Supporting Information

Visible Light-Driven C4-Selective Alkylation of Pyridinium Derivatives with Alkyl Bromides

*Sungwoo Jung,[a,b] Sanghoon Shin,[a,b] Seongjin Park,[a,b] and Sungwoo Hong[b,a,]**

Email : hongorg@kaist.ac.kr

[a]Department of Chemistry, Korea Advanced Institute of Science and Technology (KAIST), Daejeon 34141, Korea

[b]Center for Catalytic Hydrocarbon Functionalizations, Institute for Basic Science (IBS), Daejeon 34141, Korea

I. General Methods and Materials

Unless stated otherwise, reactions were performed in flame-dried glassware. Analytical thin layer chromatography (TLC) was performed on precoated silica gel 60 F254 plates and visualization on TLC was achieved by UV light (254 and 365 nm). Flash column chromatography was performed on silica gel (400-630 mesh) or a CombiFlash® Rf + system with RediSep® Rf silica columns (230-400 mesh) using a proper eluent. ^{1}H NMR was recorded on Brucker Avance 400 MHz or Agilent Technologies DD2 600 MHz. Chemical shifts were quoted in parts per million (ppm) referenced to the appropriate solvent peak or 0.0 ppm for tetramethylsilane. The following abbreviations were used to describe peak splitting patterns when appropriate: br = broad, s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, dd = doublet of doublet, td = triplet of doublet, ddd = doublet of doublet of doublet. Coupling constants, J, were reported in hertz unit (Hz). ^{13}C NMR was recorded on Brucker Avance 100 MHz or Agilent Technologies DD2 150 MHz and was fully decoupled by broad band proton decoupling. ^{19}F NMR was recorded on Brucker Avance 376 MHz. Chemical shifts were reported in ppm referenced to the centerline of a triplet at 77.0 ppm of $CDCl_3$. High-resolution mass spectra were obtained by using ESI from KAIST Research Analysis Center (Daejeon). Commercial grade reagents and solvents were used without further purification except as indicated below.

II. Experimental Procedure

General procedure 1 for site-selective alkylation of pyridinium derivatives (GP1)

Reactions were conducted in a test tube (12 mL) sealed with PTFE/rubber septa. 1-((*N*,4-dimethylphenyl)sulfonamido)-2-phenylpyridin-1-ium tetrafluoroborate (**1a**) (42.6 mg, 0.1 mmol), bromocyclohexane (**2a**) (32.6 mg, 0.2 mmol), TTMSS (49.7 mg, 0.2 mmol), and NaOAc (16.4 mg, 0.2 mmol) were combined in acetonitrile (1.0 mL) under N_2 atmosphere. The sealed test tube was placed at a reaction bath equipped with a stirp blue LED (7.5 W, 465 nm). The resulting mixture was stirred at rt. The reaction mixture was monitored by TLC using (ethyl acetate/*n*-hexane = 1:5) as the mobile phase. After disappearance of starting material, the reaction mixture was diluted and filtered through a Celite pad with CH_2Cl_2 (50 mL). After removal of solvent, the residue was purified by flash chromatography on silica gel (ethyl acetate/*n*-hexane = 1:10) to give a desired product compound **3a** (19.5 mg, 82%) as colorless oil.

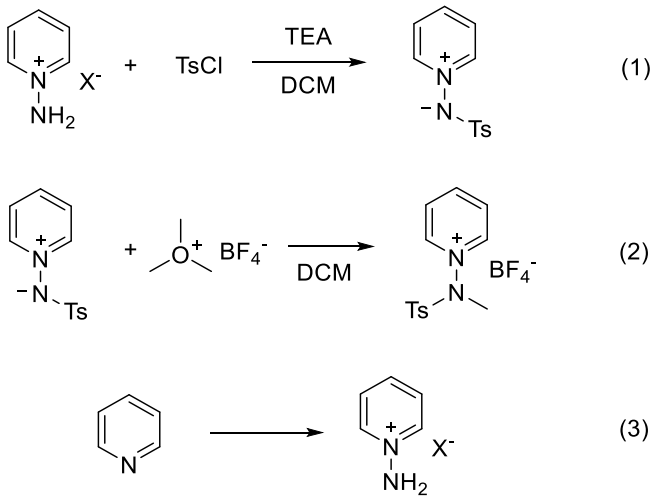
General procedure 2 for site-selective alkylation of pyridinium derivatives (GP2)

Reactions were conducted in a test tube (12 mL) sealed with PTFE/rubber septa. 1-((*N*,4-dimethylphenyl)sulfonamido)-2-phenylpyridin-1-ium tetrafluoroborate (**1a**) (42.6 mg, 0.1 mmol), 1-bromopentane (**2o**) (30.2 mg, 0.2 mmol), TTMSS (49.7 mg, 0.2 mmol), and NaOAc (16.4 mg, 0.2 mmol) were combined in acetonitrile (1.0 mL) under N_2 atmosphere. The sealed test tube was placed at a

reaction bath equipped with a Kessil blue LED (10 W, 440 nm). The resulting mixture was stirred at rt. The reaction mixture was monitored by TLC using (ethyl acetate/*n*-hexane = 1:5) as the mobile phase. After disappearance of starting material, the reaction mixture was diluted and filtered through a Celite pad with CH_2Cl_2 (50 mL). After removal of solvent, the residue was purified by flash chromatography on silica gel (ethyl acetate/*n*-hexane = 1:10) to give a desired product compound **3o** (11.7 mg, 52%) as colorless oil.

Preparation of *N*-tosyl 1-aminopyridinium salts

Scheme S1. Preparation of *N*-tosyl 1-aminopyridinium salts



(1) General procedure for *N*-tosyl 1-aminopyridinium ylides

To a solution of 1-aminopyridinium (1.0 equiv) in dichloromethane (0.2 M) were added triethylamine (2.2 equiv) and tosyl chloride (1.0 equiv) at room temperature. The reaction mixture was stirred at room temperature for 6 h. The resulting mixture was extracted with dichloromethane and water for three times, and washed with water. The combined organic layers were dried over magnessium sulfate, filtered and concentrated in vacuum. The resulting mixture was purified by flash column chromatography on silica gel (CH_2Cl_2 : MeOH = 20 : 1) to obtain *N*-tosyl 1-aminopyridinium ylides.

(2) General procedures for *N*-tosyl 1-aminopyridinium tetrafluoroborate salts (when *N*-Me)

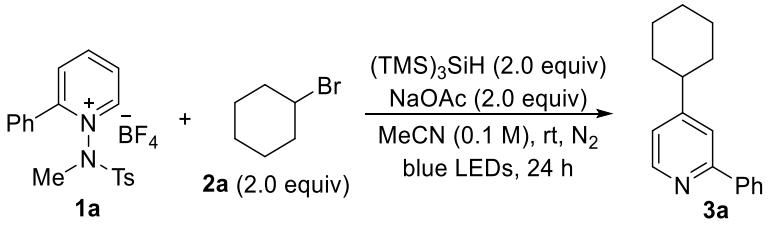
To a solution of *N*-tosyl 1-aminopyridinium ylide (1.0 equiv) in dichloromethane (0.1 M) were added trimethyloxonium tetrafluoroborate (Meerwein's reagent, 1.1 equiv) at room temperature. The reaction mixture was stirred at room temperature for 3 h. The resulting mixture was concentrated under reduced pressure. The product was recrystallized with diethylether from CH_2Cl_2 and MeOH (20:1) solution at -20 ℃. A solid product was obtained.

(3) Preparation of *N*-amino pyridinium salts from pyridines

Amination of pyridine was conducted using the previous developed method with hydroxylamine-*O*-sulfonic acid[1] or *O*-mesitylsulfonylhydroxylamine (MSH)[2]. MSH was synthesized by using previous developed method[3].

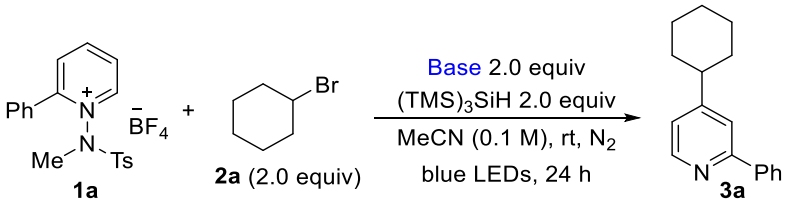
Optimization of the reaction conditions

Table S1. Variations from standard conditions



entry	variations from standard conditions	yield (%)
1	none	82
2	acetone instead of MeCN	80
3	1,2-DCE instead of MeCN	49
4	addition of $^{n}Bu_4NBr$ (0.5 equiv)	40
5	Et_3SiH instead of $(TMS)_3SiH$	NR
6	$(EtO)_3SiH$ instead of $(TMS)_3SiH$	NR
7	without NaOAc	7
8	without $(TMS)_3SiH$	NR
9	without visible light irradiation	NR
10	addition of TEMPO (2.0 equiv)	NR

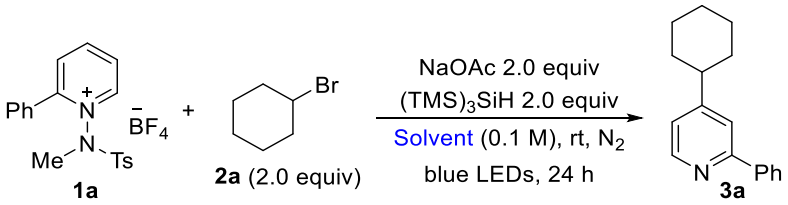
Table S2. Screening of bases



entry	base	yield (%)
1	NaOAc	82
2	$NaHCO_3$	79
3	Na_2CO_3	79

4	NaH_2PO_4	11
5	Na_2HPO_4	81
6	Na_3PO_4	30
7	NaOH	trace
8	NaO^tBu	trace
9	TEA	trace
10	LiOAc	39
11	KOAc	9
12	CsOAc	trace

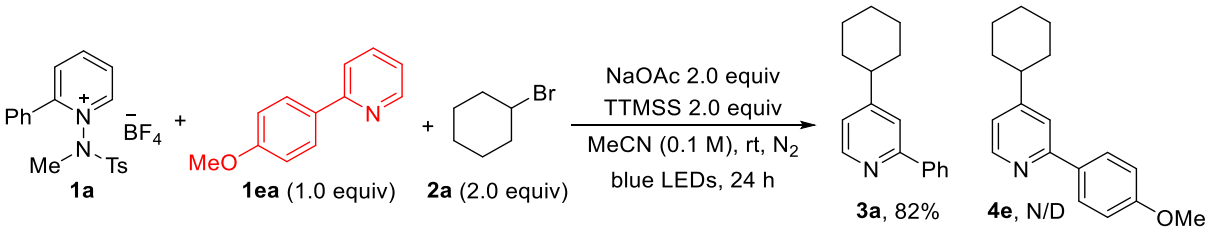
Table S2. Screening of solvents



entry	solvent	yield (%)
1	MeCN	82
2	DCM	52
3	DCE	49
4	Acetone	80
5	MeOH	trace
6	DMSO	trace
7	MeCN/DCM (1:1)	43
8	MeCN/DCE (1:1)	30
9	$MeCN/H_2O$ (9:1)	trace

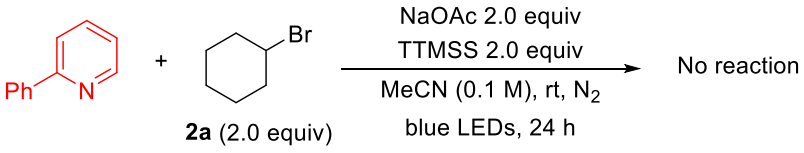
III. Control Experiments

Scheme S2. Competitive reaction with other pyridine compound

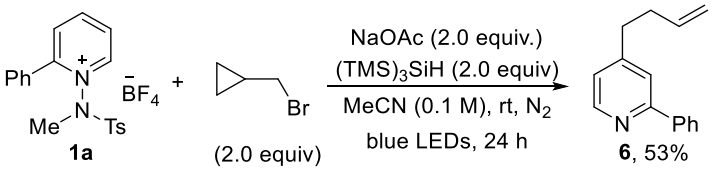


Reactions were conducted in a test tube (12 mL) sealed with PTFE/rubber septa. 1-((*N*,4-dimethylphenyl)sulfonamido)-2-phenylpyridin-1-ium tetrafluoroborate (**1a**) (42.6 mg, 0.1 mmol), bromocyclohexane (**2a**) (32.6 mg, 0.2 mmol), 2-(4-methoxyphenyl)pyridine (18.5 mg, 0.1 mmol), TTMSS (49.7 mg, 0.2 mmol), and NaOAc (16.4 mg, 0.2 mmol) were combined in acetonitrile (1.0 mL) under N_2 atmosphere. The sealed test tube was placed at a reaction bath equipped with a blue LED. The resulting mixture was stirred at rt. The reaction mixture was monitored by TLC using (ethyl acetate/*n*-hexane = 1:5) as the mobile phase. After disappearance of starting material, the reaction mixture was diluted and filtered through a Celite pad with CH_2Cl_2 (50 mL). After removal of solvent, the yield of product was determined by ^1H NMR analysis using caffeine as an internal standard. The yield of **3a** was determined to be 82% (19.5 mg, 0.088 mmol).

Scheme S3. Reaction using 2-phenylpyridine

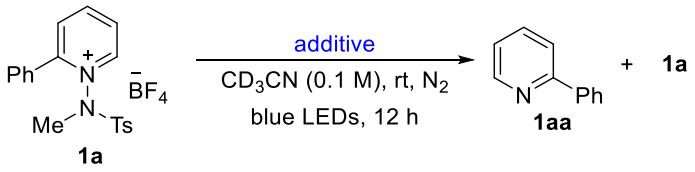


Scheme S4. Radical clock experiment with (bromomethyl)cyclopropane



The radical clock experiment was prepared according to **GP2**.

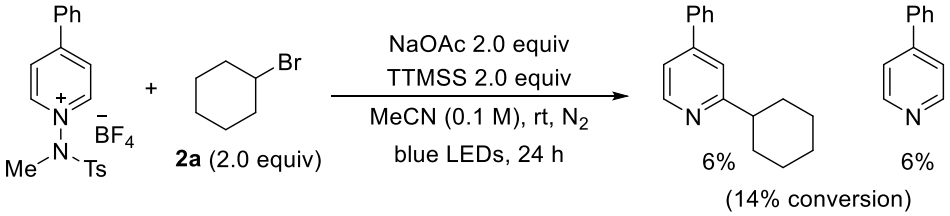
Scheme S5. Investigation of photolysis with additives



entry	entry	**1aa** (%)	**1a** (%)
1	none	N/D	>99%
2	NaOAc (2.0 equiv)	N/D	>99%
3	Na_2CO_3 (2.0 equiv)	N/D	>99%
4	Na_2HPO_4 (2.0 equiv)	N/D	>99%
5	NaOH (2.0 equiv)	13	trace
6	TEA (2.0 equiv)	95	5
7	TBAB (1.0 equiv)	3	97
8	TBAB (1.0 equiv) + TTMSS (2.0 equiv)	9	75[a]

[a]C4-silylated product **7** was observed in 14% yield.

Scheme S6. Reaction with C4-blocked pyridinium salt



IV. Absorption Spectra

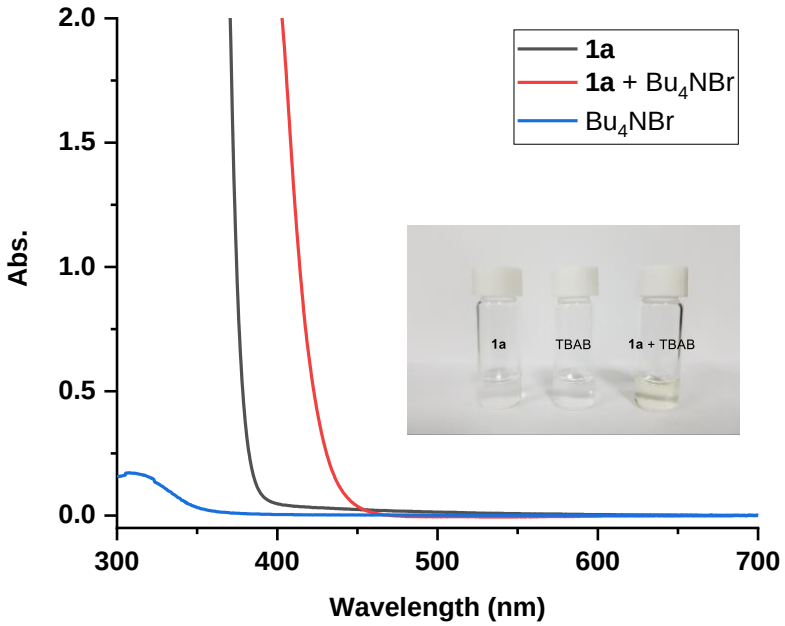


Figure S1. Absorption spectra for **1a** with tetrabutylammonium bromide (based on 0.1 M of **1a** in MeCN).

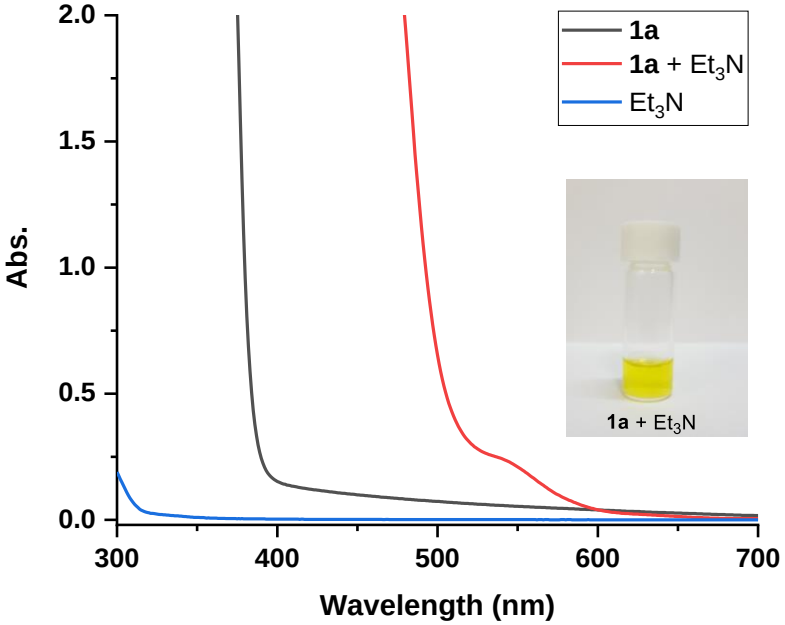


Figure S2. Absorption spectra for **1a** with triethylamine (based on 0.2 M of **1a** in MeCN).

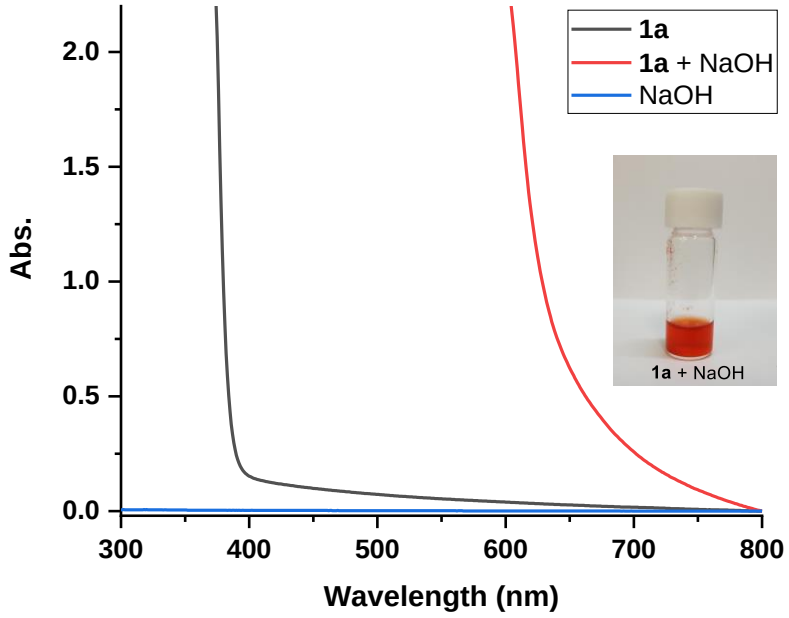


Figure S3. Absorption spectra for **1a** with sodium hydroxide (based on 0.2 M of **1a** in MeCN).

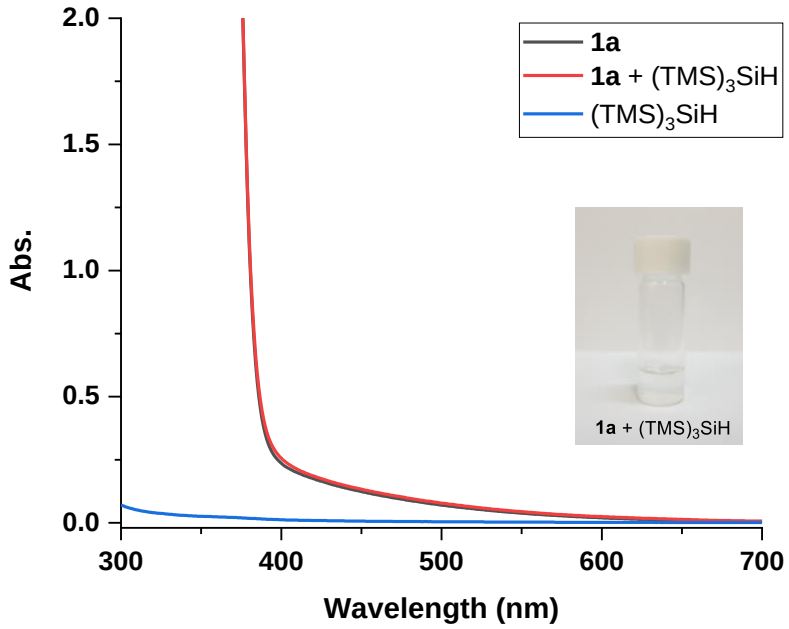


Figure S4. Absorption spectra for **1a** with tris(trimethylsilyl)silane (based on 0.2 M of **1a** in MeCN).

V. Stern-Volmer Quenching Experiment

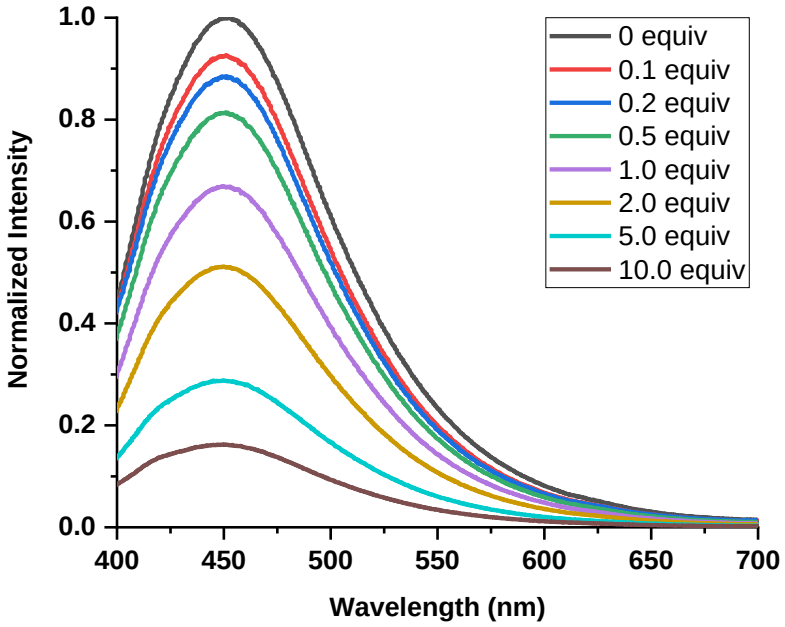


Figure S5. Quenching of the **1a** (5×10^{-3} M in MeCN) in the presence of increasing amount of $^{n}Bu_4NBr$ (Excitation wavelength: 370 nm, Ex bandwidth: 10.0 nm, Em bandwidth: 10.0 nm).

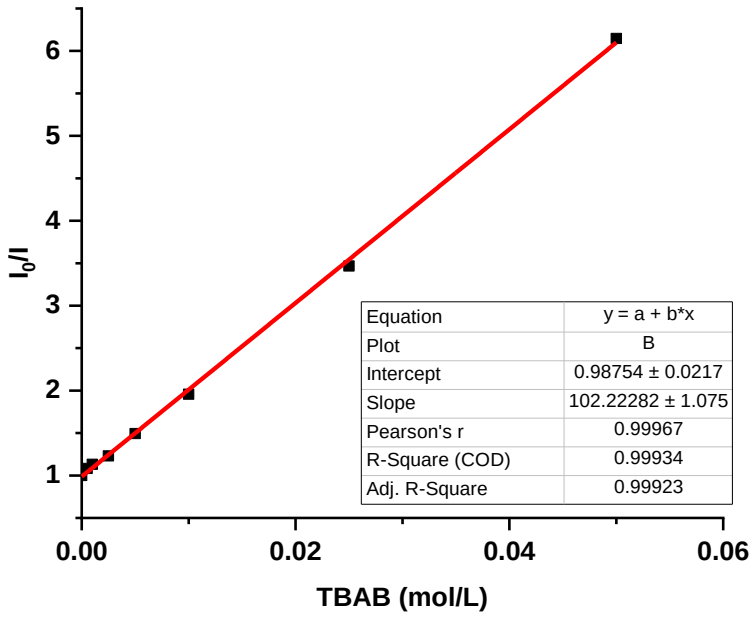


Figure S6. Stern-Volmer quenching plot of **Figure S5**.

VI. Quantum Yield Measurements

Determination of the light intensity at 415 nm.

Blue LED (λ_{max} = 415 nm) was used for measurement of quantum yield.

According to the procedure of Yoon[4] the photon flux of the LED (λ_{max} = 415 nm) was determined by standard ferrioxalate actinometry. A 0.15 M solution of ferrioxalate was prepared by dissolving potassium ferrioxalate hydrate (0.737 g) in H_2SO_4 (10 mL of a 0.05 M solution). A buffered solution of 1,10-phenanthroline was prepared by dissolving 1,10-phenanthroline (5.0 mg) and sodium acetate (1.13 g) in H_2SO_4 (5.0 mL of a 0.5 M solution). Both solutions were stored in the dark. To determine the photon flux of the LED, the ferrioxalate solution (2.0 mL) was placed in a cuvette and irradiated for 90 seconds at λ_{max} = 456 nm. After irradiation, the phenanthroline solution (0.35 mL) was added to the cuvette and the mixture was allowed to stir in the dark for 1 h to allow the ferrous ions to completely coordinate to the phenanthroline. The absorbance of the solution was measured at 510 nm. A non-irradiated sample was also prepared and the absorbance at 510 nm was measured. Conversion was calculated using eq 1.

	Non-irrad	Irrad 01	Irrad 02	Irrad 03
$A_{510\ nm}$	0.231	2.239	2.279	2.280
		Average $A_{510\ nm}$ of irradiation samples		2.280

$$\text{mol of } Fe^{2+} = \frac{V \cdot \Delta A_{510\ nm}}{l \cdot \epsilon} = \frac{(0.00235\ L) \cdot (2.049)}{(1.00\ cm) \cdot (11{,}100 \frac{L}{mol} \cdot cm)} = 4.34 \times 10^{-7}\ mol \quad (1)$$

V is the total volume (0.00235 L) of the solution after addition of phenanthroline, ΔA is the difference in absorbance at 510 nm between the irradiated and non-irradiated solutions, l is the path length (1.00 cm), and ε is the molar absorptivity of the ferrioxalate actinometer at 510 nm (11,100 $Lmol^{-1}cm^{-1}$).[5] The photon flux can be calculated using eq 2.

$$\text{Photon flux} = \frac{mol\ of\ Fe^{2+}}{\emptyset \cdot t \cdot f} = \frac{4.34 \times 10^{-7}\ mol}{(1.12) \cdot (90\ s) \cdot (0.999)} = 4.31 \times 10^{-9}\ einstein/s \quad (2)$$

Where Φ is the quantum yield for the ferrioxalate actinometer (1.12 at λ = 415 nm)[6], t is the irradiation time (90 s), and f is the fraction of light absorbed at 415 nm by the ferrioxalate actinometer. This value is calculated using eq 3 where $A_{415\ nm}$ is the absorbance of the ferrioxalate solution at 415 nm. An

absorption spectrum gave an $A_{415\ nm}$ value of >3, indicating that the fraction of absorbed light (f) is 0.999.

$$f = 1 - 10^{-A_{415\ nm}} \quad (3)$$

The photon flux was thus calculated (average of three experiments) to be 4.31×10^{-9} einsteins s^{-1}

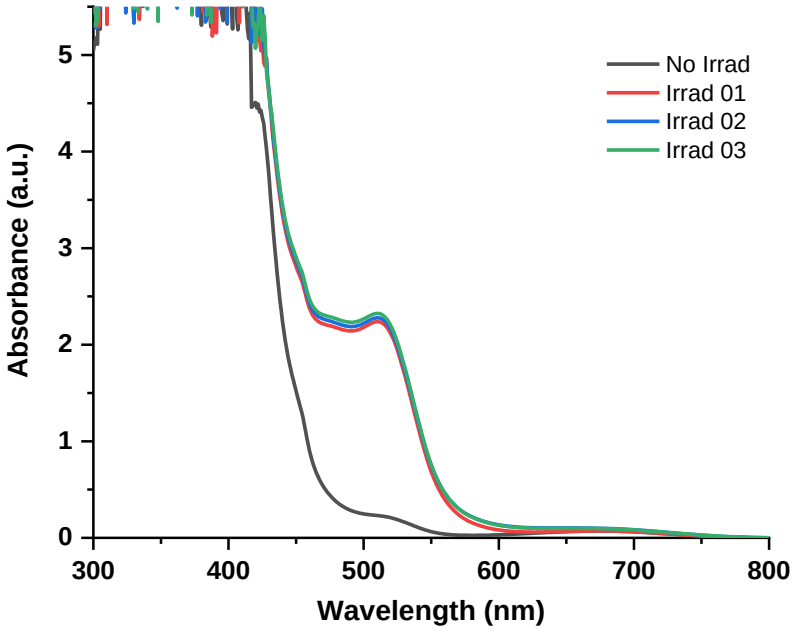


Figure S7. Absorption spectra of three irradiation experiments and non-irradiation experiment

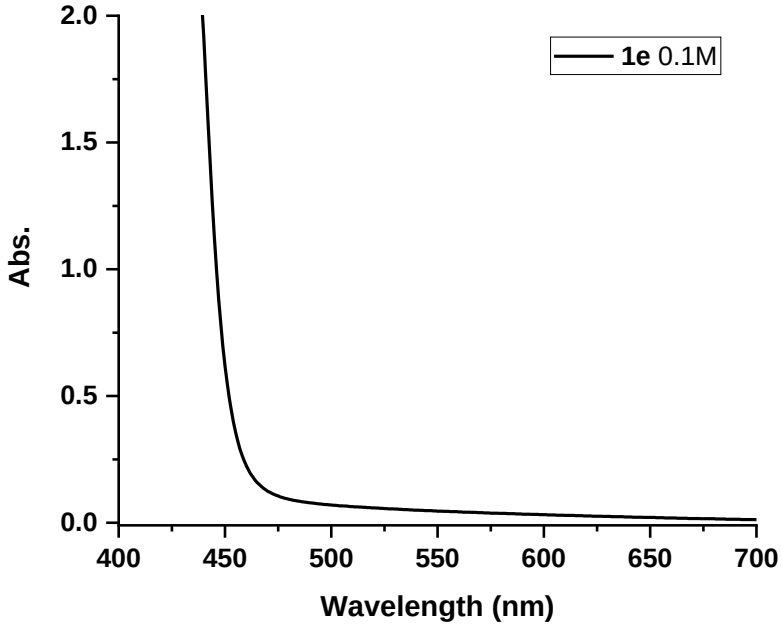
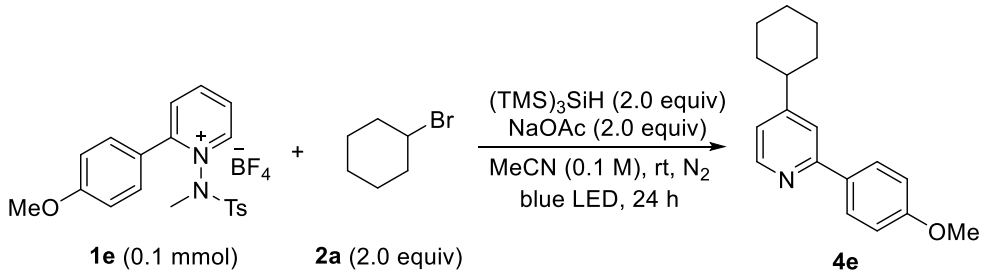


Figure S8. Absorption spectra of **1e** (0.1 M in MeCN)

Determination of the reaction quantum yield.



The reaction mixture was stirred and irradiated by blue LED (λ_{max} = 415 nm) for 600 s. The yield of product was determined by ^{1}H NMR analysis using caffeine as an internal standard. The yield of **4e** was determined to be 49% (0.49×10^{-4} mol of **4e**). The reaction quantum yield (Φ) was determined using eq 4 where the photon flux is 4.31×10^{-9} einsteins s^{-1} (determined by actinometry as described above), t is the reaction time (600 s) and f is the fraction of incident light absorbed by the catalyst, determined using eq 3. An absorption spectrum of the **1e** (0.1 M) gave an absorbance value of 2.364 at 415 nm, indicating that the fraction of light absorbed by the **1e** (f) is 0.996.

$$\Phi = \frac{mol\ of\ product}{flux \cdot t \cdot f} \qquad (4)$$

$$\Phi = \frac{0.49 \times 10^{-4}\ mol}{4.31 \times 10^{-9}\ einstein\ s^{-1} \cdot 600\ s \cdot 0.996} = 19.02$$

The reaction quantum yield (Φ) was calculated to be 19.02

References

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(4) Cismesia, M. A.; Yoon, T. P. Characterizing Chain Processes in Visible Light Photoredox Catalysis. *Chem. Sci*. **2015**, *6*, 5426–5434.

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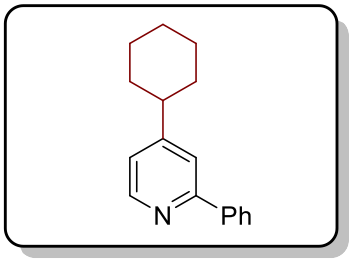
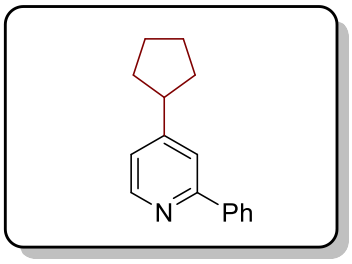
VII. Compound Characterizations

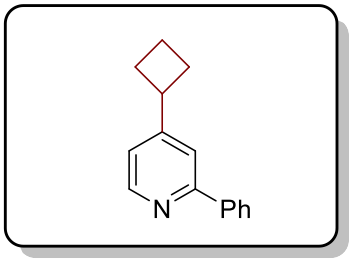
Characterization of C4-alkylated pyridine product



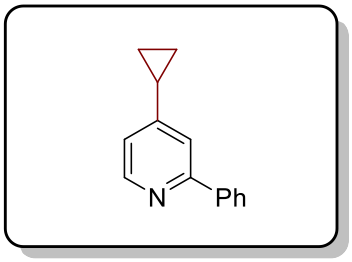
4-cyclohexyl-2-phenylpyridine (3a). Prepared according to **GP1**. Colorless oil (19.5 mg, 82%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.58 (d, *J* = 5.1 Hz, 1H), 7.98 (dd, *J* = 7.2, 1.8 Hz, 2H), 7.56 (d, *J* = 1.6 Hz, 1H), 7.47 (t, *J* = 7.3 Hz, 2H), 7.45 – 7.35 (m, 1H), 7.08 (dd, *J* = 5.1, 1.7 Hz, 1H), 2.57 (ddd, *J* = 11.7, 8.2, 3.4 Hz, 1H), 2.02 – 1.83 (m, 4H), 1.83 – 1.72 (m, 1H), 1.55 – 1.34 (m, 4H), 1.36 – 1.20 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.5, 157.4, 149.5, 139.7, 128.8, 128.7, 127.0, 120.9, 119.4, 44.1, 33.6, 26.6, 25.9. HRMS (ESI) m/z calcd. for $[C_{17}H_{19}NNa]^{+}$: 260.1410 found: 260.1410



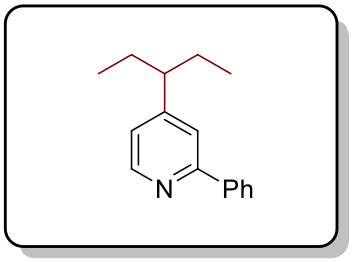
4-cyclopentyl-2-phenylpyridine (3b). Prepared according to **GP1**. Colorless oil (16.7 mg, 75%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.57 (dd, *J* = 5.1, 0.8 Hz, 1H), 8.13 – 7.89 (m, 2H), 7.58 (dt, *J* = 1.6, 0.8 Hz, 1H), 7.47 (tt, *J* = 6.7, 1.0 Hz, 2H), 7.45 – 7.36 (m, 1H), 7.11 (ddd, *J* = 5.1, 1.7, 0.6 Hz, 1H), 3.13 – 2.94 (m, 1H), 2.24 – 2.05 (m, 2H), 1.92 – 1.78 (m, 2H), 1.81 – 1.59 (m, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.1, 156.9, 149.1, 139.3, 128.9, 128.7, 127.0, 121.2, 119.8, 45.4, 34.0, 25.6. HRMS (ESI) m/z calcd. for $[C_{16}H_{17}NNa]^{+}$: 246.1253 found: 246.1256



4-cyclobutyl-2-phenylpyridine (3c). Prepared according to **GP1**. Colorless oil (12.6 mg, 60%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.59 (d, *J* = 5.0 Hz, 1H), 8.12 – 7.86 (m, 2H), 7.55 (d, *J* = 1.6 Hz, 1H), 7.47 (dd, *J* = 8.4, 6.9 Hz, 2H), 7.44 – 7.38 (m, 1H), 7.09 (dd, *J* = 5.1, 1.7 Hz, 1H), 3.73 – 3.49 (m, 1H), 2.48 – 2.31 (m, 2H), 2.29 – 2.15 (m, 2H), 2.17 – 2.05 (m, 1H), 1.98 – 1.83 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.0, 156.4, 148.9, 139.1, 129.0, 128.7, 127.1, 120.3, 118.9, 39.6, 29.0, 18.4. HRMS (ESI) m/z calcd. for $[C_{15}H_{15}NNa]^{+}$: 232.1097 found: 232.1089

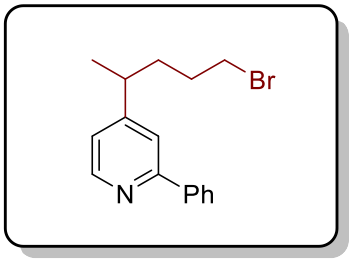


4-cyclopropyl-2-phenylpyridine (3d). Prepared according to **GP1**. Colorless oil (5.8 mg, 30%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.51 (d, *J* = 5.2 Hz, 1H), 8.05 – 7.86 (m, 2H), 7.56 – 7.36 (m, 4H), 6.89 (dd, *J* = 5.2, 1.7 Hz, 1H), 2.03 – 1.81 (m, 1H), 1.20 – 1.01 (m, 2H), 0.94 – 0.76 (m, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.2, 154.6, 149.2, 139.5, 128.9, 128.7, 127.0, 119.1, 118.0, 15.2, 10.5. HRMS (ESI) m/z calcd. for $[C_{14}H_{13}NNa]^{+}$: 218.0940 found: 218.0933

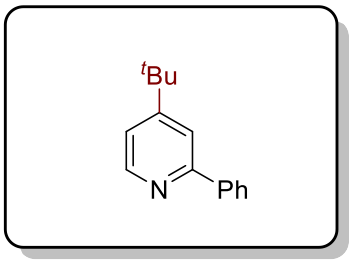


4-(pentan-3-yl)-2-phenylpyridine (3e). Prepared according to **GP1**. Colorless oil (18.3 mg, 81%, 0.1 mmol

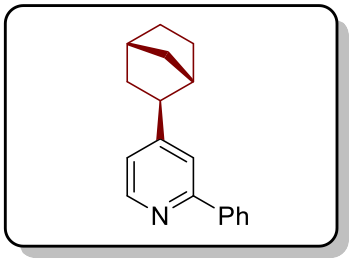
scale); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.59 (d, *J* = 5.0 Hz, 1H), 8.09 – 7.76 (m, 2H), 7.51 (d, *J* = 1.5 Hz, 1H), 7.50 – 7.45 (m, 2H), 7.43 – 7.38 (m, 1H), 7.03 (dd, *J* = 5.1, 1.6 Hz, 1H), 2.40 (tt, *J* = 9.3, 5.3 Hz, 1H), 1.75 (dqd, *J* = 14.8, 7.5, 5.3 Hz, 2H), 1.62 (ddq, *J* = 14.5, 9.1, 7.3 Hz, 2H), 0.82 (t, *J* = 7.4 Hz, 6H). ^{13}C NMR (150 MHz, Chloroform-*d*) δ 157.4, 155.7, 149.5, 139.7, 128.7, 128.7, 127.0, 121.8, 120.4, 49.5, 28.7, 12.0. HRMS (ESI) m/z calcd. for $[C_{16}H_{19}NNa]^{+}$: 248.1410 found: 248.1411



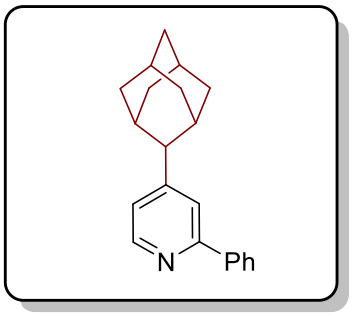
4-(5-bromopentan-2-yl)-2-phenylpyridine (3f). Prepared according to **GP2**. Colorless oil (17.6 mg, 58%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Methylene Chloride-d_2) δ 8.57 (d, *J* = 5.0 Hz, 1H), 8.06 – 7.99 (m, 2H), 7.58 (s, 1H), 7.50 – 7.45 (m, 2H), 7.45 – 7.37 (m, 1H), 7.09 (dd, *J* = 5.0, 1.5 Hz, 1H), 3.39 (t, *J* = 6.5 Hz, 2H), 2.79 (h, *J* = 6.9 Hz, 1H), 1.87 – 1.68 (m, 4H), 1.31 (d, *J* = 6.9 Hz, 3H). ^{13}C NMR (150 MHz, Methylene Chloride-d_2) δ 157.7, 157.0, 150.1, 140.0, 129.2, 129.0, 127.2, 121.4, 119.6, 39.5, 36.3, 34.3, 31.2, 21.8. HRMS (ESI) m/z calcd. for $[C_{16}H_{19}BrN]^{+}$: 304.0695 found: 304.0698



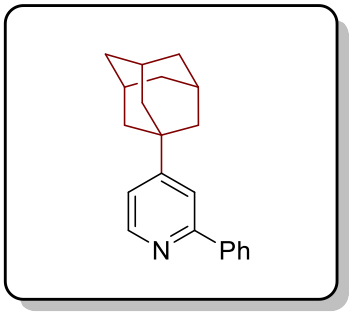
4-(tert-butyl)-2-phenylpyridine (3g). Prepared according to **GP1**. Colorless oil (17.1 mg, 81%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.60 (dd, *J* = 5.3, 0.8 Hz, 1H), 8.02 – 7.92 (m, 2H), 7.71 (dd, *J* = 1.9, 0.8 Hz, 1H), 7.51 – 7.45 (m, 2H), 7.45 – 7.38 (m, 1H), 7.24 (dd, *J* = 5.3, 1.9 Hz, 1H), 1.37 (s, 9H). ^{13}C NMR (150 MHz, Chloroform-*d*) δ 160.7, 157.5, 149.5, 140.0, 128.7, 128.7, 127.0, 119.3, 117.8, 34.9, 30.6. HRMS (ESI) m/z calcd. for $[C_{15}H_{17}NNa]^{+}$: 234.1253 found: 234.1256



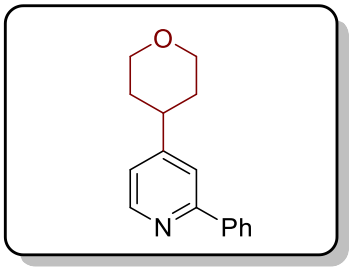
4-((1S,2S,4R)-bicyclo[2.2.1]heptan-2-yl)-2-phenylpyridine (3h). Prepared according to **GP1**. Colorless oil (17.7 mg, 71%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.57 (d, *J* = 5.3 Hz, 1H), 8.15 – 7.86 (m, 2H), 7.57 (d, *J* = 1.6 Hz, 1H), 7.51 – 7.45 (m, 2H), 7.45 – 7.35 (m, 1H), 7.11 (dd, *J* = 5.1, 1.7 Hz, 1H), 2.79 (dd, *J* = 9.2, 5.6 Hz, 1H), 2.46 (d, *J* = 4.1 Hz, 1H), 2.41 (d, *J* = 4.3 Hz, 1H), 1.84 (ddd, *J* = 12.0, 9.2, 2.4 Hz, 1H), 1.73 – 1.56 (m, 3H), 1.51 (dq, *J* = 10.0, 2.0 Hz, 1H), 1.40 (tt, *J* = 10.9, 2.5 Hz, 1H), 1.31 (dddd, *J* = 11.6, 9.6, 4.2, 2.2 Hz, 1H), 1.29 – 1.23 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.8, 157.1, 149.0, 139.2, 129.0, 128.7, 127.1, 121.1, 119.8, 47.0, 42.3, 38.6, 36.8, 36.3, 30.4, 28.7. HRMS (ESI) m/z calcd. for $[C_{18}H_{20}N]^{+}$: 250.1590 found: 250.1594



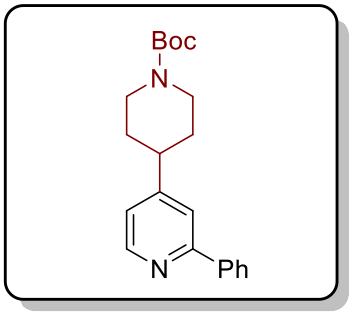
4-((1r,3r)-adamantan-2-yl)-2-phenylpyridine (3i). Prepared according to **GP1**. Pale yellow gum (23.1 mg, 80%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.62 (d, *J* = 5.4 Hz, 1H), 8.10 – 7.94 (m, 2H), 7.70 (d, *J* = 1.8 Hz, 1H), 7.48 (dd, *J* = 8.3, 6.5 Hz, 2H), 7.46 – 7.37 (m, 1H), 7.25 (dd, *J* = 5.4, 1.9 Hz, 1H), 2.22 – 2.07 (m, 3H), 2.02 – 1.91 (m, 6H), 1.89 – 1.63 (m, 6H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 161.4, 157.1, 149.0, 139.4, 128.9, 128.7, 127.1, 119.1, 117.7, 42.4, 36.6, 28.6. HRMS (ESI) m/z calcd. for $[C_{21}H_{24}N]^{+}$: 290.1903 found: 290.1908



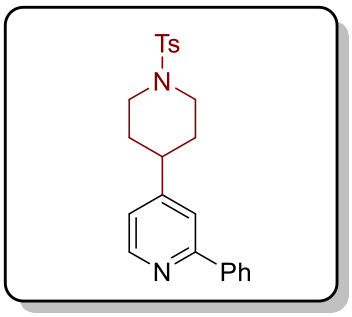
4-((3r,5r,7r)-adamantan-1-yl)-2-phenylpyridine (3j). Prepared according to **GP1**. White gum (24.6 mg, 85%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.62 (d, *J* = 5.3 Hz, 1H), 8.22 – 7.90 (m, 2H), 7.71 (s, 1H), 7.53 – 7.45 (m, 2H), 7.44 – 7.36 (m, 1H), 7.23 (dt, *J* = 5.3, 1.3 Hz, 1H), 3.03 (s, 1H), 2.54 (d, *J* = 4.1 Hz, 2H), 2.11 – 1.90 (m, 5H), 1.87 – 1.74 (m, 5H), 1.68 – 1.55 (m, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.4, 154.6, 149.4, 139.8, 128.8, 128.7, 127.0, 120.9, 119.4, 46.6, 38.9, 37.6, 32.0, 30.6, 27.8, 27.6. HRMS (ESI) m/z calcd. for $[C_{21}H_{24}N]^{+}$: 290.1903 found: 290.1900



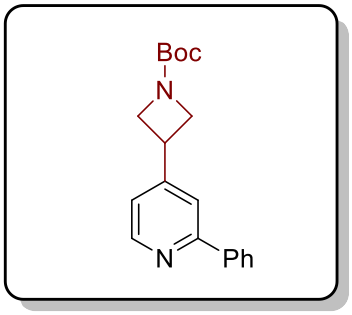
2-phenyl-4-(tetrahydro-2H-pyran-4-yl)pyridine (3k). Prepared according to **GP1**. Colorless oil (17.0 mg, 71%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.62 (d, *J* = 5.0 Hz, 1H), 8.02 – 7.93 (m, 2H), 7.60 – 7.55 (m, 1H), 7.48 (t, *J* = 7.6 Hz, 2H), 7.45 – 7.39 (m, 1H), 7.10 (dd, *J* = 5.1, 1.7 Hz, 1H), 4.16 – 4.07 (m, 2H), 3.55 (td, *J* = 11.6, 2.5 Hz, 2H), 2.83 (tt, *J* = 11.6, 4.3 Hz, 1H), 1.92 – 1.78 (m, 4H). ^{13}C NMR (150 MHz, Chloroform-*d*) δ 157.7, 155.2, 149.8, 139.4, 128.9, 128.7, 127.0, 120.6, 119.2, 68.0, 41.1, 33.0. HRMS (ESI) m/z calcd. for $[C_{16}H_{17}NNaO]^{+}$: 262.1202 found: 262.1204



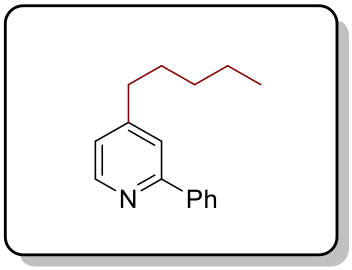
tert-butyl 4-(2-phenylpyridin-4-yl)piperidine-1-carboxylate (3l). Prepared according to **GP1**. Reaction for 72 h. Pale yellow oil (22.0 mg, 65%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.60 (dd, *J* = 5.1, 0.8 Hz, 1H), 8.05 – 7.88 (m, 2H), 7.58 – 7.53 (m, 1H), 7.51 – 7.43 (m, 2H), 7.45 – 7.36 (m, 1H), 7.07 (dd, *J* = 5.1, 1.7 Hz, 1H), 4.41 – 3.88 (m, 2H), 2.96 – 2.77 (m, 2H), 2.71 (tt, *J* = 12.2, 3.6 Hz, 1H), 1.96 – 1.80 (m, 2H), 1.78 – 1.60 (m, 2H), 1.49 (s, 9H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.7, 155.2, 154.7, 149.8, 139.4, 128.9, 128.7, 126.9, 120.7, 119.2, 79.6, 44.0, 42.3, 32.3, 28.4. HRMS (ESI) m/z calcd. for $[C_{21}H_{27}N_2O_2]^+$: 339.2067 found: 339.2063



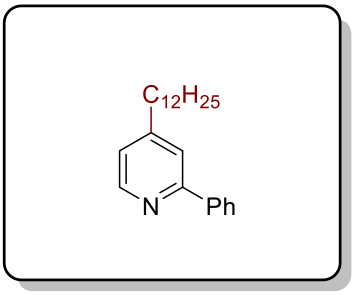
2-phenyl-4-(1-tosylpiperidin-4-yl)pyridine (3m). Prepared according to **GP1**. Reaction for 48 h. White solid (19.6 mg, 50%, 0.1 mmol scale); m.p. 167–169 °C; ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.59 (d, *J* = 5.1 Hz, 1H), 7.99 – 7.85 (m, 2H), 7.76 – 7.63 (m, 2H), 7.52 – 7.42 (m, 3H), 7.45 – 7.36 (m, 1H), 7.35 (d, *J* = 8.1 Hz, 2H), 7.01 (dd, *J* = 5.1, 1.7 Hz, 1H), 4.18 – 3.52 (m, 2H), 2.55 – 2.44 (m, 1H), 2.45 (s, 3H), 2.38 (td, *J* = 11.8, 3.5 Hz, 2H), 2.00 – 1.79 (m, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.8, 154.3, 149.8, 143.6, 139.2, 133.1, 129.7, 129.0, 128.7, 127.7, 126.9, 120.6, 119.0, 46.5, 41.4, 31.7, 21.5. HRMS (ESI) m/z calcd. for $[C_{23}H_{25}N_2O_2S]^+$: 393.1631 found: 393.1638



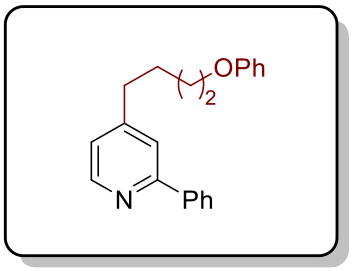
tert-butyl 3-(2-phenylpyridin-4-yl)azetidine-1-carboxylate (3n). Prepared according to **GP1**. Reaction for 48 h. Colorless oil (15.5 mg, 50%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.78 – 8.43 (m, 1H), 8.14 – 7.88 (m, 2H), 7.67 – 7.62 (m, 1H), 7.52 – 7.46 (m, 2H), 7.46 – 7.40 (m, 1H), 7.20 (dd, *J* = 5.2, 1.7 Hz, 1H), 4.39 (t, *J* = 8.7 Hz, 2H), 4.03 (dd, *J* = 8.7, 5.8 Hz, 2H), 3.77 (tt, *J* = 8.7, 5.8 Hz, 1H), 1.48 (s, 9H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 158.0, 156.3, 152.0, 149.9, 139.0, 129.2, 128.8, 127.0, 120.4, 119.0, 79.9, 55.6, 33.0, 28.4. HRMS (ESI) m/z calcd. for $[C_{19}H_{22}N_2NaO_2]^+$: 333.1573 found: 333.1577



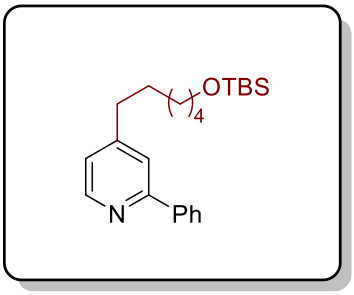
4-pentyl-2-phenylpyridine (3o). Prepared according to **GP2**. Colorless oil (11.7 mg, 56%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.57 (d, *J* = 5.0 Hz, 1H), 8.04 – 7.93 (m, 2H), 7.54 (d, *J* = 1.6 Hz, 1H), 7.47 (dd, *J* = 8.4, 6.9 Hz, 2H), 7.43 – 7.36 (m, 1H), 7.06 (dd, *J* = 5.1, 1.6 Hz, 1H), 2.91 – 2.40 (m, 2H), 1.74 – 1.54 (m, 2H), 1.44 – 1.27 (m, 4H), 1.00 – 0.79 (m, 3H). ^{13}C NMR (150 MHz, Chloroform-*d*) δ 157.4, 152.5, 149.5, 139.7, 128.8, 128.7, 127.0, 122.4, 120.8, 35.5, 31.4, 30.1, 22.5, 14.0. HRMS (ESI) m/z calcd. for $[C_{16}H_{19}NNa]^+$: 248.1410 found: 248.1407



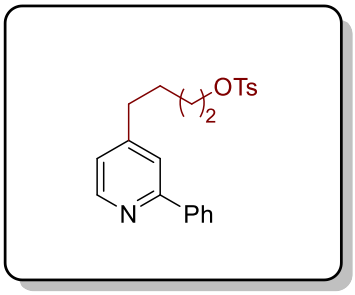
4-dodecyl-2-phenylpyridine (3p). Prepared according to **GP2**. Colorless oil (16.8 mg, 52%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.57 (d, *J* = 5.0 Hz, 1H), 8.02 – 7.92 (m, 2H), 7.55 (s, 1H), 7.52 – 7.43 (m, 2H), 7.45 – 7.36 (m, 1H), 7.07 (dd, *J* = 5.0, 1.6 Hz, 1H), 2.67 (t, 2H), 1.75 – 1.61 (m, 2H), 1.37 – 1.23 (m, 18H), 0.88 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.4, 152.6, 149.4, 139.6, 128.8, 128.7, 127.0, 122.4, 120.9, 35.5, 31.9, 30.4, 29.6, 29.6, 29.5, 29.4, 29.3, 29.2, 22.7, 14.1. HRMS (ESI) m/z calcd. for $[C_{23}H_{34}N]^{+}$: 324.2686 found: 324.2683



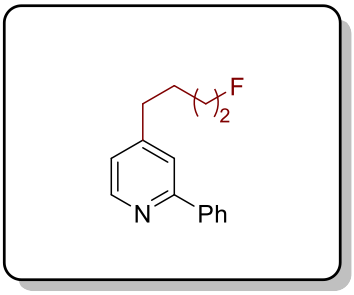
4-(4-phenoxybutyl)-2-phenylpyridine (3q). Prepared according to **GP2**. Colorless oil (17.2 mg, 56%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.59 (d, *J* = 5.0 Hz, 1H), 8.08 – 7.90 (m, 2H), 7.58 (d, *J* = 1.6 Hz, 1H), 7.51 – 7.44 (m, 2H), 7.44 – 7.38 (m, 1H), 7.33 – 7.23 (m, 2H), 7.11 (dd, *J* = 5.1, 1.6 Hz, 1H), 6.97 – 6.91 (m, 1H), 6.91 – 6.86 (m, 2H), 4.00 (t, *J* = 5.7 Hz, 2H), 2.77 (t, *J* = 7.1 Hz, 2H), 1.95 – 1.69 (m, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 158.9, 157.2, 152.5, 149.1, 139.0, 129.4, 129.0, 128.7, 127.0, 122.5, 121.0, 120.7, 114.4, 67.3, 35.2, 28.8, 26.9. HRMS (ESI) m/z calcd. for $[C_{21}H_{22}NO]^{+}$: 304.1696 found: 304.1696



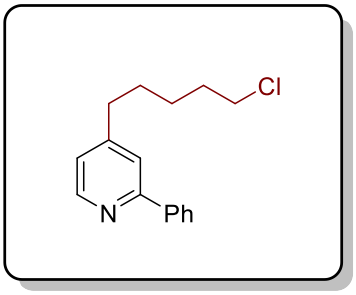
4-(6-((tert-butyldimethylsilyl)oxy)hexyl)-2-phenylpyridine (3r). Prepared according to **GP2**. Colorless oil (18.5 mg, 50%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.58 (d, *J* = 5.0 Hz, 1H), 8.02 – 7.95 (m, 2H), 7.55 (s, 1H), 7.52 – 7.43 (m, 2H), 7.46 – 7.36 (m, 1H), 7.11 – 7.02 (m, 1H), 3.60 (t, *J* = 6.5 Hz, 2H), 2.79 – 2.60 (m, 2H), 1.74 – 1.64 (m, 2H), 1.56 – 1.47 (m, 2H), 1.43 – 1.34 (m, 4H), 0.89 (s, 9H), 0.04 (s, 6H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 152.8, 149.2, 139.3, 128.9, 128.7, 127.0, 122.5, 120.9, 63.1, 35.5, 32.7, 30.4, 29.0, 26.0, 25.6, 18.4, -5.3. HRMS (ESI) m/z calcd. for $[C_{23}H_{36}NOSi]^{+}$: 370.2561 found: 370.2561



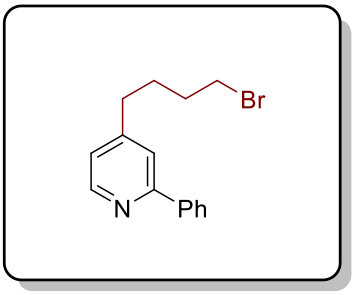
4-(2-phenylpyridin-4-yl)butyl 4-methylbenzenesulfonate (3s). Prepared according to **GP2**. Colorless oil (17.2 mg, 45%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Methylene Chloride-d_2) δ 8.53 (d, *J* = 5.0 Hz, 1H), 8.03 – 7.96 (m, 2H), 7.75 (d, *J* = 8.3 Hz, 2H), 7.53 (s, 1H), 7.50 – 7.44 (m, 2H), 7.44 – 7.39 (m, 1H), 7.34 (d, *J* = 8.1 Hz, 2H), 7.02 (dd, *J* = 5.0, 1.6 Hz, 1H), 4.04 (t, *J* = 5.7 Hz, 2H), 2.63 (t, *J* = 7.0 Hz, 2H), 2.41 (s, 3H), 1.72 – 1.63 (m, 4H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 157.5, 151.8, 149.9, 145.4, 139.8, 133.4, 130.3, 129.2, 129.0, 128.2, 127.2, 122.7, 120.8, 70.7, 35.0, 28.7, 26.6, 21.7. HRMS (ESI) m/z calcd. for $[C_{22}H_{24}NO_3]^{+}$: 382.1471 found: 382.1479



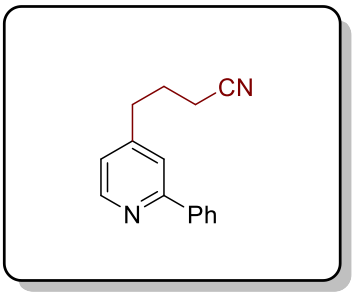
4-(4-fluorobutyl)-2-phenylpyridine (3t). Prepared according to **GP2**. Colorless Oil (12.2 mg, 53%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.59 (dd, *J* = 5.1, 0.8 Hz, 1H), 8.01 – 7.94 (m, 2H), 7.56 – 7.54 (m, 1H), 7.50 – 7.45 (m, 2H), 7.44 – 7.38 (m, 1H), 7.07 (dd, *J* = 5.0, 1.5 Hz, 1H), 4.49 (dt, *J* = 47.4, 5.7 Hz, 2H), 2.73 (t, *J* = 7.5 Hz, 2H), 1.89 – 1.67 (m, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.6, 151.6, 149.6, 139.5, 128.9, 128.7, 127.0, 122.3, 120.8, 83.7 (d, *J* = 164.9 Hz), 35.0, 29.9 (d, *J* = 19.9 Hz), 26.1 (d, *J* = 4.8 Hz). ^{19}F NMR (376 MHz, Chloroform-*d*) δ -218.73 (tt, *J* = 46.9, 25.4 Hz). HRMS (ESI) m/z calcd. for $[C_{15}H_{16}FNNa]^{+}$: 252.1159 found: 252.1159



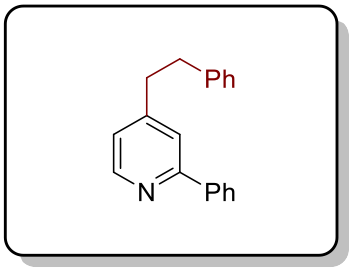
4-(5-chloropentyl)-2-phenylpyridine (3u). Prepared according to **GP2**. Colorless oil (13.3 mg, 51%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.59 – 8.55 (m, 1H), 8.01 – 7.95 (m, 2H), 7.57 – 7.52 (m, 1H), 7.50 – 7.45 (m, 2H), 7.43 – 7.37 (m, 1H), 7.06 (dd, *J* = 5.0, 1.6 Hz, 1H), 3.54 (t, *J* = 6.6 Hz, 2H), 2.70 (t, *J* = 7.7 Hz, 2H), 1.88 – 1.78 (m, 2H), 1.76 – 1.67 (m, 2H), 1.58 – 1.46 (m, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.5, 151.9, 149.6, 139.5, 128.9, 128.7, 127.0, 122.3, 120.8, 44.8, 35.3, 32.4, 29.7, 26.5. HRMS (ESI) m/z calcd. for $[C_{16}H_{18}ClNNa]^{+}$: 282.1020 found: 282.1022



4-(4-bromobutyl)-2-phenylpyridine (3v). Prepared according to **GP2**. Colorless oil (11.6 mg, 40%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.61 (d, *J* = 5.1 Hz, 1H), 8.02 – 7.96 (m, 2H), 7.57 (s, 1H), 7.53 – 7.37 (m, 3H), 7.12 – 7.05 (m, 1H), 3.45 (t, *J* = 6.4 Hz, 2H), 2.73 (t, *J* = 7.4 Hz, 2H), 1.99 – 1.78 (m, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.2, 152.3, 149.0, 138.7, 129.2, 128.8, 127.1, 122.4, 121.0, 34.6, 33.2, 32.0, 28.7. HRMS (ESI) m/z calcd. for $[C_{15}H_{17}BrN]^{+}$: 290.0539 found: 290.0537

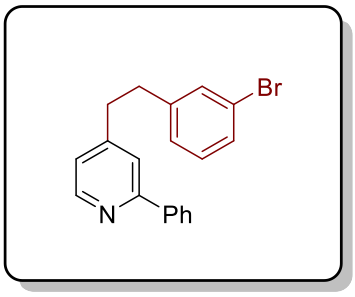


4-(2-phenylpyridin-4-yl)butanenitrile (3w). Prepared according to **GP2**. Colorless oil (8.9 mg, 40%, 0.1 mmol scale); ^{1}H (400 MHz, Methylene Chloride-d_2) δ 8.63 – 8.53 (m, 1H), 8.05 – 7.96 (m, 2H), 7.63 – 7.59 (m, 1H), 7.53 – 7.37 (m, 3H), 7.11 (dd, *J* = 5.0, 1.6 Hz, 1H), 2.84 (t, *J* = 7.7 Hz, 2H), 2.39 (t, *J* = 7.1 Hz, 2H), 2.10 – 1.95 (m, 2H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 157.8, 150.3, 150.1, 139.5, 129.4, 129.1, 127.2, 122.7, 121.9, 119.6, 34.3, 26.4, 17.0. HRMS (ESI) m/z calcd. for $[C_{15}H_{14}N_2Na]^{+}$: 245.1050 found: 245.1050

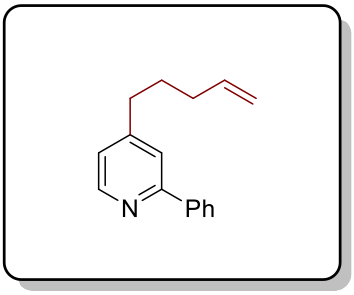


4-phenethyl-2-phenylpyridine (3x). Prepared according to **GP2**. Colorless oil (16.9 mg, 65%, 0.1 mmol scale);

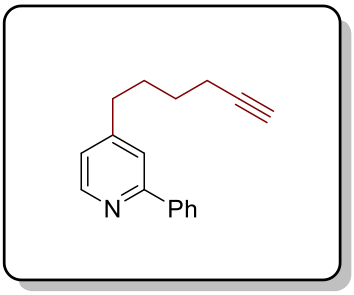
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.58 (dd, *J* = 5.0, 0.8 Hz, 1H), 8.01 – 7.89 (m, 2H), 7.53 – 7.45 (m, 3H), 7.44 – 7.37 (m, 1H), 7.35 – 7.27 (m, 2H), 7.25 – 7.20 (m, 1H), 7.20 – 7.15 (m, 2H), 7.05 (dd, *J* = 5.0, 1.6 Hz, 1H), 2.99 (s, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.4, 151.4, 149.4, 140.7, 139.3, 128.9, 128.7, 128.5, 128.5, 127.0, 126.3, 122.4, 121.0, 37.3, 36.7. HRMS (ESI) m/z calcd. for $[C_{19}H_{17}NNa]^{+}$: 282.1253 found: 282.1249



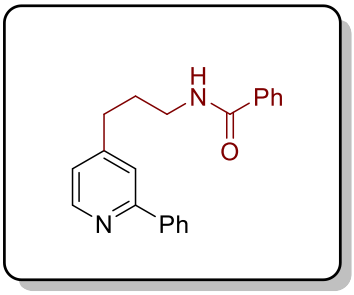
4-(3-bromophenethyl)-2-phenylpyridine (3y). Prepared according to **GP2**. Colorless oil (18.2 mg, 54%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.60 (d, *J* = 5.1 Hz, 1H), 7.98 – 7.93 (m, 2H), 7.53 – 7.40 (m, 4H), 7.38 – 7.34 (m, 2H), 7.19 – 7.13 (m, 1H), 7.10 – 7.03 (m, 2H), 3.04 – 2.89 (m, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.2, 151.4, 149.1, 142.9, 138.7, 131.5, 130.1, 129.5, 129.2, 128.8, 127.1, 127.0, 122.6, 122.4, 121.1, 37.1, 36.2. HRMS (ESI) m/z calcd. for $[C_{19}H_{17}BrN]^{+}$: 338.0539 found: 338.0533



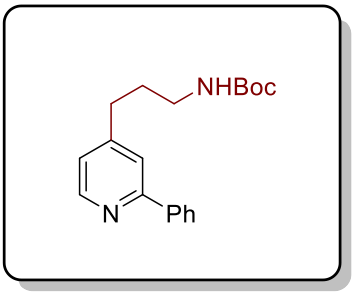
4-(pent-4-en-1-yl)-2-phenylpyridine (3z). Prepared according to **GP2**. Colorless oil (9.6 mg, 43%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.58 (d, *J* = 5.0 Hz, 1H), 8.03 – 7.92 (m, 2H), 7.55 (s, 1H), 7.52 – 7.43 (m, 2H), 7.45 – 7.36 (m, 1H), 7.06 (dd, *J* = 5.0, 1.5 Hz, 1H), 5.84 (ddt, *J* = 16.9, 10.2, 6.6 Hz, 1H), 5.11 – 4.96 (m, 2H), 2.83 – 2.28 (m, 2H), 2.28 – 2.00 (m, 2H), 1.92 – 1.69 (m, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 152.4, 149.2, 139.2, 137.9, 128.9, 128.7, 127.0, 122.5, 121.0, 115.3, 34.8, 33.1, 29.5. HRMS (ESI) m/z calcd. for $[C_{16}H_{17}NNa]^{+}$: 246.1253 found: 246.1254



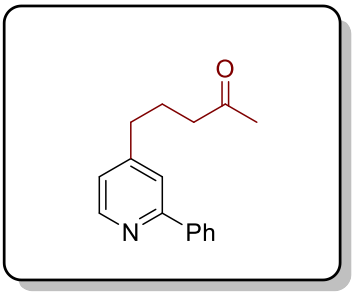
4-(hex-5-yn-1-yl)-2-phenylpyridine (3aa). Prepared according to **GP2**. Colorless oil (8.7 mg, 37%, 0.1 mmol scale); ^{1}H (600 MHz, Methylene Chloride-d_2) δ 8.56 – 8.50 (m, 1H), 8.05 – 7.98 (m, 2H), 7.60 – 7.58 (m, 1H), 7.50 – 7.44 (m, 2H), 7.44 – 7.38 (m, 1H), 7.12 – 7.03 (m, 1H), 2.70 (t, J = 7.7 Hz, 2H), 2.24 (td, J = 7.1, 2.7 Hz, 2H), 1.99 (t, J = 2.7 Hz, 1H), 1.85 – 1.75 (m, 2H), 1.65 – 1.55 (m, 2H). ^{13}C NMR (150 MHz, Chloroform-d) δ 157.5, 152.4, 149.9, 139.9, 129.1, 129.0, 127.2, 122.8, 120.9, 84.5, 68.7, 35.2, 29.8, 28.3, 18.5. HRMS (ESI) m/z calcd. for $[C_{17}H_{17}NNa]^{+}$: 258.1253 found: 246.1260



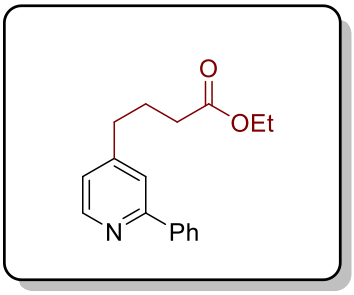
N-(3-(2-phenylpyridin-4-yl)propyl)benzamide (3ab). Prepared according to **GP2**. Colorless oil (17.1 mg, 54%, 0.1 mmol scale); ^{1}H (400 MHz, Methylene Chloride-d_2) δ 8.55 (d, J = 5.0 Hz, 1H), 8.05 – 7.89 (m, 2H), 7.75 – 7.69 (m, 2H), 7.63 (s, 1H), 7.54 – 7.37 (m, 6H), 7.12 (d, J = 5.0 Hz, 1H), 6.25 (s, 1H), 3.56 – 3.44 (m, 2H), 2.78 (t, J = 7.7 Hz, 2H), 2.09 – 1.89 (m, 2H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 167.5, 157.6, 151.8, 150.0, 139.8, 135.2, 131.7, 129.2, 129.0, 128.9, 127.2, 127.1, 122.8, 120.9, 39.9, 33.2, 30.8. HRMS (ESI) m/z calcd. for $[C_{21}H_{21}N_2O]^{+}$: 317.1648 found: 317.1648



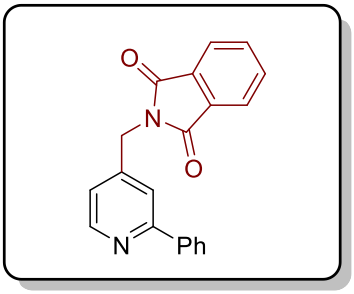
tert-butyl (3-(2-phenylpyridin-4-yl)propyl)carbamate (3ac). Prepared according to **GP2**. Colorless oil (15.6 mg, 50%, 0.1 mmol scale); ^{1}H (400 MHz, Methylene Chloride-d_2) δ 8.56 – 8.52 (m, 1H), 8.04 – 7.97 (m, 2H), 7.60 (s, 1H), 7.50 – 7.44 (m, 2H), 7.43 – 7.37 (m, 1H), 7.09 (dd, J = 5.0, 1.5 Hz, 1H), 4.67 (s, 1H), 3.23 – 3.01 (m, 2H), 2.70 (t, J = 7.8 Hz, 2H), 1.93 – 1.79 (m, 2H), 1.42 (s, 9H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 157.6, 156.2, 151.9, 150.0, 139.9, 129.2, 129.0, 127.2, 122.8, 121.0, 79.24, 40.4, 32.9, 31.3, 28.5. HRMS (ESI) m/z calcd. for $[C_{19}H_{24}N_2NaO]^+$: 335.1730 found: 335.1731



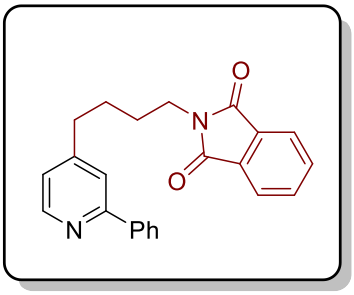
5-(2-phenylpyridin-4-yl)pentan-2-one (3ad). Prepared according to **GP2**. Colorless oil (11.0 mg, 46%, 0.1 mmol scale); ^{1}H (400 MHz, Methylene Chloride-d_2) δ 8.56 (d, J = 5.0 Hz, 1H), 8.04 – 7.97 (m, 2H), 7.62 – 7.56 (m, 1H), 7.51 – 7.44 (m, 2H), 7.44 – 7.38 (m, 1H), 7.09 (dd, J = 5.0, 1.4 Hz, 1H), 2.68 (t, J = 7.7 Hz, 2H), 2.47 (t, J = 7.3 Hz, 2H), 2.10 (s, 3H), 2.00 – 1.84 (m, 2H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 208.2, 157.5, 152.2, 149.8, 139.7, 129.3, 129.0, 127.2, 122.9, 121.0, 42.9, 34.9, 30.1, 24.6. HRMS (ESI) m/z calcd. for $[C_{16}H_{17}NNaO]^+$: 262.1202 found: 262.1205



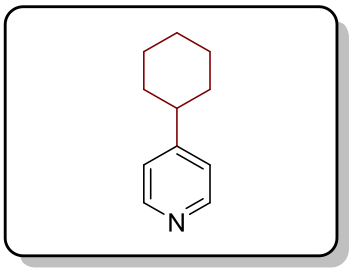
ethyl 4-(2-phenylpyridin-4-yl)butanoate (3ae). Prepared according to **GP2**. Colorless oil (12.9 mg, 48%, 0.1 mmol scale); ^{1}H (400 MHz, Chloroform-*d*) δ 8.59 (dd, *J* = 5.0, 0.6 Hz, 1H), 8.01 – 7.95 (m, 2H), 7.57 – 7.53 (m, 2H), 7.50 – 7.44 (m, 2H), 7.44 – 7.38 (m, 1H), 7.07 (dd, *J* = 5.0, 1.6 Hz, 1H), 4.14 (q, *J* = 7.1 Hz, 1H), 2.72 (t, *J* = 7.7 Hz, 2H), 2.36 (t, *J* = 7.4 Hz, 2H), 2.08 – 1.90 (m, 2H), 1.26 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 173.2, 157.7, 151.4, 149.7, 139.4, 129.1, 128.9, 127.1, 122.6, 121.0, 60.6, 34.8, 33.6, 25.6, 14.4. HRMS (ESI) m/z calcd. for $[C_{17}H_{19}NNaO]^{+}$: 292.1308 found: 181.1314



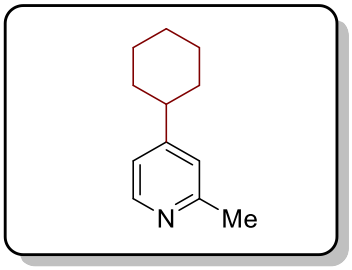
2-((2-phenylpyridin-4-yl)methyl)isoindoline-1,3-dione (3af). Prepared according to **GP2**. Colorless oil (18.2 mg, 58%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.67 – 8.61 (m, 1H), 8.00 – 7.92 (m, 2H), 7.93 – 7.84 (m, 2H), 7.79 – 7.69 (m, 3H), 7.50 – 7.36 (m, 3H), 7.26 (dd, *J* = 5.0, 1.6 Hz, 1H), 4.91 (s, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 167.8, 158.0, 149.9, 145.8, 138.8, 134.3, 131.9, 129.2, 128.7, 127.1, 123.6, 121.5, 120.1, 40.7. HRMS (ESI) m/z calcd. for $[C_{20}H_{15}N_2O_2]^{+}$: 315.1128 found: 315.1125



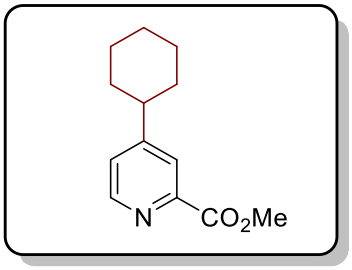
2-(4-(2-phenylpyridin-4-yl)butyl)isoindoline-1,3-dione (3ag). Prepared according to **GP2**. Colorless oil (18.5 mg, 52%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.57 (d, *J* = 5.0 Hz, 1H), 8.01 – 7.93 (m, 2H), 7.88 – 7.79 (m, 2H), 7.74 – 7.68 (m, 2H), 7.55 (s, 1H), 7.50 – 7.44 (m, 2H), 7.43 – 7.37 (m, 1H), 7.07 (dd, *J* = 5.0, 1.3 Hz, 1H), 3.74 (t, *J* = 6.7 Hz, 2H), 2.73 (t, *J* = 7.2 Hz, 2H), 1.82 – 1.66 (m, 4H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 168.4, 157.3, 151.9, 149.3, 139.2, 133.9, 132.1, 128.9, 128.7, 127.0, 123.2, 122.4, 120.9, 37.5, 34.9, 28.1, 27.6. HRMS (ESI) m/z calcd. for $[C_{23}H_{21}N_2O_2]^+$: 357.1598 found: 357.1597



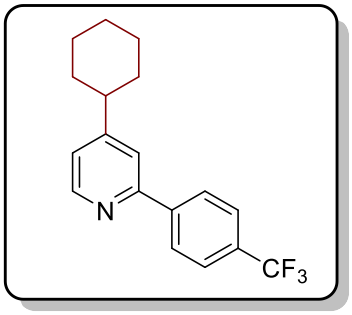
4-cyclohexylpyridine (4a). Prepared according to **GP2**. Colorless oil (9.4 mg, 58%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.72 – 8.27 (m, 2H), 7.21 – 7.00 (m, 2H), 2.50 (tt, *J* = 9.0, 3.0 Hz, 1H), 1.94 – 1.84 (m, 4H), 1.80 – 1.73 (m, 1H), 1.51 – 1.32 (m, 4H), 1.31 – 1.18 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 156.8, 149.4, 122.5, 43.8, 33.5, 26.5, 25.9. HRMS (ESI) m/z calcd. for $[C_{11}H_{16}N]^+$: 162.1277 found: 162.1274



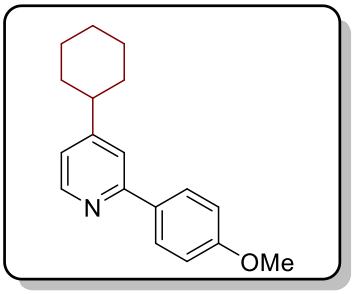
4-cyclohexyl-2-methylpyridine (4b). Prepared according to **GP2**. Colorless oil (11.2 mg, 64%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.36 (d, *J* = 5.3 Hz, 1H), 6.99 (s, 1H), 6.94 (d, *J* = 5.3 Hz, 1H), 2.53 (s, 3H), 2.49 – 2.39 (m, 1H), 1.93 – 1.79 (m, 4H), 1.80 – 1.72 (m, 1H), 1.45 – 1.30 (m, 4H), 1.30 – 1.21 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 158.0, 157.2, 148.6, 122.0, 119.6, 43.9, 33.5, 26.5, 25.9, 24.2. HRMS (ESI) m/z calcd. for $[C_{12}H_{18}N]^+$: 176.1434 found: 176.1438



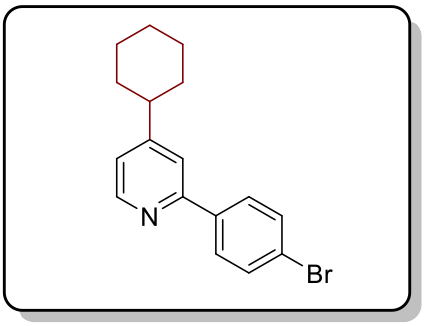
methyl 4-cyclohexylpicolinate (4c). Prepared according to **GP1**. Colorless oil (10.3 mg, 47%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.61 (d, *J* = 5.0 Hz, 1H), 7.99 (d, *J* = 1.8 Hz, 1H), 7.31 (dd, *J* = 5.0, 1.8 Hz, 1H), 3.99 (s, 3H), 2.58 (tt, *J* = 11.5, 3.4 Hz, 1H), 1.99 – 1.82 (m, 4H), 1.77 (dtt, *J* = 12.5, 3.0, 1.6 Hz, 1H), 1.53 – 1.32 (m, 4H), 1.27 (tt, *J* = 12.7, 3.2 Hz, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 165.8, 158.4, 149.5, 147.5, 125.7, 124.0, 52.9, 43.8, 33.4, 26.4, 25.8. HRMS (ESI) m/z calcd. for $[C_{13}H_{17}NNaO_2]^+$: 242.1151 found: 242.1156



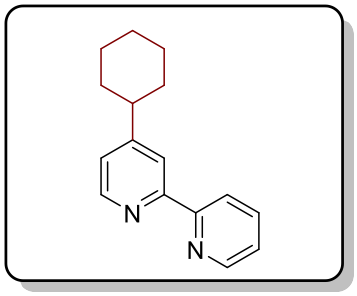
4-cyclohexyl-2-(4-(trifluoromethyl)phenyl)pyridine (4d). Prepared according to **GP1**. Colorless oil (24.7 mg, 81%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.61 (d, *J* = 5.1 Hz, 1H), 8.10 (d, *J* = 8.2 Hz, 2H), 7.72 (d, *J* = 8.2 Hz, 2H), 7.60 (d, *J* = 1.6 Hz, 1H), 7.15 (dd, *J* = 5.2, 1.6 Hz, 1H), 2.60 (tt, *J* = 11.6, 3.4 Hz, 1H), 2.00 – 1.86 (m, 4H), 1.80 (ddt, *J* = 11.2, 3.2, 1.5 Hz, 1H), 1.63 – 1.36 (m, 4H), 1.30 (tdd, *J* = 15.9, 7.6, 3.9 Hz, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 158.3, 155.6, 149.4, 142.5, 130.8 (q, *J* = 32.3 Hz), 127.3, 125.7 (q, *J* = 3.7 Hz), 124.2 (d, *J* = 272.1 Hz), 121.8, 119.9, 44.2, 33.6, 26.5, 25.9. ^{19}F NMR (376 MHz, Chloroform-*d*) δ -62.56. HRMS (ESI) m/z calcd. for $[C_{18}H_{19}F_3N]^+$: 306.1464 found: 306.1470



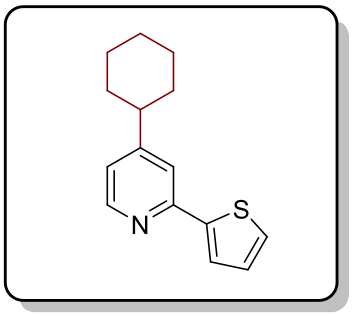
4-cyclohexyl-2-(4-methoxyphenyl)pyridine (4e). Prepared according to **GP1**. Colorless oil (24.3 mg, 91%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.54 (d, *J* = 5.2 Hz, 1H), 8.03 – 7.85 (m, 2H), 7.52 (s, 1H), 7.06 (dd, *J* = 5.2, 1.6 Hz, 1H), 7.04 – 6.96 (m, 2H), 3.86 (s, 3H), 2.65 – 2.45 (m, 1H), 1.98 – 1.84 (m, 4H), 1.83 – 1.71 (m, 1H), 1.53 – 1.36 (m, 4H), 1.36 – 1.20 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 160.3, 157.2, 157.1, 149.4, 132.4, 128.2, 120.2, 118.6, 114.0, 55.3, 44.1, 33.6, 26.6, 26.0. HRMS (ESI) m/z calcd. for $[C_{18}H_{22}NO]^{+}$: 268.1696 found: 268.1705



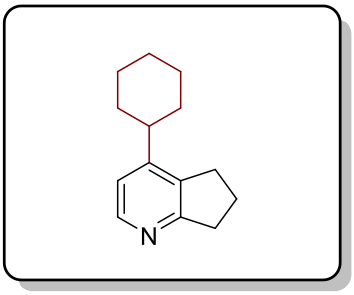
2-(4-bromophenyl)-4-cyclohexylpyridine (4f). Prepared according to **GP1**. Colorless oil (22.1 mg, 70%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.56 (d, *J* = 5.1 Hz, 1H), 7.92 – 7.82 (m, 2H), 7.61 – 7.56 (m, 2H), 7.55 – 7.47 (m, 1H), 7.09 (dd, *J* = 5.1, 1.7 Hz, 1H), 2.61 – 2.47 (m, 1H), 2.00 – 1.83 (m, 4H), 1.84 – 1.72 (m, 1H), 1.54 – 1.35 (m, 4H), 1.35 – 1.23 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.6, 156.2, 149.6, 138.6, 131.8, 128.5, 123.2, 121.2, 119.1, 44.1, 33.6, 26.5, 25.9. HRMS (ESI) m/z calcd. for $[C_{17}H_{19}BrN]^{+}$: 316.0695 found: 316.0691



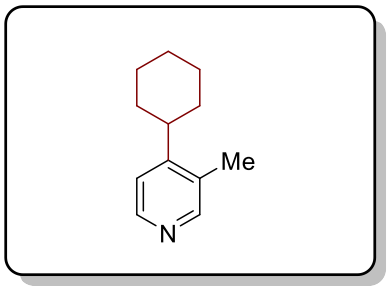
4-cyclohexyl-2,2'-bipyridine (4g). Prepared according to **GP1**. Colorless oil (12.4 mg, 52%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.70 (d, *J* = 4.3 Hz, 1H), 8.60 (d, *J* = 5.2 Hz, 1H), 8.50 (d, *J* = 7.9 Hz, 1H), 8.33 (s, 1H), 7.84 (td, *J* = 7.8, 1.7 Hz, 1H), 7.38 – 7.29 (m, 1H), 7.23 (d, *J* = 4.1 Hz, 1H), 2.64 (tt, *J* = 11.8, 3.3 Hz, 1H), 2.00 – 1.83 (m, 4H), 1.81 – 1.73 (m, 1H), 1.58 – 1.35 (m, 4H), 1.34 – 1.21 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 158.7, 155.5, 155.3, 149.1, 148.4, 137.1, 123.8, 122.7, 121.5, 120.1, 44.3, 33.4, 26.5, 25.9. HRMS (ESI) m/z calcd. for $[C_{16}H_{18}N_2Na]^+$: 261.1362 found: 261.1359



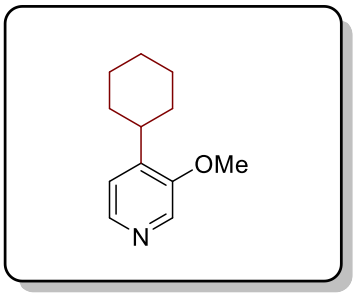
4-cyclohexyl-2-(thiophen-2-yl)pyridine (4h). Prepared according to **GP1**. Yellow oil (12.9 mg, 53%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.44 (dd, *J* = 5.1, 0.8 Hz, 1H), 7.58 (dd, *J* = 3.7, 1.1 Hz, 1H), 7.49 (d, *J* = 1.6 Hz, 1H), 7.37 (dd, *J* = 5.0, 1.1 Hz, 1H), 7.10 (dd, *J* = 5.1, 3.7 Hz, 1H), 6.99 (dd, *J* = 5.2, 1.6 Hz, 1H), 2.65 – 2.38 (m, 1H), 2.06 – 1.83 (m, 4H), 1.83 – 1.71 (m, 1H), 1.55 – 1.34 (m, 4H), 1.33 – 1.21 (m, 1H). ^{13}C NMR (150 MHz, Chloroform-*d*) δ 157.3, 152.4, 149.4, 145.1, 127.9, 127.2, 124.2, 120.7, 117.4, 44.0, 33.5, 26.5, 25.9. HRMS (ESI) m/z calcd. for $[C_{15}H_{17}NNaS]^+$: 266.0974 found: 266.0979



4-cyclohexyl-6,7-dihydro-5H-cyclopenta[b]pyridine (4i). Prepared according to **GP2**. Colorless oil (15.3 mg, 76%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.28 (d, *J* = 5.4 Hz, 1H), 6.98 (d, *J* = 5.4 Hz, 1H), 3.09 (t, *J* = 7.7 Hz, 2H), 2.94 (t, *J* = 7.5 Hz, 2H), 2.63 – 2.51 (m, 1H), 2.19 – 2.09 (m, 2H), 1.92 – 1.70 (m, 5H), 1.47 – 1.33 (m, 4H), 1.33 – 1.23 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 164.0, 154.0, 146.0, 135.9, 118.6, 41.5, 33.9, 32.3, 29.0, 26.6, 26.0, 22.7. HRMS (ESI) m/z calcd. for $[C_{14}H_{19}NNa]^{+}$: 224.1410 found: 224.1410

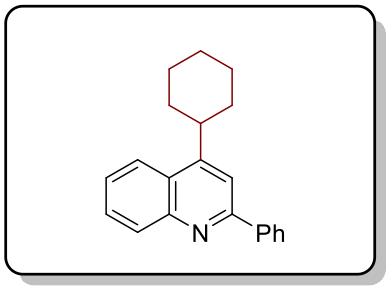


4-cyclohexyl-3-methylpyridine (4j). Prepared according to **GP2**. Yellow oil (9.8 mg, 56%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Methylene Chloride-d_2) δ 8.32 (d, *J* = 5.2 Hz, 1H), 8.29 (s, 1H), 7.10 (d, *J* = 5.1 Hz, 1H), 2.76 – 2.64 (m, 1H), 2.29 (s, 3H), 1.92 – 1.70 (m, 5H), 1.49 – 1.30 (m, 5H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 154.7, 151.1, 148.1, 131.2, 120.7, 40.1, 33.2, 27.2, 26.5, 16.2. HRMS (ESI) m/z calcd. for $[C_{12}H_{18}N]^{+}$: 176.1434 found: 176.1429

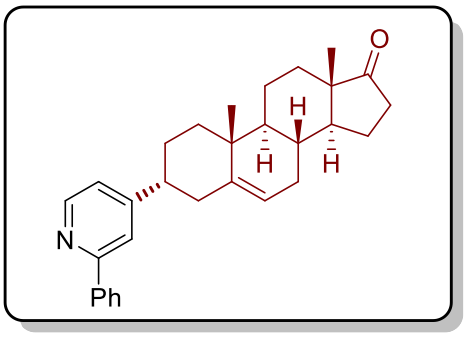


4-cyclohexyl-3-methoxypyridine (4k). Prepared according to **GP2**. Colorless oil (11.7 mg, 61%, 0.1 mmol scale);

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.62 – 8.04 (m, 2H), 7.15 (d, *J* = 5.0 Hz, 1H), 3.92 (s, 3H), 2.95 (tt, *J* = 11.5, 3.1 Hz, 1H), 1.93 – 1.64 (m, 5H), 1.53 – 1.18 (m, 5H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 153.5, 145.9, 141.8, 131.6, 121.5, 56.1, 36.5, 32.3, 26.7, 26.1. HRMS (ESI) m/z calcd. for $[C_{12}H_{18}NO]^{+}$: 192.1383 found: 192.1375

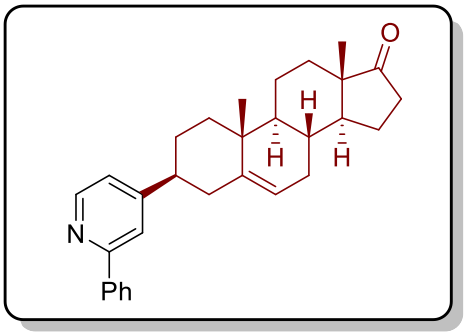


4-cyclohexyl-2-phenylquinoline (4l). Prepared according to **GP2**. Colorless oil (18.7 mg, 65%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Methylene Chloride-d_2) δ 8.23 – 8.15 (m, 2H), 8.17 – 8.10 (m, 2H), 7.81 (s, 1H), 7.73 – 7.67 (m, 1H), 7.58 – 7.51 (m, 3H), 7.50 – 7.44 (m, 1H), 3.41 (tt, *J* = 11.6, 3.4 Hz, 1H), 2.12 – 1.93 (m, 4H), 1.91 – 1.83 (m, 1H), 1.72 – 1.54 (m, 4H), 1.47 – 1.34 (m, 1H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 157.2, 154.5, 149.0, 140.5, 130.9, 129.5, 129.4, 129.1, 127.8, 126.3, 126.2, 123.4, 115.6, 39.5, 34.1, 27.4, 26.8. HRMS (ESI) m/z calcd. for $[C_{21}H_{22}N]^{+}$: 288.1747 found: 288.1747

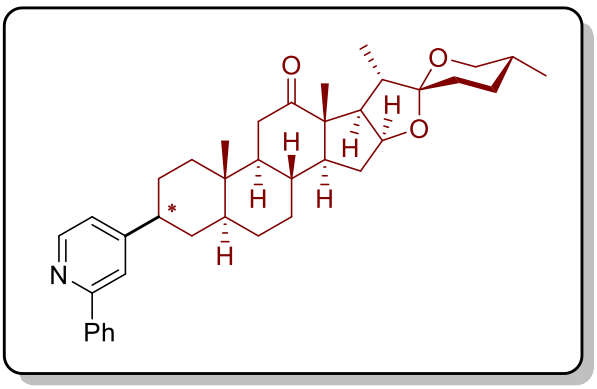


(3R,8R,9S,10R,13S,14S)-10,13-dimethyl-3-(2-phenylpyridin-4-yl)-1,2,3,4,7,8,9,10,11,12,13,14,15,16-tetradecahydro-17H-cyclopenta[a]phenanthren-17-one (5a). Prepared according to **GP1**. White solid (12.3 mg, 29%, 0.1 mmol scale); m.p. 179–181 °C; ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.55 (d, *J* = 5.1 Hz, 1H), 8.00 – 7.89 (m, 2H), 7.81 (d, *J* = 1.7 Hz, 1H), 7.47 (t, *J* = 7.7 Hz, 2H), 7.43 – 7.37 (m, 1H), 7.24 (dd, *J* = 5.2, 1.7 Hz, 1H), 5.58 (dd, *J* = 5.0, 2.5 Hz, 1H), 3.14 (t, *J* = 6.0 Hz, 1H), 2.85 (dq, *J* = 15.1, 2.9 Hz, 1H), 2.54 (dt, *J* = 15.0, 2.1 Hz, 1H), 2.46 (dd, *J* = 19.3, 8.8 Hz, 1H), 2.19 (qdd, *J* = 14.1, 5.1, 3.3 Hz, 2H), 2.09 (dt, *J* = 19.0, 9.1 Hz, 1H), 1.97 (ddd, *J* = 12.5, 8.8, 5.8 Hz, 1H), 1.89 – 1.71 (m, 4H), 1.67 – 1.50 (m, 3H), 1.45 (qd, *J* = 13.3, 4.4 Hz, 1H),

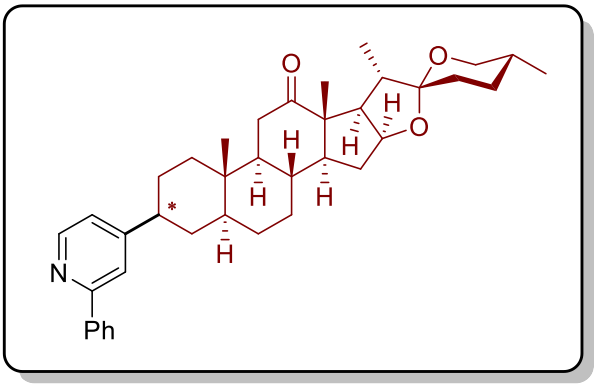
1.31 (ddd, *J* = 12.6, 10.2, 5.8 Hz, 1H), 1.25 (td, *J* = 13.0, 4.2 Hz, 1H), 1.16 – 1.01 (m, 5H), 0.89 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 221.0, 156.8, 156.1, 149.0, 141.2, 139.5, 128.8, 128.7, 126.9, 122.3, 121.5, 120.7, 51.7, 50.0, 47.5, 38.1, 37.4, 35.8, 34.9, 33.1, 31.4, 31.3, 30.9, 27.7, 21.8, 20.0, 19.7, 13.6. HRMS (ESI) m/z calcd. for $[C_{30}H_{36}NO]^+$: 426.2791 found: 426.2789



(3S,8R,9S,10R,13S,14S)-10,13-dimethyl-3-(2-phenylpyridin-4-yl)-1,2,3,4,7,8,9,10,11,12,13,14,15,16-tetradecahydro-17H-cyclopenta[a]phenanthren-17-one (5a'). Prepared according to **GP1**. White solid (11.1 mg, 26%, 0.1 mmol scale); m.p. 189–191 °C; ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.60 (d, *J* = 5.1 Hz, 1H), 8.07 – 7.87 (m, 2H), 7.58 (d, *J* = 1.6 Hz, 1H), 7.48 (dd, *J* = 8.4, 6.9 Hz, 2H), 7.45 – 7.36 (m, 1H), 7.12 (dd, *J* = 5.1, 1.6 Hz, 1H), 5.43 (dt, *J* = 5.4, 1.9 Hz, 1H), 2.65 – 2.56 (m, 1H), 2.53 – 2.39 (m, 2H), 2.26 (ddd, *J* = 13.6, 3.9, 2.2 Hz, 1H), 2.20 – 2.06 (m, 2H), 2.03 (dt, *J* = 13.2, 3.3 Hz, 1H), 1.97 (ddd, *J* = 12.6, 8.7, 5.9 Hz, 1H), 1.91 – 1.78 (m, 3H), 1.78 – 1.67 (m, 3H), 1.62 – 1.46 (m, 2H), 1.38 – 1.24 (m, 3H), 1.13 (s, 4H), 0.91 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 221.1, 157.4, 156.5, 149.4, 142.2, 139.4, 128.9, 128.7, 127.0, 120.8, 120.2, 119.4, 51.8, 50.5, 47.5, 45.2, 39.6, 39.5, 37.0, 35.8, 31.5, 30.8, 29.2, 21.9, 20.2, 19.6, 13.6. HRMS (ESI) m/z calcd. for $[C_{30}H_{36}NO]^+$: 426.2791 found: 426.2784

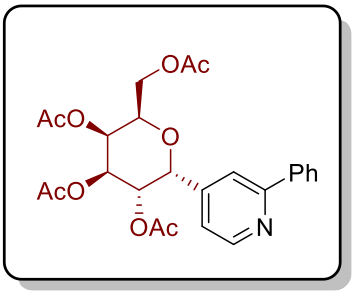


(2aS,5'R,6aS,6bS,8aS,8bR,9S,10R,11aS,12aS,12bR)-5',6a,8a,9-tetramethyl-4-(2-phenylpyridin-4-yl)icosahydro-4l3-spiro[naphtho[6',5':4,5]indeno[2,1-b]furan-10,2'-pyran]-8(2H)-one (5b). Prepared according to **GP1**. White solid (18.3 mg, 32%, 0.1 mmol scale); m.p. 226–228 °C; ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.57 (d, *J* = 5.1 Hz, 1H), 8.03 – 7.88 (m, 2H), 7.55 (d, *J* = 1.6 Hz, 1H), 7.46 (dd, *J* = 8.3, 6.5 Hz, 2H), 7.42 – 7.37 (m, 1H), 7.08 (dd, *J* = 5.2, 1.7 Hz, 1H), 4.41 – 4.30 (m, 1H), 3.49 (ddd, *J* = 11.1, 4.3, 2.0 Hz, 1H), 3.35 (t, *J* = 10.9 Hz, 1H), 2.62 (ddt, *J* = 11.2, 9.0, 4.3 Hz, 1H), 2.53 (dd, *J* = 8.8, 6.7 Hz, 1H), 2.42 (t, *J* = 13.7 Hz, 1H), 2.26 (dd, *J* = 14.3, 5.0 Hz, 1H), 2.18 – 2.07 (m, 1H), 2.02 – 1.89 (m, 1H), 1.87 – 1.51 (m, 11H), 1.50 – 1.13 (m, 8H), 1.07 (d, *J* = 7.3 Hz, 6H), 1.03 – 0.99 (m, 1H), 0.98 (s, 3H), 0.79 (d, *J* = 6.4 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 213.5, 157.5, 156.6, 149.5, 139.5, 128.8, 128.7, 127.0, 120.8, 119.3, 109.2, 79.2, 66.9, 55.8, 55.6, 55.1, 53.5, 46.6, 44.0, 42.2, 38.0, 37.6, 36.3, 35.3, 34.3, 31.5, 31.4, 31.1, 30.2, 28.7, 28.3, 17.1, 16.0, 13.2, 12.1. HRMS (ESI) m/z calcd. for $[C_{38}H_{50}NO_3]^+$: 568.3785 found: 568.3781

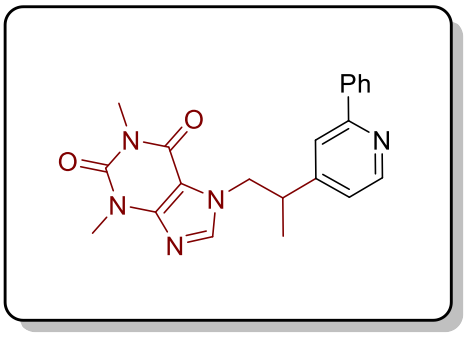


(2aS,5'R,6aS,6bS,8aS,8bR,9S,10R,11aS,12aS,12bR)-5',6a,8a,9-tetramethyl-4-(2-phenylpyridin-4-yl)icosahydro-4l3-spiro[naphtho[6',5':4,5]indeno[2,1-b]furan-10,2'-pyran]-8(2H)-one (5b'). Prepared according to **GP1**. White solid (14.2 mg, 25%, 0.1 mmol scale); m.p. 229–231 °C; ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.60 (d, *J* = 5.2 Hz, 1H), 8.02 – 7.85 (m, 2H), 7.66 (d, *J* = 1.6 Hz, 1H), 7.53 – 7.45 (m, 2H), 7.43 – 7.37 (m, 1H), 7.20 (dd, *J* = 5.2, 1.8 Hz, 1H), 4.30 (ddd, *J* = 8.7, 7.4, 6.1 Hz, 1H), 3.46 (ddd, *J* = 10.9, 4.2, 2.1 Hz, 1H), 3.32 (t, *J* = 11.0 Hz, 1H), 3.17 – 3.02 (m, 1H), 2.47 (dd, *J* = 8.8, 6.7 Hz, 1H), 2.42 – 2.33 (m, 1H), 2.24 – 2.12 (m, 2H), 2.07 (ddd, *J* = 12.1, 7.5, 5.1 Hz, 1H), 2.03 – 1.95 (m, 1H), 1.94 – 1.84 (m, 2H), 1.83 – 1.76 (m, 1H), 1.77 – 1.70 (m, 2H), 1.70 – 1.58 (m, 3H), 1.58 – 1.53 (m, 1H), 1.52 – 1.46 (m, 1H), 1.46 – 1.26 (m, 5H), 1.23 – 1.16 (m, 1H), 1.15 – 1.06 (m, 2H), 1.06 – 1.02 (m, 6H), 0.98 (s, 3H), 0.93 – 0.84 (m, 1H), 0.77 (d, *J* = 6.4 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 213.4, 157.4, 155.0, 149.4, 139.6, 128.8, 128.7, 127.0, 121.5,

120.0, 109.2, 79.1, 66.8, 55.7, 55.6, 55.0, 53.4, 42.1, 40.8, 37.3, 36.8, 36.3, 34.2, 34.0, 32.6, 31.4, 31.3, 31.0, 30.2, 28.7, 28.4, 23.9, 17.1, 16.0, 13.2, 11.7. HRMS (ESI) m/z calcd. for $[C_{38}H_{50}NO_3]^+$: 568.3785 found: 568.3787

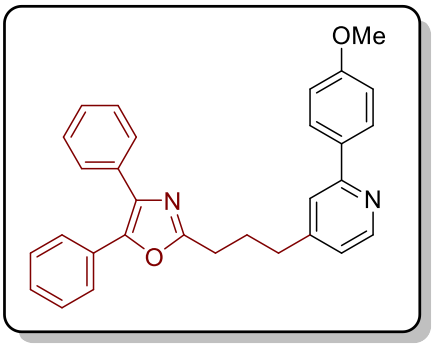


(2R,3S,4R,5S,6R)-2-(acetoxymethyl)-6-(2-phenylpyridin-4-yl)tetrahydro-2H-pyran-3,4,5-triyl triacetate (5c). Prepared according to **GP2**. White gum (20.9 mg, 43%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.68 (d, *J* = 5.2 Hz, 1H), 8.07 – 7.90 (m, 2H), 7.85 (s, 1H), 7.53 – 7.40 (m, 3H), 7.36 (d, *J* = 5.2 Hz, 1H), 5.50 (dd, *J* = 4.9, 3.3 Hz, 1H), 5.46 (dd, *J* = 6.4, 3.3 Hz, 1H), 5.40 (dd, *J* = 6.4, 3.3 Hz, 1H), 5.34 (d, *J* = 3.3 Hz, 1H), 4.69 (dd, *J* = 12.2, 8.9 Hz, 1H), 4.30 (dt, *J* = 8.8, 4.3 Hz, 1H), 4.13 (dd, *J* = 12.2, 3.7 Hz, 1H), 2.16 (s, 3H), 2.13 (s, 3H), 2.03 (s, 3H), 1.94 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 170.7, 169.7, 169.3, 169.2, 157.2, 149.0, 147.0, 138.1, 129.6, 128.9, 128.9, 127.1, 120.3, 119.1, 71.6, 70.0, 69.6, 67.5, 66.4, 60.0, 20.9, 20.7, 20.7, 20.5. HRMS (ESI) m/z calcd. for $[C_{25}H_{28}NO_9]^+$: 486.1759 found: 486.1762

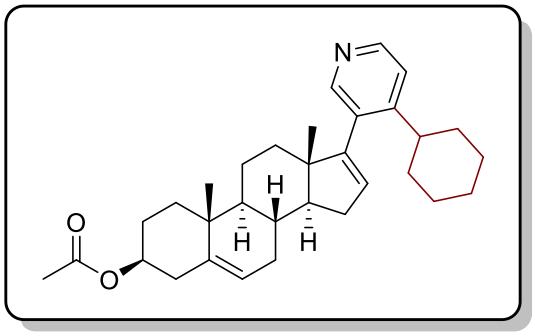


1,3-dimethyl-7-(2-(2-phenylpyridin-4-yl)propyl)-3,7-dihydro-1H-purine-2,6-dione (5d). Prepared according to **GP1**. White gum (15.8 mg, 42%, 0.1 mmol scale); ^{1}H NMR (600 MHz, Methylene Chloride-d_2) δ 8.58 (d, *J* = 5.1 Hz, 1H), 8.13 – 7.92 (m, 2H), 7.54 (s, 1H), 7.51 – 7.44 (m, 2H), 7.45 – 7.39 (m, 1H), 7.27 (s, 1H), 7.09 (dd, *J* = 5.0, 1.7 Hz, 1H), 4.59 – 4.14 (m, 2H), 3.50 (s, 3H), 3.50 – 3.44 (m, 1H), 3.37 (s, 3H), 1.38 (d, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 157.9, 155.6, 152.8, 152.0, 150.2, 149.4, 141.5, 139.4, 129.5, 129.1, 127.3, 121.4, 119.7, 107.1, 53.4, 41.1, 29.9, 28.1, 17.7. HRMS (ESI) m/z calcd. for $[C_{21}H_{22}N_5O_2]^+$: 376.1768 found: 376.1769

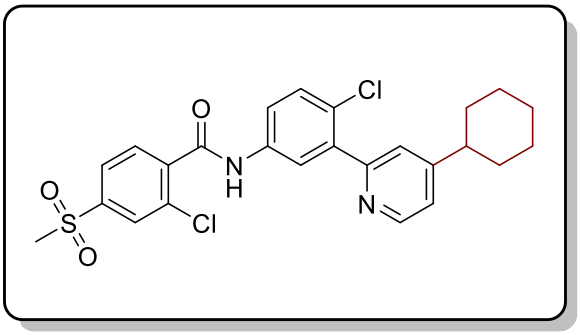


2-(3-(2-(4-methoxyphenyl)pyridin-4-yl)propyl)-4,5-diphenyloxazole (5e). Prepared according to **GP1**. Yellow oil (17.9 mg, 40%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Methylene Chloride-d_2) δ 8.51 (d, J = 5.0 Hz, 1H), 7.99 – 7.92 (m, 2H), 7.65 – 7.61 (m, 2H), 7.59 – 7.53 (m, 3H), 7.40 – 7.29 (m, 6H), 7.08 (dd, J = 5.0, 1.5 Hz, 1H), 6.99 – 6.93 (m, 2H), 3.85 (s, 3H), 2.90 (t, J = 7.4 Hz, 2H), 2.84 (t, J = 7.6 Hz, 2H), 2.25 (p, J = 7.5 Hz, 2H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 163.3, 160.9, 157.2, 151.5, 149.8, 145.6, 135.4, 133.2, 132.4, 129.6, 129.0, 128.9, 128.8, 128.5, 128.3, 128.2, 126.9, 122.2, 120.3, 114.3, 35.0, 27.9, 27.8. HRMS (ESI) m/z calcd. for $[C_{30}H_{27}N_2O_2]^+$: 447.2067 found: 447.2069

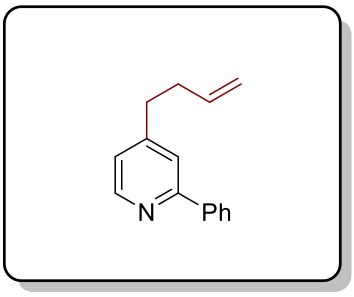


(3S,8R,9S,10R,13S,14S)-17-(4-cyclohexylpyridin-3-yl)-10,13-dimethyl-2,3,4,7,8,9,10,11,12,13,14,15-dodecahydro-1H-cyclopenta[a]phenanthren-3-yl acetate (5f). Prepared according to **GP2**. White solid (23.2 mg, 49%, 0.1 mmol scale); m.p. 89–91 °C; ^{1}H NMR (400 MHz, Chloroform-d) δ 8.56 – 8.31 (m, 1H), 8.31 – 8.06 (m, 1H), 7.20 (d, J = 5.2 Hz, 1H), 5.61 (dd, J = 3.1, 1.6 Hz, 1H), 5.41 (dt, J = 5.1, 1.7 Hz, 1H), 4.70 – 4.37 (m, 1H), 2.73 (ddd, J = 14.5, 10.1, 3.2 Hz, 1H), 2.42 – 2.24 (m, 3H), 2.15 – 2.04 (m, 2H), 2.02 (s, 3H), 1.92 – 1.54

(m, 12H), 1.53 – 1.40 (m, 4H), 1.38 – 1.21 (m, 4H), 1.20 – 1.06 (m, 2H), 1.05 (s, 3H), 0.91 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 170.5, 156.2, 150.2, 148.6, 147.0, 140.0, 132.7, 130.6, 122.2, 121.4, 73.8, 57.0, 50.3, 49.3, 40.6, 38.1, 36.9, 36.8, 34.7, 34.5, 33.5, 32.3, 31.6, 30.8, 27.7, 26.6, 26.5, 25.9, 21.4, 20.6, 19.2, 16.0. HRMS (ESI) m/z calcd. for $[C_{32}H_{44}NO_2]^+$: 474.3367 found: 474.3366

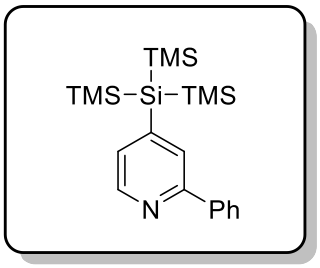


2-chloro-N-(4-chloro-3-(4-cyclohexylpyridin-2-yl)phenyl)-4-(methylsulfonyl)benzamide (5g). Prepared according to **GP1**. White solid (37.8 mg, 75%, 0.1 mmol scale); ^{1}H NMR (400 MHz, DMSO-d_6) δ 10.92 (s, 1H), 8.57 (dd, *J* = 5.1, 0.8 Hz, 1H), 8.14 (d, *J* = 1.7 Hz, 1H), 8.05 – 7.96 (m, 2H), 7.91 (d, *J* = 8.0 Hz, 1H), 7.75 (dd, *J* = 8.7, 2.6 Hz, 1H), 7.57 (d, *J* = 8.7 Hz, 1H), 7.55 – 7.50 (m, 1H), 7.30 (dd, *J* = 5.2, 1.7 Hz, 1H), 3.35 (s, 3H), 2.61 (tt, *J* = 11.6, 3.4 Hz, 1H), 1.88 – 1.74 (m, 4H), 1.75 – 1.63 (m, 1H), 1.53 – 1.30 (m, 4H), 1.25 (ddd, *J* = 12.1, 10.4, 2.9 Hz, 1H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 163.8, 156.2, 155.8, 149.4, 143.1, 140.9, 139.4, 137.6, 131.0, 130.4, 129.9, 128.1, 125.9, 125.8, 123.0, 122.5, 121.5, 120.8, 43.1, 42.9, 32.9, 26.0, 25.4. HRMS (ESI) m/z calcd. for $[C_{25}H_{24}Cl_2N_2NaO_3S]^+$: 525.0777 found: 525.0779

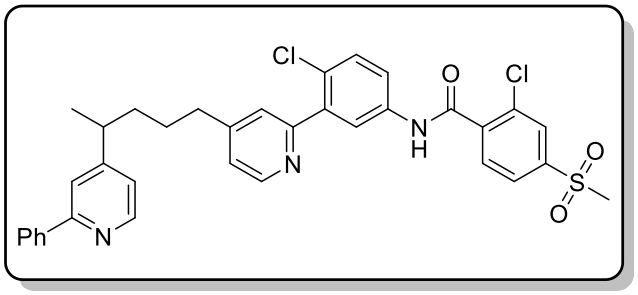


4-(but-3-en-1-yl)-2-phenylpyridine (6). Prepared according to **GP2**. Colorless oil (11.1 mg, 53%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.58 (d, *J* = 5.0 Hz, 1H), 8.19 – 7.79 (m, 2H), 7.56 (s, 1H), 7.47 (t, *J* = 7.3 Hz, 2H), 7.44 – 7.36 (m, 1H), 7.08 (d, *J* = 4.9 Hz, 1H), 5.86 (ddt, *J* = 16.9, 10.0, 6.6 Hz, 1H), 5.14 – 4.84 (m, 2H), 2.78 (t, *J* = 7.7 Hz, 2H), 2.59 – 2.22 (m, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.4, 151.5, 149.4,

139.4, 137.0, 128.9, 128.7, 127.0, 122.4, 120.9, 115.8, 34.8, 34.3. HRMS (ESI) m/z calcd. for $[C_{15}H_{15}NNa]^+$: 232.1097 found: 232.1101



4-(1,1,1,3,3,3-hexamethyl-2-(trimethylsilyl)trisilan-2-yl)-2-phenylpyridine (7). Prepared according to **GP1**. Colorless oil (5.6 mg, 14%, 0.1 mmol scale); ^{1}H NMR (400 MHz, Methylene Chloride-d_2) δ 8.50 (dd, J = 4.9, 1.0 Hz, 1H), 8.01 – 7.94 (m, 2H), 7.84 (t, J = 1.1 Hz, 1H), 7.53 – 7.44 (m, 2H), 7.44 – 7.37 (m, 1H), 7.30 (dd, J = 4.8, 1.1 Hz, 1H), 0.28 (s, 27H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 155.7, 148.8, 148.4, 140.2, 130.4, 129.1, 129.1, 128.5, 127.1, 54.4, 54.1, 53.8, 53.6, 53.3, 1.2. HRMS (ESI) m/z calcd. for $[C_{20}H_{36}NSi_4]^+$: 402.1919 found: 402.1917

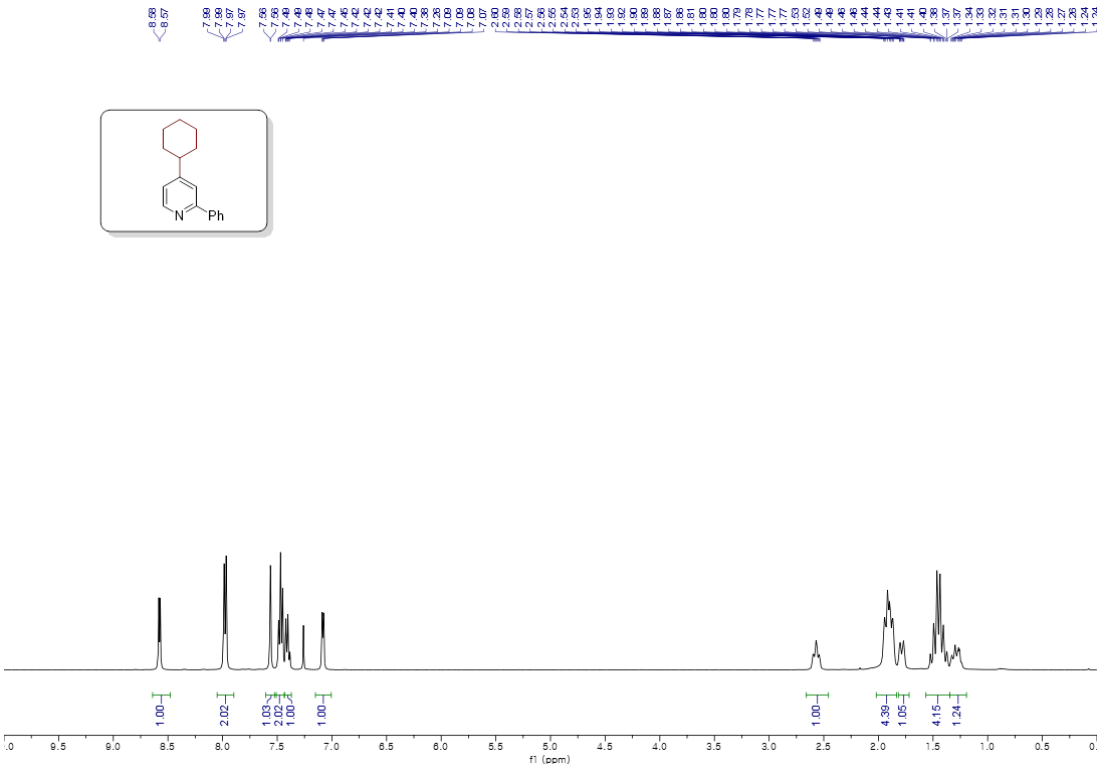


2-chloro-N-(4-chloro-3-(4-(4-(2-phenylpyridin-4-yl)pentyl)pyridin-2-yl)phenyl)-4-(methylsulfonyl)benzamide (9). Prepared according to **GP2**. White solid (30.9 mg, 48%, 0.1 mmol scale). m.p. 99–101 °C; Mixture of rotamers, major is reported; ^{1}H NMR (400 MHz, Methylene Chloride-d_2) δ 10.21 (s, 1H), 8.53 (d, J = 5.1 Hz, 1H), 8.16 (d, J = 5.1 Hz, 1H), 8.04 – 7.99 (m, 1H), 7.99 – 7.92 (m, 2H), 7.83 (d, J = 1.7 Hz, 1H), 7.66 – 7.60 (m, 2H), 7.56 (s, 1H), 7.50 – 7.35 (m, 6H), 7.07 (dd, J = 5.1, 1.6 Hz, 1H), 6.93 (dd, J = 5.2, 1.6 Hz, 1H), 2.94 (s, 3H), 2.78 (dt, J = 14.5, 7.1 Hz, 1H), 2.63 (dt, J = 19.5, 6.5 Hz, 2H), 1.73 – 1.47 (m, 4H), 1.29 (d, J = 6.9 Hz, 3H). ^{13}C NMR (100 MHz, Methylene Chloride-d_2) δ 164.3, 157.6, 157.5, 156.0, 152.4, 149.9, 148.9, 143.0, 141.2, 139.8, 139.2, 137.8, 132.4, 131.1, 130.1, 129.2, 129.2, 129.0, 127.2, 127.2, 126.2, 125.7, 124.5, 123.4, 123.1, 121.8, 121.5, 119.8, 44.6, 39.9, 37.4, 35.4, 28.4, 21.7. HRMS (ESI) m/z calcd. for $[C_{35}H_{32}Cl_2N_3O_3S]^+$: 644.1536 found: 644.1539

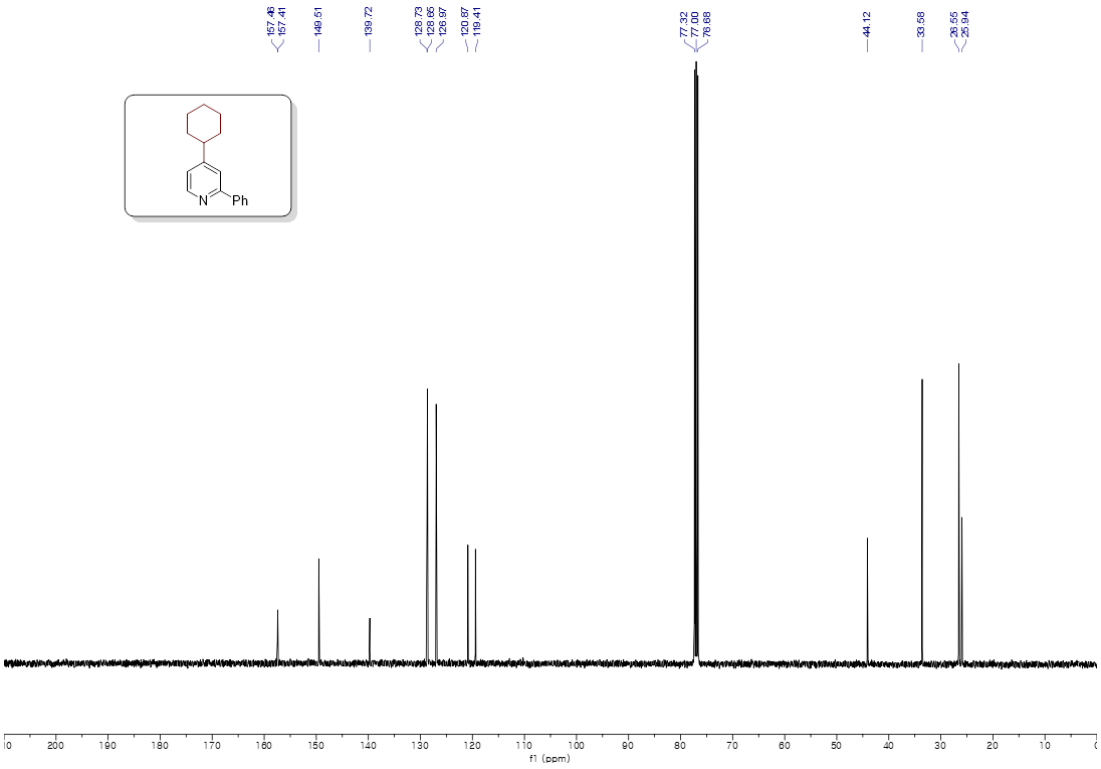
Appendix I

Spectral Copies of ^{1}H, ^{13}C and ^{19}F NMR Data Obtained in this Study

4-cyclohexyl-2-phenylpyridine (3a).

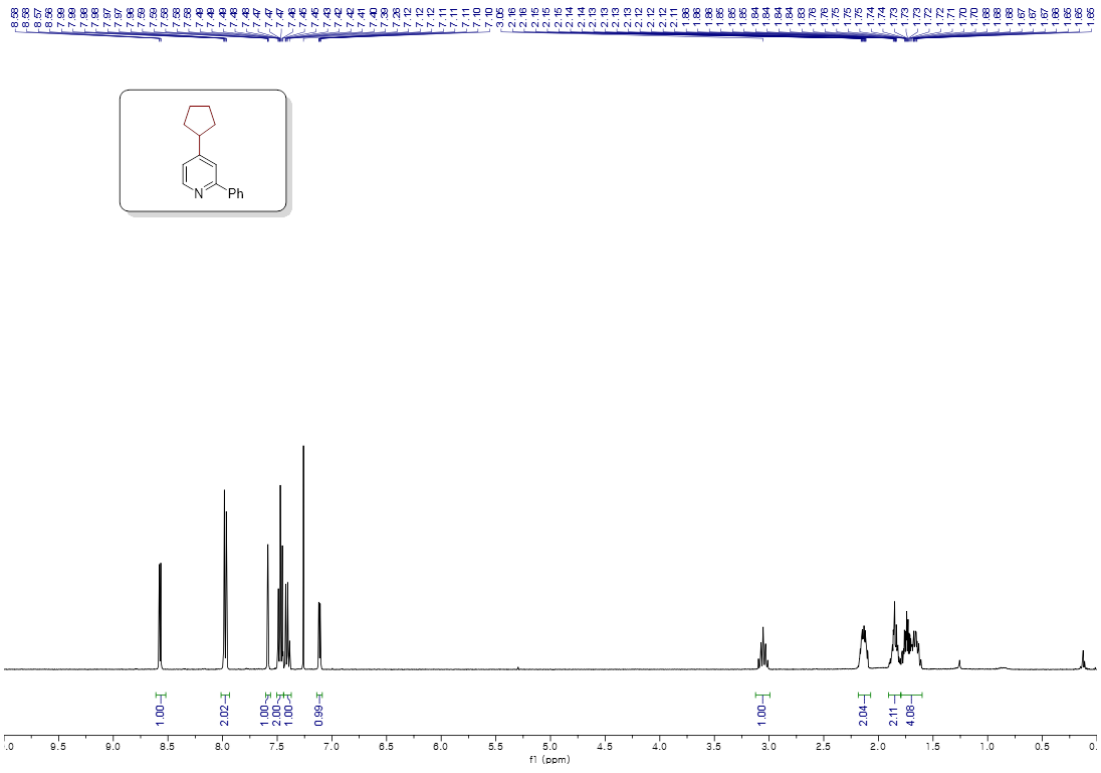


400 MHz, ^{1}H NMR in $CDCl_3$

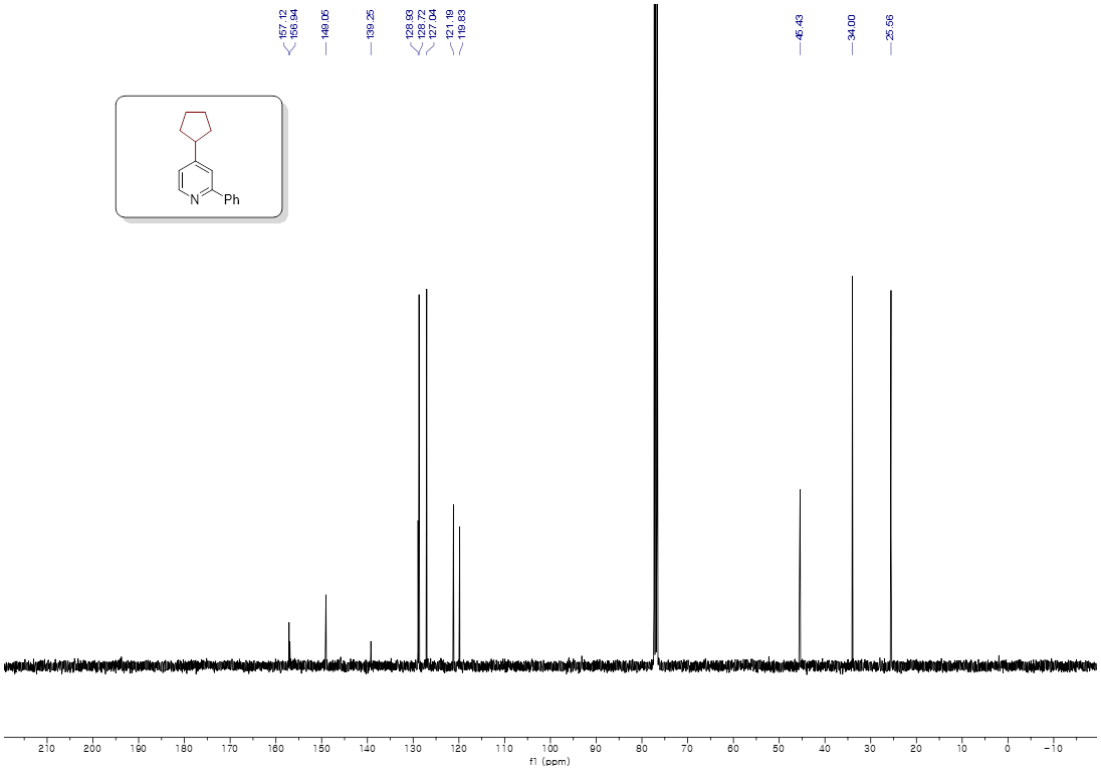


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclopentyl-2-phenylpyridine (3b).

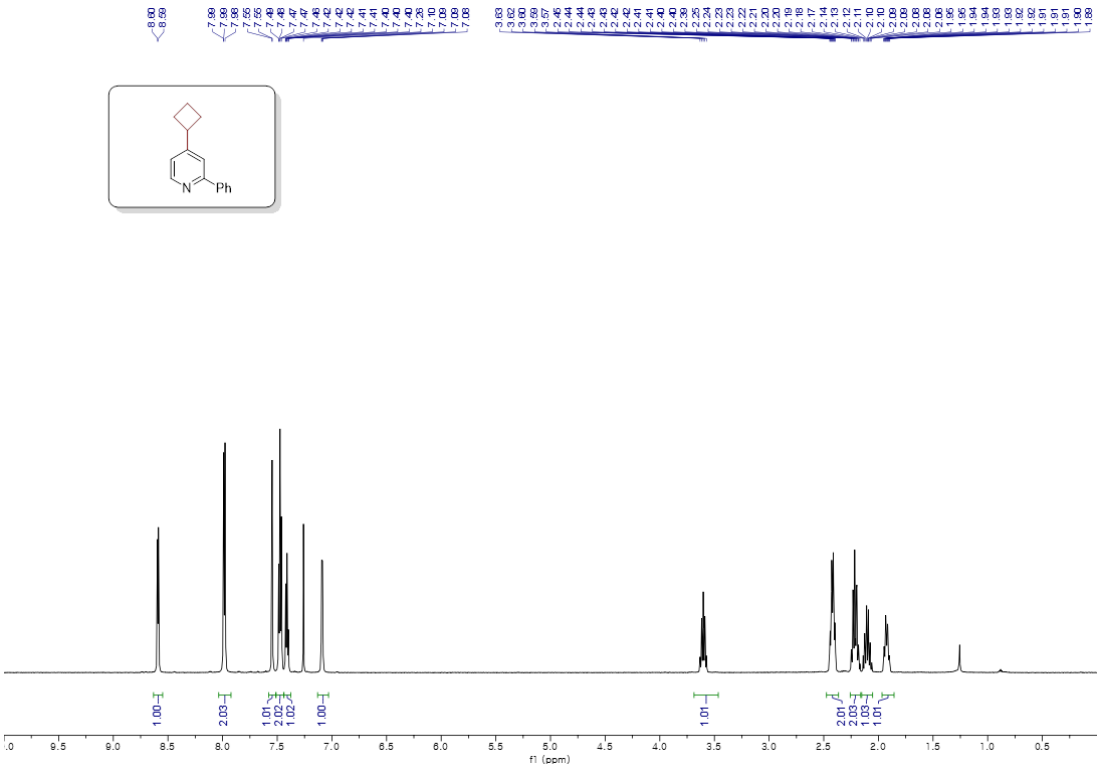


400 MHz, ^{1}H NMR in $CDCl_3$

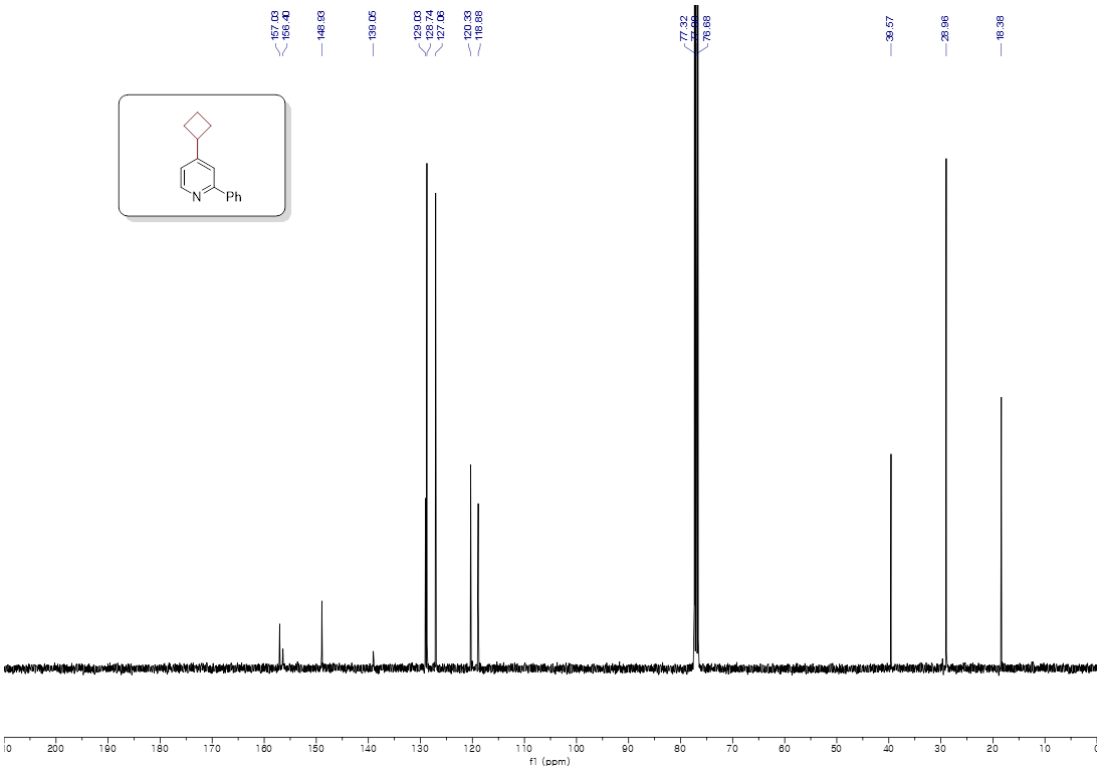


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclobutyl-2-phenylpyridine (3c).

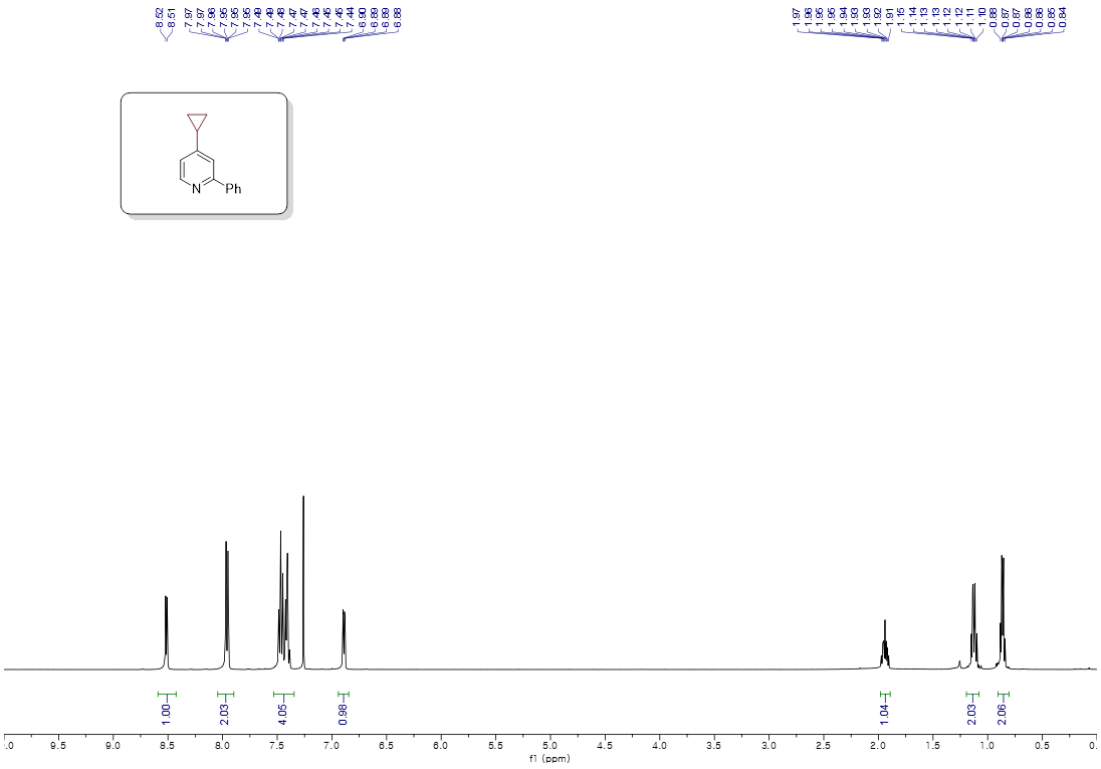


600 MHz, ^{1}H NMR in $CDCl_3$

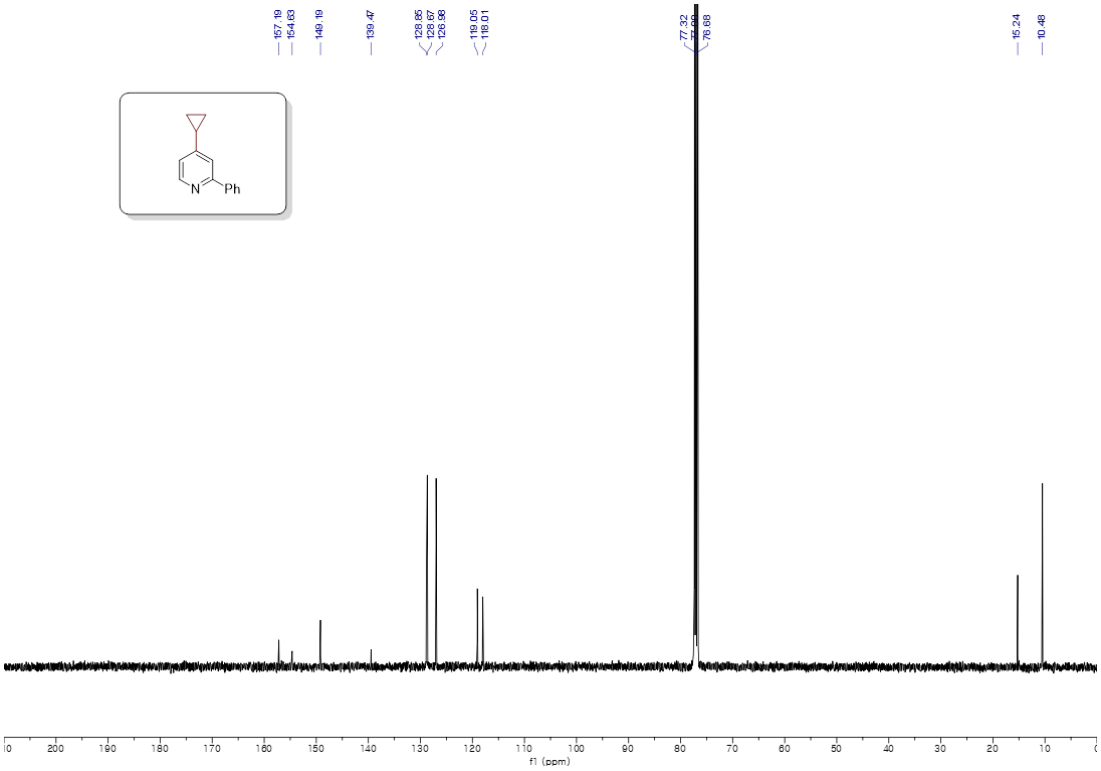


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclopropyl-2-phenylpyridine (3d).

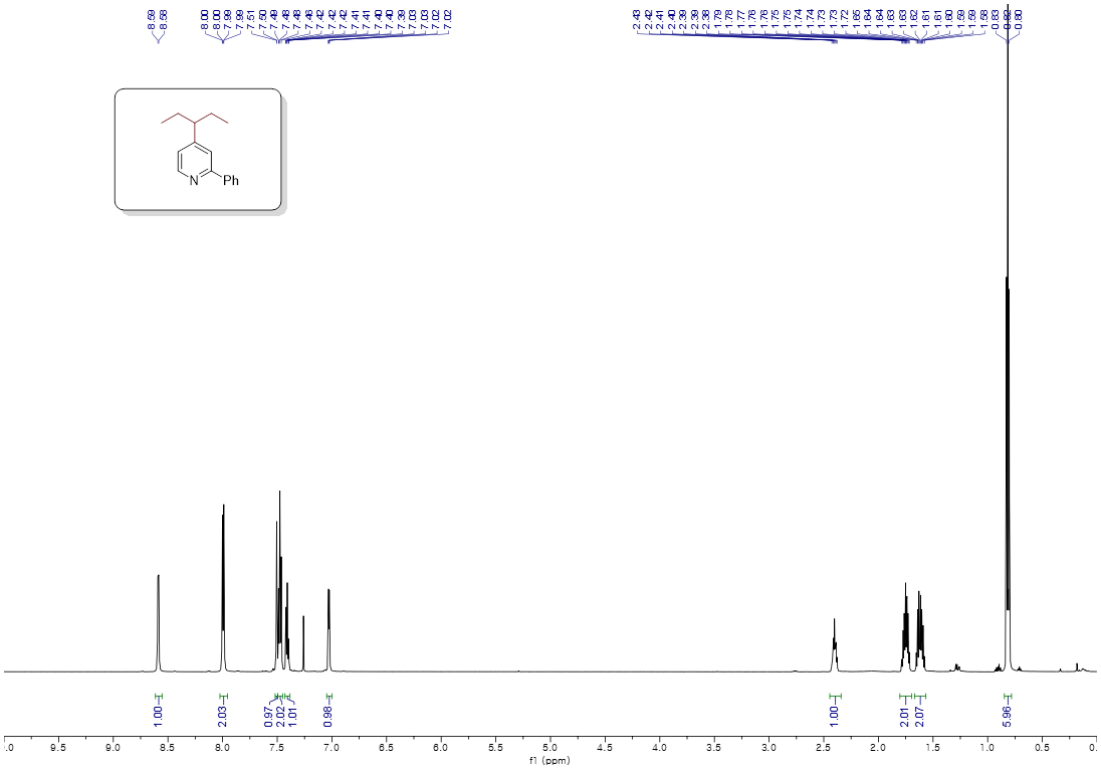


400 MHz, ^{1}H NMR in $CDCl_3$

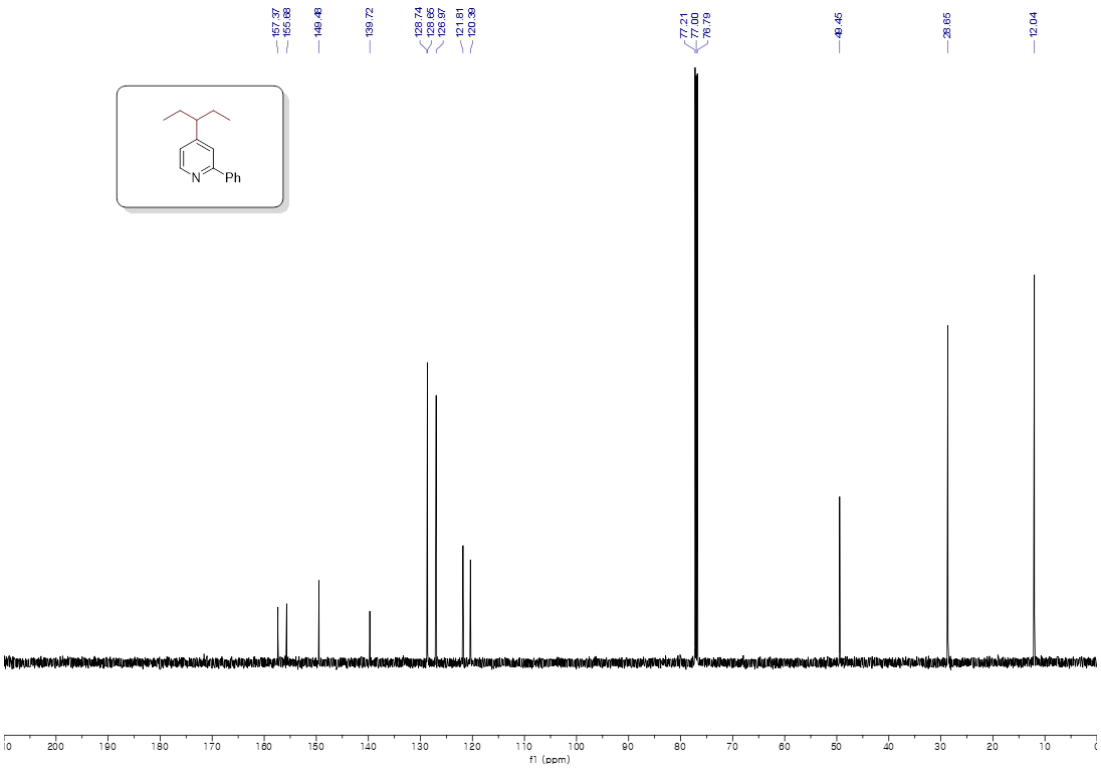


100 MHz, ^{13}C NMR in $CDCl_3$

4-(pentan-3-yl)-2-phenylpyridine (3e).

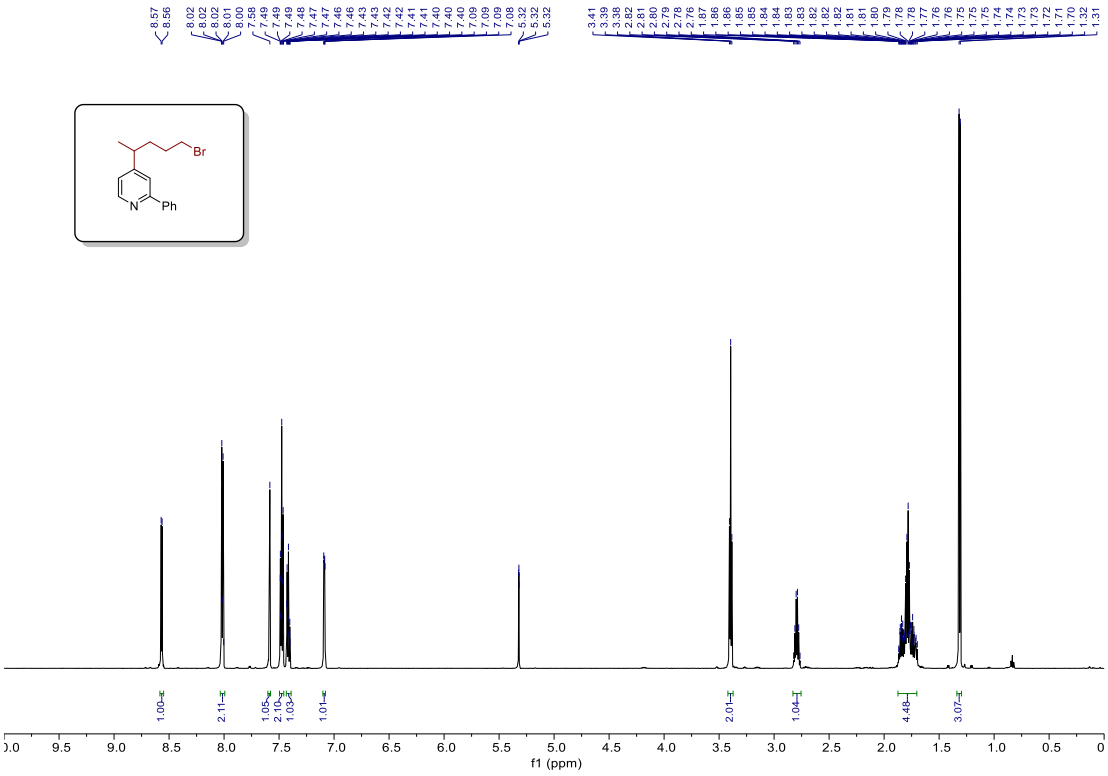


600 MHz, ^{1}H NMR in $CDCl_3$

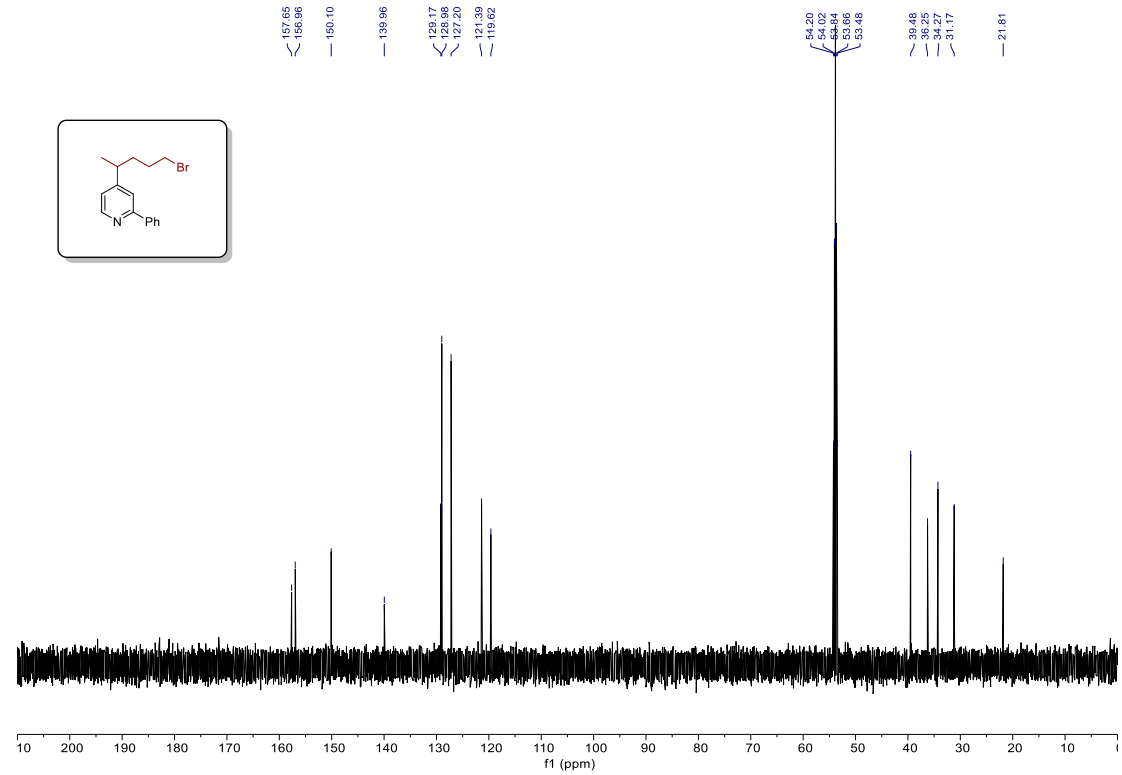


150 MHz, ^{13}C NMR in $CDCl_3$

4-(5-bromopentan-2-yl)-2-phenylpyridine (3f).

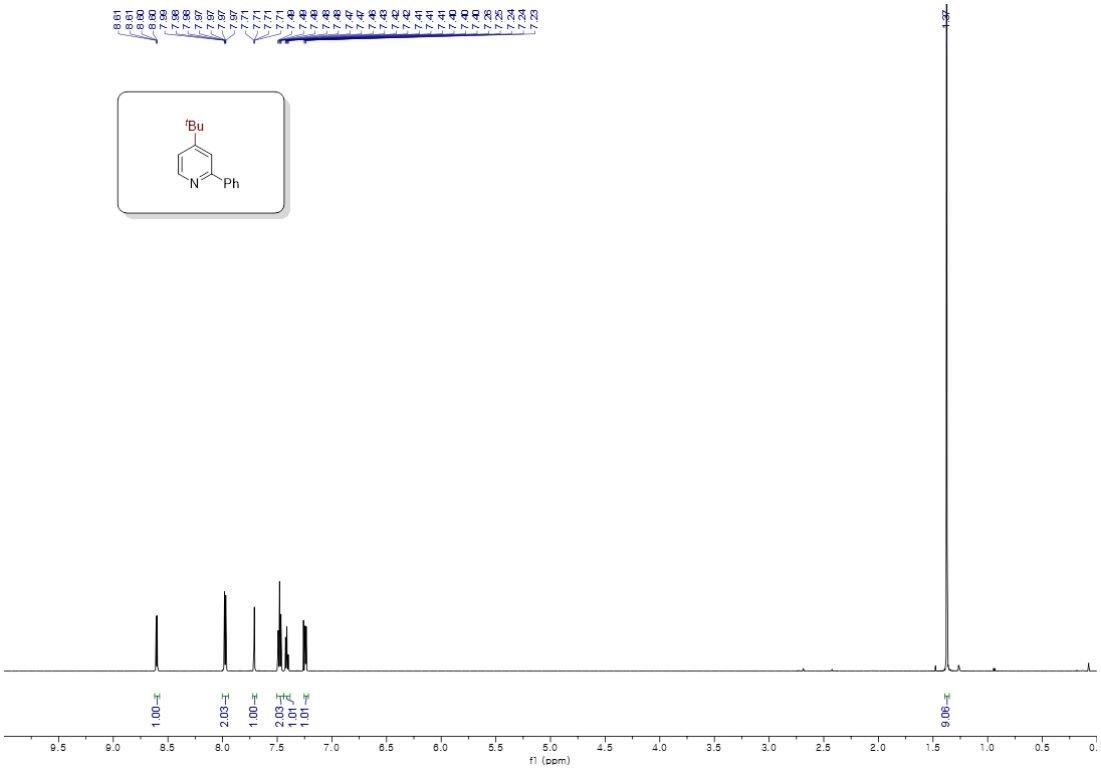


600 MHz, ^{1}H NMR in CD_2Cl_2

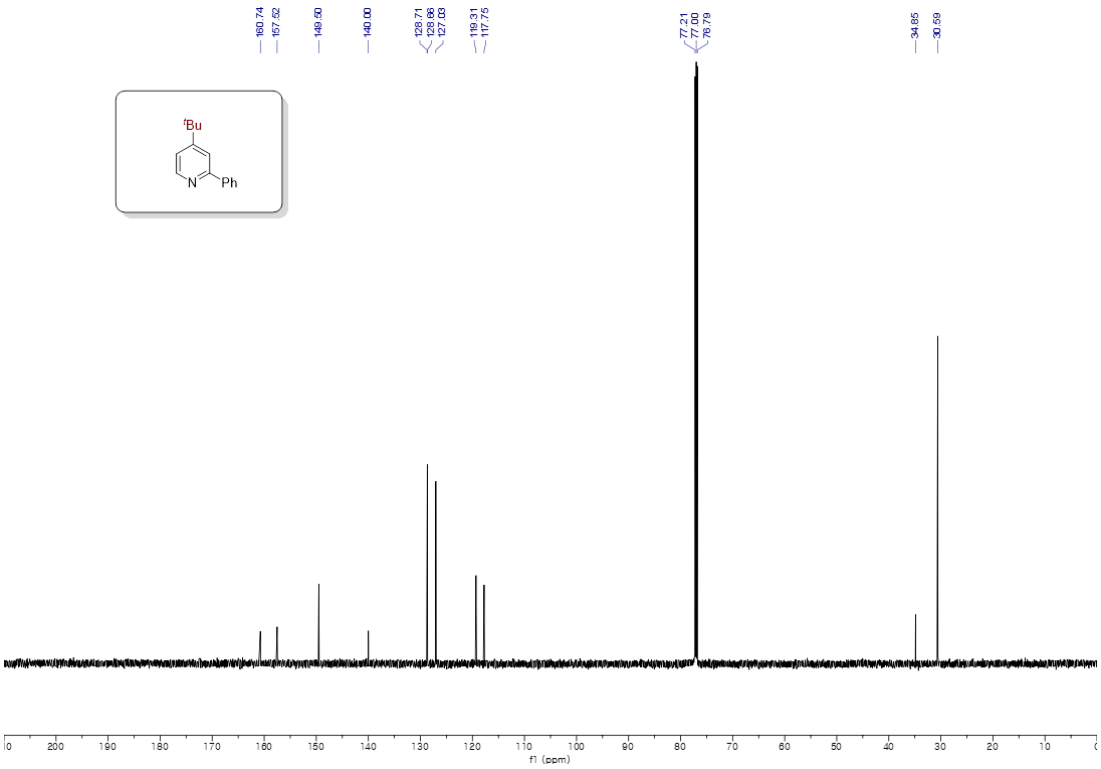


150 MHz, ^{13}C NMR in CD_2Cl_2

4-(tert-butyl)-2-phenylpyridine (3g).

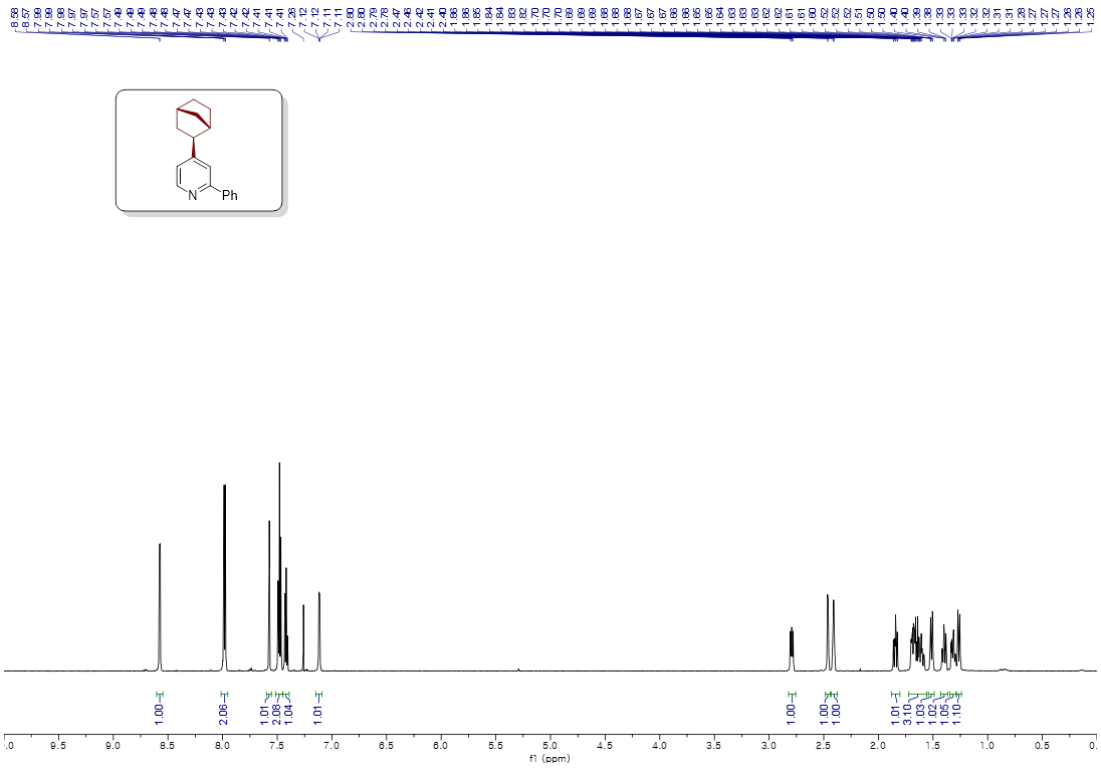


600 MHz, ^{1}H NMR in $CDCl_3$

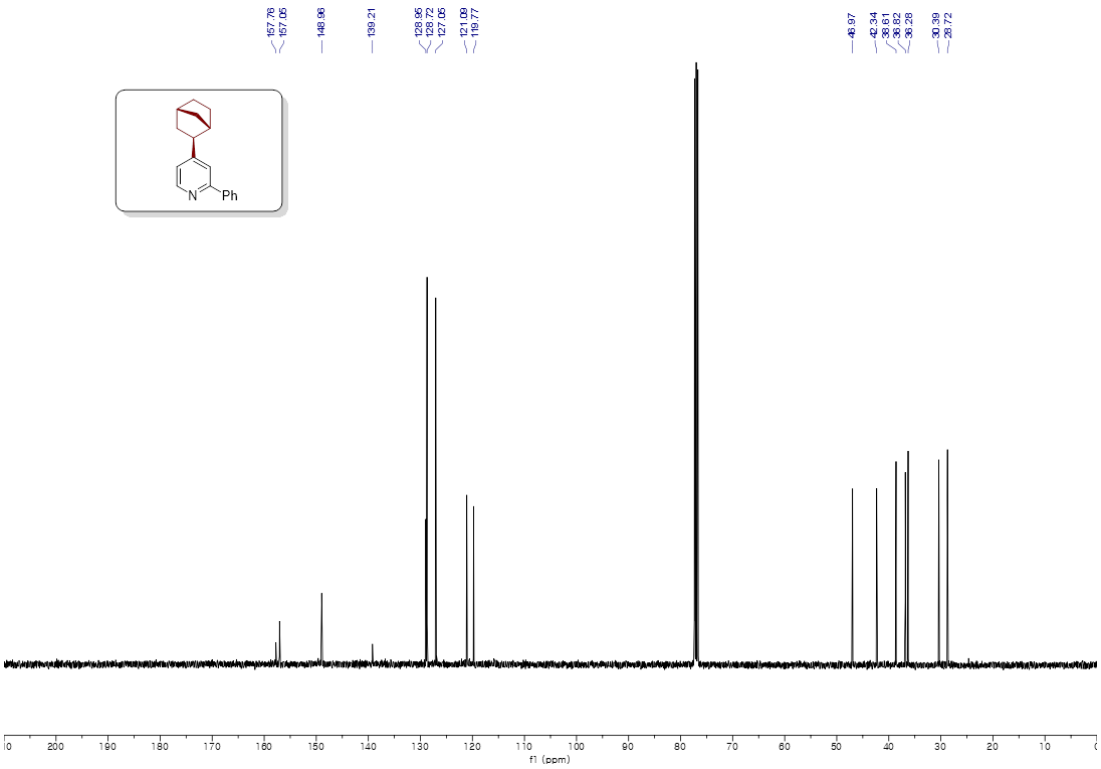


150 MHz, ^{13}C NMR in $CDCl_3$

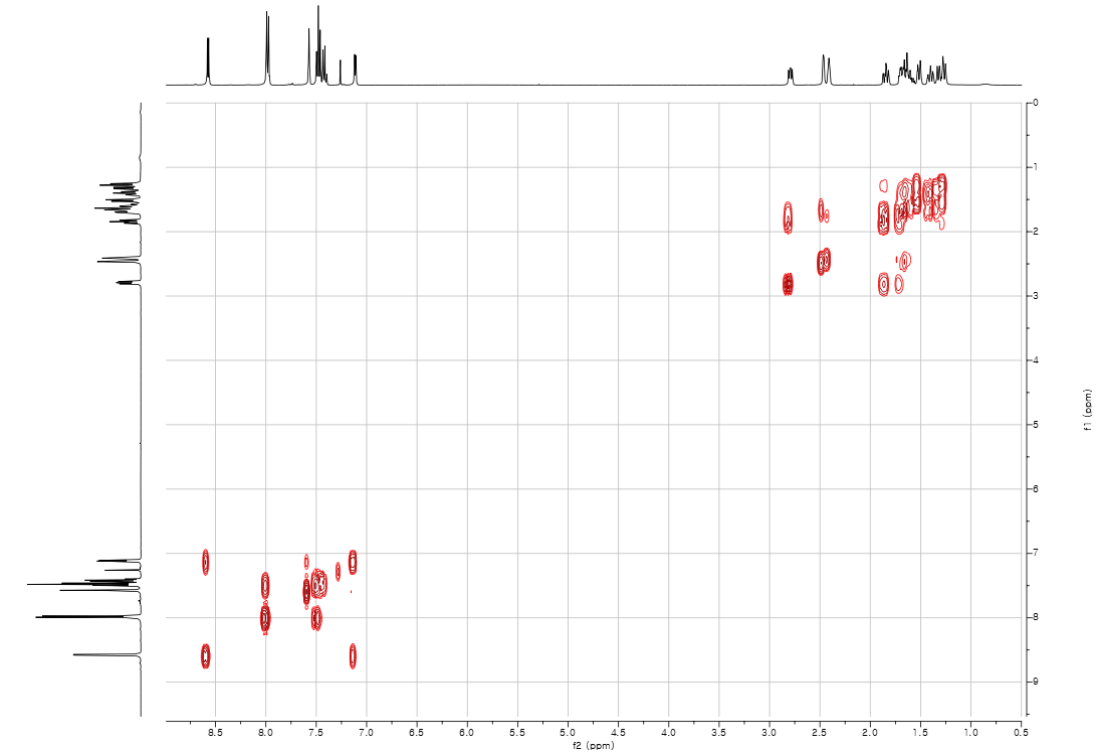
4-((1S,2S,4R)-bicyclo[2.2.1]heptan-2-yl)-2-phenylpyridine (3h).



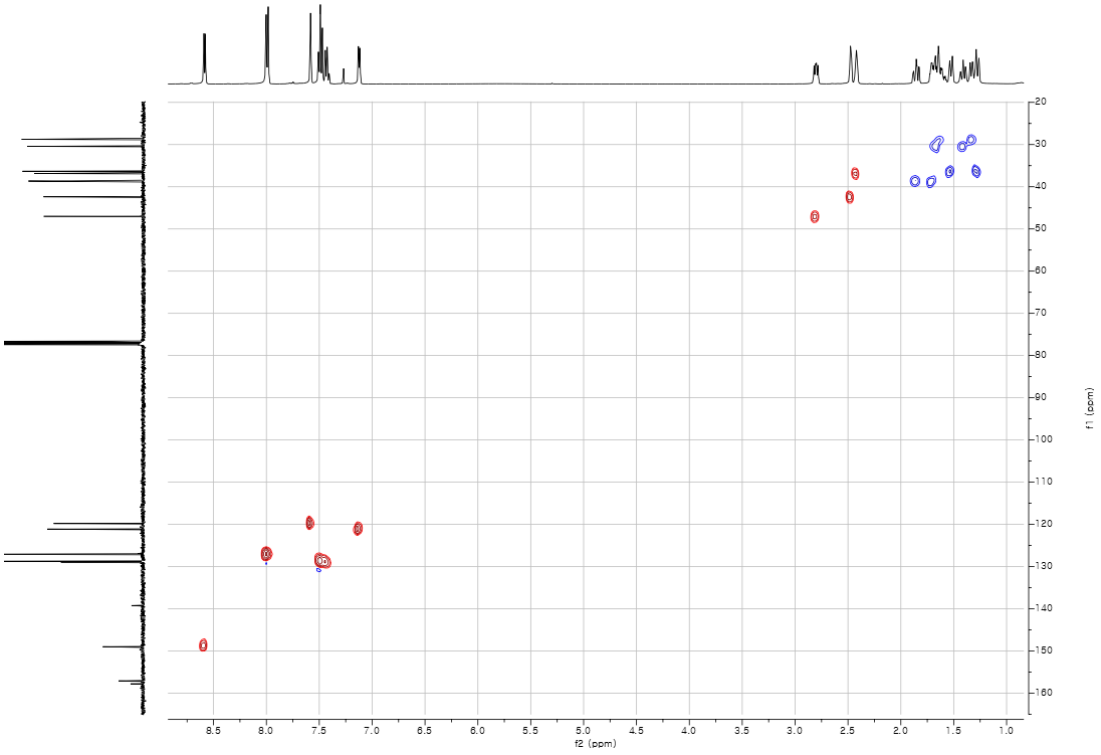
600 MHz, ^{1}H NMR in $CDCl_3$



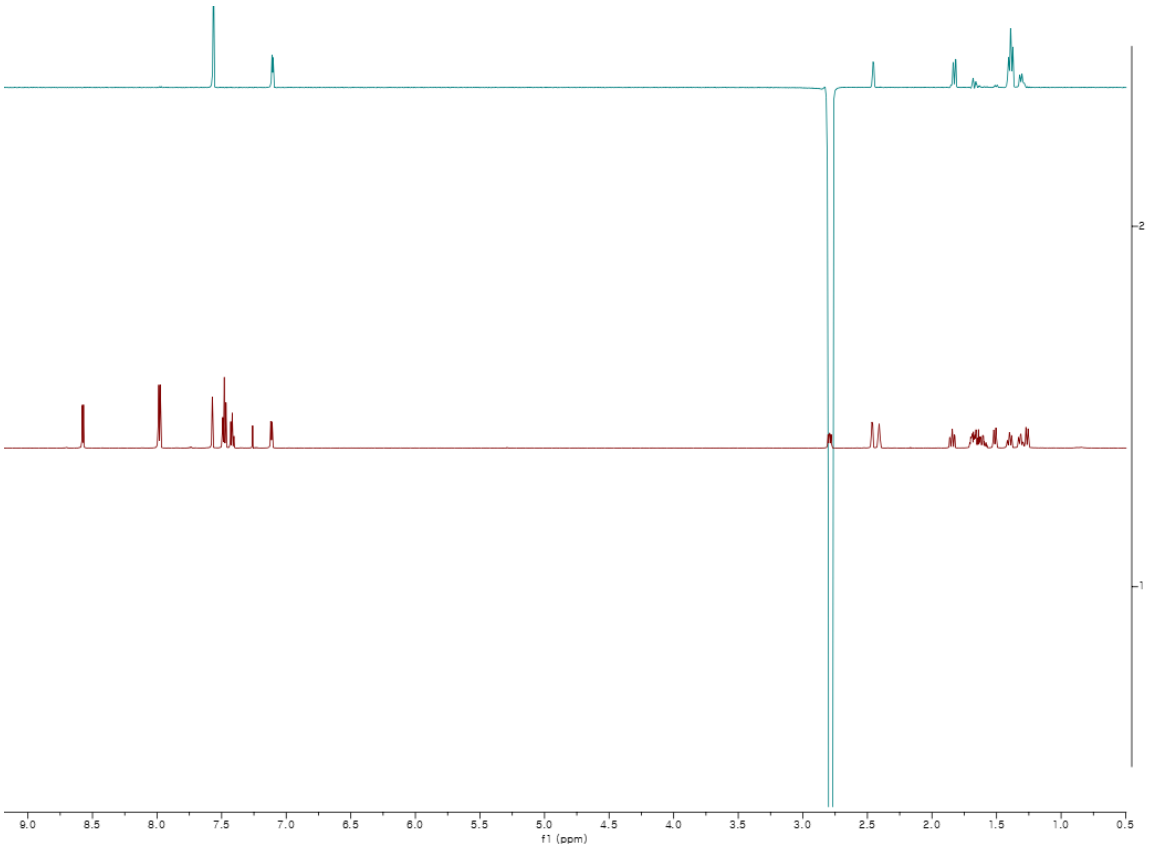
100 MHz, ^{13}C NMR in $CDCl_3$



2D COSY in $CDCl_3$

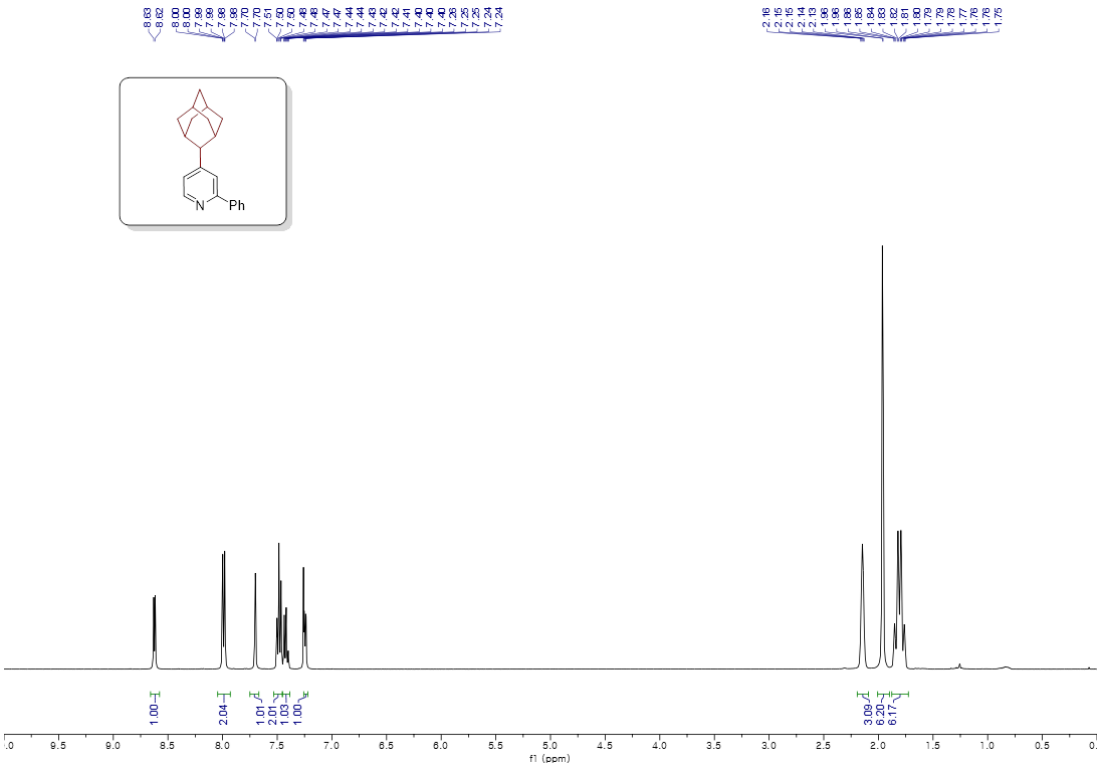


2D HSQC in $CDCl_3$

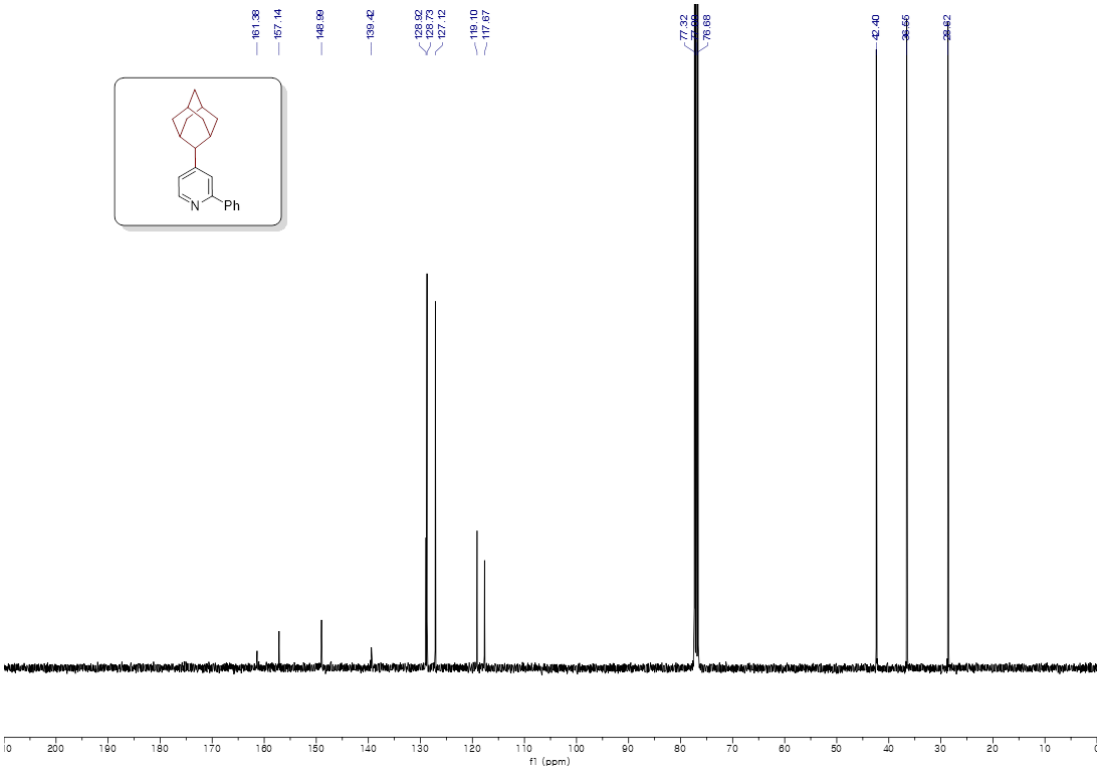


1D NOESY in $CDCl_3$

4-((1r,3r)-adamantan-2-yl)-2-phenylpyridine (3i).

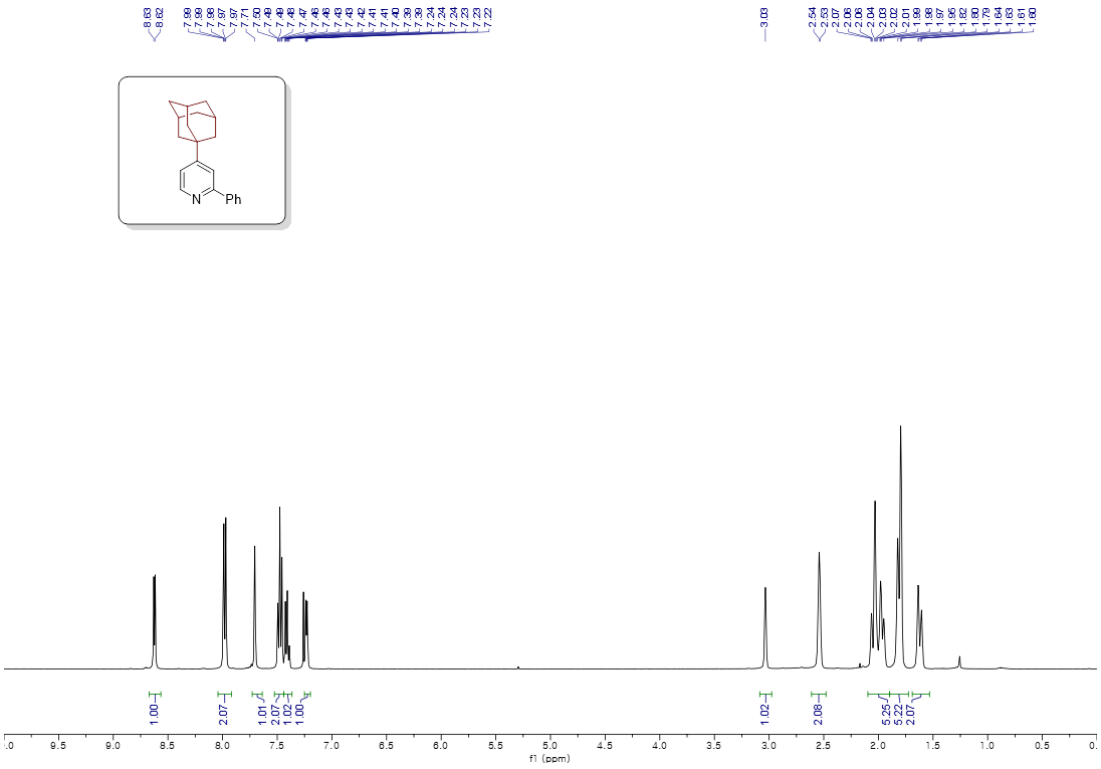


400 MHz, ^{1}H NMR in $CDCl_3$

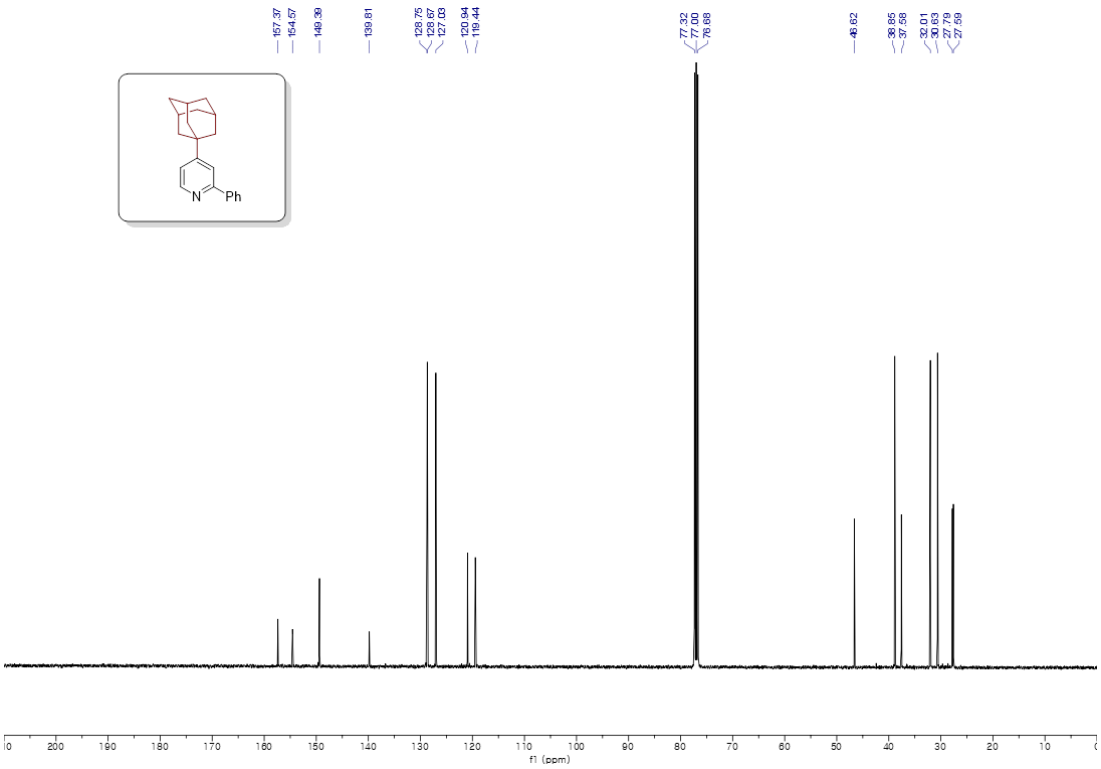


100 MHz, ^{13}C NMR in $CDCl_3$

4-((3r,5r,7r)-adamantan-1-yl)-2-phenylpyridine (3j).

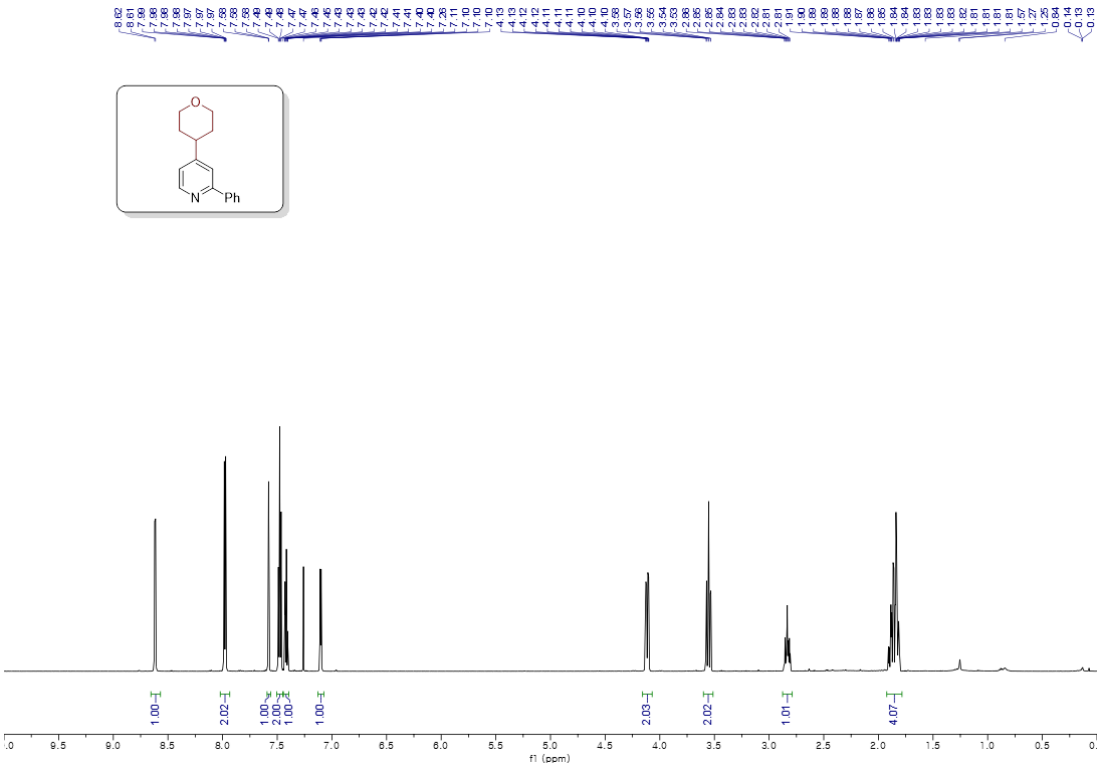


400 MHz, ^{1}H NMR in $CDCl_3$

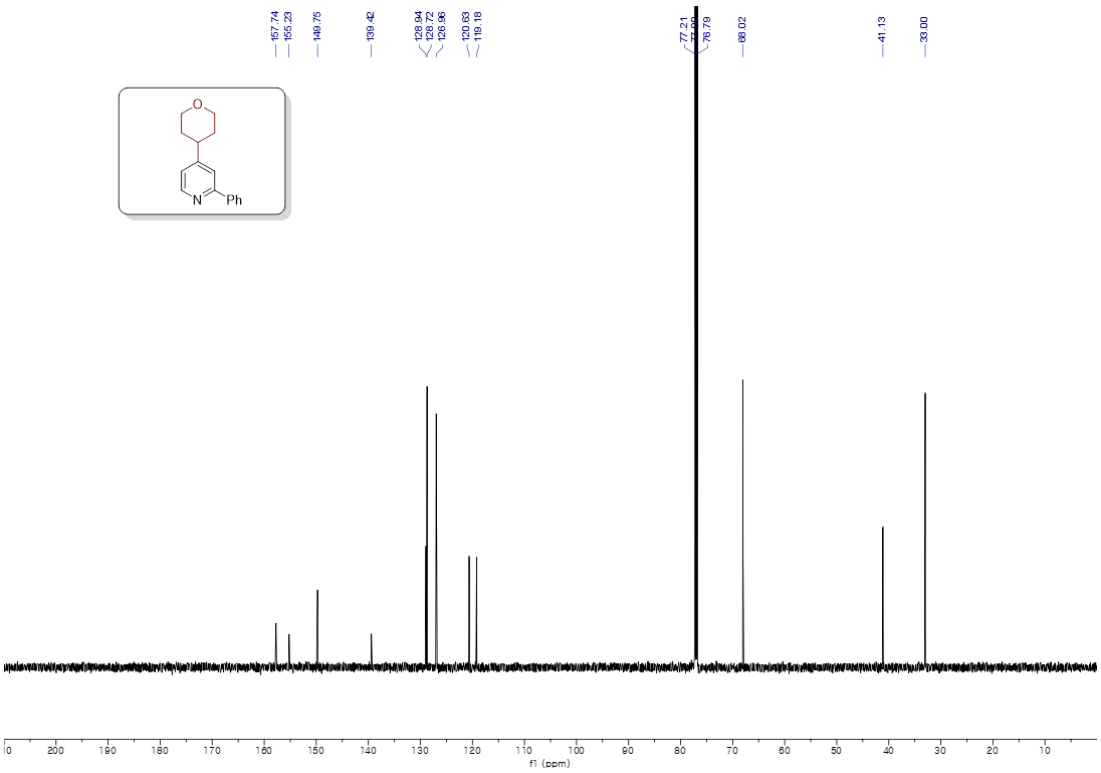


100 MHz, ^{13}C NMR in $CDCl_3$

2-phenyl-4-(tetrahydro-2H-pyran-4-yl)pyridine (3k).

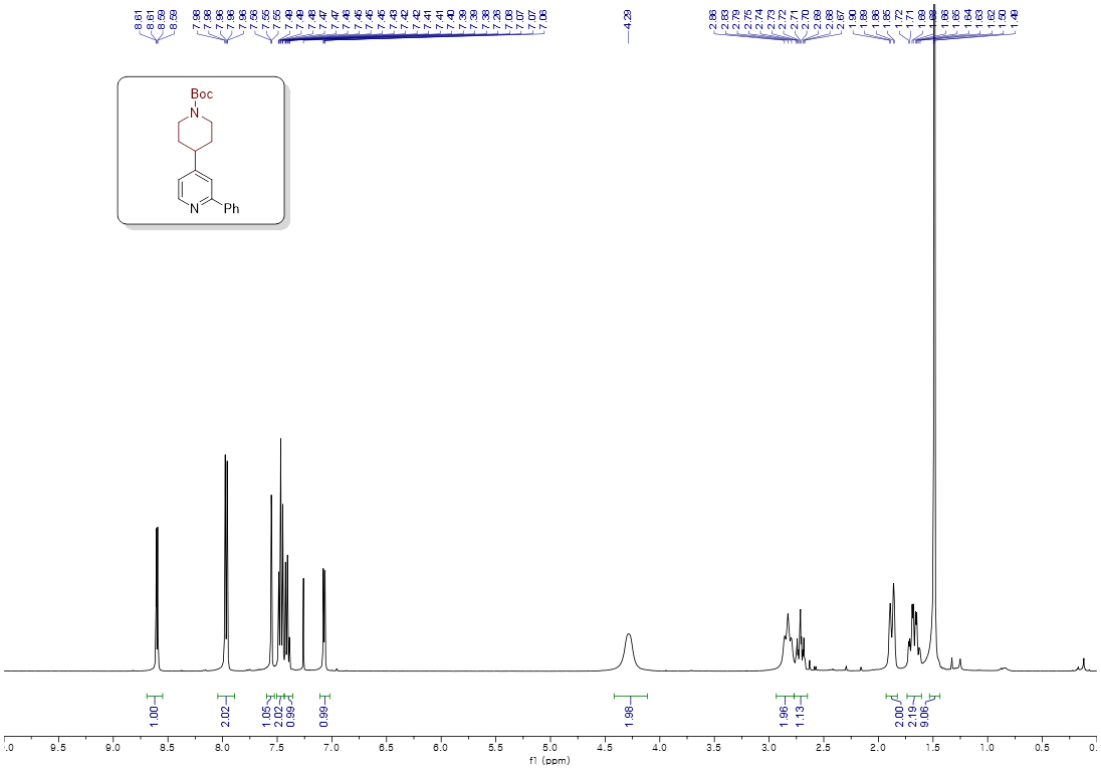


600 MHz, ^{1}H NMR in $CDCl_3$

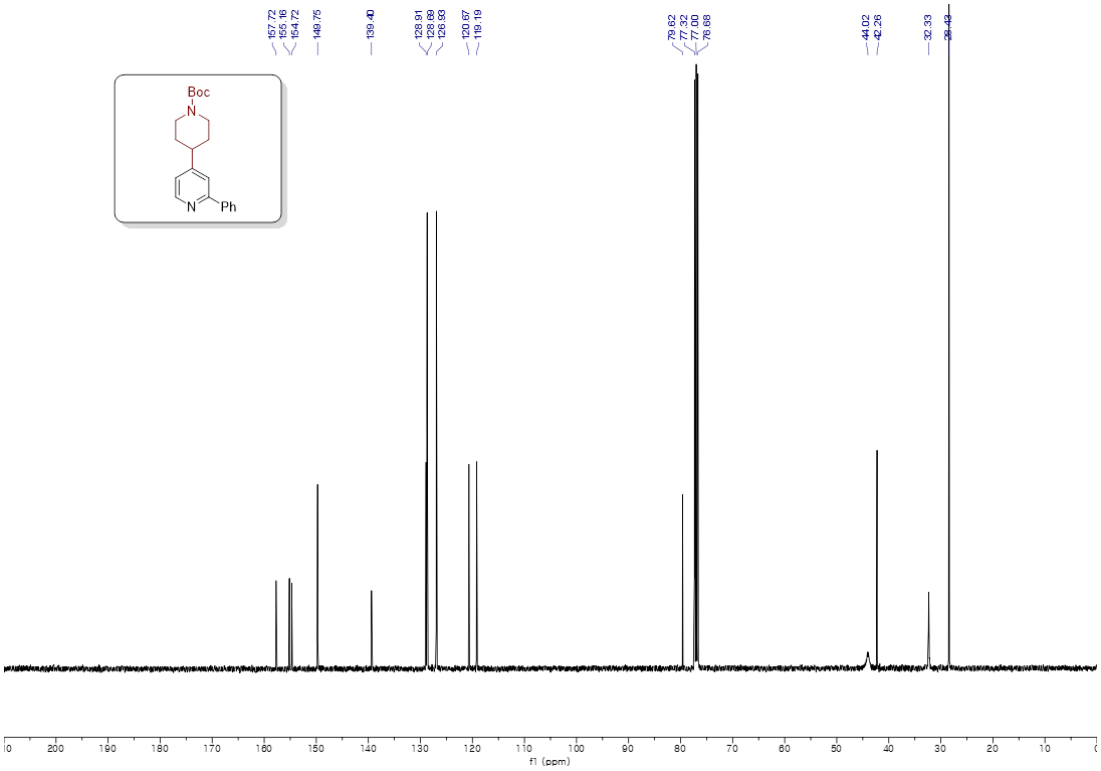


150 MHz, ^{13}C NMR in $CDCl_3$

tert-butyl 4-(2-phenylpyridin-4-yl)piperidine-1-carboxylate (3l).

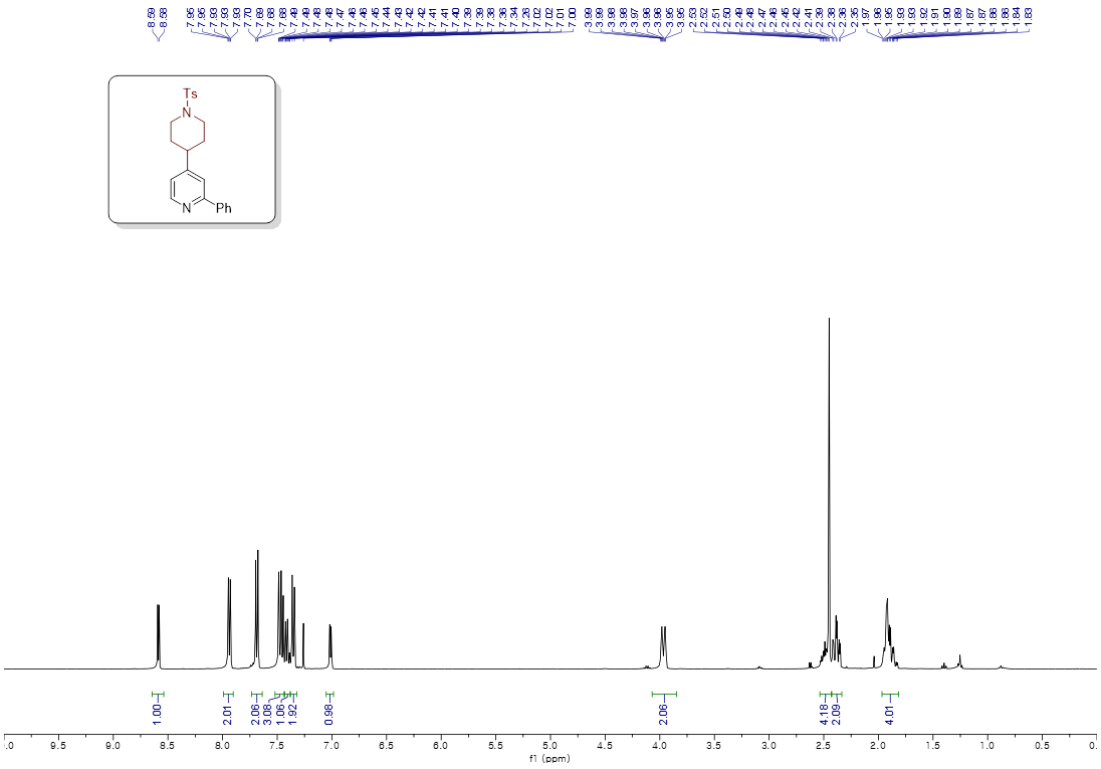


400 MHz, ^{1}H NMR in $CDCl_3$

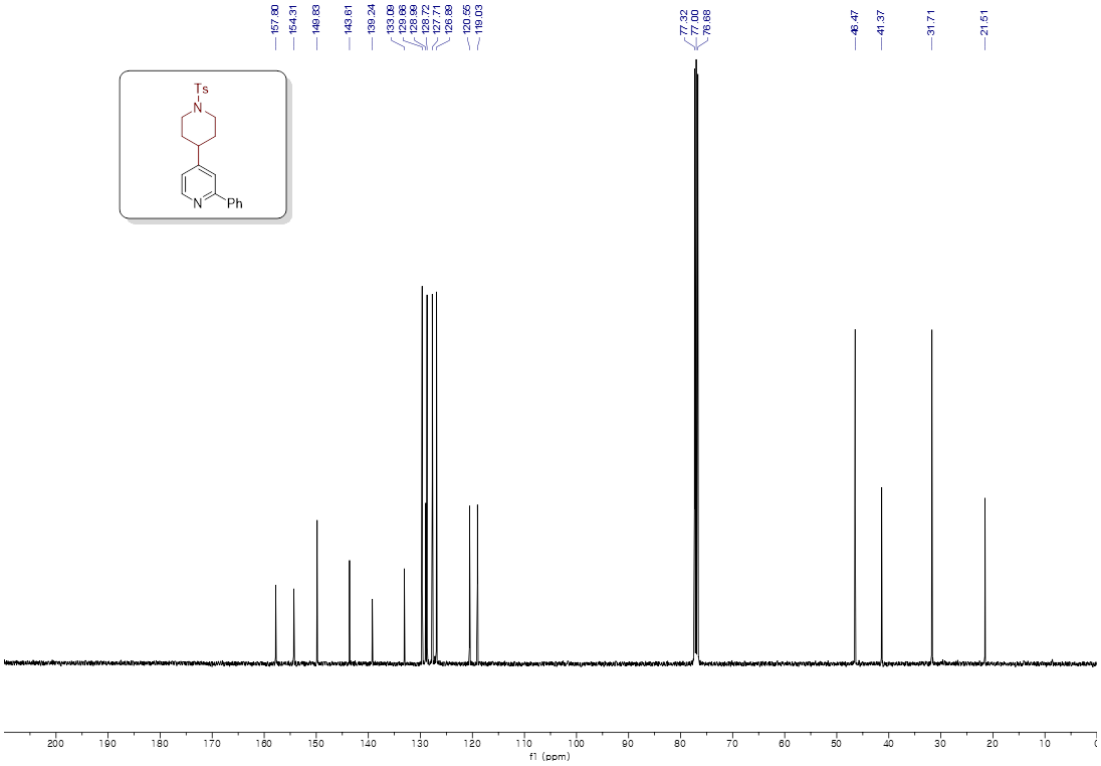


100 MHz, ^{13}C NMR in $CDCl_3$

2-phenyl-4-(1-tosylpiperidin-4-yl)pyridine (3m).

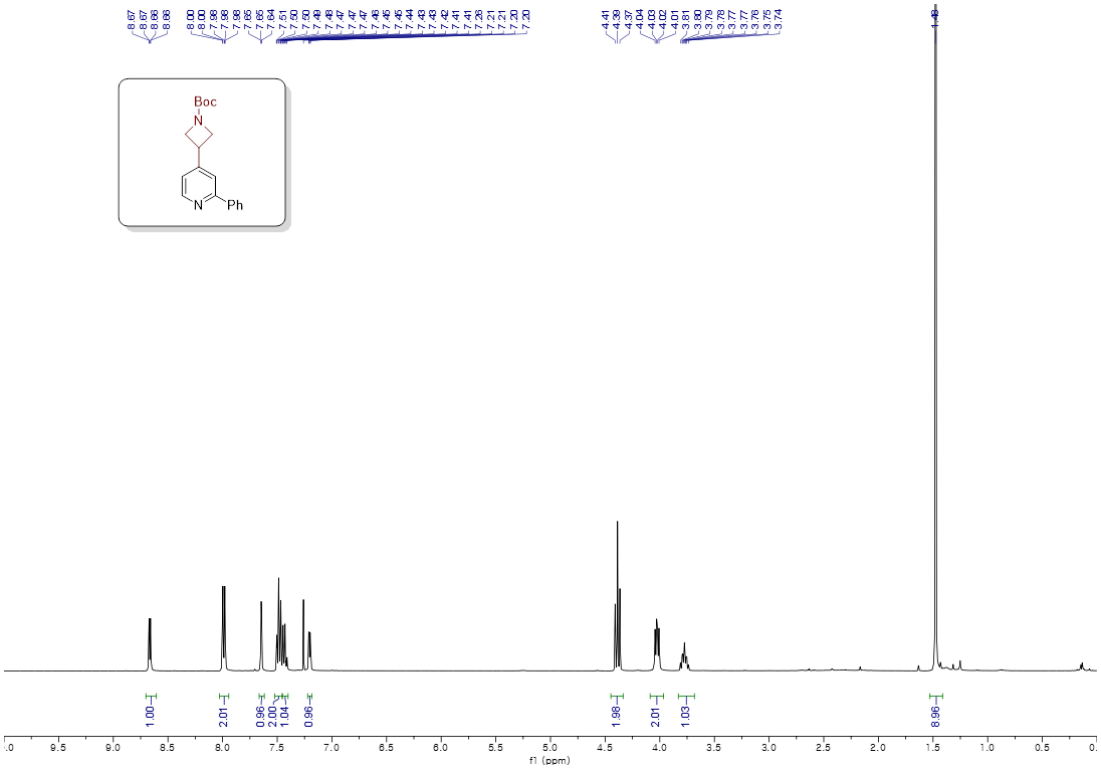


400 MHz, ^{1}H NMR in $CDCl_3$

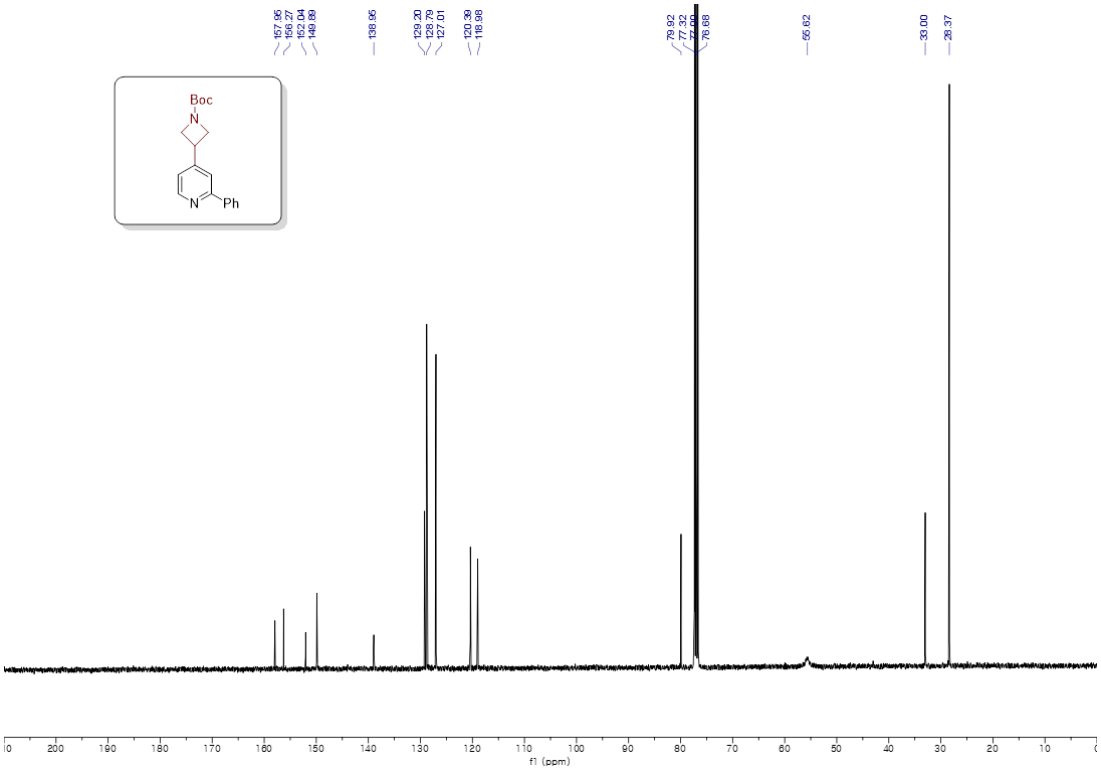


100 MHz, ^{13}C NMR in $CDCl_3$

tert-butyl 3-(2-phenylpyridin-4-yl)azetidine-1-carboxylate (3n).

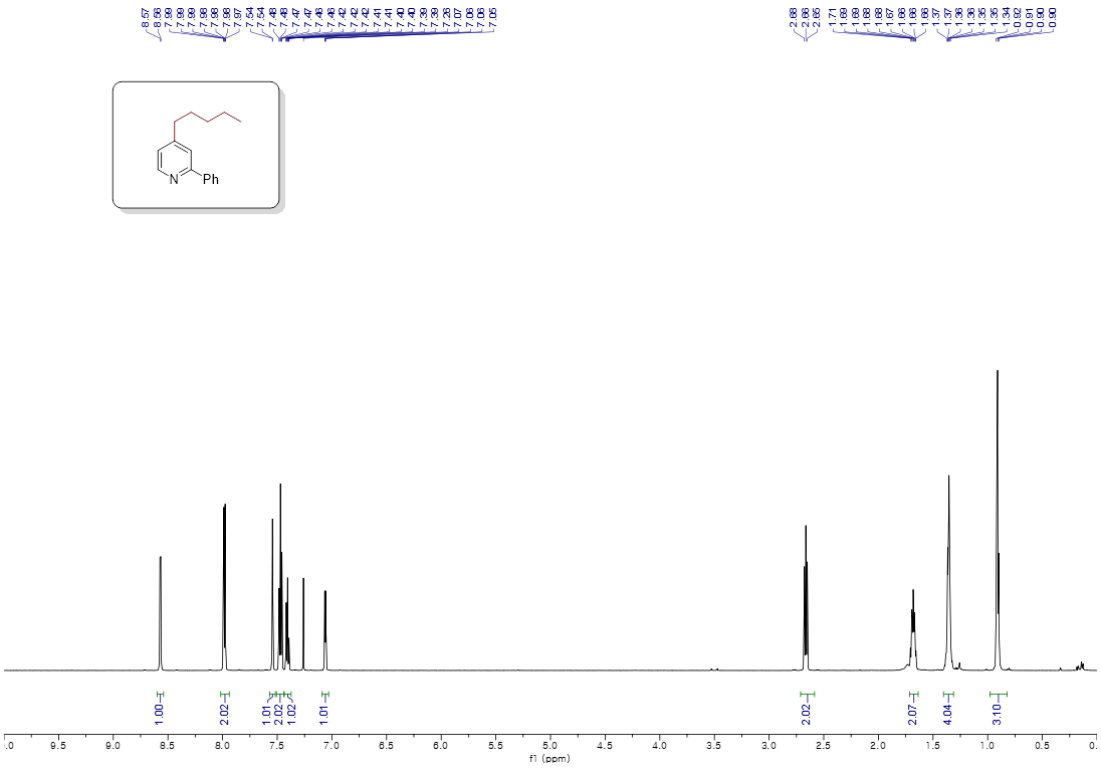


400 MHz, ^{1}H NMR in $CDCl_3$

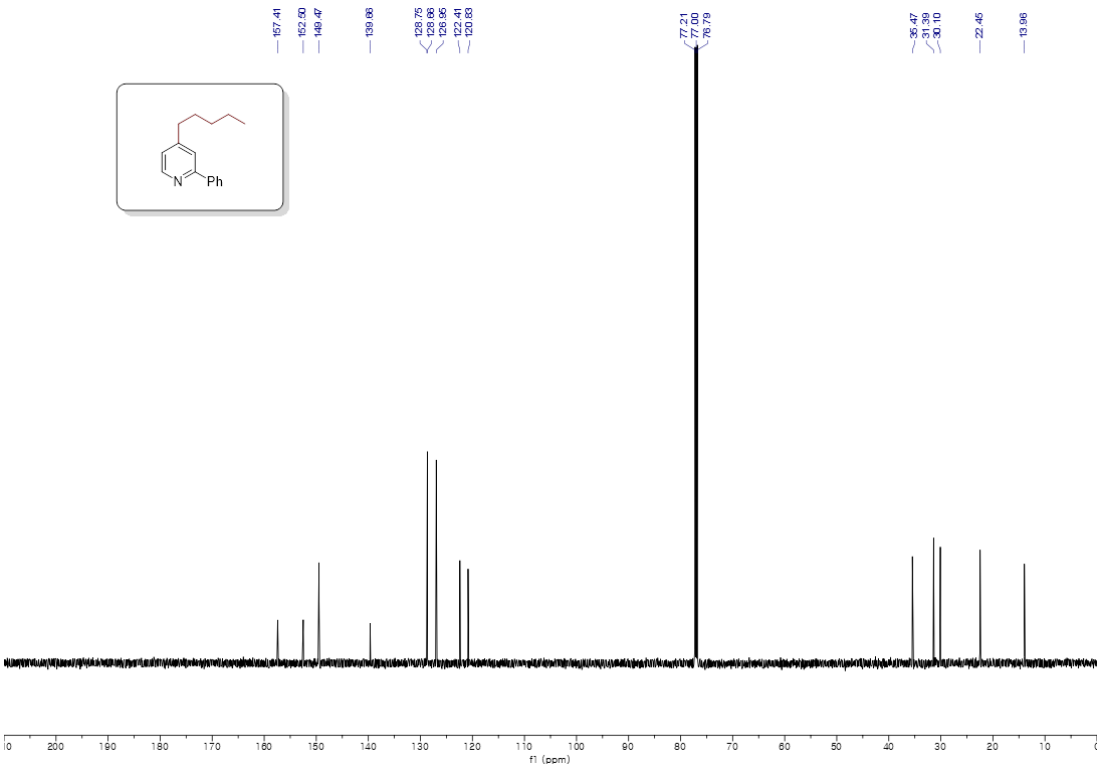


100 MHz, ^{13}C NMR in $CDCl_3$

4-pentyl-2-phenylpyridine (3o).

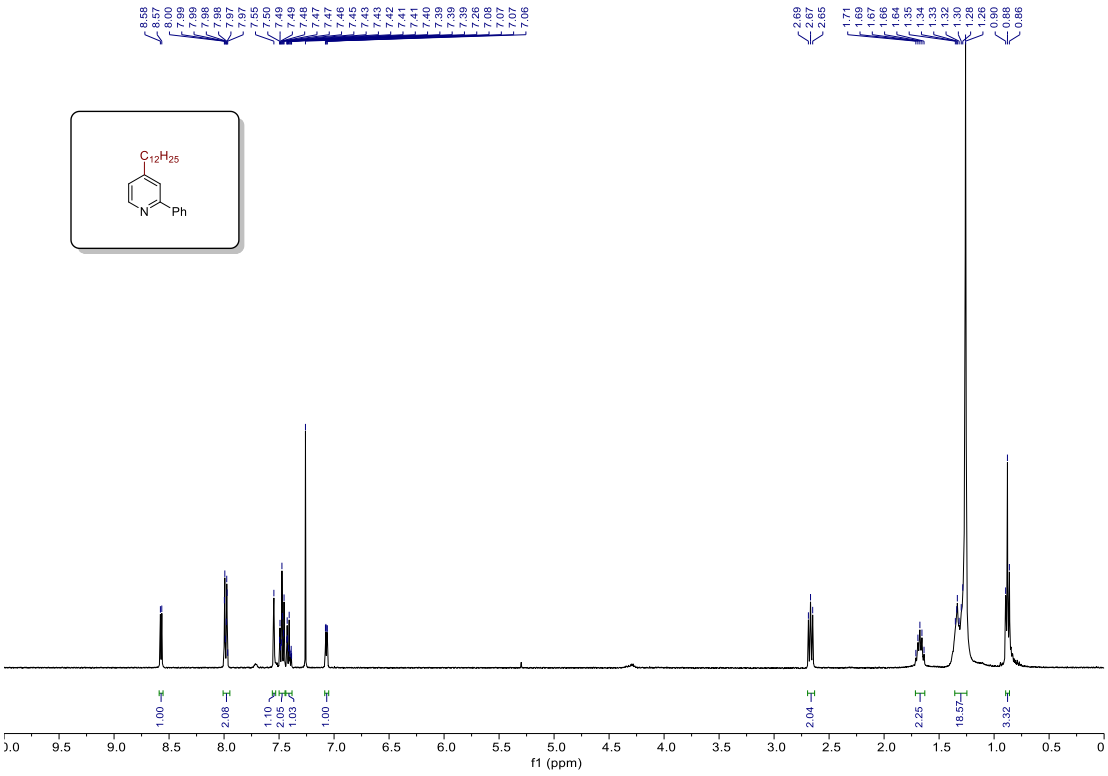


600 MHz, ^{1}H NMR in $CDCl_3$

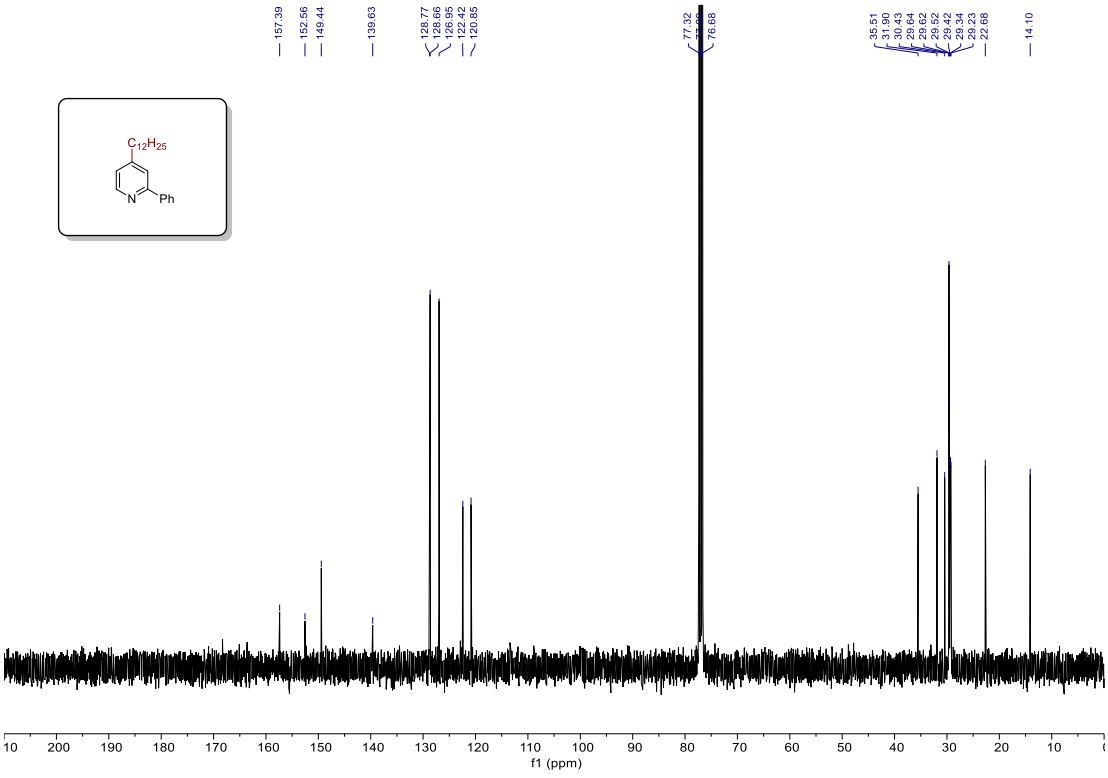


150 MHz, ^{13}C NMR in $CDCl_3$

4-dodecyl-2-phenylpyridine (3p).

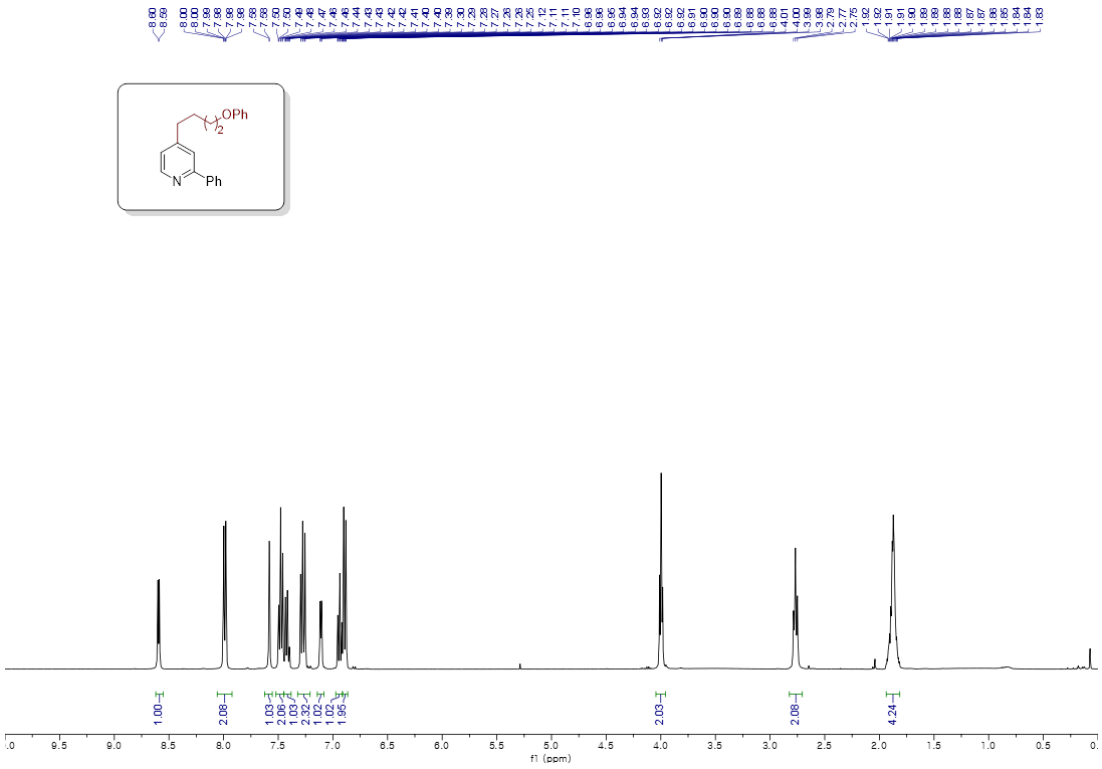


400 MHz, ^{1}H NMR in $CDCl_3$

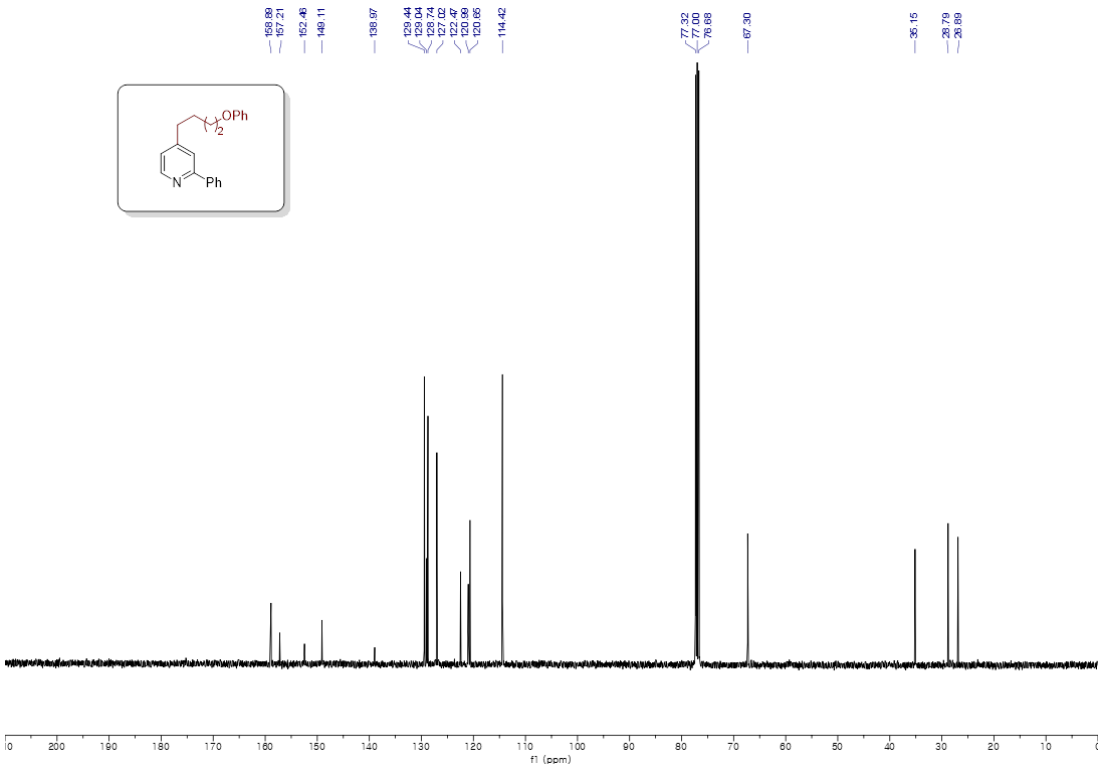


100 MHz, ^{13}C NMR in $CDCl_3$

4-(4-phenoxybutyl)-2-phenylpyridine (3q).

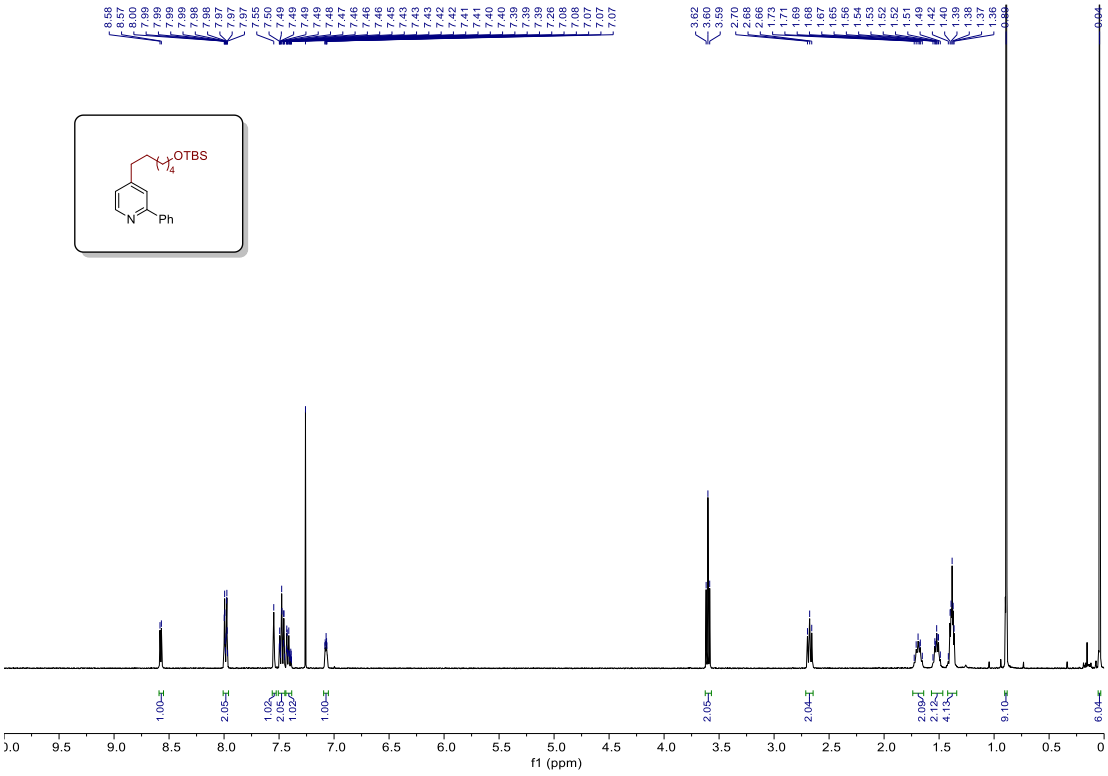


400 MHz, ^{1}H NMR in $CDCl_3$

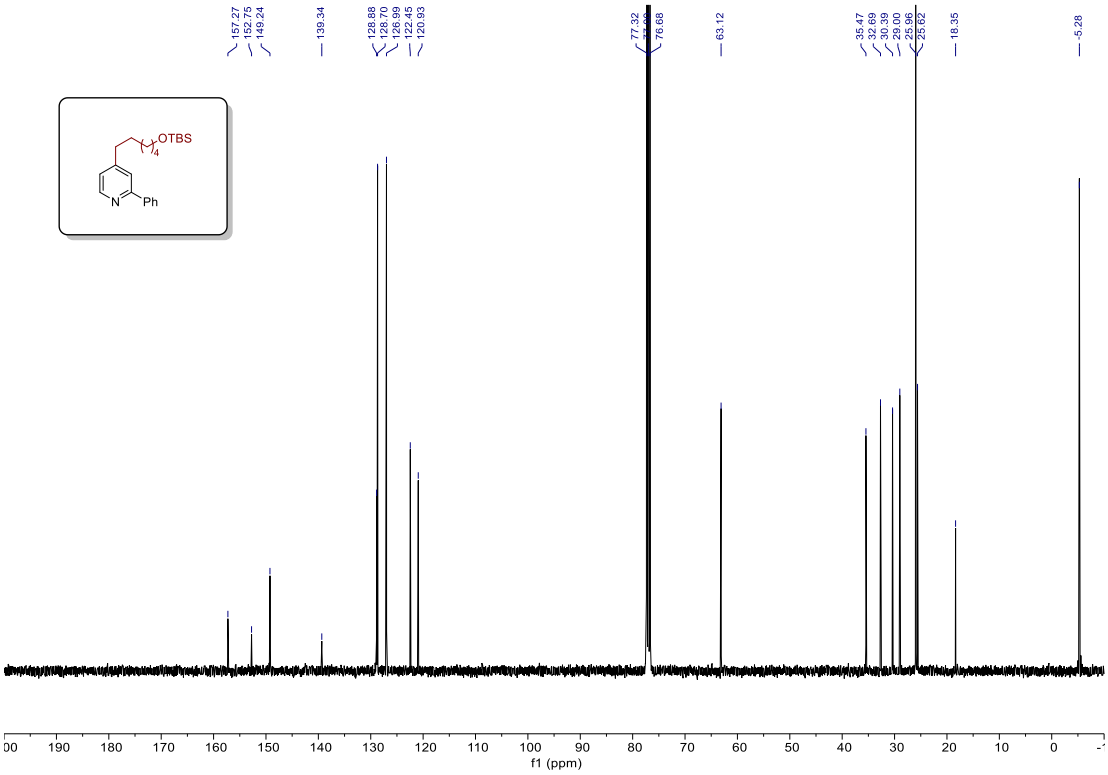


100 MHz, ^{13}C NMR in $CDCl_3$

4-(6-((tert-butyldimethylsilyl)oxy)hexyl)-2-phenylpyridine (3r).

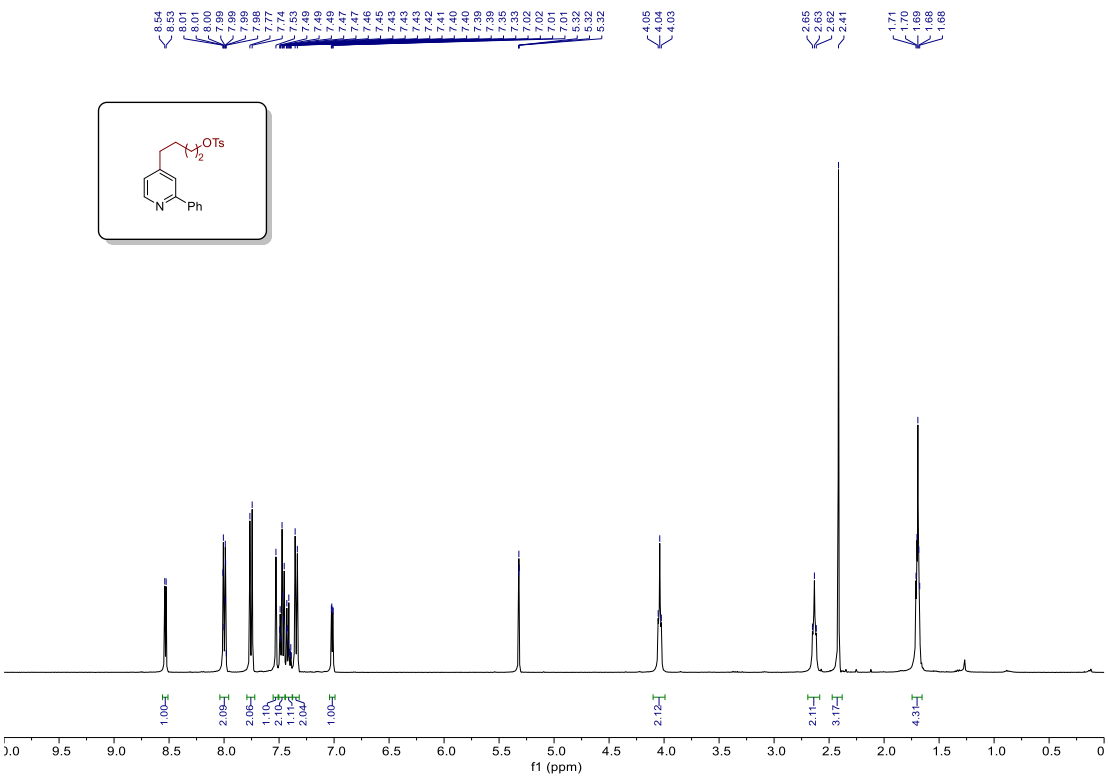


400 MHz, ^{1}H NMR in $CDCl_3$

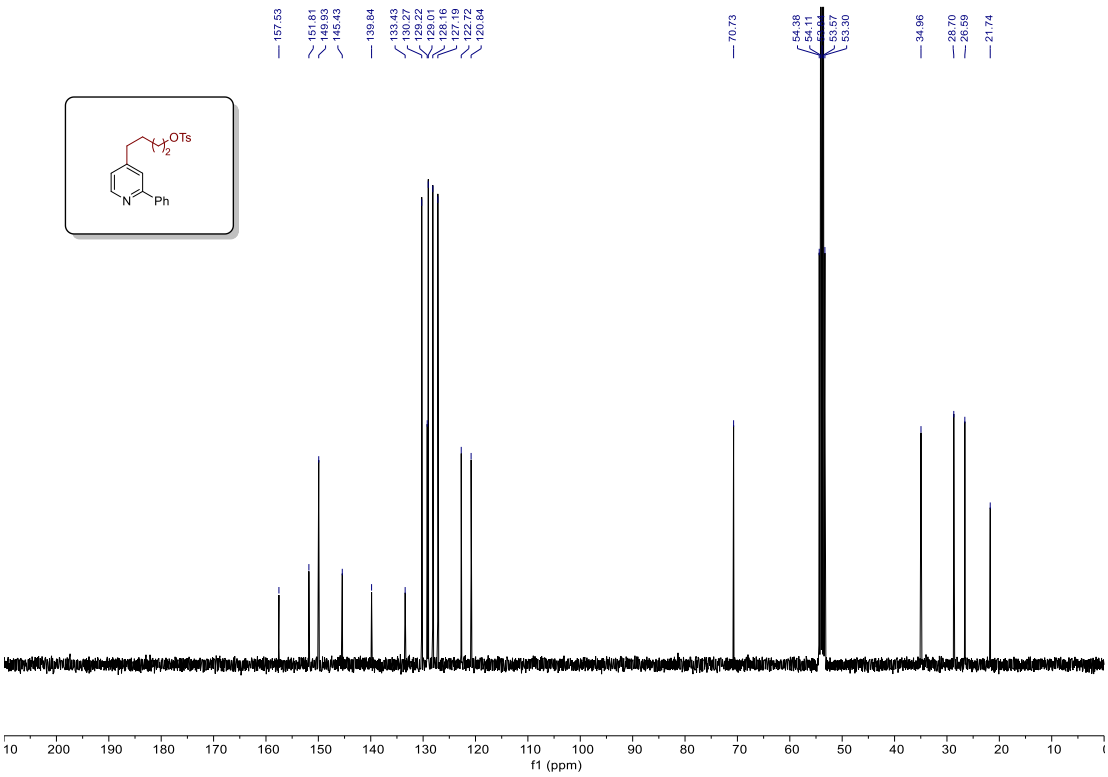


100 MHz, ^{13}C NMR in $CDCl_3$

4-(2-phenylpyridin-4-yl)butyl 4-methylbenzenesulfonate (3s).

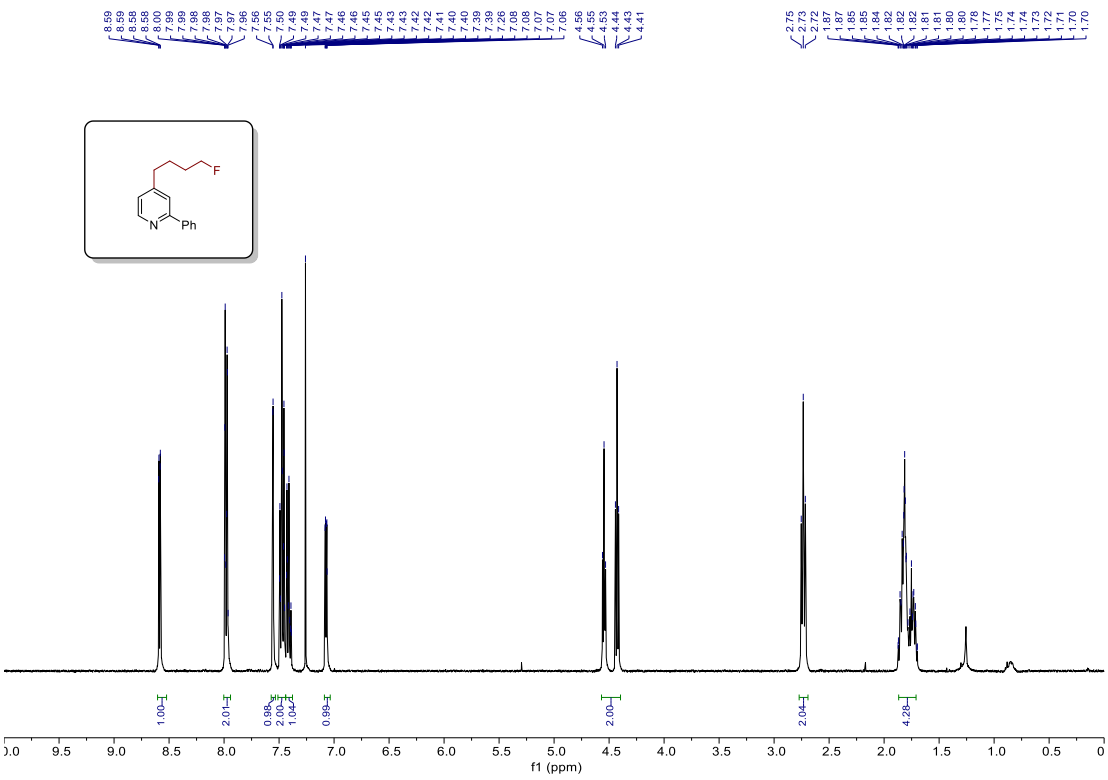


400 MHz, ^{1}H NMR in CD_2Cl_2

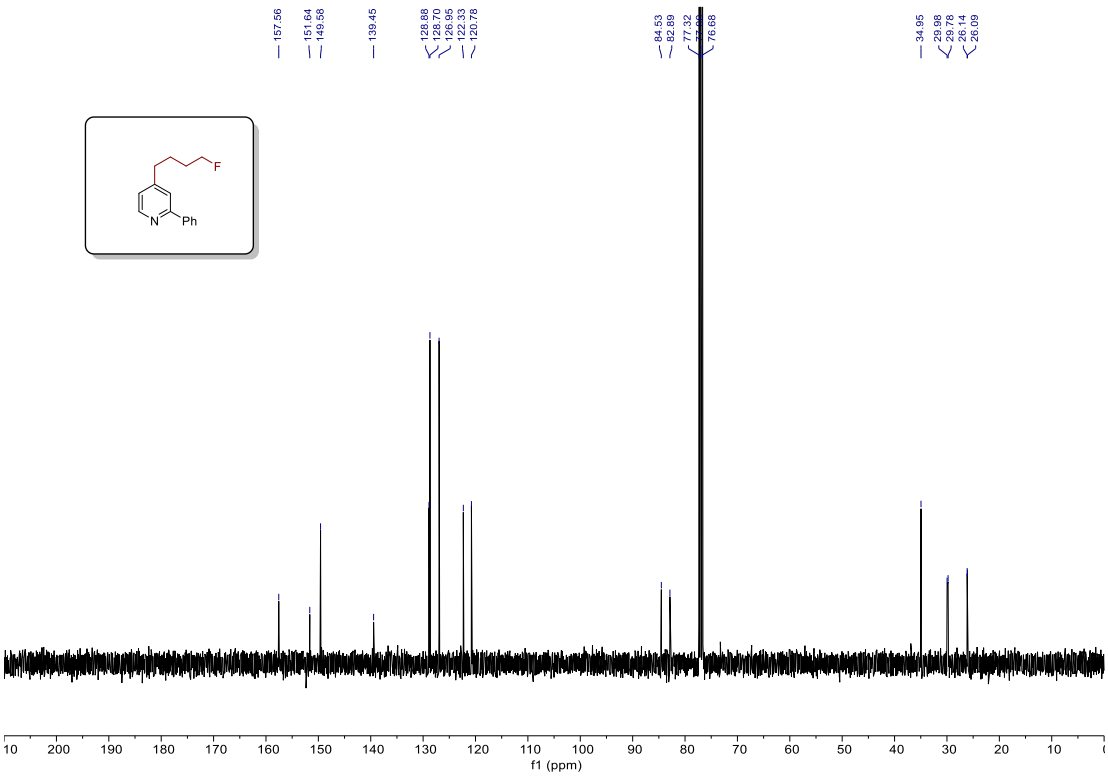


100 MHz, ^{13}C NMR in CD_2Cl_2

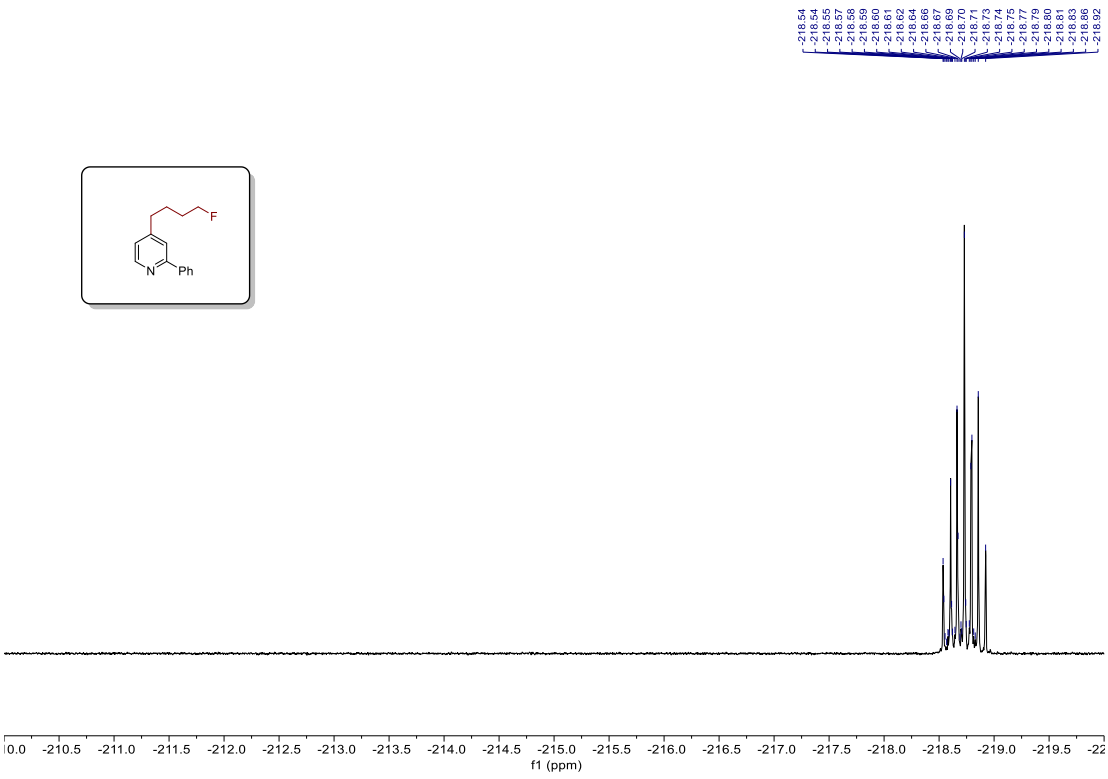
4-(4-fluorobutyl)-2-phenylpyridine (3t).



400 MHz, ^{1}H NMR in $CDCl_3$

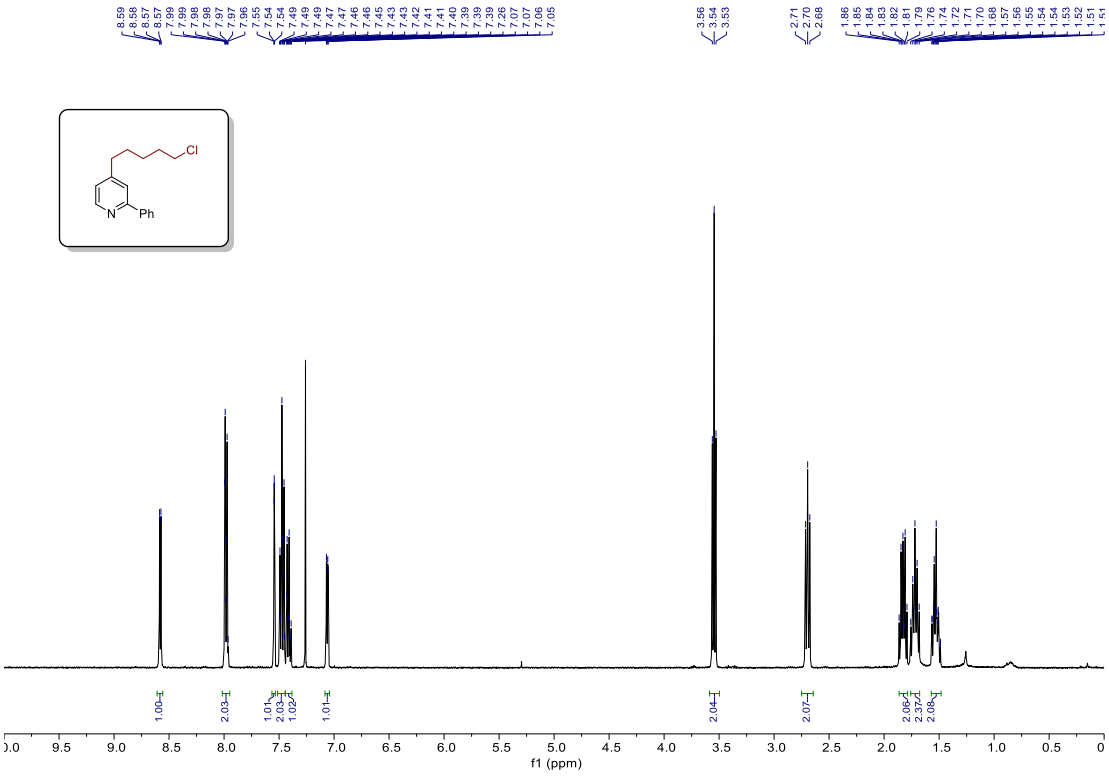


100 MHz, ^{13}C NMR in $CDCl_3$

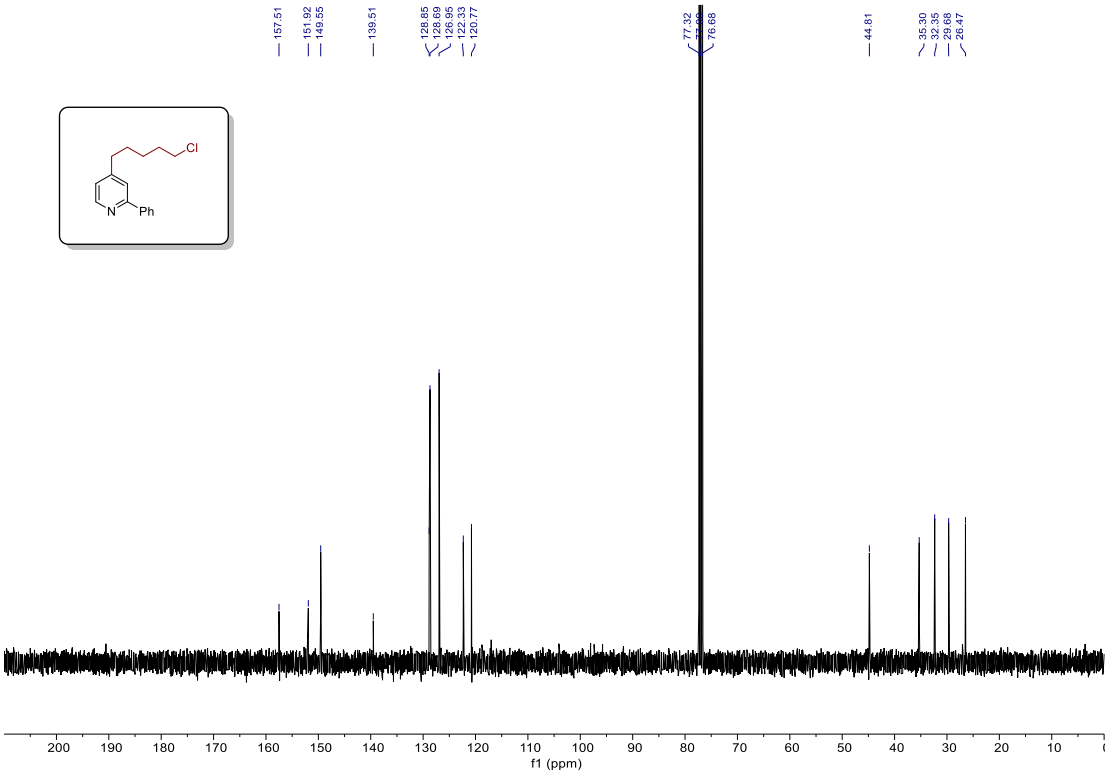


376 MHz, ^{19}F NMR in $CDCl_3$

4-(5-chloropentyl)-2-phenylpyridine (3u).

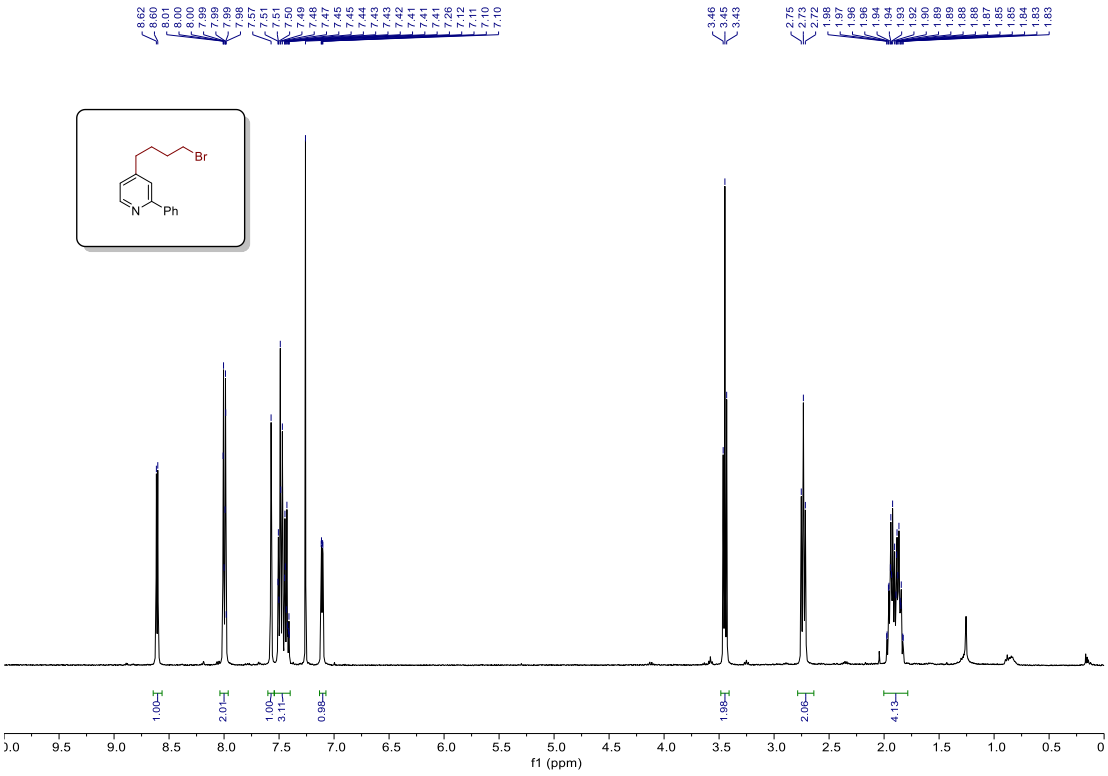


400 MHz, ^{1}H NMR in $CDCl_3$

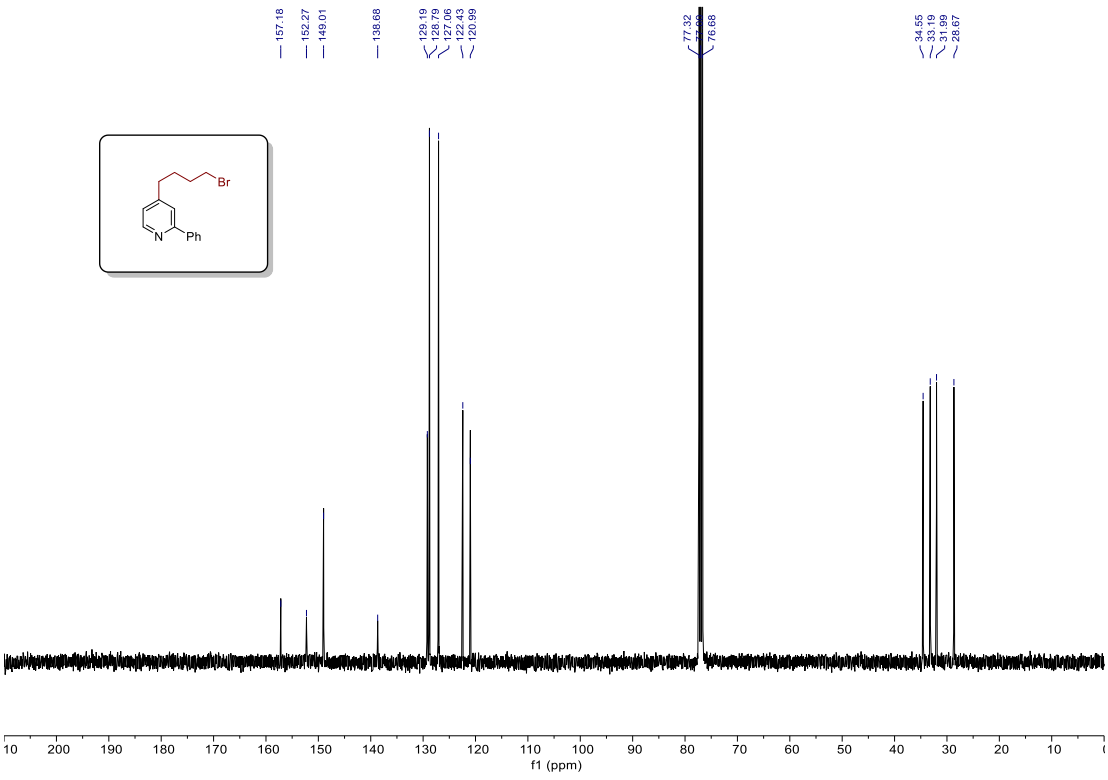


100 MHz, ^{13}C NMR in $CDCl_3$

4-(4-bromobutyl)-2-phenylpyridine (3v).

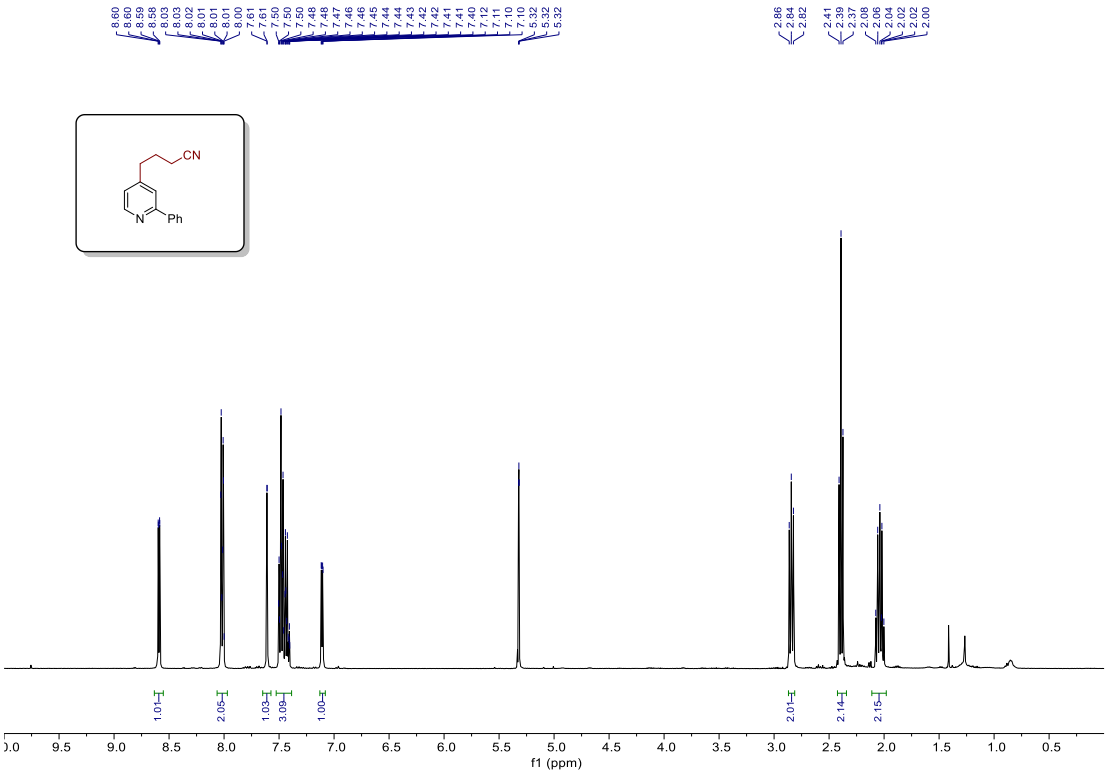


400 MHz, ^{1}H NMR in $CDCl_3$

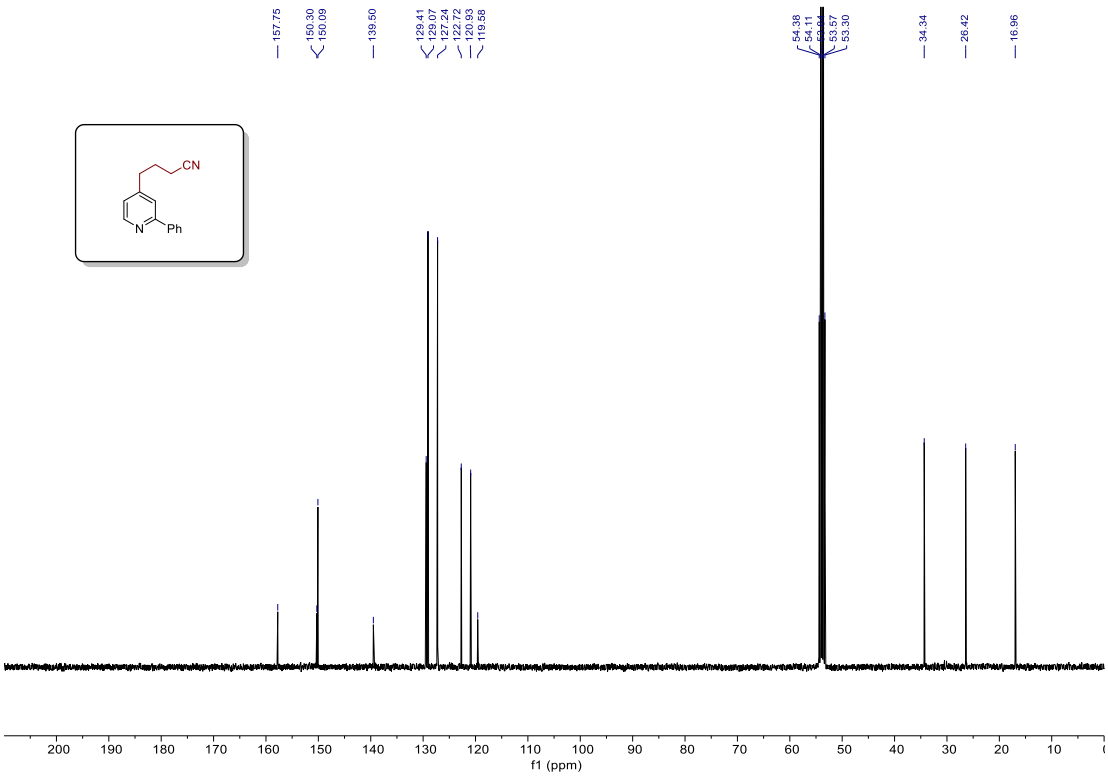


100 MHz, ^{13}C NMR in $CDCl_3$

4-(2-phenylpyridin-4-yl)butanenitrile (3w).

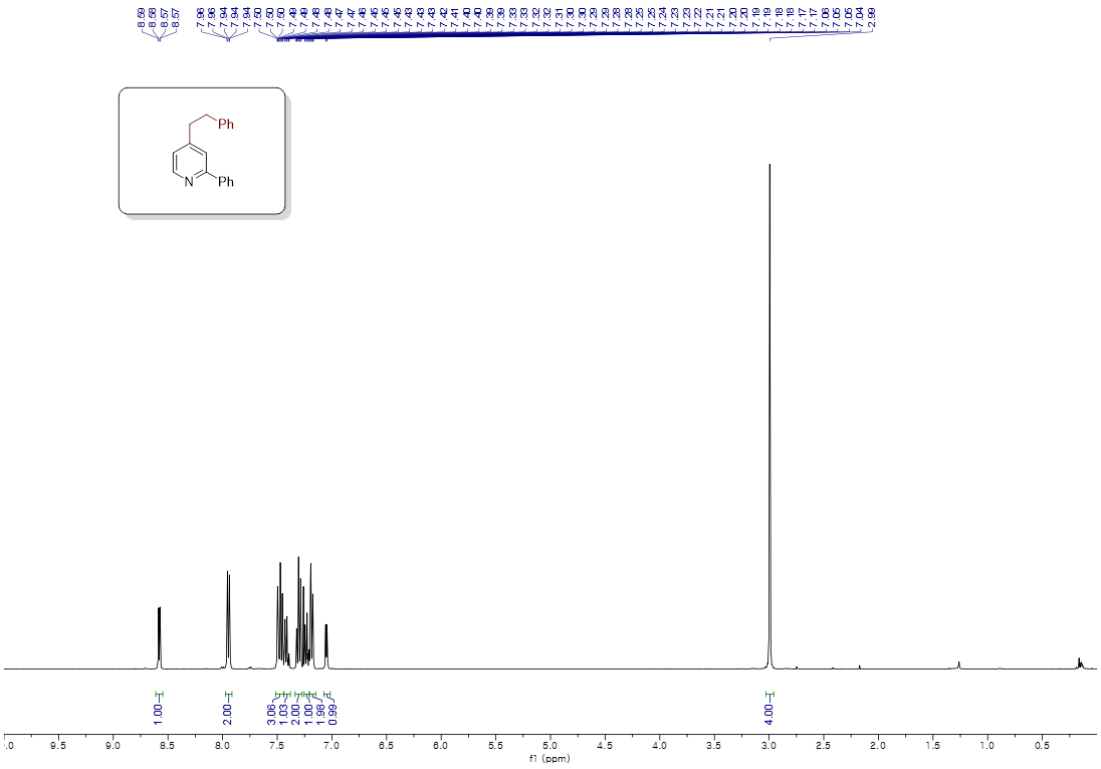


400 MHz, ^{1}H NMR in CD_2Cl_2

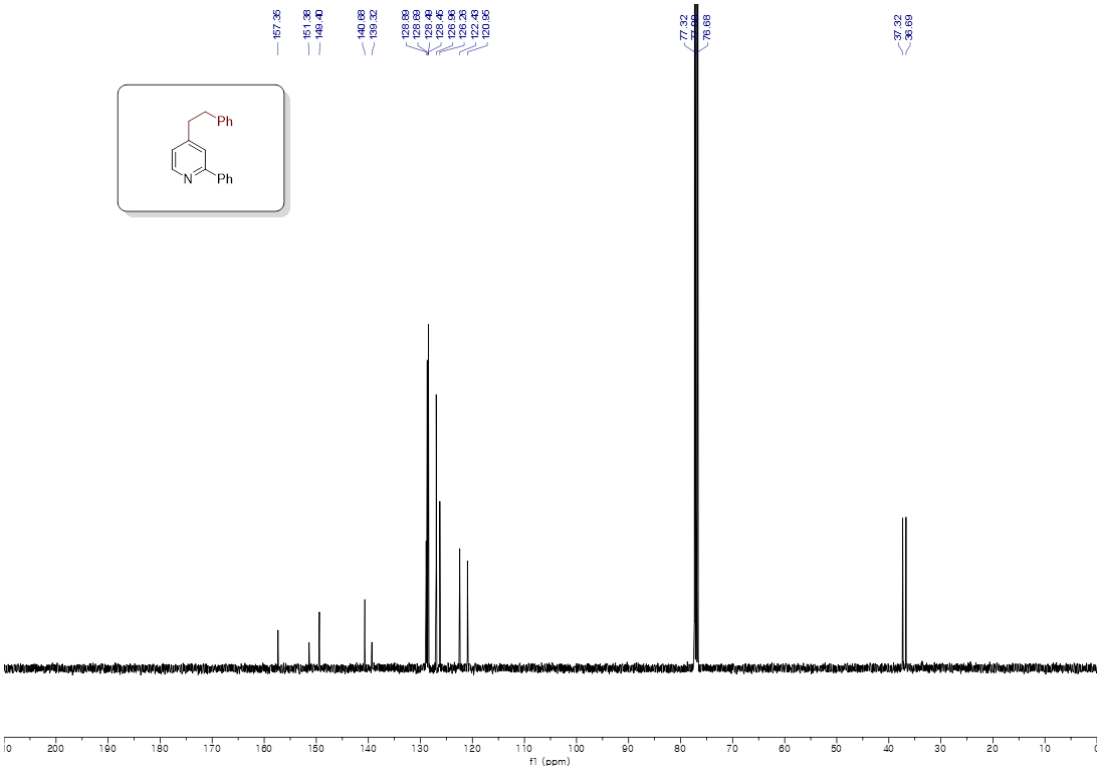


100 MHz, ^{13}C NMR in CD_2Cl_2

4-phenethyl-2-phenylpyridine (3x).

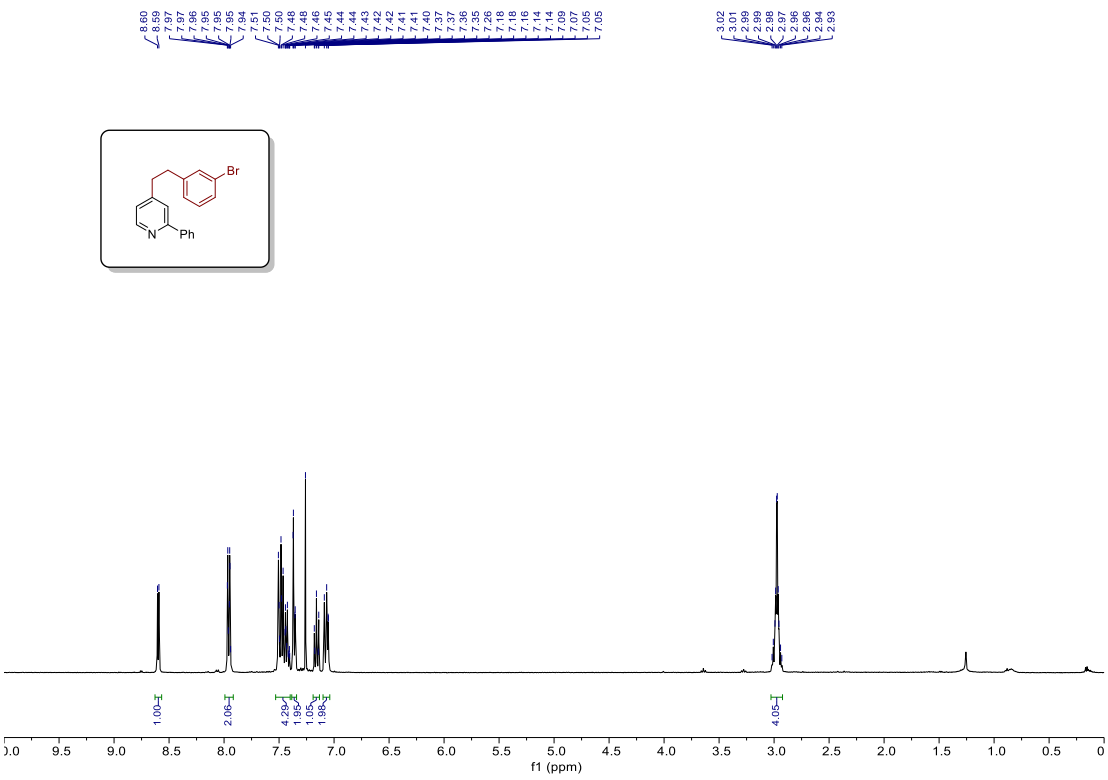


400 MHz, ^{1}H NMR in $CDCl_3$

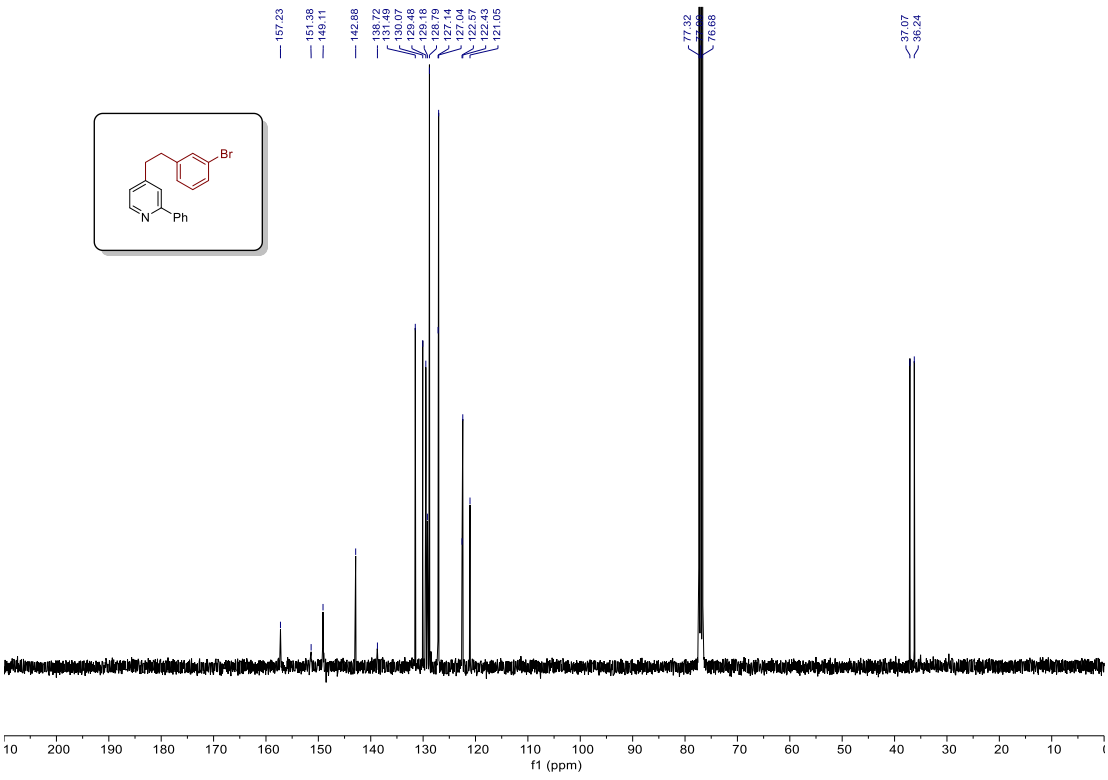


100 MHz, ^{13}C NMR in $CDCl_3$

4-(3-bromophenethyl)-2-phenylpyridine (3y).

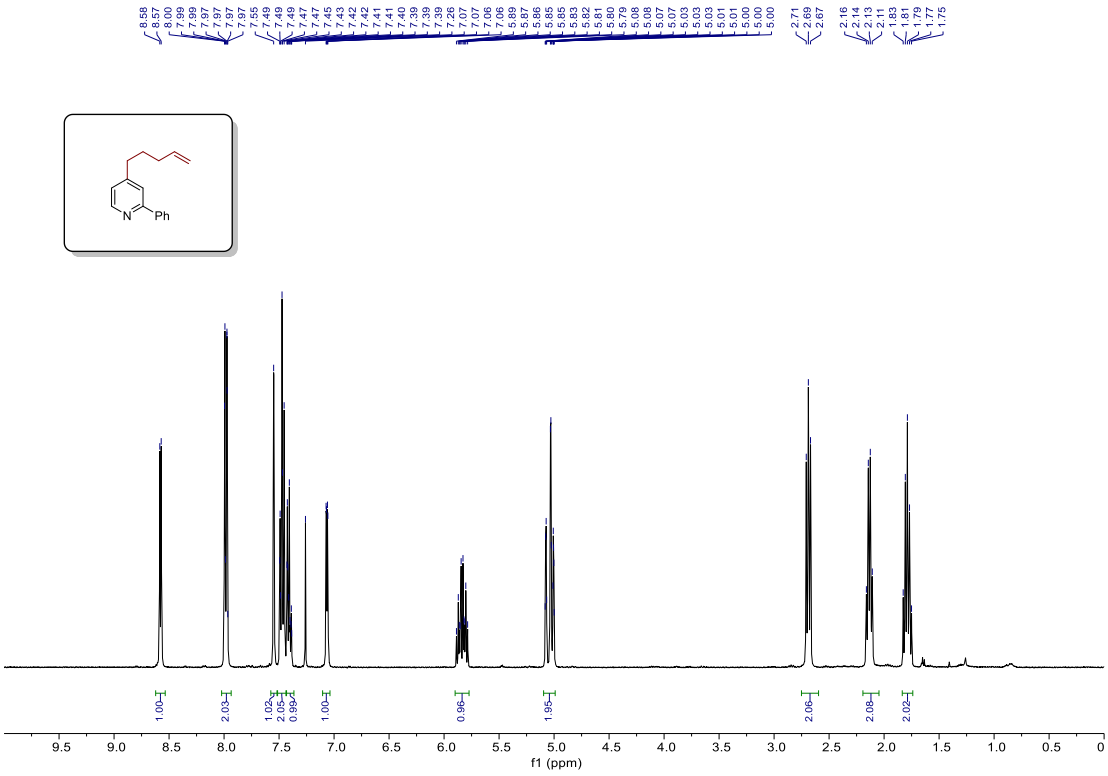


400 MHz, ^{1}H NMR in $CDCl_3$

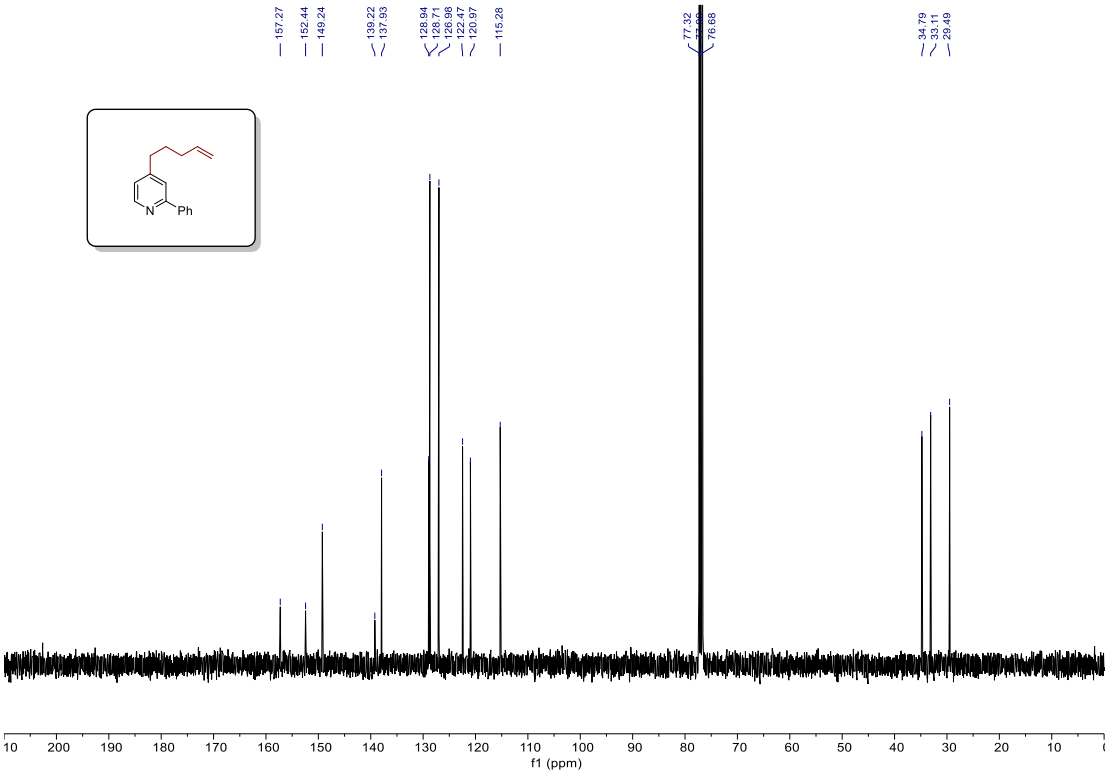


100 MHz, ^{13}C NMR in $CDCl_3$

4-(pent-4-en-1-yl)-2-phenylpyridine (3z).

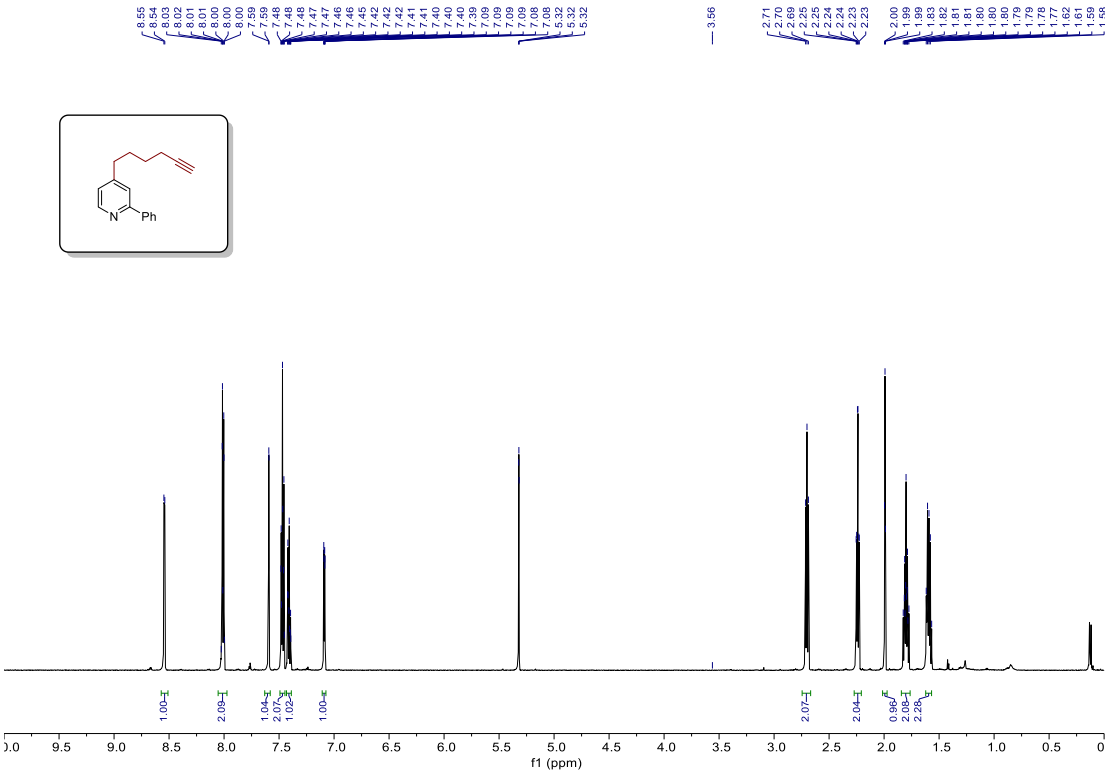


400 MHz, ^{1}H NMR in $CDCl_3$

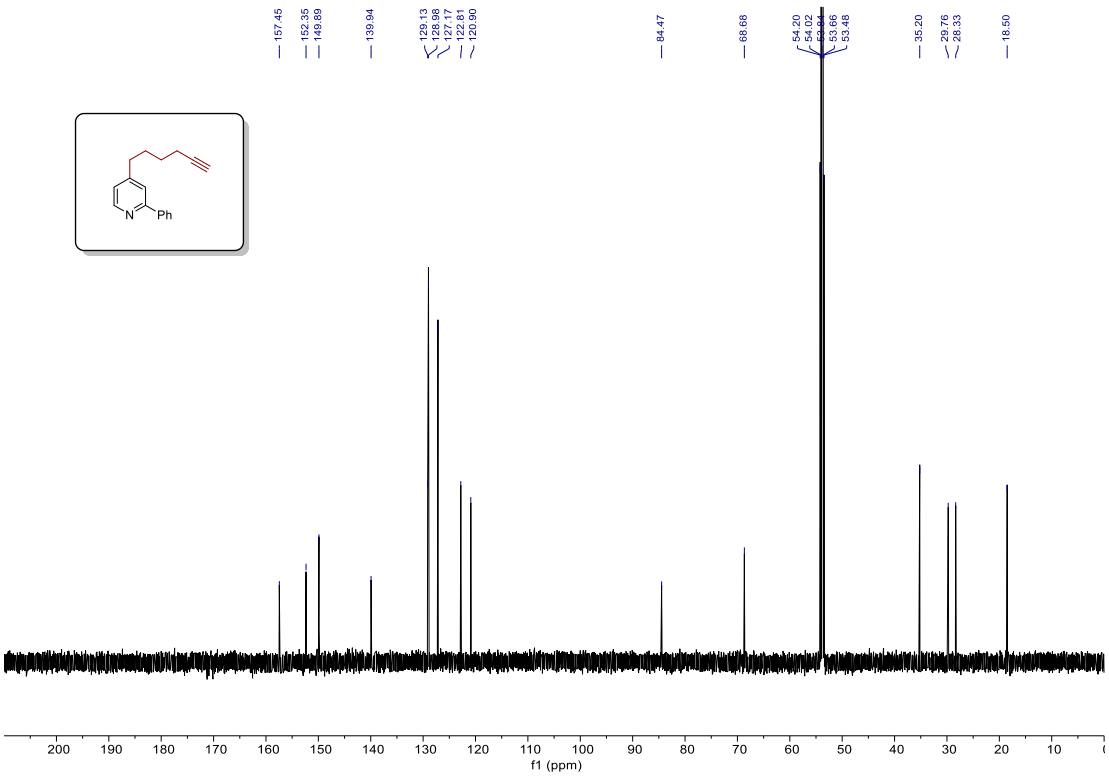


100 MHz, ^{13}C NMR in $CDCl_3$

4-(hex-5-yn-1-yl)-2-phenylpyridine (3aa).

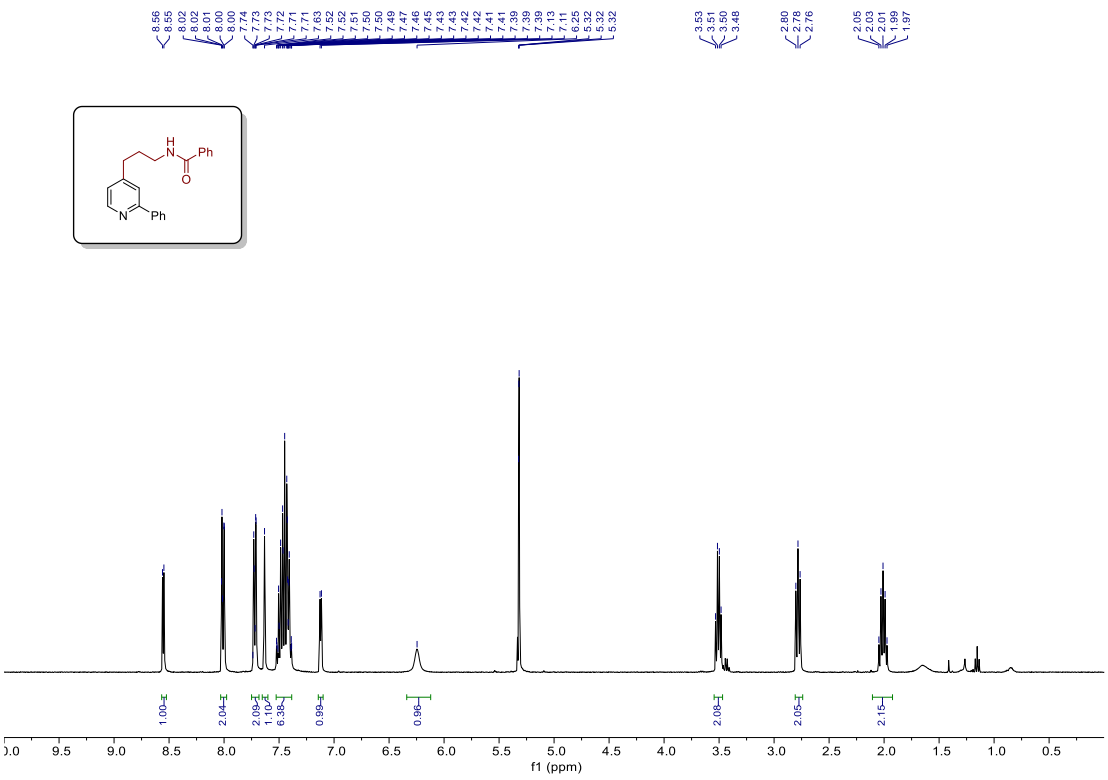


600 MHz, ^{1}H NMR in CD_2Cl_2

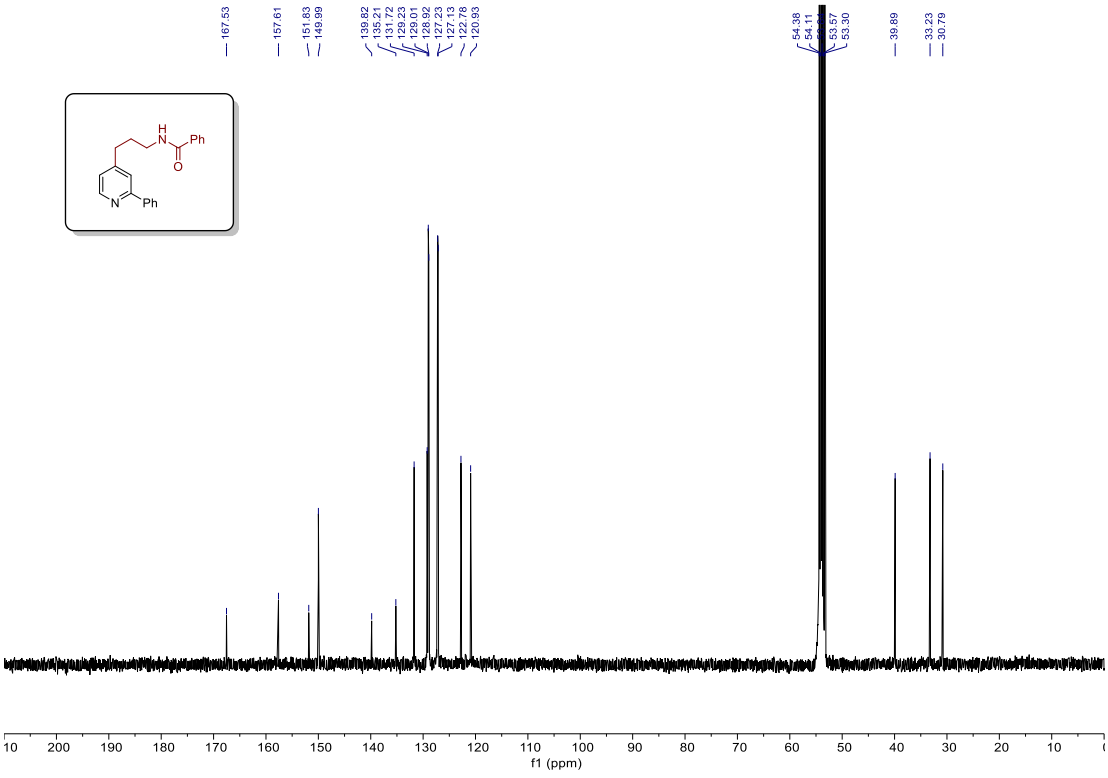


150 MHz, ^{13}C NMR in CD_2Cl_2

N-(3-(2-phenylpyridin-4-yl)propyl)benzamide (3ab).

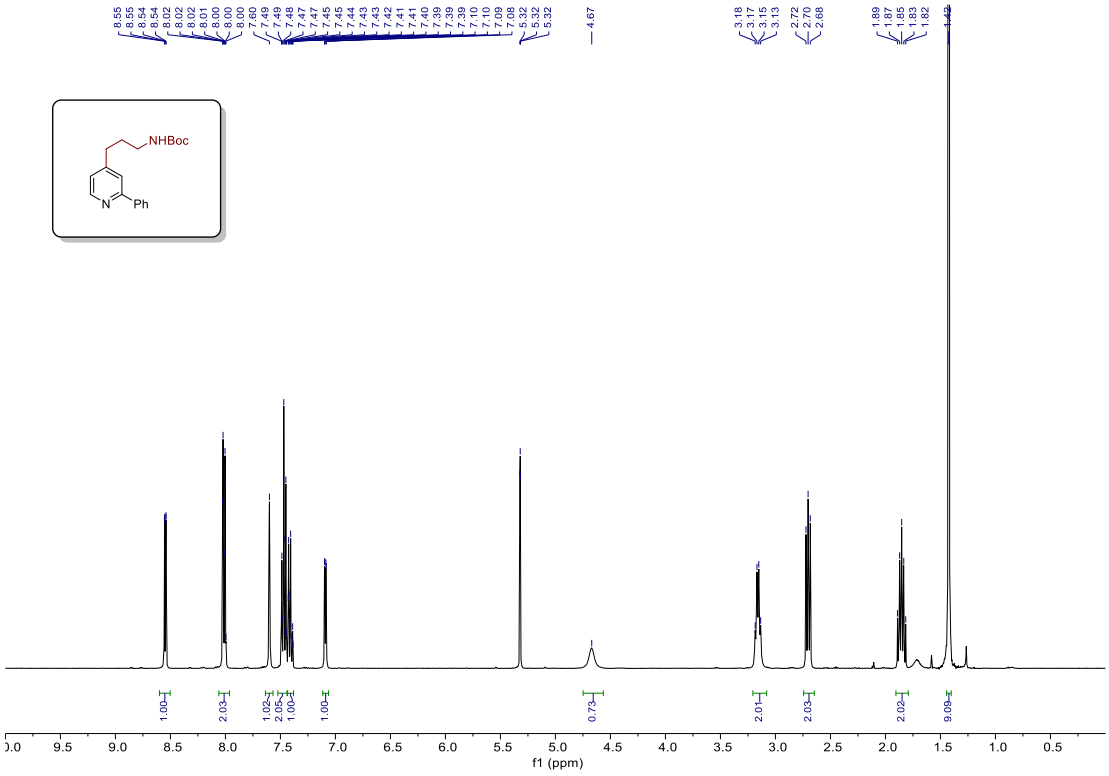


400 MHz, ^{1}H NMR in CD_2Cl_2

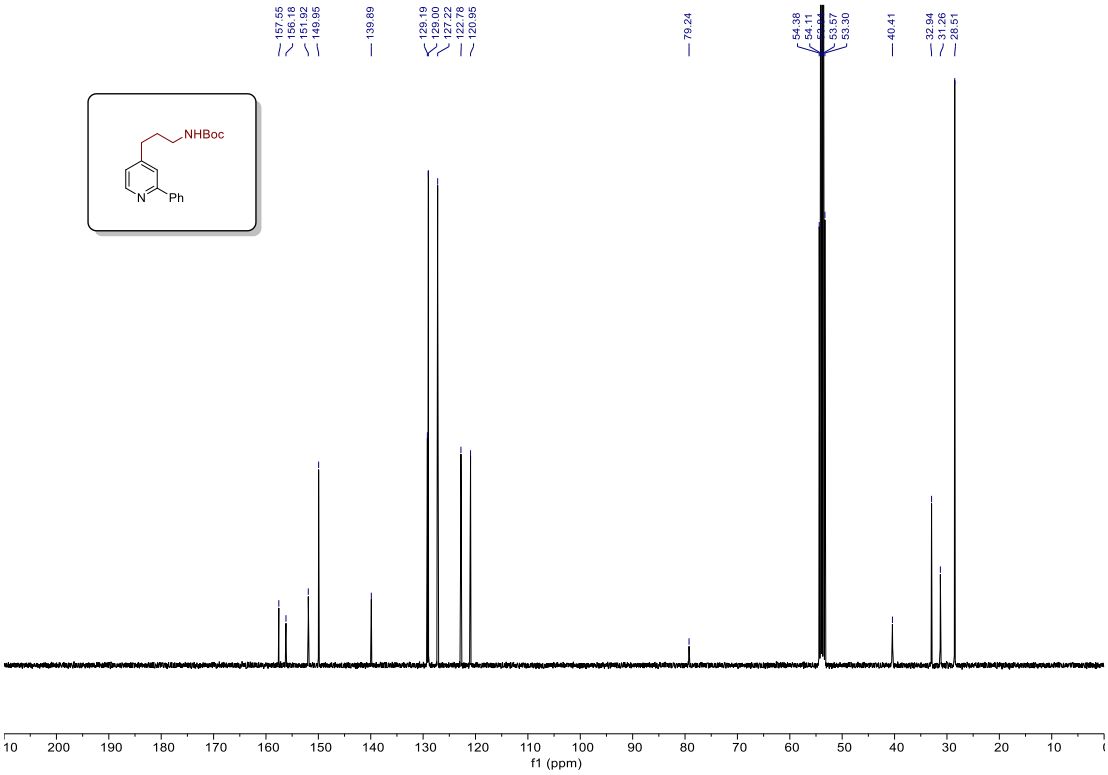


100 MHz, ^{13}C NMR in CD_2Cl_2

tert-butyl (3-(2-phenylpyridin-4-yl)propyl)carbamate (3ac).

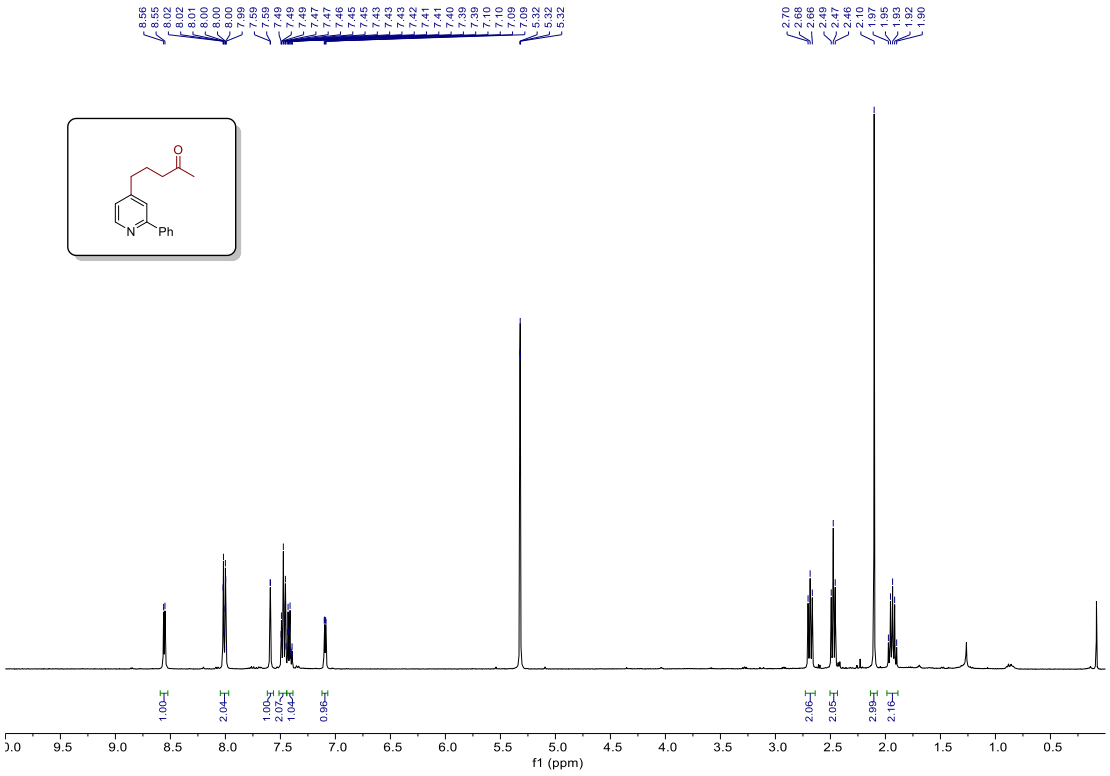


400 MHz, ^{1}H NMR in CD_2Cl_2

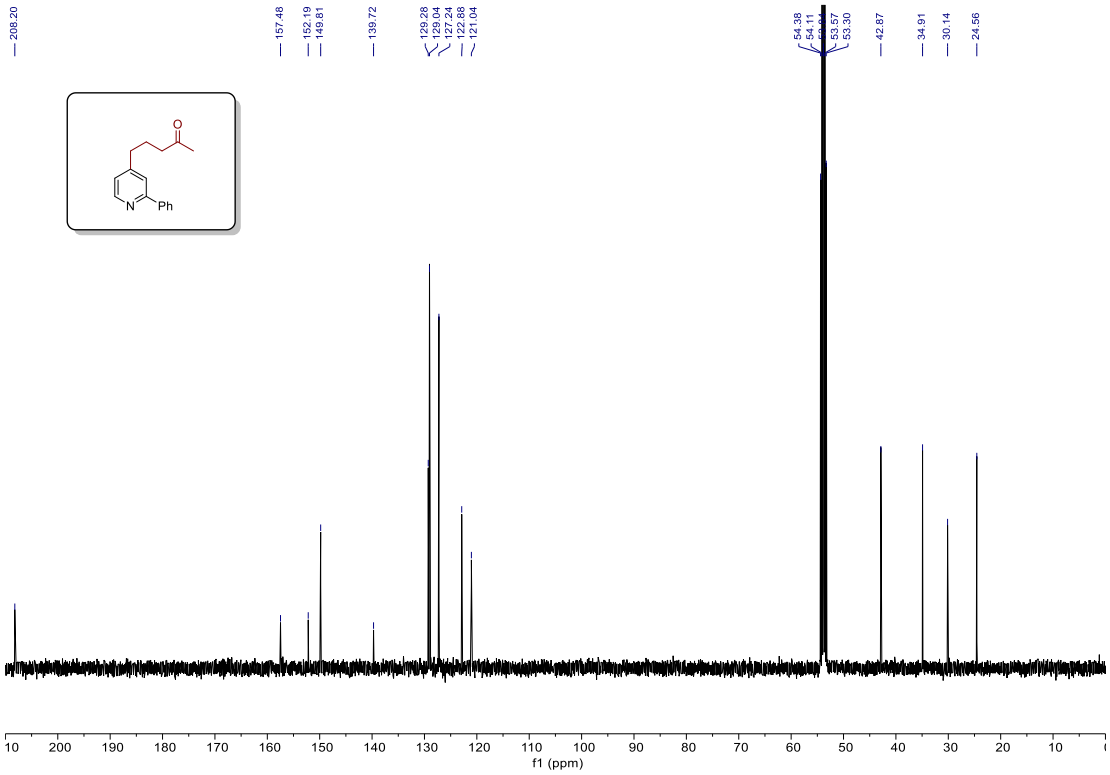


100 MHz, ^{13}C NMR in CD_2Cl_2

5-(2-phenylpyridin-4-yl)pentan-2-one (3ad).

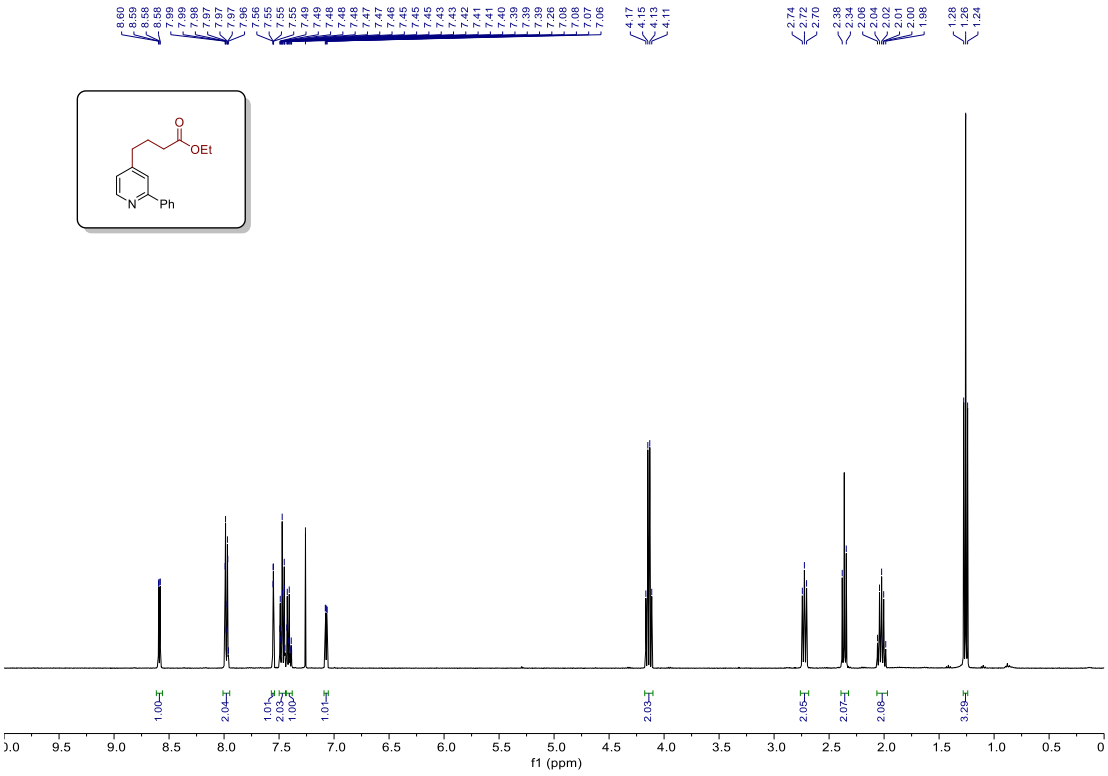


400 MHz, ^{1}H NMR in CD_2Cl_2

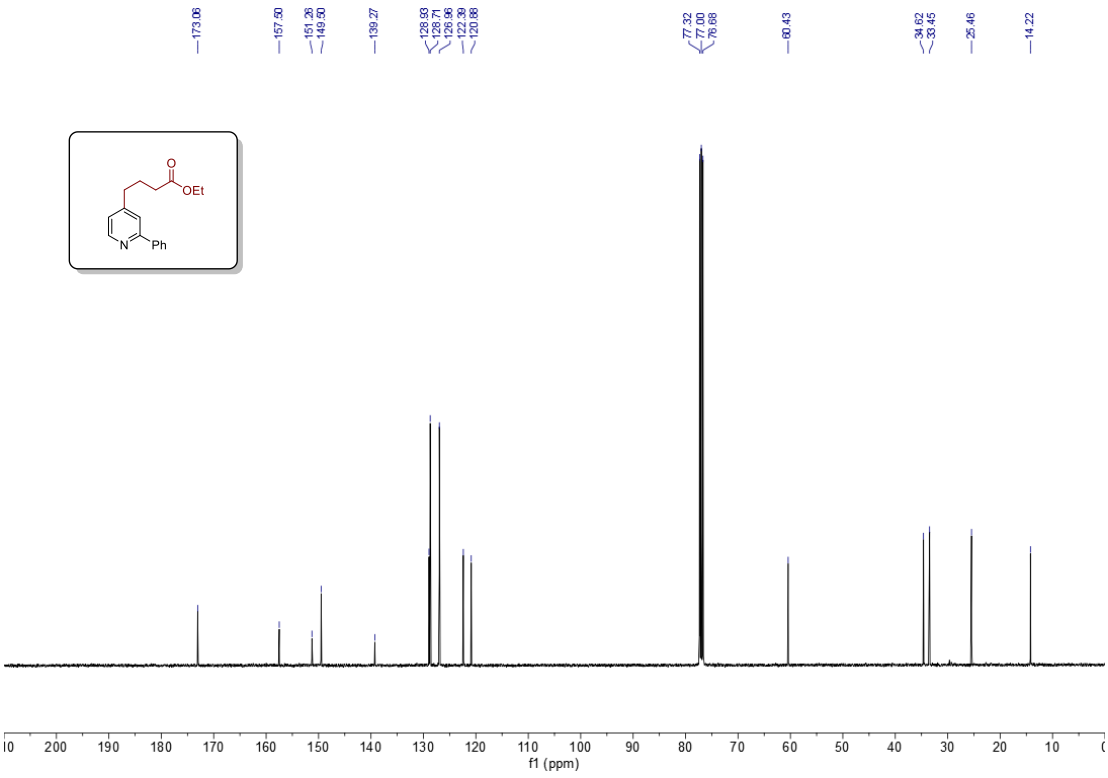


100 MHz, ^{13}C NMR in CD_2Cl_2

ethyl 4-(2-phenylpyridin-4-yl)butanoate (3ae).

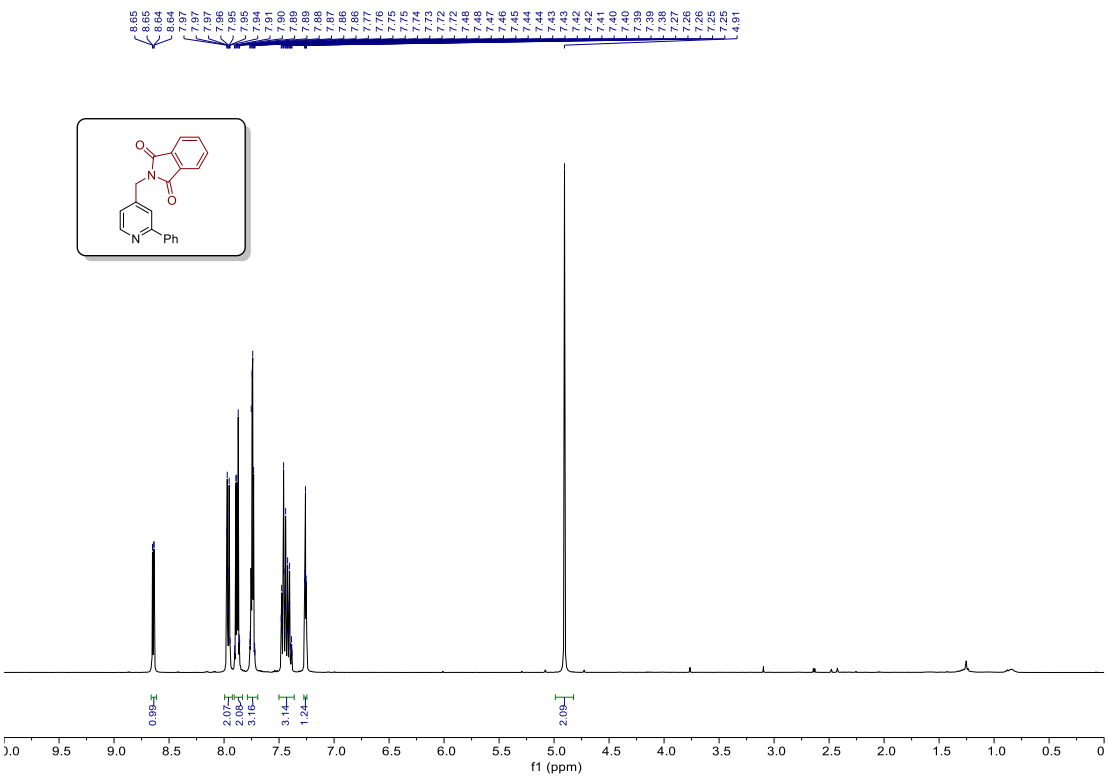


400 MHz, ^{1}H NMR in $CDCl_3$

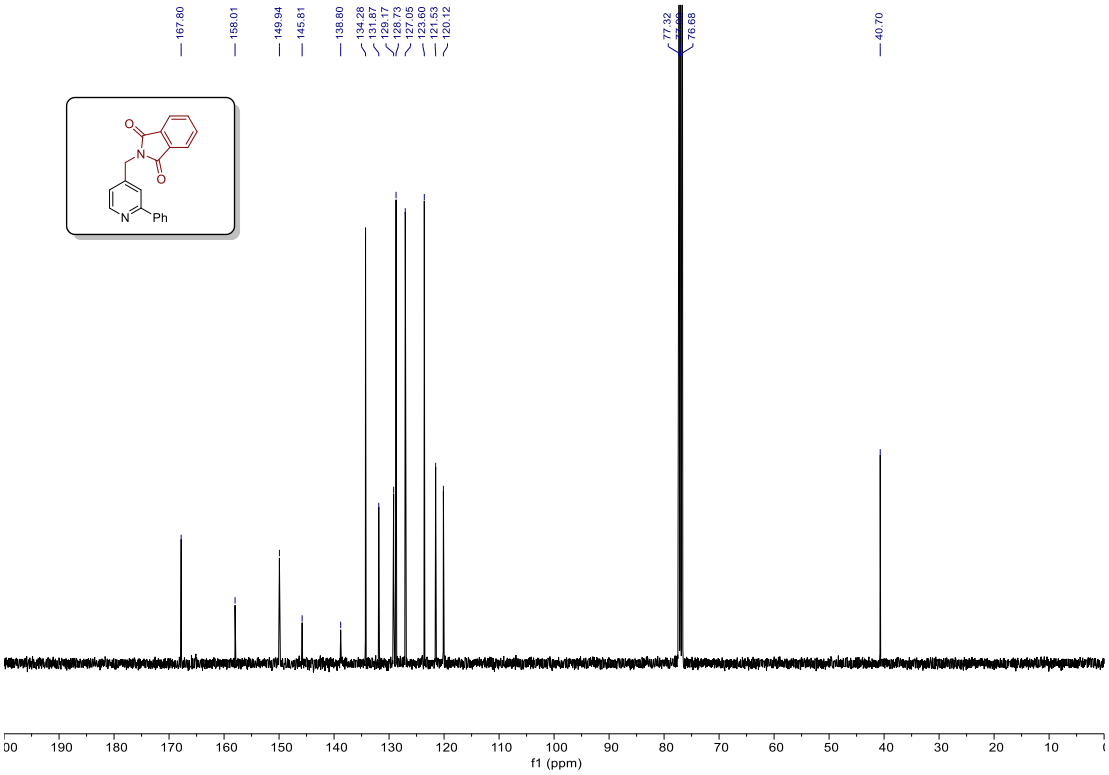


100 MHz, ^{13}C NMR in $CDCl_3$

2-((2-phenylpyridin-4-yl)methyl)isoindoline-1,3-dione (3af).

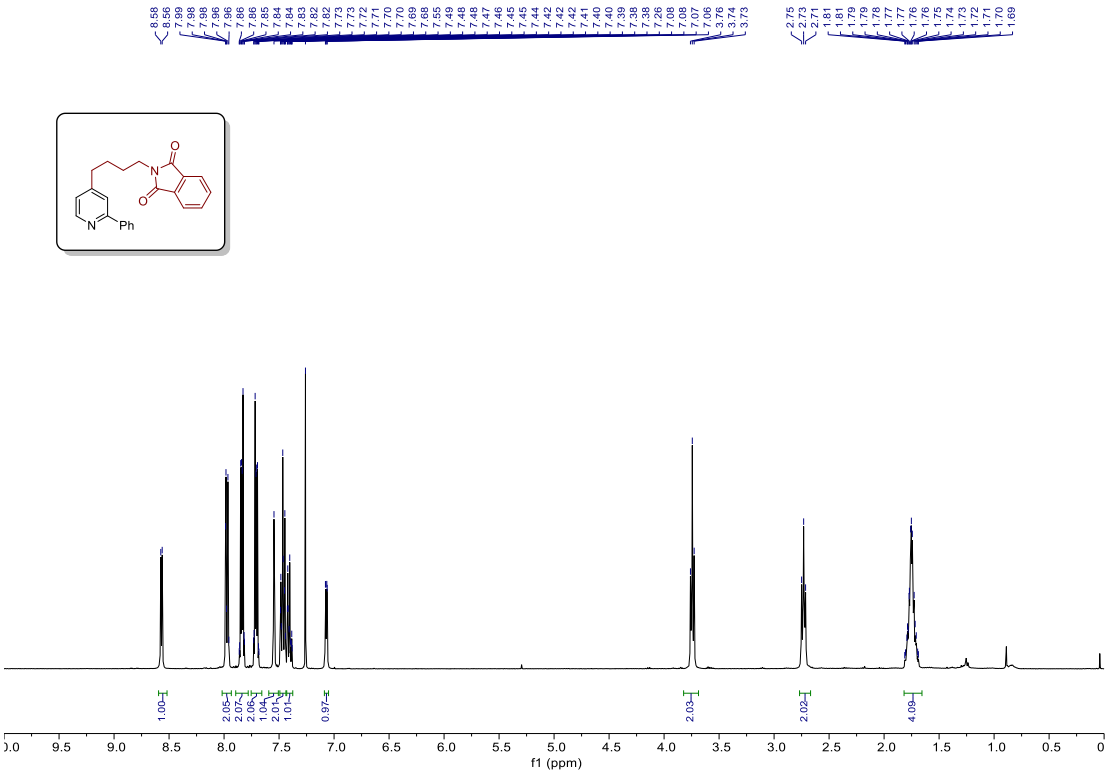


400 MHz, ^{1}H NMR in $CDCl_3$

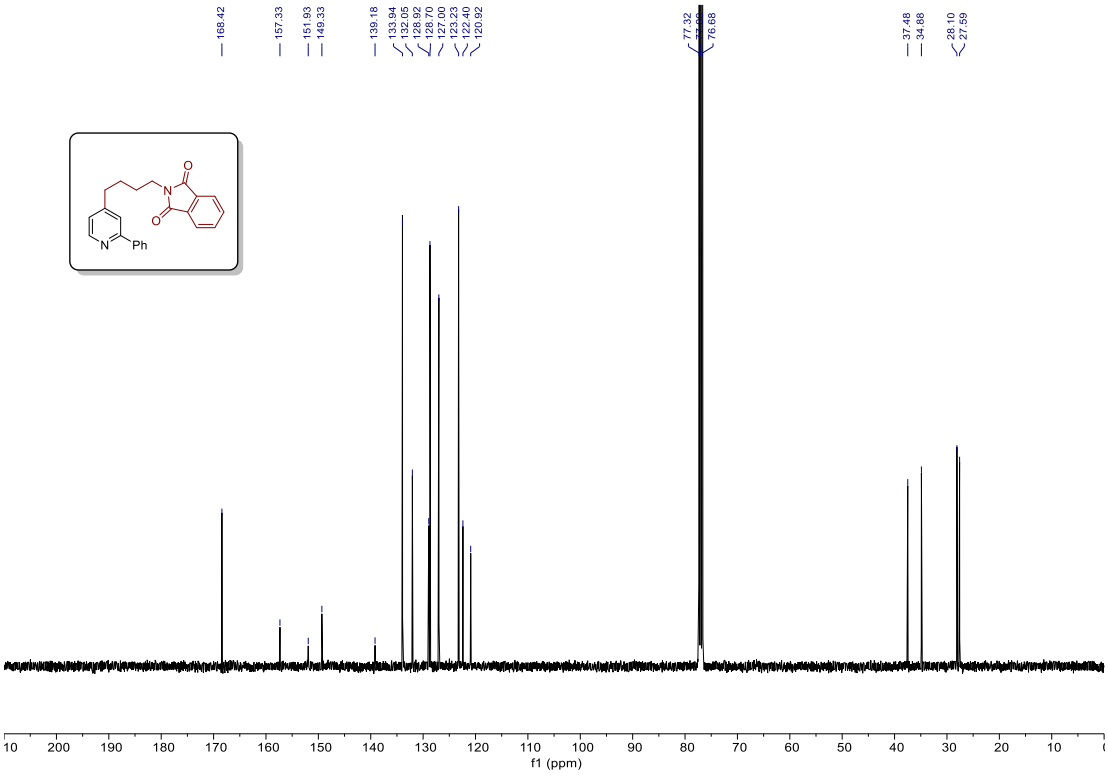


100 MHz, ^{13}C NMR in $CDCl_3$

2-(4-(2-phenylpyridin-4-yl)butyl)isoindoline-1,3-dione (3ag).

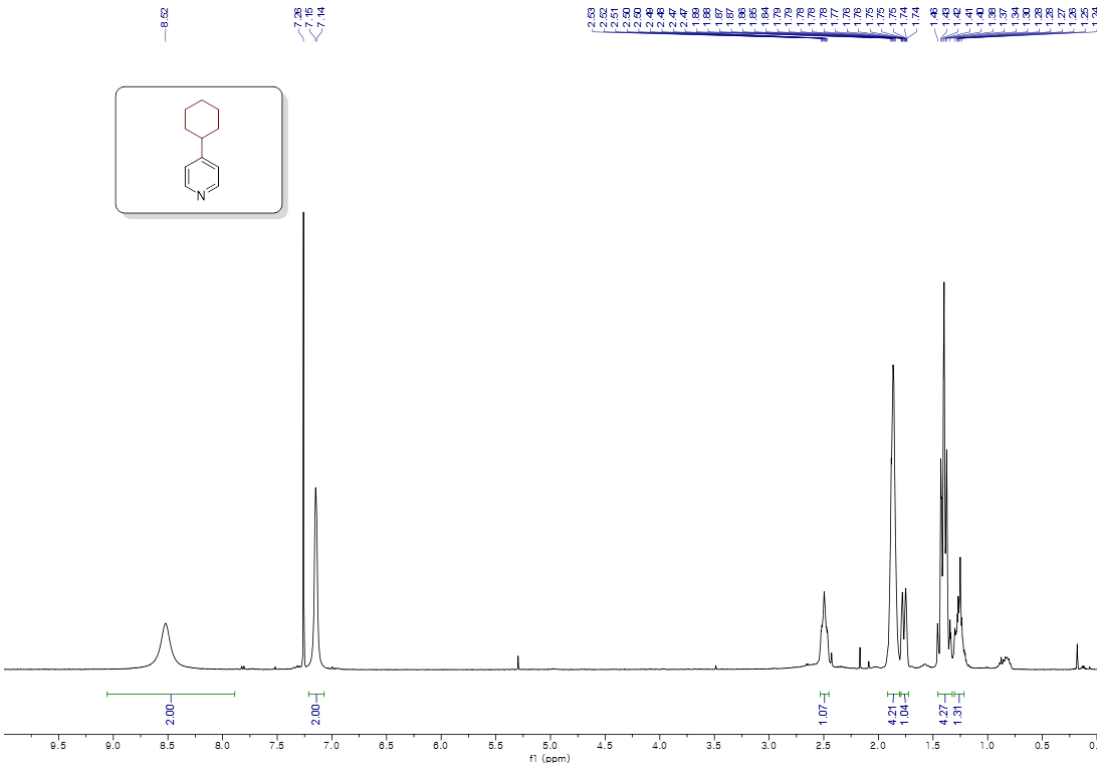


400 MHz, ^{1}H NMR in $CDCl_3$

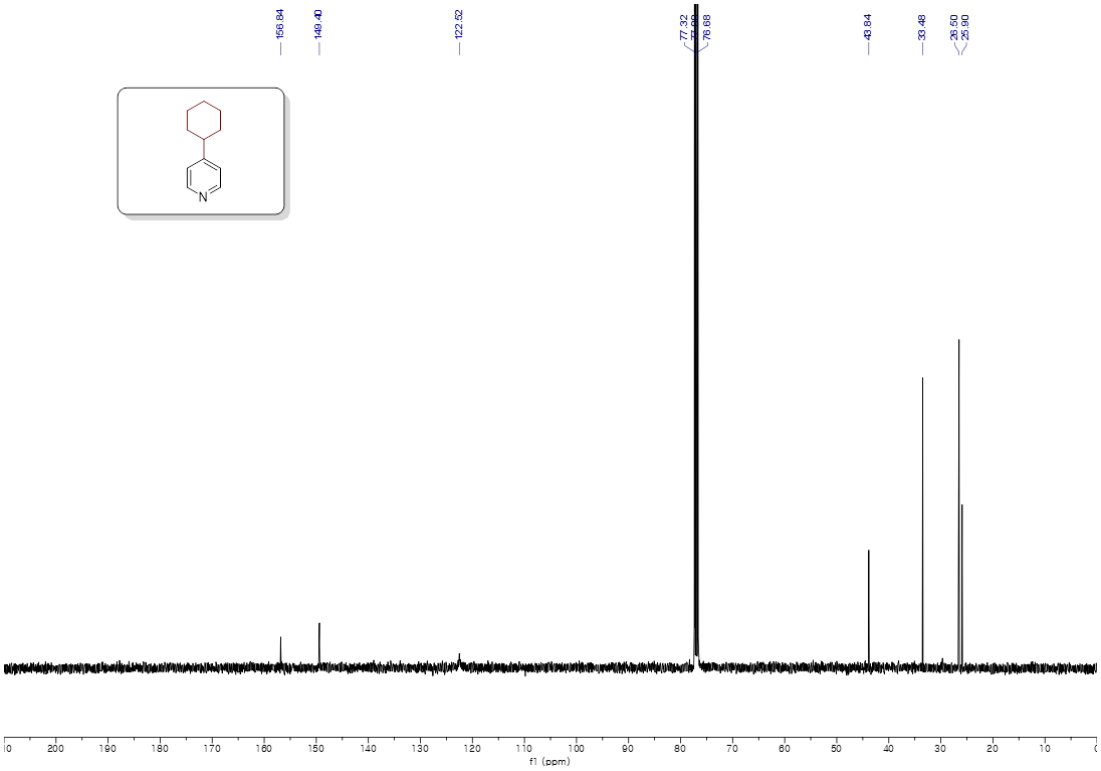


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclohexylpyridine (4a).

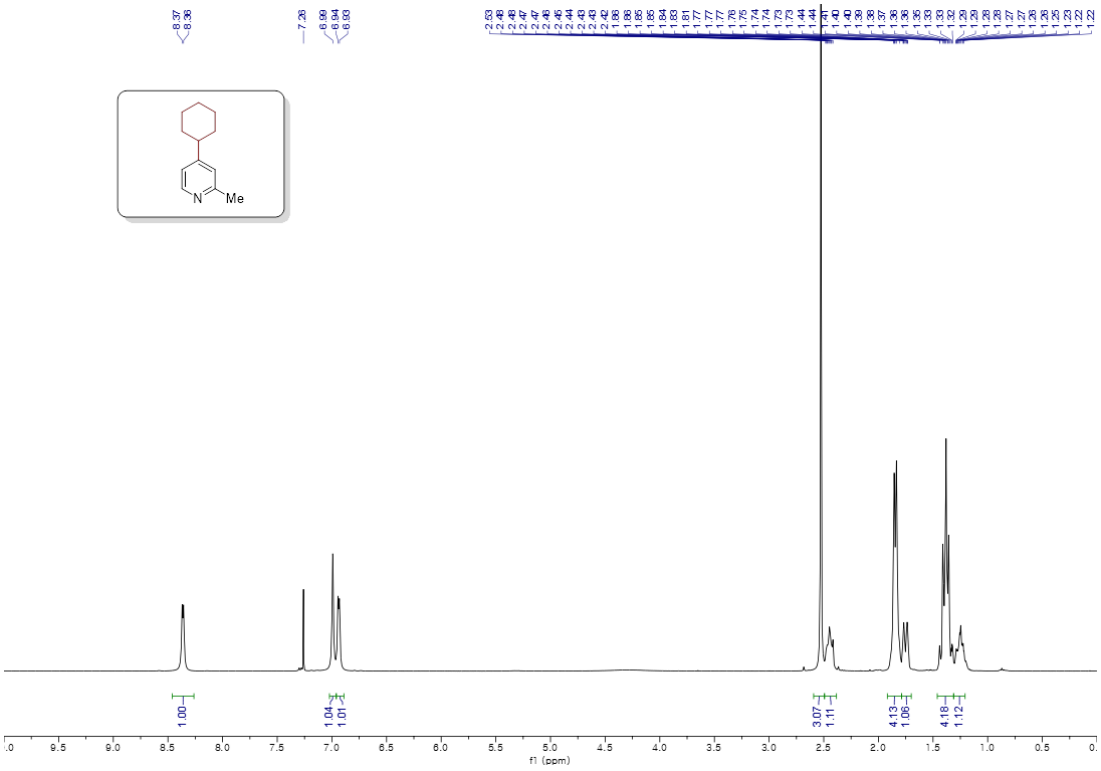


400 MHz, ^{1}H NMR in $CDCl_3$

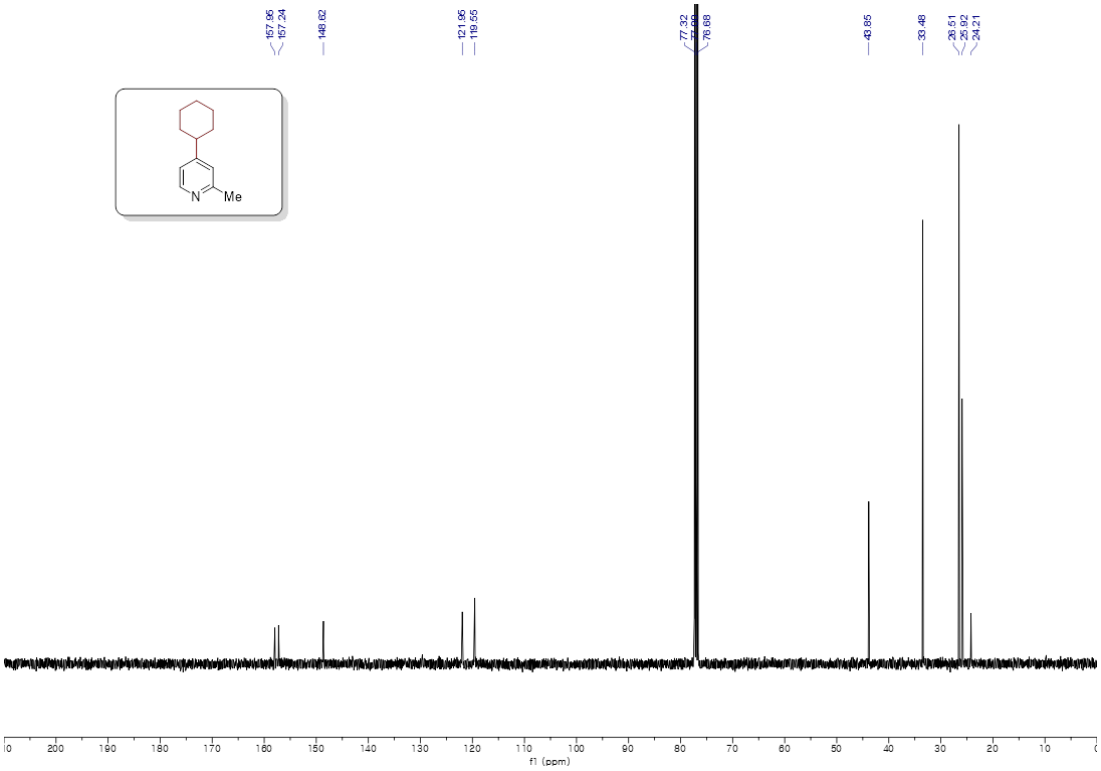


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclohexyl-2-methylpyridine (4b).

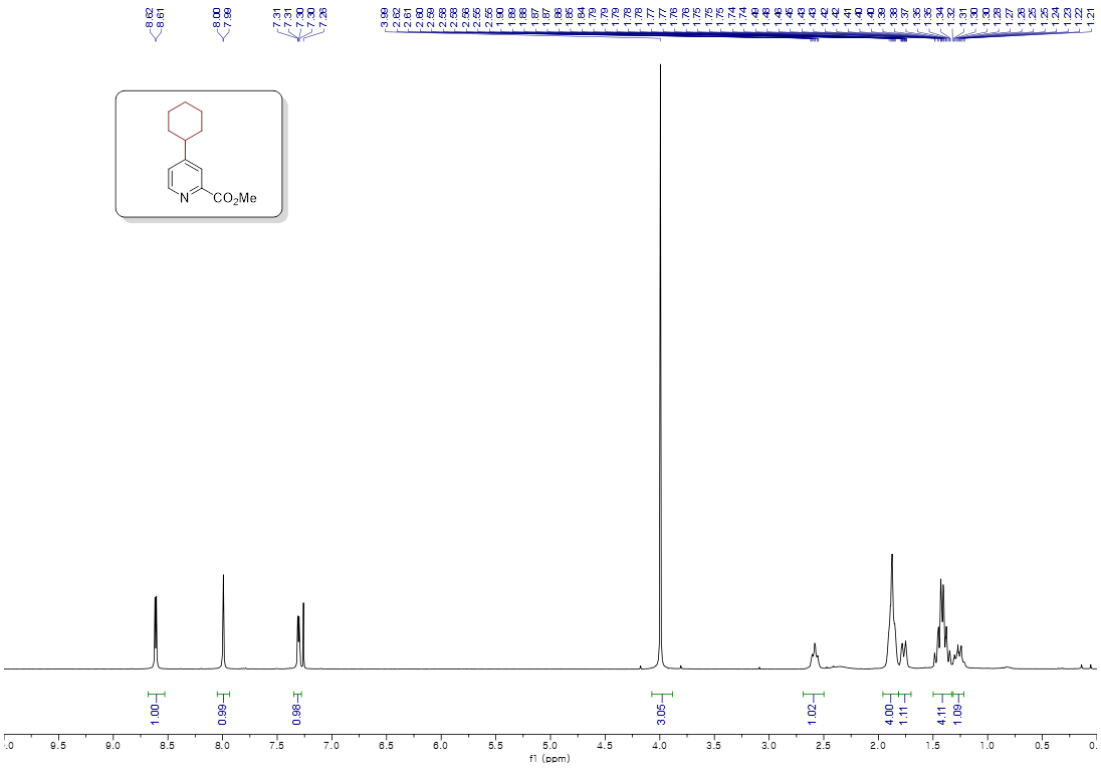


400 MHz, ^{1}H NMR in $CDCl_3$

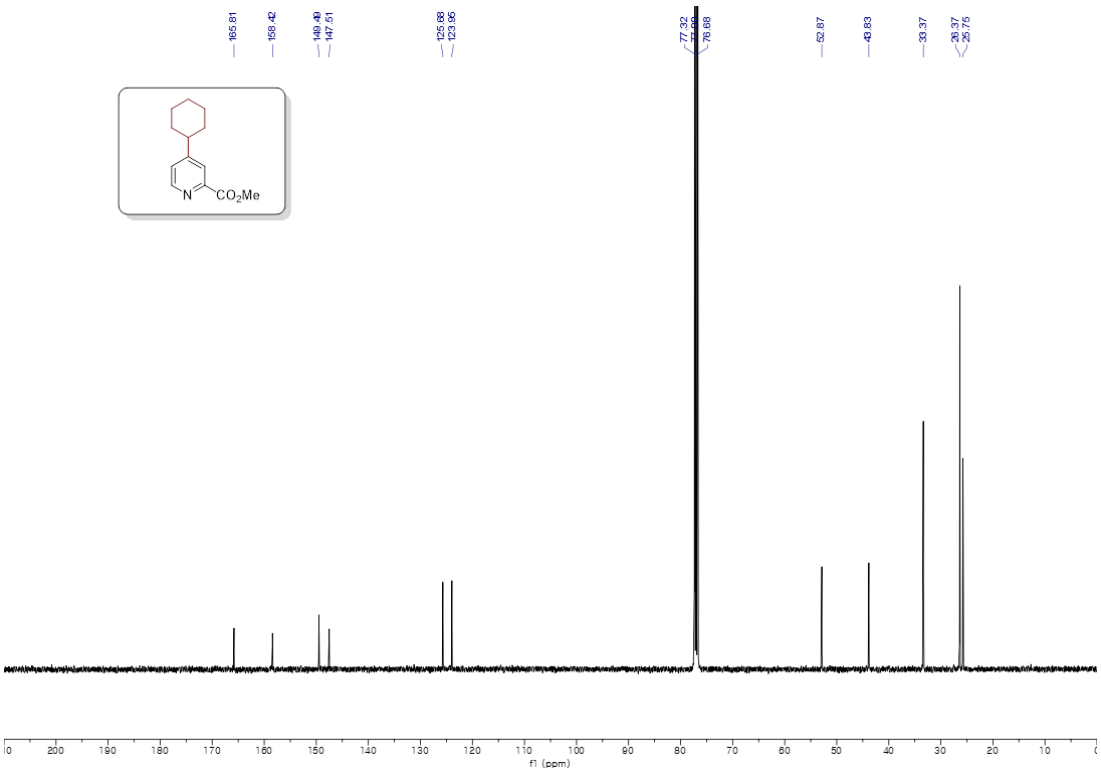


100 MHz, ^{13}C NMR in $CDCl_3$

methyl 4-cyclohexylpicolinate (4c).

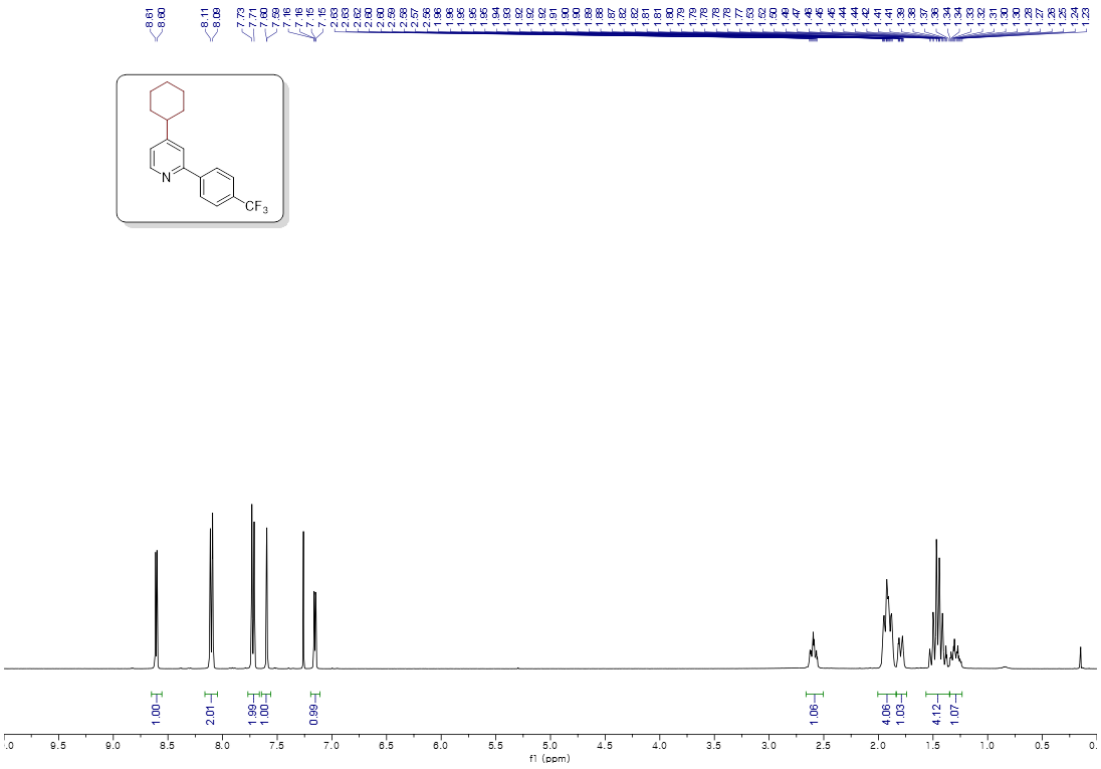


400 MHz, ^{1}H NMR in $CDCl_3$

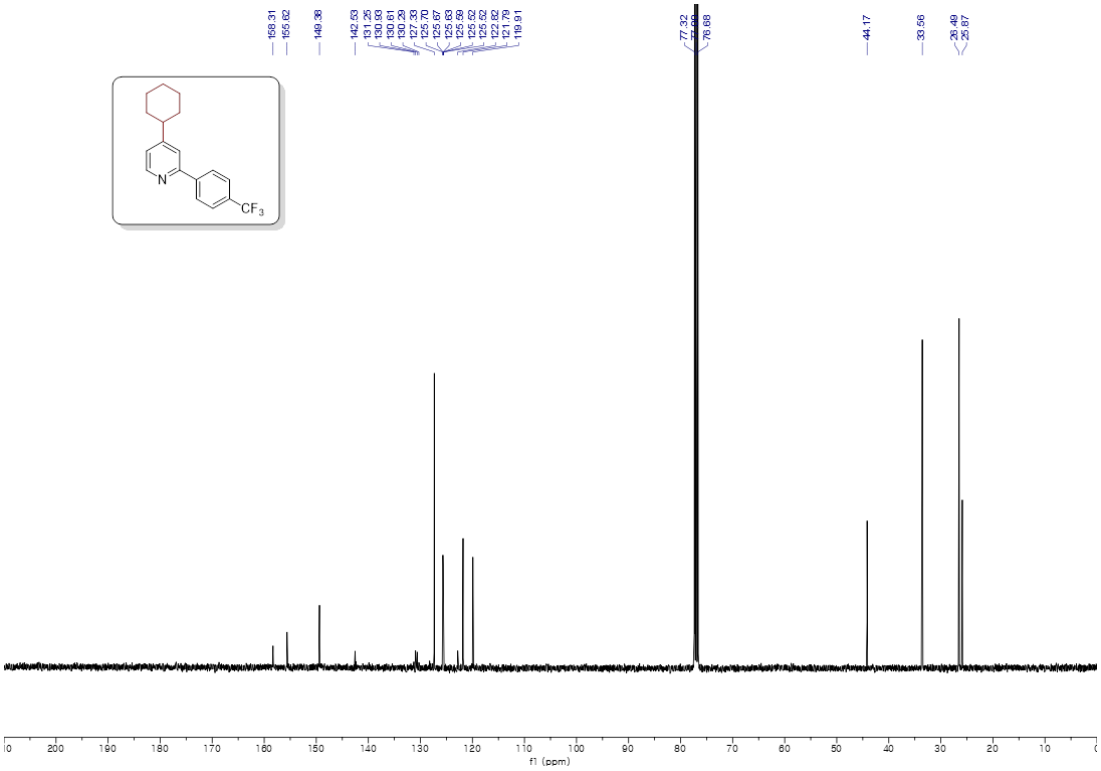


100 MHz, ^{13}C NMR in $CDCl_3$

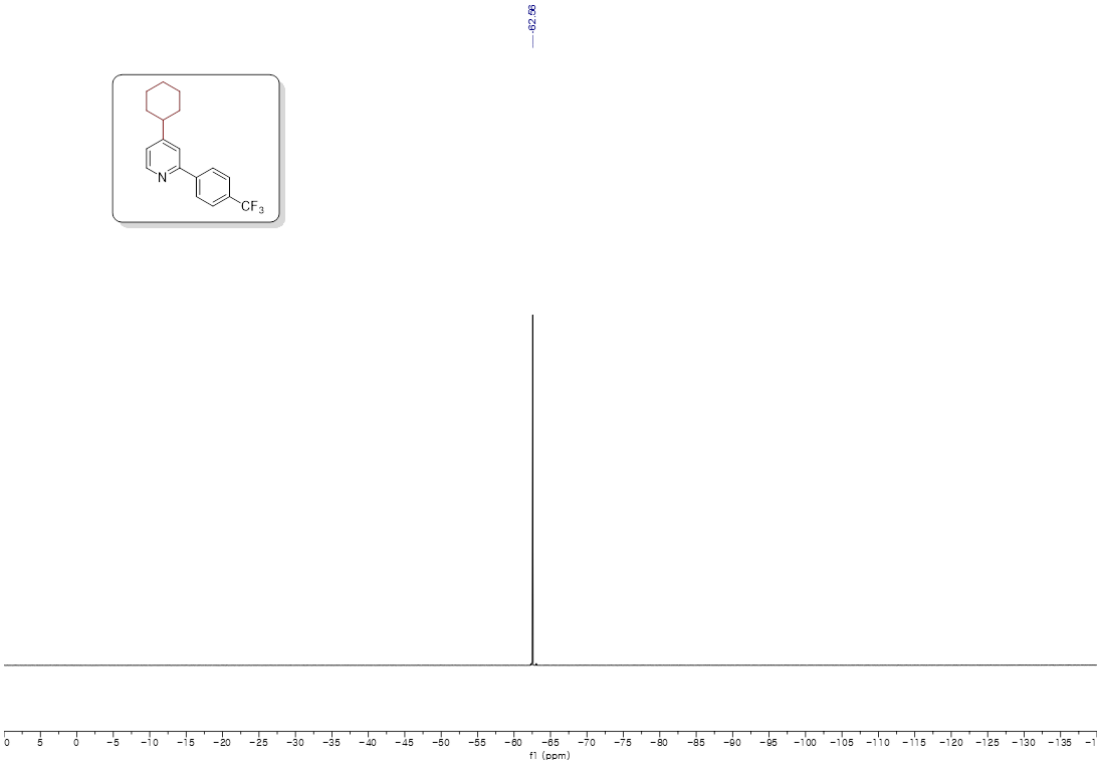
4-cyclohexyl-2-(4-(trifluoromethyl)phenyl)pyridine (4d).



400 MHz, ^{1}H NMR in $CDCl_3$

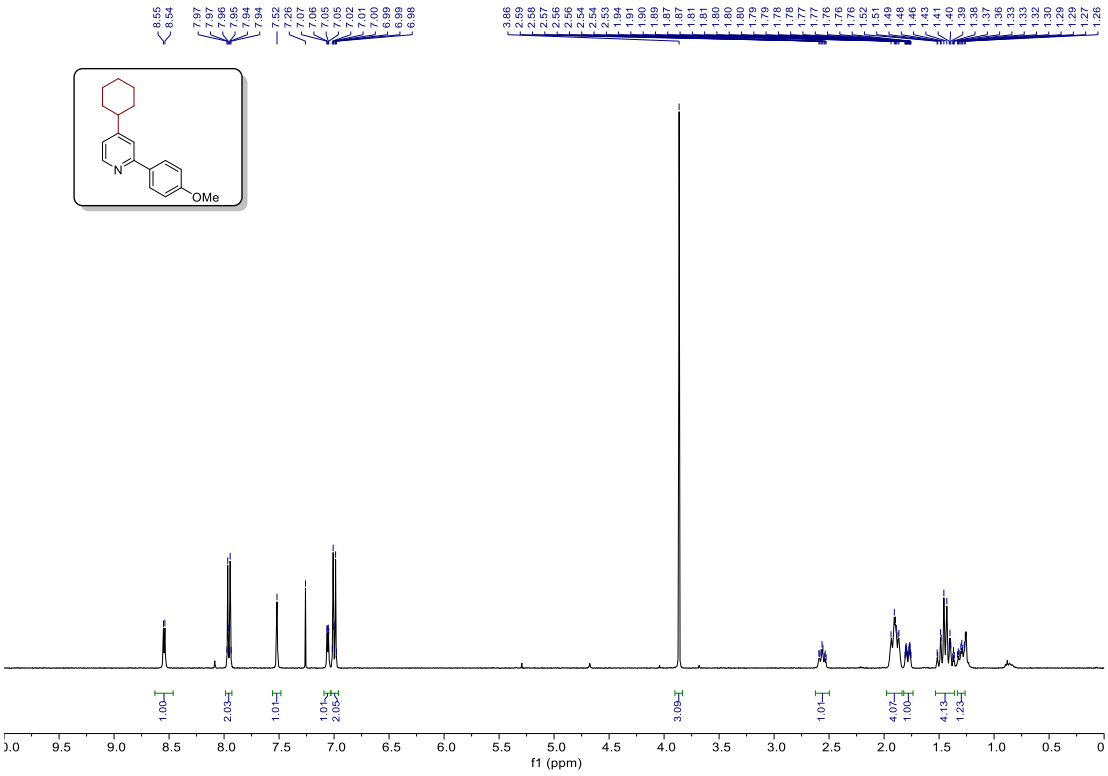


100 MHz, ^{13}C NMR in $CDCl_3$

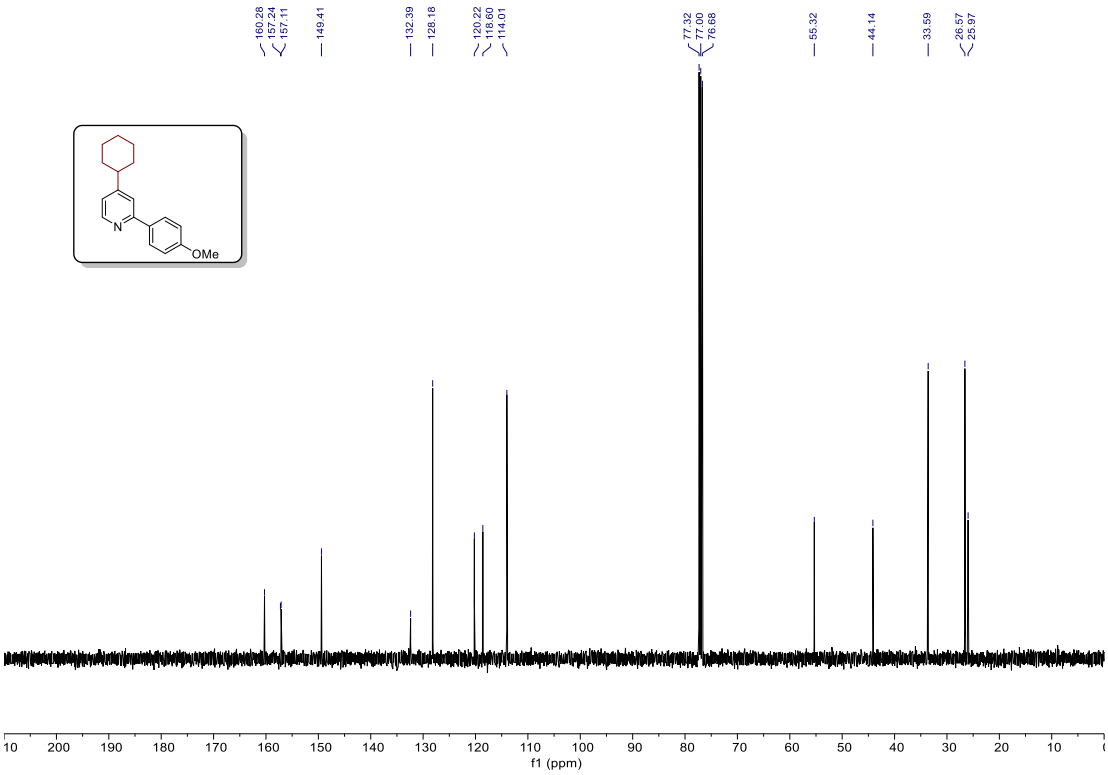


376 MHz, ^{19}F NMR in $CDCl_3$

4-cyclohexyl-2-(4-methoxyphenyl)pyridine (4e).

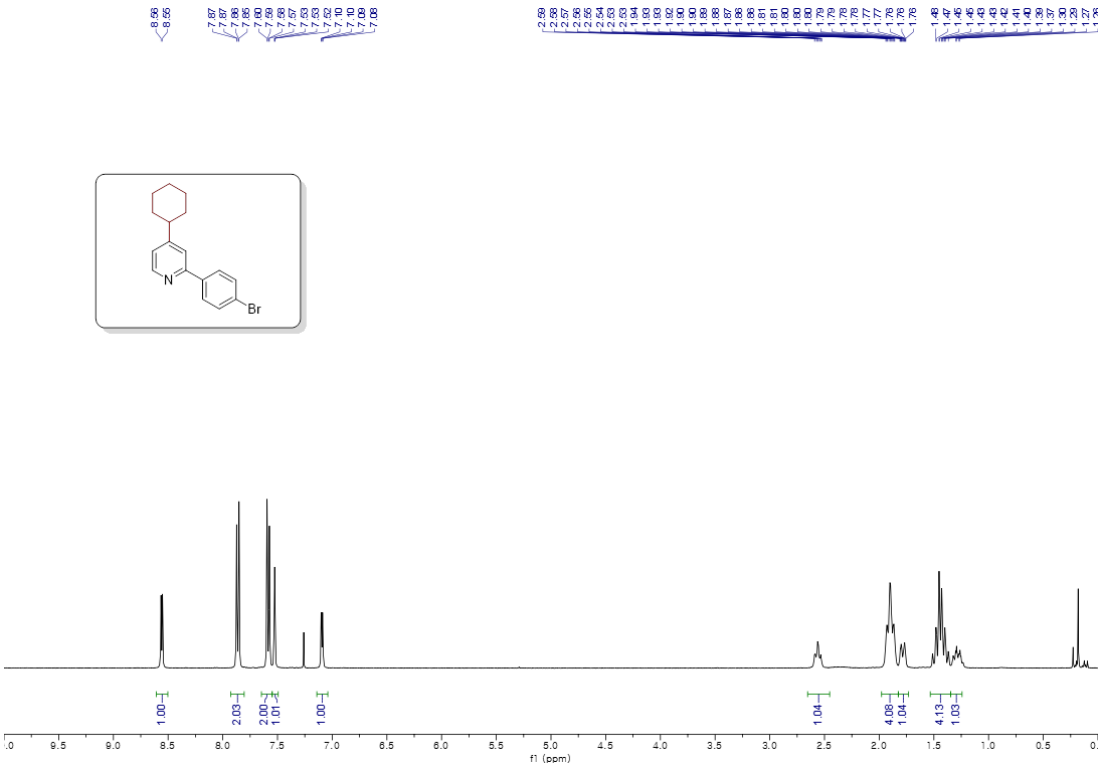


400 MHz, ^{1}H NMR in $CDCl_3$

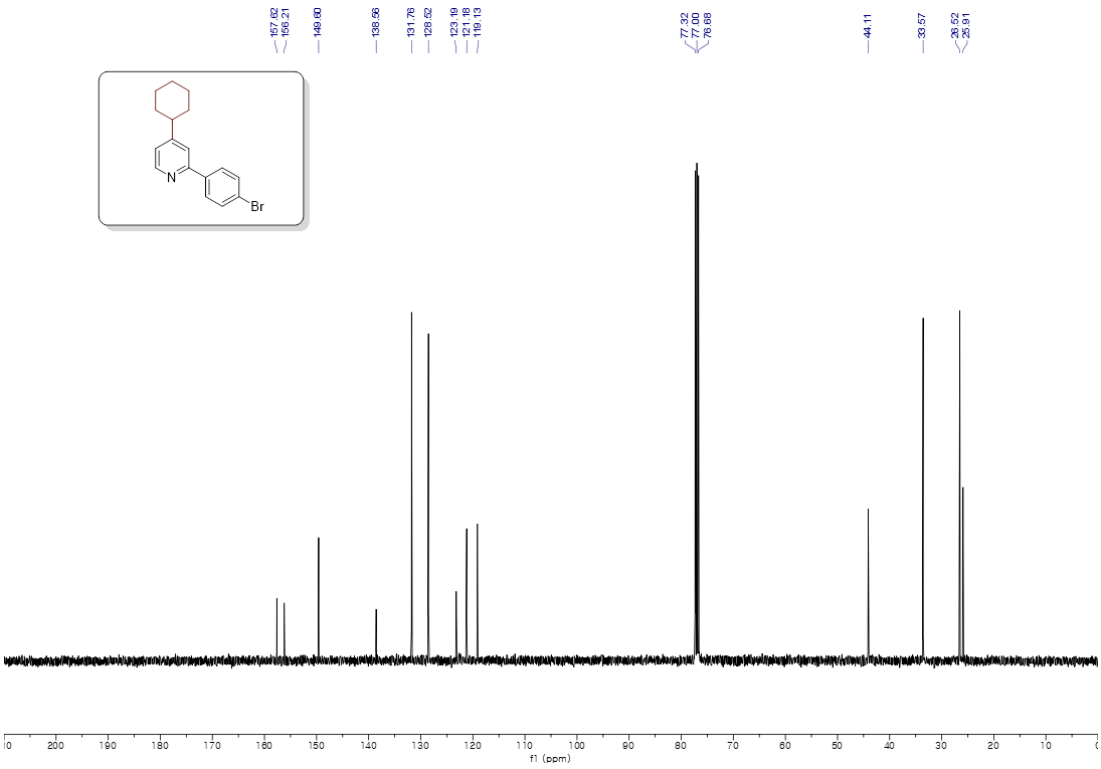


100 MHz, ^{13}C NMR in $CDCl_3$

2-(4-bromophenyl)-4-cyclohexylpyridine (4f).

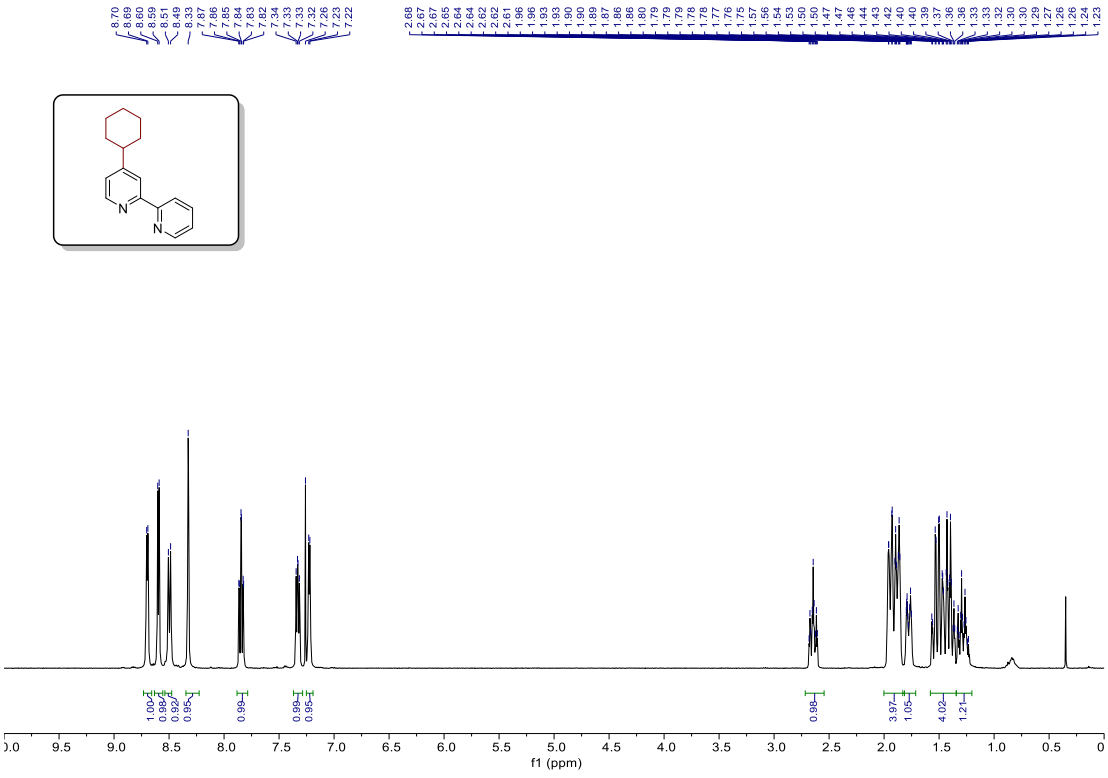


400 MHz, ^{1}H NMR in $CDCl_3$

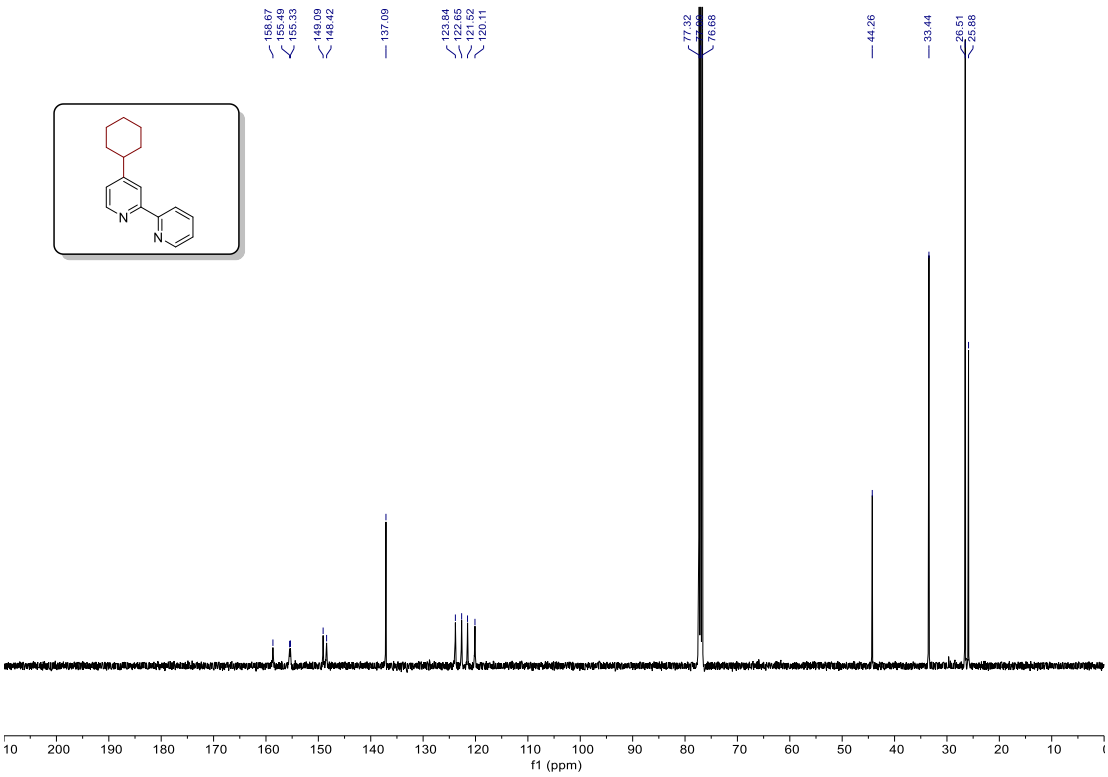


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclohexyl-2,2'-bipyridine (4g).

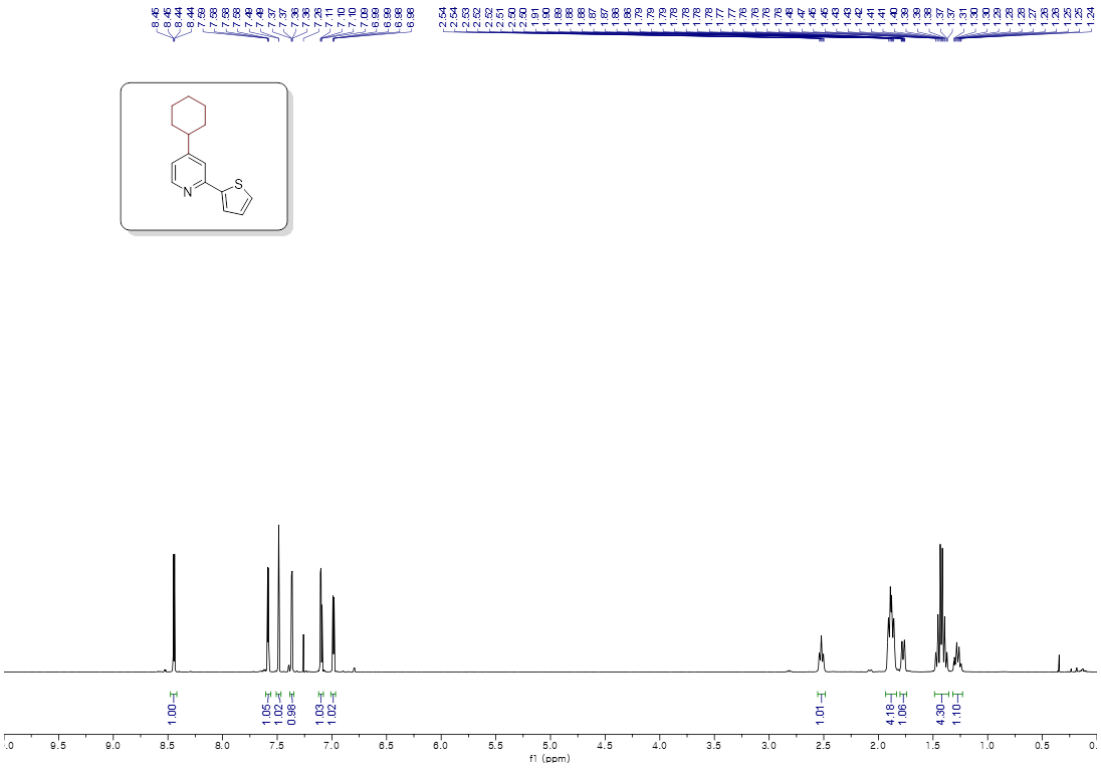


400 MHz, ^{1}H NMR in $CDCl_3$

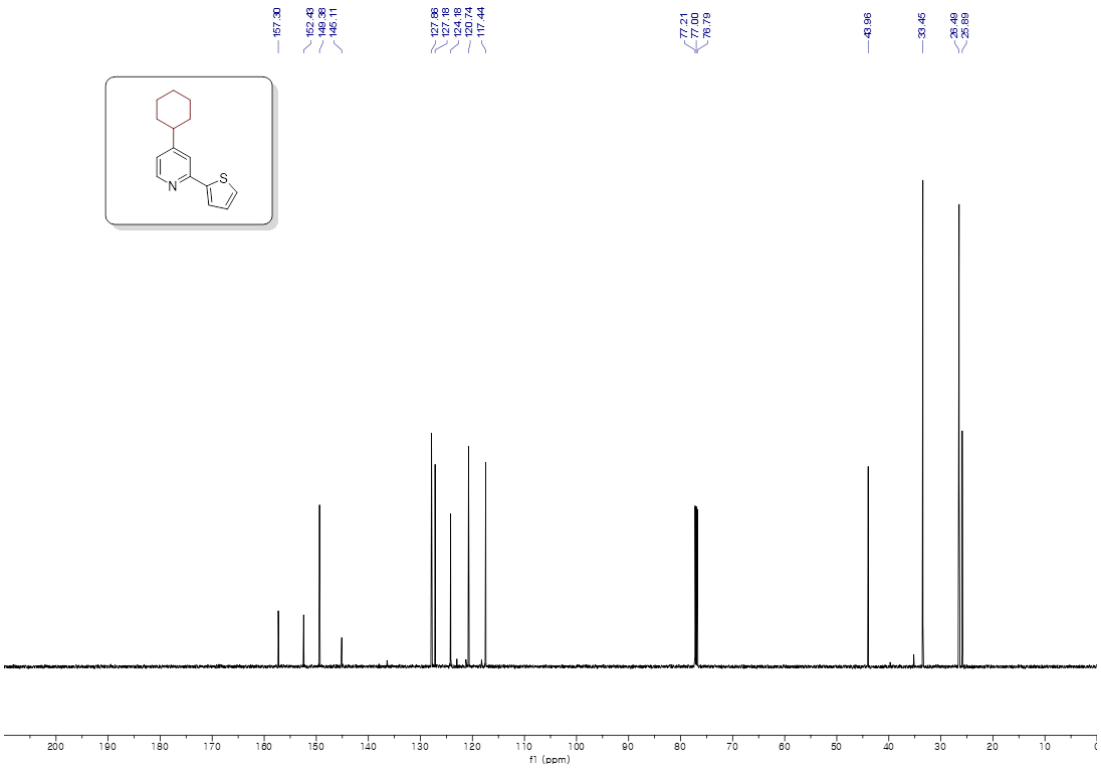


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclohexyl-2-(thiophen-2-yl)pyridine (4h).

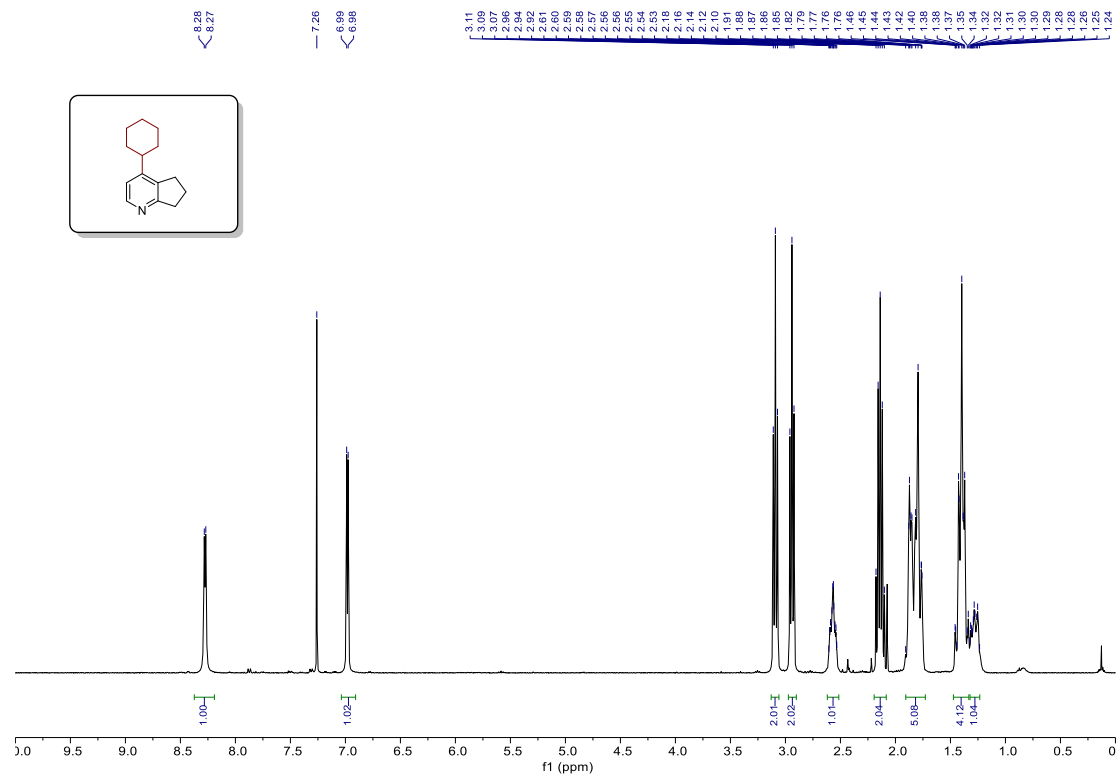


600 MHz, ^{1}H NMR in $CDCl_3$

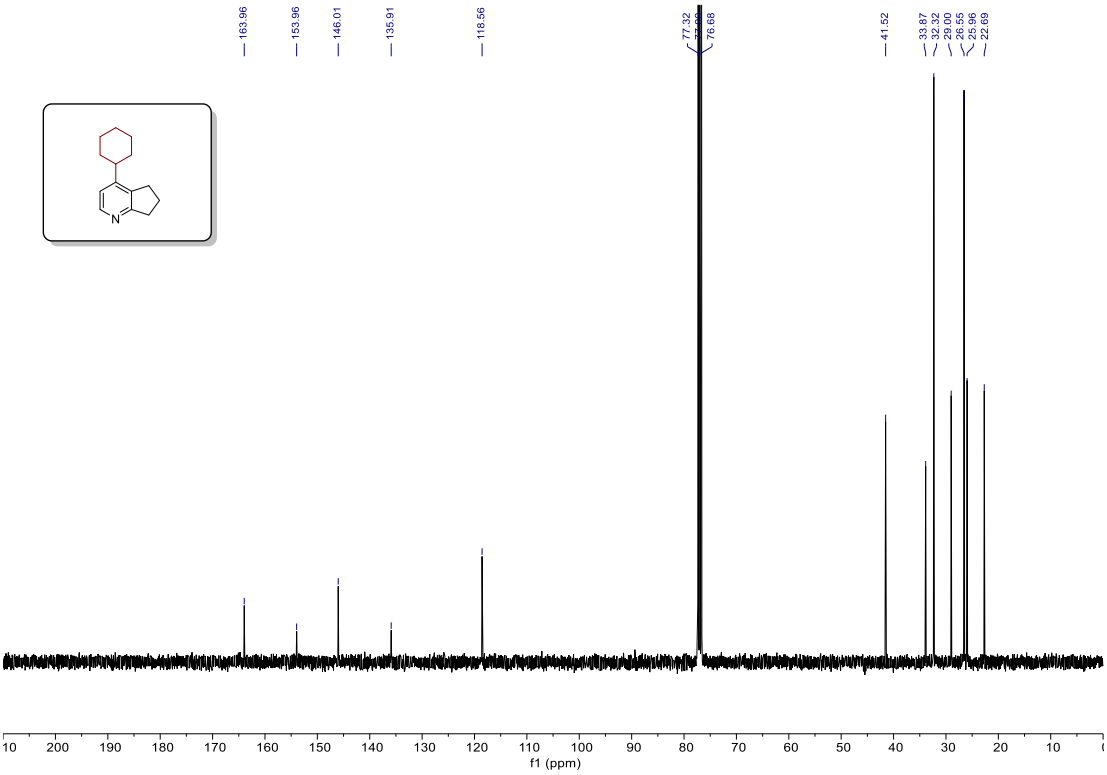


150 MHz, ^{13}C NMR in $CDCl_3$

4-cyclohexyl-6,7-dihydro-5H-cyclopenta[b]pyridine (4i).

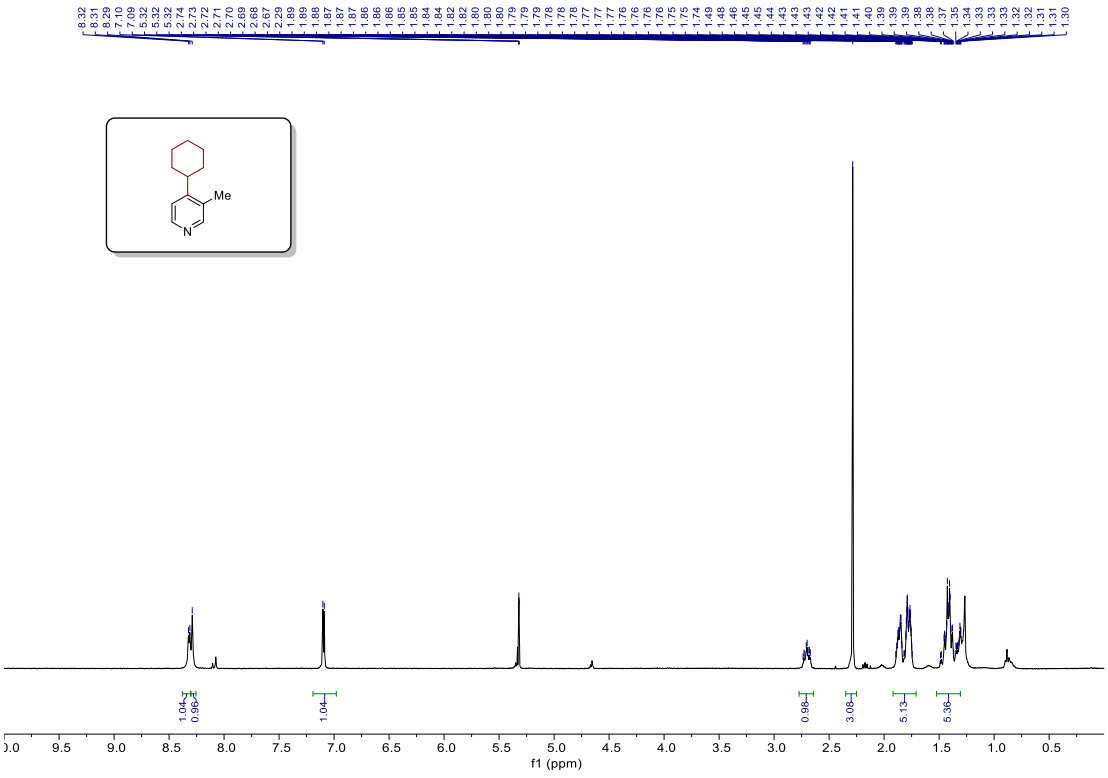


400 MHz, ^{1}H NMR in $CDCl_3$

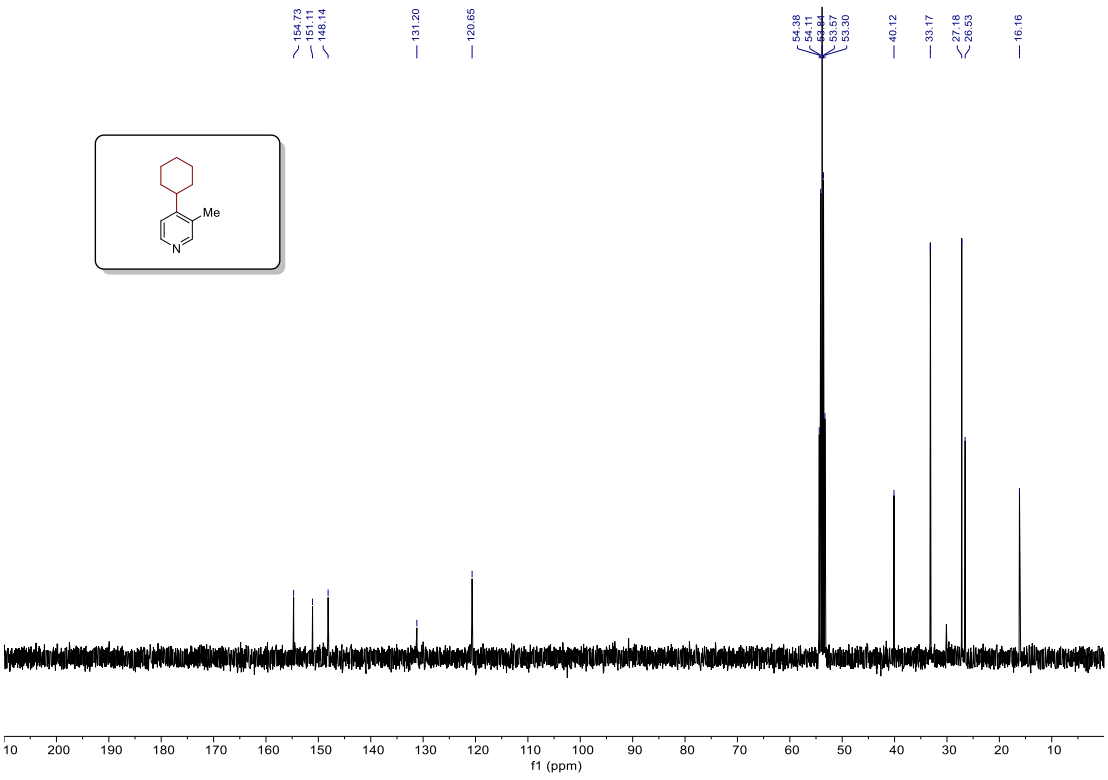


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclohexyl-3-methylpyridine (4j).

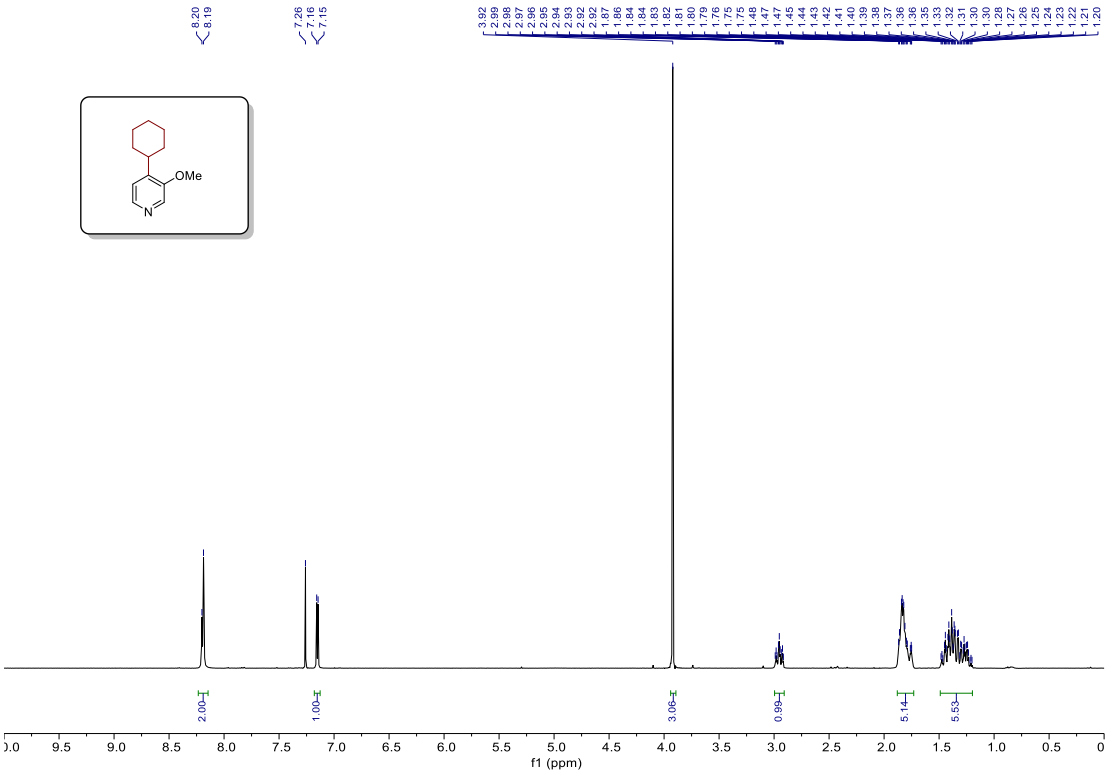


400 MHz, ^{1}H NMR in CD_2Cl_2

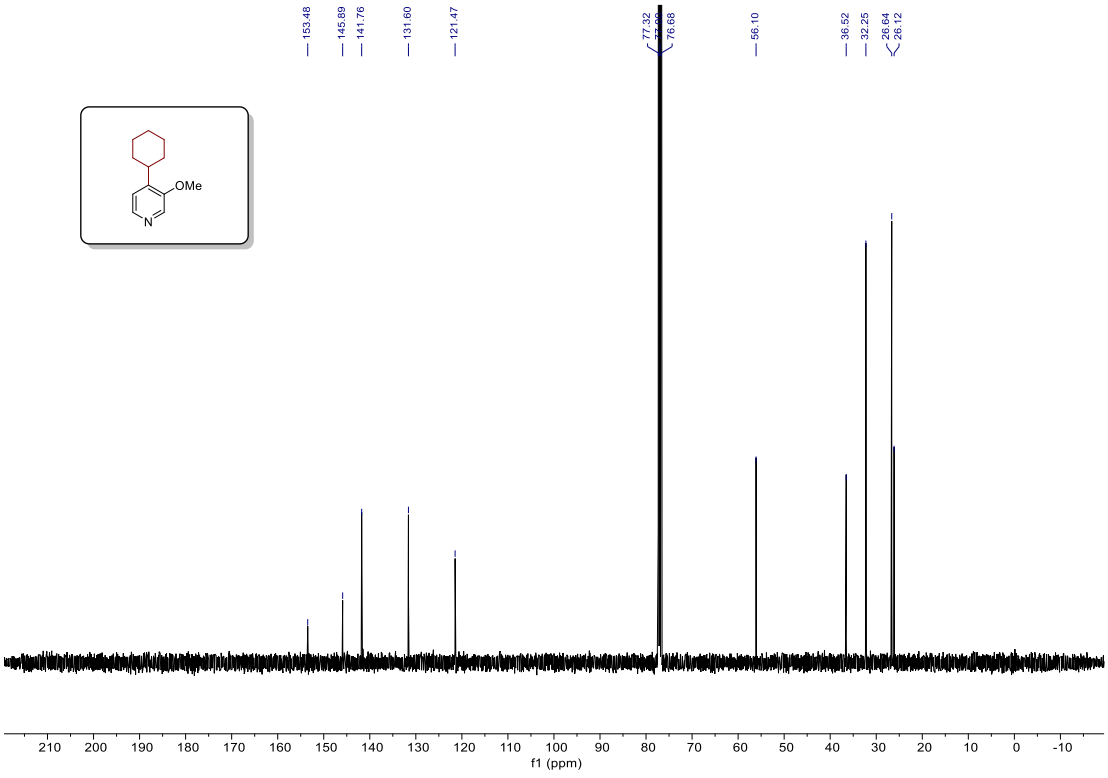


100 MHz, ^{13}C NMR in CD_2Cl_2

4-cyclohexyl-2-(4-methoxyphenyl)pyridine (4k).

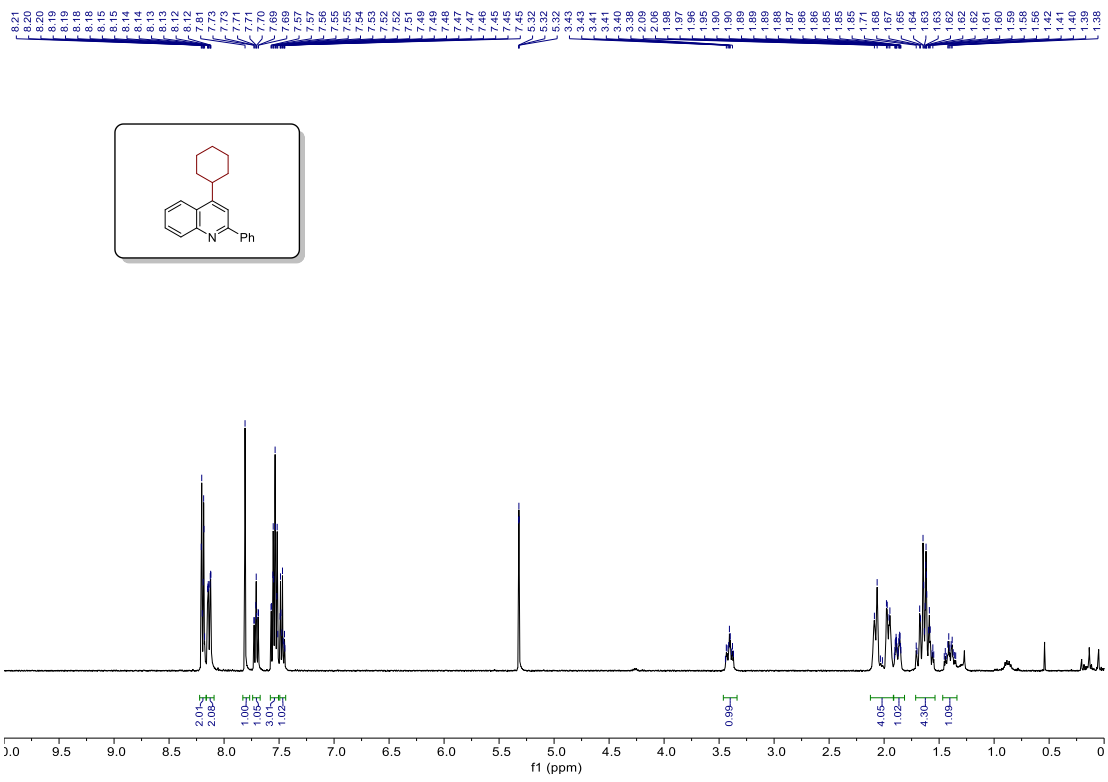


400 MHz, ^{1}H NMR in $CDCl_3$

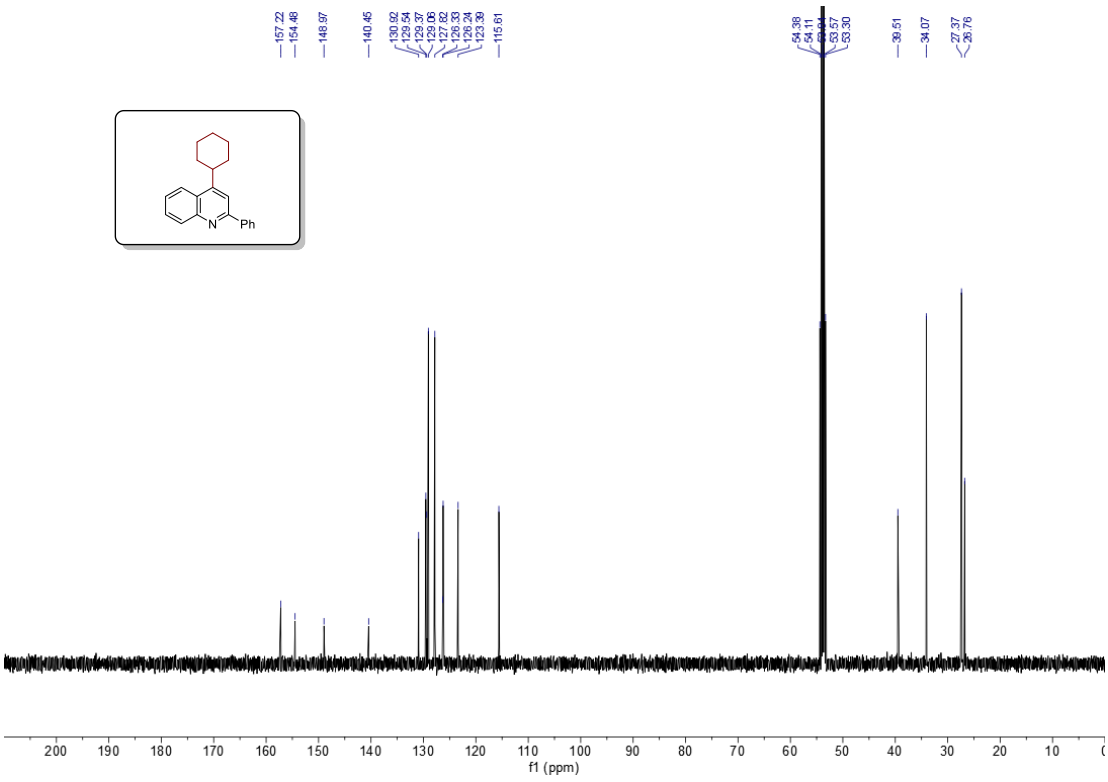


100 MHz, ^{13}C NMR in $CDCl_3$

4-cyclohexyl-2-phenylquinoline (4l).

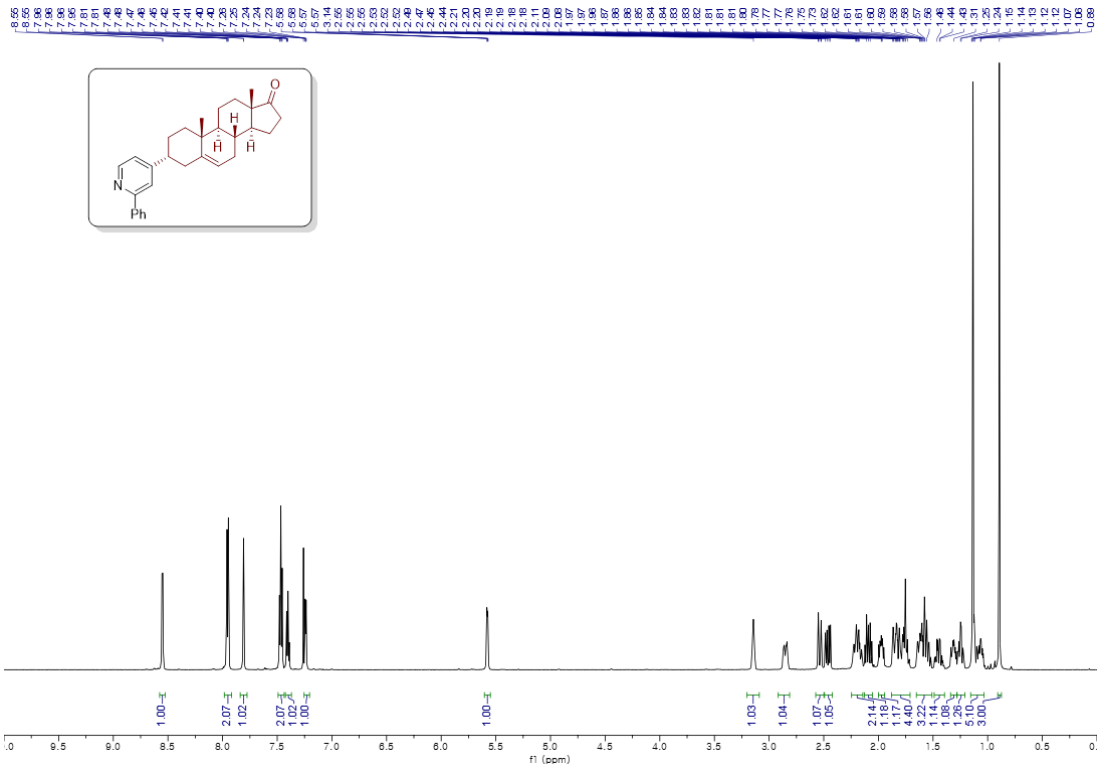


400 MHz, ^{1}H NMR in CD_2Cl_2

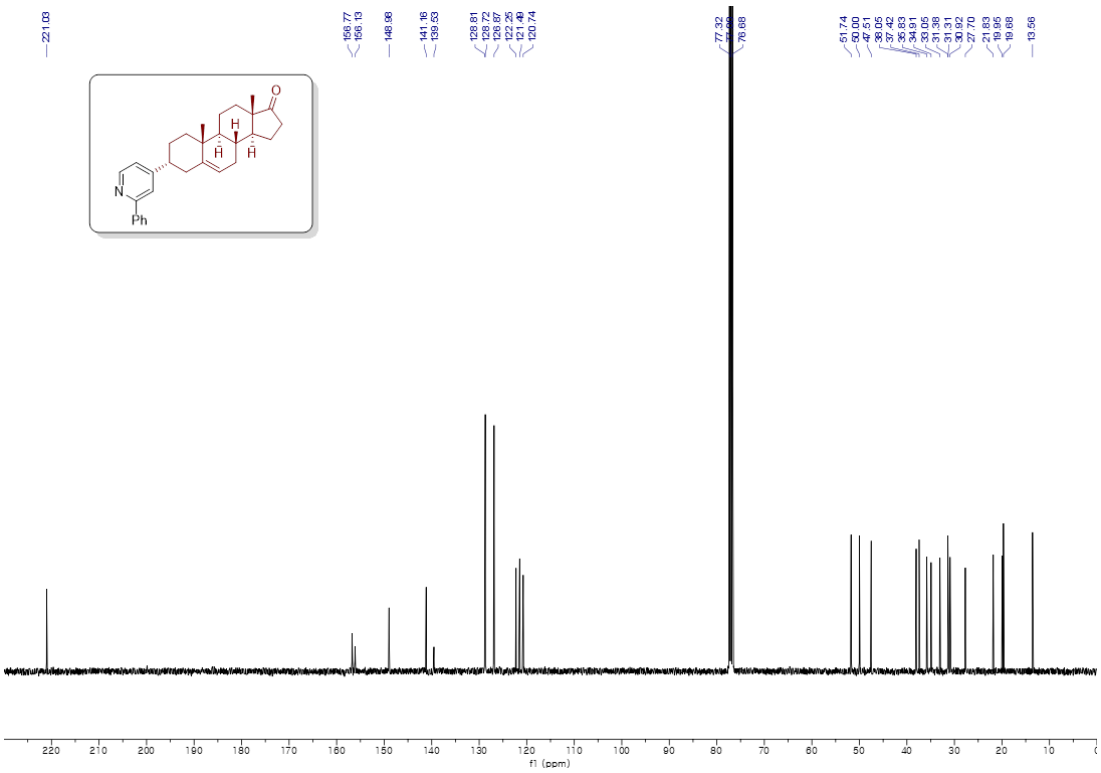


100 MHz, ^{13}C NMR in CD_2Cl_2

(3R,8R,9S,10R,13S,14S)-10,13-dimethyl-3-(2-phenylpyridin-4-yl)-1,2,3,4,7,8,9,10,11,12,13,14,15,16-tetradecahydro-17H-cyclopenta[a]phenanthren-17-one (5a).

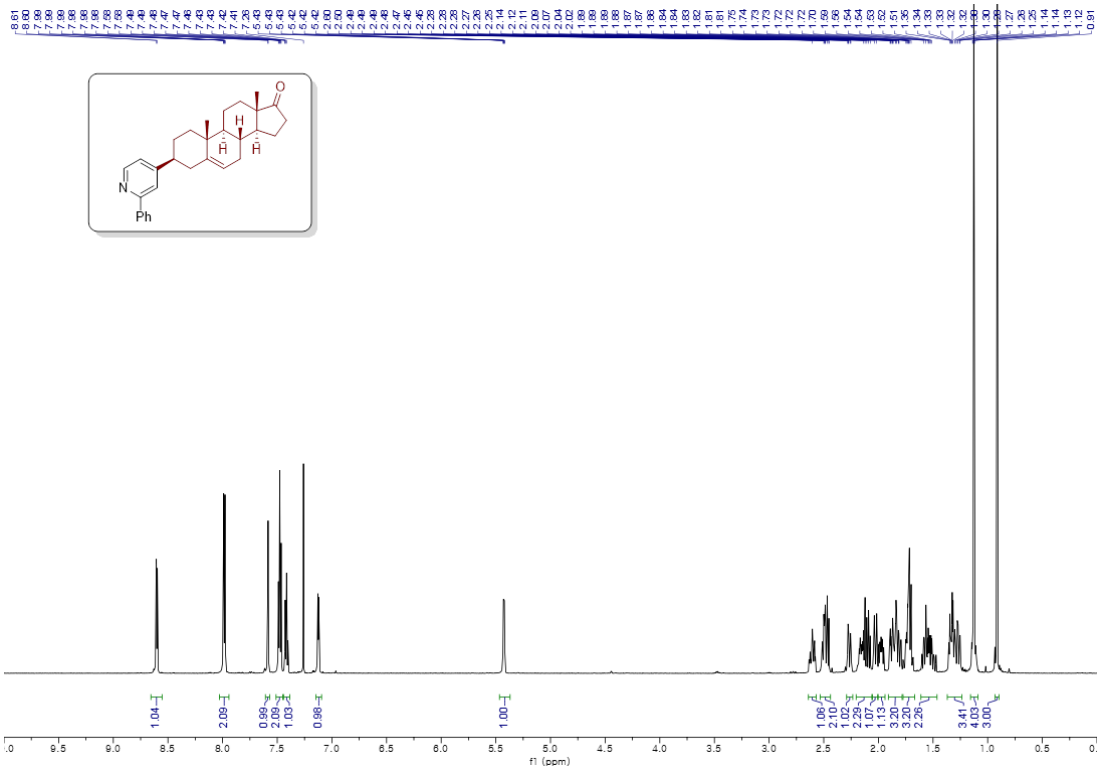


600 MHz, ^{1}H NMR in $CDCl_3$

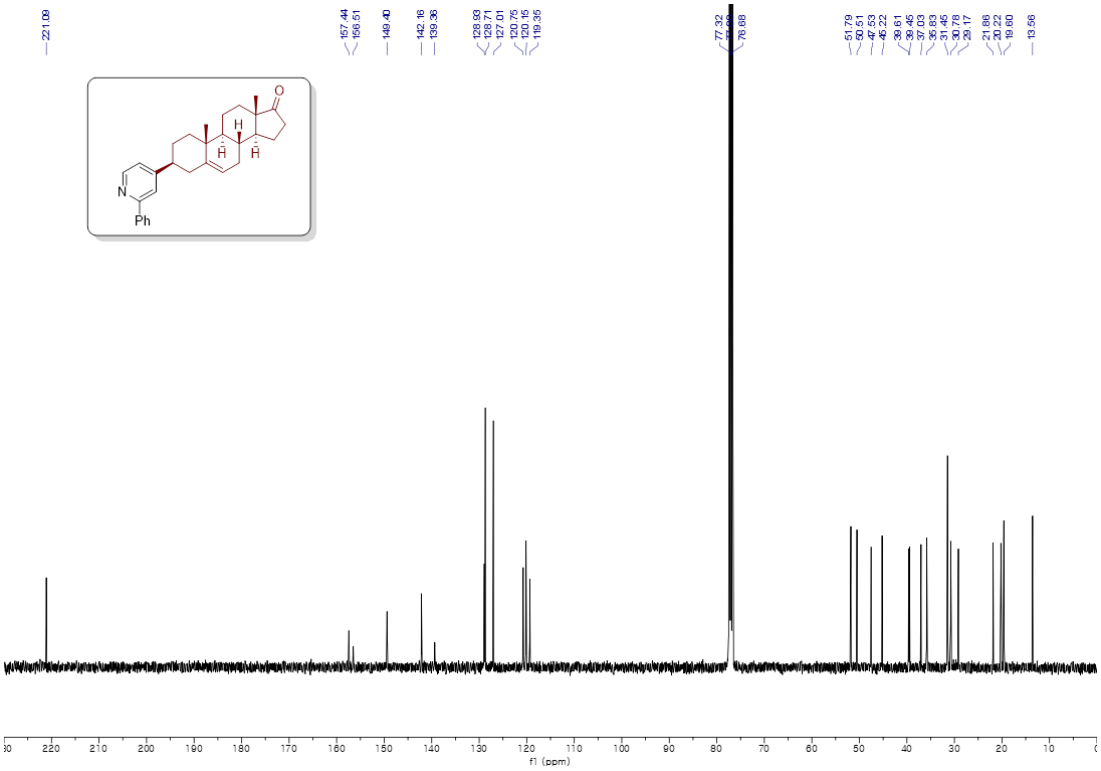


100 MHz, ^{13}C NMR in $CDCl_3$

(3S,8R,9S,10R,13S,14S)-10,13-dimethyl-3-(2-phenylpyridin-4-yl)-1,2,3,4,7,8,9,10,11,12,13,14,15,16-tetradecahydro-17H-cyclopenta[a]phenanthren-17-one (5a').

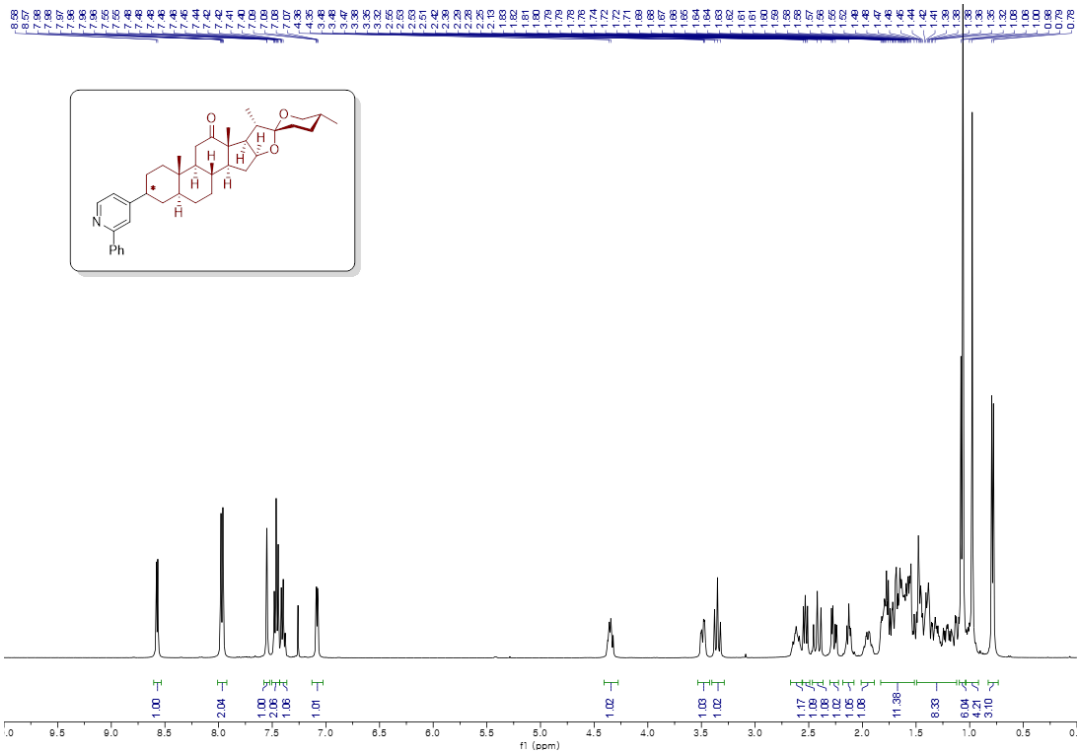


600 MHz, ^{1}H NMR in $CDCl_3$

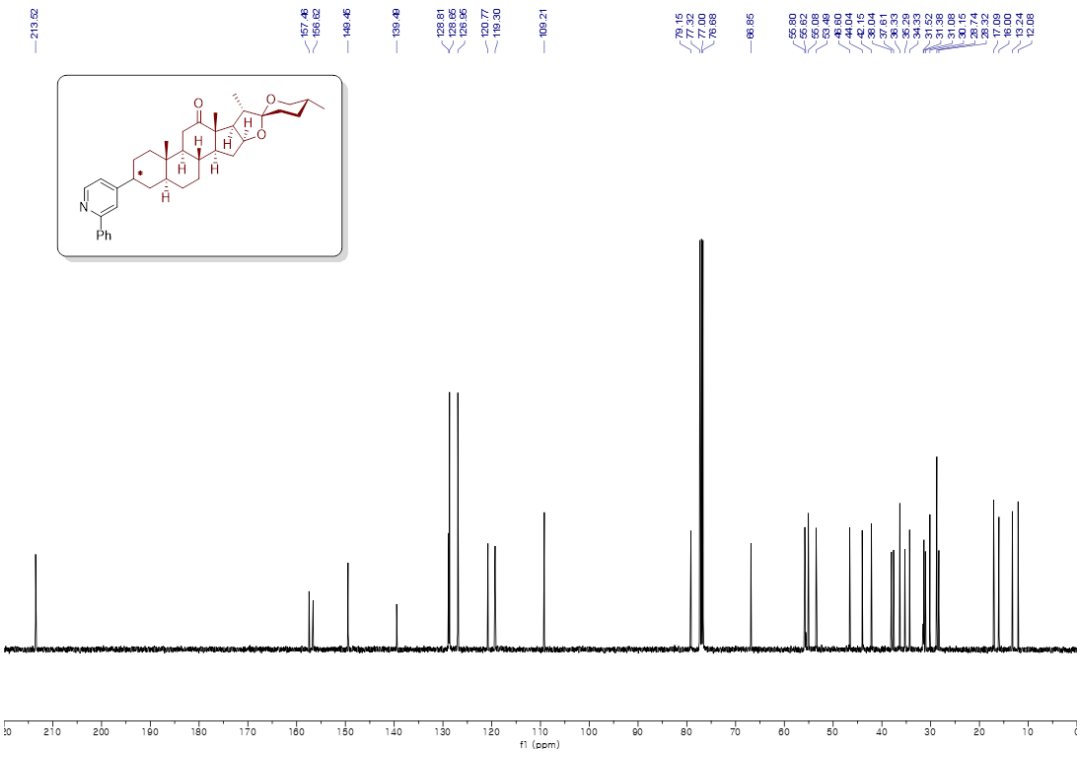


100 MHz, ^{13}C NMR in $CDCl_3$

(2aS,5'R,6aS,6bS,8aS,8bR,9S,10R,11aS,12aS,12bR)-5',6a,8a,9-tetramethyl-4-(2-phenylpyridin-4-yl)icosahydro-4l3-spiro[naphtho[6',5':4,5]indeno[2,1-b]furan-10,2'-pyran]-8(2H)-one (5b).

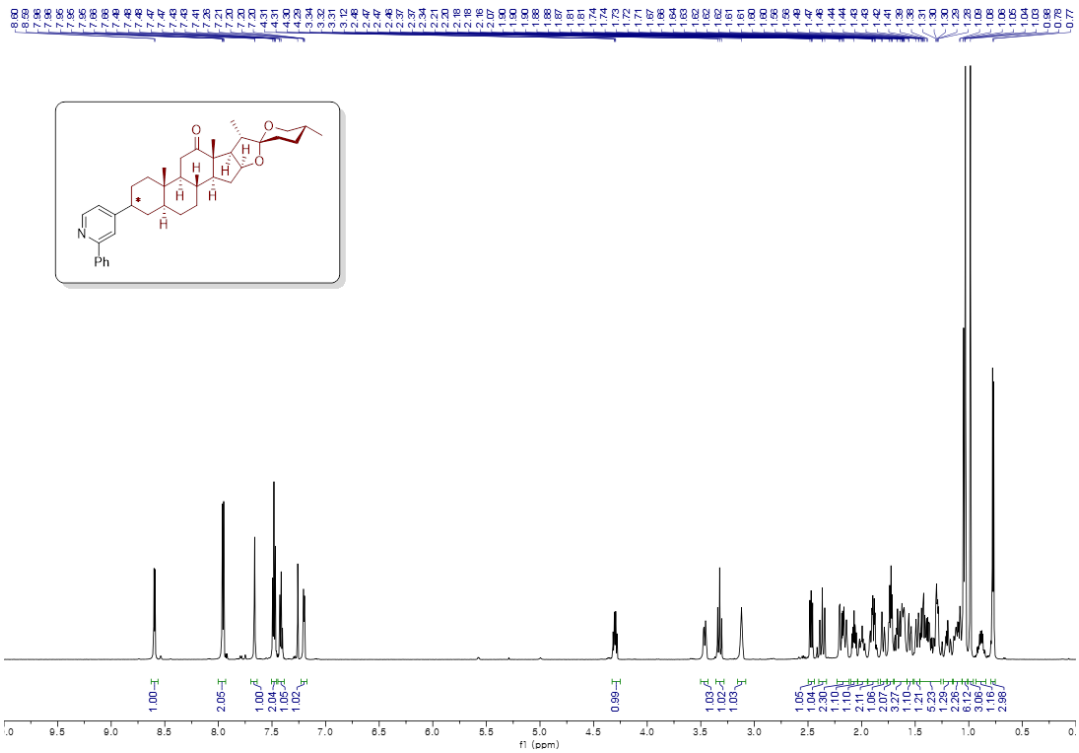


400 MHz, ^{1}H NMR in $CDCl_3$

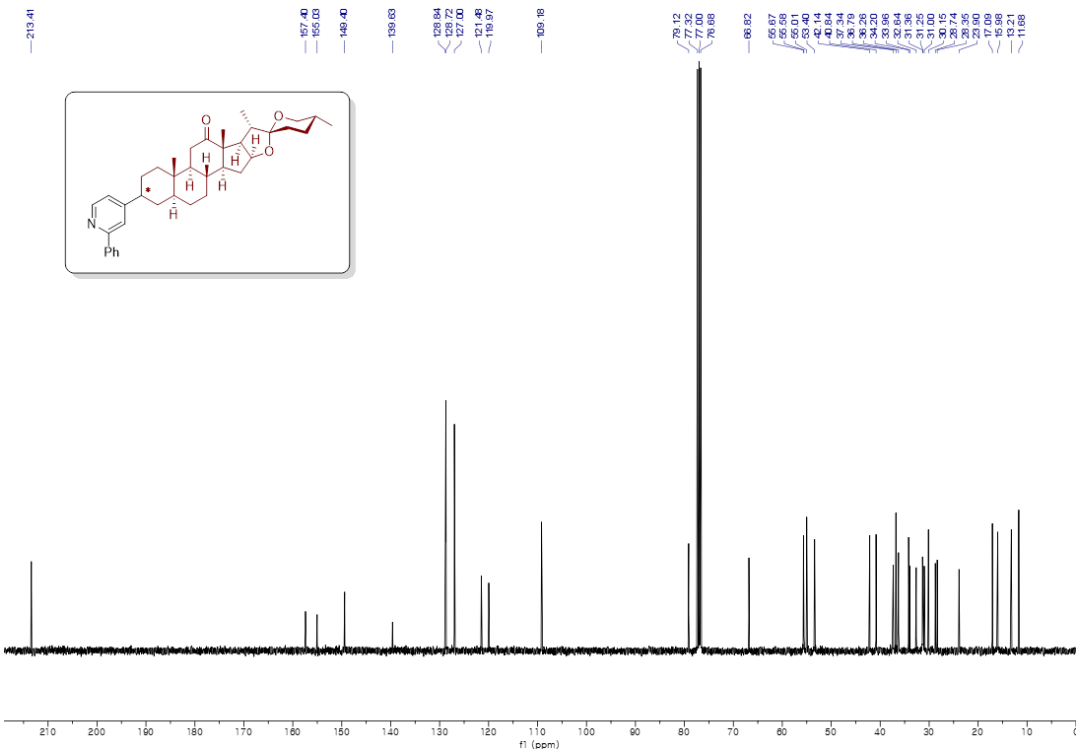


100 MHz, ^{13}C NMR in $CDCl_3$

(2aS,5'R,6aS,6bS,8aS,8bR,9S,10R,11aS,12aS,12bR)-5',6a,8a,9-tetramethyl-4-(2-phenylpyridin-4-yl)icosahydro-4l3-spiro[naphtho[6',5':4,5]indeno[2,1-b]furan-10,2'-pyran]-8(2H)-one (5b').

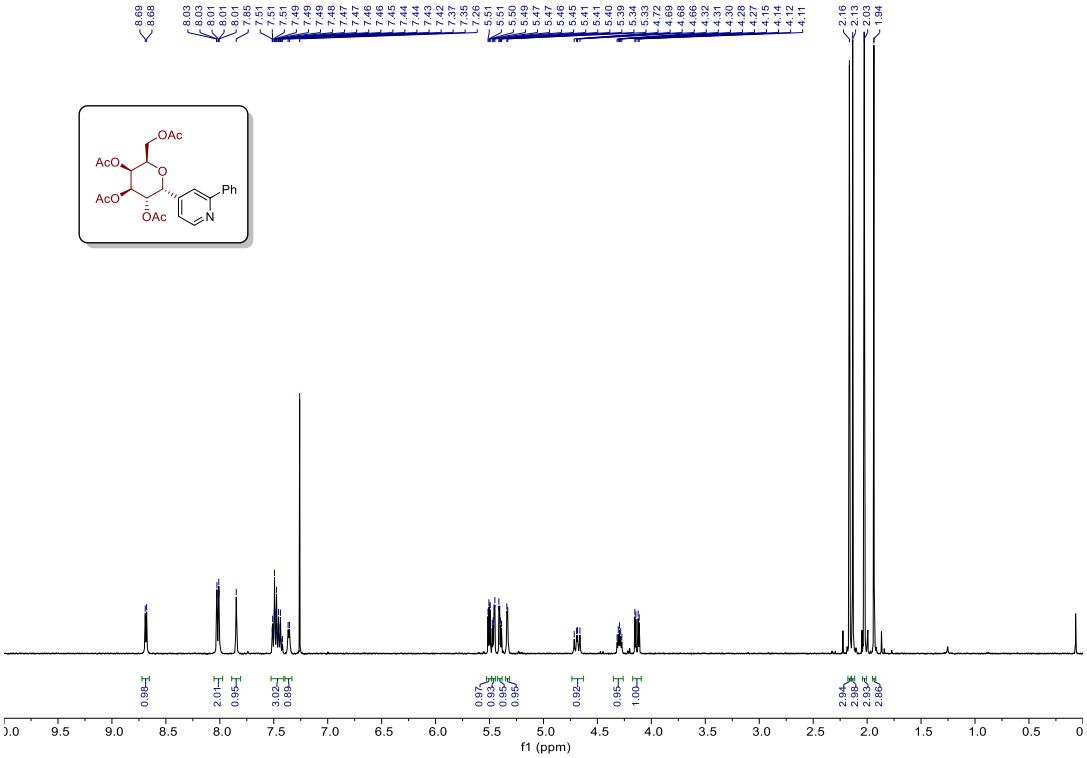


400 MHz, ^{1}H NMR in $CDCl_3$

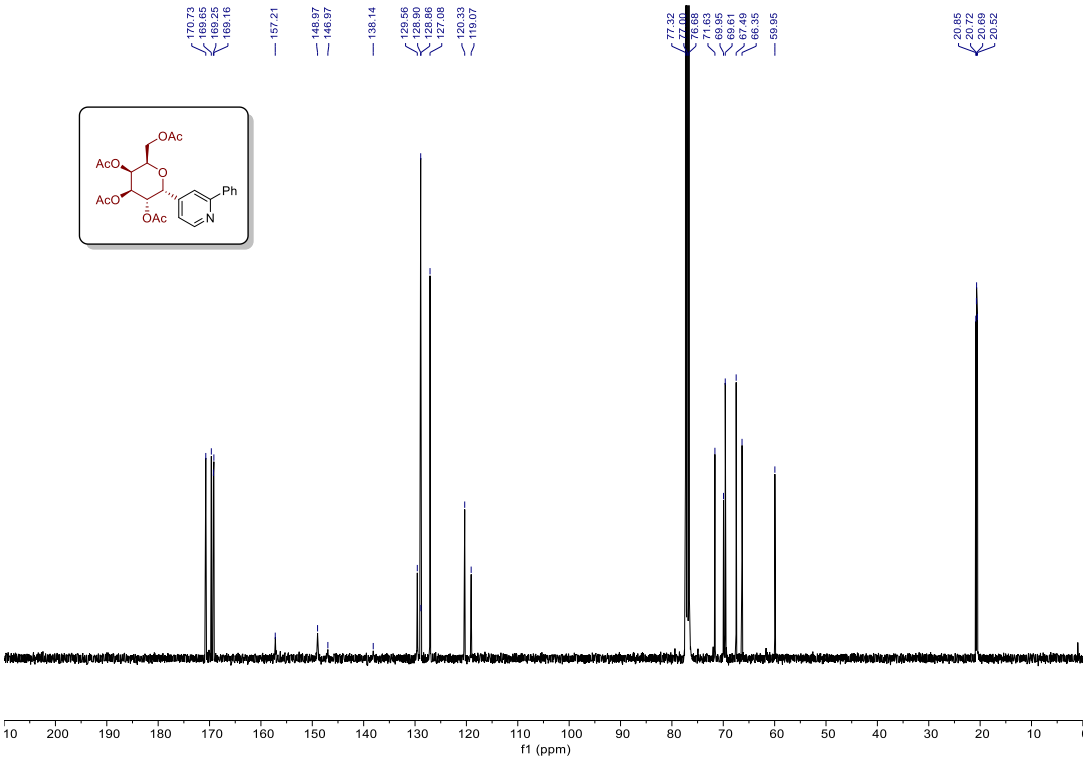


100 MHz, ^{13}C NMR in $CDCl_3$

(2R,3S,4R,5S,6R)-2-(acetoxymethyl)-6-(2-phenylpyridin-4-yl)tetrahydro-2H-pyran-3,4,5-triyl triacetate (5c).

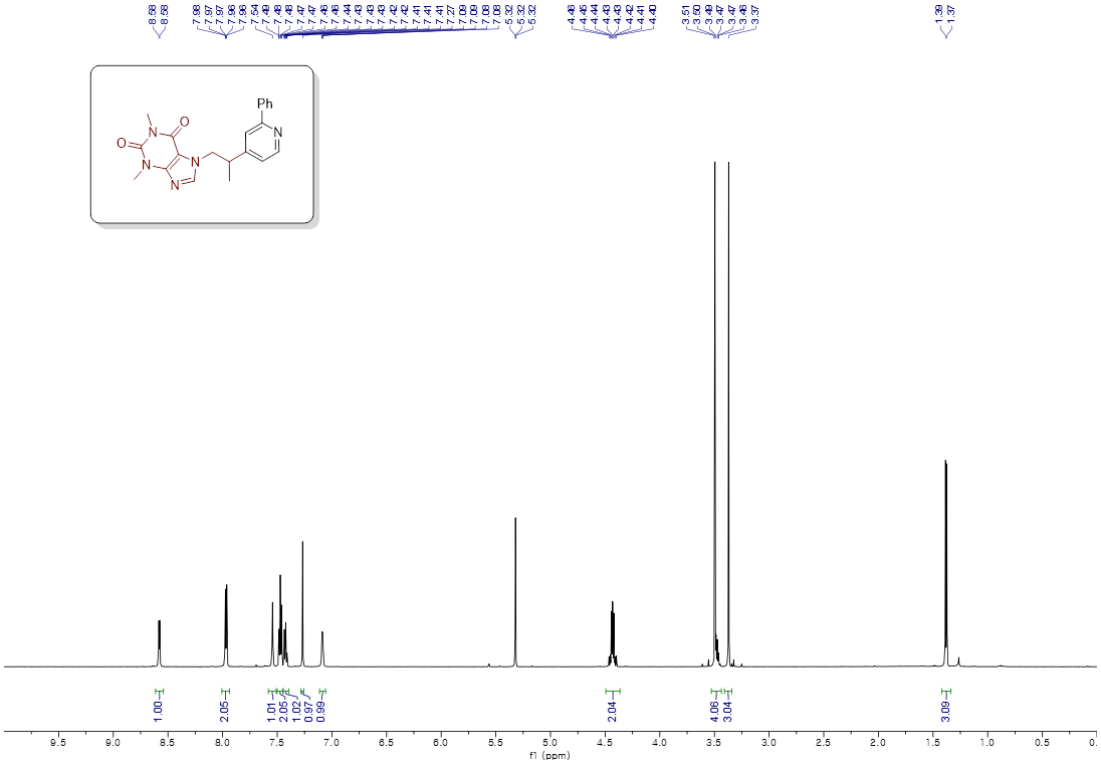


400 MHz, ^{1}H NMR in $CDCl_3$

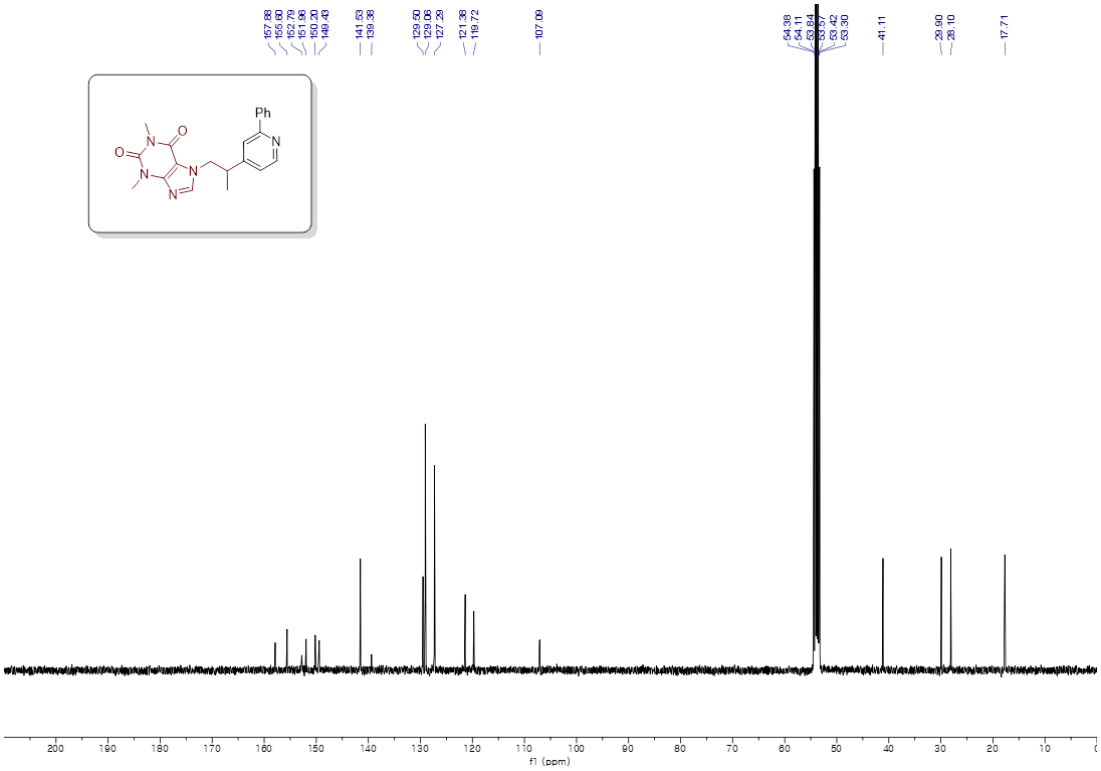


100 MHz, ^{13}C NMR in $CDCl_3$

1,3-dimethyl-7-(2-(2-phenylpyridin-4-yl)propyl)-3,7-dihydro-1H-purine-2,6-dione (5d).

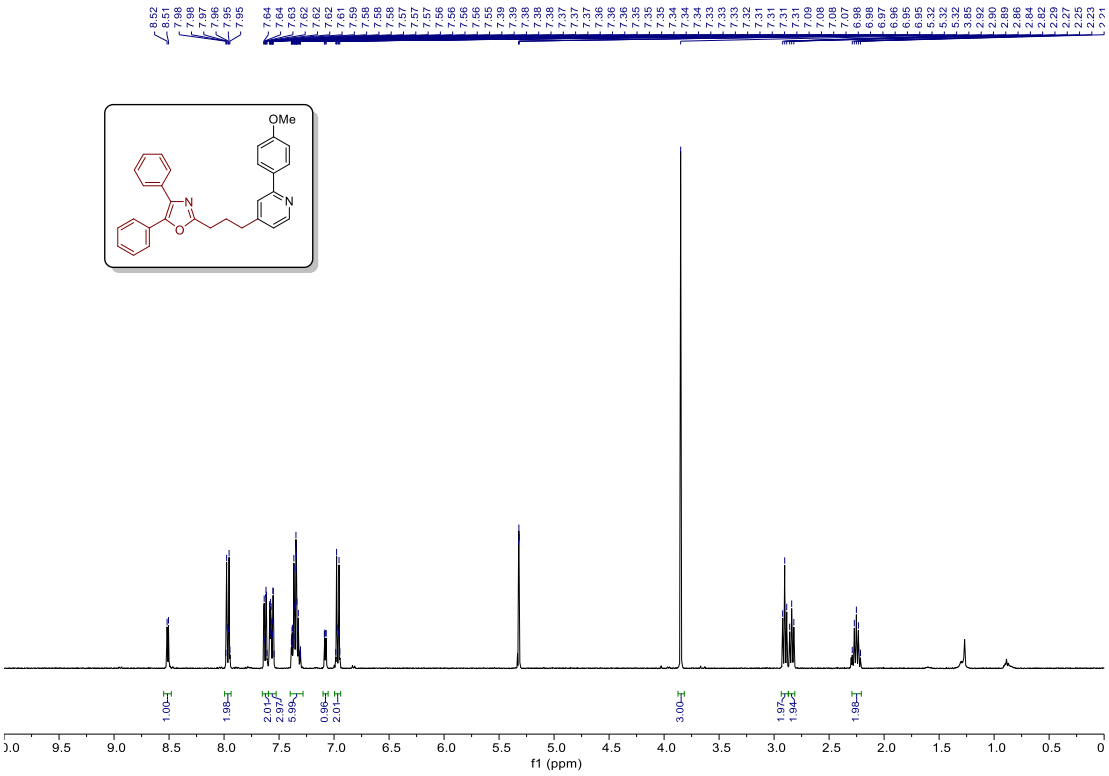


600 MHz, ^{1}H NMR in CD_2Cl_2

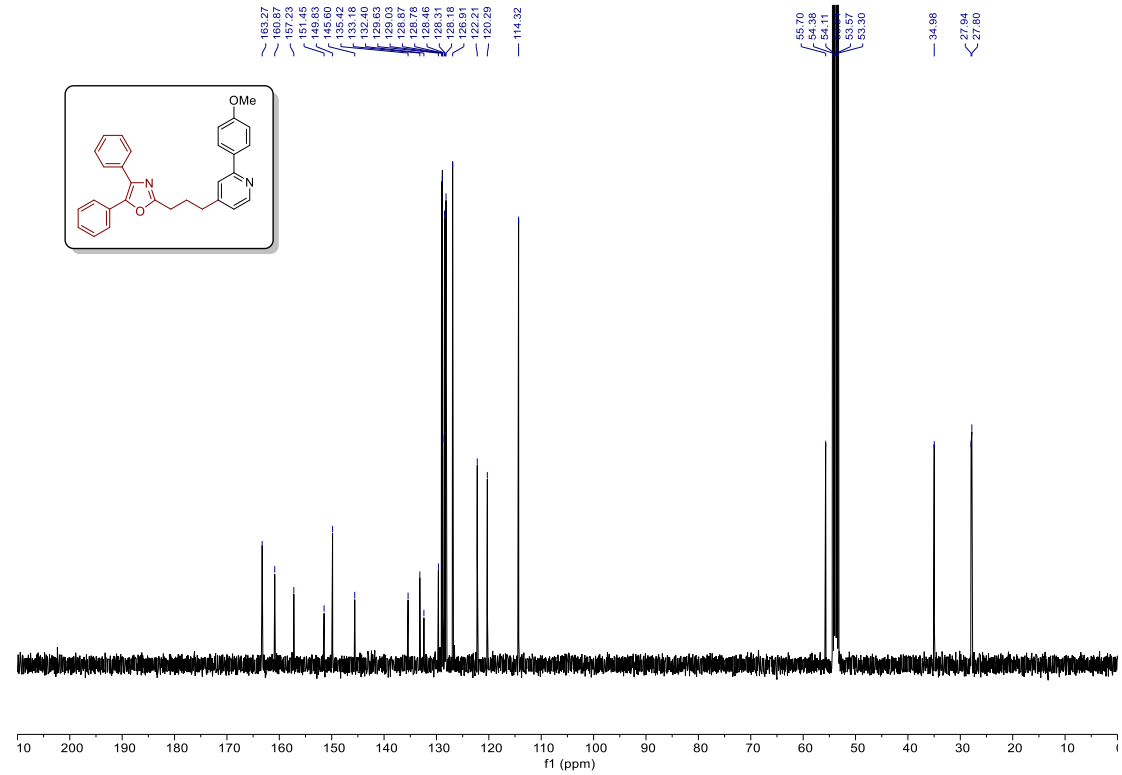


100 MHz, ^{13}C NMR in CD_2Cl_2

2-(3-(2-(4-methoxyphenyl)pyridin-4-yl)propyl)-4,5-diphenyloxazole (5e).

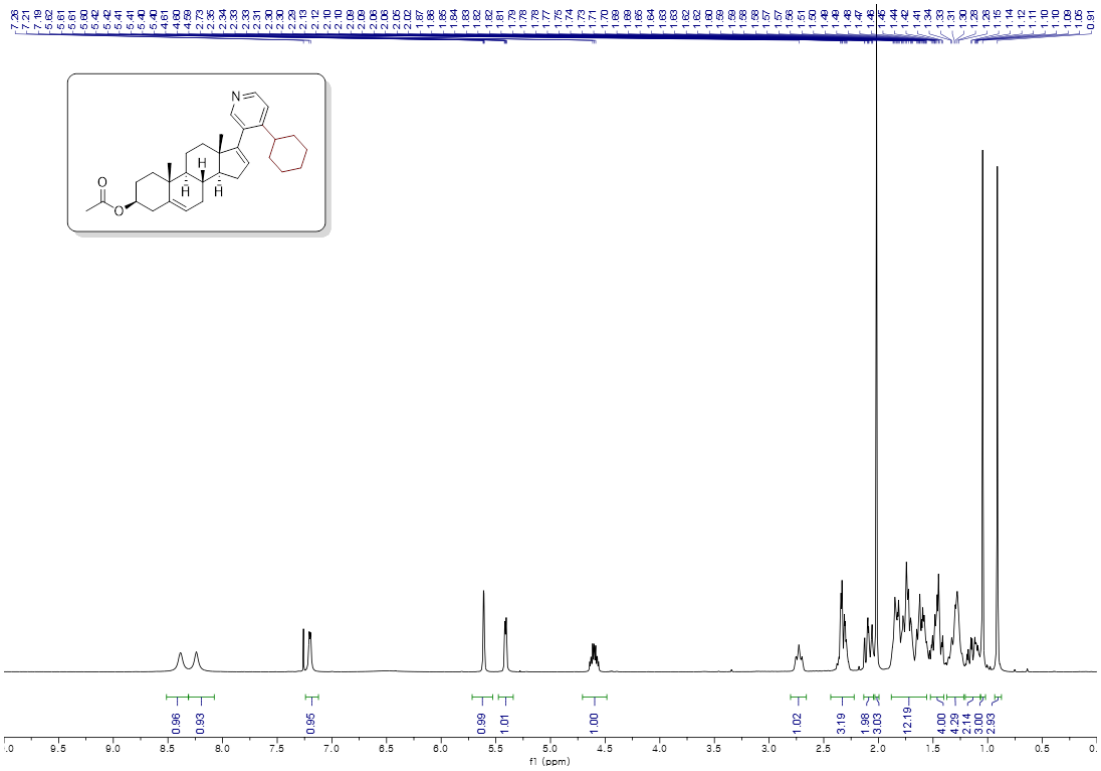


400 MHz, ^{1}H NMR in CD_2Cl_2

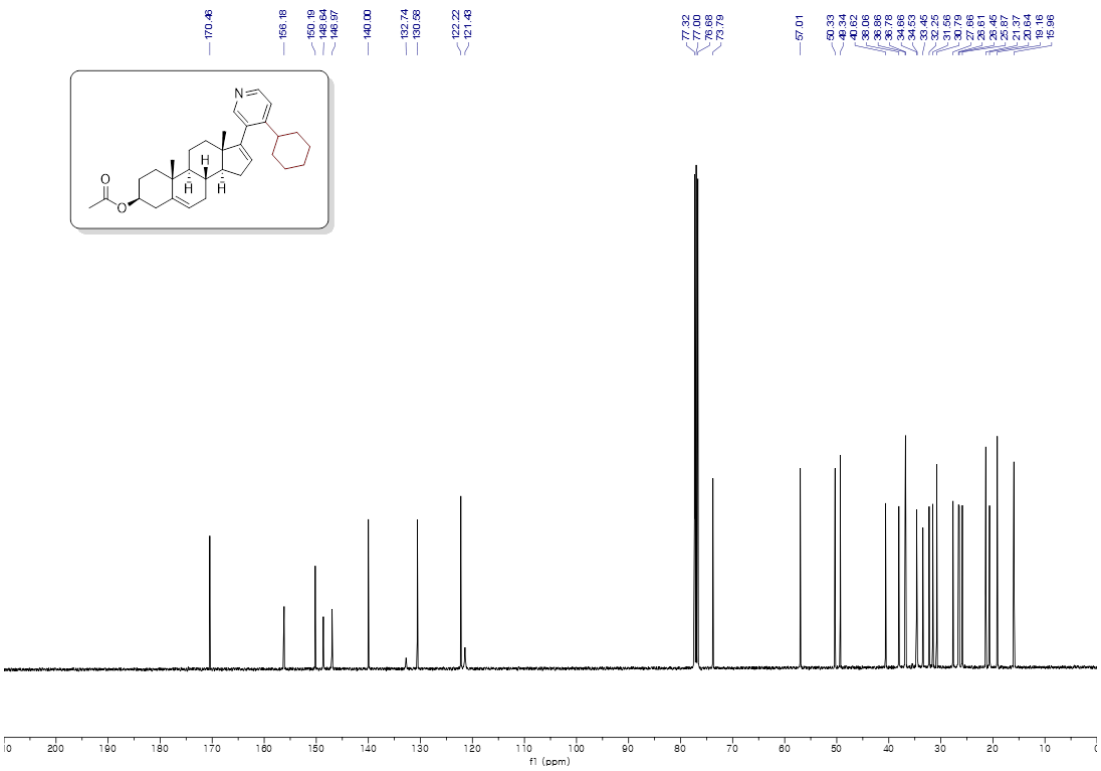


100 MHz, ^{13}C NMR in CD_2Cl_2

(3S,8R,9S,10R,13S,14S)-17-(4-cyclohexylpyridin-3-yl)-10,13-dimethyl-2,3,4,7,8,9,10,11,12,13,14,15-dodecahydro-1H-cyclopenta[a]phenanthren-3-yl acetate (5f).

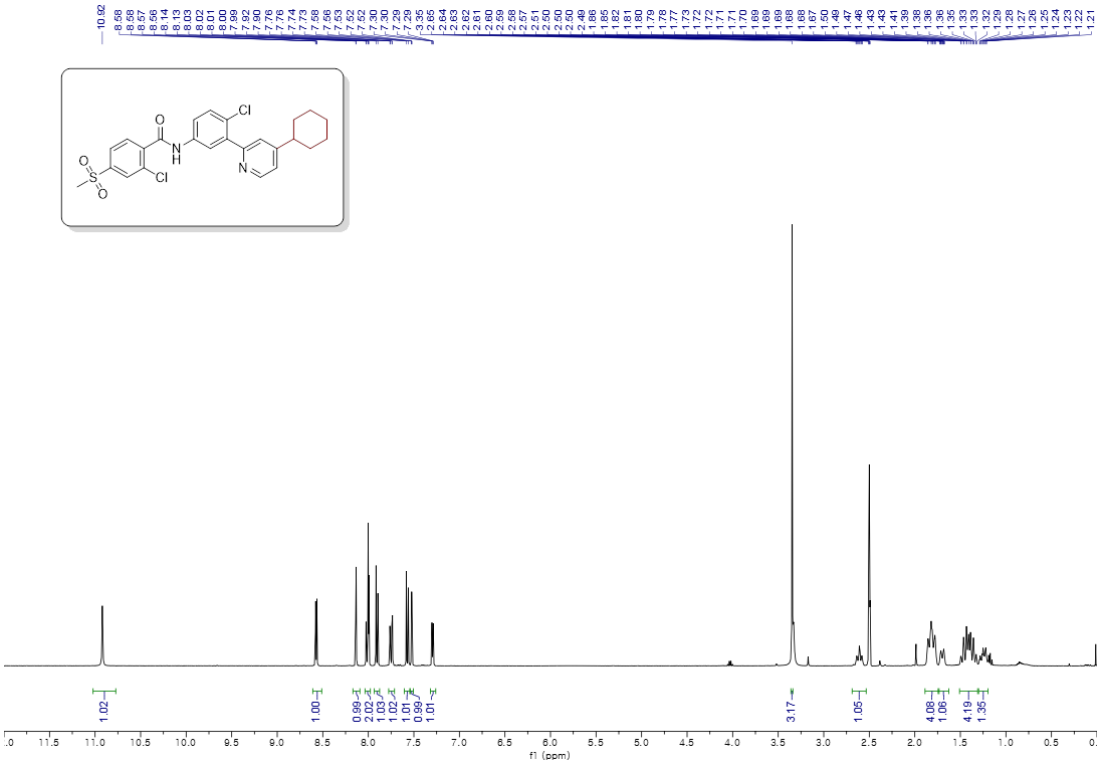


400 MHz, ^{1}H NMR in $CDCl_3$

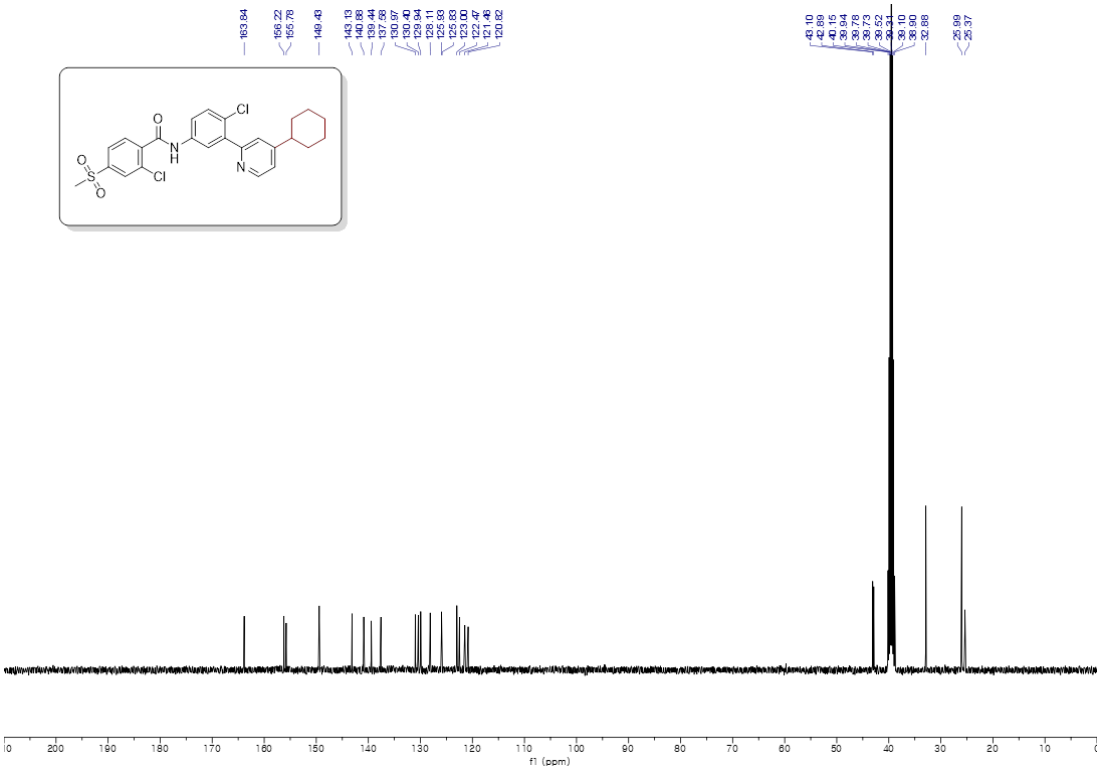


100 MHz, ^{13}C NMR in $CDCl_3$

2-chloro-N-(4-chloro-3-(4-cyclohexylpyridin-2-yl)phenyl)-4-(methylsulfonyl)benzamide (5g).

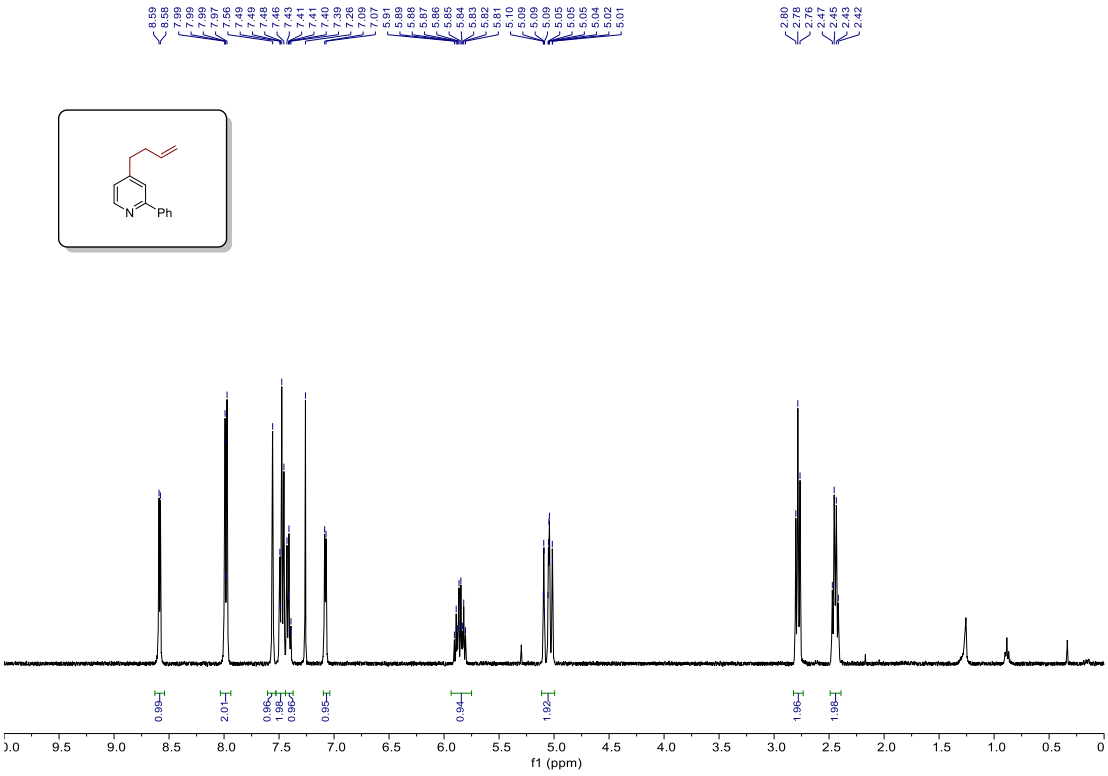


400 MHz, ^{1}H NMR in DMSO-*d*$_6$

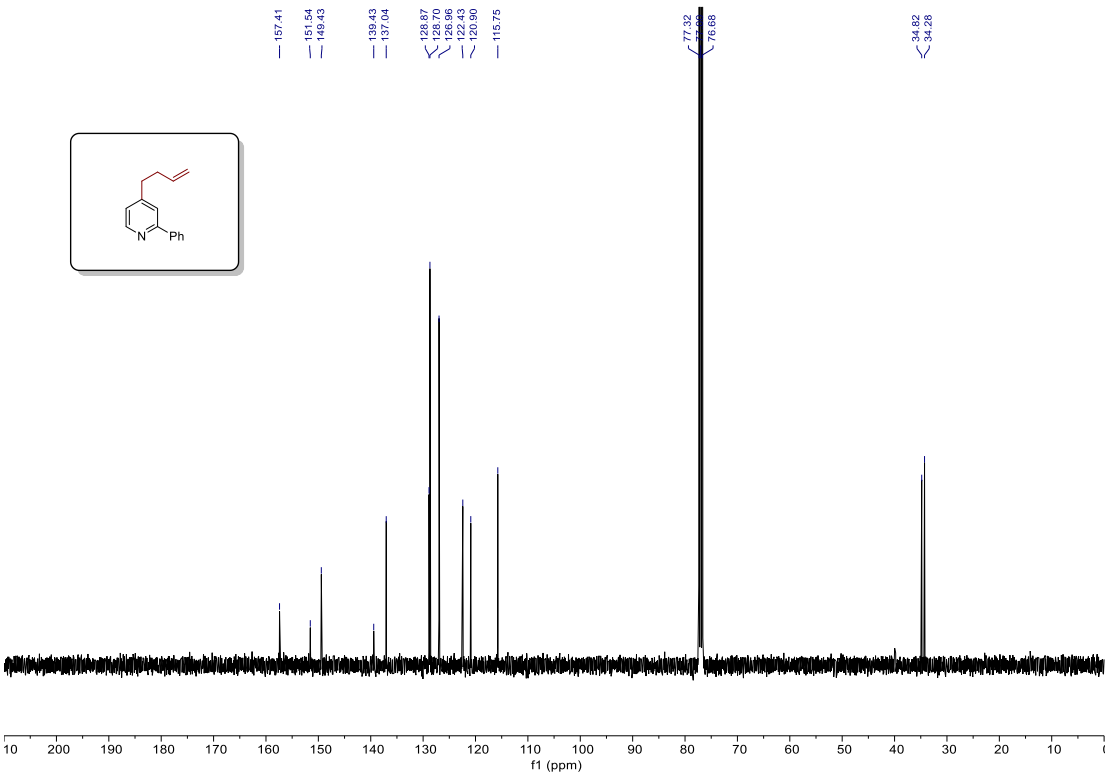


100 MHz, ^{13}C NMR in DMSO-*d*$_6$

4-(but-3-en-1-yl)-2-phenylpyridine (6).

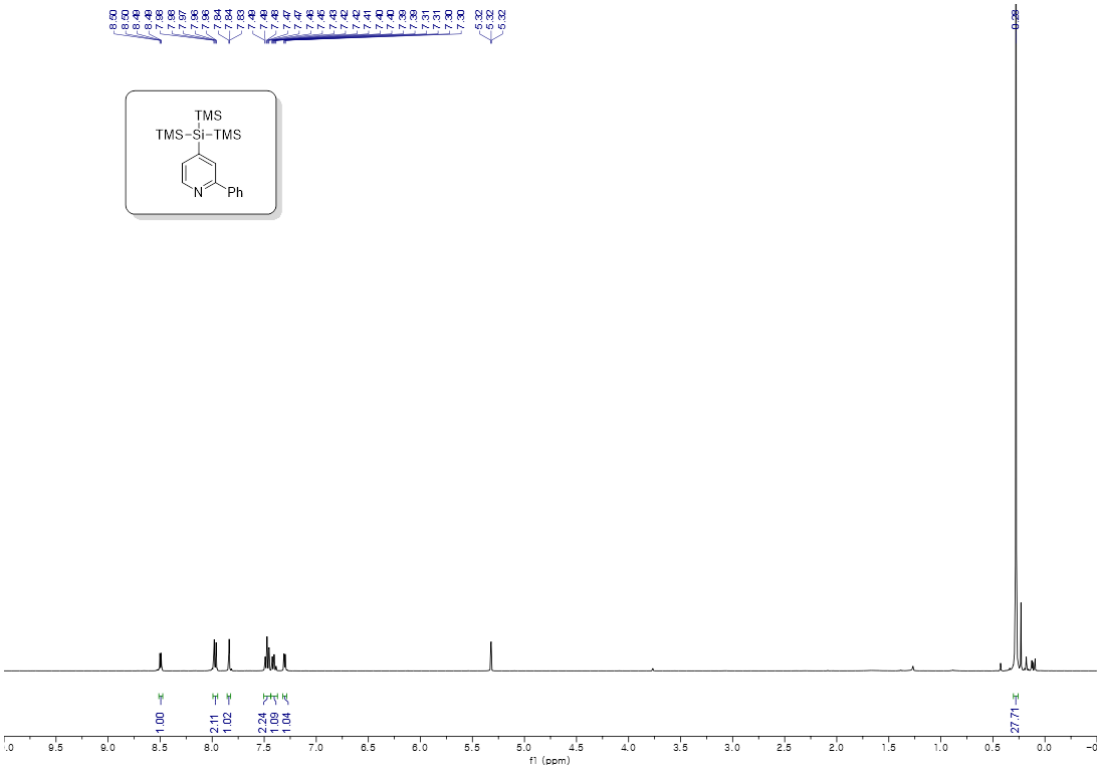


400 MHz, ^{1}H NMR in $CDCl_3$

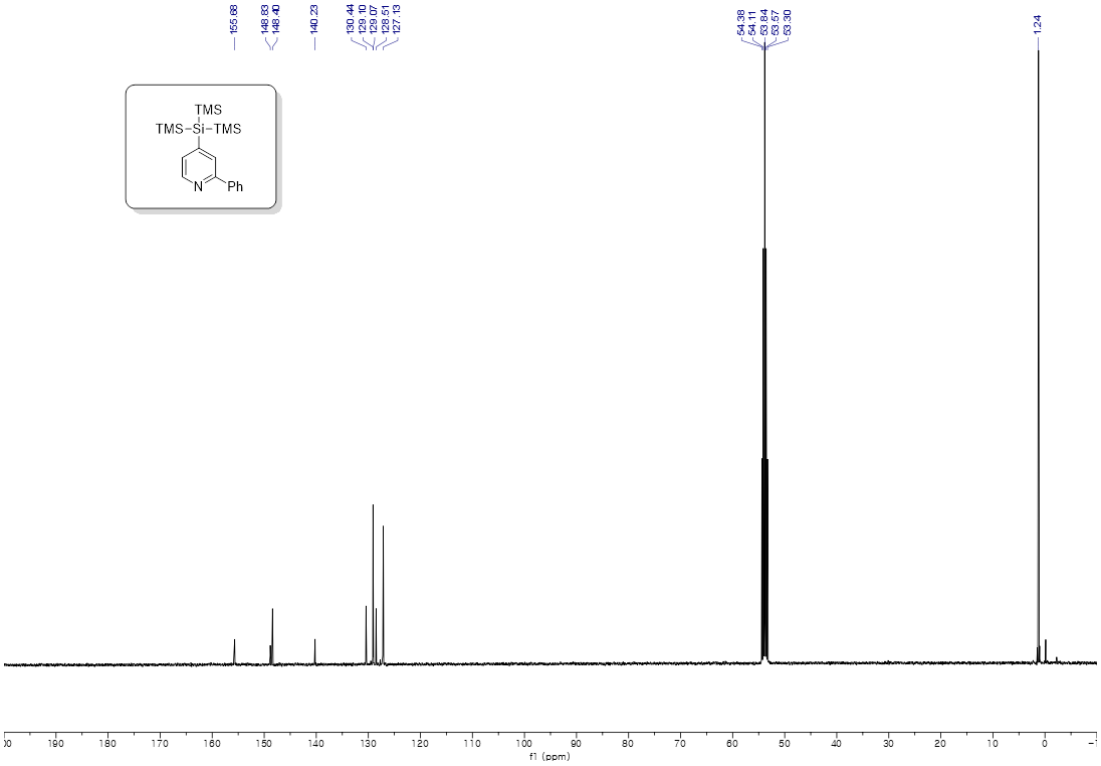


100 MHz, ^{13}C NMR in $CDCl_3$

4-(1,1,1,3,3,3-hexamethyl-2-(trimethylsilyl)trisilan-2-yl)-2-phenylpyridine (7).

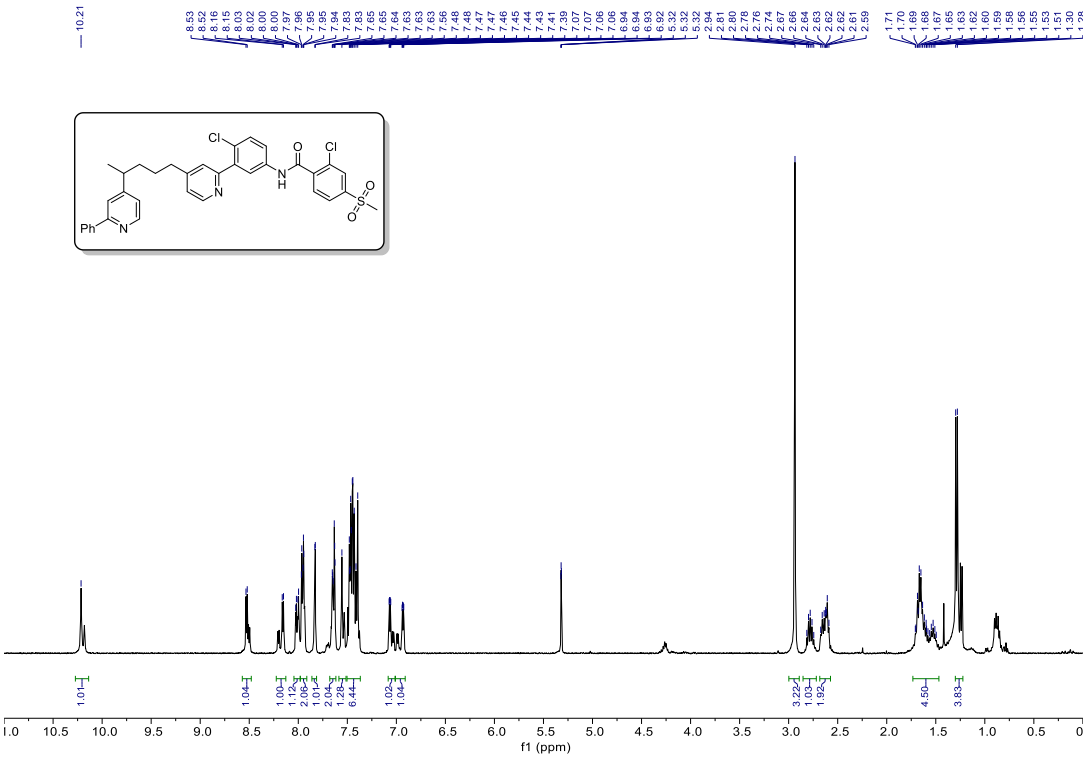


400 MHz, ^{1}H NMR in CD_2Cl_2

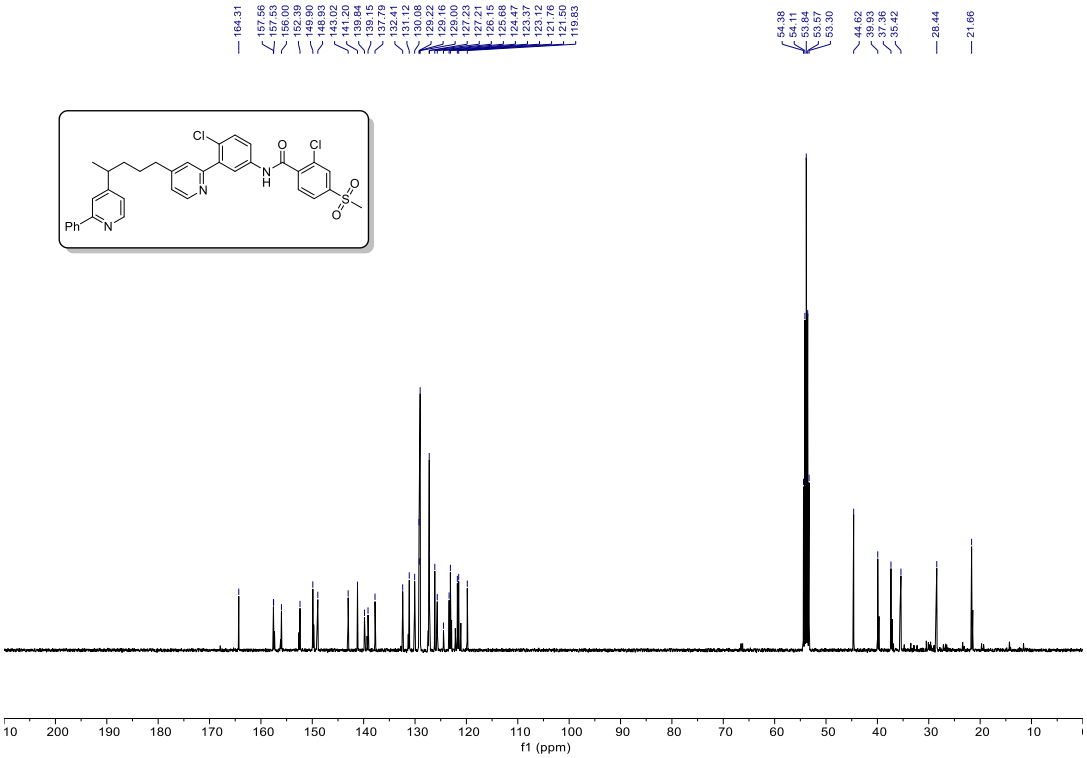


100 MHz, ^{13}C NMR in CD_2Cl_2

2-chloro-N-(4-chloro-3-(4-(4-(2-phenylpyridin-4-yl)pentyl)pyridin-2-yl)phenyl)-4-(methylsulfonyl)benzamide (9).



400 MHz, ^{1}H NMR in CD_2Cl_2

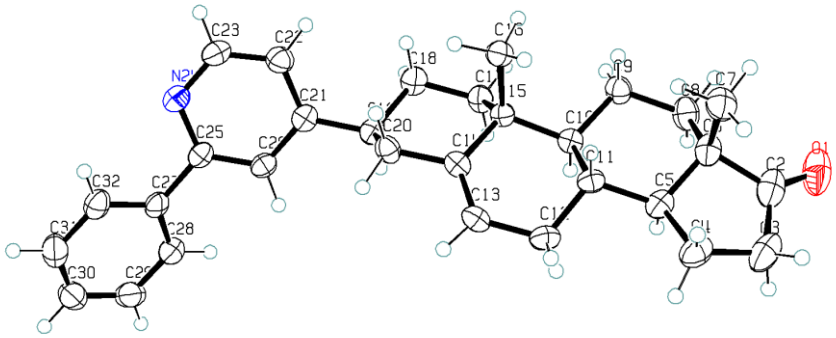


100 MHz, ^{13}C NMR in CD_2Cl_2

Appendix II

Crystallographic Data for 5a’

Crystallographic Data for 5a' (CCDC : 1994429)



ORTEP representation (50% probability) of the crystal structure of **5a'**

Table 1. Crystal data and structure refinement for **5a'**.

Empirical formula	$C_{30}H_{35}NO$	
Formula weight	425.59	
Temperature	173(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	$P2_1$	
Unit cell dimensions	a = 7.1881(4) Å	α = 90°
	b = 10.9074(5) Å	β = 100.9027(16)°
	c = 15.1088(7) Å	γ = 90°
Volume	1163.20(10) $Å^3$	
Z	2	
Density (calculated)	1.215 Mg/m^3	
Absorption coefficient	0.072 mm^{-1}	
F(000)	460	
Crystal size	0.870 x 0.307 x 0.047 mm^3	
Theta range for data collection	3.736 to 27.503°.	
Index ranges	–9<=h<=9, –14<=k<=14, –19<=l<=19	
Reflections collected	22138	
Independent reflections	5292 [R(int) = 0.0450]	
Completeness to theta = 25.242°	99.1 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7456 and 0.7081	
Refinement method	Full-matrix least-squares on F^2	

Data / restraints / parameters	5292 / 1 / 291
Goodness-of-fit on F^2	1.043
Final R indices [I>2sigma(I)]	R1 = 0.0440, wR2 = 0.0859
R indices (all data)	R1 = 0.0564, wR2 = 0.0914
Absolute structure parameter	-0.6(8)
Largest diff. peak and hole	0.193 and –0.187 e·Å^{-3}

Table 2. Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters ($Å^2$ x 10^3) for **5a'**. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
O(1)	15657(3)	3402(3)	9690(1)	66(1)
C(2)	13984(4)	3178(3)	9480(2)	47(1)
C(3)	13078(5)	1921(3)	9510(2)	55(1)
C(4)	10944(4)	2109(3)	9181(2)	44(1)
C(5)	10912(3)	3257(2)	8592(2)	32(1)
C(6)	12403(3)	4098(2)	9140(2)	36(1)
C(7)	11812(4)	4609(3)	10000(2)	44(1)
C(8)	12879(4)	5115(3)	8536(2)	41(1)
C(9)	11063(3)	5799(2)	8103(2)	35(1)
C(10)	9483(3)	4963(2)	7604(2)	28(1)
C(11)	9047(3)	3895(2)	8210(2)	28(1)
C(12)	7639(4)	3003(2)	7676(2)	35(1)
C(13)	6044(3)	3638(2)	7073(2)	33(1)
C(14)	6021(3)	4819(2)	6864(2)	29(1)
C(15)	7668(3)	5691(2)	7183(2)	27(1)
C(16)	7092(3)	6596(2)	7870(2)	35(1)
C(17)	8041(3)	6414(2)	6347(2)	33(1)
C(18)	6279(3)	7043(2)	5811(2)	36(1)
C(19)	4724(3)	6103(2)	5478(2)	31(1)
C(20)	4281(3)	5376(2)	6287(2)	33(1)
C(21)	2885(3)	6619(2)	4963(2)	31(1)
C(22)	2168(4)	7755(2)	5154(2)	38(1)
C(23)	372(4)	8086(2)	4716(2)	39(1)
N(24)	-769(3)	7398(2)	4120(1)	35(1)
C(25)	-78(3)	6304(2)	3921(2)	30(1)
C(26)	1721(3)	5902(2)	4327(2)	31(1)
C(27)	-1349(3)	5545(2)	3246(2)	31(1)
C(28)	-639(4)	4778(2)	2655(2)	39(1)
C(29)	-1844(4)	4106(2)	2007(2)	45(1)
C(30)	-3776(4)	4168(3)	1959(2)	46(1)
C(31)	-4499(4)	4917(3)	2545(2)	47(1)
C(32)	-3306(4)	5608(2)	3182(2)	38(1)

Table 3. Bond lengths [Å] and angles [°] for **5a'**.

O(1)-C(2)	1.210(4)
C(2)-C(3)	1.522(5)
C(2)-C(6)	1.529(4)
C(3)-C(4)	1.534(4)
C(3)-H(3A)	0.9900
C(3)-H(3AB)	0.9900
C(4)-C(5)	1.533(4)
C(4)-H(4A)	0.9900
C(4)-H(4AB)	0.9900
C(5)-C(11)	1.524(3)
C(5)-C(6)	1.529(4)
C(5)-H(5)	1.0000
C(6)-C(8)	1.517(4)
C(6)-C(7)	1.545(3)
C(7)-H(7A)	0.9800
C(7)-H(7B)	0.9800
C(7)-H(7C)	0.9800
C(8)-C(9)	1.537(3)
C(8)-H(8A)	0.9900
C(8)-H(8AB)	0.9900
C(9)-C(10)	1.538(3)
C(9)-H(9A)	0.9900
C(9)-H(9AB)	0.9900
C(10)-C(11)	1.549(3)
C(10)-C(15)	1.557(3)
C(10)-H(10)	1.0000
C(11)-C(12)	1.520(3)
C(11)-H(11)	1.0000
C(12)-C(13)	1.493(3)
C(12)-H(12A)	0.9900
C(12)-H(12B)	0.9900
C(13)-C(14)	1.326(3)
C(13)-H(13)	0.9500
C(14)-C(20)	1.511(3)
C(14)-C(15)	1.524(3)

C(15)-C(16)	1.545(3)
C(15)-C(17)	1.554(3)
C(16)-H(16A)	0.9800
C(16)-H(16B)	0.9800
C(16)-H(16C)	0.9800
C(17)-C(18)	1.530(3)
C(17)-H(17A)	0.9900
C(17)-H(17B)	0.9900
C(18)-C(19)	1.530(3)
C(18)-H(18A)	0.9900
C(18)-H(18B)	0.9900
C(19)-C(21)	1.510(3)
C(19)-C(20)	1.540(3)
C(19)-H(19)	1.0000
C(20)-H(20A)	0.9900
C(20)-H(20B)	0.9900
C(21)-C(26)	1.389(3)
C(21)-C(22)	1.393(3)
C(22)-C(23)	1.382(4)
C(22)-H(22)	0.9500
C(23)-N(24)	1.329(3)
C(23)-H(23)	0.9500
N(24)-C(25)	1.349(3)
C(25)-C(26)	1.393(3)
C(25)-C(27)	1.486(3)
C(26)-H(26)	0.9500
C(27)-C(28)	1.389(3)
C(27)-C(32)	1.393(3)
C(28)-C(29)	1.388(4)
C(28)-H(28)	0.9500
C(29)-C(30)	1.378(4)
C(29)-H(29)	0.9500
C(30)-C(31)	1.377(4)
C(30)-H(30)	0.9500
C(31)-C(32)	1.385(4)
C(31)-H(31)	0.9500
C(32)-H(32)	0.9500

O(1)-C(2)-C(3)	125.7(3)
O(1)-C(2)-C(6)	126.5(3)
C(3)-C(2)-C(6)	107.8(2)
C(2)-C(3)-C(4)	106.1(2)
C(2)-C(3)-H(3A)	110.5
C(4)-C(3)-H(3A)	110.5
C(2)-C(3)-H(3AB)	110.5
C(4)-C(3)-H(3AB)	110.5
H(3A)-C(3)-H(3AB)	108.7
C(5)-C(4)-C(3)	101.6(2)
C(5)-C(4)-H(4A)	111.4
C(3)-C(4)-H(4A)	111.4
C(5)-C(4)-H(4AB)	111.4
C(3)-C(4)-H(4AB)	111.4
H(4A)-C(4)-H(4AB)	109.3
C(11)-C(5)-C(6)	114.1(2)
C(11)-C(5)-C(4)	120.6(2)
C(6)-C(5)-C(4)	104.1(2)
C(11)-C(5)-H(5)	105.6
C(6)-C(5)-H(5)	105.6
C(4)-C(5)-H(5)	105.6
C(8)-C(6)-C(5)	109.1(2)
C(8)-C(6)-C(2)	116.4(2)
C(5)-C(6)-C(2)	100.9(2)
C(8)-C(6)-C(7)	111.8(2)
C(5)-C(6)-C(7)	113.3(2)
C(2)-C(6)-C(7)	105.0(2)
C(6)-C(7)-H(7A)	109.5
C(6)-C(7)-H(7B)	109.5
H(7A)-C(7)-H(7B)	109.5
C(6)-C(7)-H(7C)	109.5
H(7A)-C(7)-H(7C)	109.5
H(7B)-C(7)-H(7C)	109.5
C(6)-C(8)-C(9)	109.9(2)
C(6)-C(8)-H(8A)	109.7
C(9)-C(8)-H(8A)	109.7

C(6)-C(8)-H(8AB)	109.7
C(9)-C(8)-H(8AB)	109.7
H(8A)-C(8)-H(8AB)	108.2
C(8)-C(9)-C(10)	114.2(2)
C(8)-C(9)-H(9A)	108.7
C(10)-C(9)-H(9A)	108.7
C(8)-C(9)-H(9AB)	108.7
C(10)-C(9)-H(9AB)	108.7
H(9A)-C(9)-H(9AB)	107.6
C(9)-C(10)-C(11)	111.68(19)
C(9)-C(10)-C(15)	112.47(18)
C(11)-C(10)-C(15)	112.20(18)
C(9)-C(10)-H(10)	106.7
C(11)-C(10)-H(10)	106.7
C(15)-C(10)-H(10)	106.7
C(12)-C(11)-C(5)	111.02(19)
C(12)-C(11)-C(10)	110.87(18)
C(5)-C(11)-C(10)	107.80(18)
C(12)-C(11)-H(11)	109.0
C(5)-C(11)-H(11)	109.0
C(10)-C(11)-H(11)	109.0
C(13)-C(12)-C(11)	112.62(19)
C(13)-C(12)-H(12A)	109.1
C(11)-C(12)-H(12A)	109.1
C(13)-C(12)-H(12B)	109.1
C(11)-C(12)-H(12B)	109.1
H(12A)-C(12)-H(12B)	107.8
C(14)-C(13)-C(12)	124.7(2)
C(14)-C(13)-H(13)	117.7
C(12)-C(13)-H(13)	117.7
C(13)-C(14)-C(20)	120.0(2)
C(13)-C(14)-C(15)	123.9(2)
C(20)-C(14)-C(15)	116.10(19)
C(14)-C(15)-C(16)	108.68(18)
C(14)-C(15)-C(17)	107.61(18)
C(16)-C(15)-C(17)	109.35(19)
C(14)-C(15)-C(10)	110.58(18)

C(16)-C(15)-C(10)	111.18(18)
C(17)-C(15)-C(10)	109.35(17)
C(15)-C(16)-H(16A)	109.5
C(15)-C(16)-H(16B)	109.5
H(16A)-C(16)-H(16B)	109.5
C(15)-C(16)-H(16C)	109.5
H(16A)-C(16)-H(16C)	109.5
H(16B)-C(16)-H(16C)	109.5
C(18)-C(17)-C(15)	113.89(19)
C(18)-C(17)-H(17A)	108.8
C(15)-C(17)-H(17A)	108.8
C(18)-C(17)-H(17B)	108.8
C(15)-C(17)-H(17B)	108.8
H(17A)-C(17)-H(17B)	107.7
C(19)-C(18)-C(17)	110.7(2)
C(19)-C(18)-H(18A)	109.5
C(17)-C(18)-H(18A)	109.5
C(19)-C(18)-H(18B)	109.5
C(17)-C(18)-H(18B)	109.5
H(18A)-C(18)-H(18B)	108.1
C(21)-C(19)-C(18)	115.7(2)
C(21)-C(19)-C(20)	107.99(18)
C(18)-C(19)-C(20)	109.38(18)
C(21)-C(19)-H(19)	107.8
C(18)-C(19)-H(19)	107.8
C(20)-C(19)-H(19)	107.8
C(14)-C(20)-C(19)	113.10(19)
C(14)-C(20)-H(20A)	109.0
C(19)-C(20)-H(20A)	109.0
C(14)-C(20)-H(20B)	109.0
C(19)-C(20)-H(20B)	109.0
H(20A)-C(20)-H(20B)	107.8
C(26)-C(21)-C(22)	116.5(2)
C(26)-C(21)-C(19)	120.0(2)
C(22)-C(21)-C(19)	123.1(2)
C(23)-C(22)-C(21)	118.8(2)
C(23)-C(22)-H(22)	120.6

C(21)-C(22)-H(22)	120.6
N(24)-C(23)-C(22)	125.3(2)
N(24)-C(23)-H(23)	117.4
C(22)-C(23)-H(23)	117.4
C(23)-N(24)-C(25)	116.4(2)
N(24)-C(25)-C(26)	122.1(2)
N(24)-C(25)-C(27)	116.2(2)
C(26)-C(25)-C(27)	121.7(2)
C(21)-C(26)-C(25)	121.0(2)
C(21)-C(26)-H(26)	119.5
C(25)-C(26)-H(26)	119.5
C(28)-C(27)-C(32)	118.3(2)
C(28)-C(27)-C(25)	121.5(2)
C(32)-C(27)-C(25)	120.1(2)
C(29)-C(28)-C(27)	121.0(2)
C(29)-C(28)-H(28)	119.5
C(27)-C(28)-H(28)	119.5
C(30)-C(29)-C(28)	119.9(3)
C(30)-C(29)-H(29)	120.0
C(28)-C(29)-H(29)	120.0
C(31)-C(30)-C(29)	119.6(3)
C(31)-C(30)-H(30)	120.2
C(29)-C(30)-H(30)	120.2
C(30)-C(31)-C(32)	120.7(3)
C(30)-C(31)-H(31)	119.6
C(32)-C(31)-H(31)	119.6
C(31)-C(32)-C(27)	120.3(3)
C(31)-C(32)-H(32)	119.8
C(27)-C(32)-H(32)	119.8

Symmetry transformations used to generate equivalent atoms:

Table 4. Anisotropic displacement parameters ($Å^2$ x 10^3) for **5a'**. The anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U^{11} + ... + 2 h k a^* b^* U^{12}]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
O(1)	39(1)	103(2)	54(1)	4(1)	4(1)	24(1)
C(2)	48(2)	71(2)	25(1)	2(1)	11(1)	22(2)
C(3)	66(2)	60(2)	40(2)	13(1)	12(1)	28(2)
C(4)	58(2)	39(1)	37(1)	7(1)	12(1)	10(1)
C(5)	39(1)	37(1)	25(1)	1(1)	13(1)	8(1)
C(6)	32(1)	49(2)	28(1)	1(1)	9(1)	9(1)
C(7)	45(2)	54(2)	33(1)	-7(1)	7(1)	7(1)
C(8)	28(1)	55(2)	40(1)	4(1)	7(1)	-1(1)
C(9)	30(1)	36(1)	38(1)	3(1)	6(1)	-5(1)
C(10)	29(1)	29(1)	26(1)	0(1)	9(1)	-2(1)
C(11)	33(1)	26(1)	27(1)	-1(1)	11(1)	1(1)
C(12)	44(2)	25(1)	38(1)	1(1)	10(1)	-1(1)
C(13)	35(1)	32(1)	32(1)	-4(1)	6(1)	-9(1)
C(14)	29(1)	33(1)	25(1)	-1(1)	8(1)	-5(1)
C(15)	26(1)	27(1)	28(1)	1(1)	8(1)	-2(1)
C(16)	33(1)	32(1)	39(1)	-4(1)	6(1)	-1(1)
C(17)	30(1)	34(1)	36(1)	7(1)	7(1)	-5(1)
C(18)	35(1)	36(1)	38(1)	11(1)	10(1)	-3(1)
C(19)	33(1)	34(1)	28(1)	1(1)	7(1)	3(1)
C(20)	30(1)	35(1)	33(1)	3(1)	4(1)	-7(1)
C(21)	33(1)	34(1)	27(1)	5(1)	10(1)	1(1)
C(22)	41(2)	36(1)	34(1)	-3(1)	5(1)	0(1)
C(23)	44(2)	31(1)	43(1)	-2(1)	10(1)	7(1)
N(24)	36(1)	32(1)	38(1)	4(1)	9(1)	5(1)
C(25)	32(1)	29(1)	29(1)	7(1)	10(1)	4(1)
C(26)	35(1)	28(1)	30(1)	3(1)	9(1)	3(1)
C(27)	33(1)	27(1)	33(1)	11(1)	4(1)	4(1)
C(28)	36(1)	36(1)	45(1)	0(1)	7(1)	4(1)
C(29)	55(2)	33(1)	46(2)	-2(1)	5(1)	2(1)
C(30)	47(2)	38(1)	46(2)	7(1)	-6(1)	-6(1)
C(31)	33(2)	49(2)	54(2)	13(1)	1(1)	-2(1)
C(32)	36(1)	38(1)	40(1)	11(1)	6(1)	6(1)

Table 5. Hydrogen coordinates (x 10^4) and isotropic displacement parameters ($Å^2$ x 10^3) for **5a'**.

	x	y	z	U(eq)
H(3A)	13333	1592	10132	66
H(3AB)	13586	1339	9112	66
H(4A)	10362	1399	8824	53
H(4AB)	10285	2252	9690	53
H(5)	11449	2996	8058	39
H(7A)	10582	5020	9838	66
H(7B)	12765	5198	10290	66
H(7C)	11716	3934	10417	66
H(8A)	13491	4763	8058	49
H(8AB)	13779	5695	8894	49
H(9A)	11386	6411	7672	42
H(9AB)	10575	6250	8580	42
H(10)	9977	4584	7092	33
H(11)	8497	4237	8718	34
H(12A)	8310	2473	7306	42
H(12B)	7119	2470	8100	42
H(13)	4968	3161	6821	40
H(16A)	5795	6883	7649	52
H(16B)	7959	7298	7947	52
H(16C)	7157	6182	8451	52
H(17A)	9021	7043	6550	40
H(17B)	8550	5842	5943	40
H(18A)	5804	7656	6198	43
H(18B)	6617	7479	5289	43
H(19)	5225	5513	5074	38
H(20A)	3665	5930	6664	39
H(20B)	3372	4714	6062	39
H(22)	2901	8293	5577	45
H(23)	-83	8868	4852	47
H(26)	2159	5126	4166	37
H(28)	692	4713	2696	47

H(29)	-1338	3604	1596	55
H(30)	-4604	3696	1524	55
H(31)	-5830	4959	2512	56
H(32)	-3825	6128	3578	46