

# Nickel-Catalyzed Borylation of Halides and Pseudo-Halides with Tetrahydroxydiboron [B<sub>2</sub>(OH)<sub>4</sub>]

## Supporting Information

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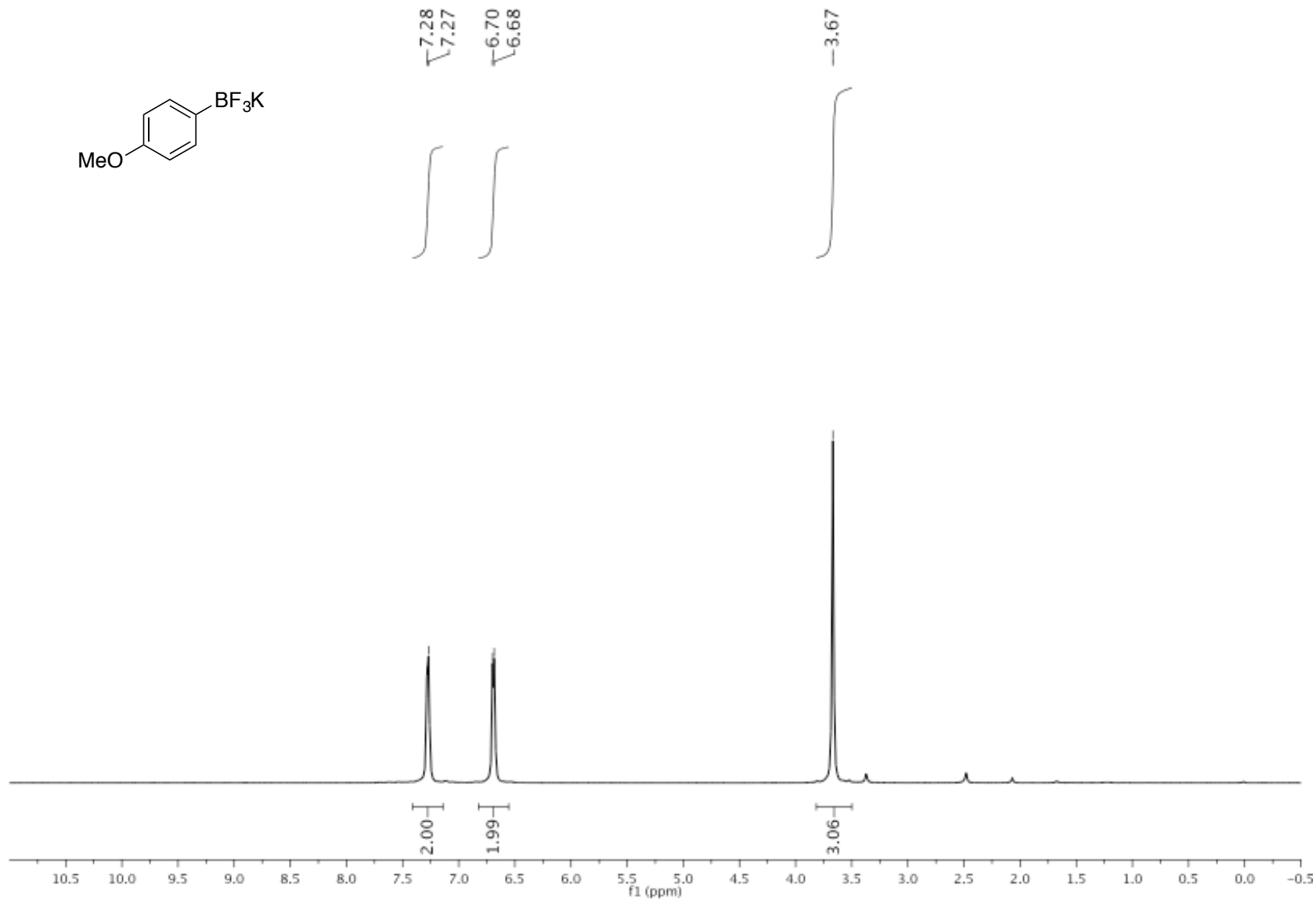
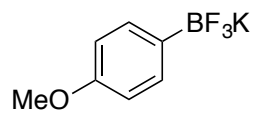
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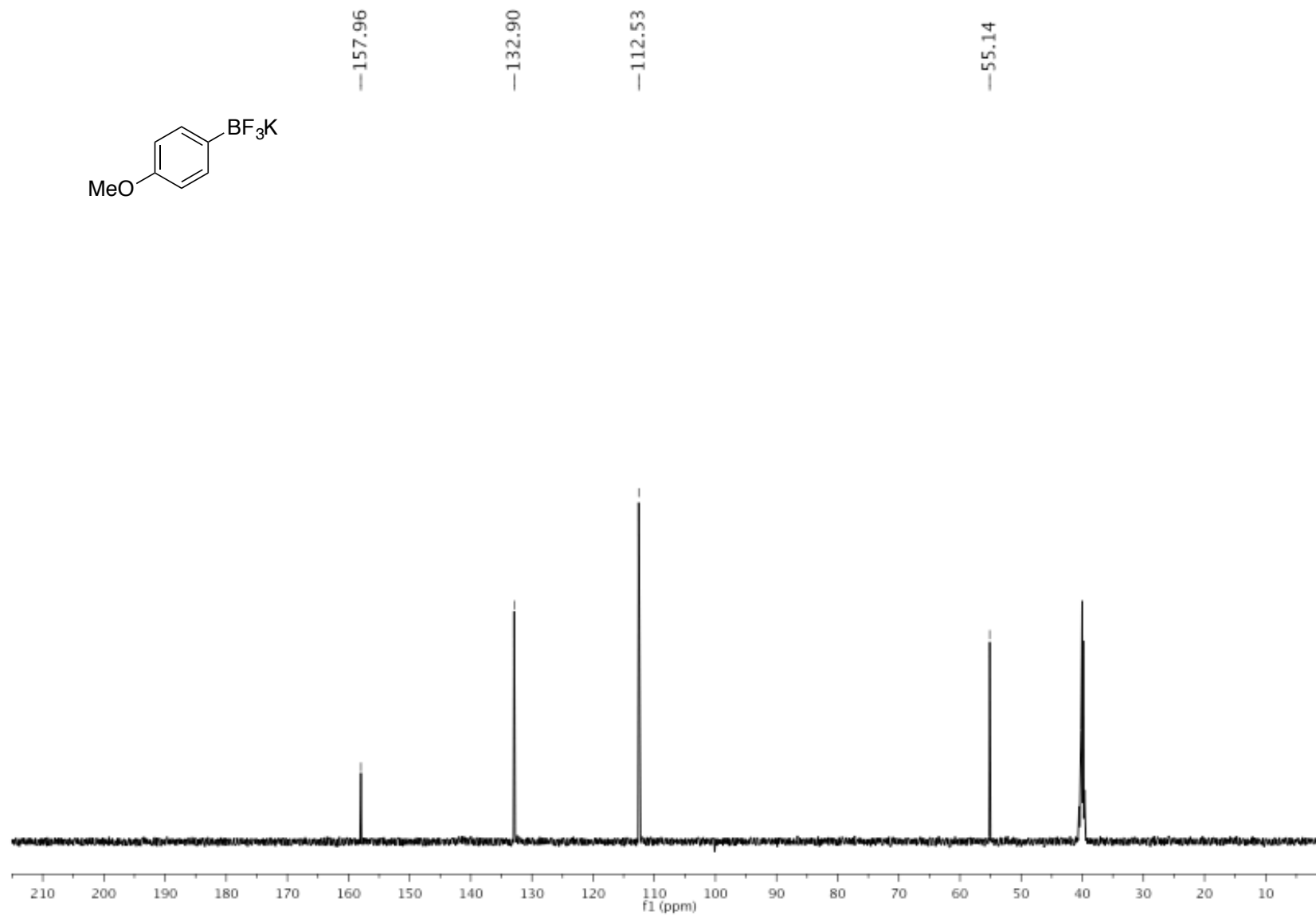
## General Considerations

**Reagents:** All reactions were carried out under and atmosphere of argon. Ethanol (200 proof, non-anhydrous) was degassed (1 h) with argon prior to use. Aryl halides were purchased from commercial sources and used as received. Tetrahydroxydiboron (BBA) was provided by AllyChem co. Ltd. The catalyst and ligand used in this method were purchased from commercial sources and used without purification. BBA, NiCl<sub>2</sub>(dppp), and PPh<sub>3</sub> were stored on a bench-top desiccator.

**Analytical Methods:** Melting points (°C) are uncorrected. All known compounds were characterized by <sup>1</sup>H, <sup>13</sup>C, <sup>19</sup>F, and <sup>11</sup>B NMR spectra, and melting point determination (for solids) and compared with literature values. All new compounds were characterized by <sup>1</sup>H, <sup>13</sup>C, <sup>19</sup>F, and <sup>11</sup>B NMR spectra, IR spectroscopy, high-resolution mass spectrometry (HRMS) and melting point determination (for solids). <sup>1</sup>H, <sup>13</sup>C, <sup>19</sup>F and <sup>11</sup>B NMR spectra were recorded at 500.4, 125.8, 470.8 and 128.4 MHz, respectively. <sup>19</sup>F NMR chemical shifts were referenced to external CFCl<sub>3</sub> (0.0 ppm). <sup>11</sup>B NMR chemical shifts were referenced to external BF<sub>3</sub>•OEt<sub>2</sub> (0.0 ppm) with a negative sign indicating an upfield shift. HRMS (CI) data were obtained in Pos mode, using methane as the ionizing gas. HRMS (ESI) data were obtained in Pos or Neg mode.

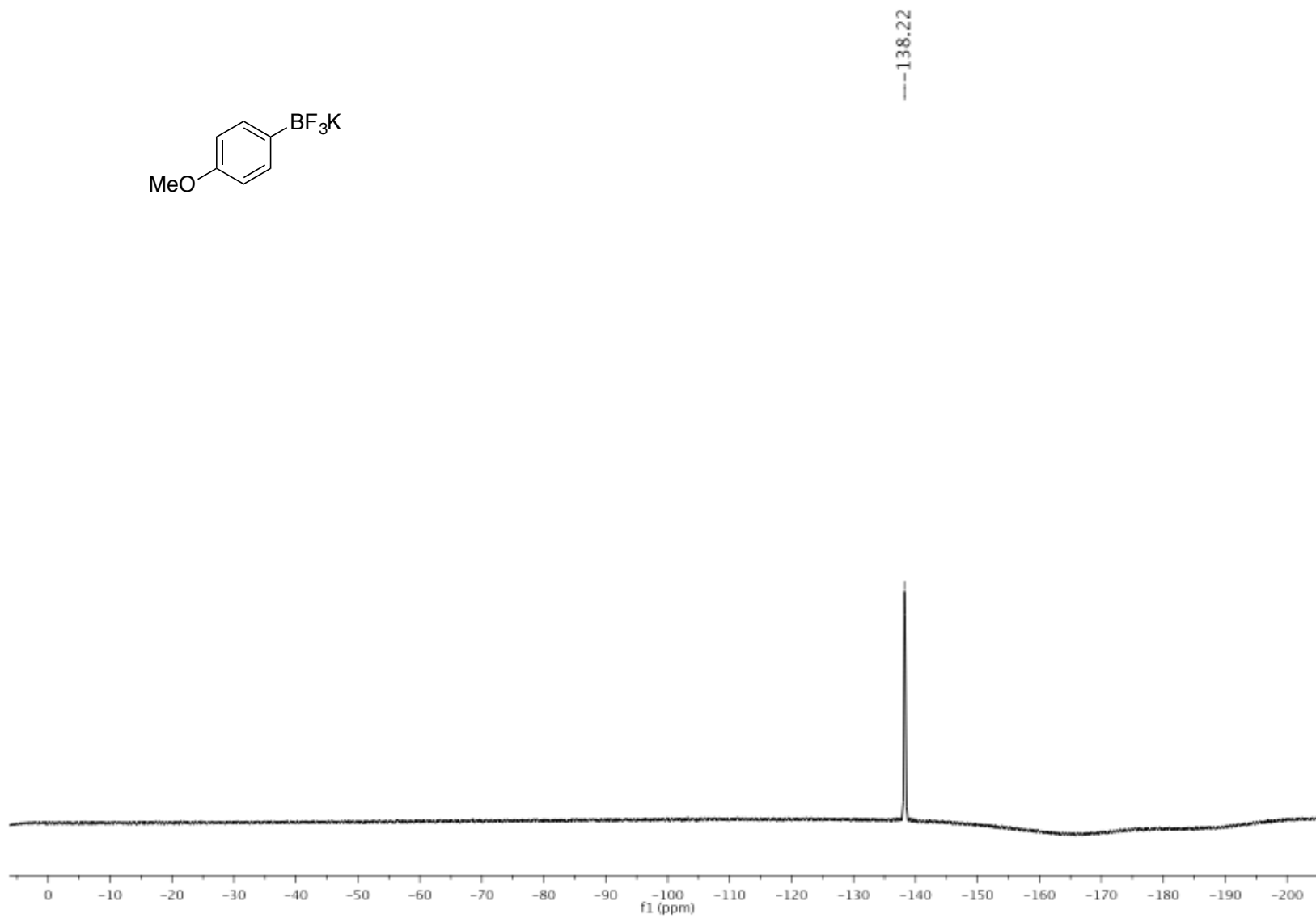
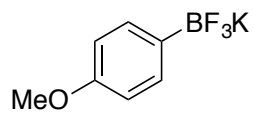


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-methoxyphenyl)borate (1a, Table 1, entry 1)**

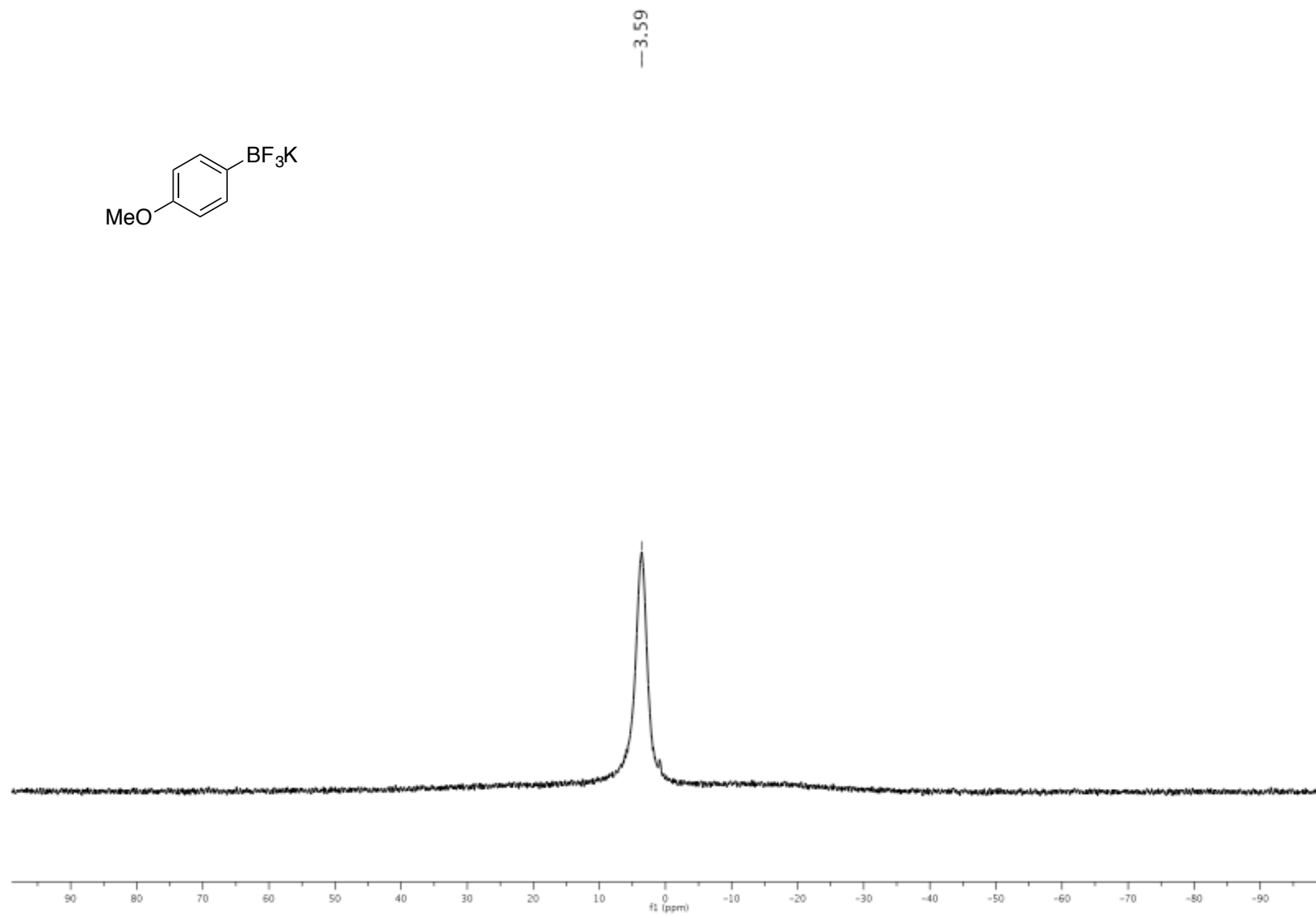
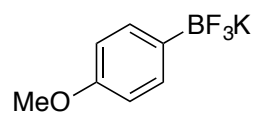


$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-methoxyphenyl)borate (1a, Table 1, entry 1)

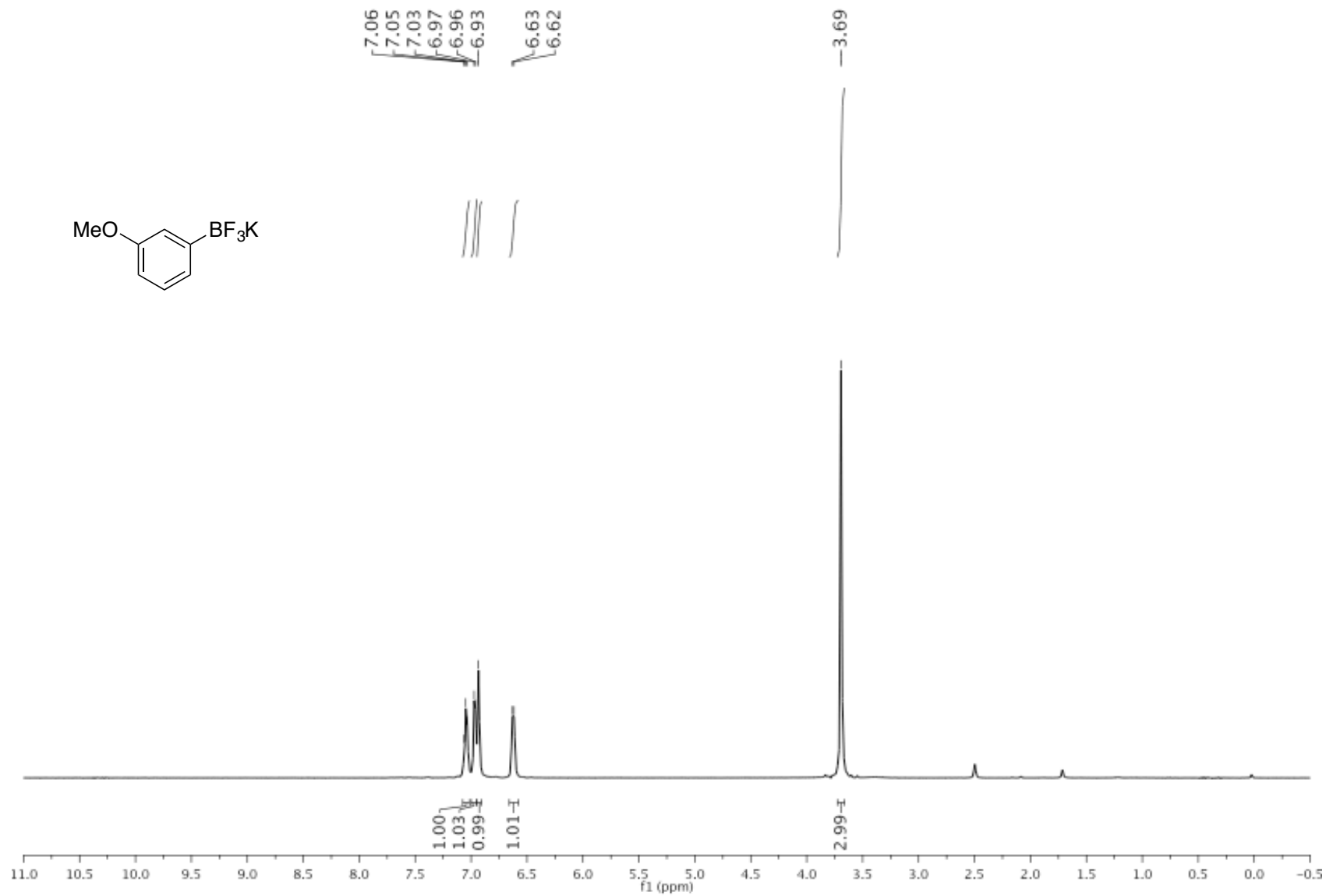




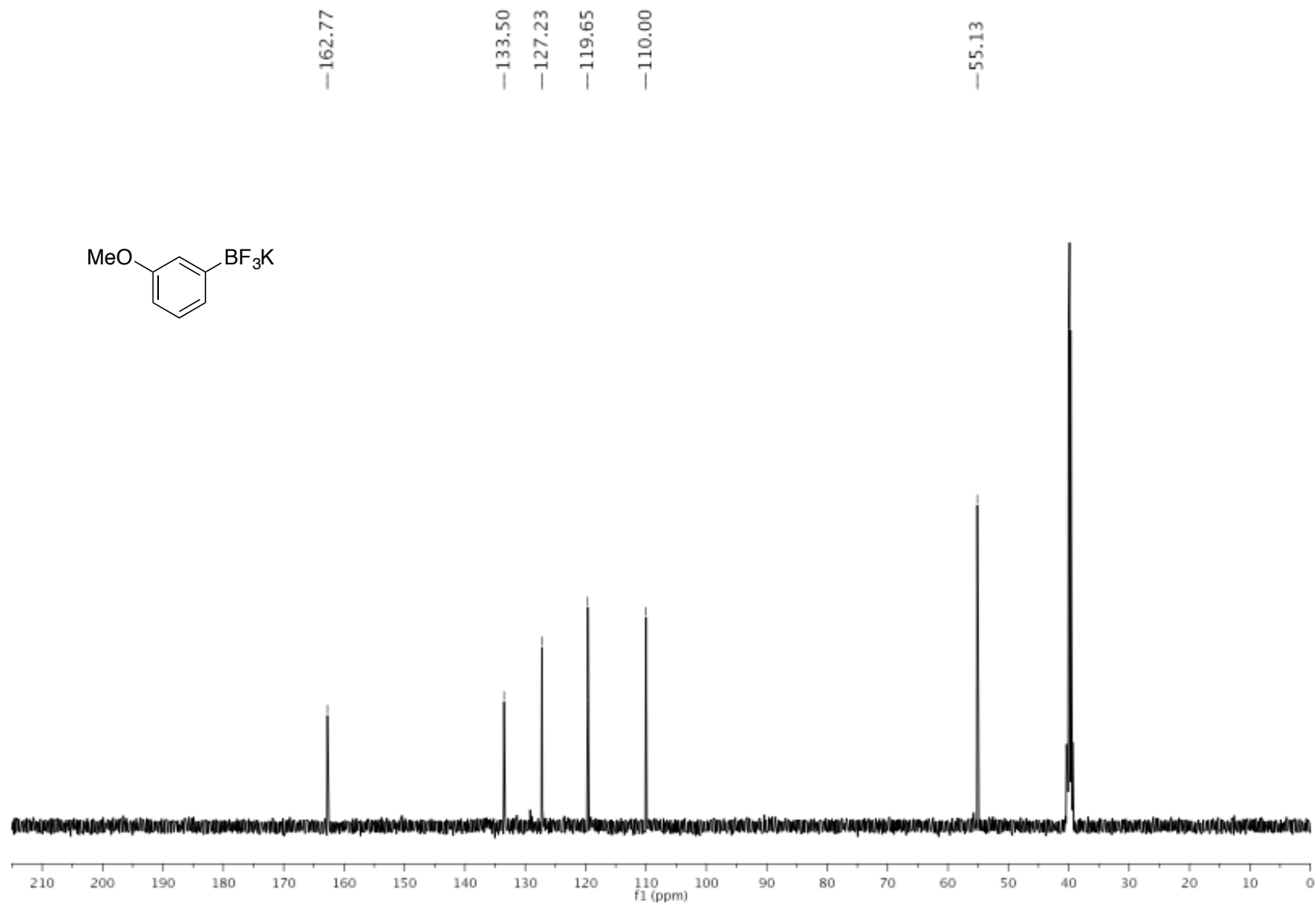
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-methoxyphenyl)borate (1a, Table 1, entry 1)**



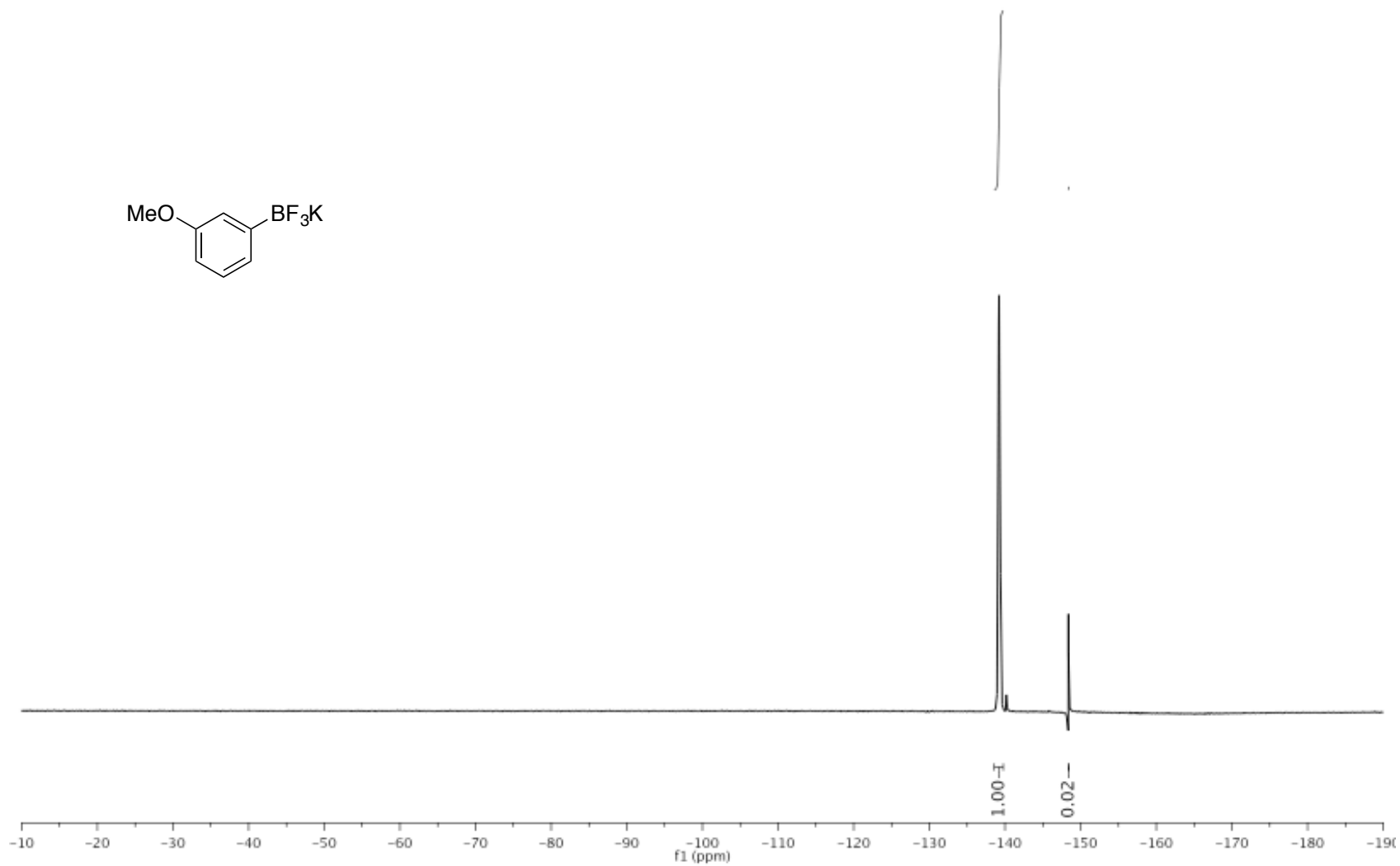
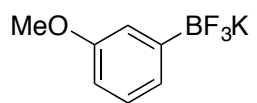
**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-methoxyphenyl)borate (1a, Table 1, entry 1)**



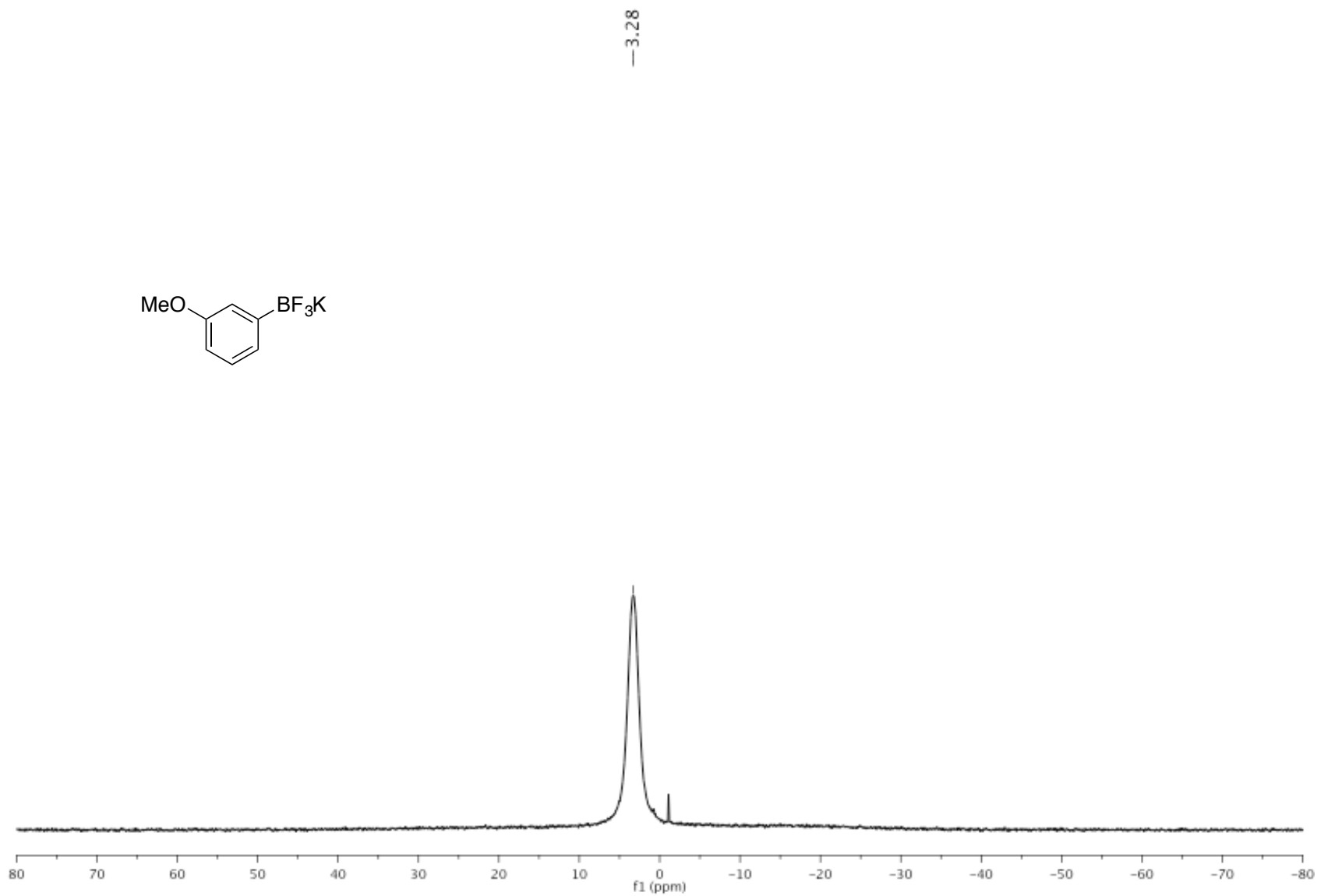
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(3-methoxyphenyl)borate (1b, Table 1, entry 2)**



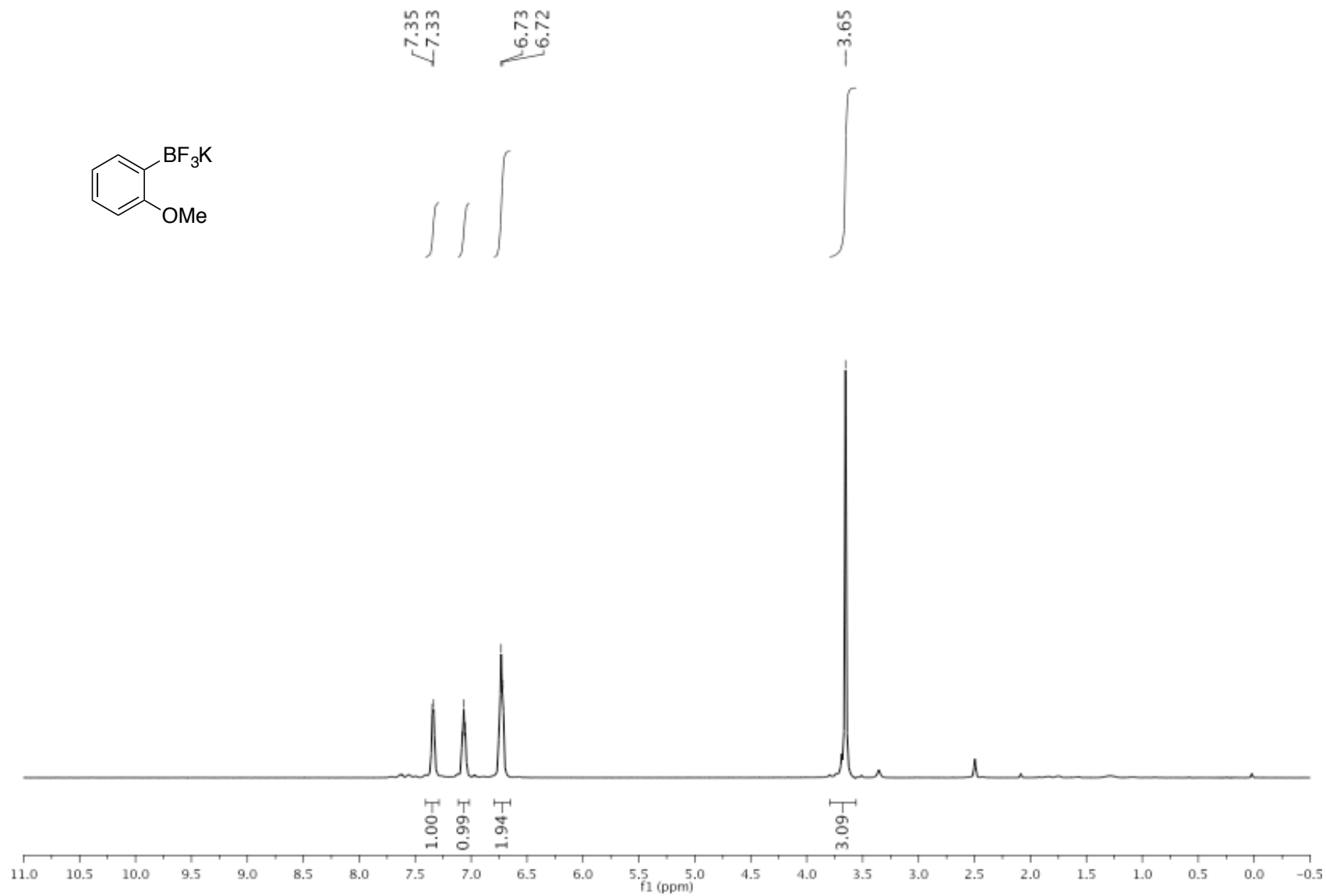
$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(3-methoxyphenyl)borate (1b, Table 1, entry 2)



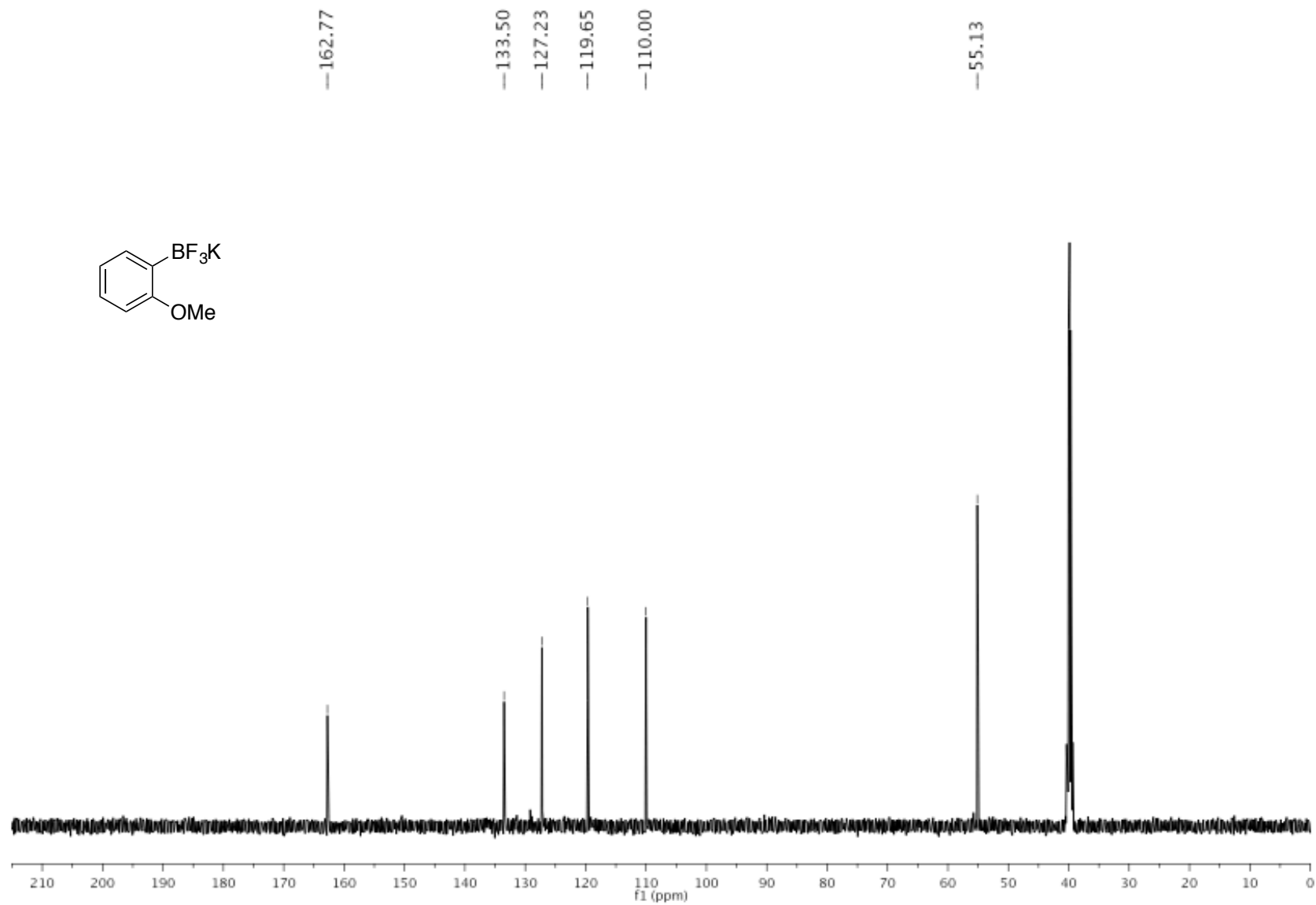
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(3-methoxyphenyl)borate (1b, Table 1, entry 2)**



$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(3-methoxyphenyl)borate (1b, Table 1, entry 2)

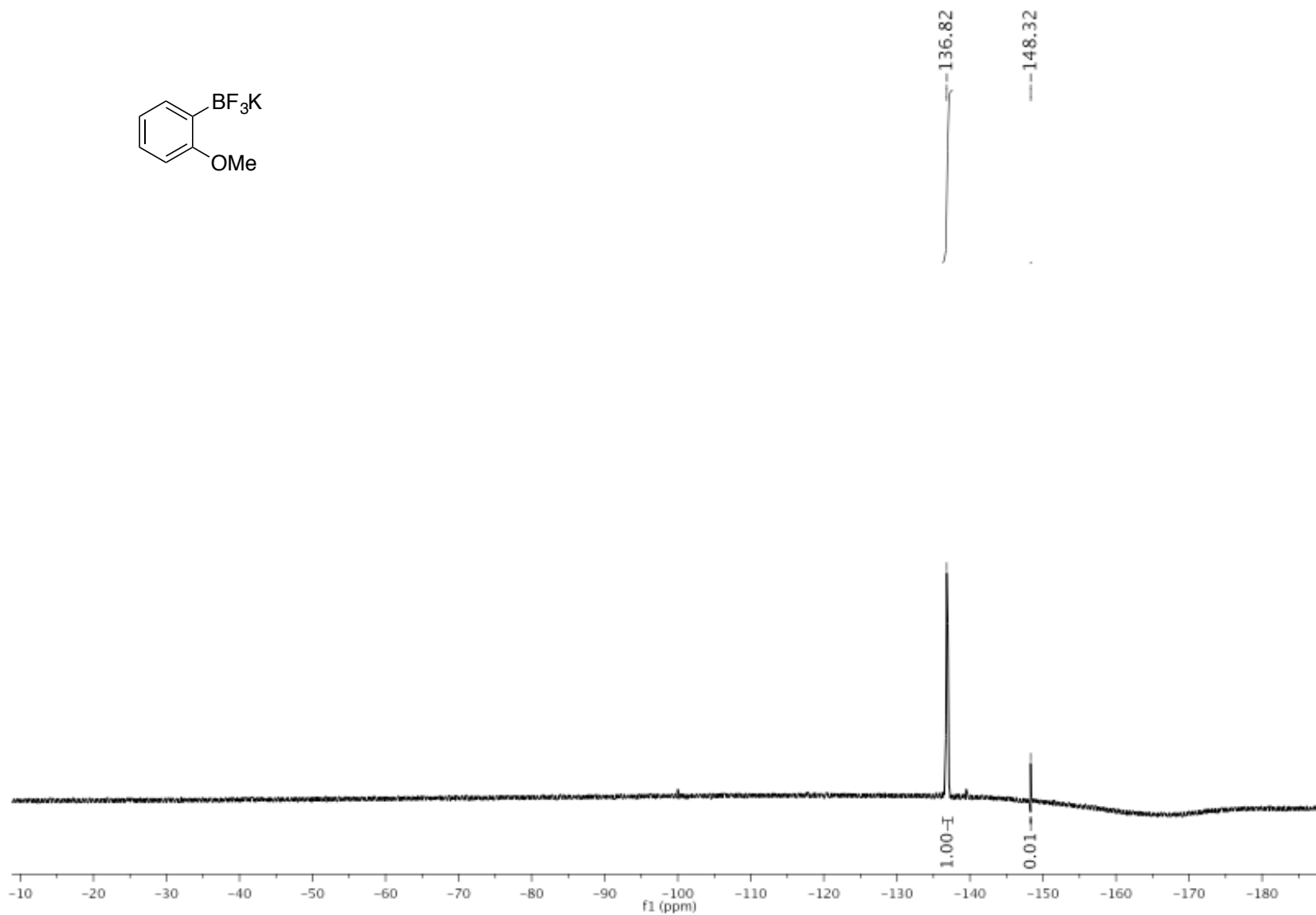
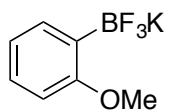


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-methoxyphenyl)borate (1c, Table 1, entry 3)**

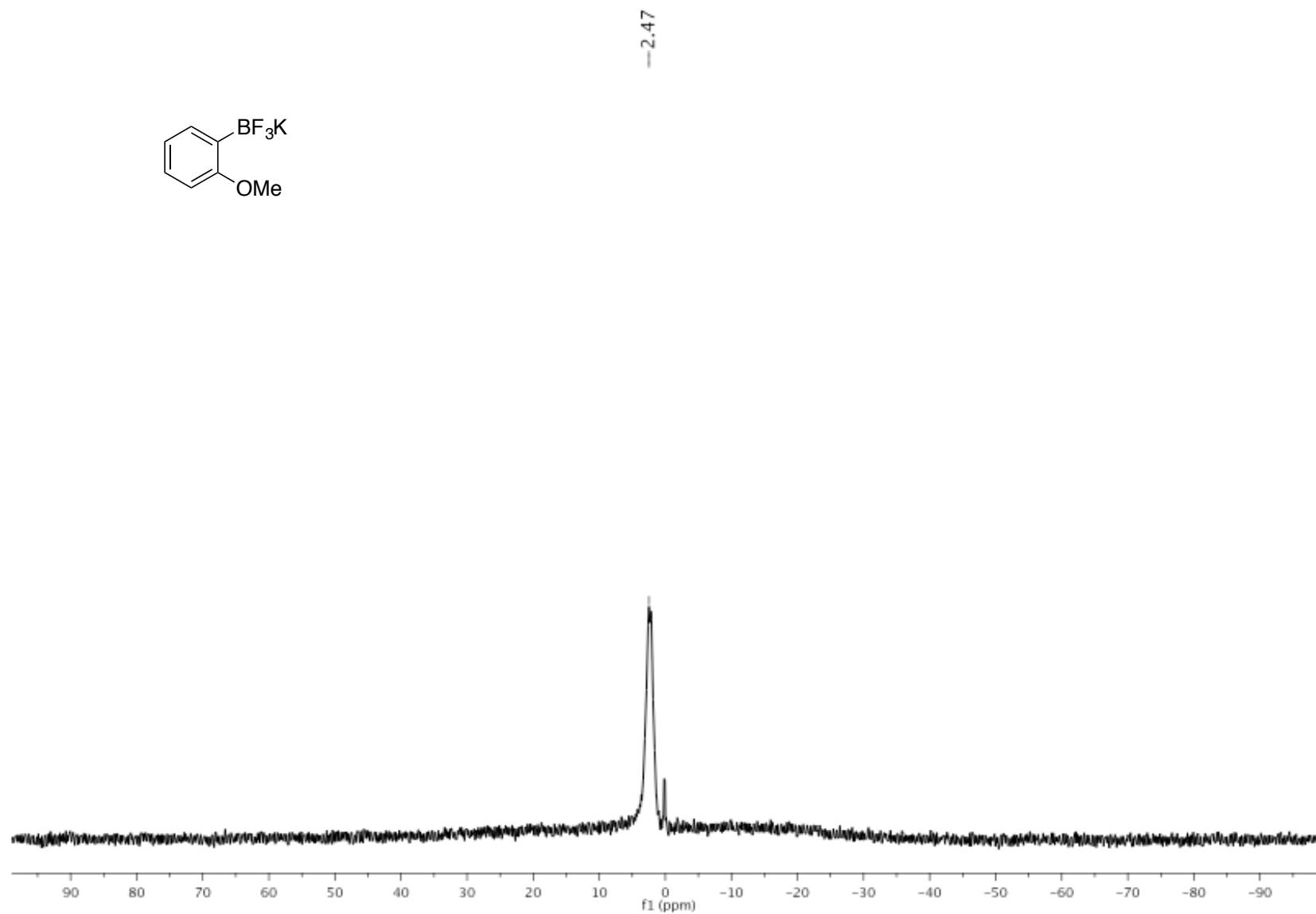


$^{13}\text{C}$  NMR (128.5 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(2-methoxyphenyl)borate (1c, Table 1, entry 3)

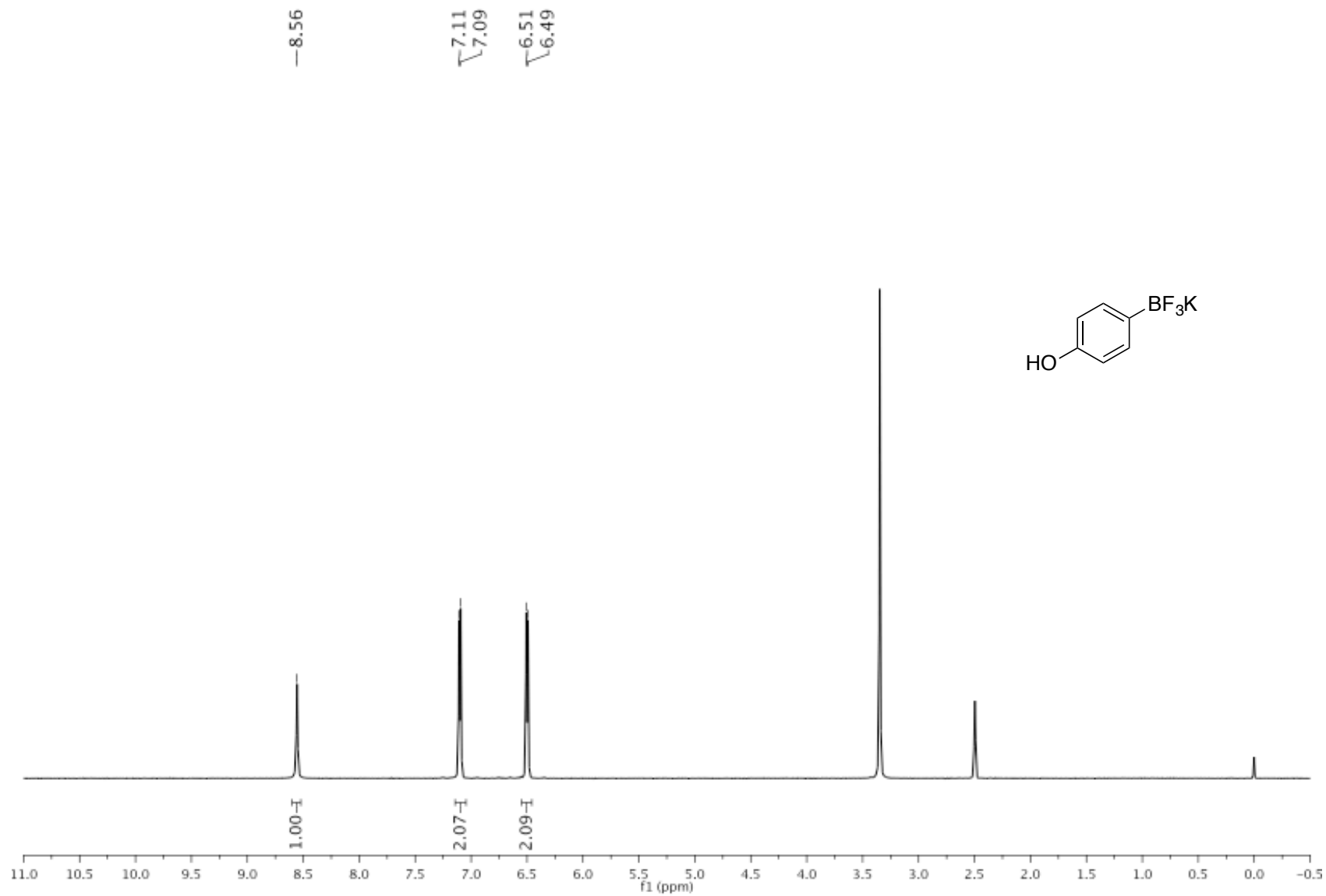




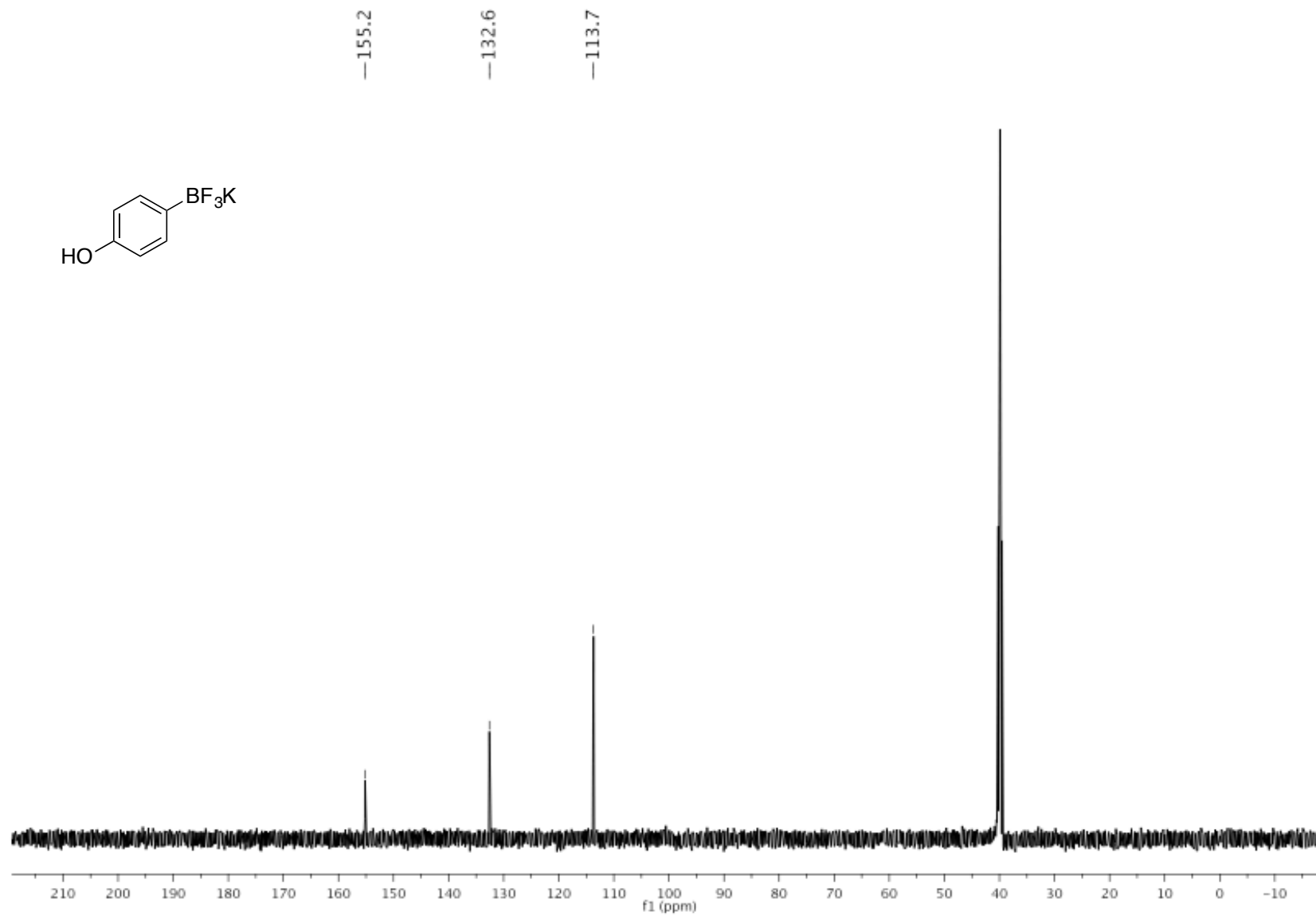
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-methoxyphenyl)borate (1c, Table 1, entry 3)**



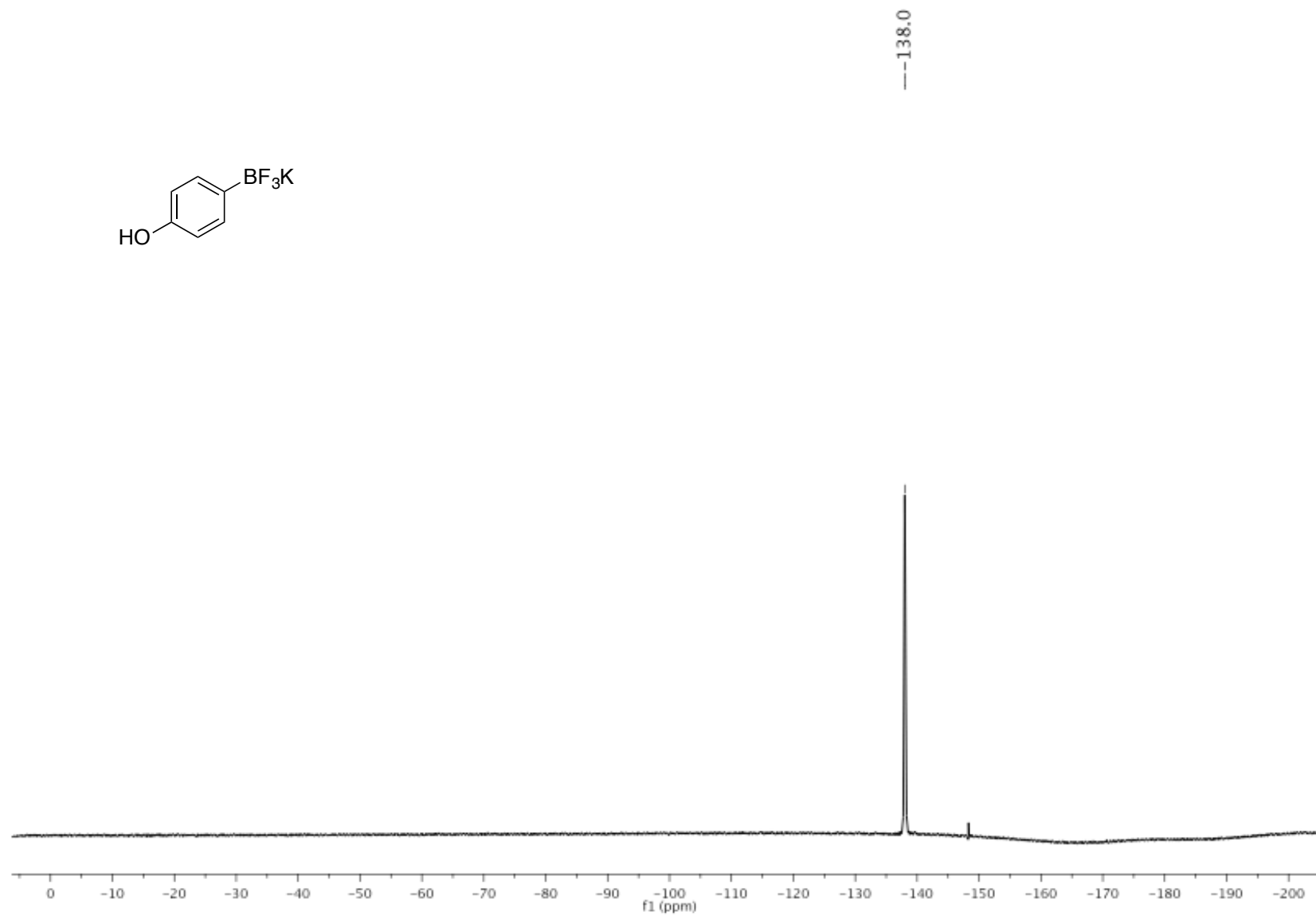
$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(2-methoxyphenyl)borate (1c, Table 1, entry 3)



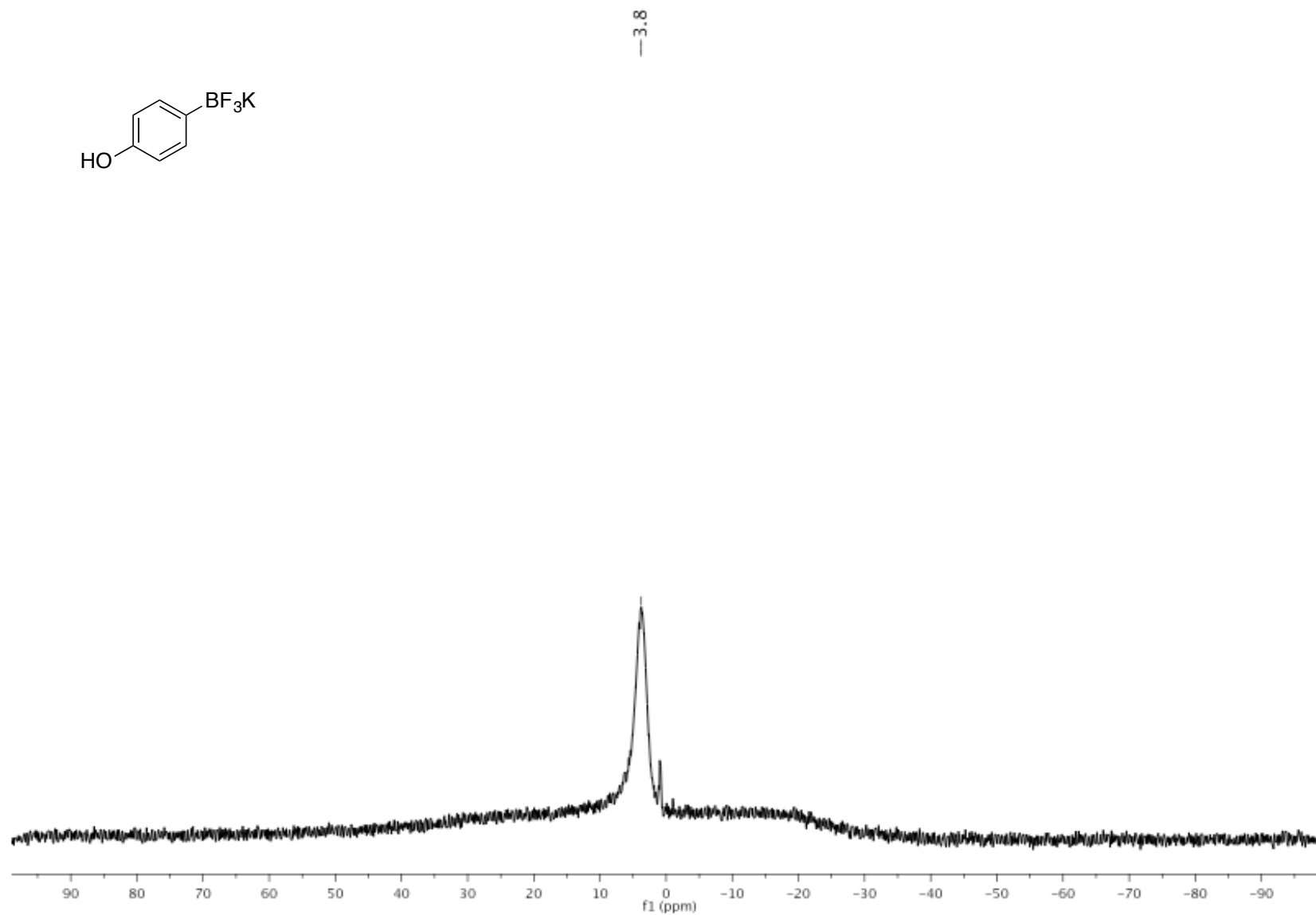
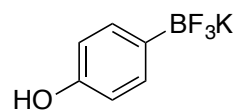
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-hydroxyphenyl)borate (1d, Table 1, entry 4)**



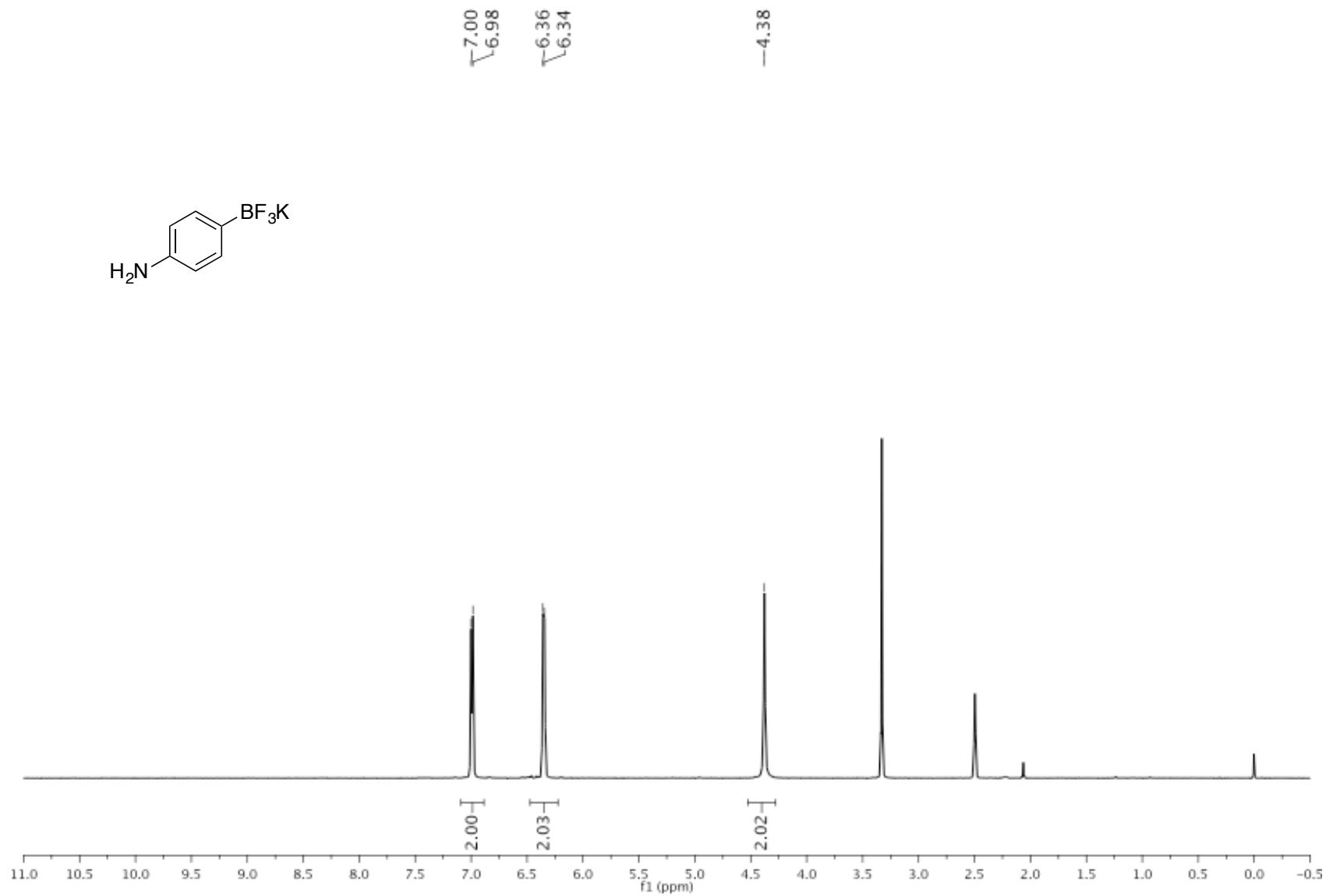
$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-hydroxyphenyl)borate (1d, Table 1, entry 4)



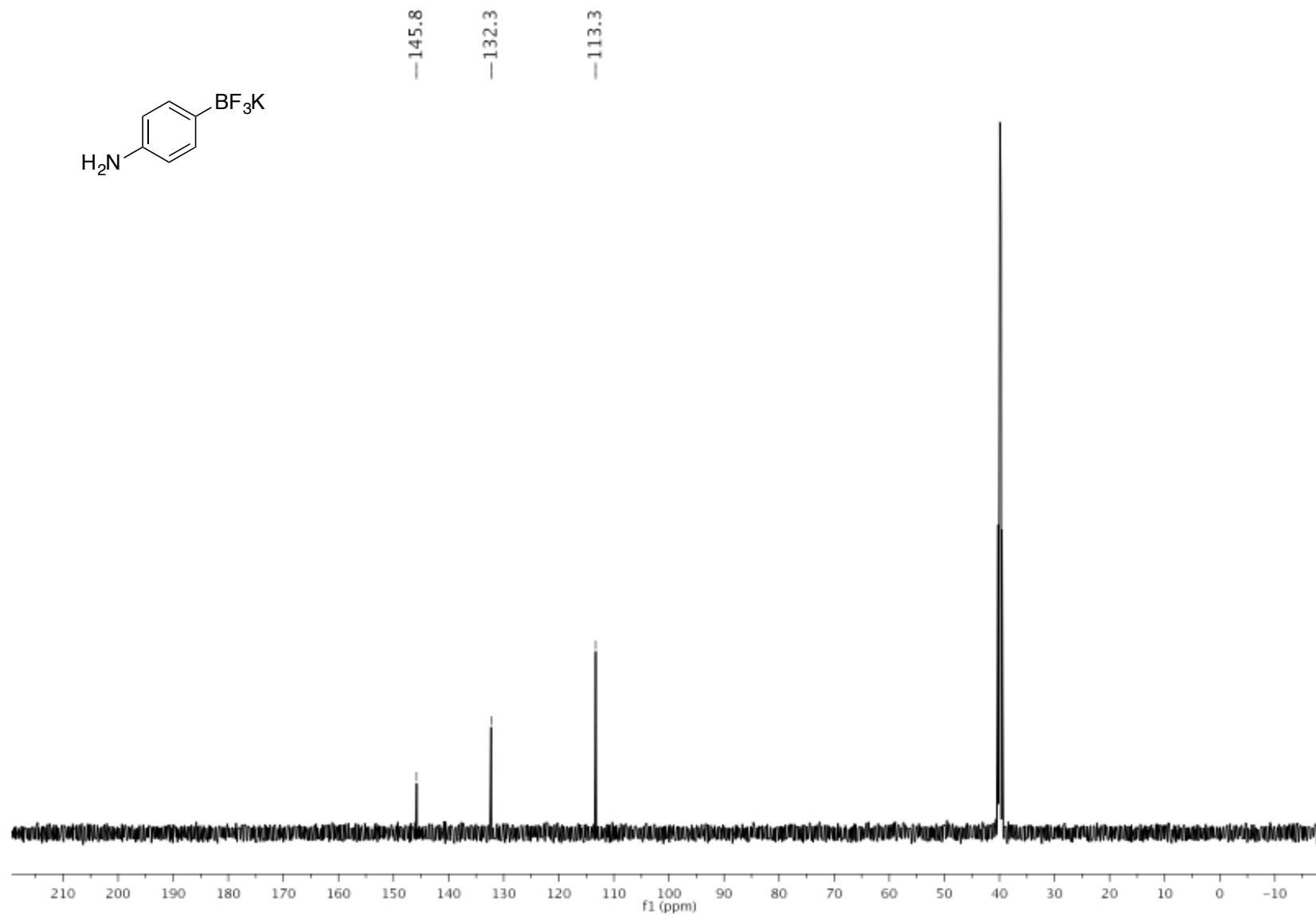
$^{19}\text{F}$  NMR (470.8 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-hydroxyphenyl)borate (1d, Table 1, entry 4)



**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-hydroxyphenyl)borate (1d, Table 1, entry 4)**

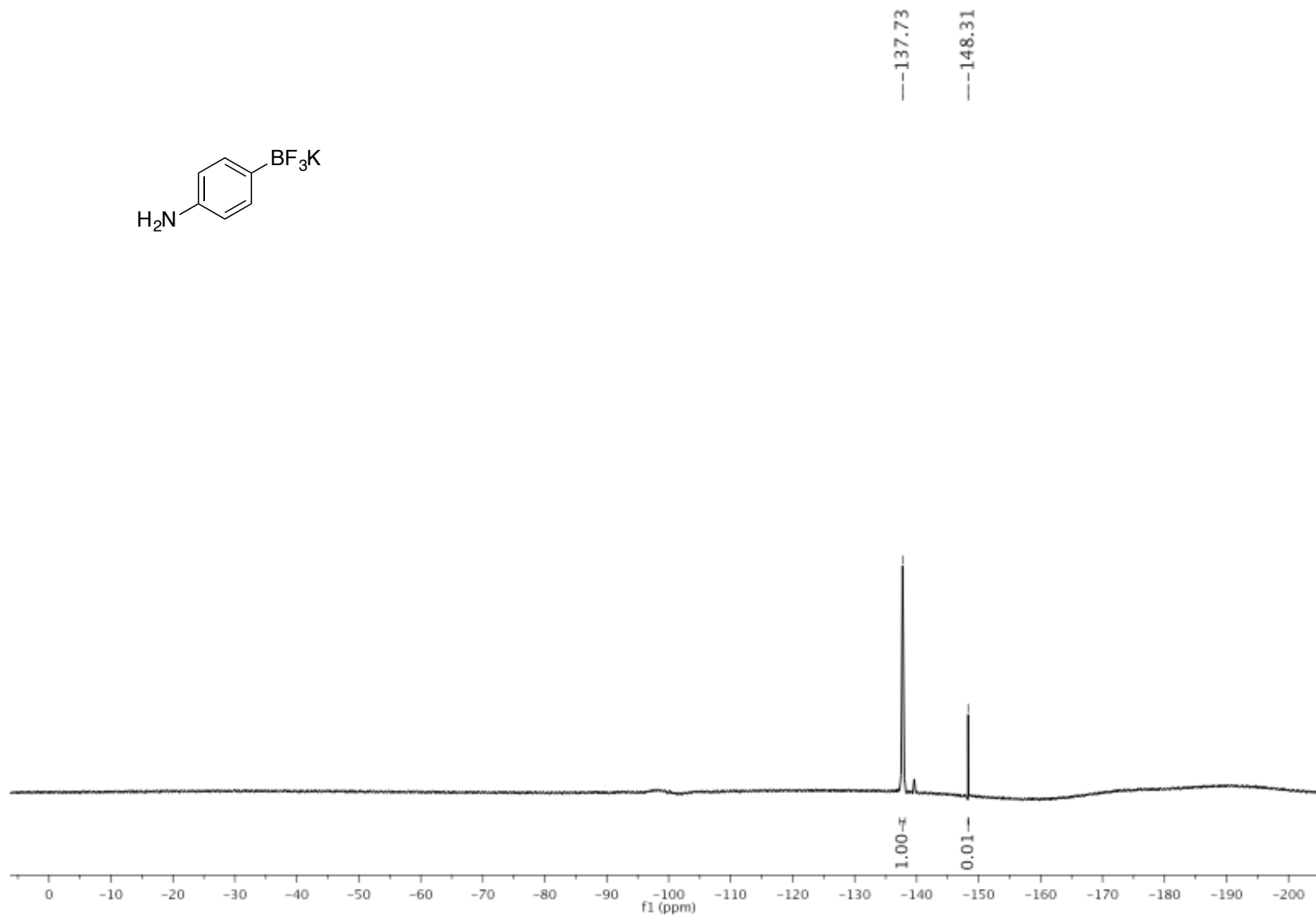
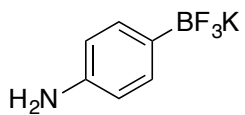


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Aminophenyl)trifluoroborate (1e, Table 1, entry 5)**

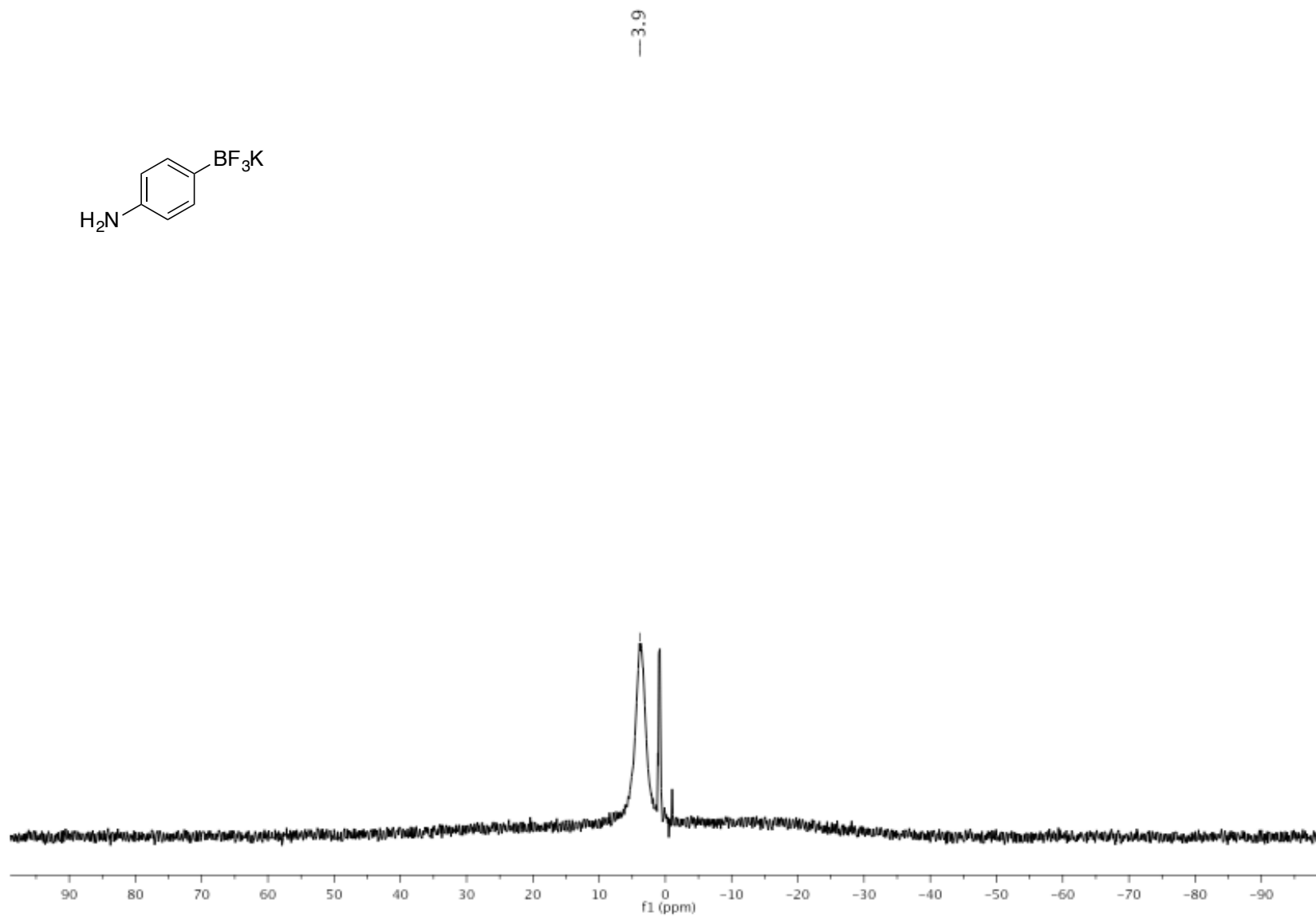
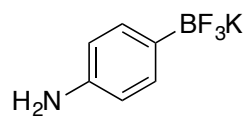


$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium (4-Aminophenyl)trifluoroborate (1e, Table 1, entry 5)

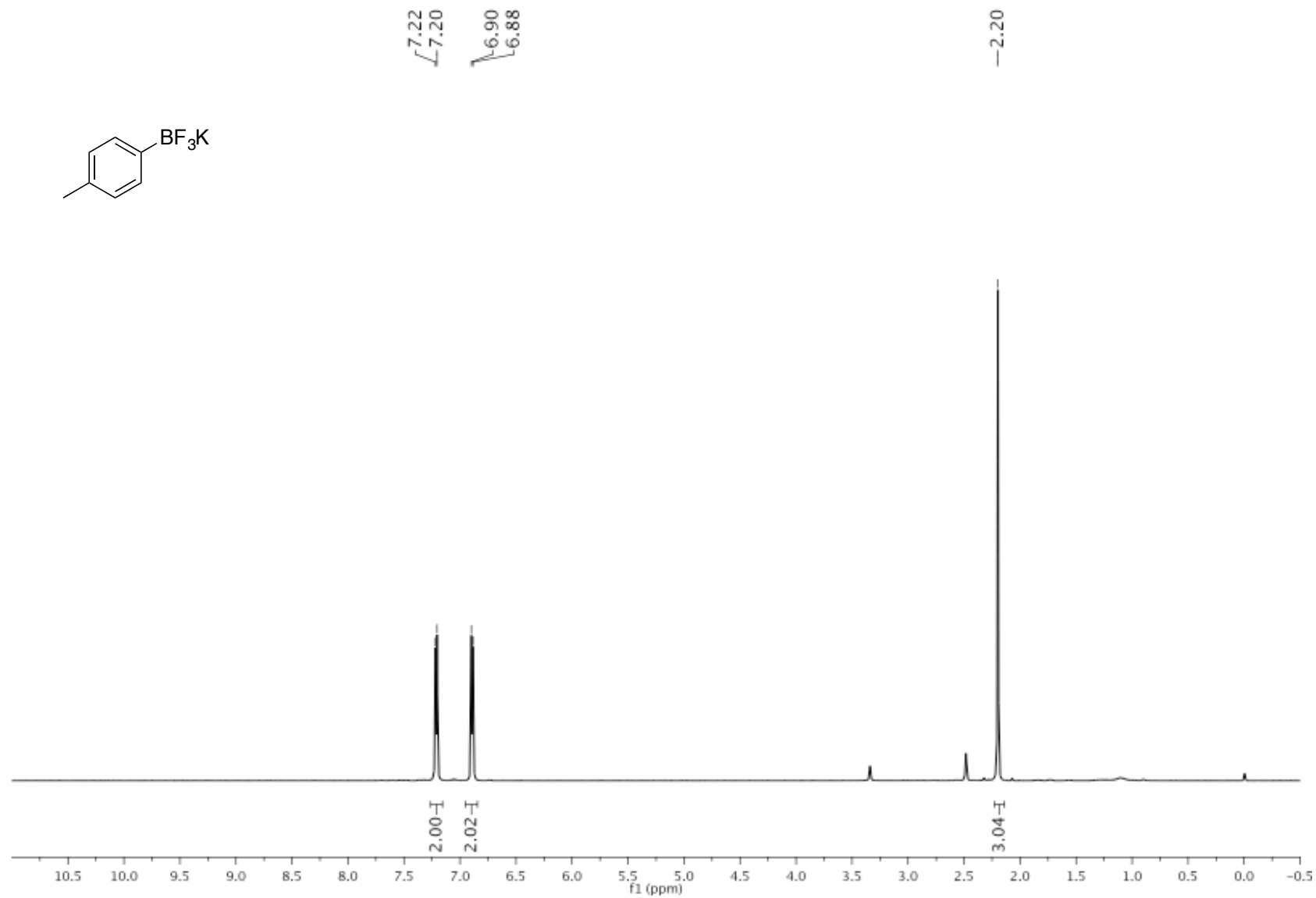




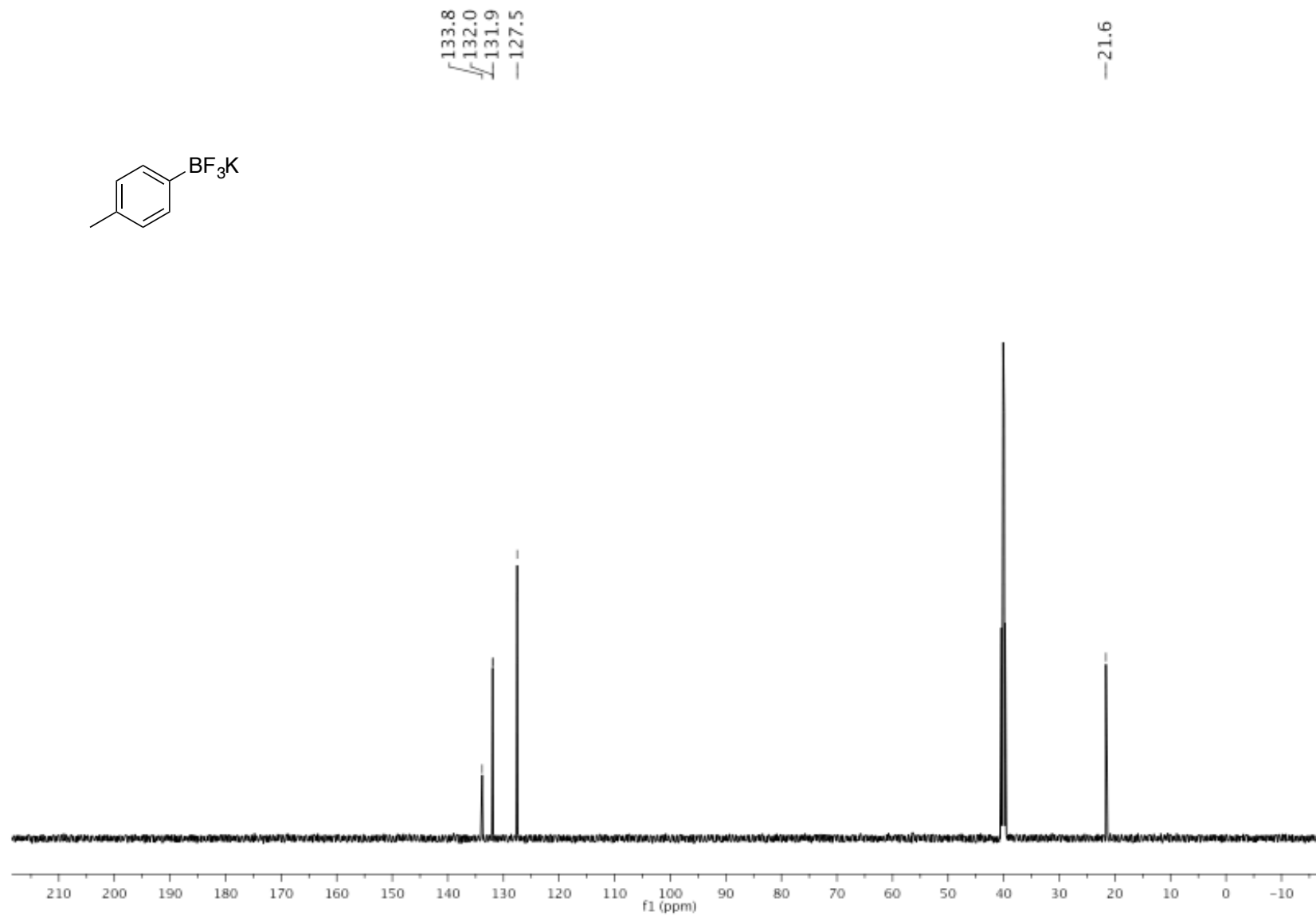
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium (4-Aminophenyl)trifluoroborate (1e, Table 1, entry 5)



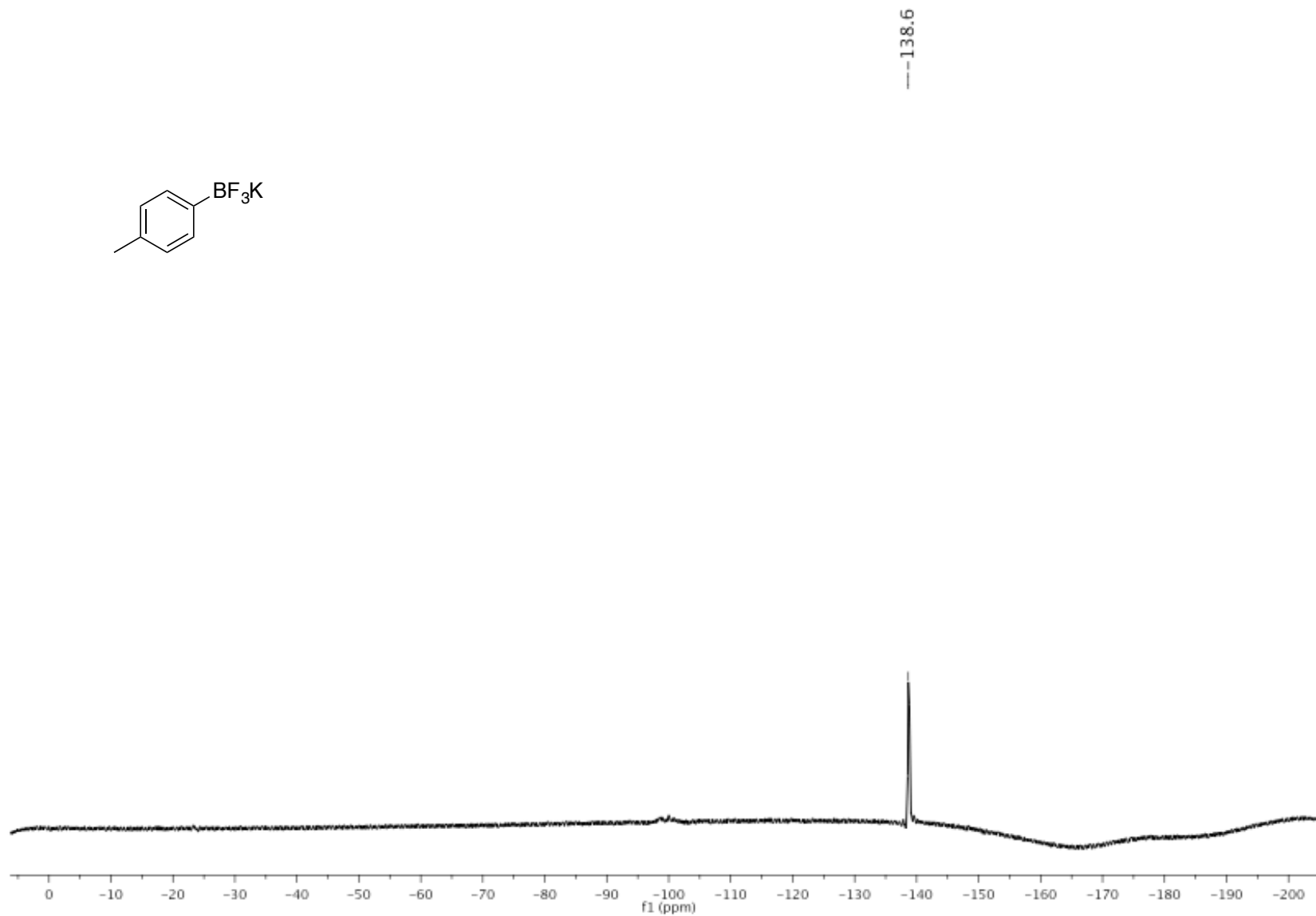
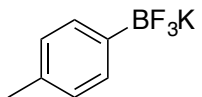
**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Aminophenyl)trifluoroborate (1e, Table 1, entry 5)**



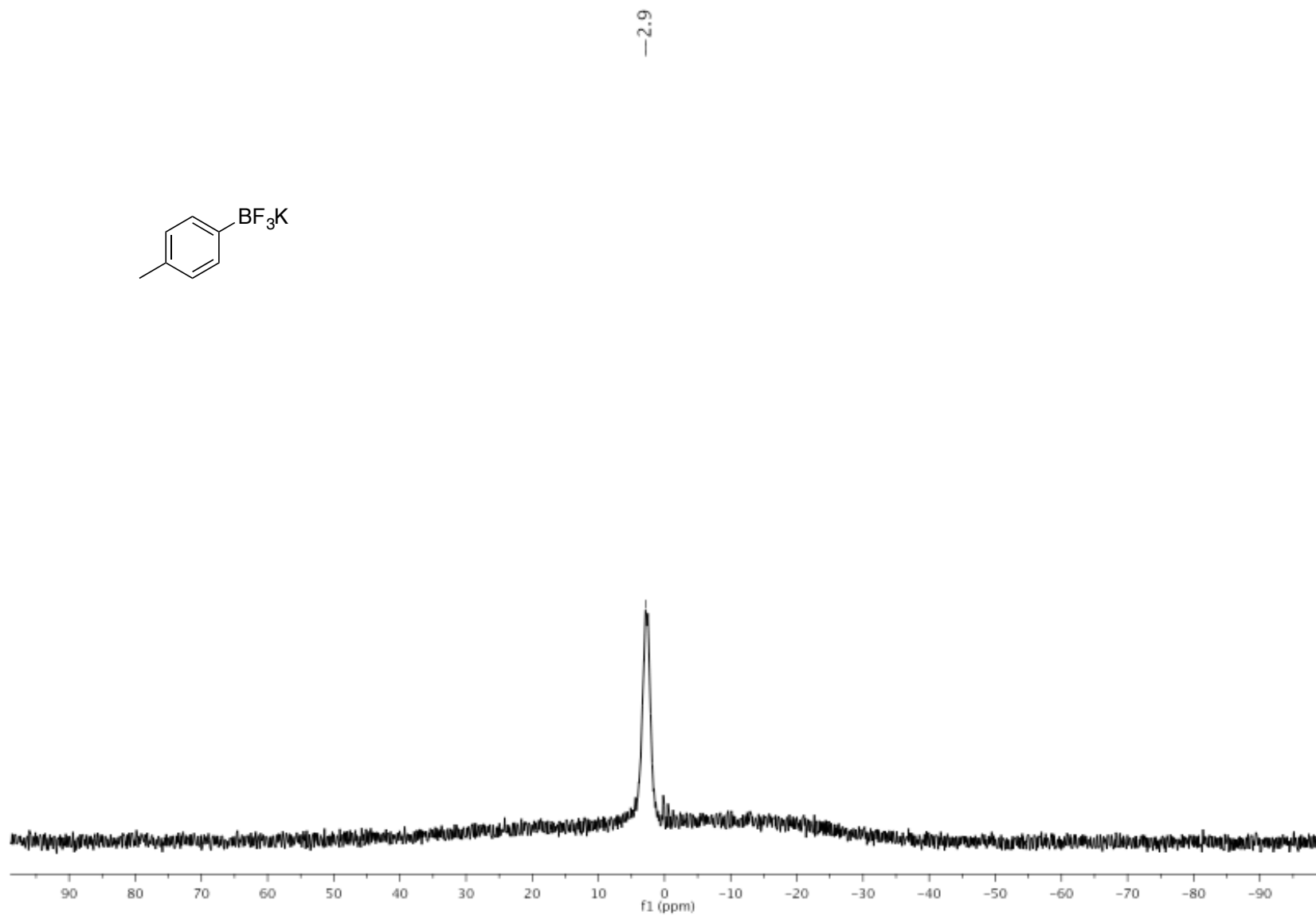
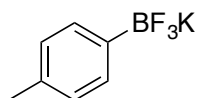
$^1\text{H}$  NMR (500 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(*p*-tolyl)borate (1f, Table 1, entry 6)



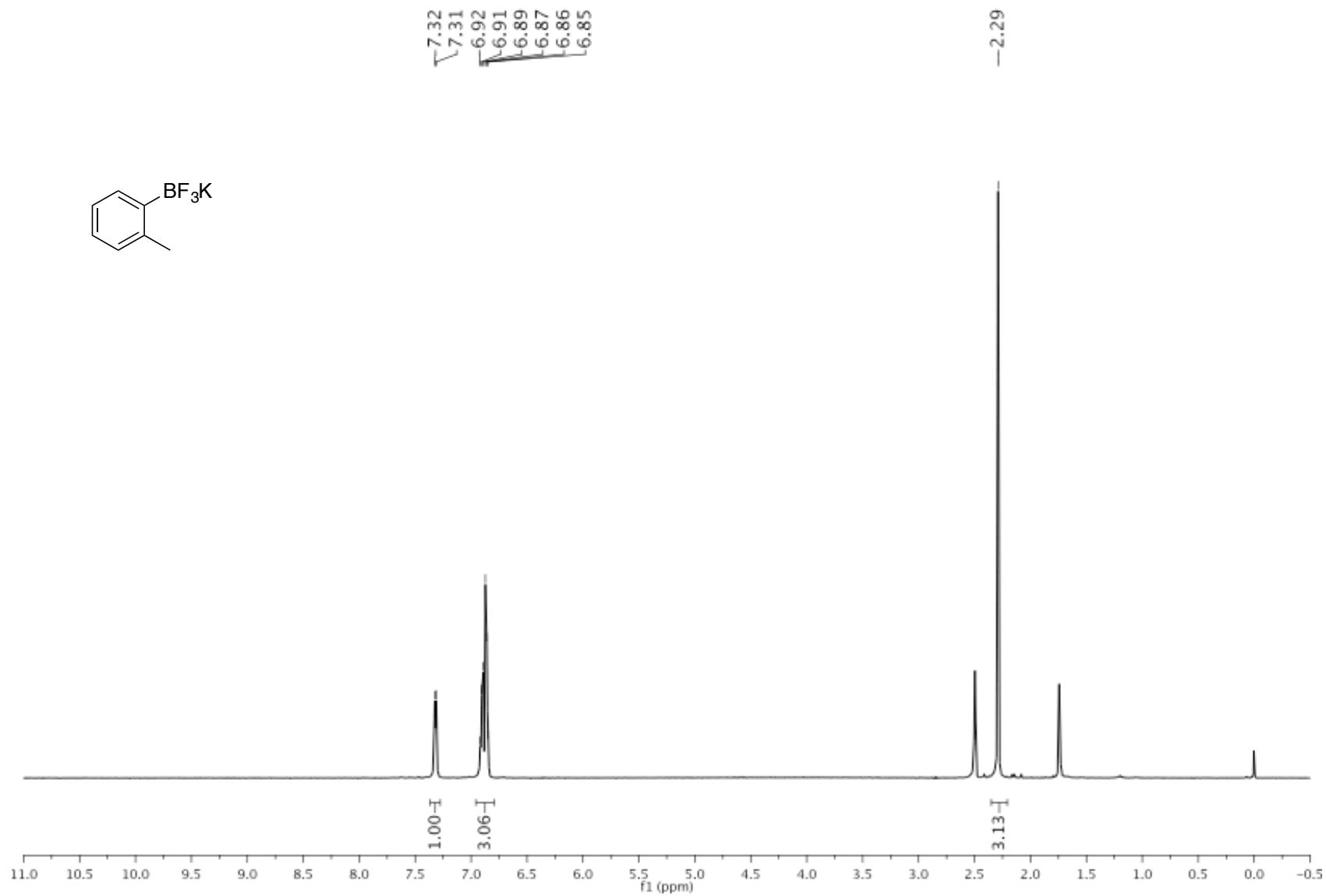
$^{13}\text{C}$  NMR (128.5 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(*p*-tolyl)borate (1f, Table 1, entry 6)



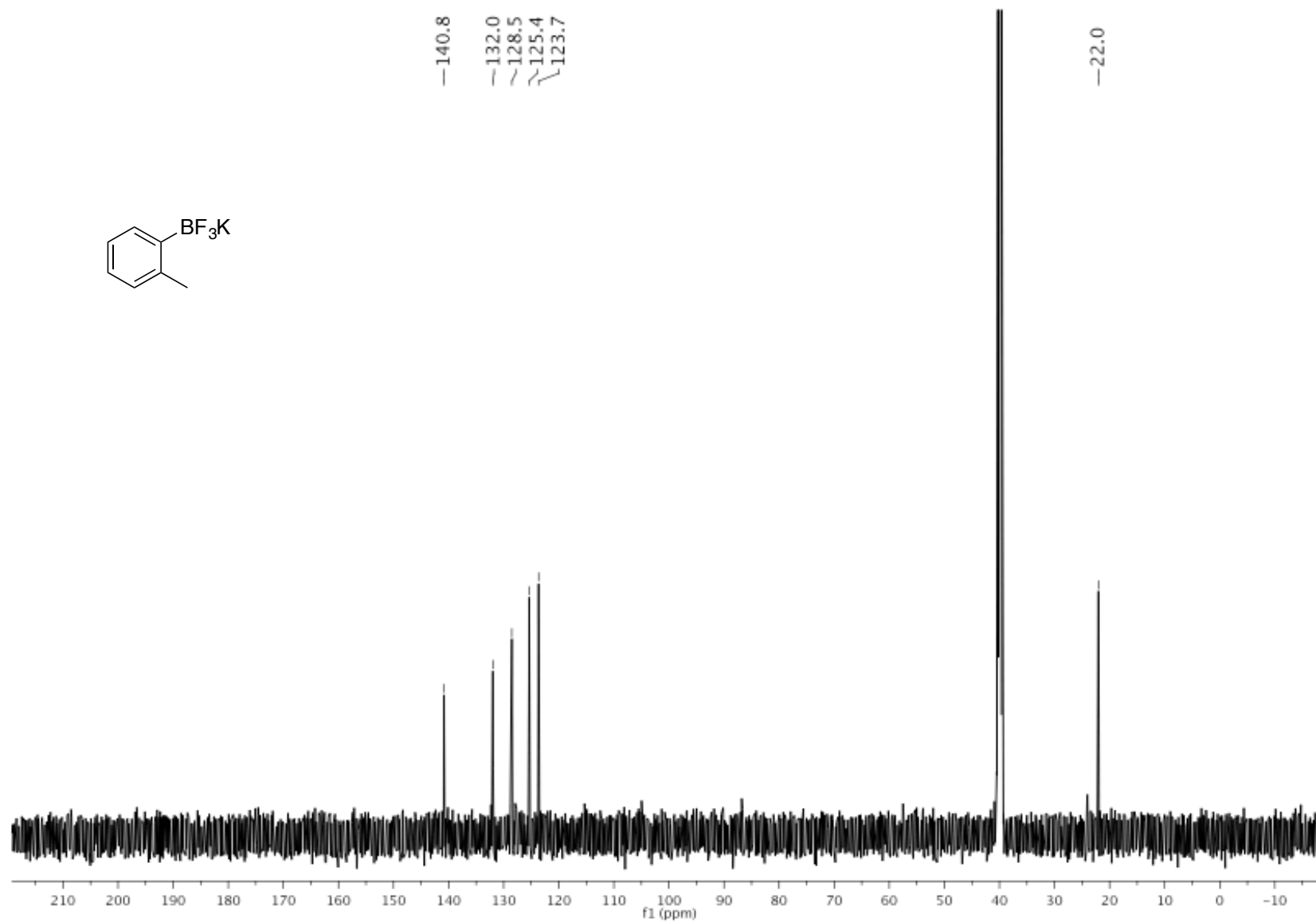
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(*p*-tolyl)borate (1f, Table 1, entry 6)**



**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(*p*-tolyl)borate (1f, Table 1, entry 6)**

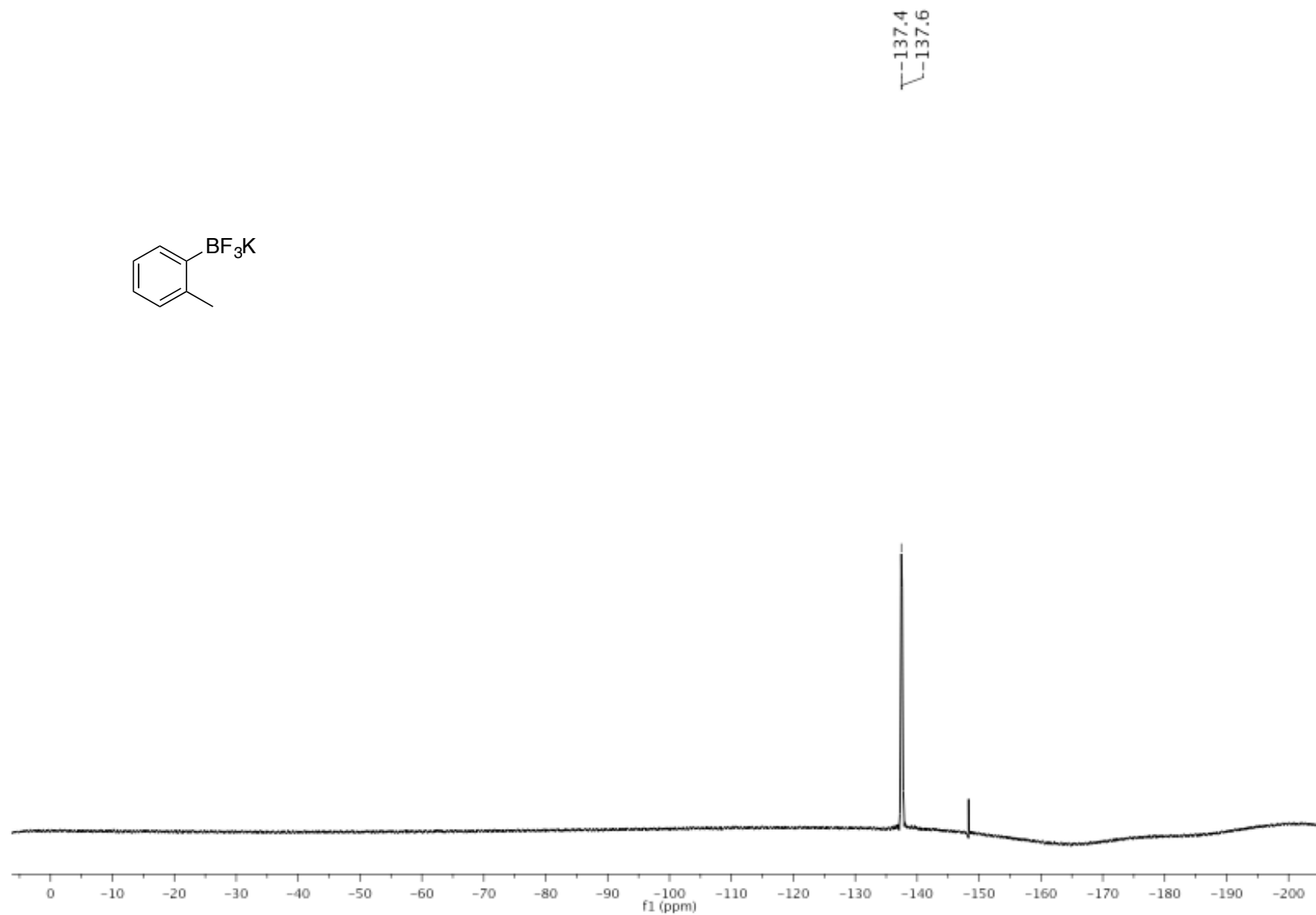


<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(*o*-tolyl)borate (1g, Table 1, entry 7)

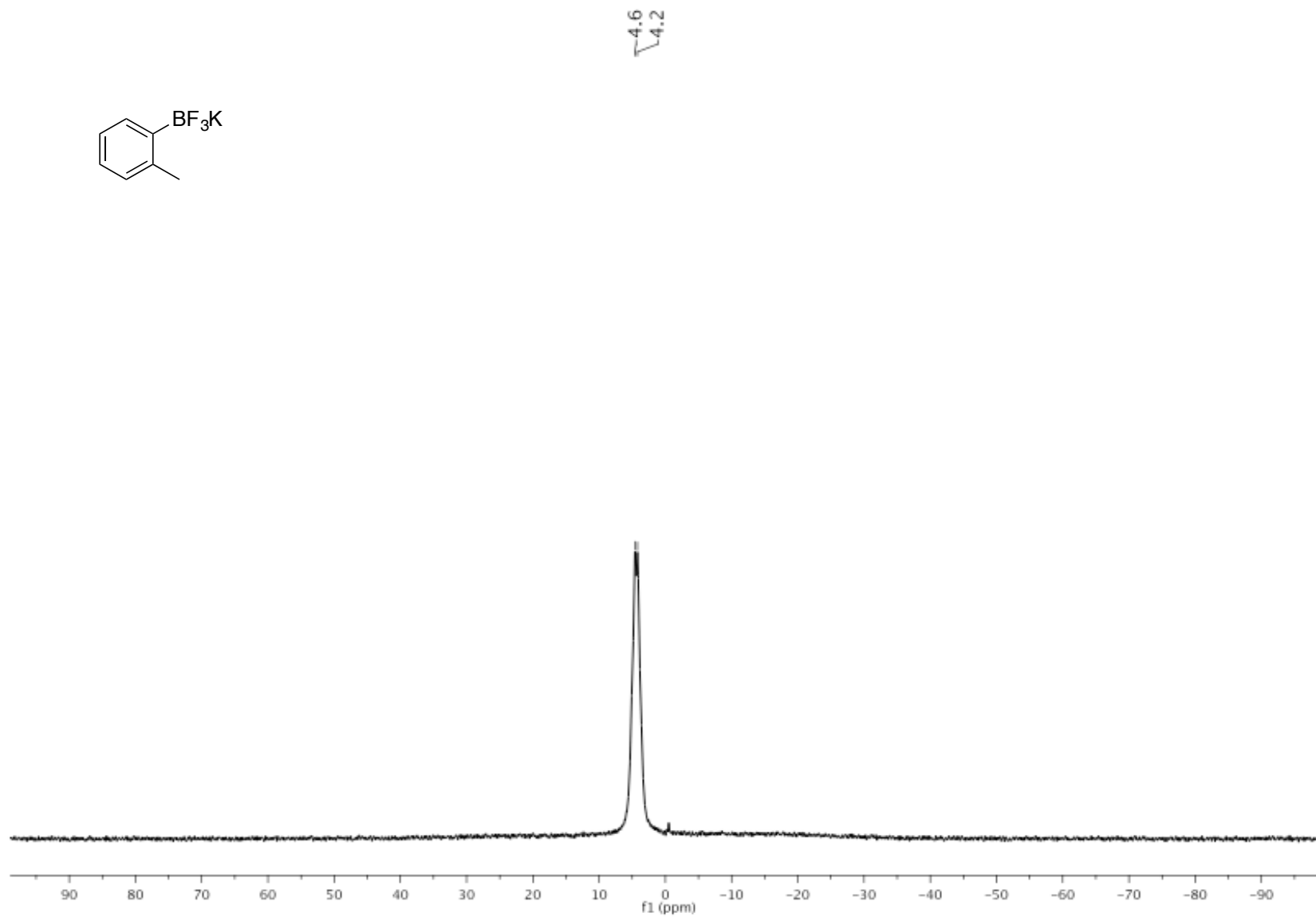
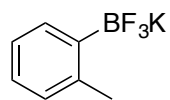


**<sup>13</sup>C NMR (128.5 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(*o*-tolyl)borate (1g, Table 1, entry 7)**

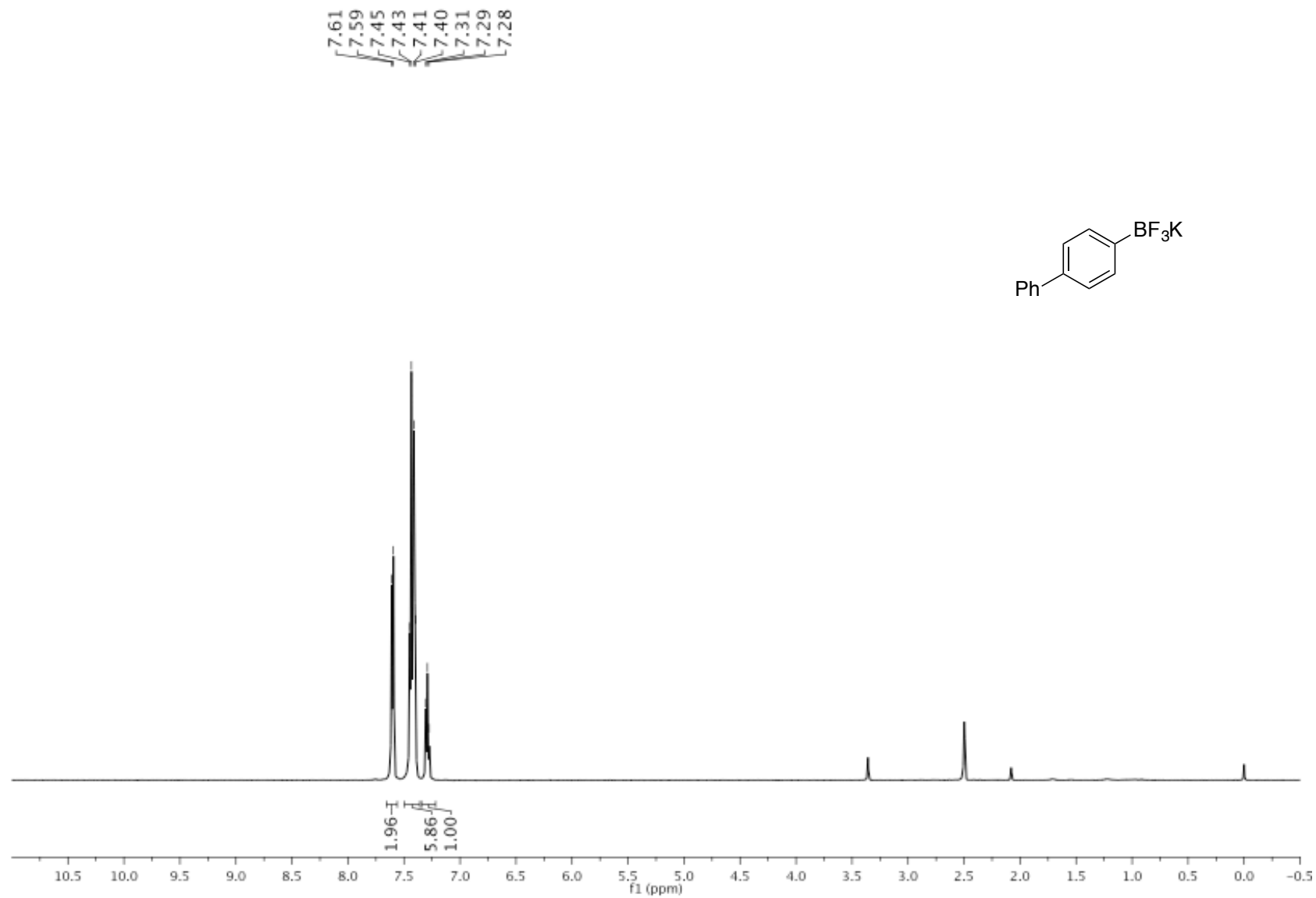




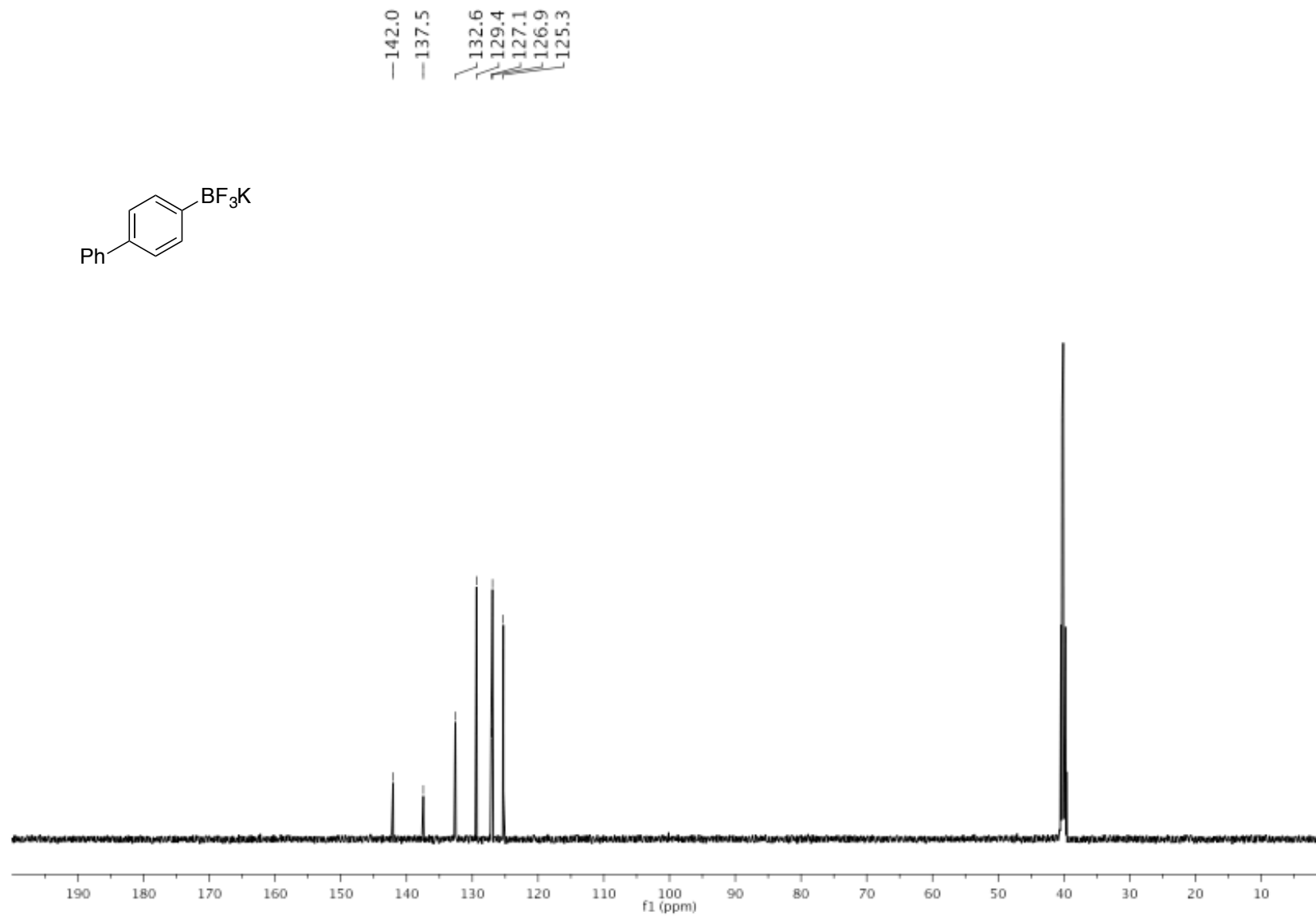
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(*o*-tolyl)borate (1g, Table 1, entry 7)



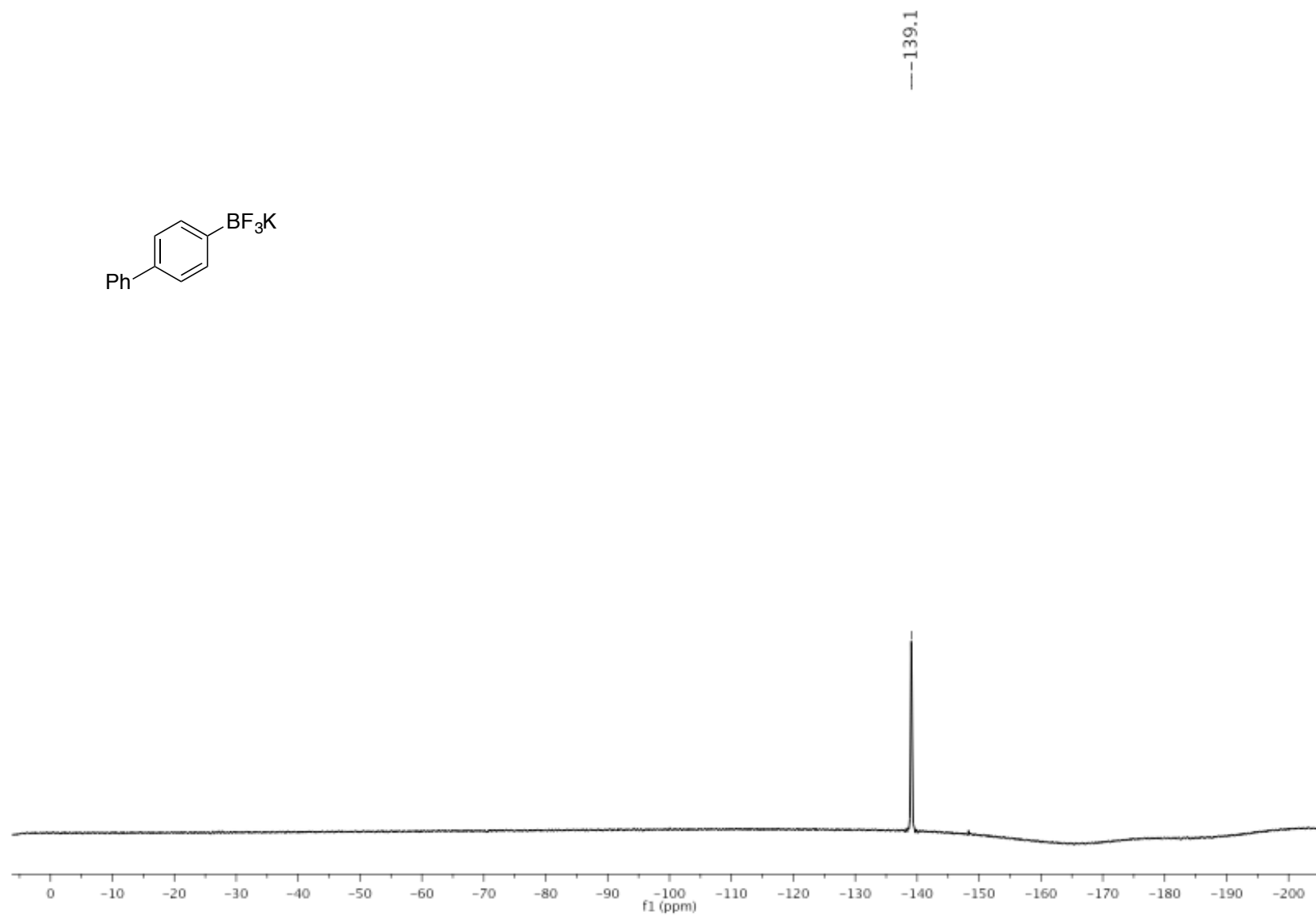
$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(*o*-tolyl)borate (1g, Table 1, entry 7)



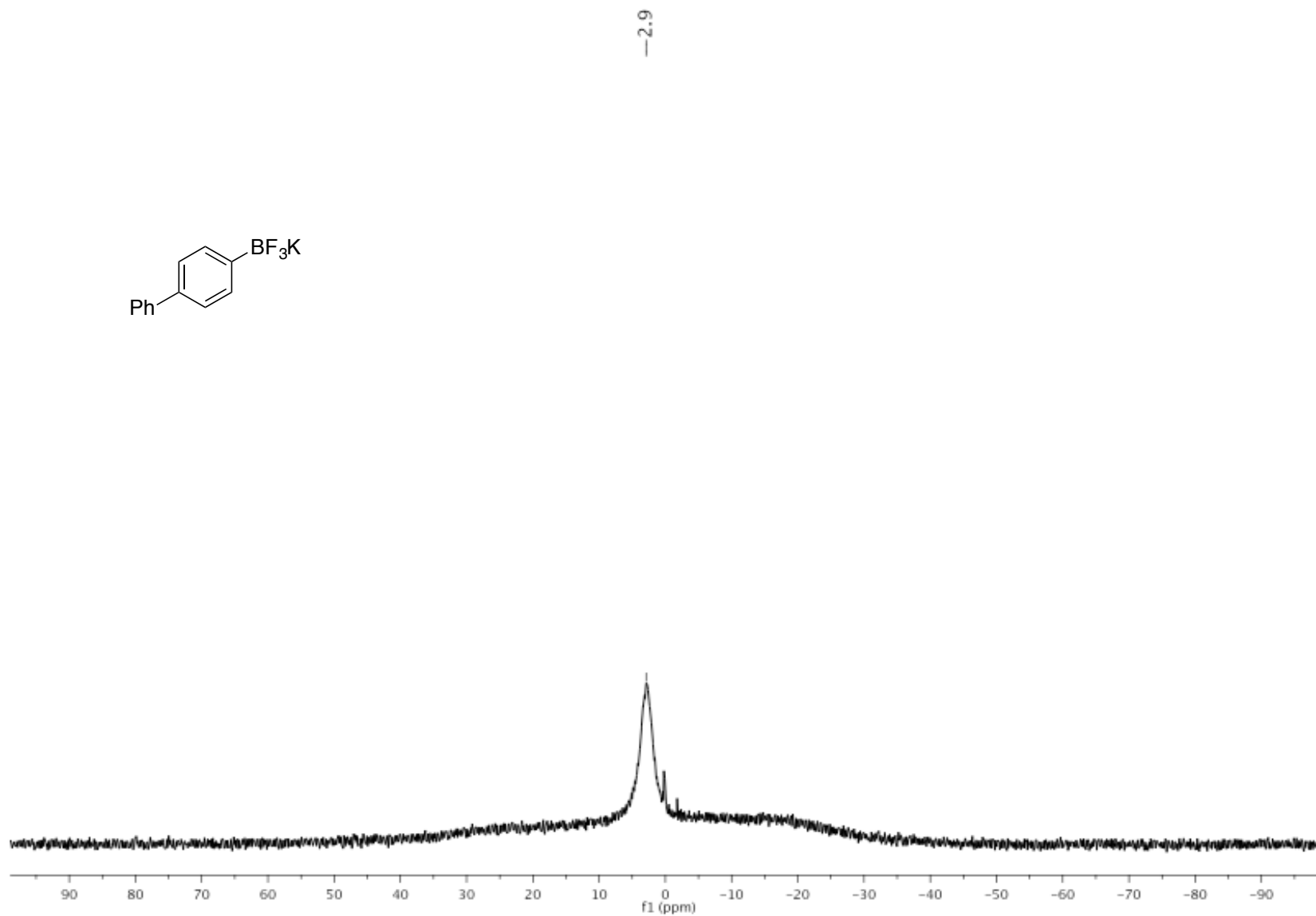
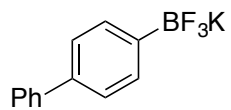
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium [1,1'-Biphenyl]-4-yltrifluoroborate (1h, Table 1, entry 8)**



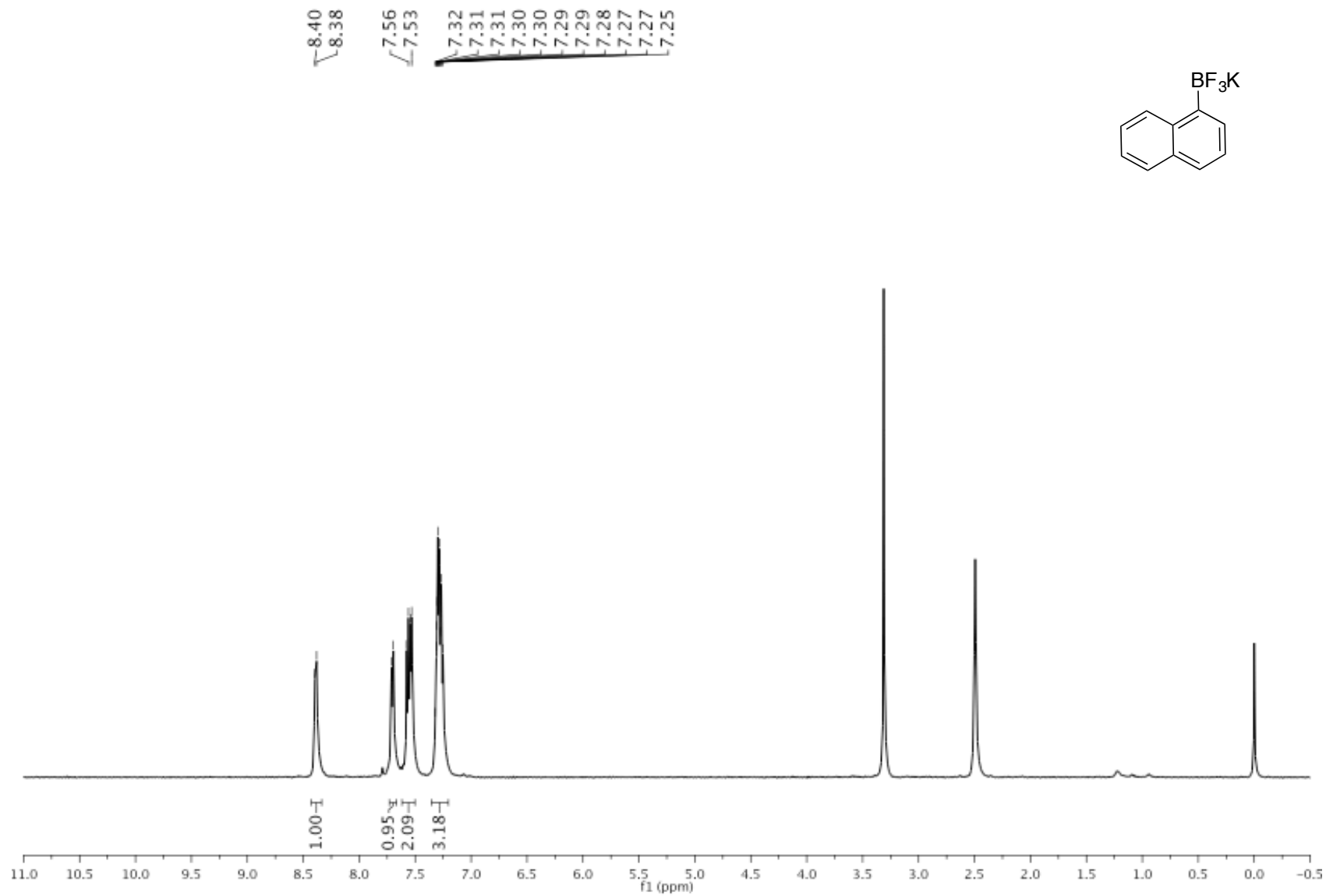
<sup>13</sup>C NMR (128.5 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium [1,1'-Biphenyl]-4-yltrifluoroborate (1h, Table 1, entry 8)



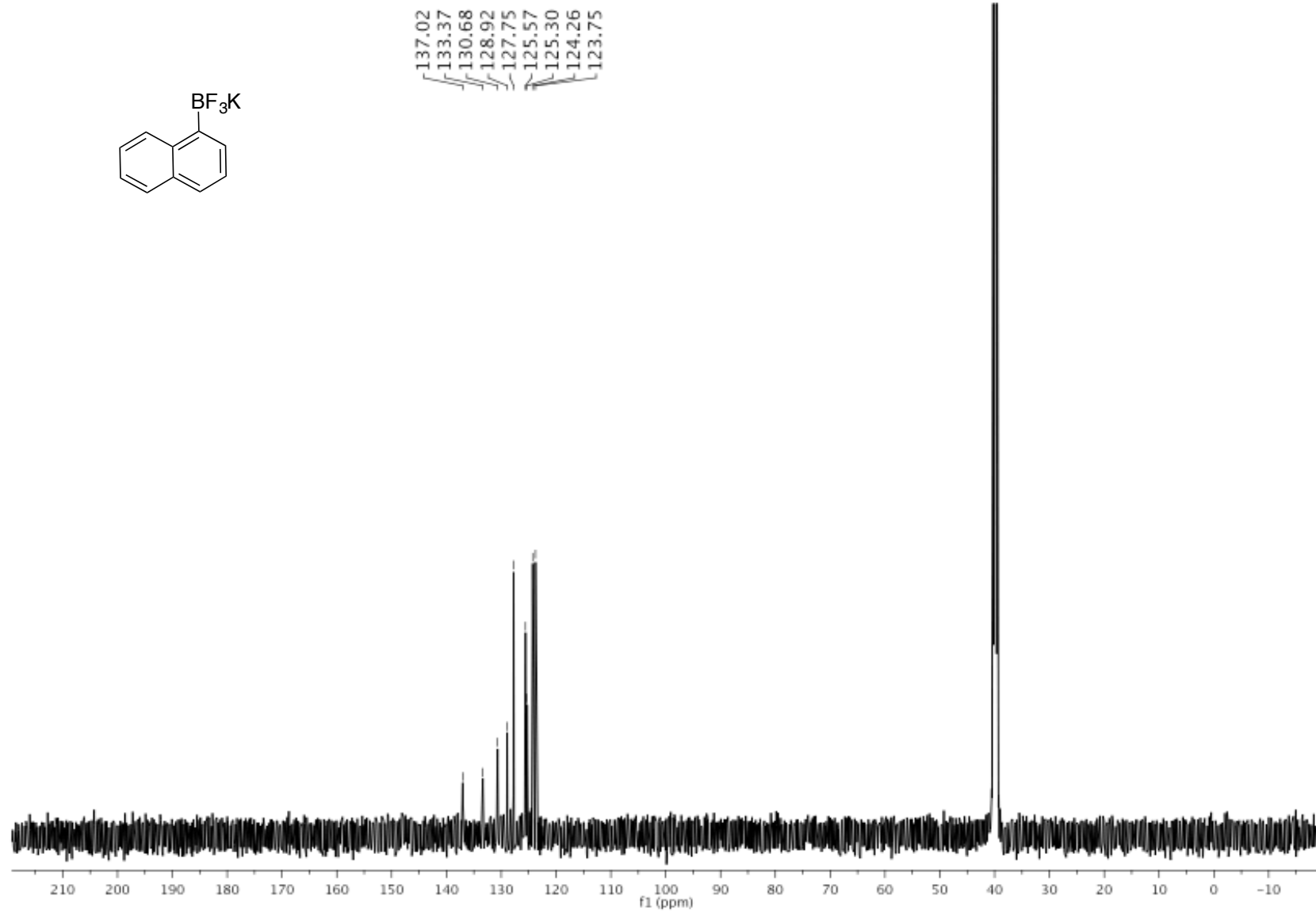
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium [1,1'-Biphenyl]-4-yltrifluoroborate (1h, Table 1, entry 8)



$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium [1,1'-Biphenyl]-4-yltrifluoroborate (1h, Table 1, entry 8)

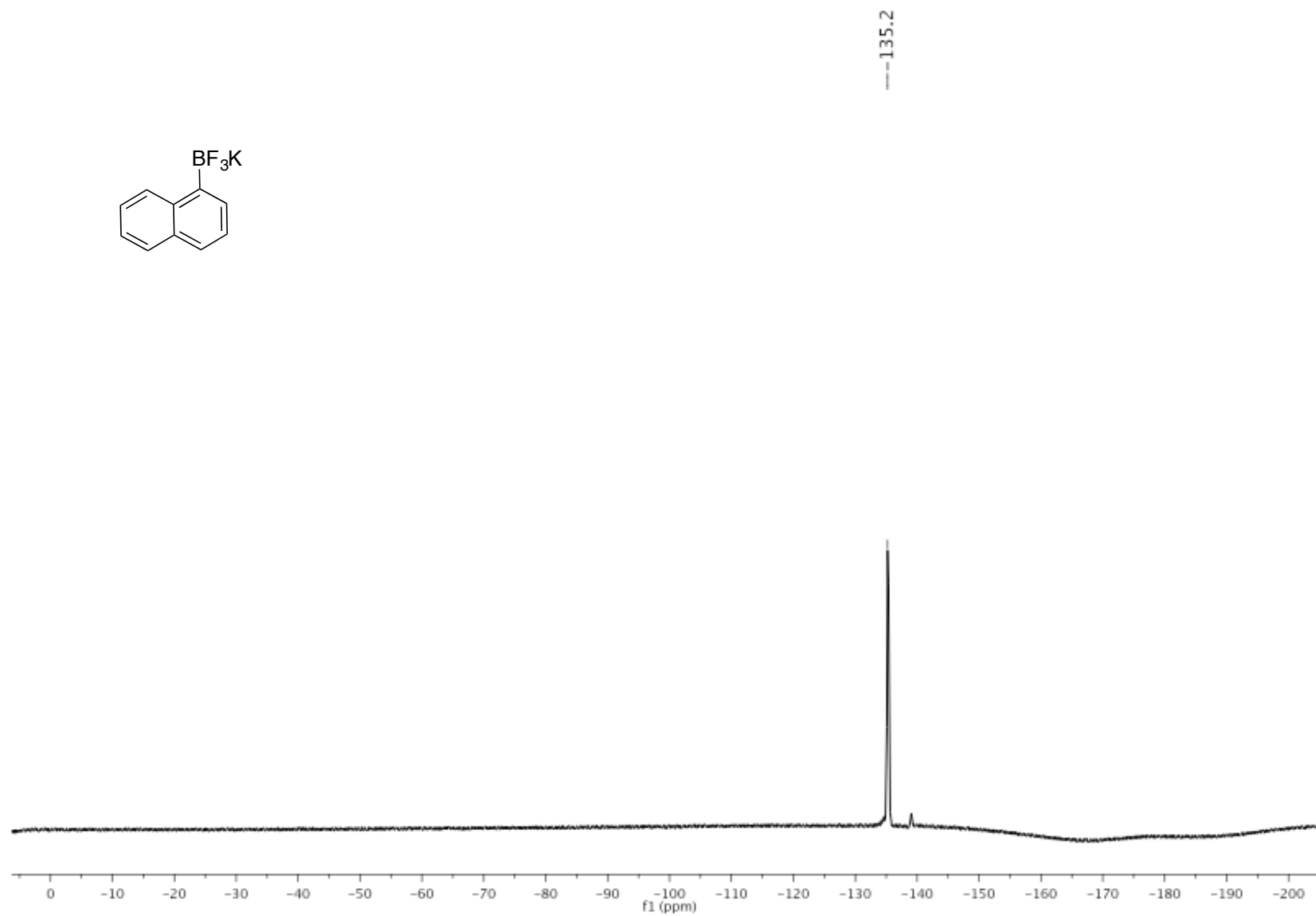


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(naphthalen-1-yl)borate (1i, Table 1, entry 9)**

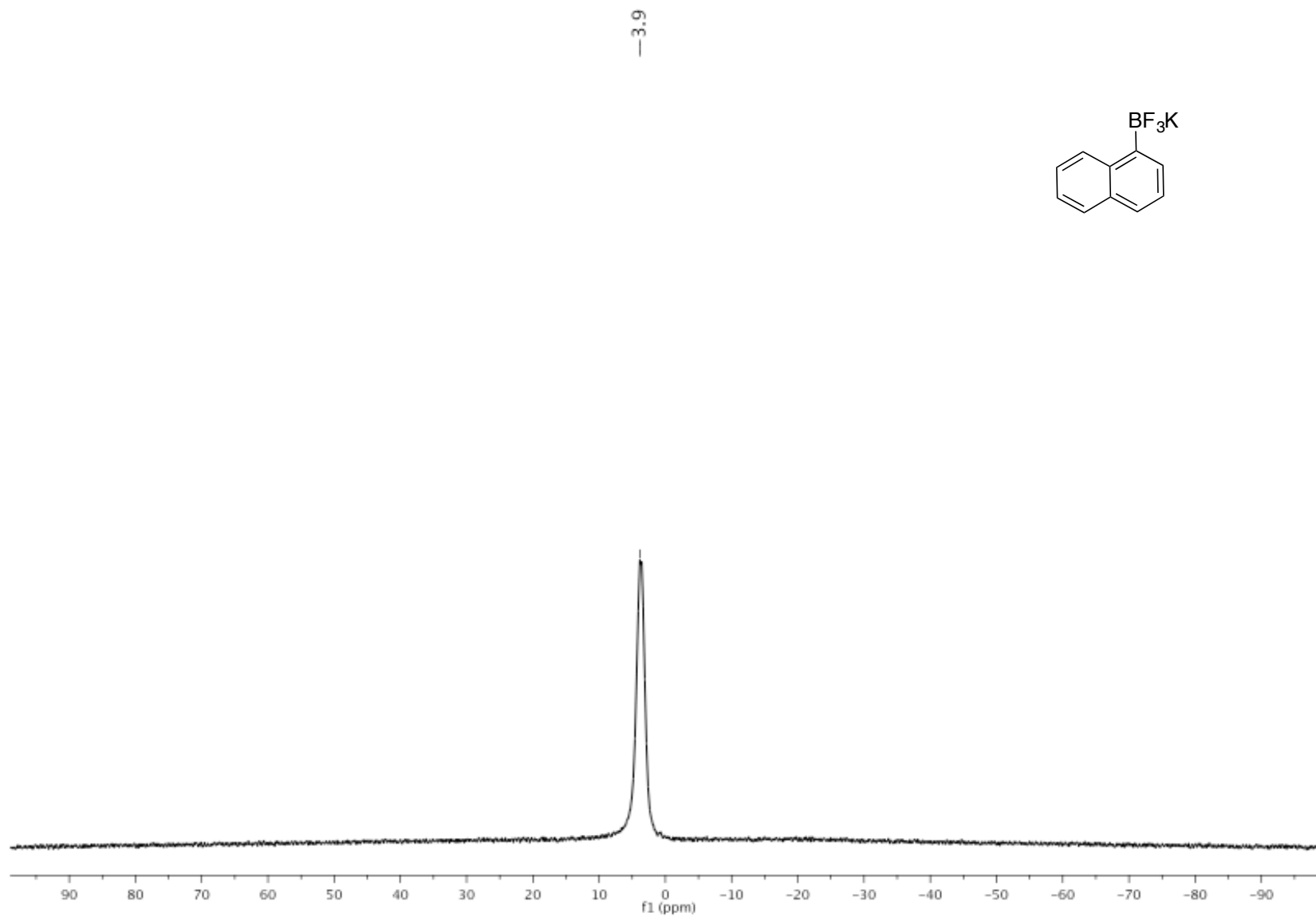


<sup>13</sup>C NMR (128.5 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(naphthalen-1-yl)borate (1i, Table 1, entry 9)

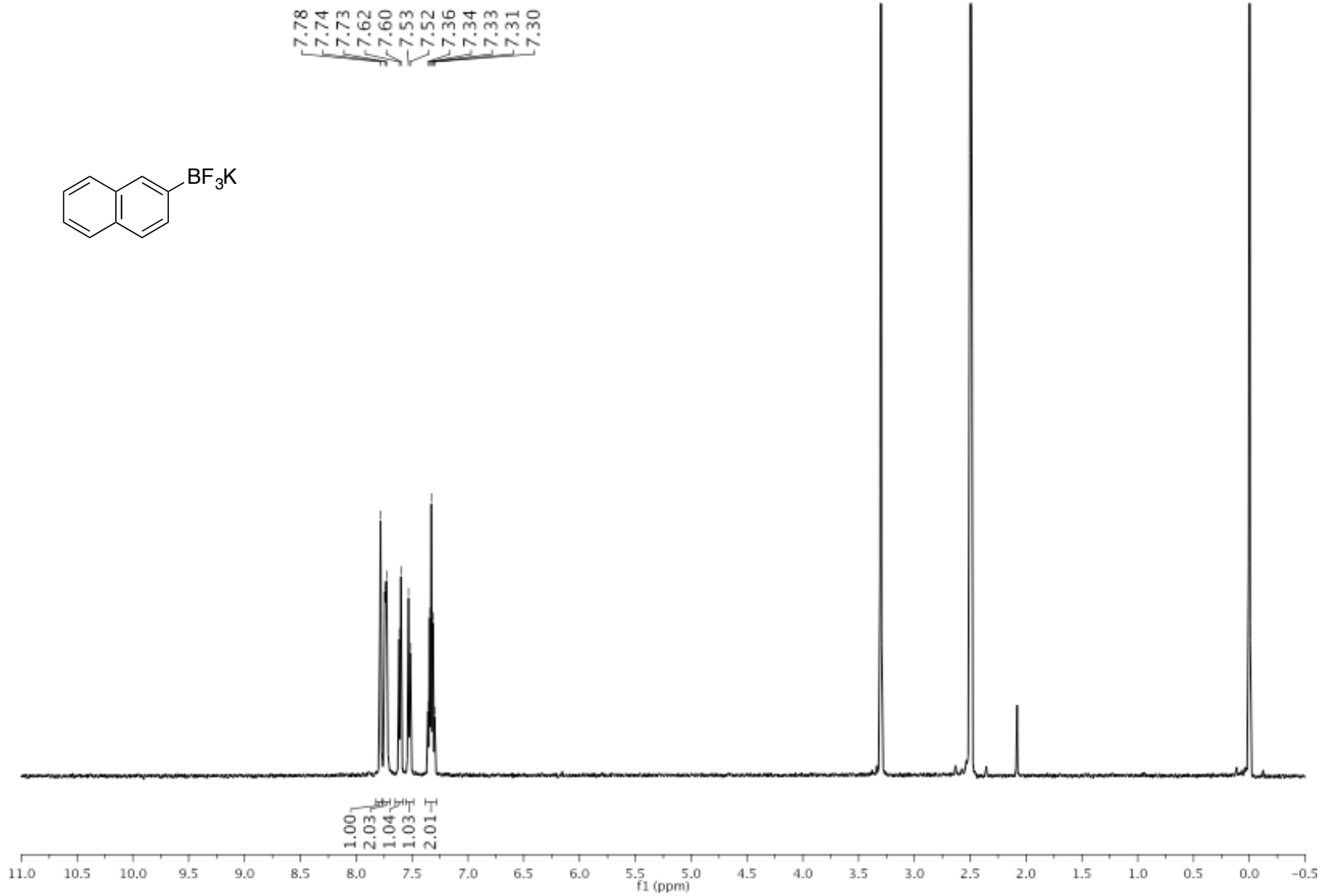




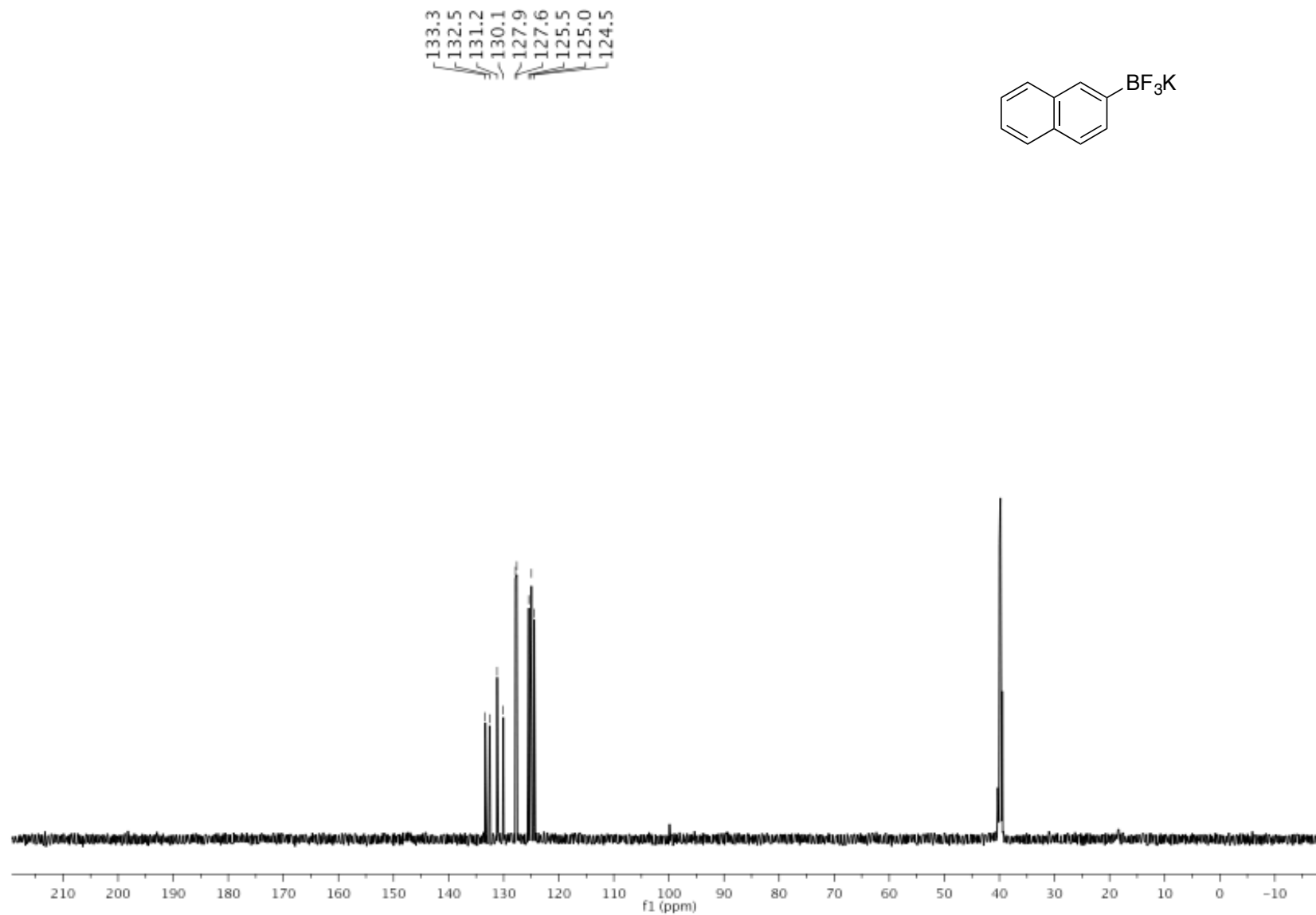
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(naphthalen-1-yl)borate (1i, Table 1, entry 9)



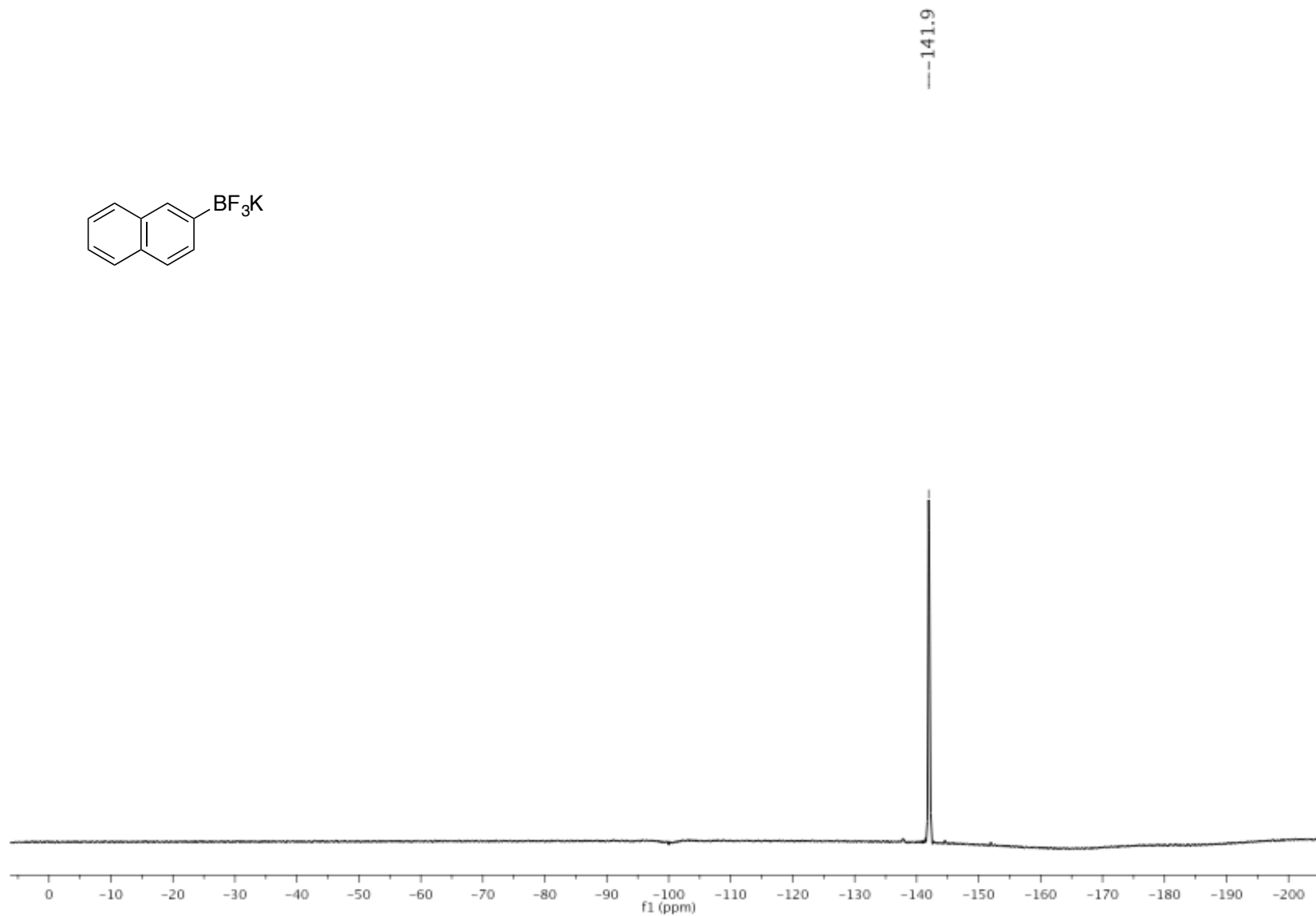
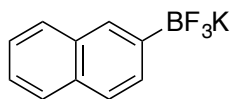
$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(naphthalen-1-yl)borate (1i, Table 1, entry 9)



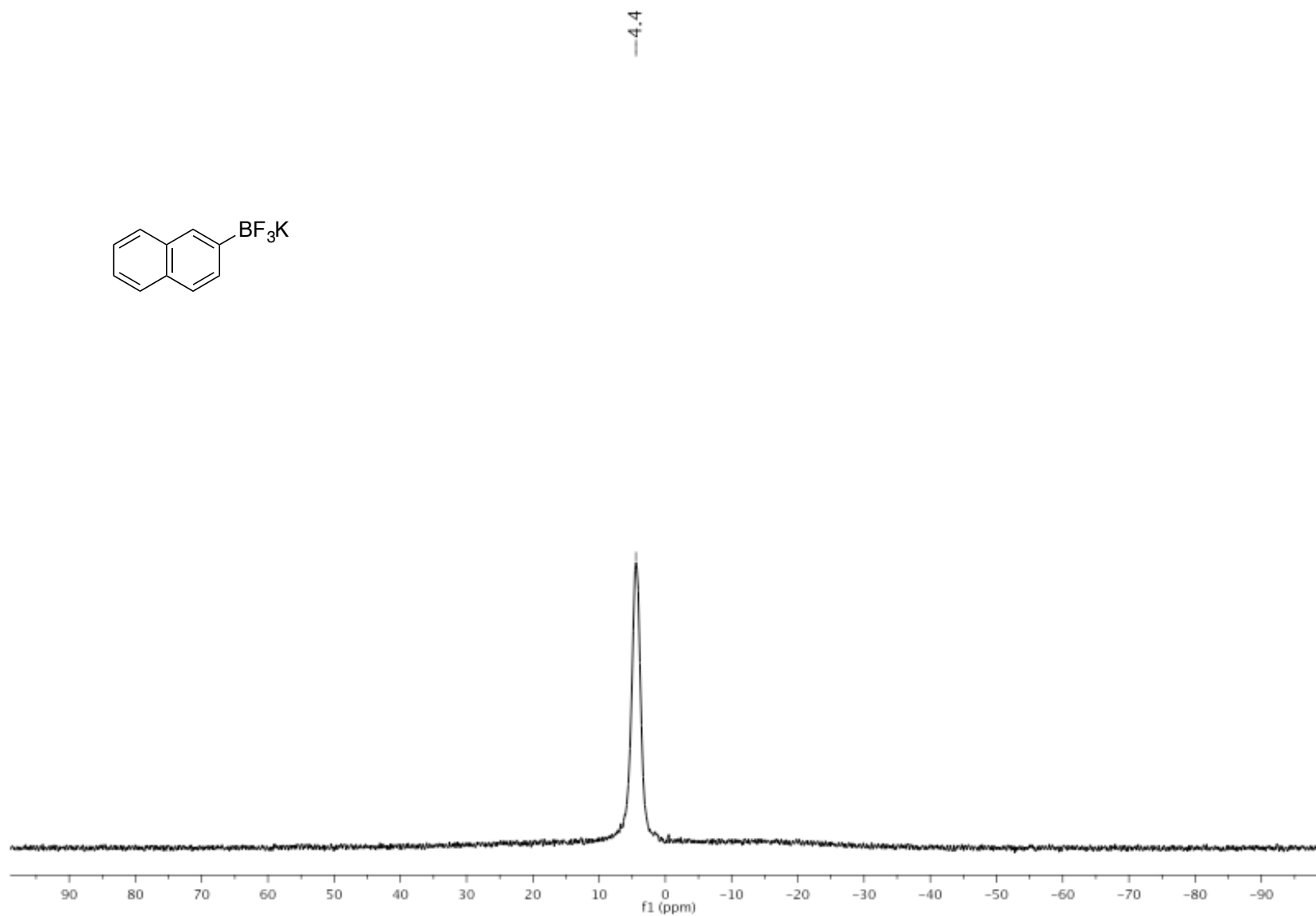
$^1\text{H}$  NMR (500 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(naphthalen-2-yl)borate (1j, Table 1, entry 10)



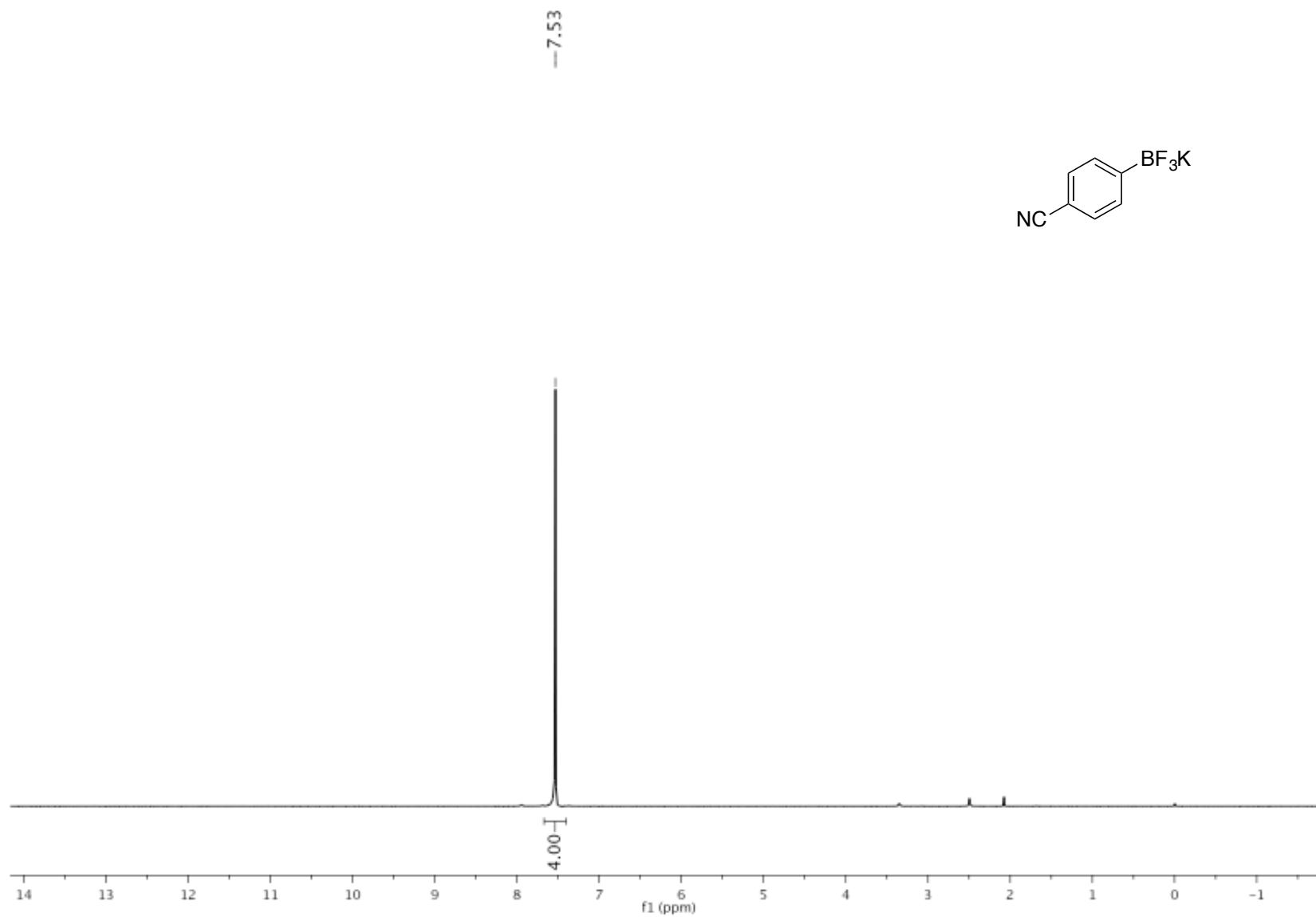
<sup>13</sup>C NMR (128.5 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(naphthalen-2-yl)borate (1j, Table 1, entry 10)



$^{19}\text{F}$  NMR (470.8 MHz, acetone- $\text{d}_6$ ) Spectrum of Potassium Trifluoro(naphthalen-2-yl)borate (1j, Table 1, entry 10)

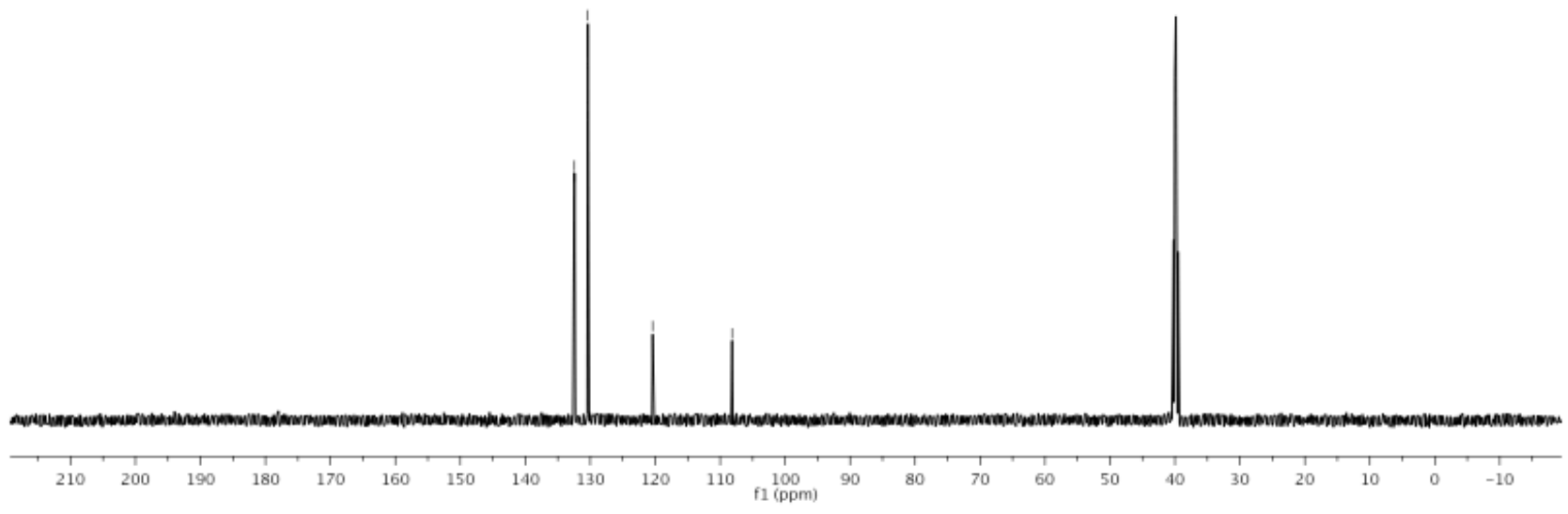
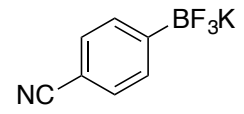


$^{11}\text{B}$  NMR (128.4 MHz, acetone- $\text{d}_6$ ) Spectrum of Potassium Trifluoro(naphthalen-2-yl)borate (1j, Table 1, entry 10)



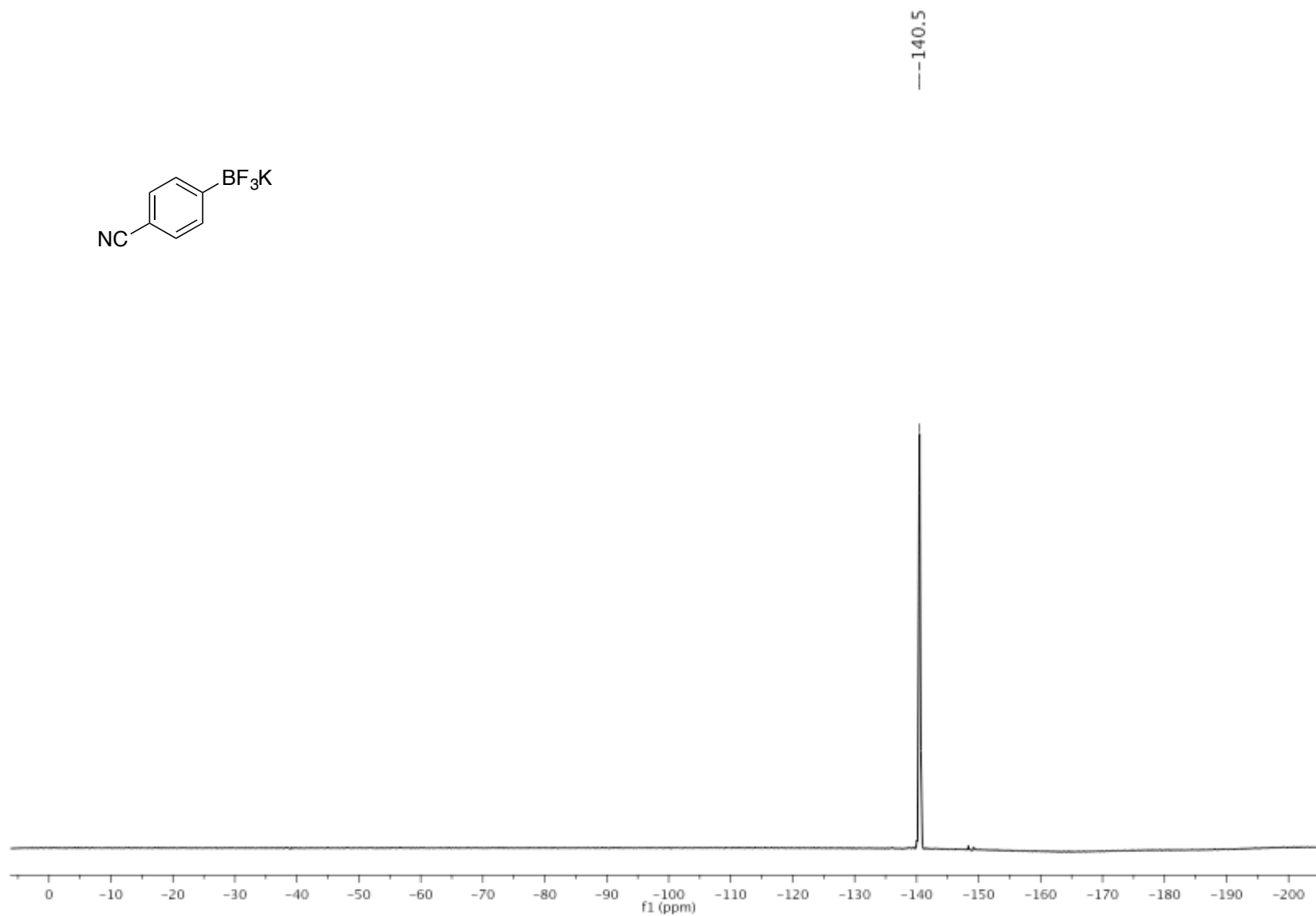
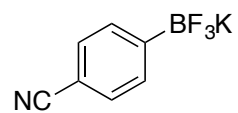
$^1\text{H}$  NMR (500 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium (4-Cyanophenyl)trifluoroborate (2a, Table 2, entry 1)

132.4  
132.4  
130.4  
120.4  
108.2

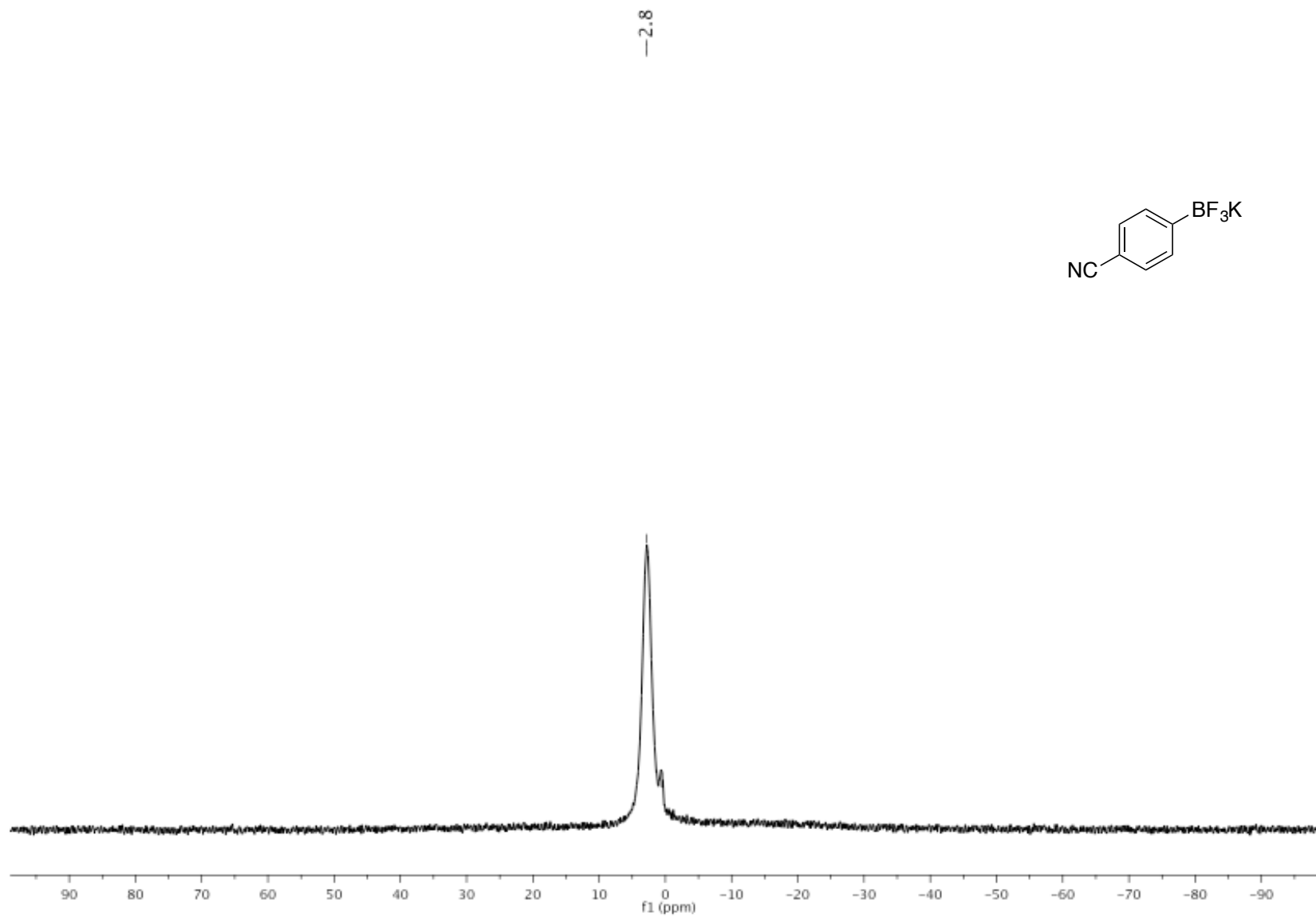


<sup>13</sup>C NMR (128.5 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Cyanophenyl)trifluoroborate (2a, Table 2, entry 1)

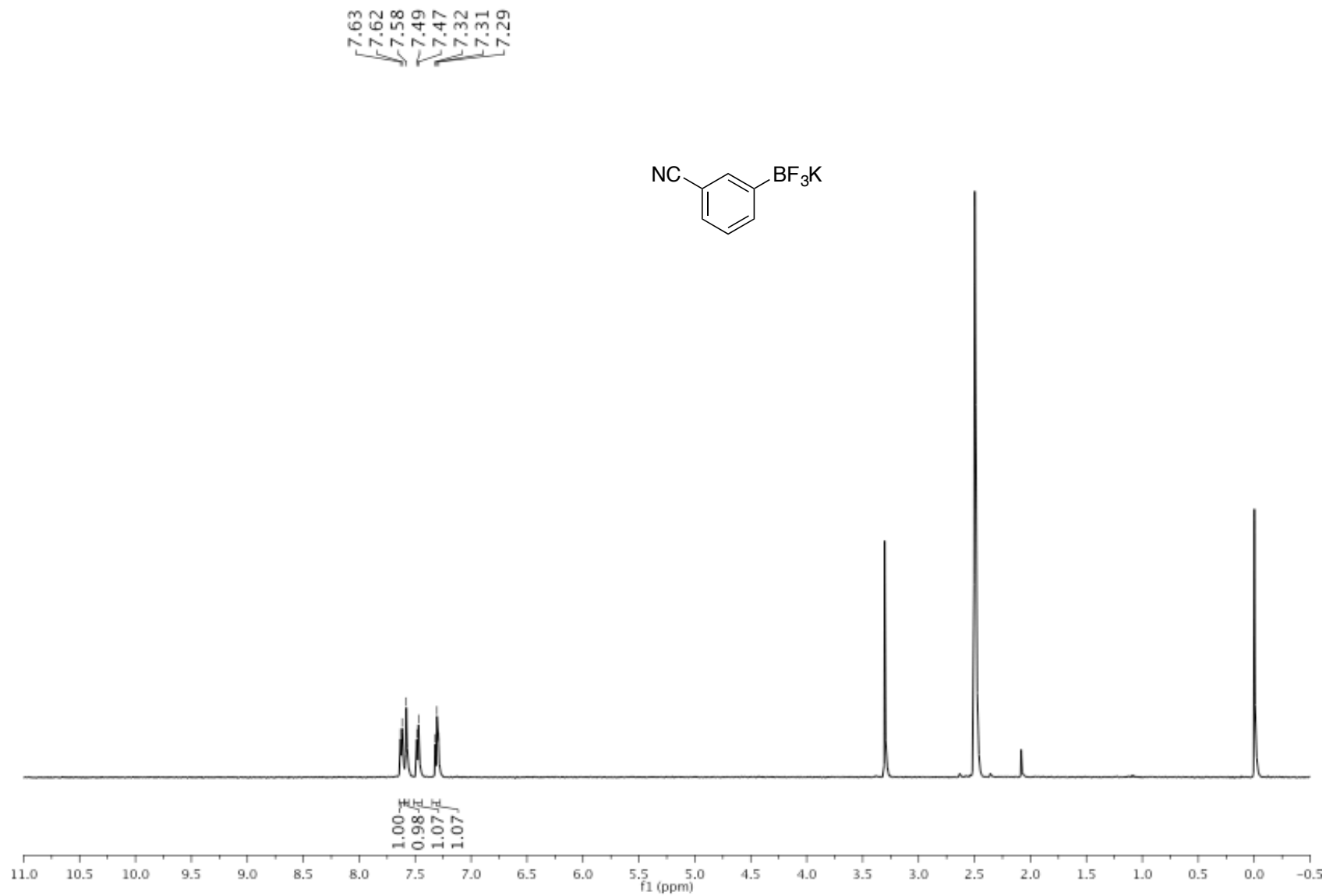




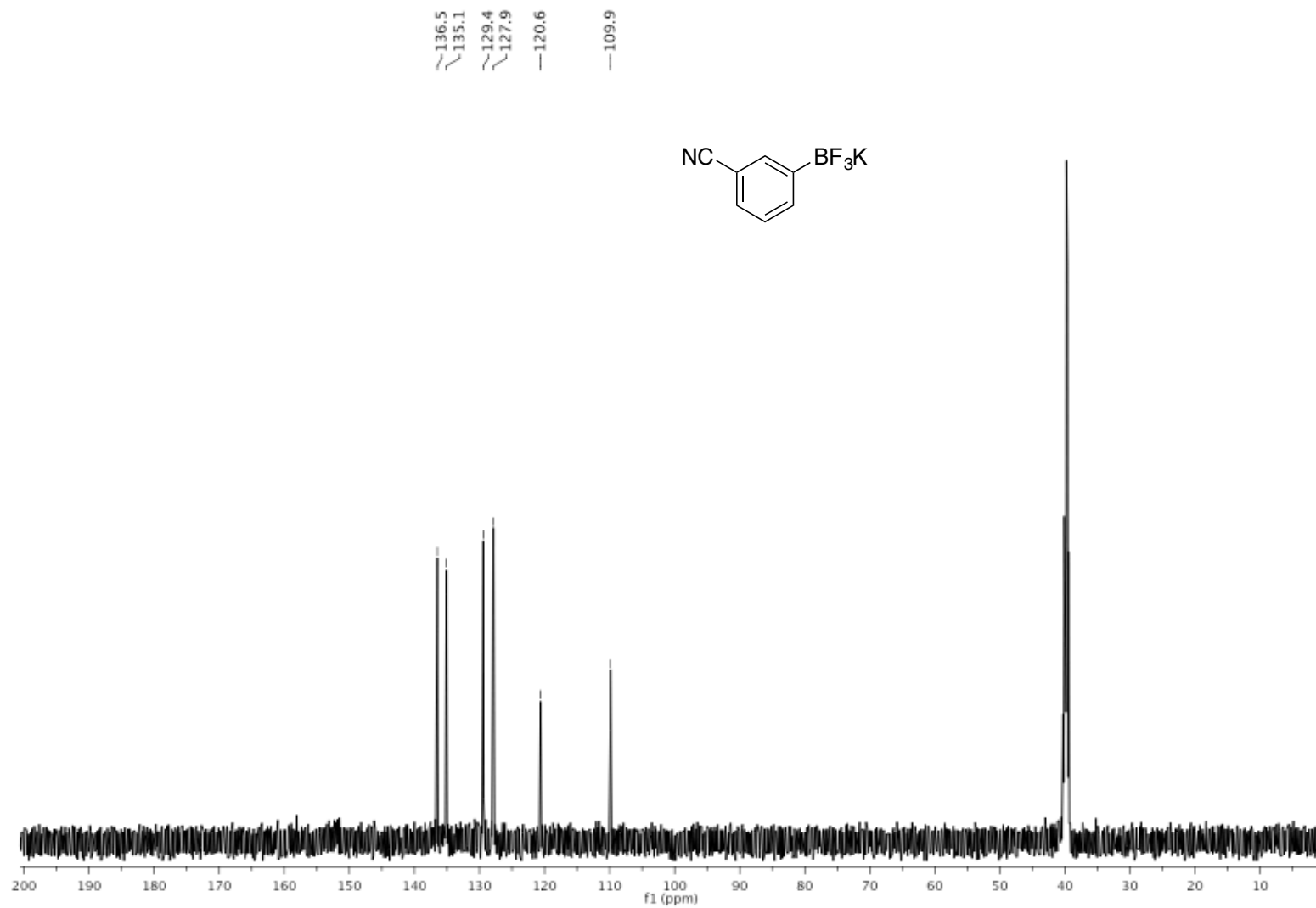
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Cyanophenyl)trifluoroborate (2a, Table 2, entry 1)**



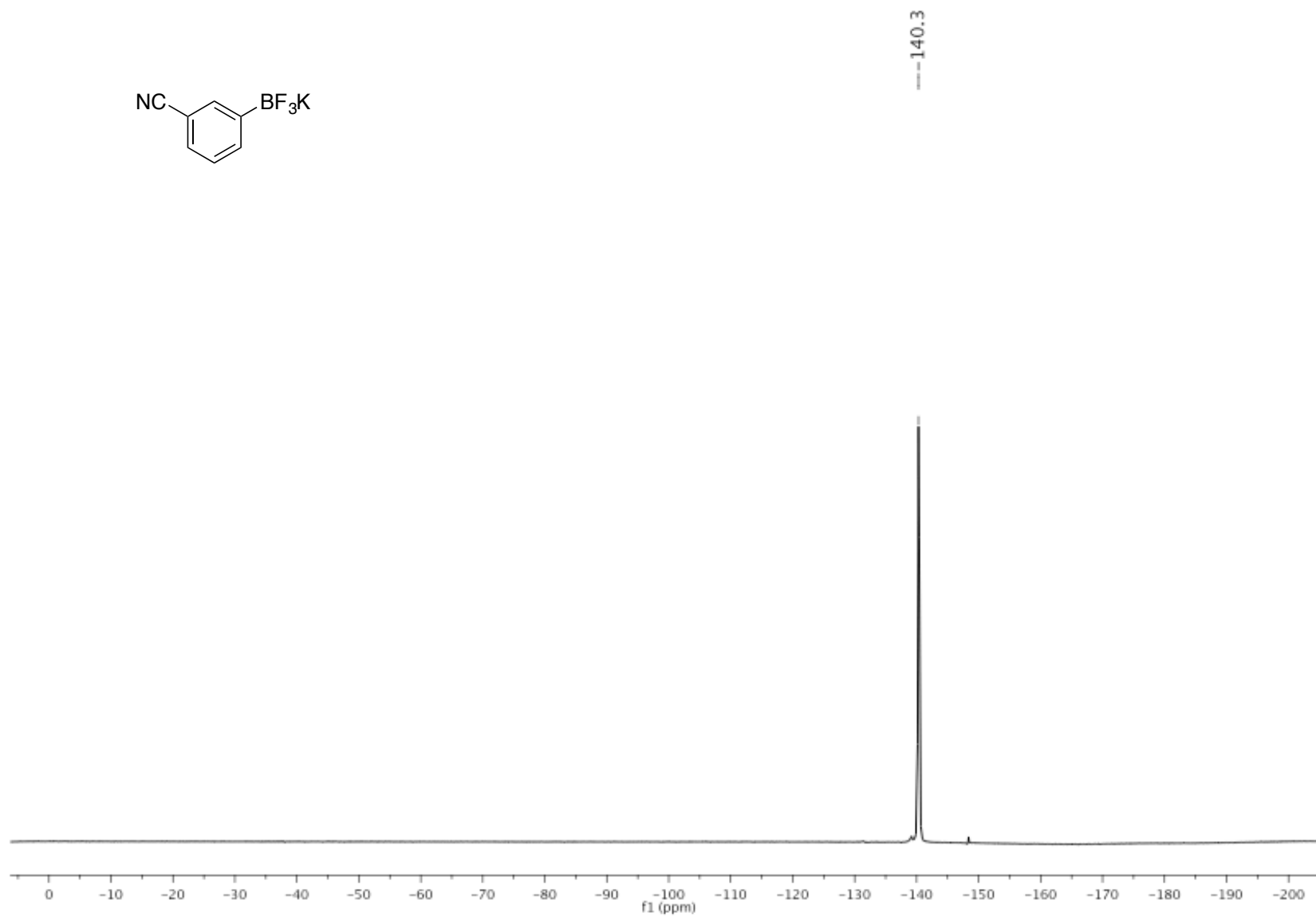
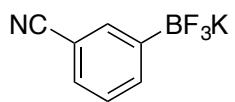
$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium (4-Cyanophenyl)trifluoroborate (2a, Table 2, entry 1)



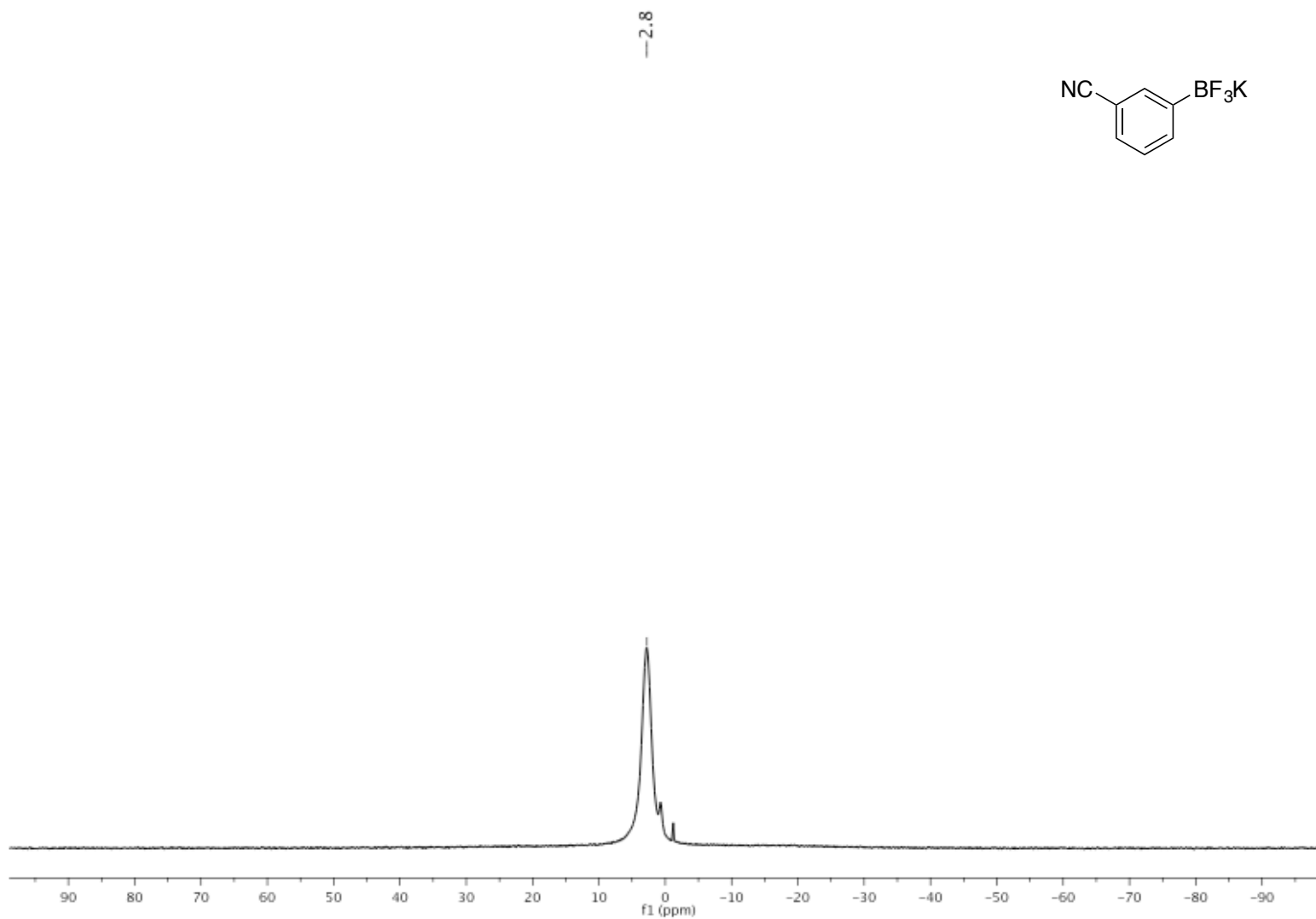
$^1\text{H}$  NMR (500 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium (3-Cyanophenyl)trifluoroborate (2b, Table 2, entry 2)



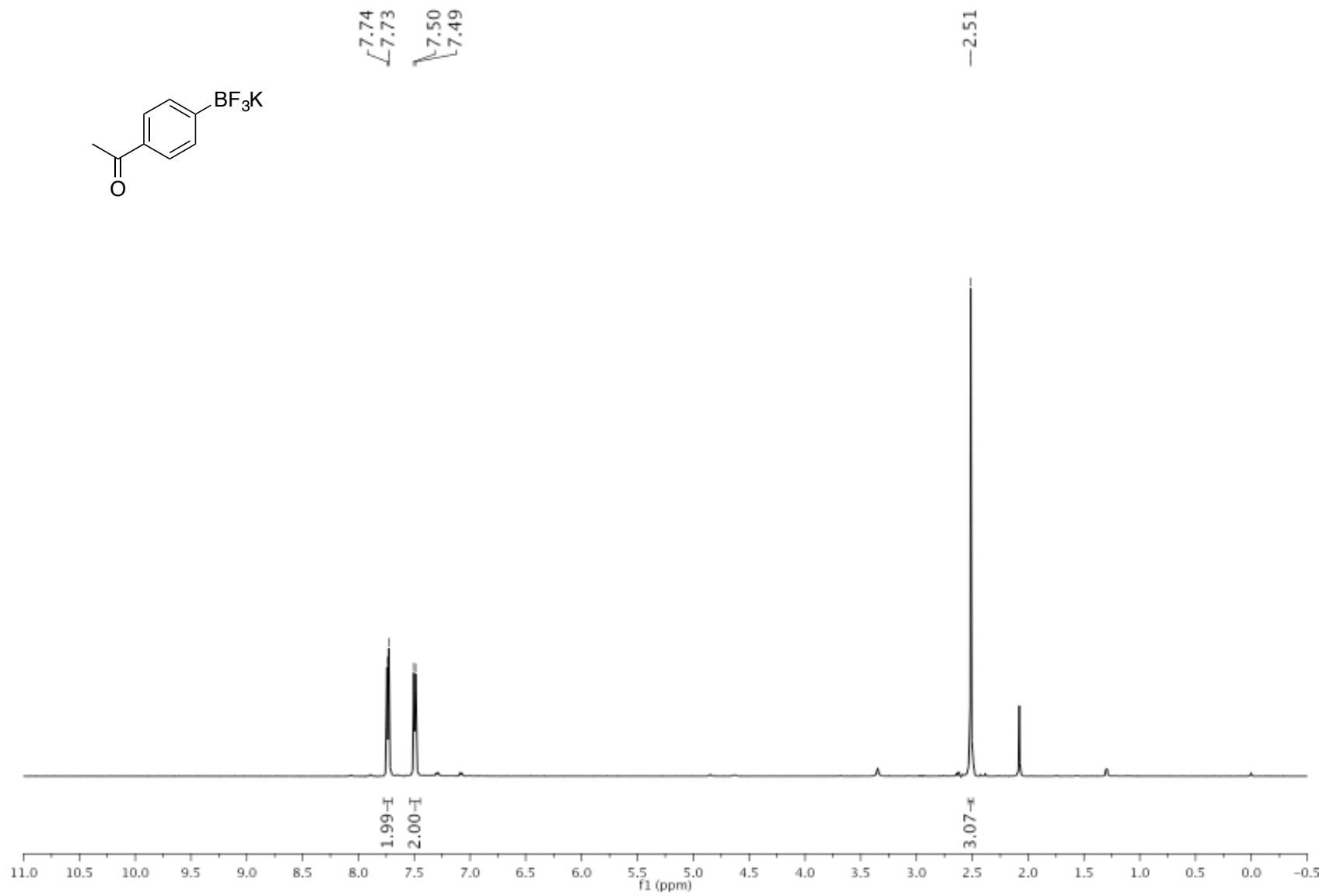
$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium (3-Cyanophenyl)trifluoroborate (2b, Table 2, entry 2)



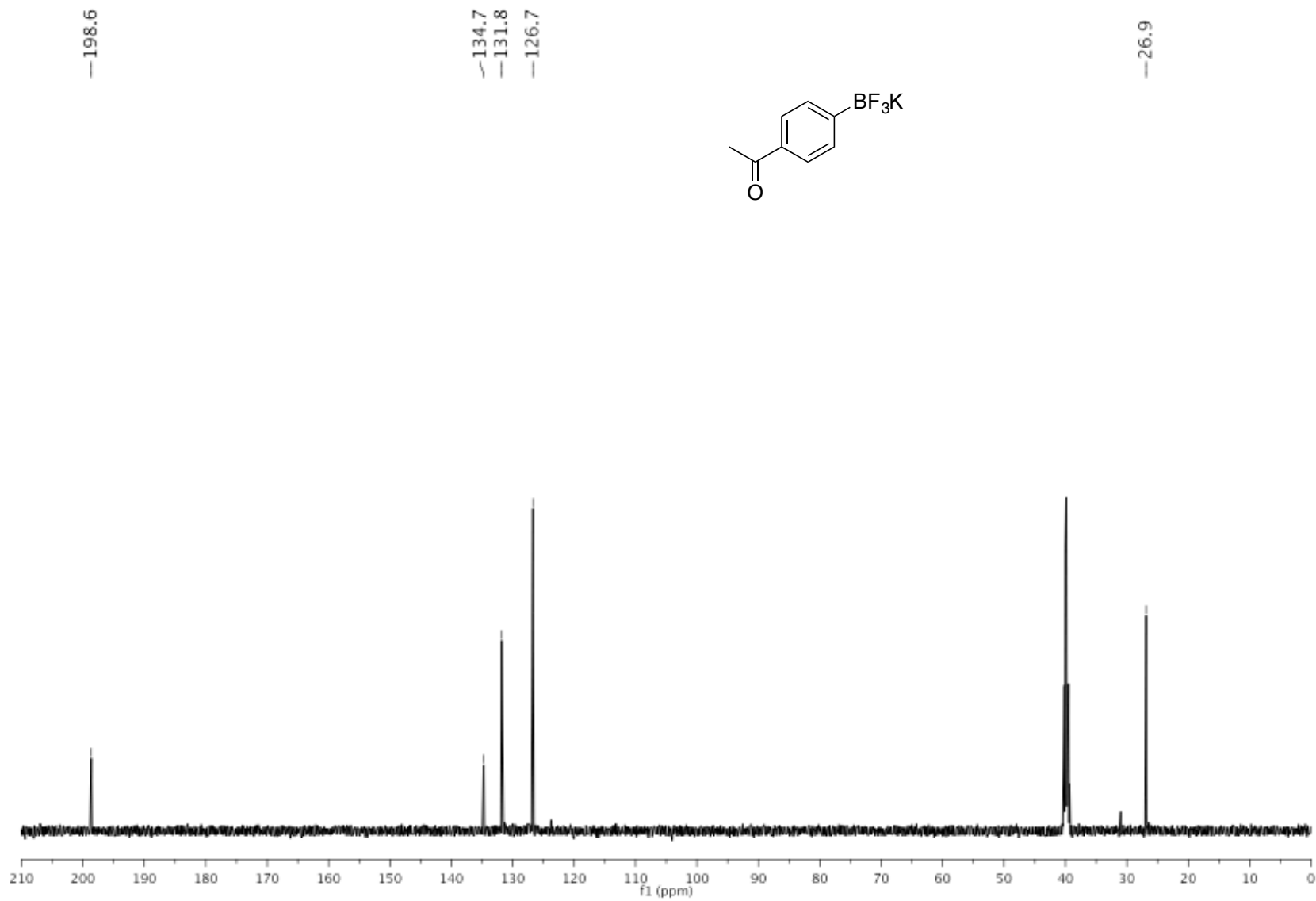
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (3-Cyanophenyl)trifluoroborate (2b, Table 2, entry 2)**



**$^{11}\text{B}$  NMR (128.4 MHz, DMSO- $d_6$ ) Spectrum of Potassium (3-Cyanophenyl)trifluoroborate (2b, Table 2, entry 2)**

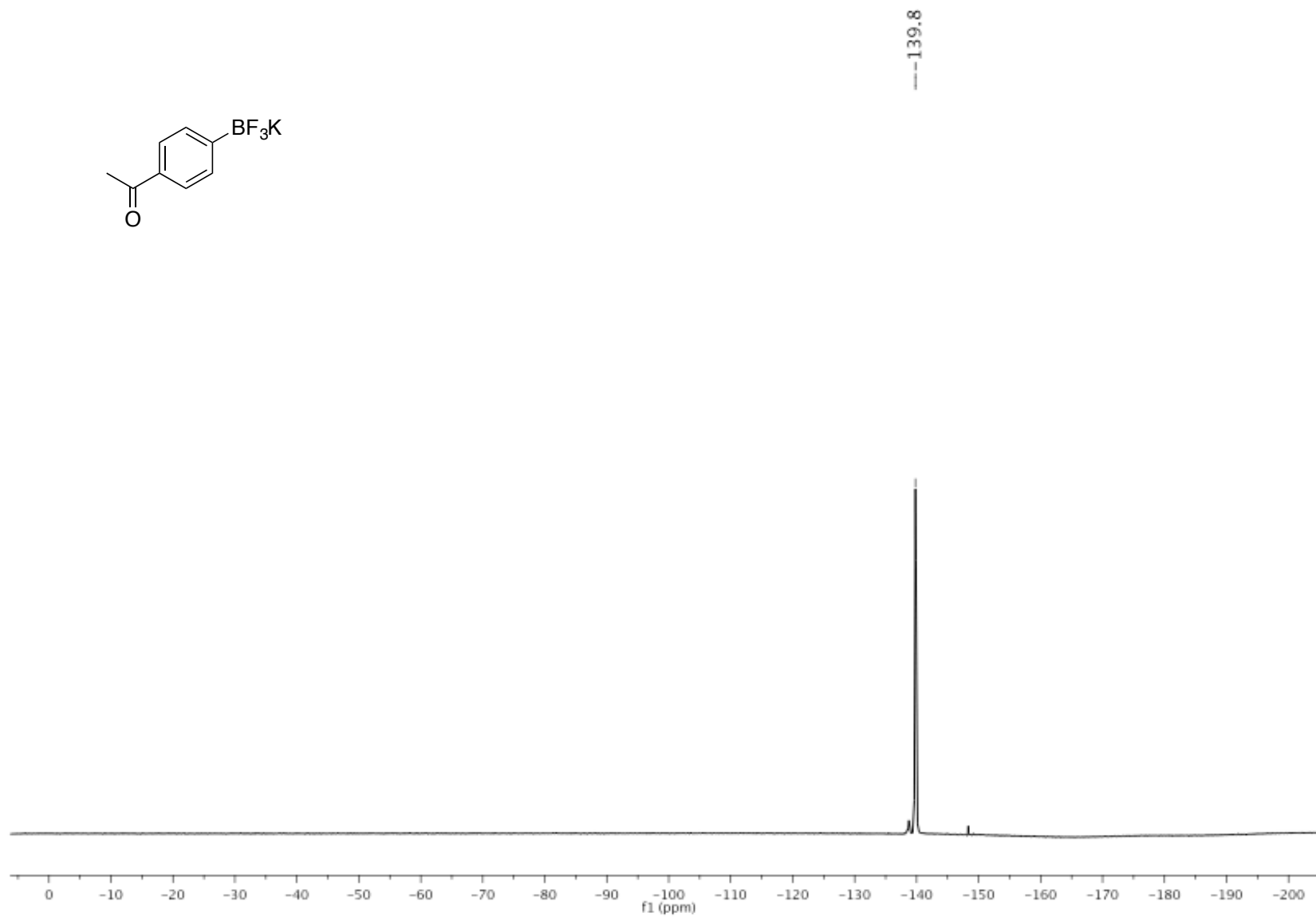
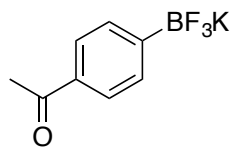


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Acetylphenyl)trifluoroborate (2c, Table 2, entry 3)**

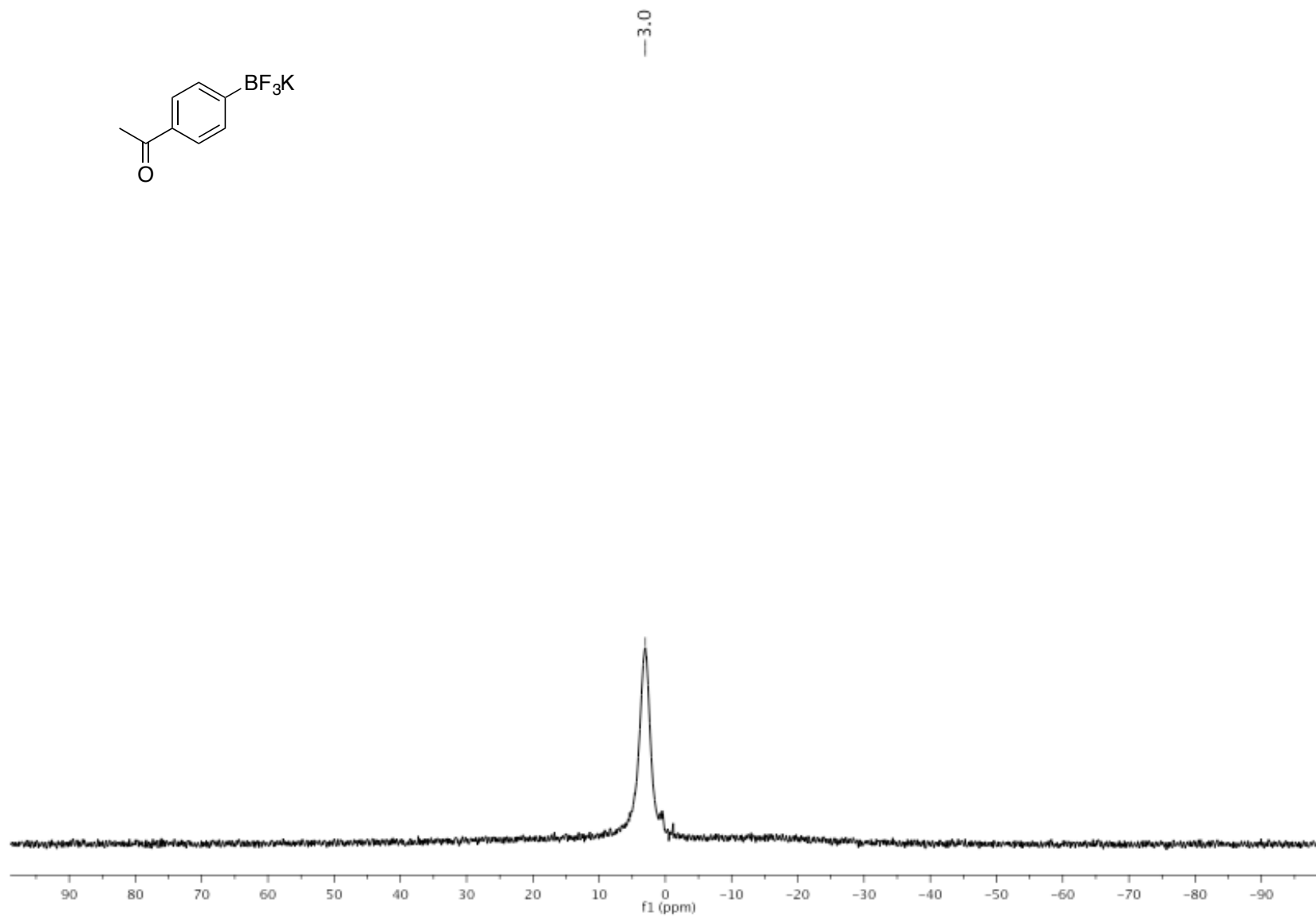
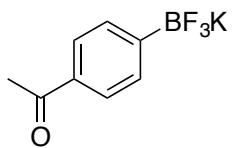


$^{13}\text{C}$  NMR (128.5 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium (4-Acetylphenyl)trifluoroborate (2c, Table 2, entry 3)

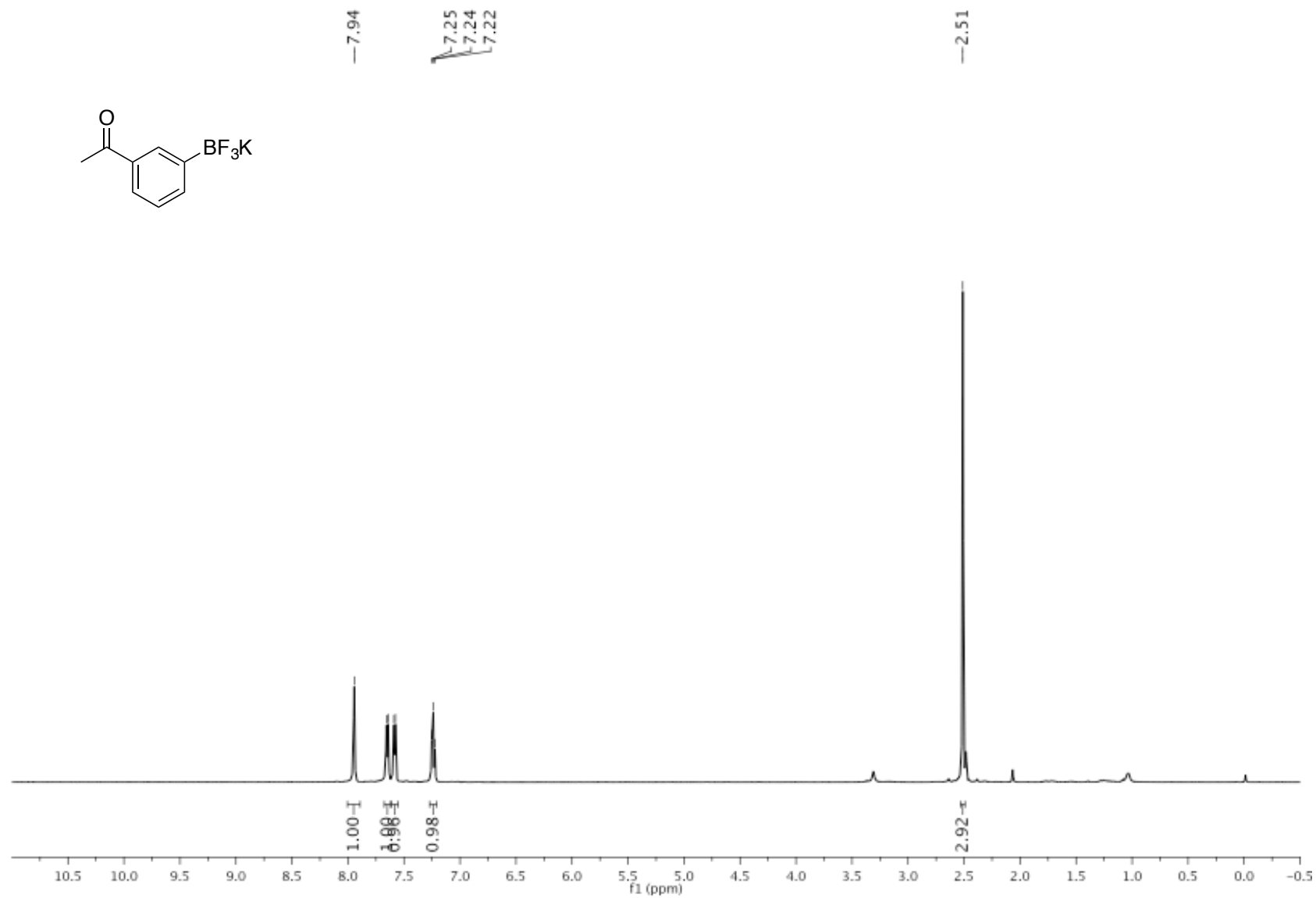




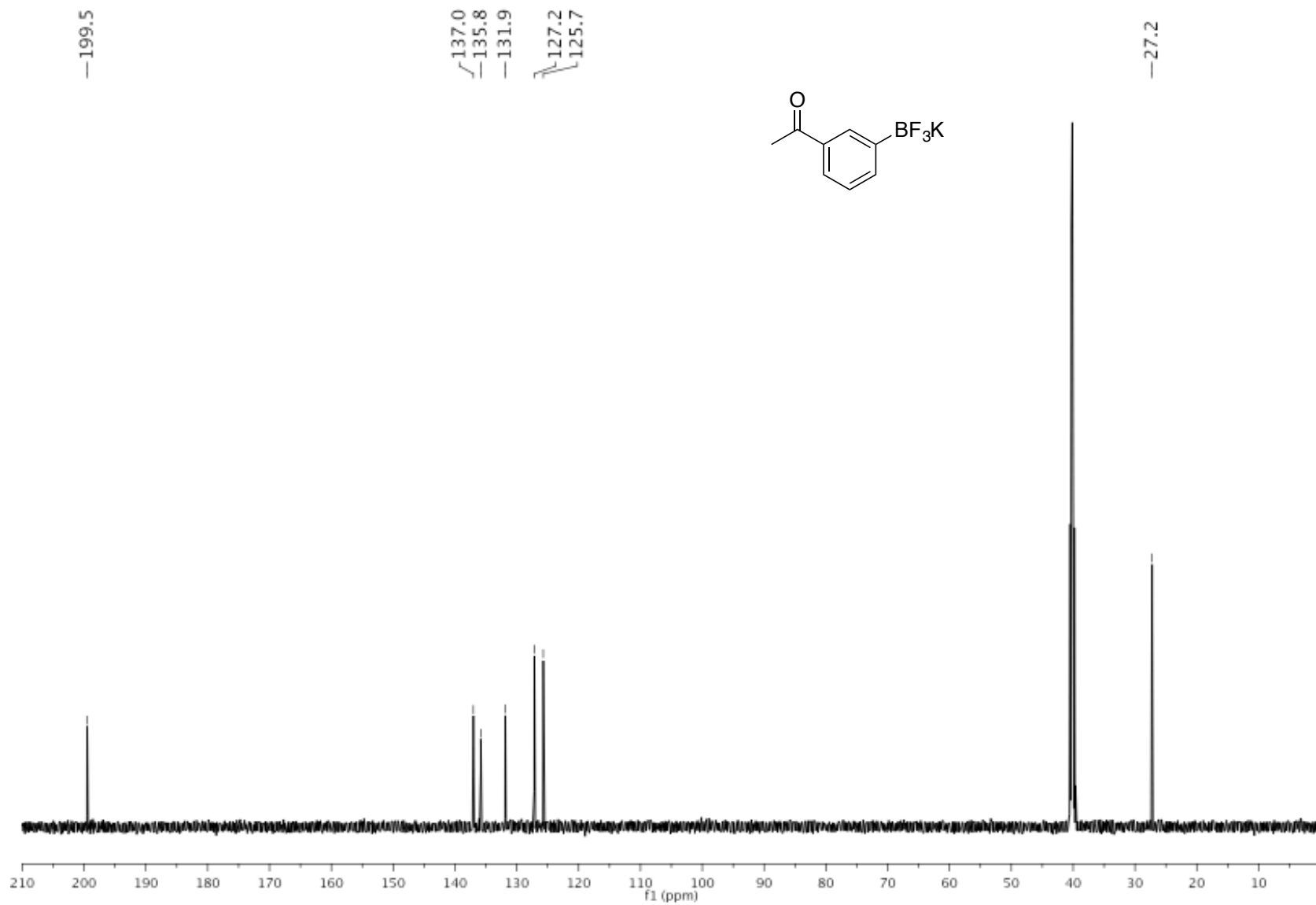
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Acetylphenyl)trifluoroborate (2c, Table 2, entry 3)**



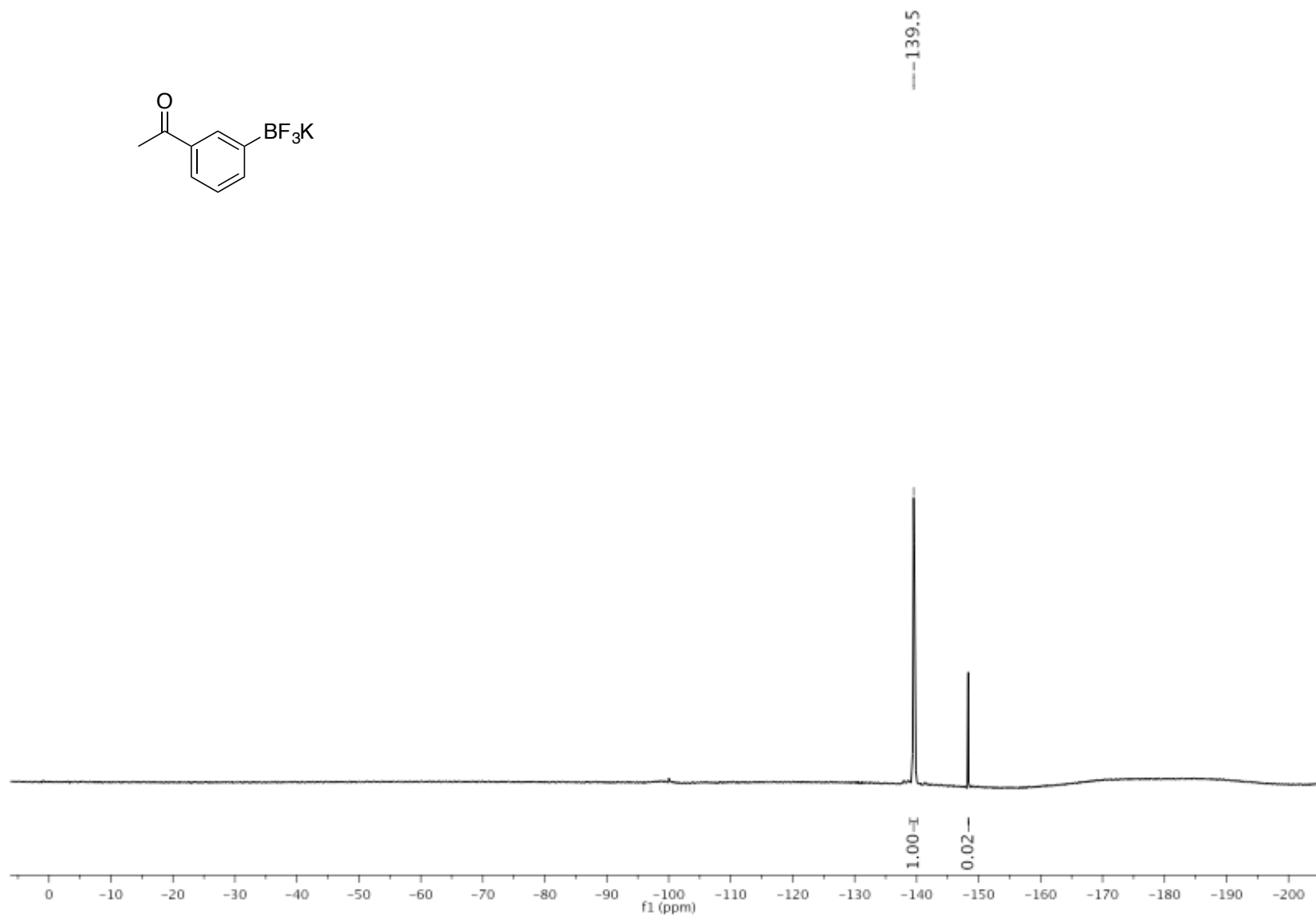
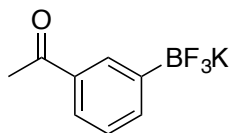
**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Acetylphenyl)trifluoroborate (2c, Table 2, entry 3)**



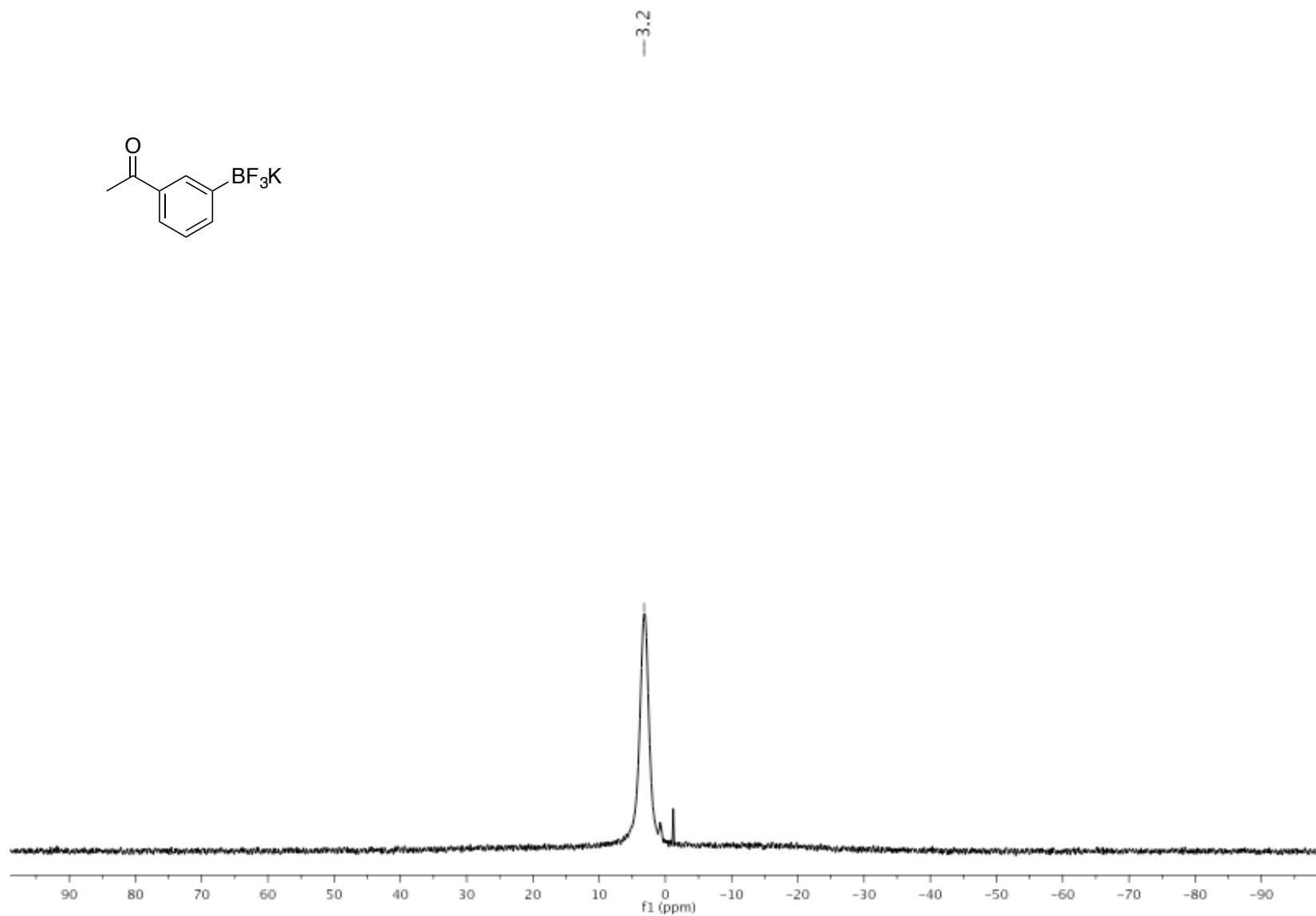
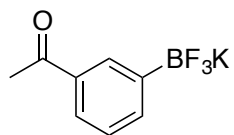
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (3-Acetylphenyl)trifluoroborate (2d, Table 2, entry 4)**



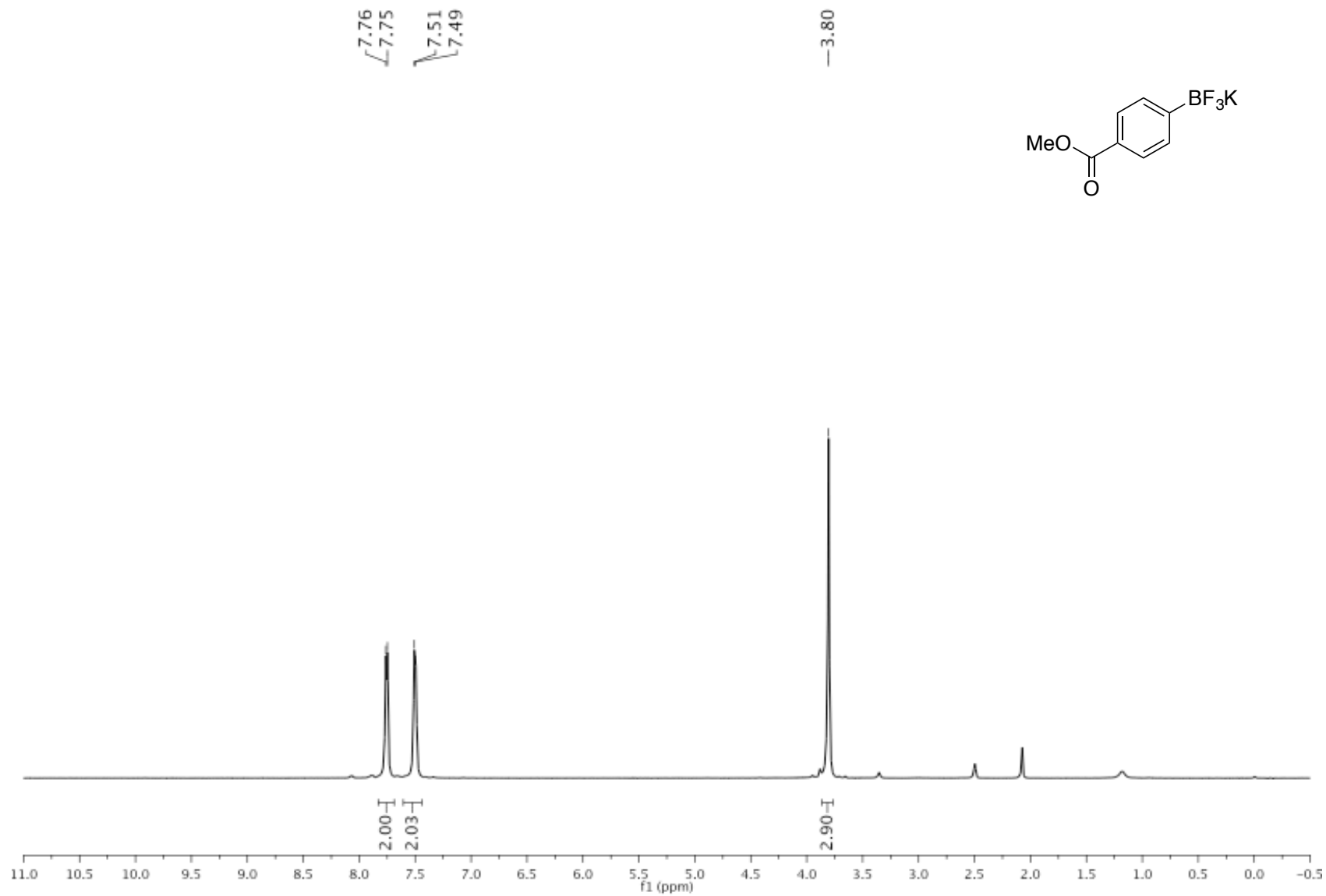
**$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium (3-Acetylphenyl)trifluoroborate (2d, Table 2, entry 4)**



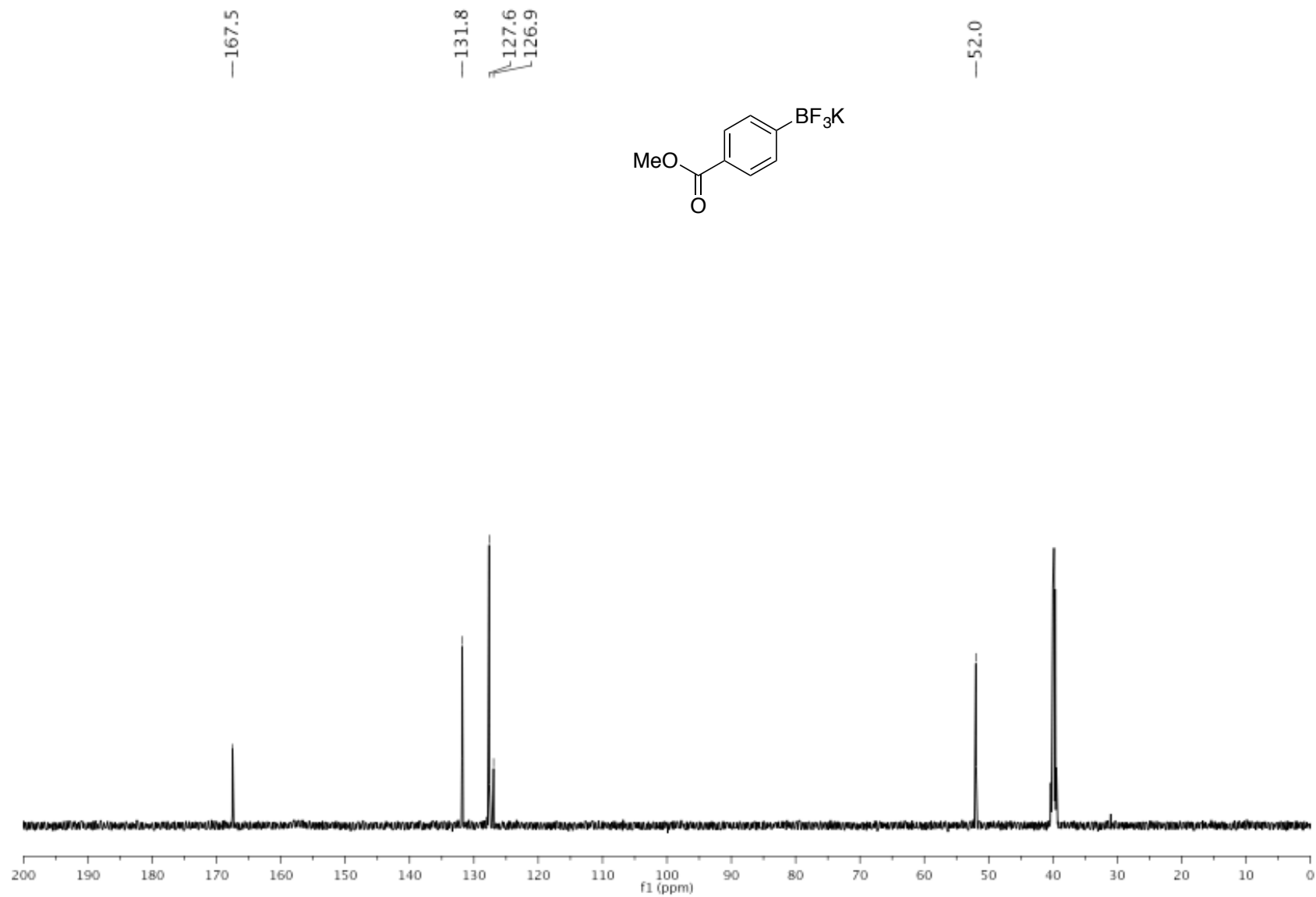
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (3-Acetylphenyl)trifluoroborate (2d, Table 2, entry 4)**



**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (3-Acetylphenyl)trifluoroborate (2d, Table 2, entry 4)**

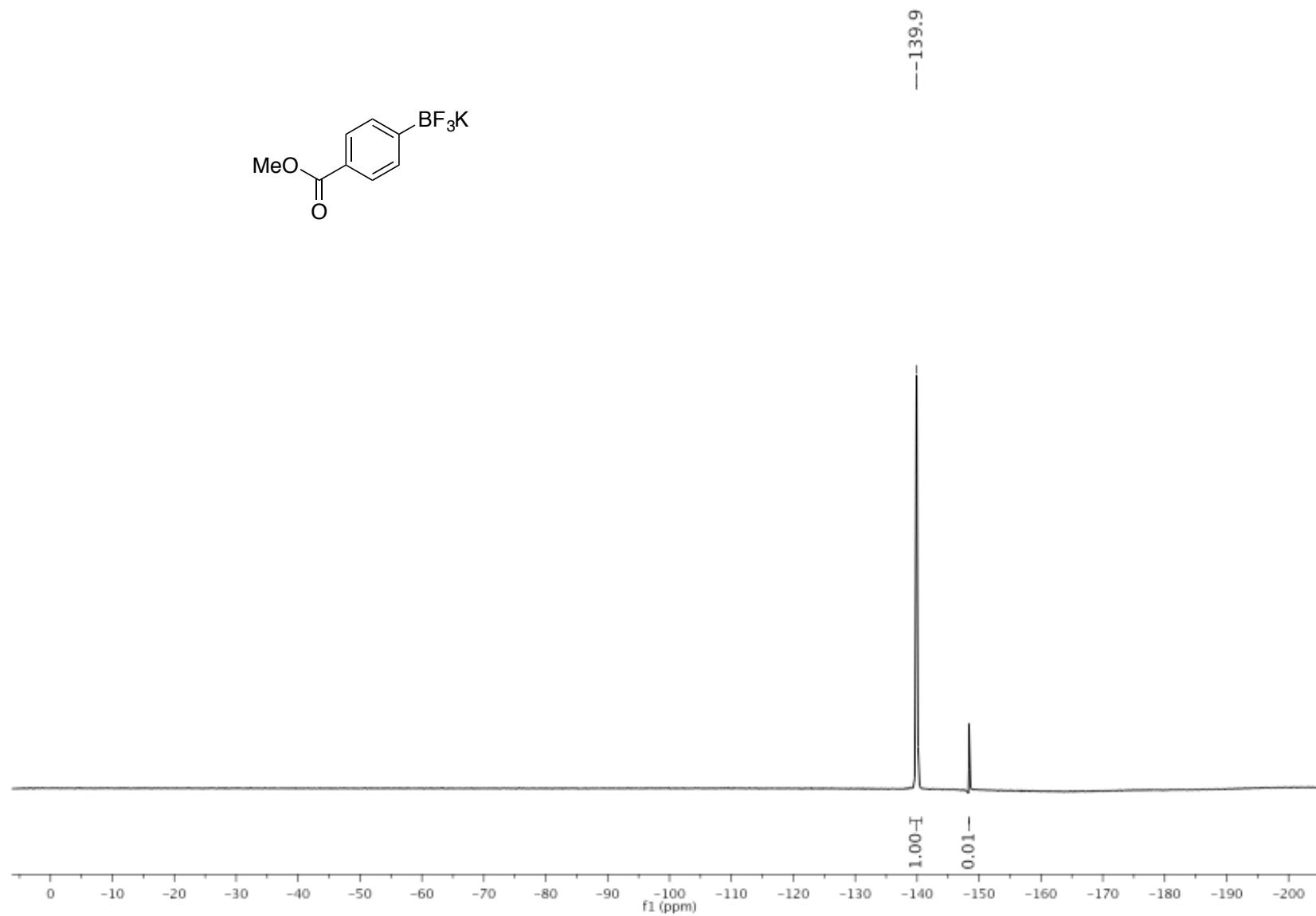
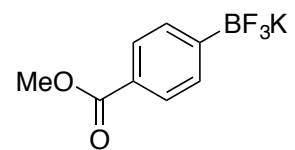


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(methoxycarbonyl)phenyl)borate (2e, Table 2, entry 5)**

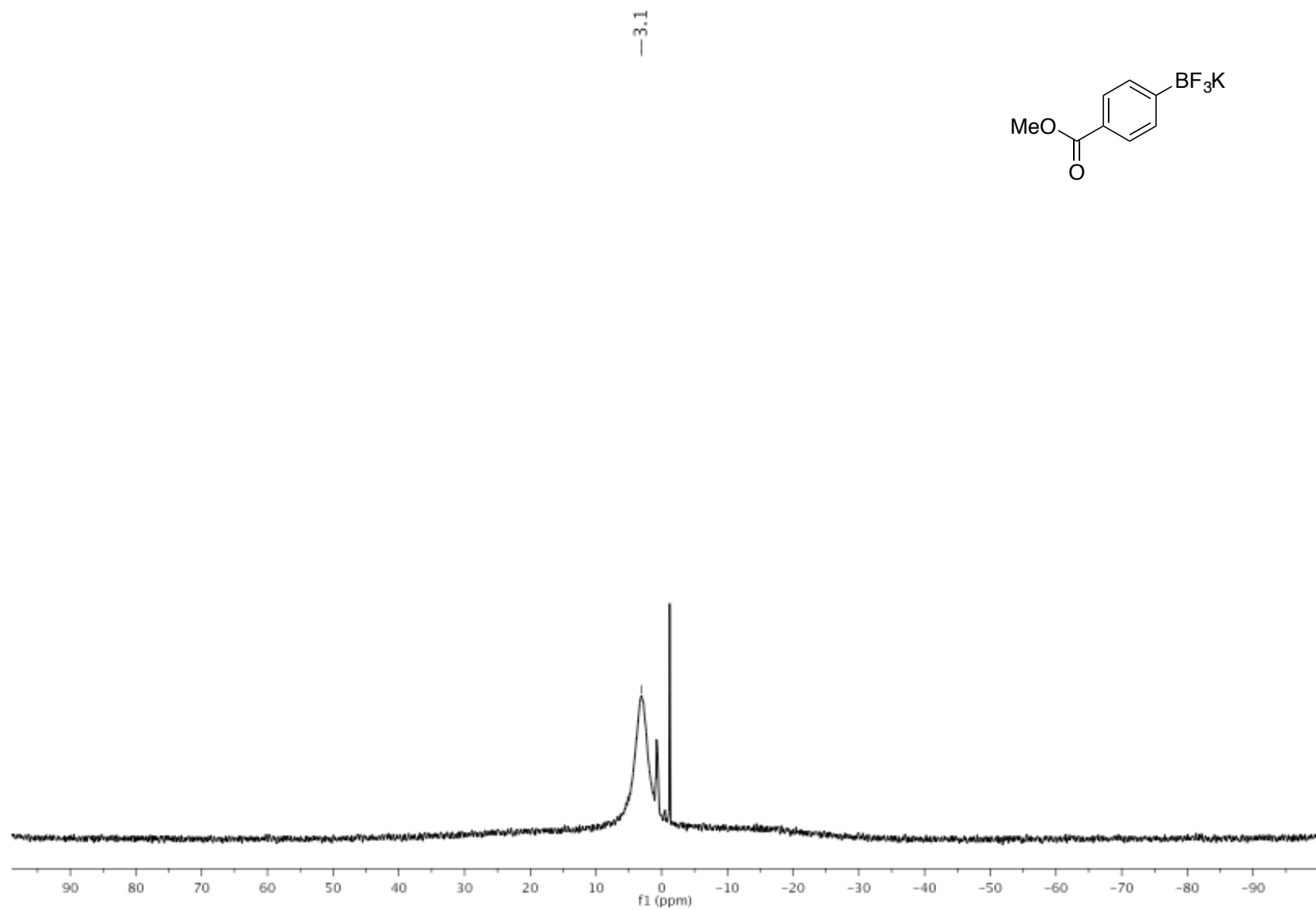


$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-(methoxycarbonyl)phenyl)borate (2e, Table 2, entry 5)

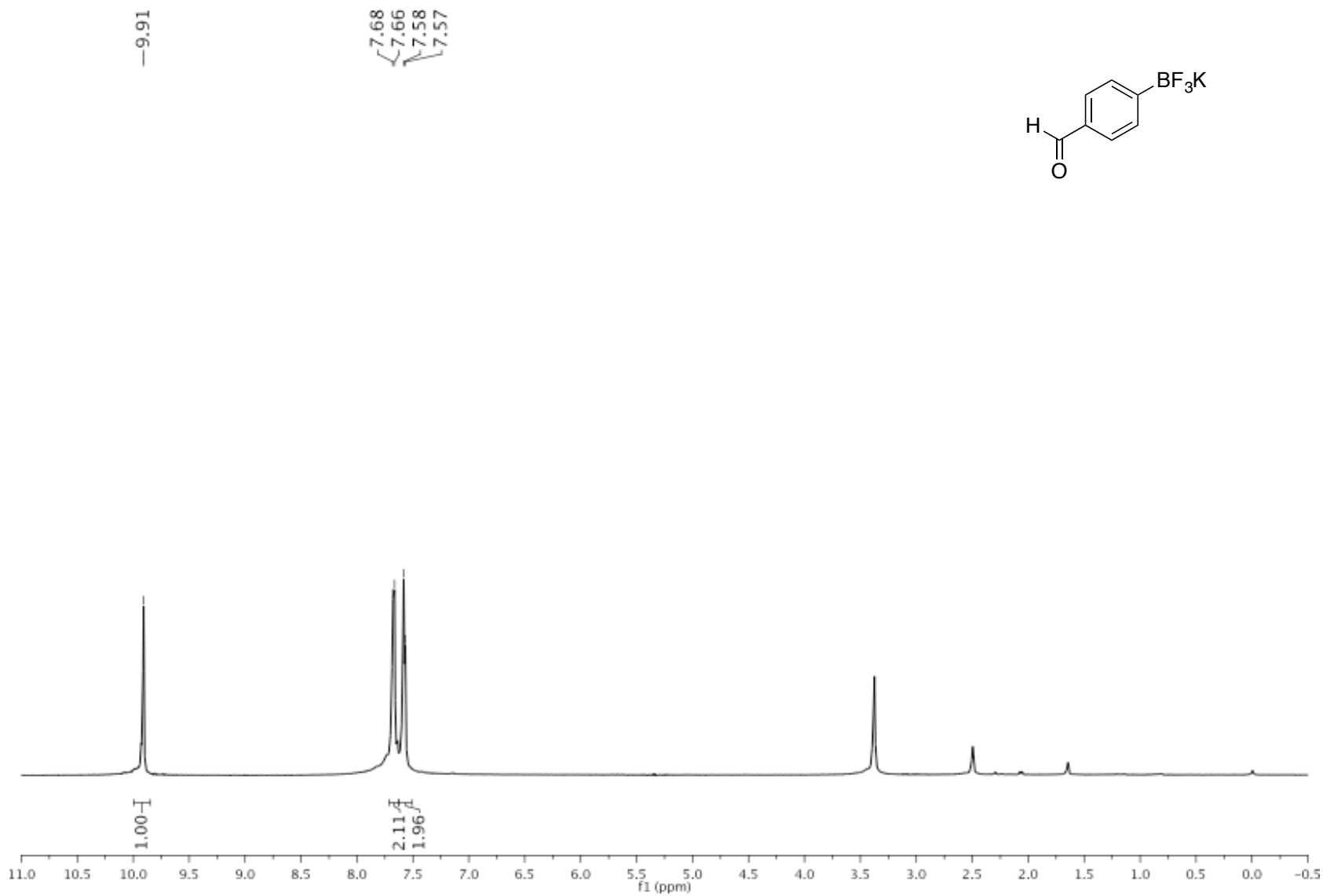




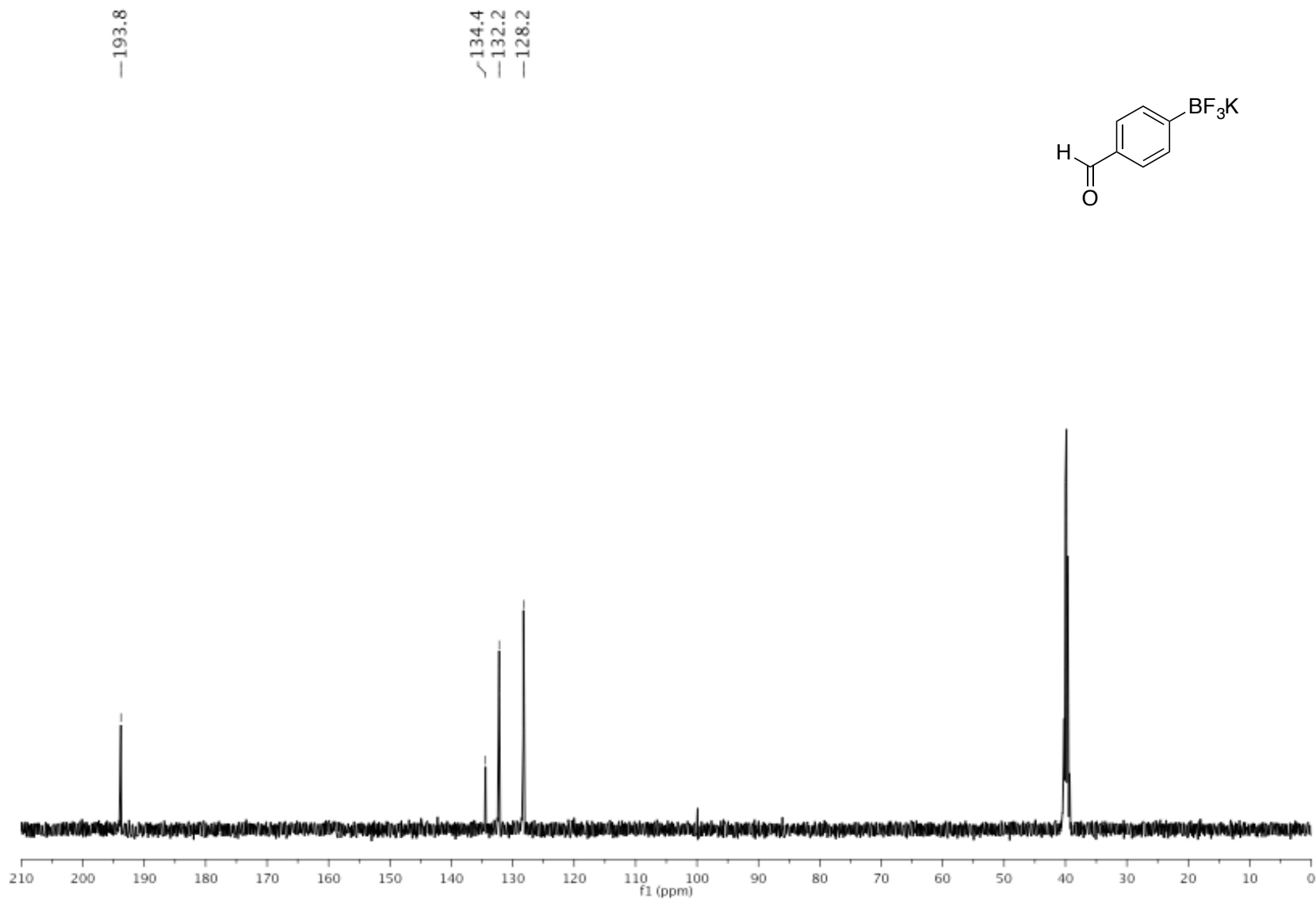
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(methoxycarbonyl)phenyl)borate (2e, Table 2, entry 5)**



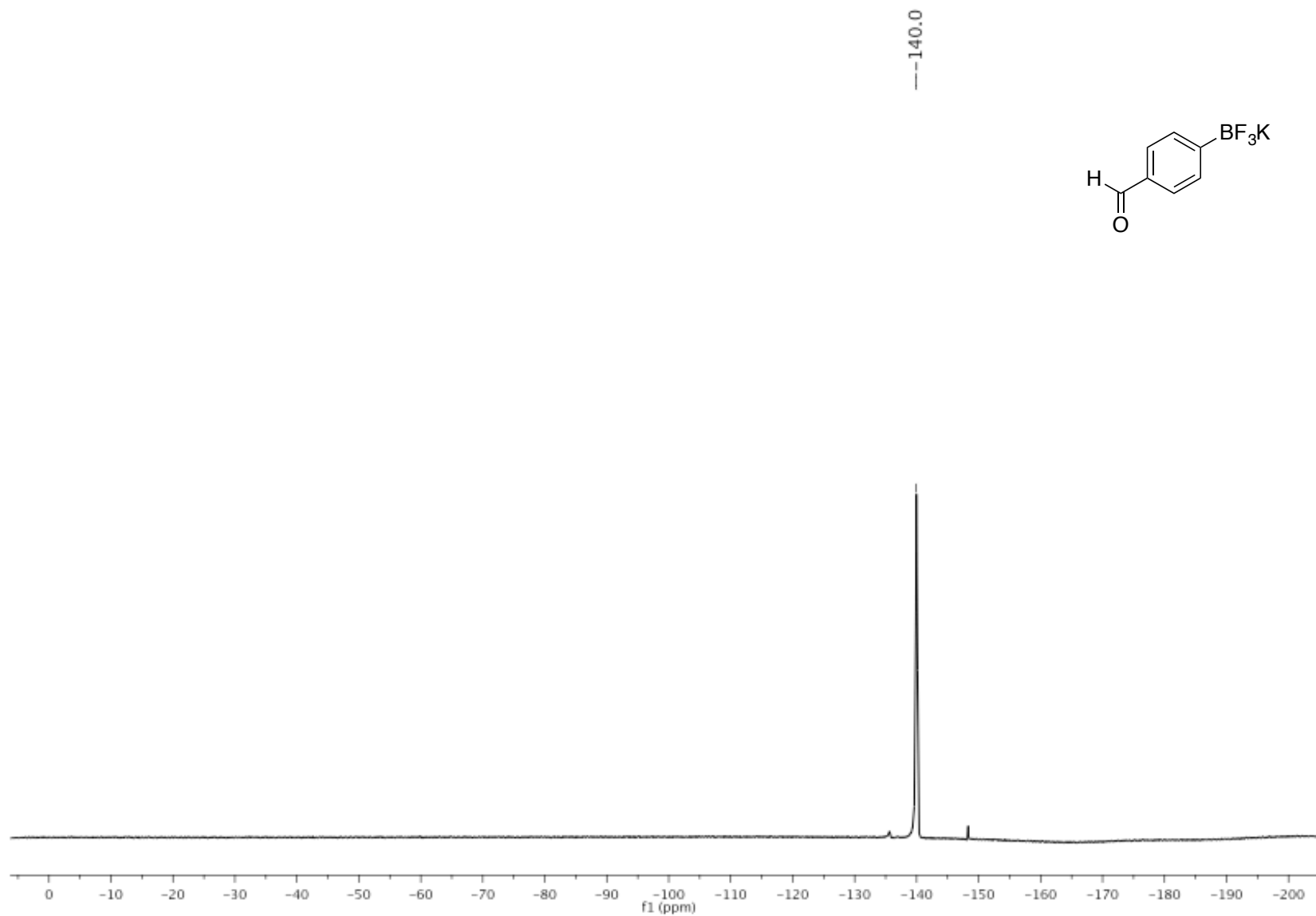
**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(methoxycarbonyl)phenyl)borate (2e, Table 2, entry 5)**



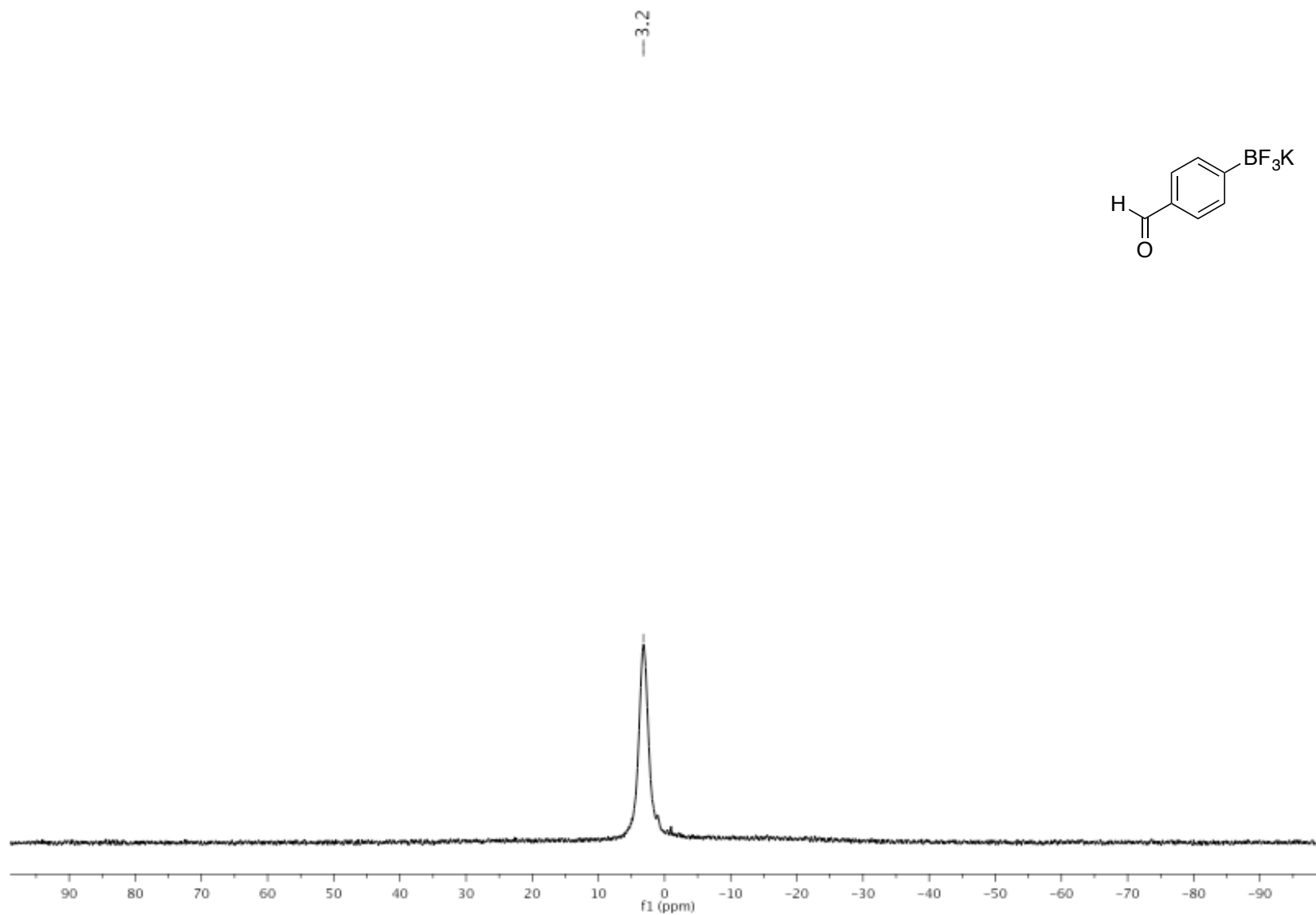
$^1\text{H}$  NMR (500 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(4-formylphenyl)borate (2f, Table 2, entry 6)



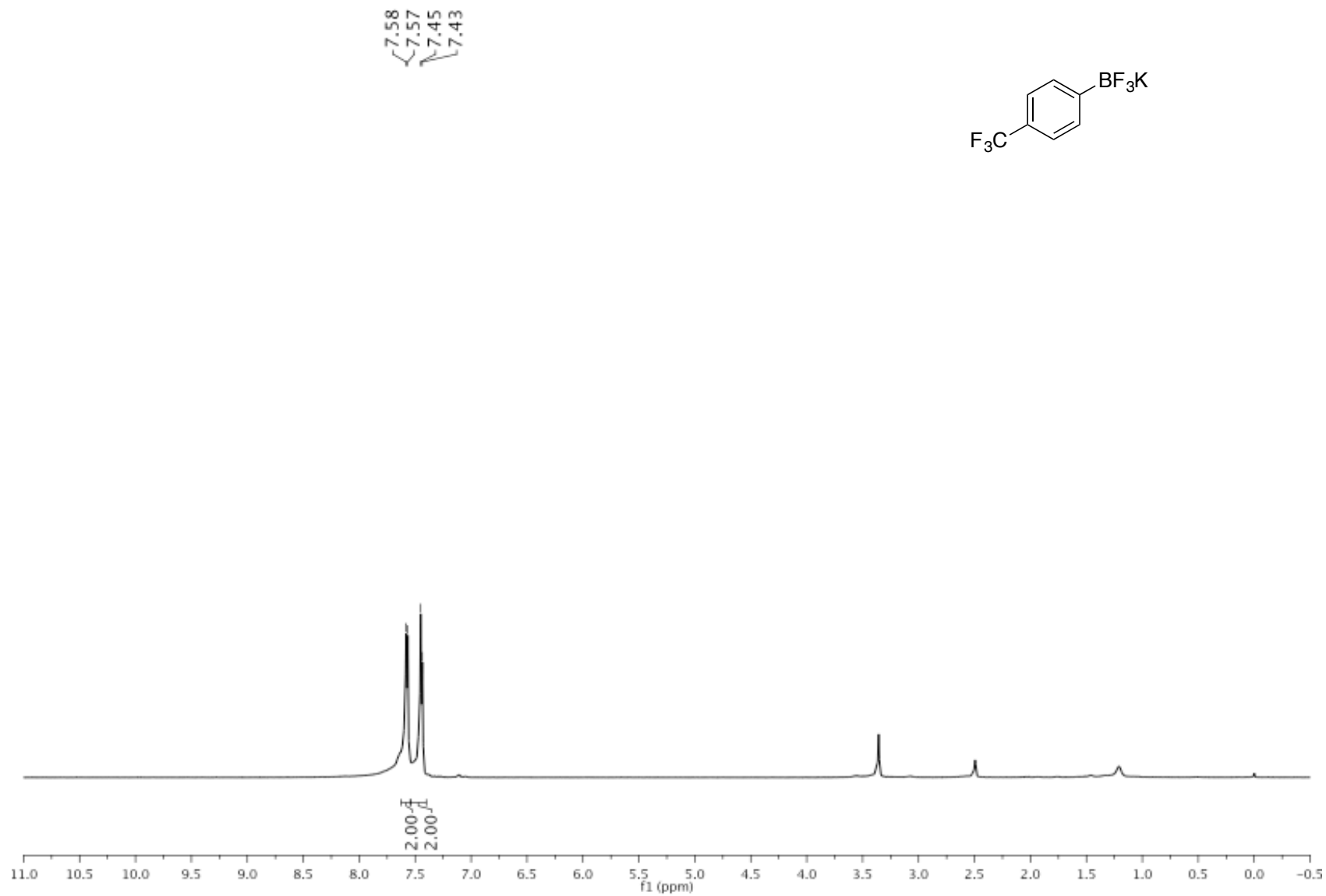
$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-formylphenyl)borate (2f, Table 2, entry 6)



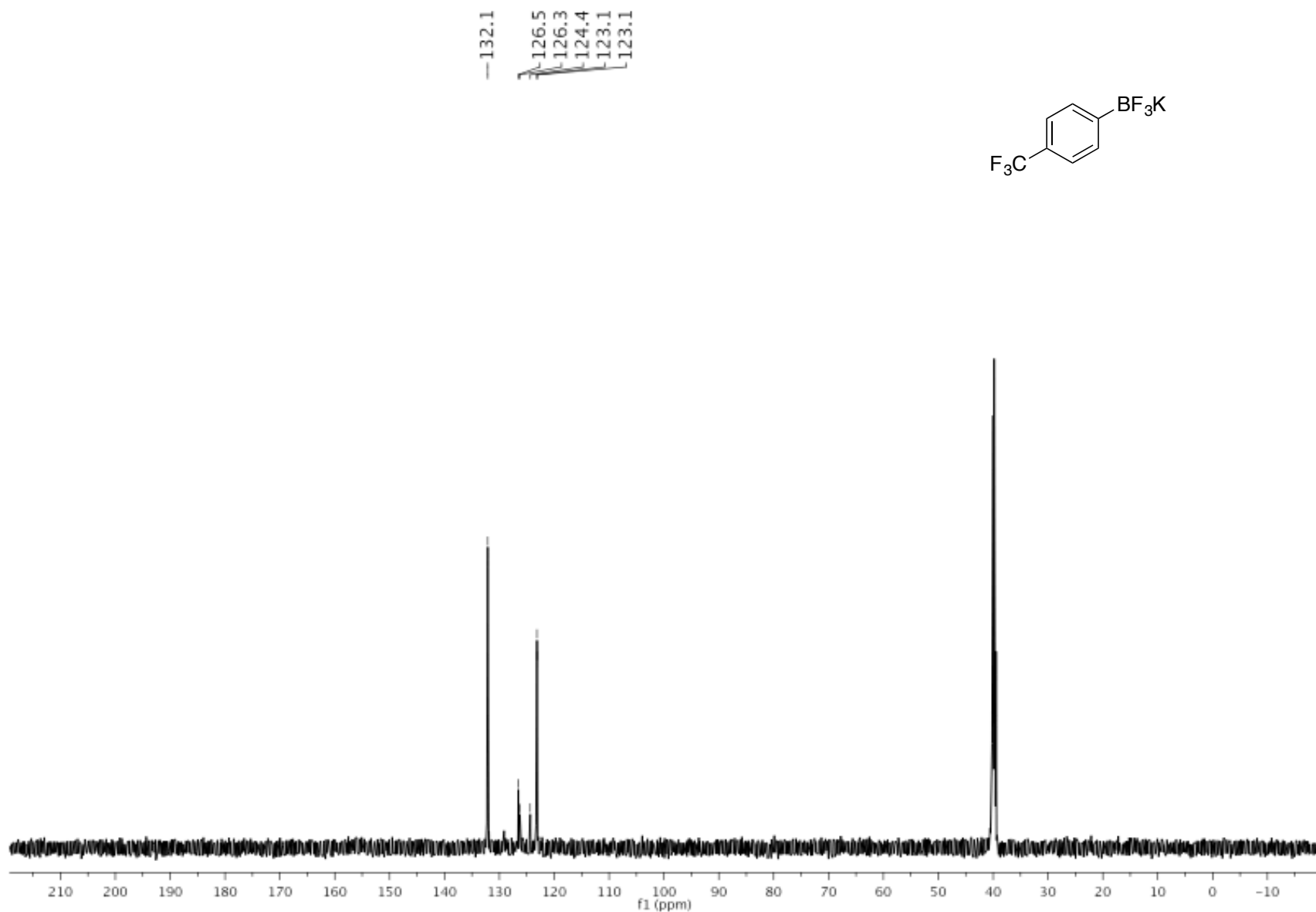
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(4-formylphenyl)borate (2f, Table 2, entry 6)



**$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(4-formylphenyl)borate (2f, Table 2, entry 6)**

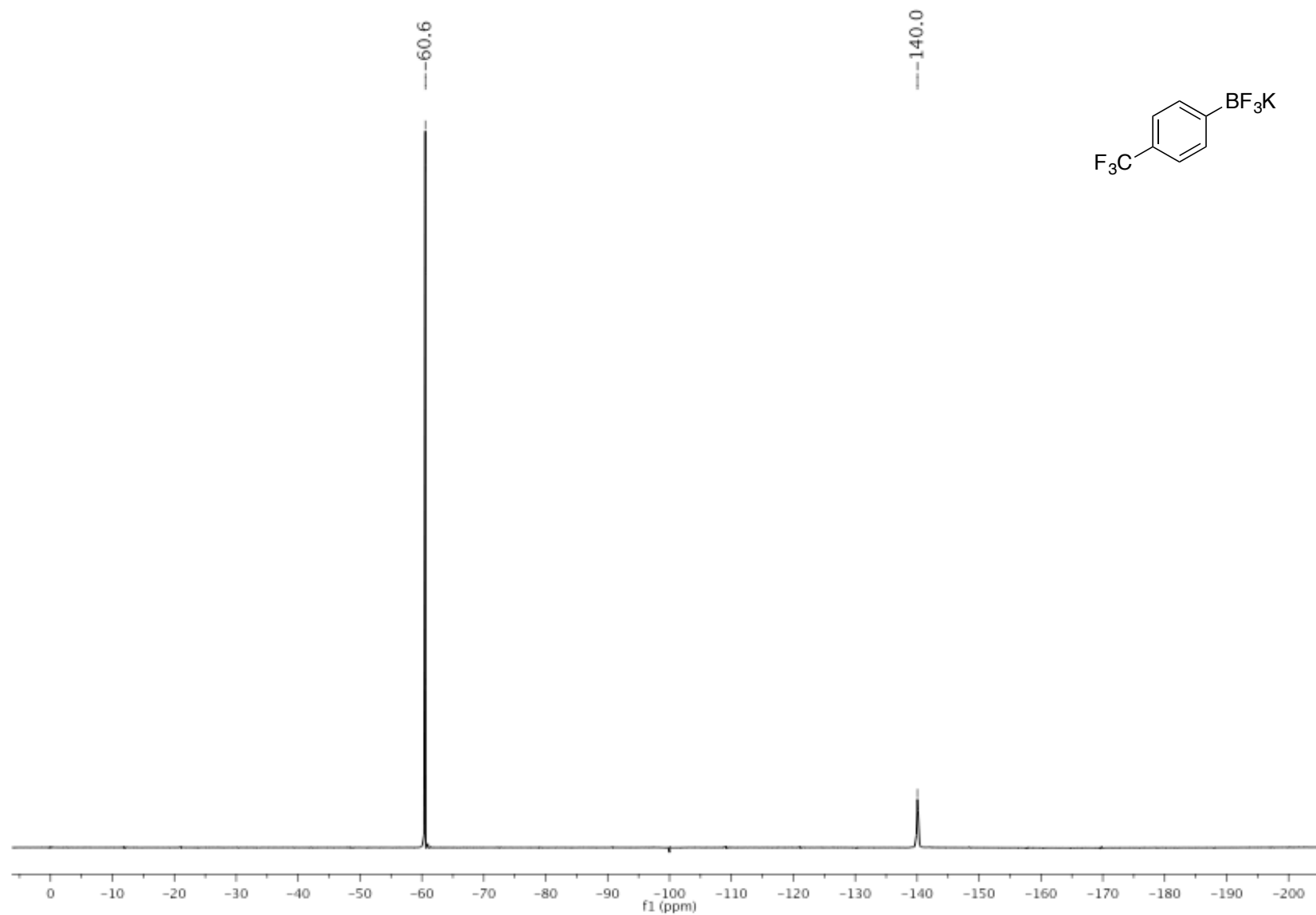


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(trifluoromethyl)phenyl)borate (2g, Table 2, entry 7)**

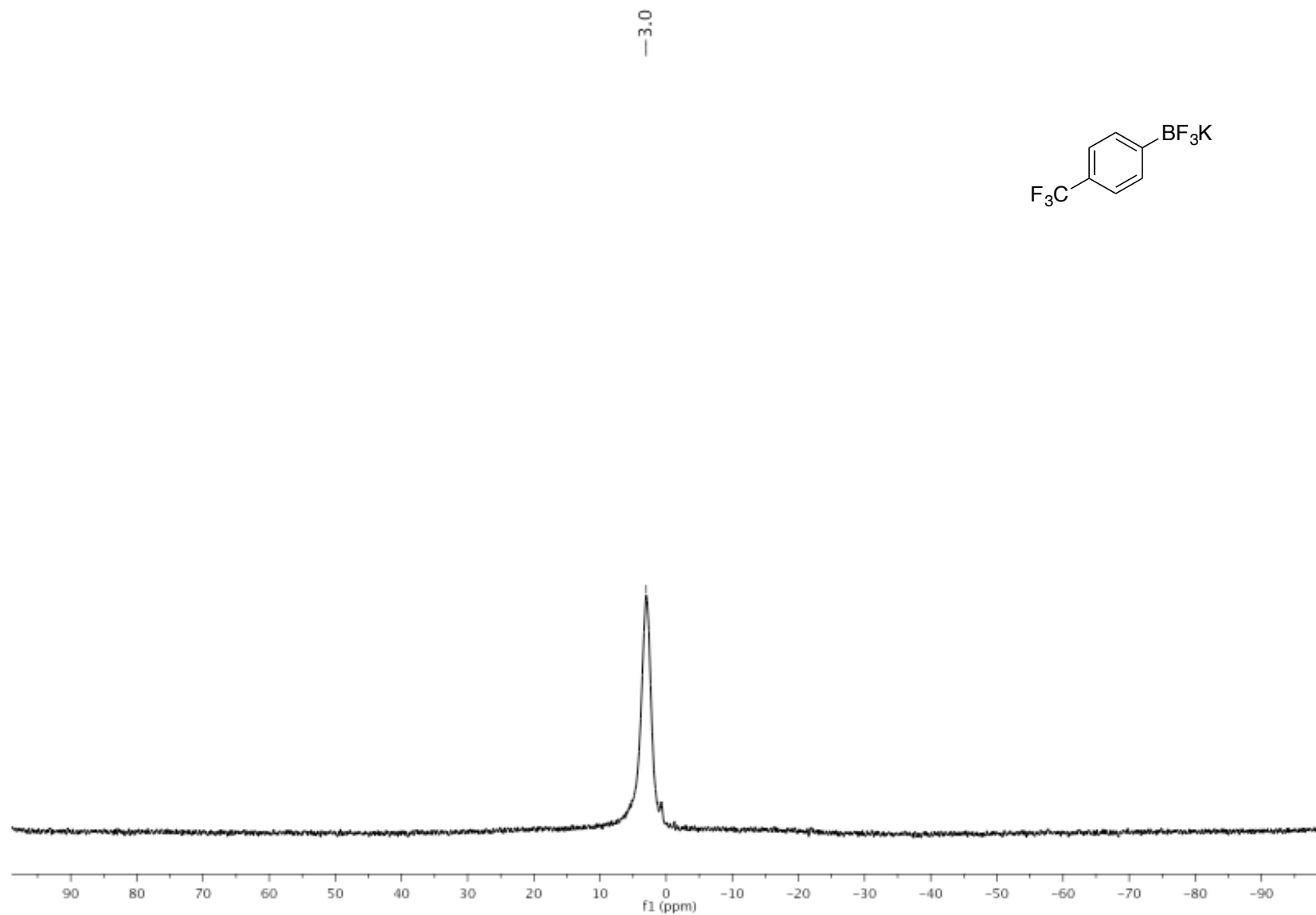


**<sup>13</sup>C NMR (128.5 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(trifluoromethyl)phenyl)borate (2g, Table 2, entry 7)**

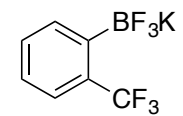
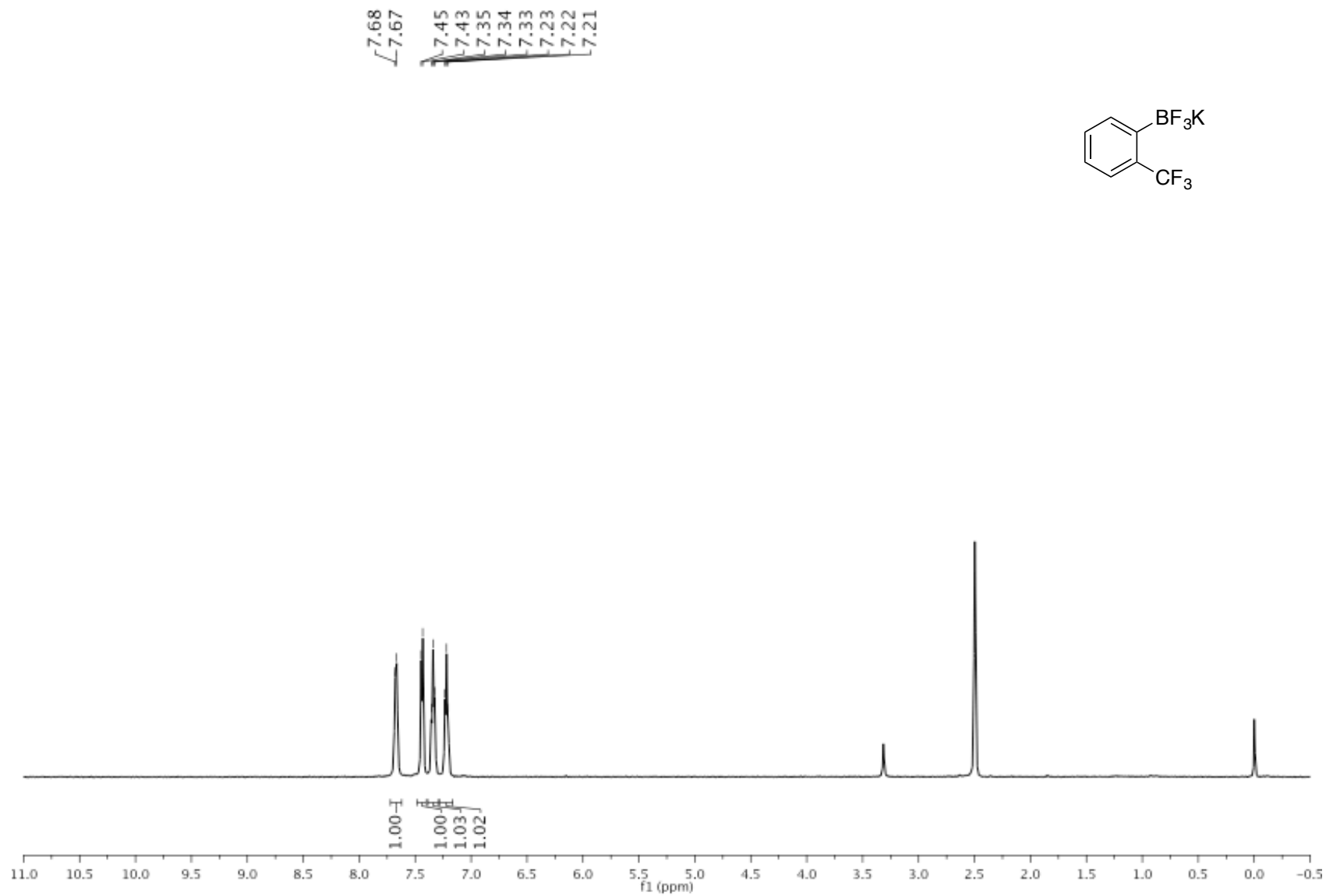




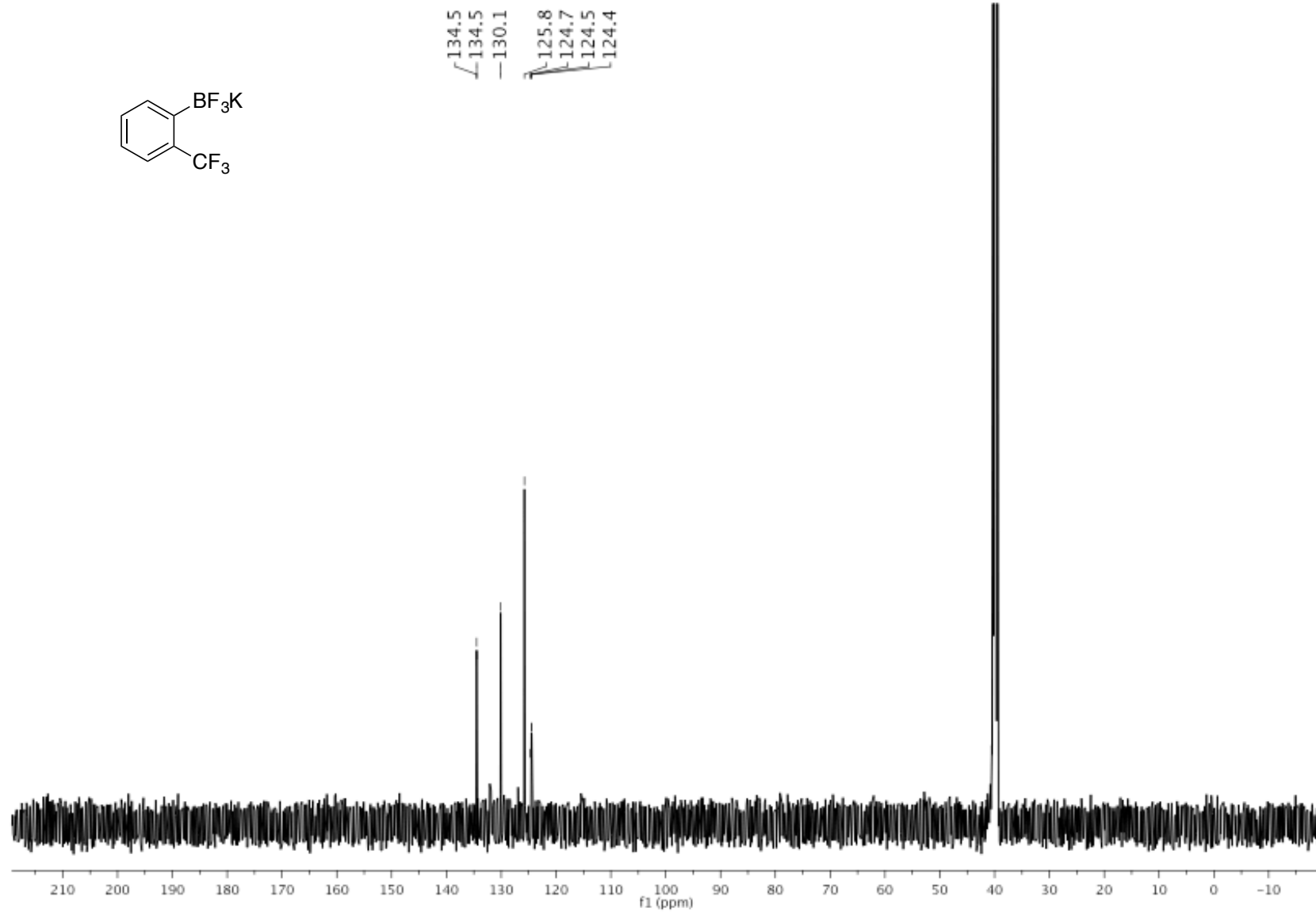
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(4-(trifluoromethyl)phenyl)borate (2g, Table 2, entry 7)



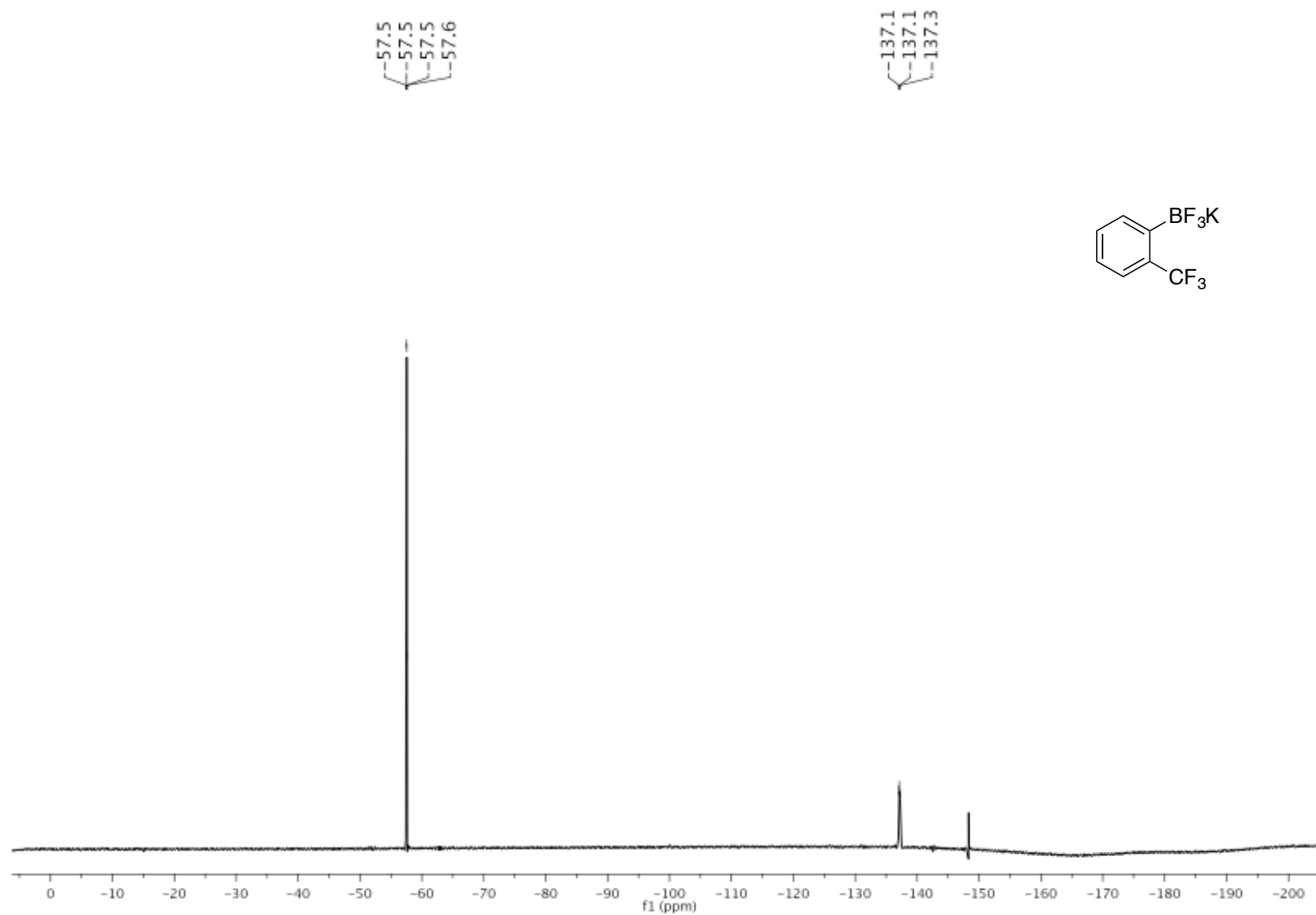
**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(trifluoromethyl)phenyl)borate (2g, Table 2, entry 7)**



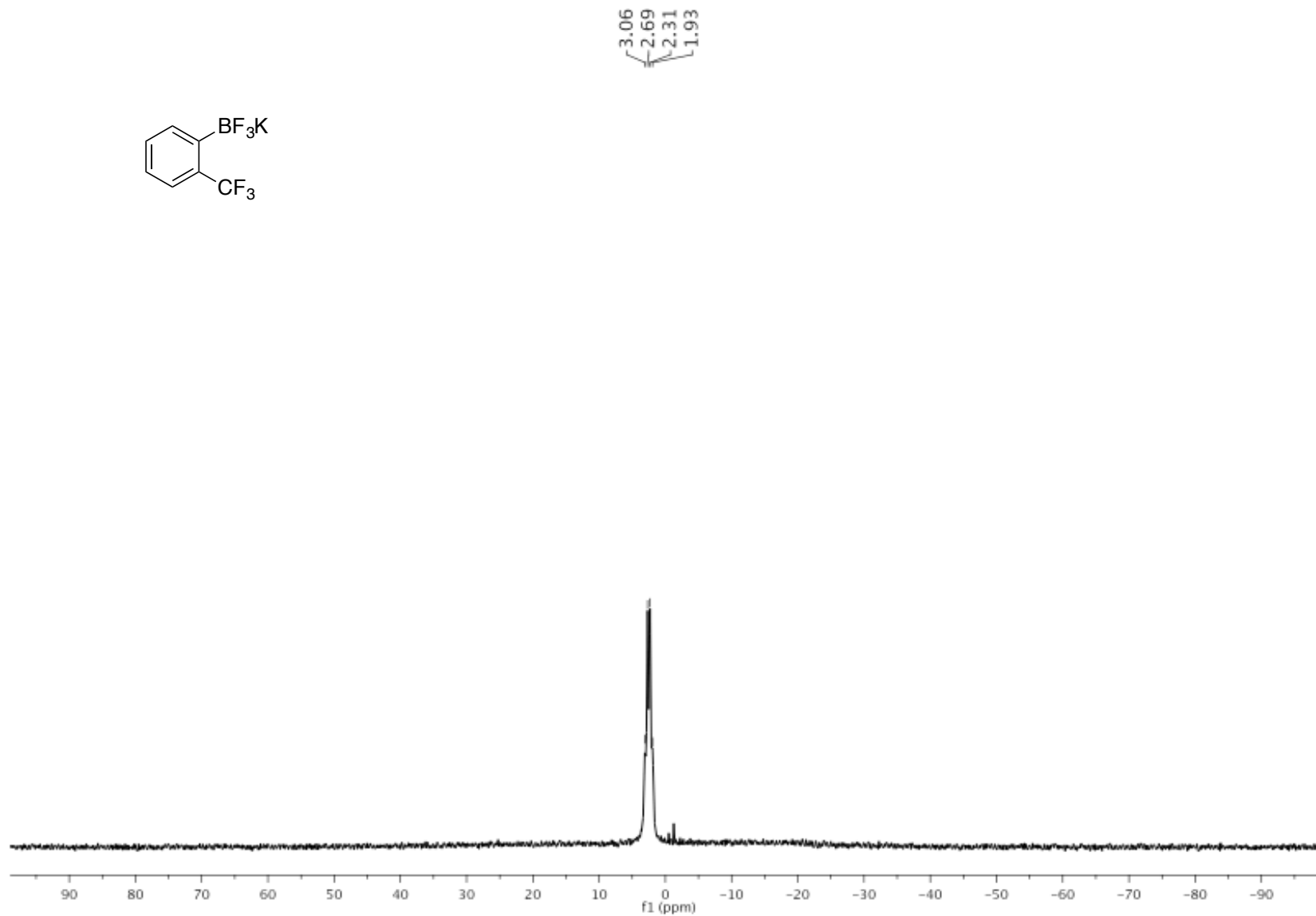
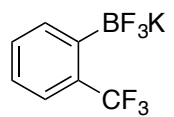
<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-(trifluoromethyl)phenyl)borate (2h, Table 2, entry 8)



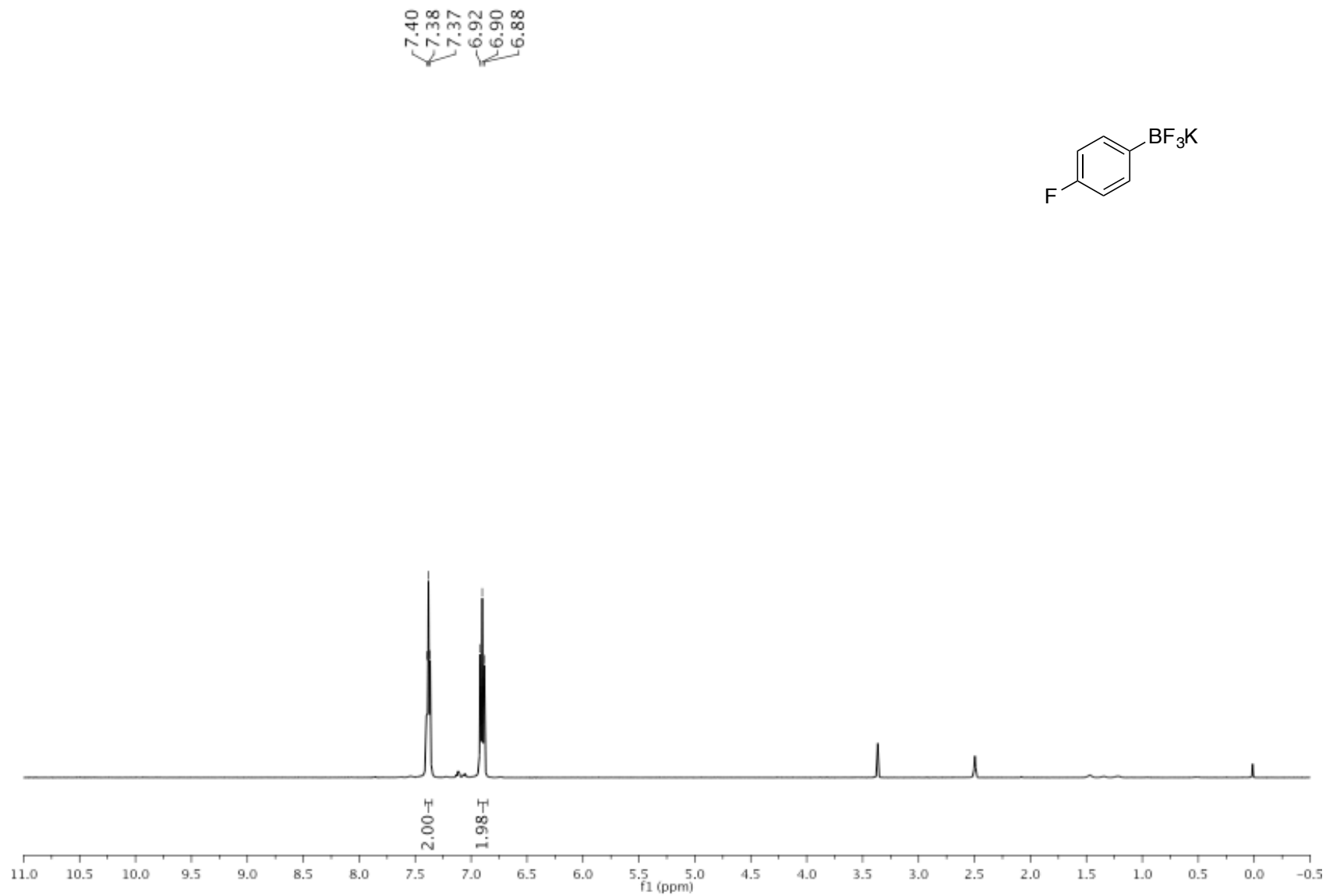
$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(2-(trifluoromethyl)phenyl)borate (2h, Table 2, entry 8)



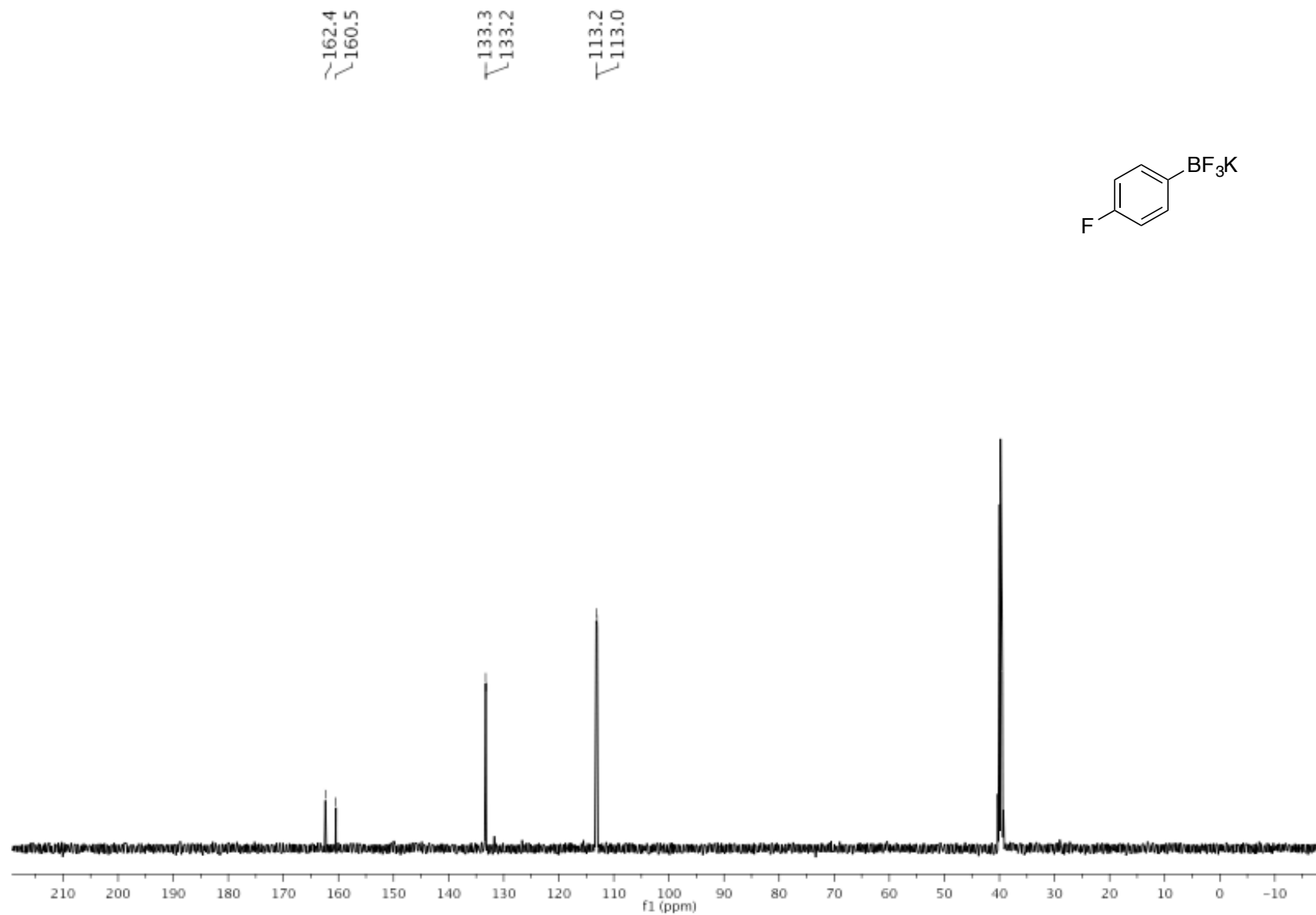
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-(trifluoromethyl)phenyl)borate (2h, Table 2, entry 8)**



$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(2-(trifluoromethyl)phenyl)borate (2h, Table 2, entry 8)

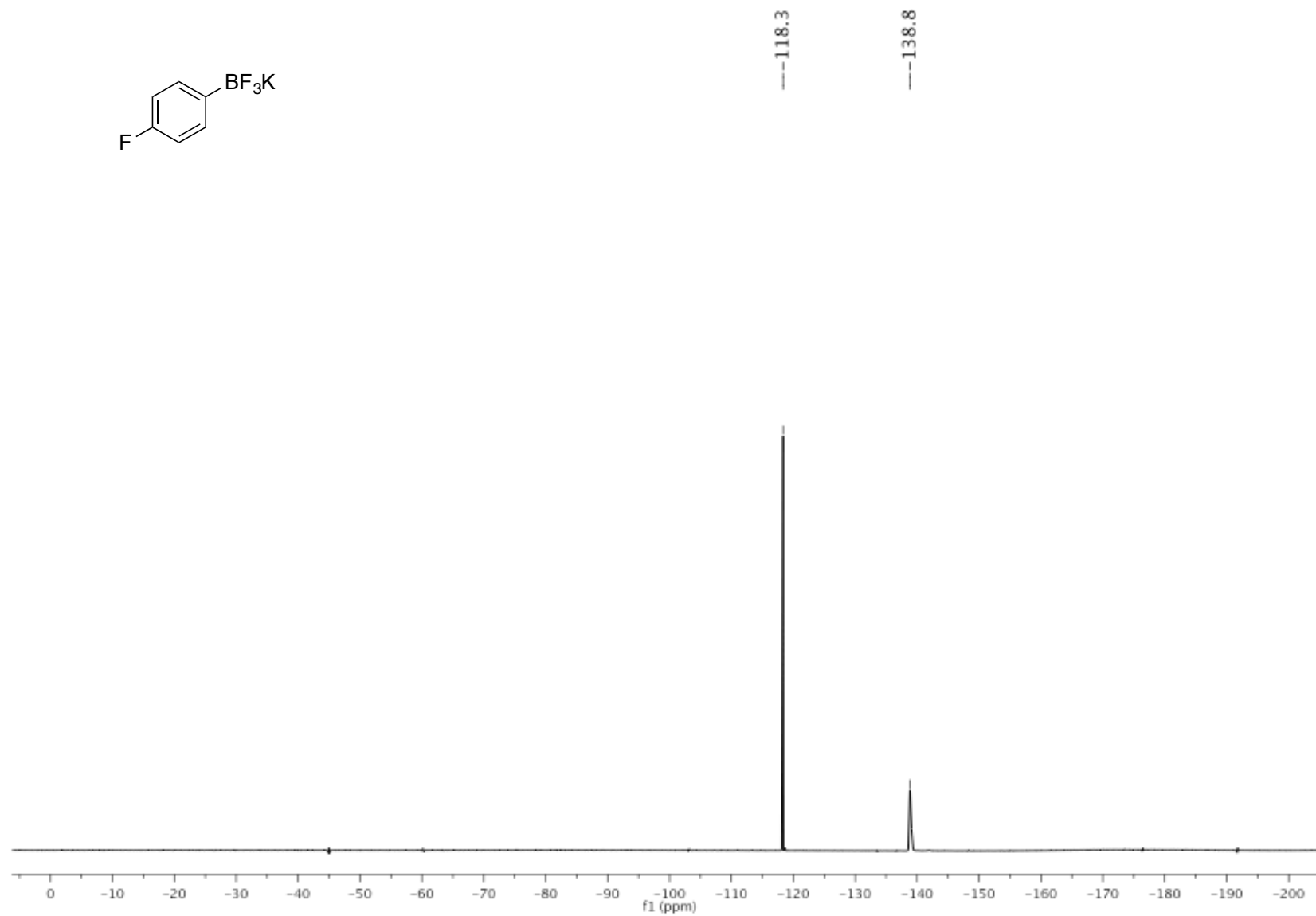


$^1\text{H}$  NMR (500 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-fluorophenyl)borate (2i, Table 2, entry 9)

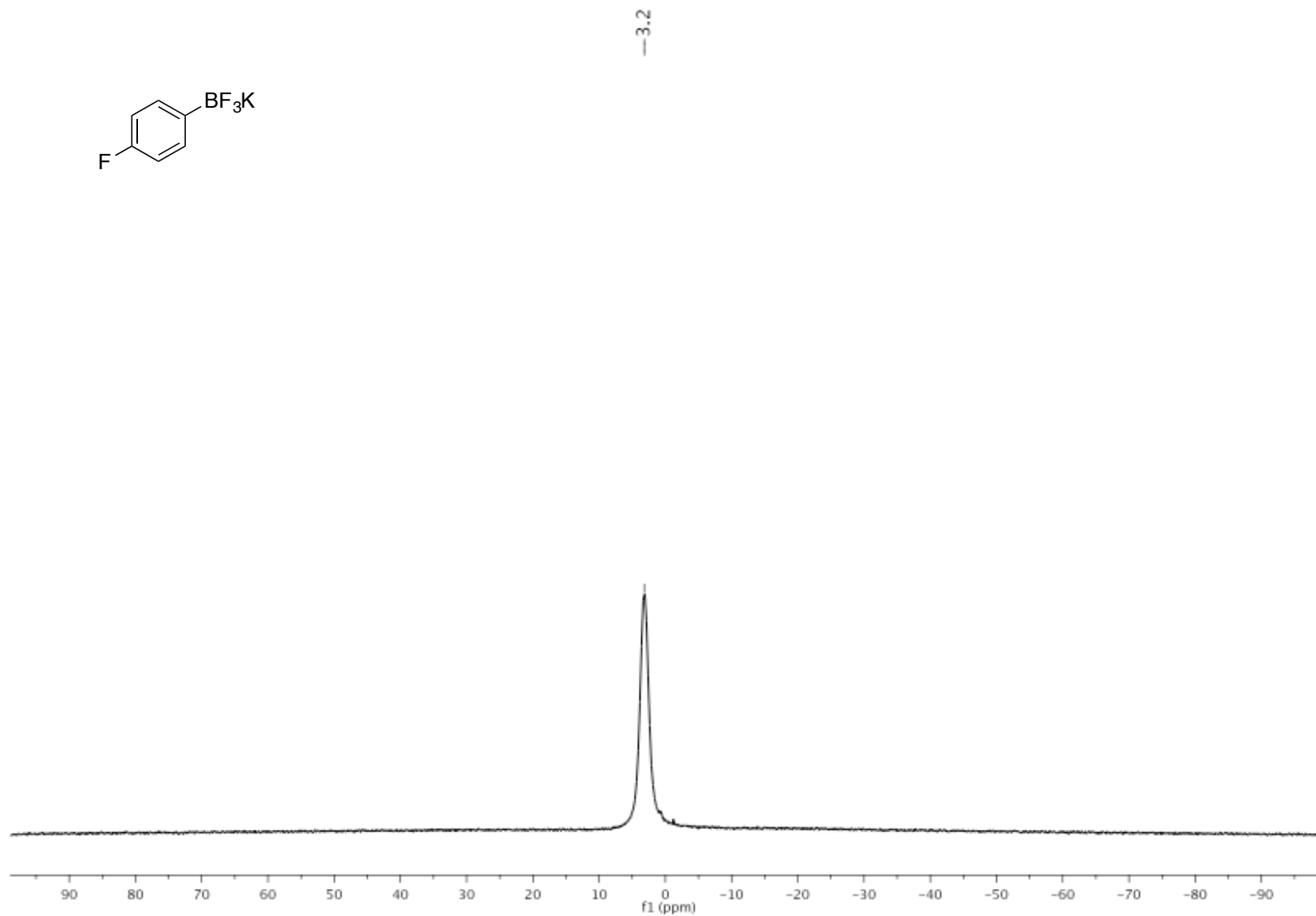
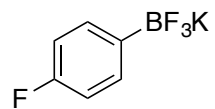


**$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-fluorophenyl)borate (2i, Table 2, entry 9)**

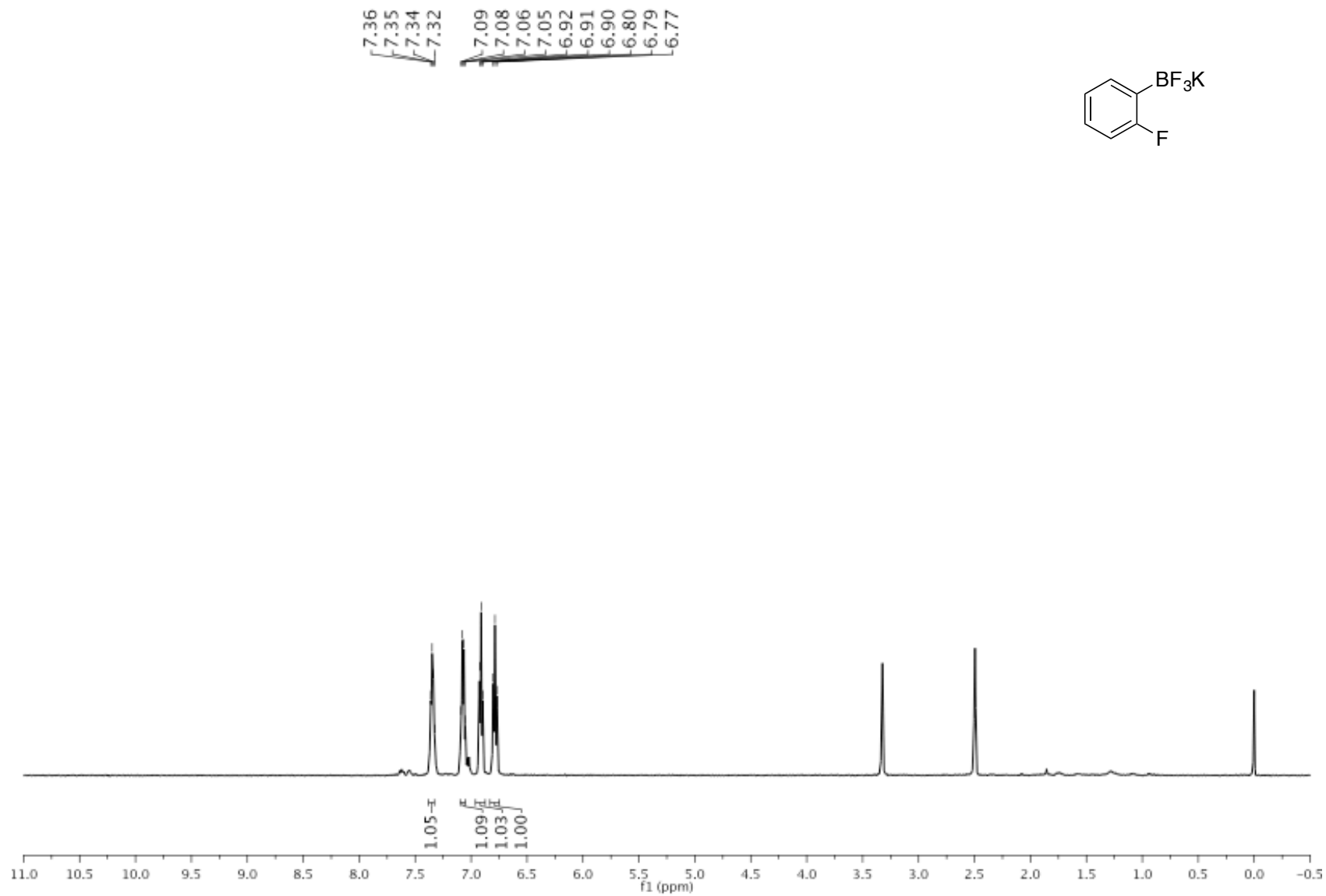




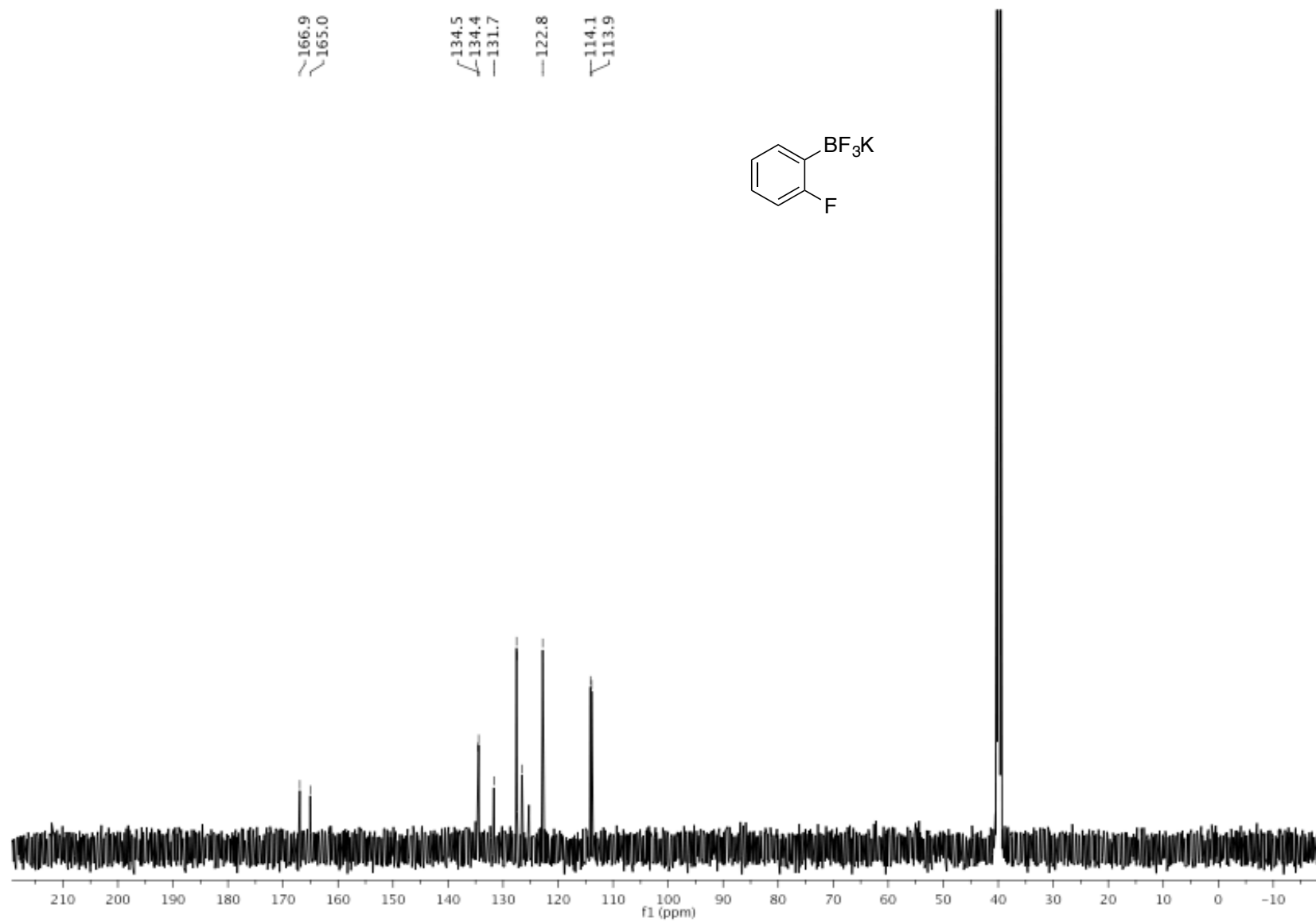
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-fluorophenyl)borate (2i, Table 2, entry 9)**



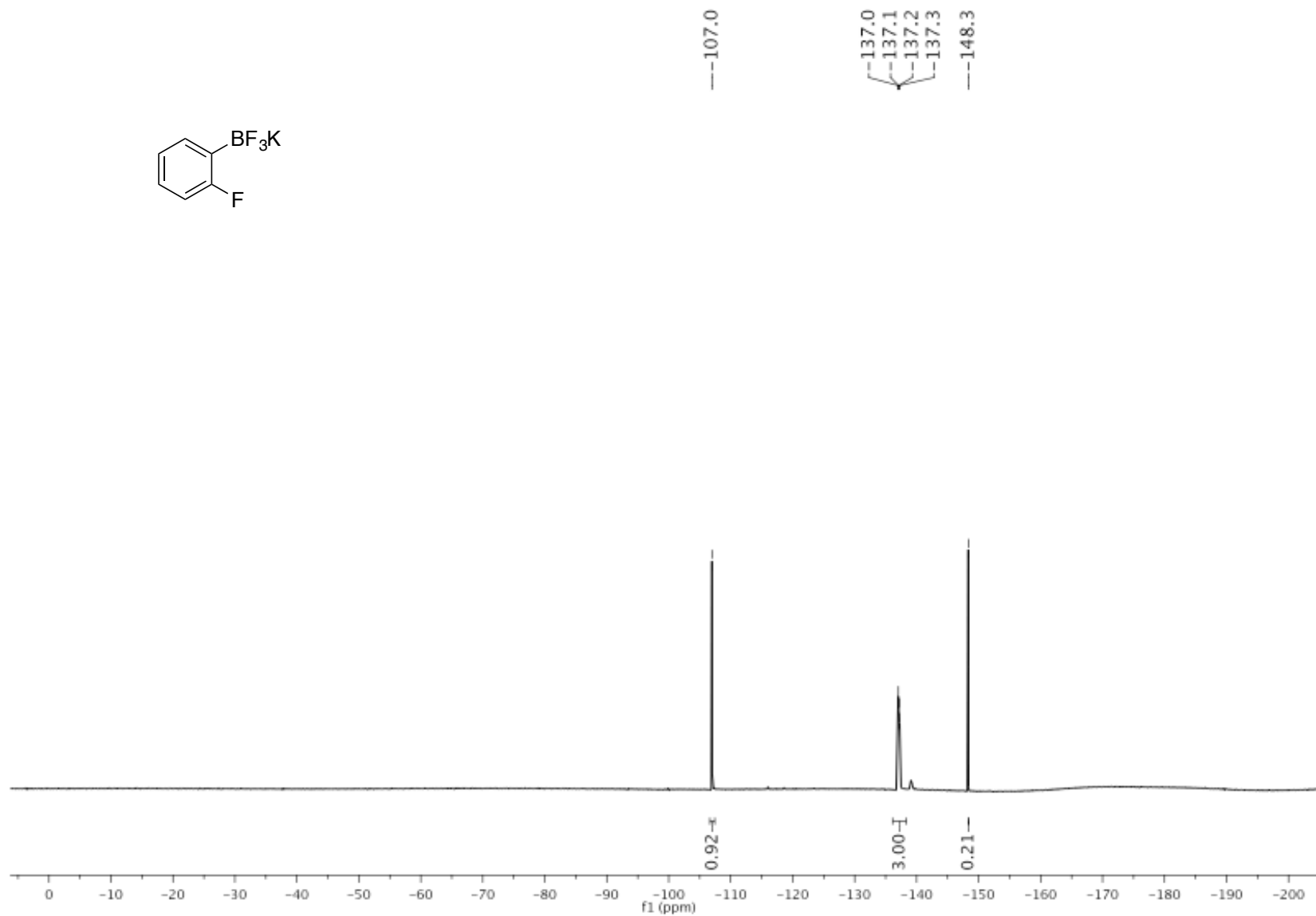
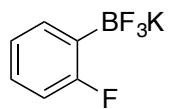
$^{11}\text{B}$  NMR (128.4 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-fluorophenyl)borate (2i, Table 2, entry 9)



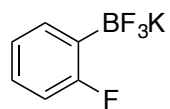
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-fluorophenyl)borate (2j, Table 2, entry 10)**



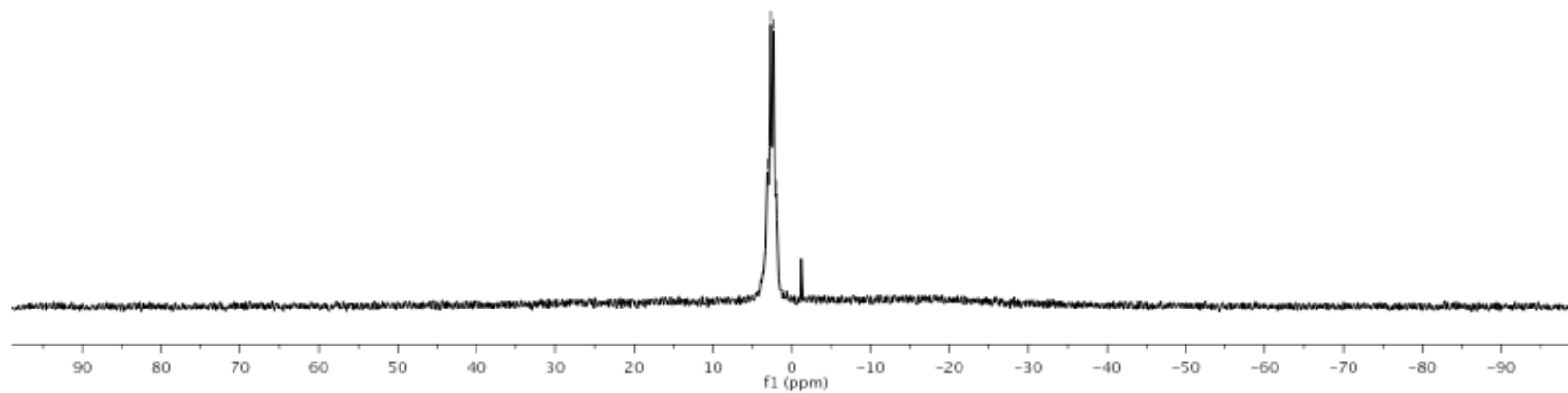
$^{13}\text{C}$  NMR (128.5 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(2-fluorophenyl)borate (2j, Table 2, entry 10)



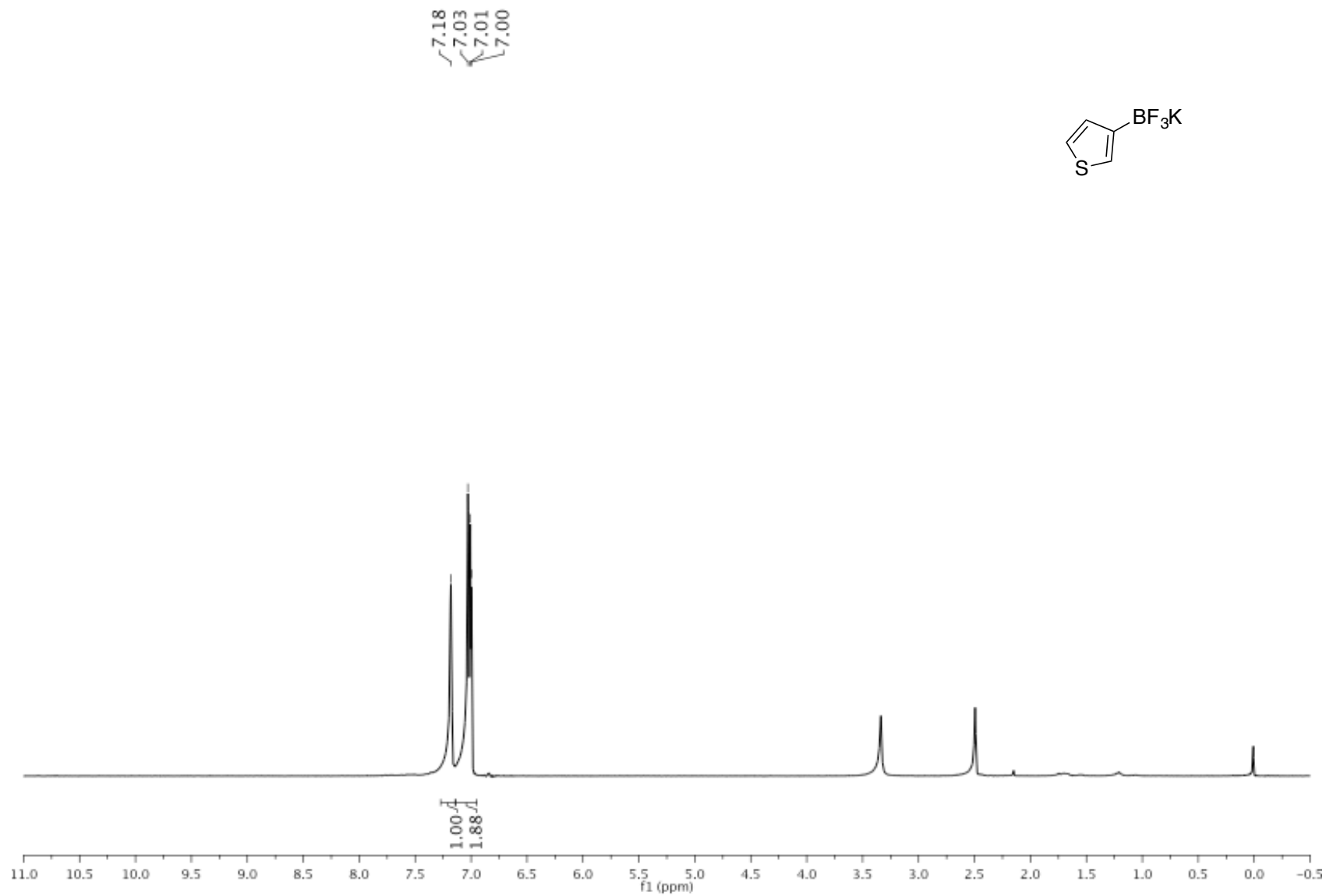
**<sup>19</sup>F NMR (470.8 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-fluorophenyl)borate (2j, Table 2, entry 10)**



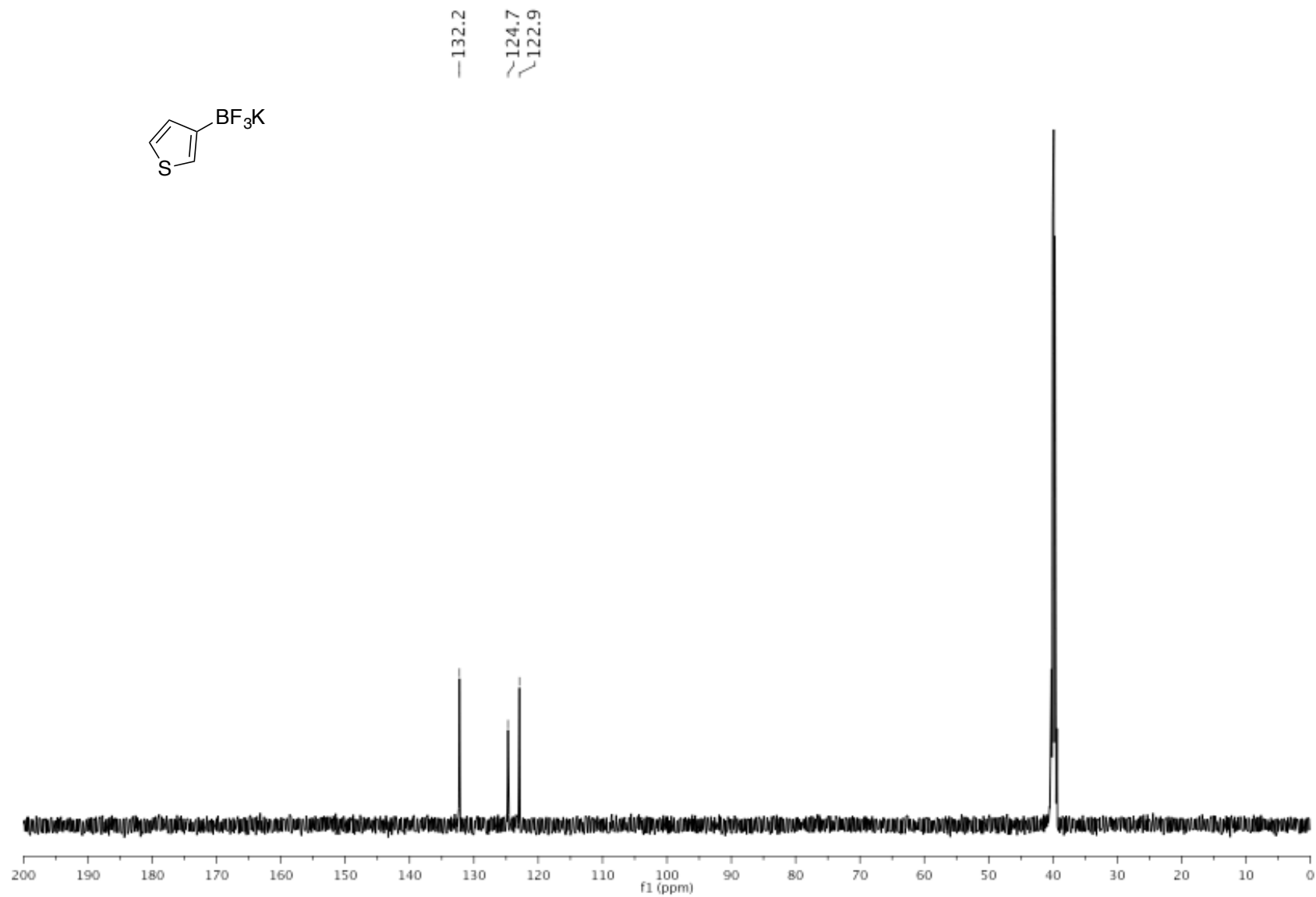
3.1  
2.7  
2.3  
1.9



$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(2-fluorophenyl)borate (2j, Table 2, entry 10)

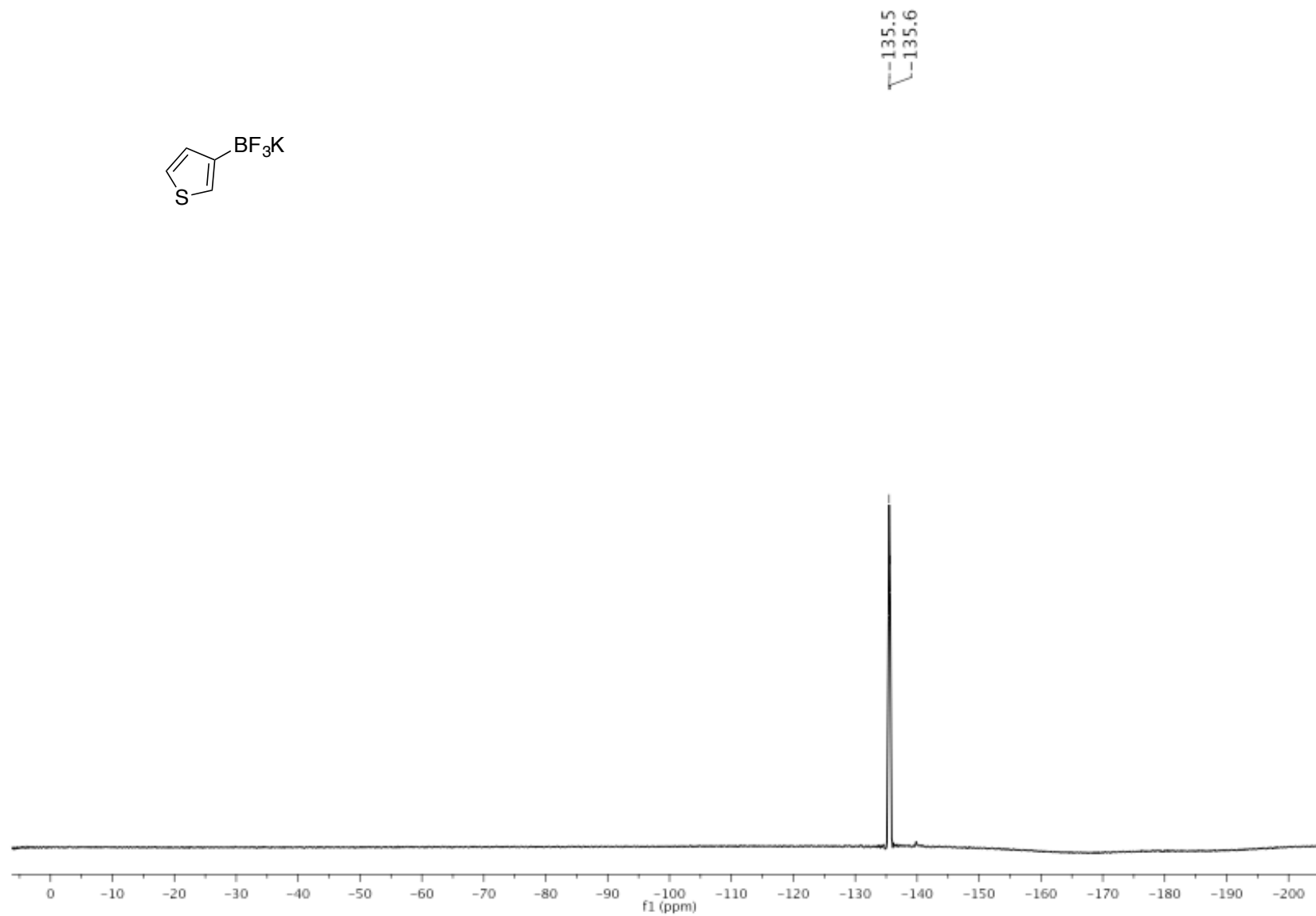


$^1\text{H}$  NMR (500 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(thien-3-yl)borate (3a, Table 3, entry 1)

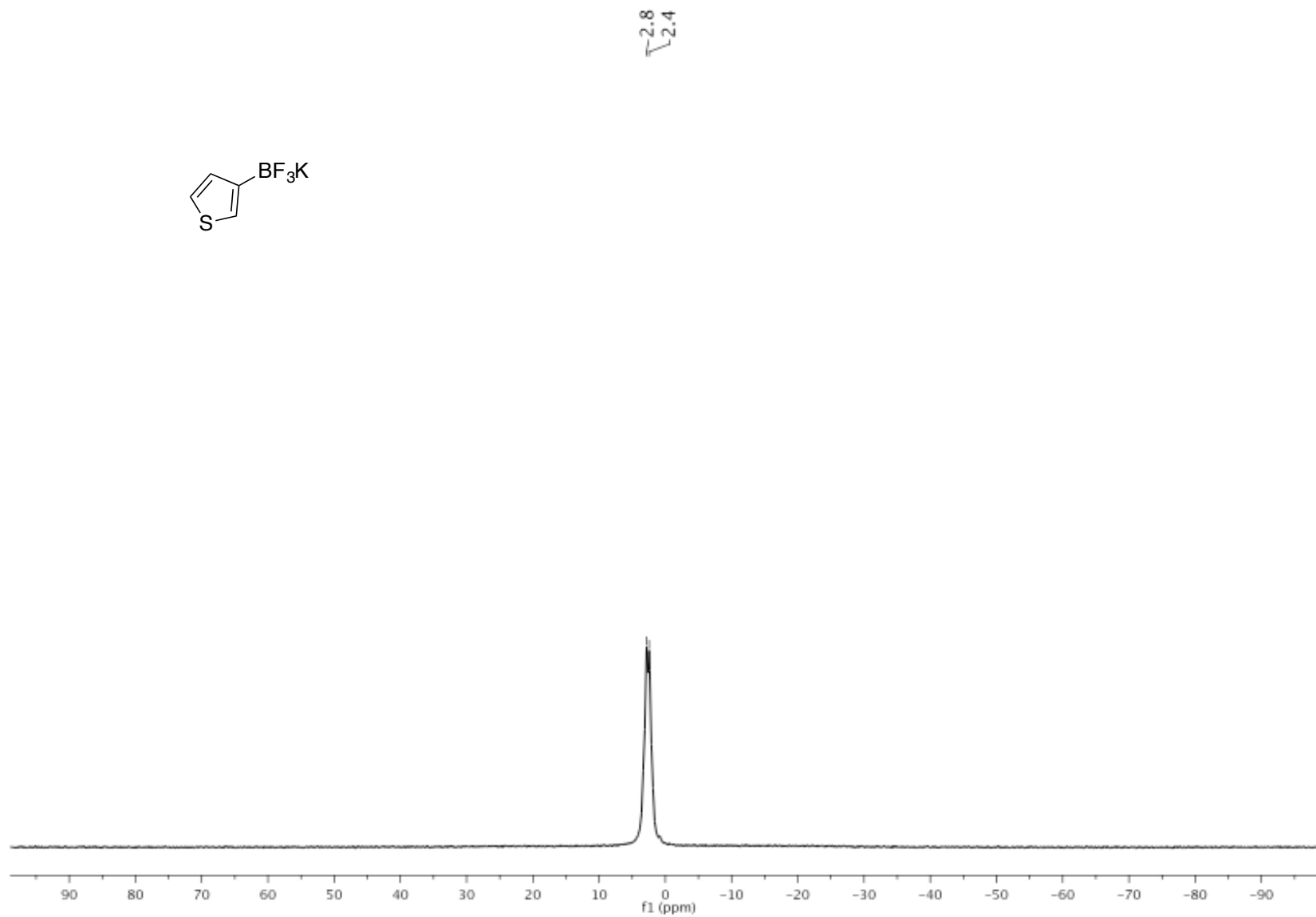
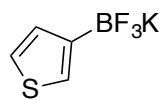


$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(thien-3-yl)borate (3a, Table 3, entry 1)

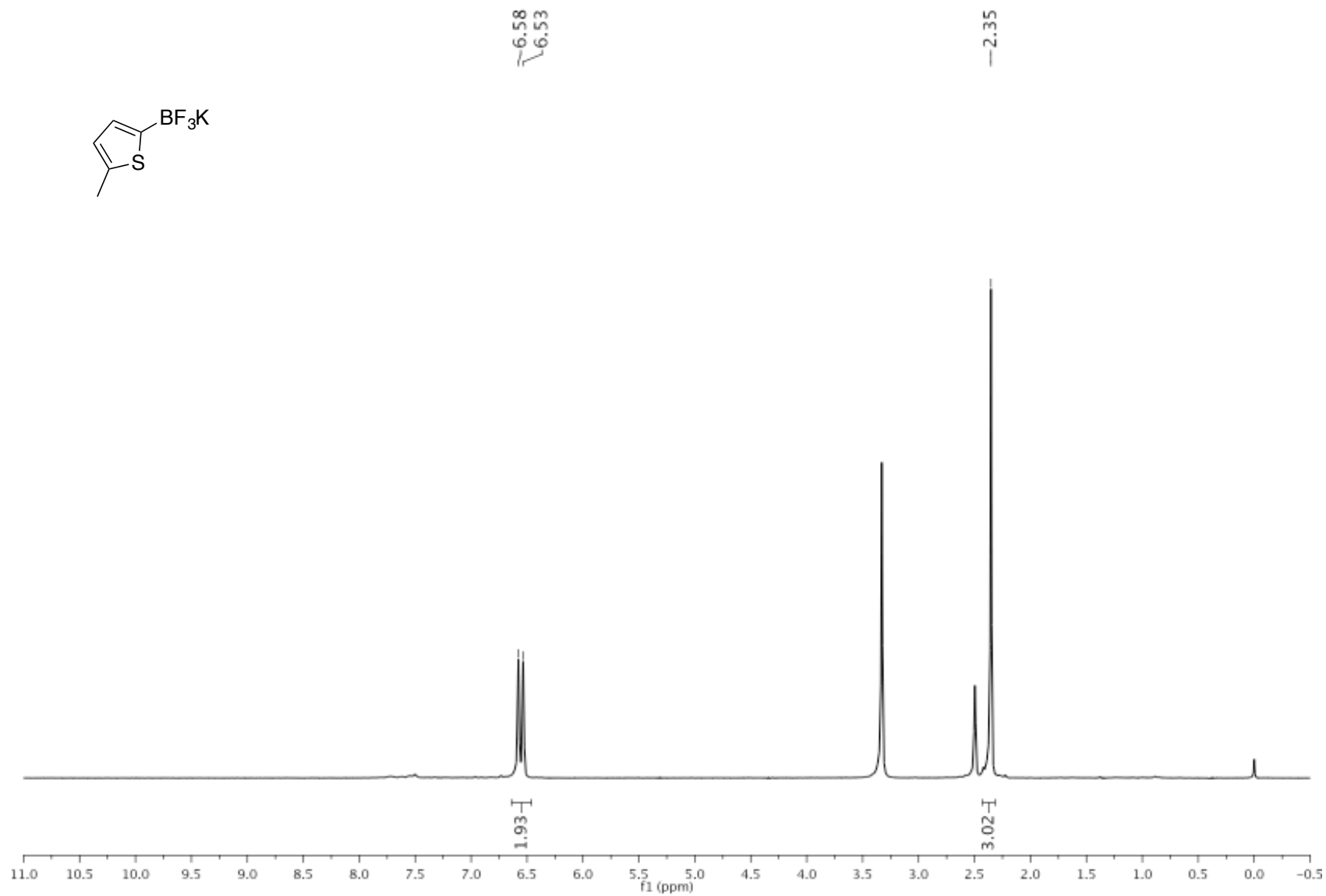




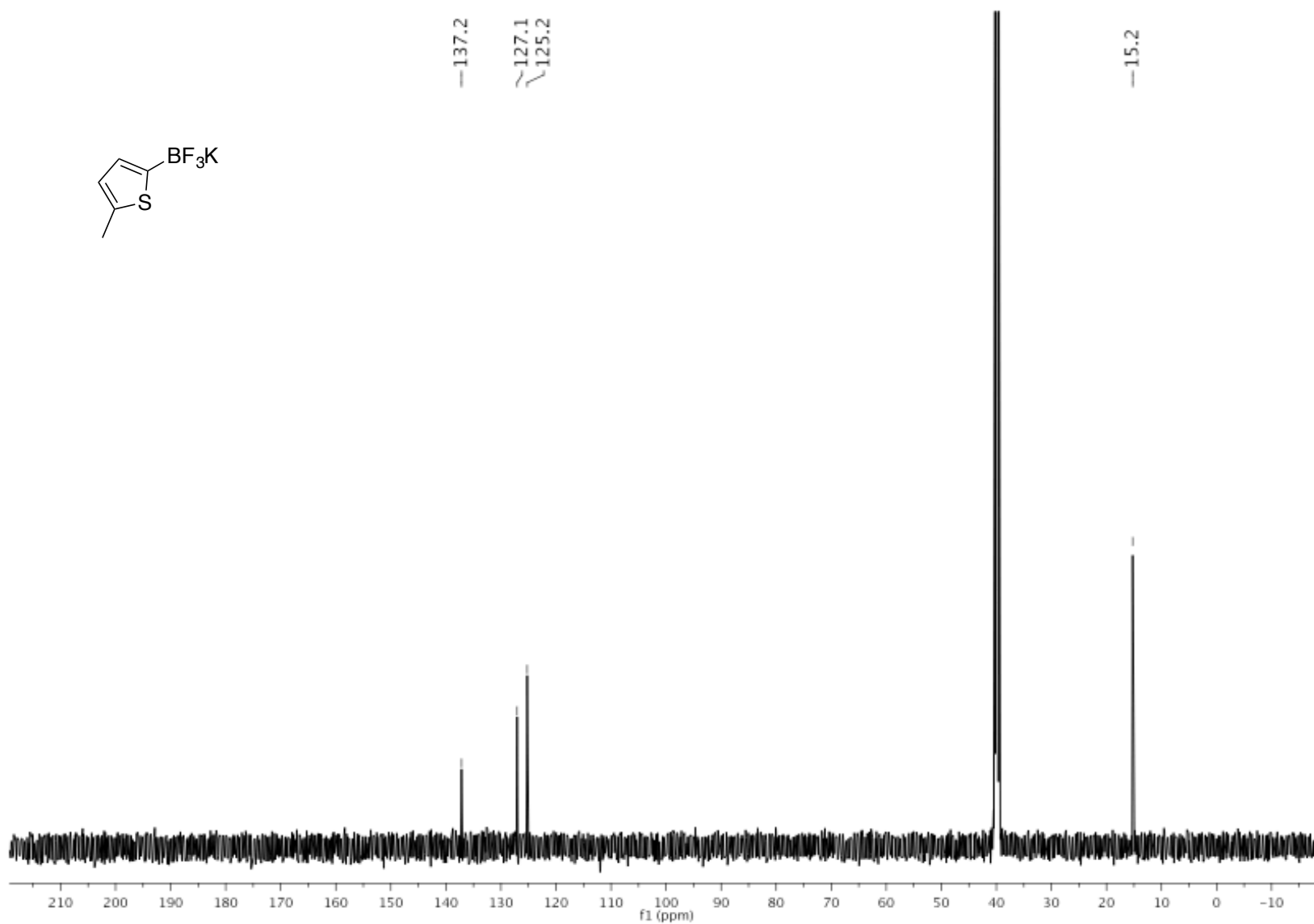
**$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(thien-3-yl)borate (3a, Table 3, entry 1)**



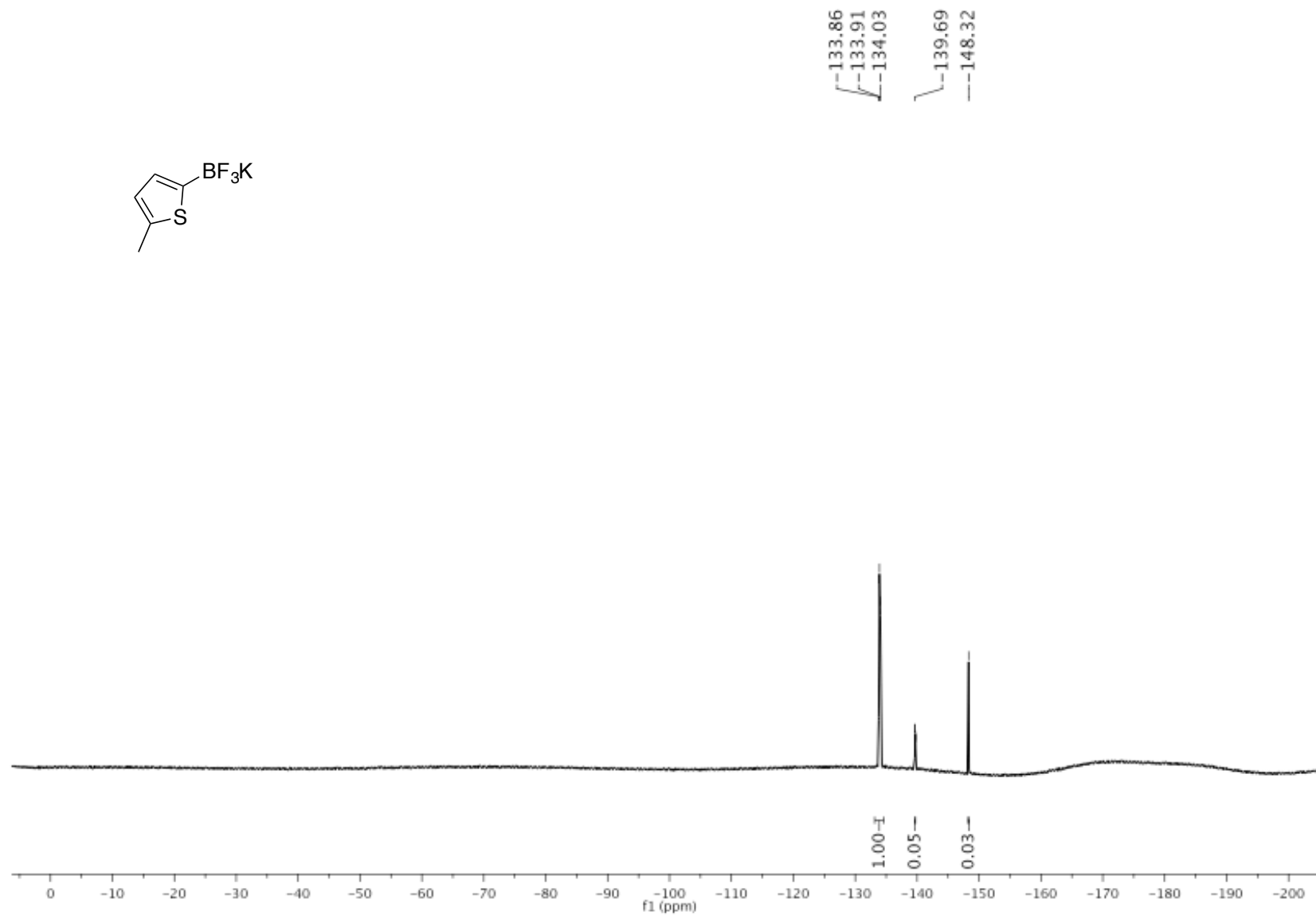
**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(thien-3-yl)borate (3a, Table 3, entry 1)**



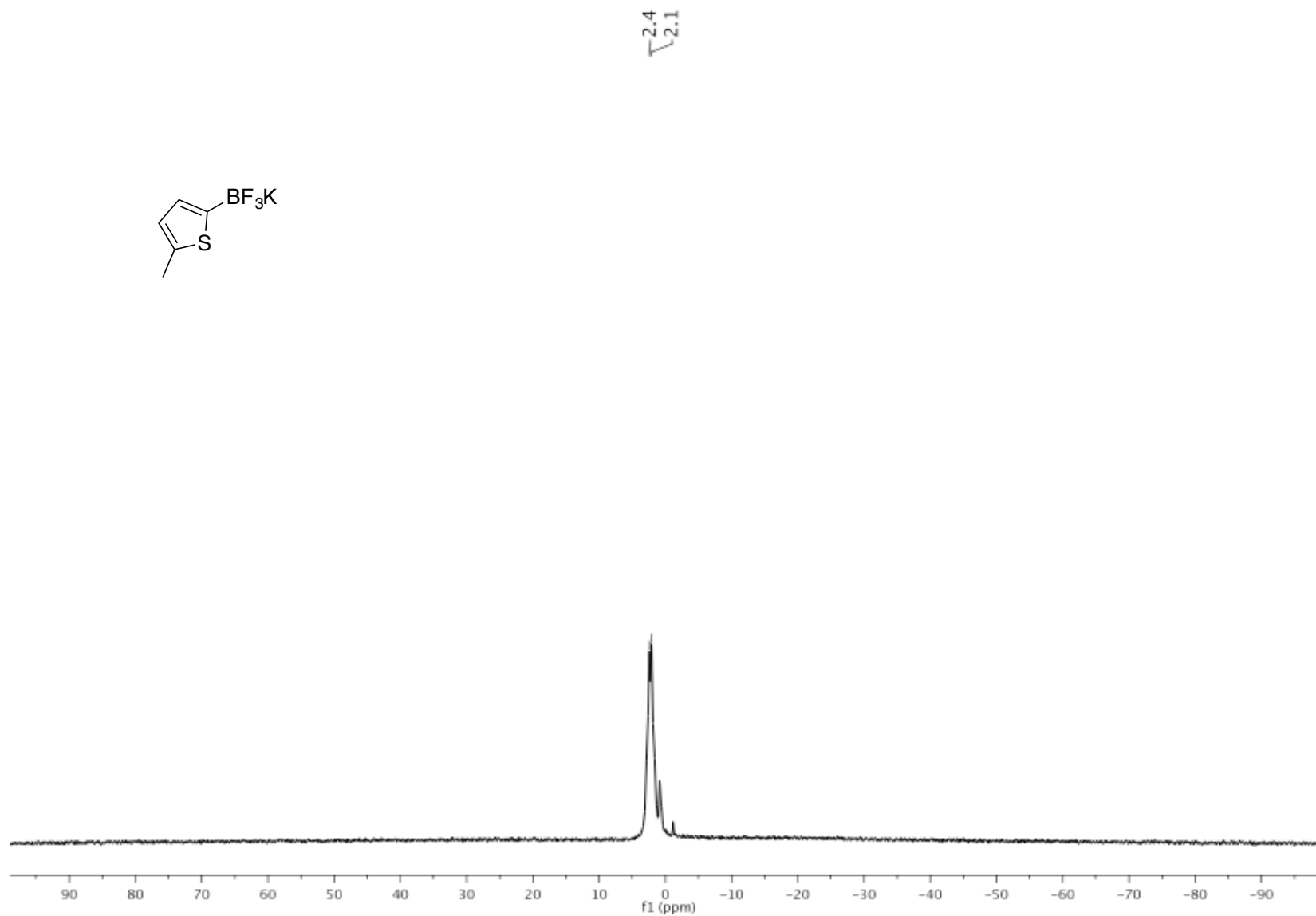
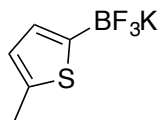
$^1\text{H}$  NMR (500 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(5-methylthien-2-yl)borate (3b, Table 3, entry 2)



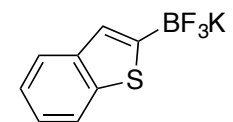
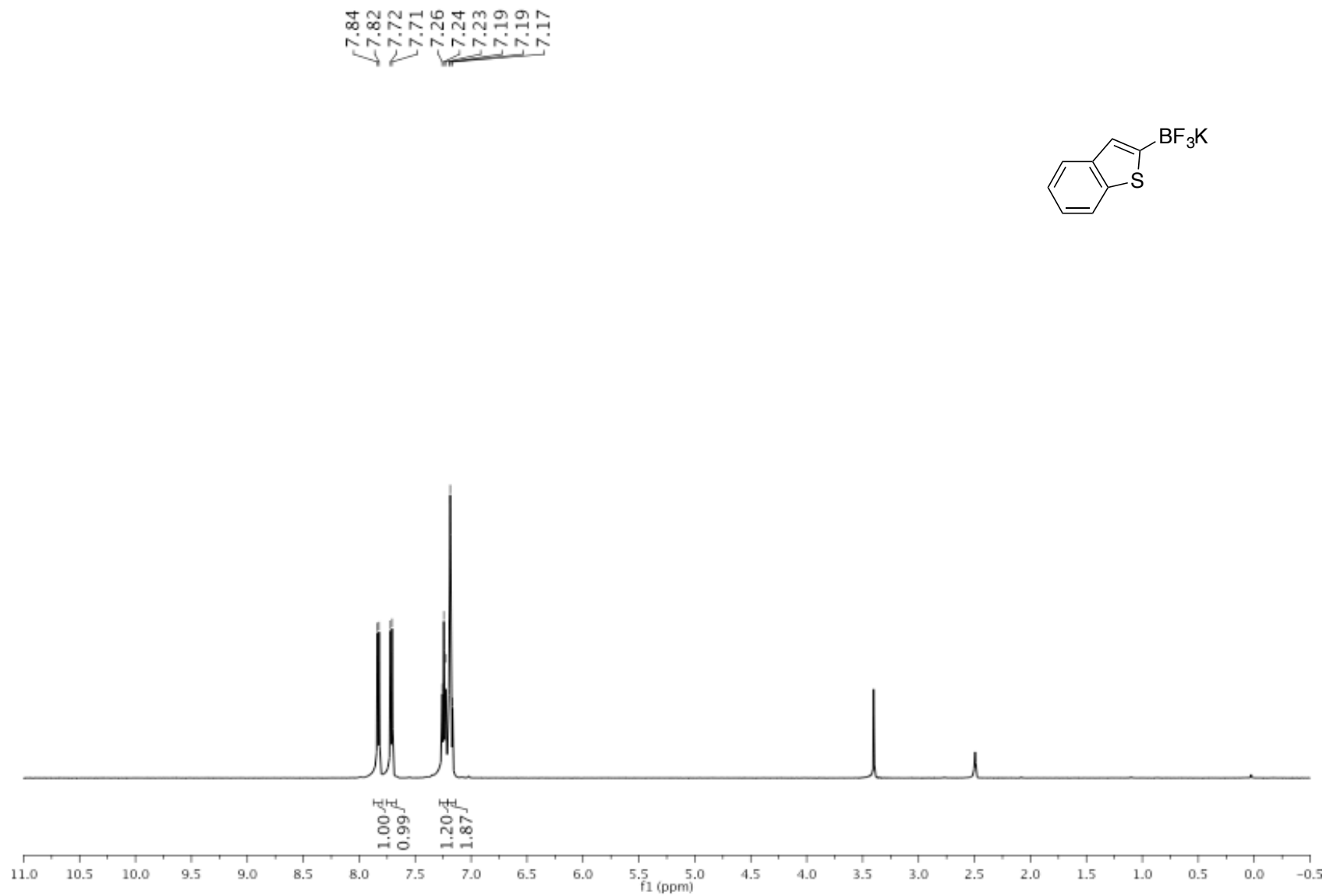
<sup>13</sup>C NMR (128.5 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(5-methylthien-2-yl)borate (3b, Table 3, entry 2)



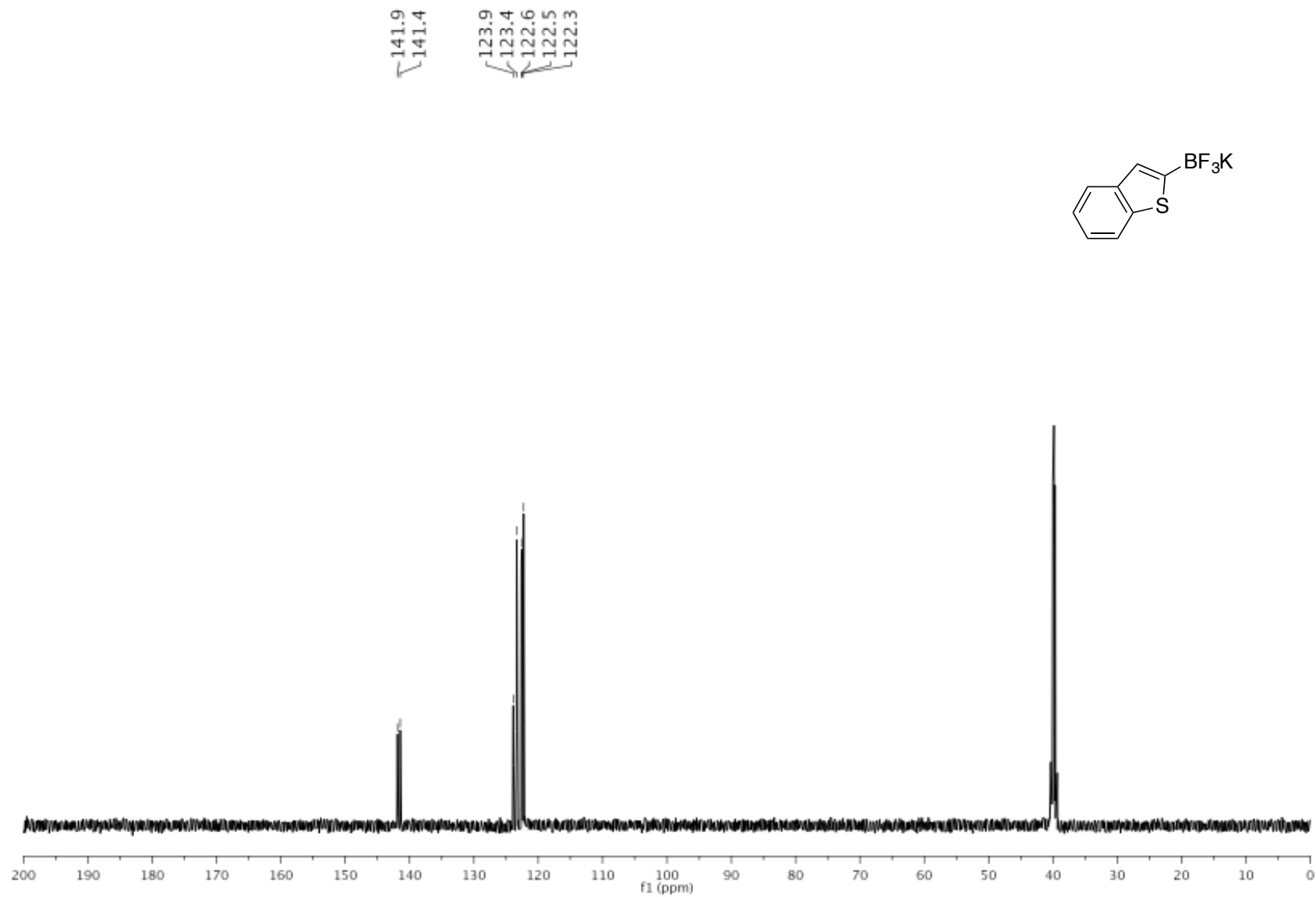
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(5-methylthien-2-yl)borate (3b, Table 3, entry 2)



$^{11}\text{B}$  NMR (128.4 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(5-methylthien-2-yl)borate (3b, Table 3, entry 2)

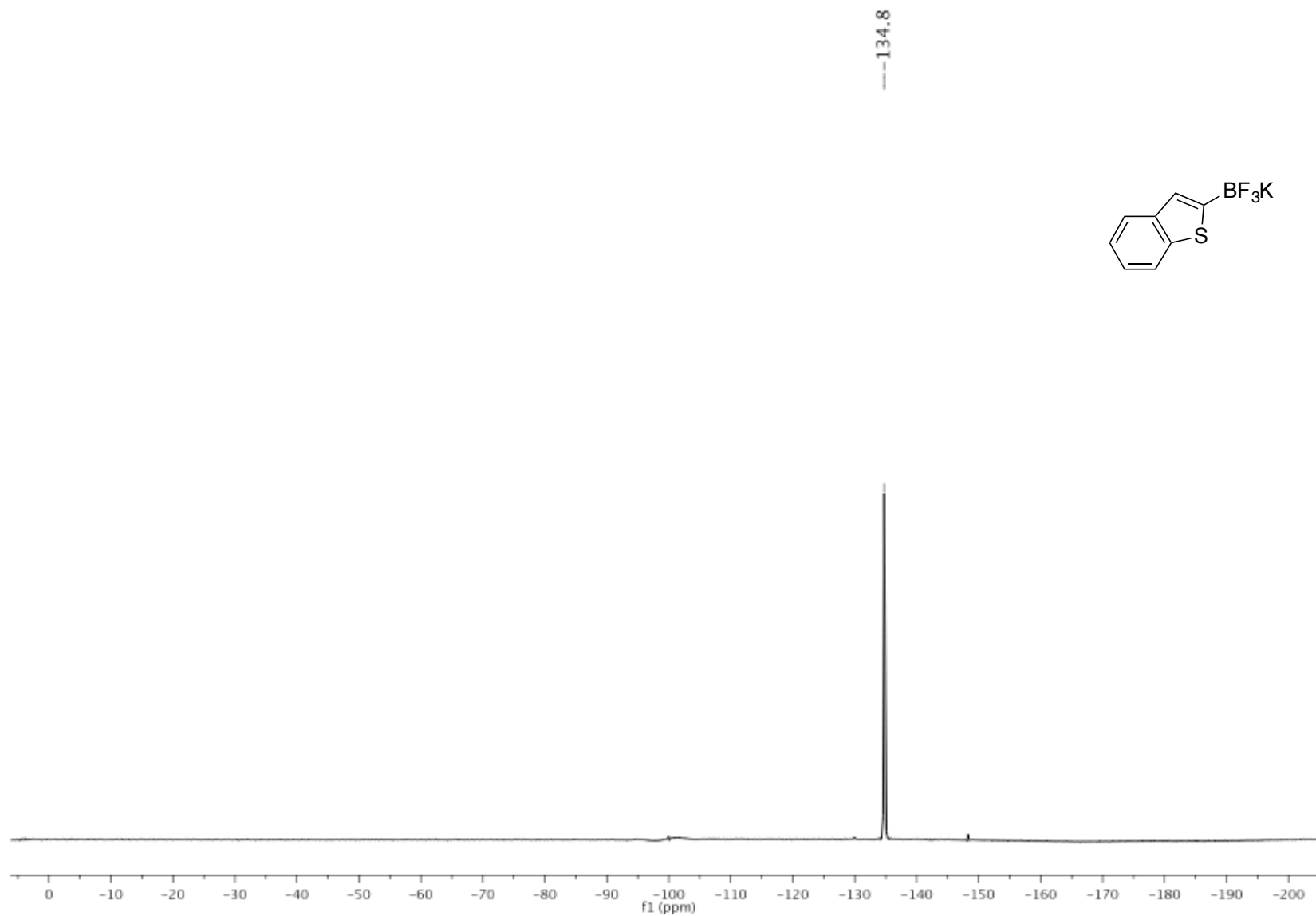


$^1\text{H}$  NMR (500 MHz, DMSO- $d_6$ ) Spectrum of Potassium Benzo[*b*]thien-2-yltrifluoroborate (3c, Table 3, entry 3)

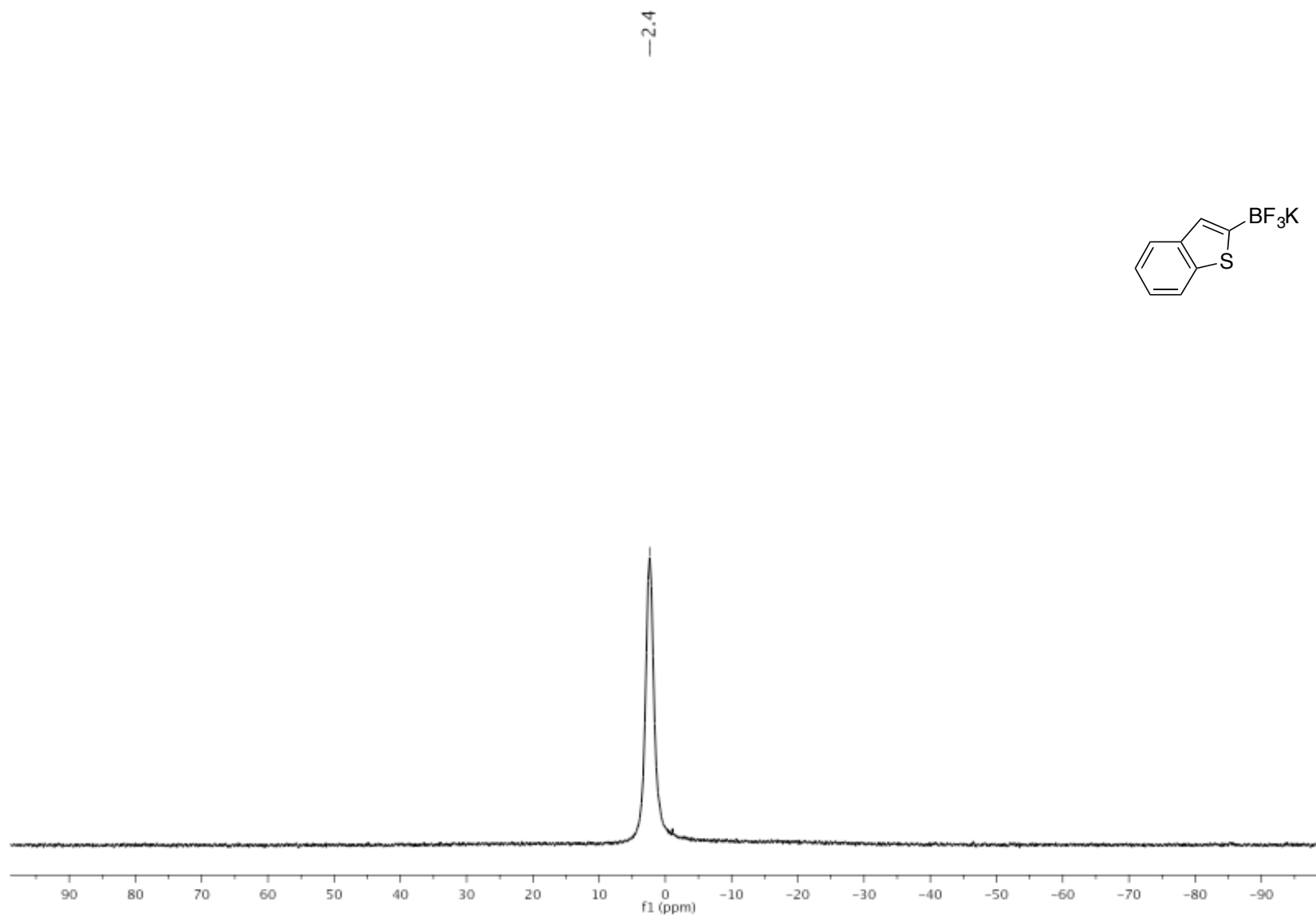


<sup>13</sup>C NMR (128.5 MHz, DMSO-*d*<sub>6</sub>) Spectrum of Potassium Benzo[*b*]thien-2-yltrifluoroborate (3c, Table 3, entry 3)

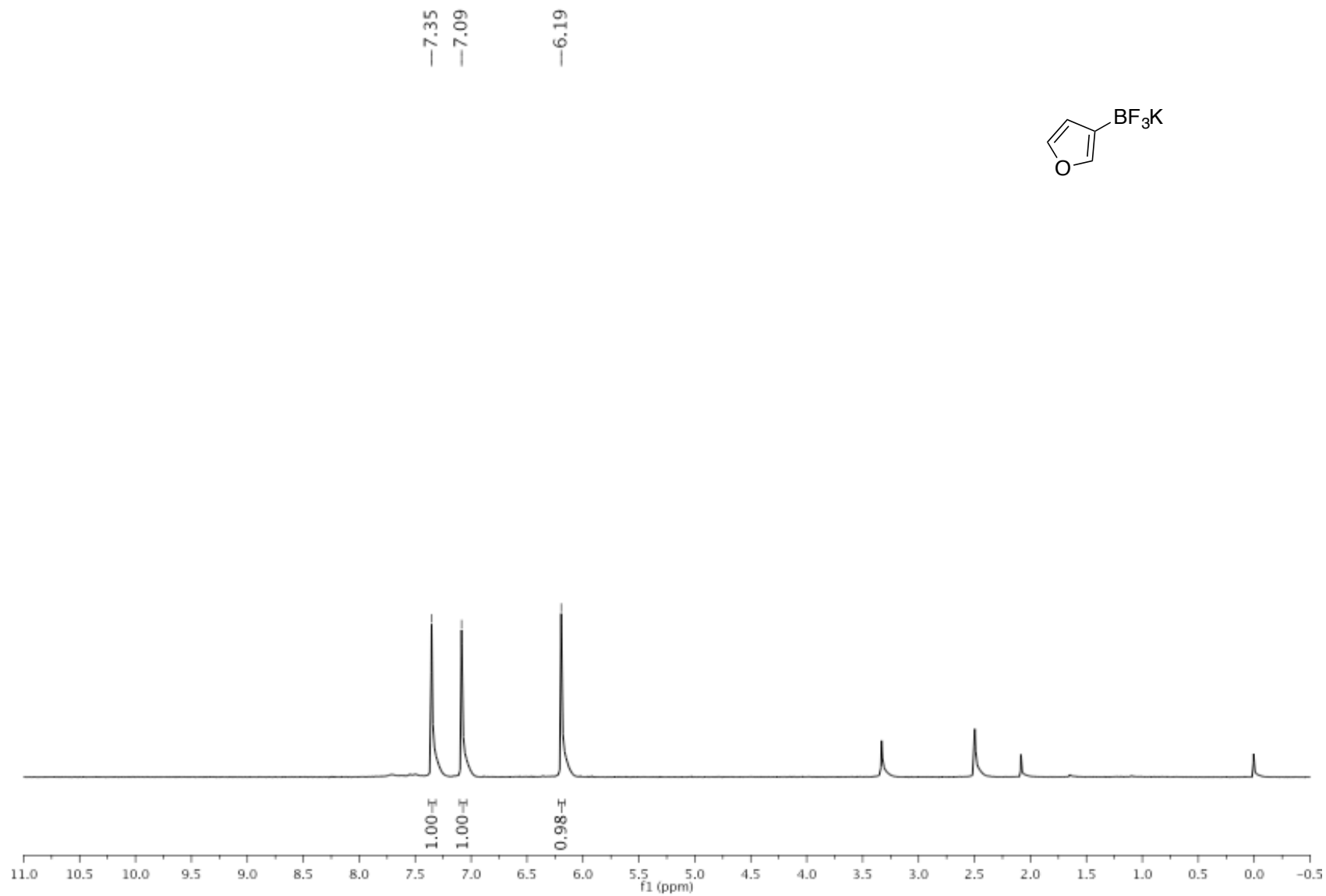




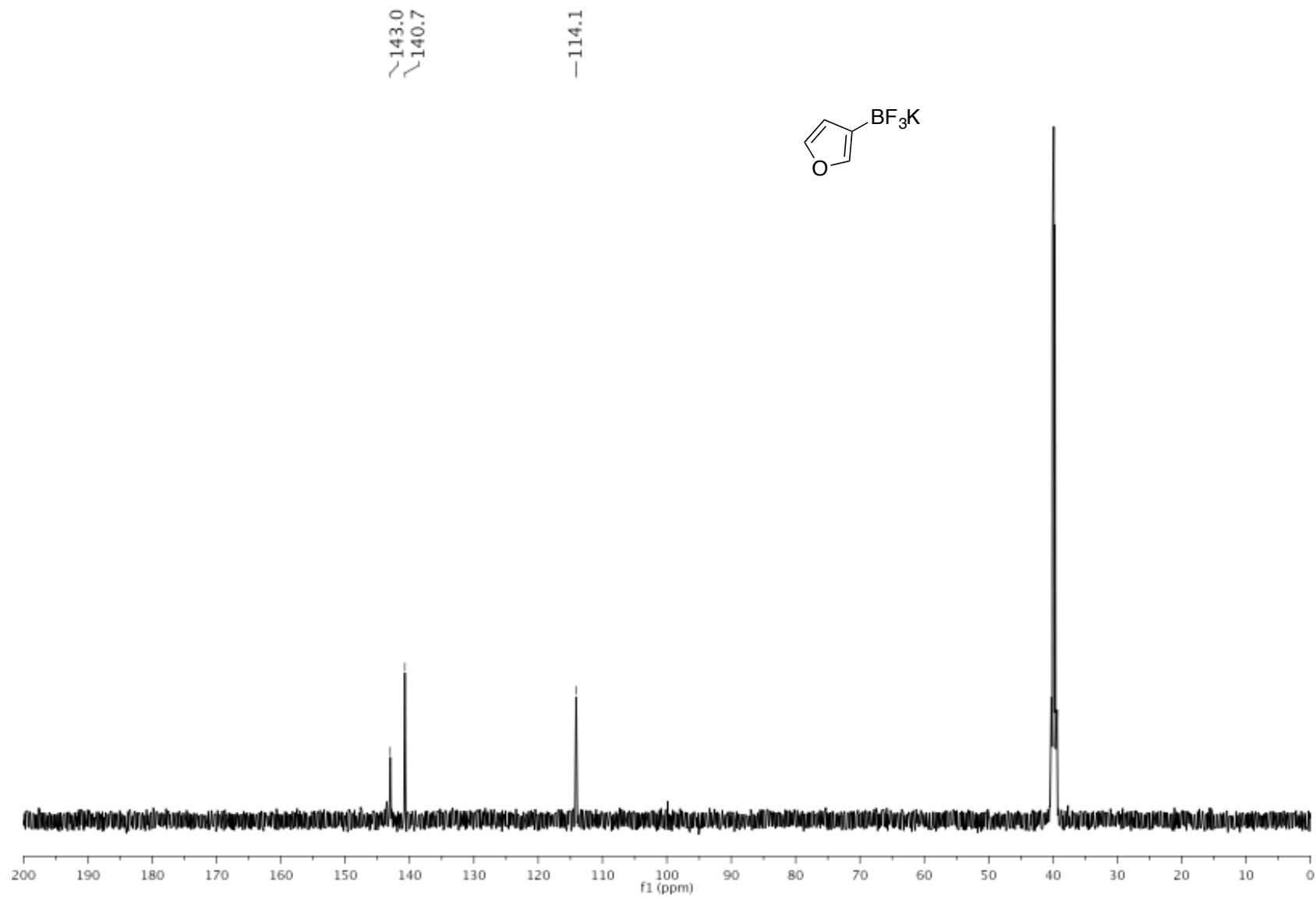
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Benzo[*b*]thien-2-yltrifluoroborate (3c, Table 3, entry 3)



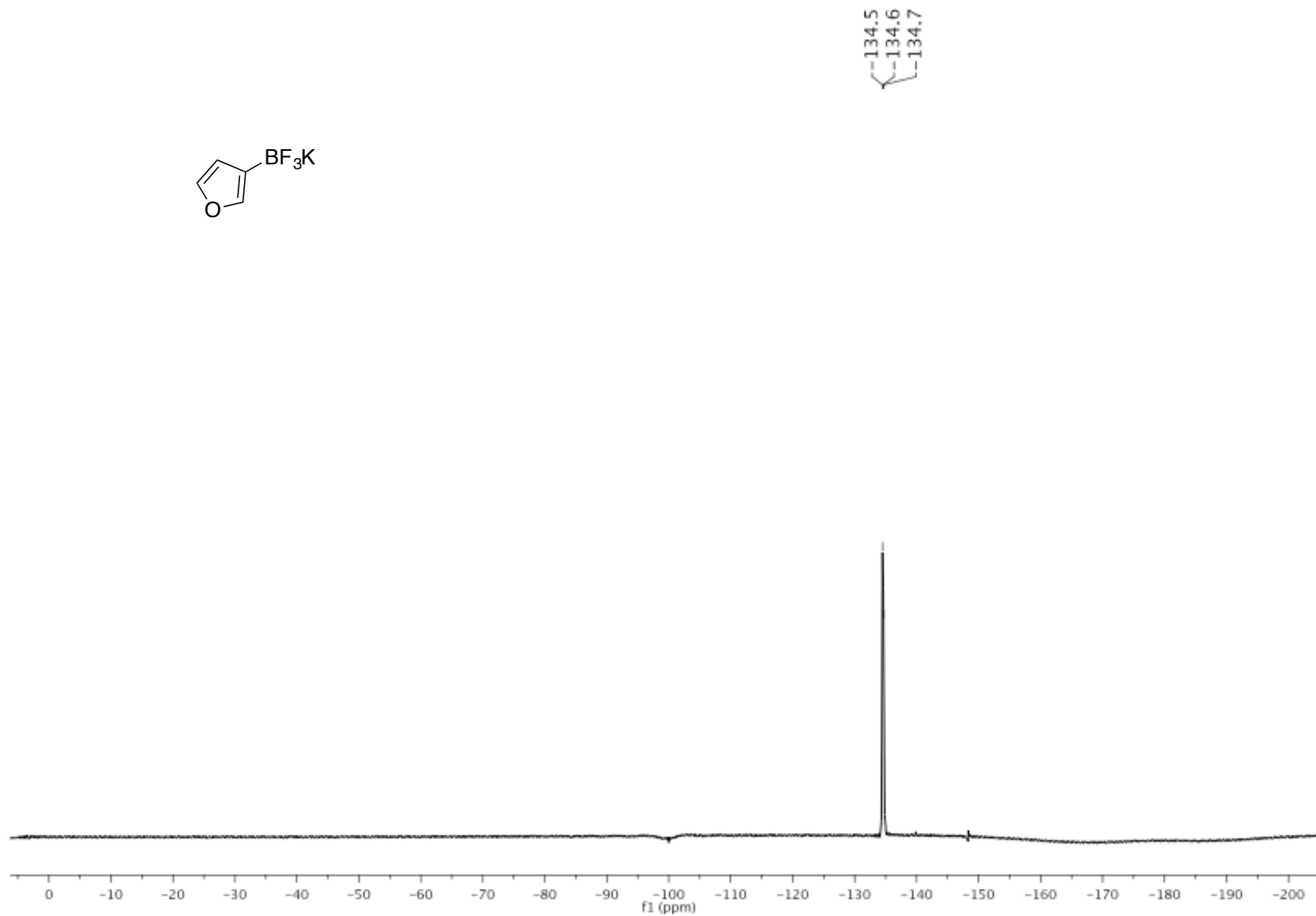
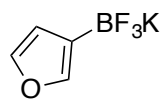
$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Benzo[*b*]thien-2-yltrifluoroborate (3c, Table 3, entry 3)



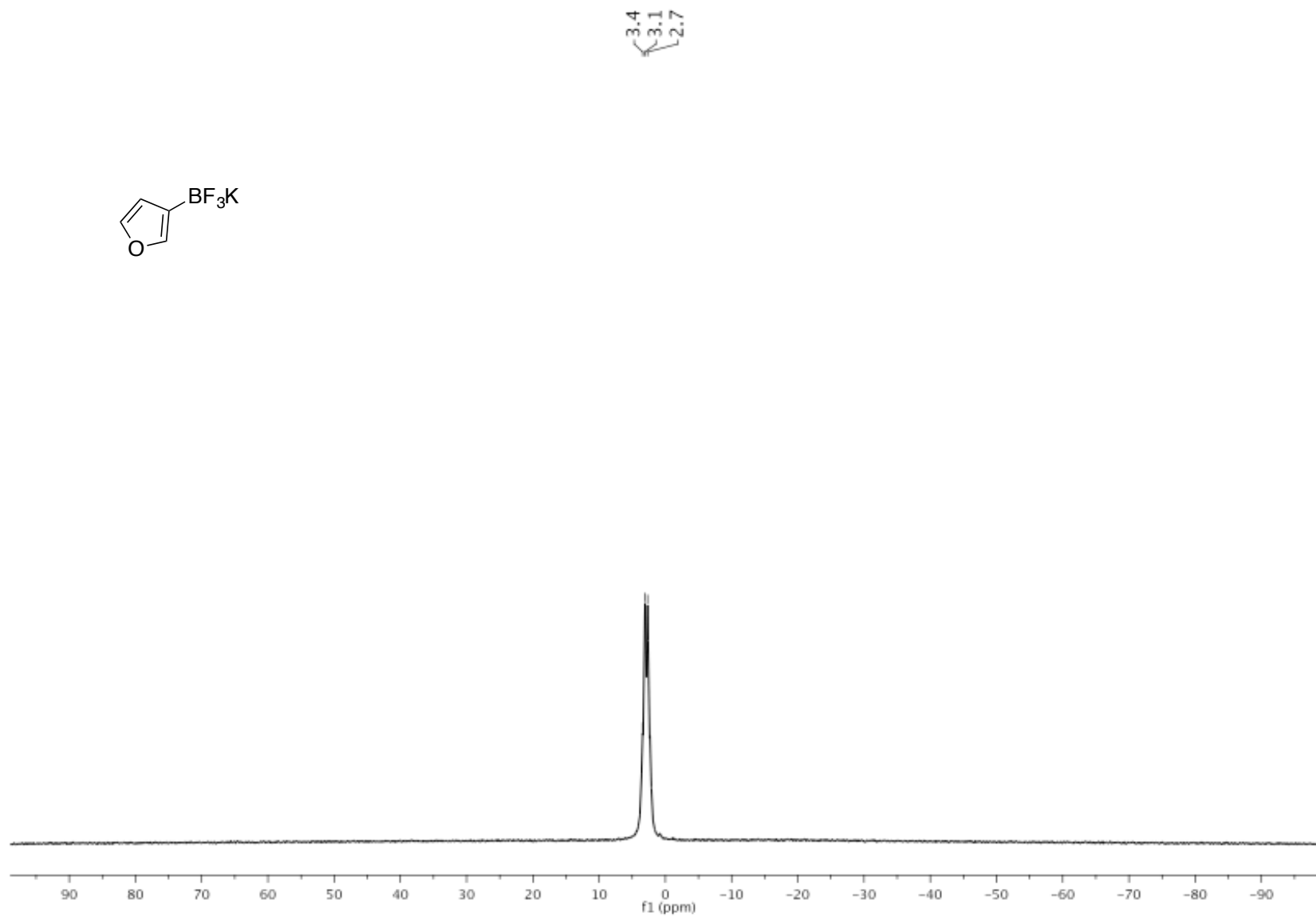
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(furan-3-yl)borate (3d, Table 3, entry 4)**



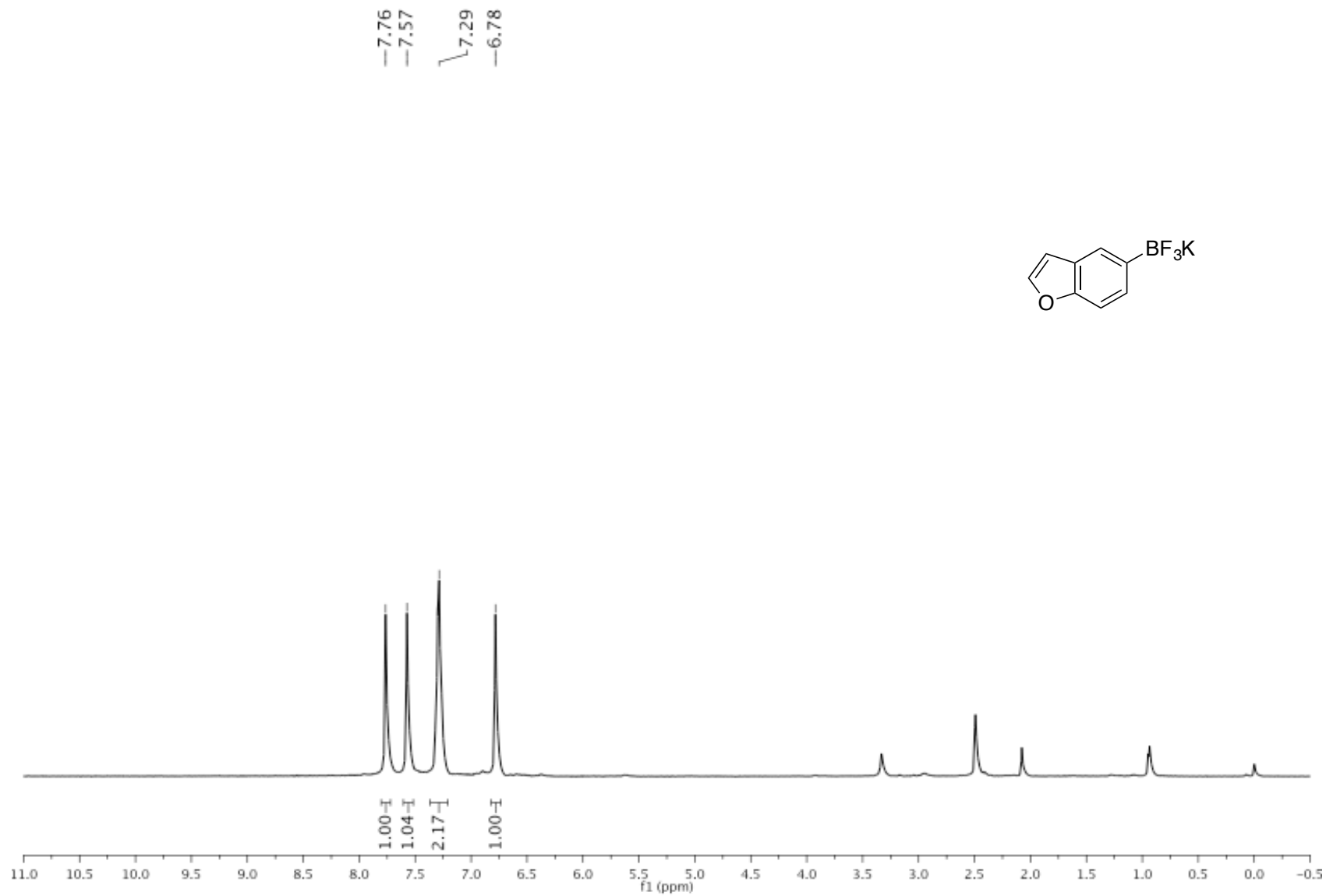
$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(furan-3-yl)borate (3d, Table 3, entry 4)



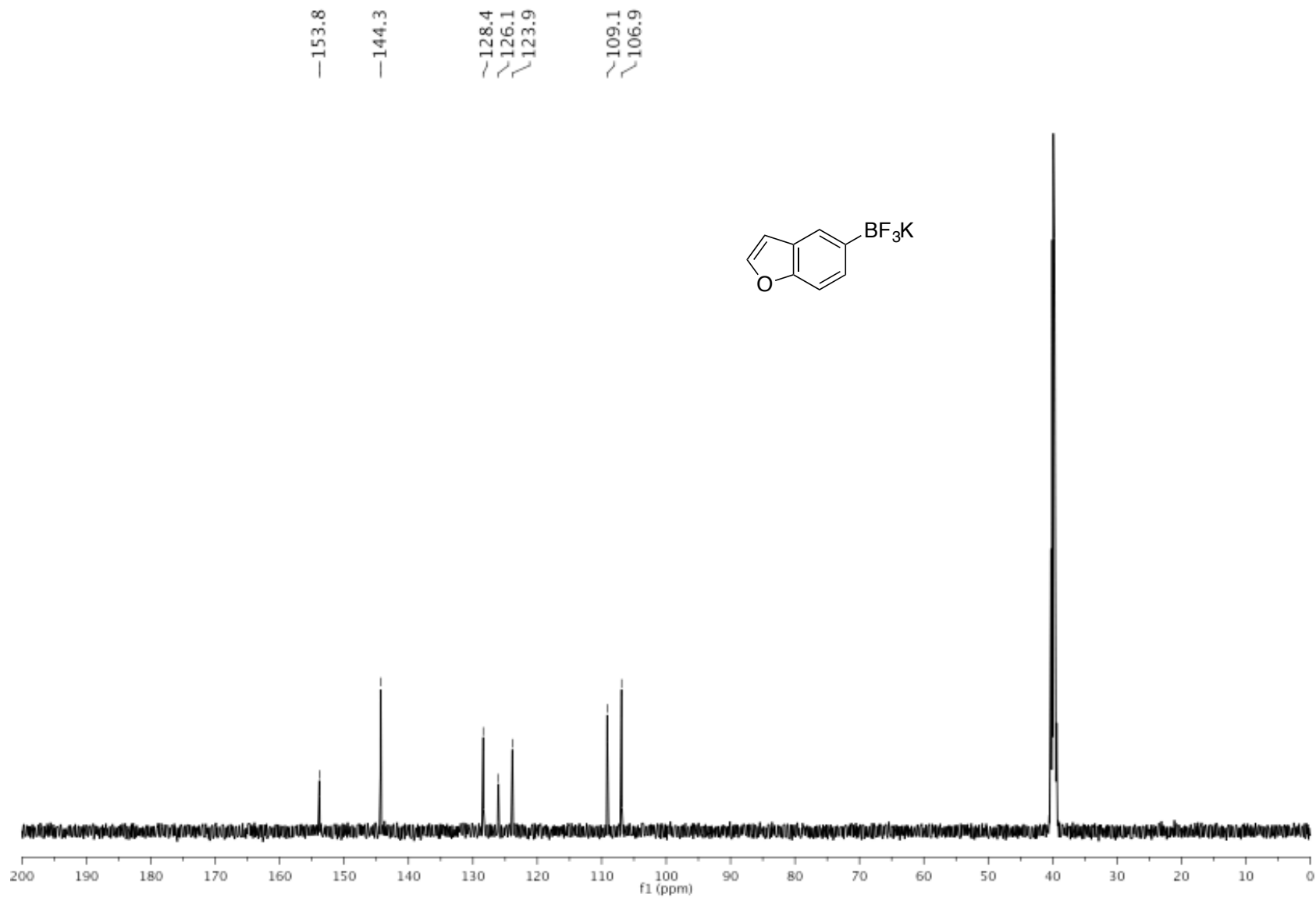
**$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(furan-3-yl)borate (3d, Table 3, entry 4)**



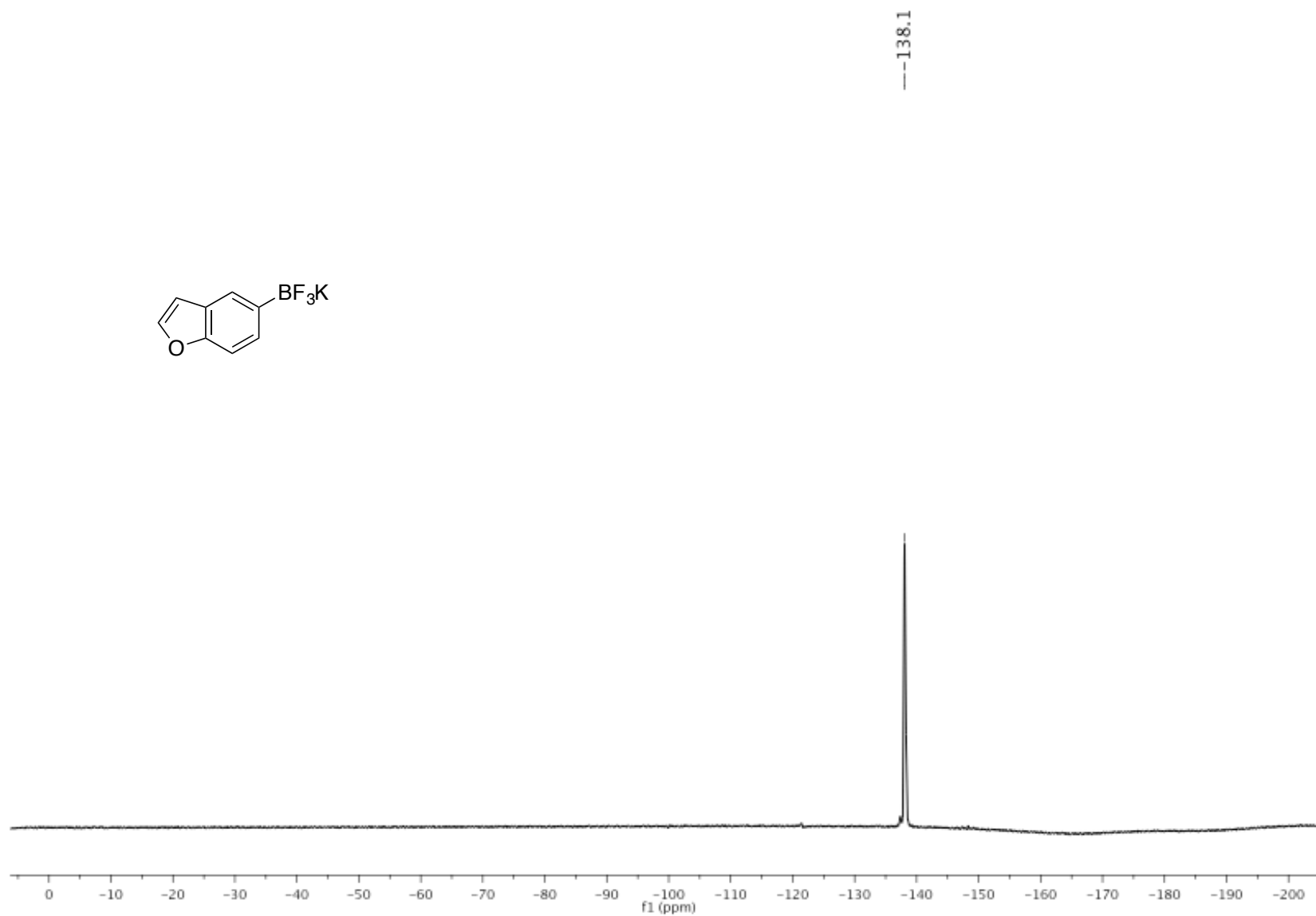
**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(furan-3-yl)borate (3d, Table 3, entry 4)**



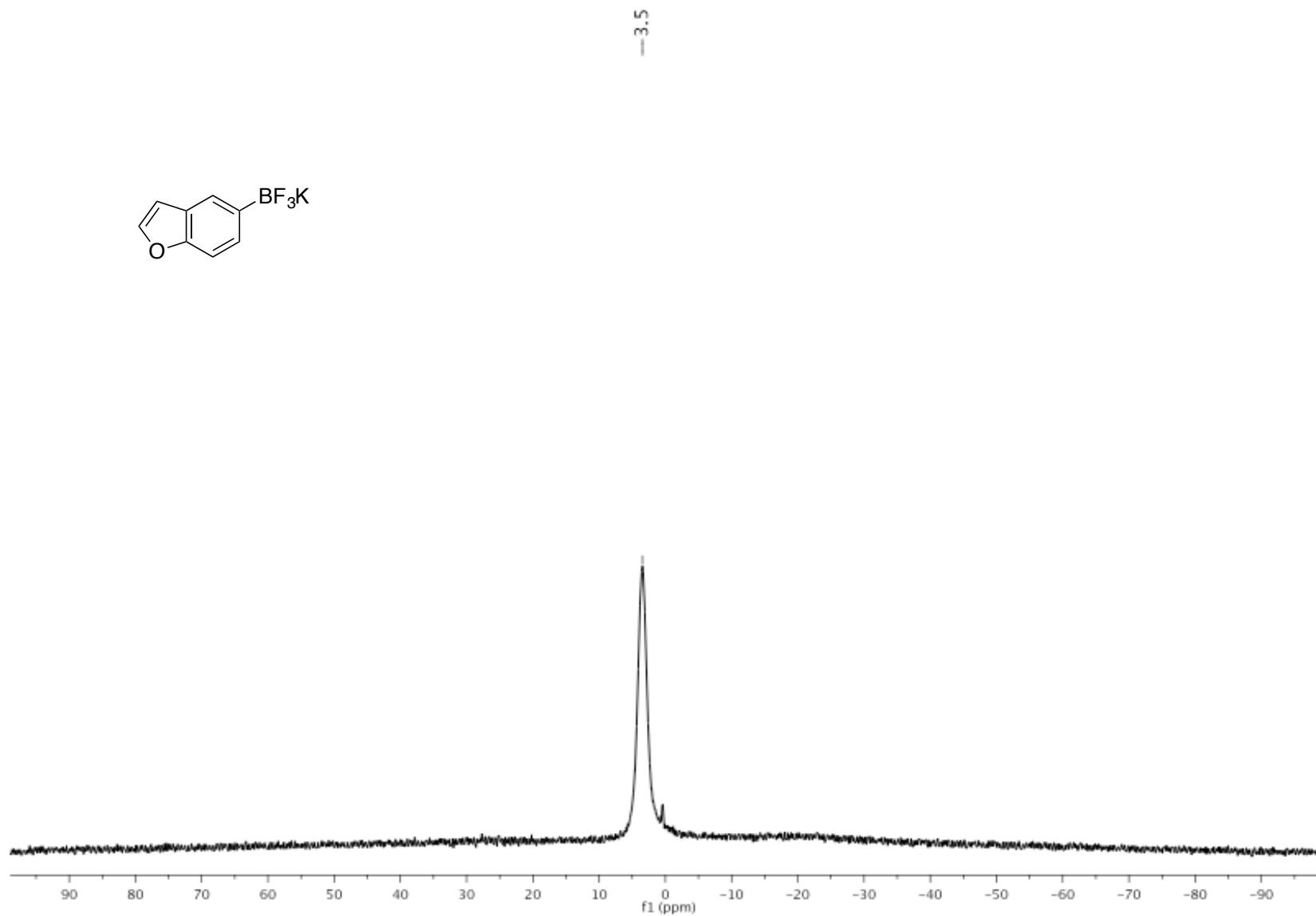
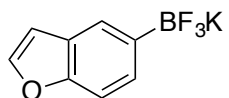
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Benzofuran-5-yltrifluoroborate (3e, Table 3, entry 5)**



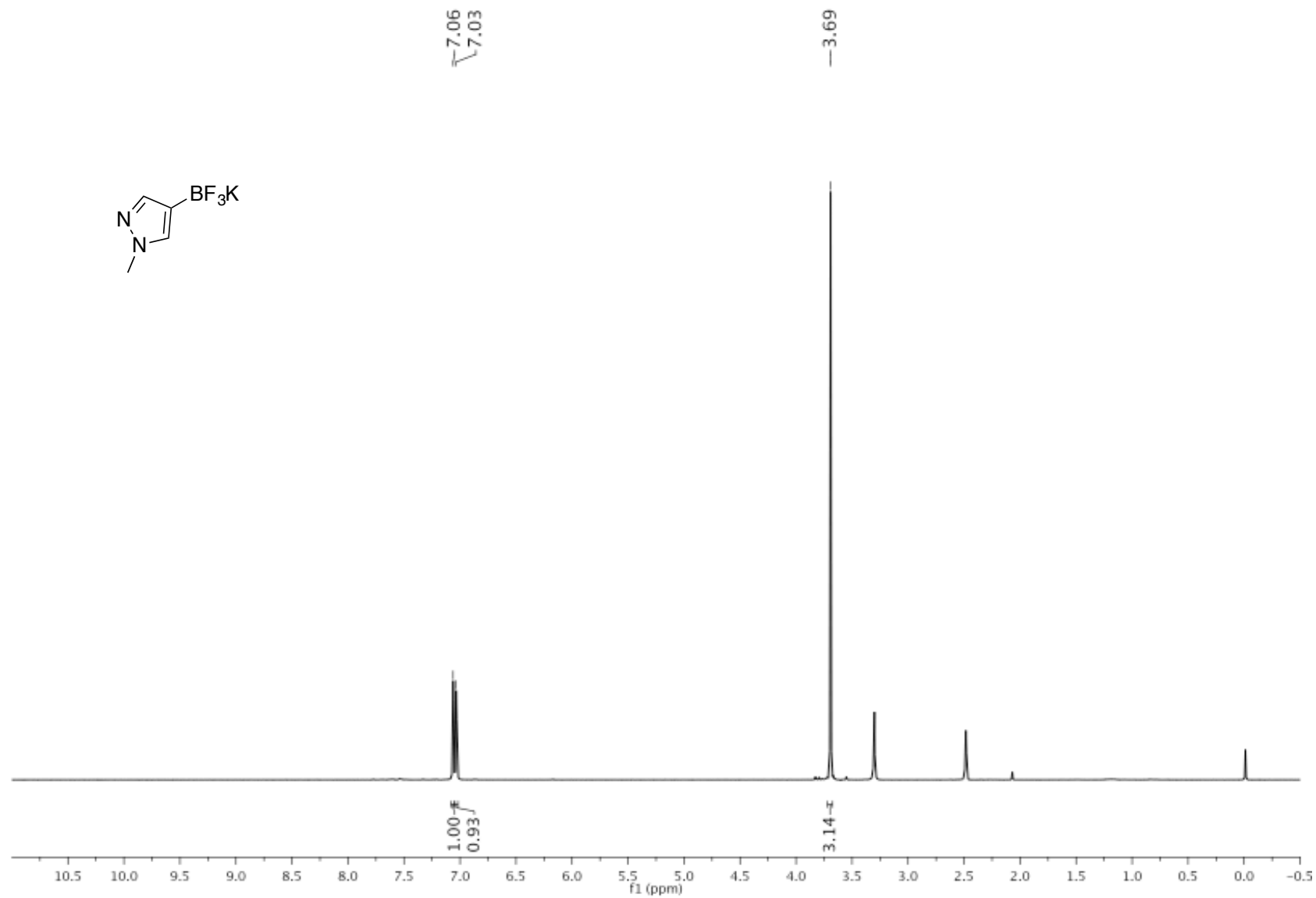




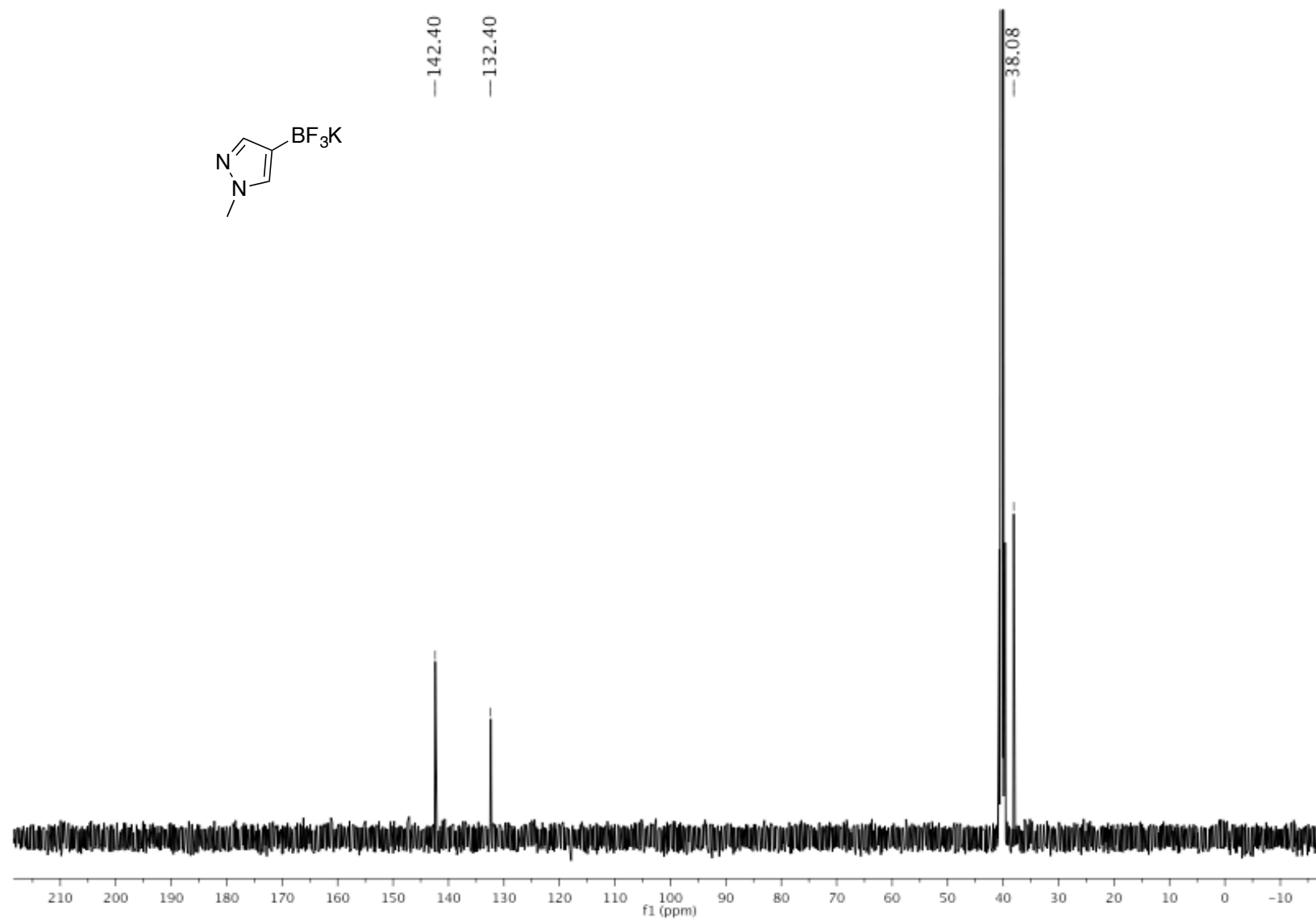
**$^{19}\text{F}$  NMR (470.8 MHz, DMSO- $d_6$ ) Spectrum of Potassium Benzofuran-5-yltrifluoroborate (3e, Table 3, entry 5)**



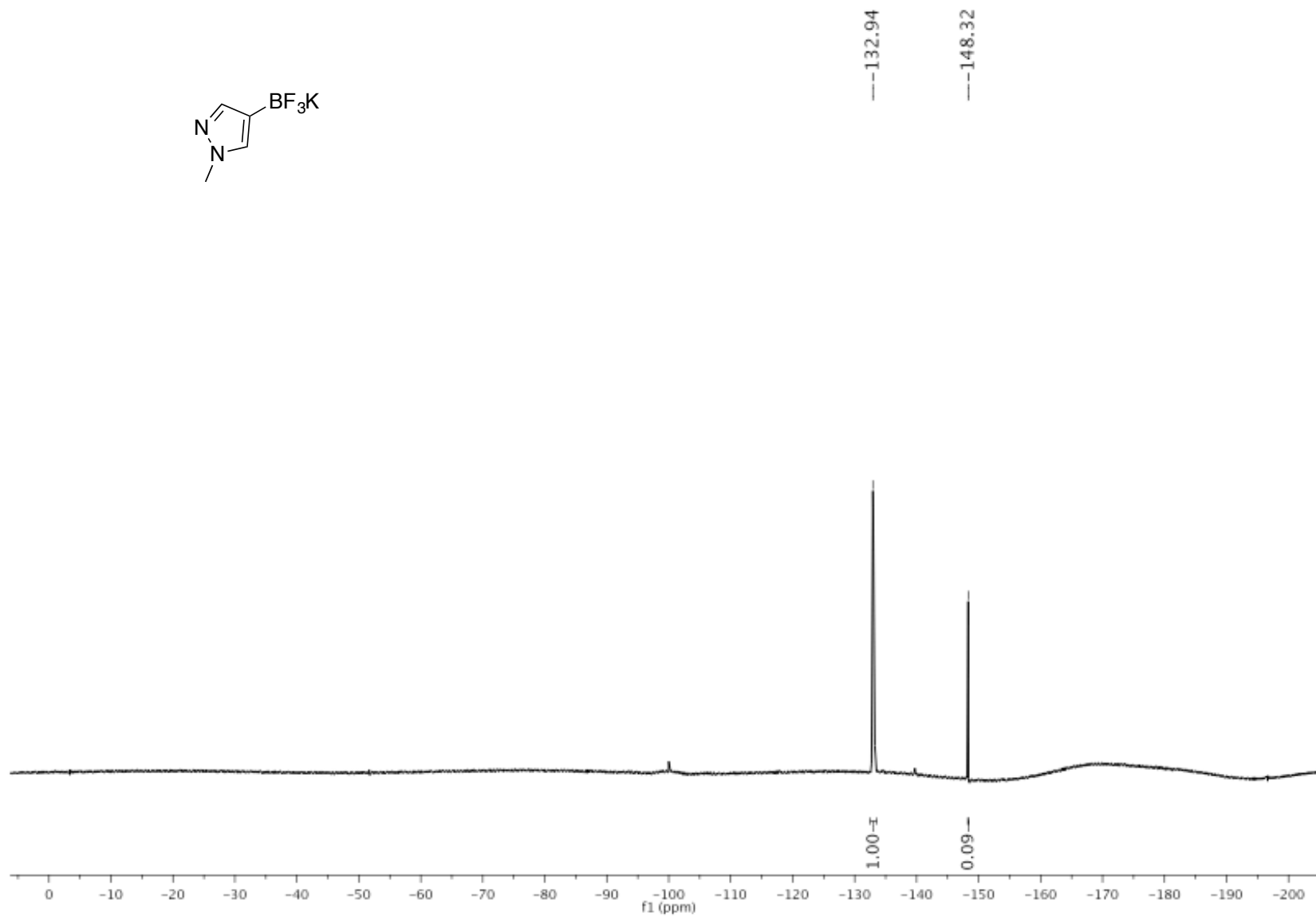
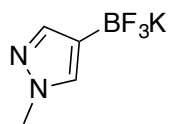
$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Benzofuran-5-yltrifluoroborate (3e, Table 3, entry 5)



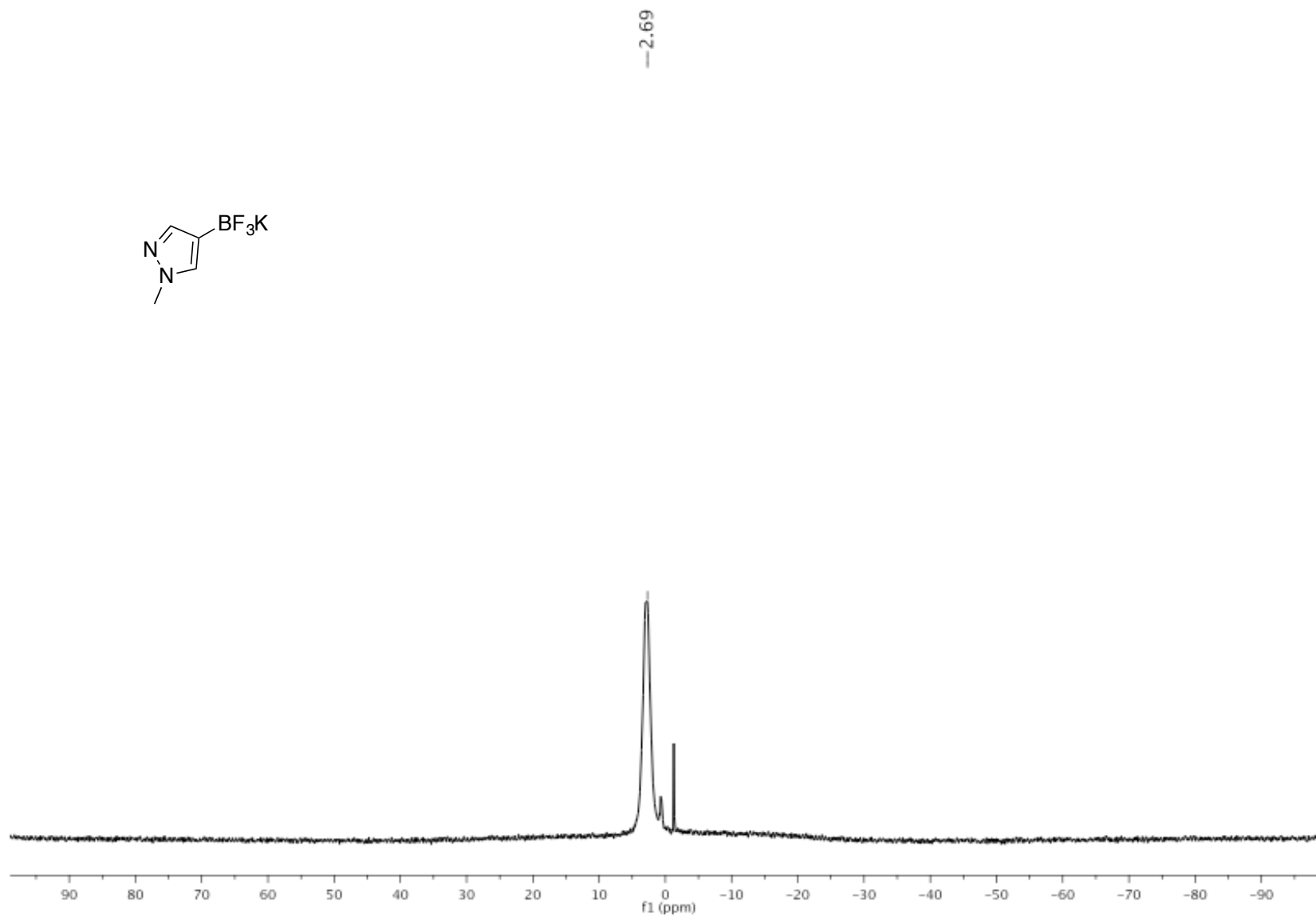
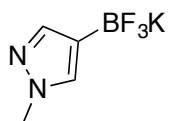
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(1-methyl-1H-pyrazol-4-yl)borate (3f, Table 3, entry 6)**



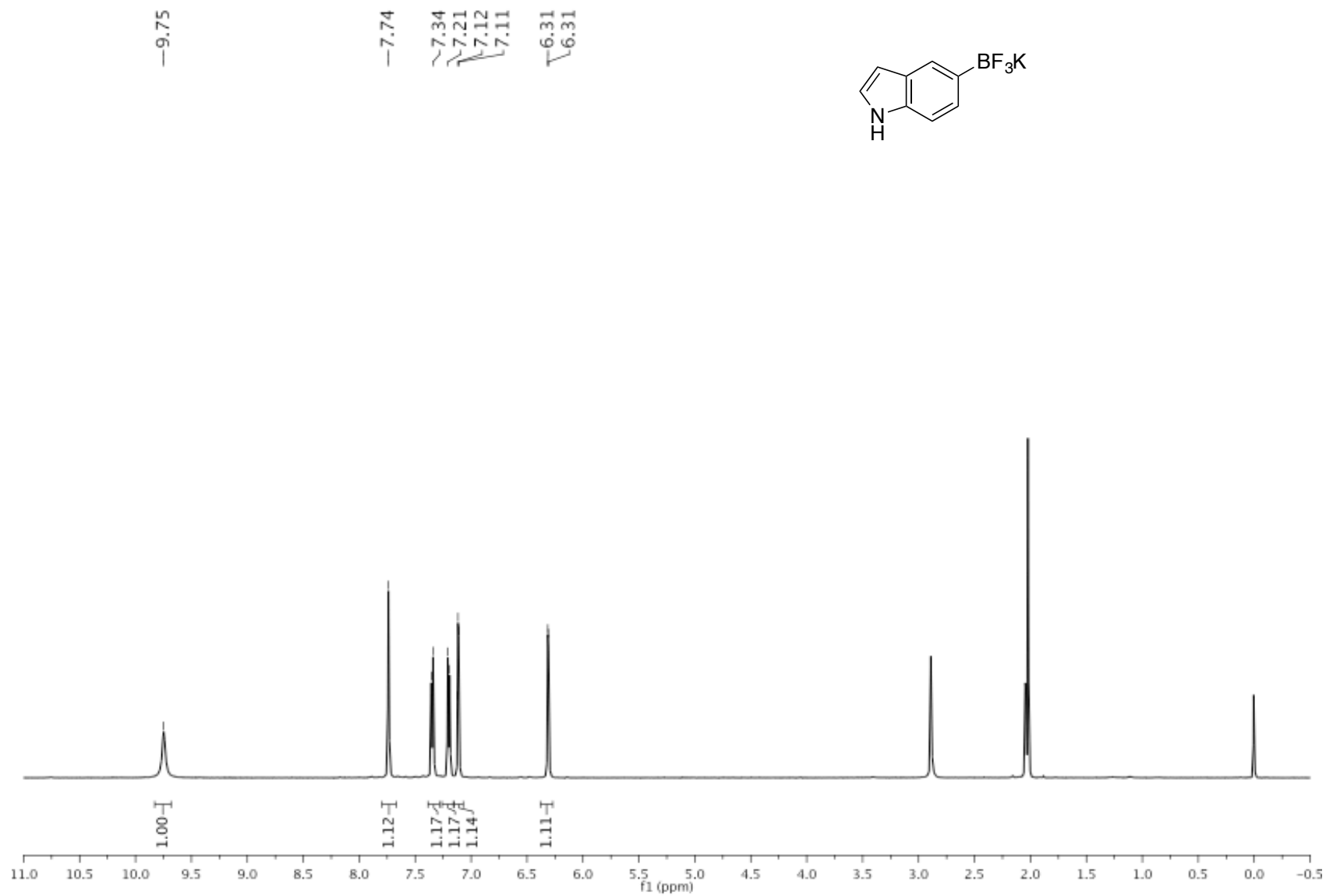
$^{13}\text{C}$  NMR (128.5 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(1-methyl-1H-pyrazol-4-yl)borate (3f, Table 3, entry 6)



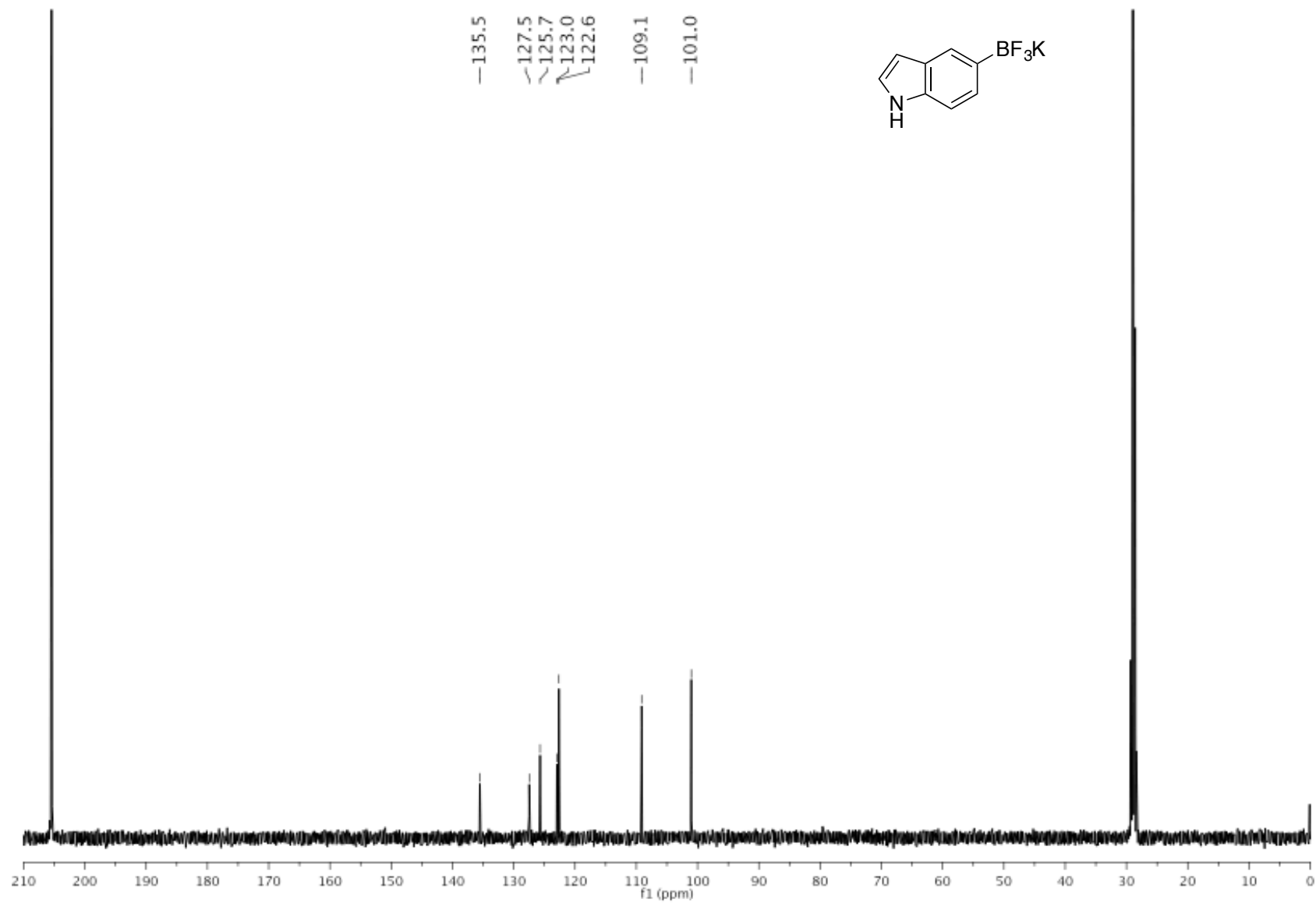
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(1-methyl-1H-pyrazol-4-yl)borate (3f, Table 3, entry 6)



**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(1-methyl-1H-pyrazol-4-yl)borate (3f, Table 3, entry 6)**

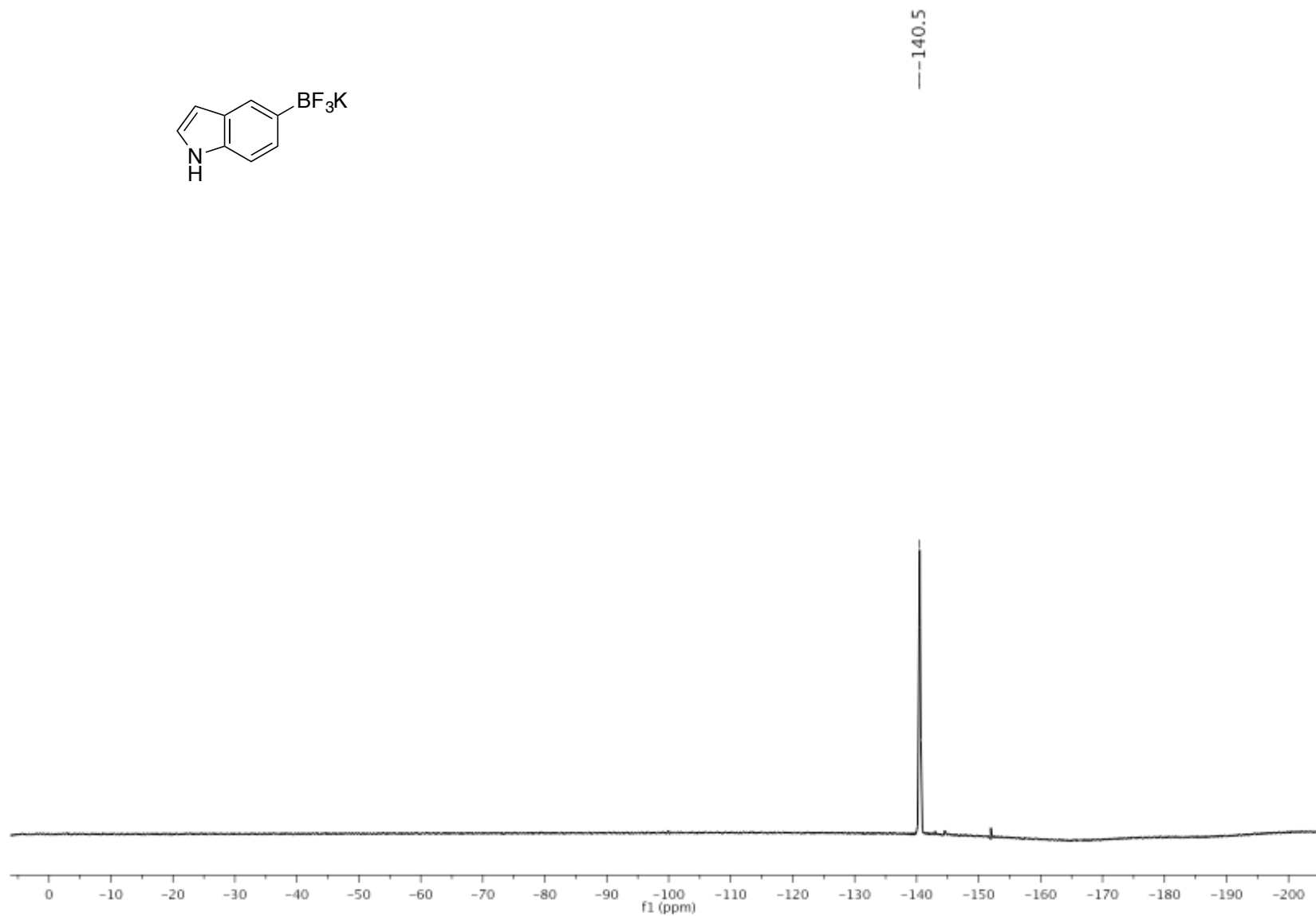
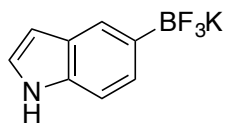


$^1\text{H}$  NMR (500 MHz, acetone- $d_6$ ) Spectrum of Potassium Trifluoro(1H-indol-5-yl)borate (3g, Table 3, entry 7)

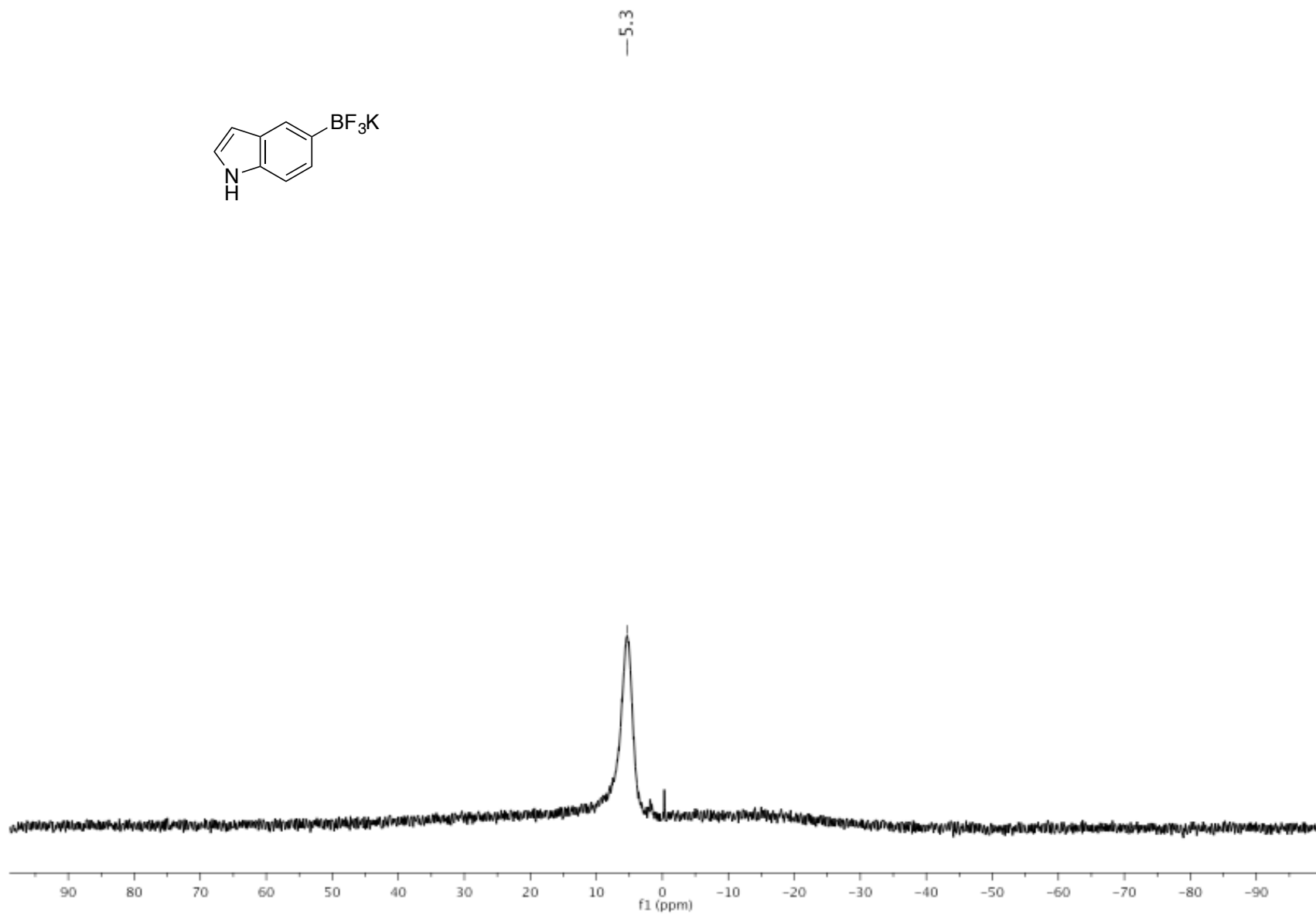
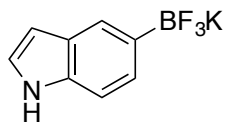


<sup>13</sup>C NMR (128.5 MHz, acetone -d<sub>6</sub>) Spectrum of Potassium Trifluoro(1*H*-indol-5-yl)borate (3g, Table 3, entry 7)

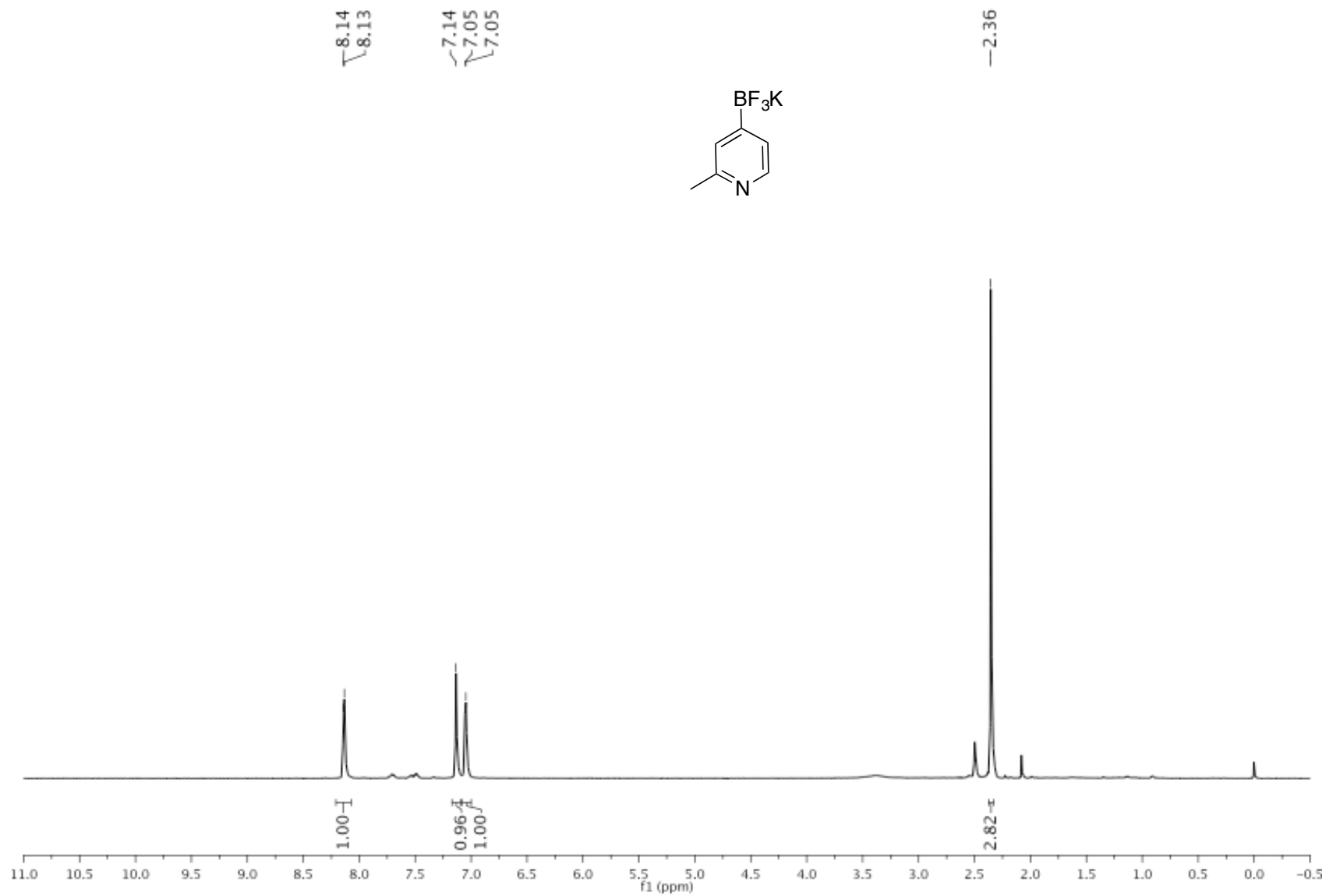




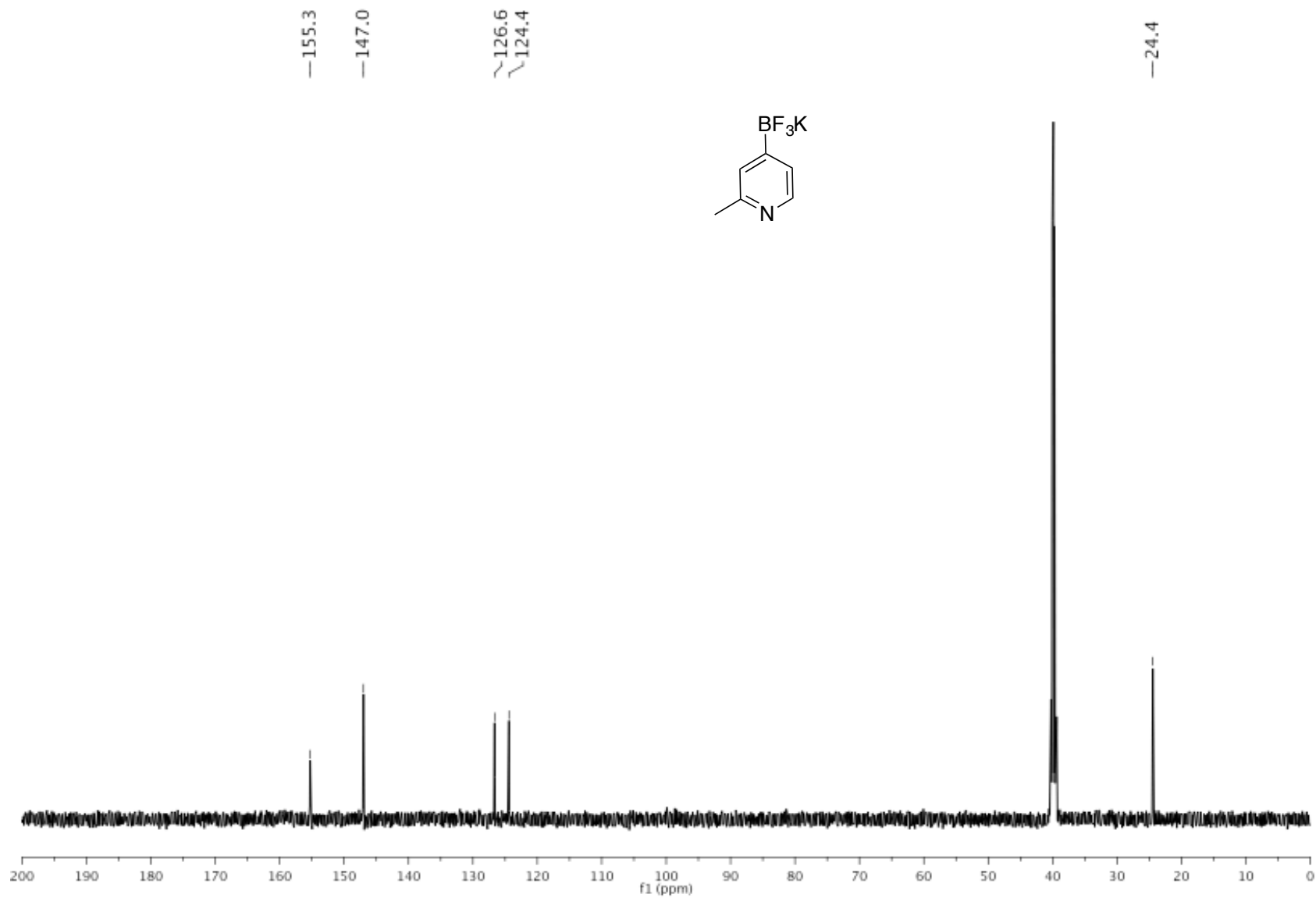
$^{19}\text{F}$  NMR (470.8 MHz, acetone- $d_6$ ) Spectrum of Potassium Trifluoro(1H-indol-5-yl)borate (3g, Table 3, entry 7)



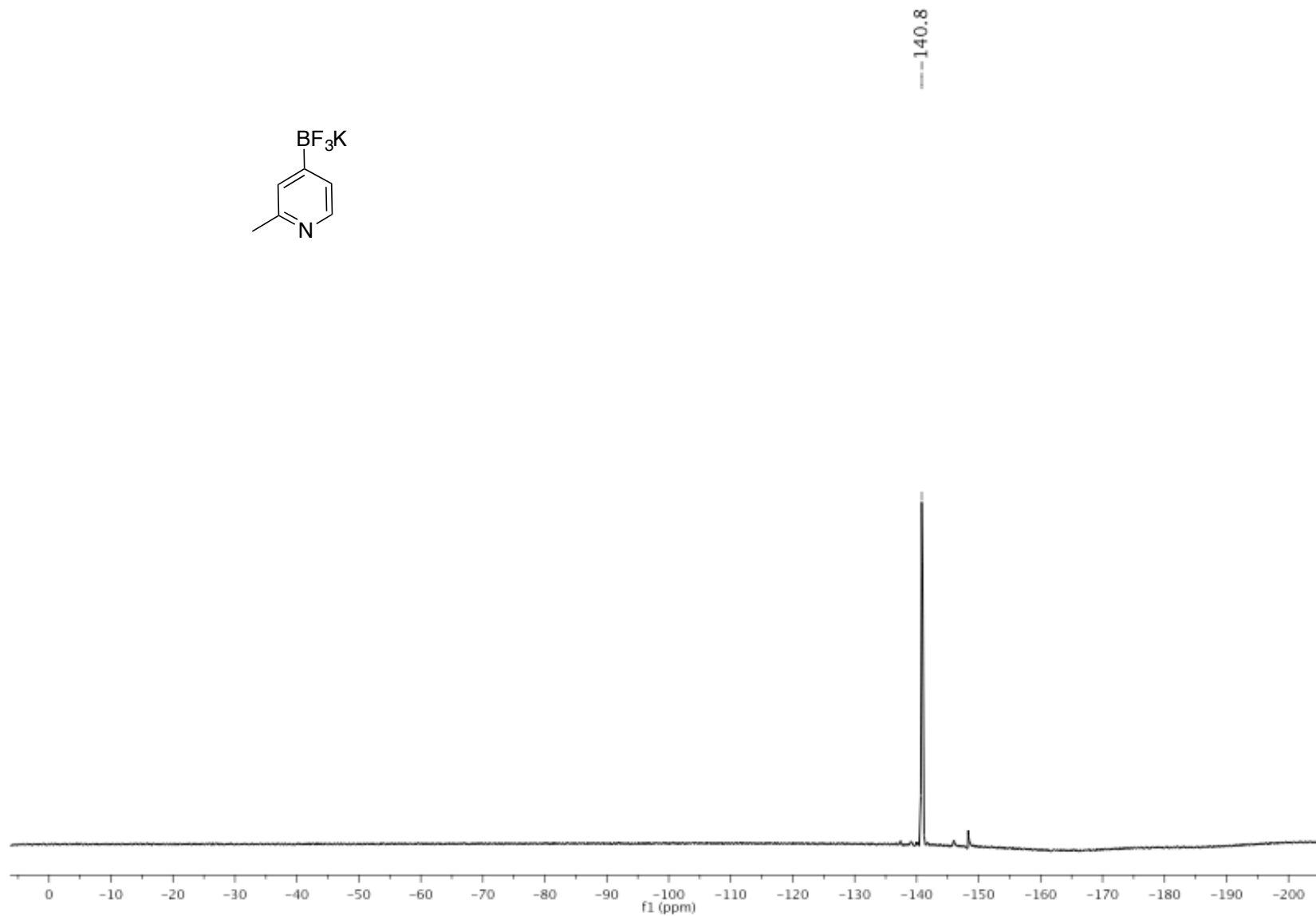
**<sup>11</sup>B NMR (128.4 MHz, acetone-d<sub>6</sub>) Spectrum of Potassium Trifluoro(1H-indol-5-yl)borate (3g, Table 3, entry 7)**



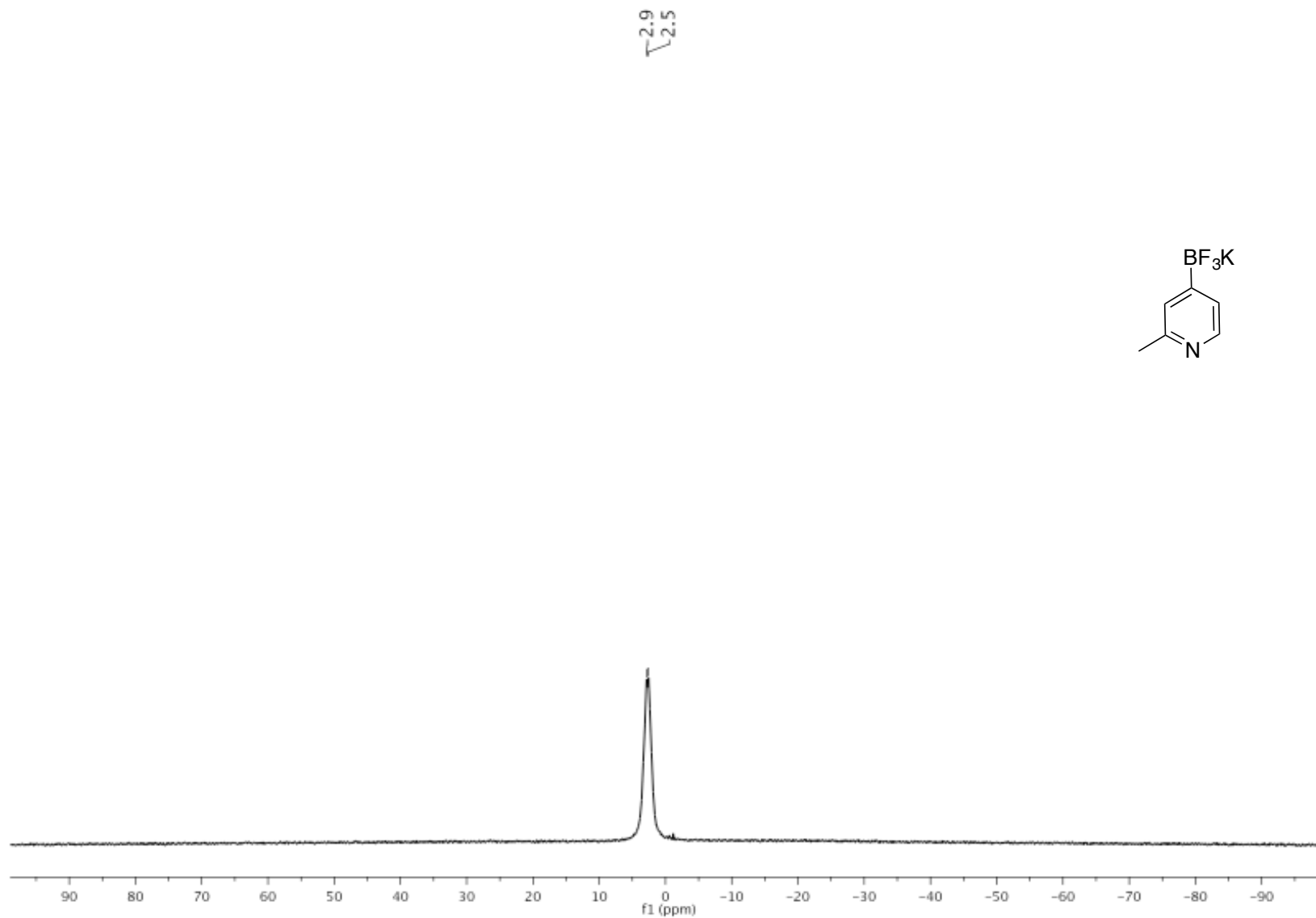
**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-methylpyridin-4-yl)borate (3h, Table 3, entry 8)**



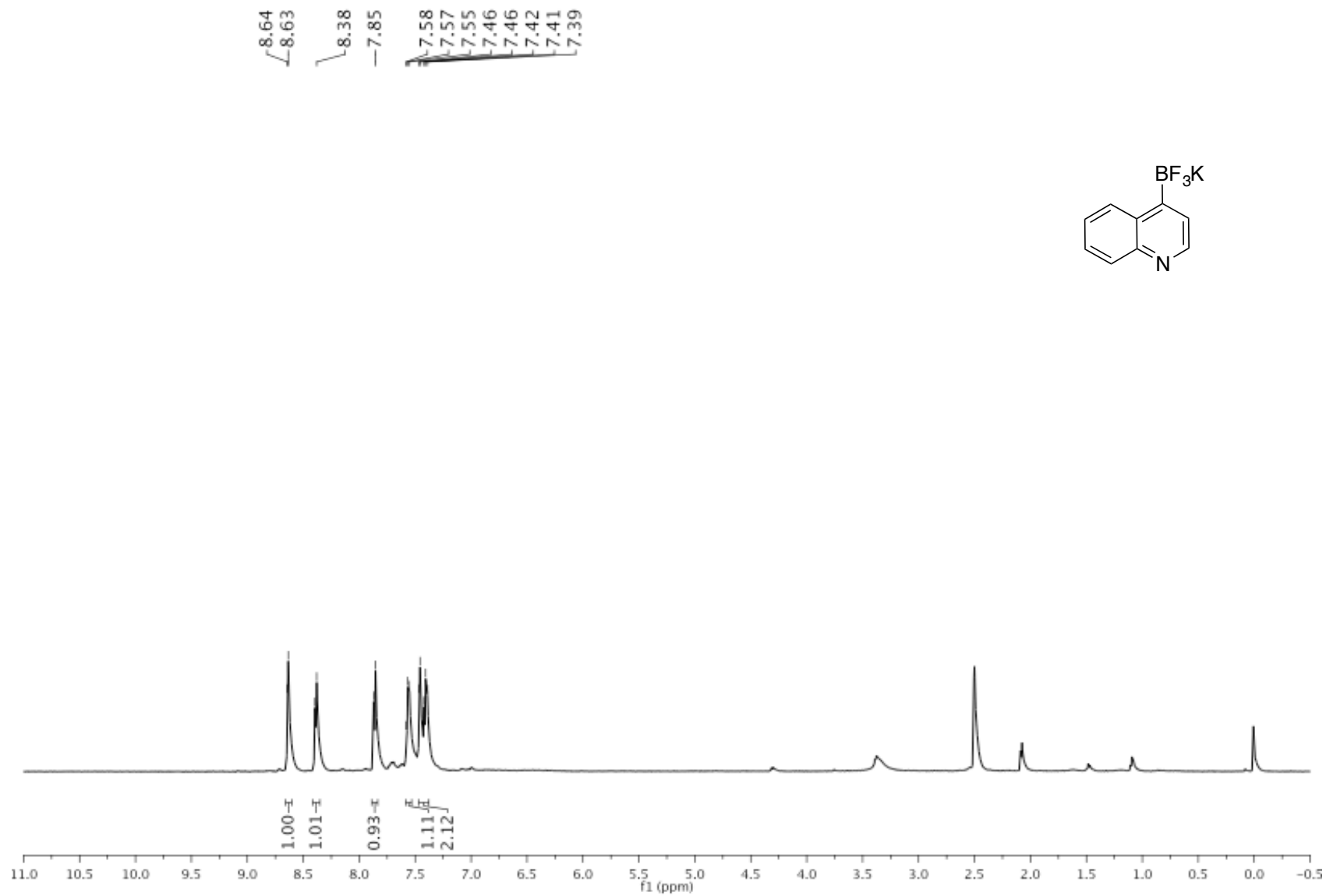
<sup>13</sup>C NMR (128.5 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-methylpyridin-4-yl)borate (3h, Table 3, entry 8)



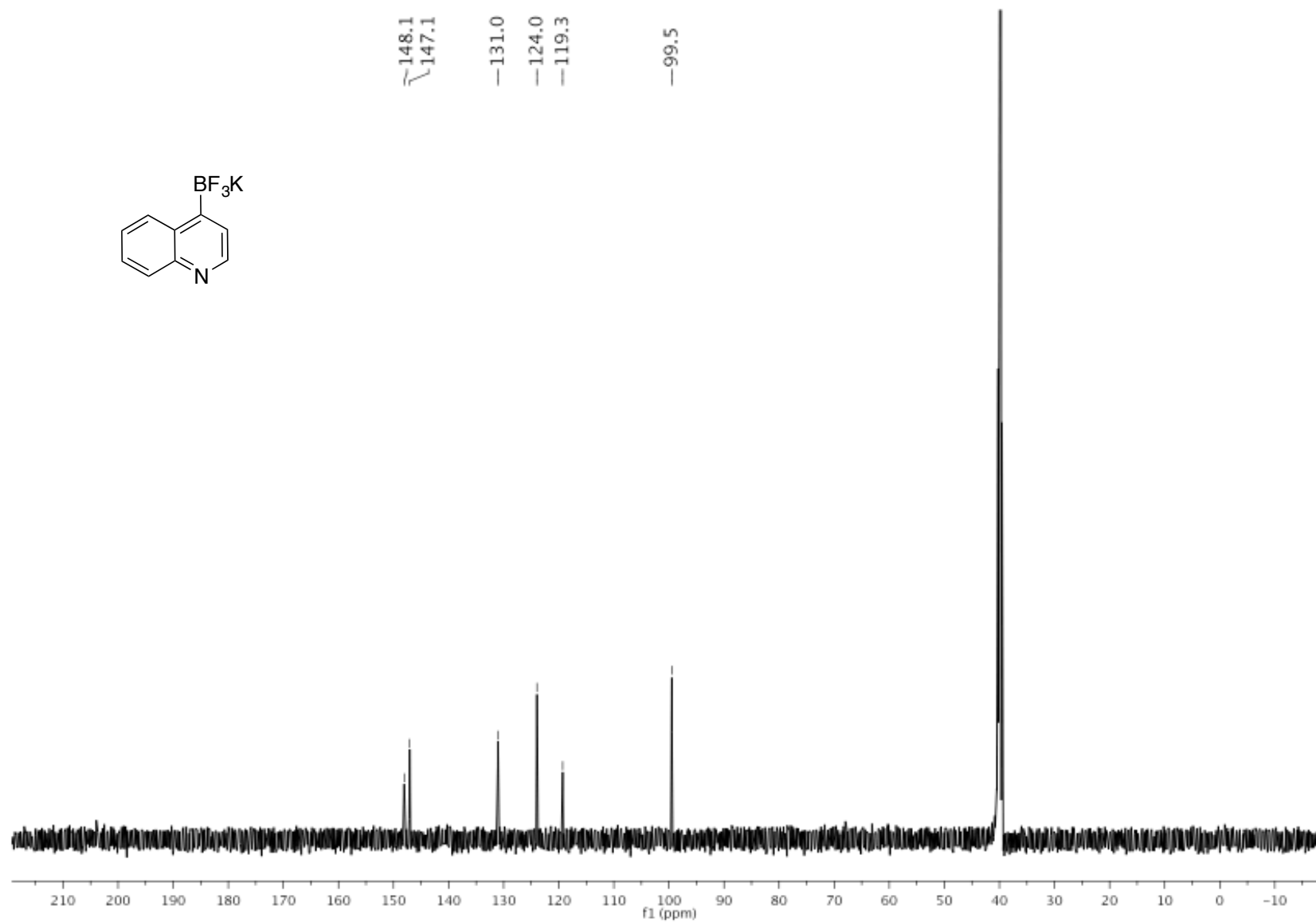
**<sup>19</sup>F NMR (470.8 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-methylpyridin-4-yl)borate (3h, Table 3, entry 8)**



**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(2-methylpyridin-4-yl)borate (3h, Table 3, entry 8)**

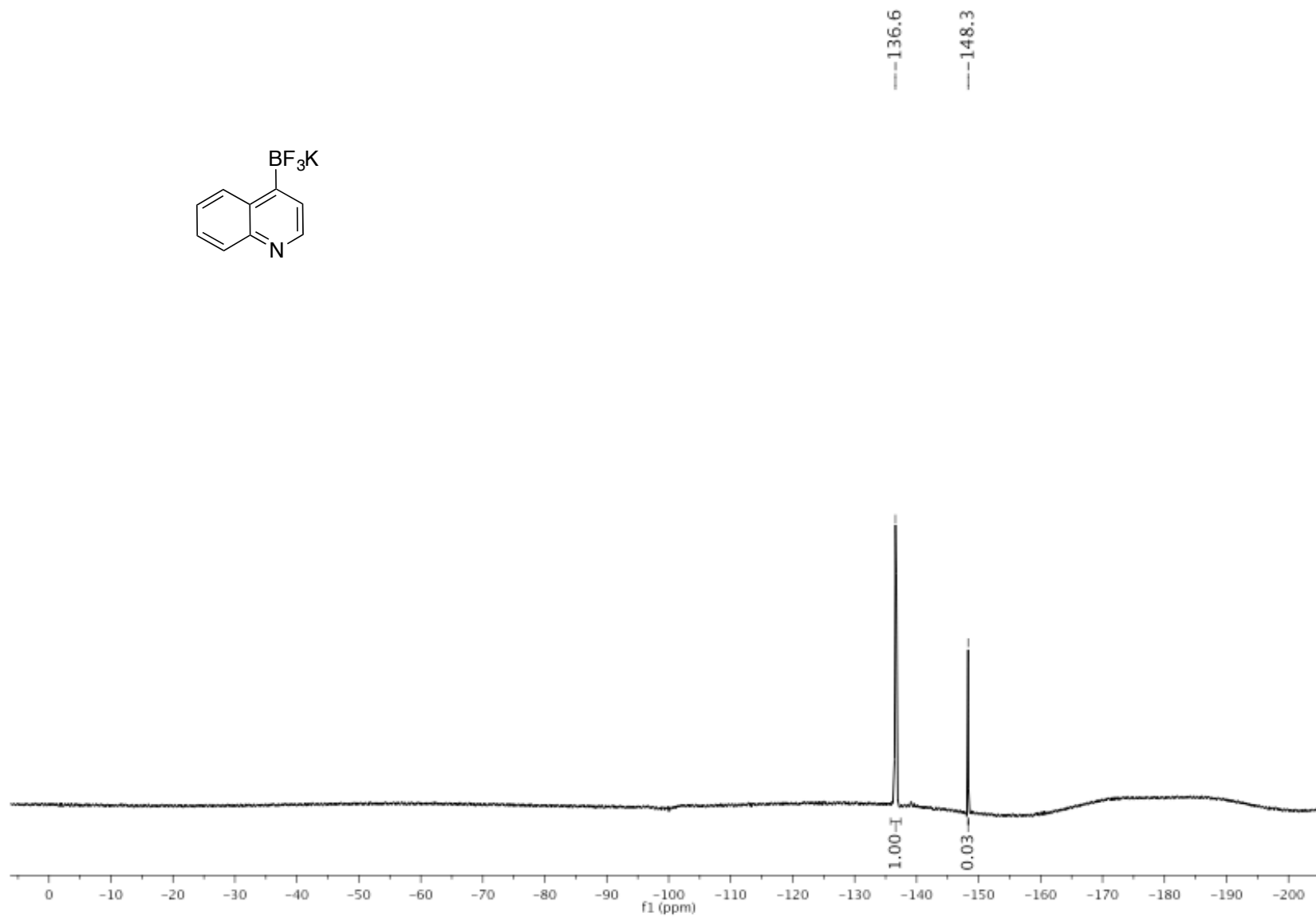
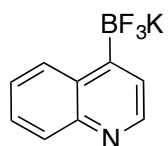


<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(quinolin-4-yl)borate (3i, Table 3, entry 9)

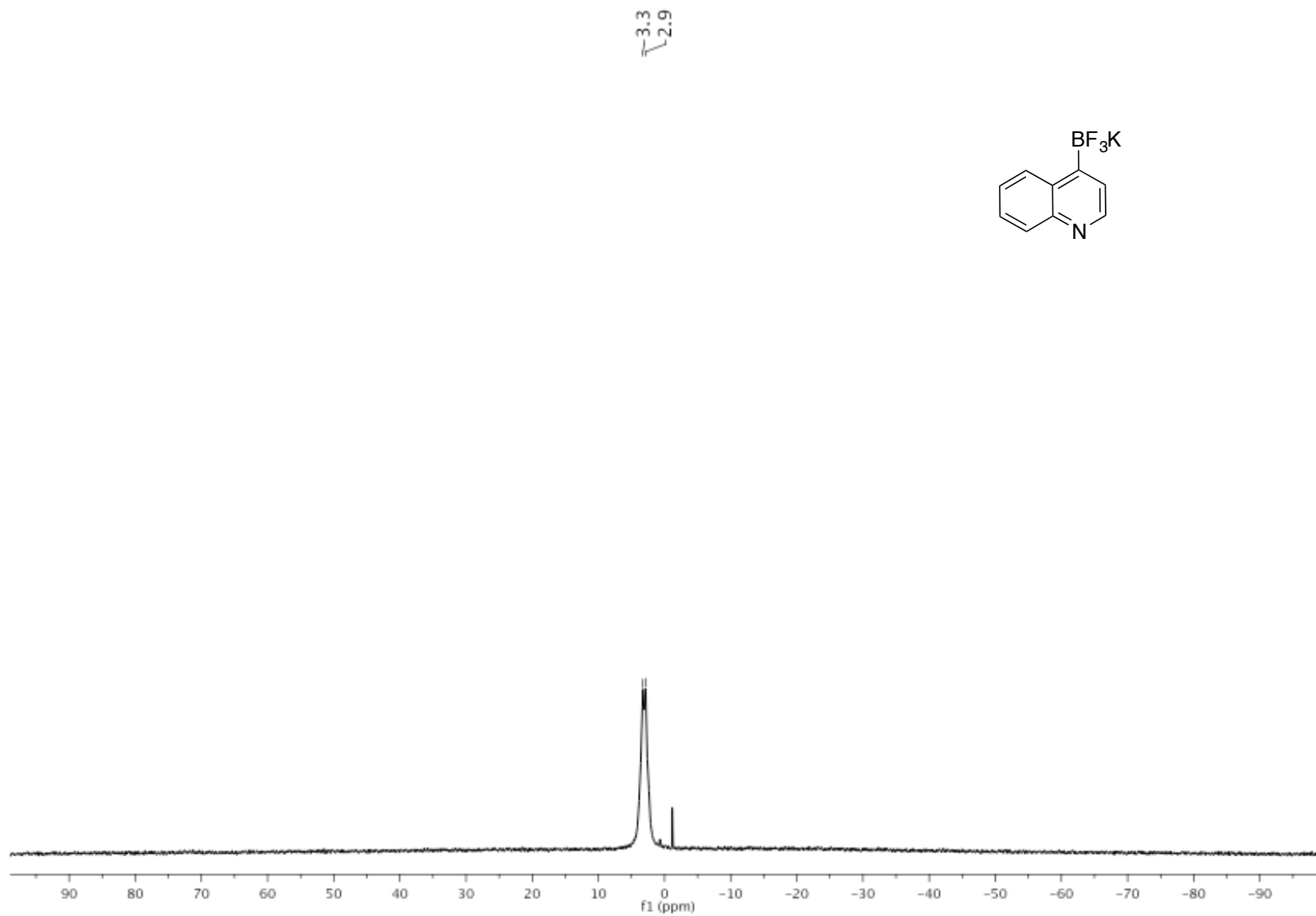


$^{13}\text{C}$  NMR (128.5 MHz, DMSO - $d_6$ ) Spectrum of Potassium Trifluoro(quinolin-4-yl)borate (3i, Table 3, entry 9)

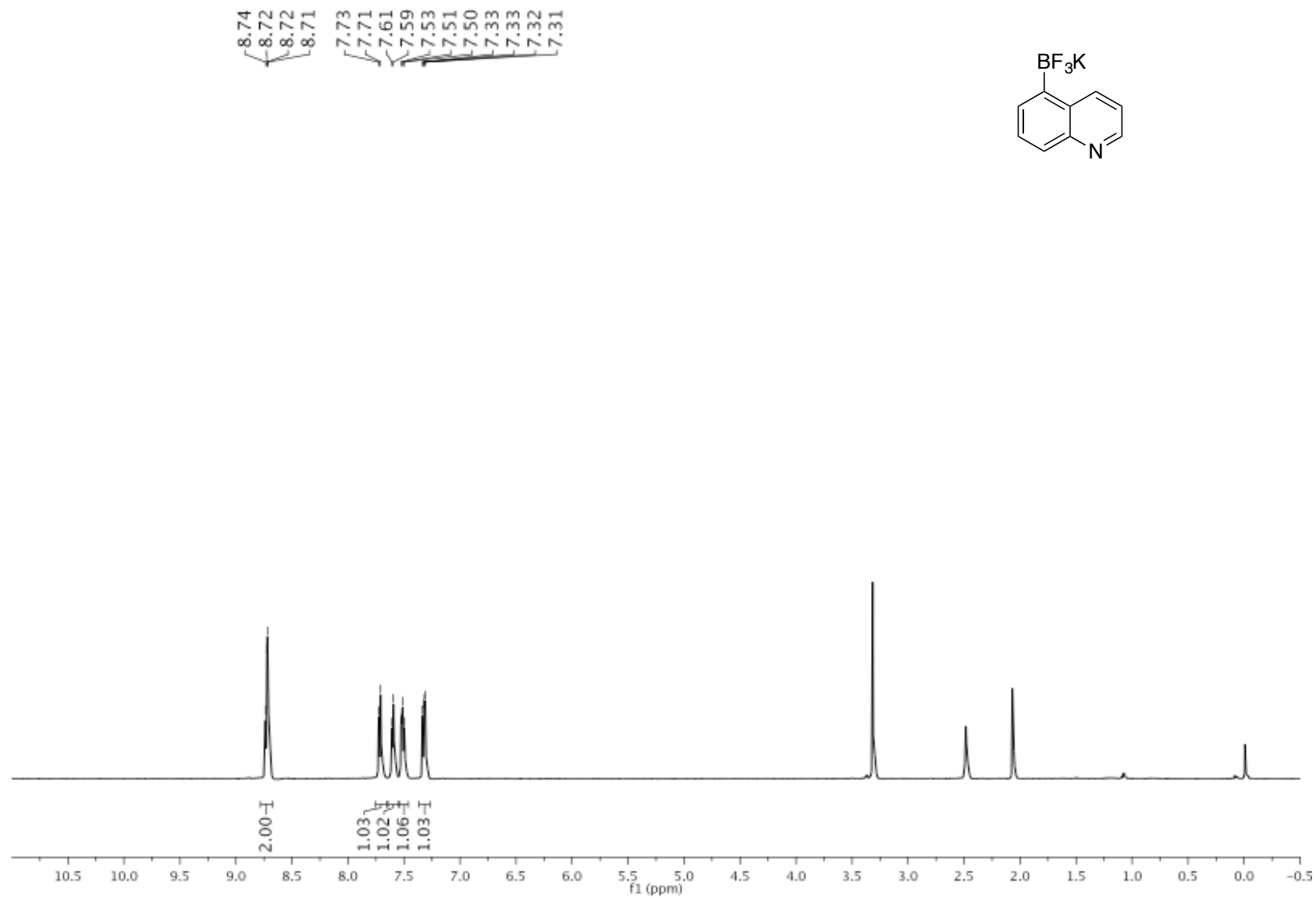




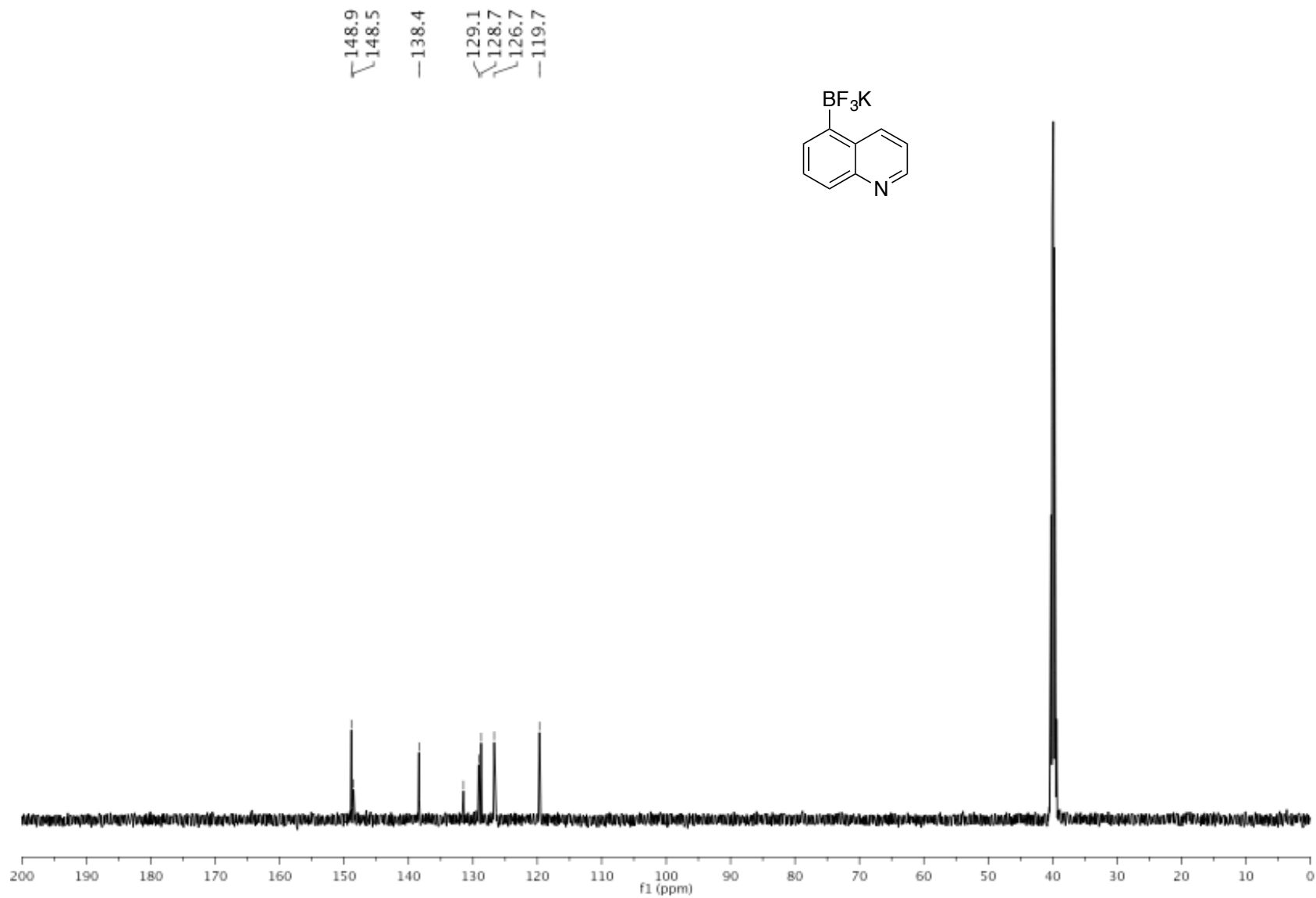
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO}-d_6$ ) Spectrum of Potassium Trifluoro(quinolin-4-yl)borate (3i, Table 3, entry 9)



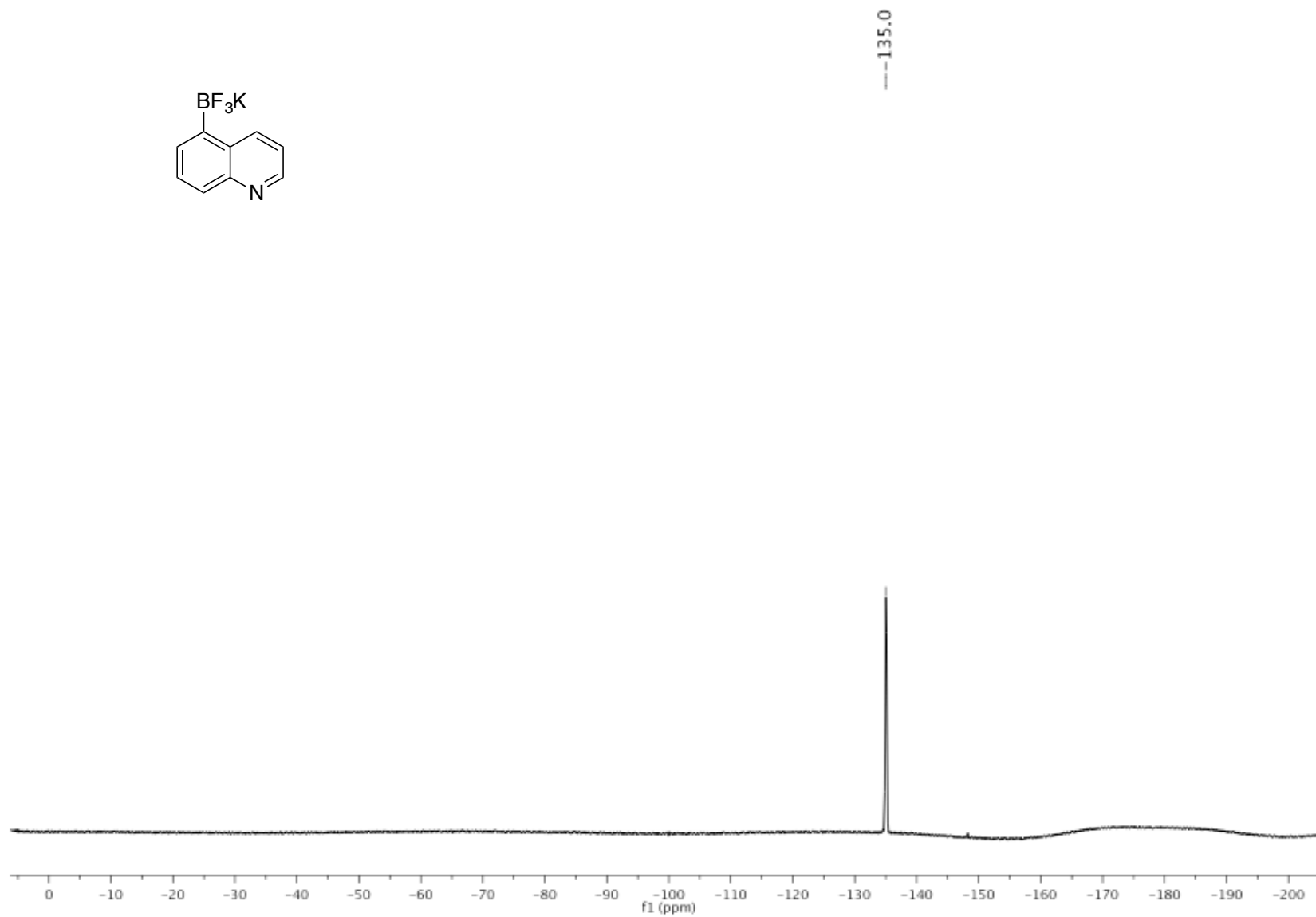
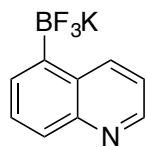
$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(quinolin-4-yl)borate (3i, Table 3, entry 9)



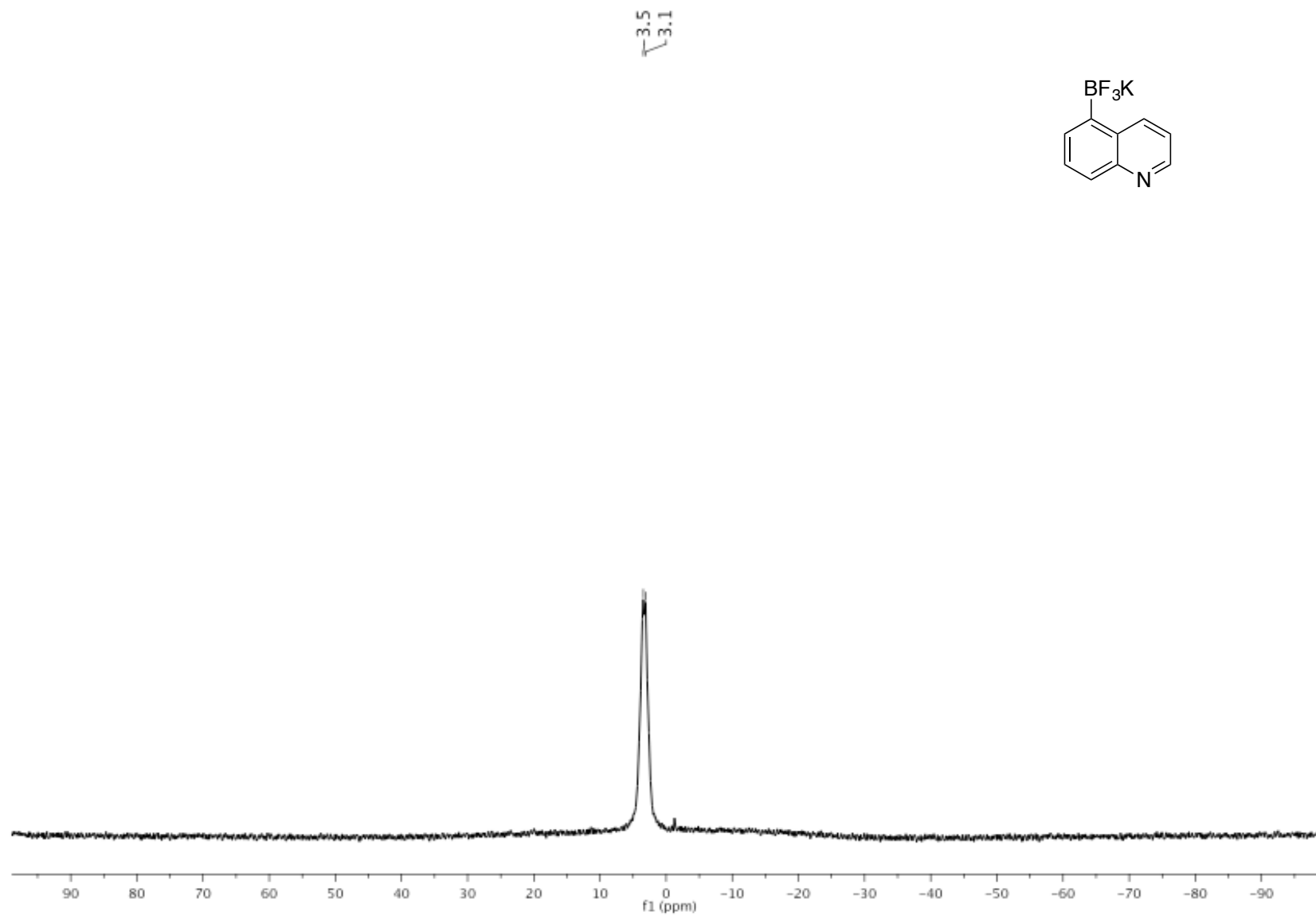
**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(quinolin-5-yl)borate (3j, Table 3, entry 10)**



**<sup>13</sup>C NMR (128.5 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(quinolin-5-yl)borate (3j, Table 3, entry 10)**



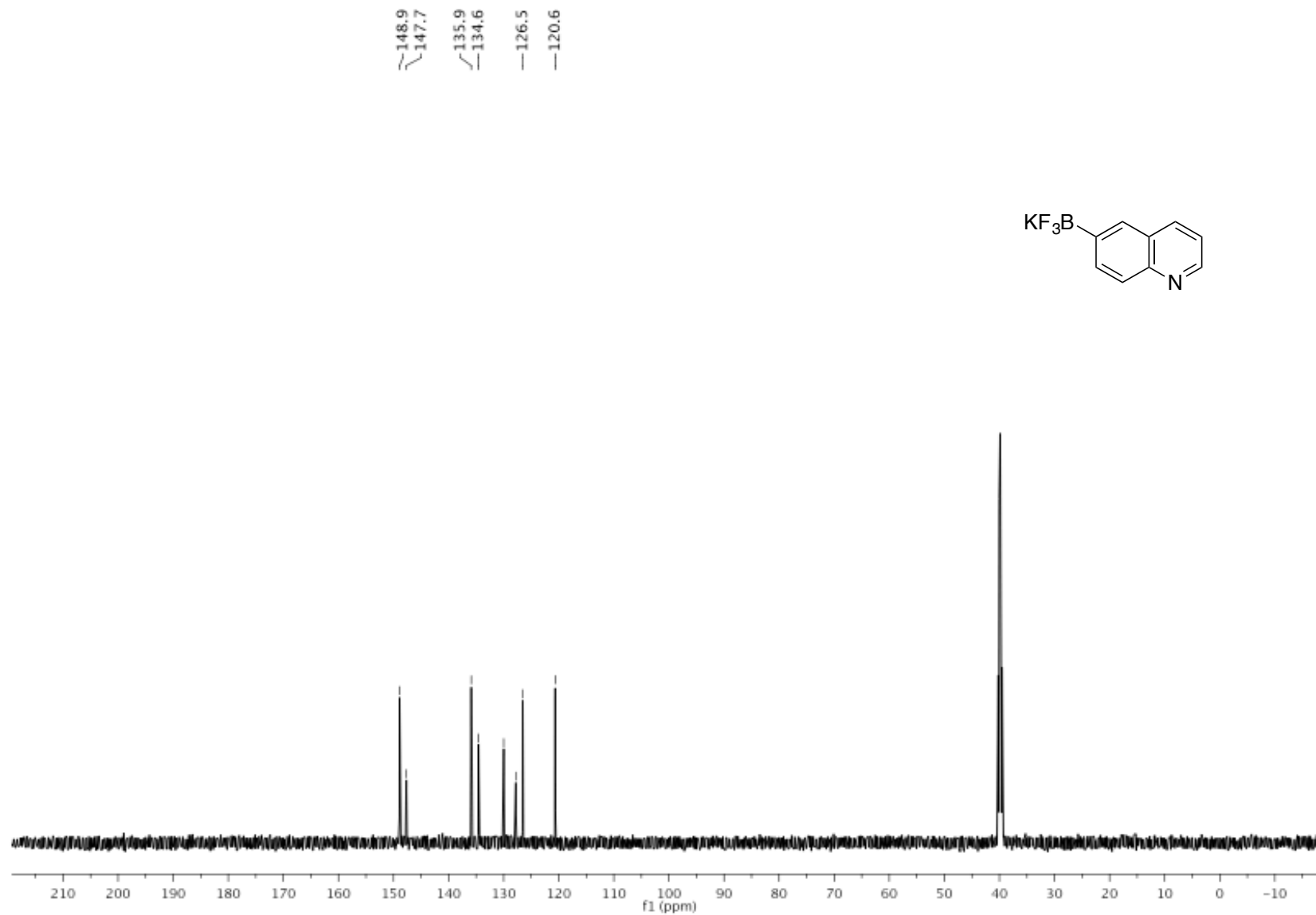
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO}-d_6$ ) Spectrum of Potassium Trifluoro(quinolin-5-yl)borate (3j, Table 3, entry 10)



$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(quinolin-5-yl)borate (3j, Table 3, entry 10)

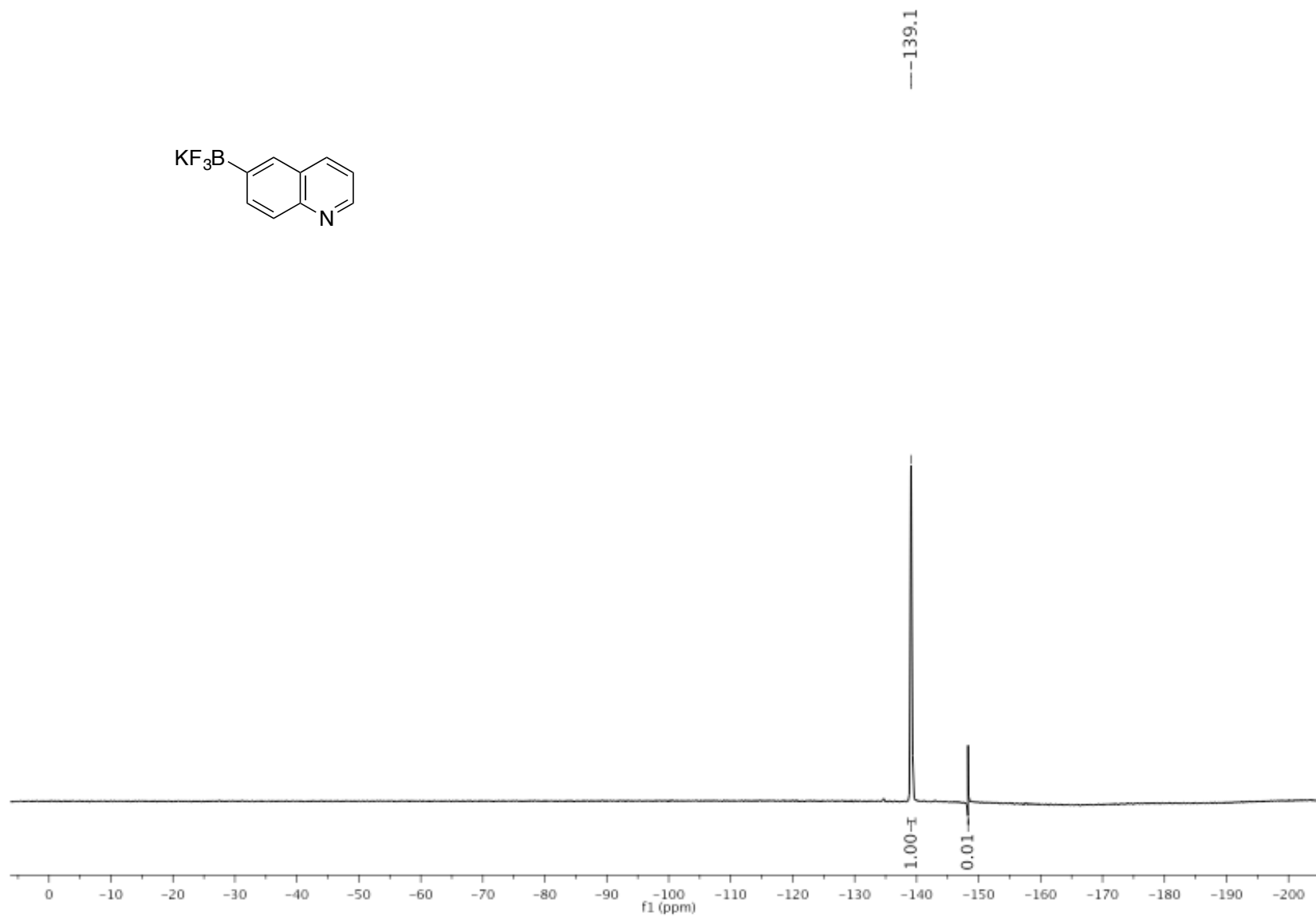
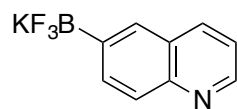


**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(quinolin-6-yl)borate (3k, Table 3, entry 11)**

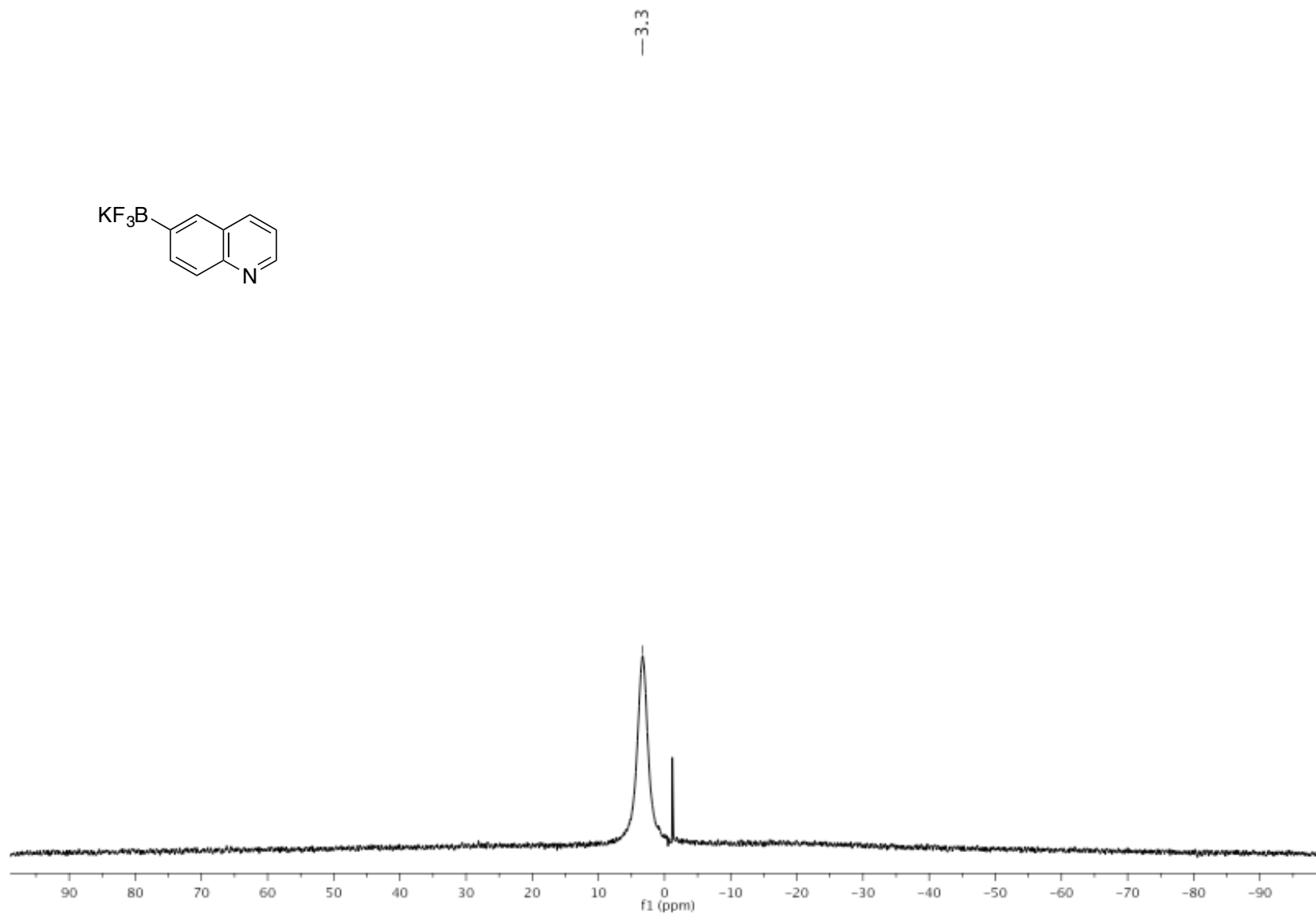
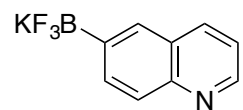


**$^{13}\text{C}$  NMR (128.5 MHz, DMSO - $d_6$ ) Spectrum of Potassium Trifluoro(quinolin-6-yl)borate (3k, Table 3, entry 11)**

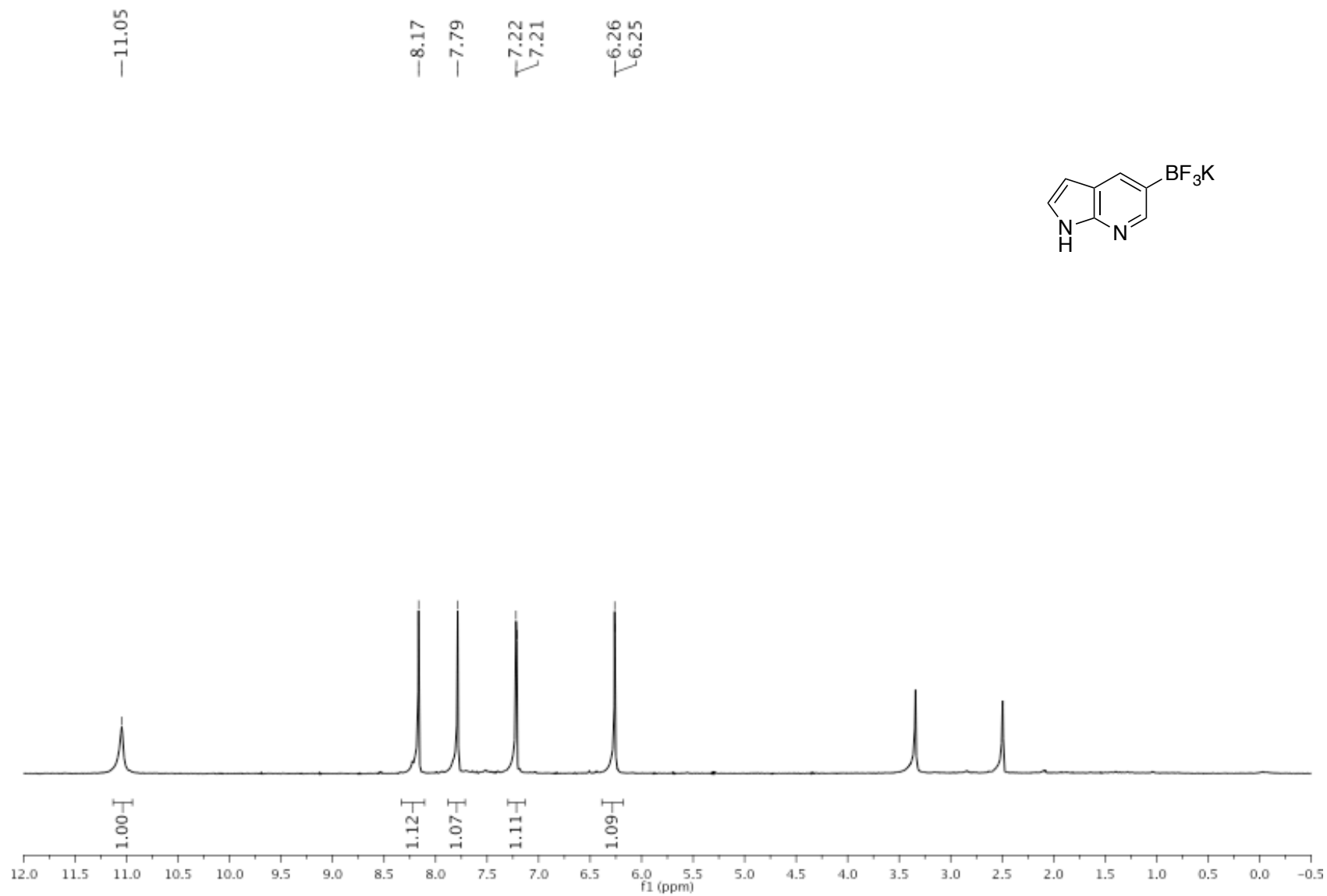




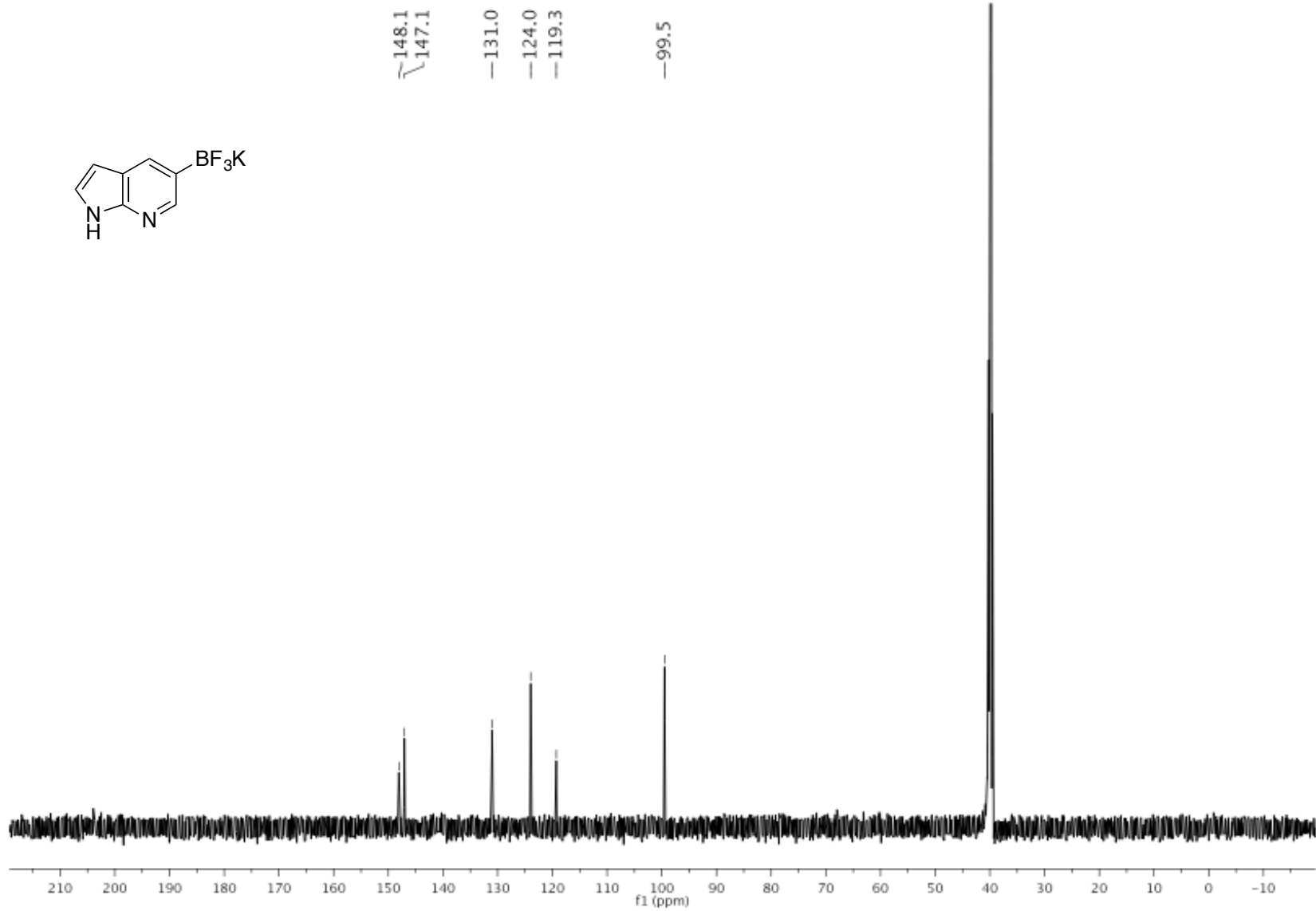
$^{19}\text{F}$  NMR (470.8 MHz,  $\text{DMSO}-d_6$ ) Spectrum of Potassium Trifluoro(quinolin-6-yl)borate (3k, Table 3, entry 11)



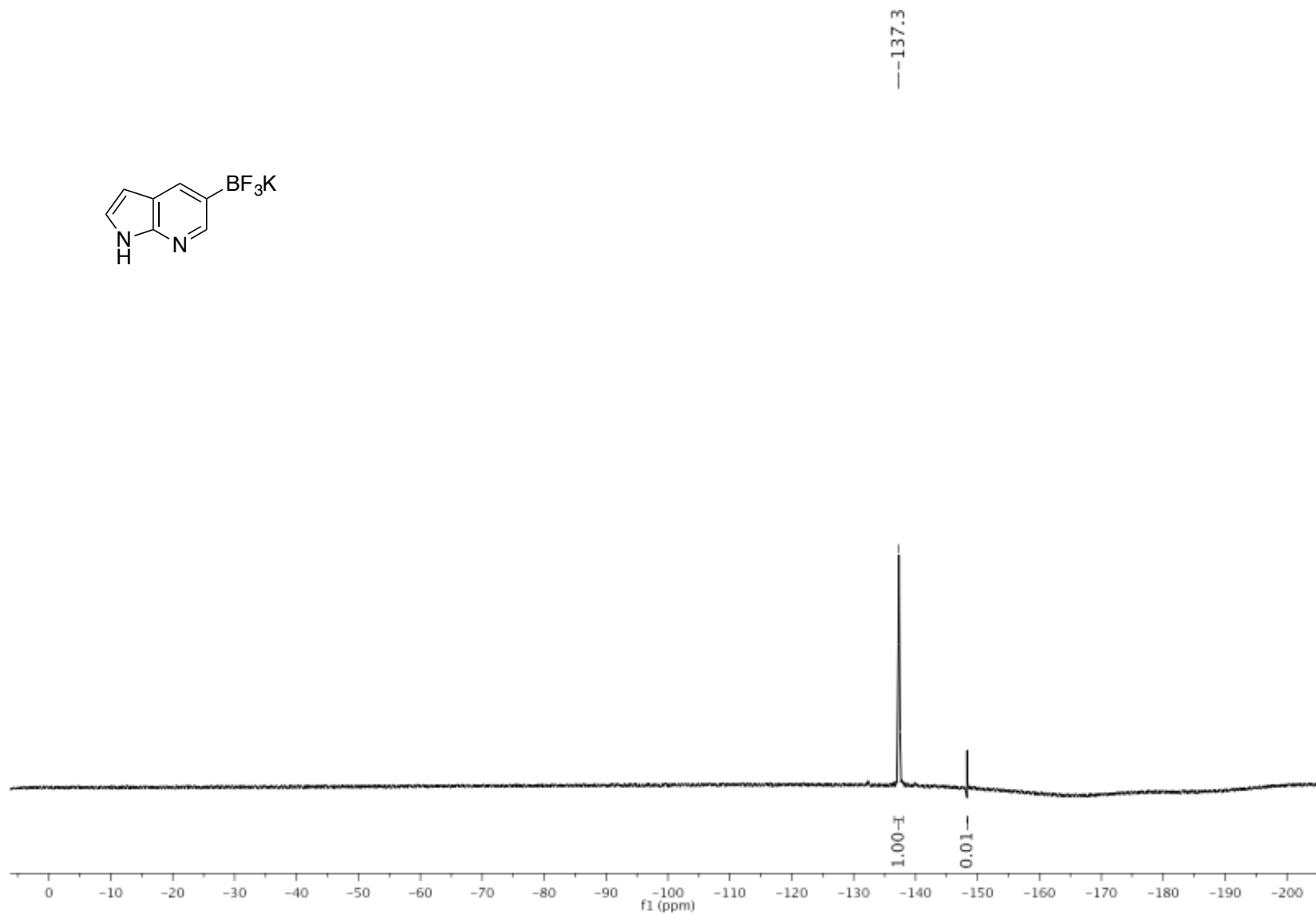
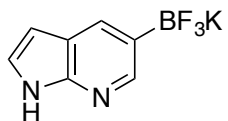
**$^{11}\text{B}$  NMR (128.4 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(quinolin-6-yl)borate (3k, Table 3, entry 11)**



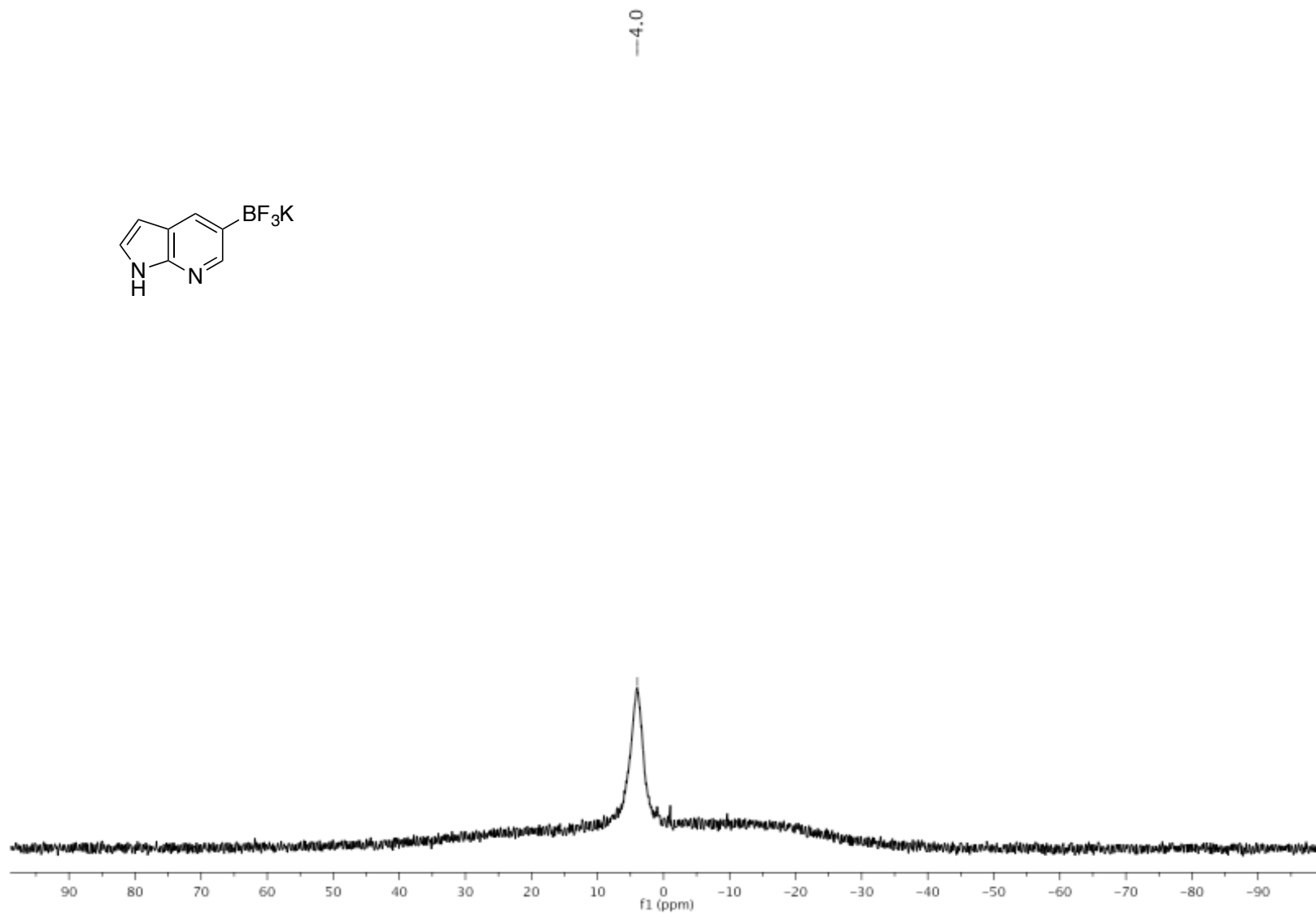
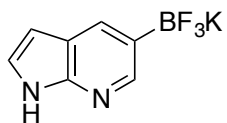
<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(1H-pyrrolo[2,3-b]pyridin-5-yl)borate (31, Table 3, entry 12)



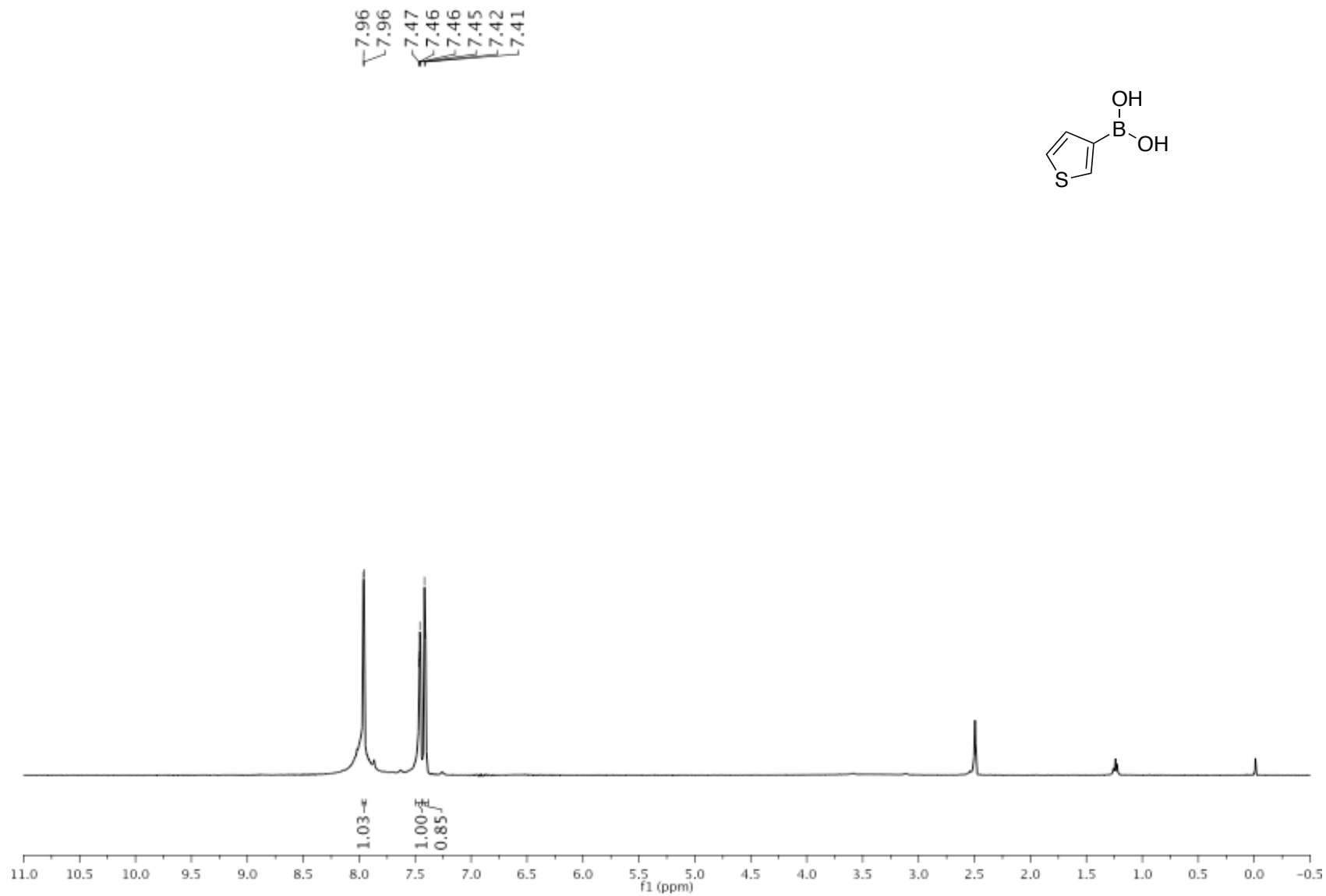
<sup>13</sup>C NMR (128.5 MHz, DMSO -*d*<sub>6</sub>) Spectrum of Potassium Trifluoro(1*H*-pyrrolo[2,3-*b*]pyridin-5-yl)borate (3l, Table 3, entry 12)



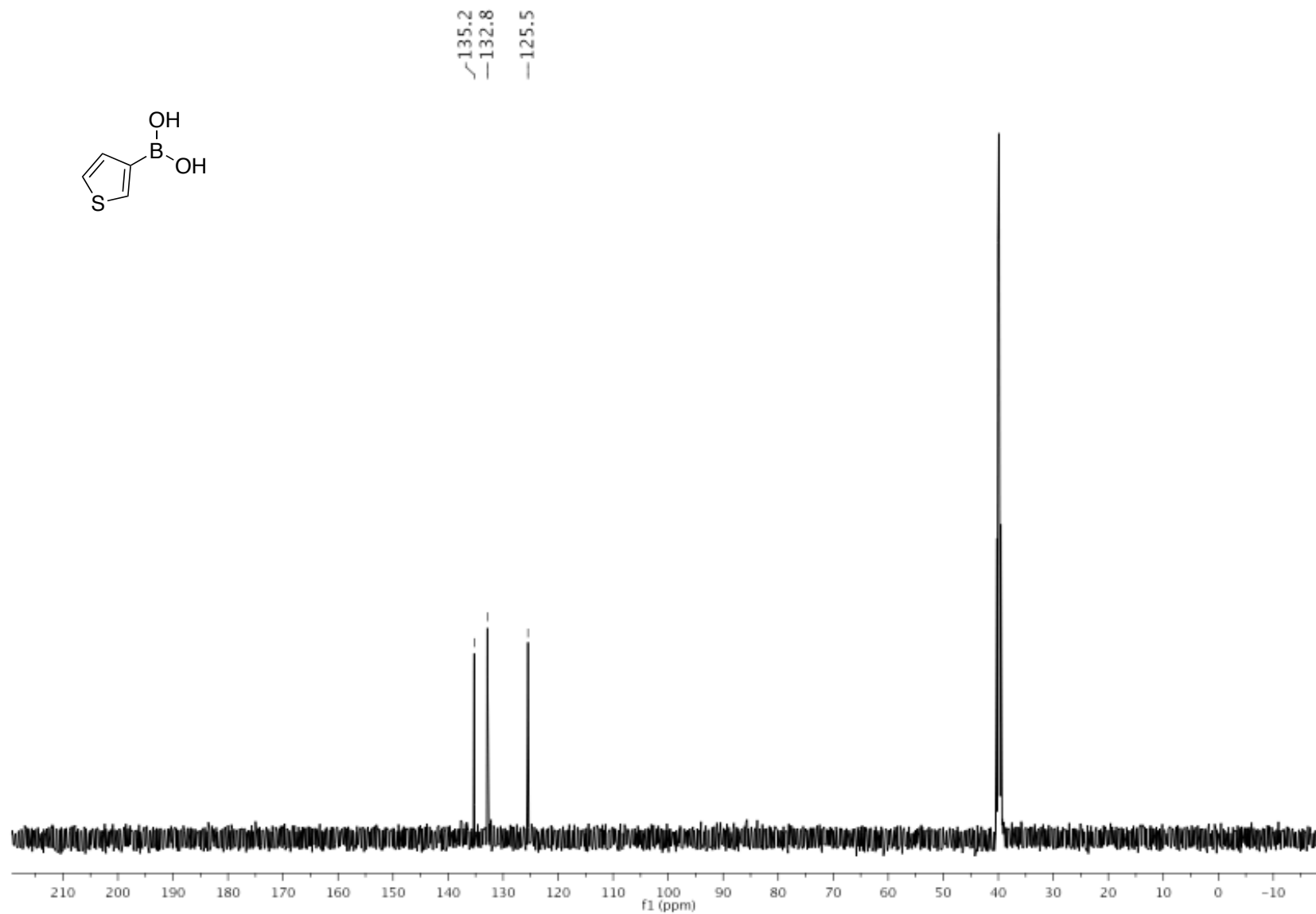
<sup>19</sup>F NMR (470.8 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(1H-pyrrolo[2,3-b]pyridin-5-yl)borate (31, Table 3, entry 12)



<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(1H-pyrrolo[2,3-b]pyridin-5-yl)borate (31, Table 3, entry 12)

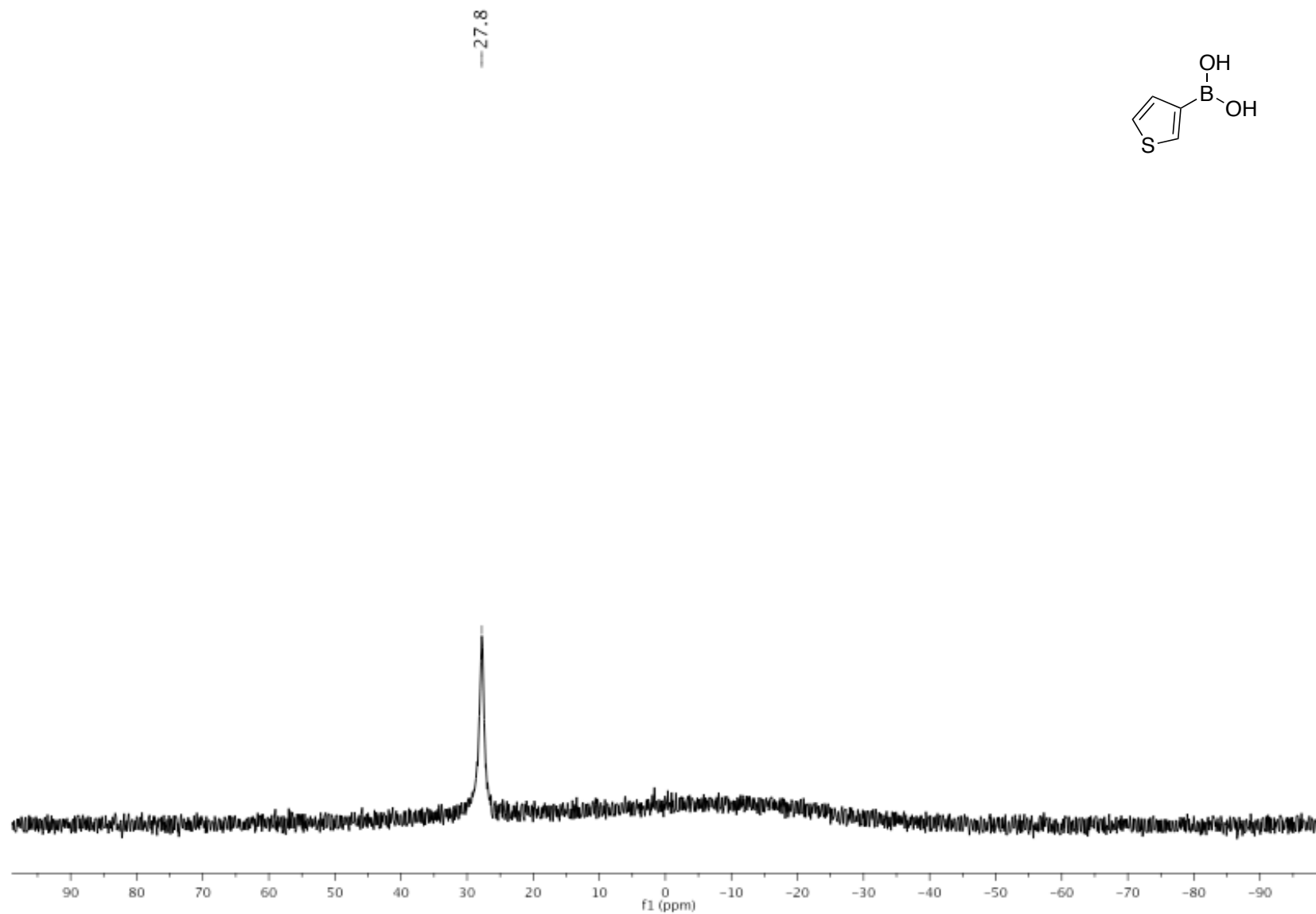


**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Thien-3-ylboronic acid (4a, Table 4, entry 1)**

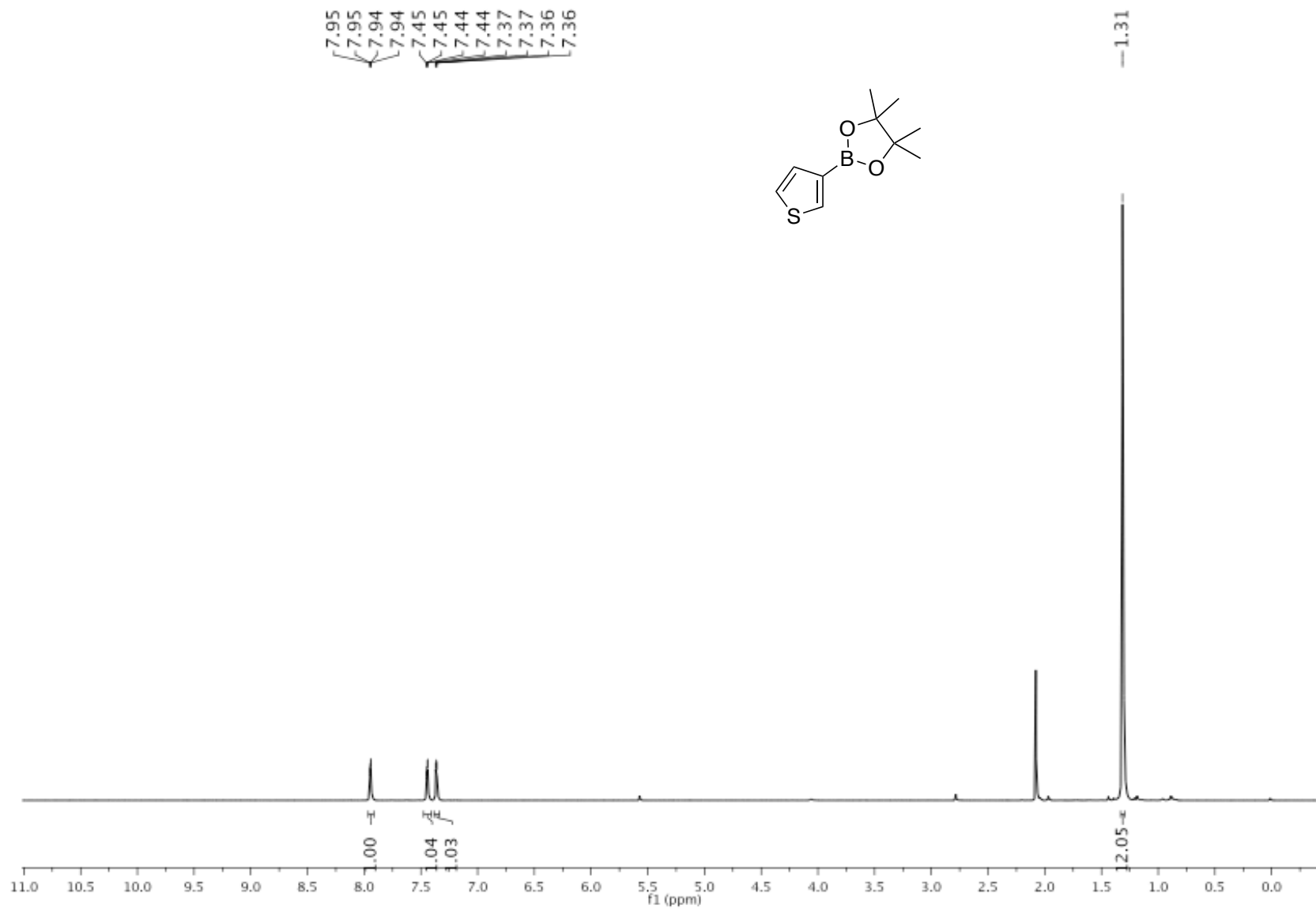


$^{13}\text{C}$  NMR (128.5 MHz,  $\text{DMSO}-d_6$ ) Spectrum of Thien-3-ylboronic acid (4a, Table 4, entry 1)

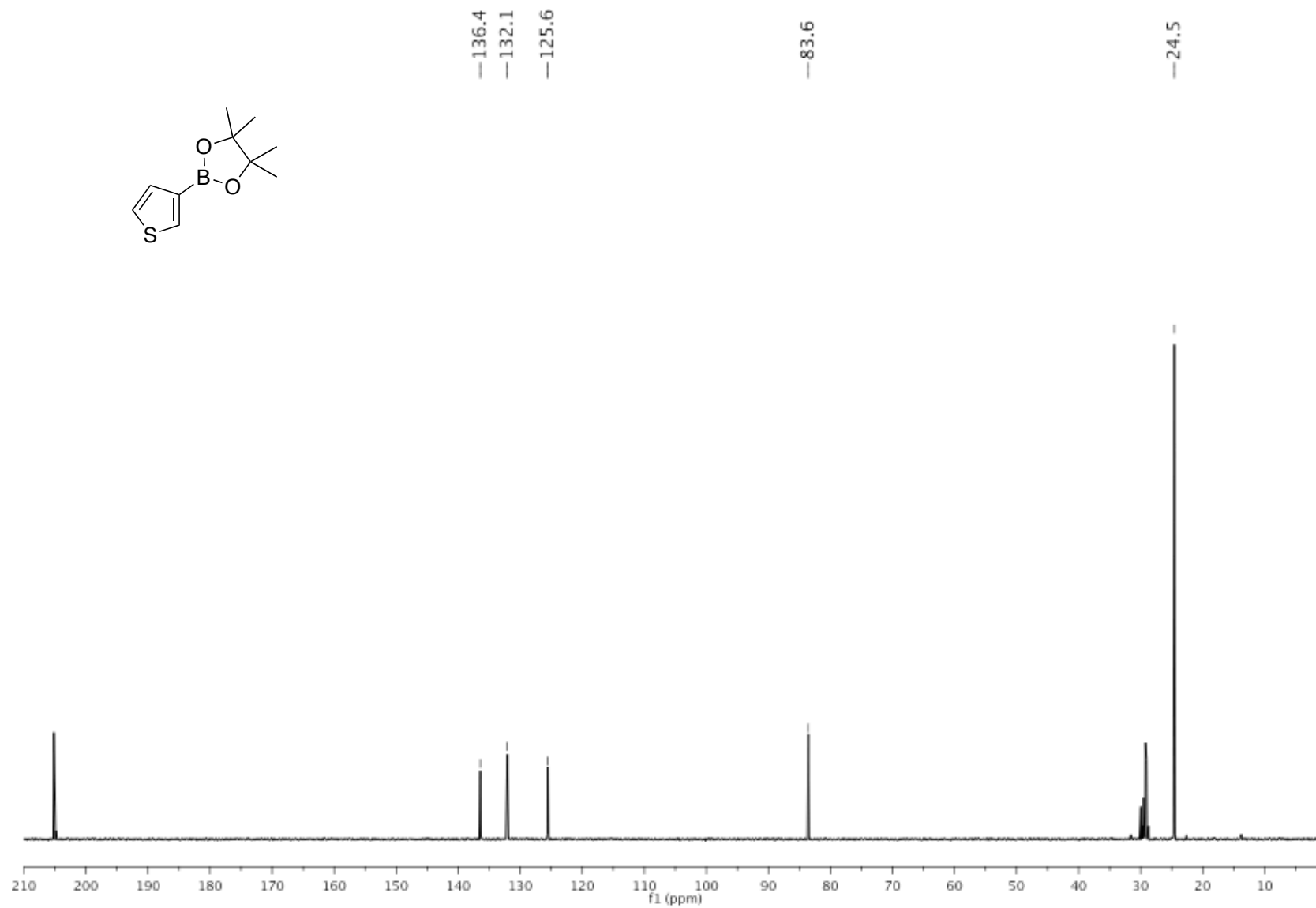
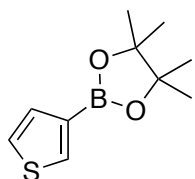




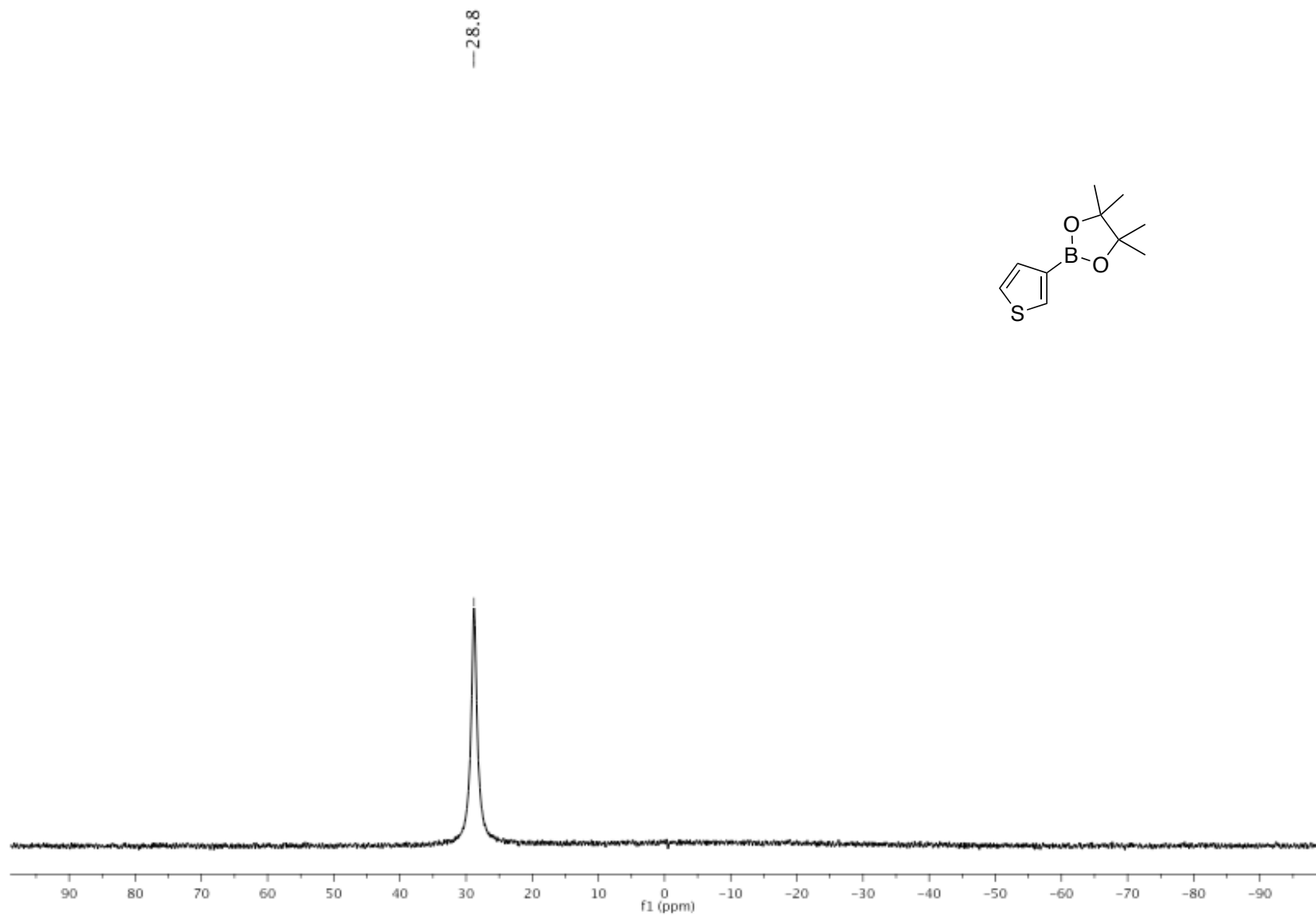
$^{11}\text{B}$  NMR (128.4 MHz, acetone- $d_6$ ) Spectrum of Thien-3-ylboronic acid (4a, Table 4, entry 1)



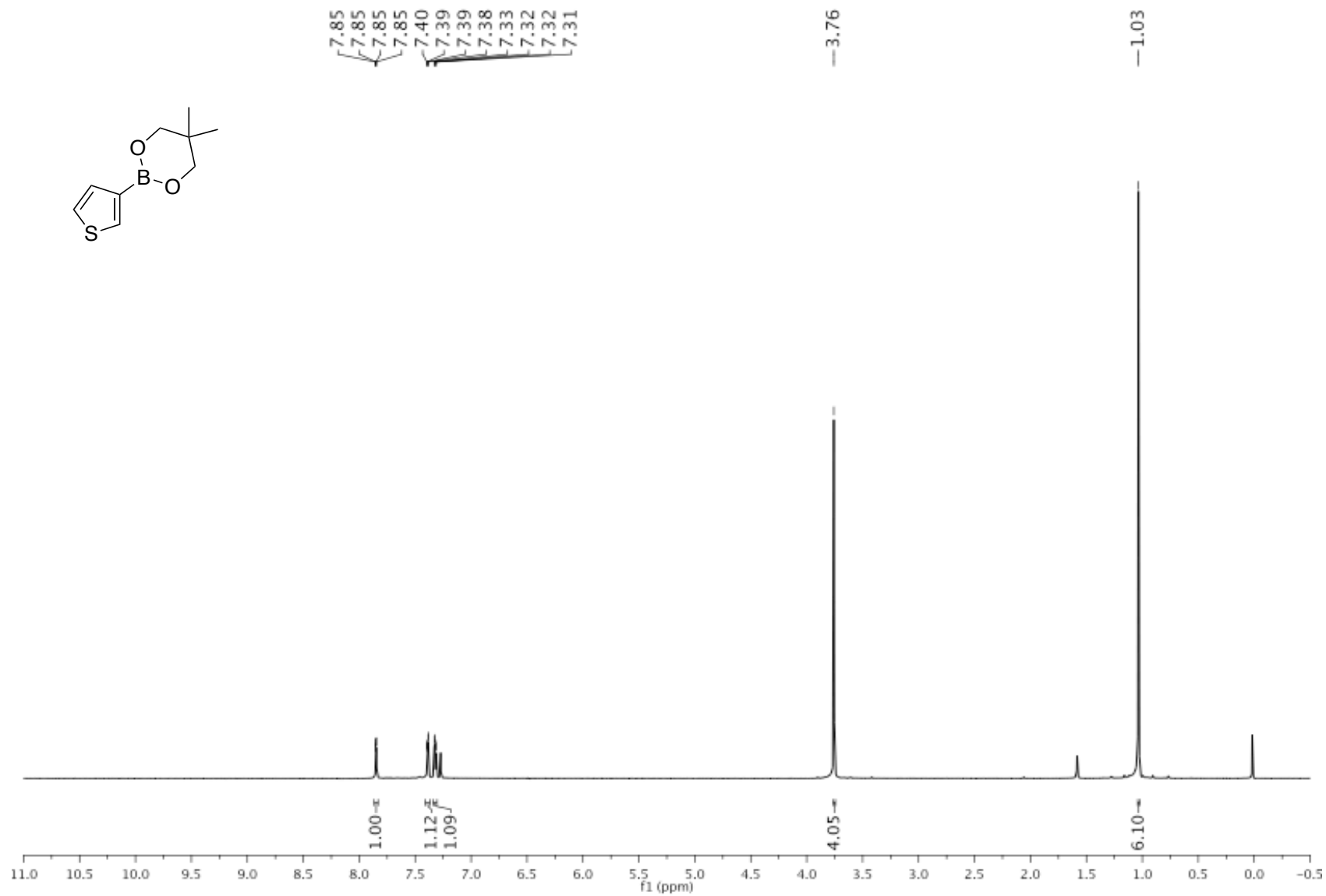
<sup>1</sup>H NMR (500 MHz, acetone -d<sub>6</sub>) Spectrum of 4,4,5,5-Tetramethyl-2-(thien-3-yl)-1,3,2-dioxaborolane (4b, Table 4, entry 2)



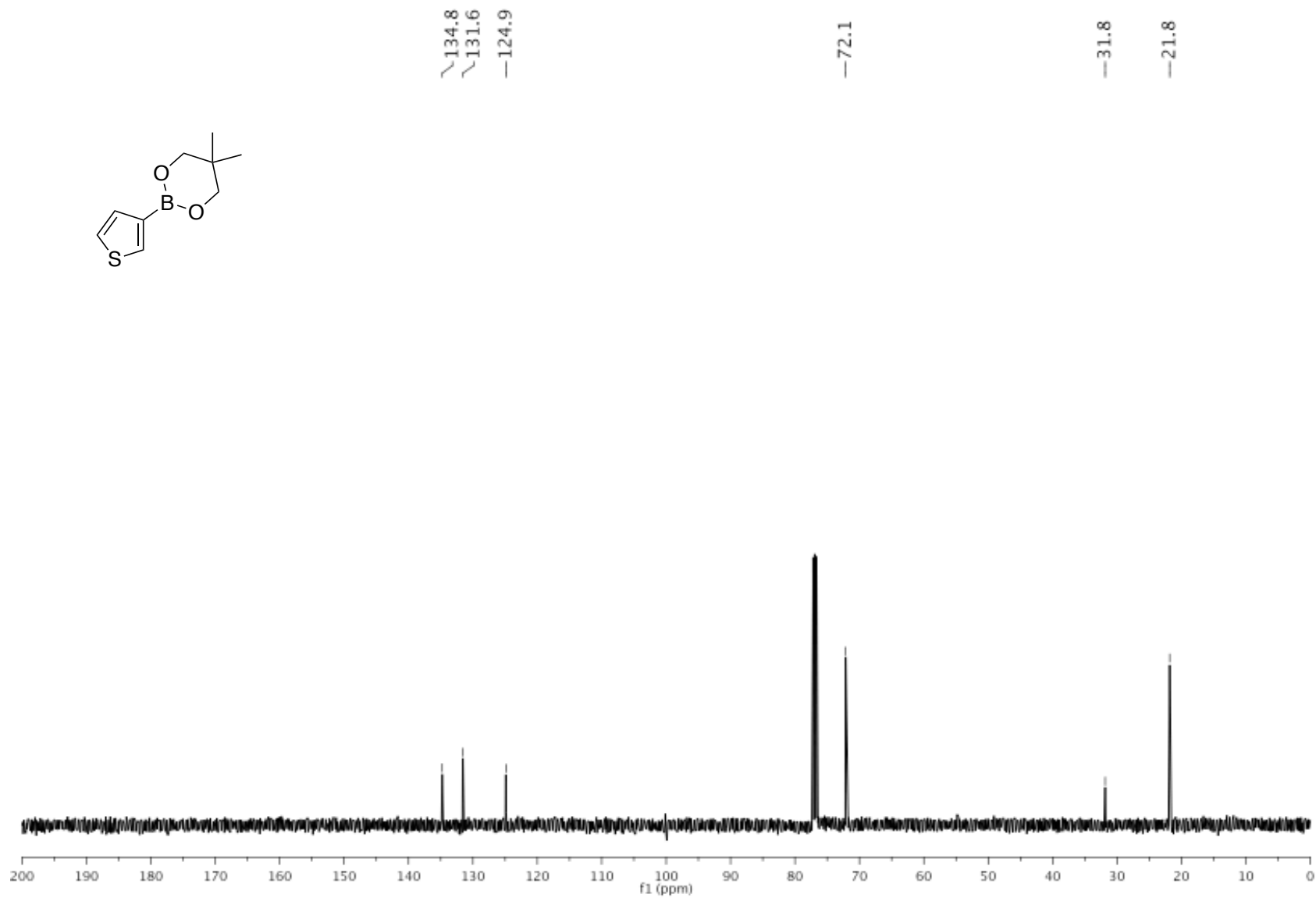
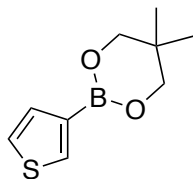
<sup>13</sup>C NMR (128.5 MHz, acetone -d<sub>6</sub>) Spectrum of 4,4,5,5-Tetramethyl-2-(thien-3-yl)-1,3,2-dioxaborolane (4b, Table 4, entry 2)



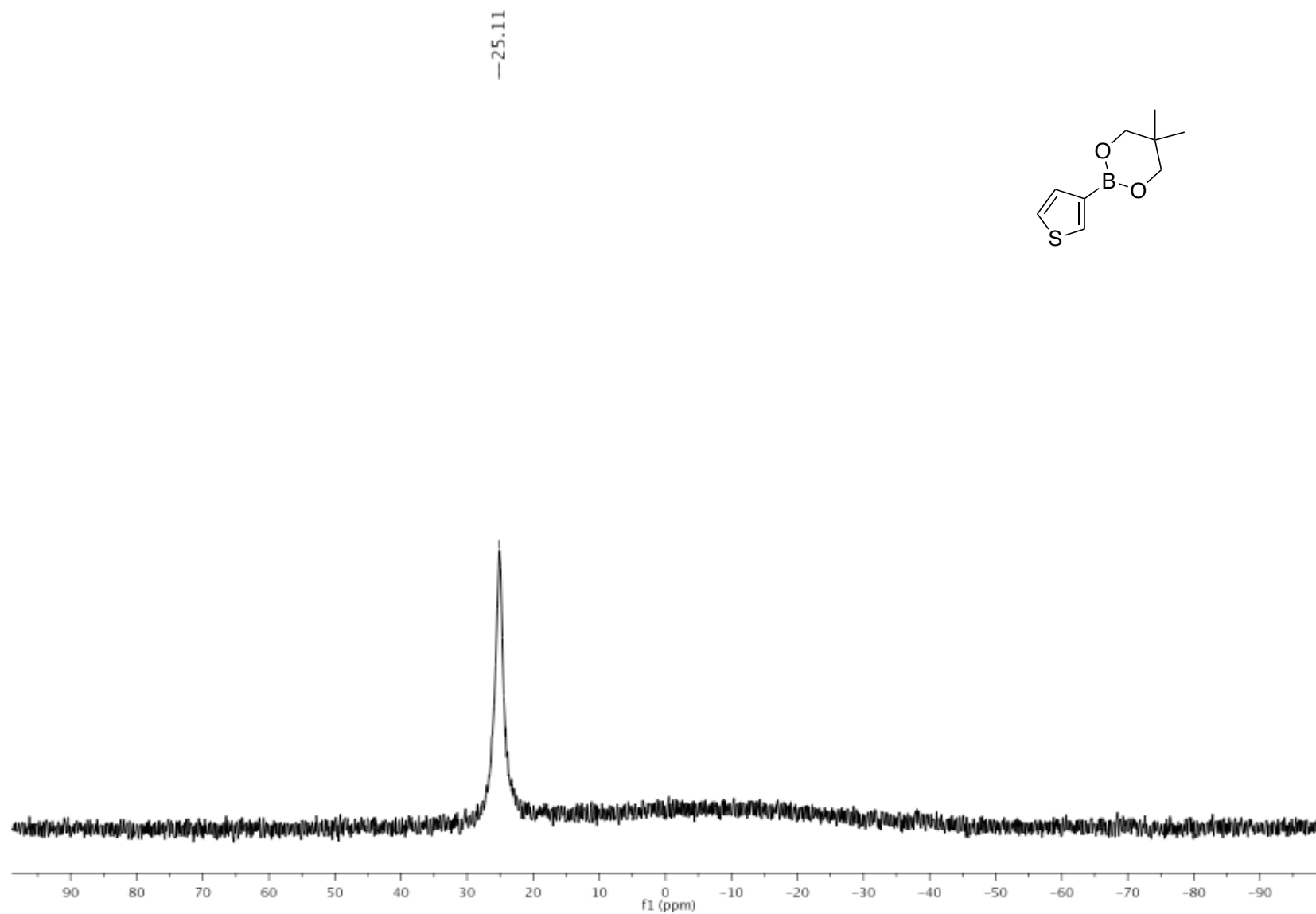
$^{11}\text{B}$  NMR (128.4 MHz, acetone- $\text{d}_6$ ) Spectrum of 4,4,5,5-Tetramethyl-2-(thien-3-yl)-1,3,2-dioxaborolane (4b, Table 4, entry 2)



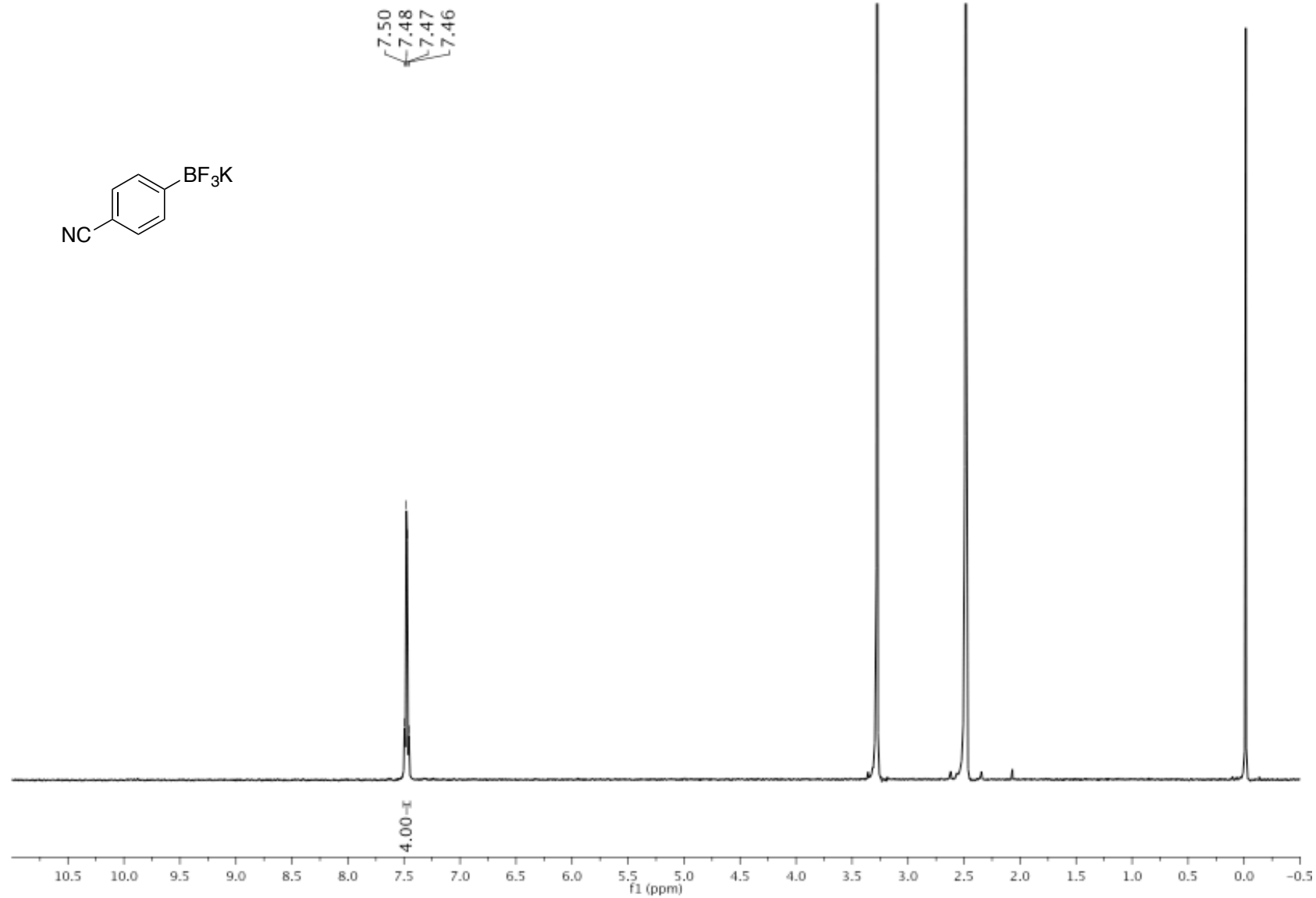
<sup>1</sup>H NMR (500 MHz, acetone -d<sub>6</sub>) Spectrum of 5,5-Dimethyl-2-(thien-3-yl)-1,3,2-dioxaborinane (4c, Table 4, entry 3)



**<sup>13</sup>C NMR (128.5 MHz, acetone -d<sub>6</sub>) Spectrum of 5,5-Dimethyl-2-(thien-3-yl)-1,3,2-dioxaborinane (4c, Table 4, entry 3)**

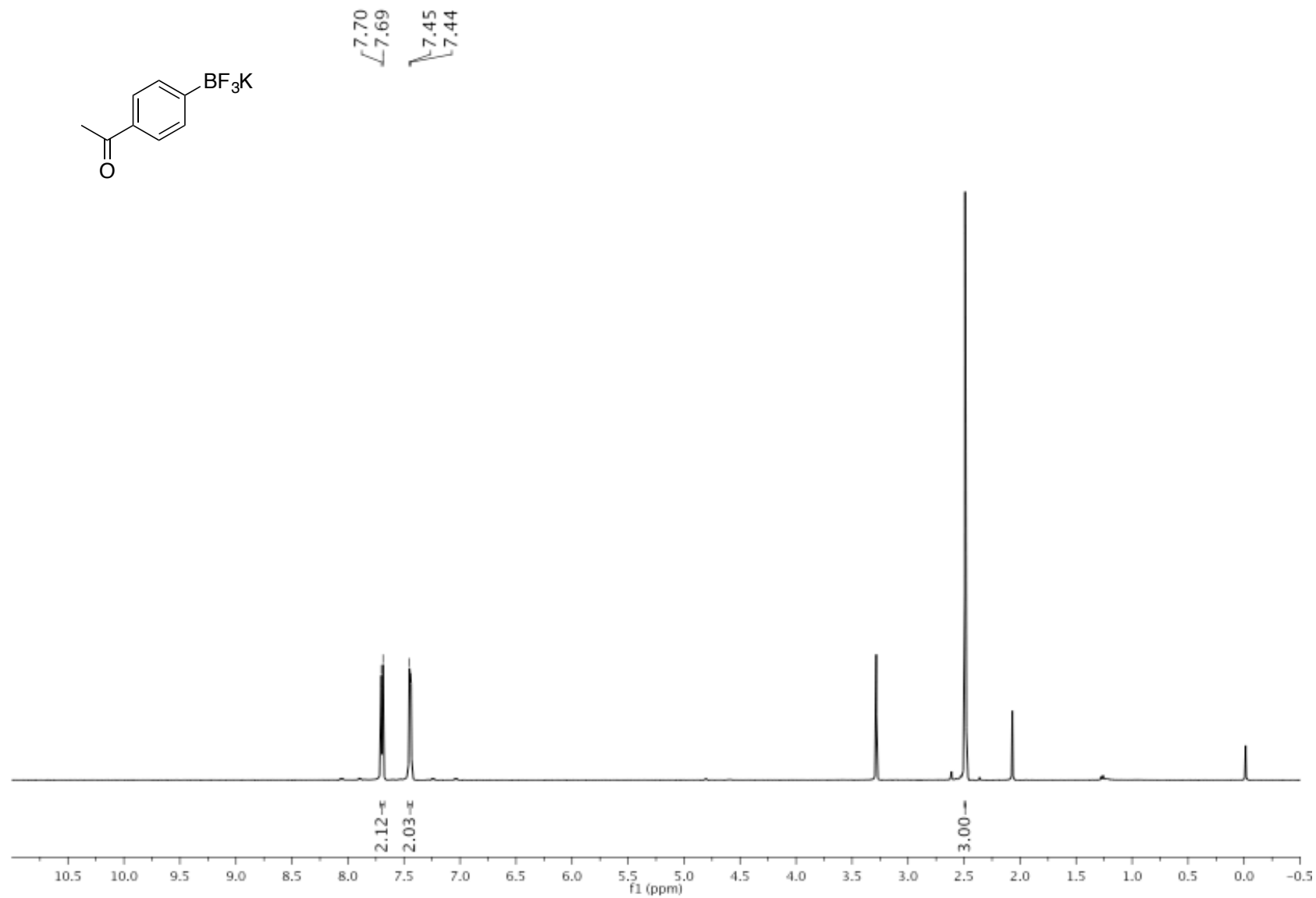


$^{11}\text{B}$  NMR (128.4 MHz, acetone- $\text{d}_6$ ) Spectrum of 5,5-Dimethyl-2-(thien-3-yl)-1,3,2-dioxaborinane (4c, Table 4, entry 3)

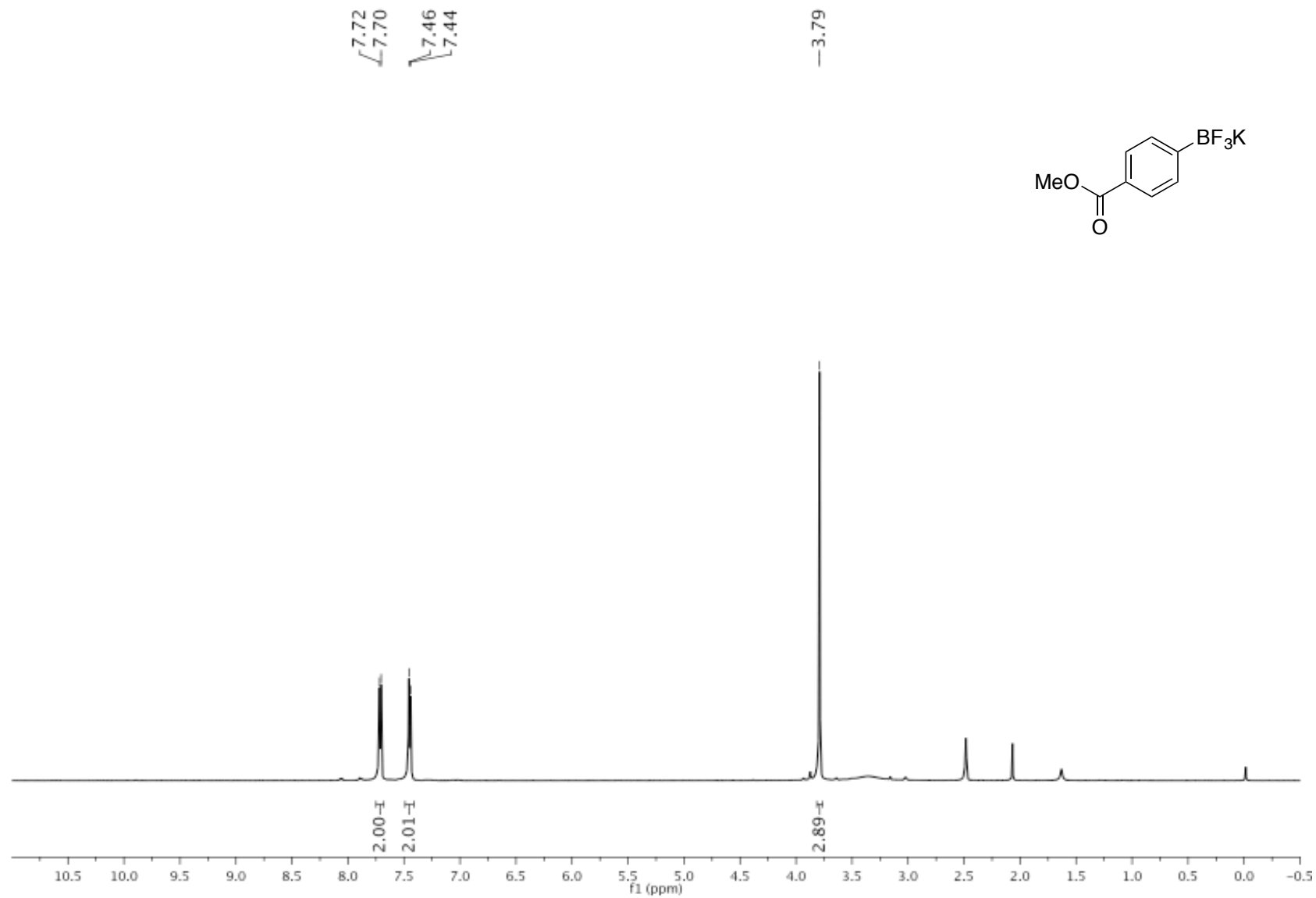


**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Cyanophenyl)trifluoroborate (2a, Table 5, entry 1)**

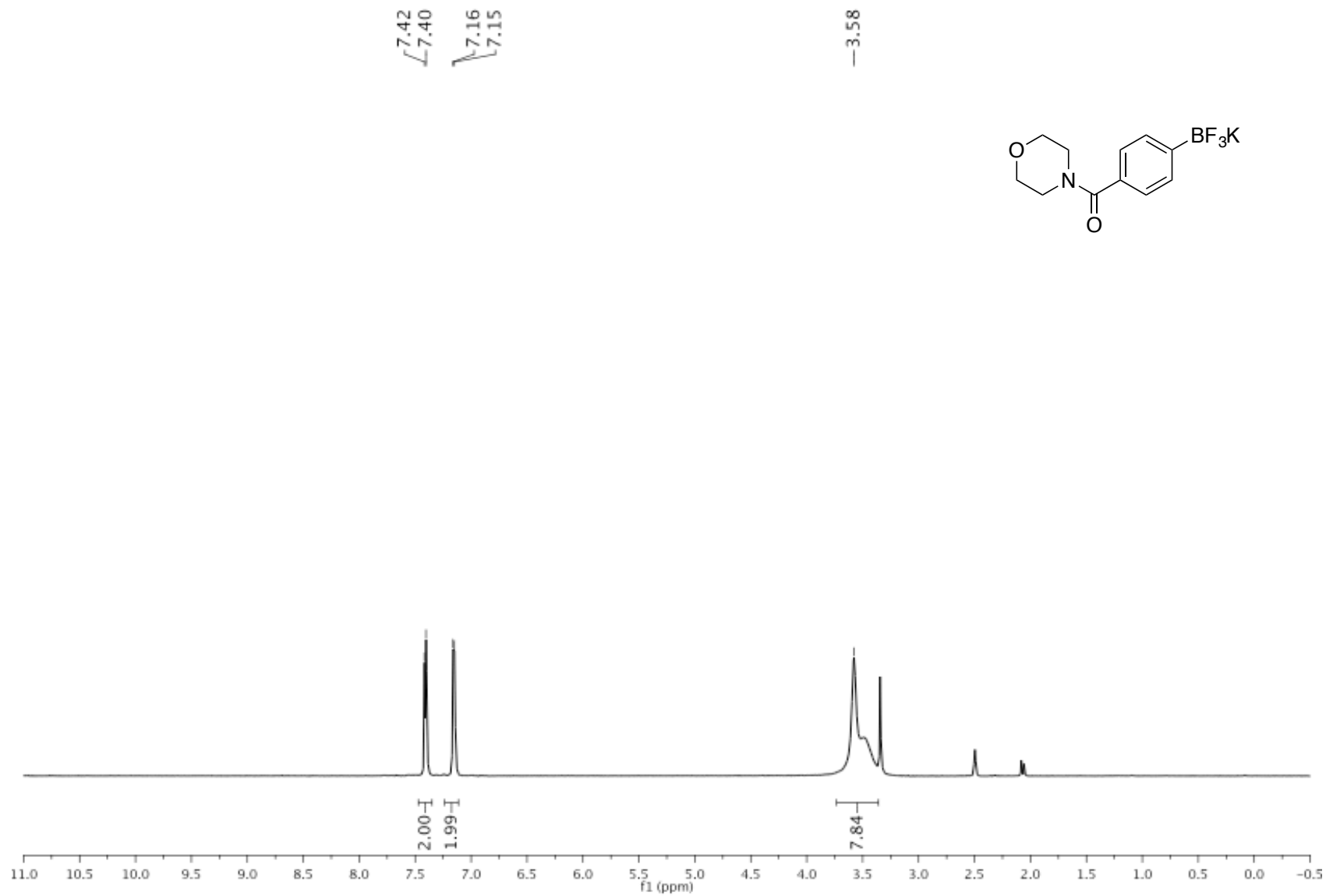




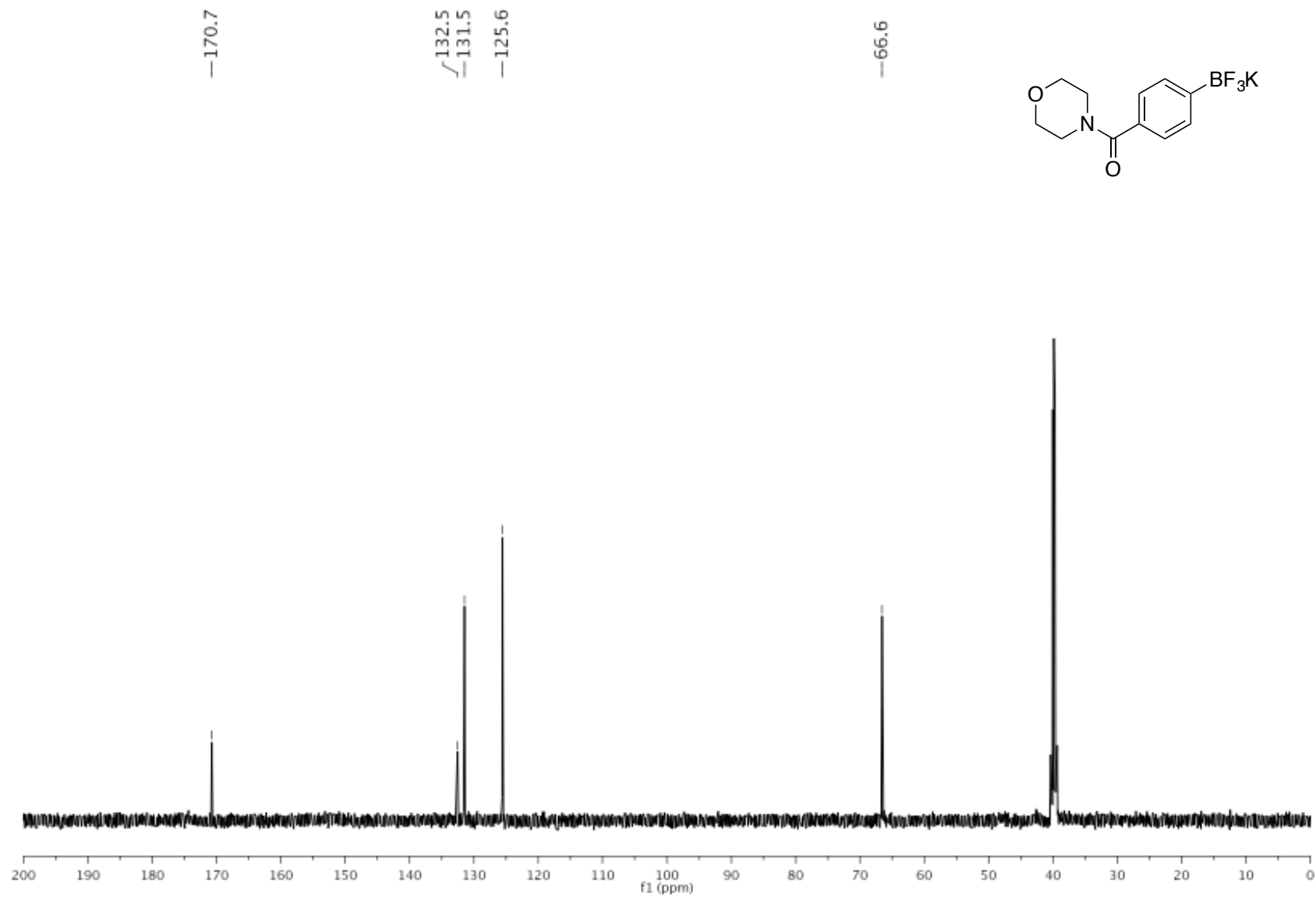
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Acetylphenyl)trifluoroborate (2c, Table 5, entry 2)**



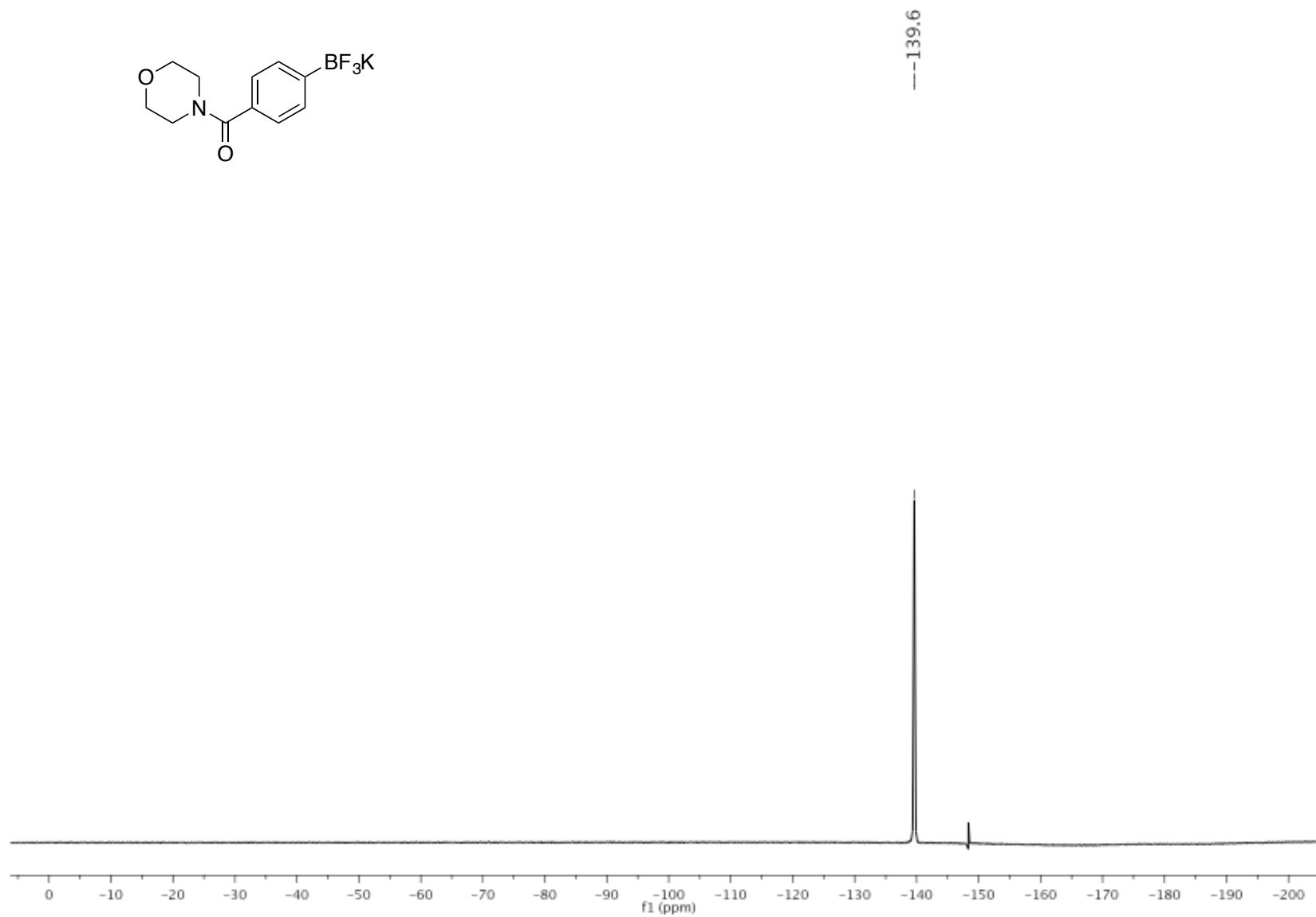
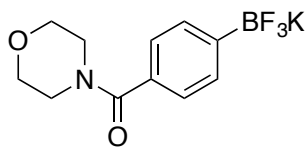
$^1\text{H}$  NMR (500 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(4-(methoxycarbonyl)phenyl)borate (2e, Table 5, entry 3)



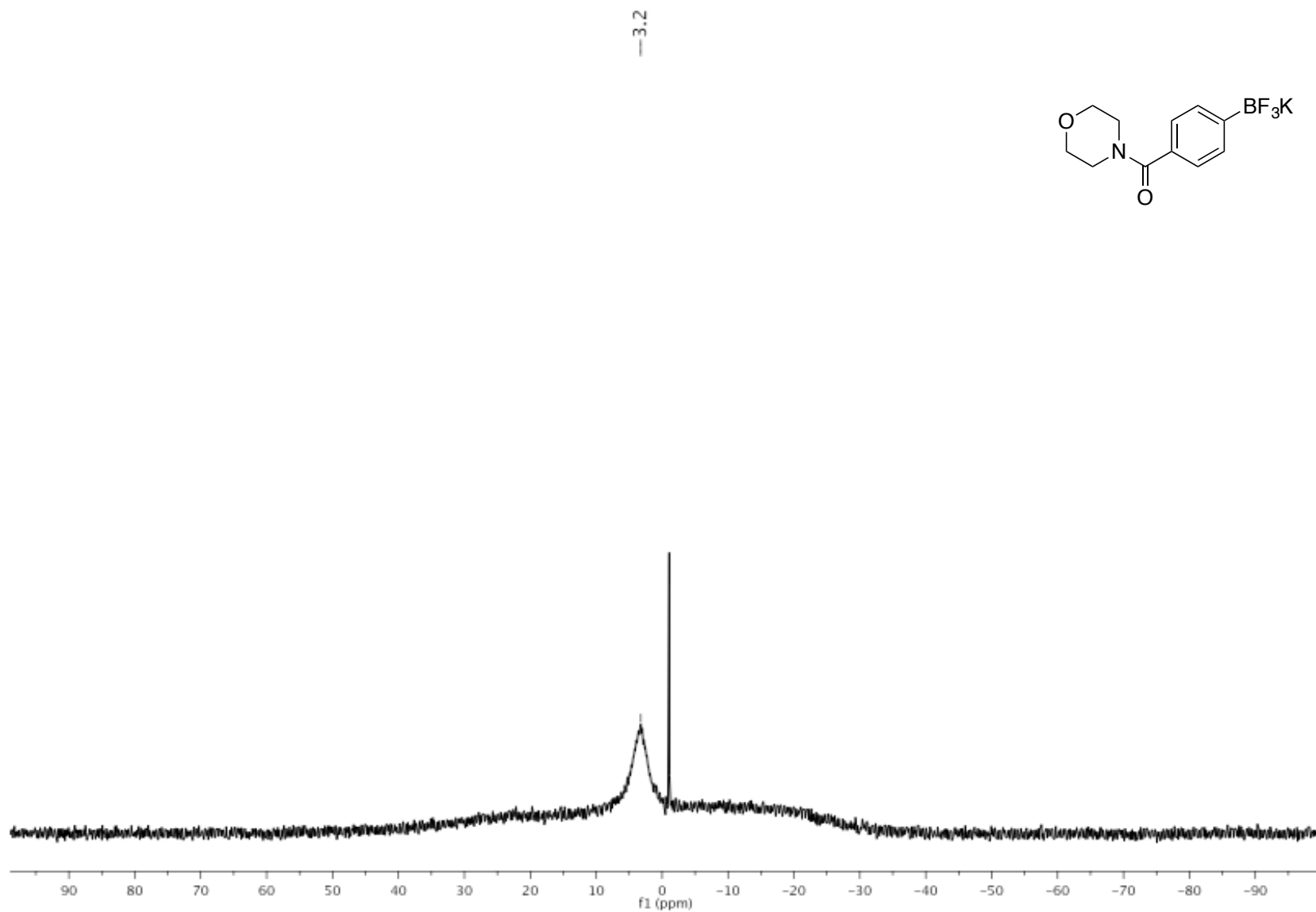
**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(morpholine-4-carbonyl)phenyl)borate (5a, Table 5, entry 4)**



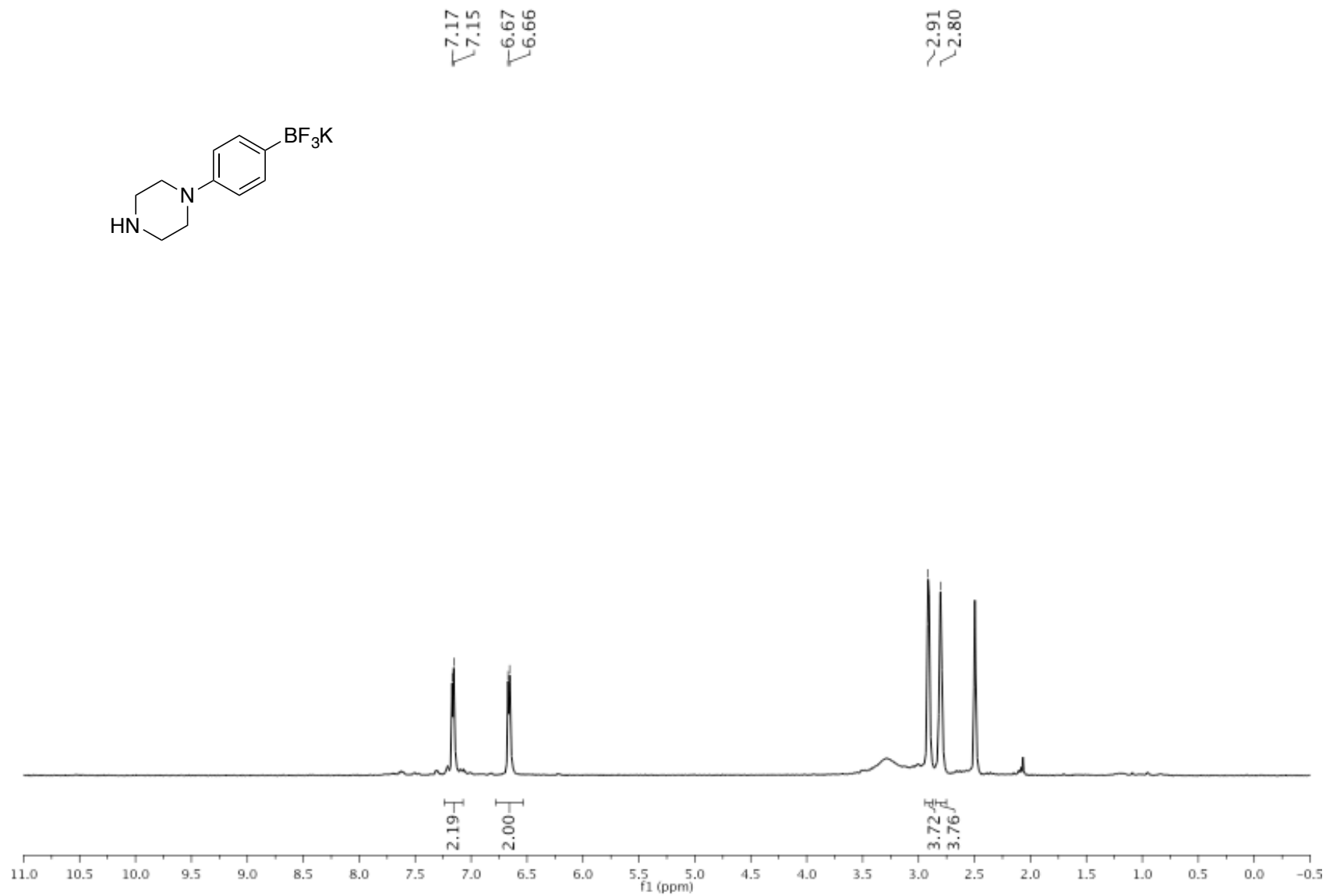
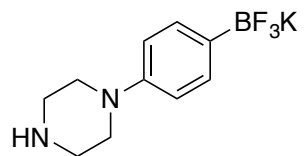
<sup>13</sup>C NMR (128.5 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(morpholine-4-carbonyl)phenyl)borate (5a, Table 5, entry 4)



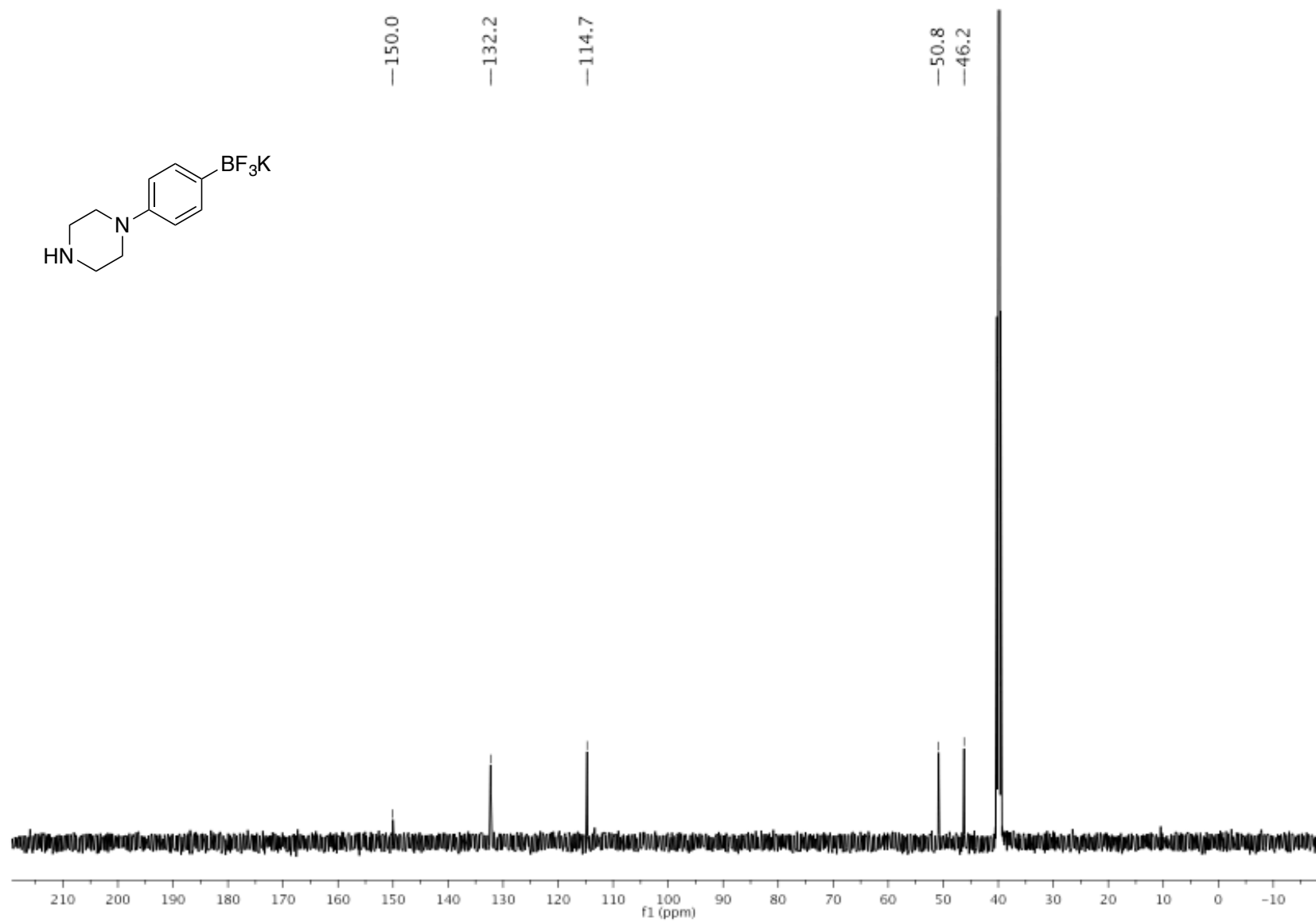
<sup>19</sup>F NMR (470.8 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(morpholine-4-carbonyl)phenyl)borate (5a, Table 5, entry 4)



$^{11}\text{B}$  NMR (128.4 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium Trifluoro(4-(morpholine-4-carbonyl)phenyl)borate (5a, Table 5, entry 4)

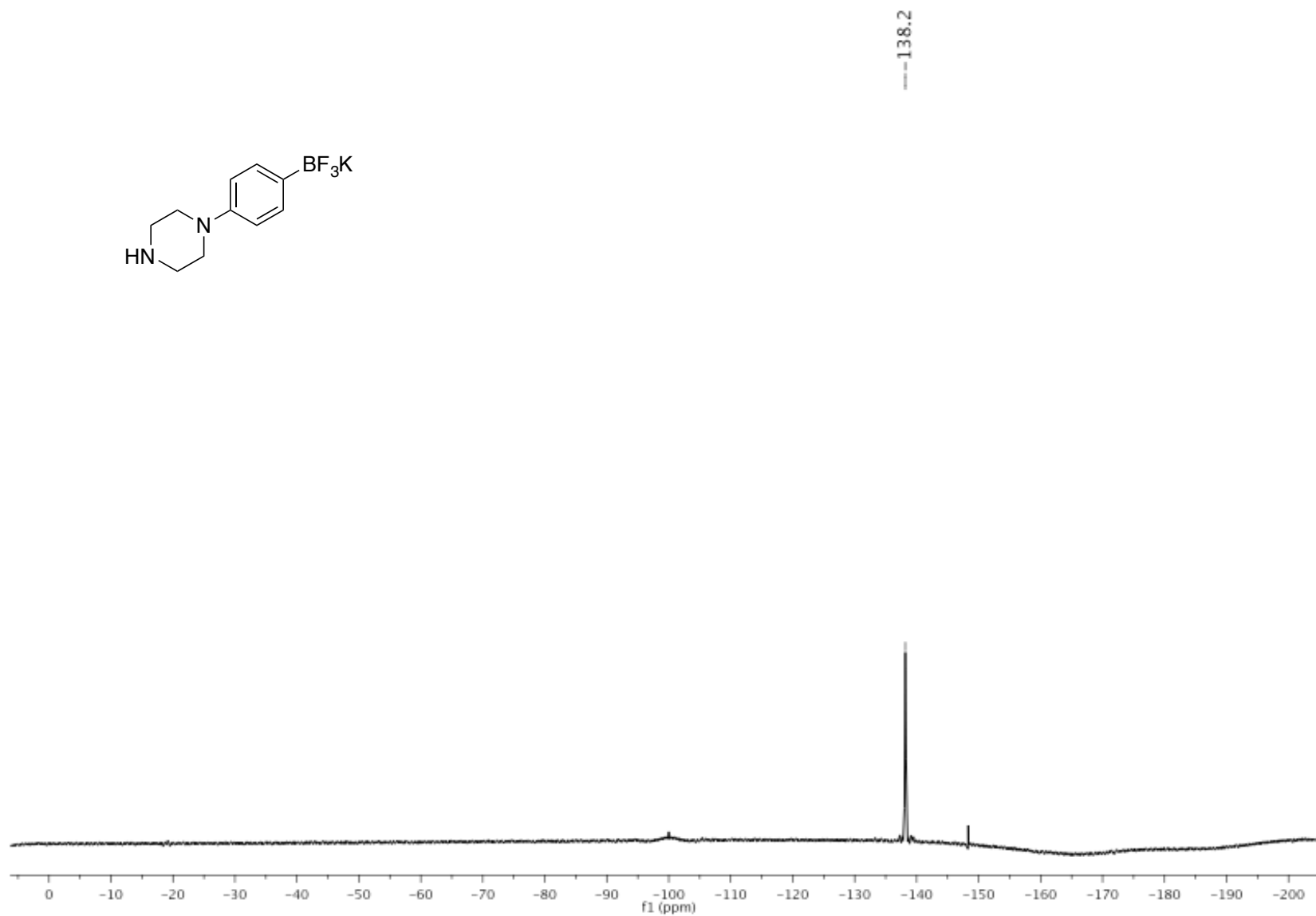
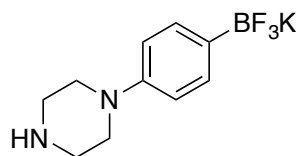


<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(piperazin-1-yl)phenyl)borate (5b, Table 5, entry 5)

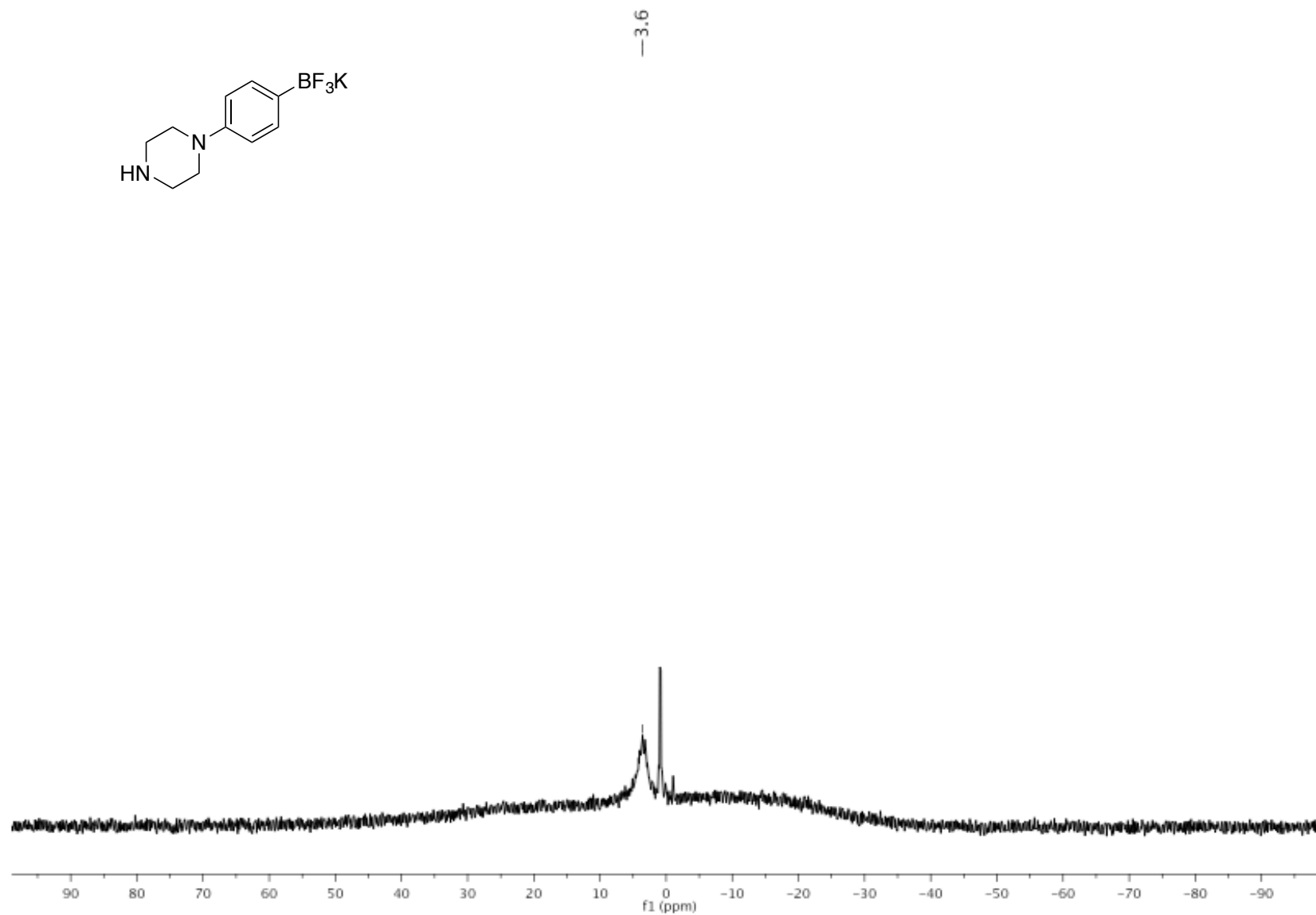


$^{13}\text{C}$  NMR (128.5 MHz, DMSO - $d_6$ ) Spectrum of Potassium Trifluoro(4-(piperazin-1-yl)phenyl)borate (5b, Table 5, entry 5)

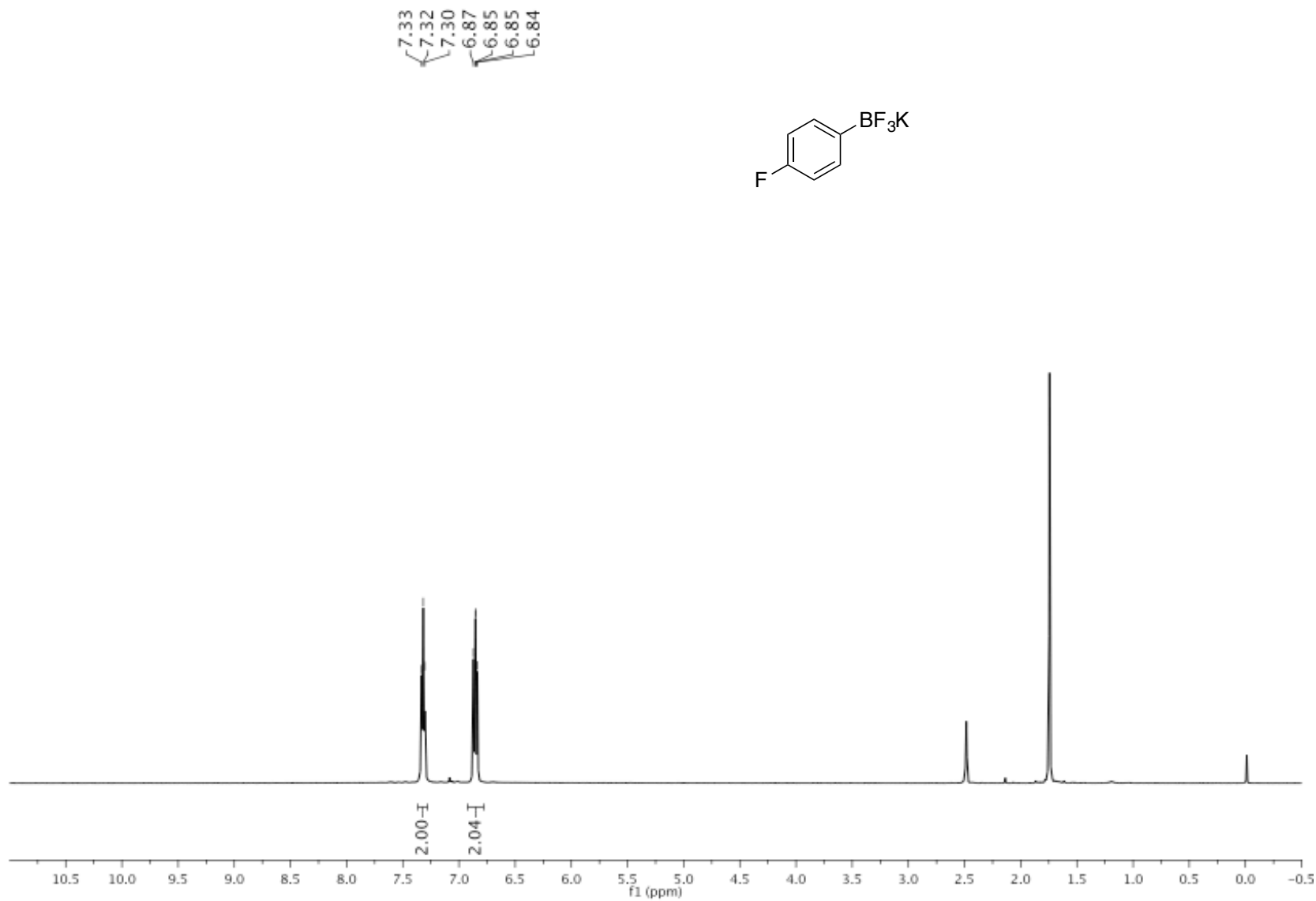




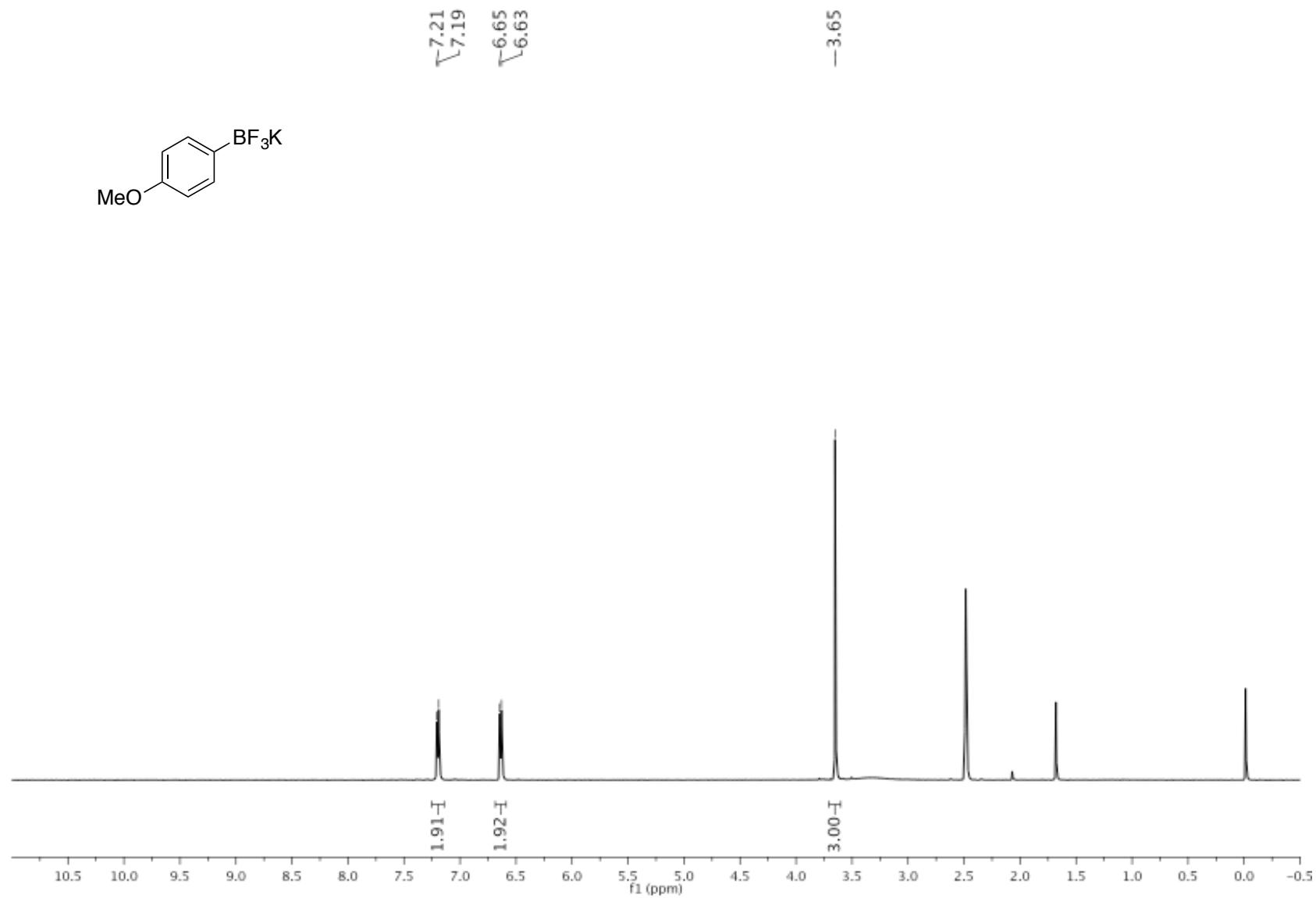
**<sup>19</sup>F NMR (470.8 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(piperazin-1-yl)phenyl)borate (5b, Table 5, entry 5)**



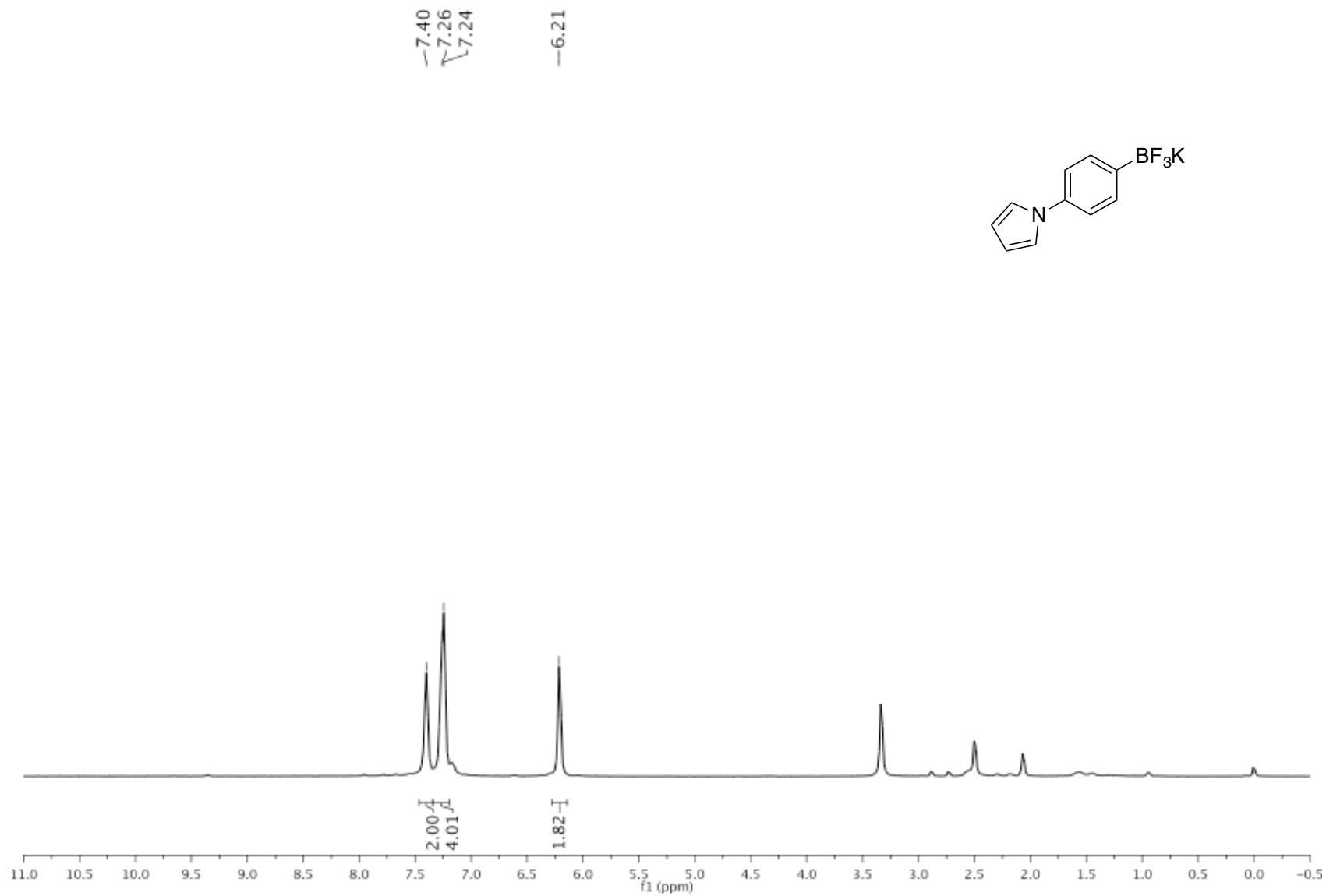
$^{11}\text{B}$  NMR (128.4 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-(piperazin-1-yl)phenyl)borate (5b, Table 5, entry 5)



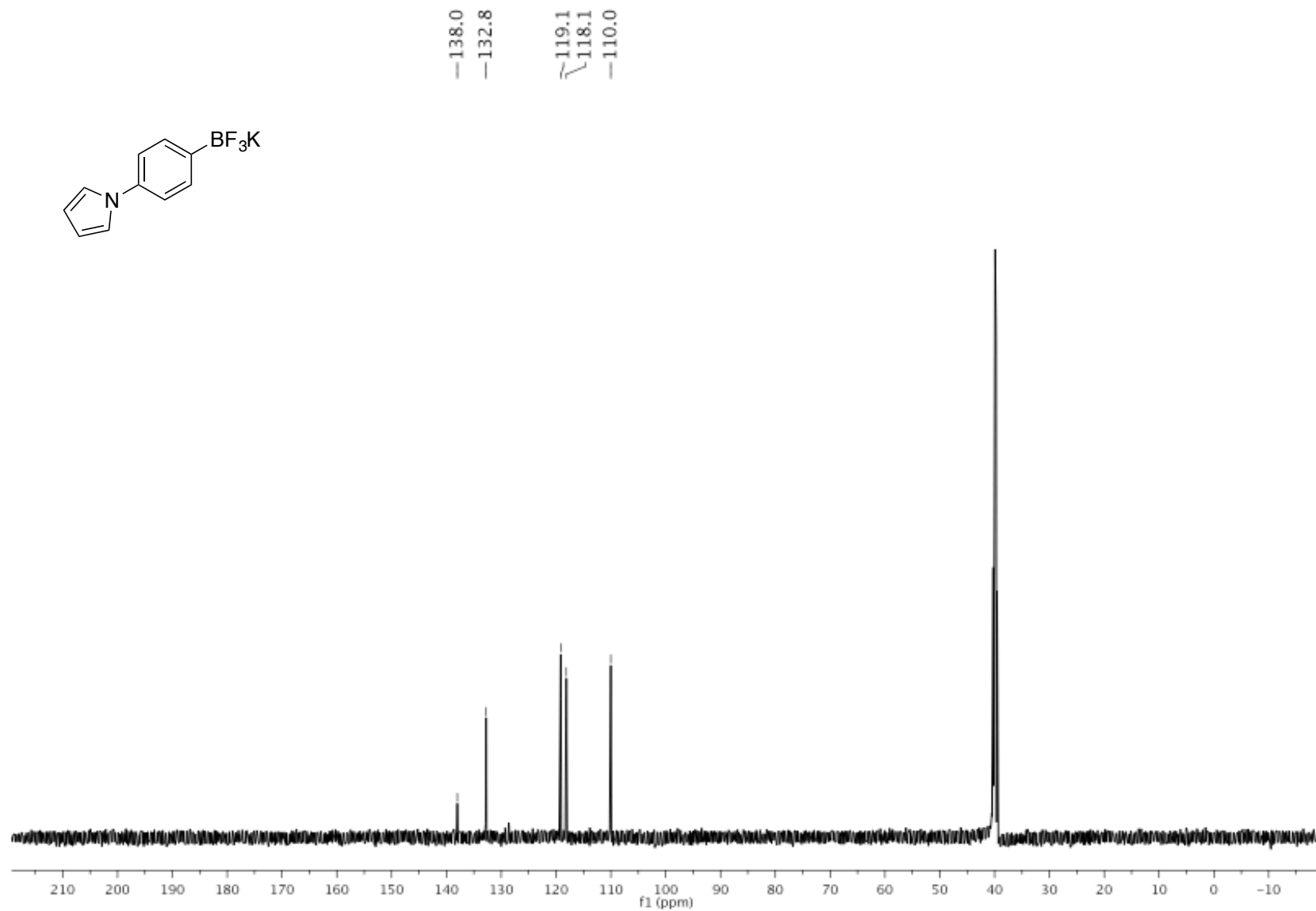
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-fluorophenyl)borate (2i, Table 5, entry 6)**



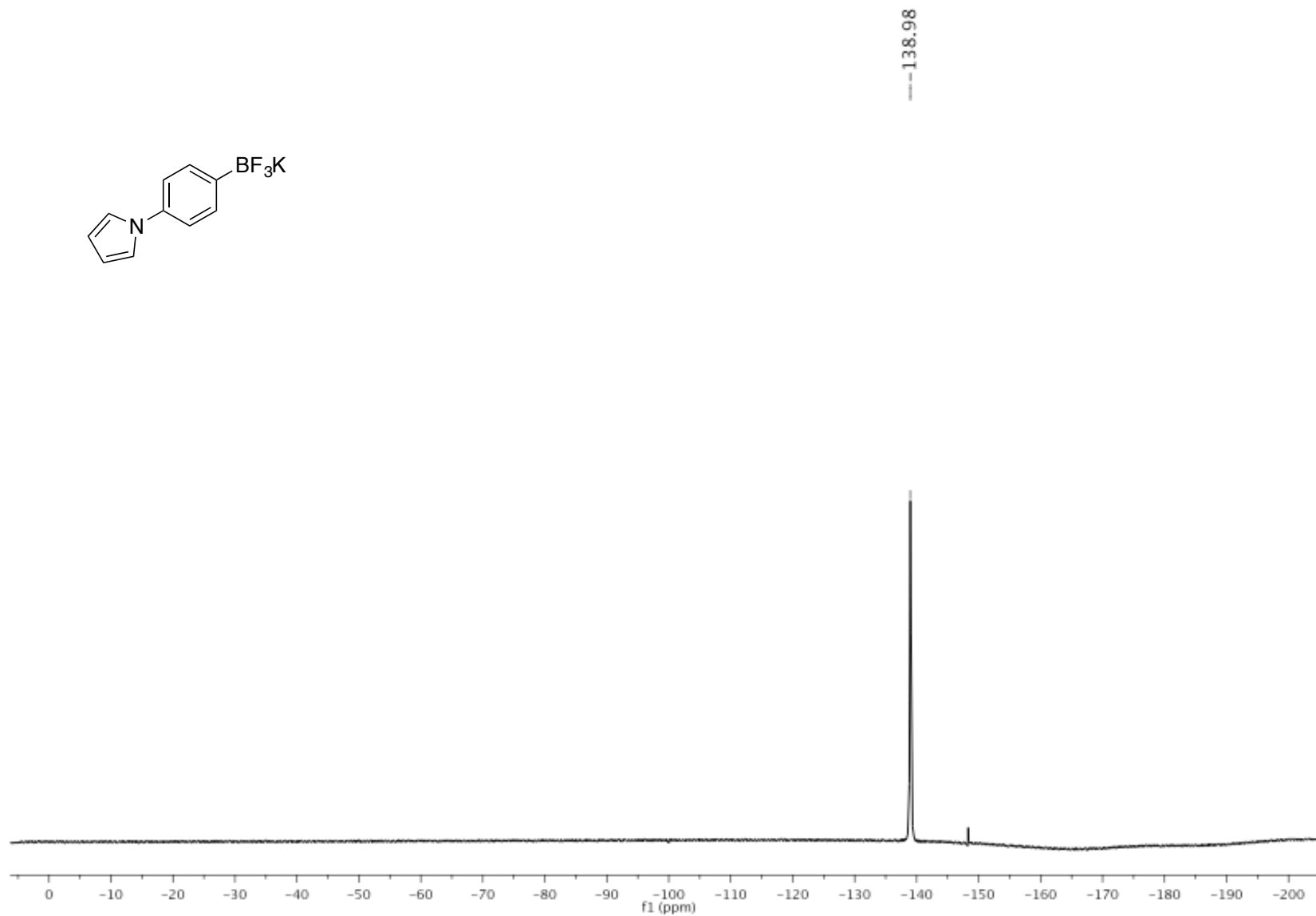
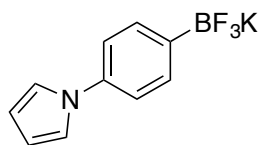
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-methoxyphenyl)borate (1a, Table 5, entry 7)**



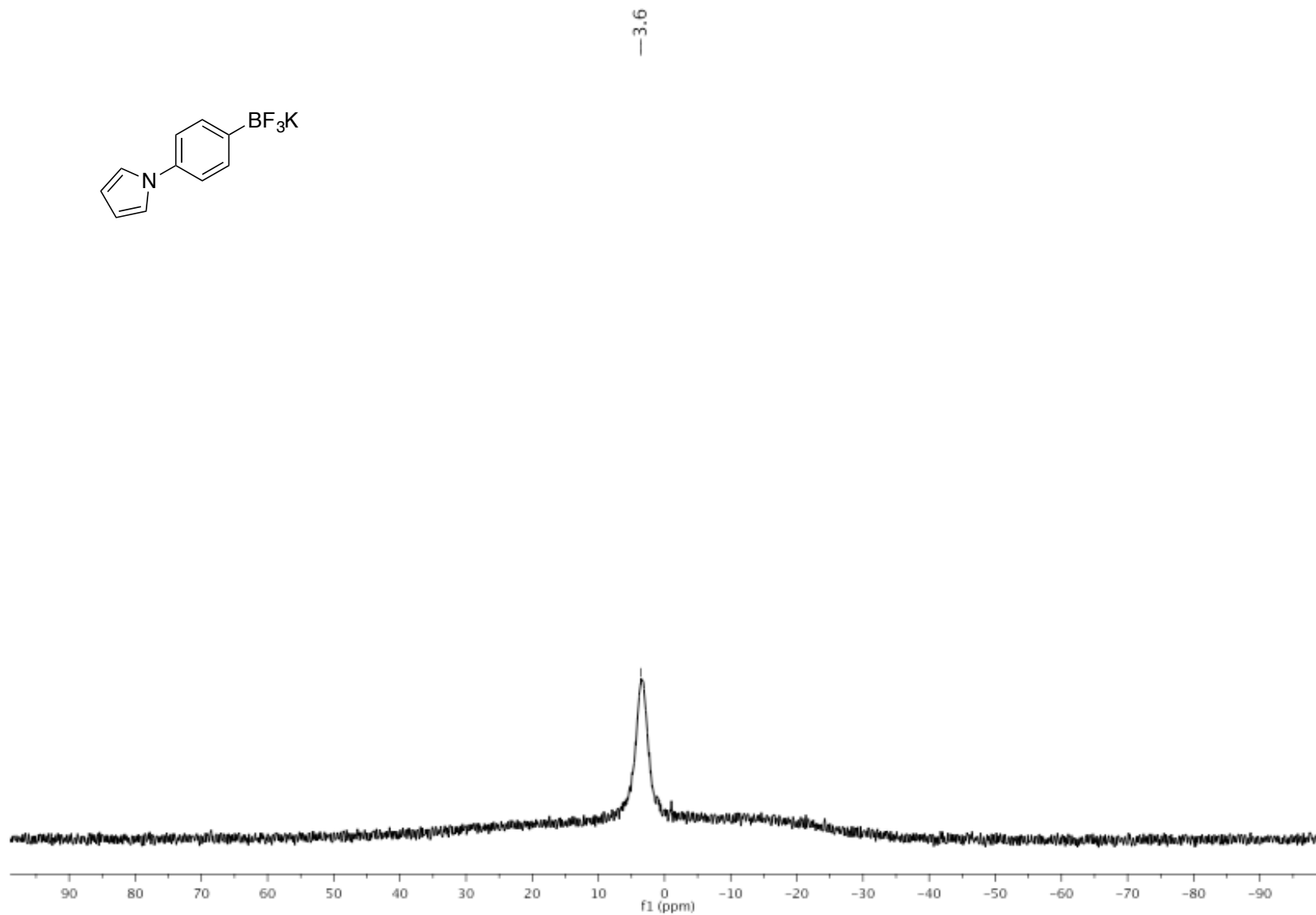
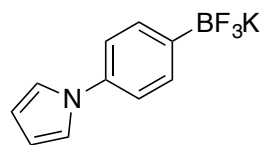
**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium (4-(1H-Pyrrol-1-yl)phenyl)trifluoroborate (5c, Table 5, entry 8)**



$^{13}\text{C}$  NMR (128.5 MHz, DMSO- $d_6$ ) Spectrum of Potassium (4-(1H-Pyrrol-1-yl)phenyl)trifluoroborate (5c, Table 5, entry 8)

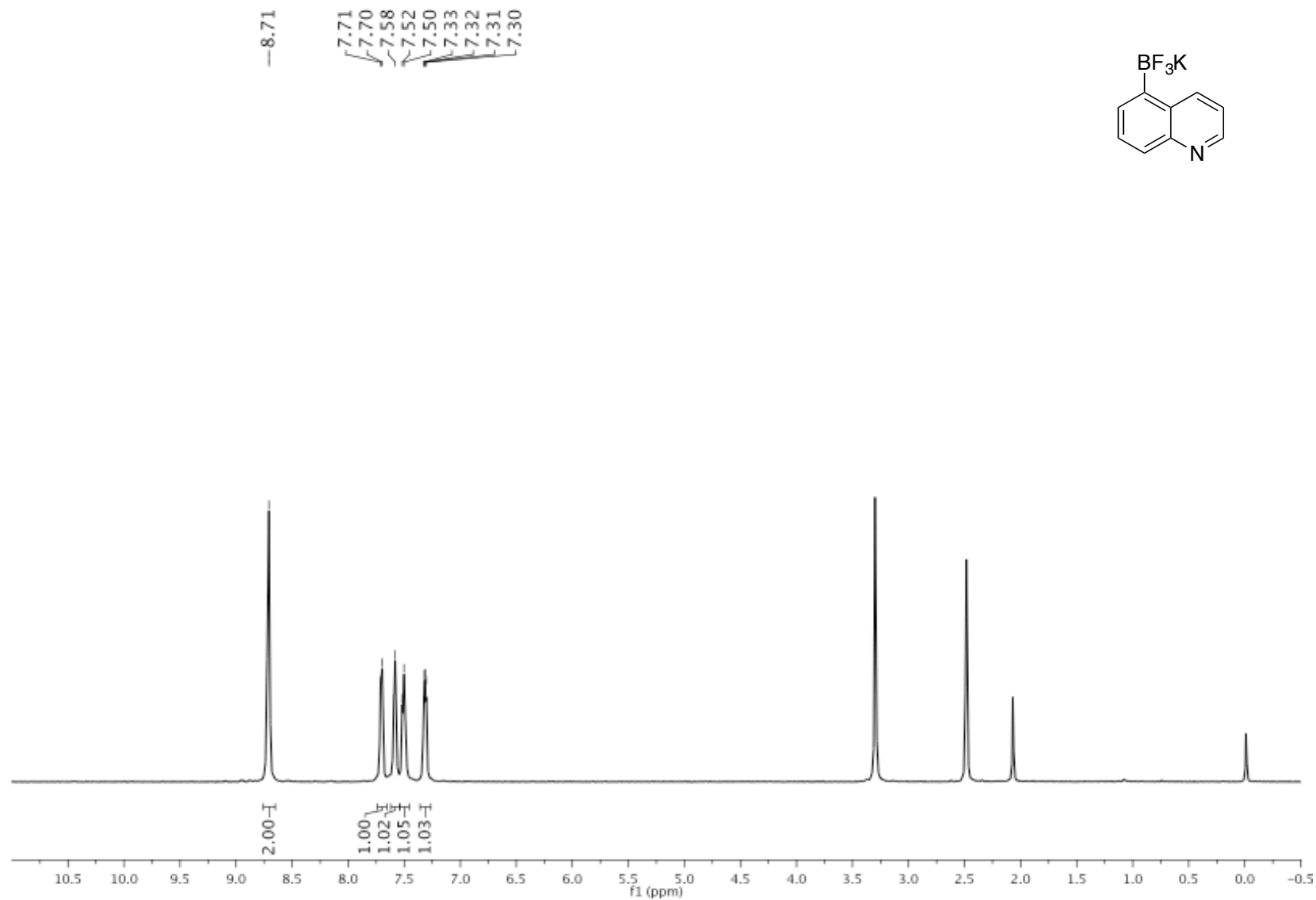


**<sup>19</sup>F NMR (470.8 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium (4-(1H-Pyrrol-1-yl)phenyl)trifluoroborate (5c, Table 5, entry 8)**

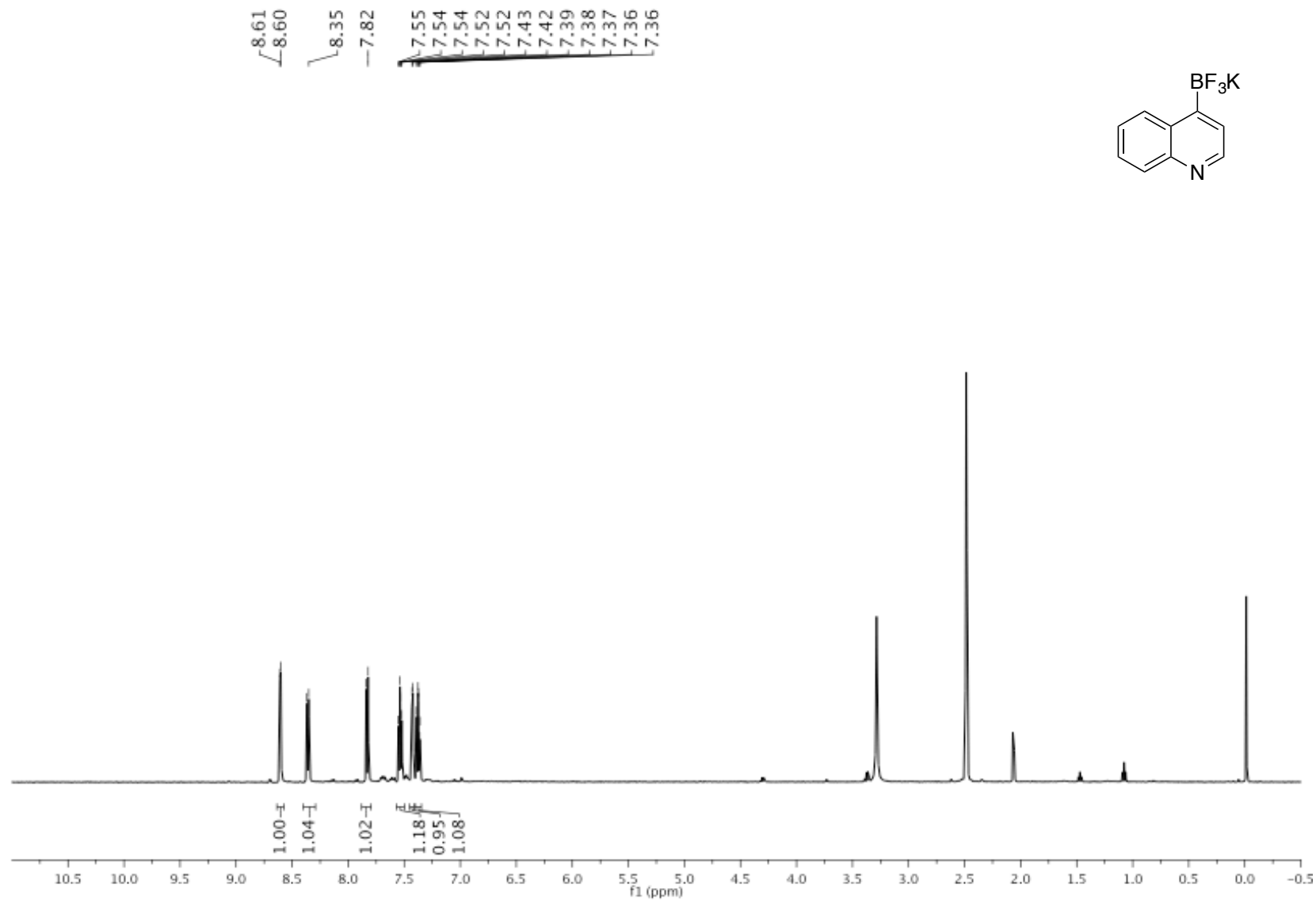


**<sup>11</sup>B NMR (128.4 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-(1H-Pyrrol-1-yl)phenyl)trifluoroborate (5c, Table 5, entry 8)**

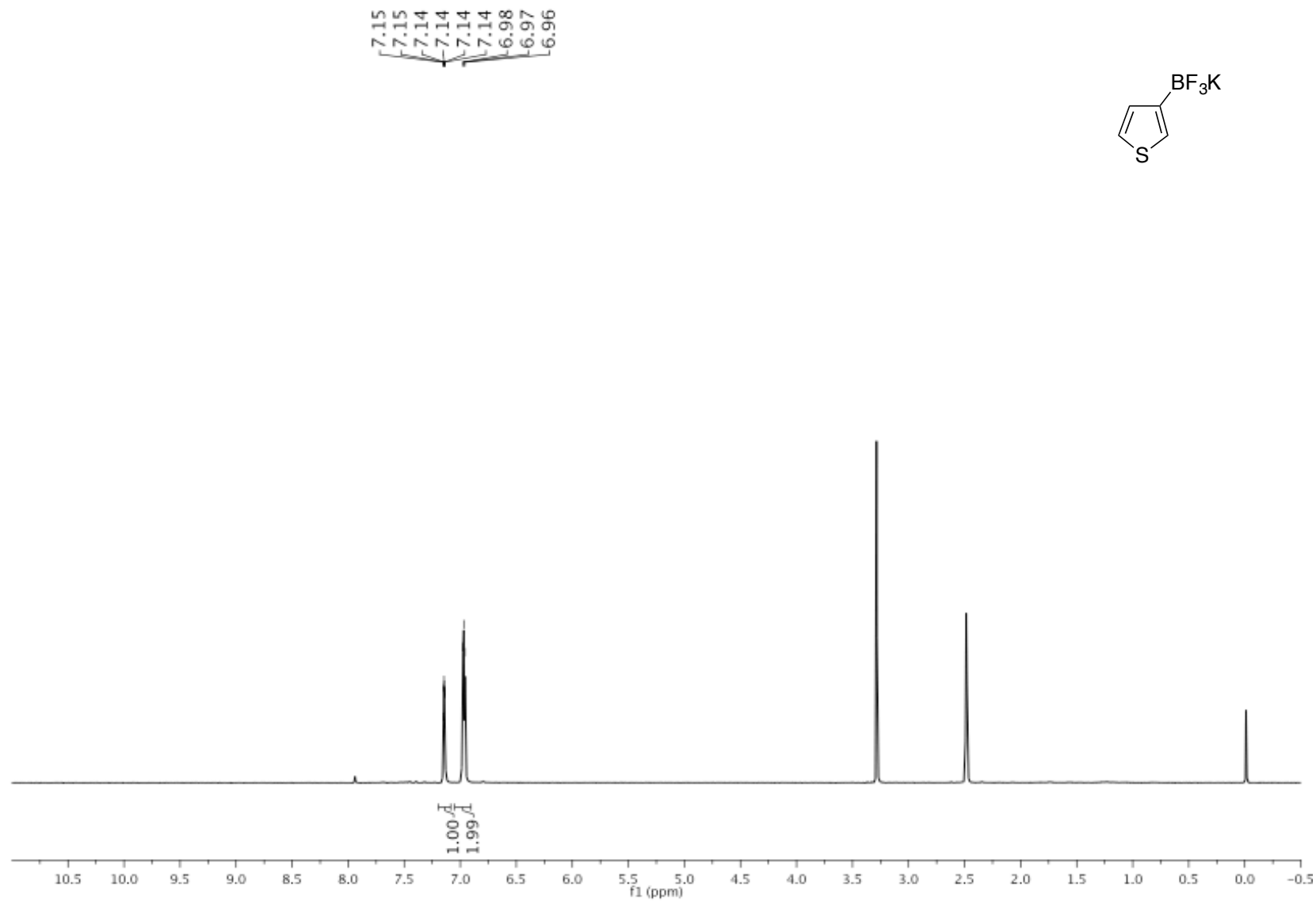




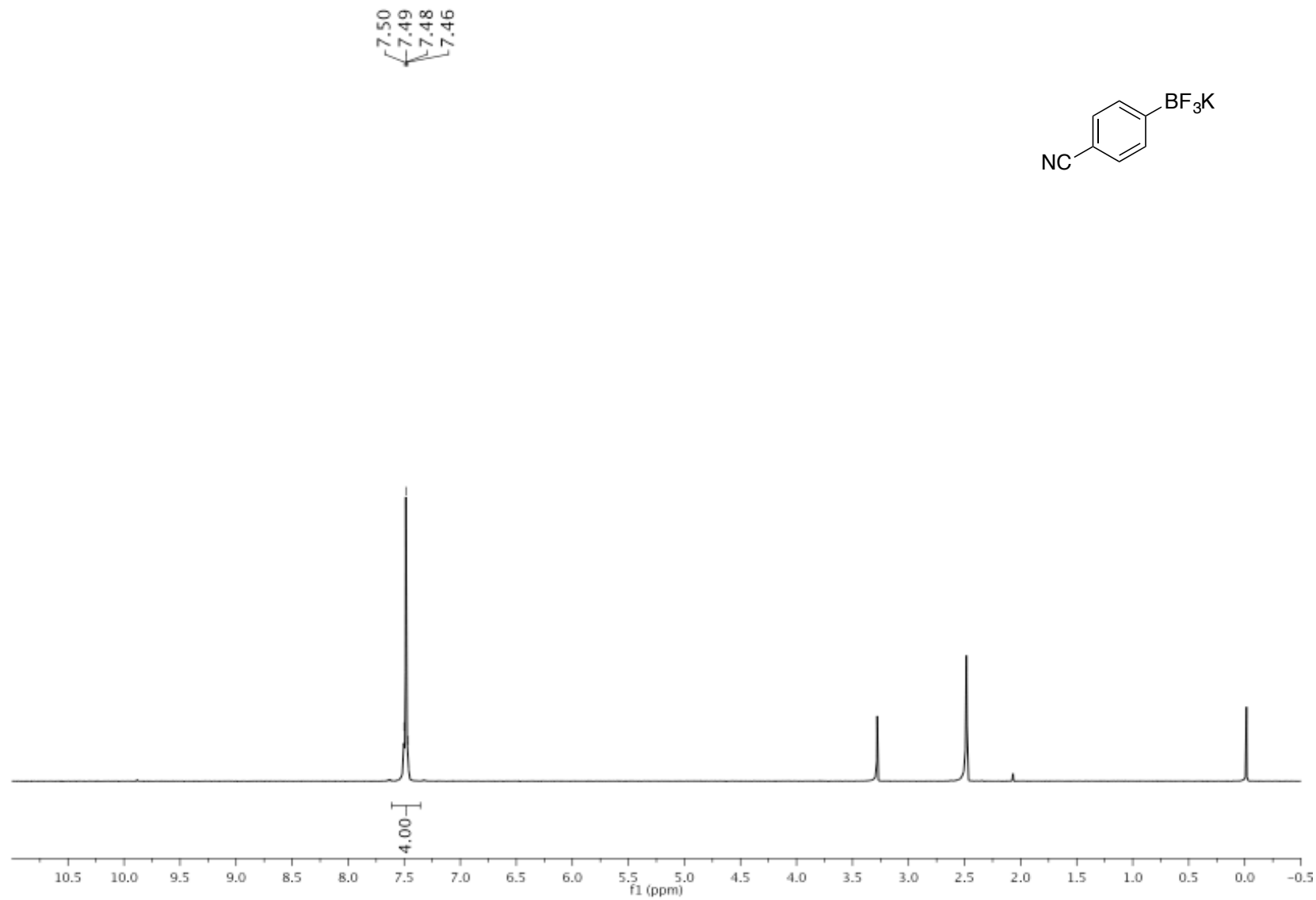
**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(quinolin-5-yl)borate (3j, Table 5, entry 9)**



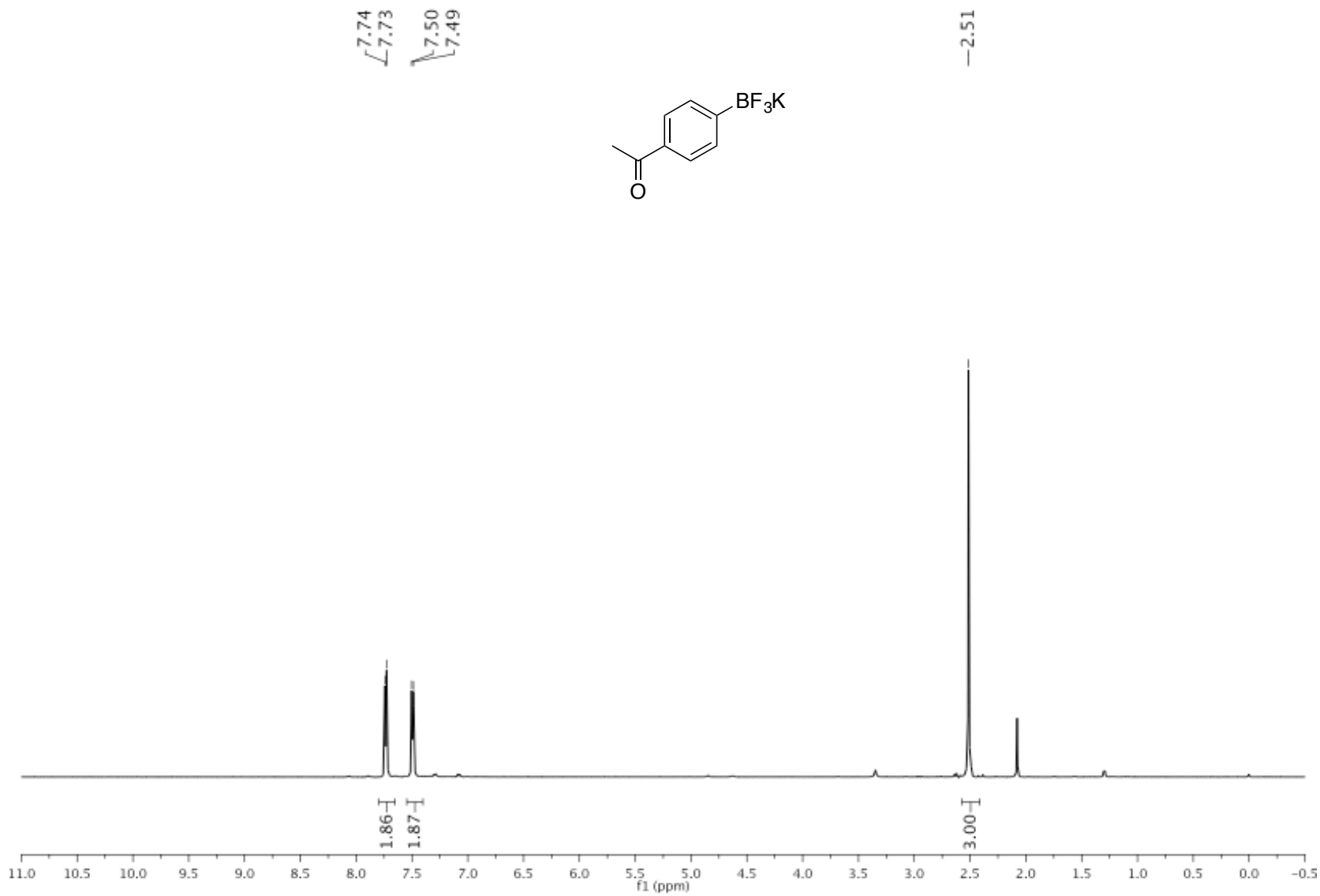
**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(quinolin-4-yl)borate (3i, Table 5, entry 10)**



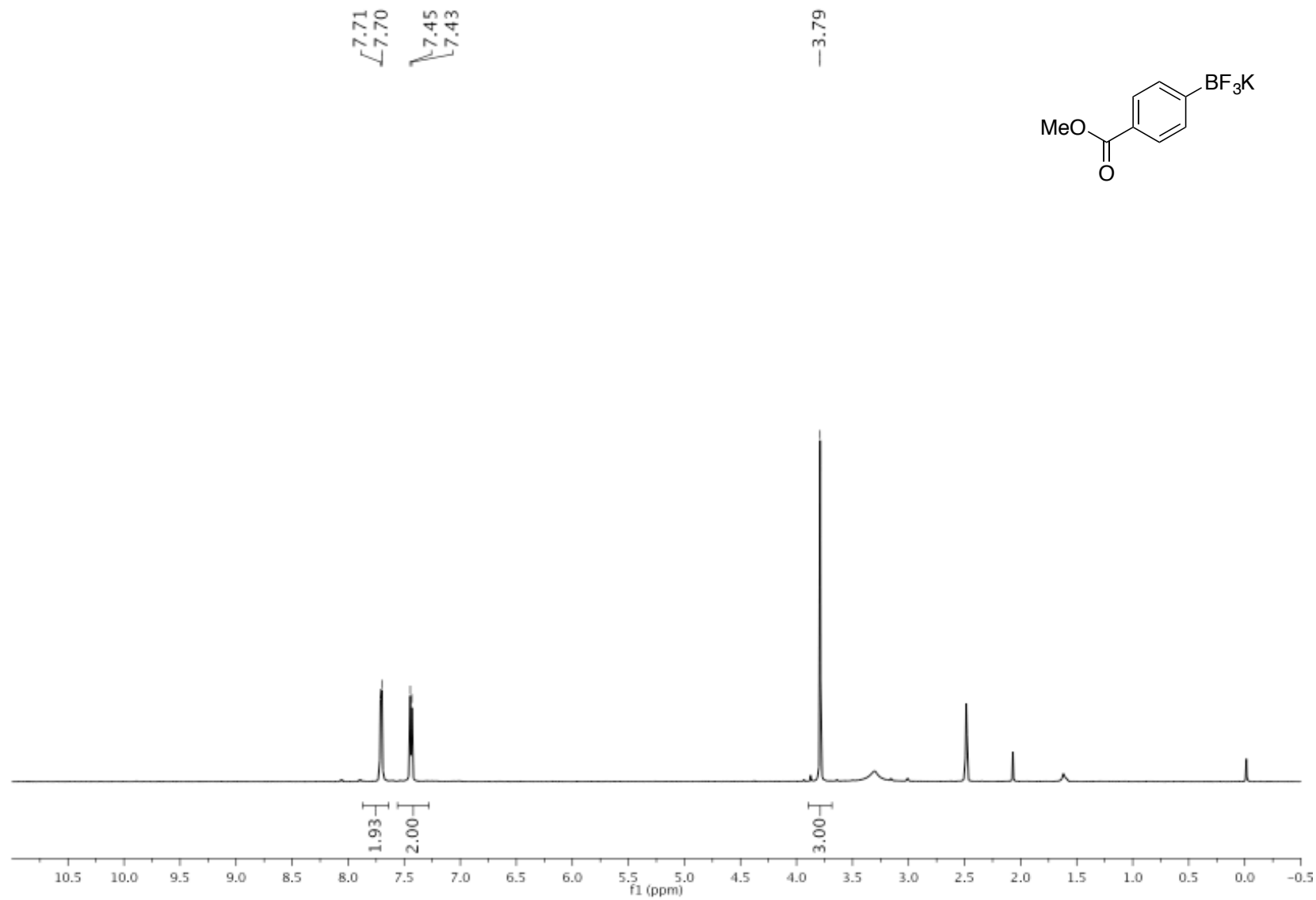
**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(thien-3-yl)borate (3a, Table 5, entry 11)**



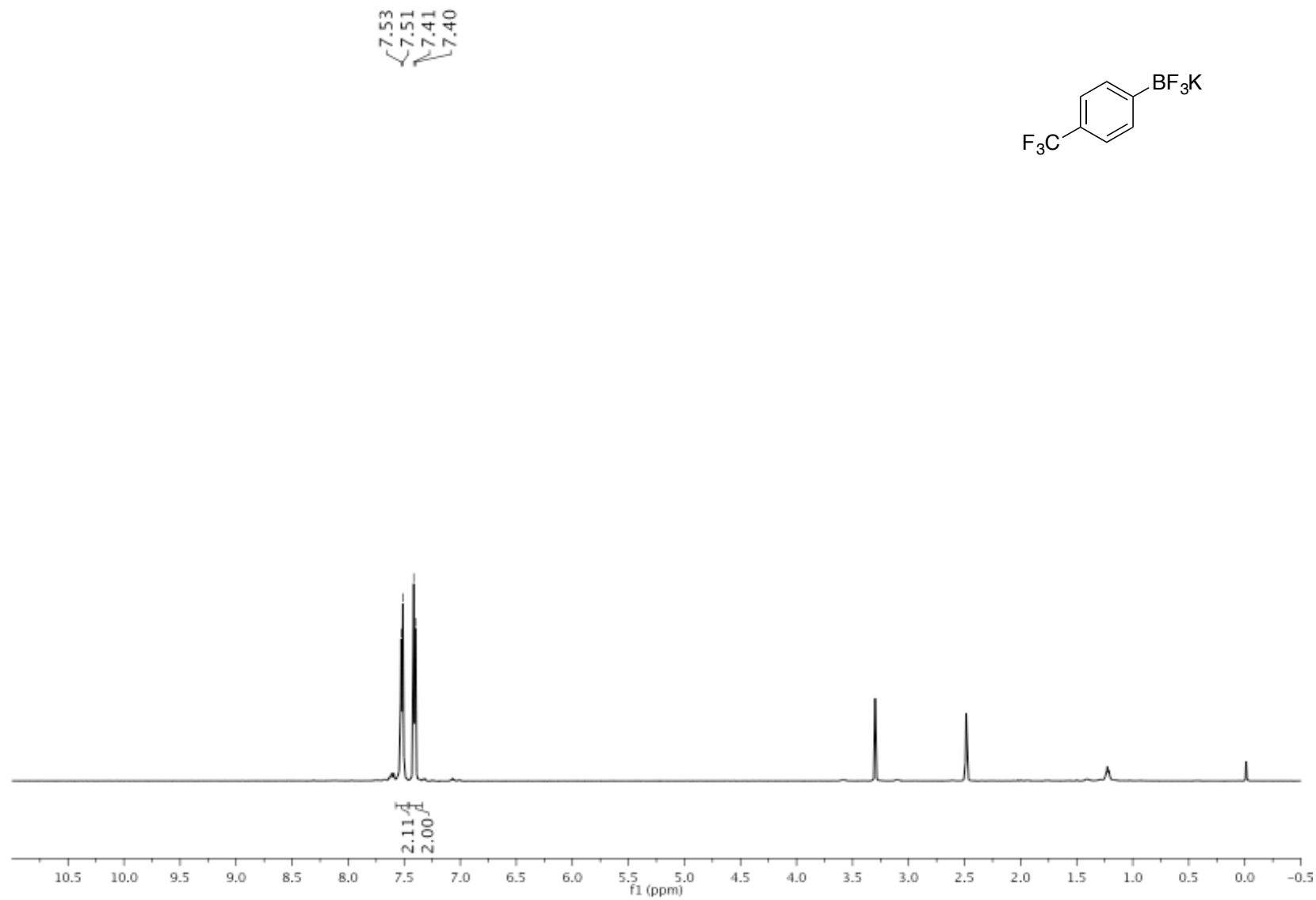
$^1\text{H}$  NMR (500 MHz,  $\text{DMSO-d}_6$ ) Spectrum of Potassium (4-Cyanophenyl)trifluoroborate (2a, Table 7, entry 1)



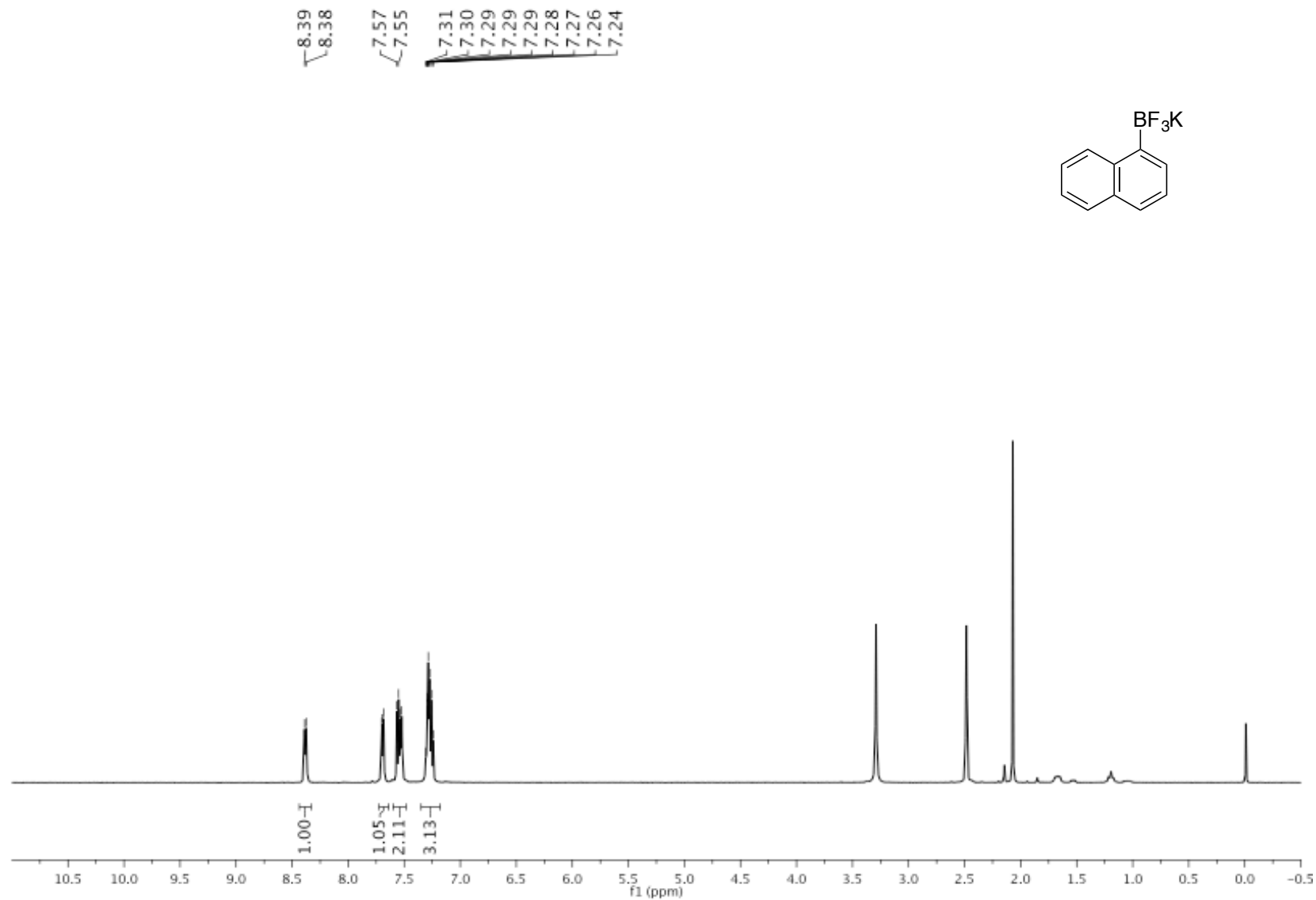
<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium (4-Acetylphenyl)trifluoroborate (2c, Table 7, entry 2)



**<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(4-(methoxycarbonyl)phenyl)borate (2e, Table 7, entry 3)**

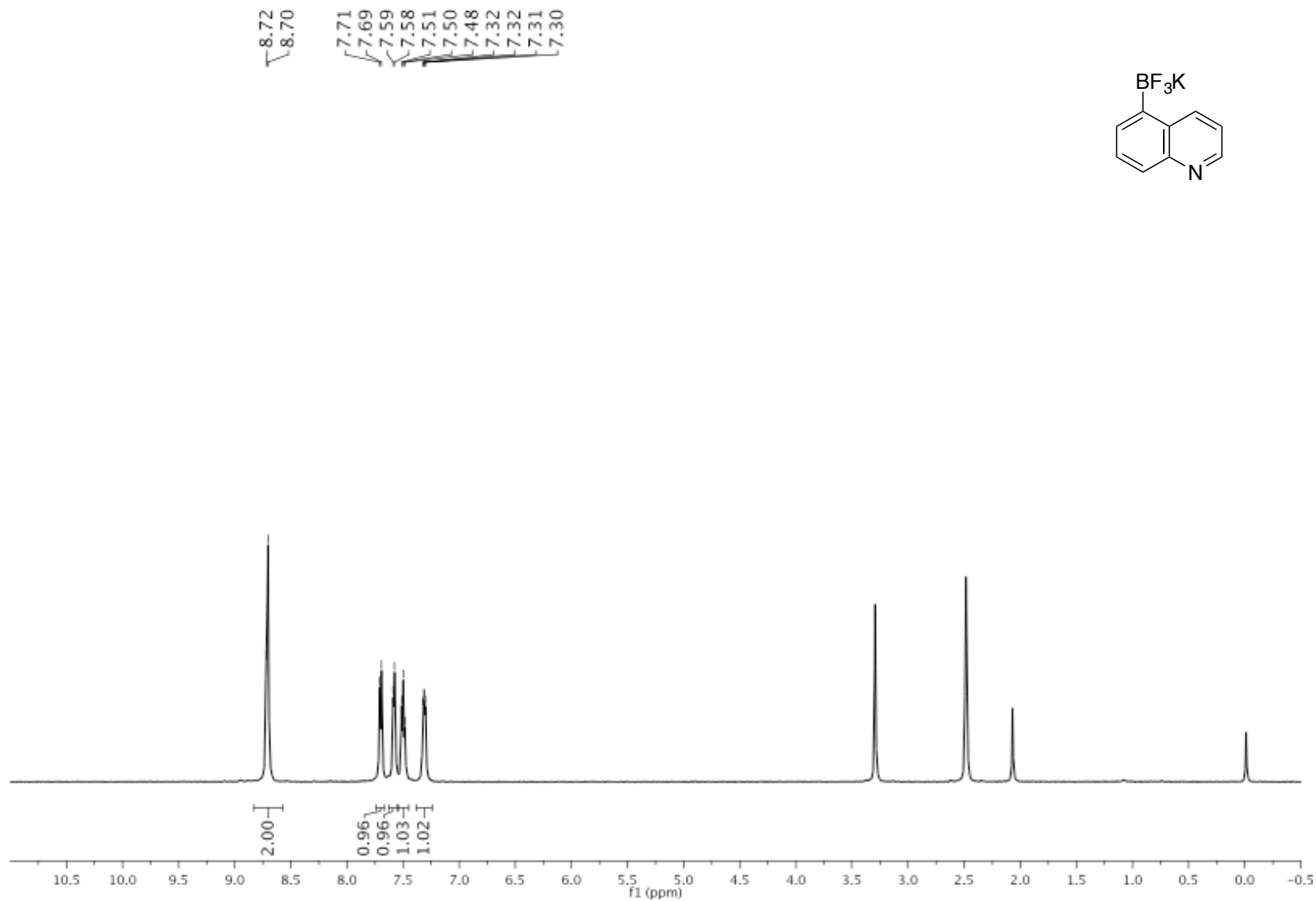


$^1\text{H}$  NMR (500 MHz, DMSO- $d_6$ ) Spectrum of Potassium Trifluoro(4-(trifluoromethyl)phenyl)borate (2g, Table 7, entry 4)



<sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>) Spectrum of Potassium Trifluoro(naphthalen-1-yl)borate (1i, Table 7, entry 5)





**<sup>1</sup>H NMR (500 MHz, DMSO -d<sub>6</sub>) Spectrum of Potassium Trifluoro(quinolin-5-yl)borate (3j, Table 7, entry 6)**