Supporting Information

Mg(OMe)2 Promoted Allylic Isomerization of γ-Hydroxy-α, β-Alkenoic Esters to The Synthesis of γ-Ketone Esters

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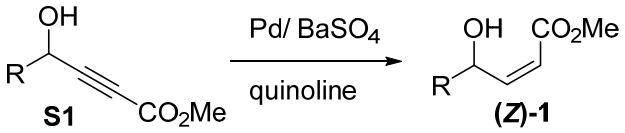
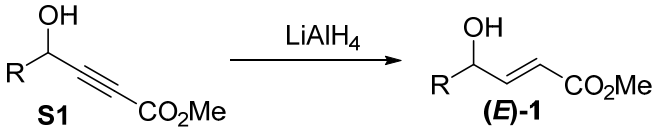
General Methods. Unless otherwise noted, all reactions were carried out with dry, freshly distilled solvents under anhydrous conditions, in flame-dried, round bottom flasks with magnetic stirring. Solvent were dried according to established procedures. Yields refer to chromatographically and spectroscopically (^{1}H NMR) homogenous materials. All reactions were monitored by TLC unless otherwise stated. Column chromatography purifications were carried out using silica gel. ^{1}H and ^{13}C NMR spectral were recorded on 300 MHz and 75 MHz instruments. Data for ^{1}H NMR are recorded as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet or unresolved, coupling constant(s) in Hz, integration). Data for ^{13}C NMR are reported in terms of chemical shift (δ, ppm).

General procedure for the synthesis of (*Z*)-γ-hydroxy-α, β-alkenoic Esters (*Z*)-1:



Lindlar Pd catalyst (5 wt% on $BaSO_4$, 10 mg) in combination with quinoline (10 μl) was added to the solution of γ-hydroxy-α, β-acetylenic ester (2 mmol) in hexane or Et_2O (5 mL). The suspension was vigorously stirred under H_2 (in balloon) for 2h until the reaction completed (monitored by ^{1}H NMR). The catalyst was then removed by filtration through a small portion of Celite®, and washed with hexane. The hexane solution was concentrated in vacuo and used for the next step without purification. It was found that the residual quinoline did not affect on the subsequent allylic isomerization.

General procedure for the synthesis of (*E*)-γ-hydroxy-α, β-alkenoic Esters (*E*)-1o:



To a suspension of $LiAlH_4$ (1 equiv) in dry THF or diethyl ether was added the γ-hydroxy-α, β-acetylenic ester in THF (or ether) dropwise at 0℃, which was then allowed to stir at room temperature. After the starting material had disappeared (TLC, 2 h), the reaction was quenched with saturated ammonium chloride solution, diluted with ether, filtered over Celite® and the organic layer was dried over Na_2SO_4. The residue obtained after removal of the solvent was purified by column chromatography (PE / EA = 9:1 to 5:1) to furnish the desired (*E*)-γ-hydroxy-α, β-alkenoic esters (*E*)-**1o** as a colorless liquid. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.44 – 7.27 (m, 5H), 7.05 (dd, *J* = 15.6, 4.8 Hz, 1H), 6.18 (dd, *J* = 15.6, 1.6 Hz, 1H), 5.36 (s, 1H), 3.73 (s, 3H), 2.26 (d, *J* = 3.0 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 166.9, 148.8, 140.9, 128.9, 128.4, 126.6, 119.8, 73.5, 51.76. [1]

General procedure for the allylic isomerization of 1 to γ-keto esters 2. To a round-bottom flask was added γ-hydroxy-α, β-alkenoic esters **1** (0.2 mmol), TMEDA (15 μl, 0.1 mmol, 50 mol %) and $Mg(OMe)_2$ (0.134 mmol, 67 mol %) in 2 mL MeOH. After stirring at room temperature for 2 h, the resulting solution was concentrated under vacuum, The residue was purified by chromatography on silica gel (PE / EA = 9:1 to 7:1) to afford the γ-keto esters **2**. [2]

Methyl 4-oxoundecanoate (2a): [2a] 91% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.68 (s, 3H), 2.72 (t, *J* = 6.2 Hz, 2H), 2.58 (t, *J* = 9.6, 2H), 2.44 (t, *J* = 7.5 Hz, 2H), 1.70 – 1.51 (m, 2H), 1.36 – 1.18 (m, 8H), 0.88 (t, *J* = 6.7 Hz, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 209.1, 173.3, 51.7, 42.8, 37.0, 31.6, 29.1, 29.0, 27.7, 23.8, 22.6, 14.0. EI-MS (*m*/*z*): 214 (M^+), 183 (M^+-31), 143 (M^+-71), 127(M^+-87), 115 (M^+-99), 57 (M^+-157).

Methyl 4-oxo-4-(*m*-tolyl)butanoate (2b): [2c] 88% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.79 (dd, *J* = 6.6, 1.2 Hz, 2H), 7.41 – 7.30 (m, 2H), 3.71 (s, 3H), 3.31 (t, *J* = 6.7 Hz, 2H), 2.77 (t, *J* = 6.7 Hz, 2H), 2.41 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 198.2, 173.4, 138.3, 136.5, 133.9, 128.5, 128.4, 125.2, 51.8, 33.4, 28.0, 21.3. EI-MS (*m*/*z*): 206 (M^+), 175 (M^+-31), 119 (M^+-87), 91 (M^+-115).

Methyl 4-oxo-4-(*p*-tolyl)butanoate (2c): [2b] 92% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.88 (d, *J* = 8.2 Hz, 1H), 7.26 (d, *J* = 7.9 Hz, 1H), 3.70 (s, 1H), 3.30 (t, *J* = 6.7 Hz, 1H), 2.76 (t, *J* = 6.7 Hz, 1H), 2.41 (s, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 197.6, 173.4, 144.0, 134.0, 129.2, 128.1, 51.7, 33.2, 28.0, 21.6. EI-MS (*m*/*z*): 206 (M^+), 175 (M^+-31), 119 (M^+-87), 91 (M^+-115).

Methyl 4-(3-chlorophenyl)-4-oxobutanoate (2d): 84% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.95 (s, 1H), 7.86 (d, *J* = 7.6 Hz, 1H), 7.55 (d, *J* = 7.9 Hz, 1H), 7.43 (q, *J* = 7.4 Hz, 1H), 3.71 (s, 3H), 3.29 (t, *J* = 6.6 Hz, 2H), 2.77 (t, *J* = 6.6 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 196.8, 173.1, 138.1, 135.0, 133.1, 130.0, 128.2, 126.1, 51.9, 33.5, 27.9. HRMS (ESI) m/z calcd for $C_{11}H_{11}ClO_3$ $[M + H]^+$: 227.0469, found m/z 227.0472.

Methyl 4-(4-chlorophenyl)-4-oxobutanoate (2e): [2c] 94% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.98 – 7.87 (m, 2H), 7.48 – 7.39 (m, 2H), 3.71 (s, 3H), 3.29 (t, *J* = 6.6 Hz, 2H), 2.77 (t, *J* = 6.6 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 197.6, 173.4, 144.0, 134.0, 129.2, 128.1, 51.8, 33.2, 28.0, 21.6. EI-MS (*m*/z): 228 (M^+), 226 (M^+), 197 (M^+-31), 195 (M^+-31), 141 (M^+-87), 139 (M^+-87), 113 (M^+-115), 111 (M^+-115).

Methyl 4-(2-chlorophenyl)-4-oxobutanoate (2f): [2c] 79% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59 – 7.53 (m, 1H), 7.46 – 7.38 (m, 2H), 7.38 – 7.30 (m, 1H), 3.71 (s, 3H), 3.27 (t, *J* = 6.6 Hz,

2H), 2.78 (t, *J* = 6.6 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 201.1, 173.0, 138.8, 131.9, 130.1, 130.6, 129.2, 126.9, 51.8, 37.6, 28.3. EI-MS (*m*/*z*): 228 (M^+), 226 (M^+), 197 (M^+-31), 195 (M^+-31), 141 (M^+-87), 139 (M^+-87), 113 (M^+-115), 111 (M^+-115).

Methyl 4-(naphthalen-2-yl)-4-oxobutanoate (2g): [2c] 94% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.52 (s, 1H), 8.04 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.97 (d, *J* = 7.8 Hz, 1H), 7.93 – 7.82 (m, 2H), 7.64 – 7.50 (m, 2H), 3.73 (s, 3H), 3.47 (t, *J* = 6.7 Hz, 2H), 2.83 (t, *J* = 6.7 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 198.0, 173.4, 135.7, 133.9, 132.5, 129.8, 129.6, 128.5, 128.4, 127.8, 126.8, 123.7, 51.8, 33.5, 28.1. EI-MS (*m*/*z*): 242 (M^+), 211 (M^+-31), 155 (M^+-87), 127 (M^+-115).

Methyl 4-(4-methoxyphenyl)-4-oxobutanoate (2h): [2c] 96% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.02 – 7.91 (m, 2H), 6.98 – 6.88 (m, 2H), 3.87 (s, 3H), 3.71 (s, 3H), 3.28 (t, *J* = 6.7 Hz, 2H), 2.75 (t, *J* = 6.7 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 196.5, 173.5, 163.5, 130.3,129.6, 113.7, 55.4, 51.8, 33.0, 28.1. EI-MS (*m*/*z*): 222 (M^+), 191 (M^+-31), 135 (M^+-87).

Methyl 4-(2-methoxyphenyl)-4-oxobutanoate (2i): [2c] 75% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.76 (dd, *J* = 7.7, 1.7 Hz, 1H), 7.54 – 7.39 (m, 1H), 7.06 – 6.91 (m, 2H), 3.92 (s, 3H), 3.70 (s, 3H), 3.33 (t, *J* = 6.7 Hz, 2H), 2.71 (t, *J* = 6.7 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 199.8, 173.6, 158.9, 133.7, 130.5, 127.4, 120.6, 111.5, 55.5, 51.7, 38.7, 28.5. EI-MS (*m*/*z*): 222 (M^+), 191 (M^+-31), 135 (M^+-87).

Methyl 4-(furan-2-yl)-4-oxobutanoate (2j): [2d] 92% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59 (d, *J* = 1.0 Hz, 1H), 7.23 (d, *J* = 3.5 Hz, 1H), 6.55 (dd, *J* = 3.5, 1.7 Hz, 1H), 3.70 (s, 3H), 3.18 (t, *J* = 6.8 Hz, 2H), 2.75 (t, *J* = 6.8 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 187.2, 173.1, 152.4, 146.3, 117.0, 112.2, 51.8, 33.1, 27.6. EI-MS (*m*/*z*): 182 (M^+), 167 (M^+-15), 151 (M^+-31), 123 (M^+-59), 95 (M^+-87).

(*E*)-Methyl 4-oxo-6-phenylhex-5-enoate (2k): [2e] 95% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59 (d, *J* = 16.4 Hz, 1H), 7.56 – 7.52 (m, 2H), 7.39 (dd, *J* = 4.0, 2.4 Hz, 3H), 6.76 (d, *J* = 16.2 Hz, 1H), 3.70 (s, 3H), 3.02 (t, *J* = 6.7 Hz, 2H), 2.70 (t, *J* = 6.7 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 197.9, 173.2, 142.8, 134.3, 130.5, 128.9, 128.2, 125.7, 51.7, 35.1, 27.8. EI-MS (*m*/*z*): 218 (M^+), 187 (M^+-31), 159 (M^+-59), 131 (M^+-87), 103 (M^+-115), 77 (M^+-141).

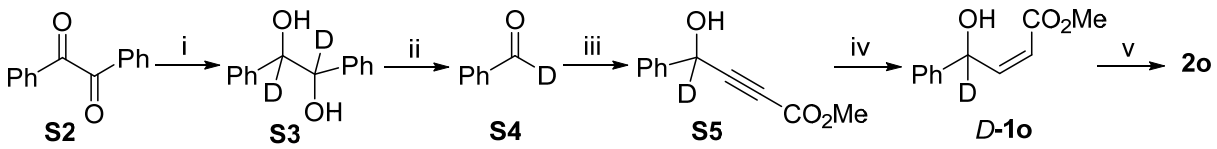
Methyl 4-cyclohexyl-4-oxobutanoate (2l): [2f] 80% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.67 (s, 3H), 2.76 (t, *J* = 6.6 Hz, 2H), 2.58 (t, *J* = 6.4 Hz, 2H), 2.38 (tt, *J* = 11.3, 3.4 Hz, 1H), 1.94 – 1.60 (m, 6H), 1.45 – 1.11 (m, 6H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 212.0, 173.4, 51.7, 50.7,34.9, 28.4, 27.6, 25.8, 25.6. EI-MS (*m*/*z*): 198 (M^+), 167 (M^+-31), 115 (M^+-83), 111(M^+-87), 83 (M^+-115).

Methyl 4-oxodecanoate (2m): [2f] 78% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.68 (s, 3H), 2.73 (t, *J* = 6.4 Hz, 2H), 2.59 (t, *J* = 6.2 Hz, 2H), 2.45 (t, *J* = 7.5 Hz, 2H), 1.57 (q, *J* = 6.9 Hz, 2H), 1.35 – 1.22 (m, 6H), 0.88 (t, *J* = 6.6 Hz, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 209.1, 173.3, 51.6 ,42.8, 37.0, 31.6, 28.9, 27.7, 23.8, 22.5,. 14.0. EI-MS (*m*/*z*): 200 (M^+), 169 (M^+-31), 143 (M^+-57), 115 (M^+-85), 43 (M^+-157).

Methyl 4-oxooctanoate (2n): [2g] 66% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.68 (s, 3H), 2.73 (t, *J* = 6.4 Hz, 2H), 2.58 (t, *J* = 9.6, 3.6 Hz, 2H), 2.45 (t, *J* = 7.5 Hz, 2H), 1.58 (dt, *J* = 15.3, 7.4 Hz, 2H), 1.32 (td, *J* = 14.8, 7.3 Hz, 2H), 0.91 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 209.1, 173.3, 51.7, 42.4, 36.9, 27.7, 25.8, 22.2, 13.8. EI-MS (*m*/*z*): 172 (M^+), 141 (M^+-31), 115 (M^+-57), 85 (M^+-87), 57 (M^+-115).

Methyl 4-oxo-4-phenylbutanoate (2o): [2a] 91% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.06 – 7.92 (m, 2H), 7.62 – 7.53 (m, 1H), 7.53 – 7.40 (m, 2H), 3.71 (s, 3H), 3.33 (t, *J* = 6.6 Hz, 2H), 2.78 (t, *J* = 6.6 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 198.0, 173.3, 136.5, 133.2, 128.6, 128.0, 51.8, 33.4, 28.0. EI-MS (*m*/*z*): 192 (M^+), 161 (M^+-31), 105 (M^+-87), 77 (M^+-115).

Deuteration Experiment:



Reduction of Benzil (S2): Following the similar procedure in literature with minor modification:[3a-b] firstly the Benzil (**S2**, 1.05g, 5 mmol) was dissolved in a mixture solvent, which containing dried THF (10 mL) and D_2O (0.5 mL). At 0°C, $NaBD_4$ (250 mg, 6.2 mmol, >98% D isotopic purity) was added in portion-wise over one hour. The misture was stirred until No **S2** left, monitored via TLC. After general workup, the reaction mixture was extracted with EtOAc, dried over Na_2SO_4, filtered and concentrated to give the product **S3** as a white solid in nearly quantity yield, which was pure enough for the next step. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.31 – 7.26 (m, 6H), 7.24 – 7.19 (m, 4H), 2.95 (s, 1H, *dl*), 2.30 (s, 1H, *Meso*). ^{13}C NMR (75 MHz, $CDCl_3$) δ 139.6, 128.2, 128.1, 128.0, 127.9, 127.0, 126.9.

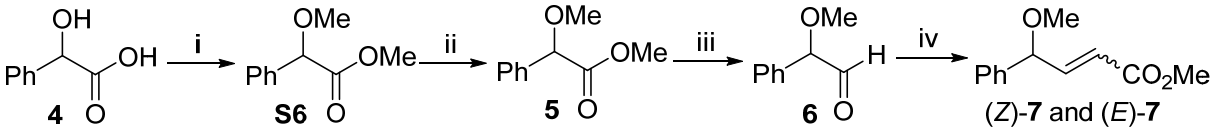
Synthesis of Deuteriobenzaldehyde S4:[3b] The diol **S3** was oxidized with $NaIO_4$ in ethanol overnight at room temperature. After the reaction was complete (monitored by TLC), the mixture was treated with general workup. Deuteriobenzaldehyde **S4** was purified over silica gel.

Synthesis of γ-hydroxy-α, β-acetylenic ester S5: Alkynylation of deuteriobenzaldehyde **S4** via treatment with n-BuLi in THF at -78°C afforded **S5** in 70% yield. 91% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.50 – 7.46 (m, 2H), 7.41 – 7.32 (m, 3H), 3.76 (s, 3H), 3.62 (s, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.8, 138.4, 128.7, 128.6, 126.5, 86.8, 77.2, 63.9, 63.6, 63.3, 52.8.

Lindlar reduction of **S5** was carried following the general procedure for the synthesis of (*Z*)-γ-hydroxy-α, β-alkenoic Esters **(*Z*)-1**. Without using quinolone, Pd catalyst was filtrated off until the hydrogenation complete (monitored via ^{1}H NMR). The organic solvent was evaporated under vacuum to afford *D*-**1o** which was used directly in the isomerization step. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.49 – 7.45 (m, 2H), 7.39 – 7.26 (m, 3H), 6.45 (d, *J* = 12 Hz, 1H), 5.89 (d, *J* = 12 Hz, 1H), 3.77 (s, 3H).

Under standard condition as in the general procedure for the allylic isomerization of 1 to γ-keto esters **2**, the allylic isomerization was carried out, and only afforded compound **2o**. No deuterated product was observed.

Synthesis of Methyl γ-Methoxy-γ-phenylbutenate 7:



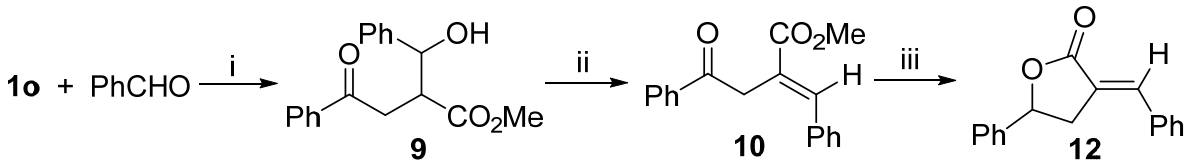
The suspension of (3.04g, 20 mmol) of the Mandelic acid (**4**) in 25mL of methanol was cooled down to 0 ^{o}C, 6mL of thionyl chloride was slowly dropped in. It was refluxed for 2h and then stirred for 8h at room temperature. The solvent was concentrated in vacuo and dried on air to give **S6** as a white solid (quantitative). ^{1}H NMR (300 MHz, $CDCl_3$) δ7.33-7.44 (m, 5H), 5.19 (s, 3H), 3.77 (s, 3H). [4a]

Sodium hydride (240 mg, 6mmol) was suspended in THF (5 mL) and cooled to 0 C, to which the solution of methyl mandelate **S6** (0.5 mg, 5mol) in THF (2 mL) was added dropwise. After stirring for 0.5h, methyl iodide (0.8 g, 6 mmol) was added and the reaction mixture was warmed to room temperature. To the reaction mixture was quenched by NH_4Cl solution (10mL) after 4h. The resulting mixture was extracted with diethyl ether (50mL) twice. The combined organic layer was washed with brine (5mL), dried over Mg_2SO_4, and concentrated in vacuo. The crude product was purified by flash chromatography on silica gel to give **5** colorless oil (51% yield). ^{1}H NMR (300 MHz, $CDCl_3$) δ7.26-7.42 (m, 5H), 4.78 (s, 1H), 3.73 (s, 3H), 3.41 (s, 3H). [4b]

To the solution of **5** (0.4 g, 2mmol) in Et_2O (10mL) at -78 ^{o}C, 1M DIBAL-H solution in hexane (2 mL) was added dropwise and the reaction mixture was allowed to stir at -78 ^{o}C for 2h. The reaction was quenched with MeOH (0.6 mL) and allowed to warm to room temperature. The mixture was treated with brine (10 mL) and extracted with Et_2O (50 mL X 3). The combined organic phase was washed with brine (10 mL) and dried over Na_2SO_4. The crude aldehyde was obtained after filtration and concentration in vacuo and was used for the next step without further purification.

Solution of methyl triphenylphosphine acetate (0.67 g, 2mmol) in MeOH (5 mL) was added to the above obtained aldehyde and stirred at 0^{o}C overnight. After the addition of water (10mL), the product was extracted with Et_2O, dried over Na_2SO_4 and purified by flash chromatography on gel (PE / EA = 25:1) to give (*Z*)-**7** and (*E*)-**7** as colorless oil. (*Z*)-**7:** 58% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.51 – 7.40 (m, 2H), 7.40 – 7.19 (m, 3H), 6.30 (dd, *J* = 11.6, 8.8 Hz, 1H), 5.98 (d, *J* = 8.9 Hz, 1H), 5.85 (dd, *J* = 11.6, 1.0 Hz, 1H), 3.72 (s, 3H), 3.32 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 166.1, 149.0, 140.1, 128.4, 127.8, 126.7, 119.3, 76.6, 56.2, 51.2. (*E*)-**7:** 29% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.44 – 7.18 (m, 5H), 6.97 (dd, *J* = 15.7, 5.4 Hz, 1H), 6.10 (dd, *J* = 15.7, 1.5 Hz, 1H), 4.78 (dd, *J* = 5.4, 1.2 Hz, 1H), 3.71 (s, 3H), 3.32 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 166.6, 147.5, 138.8, 128.6, 128.2, 128.3, 120.3, 82.3, 56.6, 51.5. [4c]

Synthesis of (*E*)-α-alkenyl-γ-butyrolactone.



Tandem allylic isomerization-Aldol reaction to 9. To a round-bottom flask was added $Mg(OMe)_2$ (5 mL, 1.34 mmol, 67 mol %), TMEDA (150 ul, 1 mmol, 50 mol %), benzaldehyde (2 mmol) and γ-hydroxy-α, β-alkenoic esters **1o** (2 mmol). After stirring at room temperature overnight, the mixture was quenched by addition of 1N HCl solution, extracted with ethyl acetate, and washed with brine. The combined organic phase was dried over sodium sulfate and concentrated under vacuum. The crude product was purified by flash chromatography on silica gel (PE / EA = 12:1) to give **9** as a white solid, 89 % yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.89 – 7.81 (m, 2H), 7.59 – 7.50 (m, 1H), 7.47 – 7.38 (m, 3H), 7.38 – 7.32 (m, 5H), 7.32 – 7.26 (m, 1H), 5.01 (d, *J* = 7.1 Hz, 1H), 3.69 (s, 3H), 3.49 – 3.40 (m, 1H), 3.40 – 3.23 (m, 2H), 3.11 (dd, *J* = 17.7, 4.5 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 197.6, 174.7, 141.2, 136.3, 133.4, 128.64, 128.58, 128.2, 128.0, 126.3, 74.5, 52.2, 47.9, 37.8. ESI-MS $(M\text{-}OH)^+$: 281. [5a]

Dehydration of Reformatsky-like adduct 9 to 10. To a solution of **9** (107 mg, 0.5 mmol) in CH_2Cl_2 (5 mL) at room temperature (1.1ml, 30 equ.) was added TFA in dropwise. The reaction mixture was stirred overnight and then quenched with $NaHCO_3$ (sat. solution), extracted with ethyl acetate, washed with brine, dried over Na_2SO_4 and concentrated in vacuum. The crude product was purified by flash chromatography on silica gel (PE / EA = 30:1) to give **10** as pale yellow oil, 98 % yield based on the recovered starting material (32%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.09 – 7.94 (m, 3H), 7.64 – 7.54 (m, 1H), 7.54 – 7.43 (m, 2H), 7.36 – 7.27 (m, 5H), 4.21 (s, 2H), 3.79 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 197.3, 167.9, 142.3, 136.6, 135.2, 133.3, 128.7, 128.64, 128.60, 128.3, 127.0, 52.2, 38.1, 29.7. EI-MS (*m*/*z*): 280 (M^+), 249 (M^+-31), 105 (M^+-175), 77 (M^+-203). [5b]

Synthesis of (*E*)- α-benzylidene-γ-phenyl butyrolactone 12. [6] After dissolving **10** (64 mg, 0.3mmol) in 5 ml of MeOH, $NaBH_4$ (34.2 mg, 3 equiv) was added to the stirred solution in small portions at 0℃. While the reduction completed (monitored by TLC, 0.5 h), 1 ml 1N HCl was then added to quench the reaction. The mixture was stirred for another half hour, extracted with EtOAc (5 ml × 3) and washed with brine, then dried over Na_2SO_4 and concentrated in vacuum. The crude product was purified by flash chromatography on silica gel (PE / EA = 30:1) to give afford **7** as a white solid, 70% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.64 (t, *J* = 2.9 Hz,

1H), 7.52 – 7.46 (m, 2H), 7.46 – 7.38 (m, 4H), 7.38 – 7.35 (m, 3H), 7.35 – 7.33 (m, 1H), 5.61 (dd, *J* = 8.3, 6.0 Hz, 1H), 3.70 (ddd, *J* = 17.5, 8.3, 2.7 Hz, 1H), 3.16 (ddd, *J* = 17.5, 5.9, 3.0 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 171.9, 140.2, 136.9, 134.5, 130.0, 129.9 128.9, 128.8, 128.5, 125.3, 124.0, 78.1, 36.5. HRMS (ESI) m/z calcd for $C_{17}H_{14}O_2$ $[M + H]^+$: 251.1067, found m/z 251.1071. [5c]

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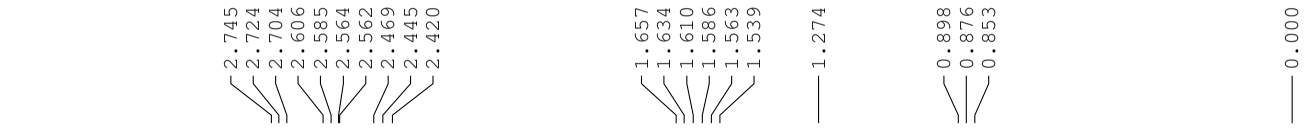
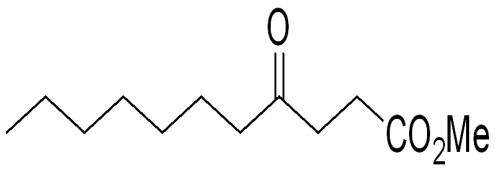
[6] Un-optimized conditions.





2a

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PROCNO                  1
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PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                       8
DS                       2
SWH             6188.119 Hz
FIDRES          0.094423 Hz
AQ              5.2953587 sec
RG                      57
DW                80.800 usec
DE                 6.50 usec
TE                294.1 K
D1           1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
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PL1                 0.00 dB
PL1W        11.55467796 W
SFO1        300.1318534 MHz
SI                  32768
SF          300.1299983 MHz
WDW                    EM
SSB                     0
LB                 0.30 Hz
GB                      0
PC                 1.00
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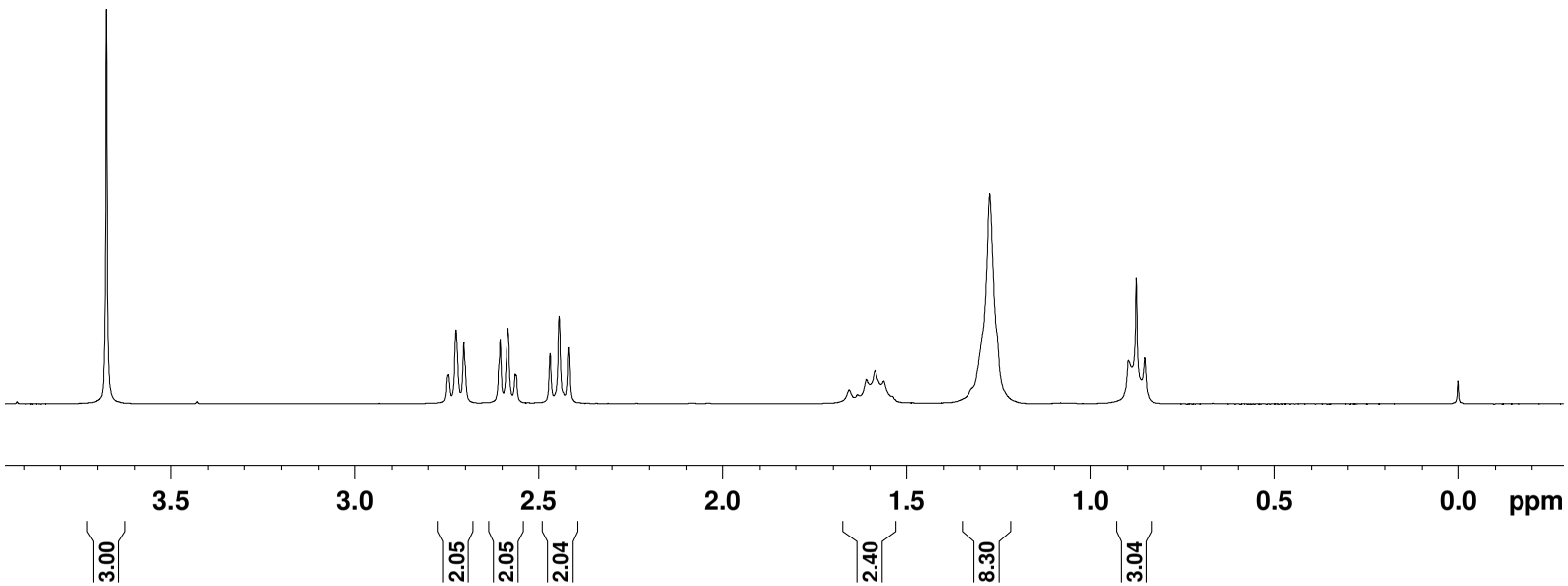

zheng xin quan

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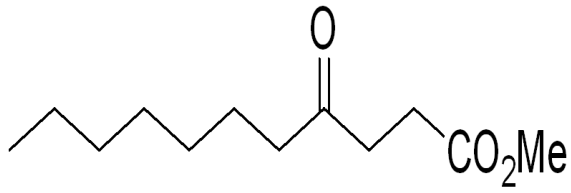
14.02



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PULPROG	zgpg30
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SOLVENT	CDCl3
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DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	294.7 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
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NUC2	1H
PCPD2	80.00 usec
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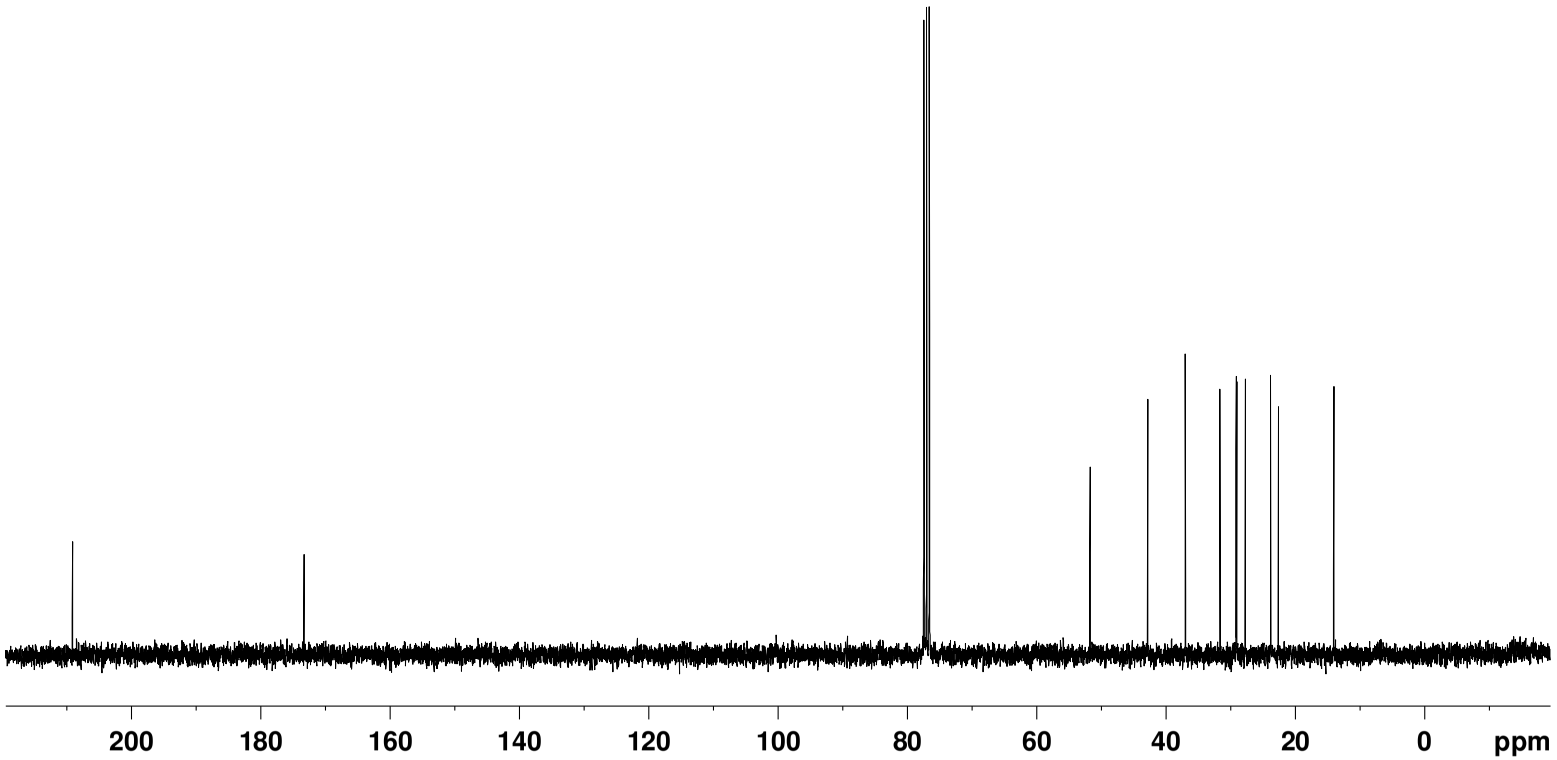
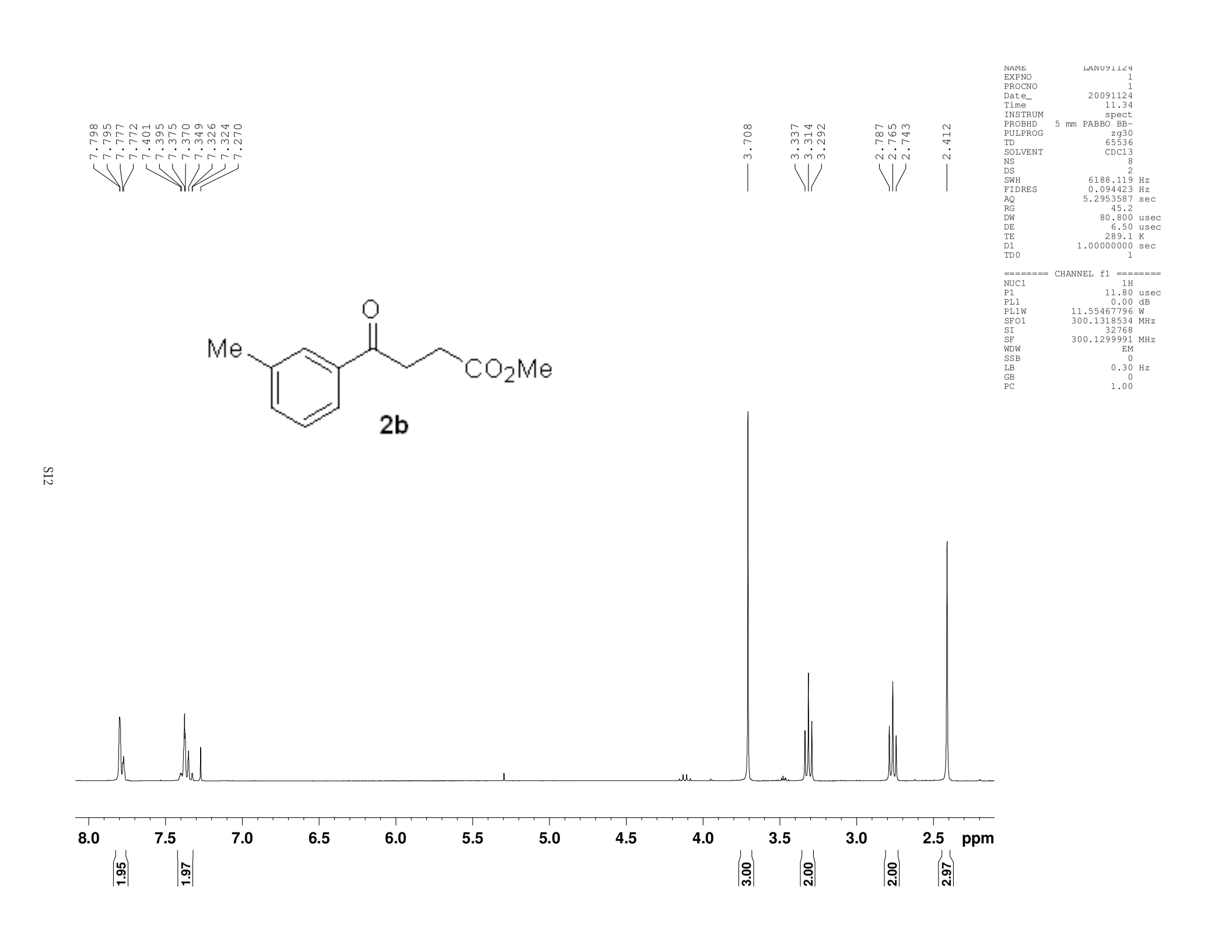
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677490 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

SII

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PROCNO 1
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Time 11.34
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PULPROG zg30
TD 65536
SOLVENT CDCl3
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FIDRES 0.094423 Hz
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RG 45.2
DW 80.800 usec
DE 6.50 usec
TE 289.1 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
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PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1299991 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
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CO2Me
2b
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6.5
6.0
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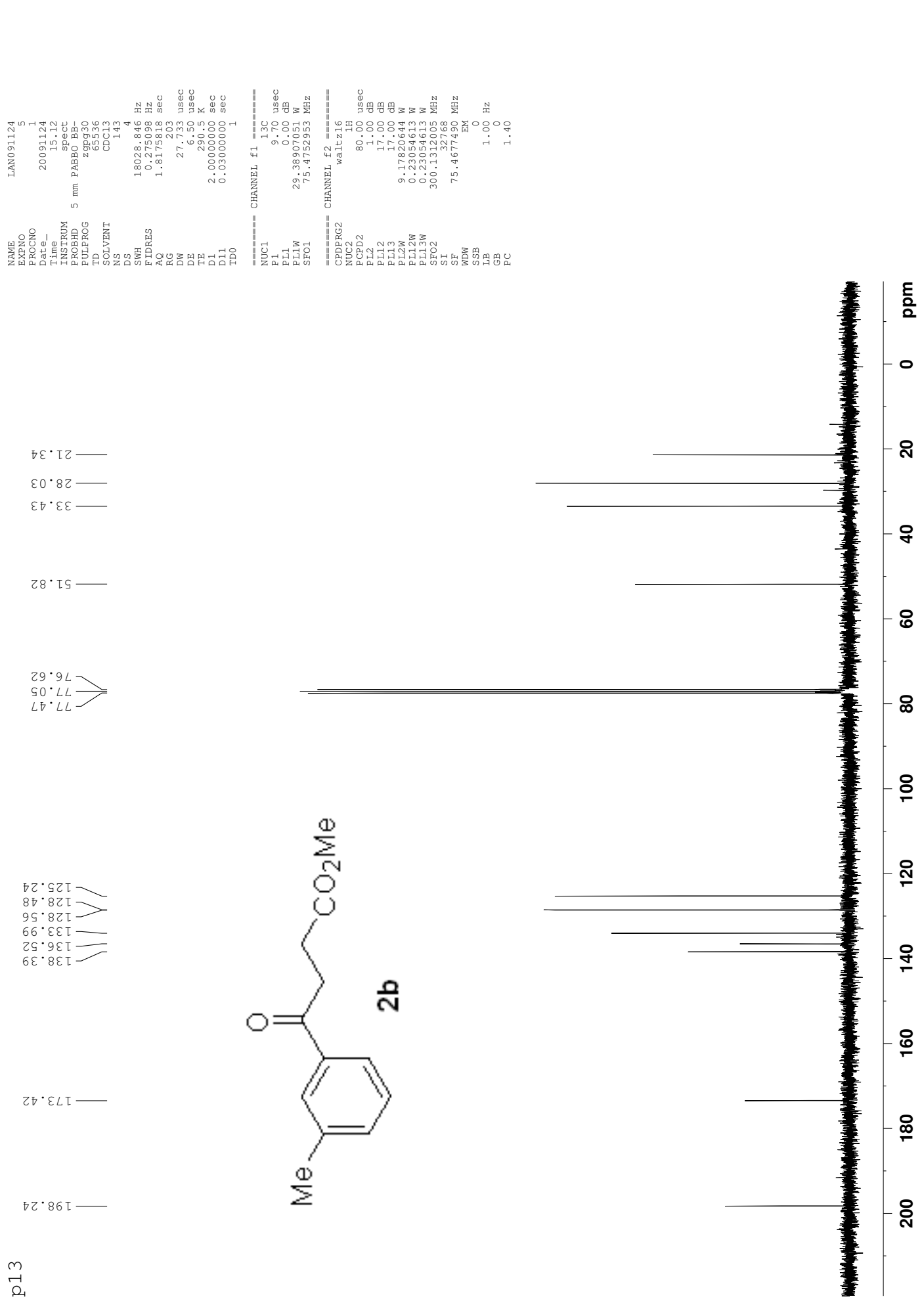
2.97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PROCNO 1
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Time 15.12
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PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 143
DS 4
SWH 18028.846 Hz
FIDRES 0.275098 Hz
AQ 1.8175818 sec
RG 203
DW 27.733 usec
DE 6.50 usec
TE 290.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 9.70 usec
PL1 0.00 dB
PL1W 29.38907051 W
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 1.00 dB
PL12 17.00 dB
PL13 17.00 dB
PL2W 9.17820644 W
PL12W 0.23054613 W
PL13W 0.23054613 W
SFO2 300.1312005 MHz
SI 32768
SF 75.4677490 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
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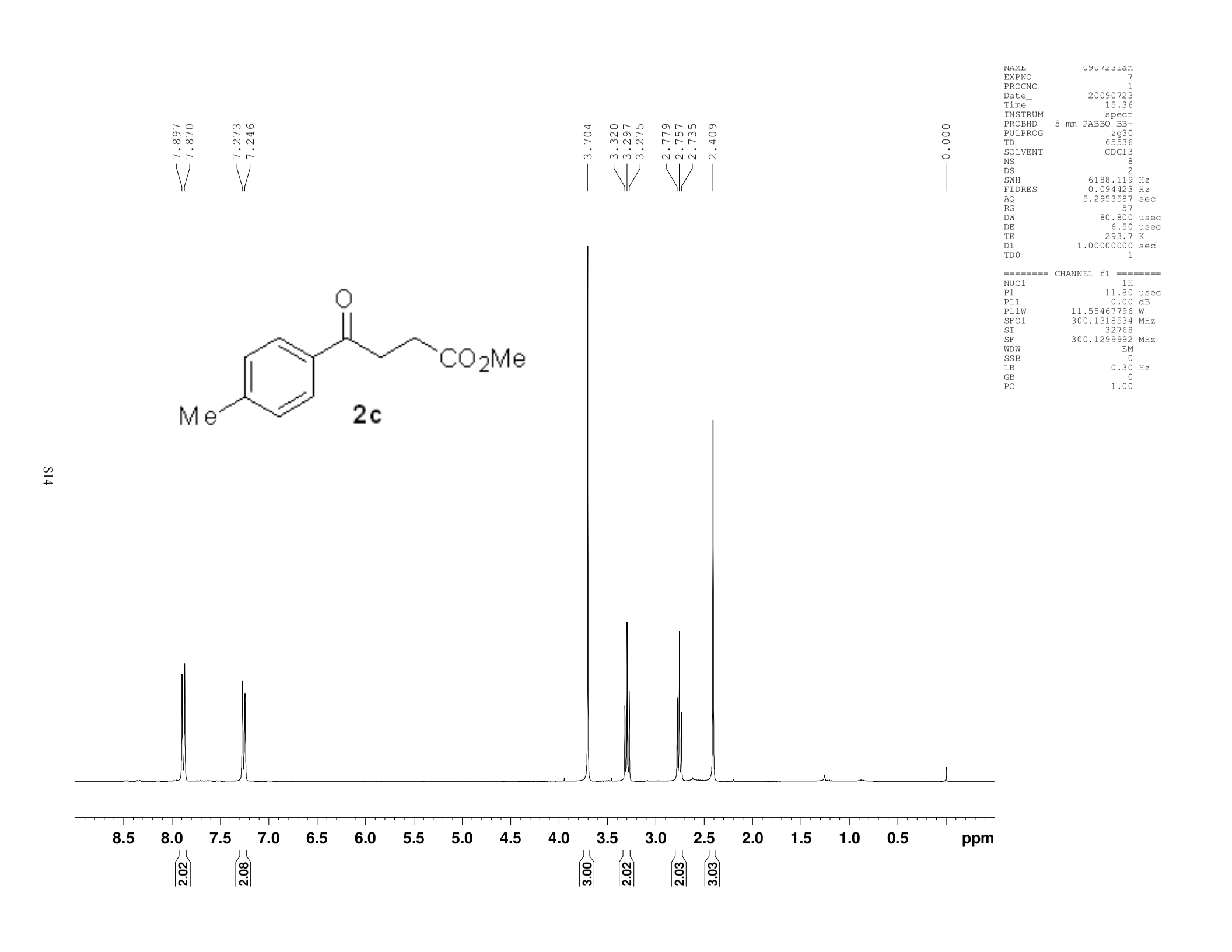

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EXPNO 7
PROCNO 1
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PULPROG zg30
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SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 57
DW 80.800 usec
DE 6.50 usec
TE 293.7 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
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SI 32768
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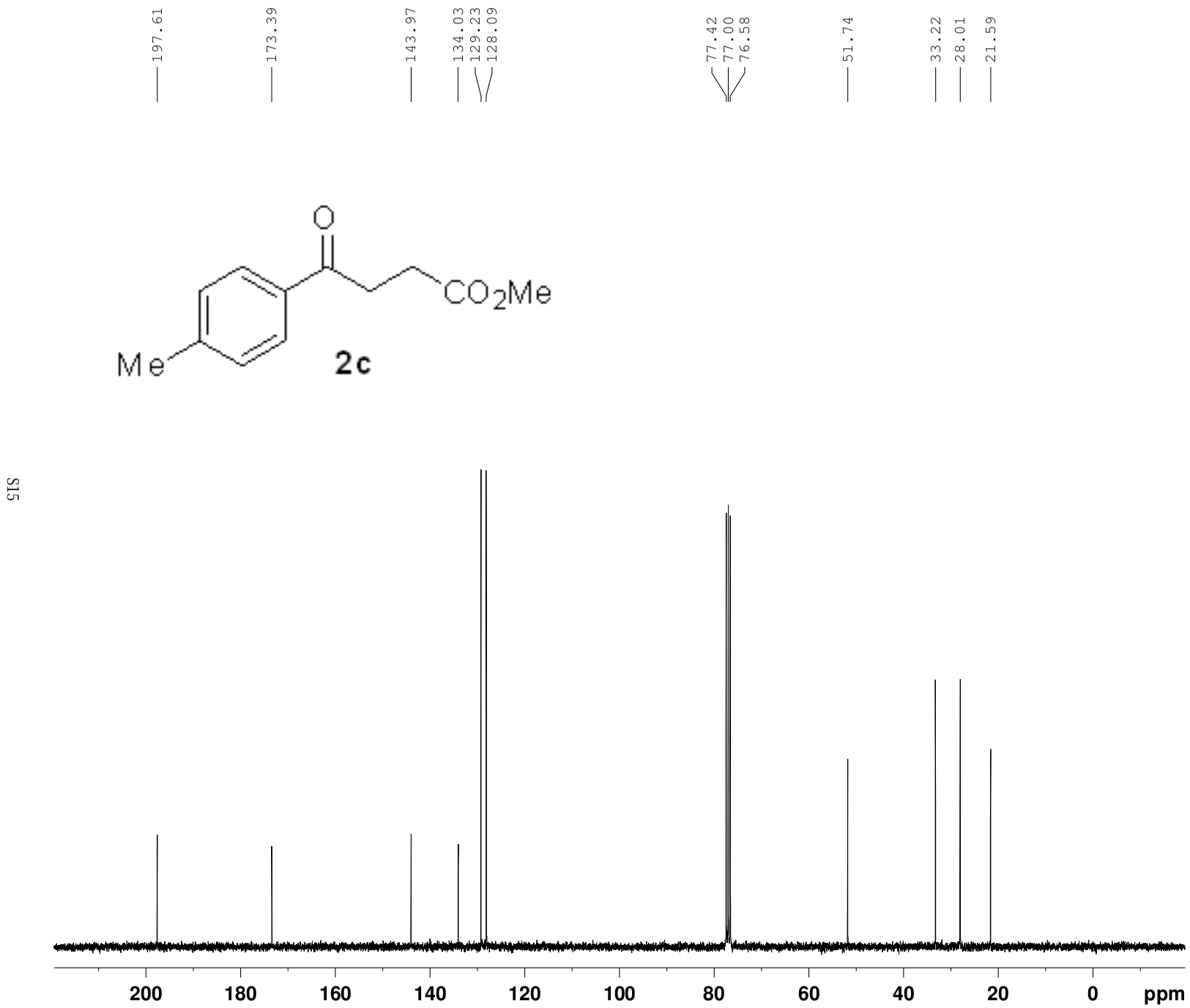

NAME	090723lan
EXPNO	8
PROCNO	1
Date_	20090723
Time	16.03
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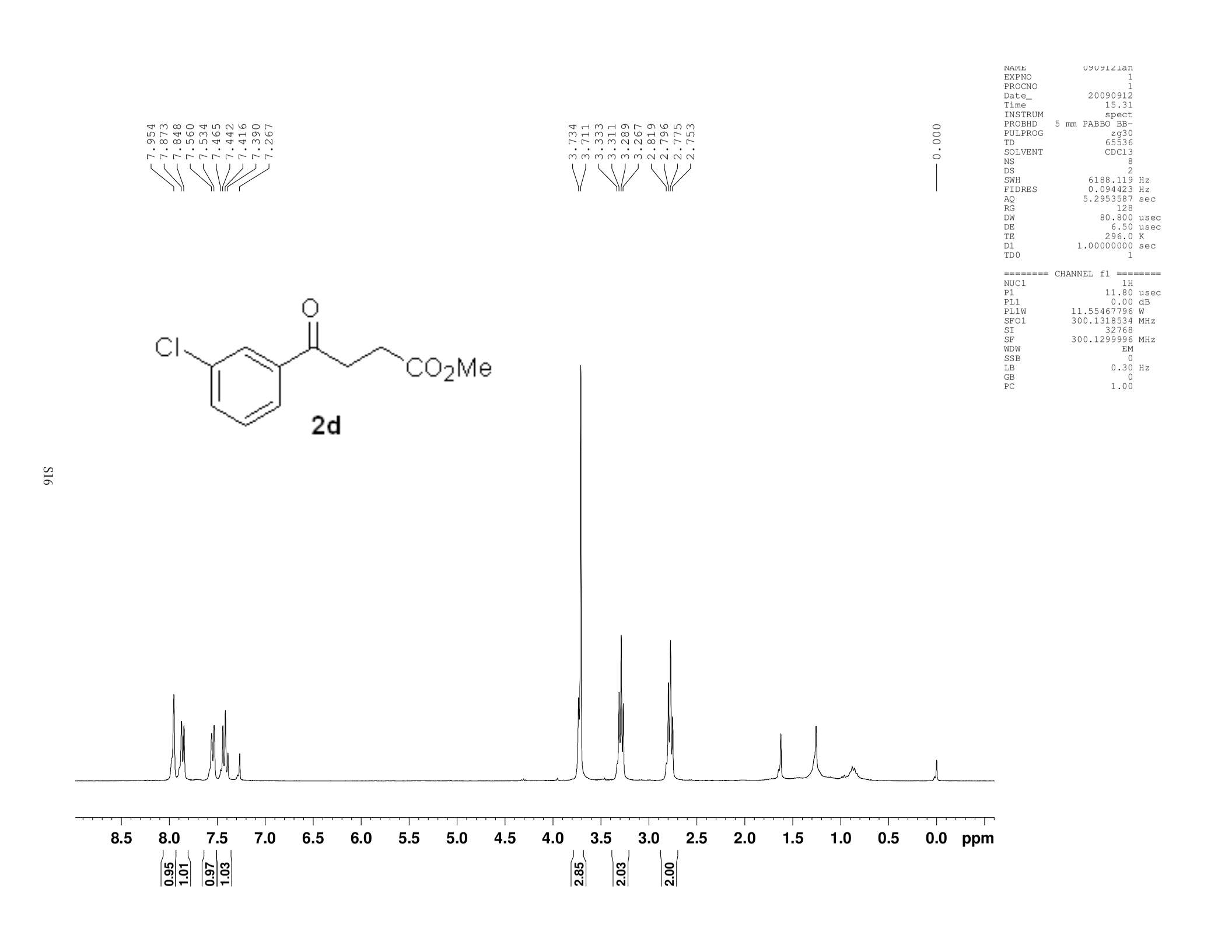
TD	65536
SOLVENT	CDCl3
NS	390
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	294.6 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677514 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40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EXPNO 1
PROCNO 1
Date_ 20090912
Time 15.31
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PULPROG zg30
TD 65536
SOLVENT CDCl3
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FIDRES 0.094423 Hz
AQ 5.2953587 sec
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DE 6.50 usec
TE 296.0 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
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PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1299996 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
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CO2Me
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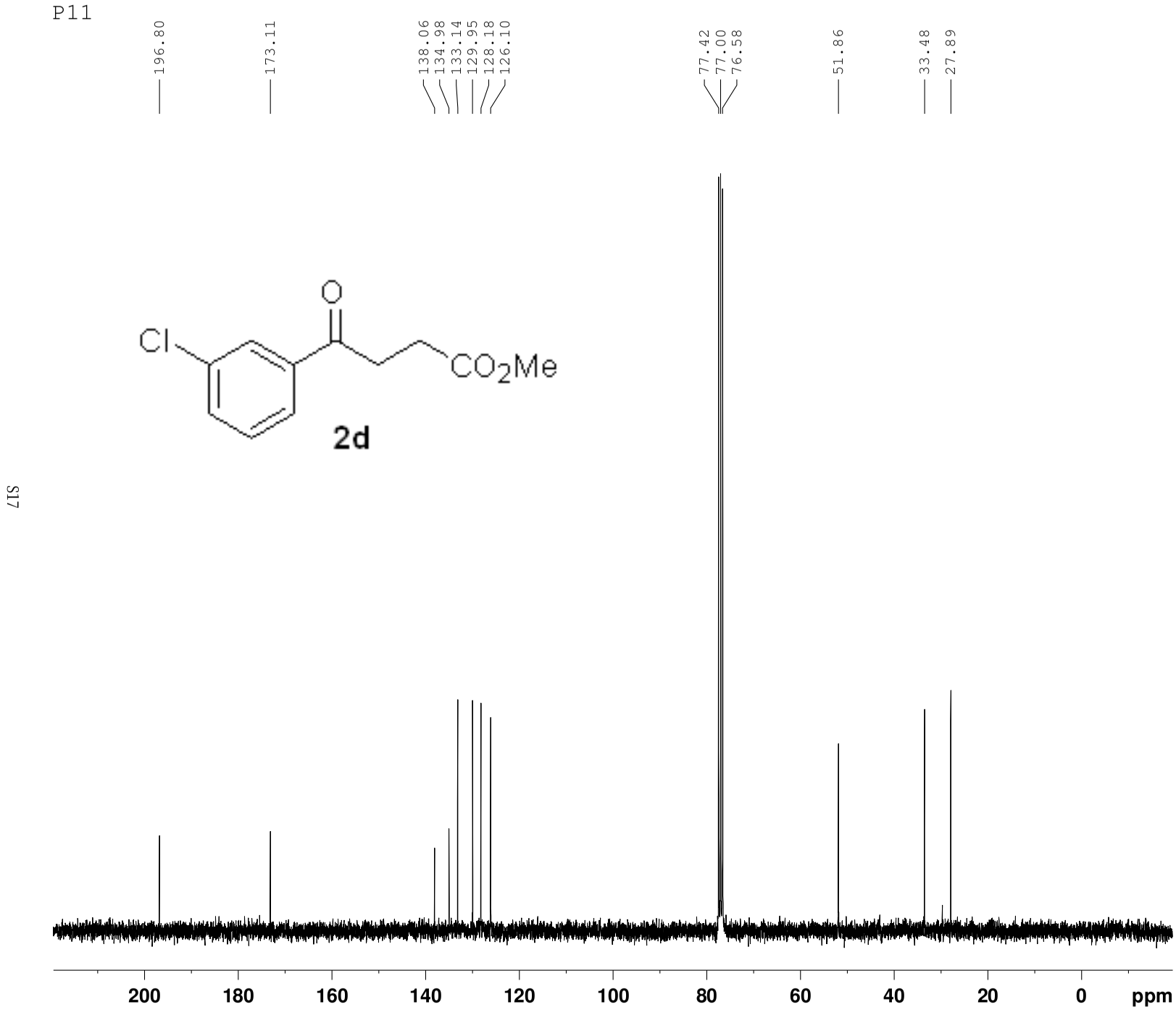
P11



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PROCNO	1
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Time	15.37
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TD	65536
SOLVENT	CDCl3
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SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	296.8 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677490 MHz
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LB	1.00 Hz
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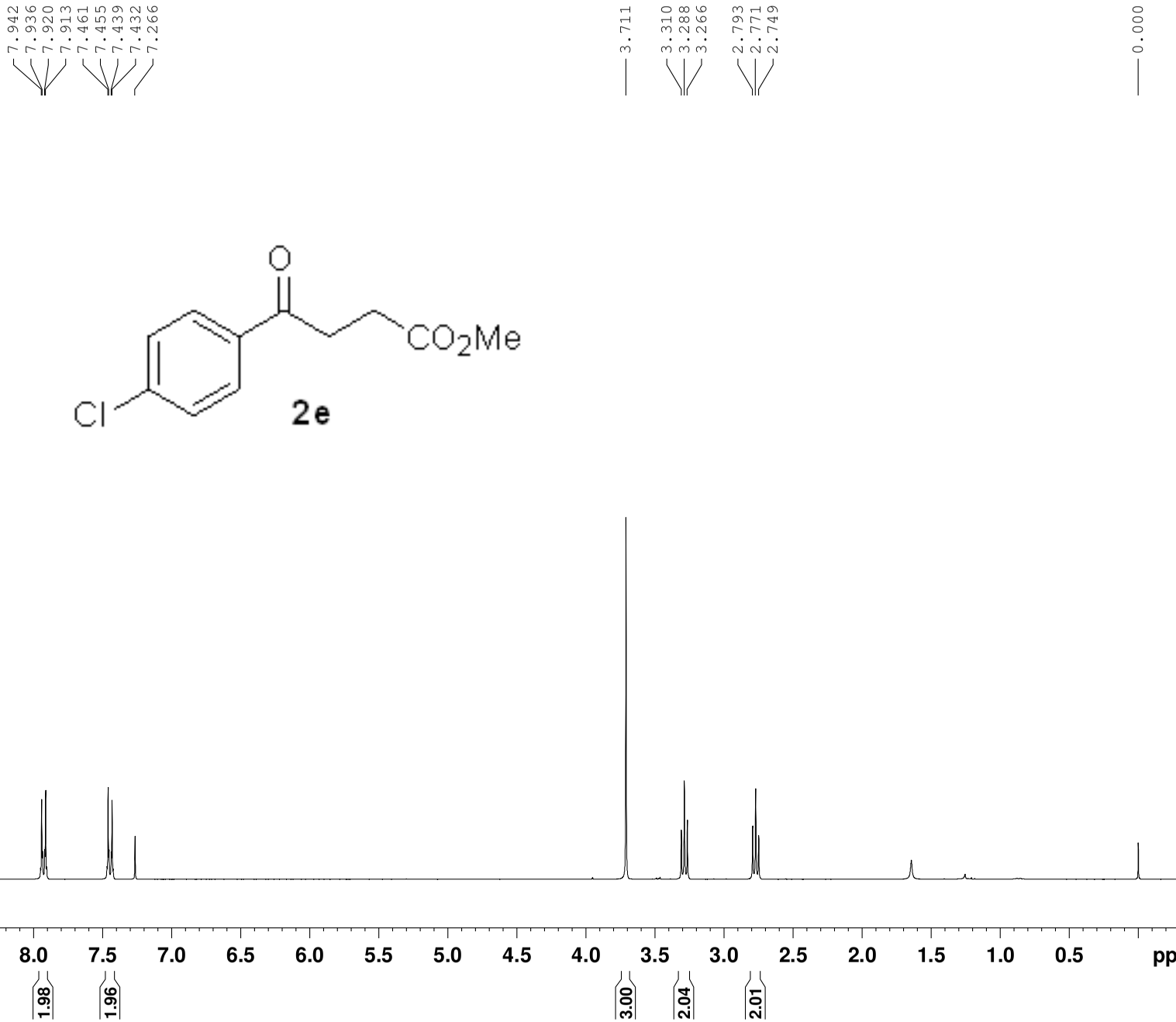
PC	1.40

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Date_            20090723
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PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                       8
DS                       2
SWH             6188.119 Hz
FIDRES          0.094423 Hz
AQ              5.2953587 sec
RG                     203
DW                80.800 usec
DE                 6.50 usec
TE                293.5 K
D1           1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  11.80 usec
PL1                  0.00 dB
PL1W          11.55467796 W
SFO1          300.1318534 MHz
SI                   32768
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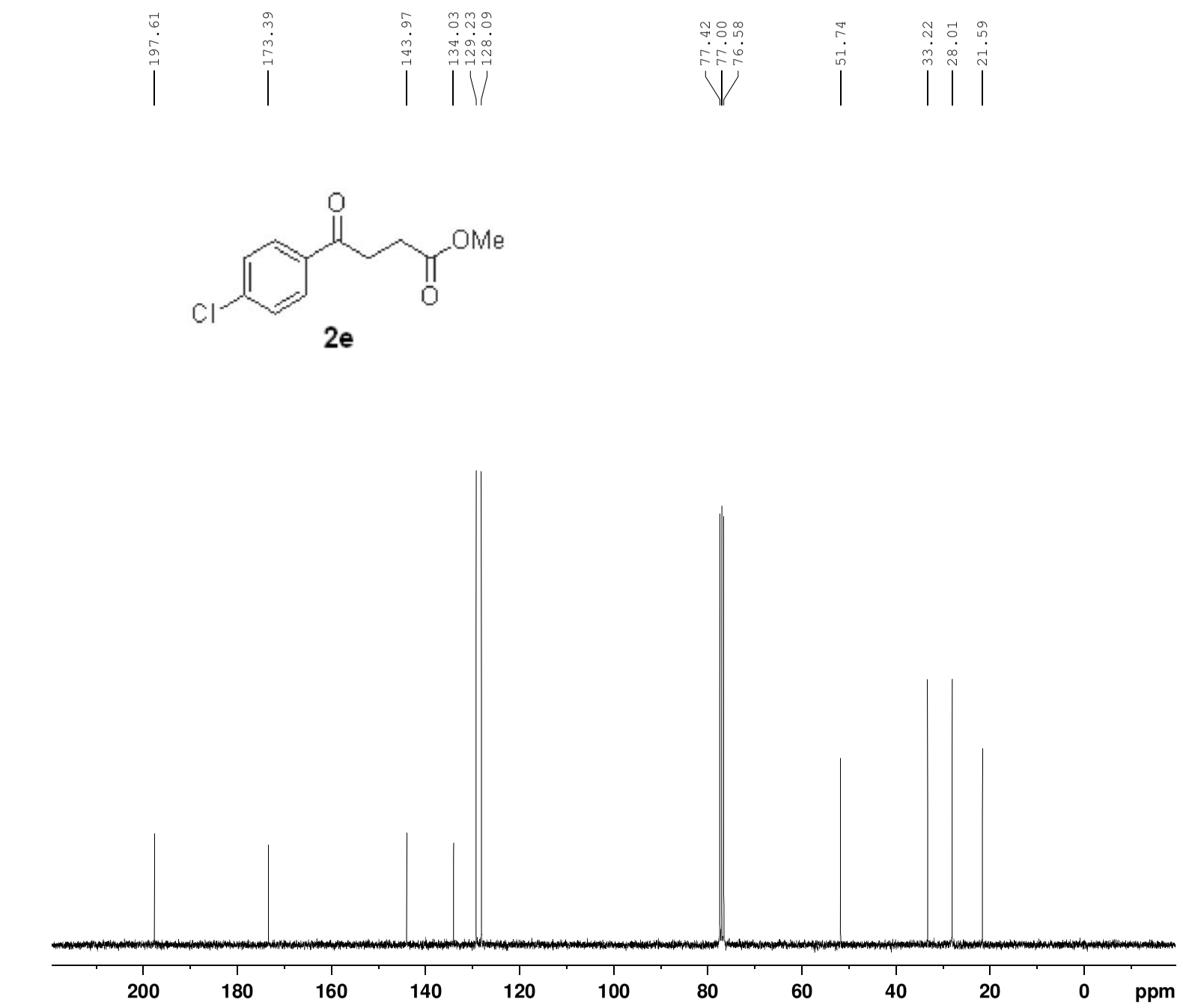


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PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     390
DS                       4
SWH              18028.846 Hz
FIDRES           0.275098 Hz
AQ               1.8175818 sec
RG                     203
DW                27.733 usec
DE                 6.50 usec
TE                294.6 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                  9.70 usec
PL1                 0.00 dB
PL1W         29.38907051 W
SFO1          75.4752953 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                  1H
PCPD2              80.00 usec
PL2                 1.00 dB
PL12               17.00 dB
PL13               17.00 dB
PL2W          9.17820644 W
PL12W         0.23054613 W
PL13W         0.23054613 W
SFO2         300.1312005 MHz
SI                  32768
SF            75.4677514 MHz
WDW                    EM
SSB                     0
LB                  1.00 Hz
GB                      0
PC                  1.40
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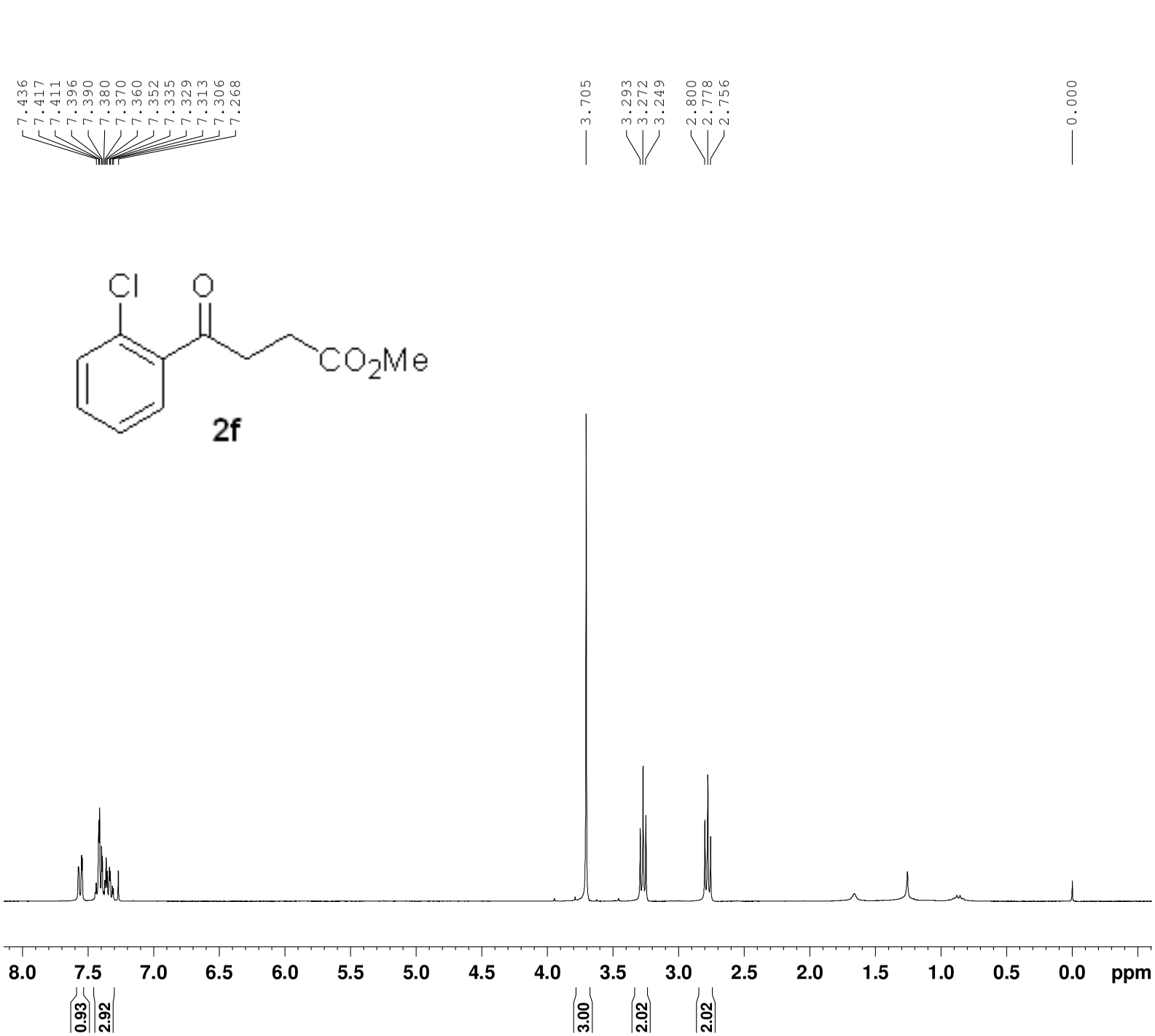
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2f
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EXPNO 3
PROCNO 1
Date_ 20090723
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INSTRUM spect
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PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 80.6
DW 80.800 usec
DE 6.50 usec
TE 293.9 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1299996 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 ppm
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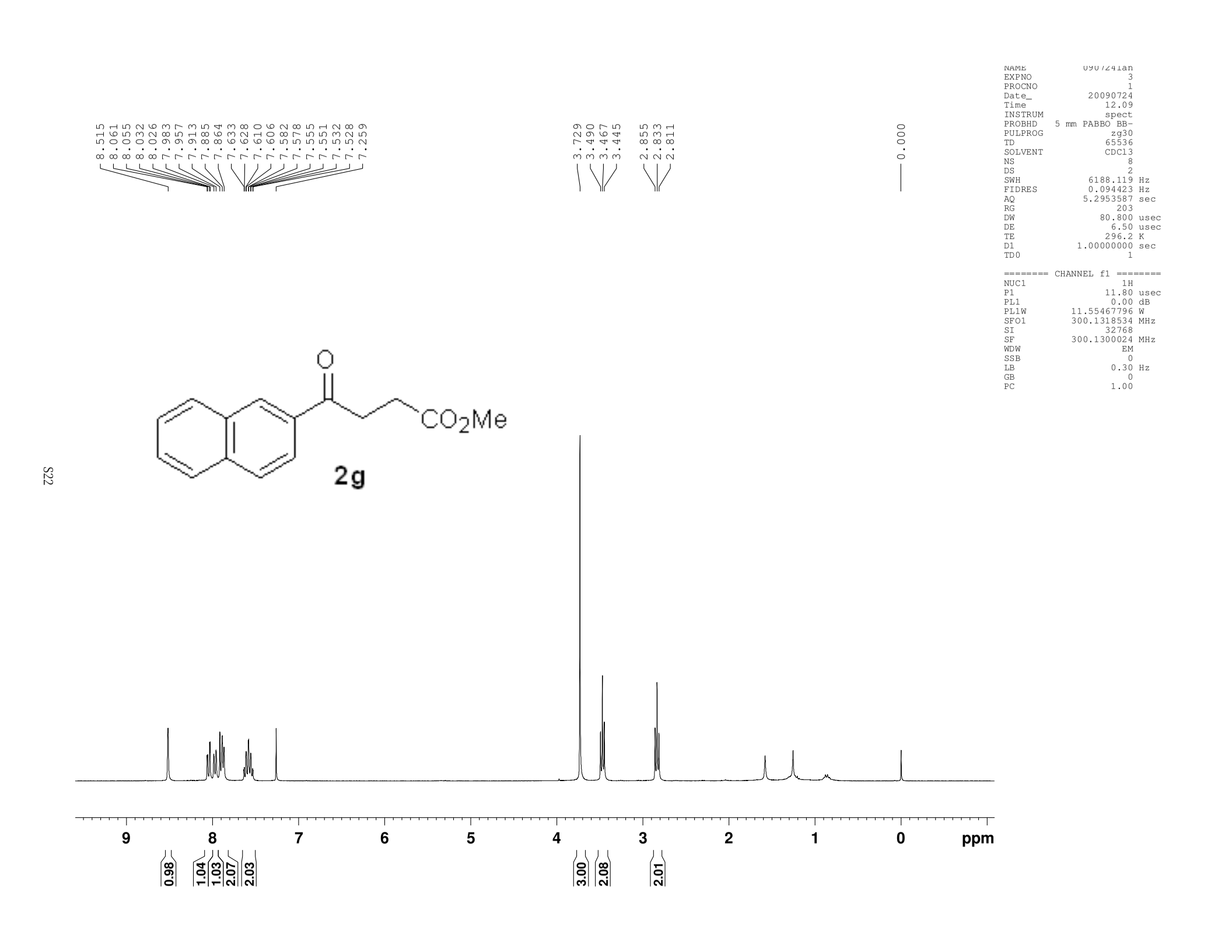
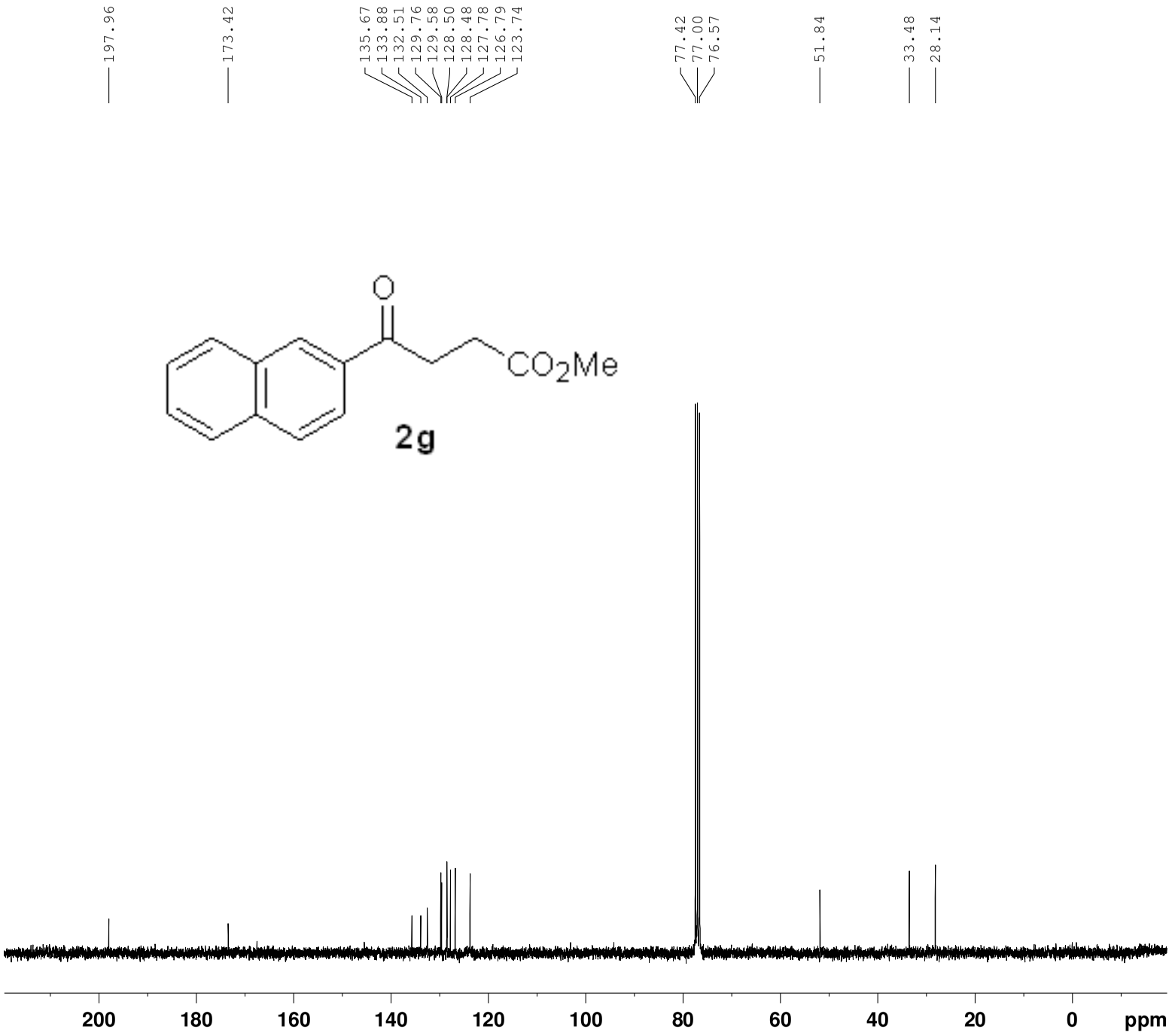
3.00
2.02
2.02


NAME 0907231an
EXPNO 4
PROCNO 1
Date_ 20090723
Time 12.58
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1024
DS 4
SWH 18028.846 Hz
FIDRES 0.275098 Hz
AQ 1.8175818 sec
RG 203
DW 27.733 usec
DE 6.50 usec
TE 294.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 9.70 usec
PL1 0.00 dB
PL1W 29.38907051 W
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 1.00 dB
PL12 17.00 dB
PL13 17.00 dB
PL2W 9.17820644 W
PL12W 0.23054613 W
PL13W 0.23054613 W
SFO2 300.1312005 MHz
SI 32768
SF 75.4677498 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
28.27
37.61
51.84
77.42
77.00
76.58
138.82
131.85
130.94
130.55
129.19
126.93
173.01
201.09
CO2Me
Cl
O
2f
ppm
200
180
160
140
120
100
80
60
40
20
0

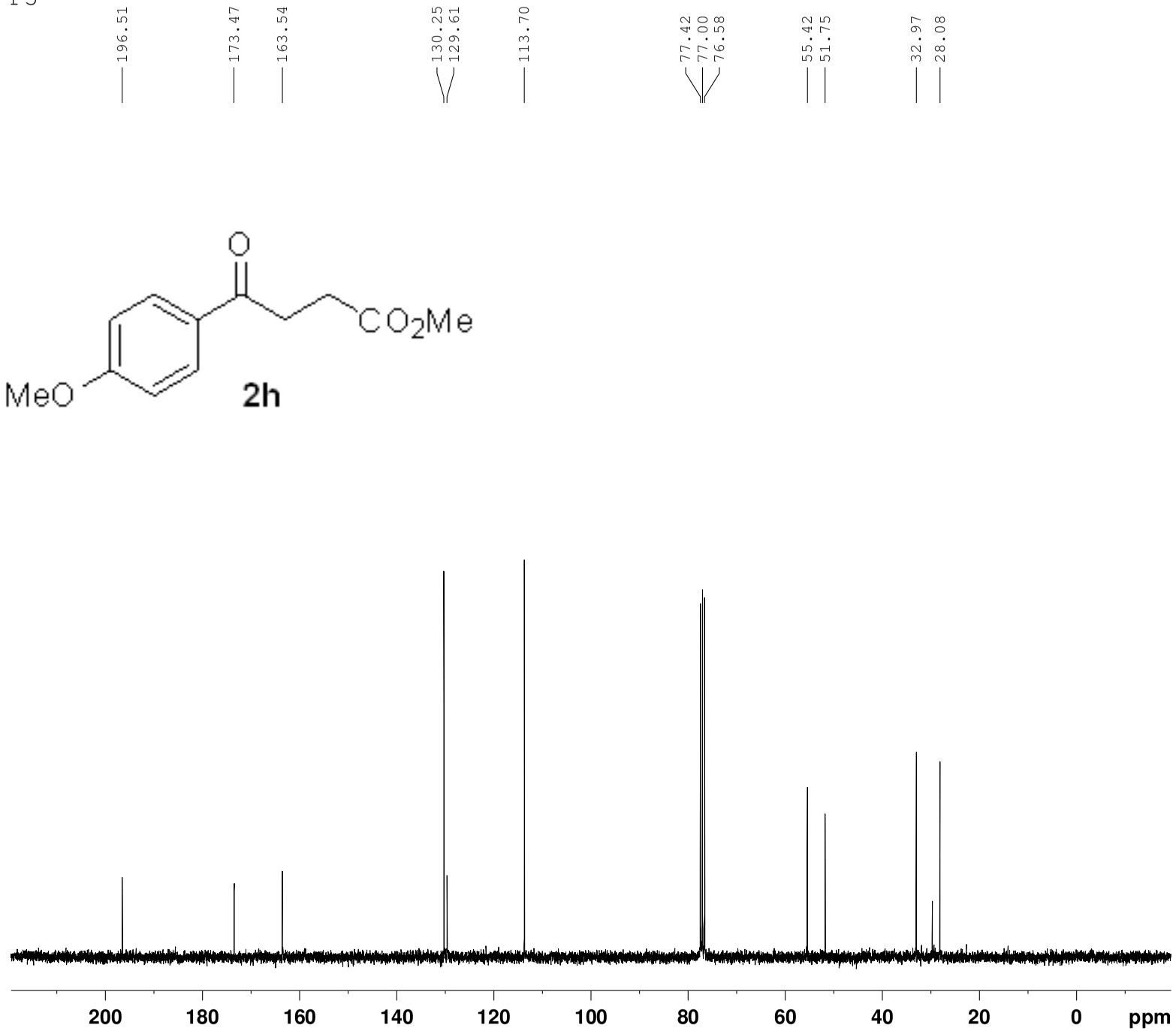

8.515
8.061
8.055
8.032
8.026
7.983
7.957
7.913
7.885
7.864
7.633
7.628
7.610
7.606
7.582
7.578
7.555
7.551
7.532
7.528
7.259
3.729
3.490
3.467
3.445
2.855
2.833
2.811
0.000
NAME 090724lan
EXPNO 3
PROCNO 1
Date_ 20090724
Time 12.09
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 203
DW 80.800 usec
DE 6.50 usec
TE 296.2 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1300024 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
CO2Me
2g
9
8
7
6
5
4
3
2
1
0
ppm
0.98
1.04
1.03
2.07
2.03
3.00
2.08
2.01



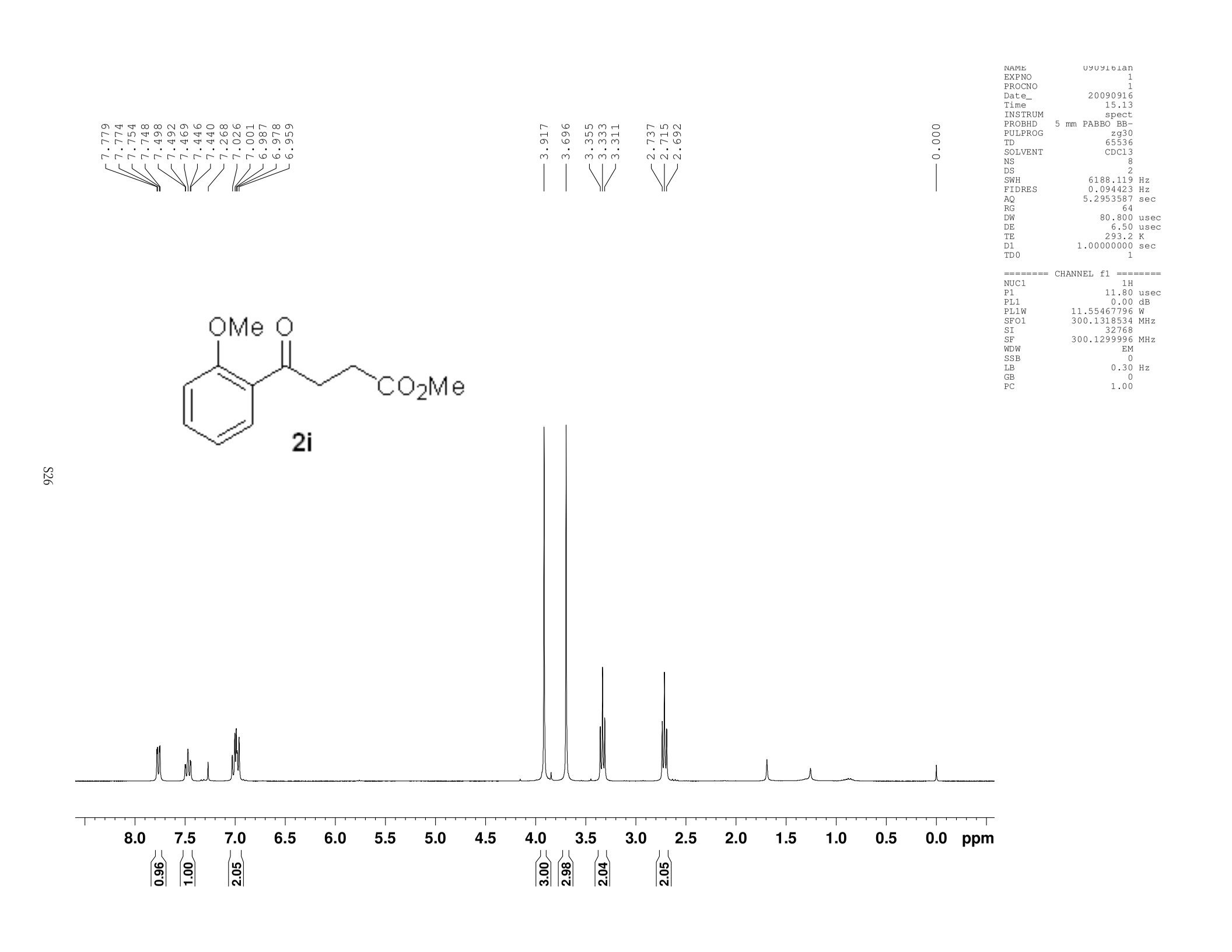
NAME	090724lan
EXPNO	2
PROCNO	1
Date_	20090724
Time	11.28
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	608
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	295.4 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677487 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

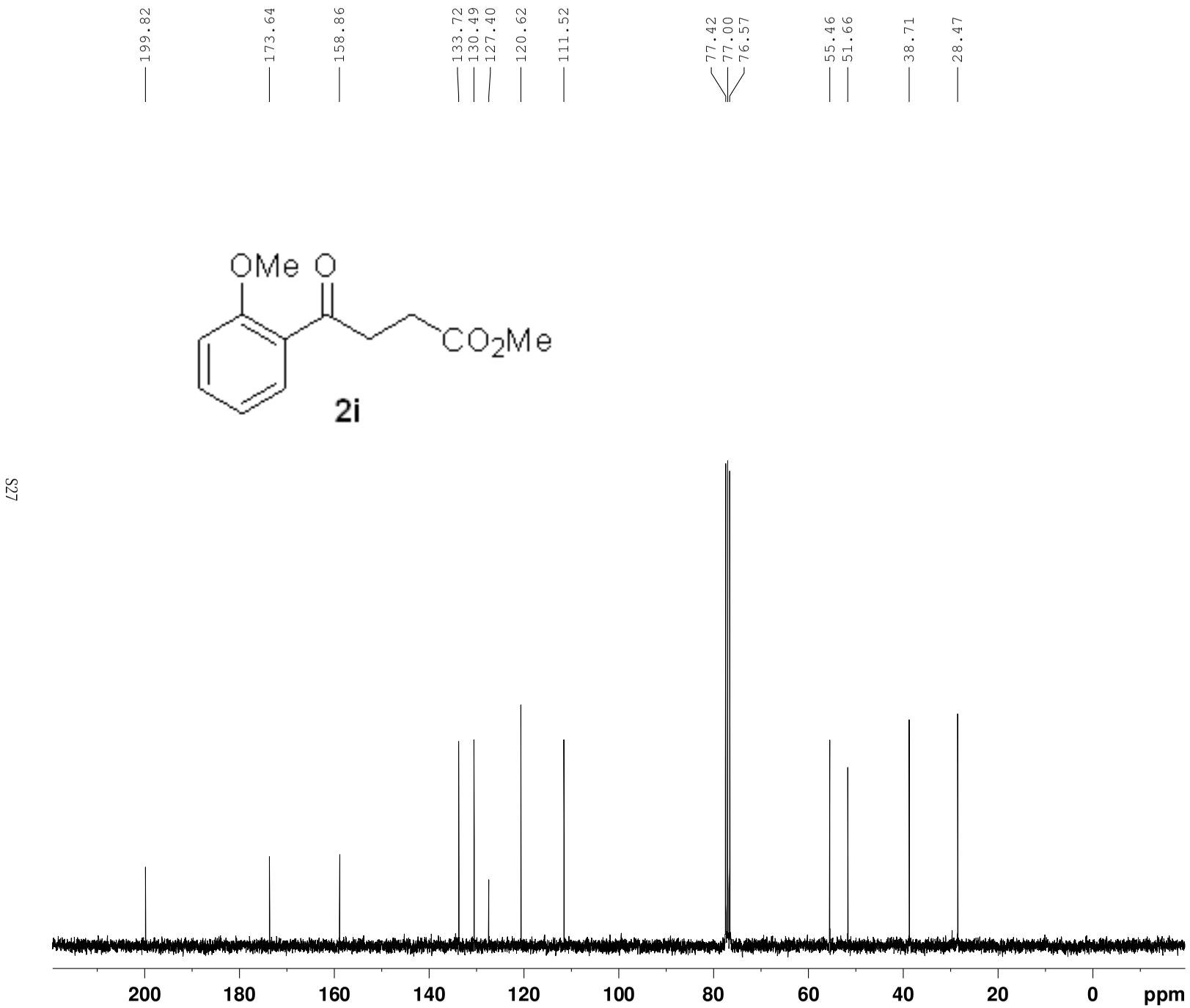
NAME	LAN090725
EXPNO	1
PROCNO	1
Date_	20090725
Time	15.47
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	8
DS	2
SWH	6188.119 Hz
FIDRES	0.094423 Hz
AQ	5.2953587 sec
RG	128
DW	80.800 usec
DE	6.50 usec
TE	294.6 K
D1	1.00000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	1H
P1	11.80 usec
PL1	0.00 dB
PL1W	11.55467796 W
SFO1	300.1318534 MHz
SI	32768
SF	300.1300000 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

P5

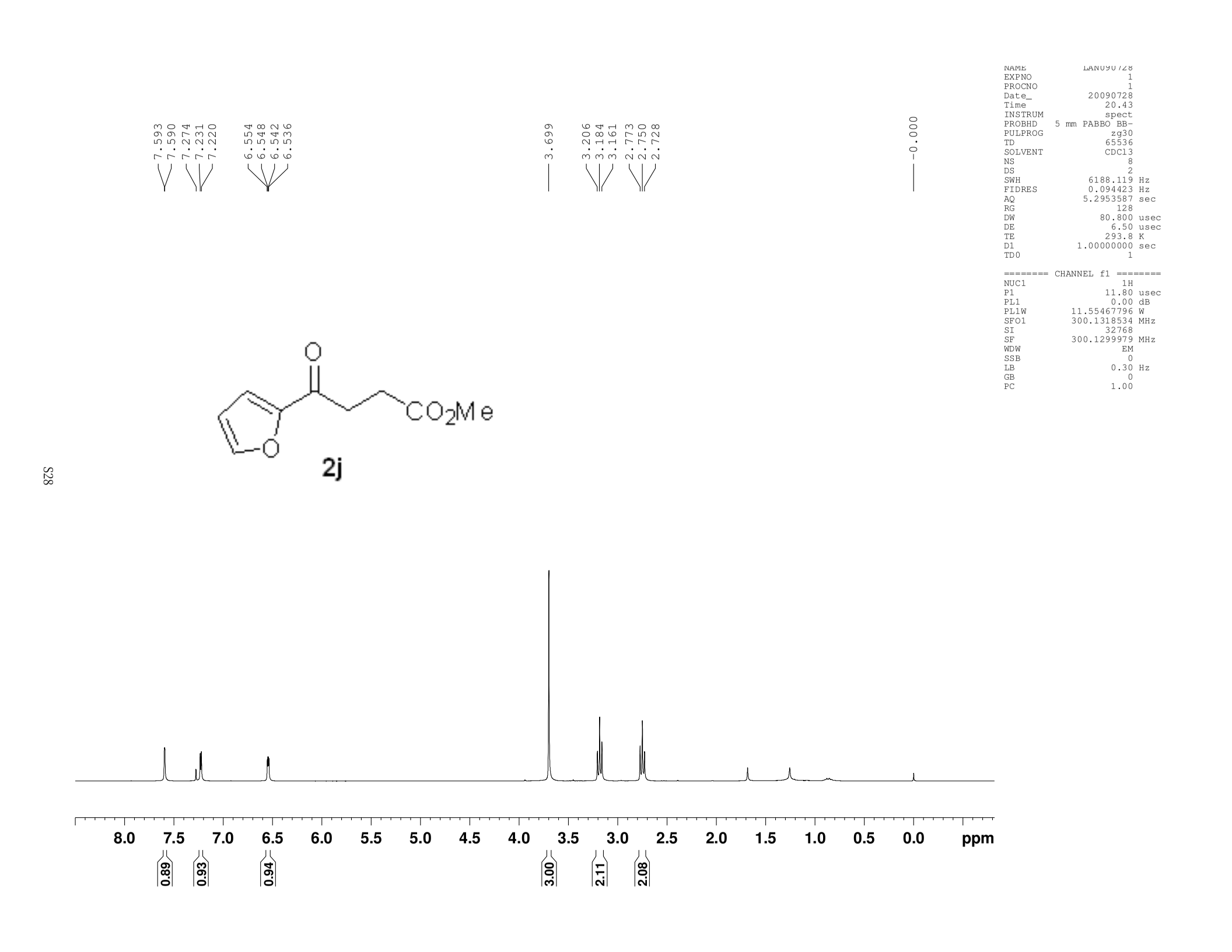


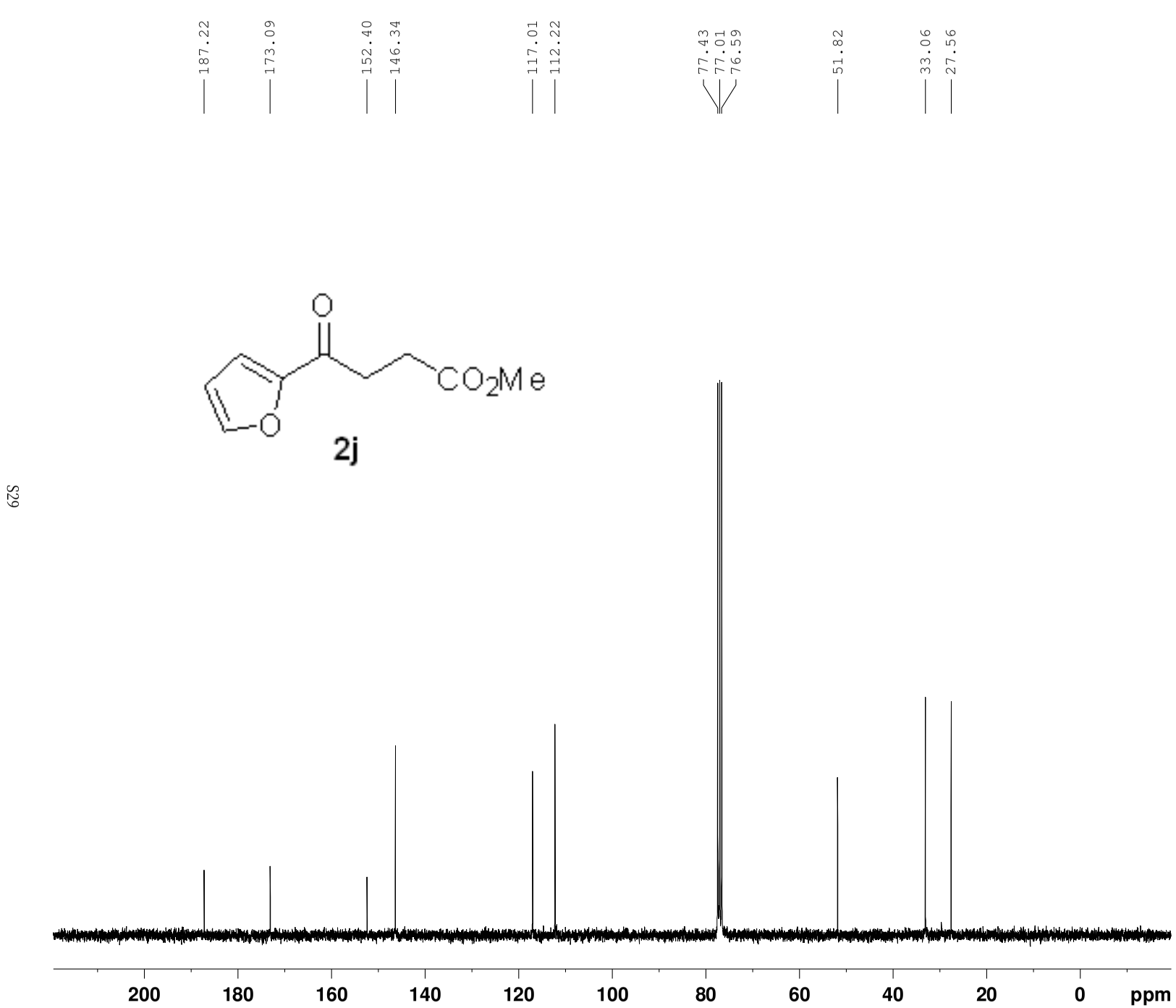
NAME	0907271an
EXPNO	3
PROCNO	1
Date_	20090727
Time	10.47
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	188
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	294.5 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677509 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40


7.779
7.774
7.754
7.748
7.498
7.492
7.469
7.446
7.440
7.268
7.026
7.001
6.987
6.978
6.959
3.917
3.696
3.355
3.333
3.311
2.737
2.715
2.692
0.000
NAME 090916lan
EXPNO 1
PROCNO 1
Date_ 20090916
Time 15.13
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 64
DW 80.800 usec
DE 6.50 usec
TE 293.2 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1299996 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
OMe O
CO2Me
2i
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
0.96
1.00
2.05
3.00
2.98
2.04
2.05

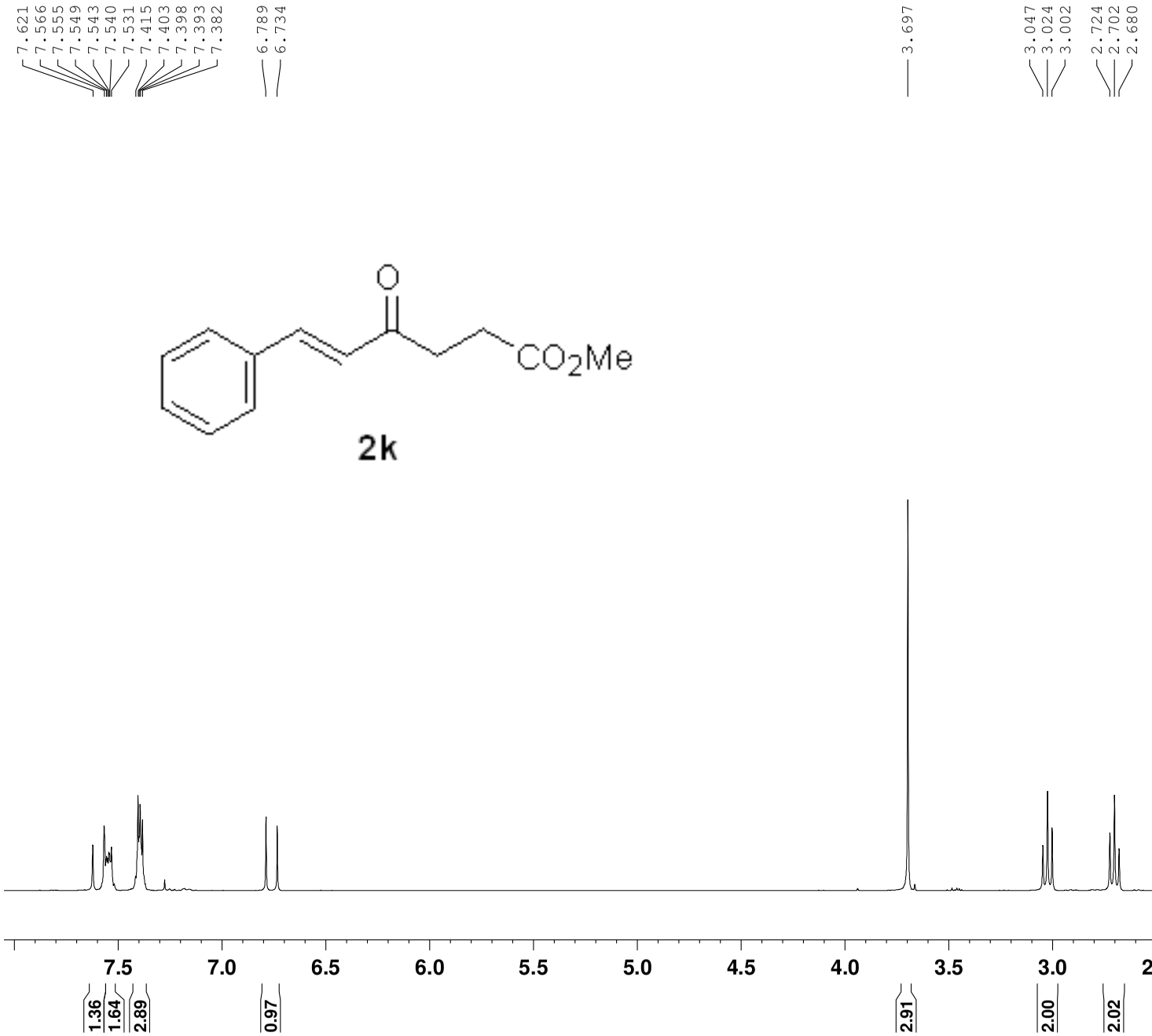


NAME	090916lan
EXPNO	2
PROCNO	1
Date_	20090916
Time	15.16
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	283
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	293.7 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677509 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40


7.593
7.590
7.274
7.231
7.220
6.554
6.548
6.542
6.536
3.699
3.206
3.184
3.161
2.773
2.750
2.728
-0.000
NAME LAN090728
EXPNO 1
PROCNO 1
Date_ 20090728
Time 20.43
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 128
DW 80.800 usec
DE 6.50 usec
TE 293.8 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1299979 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
O
CO2Me
O
2j
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
0.89
0.93
0.94
3.00
2.11
2.08

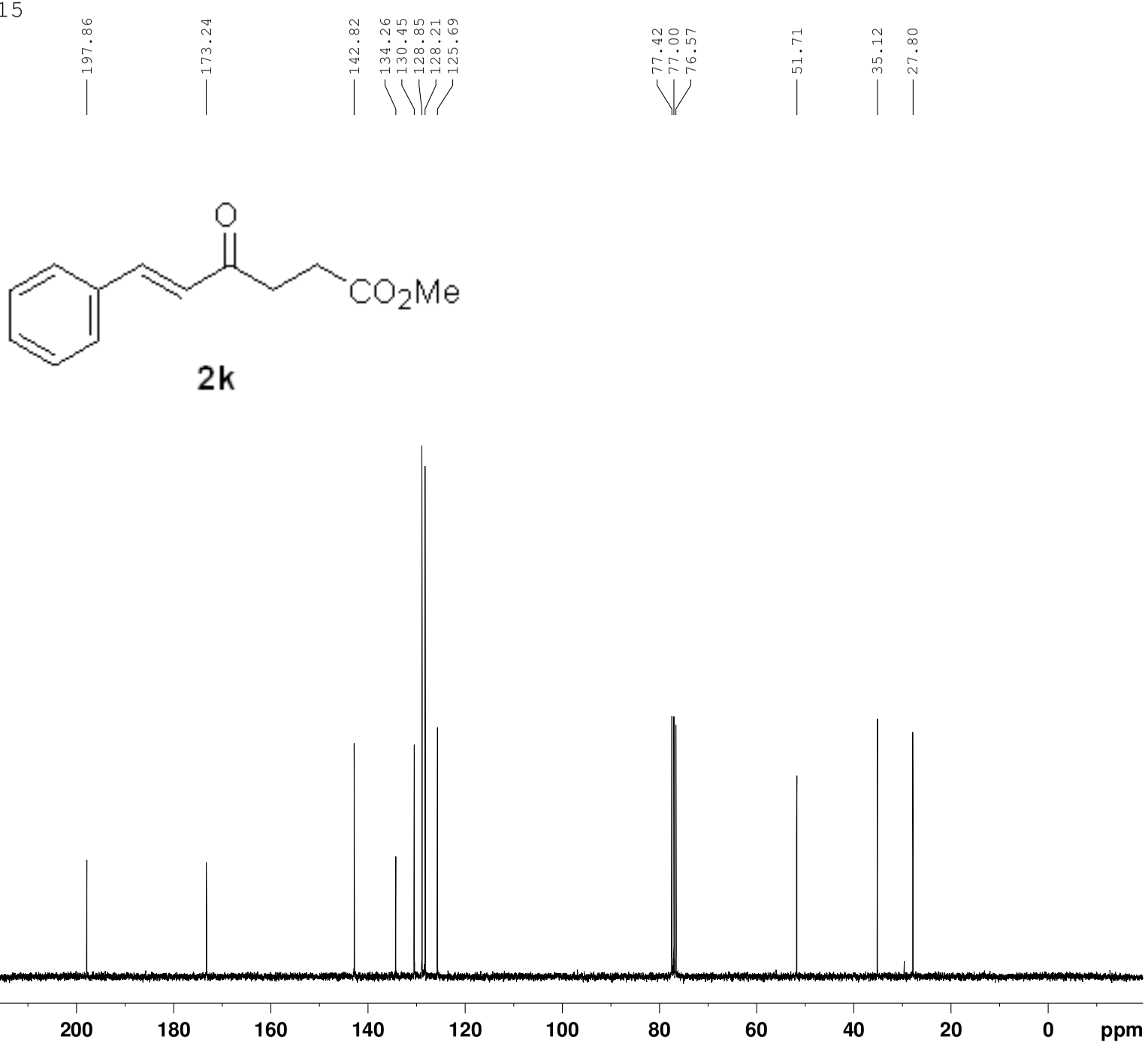


NAME	0907291an
EXPNO	1
PROCNO	1
Date_	20090729
Time	9.00
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	670
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	293.8 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677490 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

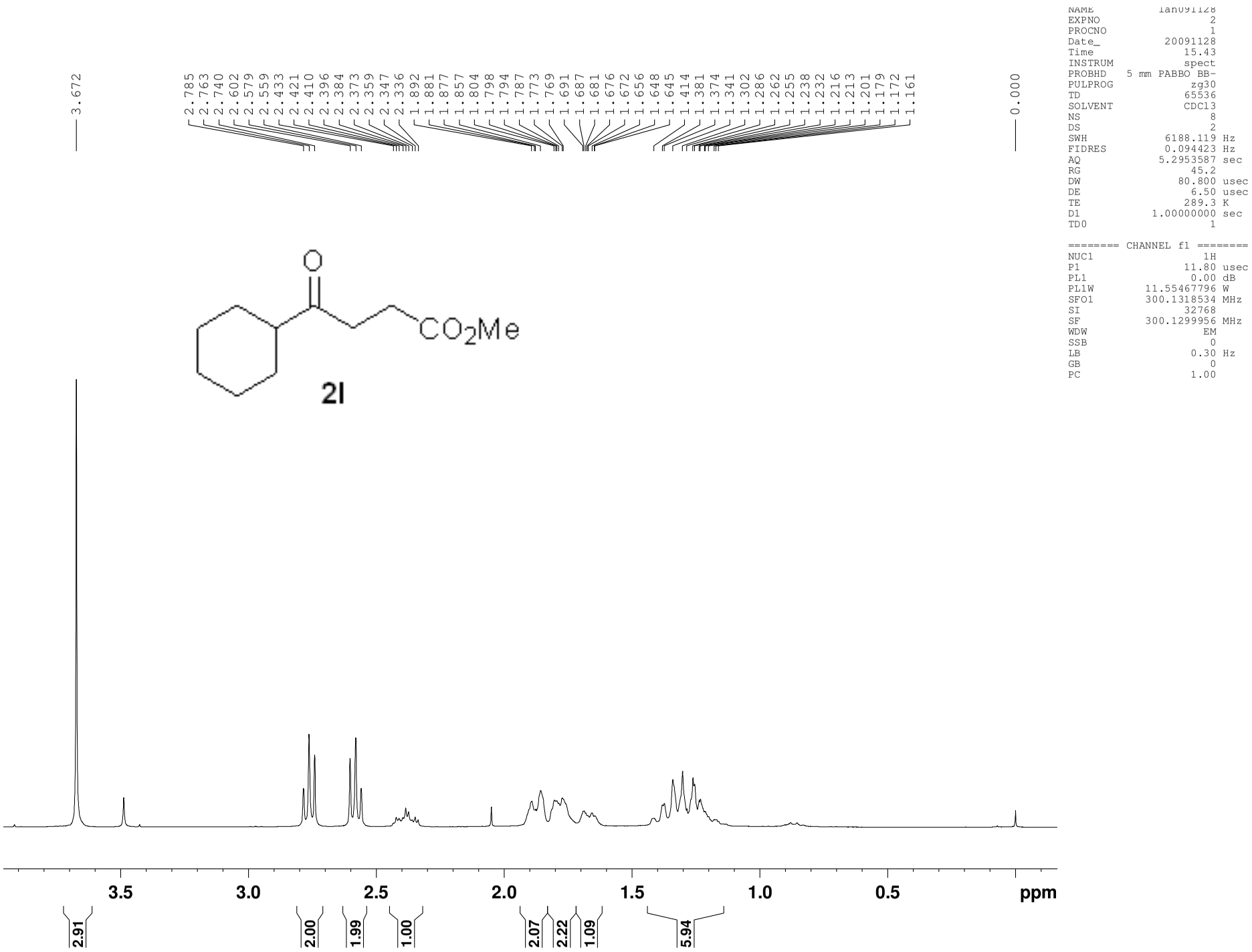


NAME	tan091128
EXPNO	4
PROCNO	1
Date_	20091128
Time	15.56
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	8
DS	2
SWH	6188.119 Hz
FIDRES	0.094423 Hz
AQ	5.2953587 sec
RG	32
DW	80.800 usec
DE	6.50 usec
TE	289.9 K
D1	1.00000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	1H
P1	11.80 usec
PL1	0.00 dB
PL1W	11.55467796 W
SFO1	300.1318534 MHz
SI	32768
SF	300.1299975 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

P15



NAME	lan091128
EXPNO	5
PROCNO	1
Date_	20091128
Time	16.03
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	154
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	290.5 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677564 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

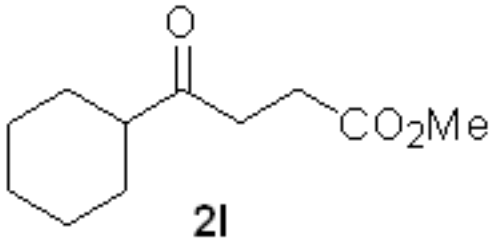



```
NAME          tan091128
EXPNO                 2
PROCNO                1
Date_          20091128
Time              15.43
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             6188.119 Hz
FIDRES          0.094423 Hz
AQ              5.2953587 sec
RG                  45.2
DW                80.800 usec
DE                 6.50 usec
TE                289.3 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                 11.80 usec
PL1                 0.00 dB
PL1W        11.55467796 W
SFO1        300.1318534 MHz
SI                 32768
SF          300.1299956 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
```

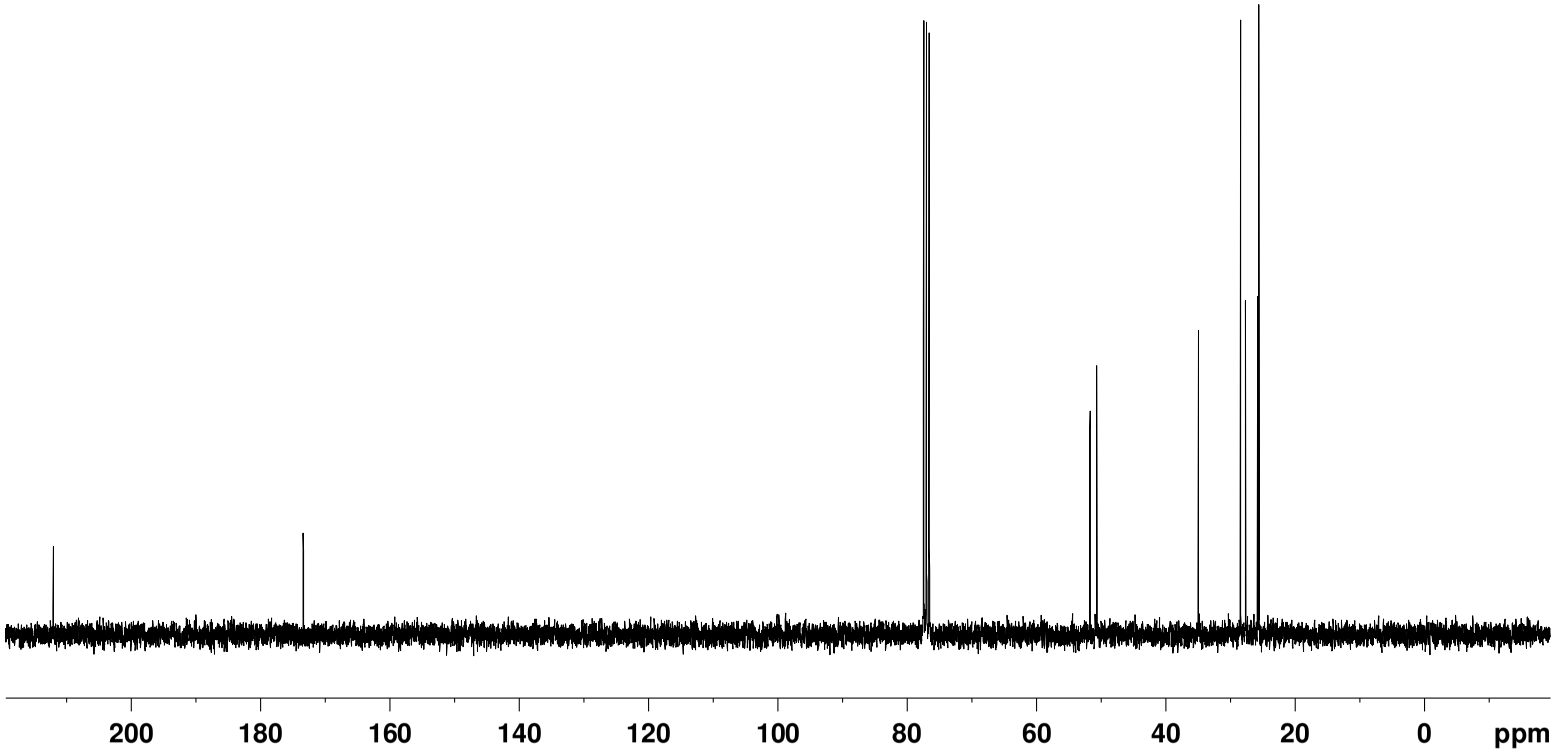
P14

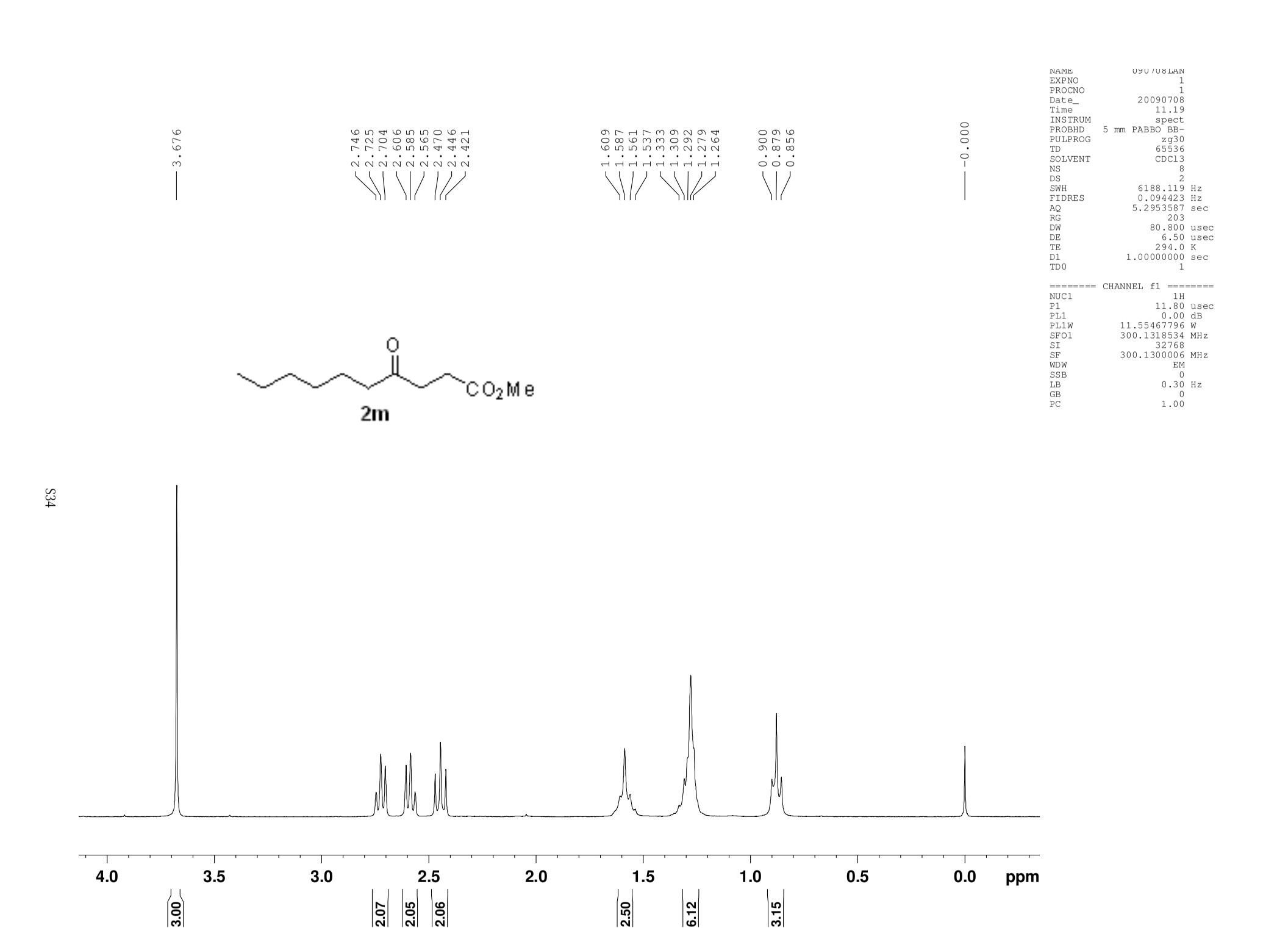
212.03
173.38
77.42
77.00
76.57
51.70
50.65
34.94
28.41
27.64
25.77
25.57



2l

NAME	lan091128
EXPNO	3
PROCNO	1
Date_	20091128
Time	15.49
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	96
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	290.6 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677514 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

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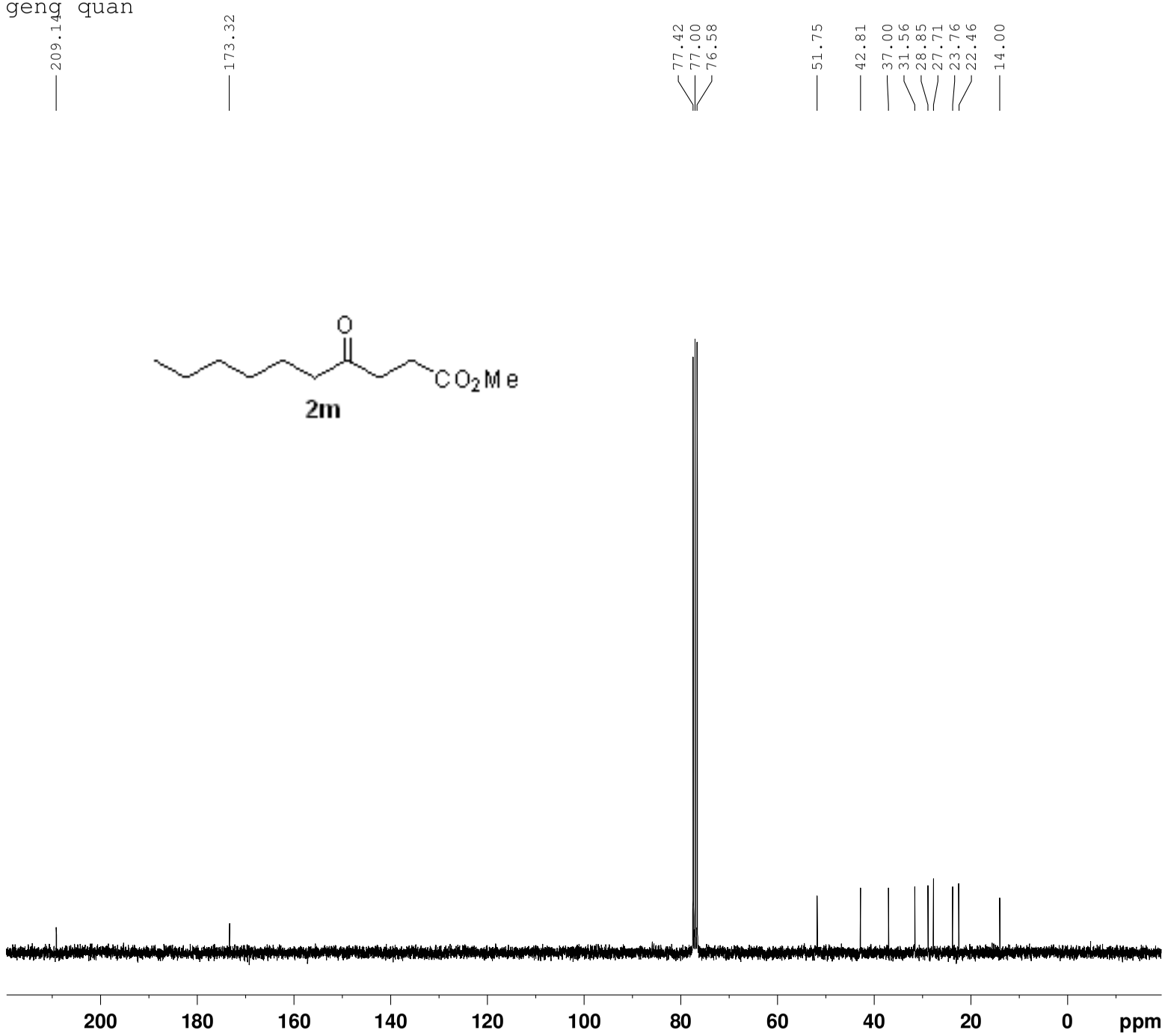
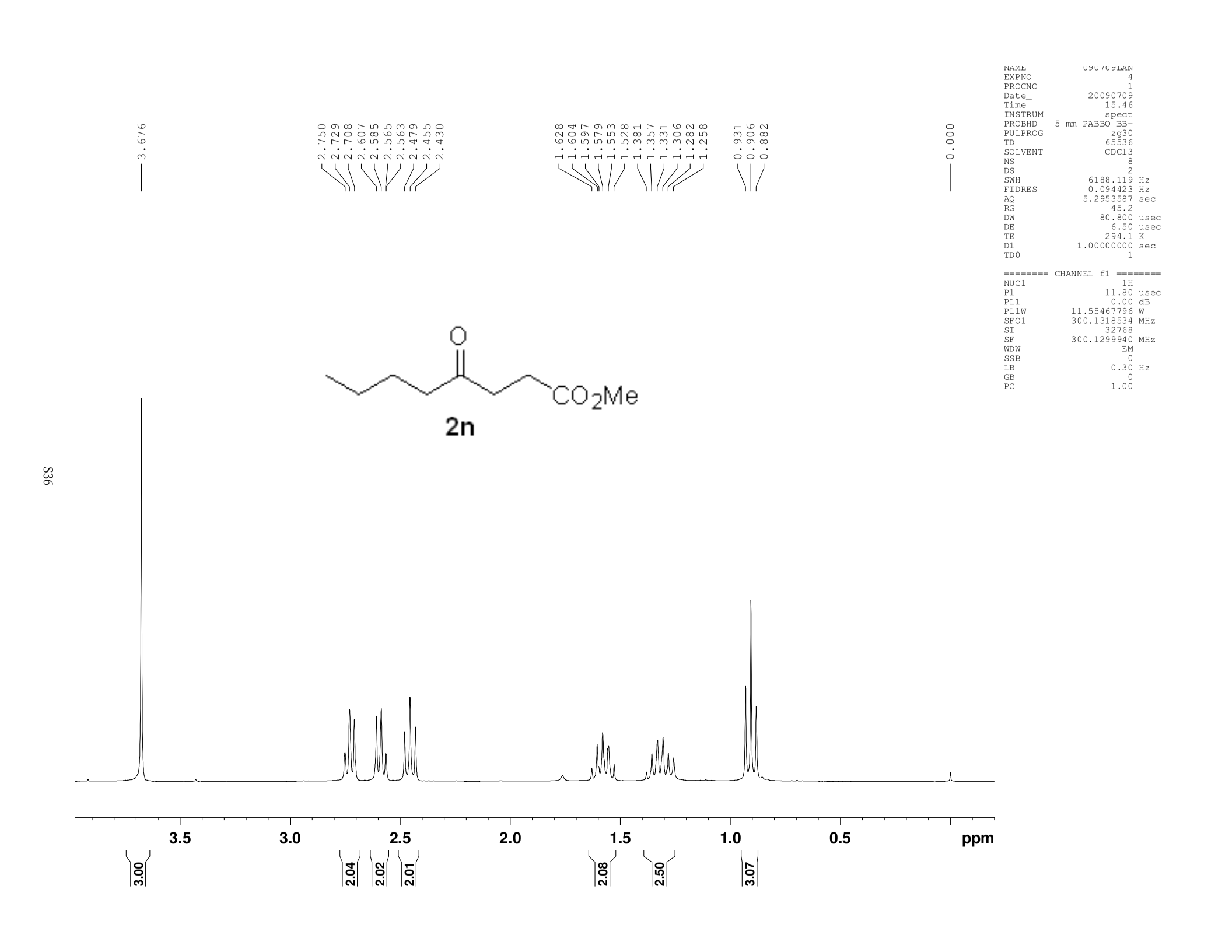
2.725
2.704
2.606
2.585
2.565
2.470
2.446
2.421
1.609
1.587
1.561
1.537
1.333
1.309
1.292
1.279
1.264
0.900
0.879
0.856
-0.000
O
CO2Me
2m
NAME 090708LAN
EXPNO 1
PROCNO 1
Date_ 20090708
Time 11.19
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 203
DW 80.800 usec
DE 6.50 usec
TE 294.0 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1300006 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
3.00
2.07
2.05
2.06
2.50
6.12
3.15

geng quan

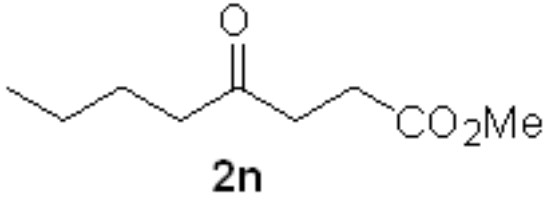


NAME	090709LAN
EXPNO	7
PROCNO	1
Date_	20090709
Time	16.02
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	293
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	294.7 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677484 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40


3.676
2.750
2.729
2.708
2.607
2.585
2.565
2.563
2.479
2.455
2.430
1.628
1.604
1.597
1.579
1.553
1.528
1.381
1.357
1.331
1.306
1.282
1.258
0.931
0.906
0.882
0.000
NAME 090709LAN
EXPNO 4
PROCNO 1
Date_ 20090709
Time 15.46
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 45.2
DW 80.800 usec
DE 6.50 usec
TE 294.1 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1299940 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
O
CO2Me
2n
S36
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
3.00
2.04
2.02
2.01
2.08
2.50
3.07

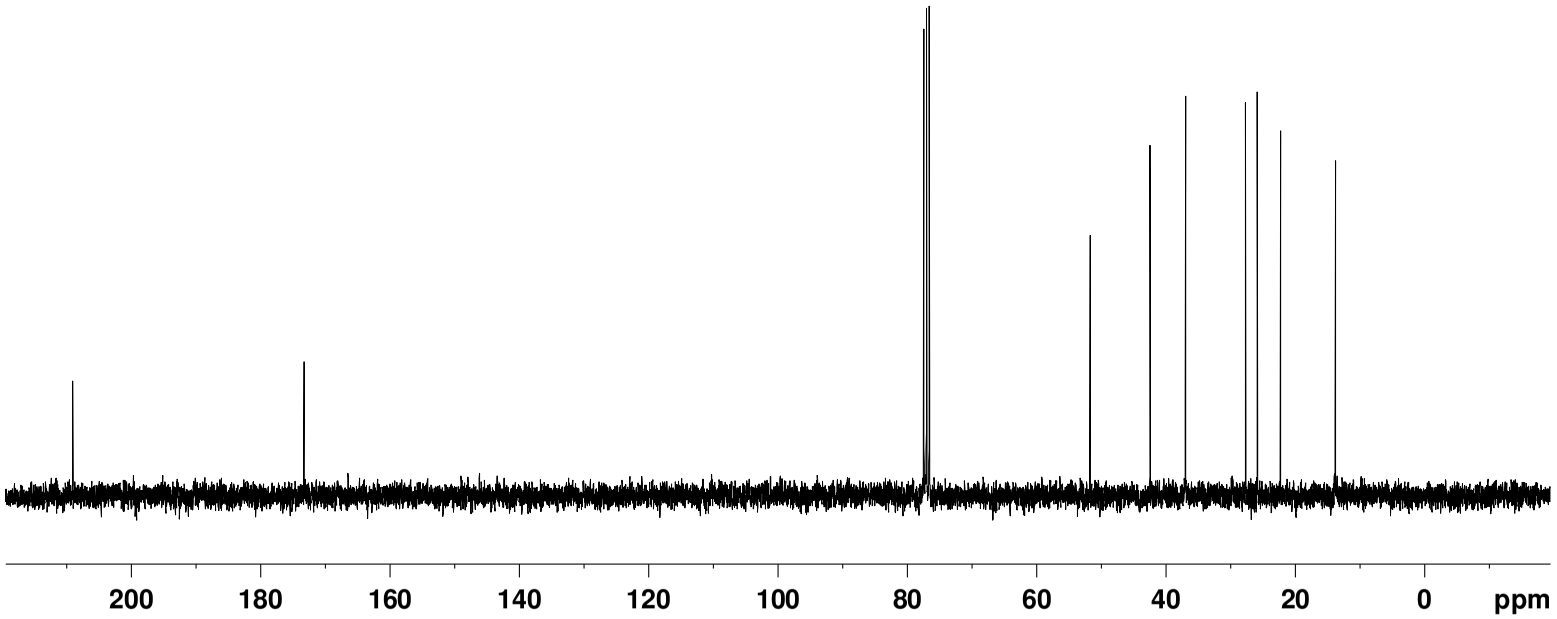
Wu guan

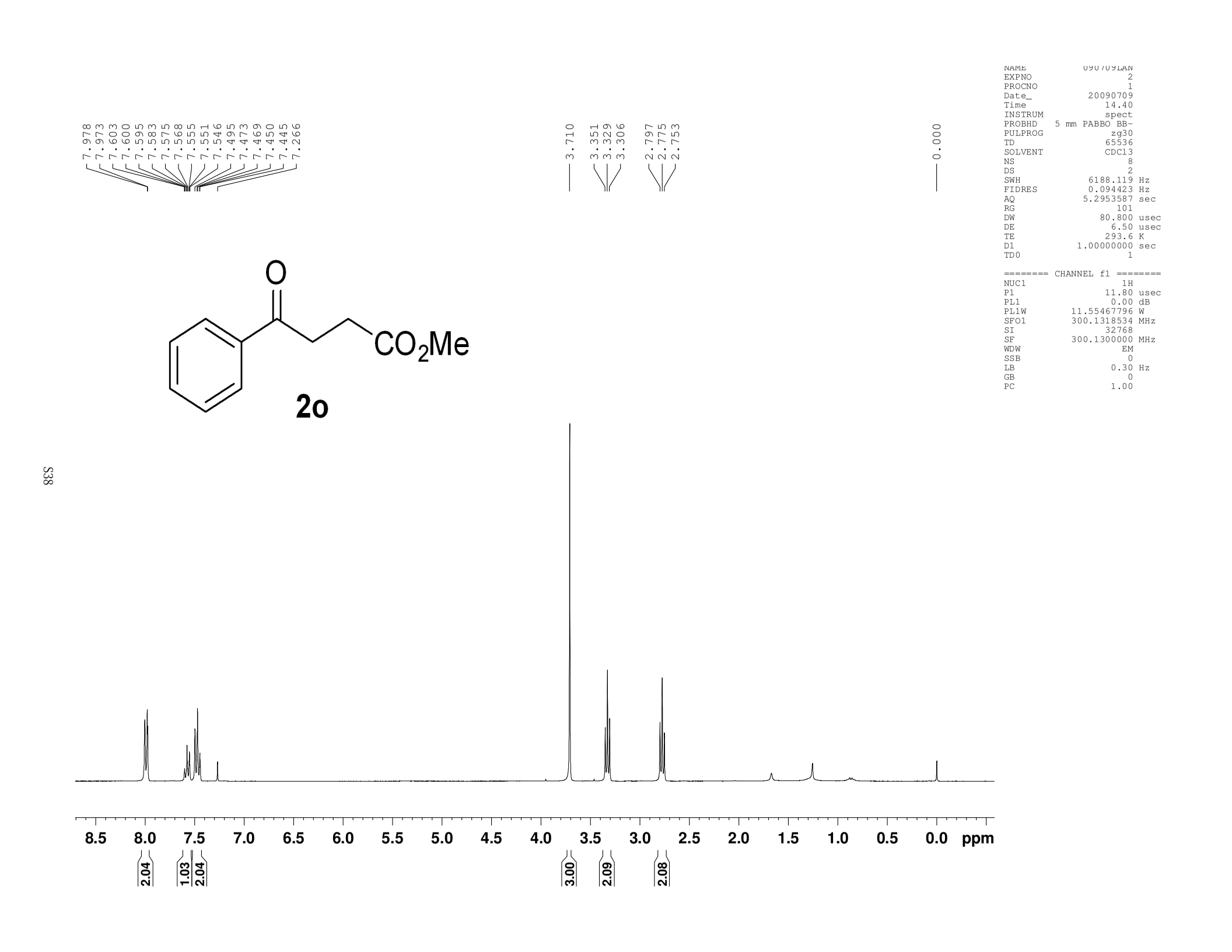
209.06
173.26
77.43
77.00
76.58
51.69
42.44
36.94
27.66
25.84
22.24
13.76



2n

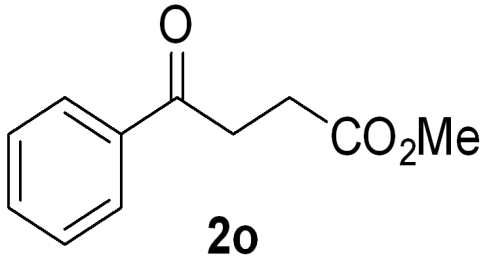
NAME	090709LAN
EXPNO	5
PROCNO	1
Date_	20090709
Time	15.51
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	70
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	294.8 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677503 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40




7.978
7.973
7.603
7.600
7.595
7.583
7.575
7.568
7.555
7.551
7.546
7.495
7.473
7.469
7.450
7.445
7.266
3.710
3.351
3.329
3.306
2.797
2.775
2.753
0.000
O
CO2Me
2o
NAME 090709LAN
EXPNO 2
PROCNO 1
Date_ 20090709
Time 14.40
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 101
DW 80.800 usec
DE 6.50 usec
TE 293.6 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 ppm
2.04
1.03
2.04
3.00
2.09
2.08

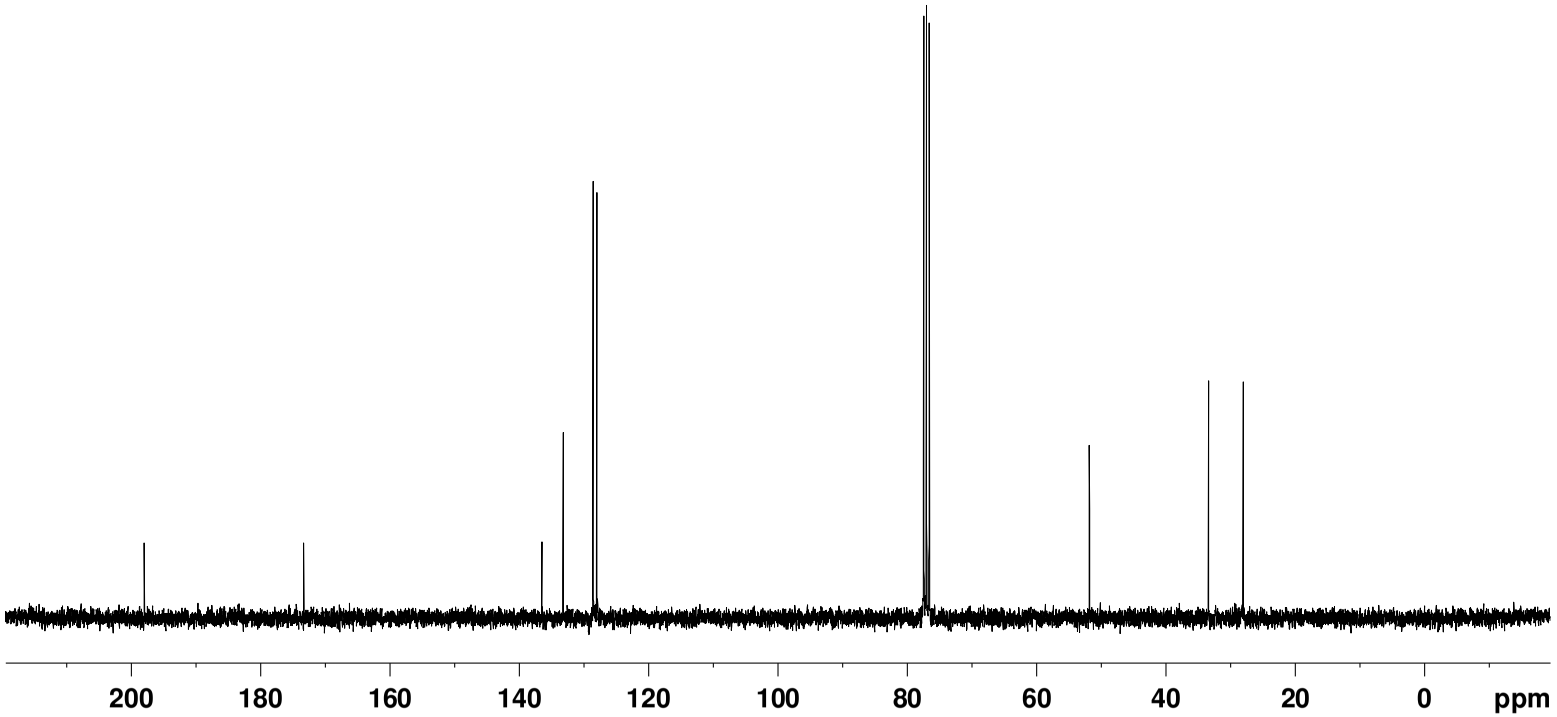
ben jia quan

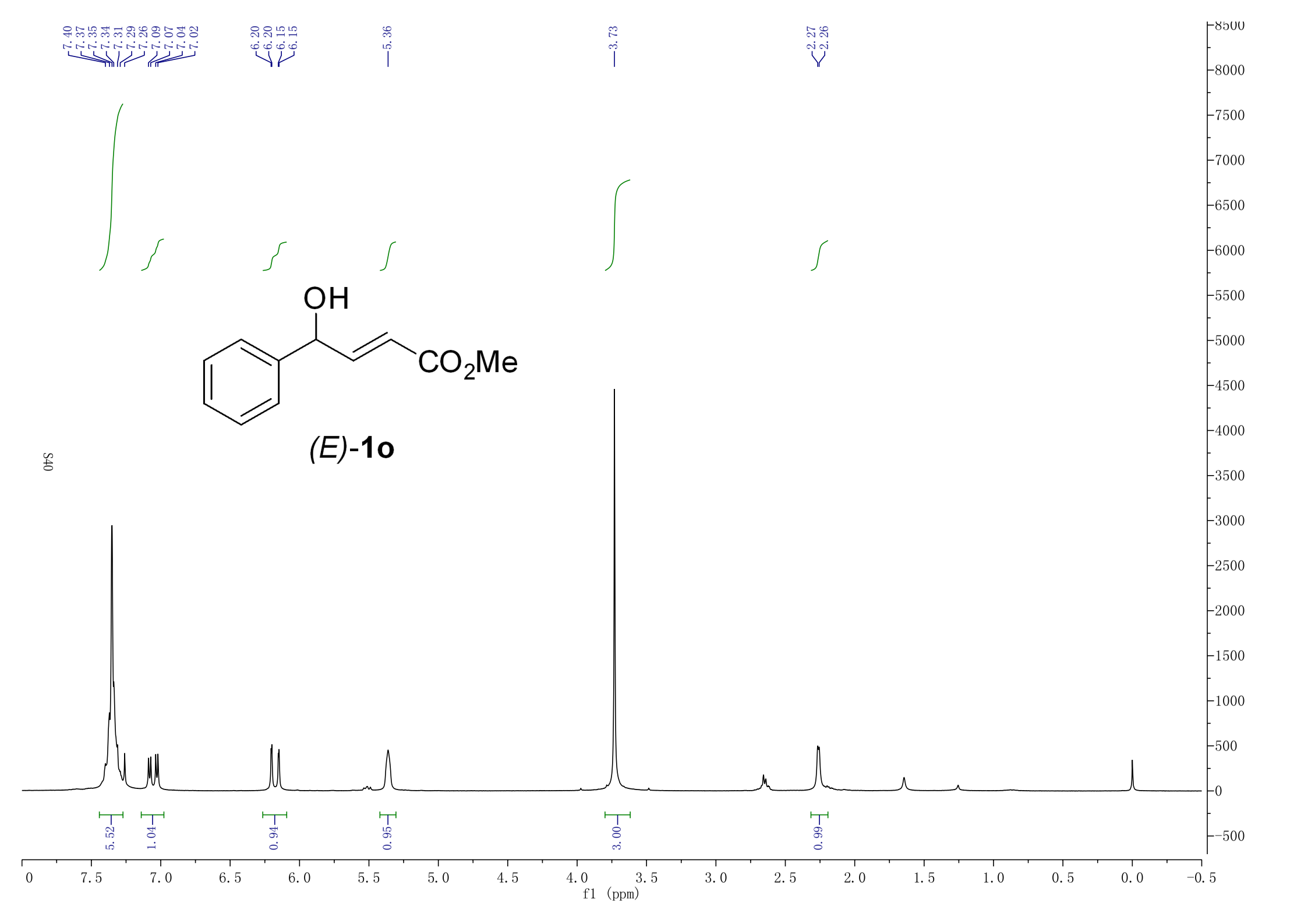
198.01
173.34
136.50
133.21
128.59
128.00
77.42
77.00
76.58
51.80
33.37
27.99

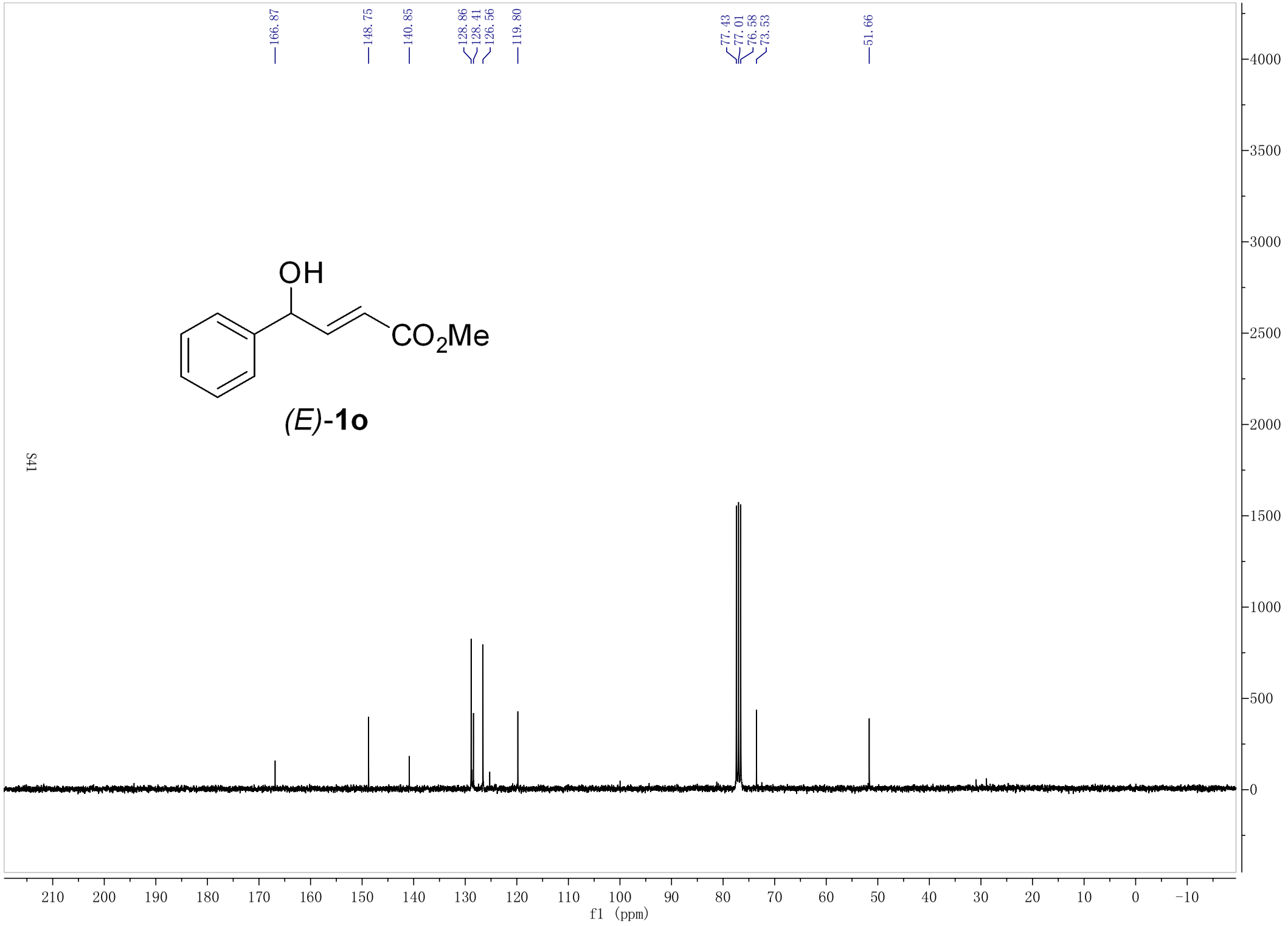


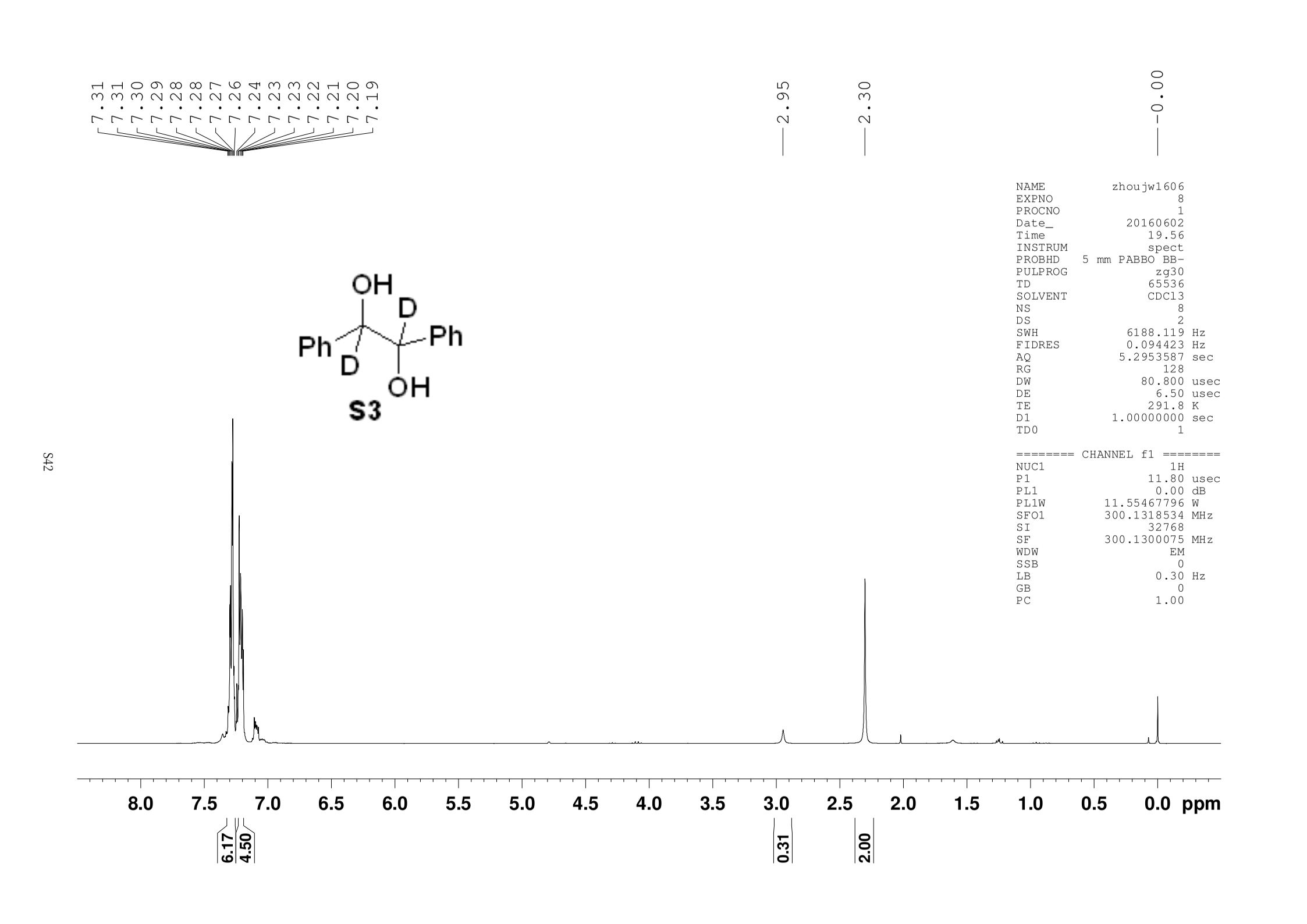
2o

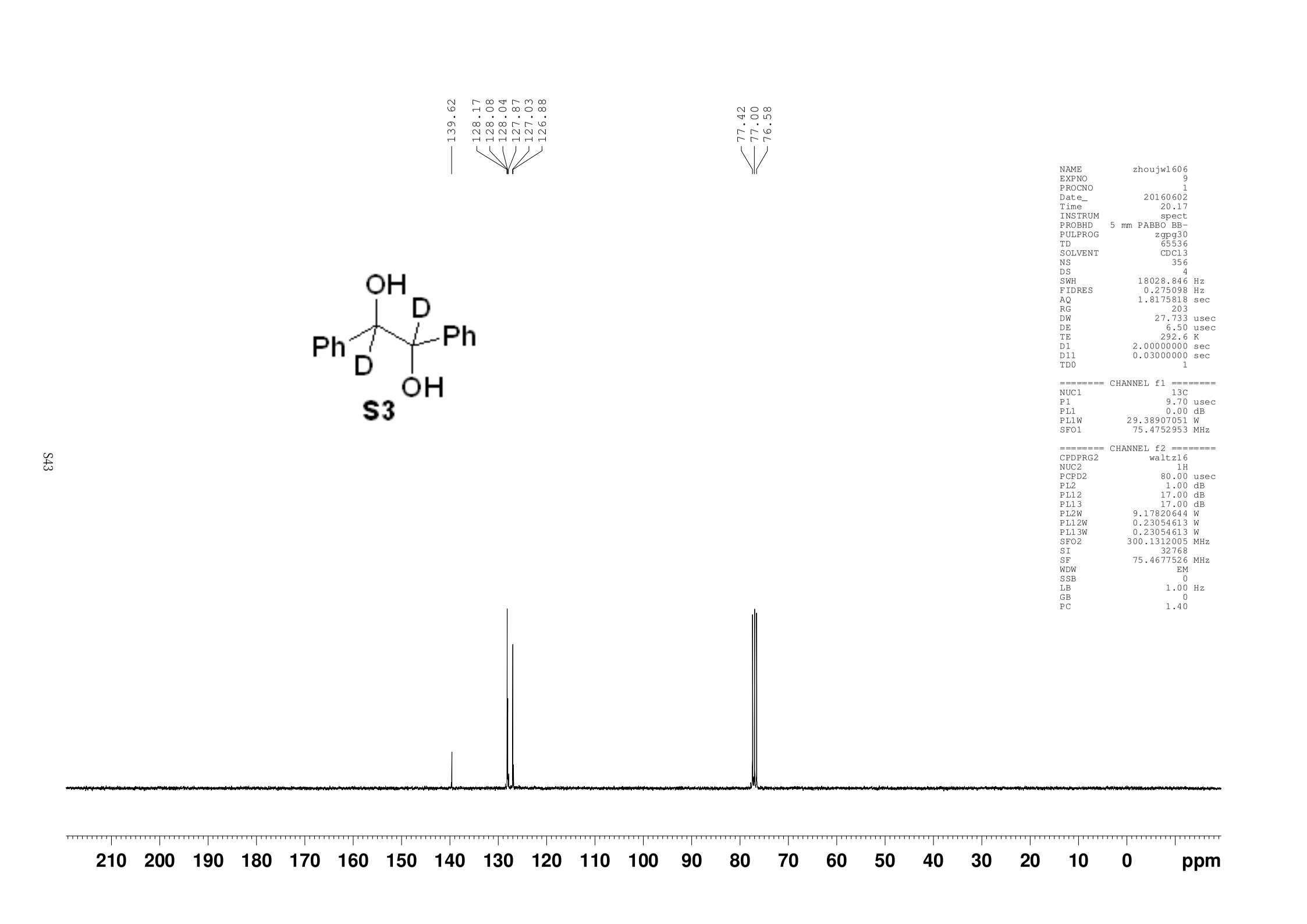
NAME	090709LAN
EXPNO	3
PROCNO	1
Date_	20090709
Time	14.49
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	127
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	294.4 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677503 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

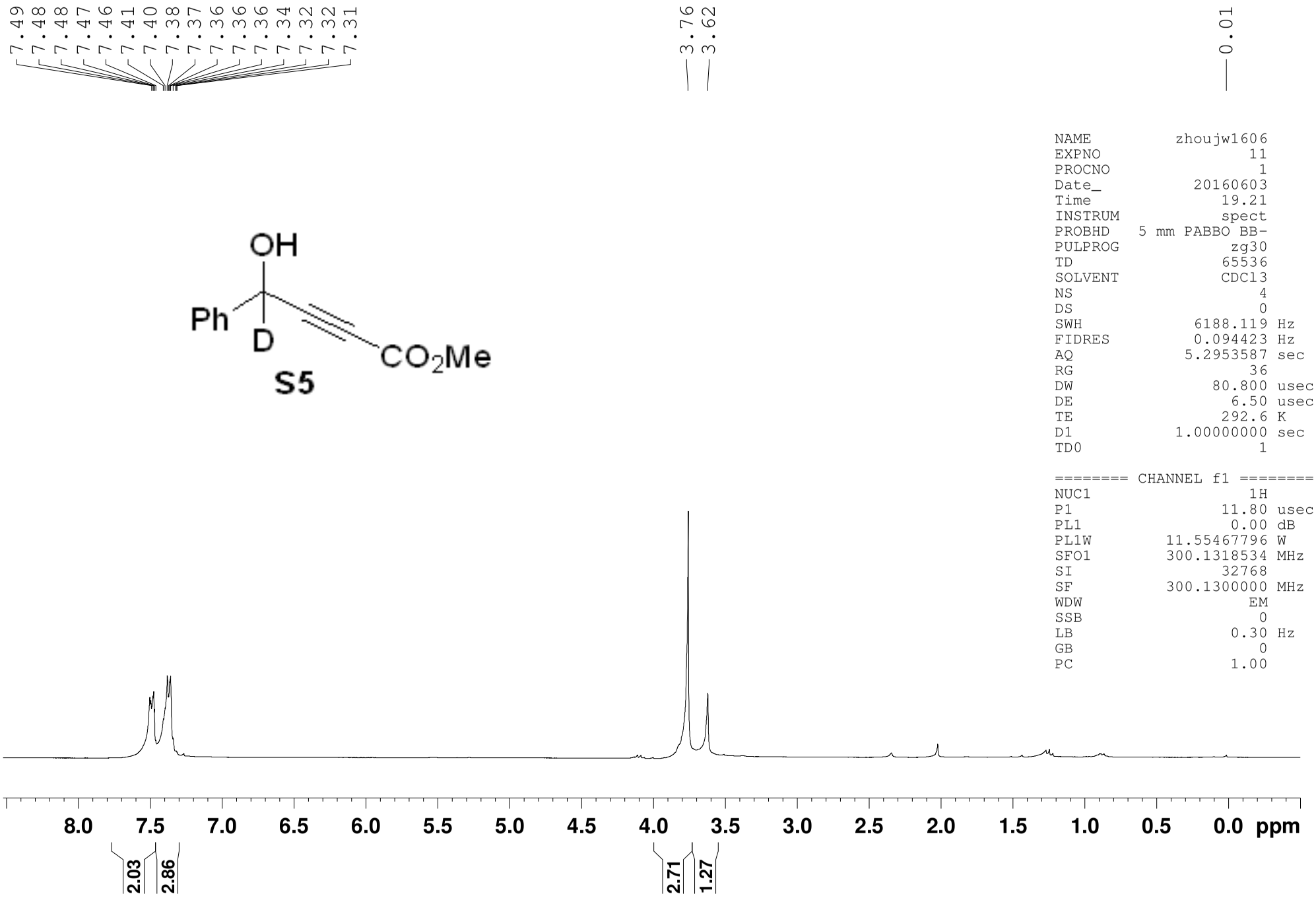


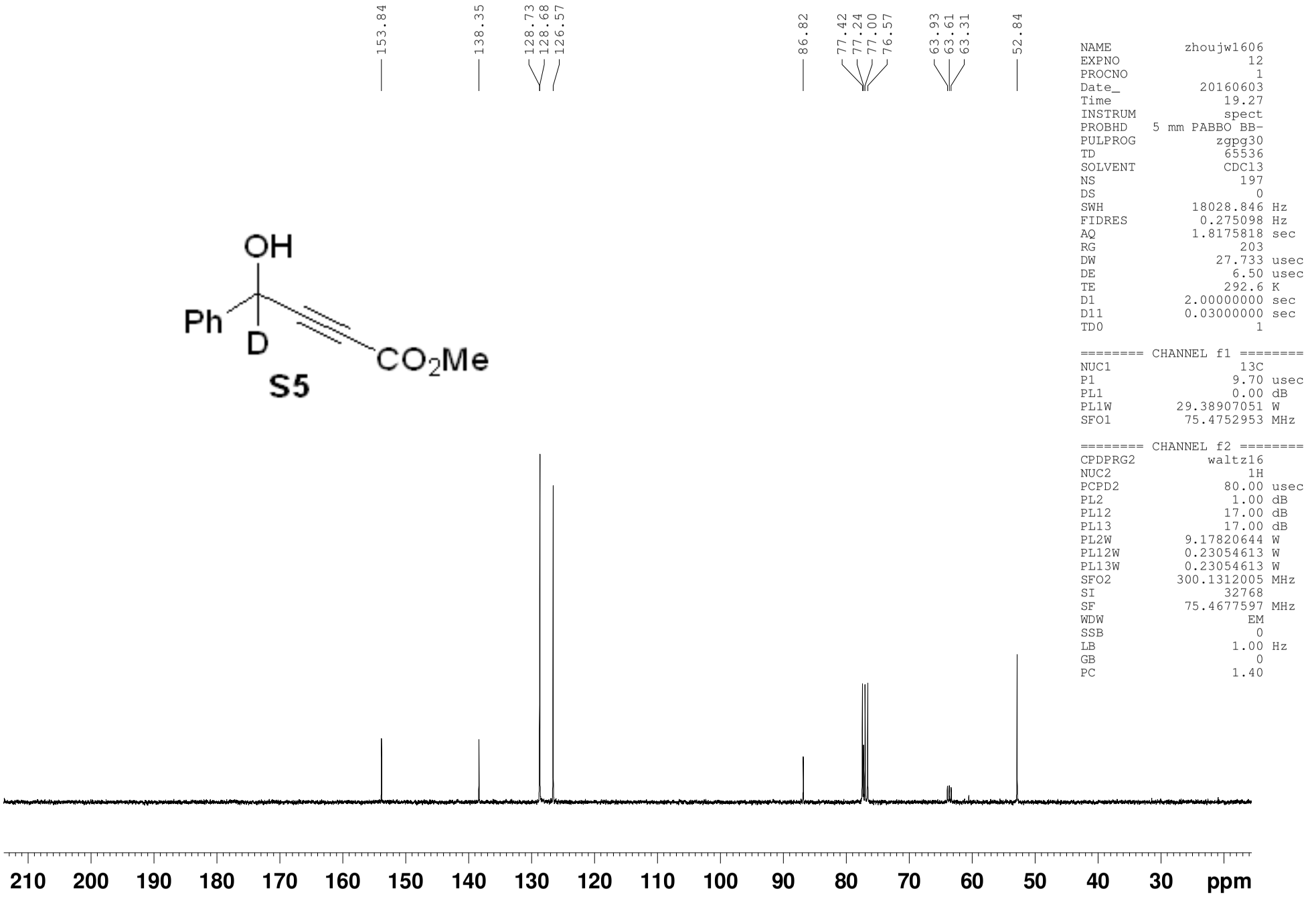

7.40
7.37
7.35
7.34
7.31
7.29
7.26
7.09
7.07
7.04
7.02
6.20
6.20
6.15
6.15
5.36
3.73
2.27
2.26
OH
CO2Me
(E)-1o
S40
5.52
1.04
0.94
0.95
3.00
0.99
f1 (ppm)


166.87
148.75
140.85
128.86
128.41
126.56
119.80
77.43
77.01
76.58
73.53
51.66
OH
CO2Me
(E)-1o
S41
4000
3500
3000
2500
2000
1500
1000
500
0
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

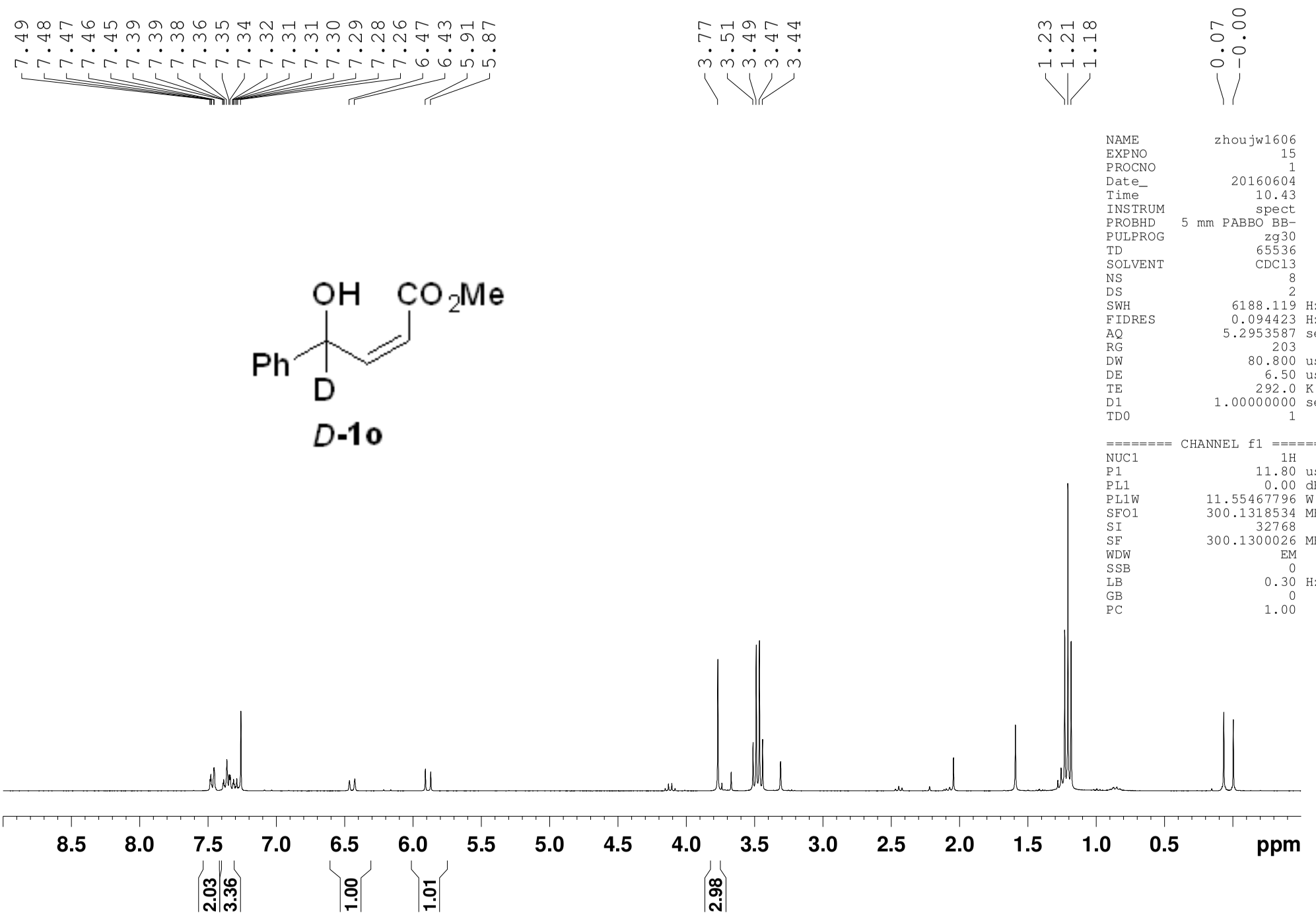

7.31
7.31
7.30
7.29
7.28
7.28
7.27
7.26
7.24
7.23
7.23
7.22
7.21
7.20
7.19
2.95
2.30
0.00
OH
D
Ph
Ph
D
OH
S3
NAME zhoujw1606
EXPNO 8
PROCNO 1
Date_ 20160602
Time 19.56
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDC13
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 128
DW 80.800 usec
DE 6.50 usec
TE 291.8 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1300075 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 ppm
6.17
4.50
0.31
2.00

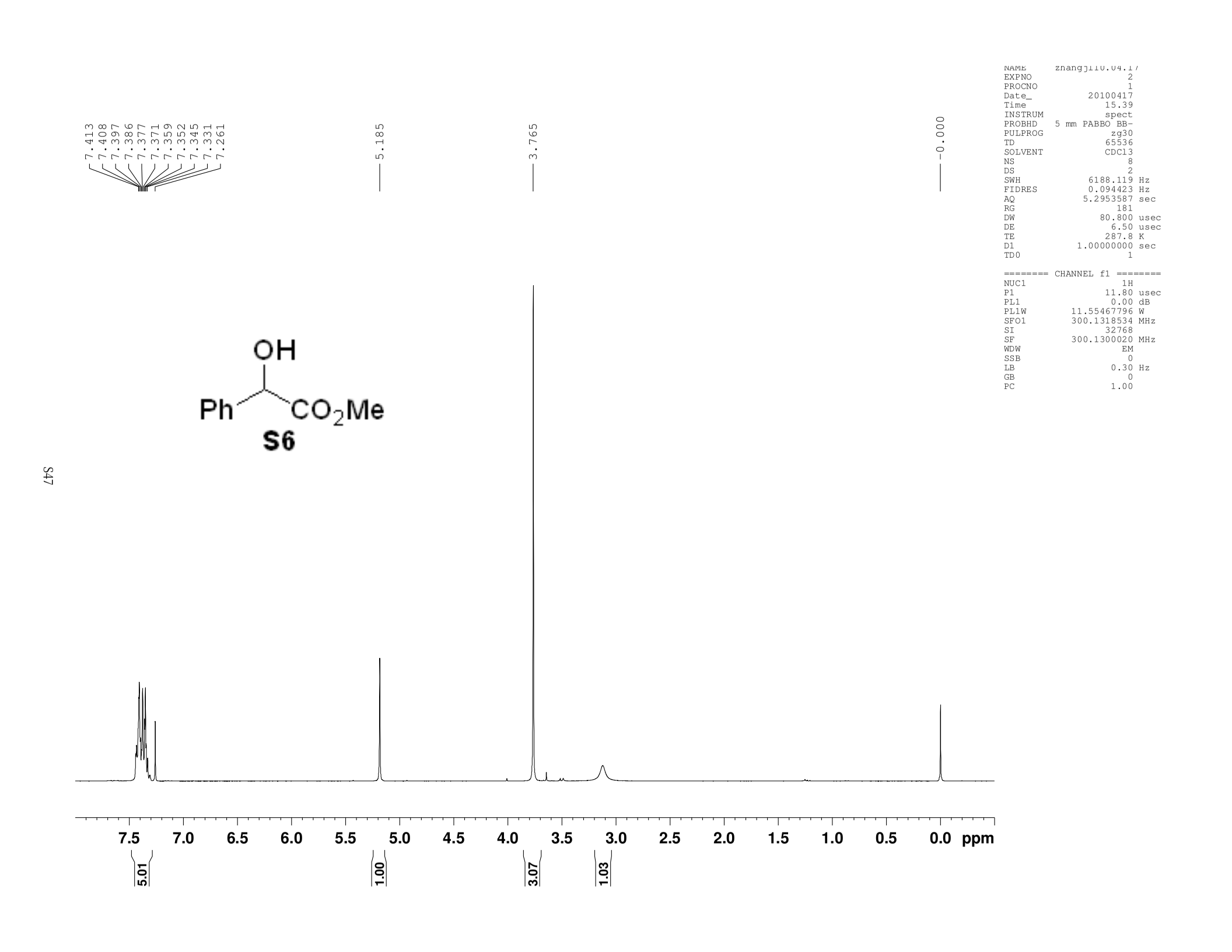

139.62
128.17
128.08
128.04
127.87
127.03
126.88
77.42
77.00
76.58
OH
D
Ph
Ph
D
OH
S3
NAME zhoujw1606
EXPNO 9
PROCNO 1
Date_ 20160602
Time 20.17
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 356
DS 4
SWH 18028.846 Hz
FIDRES 0.275098 Hz
AQ 1.8175818 sec
RG 203
DW 27.733 usec
DE 6.50 usec
TE 292.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 9.70 usec
PL1 0.00 dB
PL1W 29.38907051 W
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 1.00 dB
PL12 17.00 dB
PL13 17.00 dB
PL2W 9.17820644 W
PL12W 0.23054613 W
PL13W 0.23054613 W
SFO2 300.1312005 MHz
SI 32768
SF 75.4677526 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm


7.49
7.48
7.48
7.47
7.46
7.41
7.40
7.38
7.37
7.36
7.36
7.36
7.34
7.32
7.32
7.31
3.76
3.62
0.01
OH
Ph
D
CO2Me
S5
NAME zhoujw1606
EXPNO 11
PROCNO 1
Date_ 20160603
Time 19.21
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 4
DS 0
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 36
DW 80.800 usec
DE 6.50 usec
TE 292.6 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0 ppm
2.03
2.86
2.71
1.27



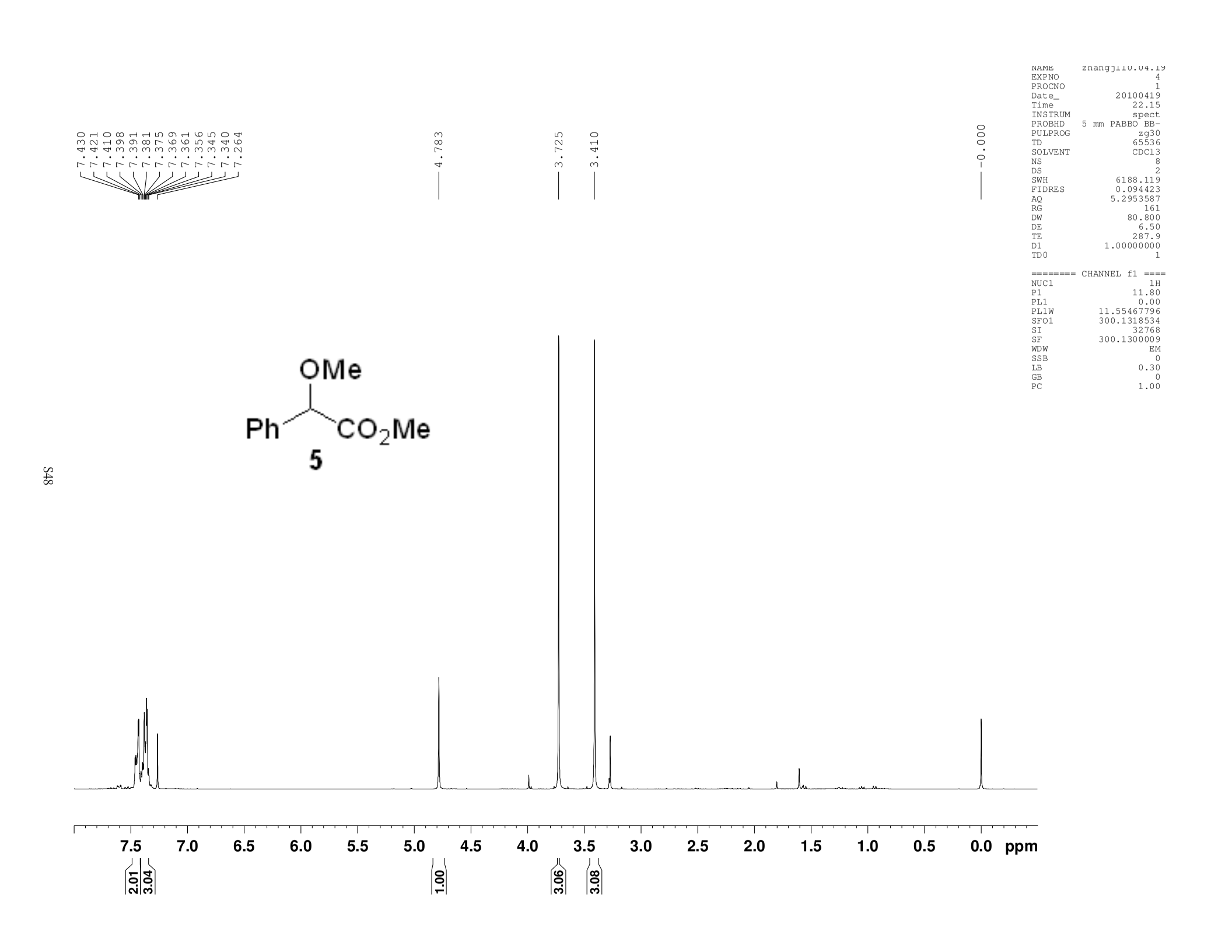
NAME	zhoujw1606
EXPNO	12
PROCNO	1
Date_	20160603
Time	19.27
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	197
DS	0
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	292.6 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677597 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

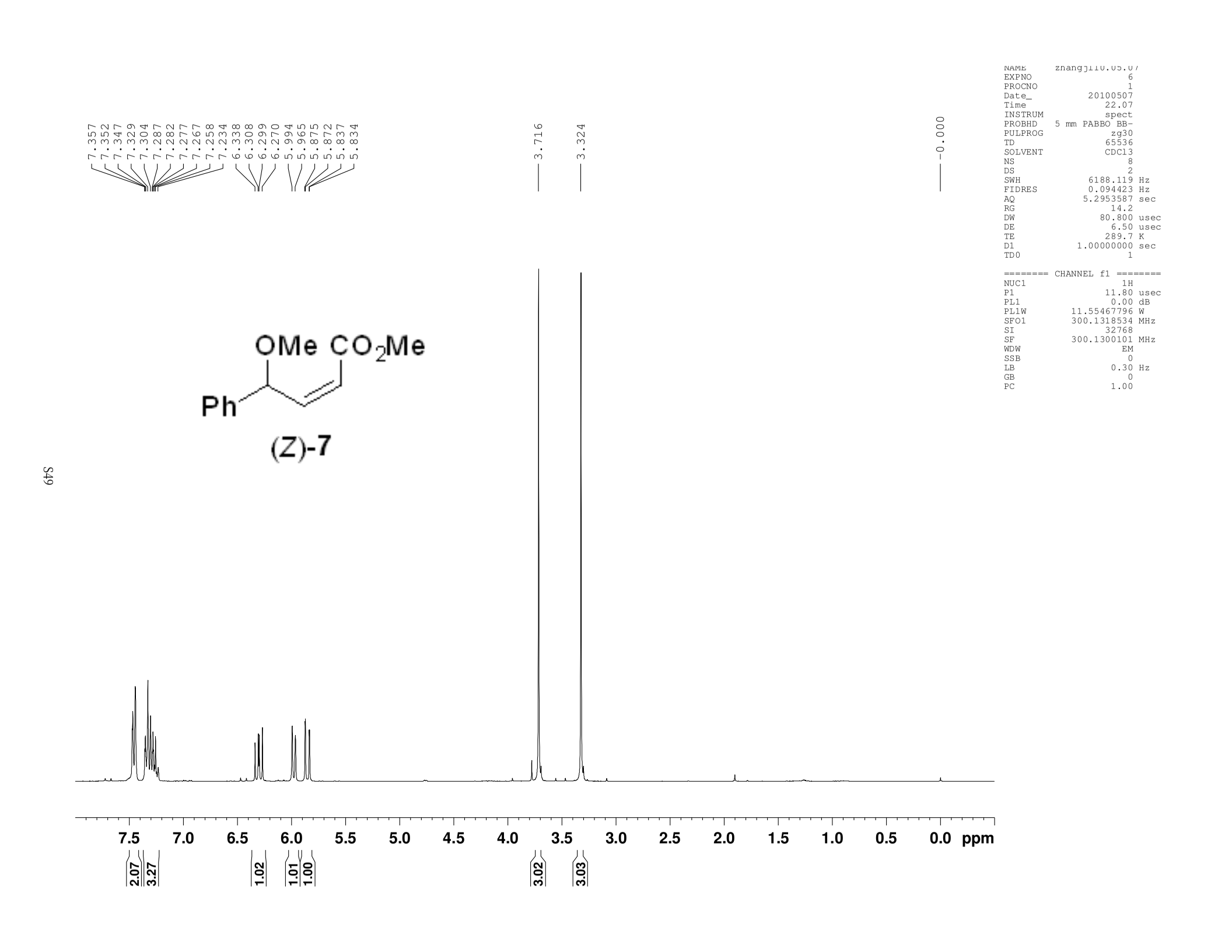

7.49
7.48
7.47
7.46
7.45
7.39
7.39
7.38
7.36
7.35
7.34
7.32
7.31
7.31
7.30
7.29
7.28
7.26
6.47
6.43
5.91
5.87
3.77
3.51
3.49
3.47
3.44
1.23
1.21
1.18
0.07
0.00
OH
CO2Me
Ph
D
D-1o
NAME zhoujw1606
EXPNO 15
PROCNO 1
Date_ 20160604
Time 10.43
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDC13
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 se
RG 203
DW 80.800 us
DE 6.50 us
TE 292.0 K
D1 1.00000000 se
TD0 1
======== CHANNEL f1 ======
NUC1 1H
P1 11.80 us
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MH
SI 32768
SF 300.1300026 MH
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
2.03
3.36
1.00
1.01
2.98



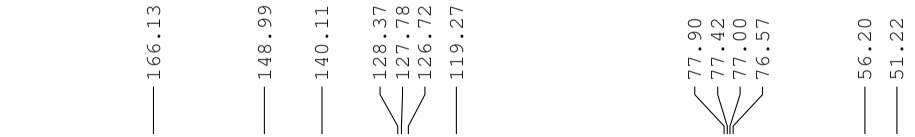
NAME zhangjl10.04.17
EXPNO 2
PROCNO 1
Date_ 20100417
Time 15.39
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 181
DW 80.800 usec
DE 6.50 usec
TE 287.8 K
D1 1.00000000 sec
TD0 1

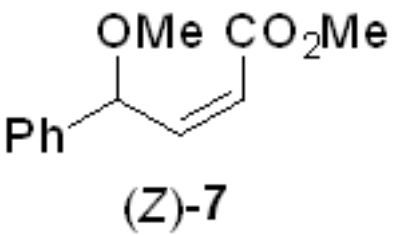
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1300020 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00


7.430
7.421
7.410
7.398
7.391
7.381
7.375
7.369
7.361
7.356
7.345
7.340
7.264
4.783
3.725
3.410
0.000
NAME zhangjl10.04.19
EXPNO 4
PROCNO 1
Date_ 20100419
Time 22.15
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119
FIDRES 0.094423
AQ 5.2953587
RG 161
DW 80.800
DE 6.50
TE 287.9
D1 1.00000000
TD0 1
======== CHANNEL f1 ====
NUC1 1H
P1 11.80
PL1 0.00
PL1W 11.55467796
SFO1 300.1318534
SI 32768
SF 300.1300009
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00
OMe
Ph
CO2Me
5
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
2.01
3.04
1.00
3.06
3.08



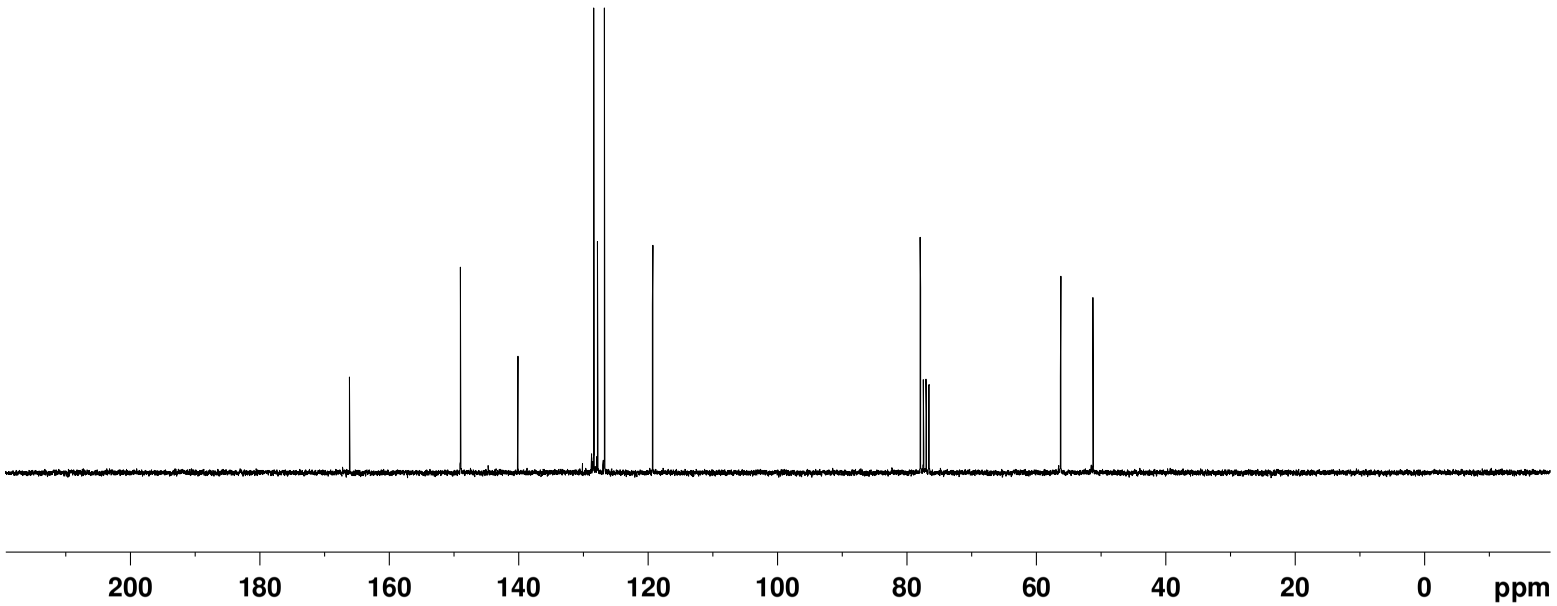

```
NAME      zhangjl10.05.07
EXPNO                   6
PROCNO                  1
Date_            20100507
Time                22.07
INSTRUM             spect
PROBHD   5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                      8
DS                      2
SWH           6188.119 Hz
FIDRES        0.094423 Hz
AQ            5.2953587 sec
RG                   14.2
DW                80.800 usec
DE                 6.50 usec
TE                289.7 K
D1           1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 11.80 usec
PL1                 0.00 dB
PL1W       11.55467796 W
SFO1       300.1318534 MHz
SI                  32768
SF         300.1300101 MHz
WDW                    EM
SSB                     0
LB                 0.30 Hz
GB                      0
PC                 1.00
```

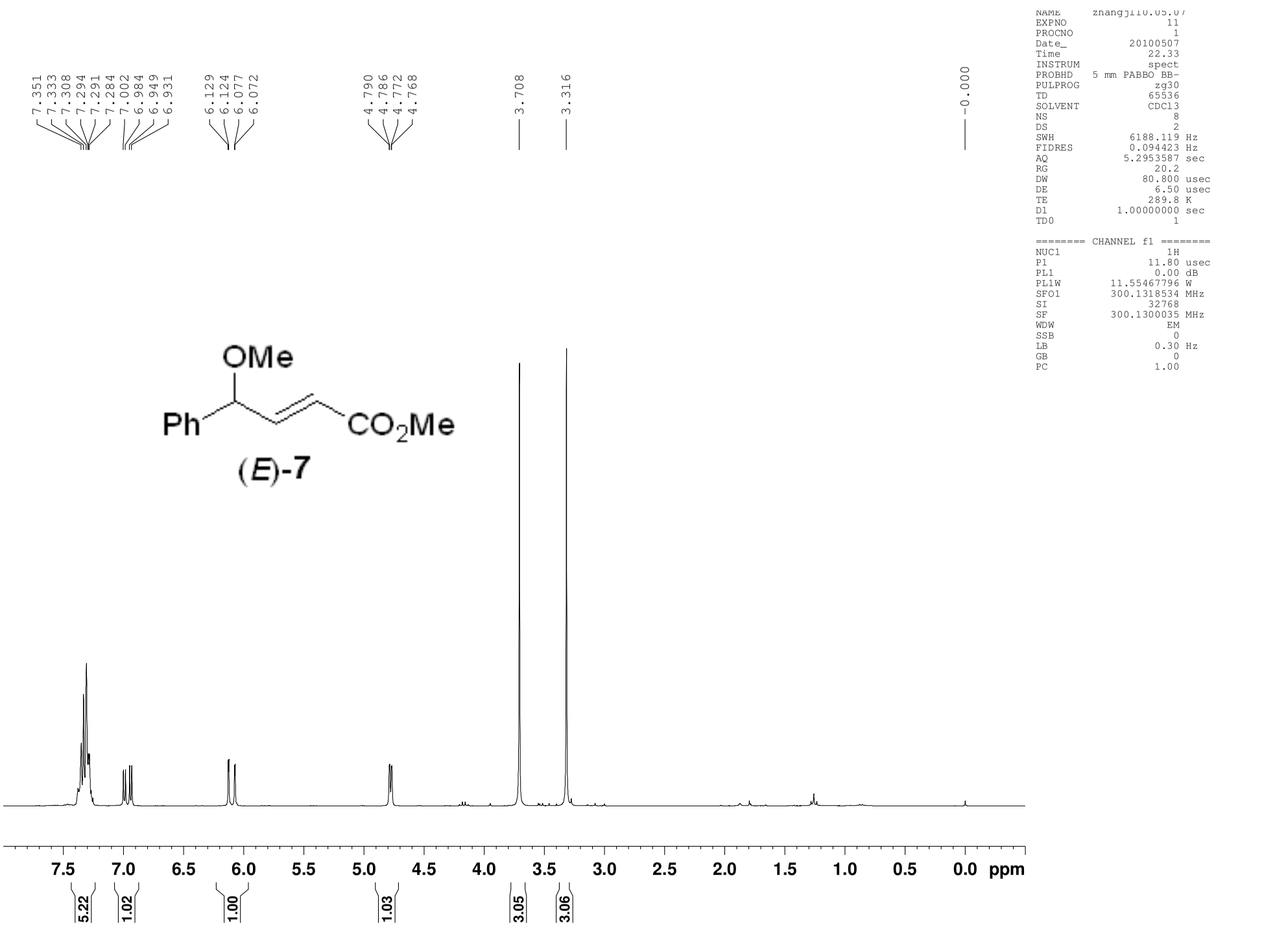




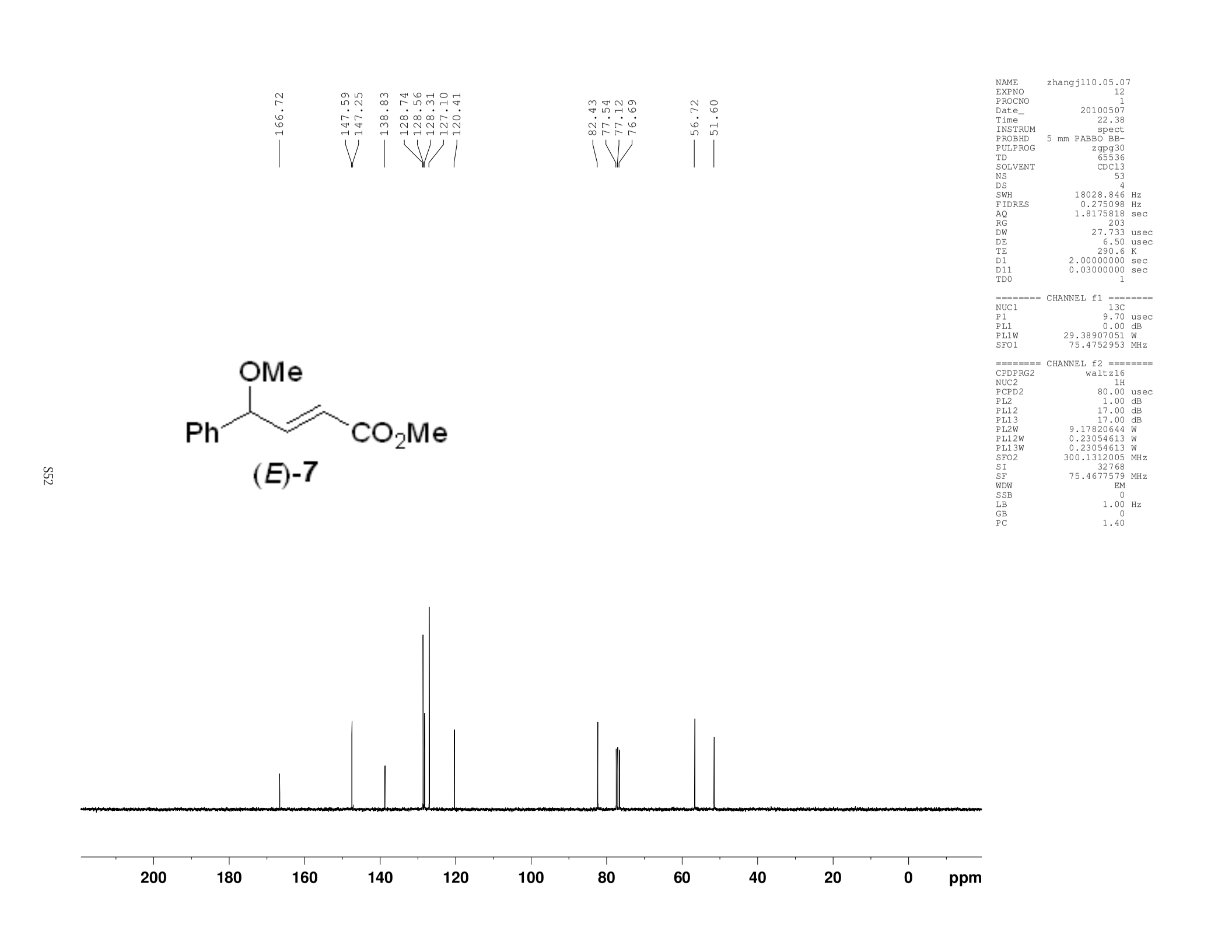
(Z)-**7**

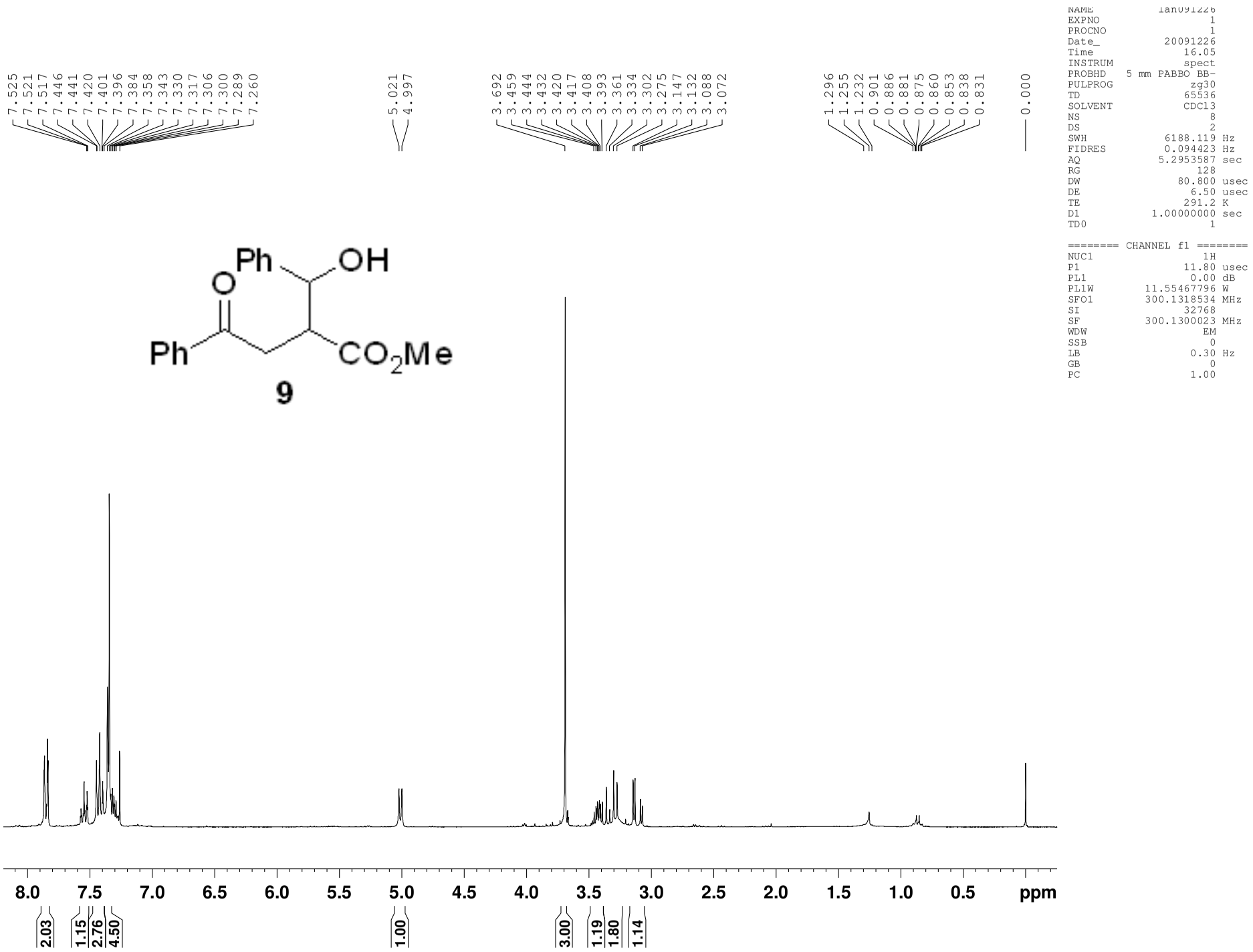
```
NAME      zhangjl10.05.07
EXPNO                  7
PROCNO                 1
Date_           20100507
Time               22.12
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                   40
DS                    4
SWH           18028.846 Hz
FIDRES         0.275098 Hz
AQ             1.8175818 sec
RG                  203
DW                27.733 usec
DE                 6.50 usec
TE                290.4 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                13C
P1                 9.70 usec
PL1                0.00 dB
PL1W        29.38907051 W
SFO1         75.4752953 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                1H
PCPD2              80.00 usec
PL2                 1.00 dB
PL12               17.00 dB
PL13               17.00 dB
PL2W         9.17820644 W
PL12W        0.23054613 W
PL13W        0.23054613 W
SFO2        300.1312005 MHz
SI                32768
SF           75.4677619 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

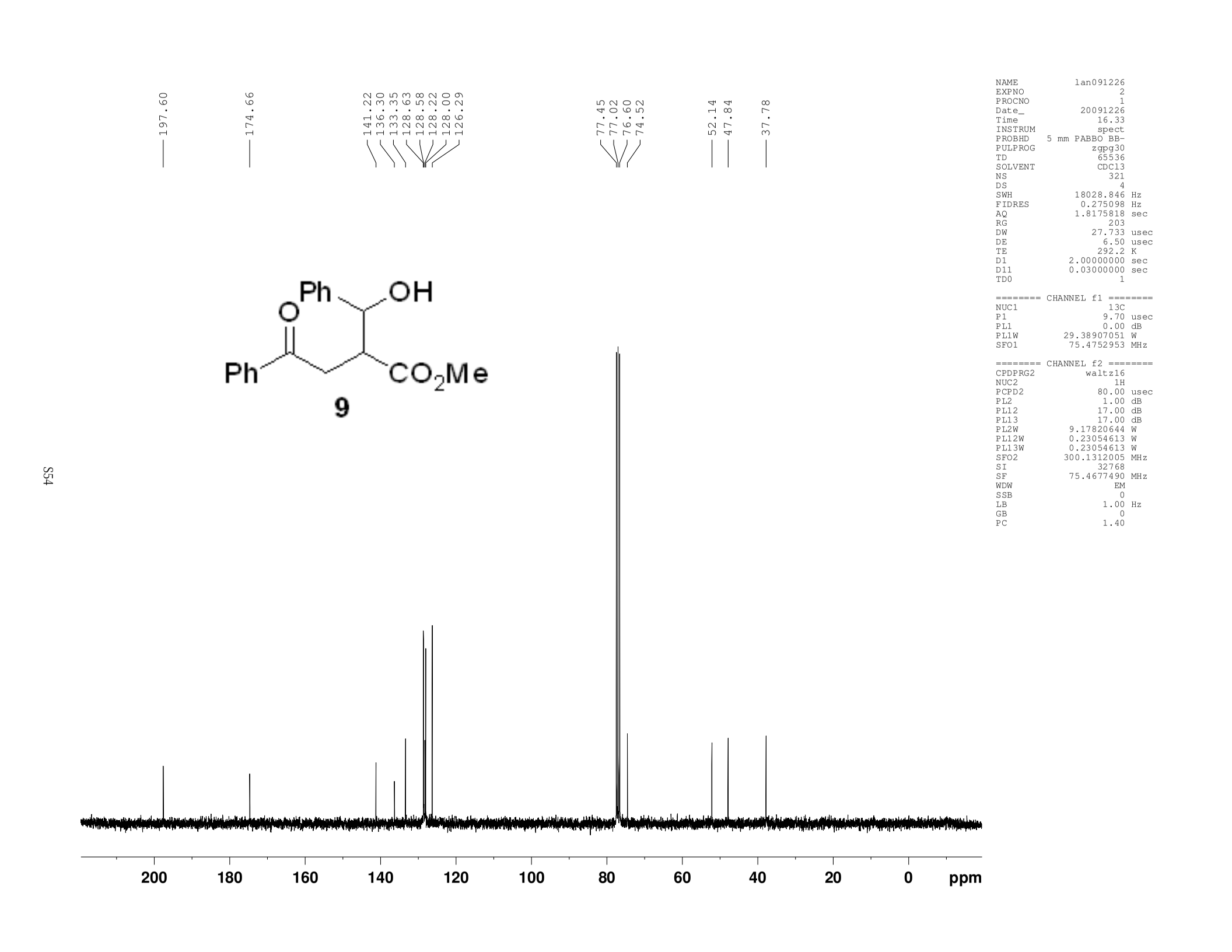




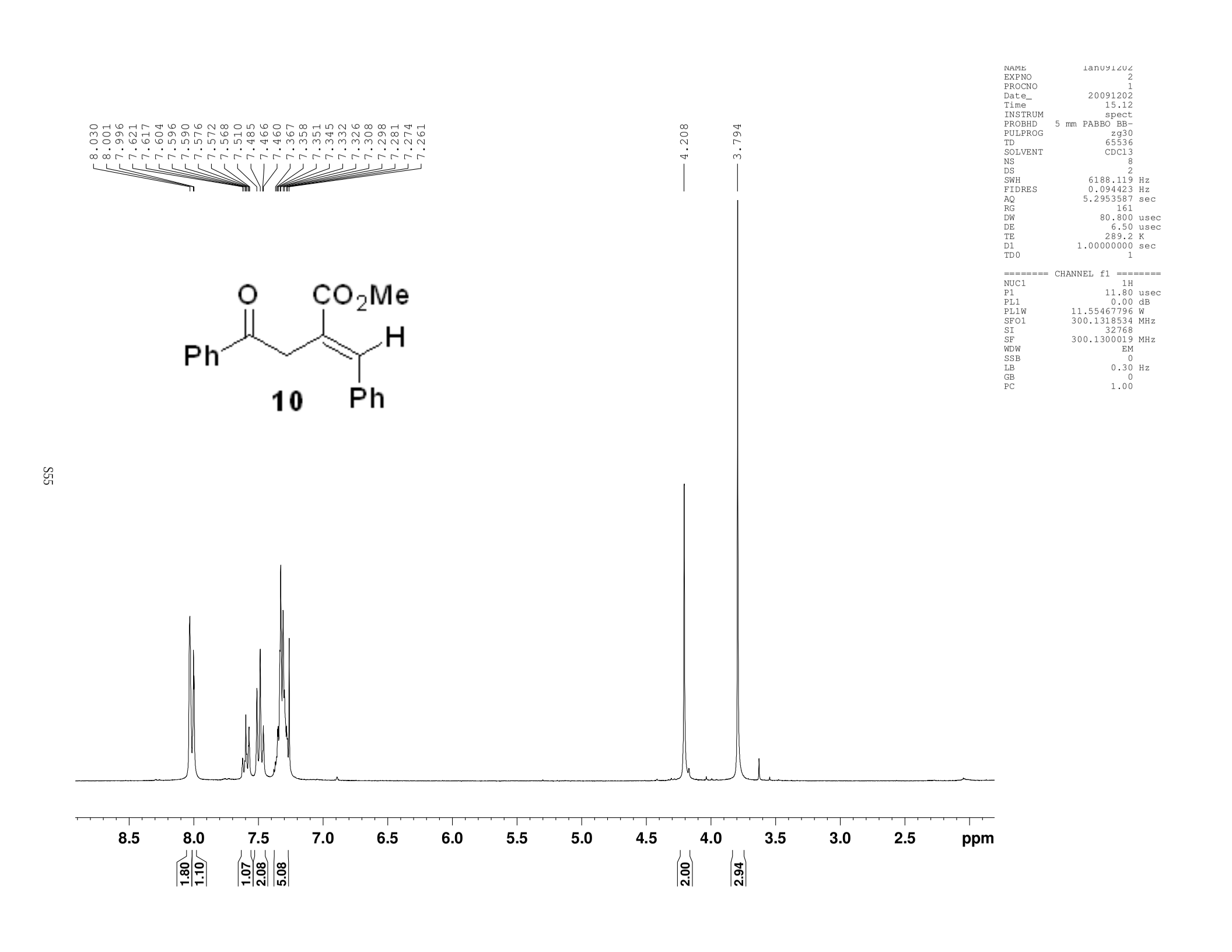
NAME	zhangjl10.05.07
EXPNO	11
PROCNO	1
Date_	20100507
Time	22.33
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	8
DS	2
SWH	6188.119 Hz
FIDRES	0.094423 Hz
AQ	5.2953587 sec
RG	20.2
DW	80.800 usec
DE	6.50 usec
TE	289.8 K
D1	1.00000000 sec
TD0	1
========	CHANNEL f1 ========
NUC1	1H
P1	11.80 usec
PL1	0.00 dB
PL1W	11.55467796 W
SFO1	300.1318534 MHz
SI	32768
SF	300.1300035 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00


166.72
147.59
147.25
138.83
128.74
128.56
128.31
127.10
120.41
82.43
77.54
77.12
76.69
56.72
51.60
NAME zhangjl10.05.07
EXPNO 12
PROCNO 1
Date_ 20100507
Time 22.38
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 53
DS 4
SWH 18028.846 Hz
FIDRES 0.275098 Hz
AQ 1.8175818 sec
RG 203
DW 27.733 usec
DE 6.50 usec
TE 290.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 9.70 usec
PL1 0.00 dB
PL1W 29.38907051 W
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 1.00 dB
PL12 17.00 dB
PL13 17.00 dB
PL2W 9.17820644 W
PL12W 0.23054613 W
PL13W 0.23054613 W
SFO2 300.1312005 MHz
SI 32768
SF 75.4677579 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
OMe
Ph
CO2Me
(E)-7
200
180
160
140
120
100
80
60
40
20
0
ppm

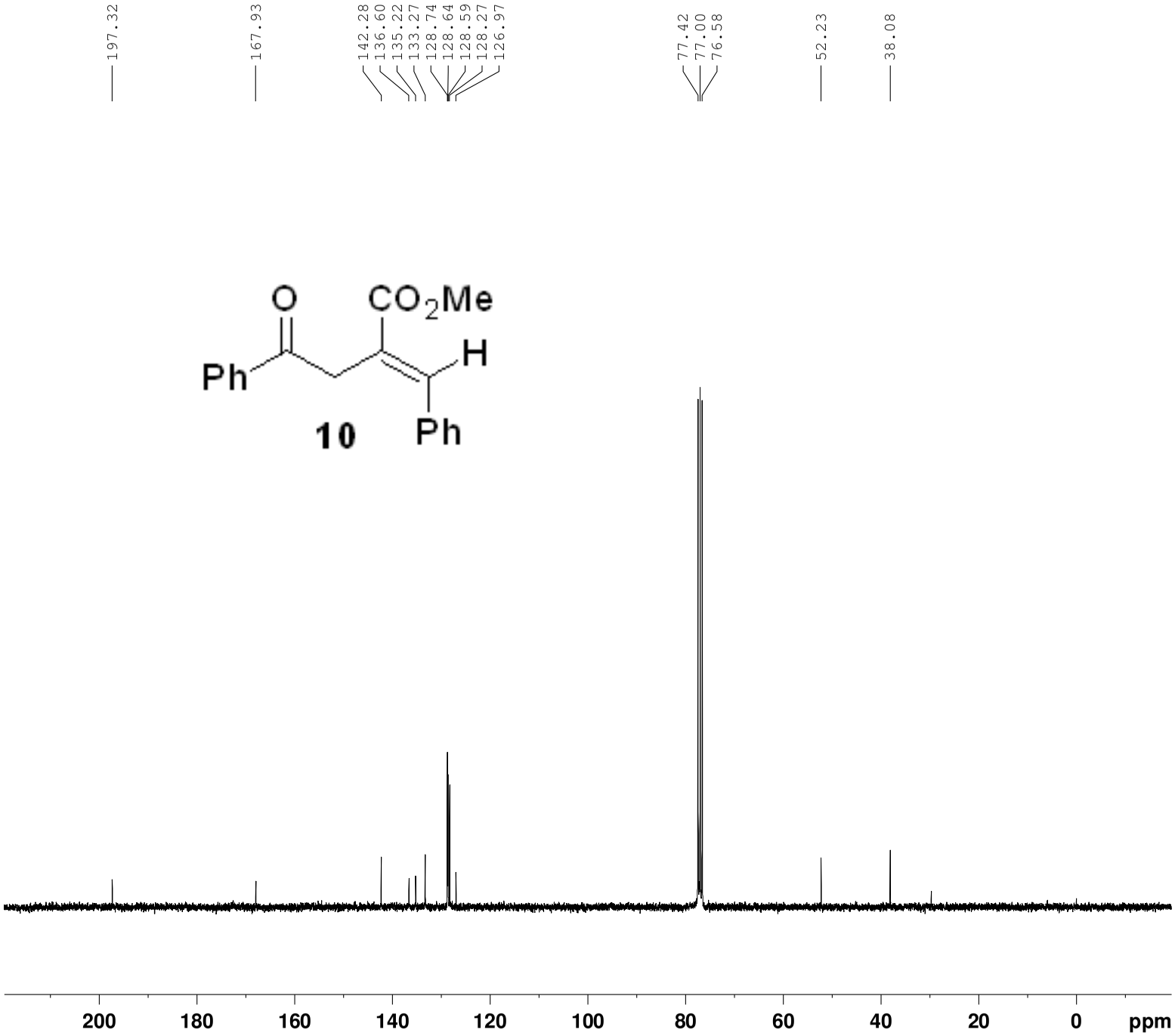

7.525
7.521
7.517
7.446
7.441
7.420
7.401
7.396
7.384
7.358
7.343
7.330
7.317
7.306
7.300
7.289
7.260
5.021
4.997
3.692
3.459
3.444
3.432
3.420
3.417
3.408
3.393
3.361
3.334
3.302
3.275
3.147
3.132
3.088
3.072
1.296
1.255
1.232
0.901
0.886
0.881
0.875
0.860
0.853
0.838
0.831
0.000
NAME 1an091226
EXPNO 1
PROCNO 1
Date_ 20091226
Time 16.05
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6188.119 Hz
FIDRES 0.094423 Hz
AQ 5.2953587 sec
RG 128
DW 80.800 usec
DE 6.50 usec
TE 291.2 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.80 usec
PL1 0.00 dB
PL1W 11.55467796 W
SFO1 300.1318534 MHz
SI 32768
SF 300.1300023 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
Ph
OH
O
Ph
CO2Me
9
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
2.03
1.15
2.76
4.50
1.00
3.00
1.19
1.80
1.14



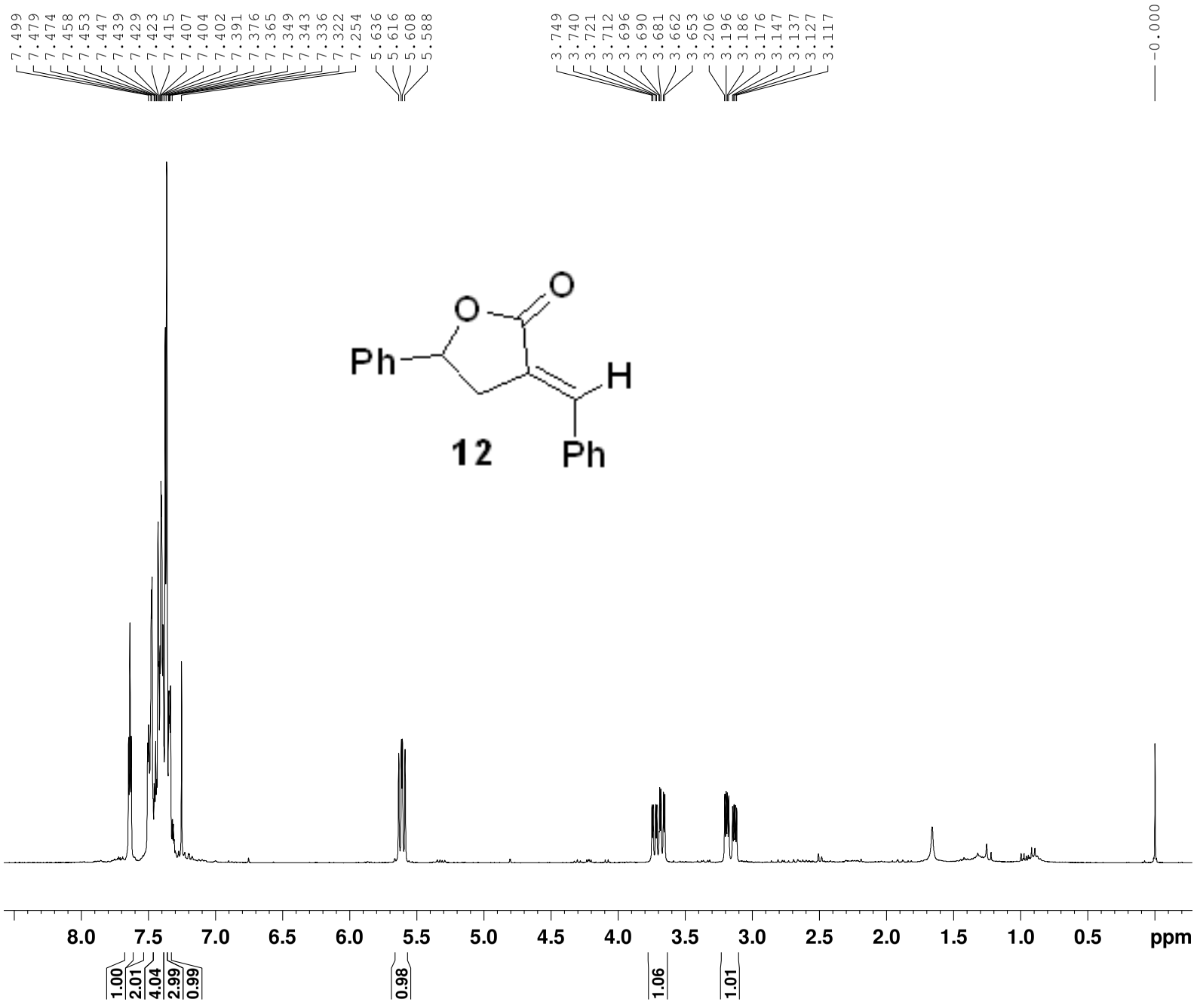

```
NAME            lan091226
EXPNO                   2
PROCNO                  1
Date_            20091226
Time                16.33
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   321
DS                     4
SWH            18028.846 Hz
FIDRES          0.275098 Hz
AQ              1.8175818 sec
RG                   203
DW                27.733 usec
DE                 6.50 usec
TE                292.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                 13C
P1                  9.70 usec
PL1                 0.00 dB
PL1W         29.38907051 W
SFO1          75.4752953 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                 1H
PCPD2              80.00 usec
PL2                 1.00 dB
PL12               17.00 dB
PL13               17.00 dB
PL2W          9.17820644 W
PL12W         0.23054613 W
PL13W         0.23054613 W
SFO2         300.1312005 MHz
SI                 32768
SF            75.4677490 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```



NAME	tan091202
EXPNO	2
PROCNO	1
Date_	20091202
Time	15.12
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	8
DS	2
SWH	6188.119 Hz
FIDRES	0.094423 Hz
AQ	5.2953587 sec
RG	161
DW	80.800 usec
DE	6.50 usec
TE	289.2 K
D1	1.00000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	1H
P1	11.80 usec
PL1	0.00 dB
PL1W	11.55467796 W
SFO1	300.1318534 MHz
SI	32768
SF	300.1300019 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

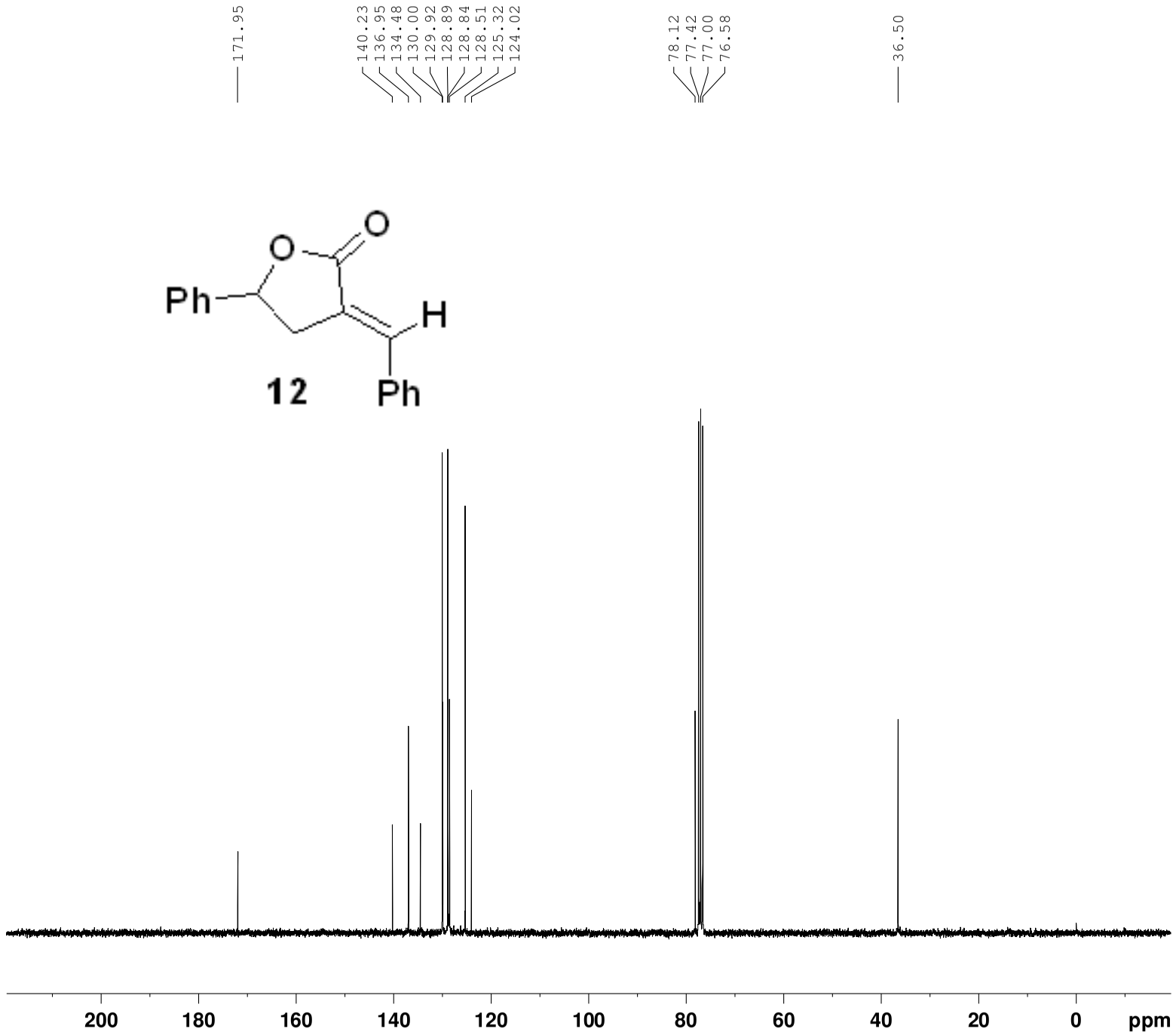


NAME	lan091202
EXPNO	3
PROCNO	1
Date_	20091202
Time	15.18
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	1024
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	290.4 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677498 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

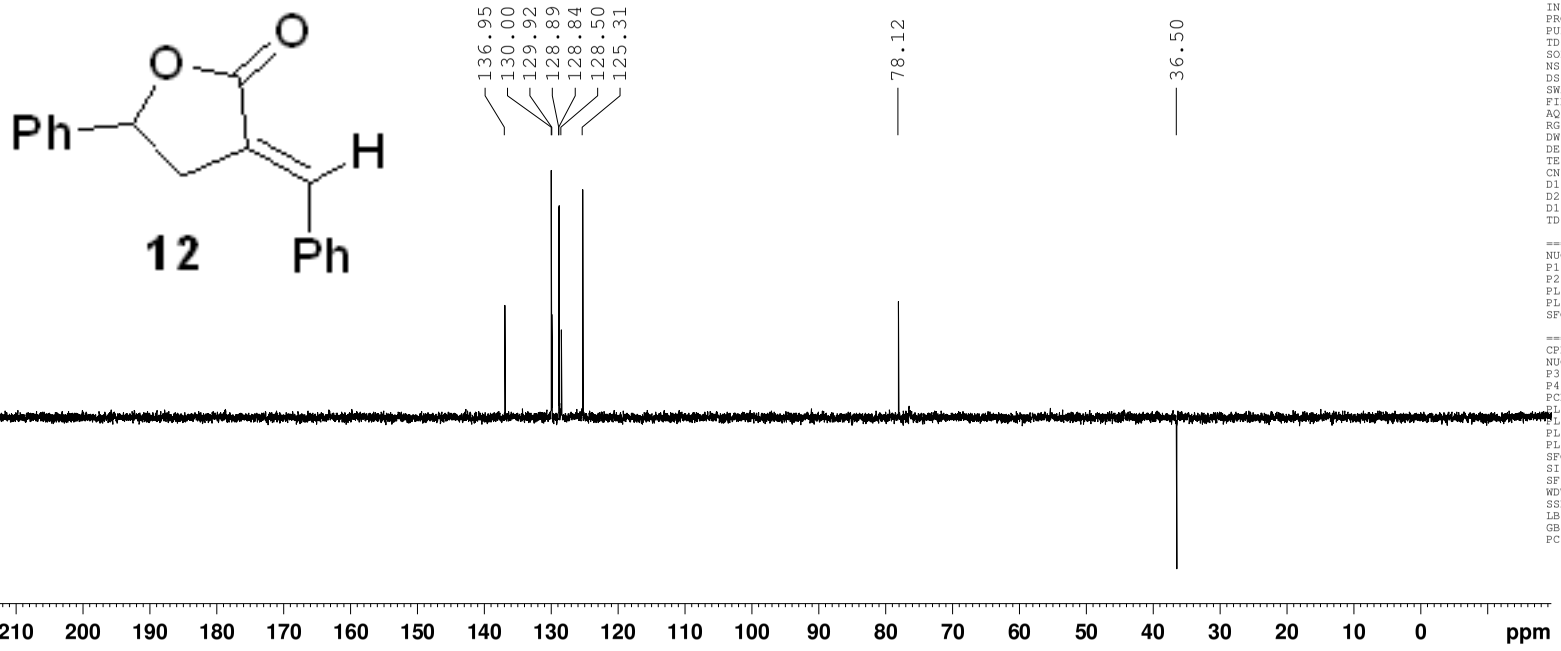


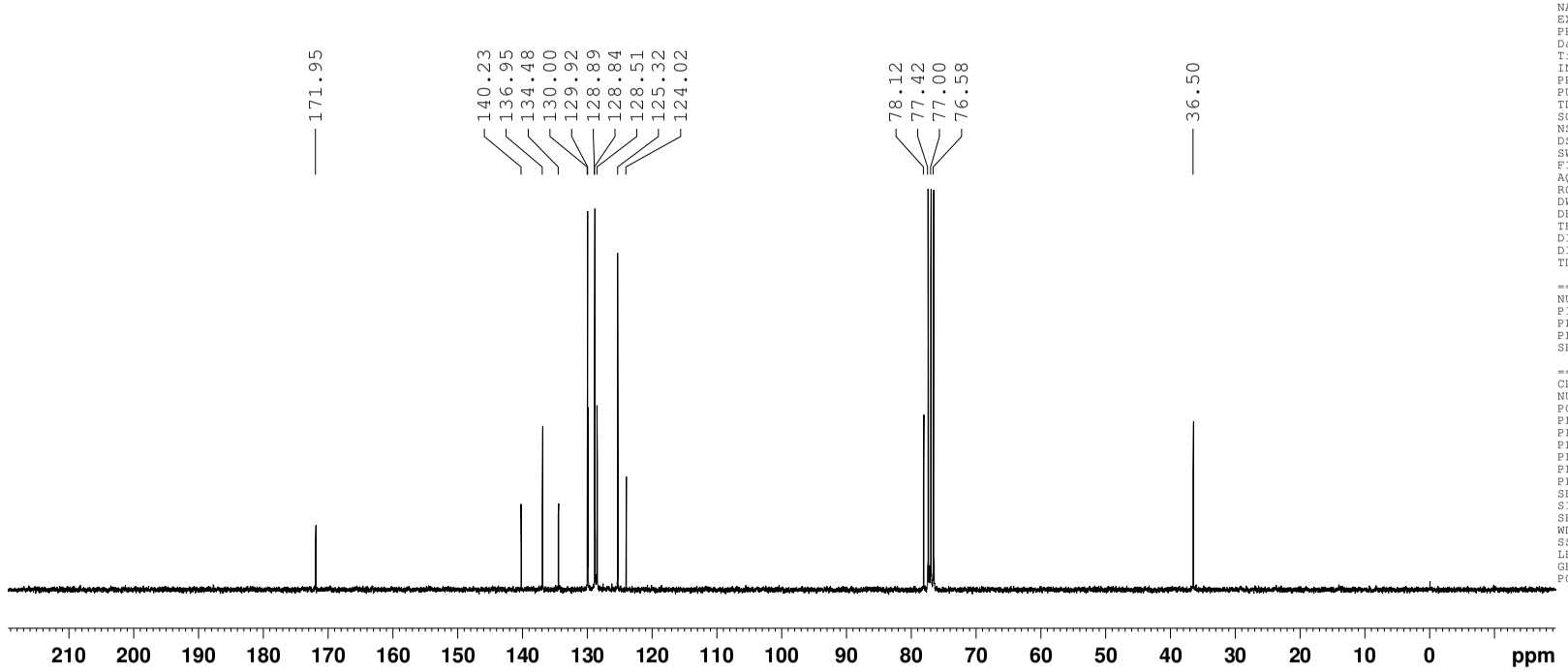
S57

```
NAME        LinL120100520
EXPNO                   1
PROCNO                  1
Date_            20100520
Time                17.59
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                       8
DS                       2
SWH              6188.119 Hz
FIDRES           0.094423 Hz
AQ               5.2953587 sec
RG                      57
DW                 80.800 usec
DE                  6.50 usec
TE                 289.4 K
D1            1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  11.80 usec
PL1                  0.00 dB
PL1W         11.55467796 W
SFO1         300.1318534 MHz
SI                   32768
SF           300.1300040 MHz
WDW                     EM
SSB                      0
LB                  0.30 Hz
GB                       0
PC                   1.00
```



NAME	LinLi20100520
EXPNO	2
PROCNO	1
Date_	20100520
Time	19.05
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	994
DS	4
SWH	18028.846 Hz
FIDRES	0.275098 Hz
AQ	1.8175818 sec
RG	203
DW	27.733 usec
DE	6.50 usec
TE	290.6 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.70 usec
PL1	0.00 dB
PL1W	29.38907051 W
SFO1	75.4752953 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	80.00 usec
PL2	1.00 dB
PL12	17.00 dB
PL13	17.00 dB
PL2W	9.17820644 W
PL12W	0.23054613 W
PL13W	0.23054613 W
SFO2	300.1312005 MHz
SI	32768
SF	75.4677530 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40


O
O
Ph
H
12
Ph
136.95
130.00
129.92
128.89
128.84
128.50
125.31
78.12
36.50
NAME LinLi20100520
EXPNO 3
PROCNO 1
Date_ 20100520
Time 19.09
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG dept135
TD 65536
SOLVENT CDCl3
NS 66
DS 0
SWH 18028.846 Hz
FIDRES 0.275098 Hz
AQ 1.8175818 sec
RG 203
DW 27.733 usec
DE 6.50 usec
TE 289.9 K
CNST2 145.0000000
D1 2.00000000 sec
D2 0.00344828 sec
D12 0.00002000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 9.70 usec
P2 19.40 usec
PL1 0.00 dB
PL1W 29.38907051 W
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
P3 13.00 usec
P4 26.00 usec
PCPD2 80.00 usec
PL2 1.00 dB
PL12 17.00 dB
PL2W 9.17820644 W
PL12W 0.23054613 W
SFO2 300.1312005 MHz
SI 32768
SF 75.4677536 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm


171.95
140.23
136.95
134.48
130.00
129.92
128.89
128.84
128.51
125.32
124.02
78.12
77.42
77.00
76.58
36.50
NAME LinLi20100520
EXPNO 2
PROCNO 1
Date_ 20100520
Time 19.05
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 994
DS 4
SWH 18028.846 Hz
FIDRES 0.275098 Hz
AQ 1.8175818 sec
RG 203
DW 27.733 usec
DE 6.50 usec
TE 290.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 9.70 usec
PL1 0.00 dB
PL1W 29.38907051 W
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 1.00 dB
PL12 17.00 dB
PL13 17.00 dB
PL2W 9.17820644 W
PL12W 0.23054613 W
PL13W 0.23054613 W
SFO2 300.1312005 MHz
SI 32768
SF 75.4677530 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm