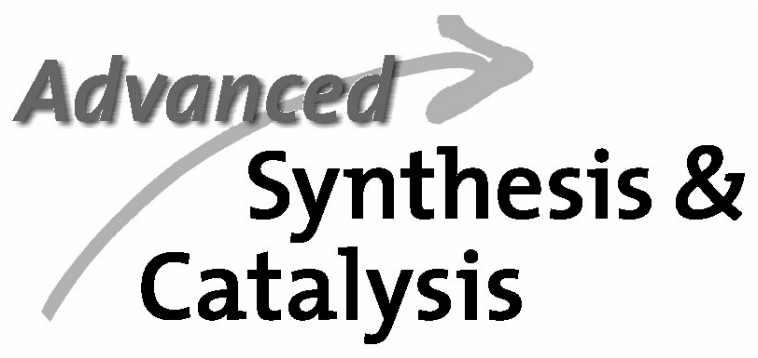

Supporting Information

Palladium-Catalyzed Stille Cross-Coupling Reaction of Aryl Chlorides using a Pre-Milled Palladium Acetate and XPhos Catalyst System.

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General. All reactions were carried out under an argon atmosphere. Dimethoxyethane (DME 99.5%, Anhydrous) and 1,4-dioxane (99.8%, Anhydrous) were purchased from Aldrich Chemical Co. Commercially available materials were used without further purification unless otherwise noted. XPhos was synthesized in our laboratories but is commercially available from Aldrich Chemical Co. or Strem Chemicals, Inc. Aryl halides were purchased from Aldrich Chemical Co. or Alfa Aesar. Phenyl- furyl- thiophenyl- and allyltributylstannanes were purchased from Aldrich Chemical Co. or Gelest, Inc. In analogy to the procedures described by Littke and Fu,[1] other stannanes were prepared by lithiation of the corresponding aryl bromides with *n*-BuLi (2.5 M in hexanes, Aldrich) followed by quenching with tributyltin chloride; 1-lithio-2,6-dimethoxybenzene was prepared by directed lithiation[2] and quenched with tributyltin chloride. Cesium fluoride (99.9%) was purchased from Aldrich Chemical Co. and stored in a bench-top dessicator. Palladium acetate was supplied by BASF. All products from coupling reactions were characterized by ^{1}H NMR, ^{13}C NMR, IR spectroscopy, elemental analysis and melting points for solids. Known compounds were compared to their literature values. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker Advance 400. Infrared spectra were recorded on a Perkin-Elmer Model 2000 FT-IR using NaCl plates (thin film). Elemental analyses were performed by Atlantic Microlabs Inc., Norcros, GA. All ^{1}H NMR experiments are reported in parts per million (ppm) downfield of TMS and were measured relative to the signals for chloroform (7.24 ppm). All ^{13}C NMR spectra were reported in ppm relative to residual chloroform (77.23 ppm) and were obtained with ^{1}H decoupling. Melting points were obtained on a Mel-Temp capillary melting point apparatus. Gas chromatographic analyses were preformed on Hewlett-Packard 6890 gas chromatography instrument with a FID detector using 25m x 0.20 mm capillary column with cross-linked methyl siloxane as a stationary phase. The yields in tables 2

and 3 refer to isolated yields (average of two runs) of compounds estimated to be ≥ 95% pure as determined by ^{1}H NMR and GC analysis and/or combustion analysis. The procedures described in this section are representative and may differ slightly from those given in tables 2 and 3.

$Pd(OAc)_2$ (225 mg, 1.00 mmol) and XPhos (524 mg, 1.10 mmol) were ground together using a mortar and pestle until a fine beige powder was formed. This powder (effective molecular weight: 749 g/mol) was stored in a bench-top dessicator for up to six months with no loss of activity and was used as the catalyst for all reactions described in this paper except where noted.

General Procedure A:

Pre-milled $Pd(OAc)_2$/XPhos and CsF (334 mg, 2.20 mmol) were added to an oven-dried test tube. The tube was fitted with a rubber septum, sealed with electrical tape, and evacuated and backfilled with argon (this process was repeated a total of 3 times). Dimethoxyethane (DME, 1.0 mL), aryl chloride (1.00 mmol) and stannane (1.10 mmol) were added via syringe to the tube. The reaction was heated to 80 °C with stirring for 4 h. At this time the reaction was removed from the oil bath, allowed to cool to room temperature, diluted with ethyl acetate (5 mL) and filtered through a pad of silica gel, eluting with ethyl acetate (150 mL). The solvent was removed with the aid of a rotary evaporator, and the residue was taken up in dichloromethane (20 mL) and added to silica gel (~1 g). The solvent was concentrated under reduced pressure and the residue (adsorbed on silica) was loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4.

2-(4-Methoxyphenyl)furan (Table 2, entry 1).[3] Following general procedure A, 4-chloroanisole (123 μL, 1.00 mmol), tributyl(2-furanyl)stannane (346 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (15.0 mg, 0.020 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 99% yield (173 mg) as a white solid, mp 55-56 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, J = 9.0 Hz, 2H), 7.41 (dd, J = 1.5, 0.5 Hz, 1H), 6.91 (d, J = 9.0 Hz, 2H), 6.50 (dd, J = 3.5, 0.5 Hz, 1H), 6.43 (dd, J = 3.5, 1.5 Hz, 1H), 3.82 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.2, 154.2, 141.6, 125.4, 124.2, 114.3, 111.7, 103.5, 55.5; IR (neat, cm^{-1}) 3450, 2958, 2837, 1515, 485, 1254, 1026, 834, 801, 734. Anal. Calc'd. for $C_{11}H_{10}O_2$: C, 75.84; H, 5.79.

Found C, 75.71; H, 5.77.

4'-Methoxy-2,4,6-trimethylbiphenyl (Table 2, entry 2).[4] Following general procedure A, 4-chloroanisole (123 μL, 1.00 mmol), tributyl(2,4,6-mesityl)stannane (401 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 95% yield (215 mg) as a white solid, mp 75-77 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.04 (d, *J* = 9.0 Hz, 2H), 6.94 (d, *J* = 9.0 Hz, 2H), 6.93 (s, 2H), 3.84 (s, 3H), 2.37 (s, 3H), 2.00 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.3, 138.8, 136.6, 133.4, 130.5, 128.2, 113.9, 55.4, 21.2, 21.0; IR (neat, cm^{-1}) 2933, 2833, 1609, 1514, 1285, 1245, 1042, 854, 832, 733. Anal. Calc'd. for $C_{16}H_{18}O$: C, 84.91; H, 8.02. Found C, 84.81; H, 8.04.

5-(2-Furanyl)benzo[*d*][1,3]dioxole (Table 2, entry 3).[5] Following general procedure A, 5-chlorobenzo[*d*][1,3]dioxole (117 μL, 1.00 mmol), tributyl(2-furanyl)stannane (346 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 95% yield (178 mg) as a yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, *J* = 2.0 Hz, 1H), 7.16 (dd, *J* = 8.0, 2.0 Hz, 1H), 7.13 (d, *J* = 2.0 Hz, 1H), 6.81 (d, *J* = 8.0 Hz, 1H), 6.48 (d, *J* = 3.0 Hz, 1H), 6.42 (dd, *J* = 3.0, 2.0 Hz, 1H), 5.96 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.9, 148.1, 147.1, 141.6, 125.5, 117.7, 111.7, 108.7, 104.7, 104.0, 101.2; IR (neat, cm^{-1}) 3457, 2894, 1507, 1479, 1451, 1257, 1227, 1040, 811, 733. Anal. Calc'd. for $C_{11}H_8O_3$: C, 70.21; H, 4.29. Found C, 70.16; H, 4.21.

5-*o*-tolylbenzo[*d*][1,3]dioxole (Table 2, entry 4).[6] Following general procedure A, 5-chlorobenzo[*d*][1,3]dioxole (117 μL, 1.00 mmol), tributyl(*o*-tolyl)stannane (373 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 91% yield (192 mg) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.23 (m, 4H), 6.86 (d, *J* = 8.0 Hz, 1H), 6.82 (d, *J* = 1.5 Hz, 1H), 6.77 (dd, *J* = 8.0, 1.5

Hz, 1H), 5.99 (s, 2H), 2.28 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.5, 146.6, 141.7, 136.0, 135.7, 130.5, 130.0, 127.3, 125.9, 122.7, 110.0, 108.2, 101.2, 20.7; IR (neat, cm^{-1}) 2460, 2889, 1504, 1478, 1246, 1221, 1040, 760, 731. Anal. Calc'd. for $C_{14}H_{12}O_2$: C, 79.22; H, 5.70. Found C, 79.14; H, 5.84.

5-*o*-tolylbenzo[*d*][1,3]dioxole (Table 2, entry 5).[6] Modification to general procedure A, 5-chlorobenzo[*d*][1,3]dioxole (117 μL, 1.00 mmol), tributyl(*o*-tolyl)stannane (373 μL, 1.10 mmol), $Pd(OAc)_2$ (2.3 mg 0.010 mmol), XPhos (5.2 mg, 0.011 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 96% yield (203 mg) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (m, 4H), 6.88 (d, J = 8.0 Hz, 1H), 6.84 (d, J = 1.5 Hz, 1H), 6.79 (dd, J = 8.0, 1.5 Hz, 1H), 6.01 (s, 2H), 2.30 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.4, 146.6, 141.7, 136.0, 135.6, 130.5, 130.0, 127.3, 125.9, 122.6, 110.0, 108.2, 101.1, 20.7.

***N,N*-Dimethyl-2'-(trifluoromethyl)biphenyl-3-amine (Table 2, entry 6).** Following general procedure A, 3-chloro-*N,N*-dimethylaniline (137 μL, 1.00 mmol), tributyl(2-(trifluoromethyl)phenyl)stannane (389 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (15.0 mg, 0.020 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 87% yield (229 mg) as a pale yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, J = 7.5 Hz, 1H), 7.53 (t, J = 7.5 Hz, 1H), 7.43 (t, J = 7.5 Hz, 1H), 7.36 (d, J = 7.5 Hz, 1H), 7.25 (t, J = 8.0 Hz, 1H), 6.75 (d, J = 8.0 Hz, 1H), 6.66 (m, 2H), 2.95 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.0, 142.5, 140.8, 132.2, 131.4, 128.6, 128.6 (q, J = 30 Hz), 127.3, 126.2 (q, J = 5 Hz), 124.5 (q, J = 272 Hz), 117.6, 113.6, 111.8, 40.7; IR (neat, cm^{-1}) 2888, 1601, 1491, 1314, 1170, 1128. 1109, 768, 701. Anal. Calc'd. for $C_{15}H_{14}F_3N$: C, 67.91; H, 5.32. Found C, 67.98; H, 5.42.

***N,N*-Dimethylbiphenyl-3-amine (Table 2, entry 7).**[7] Following general procedure A, 3-chloro-*N,N*-dimethylaniline (137 μL, 1.00 mmol), tributyl(phenyl)stannane (359 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (15.0 mg, 0.020 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded

onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 90% yield (178 mg) as a pale yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 8.0 Hz, 2H), 7.50 (t, *J* = 7.5 Hz, 2H), 7.39 (m, 2H), 7.02 (m, 2H), 6.81 (dd, *J* = 8.0, 2.5 Hz, 1H), 3.06 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 151.1, 142.4, 142.4, 129.6, 128.8, 127.5, 127.3, 116.0, 111.8, 111.7, 40.9; IR (neat, cm^{-1}) 3030, 2881, 2801, 1598, 1491, 1354, 755, 698; Anal. Calc'd. for $C_{14}H_{15}N$: C, 85.24; H, 7.66. Found C, 85.21; H, 7.66.

Biphenyl-2-carbonitrile (Table 3, entry 1).[8] Following general procedure A, 2-chlorobenzonitrile (138 mg, 1.00 mmol), tributyl(phenyl)stannane (359 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 88% yield (158 mg) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (dd, *J* = 8.0, 1.0 Hz, 1H), 7.63 (td, *J* = 8.0, 1.0 Hz, 1H), 7.48 (m, 7H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 145.6, 128.3, 133.9, 133.0, 130.3, 128.9, 128.9, 128.9, 127.7, 118.9, 111.4; IR (neat, cm^{-1}) 3064, 2963, 2223, 1261, 1076, 1027, 799, 758; Anal. Calc'd. for $C_{13}H_9N$: C, 87.12; H, 5.06. Found C, 86.87; H, 5.09.

2-(2-Thiophenyl)benzonitrile (Table 3, entry 2).[8] Following general procedure A, 2-chlorobenzonitrile (138 mg, 1.00 mmol), tributyl(2-thiophenyl)stannane (349 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 92% yield (171 mg) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (dd, *J* = 8.0, 1.0 Hz, 1H), 7.62 (dd, *J* = 3.5, 1.0 Hz, 1H), 7.58 (m, 2H), 7.42 (dd, *J* = 5.0, 1.0 Hz, 1H), 7.37 (td, *J* = 8.0, 1.5 Hz, 1H), 7.14 (dd, *J* = 5.0, 3.5 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.6, 137.7, 134.5, 133.2, 129.9, 128.4, 127.8, 127.7, 127.5, 119.1, 110.1; IR (neat, cm^{-1}) 3107, 2224, 1595, 1482, 1444, 760, 702. Anal. Calc'd. for $C_{11}H_7NS$: C, 71.32; H, 3.81. Found C, 71.40; H, 3.59.

2',6'-Dimethoxybiphenyl-2-carbonitrile (Table 3, entry 3).[9] Following general procedure A, 2-chlorobenzonitrile (138 mg, 1.00 mmol), tributyl(2,6-dimethoxyphenyl)stannane (403 μL, 1.10

mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 76% yield (181 mg) as a white solid, mp 100-101 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.5 Hz, 1H), 7.59 (td, *J* = 7.5, 1.5 Hz, 1H), 7.38 (m, 2H), 7.34 (t, *J* = 8.5 Hz, 1H), 6.66 (d, *J* = 8.5 Hz, 2H), 3.75 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.7, 138.9, 132.7, 132.3, 132.1, 130.6, 127.3, 118.9, 115.7, 115.7, 114.6, 104.3, 56.0; IR (neat, cm^{-1}) 2940, 2838, 2225, 1590, 1473, 1250, 1108. Anal. Calc'd. for $C_{15}H_{13}NO_2$: C, 75.30; H, 5.48. Found C, 75.19; H, 5.32.

Methyl 4-(2-thiophenyl)benzoate (Table 3, entry 4).[10] Following general procedure A, methyl 4-chlorobenzoate (171 mg, 1.00 mmol), tributyl(2-thiophenyl)stannane (349 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 89% yield (195 mg) as a white solid, mp 140-141 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.5 Hz, 2H), 7.66 (d, *J* = 8.5 Hz, 2H), 7.41 (dd, *J* = 3.5, 1.0 Hz, 1H), 7.34 (dd, *J* = 5.0, 1.0 Hz, 1H), 7.10 (dd, *J* = 5.0, 3.5 Hz, 1H), 3.91 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.9, 143.1, 138.7, 130.4, 128.8, 128.5, 126.4, 125.6, 124.6, 52.3; IR (neat, cm^{-1}) 1712, 1282, 1261, 1113, 769, 724, 698. Anal. Calc'd. for $C_{12}H_{10}O_2S$: C, 66.03; H, 4.62. Found C, 66.00; H, 4.67.

Methyl 4-allylbenzoate (Table 3, entry 5).[11] Following general procedure A, methyl 4-chlorobenzoate (171 mg, 1.00 mmol), allyltributylstannane (341 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 86% yield (152 mg) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.0 Hz, 1H), 7.24 (d, *J* = 8.0 Hz, 1H), 5.94 (ddt, *J* = 17.5, 9.0, 6.5 Hz, 1H), 5.09 (dd, *J* = 9.0, 1.0 Hz, 1H), 5.08 (dd, *J* = 17.6, 1.0 Hz, 1H), 3.88 (s, 3H), 3.42 (d, *J* = 6.5 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.3, 145.7, 136.6, 130.0, 128.8, 128.3, 116.8, 52.2, 40.4; IR (neat, cm^{-1}) 2952, 1723, 1611, 1435, 1280, 1178, 1109, 758, 707. Anal. Calc'd. for $C_{11}H_{12}O_2$: C, 74.98; H,

6.86. Found C, 75.11; H, 6.90.

Methyl 4-(2-furanyl)benzoate (Table 3, entry 6).[12] Following general procedure A, methyl 4-chlorobenzoate (171 mg, 1.00 mmol), tributyl(2-furanyl)stannane (346 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 97% yield (196 mg) as a white solid, mp 120-121 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.5 Hz, 2H), 7.71 (d, *J* = 8.5 Hz, 2H), 7.50 (d, *J* = 1.5 Hz, 1H), 6.77 (d, *J* = 3.5 Hz, 1H), 6.49 (dd, *J* = 3.5, 1.5 Hz, 1H), 3.91 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.9, 153.0, 143.2, 134.8, 130.2, 128.6, 123.5, 112.1, 107.4, 52.2; IR (neat, cm^{-1}) 1718, 1282, 1114, 772, 743, 701. Anal. Calc'd. for $C_{12}H_{10}O_3$: C, 71.28; H, 4.98. Found C, 71.09; H, 4.84.

Methyl 2',4',6'-trimethylbiphenyl-4-carboxylate (Table 3, entry 7).[13] Following general procedure A, methyl 4-chlorobenzoate (171 mg, 1.00 mmol), tributyl(2,4,6-mesityl)stannane (401 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (7.5 mg, 0.010 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 94% yield (238 mg) as a white solid, mp 125-126 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 8.0 Hz, 2H), 6.93 (s, 2H), 3.92 (s, 3H), 2.38 (s, 3H), 1.96 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.3, 146.5, 138.2, 137.3, 135.7, 129.9, 129.7, 128.7, 128.4, 52.3, 21.2, 20.8; IR (neat, cm^{-1}) 2948, 1720, 1437, 1285, 1116, 1099, 858. Anal. Calc'd. for $C_{17}H_{18}O_2$: C, 80.28; H, 7.13. Found C, 80.02; H, 7.09.

2,4,6-Trimethyl-2'-(trifluoromethyl)biphenyl (Table 3, entry 8). Following general procedure A, 2-chlorobenzotrifluoride (131 μL, 1.00 mmol), tributyl(2,4,6-mesityl)stannane (401 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (15.0 mg, 0.020 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 59% yield (157 mg) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 7.5 Hz, 1H), 7.58 (t, *J* = 7.5 Hz, 1H), 7.46 (t, *J* = 7.5 Hz, 1H), 7.16 (d, *J* =

7.5 Hz, 1H), 6.92 (s, 2H), 2,33 (s, 3H), 1.90 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 140.3, 137.3, 136.3, 136.0, 132.2, 131.7, 128.9, 127.9, 137.4, 126.5 (q, *J* = 5.0 Hz), 122.8, 21.3, 20.6; IR (neat, cm^{-1}) 3442, 2923, 1315, 1172, 1128, 1035, 763. Anal. Calc'd. for $C_{16}H_{15}F_3$: C, 72.71; H, 5.72. Found C, 72.56; H, 5.73.

4'-Fluoro-2,6-dimethoxybiphenyl (Table 3, entry 9). Following general procedure A, 1-chloro-4-fluorobenzene (107 μL, 1.00 mmol), tributyl(2,6-dimethoxyphenyl)stannane (403 μL, 1.10 mmol), pre-milled $Pd(OAc)_2$/XPhos (15.0 mg, 0.020 mmol) and CsF (334 mg, 2.20 mmol) were heated to 80 °C in DME with stirring for 4 h. The crude product was adsorbed on silica, loaded onto the top of a Biotage 25M column and purified by flash chromatography using a Biotage SP4 to provide the titled compound in 93% yield (215 mg) as a white solid, mp 127-128 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 (m, 3H), 7.07 (t, *J* = 8.5 Hz, 2H), 6.64 (d, *J* = 8.5 Hz, 2H), 3.72 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.9 (d, *J* = 244 Hz), 157.8, 132.7 (d, *J* = 8 Hz), 130.0 (d, *J* = 3 Hz), 129.0, 118.5, 114.9 (d, *J* = 21 Hz), 104.3, 56.1; IR (neat, cm^{-1}) 2835, 1585, 1517, 1472, 1245, 1114, 830, 725, 711. Anal. Calc'd. for $C_{14}H_{13}FO_2$: C, 72.40; H, 5.64. Found C, 72.38; H, 5.65.

3-Phenylpyridine (Table 3, entry 10).[14] Modification to general procedure A, 3-chloropyridine (95 μL, 1.00 mmol), tributyl(phenyl)stannane (393 μL, 1.20 mmol), pre-milled $Pd(OAc)_2$:XPhos (1:3 ratio, 33.0 mg, 0.020 mmol) and CsF (334 mg, 2.20 mmol) were heated to 100 °C in 1,4-dioxane with stirring for 4 h. The crude product was purified by flash chromatography using a Biotage SP4 and 25M cartridge to provide the titled compound in 91% yield (141 mg) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.82 (d, J = 1.5 Hz, 1H), 8.55 (dd, J = 4.5, 1.5 Hz, 1H), 7.81 (dt, J = 7.5, 1.5 Hz, 1H), 7.53 (d, J = 7.5 Hz, 2H), 7.43 (t, J = 7.5 Hz, 2H), 7.36 (t, J = 7.5 Hz, 1H), 7.30 (dd, J = 7.5, 4.5 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 148.5, 148.4, 137.8, 136.6, 134.3, 129.1, 128.1, 127.2, 123.6; IR (neat, cm^{-1}) 3031, 1581, 1473, 1450, 1407, 1005, 754, 712.

6-Phenylquinoline (Table 3, entry 11).[15] Modification to general procedure A, 6-chloroquinoline (164 mg, 1.00 mmol), tributyl(phenyl)stannane (393 μL, 1.20 mmol), pre-milled $Pd(OAc)_2$:XPhos (1:3 ratio, 33.0 mg, 0.020 mmol) and CsF (334 mg, 2.20 mmol) were heated to 100 °C in 1,4-dioxane with stirring for 4 h. The crude product was purified by flash

chromatography using a Biotage SP4 and 25M cartridge to provide the titled compound in 96% yield (197 mg) as a white solid, mp 110-112 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.87 (dd, J = 4.0, 1.5 Hz, 1H), 8.15 (d, J = 8.5 Hz, 1H), 8.08 (d, J = 8.5 Hz, 1H), 7.92 (m, 2H), 7.65 (d, J = 7.5 Hz, 2H), 7.44 (t, J = 7.5 Hz, 2H), 7.34 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.4, 147.7, 140.2, 139.2, 136.2, 129.9, 129.2, 129.0, 128.4, 127.8, 127.5, 125.5, 121.5; IR (neat, cm^{-1}) 3060, 1576, 1460, 1352, 1326, 1122, 891, 844, 784, 765, 700.

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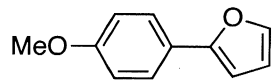

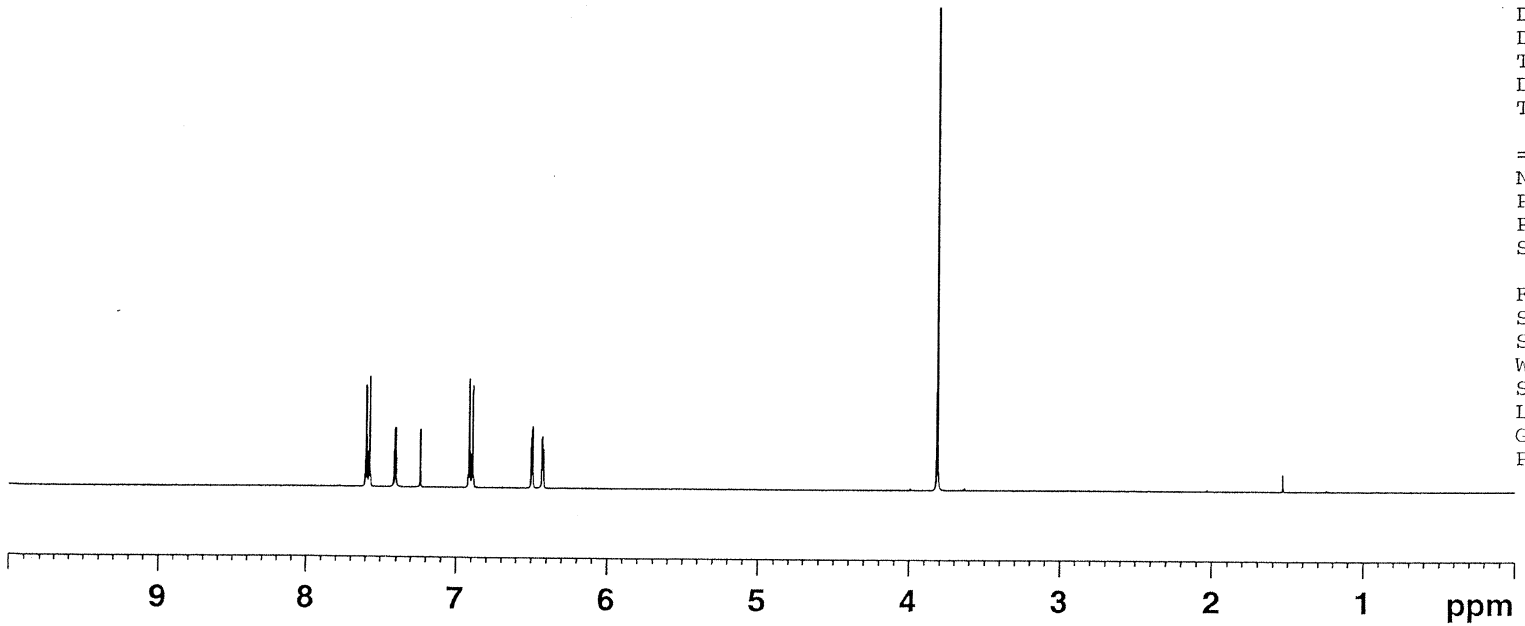

Current Data Parameters

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EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

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INSTRUM	spect
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PULPROG	zg30
TD	65536
SOLVENT	
NS	16
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	203.2
DW	60.400 usec
DE	6.00 usec
TE	293.2 K
D1	1.00000000 sec
TD0	1

======== CHANNEL f1 ========

NUC1	1H
P1	15.07 usec
PL1	0.00 dB
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	65536
SF	400.1300178 MHz
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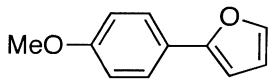
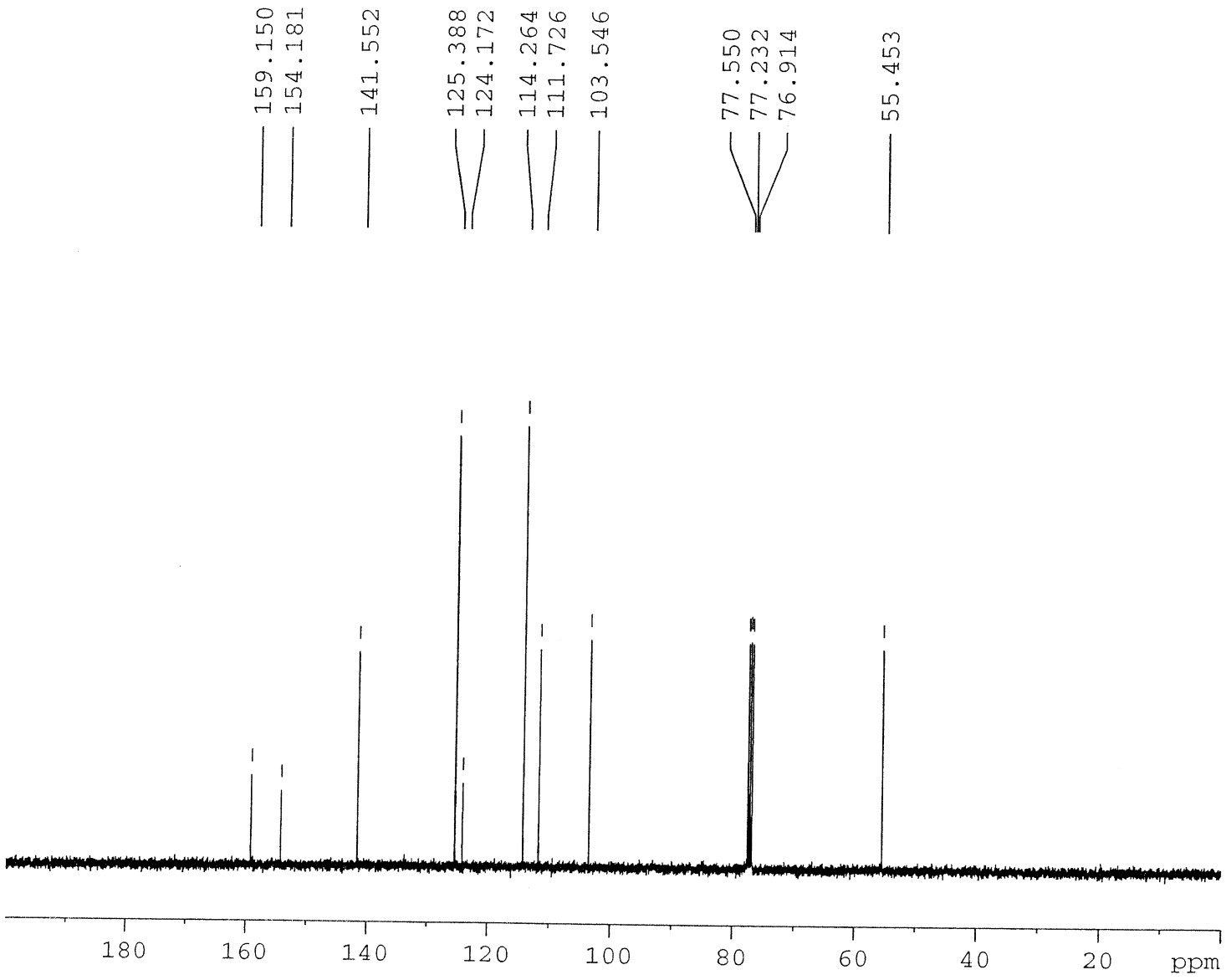
SSB	0
LB	0.30 Hz
GB	0
PC	1.00





Current Data Parameters

NAME	JN2-272-010
EXPNO	13
PROCNO	1

F2 - Acquisition Parameters

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Time	14.06
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PROBHD	5 mm QNP 1H/13
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	40
DS	2
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	2048
DW	20.850 usec
DE	6.00 usec
TE	292.2 K
D1	2.00000000 sec
d11	0.03000000 sec
DELTA	1.89999998 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	8.45 usec
PL1	0.00 dB
SFO1	100.6228298 MHz

======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	0.00 dB
PL12	16.10 dB
PL13	19.00 dB
SFO2	400.1316005 MHz

F2 - Processing parameters

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SF	100.6127561 MHz
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SSB	0
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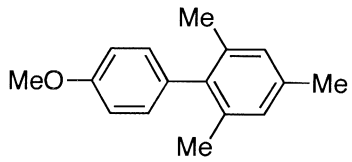
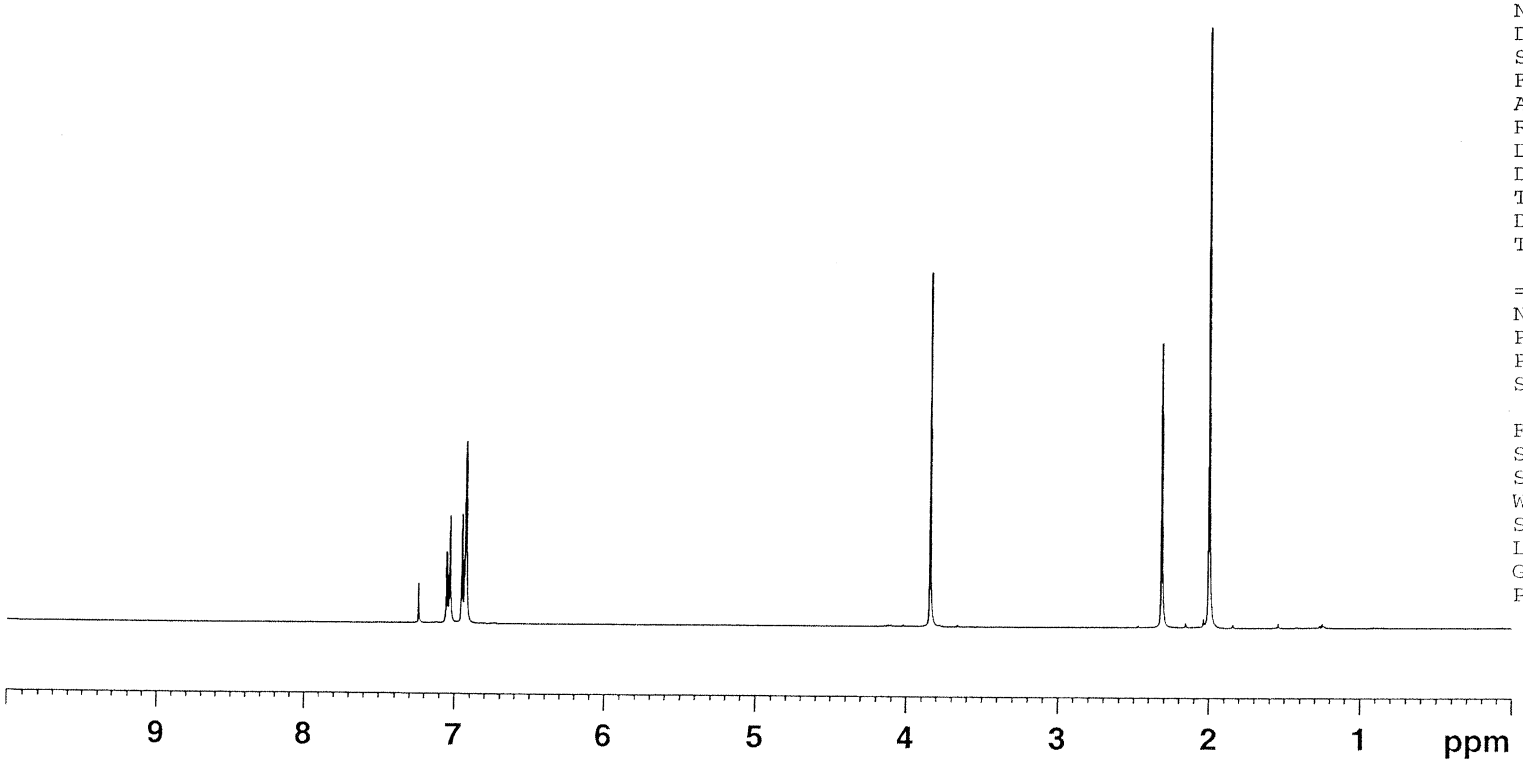
PC	1.40





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EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
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Time 21.37
INSTRUM spect
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PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 256
DW 60.400 usec
DE 6.00 usec
TE 291.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
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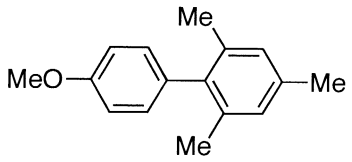
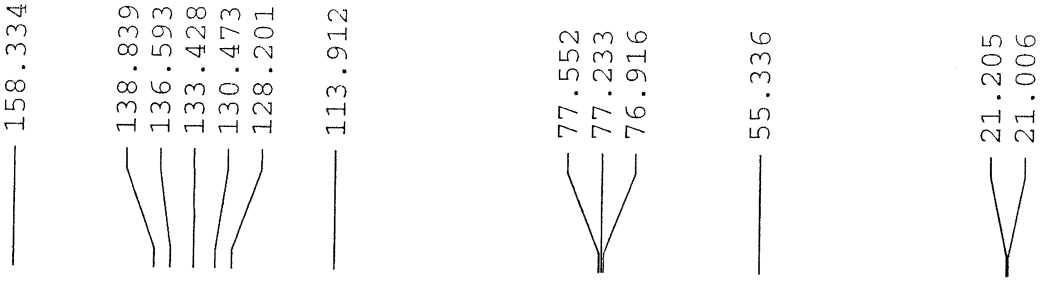
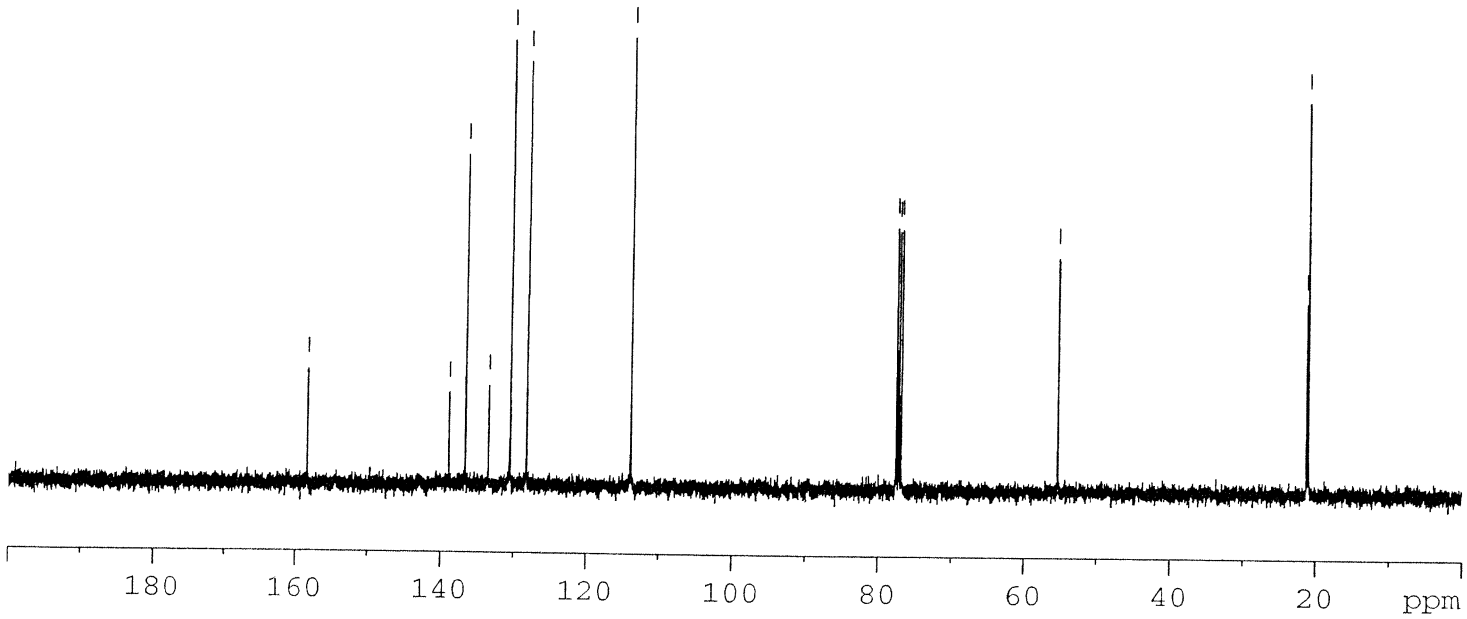
SF 400.1300172 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00







Current Data Parameters
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EXPNO 13
PROCNO 1

F2 - Acquisition Parameters
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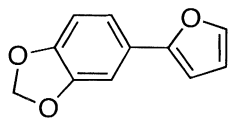
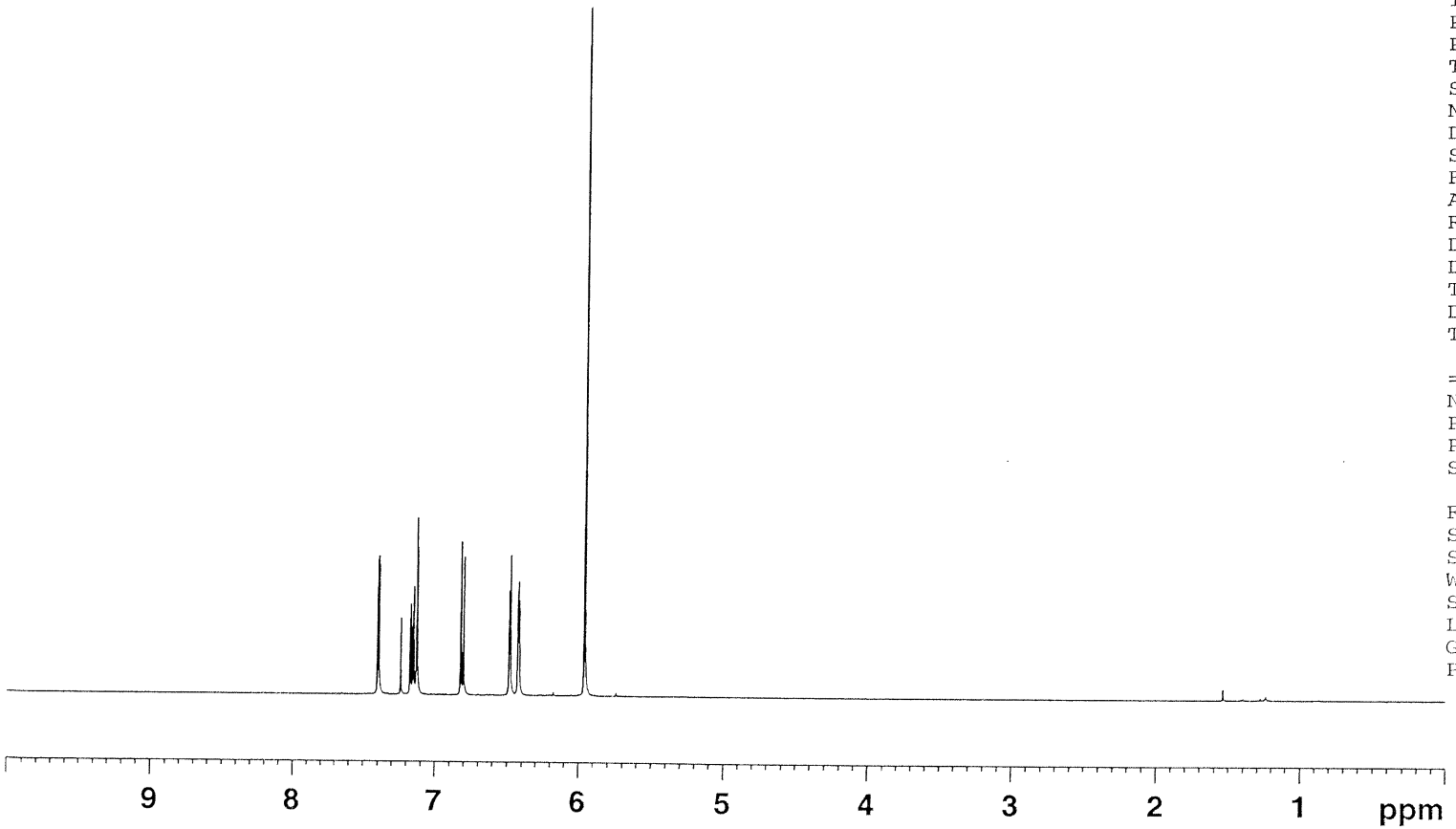
Time 18.23
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 40
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 2896.3
DW 20.850 usec
DE 6.00 usec
TE 292.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127600 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





Current Data Parameters

NAME	JN2-279-010
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

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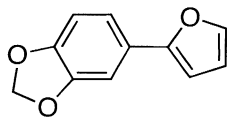
Time	21.22
INSTRUM	spect
PROBHD	5 mm QNP 1H/13
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	16
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	287.4
DW	60.400 usec
DE	6.00 usec
TE	291.2 K
D1	1.00000000 sec
TD0	1

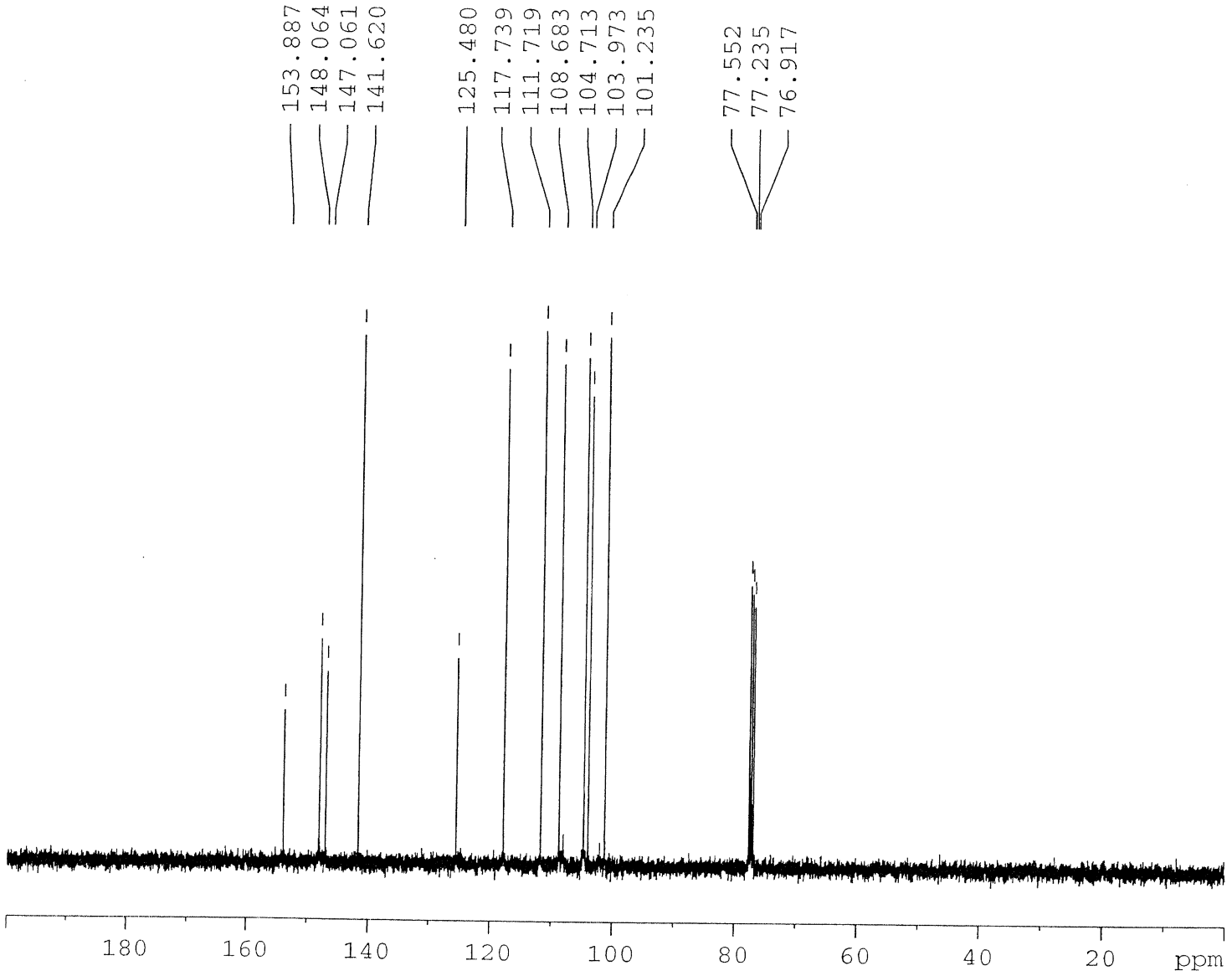
======== CHANNEL f1 ========

NUC1	1H
P1	14.00 usec
PL1	0.00 dB
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	65536
SF	400.1300174 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	10.00





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EXPNO 13
PROCNO 1

F2 - Acquisition Parameters
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Time 19.03
INSTRUM spect
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PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 30
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 4096
DW 20.850 usec
DE 6.00 usec
TE 292.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
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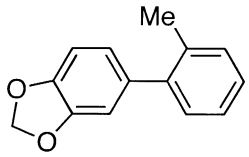
SF 100.6127634 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



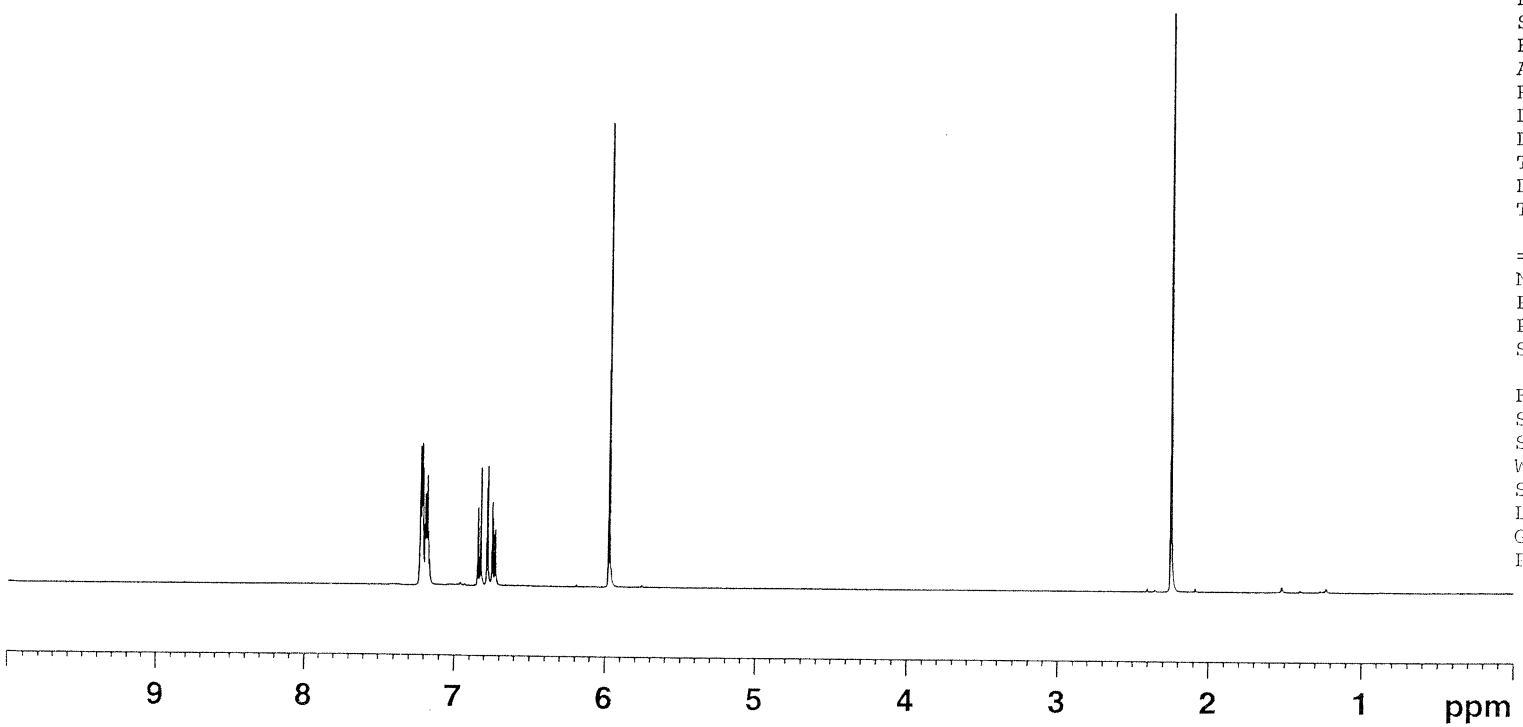
BRUKER

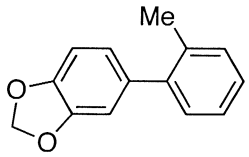
Current Data Parameters
NAME JN2-292-010
EXPNO 1
PROCNO 1

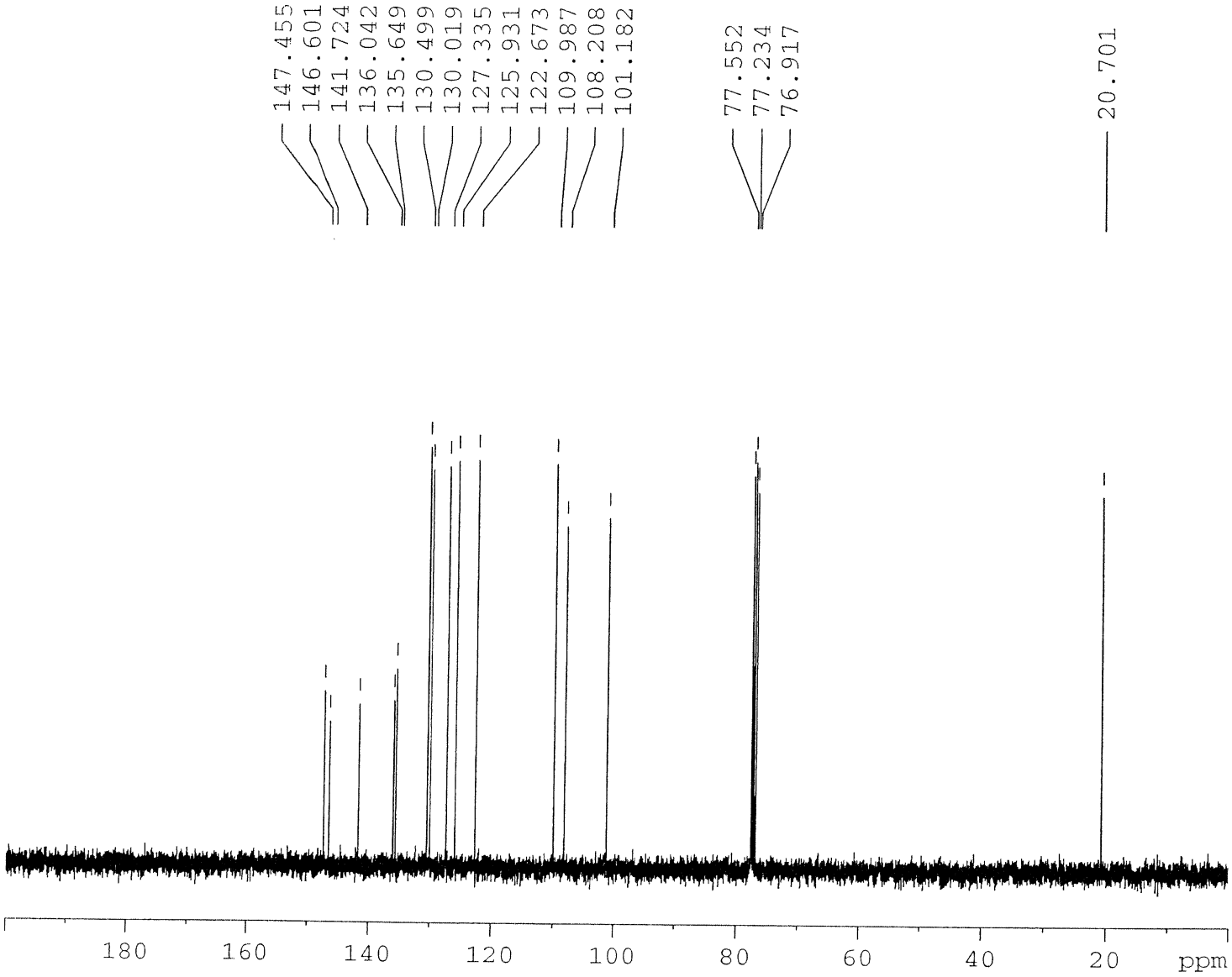
F2 - Acquisition Parameters
Date_ 20071105
Time 19.09
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 362
DW 60.400 usec
DE 6.00 usec
TE 293.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300220 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00







BRUKER

Current Data Parameters
NAME JN2-292-010
EXPNO 13
PROCNO 1

F2 - Acquisition Parameters
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Time 18.30
INSTRUM spect
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PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 25
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 5792.6
DW 20.850 usec
DE 6.00 usec
TE 293.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
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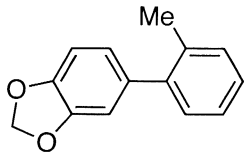
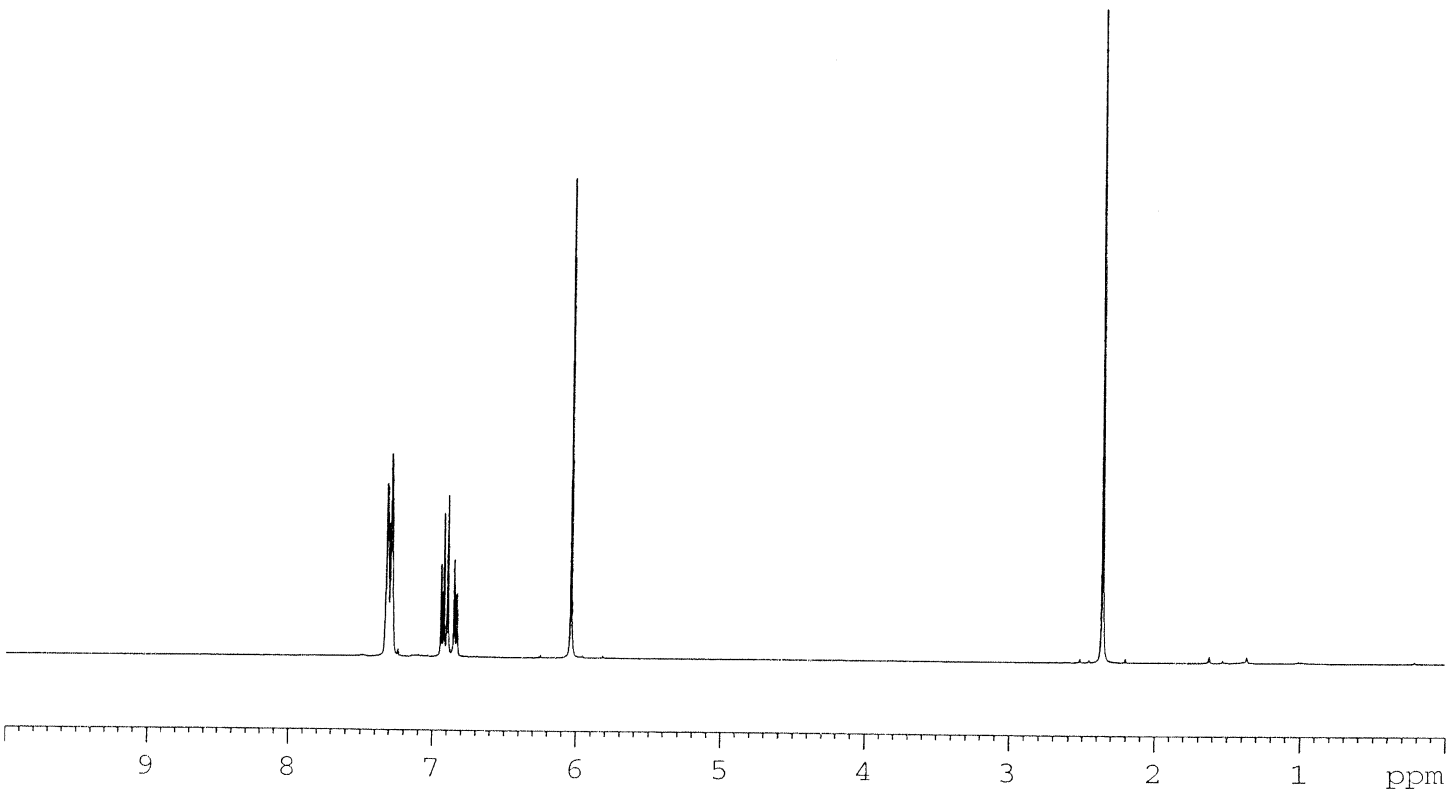
SF 100.6127568 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





BRUKER

Current Data Parameters
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EXPNO 1
PROCNO 1

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INSTRUM spect
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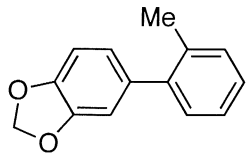
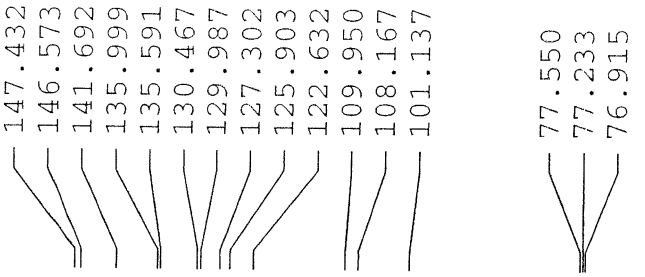
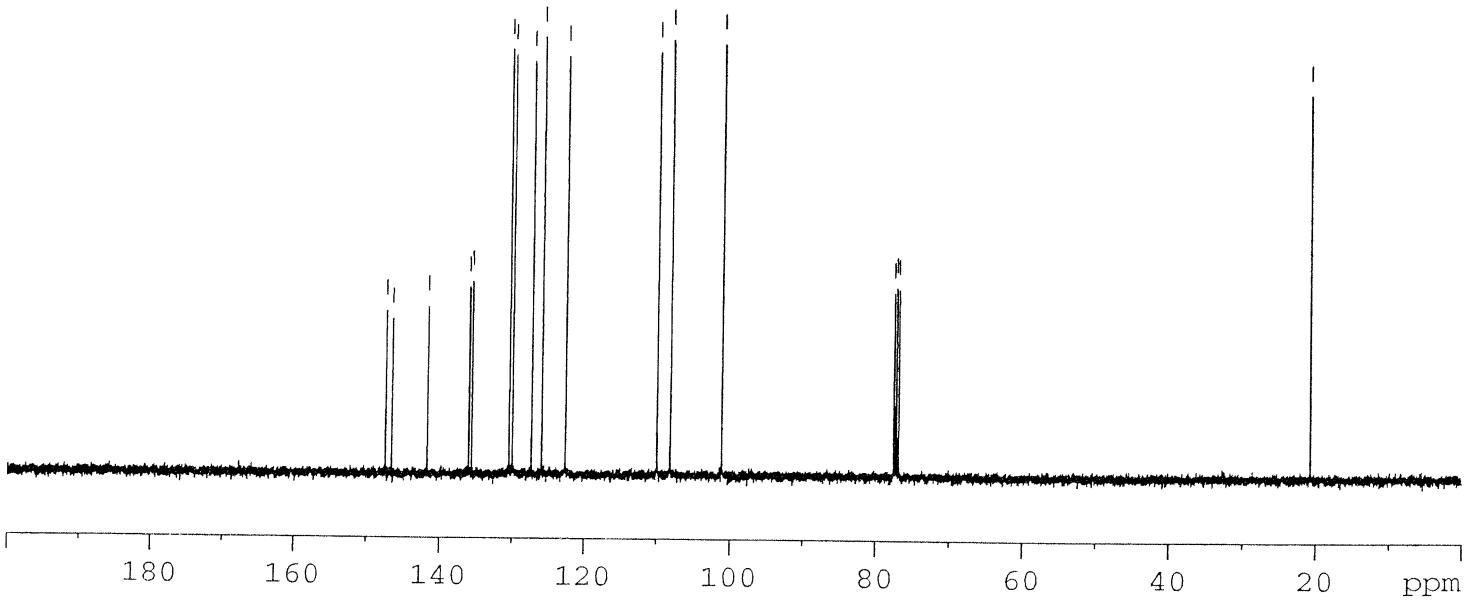
PULPROG zg30
TD 65536
SOLVENT
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 32
DW 60.400 usec
DE 6.00 usec
TE 292.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 15.07 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300175 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00







Current Data Parameters
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EXPNO 13
PROCNO 1

F2 - Acquisition Parameters

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PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	23
DS	2
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	5792.6
DW	20.850 usec
DE	6.00 usec
TE	292.2 K
D1	2.00000000 sec
d11	0.03000000 sec
DELTA	1.89999998 sec
TD0	1

======== CHANNEL f1 ========

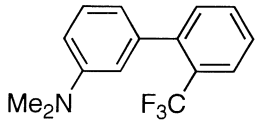
NUC1	13C
P1	8.75 usec
PL1	-3.00 dB
SFO1	100.6228298 MHz

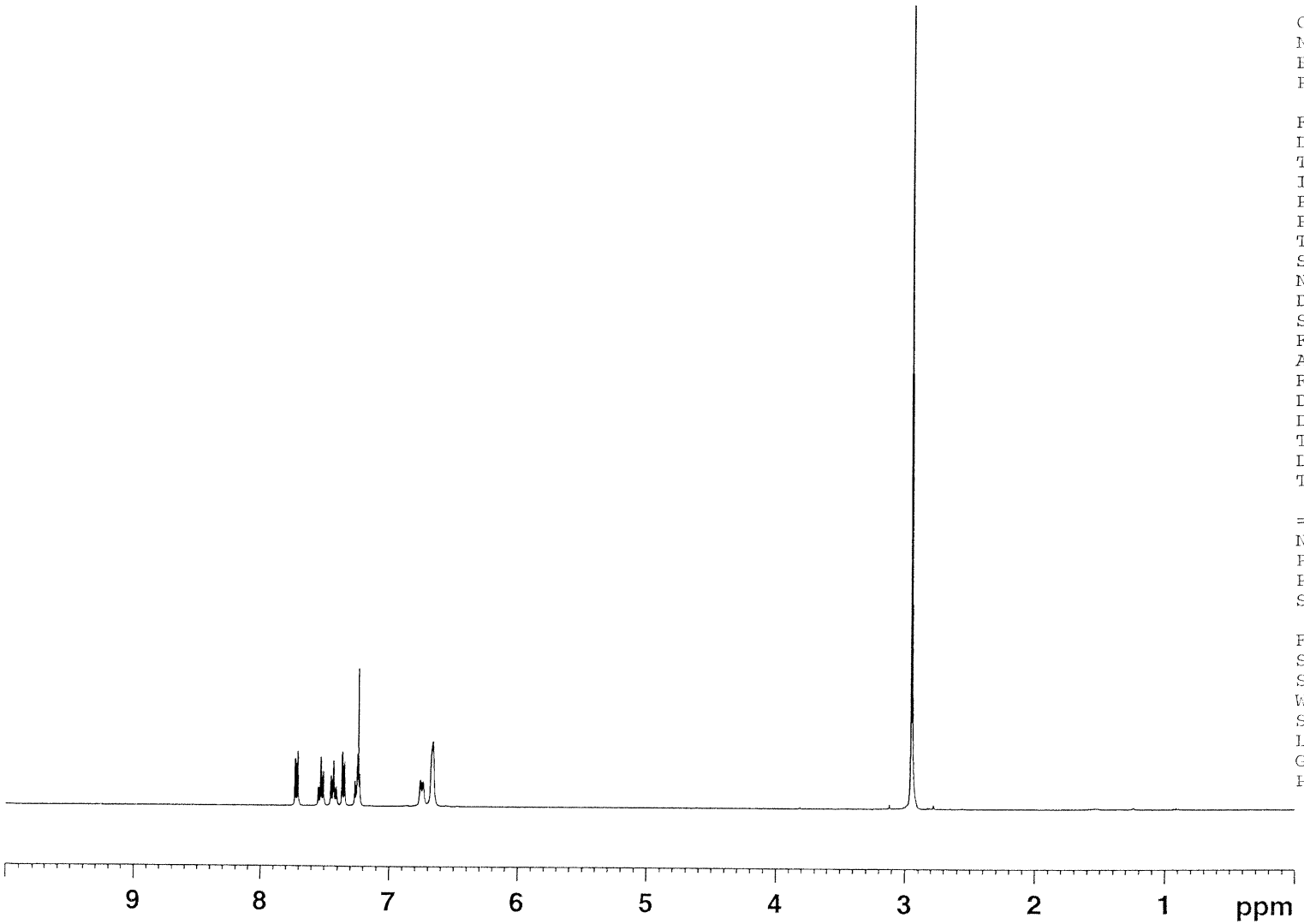
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	-1.00 dB
PL12	14.52 dB
PL13	18.00 dB
SFO2	400.1316005 MHz

F2 - Processing parameters

SI	65536
SF	100.6127662 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40



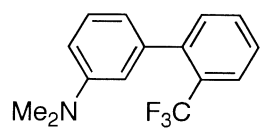


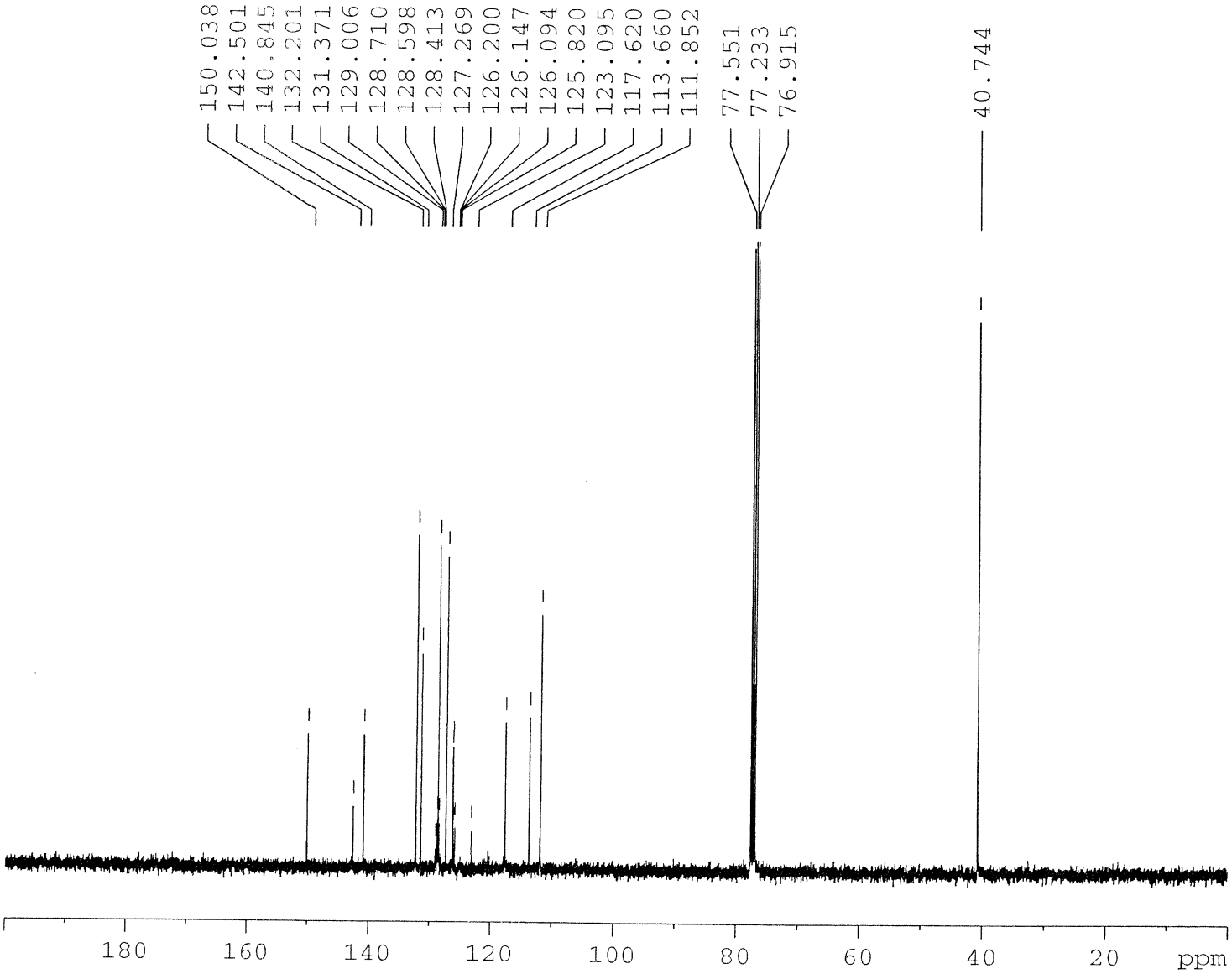
Current Data Parameters
NAME JN2-280-020
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071105
Time 19.14
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 362
DW 60.400 usec
DE 6.00 usec
TE 292.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300175 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00





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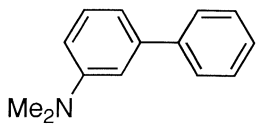
Current Data Parameters
NAME JN2-287-030
EXPNO 13
PROCNO 1

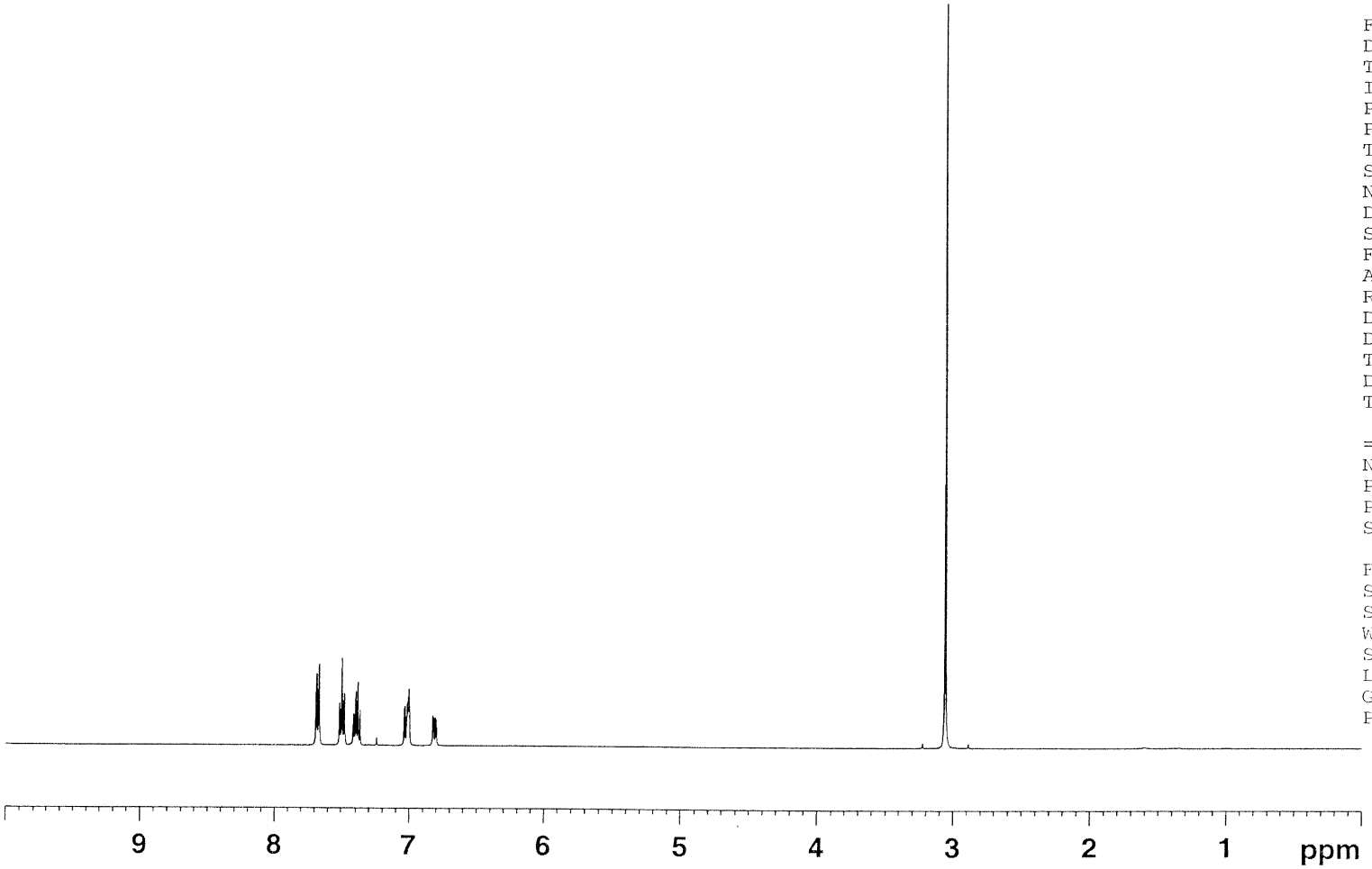
F2 - Acquisition Parameters
Date_ 20071110
Time 11.29
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 168
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 4096
DW 20.850 usec
DE 6.00 usec
TE 293.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127525 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





Current Data Parameters

NAME	JN2-289-010
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

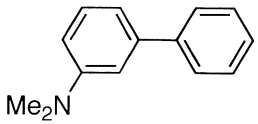
Date_	20071020
Time	10.18
INSTRUM	spect
PROBHD	5 mm BBO BB-1H
PULPROG	zg30
TD	65536
SOLVENT	
NS	8
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	45.3
DW	60.400 usec
DE	6.00 usec
TE	293.2 K
D1	1.00000000 sec
TD0	1

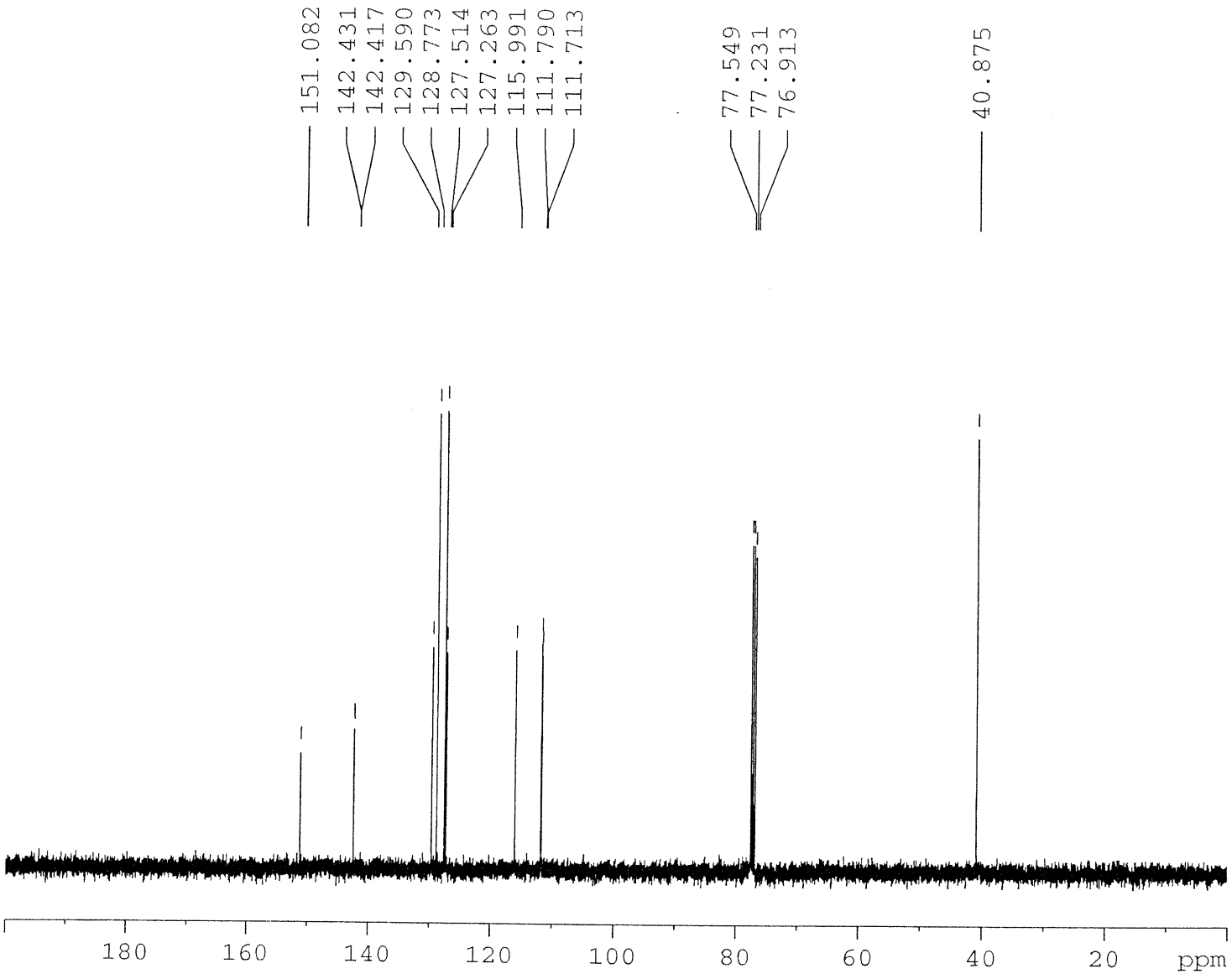
======== CHANNEL f1 ========

NUC1	1H
P1	15.07 usec
PL1	0.00 dB
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	65536
SF	400.1300177 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00





Current Data Parameters

NAME	JN2-289-010
EXPNO	13
PROCNO	1

F2 - Acquisition Parameters

Date_	20071020
Time	10.20
INSTRUM	spect
PROBHD	5 mm BBO BB-1H
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	20
DS	2
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	13004
DW	20.850 usec
DE	6.00 usec
TE	293.2 K
D1	2.00000000 sec
d11	0.03000000 sec
DELTA	1.89999998 sec
TD0	1

======== CHANNEL f1 ========

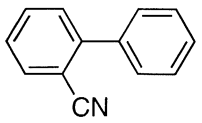
NUC1	13C
P1	8.75 usec
PL1	-3.00 dB
SFO1	100.6228298 MHz

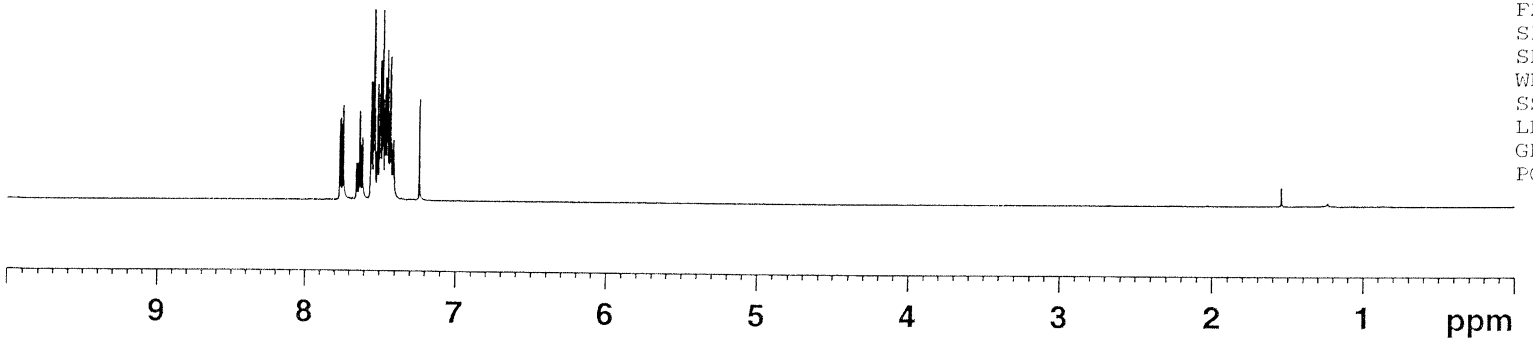
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	-1.00 dB
PL12	14.52 dB
PL13	18.00 dB
SFO2	400.1316005 MHz

F2 - Processing parameters

SI	65536
SF	100.6127634 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40



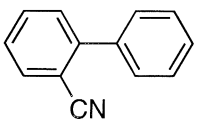


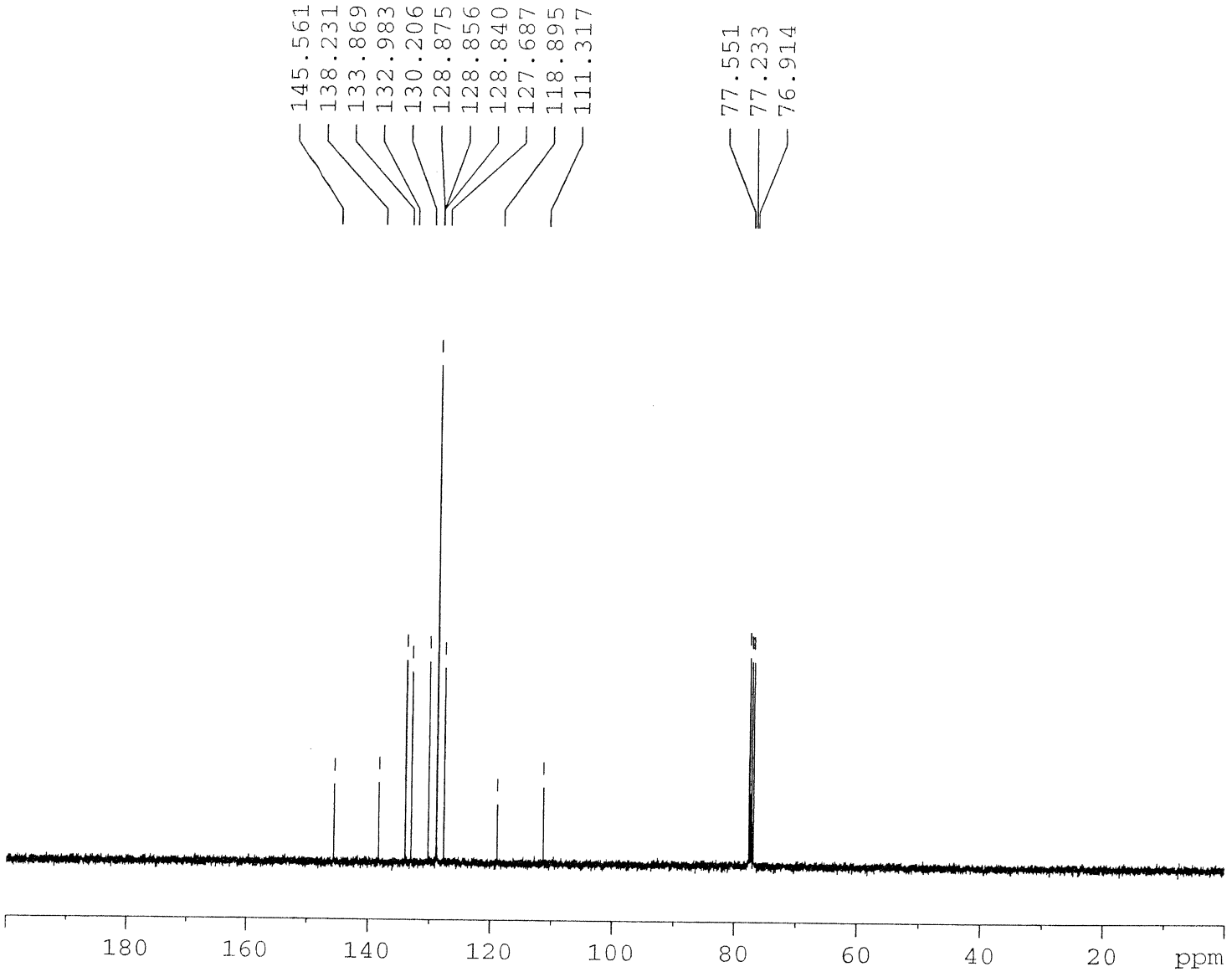
Current Data Parameters
NAME JN2-276-010
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071014
Time 12.55
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 362
DW 60.400 usec
DE 6.00 usec
TE 291.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300175 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00





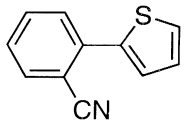
Current Data Parameters
NAME JN2-276-010
EXPNO 13
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071014
Time 13.53
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 41
DS 2
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 2896.3
DW 20.850 usec
DE 6.00 usec
TE 292.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 8.45 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 65536
SF 100.6127617 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



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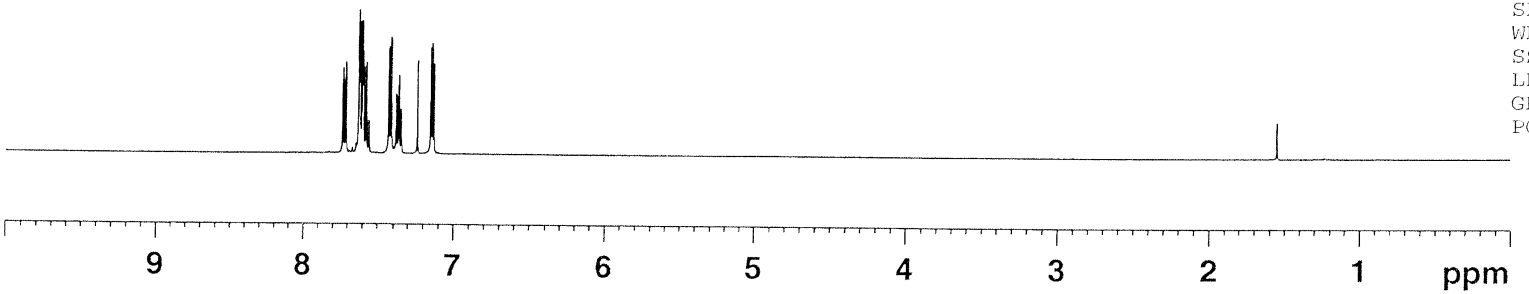
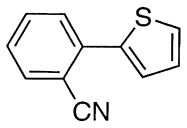
Current Data Parameters
NAME JN2-270-010
EXPNO 1
PROCNO 1

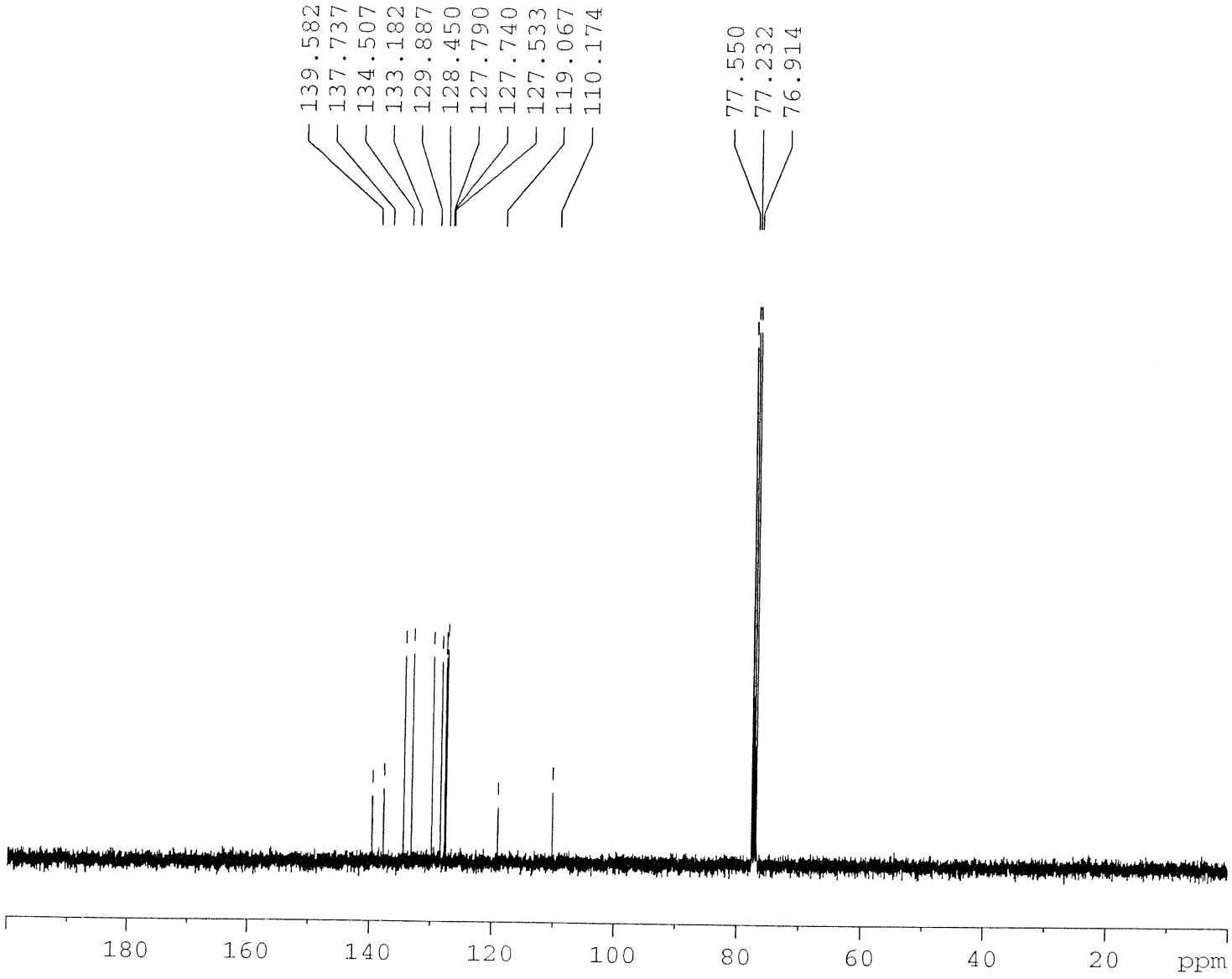
F2 - Acquisition Parameters
Date_ 20071012
Time 15.30
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 65536
SOLVENT
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 181
DW 60.400 usec
DE 6.00 usec
TE 293.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 15.07 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300177 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00







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Current Data Parameters

NAME	JN2-261-020
EXPNO	13
PROCNO	1

F2 - Acquisition Parameters

Date_	20071014
Time	13.45
INSTRUM	spect
PROBHD	5 mm QNP 1H/13
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	76
DS	2
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	1625.5
DW	20.850 usec
DE	6.00 usec
TE	292.2 K
D1	2.00000000 sec
d11	0.03000000 sec
DELTA	1.89999998 sec
TD0	1

======== CHANNEL f1 ========

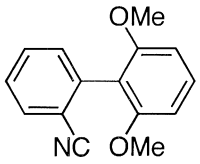
NUC1	13C
P1	8.45 usec
PL1	0.00 dB
SFO1	100.6228298 MHz

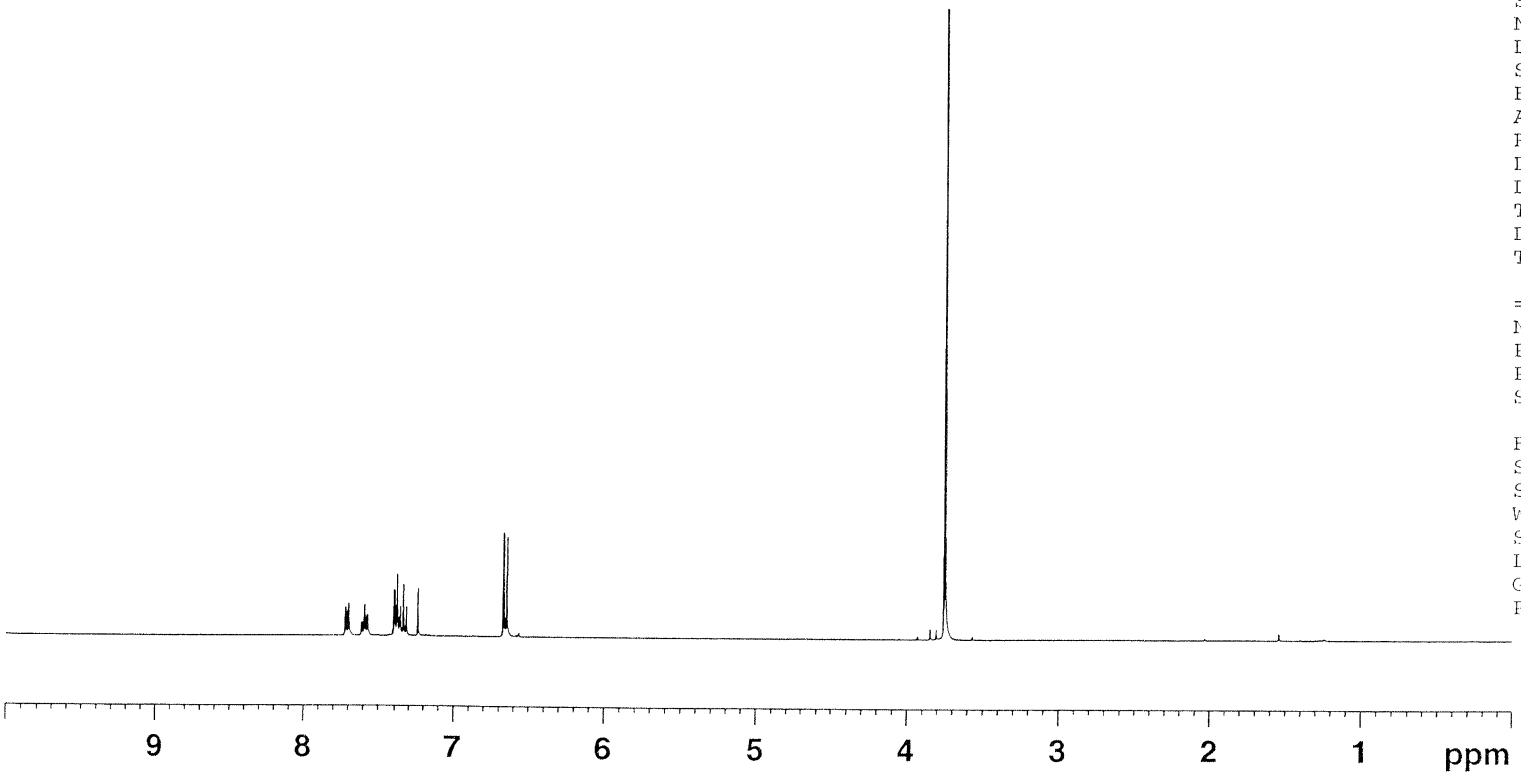
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	0.00 dB
PL12	16.10 dB
PL13	19.00 dB
SFO2	400.1316005 MHz

F2 - Processing parameters

SI	65536
SF	100.6127540 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40



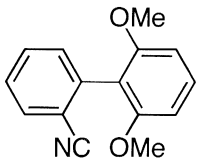


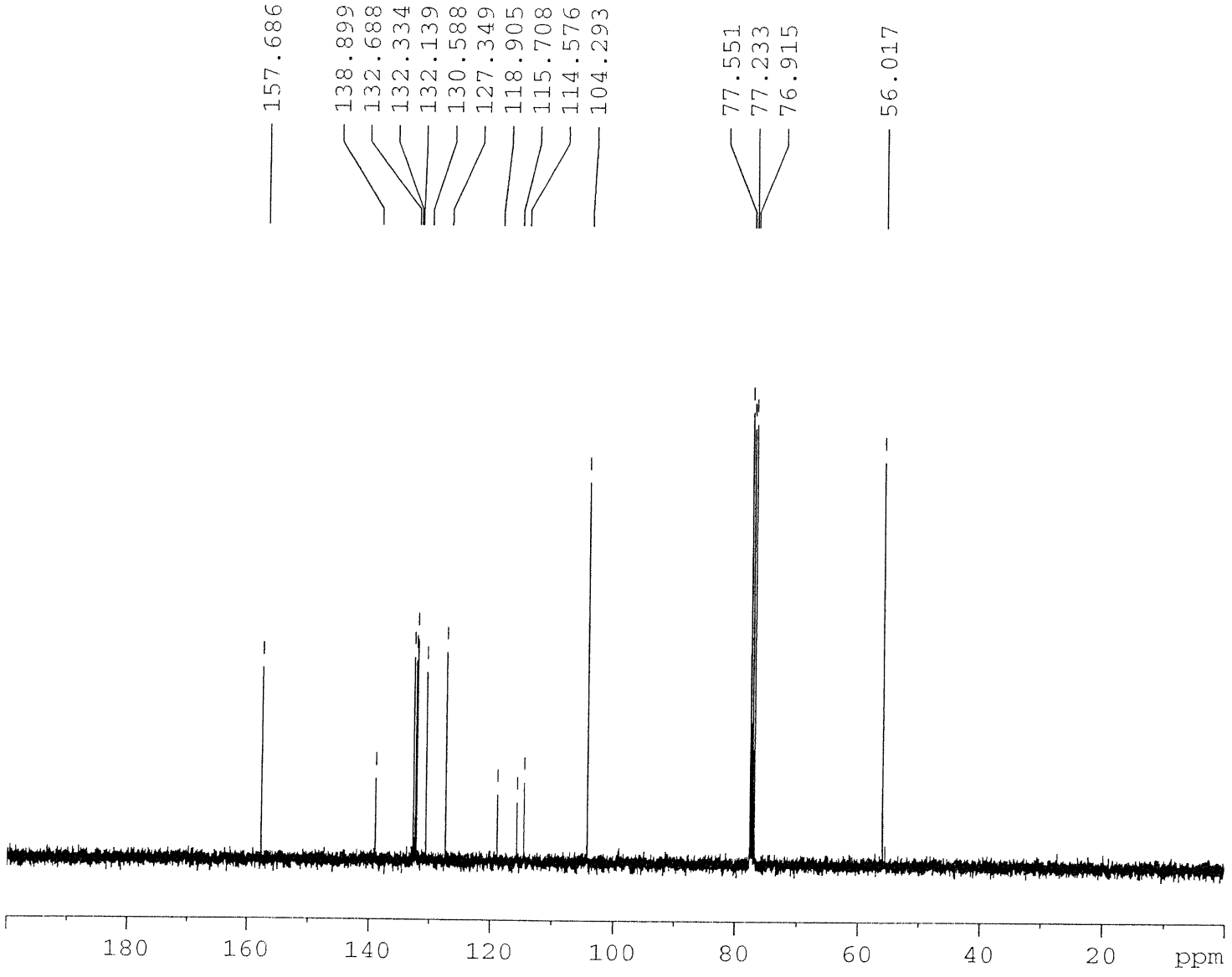
Current Data Parameters
NAME JN2-281-010
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071016
Time 21.32
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 203.2
DW 60.400 usec
DE 6.00 usec
TE 291.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300174 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00





Current Data Parameters
NAME JN2-281-010
EXPNO 13
PROCNO 1

F2 - Acquisition Parameters

Date_	20071025
Time	18.35
INSTRUM	spect
PROBHD	5 mm QNP 1H/13
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	100
DS	4
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	3251
DW	20.850 usec
DE	6.00 usec
TE	292.2 K
D1	2.00000000 sec
d11	0.03000000 sec
DELTA	1.89999998 sec
TD0	1

======== CHANNEL f1 ========

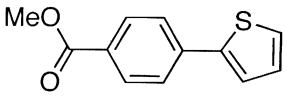
NUC1	13C
P1	9.38 usec
PL1	0.00 dB
SFO1	100.6228298 MHz

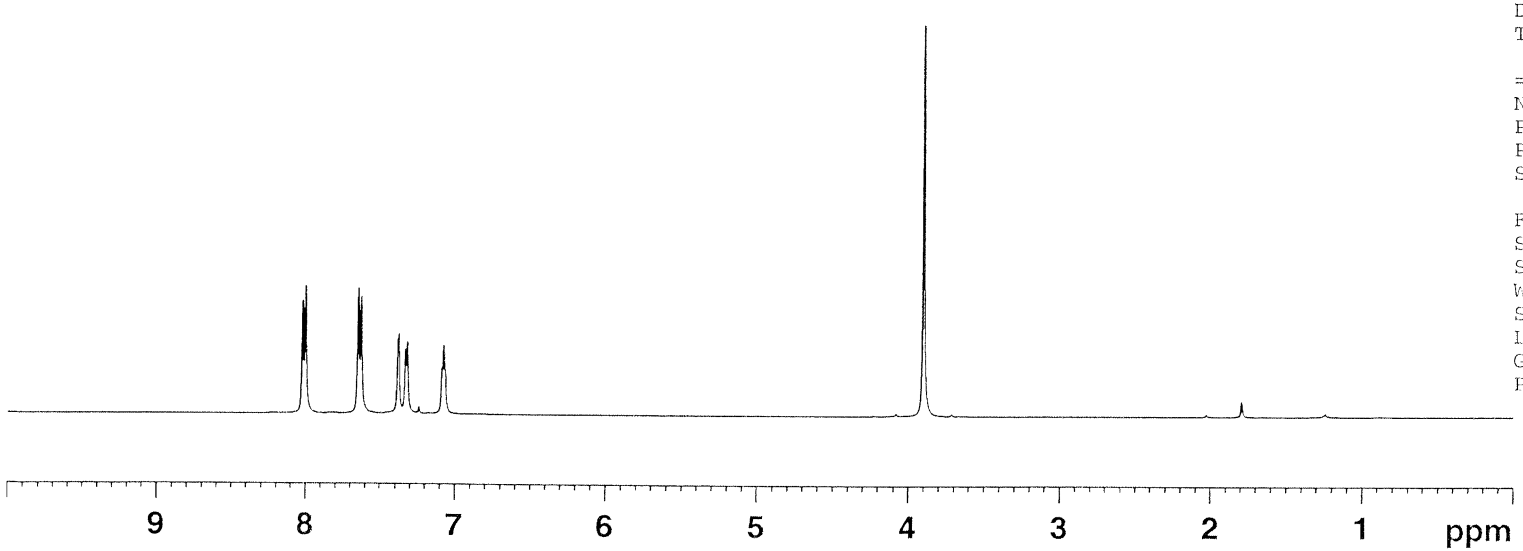
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	0.00 dB
PL12	16.10 dB
PL13	19.00 dB
SFO2	400.1316005 MHz

F2 - Processing parameters

SI	32768
SF	100.6127556 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40





Current Data Parameters
NAME JN2-285-010
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters

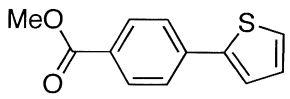
Date_	20071025
Time	18.14
INSTRUM	spect
PROBHD	5 mm QNP 1H/13
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	16
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	90.5
DW	60.400 usec
DE	6.00 usec
TE	291.2 K
D1	1.00000000 sec
TD0	1

======== CHANNEL f1 ========

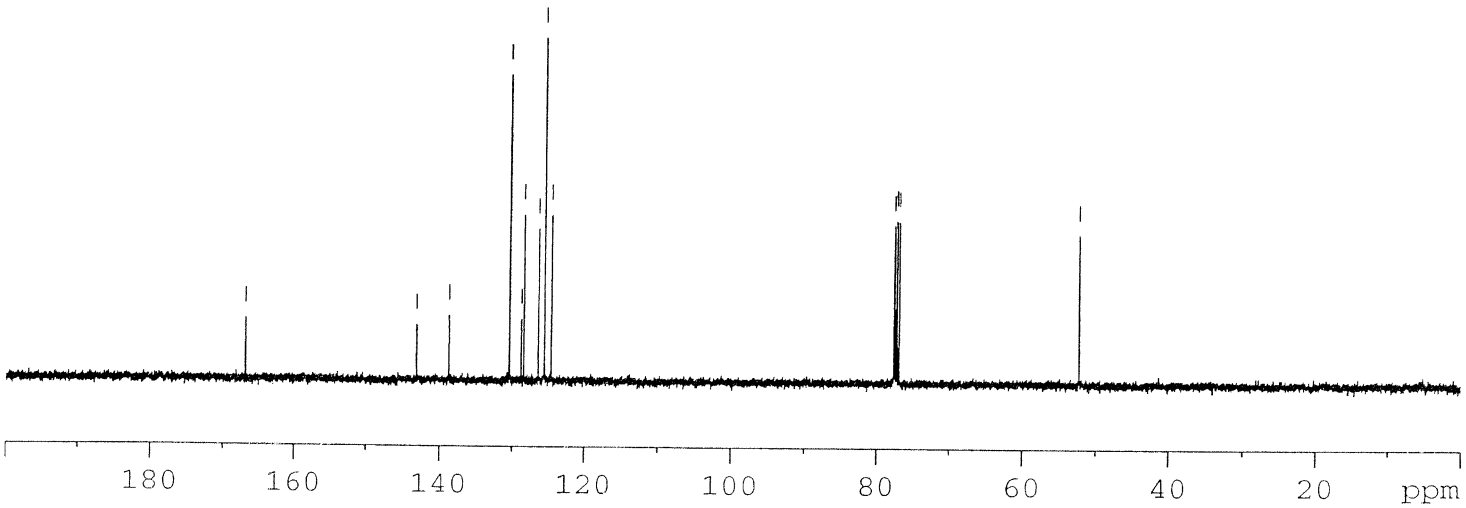
NUC1	1H
P1	14.00 usec
PL1	0.00 dB
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	65536
SF	400.1300170 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00



166.862
143.136
138.717
130.396
128.832
128.455
126.424
125.597
124.622
77.551
77.233
76.915
52.268



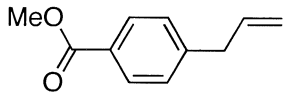
Current Data Parameters
NAME JN2-285-010
EXPNO 13
PROCNO 1

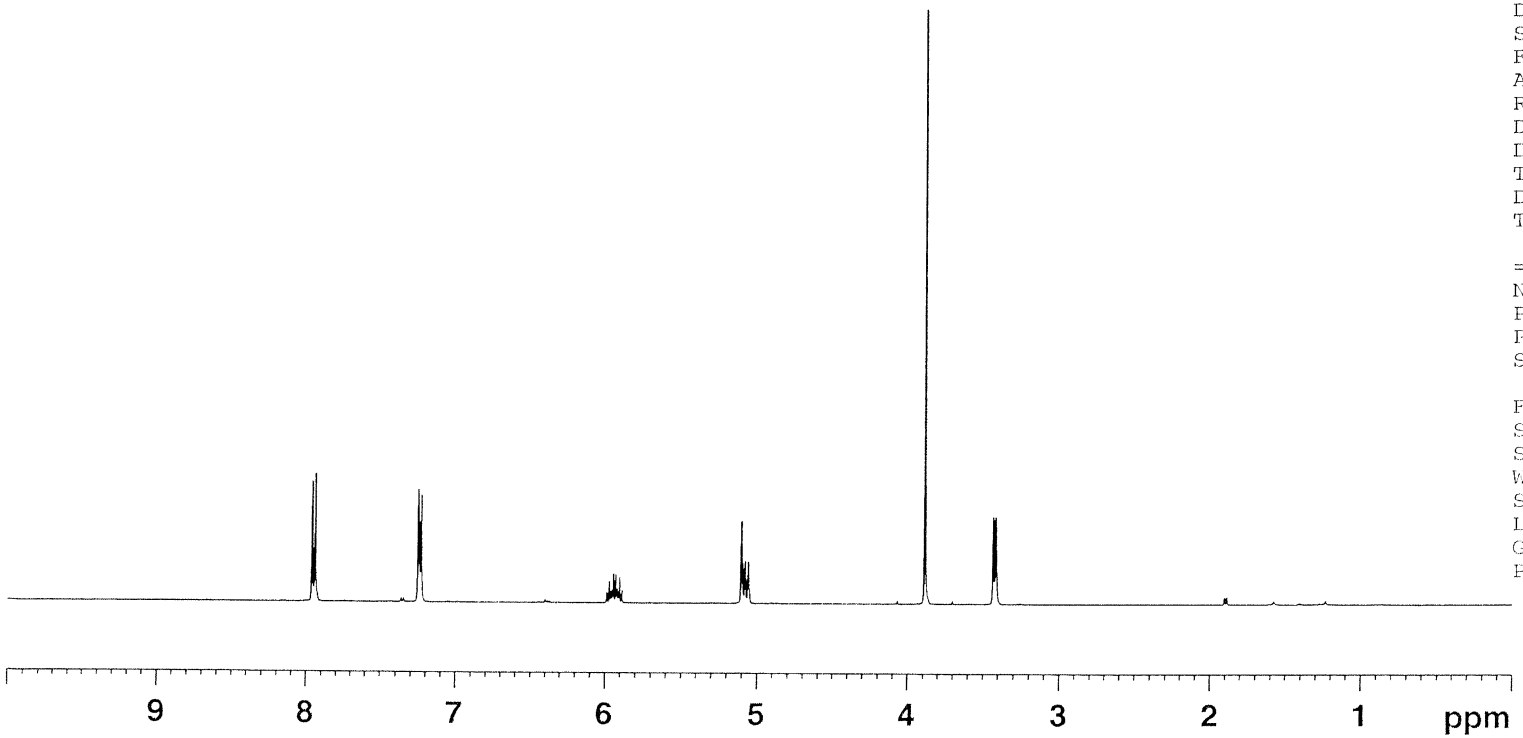
F2 - Acquisition Parameters
Date_ 20071025
Time 18.17
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 30
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 2896.3
DW 20.850 usec
DE 6.00 usec
TE 291.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127596 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



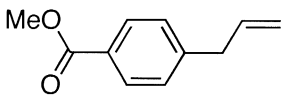


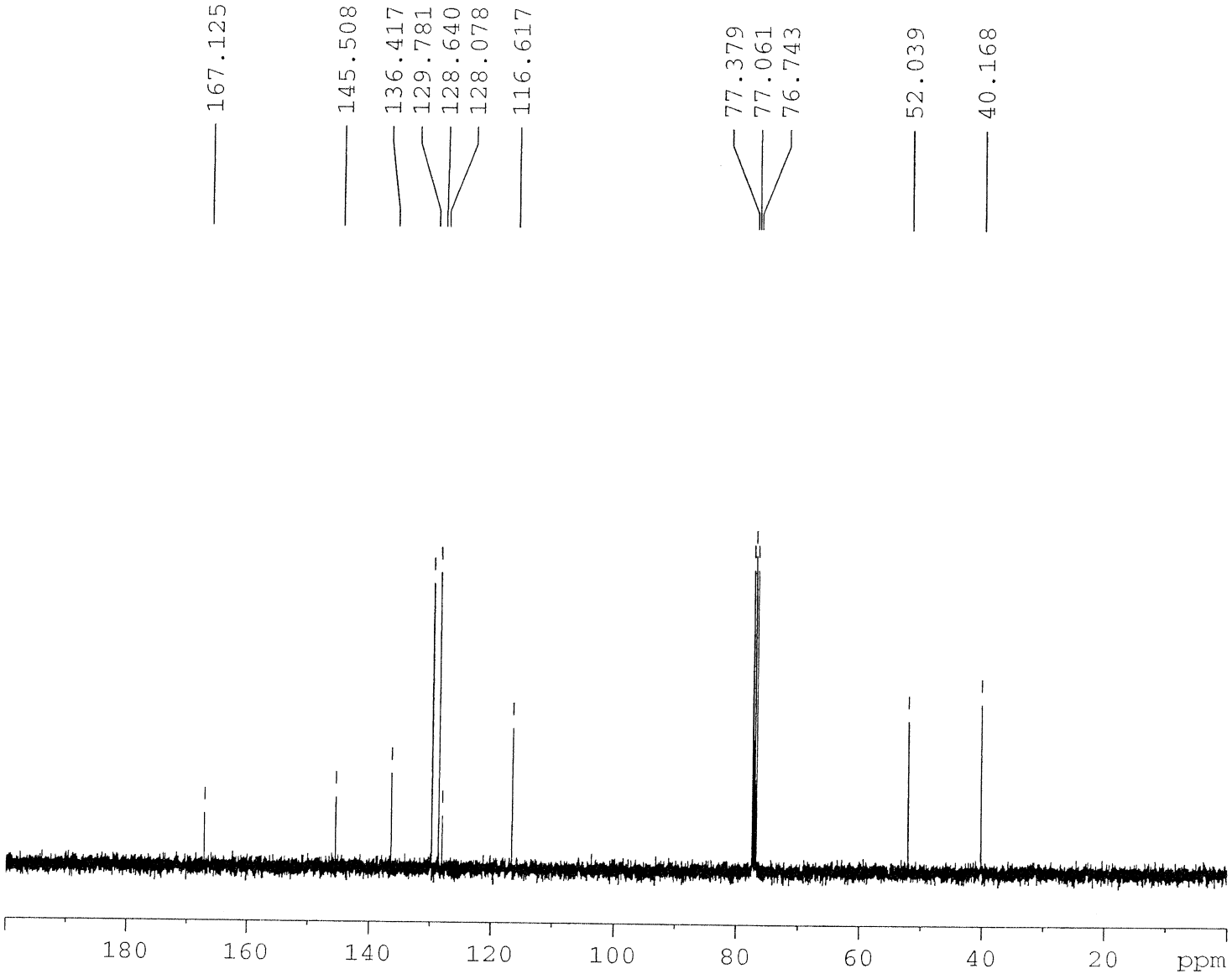
Current Data Parameters
NAME JN2-294-010
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071105
Time 19.33
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 256
DW 60.400 usec
DE 6.00 usec
TE 292.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300173 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00





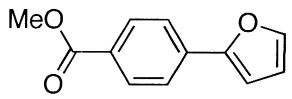
Current Data Parameters
NAME JN3-019-010
EXPNO 13
PROCNO 1

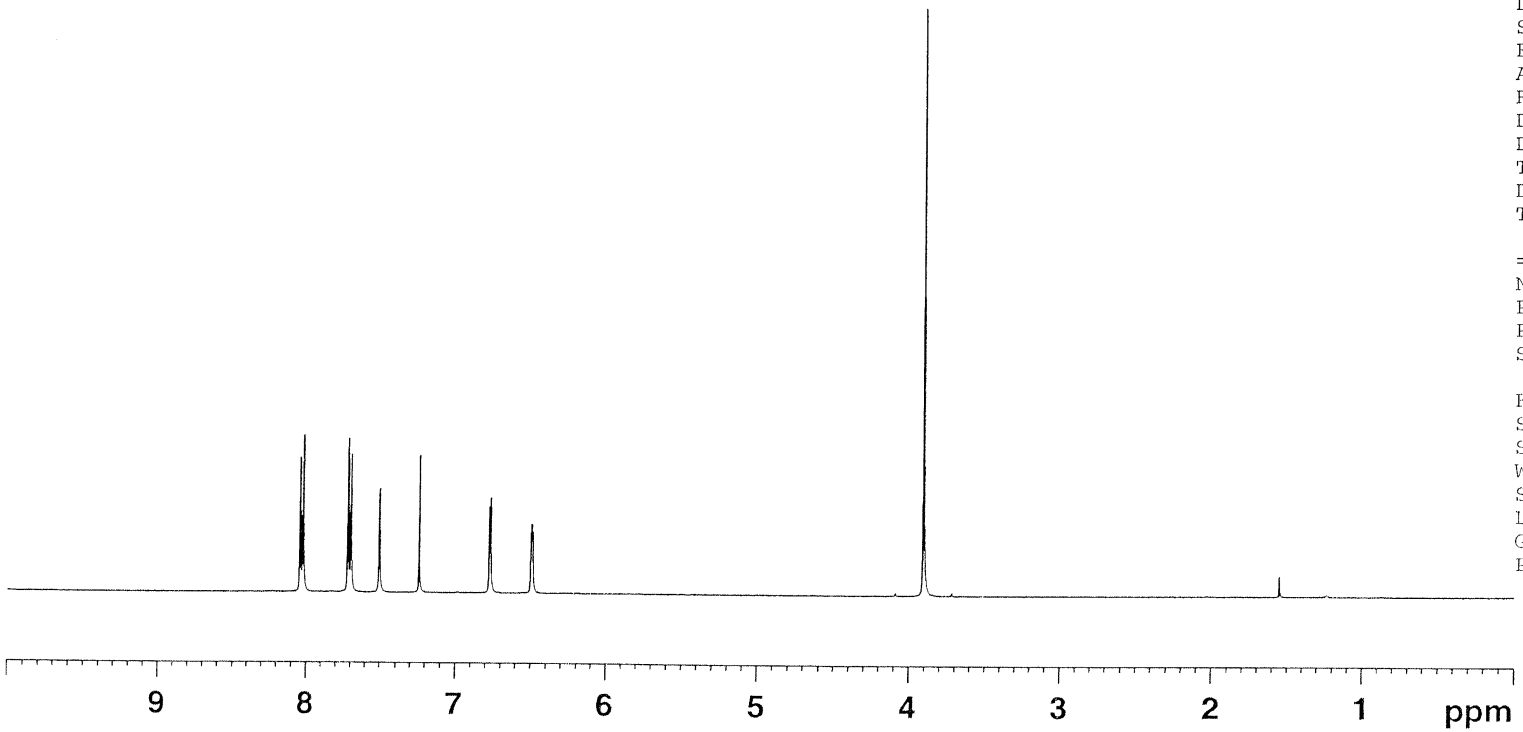
F2 - Acquisition Parameters
Date_ 20071110
Time 12.31
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 20
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 4096
DW 20.850 usec
DE 6.00 usec
TE 293.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



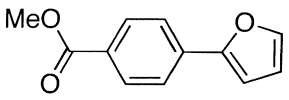


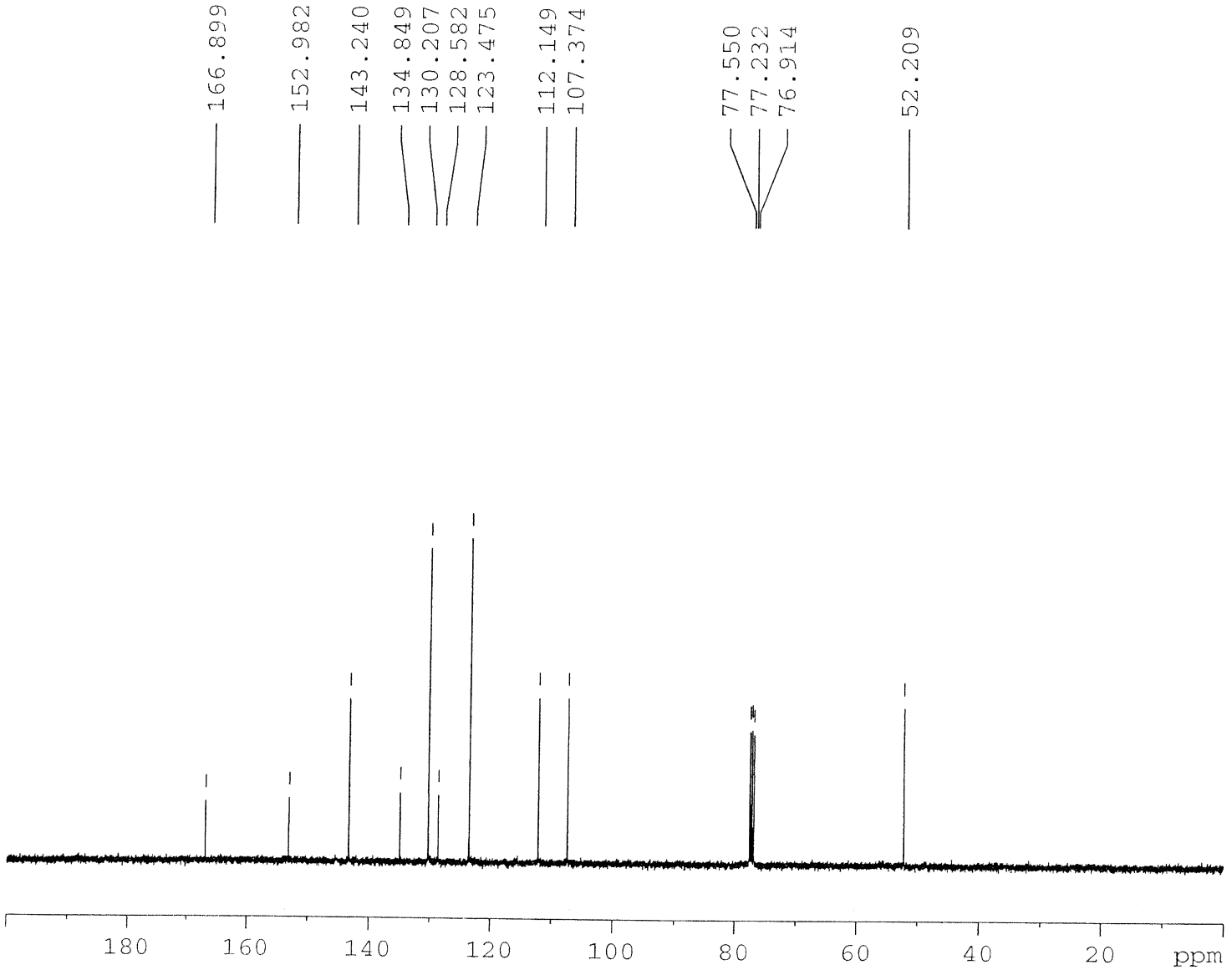
Current Data Parameters
NAME JN2-283-010
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071016
Time 21.43
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 322.5
DW 60.400 usec
DE 6.00 usec
TE 291.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300175 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00





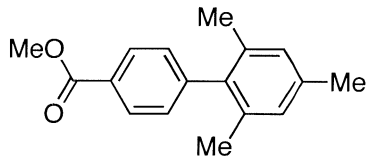
Current Data Parameters
NAME JN2-271-010
EXPNO 13
PROCNO 1

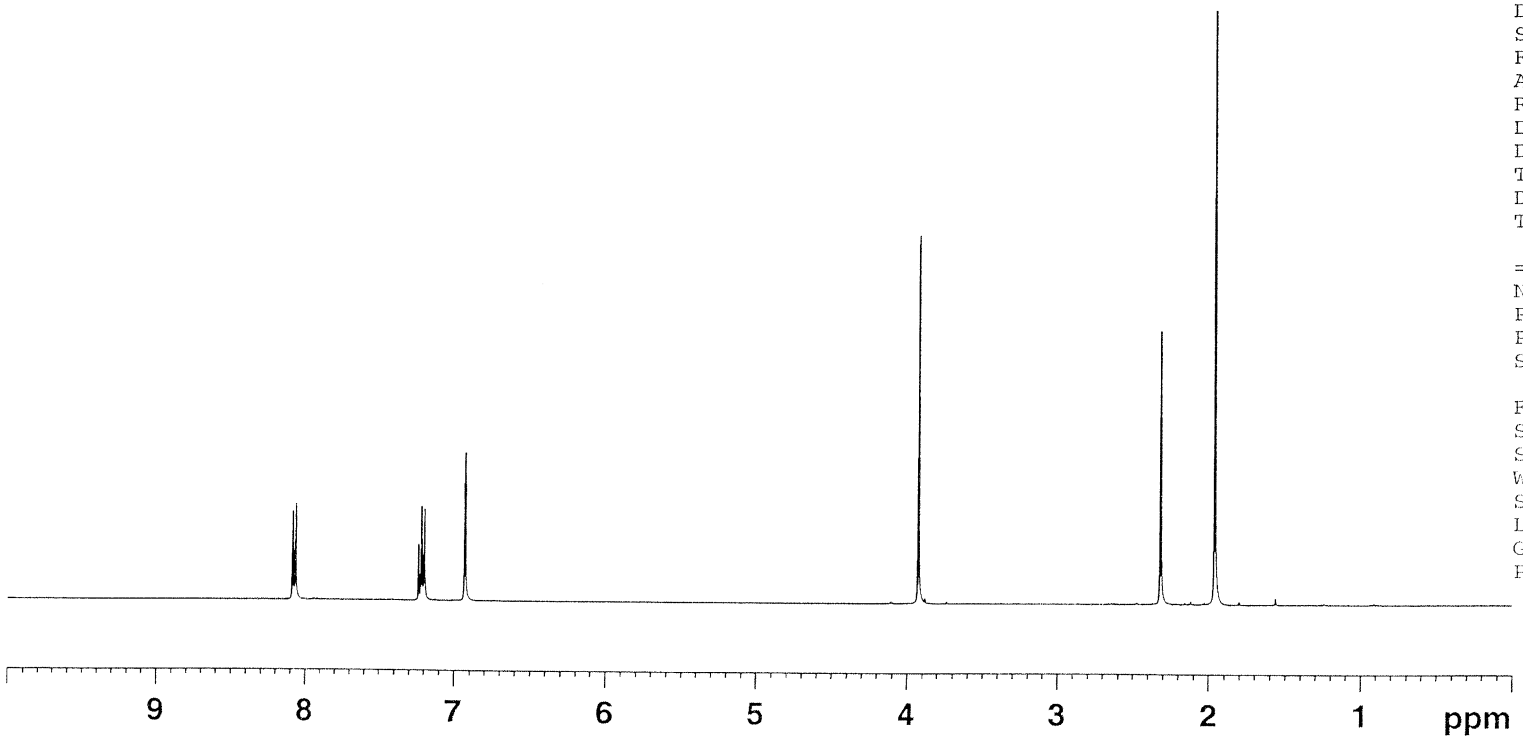
F2 - Acquisition Parameters
Date_ 20071014
Time 13.59
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 39
DS 2
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 2580.3
DW 20.850 usec
DE 6.00 usec
TE 292.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 8.45 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 65536
SF 100.6127595 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



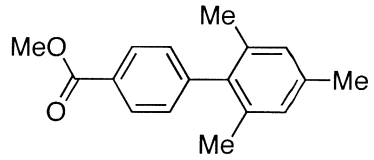


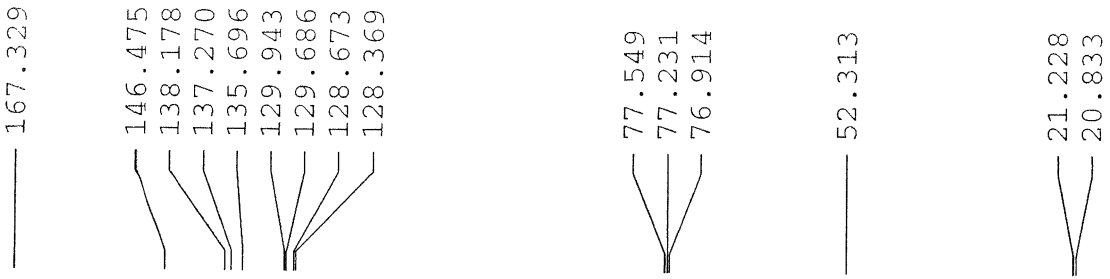
Current Data Parameters
NAME JN2-275-010
EXPNO 1
PROCNO 1

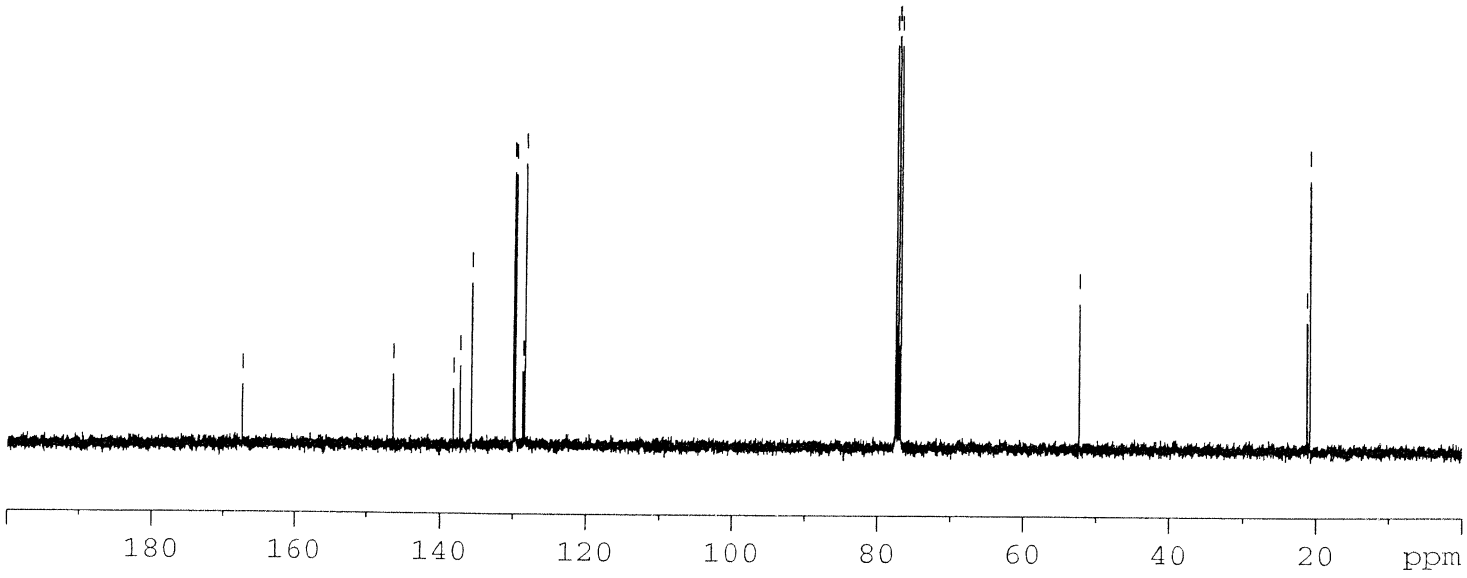
F2 - Acquisition Parameters
Date_ 20071014
Time 13.00
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 287.4
DW 60.400 usec
DE 6.00 usec
TE 291.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300174 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00







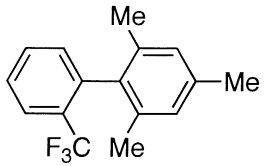
Current Data Parameters
NAME JN2-262-010
EXPNO 13
PROCNO 1

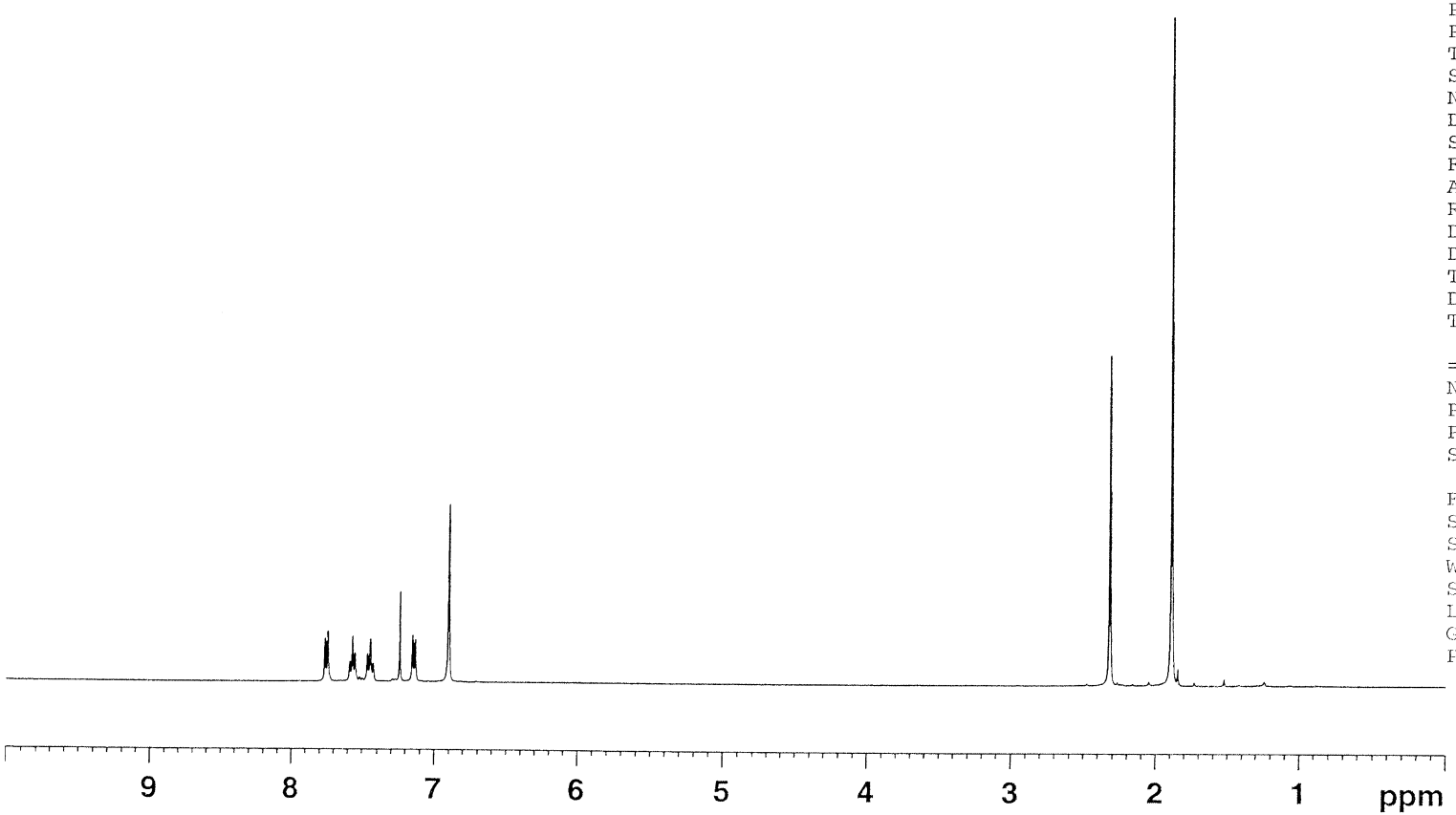
F2 - Acquisition Parameters
Date_ 20071014
Time 13.08
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 77
DS 2
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 2580.3
DW 20.850 usec
DE 6.00 usec
TE 291.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 8.45 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 65536
SF 100.6127536 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



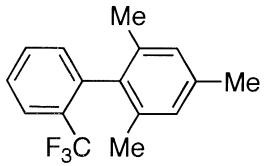


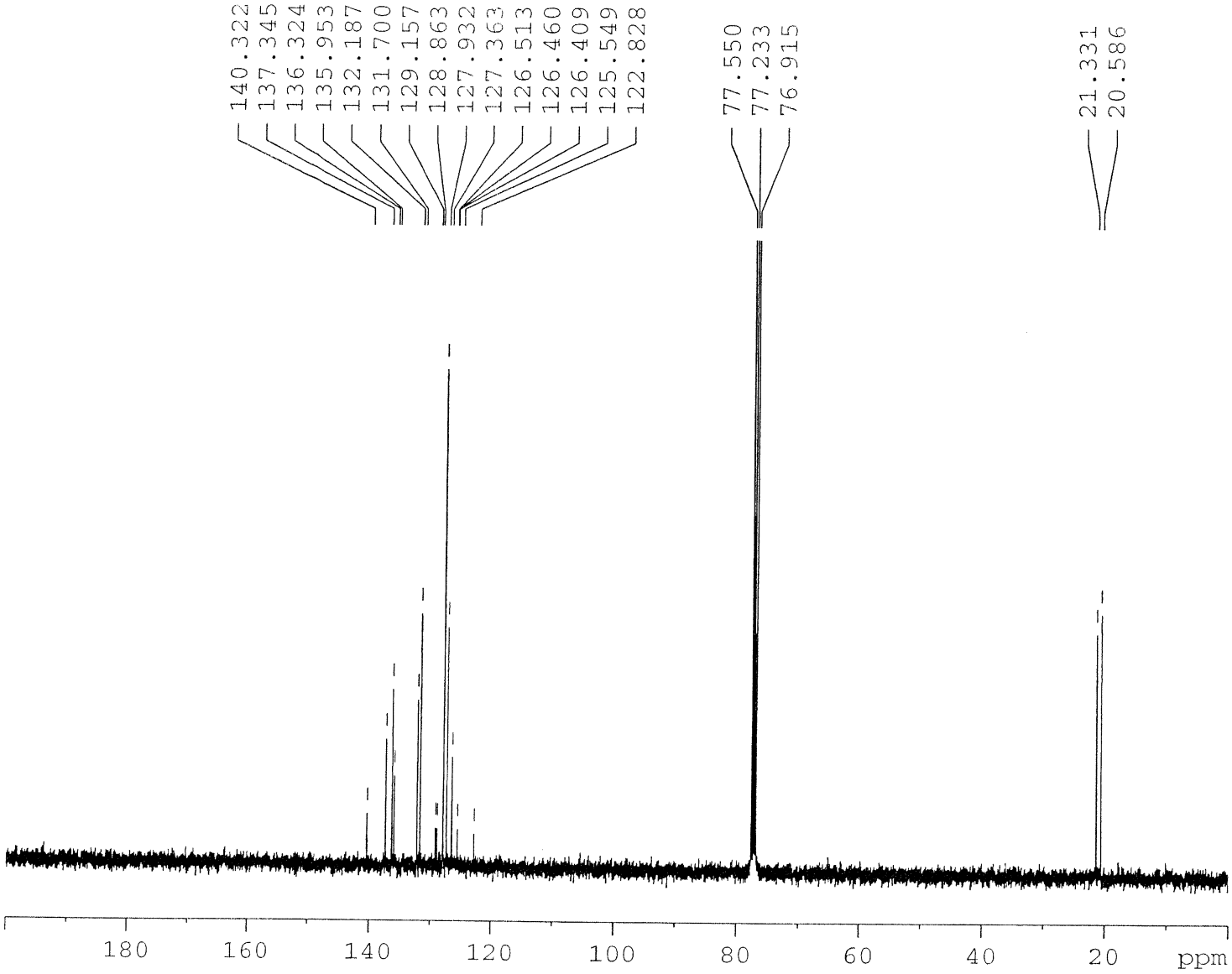
Current Data Parameters
NAME JN3-016-010
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071110
Time 12.39
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 256
DW 60.400 usec
DE 6.00 usec
TE 293.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300173 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00





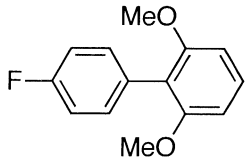
Current Data Parameters
NAME JN3-016-010
EXPNO 13
PROCNO 1

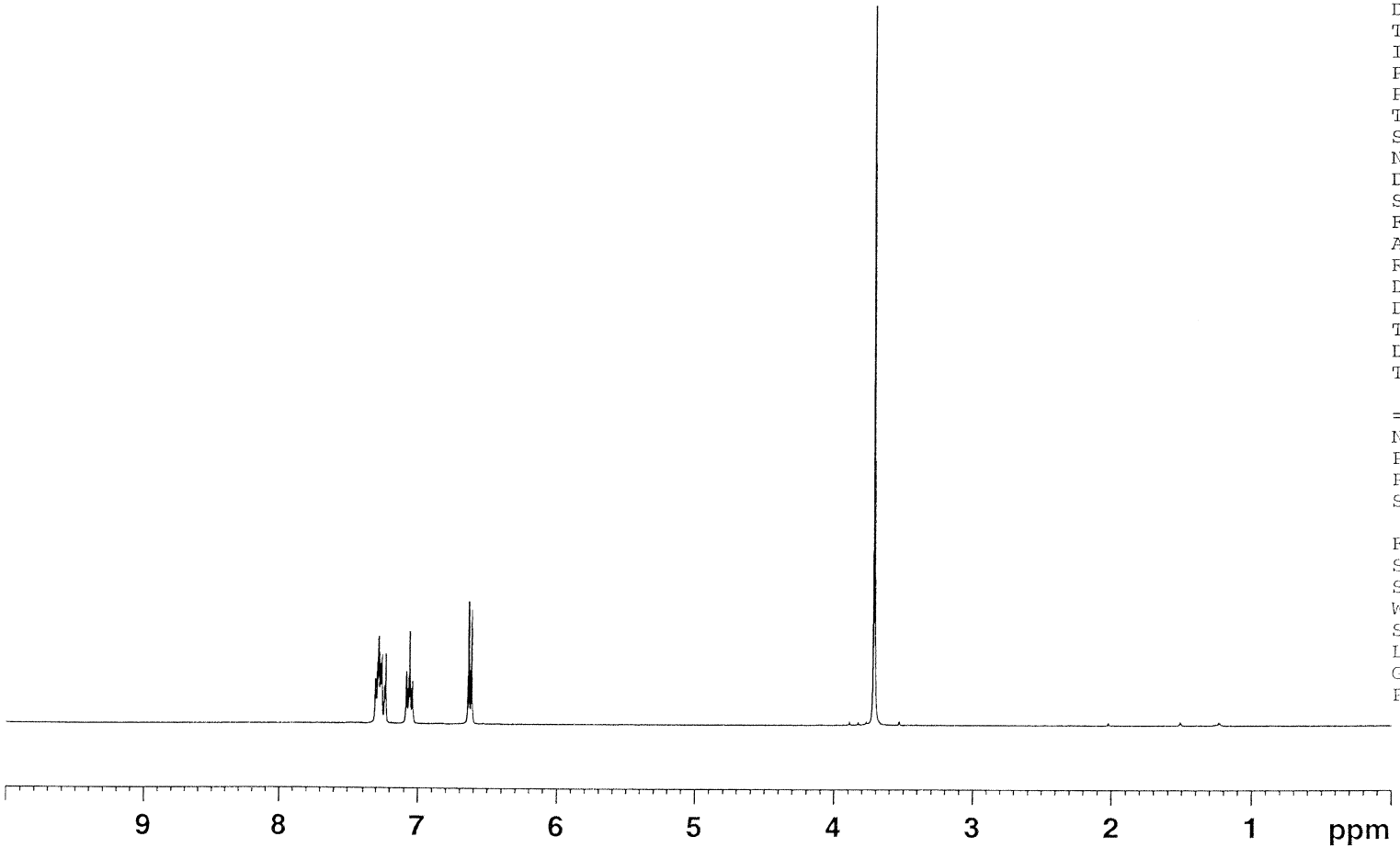
F2 - Acquisition Parameters
Date_ 20071110
Time 11.44
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 285
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 3649.1
DW 20.850 usec
DE 6.00 usec
TE 293.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127498 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



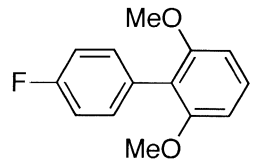


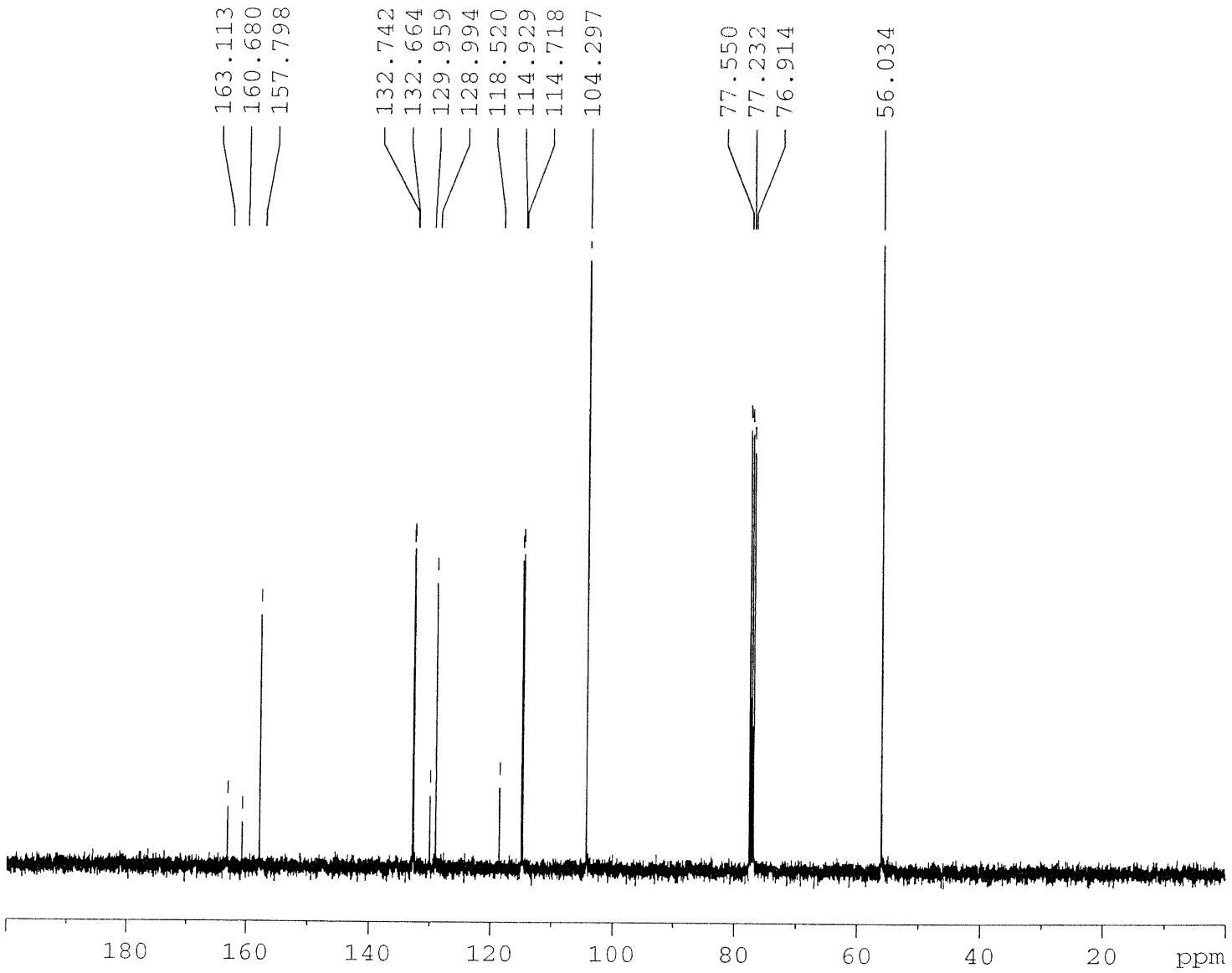
Current Data Parameters
NAME JN3-018-010
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071110
Time 12.56
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 228.1
DW 60.400 usec
DE 6.00 usec
TE 293.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0.00 dB
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300220 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00





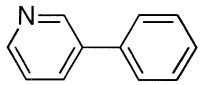
Current Data Parameters
NAME JN3-018-010
EXPNO 13
PROCNO 1

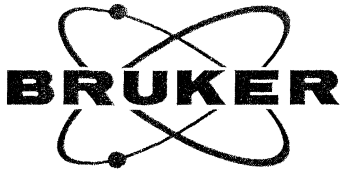
F2 - Acquisition Parameters
Date_ 20071110
Time 12.16
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 75
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 4597.6
DW 20.850 usec
DE 6.00 usec
TE 293.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127585 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





```
Current Data Parameters
NAME                  JN3-076a-010
EXPNO                            1
PROCNO                           1

F2 - Acquisition Parameters
Date_                     20080131
Time                         17.18
INSTRUM                      spect
PROBHD           5 mm QNP 1H/13
PULPROG                      zg30
TD                          65536
SOLVENT                     CDCl3
NS                             16
DS                              2
SWH                      8278.146 Hz
FIDRES                   0.126314 Hz
AQ                       3.9584243 sec
RG                             57
DW                          60.400 usec
DE                           6.00 usec
TE                          291.2 K
D1                     1.00000000 sec
TD0                             1

======== CHANNEL f1 ========
NUC1                           1H
P1                          14.00 usec
PL1                          0.00 dB
SFO1                400.1324710 MHz

F2 - Processing parameters
SI                          65536
SF                400.1300220 MHz
WDW                            EM
SSB                             0
LB                           0.30 Hz
GB                              0
PC                           1.00
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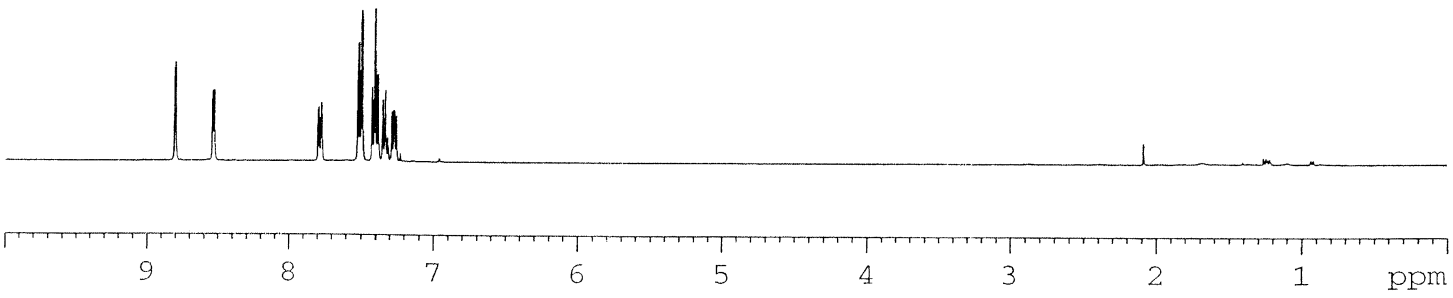
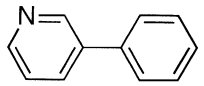
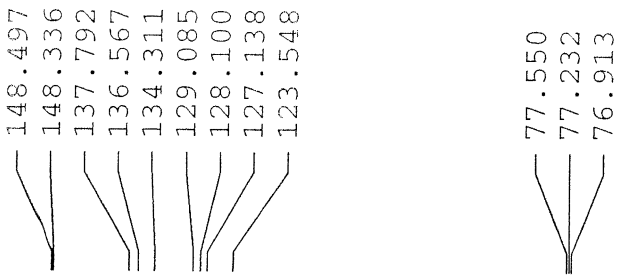
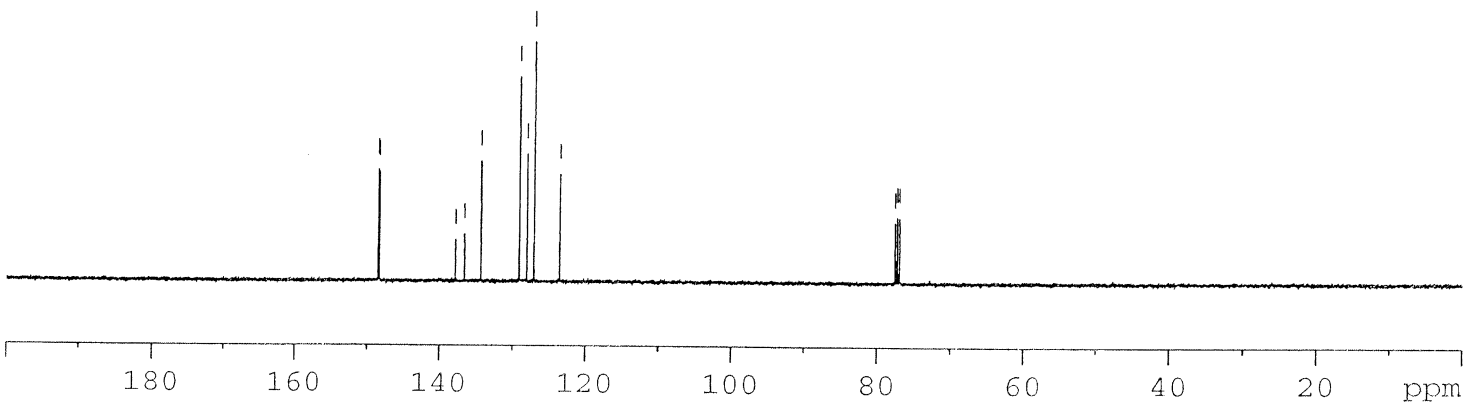








BRUKER

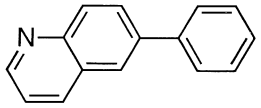
Current Data Parameters
NAME JN3-076a-010
EXPNO 13
PROCNO 1

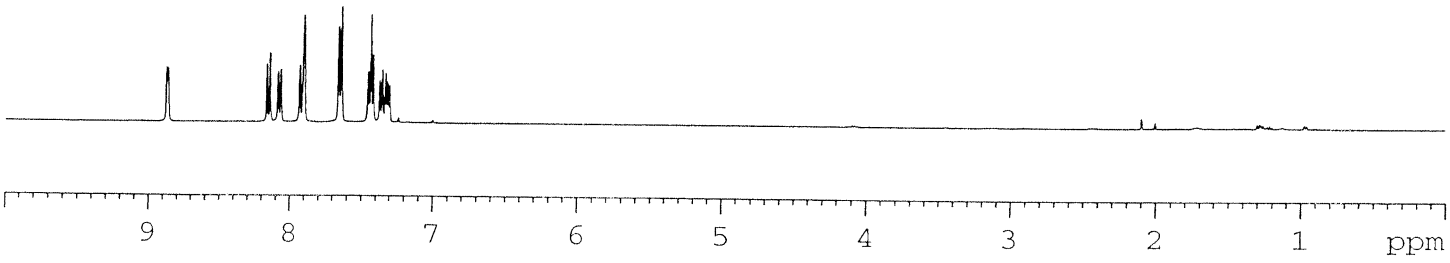
F2 - Acquisition Parameters
Date_ 20080131
Time 17.21
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 17
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 1625.5
DW 20.850 usec
DE 6.00 usec
TE 291.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.38 usec
PL1 0.00 dB
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.10 dB
PL13 19.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127707 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





Current Data Parameters

NAME	JN3-078a-010
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

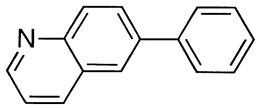
Date_	20080131
Time	17.34
INSTRUM	spect
PROBHD	5 mm BBO BB-1H
PULPROG	zg30
TD	65536
SOLVENT	
NS	16
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	40.3
DW	60.400 usec
DE	6.00 usec
TE	292.2 K
D1	1.00000000 sec
TD0	1

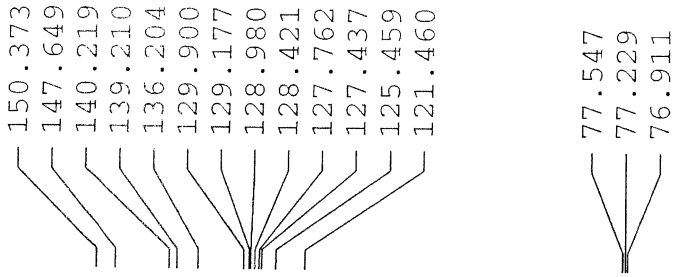
======== CHANNEL f1 ========

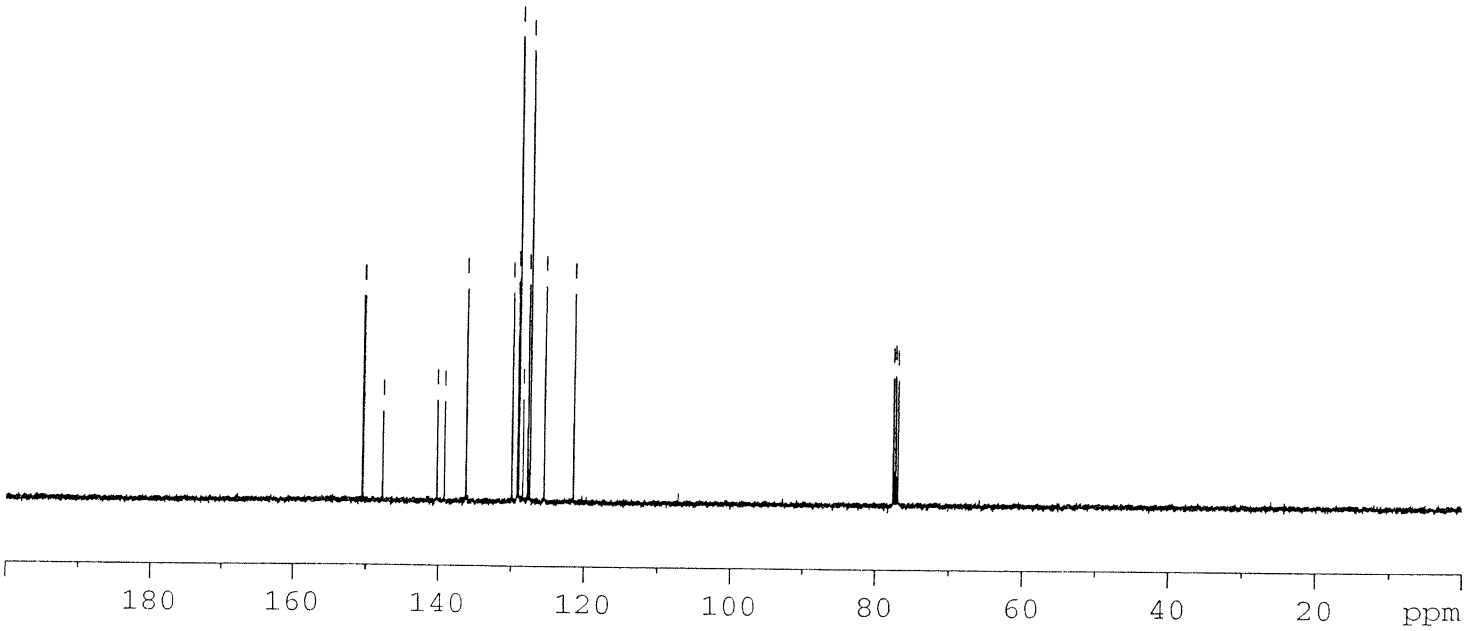
NUC1	1H
P1	15.07 usec
PL1	0.00 dB
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	65536
SF	400.1300177 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00







Current Data Parameters
NAME JN3-078a-010
EXPNO 13
PROCNO 1

F2 - Acquisition Parameters

Date_	20080131
Time	17.37
INSTRUM	spect
PROBHD	5 mm BBO BB-1H
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	24
DS	2
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	8192
DW	20.850 usec
DE	6.00 usec
TE	292.2 K
D1	2.00000000 sec
d11	0.03000000 sec
DELTA	1.89999998 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	8.75 usec
PL1	-3.00 dB
SFO1	100.6228298 MHz

======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	-1.00 dB
PL12	14.52 dB
PL13	18.00 dB
SFO2	400.1316005 MHz

F2 - Processing parameters

SI	65536
SF	100.6127716 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40