Supporting Information

Pd-catalyzed C3-selective Arylation of Pyridines with Phenyl Tosylates

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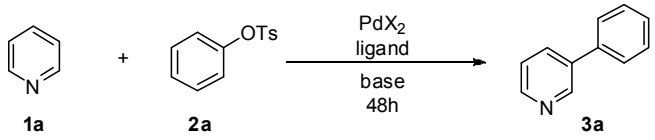
General Consideration:

All solvents and reagents were purchased from the suppliers and used after further dried. ^{1}H NMR and ^{13}C NMR were recorded in $CDCl_3$ at room temperature on the spectrometer (400 MHz ^{1}H, 100 MHz ^{13}C). The chemical-shifts scale is based on internal TMS. Data for ^{1}H NMR and ^{13}C NMR are reported as follows: chemical shift (δppm), multiplicity, integration, and coupling constant (Hz). All reactions were carried out under dry nitrogen atmosphere.

Table 1 Reaction condition optimization[a]

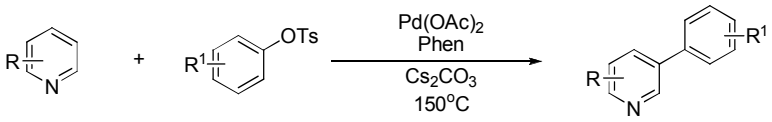


1a 2a 3a

Entry	PdX_2 (mol %)	Base (equiv)	Ligand (mol%)	Temp (°C)	Yield (%)[b]
1	$Pd(OAc)_2$ (5)	Cs_2CO_3 (3)	Phen (15)	140	21
2	$Pd(OAc)_2$ (10)	Cs_2CO_3 (3)	Phen (15)	140	32
3	$Pd(OAc)_2$ (10)	Cs_2CO_3 (3)	Phen (30)	140	38
4	$Pd(OAc)_2$ (10)	Cs_2CO_3 (3)	Phen (30)	150	63
5	$Pd(OAc)_2$ (15)	Cs_2CO_3 (3)	Phen (30)	150	56
6	$Pd(OAc)_2$ (10)	Cs_2CO_3 (3)	Phen (30)	160	52
7	$PdCl_2$ (10)	Cs_2CO_3 (3)	Phen (30)	150	50
8	$Pd(TFA)_2$ (10)	Cs_2CO_3 (3)	Phen (30)	150	15
9	$Pd(OAc)_2$ (10)	K_3CO_3 (3)	Phen (30)	150	41
10	$Pd(OAc)_2$ (10)	K_3PO_4 (3)	Phen (30)	150	42
11	$Pd(OAc)_2$ (10)	Cs_2CO_3 (3)	Phen (30)	150	5[c]
12	$Pd(OAc)_2$ (10)	Cs_2CO_3 (3)	Phen (30)	150	41[d]
13	—	Cs_2CO_3 (3)	Phen (30)	150	0

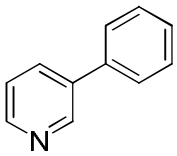
[a] Reaction conditions: pyridine (3.0 mL) and **2a** (0.5 mmol) were stirred with 3 equiv of base in the presence of Pd-catalyst and ligand at desired temperature in a sealed tube under N_2 for 48 h. [b] Isolated yields. [c] Pyridine (0.24 mL, 3.0 mmol) with DMF (1 mL) was used. [d] Pyridine (2.0 mL, 25 mmol) with DMF (1 mL) was used.

1. General Procedure:

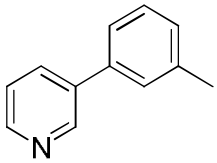


General Procedure for Pd(II)-catalyzed C-3 Arylation of Pyridine Derivatives:

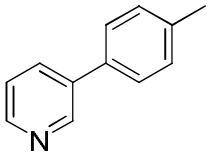
To a 15 mL sealed tube were added $Pd(OAc)_2$ (11.2 mg, 0.05 mmol), 1,10-phenanthroline (27 mg, 0.3 mmol), Cs_2CO_3 (489 mg, 1.5 mmol), aryl tosylate (0.5 mmol) and pyridine derivative (3.0 mL). The tube was capped and stirred under N_2 at 150 ° C for 48 h. The reaction mixture was cooled to room temperature and diluted with EtOAc, filtered through a short pad of Celite, washed with EtOAc, and concentrated in *vacuo*. The resulting residue was purified by flash column chromatography using hexanes:EtOAc (3:1 to 1:1, depending on different substrates) as the eluent. Known compounds are characterized by ^{1}H NMR, ^{13}C NMR and their comparison to literature values. Unknown compounds are characterized by ^{1}H NMR, ^{13}C NMR and HRMS.



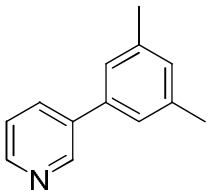
3-Phenylpyridine (3a)[1]**:** Yield: 63%; Colorless oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.77 (s, 1H), 8.52 (d, *J* = 4.0 Hz, 1H), 7.80 (d, *J* = 8.0 Hz, 1H), 7.51 (d, *J* = 8.0 Hz, 2H), 7.41 (t, *J* = 8.0 Hz, 2H), 7.34 (d, *J*= 8.0 Hz, 1H), 7.30 (dd, *J* = 4.0 Hz, 8.0 Hz, 1H).; **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 147.5, 147.3, 136.9, 135.7, 133.3, 128.1, 127.1, 126.2, 122.5; **MS**: m/z $C_{11}H_9N$ 155 (M+);



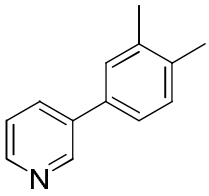
3-(*m*-Tolyl)pyridine (3b)[2]**:** Yield: 55%; Colorless oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.75 (s, 1H), 8.49 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.30 - 7.24 (m, 4H), 7.14 (d, *J* = 4.0 Hz, 1H), 2.35 (s, 3H).; **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 147.3, 147.3, 137.7, 136.8, 135.7, 133.3, 127.9, 127.8, 126.9, 123.2, 122.5, 20.5; **MS**: m/z $C_{12}H_{11}N$ 169 (M+);



3-(*p*-Tolyl)pyridine (3c)[3]**:** Yield: 59%; Colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.77 (s, 1H), 8.50 (s, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.41 (d, *J* = 8.0 Hz, 2H), 7.28 (dd, *J* = 4.0 Hz, 8.0 Hz, 1H), 7.20 (d, *J* = 8.0 Hz, 2H), 2.34 (s, 3H). **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 148.2, 138.1, 135.0, 134.2, 129.8, 127.0, 123.6, 21.2; **MS**: m/z $C_{12}H_{11}N$ 169 (M+);

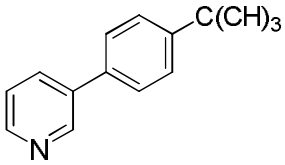


3-(3,5-Dimethylphenyl)pyridine (3d)[4]**:** Yield: 67%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.74 (s, 1H), 8.48 (d, *J* = 4.0 Hz, 1H), 7.76 (d, *J* = 8.0 Hz, 1H), 7.25 (dd, *J* = 4.0 Hz, 8.0 Hz, 1H), 7.10 (s, 2H), 6.96 (s, 1H), 2.30 (s, 6H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 147.4, 147.3, 137.6, 136.8, 135.9, 133.3, 128.7, 124.0, 122.4, 20.3; **MS**: m/z $C_{13}H_{13}N$ 183 (M+);

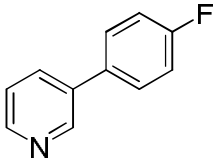


3-(3,4-Dimethylphenyl)pyridine (3e): Yield: 61%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.75 (s, 1H), 8.48 (d, *J* = 4.0 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.28-7.24 (m, 3H), 7.16 (d, *J* = 8.0 Hz, 1H), 2.26 (s, 3H), 2.24 (s, 3H); **^{13}C**

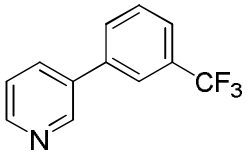
NMR ($CDCl_3$, 100 MHz) δ 147.2, 147.1, 136.3, 135.7, 135.6, 134.3, 133.1, 129.3, 127.3, 123.4, 122.4, 18.9, 18.5; **HRMS**: m/z calcd for $C_{13}H_{13}N$ (M+.): 183.1048, found: 183.1052;



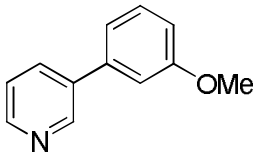
3-(4-Tert-Butylphenyl)pyridine (3f)[5]**:** Yield: 41%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.85 (s, *J* = 1.6 Hz, 1H), 8.57 (d, *J* = 4.0 Hz, 1H), 7.76 (d, *J* = 8.0 Hz, 1H), 7.55-7.49 (m, 4H), 7.34 (dd, *J* = 4.4 Hz, 8.0 Hz, 1H), 1.37 (s, 9H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 151.2, 148.2, 148.2, 136.5, 134.9, 134.2, 126.8, 126.0, 123.5, 34.6, 31.3; **MS**: m/z $C_{15}H_{17}N$ 211 (M+);



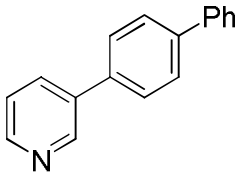
3-(4-Fluorophenyl)pyridine (3g)[6]**:** Yield: 46%; Colorless oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.73 (s, 1H), 8.52 (d, *J* = 4.0 Hz, 1H), 7.76 (d, *J* = 8.0 Hz, 1H), 7.47 (dd, *J* = 5.2 Hz, 8.0 Hz, 2H), 7.29 (dd, *J* =4.8 Hz, 8.0 Hz, 1H), 7.10 (t, *J* = 8.0 Hz, 2H). **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 161.87 (*J* = 246 Hz), 147.5, 147.1, 134.7, 133.2, 127.8, 127.8, 122.6, 115.1 (*J* = 22 Hz), **MS**: m/z $C_{11}H_8NF$ 173 (M+);



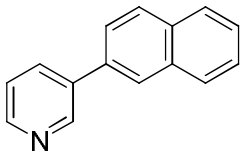
3-(3-(Trifluoromethyl)phenyl)pyridine (3h)[7]**:** Yield: 32%; Colorless oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.78 (s, 1H), 8.58 (d, *J* = 4.0 Hz, 1H), 7.83 (d, *J* = 8.0 Hz, 1H), 7.75 (s, 1H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.60 (d, *J* = 8.0 Hz, 1H), 7.54 (t, *J* = 8.0 Hz, 1H), 7.35 (dd, *J* = 4.0, 8.0 Hz, 1H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 148.1, 147.1, 137.6, 134.3, 133.6, 130.7, 130.3, 129.4, 128.6, 123.8, 123.0, 122.8; **MS**: m/z $C_{12}H_8NF_3$ 223 (M+);



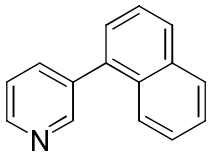
3-(3-Methoxyphenyl)pyridine (3i)[8]**:** Yield: 48%; Colorless oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.77 (s, 1H), 8.51 (d, *J* = 4.4 Hz, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.33-7.26 (m, 2H), 7.08 (d, *J* = 8.0 Hz, 1H), 7.02 (s, 1H), 6.87 (d, *J* = 8.0 Hz, 1H), 3.79 (s, 3H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 159.1, 147.6, 147.3, 138.3, 135.5, 133.4, 129.1, 122.5, 118.6, 112.4, 111.9, 54.3; **HRMS**: m/z calcd for $C_{21}H_{15}N$ 185 (M+.);



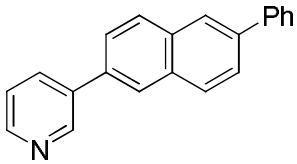
3-([1,1'-Biphenyl]-4-yl)pyridine (3j)[9]**:** Yield: 57%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.83 (s, 1H), 8.54 (d, *J* = 4.0Hz, 1H), 7.84 (d, *J* = 8.0 Hz, 1H), 7.65 – 7.56 (m, 6H), 7.41 – 7.34 (m, 2H), 7.32 – 7.28 (m, 2H). **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 147.5, 147.2, 140.0, 139.3, 135.6, 135.1, 133.2, 127.9, 126.8, 126.6, 126.5, 126.0, 122.6; **MS**: m/z $C_{17}H_{13}N$ 231 (M+);



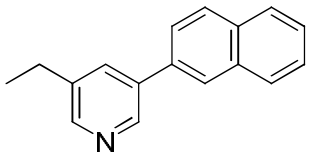
3-(Naphthalen-2-yl)pyridine (3k)[10]**:** Yield: 60%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.97 (d, *J* =2.0 Hz, 1H), 8.62 (dd, *J* = 1.2 Hz, 4.8 Hz, 1H), 8.03 (s, 1H), 8.00 – 7.86 (m, 4H), 7.69 (dd, *J* = 1.6 Hz, 8.4 Hz, 1H), 7.53–7.50 (m, 2H), 7.39 (dd, *J* = 4.8 Hz, 7.6 Hz, 1H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 148.5, 148.5, 136.5, 135.1, 134.5, 133.5, 132.8, 128.9, 128.2, 127.7, 126.6, 126.4, 126.1, 125.0, 123.6; **MS**: m/z $C_{15}H_{11}N$ 205 (M+);



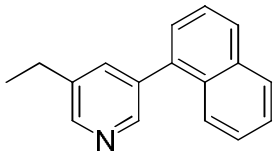
3-(Naphthalen-1-yl)pyridine (3l)[11]**:** Yield: 52%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.75 (d, *J* =1.6Hz, 1H), 8.67 (dd, *J* = 1.6 Hz, 4.4 Hz, 1H), 7.91 (t, *J* = 7.2 Hz, 2H), 7.80 (d, *J* = 8.0 Hz, 1H), 7.55–7.40 (m, 5H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 150.5, 148.5, 137.3, 136.3, 136.2, 133.7, 131.4, 128.5, 128.4, 127.3, 126.5, 126.0, 125.3, 125.2, 123.1; **MS**: m/z $C_{15}H_{11}N$ 205 (M+);



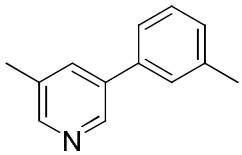
3-(6-Phenylnaphthalen-2-yl)pyridine (3m): Yield: 60%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.99 (d, *J* =1.6 Hz, 1H), 8.62 (dd, *J* = 1.2 Hz, 4.8 Hz, 1H), 8.06 (d, *J* =7.6 Hz, 2H), 8.01 – 7.81 (m, 3H), 7.78 (dd, *J* = 1.6 Hz, 4.4 Hz, 1H), 7.75–7.14 (m, 3H), 7.50 (t, *J* =8.0 Hz, 2H), 7.41–7.38 (m, 2H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 148.5, 140.8, 139.1, 136.5, 135.1, 134.5, 133.1, 132.7, 129.2, 128.9, 128.7, 127.5, 127.4, 126.3, 125.9, 125.5, 125.4, 123.6; **HRMS**: m/z calcd for $C_{21}H_{15}N$ (M+.): 281.1204, found: 281.1207;



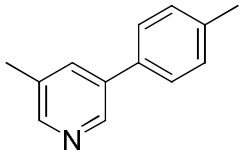
3-Ethyl-5-(Naphthalen-2-yl)pyridine (3n): Yield: 52%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.80 (d, *J* = 2.0 Hz, 1H), 8.48 (d, *J* = 2.0 Hz, 1H), 8.04 (s, 1H), 7.96 (s, 1H), 7.94-7.87 (m, 2H), 7.82 (s, 1H), 7.71 (dd, *J* = 2.0 Hz, 8.4 Hz 1H), 7.54-7.51 (m, 3H), 2.75 (q, *J* = 7.6 Hz, 2H), 8.48 (t, *J* = 7.6 Hz, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.3, 146.0, 139.2, 136.2, 135.3, 134.0, 133.5, 132.8, 128.8, 128.2, 127.7, 126.5, 126.3, 126.2, 125.1, 26.1, 15.4; **HRMS**: m/z calcd for $C_{17}H_{15}N$ (M+.): 233.1204, found: 233.1206;



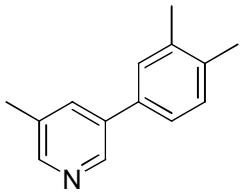
3-Ethyl-5-(Naphthalen-1-yl)pyridine (3o): Yield: 51%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.49 (s, 1H), 8.45 (s, 1H), 7.81 (t, *J* = 8.0 Hz, 2H), 7.43 (d, *J* = 8.0 Hz, 1H), 7.55 (s, 1H), 7.46-7.31 (m, 4H), 2.66 (q, *J* = 7.6 Hz, 2H), 8.48 (t, *J* = 7.6 Hz, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.2, 148.0, 138.8, 136.8, 136.6, 136.0, 133.8, 131.6, 128.5, 128.4, 127.4, 126.5, 126.1, 125.4, 26.1, 15.4; **HRMS**: m/z calcd for $C_{17}H_{15}N$ (M+.): 233.1204, found: 233.1209;



3-(*m*-Tolyl)pyridine (3p): Yield: 54%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.57 (s, 1H), 8.34 (s, 1H), 7.59 (s, 1H), 7.31-7.28 (m, 3H), 7.14 (d, *J* = 4.0 Hz, 1H), 2.35 (s, 3H), 2.32 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 147.8, 144.5, 137.7, 136.9, 135.2, 134.0, 131.9, 127.9, 127.7, 126.9, 123.2, 20.5, 17.5; **HRMS**: m/z calcd for $C_{13}H_{13}N$ (M+.):183.1048, found: 183.1055;

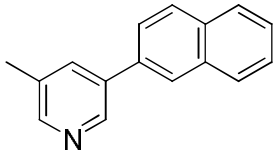


3-(*p*-Tolyl)pyridine (3q): Yield: 50%;White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.57 (s, 1H), 8.33 (s, 1H), 7.59 (s, 1H), 7.40 (d, *J* = 8.0 Hz, 2H), 7.20 (d, *J* = 4.0 Hz, 2H), 2.33 (s, 3H), 2.32 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.7, 145.4, 137.9, 135.0, 134.8, 129.8, 127.0, 21.2, 18.5; **HRMS**: m/z calcd for $C_{13}H_{13}N$ (M+.):183.1048, found: 183.1058;

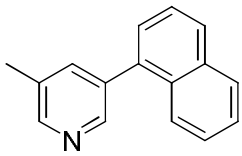


3-Methyl-5-(3,4-Dimethylphenyl)pyridine (3r): Yield: 56%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.56 (s, 1H), 8.31 (s, 1H), 7.57 (s, 1H), 7.27 (s, 1H), 7.23 (d, *J* = 7.6 Hz, 1H), 7.14 (d, *J* = 7.6 Hz, 1H), 2.31 (s, 3H), 2.26 (s, 3H), 2.23 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 147.6, 144.4, 136.2, 135.5, 135.2, 134.5,

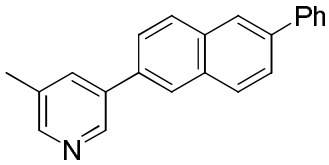
133.7, 131.8, 129.3, 127.3, 123.5, 18.9, 18.4, 17.4; **HRMS**: m/z calcd for $C_{14}H_{15}N$ (M+.):197.1204, found: 197.1214;



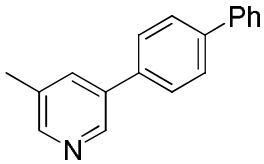
3-Methyl-5-(Naphthalen-2-yl)pyridine (3s): Yield: 46%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.77 (d, *J* = 2.0 Hz, 1H), 8.45 (d, *J* = 1.2Hz, 1H), 8.02 (d, *J* = 1.2 Hz, 1H), 7.94 (s, 1H), 7.92-7.86 (m, 2H), 7.79 (d, *J* = 0.8 Hz, 1H), 7.69 (dd, *J* = 2.0 Hz, 8.4 Hz 1H) , 7.52-7.50 (m, 2H), 2.42 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.0, 145.7, 136.0, 135.2, 135.2, 133.5, 133.0, 132.8, 128.7, 128.2, 127.6, 126.5, 126.3, 126.0, 125.1, 18.5; **HRMS**: m/z calcd for $C_{16}H_{13}N$ (M+.):219.1048, found: 219.1053;



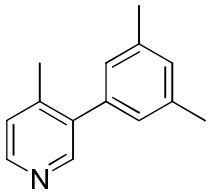
3-Methyl-5-(Naphthalen-1-yl)pyridine (3t): Yield: 47%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.56 (s, 1H), 8.52 (s, 1H), 7.90 (t, *J* = 8.4 Hz, 2H), 7.81 (d, *J* = 8.4 Hz, 1H), 7.62 (s, 1H), 7.55-7.43 (m, 3H), 7.39 (dd, *J* = 0.8 Hz, 7.2 Hz 1H), 2.42 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.0, 147.7, 137.8, 136.4, 135.8, 133.7, 132.6, 131.5, 128.4, 128.3, 127.2, 126.4, 126.0, 125.3, 125.3, 18.4; **HRMS**: m/z calcd for $C_{16}H_{13}N$ (M+.):219.1048, found: 219.1042;



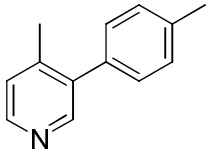
3-Methyl-5-(6-Naphthalen-2-yl)pyridine (3u): Yield: 49%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.79 (d, *J* = 1.6Hz, 1H), 8.45 (s, 1H), 8.06-8.03 (m, 2H), 7.99-7.80 (m, 2H), 7.79-7.70 (m, 5H), 7.51- 7.47(m, 2H), 7.39 (t, *J* = 7.2 Hz, 1H) , 2.43 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.0, 145.7, 140.8, 139.0, 136.0, 135.2, 135.1, 133.1, 132.7, 129.1, 128.9, 128.7, 127.5, 127.3, 126.2, 125.8, 125.5, 18.5; **HRMS**: m/z calcd for $C_{22}H_{17}N$ (M+.):295.1361, found: 295.1371;



3-Methyl-5-([1,1'-Biphenyl]-4-yl)pyridine (3v): Yield: 53%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.63 (s, 1H), 8.36 (s, 1H), 7.64-7.55 (m, 7H), 7.39 (t, *J* = 8.0 Hz, 2H), 7.29 (t, *J* = 8.0 Hz, 1H) , 2.33 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.0, 144.4, 139.8, 139.4, 135.7, 134.6, 133.8, 132.0, 127.8, 126.7, 126.5, 126.5, 126.0, 17.5; **HRMS**: m/z calcd for $C_{18}H_{15}N$ (M+.): 245.1024, found: 245.1034;

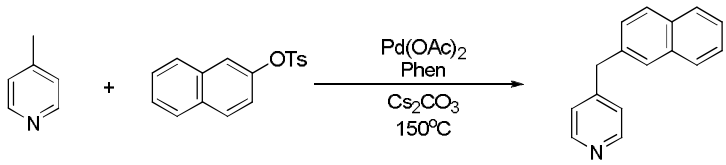


4-Methyl-3-(3,5-Dimethylphenyl)pyridine (3w): Yield: 61%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.33 (s, 2H), 7.09 (d, *J* = 4.0 Hz, 1H), 6.95 (s, 1H), 6.85 (s, 2H), 2.29 (s, 6H), 2.21 (s, 3H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 148.9, 147.0, 143.4, 136.9, 136.8, 128.1, 126.0, 124.0, 20.3, 18.8; **HRMS**: m/z calcd for $C_{14}H_{15}N$ (M+.):197.1204, found: 197.1031;



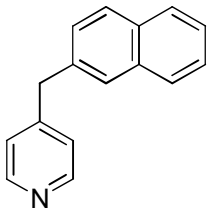
4-Methyl-3-(*p*-Tolyl)pyridine (3x): Yield: 53%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.35 (s, 2H), 7.19 (d, *J* = 8.0 Hz, 2H), 7.14 (d, *J* = 8.0 Hz, 2H), 7.10 (d, *J* = 5.2 Hz, 1H), 2.34 (s, 3H), 2.21 (s, 3H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ 149.0, 147.1, 143.5, 136.6, 136.3, 133.9, 128.1, 128.1, 124.1, 20.2, 18.8; **HRMS**: m/z calcd for $C_{13}H_{13}N$ (M+.):183.1048, found: 183.1056;

2. General Procedure:



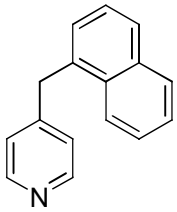
General Procedure for Pd(II)-catalyzed Arylation of Pyridine Derivatives:

To a 15-mL sealed tube were added $Pd(OAc)_2$ (16.8 mg, 0.15 mmol), 1,10-phenanthroline (40.6 mg, 0.225 mmol), Cs_2CO_3 (489 mg, 1.5 mmol), Naphthyltosylates (0.5 mmol) and 4-methyl pyridine (3.0 mL). The tube was capped and stirred under N_2 at 150 ° C for 48 h. The reaction mixture was cooled to room temperature and diluted with EtOAc, filtered through a short pad of Celite, washed with EtOAc, and concentrated in *vacuo*. The resulting residue was purified by flash column chrotography using hexanes:EtOAc (3:1 to 1:1, depending on different substrates) as the eluent.

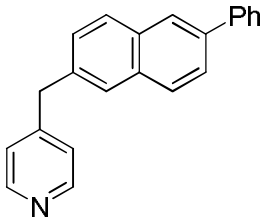


4-(naphthalen-2-ylmethyl)pyridine (3y): Yield: 51%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.49 (d, *J* = 6.0 Hz, 2H), 7.82-7.76 (m, 3H), 7.62 (s, 1H) 7.49-7.43 (m, 2H), 7.25 (dd, *J* = 2.0 Hz, 8.0 Hz, 1H), 7.13 (d, *J* = 6.0 Hz, 2H), 4.11 (s, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.8, 135.3, 132.5, 131.2, 127.4, 126.7, 126.5, 126.5, 126.3, 125.2, 124.7, 123.2, 40.3; **HRMS**: m/z calcd for

$C_{16}H_{13}N$ (M+.):219.1048, found: 219.1056;



4-(naphthalen-1-ylmethyl)pyridine (3z): Yield: 47%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.46 (s, 2H), 7.88-7.79 (m, 3H), 7.47-7.42 (m, 3H), 7.31 (d, *J* = 7.2 Hz, 1H), 7.08 (d, *J* = 5.2 Hz, 2H), 4.41 (s, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.8, 134.3, 133.9, 131.8, 128.8, 127.8, 127.7, 126.2, 125.8, 125.5, 123.9, 38.4; **HRMS**: m/z calcd for $C_{16}H_{13}N$ (M+.):219.1048, found: 219.1056;



4-((6-phenylnaphthalen-2-yl)methyl)pyridine (3aa): Yield: 59%; White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.50 (d, *J* = 6.0 Hz, 2H), 8.01 (s, 1H), 7.85-7.82 (m, 2H), 7.75-7.69 (m, 3H), 7.63 (s, 1H), 7.47 (t, *J* = 7.6Hz, 2H), 7.36 (t, *J* = 8.0 Hz, 1H), 7.28 (dd, *J* = 2.0, 8.8 Hz 1H), 7.13 (d, *J* = 6.0Hz, 2H), 4.11 (s, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.8, 149.8, 140.9, 138.4, 136.4, 132.7, 132.4, 128.8, 128.7, 128.0, 127.7, 127.3, 127.2, 126.0, 125.5, 124.2, 41.3; **HRMS**: m/z calcd for $C_{22}H_{17}N$ (M+.):295.1361, found: 295.1369;

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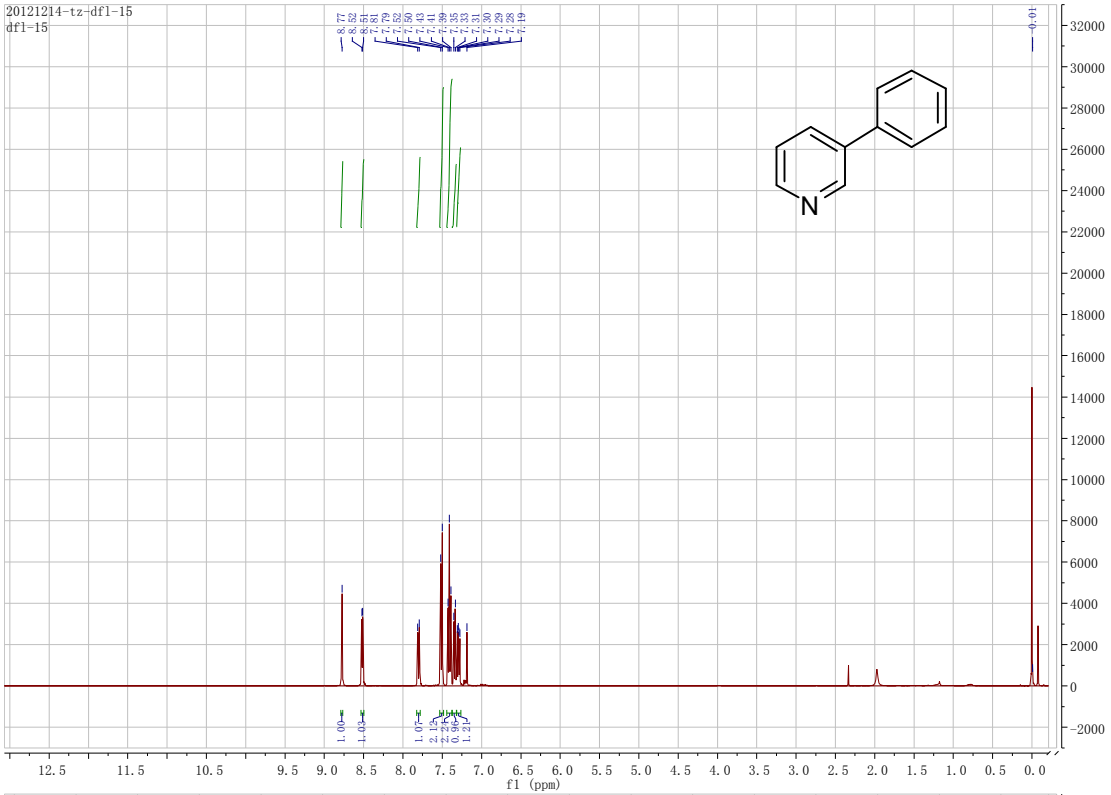
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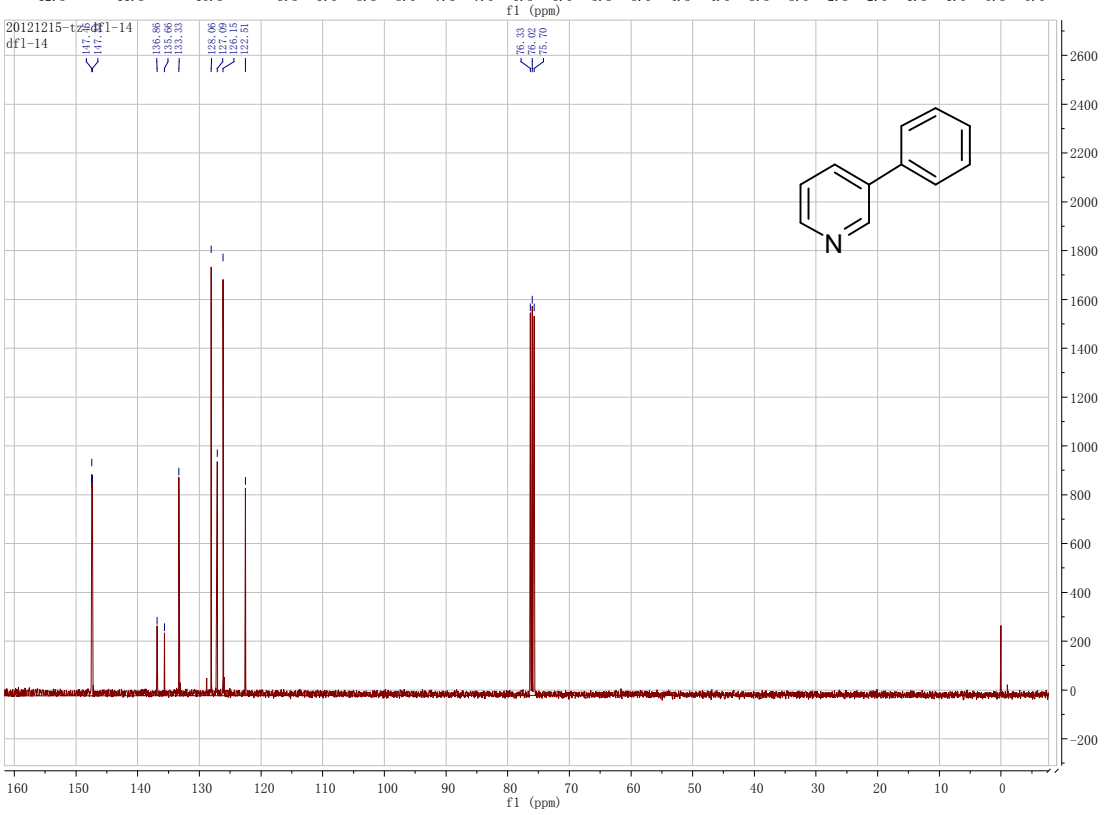
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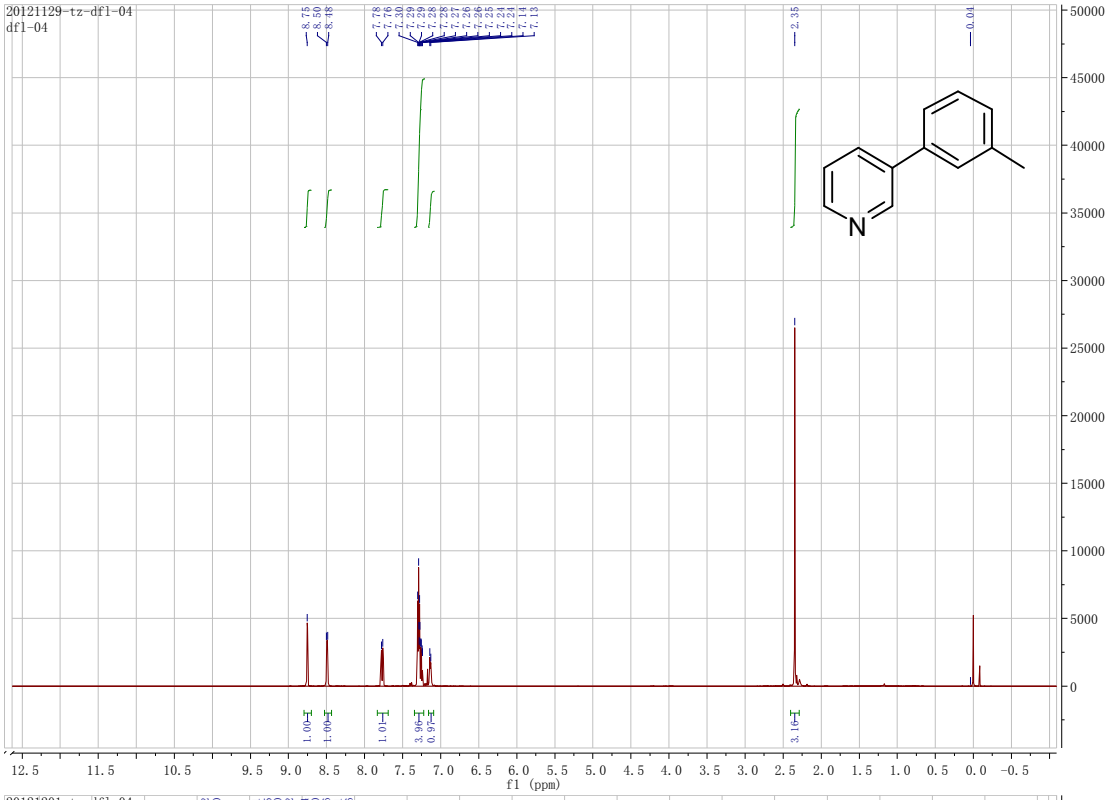
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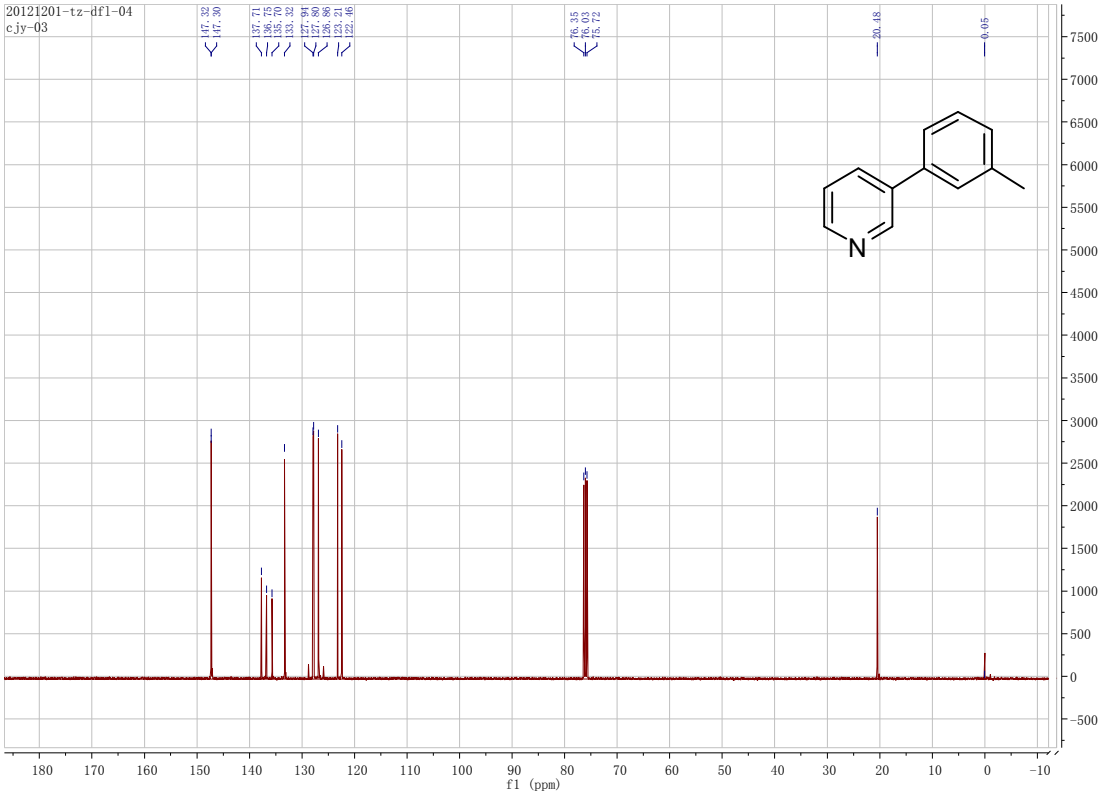
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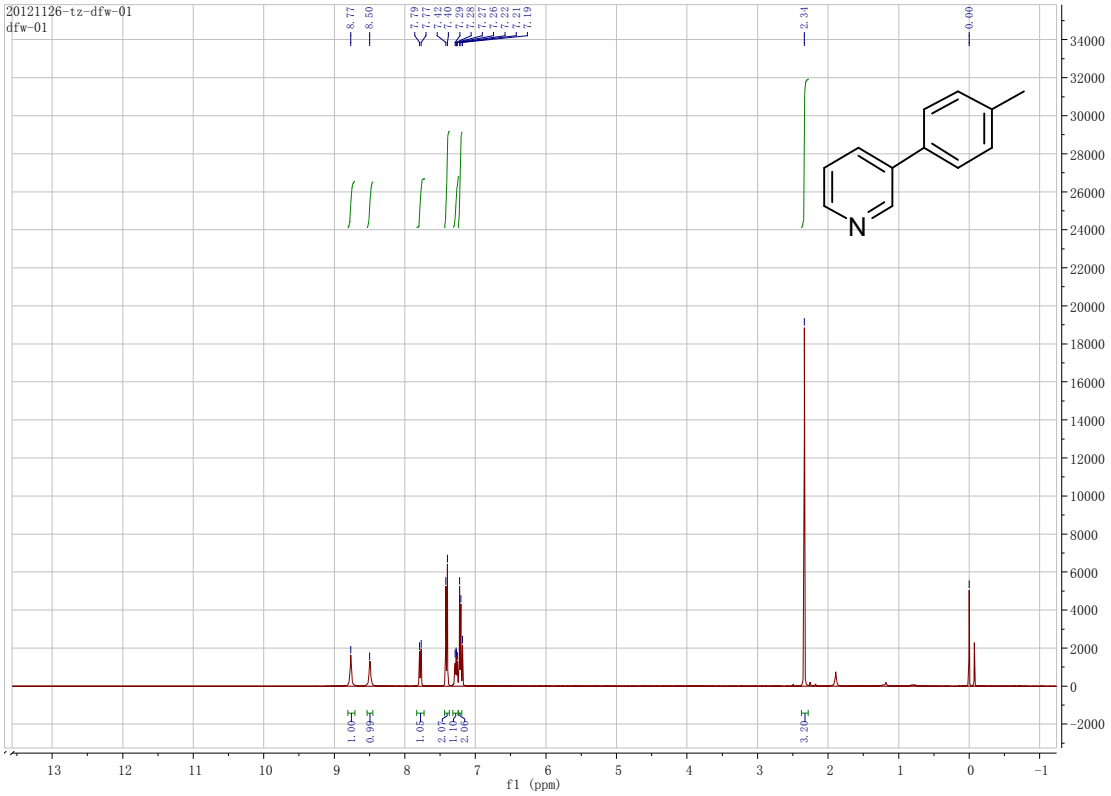
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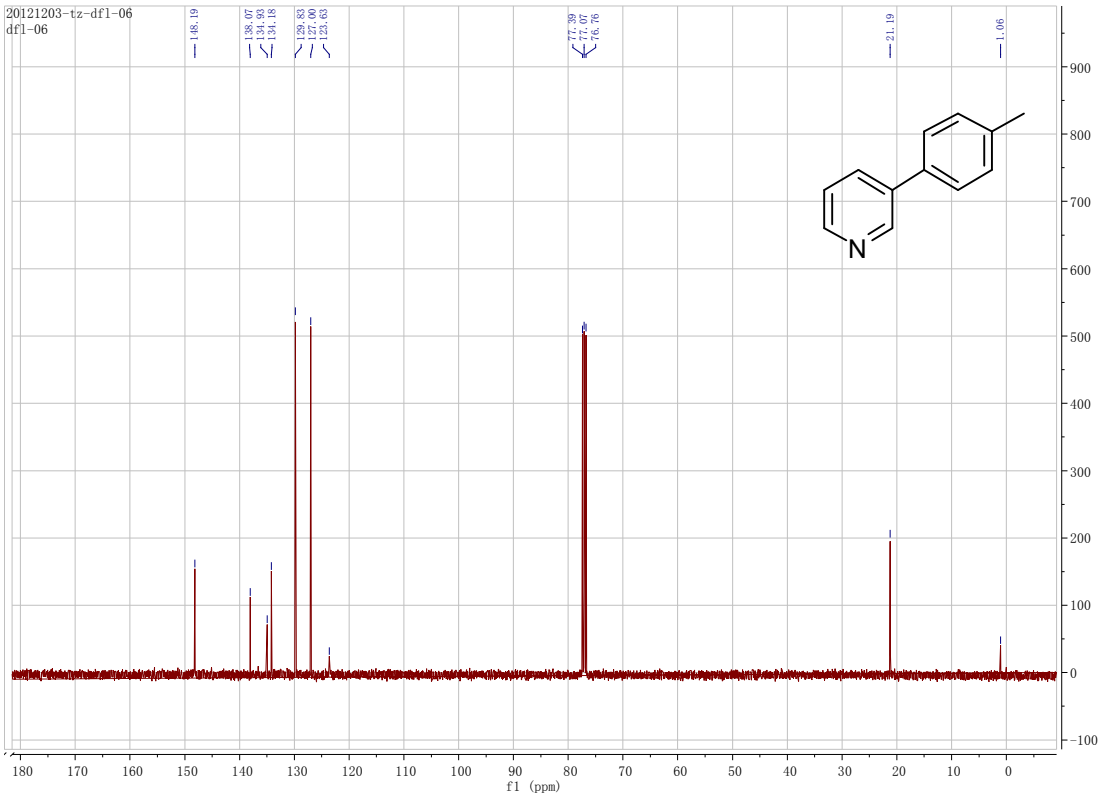
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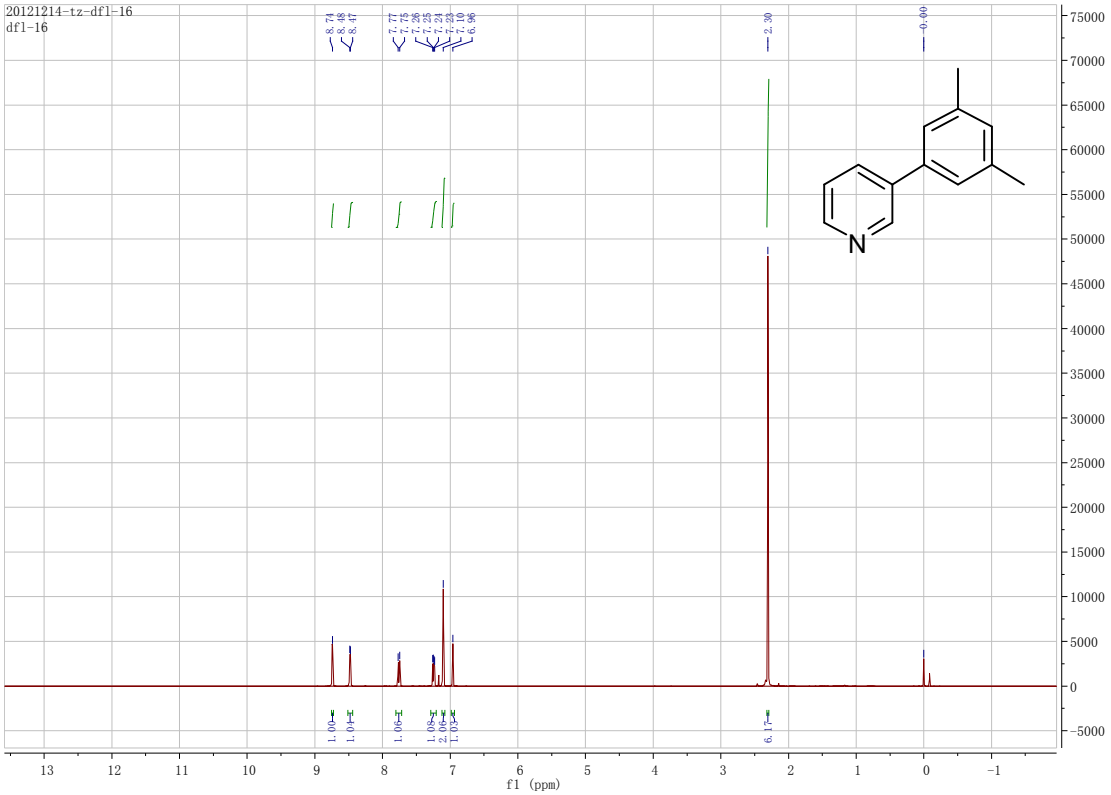
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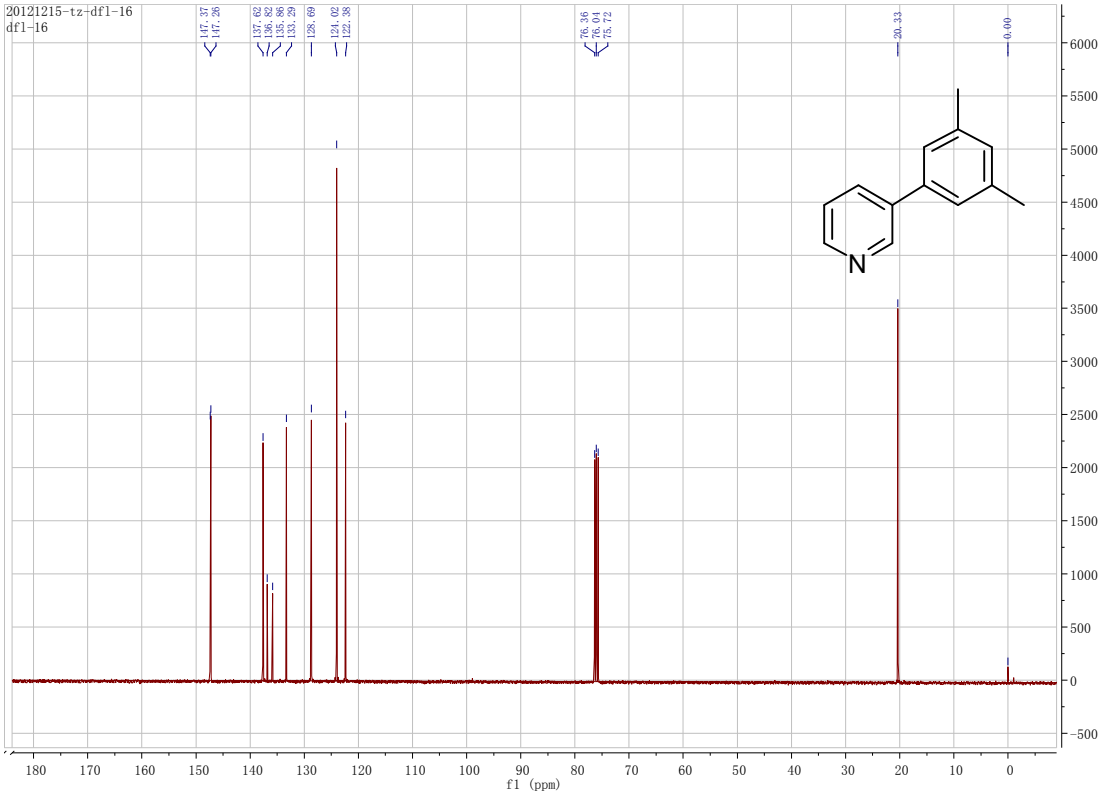
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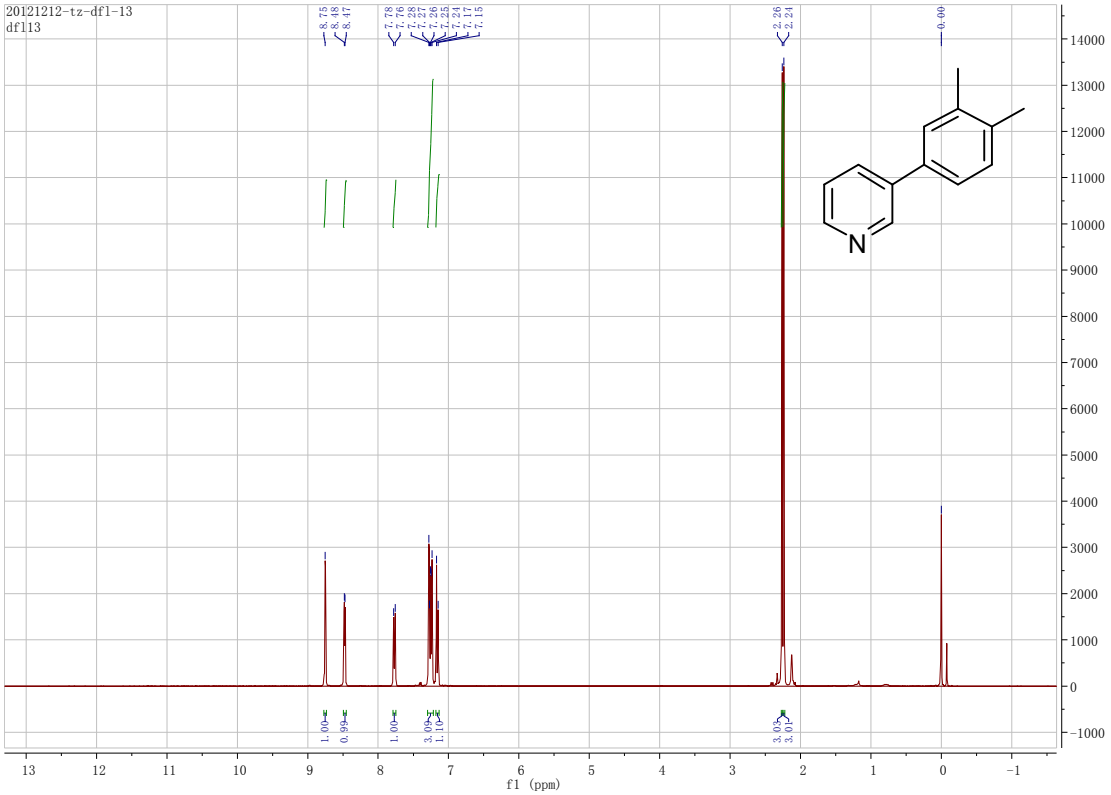
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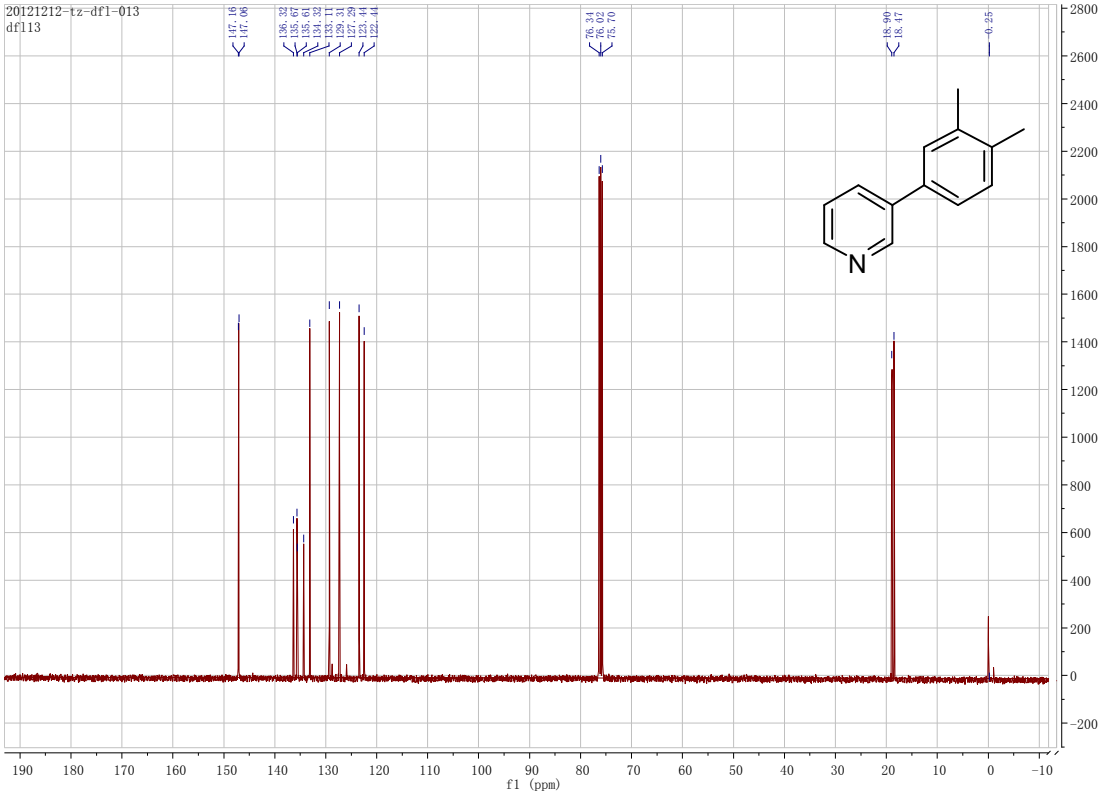
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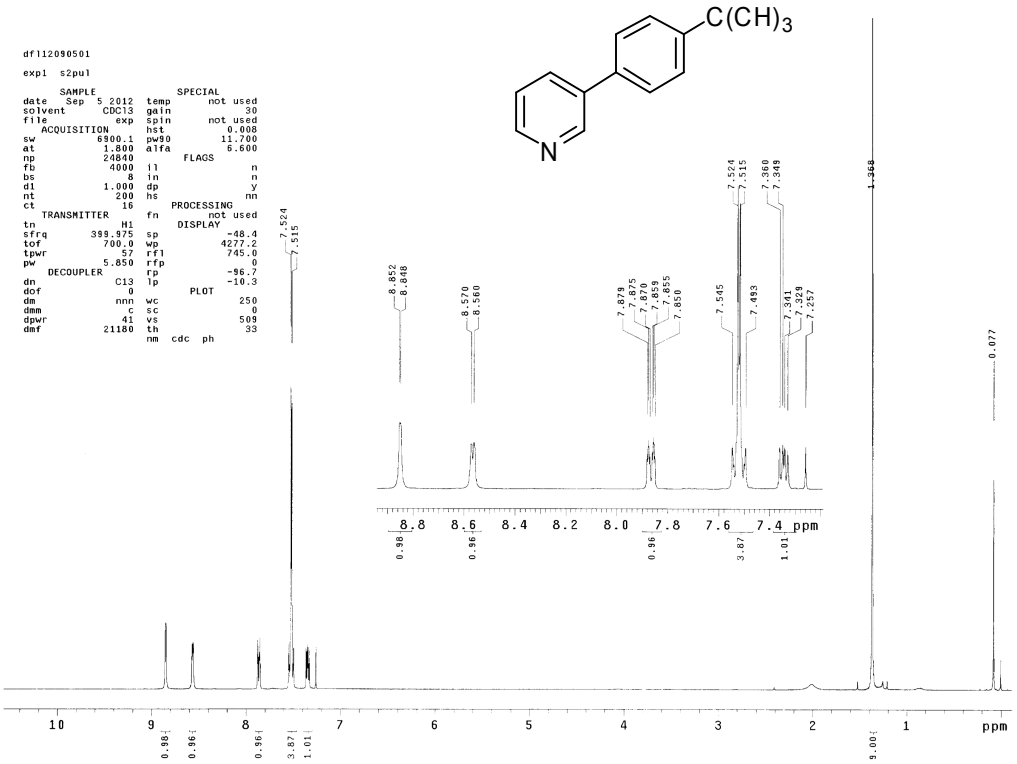
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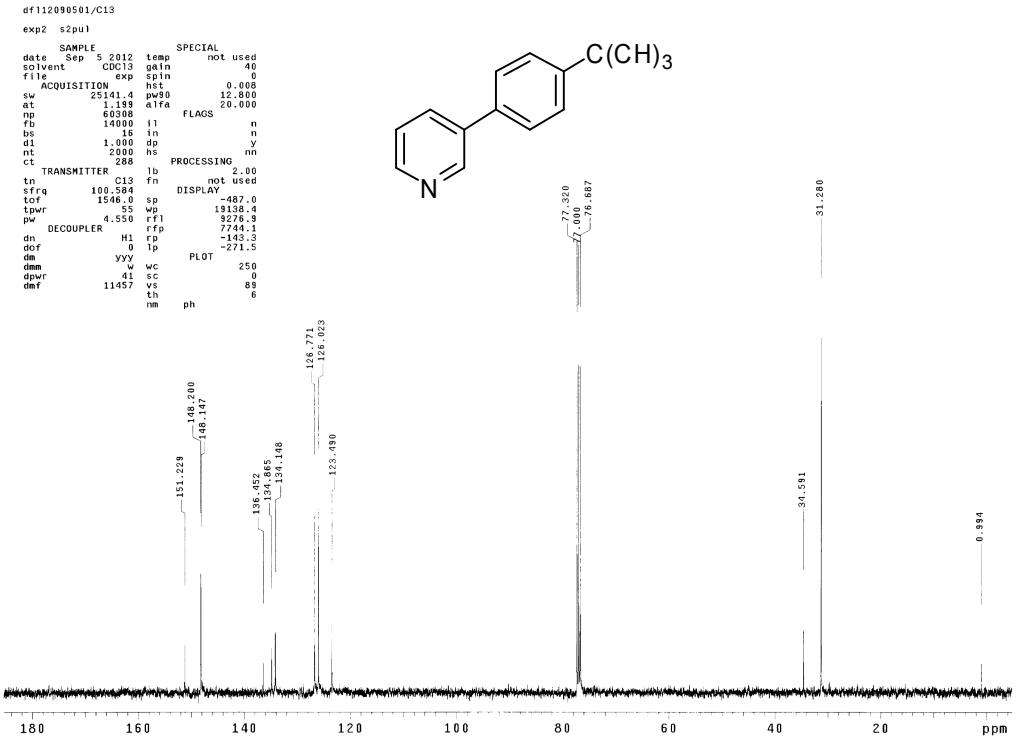
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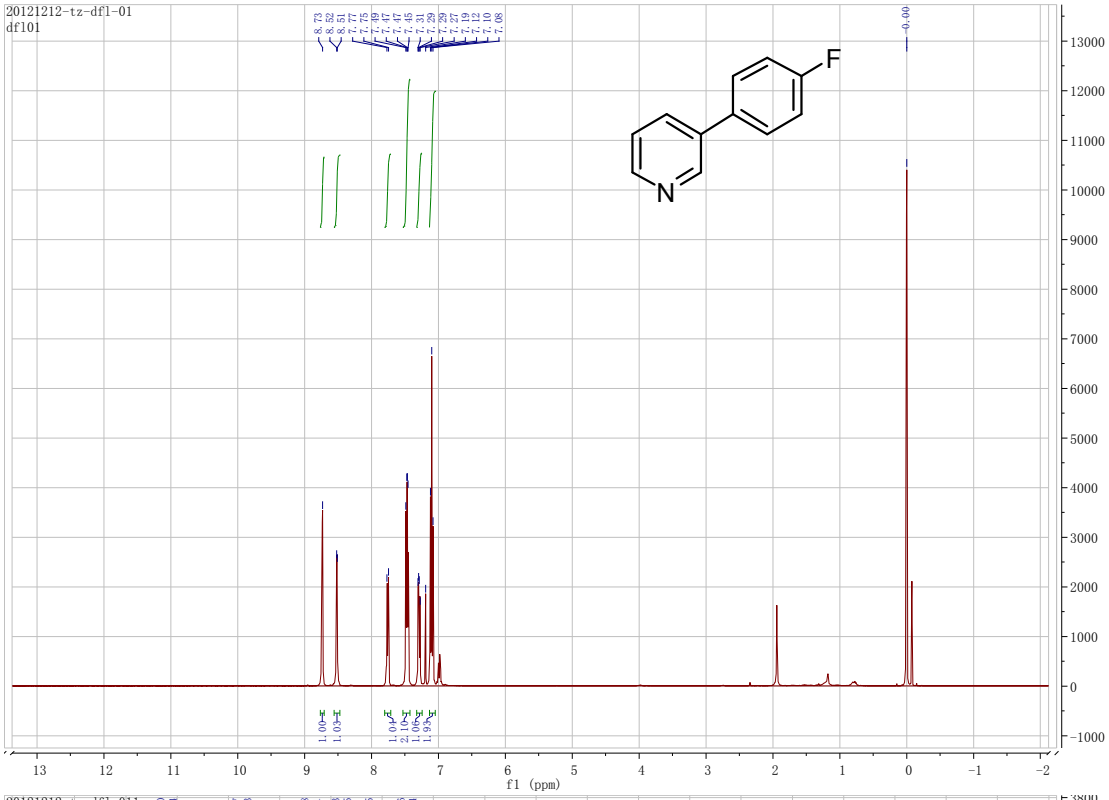
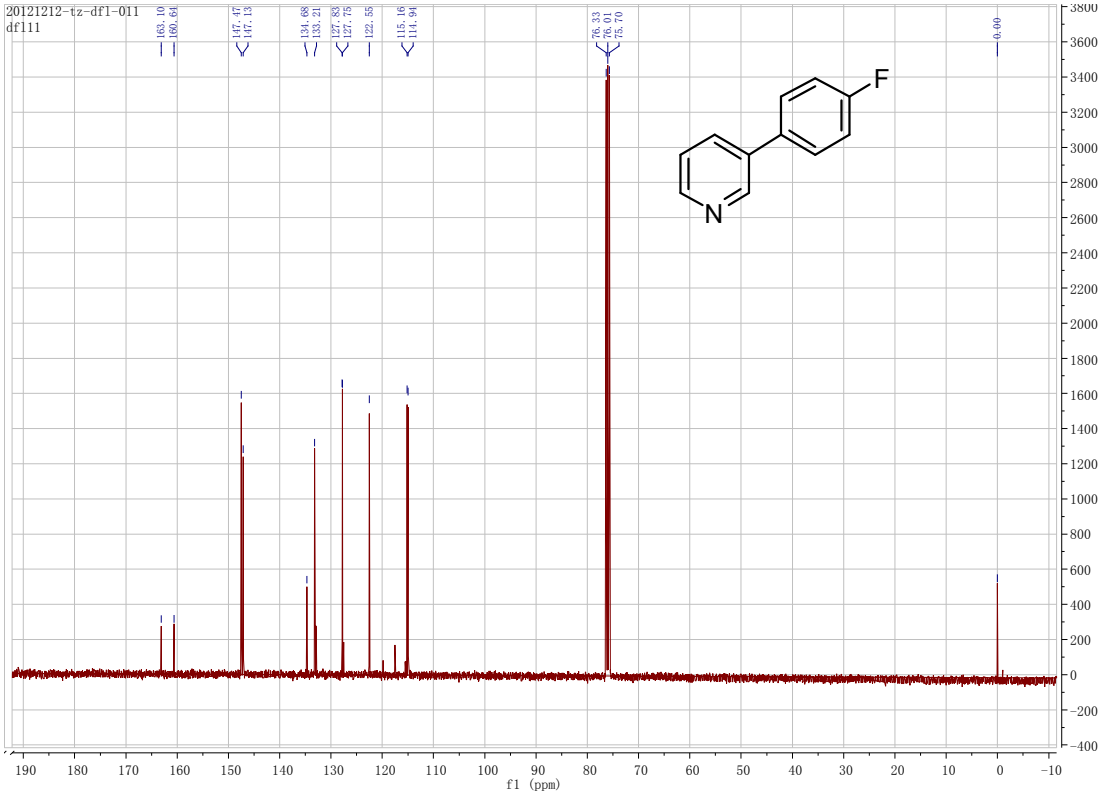
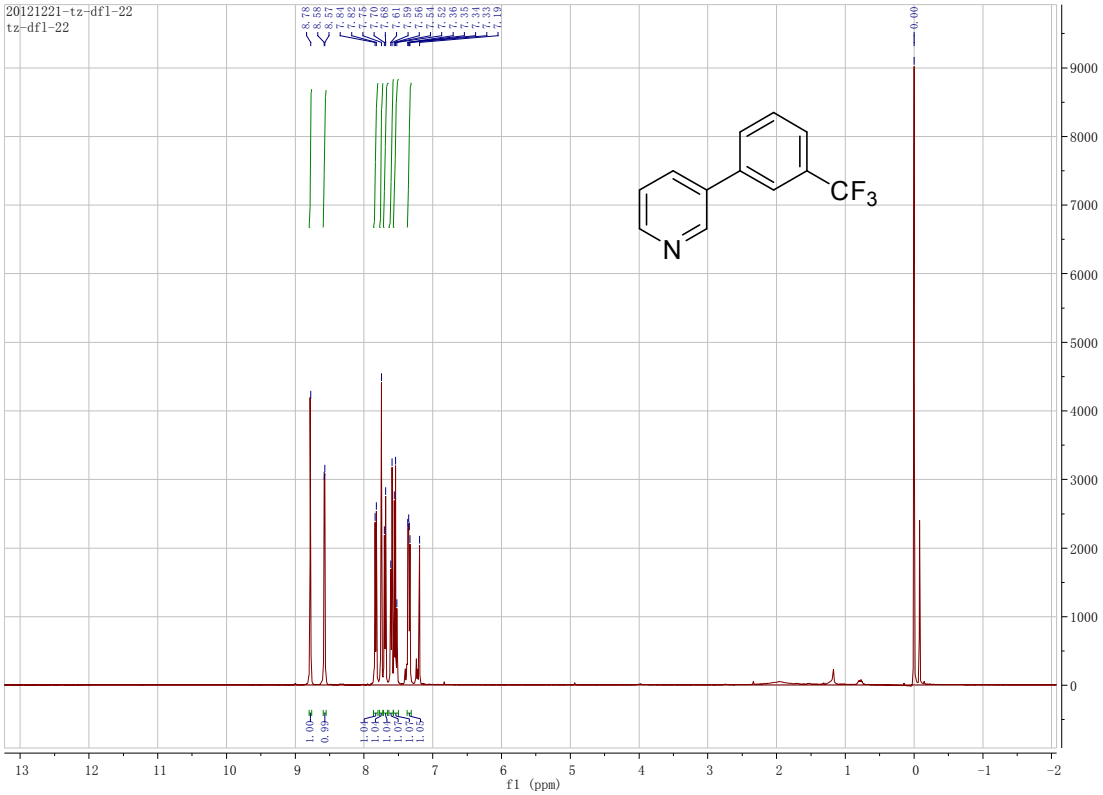
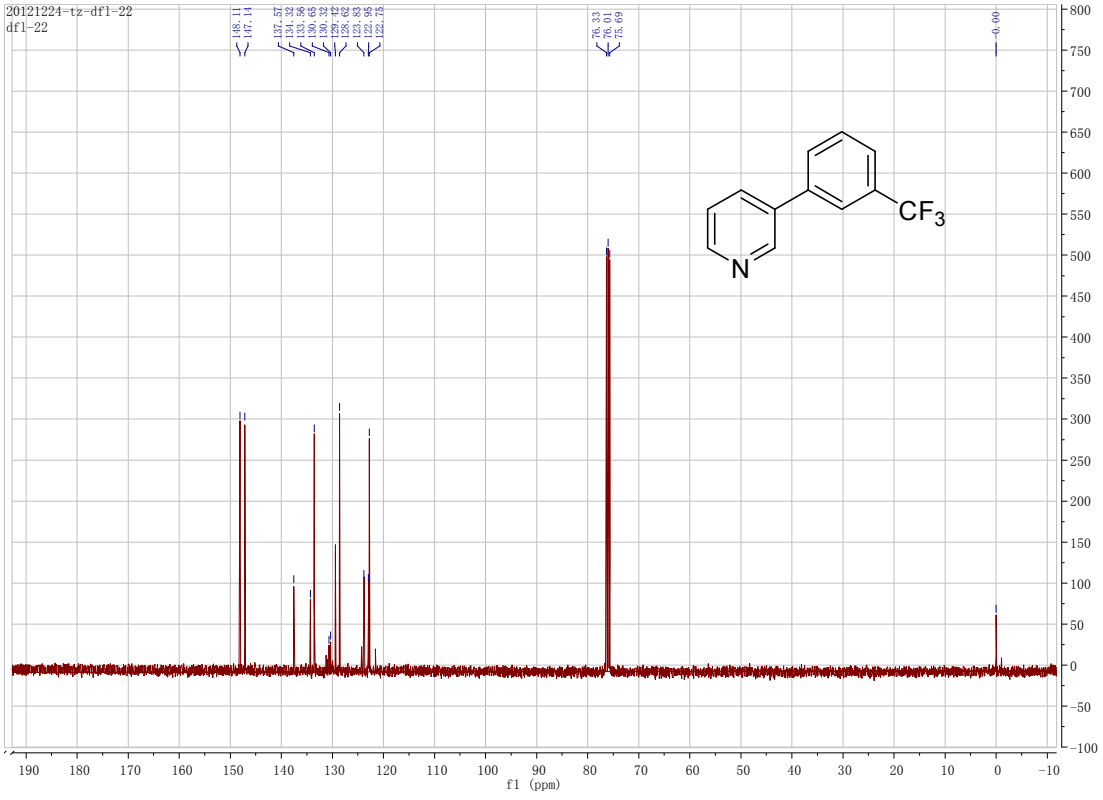
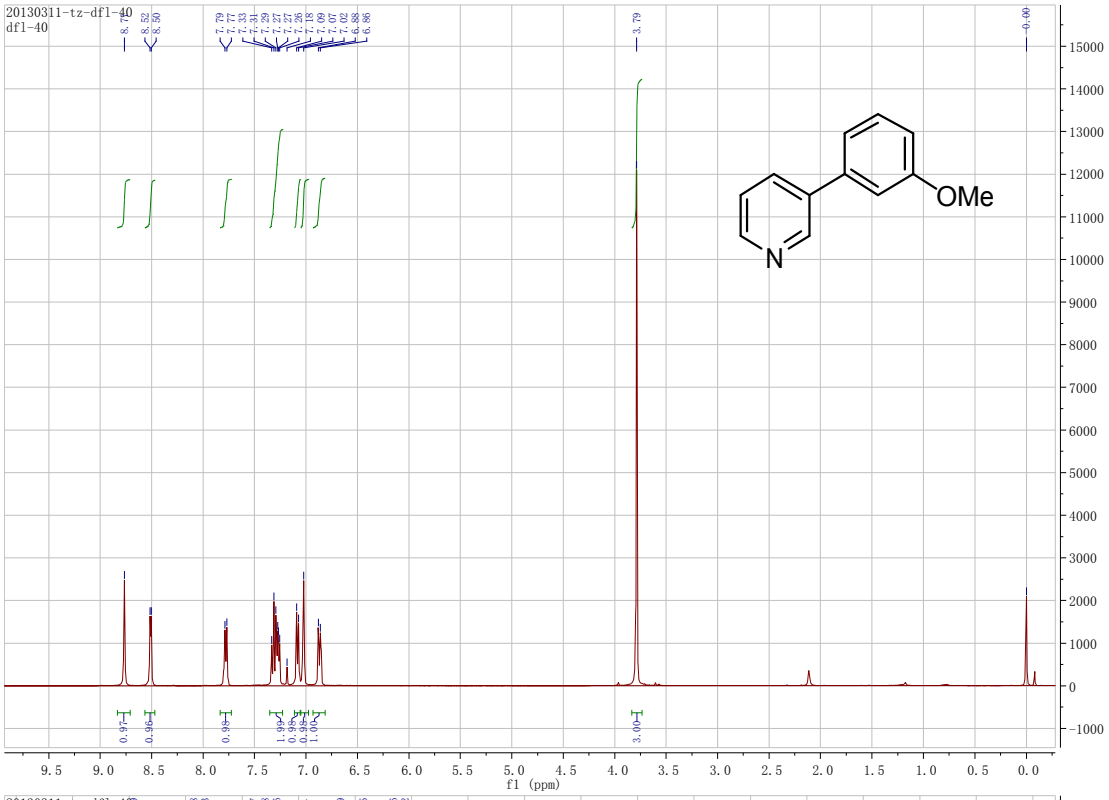
126.023
123.490
77.320
77.000
76.687
34.591
31.280
0.994
180 160 140 120 100 80 60 40 20 ppm

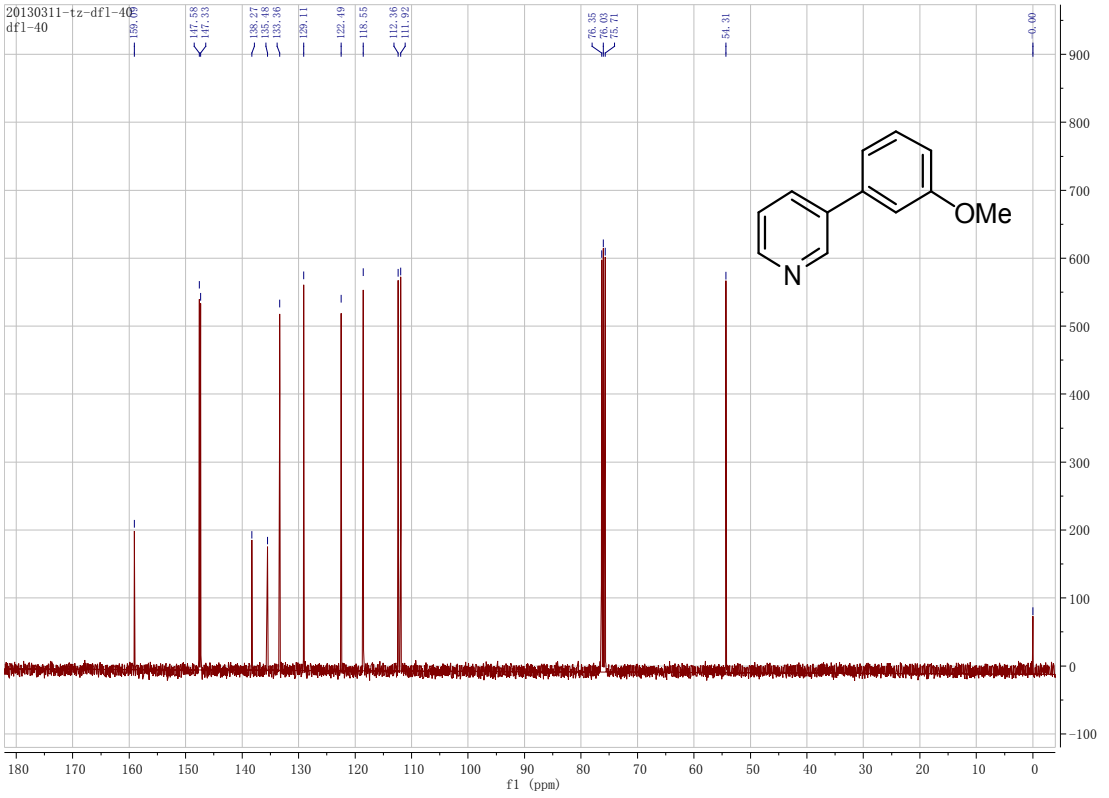

20121212-tz-dfl-01
df101
F
N
f1 (ppm)

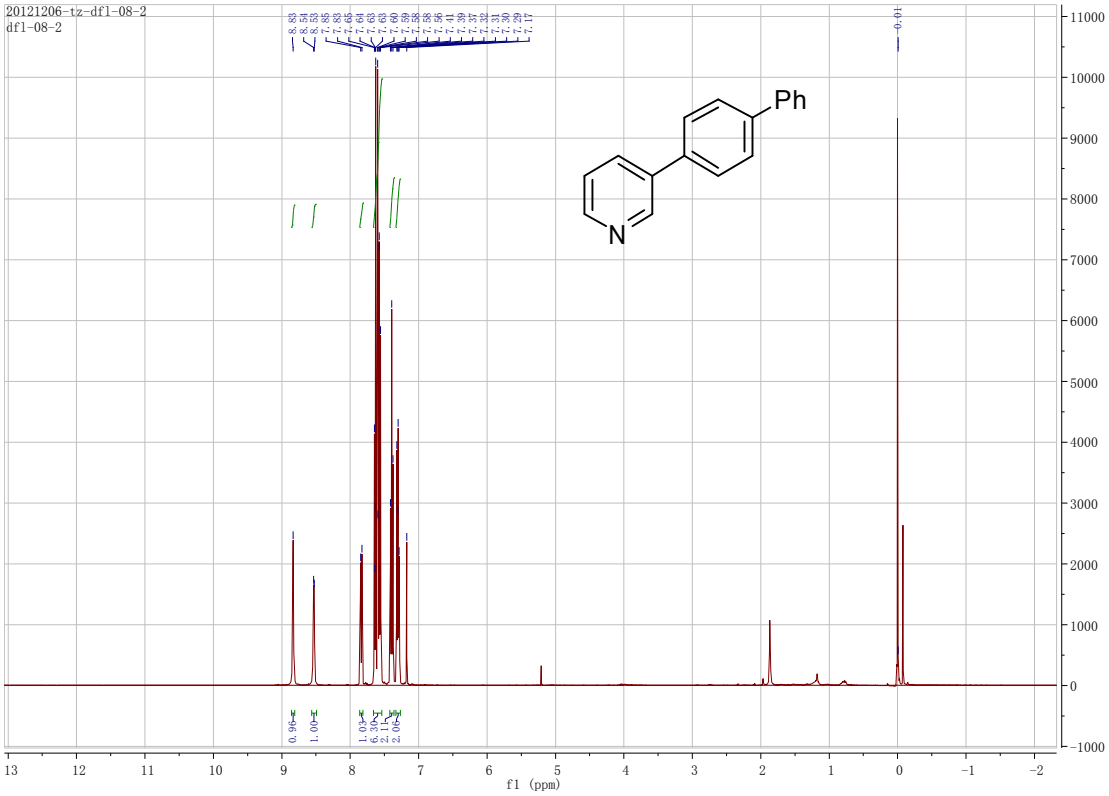

20121212-tz-dfl-011
df111
F
N
f1 (ppm)

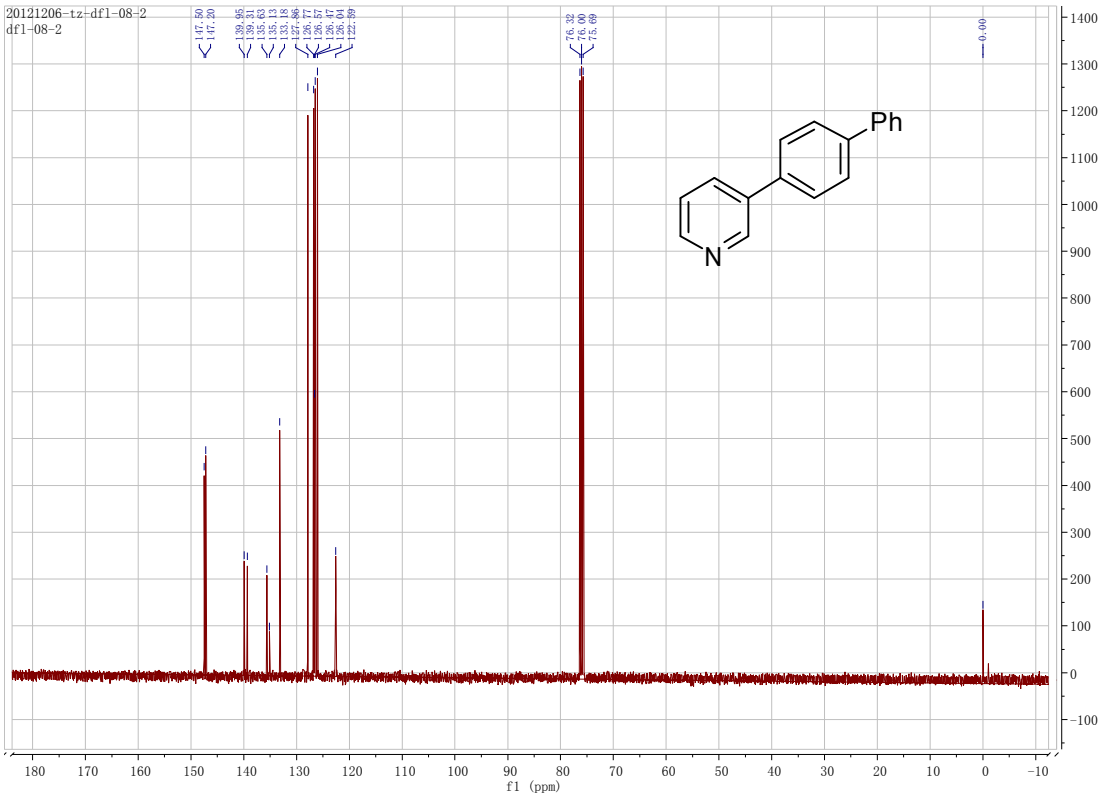

20121221-tz-dfl-22
tz-dfl-22
8.78
8.58
8.57
7.84
7.82
7.75
7.70
7.68
7.61
7.59
7.56
7.54
7.52
7.36
7.35
7.34
7.33
7.19
0.00
1.00
0.99
1.04
1.04
1.04
1.07
1.07
1.09
CF3
N
f1 (ppm)

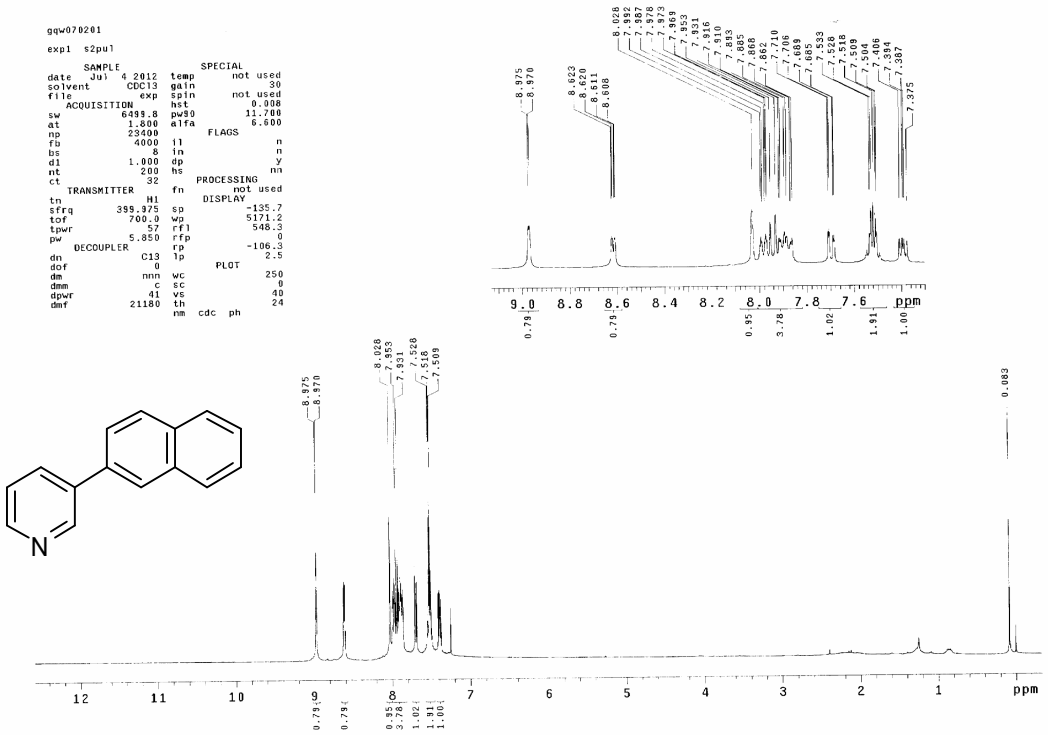

20121224-tz-dfl-22
dfl-22
148.11
147.14
137.57
134.32
133.56
130.65
130.32
129.72
128.62
123.83
122.95
122.15
76.33
76.01
75.69
0.00
CF3
N
f1 (ppm)

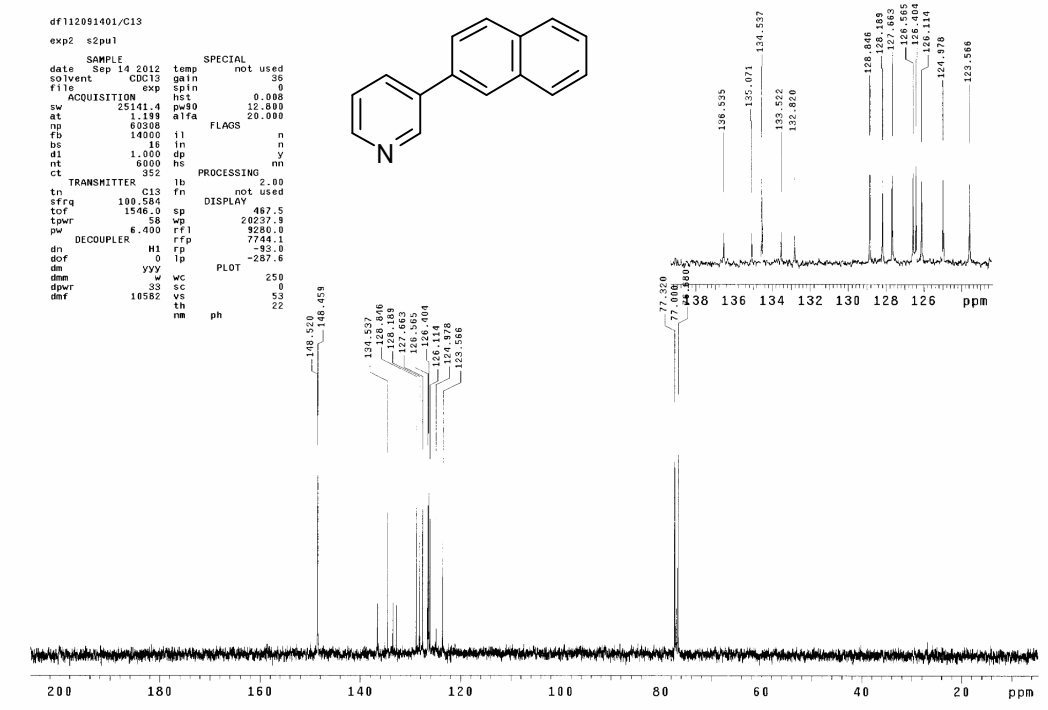

20130311-tz-dfl-40
dfl-40
8.74
8.52
8.50
7.79
7.77
7.33
7.30
7.29
7.27
7.26
7.25
7.09
7.07
7.02
6.88
6.86
3.79
0.00
OMe
N
f1 (ppm)

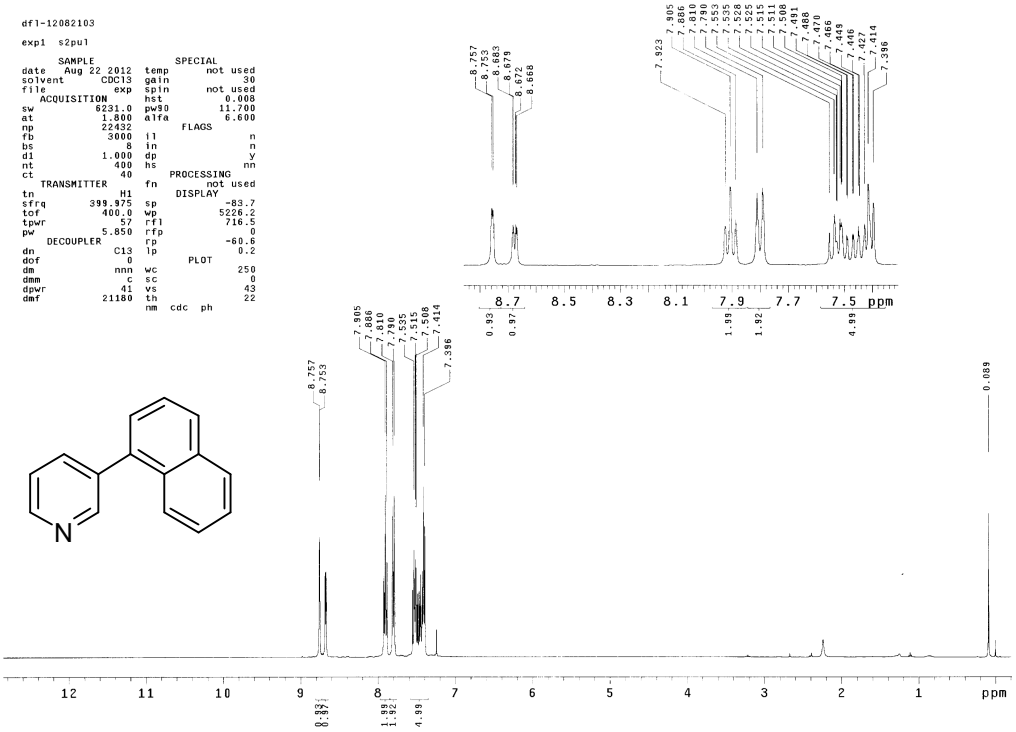

20130311-tz-dfl-40
dfl-40
159.07
147.58
147.33
138.27
135.48
133.36
129.11
122.49
118.55
112.36
111.92
76.35
76.00
75.71
54.31
0.00
OMe
N
f1 (ppm)

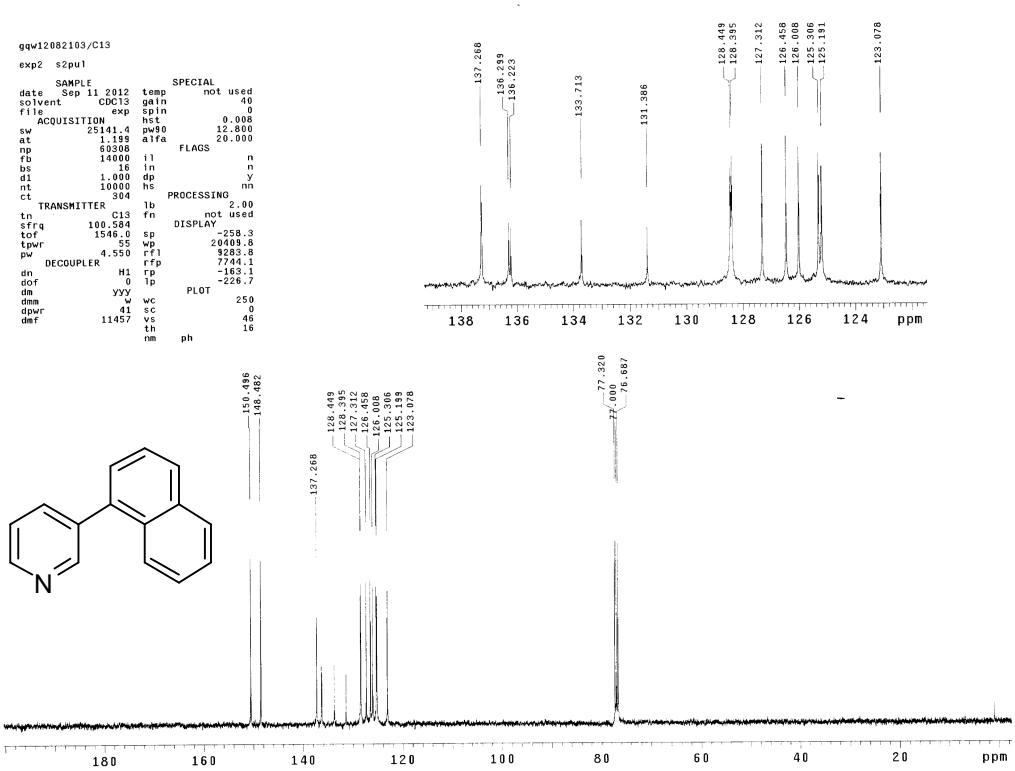

20121206-tz-dfl-08-2
dfl-08-2
Ph
N
f1 (ppm)

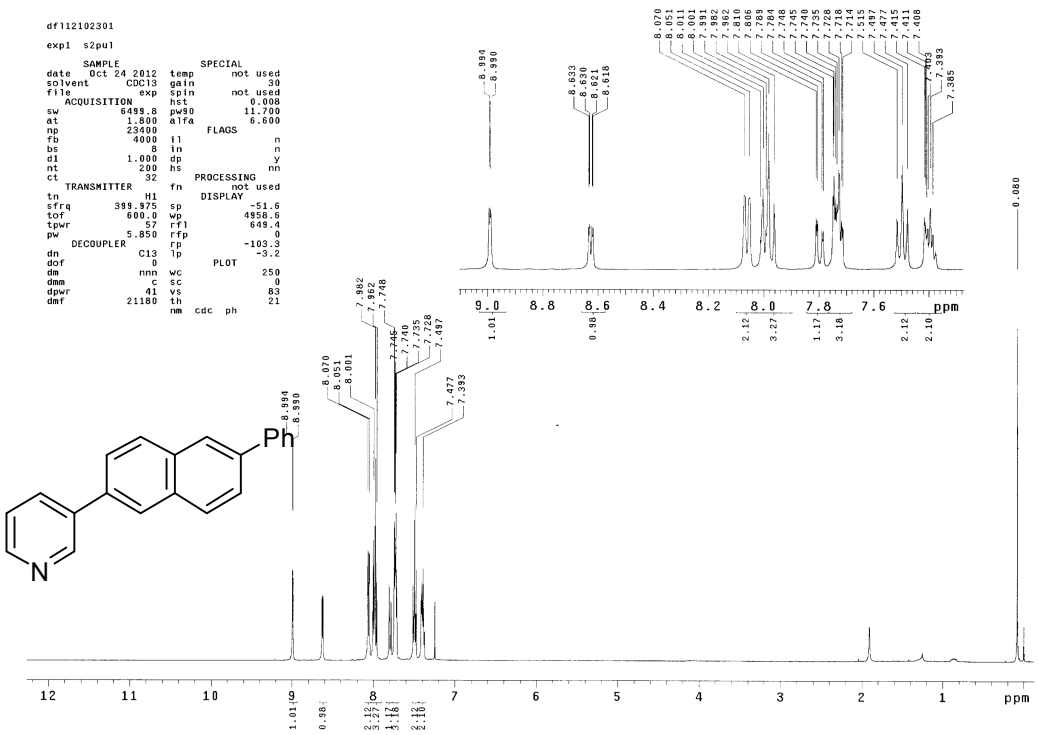

20121206-tz-dfl-08-2
dfl-08-2
Ph
N
f1 (ppm)

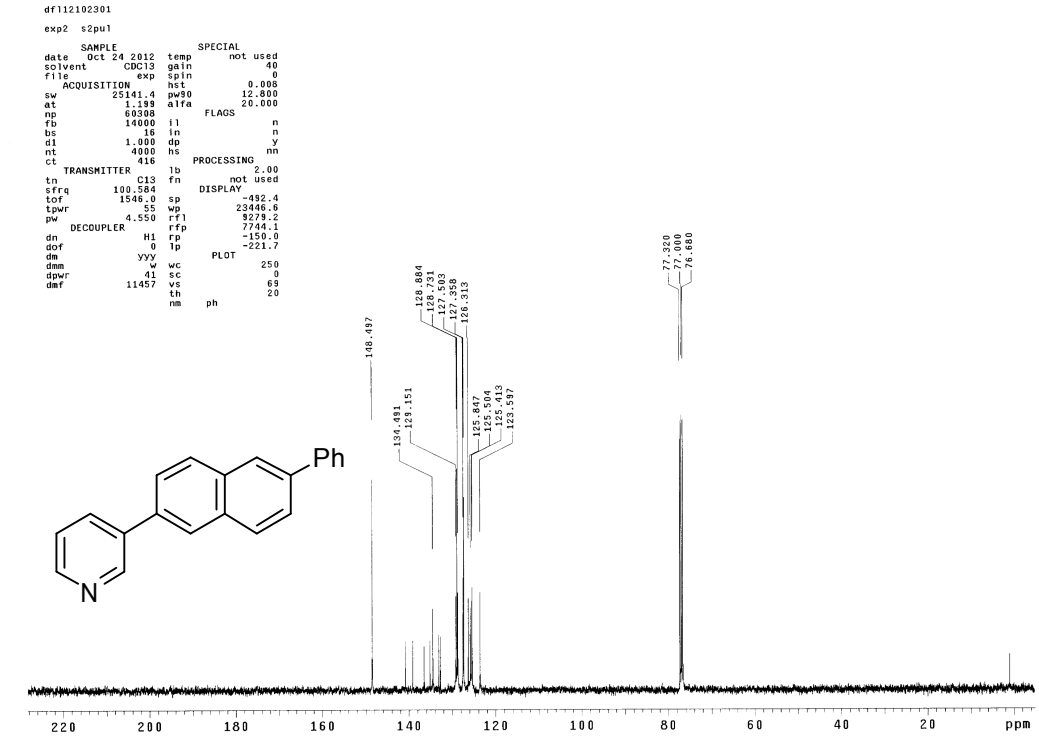

gqw070201
exp1 s2pul
SAMPLE
date Jul 4 2012
solvent CDCl3
file exp
ACQUISITION
sw 6499.8
at 1.800
np 23400
fb 4000
bs 8
d1 1.000
nt 200
ct 32
TRANSMITTER
tn H1
sfrq 399.975
tof 700.0
tpwr 57
pw 5.850
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 21180
SPECIAL
temp not used
gain 30
spin not used
hst 0.008
pw90 11.700
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn not used
DISPLAY
sp -135.7
wp 5171.2
rfl 548.3
rfp 0
rp -106.3
lp 2.5
PLOT
wc 250
sc 0
vs 40
th 24
nm cdc ph
8.975
8.970
8.623
8.620
8.611
8.608
8.028
7.992
7.987
7.978
7.973
7.969
7.953
7.931
7.915
7.910
7.893
7.885
7.868
7.862
7.710
7.706
7.689
7.685
7.553
7.528
7.518
7.509
7.504
7.496
7.394
7.387
7.375
9.0 8.8 8.6 8.4 8.2 8.0 7.8 7.6 ppm
0.79 0.79 0.95 3.78 1.02 1.91 1.00
8.028
7.953
7.931
7.528
7.516
7.509
8.975
8.970
0.083
12 11 10 9 8 7 6 5 4 3 2 1 ppm
0.79 0.79 0.95 3.78 1.02 1.91 1.00
N

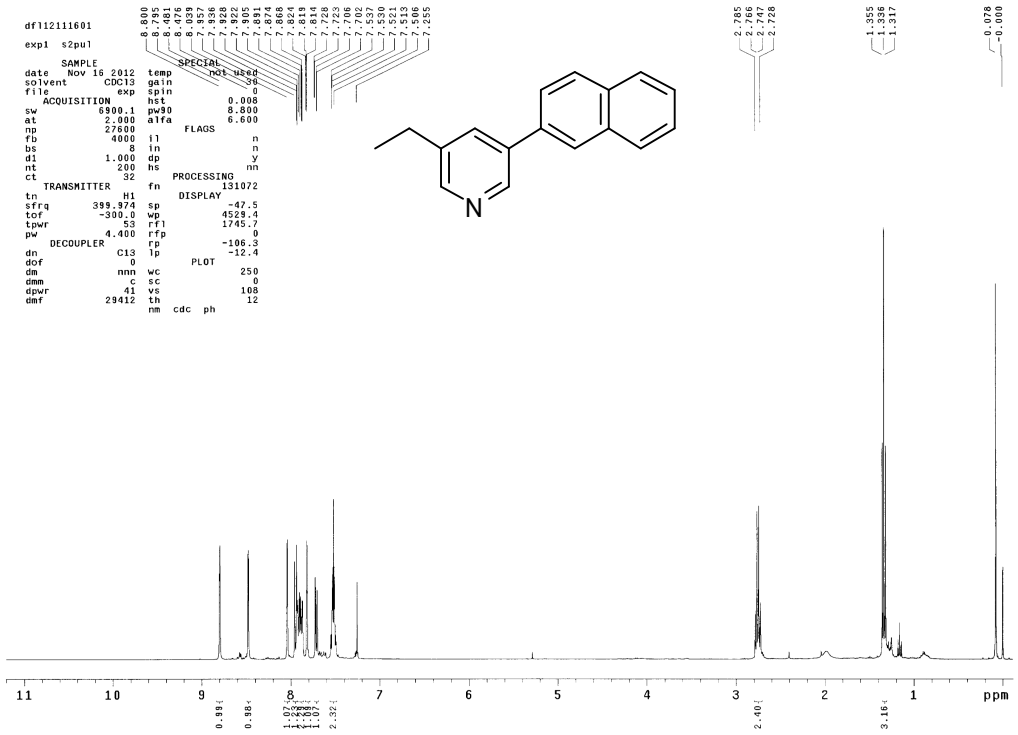

df112091401/C13
exp2 s2pul
SAMPLE
date Sep 14 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 6000
ct 352
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 58
pw 6.400
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 33
dmf 10582
SPECIAL
temp not used
gain 36
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 2.00
fn not used
DISPLAY
sp 467.5
wp 20237.9
rfl 9280.0
rfp 7744.1
rp -93.0
lp -287.6
PLOT
wc 250
sc 0
vs 53
th 22
nm ph
N
148.520
148.459
134.537
128.846
128.189
127.663
126.555
126.404
126.114
124.978
123.566
136.535
135.071
134.537
133.522
132.820
128.846
128.189
127.663
126.555
126.404
126.114
124.978
123.566
77.320
77.000
76.680
138 136 134 132 130 128 126 ppm
200 180 160 140 120 100 80 60 40 20 ppm

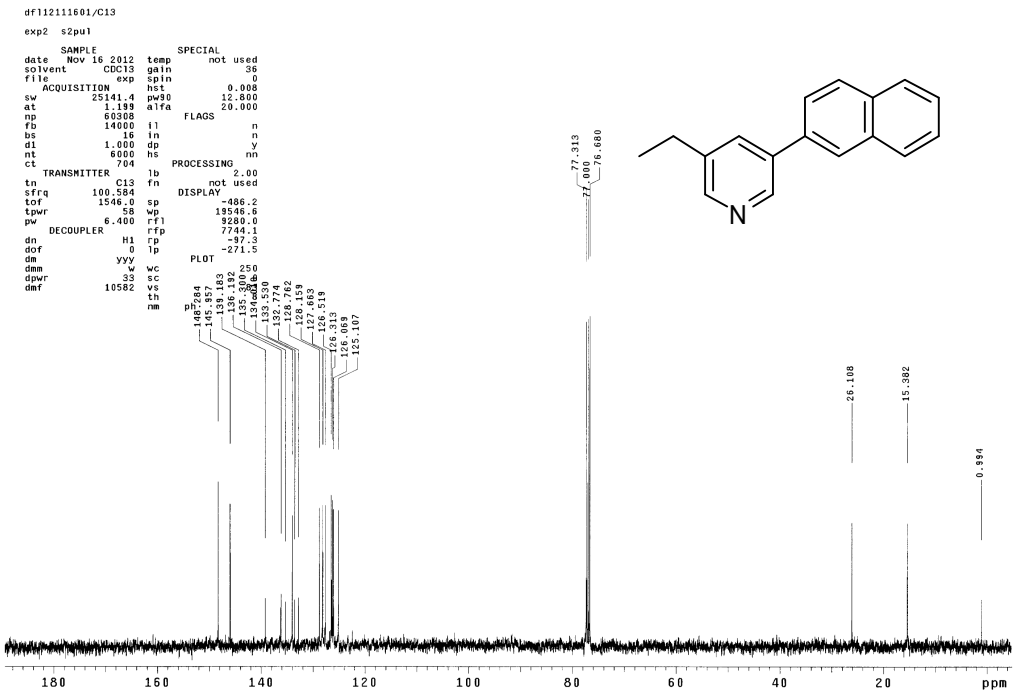

df1-12082103
exp1 s2pul
SAMPLE
date Aug 22 2012
solvent CDCl3
file exp
ACQUISITION
sw 6231.0
at 1.800
np 22432
fb 3000
bs 8
d1 1.000
nt 400
ct 40
TRANSMITTER
tn H1
sfrq 399.975
tof 400.0
tpwr 57
pw 5.850
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 21180
SPECIAL
temp not used
gain 30
spin not used
hst 0.008
pw90 11.700
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn not used
DISPLAY
sp -83.7
wp 5226.2
rfl 716.5
rfp 0
rp -60.6
lp 0.2
PLOT
wc 250
sc 0
vs 43
th 22
nm cdc ph
8.757
8.753
8.683
8.679
8.672
8.668
7.923
7.905
7.886
7.810
7.790
7.553
7.535
7.528
7.515
7.511
7.508
7.491
7.488
7.470
7.466
7.449
7.446
7.421
7.414
7.396
0.089
8.7
8.5
8.3
8.1
7.9
7.7
7.5 ppm
0.93
0.97
1.99
1.92
4.99
12
11
10
9
8
7
6
5
4
3
2
1
ppm

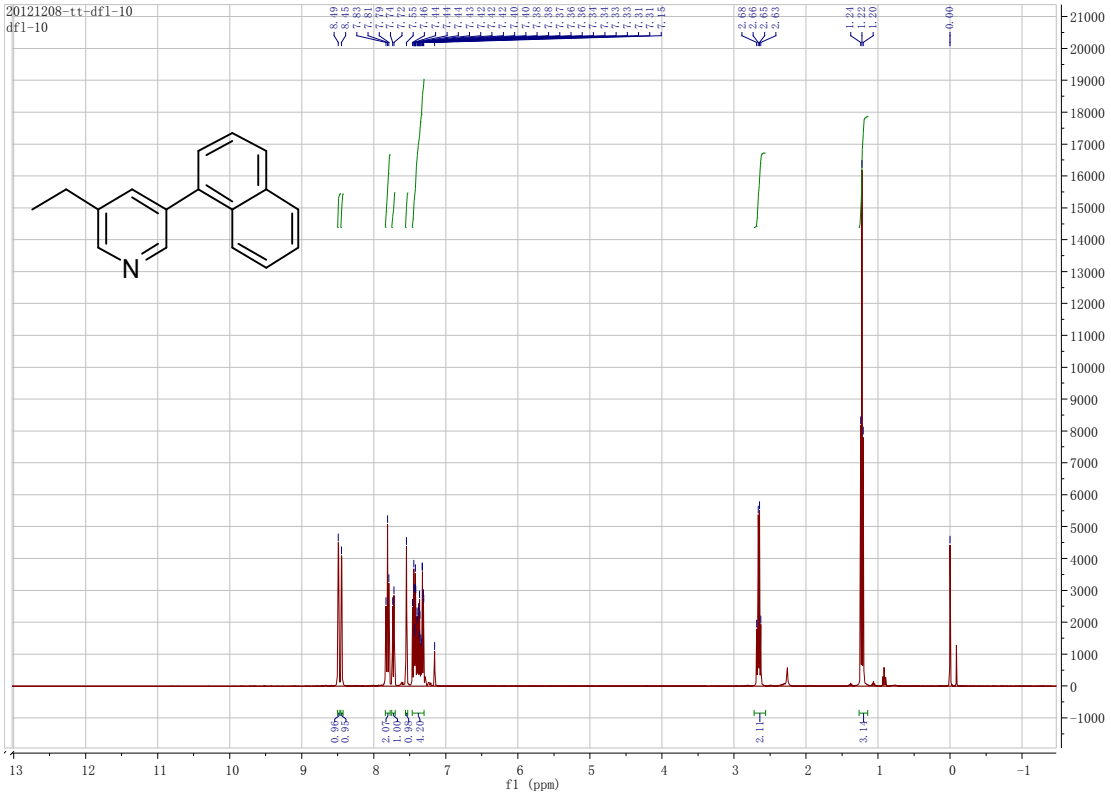

gqw12082103/C13
exp2 s2pul
SAMPLE
date Sep 11 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60306
fb 14000
bs 16
d1 1.000
nt 10000
ct 304
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 55
pw 4.550
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 41
dmf 11457
SPECIAL
temp not used
gain 40
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 2.00
fn not used
DISPLAY
sp -258.3
wp 20409.8
rfl 9283.8
rfp 7744.1
rp -163.1
lp -226.7
PLOT
wc 250
sc 0
vs 46
th 16
nm ph
137.268
136.299
136.223
133.713
131.386
128.449
128.395
127.312
126.458
126.008
125.306
125.191
123.078
150.496
148.482
77.320
77.000
76.687
138
136
134
132
130
128
126
124
ppm
180
160
140
120
100
80
60
40
20
ppm

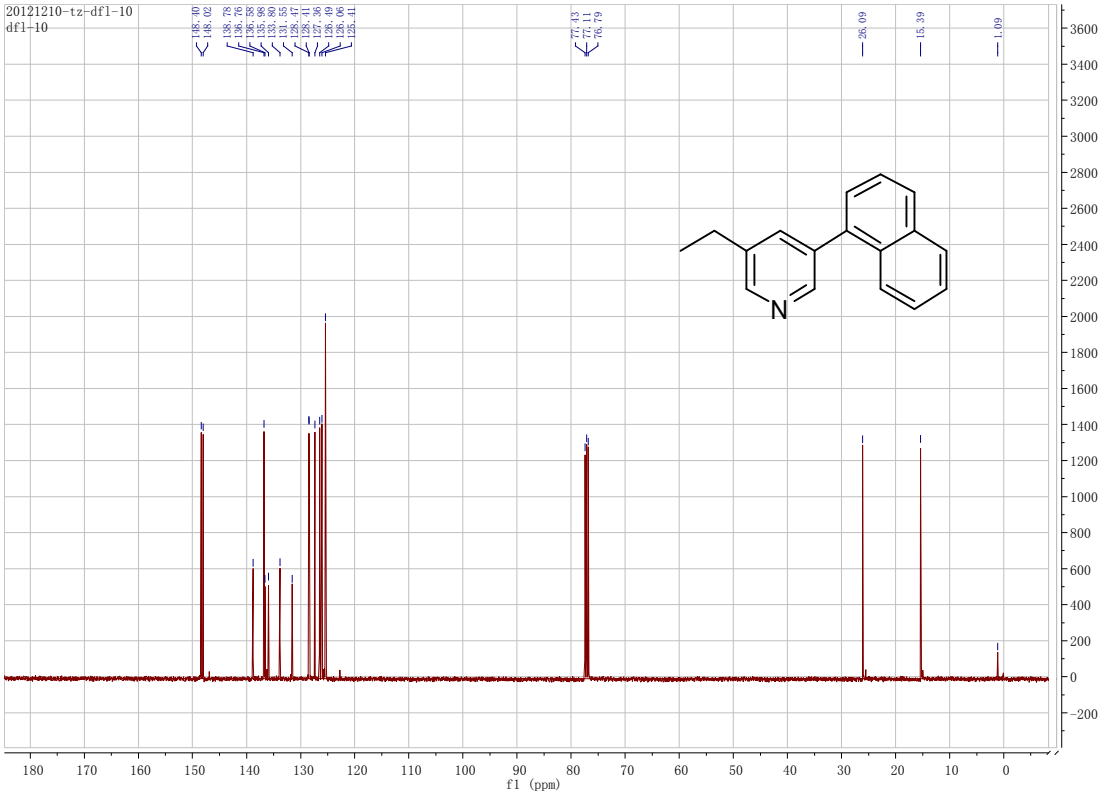

df112102301
exp1 s2pul
SAMPLE
date Oct 24 2012
solvent CDCl3
file exp
ACQUISITION
sw 6498.8
at 1.800
np 23400
fb 4000
bs 8
d1 1.000
nt 200
ct 32
TRANSMITTER
tn H1
sfrq 399.975
tof 600.0
tpwr 57
pw 5.850
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 21180
SPECIAL
temp not used
gain 30
spin not used
hst 0.008
pw90 11.700
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn not used
DISPLAY
sp -51.6
wp 4958.6
rfl 649.4
rfp 0
rp -103.3
lp -3.2
PLOT
wc 250
sc 0
vs 83
th 21
nm cdc ph
Ph
N
ppm

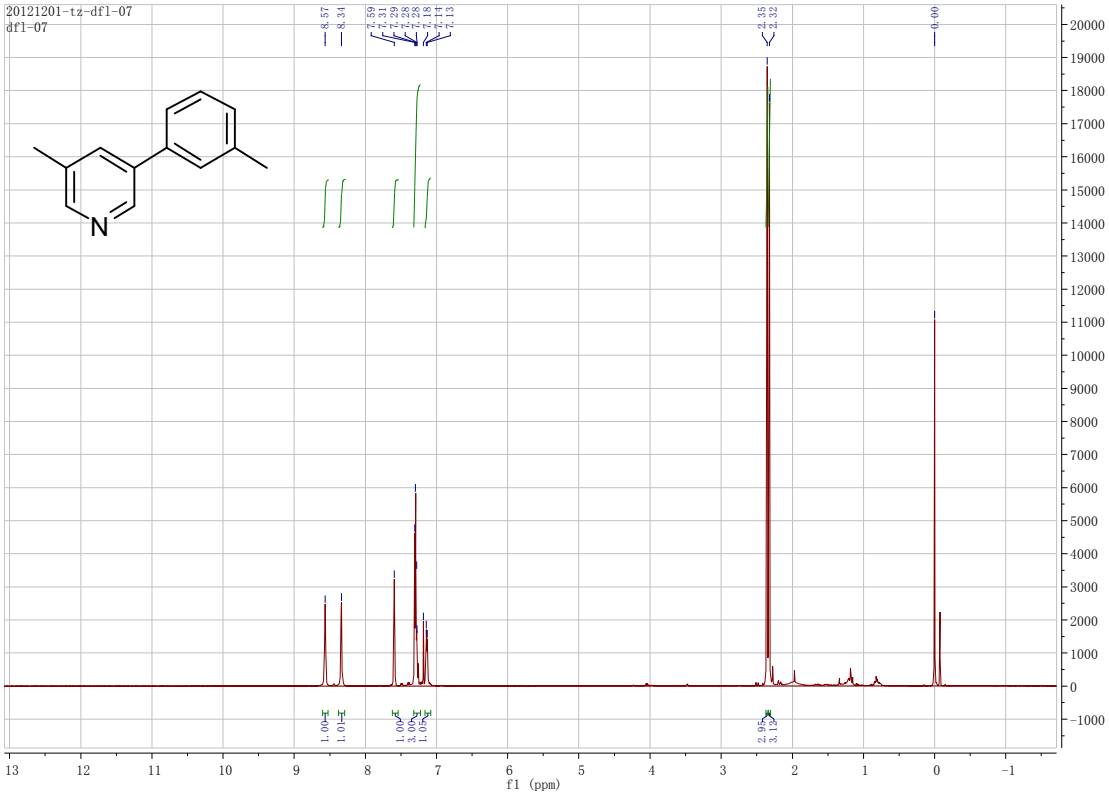

df112102301
exp2 s2pul
SAMPLE
date Oct 24 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 4000
ct 416
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 55
pw 4.550
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 41
dmf 11457
SPECIAL
temp not used
gain 40
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
lb 2.00
fn not used
DISPLAY
sp -492.4
wp 23446.6
rfl 9279.2
rfp 7744.1
rp -150.0
lp -221.7
PLOT
wc 250
sc 0
vs 69
th 20
nm ph
Ph
N
ppm

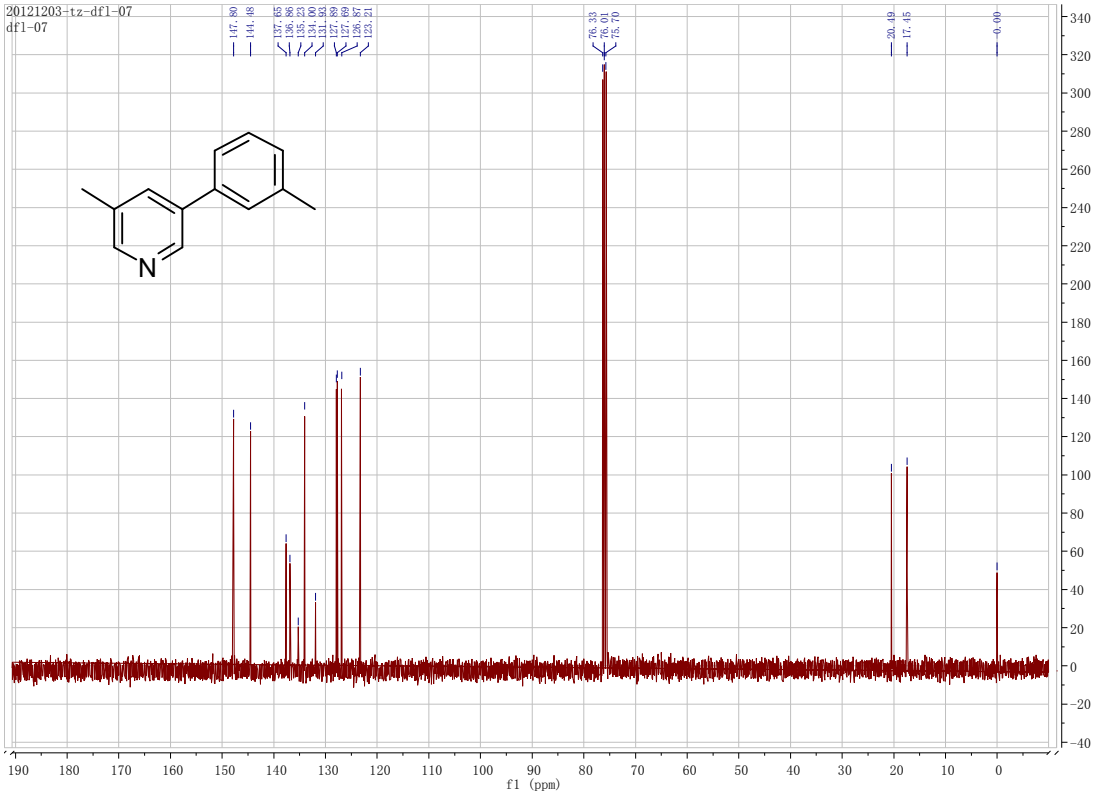

df112111601
exp1 s2pul
SAMPLE
date Nov 16 2012
solvent CDCl3
file exp
ACQUISITION
sw 6800.1
at 2.000
np 27600
fb 4000
bs 8
d1 1.000
nt 200
ct 32
TRANSMITTER
tn H1
sfrq 399.974
tof -300.0
tpwr 53
pw 4.400
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 29412
SPECIAL
temp not used
gain 28
spin 0
hst 0.008
pw90 8.800
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn 131072
DISPLAY
sp -47.5
wp 4529.4
rfl 1745.7
rfp 0
rp -106.3
lp -12.4
PLOT
wc 250
sc 0
vs 108
th 12
nm cdc ph
8.800
8.795
8.481
8.476
8.039
7.957
7.936
7.928
7.922
7.905
7.891
7.874
7.868
7.864
7.819
7.814
7.728
7.723
7.706
7.702
7.537
7.530
7.521
7.513
7.506
7.255
2.785
2.766
2.747
2.728
1.355
1.338
1.317
0.078
-0.000
N
11
10
9
8
7
6
5
4
3
2
1
ppm
0.99
0.88
1.07
1.03
1.00
1.00
2.32
2.40
3.16

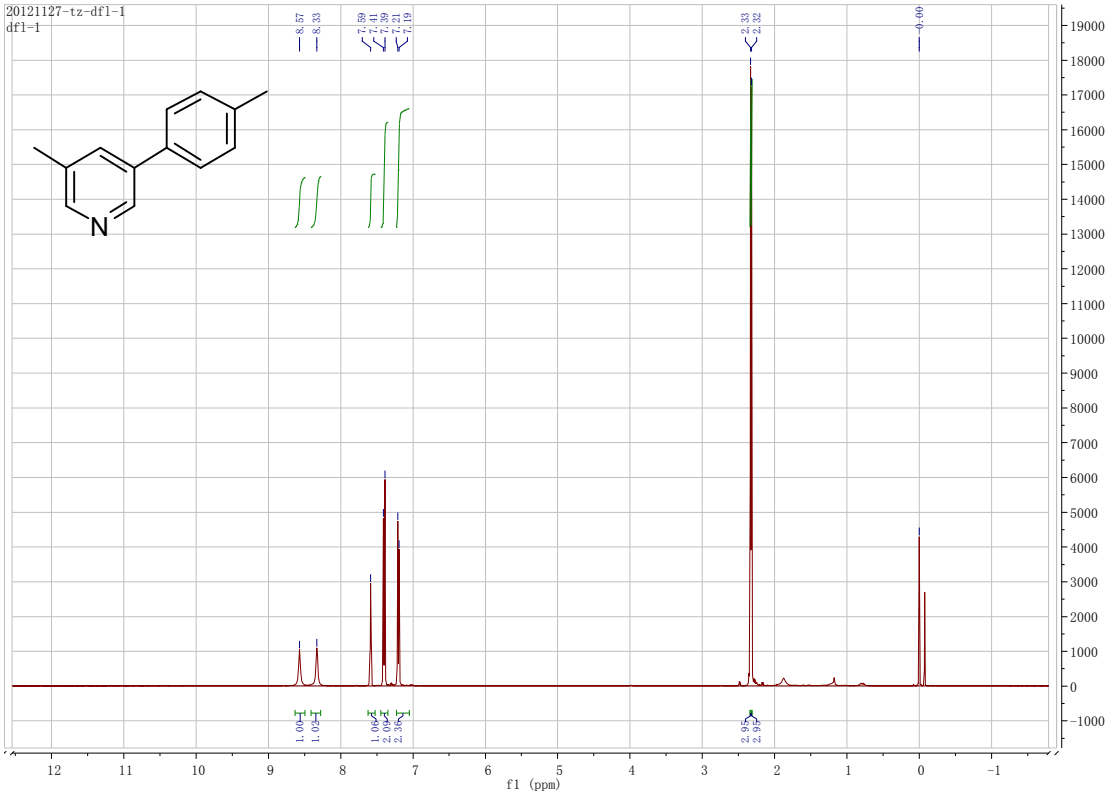

df112111601/C13
exp2 s2pul
SAMPLE
date Nov 16 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 6000
ct 704
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 58
pw 6.400
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 33
dmf 10582
SPECIAL
temp not used
gain 36
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 2.00
fn not used
DISPLAY
sp -486.2
wp 19546.6
rfl 9280.0
rfp 7744.1
rp -97.3
lp -271.5
PLOT
wc 250
sc 0
vs 1
th 1
nm ph
148.284
145.957
141.183
136.192
135.300
134.688
133.530
132.774
128.762
128.159
127.663
126.519
126.213
126.069
125.107
77.313
77.000
76.680
26.108
15.382
0.994
N
180
160
140
120
100
80
60
40
20
ppm

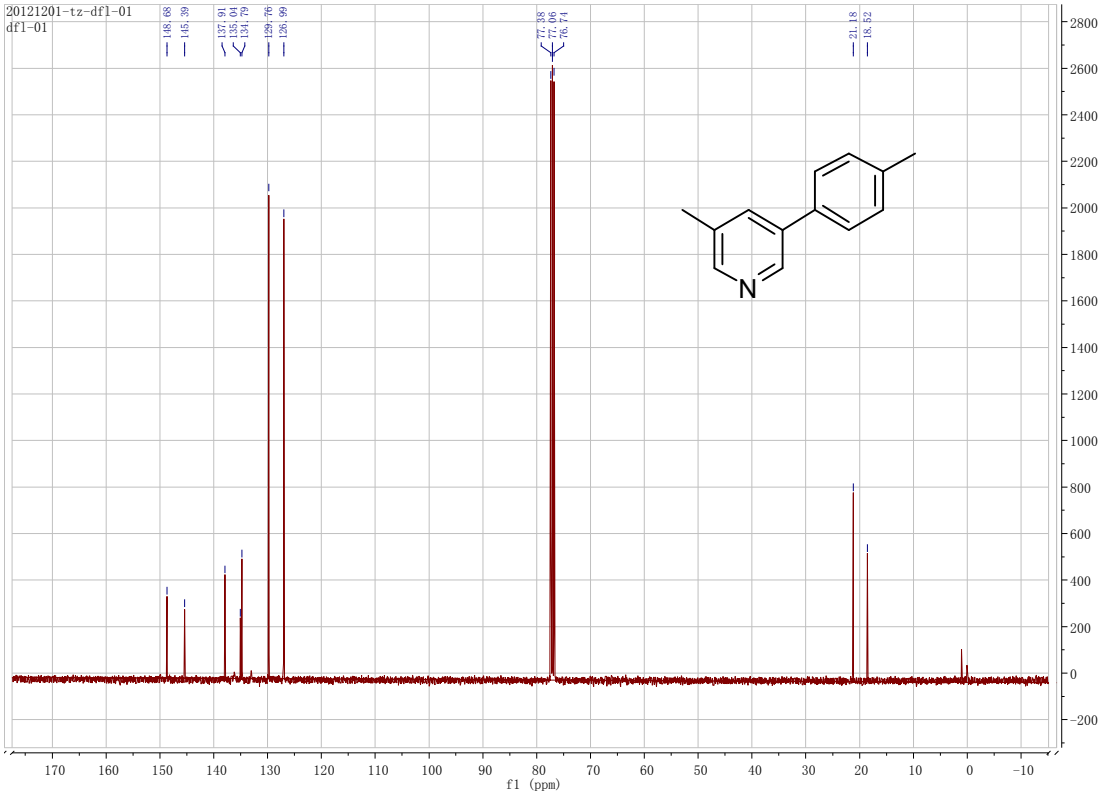

20121208-tt-dfl-10
dfl-10
f1 (ppm)

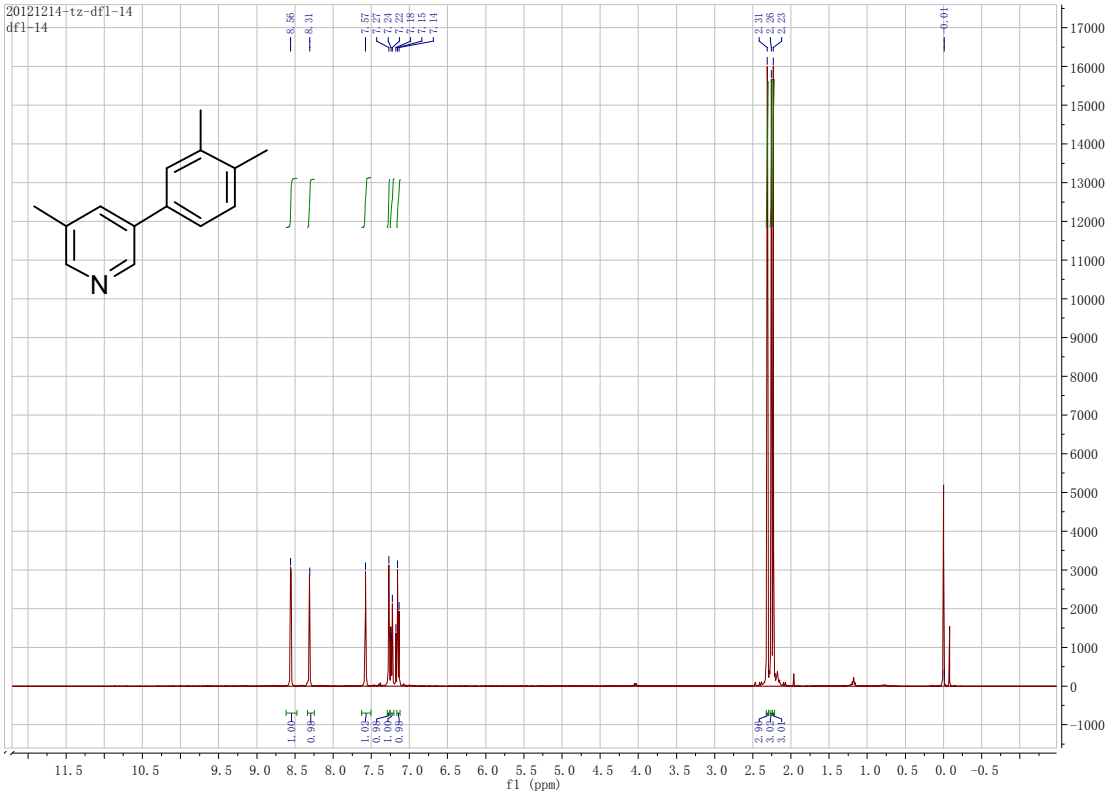

20121210-tz-dfl-10
dfl-10
f1 (ppm)

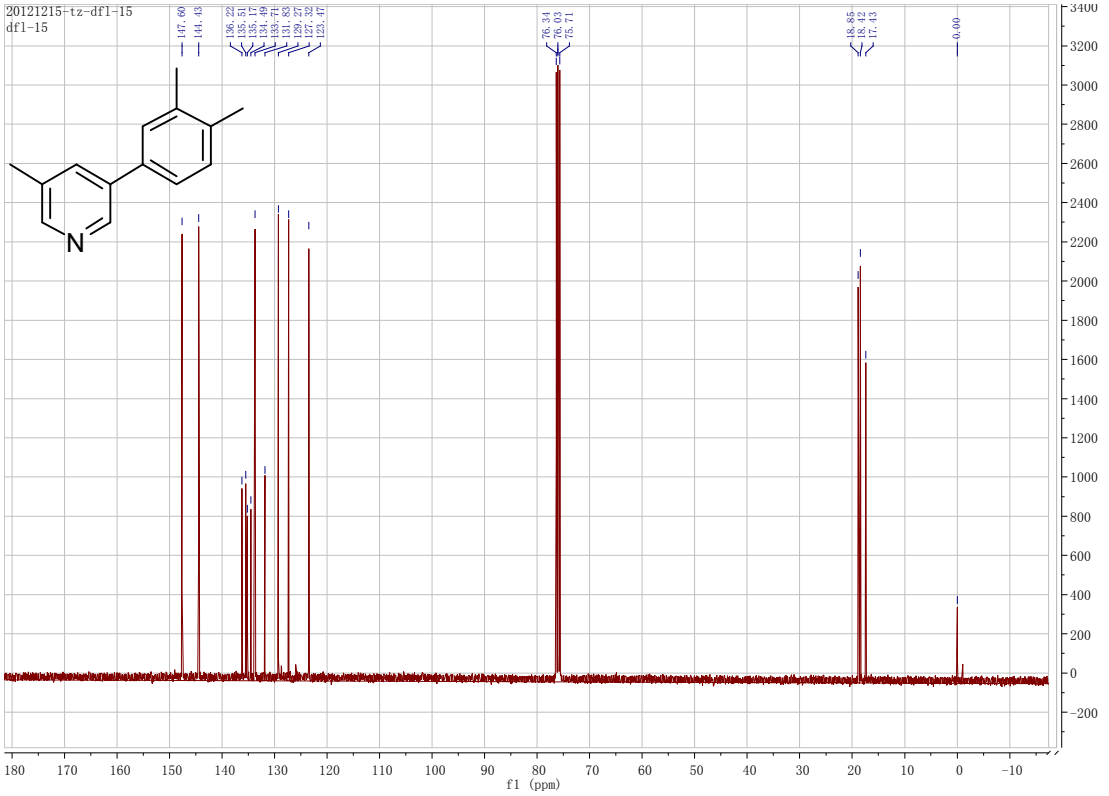

20121201-tz-dfl-07
dfl-07
8.57
8.34
7.59
7.31
7.29
7.28
7.18
7.14
7.13
2.35
2.32
0.00
1.04
1.01
1.04
3.09
1.05
2.97
3.12
f1 (ppm)

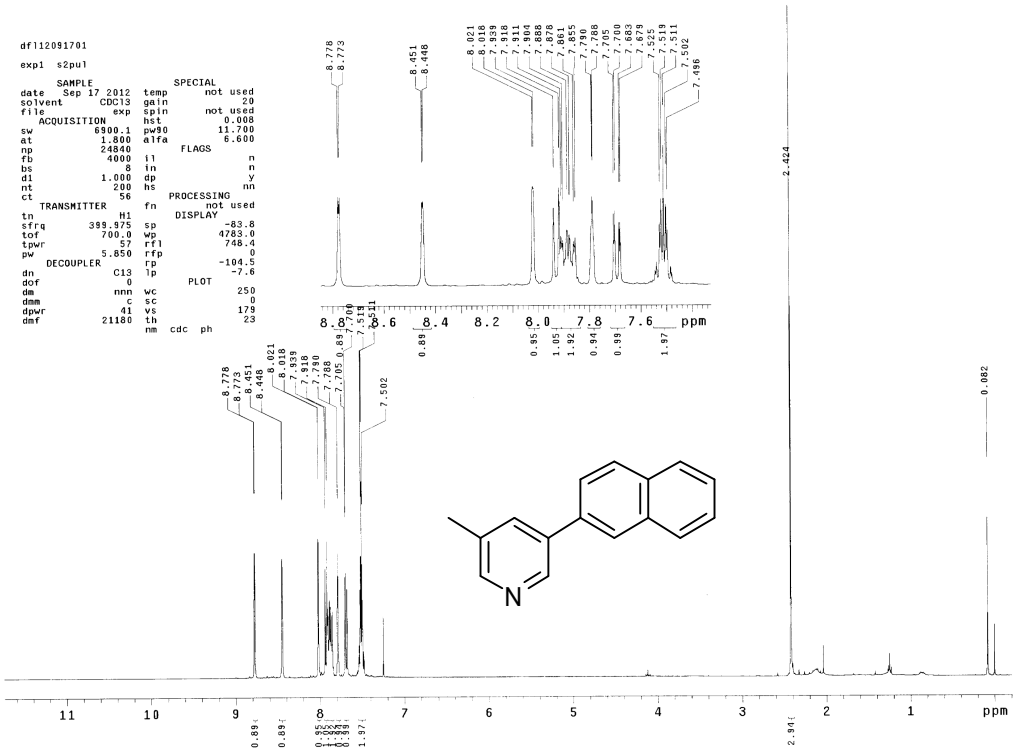

20121203-tz-dfl-07
dfl-07
147.80
144.48
137.65
136.86
135.23
131.00
131.55
127.89
127.69
126.87
123.21
76.33
76.01
75.70
20.49
17.45
0.00
f1 (ppm)

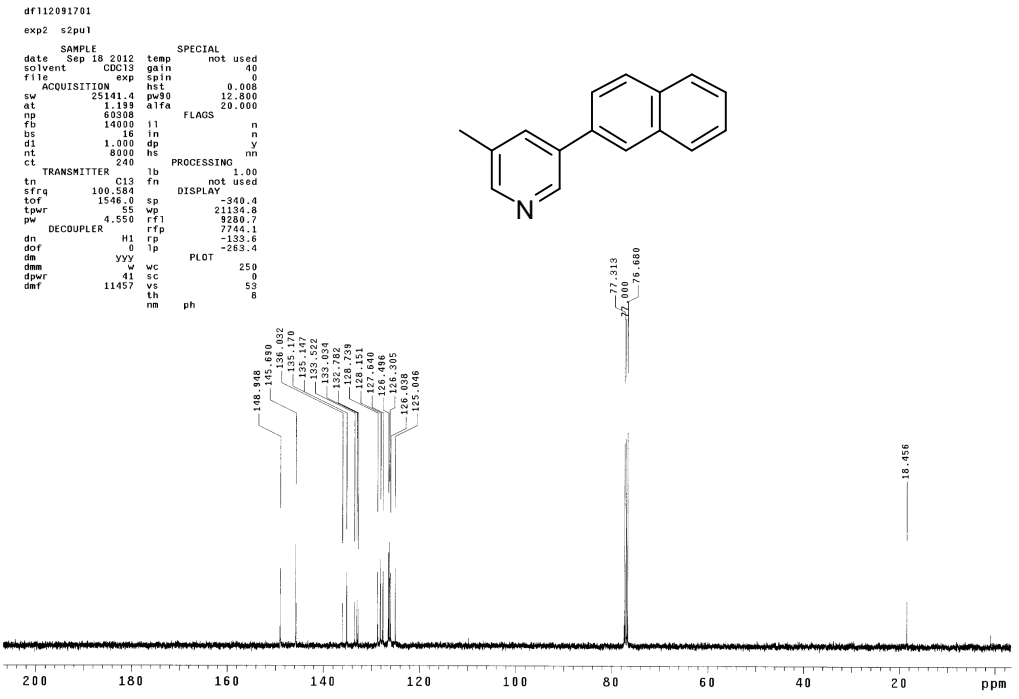

20121127-tz-dfl-1
dfl-1
8.57
8.53
7.59
7.41
7.39
7.23
7.19
2.33
2.32
0.00
1.00
1.02
1.04
2.04
2.36
2.95
2.98
f1 (ppm)

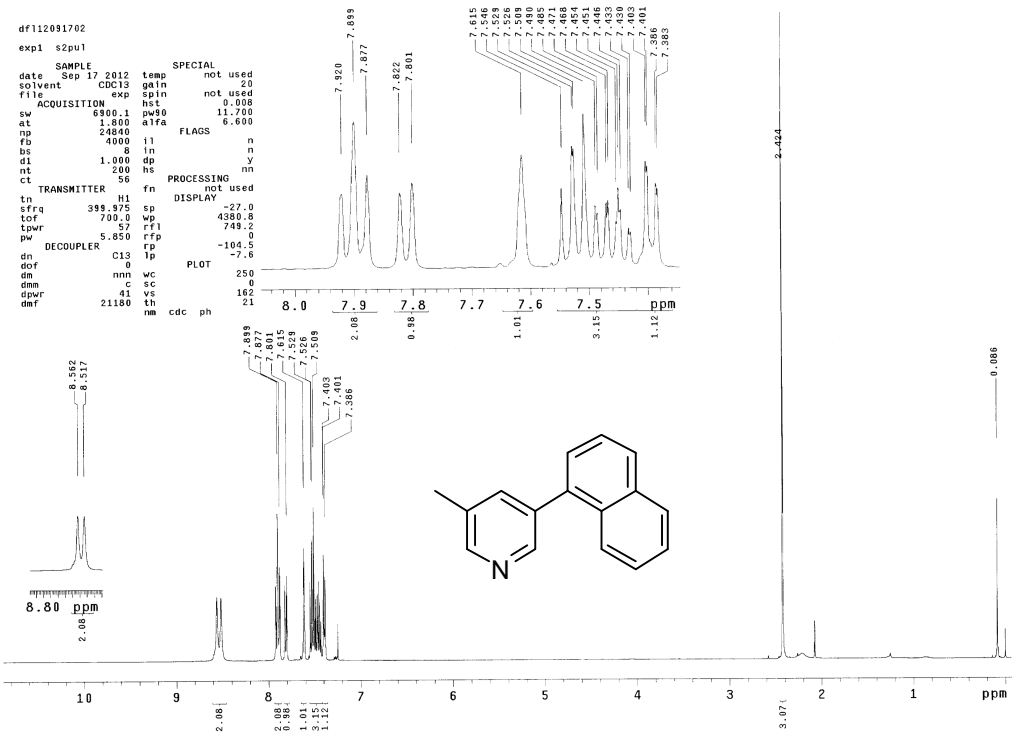

20121201-tz-dfl-01
dfl-01
148.68
146.39
137.91
135.04
134.79
129.76
126.99
77.38
77.06
76.74
21.18
18.52
f1 (ppm)

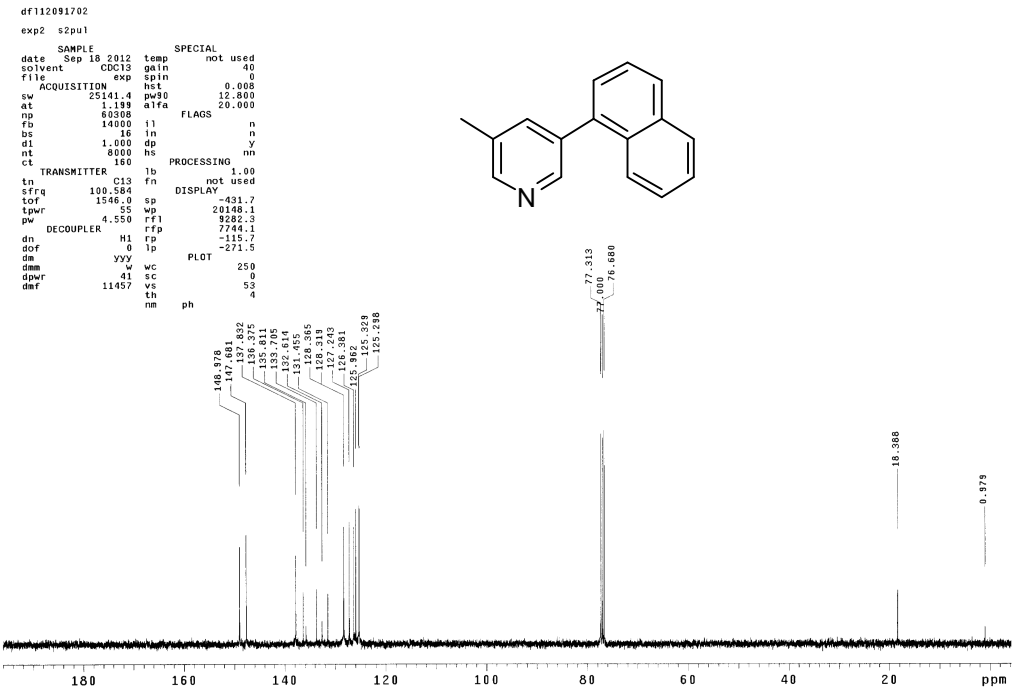

20121214-tz-dfl-14
dfl-14
8.56
8.31
7.57
7.27
7.24
7.22
7.18
7.15
7.14
2.31
2.28
2.23
0.01
f1 (ppm)

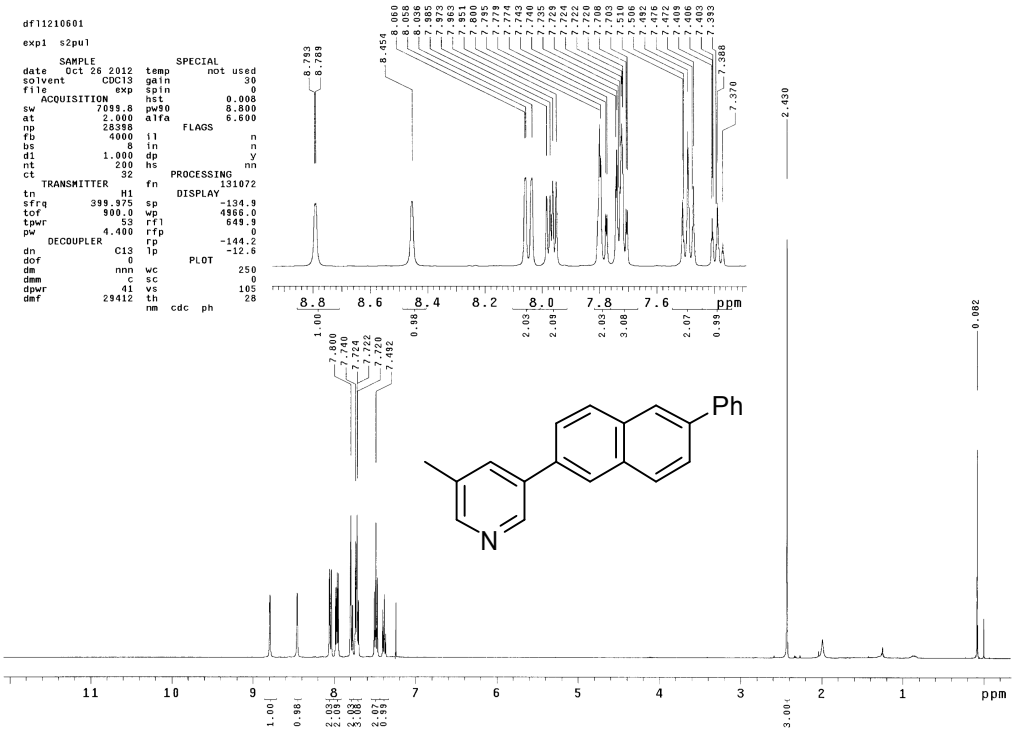

20121215-tz-dfl-15
dfl-15
147.60
144.43
136.22
135.51
135.17
134.49
133.71
131.83
129.27
127.23
123.47
76.34
76.03
75.71
18.85
18.42
17.43
0.00
f1 (ppm)

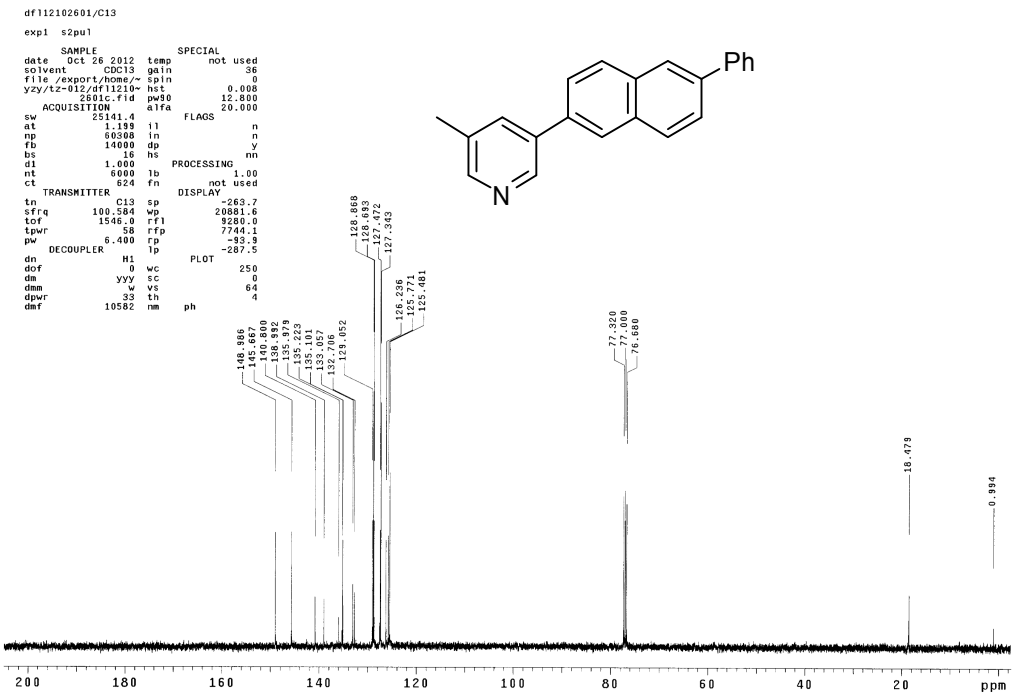

df112091701
exp1 s2pul
SAMPLE
date Sep 17 2012
solvent CDCl3
file exp
ACQUISITION
sw 6900.1
at 1.800
np 24840
fb 4000
bs 8
d1 1.000
nt 200
ct 56
TRANSMITTER
tn H1
sfrq 399.975
tof 700.0
tpwr 57
pw 5.850
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 21180
SPECIAL
temp not used
gain 20
spin not used
hst 0.008
pw90 11.700
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn not used
DISPLAY
sp -83.8
wp 4783.0
rfl 748.4
rfp 0
rp -104.5
lp -7.6
PLOT
wc 250
sc 0
vs 179
th 23
nm cdc ph
8.778
8.773
8.451
8.448
8.021
8.018
7.939
7.918
7.911
7.904
7.888
7.878
7.861
7.855
7.790
7.788
7.705
7.700
7.683
7.679
7.525
7.519
7.511
7.502
7.496
2.424
0.082
ppm

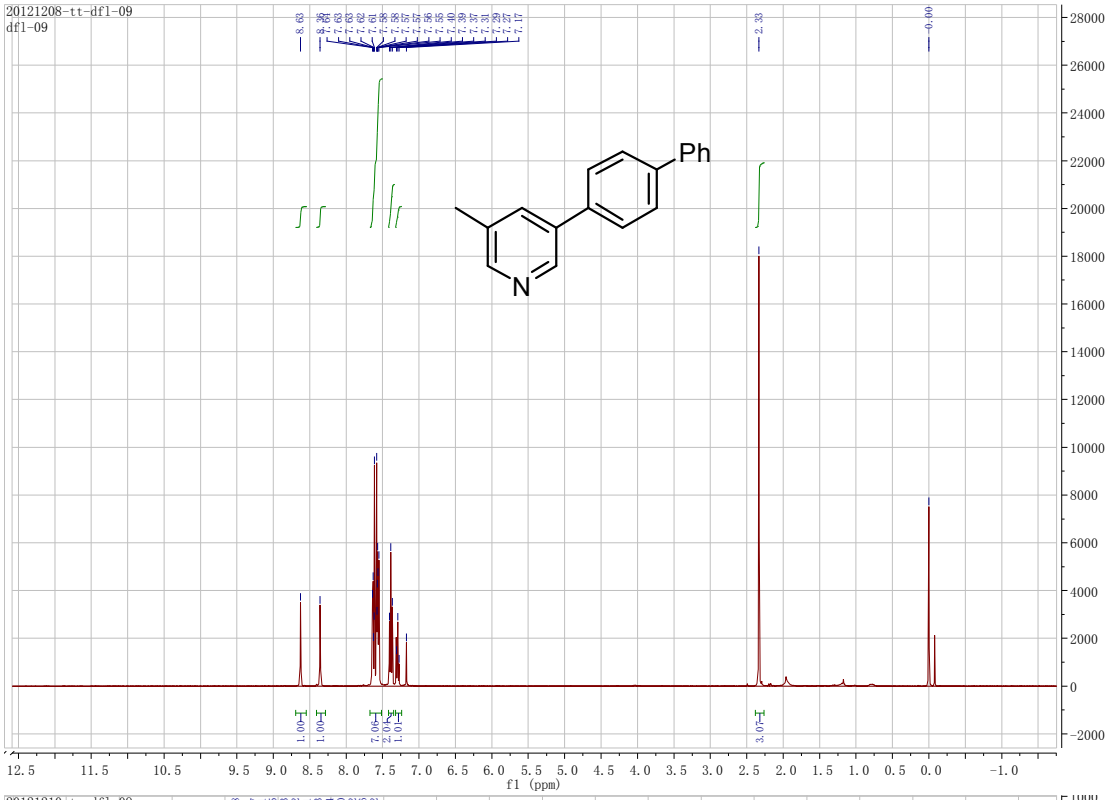

df112091701
exp2 s2pul
SAMPLE
date Sep 18 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 8000
ct 240
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 55
pw 4.550
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 41
dmf 11457
SPECIAL
temp not used
gain 40
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 1.00
fn not used
DISPLAY
sp -340.4
wp 21134.8
rfl 9280.7
rfp 7744.1
rp -133.6
lp -263.4
PLOT
wc 250
sc 0
vs 53
th 8
nm ph
148.948
145.690
136.032
135.170
135.127
133.522
133.034
132.782
128.739
128.151
127.640
126.496
126.305
126.038
125.046
77.313
77.000
76.680
18.456
ppm

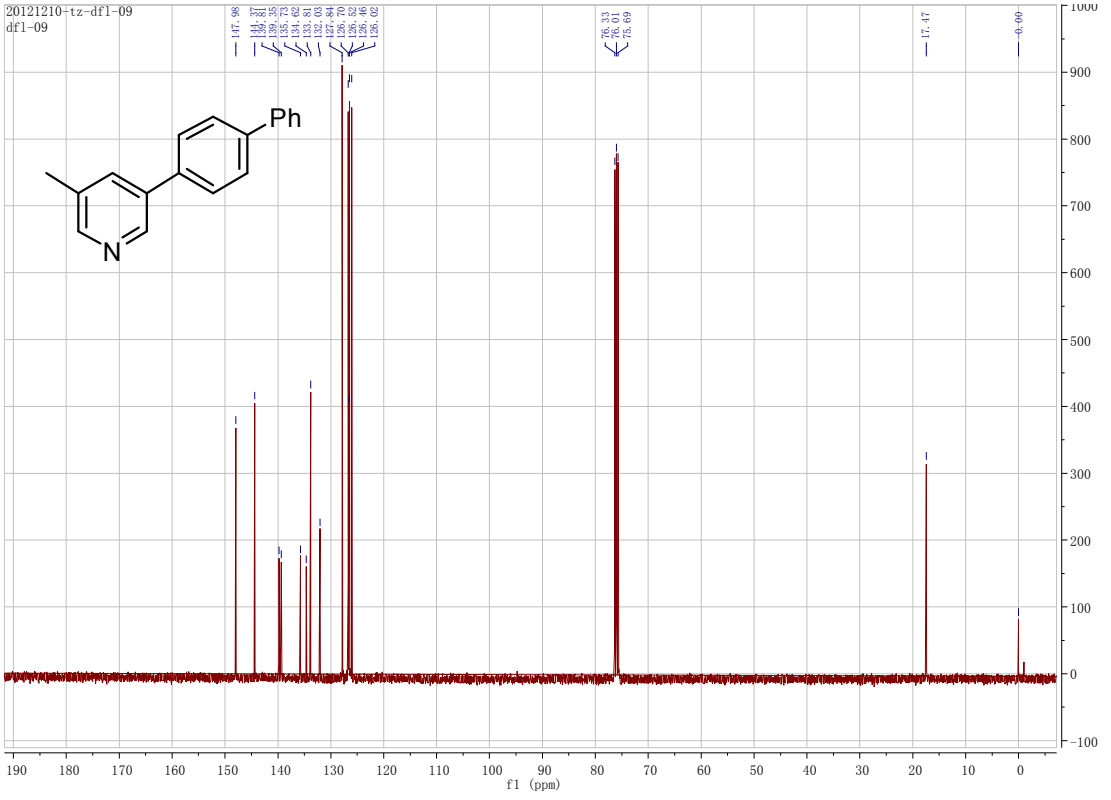

df112091702
exp1 s2pul
SAMPLE
date Sep 17 2012
solvent CDCl3
file exp
ACQUISITION
sw 6900.1
at 1.800
np 24840
fb 4000
bs 8
d1 1.000
nt 200
ct 56
TRANSMITTER
tn H1
sfrq 399.975
tof 700.0
tpwr 57
pw 5.850
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 21180
SPECIAL
temp not used
gain 20
spin not used
hst 0.008
pw90 11.700
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn not used
DISPLAY
sp -27.0
wp 4380.8
rfl 749.2
rfp 0
rp -104.5
lp -7.6
PLOT
wc 250
sc 0
vs 162
th 21
nm cdc ph
7.899
7.877
7.822
7.801
7.615
7.546
7.529
7.526
7.509
7.490
7.485
7.471
7.468
7.454
7.451
7.446
7.433
7.430
7.403
7.401
7.386
7.383
2.424
8.562
8.517
8.80 ppm
0.086
ppm

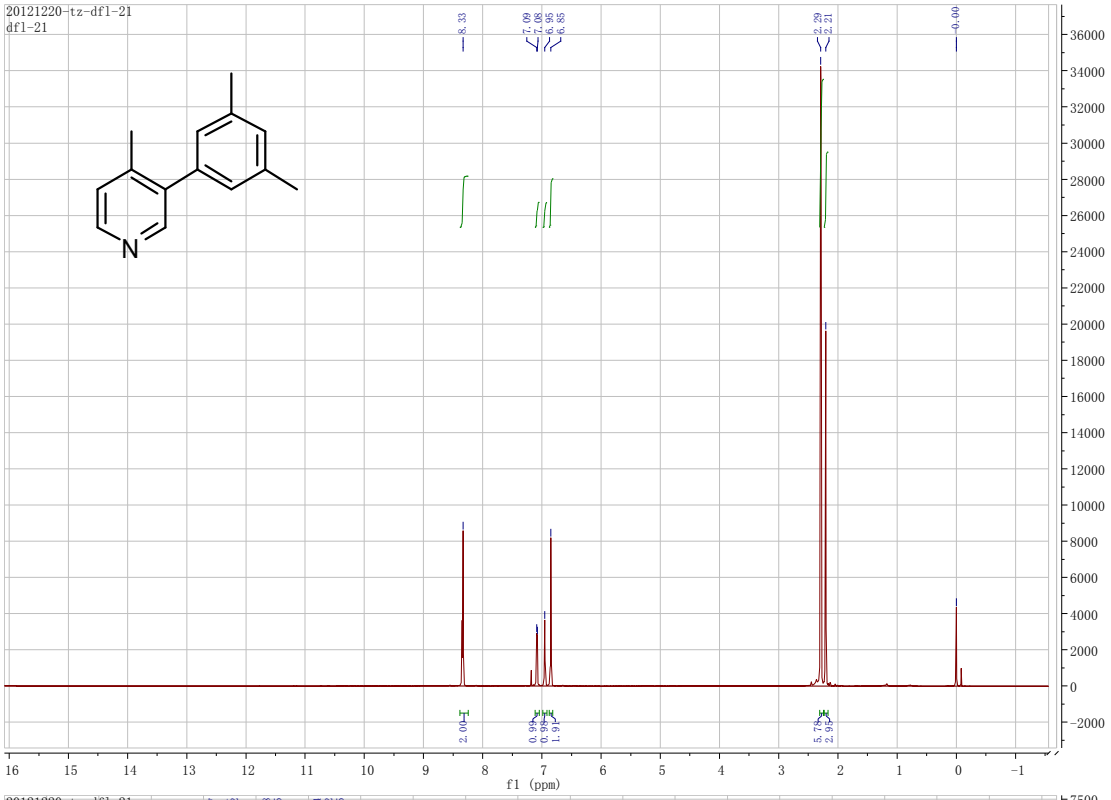

df112091702
exp2 s2pul
SAMPLE
date Sep 18 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 8000
ct 160
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 55
pw 4.550
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 41
dmf 11457
SPECIAL
temp not used
gain 40
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 1.00
fn not used
DISPLAY
sp -431.7
wp 20148.1
rfl 9282.3
rfp 7744.1
rp -115.7
lp -271.5
PLOT
wc 250
sc 0
vs 53
th 4
nm ph
148.978
147.681
137.832
136.375
135.811
133.705
132.614
131.455
128.365
128.319
127.403
126.981
125.962
125.329
125.298
77.313
77.000
76.680
18.368
0.979
ppm

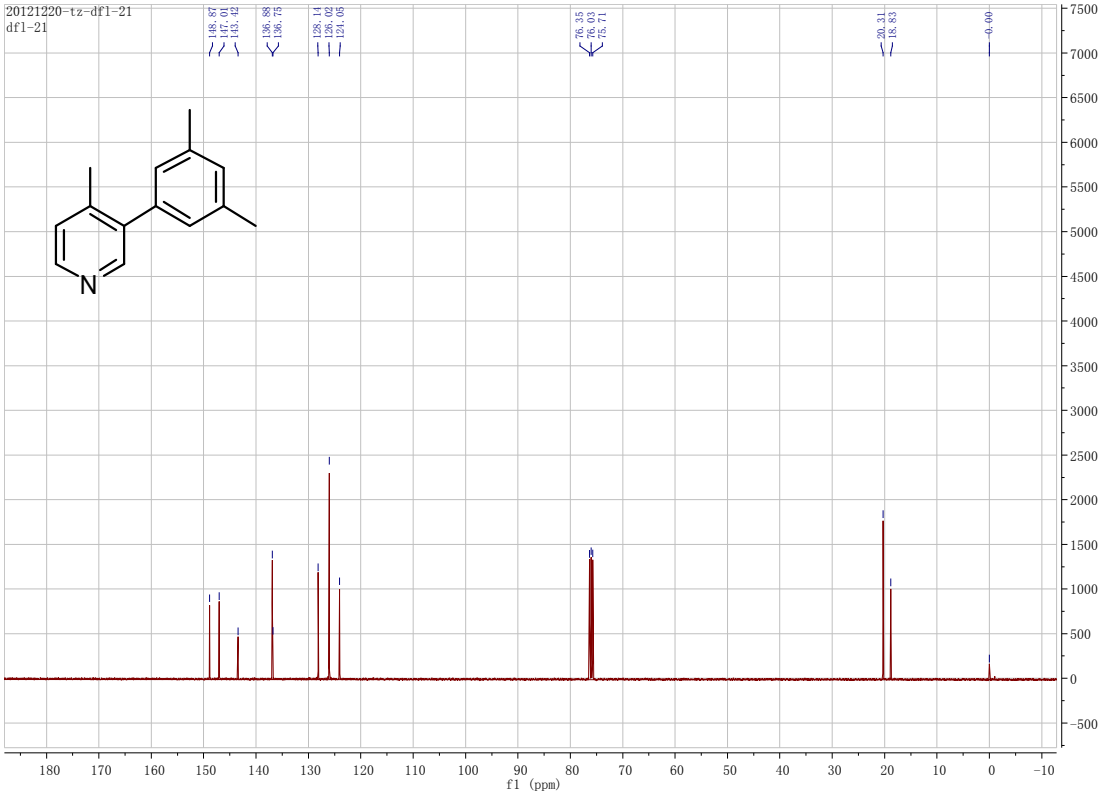

df11210601
exp1 s2pul
SAMPLE
date Oct 26 2012
solvent CDCl3
file exp
ACQUISITION
sw 7099.8
at 2.000
np 28398
fb 4000
bs 8
d1 1.000
nt 200
ct 32
TRANSMITTER
tn H1
sfrq 399.975
tof 900.0
tpwr 53
pw 4.400
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 29412
SPECIAL
temp not used
gain 30
spin 0
hst 0.008
pw90 8.800
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn 131072
DISPLAY
sp -134.9
wp 4966.0
rfl 649.9
rfp 0
rp -144.2
lp -12.6
PLOT
wc 250
sc 0
vs 105
th 28
nm cdc ph
8.793
8.789
8.454
8.060
8.058
8.036
7.995
7.973
7.963
7.951
7.800
7.795
7.779
7.774
7.743
7.740
7.735
7.729
7.724
7.722
7.720
7.708
7.703
7.510
7.506
7.492
7.476
7.472
7.409
7.406
7.403
7.393
7.388
7.370
2.430
0.082
Ph
N
ppm

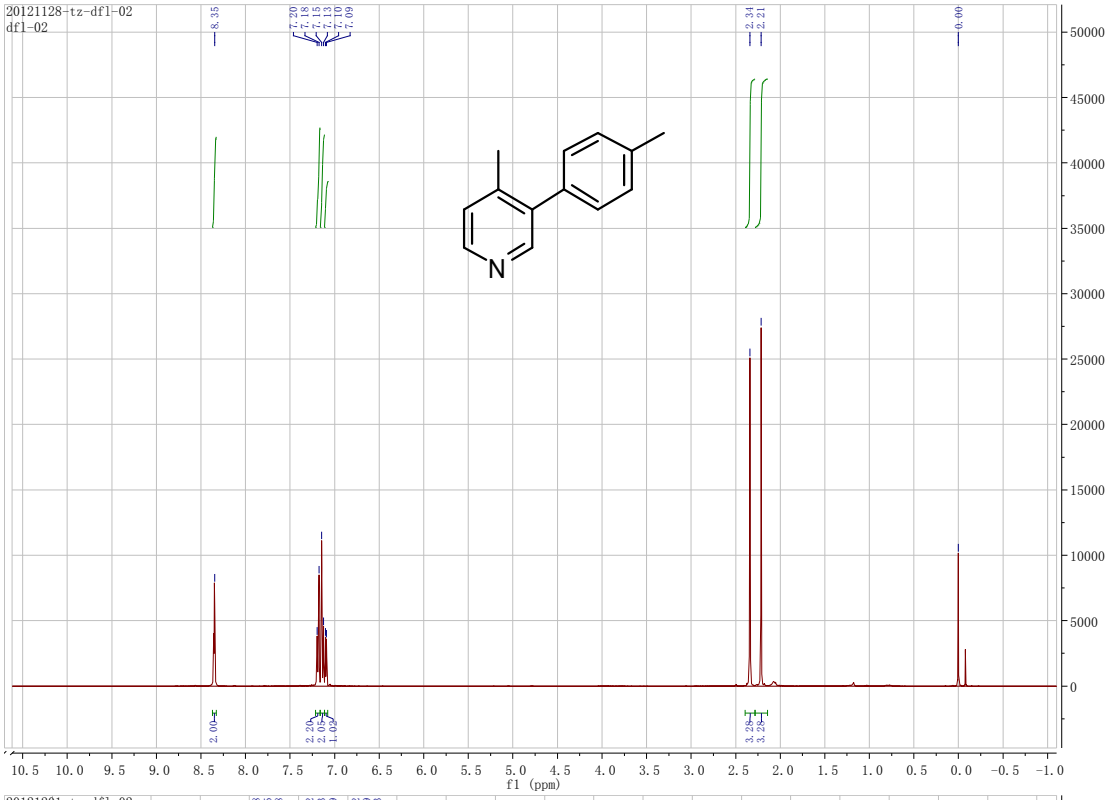

df112102601/C13
exp1 s2pul
SAMPLE
date Oct 26 2012
solvent CDCl3
file /export/home/~
yzy/tz-012/df11210~
2601c.fid
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 6000
ct 624
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 58
pw 6.400
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 33
dmf 10582
SPECIAL
temp not used
gain 36
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 1.00
fn not used
DISPLAY
sp -263.7
wp 20881.6
rfl 9280.0
rfp 7744.1
rp -93.9
lp -287.5
PLOT
wc 250
sc 0
vs 64
th 4
nm ph
148.986
145.667
140.800
138.892
135.979
135.223
135.101
133.057
132.706
128.052
128.868
128.693
127.472
127.343
126.236
125.771
125.481
77.320
77.000
76.680
18.479
0.994
Ph
N
ppm

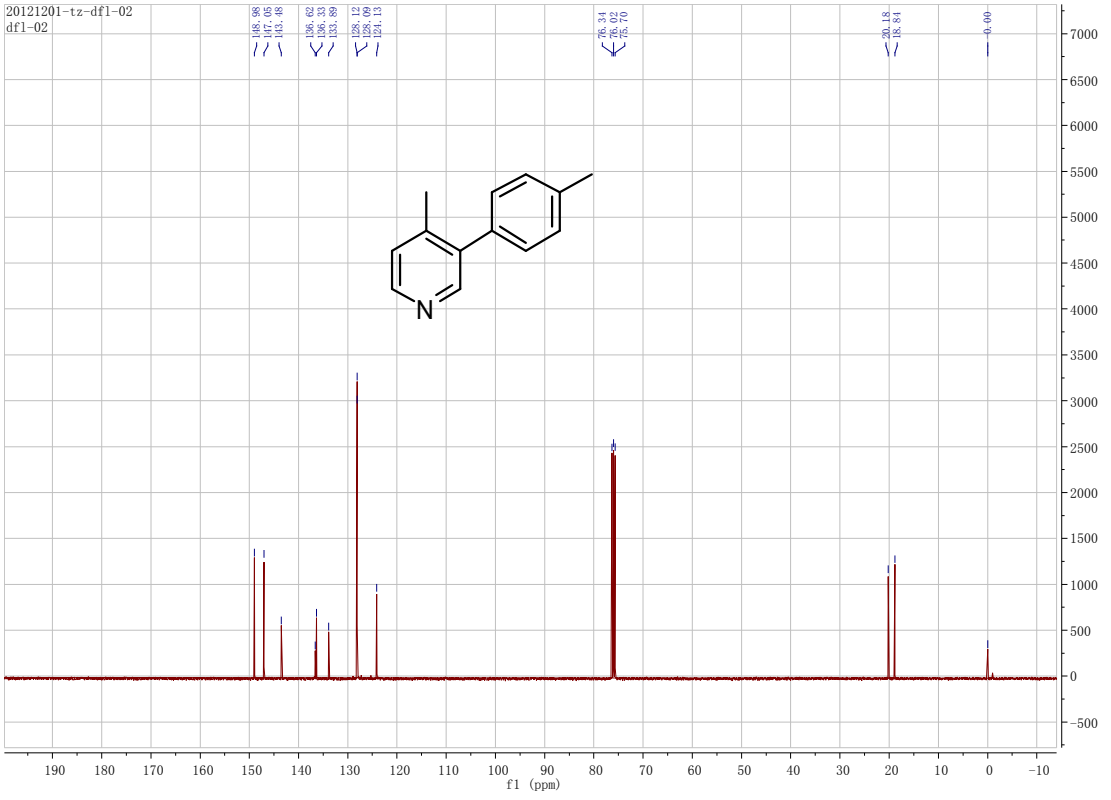

20121208-tt-dfl-09
dfl-09
Ph
N
f1 (ppm)

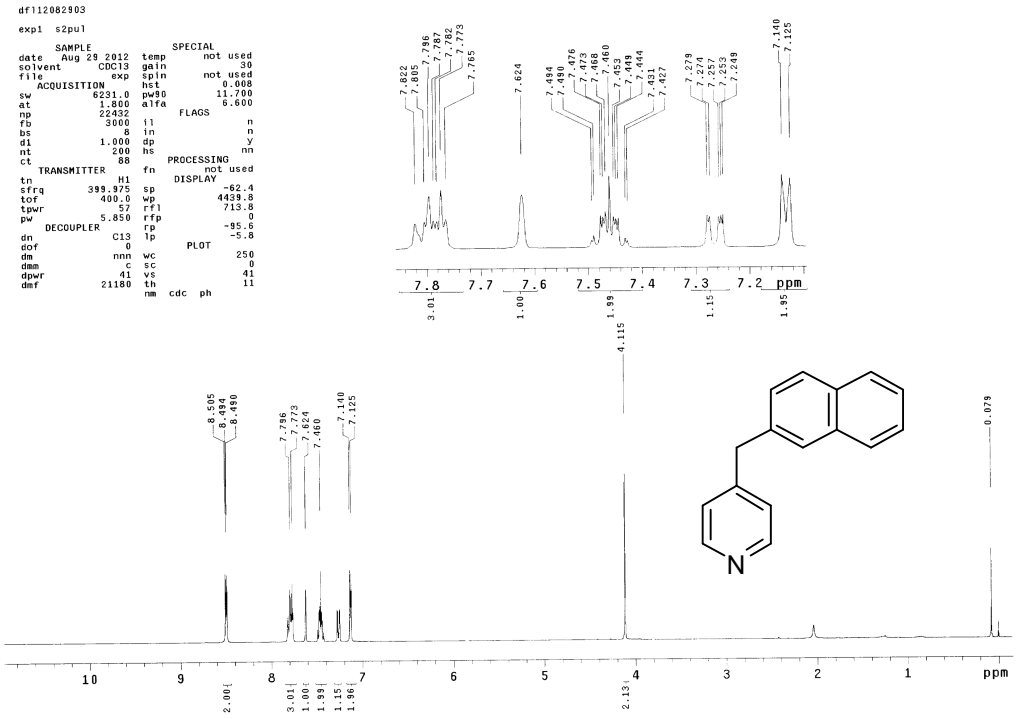

20121210-tz-dfl-09
dfl-09
Ph
N
f1 (ppm)

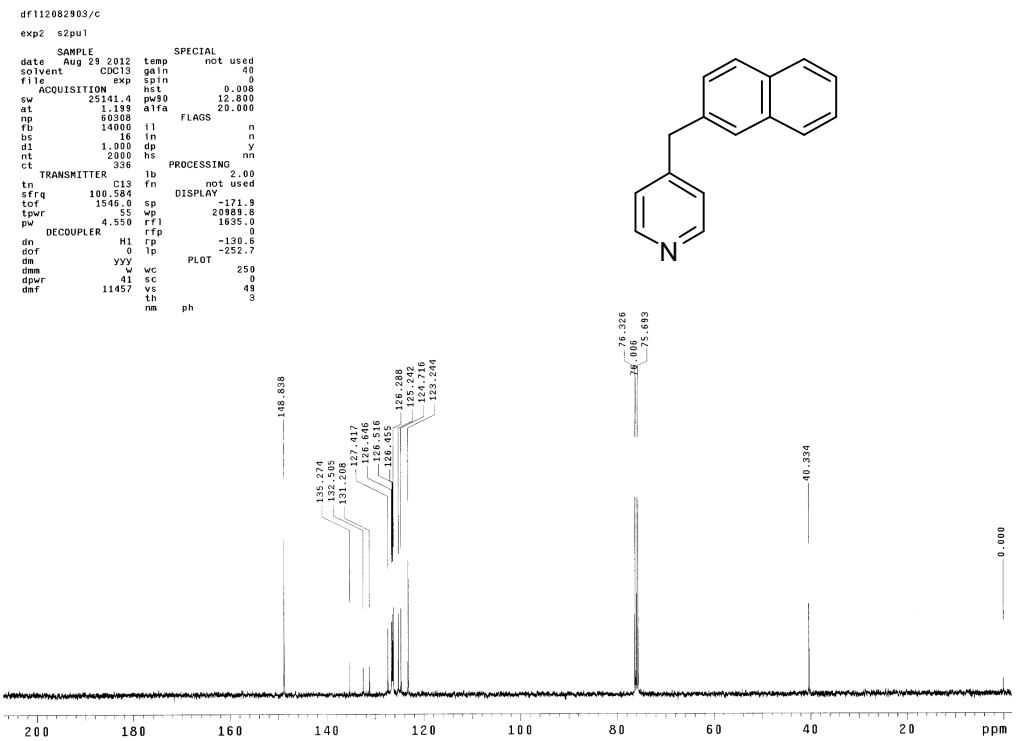

20121220-tz-dfl-21
dfl-21
8.33
7.09
7.08
6.95
6.95
2.29
2.21
0.00
2.04
0.99
0.99
1.97
5.79
2.95
f1 (ppm)

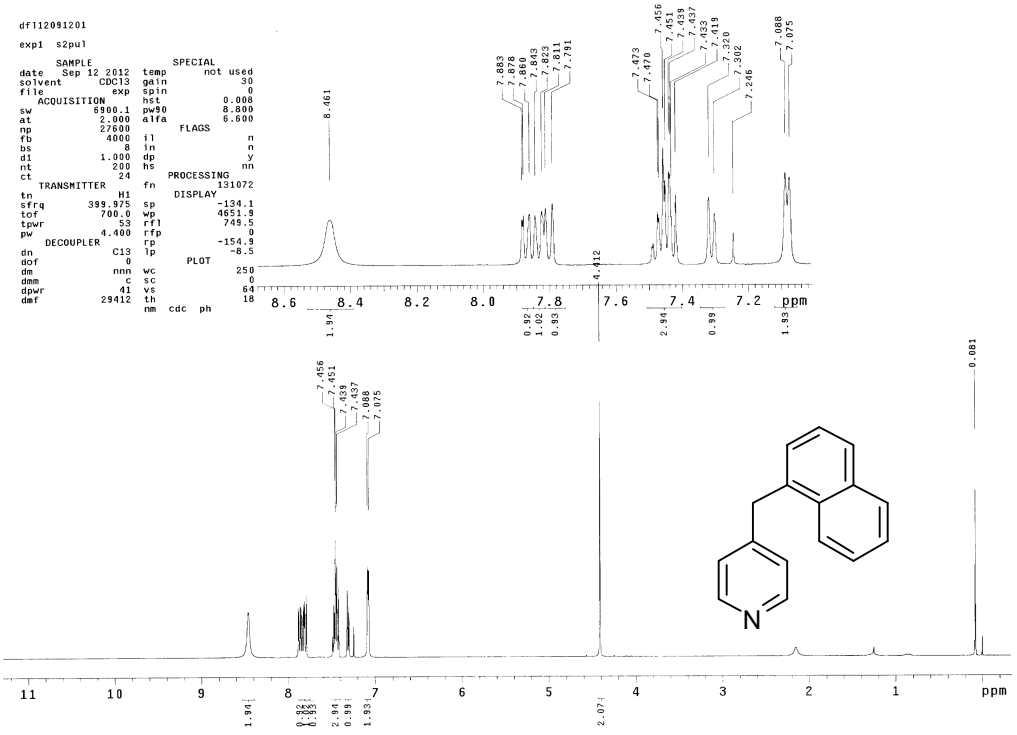

20121220-tz-dfl-21
dfl-21
148.87
147.01
143.42
136.88
136.75
128.14
126.02
124.05
76.35
76.03
75.71
20.31
18.83
0.00
f1 (ppm)

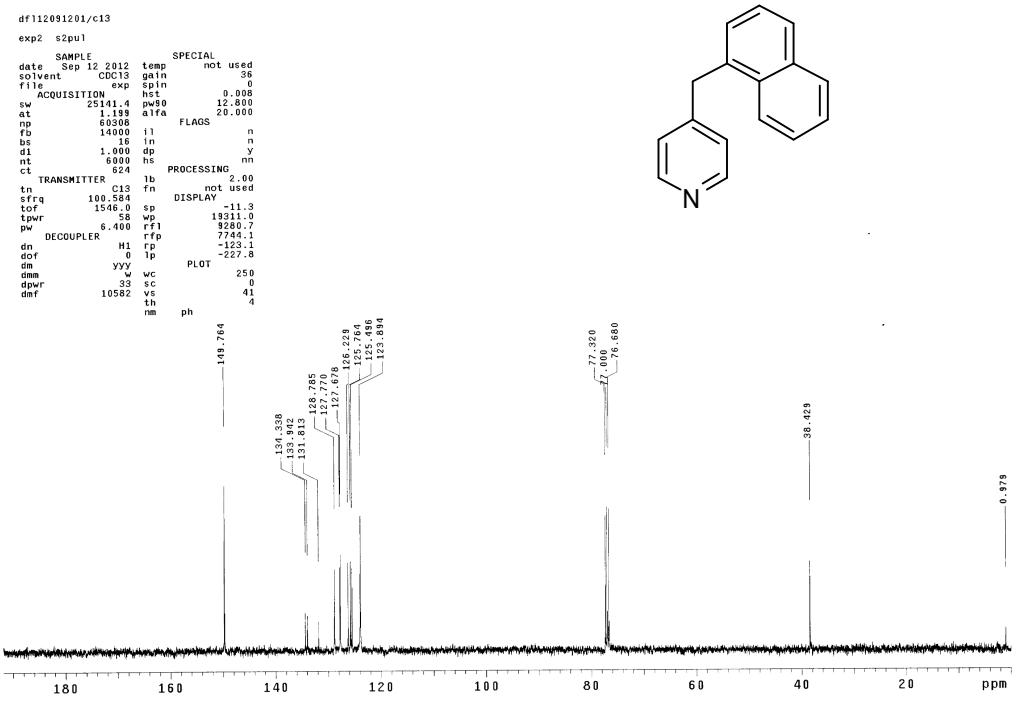

20121128-tz-dfl-02
dfl-02
8.35
7.20
7.18
7.15
7.13
7.10
7.09
2.34
2.21
0.00
2.00
2.05
1.02
3.28
3.28
N
f1 (ppm)

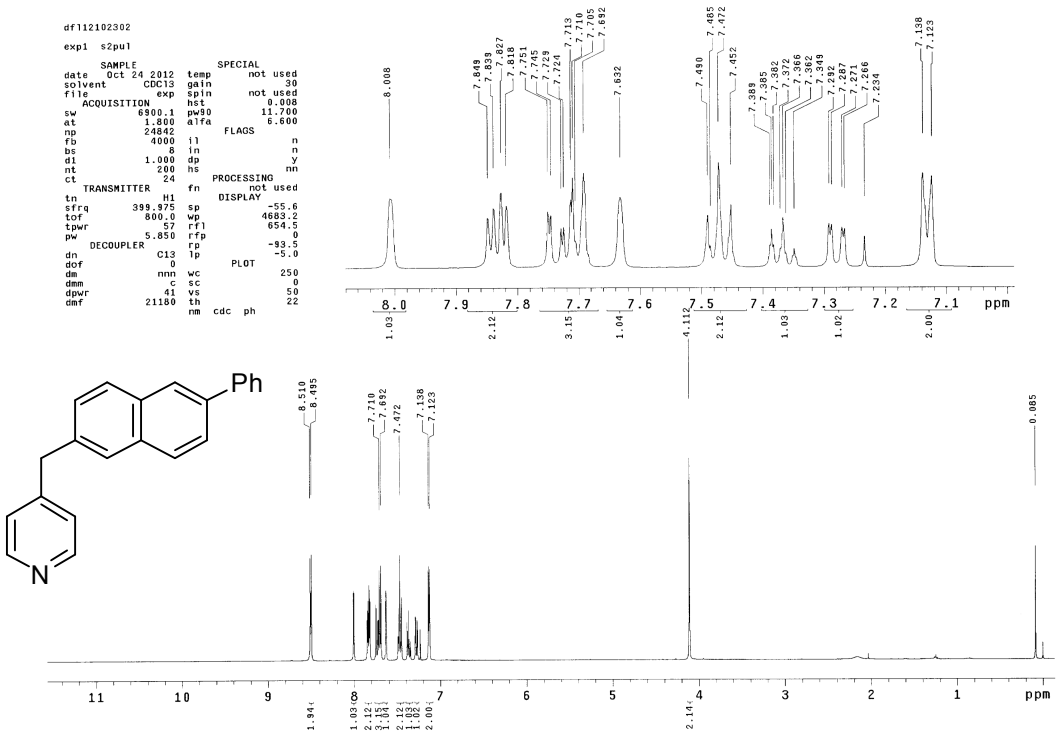

20121201-tz-dfl-02
dfl-02
148.98
147.65
143.48
136.62
136.33
133.89
128.12
126.09
124.13
76.34
76.02
75.70
20.18
18.84
0.00
N
f1 (ppm)

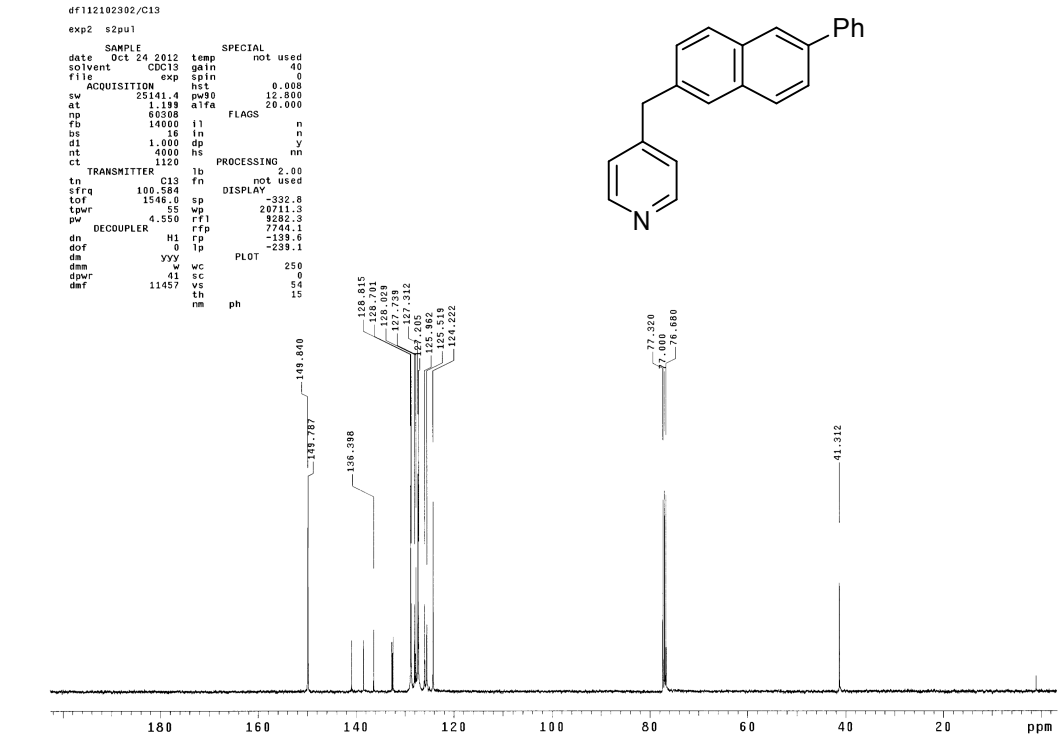

df112082903
exp1 s2pul
SAMPLE
date Aug 29 2012
solvent CDCl3
file exp
ACQUISITION
sw 6231.0
at 1.800
np 22432
fb 3000
bs 8
d1 1.000
nt 200
ct 88
TRANSMITTER
tn H1
sfrq 399.975
tof 400.0
tpwr 57
pw 5.850
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 21180
SPECIAL
temp not used
gain 30
spin not used
hst 0.008
pw90 11.700
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn not used
DISPLAY
sp -62.4
wp 4439.8
rfl 713.8
rfp 0
rp -95.6
lp -5.8
PLOT
wc 250
sc 0
vs 41
th 11
nm cdc ph
7.822
7.805
7.796
7.787
7.782
7.773
7.765
7.624
7.494
7.490
7.476
7.473
7.468
7.460
7.453
7.449
7.444
7.431
7.427
7.279
7.274
7.257
7.253
7.248
7.140
7.125
7.8
7.7
7.6
7.5
7.4
7.3
7.2 ppm
3.01
1.00
1.99
1.15
1.95
8.505
8.494
8.480
7.796
7.773
7.624
7.460
7.140
7.125
4.115
0.079
N
10
9
8
7
6
5
4
3
2
1
ppm
2.00
3.01
1.00
1.99
1.15
1.96
2.13


df112082903/c
exp2 s2pul
SAMPLE
date Aug 29 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 2000
ct 336
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 55
pw 4.550
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 41
dmf 11457
SPECIAL
temp not used
gain 40
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 2.00
fn not used
DISPLAY
sp -171.9
wp 20988.8
rfl 1635.0
rfp 0
rp -130.6
lp -252.7
PLOT
wc 250
sc 0
vs 49
th 3
nm ph
148.838
135.274
132.505
131.208
127.417
126.646
126.516
126.455
126.288
125.242
124.716
123.244
76.326
76.006
75.693
40.334
0.000
N
200
180
160
140
120
100
80
60
40
20
ppm


df112091201
exp1 s2pul
SAMPLE
date Sep 12 2012
solvent CDCl3
file exp
ACQUISITION
sw 6900.1
at 2.000
np 27600
fb 4000
bs 8
d1 1.000
nt 200
ct 24
TRANSMITTER
tn H1
sfrq 399.975
tof 700.0
tpwr 53
pw 4.400
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 29412
SPECIAL
temp not used
gain 30
spin 0
hst 0.008
pw90 8.800
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn 131072
DISPLAY
sp -134.1
wp 4651.9
rfl 749.5
rfp 0
rp -154.9
lp -8.5
PLOT
wc 250
sc 0
vs 64
th 18
nm cdc ph
8.461
7.883
7.878
7.860
7.843
7.823
7.811
7.791
7.473
7.470
7.456
7.451
7.439
7.437
7.433
7.419
7.320
7.302
7.246
7.088
7.075
4.412
8.6
8.4
8.2
8.0
7.8
7.6
7.4
7.2
ppm
1.94
0.92
1.02
0.93
2.94
0.99
1.93
0.081
2.07
11
10
9
8
7
6
5
4
3
2
1
N


df112091201/c13
exp2 s2pul
SAMPLE
date Sep 12 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60306
fb 14000
bs 16
d1 1.000
nt 6000
ct 624
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 58
pw 6.400
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 33
dmf 10582
SPECIAL
temp not used
gain 36
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 2.00
fn not used
DISPLAY
sp -11.3
wp 19311.0
rfl 9280.7
rfp 7744.1
rp -123.1
lp -227.8
PLOT
wc 250
sc 0
vs 41
th 4
nm ph
149.764
134.338
133.942
131.613
128.785
127.770
127.678
126.229
125.764
125.686
123.894
77.320
77.000
76.680
38.429
0.979
180
160
140
120
100
80
60
40
20
ppm
N


df112102302
exp1 s2pul
SAMPLE
date Oct 24 2012
solvent CDCl3
file exp
ACQUISITION
sw 6900.1
at 1.800
np 24842
fb 4000
bs 8
d1 1.000
nt 200
ct 24
TRANSMITTER
tn H1
sfrq 399.975
tof 800.0
tpwr 57
pw 5.850
DECOUPLER
dn C13
dof 0
dm nnn
dmm c
dpwr 41
dmf 21180
SPECIAL
temp not used
gain 30
spin not used
hst 0.008
pw90 11.700
alfa 6.600
FLAGS
il n
in n
dp y
hs nn
PROCESSING
fn not used
DISPLAY
sp -55.6
wp 4683.2
rfl 654.5
rfp 0
rp -93.5
lp -5.0
PLOT
wc 250
sc 0
vs 50
th 22
nm cdc ph
Ph
N
ppm


df112102302/C13
exp2 s2pul
SAMPLE
date Oct 24 2012
solvent CDCl3
file exp
ACQUISITION
sw 25141.4
at 1.199
np 60308
fb 14000
bs 16
d1 1.000
nt 4000
ct 1120
TRANSMITTER
tn C13
sfrq 100.584
tof 1546.0
tpwr 55
pw 4.550
DECOUPLER
dn H1
dof 0
dm yyy
dmm w
dpwr 41
dmf 11457
SPECIAL
temp not used
gain 40
spin 0
hst 0.008
pw90 12.800
alfa 20.000
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 2.00
fn not used
DISPLAY
sp -332.8
wp 20711.3
rfl 9282.3
rfp 7744.1
rp -139.6
lp -239.1
PLOT
wc 250
sc 0
vs 54
th 15
nm ph
Ph
N
ppm