Supporting Information

Zirconium(IV)- and Hafnium(IV)-Catalyzed Highly Enantioselective Epoxidation of Homoallylic and Bishomoallylic Alcohols

Zhi Li, and Hisashi Yamamoto*

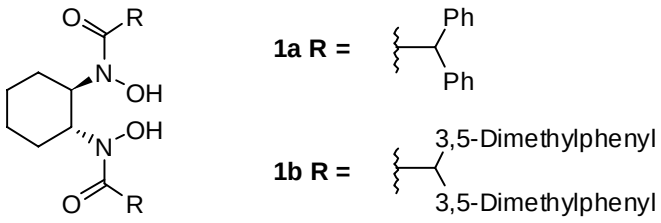
Department of Chemistry, The University of Chicago

5735 South Ellis Avenue, Chicago, IL 60637

General

Infrared (IR) spectra were recorded on a Nicolet 20 SXB FTIR. ^{1}H NMR spectra were recorded on Bruker DMX Model 500 (500 MHz) spectrometers. Chemical shift values (δ) are expressed in ppm downfield relative to internal standard (tetramethylsilane at 0 ppm). Multiplicities are indicated as s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet) and br (broad). ^{13}C NMR spectra were recorded on a Bruker DMX Model 500 (125 MHz) spectrometer and are expressed in ppm using solvent as the internal standard ($CDCl_3$ at 77.0 ppm). Analytical gas-liquid chromatography (GLC) was performed on a Shimadzu GC-17A instrument equipped with a flame ionization detector and capillary columns of β-TA (0.25mm × 20m), γ-TA (0.25mm × 20m), β-DM (0.25mm × 20m) and β-DP (0.25mm × 20m) from Chiraldex using nitrogen as carrier gas. High-performance liquid chromatography (HPLC) was performed on a Varian ProStar Series equipped with a variable wavelength detector using chiral stationary columns (Chiracel AD-H, OB-H or OD-H, 0.46 cm x 25 cm) from Daicel. Optical rotations were measured on a JASCO DIP-1000 digital polarimeter. High-resolution electro spray ionization (HRMS-ESI) mass spectra were obtained from the Mass Spectrometry Lab of University of Illinois at Urbana-Champaign.

All reactions were carried out in flame-dried glassware with nitrogen atmosphere and magnetic stirring unless otherwise noted. Analytical thin-layer chromatography (TLC) was performed on Merck pre-coated TLC plates (silica gel 60 GF254, 0.25 mm). Flash chromatography was performed on silica gel E. Merck 9385 or silica gel 60 extra pure (for all the bis-hydroxamic acids). Dichloromethane (CH_2Cl_2) and toluene ($PhCH_3$) were purchased from J.T.Baker as Low water and purified with MBRAUN MB-SPS Solvent Purifier System prior to use. $Zr(OtBu)_4$ and $Hf(OtBu)_4$ were purchased from Strem and stored and handled in the glove box. Powdered molecular sieves were purchased from Sigma-Aldrich and activated with microwave oven. 1,3-Dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone (DMPU) was purchased from Sigma-Aldrich and distilled from CaH_2 prior to use. Homoallylic alcohols and products in Tables 1 and 2 have been previously isolated and characterized. References can be found elsewhere. All other reagents and starting materials, unless otherwise noted, were purchased from commercial vendors and used without further purification.

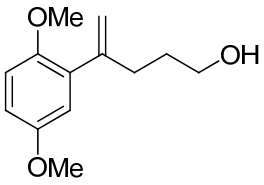


Bishydroxamic Acid (BHA)

Preparation of Ligands 1a and 1b: Refer to previous reports of our group.[1-3] They are commercially available in both enantiomer forms.

Preparation of substrates

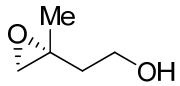
Substrates **2a**, **2b**, **2g**, **2h**, **2i** and **4h** were purchased from commercial vendors and stored on 4Å molecular sieves pellets after received. Substrates **2c**,[4] **2d**,[5] **2e**,[4] **2f**,[6] **2j**[5] **4a-4c,**[7] **4d**,[8, 9] **4e-4g**[7] were synthesized according to reported procedures.



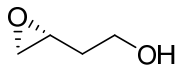
4-(2,5-dimethoxyphenyl)pent-4-en-1-ol (4e): Yield 54%. ^{1}H NMR (500 MHz, $CDCl_3$): δ 6.82-6.70 (m, 3 H), 5.17 (d, *J* = 1 Hz, 1 H), 5.05 (d, *J* = 1.5 Hz, 1 H), 3.77 (s, 6 H), 3.64 (m, 2 H), 2.56 (t, *J* = 7.5 Hz, 2 H), 1.64 (m, 2 H), 1.50 (br, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 153.5, 150.7, 148.0, 132.9, 116.3, 114.7, 112.4, 111.9, 62.5, 56.2, 55.7, 32.5, 31.0; $[M+H]^+$: $C_{13}H_{19}O_3^+$, calc. 223.1334, found 223.1330.

General procedure for asymmetric epoxidation of homoallylic alcohols.
$[Zr(OtBu)_4]$ (4.0 μL, 0.0100 mmol) or $[Hf(OtBu)_4]$ (4.0 μL, 0.0099 mmol) was added to a mixture of **1a** (5.4 mg, 0.0101 mmol), DMPU (2.6mg, 0.0203mmol), and 4Å molecular sieves powder (100mg) in toluene (0.5 mL). The catalyst mixture was stirred for 1h at RT. The resulting solution was cooled to 0 °C, and 3-methyl-3-buten-1-ol (**2a**) (43.0 mg, 0.50 mmol) and 80% cumene hydroperoxide (0.13 mL, 0.75 mmol) were added sequentially. The mixture was stirred at 0 °C for 4 h, then warmed to RT, and stirred for the next 36 hr. Methanol was then added, and the reaction mixture was stirred for 10 min at RT. The mixture was purified by flash column chromatography on silica gel to provide the epoxy alcohol **3a** (81%, 97% ee). A solution of 50% ethyl ether in pentane was used as chromatography eluent. Evaporation of solvents should be carefully carried out under 0 °C because **3a** is a volatile liquid. The same measures were performed in purification of **3b**. In all other cases, different ration of hexanes and ethyl acetate mixture solutions were used as eluents.

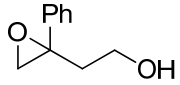
General procedure for asymmetric epoxidation of bishomoallylic alcohols.
$[Zr(OtBu)_4]$ (4.0 μL, 0.0100 mmol) or $[Hf(OtBu)_4]$ (4.0 μL, 0.0099 mmol) was added to a mixture of **1a** (5.4 mg, 0.0101 mmol), DMPU (2.6mg, 0.0203mmol), and corresponding molecular sieves powder (100mg) in toluene (0.5 mL). The catalyst mixture was stirred for 1h at RT. 4-phenyl-4-penten-1-ol (**4a**) (16.2 mg, 0.10 mmol) and 80% cumene hydroperoxide (0.025 mL, 0.15 mmol) were added sequentially. The mixture was stirred at RT for 48 h. Methanol was then added, and the reaction mixture was stirred for 10 min. The mixture was purified by flash column chromatography on silica gel with 1% triethylamine in 5:1 hexanes/ethyl acetate solution to provide the epoxy alcohol **5a** (75%, 99% ee). A solution of 15% ethyl ether in pentane was used as chromatography eluent when purifying **6h**. Evaporation of solvents should be carefully carried out under 0 °C because it is a volatile liquid.



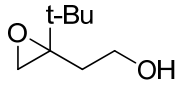
(*R*)-2-(2-methyloxiran-2-yl)ethanol (3a): Reaction time 40 hr, yield 61% ee 91% with Zr-BHA, yield 81% ee 97% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.79-3.67 (m, 2 H), 2.83 (d, *J* = 4.5 Hz, 1 H), 2.65 (d, *J* = 4.5 Hz, 1 H), 2.12 (m, 1 H), 2.00-1.94 (m, 1 H), 1.90-1.84 (m, 1 H), 1.39 (s, 3 H); It is consistent with literature value.[1] Optical rotation: $[\alpha]_D^{23}$ –7.9°(*c* 0.92, $CHCl_3$) (97% ee); Chiral GC (Chiraldex γ-TA): Condition: injection temperature 100 °C, column temp. = 70°C, injection pressure = 100 kpa, detector temperature 250 °C; result: 8.0min (major), 10.0min (minor).



(*R*)-2-(oxiran-2-yl)ethanol (3b): Reaction time 40 hr, yield 37% ee 63% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.81 (t, *J* = 6.0 Hz, 2 H), 3.13-3.10 (m, 1 H), 2.82 (t, *J* = 4.5 Hz, 1 H), 2.60 (m, 1 H), 2.02-1.97 (m, 1 C*H*$_2$ and 1 O*H*), 1.73-1.70 (m, 1 H); It is consistent with literature value.[10] Optical rotation: $[\alpha]_D^{24}$ +4.2°(*c* 0.74, $CHCl_3$) (63% ee);[11] Chiral GC (Chiraldex γ-TA): Condition: injection temperature 100 °C, column temp. = 70 °C, injection pressure = 100 kpa, detector temperature 250 °C; result: 6.5 min (major), 7.3 min (minor).

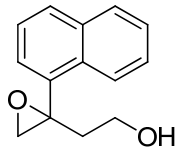


2-(2-phenyloxiran-2-yl)ethanol (3c): Reaction time 40 hr, yield 67% ee 92% with Zr-BHA, yield 69% ee 98% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.40-7.28 (m, 5 H), 3.78-3.70 (m, 2 H), 3.13 (d, *J* = 5.0 Hz, 2 H), 2.78 (d, *J* = 5.0 Hz, 1 H), 2.54-2.48 (m, 1 H), 2.15-2.09 (m, 1 H), 2.00 (t, *J* = 5.5 Hz, 1 H); It is consistent with literature value.[12] Optical rotation: $[\alpha]_D^{27}$ +12.2°(*c* 0.67, $CHCl_3$) (92% ee); Chiral HPLC (Chiracel AD-H): Condition: 95:5 Hexanes/2-Propanol, flow rate 1.0mL/min; result: 13.9 min (minor), 14.7 min (major).

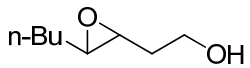


2-(2-*tert*-butyloxiran-2-yl)ethanol(3d): Reaction time 40 hr, yield 67% ee 63% with Zr-BHA, yield 70% ee 71% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.60-3.55 (m, 2 H), 2.88 (d, *J* = 3.8 Hz, 1 H), 2.83 (d, *J* = 3.8 Hz, 1 H), 2.55-2.52 (m, 1 H), 2.27-2.20 (m,

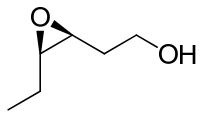
1 H), 1.97-1.91 (m, 1 H), 0.95 (s, 9 H). ^{13}C NMR (125 MHz, $CDCl_3$): δ 64.0, 58.8, 48.3, 33.8, 30.2, 25.6; [M+Na]+: $C_8H_{16}O_2Na$, calc. 167.1048, found 167.1044; Optical rotation: $[\alpha]_D^{27}$ +20.6°(*c* 0.88, $CHCl_3$) (71% ee); Chiral GC (Chiraldex β-DP): Condition: injection temperature 120 °C, column temperature 90 °C, column pressure 100 kPa, detector temperature 250 °C; result: 16.3 min (major), 17.9 min (minor).



2-(2-(naphthalen-1-yl)oxiran-2-yl)ethanol(3e): Reaction time 40 hr, yield 31%, ee 91% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.11 (d, *J* = 7.1 Hz, 1 H), 7.88 (d, *J* = 7.5 Hz, 1H), 7.82 (d, *J* = 8.2 Hz, 1 H), 7.60-7.44 (m, 4 H), 3.77-3.65 (m, 2 H), 3.33 (d, *J* = 5.0 Hz, 1 H), 2.98 (d, *J* = 5.0 Hz, 1 H), 2.46-2.41 (m, 1 H), 2.30-2.24 (m, 1 H), 2.15 (br, 1H). It is consistent with literature value.[13] Chiral HPLC (Chiracel AD-H): Condition: 95:5 Hexanes/2-Propanol, flow rate 0.5mL/min; result: 36.2 min (major), 37.9 min (minor).

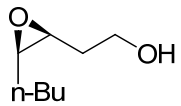


2-(3-butyloxiran-2-yl)ethanol(3f): Reaction time 40 hr, yield 47% ee 73% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.81-3.75 (m, 2 H), 2.88-2.85 (m, 1 H), 2.82-2.79 (m, 1 H), 2.03-1.96 (m, 1 H), 1.85 (br, 1 H), 1.75-1.65 (m, 1 H), 1.57-1.52 (m, 2 H), 1.45-1.34 (m, 4 H), 0.92 (t, *J* = 7.1 Hz, 3 H). ^{13}C NMR (125 MHz, $CDCl_3$): δ 60.1, 58.2, 56.9, 34.1, 31.6, 28.1, 22.5, 14.0; [M+Na]+: $C_8H_{16}O_2Na$, calc. 167.1048, found 167.1048; Optical rotation: $[\alpha]_D^{26}$ +30.8°(*c* 0.66, $CHCl_3$) (71% ee); Chiral GC (Chiraldex β-DP): Condition: injection temperature 120 °C, column temperature 80 °C for 60 min, and then heat to 100 °C on the rate of 2 °C/min, column pressure 100 kPa, detector temperature 250 °C; result: 81.9 min (minor), 82.9 min (major).

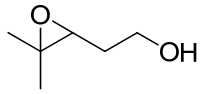


2-((2*S*,3*R*)-3-ethyloxiran-2-yl)ethanol(3g): Reaction time 40 hr, yield 45%, ee 93% with Zr-BHA, yield 82% ee 94% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.91-3.85 (m, 2 H), 3.13-3.10 (m, 1 H), 2.95-2.92 (m, 1 H), 1.92-1.86 (m, 1 H), 1.76-1.66 (m, 2 H (including 1 O*H*)), 1.65-1.49 (m, 2 H), 1.06 (t, *J* = 7.5 Hz, 3 H); It is consistent with literature value.[2] Optical rotation: $[\alpha]_D^{25}$ –28.3°(*c* 0.90, $CHCl_3$) (93% ee);[11] Chiral GC

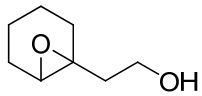
(Chiraldex γ-TA)[2]: Condition: injection temperature 120 °C, column temperature 90 °C, column pressure 100 kPa, detector temperature 250 °C; result: 7.8 min (major), 8.8 min (minor).



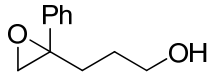
2-((2*S*,3*R*)-3-butyloxiran-2-yl)ethanol(3h): Reaction time 40 hr, yield 80% ee 92% with Zr-BHA, yield 83% ee 96% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.92-3.84 (m, 2 H), 3.12-3.09 (m, 1 H), 2.97-2.94 (m, 1 H), 1.94-1.86 (m, 1 H), 1.79 (br, 1 H), 1.76-1.67 (m, 1 H), 1.60-1.36 (m, 6 H), 0.93 (t, *J* = 6.5 Hz, 3 H); It is consistent with literature value.[2] Optical rotation: $[\alpha]_D^{25}$ −19.7°(*c* 0.74, $CHCl_3$) (95% ee); Chiral GC (Chiraldex γ-TA): Condition: injection temperature 120 °C, column temperature 80 °C, column pressure 100 kPa, detector temperature 250 °C; result: 44.6 min (major), 50.0 min (minor).



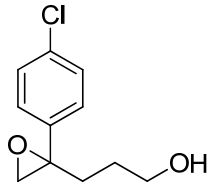
2-(3,3-dimethyloxiran-2-yl)ethanol(3i): Reaction time 40 hr, yield 41% ee 71% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.91-3.82 (m, 2 H), 2.93-2.90 (m, 1 H), 1.96-1.87 (m, 1 H), 1.79-1.69 (m, 2 H (including 1 O*H*)), 1.34 (s, 3 H), 1.30 (s, 3 H); It is consistent with literature value.[10] Chiral GC (Chiraldex γ-TA)[13]: Condition: injection temperature 100 °C, column temperature 70 °C, column pressure 100 kPa, detector temperature 250 °C; result: 17.0 min (major), 19.6 min (minor).



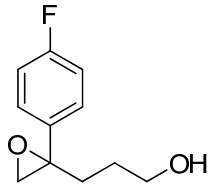
2-(7-oxabicyclo[4.1.0]heptan-1-yl)ethanol(3j): Reaction time 40 hr, yield 72% ee 76% with Zr-BHA, yield 81% ee 89% with Hf-BHA; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.77-3.70 (m, 2 H), 3.19 (d, *J* = 3.0 Hz, 1 H), 2.32-2.30 (m, 1 H), 2.03-1.69 (m, 6 H), 1.50-1.39 (m, 2 H), 1.35-1.19 (m, 2 H); It is consistent with literature value.[14] Optical rotation: $[\alpha]_D^{26}$ +23.7°(*c* 0.95, $CHCl_3$) (87% ee); Chiral GC (Chiraldex β-DP): Condition: injection temperature 130 °C, column temperature 110 °C, column pressure 100 kPa, detector temperature 250 °C; result: 21.7 min (minor), 22.4 min (major).



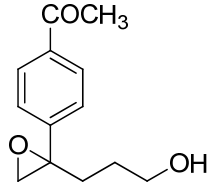
3-(2-phenyloxiran-2-yl)propan-1-ol(5a): Reaction time 48 hr. Yield 75%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.40-7.26 (m, 5 H), 3.67-3.63 (m, 2 H), 3.01 (d, *J* = 5.0 Hz, 1 H), 2.76 (d, *J* = 5.5 Hz, 1 H), 2.45-2.40 (m, 1 H), 1.80-1.74 (m, 1 H), 1.68-1.63 (m, 3 H (including 1 O*H*)); It is consistent with literature value.[15] 99% e.e., Optical rotation: $[\alpha]_D^{28}$ –3.4°(*c* 0.68, $CHCl_3$) (97% ee); Chiral HPLC (Chiracel OB-H): Condition: 95:5 Hexanes/2-Propanol, flow rate 1.0 mL/min; result: 15.6 min (major), 26.6 min (minor).



3-(2-(4-chlorophenyl)oxiran-2-yl)propan-1-ol(5b): Reaction time 48 hr. Yield 57%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.31 (apparent singlet, 4 H), 3.65-3.61 (m, 2 H), 3.00 (d, *J* = 5.0 Hz, 1 H), 2.72 (d, *J* = 5.0 Hz, 1 H), 2.43-2.36 (m, 1 H), 1.79-1.72 (m, 2 H (including 1 O*H*)), 1.66-1.59 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 138.1, 133.3, 128.6, 127.3, 62.2, 59.7, 56.1, 31.5, 27.7; $[M+Na]^+$: $C_{11}H_{13}ClO_2Na$, calc. 235.0502, found 235.0498; 97% e.e.; Chiral HPLC (Chiracel OB-H): Condition: 99:1 Hexanes/2-Propanol, flow rate 1.0 mL/min; result: 59.9 min (minor), 64.9 min (major).

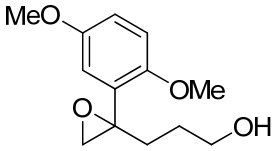


3-(2-(4-fluorophenyl)oxiran-2-yl)propan-1-ol(5c): Reaction time 48 hr. Yield 73%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.36-7.33 (m, 2 H), 7.05-7.00 (m, 2 H), 3.64 (t, *J* = 6.3 Hz, 2 H), 3.00 (d, *J* = 5.5 Hz, 1 H), 2.73 (d, *J* = 5.0 Hz, 1 H), 2.42-2.35 (m, 1 H), 1.80-1.73 (m, 1 H), 1.66-1.57 (m, 3 H (including 1 O*H*)); ^{13}C NMR (125 MHz, $CDCl_3$): δ 127.6, 127.6, 115.4, 115.2, 62.2, 59.7, 56.1, 31.7, 27.8; $[M+Na]^+$: $C_{11}H_{13}FO_2Na$, calc. 219.0797, found 219.0788; 97% e.e.; Chiral HPLC (Chiracel OB-H): Condition: 95:5 Hexanes/2-Propanol, flow rate 1.0 mL/min; result: 17.2 min (minor), 19.7 min (major).

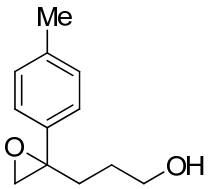


1-(4-(2-(3-hydroxypropyl)oxiran-2-yl)phenyl)ethanone (5d): Reaction time 48 hr.

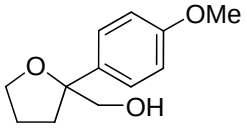
Yield 79%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.94-7.92 (m, 2 H), 7.48-7.45 (m, 2 H), 3.65-3.62 (m, 2 H), 3.04 (d, *J* = 5.5 Hz, 1 H), 2.73 (d, *J* = 5.5 Hz, 1 H), 2.59 (s, 3 H), 2.49-2.44 (m, 1 H), 1.80-1.74 (m, 1 H), 1.66-1.60 (m, 2 H (including 1 O*H*)); ^{13}C NMR (125 MHz, $CDCl_3$): δ 197.6, 145.0, 136.4, 128.5, 126.0, 62.2, 59.9, 56.2, 31.3, 27.7, 26.6; 97% e.e.; Chiral HPLC (Chiracel OB-H): Condition: 95:5 Hexanes/2-Propanol, flow rate 1.0 mL/min; result: 37.3 min (major), 43.5 min (minor).



3-(2-(2,5-dimethoxyphenyl)oxiran-2-yl)propan-1-ol(5e): Yield 25%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 6.94-6.92 (m, 1 H), 6.79-6.78 (m, 2 H), 3.81 (s, 3 H), 3.77 (s, 3 H), 3.67-3.60 (m, 2 H), 2.99 (d, *J* = 5.0 Hz, 1 H), 2.76 (d, *J* = 5.0 Hz, 1 H), 2.35-2.28 (m, 1 H), 1.75-1.68 (m, 1 H), 1.64-1.56 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 129.2, 127.9, 116.1, 113.9, 113.5, 111.4, 62.7, 59.2, 55.8, 55.8, 54.5, 32.0, 28.0; $[M+Na]^+$: $C_{13}H_{18}O_4Na$, calc. 261.1103, found 261.1108; 97% e.e.; Chiral HPLC (Chiracel OB-H): Condition: 95:5 Hexanes/2-Propanol, flow rate 1.0 mL/min; result: 32.7 min (minor), 36.7 min (major).

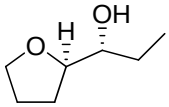


3-(2-p-tolyloxiran-2-yl)propan-1-ol(5f): Reaction time 48 hr. Yield 53%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.29-7.24 (m, 2 H), 7.16-7.14 (m, 2 H), 3.65-3.61 (m, 2 H), 2.98 (d, *J* = 5.5 Hz, 1 H), 2.74 (d, *J* = 5.5 Hz, 1 H), 2.42-2.36 (m, 1 H), 2.34 (s, 3 H), 1.79-1.73 (m, 2 H (including 1 O*H*)), 1.66-1.61 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 137.2, 136.5, 129.1, 125.7, 62.3, 60.0, 56.1, 31.8, 27.9; $[M+Na]^+$: $C_{12}H_{16}O_2Na$, calc. 215.1048, found 215.1045; 97% e.e.; Chiral HPLC (Chiracel OB-H): Condition: 98:2 Hexanes/2-Propanol, flow rate 1.0 mL/min; result: 28.8 min (minor), 30.1 min (major).



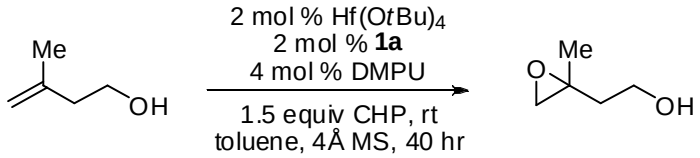
(2-(4-methoxyphenyl)tetrahydrofuran-2-yl)methanol(6g): Reaction time 48 hr, yield 47%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.31-7.28 (m, 2 H), 6.90-6.86 (m, 2 H), 4.02-3.97 (m, 1 H), 3.94-3.89 (m, 1 H), 3.79 (s, 3 H), 3.65-3.57 (m, 2 H), 2.34-2.27 (m, 1 H), 2.10-2.04 (m, 1 H), 2.00-1.93 (m, 2 H (including 1 O*H*)), 1.88-1.81 (m, 1 H); ^{13}C NMR (125

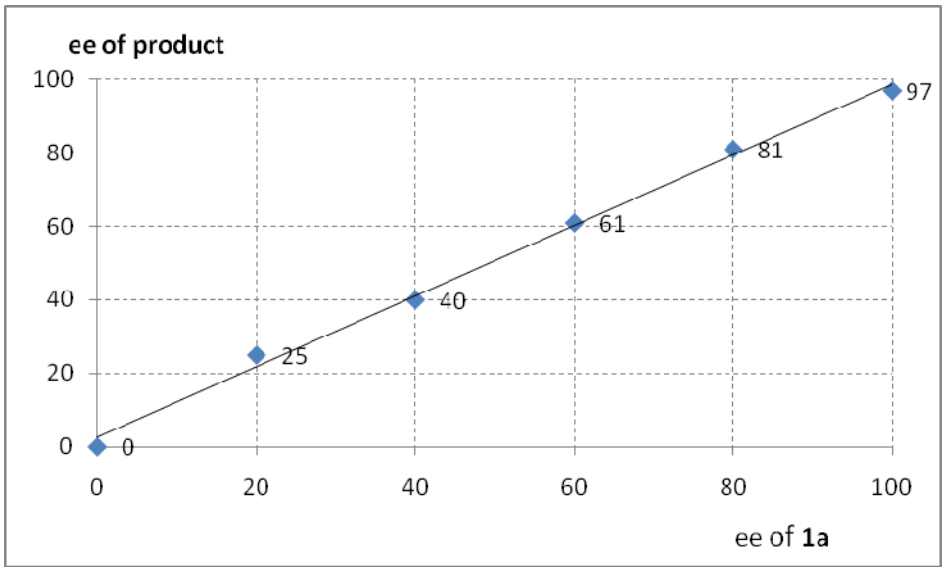
MHz, $CDCl_3$): δ 158.6, 136.2, 126.5, 113.7, 87.0, 69.1, 68.3, 55.3, 33.9, 26.1; 59% e.e.; Chiral HPLC (Chiracel OD-H): Condition: 95:5 Hexanes/2-Propanol, flow rate 1.0 mL/min; result: 9.4 min (major), 12.1 min (minor).



(*R*)-1-((*R*)-tetrahydrofuran-2-yl)propan-1-ol(6h): Reaction time 72 hr; Yield 41%; ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.86-3.73 (m, 3 H), 3.35-3.30 (m, 1 H), 2.18 (br, 1 H), 1.97-1.89 (m, 3 H), 1.67-1.60 (m, 1 H), 1.57-1.41 (m, 2 H), 1.01 (t, 3 H, J = 7.5 Hz); It is consistent with literature value.[16] 95% e.e.; Chiral GC (Chiraldex γ-TA): Condition: injection temperature 100 °C, column temp. = 60 °C, injection pressure = 80 kpa, detector temperature 250 °C; result: 19.5min (minor), 20.6 min (major). Retention time of diastereomer **6h**': 20.9 min.

Results of non-linear effect experiment:





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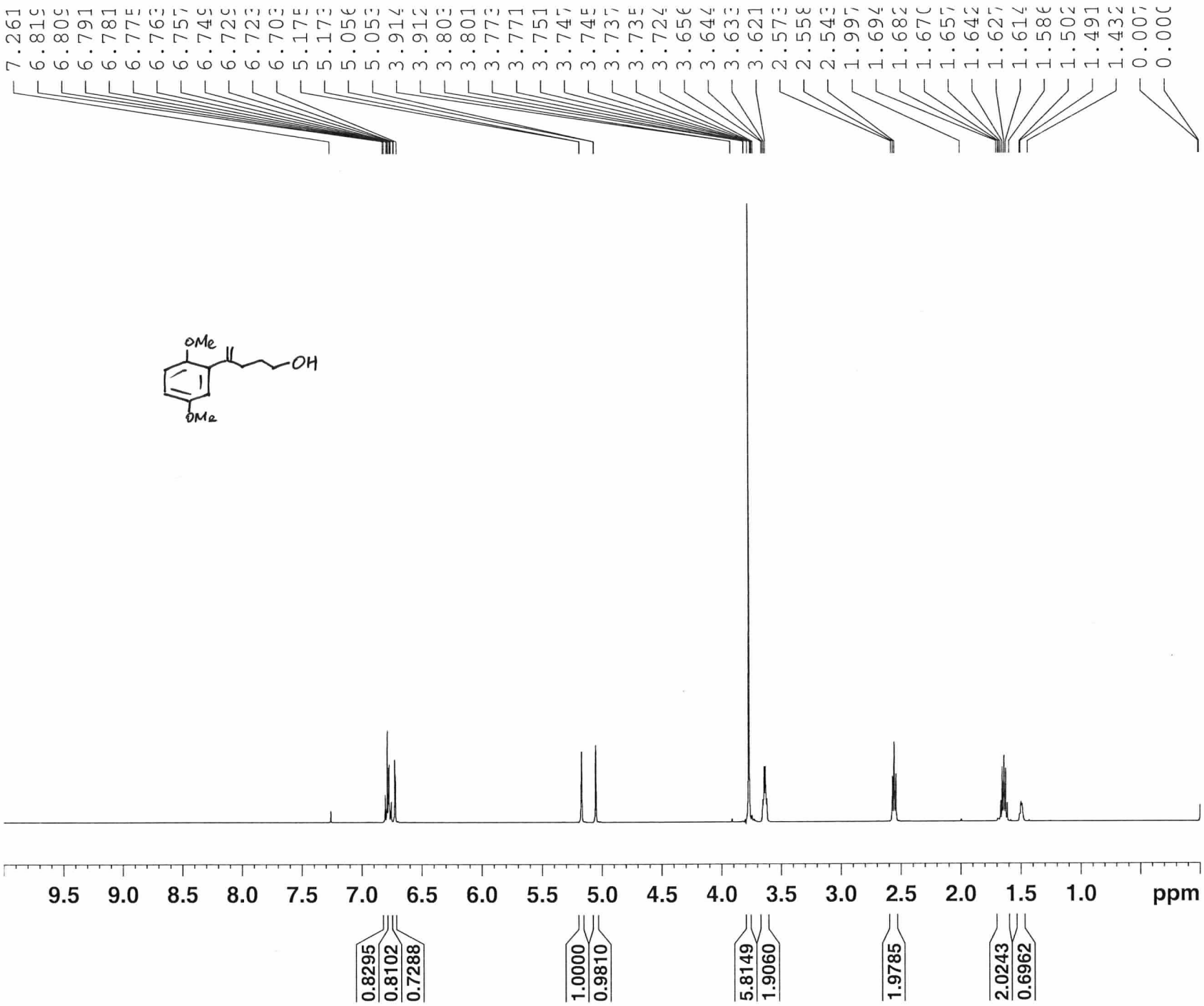


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Current Data Parameters
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EXPNO                          1
PROCNO                         1

F2 - Acquisition Parameter
Date_                   20100107
Time                       21.18
INSTRUM                    spect
PROBHD   5 mm PABBI 1H/
PULPROG                       zg
TD                         59998
SOLVENT                    CDCl3
NS                             8
DS                             0
SWH                 10000.000 Hz
FIDRES                0.166672 Hz
AQ                    2.9999499 se
RG                            32
DW                       50.000 us
DE                        7.50 us
TE                       295.0 K
D1                  1.00000000 se
TD0                            1

======== CHANNEL f1 ======
NUC1                          1H
P1                        5.35 us
PL1                       0.00 dB
SFO1                499.8729992 MH

F2 - Processing parameters
SI                         32768
SF                  499.8700172 MH
WDW                           EM
SSB                            0
LB                        0.30 Hz
GB                             0
PC                         1.00
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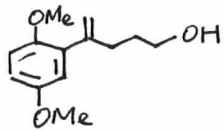
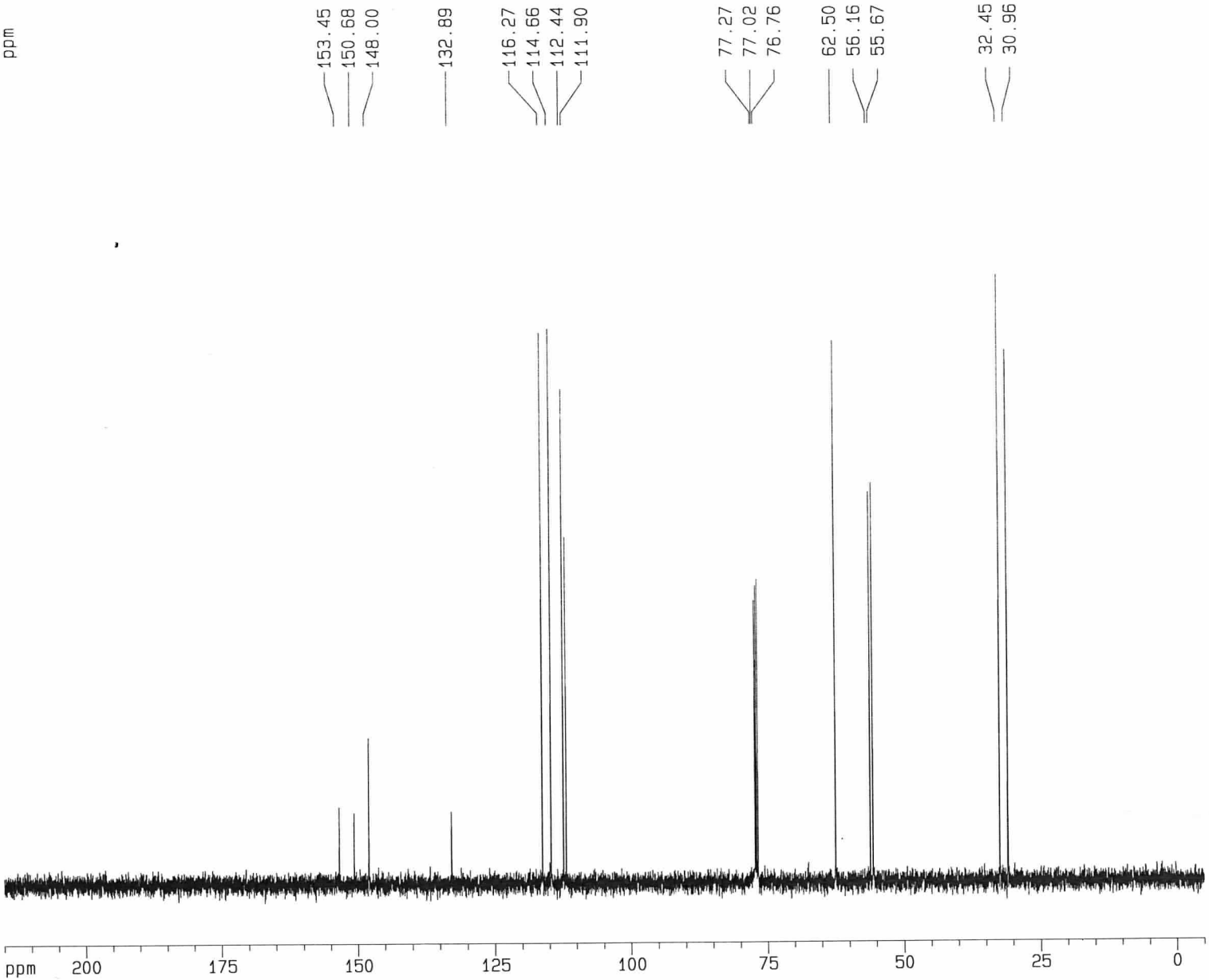




Current Data Parameters

NAME	ZL7R316C167A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100108
Time	22.48
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zgdc
TD	75184
SOLVENT	CDCl3
NS	134
DS	0
SWH	37593.984 Hz
FIDRES	0.500026 Hz
AQ	0.9999972 sec
RG	4096
DW	13.300 usec
DE	7.50 usec
TE	300.0 K
D1	0.10000000 sec
d11	0.03000000 sec

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

NUC1	13C
P1	4.60 usec
PL1	0.00 dB
SFO1	125.7690572 MHz

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

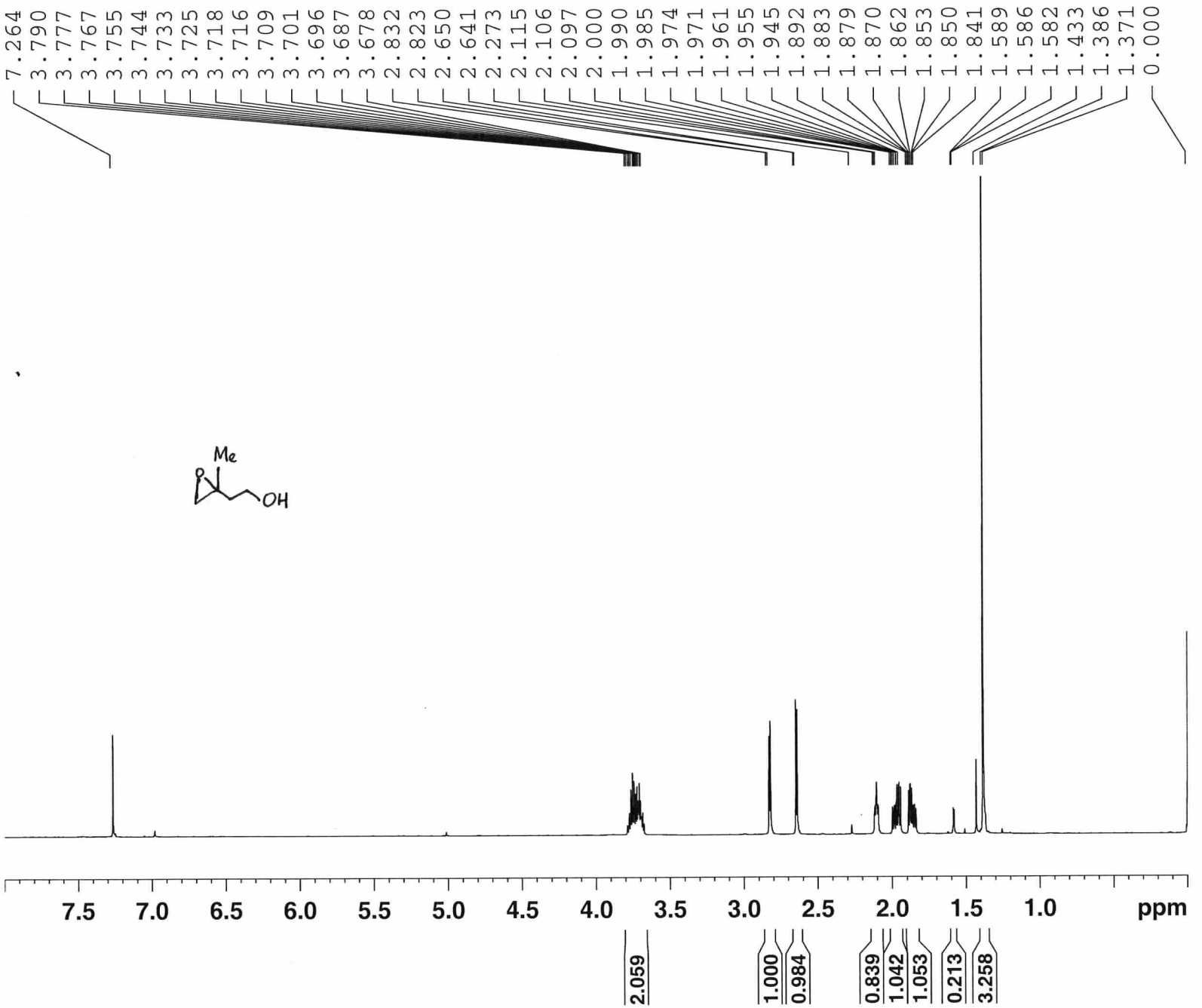
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	120.00 dB
PL12	19.00 dB
SFO2	500.1320005 MHz

F2 - Processing parameters

SI	32768
SF	125.7577941 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	215.000 ppm
F1	27037.92 Hz
F2P	-5.000 ppm
F2	-628.79 Hz
PPMCM	11.00000 ppm/cm
HZCM	1383.33582 Hz/cm

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Current Data Parameters
NAME        ZL6R212H136A
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameter
Date_           20090415
Time               18.22
INSTRUM            spect
PROBHD   5 mm PABBI 1H/
PULPROG               zg
TD                 59998
SOLVENT            CDCl3
NS                     8
DS                     0
SWH          10000.000 Hz
FIDRES        0.166672 Hz
AQ            2.9999499 se
RG                   256
DW              50.000 us
DE               7.50 us
TE              295.6 K
D1          1.00000000 se
TD0                    1

======== CHANNEL f1 ======
NUC1                  1H
P1                 5.35 us
PL1                0.00 dB
SFO1       499.8729992 MH

F2 - Processing parameters
SI                 32768
SF         499.8700151 MH
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                 1.00
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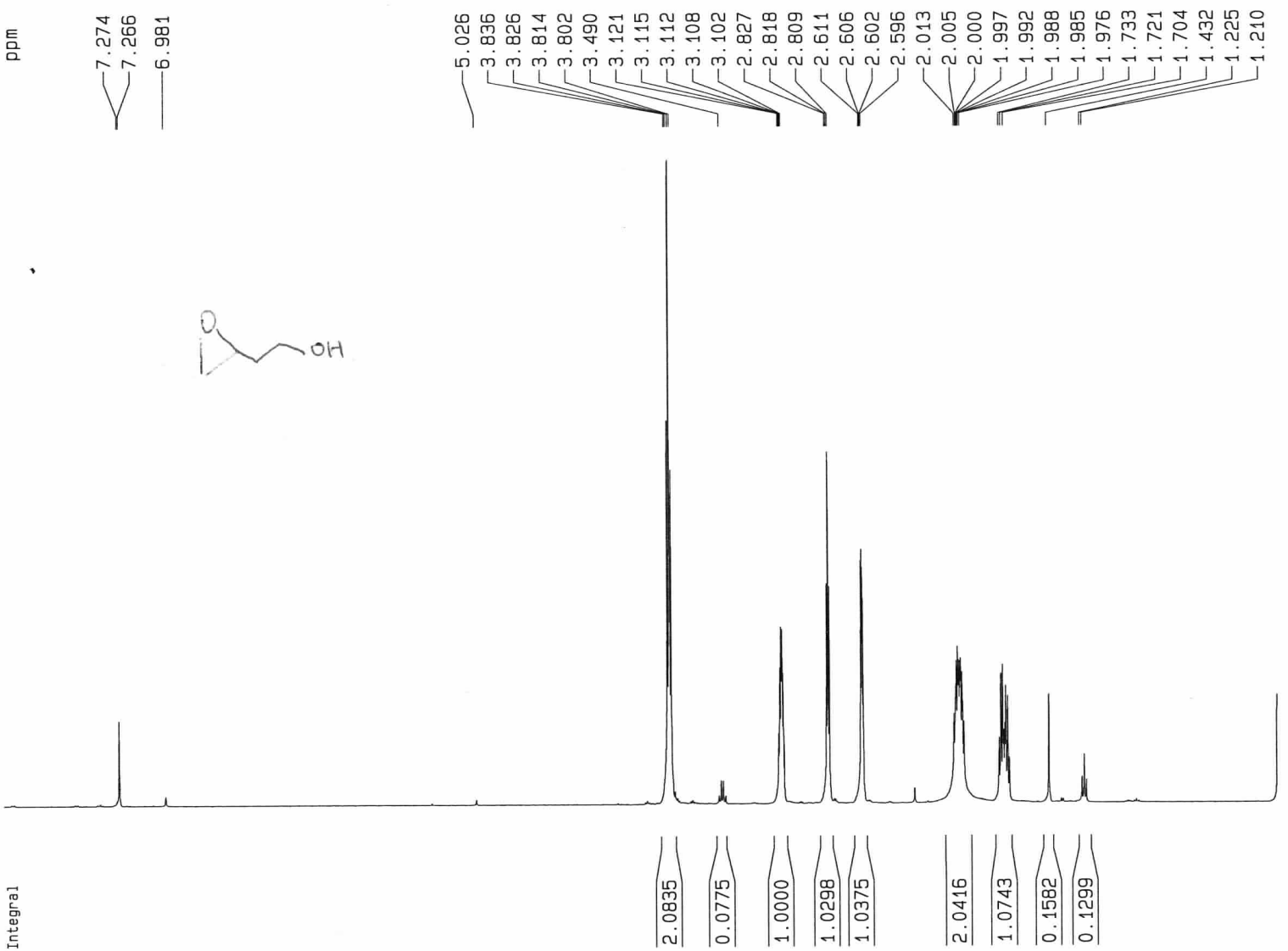


Current Data Parameters

NAME	ZL6R242H146B
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20090414
Time	18.25
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	128
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

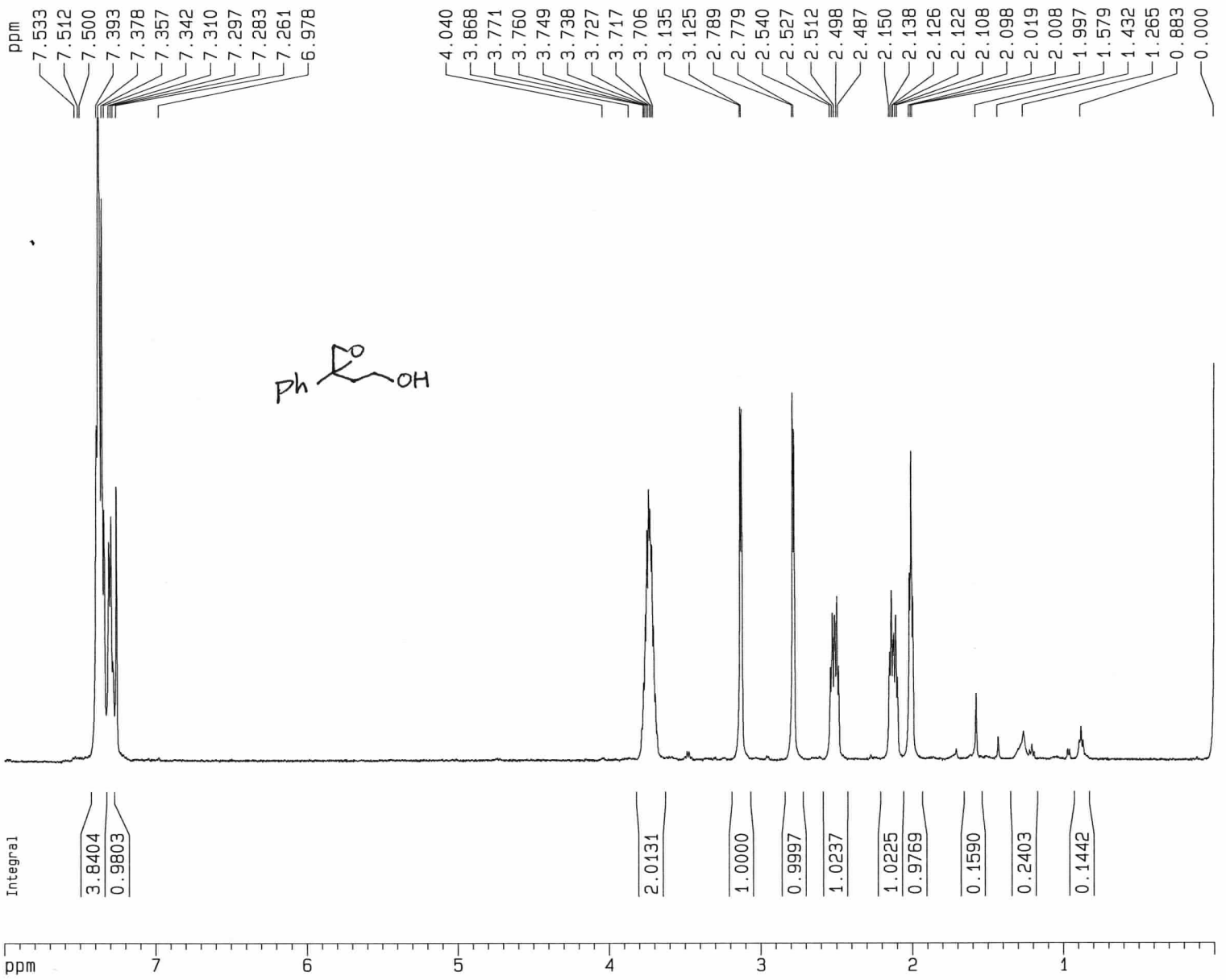
NUC1	1H
P1	9.50 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300068 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm



Current Data Parameters

NAME	ZL6R243H149A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20090420
Time	12.56
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	256
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

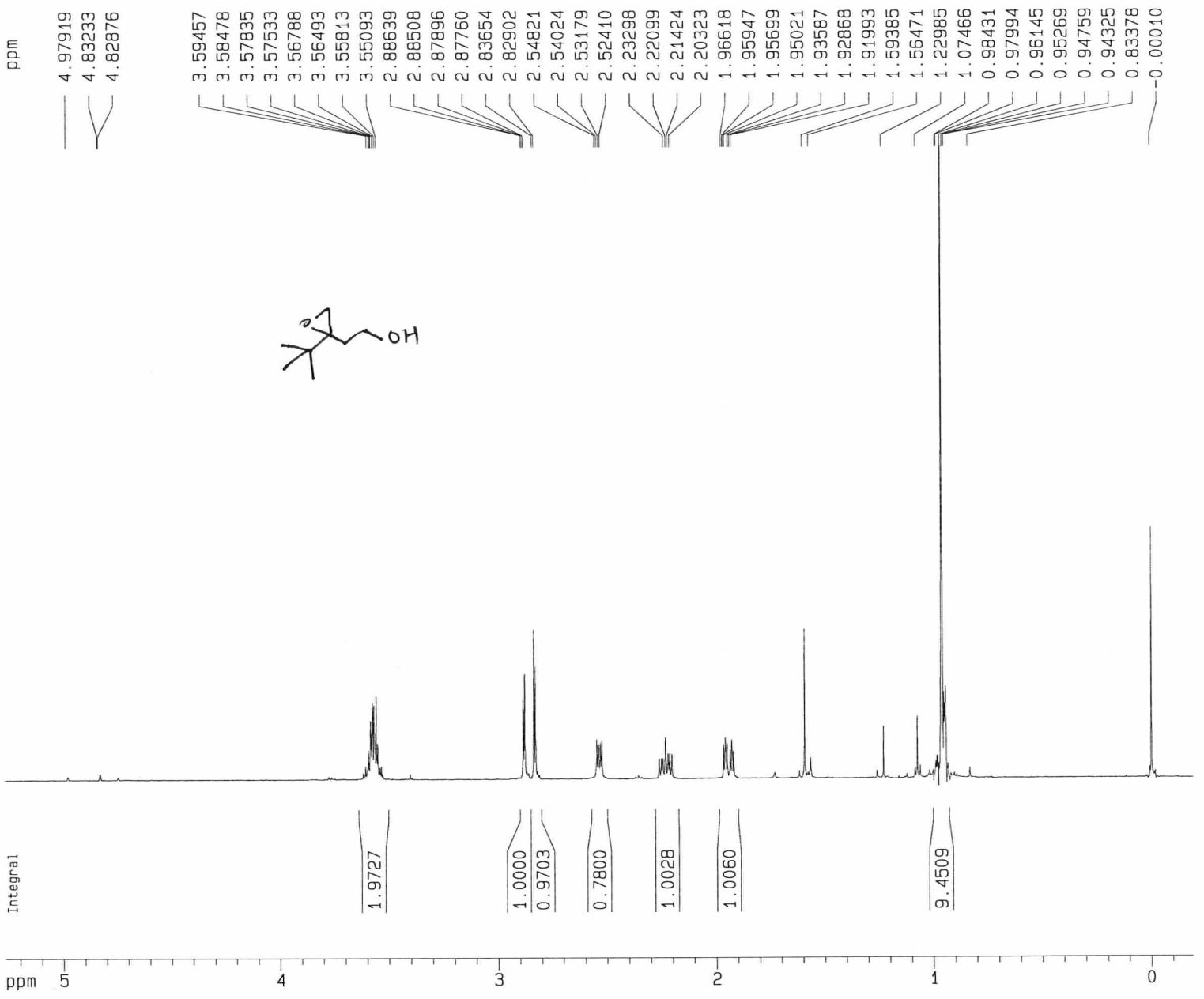
NUC1	1H
P1	9.50 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300143 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm



Current Data Parameters

NAME	ZL7R279H095A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100128
Time	23.54
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	Aceton
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	256
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

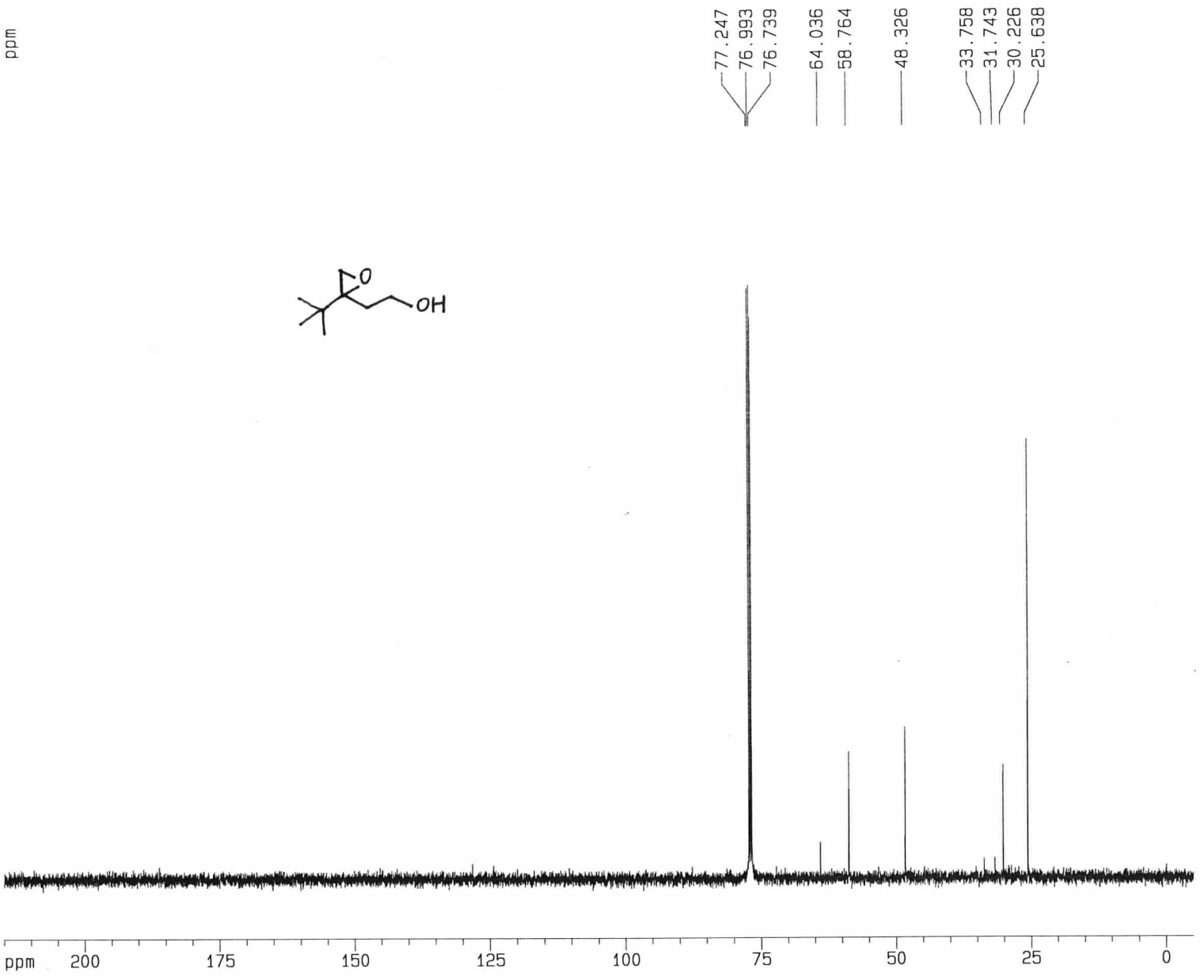
NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300124 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	5.269 ppm
F1	2635.29 Hz
F2P	-0.191 ppm
F2	-95.54 Hz
PPMCM	0.27301 ppm/cm
HZCM	136.54134 Hz/cm



Current Data Parameters

NAME	ZL7R279C095A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

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Time	23.21
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PULPROG	zgdc
TD	75184
SOLVENT	CDCl3
NS	2048
DS	0
SWH	37593.984 Hz
FIDRES	0.500026 Hz
AQ	0.9999972 sec
RG	8192
DW	13.300 usec
DE	7.50 usec
TE	300.0 K
D1	0.10000000 sec
d11	0.03000000 sec

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

NUC1	13C
P1	4.60 usec
PL1	0.00 dB
SFO1	125.7690572 MHz

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

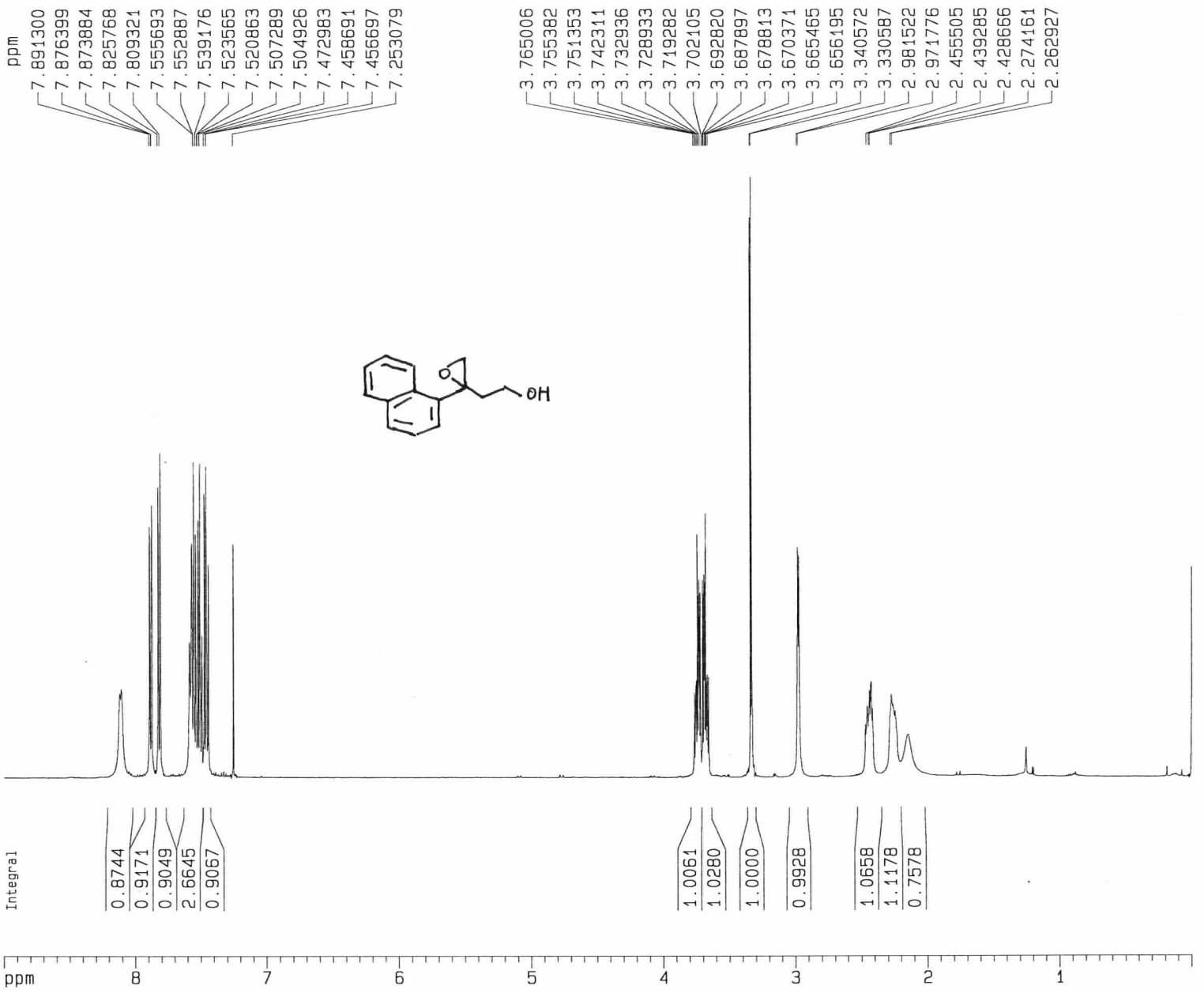
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	120.00 dB
PL12	19.00 dB
SFO2	500.1320005 MHz

F2 - Processing parameters

SI	32768
SF	125.7577929 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	215.000 ppm
F1	27037.93 Hz
F2P	-5.000 ppm
F2	-628.79 Hz
PPMCM	11.00000 ppm/cm
HZCM	1383.33569 Hz/cm



Current Data Parameters

NAME	ZL7R282H077A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100129
Time	0.08
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	Aceton
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	128
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300169 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	9.000 ppm
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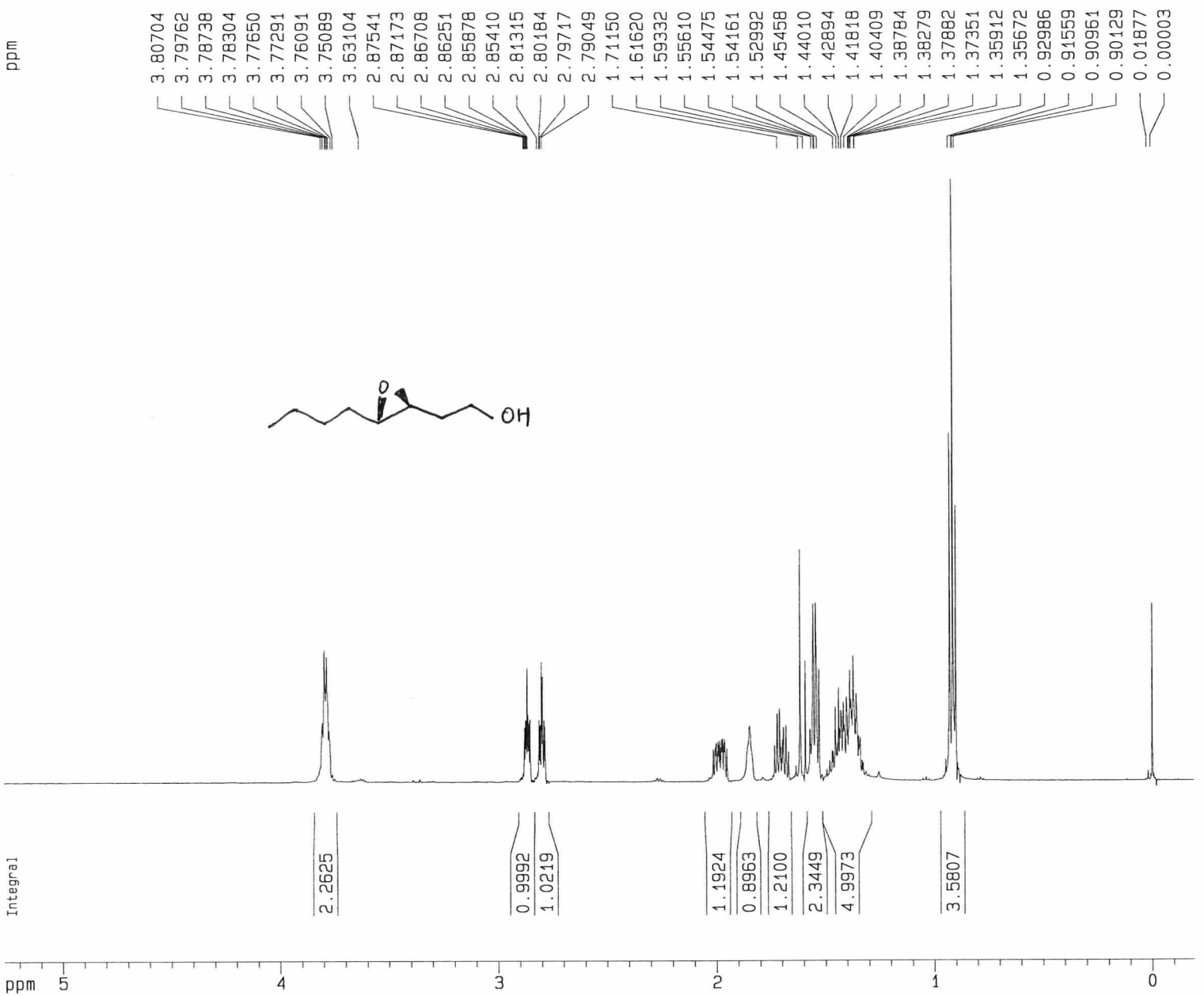
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.45000 ppm/cm
HZCM	225.05850 Hz/cm



Current Data Parameters

NAME	ZL7R241H110A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100129
Time	0.01
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	Aceton
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	128
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

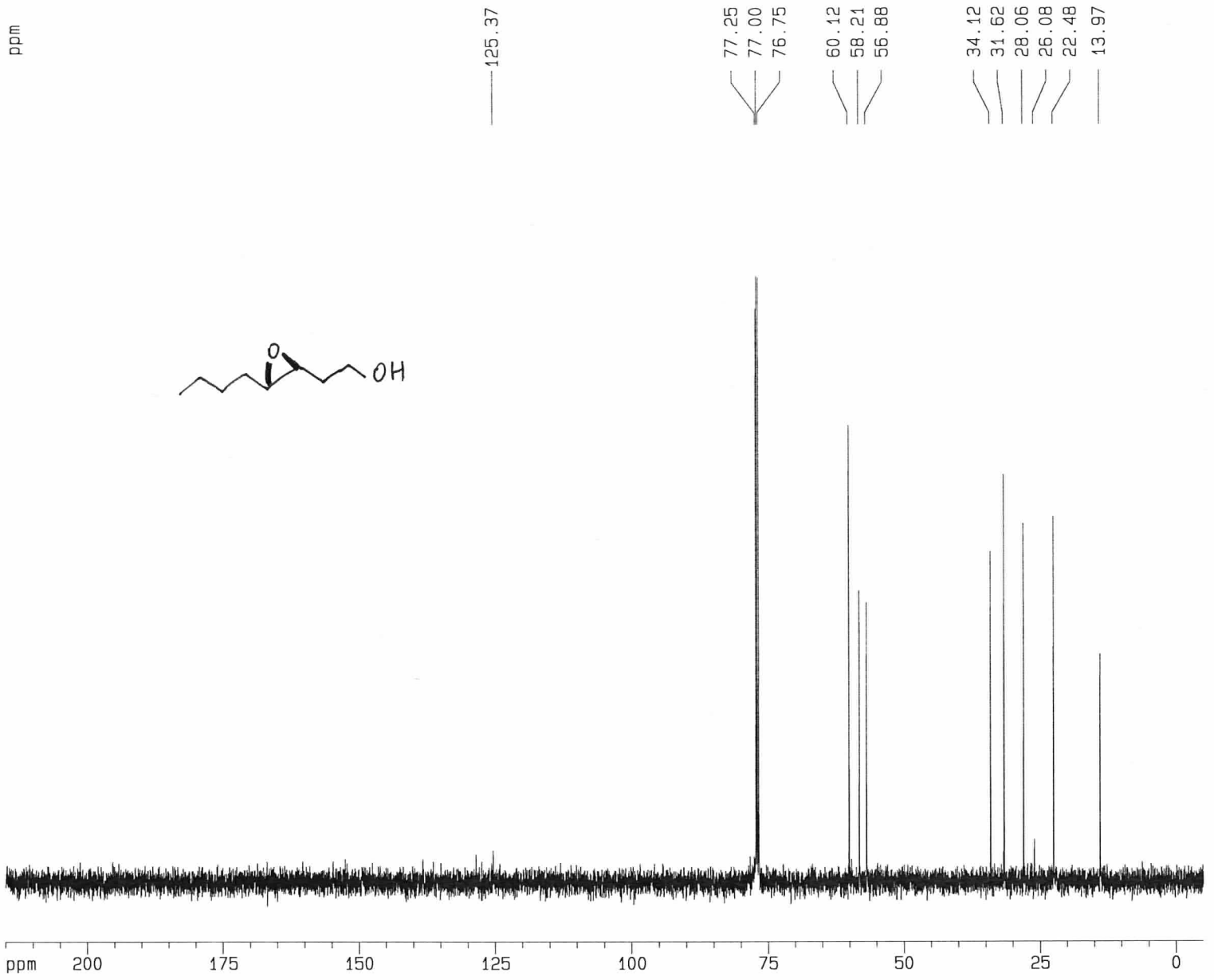
NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SF01	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300109 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	5.269 ppm
F1	2635.29 Hz
F2P	-0.191 ppm
F2	-95.54 Hz
PPMCM	0.27301 ppm/cm
HZCM	136.54134 Hz/cm



Current Data Parameters
NAME ZL7R241C110A
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
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Time 17.56
INSTRUM spect
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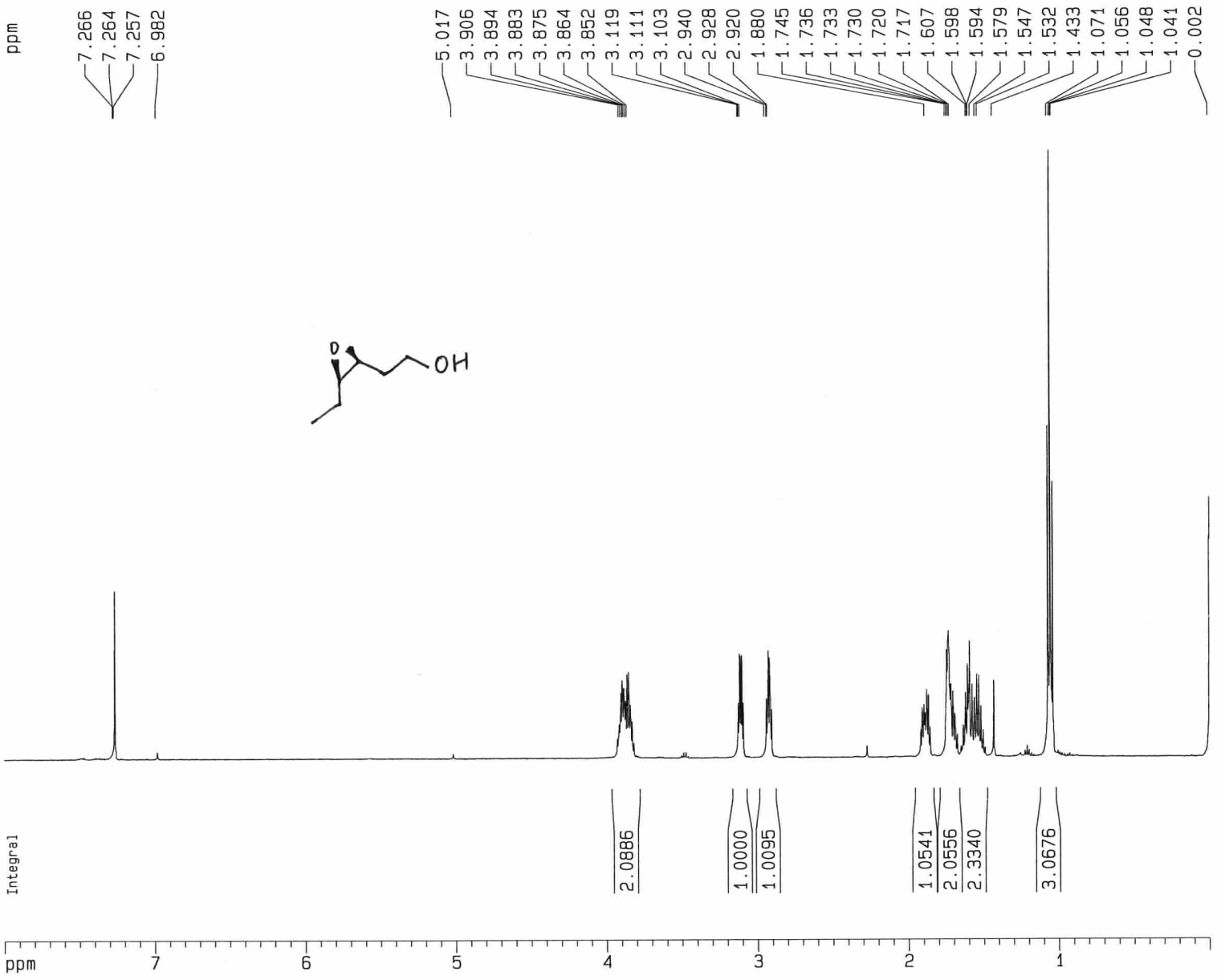
PULPROG zgdc
TD 75184
SOLVENT CDCl3
NS 499
DS 0
SWH 37593.984 Hz
FIDRES 0.500026 Hz
AQ 0.9999972 sec
RG 8192
DW 13.300 usec
DE 7.50 usec
TE 300.0 K
D1 0.10000000 sec
d11 0.03000000 sec

========== CHANNEL f1 ==========
NUC1 13C
P1 4.60 usec
PL1 0.00 dB
SFO1 125.7690572 MHz

========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 120.00 dB
PL12 19.00 dB
SFO2 500.1320005 MHz

F2 - Processing parameters
SI 32768
SF 125.7577929 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
F1P 215.000 ppm
F1 27037.93 Hz
F2P -5.000 ppm
F2 -628.79 Hz
PPMCM 11.00000 ppm/cm
HZCM 1383.33569 Hz/cm



Current Data Parameters
NAME ZL6R244H139A
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
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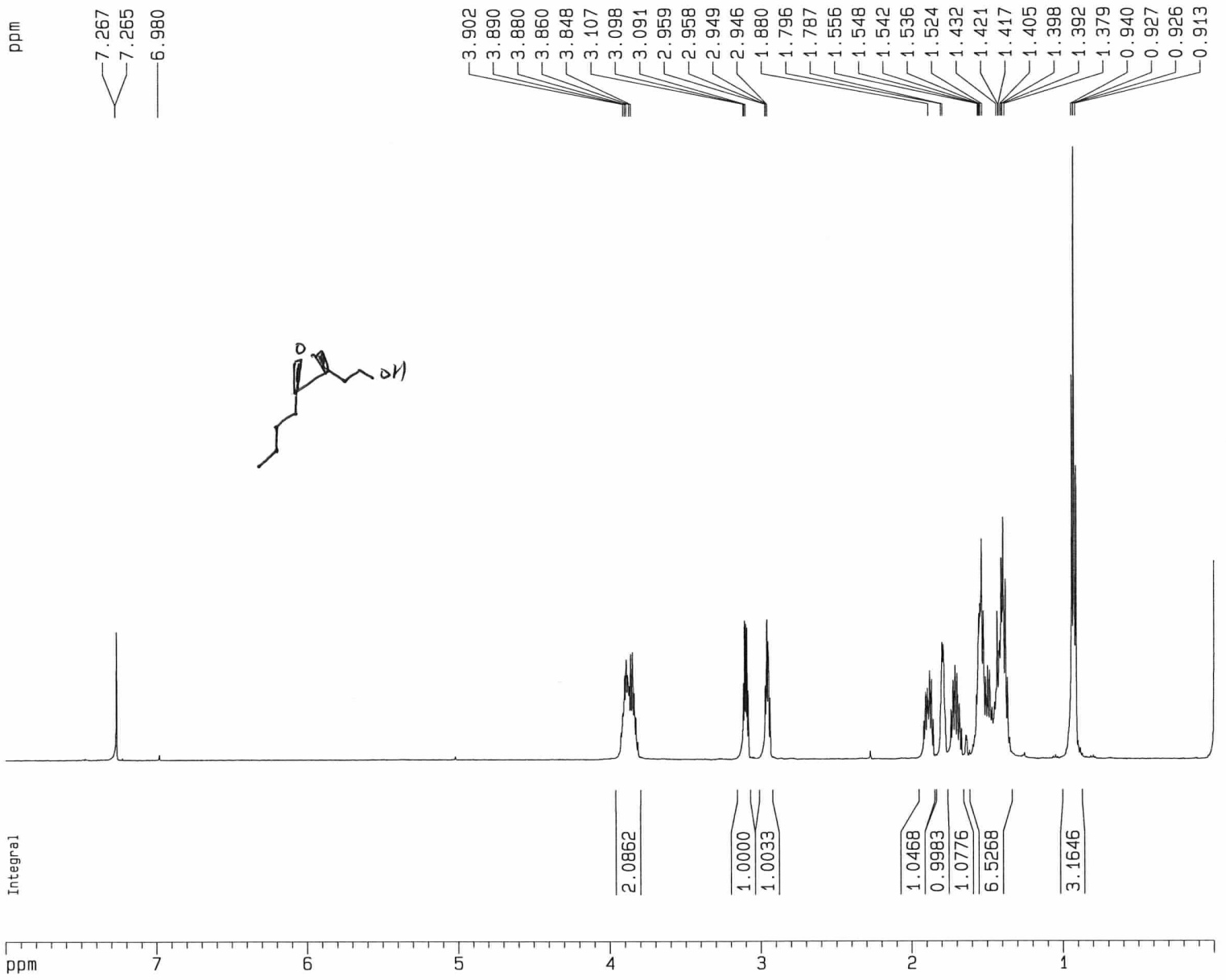
PULPROG zg
TD 48076
SOLVENT CDCl3
NS 8
DS 0
SWH 8012.820 Hz
FIDRES 0.166670 Hz
AQ 2.9999924 sec
RG 256
DW 62.400 usec
DE 4.50 usec
TE 300.0 K
D1 3.00000000 sec

========== CHANNEL f1 ========
NUC1 1H
P1 9.50 usec
PL1 0.00 dB
SFO1 500.1325006 MHz

F2 - Processing parameters
SI 65536
SF 500.1300114 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

1D NMR plot parameters
CX 20.00 cm
F1P 8.000 ppm
F1 4001.04 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.40000 ppm/cm
HZCM 200.05200 Hz/cm



Current Data Parameters

NAME	ZL6R171H138A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20090416
Time	13.11
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	256
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

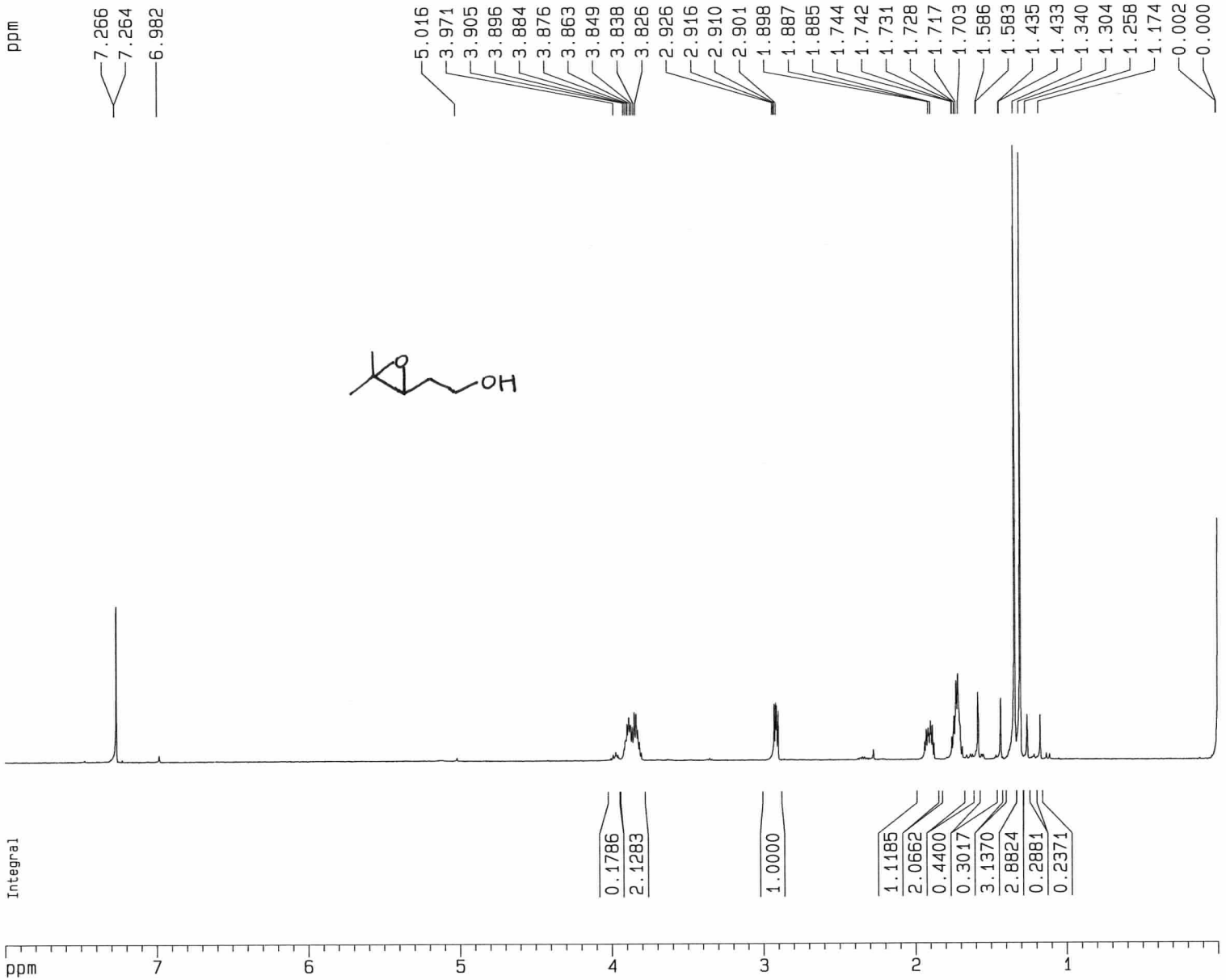
NUC1	1H
P1	9.50 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300112 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm



Current Data Parameters

NAME	ZL6R247H144A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20090415
Time	22.59
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	512
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

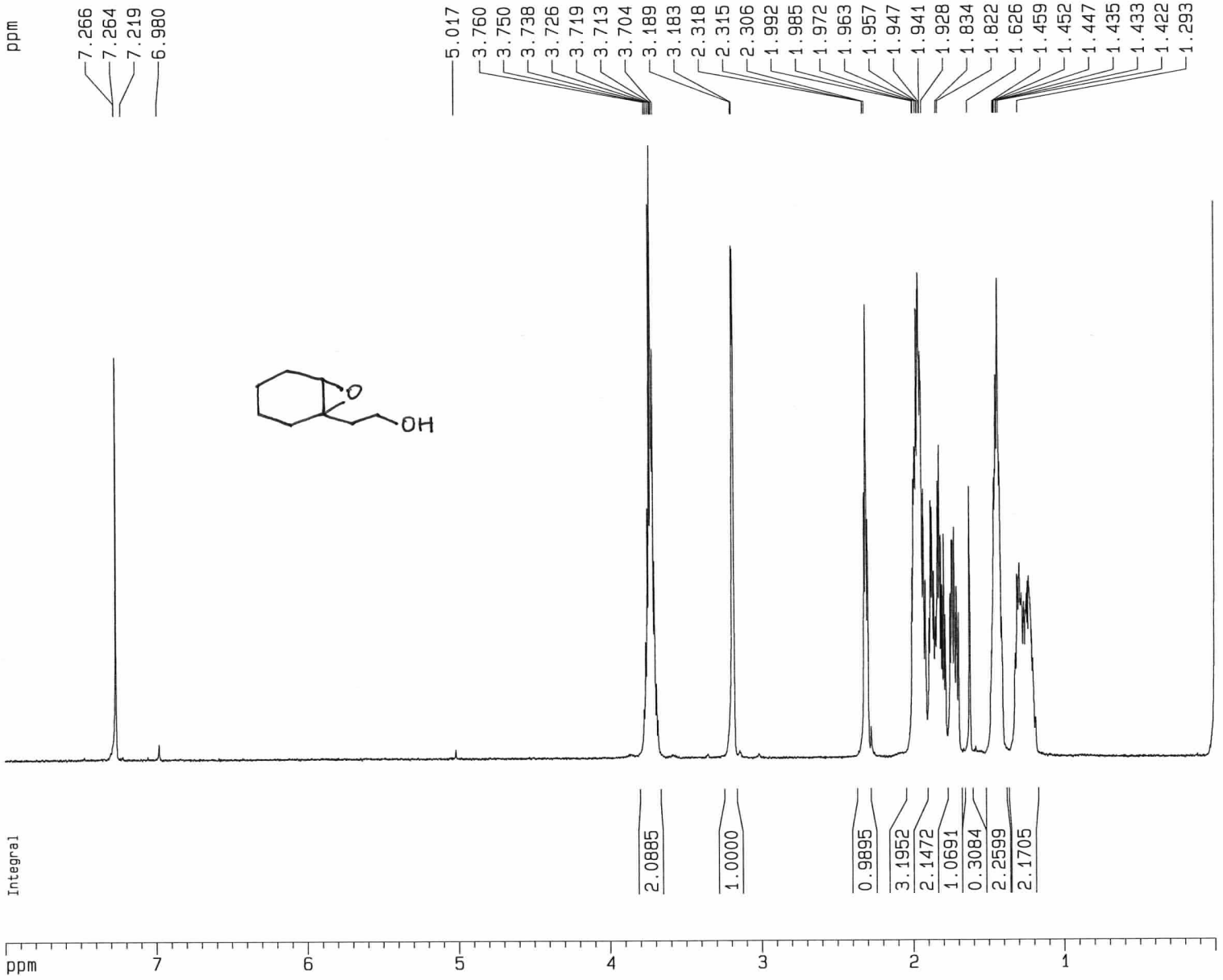
NUC1	1H
P1	9.50 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300116 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm



Current Data Parameters

NAME	ZL6R248H145A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20090416
Time	13.16
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	256
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

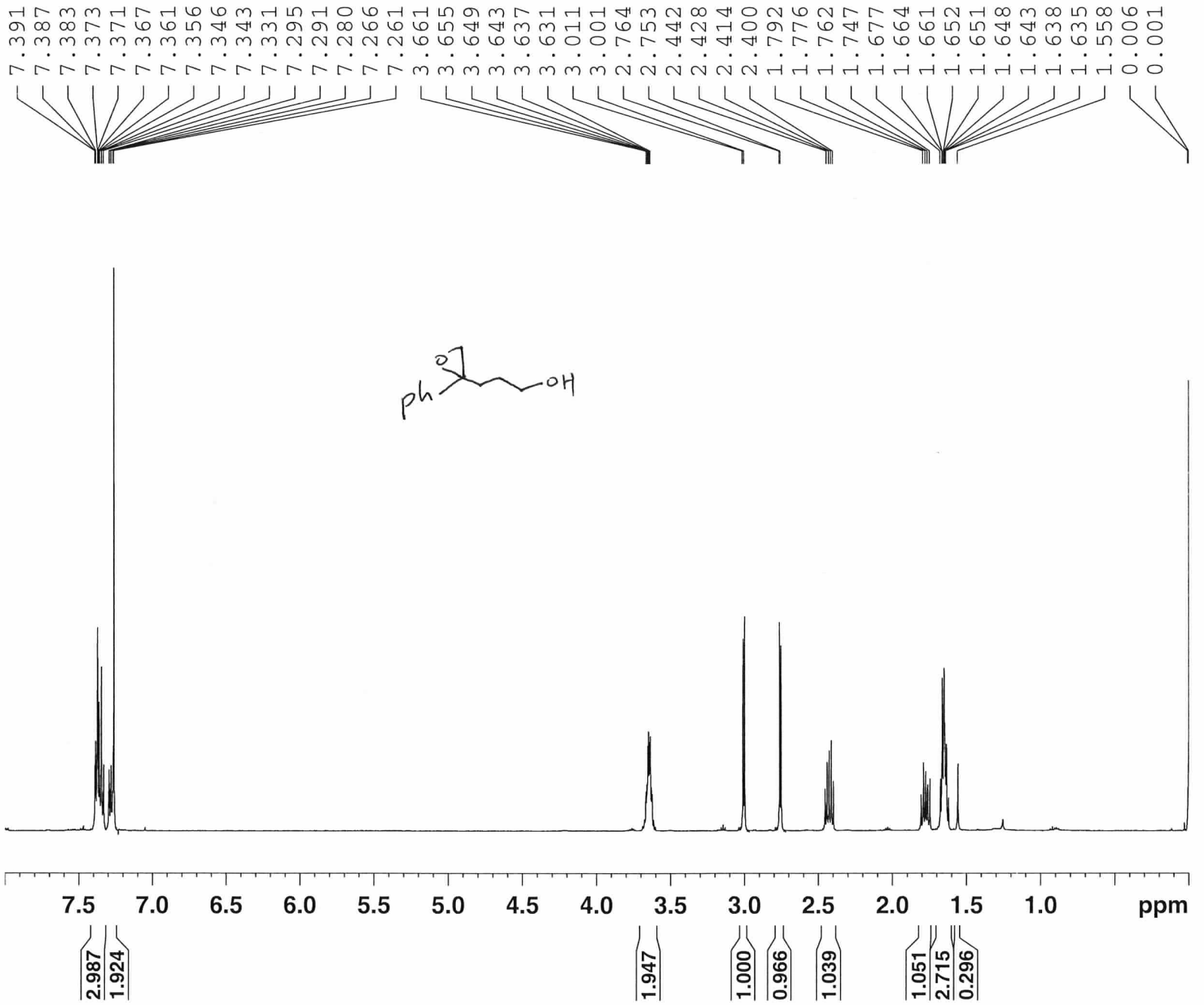
NUC1	1H
P1	9.50 usec
PL1	0.00 dB
SF01	500.1325006 MHz

F2 - Processing parameters

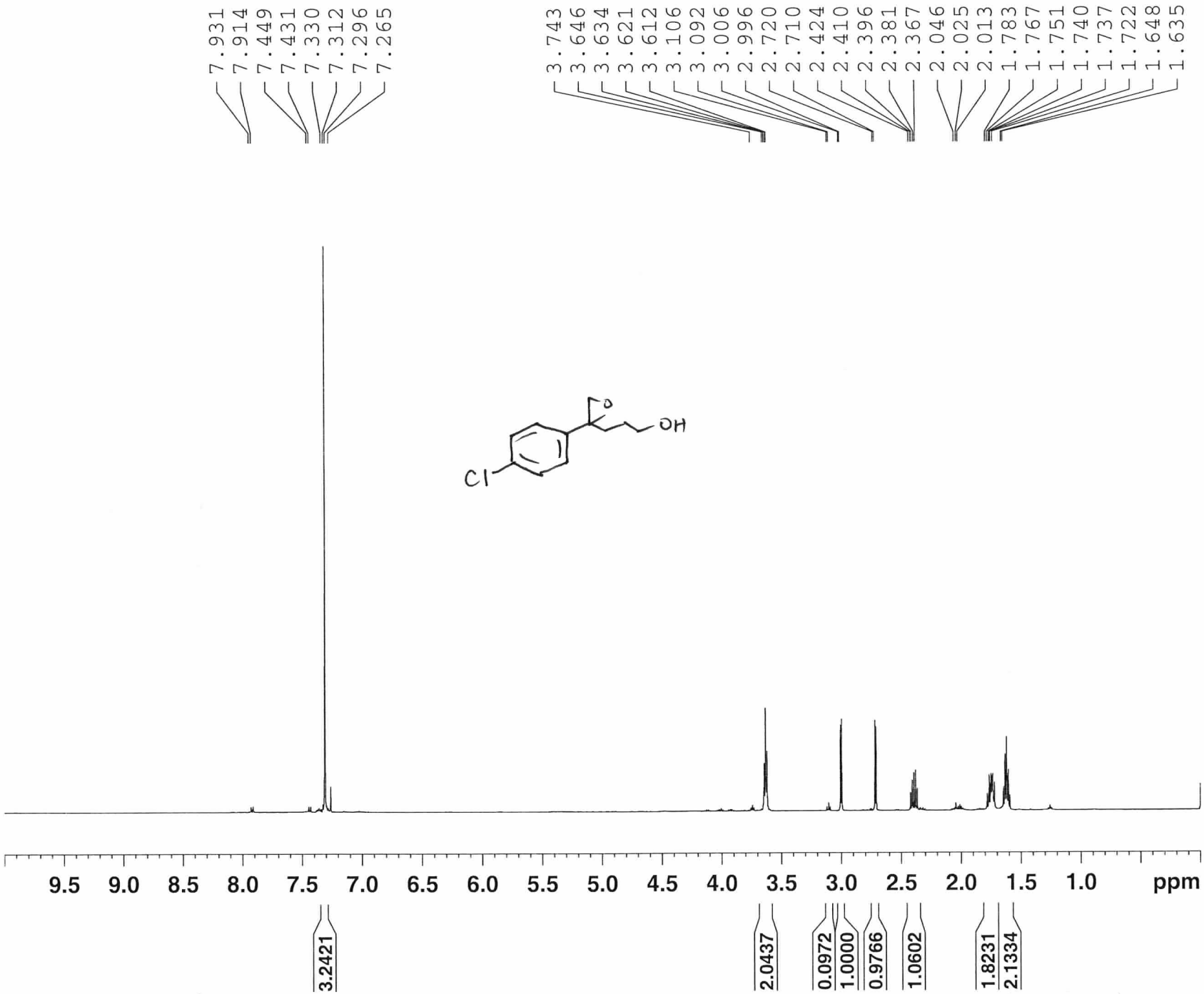
SI	65536
SF	500.1300116 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

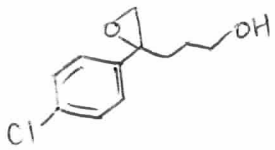
CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm

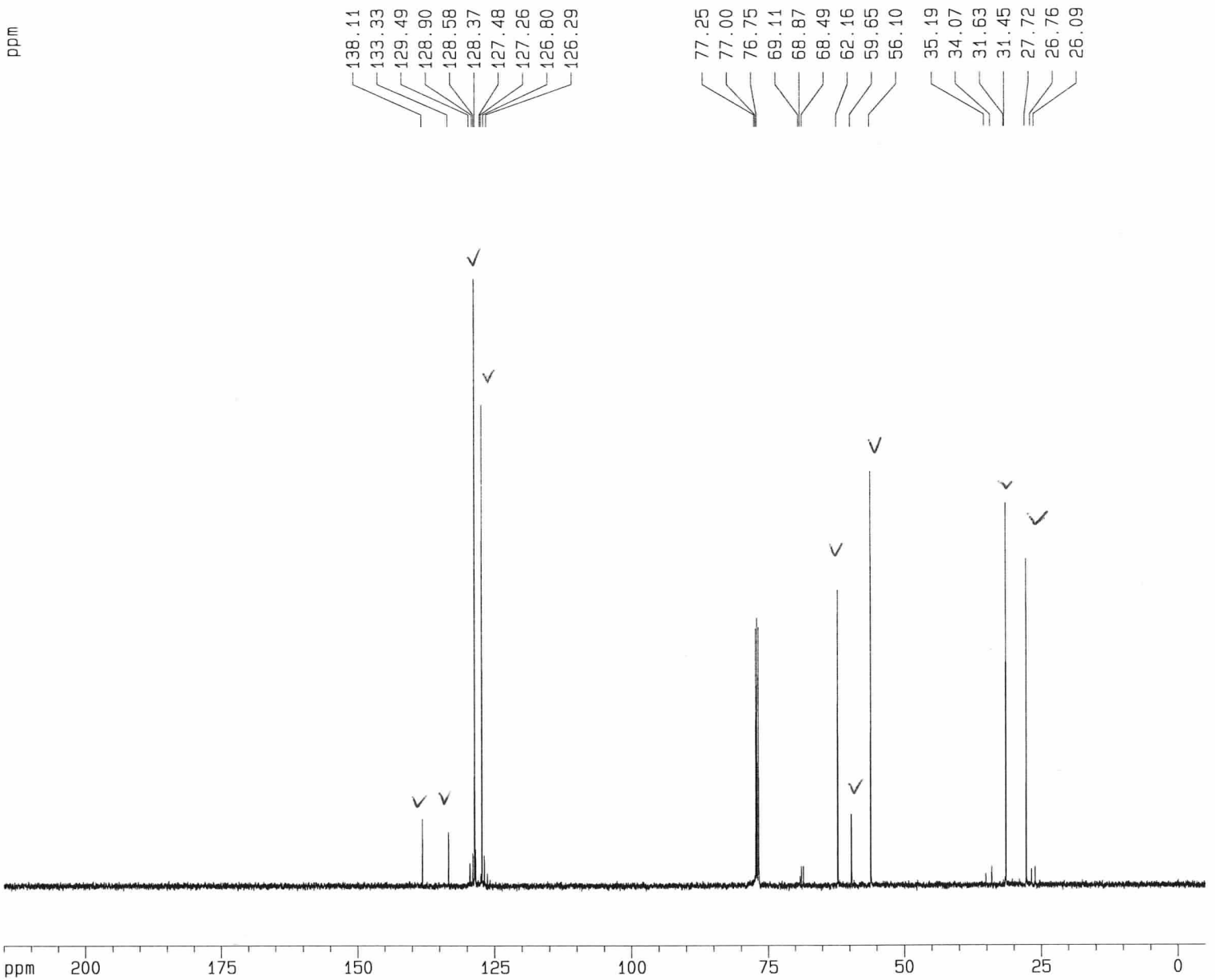



```
Current Data Parameters
NAME        ZL7R192H079A
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameter
Date_           20091112
Time                1.46
INSTRUM            spect
PROBHD   5 mm PABBI 1H/
PULPROG               zg
TD                 59998
SOLVENT            CDCl3
NS                     8
DS                     0
SWH          10000.000 Hz
FIDRES        0.166672 Hz
AQ            2.9999499 se
RG                   256
DW                50.000 us
DE                 7.50 us
TE                295.6 K
D1           1.00000000 se
TD0                    1

======== CHANNEL f1 ======
NUC1                  1H
P1                 5.35 us
PL1                0.00 dB
SFO1        499.8729992 MH

F2 - Processing parameters
SI                 32768
SF          499.8700172 MH
WDW                   EM
SSB                    0
LB                 0.30 Hz
GB                     0
PC                  1.00
```




```
Current Data Parameters
NAME          ZL7R318H169A
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameter
Date_              20100107
Time                 21.46
INSTRUM              spect
PROBHD   5 mm PABBI 1H/
PULPROG                 zg
TD                   59998
SOLVENT              CDCl3
NS                       8
DS                       0
SWH           10000.000 Hz
FIDRES            0.166672 Hz
AQ                2.9999499 se
RG                    45.3
DW                50.000 us
DE                 7.50 us
TE                295.0 K
D1            1.00000000 se
TD0                      1

======== CHANNEL f1 ======
NUC1                    1H
P1                 5.35 us
PL1                0.00 dB
SFO1         499.8729992 MH

F2 - Processing parameters
SI                   32768
SF           499.8700157 MH
WDW                     EM
SSB                      0
LB                0.30 Hz
GB                       0
PC                1.00
```





Current Data Parameters

NAME	ZL7R318C169A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100108
Time	22.41
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zgdc
TD	75184
SOLVENT	CDCl3
NS	1862
DS	0
SWH	37593.984 Hz
FIDRES	0.500026 Hz
AQ	0.9999972 sec
RG	8192
DW	13.300 usec
DE	7.50 usec
TE	300.0 K
D1	0.10000000 sec
d11	0.03000000 sec

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

NUC1	13C
P1	4.60 usec
PL1	0.00 dB
SFO1	125.7690572 MHz

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

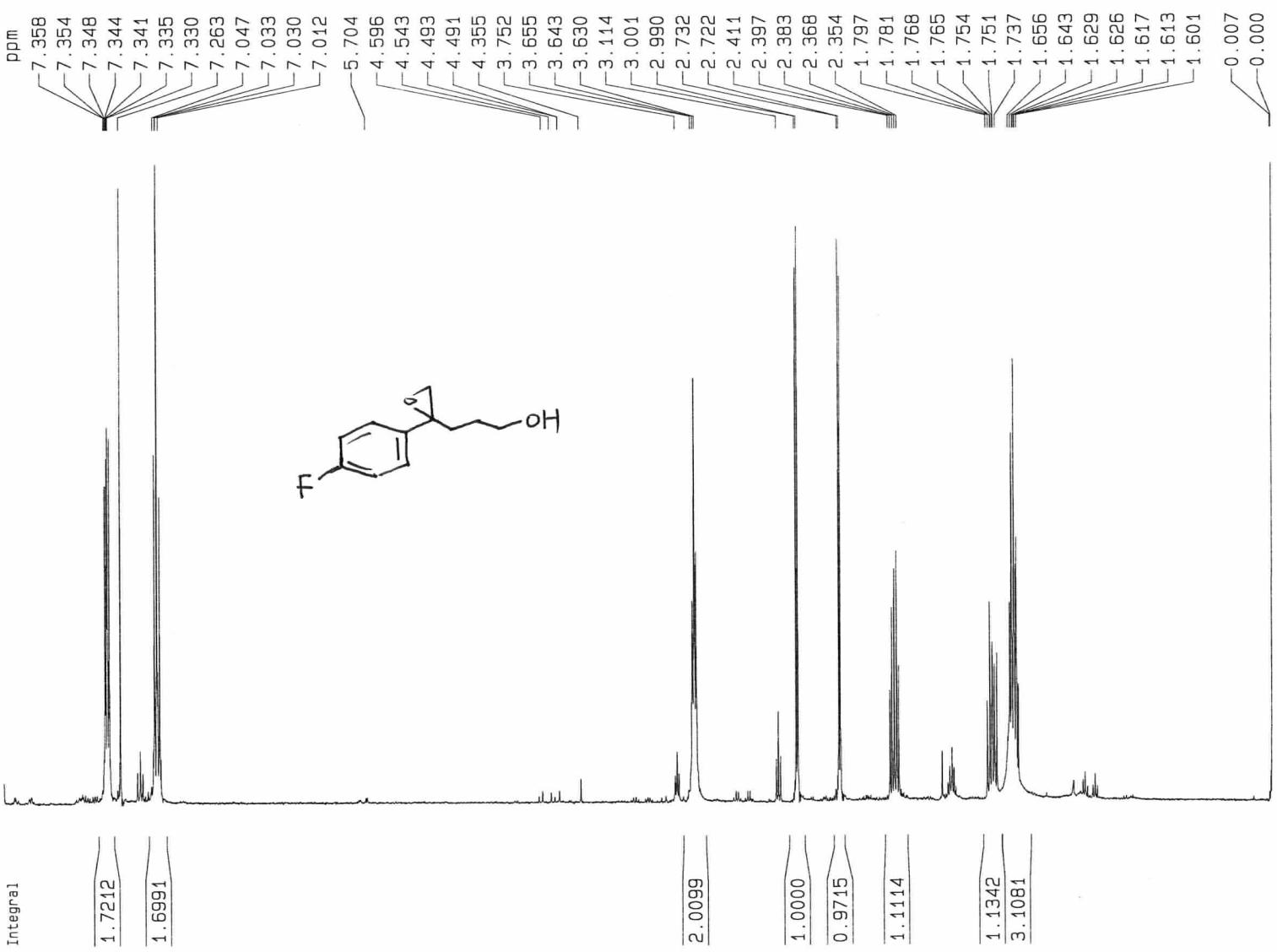
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	120.00 dB
PL12	19.00 dB
SFO2	500.1320005 MHz

F2 - Processing parameters

SI	32768
SF	125.7577941 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	215.000 ppm
F1	27037.93 Hz
F2P	-5.000 ppm
F2	-628.79 Hz
PPMCM	11.00000 ppm/cm
HZCM	1383.33582 Hz/cm



Current Data Parameters

NAME	ZL7R317H189A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100121
Time	21.48
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	256
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

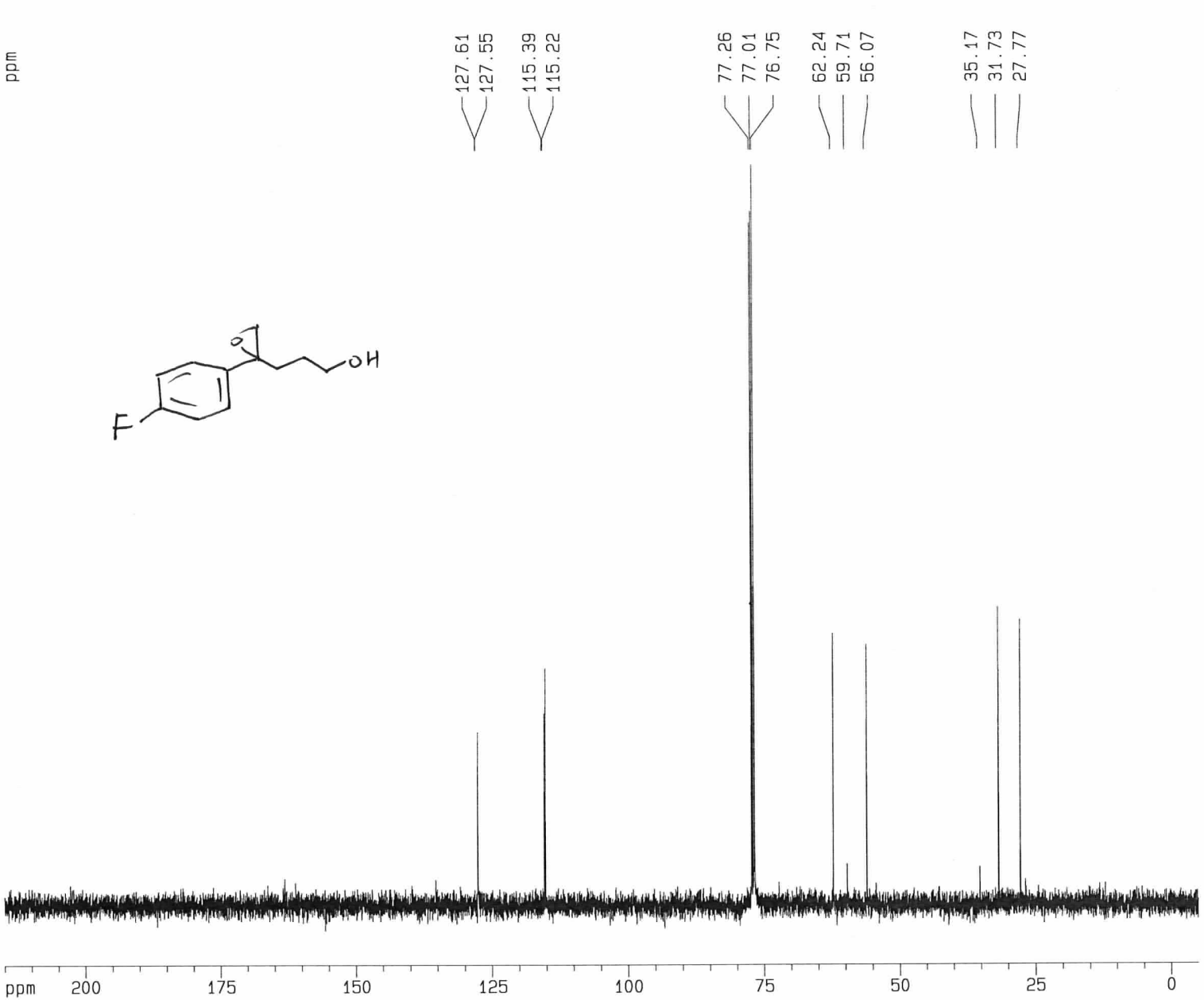
NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300124 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm



Current Data Parameters

NAME	ZL7R317C189A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100121
Time	22.09
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zgdc
TD	75184
SOLVENT	C6D6
NS	1024
DS	0
SWH	37593.984 Hz
FIDRES	0.500026 Hz
AQ	0.9999972 sec
RG	8192
DW	13.300 usec
DE	7.50 usec
TE	300.0 K
D1	0.10000000 sec
d11	0.03000000 sec

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

NUC1	13C
P1	4.60 usec
PL1	0.00 dB
SFO1	125.7690572 MHz

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

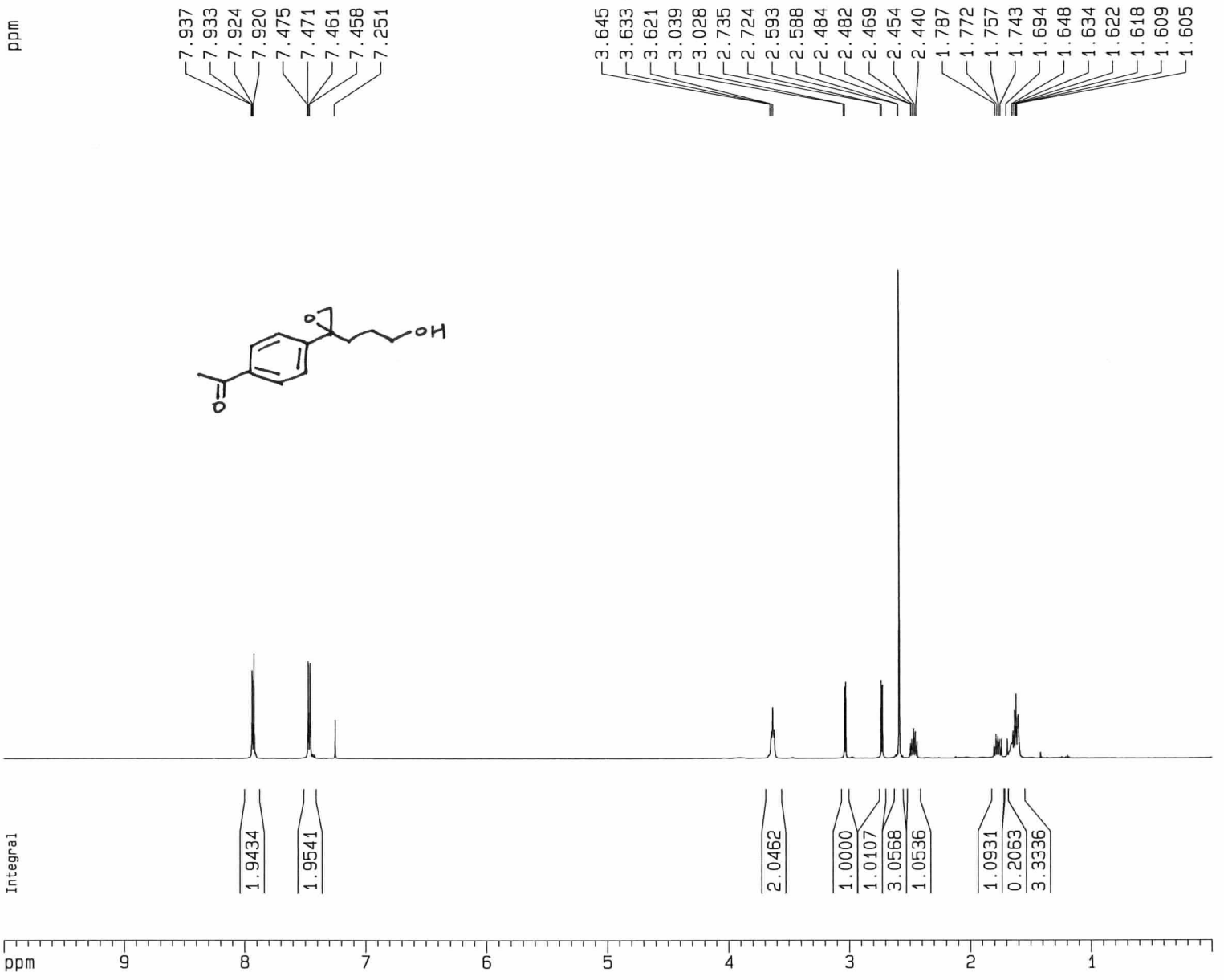
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	120.00 dB
PL12	19.00 dB
SFO2	500.1320005 MHz

F2 - Processing parameters

SI	32768
SF	125.7577918 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	215.000 ppm
F1	27037.93 Hz
F2P	-5.000 ppm
F2	-628.79 Hz
PPMCM	11.00000 ppm/cm
HZCM	1383.33569 Hz/cm



Current Data Parameters

NAME	ZL7R348H249A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100430
Time	16.30
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	128
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

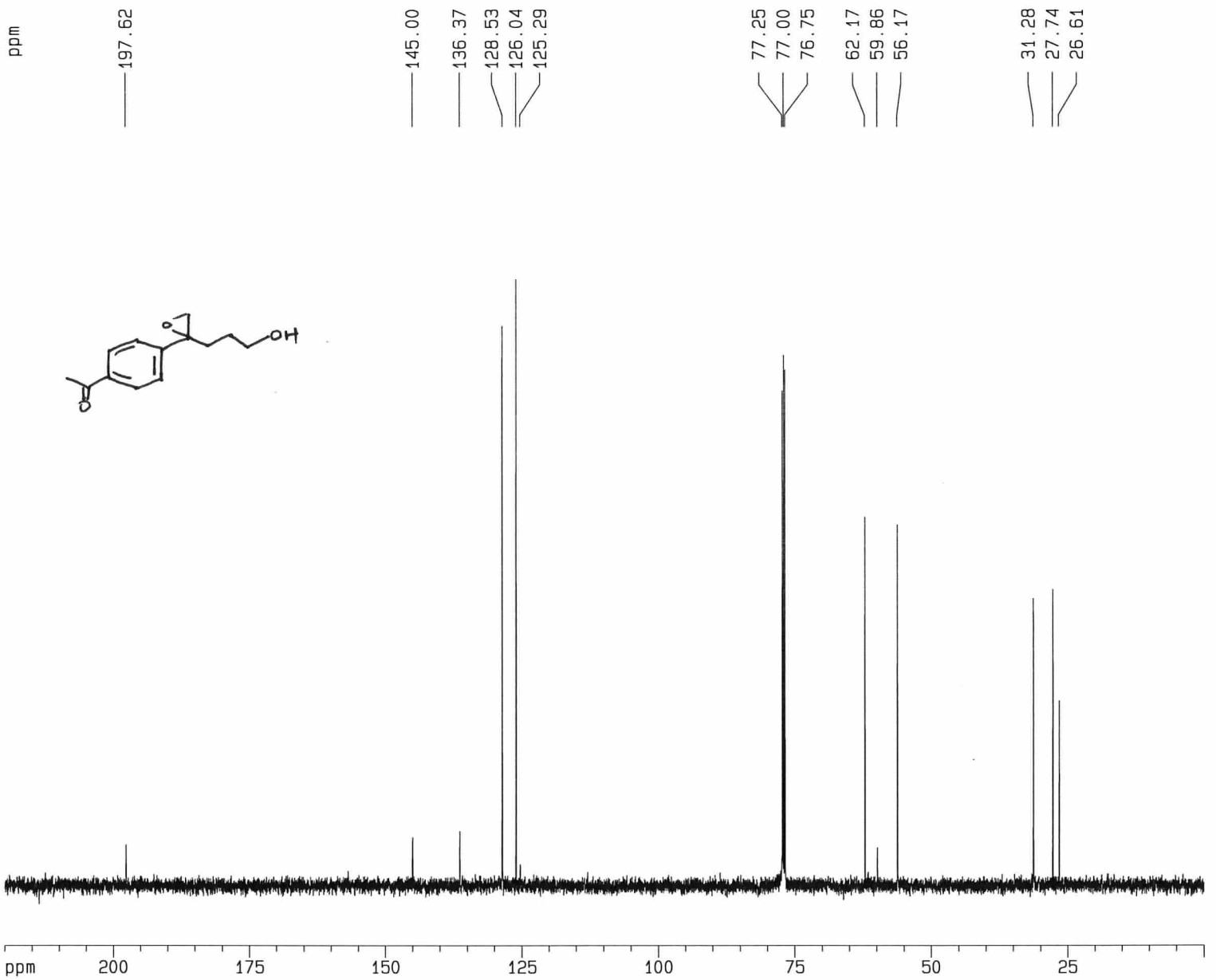
NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

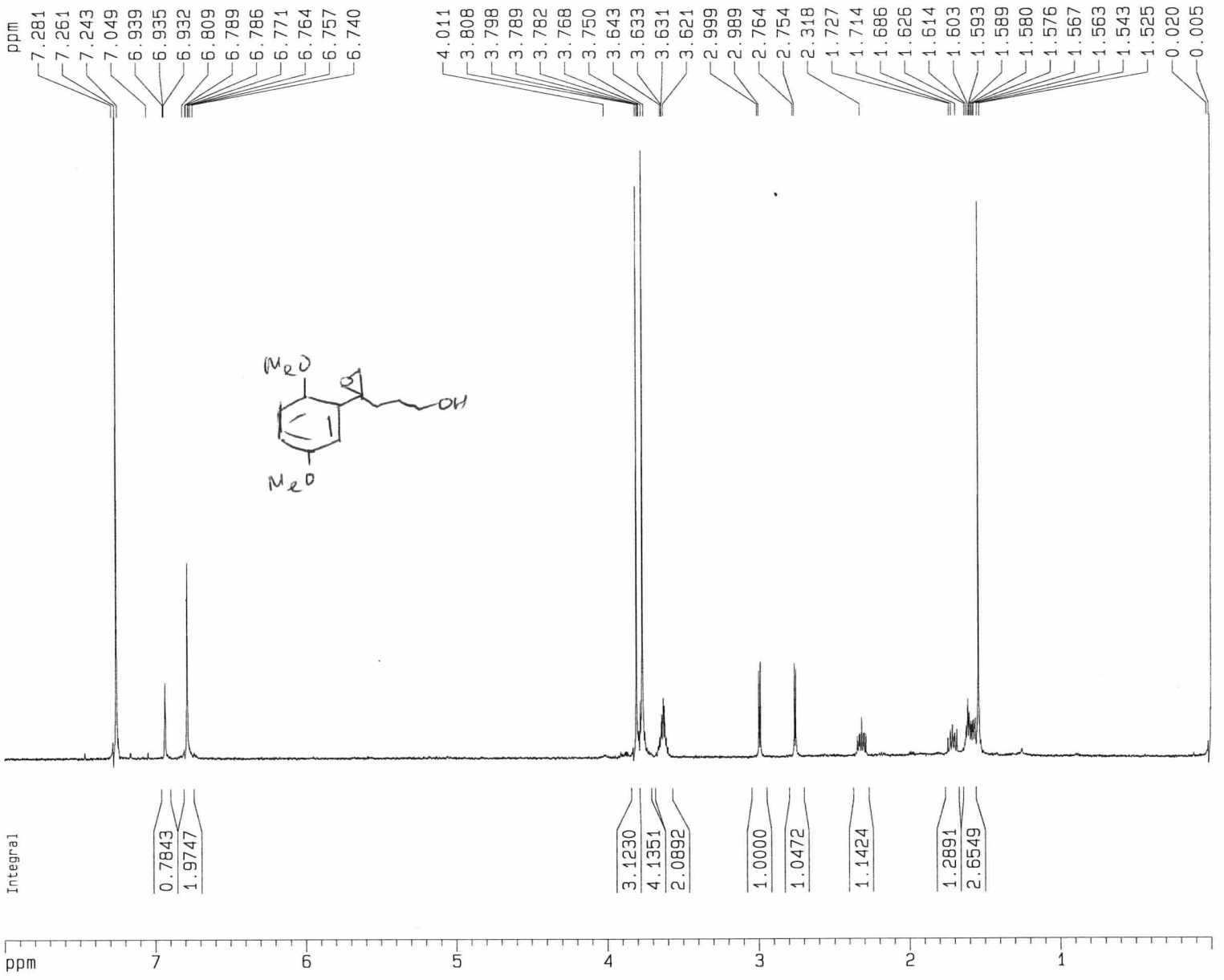
SI	65536
SF	500.1300181 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	10.000 ppm
F1	5001.30 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.50000 ppm/cm
HZCM	250.06500 Hz/cm




```
Current Data Parameters
NAME        ZL7R348C249A
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20100430
Time               16.58
INSTRUM            spect
PROBHD     5 mm QNP  1H
PULPROG            zgdc
TD                75184
SOLVENT            C6D6
NS                 1318
DS                    0
SWH           37593.984 Hz
FIDRES         0.500026 Hz
AQ             0.9999972 sec
RG                 4096
DW               13.300 usec
DE                7.50 usec
TE                300.0 K
D1           0.10000000 sec
d11          0.03000000 sec

============ CHANNEL f1 ==========
NUC1                13C
P1                 4.60 usec
PL1                0.00 dB
SFO1         125.7690572 MHz

============ CHANNEL f2 ==========
CPDPRG2          waltz16
NUC2                1H
PCPD2            90.00 usec
PL2              120.00 dB
PL12              19.00 dB
SFO2         500.1320005 MHz

F2 - Processing parameters
SI                 32768
SF           125.7577918 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40

1D NMR plot parameters
CX                 20.00 cm
F1P              220.000 ppm
F1              27666.71 Hz
F2P                0.000 ppm
F2                 0.00 Hz
PPMCM          11.00000 ppm/cm
HZCM         1383.33569 Hz/cm
```



Current Data Parameters

NAME	ZL7R320H175A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100201
Time	19.18
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	20
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	512
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

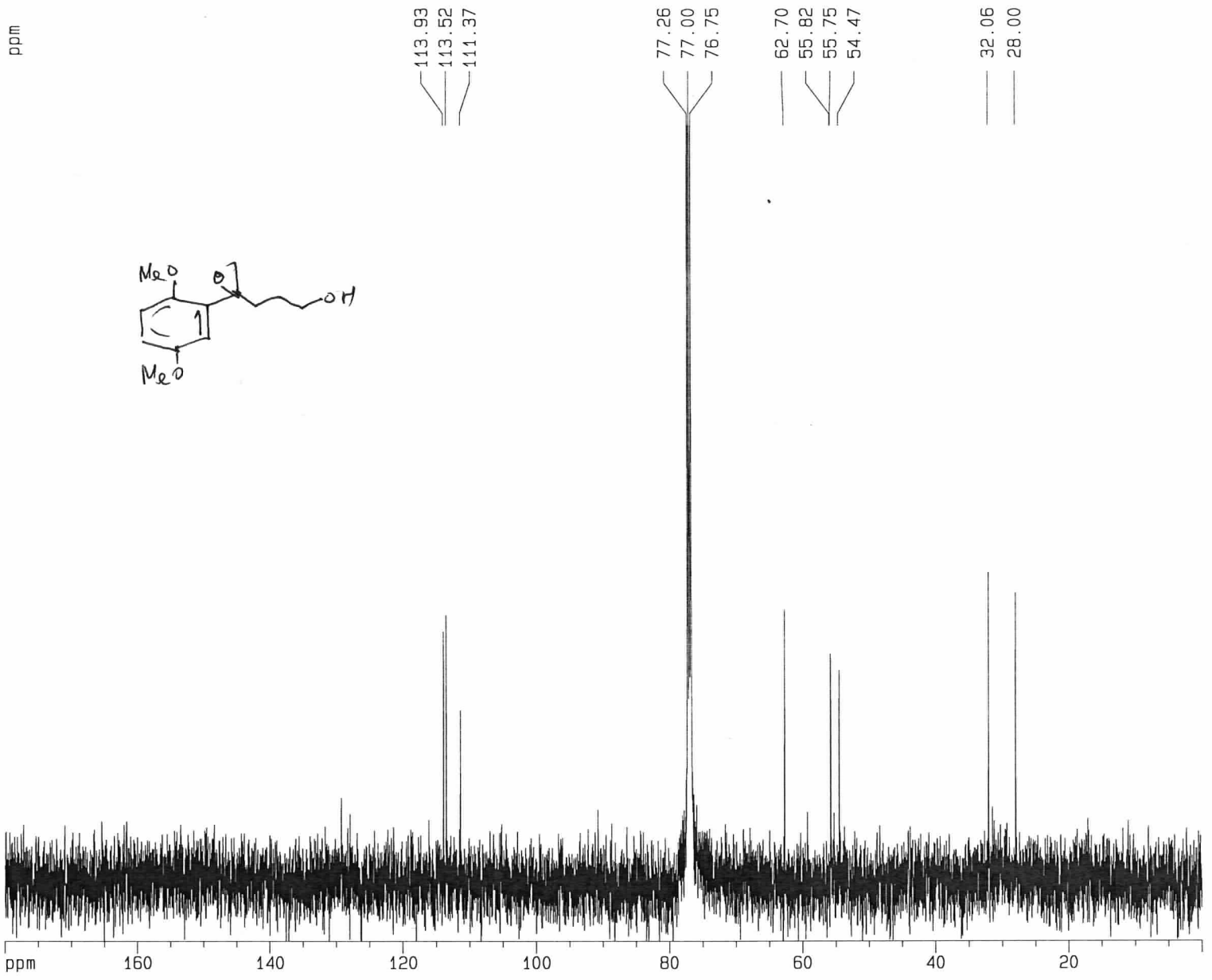
NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

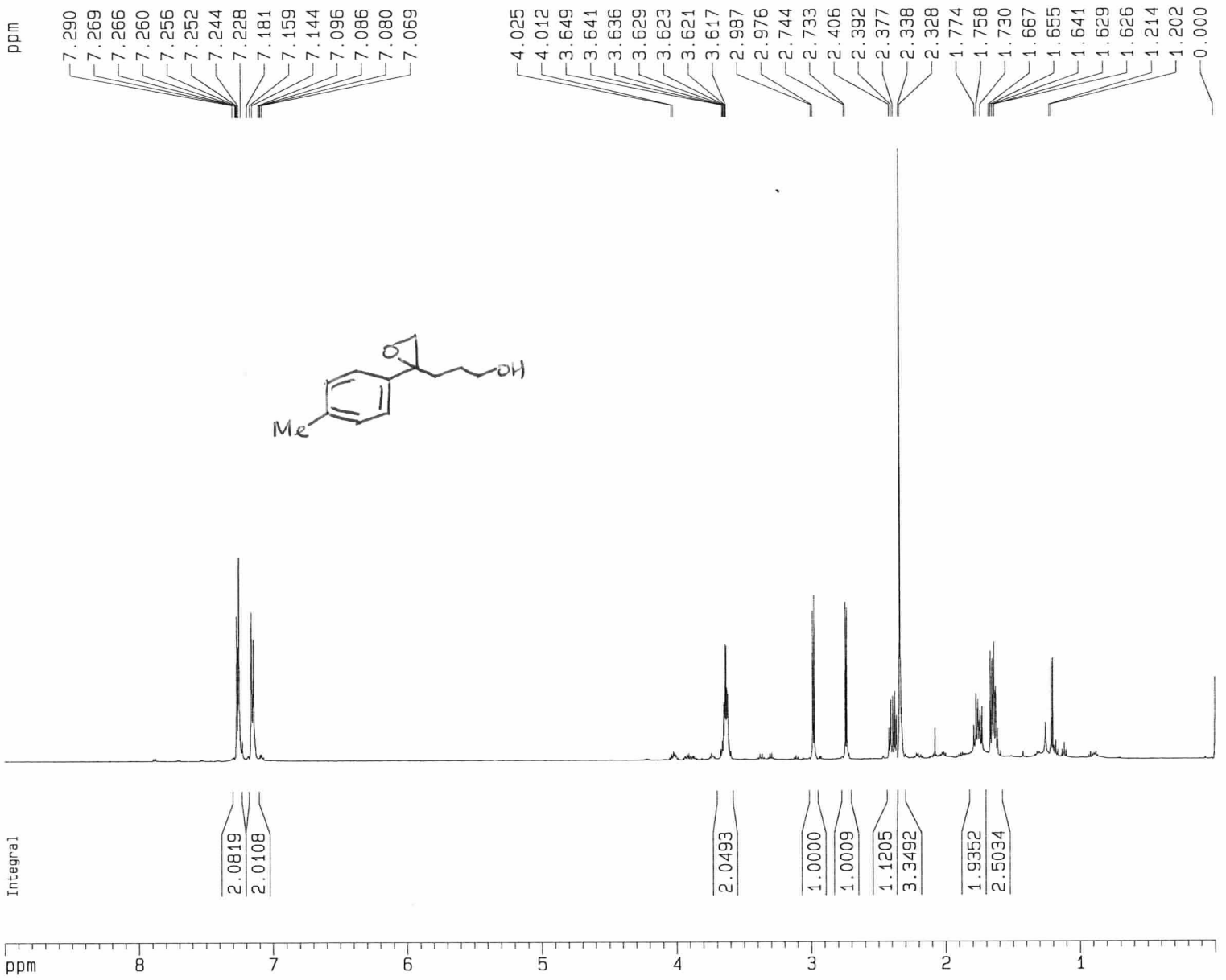
SI	65536
SF	500.1300133 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm




```
Current Data Parameters
NAME        ZL7R320C175A
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20100201
Time               22.22
INSTRUM            spect
PROBHD     5 mm QNP  1H
PULPROG             zgdc
TD                 75184
SOLVENT             C6D6
NS                  6269
DS                     0
SWH          37593.984 Hz
FIDRES        0.500026 Hz
AQ           0.9999972 sec
RG                  8192
DW              13.300 usec
DE               7.50 usec
TE              300.0 K
D1           0.10000000 sec
d11          0.03000000 sec

============ CHANNEL f1 ==========
NUC1                13C
P1               4.60 usec
PL1              0.00 dB
SFO1        125.7690572 MHz

============ CHANNEL f2 ==========
CPDPRG2          waltz16
NUC2                1H
PCPD2           90.00 usec
PL2             120.00 dB
PL12             19.00 dB
SFO2        500.1320005 MHz

F2 - Processing parameters
SI                 32768
SF          125.7577906 MHz
WDW                   EM
SSB                    0
LB                1.00 Hz
GB                     0
PC                 1.40

1D NMR plot parameters
CX                20.00 cm
F1P              180.000 ppm
F1             22636.40 Hz
F2P              0.000 ppm
F2               0.00 Hz
PPMCM          9.00000 ppm/cm
HZCM        1131.82007 Hz/cm
```



Current Data Parameters

NAME	ZL7R319H185A2
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100201
Time	19.08
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	4
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	128
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

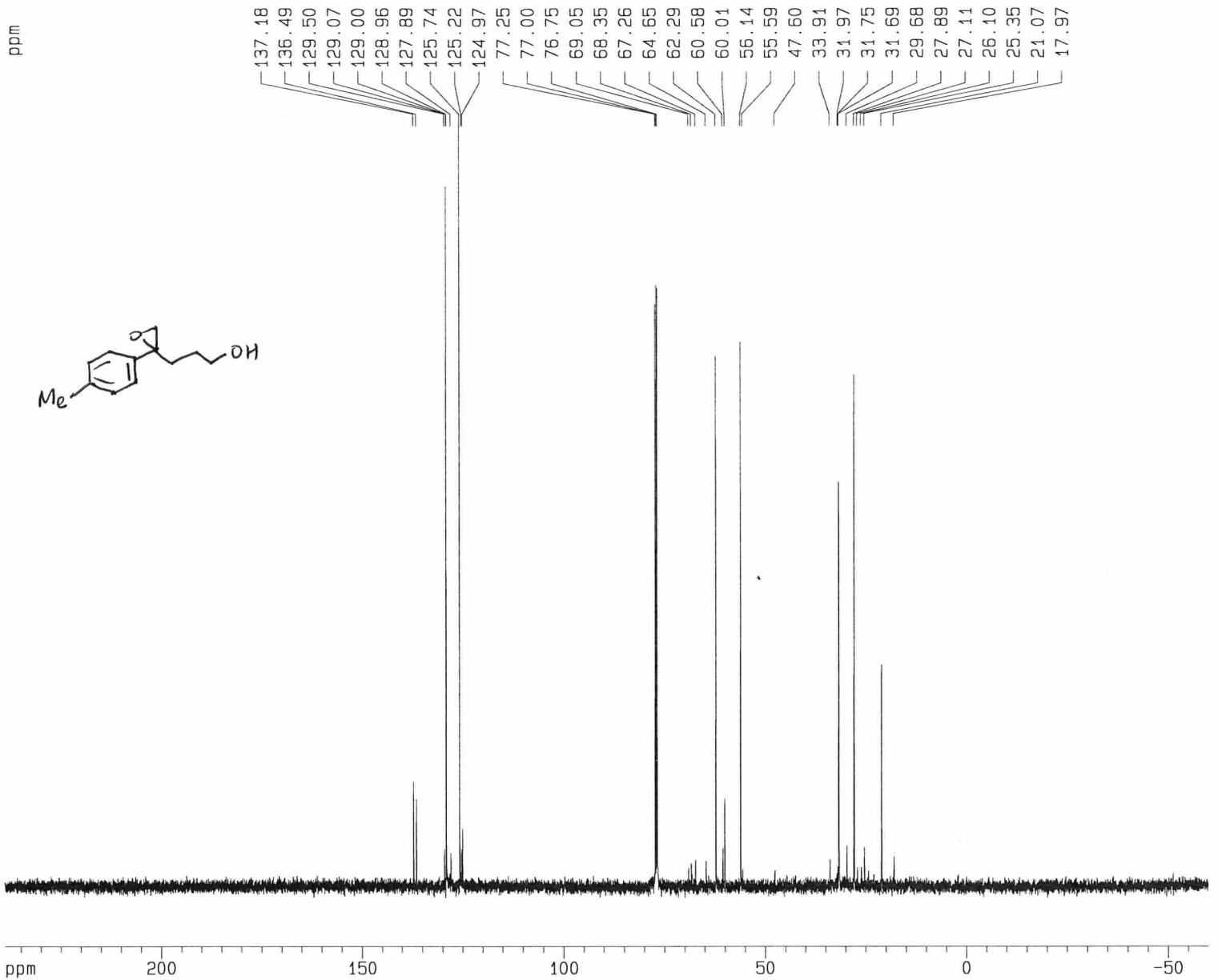
NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300133 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	9.000 ppm
F1	4501.17 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.45000 ppm/cm
HZCM	225.05850 Hz/cm



Current Data Parameters

NAME	ZL7R319C185A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100201
Time	20.48
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zgdc
TD	75184
SOLVENT	C6D6
NS	2048
DS	0
SWH	37593.984 Hz
FIDRES	0.500026 Hz
AQ	0.9999972 sec
RG	8192
DW	13.300 usec
DE	7.50 usec
TE	300.0 K
D1	0.10000000 sec
d11	0.03000000 sec

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

NUC1	13C
P1	4.60 usec
PL1	0.00 dB
SFO1	125.7690572 MHz

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

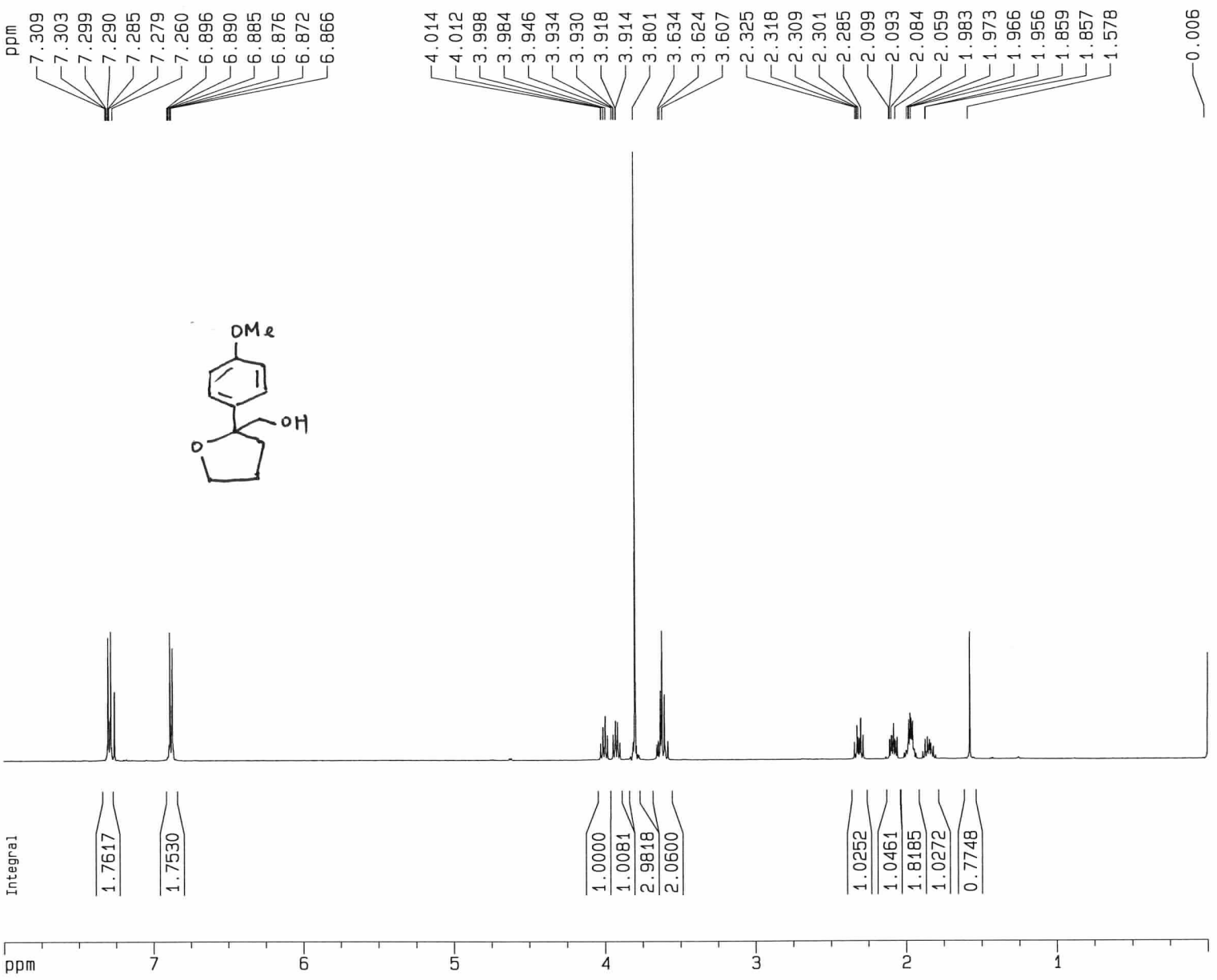
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	120.00 dB
PL12	19.00 dB
SFO2	500.1320005 MHz

F2 - Processing parameters

SI	32768
SF	125.7577929 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	238.970 ppm
F1	30052.33 Hz
F2P	-59.970 ppm
F2	-7541.65 Hz
PPMCM	14.94698 ppm/cm
HZCM	1879.69897 Hz/cm



Current Data Parameters

NAME	ZL7R322H192A2
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100430
Time	20.05
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	256
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

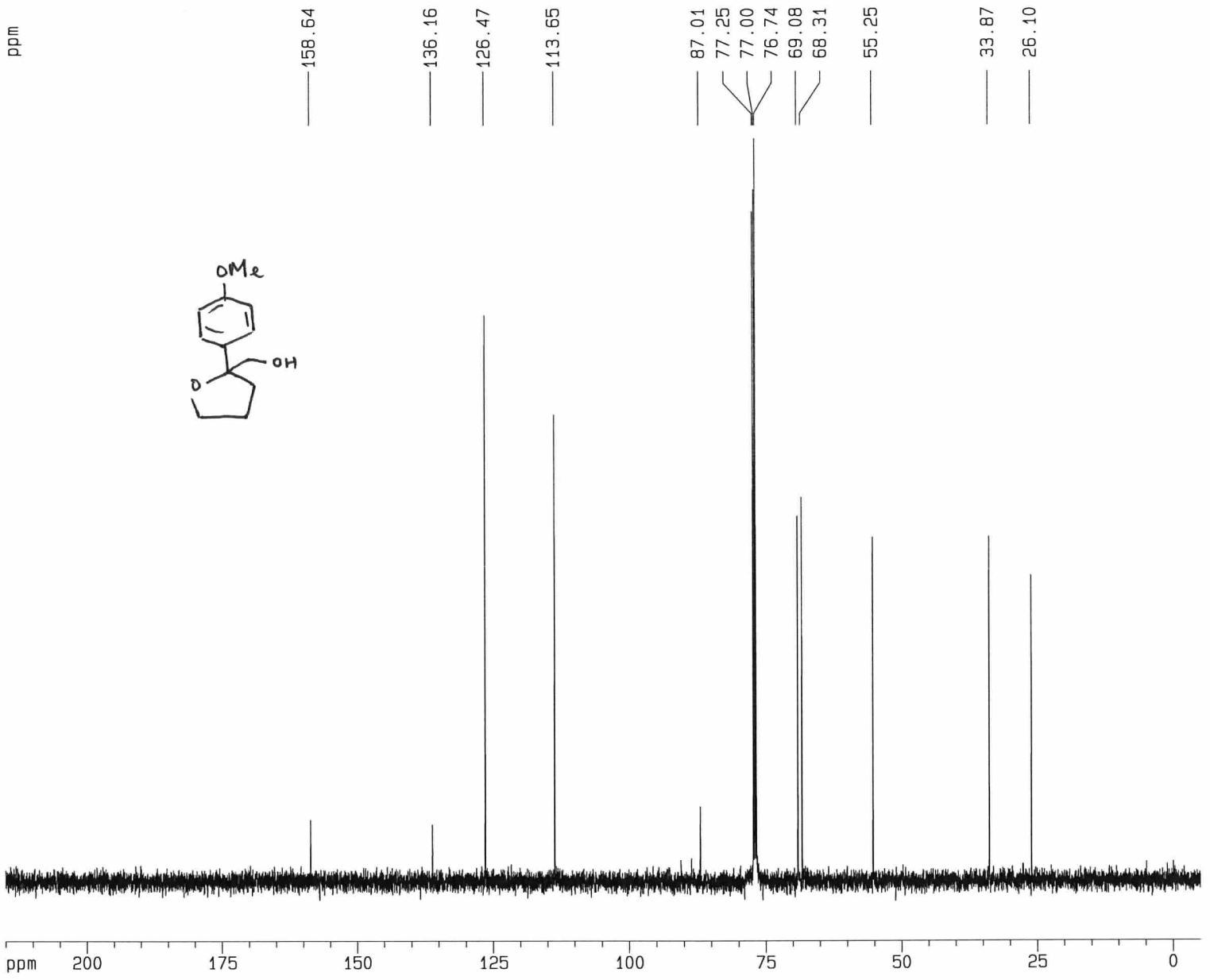
NUC1	1H
P1	9.00 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300131 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm



Current Data Parameters

NAME	ZL7R322C192A2
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20100430
Time	20.13
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zgdc
TD	75184
SOLVENT	C6D6
NS	1508
DS	0
SWH	37593.984 Hz
FIDRES	0.500026 Hz
AQ	0.9999972 sec
RG	8192
DW	13.300 usec
DE	7.50 usec
TE	300.0 K
D1	0.10000000 sec
d11	0.03000000 sec

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

NUC1	13C
P1	4.60 usec
PL1	0.00 dB
SFO1	125.7690572 MHz

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

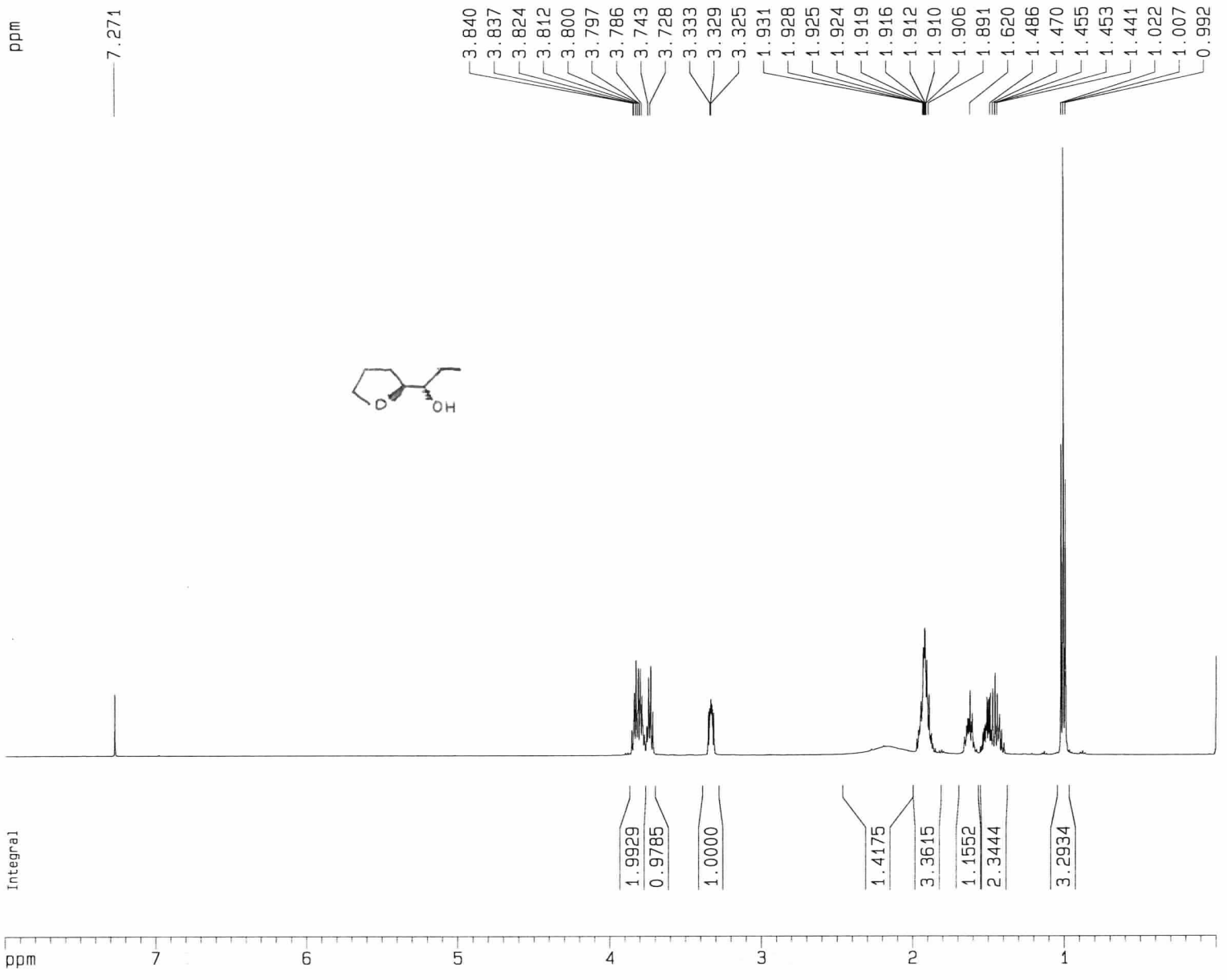
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	120.00 dB
PL12	19.00 dB
SFO2	500.1320005 MHz

F2 - Processing parameters

SI	32768
SF	125.7577918 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	215.000 ppm
F1	27037.93 Hz
F2P	-5.000 ppm
F2	-628.79 Hz
PPMCM	11.00000 ppm/cm
HZCM	1383.33569 Hz/cm



Current Data Parameters

NAME	ZL4R20H220A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20080727
Time	16.35
INSTRUM	spect
PROBHD	5 mm QNP 1H
PULPROG	zg
TD	48076
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.166670 Hz
AQ	2.9999924 sec
RG	64
DW	62.400 usec
DE	4.50 usec
TE	300.0 K
D1	3.00000000 sec

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

NUC1	1H
P1	9.50 usec
PL1	0.00 dB
SFO1	500.1325006 MHz

F2 - Processing parameters

SI	65536
SF	500.1300086 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	8.000 ppm
F1	4001.04 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	0.40000 ppm/cm
HZCM	200.05200 Hz/cm