

## Supplementary Material

### Synthesis of 3-substituted pyrrolidin-2-ones and 3-substituted piperidin-2-ones from esters

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## NMR spectra:

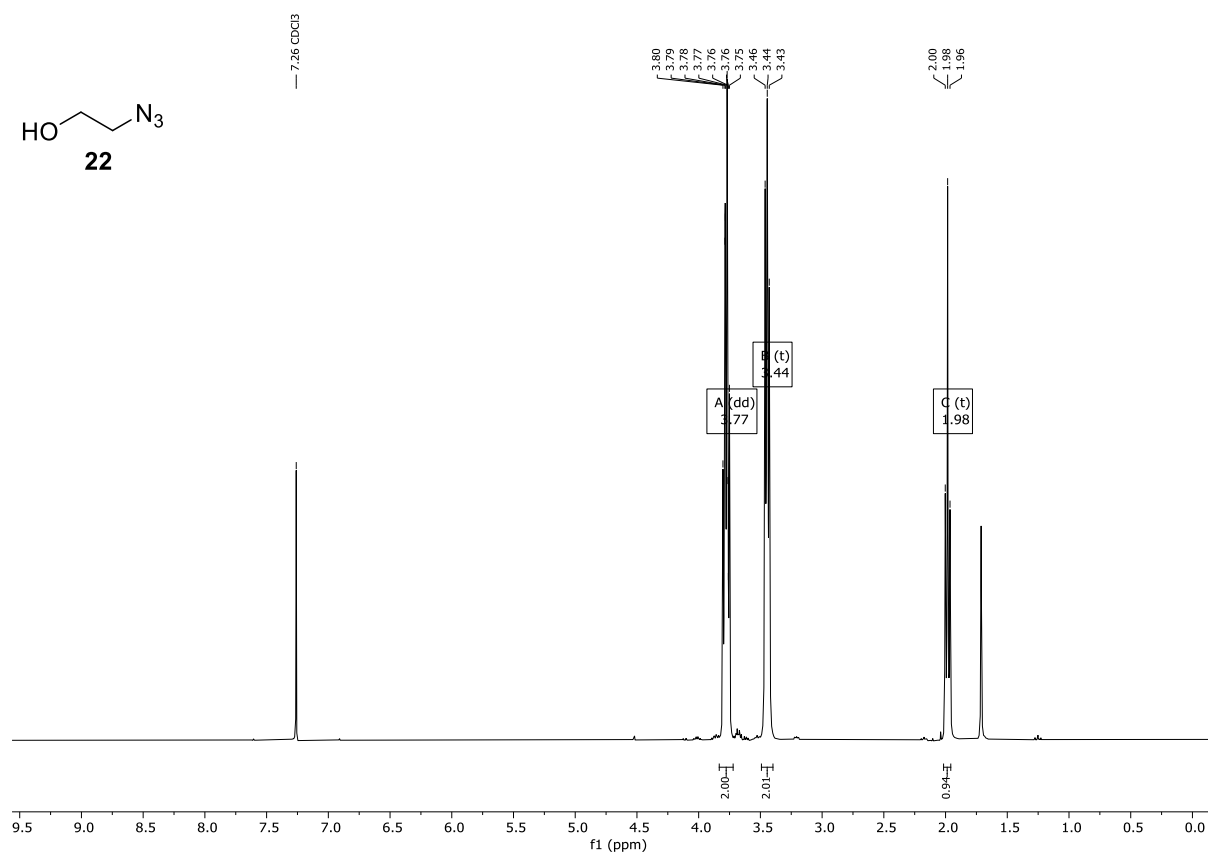


Figure 1: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 2-azidoethan-1-ol (**22**).

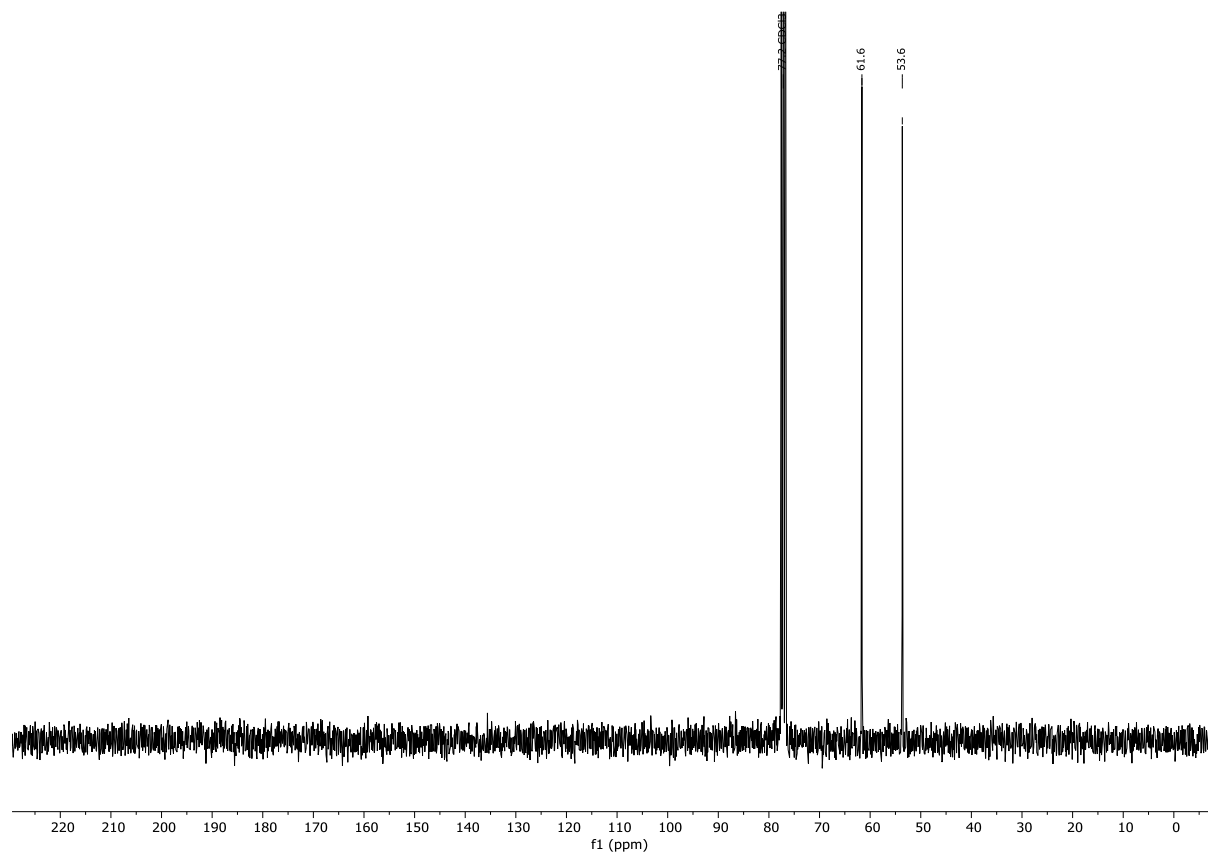


Figure 2: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 2-azidoethan-1-ol (**22**).

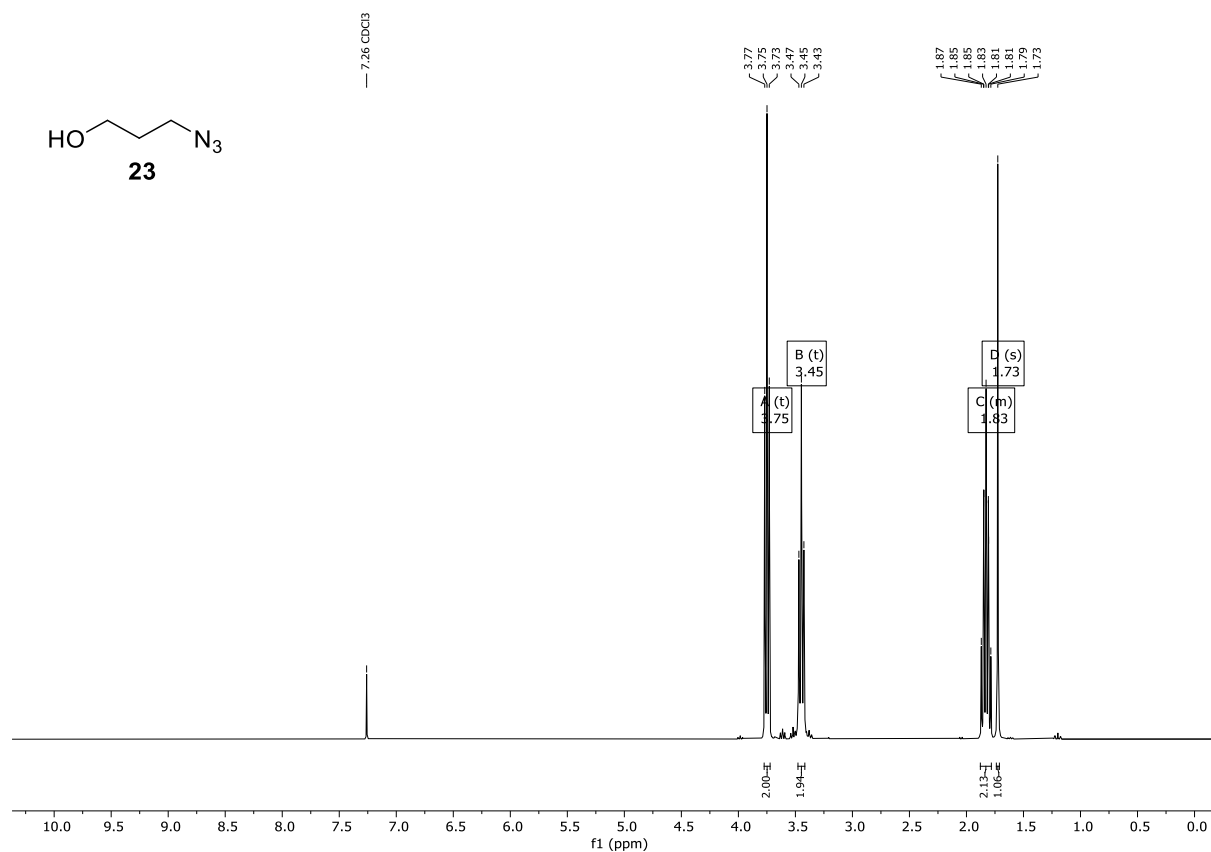


Figure 3: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-azidopropan-1-ol (**23**).

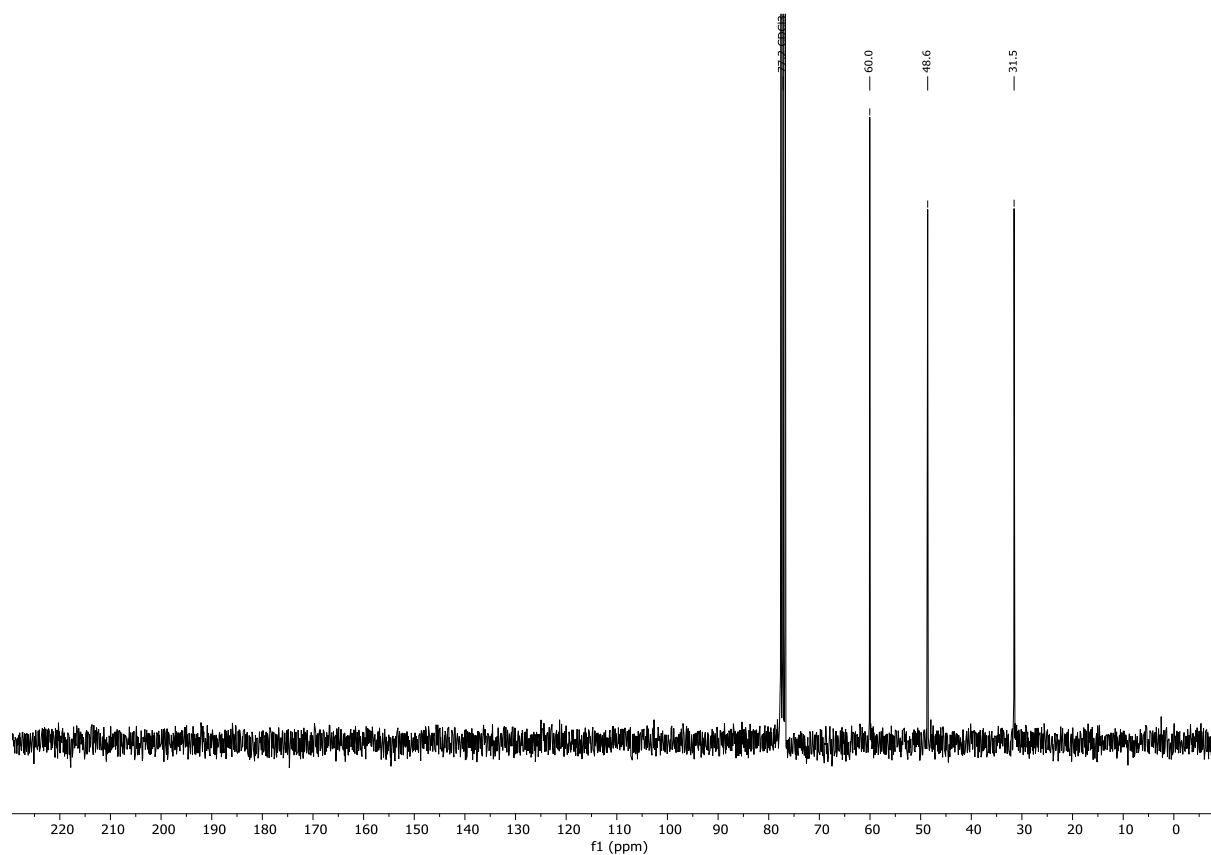


Figure 4: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-azidopropan-1-ol (**23**).

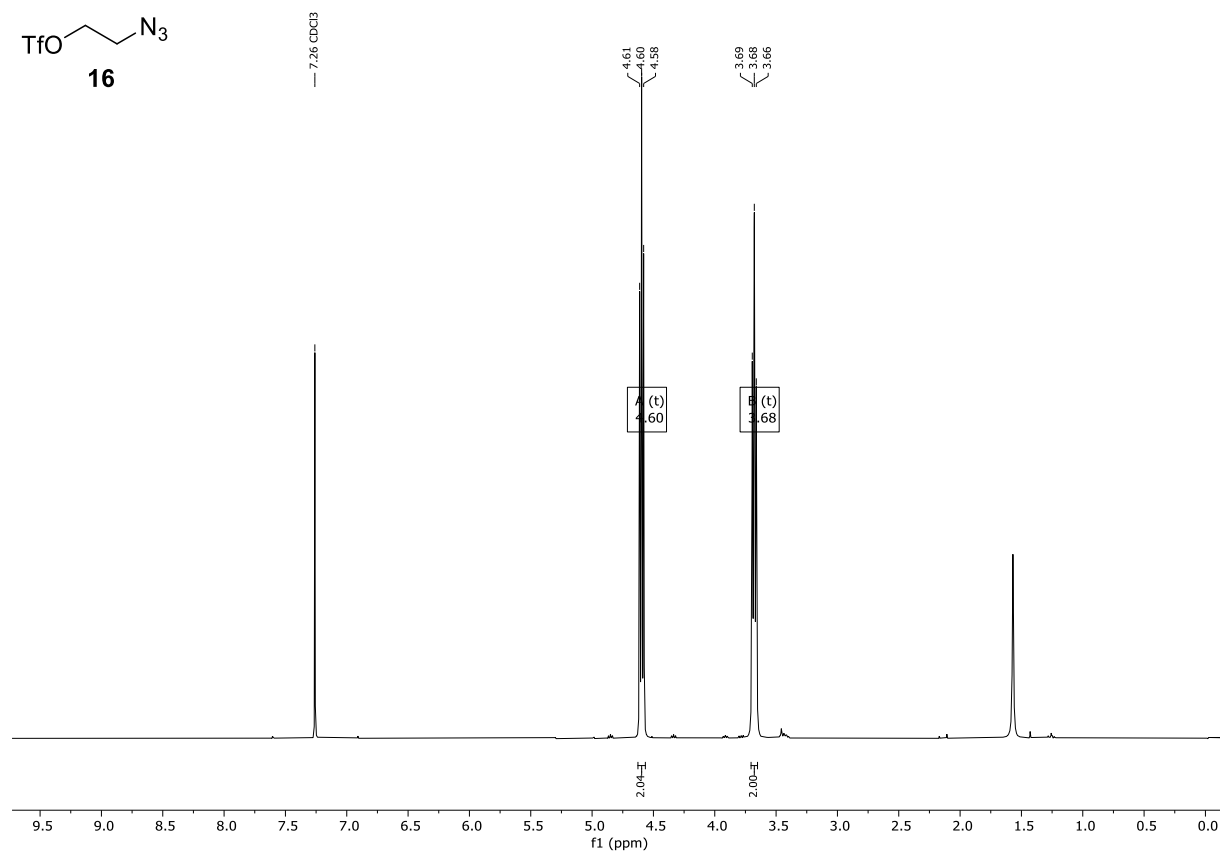


Figure 5: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 2-azidoethyl trifluoromethanesulfonate (**16**).

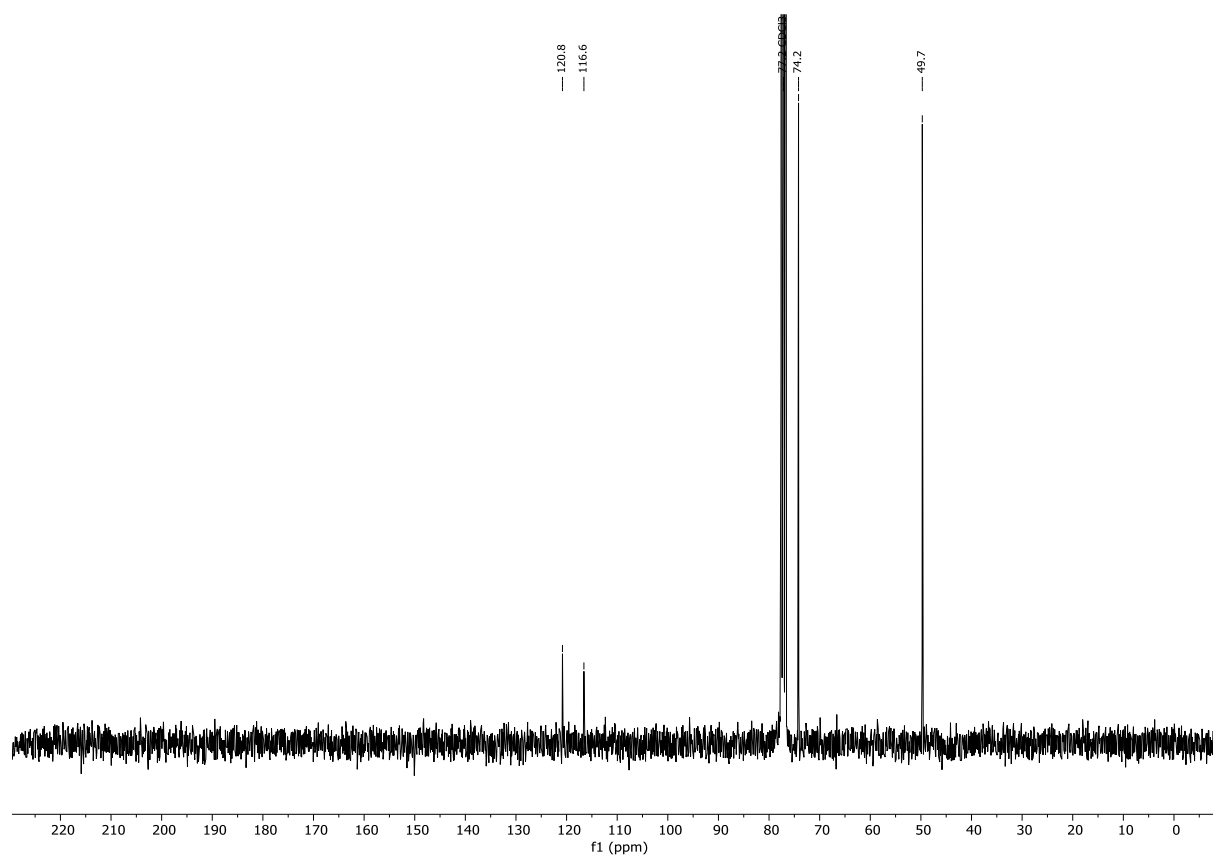


Figure 6: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 2-azidoethyl trifluoromethanesulfonate (**16**).

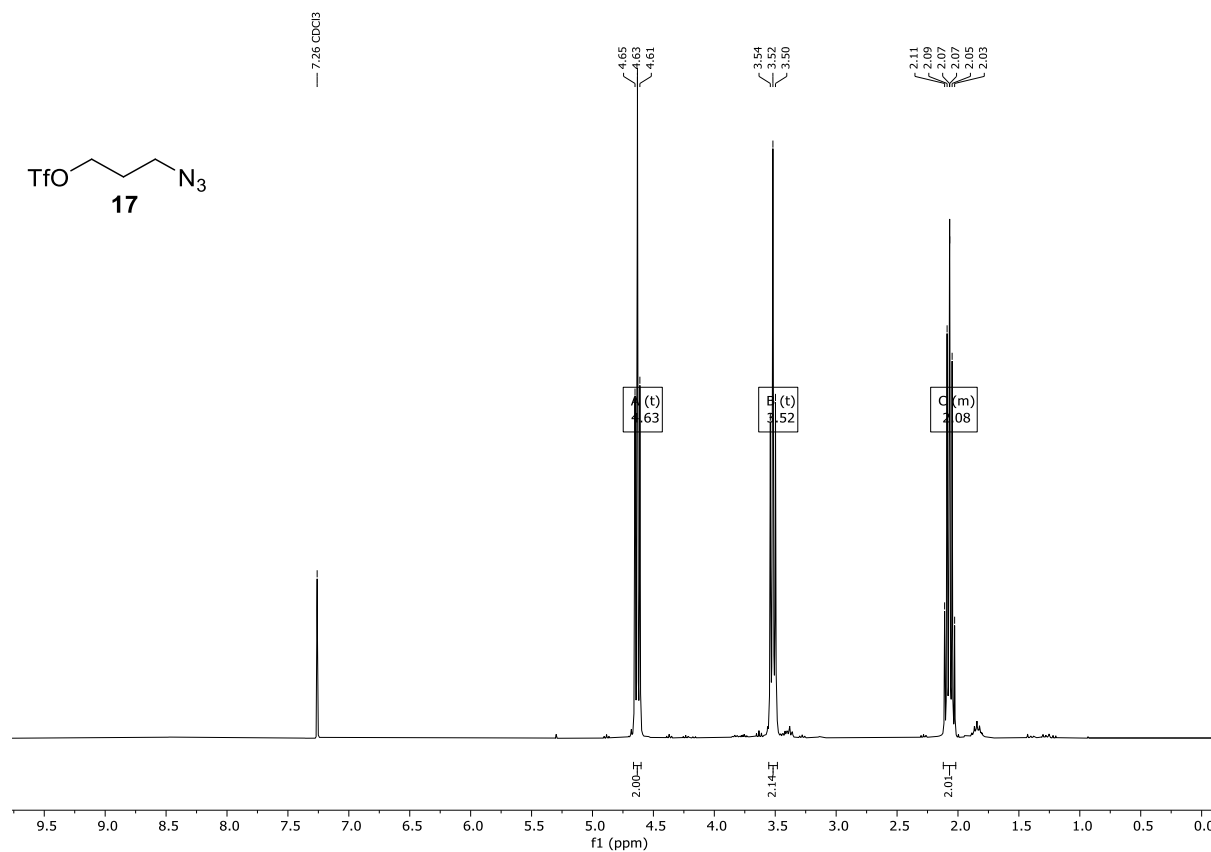


Figure 7: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-azidopropyl trifluoromethanesulfonate (17).

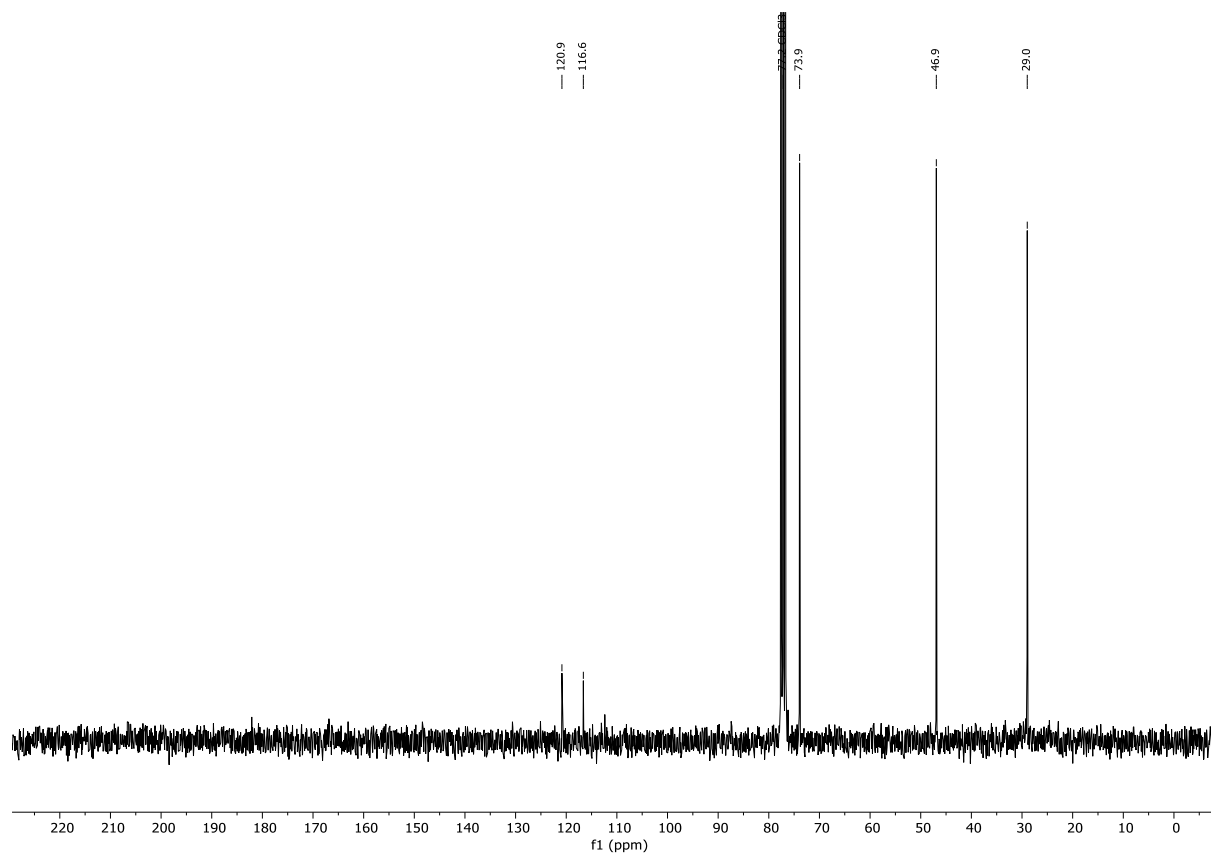


Figure 8: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-azidopropyl trifluoromethanesulfonate (17).

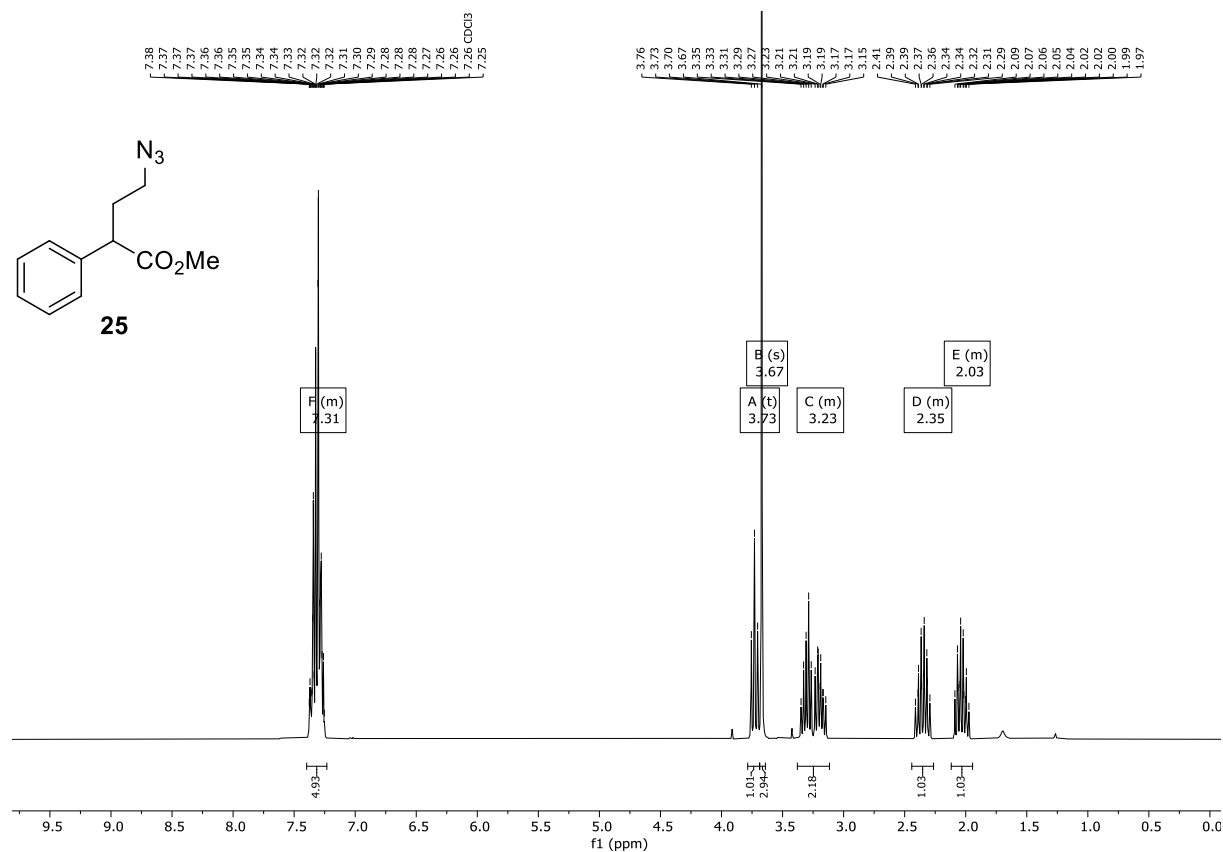


Figure 9: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of methyl 4-azido-2-phenylbutanoate (**25**).

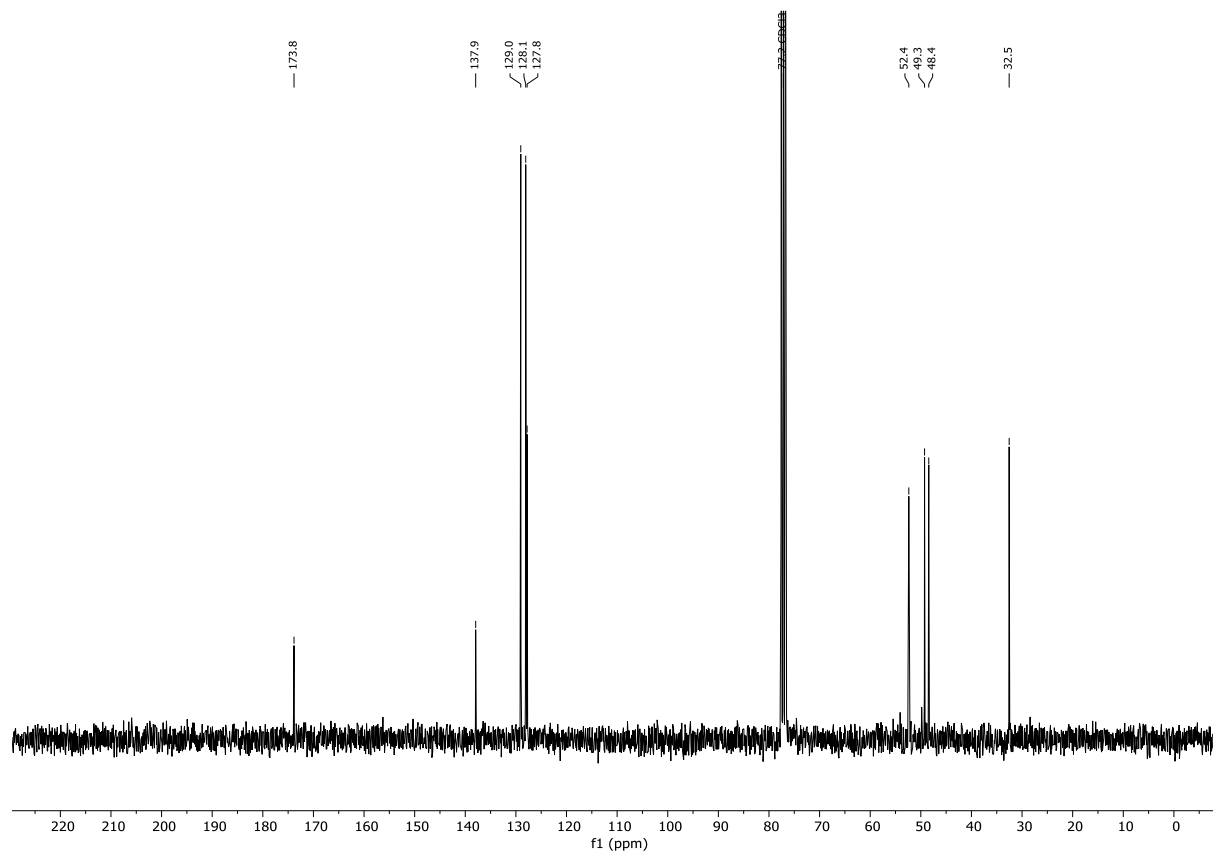
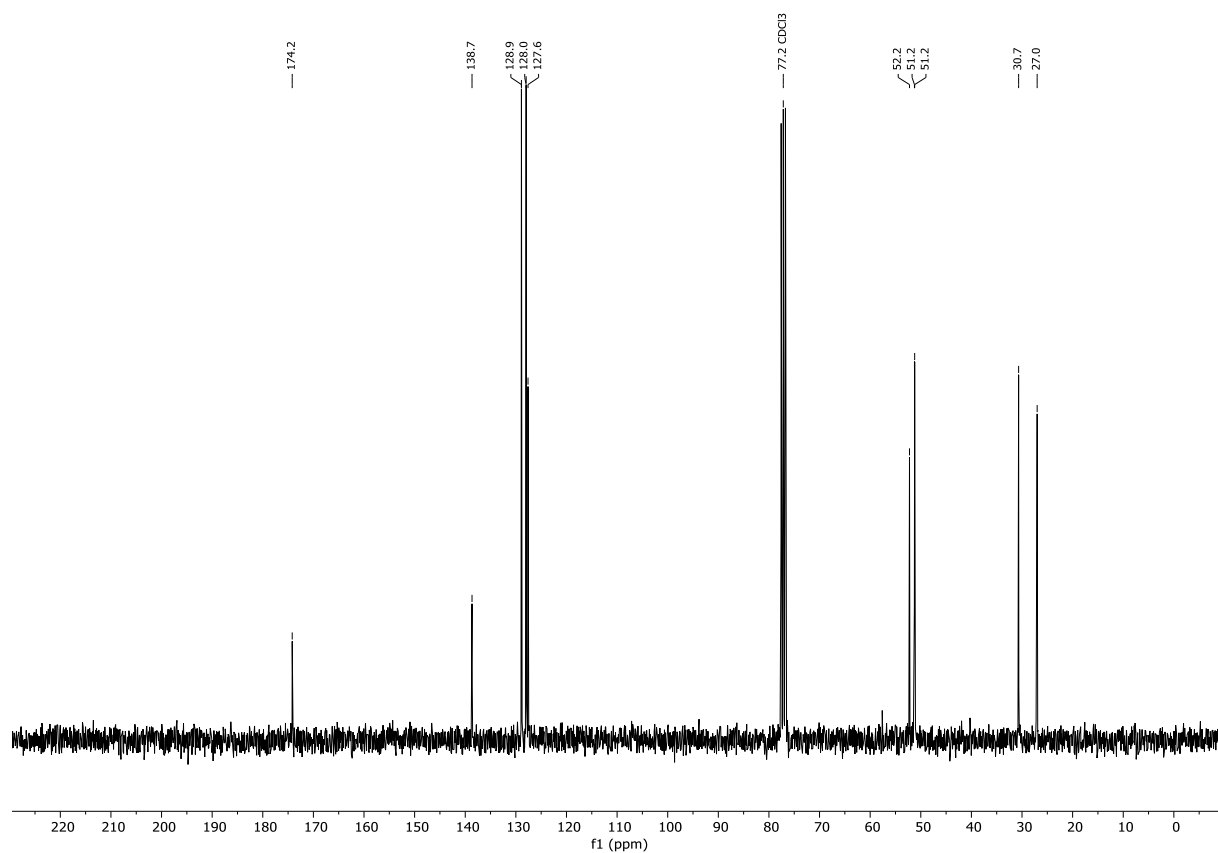
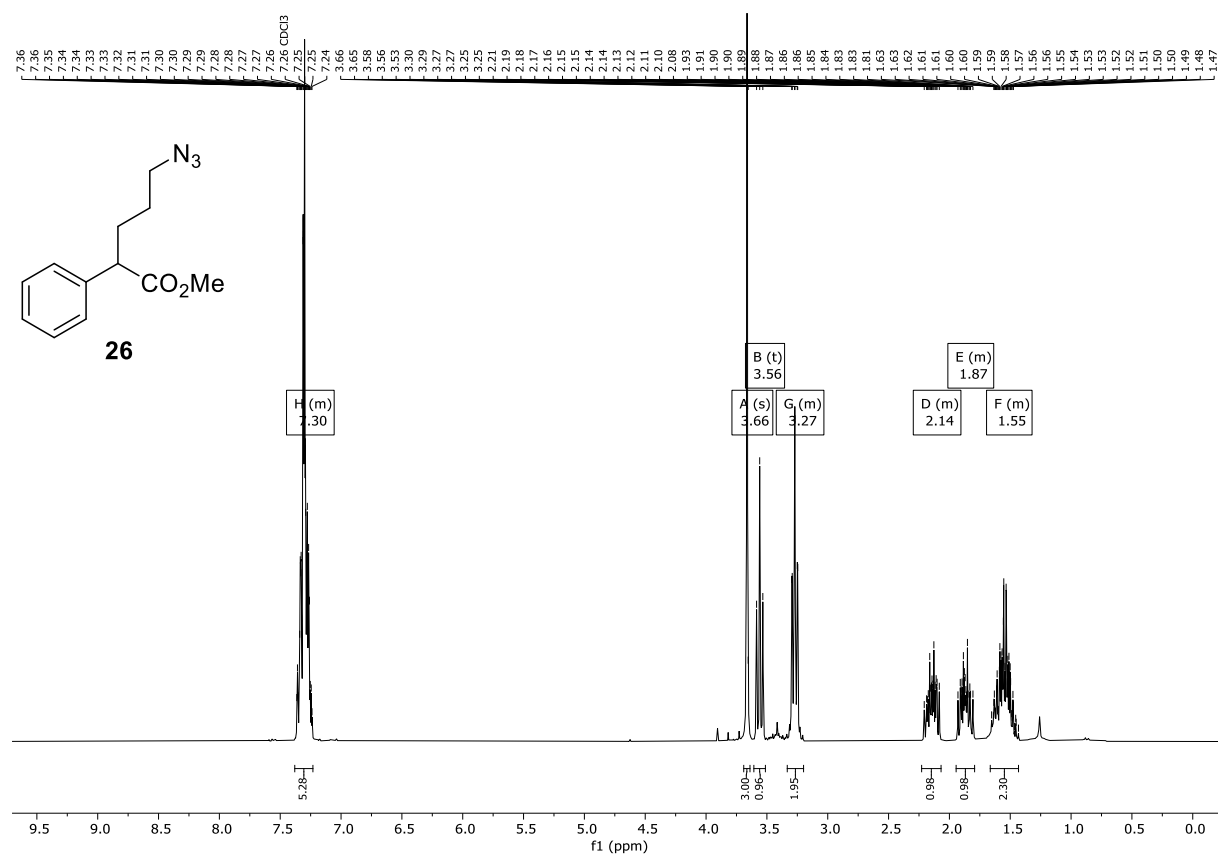
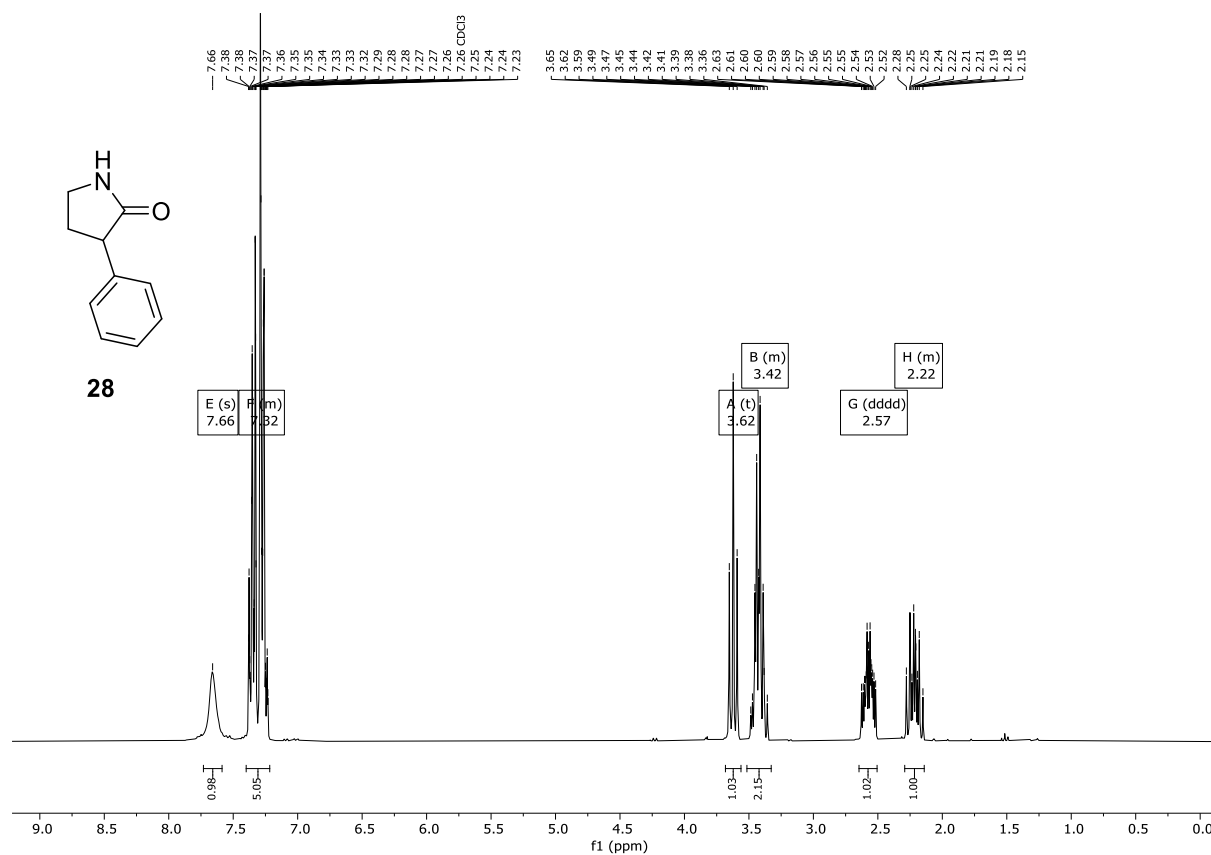
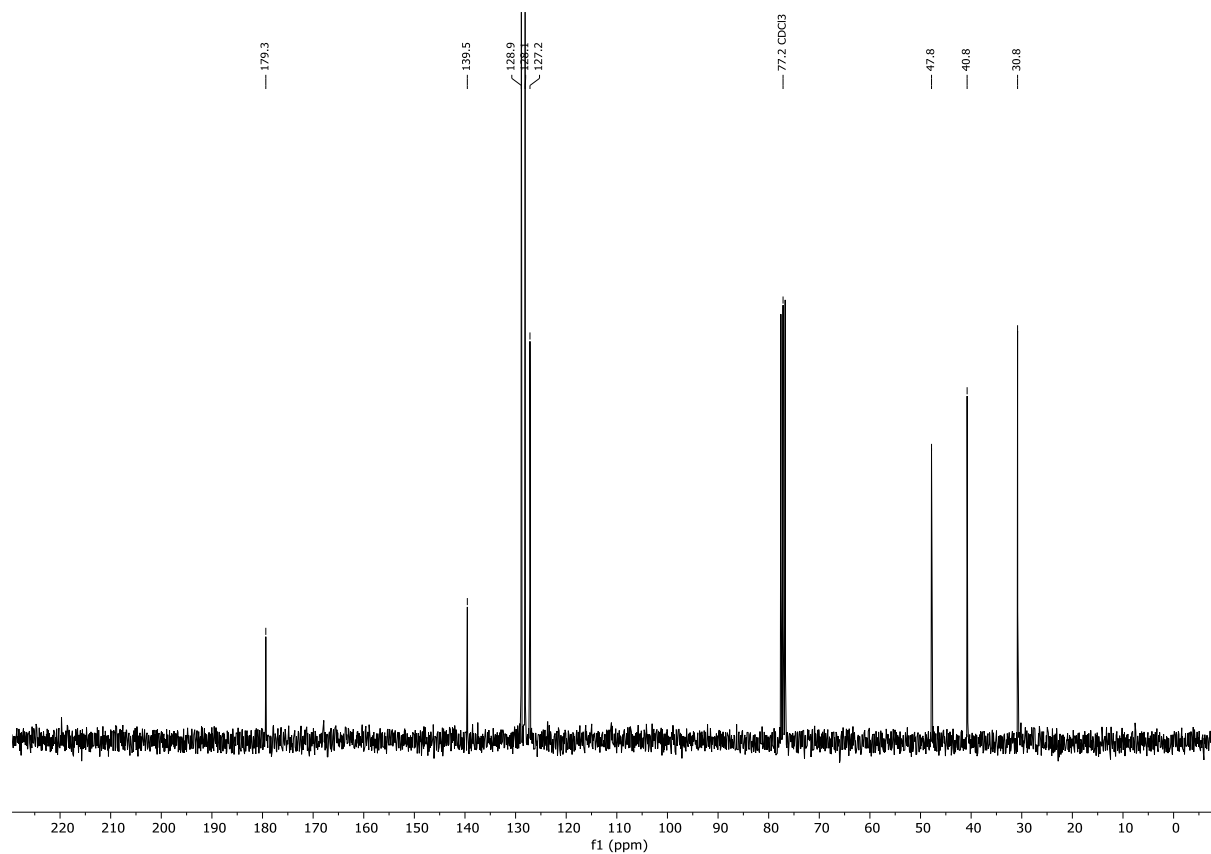


Figure 10: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of methyl 4-azido-2-phenylbutanoate (**25**).





**Figure 13:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-phenylpyrrolidin-2-one (**28**).



**Figure 14:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-phenylpyrrolidin-2-one (**28**).



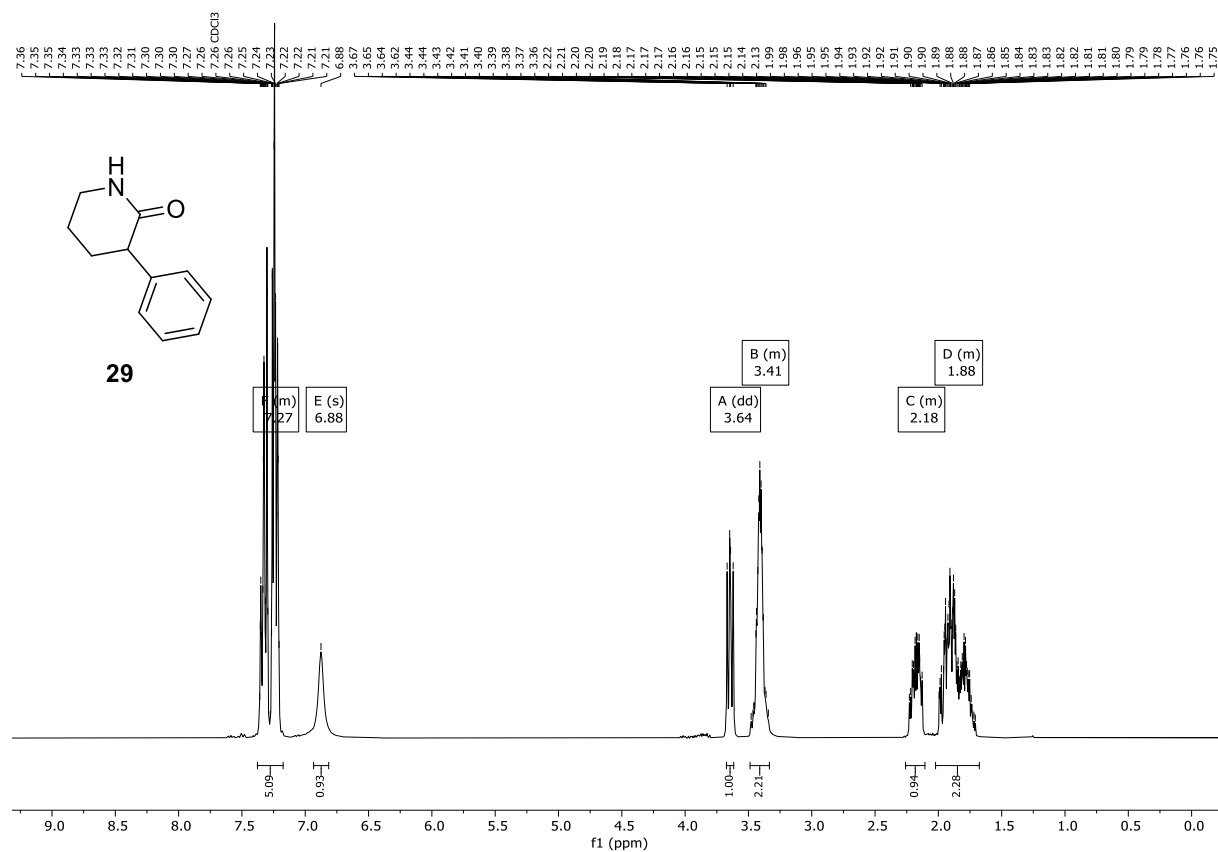


Figure 15: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-phenylpiperidin-2-one (**29**).

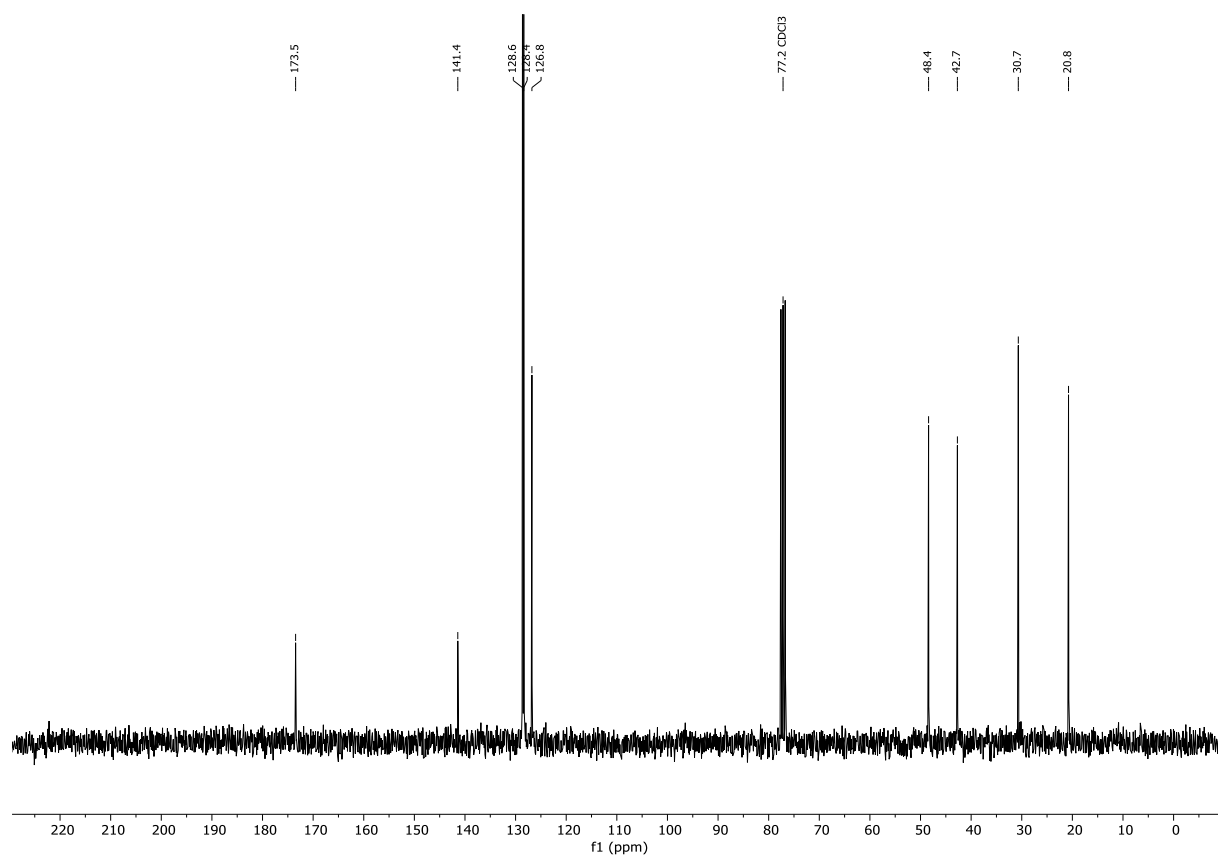


Figure 16: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-phenylpiperidin-2-one (**29**).

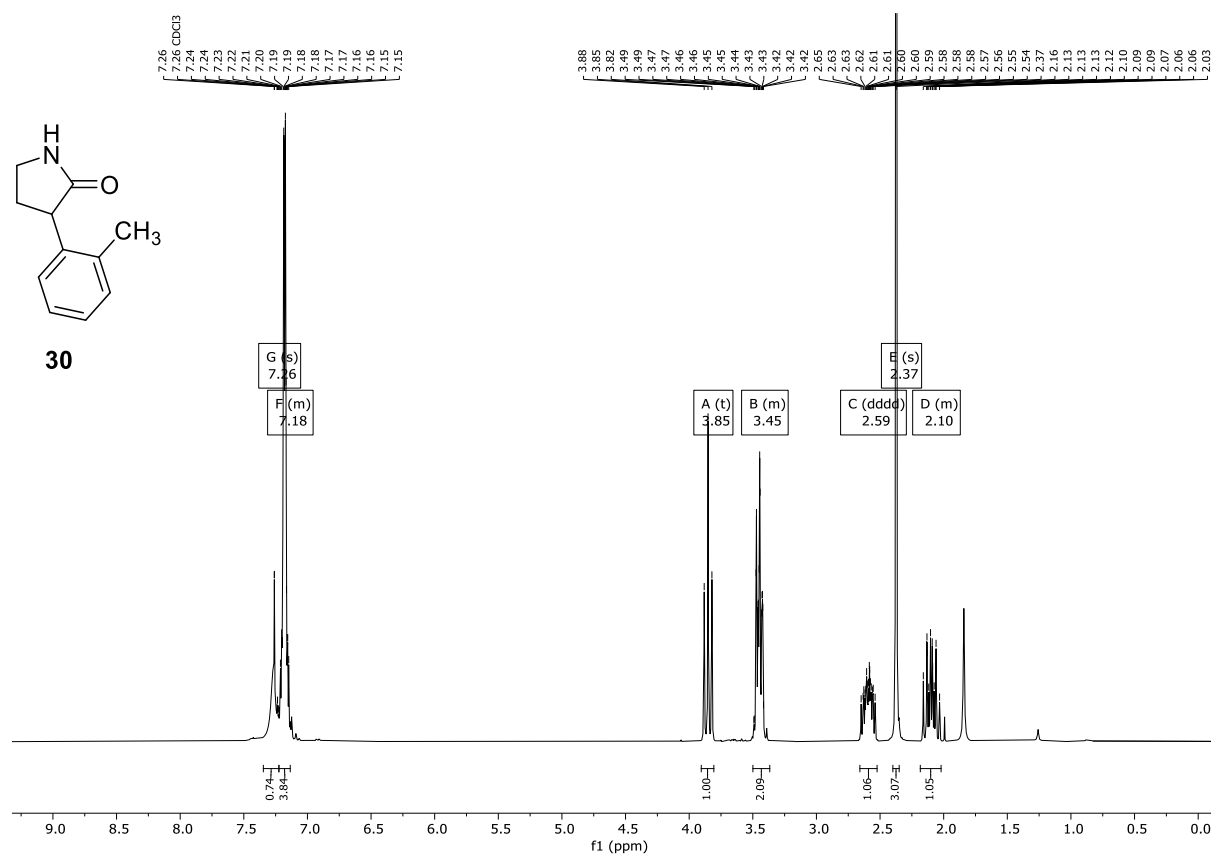


Figure 17:  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(*o*-tolyl)pyrrolidin-2-one (**30**).

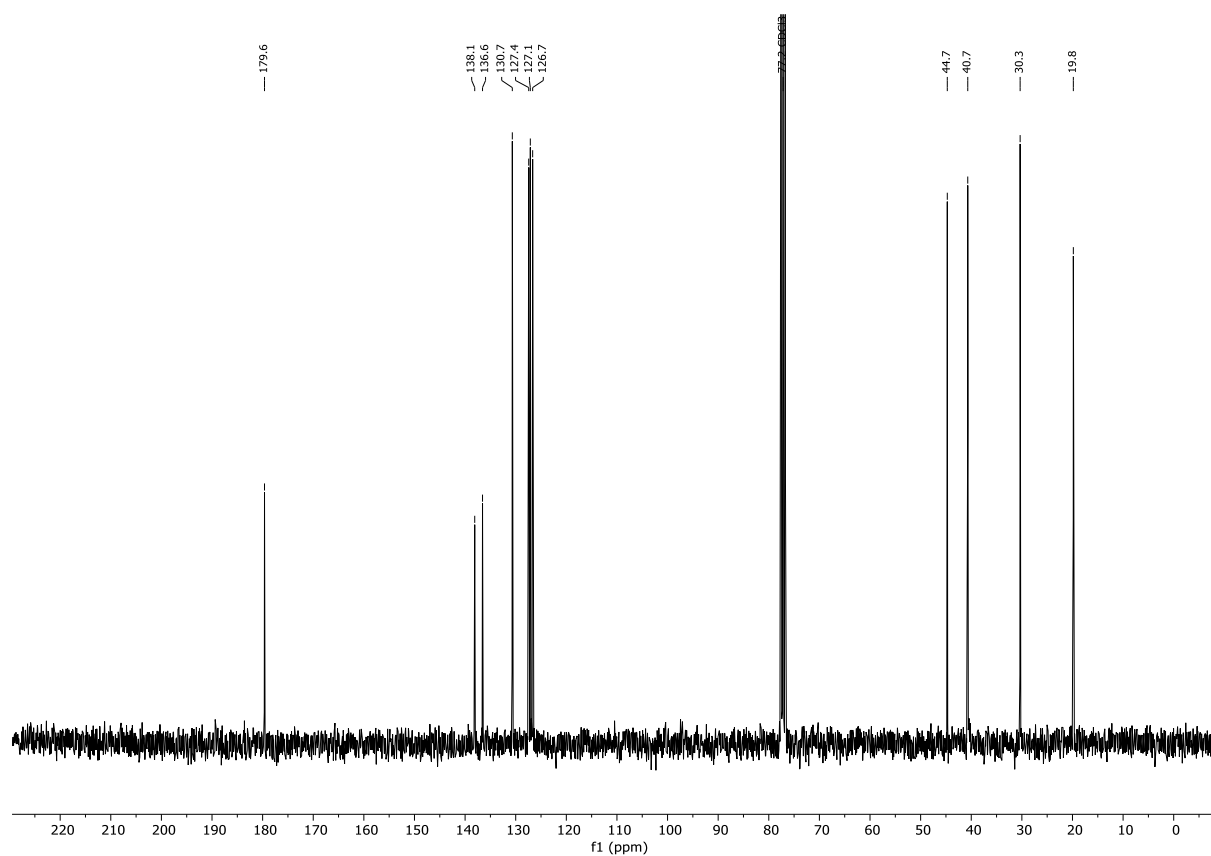


Figure 18:  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(*o*-tolyl)pyrrolidin-2-one (**30**).

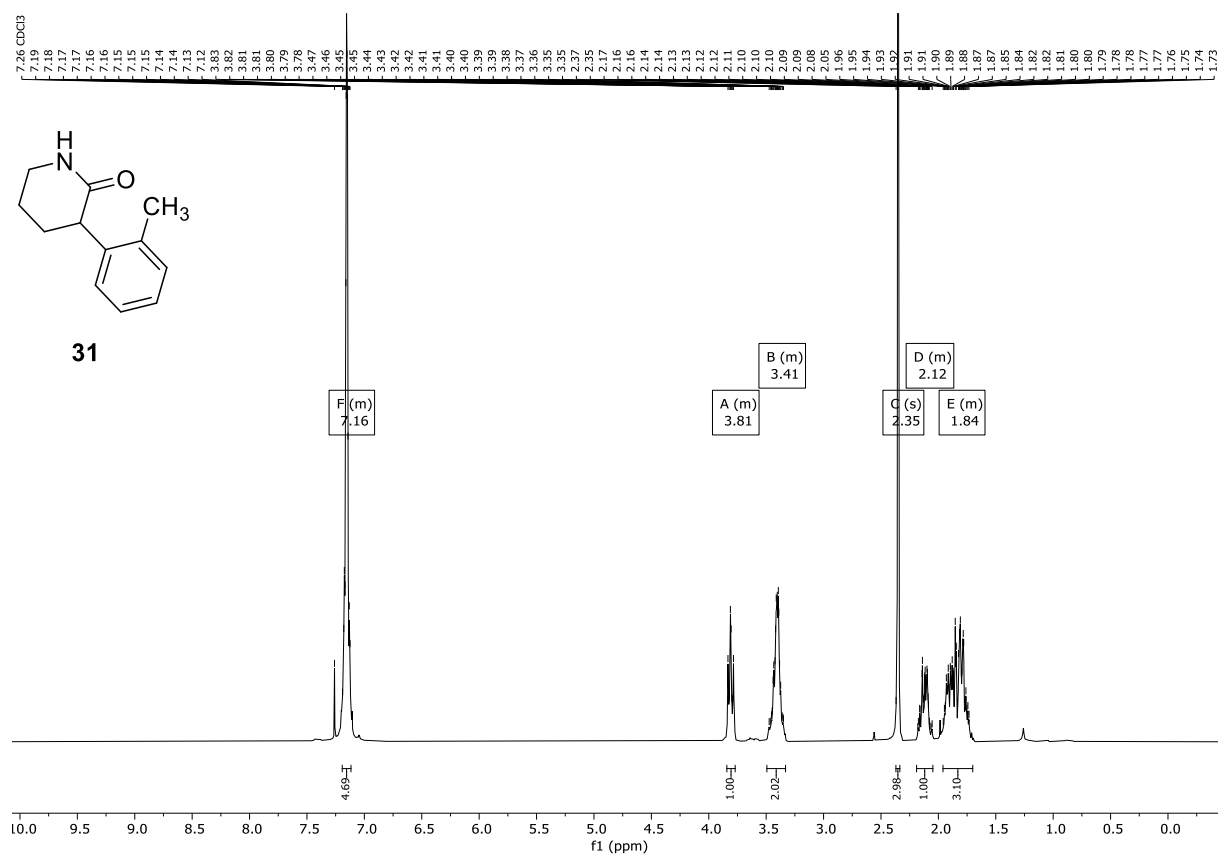


Figure 19: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(*o*-tolyl)piperidin-2-one (**31**).

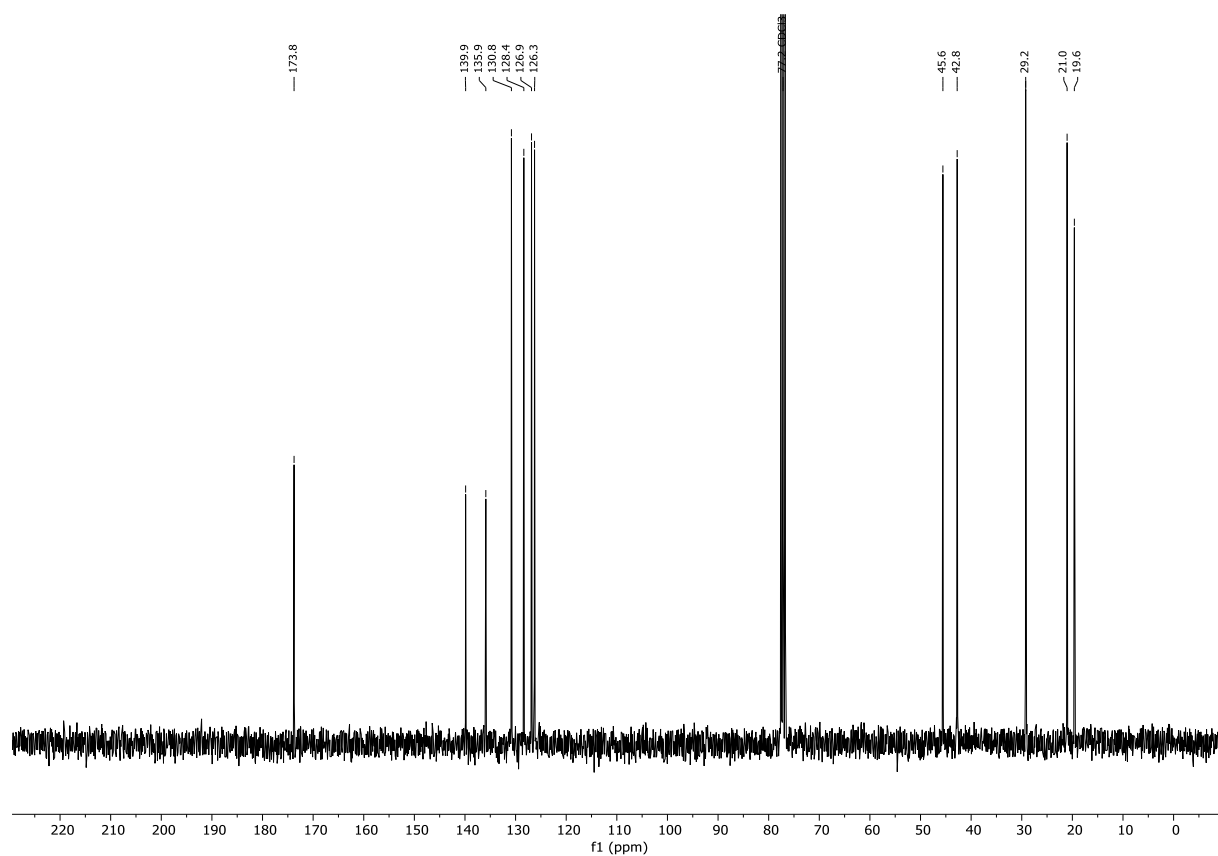


Figure 20: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(*o*-tolyl)piperidin-2-one (**31**).

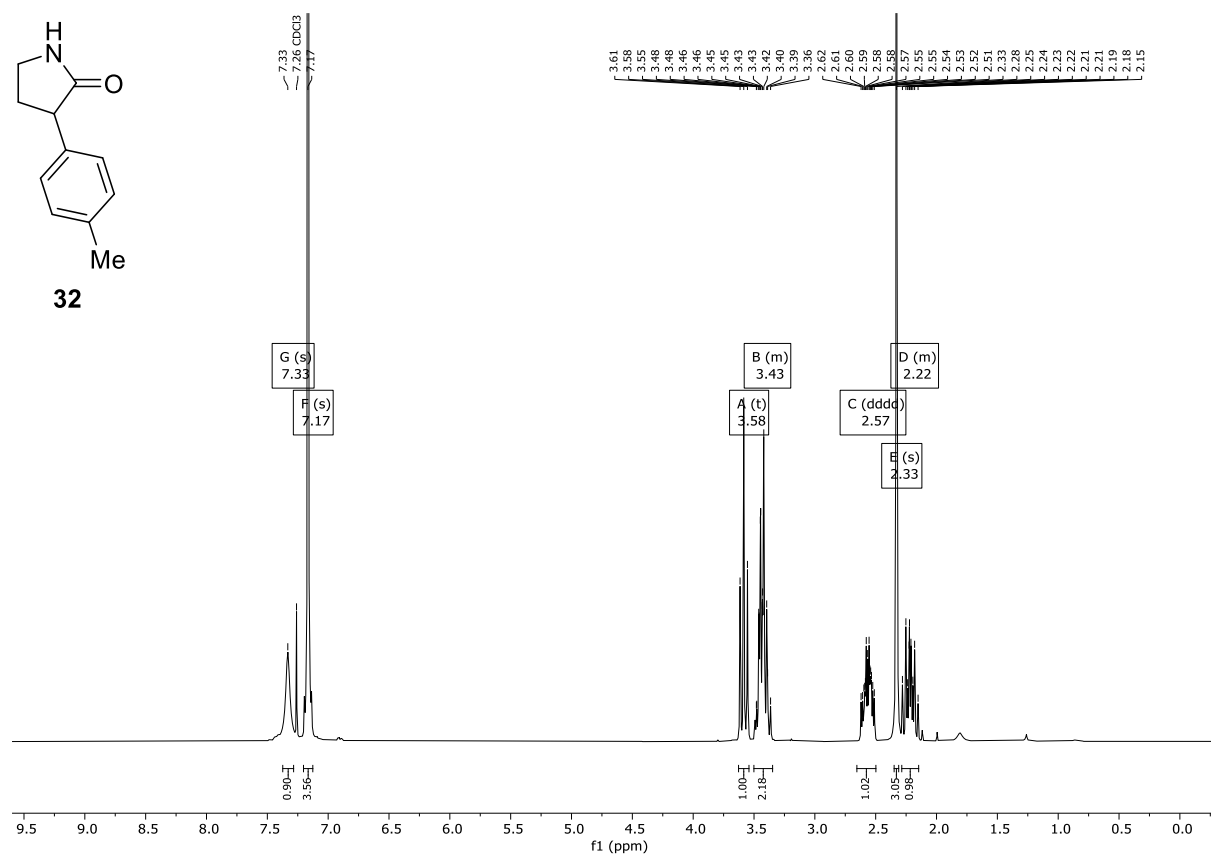


Figure 21: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(*p*-tolyl)pyrrolidin-2-one (**32**).

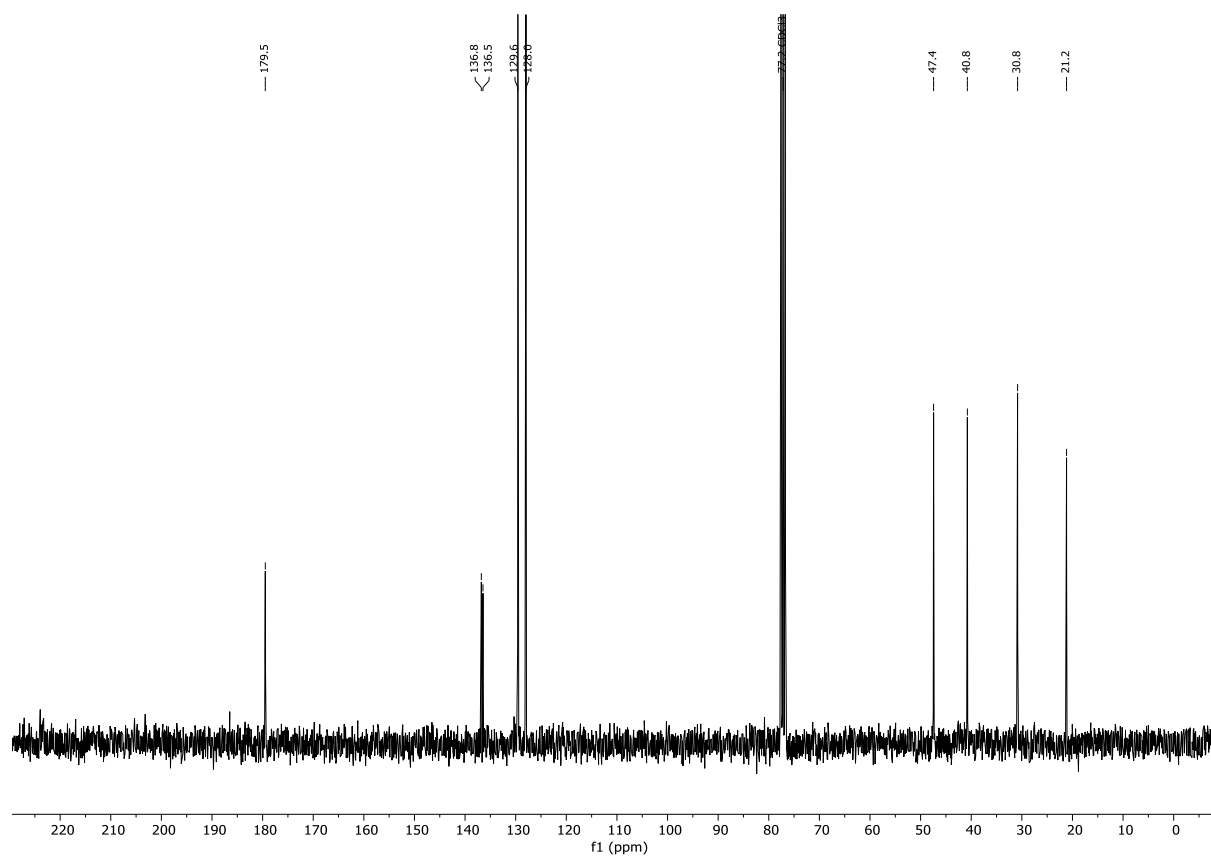


Figure 22: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(*p*-tolyl)pyrrolidin-2-one (**32**).

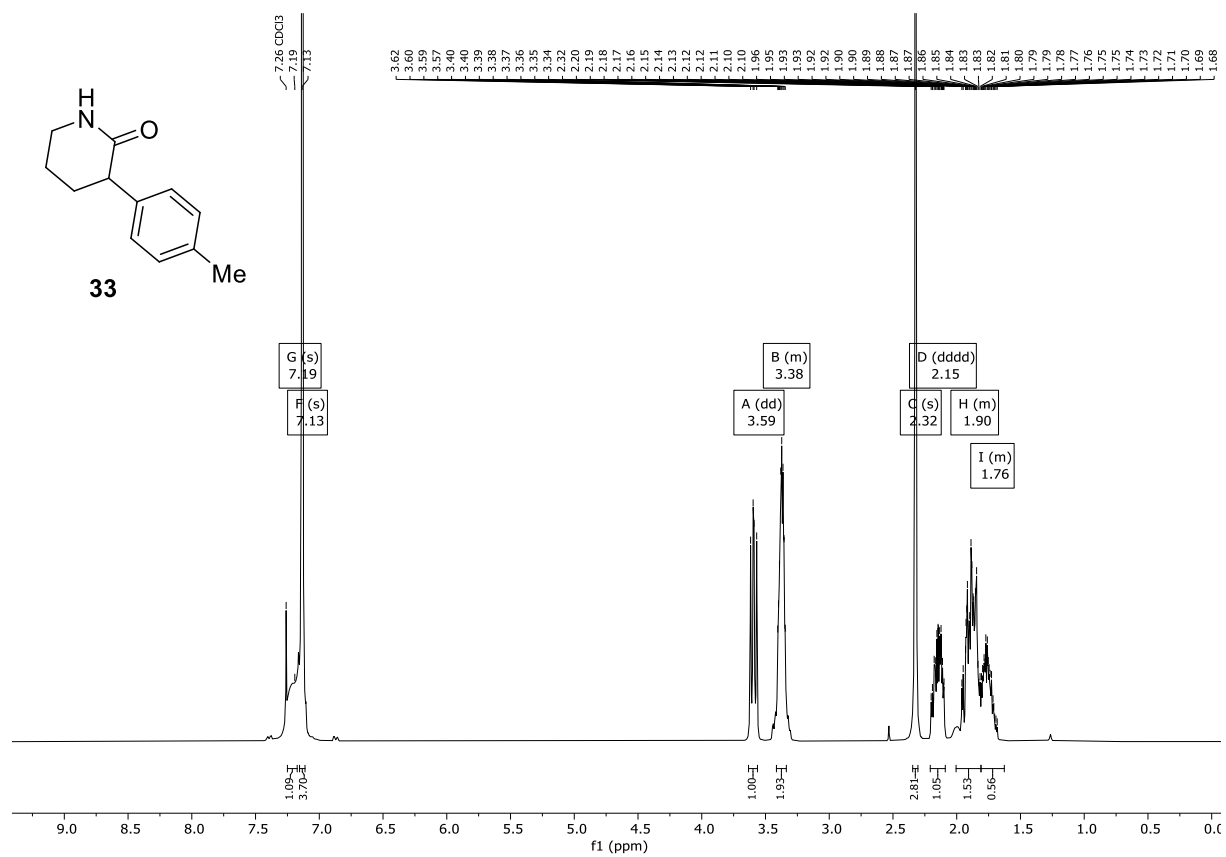


Figure 23: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(*p*-tolyl)piperidin-2-one (**33**).

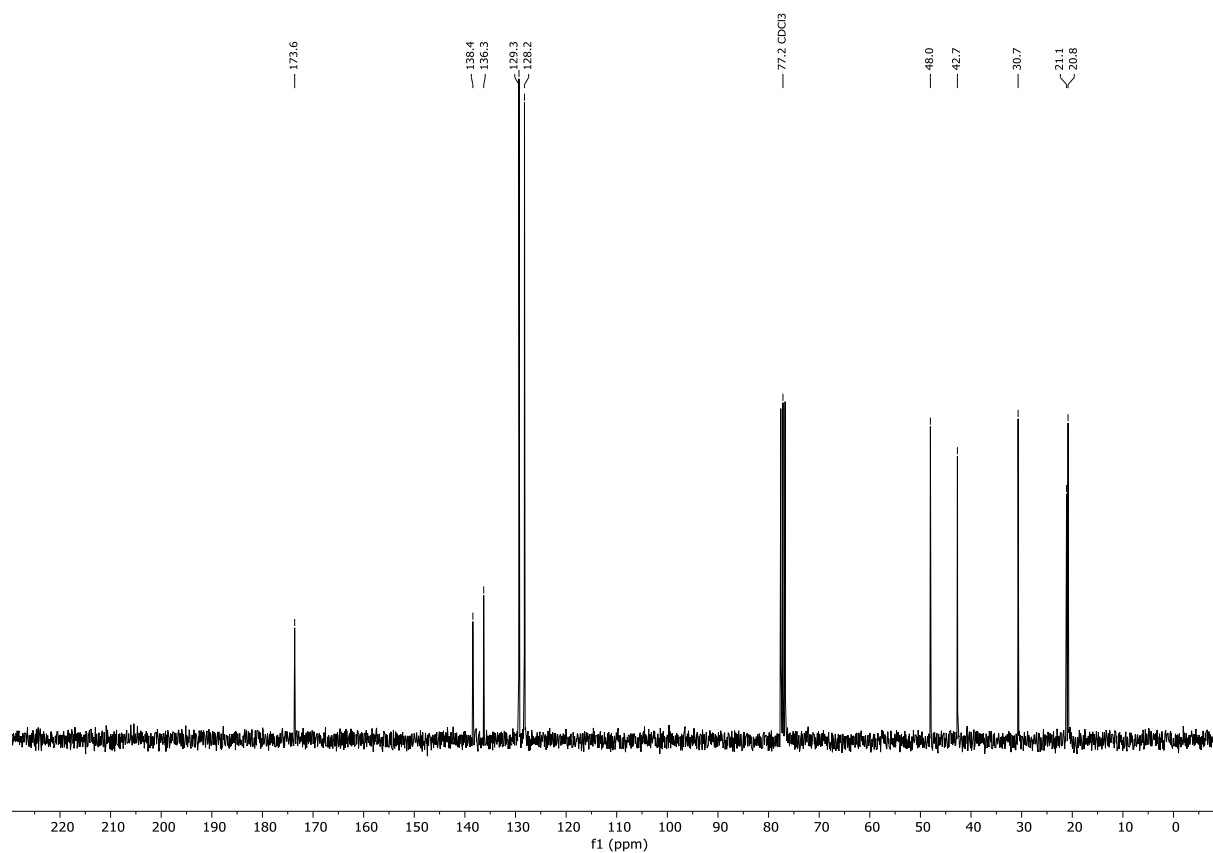


Figure 24: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(*p*-tolyl)piperidin-2-one (**33**).

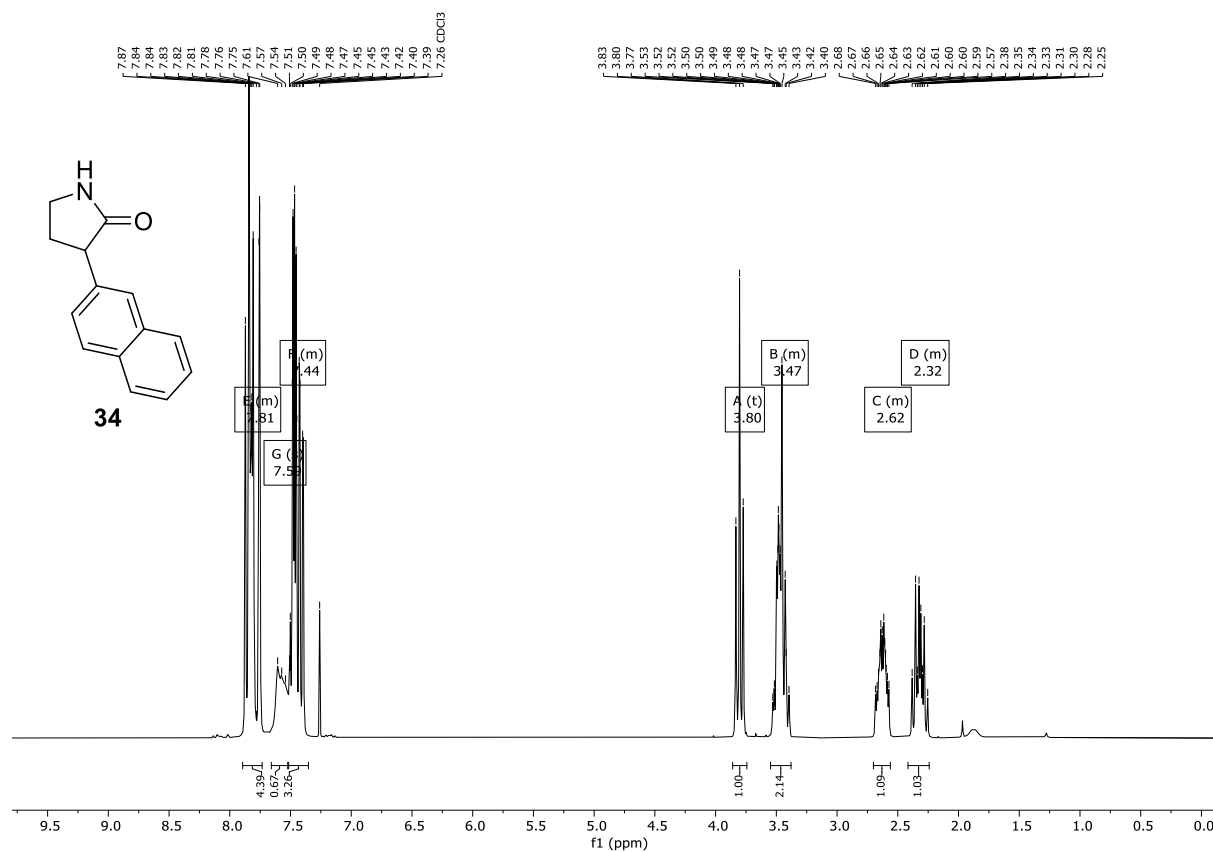


Figure 25:  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(naphthalen-2-yl)pyrrolidin-2-one (**34**).

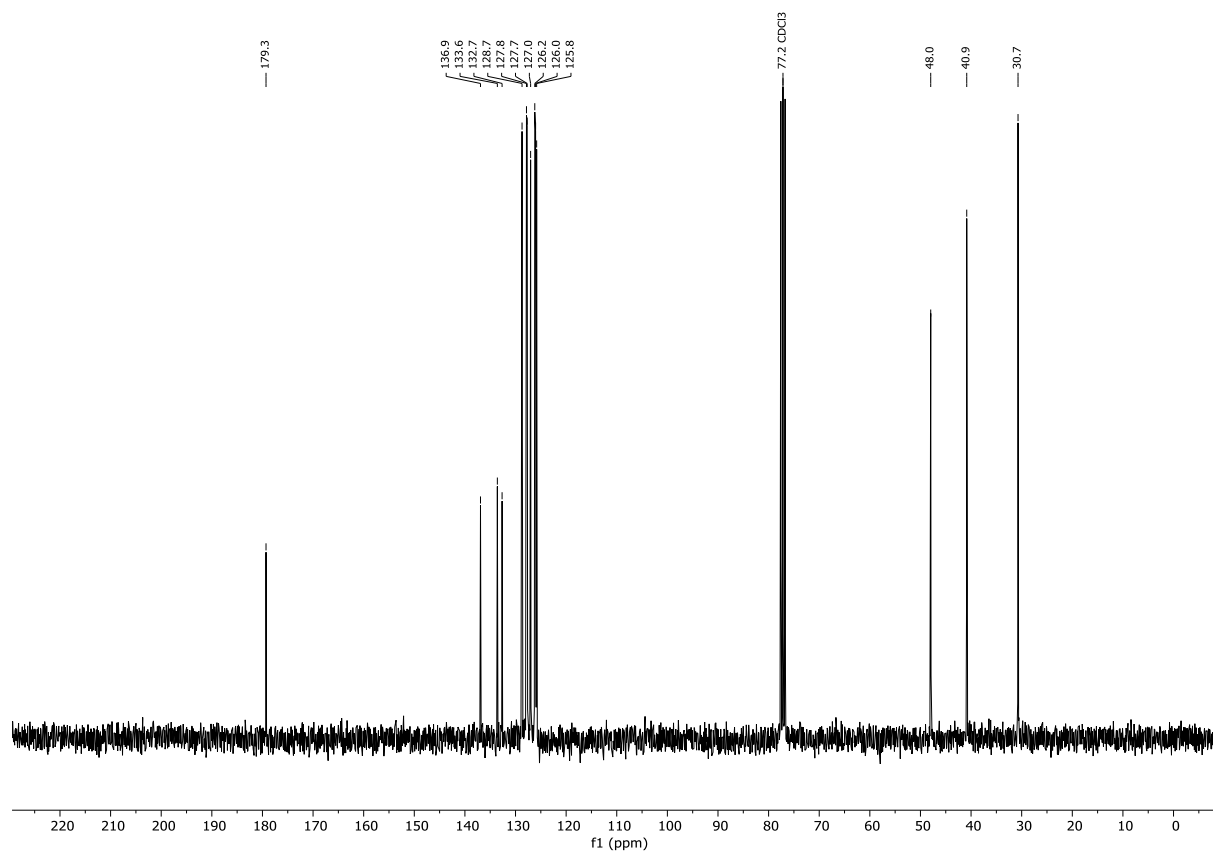


Figure 26:  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(naphthalen-2-yl)pyrrolidin-2-one (**34**).

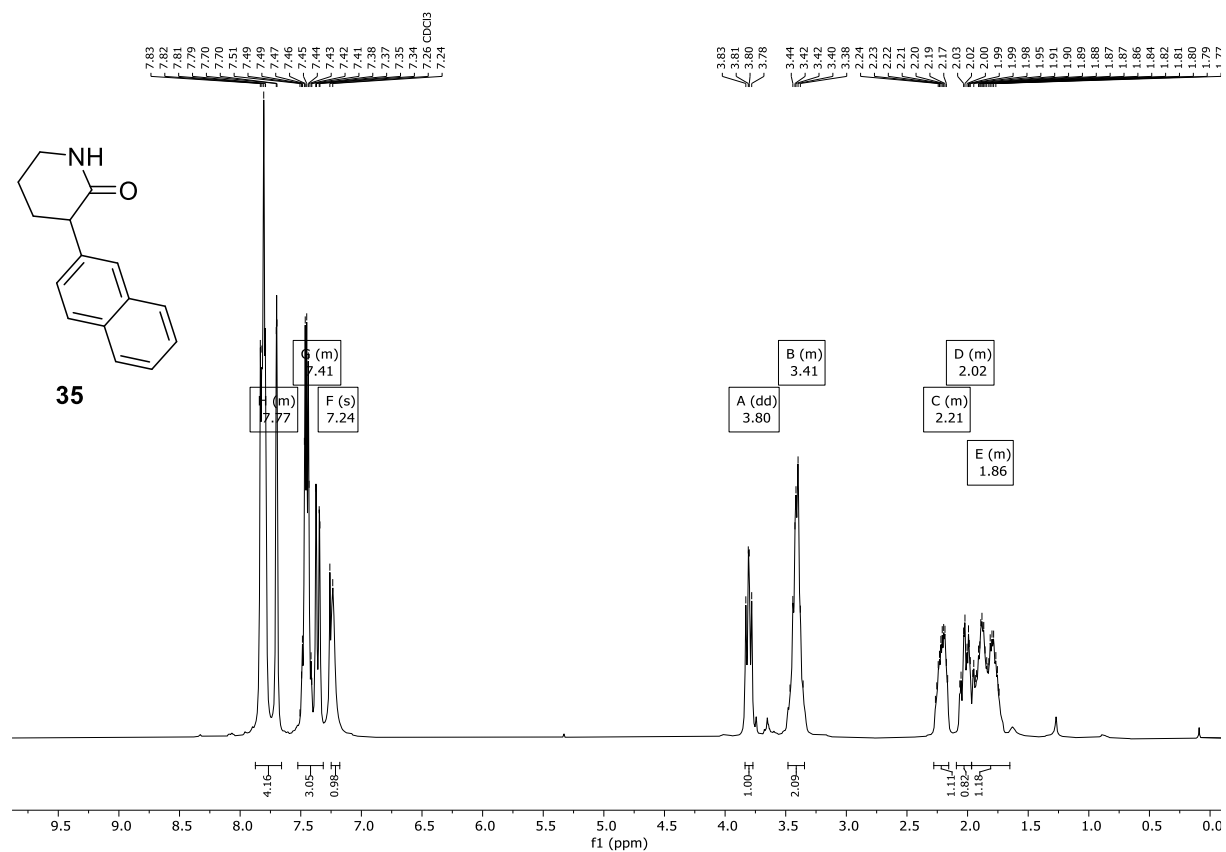


Figure 27: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(naphthalen-2-yl)piperidin-2-one (**35**).

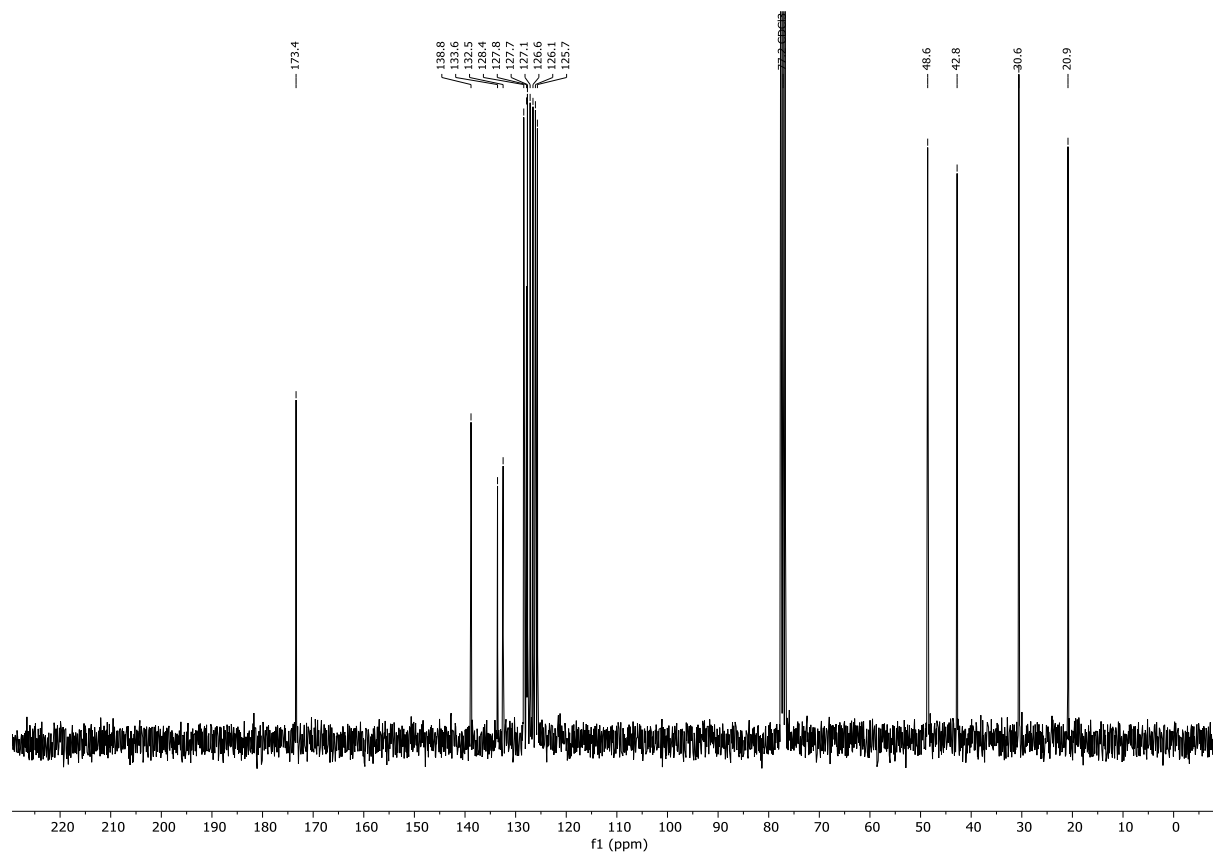


Figure 28: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(naphthalen-2-yl)piperidin-2-one (**35**).

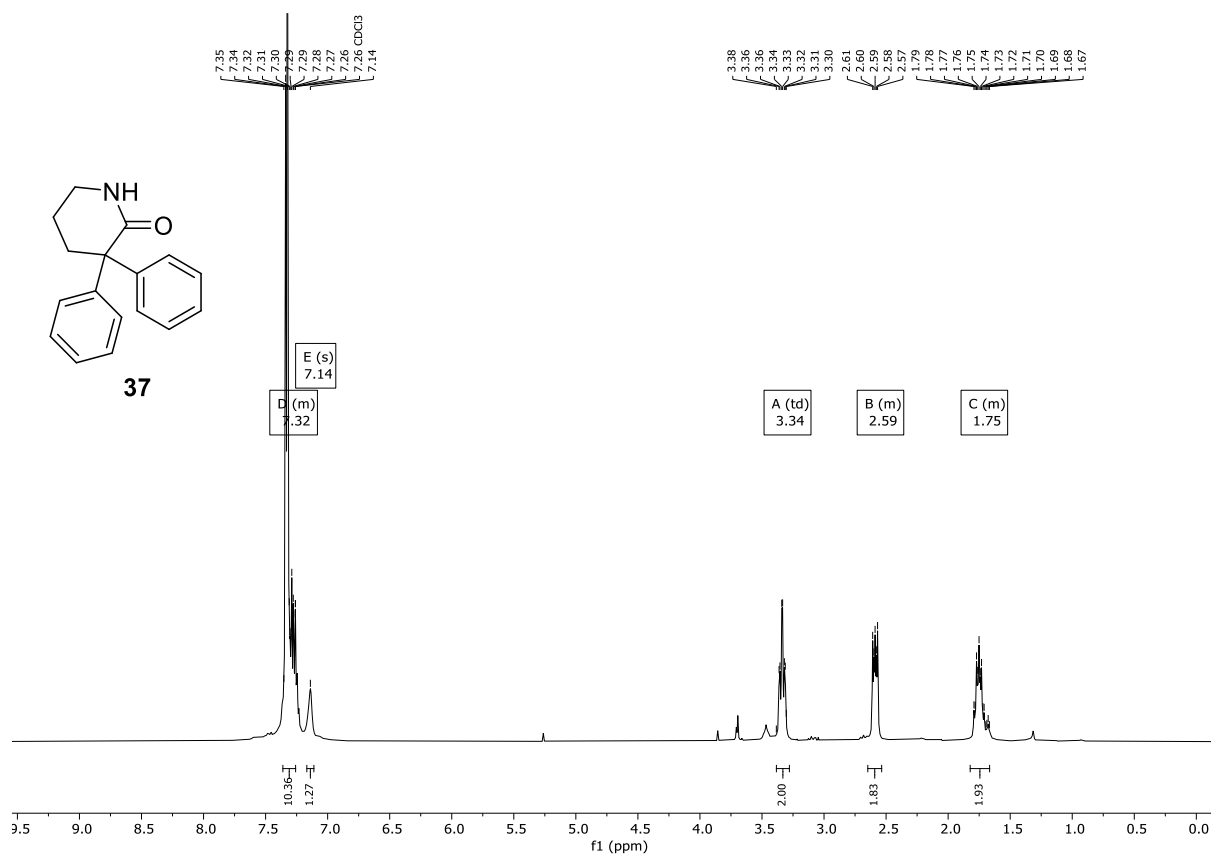


Figure 29: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3,3-diphenylpiperidin-2-one (**37**).

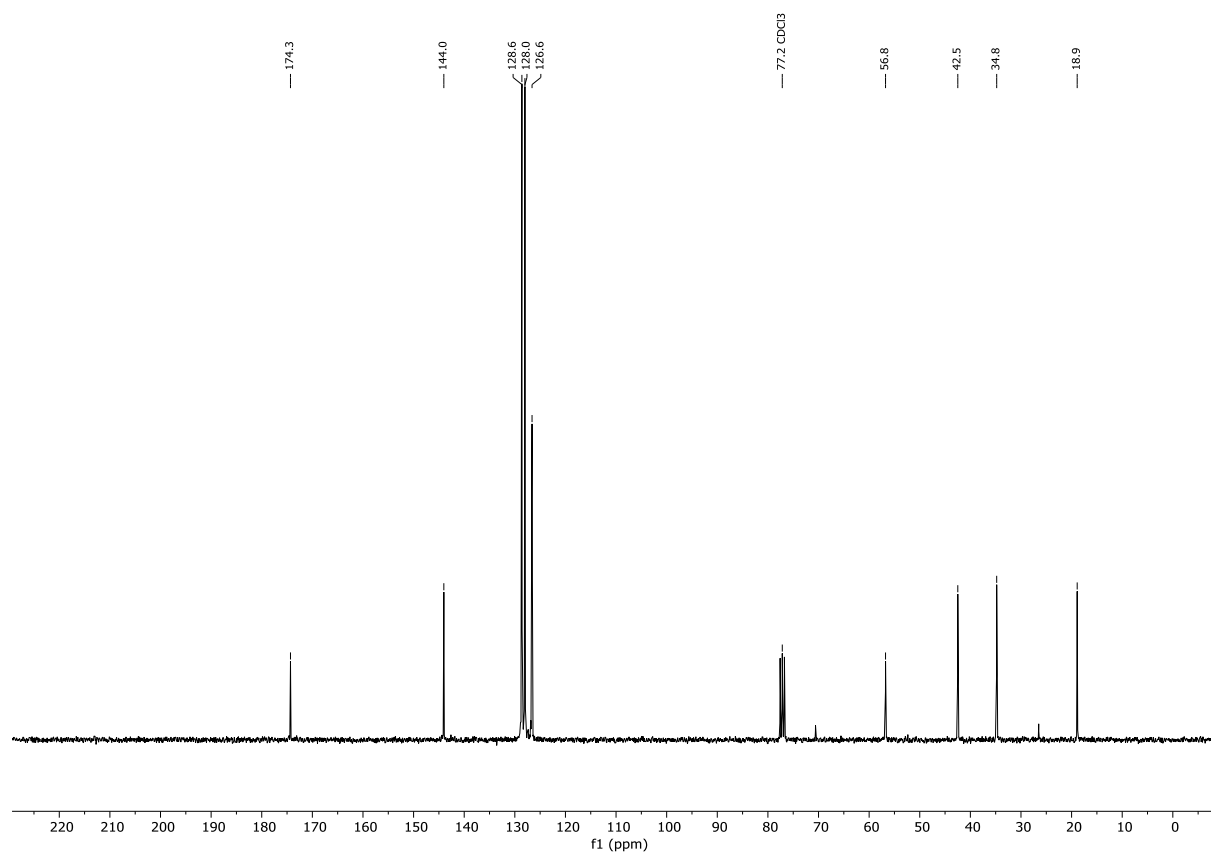
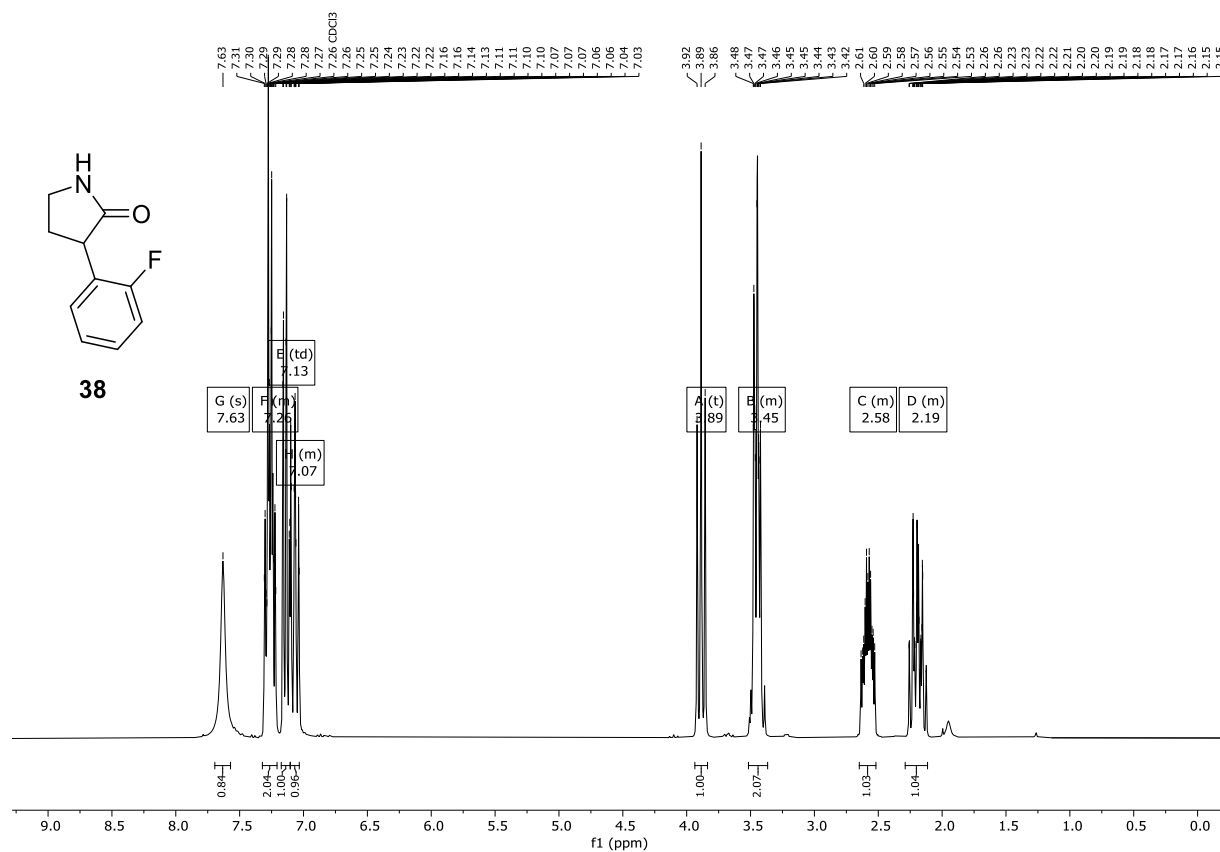
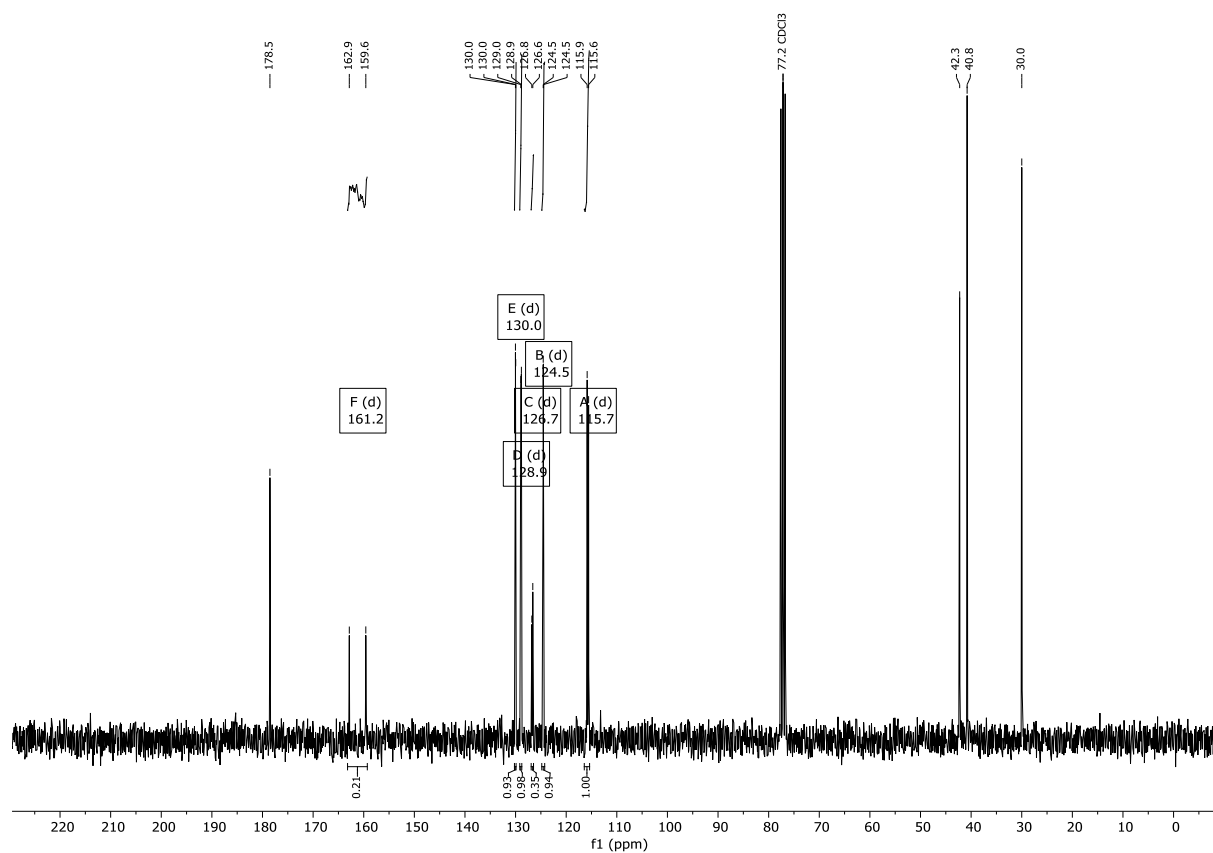


Figure 30: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3,3-diphenylpiperidin-2-one (**37**).





**Figure 31:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(2-fluorophenyl)pyrrolidin-2-one (**38**).



**Figure 32:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(2-fluorophenyl)pyrrolidin-2-one (**38**).

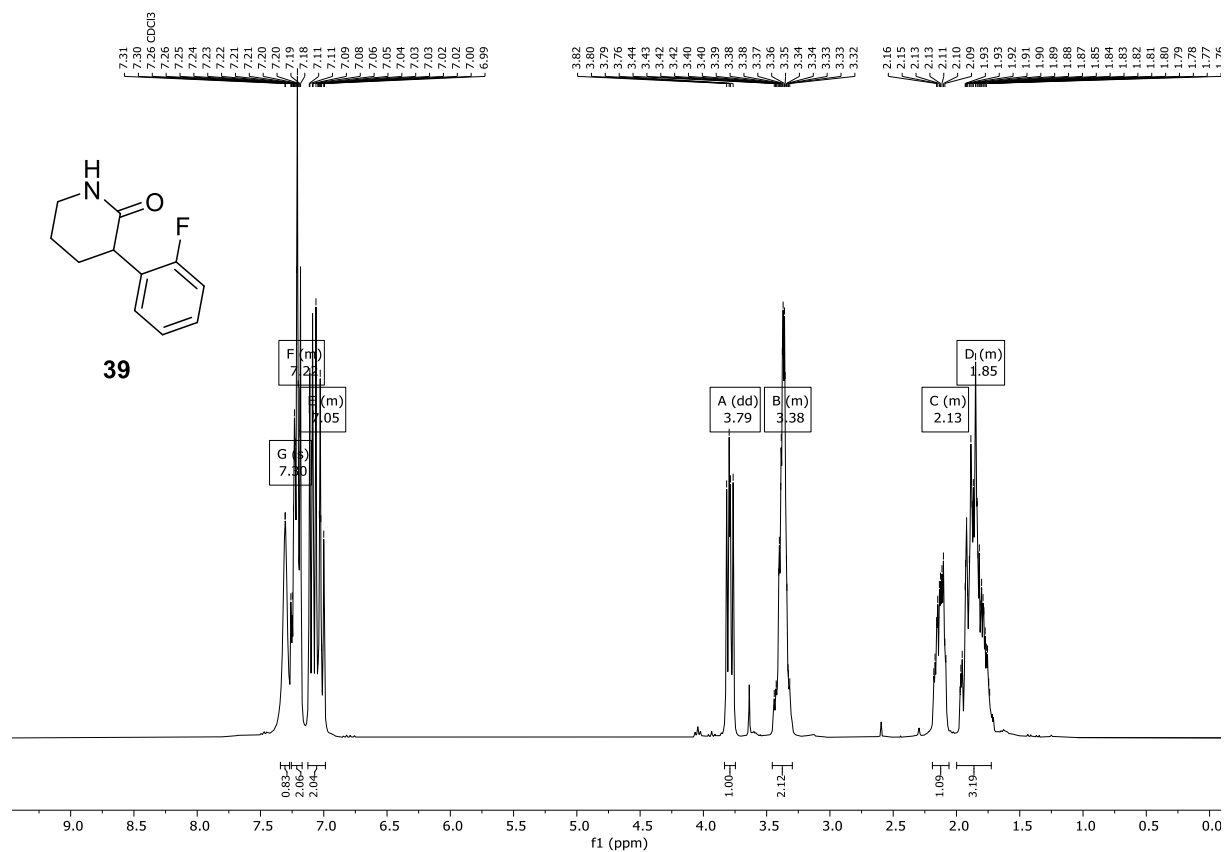


Figure 33: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(2-fluorophenyl)piperidin-2-one (39).

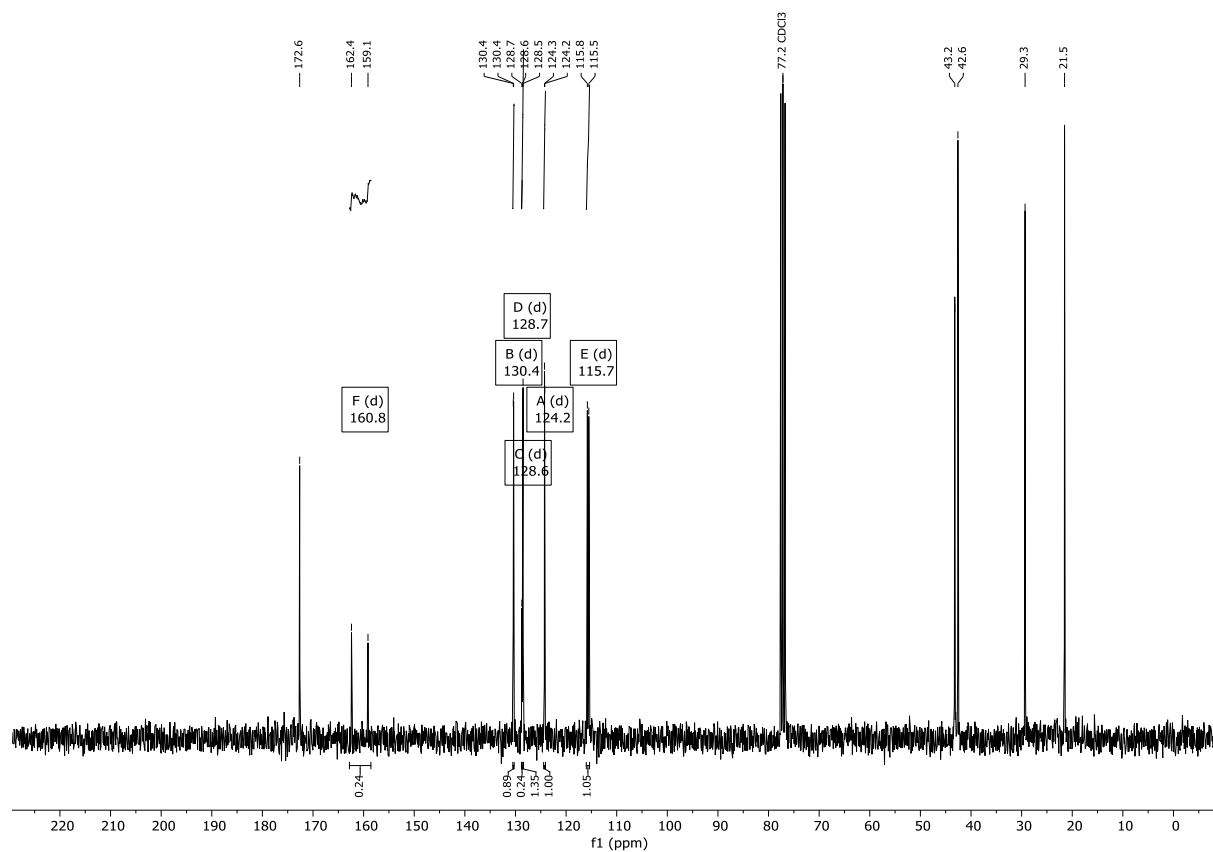
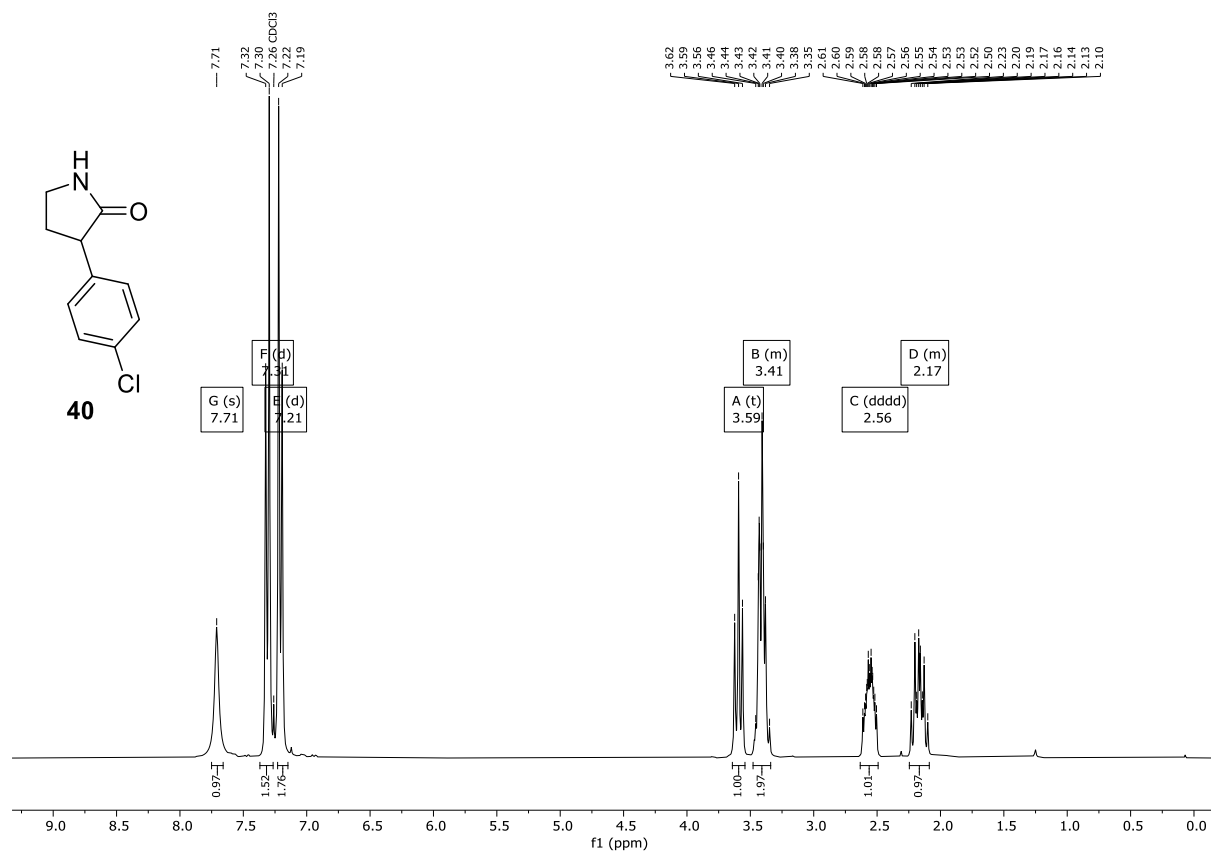
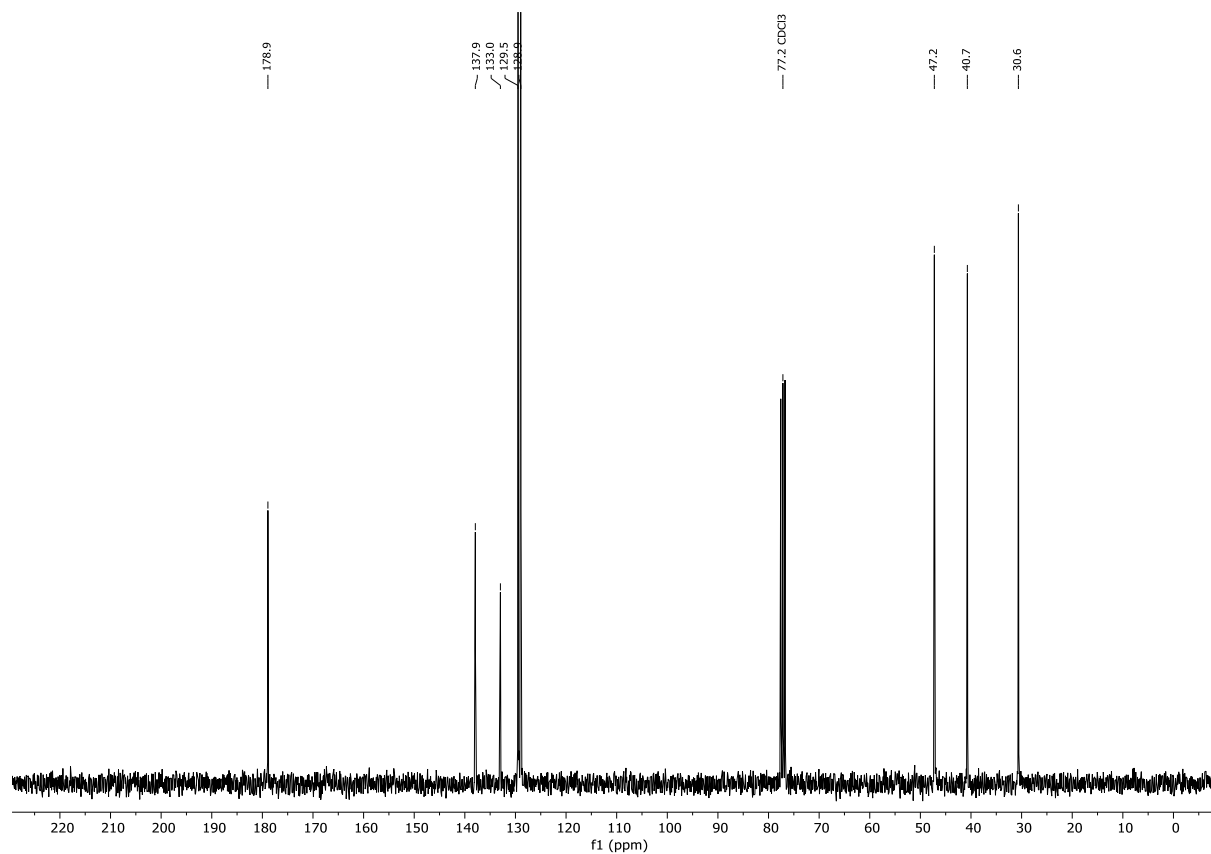


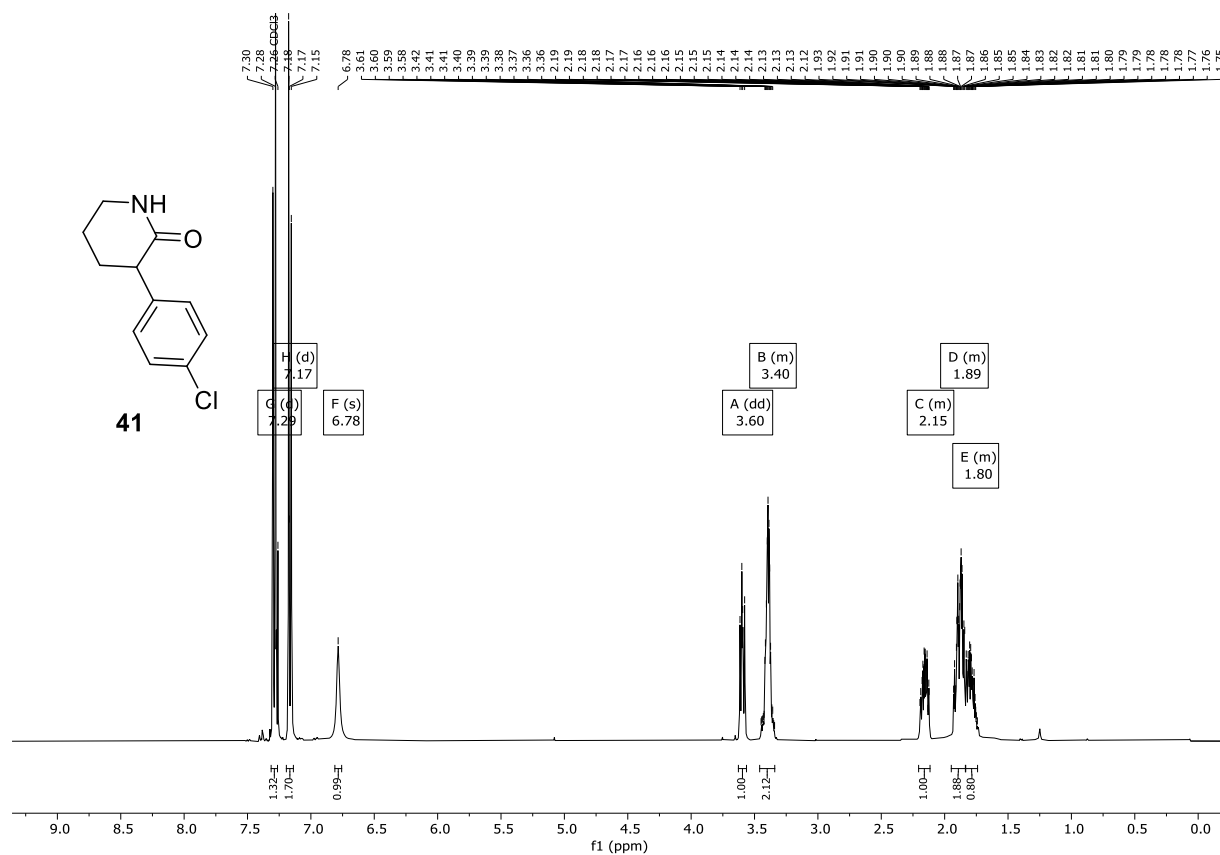
Figure 34: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(2-fluorophenyl)piperidin-2-one (39).



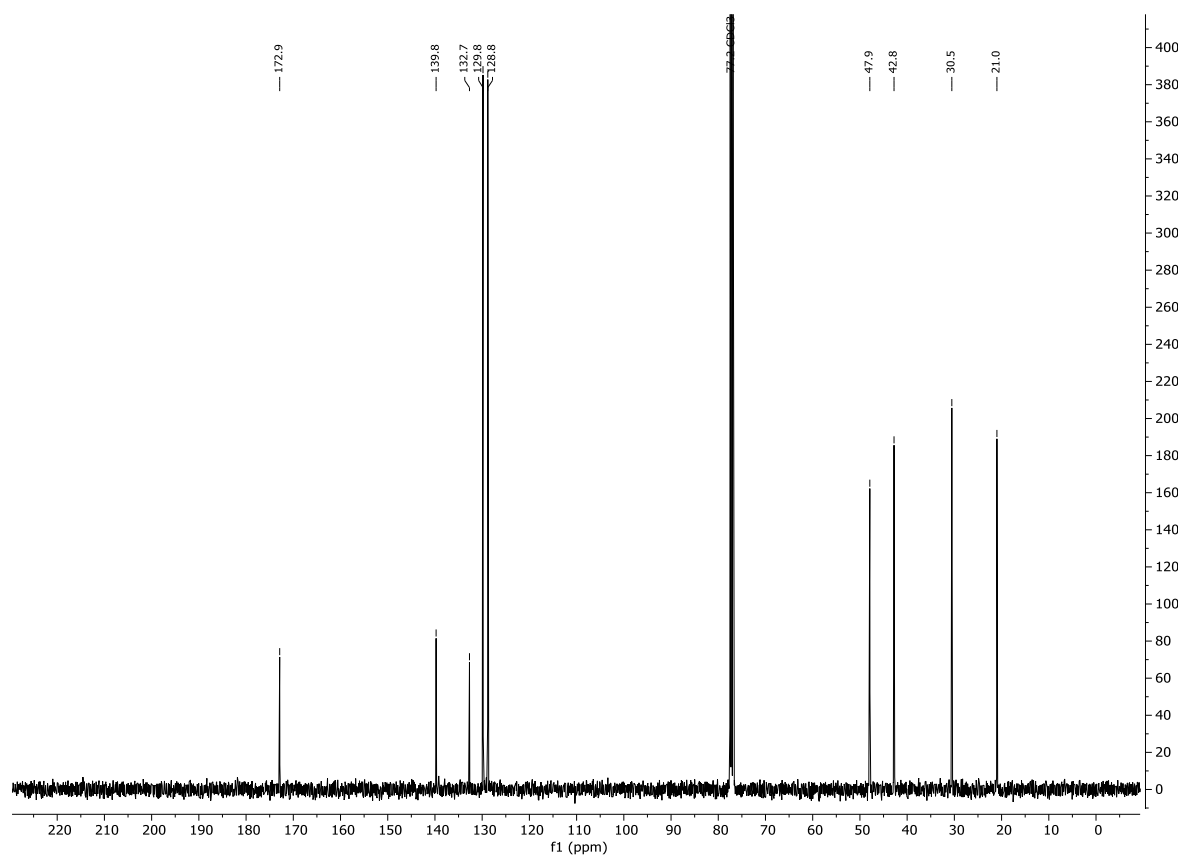
**Figure 35:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(4-chlorophenyl)pyrrolidin-2-one (**40**).



**Figure 36:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(4-chlorophenyl)pyrrolidin-2-one (**40**).



**Figure 37:** <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>) of 3-(4-chlorophenyl)piperidin-2-one (**41**).



**Figure 38:** <sup>13</sup>C-NMR (101 MHz, CDCl<sub>3</sub>) of 3-(4-chlorophenyl)piperidin-2-one (**41**).

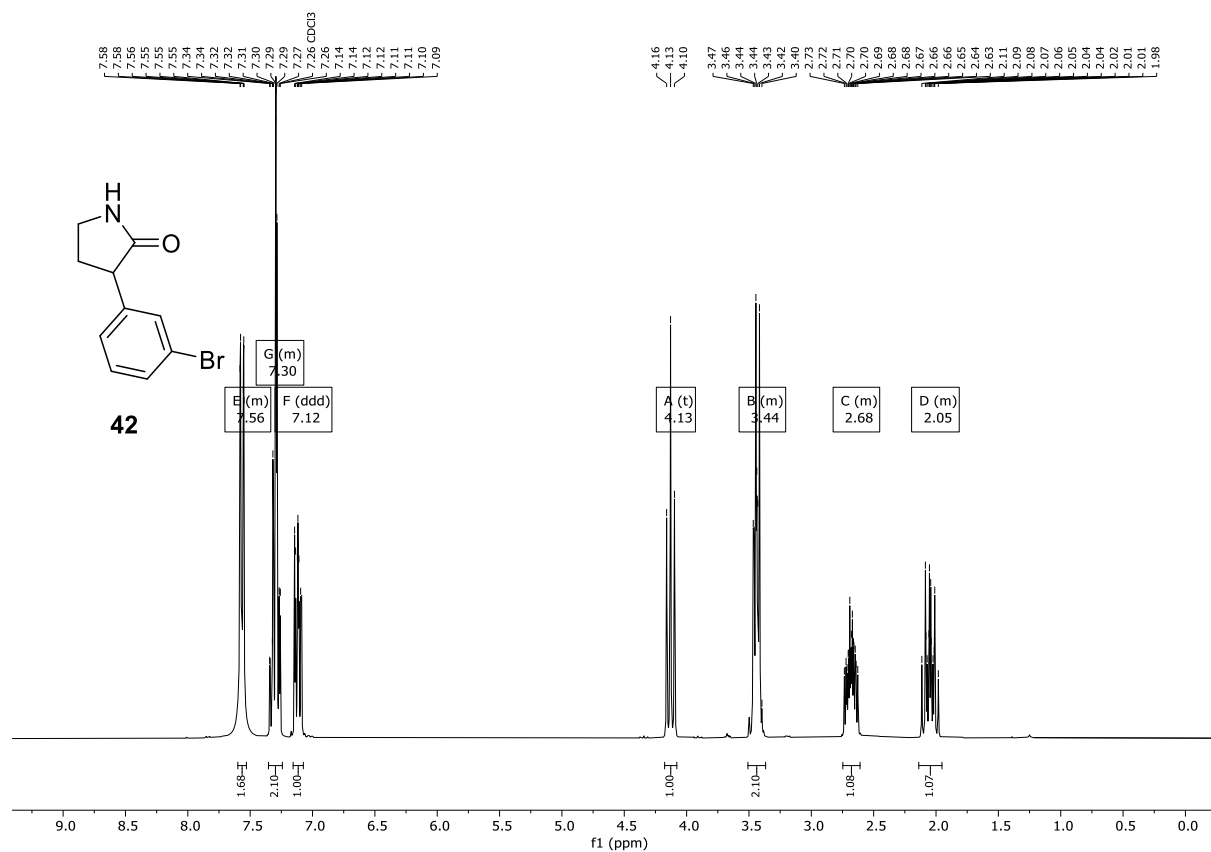


Figure 39: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(3-bromophenyl)pyrrolidin-2-one (**42**).

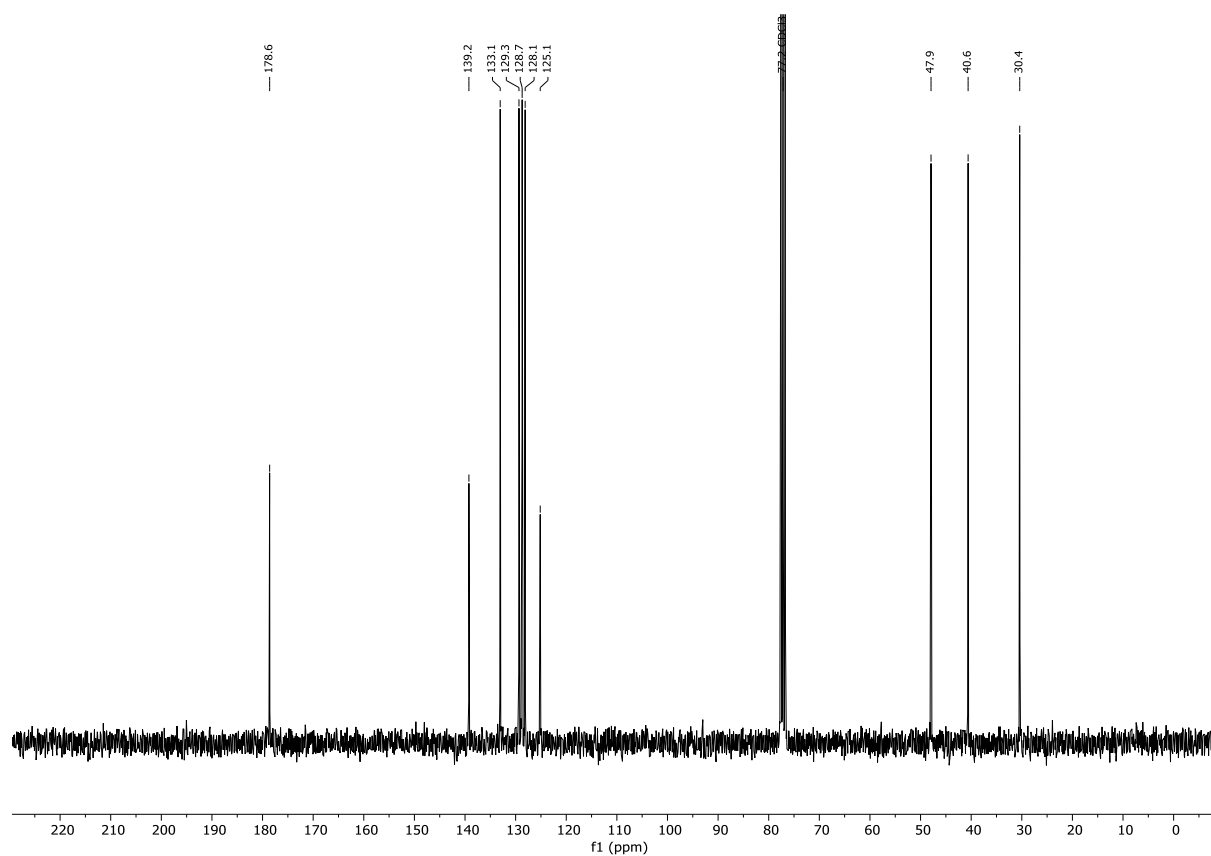


Figure 40: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(3-bromophenyl)pyrrolidin-2-one (**42**).

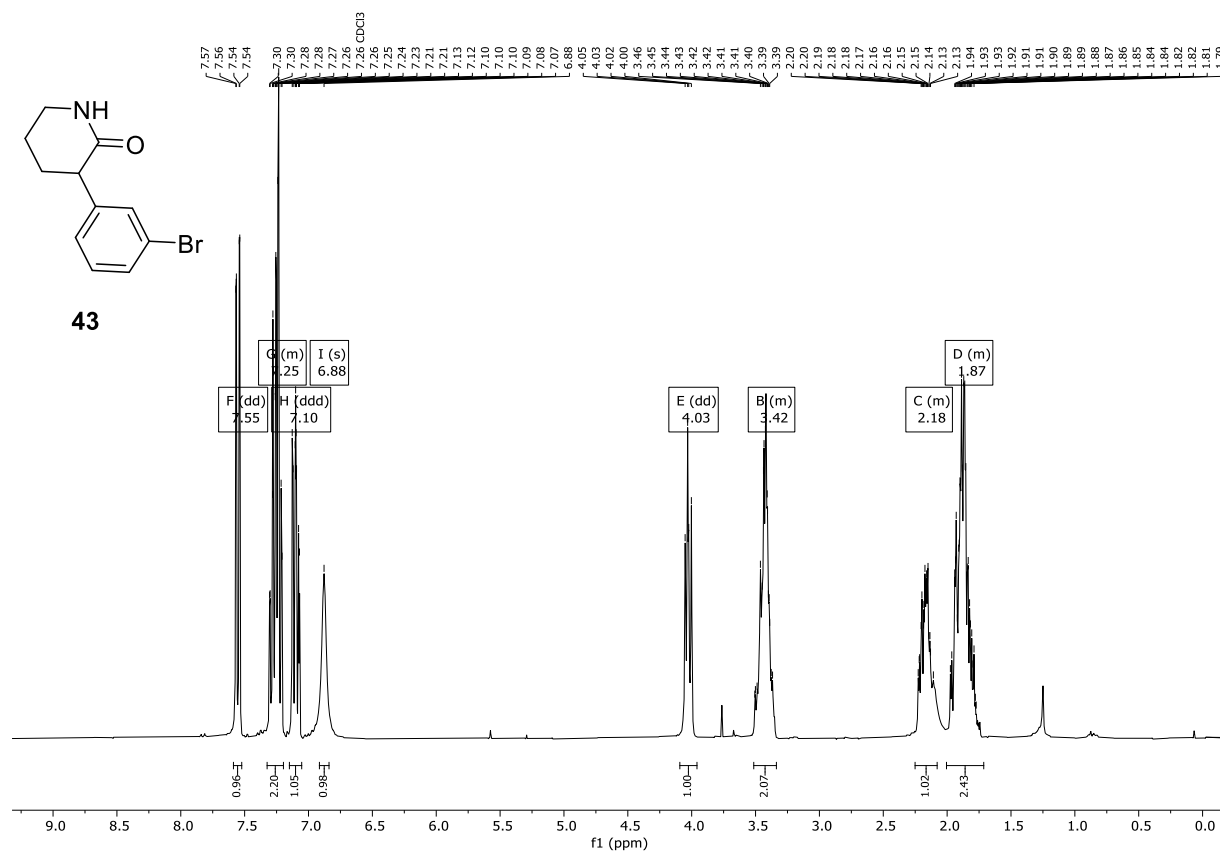


Figure 41: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(3-bromophenyl)piperidin-2-one (**43**).

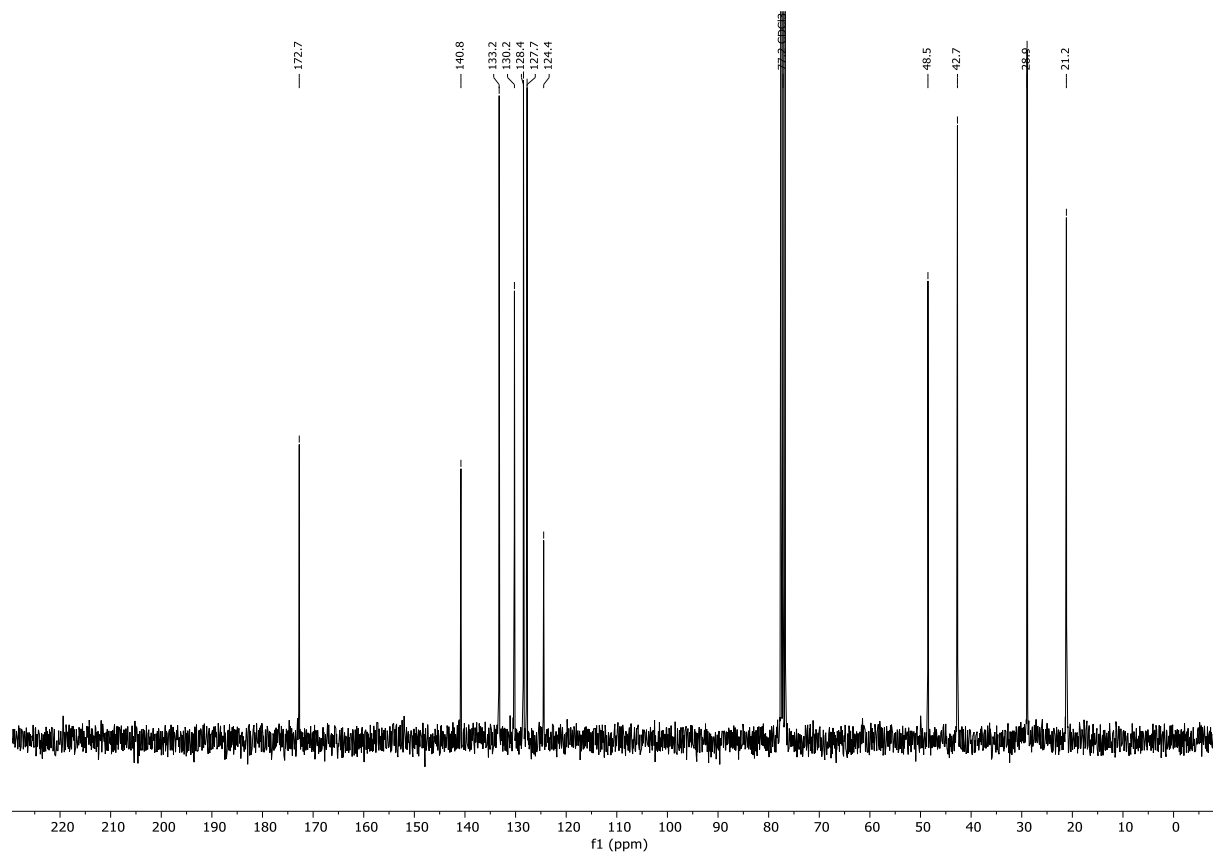
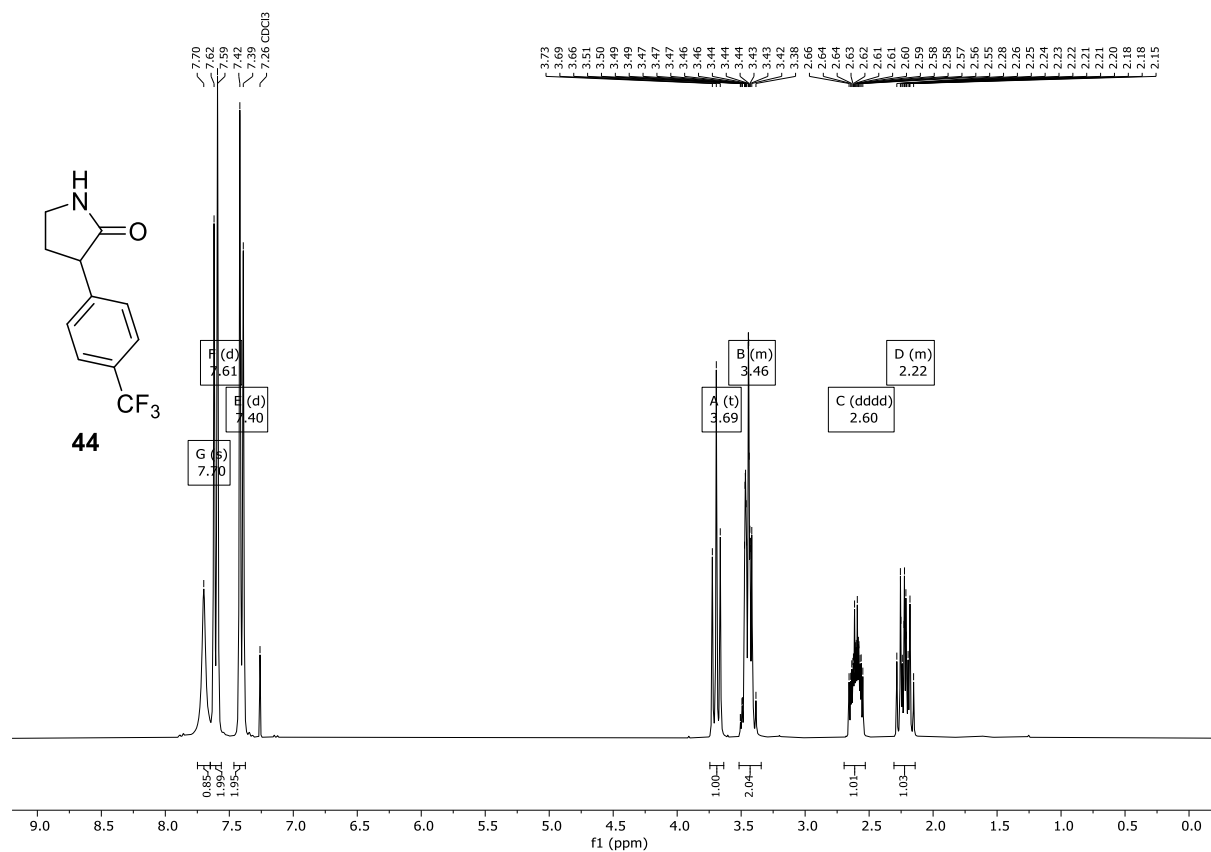
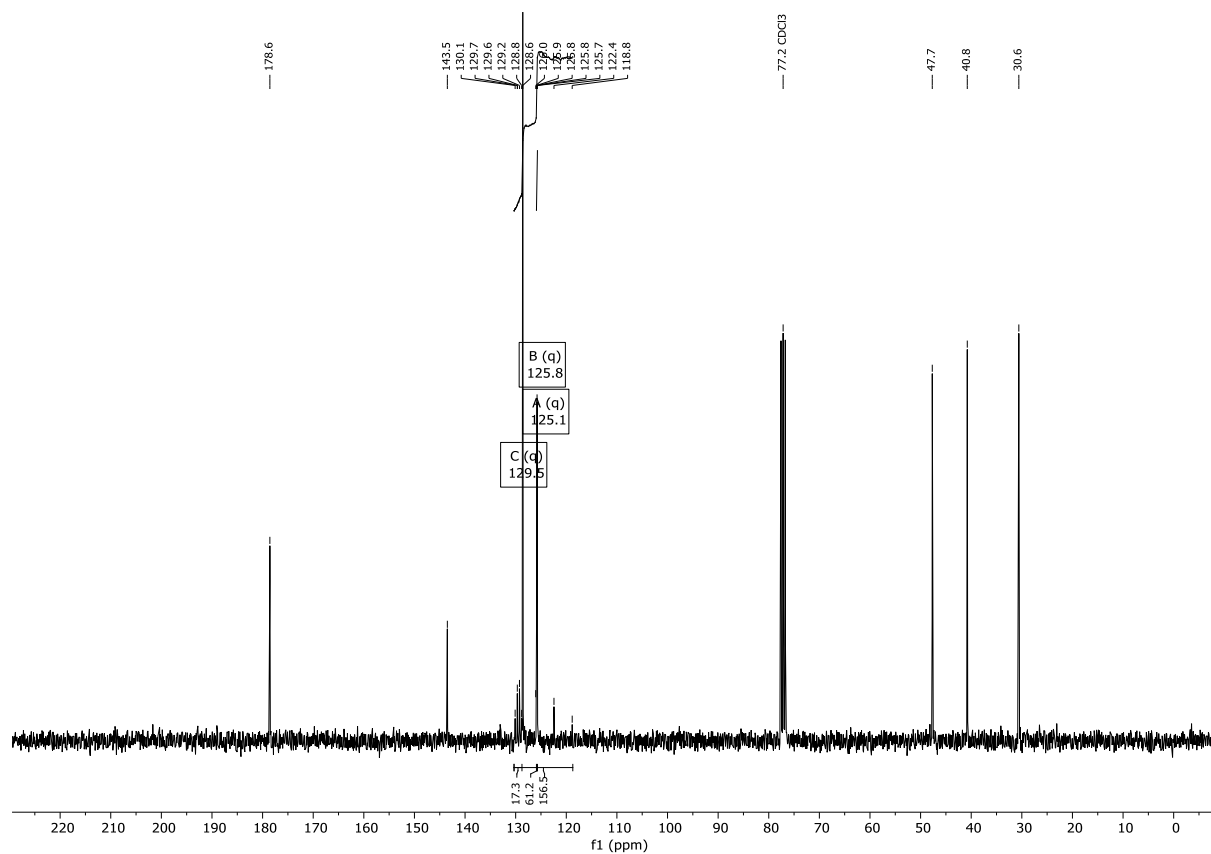


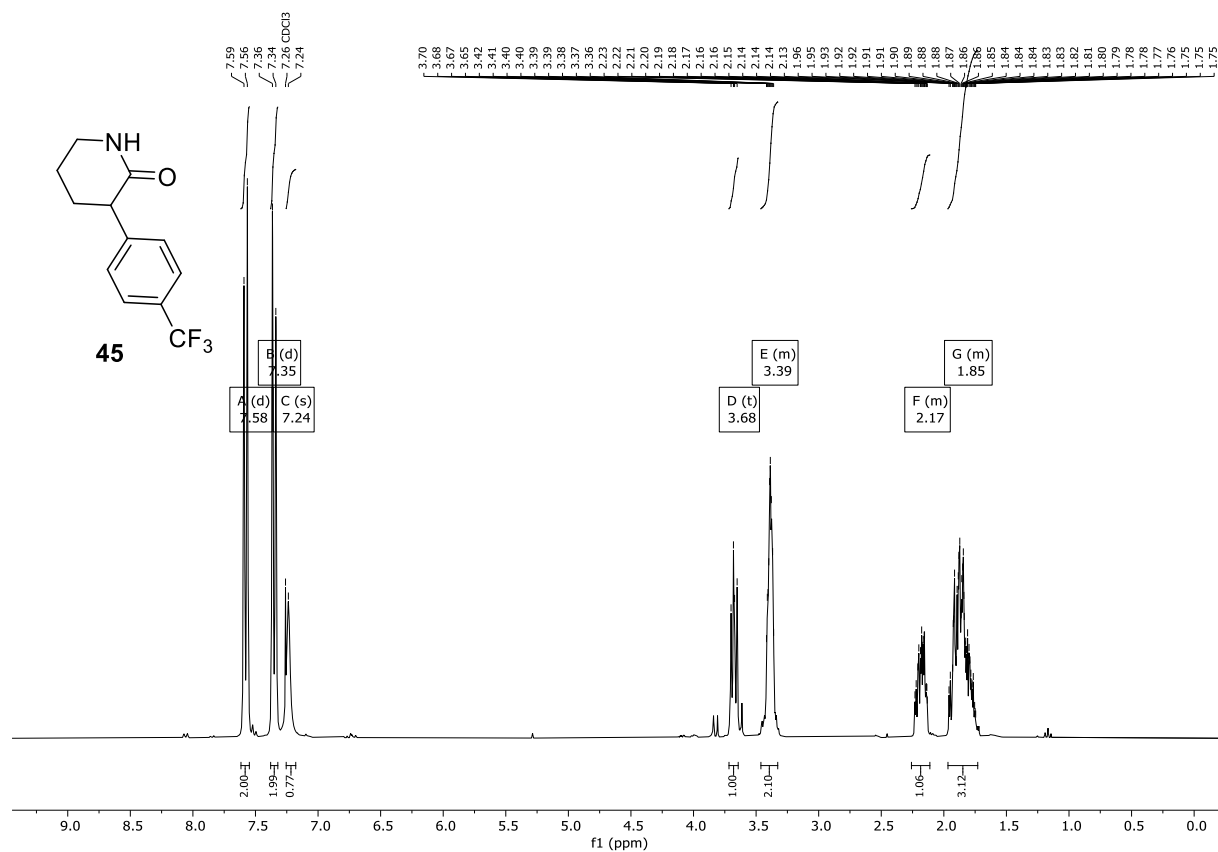
Figure 42: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(3-bromophenyl)piperidin-2-one (**43**).



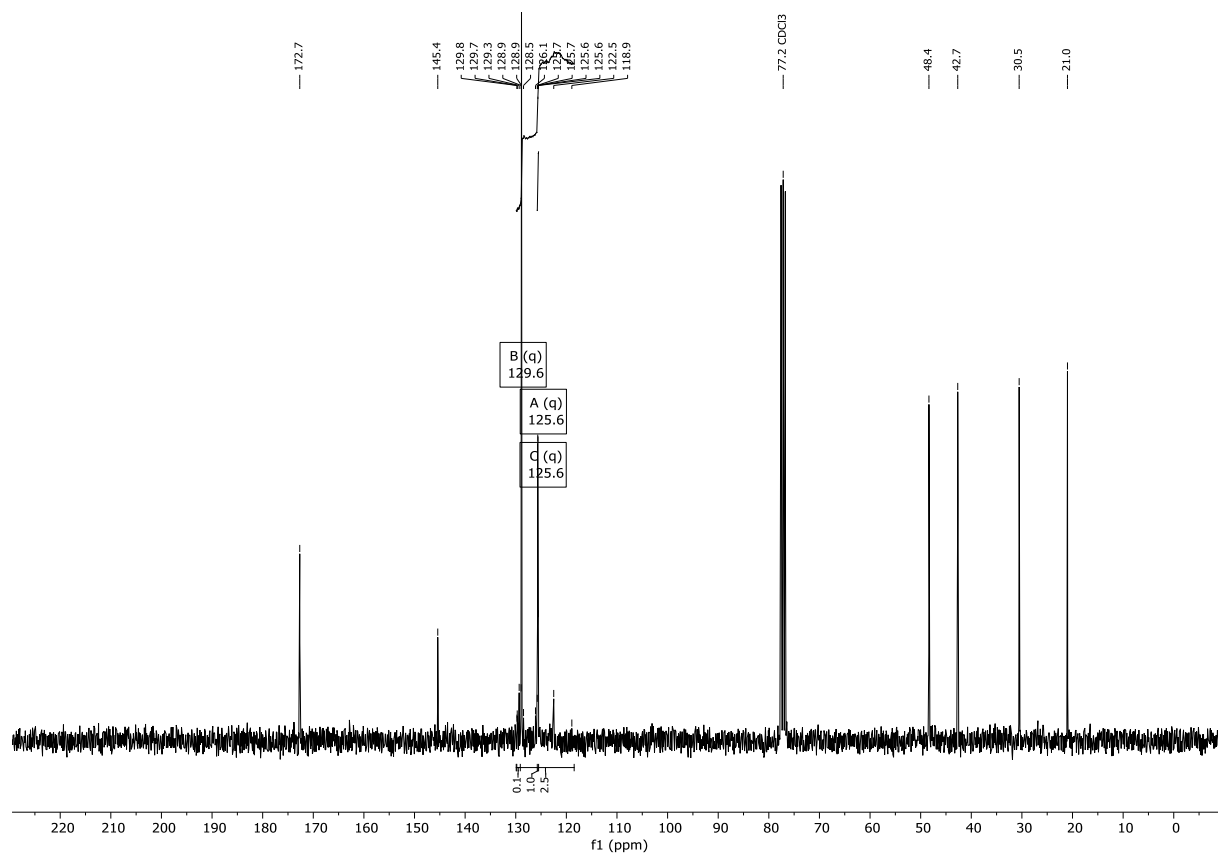
**Figure 43:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(4-(trifluoromethyl)phenyl)pyrrolidin-2-one (**44**).



**Figure 44:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(4-(trifluoromethyl)phenyl)pyrrolidin-2-one (**44**).

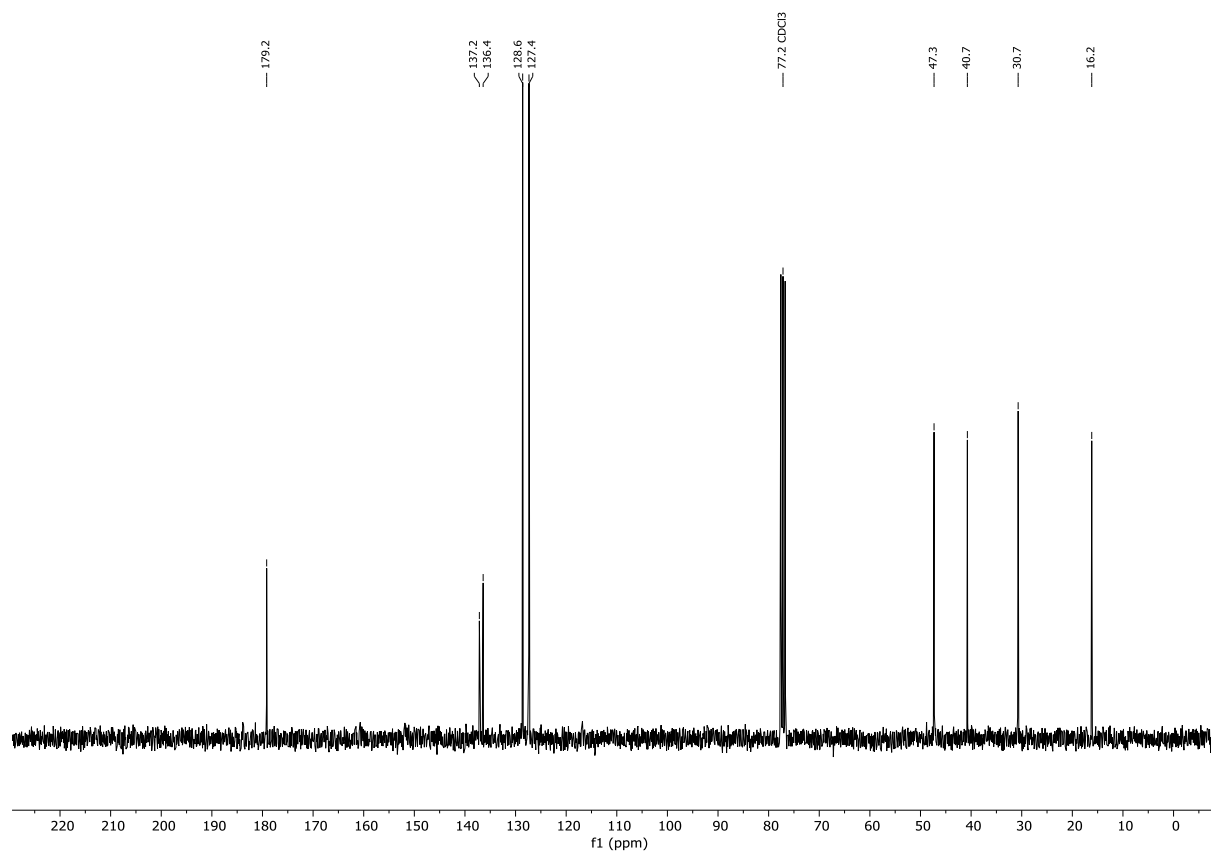
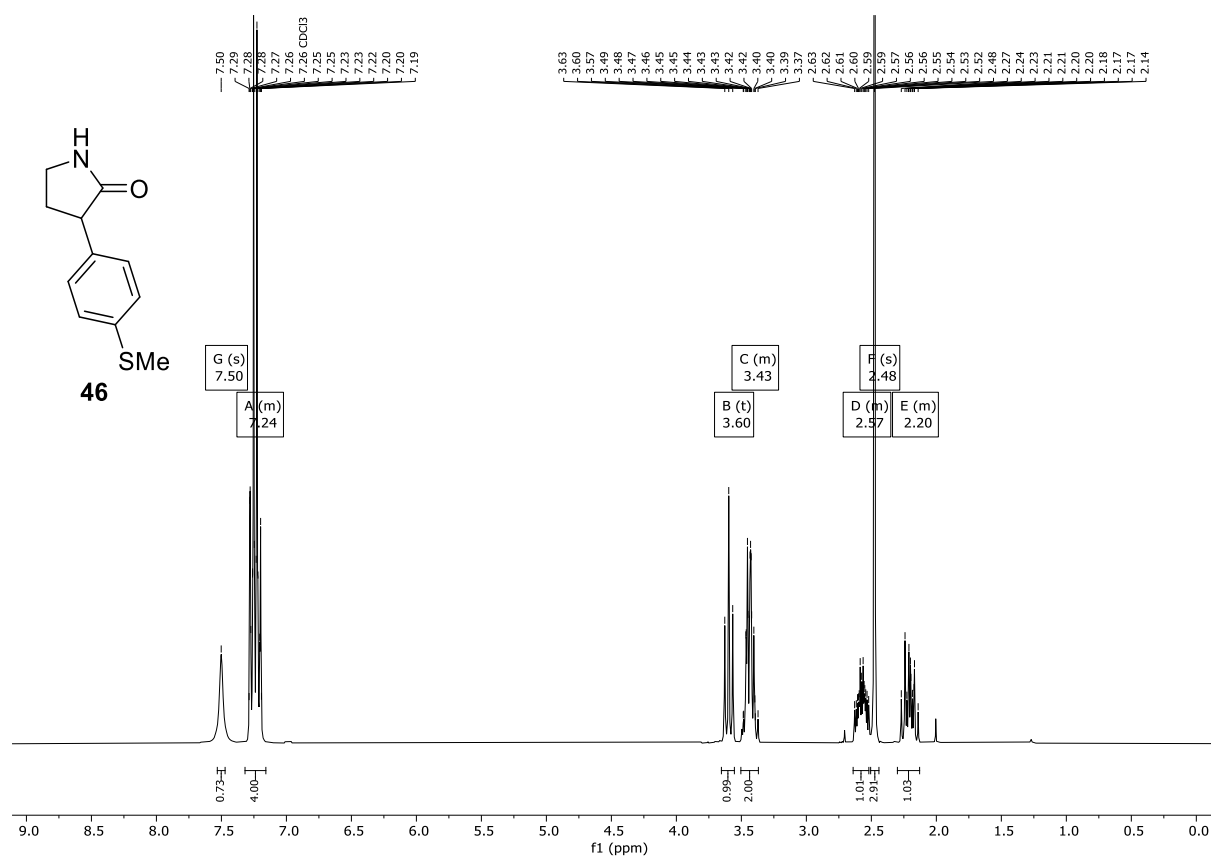


**Figure 45:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(4-(trifluoromethyl)phenyl)piperidin-2-one (**45**).



**Figure 46:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(4-(trifluoromethyl)phenyl)piperidin-2-one (**45**).





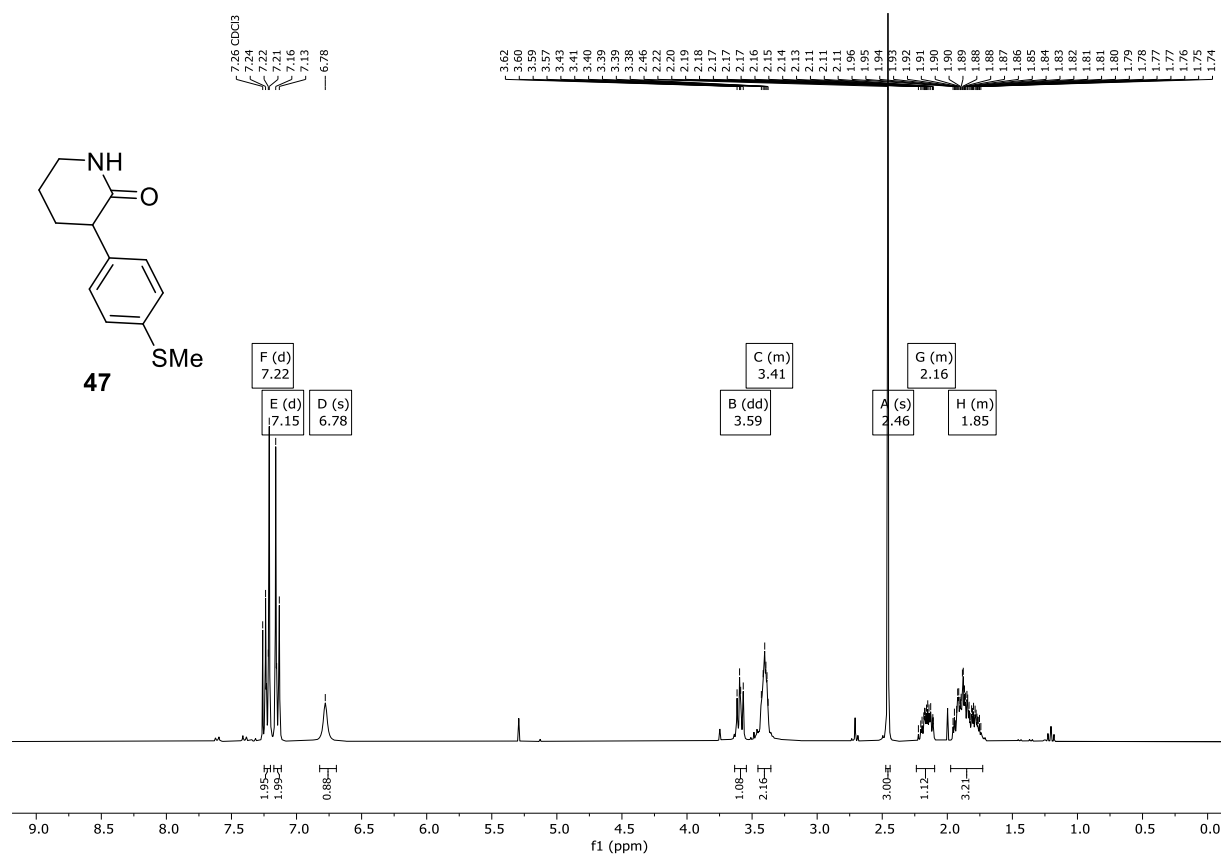


Figure 49: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(4-(methylthio)phenyl)piperidin-2-one (**47**).

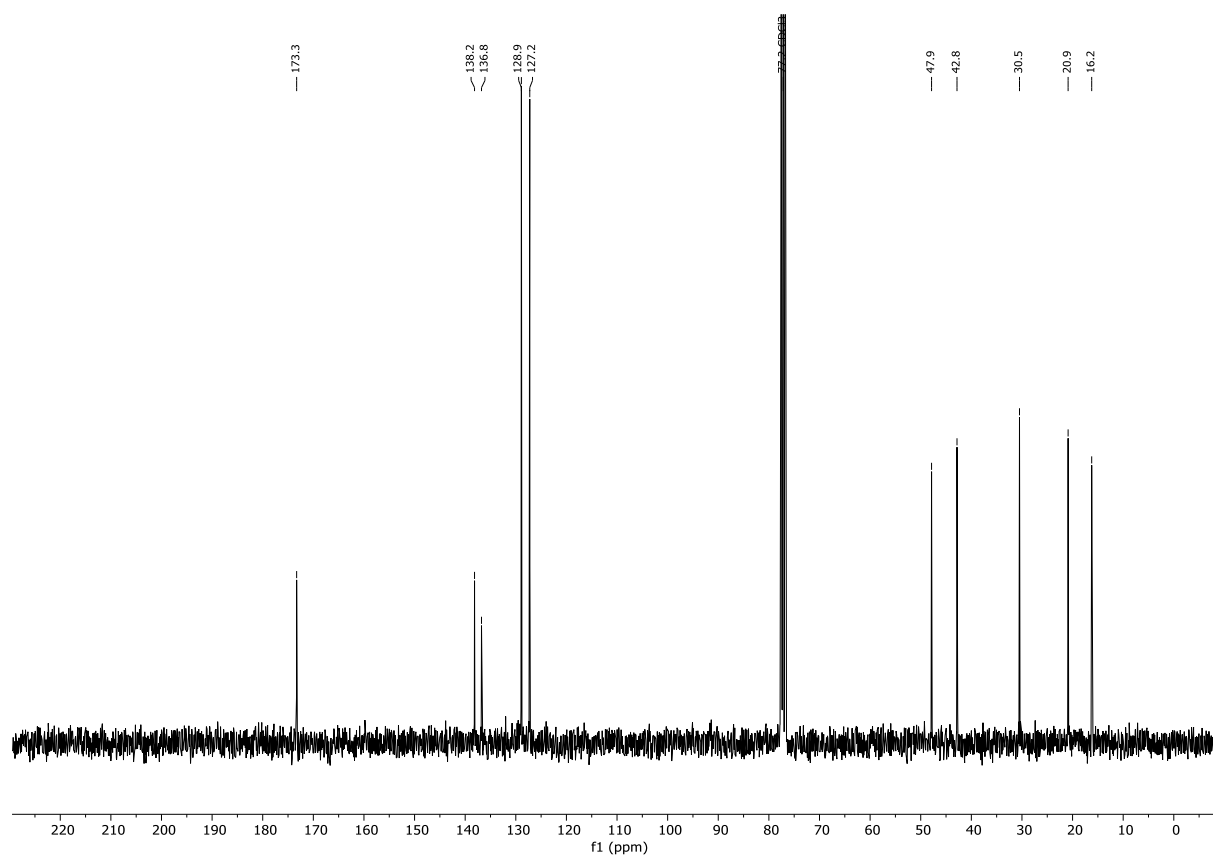
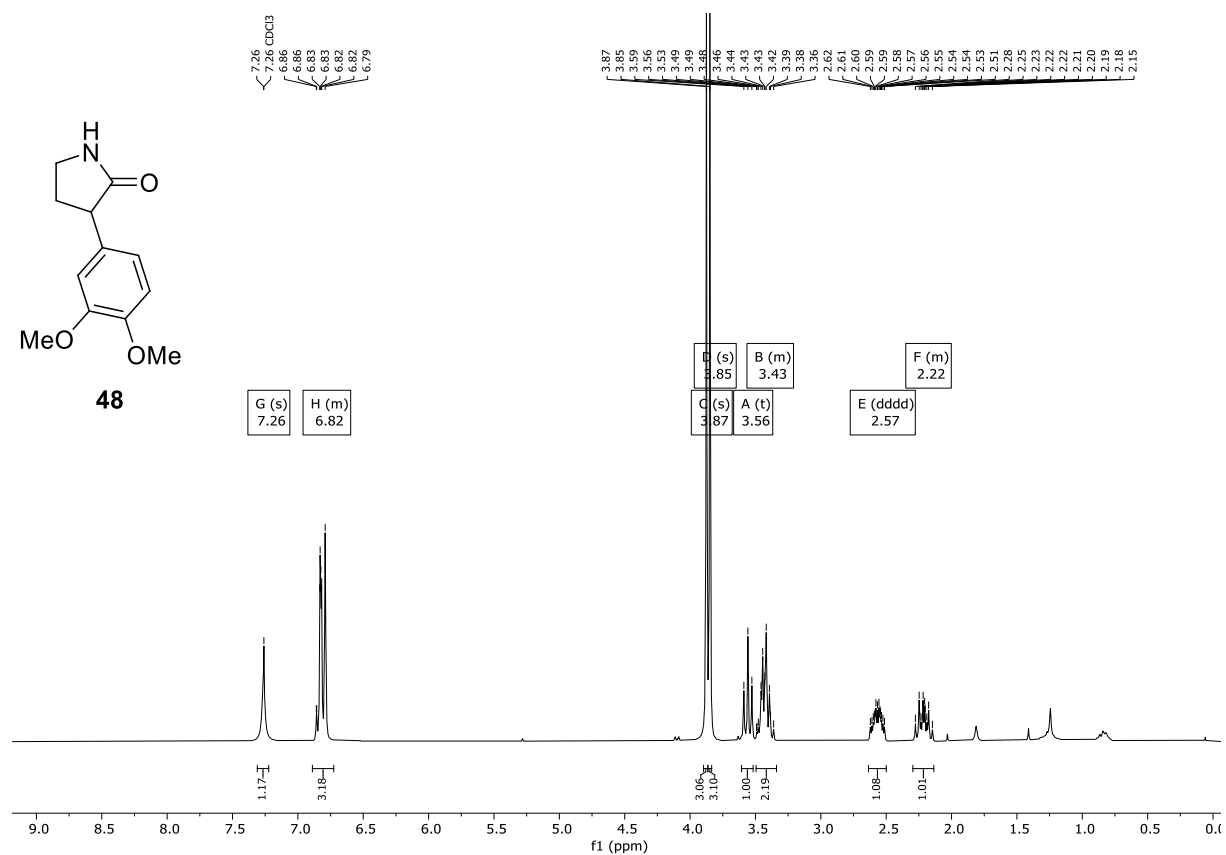
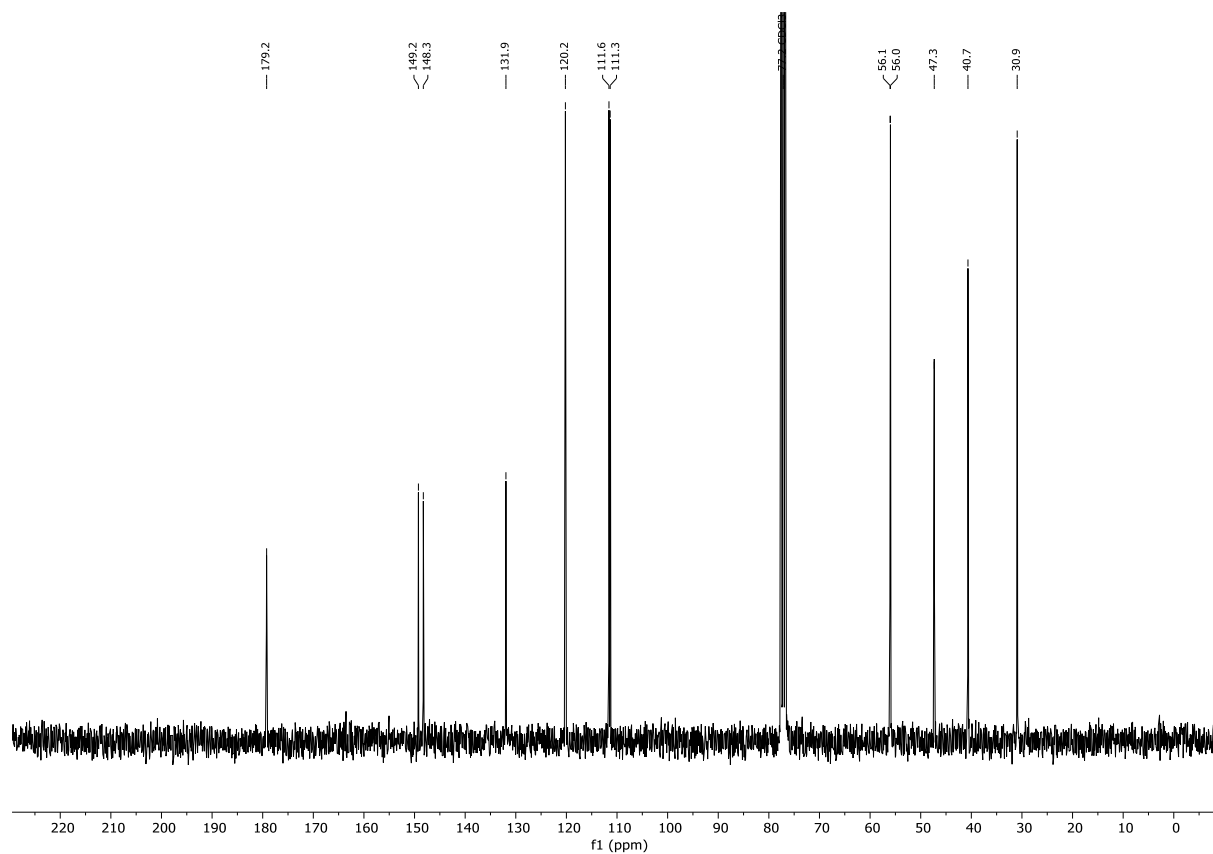


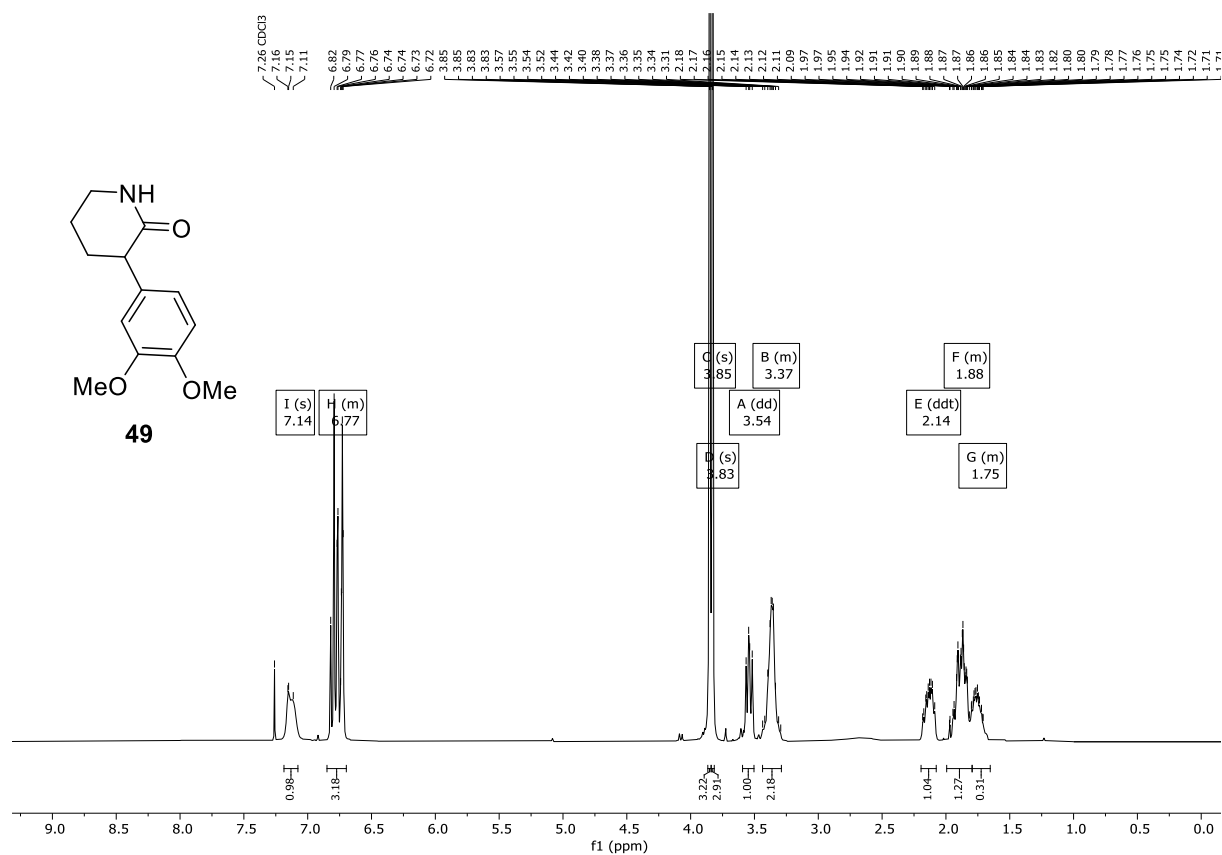
Figure 50: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(4-(methylthio)phenyl)piperidin-2-one (**47**).



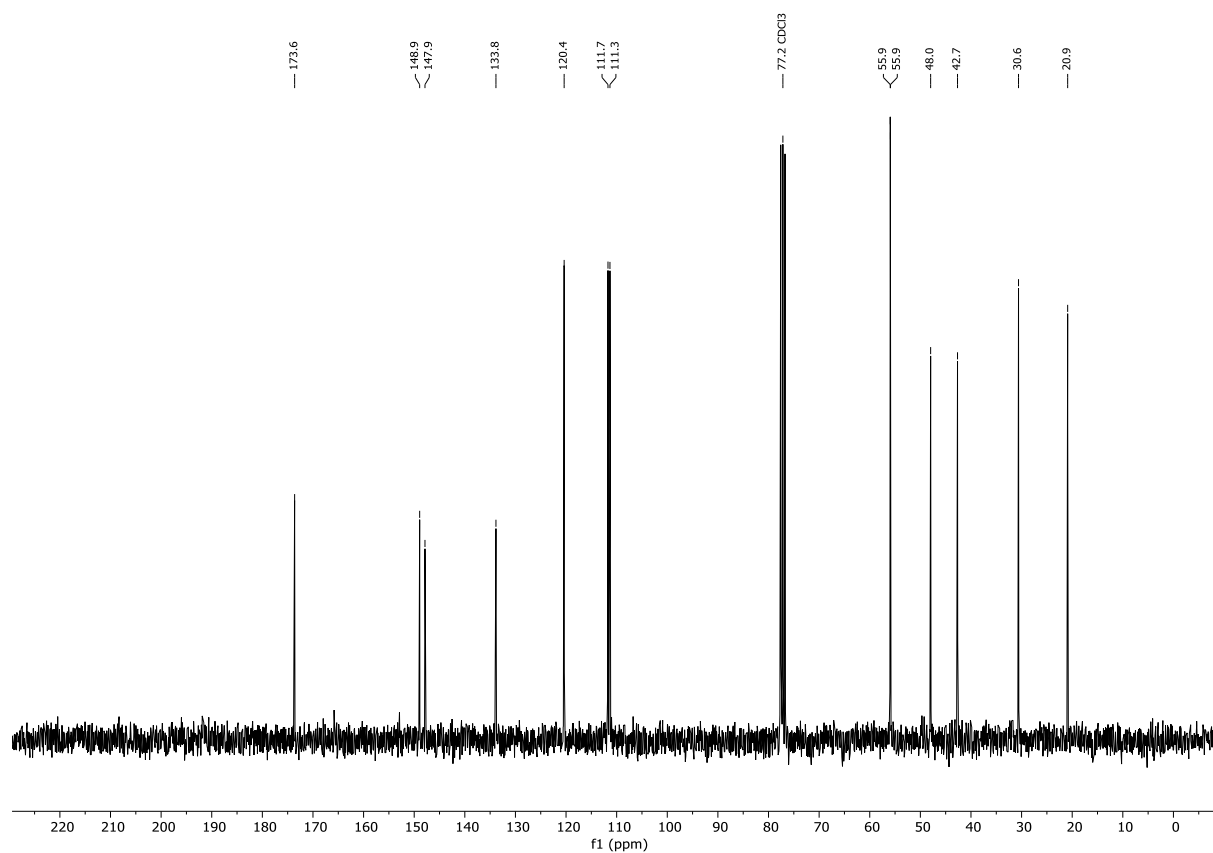
**Figure 51:** <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(3,4-dimethoxyphenyl)pyrrolidin-2-one (**48**).



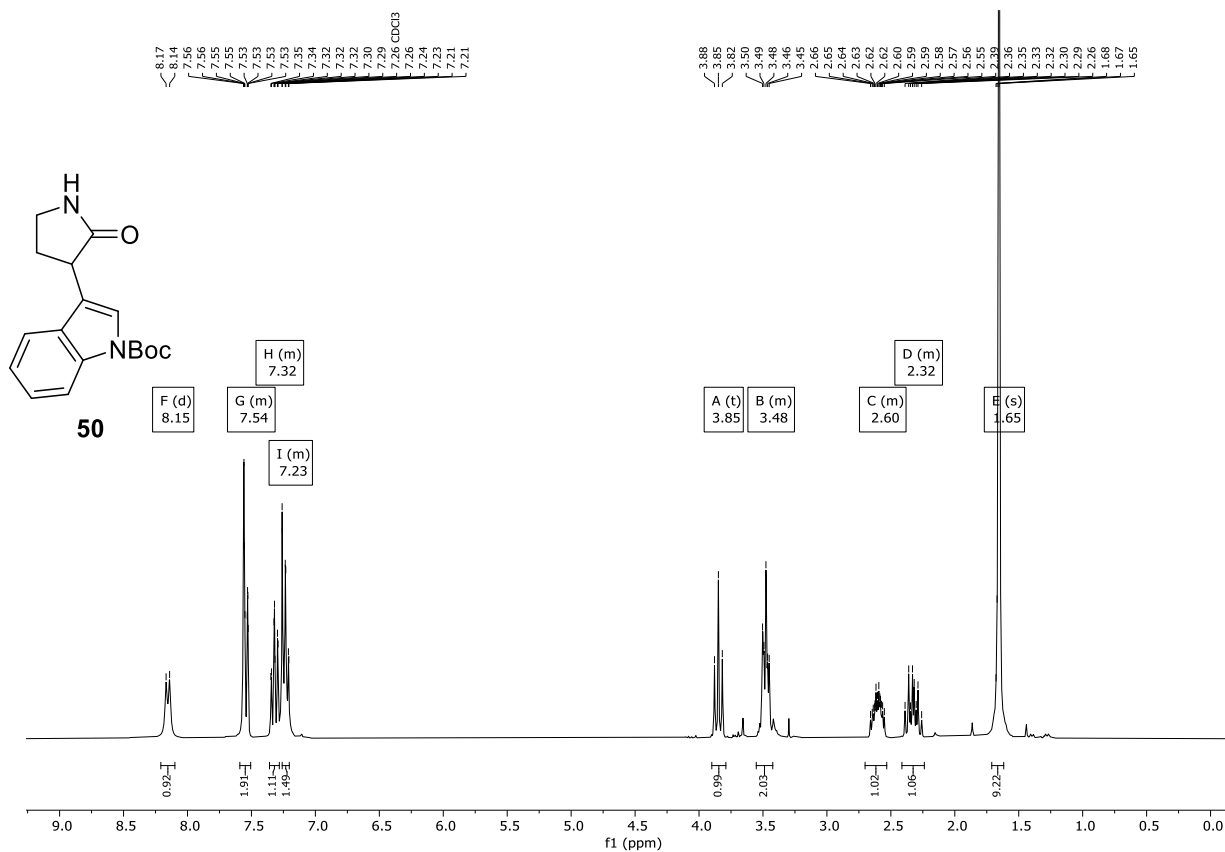
**Figure 52:** <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(3,4-dimethoxyphenyl)pyrrolidin-2-one (**48**).



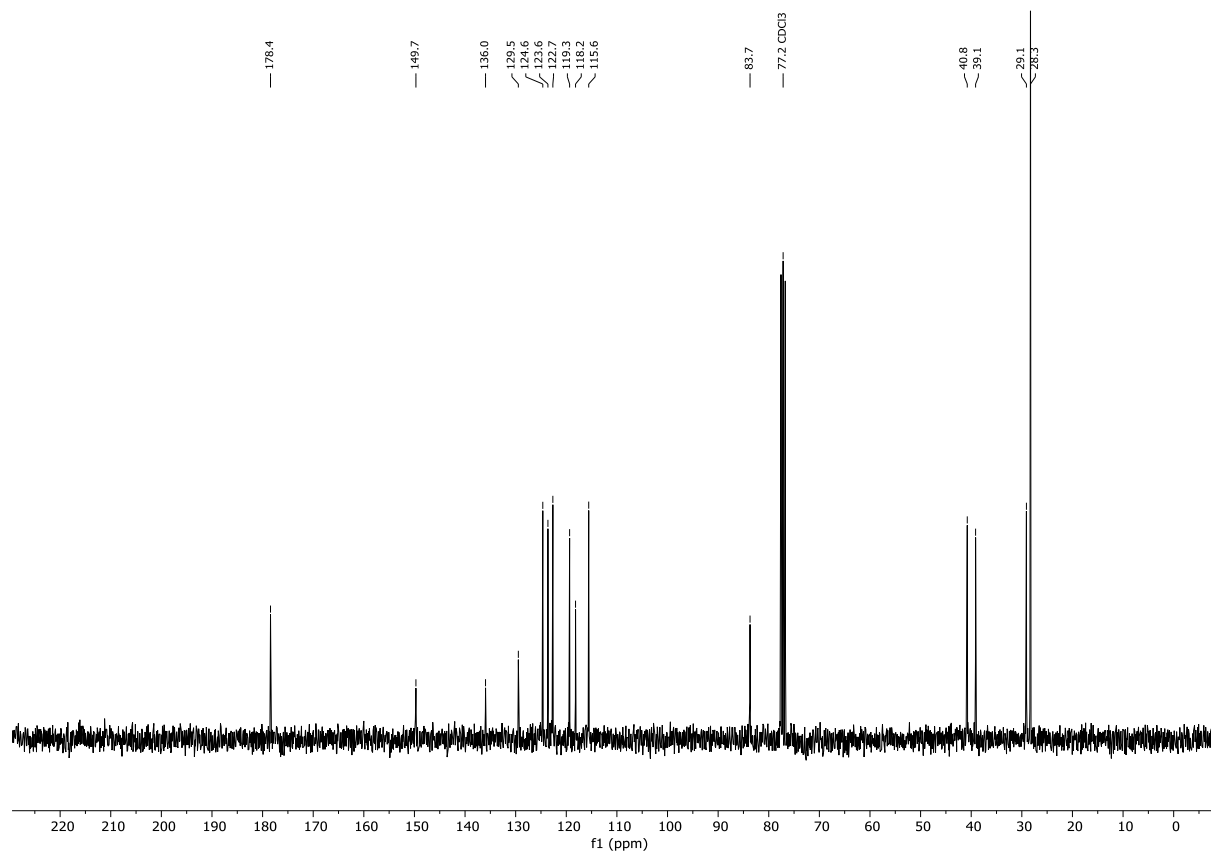
**Figure 53:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(3,4-dimethoxyphenyl)piperidin-2-one (**49**).



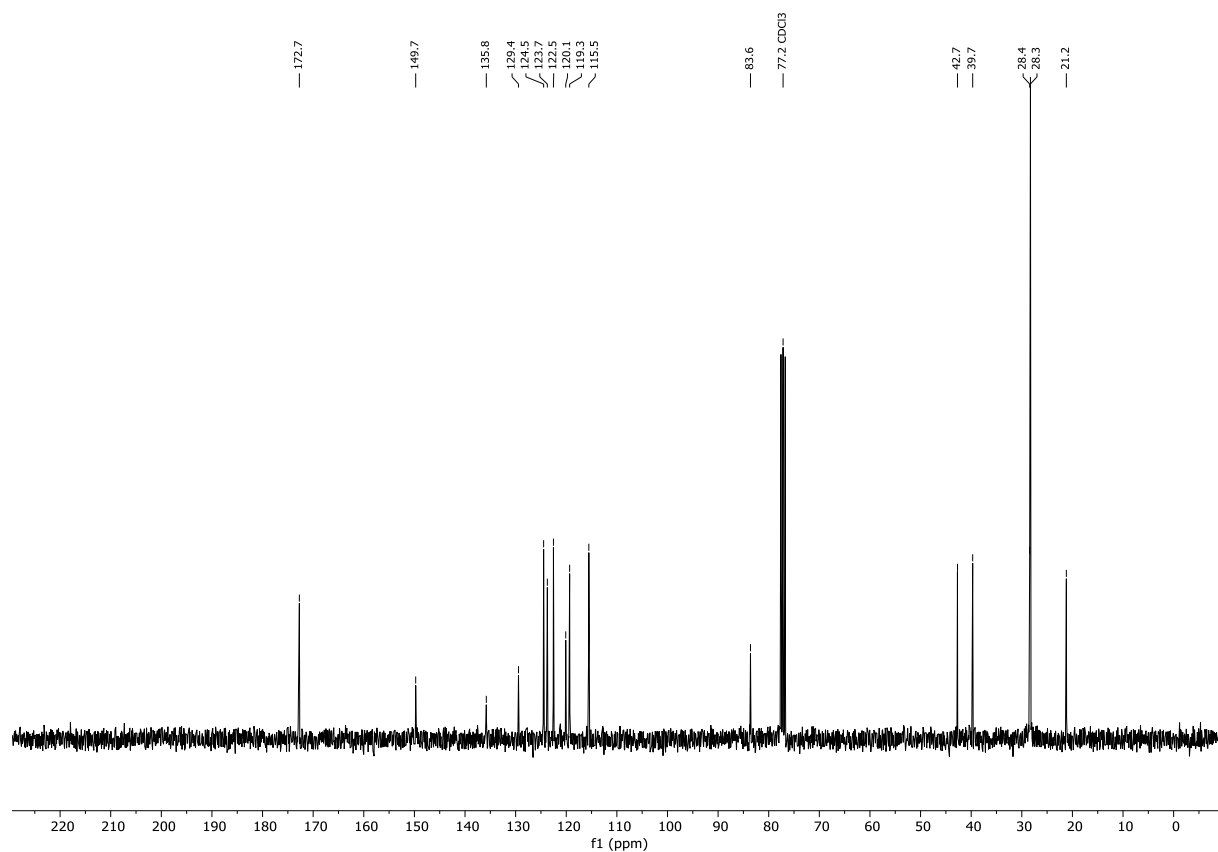
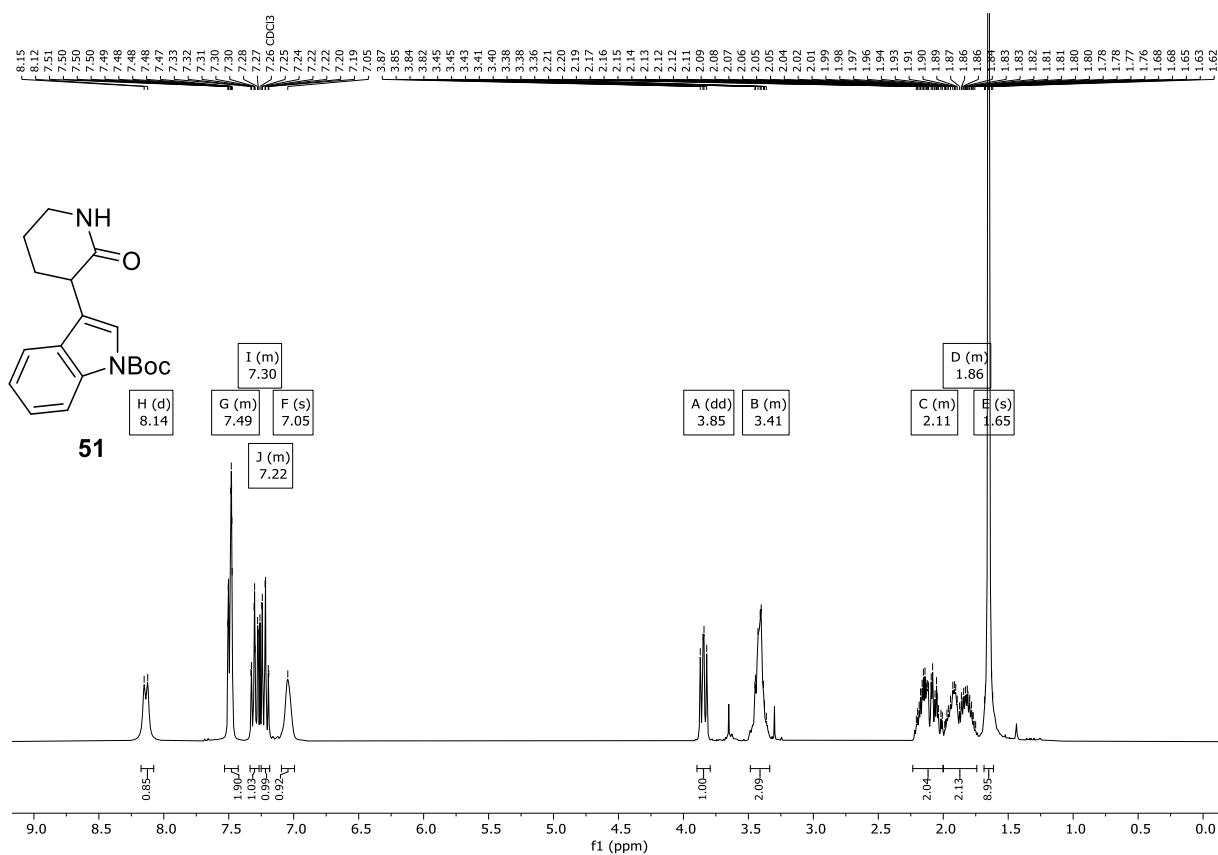
**Figure 54:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(3,4-dimethoxyphenyl)piperidin-2-one (**49**).



**Figure 55:** <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of *tert*-butyl 3-(2-oxopyrrolidin-3-yl)-1*H*-indole-1-carboxylate (**50**).



**Figure 56:** <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of *tert*-butyl 3-(2-oxopyrrolidin-3-yl)-1*H*-indole-1-carboxylate (**50**).



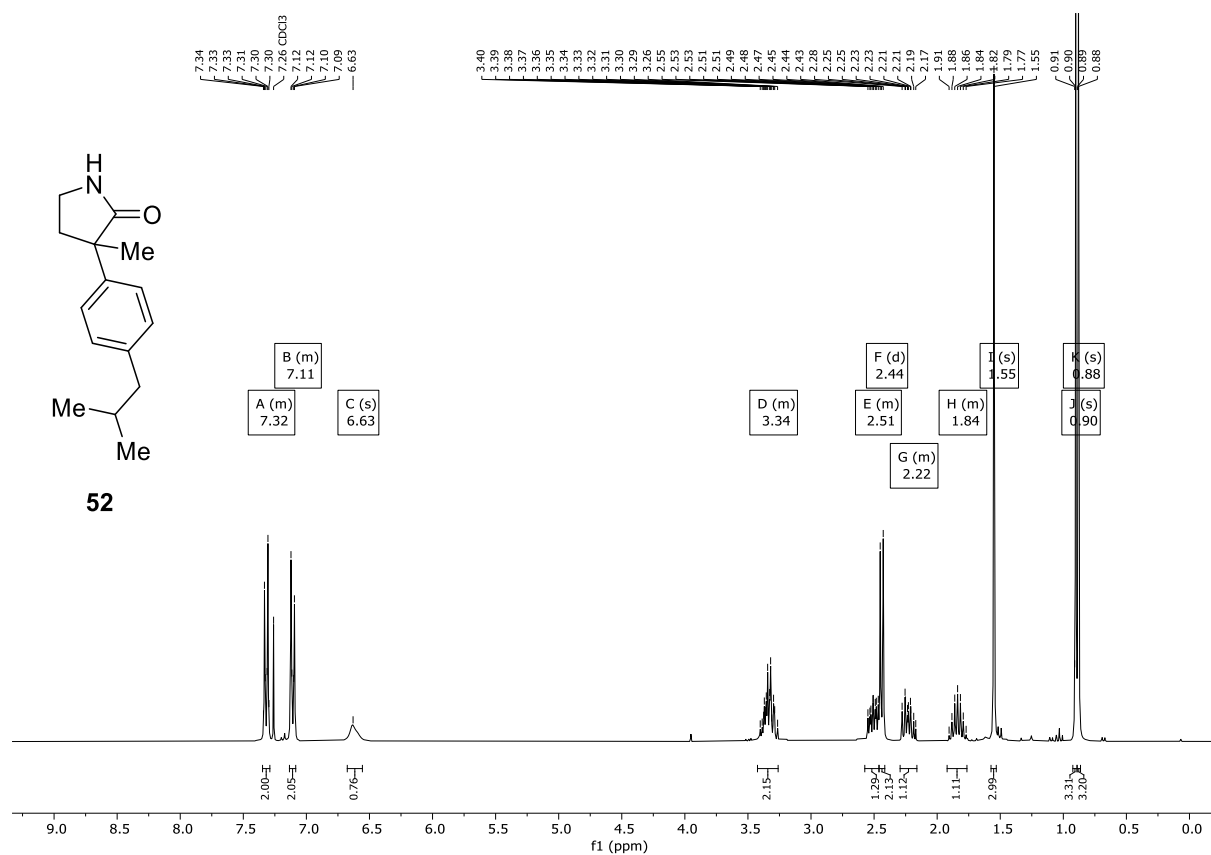


Figure 59: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(4-isobutylphenyl)-3-methylpyrrolidin-2-one (**52**).

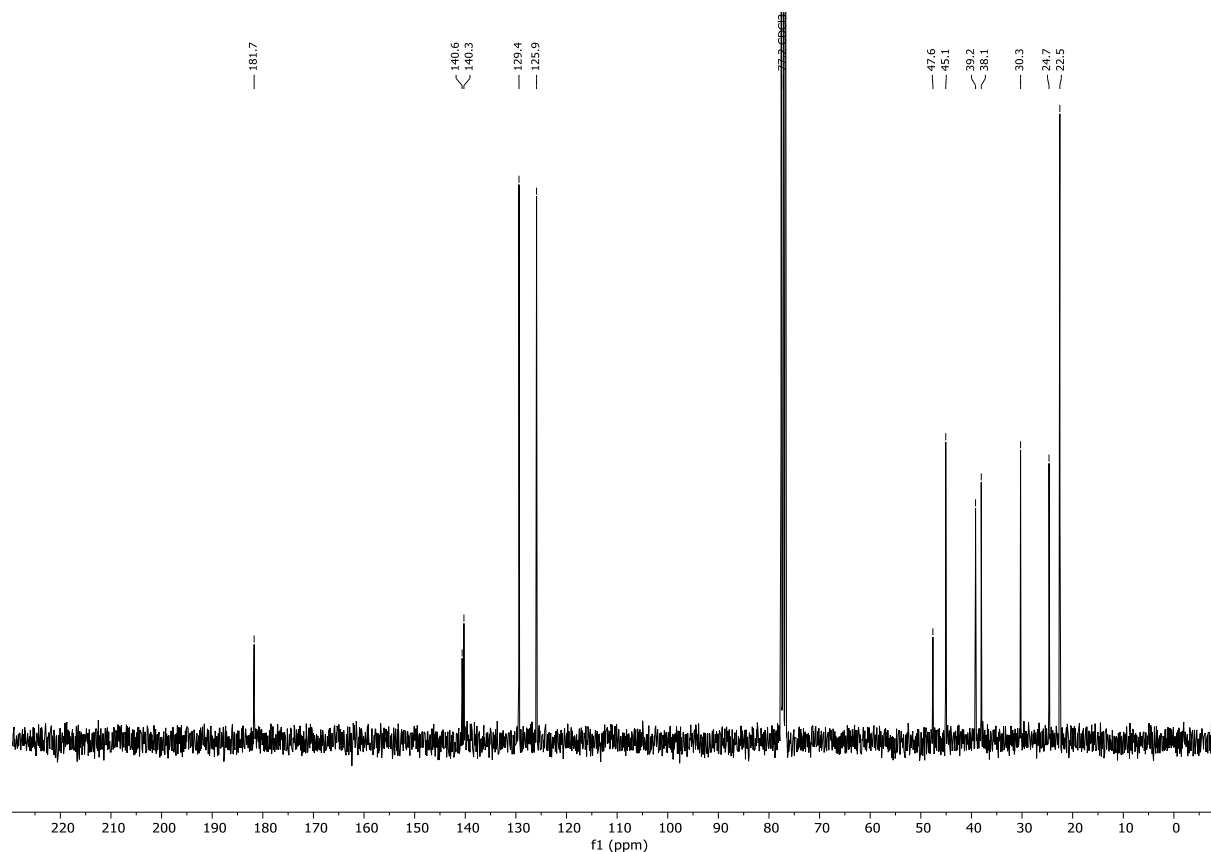


Figure 60: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(4-isobutylphenyl)-3-methylpyrrolidin-2-one (**52**).

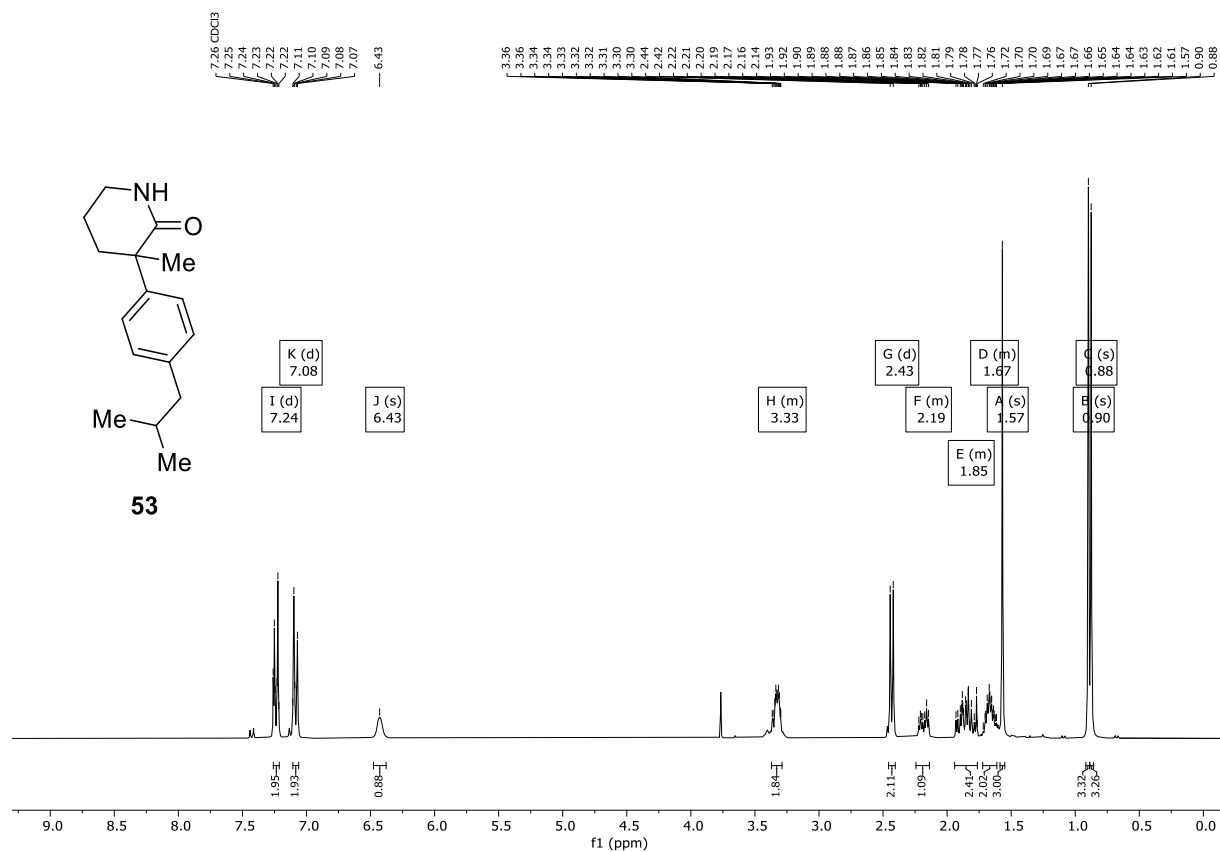


Figure 61: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-(4-isobutylphenyl)-3-methylpiperidin-2-one (**53**).

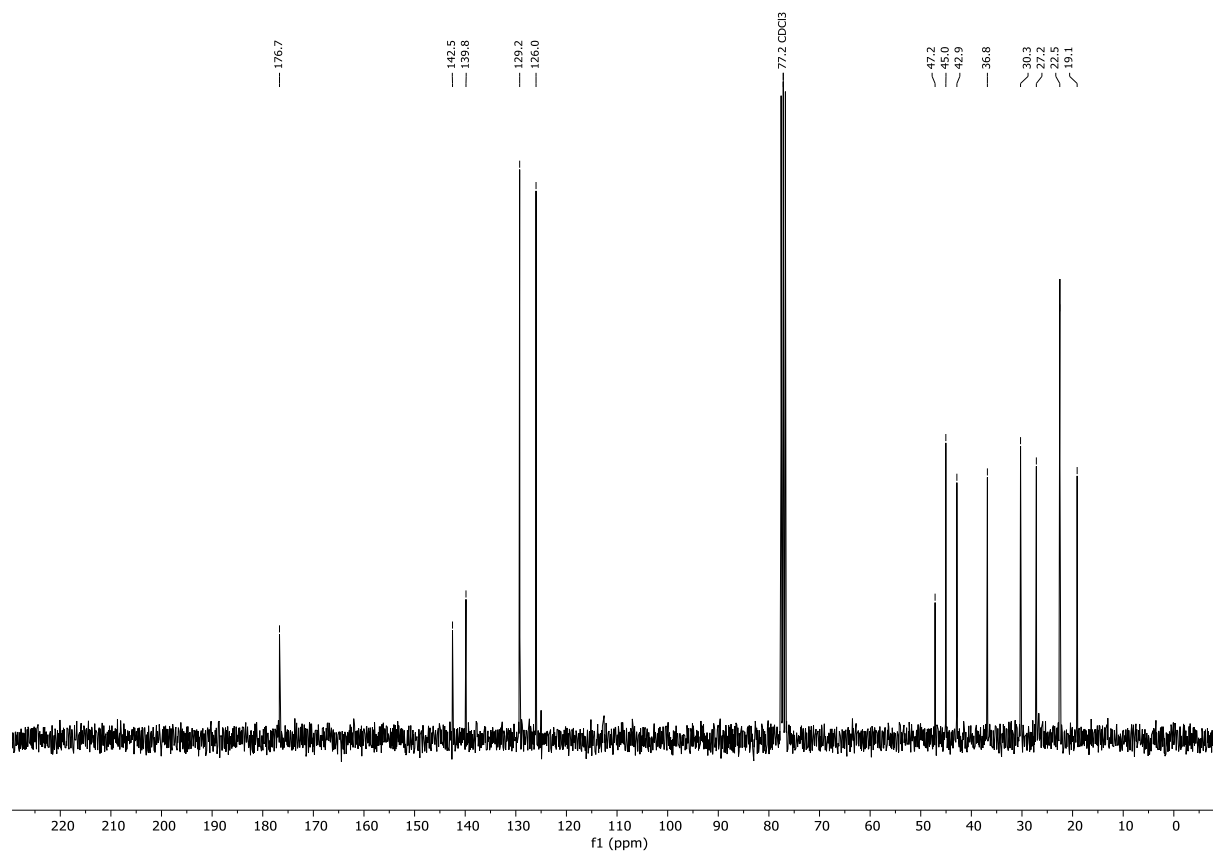


Figure 62: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-(4-isobutylphenyl)-3-methylpiperidin-2-one (**53**).



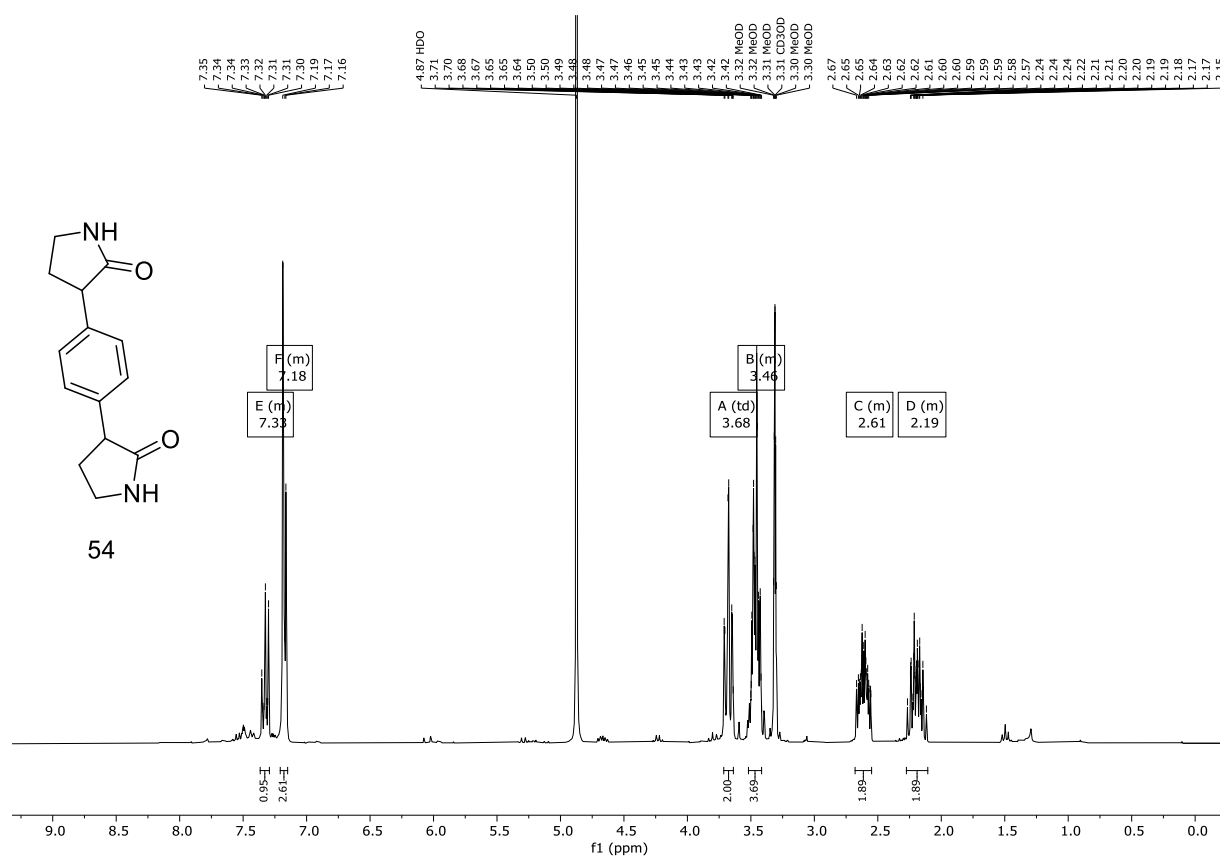


Figure 63: <sup>1</sup>H-NMR (300 MHz, MeOD-d<sub>4</sub>) of 3,3'-(1,4-phenylene)bis(piperidin-2-one) (**54**).

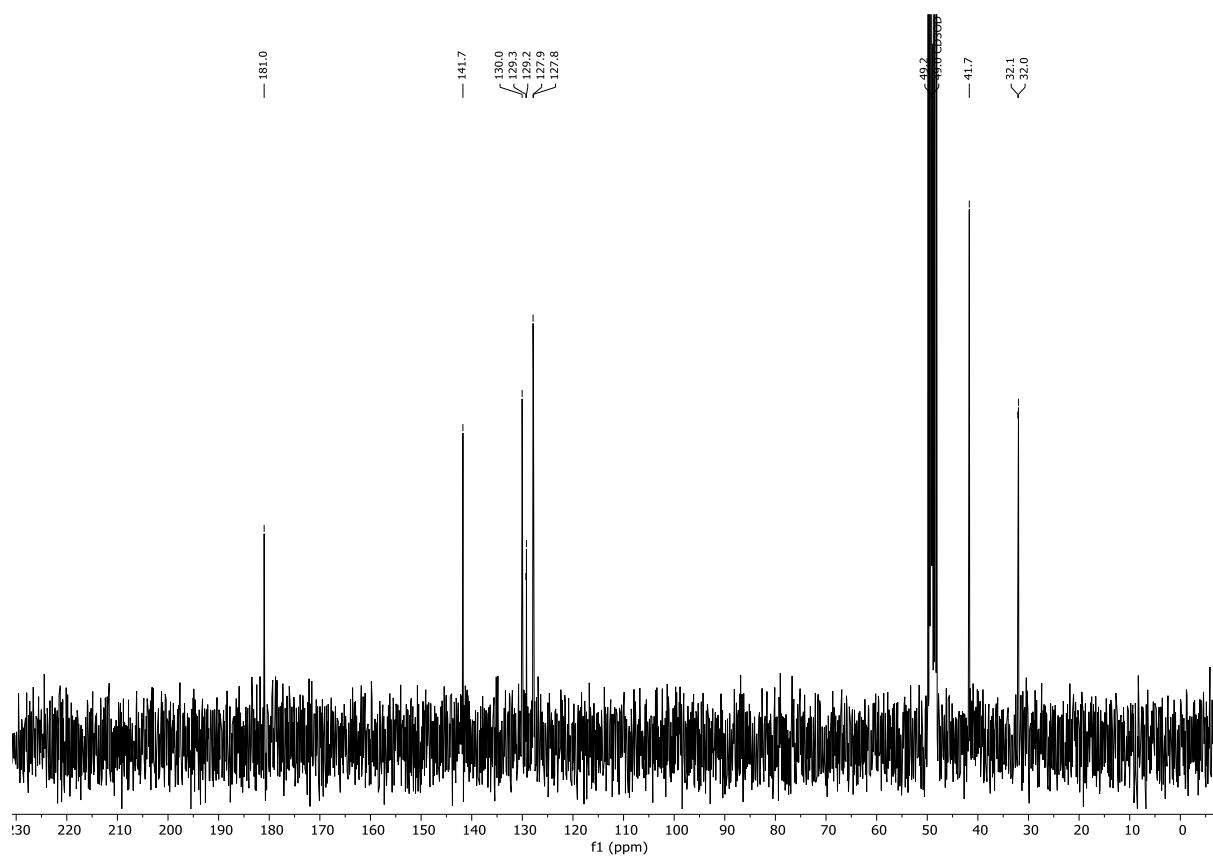
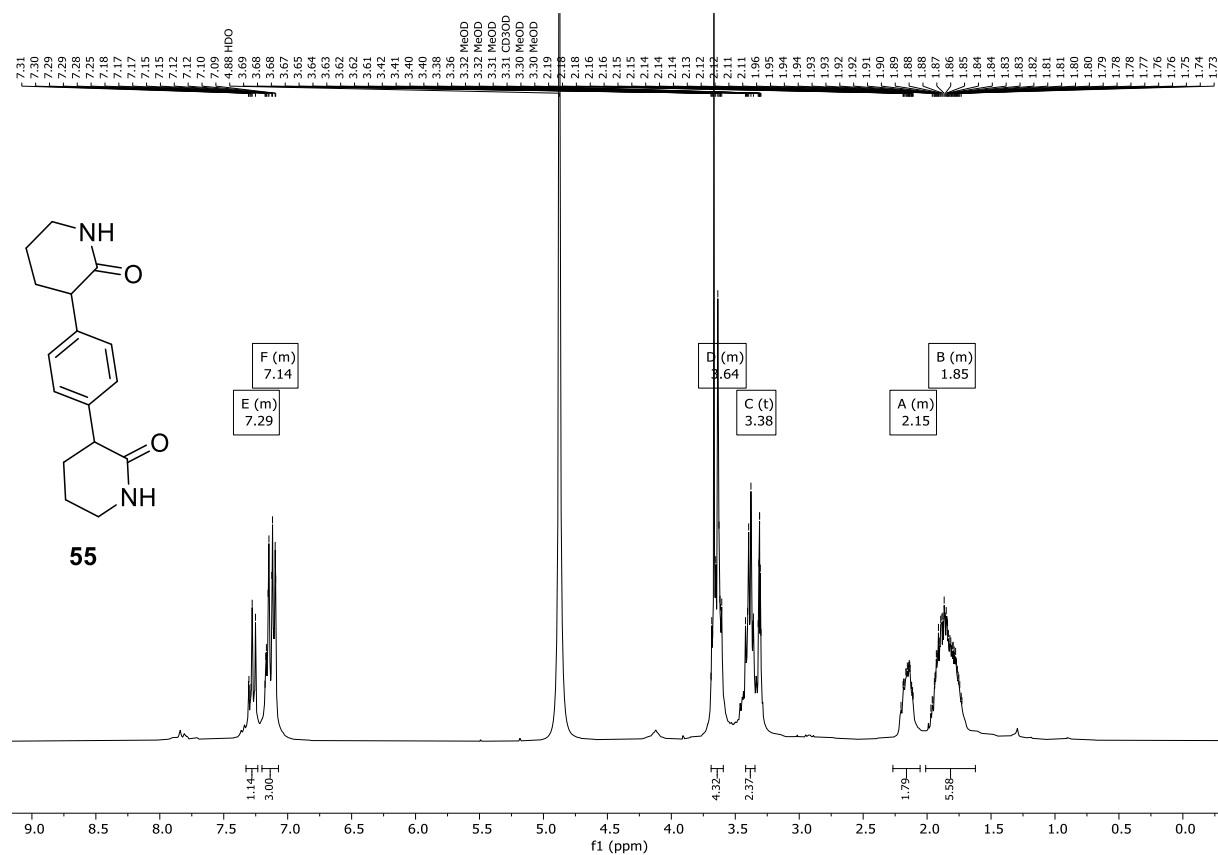
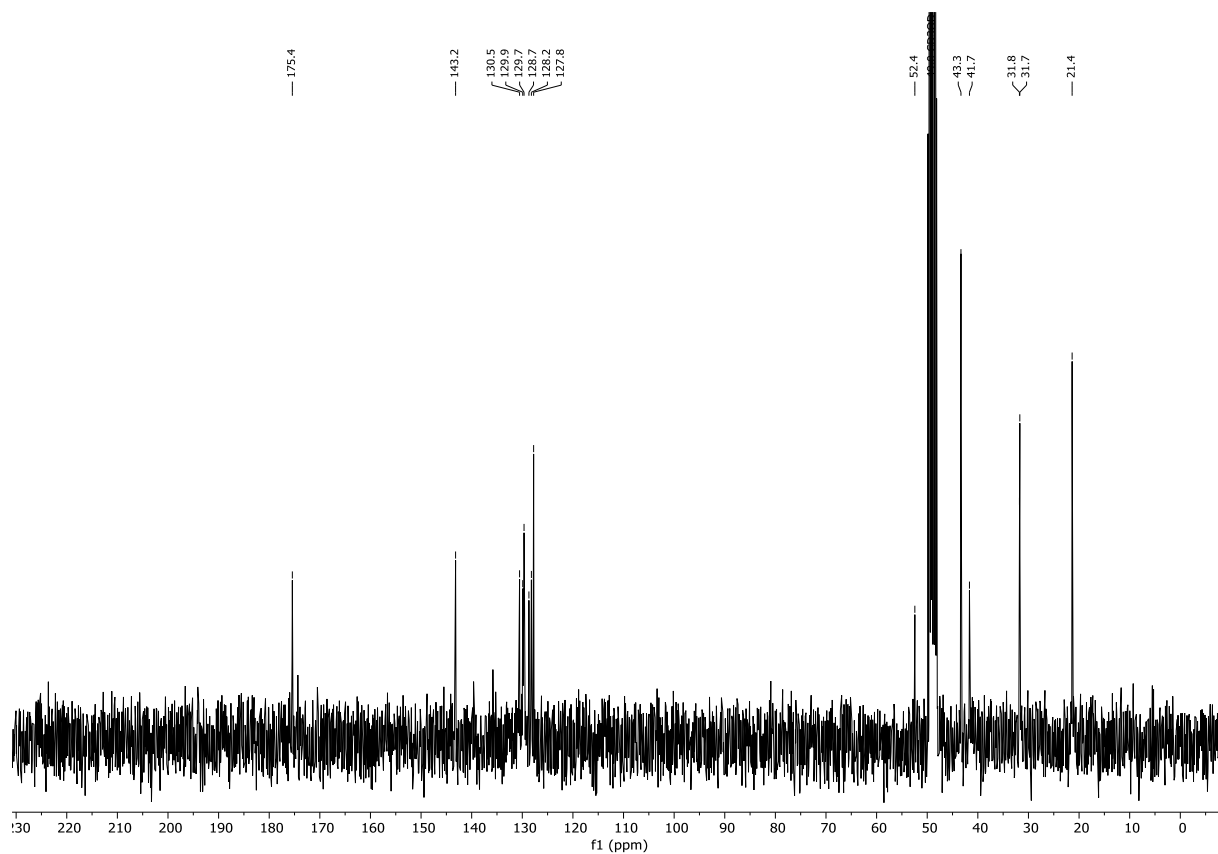


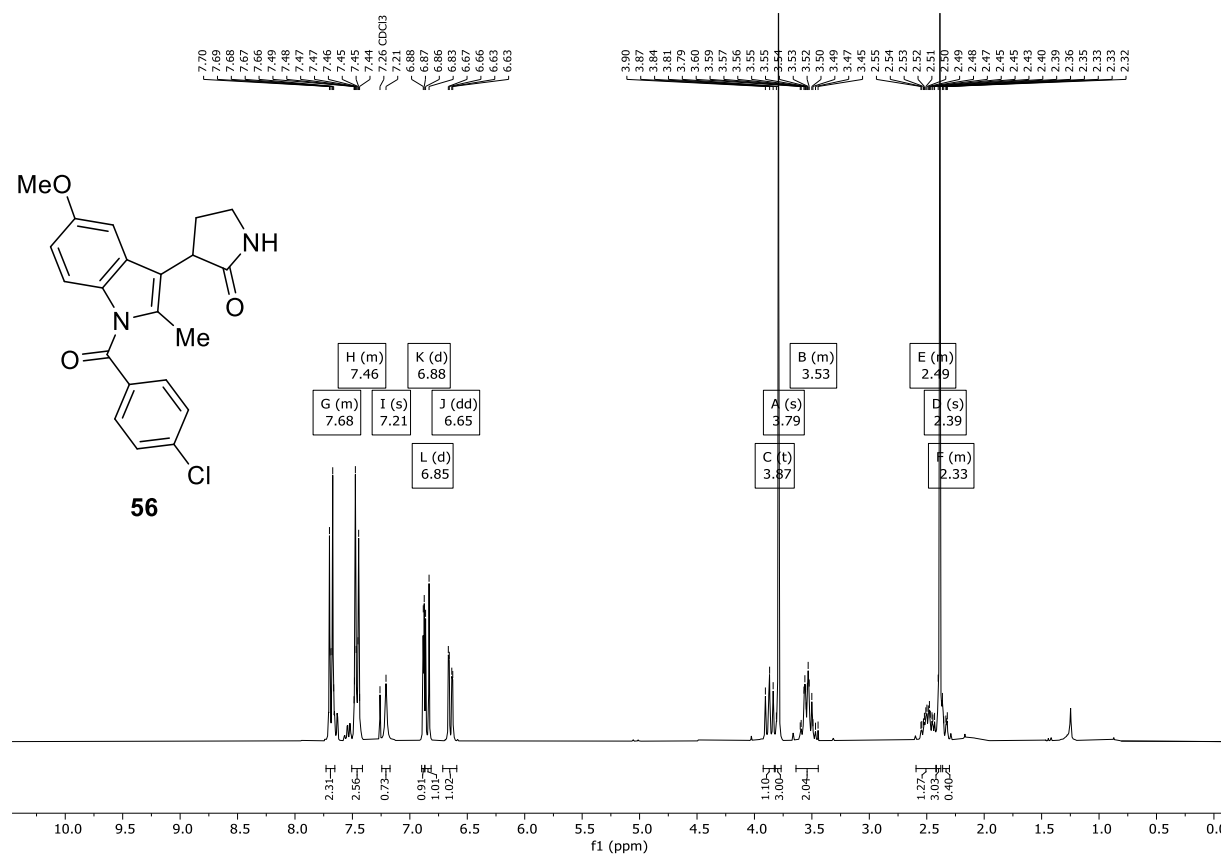
Figure 64: <sup>13</sup>C-NMR (75 MHz, MeOD-d<sub>4</sub>) of 3,3'-(1,4-phenylene)bis(piperidin-2-one) (**54**).



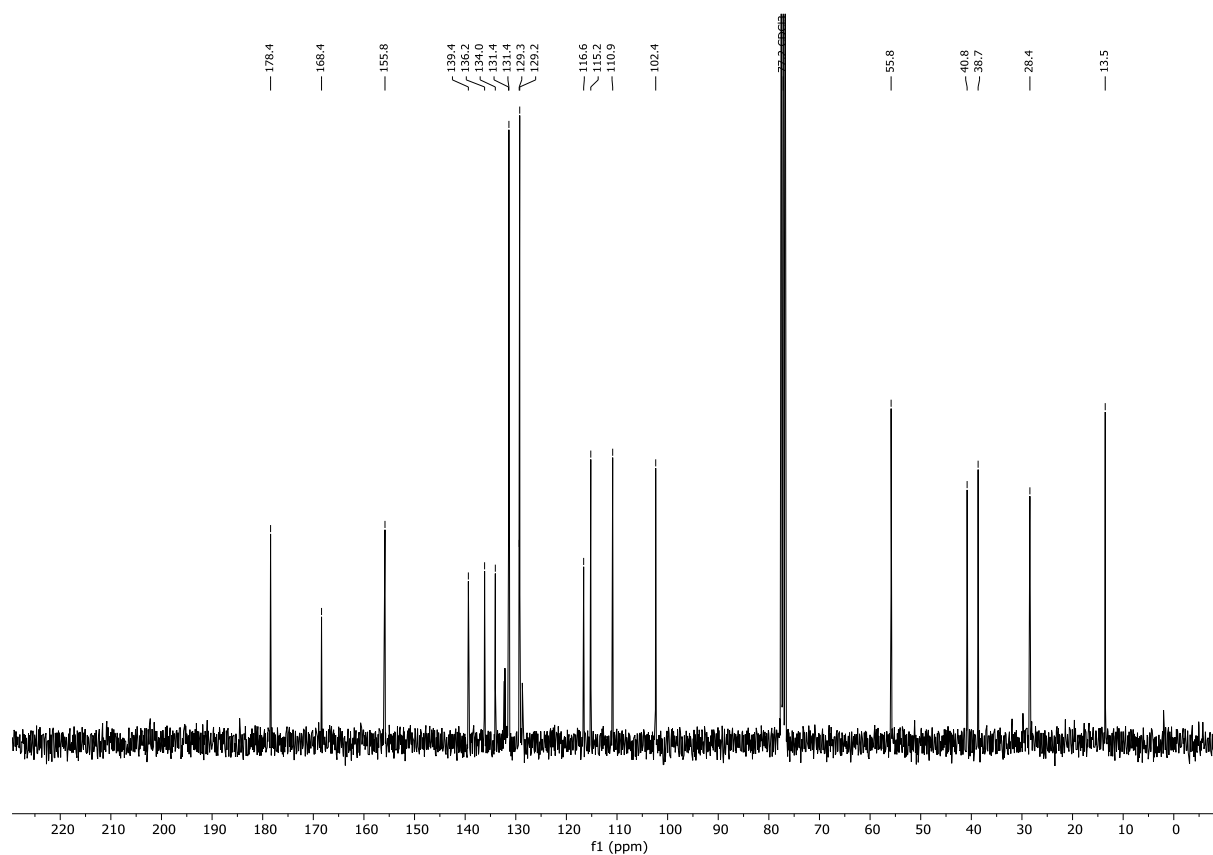
**Figure 65:**  $^1\text{H-NMR}$  (300 MHz,  $\text{MeOD-d}_4$ ) of 3,3'-(1,4-phenylene)bis(piperidin-2-one) (**55**).



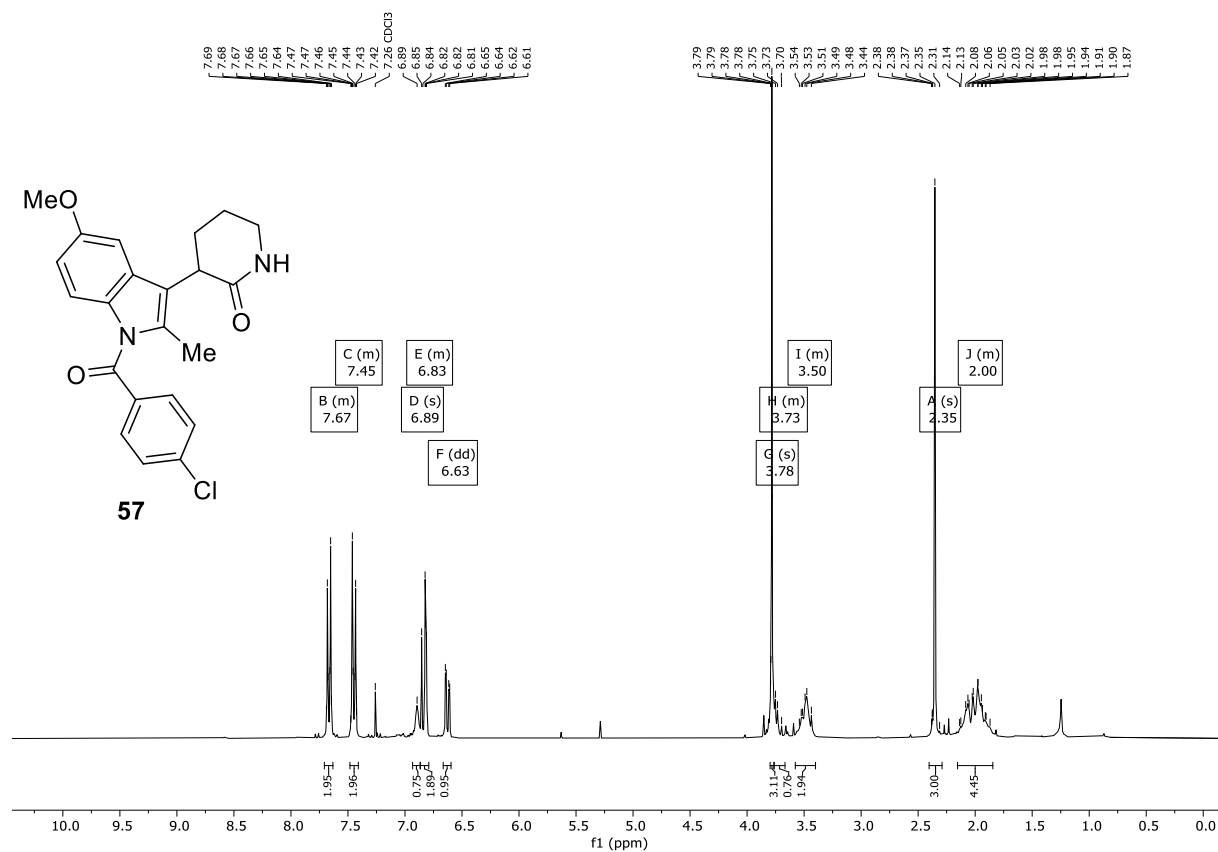
**Figure 66:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{MeOD-d}_4$ ) of 3,3'-(1,4-phenylene)bis(piperidin-2-one) (**55**).



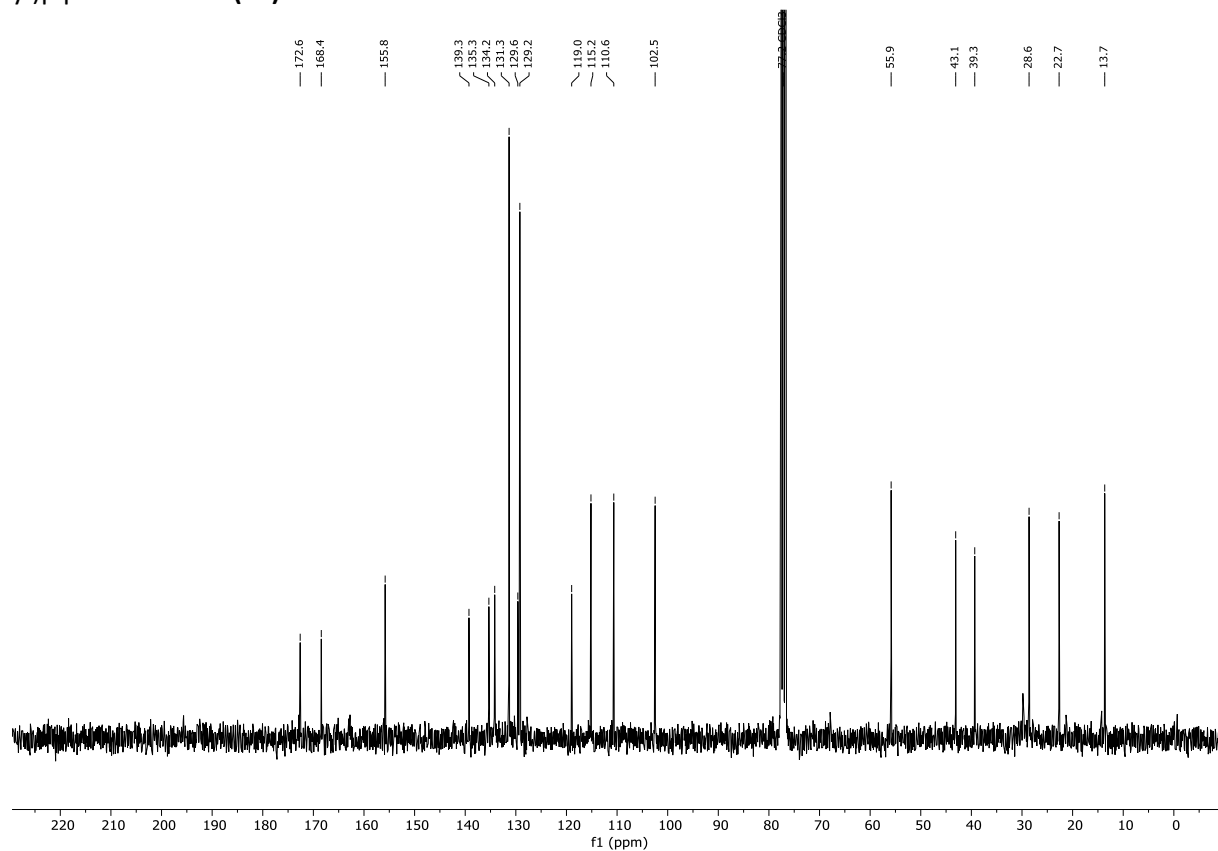
**Figure 67:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(1-(4-chlorobenzoyl)-5-methoxy-2-methyl-1H-indol-3-yl)pyrrolidin-2-one (**56**).



**Figure 68:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(1-(4-chlorobenzoyl)-5-methoxy-2-methyl-1H-indol-3-yl)pyrrolidin-2-one (**56**).



**Figure 69:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-(1-(4-chlorobenzoyl)-5-methoxy-2-methyl-1*H*-indol-3-yl)piperidin-2-one (**57**).



**Figure 70:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-(1-(4-chlorobenzoyl)-5-methoxy-2-methyl-1*H*-indol-3-yl)piperidin-2-one (**57**).

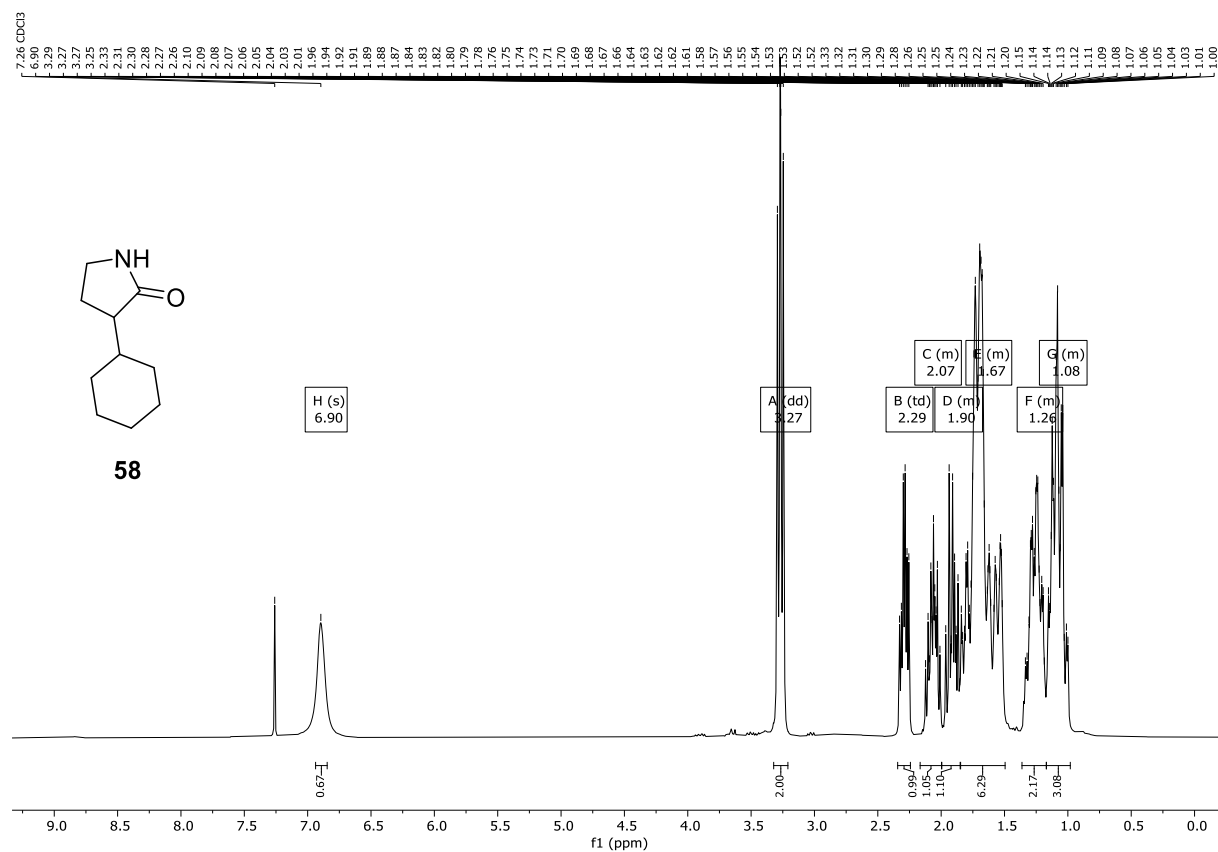


Figure 71: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-cyclohexylpyrrolidin-2-one (**58**).

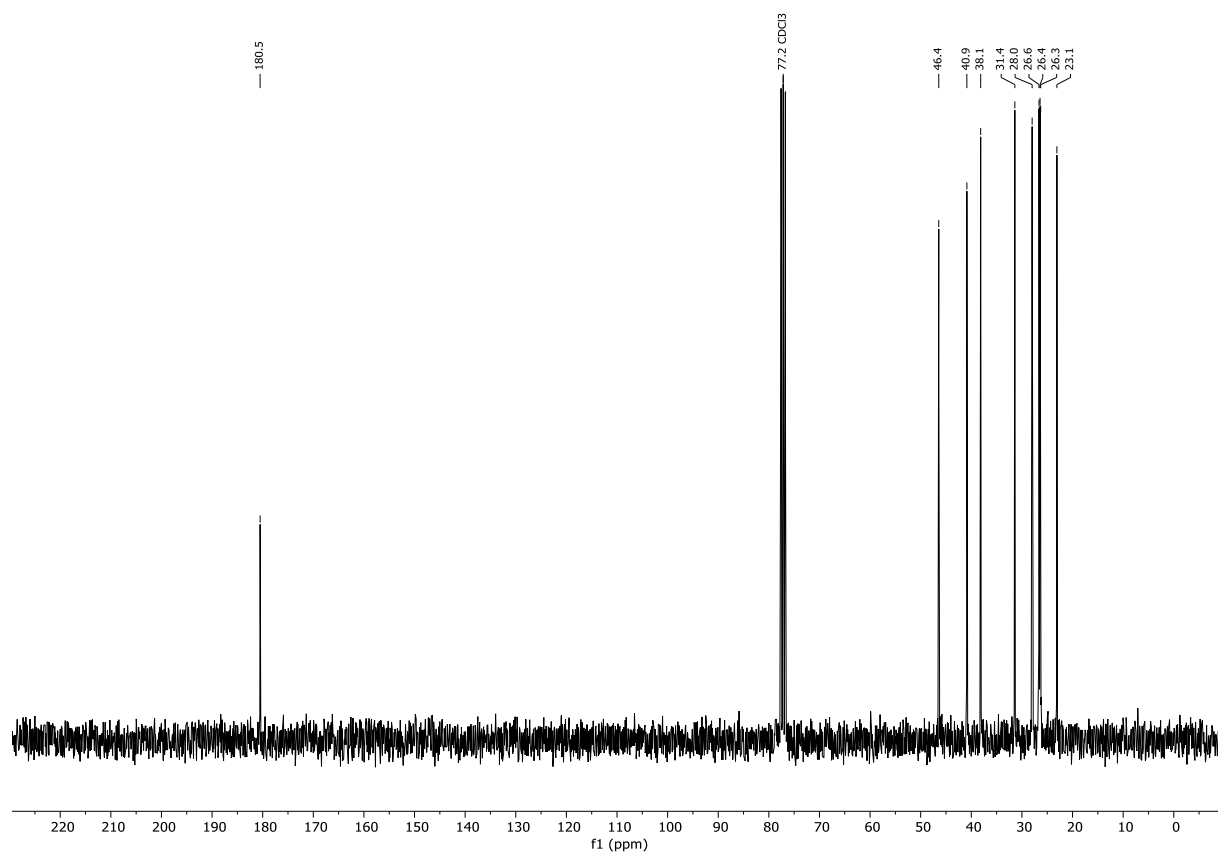


Figure 72: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-cyclohexylpyrrolidin-2-one (**58**).

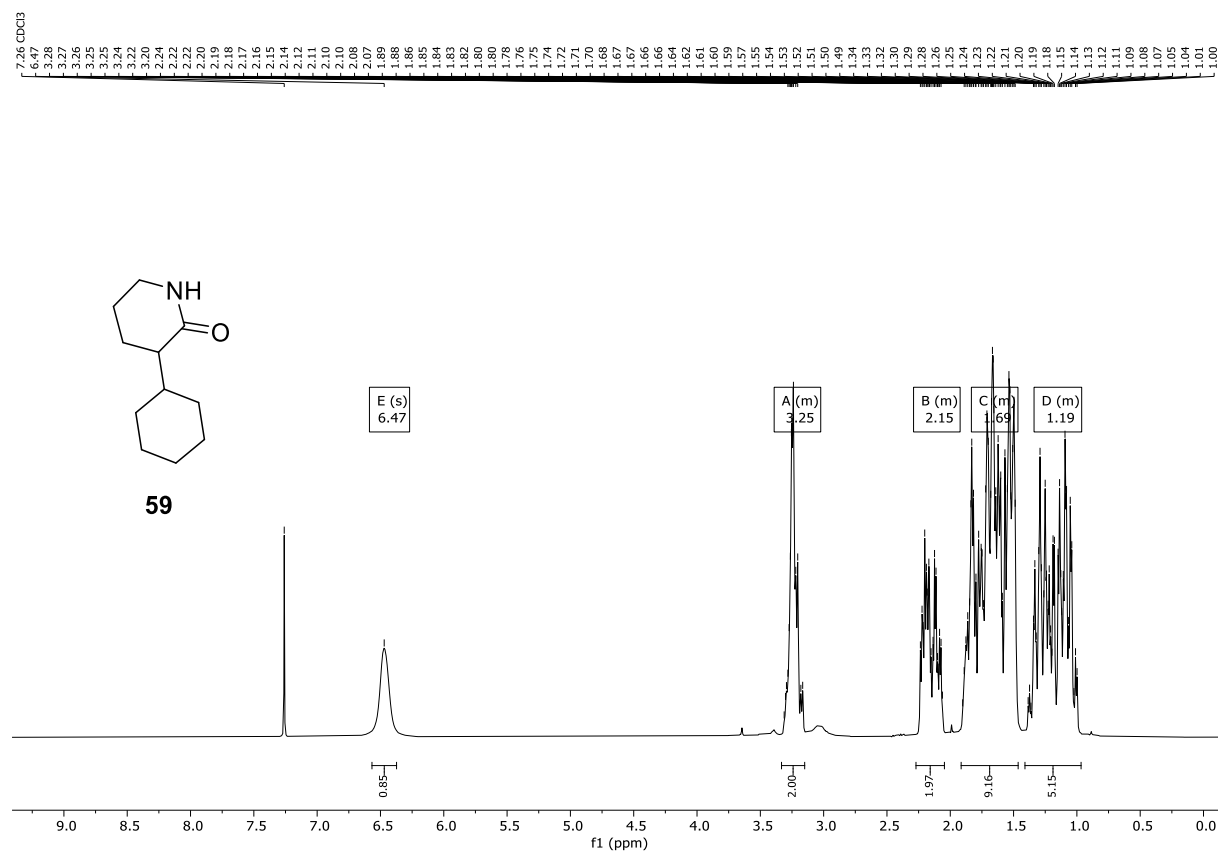


Figure 73: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-cyclohexylpiperidin-2-one (**59**).

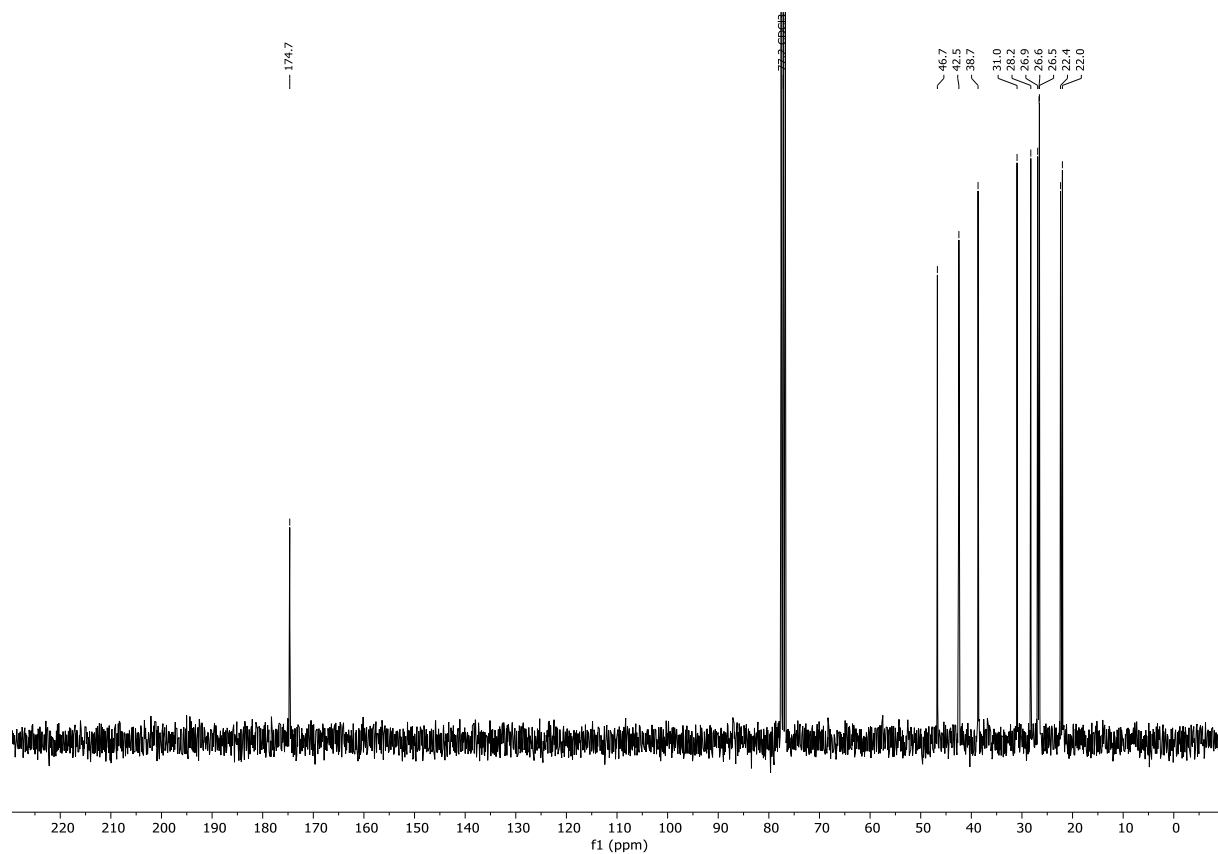


Figure 74: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-cyclohexylpiperidin-2-one (**59**).

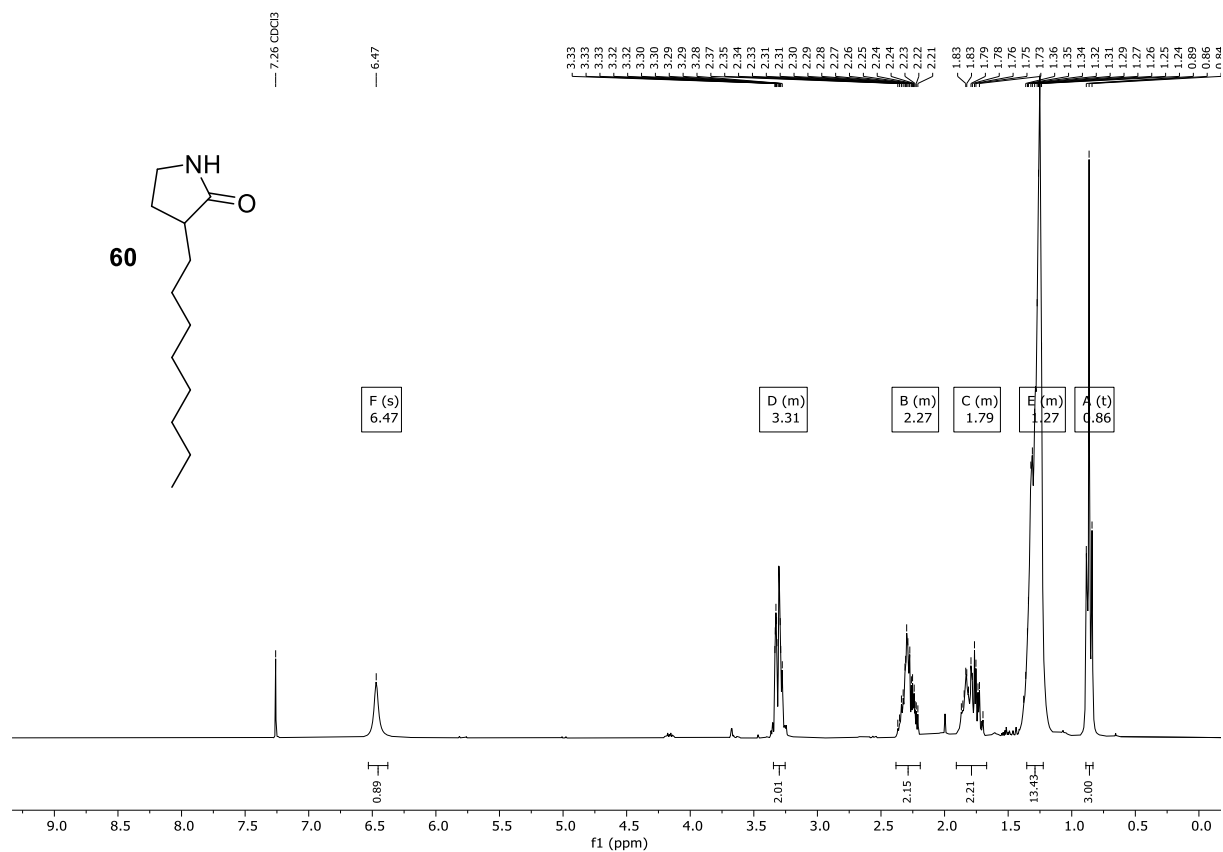


Figure 75: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-octylpyrrolidin-2-one (**60**).

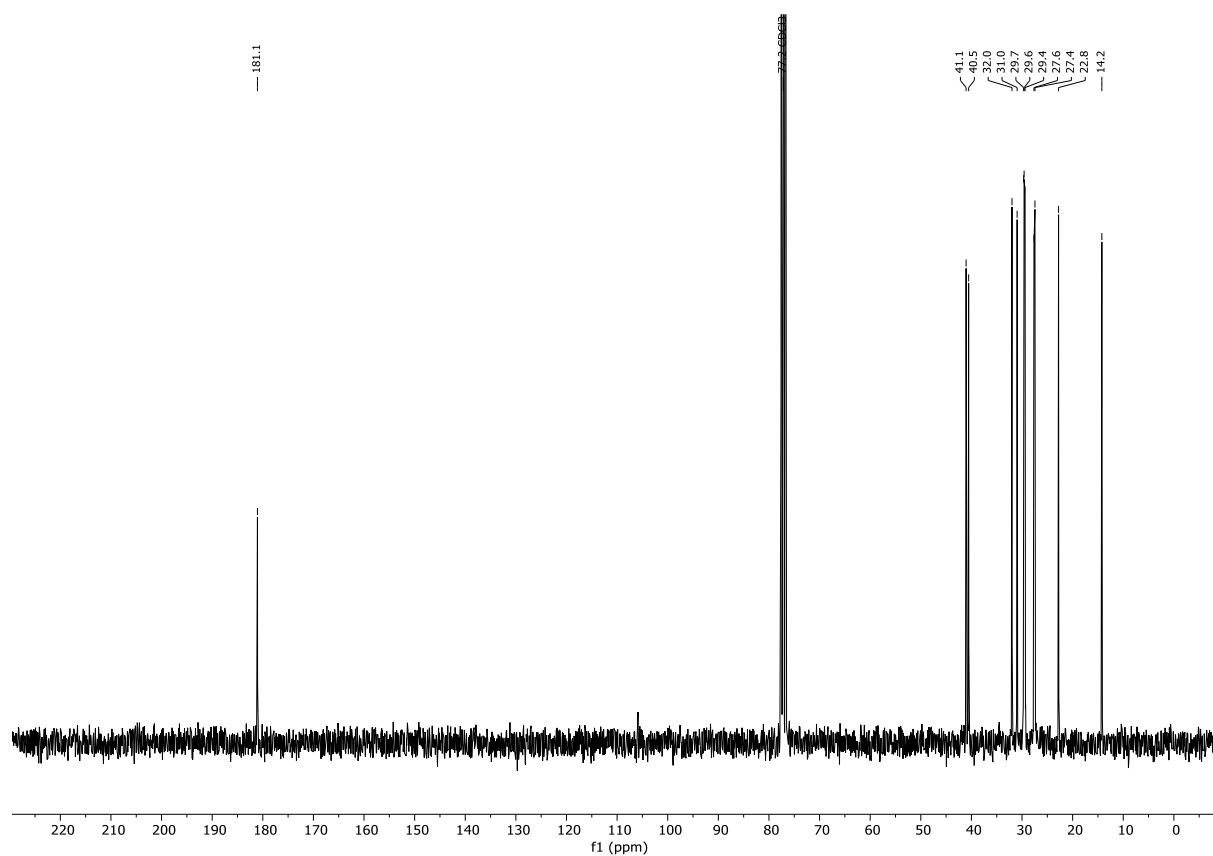


Figure 76: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-octylpyrrolidin-2-one (**60**).

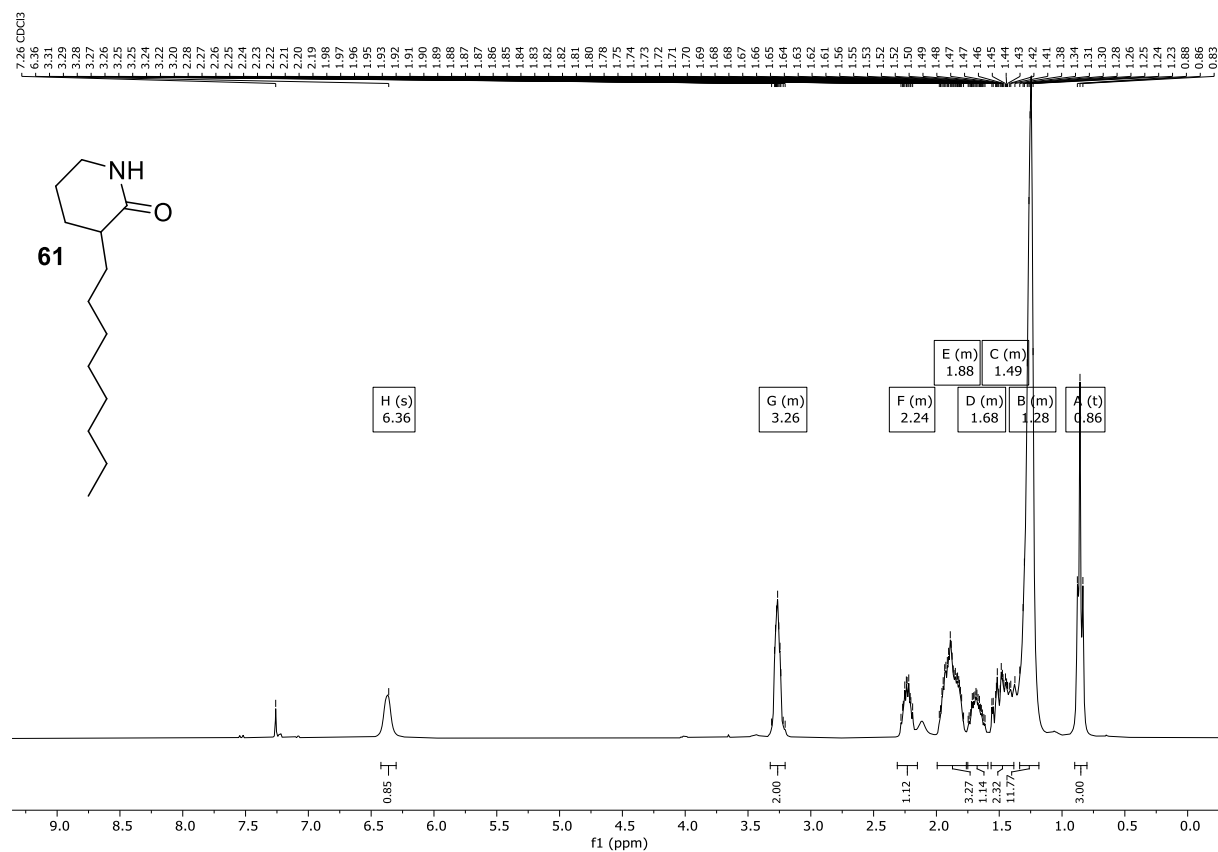


Figure 77: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-octylpiperidin-2-one (**61**).

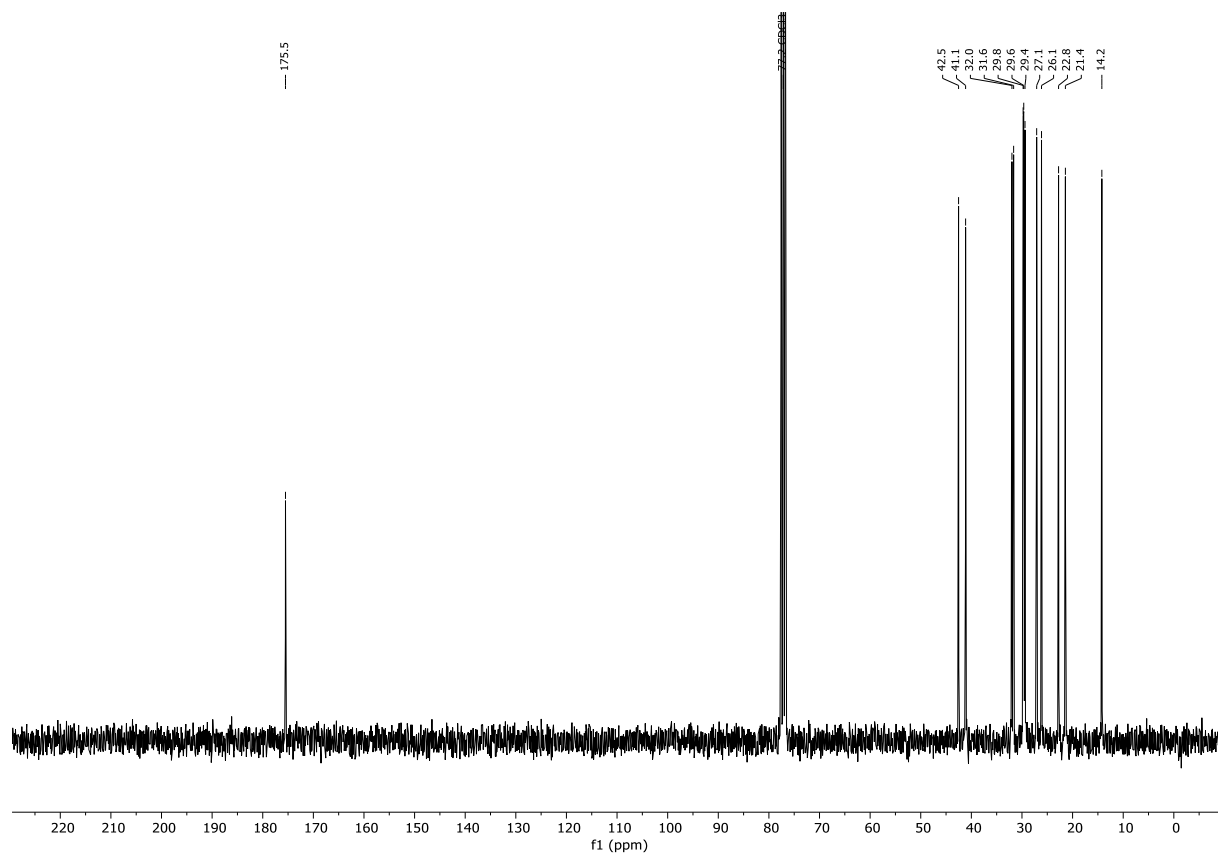


Figure 78: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-octylpiperidin-2-one (**61**).



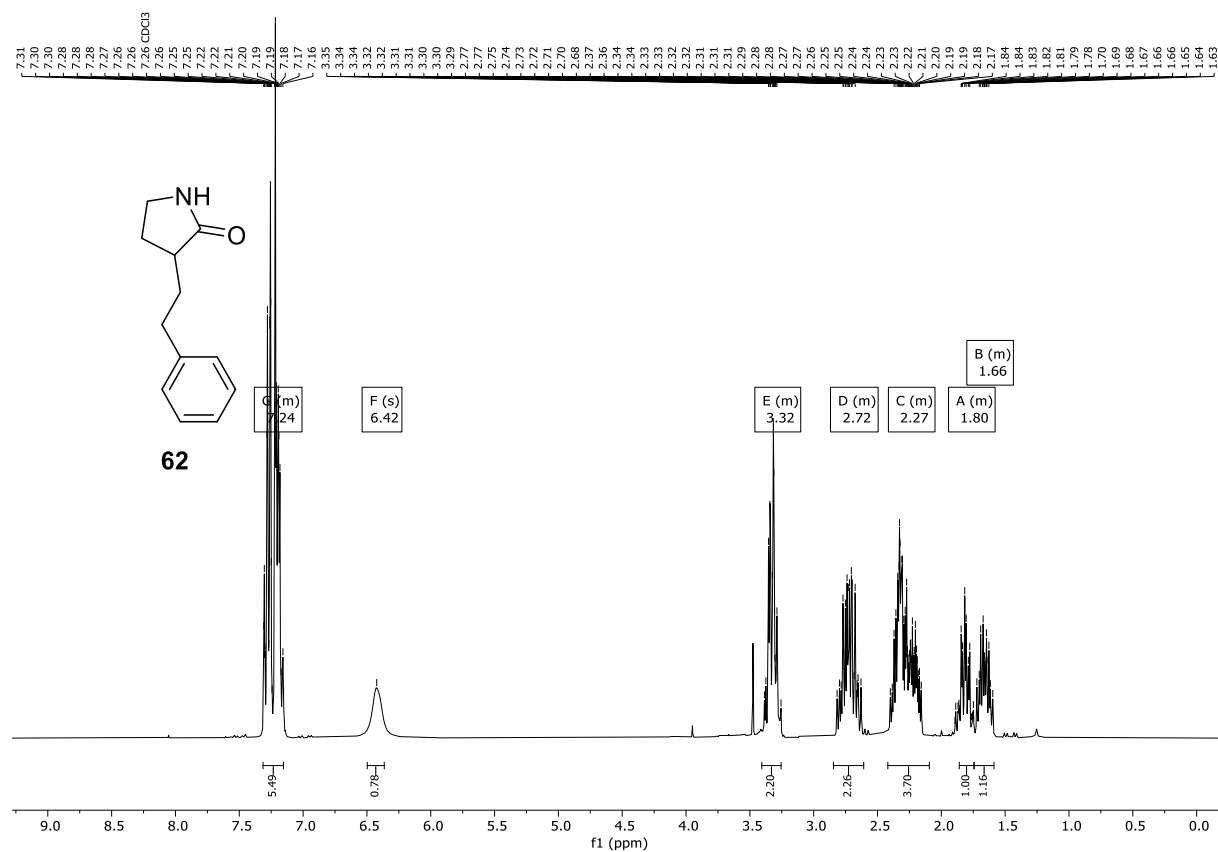


Figure 79: <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) of 3-phenethylpyrrolidin-2-one (**62**).

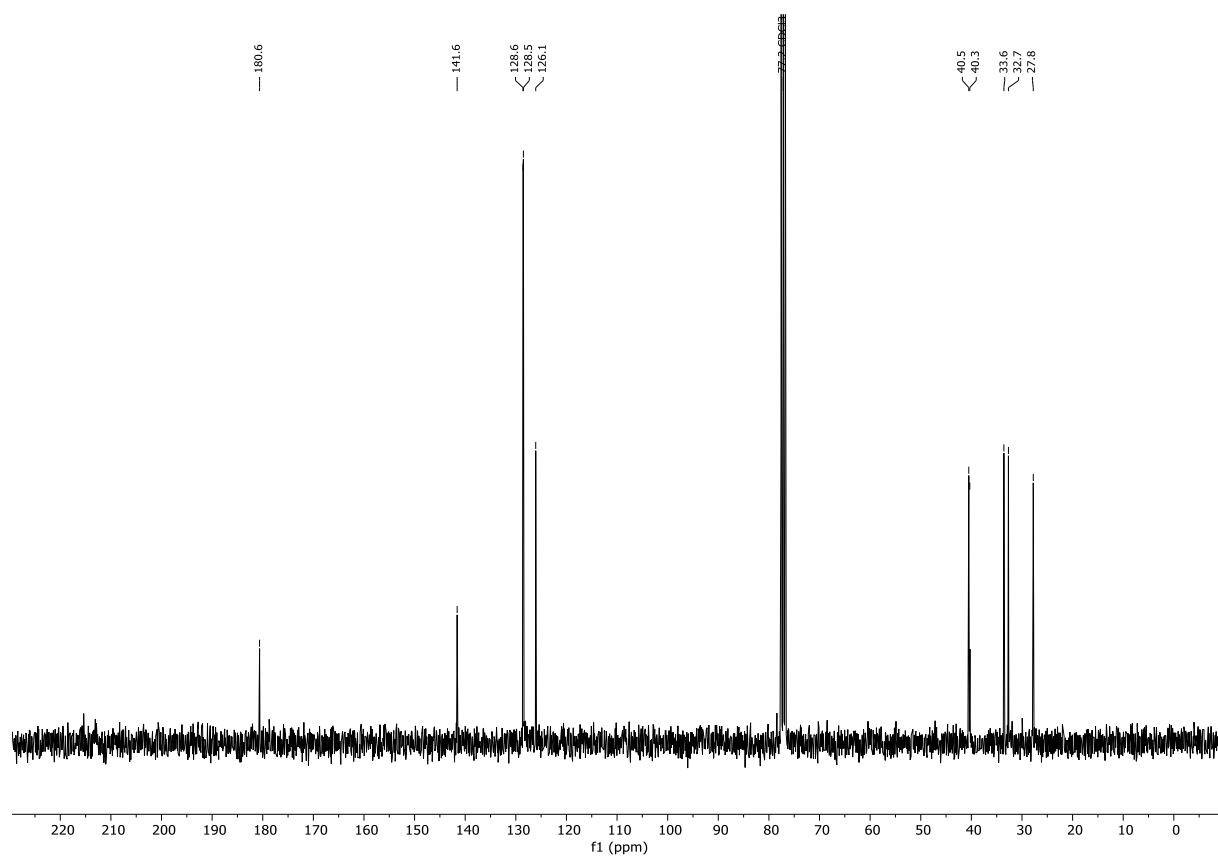
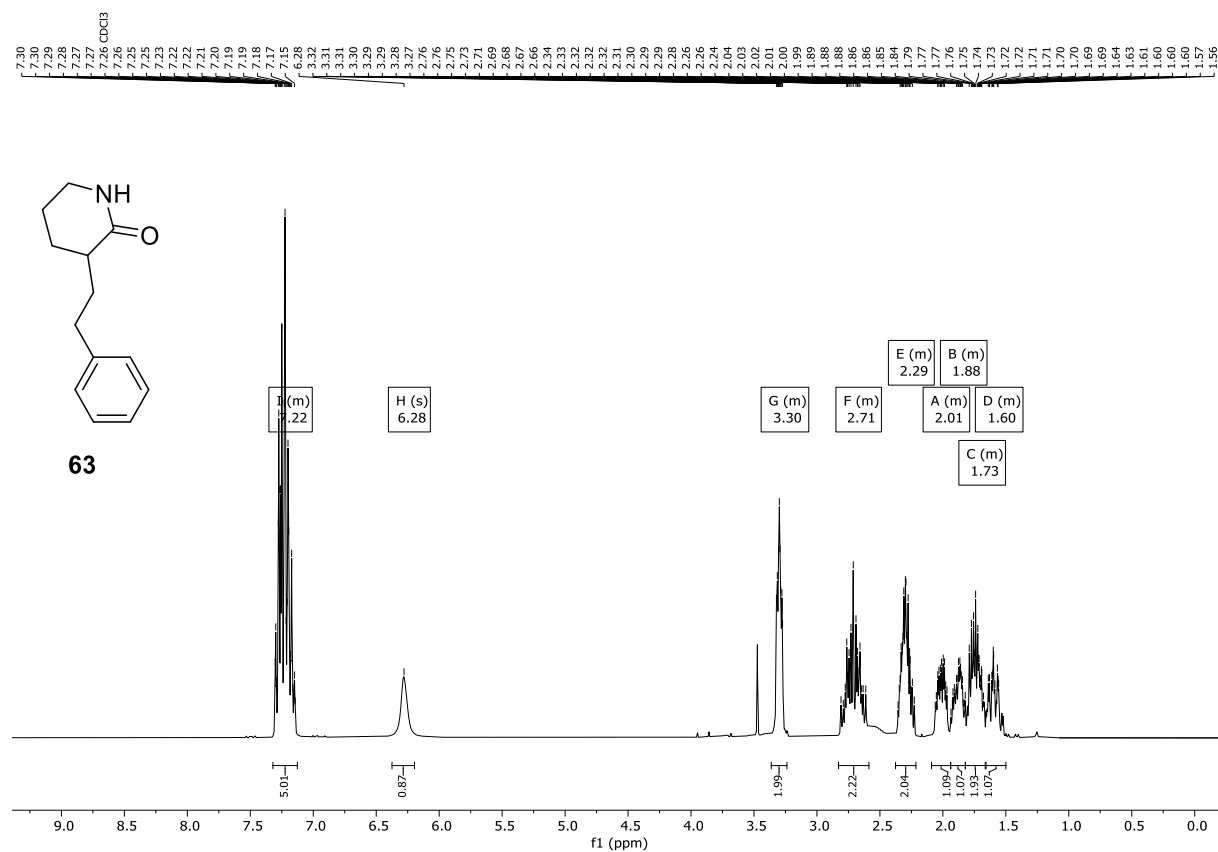
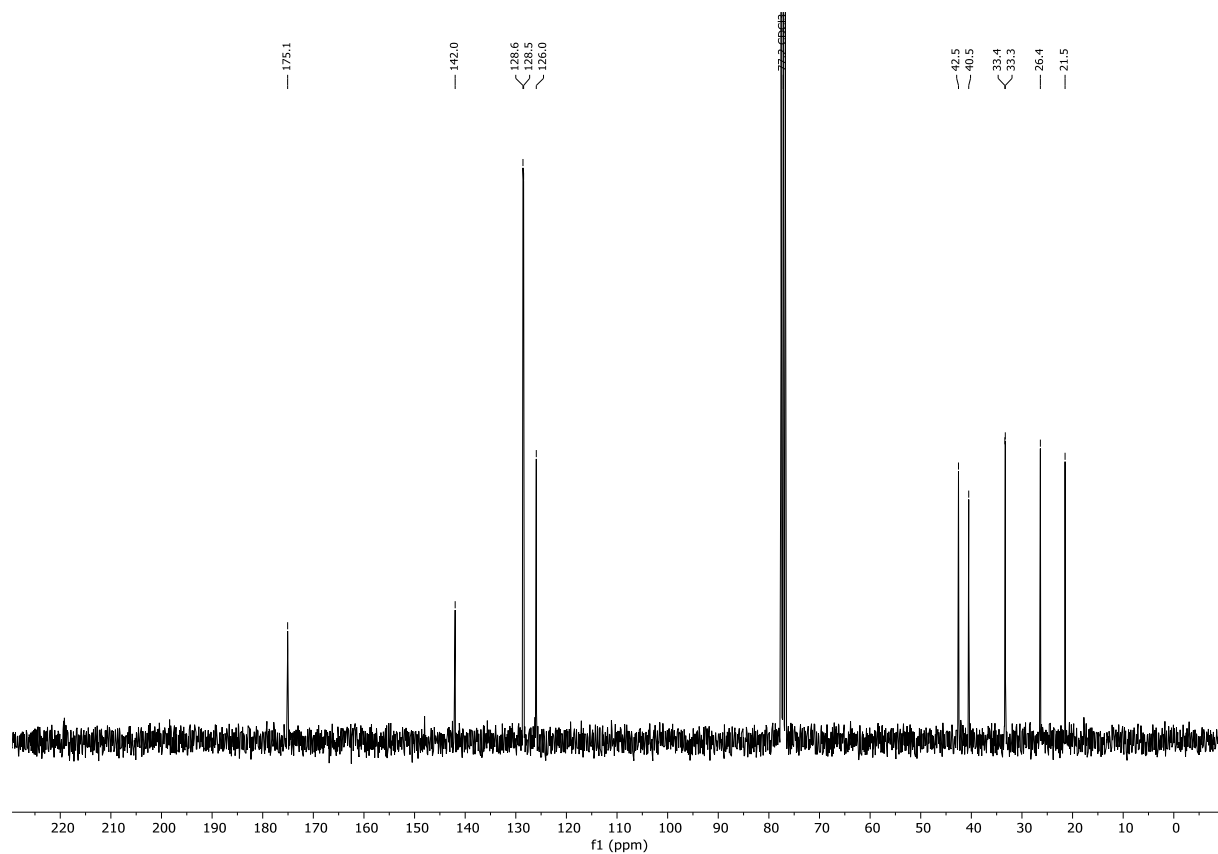


Figure 80: <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) of 3-phenethylpyrrolidin-2-one (**62**).



**Figure 81:**  $^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ ) of 3-phenethylpiperidin-2-one (**63**).



**Figure 82:**  $^{13}\text{C-NMR}$  (75 MHz,  $\text{CDCl}_3$ ) of 3-phenethylpiperidin-2-one (**63**).