

# ChemCatChem

Supporting Information

## **Synthesis of Heteroarylated Pyridines via a Double C–H Bond Functionalization using Palladium-catalyzed 1,4-Migration Combined with Direct Arylation**

Mohamed Niyaz Vellala Syed Ali, Linhao Liu, Monika Ravi, and Henri Doucet\*

## Table of Contents

1 General.....	S2
2 Preparation of the PdCl(C <sub>3</sub> H <sub>5</sub> )(dppb) catalyst.....	S2
3 General procedures for the preparation of 3- or 4-(2-bromoaryl)pyridines <b>1a-1p</b> and 5-(2-bromophenyl)pyrimidine <b>1q</b> .....	S2
4 General procedure for the preparation of arylated 4-arylpyridines <b>2a-35a</b> .....	S8
4 References.....	S19
5 NMR Spectra.....	S20

## 1 General

Pd(OAc)<sub>2</sub> (98%) was purchased from Aldrich. DMA (99+%) extra pure was purchased from ACROS. KOPiv (95%), the 1,2-dihalobenzenes, the pyridineboronic acid derivatives, dppb and dppf were purchased from Doug Discovery. These compounds were not purified before use. All reagents were weighed and handled in air. All reactions were carried out under an inert atmosphere with standard Schlenk techniques. <sup>1</sup>H, <sup>19</sup>F and <sup>13</sup>C NMR spectra were recorded on a Bruker Avance III 400 MHz spectrometer. Low-resolution mass spectra were measured on a Shimadzu GCMS-QP2010 SE. High-resolution mass spectra were measured on a Bruker MaXis 4G spectrometer. Melting points were determined with a Kofler hot bench system. Chromatography purifications were performed using a CombiFlash NextGen 300 with Buchi FlashPure cartridges containing 40 μm irregular silica.

## 2 Preparation of the PdCl(C<sub>3</sub>H<sub>5</sub>)(dppb) catalyst:<sup>16</sup>

An oven-dried 40 mL Schlenk tube equipped with a magnetic stirring bar under argon atmosphere, was charged with [Pd(C<sub>3</sub>H<sub>5</sub>)Cl]<sub>2</sub> (182 mg, 0.5 mmol) and dppb (426 mg, 1 mmol). 10 mL of anhydrous dichloromethane were added, then, the solution was stirred at room temperature for twenty minutes. The solvent was removed in vacuum. The yellow powder was used without purification. <sup>31</sup>P NMR (162 MHz, CDCl<sub>3</sub>) δ = 19.3 (s).

## 3 General procedures for the preparation of 3- or 4-(2-bromoaryl)pyridines 1a-1p and 5-(2-bromophenyl)pyrimidine 1q:

As a typical experiment, a mixture of 1-bromo-2-iodobenzene derivative (4 mmol), pyridineboronic or pyrimidineboronic acid derivative (2 mmol), K<sub>2</sub>CO<sub>3</sub> (0.552 g, 4 mmol), Pd(OAc)<sub>2</sub> (22.4 mg, 0.1 mmol) and dppf (55.4 mg, 0.1 mmol) in DMA (5 mL) was stirred at 100 °C for 16 h. After being allowed to cool to room temperature, the resulting mixture was extracted with Et<sub>2</sub>O (3 × 10 mL). The combined organic phase was dried over MgSO<sub>4</sub>, filtrated, and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (heptane/EtOAc 5/1) to give the (2-bromoaryl)pyridines or (2-bromoaryl)pyrimidines **1a-1q**.

#### 4-(2-Bromophenyl)pyridine (**1a**)<sup>[12]</sup>

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1a** was isolated in 74% (0.346 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.77 (bs, 2H), 7.68 (dd,  $J = 7.7, 1.0$  Hz, 1H), 7.43-7.36 (m, 3H), 7.32-7.23 (m, 2H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>):  $\delta$  149.3, 148.8, 139.8, 133.5, 130.7, 129.9, 127.7, 124.7, 121.7.

LRMS calcd for [M]<sup>+</sup> C<sub>11</sub>H<sub>8</sub>BrN 235, found: 235.

#### 4-(2-Bromo-4-methylphenyl)pyridine (**1b**)

From 3-bromo-4-iodotoluene (1.188 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1b** was isolated in 76% (0.377 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.60 (d,  $J = 5.3$  Hz, 2H), 7.46 (s, 1H), 7.27 (d,  $J = 5.3$  Hz, 2H), 7.17-7.10 (m, 2H), 2.32 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>):  $\delta$  149.4, 148.7, 140.2, 136.8, 133.9, 130.5, 128.5, 124.4, 121.4, 20.8.

LRMS calcd for [M]<sup>+</sup> C<sub>12</sub>H<sub>10</sub>BrN 249, found: 249.

#### 4-(2-Bromo-4-fluorophenyl)pyridine (**1c**)

From 2-bromo-4-fluoriodobenzene (1.204 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1c** was isolated in 62% (0.312 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.64 (d,  $J = 6.1$  Hz, 2H), 7.40 (dd,  $J = 8.2, 2.5$  Hz, 1H), 7.28 (d,  $J = 6.1$  Hz, 2H), 7.25 (dd,  $J = 8.5, 6.0$  Hz, 1H), 7.09 (td,  $J = 6.9, 2.5$  Hz, 1H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>):  $\delta$  162.2 (d,  $J = 252.7$  Hz), 149.6, 147.7, 136.1 (d,  $J = 3.6$  Hz), 131.7 (d,  $J = 8.5$  Hz), 124.3, 122.0 (d,  $J = 9.6$  Hz), 120.6 (d,  $J = 24.4$  Hz), 114.9 (d,  $J = 21.2$  Hz).

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>):  $\delta$  -111.2.

LRMS calcd for [M]<sup>+</sup> C<sub>11</sub>H<sub>7</sub>BrFN 251, found: 251.

#### 4-(2-Bromo-4-chlorophenyl)pyridine (**1d**)

From 2-bromo-4-chloriodobenzene (1.270 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1d** was isolated in 71% (0.380 g) yield as a colorless oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.62 (d,  $J = 6.1$  Hz, 2H), 7.66-7.60 (m, 1H), 7.35-7.28 (m, 1H), 7.28-7.21 (m, 2H), 7.21-7.13 (m, 1H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  149.7, 147.4, 138.3, 135.0, 133.0, 131.4, 128.0, 124.1, 122.2.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{11}\text{H}_7\text{BrClN}$  267, found: 267.

#### **4-(2-Bromo-4-(trifluoromethyl)phenyl)pyridine (1e)**

From 2-bromo-1-iodo-4-(trifluoromethyl)benzene (1.404 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1e** was isolated in 75% (0.453 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.70 (d,  $J = 6.0$  Hz, 2H), 7.96 (s, 1H), 7.66 (d,  $J = 8.8$  Hz, 1H), 7.42 (d,  $J = 8.8$  Hz, 1H), 7.32 (d,  $J = 6.0$  Hz, 2H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\nu$  149.9, 147.4, 143.5, 132.0 (q,  $J = 33.4$  Hz), 131.1, 130.4 (q,  $J = 3.8$  Hz), 124.6 (q,  $J = 3.8$  Hz), 123.8, 123.0 (q,  $J = 273.0$  Hz), 122.2.

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ ):  $\delta$  -62.8.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{12}\text{H}_7\text{BrF}_3\text{N}$  301, found: 301.

#### **4-(2-Bromo-4-(trifluoromethoxy)phenyl)pyridine (1f)**

From 2-bromo-1-iodo-4-(trifluoromethoxy)benzene (1.468 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1f** was isolated in 71% (0.451 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.69-8.59 (m, 2H), 7.57-7.50 (m, 1H), 7.33-7.19 (m, 4H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  149.7, 149.1, 147.3, 138.6, 131.5, 125.8, 124.1, 122.2, 120.4 (q,  $J = 258.8$  Hz), 120.0.

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ ):  $\delta$  -57.9.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{12}\text{H}_7\text{BrF}_3\text{NO}$  317, found: 317.

#### **Methyl 3-bromo-4-(4pyridine-4-yl)benzoate (1g)**

From methyl 3-bromo-4-iodobenzoate (1.364 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1g** was isolated in 76% (0.444 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.66 (d,  $J = 6.1$  Hz, 2H), 8.32 (d,  $J = 1.6$  Hz, 1H), 8.01 (dd,  $J = 8.0$ , 1.6 Hz, 1H), 7.34 (d,  $J = 8.0$  Hz, 1H), 7.31 (d,  $J = 6.1$  Hz, 2H), 3.92 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  165.3, 149.8, 147.7, 144.1, 134.5, 131.6, 130.7, 128.7, 123.9, 121.8, 52.5.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{13}\text{H}_{10}\text{BrNO}_2$  291, found: 290.

#### 4-(2-Bromo-5-methylphenyl)pyridine (**1h**)

From 1-bromo-2-iodo-4-methylbenzene (1.188 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1h** was isolated in 64% (0.317 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.64 (d,  $J = 5.3$  Hz, 2H), 7.52 (d,  $J = 7.1$  Hz, 1H), 7.31 (d,  $J = 5.3$  Hz, 2H), 7.09 (s, 1H), 7.05 (d,  $J = 7.1$  Hz, 1H), 2.33 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  149.5, 148.8, 139.5, 137.7, 133.2, 131.5, 130.7, 124.3, 118.3, 20.9.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{12}\text{H}_{10}\text{BrN}$  249, found: 249.

#### 4-(2-Bromo-5-fluorophenyl)pyridine (**1i**)

From 2-bromo-5-fluoriodobenzene (1.204 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1i** was isolated in 62% (0.312 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.64 (d,  $J = 6.1$  Hz, 2H), 7.62-7.56 (m, 1H), 7.28 (d,  $J = 6.1$  Hz, 2H), 7.03-6.91 (m, 2H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  161.9 (d,  $J = 248.8$  Hz), 149.7, 147.5, 141.4 (d,  $J = 7.8$  Hz), 134.8 (d,  $J = 8.0$  Hz), 123.9, 117.8 (d,  $J = 23.5$  Hz), 117.0 (d,  $J = 22.3$  Hz), 116.0 (d,  $J = 3.4$  Hz).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ ):  $\delta$  -114.1.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{11}\text{H}_7\text{BrFN}$  251, found: 251.

#### 4-(2-Bromo-6-fluorophenyl)pyridine (**1j**)

From 2-bromo-6-fluoriodobenzene (1.204 g, 4 mmol) and 4-pyridineboronic acid (0.246 g, 2 mmol), **1j** was isolated in 60% (0.302 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.68 (d,  $J = 6.1$  Hz, 2H), 7.45 (d,  $J = 8.1$  Hz, 1H), 7.26-7.17 (m, 3H), 7.10 (t,  $J = 8.4$  Hz, 1H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  159.6 (d,  $J = 250.9$  Hz), 149.7, 142.4, 130.7 (d,  $J = 9.0$  Hz), 128.9 (d,  $J = 3.7$  Hz), 128.3 (d,  $J = 18.2$  Hz), 125.0, 123.2 (d,  $J = 2.9$  Hz), 115.1 (d,  $J = 22.6$  Hz).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ ):  $\delta$  -109.8.

LRMS calcd for  $[M]^+$  C<sub>11</sub>H<sub>7</sub>BrFN 251, found: 251.

#### **4-(2-Bromophenyl)-2-fluoropyridine (1k)**

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol) and (2-fluoropyridin-4-yl)boronic acid (0.282 g, 2 mmol), **1k** was isolated in 50% (0.252 g) yield as a colorless oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.28 (d,  $J = 5.1$  Hz, 1H), 7.70 (d,  $J = 8.1$  Hz, 1H), 7.41 (ddd,  $J = 7.8, 7.0, 1.3$  Hz, 1H), 7.34-7.27 (m, 2H), 7.26-7.21 (m, 1H), 7.00-6.98 (m, 1H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>):  $\delta$  163.5 (dd,  $J = 238.5, 3.1$  Hz), 153.9 (m), 147.3 (d,  $J = 15.5$  Hz), 138.7, 133.5, 130.6, 130.3, 127.8, 122.3 (d,  $J = 4.0$  Hz), 121.4 (d,  $J = 3.4$  Hz), 110.8 (d,  $J = 36.9$  Hz).

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>):  $\delta$  -67.6.

LRMS calcd for  $[M]^+$  C<sub>11</sub>H<sub>7</sub>BrFN 251, found: 251.

#### **3-(2-Bromophenyl)pyridine (1l)<sup>[22]</sup>**

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol) and 3-pyridineboronic acid (0.246 g, 2 mmol), **1l** was isolated in 77% (0.360 g) yield as a purple oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.66 (d,  $J = 2.3$  Hz, 1H), 8.60 (dd,  $J = 5.0, 1.7$  Hz, 1H), 7.73 (dt,  $J = 7.9, 2.0$  Hz, 1H), 7.67 (dd,  $J = 8.0, 1.3$  Hz, 1H), 7.40-7.27 (m, 3H), 7.22 (dd,  $J = 7.3, 1.9$  Hz, 1H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>):  $\delta$  149.9, 148.7, 138.9, 136.8, 136.7, 133.3, 131.2, 129.6, 127.7, 122.8, 122.7.

LRMS calcd for  $[M]^+$  C<sub>11</sub>H<sub>8</sub>BrN 233, found: 233.

#### **5-(2-Bromophenyl)-2-methoxypyridine (1m)**

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol), (6-methoxypyridin-3-yl)boronic acid (0.306 g, 2 mmol), **1m** was isolated in 85% (0.449 g) yield as a colorless oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.20 (dd,  $J = 3.5, 0.8$  Hz, 1H), 7.70-7.64 (m, 2H), 7.37 (td,  $J = 7.4, 1.2$  Hz, 1H), 7.31 (dd,  $J = 7.5, 1.8$  Hz, 1H), 7.22 (td,  $J = 8.0, 1.8$  Hz, 1H), 6.80 (dd,  $J = 8.5, 0.8$  Hz, 1H), 3.99 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  163.5, 146.9, 139.8, 139.1, 133.3, 131.3, 130.0, 129.1, 127.6, 123.2, 110.0, 53.5.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{12}\text{H}_{10}\text{BrNO}$  263, found: 263.

### **5-(2-Bromophenyl)-2-fluoropyridine (1n)**

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol) and (6-fluoropyridin-3-yl)boronic acid (0.282 g, 2 mmol), **1n** was isolated in 70% (0.353 g) yield as a colorless oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.22 (d,  $J = 2.5$  Hz, 1H), 7.85 (td,  $J = 5.6, 2.5$  Hz, 1H), 7.67 (dd,  $J = 8.0, 1.2$  Hz, 1H), 7.38 (td,  $J = 7.4, 1.2$  Hz, 1H), 7.29 (dd,  $J = 7.6, 1.8$  Hz, 1H), 7.24 (td,  $J = 7.4, 2.1$  Hz, 1H), 6.98 (ddd,  $J = 8.4, 3.0, 0.7$  Hz, 1H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  163.0 (d,  $J = 250.0$  Hz), 147.8 (d,  $J = 15.0$  Hz), 142.1 (d,  $J = 8.0$  Hz), 137.8, 134.6 (d,  $J = 4.7$  Hz), 133.4, 131.2, 129.8, 127.8, 122.8, 108.7 (d,  $J = 37.5$  Hz).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ ):  $\delta$  -69.1.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{11}\text{H}_7\text{BrFN}$  251, found: 251.

### **3-(2-Bromophenyl)-2-methoxypyridine (1o)**

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol), (2-methoxypyridin-3-yl)boronic acid (0.306 g, 2 mmol), **1o** was isolated in 61% (0.322 g) yield as a colorless oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.24 (dd,  $J = 5.0, 2.0$  Hz, 1H), 7.65 (dd,  $J = 8.0, 1.2$  Hz, 1H), 7.46 (dd,  $J = 7.2, 2.0$  Hz, 1H), 7.32 (td,  $J = 7.5, 1.2$  Hz, 1H), 7.27 (dd,  $J = 7.5, 2.0$  Hz, 1H), 7.18 (td,  $J = 7.5, 2.0$  Hz, 1H), 6.93 (dd,  $J = 57.2, 5.0$  Hz, 1H), 3.94 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  160.9, 146.7, 139.3, 138.1, 132.8, 131.5, 129.3, 127.3, 124.4, 124.1, 116.5, 53.6.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{12}\text{H}_{10}\text{BrNO}$  263, found: 263.

### **3-(2-Bromophenyl)-2-fluoropyridine (1p)**

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol) and (2-fluoropyridin-3-yl)boronic acid (0.282 g, 2 mmol), **1p** was isolated in 78% (0.393 g) yield as a colorless oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.20 (bs, 1H), 7.71-7.57 (m, 2H), 7.36-7.15 (m, 4H).



$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  160.2 (d,  $J = 250.9$  Hz), 147.4 (d,  $J = 14.3$  Hz), 142.0 (d,  $J = 4.1$  Hz), 135.0 (d,  $J = 4.2$  Hz), 133.0, 131.4, 130.1, 127.5, 123.4, 123.3 (d,  $J = 31.2$  Hz), 121.2 (d,  $J = 4.3$  Hz).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ ):  $\delta$  -68.2.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{11}\text{H}_7\text{BrFN}$  251, found: 251.

### 5-(2-Bromophenyl)pyrimidine (**1q**)<sup>[23]</sup>

From 1-bromo-2-iodobenzene (1.134 g, 4 mmol) and pyrimidin-5-ylboronic acid (0.248 g, 2 mmol) at 70 °C, **1q** was isolated in 70% (0.329 g) yield as a colorless oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  9.27 (s, 1H), 8.86 (s, 2H), 7.76 (d,  $J = 8.5$  Hz, 1H), 7.47 (t,  $J = 7.8$  Hz, 1H), 7.38-7.31 (m, 2H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  157.7, 156.8, 135.5, 134.7, 133.6, 131.1, 130.5, 128.1, 122.7.

LRMS calcd for  $[\text{M}]^+$   $\text{C}_{10}\text{H}_7\text{BrN}_2$  234, found: 234.

### 4 General procedure for the preparation of arylated arylpyridines 2a-35a:

As a typical experiment, the reaction of the (2-bromoaryl)pyridine derivative **1a-1p** (1 mmol), heteroarene (2 mmol) and KO $\text{Piv}$  (0.280 g, 2 mmol) at 150 °C during 16 h in DMA (4 mL) in the presence of  $\text{PdCl}(\text{C}_3\text{H}_5)(\text{dppb})$  (12.2 mg, 0.02 mmol) under argon affords the coupling product after evaporation of the solvent and purification on silica gel. The **a:b** ratios were determined by  $^1\text{H}$  NMR and GC/MS analysis of the crude mixtures.

### 2-Isopropyl-4-methyl-5-(4-phenylpyridin-3-yl)thiazole (**2a**)

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-isopropyl-4-methylthiazole (0.282 g, 2 mmol), **2a** was isolated in 63% (0.185 g) yield as a yellow solid: mp 64-66 °C.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.64-8.62 (m, 2H), 7.39-7.34 (m, 1H), 7.34-7.27 (m, 3H), 7.21-7.14 (m, 2H), 3.20 (sept.,  $J = 7.1$  Hz, 1H), 1.98 (s, 3H), 1.33 (d,  $J = 7.1$  Hz, 6H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  177.4, 151.9, 149.9, 149.3, 149.2, 138.1, 128.7, 128.5, 128.4, 126.8, 125.3, 124.4, 33.3, 23.1, 15.5.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{18}\text{H}_{19}\text{N}_2\text{S}$  295.1264, found: 295.1266.

One fraction containing product **2b** was also analysed by  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  176.7, 150.2, 148.8, 148.1, 139.6, 132.3, 130.4, 129.9, 33.2, 23.2, 15.6.

### **2-Isobutyl-5-(4-phenylpyridin-3-yl)thiazole (3a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-isobutylthiazole (0.282 g, 2 mmol), **3a** was isolated in 72% (0.212 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.74 (s, 1H), 8.60 (d,  $J = 5.0$  Hz, 1H), 7.46 (s, 1H), 7.39-7.32 (m, 3H), 7.30 (d,  $J = 5.0$  Hz, 1H), 7.24-7.20 (m, 2H), 2.76 (d,  $J = 7.1$  Hz, 2H), 2.07-1.93 (m, 1H), 0.93 (d,  $J = 7.1$  Hz, 6H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  171.8, 150.2, 149.0, 148.7, 141.3, 137.9, 133.1, 129.0, 128.6, 128.5, 126.4, 124.7, 42.2, 29.7, 22.2.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{18}\text{H}_{19}\text{N}_2\text{S}$  295.1264, found: 295.1266.

### **3-(5-Methylthiophen-2-yl)-4-phenylpyridine (4a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **4a** was isolated in 78% (0.196 g) yield as a yellow solid: mp 68-70 °C.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.74 (s, 1H), 8.54 (d,  $J = 5.0$  Hz, 1H), 7.39-7.34 (m, 3H), 7.30-7.24 (m, 3H), 6.60 (d,  $J = 3.5$  Hz, 1H), 6.58 (dq,  $J = 3.5, 1.1$  Hz, 1H), 2.41 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  150.1, 148.0, 147.8, 141.6, 138.6, 136.3, 129.6, 129.0, 128.4, 128.3, 127.7, 125.6, 125.0, 15.3.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{16}\text{H}_{14}\text{NS}$  252.0842, found: 252.0844.

### **3-(5-Chlorothiophen-2-yl)-4-phenylpyridine (5a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-chlorothiophene (0.237 g, 2 mmol), **5a** was isolated in 54% (0.147 g) yield as a brown solid: mp 176-178 °C.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.71 (s, 1H), 8.59 (d,  $J = 5.0$  Hz, 1H), 7.43-7.34 (m, 3H), 7.31 (d,  $J = 5.1$  Hz, 1H), 7.30-7.24 (m, 2H), 6.76 (d,  $J = 3.5$  Hz, 1H), 6.65 (d,  $J = 3.5$  Hz, 1H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  149.6, 148.7, 148.2, 137.9, 137.3, 131.5, 129.0, 128.7, 128.6, 128.5, 127.0, 126.4, 125.1.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{15}\text{H}_{11}\text{ClNS}$  272.0295, found: 272.0295.

### **1-(5-(4-Phenylpyridin-3-yl)thiophen-2-yl)ethan-1-one (6a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-acetylthiophene (0.252 g, 2 mmol), **6a** was isolated in 60% (0.167 g) yield as a yellow solid: mp 112-114 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.76 (s, 1H), 8.63 (d, *J* = 5.0 Hz, 1H), 7.48 (d, *J* = 3.9 Hz, 1H), 7.38-7.30 (m, 4H), 7.25-7.20 (m, 2H), 6.76 (d, *J* = 3.9 Hz, 1H), 2.49 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 190.4, 150.3, 149.5, 148.6, 147.4, 145.0, 137.8, 132.4, 128.9, 128.8, 128.7, 128.4, 125.0, 26.6.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>14</sub>NOS 280.0791, found: 280.0794.

### **Ethyl 5-(4-phenylpyridin-3-yl)thiophene-2-carboxylate (7a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and ethyl thiophene-2-carboxylate (0.312 g, 2 mmol), **7a** was isolated in 64% (0.198 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.76 (bs, 1H), 8.64 (bs, 1H), 7.58 (d, *J* = 3.9 Hz, 1H), 7.39-7.30 (m, 4H), 7.26-7.20 (m, 2H), 6.72 (d, *J* = 3.9 Hz, 1H), 4.31 (q, *J* = 7.6 Hz, 2H), 1.34 (t, *J* = 7.6 Hz, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 162.0, 150.3, 149.3, 148.7, 145.7, 137.9, 134.6, 133.3, 128.9, 128.7, 128.6, 128.5, 125.0, 61.2, 14.3.

HRMS calcd for [M+H]<sup>+</sup> C<sub>18</sub>H<sub>16</sub>NO<sub>2</sub>S 310.0896, found: 310.0899.

### **Cyclopropyl(5-(4-phenylpyridin-3-yl)thiophen-2-yl)methanone (8a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and cyclopropyl(thiophen-2-yl)methanone (0.304 g, 2 mmol), **8a** was isolated in 62% (0.189 g) yield as a yellow solid: mp 108-110 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.78 (s, 1H), 8.63 (s, 1H), 7.60 (d, *J* = 3.9 Hz, 1H), 7.39-7.31 (m, 4H), 7.27-7.21 (m, 2H), 6.78 (d, *J* = 3.9 Hz, 1H), 2.49-2.39 (m, 1H), 1.27-1.17 (m, 2H), 1.04-0.95 (m, 2H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 192.6, 149.9, 149.0, 148.9, 146.5, 145.6, 137.7, 131.4, 129.0, 128.9, 128.8, 128.7, 125.2, 17.9, 11.5.

HRMS calcd for [M+H]<sup>+</sup> C<sub>19</sub>H<sub>16</sub>NOS 306.0947, found: 306.0948.

### 3-(5-(2-Methyl-1,3-dioxolan-2-yl)thiophen-2-yl)-4-phenylpyridine (9a)

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-methyl-2-(thiophen-2-yl)-1,3-dioxolane (0.340 g, 2 mmol), **9a** was isolated in 68% (0.220 g) yield as a yellow solid: mp 88-90 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.76 (s, 1H), 8.58 (s, 1H), 7.40-7.30 (m, 4H), 7.28-7.22 (m, 2H), 6.85 (d, *J* = 3.9 Hz, 1H), 6.66 (d, *J* = 3.9 Hz, 1H), 4.07-3.83 (m, 4H), 1.70 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 149.3, 149.2, 149.1, 147.1, 138.1, 137.8, 129.0, 128.6, 128.5, 127.8, 125.2, 124.3, 107.0, 64.9, 27.3.

HRMS calcd for [M+H]<sup>+</sup> C<sub>19</sub>H<sub>18</sub>NO<sub>2</sub>S 324.1053, found: 324.1057.

### 2-(5-(4-Phenylpyridin-3-yl)thiophen-2-yl)acetonitrile (10a)

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-(thiophen-2-yl)acetonitrile (0.246 g, 2 mmol), **10a** was isolated in 62% (0.171 g) yield as a purple oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.73 (s, 1H), 8.59 (d, *J* = 5.0 Hz, 1H), 7.40-7.32 (m, 3H), 7.28 (d, *J* = 5.0 Hz, 1H), 7.27-7.22 (m, 2H), 6.90 (d, *J* = 3.7 Hz, 1H), 6.71 (d, *J* = 3.7 Hz, 1H), 3.83 (s, 2H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 150.5, 149.1, 148.0, 139.8, 138.2, 132.1, 129.0, 128.6, 128.5, 128.4, 127.7, 127.4, 124.8, 116.6, 18.7.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>13</sub>N<sub>2</sub>S 277.0794, found: 277.0795.

### 3-(3-Methylbenzo[*b*]thiophen-2-yl)-4-phenylpyridine (11a)

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 3-methylbenzo[*b*]thiophene (0.296 g, 2 mmol), **11a** was isolated in 66% (0.199 g) yield as a yellow solid: mp 200-202 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.72 (bs, 1H), 8.69 (d, *J* = 5.1 Hz, 1H), 7.78 (d, *J* = 7.1 Hz, 1H), 7.58 (d, *J* = 8.2 Hz, 1H), 7.42 (d, *J* = 5.1 Hz, 1H), 7.39-7.30 (m, 2H), 7.28-7.22 (m, 5H), 1.93 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 152.4, 149.7, 149.6, 140.2, 139.8, 138.3, 133.2, 130.2, 128.7, 128.6, 128.5, 128.2, 124.5, 124.3, 124.1, 122.2, 122.1, 12.2.

HRMS calcd for [M+H]<sup>+</sup> C<sub>20</sub>H<sub>16</sub>NS 302.0998, found: 302.0999.

### 3-(5-Butylfuran-2-yl)-4-phenylpyridine (12a)

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 2-butylfuran (0.248 g, 2 mmol), **12a** was isolated in 91% (0.252 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.97 (s, 1H), 8.48 (d,  $J = 5.0$  Hz, 1H), 7.44-7.36 (m, 3H), 7.30-7.24 (m, 2H), 7.17 (d,  $J = 5.0$  Hz, 1H), 5.87 (d,  $J = 3.3$  Hz, 1H), 5.73 (d,  $J = 3.3$  Hz, 1H), 2.55 (t,  $J = 7.6$  Hz, 2H), 1.50 (quint.,  $J = 7.6$  Hz, 2H), 1.31 (sext.,  $J = 7.6$  Hz, 2H), 0.89 (t,  $J = 7.6$  Hz, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  157.0, 148.1, 147.7, 147.3, 146.1, 139.5, 128.5, 128.3, 128.2, 125.7, 124.9, 111.1, 106.8, 30.0, 27.7, 22.2, 13.8.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{19}\text{H}_{20}\text{NO}$  278.1539, found: 278.1539.

### **1-(5-(4-Phenylpyridin-3-yl)furan-2-yl)butan-1-one (13a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 1-furan-2-ylbutan-1-one (0.276 g, 2 mmol), **13a** was isolated in 78% (0.227 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  9.05 (s, 1H), 8.62 (d,  $J = 5.0$  Hz, 1H), 7.47-7.38 (m, 3H), 7.30-7.23 (m, 3H), 7.05 (d,  $J = 3.7$  Hz, 1H), 6.07 (d,  $J = 3.7$  Hz, 1H), 2.54 (t,  $J = 7.4$  Hz, 2H), 1.62 (sext.,  $J = 7.4$  Hz, 2H), 0.92 (t,  $J = 7.4$  Hz, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  189.8, 153.5, 152.4, 149.6, 149.0, 147.6, 138.8, 128.7, 128.6, 128.3, 125.0, 124.3, 117.5, 112.2, 40.2, 17.6, 13.9.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{19}\text{H}_{18}\text{NO}_2$  292.1332, found: 292.1335.

### **3-(3,6-Dimethyl-4,5,6,7-tetrahydrobenzofuran-2-yl)-4-phenylpyridine (14a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 3,6-dimethyl-4,5,6,7-tetrahydrobenzofuran (0.300 g, 2 mmol), **14a** was isolated in 76% (0.230 g) yield as a yellow oil.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.80 (bs, 1H), 8.56 (bs, 1H), 7.39-7.28 (m, 4H), 7.28-7.20 (m, 2H), 2.53 (dd,  $J = 16.0, 5.2$  Hz, 1H), 2.37-2.22 (m, 2H), 2.14-2.00 (m, 1H), 1.94-1.76 (m, 2H), 1.56 (s, 3H), 1.41-1.26 (m, 1H), 1.02 (d,  $J = 6.7$  Hz, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  150.8, 150.7, 148.3, 148.0, 143.5, 139.2, 128.4, 128.3, 127.9, 126.4, 124.6, 118.8, 118.5, 31.3, 31.2, 29.6, 21.4, 20.0, 8.5.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{21}\text{H}_{22}\text{NO}$  304.1618, found: 304.1616.

### **1-(1-Ethyl-5-(4-phenylpyridin-3-yl)-1H-pyrrol-2-yl)ethan-1-one (15a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 1-(1-ethylpyrrol-2-yl)ethan-1-one (0.274 g, 2 mmol), **15a** was isolated in 50% (0.145 g) yield as a yellow solid: mp 136-138 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.71 (d, *J* = 5.1 Hz, 1H), 8.61 (s, 1H), 7.42 (d, *J* = 5.1 Hz, 1H), 7.32-7.24 (m, 3H), 7.21-7.14 (m, 2H), 7.00 (d, *J* = 4.0 Hz, 1H), 6.13 (d, *J* = 4.0 Hz, 1H), 3.96-3.76 (m, 2H), 2.44 (s, 3H), 0.93 (t, *J* = 7.0 Hz, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 188.0, 151.9, 150.3, 149.2, 137.8, 137.1, 130.3, 128.7, 128.6, 128.4, 126.4, 124.1, 120.3, 111.5, 41.2, 27.5, 16.1.

HRMS calcd for [M+H]<sup>+</sup> C<sub>19</sub>H<sub>19</sub>N<sub>2</sub>O 291.1492, found: 291.1495.

### **3-(1,2-Dimethylimidazol-5-yl)-4-phenylpyridine (16a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and 1,2-dimethylimidazole (0.192 g, 2 mmol), **16a** was isolated in 48% (0.119 g) yield as a purple solid: mp 166-168 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.70 (d, *J* = 5.1 Hz, 1H), 8.61 (s, 1H), 7.43 (d, *J* = 5.1 Hz, 1H), 7.37-7.30 (m, 3H), 7.25-7.20 (m, 2H), 7.05 (s, 1H), 2.75 (s, 3H), 2.32 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 152.3, 150.4, 148.4, 146.0, 138.1, 129.2, 128.8, 128.7, 128.4, 126.8, 124.2, 124.0, 30.6, 13.3.

HRMS calcd for [M+H]<sup>+</sup> C<sub>16</sub>H<sub>16</sub>N<sub>3</sub> 250.1339, found: 250.1341.

### **3-(4-Phenylpyridin-3-yl)imidazo[1,2-*a*]pyridine (17a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and imidazo[1,2-*a*]pyridine (0.236 g, 2 mmol), **17a** was isolated in 62% (0.168 g) yield as a brown solid: mp 170-172 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.81-8.71 (m, 2H), 7.70 (s, 1H), 7.58 (d, *J* = 9.1 Hz, 1H), 7.49 (d, *J* = 5.0 Hz, 1H), 7.36 (d, *J* = 6.9 Hz, 1H), 7.24-7.11 (m, 5H), 7.06 (dd, *J* = 9.1, 6.7 Hz, 1H), 6.46 (dd, *J* = 6.9, 1.0 Hz, 1H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 152.3, 150.4, 148.4, 146.0, 137.8, 134.1, 128.8, 128.7, 127.5, 124.5, 124.4, 123.2, 123.1, 121.5, 117.8, 112.0.

HRMS calcd for [M+H]<sup>+</sup> C<sub>18</sub>H<sub>14</sub>N<sub>3</sub> 272.1183, found: 272.1182.

### **3-(4-Phenylpyridin-3-yl)imidazo[1,2-*c*]pyrimidine (18a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and imidazo[1,2-*c*]pyrimidine (0.238 g, 2 mmol), **18a** was isolated in 80% (0.218 g) yield as a brown solid: mp 184-186 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.92 (s, 1H), 8.71 (d, *J* = 5.1, Hz, 1H), 8.06 (dd, *J* = 4.4, 1.6, Hz, 1H), 7.91 (dd, *J* = 9.1, 1.6, Hz, 1H), 7.62 (s, 1H), 7.45 (d, *J* = 5.0 Hz, 1H), 7.25-7.10 (m, 5H), 6.95 (dd, *J* = 9.1, 4.4 Hz, 1H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 151.2, 149.8, 149.6, 142.6, 139.5, 138.7, 134.5, 128.4, 128.3, 127.8, 125.7, 125.2, 124.6, 122.9, 116.8.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>13</sub>N<sub>4</sub> 273.1135, found: 273.1138.

### **3-(4-Phenylpyridin-3-yl)imidazo[1,2-*b*]pyridazine (19a)**

From 4-(2-bromophenyl)pyridine **1a** (0.234 g, 1 mmol) and imidazo[1,2-*b*]pyridazine (0.238 g, 2 mmol), **19a** was isolated in 76% (0.207 g) yield as a brown solid: mp 182-184 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.91 (s, 1H), 8.72 (d, *J* = 5.0 Hz, 1H), 8.05 (dd, *J* = 4.4, 1.7 Hz, 1H), 7.91 (dd, *J* = 9.2, 1.7 Hz, 1H), 7.63 (s, 1H), 7.45 (d, *J* = 5.1 Hz, 1H), 7.24-7.09 (m, 5H), 6.95 (dd, *J* = 9.2, 4.4 Hz, 1H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 151.4, 150.1, 149.4, 142.6, 139.5, 138.8, 134.6, 128.3, 128.2, 127.8, 125.7, 125.3, 124.5, 122.8, 116.7.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>13</sub>N<sub>4</sub> 273.1135, found: 273.1137.

### **3-(5-Methylthiophen-2-yl)-4-(*p*-tolyl)pyridine (20a)**

From 4-(2-bromo-4-methylphenyl)pyridine **1b** (0.248 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **20a** was isolated in 78% (0.207 g) yield as a yellow solid: mp 100-102 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.71 (s, 1H), 8.51 (d, *J* = 5.0 Hz, 1H), 7.23 (d, *J* = 5.0 Hz, 1H), 7.17-7.14 (m, 4H), 6.61 (d, *J* = 3.5 Hz, 1H), 6.58 (d, *J* = 3.5 Hz, 1H), 2.43 (d, *J* = 1.0 Hz, 3H), 2.38 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 150.5, 148.2, 147.7, 141.3, 138.1, 136.7, 135.8, 129.4, 129.1, 128.9, 127.5, 125.5, 124.9, 21.3, 15.3.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>16</sub>NS 266.0998, found: 266.1001.

### **3-(5-Butylfuran-2-yl)-4-(*p*-tolyl)pyridine (21a)**

From 4-(2-bromo-4-methylphenyl)pyridine **1b** (0.248 g, 1 mmol) and 2-butylfuran (0.248 g, 2 mmol), **21a** was isolated in 76% (0.221 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.94 (s, 1H), 8.46 (d, *J* = 5.0 Hz, 1H), 7.21 (d, *J* = 7.7 Hz, 2H), 7.19-7.14 (m, 3H), 5.87 (d, *J* = 3.3 Hz, 1H), 5.76 (d, *J* = 3.3 Hz, 1H), 2.56 (t, *J* = 7.6 Hz, 2H), 2.41 (s, 3H), 1.50 (quint., *J* = 7.6 Hz, 2H), 1.32 (sext., *J* = 7.6 Hz, 2H), 0.90 (t, *J* = 7.6 Hz, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 156.8, 148.4, 148.0, 147.6, 146.0, 137.9, 136.6, 129.2, 128.2, 125.7, 124.9, 110.9, 106.7, 30.1, 27.7, 22.2, 21.3, 13.8.

HRMS calcd for [M+H]<sup>+</sup> C<sub>20</sub>H<sub>22</sub>NO 292.1996, found: 292.1700.

#### 4-(4-Fluorophenyl)-3-(5-methylthiophen-2-yl)pyridine (**22a**)

From 4-(2-bromo-4-fluorophenyl)pyridine **1c** (0.252 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **22a** was isolated in 71% (0.191 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.72 (s, 1H), 8.53 (d, *J* = 5.0 Hz, 1H), 7.28-7.19 (m, 3H), 7.04 (t, *J* = 8.8 Hz, 2H), 6.61 (d, *J* = 3.3 Hz, 1H), 6.59 (d, *J* = 3.3 Hz, 1H), 2.42 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 162.8 (d, *J* = 248.1 Hz), 150.6, 148.4, 146.6, 141.6, 136.3, 134.7 (d, *J* = 3.4 Hz), 130.8 (d, *J* = 18.2 Hz), 129.5, 127.6, 125.6, 124.7, 115.5 (d, *J* = 21.6 Hz), 15.2.

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>): δ -113.4.

HRMS calcd for [M+H]<sup>+</sup> C<sub>16</sub>H<sub>13</sub>FNS 270.0742, found: 270.0750.

#### 4-(4-Chlorophenyl)-3-(5-methylthiophen-2-yl)pyridine (**23a**)

From 4-(2-bromo-4-chlorophenyl)pyridine **1d** (0.267 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **23a** was isolated in 51% (0.145 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.72 (s, 1H), 8.55 (d, *J* = 5.0 Hz, 1H), 7.33 (d, *J* = 8.5 Hz, 2H), 7.23-7.19 (m, 3H), 6.60 (s, 2H), 2.43 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 150.7, 148.5, 146.4, 141.7, 137.2, 136.1, 134.4, 130.4, 129.4, 128.7, 127.8, 125.7, 124.5, 15.3.

HRMS calcd for [M+H]<sup>+</sup> C<sub>16</sub>H<sub>13</sub>ClNS 286.0452, found: 286.0454.

#### 3-(5-Methylthiophen-2-yl)-4-(4-(trifluoromethyl)phenyl)pyridine (**24a**)



From 4-(2-bromo-4-(trifluoromethyl)phenyl)pyridine **1e** (0.302 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **24a** was isolated in 73% (0.233 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.76 (s, 1H), 8.57 (d, *J* = 5.0 Hz, 1H), 7.62 (d, *J* = 8.2 Hz, 2H), 7.39 (d, *J* = 8.2 Hz, 2H), 7.23 (d, *J* = 5.0 Hz, 1H), 6.60 (d, *J* = 3.3 Hz, 1H), 6.57 (d, *J* = 3.3 Hz, 1H), 2.42 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 150.8, 148.5, 146.1, 142.4, 141.9, 135.7, 130.3 (q, *J* = 32.6 Hz), 129.4, 129.3, 127.9, 125.8, 125.4 (q, *J* = 3.7 Hz), 124.4, 124.1 (q, *J* = 273.5 Hz), 15.2.

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>): δ -62.6.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>13</sub>F<sub>3</sub>NS 320.0637, found: 320.0634.

### 3-(5-Methylthiophen-2-yl)-4-(4-(trifluoromethoxy)phenyl)pyridine (**25a**)

From 4-(2-bromo-4-(trifluoromethoxy)phenyl)pyridine **1f** (0.239 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **25a** was isolated in 61% (0.204 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.74 (s, 1H), 8.56 (d, *J* = 5.0 Hz, 1H), 7.30 (d, *J* = 8.2 Hz, 2H), 7.23 (d, *J* = 5.0 Hz, 1H), 7.20 (d, *J* = 8.2 Hz, 2H), 6.60 (s, 2H), 2.43 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 150.7, 149.2, 148.5, 146.2, 141.8, 137.3, 136.0, 130.6, 129.4, 127.8, 125.6, 124.5, 120.8, 120.3 (q, *J* = 257.6 Hz), 15.2.

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>): δ -57.8.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>13</sub>F<sub>3</sub>NOS 336.0586, found: 336.0587.

### 3-(5-Methylthiophen-2-yl)-4-(*m*-tolyl)pyridine (**27a**)

From 4-(2-bromo-5-methylphenyl)pyridine **1h** (0.248 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **27a** was isolated in 71% (0.188 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.72 (s, 1H), 8.52 (bs, 1H), 7.28-7.14 (m, 3H), 7.11 (s, 1H), 7.04 (d, *J* = 7.4 Hz, 1H), 6.60 (d, *J* = 3.5 Hz, 1H), 6.58 (d, *J* = 3.5 Hz, 1H), 2.42 (s, 3H), 2.34 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 150.5, 148.2, 147.7, 141.3, 138.7, 138.1, 136.6, 129.6, 129.4, 128.9, 128.2, 127.6, 126.1, 125.5, 124.8, 21.4, 15.3.

HRMS calcd for [M+H]<sup>+</sup> C<sub>17</sub>H<sub>16</sub>NS 266.0998, found: 266.1001.

### 4-(3-Fluorophenyl)-3-(5-methylthiophen-2-yl)pyridine (**28a**)

From 4-(2-bromo-5-fluorophenyl)pyridine **1i** (0.252 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **28a** was isolated in 74% (0.199 g) yield as a yellow oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.74 (s, 1H), 8.54 (d, *J* = 5.0 Hz, 1H), 7.36-7.28 (m, 1H), 7.22 (d, *J* = 5.0 Hz, 1H), 7.09-7.02 (m, 2H), 6.98 (d, *J* = 9.0 Hz, 1H), 6.63-6.57 (m, 2H), 2.42 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 162.6 (d, *J* = 246.4 Hz), 150.7, 148.4, 146.2 (d, *J* = 2.1 Hz), 141.7, 140.9 (d, *J* = 7.8 Hz), 135.9, 130.0 (d, *J* = 8.3 Hz), 129.3, 127.7, 125.6, 124.8 (d, *J* = 3.0 Hz), 124.5, 116.1 (d, *J* = 22.3 Hz), 115.1 (d, *J* = 21.1 Hz), 15.3.

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>): δ -112.6.

HRMS calcd for [M+H]<sup>+</sup> C<sub>16</sub>H<sub>13</sub>FNS 270.0747, found: 270.0747.

#### **4-(2-Fluorophenyl)-3-(5-methylthiophen-2-yl)pyridine (29a)**

From 4-(2-Bromo-6-fluorophenyl)pyridine **1j** (0.252 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **29a** was isolated in 76% (0.204 g) yield as a white solid: mp 110-112 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.79 (s, 1H), 8.54 (bs, 1H), 7.42-7.34 (m, 1H), 7.28-7.14 (m, 3H), 7.06 (t, *J* = 8.5 Hz, 1H), 6.62 (d, *J* = 3.3 Hz, 1H), 6.58 (d, *J* = 3.3 Hz, 1H), 2.40 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 159.5 (d, *J* = 248.2 Hz), 150.1, 149.5, 147.0, 141.5 (d, *J* = 7.6 Hz), 136.3, 131.2 (d, *J* = 3.1 Hz), 130.4 (d, *J* = 8.0 Hz), 127.0, 126.5 (d, *J* = 15.7 Hz), 125.6, 125.3, 124.3 (d, *J* = 3.6 Hz), 115.9 (d, *J* = 21.8 Hz), 15.3.

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>): δ -114.6.

HRMS calcd for [M+H]<sup>+</sup> C<sub>16</sub>H<sub>13</sub>FNS 270.0747, found: 270.0749.

#### **2-Fluoro-5-(5-methylthiophen-2-yl)-4-phenylpyridine (30a)**

From 4-(2-bromophenyl)-2-fluoropyridine **1k** (0.252 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **30a** was isolated in 41% (0.110 g) yield as a colorless oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.31 (s, 1H), 7.40-7.31 (m, 5H), 6.92 (d, *J* = 2.2 Hz, 1H), 6.57 (d, *J* = 3.3 Hz, 1H), 6.54 (d, *J* = 3.3 Hz, 1H), 2.41 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>): δ 163.0 (d, *J* = 240.1 Hz), 153.3 (d, *J* = 8.2 Hz), 148.3 (d, *J* = 15.3 Hz), 141.4, 137.8 (d, *J* = 2.7 Hz), 135.3, 128.8, 128.7, 128.5, 127.8 (d, *J* = 5.0 Hz), 127.7, 125.5, 110.0 (d, *J* = 27.5 Hz), 15.3.

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>): δ -70.8.

HRMS calcd for  $[M+H]^+$  C<sub>16</sub>H<sub>13</sub>FNS 270.0747, found: 270.0749.

### **6-Fluoro-2-(5-methylthiophen-2-yl)-3-phenylpyridine (33a)**

From 5-(2-bromophenyl)-2-fluoropyridine **1n** (0.252 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **33a** was isolated in 41% (0.110 g) yield as a colorless oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  7.59 (t,  $J$  = 8.1 Hz, 1H), 7.46-7.39 (m, 3H), 7.35-7.28 (m, 2H), 6.77 (dd,  $J$  = 8.1, 3.5 Hz, 1H), 6.46 (s, 2H), 2.41 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>):  $\delta$  161.6 (d,  $J$  = 238.6 Hz), 148.7 (d,  $J$  = 14.1 Hz), 143.9 (d,  $J$  = 7.8 Hz), 143.2, 140.1, 139.1, 131.5 (d,  $J$  = 4.6 Hz), 129.3, 129.1, 128.9, 128.1, 125.9, 106.1 (d,  $J$  = 37.8 Hz), 15.3.

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>):  $\delta$  -69.2.

HRMS calcd for  $[M+H]^+$  C<sub>16</sub>H<sub>13</sub>FNS 270.0747, found: 270.0747.

### **2-Methoxy-4-(5-methylthiophen-2-yl)-3-phenylpyridine (34a)**

From 3-(2-bromophenyl)-2-methoxypyridine **1o** (0.264 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **34a** was isolated in 75% (0.211 g) yield as a white solid: mp 136-138 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.12 (d,  $J$  = 5.4 Hz, 1H), 7.41-7.34 (m, 3H), 7.25-7.20 (m, 2H), 7.11 (d,  $J$  = 5.4 Hz, 1H), ), 6.55 (d,  $J$  = 3.3 Hz, 1H), 6.51 (d,  $J$  = 3.3 Hz, 1H), 3.89 (s, 3H), 2.34 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>):  $\delta$  162.3, 145.4, 142.8, 142.2, 138.0, 135.7, 130.6, 128.5, 128.4, 127.6, 125.5, 121.6, 117.0, 53.9, 15.2.

HRMS calcd for  $[M+H]^+$  C<sub>17</sub>H<sub>16</sub>NOS 282.0947, found: 282.0948.

### **2-Fluoro-4-(5-methylthiophen-2-yl)-3-phenylpyridine (35a)**

From 3-(2-bromophenyl)-2-fluoropyridine **1p** (0.252 g, 1 mmol) and 2-methylthiophene (0.196 g, 2 mmol), **35a** was isolated in 78% (0.210 g) yield as a white solid: mp 130-132 °C.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):  $\delta$  8.13 (d,  $J$  = 5.3 Hz, 1H), 7.44-7.39 (m, 3H), 7.37 (d,  $J$  = 5.3 Hz, 1H), 7.31-7.24 (m, 2H), 6.63 (d,  $J$  = 3.3 Hz, 1H), 6.54 (d,  $J$  = 3.3 Hz, 1H), 2.39 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ):  $\delta$  161.8 (d,  $J = 235.9$  Hz), 146.1 (d,  $J = 8.1$  Hz), 145.7 (d,  $J = 5.0$  Hz), 143.4, 136.5 (d,  $J = 4.6$  Hz), 132.8 (d,  $J = 2.5$  Hz), 130.3, 129.3, 128.7, 128.5, 125.9, 121.0 (d,  $J = 3.8$  Hz), 120.6 (d,  $J = 33.1$  Hz), 15.3.

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ ):  $\delta$  -68.5.

HRMS calcd for  $[\text{M}+\text{H}]^+$   $\text{C}_{16}\text{H}_{13}\text{FNS}$  270.0747, found: 270.0750.

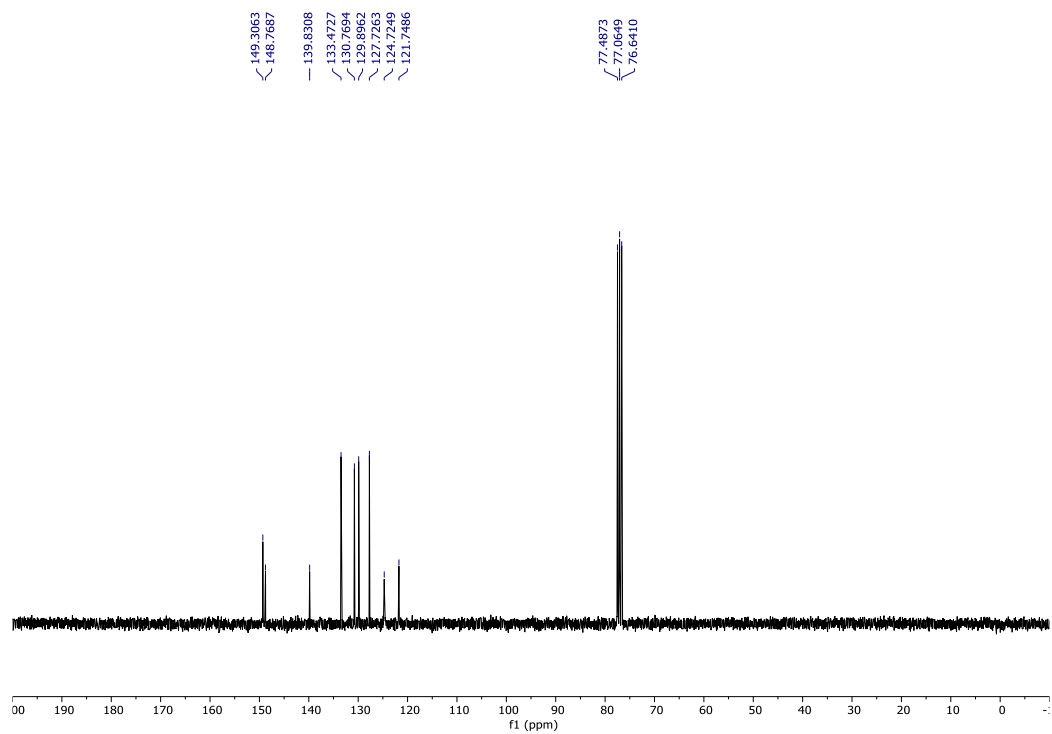
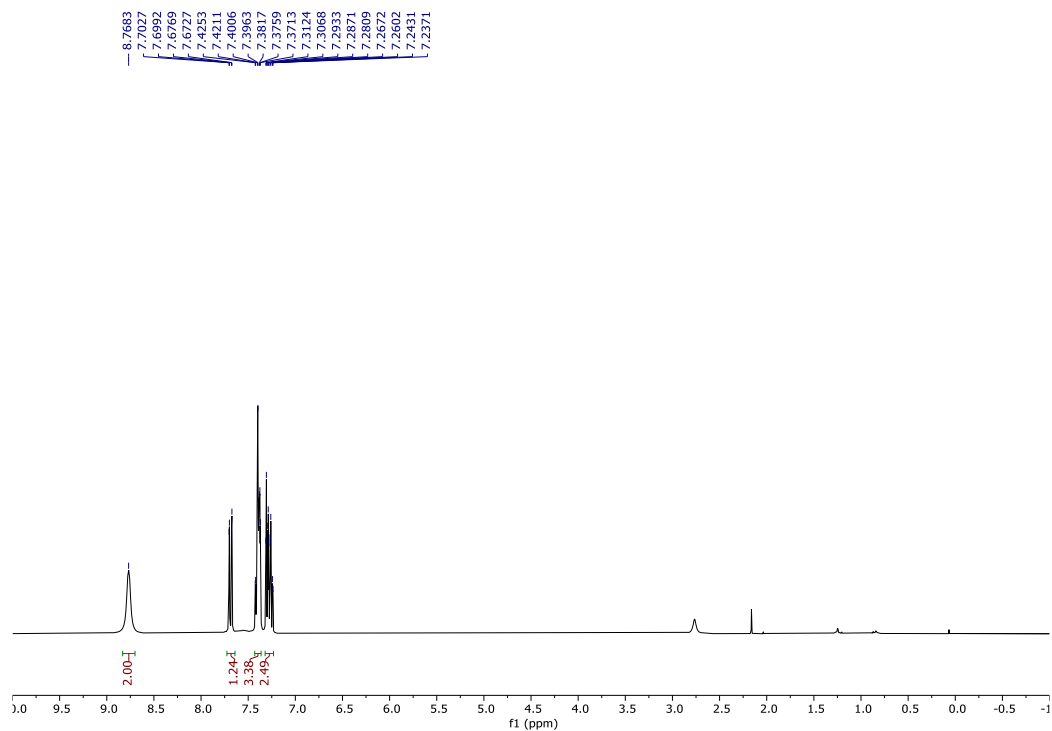
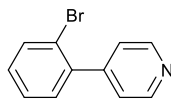
## 5 References

[22] C.-G. Dong, T.-P. Liu, Q.-S. Hu, *Synlett* **2009**, 1081-1086.

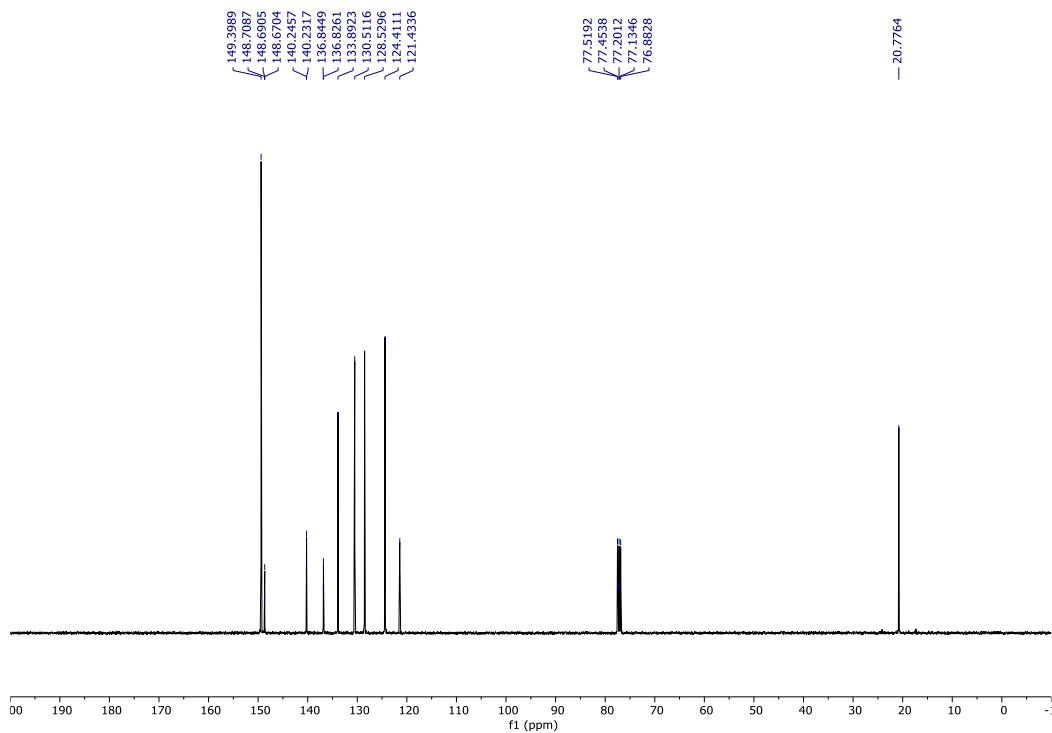
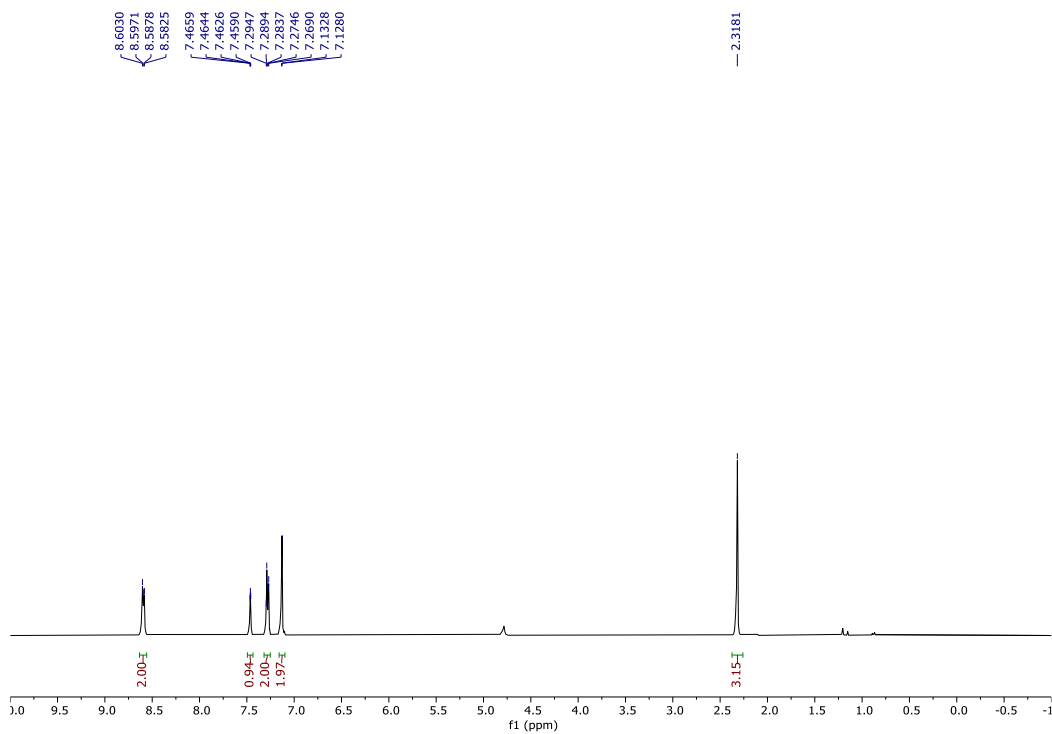
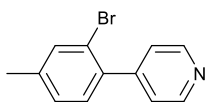
[23] J. Ruch, A. Aubin, G. Erbland, A. Fortunato, J.-P. Goddard, *Chem. Commun.* **2016**, 52, 2326-2329.

# 6 NMR Spectra for all Products

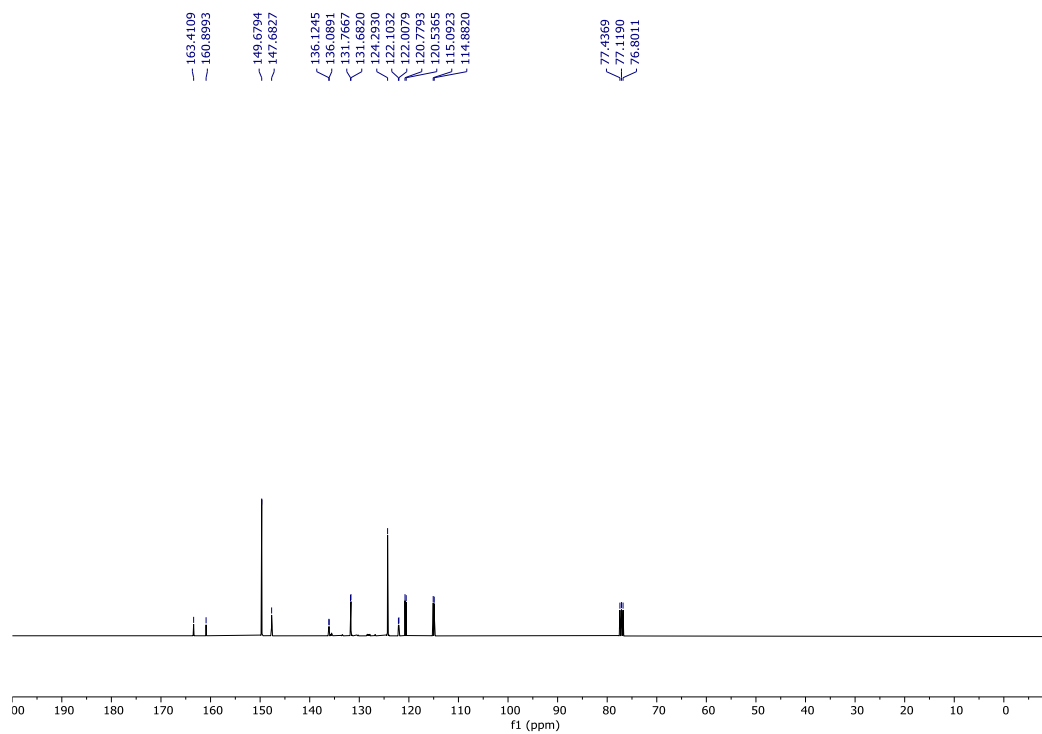
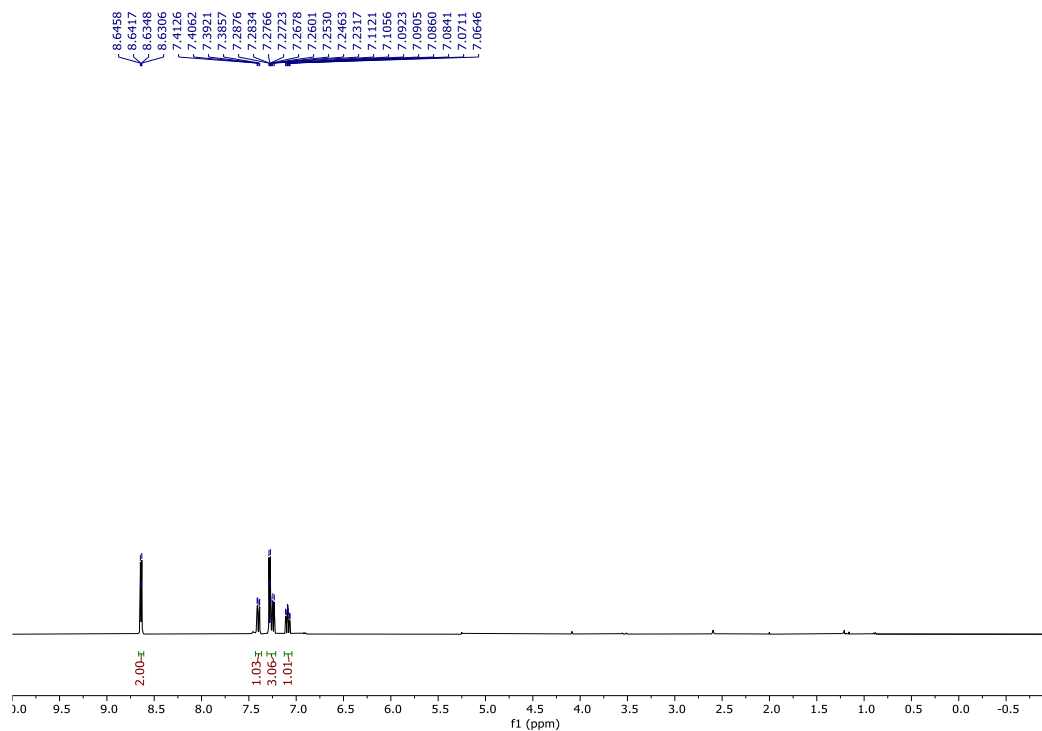
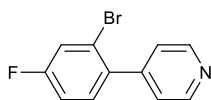
## 4-(2-Bromophenyl)pyridine (1a)

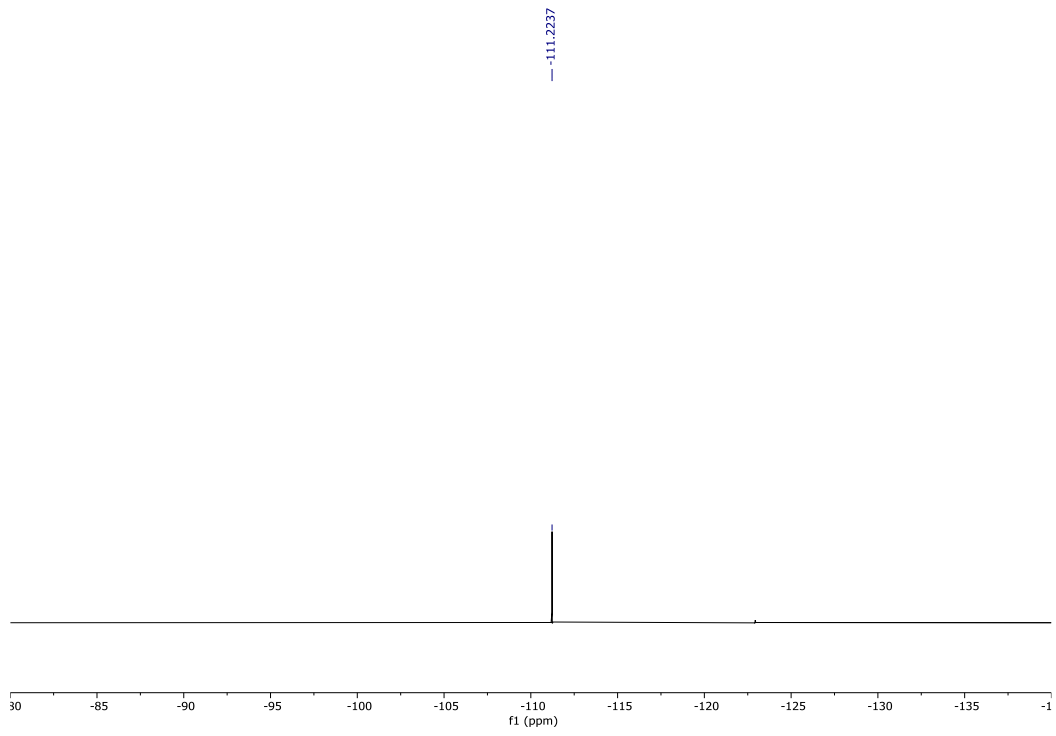


# 4-(2-Bromo-4-methylphenyl)pyridine (1b)



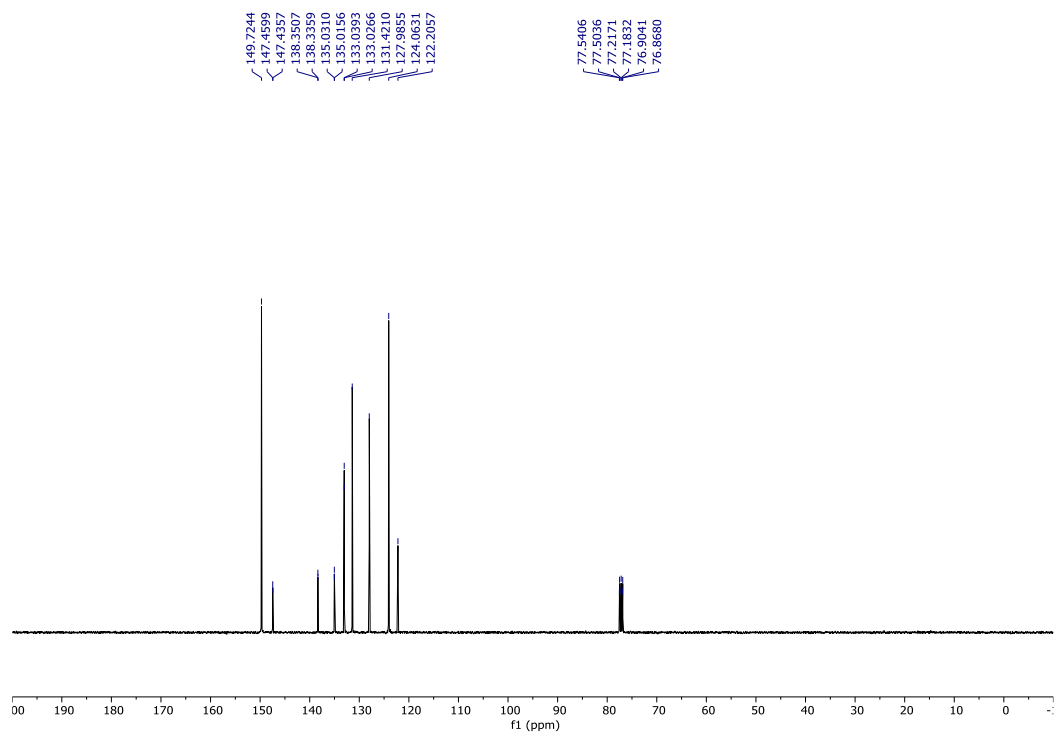
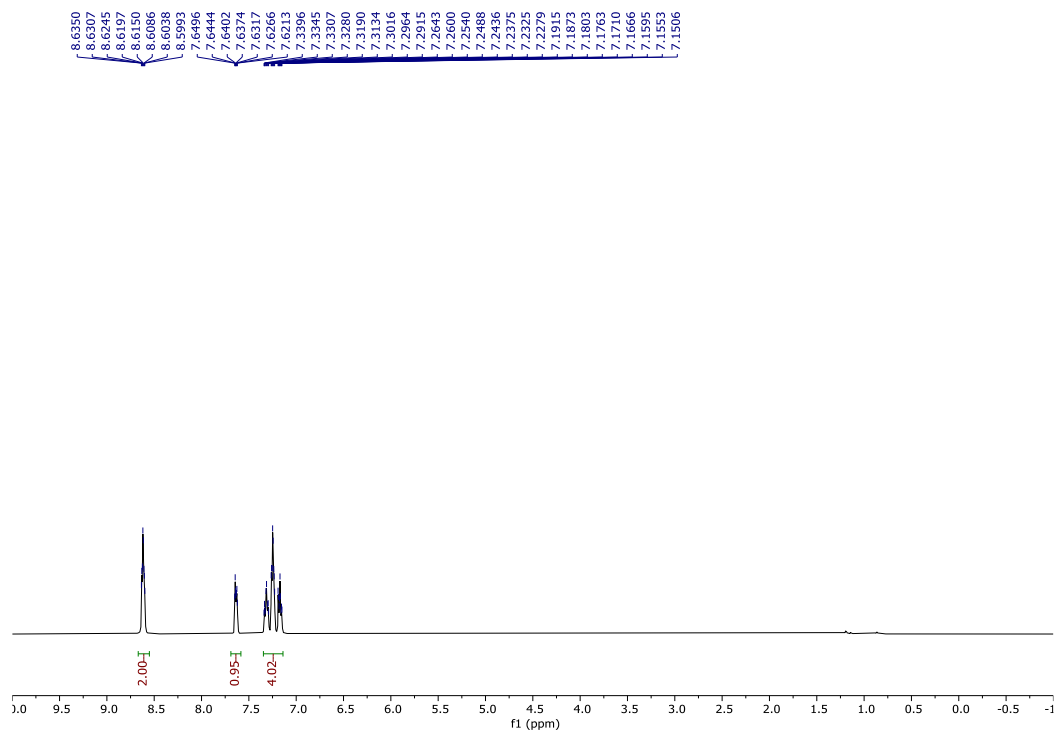
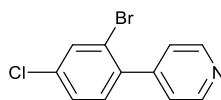
# 4-(2-Bromo-4-fluorophenyl)pyridine (1c)



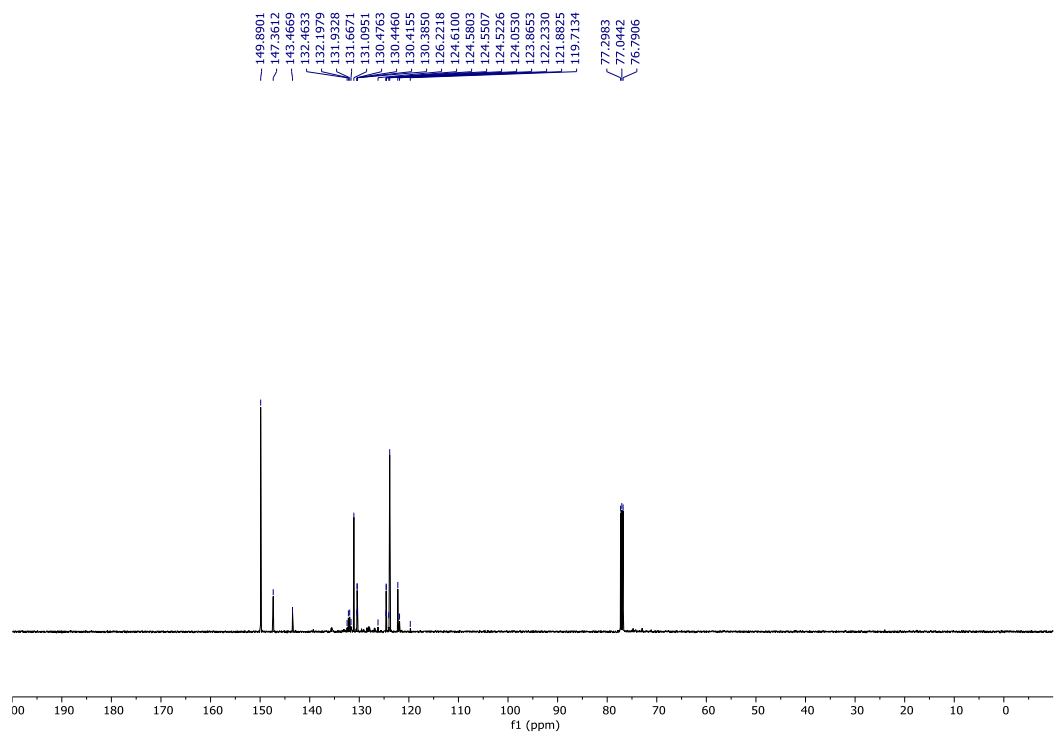
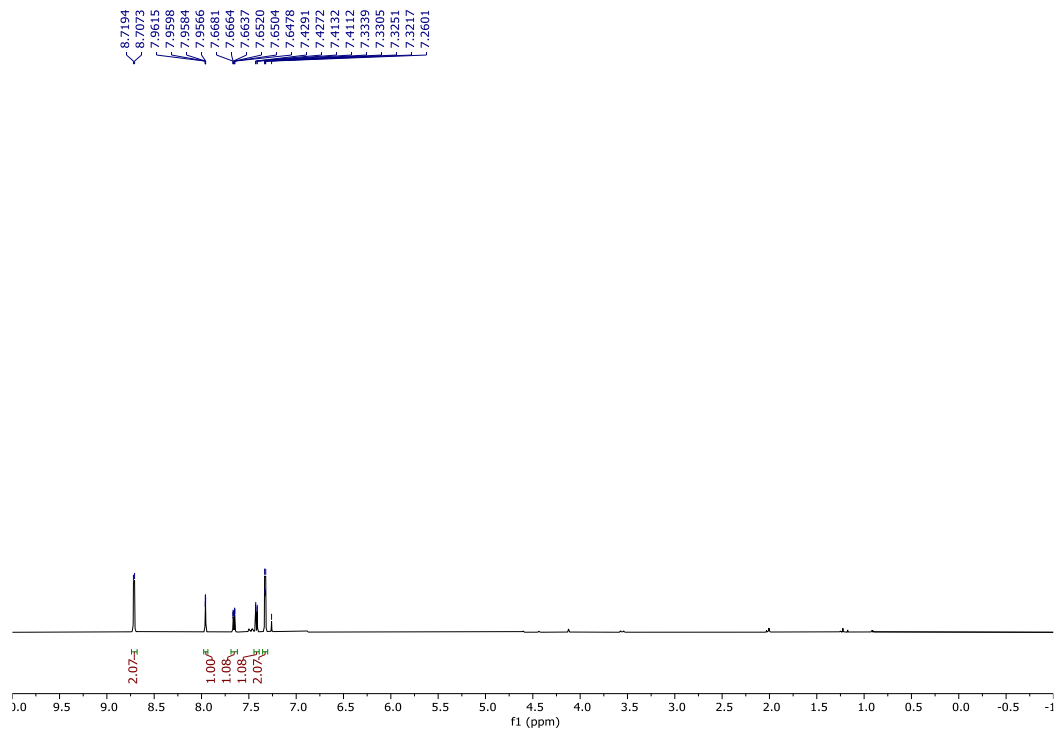
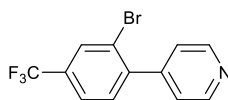


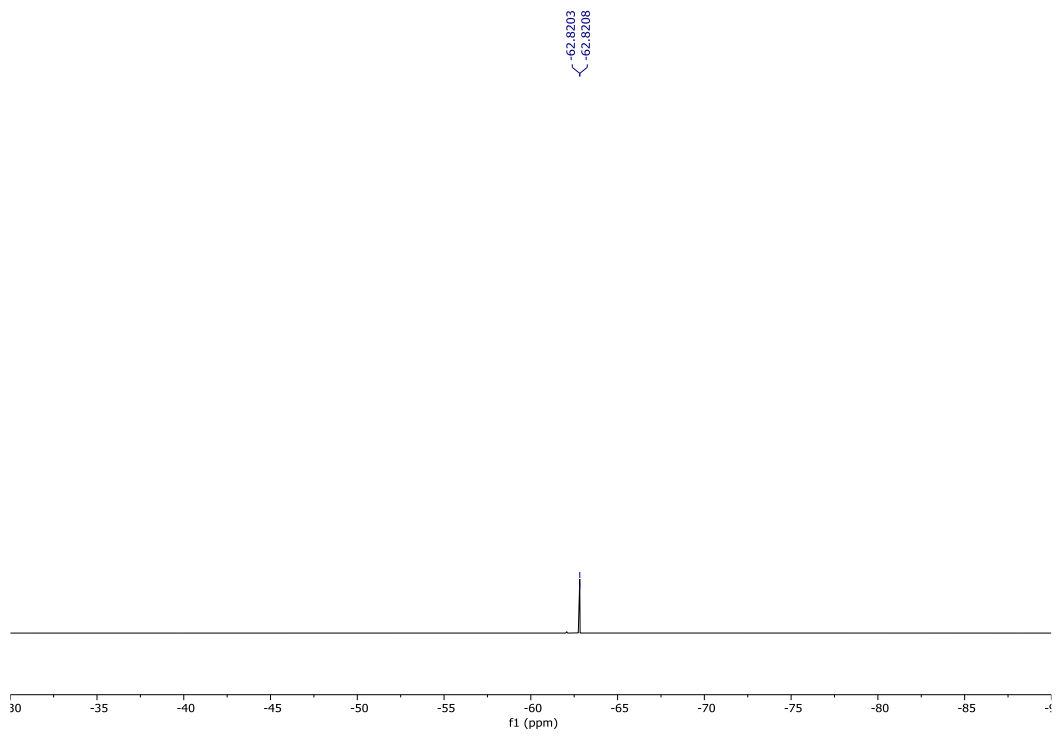


# 4-(2-Bromo-4-chlorophenyl)pyridine (1d)

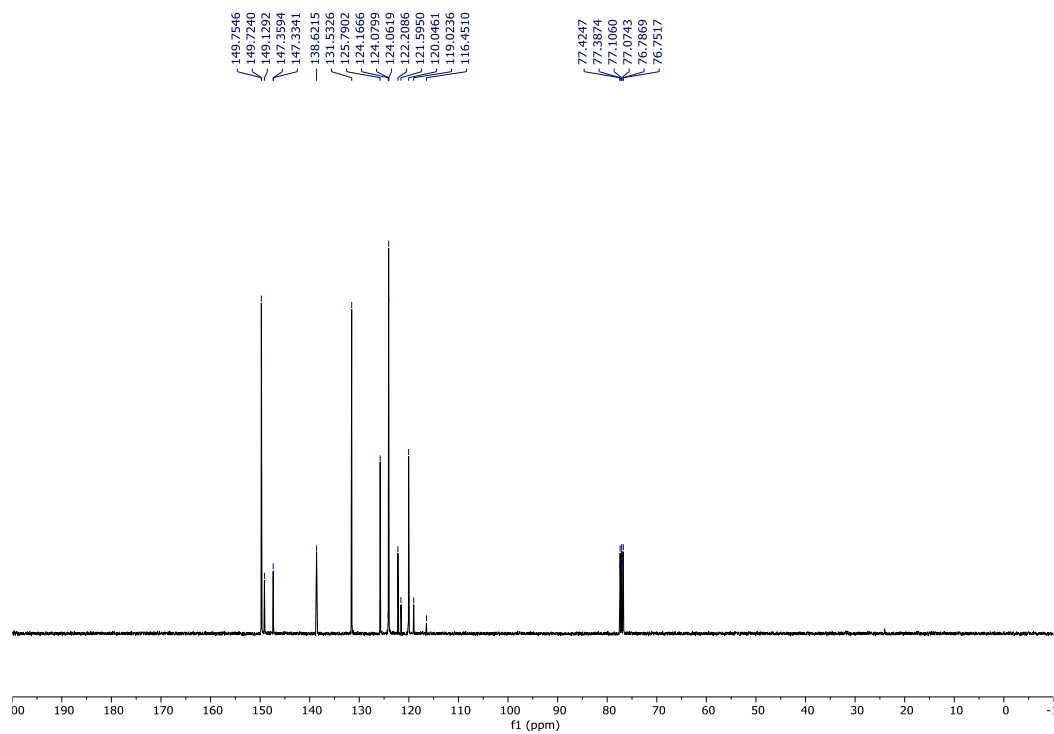
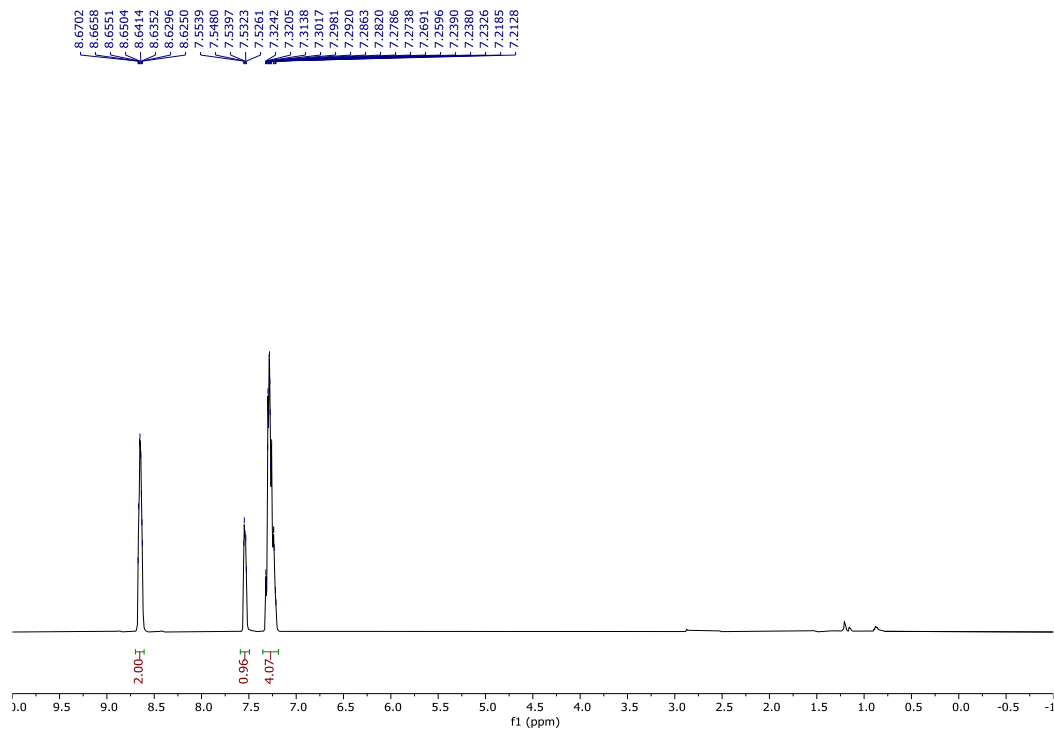
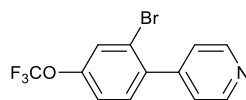


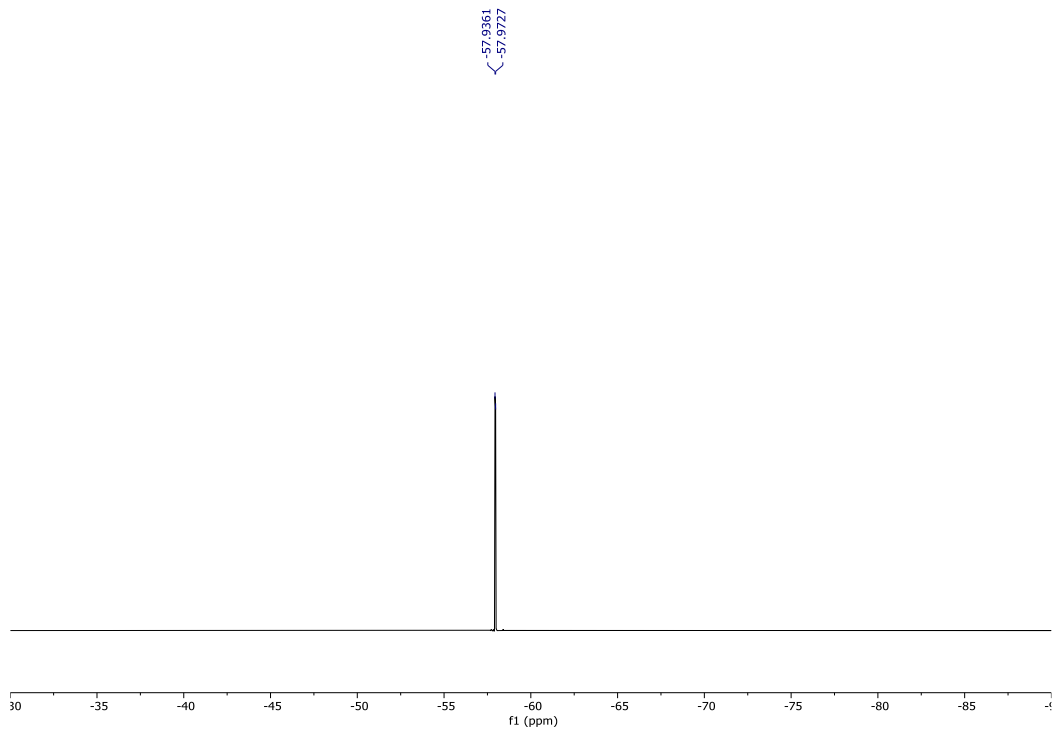
# 4-(2-Bromo-4-(trifluoromethyl)phenyl)pyridine (1e)



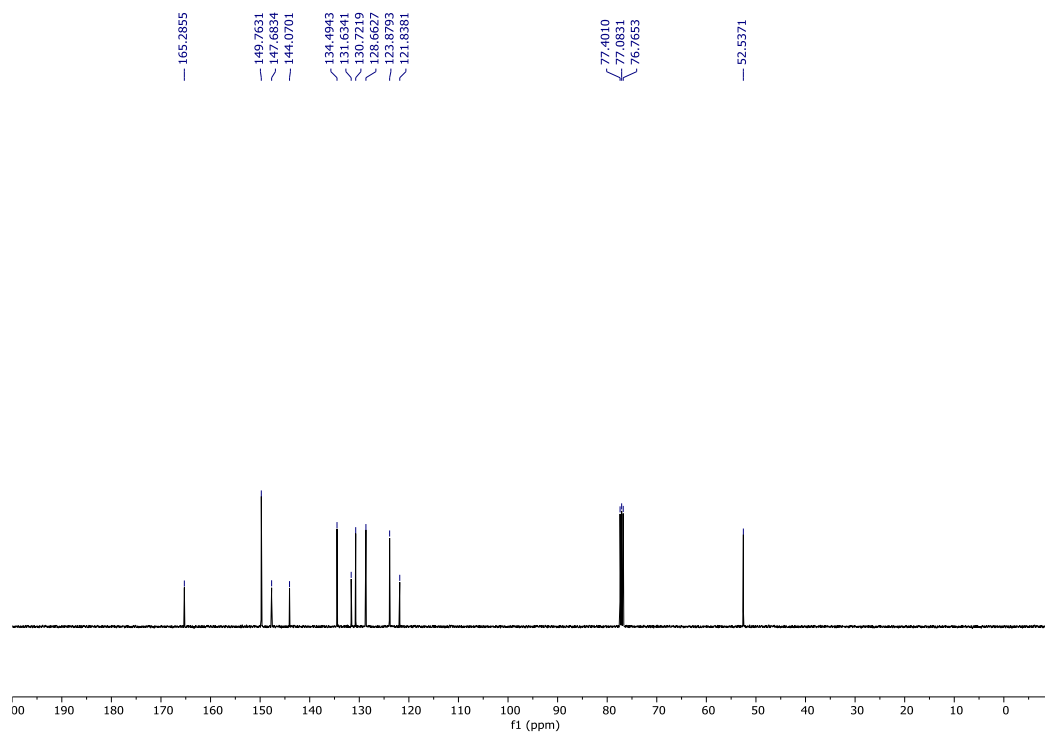
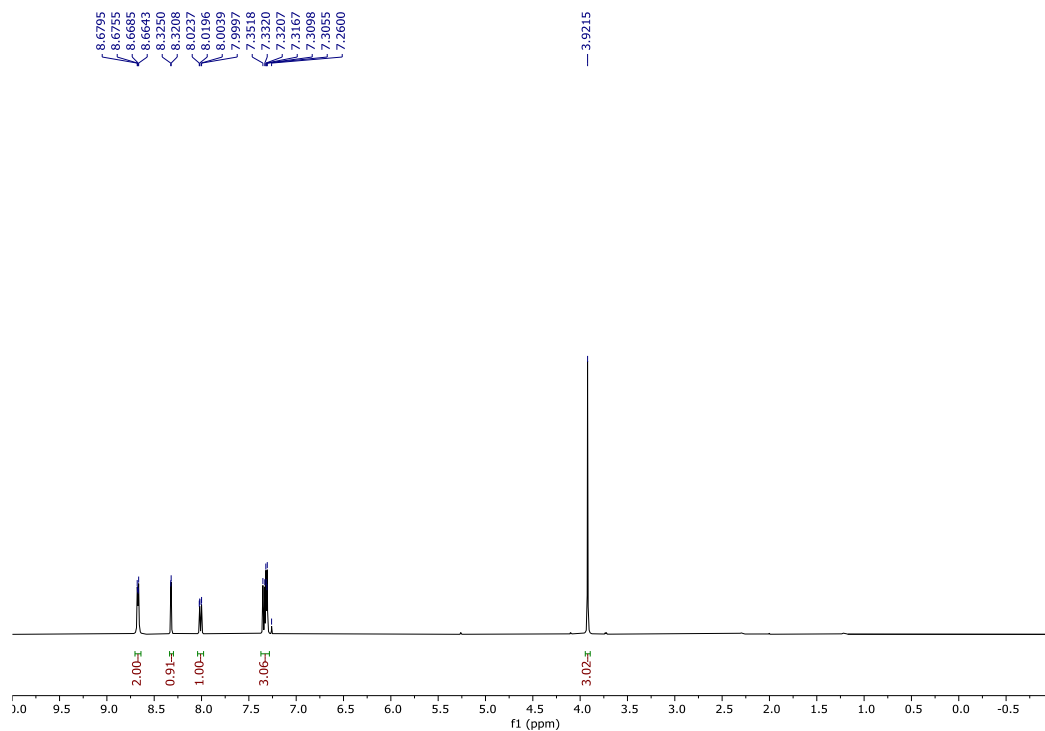
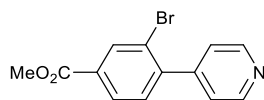


# 4-(2-Bromo-4-(trifluoromethoxy)phenyl)pyridine (1f)

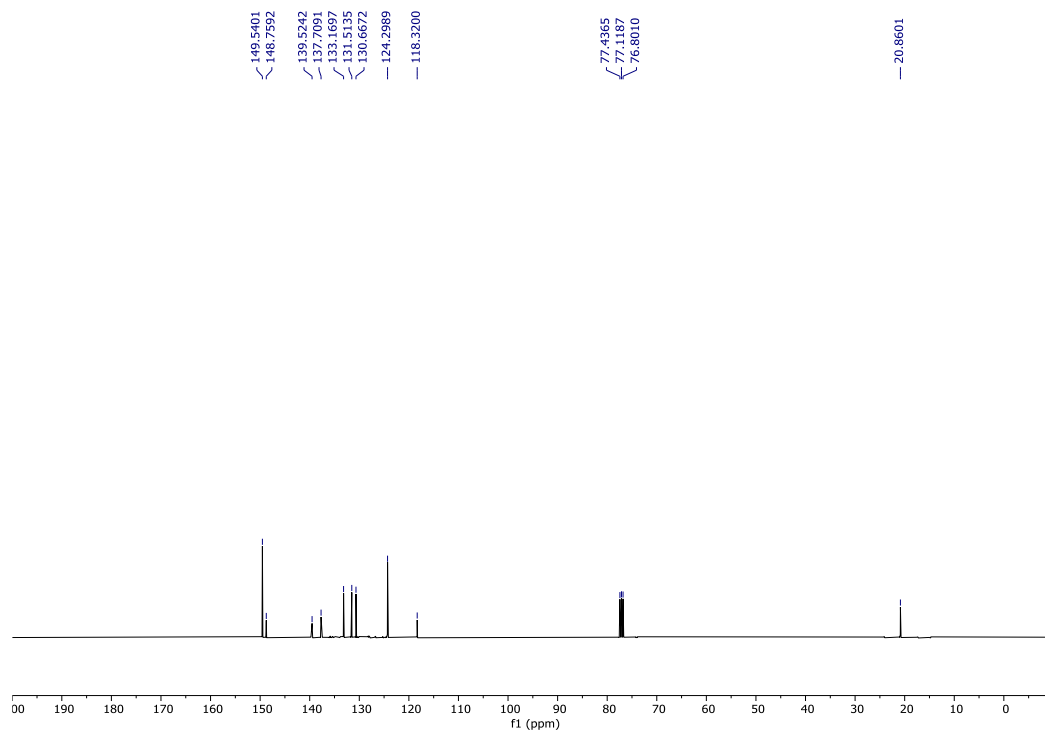
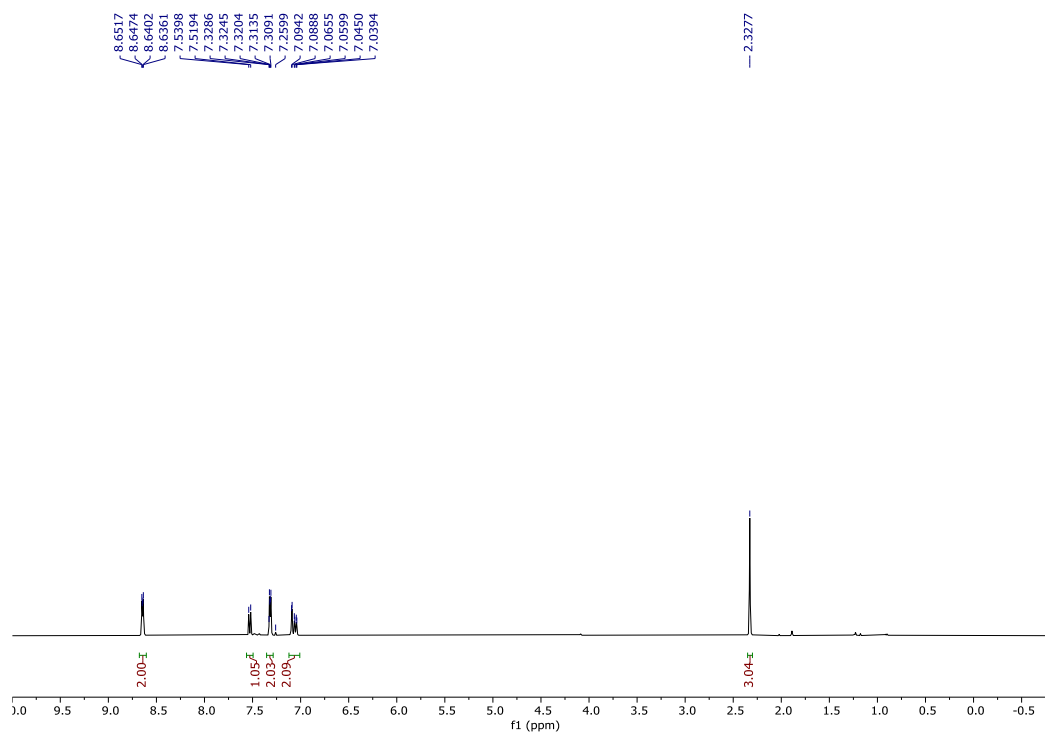
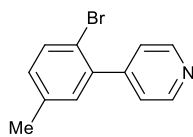




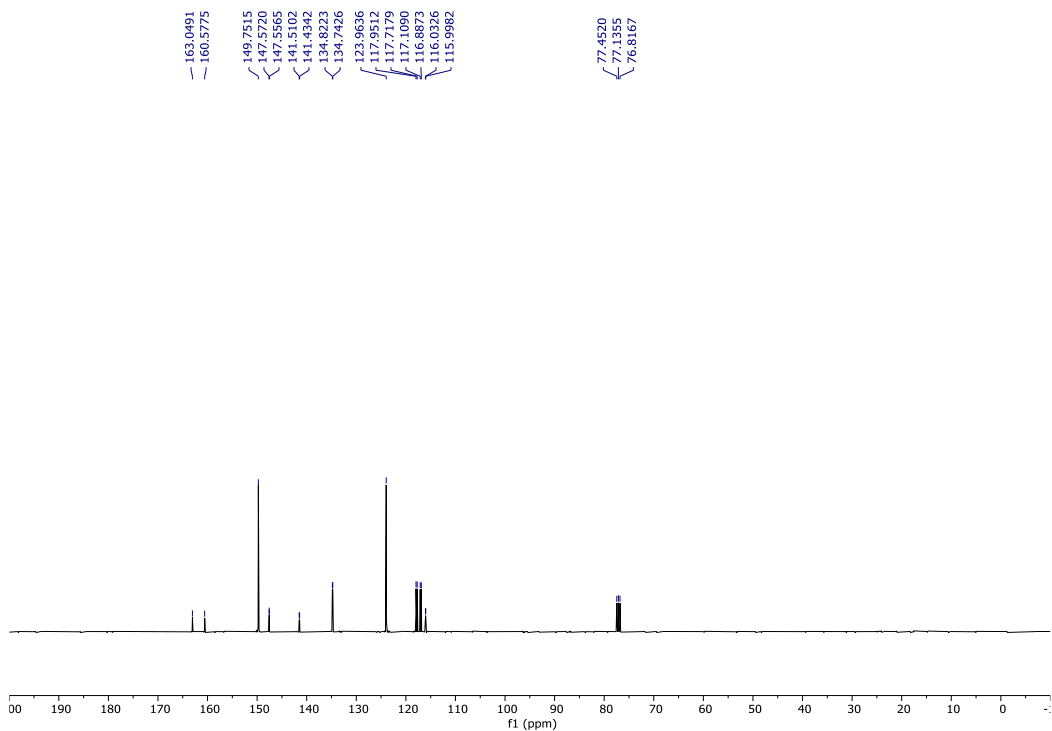
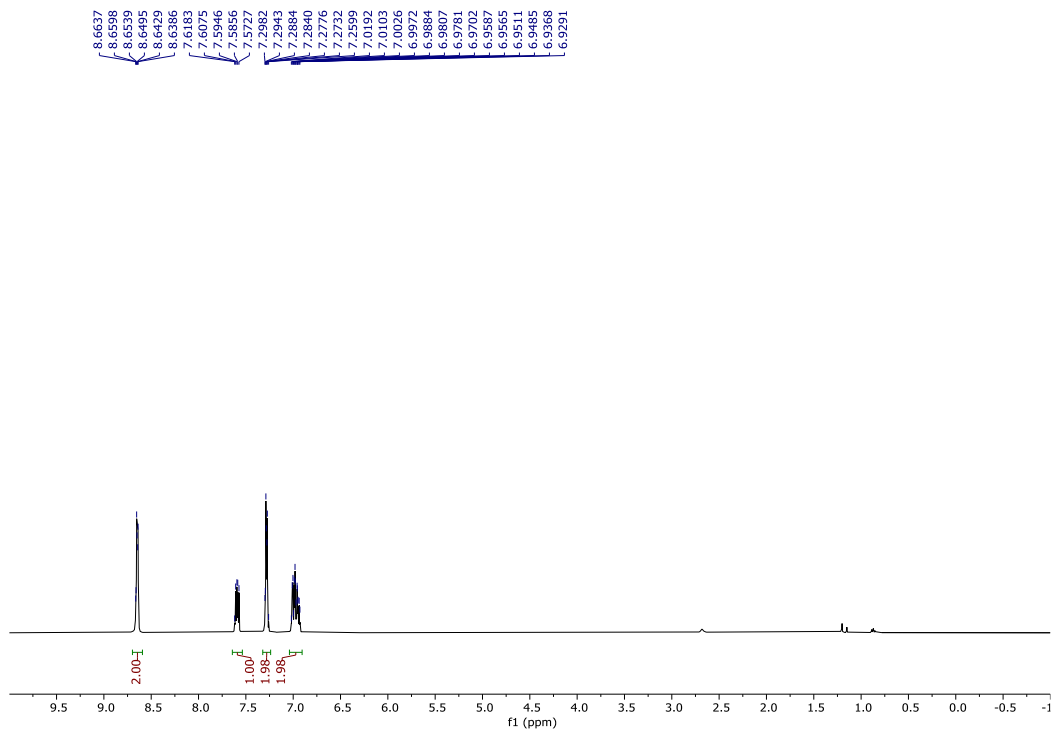
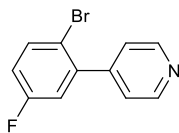
# Methyl 3-bromo-4-(pyridin-4-yl)benzoate (1g)



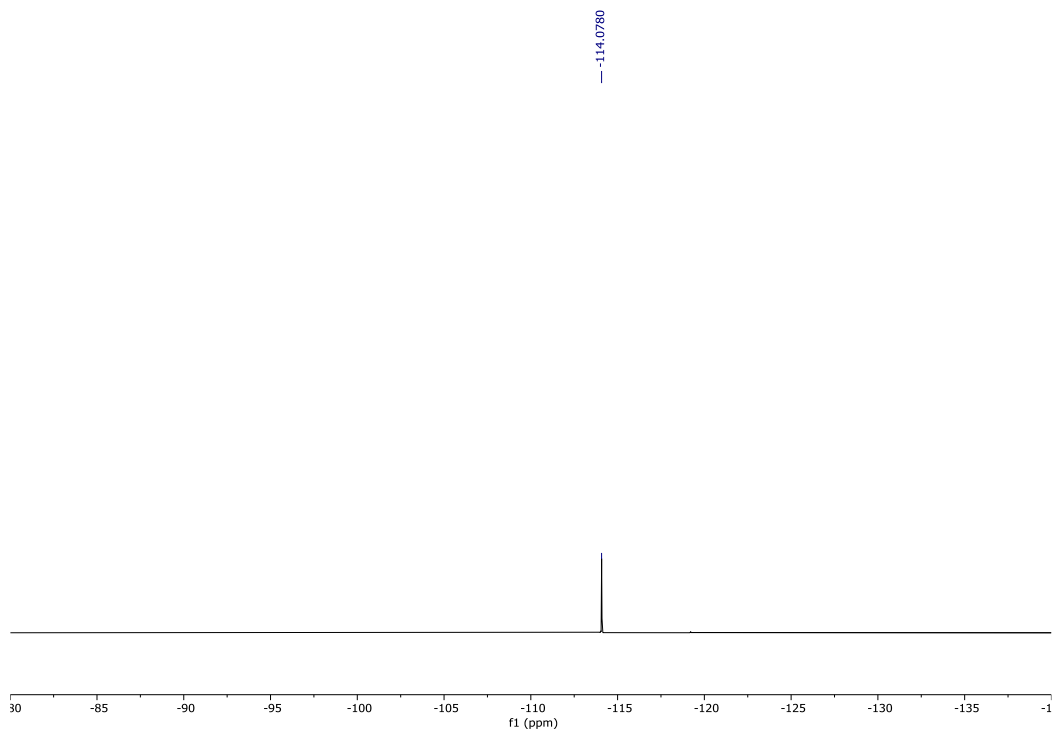
# 4-(2-Bromo-5-methylphenyl)pyridine (1h)



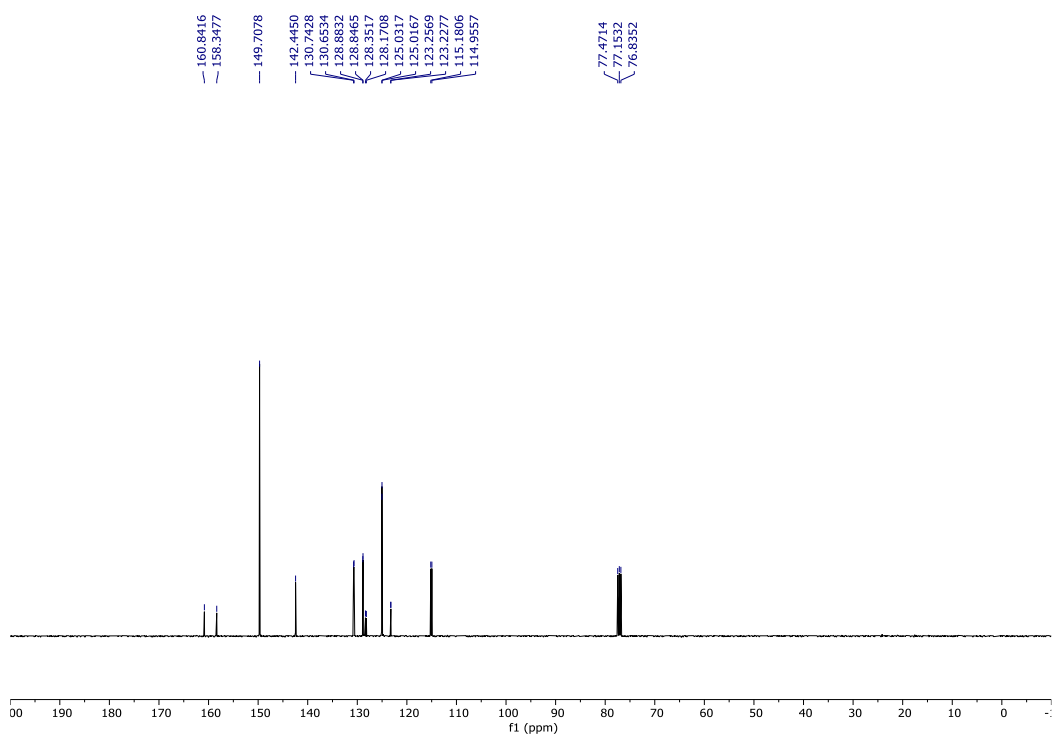
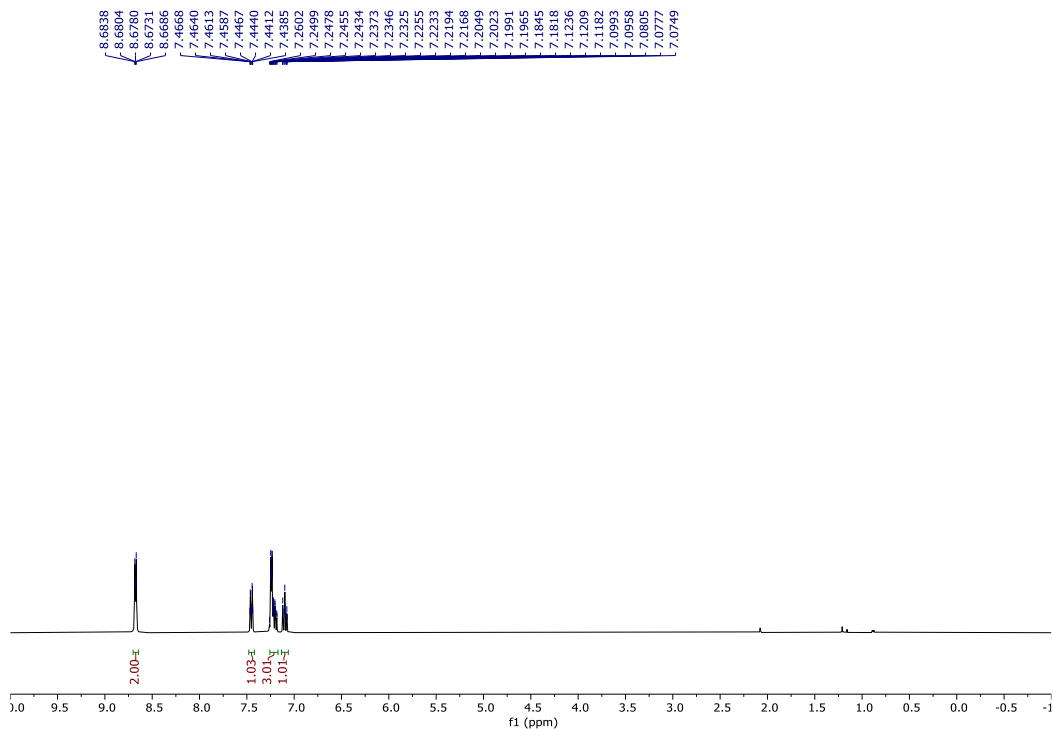
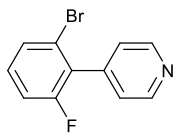
# 4-(2-Bromo-5-fluorophenyl)pyridine (1i)

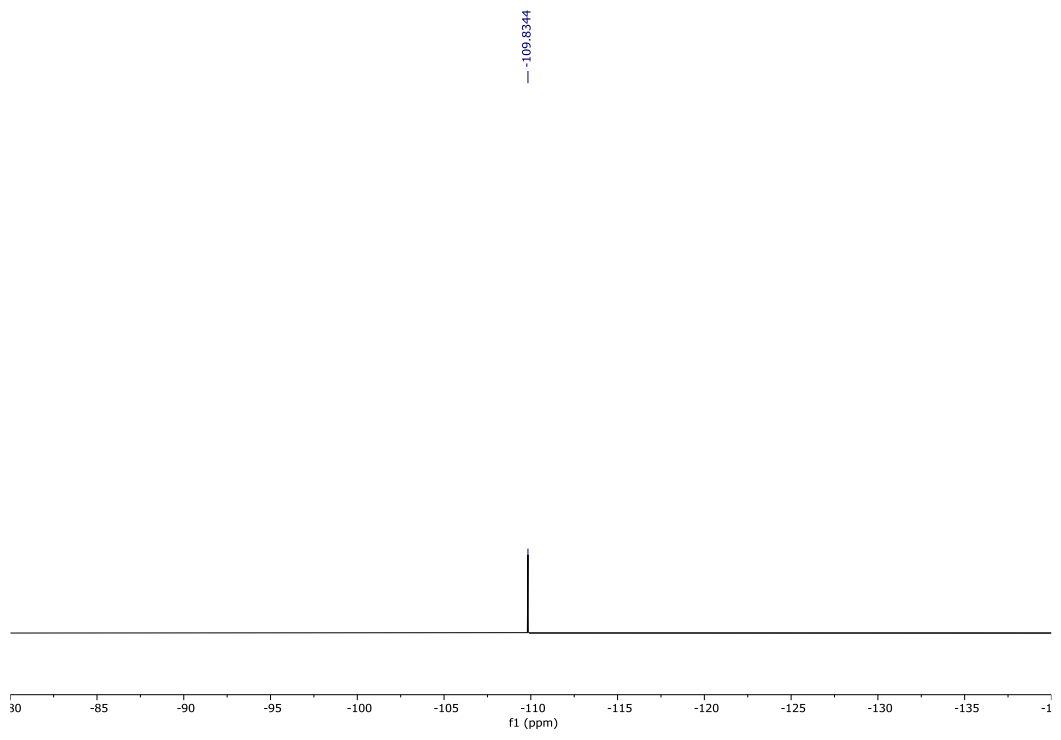




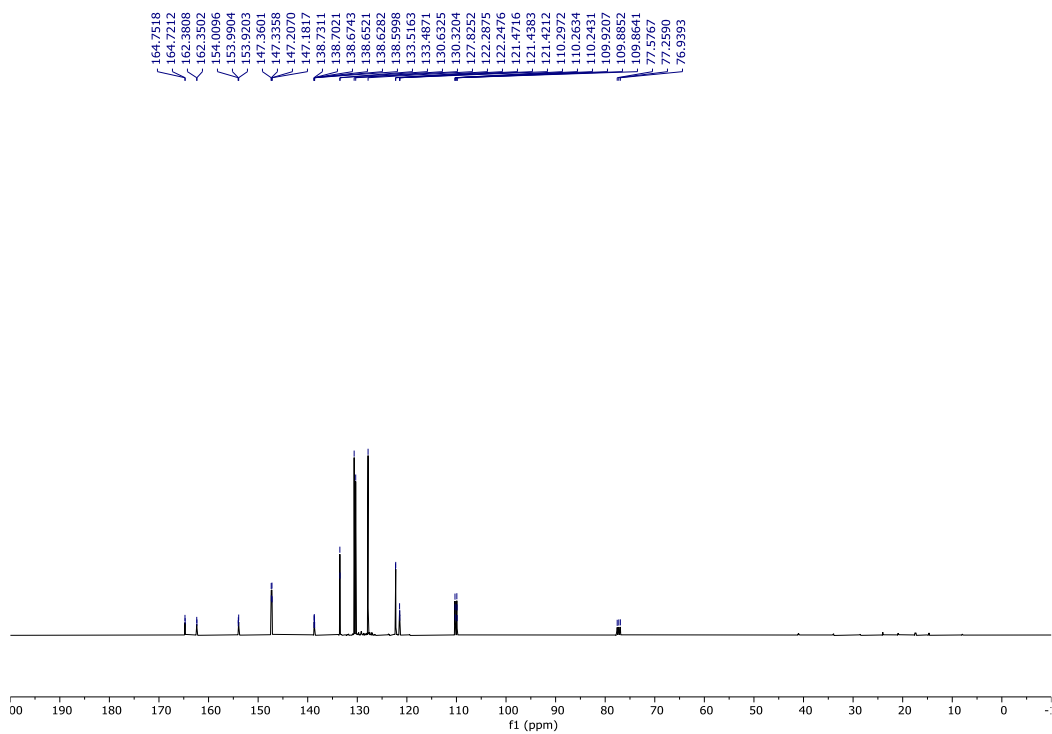
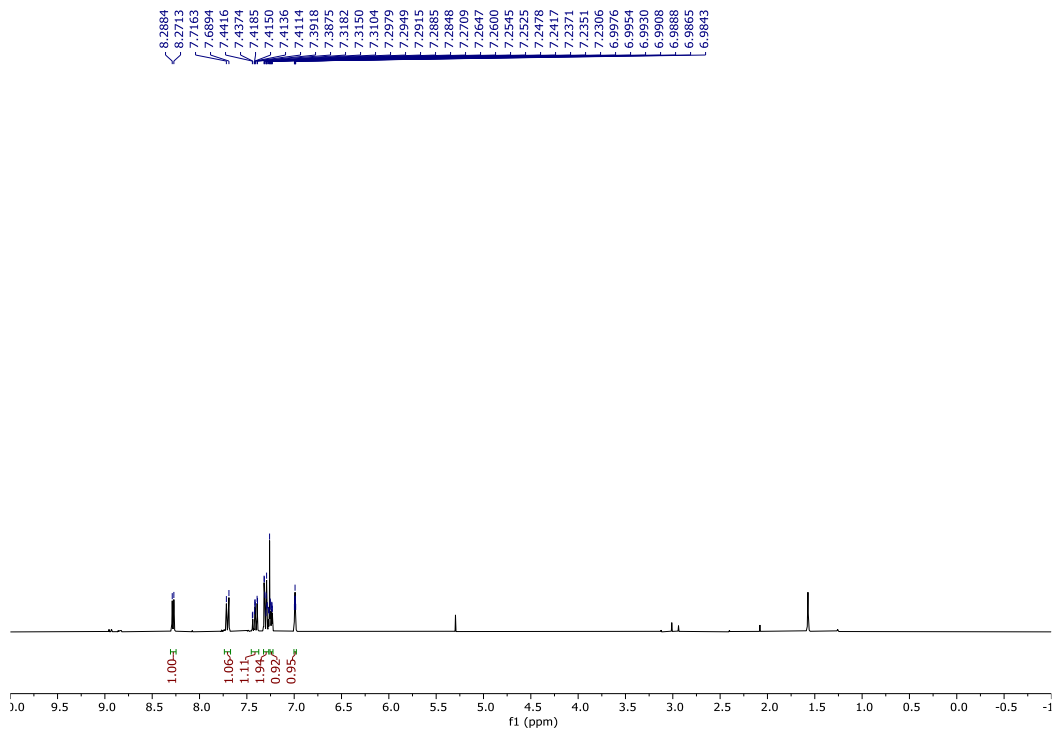
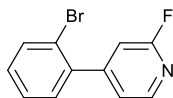


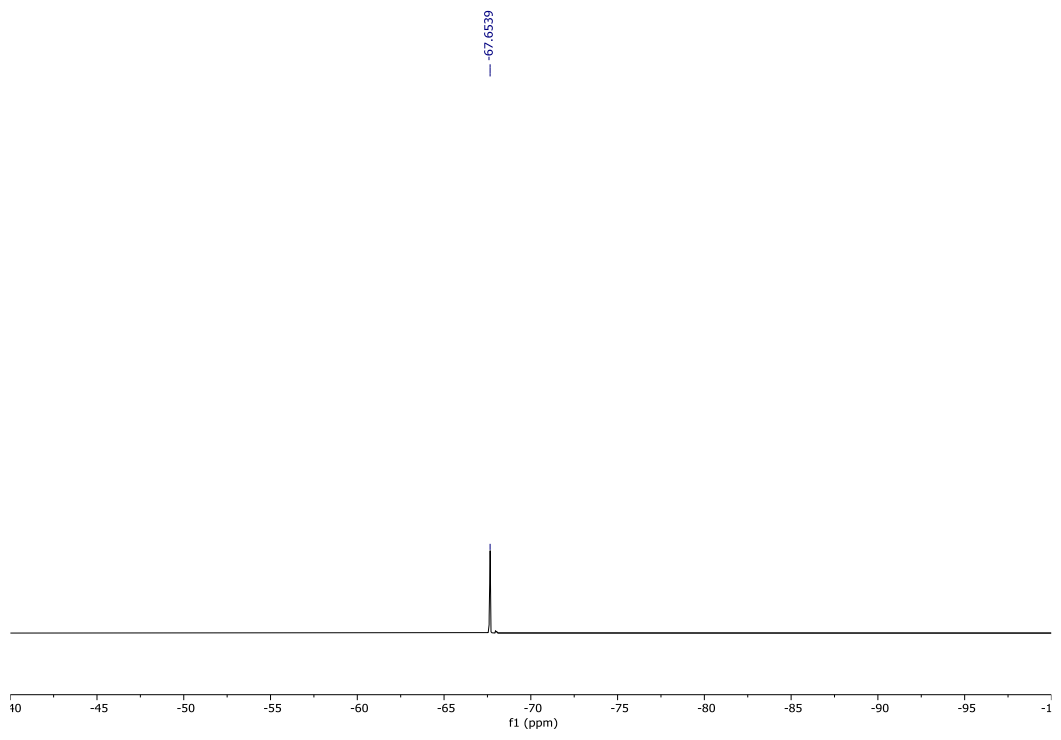
# 4-(2-Bromo-6-fluorophenyl)pyridine (1j)



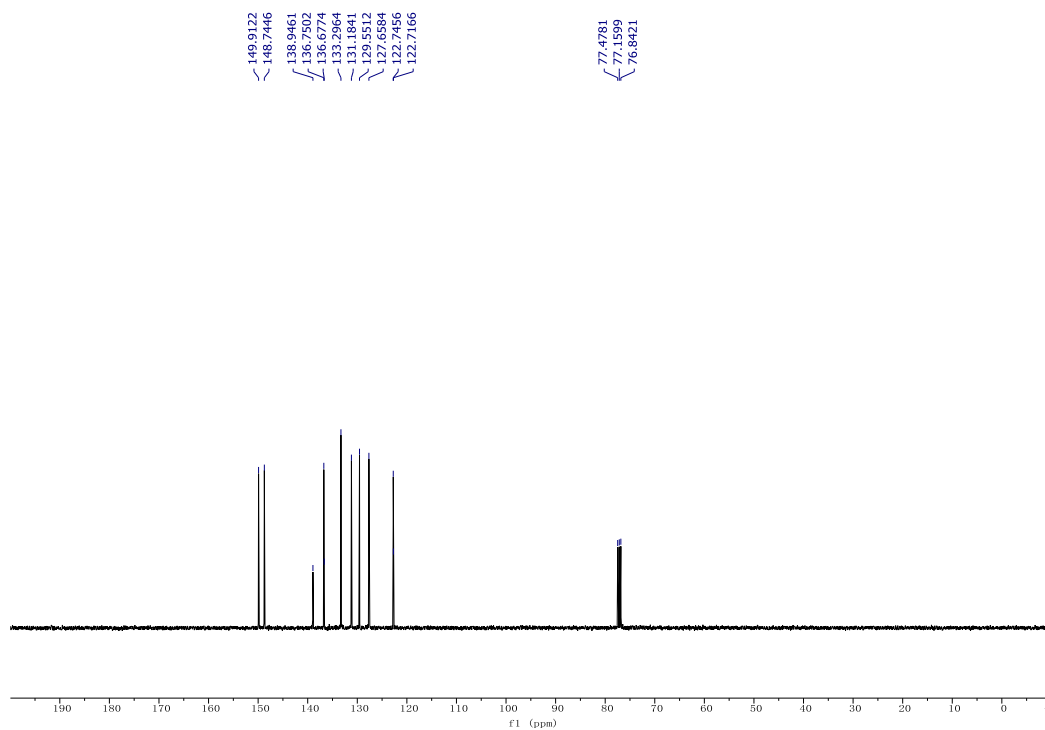
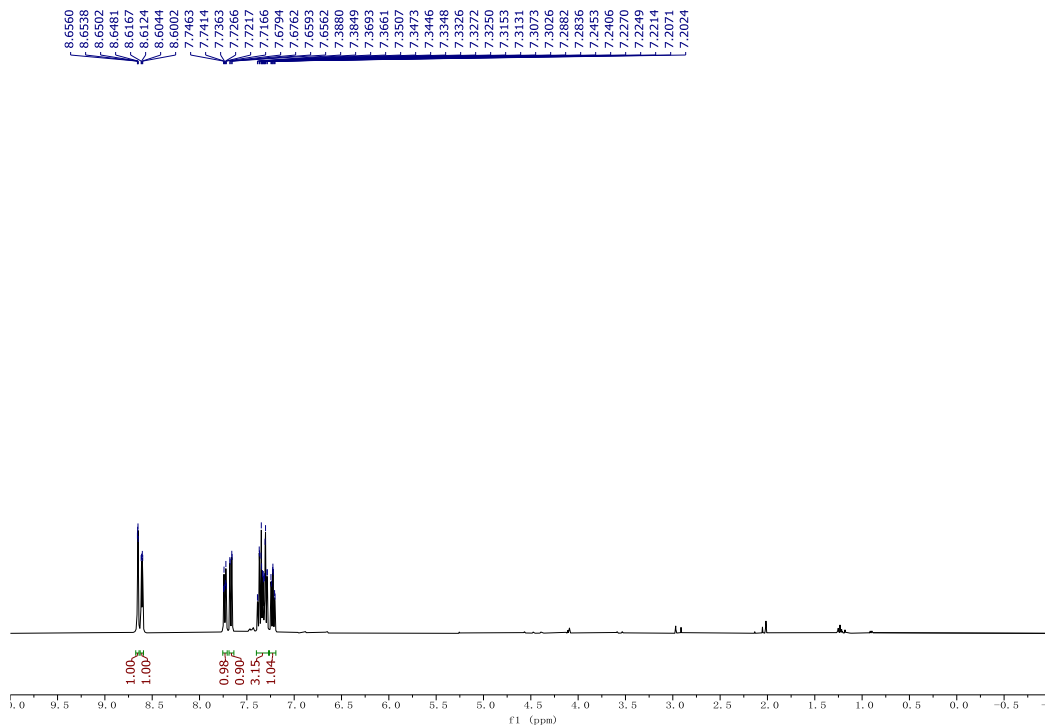
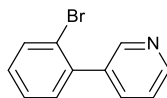


# 4-(2-Bromophenyl)-2-fluoropyridine (1k)

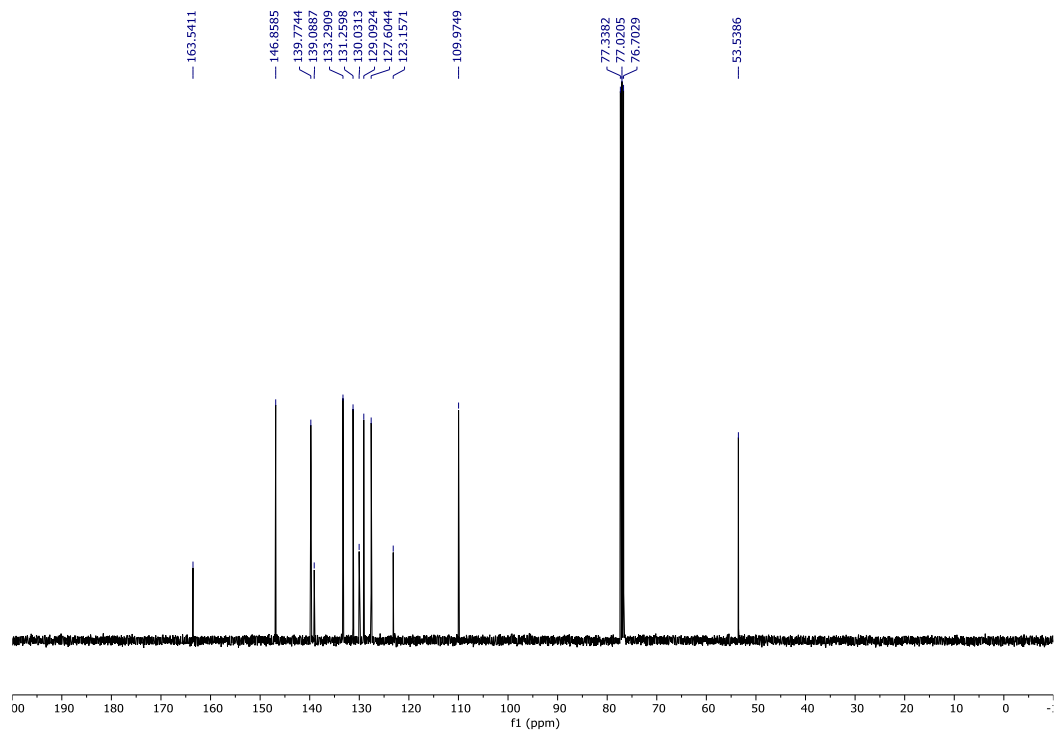
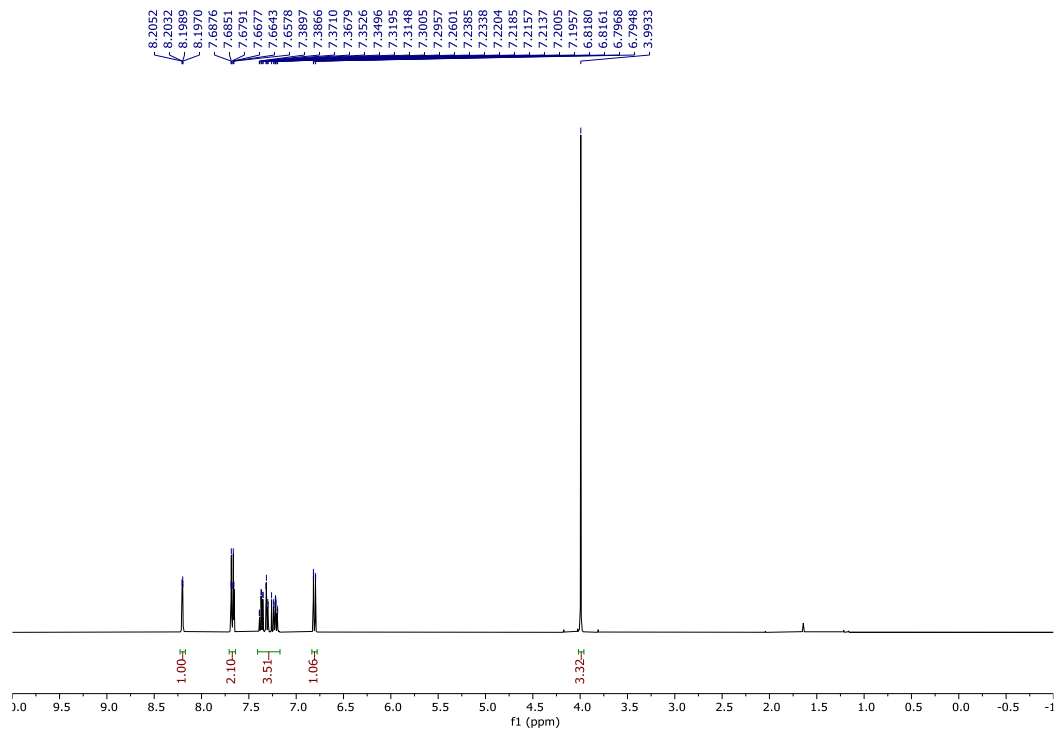
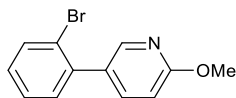




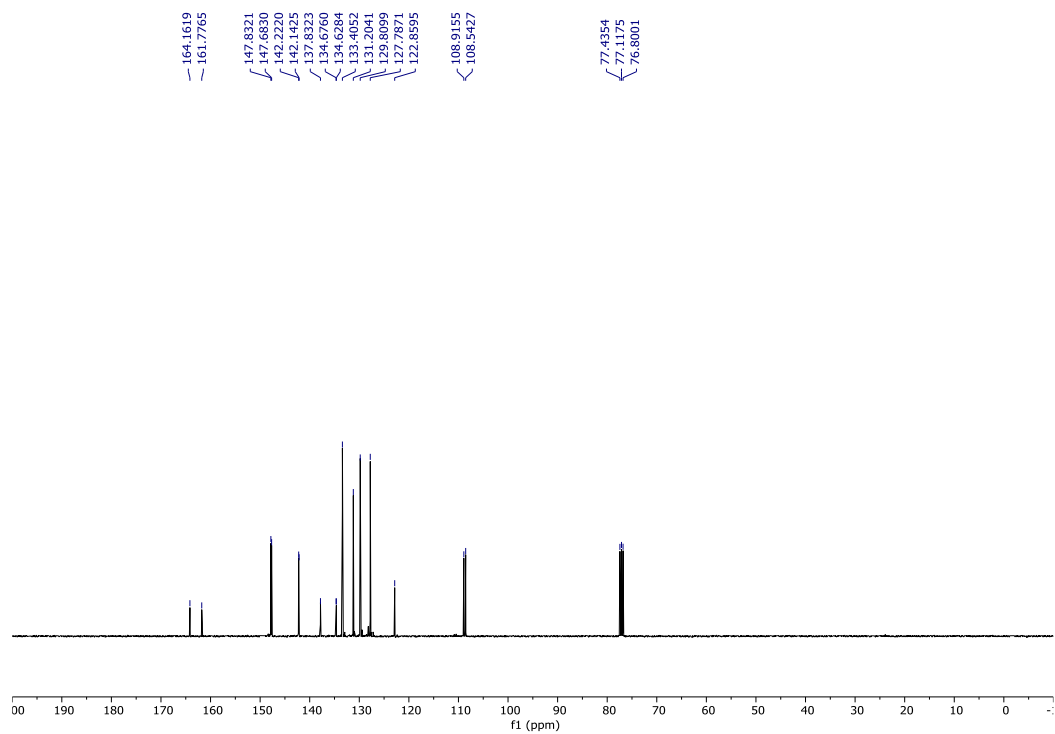
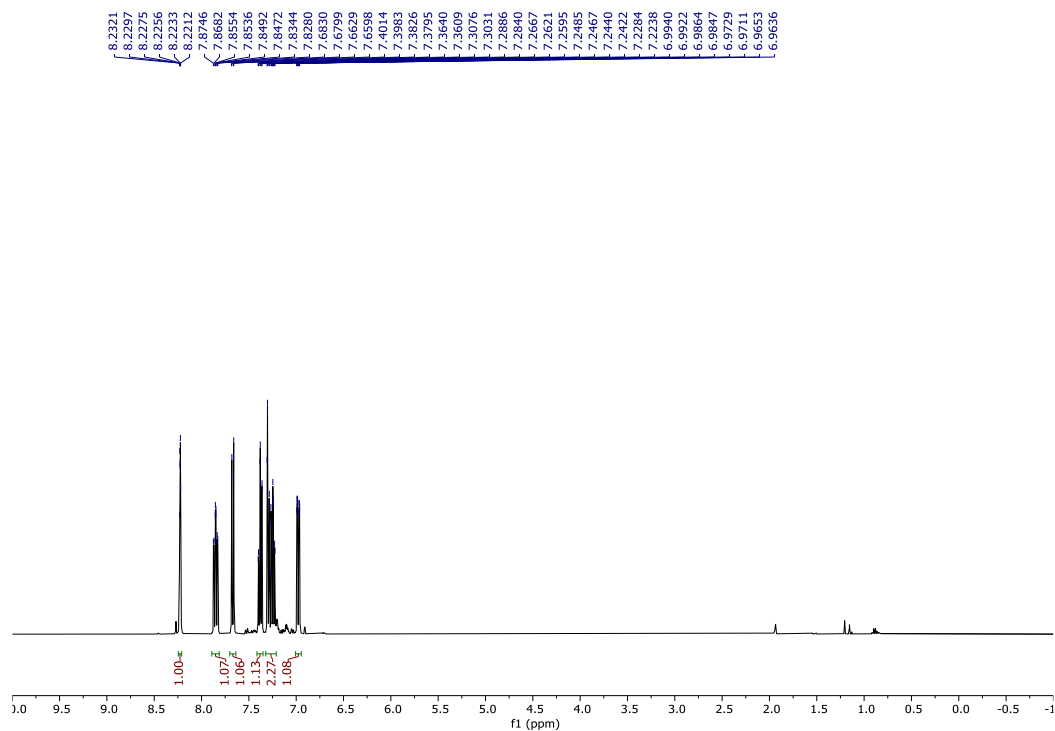
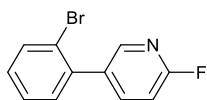
# 3-(2-Bromophenyl)pyridine (11)



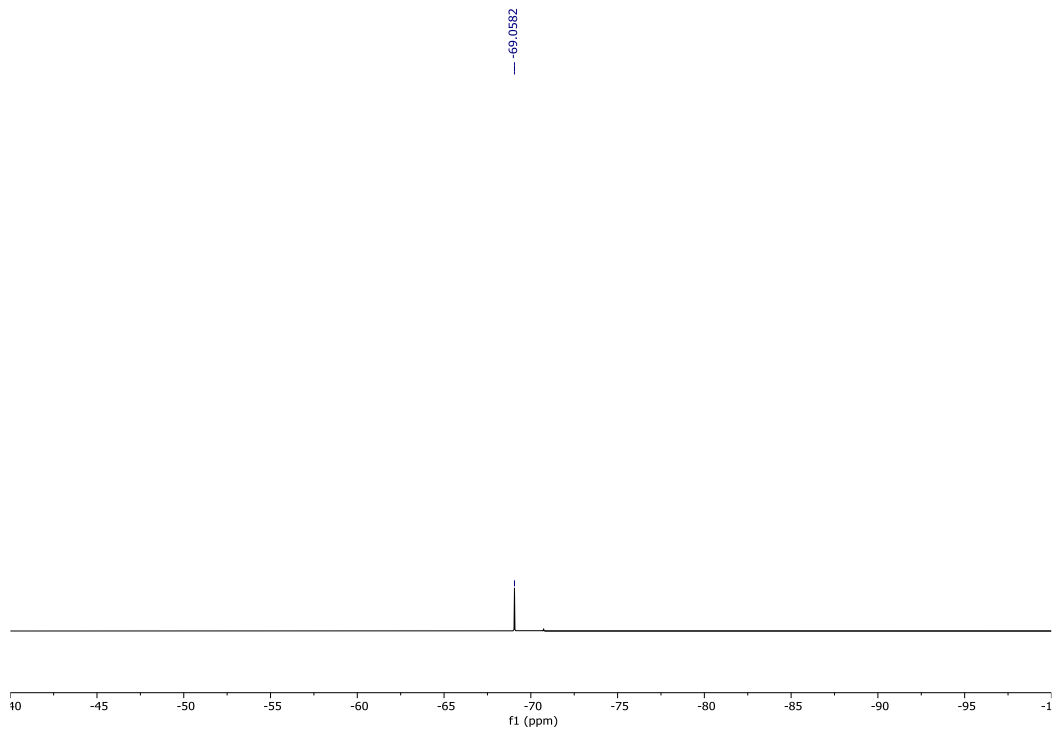
# 5-(2-Bromophenyl)-2-methoxypyridine (1m)



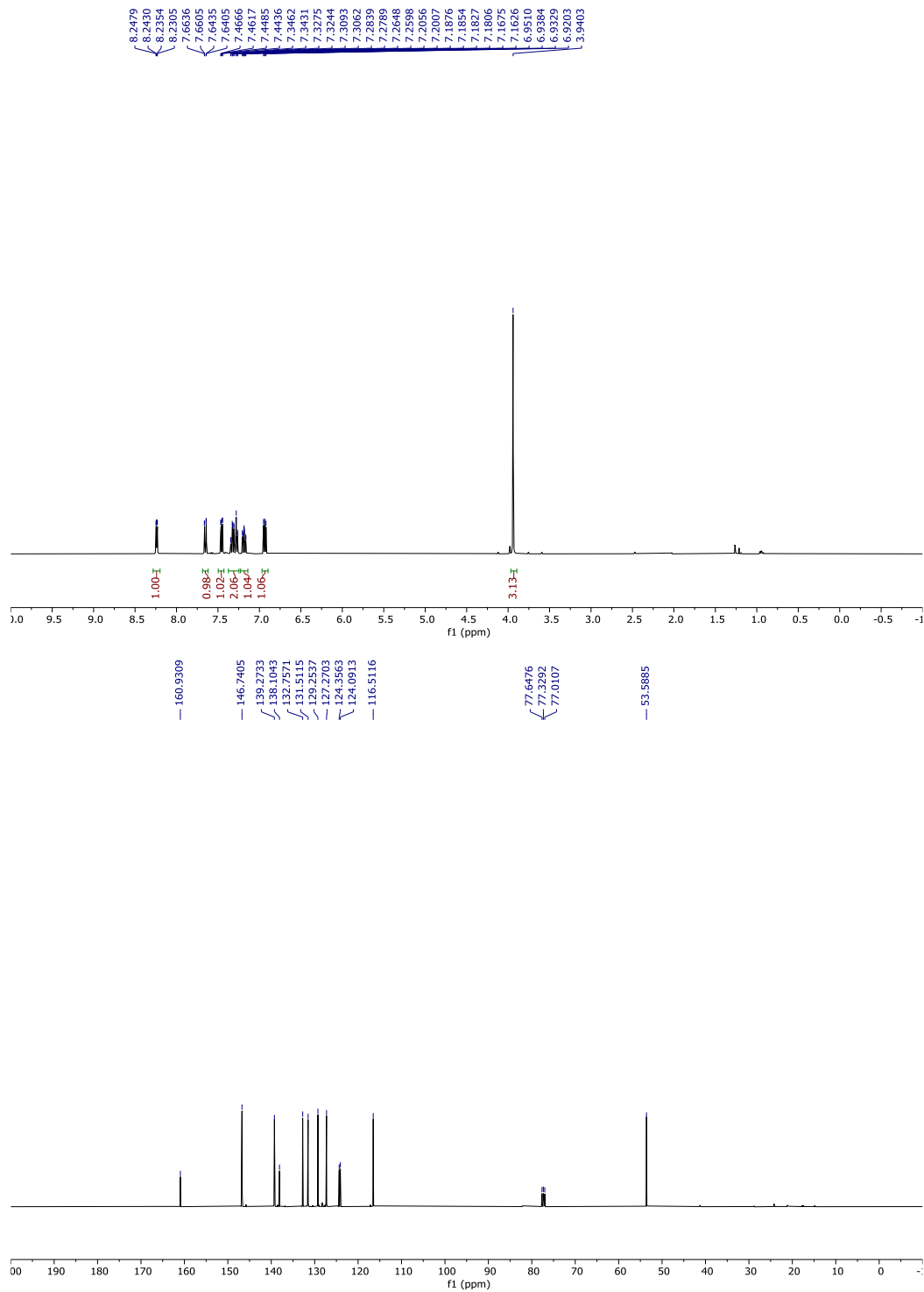
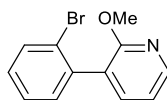
# 5-(2-Bromophenyl)-2-fluoropyridine (1n)



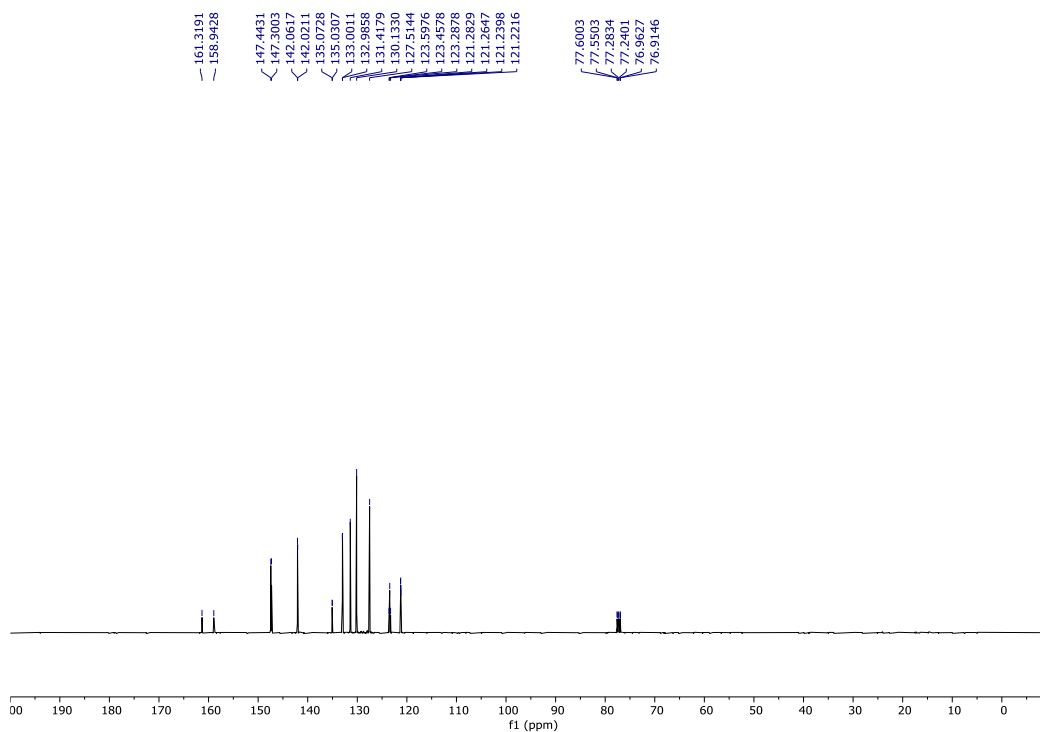
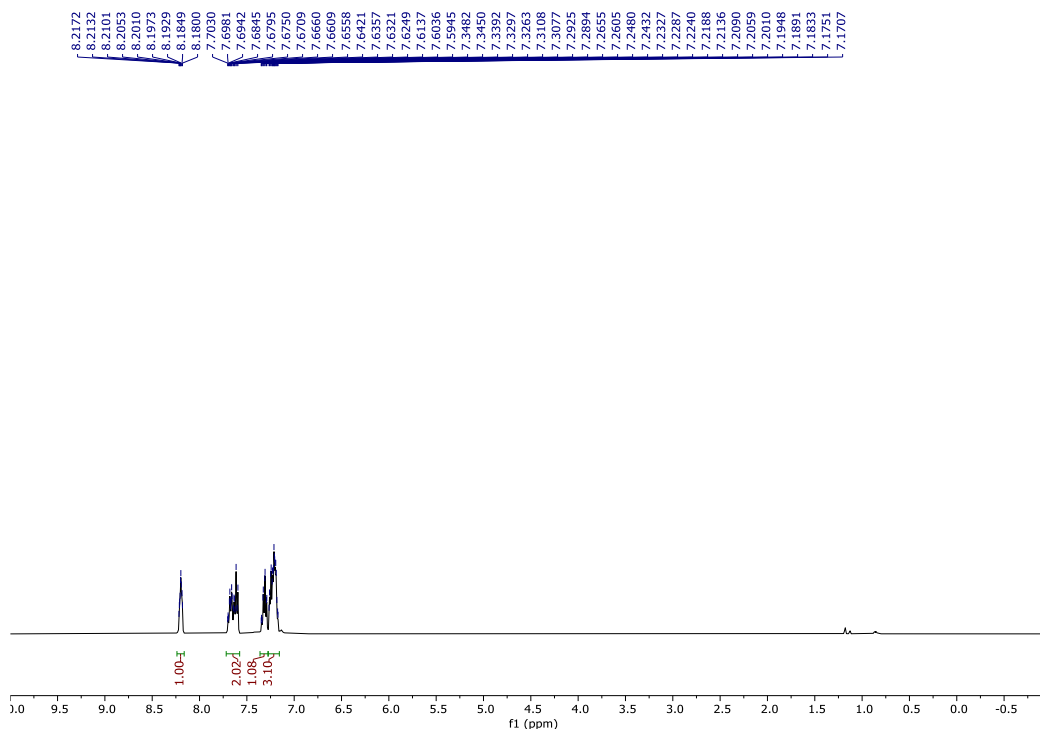
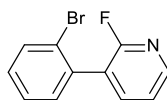


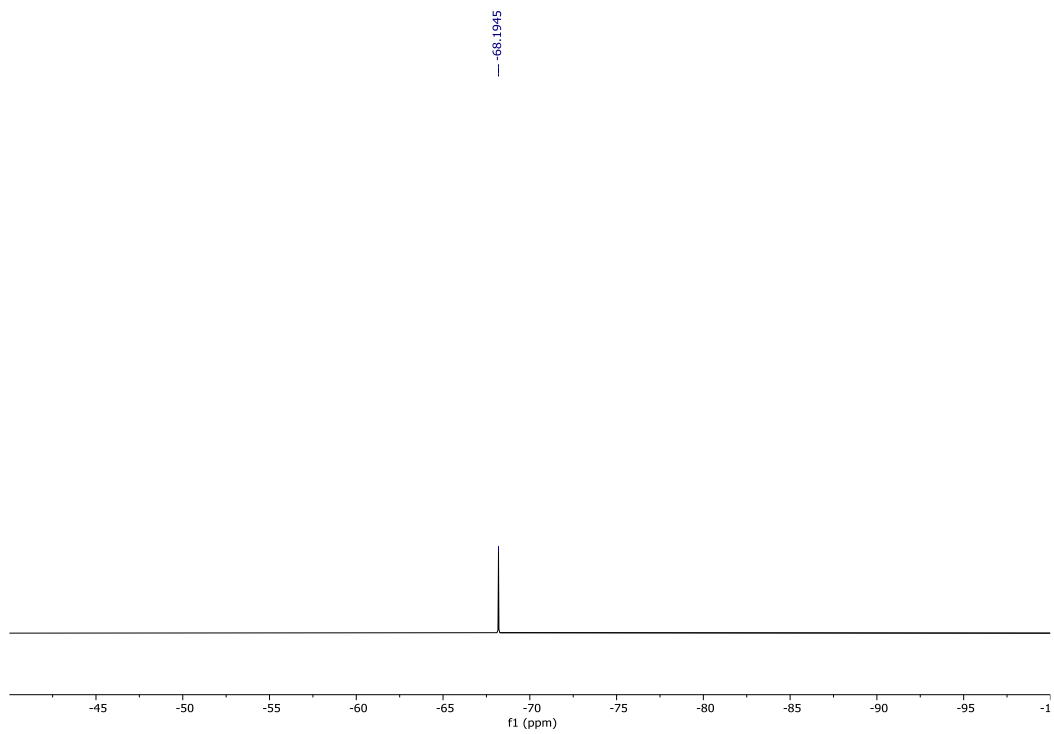


### 3-(2-Bromophenyl)-2-methoxypyridine (1o)

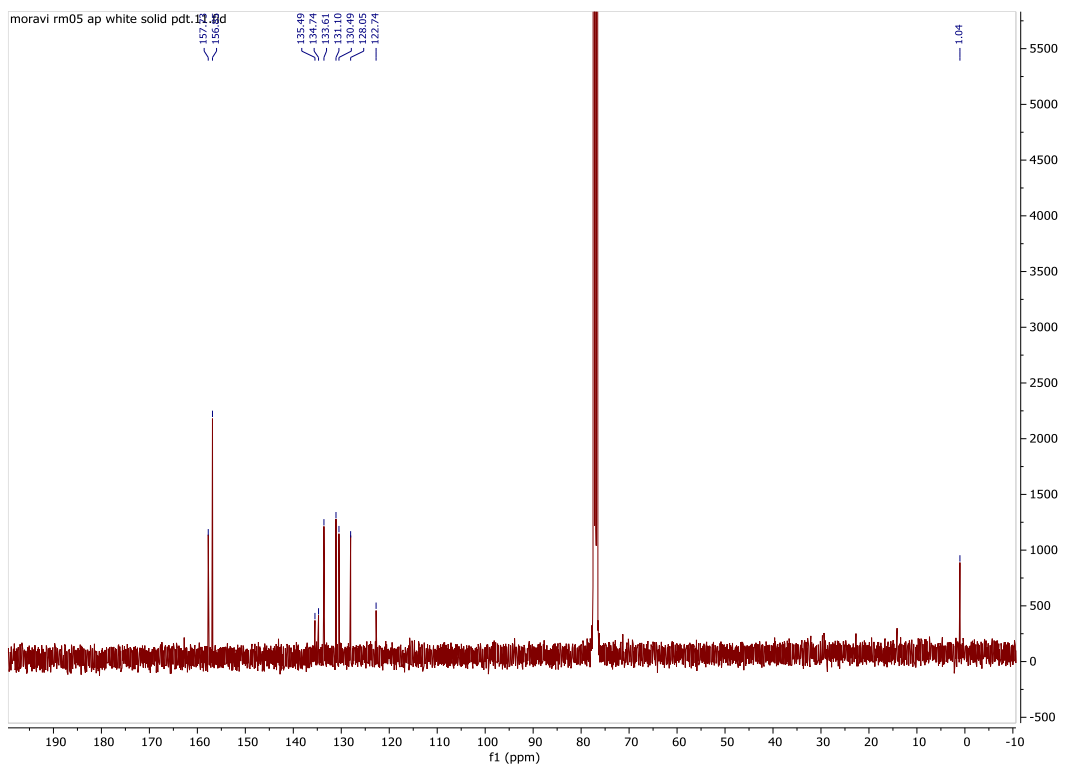
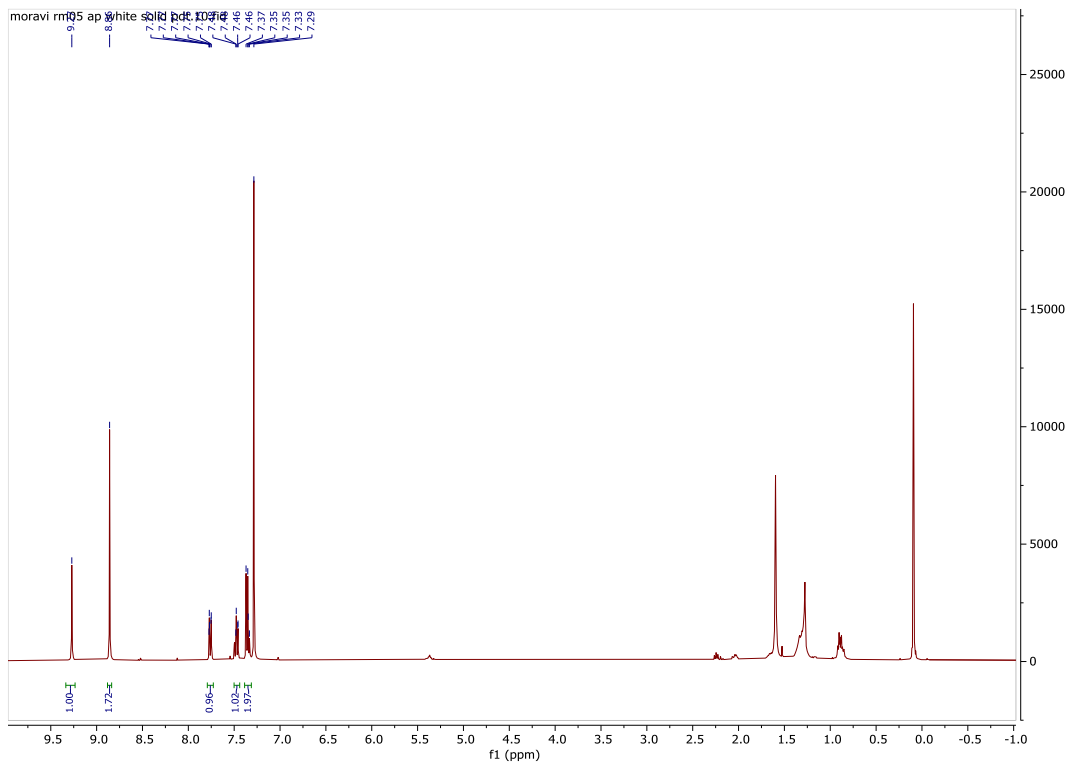


### 3-(2-Bromophenyl)-2-fluoropyridine (1p)



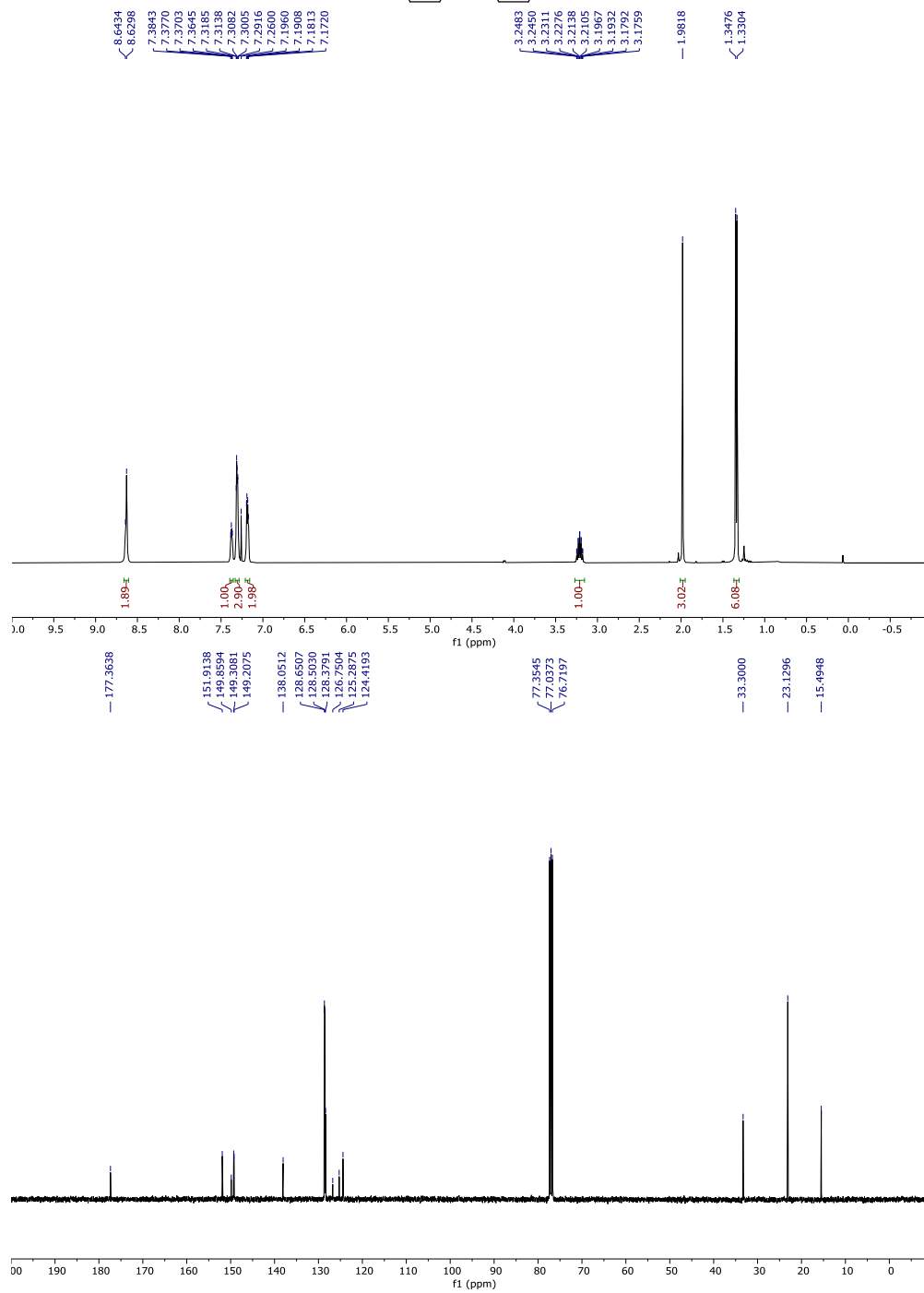
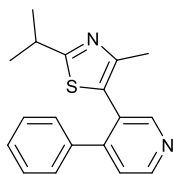


# 5-(2-Bromophenyl)pyrimidine (1q)

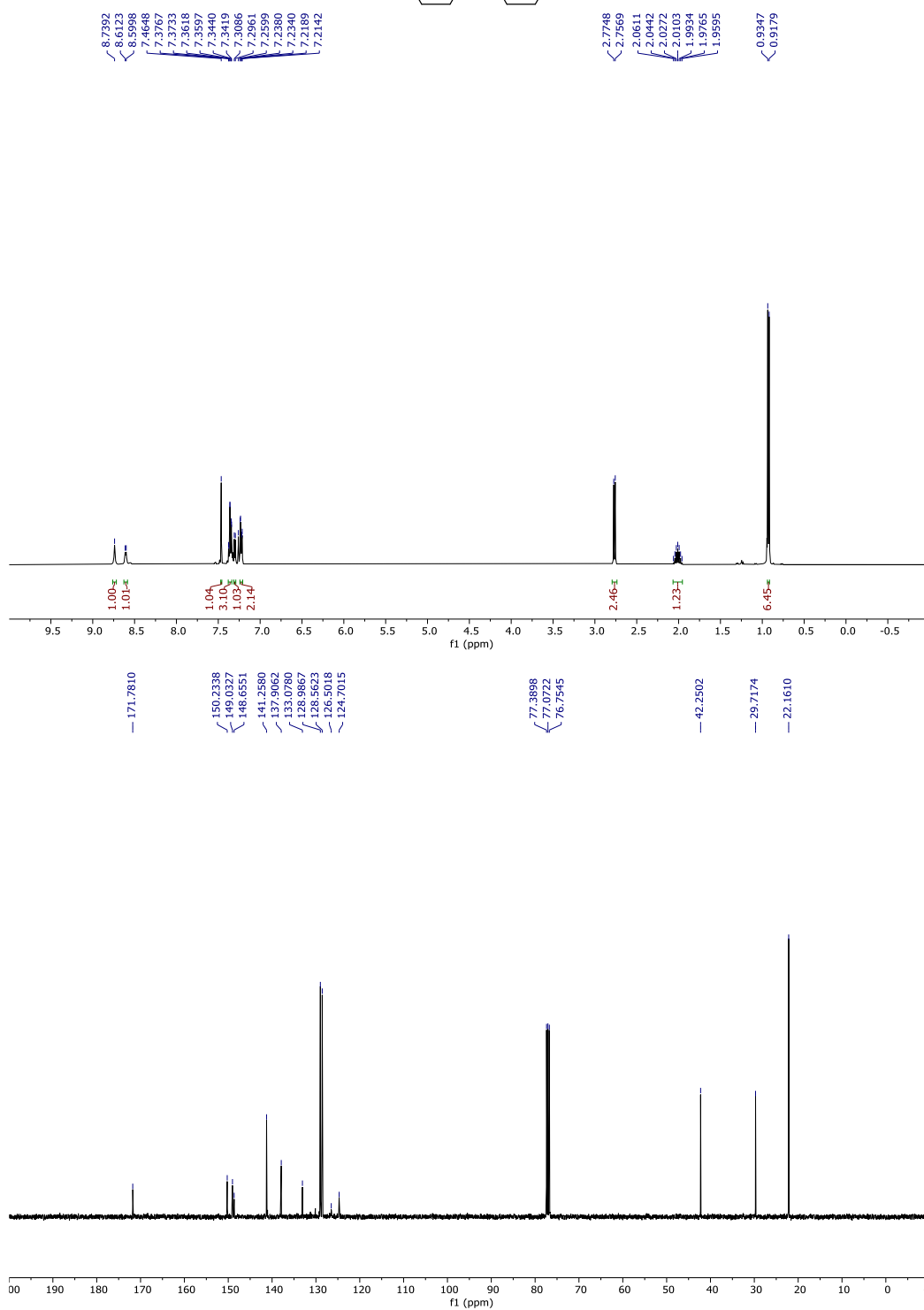
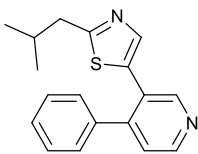


# Arylated 4-arylpiperidines 2a-35a:

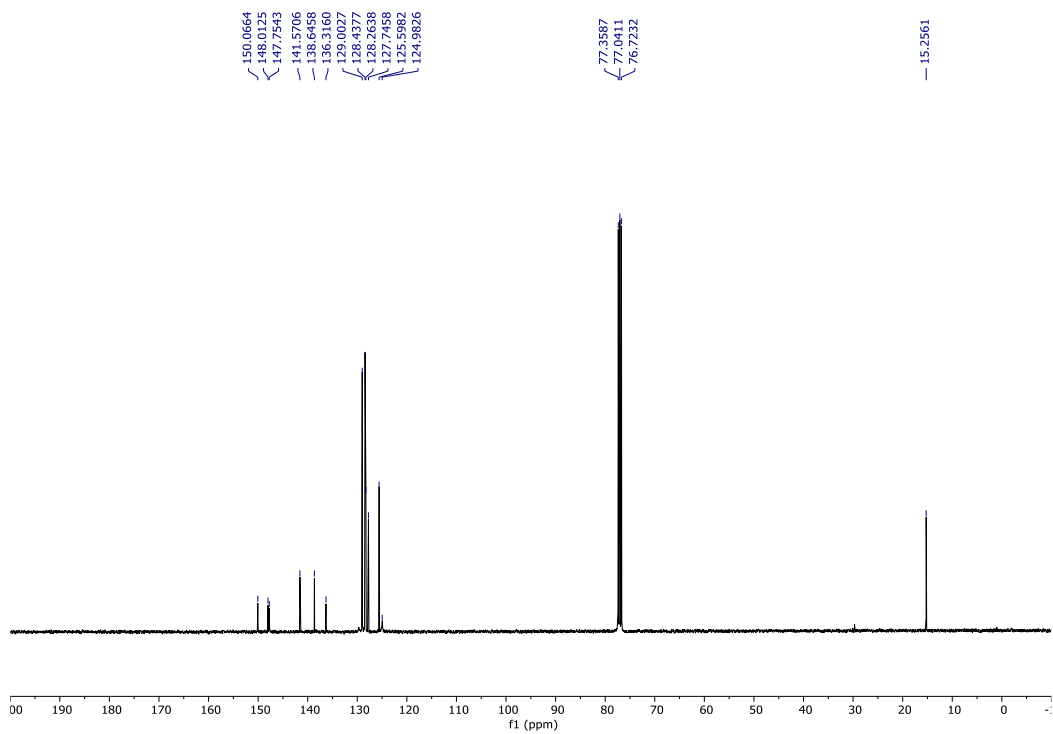
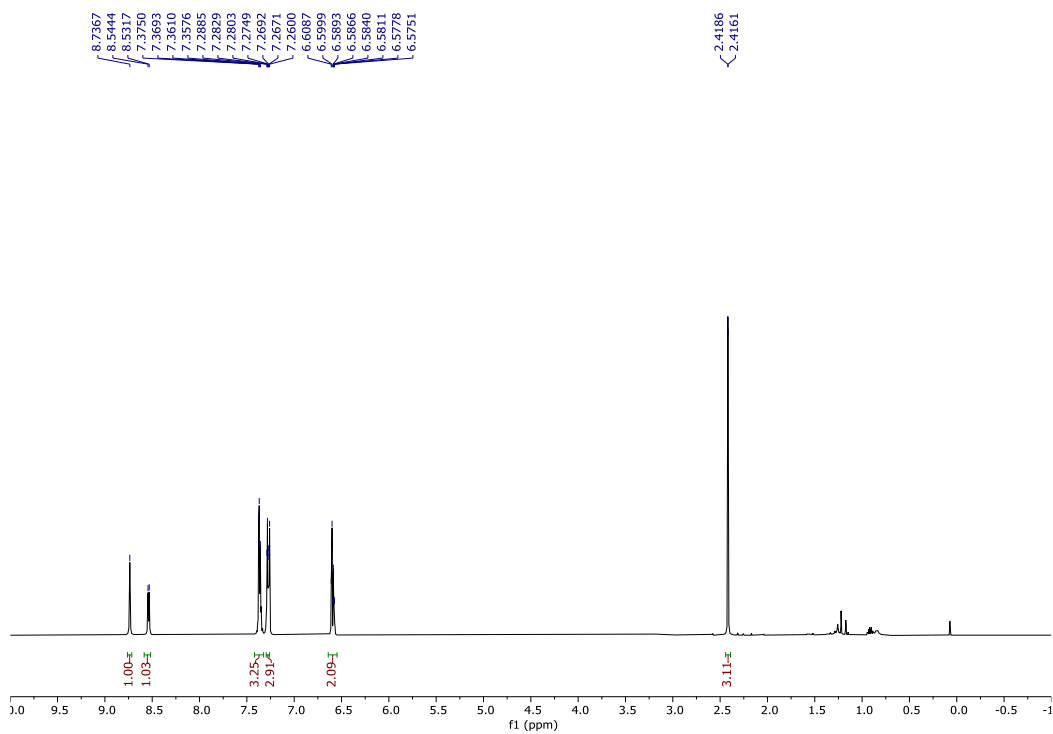
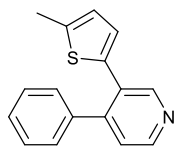
## 2-Isopropyl-4-methyl-5-(4-phenylpyridin-3-yl)thiazole (2a)



## 2-Isobutyl-5-(4-phenylpyridin-3-yl)thiazole (3a)

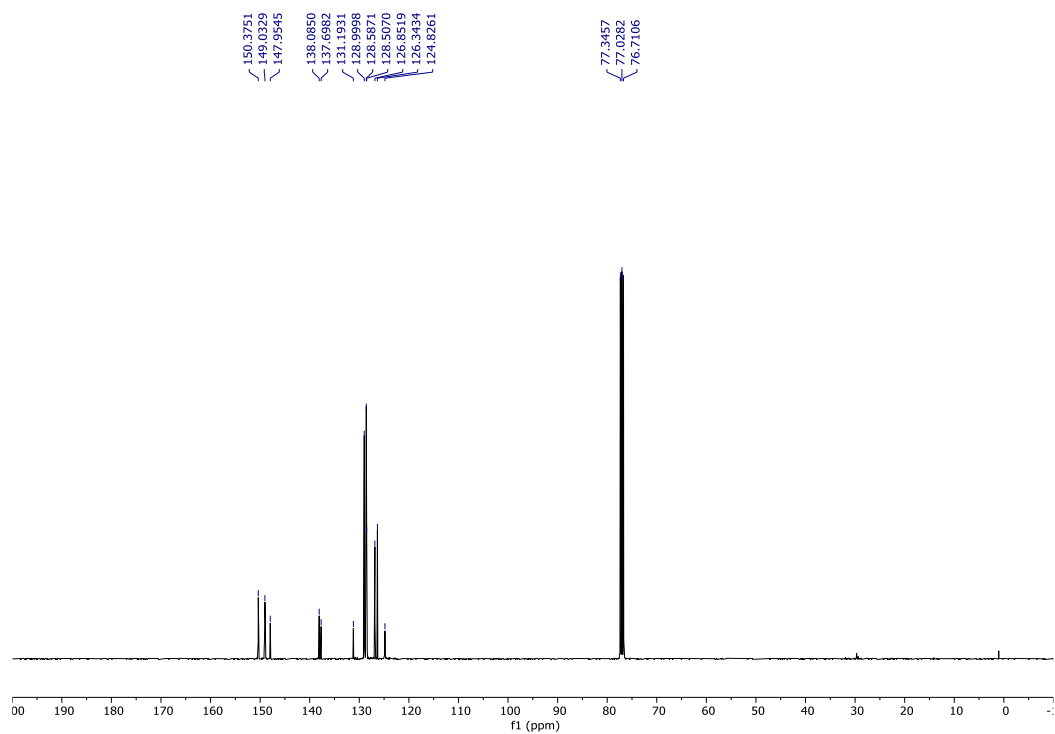
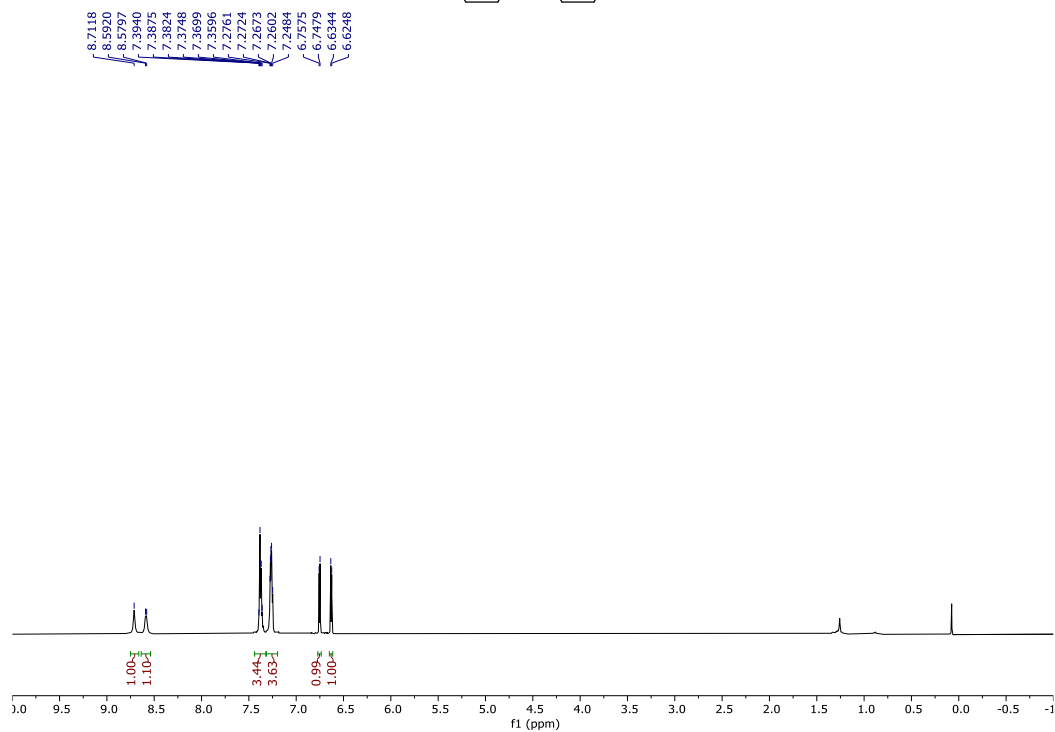
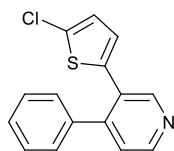


### 3-(5-Methylthiophen-2-yl)-4-phenylpyridine (4a)

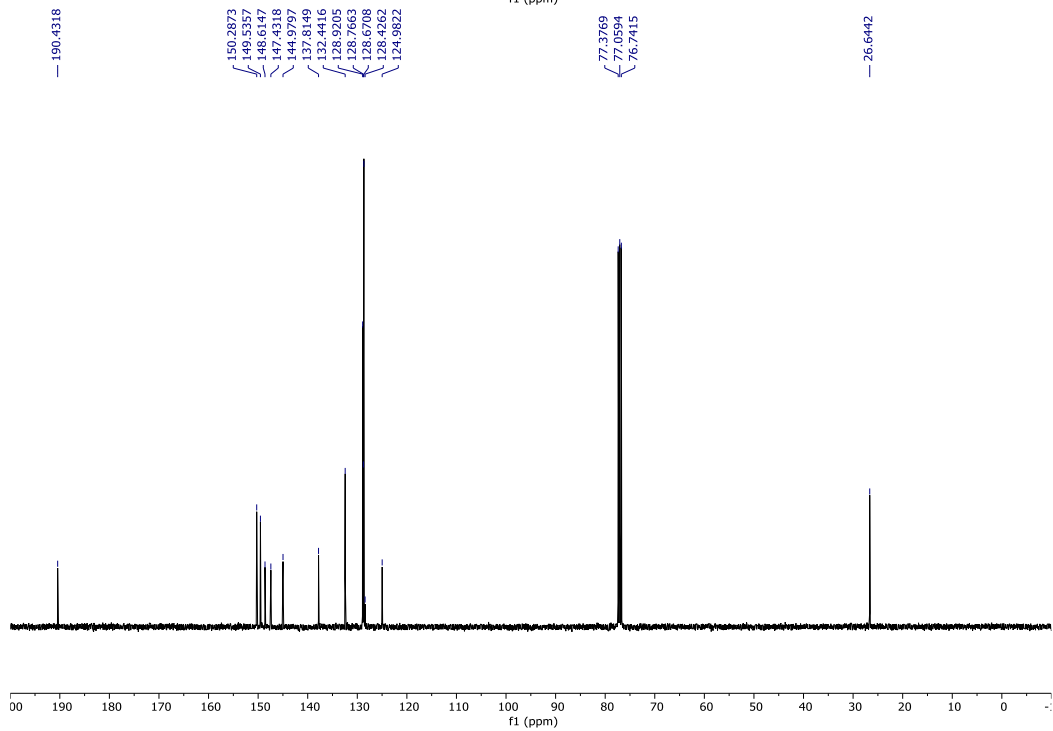
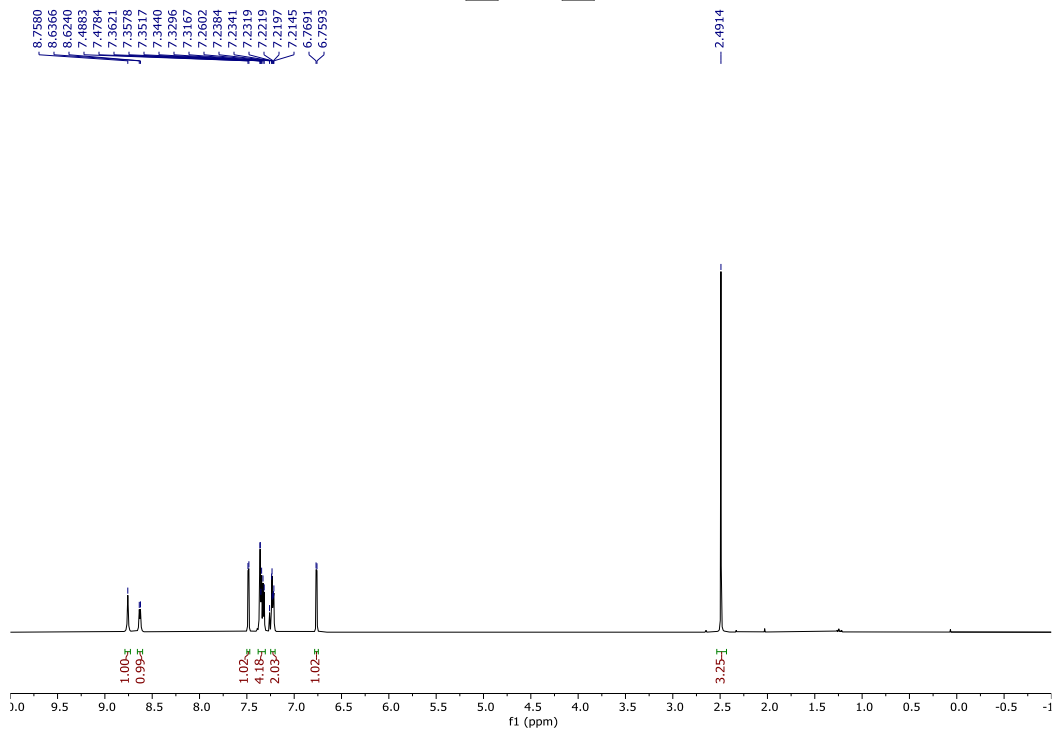
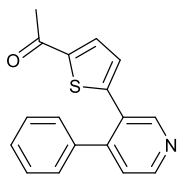




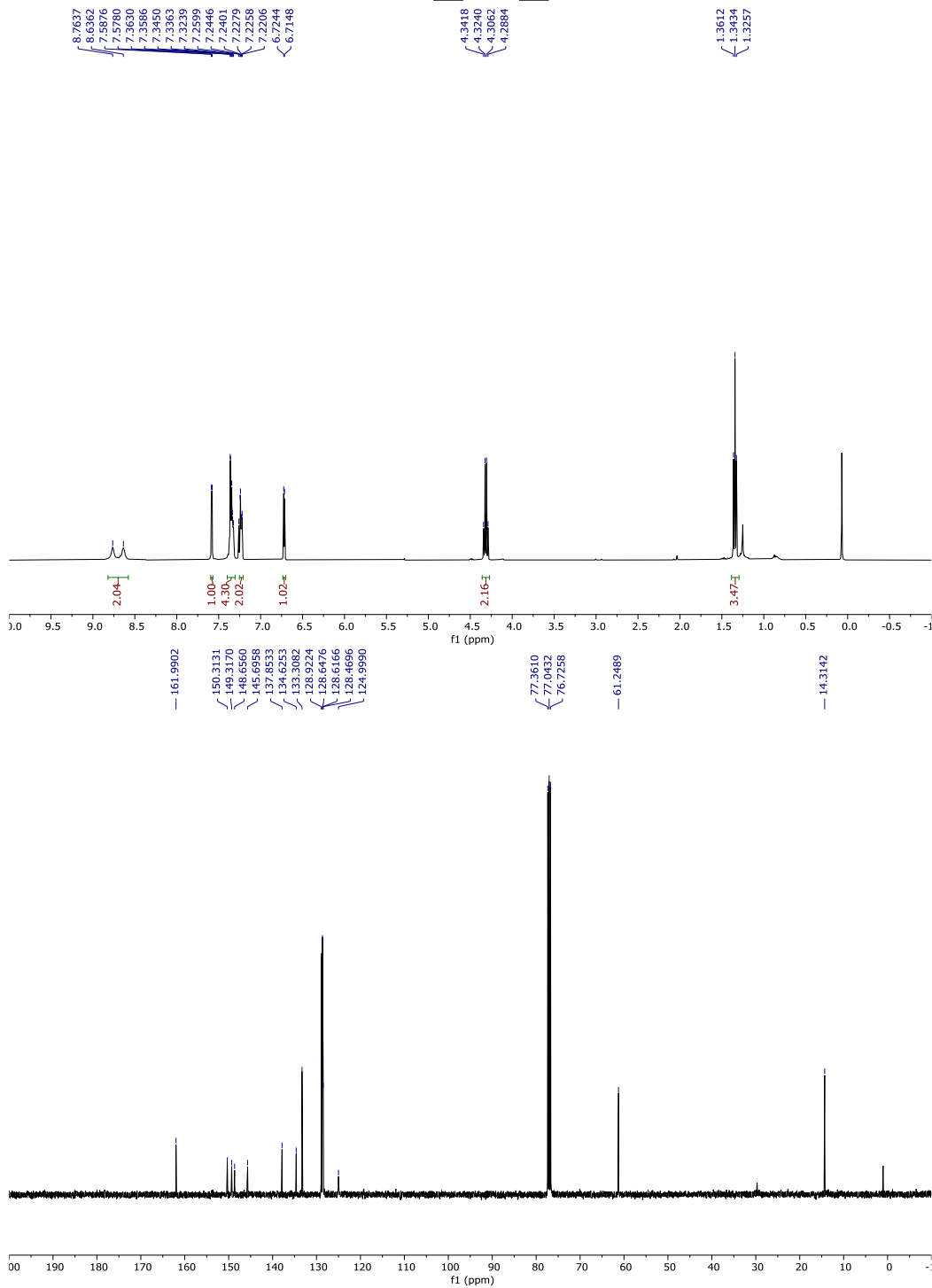
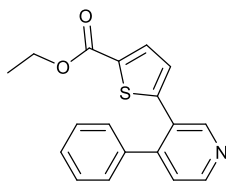
### 3-(5-Chlorothiophen-2-yl)-4-phenylpyridine (5a)



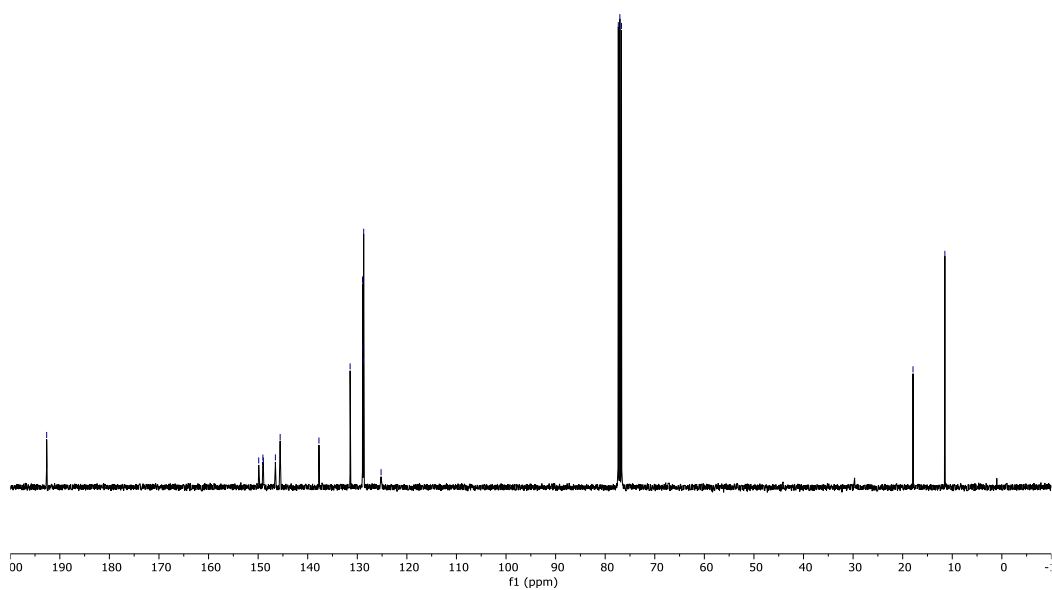
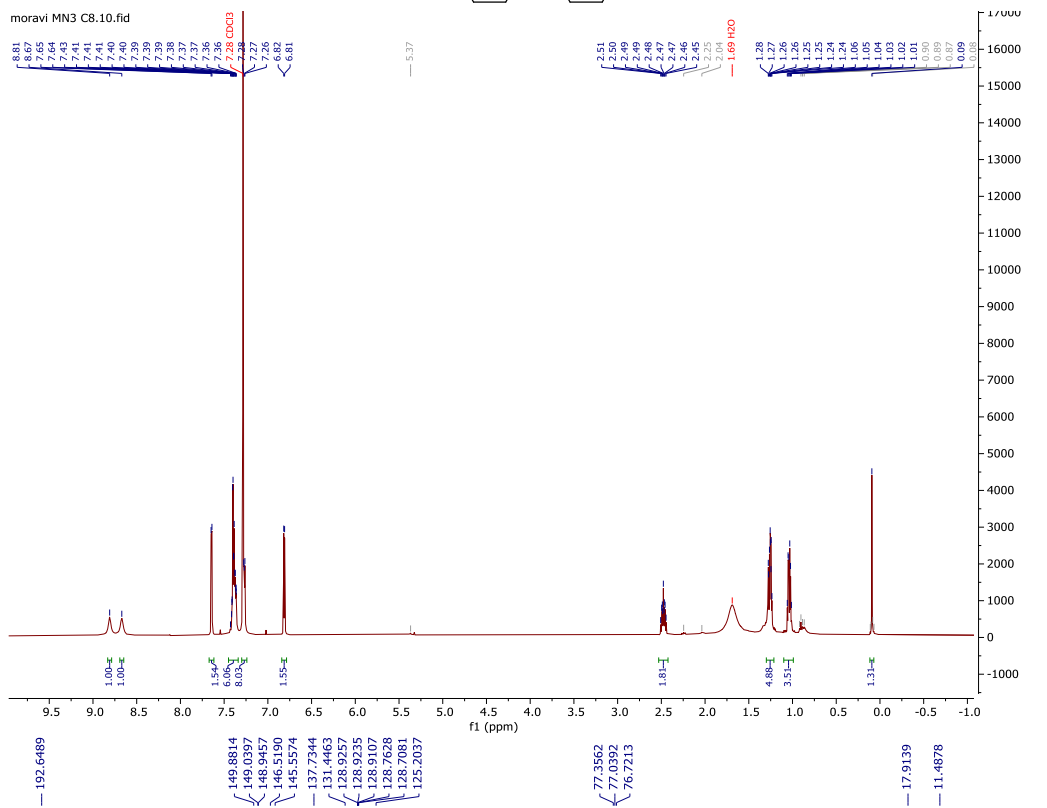
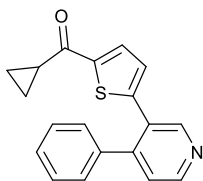
# 1-(5-(4-Phenylpyridin-3-yl)thiophen-2-yl)ethan-1-one (6a)



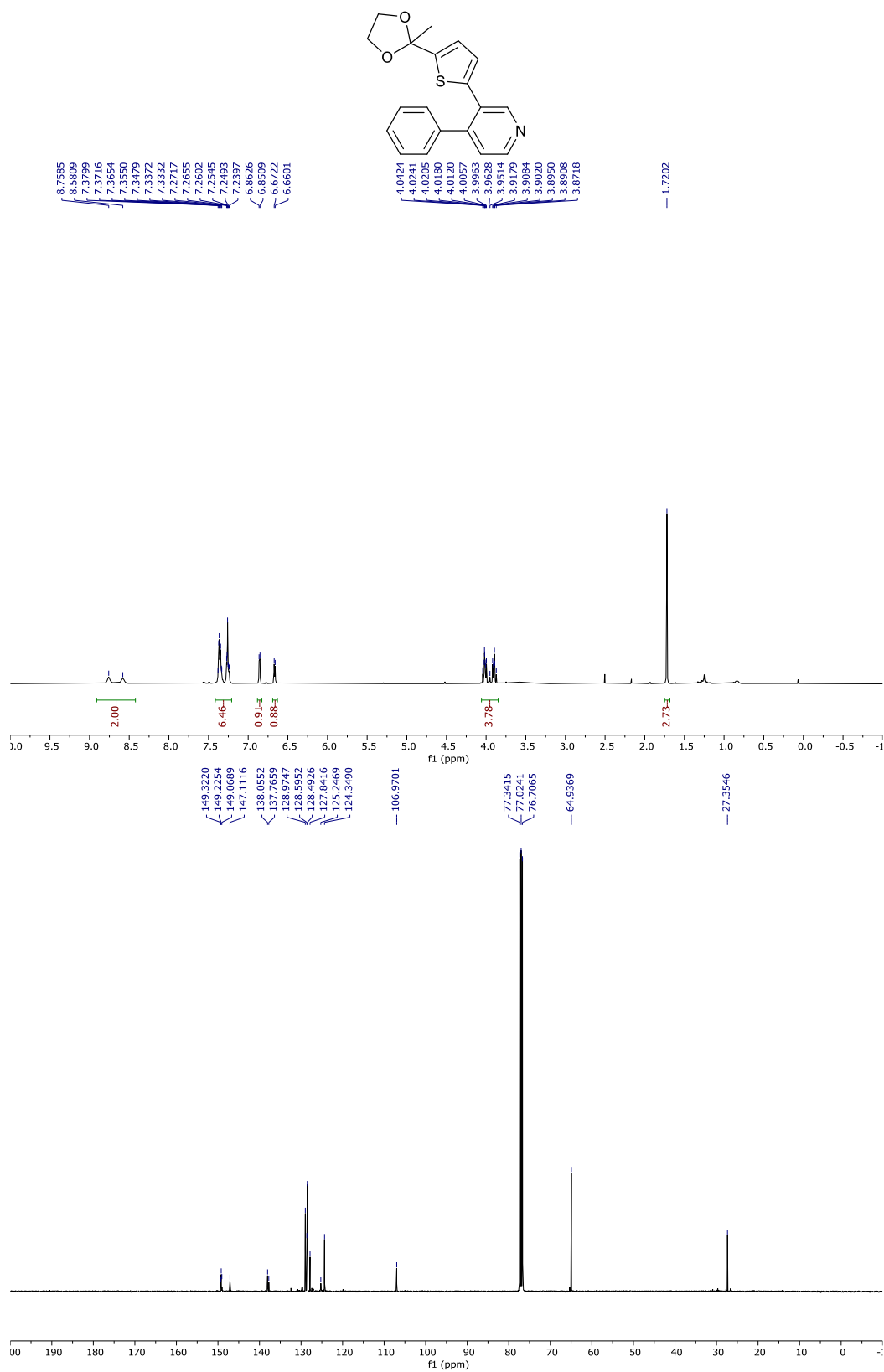
# Ethyl 5-(4-phenylpyridin-3-yl)thiophene-2-carboxylate (7a)



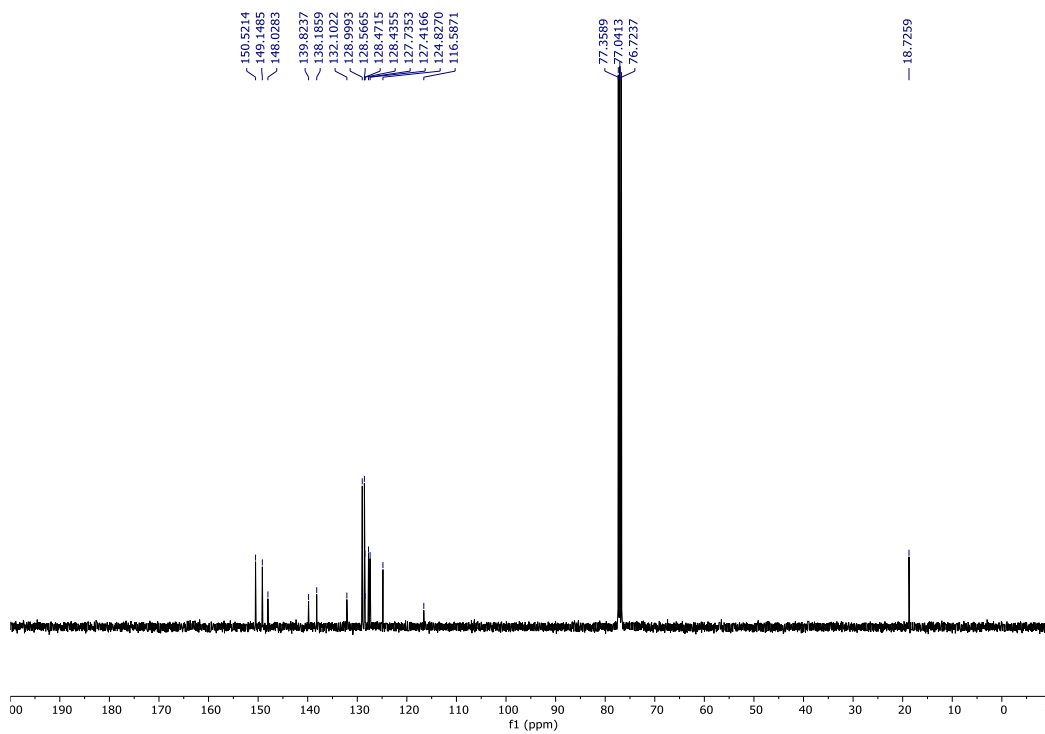
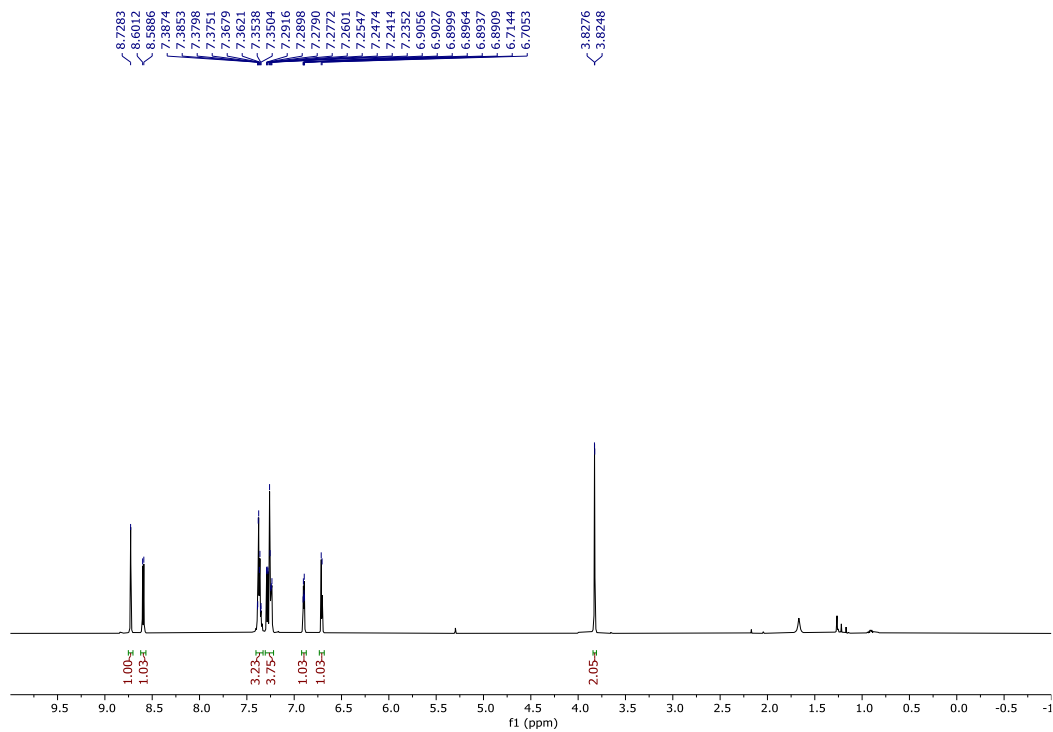
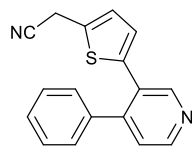
# Cyclopropyl(5-(4-phenylpyridin-3-yl)thiophen-2-yl)methanone (8a)



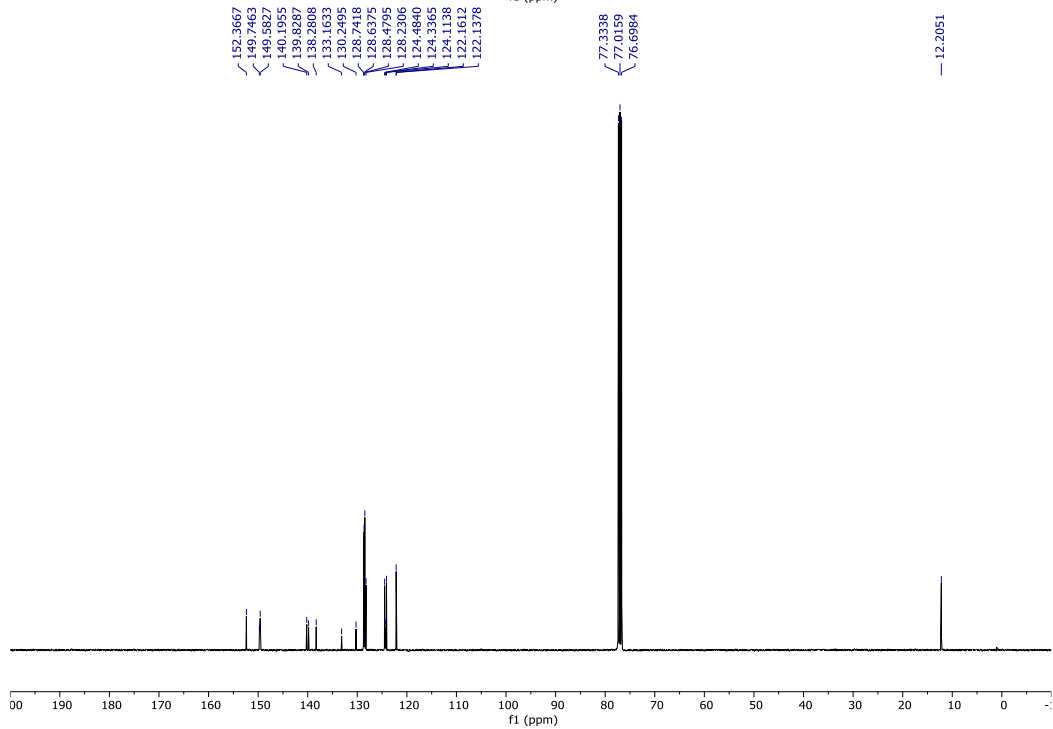
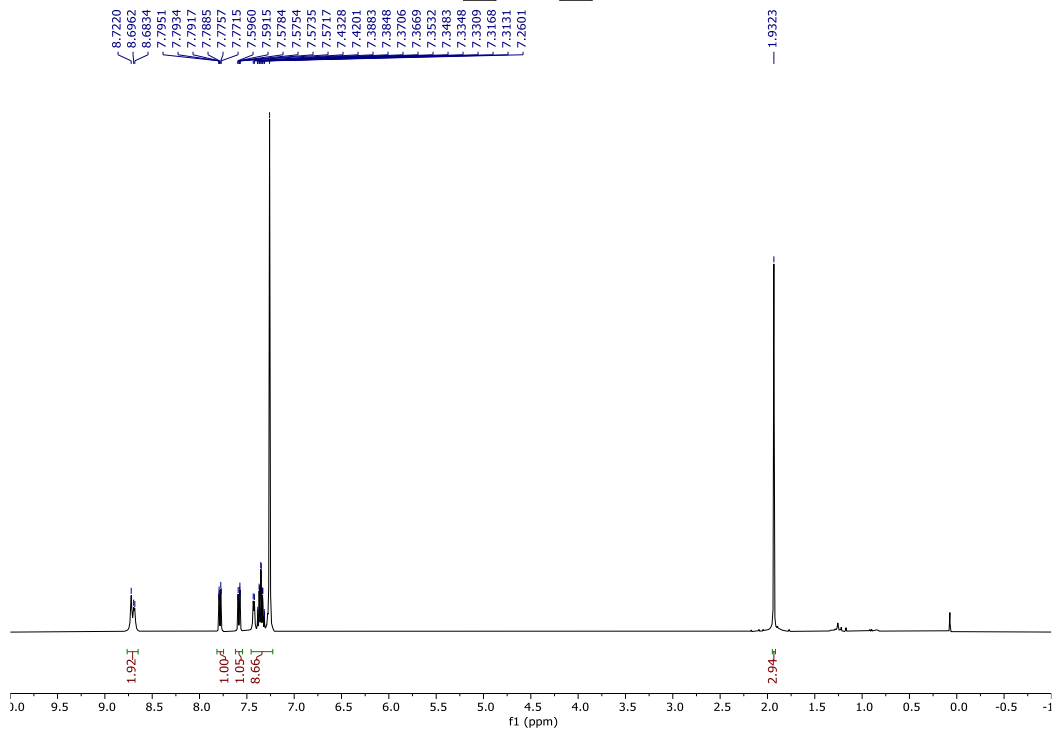
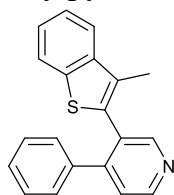
### 3-(5-(2-Methyl-1,3-dioxolan-2-yl)thiophen-2-yl)-4-phenylpyridine (9a)



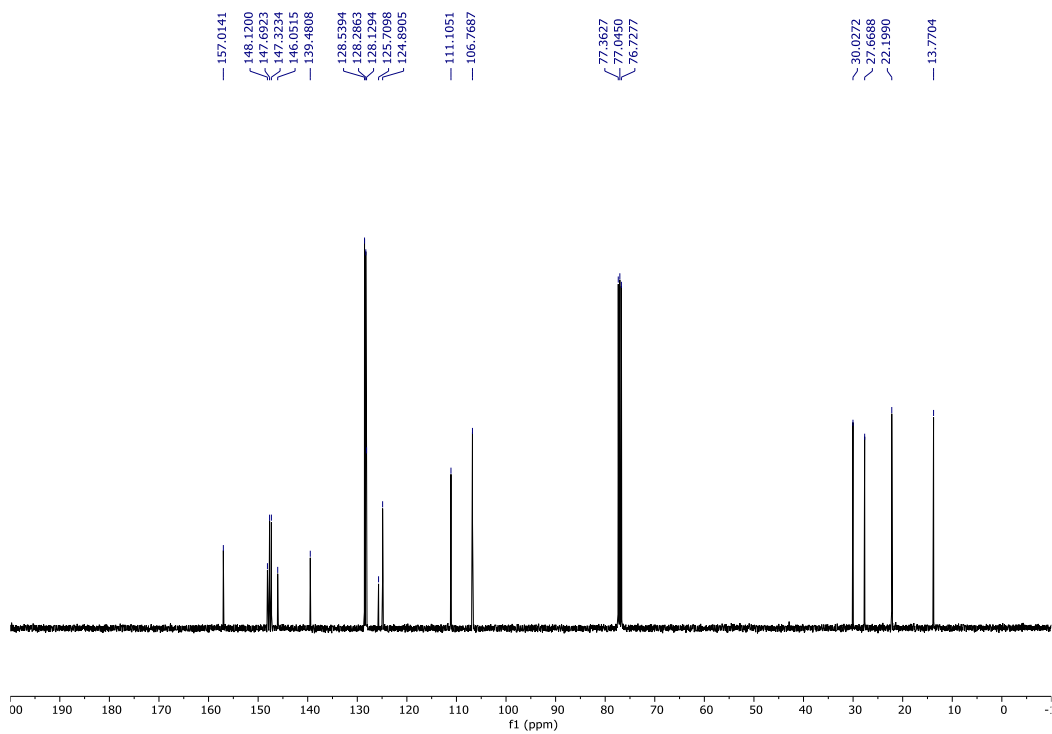
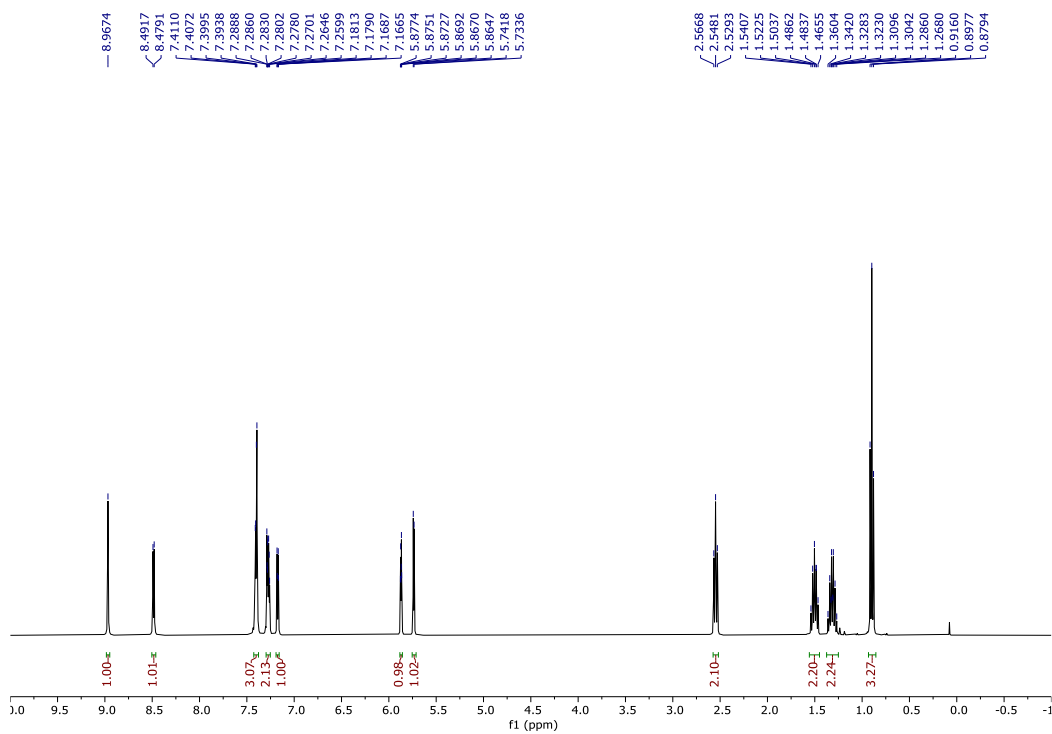
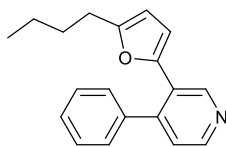
# 2-(5-(4-Phenylpyridin-3-yl)thiophen-2-yl)acetonitrile (10a)



### 3-(3-Methylbenzo[*b*]thiophen-2-yl)-4-phenylpyridine (11a)

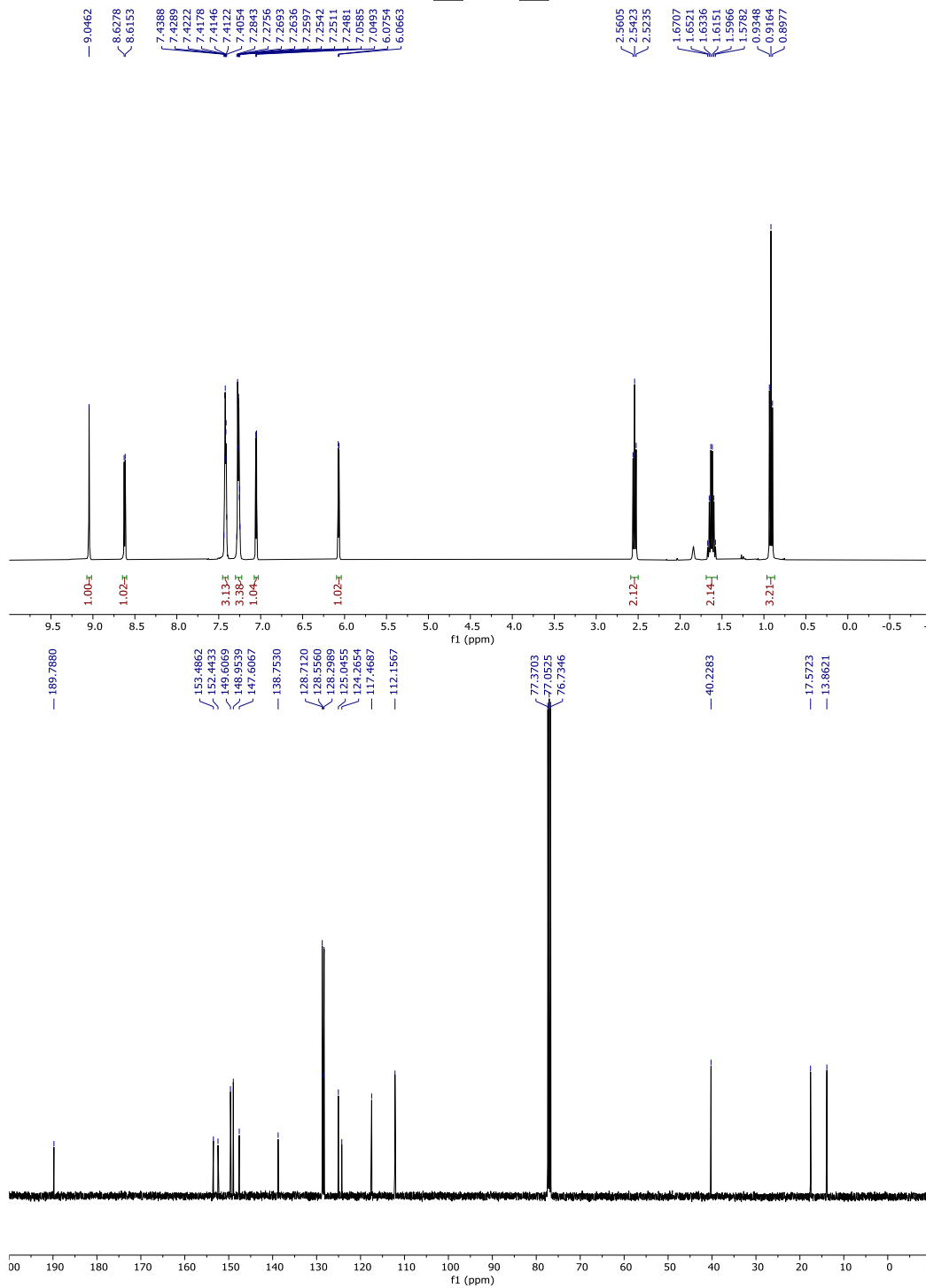
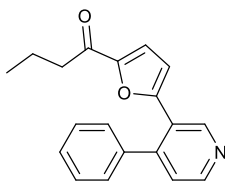


### 3-(5-Butylfuran-2-yl)-4-phenylpyridine (12a)

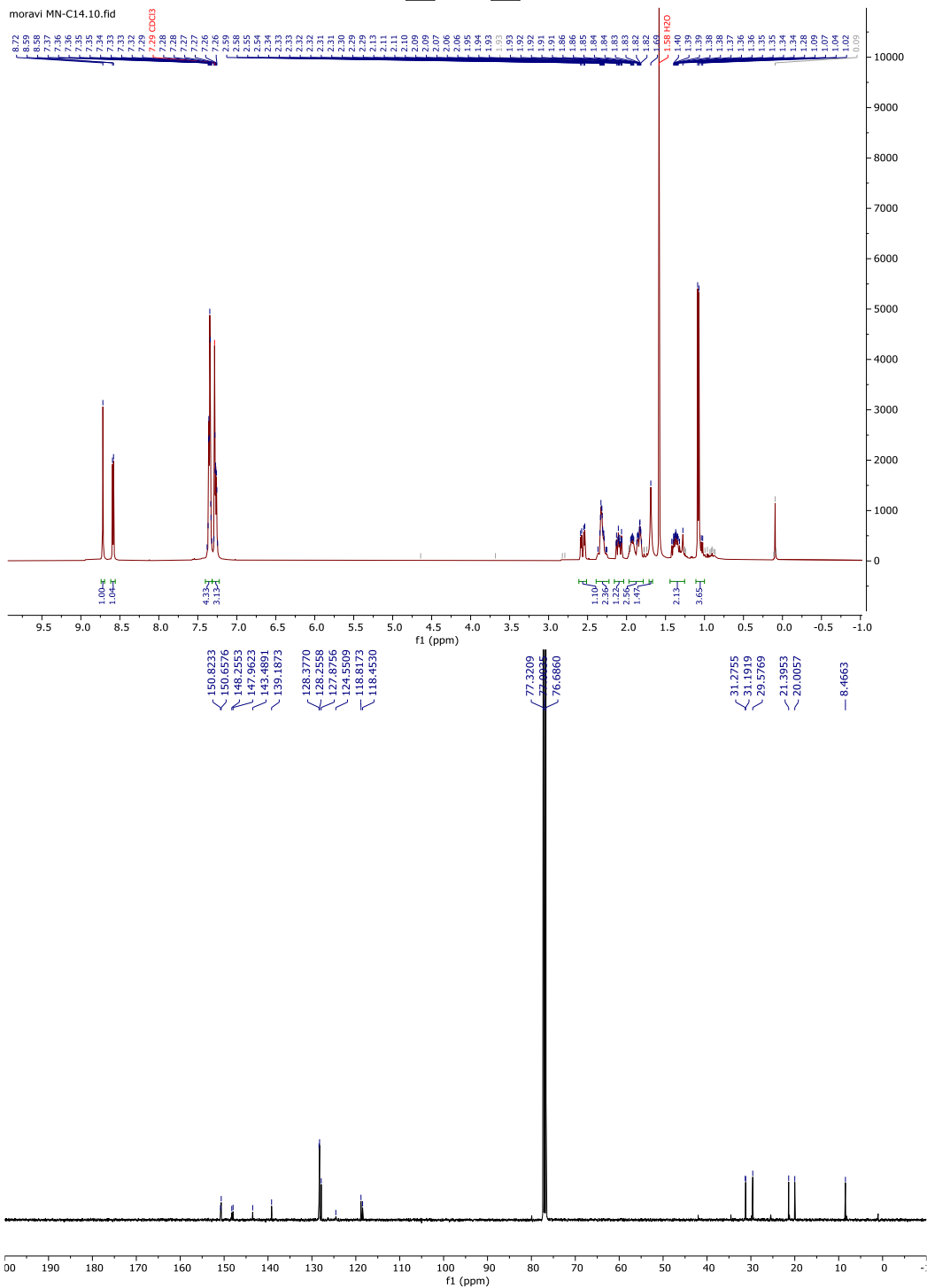
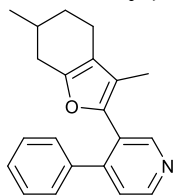




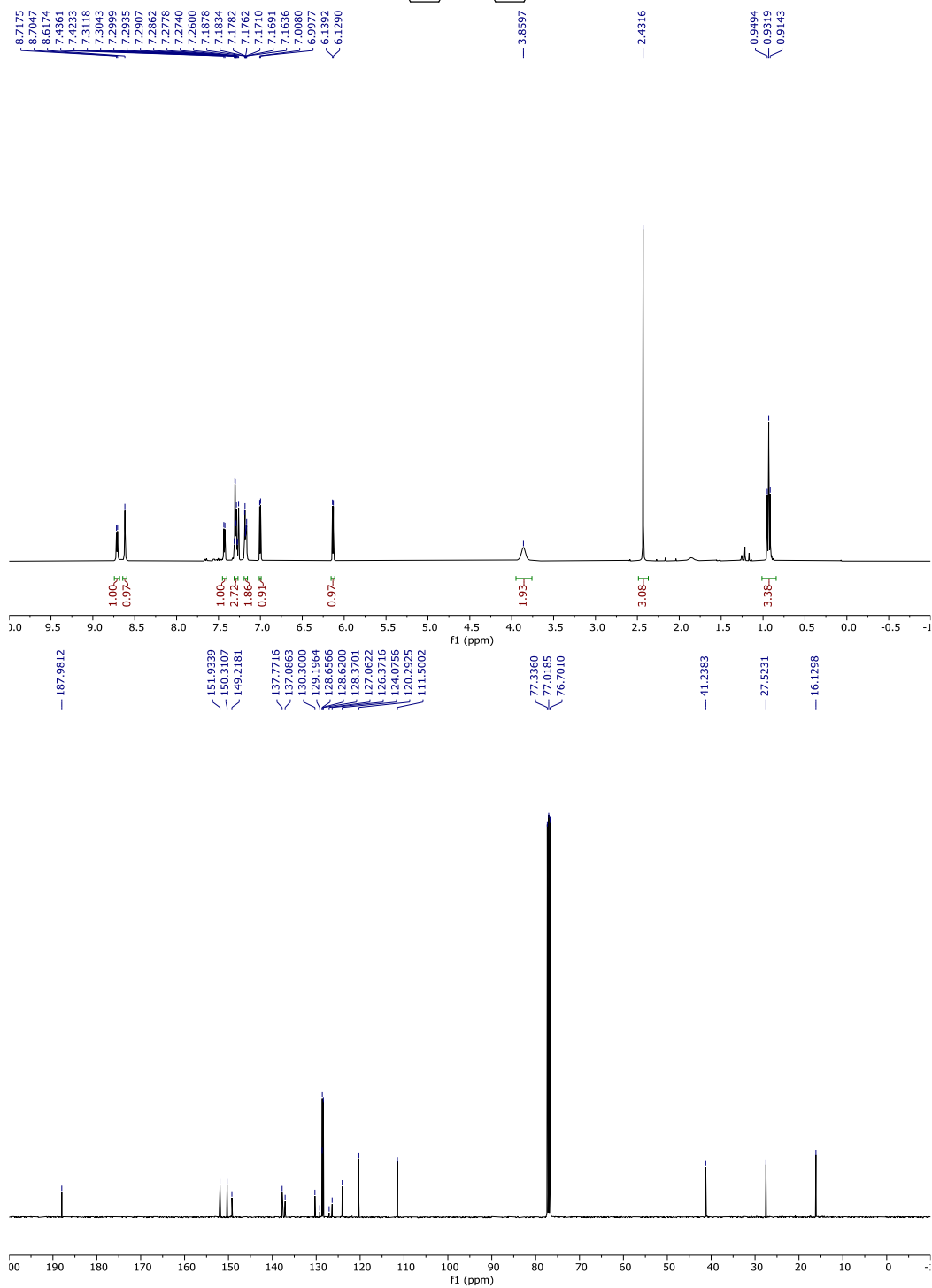
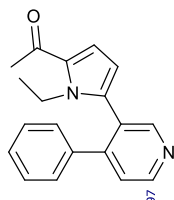
# 1-(5-(4-Phenylpyridin-3-yl)furan-2-yl)butan-1-one (13a)



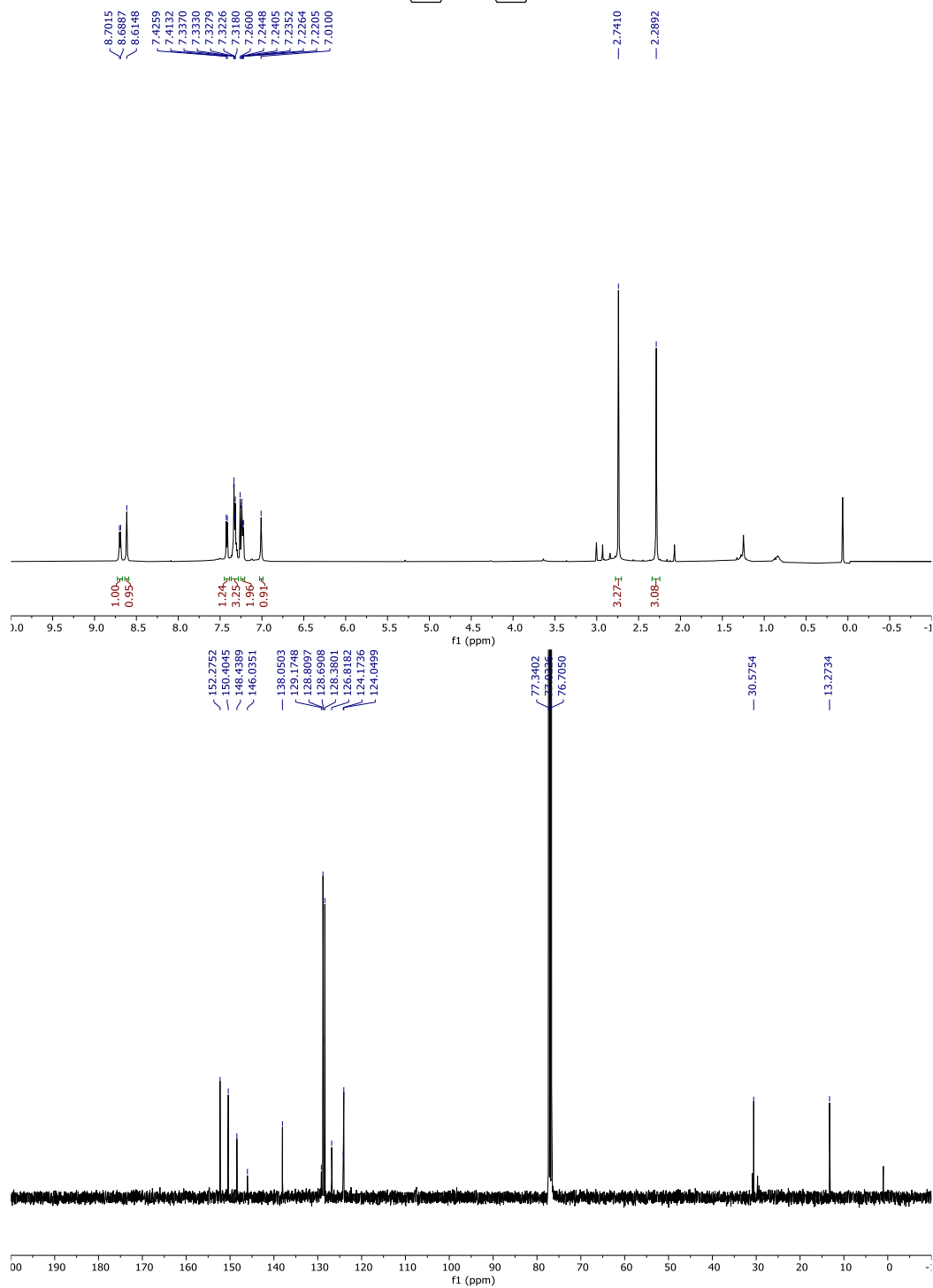
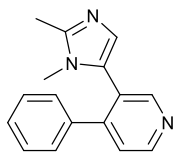
### 3-(3,6-Dimethyl-4,5,6,7-tetrahydrobenzofuran-2-yl)-4-phenylpyridine (14a)



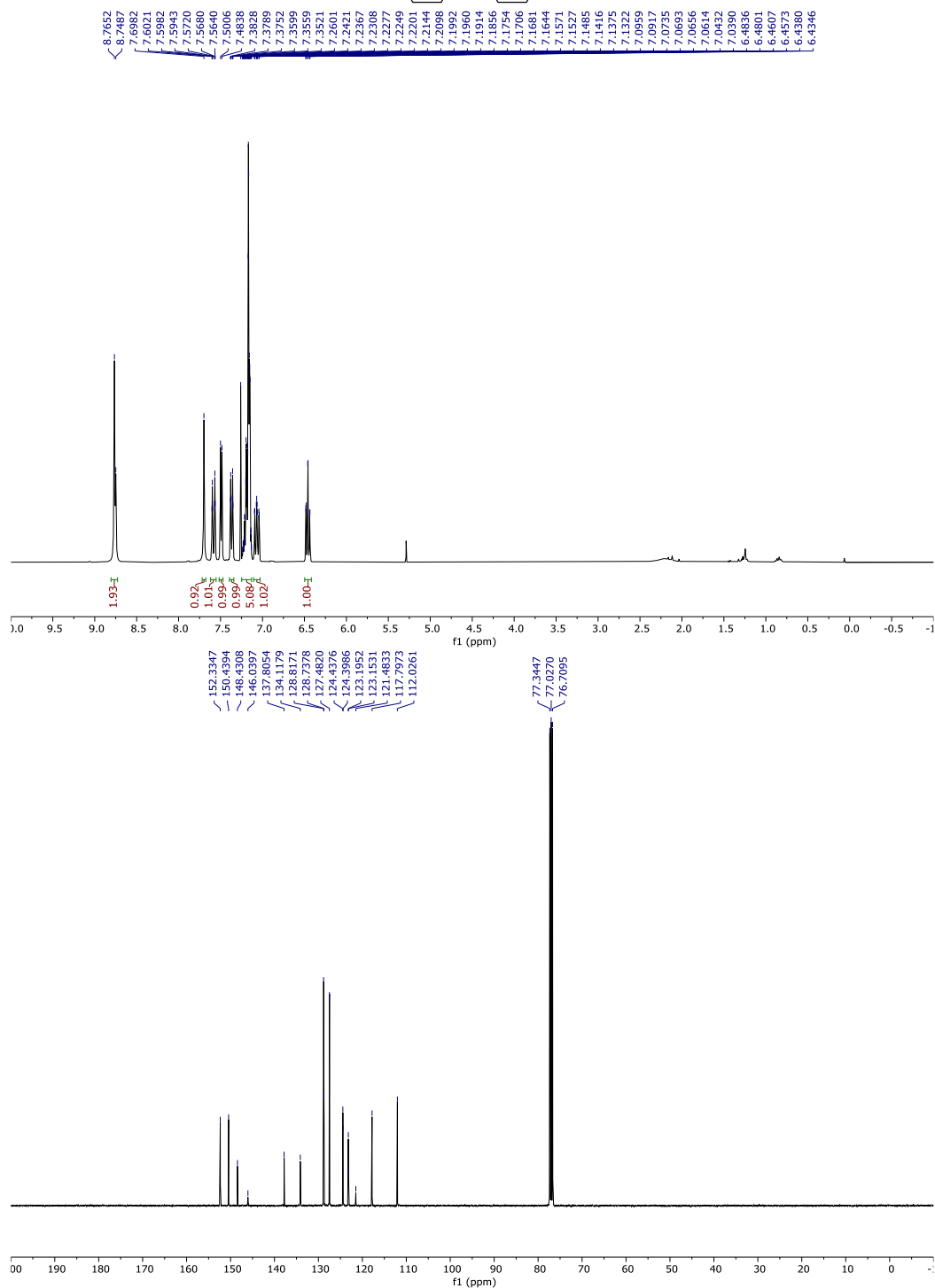
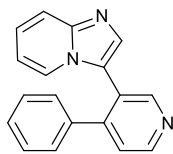
# 1-(1-Ethyl-5-(4-phenylpyridin-3-yl)-1H-pyrrol-2-yl)ethan-1-one (15a)



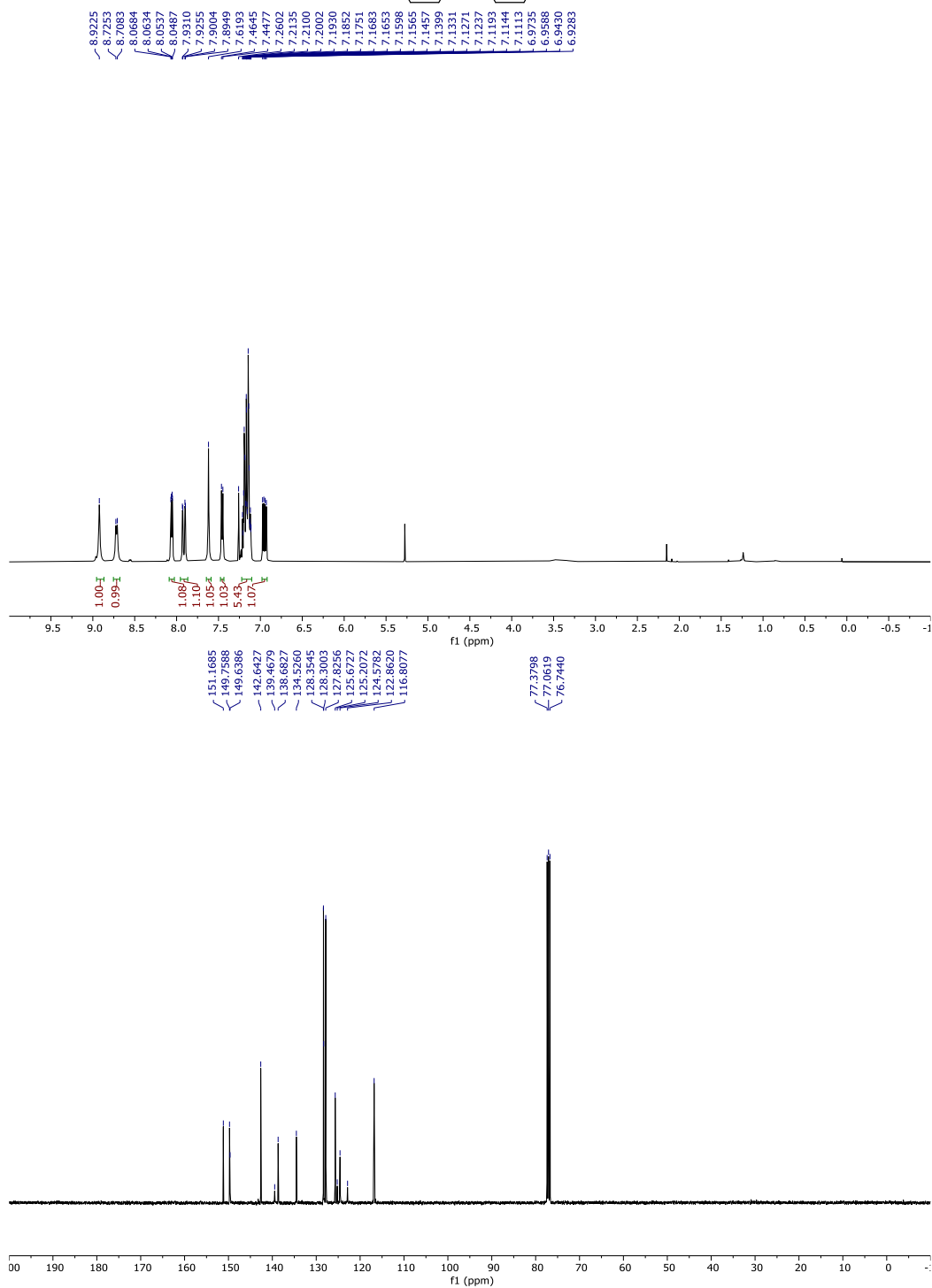
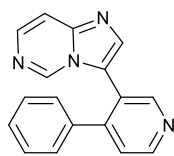
### 3-(1,2-Dimethylimidazol-5-yl)-4-phenylpyridine (16a)



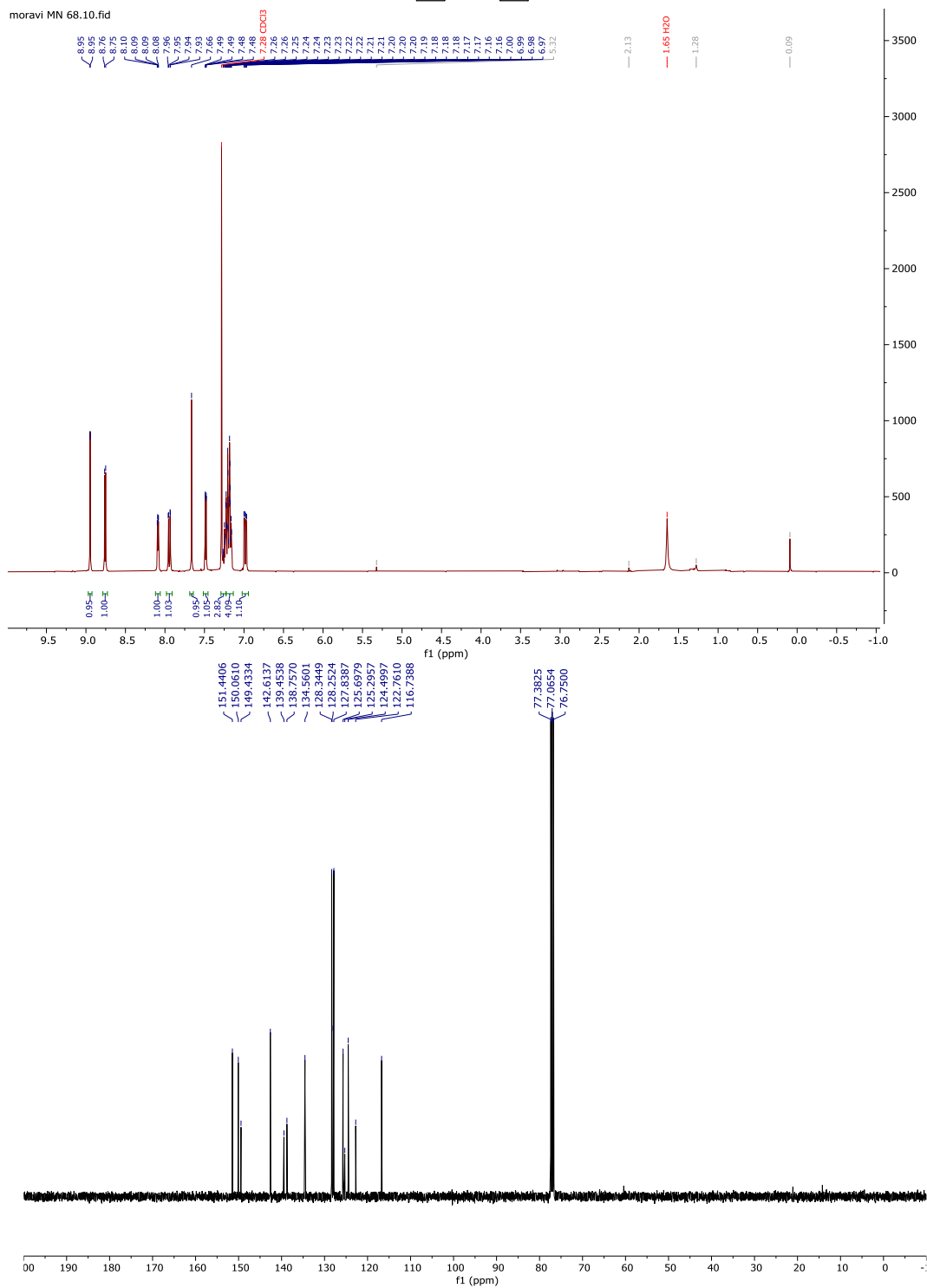
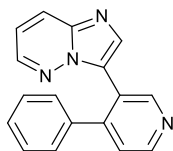
### 3-(4-Phenylpyridin-3-yl)imidazo[1,2-a]pyridine (17a)



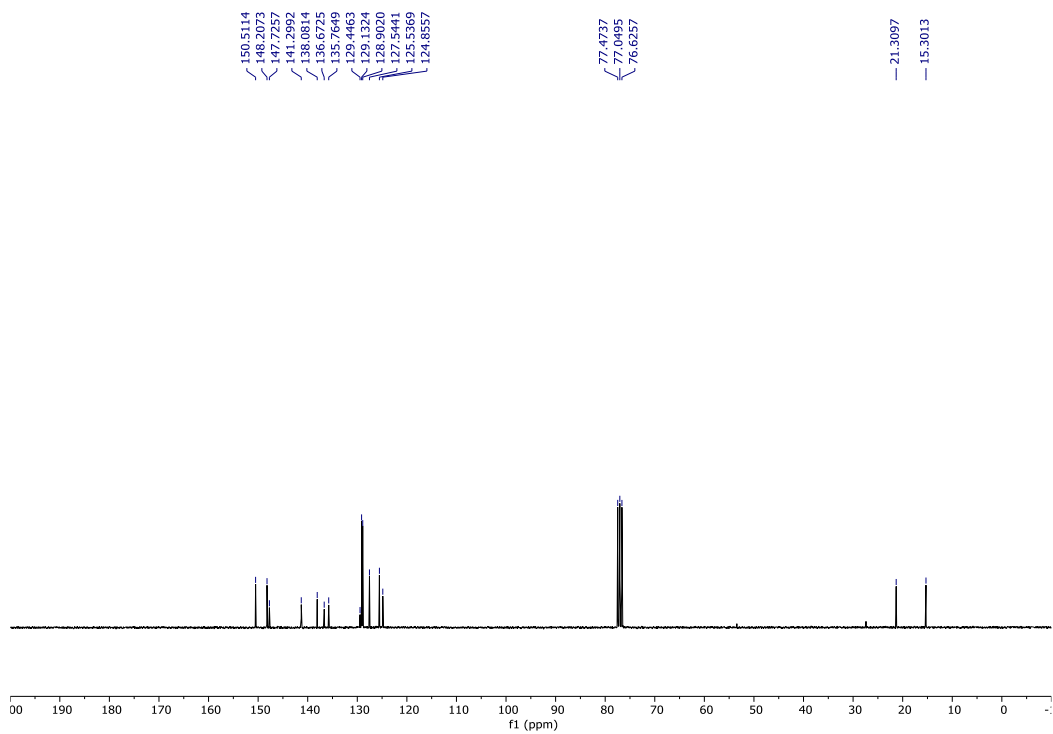
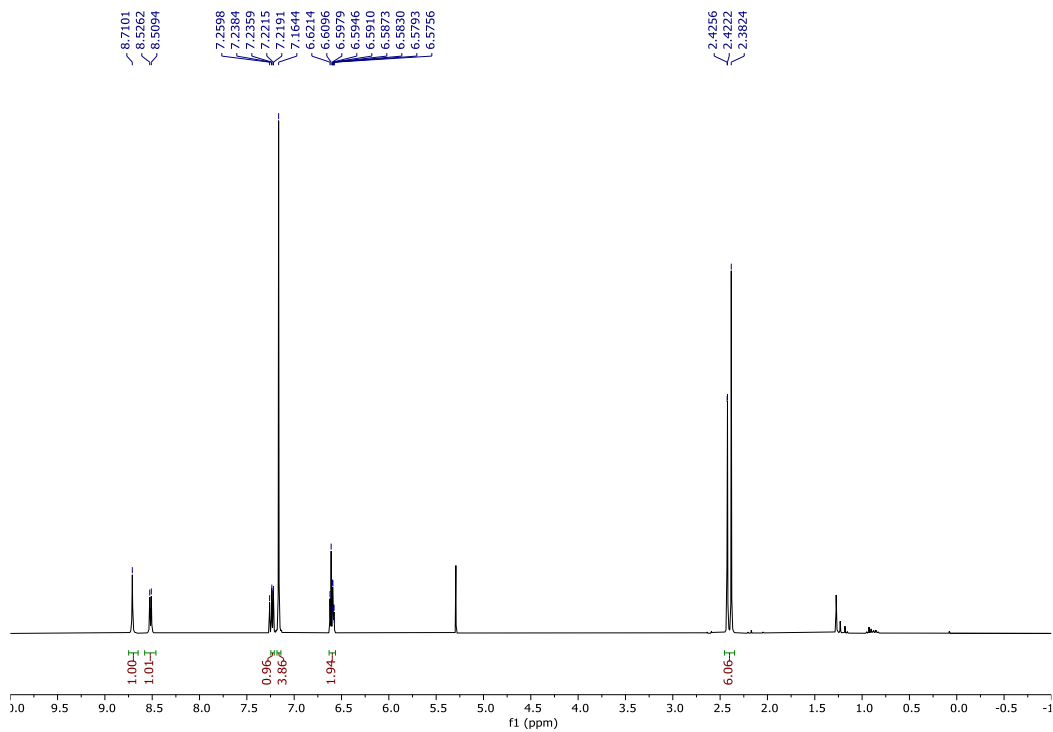
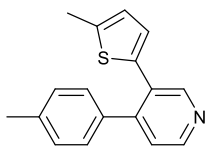
### 3-(4-Phenylpyridin-3-yl)imidazo[1,2-c]pyrimidine (18a)



### 3-(4-Phenylpyridin-3-yl)imidazo[1,2-b]pyridazine (19a)

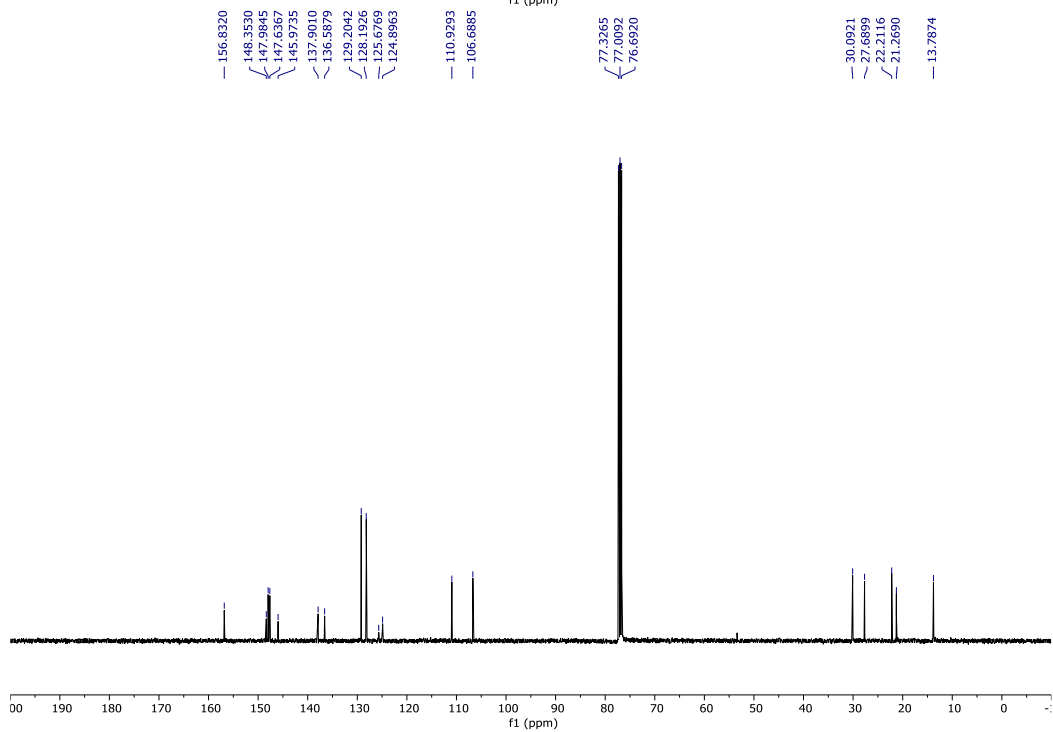
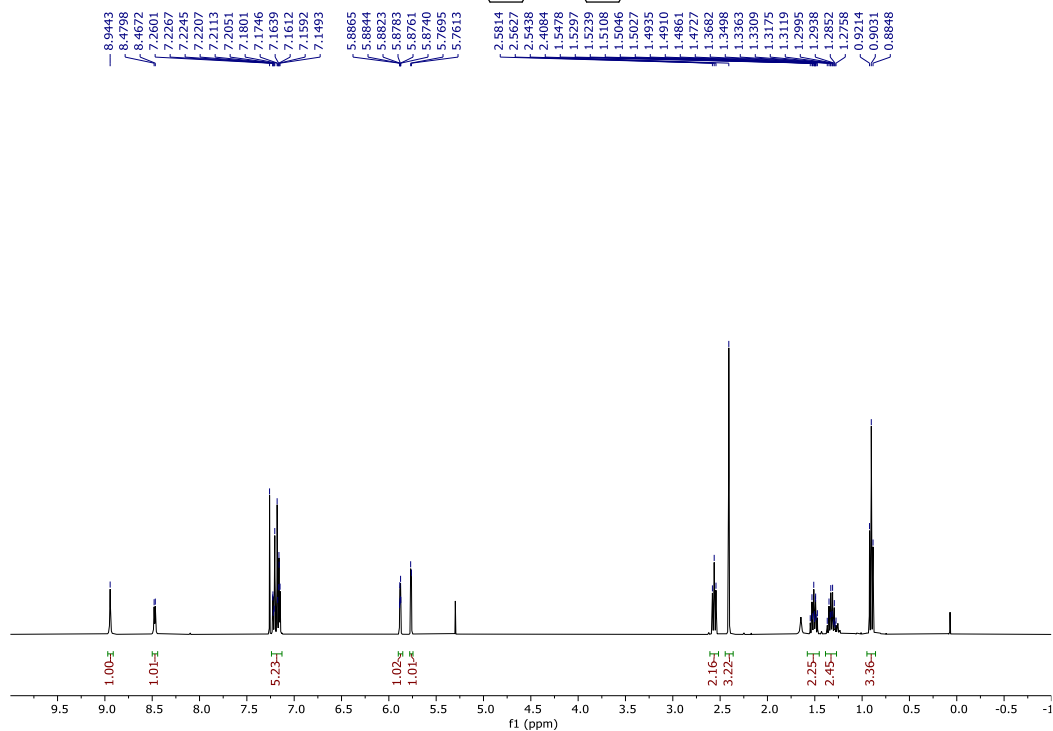
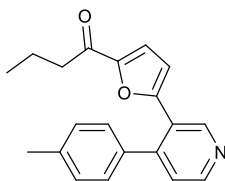


### 3-(5-Methylthiophen-2-yl)-4-(*p*-tolyl)pyridine (20a)

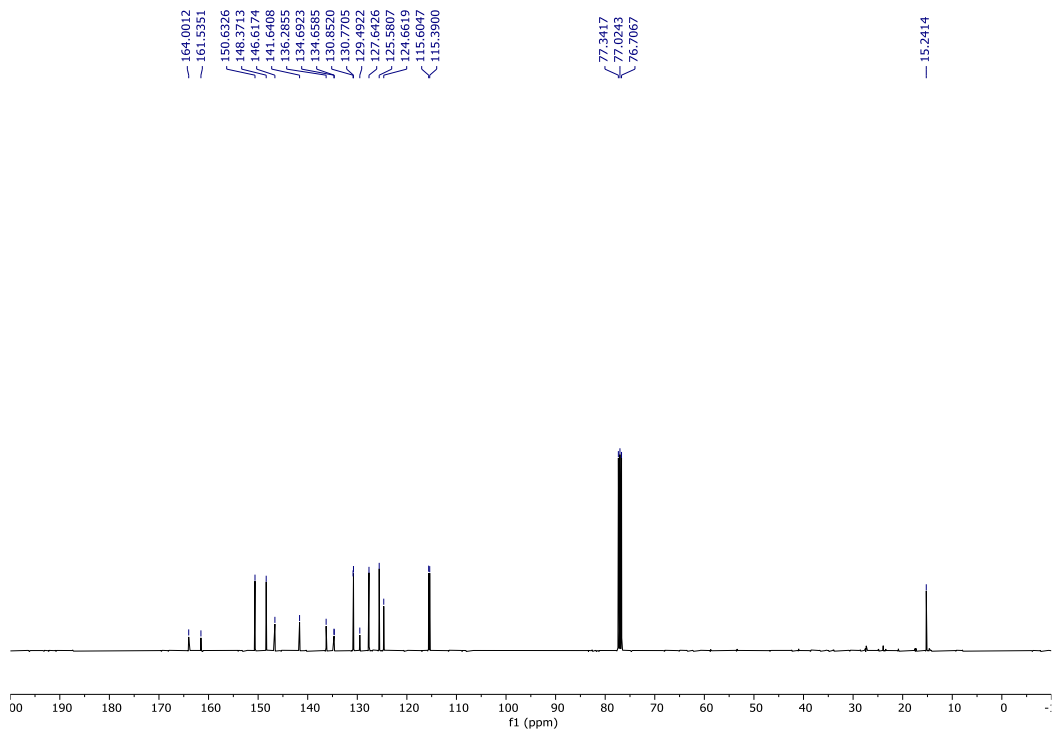
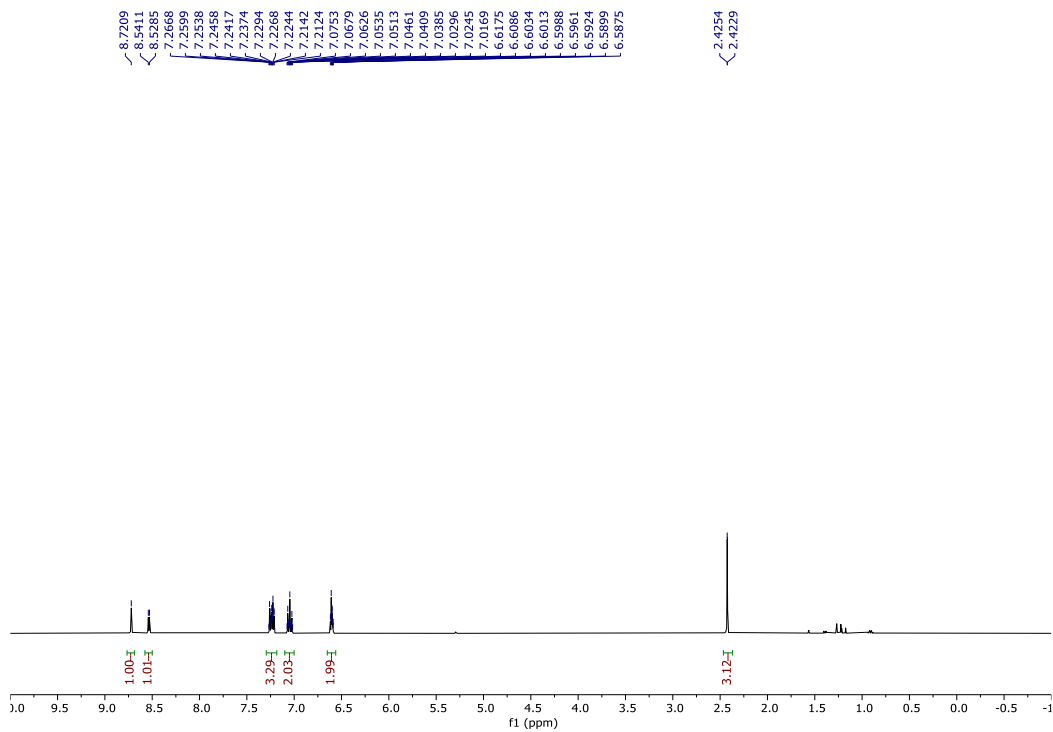
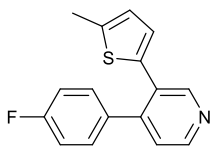


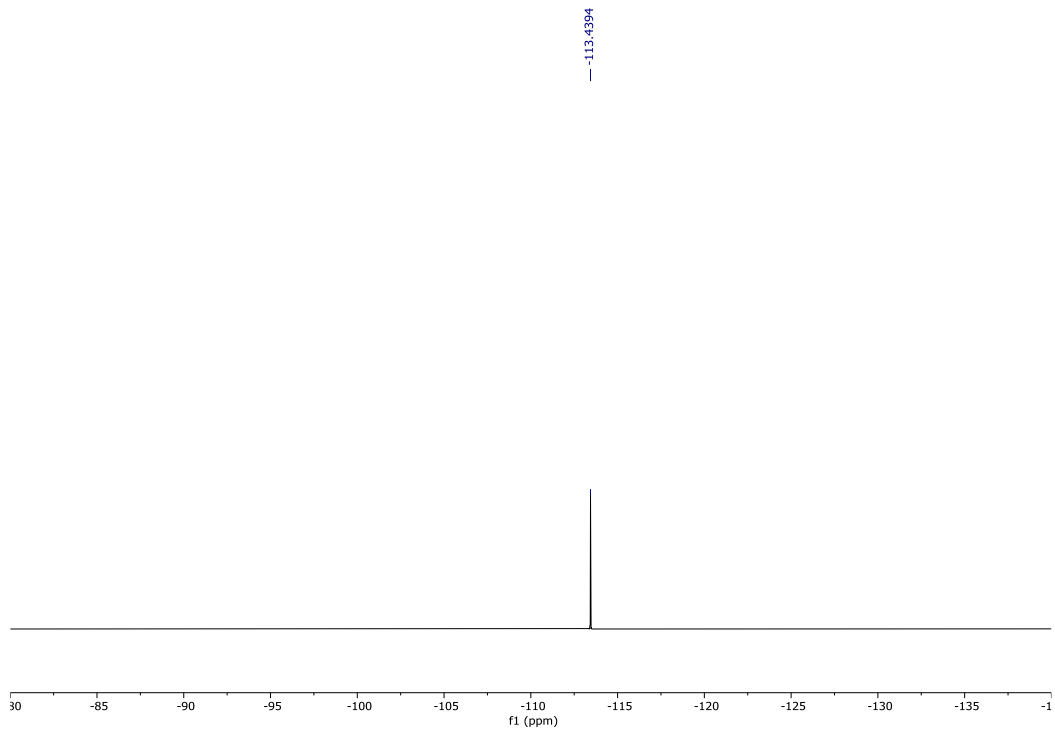


### 3-(5-Butylfuran-2-yl)-4-(*p*-tolyl)pyridine (21a)

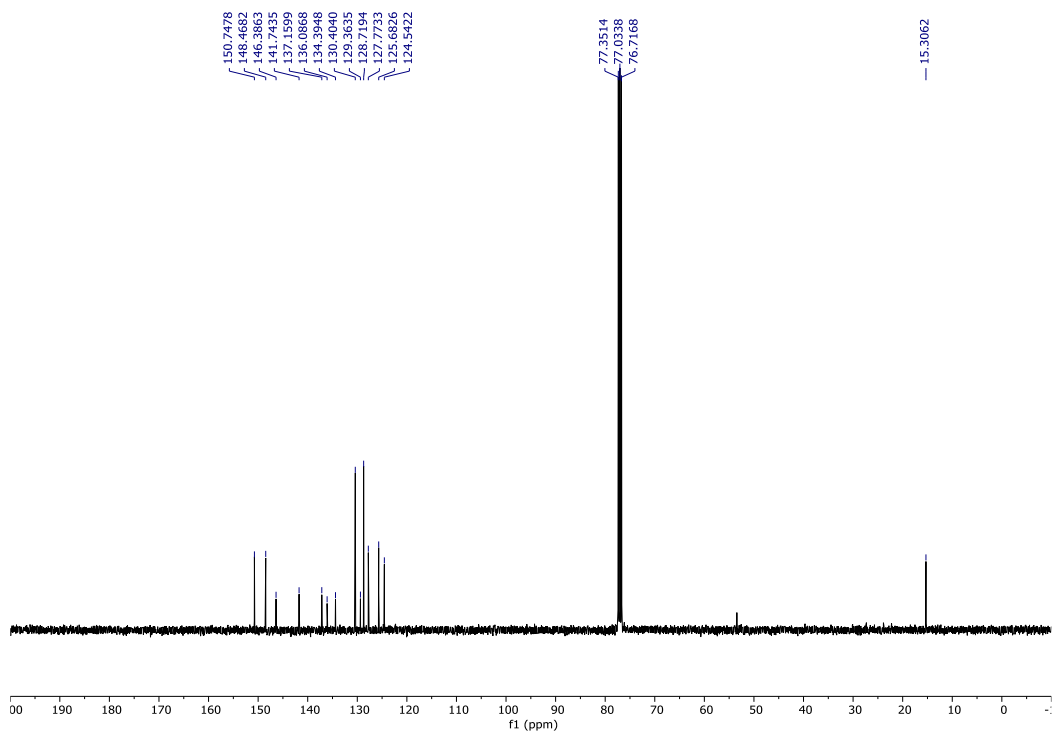
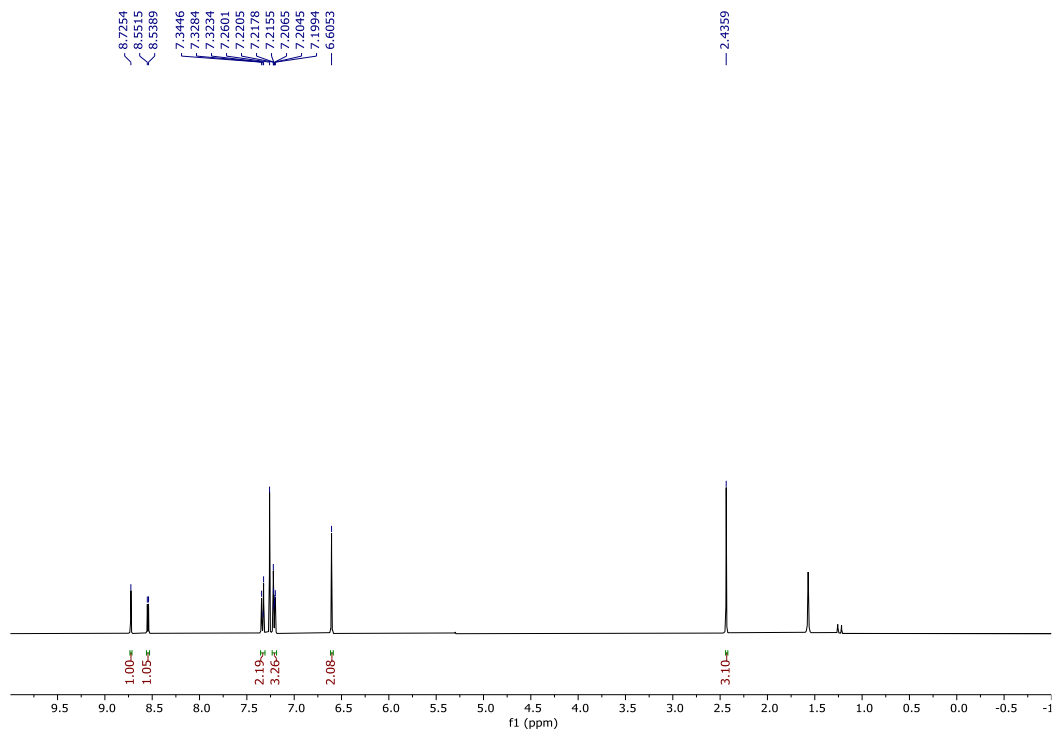
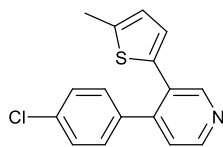


# 4-(4-Fluorophenyl)-3-(5-methylthiophen-2-yl)pyridine (22a)

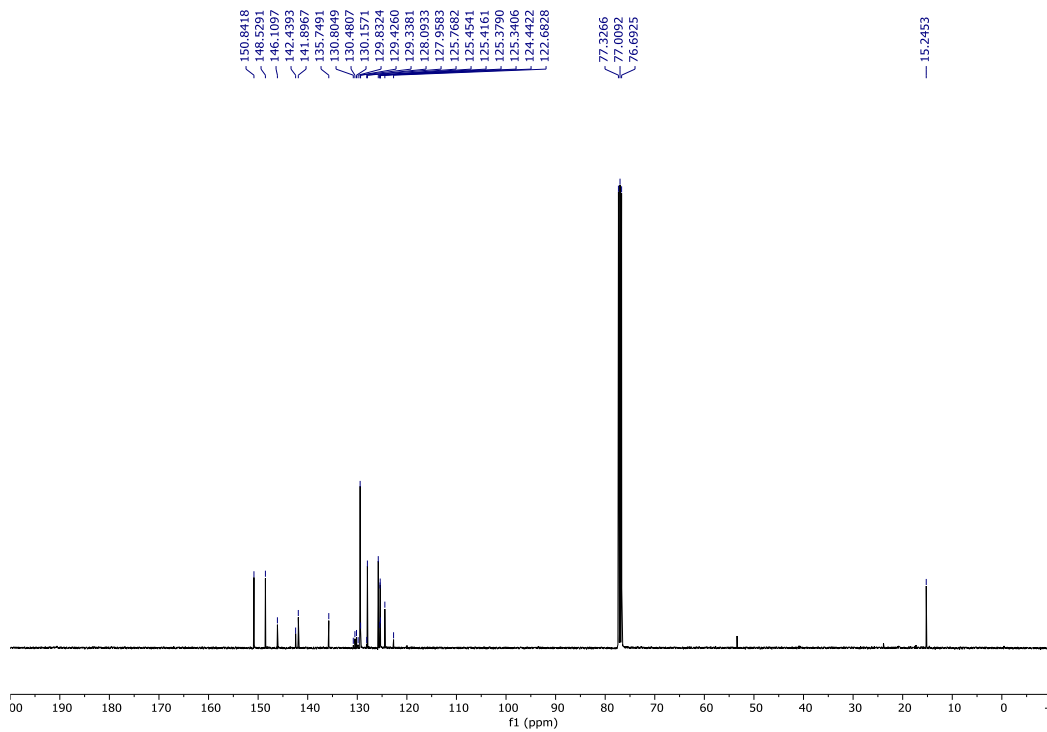
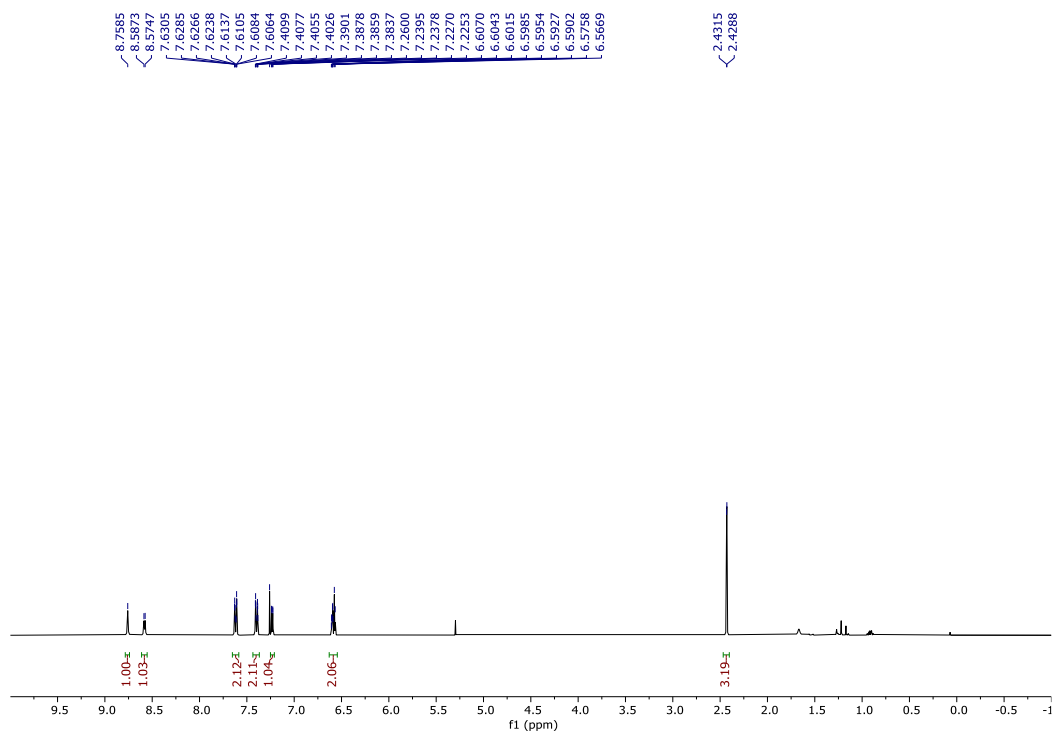
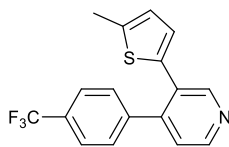


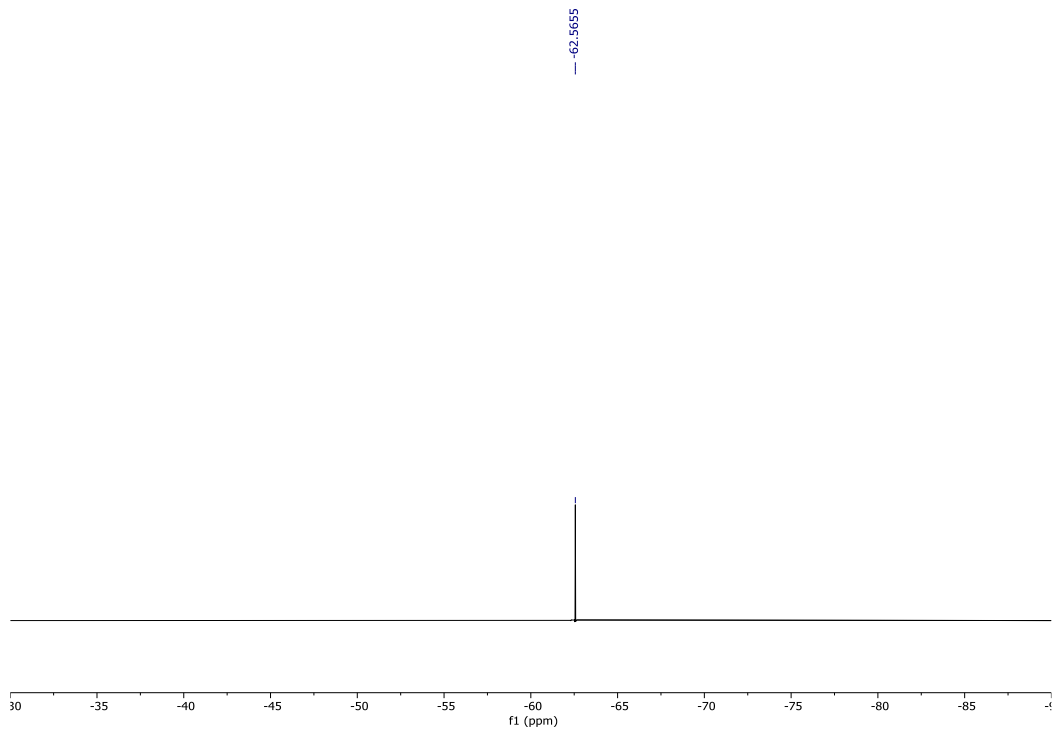


# 4-(4-Chlorophenyl)-3-(5-methylthiophen-2-yl)pyridine (23a)

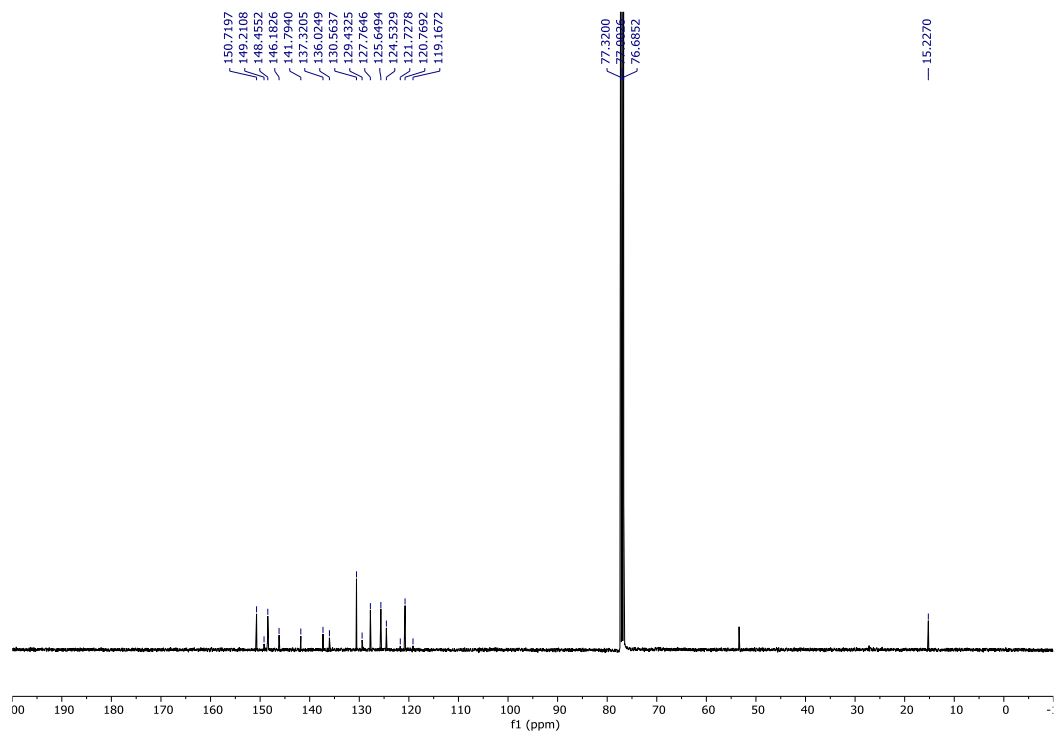
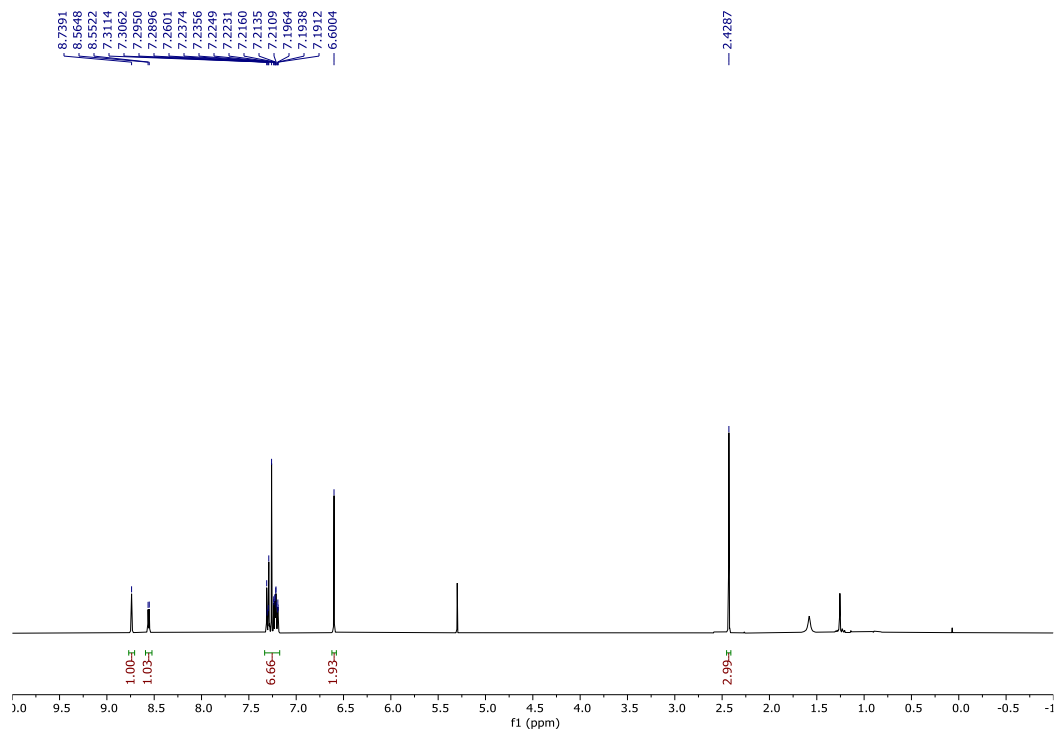
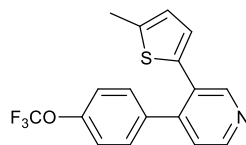


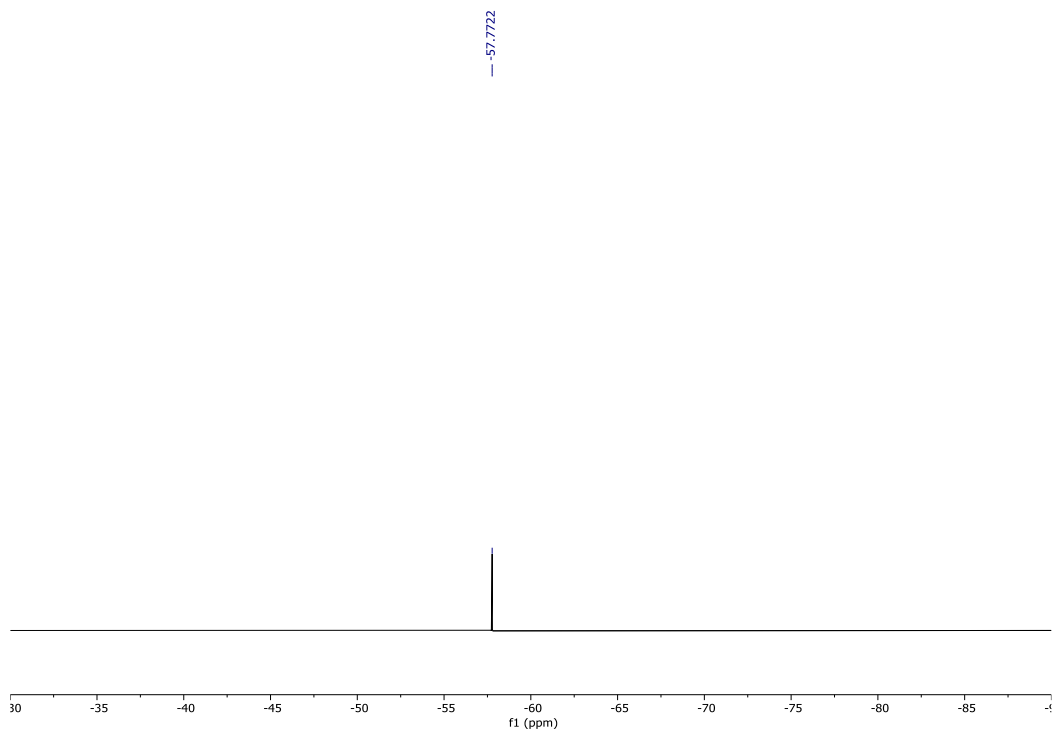
### 3-(5-Methylthiophen-2-yl)-4-(4-(trifluoromethyl)phenyl)pyridine (24a)





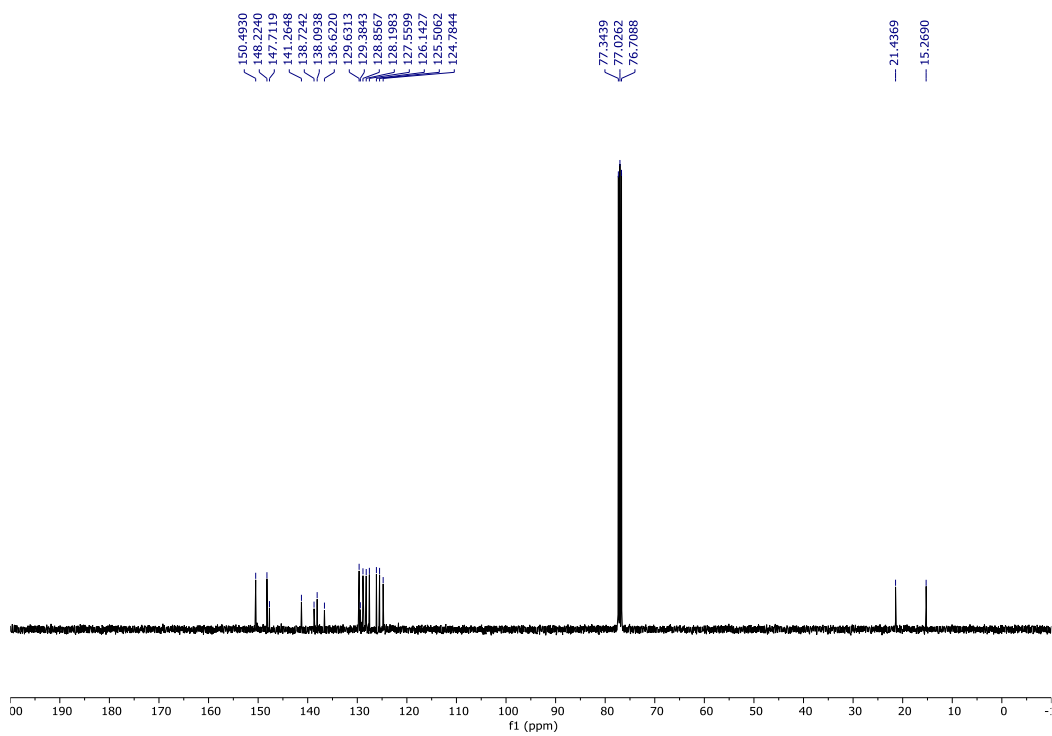
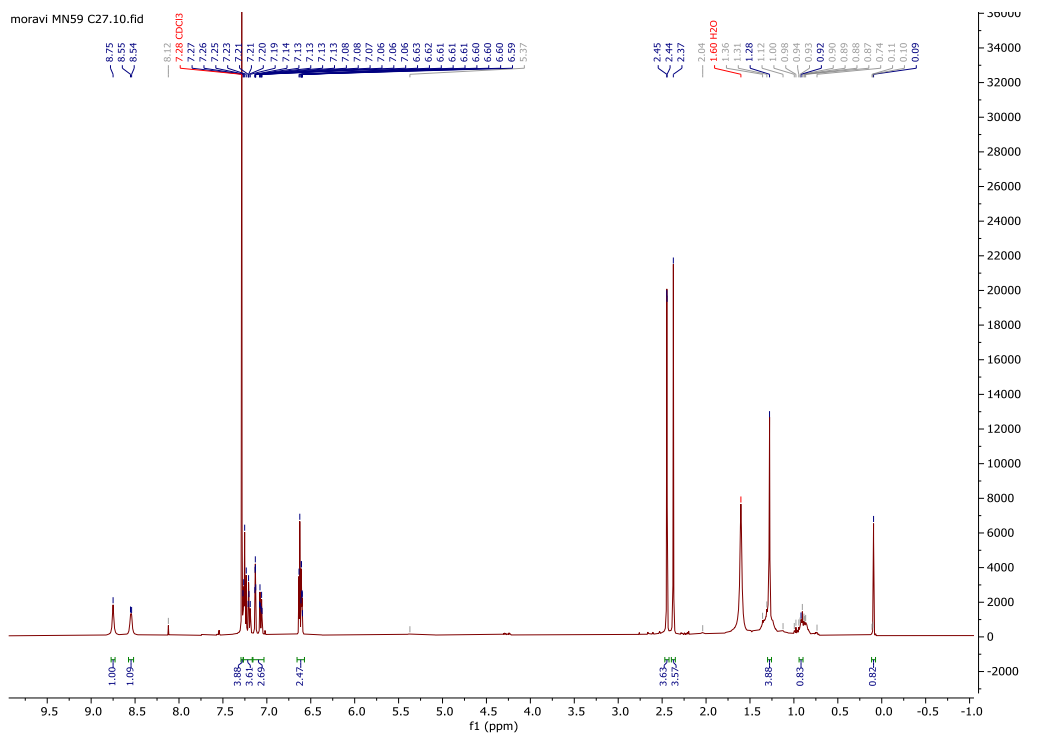
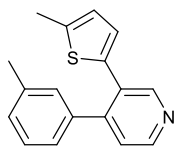
### 3-(5-Methylthiophen-2-yl)-4-(4-(trifluoromethoxy)phenyl)pyridine (25a)



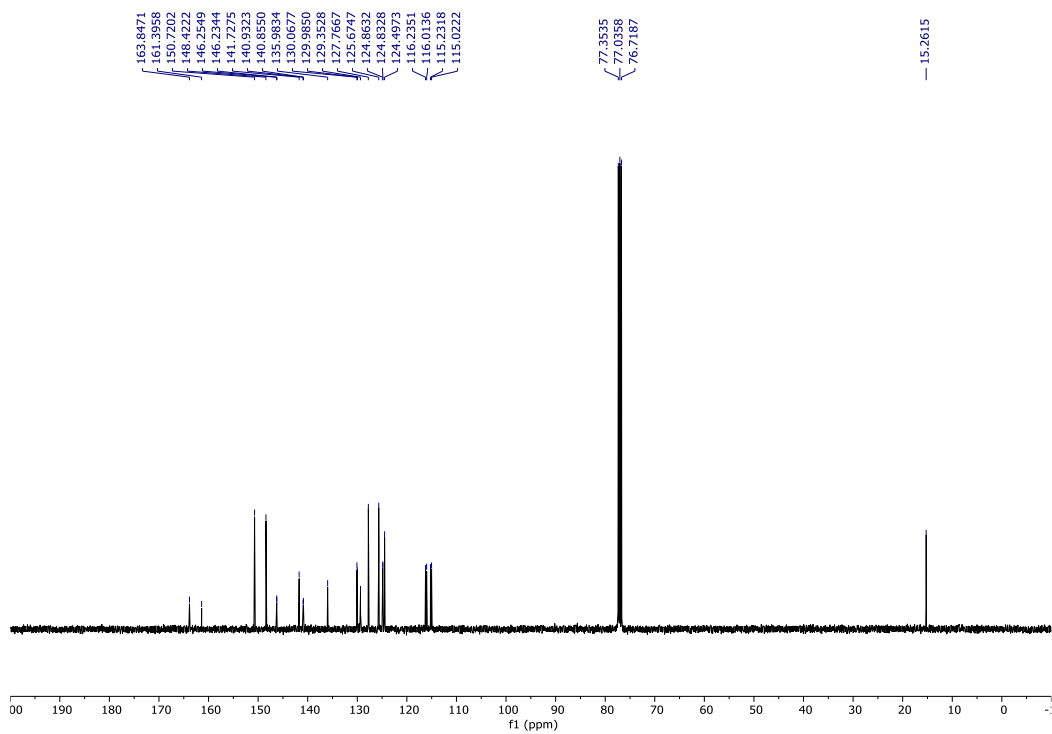
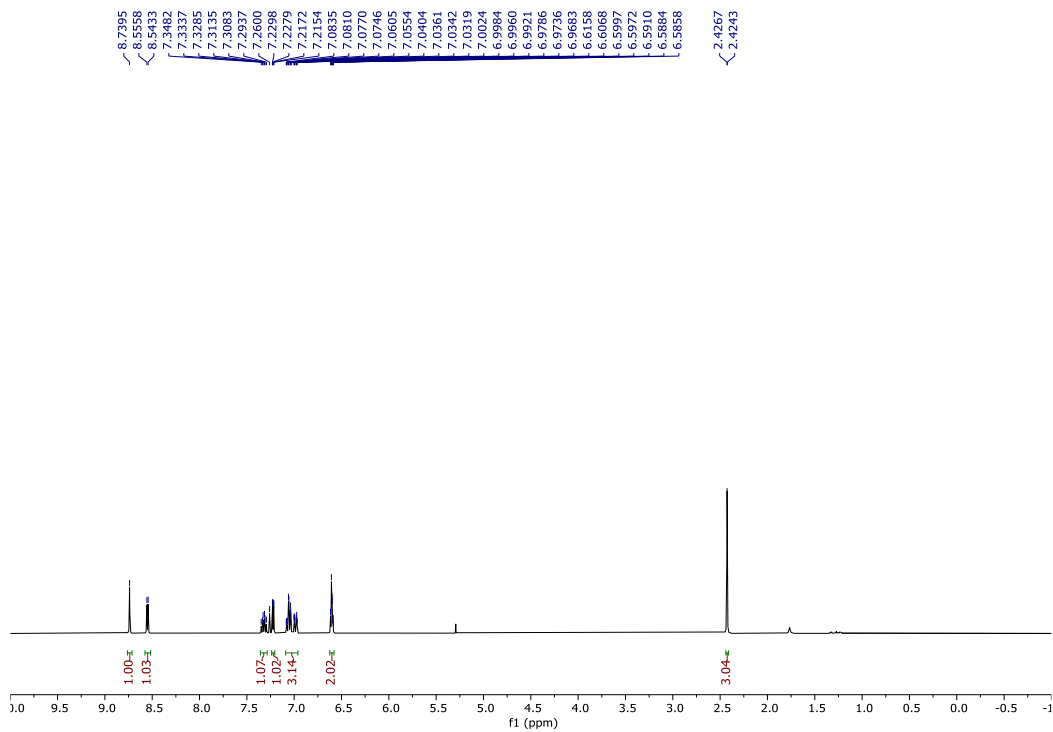
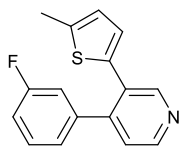


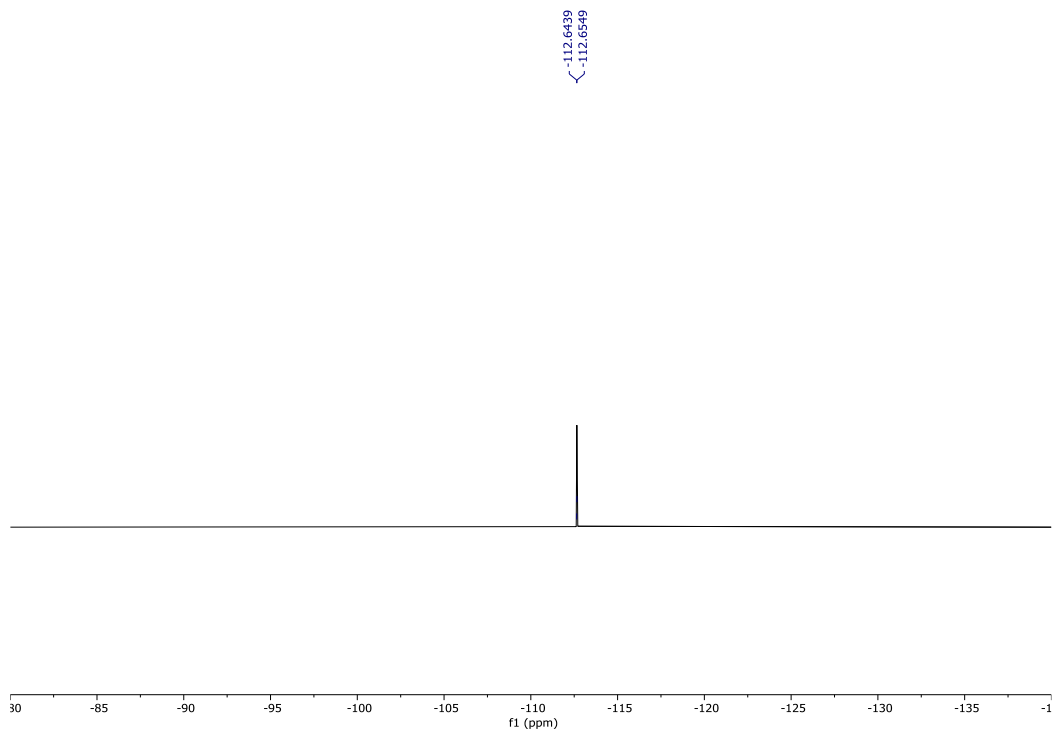


### 3-(5-Methylthiophen-2-yl)-4-(*m*-tolyl)pyridine (27a)

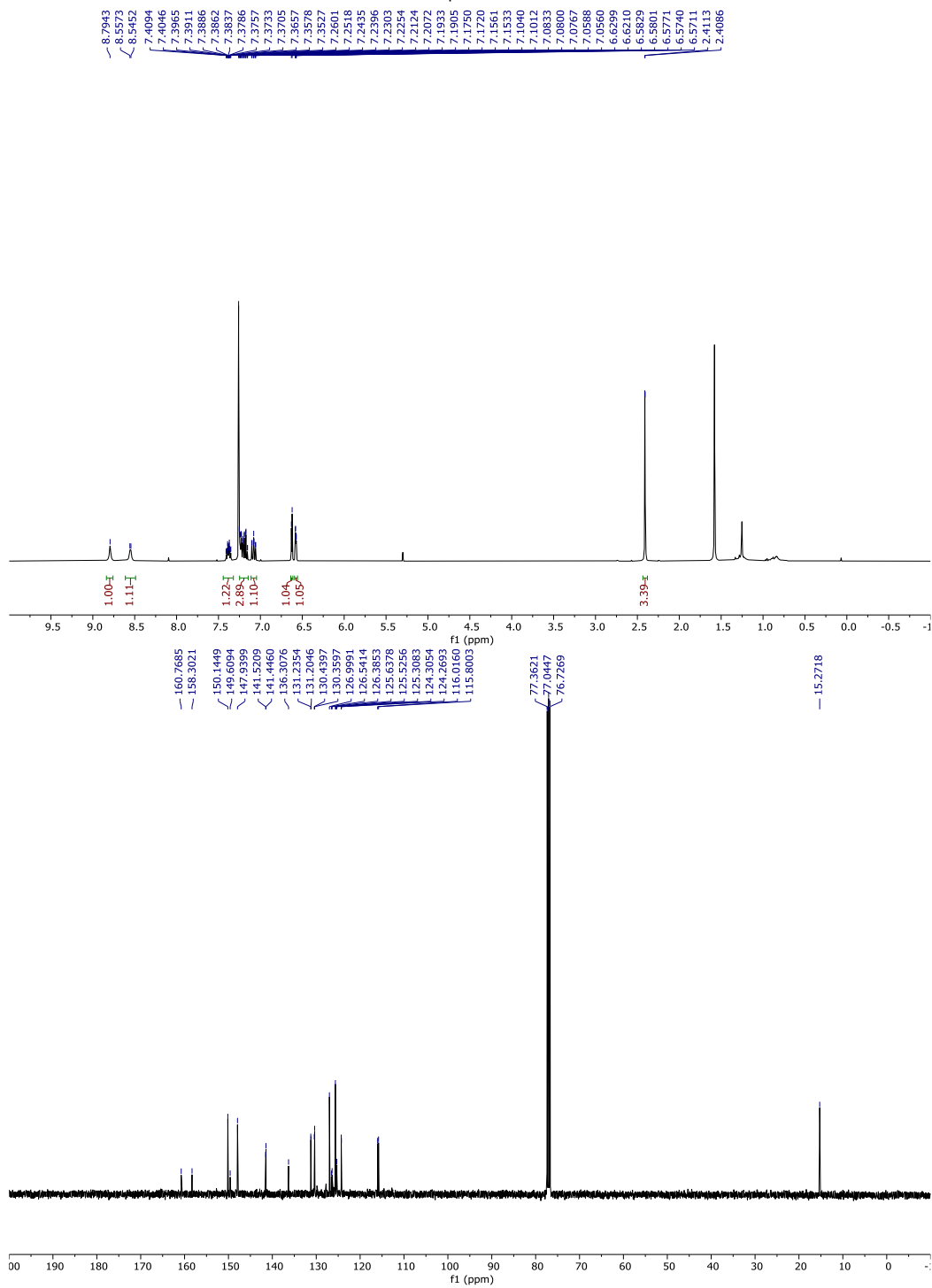
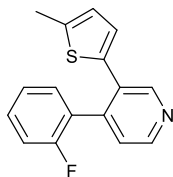


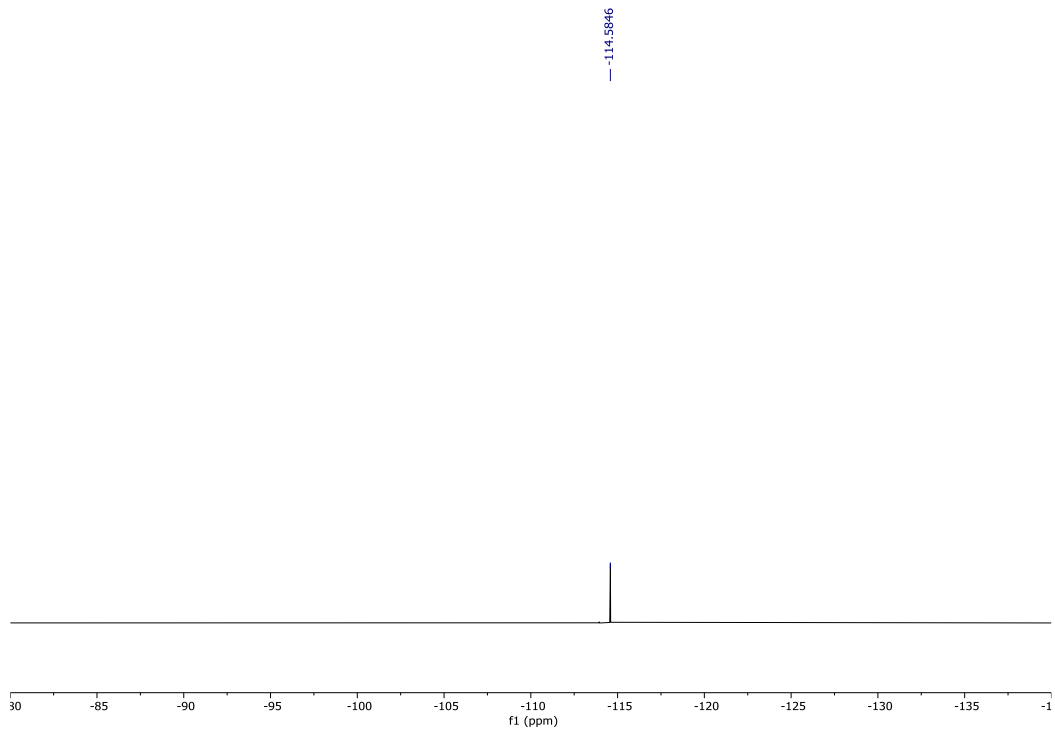
# 4-(3-Fluorophenyl)-3-(5-methylthiophen-2-yl)pyridine (28a)



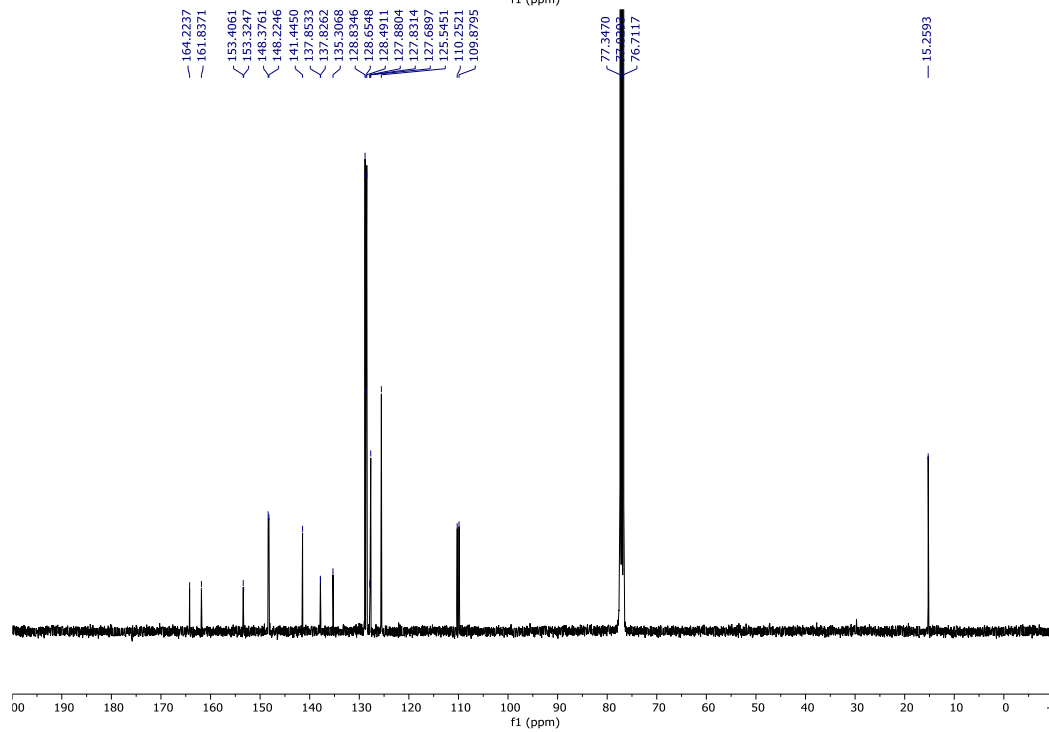
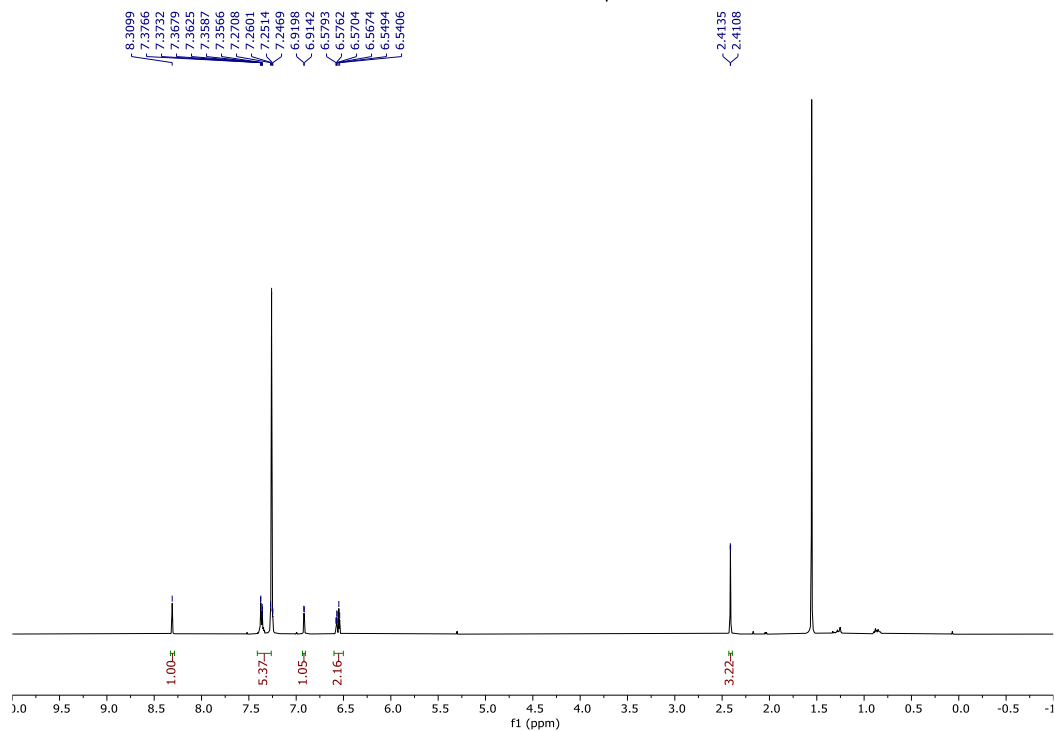
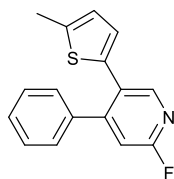


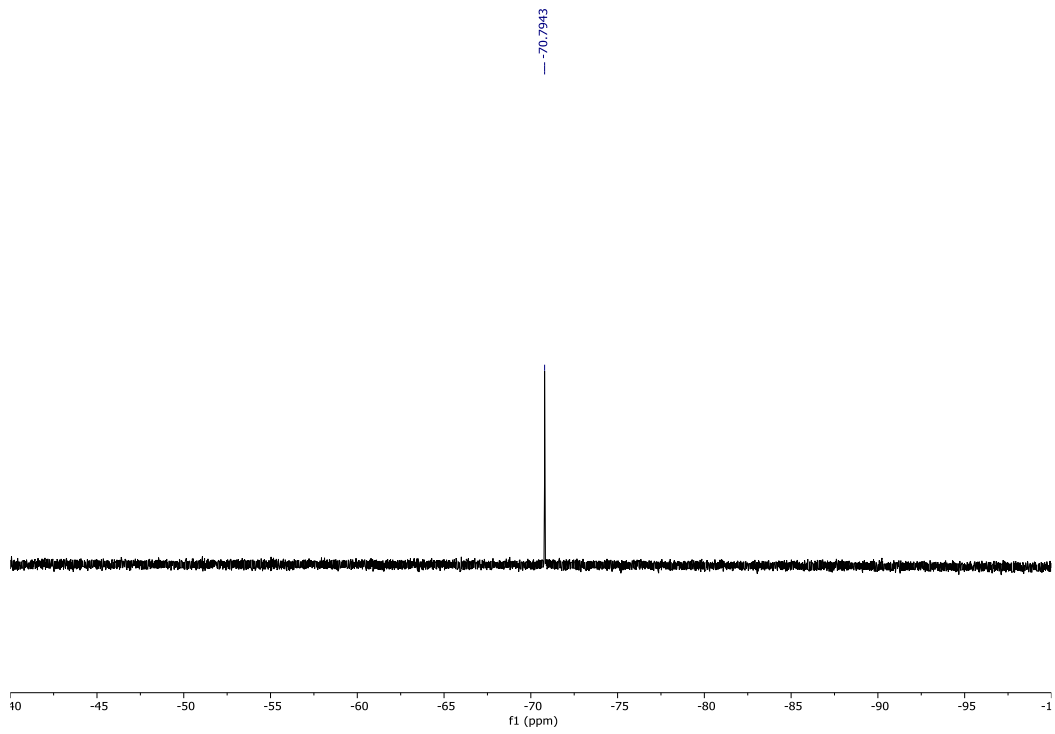
# 4-(2-Fluorophenyl)-3-(5-methylthiophen-2-yl)pyridine (29a)



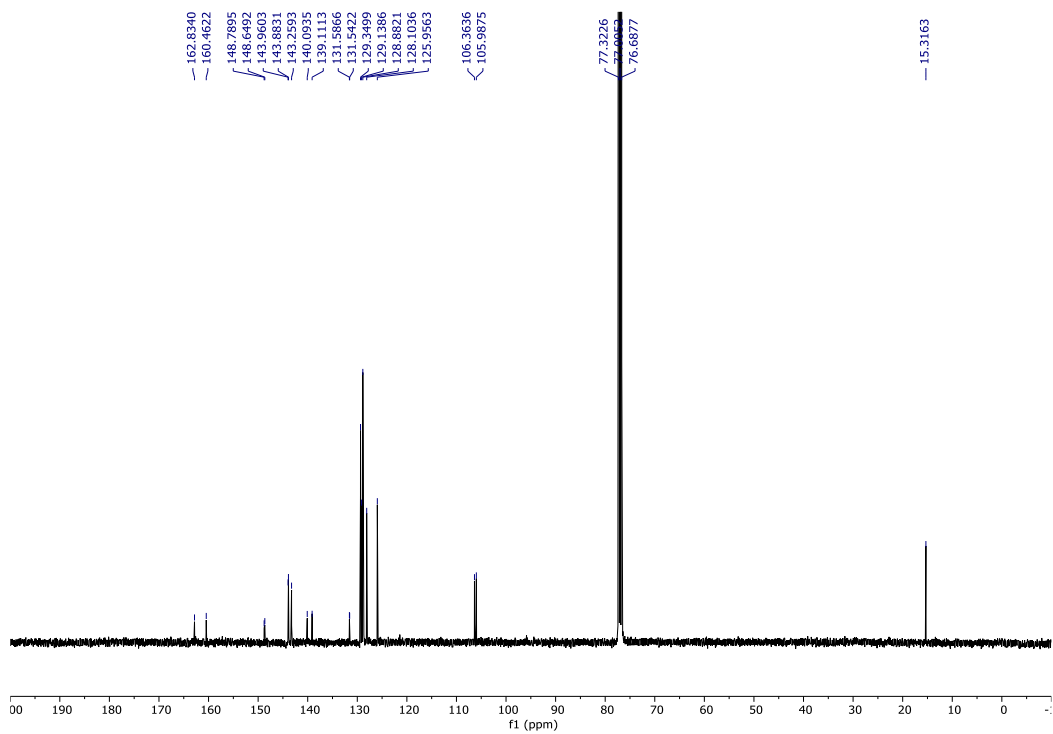
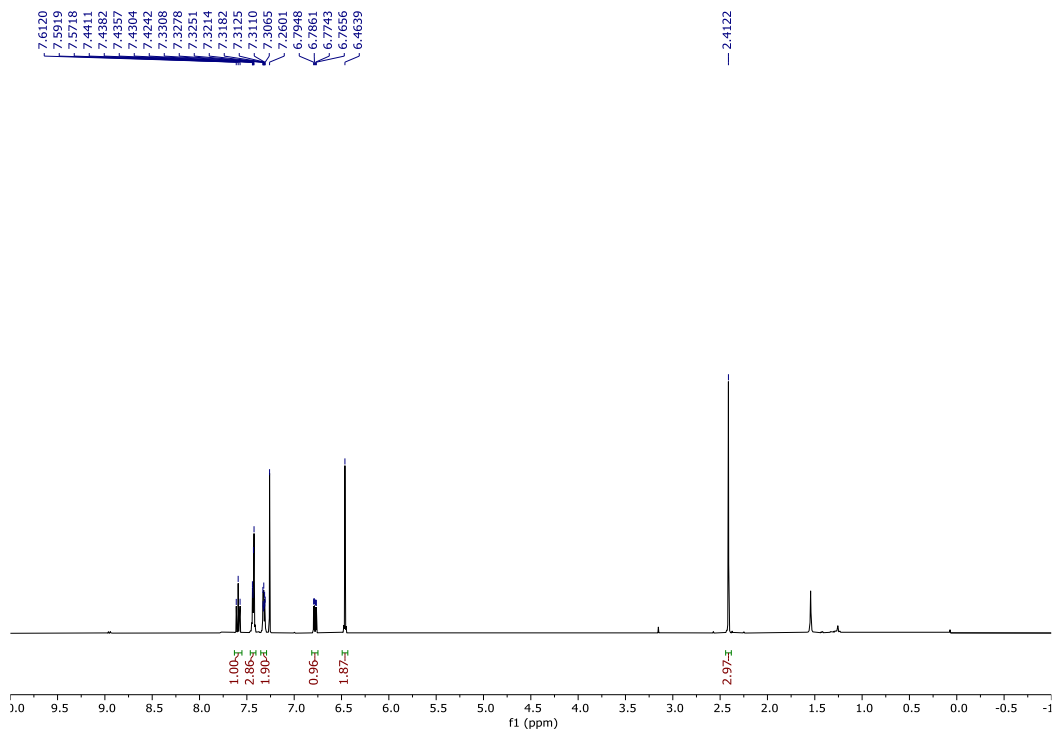
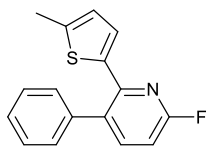


# 2-Fluoro-5-(5-methylthiophen-2-yl)-4-phenylpyridine (30a)

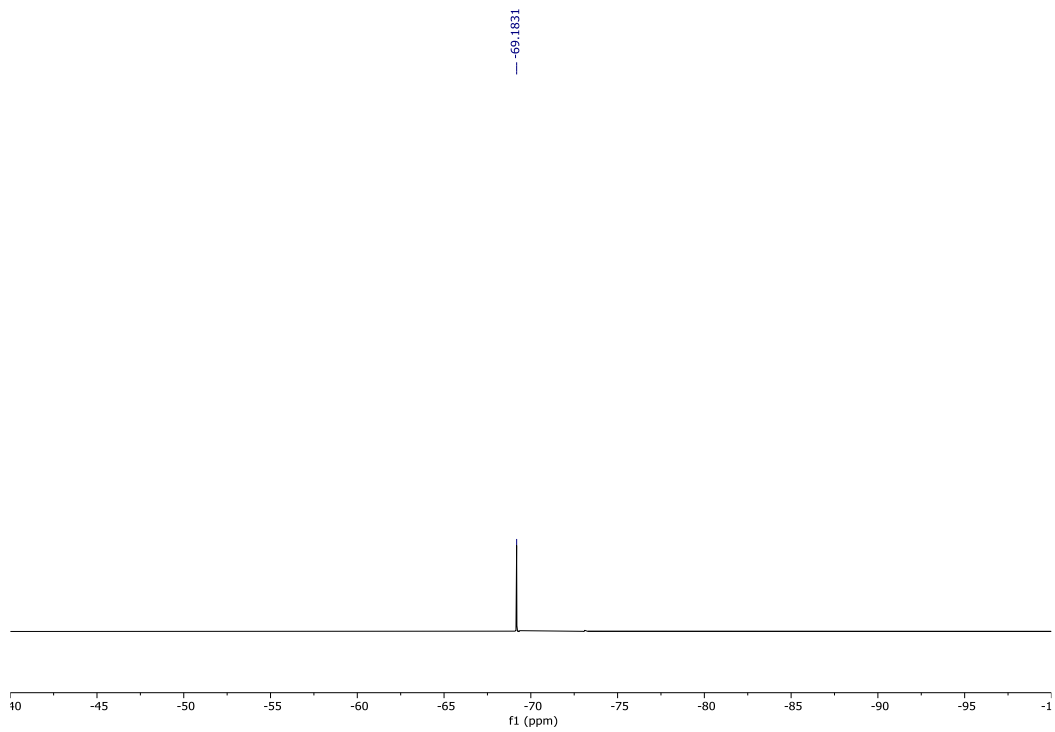




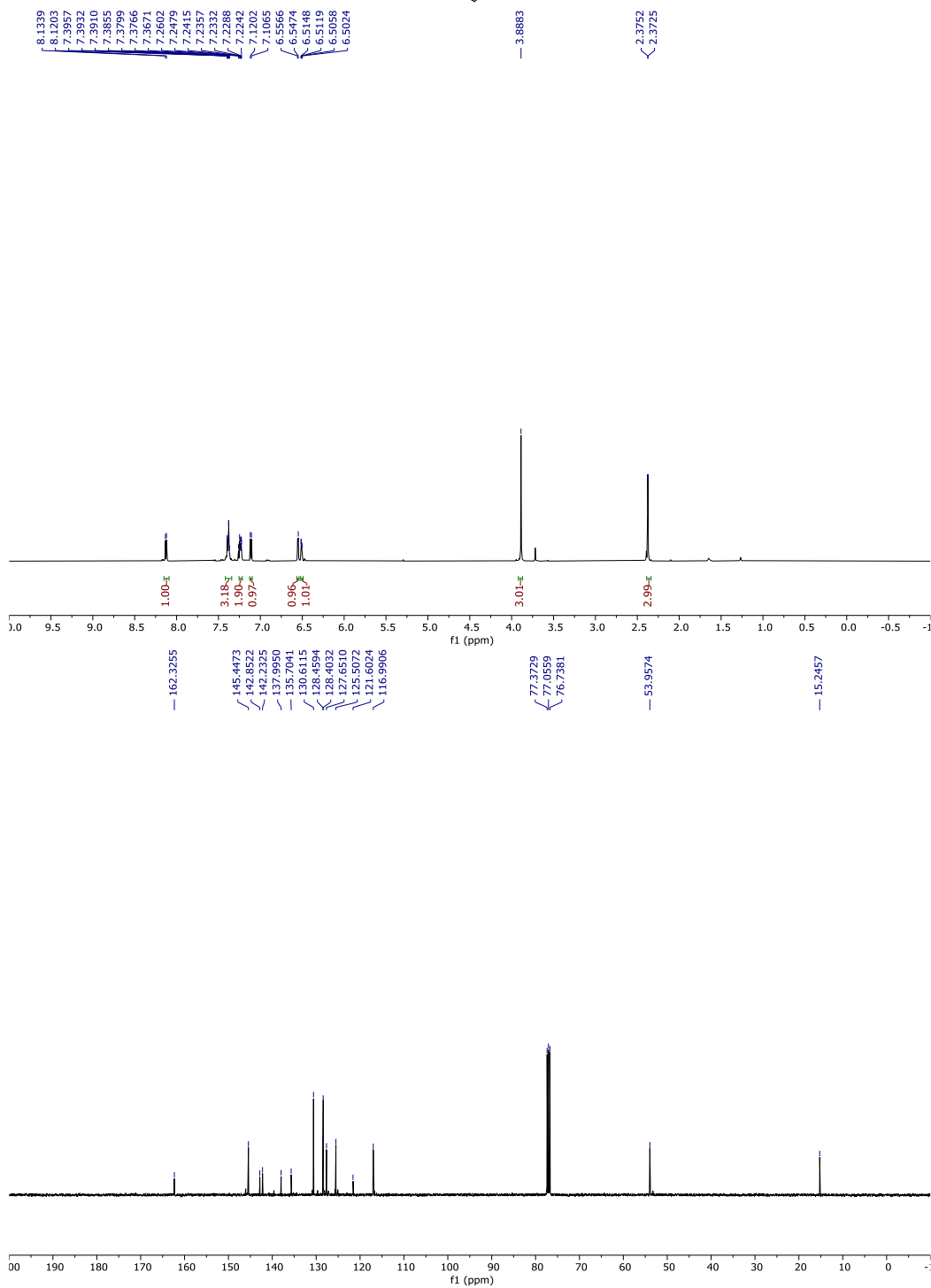
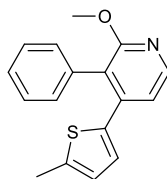
# 6-Fluoro-2-(5-methylthiophen-2-yl)-3-phenylpyridine (33a)







# 2-Methoxy-4-(5-methylthiophen-2-yl)-3-phenylpyridine (34a)



# 2-Fluoro-4-(5-methylthiophen-2-yl)-3-phenylpyridine (35a)

