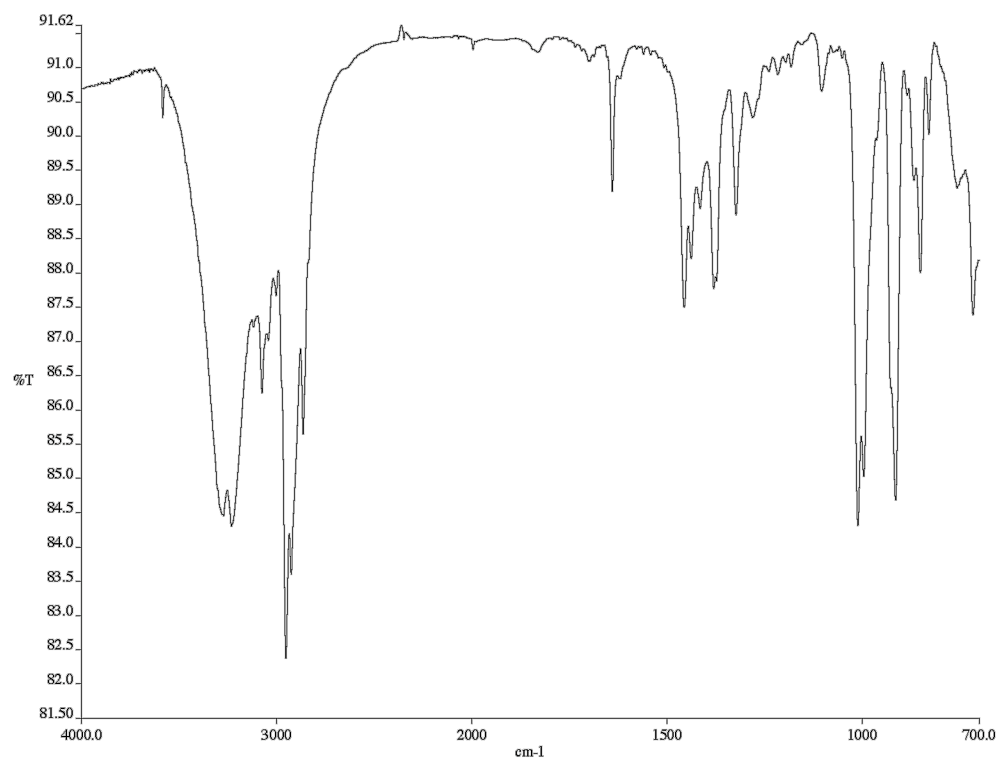


Figure A2.82.2. Infrared spectrum (thin film/NaCl) of compound **83**.

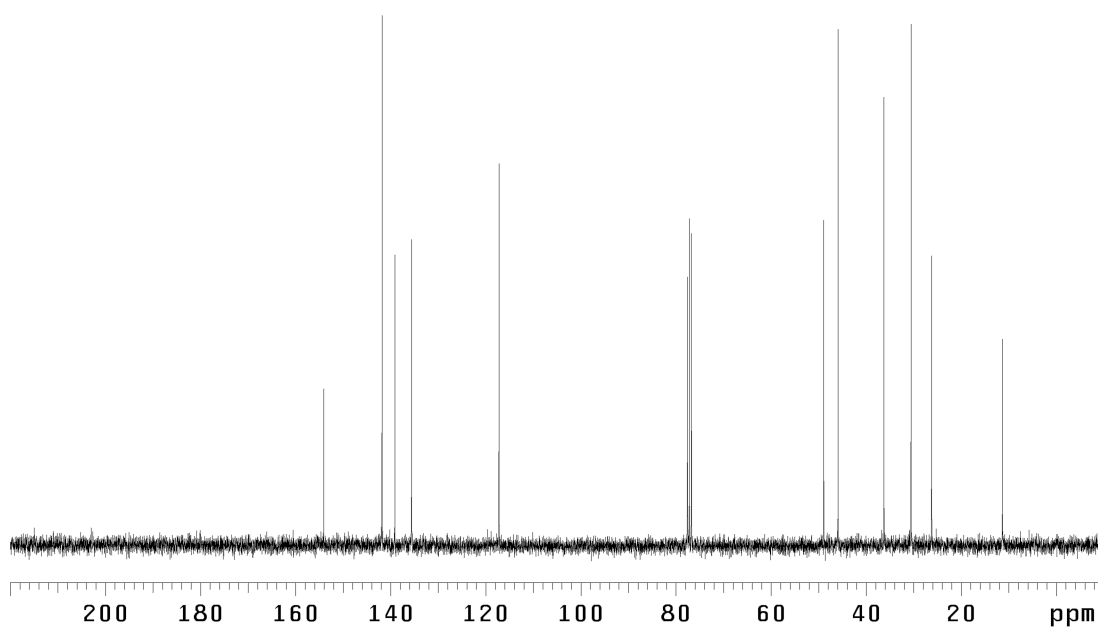
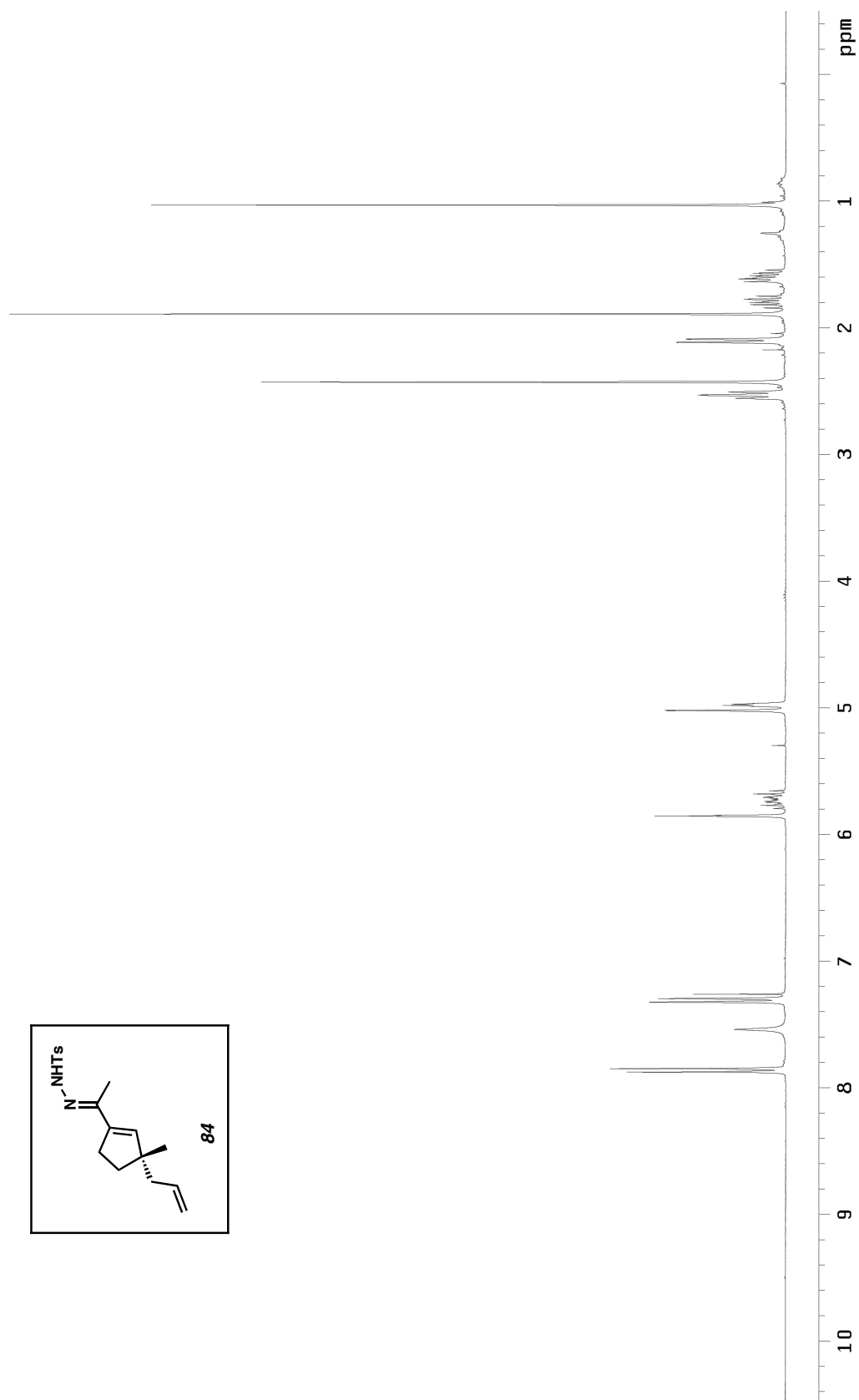


Figure A2.82.3. ¹³C NMR (75 MHz, CDCl₃) of compound **83**.

Figure A2.83.1. ^1H NMR (300 MHz, CDCl_3) of compound **84**.

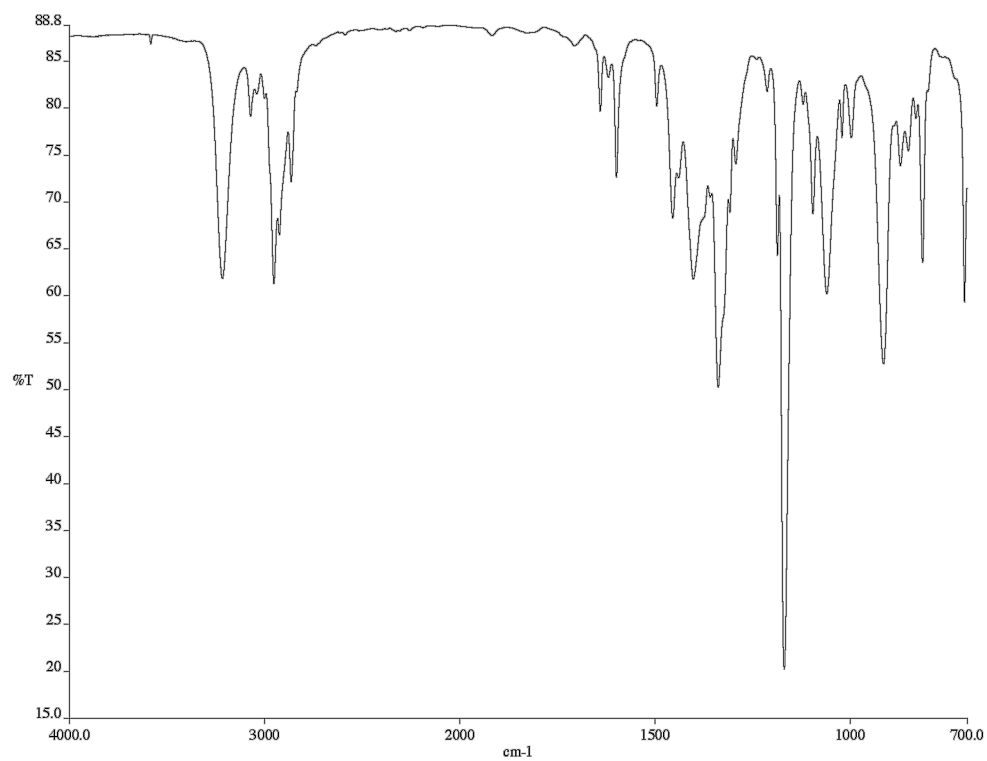


Figure A2.83.2. Infrared spectrum (thin film/NaCl) of compound **84**.

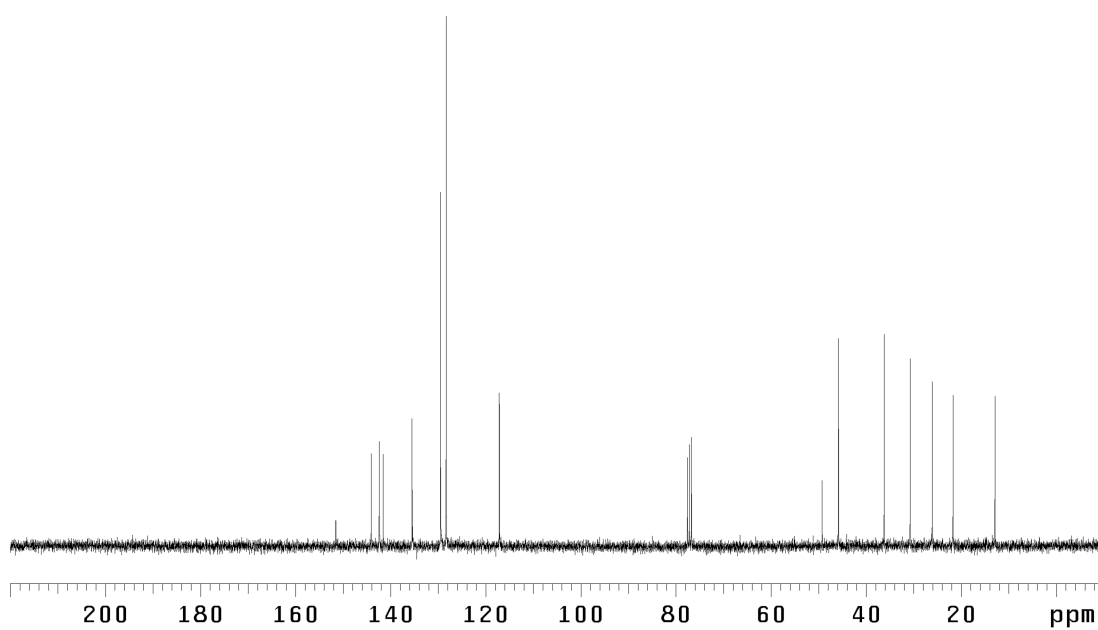


Figure A2.83.3. ¹³C NMR (75 MHz, CDCl₃) of compound **84**.

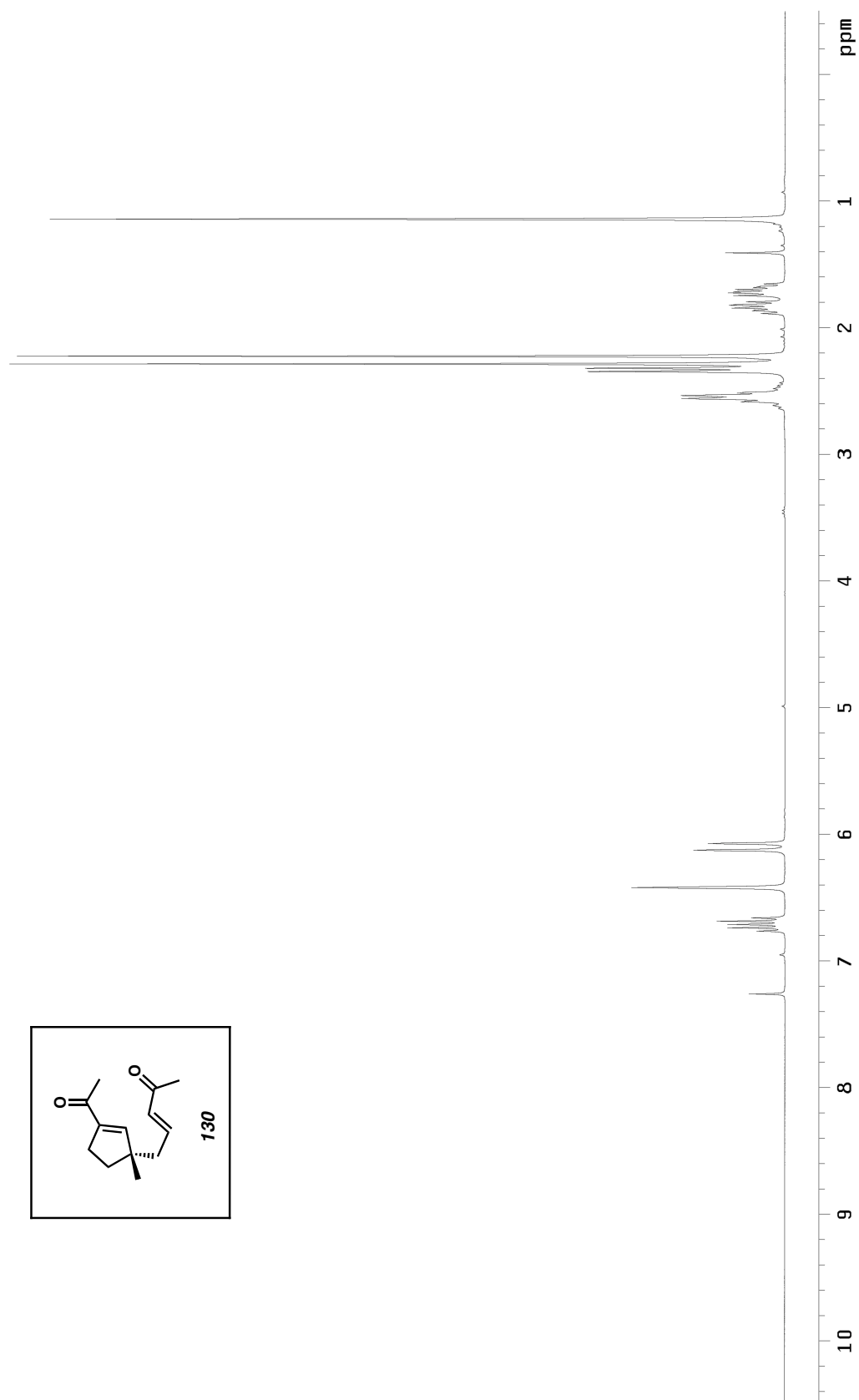


Figure A2.84.1. ¹H NMR (300 MHz, CDCl₃) of compound **130**.

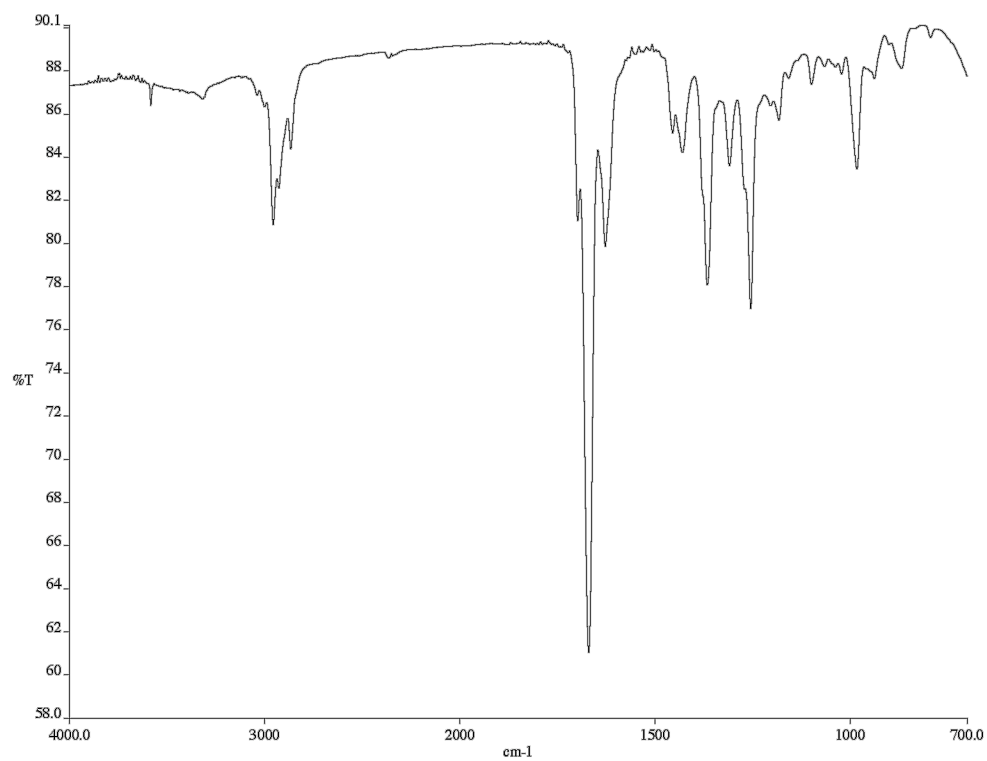


Figure A2.84.2. Infrared spectrum (thin film/NaCl) of compound **130**.

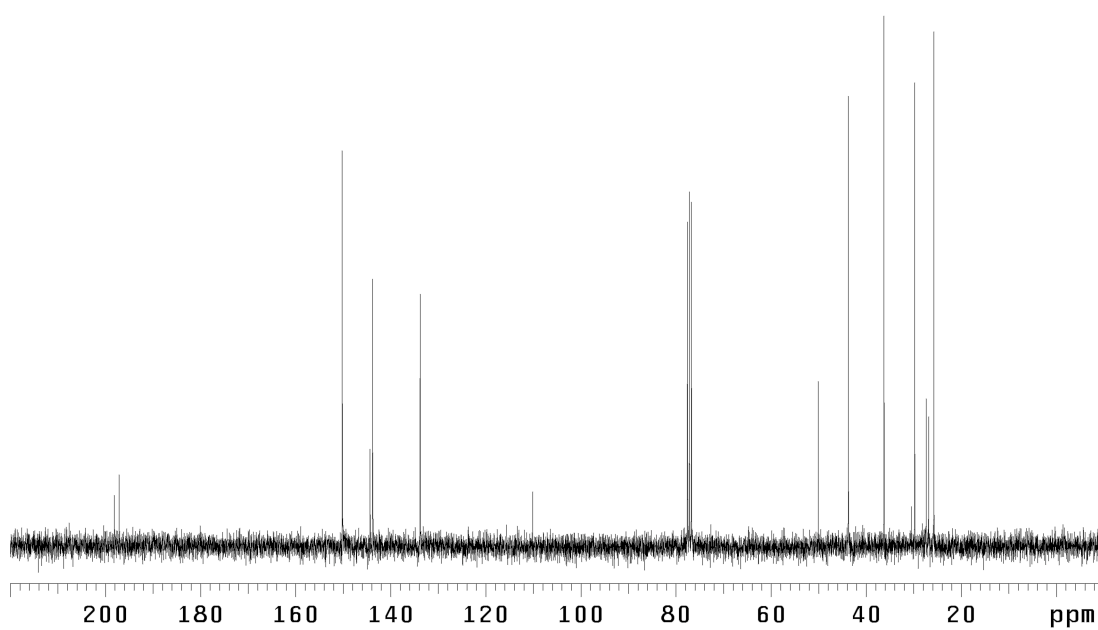


Figure A2.84.3. ¹³C NMR (75 MHz, CDCl₃) of compound **130**.

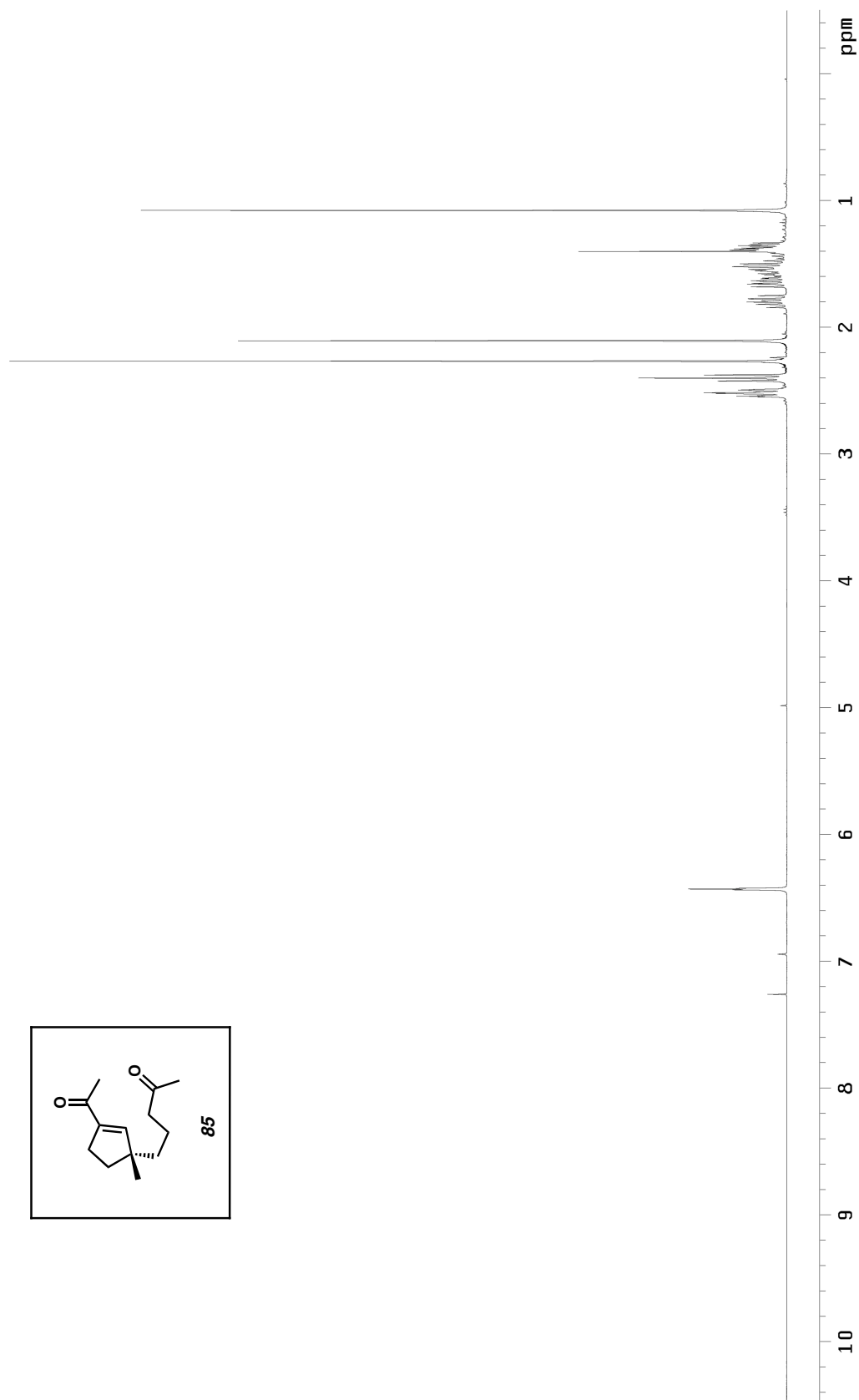


Figure A2.85.1. ^1H NMR (300 MHz, CDCl_3) of compound **85**.

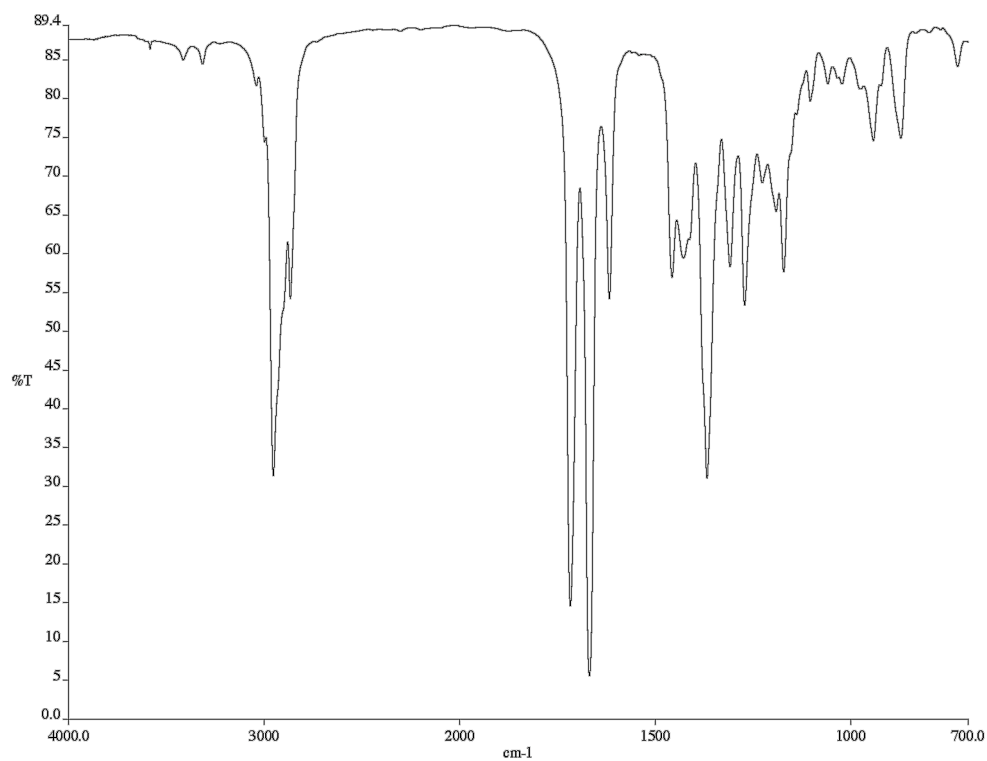


Figure A2.85.2. Infrared spectrum (thin film/NaCl) of compound **85**.

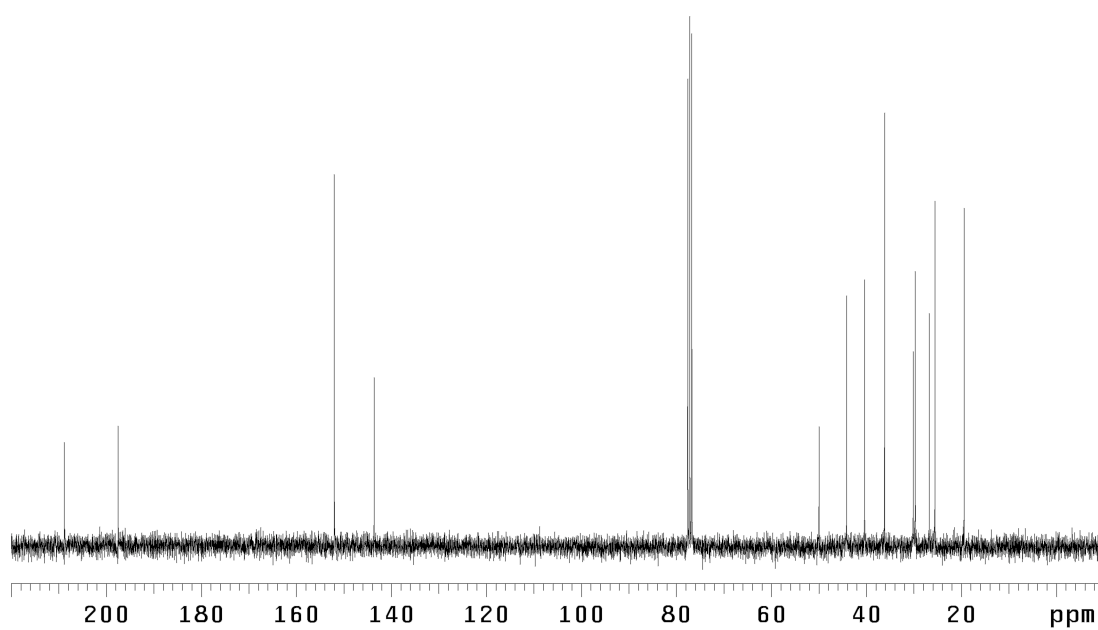


Figure A2.85.3. ¹³C NMR (75 MHz, CDCl₃) of compound **85**.

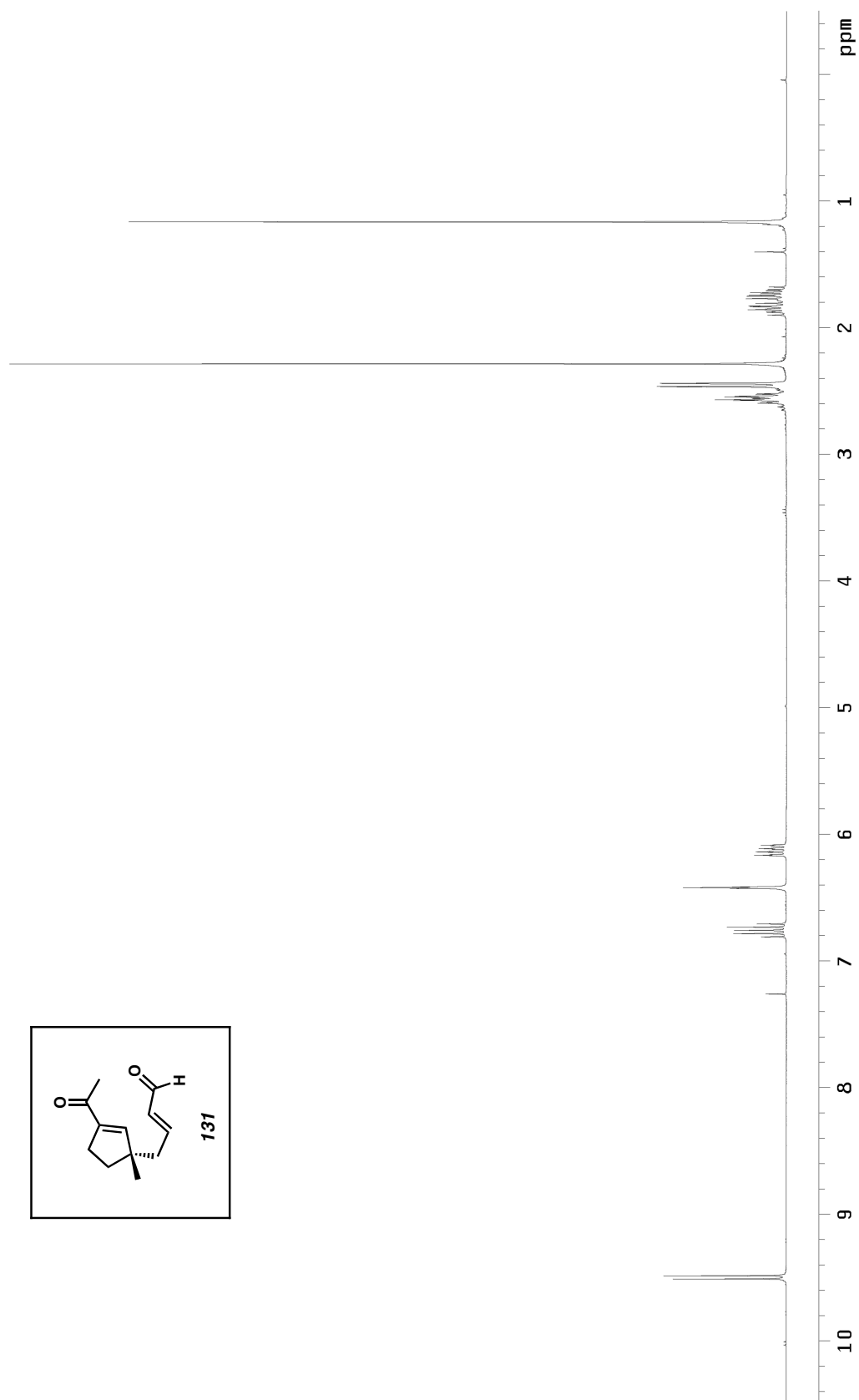


Figure A2.86.1. ^1H NMR (300 MHz, CDCl_3) of compound **131**.

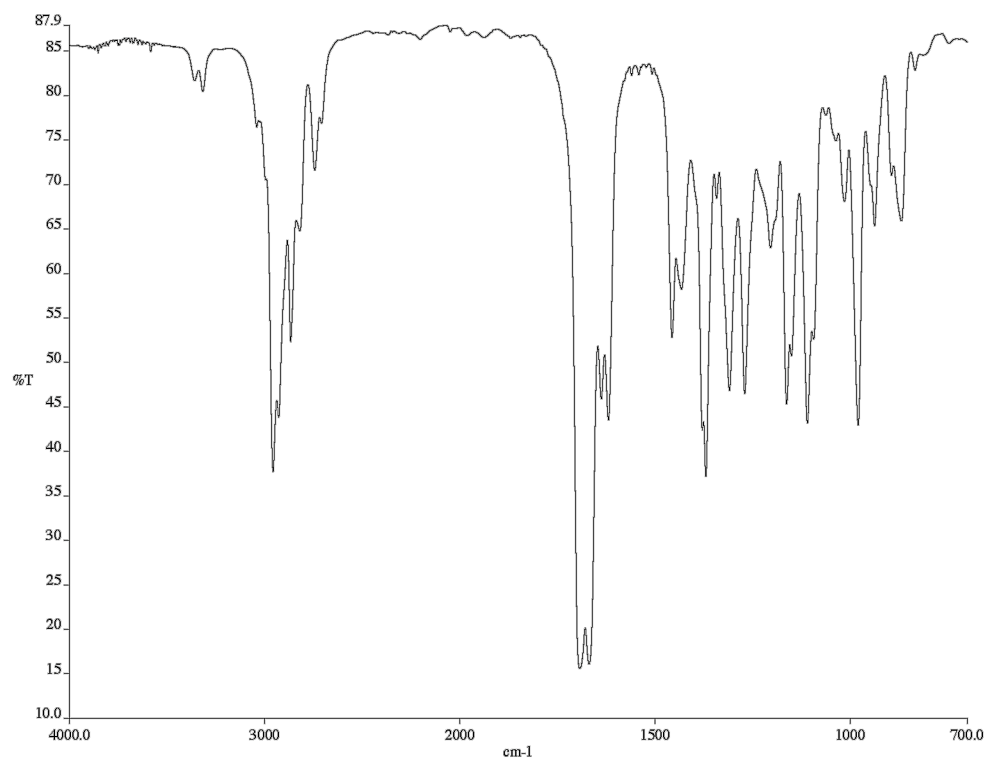


Figure A2.86.2. Infrared spectrum (thin film/NaCl) of compound **131**.

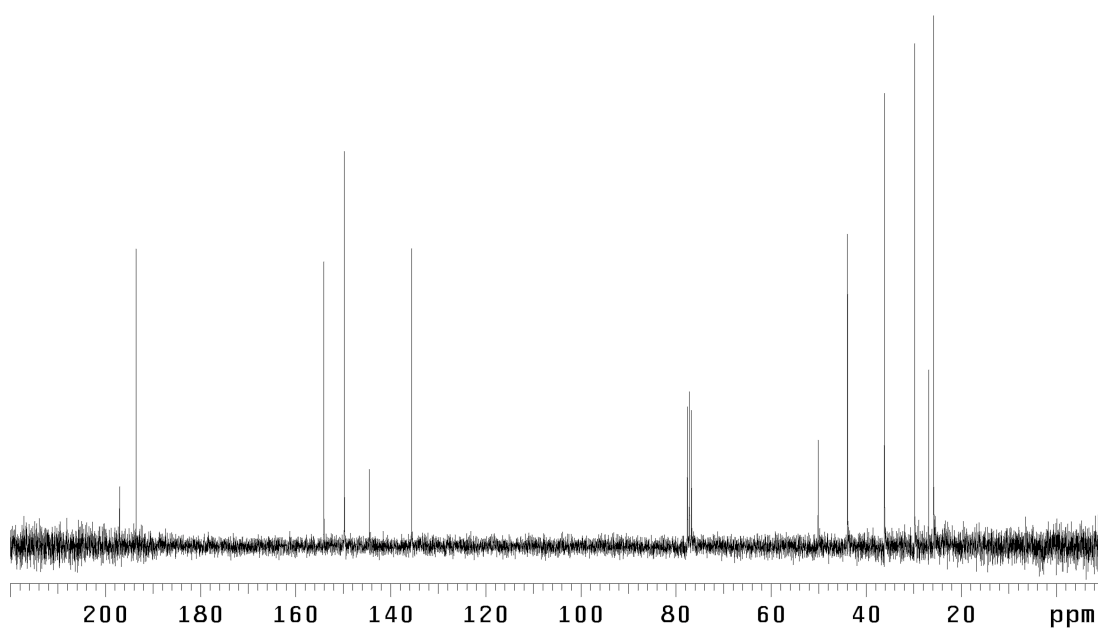


Figure A2.86.3. ¹³C NMR (75 MHz, CDCl₃) of compound **131**.

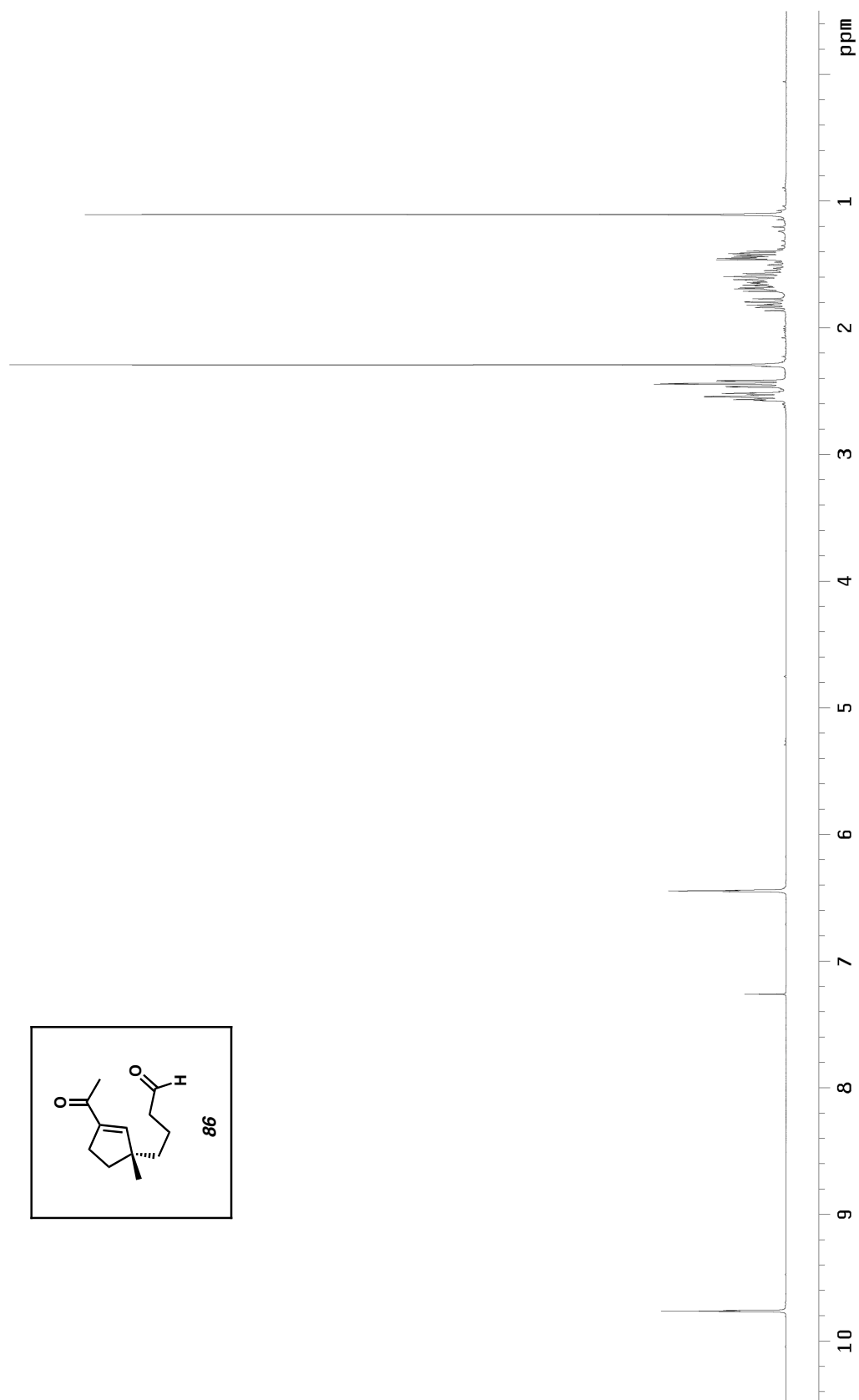


Figure A2.87.1. ^1H NMR (300 MHz, CDCl_3) of compound **86**.

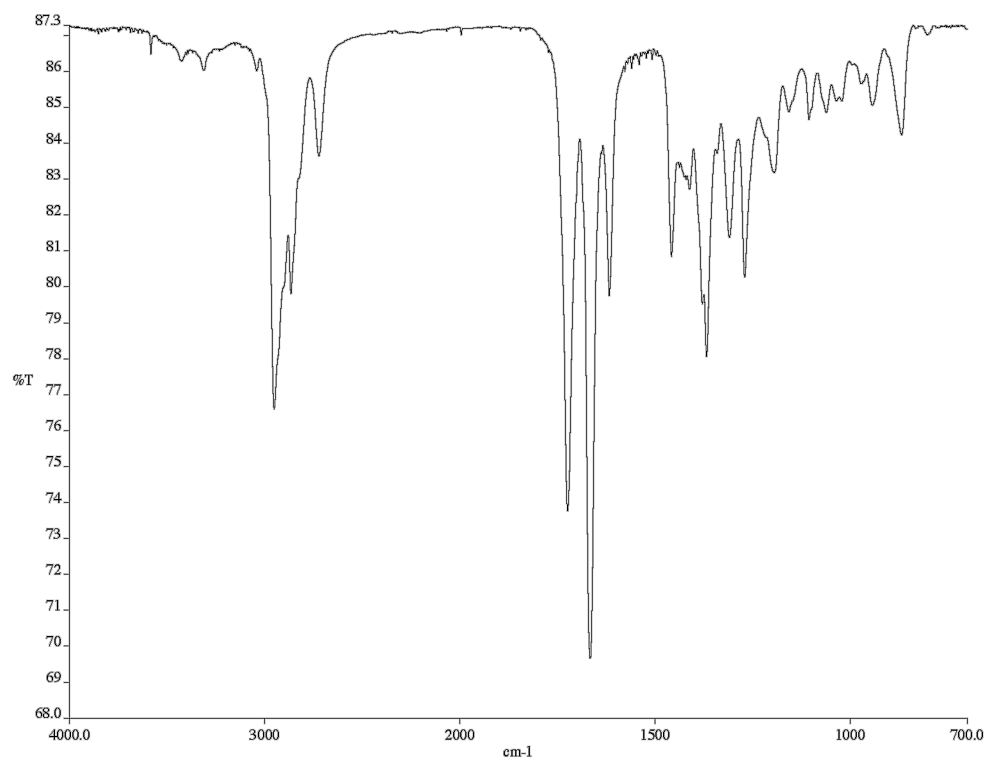


Figure A2.87.2. Infrared spectrum (thin film/NaCl) of compound **86**.

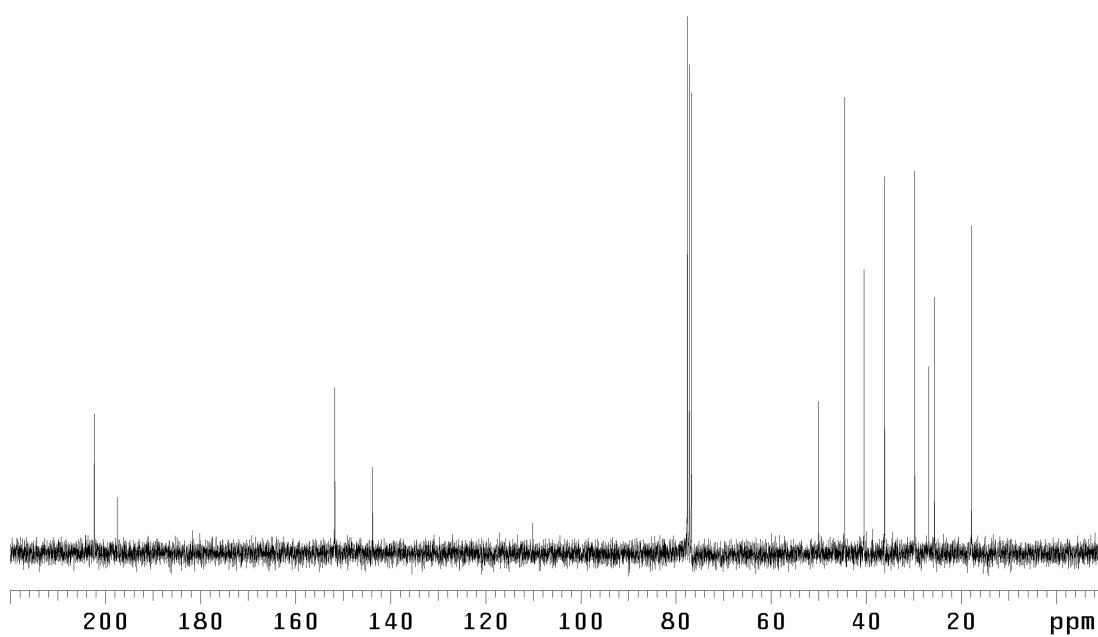


Figure A2.87.3. ¹³C NMR (75 MHz, CDCl₃) of compound **86**.

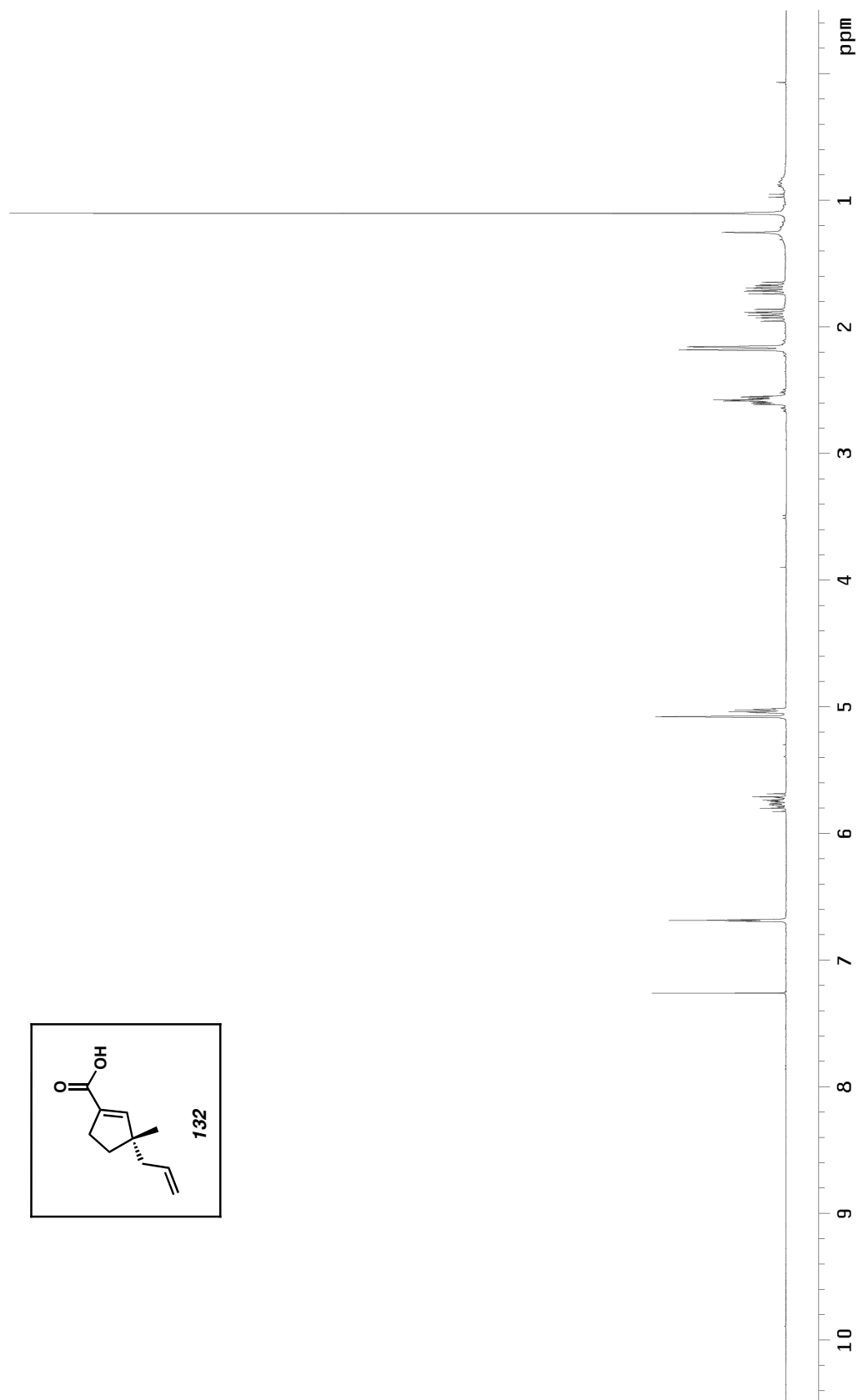


Figure A2.88.1. ^1H NMR (300 MHz, CDCl_3) of compound **132**.

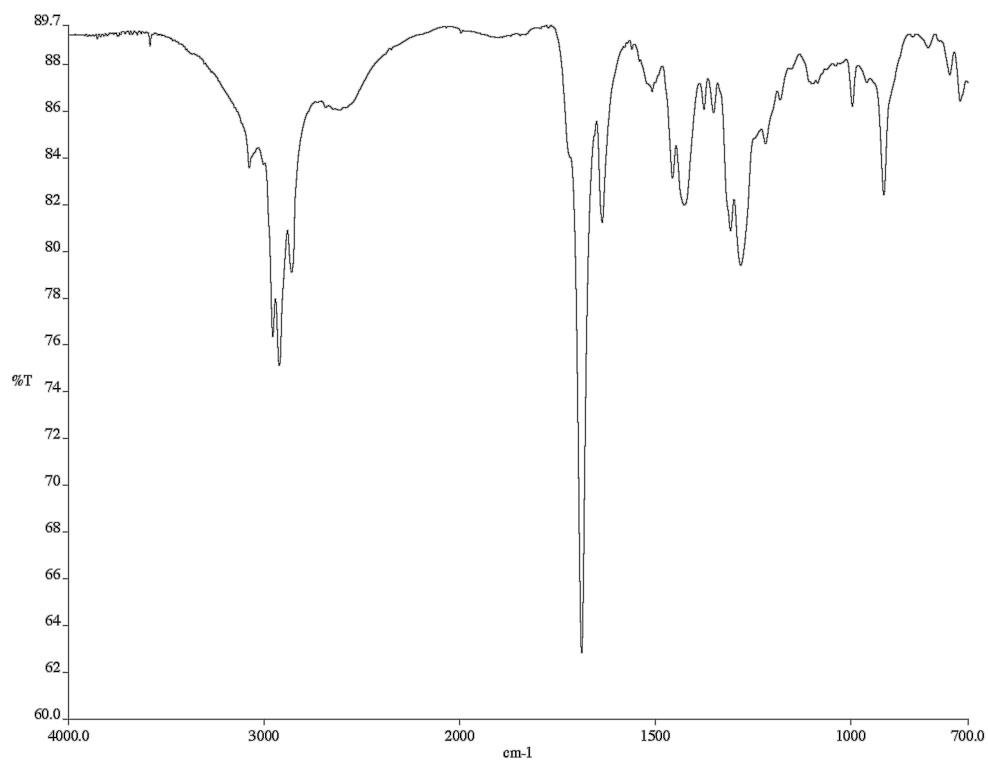


Figure A2.88.2. Infrared spectrum (thin film/NaCl) of compound **132**.

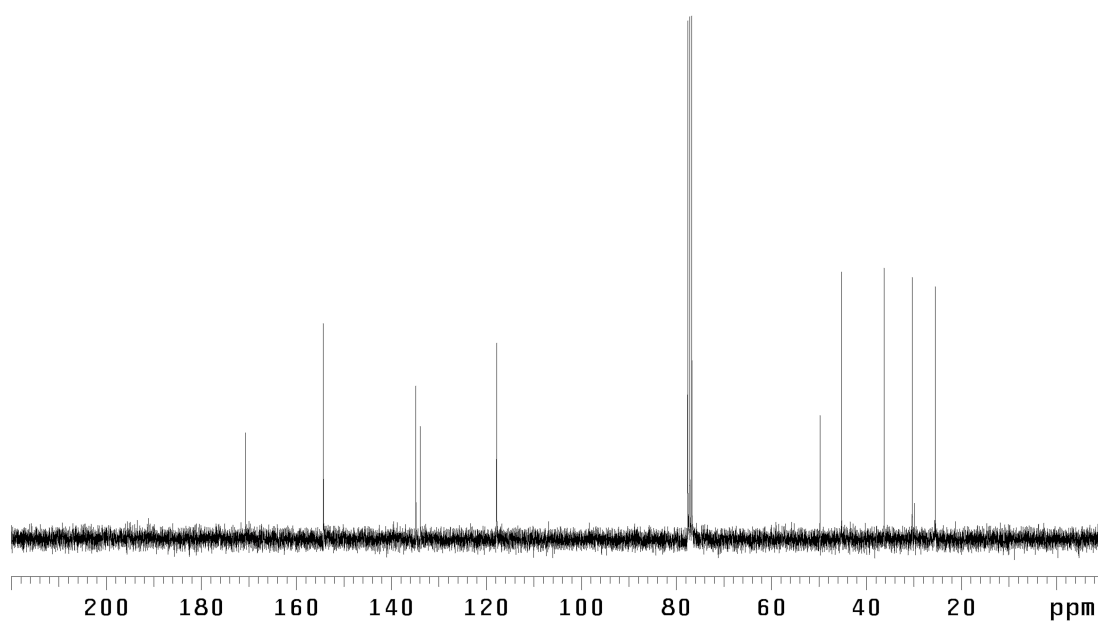


Figure A2.88.3. ¹³C NMR (75 MHz, CDCl₃) of compound **132**.

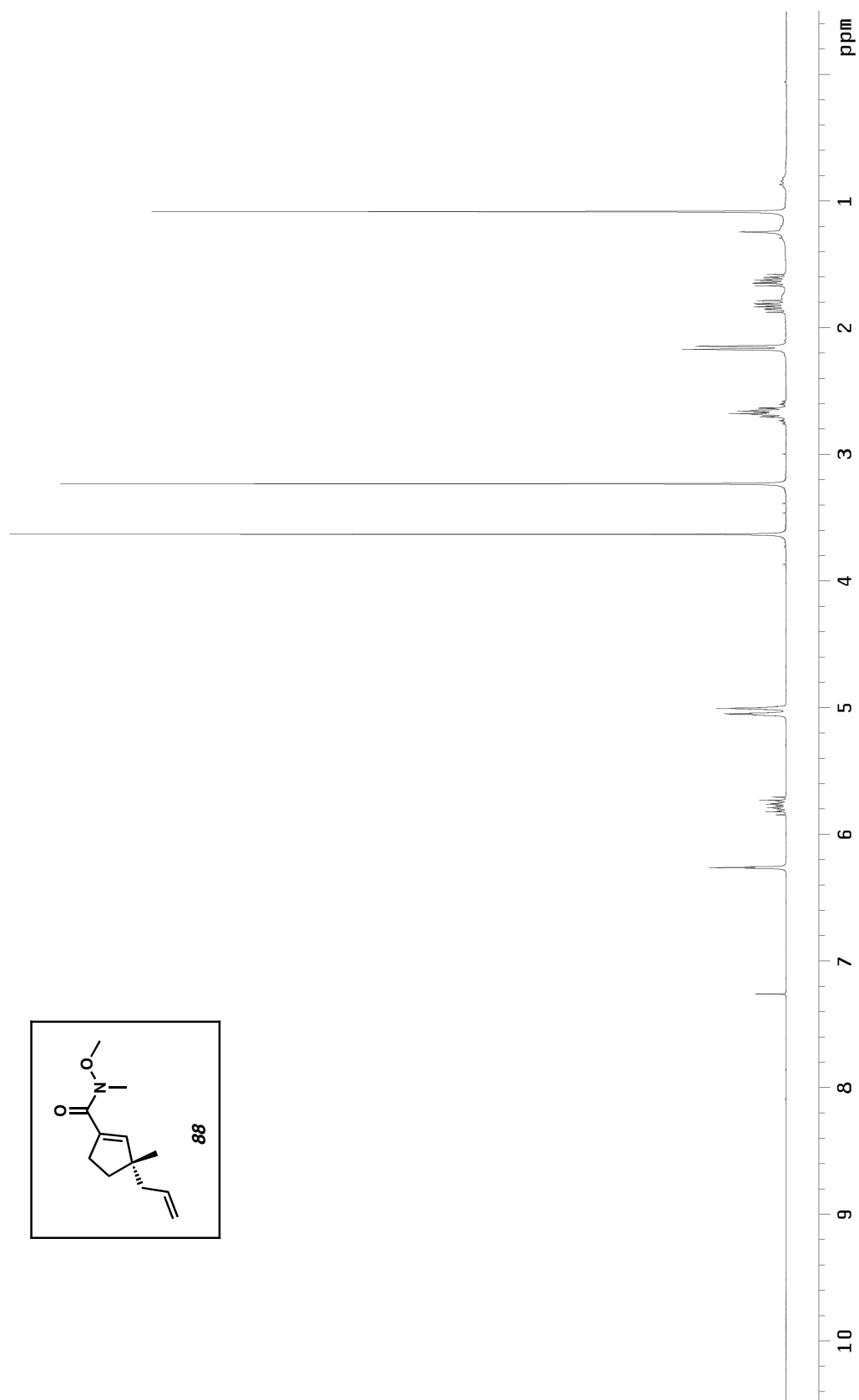


Figure A2.89.1. ^1H NMR (300 MHz, CDCl_3) of compound **88**.

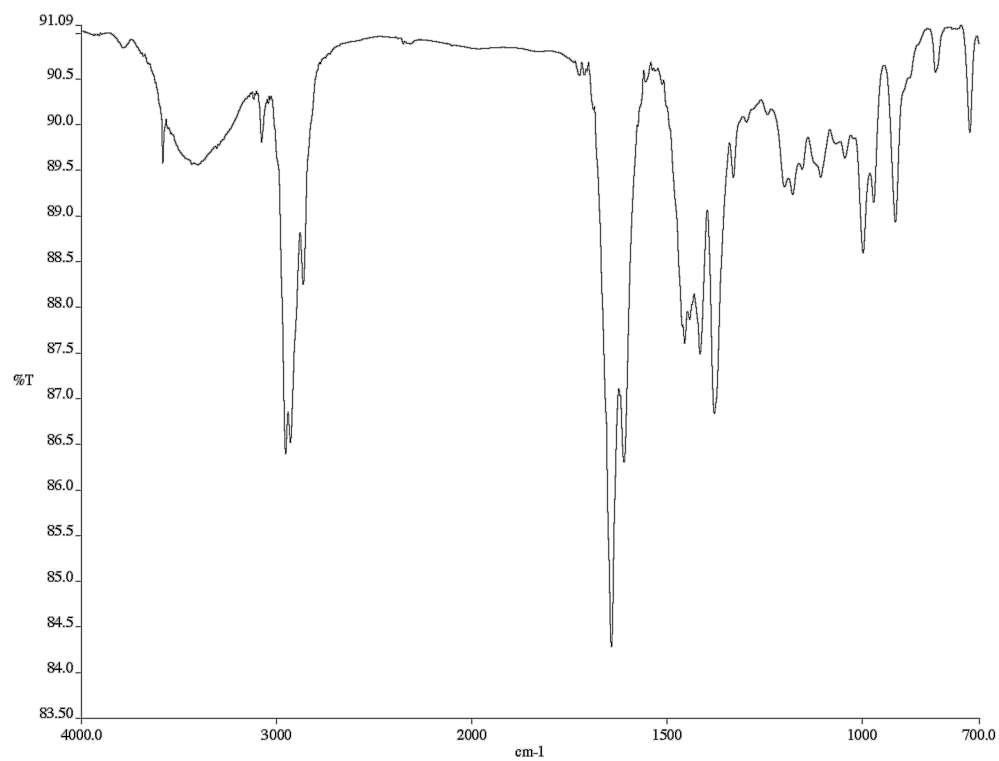


Figure A2.89.2. Infrared spectrum (thin film/NaCl) of compound **88**.

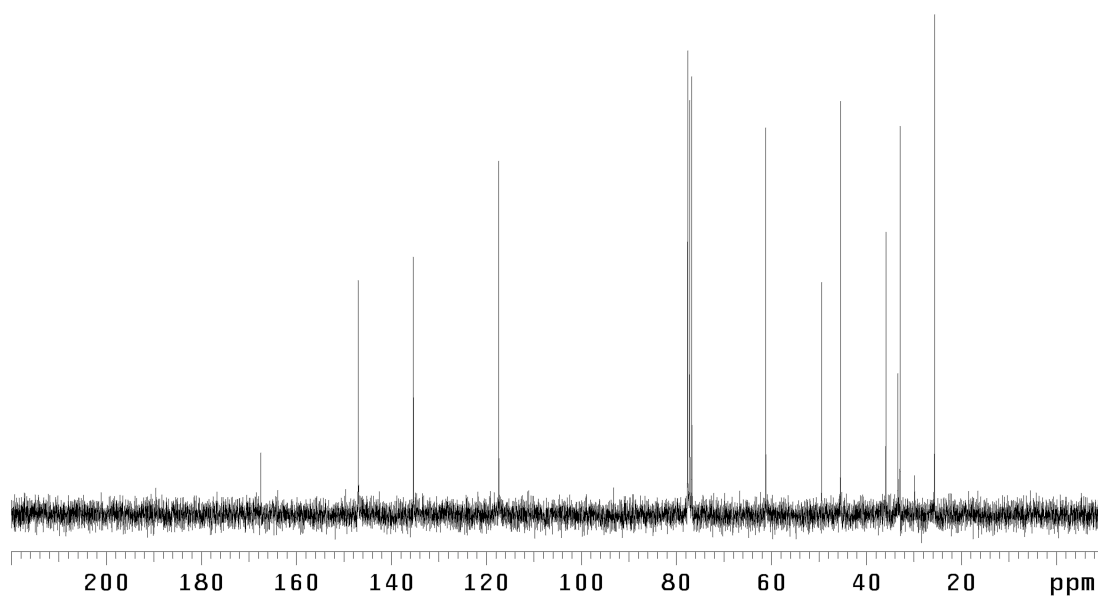


Figure A2.89.3. ¹³C NMR (75 MHz, CDCl₃) of compound **88**.

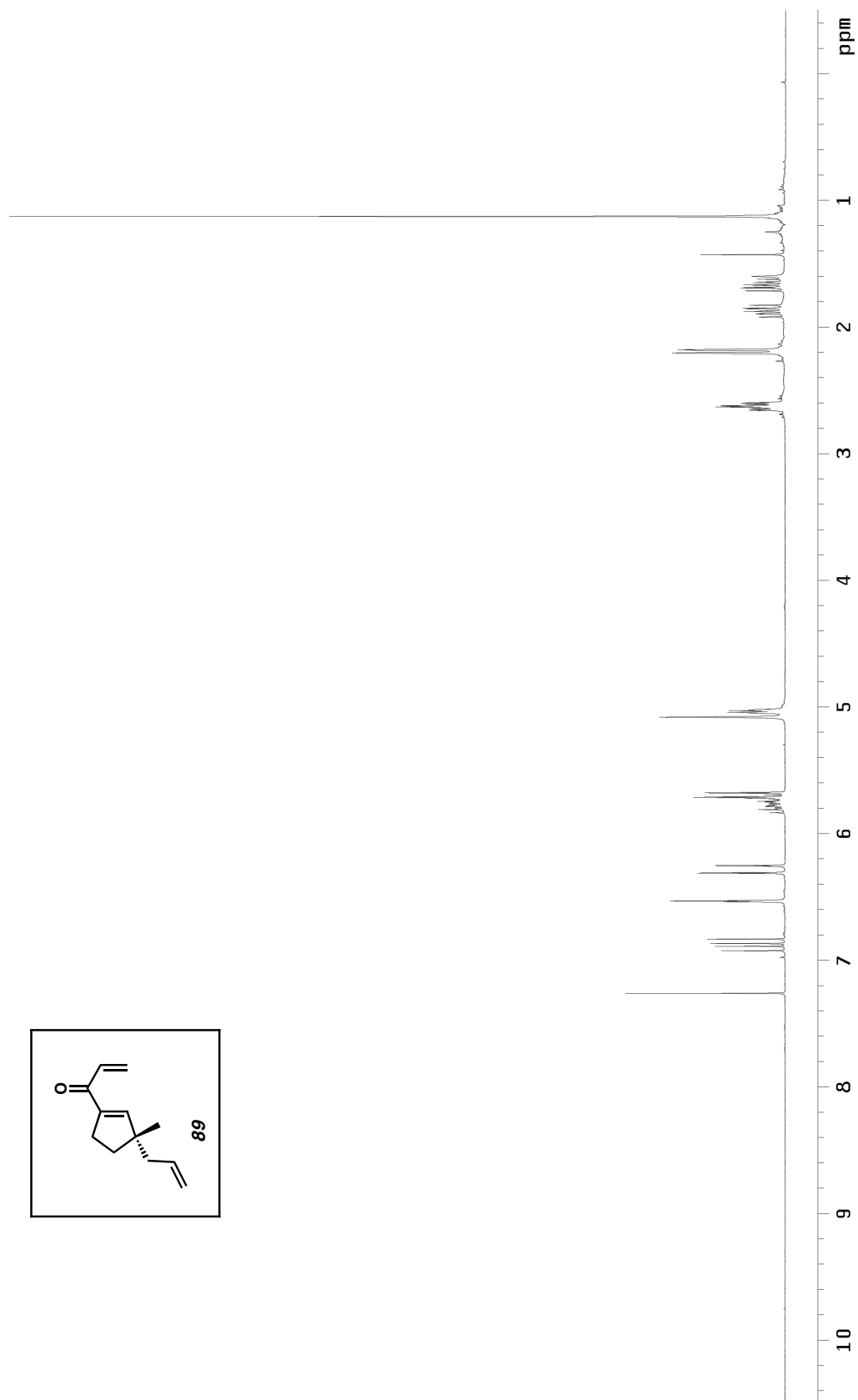


Figure A2.90.1. ^1H NMR (300 MHz, CDCl_3) of compound **89**.

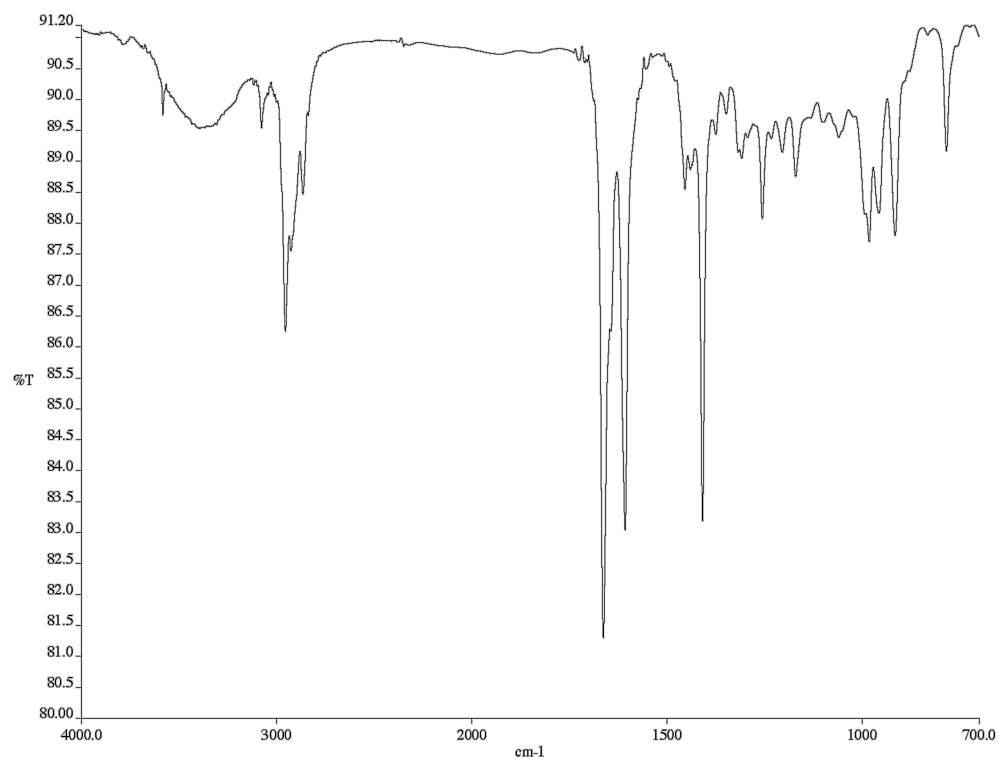


Figure A2.90.2. Infrared spectrum (thin film/NaCl) of compound **89**.

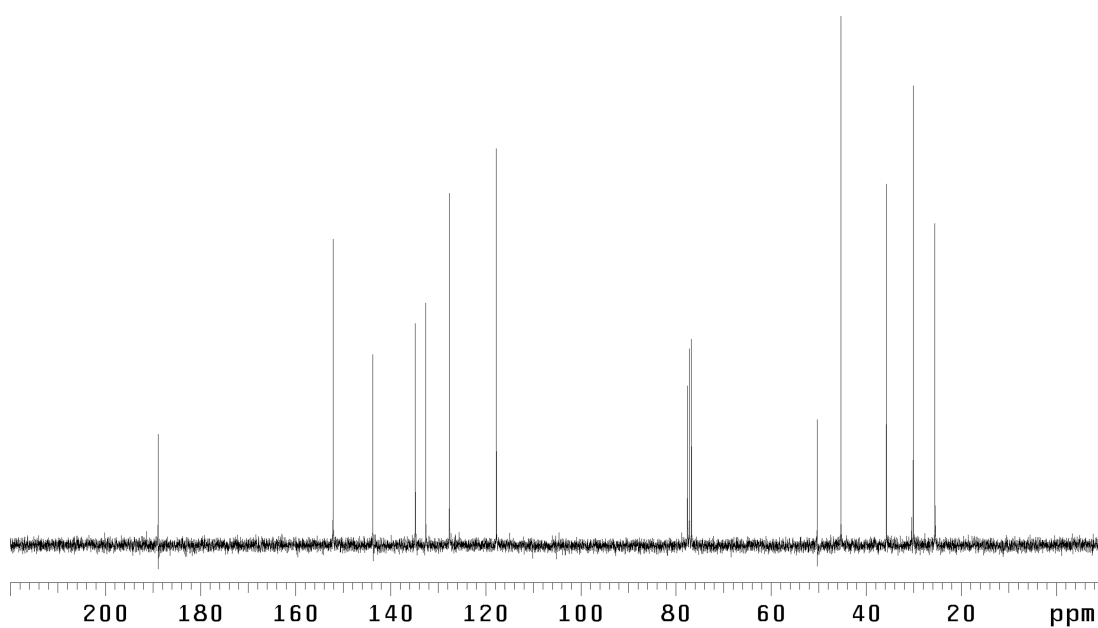


Figure A2.90.3. ¹³C NMR (75 MHz, CDCl₃) of compound **89**.

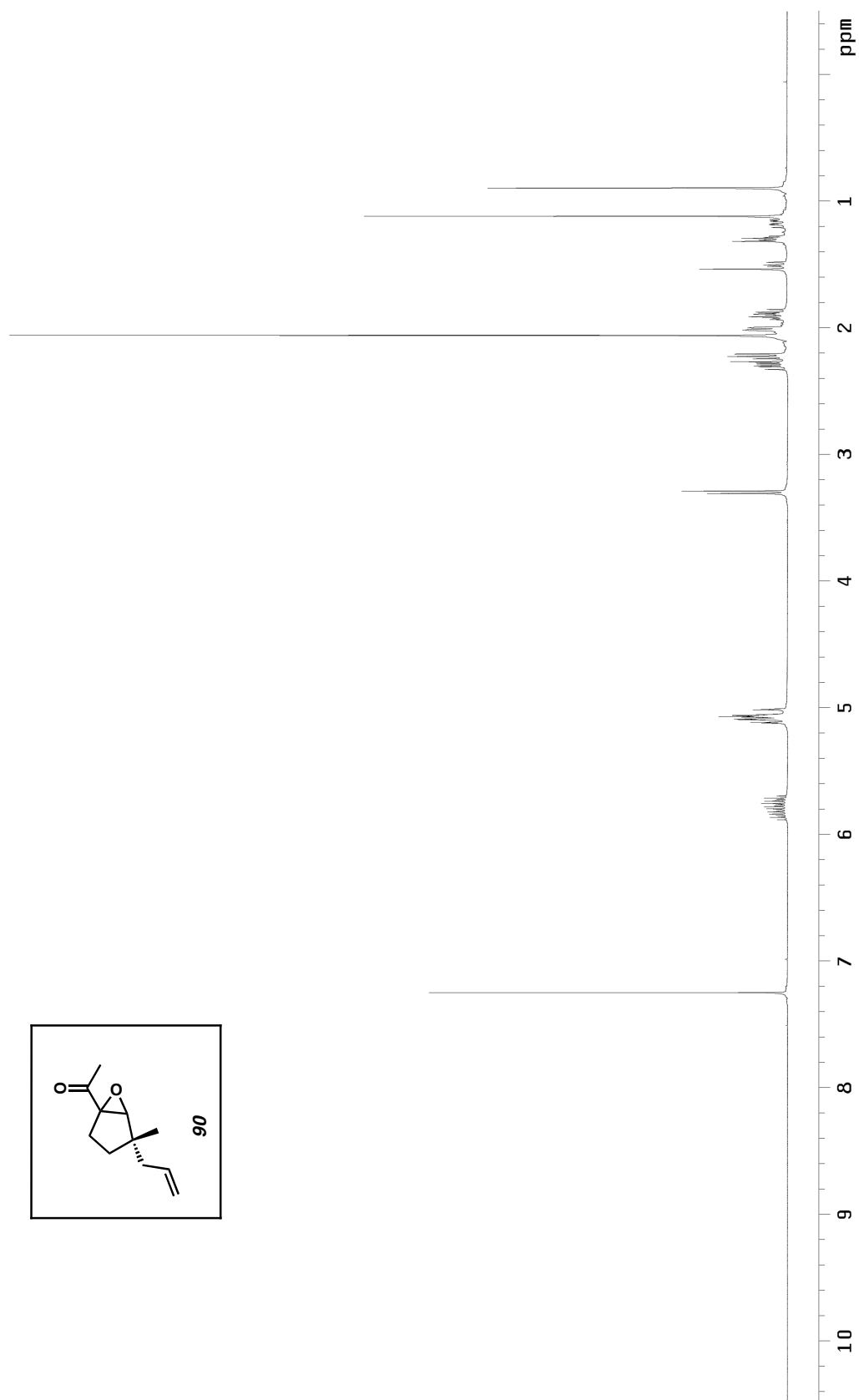


Figure A2.91.1. ^1H NMR (400 MHz, CDCl_3) of compound **90**.

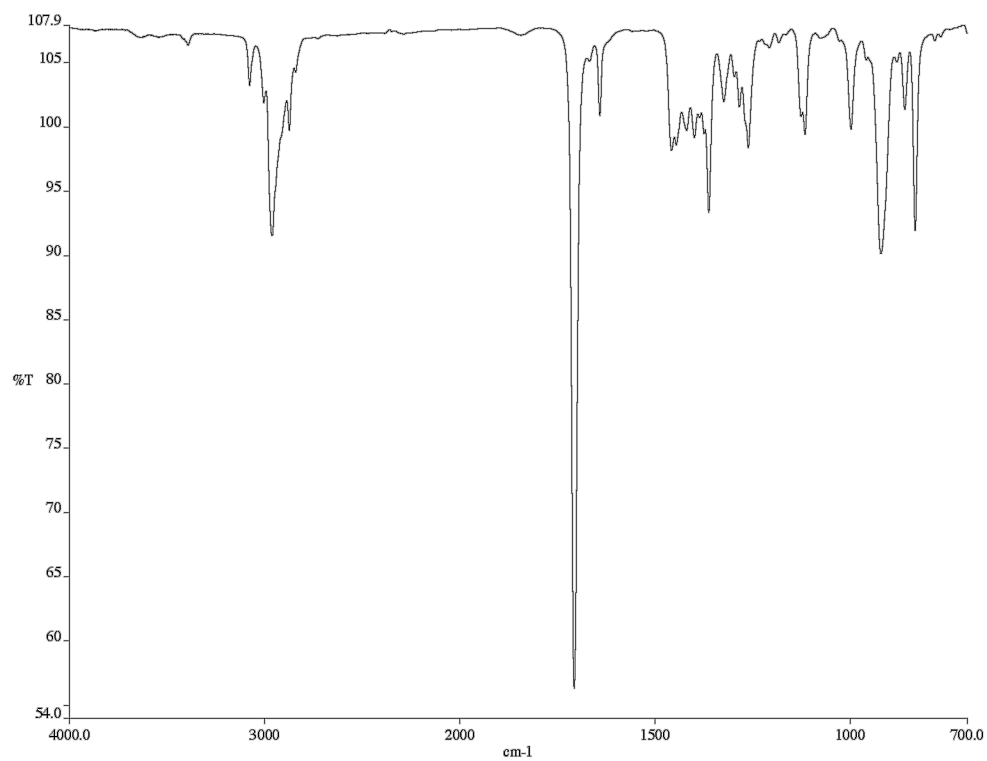


Figure A2.91.2. Infrared spectrum (thin film/NaCl) of compound **90**.

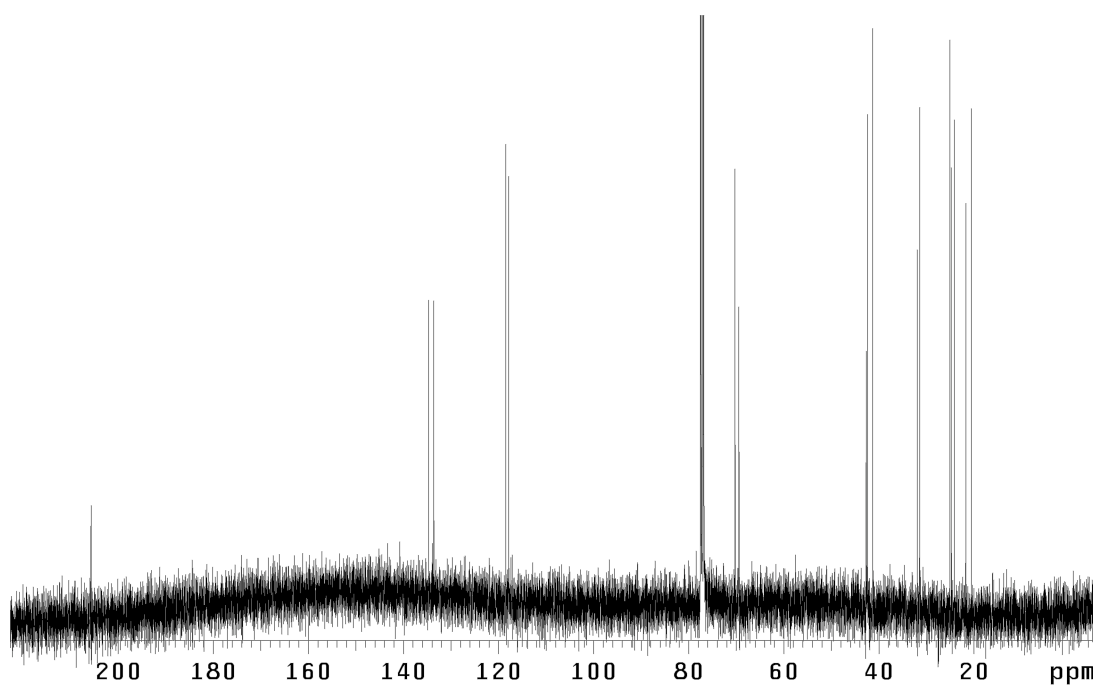


Figure A2.91.3. ^{13}C NMR (100 MHz, CDCl_3) of compound **90**.

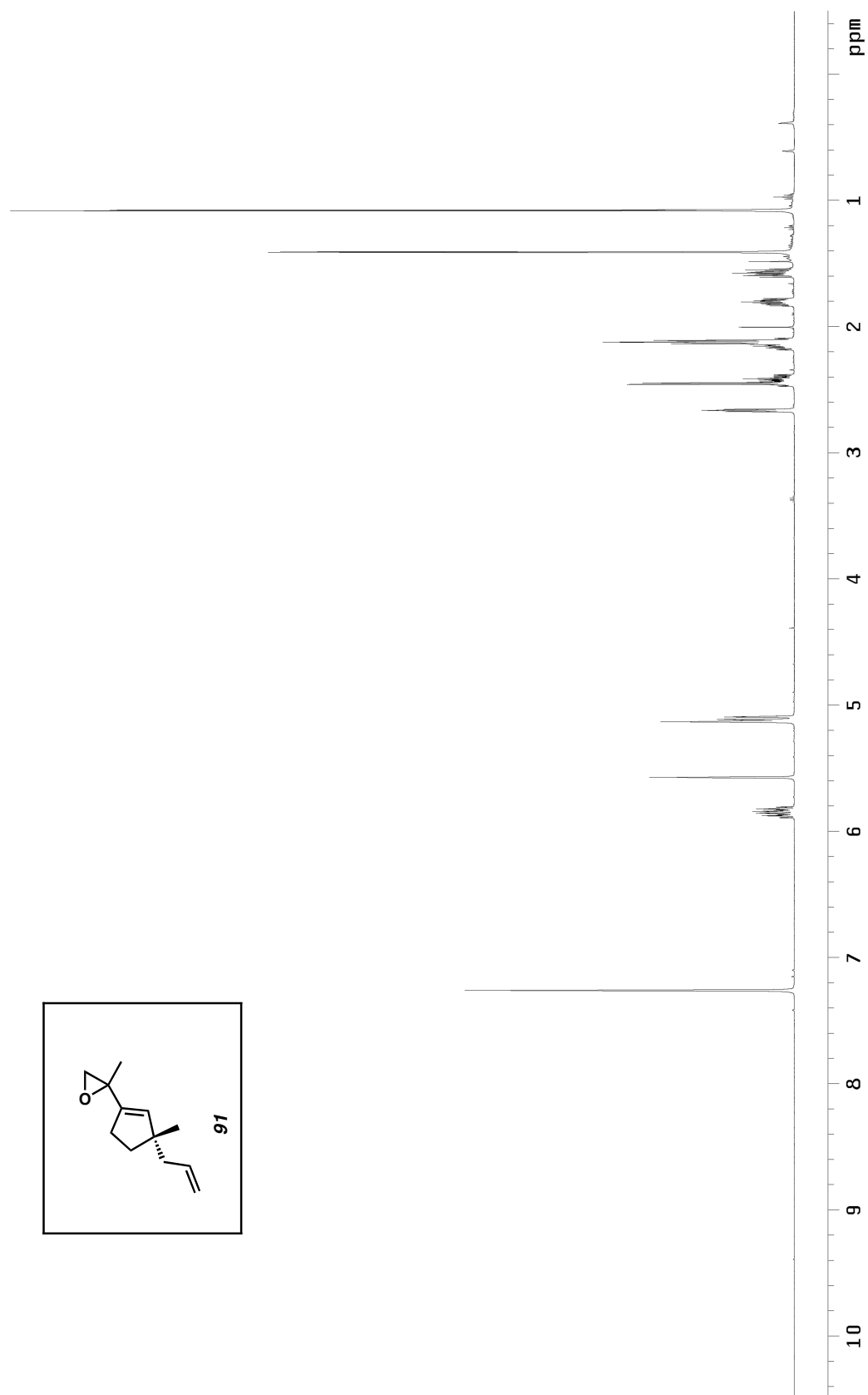


Figure A2.92.1. ^1H NMR (500 MHz, CDCl_3) of compound **91**.

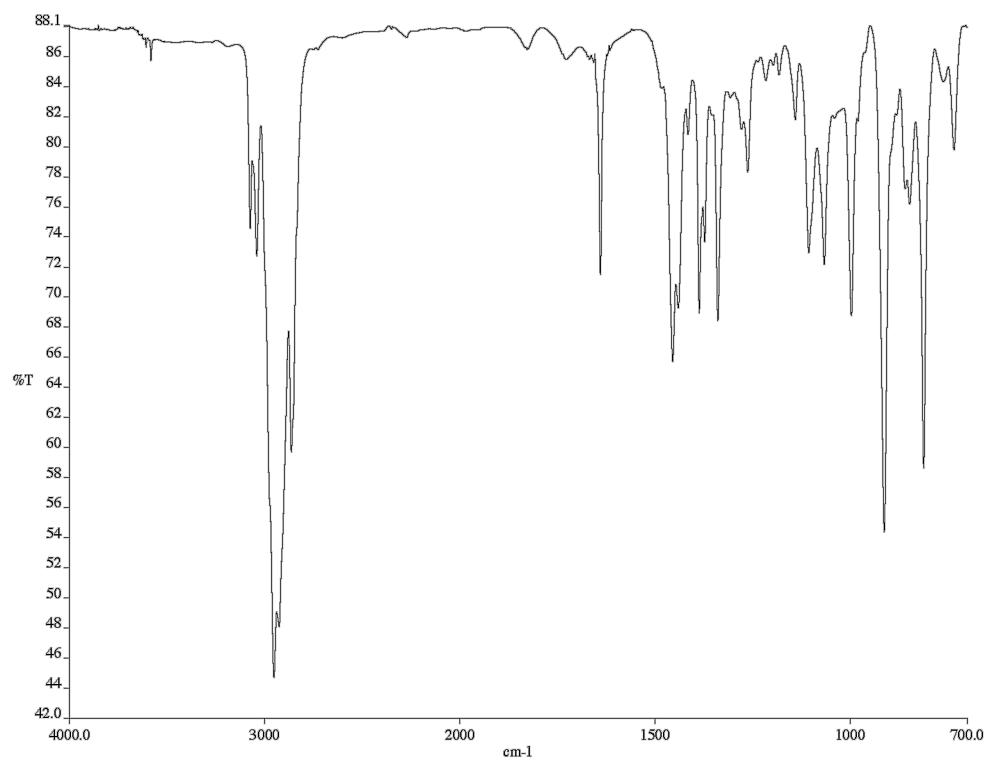


Figure A2.92.2. Infrared spectrum (thin film/NaCl) of compound **91**.

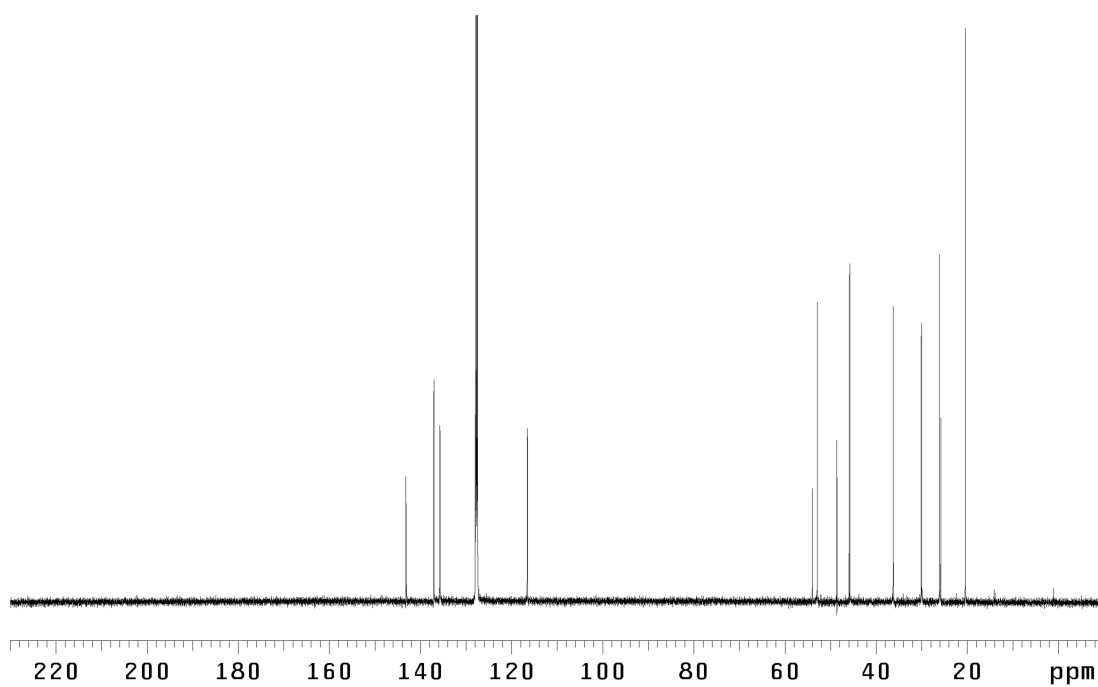


Figure A2.92.3. ¹³C NMR (125 MHz, CDCl₃) of compound **91**.

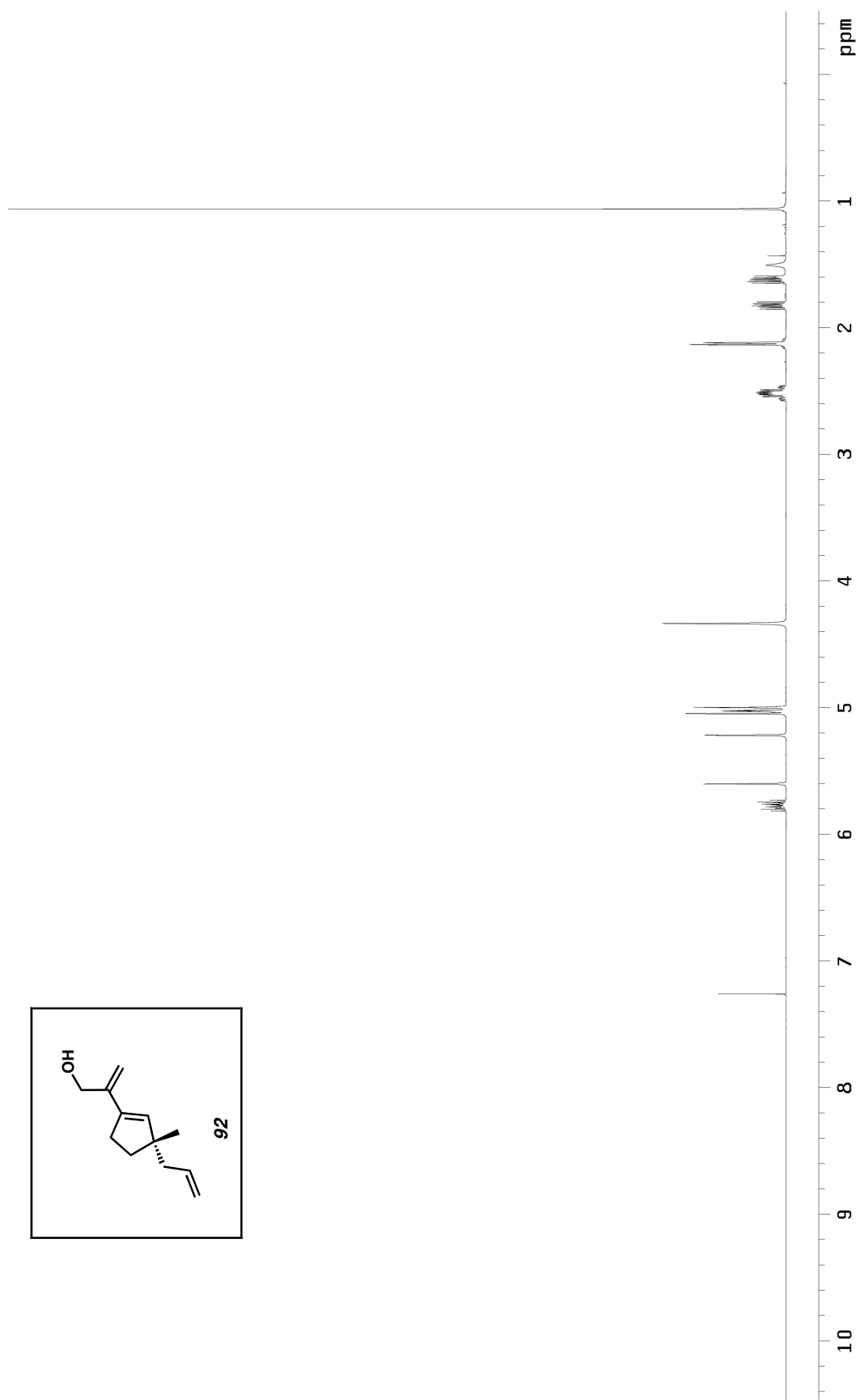


Figure A2.93.1. ^1H NMR (500 MHz, CDCl_3) of compound **92**.

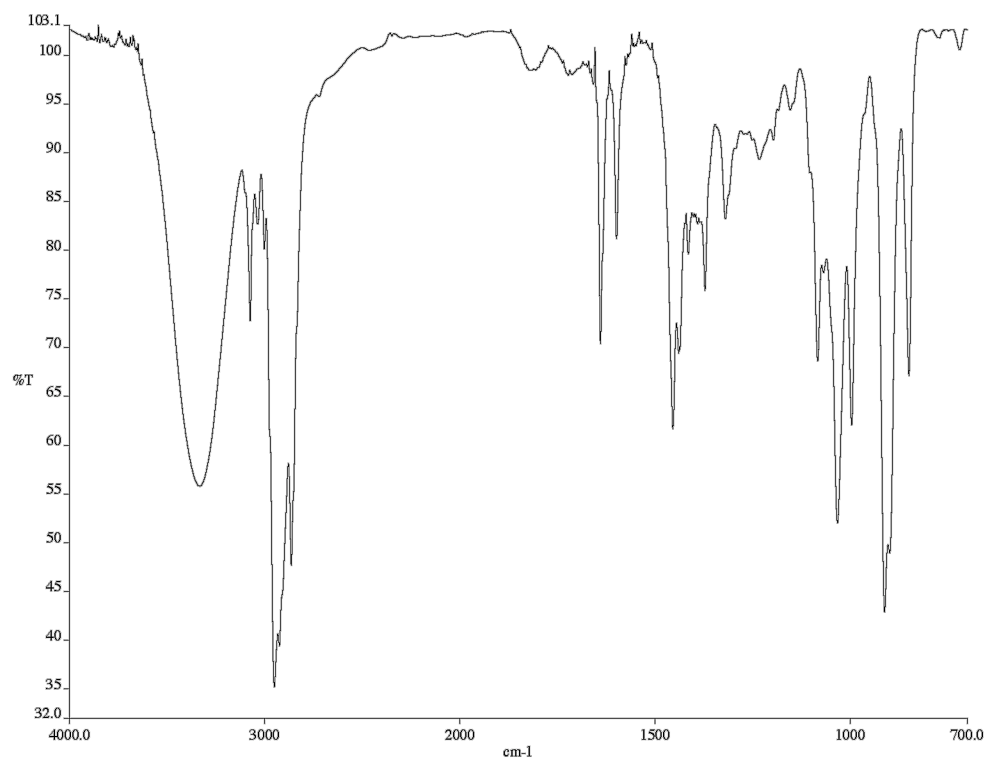


Figure A2.93.2. Infrared spectrum (thin film/NaCl) of compound **92**.

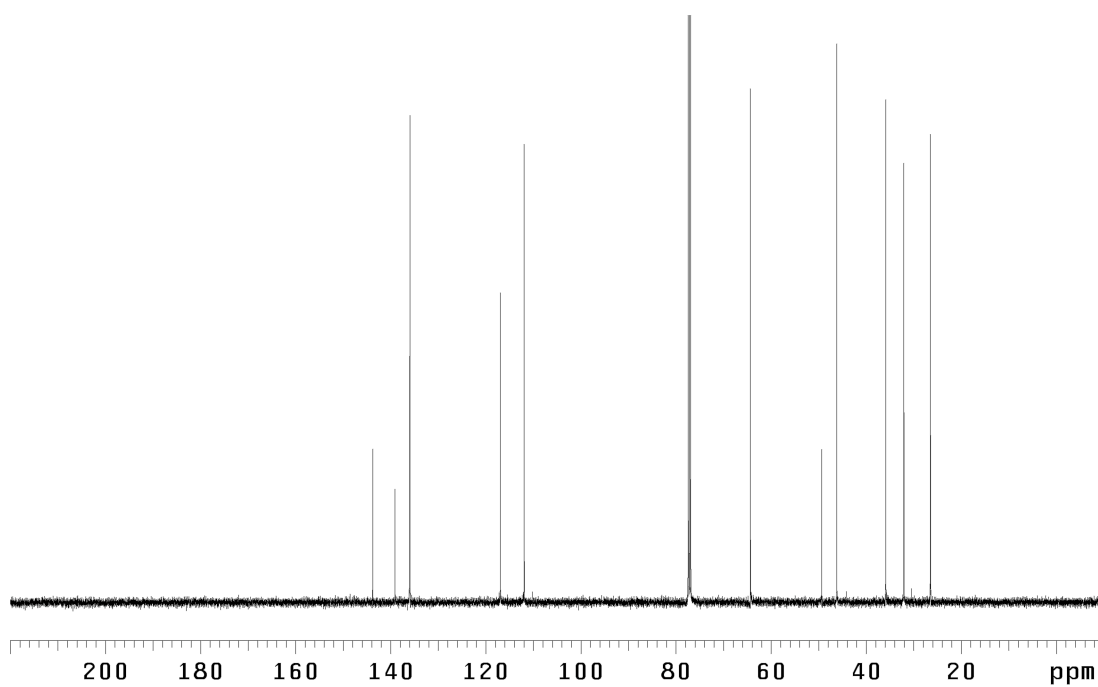


Figure A2.93.3. ¹³C NMR (125 MHz, CDCl₃) of compound **92**.

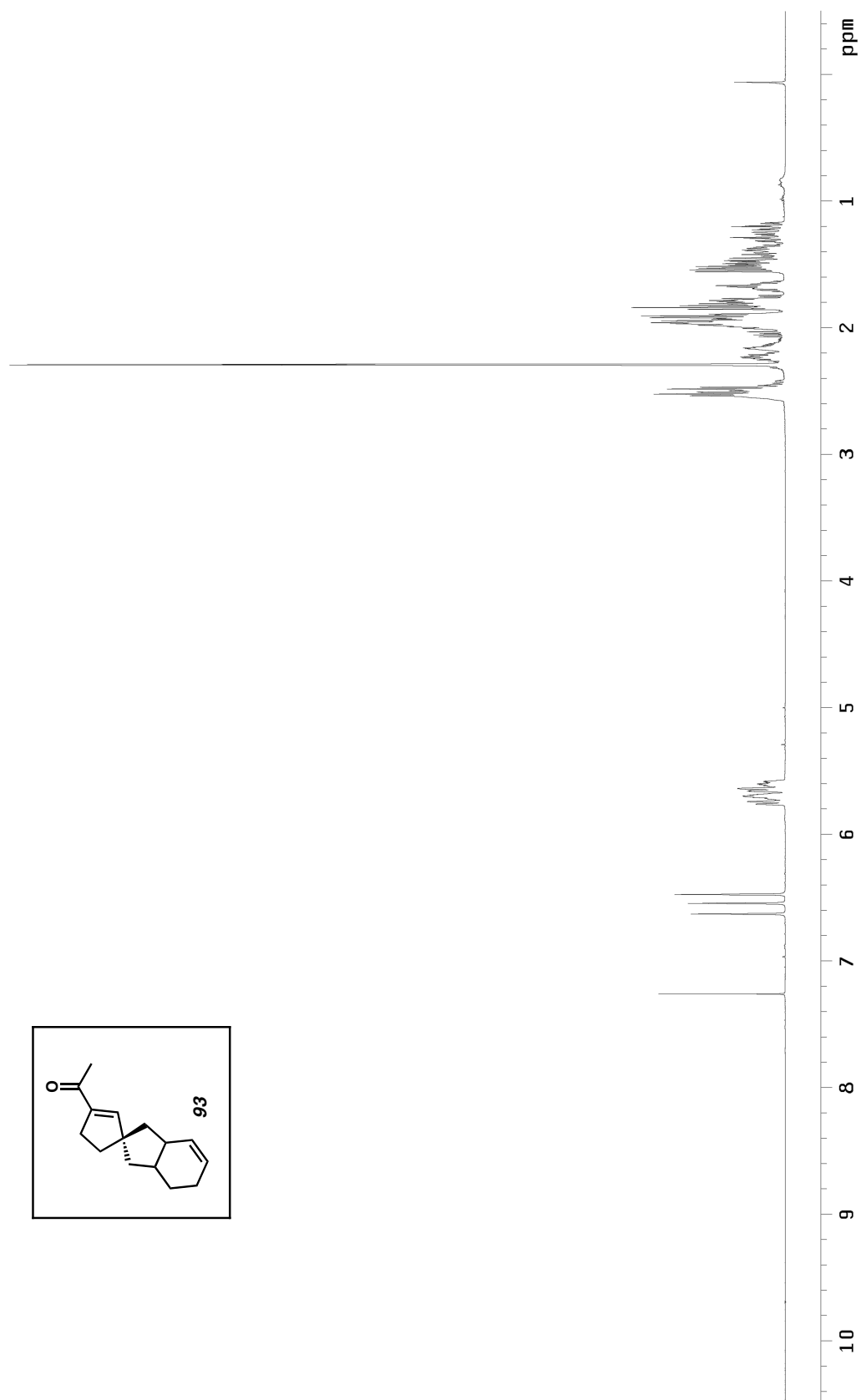


Figure A2.94.1. ^1H NMR (500 MHz, CDCl_3) of compound **93**.

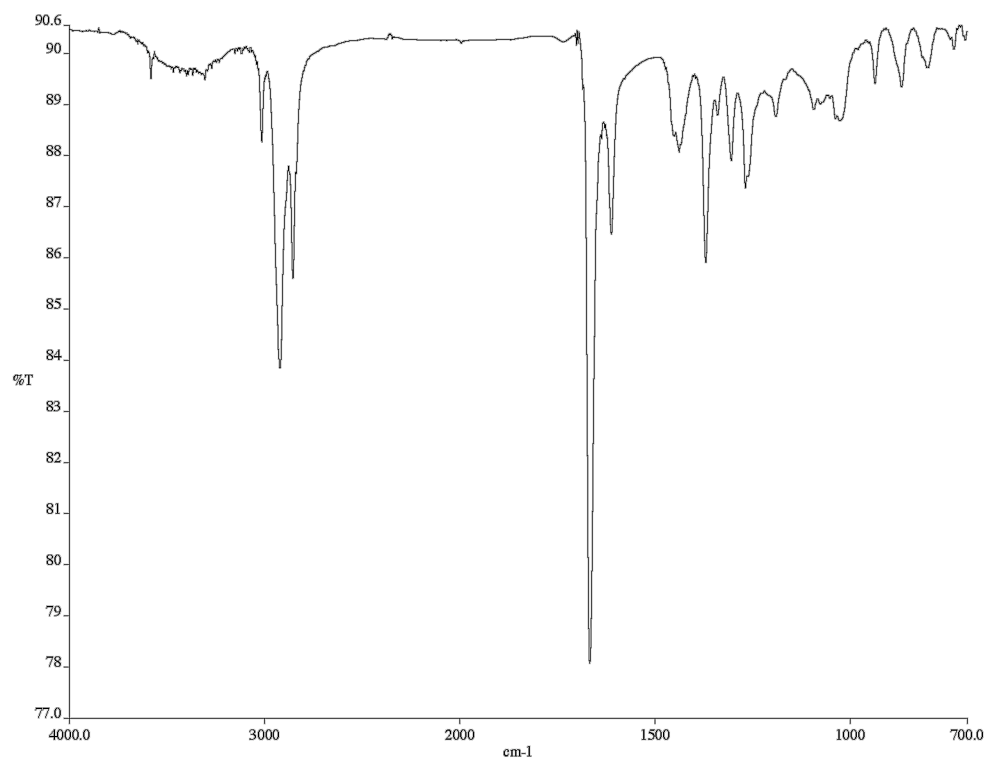


Figure A2.94.2. Infrared spectrum (thin film/NaCl) of compound **93**.

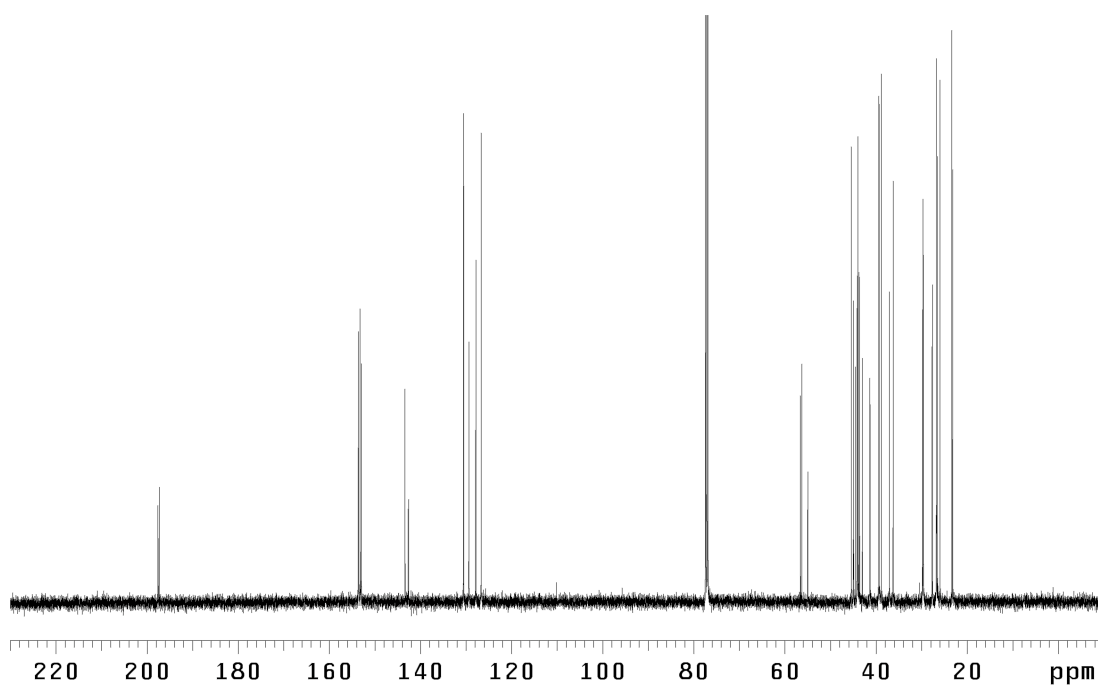


Figure A2.94.3. ¹³C NMR (125 MHz, CDCl₃) of compound **93**.

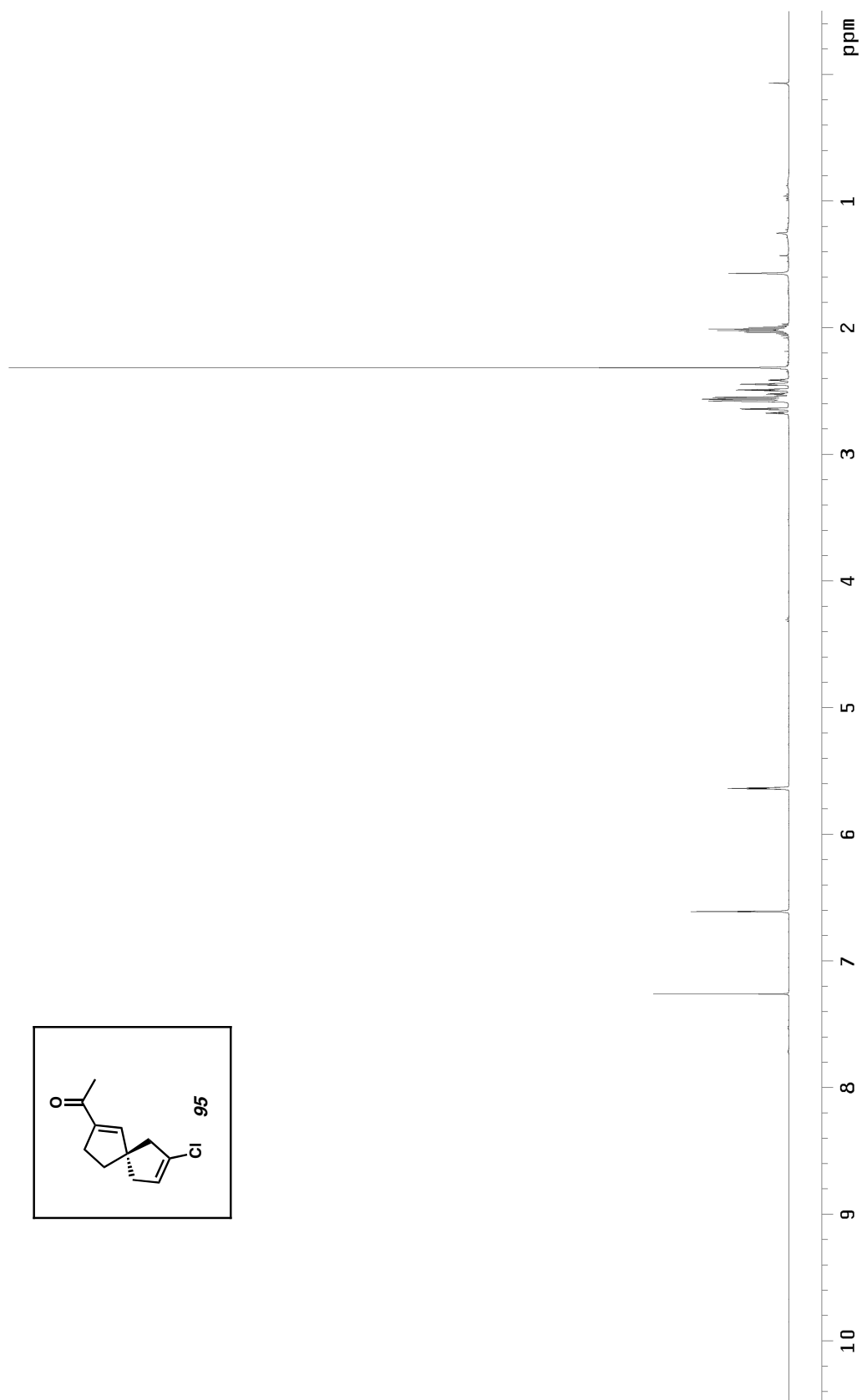


Figure A2.95.1. ^1H NMR (500 MHz, CDCl_3) of compound **95**.

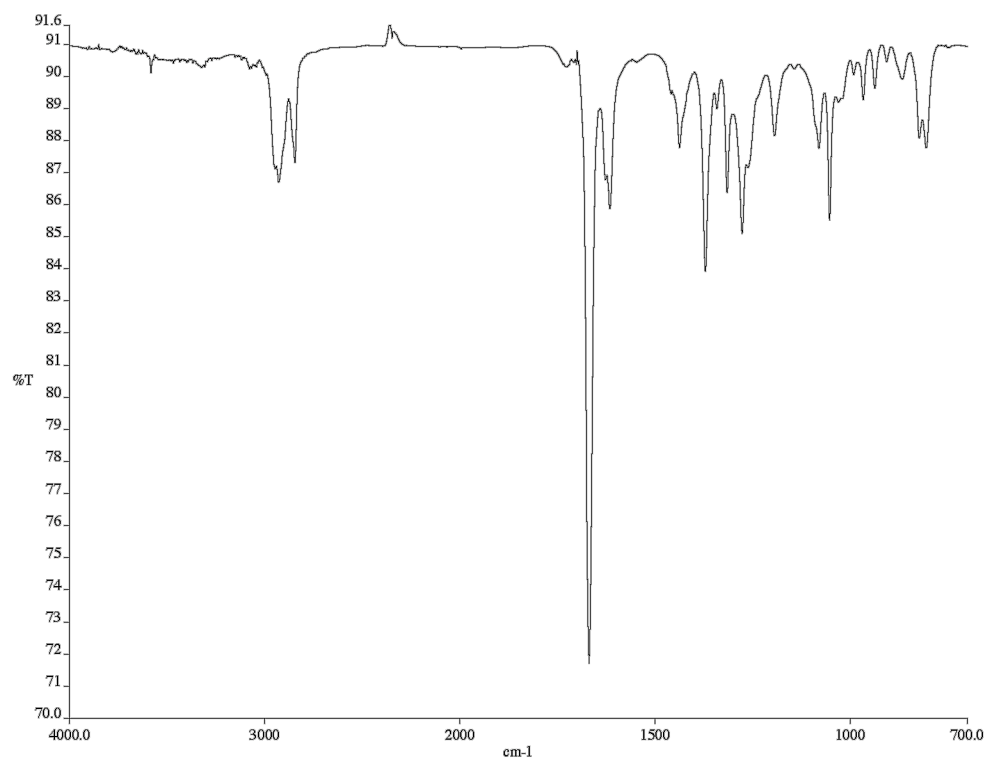


Figure A2.95.2. Infrared spectrum (thin film/NaCl) of compound **95**.

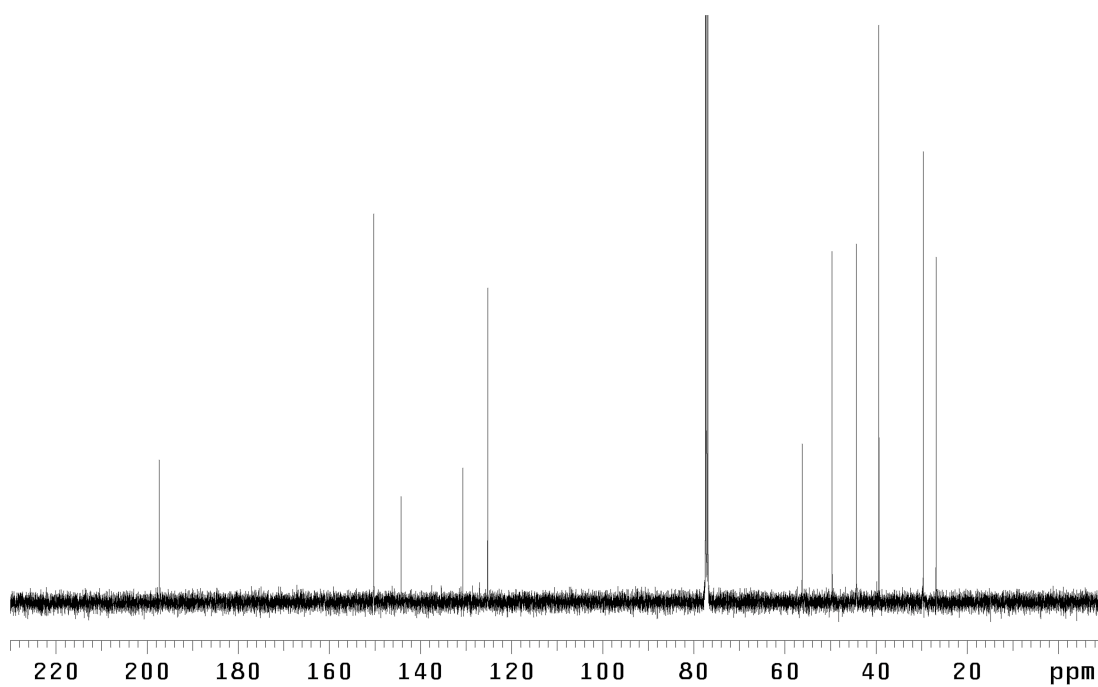


Figure A2.95.3. ¹³C NMR (125 MHz, CDCl₃) of compound **95**.

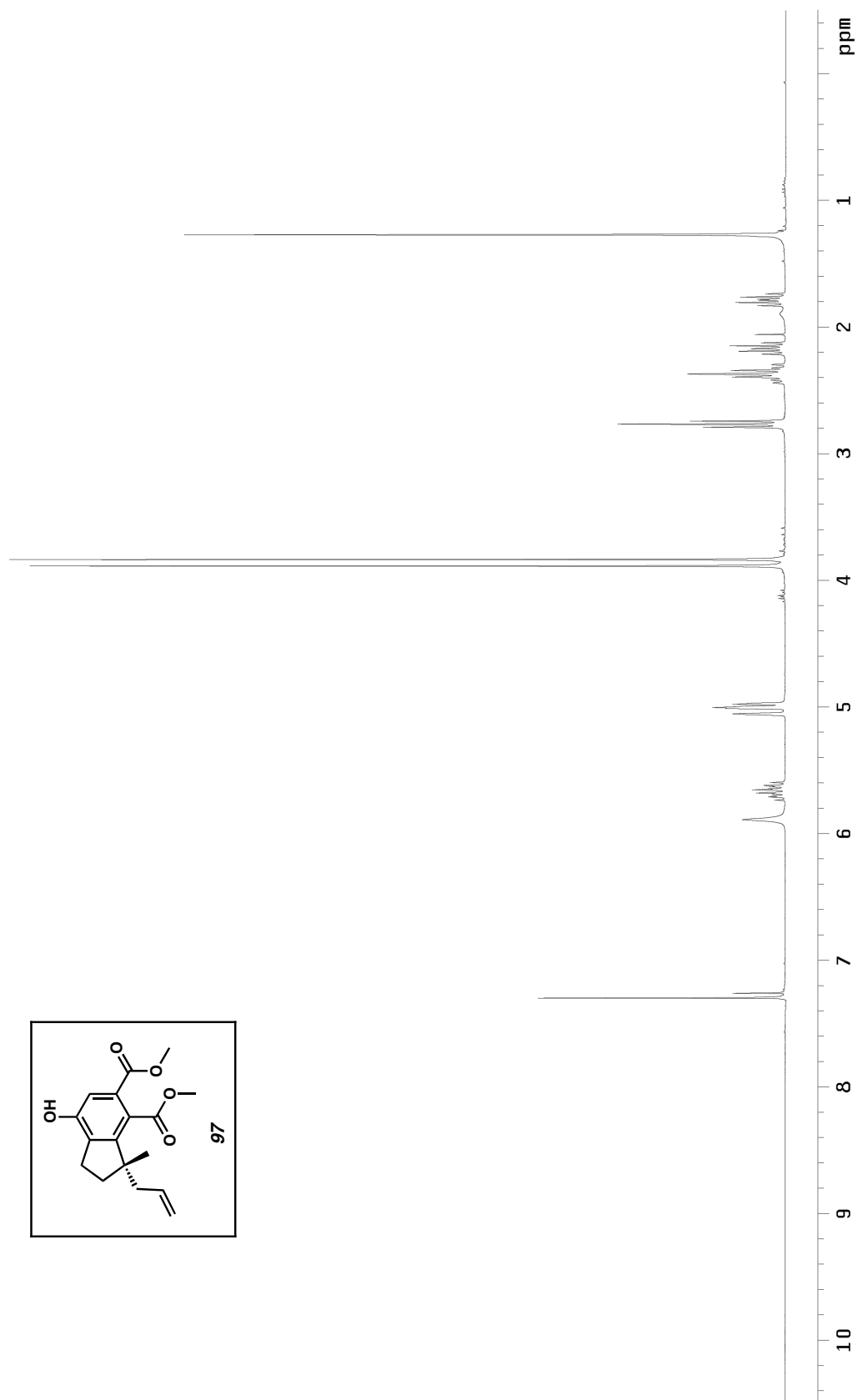


Figure A2.96.1. ¹H NMR (300 MHz, CDCl₃) of compound **97**.

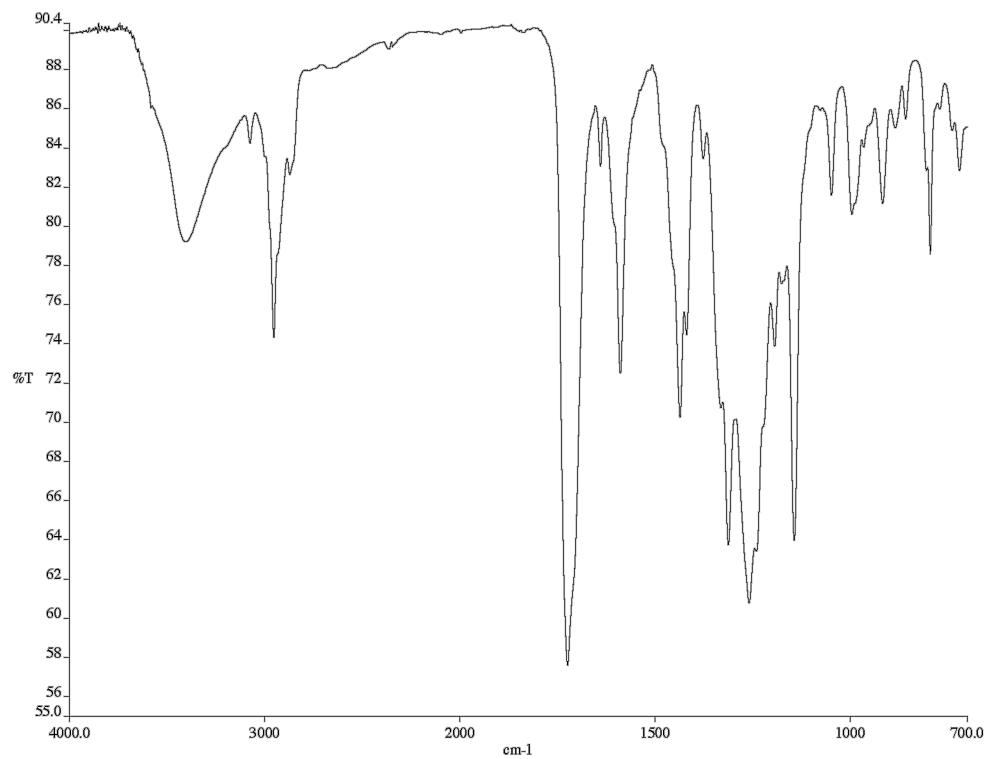


Figure A2.96.2. Infrared spectrum (thin film/NaCl) of compound **97**.

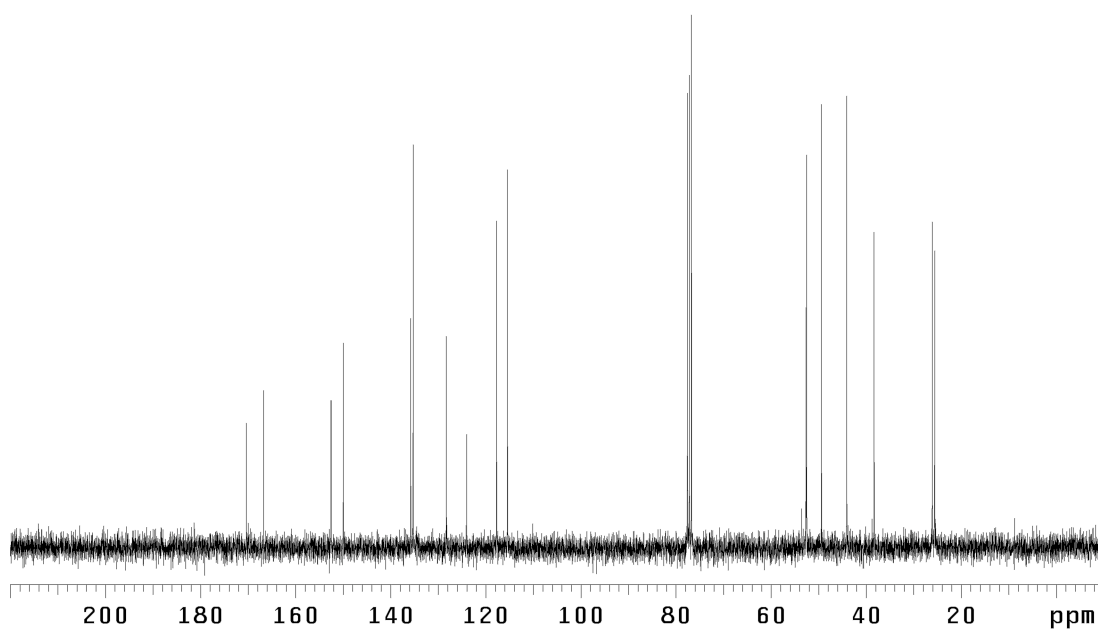
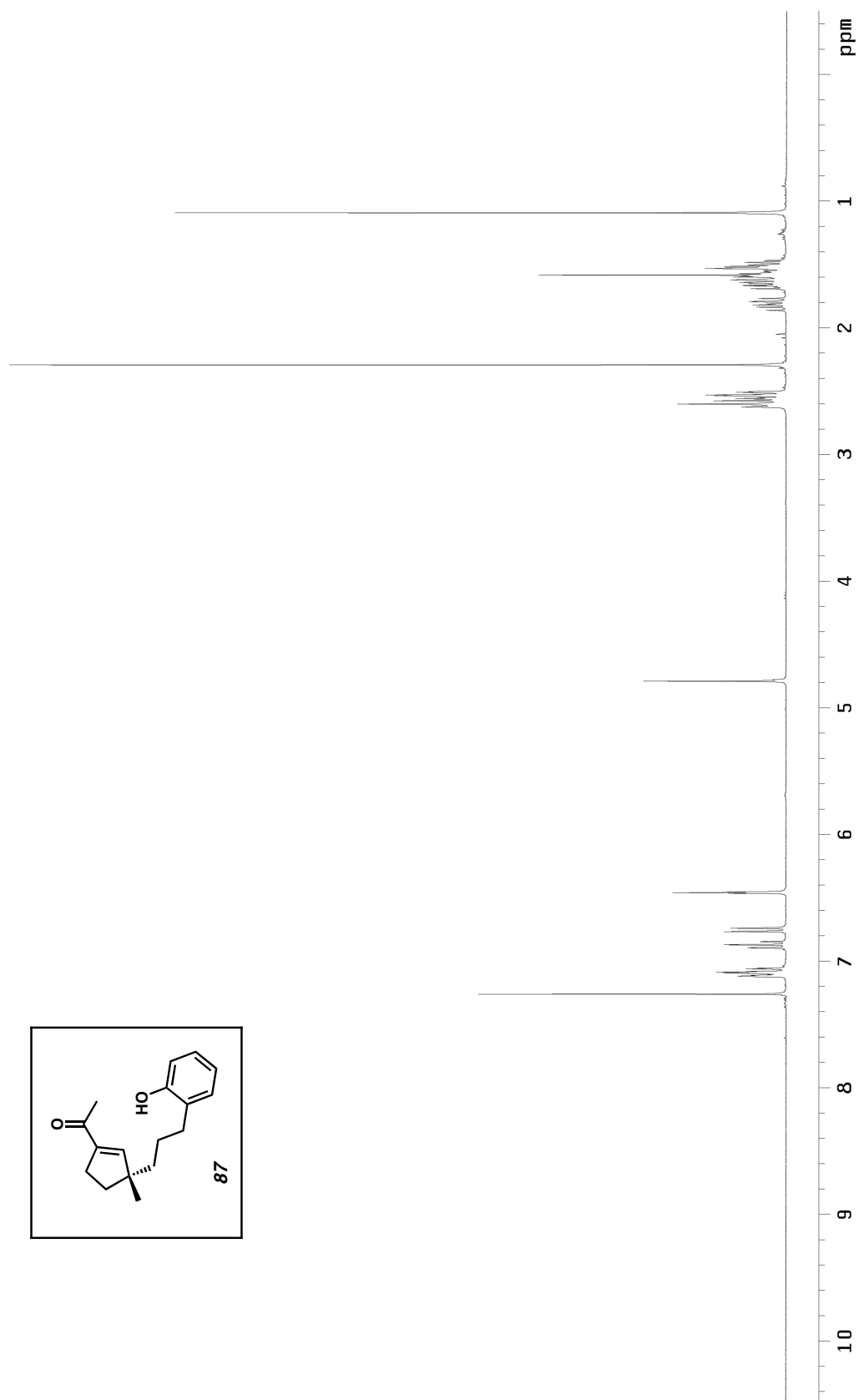


Figure A2.96.3. ¹³C NMR (75 MHz, CDCl₃) of compound **97**.

Figure A2.97.1. ^1H NMR (300 MHz, CDCl_3) of compound **87**.

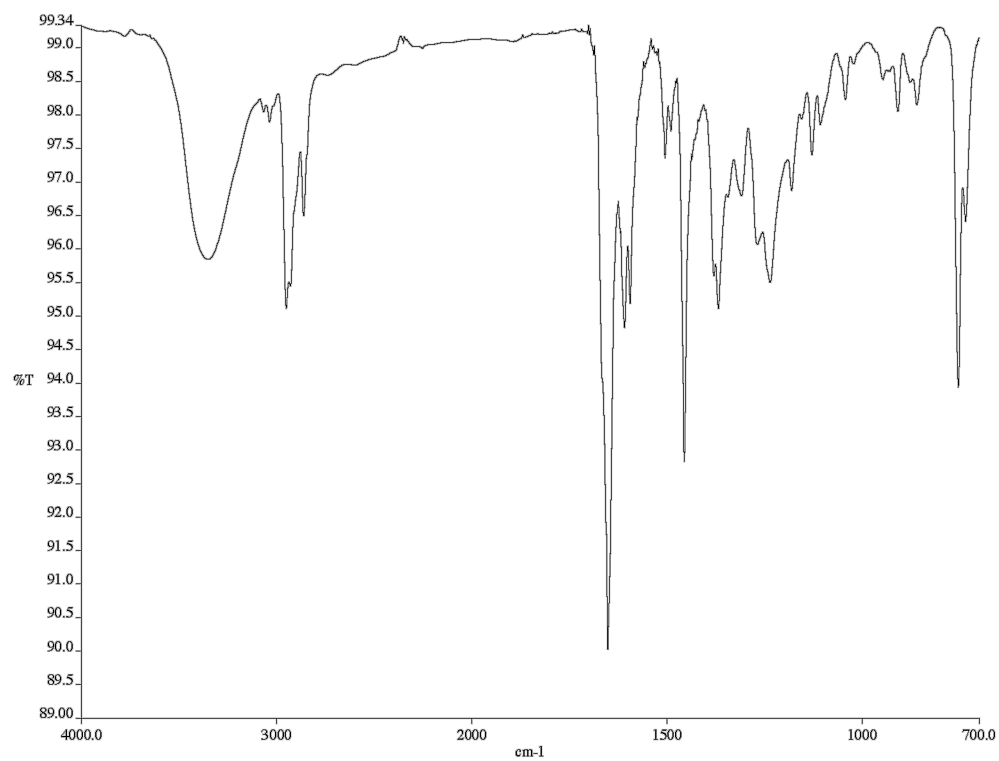


Figure A2.97.2. Infrared spectrum (thin film/NaCl) of compound **87**.

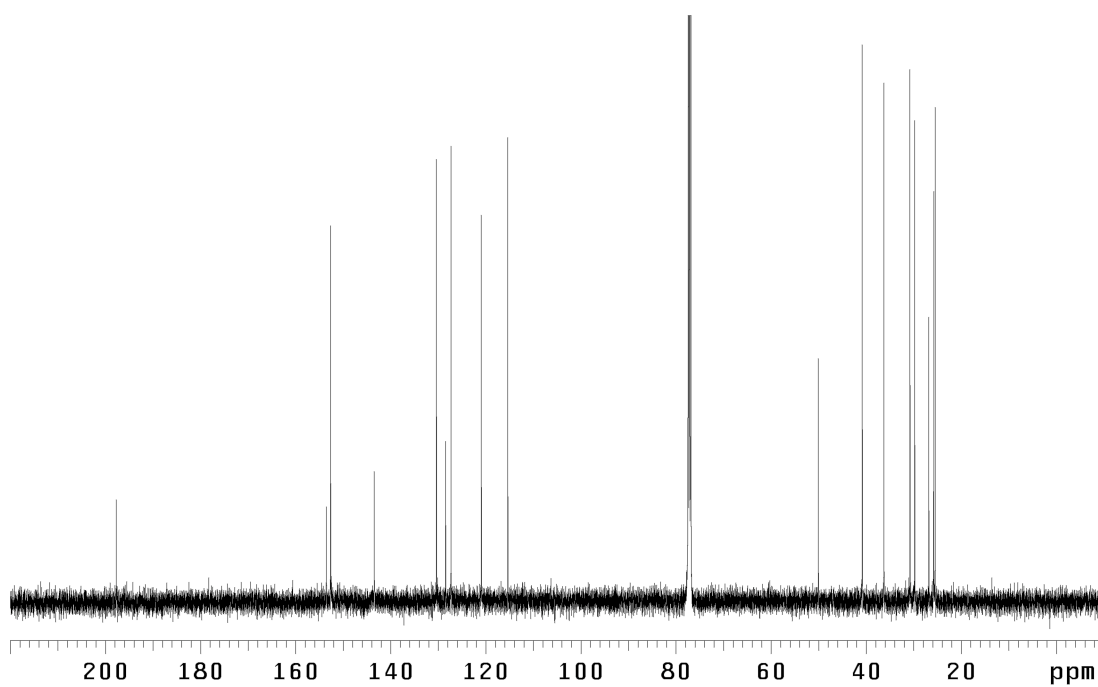


Figure A2.97.3. ¹³C NMR (125 MHz, CDCl₃) of compound **87**.

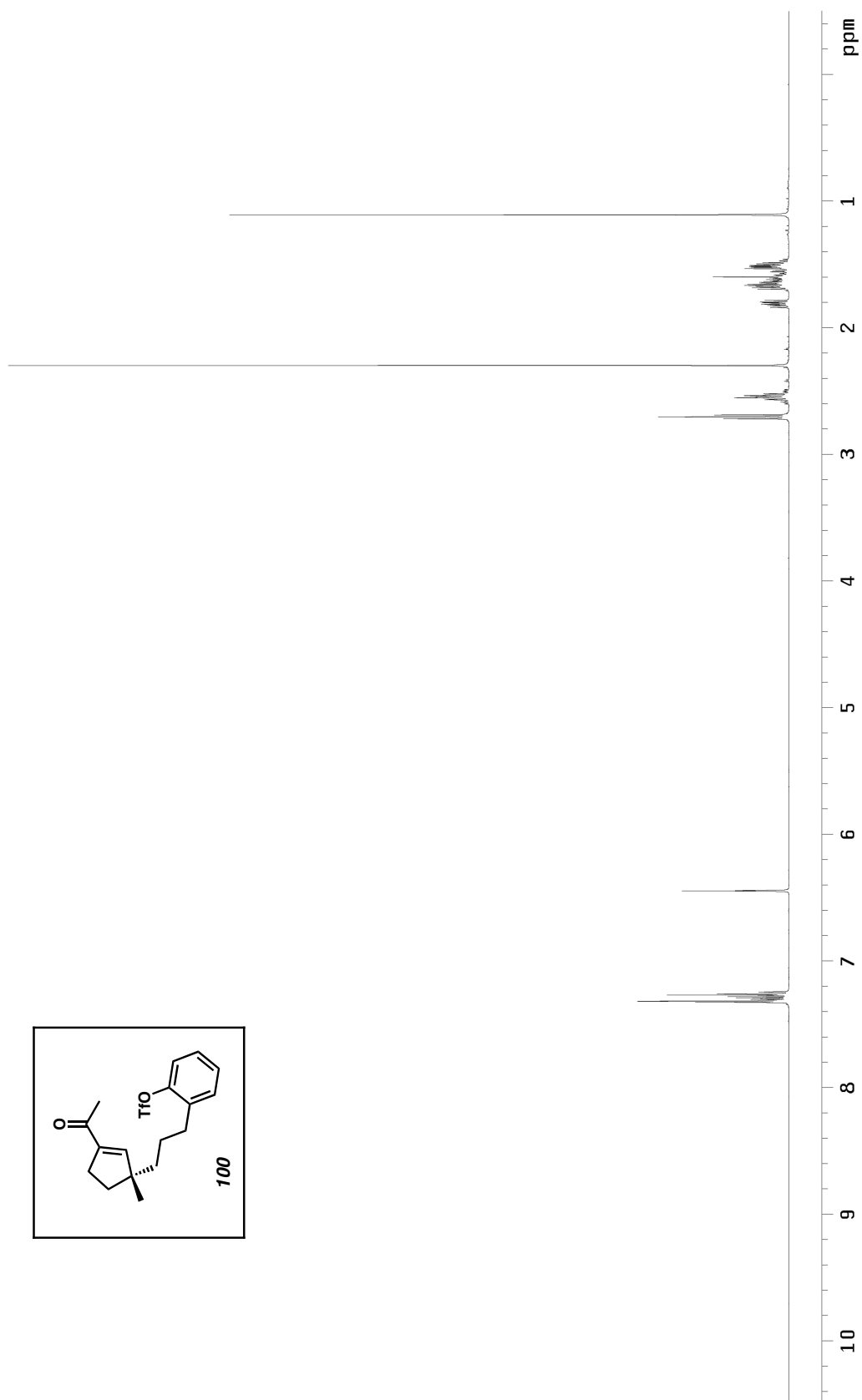


Figure A2.98. 1. ^1H NMR (500 MHz, CDCl_3) of compound **100**.

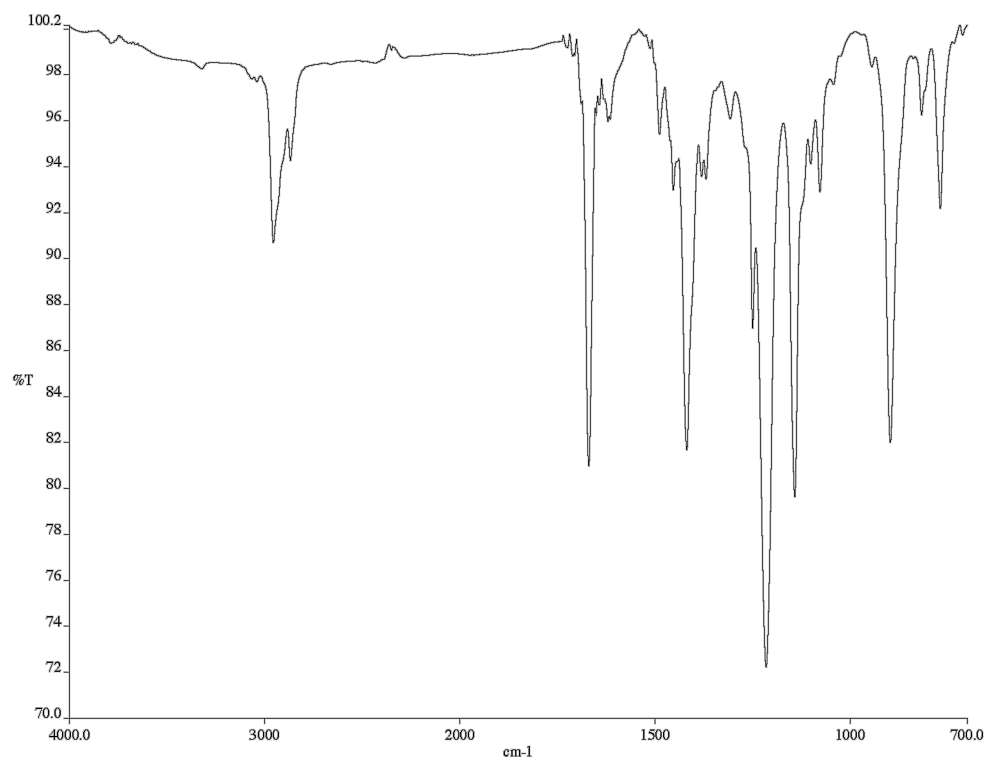


Figure A2.98.2. Infrared spectrum (thin film/NaCl) of compound **100**.

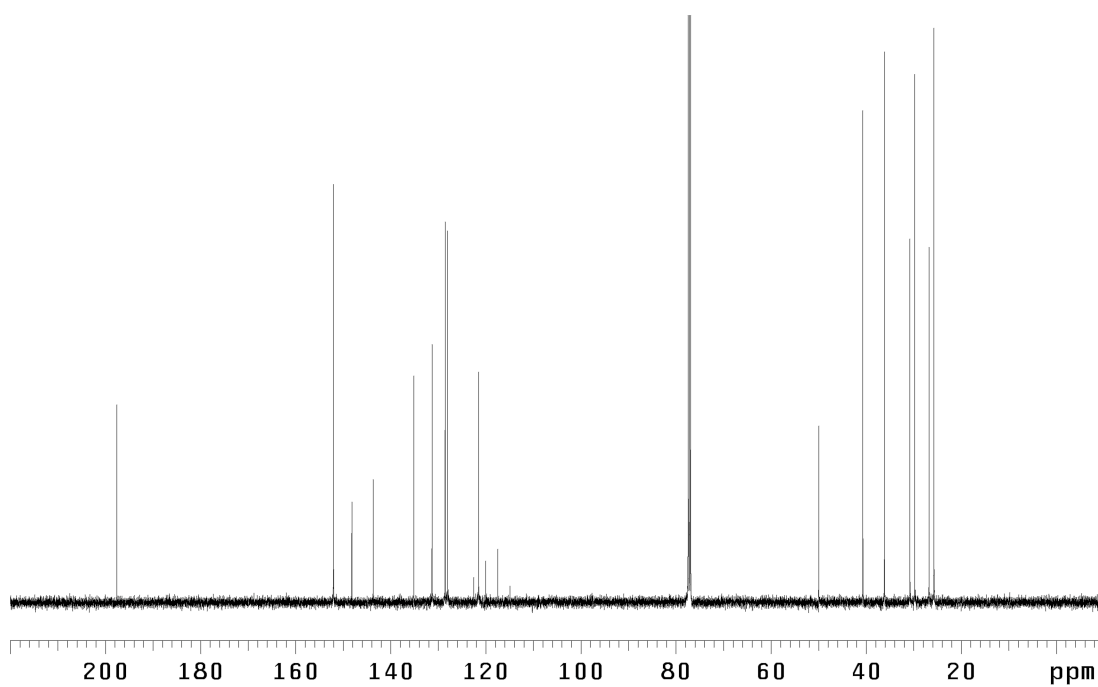


Figure A2.98.3. ¹³C NMR (125 MHz, CDCl₃) of compound **100**.

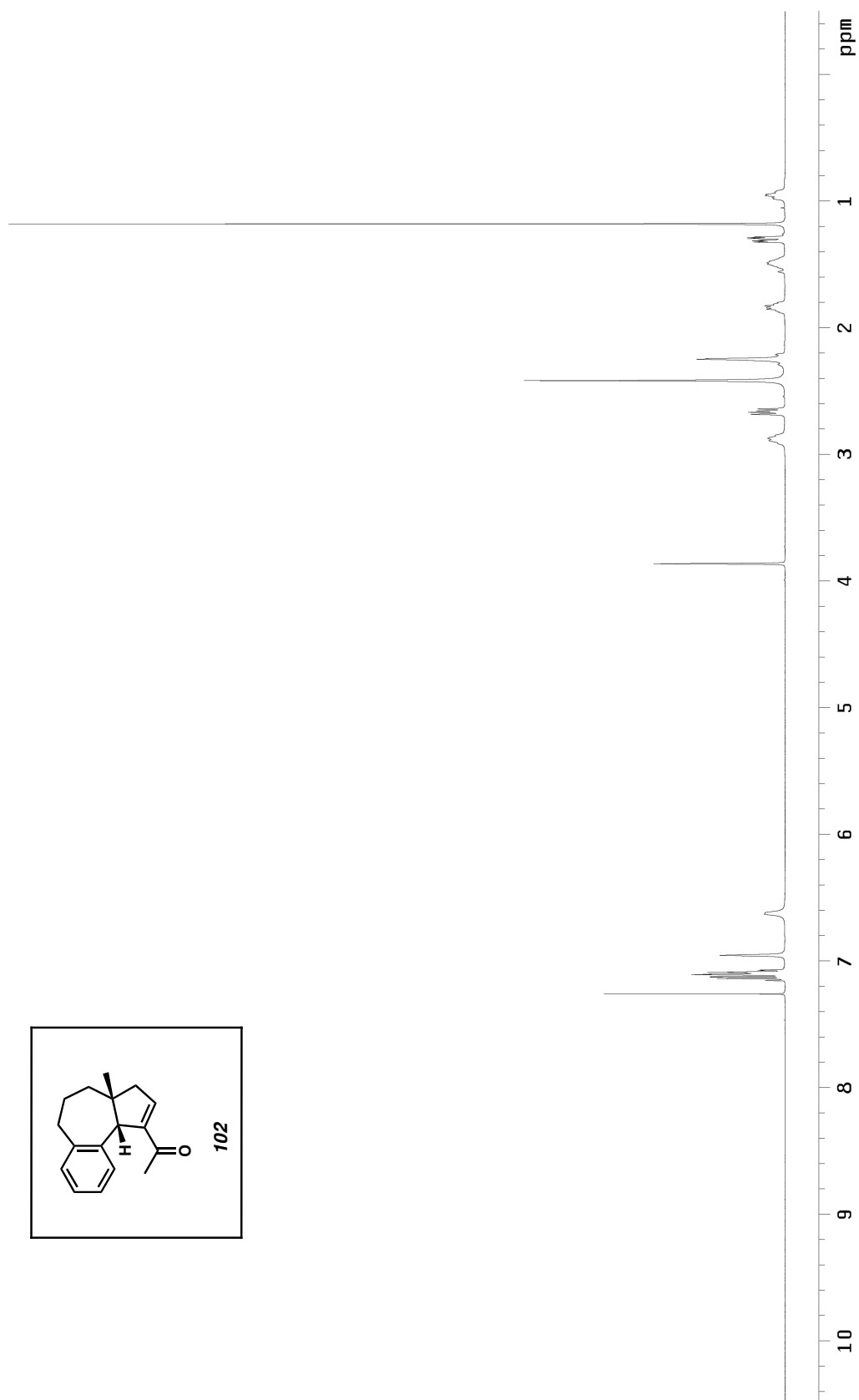


Figure A2.99.1. ^1H NMR (500 MHz, CDCl_3) of compound **102**.

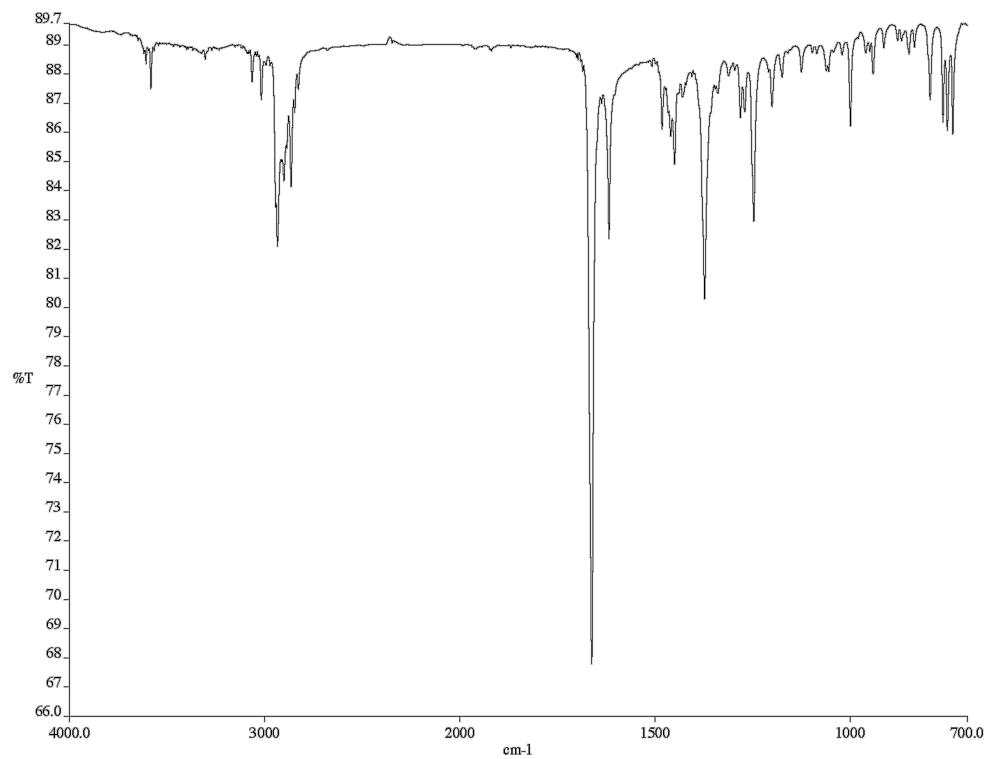


Figure A2.99.2. Infrared spectrum (thin film/NaCl) of compound **102**.

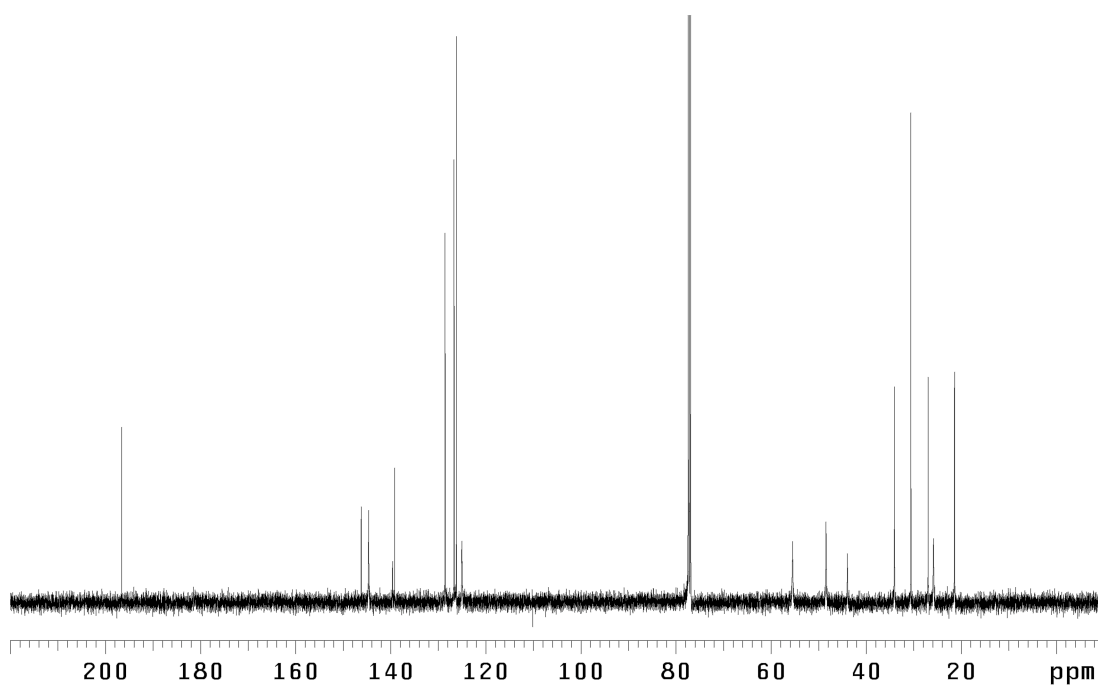
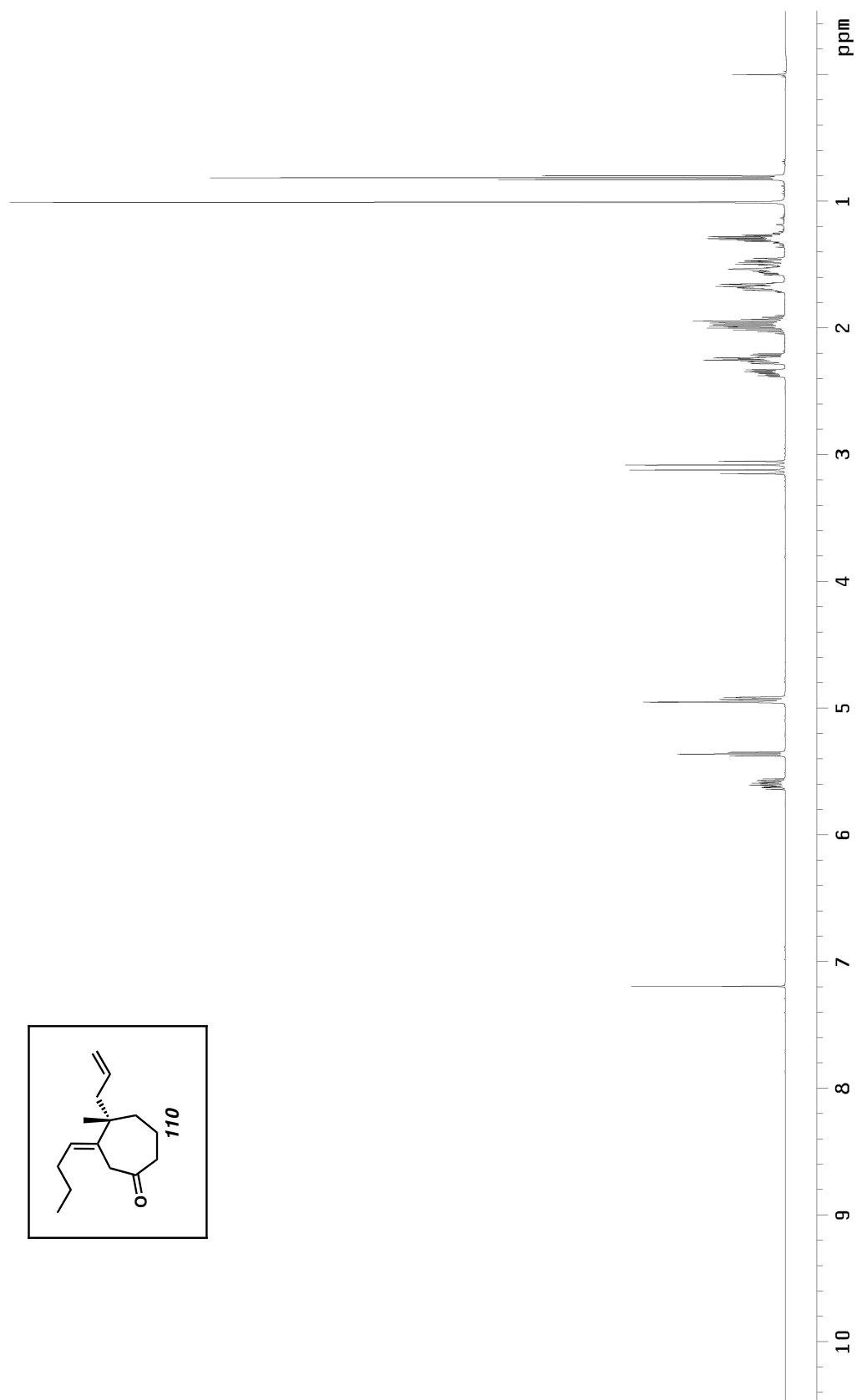


Figure A2.99.3. ¹³C NMR (125 MHz, CDCl₃) of compound **102**.



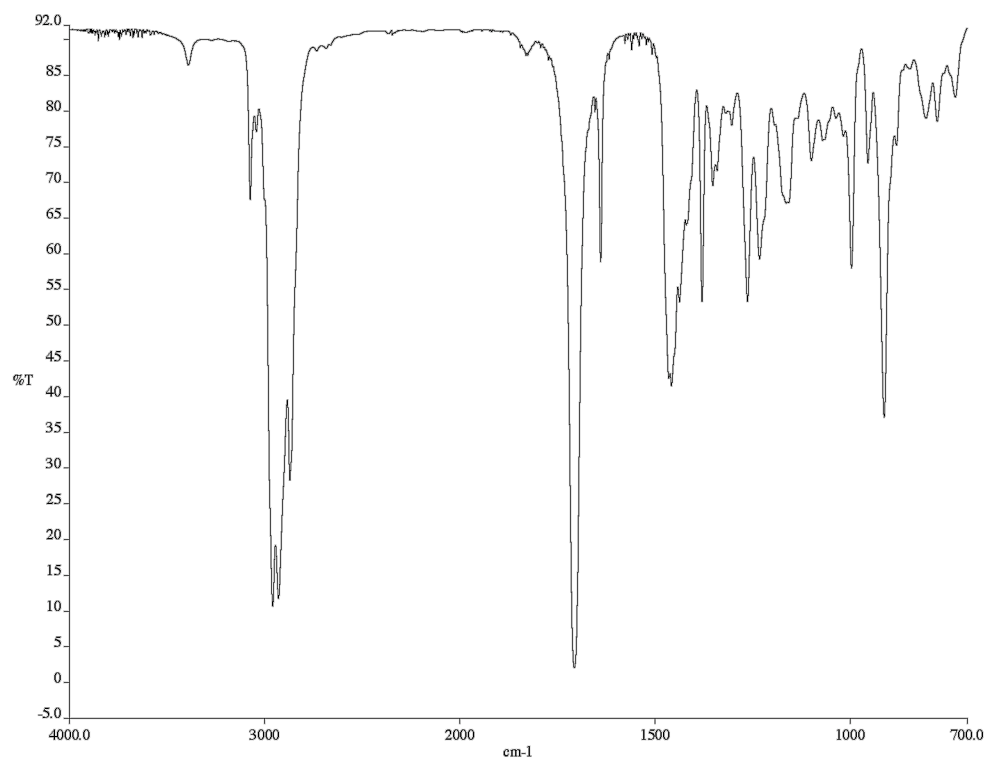


Figure A2.100.2. Infrared spectrum (thin film/NaCl) of compound **110**.

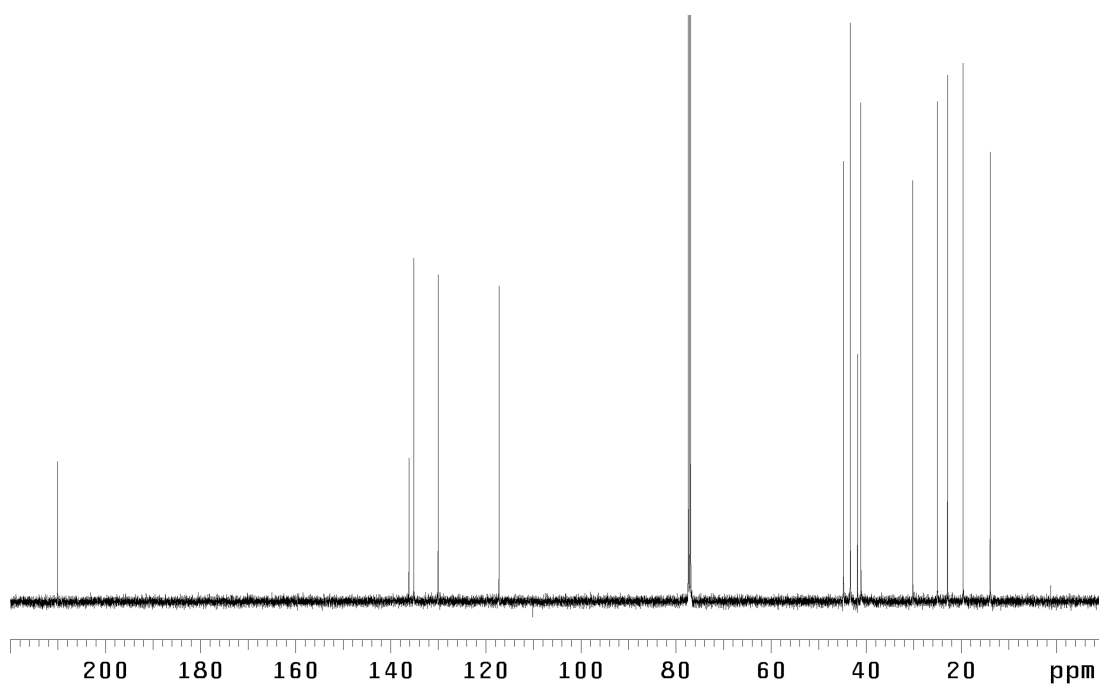
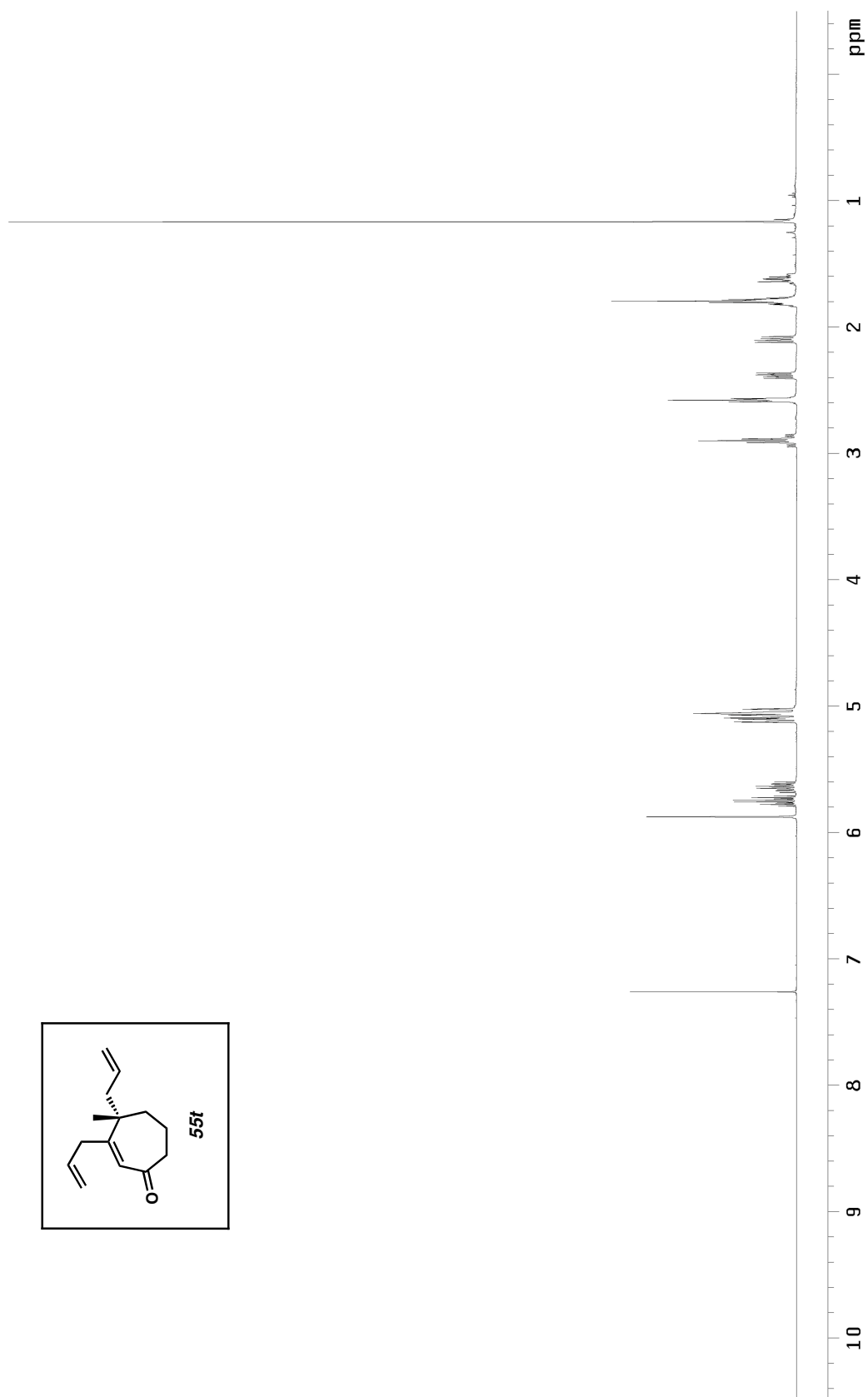


Figure A2.100.3. ¹³C NMR (125 MHz, CDCl₃) of compound **110**.

Figure A2.101.1. ^1H NMR (500 MHz, CDCl_3) of compound **55t**.

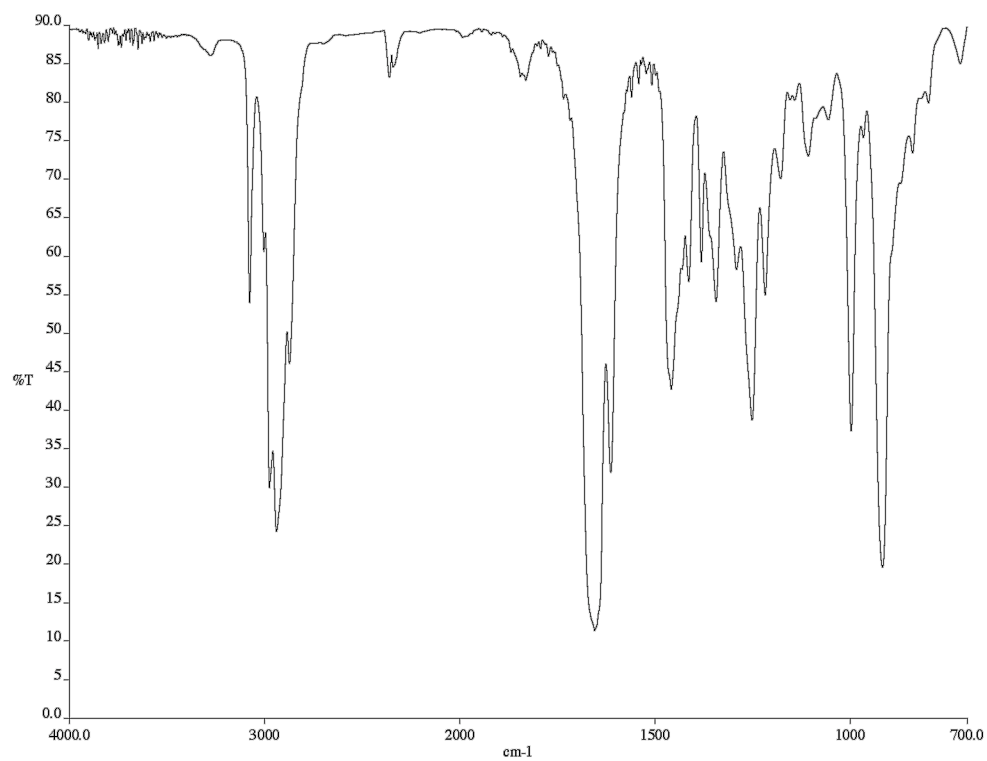


Figure A2.101.2. Infrared spectrum (thin film/NaCl) of compound **55t**.

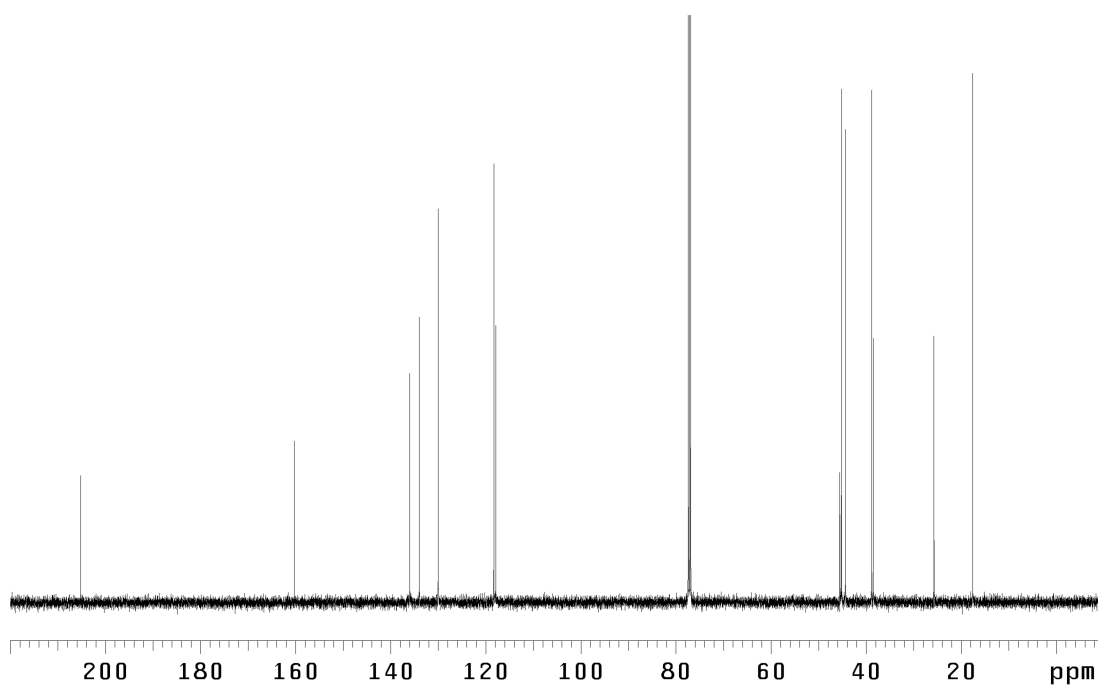
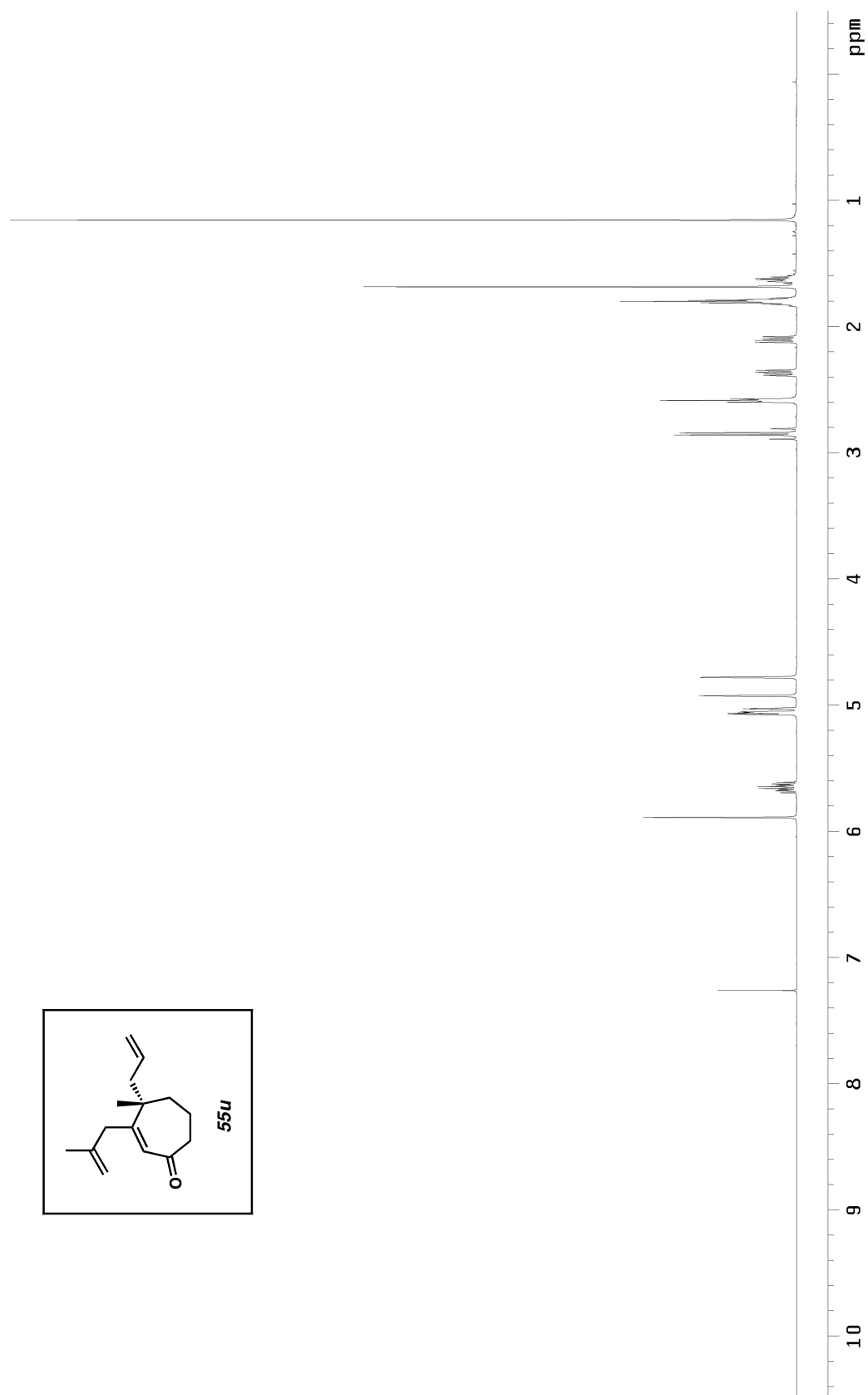


Figure A2.101.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55t**.

Figure A2.102.1. ^1H NMR (500 MHz, CDCl_3) of compound **55u**.

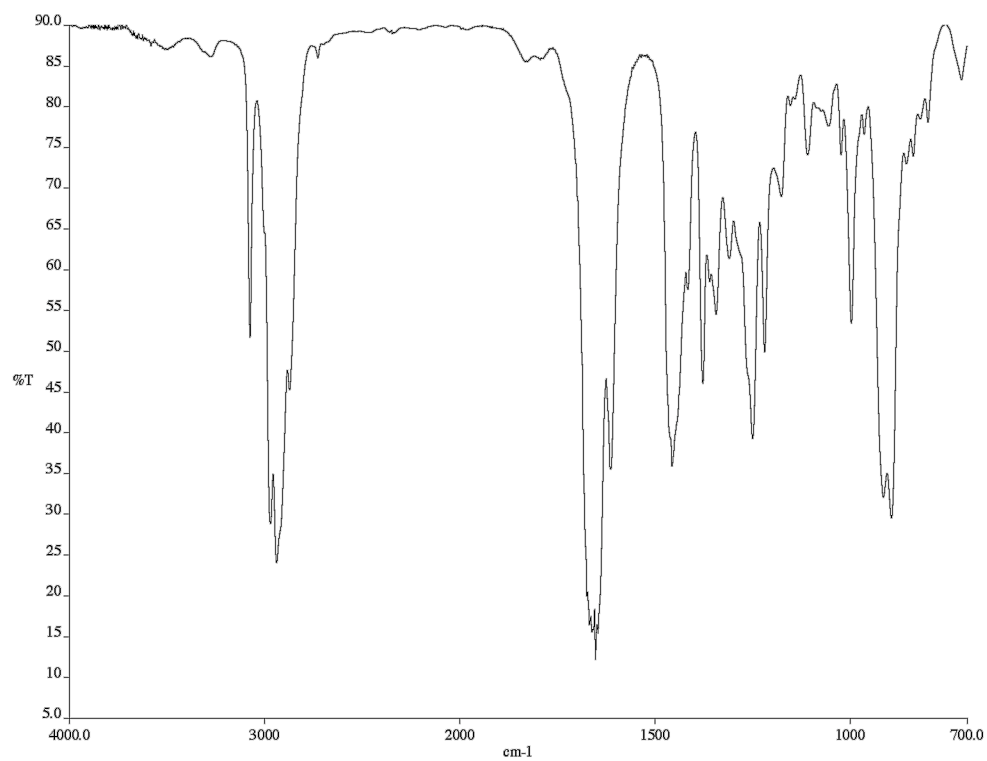


Figure A2.102.2. Infrared spectrum (thin film/NaCl) of compound **55u**.

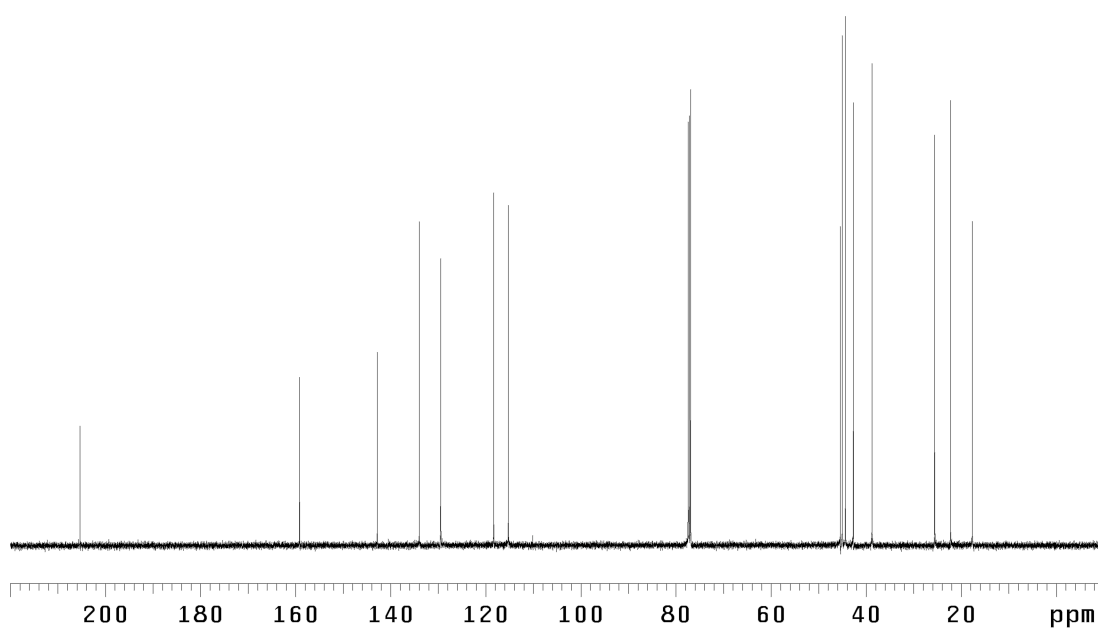


Figure A2.102.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55u**.

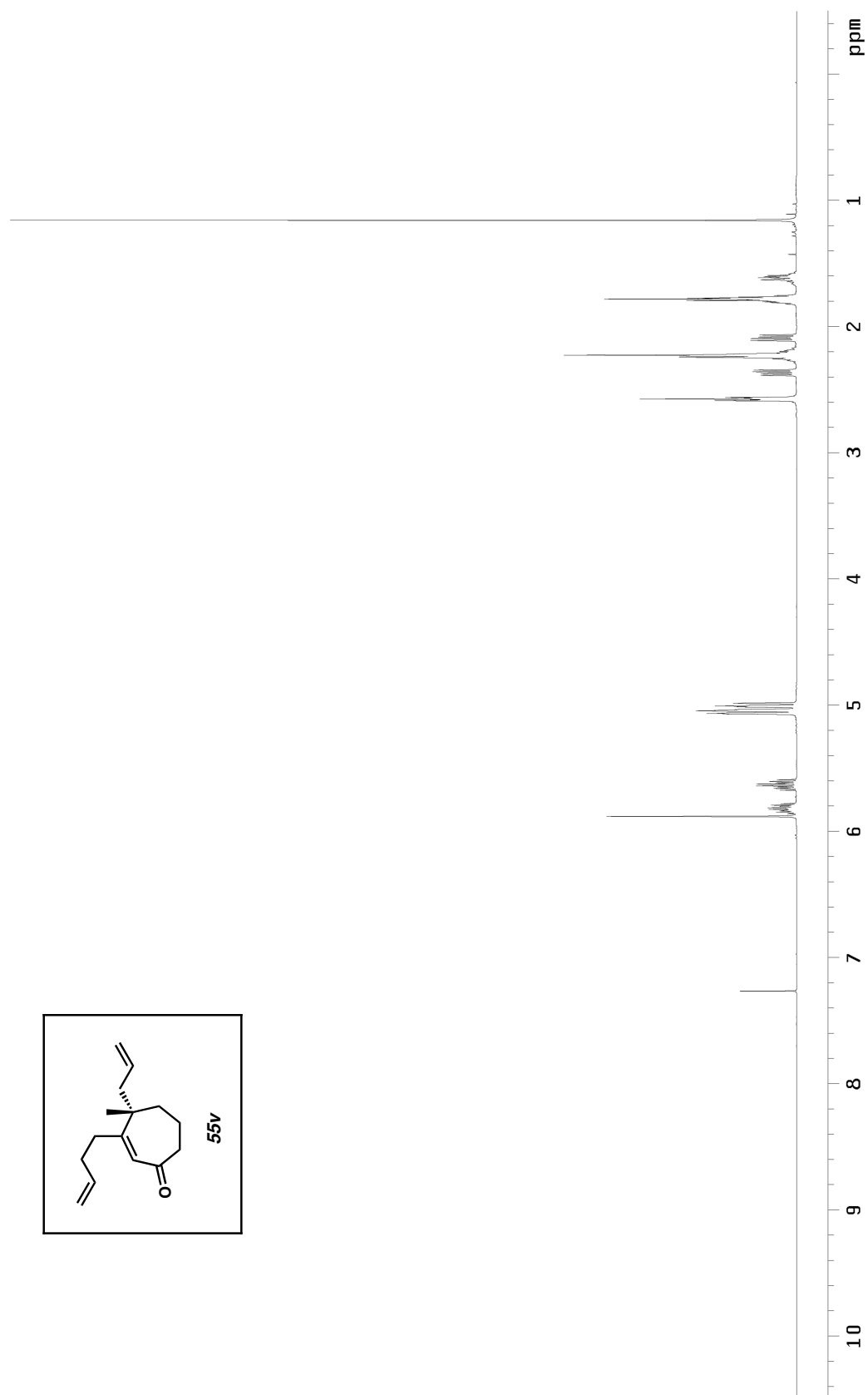


Figure A2.103.1. ^1H NMR (500 MHz, CDCl_3) of compound 55v.

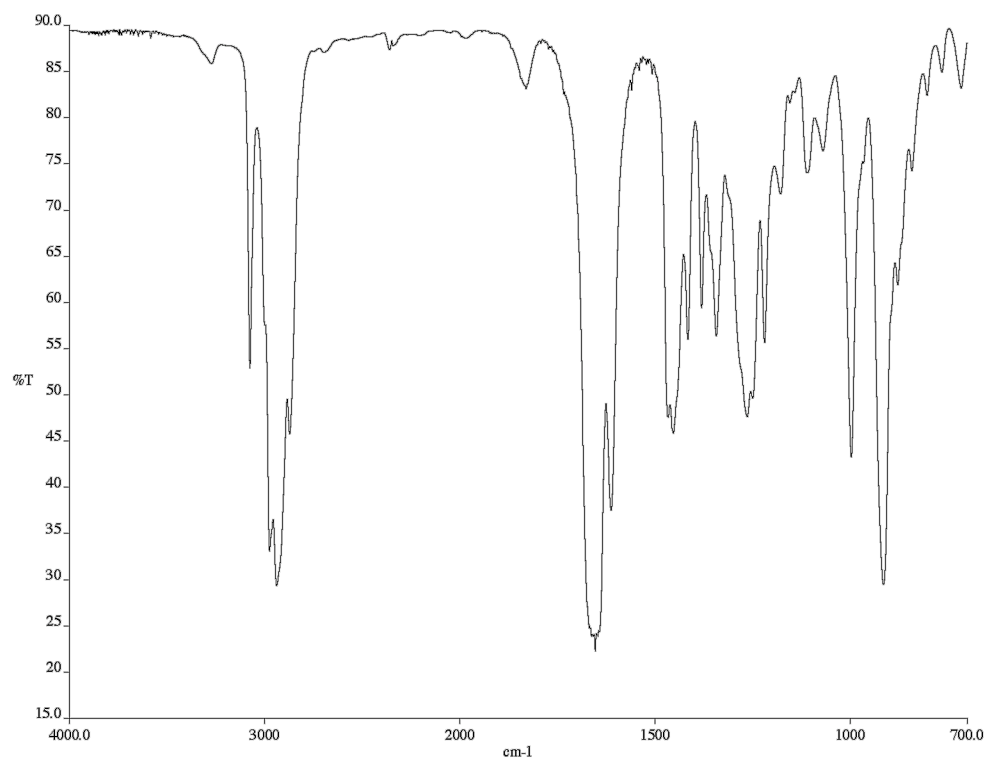


Figure A2.103.2. Infrared spectrum (thin film/NaCl) of compound **55v**.

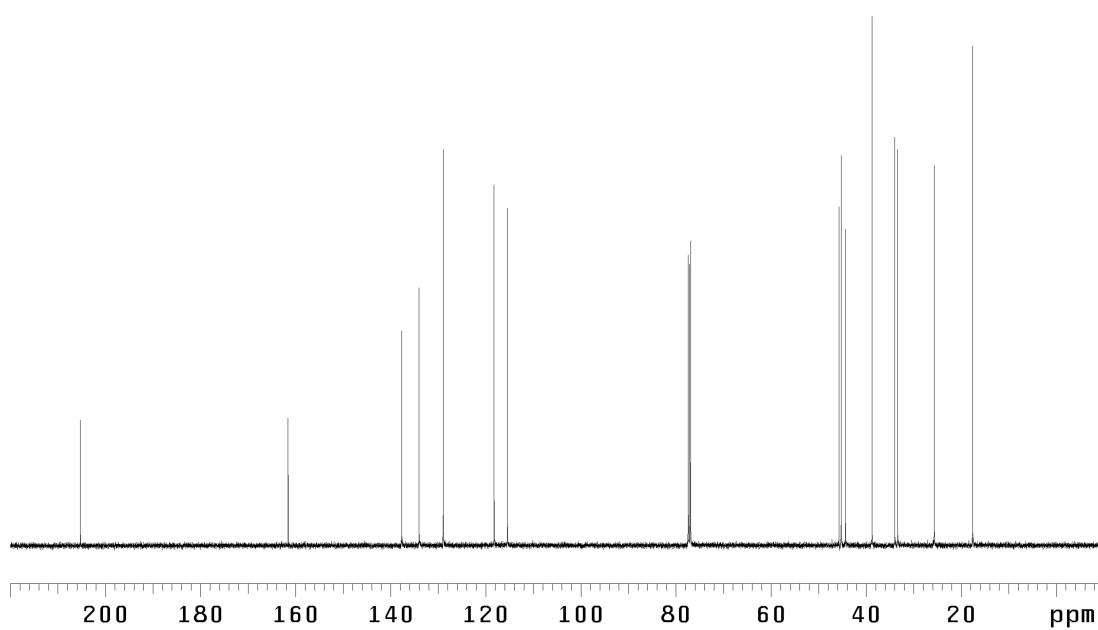
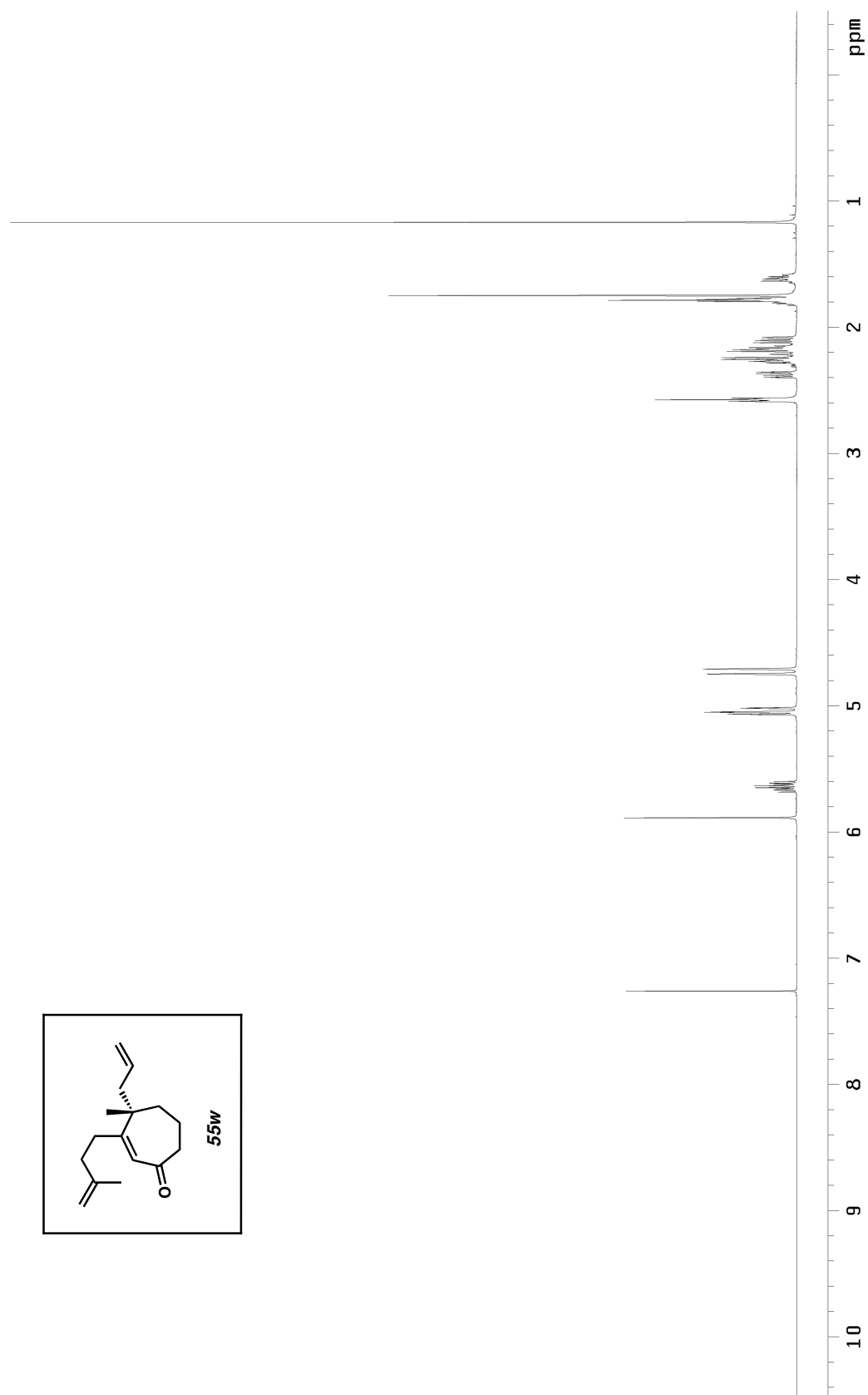


Figure A2.103.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55v**.

Figure A2.104.1. ^1H NMR (500 MHz, CDCl_3) of compound 55w.

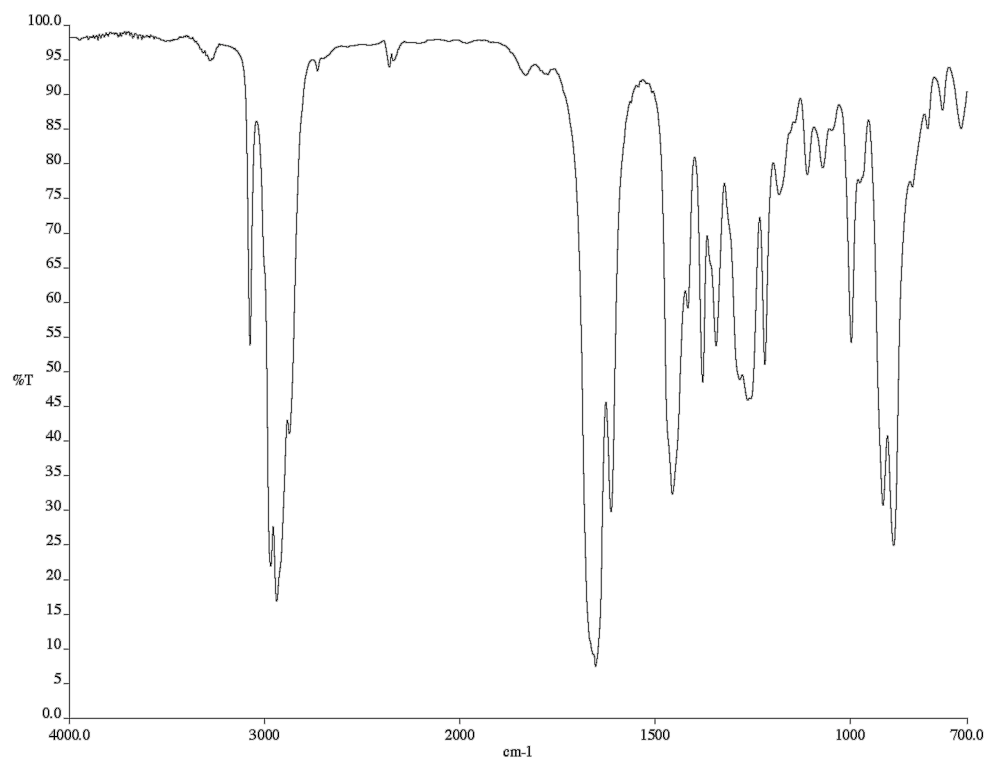


Figure A2.104.2. Infrared spectrum (thin film/NaCl) of compound **55w**.

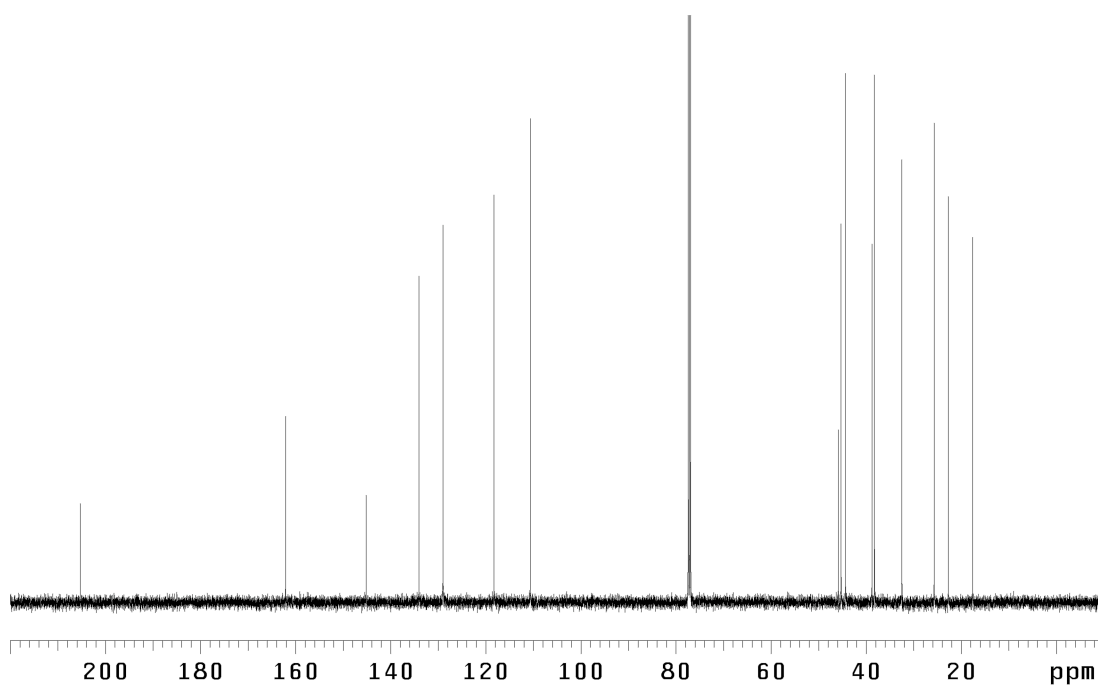


Figure A2.104.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55w**.

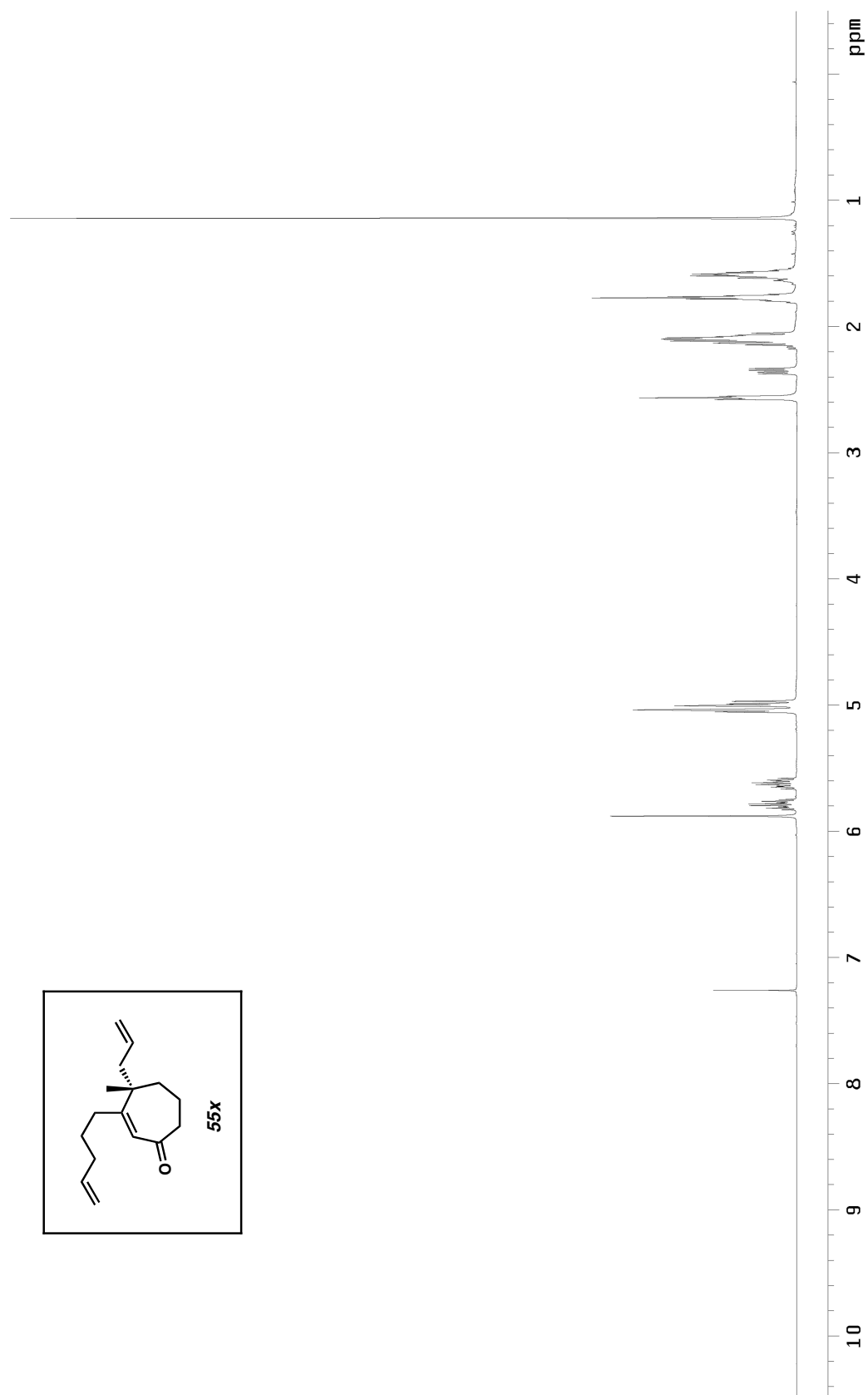


Figure A2.105.1. ^1H NMR (500 MHz, CDCl_3) of compound 55x.

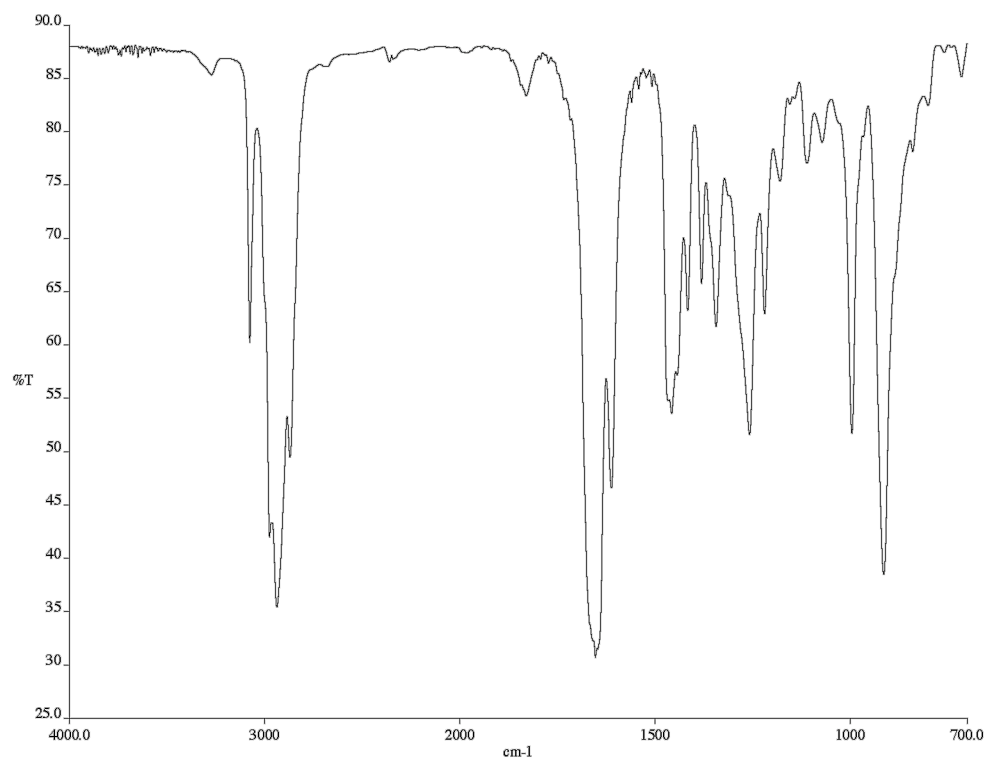


Figure A2.105.2. Infrared spectrum (thin film/NaCl) of compound **55x**.

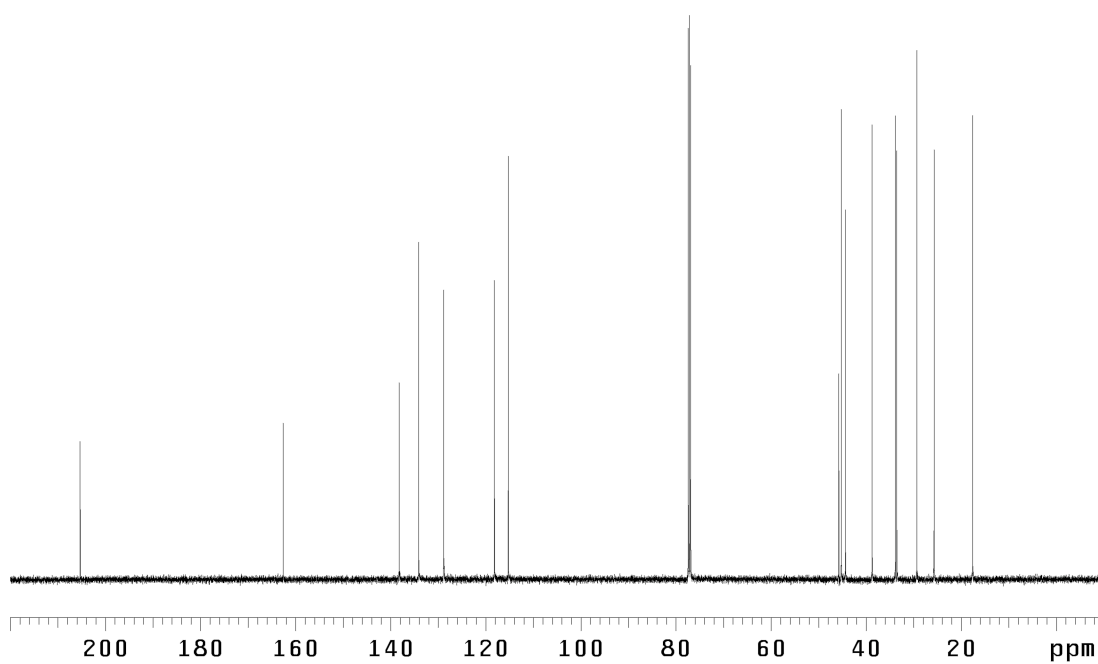


Figure A2.105.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55x**.

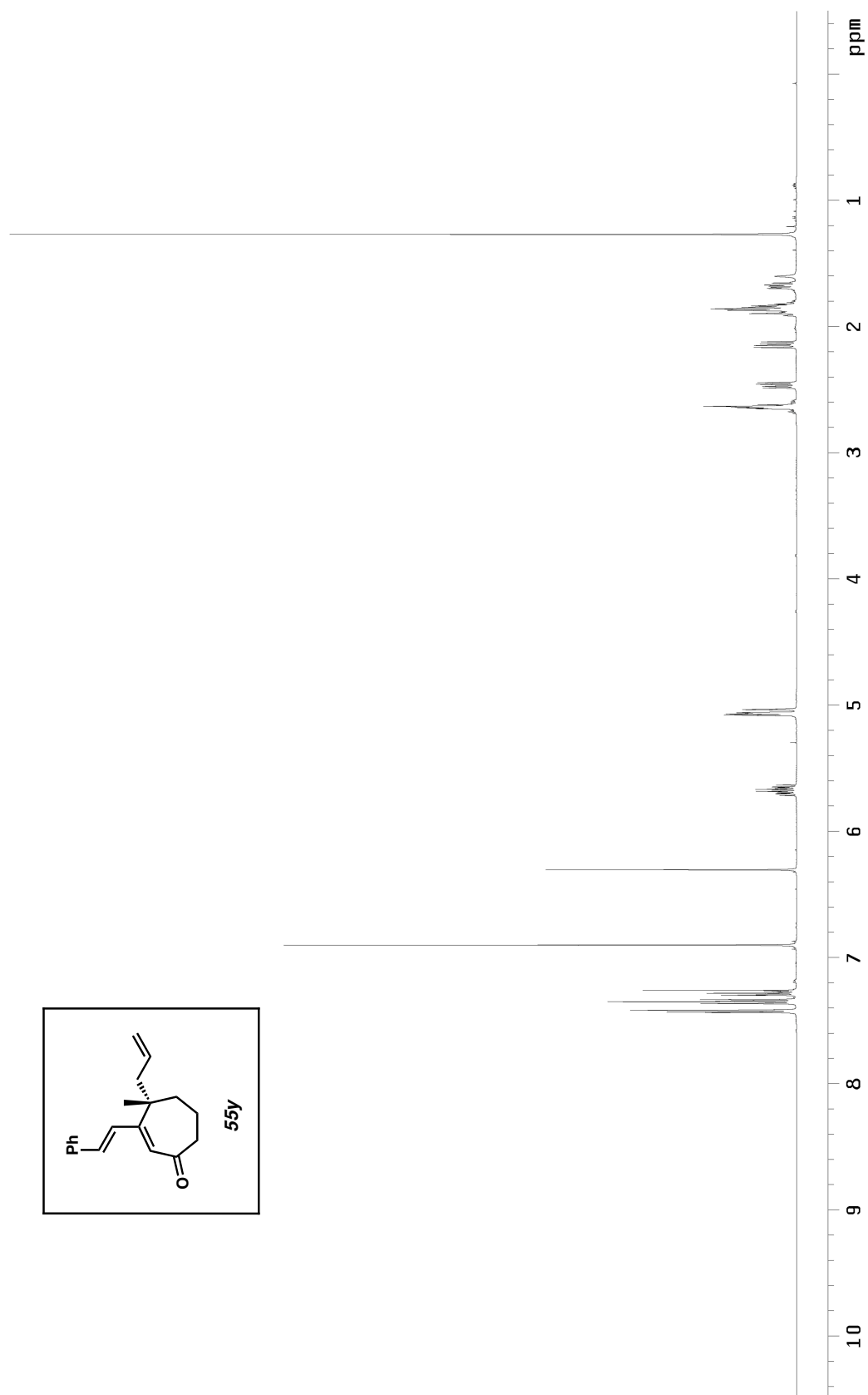


Figure A2.106.1. ^1H NMR (500 MHz, CDCl_3) of compound **55y**.

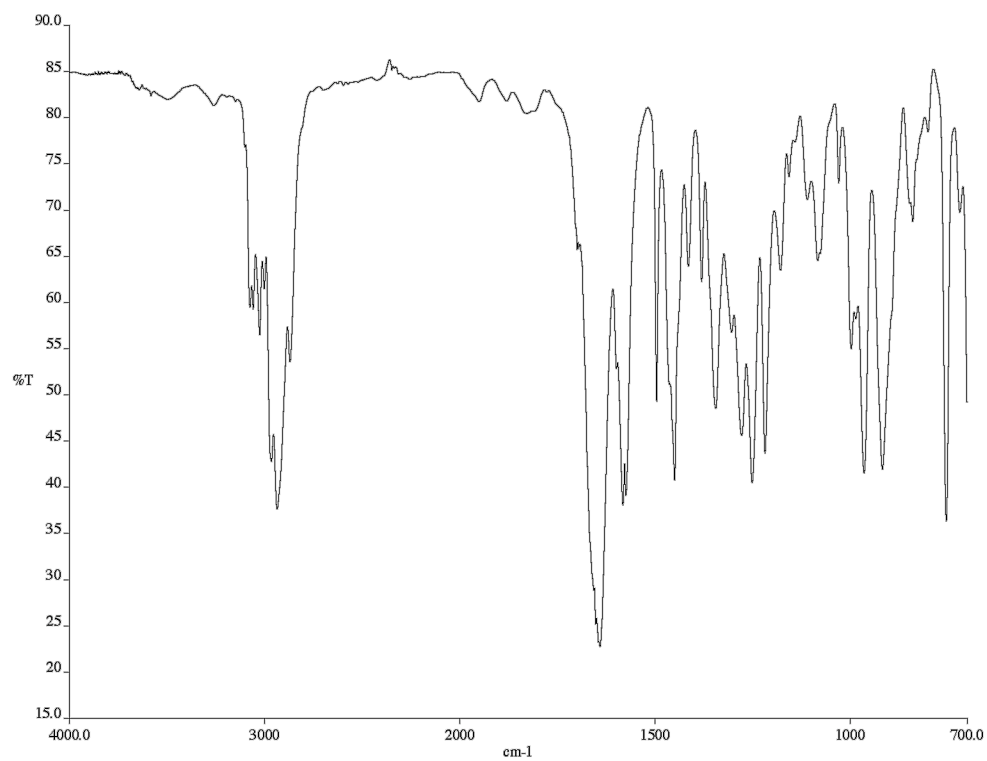


Figure A2.106.2. Infrared spectrum (thin film/NaCl) of compound **55y**.

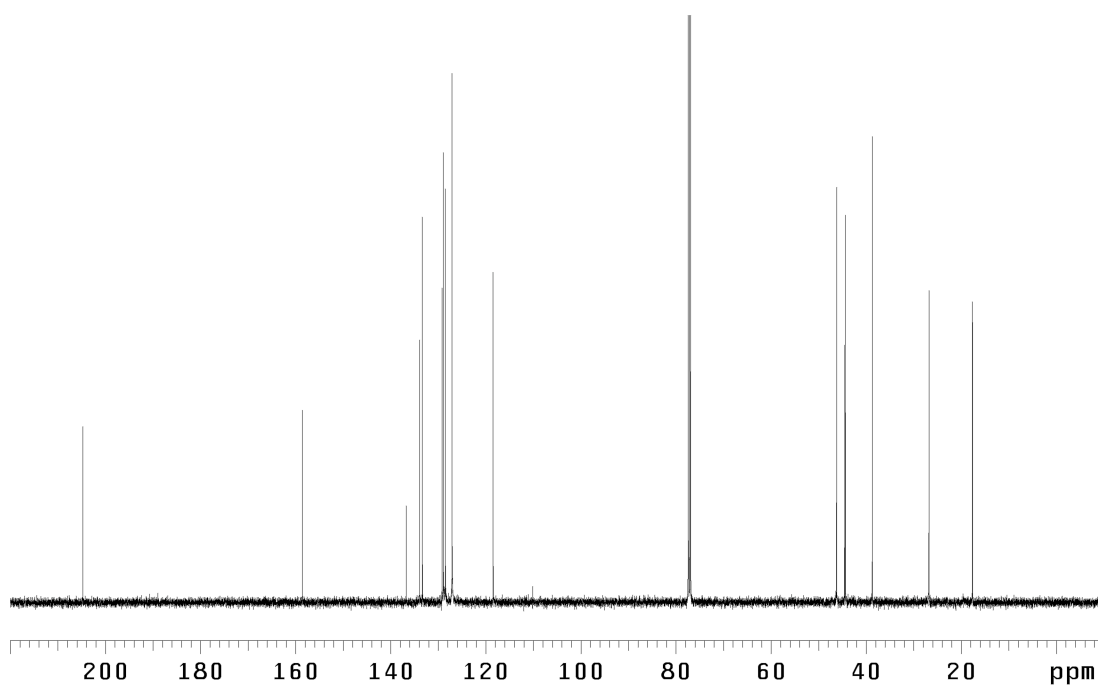


Figure A2.106.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55y**.

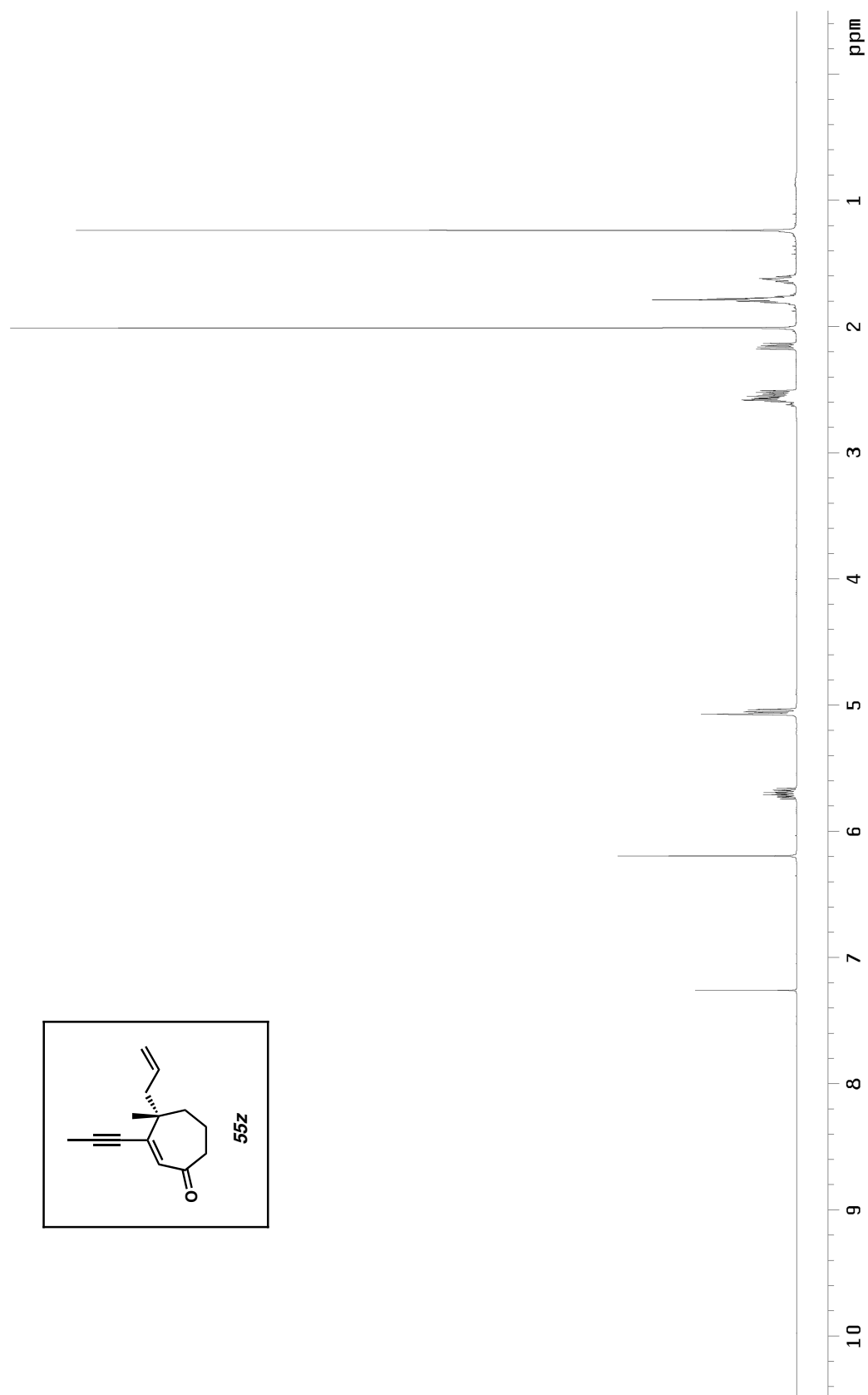


Figure A2.107.1. ^1H NMR (500 MHz, CDCl_3) of compound **55z**.

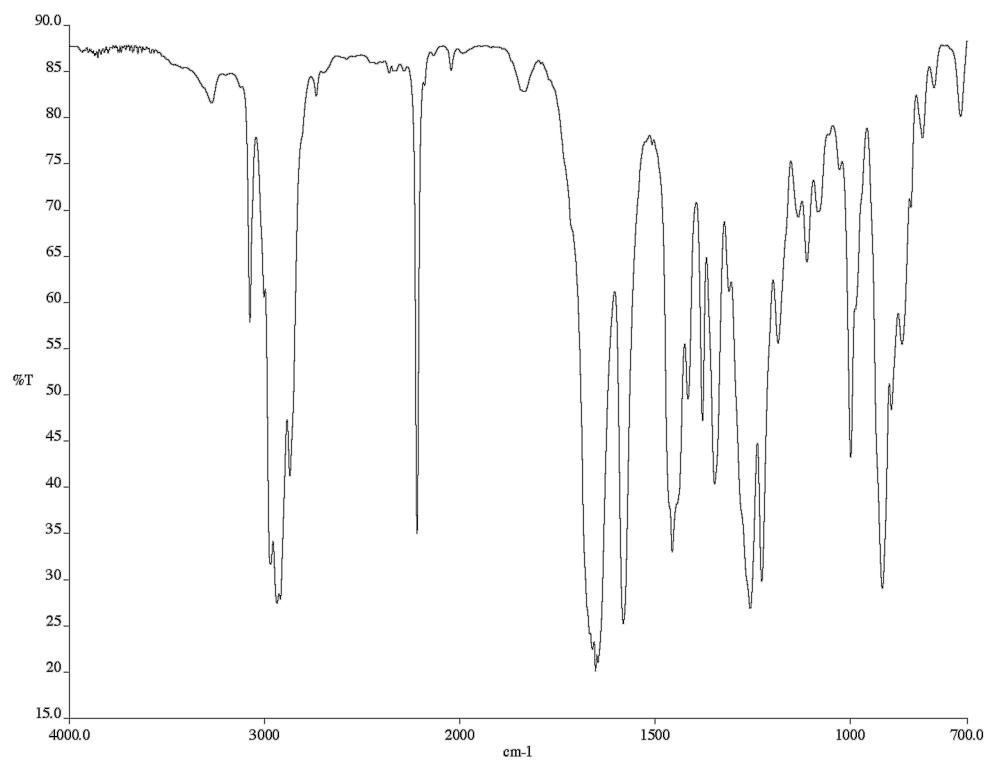


Figure A2.107.2. Infrared spectrum (thin film/NaCl) of compound **55z**.

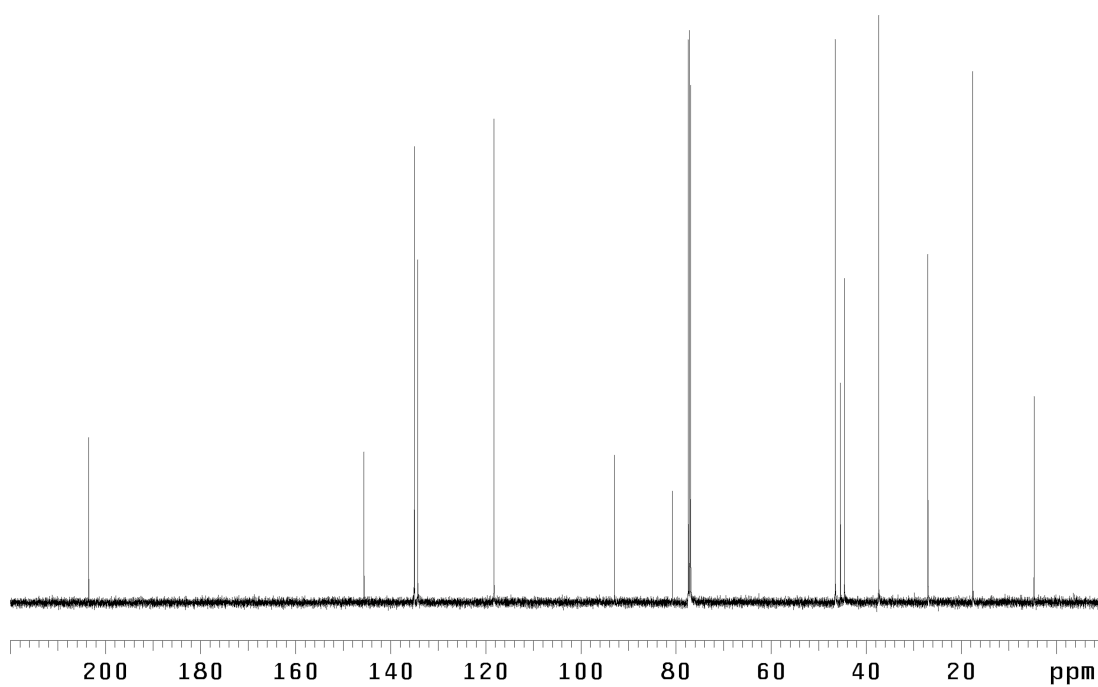


Figure A2.107.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55z**.

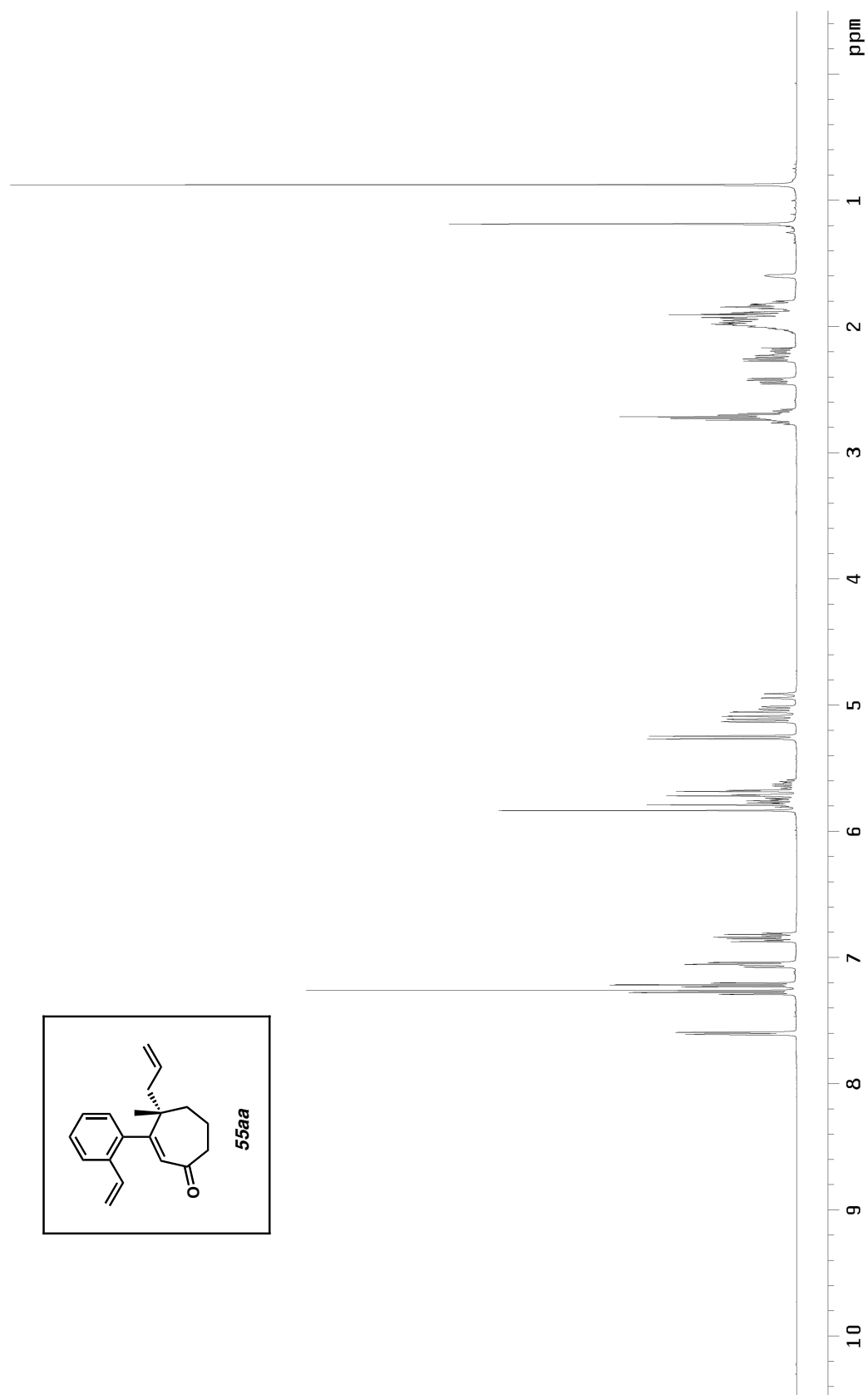


Figure A2.108.1. ^1H NMR (500 MHz, CDCl_3) of compound **55aa**.

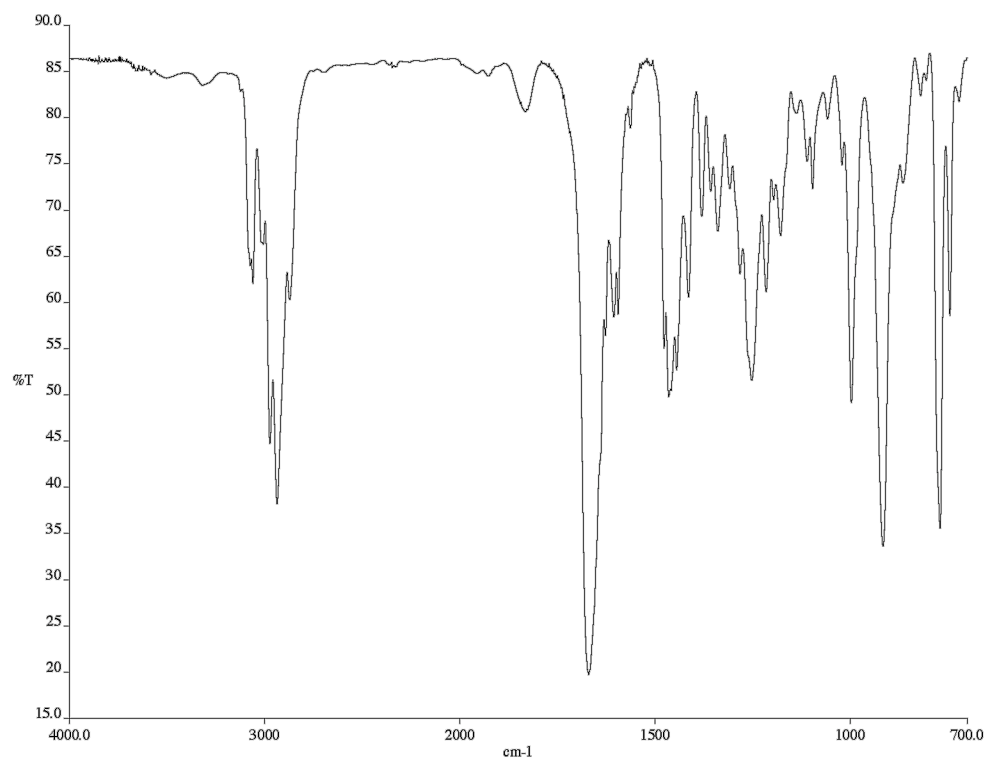


Figure A2.108.2. Infrared spectrum (thin film/NaCl) of compound **55aa**.

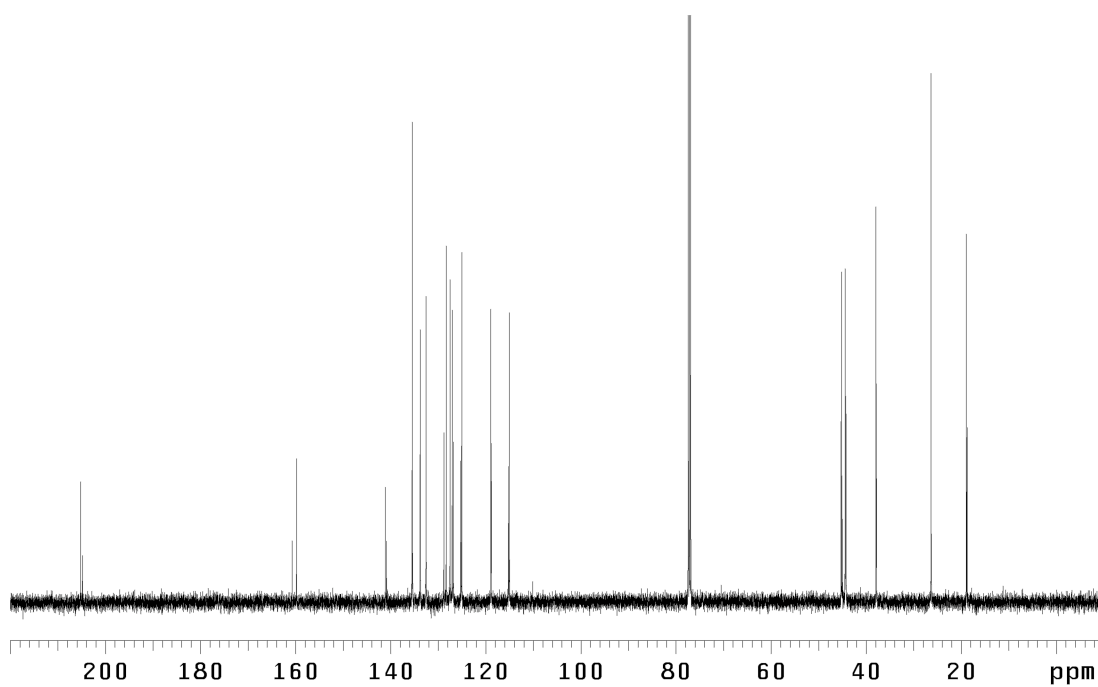


Figure A2.108.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55aa**.

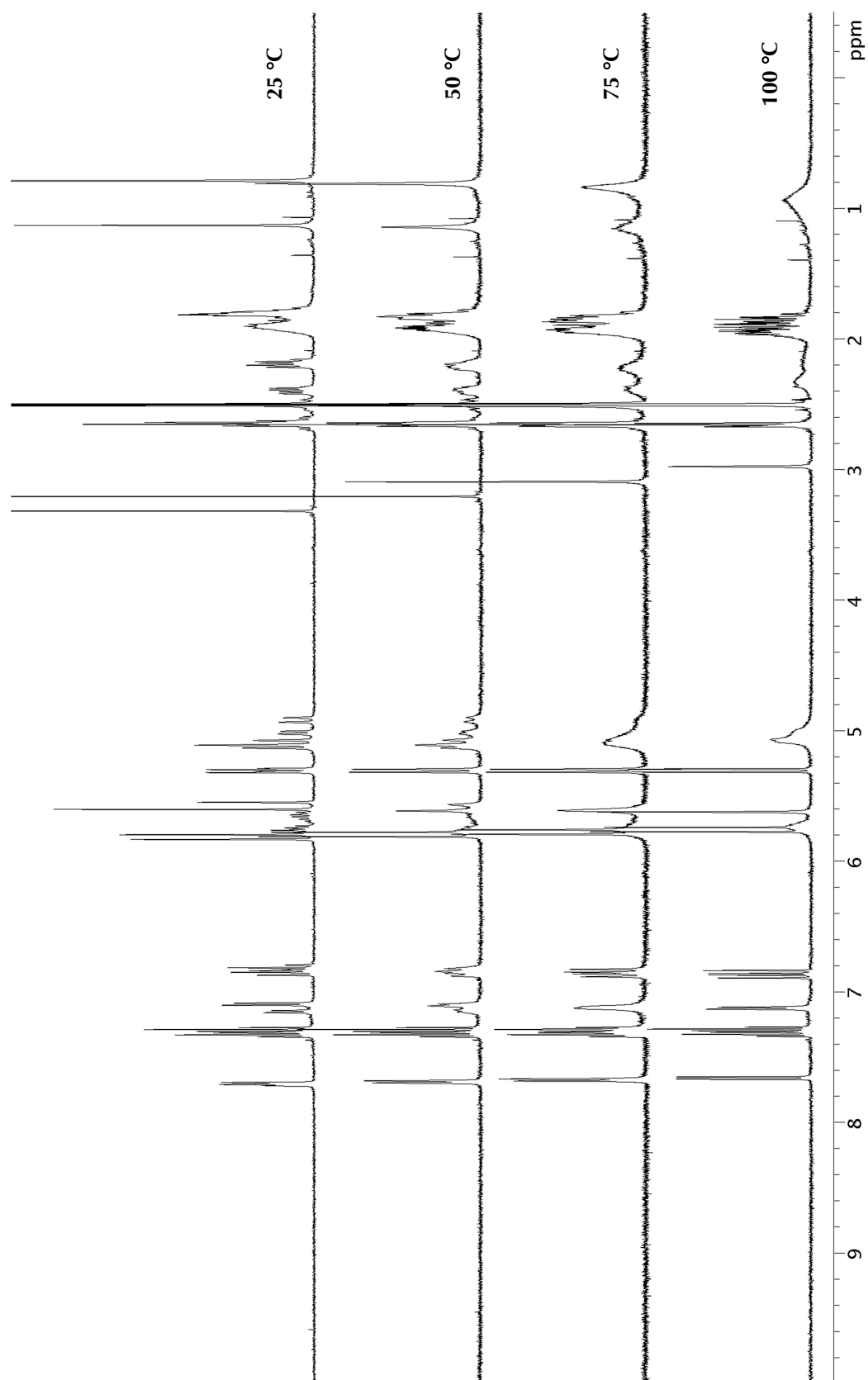


Figure A2.108.4. Variable Temperature ^1H NMR (500 MHz, DMSO-d_6) of compound 55aa.

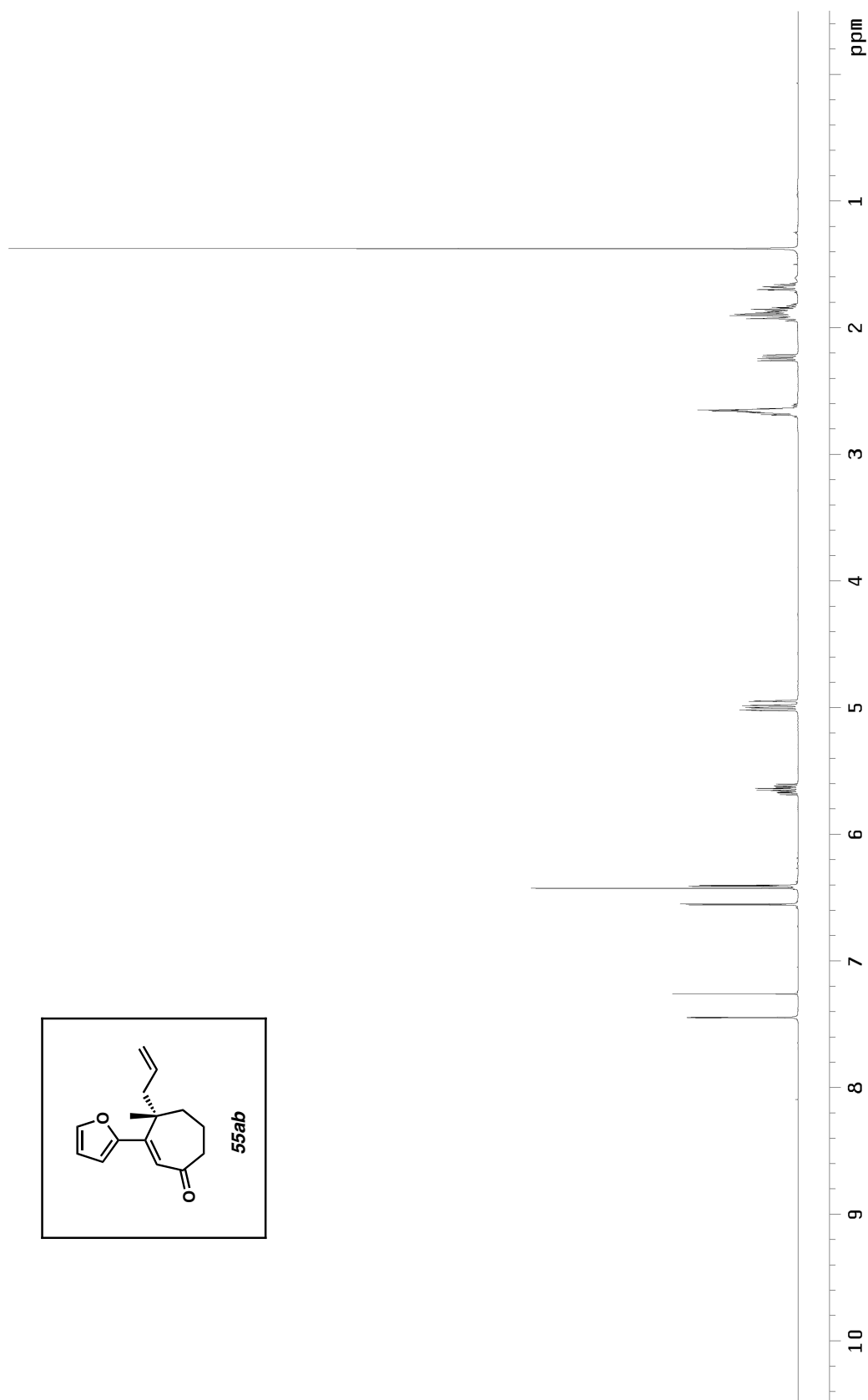


Figure A2.109.1. ^1H NMR (500 MHz, CDCl_3) of compound **55ab**.

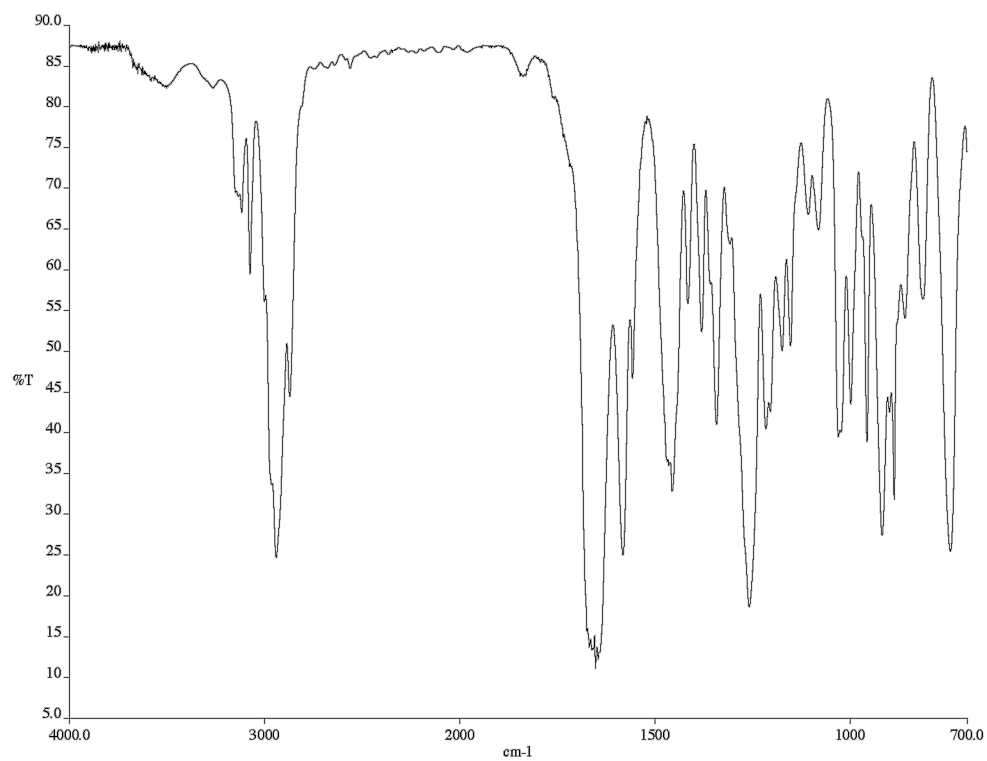


Figure A2.109.2. Infrared spectrum (thin film/NaCl) of compound **55ab**.

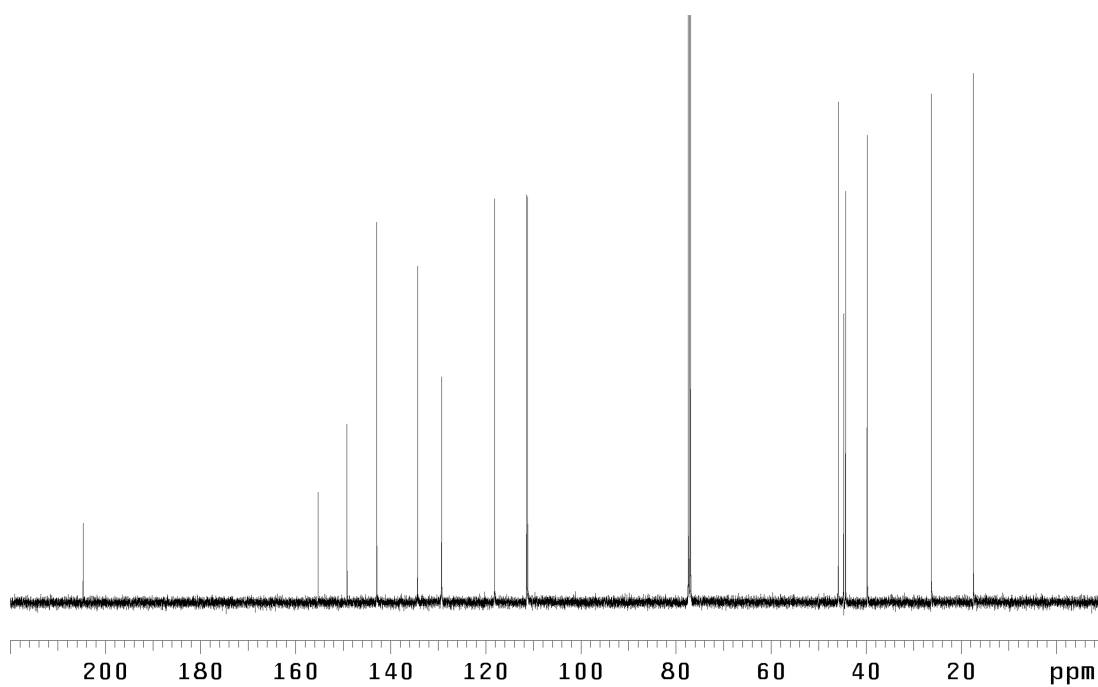
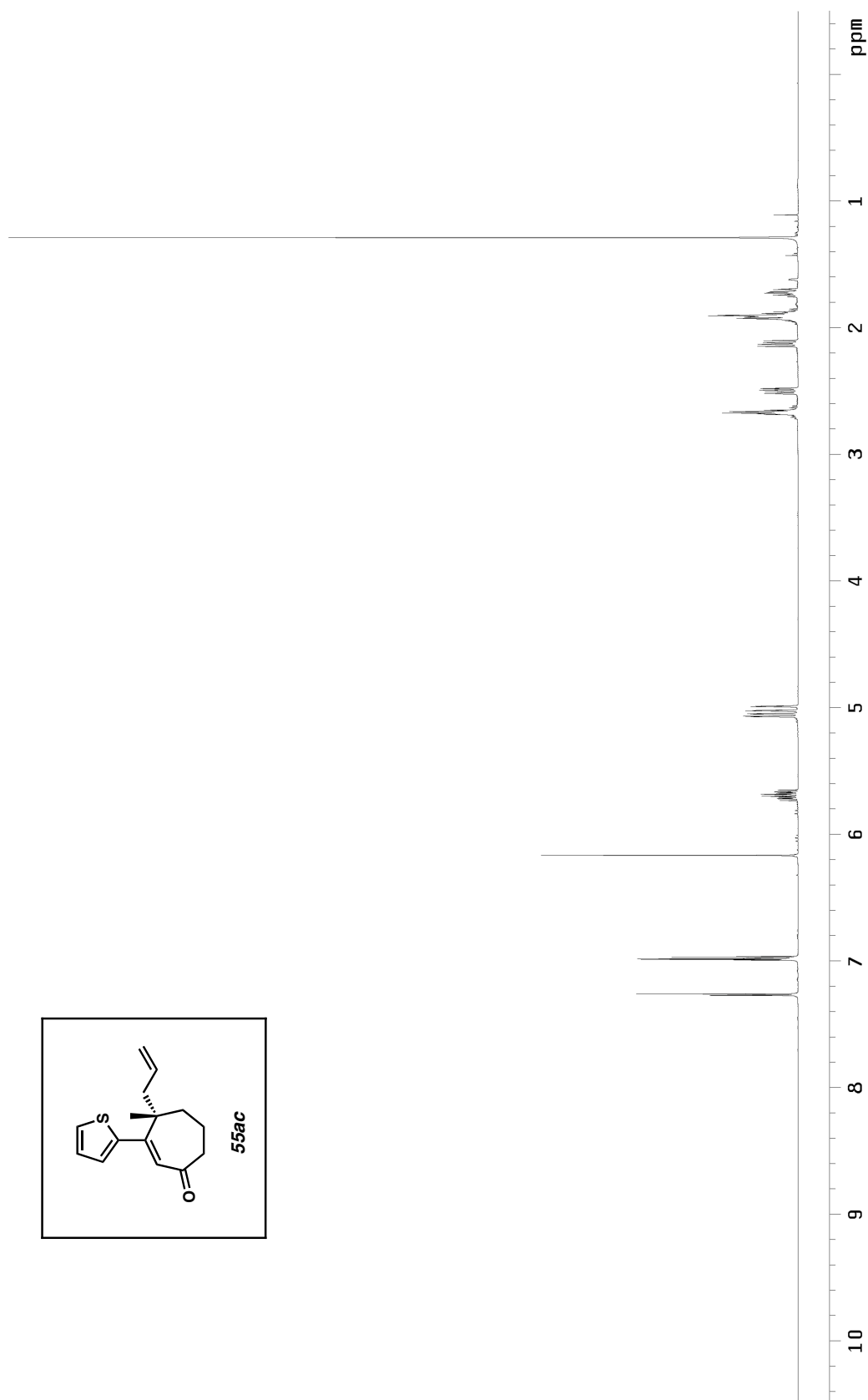


Figure A2.109.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55ab**.

Figure A2.110.1. ^1H NMR (500 MHz, CDCl_3) of compound **55ac**.

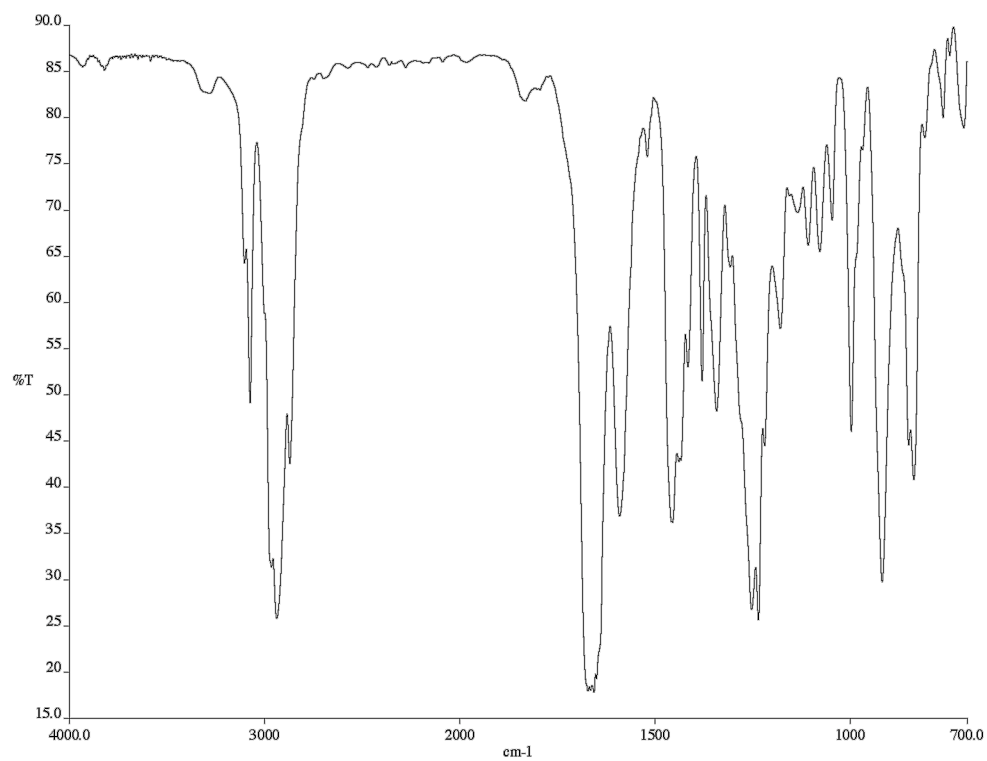


Figure A2.110.2. Infrared spectrum (thin film/NaCl) of compound **55ac**.

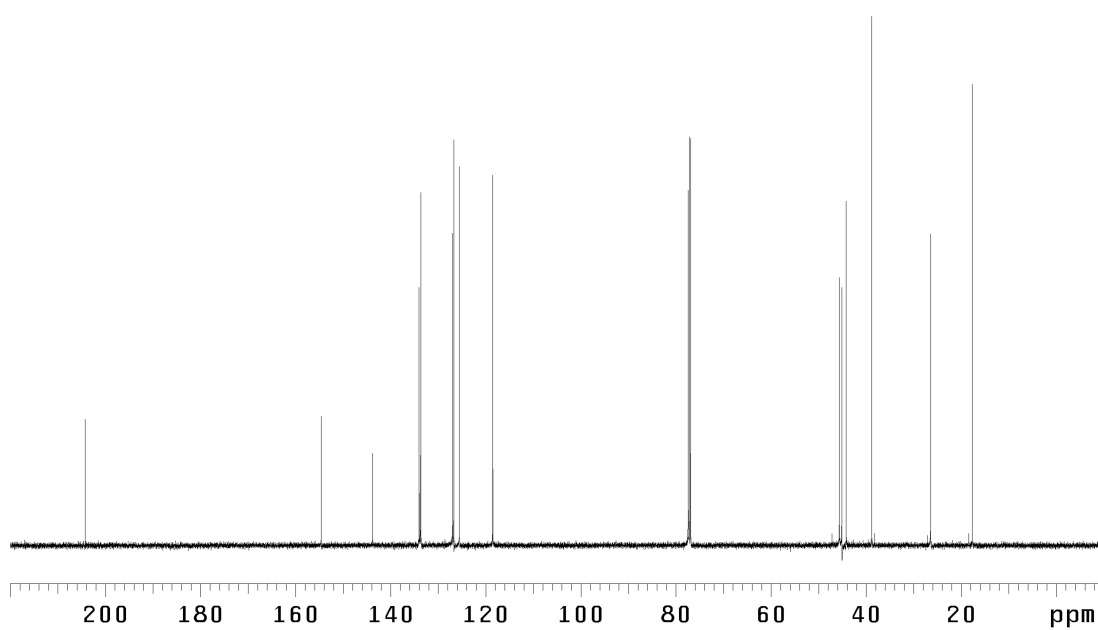


Figure A2.110.3. ¹³C NMR (125 MHz, CDCl₃) of compound **55ac**.

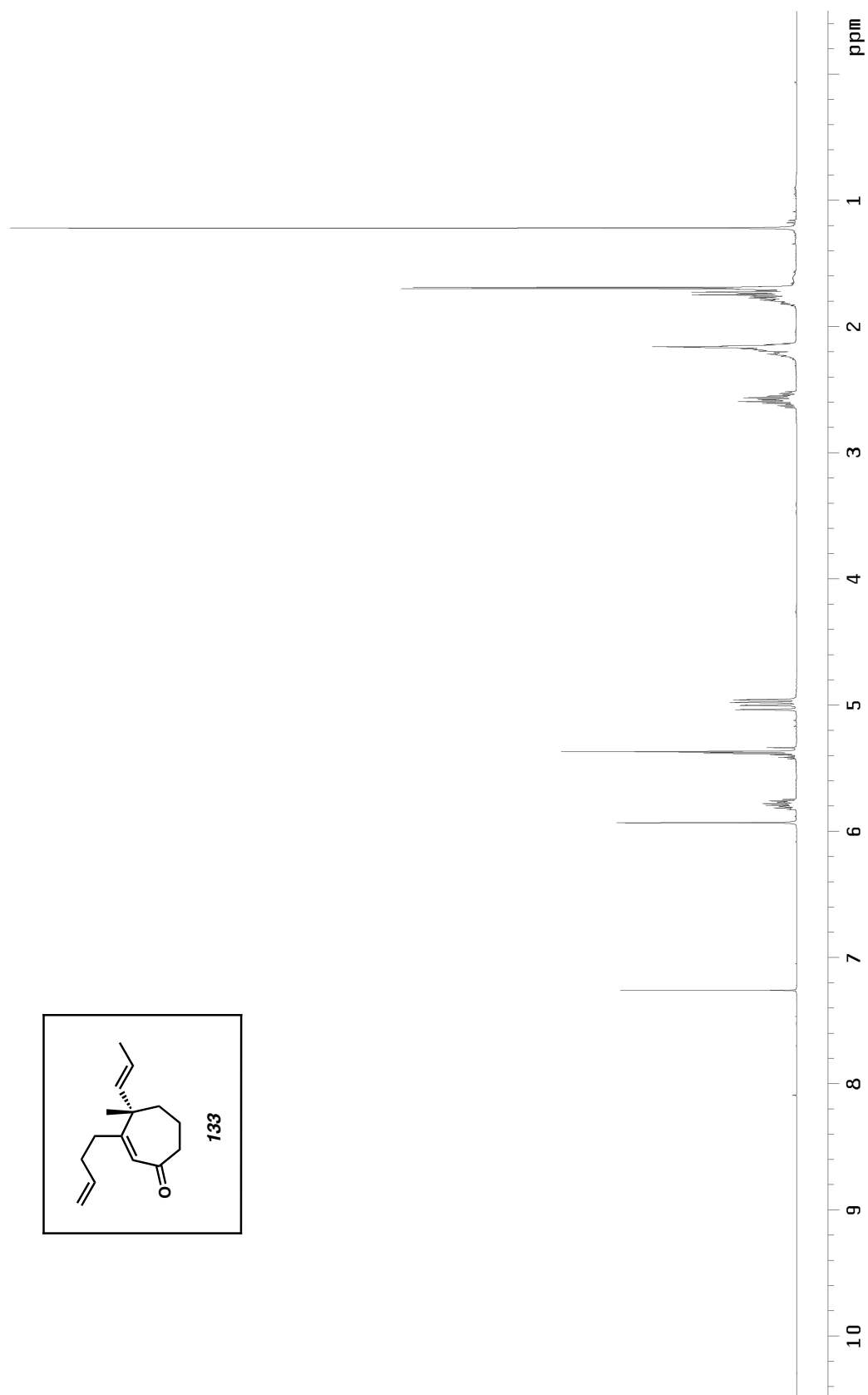


Figure A2.111.1. ^1H NMR (500 MHz, CDCl_3) of compound **133**.

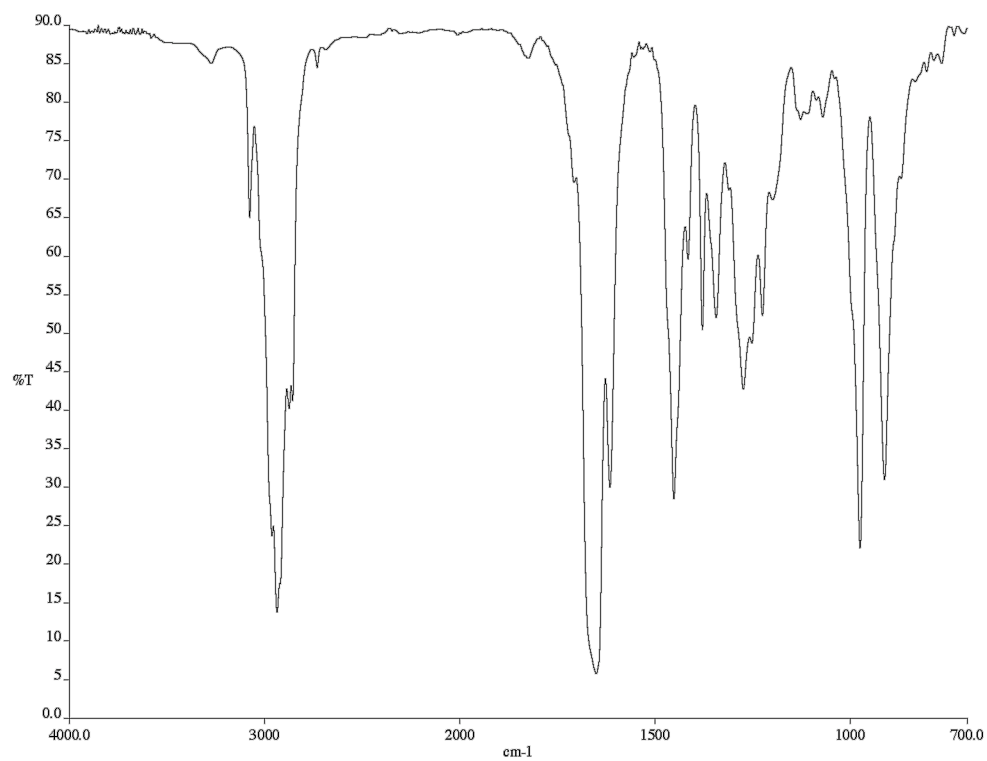


Figure A2.111.2. Infrared spectrum (thin film/NaCl) of compound **133**.

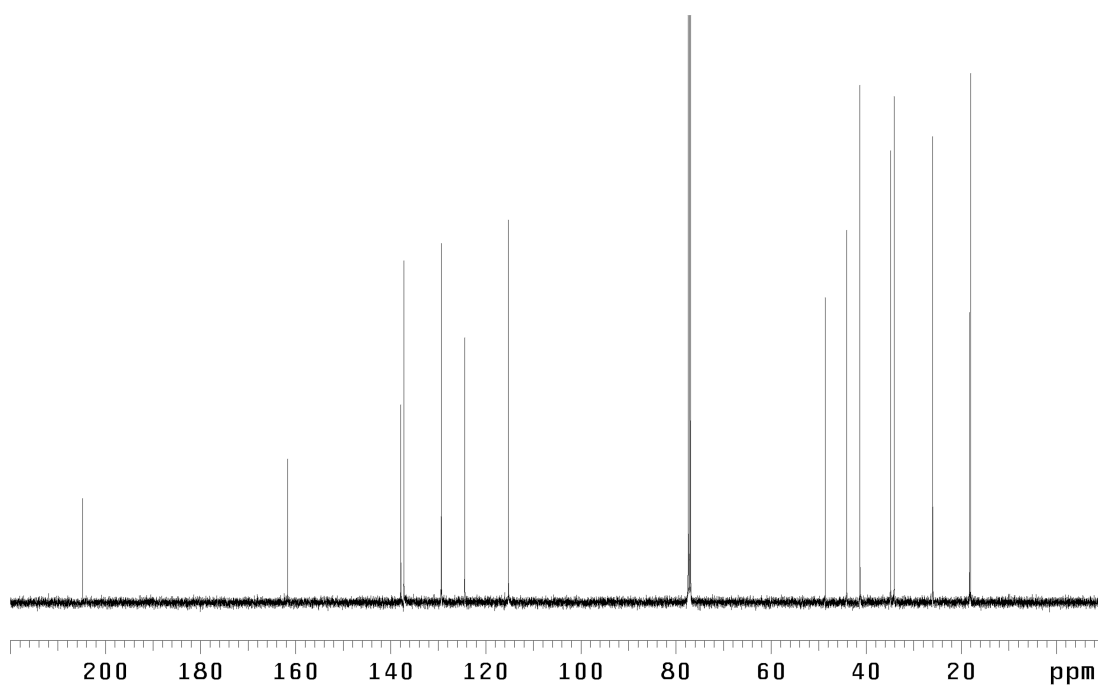


Figure A2.111.3. ¹³C NMR (125 MHz, CDCl₃) of compound **133**.

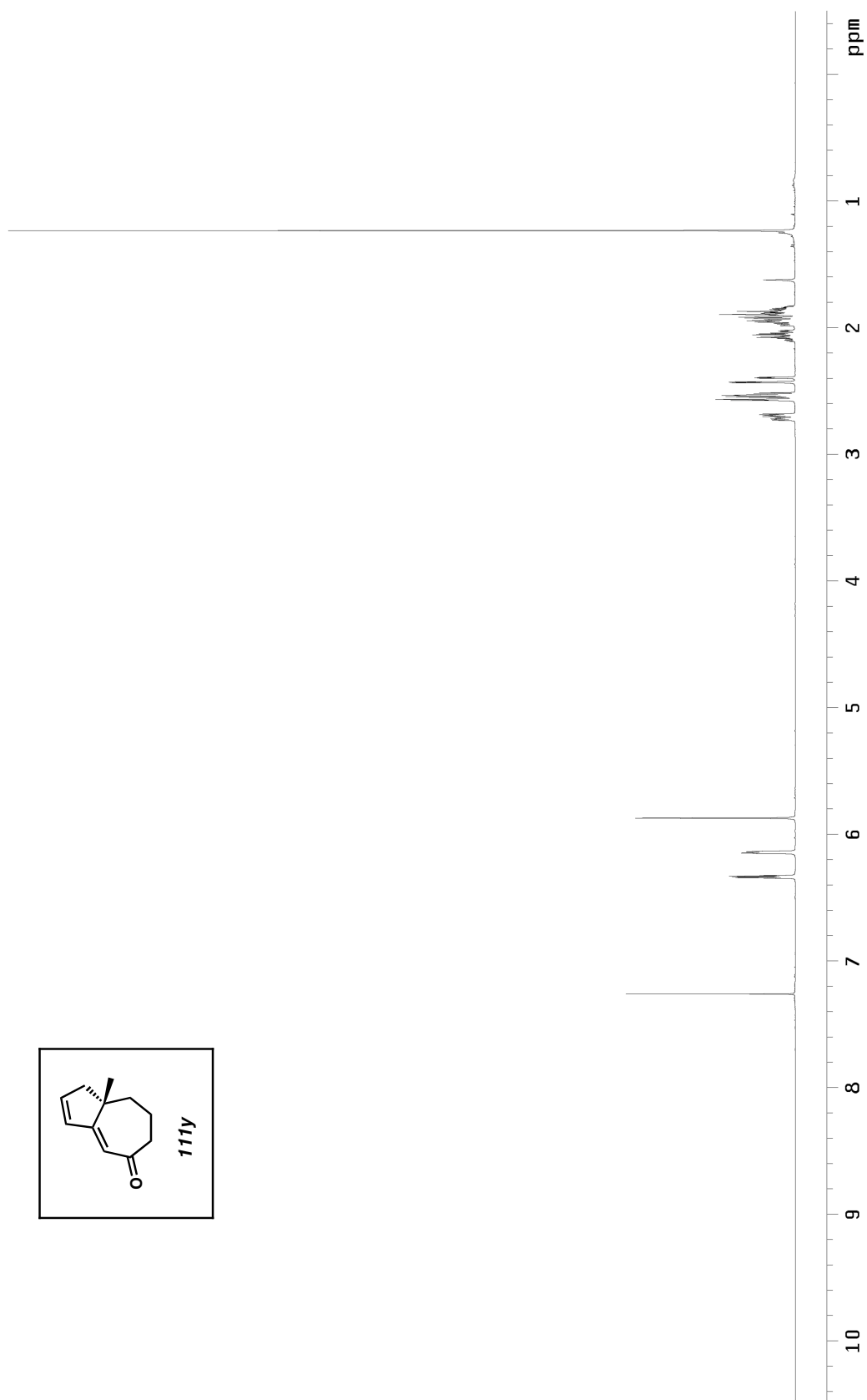


Figure A2.112.1. ^1H NMR (500 MHz, CDCl_3) of compound **111y**.

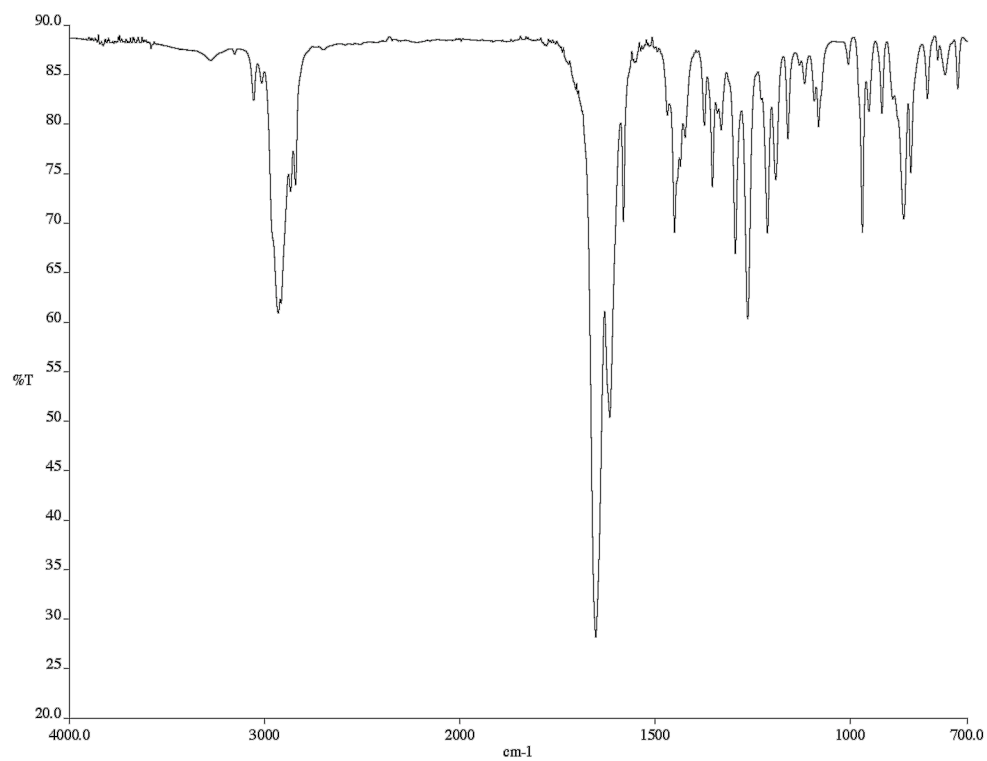


Figure A2.112.2. Infrared spectrum (thin film/NaCl) of compound **111y**.

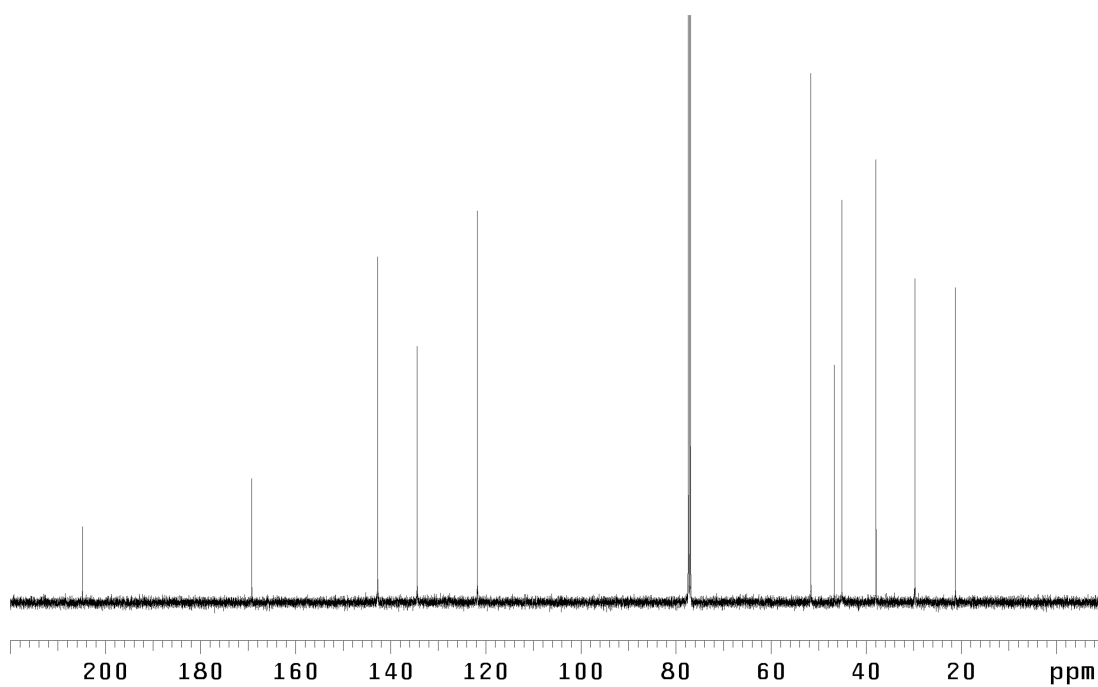


Figure A2.112.3. ¹³C NMR (125 MHz, CDCl₃) of compound **111y**.

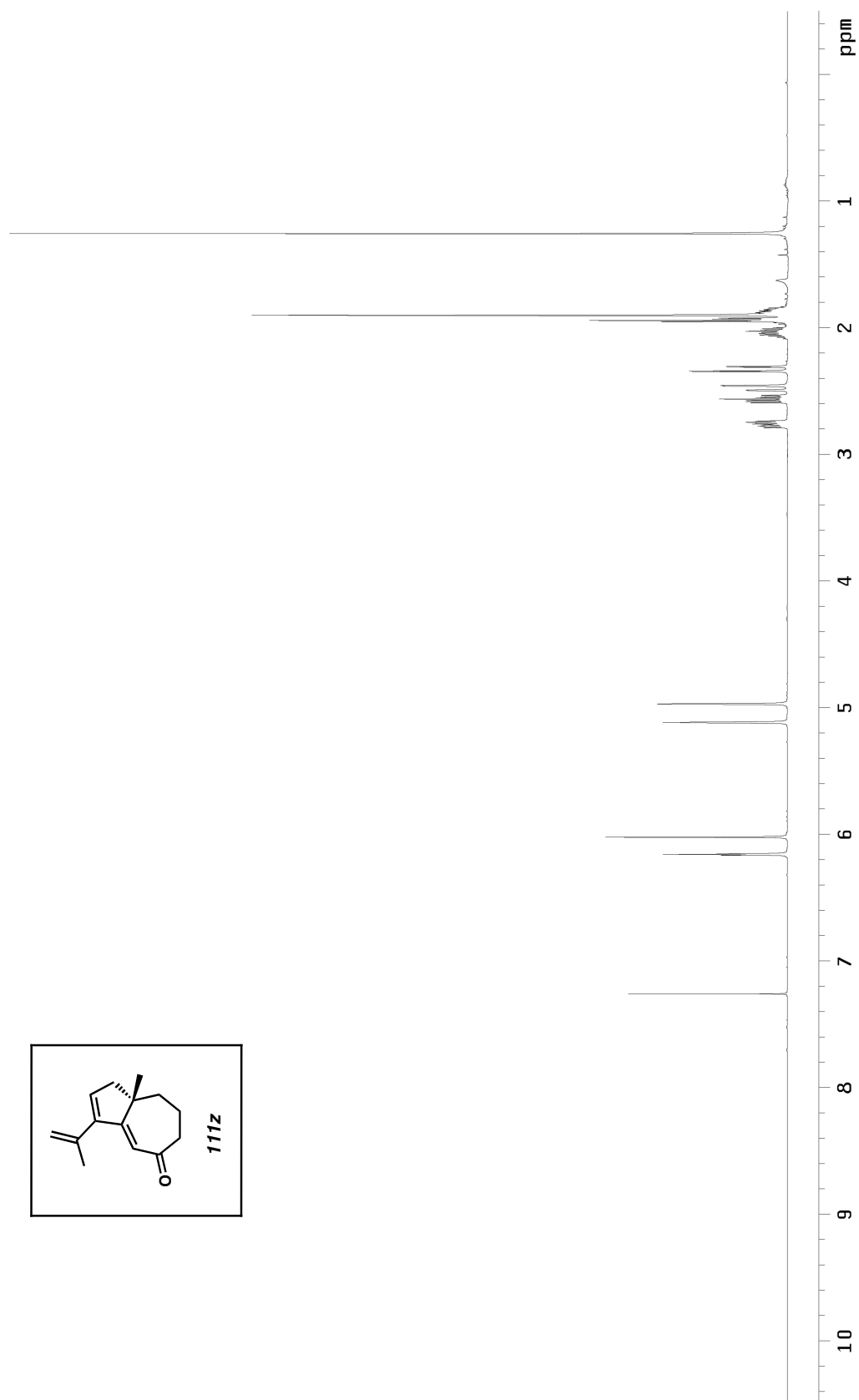


Figure A2.113.1. ^1H NMR (500 MHz, CDCl_3) of compound **111z**.

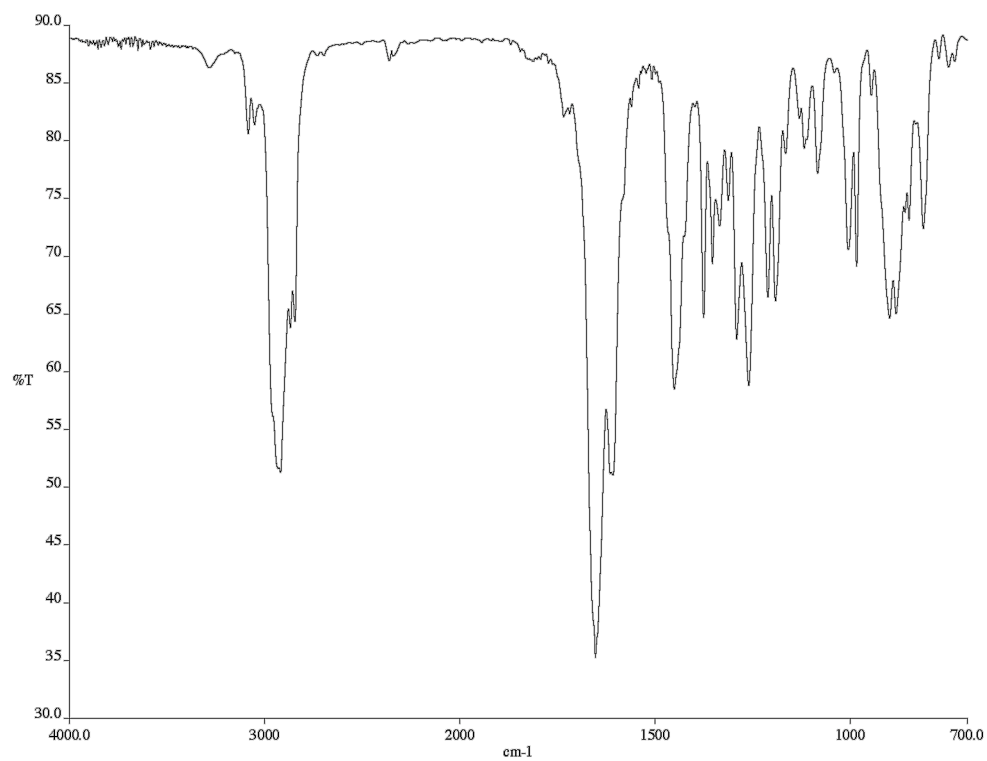


Figure A2.113.2. Infrared spectrum (thin film/NaCl) of compound **111z**.

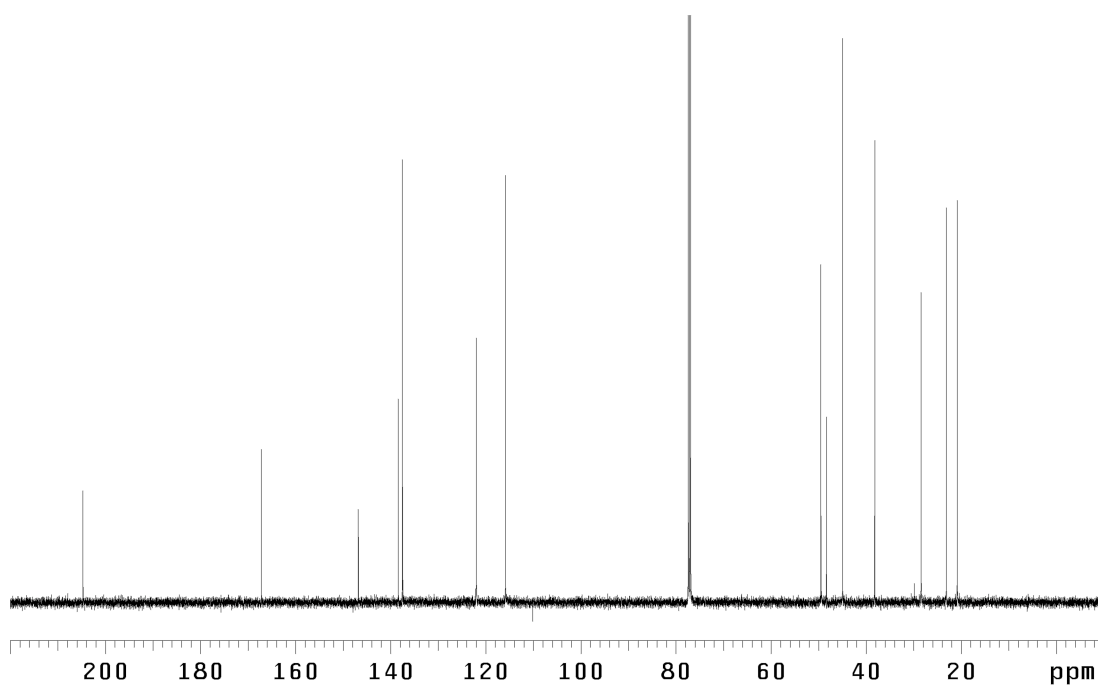


Figure A2.113.3. ¹³C NMR (125 MHz, CDCl₃) of compound **111z**.

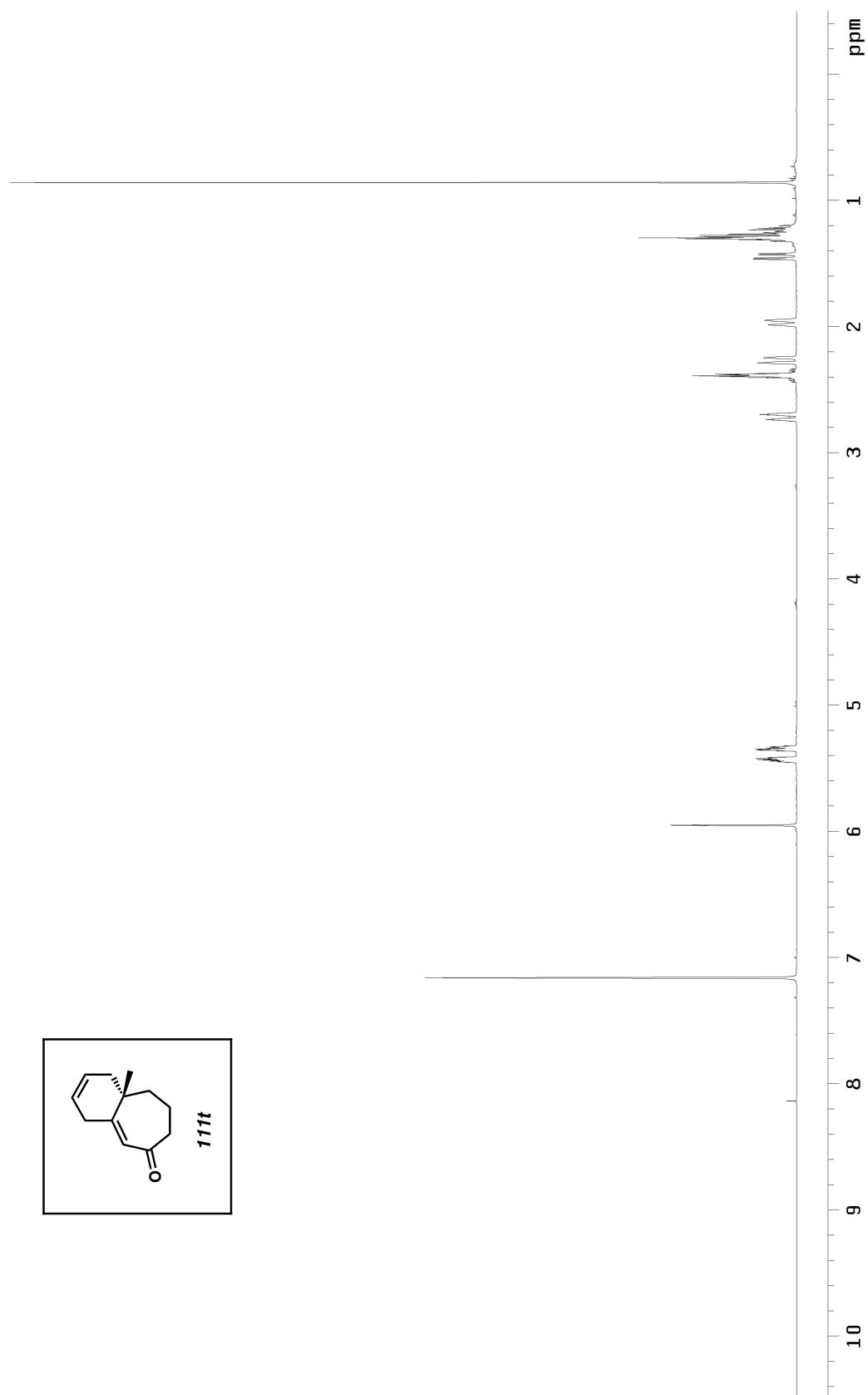


Figure A2.114.1. ^1H NMR (500 MHz, C_6D_6) of compound **111t**.

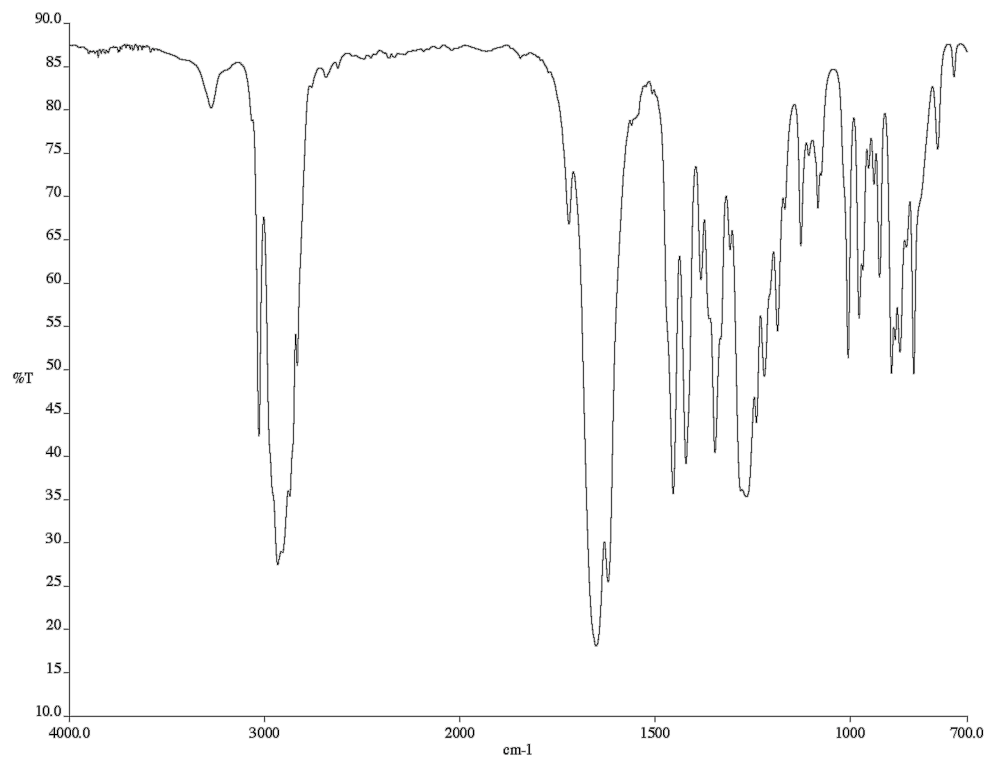


Figure A2.114.2. Infrared spectrum (thin film/NaCl) of compound **111t**.

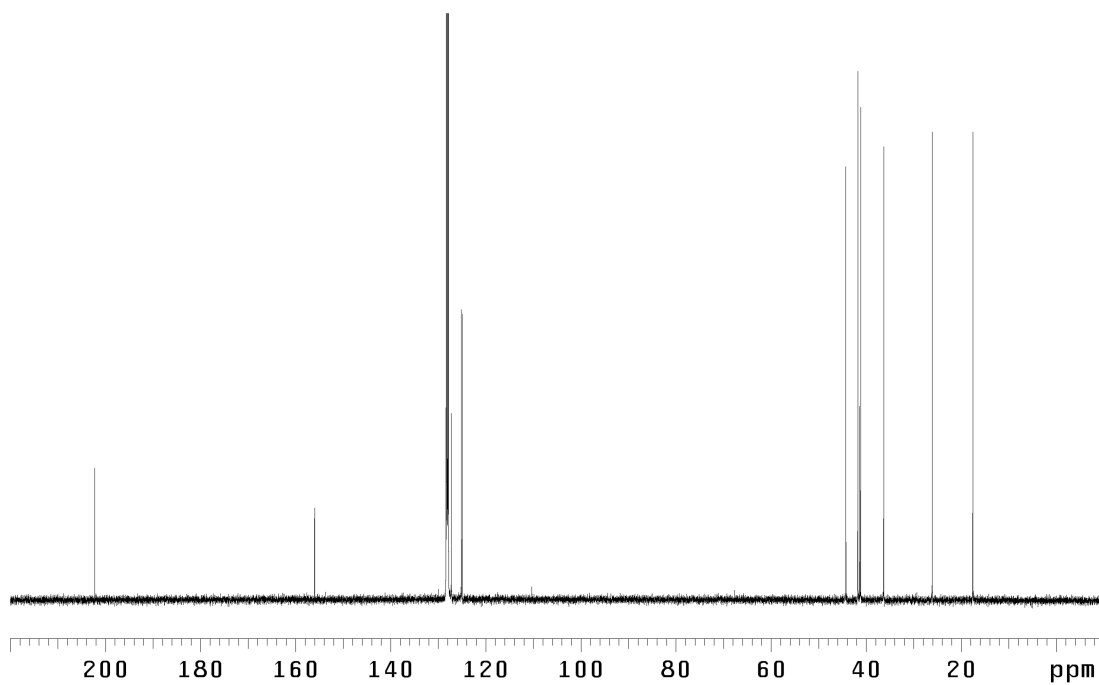


Figure A2.114.3. ¹³C NMR (125 MHz, C₆D₆) of compound **111t**.

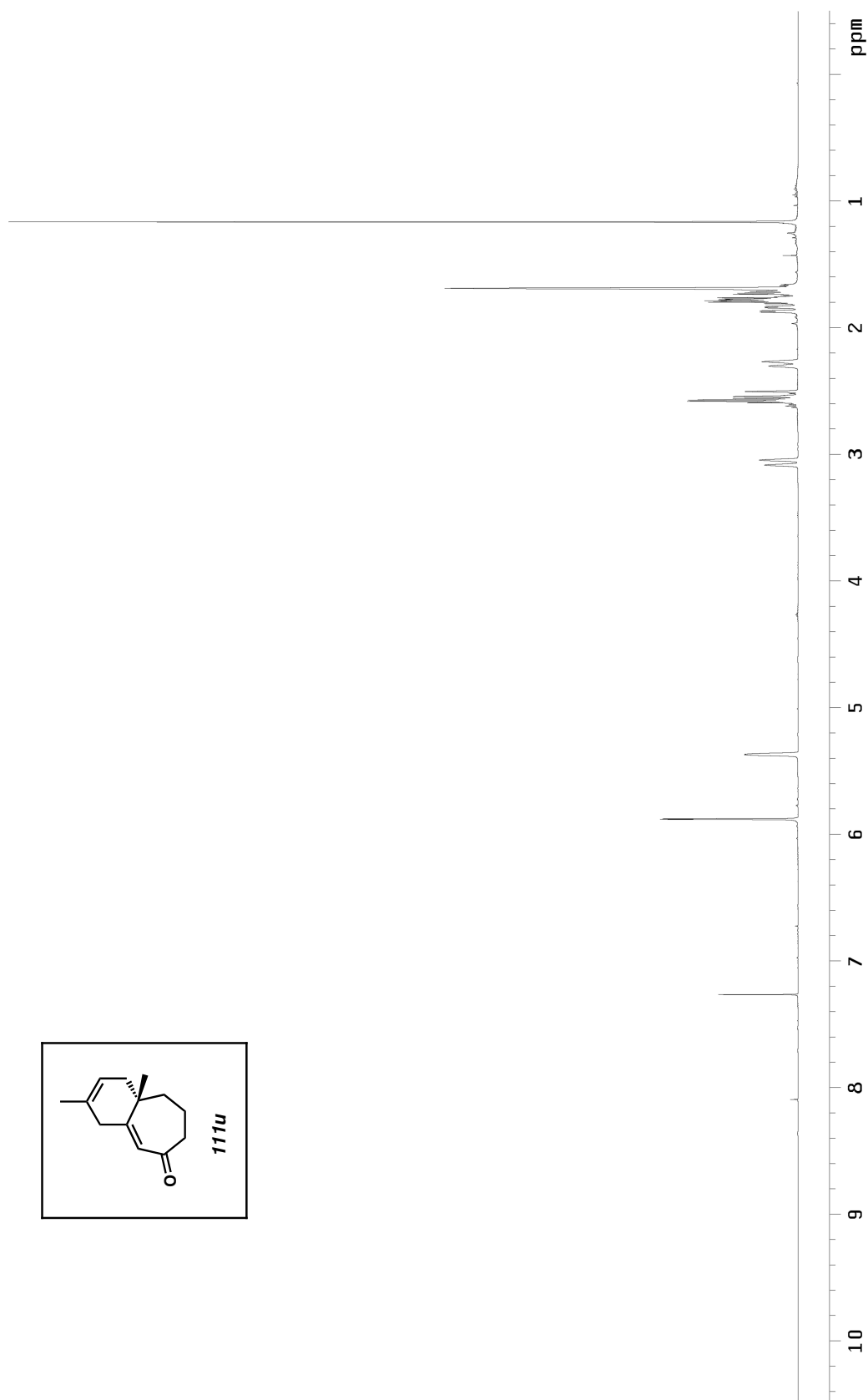


Figure A2.115.1. ¹H NMR (500 MHz, CDCl₃) of compound **111u**.

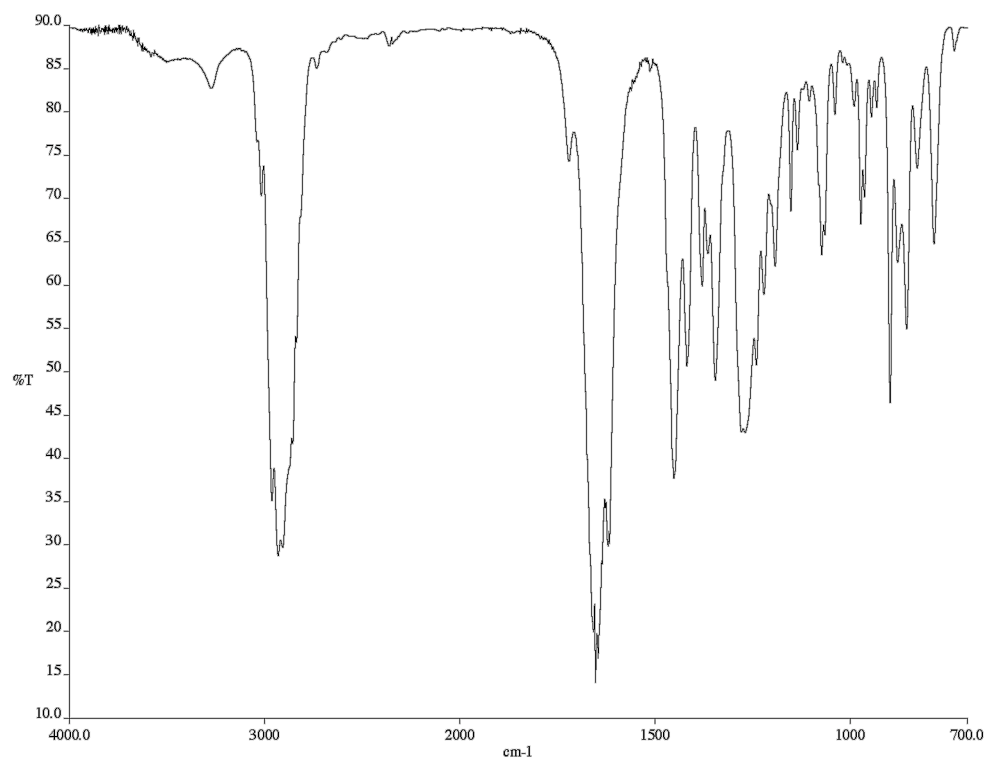


Figure A2.115.2. Infrared spectrum (thin film/NaCl) of compound **111u**.

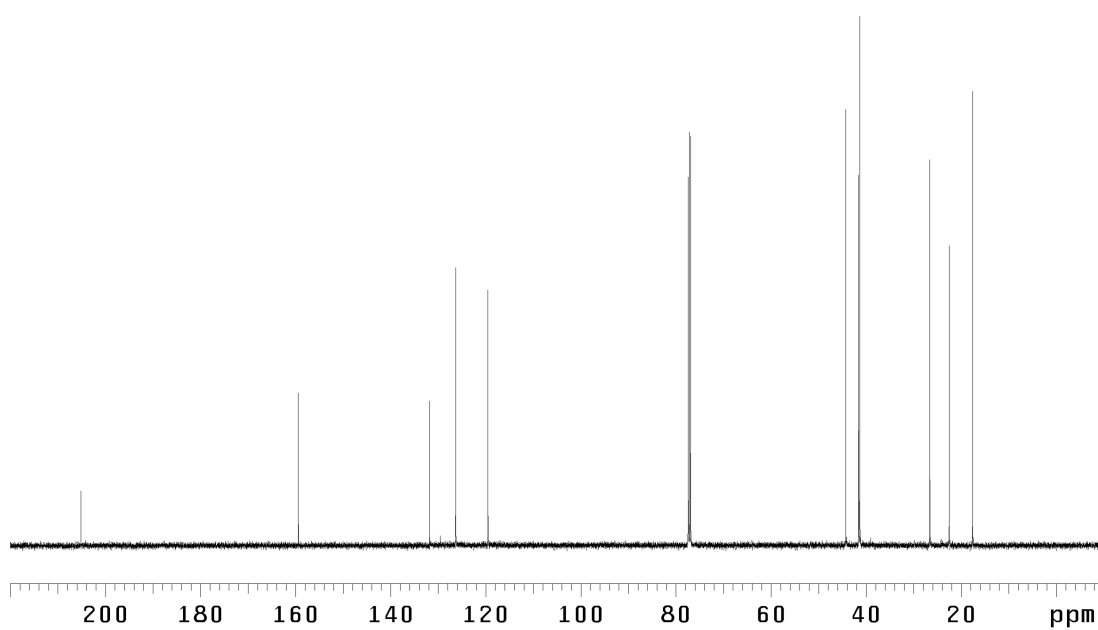


Figure A2.115.3. ¹³C NMR (125 MHz, CDCl₃) of compound **111u**.

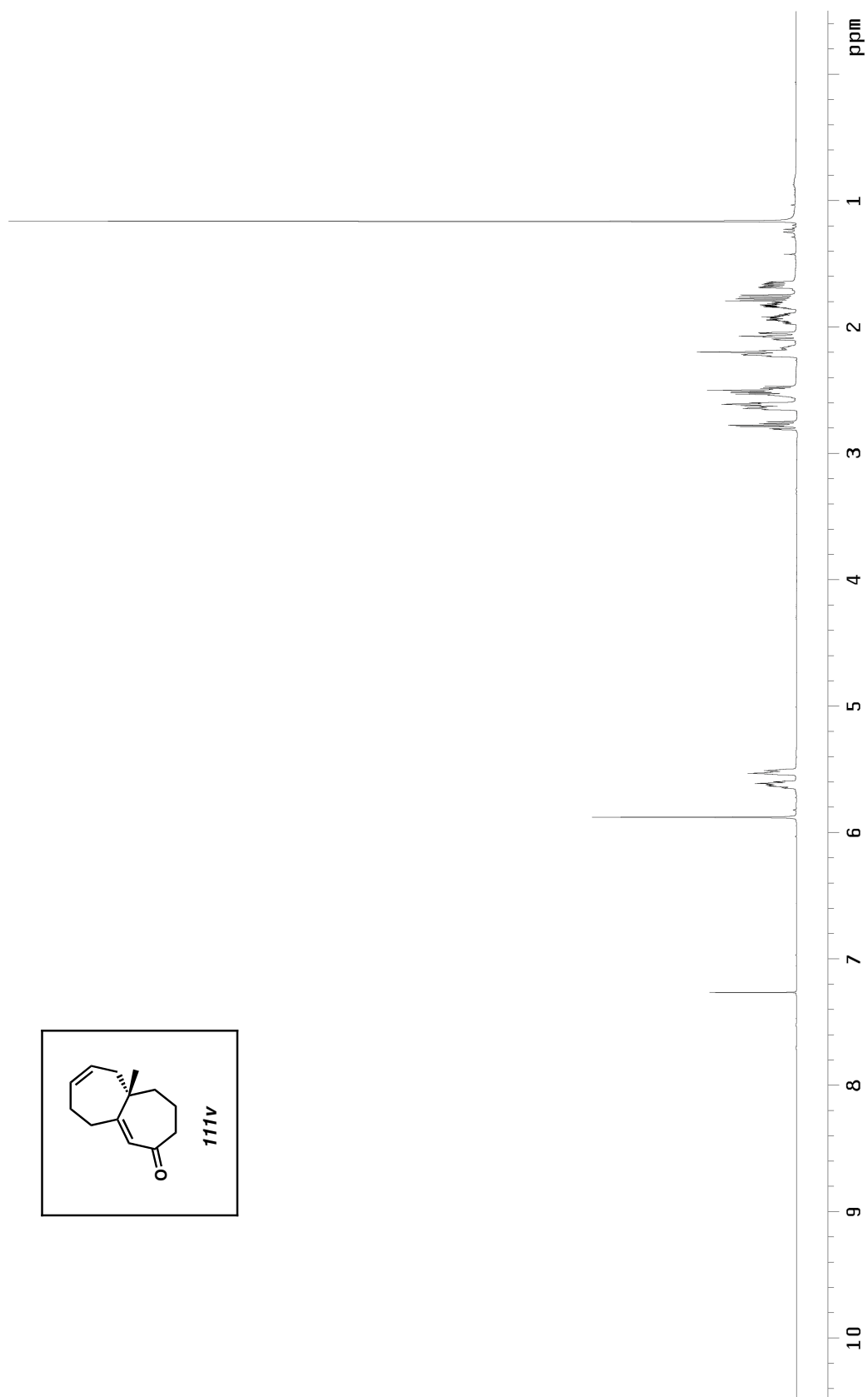


Figure A2.116.1. ^1H NMR (500 MHz, CDCl_3) of compound **111v**.

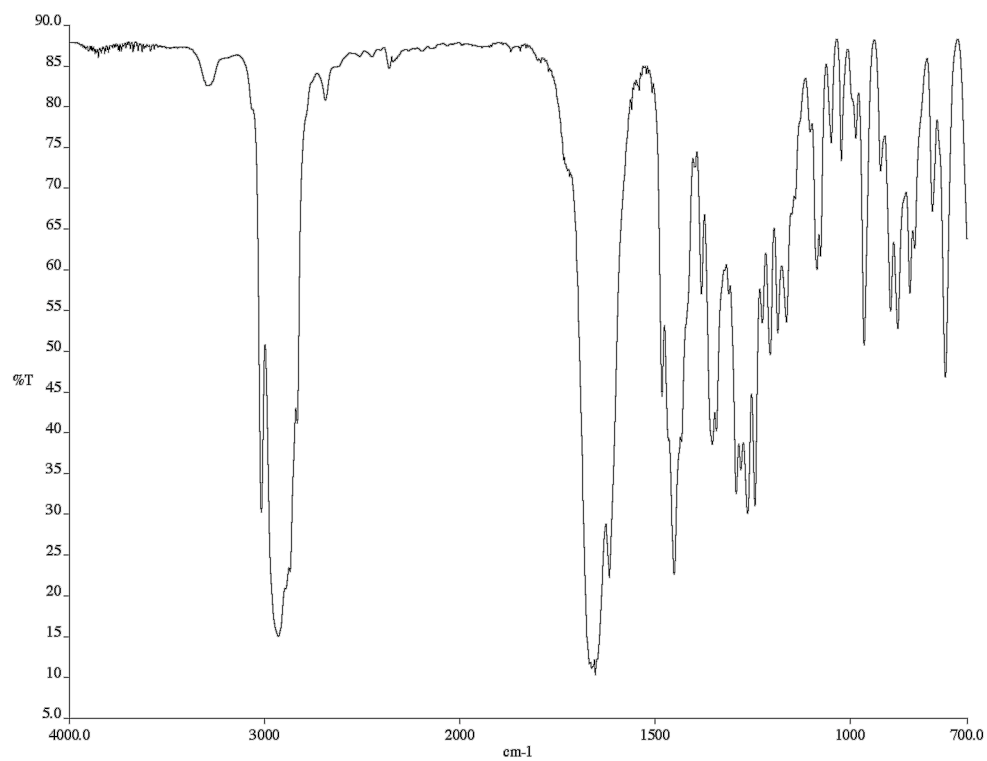


Figure A2.116.2. Infrared spectrum (thin film/NaCl) of compound **111v**.

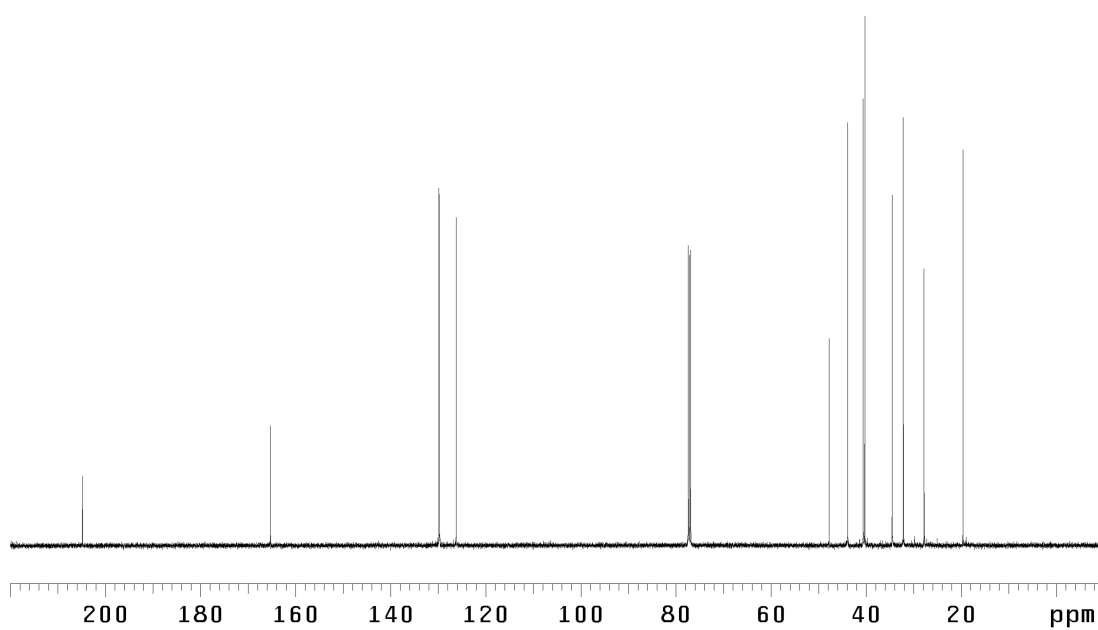


Figure A2.116.3. ¹³C NMR (125 MHz, CDCl₃) of compound **111v**.

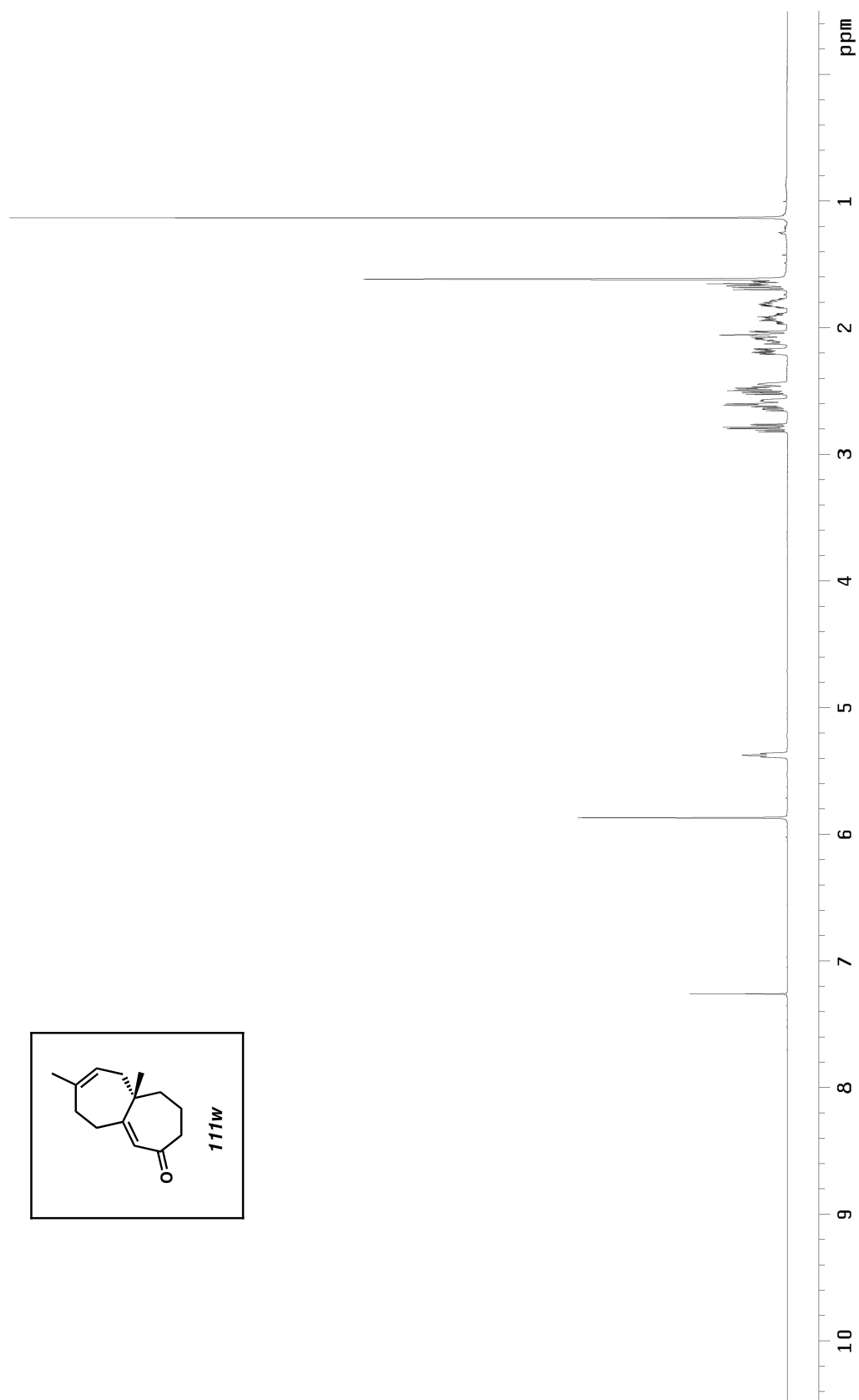


Figure A2.117.1. ^1H NMR (500 MHz, CDCl_3) of compound **111w**.

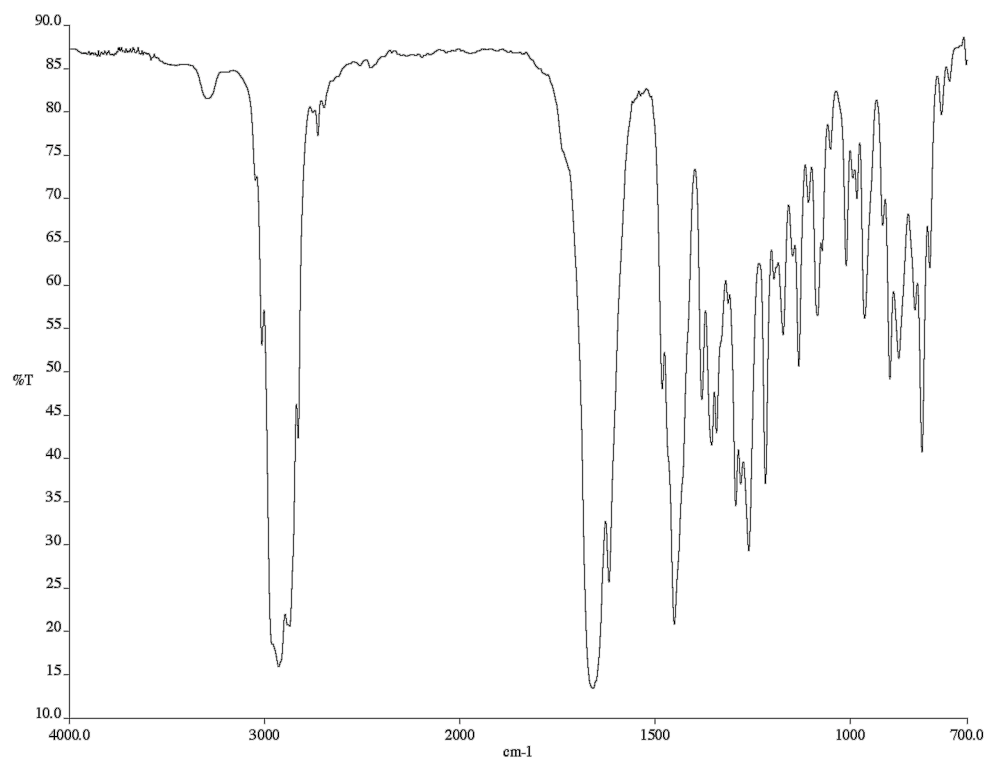


Figure A2.117.2. Infrared spectrum (thin film/NaCl) of compound **111w**.

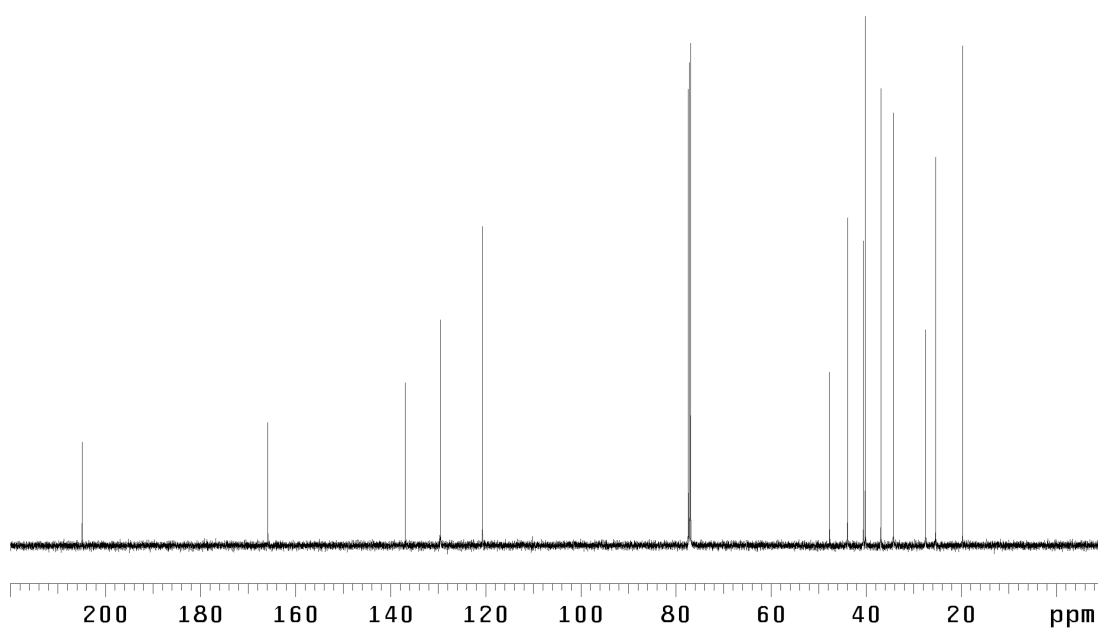


Figure A2.117.3. ¹³C NMR (125 MHz, CDCl₃) of compound **111w**.

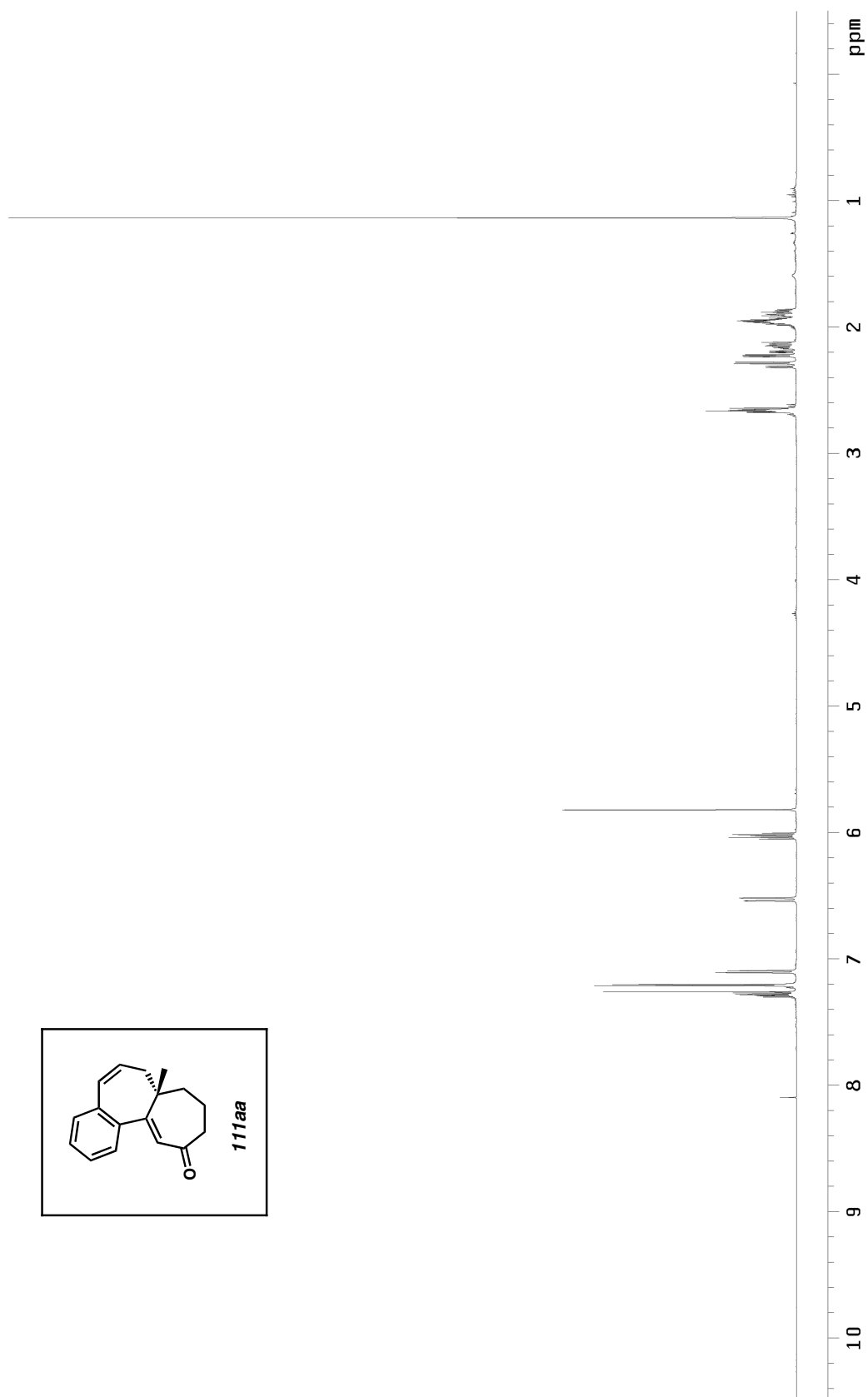


Figure A2.118.1. ^1H NMR (500 MHz, CDCl_3) of compound **111aa**.

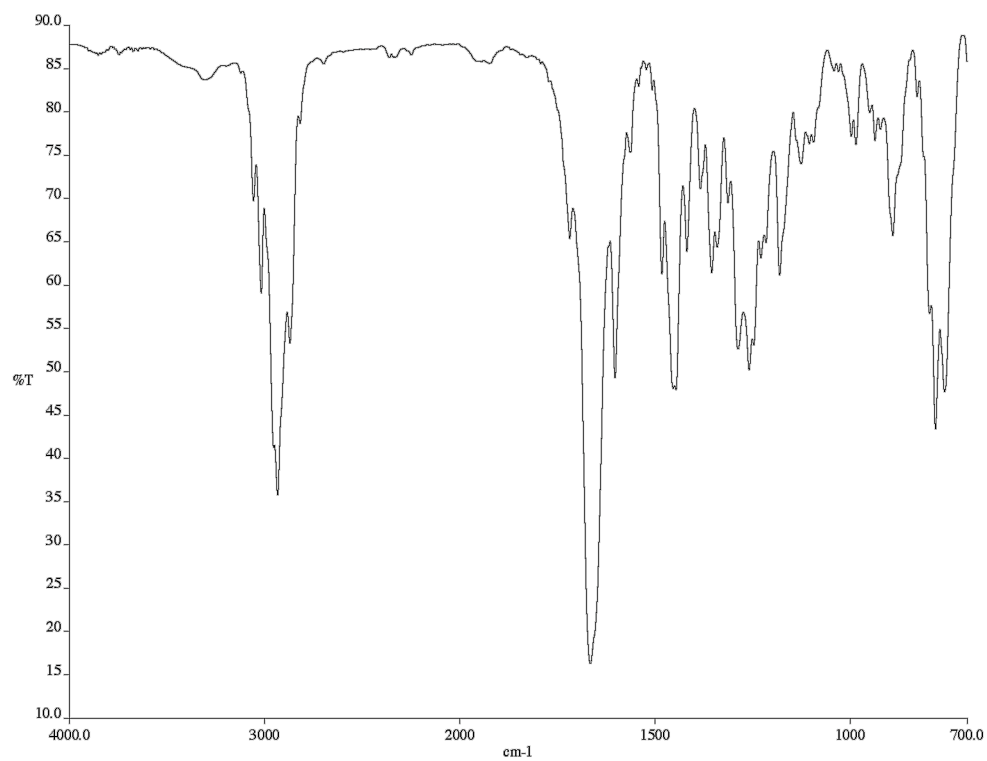


Figure A2.118.2. Infrared spectrum (thin film/NaCl) of compound **111aa**.

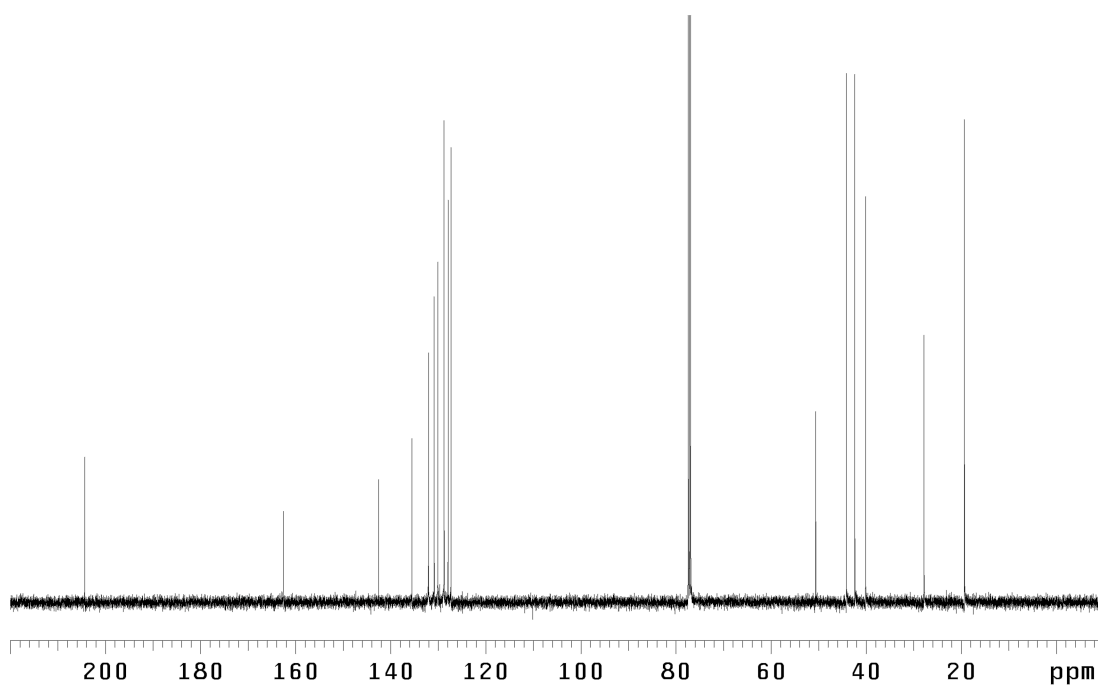


Figure A2.118.3. ¹³C NMR (125 MHz, CDCl₃) of compound **111aa**.

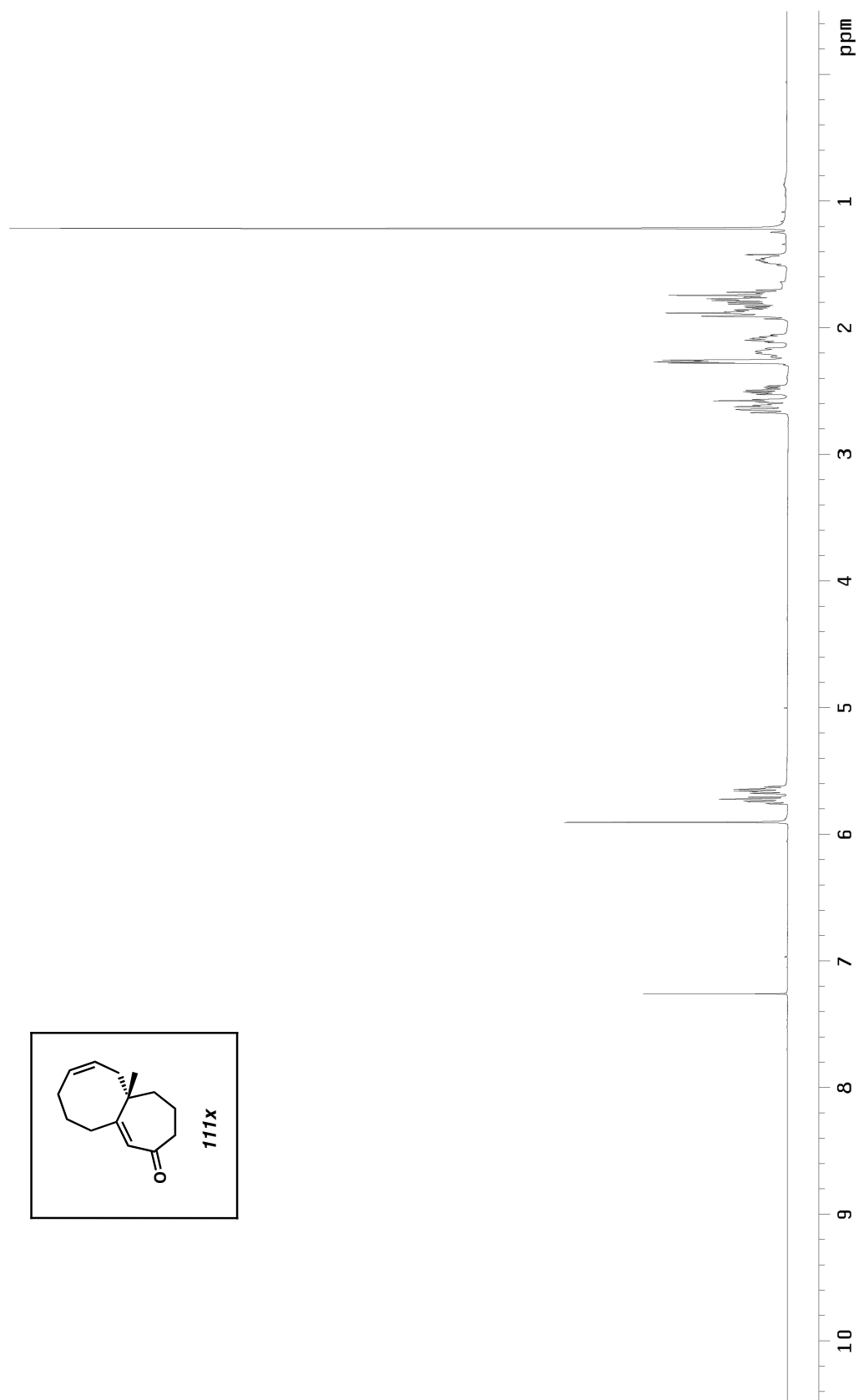


Figure A2.119.1. ^1H NMR (500 MHz, CDCl_3) of compound **111x**.

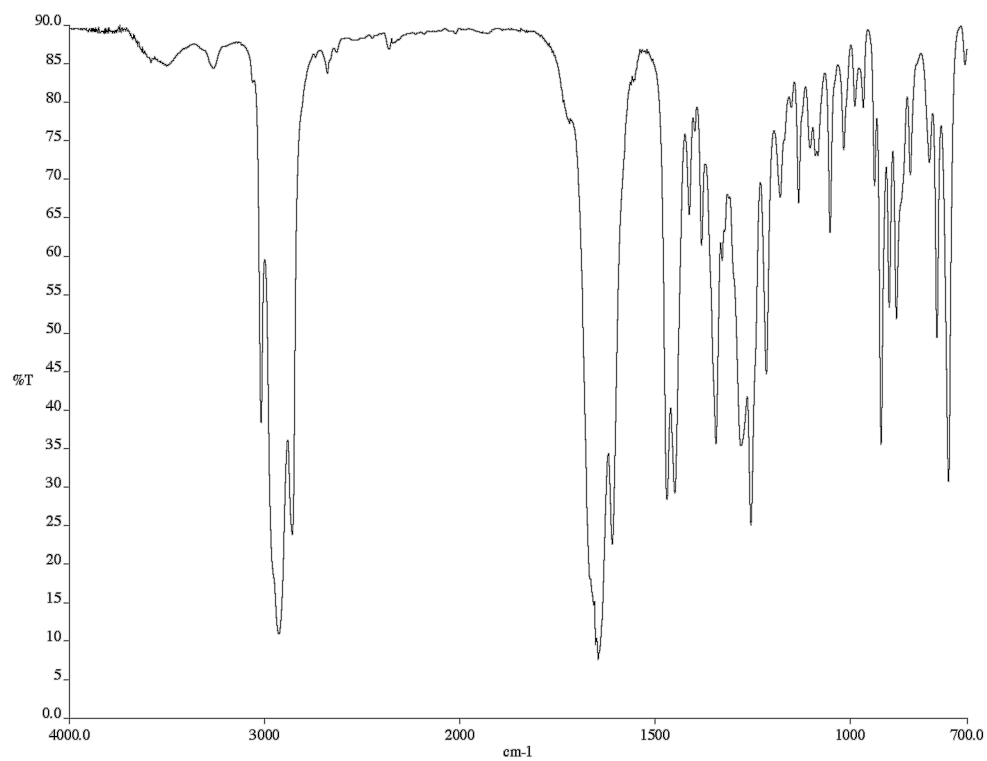


Figure A2.119.2. Infrared spectrum (thin film/NaCl) of compound **111x**.

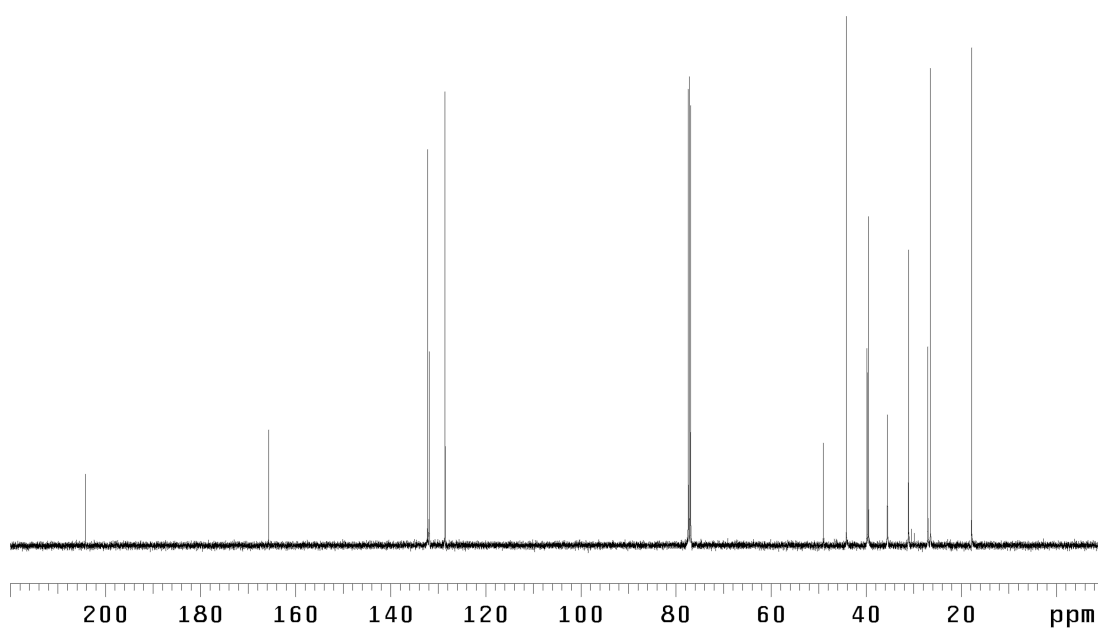


Figure A2.119.3. ¹³C NMR (125 MHz, CDCl₃) of compound **111x**.

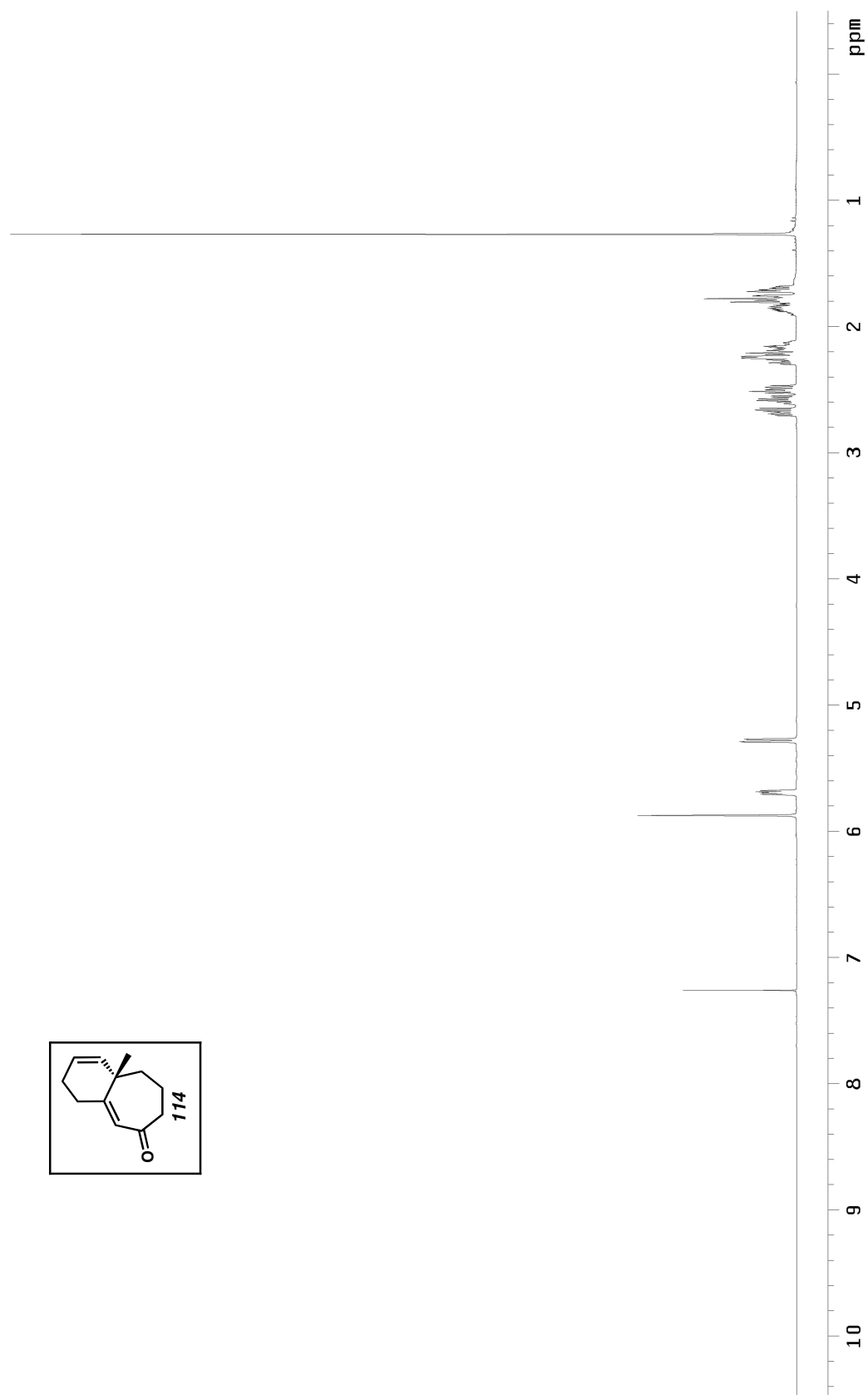


Figure A2.120.1. ^1H NMR (500 MHz, CDCl_3) of compound **114**.

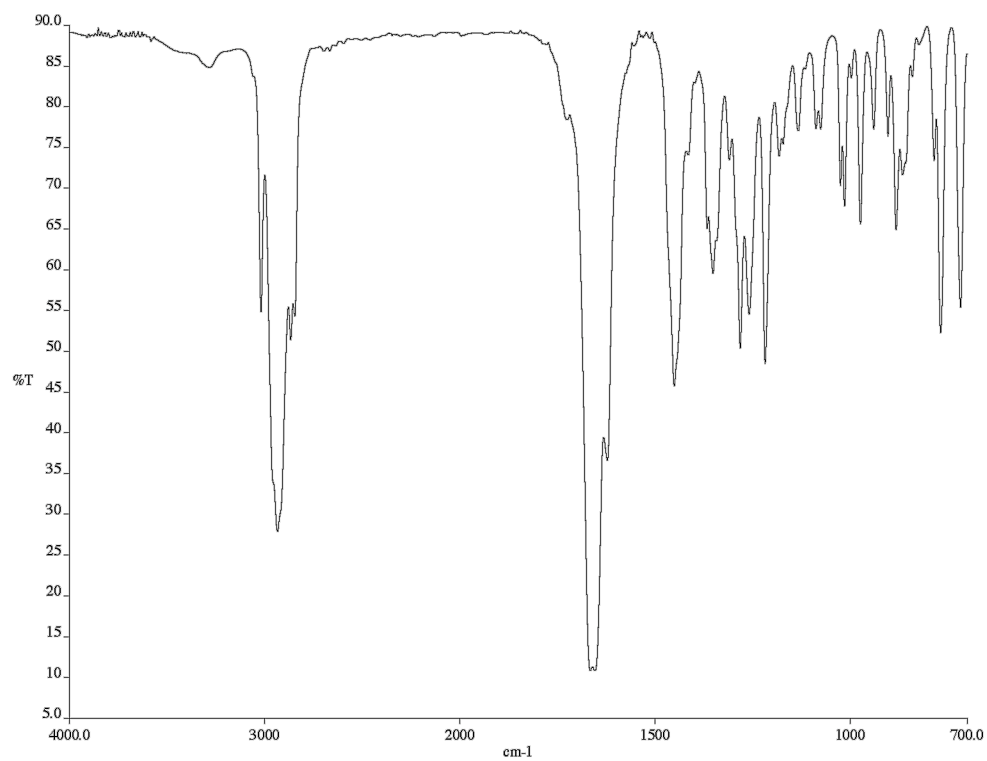


Figure A2.120.2. Infrared spectrum (thin film/NaCl) of compound **114**.

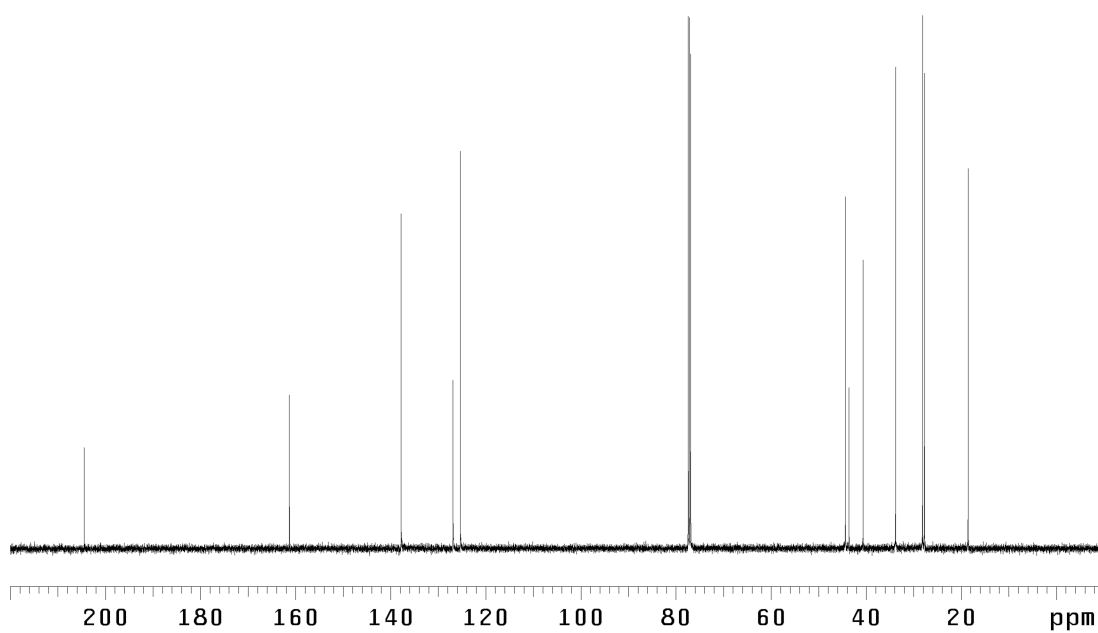


Figure A2.120.3. ¹³C NMR (125 MHz, CDCl₃) of compound **114**.

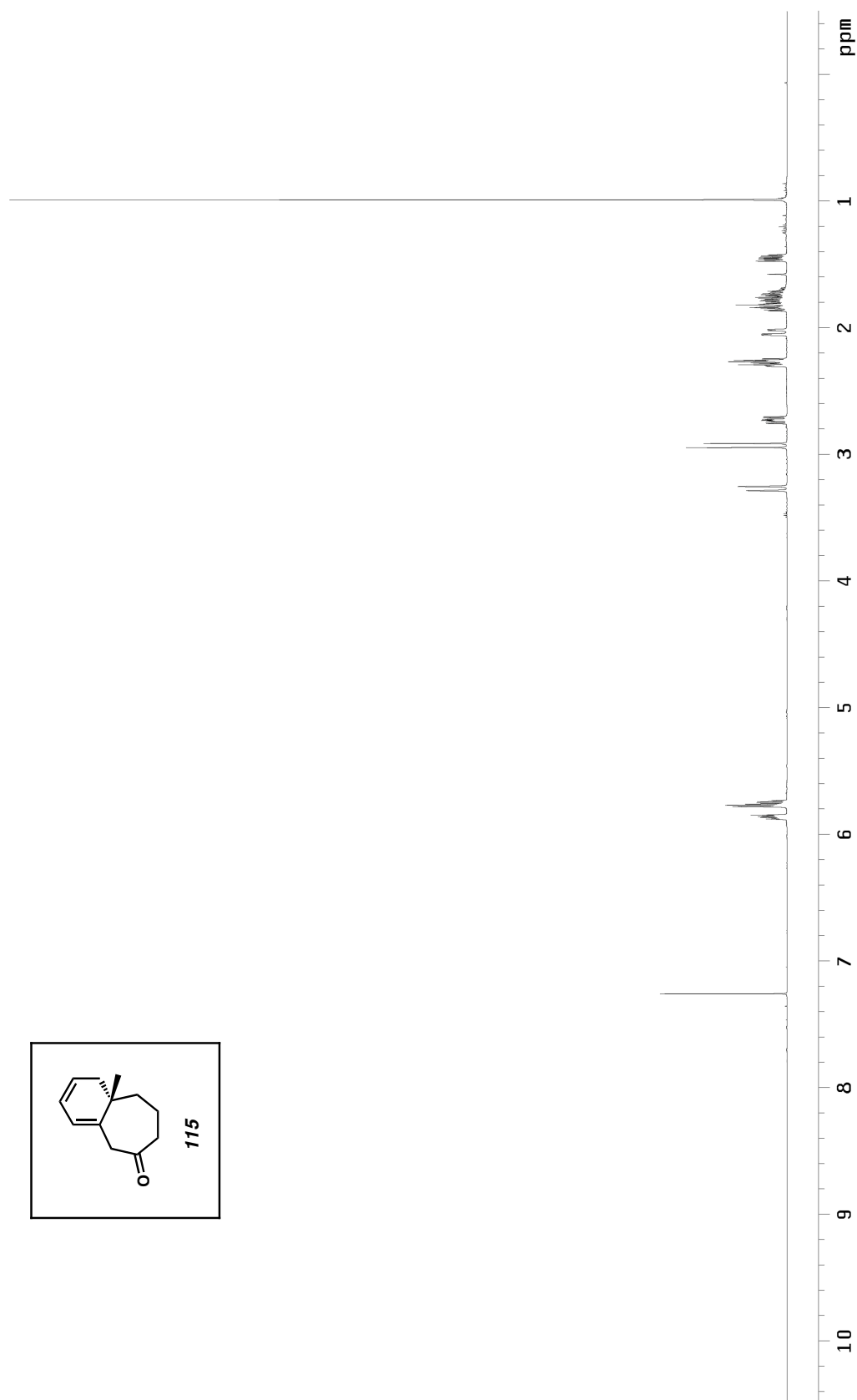


Figure A2.121.1. ^1H NMR (500 MHz, CDCl_3) of compound **115**.

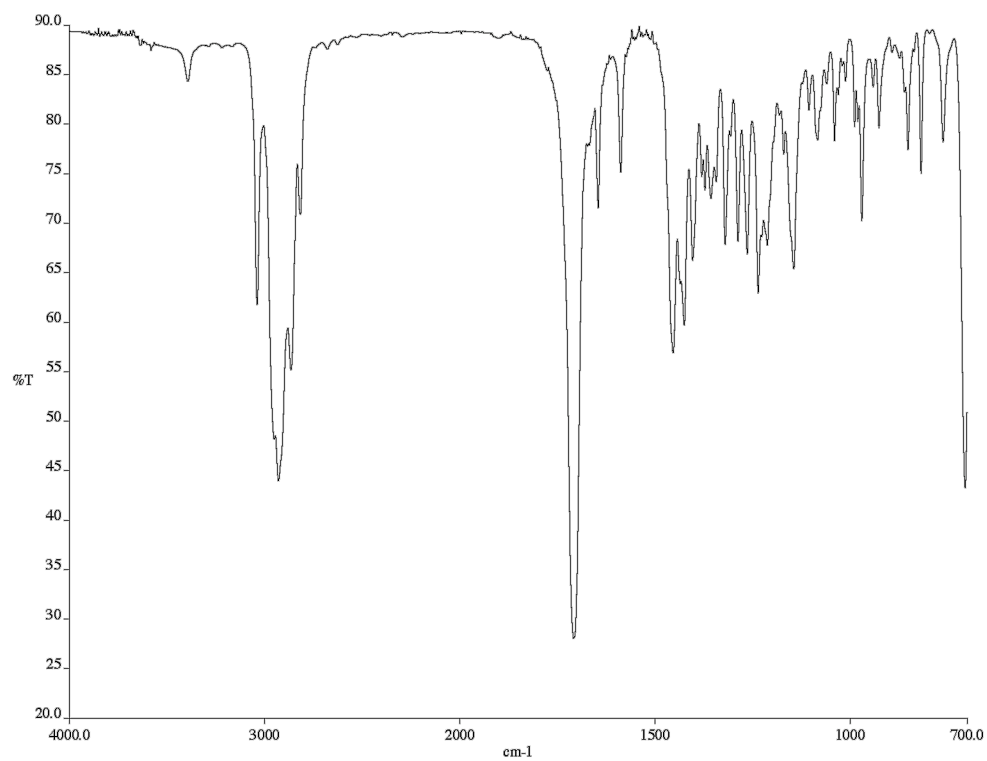


Figure A2.121.2. Infrared spectrum (thin film/NaCl) of compound **115**.

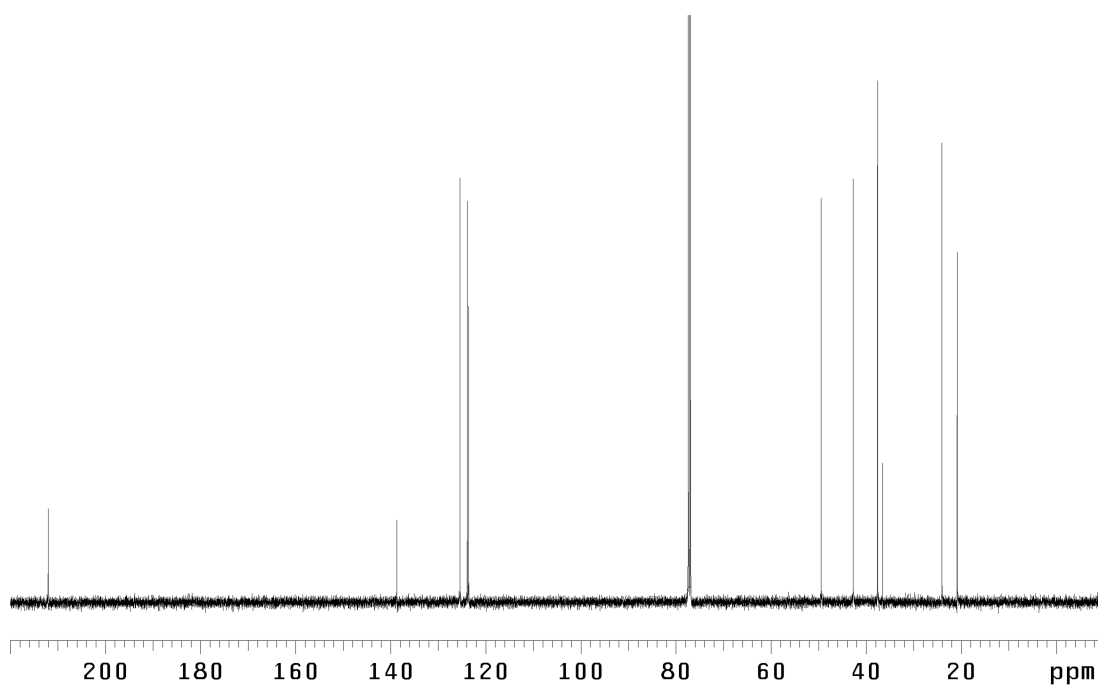


Figure A2.121.3. ¹³C NMR (125 MHz, CDCl₃) of compound **115**.

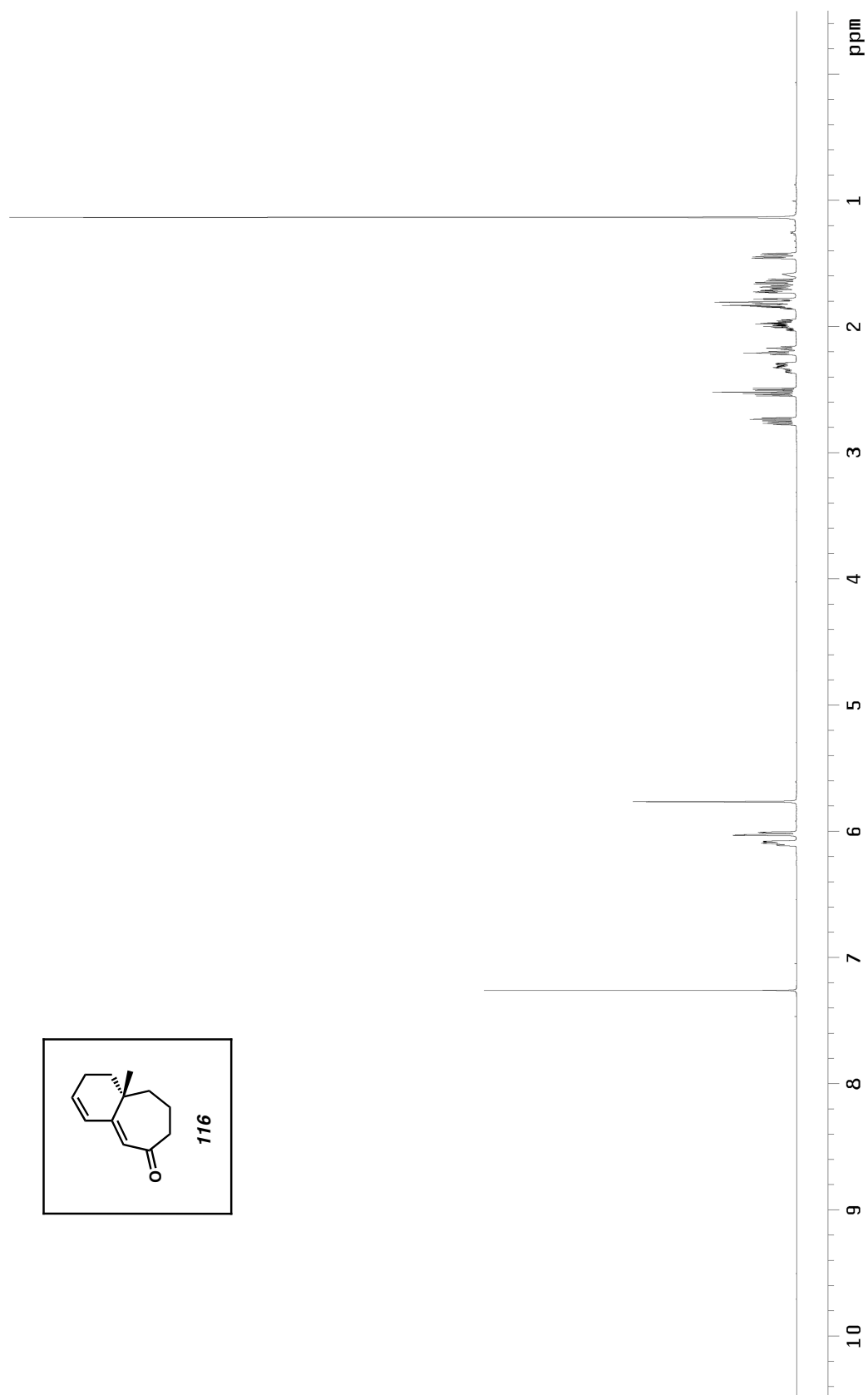


Figure A2.122.1. ^1H NMR (500 MHz, CDCl_3) of compound **116**.

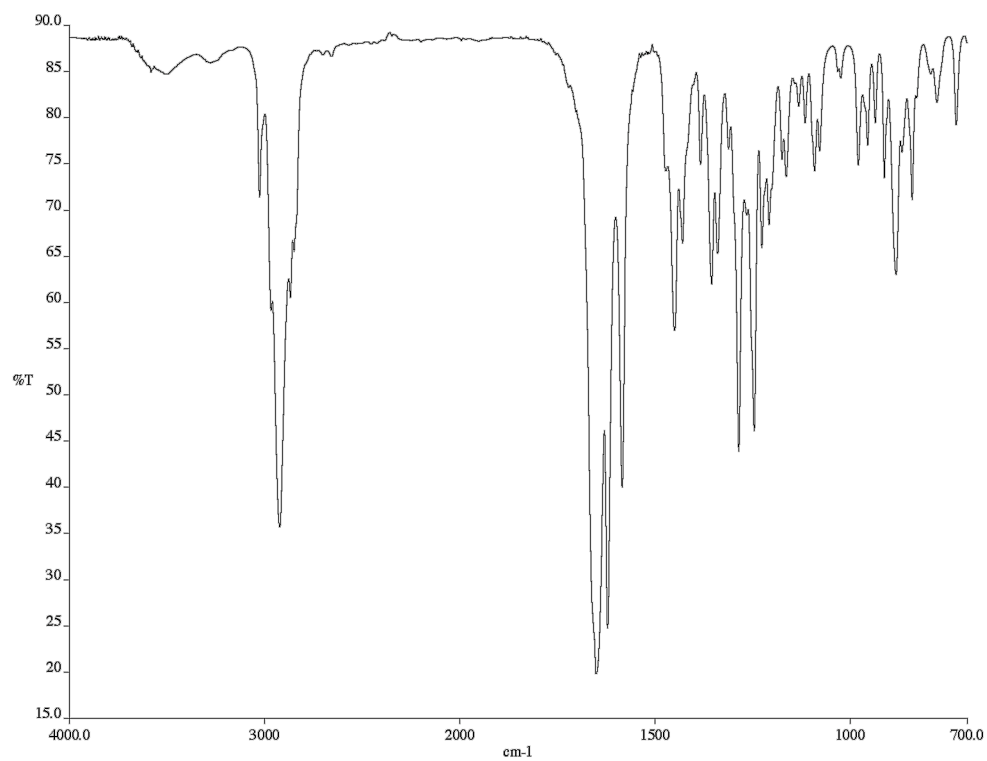


Figure A2.122.2. Infrared spectrum (thin film/NaCl) of compound **116**.

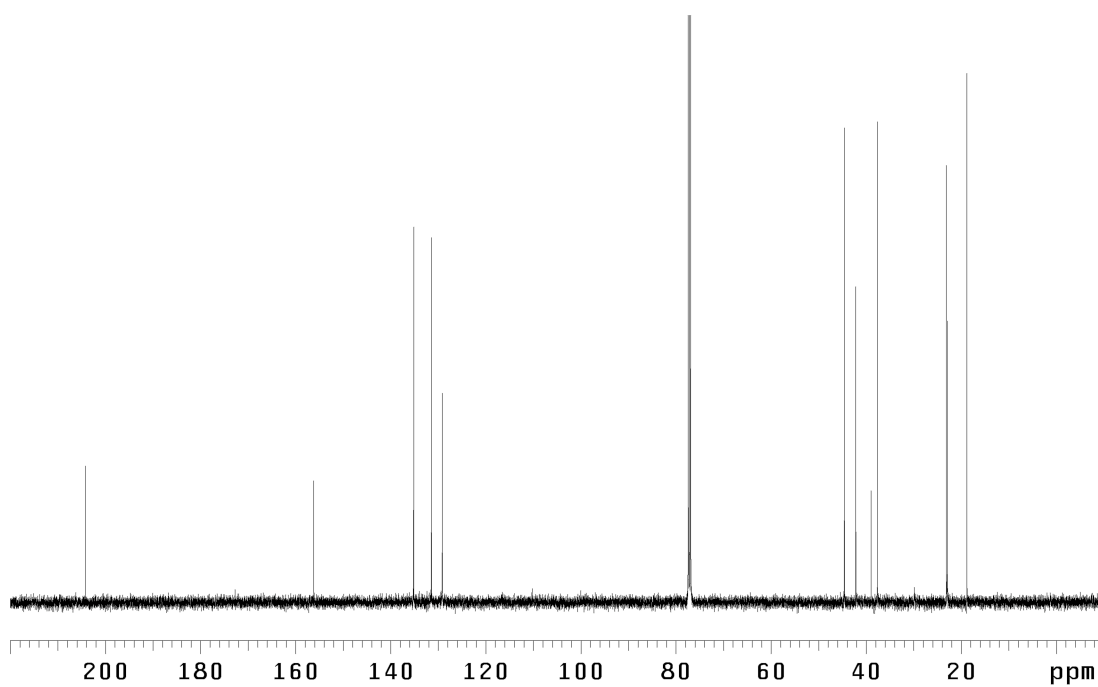


Figure A2.122.3. ¹³C NMR (125 MHz, CDCl₃) of compound **116**.

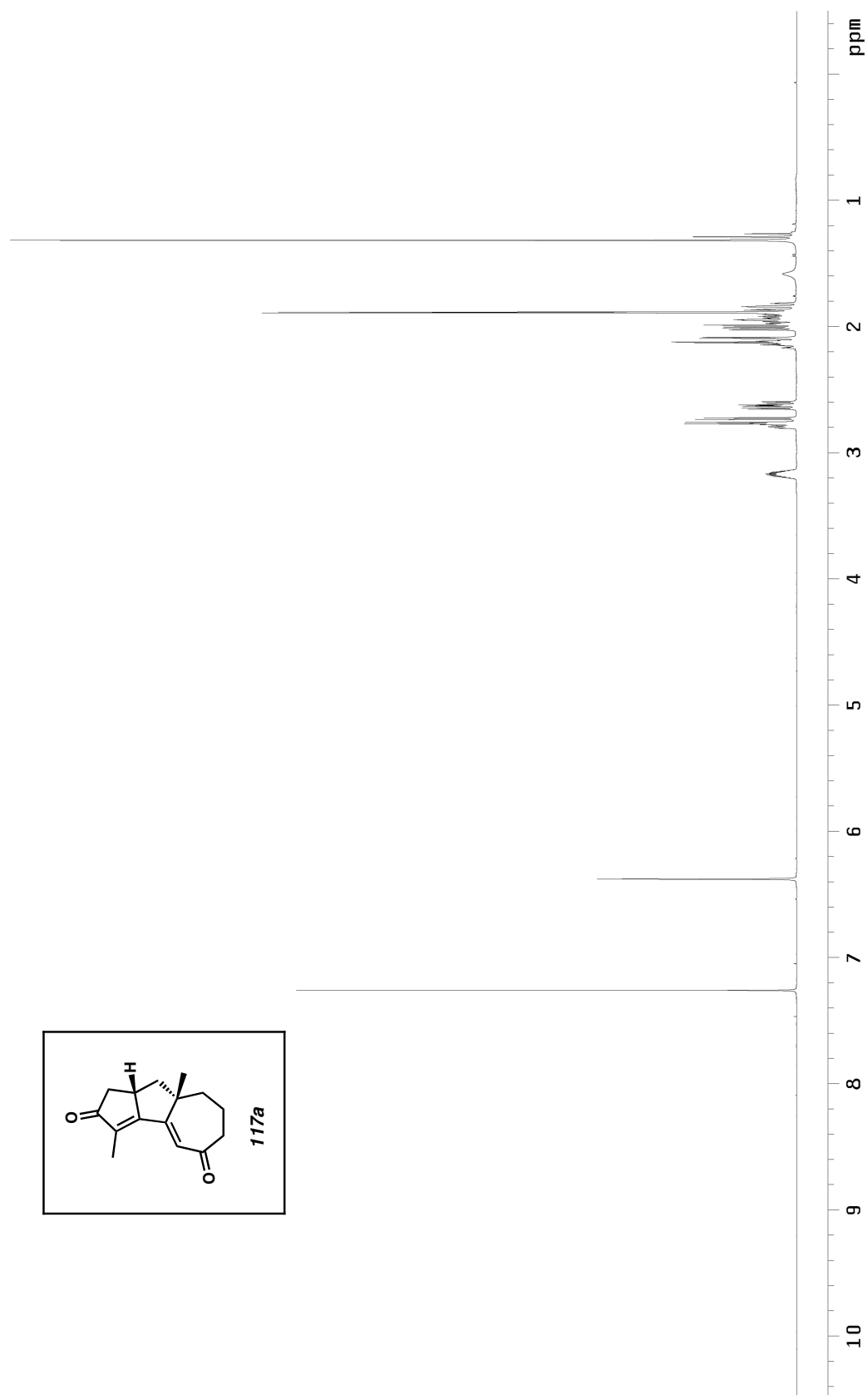


Figure A2.123.1. ^1H NMR (500 MHz, CDCl_3) of compound **117a**.

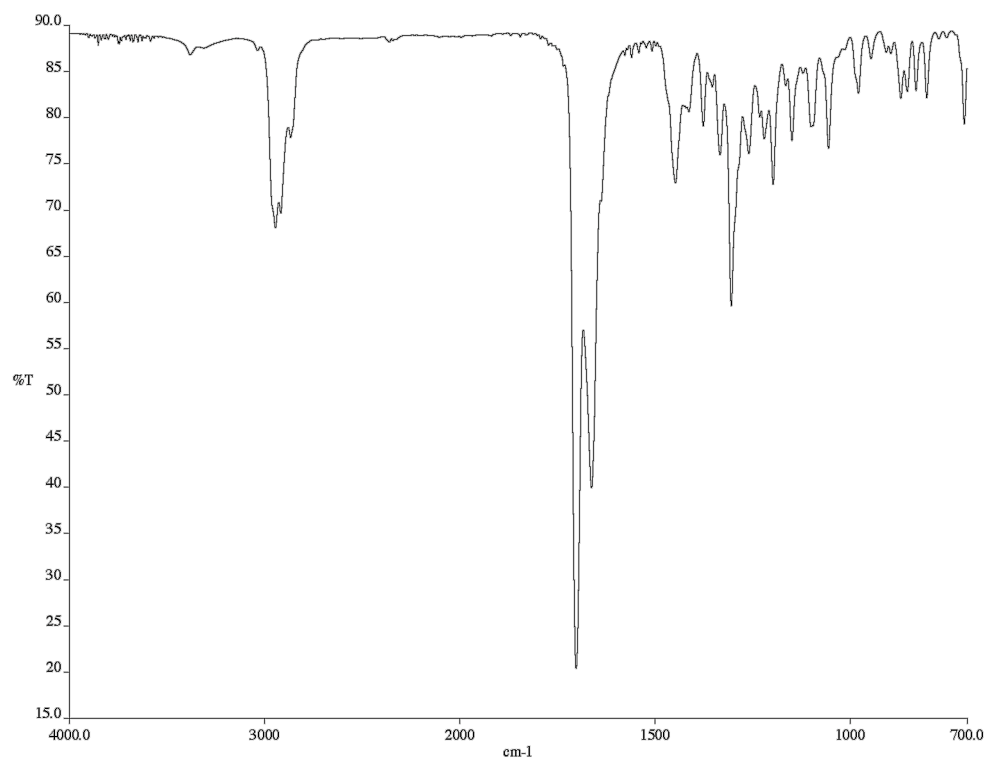


Figure A2.123.2. Infrared spectrum (thin film/NaCl) of compound **117a**.

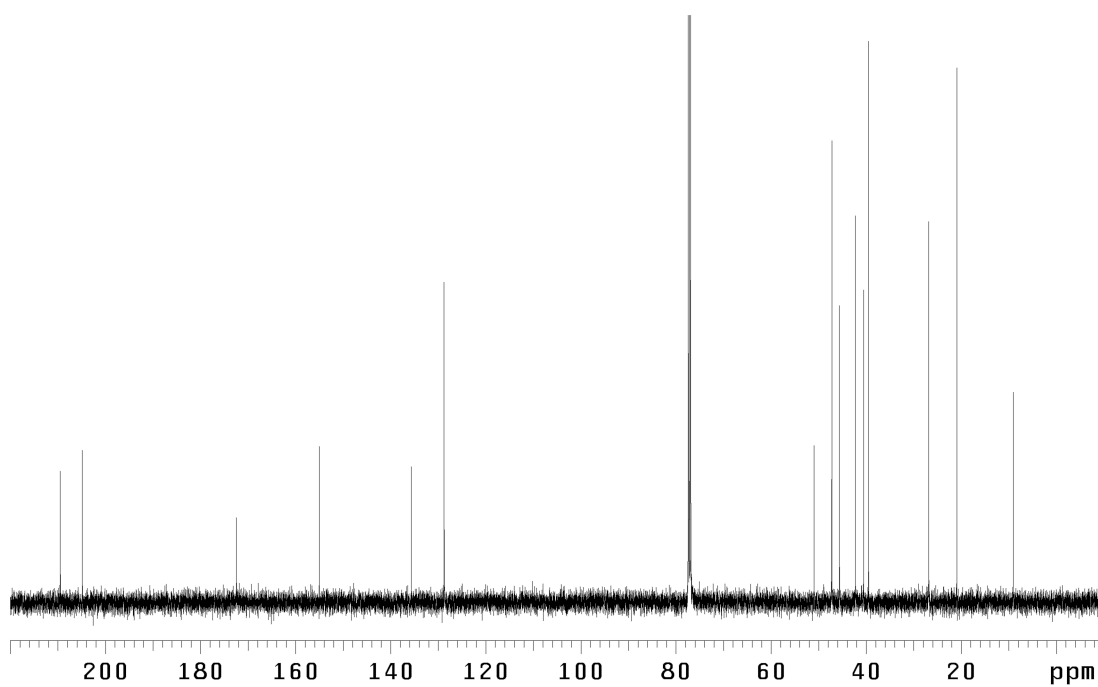
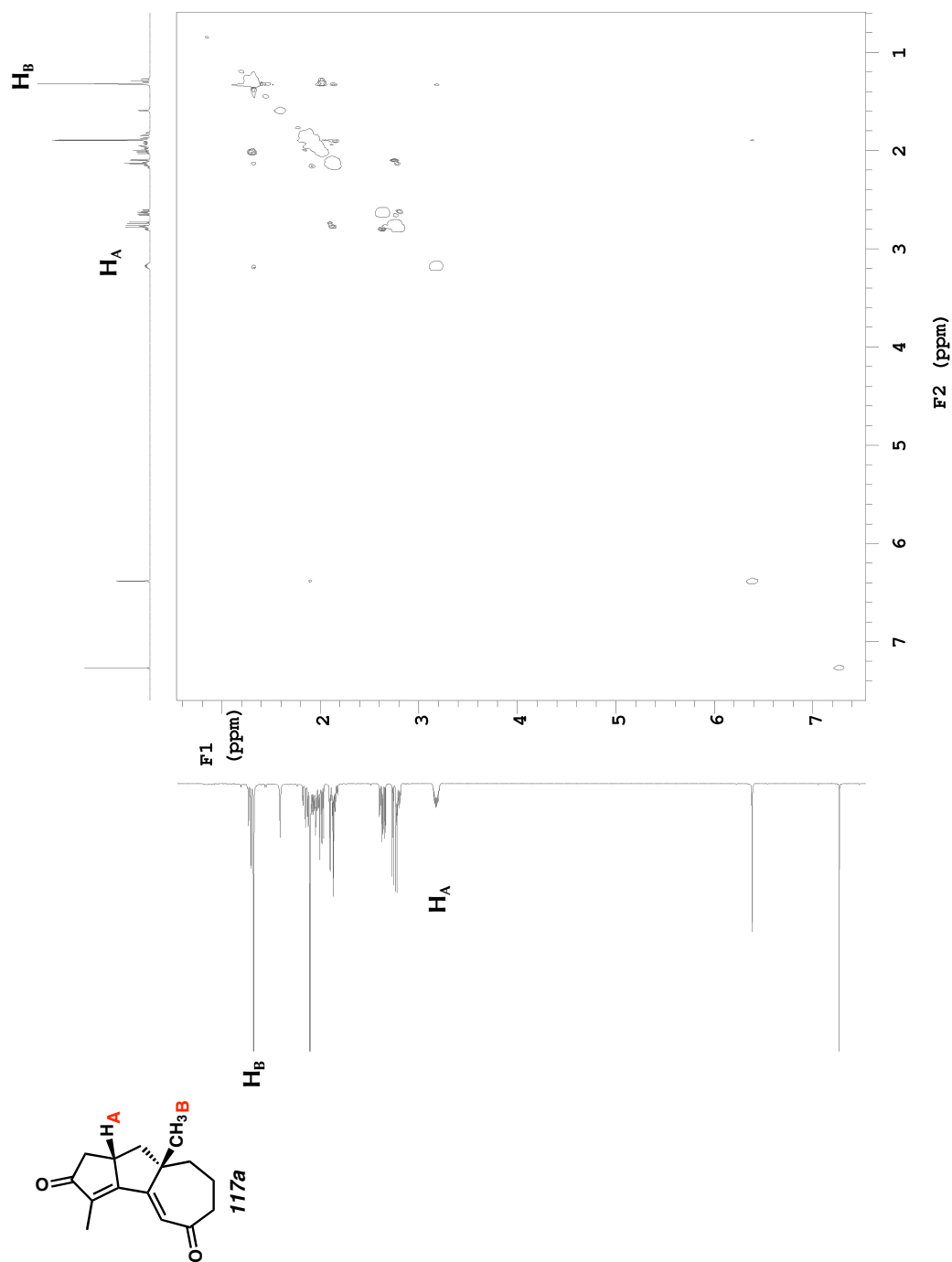


Figure A2.123.3. ¹³C NMR (125 MHz, CDCl₃) of compound **117a**.

Figure A2.123.4. NOESY (500 MHz, $CDCl_3$) of compound **117a**.

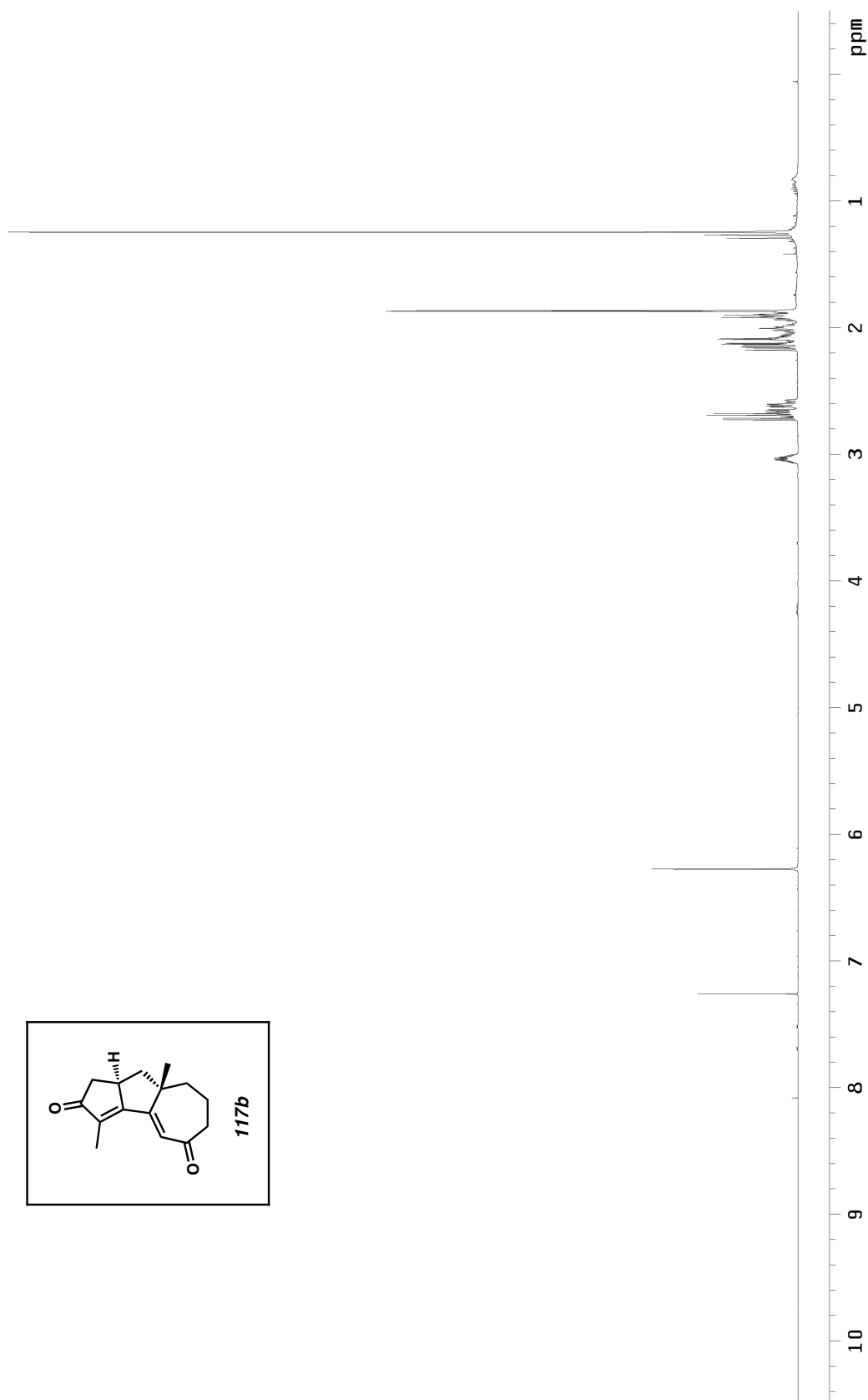


Figure A2.124.1. ^1H NMR (500 MHz, CDCl_3) of compound **117b**.

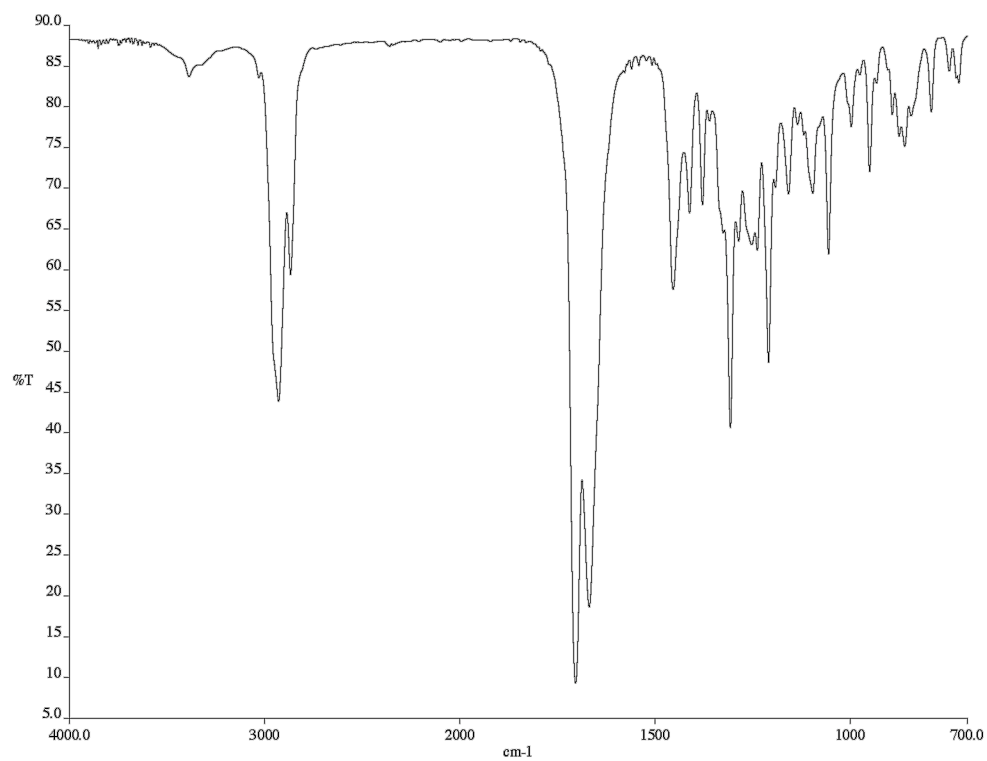


Figure A2.124.2. Infrared spectrum (thin film/NaCl) of compound **117b**.

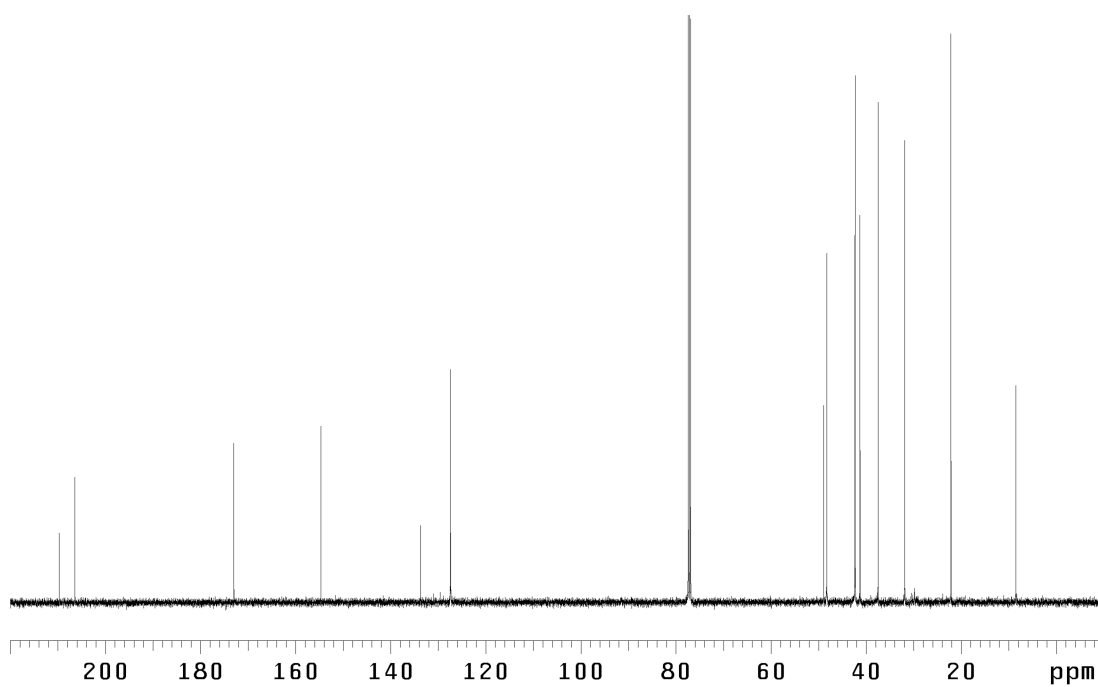
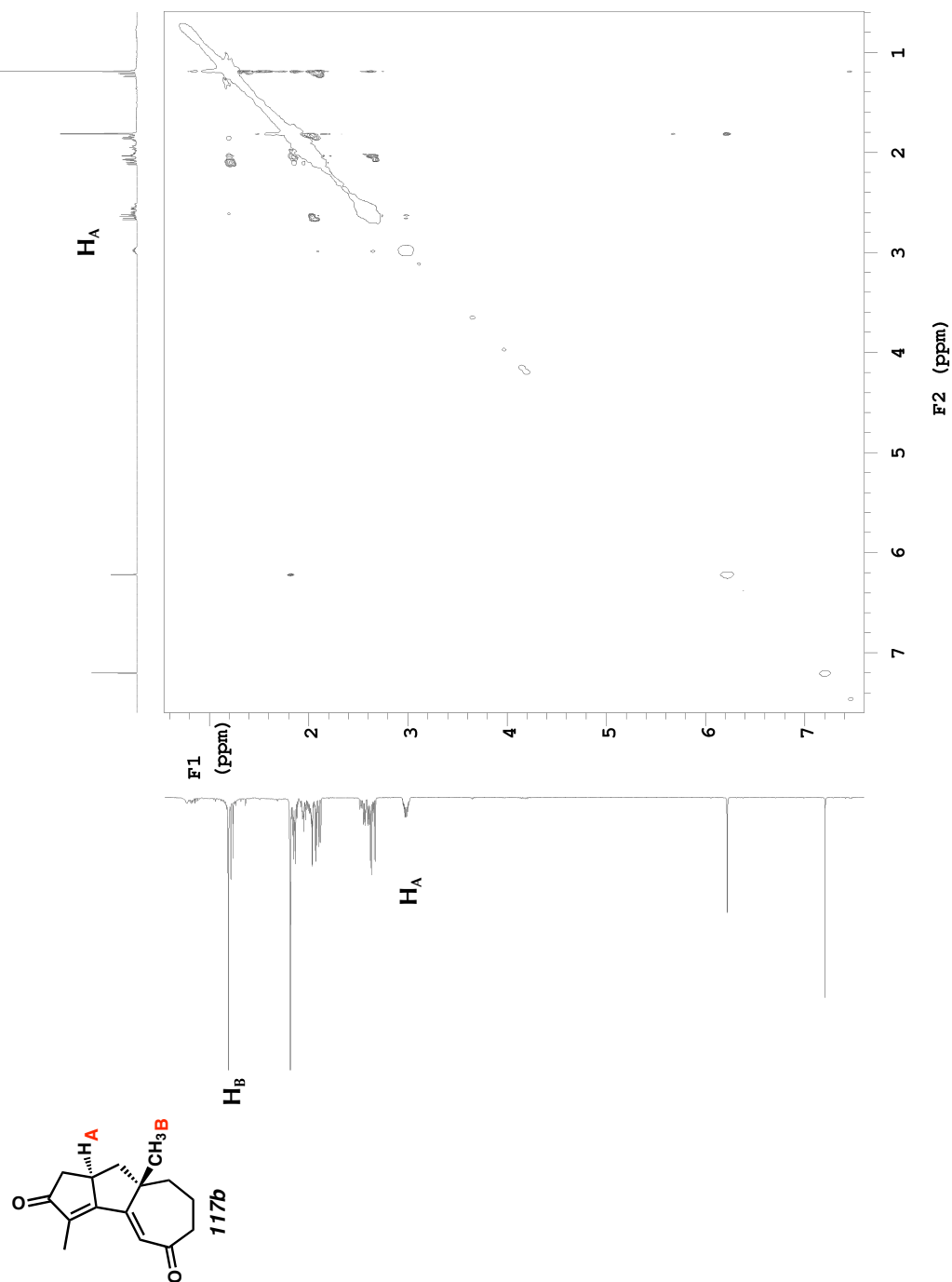


Figure A2.124.3. ¹³C NMR (125 MHz, CDCl₃) of compound **117b**.

Figure A2.124.4. NOESY (500 MHz, CDCl₃) of compound **117b**.