Supplementary Materials for

Enantioselective Heck Arylations of Acyclic Alkenyl Alcohols Using a Redox-Relay Strategy

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General Considerations

Dry dimethylacetamide (DMA), and dimethylformamide (DMF) were purchased from Aldrich and stored over activated 3 angstrom molecular sieves (3 Å MS).

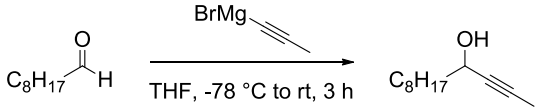
Tetrahydrofuran (THF) and dichloromethane (DCM) were dried before use by passing through a column of activated alumina. Alkene substrates were purchased from Aldrich, TCI or Acros, or synthesized according to the procedures referenced. Aldehyde precursors to alkene substrates were purchased from Aldrich. Propargyl magnesium bromide was purchased from Aldrich. Alkyne precursors to alkene substrates were purchased from Aldrich. Aniline precursors to aryldiazonium tetrafluoroborates and hexafluorophosphates were purchased from Aldrich. Palladium(II) chloride was purchased from Pressure Chemicals. Pd_2dba_3 was synthesized according to the literature procedure.(*35*) Picolinic acid derivatives were purchased from Aldrich or Matrix scientific. Amino alcohols were synthesized according to the literature procedure. ^{1}H-NMR spectra were obtained at 300 MHz or 400 MHz, chemical shifts are reported in ppm, and referenced to the $CHCl_3$ singlet at 7.26 ppm. ^{13}C-NMR spectra were obtained at 75 MHz or 100 MHz and referenced to the center peak of the $CDCl_3$ triplet at 77.23 ppm. The abbreviations s, d, t, quint, dd, dt, and m stand for the resonance multiplicities singlet, doublet, triplet, quintet, doublet of doublets, doublet of triplets and multiplet, respectively. Thin-layer chromatography was performed with EMD silica gel 60 F254 plates eluting with solvents indicated, visualized by a 254 nm UV lamp and stained with phosphomolybdic acid. Flash chromatography was performed using EM reagent silica 60 (230-400 mesh). IR spectra were recorded using a Thermo Nicolet FT-IR. High resolution mass spectrometry (HRMS) data were obtained on a Waters LCP Premier XE instrument by ESI/TOF. Achiral GC (gas chromatography) was performed using a Hewlett Packard HP 6890 series GC system fitted with an Agilent HP-5 column. Chiral GC analysis was performed using a Hewlett Packard HP 6890 Series CG system fitted

with a HP-Chiral permethylated β-cyclodextrin column. SFC (supercritical fluid chromatography) analysis was performed at 40 ºC, using a Thar instrument fitted with a chiral stationary phase as indicated. Optical rotations were measured (Na D line) on a Perkin Elmer Model 343 Polarimeter fitted with a micro cell with a 1 dm path length; concentrations are reported in g/100 mL. (*S*)-(+)-**3f** is a previously reported compound with a known optical rotation,(*33, 34*) and the absolute stereochemistry of products **3a-3m** were assigned based on analogy to this compound where possible. ***It should be noted that while no incident occurred during this study, aryldiazonium salts can be explosive.***

Synthesis of alkene substrates

General procedure for the synthesis of propargylic alcohol precursors to allylic alcohol substrates

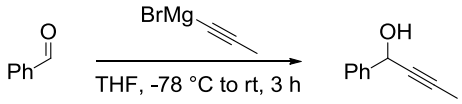
Dodec-2-yn-4-ol (**S1**)



To a dry 100 mL round-bottom flask containing a stir bar was added nonanal (1.42 g, 10 mmol). The flask was placed under an N_2 atmosphere, and cooled to -78 ^oC. A solution of 1-propynyl magnesium bromide (22 mL, 0.5 M in THF, 1.1 equiv) was added slowly while stirring. The mixture was stirred at that temperature for 1 h, prior to allowing it to warm to room temperature, and stirring for an additional 2 h. Saturated ammonium chloride (20 mL) was added slowly, prior to transferring the mixture to a 250 mL separatory funnel with diethyl ether. The aqueous layer was extracted with ether (3 x 50 mL). The combined organic layers were washed with water (1 x 50 mL), then brine,

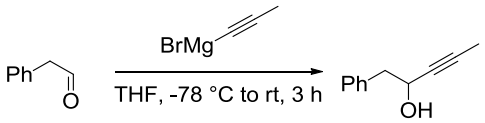
and then dried over sodium sulfate. The organic mixture was concentrated under reduced pressure, and the concentrate was purified by silica gel flash chromatography using 5% acetone in hexanes to give dodec-2-yn-4-ol as a colorless oil (1.24 g, 68%). The purity was confirmed by ^{1}H NMR.(*36*)

1-Phenylbut-2-yn-1-ol (**S2**)



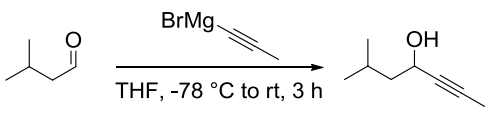
The procedure used for the preparation of dodec-2-yn-4-ol was used except benzaldehyde (1.06 g, 10 mmol) was used. The product was purified by silica gel chromatography using 5% acetone in hexanes to give 1-phenylbut-2-yn-1-ol (1.41 g, 97%). The purity was confirmed by ^{1}H NMR.(*37*)

1-Phenylpent-3-yn-2-ol (**S3**)



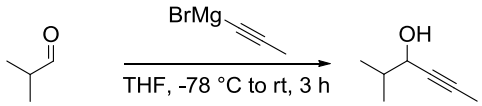
The procedure used for the preparation of dodec-2-yn-4-ol was used except 2-phenylacetaldehyde (1.20 g, 10 mmol) was used. The product was purified by silica gel chromatography using 5% acetone in hexanes to give 1-phenylpent-3-yn-2-ol (1.04 g, 65%). The purity was confirmed by ^{1}H NMR.(*38*)

6-Methylhept-2-yn-4-ol (**S4**)



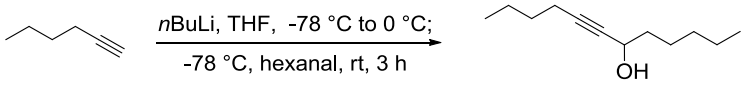
The procedure used for the preparation of dodec-2-yn-4-ol was used except 3-methybutanal (860 mg, 10 mmol) was used. The product was purified by silica gel chromatography using 3% acetone in hexanes to give 6-methylhept-2-yn-4-ol (810 mg, 64%). The purity was confirmed by ^{1}H NMR.(*39*)

2-Methylhex-4-yn-3-ol (**S5**)



The procedure used for the preparation of dodec-2-yn-4-ol was used except isobutyraldehyde (360 mg, 5 mmol) was used. The product was purified by silica gel chromatography using 3% acetone in hexanes to give 6-methylhex-4-yn-2-ol (380 mg, 68%). The purity was confirmed by ^{1}H NMR.(*40*)

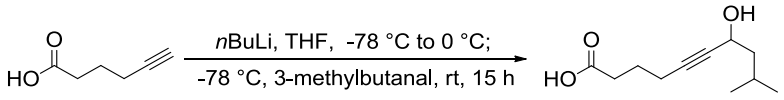
Synthesis of dodec-7-yn-6-ol (**S6**)



To a dry 100 mL round-bottom flask containing a stir bar and under an N_2 atmosphere was added THF (15 mL). The solvent was cooled to -78 ^{o}C, prior to adding 1-hexyne via syringe (870 μL, 620 mg, 7.5 mmol). To this mixture was added *n*BuLi (3.2 mL of 2.5 M solution in THF, 8.0 mmol, 1.1 equiv) via syringe. The mixture was allowed to warm to 0 ^{o}C, and stirred at that temperature for 1 h. The mixture was then cooled to -78 ^{o}C, and to this mixture hexanal (930 μL, 650 mg, 7.5 mmol) was added dropwise via syringe. The mixture was allowed to warm to room temperature, and stirred for 3 h. Saturated ammonium chloride (15 mL) was added slowly, prior to transferring

the mixture to a 250 mL separatory funnel with diethyl ether. The aqueous layer was extracted with ether (3 x 40 mL). The combined organic layers were washed with water (1 x 40 mL), then brine (1 x 40 mL), and then dried over sodium sulfate. The organic mixture was concentrated under reduced pressure, and the concentrate was purified by silica gel flash chromatography using 2% acetone in hexanes to give dodec-7-yn-6-ol as a colorless oil (980 mg, 72% yield). Purity was confirmed by ^{1}H NMR.(*41*)

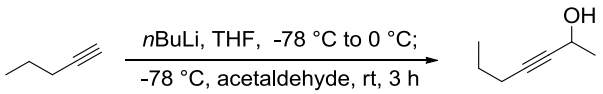
Synthesis of 7-hydroxy-9-methyldec-5-ynoic acid (**S7**)



To a dry 100 mL round-bottom flask containing a stir bar was added 560 mg hex-5-ynoic acid (560 mg, 5 mmol). The flask was placed under an N_2 atmosphere, prior to adding THF (50 mL) and cooling the mixture to -78 ^{o}C. To the cooled solution was added *n*BuLi (5 mL of a 2.5 M solution in hexanes, 11 mmol, 2.2 equiv) dropwise via syringe. The mixture was allowed to warm to room temperature and stirred for 1 h. The mixture was cooled to -78 ^{o}C, and then to this mixture 3-methylbutanal (600 μL, 470 mg, 5.5 mmol, 1.1 equiv) was added dropwise via syringe. The mixture was allowed to warm to room temperature, and stirred for 15 h. Saturated ammonium chloride (15 mL) was added slowly, prior to transferring the mixture to a 250 mL separatory funnel with diethyl ether. The aqueous layer was extracted with ether (3 x 40 mL). The combined organic layers were washed with water (1 x 40 mL), then brine (1 x 40 mL), and then dried over sodium sulfate. The organic mixture was concentrated under reduced pressure, and the concentrate was purified by silica gel flash chromatography using 20% acetone in

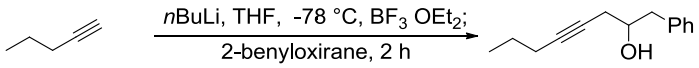
hexanes to give 7-hydroxy-9-methyldec-5-ynoic (800 mg) with minor impurities. This mixture was carried forward without further purification.

Synthesis of hept-3-yn-2-ol (**S8**)



The procedure used for the preparation of dodec-7-yn-6-ol was followed except 1-pentyne (990 μL, 680 mg, 10 mmol) and acetaldehyde (620 μL, 480 mg, 11 mmol) were used. The product was purified by silica gel chromatography using 5% acetone in hexanes to give hept-3-yn-2-ol (670 mg, 60%). The purity was confirmed by ^{1}H NMR.(*42*)

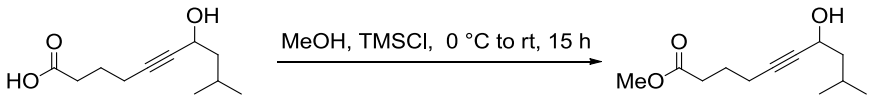
Synthesis of 1-phenyloct-4-yn-2-ol (**S9**)



A dry 50 mL round bottom flask containing a stir bar was placed under an N_2 atmosphere prior to adding THF (10 mL). The mixture was cooled to -78 ^{o}C, and to it was added 1-pentyne (740 μL, 510 mg, 7.5 mmol). To this mixture was added *n*BuLi (3.0 mL of a 2.5 M solution in hexanes, 7.5 mmol) dropwise via syringe. To this mixture was added borontrifluoride etherate (930 μL, 7.5 mmol) dropwise via syringe, and the resulting mixture was stirred for 30 min. To this mixture was added 2-benzyloxirane (810 μL, 1.00 g, 7.5 mmol), and the resulting mixture was stirred for 2 h. Saturated ammonium chloride (15 mL) was added slowly, prior to transferring the mixture to a 250 mL separatory funnel with diethyl ether. The aqueous layer was extracted with ether (3 x

40 mL). The combined organic layers were washed with water (1 x 40 mL), then brine (1 x 40 mL), and then dried over sodium sulfate. The organic mixture was concentrated under reduced pressure, and the concentrate was purified by silica gel flash chromatography using hexanes to 5% acetone in hexanes to give 1-phenyloct-4-yn-2-ol (1.26 g) with minor impurities. This mixture was carried forward without further purification.

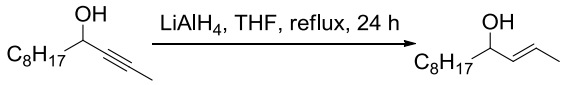
Synthesis of methyl 7-hydroxy-9-methyldec-5-ynoate (**S10**)



To a dry 25 mL round-bottom flask containing a stir bar was added 7-hydroxy-9-methyldec-5-ynoic (570 mg, 2.9 mmol). The flask was placed under an N_2 atmosphere, prior to add methanol (2 mL). The mixture was cooled to 0 ^{o}C, and to the cooled mixture was added chlorotrimethylsilane (560 uL, 480 mg, 4.4 mmol, 1.5 equiv). The mixture was allowed to warm to room temperature, and stirred for 15 h. The solvent was removed under reduced pressure, resulting in a yellow oil. The residue was transferred to a separatory funnel using 50 mL diethyl ether. The organic mixture was washed with water (3 x 10 mL), then brine (1 x 10 mL), and was then dried over sodium sulfate. The organic layer was concentrated under reduced pressure to give a light yellow oil (620 mg), which was carried forward without purification.

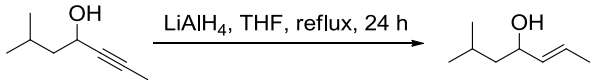
General procedure for the synthesis of (*E*)-allylic alcohol substrates

Synthesis of (*E*)-dodec-2-en-4-ol (**S11**)



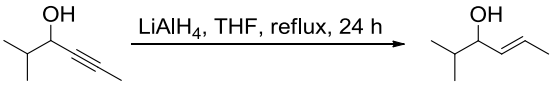
To a dry 100 mL round-bottom flask equipped with a stir bar was added lithium aluminum hydride (230 mg, 6 mmol, 3 equiv). The flask was equipped with a condenser, and the apparatus was placed under an N_2 atmosphere. To this flask was added THF (30 mL), and the mixture was stirred. To this mixture was slowly added dodec-2-yn-4-ol (360 mg, 2 mmol) in THF (10 mL). The mixture was heated to gentle reflux using a heating mantle, and stirred for 24 h. The mixture was cooled to 0 ^oC, the condenser was removed, and the mixture was diluted with diethyl ether (10 mL). To this mixture was added water (230 μL), dropwise via syringe. To the resulting mixture was added 20 wt% KOH (230 μL), then water (690 μL). This mixture was stirred for 1 h, then placed in a sonicating water bath for an additional 1 h. The mixture was then filtered through Celite, and the resulting homogeneous organic solution was concentrated under reduced pressure. The mixture was purified by silica gel flash chromatography using 2% acetone in hexanes to give (*E*)-dodec-2-en-4-ol (260 mg, 69%). The purity was confirmed by ^1H NMR.(*43*)

Synthesis of (*E*)-6-methylhept-2-en-4-ol (**S12**)



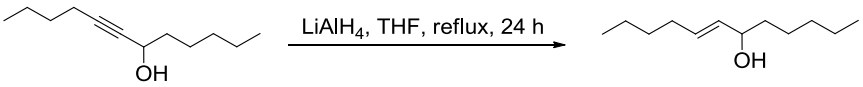
The procedure used for the preparation of (*E*)-dodec-2-en-4-ol was followed except 6-methylhept-2-yn-4-ol (250 mg, 2 mmol) was used. The product was purified by silica gel flash chromatography using 2% acetone in hexanes to give (*E*)-6-methylhept-2-en-4-ol (95 mg, 37%). The purity was confirmed by ^1H NMR.(*44*)

Synthesis of (*E*)-2-methylhex-4-en-3-ol (**S13**)



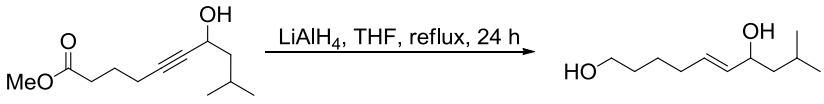
The procedure used for the preparation of (*E*)-dodec-2-en-4-ol was followed except 2-methylhex-4-yn-3-ol (330 mg, 2.9 mmol) was used. The product was purified by silica gel flash chromatography using 2% acetone in hexanes to give (*E*)-2-methylhex-4-en-3-ol (180 mg, 54%). The purity was confirmed by ^{1}H NMR.(*45*)

Synthesis of (*E*)-dodec-7-en-6-ol (**S14**)



The procedure used for the preparation of (*E*)-dodec-2-en-4-ol was followed except dodec-7-yn-6-ol (540 mg, 3.0 mmol) was used. The product was purified by silica gel flash chromatography using 2% acetone in hexanes to give (*E*)-dodec-7-en-6-ol (420 mg, 76%). The purity was confirmed by ^{1}H NMR.(*46*)

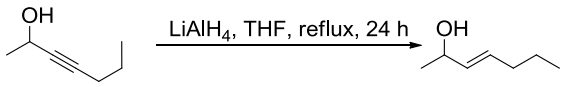
Synthesis of (*E*)-9-methyldec-5-ene-1,7-diol (**S15**)



The procedure used for the preparation of (*E*)-dodec-2-en-4-ol was followed except methyl-7-hydroxy-9-methyldec-5-ynoate (370 mg, 1.7 mmol), and 330 mg $LiAlH_4$ (8.8 mmol 5.0 equiv) were used. The product was purified by silica gel flash chromatography using 10% acetone in hexanes to give (*E*)-9-methyldec-5-ene-1,7-diol

(280 mg, 86%) as a colorless oil. R_f = 0.31 w/ 20% acetone:hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.69-5.60 (m, 1 H), 5.51-5.43 (m, 1 H), 4.16-4.08 (m, 1 H), 3.65 (q, *J* = 6.2 Hz, 2 H), 2.08 (dt, *J* = 7.3, 6.7 Hz, 2 H), 1.76-1.21 (m, 8 H), 0.92 (d, *J* = 6.6 Hz, 3 H), 0.91 (d, *J* = 6.6 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 134.0, 131.6, 71.5, 63.0, 46.7, 32.4, 32.1, 25.5, 24.8, 23.1, 22.7. IR (neat): 3313, 2953, 2929, 2968, 1467, 1366, 1056, 968 cm^{-1}. HRMS $C_{11}H_{22}O_2$ $(M+Na)^+$ calcd. 209.1517, obsvd. 209.1520.

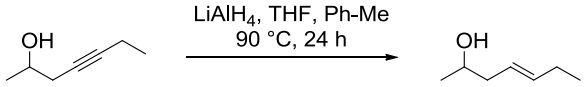
Synthesis of (*E*)-hept-3-en-2-ol (**S16**)



The procedure used for the preparation of (*E*)-dodec-2-en-4-ol was followed except hept-3-yn-2-ol (1.84 g, 16.4 mmol) was used. The product was purified by silica gel flash chromatography using 2% acetone in hexanes to give (*E*)-hept-3-en-ol (330 mg, 29%). The purity was confirmed by ^{1}H NMR.(*47*)

General procedure for the synthesis of (*E*)-homoallylic alcohol substrates

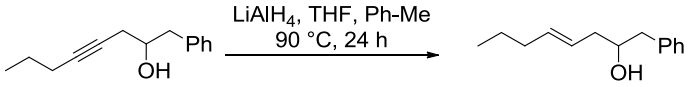
Synthesis of (*E*)-hept-4-en-2-ol (**S17**)



To a dry 100 mL round-bottom flask equipped with a stir bar was added lithium aluminum hydride (1.20 g, 32 mmol, 3.2 equiv). The flask was equipped with a condenser, and the apparatus was placed under an N_2 atmosphere. To this flask was added toluene (13 mL), and THF (6 mL) and the mixture was stirred. To this mixture was slowly added hept-4-yn-2-ol (1.12 g, 10 mmol) in THF (7 mL). The mixture was

heated to 90 °C, using a temperature-regulated oil bath, and stirred for 24 h. The mixture was cooled to 0 °C, the condenser was removed, and the mixture was diluted with diethyl ether (20 mL). To this mixture was added water (1.2 mL), dropwise via syringe. To the resulting mixture was added 20 wt% KOH (1.2 mL), then water (3.6 mL). This mixture was stirred for 1 h, then placed in a sonicating water bath for an additional 1 h. The mixture was then filtered through Celite, and the resulting homogeneous organic mixture was concentrated under reduced pressure to give a mixture containing toluene. The mixture was purified by silica gel flash chromatography using 0% to 10% to 20% diethyl ether in pentane to give (*E*)-hept-4-en-2-ol (760 mg, 67%). The purity was confirmed by ^{1}H NMR.(*48*)

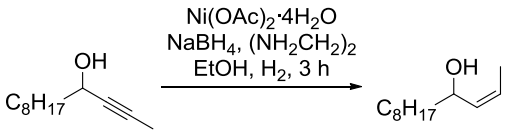
Synthesis of (*E*)-1-phenyloct-4-en-2-ol (**S18**)



The procedure used for the preparation of (*E*)-hept-4-en-2-ol was followed except 1-phenyloct-4-yn-2-ol (400 mg, 2 mmol) was used. The product was purified by silica gel flash chromatography using 0 to 3% acetone in hexanes to give (*E*)-1-phenyloct-4-en-2-ol (240 mg, 59%) as a colorless oil. R_f = 0.34 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.34-7.21 (m, 5 H), 5.61-5.52 (m, 1 H), 5.49-5.39 (m, 1 H). 3.88-3.78 (m, 1 H), 2.84-2.68 (m, 2 H), 2.32-2.10 (m, 2 H), 2.01 (dt, *J* = 7.3, 6.6 Hz, 2 H), 1.70 (d, *J* = 3.4 Hz, 1 H), 1.39 (sextet, *J* = 7.4 Hz, 2 H), 0.90 (t, *J* = 7.3 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 138.8, 134.7, 129.6, 128.6, 126.6, 126.0, 72.2, 43.4, 40.2, 35.0, 22.7, 13.9. IR (neat): 3933, 3027 2956, 2925, 1496, 1436, 1078, 970, 741, 699 cm^{-1}. HRMS $C_{14}H_{20}O$ $(M+Na)^+$ calcd. 227.1412, obsvd. 227.1411.

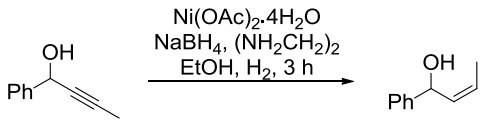
General procedure for the synthesis of (*Z*)-allylic alcohol and (*Z*)-homoallylic alcohol substrates

Synthesis of (*Z*)-dodec-2-en-4-ol (**S19**)



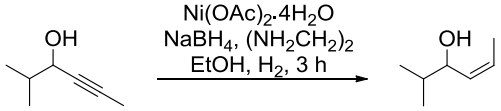
The 95:5 by weight mixture of ethanol and water that was used as solvent was prepared by diluting absolute ethanol (95 g) with water (5 g). To a 50 mL Schlenk flask containing a stir bar was added nickel(II) acetate tetrahydrate (124 mg, 0.5 mmol, 25 mol %), and sodium borohydride (20 mg, 0.5 mmol, 25 mol %). To this mixture was added 95 wt% ethanol (15 mL), and the mixture was stirred for 10 min. To this mixture was added ethylenediamine (80 mL, 1 mmol, 50 mol%) via syringe. A three-way joint was fitted with a balloon of H_2 and attached to the flask. The apparatus was evacuated and refilled with hydrogen three times. The mixture was stirred under H_2 atmosphere for 10 min. To the mixture was added dodec-2-yn-4-ol (360 mg, 2.0 mmol) in 95 wt% ethanol (5 mL). The mixture was stirred at room temperature for 3 h, before it was filtered through Celite with diethyl ether. The resulting homogeneous mixture was transferred to a separatory funnel using ether (10 mL) and water (10 mL). The aqueous layer was extracted with ether (3 x 15 mL), and the combined organic layers were washed with water (3 x 15 mL), then brine (1 x 15 mL). The combined organic layers were dried over sodium sulfate, before they were concentrated under reduced pressure. The mixture was purified by silica gel flash chromatography using 2% acetone in hexanes to give (*Z*)-dodec-2-en-4-ol (260 mg, 69%). The purity was confirmed by ^{1}H NMR.(*43*)

Synthesis of (*Z*)-1-phenylbut-2-en-1-ol (**S20**)



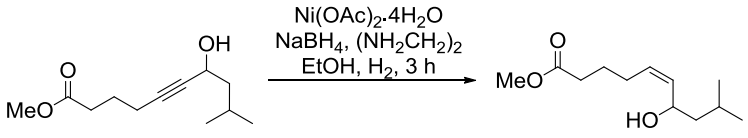
The procedure used for the preparation of (*Z*)-dodec-2-en-4-ol was followed except 1-phenylbut-2-yn-1-ol (290 mg, 2.0 mmol) was used. The product was purified by silica gel flash chromatography using 3% acetone in hexanes to give (*Z*)-1-phenylbut-2-en-1-ol (170 mg, 58%). The purity was confirmed by ^{1}H NMR.(*49*)

Synthesis of (*Z*)-2-methylhex-4-en-3-ol (**S21**)



The procedure used for the preparation of (*Z*)-dodec-2-en-4-ol was followed except 2-methylhex-4-yn-3-ol (450 mg, 4.0 mmol) was used. The product was purified by silica gel flash chromatography using 3% acetone in hexanes to give (*Z*)-2-methylhex-4-en-2-ol (180 mg, 39%). The purity was confirmed by ^{1}H NMR.(*50*)

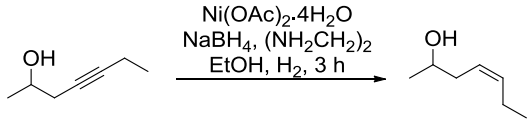
Synthesis of (*Z*)-methyl 7-hydroxy-9-methyldec-5-enoate (**S22**)



The procedure used for the preparation of (*Z*)-dodec-2-en-4-ol was followed except methyl 7-hydroxy-9-methyldec-5-ynoate (230 mg, 1.1 mmol) was used, and the mixture was stirred for 15 h under H_2. The product was purified by silica gel flash

chromatography using 10% acetone in hexanes to give (*Z*)-methyl 7-hydroxy-9-methyldec-5-enoate (170 mg, 72%) containing minor amounts of the (*E*)-isomer. R_f = 0.34 w/ 10% acetone in hexanes. Major isomer: ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.46-5.36 (m, 2 H), 4.51-4.34 (m, 1 H), 3.67 (s, 3 H), 2.33 (t, *J* = 7.3 Hz, 2 H) 2.34-2.06 (m, 2 H), 1.78-1.61 (m, 4 H), 1.55-1.46 (m, 2 H), 1.33-1.20 (m, 2 H), 0.94-0.90 (m, 6 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 174.3, 134.5, 130.6, 65.8, 51.8, 46.7, 33.5, 27.0, 25.0, 23.2, 22.8. IR (neat): 3417, 2953, 2869, 1734, 1437, 1214, 1163, 1053, 1013. cm^{-1}. HRMS $C_{12}H_{22}O_3$ $(M+Na)^+$ calcd. 237.1467, obsvd. 237.1472.

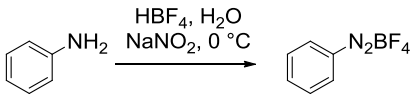
Synthesis of (*Z*)-hept-4-en-2-ol (**23**)



The procedure used for the preparation of (Z)-dodec-2-en-4-ol was followed except hept-4-yn-2-ol (330 mg, 3.0 mmol) was used. The product was purified by silica gel flash chromatography using 5% diethyl ether in pentane to give (*Z*)-hept-4-en-2-ol (200 mg, 58%). The purity was confirmed by ^{1}H NMR. *(50)*

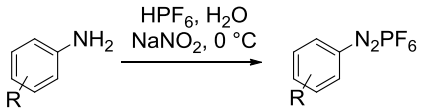
<u>Synthesis of aryldiazonium salts</u>

Synthesis of benzenediazonium tetrafluoroborate (**S24**)



Benzene diazonium tetrafluoroborate was synthesized by a previously reported procedure.(*13*)

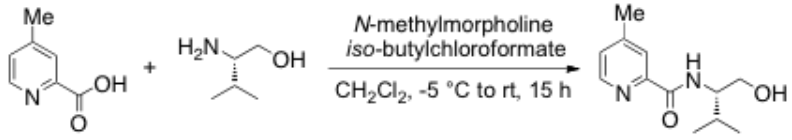
Synthesis of aryldiazonium hexafluorophosphates (**S25**)



Aryl diazonium hexafluorophosphate reagents were synthesized by a previously reported procedure.(*51*)

General procedure for the synthesis of PyrOx ligands-Anderson coupling

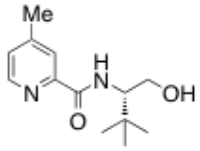
Synthesis of (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-methylpicolinamide (**S26**)



To a dry 100 mL round-bottom flask containing a stir bar was added 4-methylpicolinic acid (140 mg, 1.0 mmol). The flask was placed under an N_2 atmosphere. Dichloromethane (20 mL) was added via syringe, followed by *N*-methylmorpholine (170 mL, 1.5 mmol, 1.15 equiv). The reaction mixture was cooled to 0 ^{o}C, then *iso*-butyl chloroformate was added (160 uL, 1.2 mmol, 1.2 equiv). The mixture was stirred for 20 min, then (*S*)-leucinol (120 mg, 1.2 mmol, 1.2 equiv) was added in dichloromethane (15 mL). The mixture was allowed to warm to rt and stirred for 15 h). The mixture was transferred to a separatory funnel with dichloromethane (10 mL) and water (10 mL). The aqueous layer was extracted with dichloromethane (1 x 15 mL), and the combined organic layers were washed with water (1 x 20 mL), and brine (1 x 20 mL), then dried over sodium sulfate. The dried organic mixture was concentrated under reduced pressure

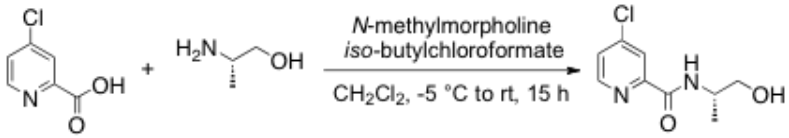
and purified by silica gel flash chromatography with 2:1 hexanes:ethyl acetate to give (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-methylpicolinamide (70 mg, 30%).

Synthesis of (*S*)-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)-4-methyl picolinamide (**S27**)



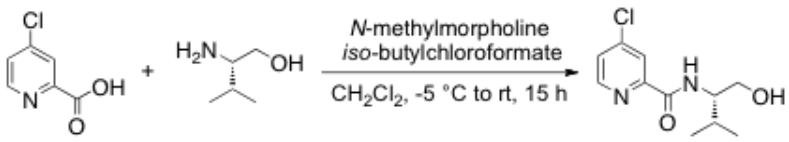
(*S*)-*N*-(1-Hydroxy-3,3-dimethylbutan-2-yl)-4-methylpicolinamide was prepared by following a literature procedure.(*29*)

Synthesis of (*S*)-4-chloro-*N*-(1-hydroxypropan-2-yl) picolinamide (**S28**)



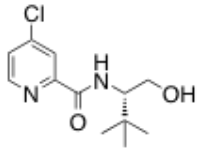
The procedure used for the preparation of (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-methylpicolinamide was used except 4-chloropicolinic acid (320 mg, 2.0 mmol) and (*S*)-alinol (140 mg, 2.4 mmol, 1.2 equiv) were used. The mixture was purified by silica gel flash chromatography with 2:1 hexanes:ethyl acetate to give (*S*)-4-chloro-*N*-(1-hydroxypropan-2-yl)picolinamide (246 mg, 58%).

Synthesis of (*S*)-4-chloro-*N*-(1-hydroxy-3-methylbutan-2-yl)picolinamide (**S29**)



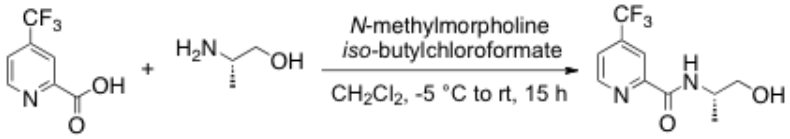
The procedure used for the preparation of (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-methylpicolinamide was used except 4-chloropicolinic acid (630 mg, 4.0 mmol) and (*S*)-leucinol (500 mg, 4.8 mmol, 1.2 equiv) were used. The mixture was purified by silica gel flash chromatography with 2:1 hexanes:ethyl acetate to give (*S*)-4-chloro-*N*-(1-hydroxy-3-methylbutan-2-yl)picolinamide (830 mg, 87%).

Synthesis of (*S*)-4-chloro-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)picolinamide (**S30**)



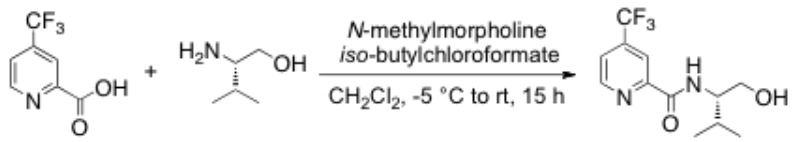
(*S*)-4-Chloro-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)picolinamide was prepared by following a literature procedure.(*29*)

Synthesis of (*S*)-*N*-(1-hydroxypropan-2-yl)-4-(trifluoromethyl)picolinamide (**S31)**



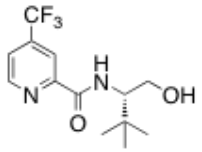
The procedure used for the preparation of (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-methylpicolinamide was used except 4-trifluoromethylpicolinic acid (380 mg, 2.0 mmol) and (*S*)-alinol (180 mg, 2.4 mmol, 1.2 equiv) were used. The mixture was purified by silica gel flash chromatography with 2:1 hexanes:ethyl acetate to give (*S*)-*N*-(1-hydroxypropan-2-yl)-4-(trifluoromethyl)picolinamide (370 mg, 75%).

Synthesis of (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-(trifluoromethyl) picolinamide (**S32**)



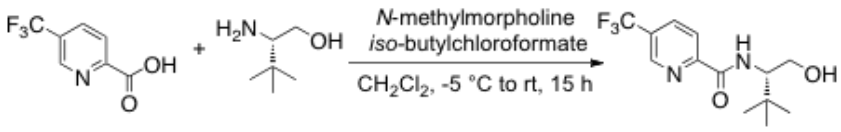
The procedure used for the preparation of (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-methylpicolinamide was used except 4-trifluoromethylpicolinic acid (380 mg, 2.0 mmol) and (*S*)-leucinol (250 mg, 2.4 mmol, 1.2 equiv) were used. The mixture was purified by silica gel flash chromatography with 2:1 hexanes:ethyl acetate to give (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-(trifluoromethyl)picolinamide (350 mg, 72%).

Synthesis of (*S*)-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)-4-(trifluoromethyl) picolinamide (**S33**)



(*S*)-*N*-(1-Hydroxy-3,3-dimethylbutan-2-yl)-4-(trifluoromethyl)picolinamide was prepared by following a literature procedure.(*29*)

Synthesis of (*S*)-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)-5-(trifluoromethyl) picolinamide (**S34**)

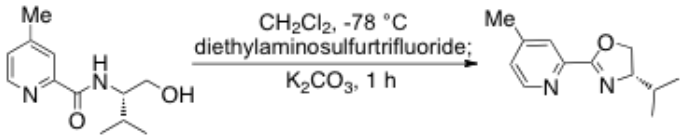


The procedure used for the preparation of (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-methylpicolinamide was used except 5-trifluoromethylpicolinic acid (280 mg, 1.5 mmol) and (*S*)-*tert*-leucinol (190 mg, 1.6 mmol, 1.1 equiv) were used. The mixture was

purified by silica gel flash chromatography with 2:1 hexanes:ethyl acetate to give (*S*)-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)-5-(trifluoromethyl)picolinamide (410 mg, 94%). $[\alpha]^{20}_D = -10^o$ (c = 0.113, $CHCl_3$). R_f = 0.14 w/ 2:1 hexanes:EtOAc. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 8.83 (br s, 1 H), 8.31 (d, *J* = 8.1 Hz, 1 H), 8.25 (br d, *J* = 9.1 Hz, 1 H), 8.09 (dd, *J* = 8.1, 1.7 Hz, 1 H), 4.06-3.97 (m, 2 H), 3.73-3.67 (m, 1 H), 2.57 (br s, 1 H), 1.04 (s, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 164.1, 152.7, 145.4 (q, *J* = 4.0 Hz), 135.0 (q, *J* = 3.6 Hz), 129.0 (q, *J* = 33.1 Hz), 123.3 (q, *J* = 272.7 Hz), 122.4, 63.2, 60.5, 34.1, 27.1. IR (neat): 3379, 2964, 1673, 1528, 1327, 1166, 1135, 1076, 1054, 1018 cm-^{1}. HRMS $C_{13}H_{17}F_3N_2O_2$ $(M+Na)^+$ calcd. 313.1140, obsvd. 313.1147.

General procedure for the synthesis of PyrOx ligands-oxazoline formation

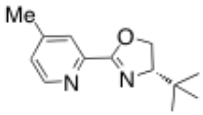
Synthesis of (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole (**S35**)



To a dry 25 mL round-bottom flask containing a stir bar was added (*S*)-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)-4-methylpicolinamide (60 mg, 0.3 mmol). The flask was placed under an N_2 atmosphere, then dichloromethane (4 mL) was added via syringe. The reaction mixture was cooled to -78 ^{o}C and diethylaminosulfur trifluoride (50 mL, 0.4 mmol, 1.4 equiv) was added. The reaction mixture was stirred for 1 h, then potassium carbonate (80 mg, 0.6 mmol, 2 equiv) was added. The mixture was warmed to rt, transferred to a separatory funnel with dichloromethane (10 mL) and water (10 mL). The organic layer was washed with saturated sodium bicarbonate (1 x 10 mL), and brine (1 x 10 mL), then dried over sodium sulfate. The dried organic layer was concentrated under

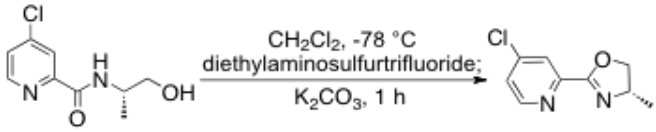
reduced pressure, and the mixture purified by silica gel flash chromatography using 2:1 hexanes:ethyl acetate + 0.1% triethylamine to give the product (10 mg, 18%). This material decomposed rapidly, and was used immediately as ligand.

Synthesis of (*S*)-4-(*tert*-butyl)-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole (**S36**)



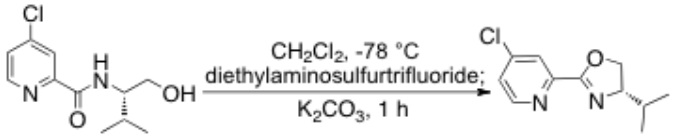
(*S*)-*N*-(1-Hydroxy-3,3-dimethylbutan-2-yl)-4-methylpicolinamide was prepared by following a literature procedure.(*29*) The material decomposed rapidly, and was used immediately as ligand.

Synthesis of (*S*)-2-(4-chloropyridin-2-yl)-4-methyl -4,5-dihydrooxazole (**S37**)



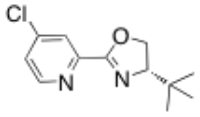
The procedure used for the preparation for the preparation of (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole was used except (*S*)-4-chloro-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)picolinamide (110 mg, 0.5 mmol) was used. The product was purified in the same fashion, to give a material (10 mg, 11%) that decomposed rapidly, and was used immediately as ligand.

Synthesis of (*S*)-2-(4-chloropyridin-2-yl)-4-isopropyl-4,5-dihydrooxazole (**S38**)



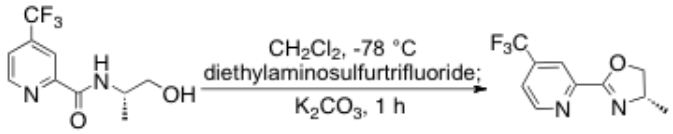
The procedure used for the preparation for the preparation of (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole was used except (*S*)-4-chloro-*N*-(1-hydroxy-3-methylbutan-2-yl)picolinamide (110 mg, 0.4 mmol) was used. The product was purified in the same fashion, to give a material (70 mg, 62%) that was used immediately as ligand.

Synthesis of (*S*)-4-(*tert*-butyl)-2-(4-chloropyridin-2-yl)-4,5-dihydrooxazole (**S39)**



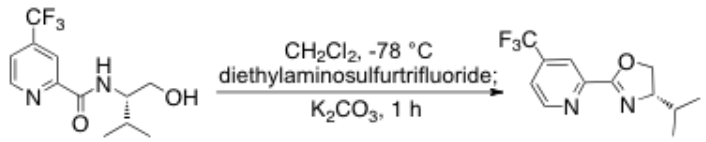
S)-4-(*tert*-butyl)-2-(4-chloropyridin-2-yl)-4,5-dihydrooxazole was prepared by following a literature procedure.(*29*)

Synthesis of (*S*)-4-methyl-2-(4-(trifluoromethyl)pyridin-2-yl)-4,5-dihydrooxazole (**S40**)



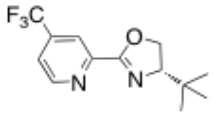
The procedure used for the preparation for the preparation of (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole was used except (*S*)-*N*-(1-hydroxypropan-2-yl)-4-(trifluoromethyl)picolinamide (110 mg, 0.4 mmol) was used. The product was purified in the same fashion, to give a material (32 mg, 28%) that decomposed rapidly and was used immediately as ligand.

Synthesis of (*S*)-4-isopropyl-2-(4-(trifluoromethyl)pyridin-2-yl)-4,5-dihydrooxazole (**S41**)



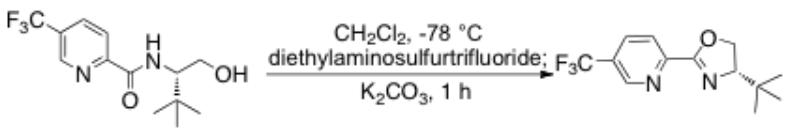
The procedure used for the preparation for the preparation of (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole was used except (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-4-(trifluoromethyl)picolinamide (140 mg, 0.5 mmol) was used. The product was purified in the same fashion, to give a material (70 mg, 51%) that was used immediately as ligand.

Synthesis of (*S*)-4-(*tert*-butyl)-2-(4-(trifluoromethyl)pyridin-2-yl)-4,5-dihydrooxazole (**1a**)



(*S*)-4-(*tert*-Butyl)-2-(4-(trifluoromethyl)pyridin-2-yl)-4,5-dihydrooxazole was prepared following a literature procedure.(*29*)

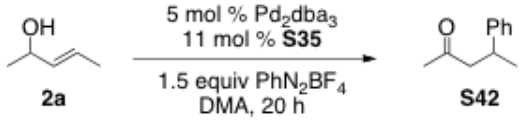
Synthesis of (*S*)-4-(*tert*-Butyl)-2-(5-(trifluoromethyl)pyridin-2-yl)-4,5-dihydrooxazole (**1b**)



The procedure used for the preparation for the preparation of (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole was used except (*S*)-*N*-(1-hydroxy-3-methylbutan-2-yl)-5-(trifluoromethyl)picolinamide (290 mg, 1.0 mmol) was used. The product was purified in the same fashion, to give (*S*)-*N*-(1-hydroxy-3,3-dimethylbutan-2-yl)-5-(trifluoromethyl)picolinamide (230 mg, 85%). $[\alpha]^{20}_{D} = -73^{o}$ (c = 0.100, $CHCl_3$). R_f = 0.57 w/ 2:1 hexanes:EtOAc. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 8.95 (d, *J* = 5.2 Hz, 1 H), 8.22 (d, *J* = 8.2 Hz, 1 H), 8.01 (ddd, *J* = 8.2, 2.3, 0.6 Hz, 1 H), 4.48 (dd, *J* = 10.3, 8.8 Hz, 1 H), 4.34 (t, *J* = 8.5 Hz, 1H), 4.16 (dd, *J* = 10.3, 8.4 Hz, 1 H), 0.98 (s, 9 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 161.6, 150.2, 146.7 (q, *J* = 4.0 Hz) 134.0 (q, *J* = 3.6 Hz), 128.1 (q, *J* = 33.4 Hz), 123.4 (q, *J* = 272.7 Hz), 123.9, 76.9, 69.8, 34.2, 26.1. IR (neat): 2963, 1645, 1399, 1329, 1166, 1127, 1098, 1012, 668 cm^{-1}. HRMS $C_{13}H_{15}F_3N_2O$ $(M+Na)^+$ calcd. 295.1034, obsvd. 295.1038.

<u>General procedure for the identification of optimal PyrOx ligand in the asymmetric Heck reaction</u>

Figure 2, use of (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole (ligand **S35**)

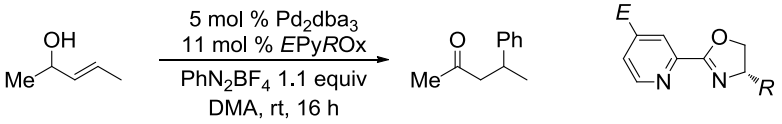


In the dry box, a 1 M solution of (*E*)-pent-3-en-2-ol (**2a**), containing 10 wt% tetradecane, in DMA was prepared. To a 20 mL scintillation vial equipped with a stir bar was added benzenediasonium tetrafluoroborate (14 mg, 0.08 mmol, 1.5 equiv). To a separate vial was added Pd_2dba_3 (2 mg, 0.003 mmol, 0.05 equiv). To a separate vial was

added (*S*)-4-isopropyl-2-(4-methylpyridin-2-yl)-4,5-dihydrooxazole (**S35**) (1 mg, 0.006 mmol, 0.11 equiv). To the vial containing palladium was added DMA (0.25 mL), and to the vial containing the ligand was added DMA (0.20 mL). With a pipet, the mixture containing the ligand was added to the mixture containing palladium. With a pipet, the resulting mixture was perturbed several times to ensure mixing, and it was allowed to sit for 10 min. To this mixture was added 50 μL of the mixture containing the substrate and tetradecane (0.05 mmol, 1 equiv). This mixture was added to the vial containing the aryldiazonium salt, and the vial was fitted with a lid, removed from the dry box, and stirred for 20 h. The mixture was then passed through a silica gel pipet with diethyl ether, and analyzed for product formation and enantiomeric ratio by gas chromatography. The modifications described below were applied in order to identify the optimal ligand.

Modifications

Table S1. Yield and enantiomeric ratio for the asymmetric Heck reaction of substrate **2a**, using the nine-membered ligand PyrOx ligand library



2a	**S42**	*E*Py*R*Ox
Ligand	yield	er
E = Me, R = Me, **S43***	NA	NA
E = Me, R = *i*Pr, **S35**	38.1	91.5:8.5
E = Me, R = *t*Bu, **S36**	47.7	90.0:10
E = Cl, R = Me, **S37**	27.3	64.0:36.0
E = Cl, R = *i*Pr, **S38**	35.7	72.7:27.3
E = Cl, R = *t*Bu, **S39**	58.7	90.9:8.1
E =CF_3, R = Me, **S40**	25.5	63.5:35.5
E = CF_3, R = *i*Pr, **S41**	43.8	70.2:29.8
E = CF_3, R = *t*Bu, **1a**	57.4	91.5:8.5

Yield was calculated by comparing product peak integration to integration of an internal standard using corrected GC analysis. er was determined by comparing enantiomer product peak integrations using chiral GC analysis. *Ligand was synthetically inaccessible.

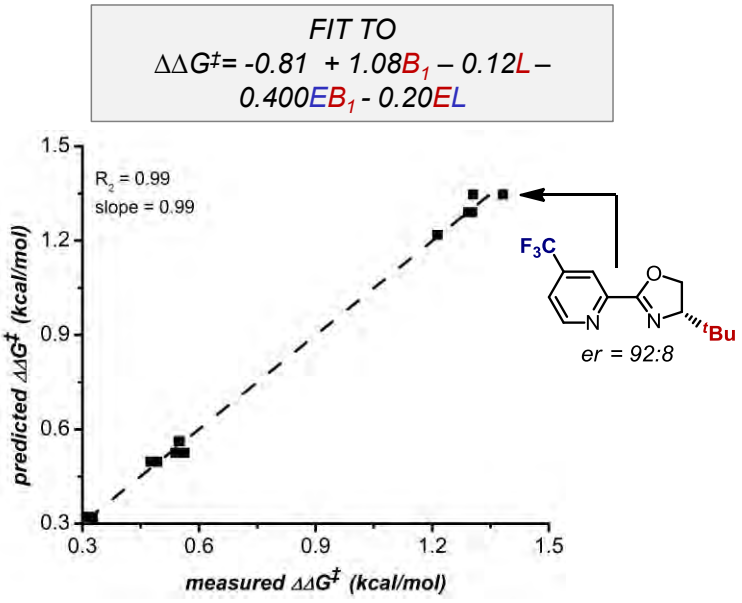


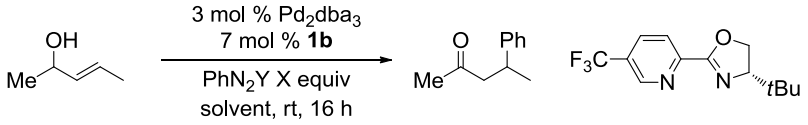
Figure S1. Multi-parameter optimization output.

Optimization of the asymmetric Heck reaction using (*S*)-4-(*tert*-butyl)-2-(5-(trifluoromethyl)pyridin-2-yl)-4,5-dihydrooxazole (ligand **1b**)

In the dry box, to a 20 mL scintillation vial equipped with a stir bar was added benzenediazonium tetrafluoroborate (28 mg, 0.15 mmol, 1.5 equiv). To a separate vial was added Pd_2dba_3 (3 mg, 0.003 mmol, 0.03 equiv). To a separate vial was added (*S*)-4-(*tert*-butyl)-2-(5-(trifluoromethyl)pyridin-2-yl)-4,5-dihydrooxazole (**1b**) (2 mg, 0.007 mmol, 0.07 equiv). To the vial containing palladium was added DMA (0.5 mL), and to the vial containing the ligand was added DMA (0.45 mL). With a pipet, the mixture containing the ligand was added to the mixture containing palladium. With a pipet, the resulting mixture was perturbed several times to ensure mixing, and it was allowed to sit for 10 min. To this mixture was added 100 μL of the mixture containing the substrate (**2a**) and tetradecane (0.1 mmol, 1 equiv). This mixture was added to the vial containing the aryldiazonium salt, and the vial was fitted with a lid, removed from the dry box, and stirred for 20 h. The mixture was then passed through a silica gel pipet with diethyl ether, and analyzed for product formation and enantiomeric ratio by gas chromatography. The modifications described below were applied in order to optimize the reaction.

Modifications

Table S2. Optimization of the asymmetric Heck reaction using ligand **1b**

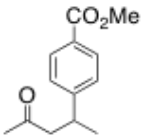


2a **S42** **1b**

entry	X	Y	Solvent	%conversion	%yield	er
1	1.1	BF_4	DMA	85.6	41.2	91.2:8.8
2	1.1	BF_4	DMF	100	58.7	92.7:7.3
3	1.1	PF_6	DMF	100	41.9	93.8:6.2
4	2.2	PF_6	DMF	100	70.5	93.7:6.3

Yield was calculated by comparing product peak integration to integration of an internal standard using corrected GC analysis. er was determined by comparing enantiomer product peak integrations using chiral GC analysis.

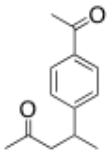
General procedure for the preparation of (*S*)-methyl 4-(4-oxopentan-2-yl) benzoate (**3a**) under optimized conditions (Table 1, entry 1)



In the dry box, to a 25 mL round-bottom flask equipped with a stir bar was added the aryldiazonium hexafluorophosphate salt (360 mg, 1.1 mmol, 2.2 equiv) derived from methy-4-aminobenzoate. To a separate vial was added Pd_2dba_3 (14 mg, 0.02 mmol, 0.03 equiv). To a separate vial was added **1b** (10 mg, 0.04 mmol, 0.07 equiv). To a separate vial was added **2a** (43 mg, 0.5 mmol). To the vial containing palladium was added DMF (2 mL), to the vial containing the ligand was added DMF (2 mL), and to the vial containing the alkene was added DMF (1 mL). With a pipet, the mixture containing the ligand was added to the mixture containing palladium. With a pipet, the resulting mixture was perturbed several times to ensure mixing, and it was allowed to sit for 10 min. To this mixture was added the mixture containing the alkene. The mixture

containing both the catalyst and the alkene was added to the flask containing the aryldiazonium salt, and the flask was fitted with a septum, removed from the dry box, and stirred for 3 h. The mixture was diluted with diethyl ether (10 mL) and water (10 mL). The aqueous layer was extracted with dithyl ether (2 x 15 mL). The combined organic layers were washed with water (3 x 15 mL), brine (1 x 15 mL), and dried over sodium sulfate. The dry organic solution was concentrated under reduced pressure, then purified by silica gel flash chromatography using 3 to 6% acetone in hexanes. The product was isolated as a clear oil in 71-72% yield (78 and 79 mg). $[\alpha]^{20}_{D} = +40^{o}$ (c = 0.183, $CHCl_3$). R_f = 0.25 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.96 (d, *J* = 8.4 Hz, 2 H), 7.28 (d, *J* = 8.1 Hz, 2 H), 3.90 (s, 3 H), 3.37 (sextet, *J* = 7.0 Hz, 1 H), 2.73 (m, 2 H), 2.07 (s, 3 H), 1.27 (d, *J* = 6.9 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 207.4, 167.2, 151.8, 130.1, 128.5, 127.1, 52.2, 51.7, 35.5, 30.8, 21.9. IR (neat): 2958, 1712, 1610, 1435, 1256, 1163, 1110, 1018, 773, 707 cm^{-1}. HRMS $C_{13}H_{16}O_3$ $(M+H)^+$ calcd. 221.1178, obsvd. 221.1180.

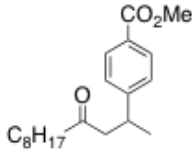
Table 1, entry 2 ((*S*)-4-(4-acetylphenyl)pentan-2-one) (**3b**)



The general procedure for the preparation of **3a** was used with the modifications that the aryldiazonium hexafluorophospate (330 mg 1.1 mmol, 2.2 equiv) derived from 4-aminoacetophenone was used. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3 to 6% acetone in hexanes to give the product as a clear oil in 64-66% yield (65 mg and 67 mg).

$[\alpha]^{20}_D$ = + 51° (c = 0.113, $CHCl_3$). R_f = 0.18 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.89 (d, *J* = 8.5 Hz, 2 H), 7.30 (d, *J* = 8.2 Hz, 2 H), 3.38 (sextet, *J* = 7.0 Hz, 1 H), 2.82-2.65 (m, 2 H), 2.58 (s, 3 H), 2.08 (s, 3 H), 1.27 (d, *J* = 7.0 Hz, 3H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 207.3 197.9, 152.1, 135.6, 128.9, 127.2, 51.6, 35.4, 30.8, 26.8, 22.0. IR (neat): 2963, 2928, 1713, 1677, 1603, 1415, 1358, 1267, 1163, 957, 831, 598 cm^{-1}. HRMS $C_{13}H_{16}O_2$ $(M+Na)^+$ calcd. 227.1048, obsvd. 227.1043.

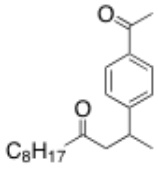
Table 1, entry 3 ((*S*)-methyl 4-(4-oxododecan-2-yl)benzoate) (**3c**)



The general procedure for the preparation of **3a** was used with the following modifications. (*E*)-Dodec-2-en-4-ol (73 mg, 0.4 mmol) and the aryldiazonium hexafluorophospate (280 mg 0.9 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 4 mL DMF. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 2% acetone in hexanes to give the product as a clear oil in 71-80% yield (91 mg and 102 mg). $[\alpha]^{20}_D$ = + 33° (c = 0.112, $CHCl_3$). R_f = 0.50 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.96 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 8.3 Hz, 2 H), 3.90 (s, 3 H), 3.39 (sextet, *J* = 7.1 Hz, 1 H), 2.77-2.60 (m, 2 H), 2.38-2.20 (m, 2 H), 1.48 (pentet, *J* = 7.2 Hz, 2 H) 1.32-1.16 (m, 13 H), 0.86 (t, *J* = 7.0 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.8, 167.2, 152.0, 130.1, 128.4, 127.1, 52.2, 50.8, 43.7, 35.5, 32.0, 29.5, 29.3, 29.3, 23.8, 22.8, 21.9, 14.3. IR (neat): 2954, 2926, 2855, 1720, 1611, 1279, 1113, 775, 708 cm^-

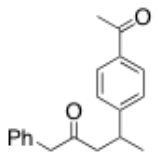
[1]. HRMS $C_{20}H_{30}O_3$ $(M+H)^+$ calcd. 319.2273, obsvd. 319.2272.

Table 1, entry 4 ((*S*)-2-(4-acetylphenyl)dodecan-4-one) (**3d**) from (*E*)-alkene



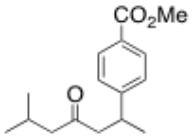
The general procedure for the preparation of **3a** was used with the following modifications. (*E*)-Dodec-2-en-4-ol (73 mg, 0.4 mmol) and the aryldiazonium hexafluorophospate (280 mg 0.9 mmol, 2.2 equiv) derived from 4-aminoacetophenone were used, in a total of 4 mL DMF. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 2% acetone in hexanes to give the product as a clear oil in 67-68% yield (81 mg and 82 mg). $[\alpha]^{20}_D$ = + 28° (c = 28, $CHCl_3$). R_f = 0.44 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.89 (d, *J* = 8.5 Hz, 2H), 7.30 (d, *J* = 8.1 Hz, 2H), 3.40 (sextet, *J* = 7.2 Hz, 1 H), 2.78-2.61 (m, 2 H), 2.58 (s, 3 H), 2.39-2.22 (m, 2 H), 1.49 (pentet, *J* = 6.8 Hz, 2 H), 1.35-1.15 (m, 13 H), 0.86 (t, *J* = 7.0 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.8, 197.9, 152.2, 135.6, 128.9, 127.3, 50.7, 43.7, 35.4, 32.0, 29.5, 29.3, 29.3, 26.8, 23.8, 22.8, 21.9, 14.3. IR (neat): 2956, 2925, 2824, 1713, 1682, 1610, 1557, 1414, 1358, 1267, 830, 599 cm^{-1}. HRMS $C_{20}H_{30}O_2$ $(M+H)^+$ calcd. 303.2324, obsvd. 303.2320.

Table 1, entry 5 ((*S*)-4-(4-acetylphenyl)-1-phenylpentan-2-one) (**3e**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 10 mg Pd_2dba_3 (0.011 mmol, 0.03 equiv), and 7 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-1-phenylpent-3-en-2-ol (57 mg, 0.35 mmol) and the aryldiazonium hexafluorophospate (230 mg 0.8 mmol, 2.2 equiv) derived from 4-aminoacetophenone were used, in a total of 3.5 mL DMF. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes to give the product as a clear oil in 71-74% yield (70 mg and 73 mg). $[\alpha]^{20}_D$ = + 10° (c = 0.097, $CHCl_3$). R_f = 0.38 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.85 (d, *J* = 8.4 Hz, 2 H), 7.33-7.21 (m, 5 H), 7.10 (dd, *J* = 8.0, 3.0 Hz, 2 H), 3.59 (s, 2 H), 3.67 (sextet, *J* = 7.1 Hz, 1 H), 2.84-2.64 (m, 2 H), 2.57 (s, 3 H), 1.21 (d, *J* = 6.9 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 206.7, 198.0, 152.0, 135.6, 133.9, 129.6, 128.9, 128.9, 127.3, 127.2, 51.0, 49.7, 35.4, 26.8, 21.8. IR (neat): 3029, 2963, 2928, 1713, 1680, 1607, 1269, 1013, 835, 702 cm^{-1}. HRMS $C_{19}H_{20}O_2$ $(M+Na)^+$ calcd. 303.1361, obsvd. 303.1362.

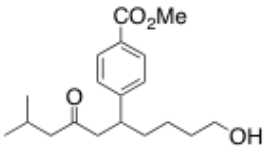
Table 1, entry 6 ((*S*)-methyl 4-(6-methyl-4-oxoheptan-2-yl)benzoate) (**3f**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 10 mg Pd_2dba_3 (0.01 mmol, 0.03 equiv), and 7 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-6-methylhept-2-en-4-ol (45 mg, 0.35 mmol) and the aryldiazonium hexafluorophospate (240 mg 0.8 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 3.5 mL DMF. Following

the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 2% acetone in hexanes to give the product as a white solid in 65-69% yield (60 mg and 63 mg). This product was the only entry in Tables 4.3-4.5 that was previously known,(*33, 34*) and had reported the optical rotation of either enantiomer. The optical rotation reported in the literature for (*S*)- methyl 4-(6-methyl-4-oxoheptan-2-yl)benzoate (also known as *ar*-(+)-juvabione) is $[\alpha]^{27}_{D}$ = + 23° (concentration and solvent not provided). This value was used to assign the absolute configuration of compounds **3a-3m** by analogy. $[\alpha]^{20}_{D}$ = + 27° (c = 0.117, $CHCl_3$). R_f = 0.72 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.96 (d, *J* = 8.4 Hz, 2 H), 7.28 (d, *J* = 9.1 Hz, 2 H), 3.90 (s, 3 H), 3.39 (sextet, *J* = 7.1 Hz, 1 H), 2.76-2.59 (m, 2 H), 2.26-2.00 (m, 3 H), 1.26 (d, *J* = 7.0 Hz, 3 H), 0.84 (d, *J* = 6.5 Hz, 3 H), 0.83 (d, *J* = 6.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.4, 167.2, 152.0, 130.1, 128.4, 127.1, 52.7, 52.2, 51.3, 35.4, 24.7, 22.7, 21.9. IR (neat): 2956, 2872, 1713, 1610, 1435, 1277, 1112, 1012, 856, 774, 708 cm^{-1}. HRMS $C_{16}O_{22}O_3$ $(M+H)^+$ calcd. 263.1647, obsvd. 263.1639.

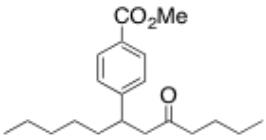
Table 1, entry 7 ((*S*)-methyl 4-(1-hydroxy-9-methyl-7-oxodecan-5-yl)benzoate) (**3g**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 10 mg Pd_2dba_3 (0.01 mmol, 0.03 equiv), and 7 mg ligand **1b** (0.02 mmol, 0.07 equiv). (*E*)-9-Methyldec-5-ene-1,7-diol (65 mg, 0.35 mmol) and the aryldiazonium hexafluorophospate (240 mg 0.8 mmol, 2.2

equiv) derived from methyl 4-aminobenzoate were used, in a total of 3.5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 10% acetone in hexanes to give the product as a yellow oil in 71-75% yield (80 mg and 84 mg). $[\alpha]^{20}_{D}$ = + 14° (c = 0.107, $CHCl_3$). R_f = 0.08 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.95 (d, *J* = 8.4 Hz, 2 H), 7.24 (d, *J* = 8.7 Hz, 2 H), 3.90 (s, 3 H), 3.58-5.53 (m, 2 H), 3.28-3.18 (m, 1 H), 2.69 (dd, *J* = 7.1, 7.0 Hz, 2 H), 2.20-1.99 (m, 3 H), 1.69-1.43 (m, 4 H), 1.29-1.05 (m, 3 H), 0.81 (d, *J* = 6.5 Hz, 3 H), 0.80 (d, *J* = 6.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.5, 167.2, 150.3, 130.0, 128.5, 127.8, 62.8, 52.7, 52.2, 50.2, 41.0, 36.0, 32.7, 24.6, 23.8, 22.7, 22.6. IR (neat): 3512, 2953, 2870, 1717, 1610, 1436, 1280, 1113, 774, 668 cm^{-1}. HRMS $C_{19}H_{28}O_4$ $(M+Na)^+$ calcd. 343.1885, obsvd. 343.1880.

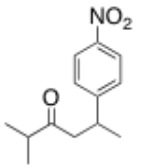
Table 1, entry 8 ((*S*)-methyl 4-(8-oxododecan-6-yl)benzoate) (**3h)**



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 10 mg Pd_2dba_3 (0.01 mmol, 0.03 equiv), and 7 mg ligand **1b** (0.02 mmol, 0.07 equiv). (*E*)-Dodec-6-en-5-ol (65 mg, 0.35 mmol) and the aryldiazonium hexafluorophospate (240 mg 0.8 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 3.5 mL DMF. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 1% acetone in hexanes to give the product as a clear oil

in 61-68% yield (68 mg and 76 mg). $[\alpha]^{20}_{D}$ = + 15° (c = 0.100, $CHCl_3$). R_f = 0.63 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.95 (d, *J* = 8.5 Hz, 2 H), 7.24 (d, *J* = 8.2 Hz, 2 H), 3.90 (s, 3 H), 3.25-3.16 (m, 1 H), 2.69 (d, *J* = 7.1 Hz, 2 H), 2.35-2.15 (m, 2 H), 1.67-1.42 (m, 4 H), 1.35-1.00 (m, 8 H), 0.82 (q, *J* = 7.0 Hz, 6 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 210.0, 167.3, 150.6, 130.0, 128.4, 127.8, 52.2, 50.0, 43.8, 41.3, 36.1, 31.4, 29.7, 23.4, 22.7, 22.6, 14.1, 14.1. IR (neat): 2955, 2930, 2859, 1721, 1610, 1279, 1113 cm^{-1}. HRMS $C_{20}H_{30}O_3$ $(M+H)^+$ calcd. 319.2273, obsvd. 319.2272.

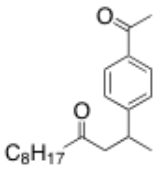
Table 1, entry 9 ((*S*)-2-methyl-5-(4-nitrophenyl)hexan-3-one (**3i**) from (*E*)-alkene)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.011 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-2-methylhex-4-en-3-ol (57 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (330 mg 1.1 mmol, 2.2 equiv) derived from 4-nitroaniline were used, in a total of 5 mL DMF. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 4% acetone in hexanes to give the product as a clear oil in 58-59% yield (68 mg and 69 mg). $[\alpha]^{20}_{D}$ = + 24° (c = 0.100, $CHCl_3$). R_f = 0.36 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 8.25 (d, *J* = 8.8 Hz, 2 H), 7.38, (d, *J* = 8.7 Hz, 2 H), 3.48 (sextet, *J* = 7.0 Hz, 1 H), 2.84-2.69 (m, 2 H), 2.50 (septet, *J* = 7.0 Hz, 1 H), 1.28 (d, *J* = 7.0 Hz, 3 H), 1.05 (d, *J* = 6.9 Hz, 3 H), 0.99 (d, *J* = 7.0 Hz, 3 H). ^{13}C-

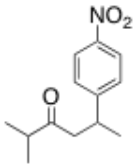
NMR (75 MHz, $CDCl_3$) δ = 212.6, 154.5, 129.2, 128.0, 124.0, 48.3, 41.4, 35.1, 21.8, 18.2, 18.1. IR (neat): 2969, 2933, 1710, 1599, 1517, 1345, 1110, 1008, 855, 700 cm^{-1}. HRMS $C_{13}H_{17}NO_3$ $(M)^+$ calcd. 235.1208, obsvd. 235.1212.

Table 1, entry 10 ((*R*)-2-(4-acetylphenyl)dodecan-4-one) (**3d**) from (*Z*)-alkene



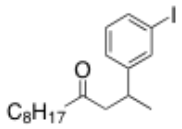
The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 15 mg Pd_2dba_3 (0.02 mmol, 0.04 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.09 equiv). (*Z*)-Dodec-2-en-4-ol (73 mg, 0.4 mmol) and the aryldiazonium hexafluorophospate (280 mg 0.9 mmol, 2.2 equiv) derived from 4-aminoacetophenone were used, in a total of 4 mL DMF. The mixture was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 2% acetone in hexanes to give the product as a clear oil in 74-75% yield (90 mg and 92 mg). $[\alpha]^{20}_D = -28^o$ (c = 0.114, $CHCl_3$). The ^1H NMR spectrum, see below, was compared with that of the product arising from the (*E*)-isomer of the same alkene.

Table 1, entry 11 ((*R*)-2-methyl-5-(4-nitrophenyl)hexan-3-one (**3i**) from (*Z*)-alkene)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 18 mg Pd_2dba_3 (0.02 mmol, 0.04 equiv), and 12 mg ligand **1b** (0.05 mmol, 0.09 equiv). (*E*)-Methylhex-4-en-3-ol (57 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (330 mg 1.1 mmol, 2.2 equiv) derived from 4-nitroaniline were used, in a total of 5 mL DMF. The reaction was stirred for 24 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 4% acetone in hexanes to give the product as a clear oil in 70-80% yield (82 mg and 94 mg). $[\alpha]^{20}_D = -24^o$ (c = 0.117, $CHCl_3$). The ^1H NMR spectrum, see below, was compared to that of the product arising from the (*E*)-isomer of the same alkene.

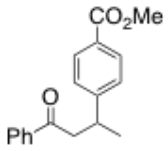
Table 1, entry 12 ((*R*)-2-(3-iodophenyl)dodecan-4-one) (**3j**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 13 mg Pd_2dba_3 (0.01 mmol, 0.04 equiv), and 9 mg ligand **1b** (0.03 mmol, 0.09 equiv). (*Z*)-Dodec-2-en-4-ol (65 mg, 0.35 mmol) and the aryldiazonium hexafluorophospate (300 mg 0.8 mmol, 2.2 equiv) derived from 3-iodoaniline one were used, in a total of 3.5 mL DMF. The mixture was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 1% acetone in hexanes to give the product as a yellow oil in 85-88% yield (115 mg and 119 mg). $[\alpha]^{20}_D = -21^o$ (c = 0.213, $CHCl_3$). R_f = 0.71 w/ 10% acetone in hexanes. ^1H-NMR (300 MHz, $CDCl_3$) δ = 7.55-

7.50 (m, 2 H), 7.17 (d, *J* = 7.8 Hz, 1 H), 7.02 (t, *J* = 7.7 Hz, 1 H), 3.26 (sextet, *J* = 7.1 Hz, 1 H), 2.73-2.56 (m, 2 H), 2.39-2.22 (m, 2 H), 1.50 (pentet, *J* = 7.1 Hz, 2 H), 1.36-1.06 (m, 3 H), 0.87 (t, J = 7.0 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.8, 149.1, 136.0, 135.5, 130.4, 126.5, 94.8, 50.9, 43.8, 35.1, 32.0, 29.5, 29.3, 29.3, 23.8, 22.8, 22.0, 14.3. IR (neat): 2955, 2925, 2854, 1714, 1563, 1465, 994, 782, 696 cm^{-1}. HRMS $C_{18}H_{27}IO$ $(M+H)^+$ calcd. 387.1185, obsvd. 387.1194.

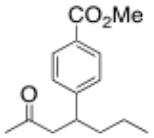
Table 1, entry 13 ((+)-methyl 4-(4-oxo-4-phenylbutan-2-yl)benzoate) (**3k**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*Z*)-1-Phenylbut-2-en-1-ol (89 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (350 mg 1.1 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 5 mL DMF. The mixture was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 1% acetone in hexanes to give the product as a white solid in 50-53% yield (71 mg and 75 mg). This product could not be fully purified, and the characterization data that follows pertains to a mixture of the desired product and unknown impurities. $[\alpha]^{20}_D$ = + 7° (c = 0.097, $CHCl_3$). R_f = 0.38 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.98-7.90 (m, 4 H), 7.58-7.53 (m, 1 H), 7.47-7.42 (m, 2 H), 7.36-7.33 (m, 2 H). 3.59 (s, 3 H), 3.62-3.55 (m, 1 H), 3.59-3.17 (m, 2 H), 1.35 (d, *J* = 7.0 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 198.7,

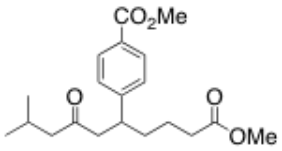
167.2, 152.1, 137.2, 133.3, 130.1, 128.8, 128.2, 127.2, 120.4, 52.2, 46.7, 35.7, 22.0. IR (neat): 2953, 1716, 1684, 1610, 1435, 1276, 1111, 1000, 753, 691 cm^{-1}. HRMS $C_{18}H_{18}O_3$ $(M+H)^+$ calcd. 283.1334, obsvd. 283.1328.

Table 1, entry 14 ((*S*)-methyl 4-(2-oxoheptan-4-yl)benzoate) (**3l**)



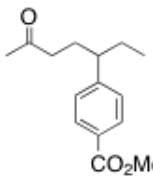
The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-Hept-3-en-2-ol (57 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (350 mg 1.1 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 5 mL DMF. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 5% acetone in hexanes to give the product as a colorless oil in 70-77% yield (87 mg and 96 mg). $[\alpha]^{20}_D$ = + 21° (c = 0.123, $CHCl_3$). R_f = 0.39 w/10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.95 (d, *J* = 8.4 Hz, 2 H), 7.25 (d, *J* = 7.7 Hz, 2 H), 3.89 (s, 3 H), 3.26-3.16 (m, 1 H), 2.73 (d, *J* = 7.1 Hz, 2 H), 2.03 (s, 3 H), 1.65-1.48 (m, 2 H), 1.25-1.04 (m, 2 H), 0.84 (t, *J* = 7.3 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 207.5, 167.2, 150.4, 130.0, 128.5, 127.7, 52.2, 50.6, 41.0, 38.6, 30.8, 20.6, 14.1. IR (neat): 2956, 2931, 2872, 1719, 1610, 1436, 1729, 1113, 773, 668 cm^{-1}. HRMS $C_{15}H_{20}O_3$ $(M+H)^+$ calcd. 249.1491, obsvd. 249.1492.

Table 1, entry 15 ((*R*)-methyl 4-(1-methoxy-9-methyl-1,7-dioxodecan-5-yl)benzoate) (**3m)**



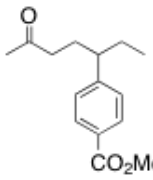
The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 11 mg Pd_2dba_3 (0.01 mmol, 0.04 equiv), and 7 mg ligand **1b** (0.03 mmol, 0.09 equiv). (*Z*)-Methyl 7-hydroxy-9-methyldec-5-enoate (64 mg, 0.3 mmol) and the aryldiazonium hexafluorophospate (210 mg 0.7 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 3 mL DMF. The reaction was stirred for 22 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes to give the product as a clear oil in 78-88% yield (82 mg and 92 mg). $[\alpha]^{20}_D = -10^o$ (c = 0.097, $CHCl_3$). R_f = 0.48 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.92 (d, *J* = 8.4 Hz, 2 H), 7.22 (d, *J* = 8.2 Hz, 2 H), 3.87 (s, 3 H), 3.59 (s, 3 H), 3.25-3.15 (m, 1 H), 2.66 (dd, *J* = 7.3, 6.9 Hz, 2 H), 2.24 – 1.93 (m, 5 h), 1.65-1.34 (m, 4 H), 0.77 (d, *J* = 6.5 Hz, 3 H), 0.76 (d, *J* = 6.6 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.2, 173.9, 167.2, 149.9, 130.1, 128.6, 127.8, 52.7, 52.2, 51.7, 50.1, 40.8, 35.6, 33.9, 24.6, 22.9, 22.7, 22.6. IR (neat): 2954, 1718, 1653, 1436, 1281, 1182, 1112, 668 cm^{-1}. HRMS $C_{20}H_{28}O_5$ $(M+H)^+$ calcd. 349.2015, obsvd. 349.2018.

Table 2, entry 1 ((+)-methyl 4-(6-oxoheptan-3-yl)benzoate) (**4a**) from (*Z*)-alkene



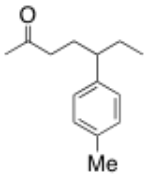
The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*Z*)-Hept-4-en-2-ol (57 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (350 mg 1.1 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 5% acetone in hexanes to give the product as a clear oil in 79% yield (98 mg and 98 mg). The γ-isomer shown was isolated along with approximately 3% of the β-isomer. $[\alpha]^{20}_D$ = + 4° (c = 0.113, $CHCl_3$). R_f = 0.39 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.97 (d, *J* = 8.4 Hz, 2 H), 7.19 (d, *J* = 8.1 Hz, 2 H), 3.91 (s, 3 H), 2.52-2.43 (m, 1 H), 2.33-2.13 (m, 2 H), 2.07-1.93 (m, 4 H), 1.82-1.51 (m, 3 H), 0.75 (t, *J* = 7.3 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.0, 167.2, 150.6, 129.9, 128.4, 127.9, 52.2, 47.3, 41.7, 30.1, 30.0, 30.0, 12.2. IR (neat): 2958, 1718, 1609, 1436, 1280, 1113, 776, 709 cm^{-1}. HRMS $C_{15}H_{20}O_3$ $(M+H)^+$ calcd. 249.1491, obsvd. 249.1488.

Table 2, entry 2 ((−)-methyl 4-(6-oxoheptan-3-yl)benzoate) (**4a**) from (*E*)-alkene



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-Hept-4-en-2-ol (57 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (350 mg 1.1 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 5% acetone in hexanes to give the product as a colorless oil in 56-59% yield (70 mg and 73 mg). $[\alpha]^{20}_{D} = -4^{o}$ (c = 0.09, $CHCl_3$). The γ-isomer shown was isolated along with approximately 14% of the β-isomer. The ^{1}H NMR spectrum, see below, was compared to that of the product arising from the (*Z*)-isomer of the same alkene.

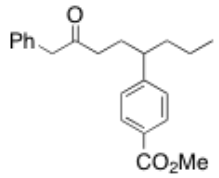
Table 2, entry 3 ((+)-5-(*p*-tolyl)heptan-2-one) (**4b**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*Z*)-Hept-4-en-2-ol (57 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (320 mg 1.1 mmol, 2.2 equiv) derived from *p*-toluidine were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 1% acetone in hexanes to give the

product as a colorless oil in 70-74% yield (72 mg and 76 mg). $[\alpha]^{20}_D$ = + 2° (c = 0.120, $CHCl_3$). The γ-isomer shown was isolated along with approximately 10% of the β-isomer. R_f = 0.50 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.12-7.07 (m, 2 H), 7.01-6.99 (m, 2 H), 2.38-2.17 (m, 6 H), 2.03-1.91 (m, 4 H), 1.78-1.50 (m, 3 H), 0.77 (t, *J* = 7.4 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.5, 141.8, 135.8, 129.3, 127.8, 47.0, 42.1, 30.3, 30.2, 30.1, 21.2, 12.4. IR (neat): 2960, 2926, 2873, 1717, 1514, 1357, 1161, 816, 668 cm^{-1}. HRMS $C_{14}H_{20}O$ $(M+Na)^+$ calcd. 227.1412, obsvd. 227.1413.

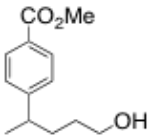
Table 2, entry 4 ((+)-methyl 4-(7-oxo-8-phenyloctan-4-yl)benzoate) (**4c**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 11 mg Pd_2dba_3 (0.01 mmol, 0.03 equiv), and 8 mg ligand **1b** (0.03 mmol, 0.07 equiv). (*E*)-1-Phenyloct-3-en-2-ol (82 mg, 0.4 mmol) and the aryldiazonium hexafluorophospate (280 mg 0.9 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 4 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes to give the product as a colorless oil in 64-68% yield (87 mg and 92 mg). $[\alpha]^{20}_D$ = + 5° (c = 0.107, $CHCl_3$). R_f = 0.39 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.92 (d, *J* = 8.4 Hz, 2 H), 7.32-7.25 (m, 4 H), 7.11-7.07 (m, 3 H), 3.91 (s, 3 H), 3.55 (s, 2 H), 2.57-2.46 (m, 1 H), 2.32-2.16 (m, 2 H), 2.03-1.92 (m, 1 H), 1.76-1.54 (m, 3 H), 1.25-

1.00 (m, 2 H), 0.80 (t, J = 7.3 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 208.2, 167.3, 150.8, 134.3 130.0, 129.5, 128.9, 128.4, 127.9, 127.2, 52.2, 50.4, 45.1, 39.9, 39.1, 30.3, 20.7, 14.2. IR (neat): 2954, 2929, 2871, 1719, 1609, 1436, 1280, 1123, 774, 700, 668 cm^{-1}. HRMS $C_{22}H_{26}O_3$ $(M+Na)^+$ calcd. 361.1780, obsvd. 362.2784.

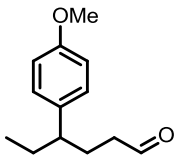
Table 2, entry 5 ((+)-methyl 4-(5-hydroxypentan-2-yl)benzoate derived from corresponding aldehyde, **4d**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-Pent-3-en-1-ol (43 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (350 mg 1.1 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes containing 0.1 % triethylamine to give an aldehyde product as a colorless oil in 67-74% yield (74 mg and 81 mg). This product was dissolved in MeOH, (3 mL) in a 20 mL scintillation vial equipped with a stir bar. The mixture was cooled to 0 ^{o}C. Sodium borohydride (19 mg, 0.5 mmol, 1.5 equiv) was added, and the resulting mixture was stirred for 30 min. The solvent was removed under reduced pressure, and the resulting residue was transferred to a separatory funnel using diethyl ether (10 mL) and water (10 mL). The aqueous layer was extracted with diethyl ether (2 x 15 mL), and the combined

organic layers were washed with water (2 x 10 mL), and brine (1 x 10 mL). The organic layer was then dried over sodium sulfate, and concentrated under reduced pressure. The resulting mixture was purified using silica gel flash chromatography using 7% acetone in hexanes to give the alcohol product. The product was isolated along with regioisomeric products. $[\alpha]^{20}_{D} = +10^{o}$ (c = 0.125, $CHCl_3$). $R_f = 0.33$ w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) (major product) δ 7.99-7.95 (m, 2 H), 7.27-7.24 (m, 2 H), 3.90 (s, 3 H), 3.60 (t , *J* = 6.6 Hz, 2 H), 2.78 (sextet, *J* = 6.9 Hz, 1 H), 1.75-1.37 (m, 4 H), 1.27 (d, *J* = 7 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) (all resonances) δ = 153.1, 130.1, 130.0, 129.9, 129.8, 128.2, 128.0, 127.3, 127.3, 126.3, 125.9, 125.7, 63.1, 62.4, 61.1, 52.2, 48.0, 44.4, 40.1, 39.2, 3.1, 24.4, 32.6, 31.0, 29.8, 24.1, 22.3, 12.2. IR (neat): 3420, 2954, 1719, 1436, 1280, 1114, 773, 668 cm^{-1}. HRMS $C_{13}H_{18}O_3$ $(M+Na)^+$ calcd. 245.1154, obsvd. 245.1137.

Table 2, entry 6 ((+)-4-(4-methoxyphenyl)hexanal) (**4e**)



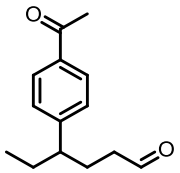
The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*Z*)-Hex-3-en-1-ol (50 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (308 mg 1.1 mmol, 2.2 equiv) derived from p-anisidine were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes containing 0.1

% triethylamine to give an aldehyde product as a colorless oil in 73% yield (75 mg). The product **4e** was isolated along with regioisomeric product. $[\alpha]^{20}_{D}$ = + 4° (c = 0.090, $CHCl_3$). R_f = 0.52 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 9.64 (t, *J* = 1.5 Hz, 1 H), 7.03 (d, *J* = 8.7 Hz, 2 H), 6.84 (d, *J* = 8.7 Hz, 2 H), 3.79 (s, 3 H), 2.42–2.28 (m, 1 H), 2.30–2.23 (m, 2 H), 2.06–1.95 (m, 1 H), 1.83–1.53 (m, 3 H), 0.77 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 202.6, 158.1, 136.1, 128.5, 113.8, 55.1, 46.3, 42.2, 29.8, 28.7, 12.1. IR (neat): 2957, 1721, 1610, 1510, 1245, 1177, 1034, 829 cm^{-1}. HRMS $(M+H)^+$ calcd. 207.1385, obsvd. 207.1390.

In order to determine the er of the product, the corresponding primary alcohol was prepared by the following protocol. This product, **4e** was dissolved in MeOH, (3 mL) in a 20 mL scintillation vial equipped with a stir bar. The mixture was cooled to 0 °C. Sodium borohydride (19 mg, 0.5 mmol, 1.5 equiv) was added, and the resulting mixture was stirred for 30 min. The solvent was removed under reduced pressure, and the resulting residue was transferred to a separatory funnel using diethyl ether (10 mL) and water (10 mL). The aqueous layer was extracted with diethyl ether (2 x 15 mL), and the combined organic layers were washed with water (2 x 10 mL), and brine (1 x 10 mL). The organic layer was then dried over sodium sulfate, and concentrated under reduced pressure. The resulting mixture was purified using silica gel flash chromatography using 7% acetone in hexanes to give the alcohol product, **4ea**. The product was isolated along with regioisomeric products. $[\alpha]^{20}_{D}$ = + 7° (c = 0.130, $CHCl_3$). R_f = 0.40 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) 7.03 (d, *J* = 8.7 Hz, 2 H), 6.83 (d, *J* = 8.7 Hz, 2 H), 3.79 (s, 3 H), 3.57 (t, *J* = 6.3 Hz, 2 H), 2.42–2.31 (m, 1 H), 1.81–1.34 (m, 6 H), 0.76 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 157.7, 137.4, 128.5, 113.6, 63.1,

55.2, 46.8, 32.7, 30.9, 29.9, 12.2. IR (neat): 2929, 1611, 1511, 1457, 1245, 1036, 829, 681 cm^{-1}. HRMS $(M+Na)^+$ calcd. 231.1361, obsvd. 231.1362.

Table 2, entry 7 ((+)-4-(4-acetylphenyl)hexanal) (**4f**)

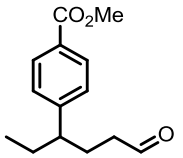


The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*Z*)-Hex-3-en-1-ol (50 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (321 mg 1.1 mmol, 2.2 equiv) derived from 4-aminoacetophenone were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes containing 0.1 % triethylamine to give an aldehyde product as a colorless oil in 71% yield (77 mg). $[\alpha]^{20}_D$ = + 7° (c = 0.10, $CHCl_3$). R_f = 0.40 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 9.66 (t, *J* = 1.5 Hz, 1 H), 7.90 (d, *J* = 8.1 Hz, 2 H), 7.22 (d, *J* = 8.1 Hz, 2 H), 2.58 (s, 3 H), 2.55–2.48 (m, 1 H), 2.28–2.24 (m, 2 H), 2.12–2.03 (m, 1 H), 1.90–1.57 (m, 3 H), 0.77 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 202.0, 197.8, 150.2, 135.6, 128.7, 127.9, 47.1, 42.0, 29.5, 28.2, 26.6, 12.0. IR (neat): 2961, 1721, 1680, 1606, 1415, 1266, 1113, 733, 600 cm^{-1}. HRMS $(M+H)^+$ calcd. 219.1385, obsvd. 219.1390.

In order to determine the er of the product, the corresponding primary alcohol was prepared by the following protocol. This product, **4f** was dissolved in MeOH, (3 mL) in

a 20 mL scintillation vial equipped with a stir bar. The mixture was cooled to 0 ^{o}C. Sodium borohydride (19 mg, 0.5 mmol, 1.5 equiv) was added, and the resulting mixture was stirred for 30 min. The solvent was removed under reduced pressure, and the resulting residue was transferred to a separatory funnel using diethyl ether (10 mL) and water (10 mL). The aqueous layer was extracted with diethyl ether (2 x 15 mL), and the combined organic layers were washed with water (2 x 10 mL), and brine (1 x 10 mL). The organic layer was then dried over sodium sulfate, and concentrated under reduced pressure. The resulting mixture was purified using silica gel flash chromatography using 7% acetone in hexanes to give the alcohol product, **4fa**. The product was isolated along with regioisomeric products. $[\alpha]^{20}_{D}$ = + 14^{o} (c = 0.099, $CHCl_3$). R_f = 0.36 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.90 (d, *J* = 8.4 Hz, 2 H), 7.24 (d, *J* = 8.4 Hz, 2 H), 3.58 (t, *J* = 6.3 Hz, 2 H), 2.59 (s, 3H), 2.54–2.46 (m, 1 H), 1.83–1.26 (m, 6 H), 0.77 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 198.0, 151.5, 135.2, 128.5, 127.9, 62.8, 47.8, 32.3, 30.7, 29.5, 26.5, 12.1. IR (neat): 2958, 1677, 1605, 1415, 1268, 1059, 834, 601 cm^{-1}. HRMS $(M+H)^{+}$ calcd. 221.1542, obsvd. 221.1538.

Table 2, entry 8 ((+)-methyl 4-(6-oxohexan-3-yl)benzoate (**4g**)



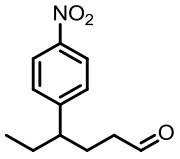
The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*Z*)-Hex-3-en-1-ol (50 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (339 mg 1.1 mmol, 2.2 equiv) derived

from methyl 4-aminobenzoate were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes containing 0.1 % triethylamine to give an aldehyde product as a colorless oil in 63% yield (74 mg). The product was isolated along with regioisomeric products. $[\alpha]^{20}_{D} = +13^{o}$ (c = 0.11, $CHCl_3$). R_f = 0.40 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 9.65 (t, *J* = 1.5 Hz, 1 H), 7.96 (d, *J* = 8.7 Hz, 2 H), 7.20 (d, *J* = 8.7 Hz, 2 H), 3.89 (s, 3 H), 2.53–2.46 (m, 1 H), 2.29–2.22 (m, 2 H), 2.09–2.01 (m, 1 H), 1.88–1.54 (m, 3 H), 0.77 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 202.0, 167.0, 149.9, 129.8, 128.4, 127.7, 52.0, 47.1, 42.0, 29.5, 28.3, 12.0. IR (neat): 2957, 1716, 1609, 1435, 1275, 1111, 771, 708 cm^{-1}. HRMS $(M+H)^{+}$ calcd. 235.1334, obsvd. 235.1339.

In order to determine the er of the product, the corresponding primary alcohol was prepared by the following protocol. This product, **4g** was dissolved in MeOH, (3 mL) in a 20 mL scintillation vial equipped with a stir bar. The mixture was cooled to 0 ^{o}C. Sodium borohydride (19 mg, 0.5 mmol, 1.5 equiv) was added, and the resulting mixture was stirred for 30 min. The solvent was removed under reduced pressure, and the resulting residue was transferred to a separatory funnel using diethyl ether (10 mL) and water (10 mL). The aqueous layer was extracted with diethyl ether (2 x 15 mL), and the combined organic layers were washed with water (2 x 10 mL), and brine (1 x 10 mL). The organic layer was then dried over sodium sulfate, and concentrated under reduced pressure. The resulting mixture was purified using silica gel flash chromatography using 7% acetone in hexanes to give the alcohol product, **4ga**. The product was isolated along with regioisomeric products. $[\alpha]^{20}_{D} = +17^{o}$ (c = 0.089, $CHCl_3$). R_f = 0.33 w/ 20%

acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.95 (d, *J* = 8.4 Hz, 2 H), 7.20 (d, *J* = 8.4 Hz, 2 H), 3.88 (s, 3 H), 3.54 (t, *J* = 6.6 Hz, 2 H), 2.54–2.44 (m, 1 H), 1.83–1.25 (m, 6 H), 0.75 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 157.7, 137.4, 128.5, 113.6, 63.1, 55.2, 46.8, 32.7, 30.9, 29.9, 12.2. IR (neat): 2931, 1718, 1609, 1435, 1275, 1111, 773, 707 cm^{-1}. HRMS $(M+H)^+$ calcd. 237.1491, obsvd. 237.1490.

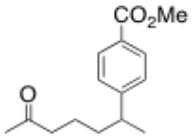
Table 2, entry 9 ((-)-4-(4-nitrophenyl)hexanal) (**4h**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*Z*)-Hex-3-en-1-ol (50 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (325 mg 1.1 mmol, 2.2 equiv) derived from methyl 4-nitroaniline were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes containing 0.1 % triethylamine to give an aldehyde product as a colorless oil in 61% yield (67 mg). $[\alpha]^{20}_{D} = -16^{o}$ (c = 0.110, $CHCl_3$). R_f = 0.37 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ = 9.68 (t, *J* = 1.5 Hz, 1 H), 8.16 (d, *J* = 8.7 Hz, 2 H), 7.30 (d, *J* = 8.7 Hz, 2 H), 3.79 (s, 3 H), 2.66–2.52 (m, 1 H), 2.32–2.26 (m, 2 H), 2.10–2.06 (m, 1 H), 1.86–1.60 (m, 3 H), 0.78 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 201.6, 152.4, 146.7, 128.5, 123.8, 47.0, 41.8, 29.4, 28.1, 11.9. IR (neat): 2961, 1720, 1596, 1515, 1343, 1110, 853, 701 cm^{-1}. HRMS (M+H) calcd. 222.1130, obsvd. 222.1133.

In order to determine the er of the product, the corresponding primary alcohol was prepared by the following protocol. This product, **4h** was dissolved in MeOH, (3 mL) in a 20 mL scintillation vial equipped with a stir bar. The mixture was cooled to 0 ^{o}C. Sodium borohydride (19 mg, 0.5 mmol, 1.5 equiv) was added, and the resulting mixture was stirred for 30 min. The solvent was removed under reduced pressure, and the resulting residue was transferred to a separatory funnel using diethyl ether (10 mL) and water (10 mL). The aqueous layer was extracted with diethyl ether (2 x 15 mL), and the combined organic layers were washed with water (2 x 10 mL), and brine (1 x 10 mL). The organic layer was then dried over sodium sulfate, and concentrated under reduced pressure. The resulting mixture was purified using silica gel flash chromatography using 7% acetone in hexanes to give the alcohol product, **4ha**. $[\alpha]^{20}_{D} = -12^{o}$ (c = 0.110, $CHCl_3$). R_f = 0.30 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) 8.12 (d, *J* = 8.7 Hz, 2 H), 7.28 (d, *J* = 8.7 Hz, 2 H), 3.55 (t, *J* = 6.3 Hz, 2 H), 2.59–2.50 (m, 1 H), 1.84–1.22 (m, 6 H), 0.74 (t, *J* = 7.5 Hz, 3 H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 153.7, 146.4, 128.5, 123.6, 62.7, 47.7, 32.3, 30.6, 29.5, 12.0. IR (neat): 2931, 1596, 1514, 1342, 851, 700 cm^{-1}. HRMS $(M+H)^{+}$ calcd. 224.1287, obsvd. 224.1288.

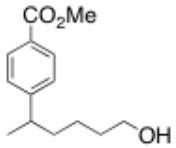
Figure 3 ((+)-methyl 4-(6-oxoheptan-2-yl)benzoate) (**5a**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-Hept-5-en-2-ol (57 mg, 0.5

mmol) and the aryldiazonium hexafluorophospate (350 mg, 1.1 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 5 mL DMF. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes to give **5a** as a colorless oil in 48-54% yield (60 mg and 67 mg). $[\alpha]^{20}_{D} = +8^{o}$ (c = 0.230, $CHCl_3$). R_f = 0.39 w/ 10% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.4 Hz, 2 H), 7.24 (d, *J* = 8.2 Hz, 2 h), 3.90 (s, 3 H), 2.75 (sextet, *J* = 7.0 Hz, 1 H), 2.38 (t, *J* = 6.9 Hz, 2 H), 2.08 (s, 3 H), 1.61-1.35 (m, 4 H), 1.24 (d, *J* = 6.9 Hz, 3H). ^{13}C-NMR (75 MHz, $CDCl_3$) δ = 209.1, 153.0, 130.0, 130.0, 128.2, 127.2, 52.2, 43.8, 40.2, 37.7, 30.1, 22.2, 22.1. IR (neat): 2953, 1713, 1609, 1435, 1275, 1111, 1019, 857, 775, 708 cm^{-1}. HRMS $C_{15}H_{20}O_3$ $(M+Na)^+$ calcd. 271.1310, obsvd. 271.1315.

Figure 3 ((+)-methyl 4-(6-hydroxyhexan-2-yl)benzoate derived from corresponding aldehyde, **5b**)



The general procedure for the preparation of **3a** was used with the following modifications. The ligated catalyst mixture contained 14 mg Pd_2dba_3 (0.02 mmol, 0.03 equiv), and 10 mg ligand **1b** (0.04 mmol, 0.07 equiv). (*E*)-Hex-4-en-1-ol (50 mg, 0.5 mmol) and the aryldiazonium hexafluorophospate (350 mg 1.1 mmol, 2.2 equiv) derived from methyl 4-aminobenzoate were used, in a total of 5 mL DMA. The reaction was stirred for 15 h. Following the aqueous workup described above and concentration, the product was purified by silica gel flash chromatography using 3% acetone in hexanes

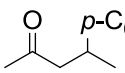
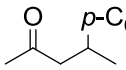
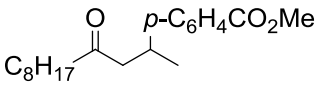
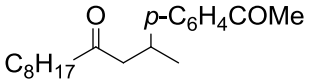
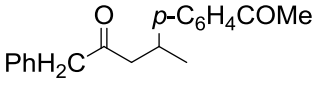
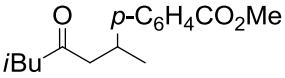
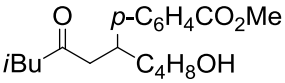
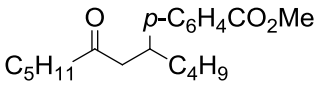
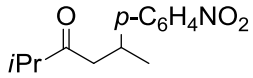
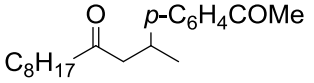
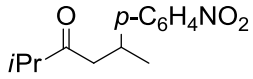
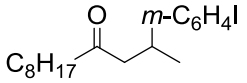
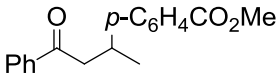
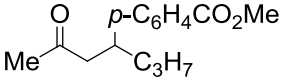
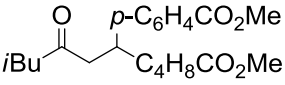
containing 0.1 % triethylamine to give an aldehyde product as a colorless oil in 56-61% yield (65 mg and 71 mg). This product was dissolved in MeOH, (3 mL) in a 20 mL scintillation vial equipped with a stir bar. The mixture was cooled to 0 ^{o}C. Sodium borohydride (17 mg, 0.43 mmol, 1.5 equiv) was added, and the resulting mixture was stirred for 30 min. The solvent was removed under reduced pressure, and the resulting residue was transferred to a separatory funnel using diethyl ether (10 mL) and water (10 mL). The aqueous layer was extracted with diethyl ether (2 x 15 mL), and the combined organic layers were washed with water (2 x 10 mL), and brine (1 x 10 mL). The organic layer was then dried over sodium sulfate, and concentrated under reduced pressure. The resulting mixture was purified using silica gel flash chromatography using 7% acetone in hexanes to give the alcohol product. The product was isolated along with regioisomeric products. $[\alpha]^{20}_{D} = +10^{o}$ (c = 0.105, $CHCl_3$). R_f = 0.33 w/ 20% acetone in hexanes. ^{1}H-NMR (300 MHz, $CDCl_3$) (major product) δ 7.96 (d, *J* = 8.2 Hz, 2 H), 7.21 (d, *J* = 8.7 Hz, 2 h), 3.90 (s, 3 H), 3.63-3.51 (m, 2 H), 2.75 (sextet, *J* = 7.2 Hz, 1 H), 1.83-1.17 (m, 9 H). ^{13}C-NMR (75 MHz, $CDCl_3$) (all resonances) δ = 167.4, 153.3, 151.4, 129.9, 129.9, 128.1, 128.0, 127.2, 63.1, 63.0, 52.2, 48.0, 40.3, 38.1, 32.9, 32.6, 31.0, 30.0, 24.0, 22.3, 12.3. IR (neat): 3446, 2933, 2873, 1718, 1700, 1559, 1457, 1114, 668 cm^{-1}. HRMS $C_{14}H_{20}O_3$ $(M+Na)^{+}$ calcd. 259.1310, obsvd. 259.1310.

Preparation of racemic products in Tables 1 and 2 and Figure 3

The procedure for the preparation of each product in Tables 1 and 2 and Figure 3 was used with the modification that the ligand was omitted from the reaction mixture. The reactions were performed in otherwise identical fashion as the enantiomerically enriched products. The products were worked up and purified in the same fashion as described for the enantiomerically enriched products.

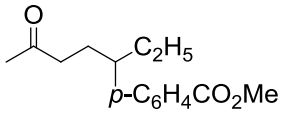
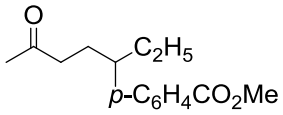
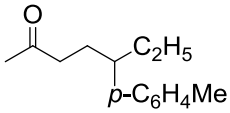
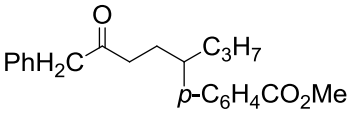
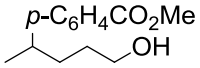
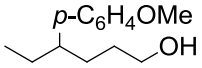
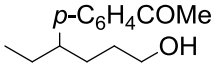
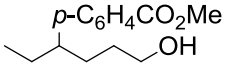
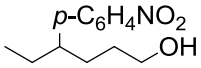
Determination of enantiomeric ratio

Table S3. Products shown in Table 1

entry	compound		conditions	retention time	er
1		**3a**	SFC, AD-Y column 2% MeOH, 2 mL/min	7.9 and 9.8 min	95:5
2		**3b**	SFC, AD-H column 5-50% MeOH, 2 mL/min	3.5 and 3.9 min	91:9
3		**3c**	SFC, AD-H column 5-50% MeOH, 2 mL/min	3.9 and 5.5 min	97:3
4		**3d**	SFC, AD-H column 5-50% MeOH, 2 mL/min	5.0 and 6.3 min	96:4
5		**3e**	SFC, AD-H column 5-50% MeOH, 2 mL/min	4.9 and 6.0 min	97:3
6		**3f**	SFC, AD-H column 5-50% MeOH, 2 mL/min	3.6 and 4.9 min	96:4
7		**3g**	SFC, AD-H column 5-50% *i*PrOH, 2 mL/min	6.5 and 6.8 min	94:6
8		**3h**	SFC, AD-H column 5-50% *i*PrOH, 2 mL/min	4.0 and 4.5 min	95:5
9		**3i**	SFC, AD-Y column 2% MeOH, 2 mL/min	7.9 and 10.5 min	95:5
10*		**3d**	SFC, AD-H column 5-50% MeOH, 2 mL/min	4.8 and 6.1 min	4:96
11*		**3i**	SFC, AD-Y column 2% MeOH, 2 mL/min	7.5 and 9.6 min	3:97
12*		**3j**	SFC, AD-H column 5-15% *i*PrOH, 1 mL/min	14.3 and 14.7 min	3:97
13*		**3k**	SFC, AD-H column 5-50% MeOH, 2 mL/min	5.6 and 7.6 min	3:97
14*		**3l**	SFC, AD-H column 5-50% MeOH, 2 mL/min	3.5 and 3.8 min	4:96
15*		**3m**	SFC, AD-H column 5-50% *i*PrOH, 2 mL/min	4.2 and 4.4 min	7:93

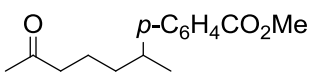
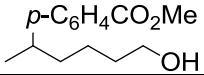
All compounds are products of the asymmetric Heck reaction using (*E*)-allylic alcohol starting materials unless otherwise noted. *Compounds are the products of the asymmetric Heck reaction using (*Z*)-allylic alcohol starting materials.

Table S4. Products shown in Table 2

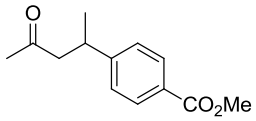
entry	compound		conditions	retention time	er
1*		**4a**	SFC, AD-H column 5-15% *i*PrOH, 1 mL/min	13.2 and 14.9 min	96:4
2		**4a**	SFC, AD-H column 5-15% *i*PrOH, 1 mL/min	13.5 and 14.9 min	10:90
3*		**4b**	SFC, AD-H column 1-50% MeOH, 2 mL/min	22.8 and 27.9 min	97:3
4		**4c**	SFC, AD-H column 5-50% *i*PrOH, 2 mL/min	5.3 and 5.4 min	6:94
5†		**4d**	SFC, AS-H column 5-15% *i*PrOH, 1 mL/min	14.0 and 14.6 min	3:97
6†		**4e**	SFC, AD-H column 5-15% MeOH, 2 mL/min	5.4 and 5.6 min	2:98
7†		**4f**	SFC, AD-H column 5-15% MeOH, 2 mL/min	8.4 and 9.8 min	1:99
8†		**4g**	SFC, AD-H column 5-15% MeOH, 2 mL/min	7.6 and 8.2 min	2:98
9†		**4h**	SFC, AD-H column 5-15% MeOH, 2 mL/min	7.5 and 8.2 min	2.5:97.5

All compounds are products of the asymmetric Heck reaction using (*E*)-allylic alcohol starting materials unless otherwise noted. *Compounds are the products of the asymmetric Heck reaction using (*Z*)-allylic alcohol starting materials. †All compounds are alcohol derivatives of aldehydes synthesized using the asymmetric Heck reaction using (*Z*)-allylic alcohol starting materials

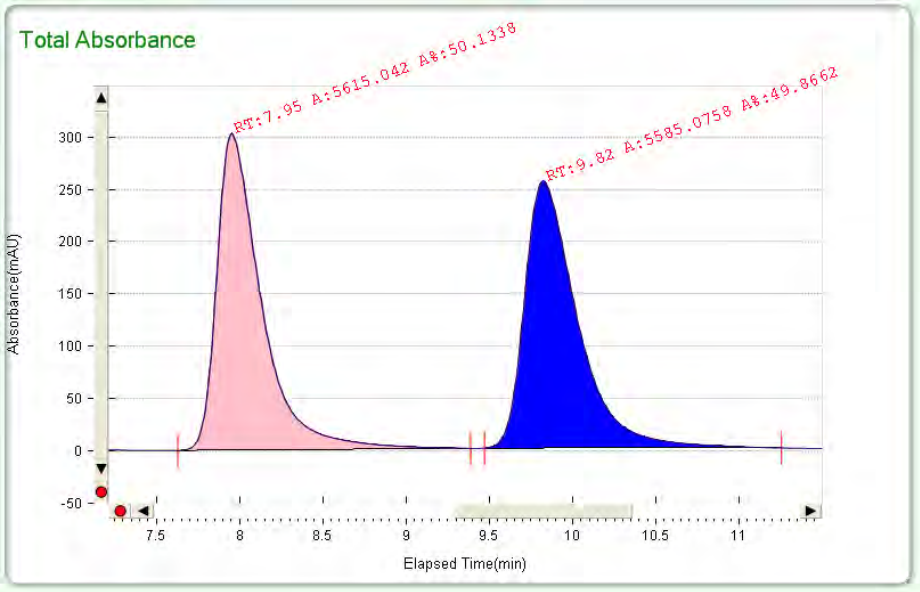
Table **S5**. Product shown in Figure 3

entry	compound		conditions	retention time	er
1		**5a**	SFC, AD-H 5-50% *i*PrOH, 2 mL/min	4.0 and 4.2 min	96:4
2		**5b**	SFC, AD-H column 5-50% *i*PrOH, 2 mL/min	5.9 and 6.1 min	94:6

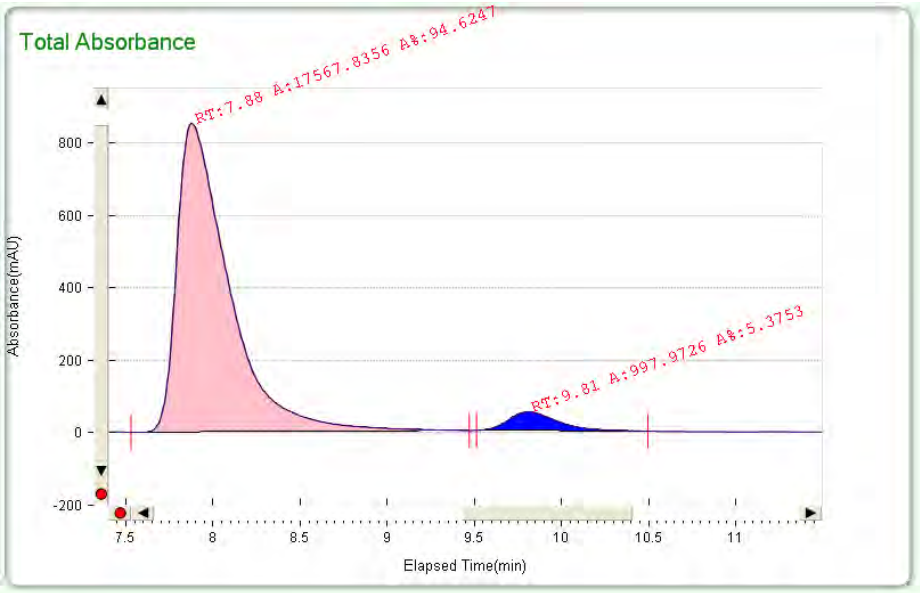
Chiral Separations

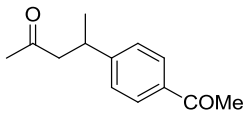


(±)-**3a**

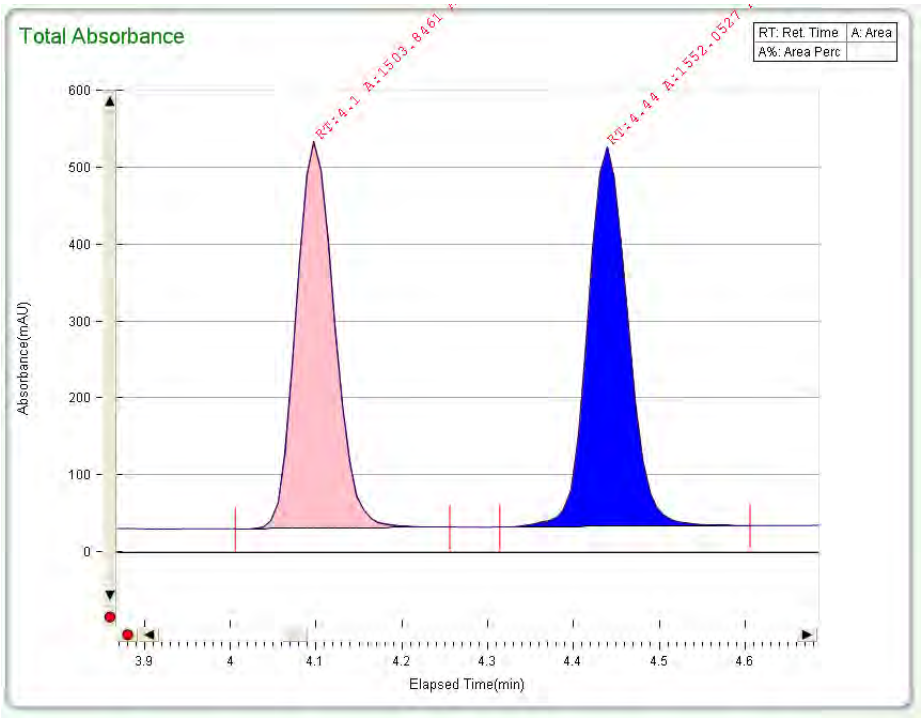


(+)-**3a**

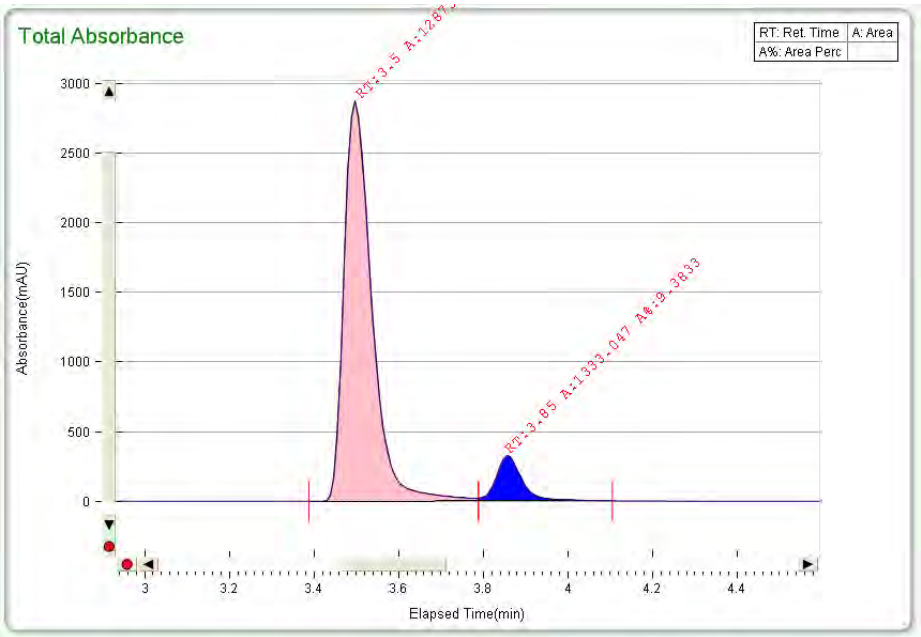


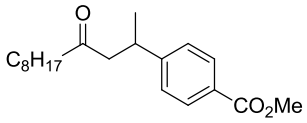

O
COMe

(±)-**3b**

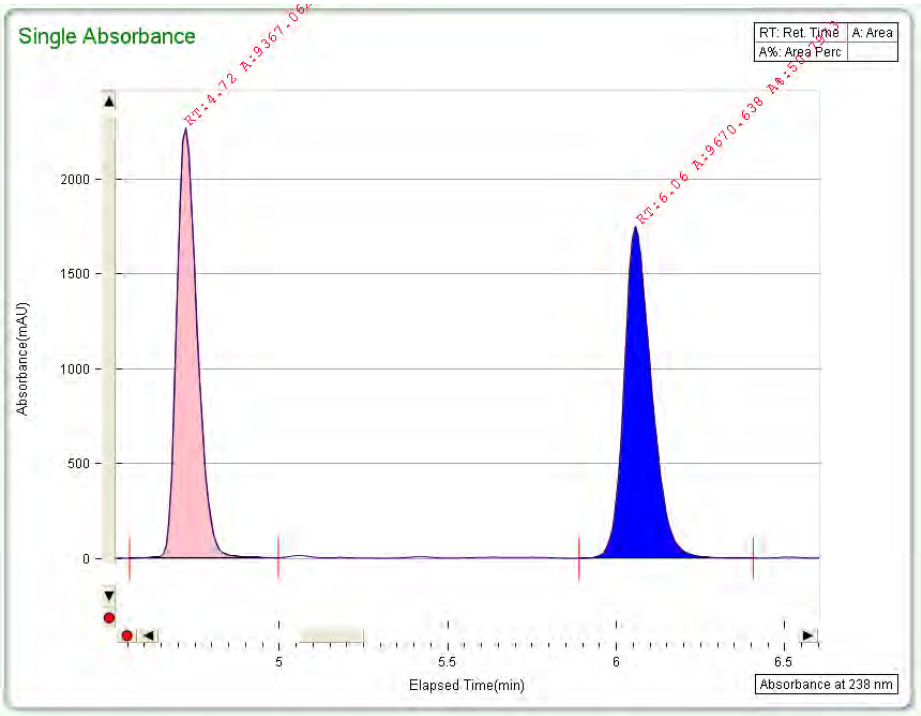

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:4.1 A:1503.8461
RT:4.44 A:1552.0527
Absorbance(mAU)
Elapsed Time(min)

(+)-**3b**

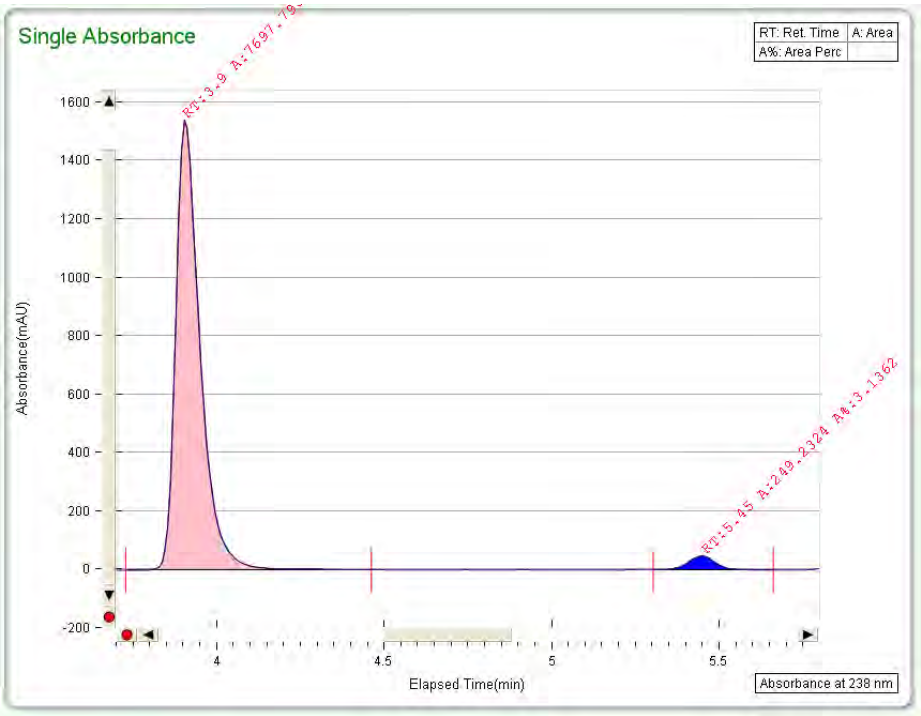

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:3.5 A:1287
RT:3.85 A:1333.047 A%:9.3833
Absorbance(mAU)
Elapsed Time(min)

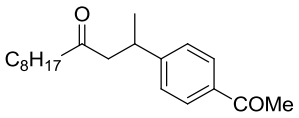

O
C8H17
CO2Me

(±)-3c

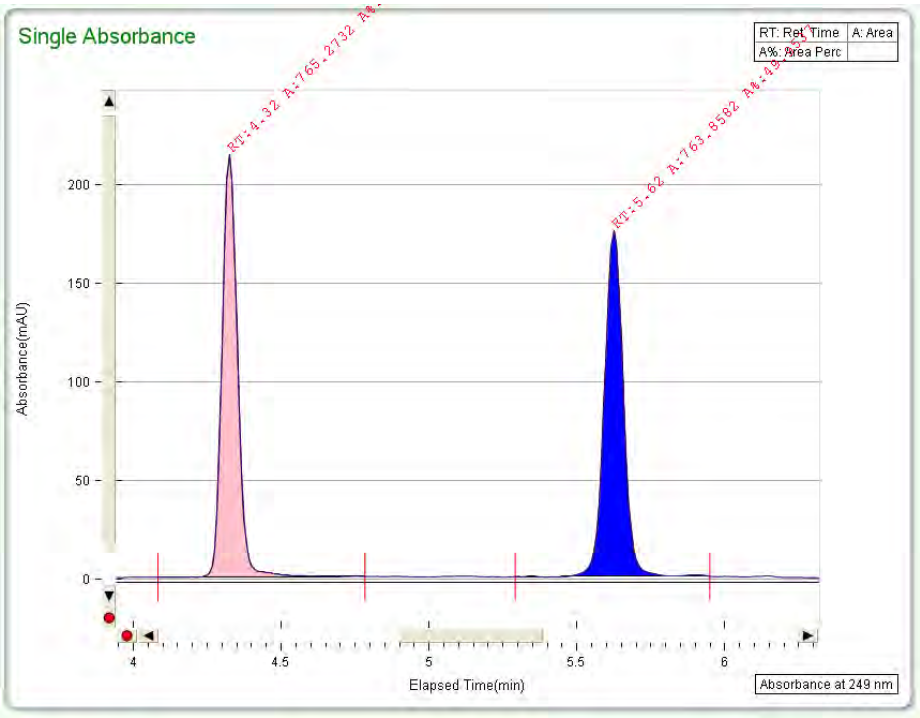

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:4.72 A:9367.06
RT:6.06 A:9670.638
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 238 nm

(+)-3c

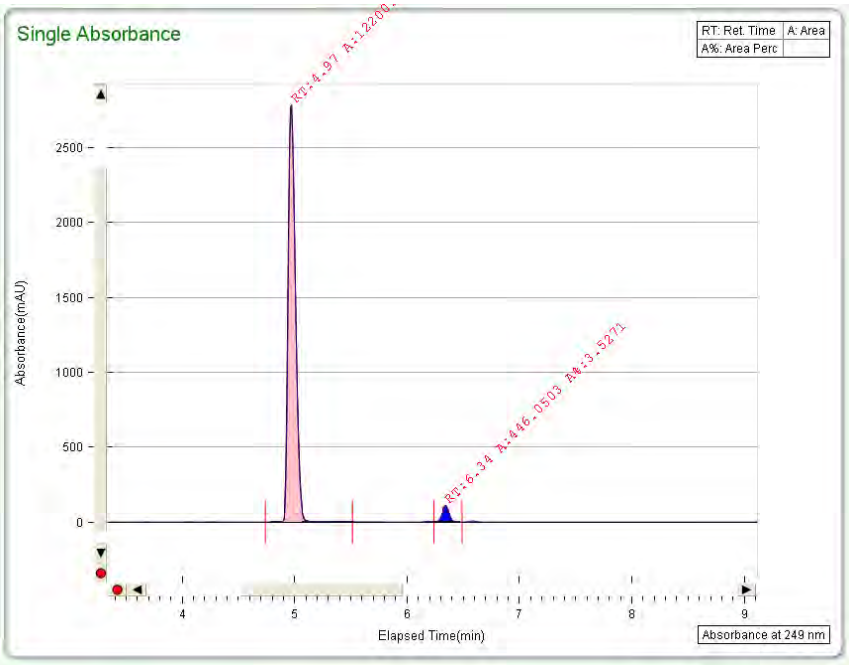

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:3.9 A:7697.79
RT:5.45 A:249.2324 A%:3.1362
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 238 nm

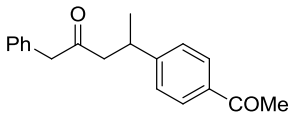

O
C8H17
COMe

(±)-**3d**

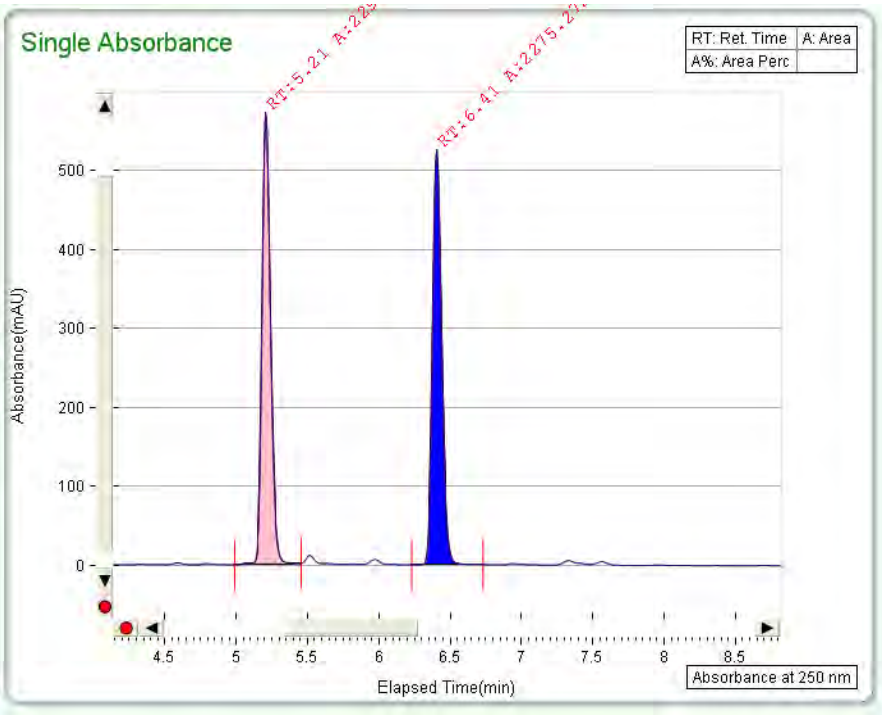

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:4.32 A:765.2732
RT:5.62 A:763.8582
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 249 nm

(+)-**3d**

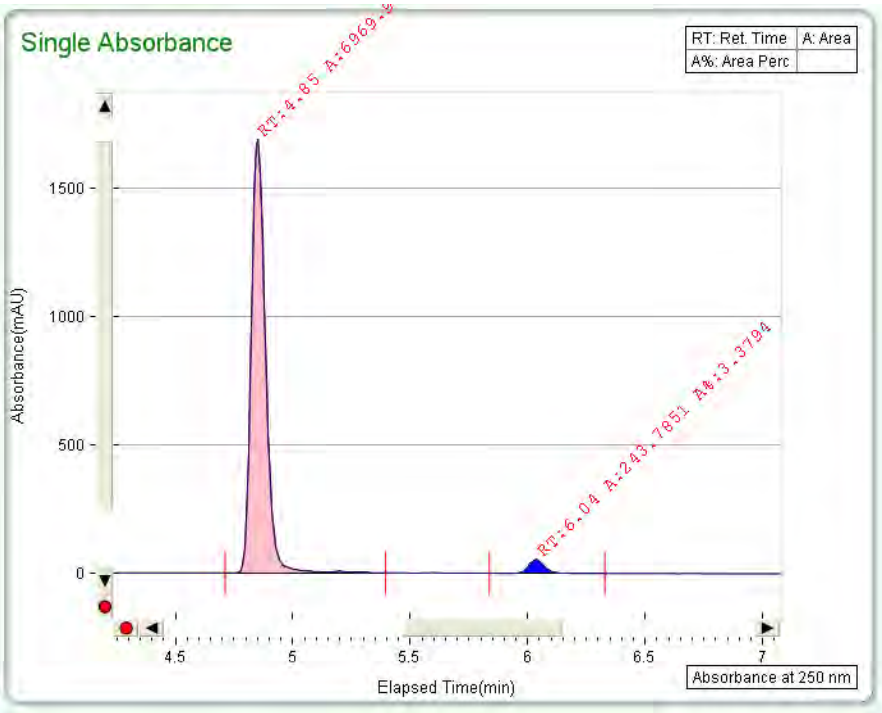

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:4.97
RT:6.34 A:446.0503 A%:3.5271
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 249 nm

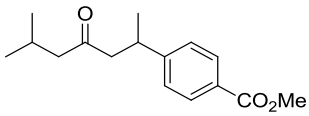

O
Ph
COMe

(±)-**3e**

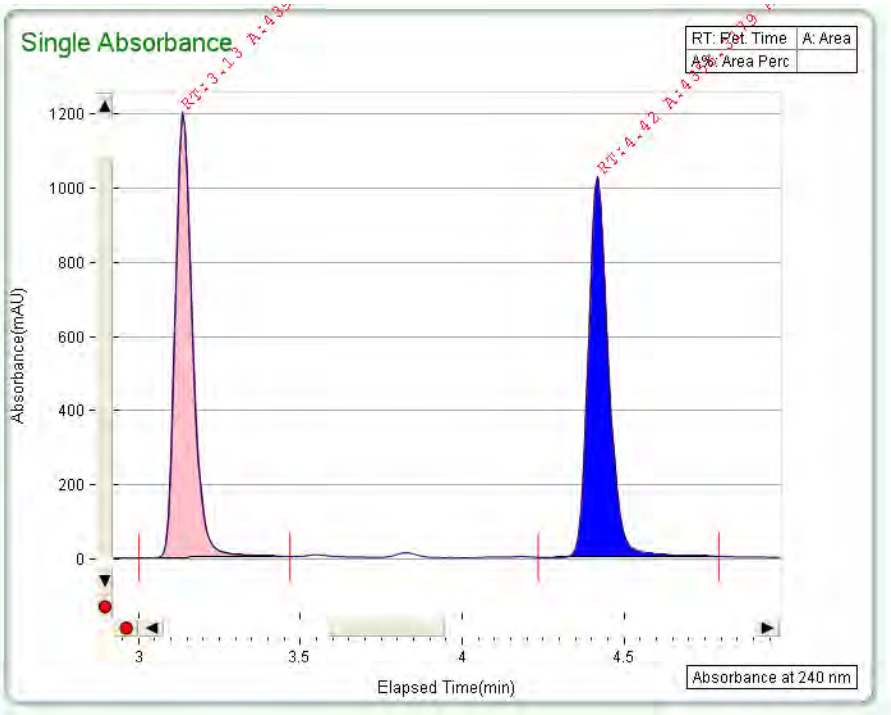

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
Rt:5.21 A:22
Rt:6.41 A:2275 2
Absorbance(mAU)
500
400
300
200
100
0
4.5
5
5.5
6
6.5
7
7.5
8
8.5
Elapsed Time(min)
Absorbance at 250 nm

(+)-**3e**

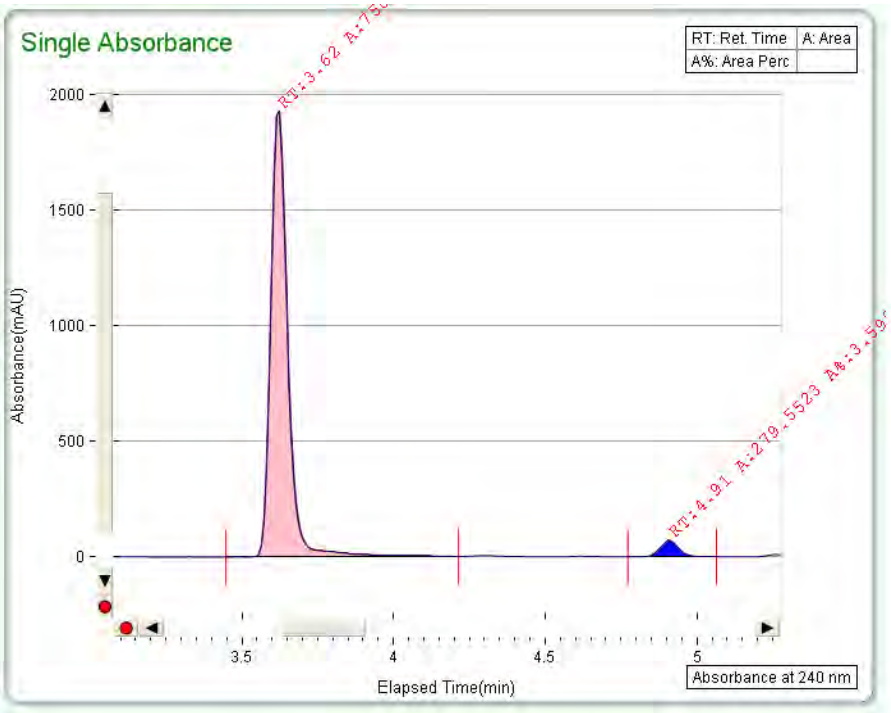

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
Rt:4.85 A:6969
Rt:6.04 A:243.7851 A%:3.3794
Absorbance(mAU)
1500
1000
500
0
4.5
5
5.5
6
6.5
7
Elapsed Time(min)
Absorbance at 250 nm

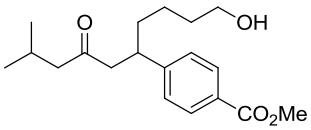

O
CO2Me

(±)-**3f**

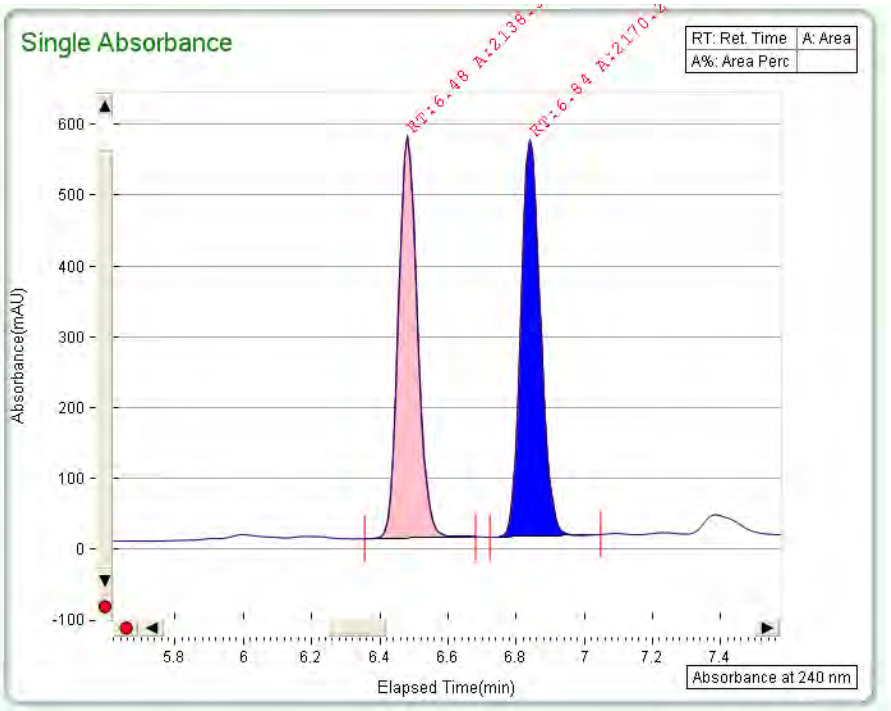

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 3.13
RT: 4.42
1200
1000
800
600
400
200
0
Absorbance(mAU)
3
3.5
4
4.5
Elapsed Time(min)
Absorbance at 240 nm

(+)-**3f**

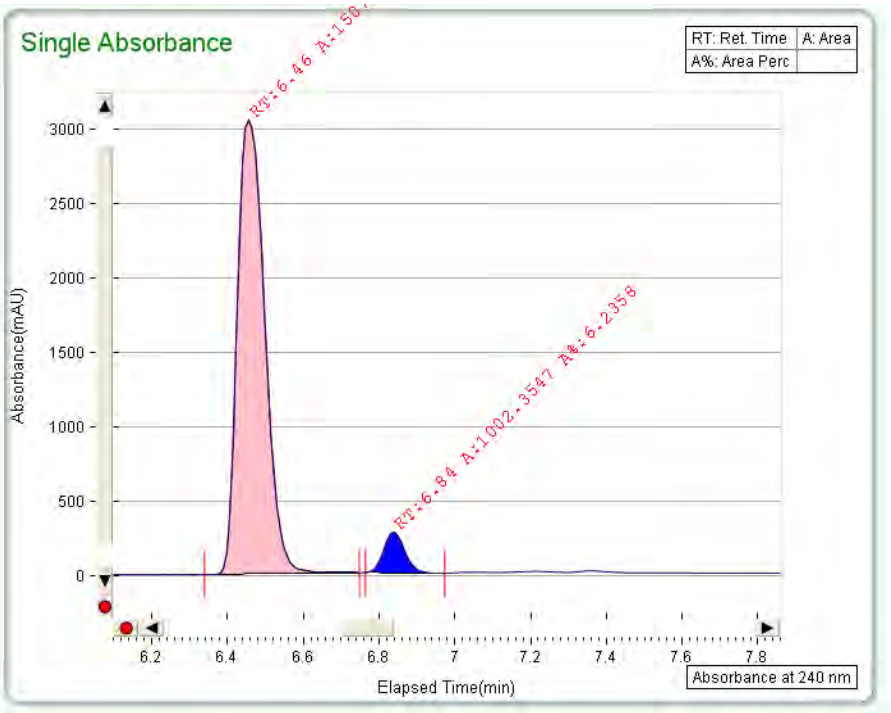

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 3.62
RT: 4.91
2000
1500
1000
500
0
Absorbance(mAU)
3.5
4
4.5
5
Elapsed Time(min)
Absorbance at 240 nm

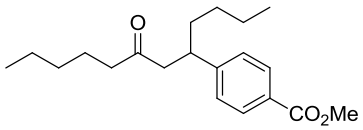

O
OH
CO2Me

(±)-**3g**

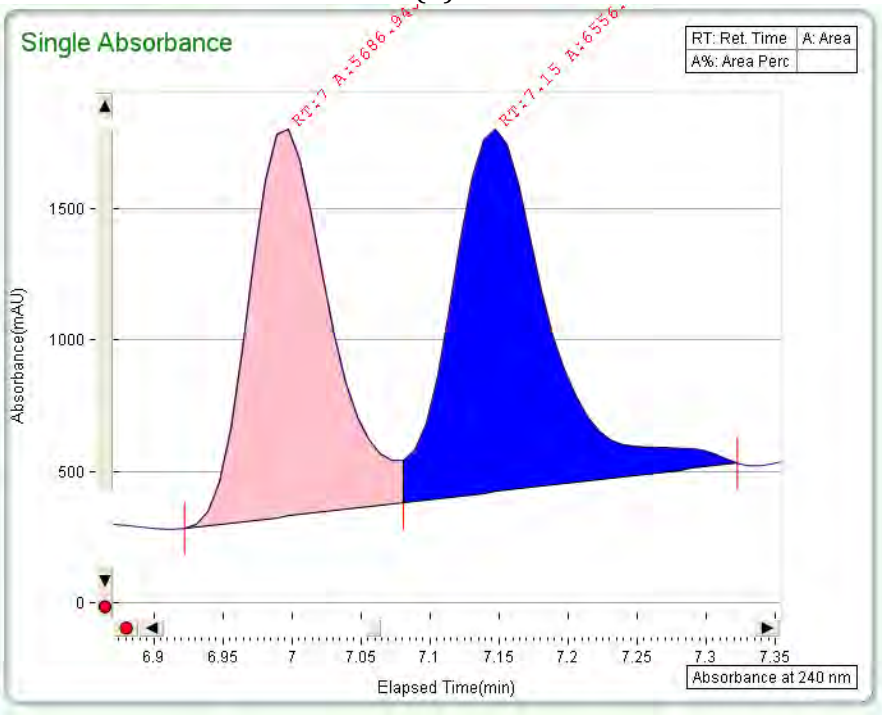

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 6.48 A: 2138
RT: 6.84 A: 2170
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 240 nm

(+)-**3g**

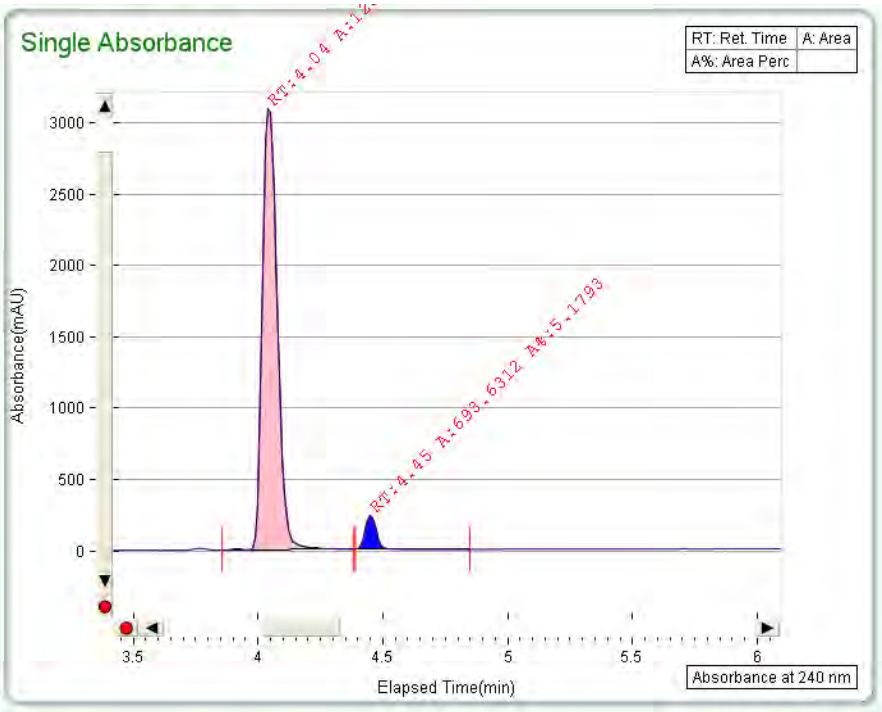

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 6.46
RT: 6.84 A: 1002 A%: 6.2358
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 240 nm

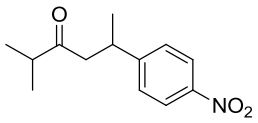

O
CO2Me

(±)-**3h**

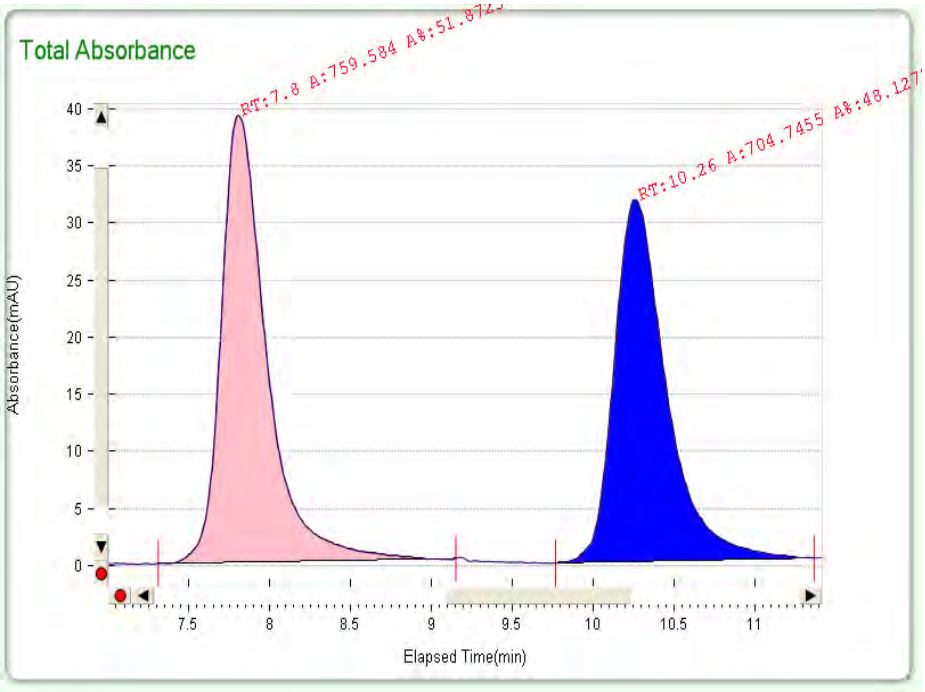

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 240 nm

(+)-**3h**

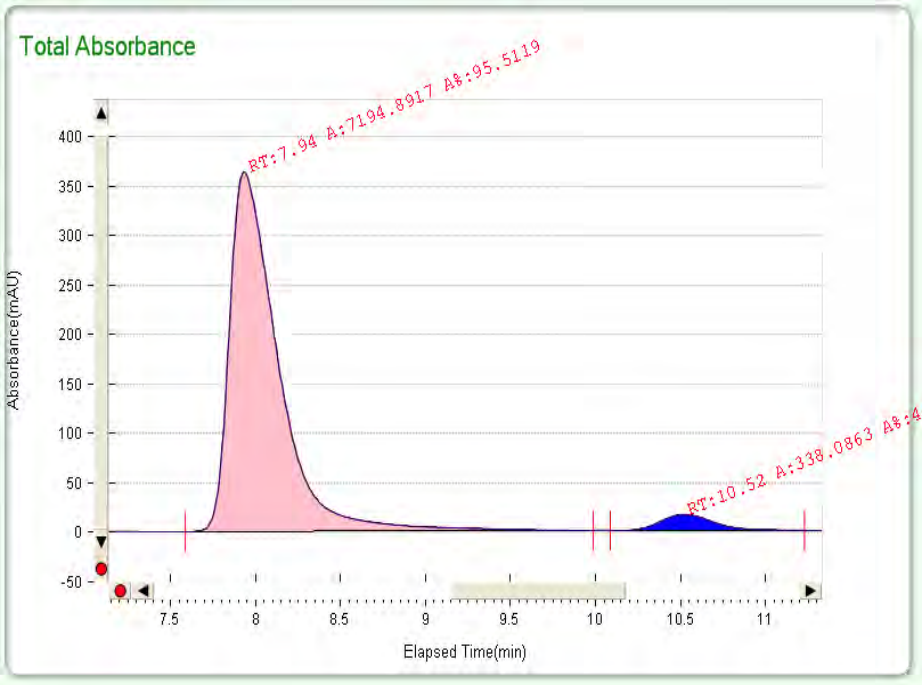

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 240 nm

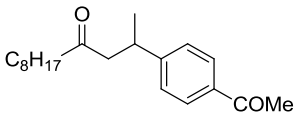

O
NO2

(±)-**3i**

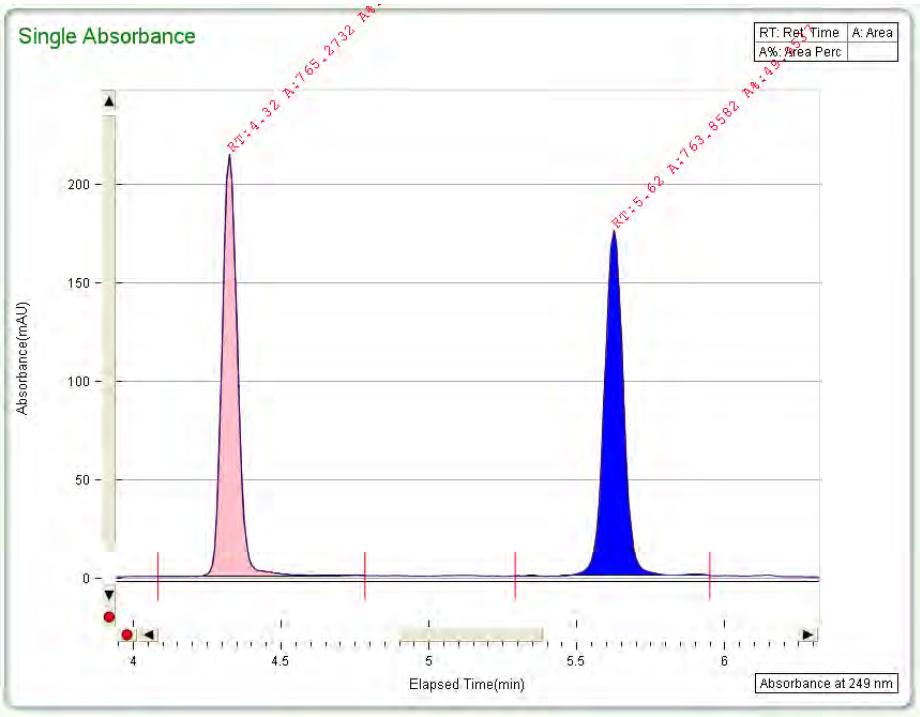

Total Absorbance
RT:7.8 A:759.584 A%:51.872
RT:10.26 A:704.7455 A%:48.127
Absorbance(mAU)
Elapsed Time(min)

(+)-**3i**

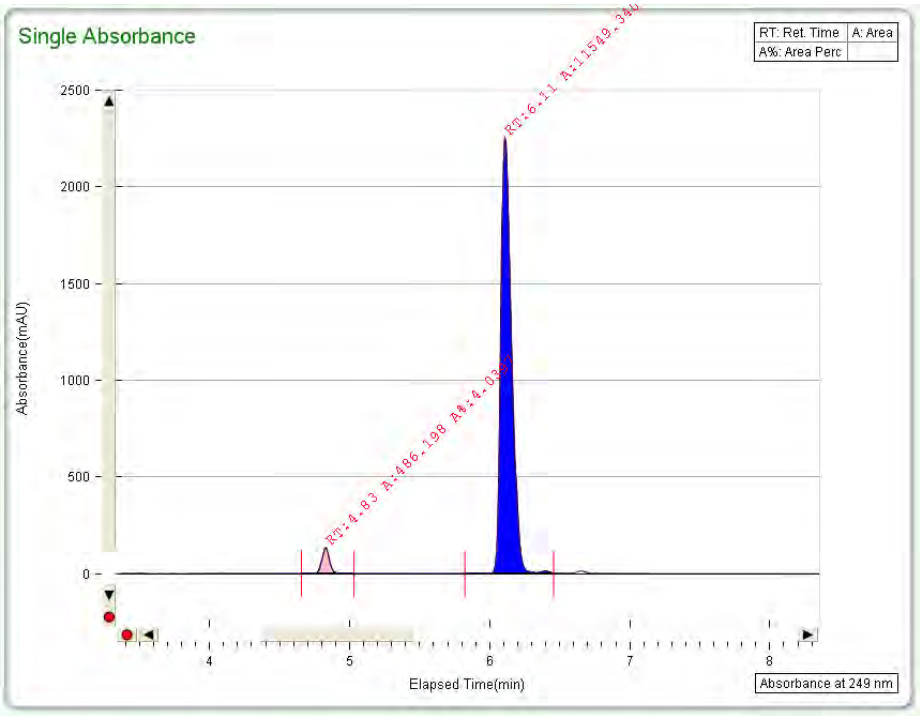

Total Absorbance
RT:7.94 A:7194.8917 A%:95.5119
RT:10.52 A:338.0863 A%:4
Absorbance(mAU)
Elapsed Time(min)

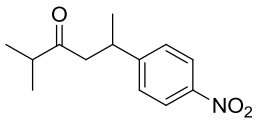

O
C8H17
COMe

(±)-**3d**

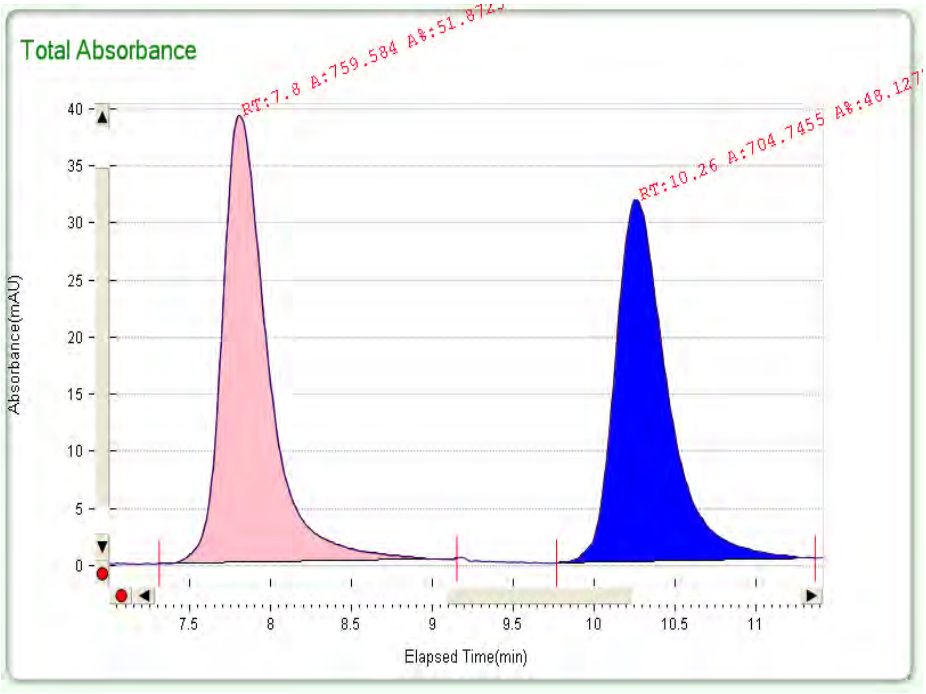

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:4.32 A:765.2732
RT:5.62 A:763.8582
Absorbance(mAU)
200
150
100
50
0
4
4.5
5
5.5
6
Elapsed Time(min)
Absorbance at 249 nm

(-)-**3d**

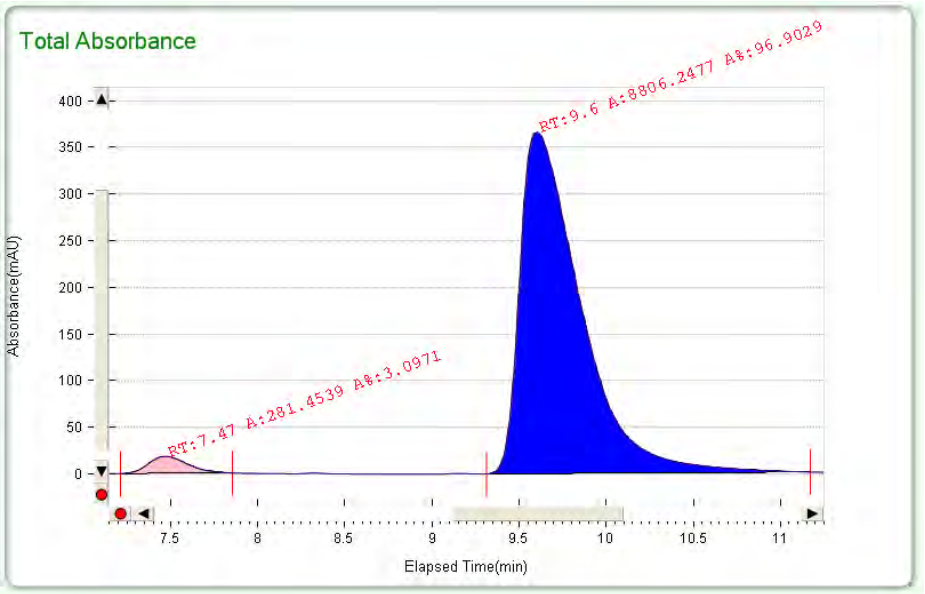

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:6.11 A:11549.340
RT:4.83 A:486.198
Absorbance(mAU)
2500
2000
1500
1000
500
0
4
5
6
7
8
Elapsed Time(min)
Absorbance at 249 nm

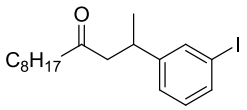

O
NO2

(±)-**3i**

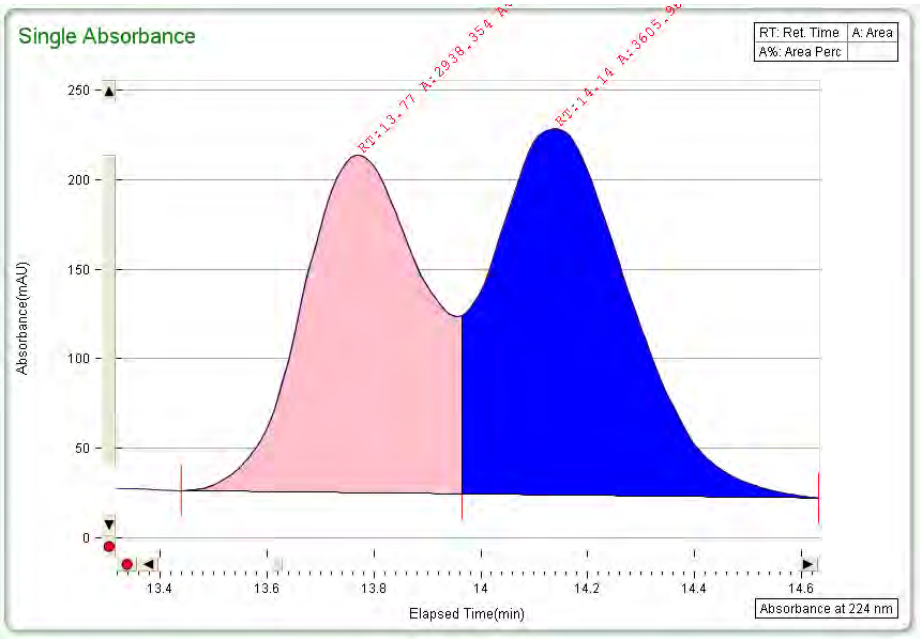

Total Absorbance
RT:7.8 A:759.584 A%:51.872
RT:10.26 A:704.7455 A%:48.127
Absorbance(mAU)
Elapsed Time(min)

(-)-**3i**

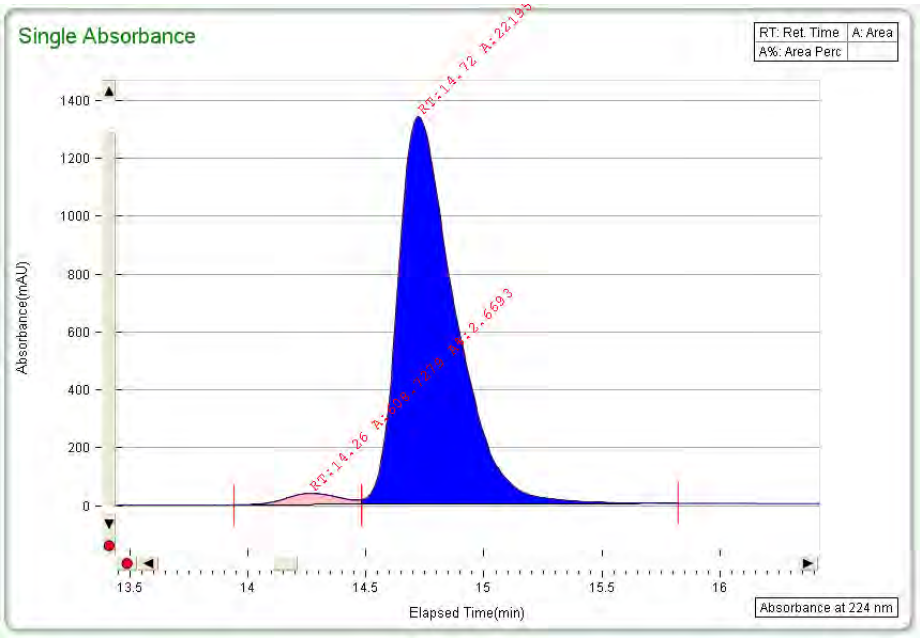

Total Absorbance
RT:9.6 A:8806.2477 A%:96.9029
RT:7.47 A:281.4539 A%:3.0971
Absorbance(mAU)
Elapsed Time(min)

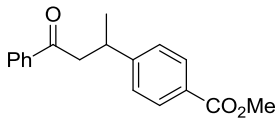

O
C_8H_{17}
I

(±)-3j

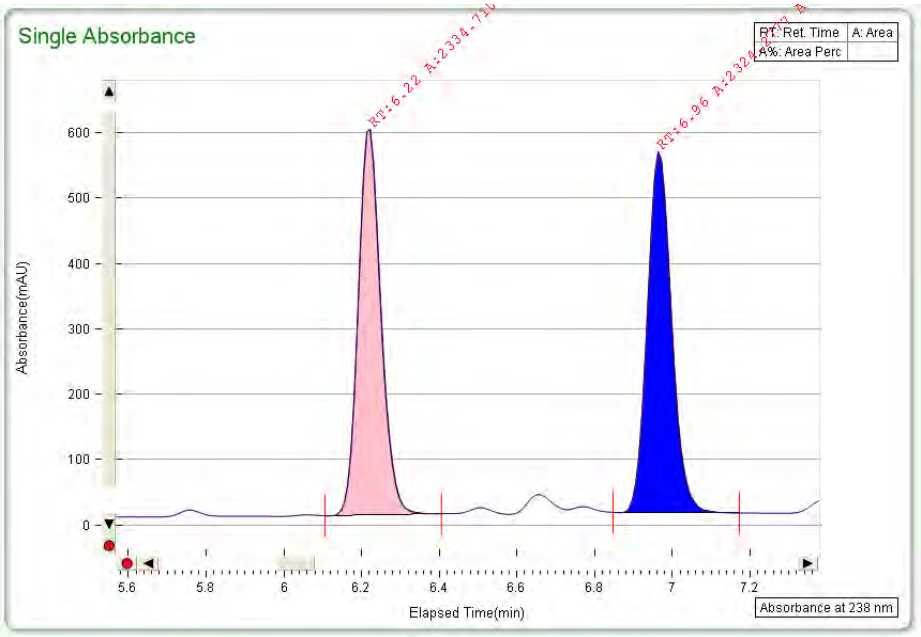

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:13.77 A:29938.354
RT:14.14 A:36055.9
Absorbance(mAU)
250
200
150
100
50
0
13.4
13.6
13.8
14
14.2
14.4
14.6
Elapsed Time(min)
Absorbance at 224 nm

(-)-3j

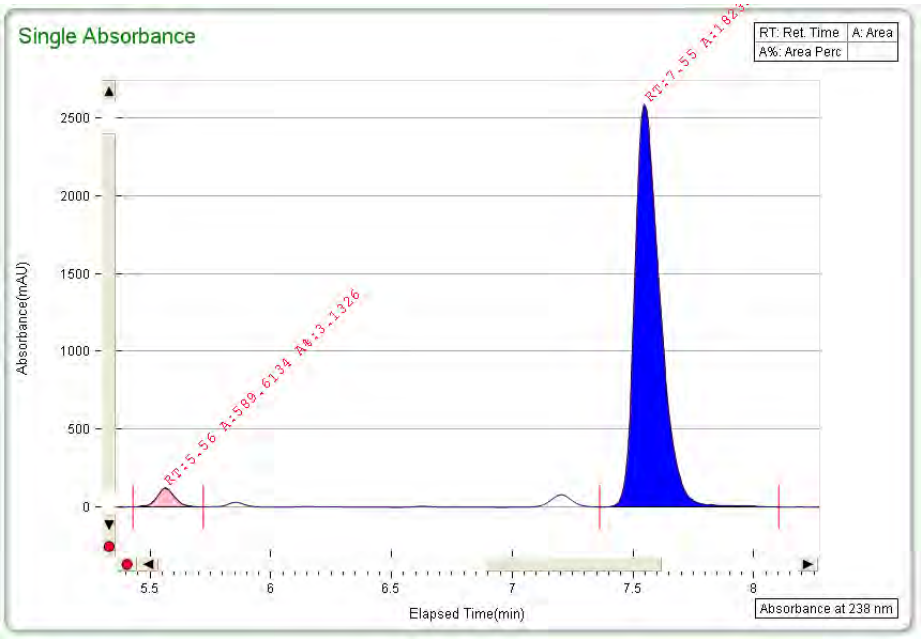

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:14.72 A:22193
RT:14.26 A:2693
Absorbance(mAU)
1400
1200
1000
800
600
400
200
0
13.5
14
14.5
15
15.5
16
Elapsed Time(min)
Absorbance at 224 nm

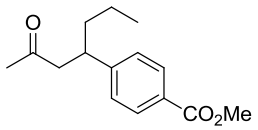

O
Ph
CO2Me

(±)-3k

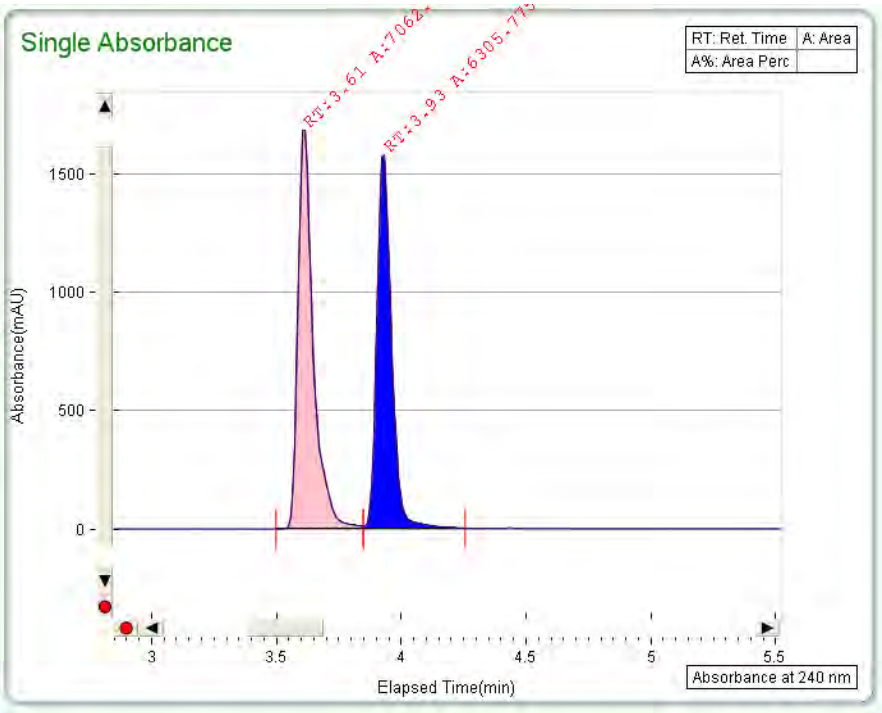

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:6.22 A:2334.71
RT:6.96 A:2324
Absorbance(mAU)
600
500
400
300
200
100
0
5.6
5.8
6
6.2
6.4
6.6
6.8
7
7.2
Elapsed Time(min)
Absorbance at 238 nm

(+)-3k

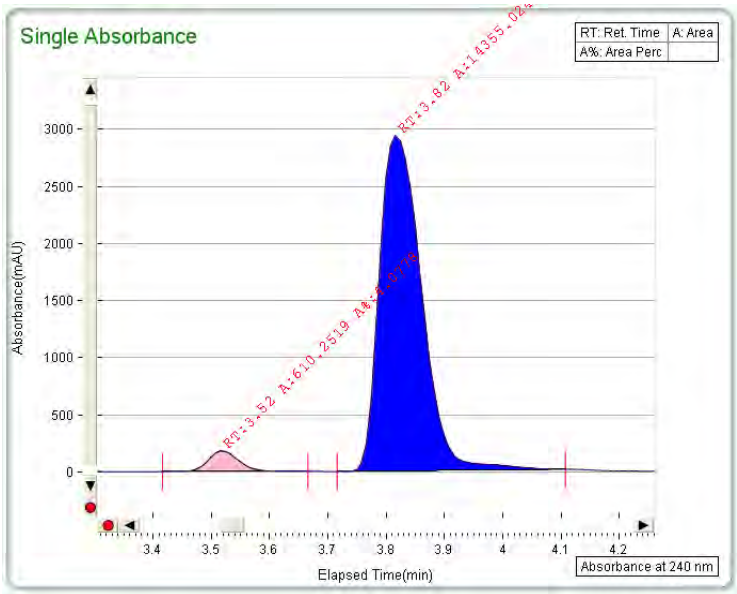

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:7.55 A:1823
RT:5.56 A:589.6134 A%:3.1326
Absorbance(mAU)
2500
2000
1500
1000
500
0
5.5
6
6.5
7
7.5
8
Elapsed Time(min)
Absorbance at 238 nm

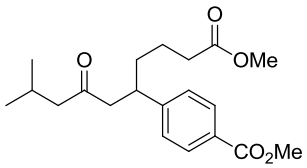

O
CO2Me

(±)-**3l**

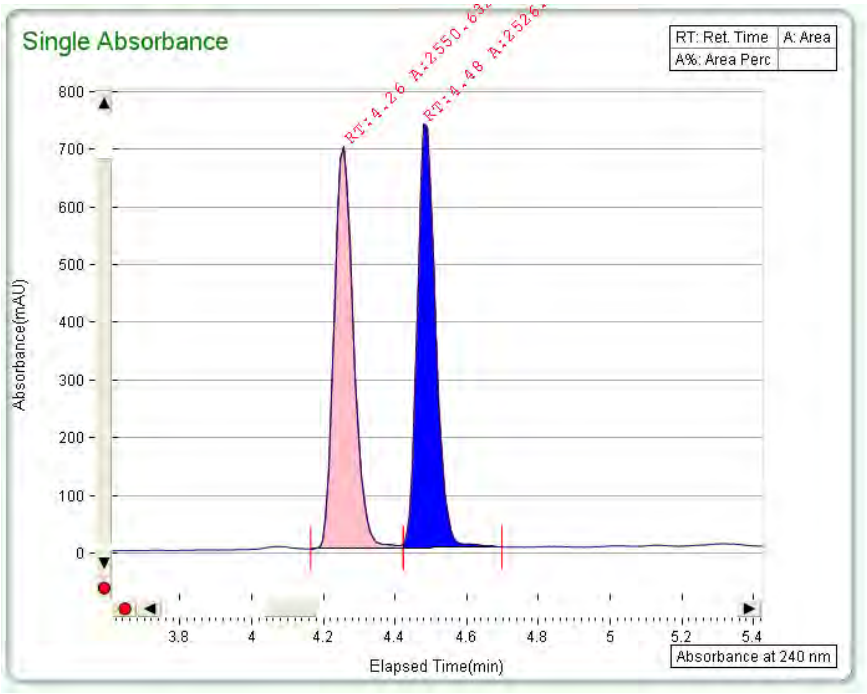

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:3.61 A:7062
RT:3.93 A:6305
1500
1000
500
0
Absorbance(mAU)
3
3.5
4
4.5
5
5.5
Elapsed Time(min)
Absorbance at 240 nm

(+)-**3l**

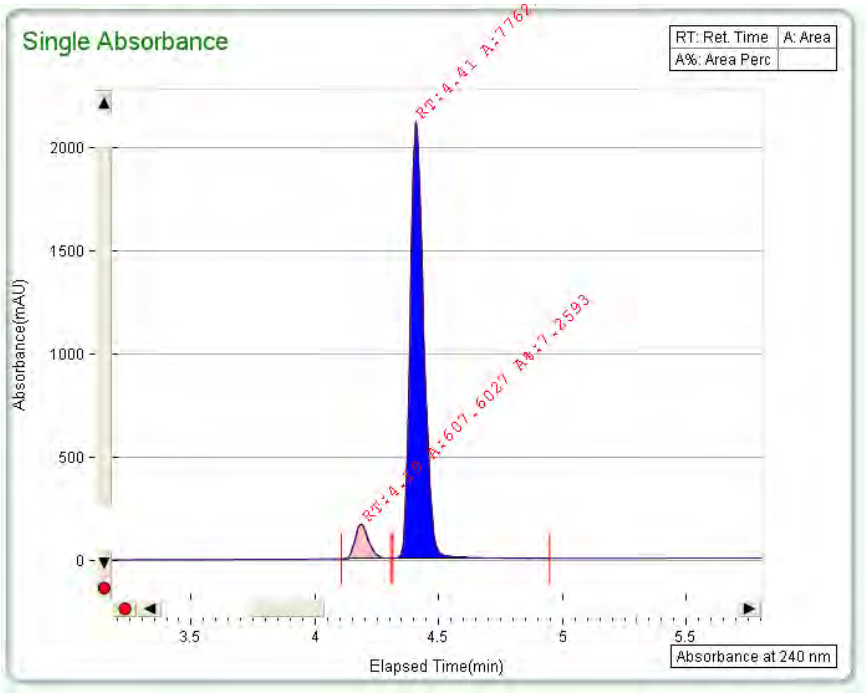

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:3.82 A:14355
RT:3.52 A:610.2519
3000
2500
2000
1500
1000
500
0
Absorbance(mAU)
3.4
3.5
3.6
3.7
3.8
3.9
4
4.1
4.2
Elapsed Time(min)
Absorbance at 240 nm

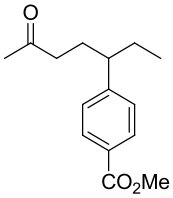

O
O
OMe
CO2Me

(±)-**3m**

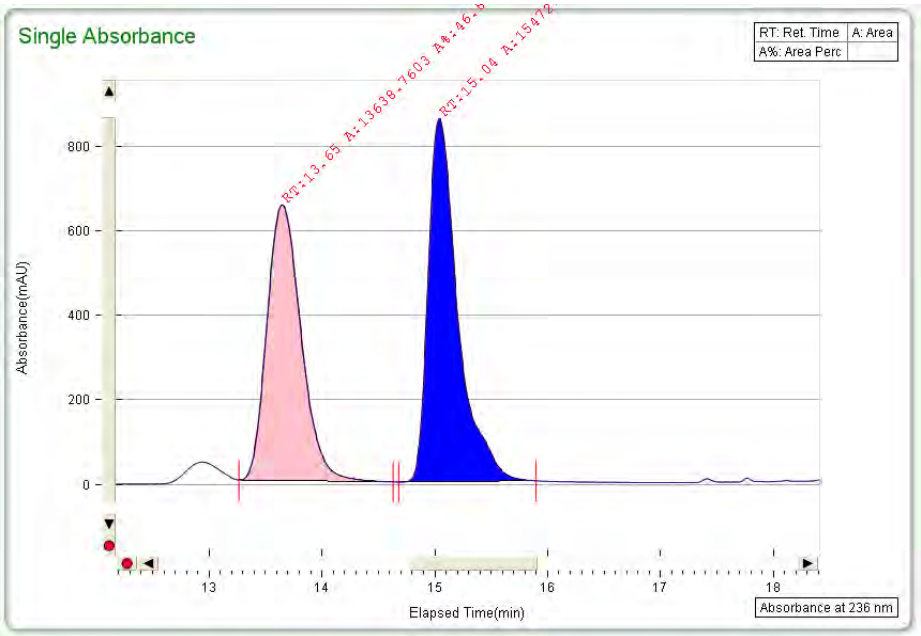

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 4.26 A: 2550
RT: 4.48 A: 2526
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 240 nm

(-)-**3m**

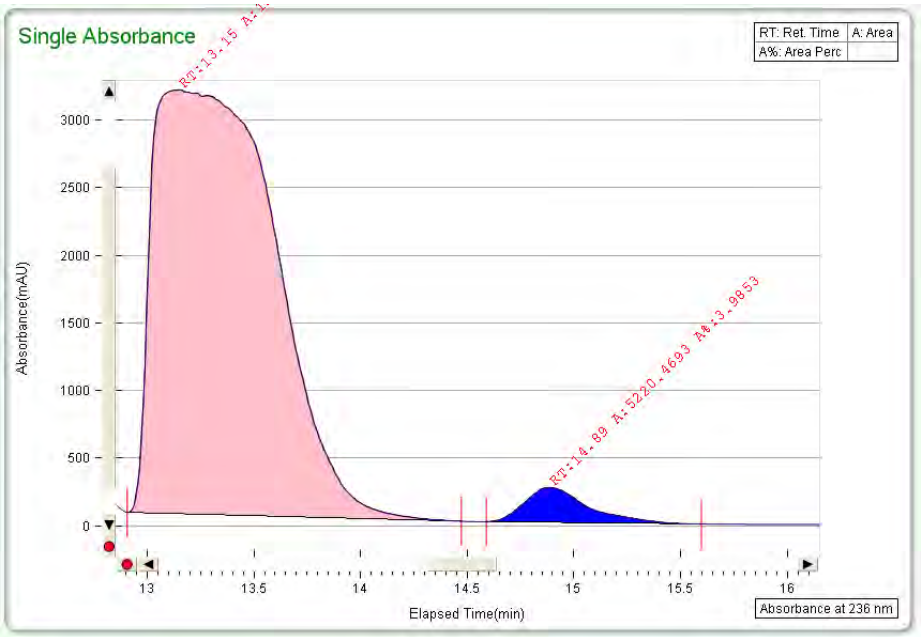

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 4.41 A: 7762
RT: 4.10 A: 607.6027 A%: 7.2593
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 240 nm

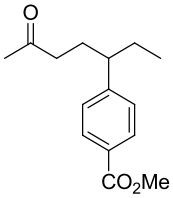

O
CO2Me

(±)-**4a**

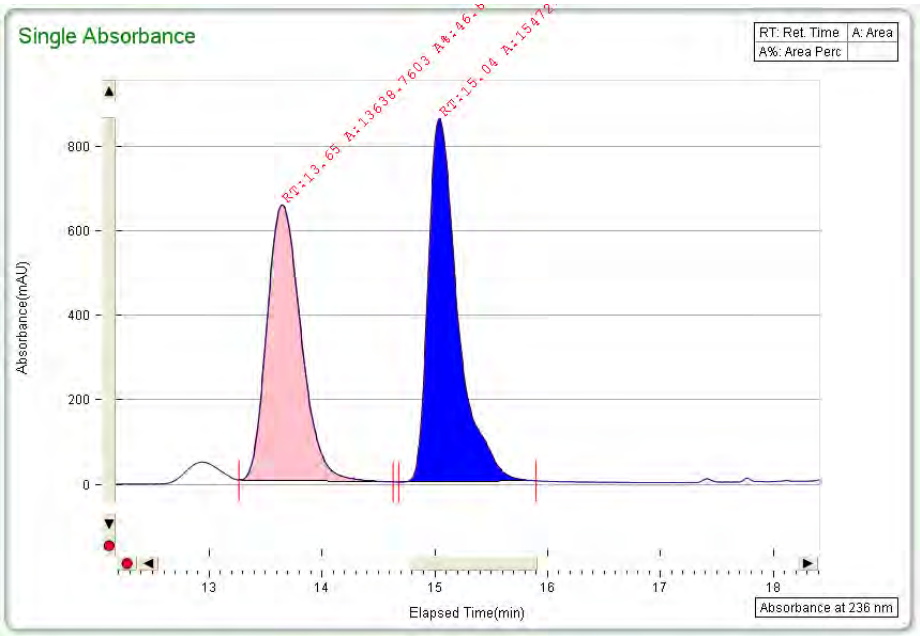

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:13.65 A:13638.7603 A%:46.
RT:15.04 A:15472
800
600
400
200
0
Absorbance(mAU)
13
14
15
16
17
18
Elapsed Time(min)
Absorbance at 236 nm

(+)-**4a**

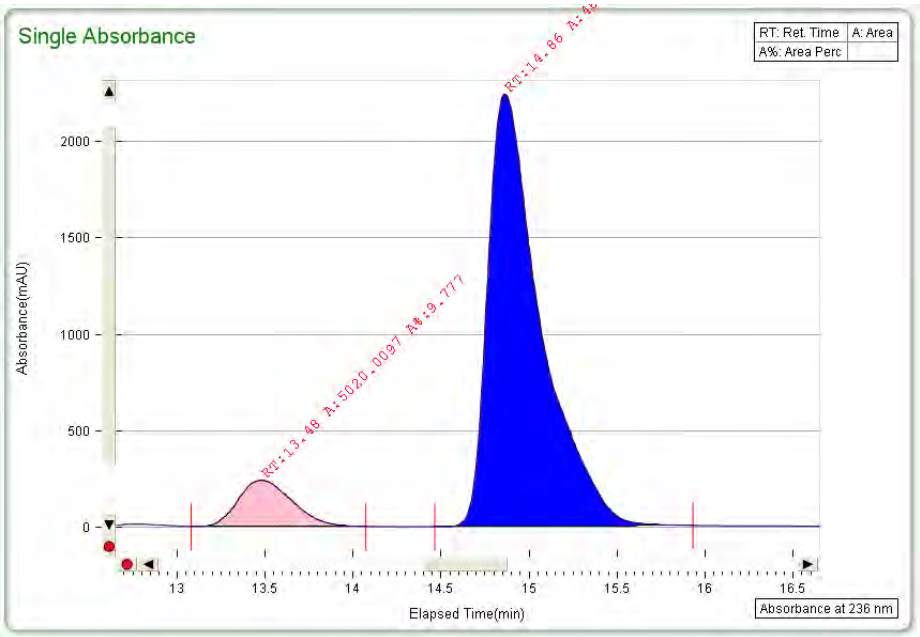

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:13.15 A:1
RT:14.89 A:5220.4693 A%:3.9853
3000
2500
2000
1500
1000
500
0
Absorbance(mAU)
13
13.5
14
14.5
15
15.5
16
Elapsed Time(min)
Absorbance at 236 nm

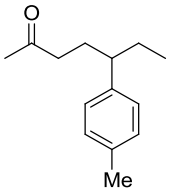

O
CO2Me

(±)-**4a**

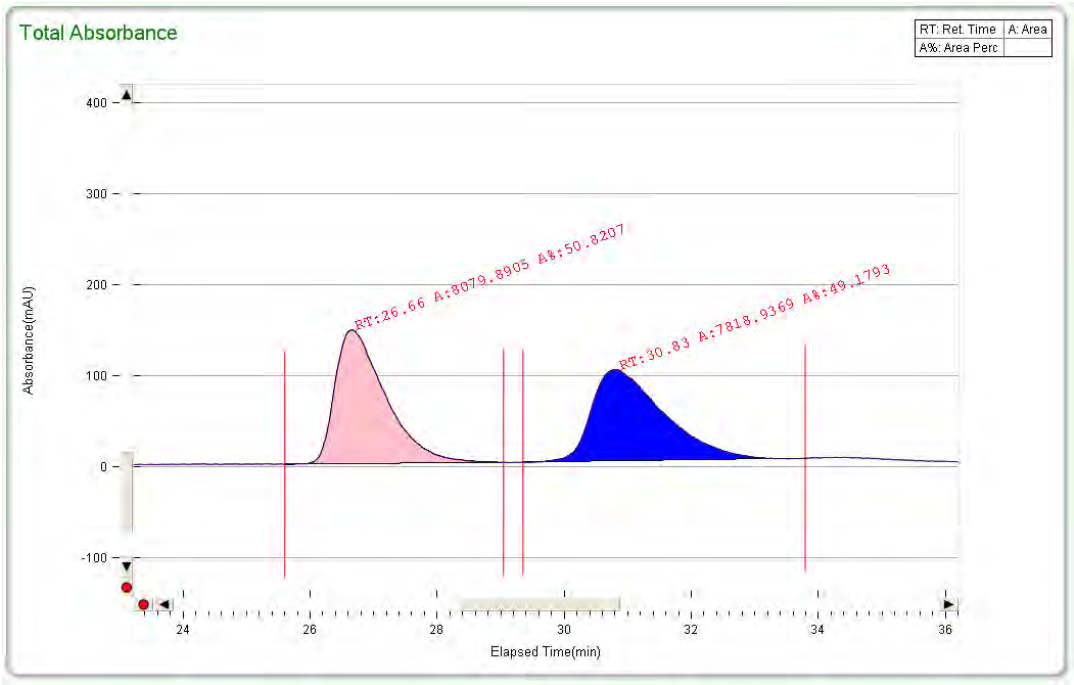

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:13.65 A:13638.7603 A%:46.
RT:15.04 A:15472
Absorbance(mAU)
800
600
400
200
0
13
14
15
16
17
18
Elapsed Time(min)
Absorbance at 236 nm

(-)-**4a**

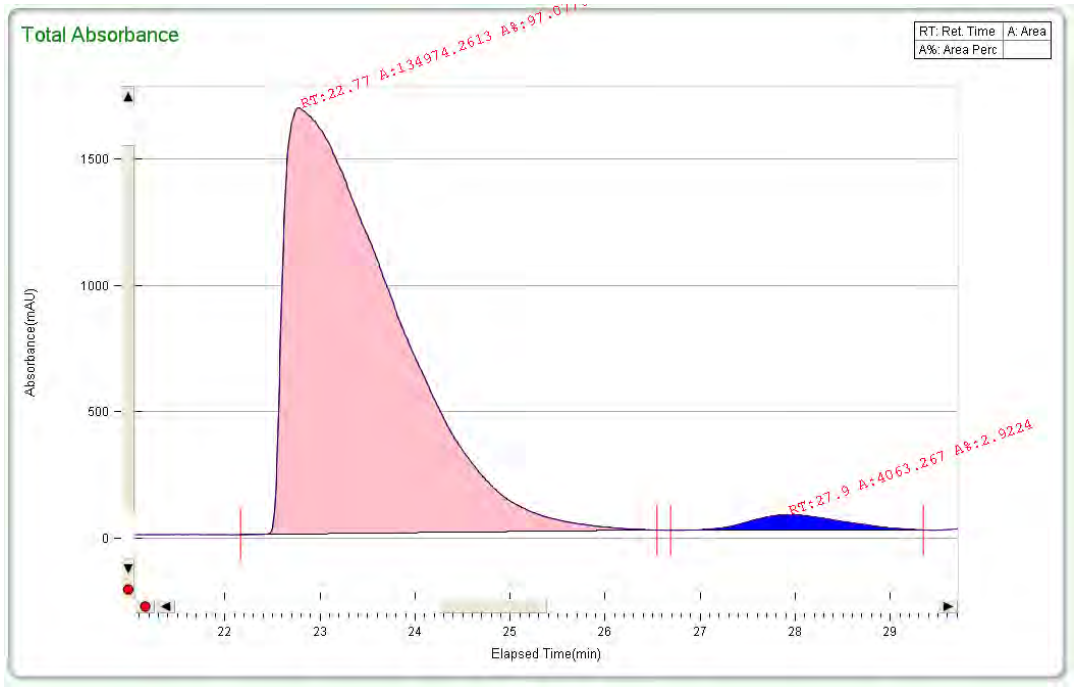

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:14.86 A:4
RT:13.48 A:5020.0097 A%:9.777
Absorbance(mAU)
2000
1500
1000
500
0
13
13.5
14
14.5
15
15.5
16
16.5
Elapsed Time(min)
Absorbance at 236 nm

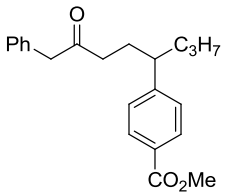

O
Me

(±)-**4b**

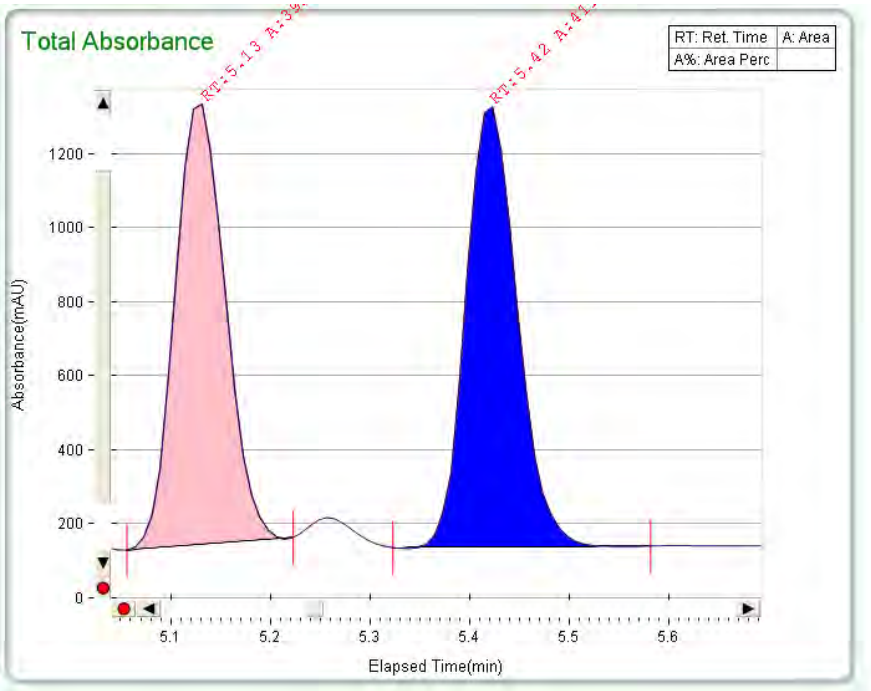

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:26.66 A:8079.8905 A%:50.8207
RT:30.83 A:7818.9369 A%:49.1793
Absorbance(mAU)
Elapsed Time(min)

(-)-4b

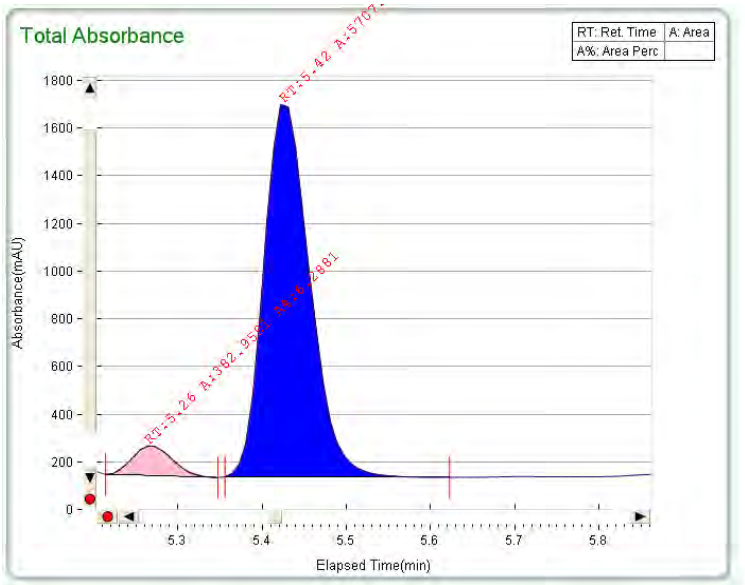

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:22.77 A:134974.2613
RT:27.9 A:4063.267 A%:2.9224
Absorbance(mAU)
Elapsed Time(min)

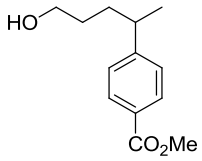

O
Ph
C_3H_7
CO_2Me

(±)-**4c**

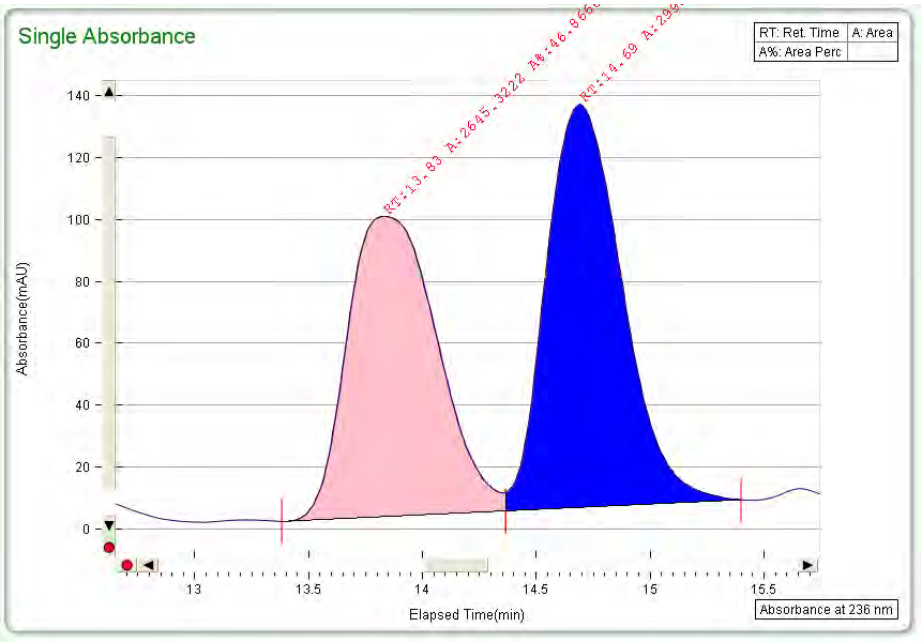

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 5.13
RT: 5.42
Absorbance(mAU)
1200
1000
800
600
400
200
0
5.1
5.2
5.3
5.4
5.5
5.6
Elapsed Time(min)

(+)-**4c**

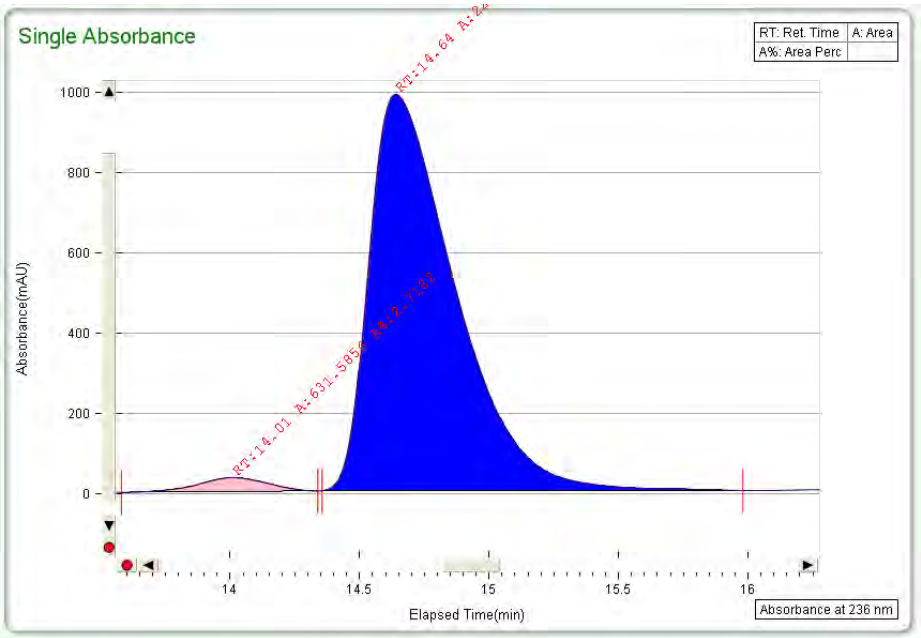

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT: 5.42
RT: 5.26
Absorbance(mAU)
1800
1600
1400
1200
1000
800
600
400
200
0
5.3
5.4
5.5
5.6
5.7
5.8
Elapsed Time(min)

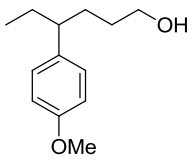

HO
CO2Me

(±)-**4da**

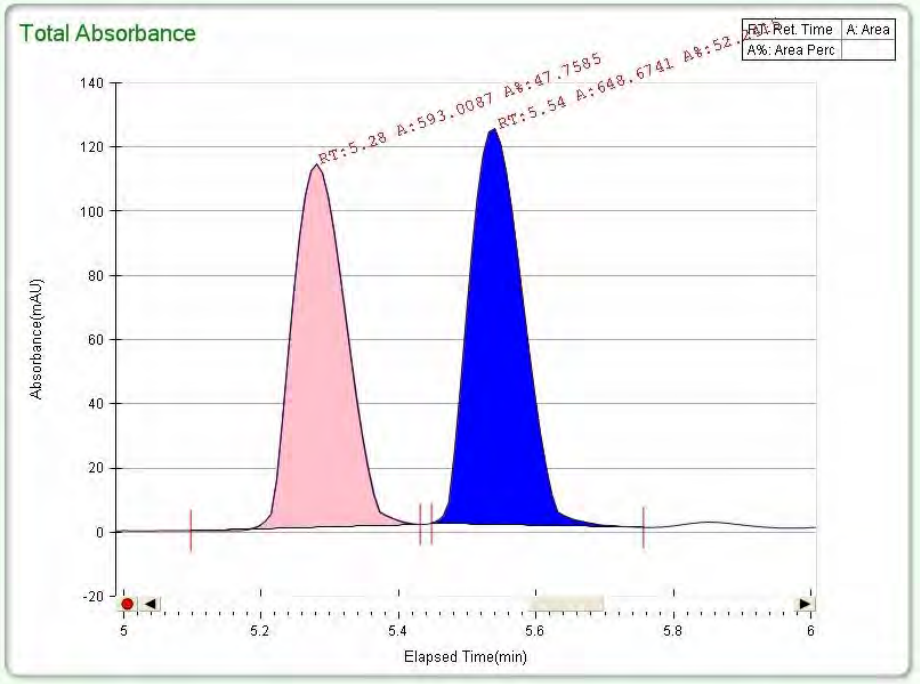

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:13.83 A:2645.3222
RT:14.69
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 236 nm

(+)-**4da**

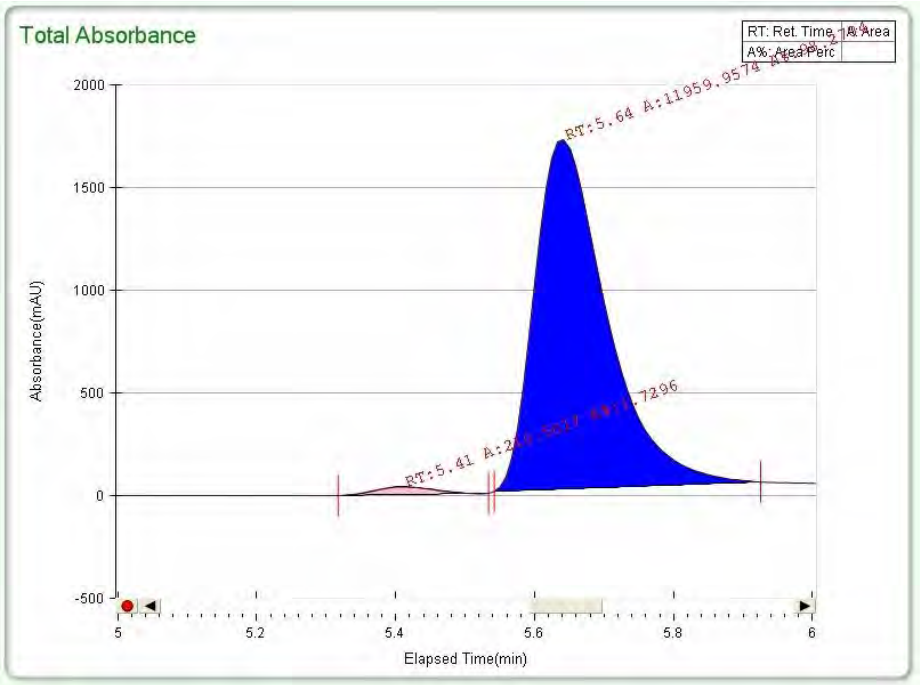

Single Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:14.64
RT:14.01
Absorbance(mAU)
Elapsed Time(min)
Absorbance at 236 nm

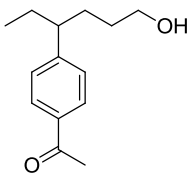

OH
OMe

(±)-**4ea**

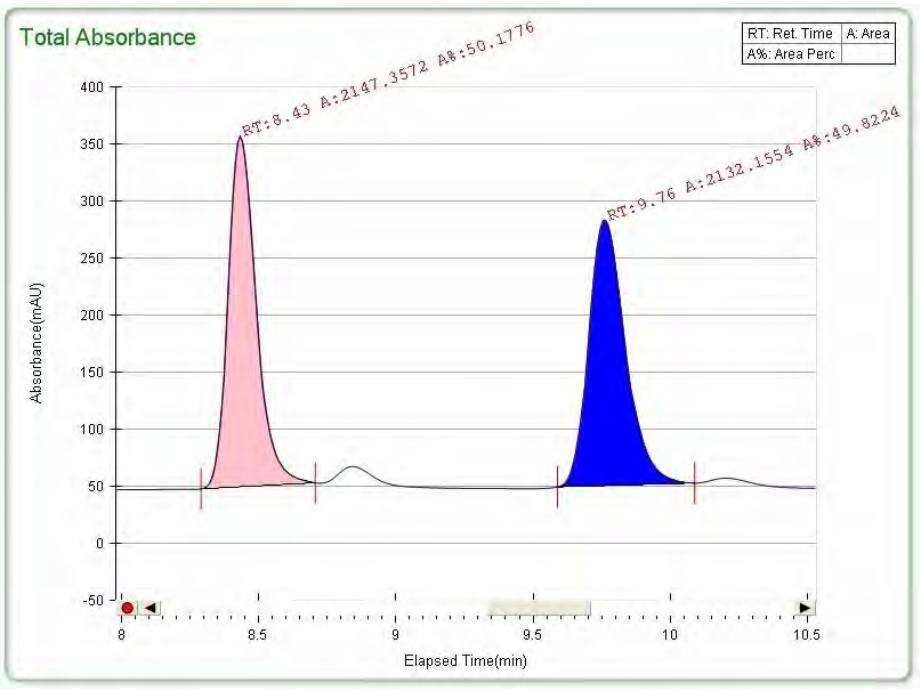

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:5.28 A:593.0087 A%:47.7585
RT:5.54 A:648.6741 A%:52.
Absorbance(mAU)
Elapsed Time(min)

(+)-**4ea**

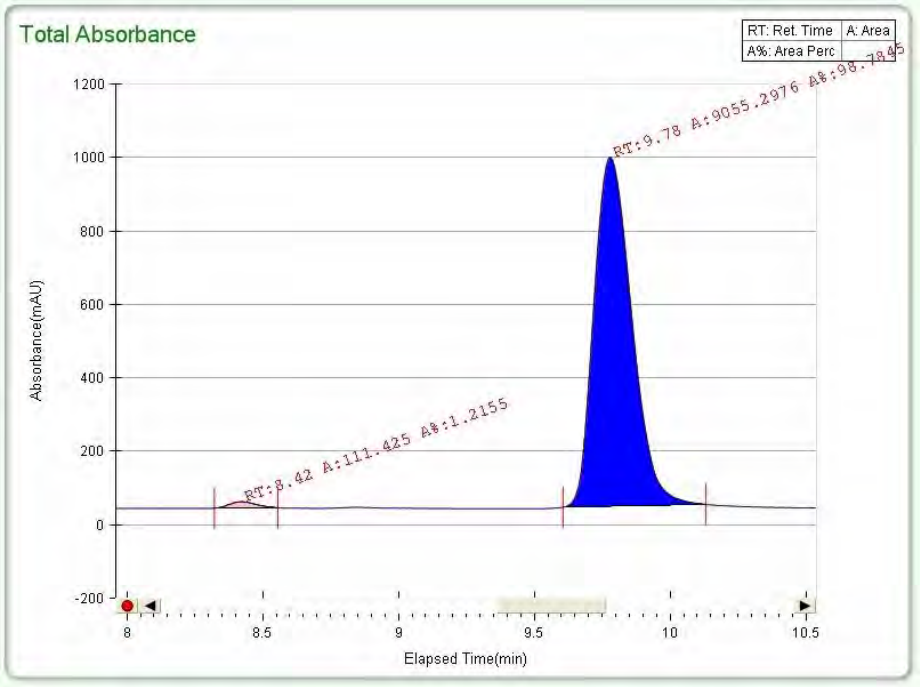

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:5.64 A:11959.9574
RT:5.41
Absorbance(mAU)
Elapsed Time(min)

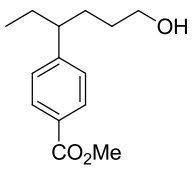

OH
O

(±)-**4fa**

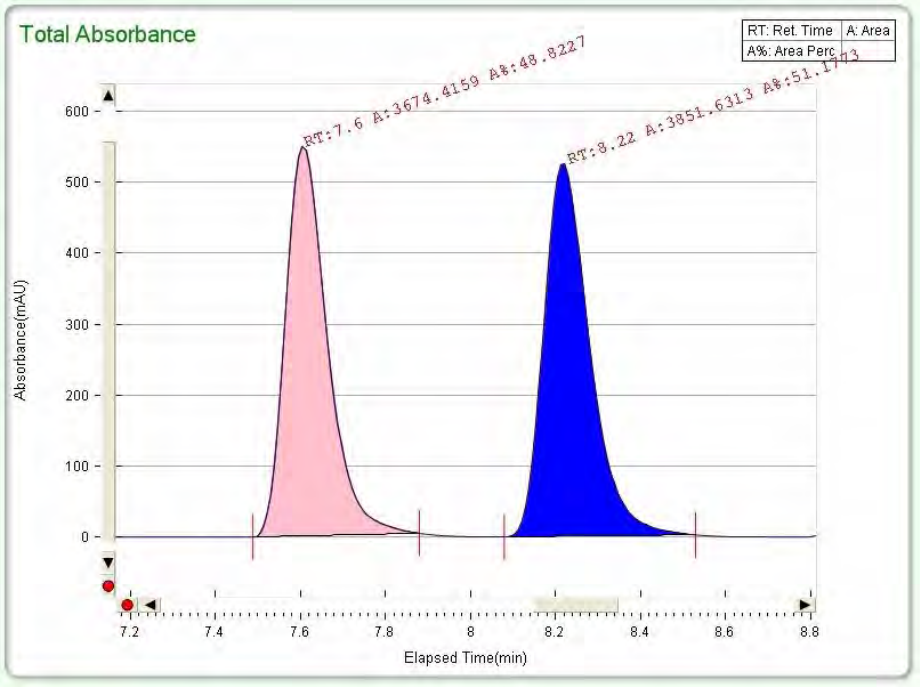

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:8.43 A:2147.3572 A%:50.1776
RT:9.76 A:2132.1554 A%:49.8224
Absorbance(mAU)
Elapsed Time(min)

(+)-**4fa**

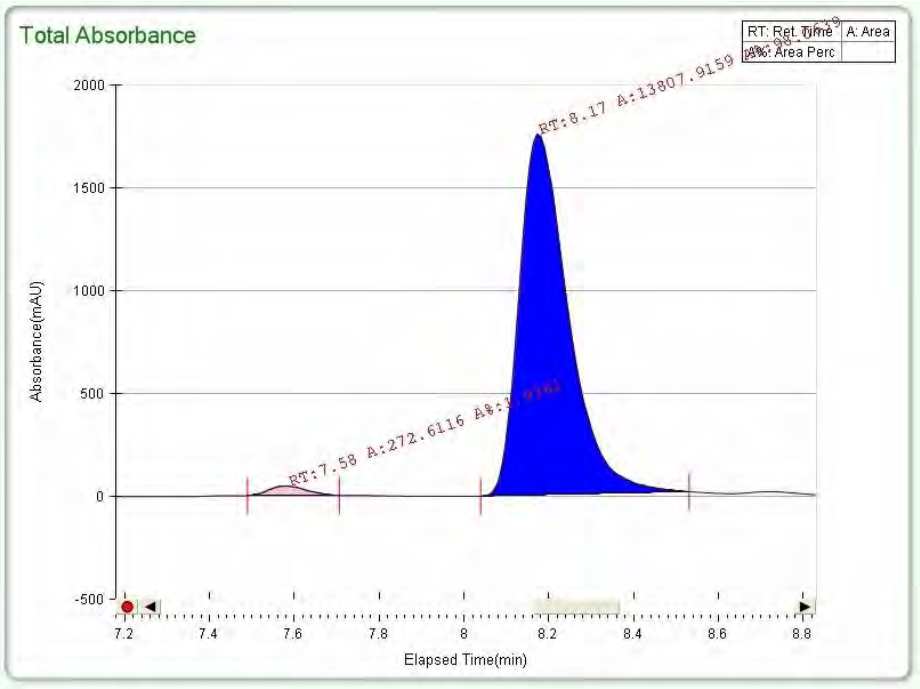

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:9.78 A:9055.2976 A%:98.7845
RT:8.42 A:111.425 A%:1.2155
Absorbance(mAU)
Elapsed Time(min)

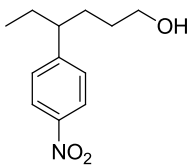

OH
CO2Me

(±)-**4ga**

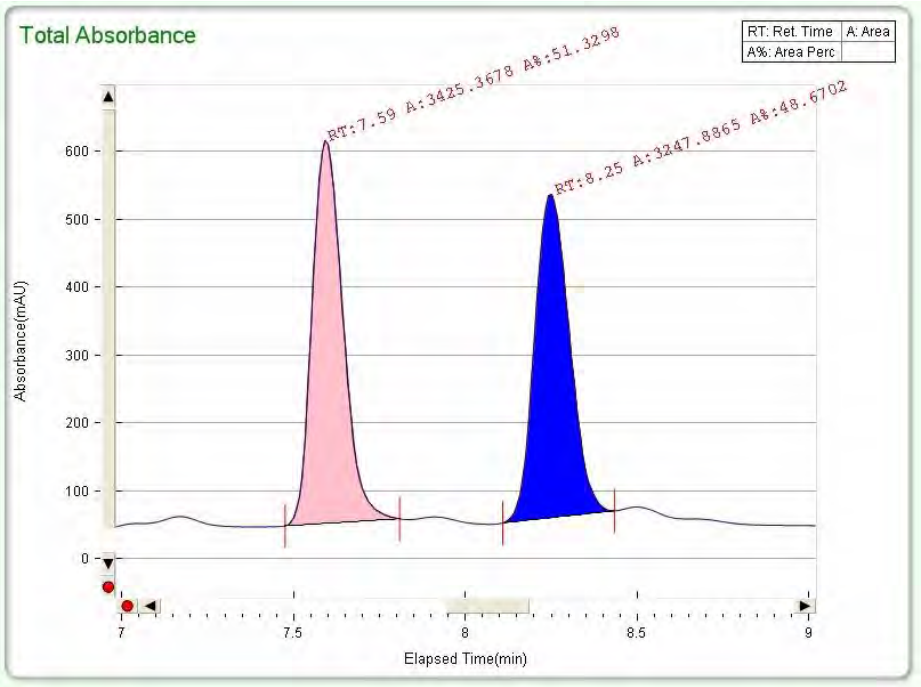

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:7.6 A:3674.4159 A%:48.8227
RT:8.22 A:3851.6313 A%:51.1773
Absorbance(mAU)
Elapsed Time(min)

(+)-**4ga**

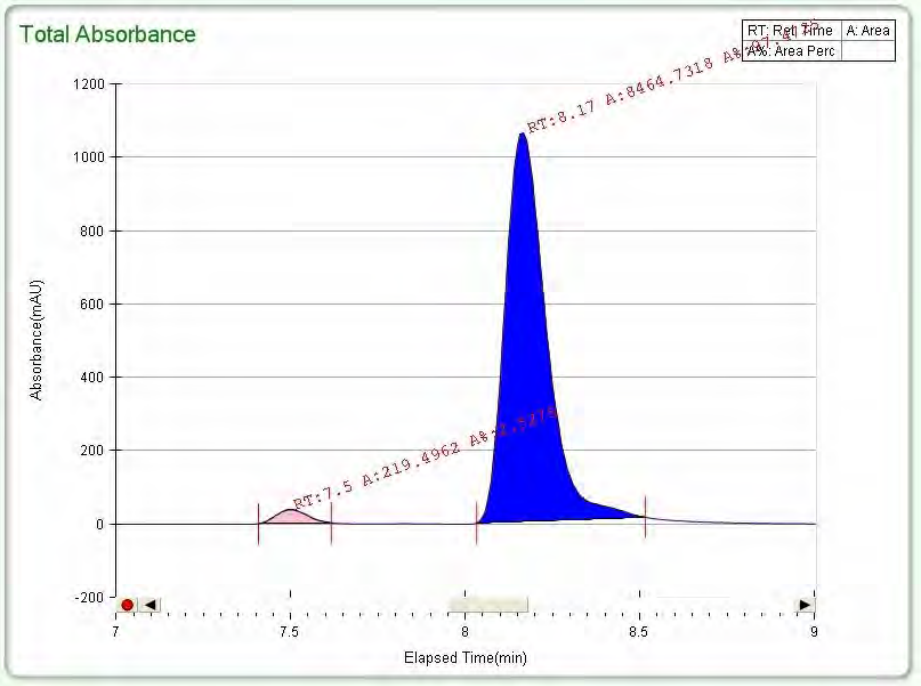

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:8.17 A:13807.9159
RT:7.58 A:272.6116
Absorbance(mAU)
Elapsed Time(min)

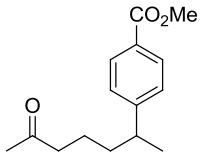

OH
NO2

(±)-**4ha**

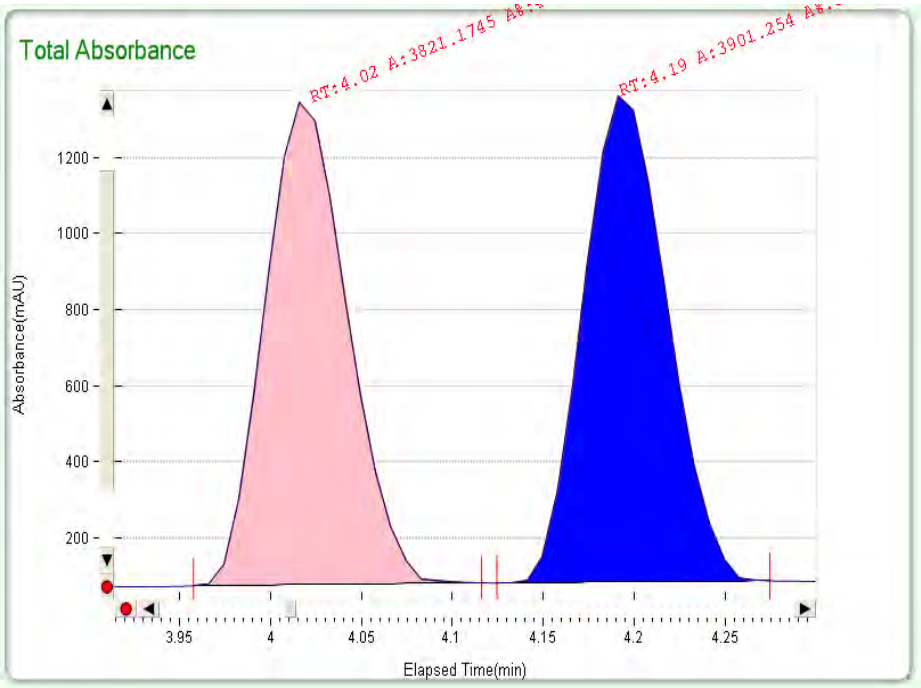

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:7.59 A:3425.3678 A%:51.3298
RT:8.25 A:3247.8865 A%:48.6702
Absorbance(mAU)
Elapsed Time(min)

(-)-**4ha**

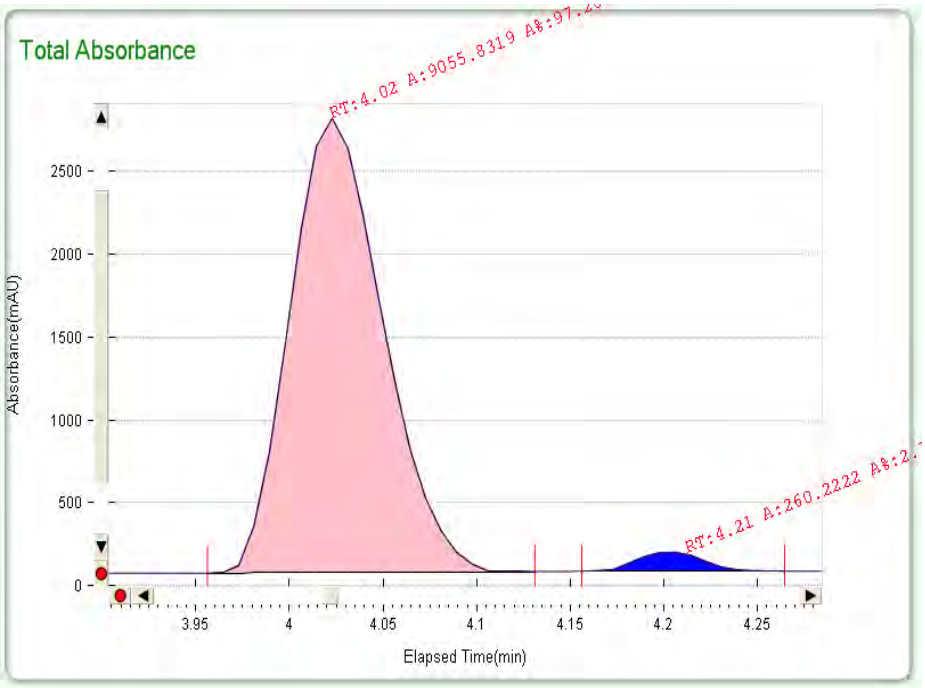

Total Absorbance
RT: Ret. Time
A: Area
A%: Area Perc
RT:8.17 A:8464.7318
RT:7.5 A:219.4962
Absorbance(mAU)
Elapsed Time(min)

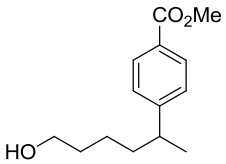

CO2Me
O

(±)-5a

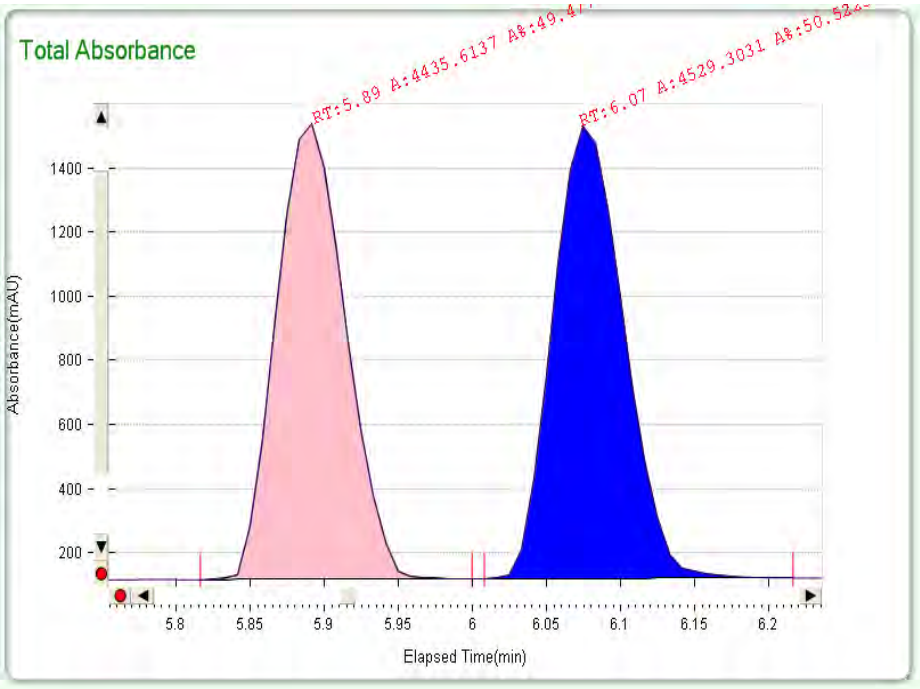

Total Absorbance
RT:4.02 A:3821.1745
RT:4.19 A:3901.254
Absorbance(mAU)
1200
1000
800
600
400
200
3.95
4
4.05
4.1
4.15
4.2
4.25
Elapsed Time(min)

(+)-5a

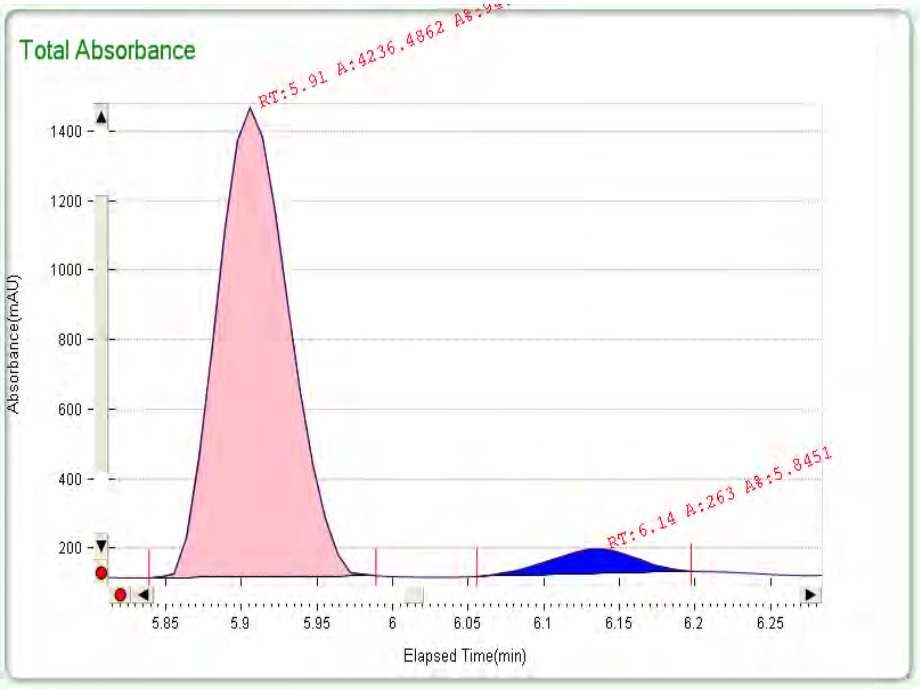

Total Absorbance
RT:4.02 A:9055.8319
RT:4.21 A:260.2222
Absorbance(mAU)
2500
2000
1500
1000
500
0
3.95
4
4.05
4.1
4.15
4.2
4.25
Elapsed Time(min)

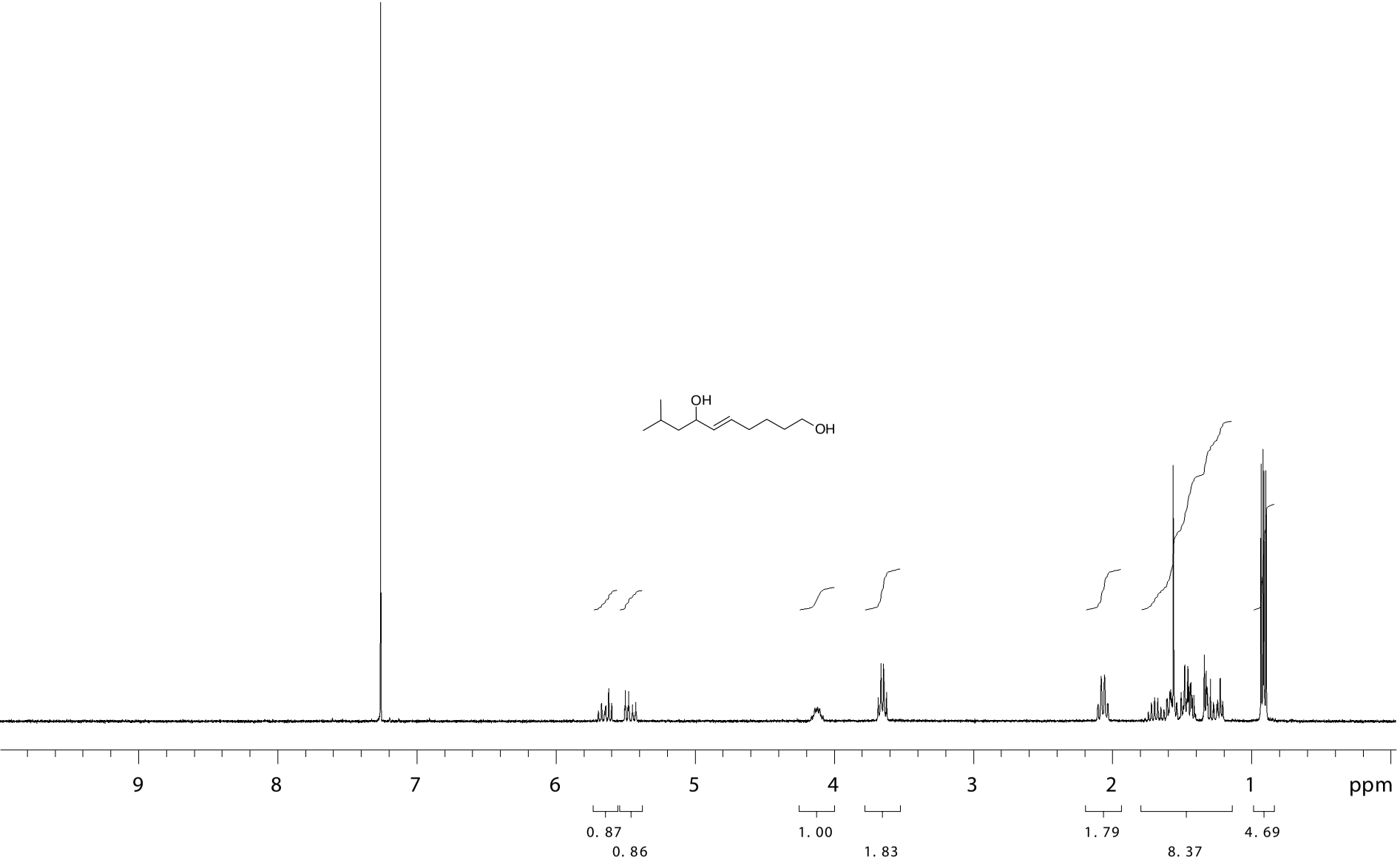

CO2Me
HO

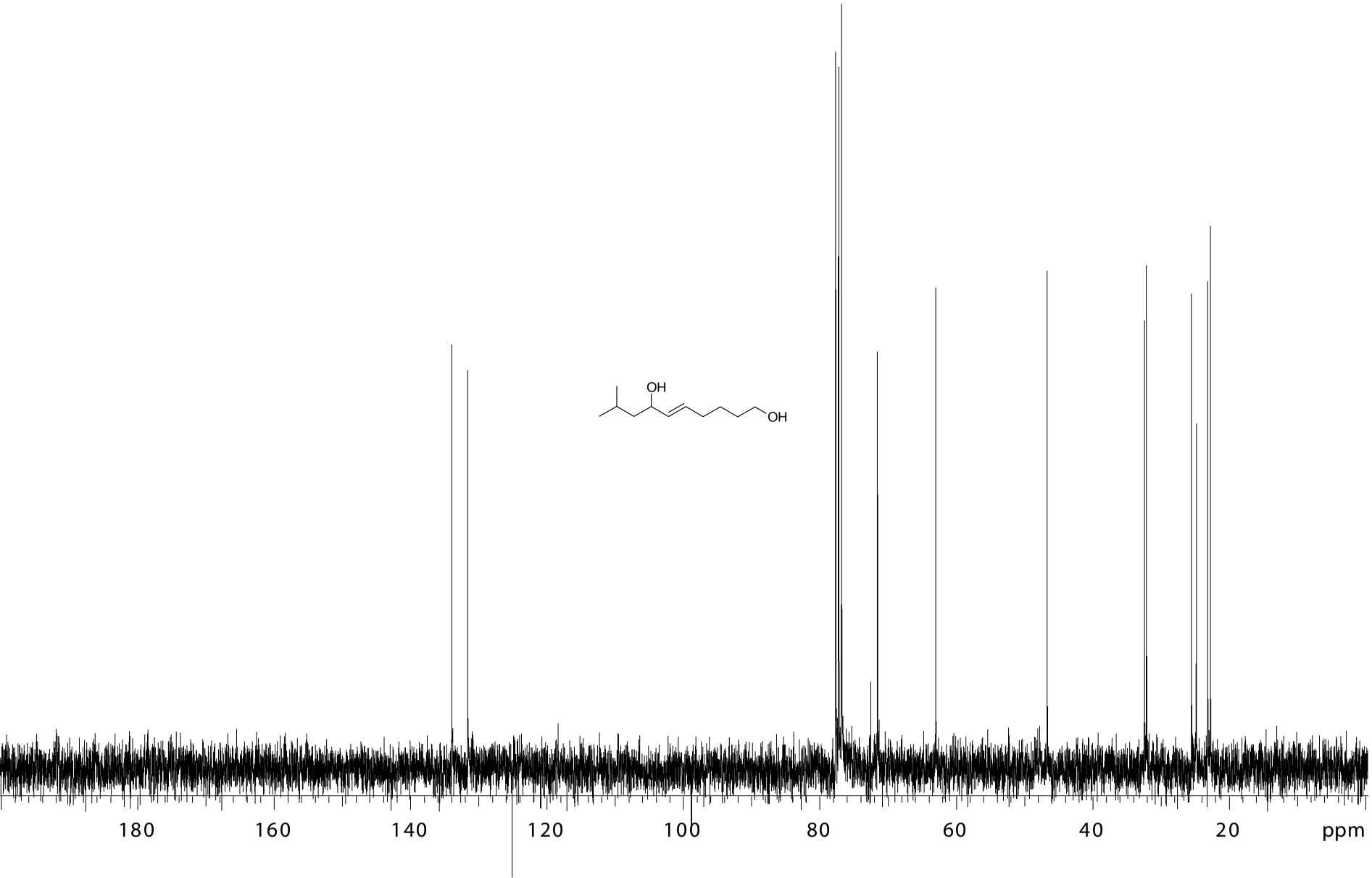
(±)-**5b**

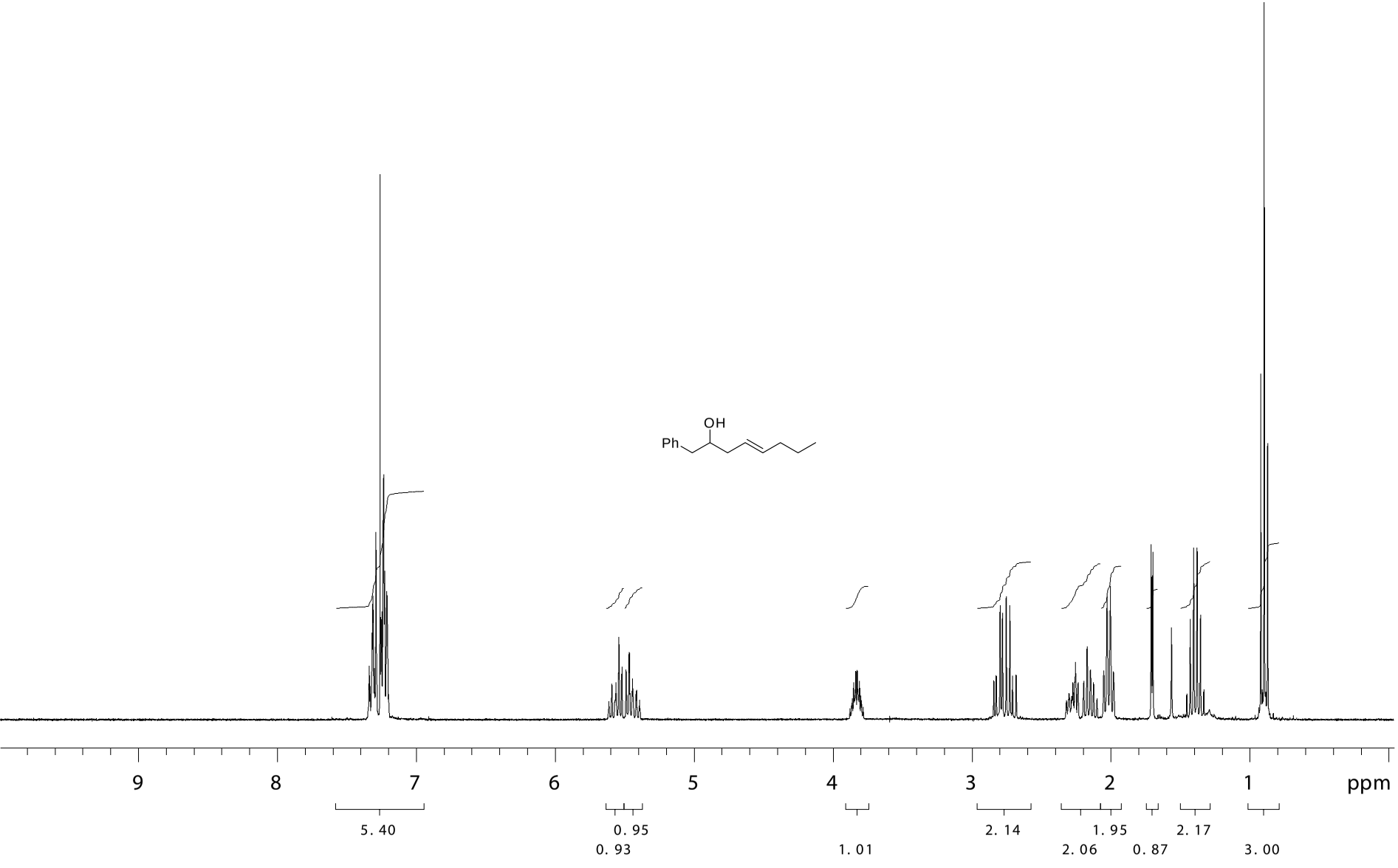

Total Absorbance
RT:5.89 A:4435.6137
RT:6.07 A:4529.3031
Absorbance(mAU)
Elapsed Time(min)

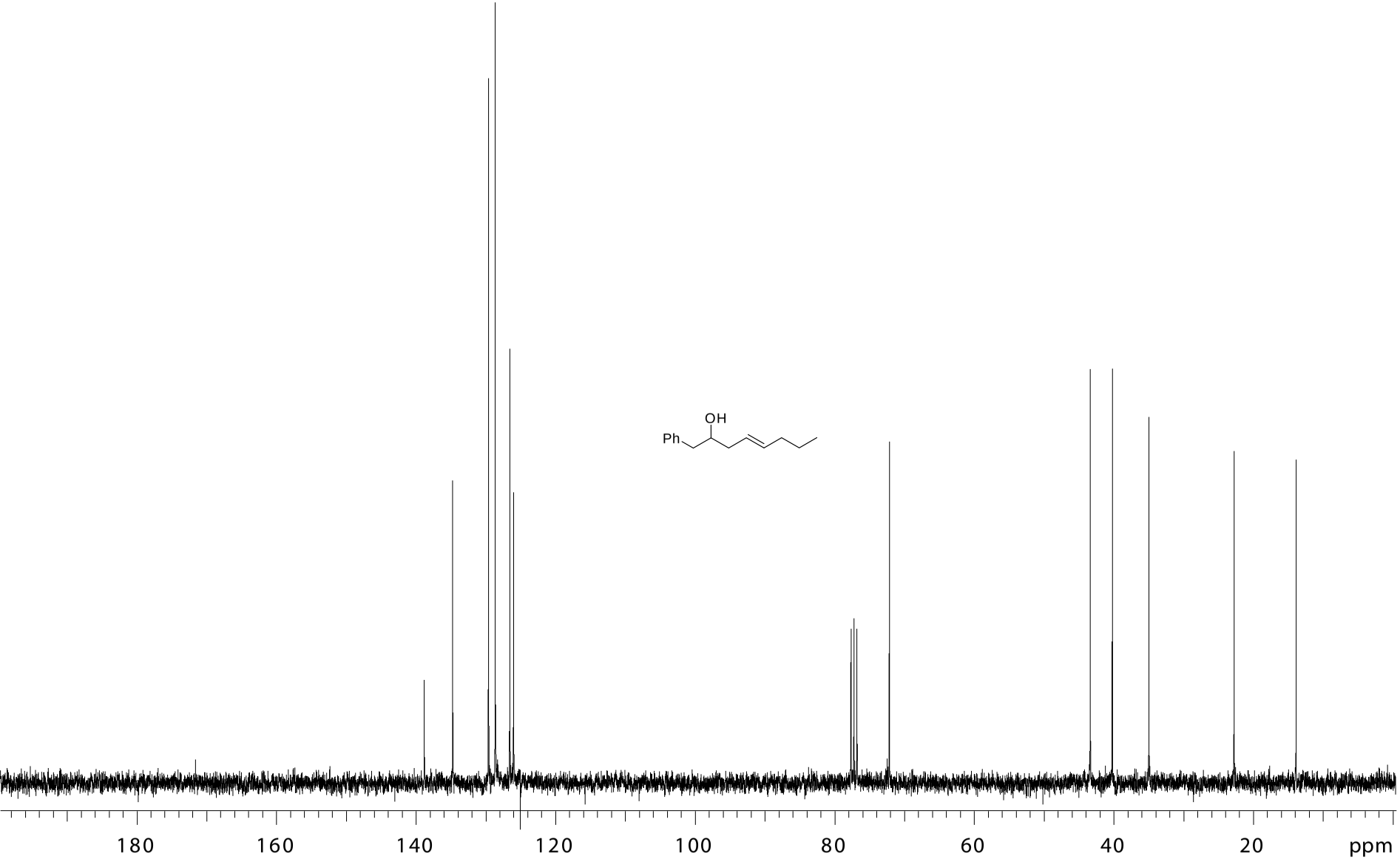
(+)-**5b**

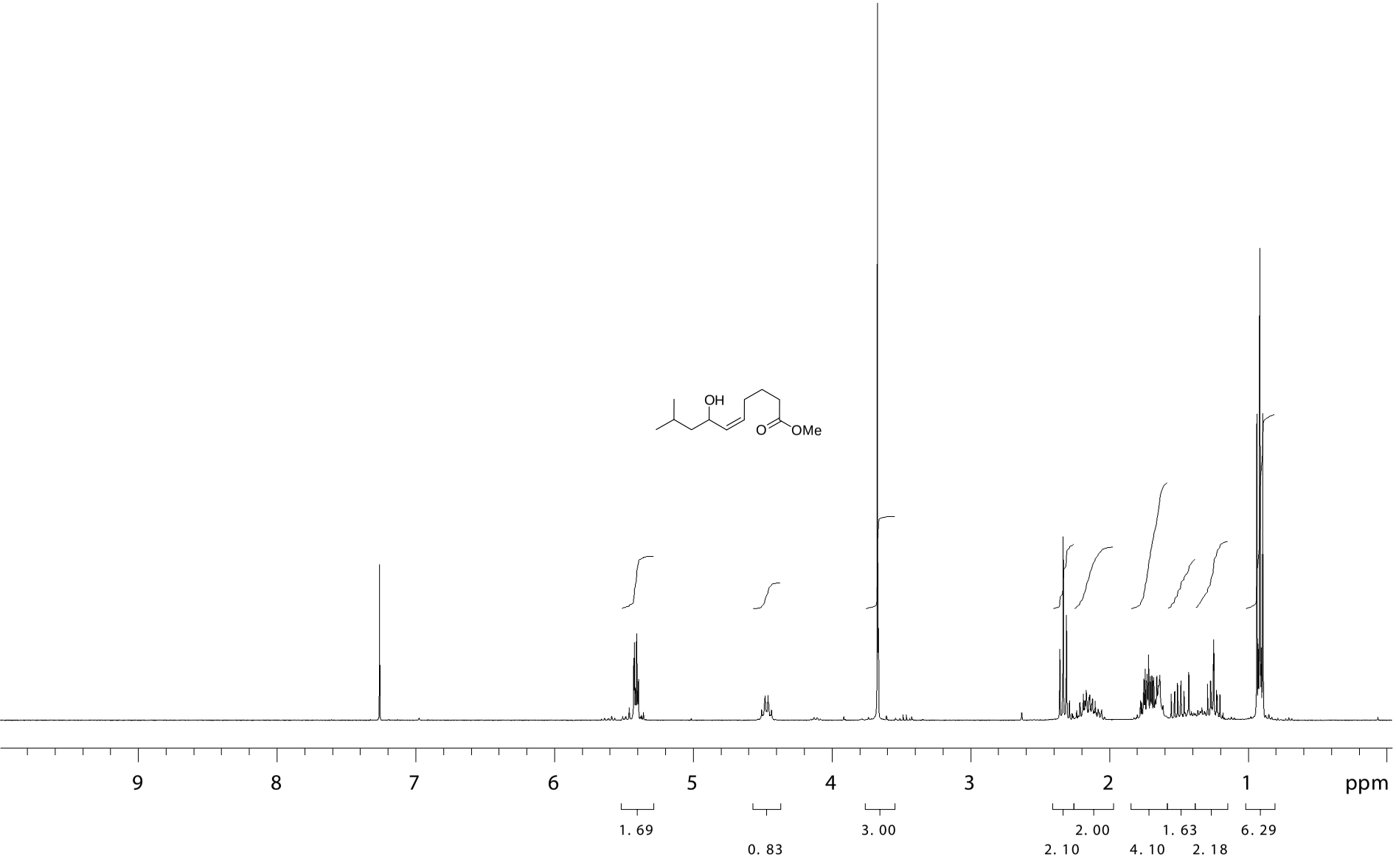

Total Absorbance
RT:5.91 A:4236.4862
RT:6.14 A:263 A%:5.8451
Absorbance(mAU)
Elapsed Time(min)

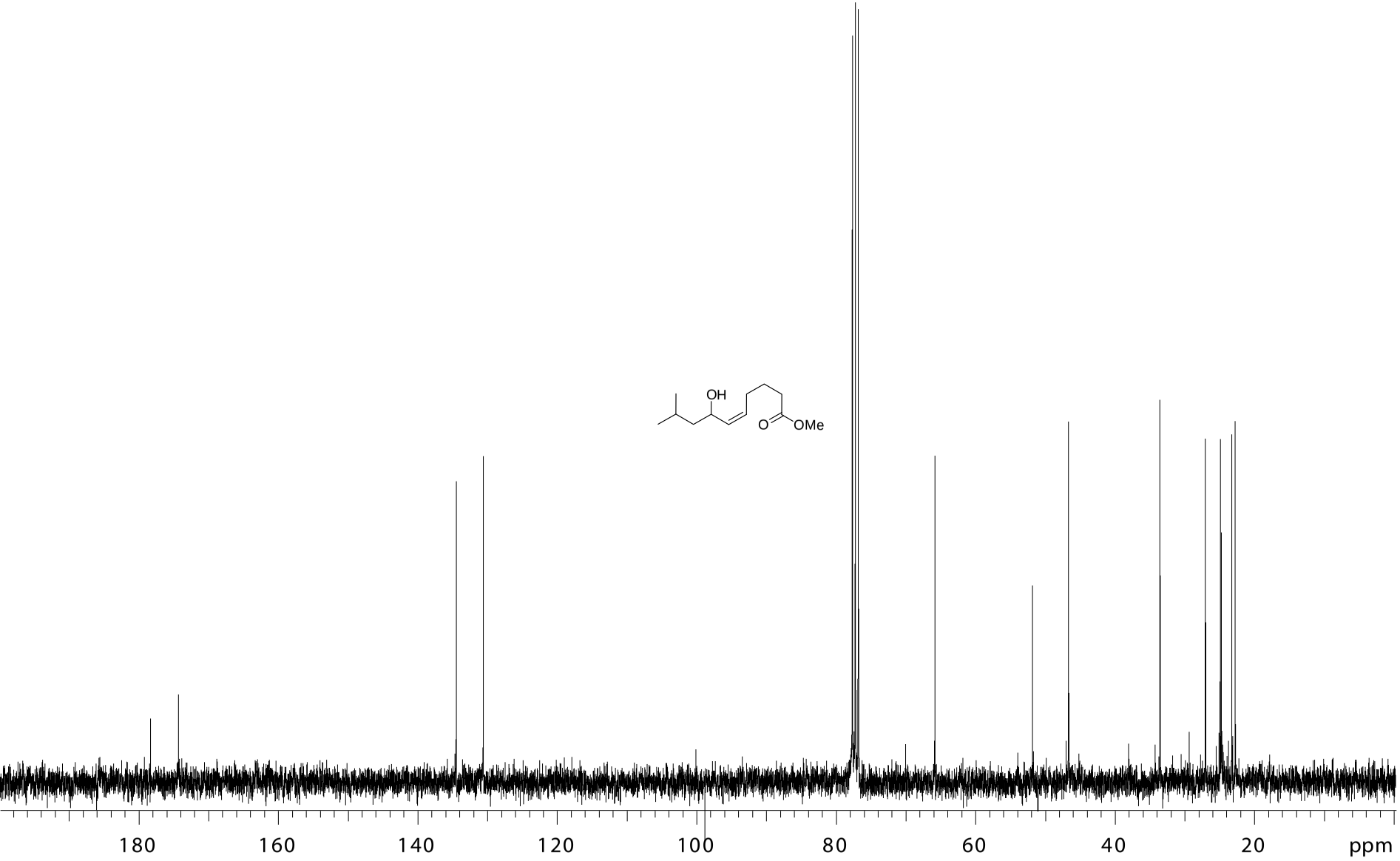

OH
OH
9
8
7
6
5
4
3
2
1
ppm
0. 87
0. 86
1. 00
1. 83
1. 79
8. 37
4. 69

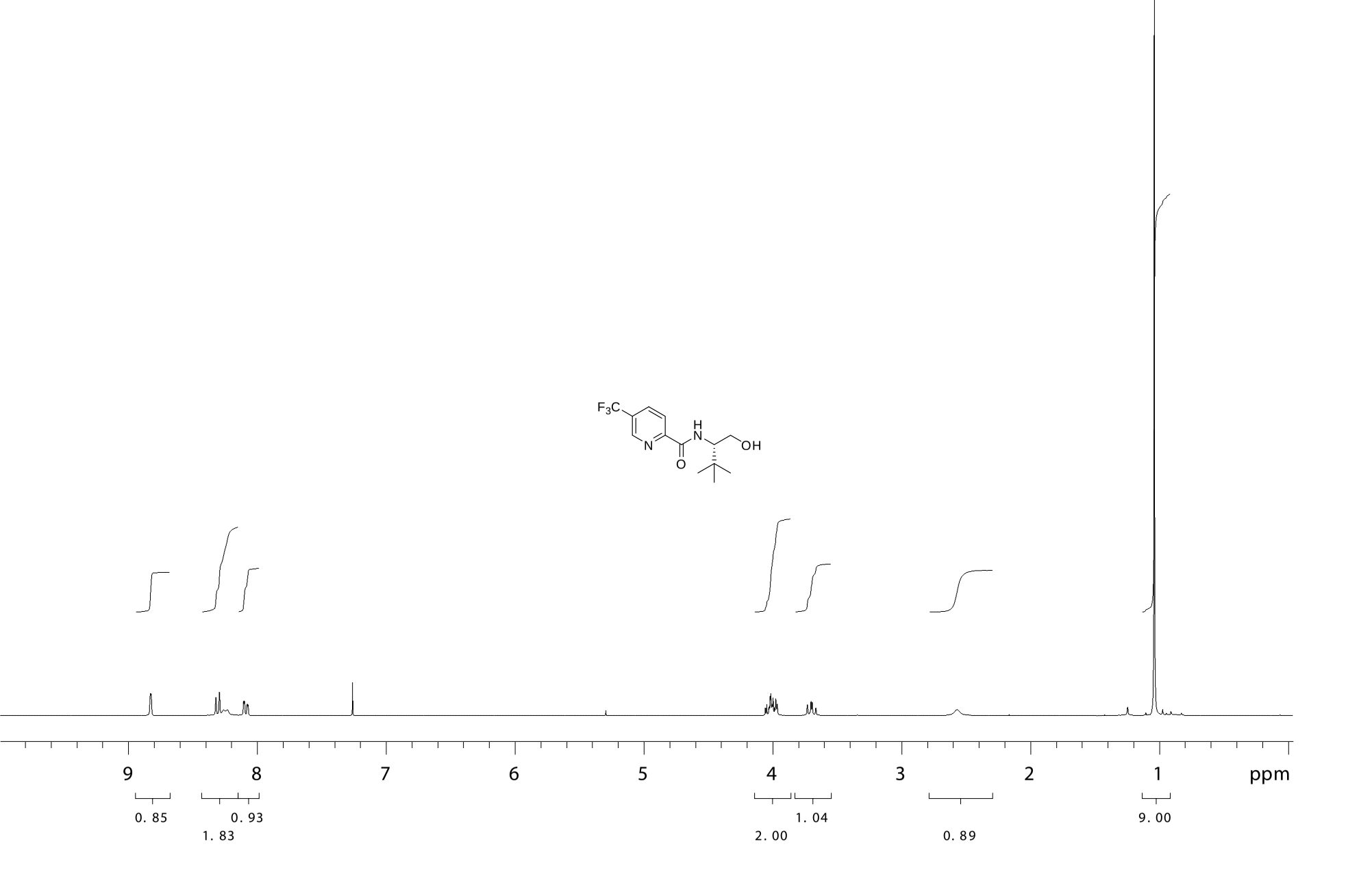

OH
OH
180
160
140
120
100
80
60
40
20
ppm

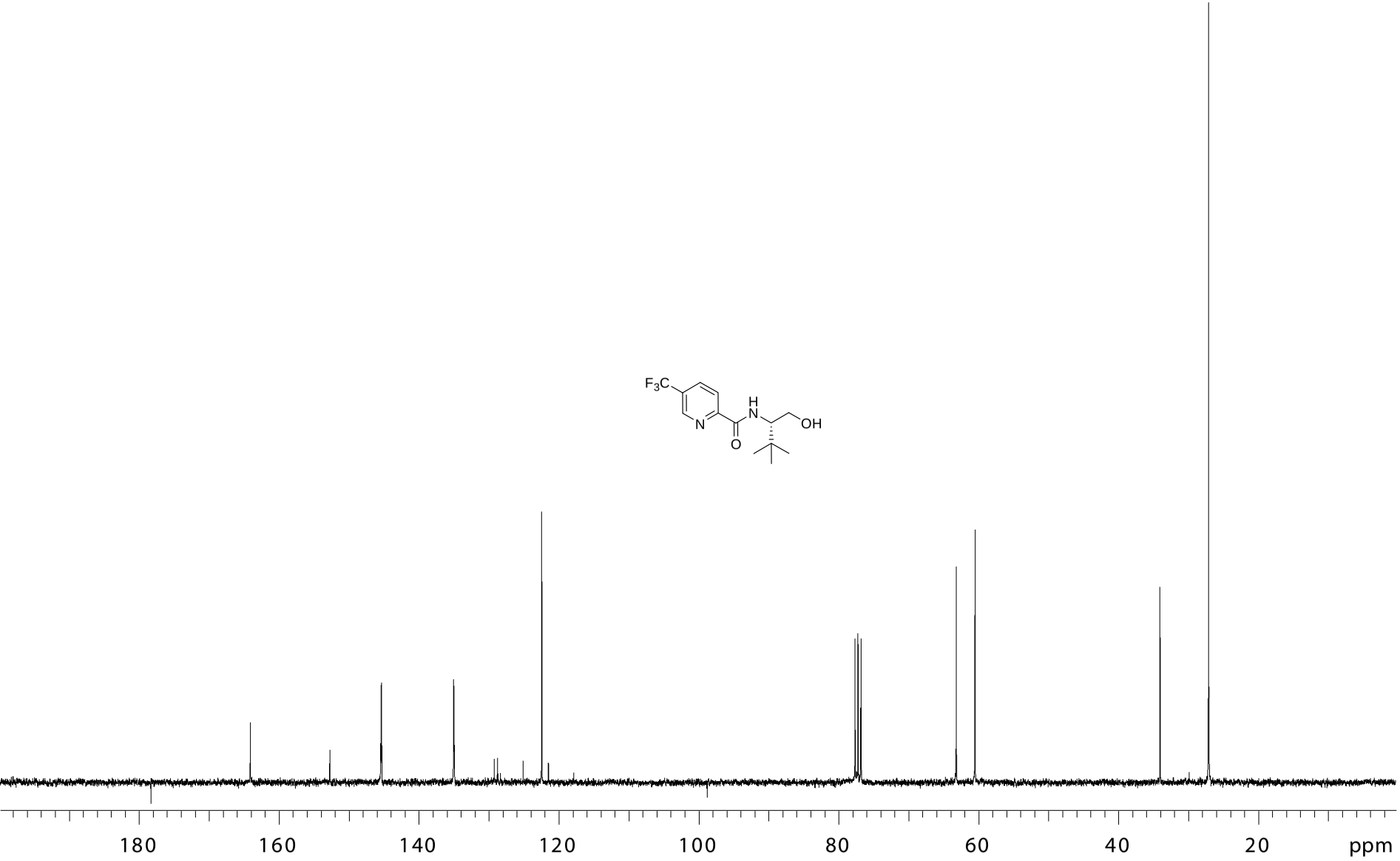

OH
Ph
9
8
7
6
5
4
3
2
1
ppm
5. 40
0. 95
0. 93
1. 01
2. 14
1. 95
2. 06
0. 87
2. 17
3. 00

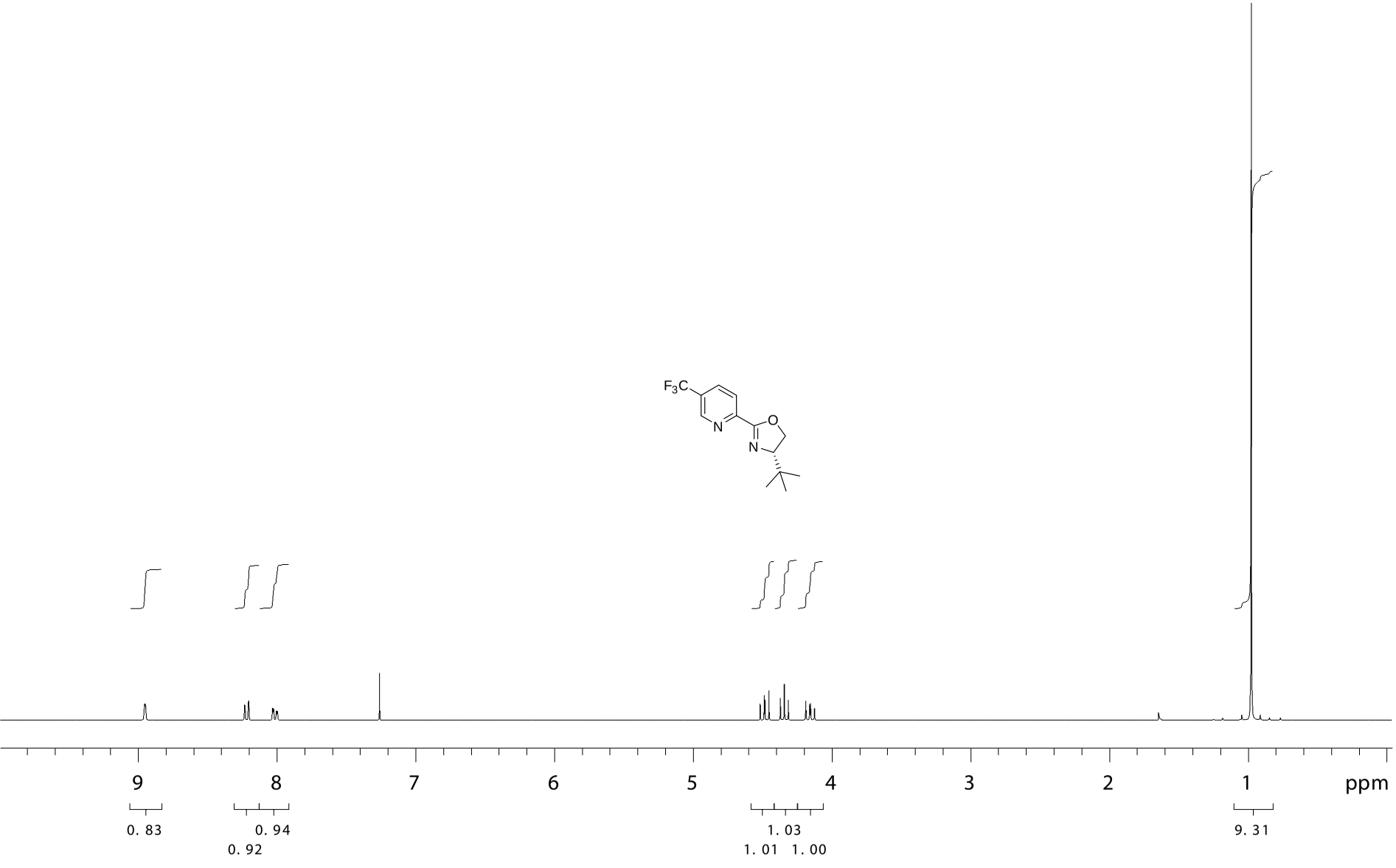

OH
Ph
180
160
140
120
100
80
60
40
20
ppm

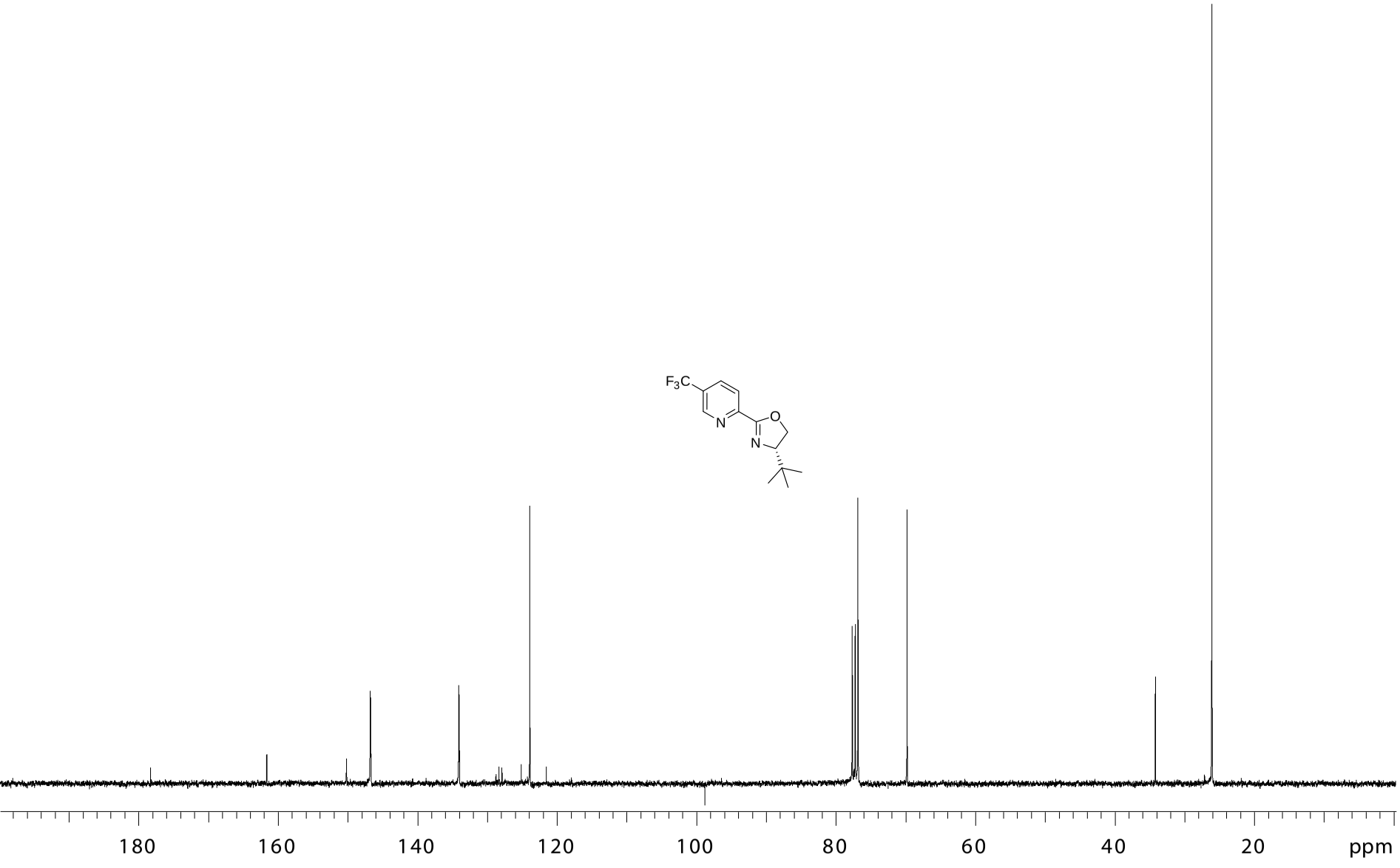

OH
O
OMe
9
8
7
6
5
4
3
2
1
ppm
1. 69
0. 83
3. 00
2. 10
2. 00
4. 10
1. 63
2. 18
6. 29

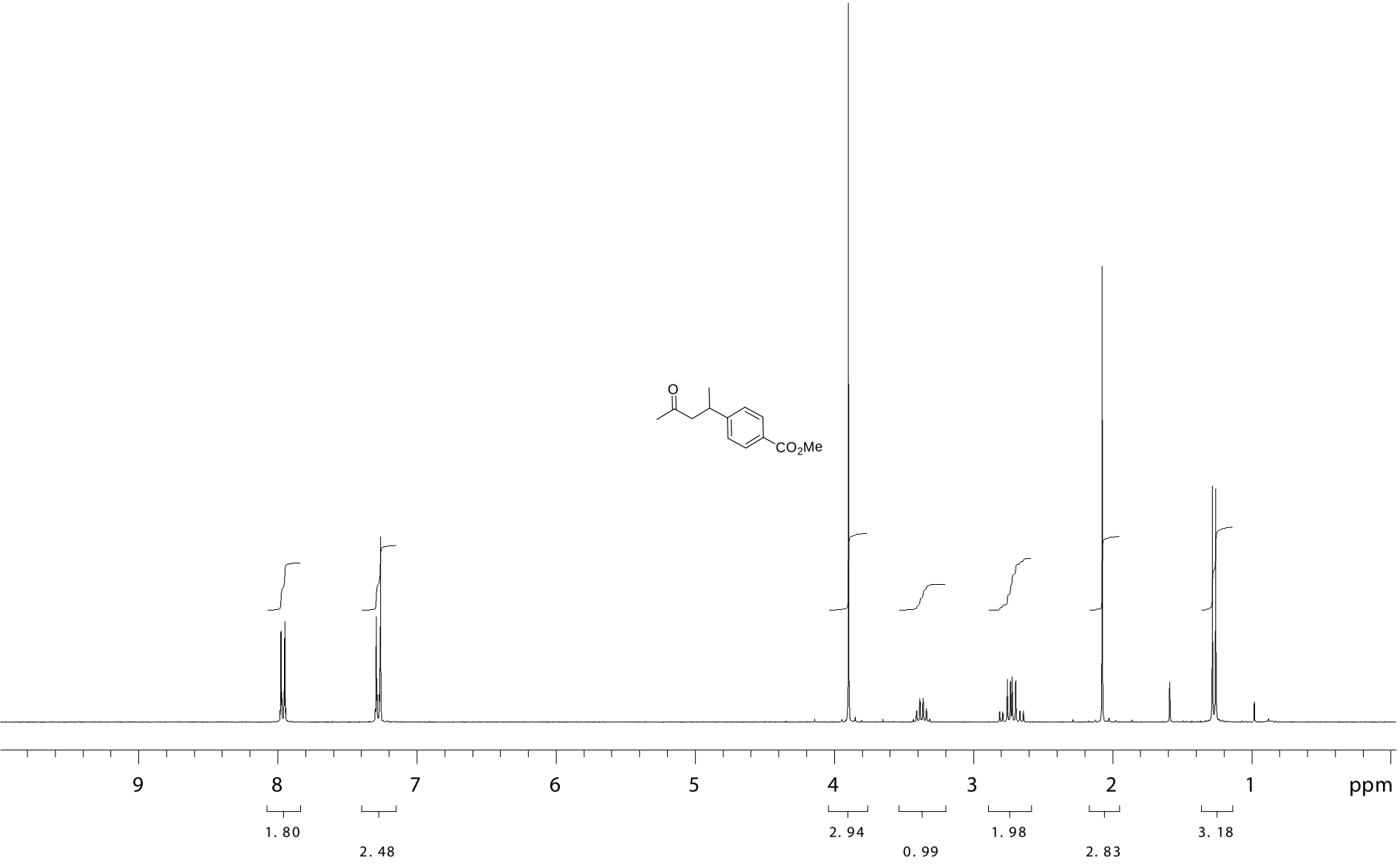

OH
O
OMe
180
160
140
120
100
80
60
40
20
ppm

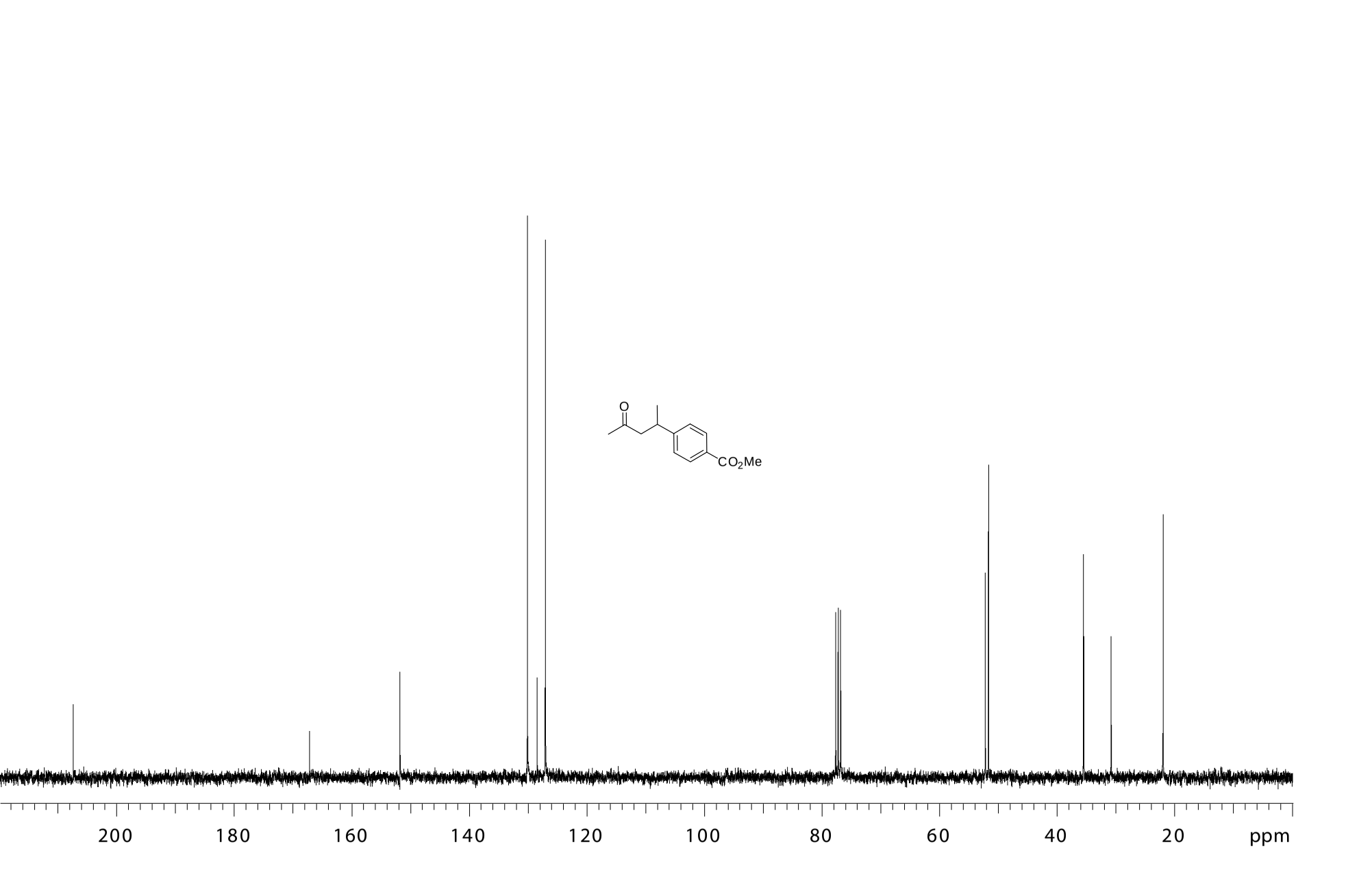

F3C
N
H
N
O
OH
9
8
7
6
5
4
3
2
1
ppm
0. 85
1. 83
0. 93
2. 00
1. 04
0. 89
9. 00

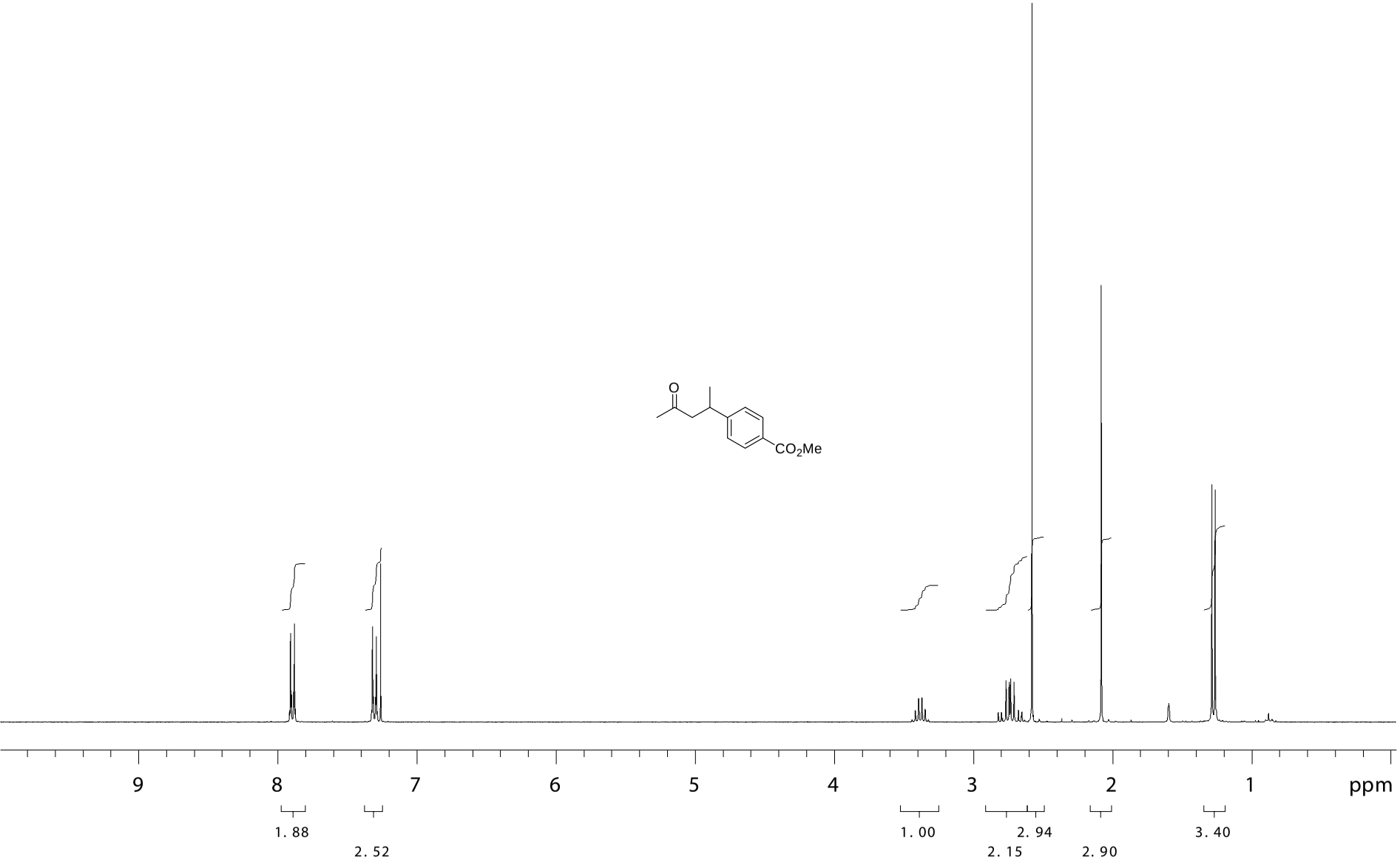

F3C
N
H
N
O
OH
180
160
140
120
100
80
60
40
20
ppm

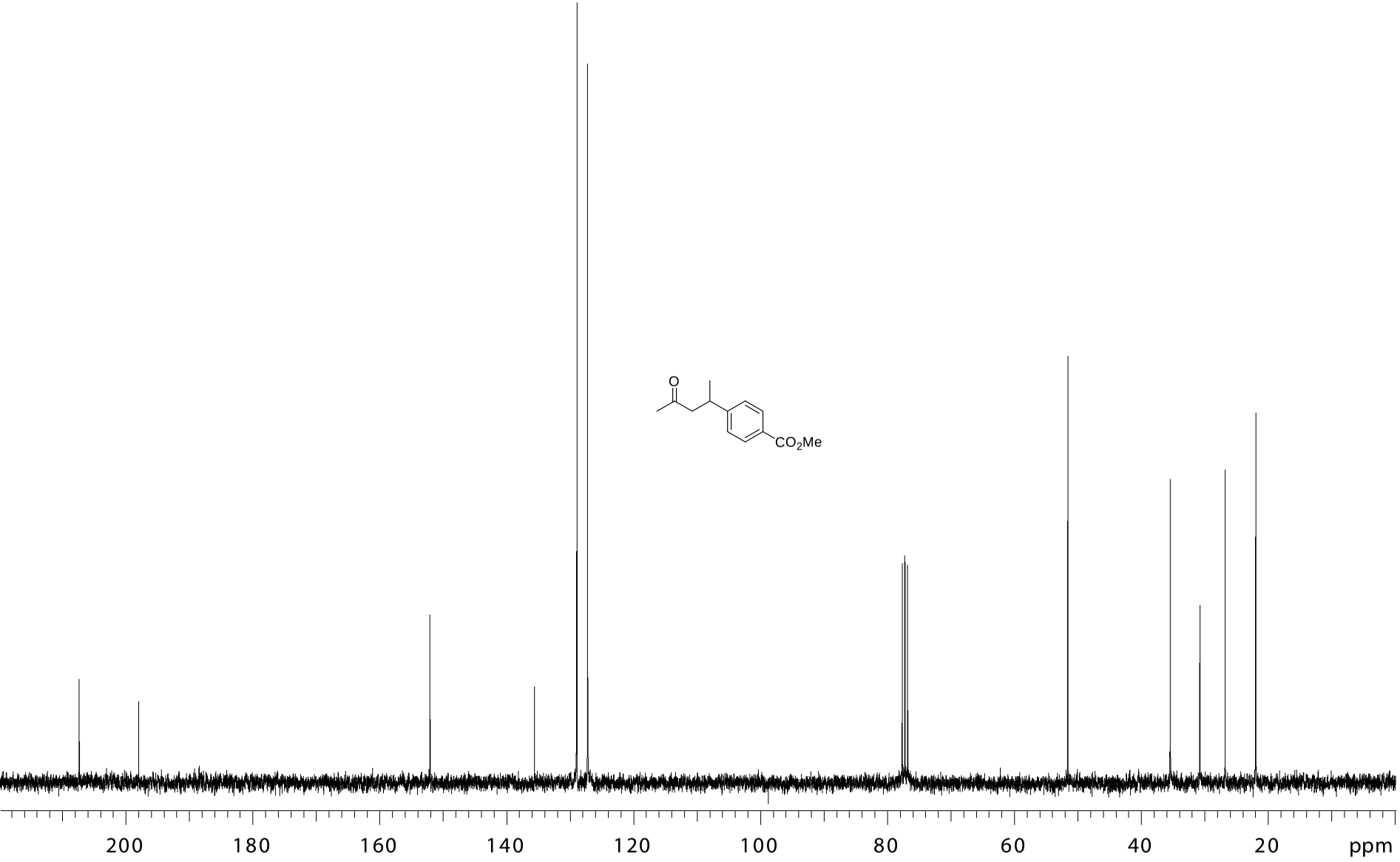

F3C
N
O
N
9
8
7
6
5
4
3
2
1
ppm
0. 83
0. 94
0. 92
1. 03
1. 01
1. 00
9. 31

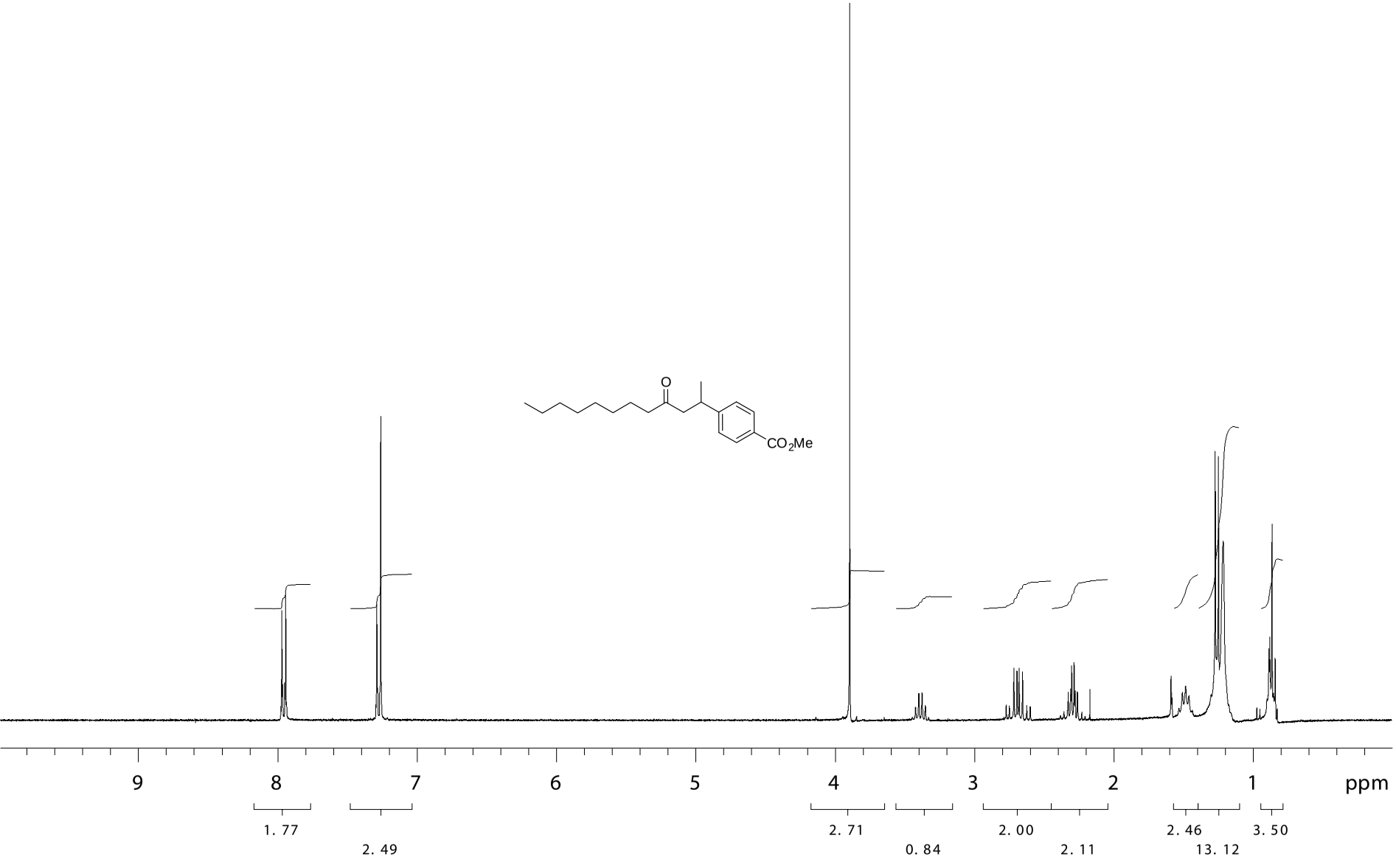

F3C
N
O
N
180
160
140
120
100
80
60
40
20
ppm

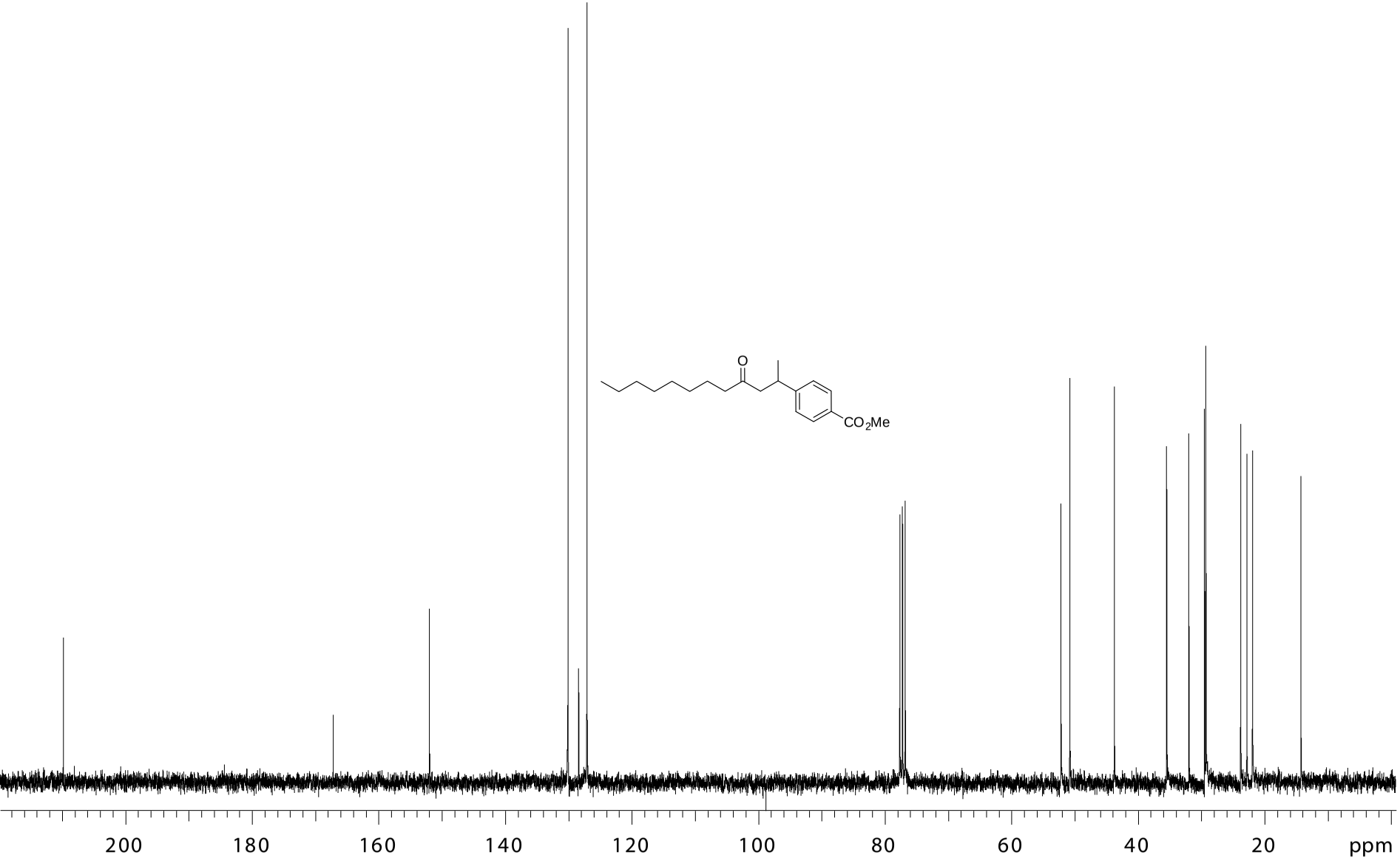

O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
1. 80
2. 48
2. 94
0. 99
1. 98
2. 83
3. 18

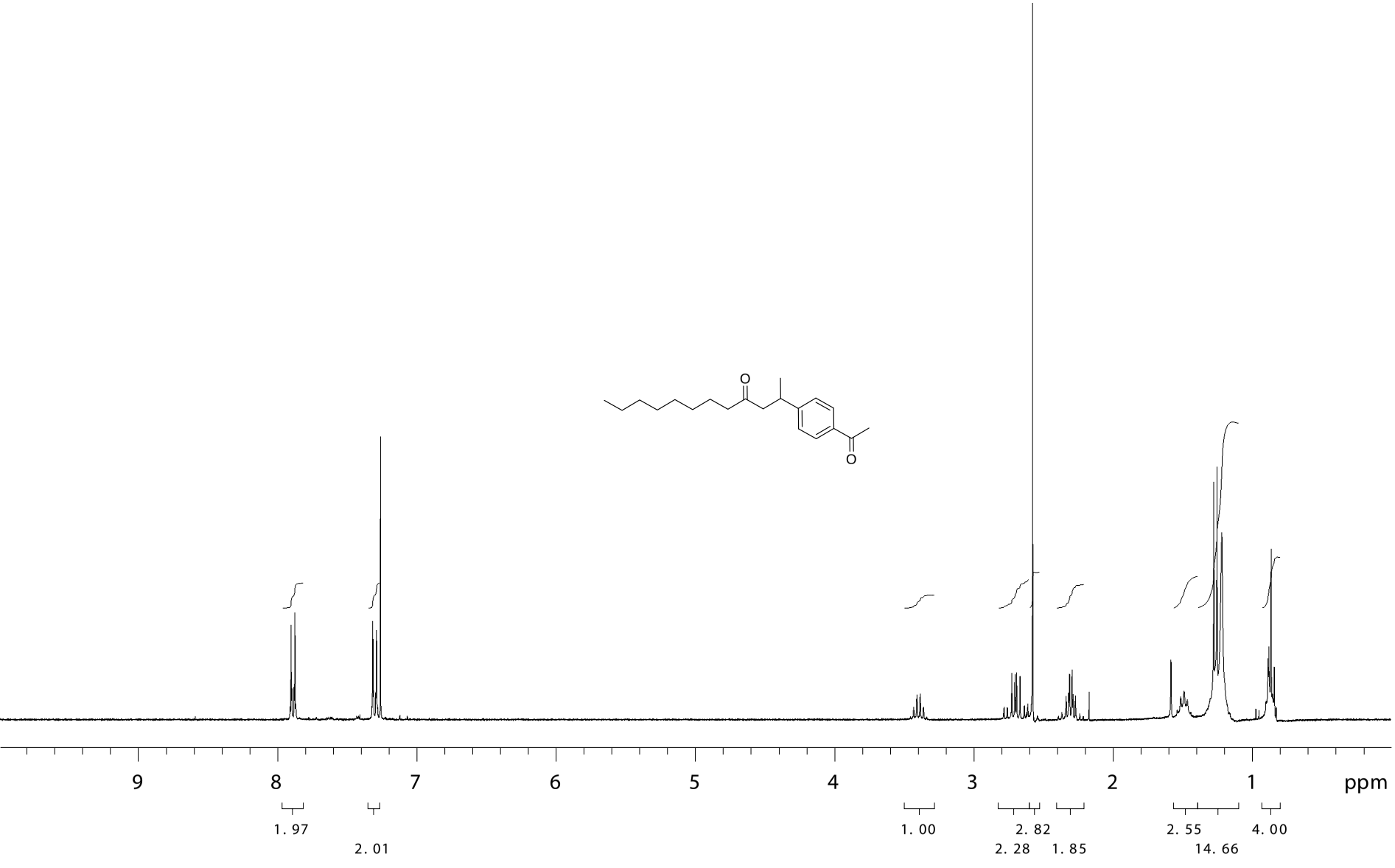

O
CO2Me
200
180
160
140
120
100
80
60
40
20
ppm

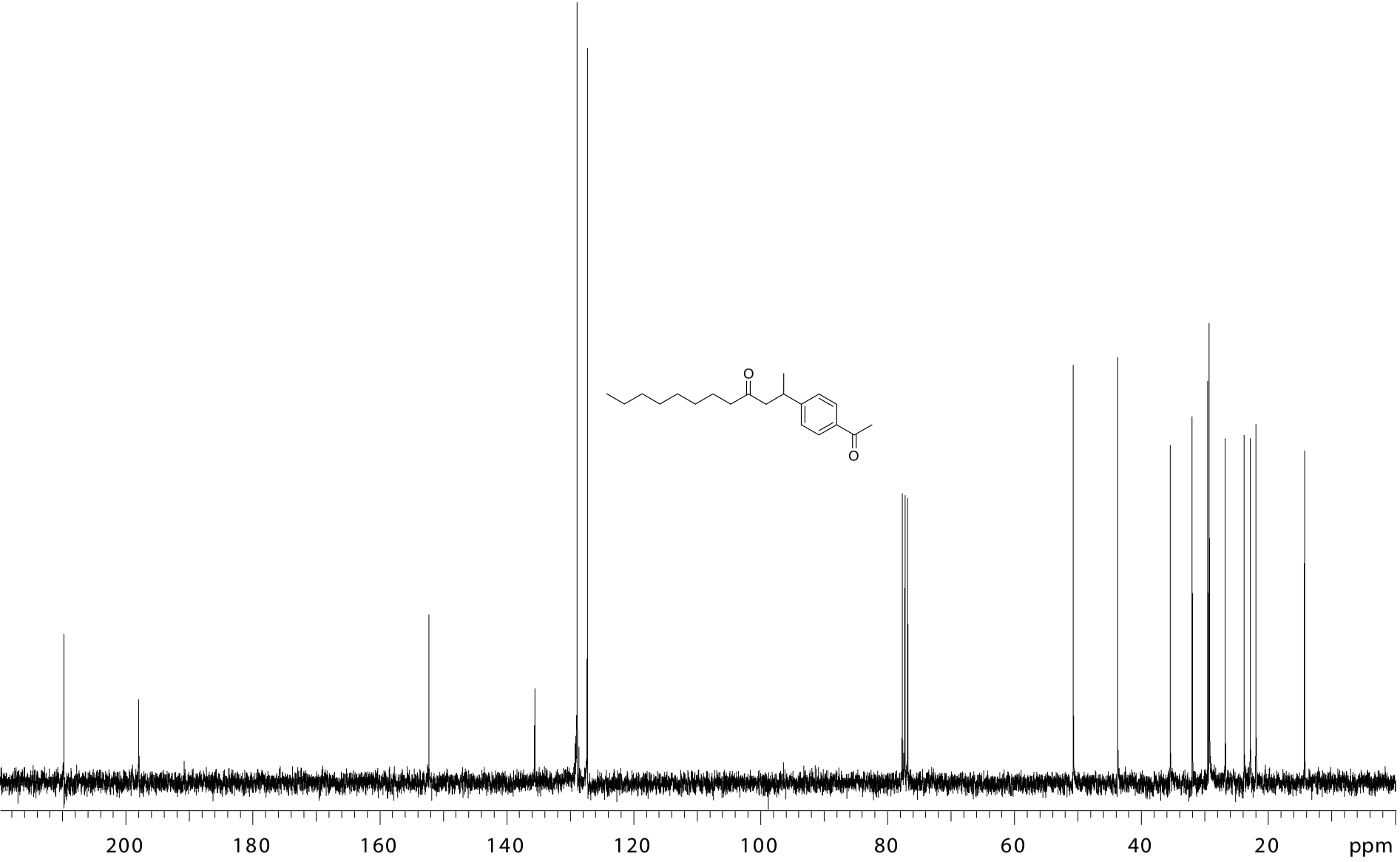

O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
1. 88
2. 52
1. 00
2. 15
2. 94
2. 90
3. 40

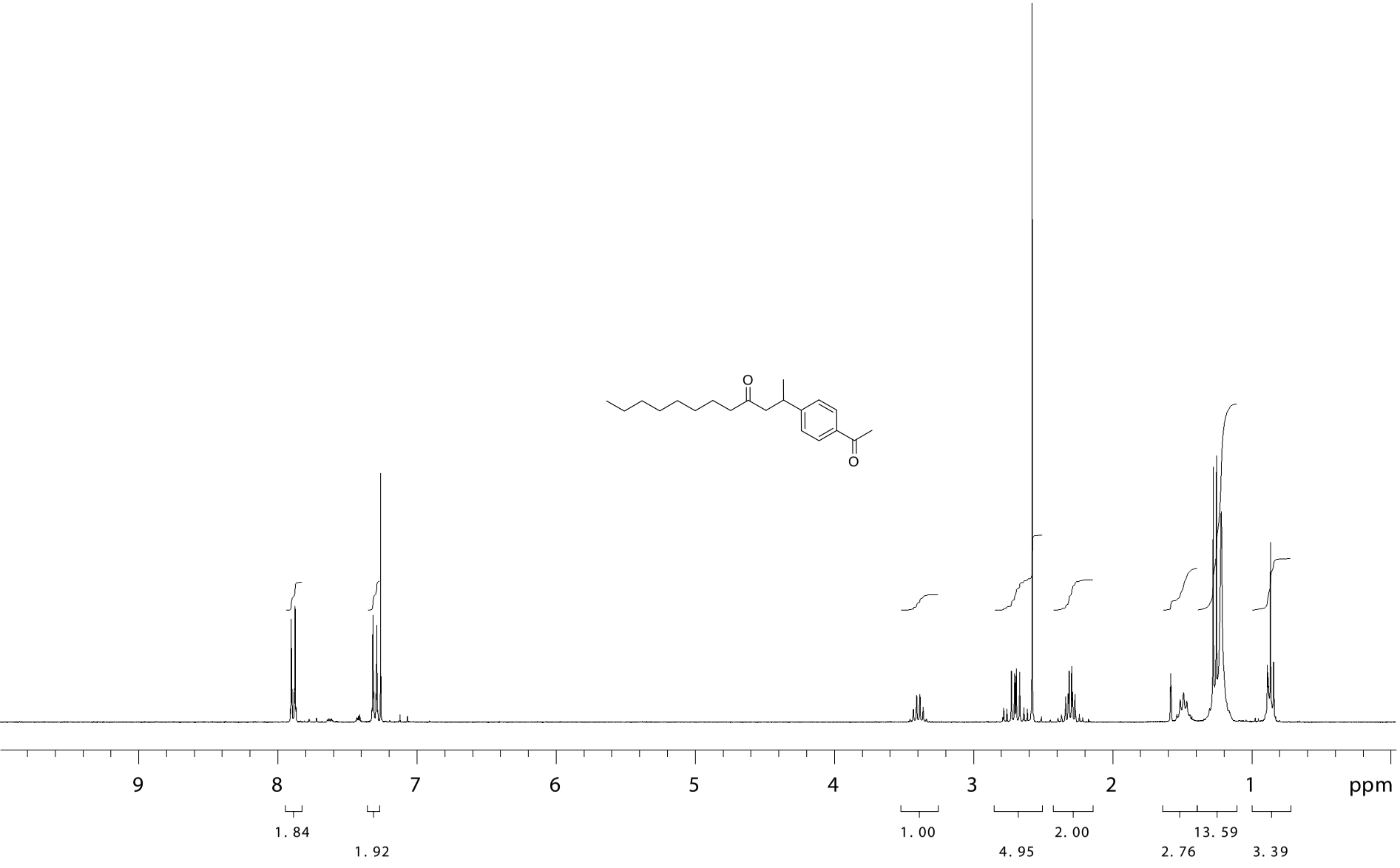

O
CO2Me
200
180
160
140
120
100
80
60
40
20
ppm

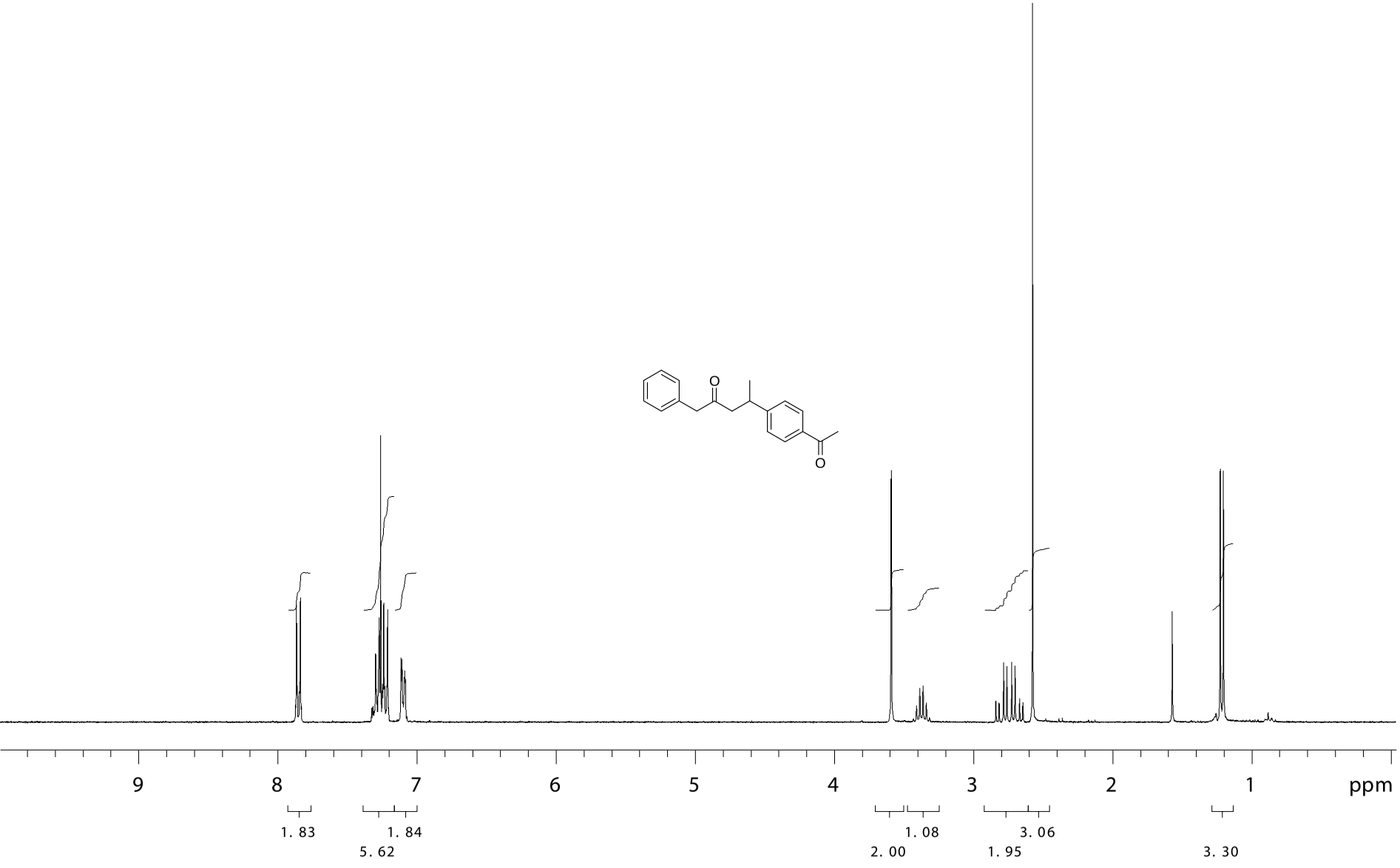

O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
1. 77
2. 49
2. 71
0. 84
2. 00
2. 11
2. 46
13. 12
3. 50

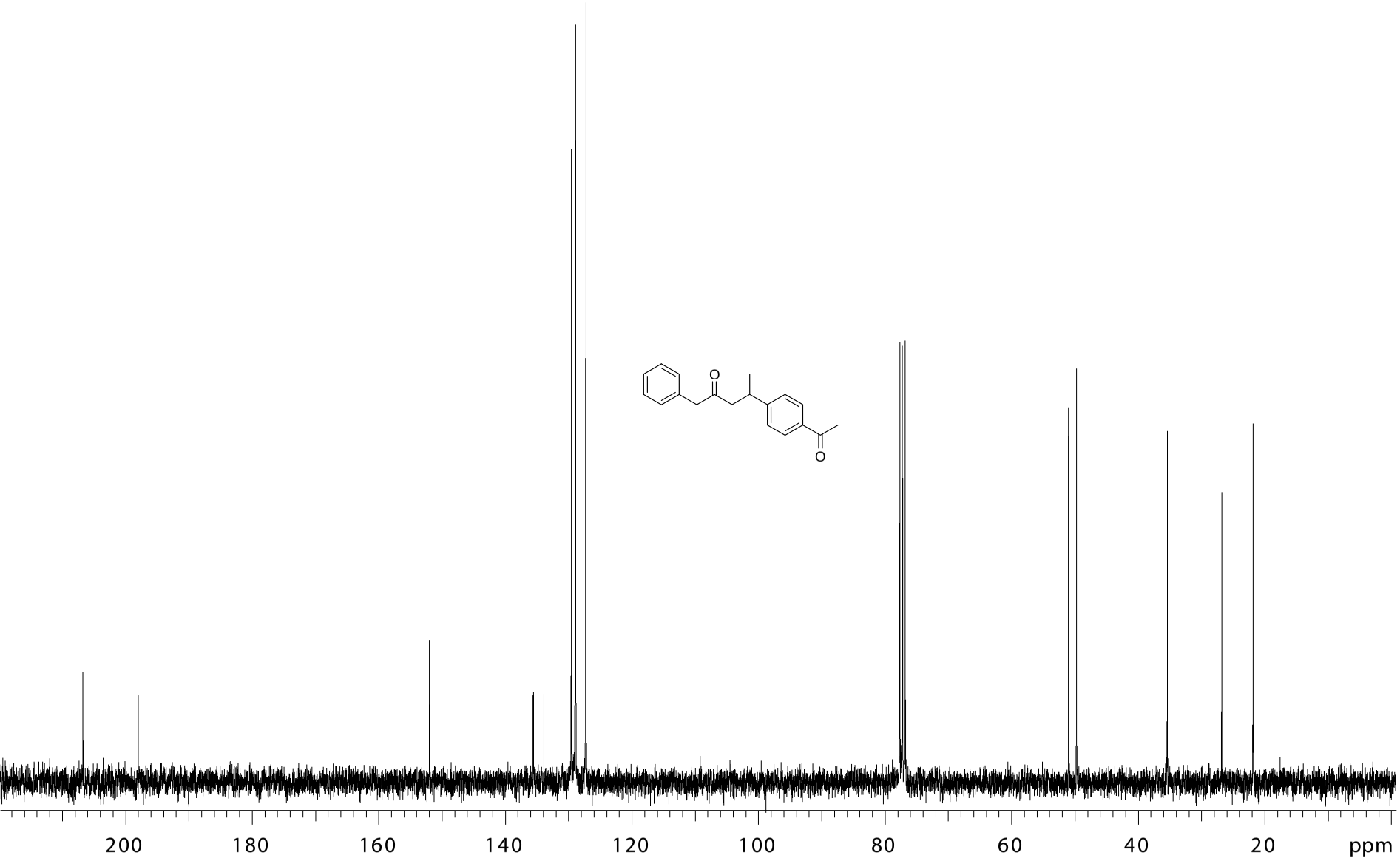

O
CO2Me
200
180
160
140
120
100
80
60
40
20
ppm

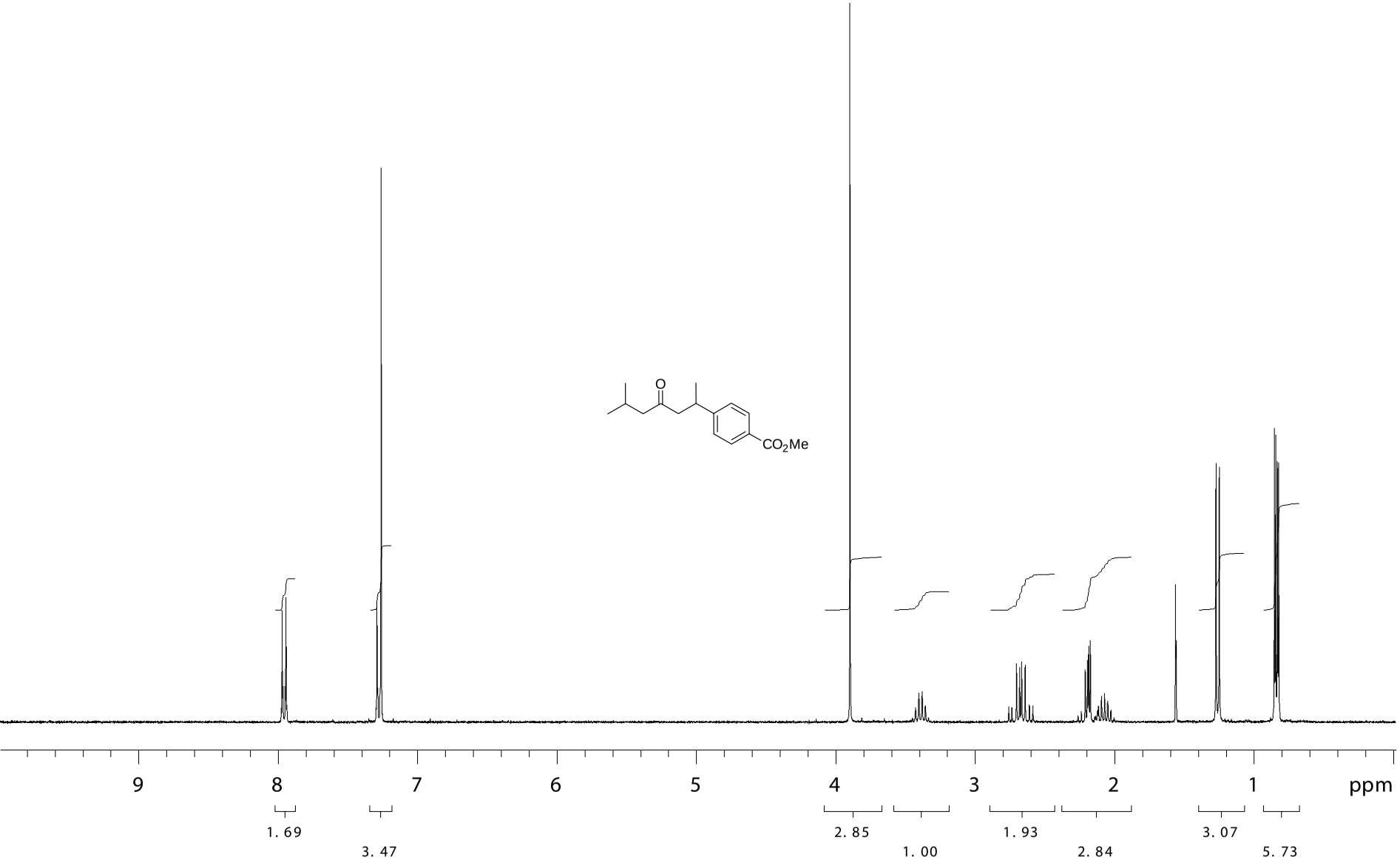

O
O
9
8
7
6
5
4
3
2
1
ppm
1. 97
2. 01
1. 00
2. 82
2. 28
1. 85
2. 55
14. 66
4. 00

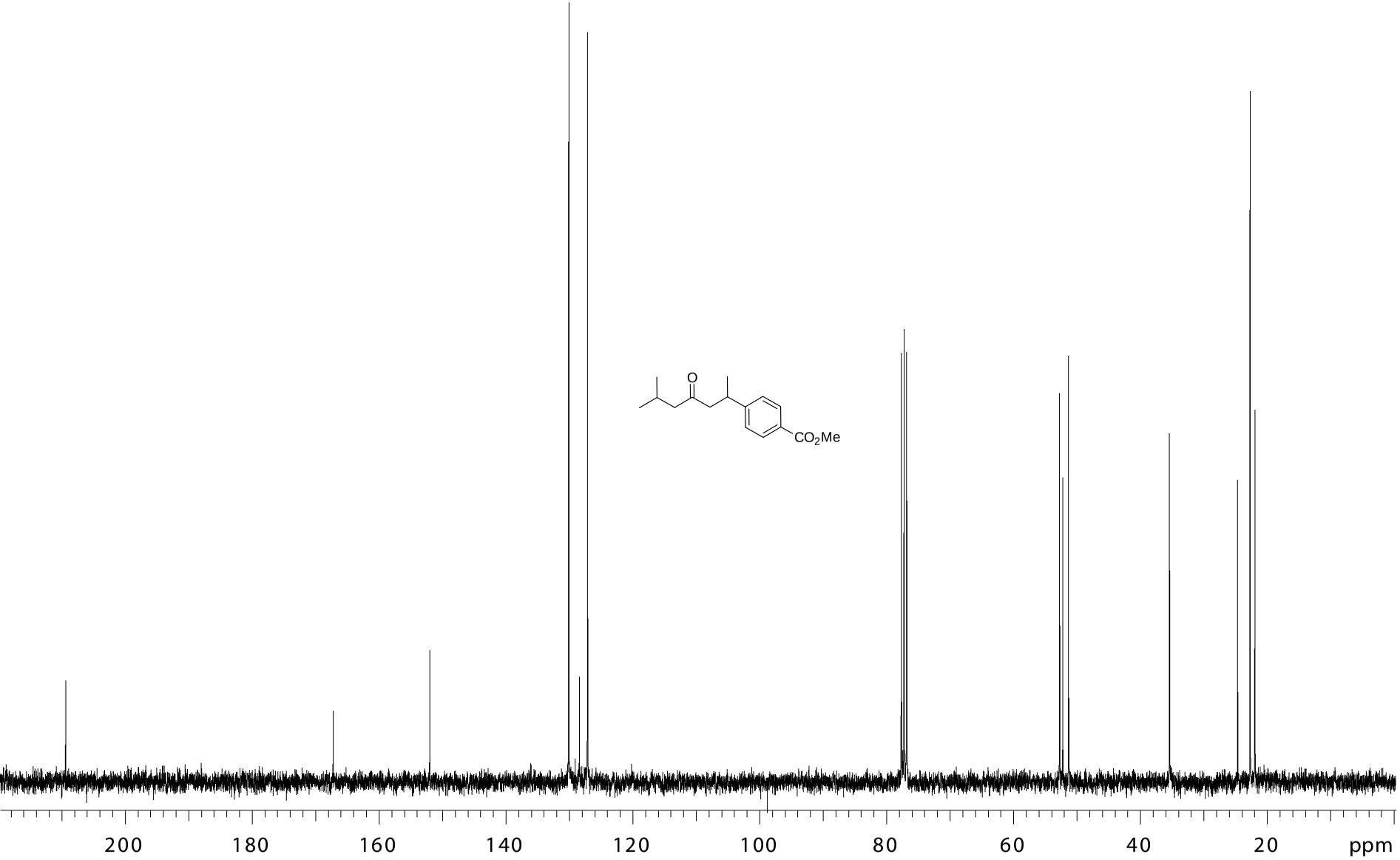

O
O
200
180
160
140
120
100
80
60
40
20
ppm

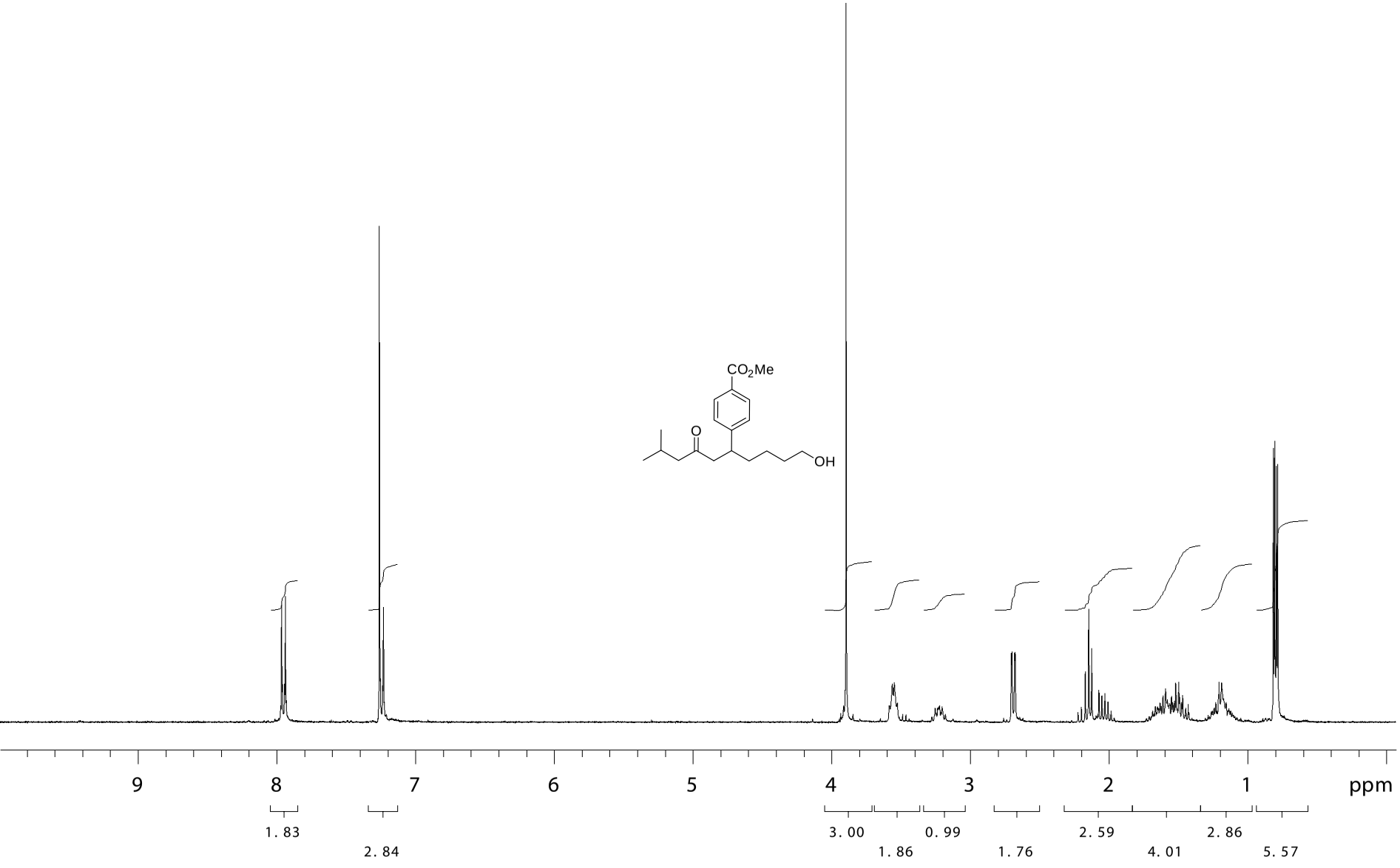

O
O
9
8
7
6
5
4
3
2
1
ppm
1. 84
1. 92
1. 00
4. 95
2. 00
2. 76
13. 59
3. 39

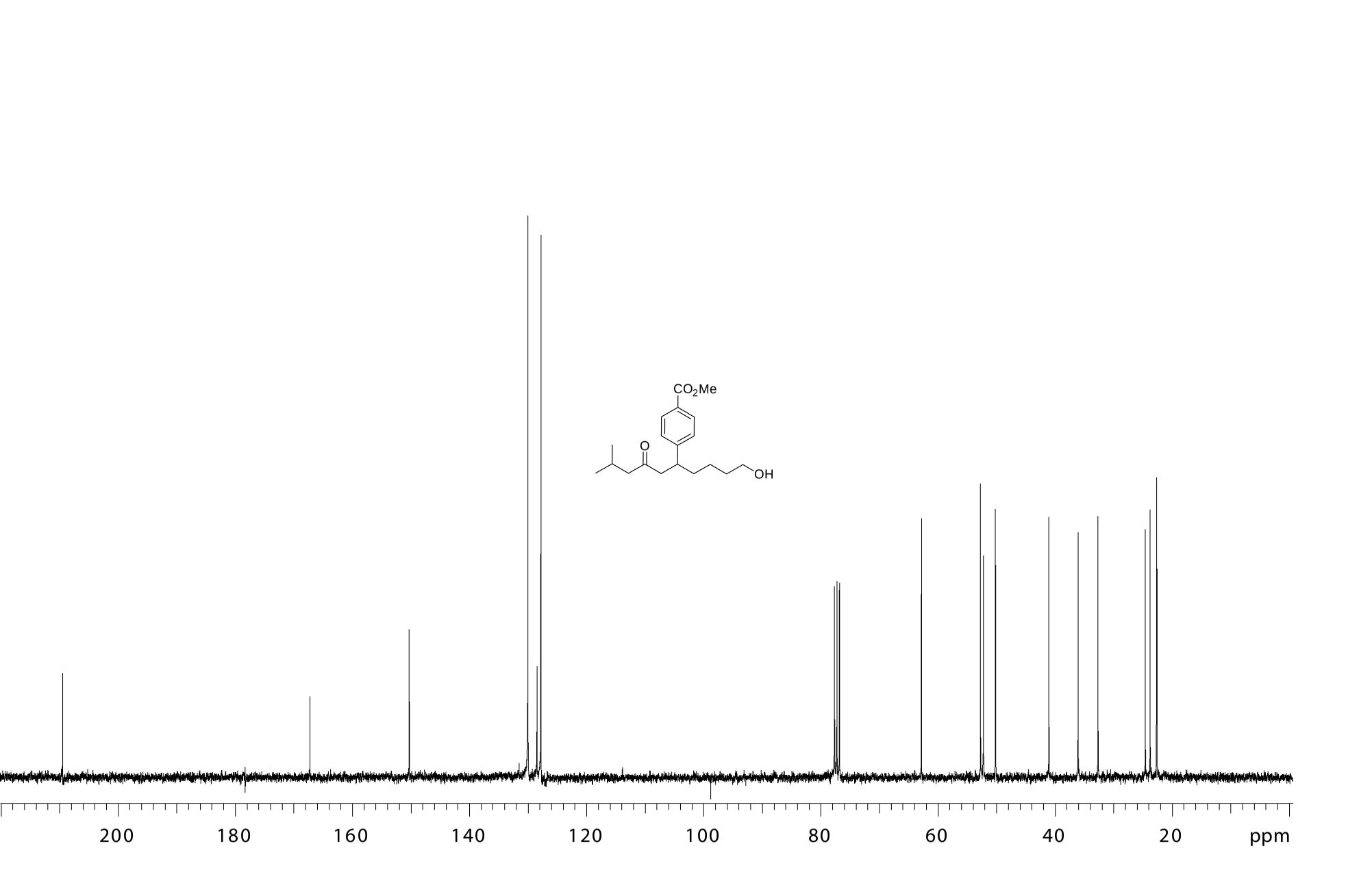

O
O
9
8
7
6
5
4
3
2
1
ppm
1. 83
1. 84
5. 62
2. 00
1. 08
1. 95
3. 06
3. 30

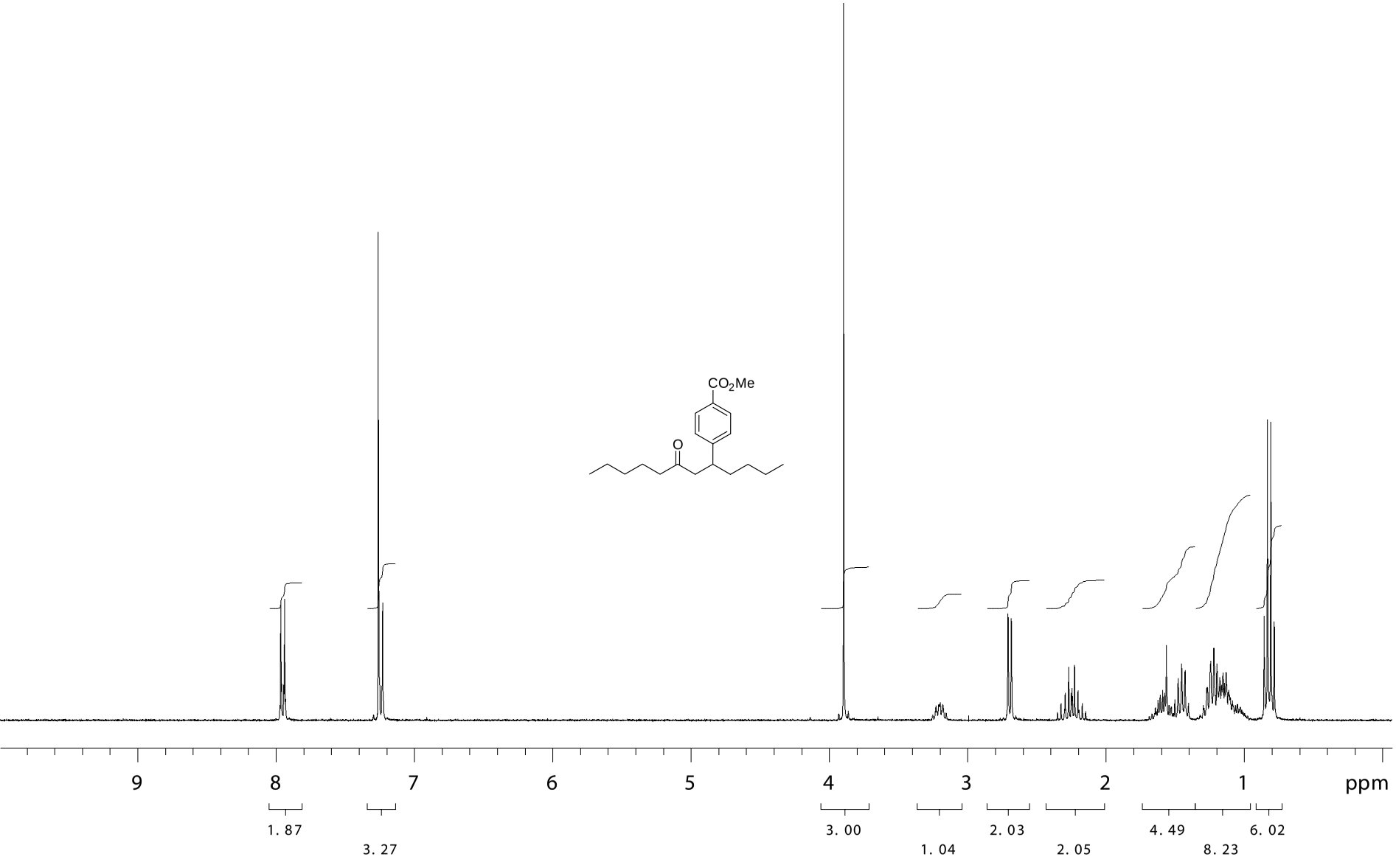

O
O
200
180
160
140
120
100
80
60
40
20
ppm

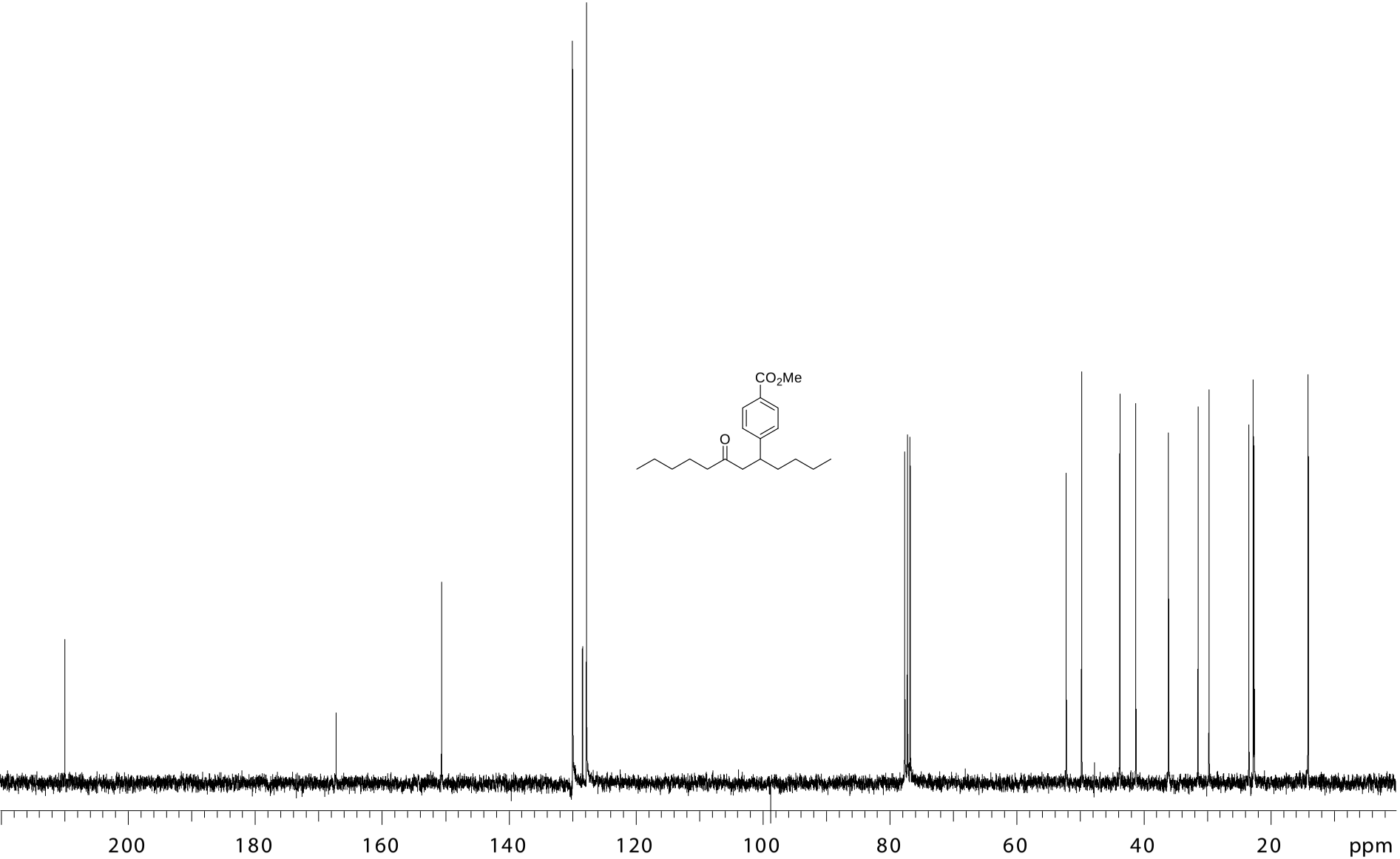

O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
1. 69
3. 47
2. 85
1. 00
1. 93
2. 84
3. 07
5. 73

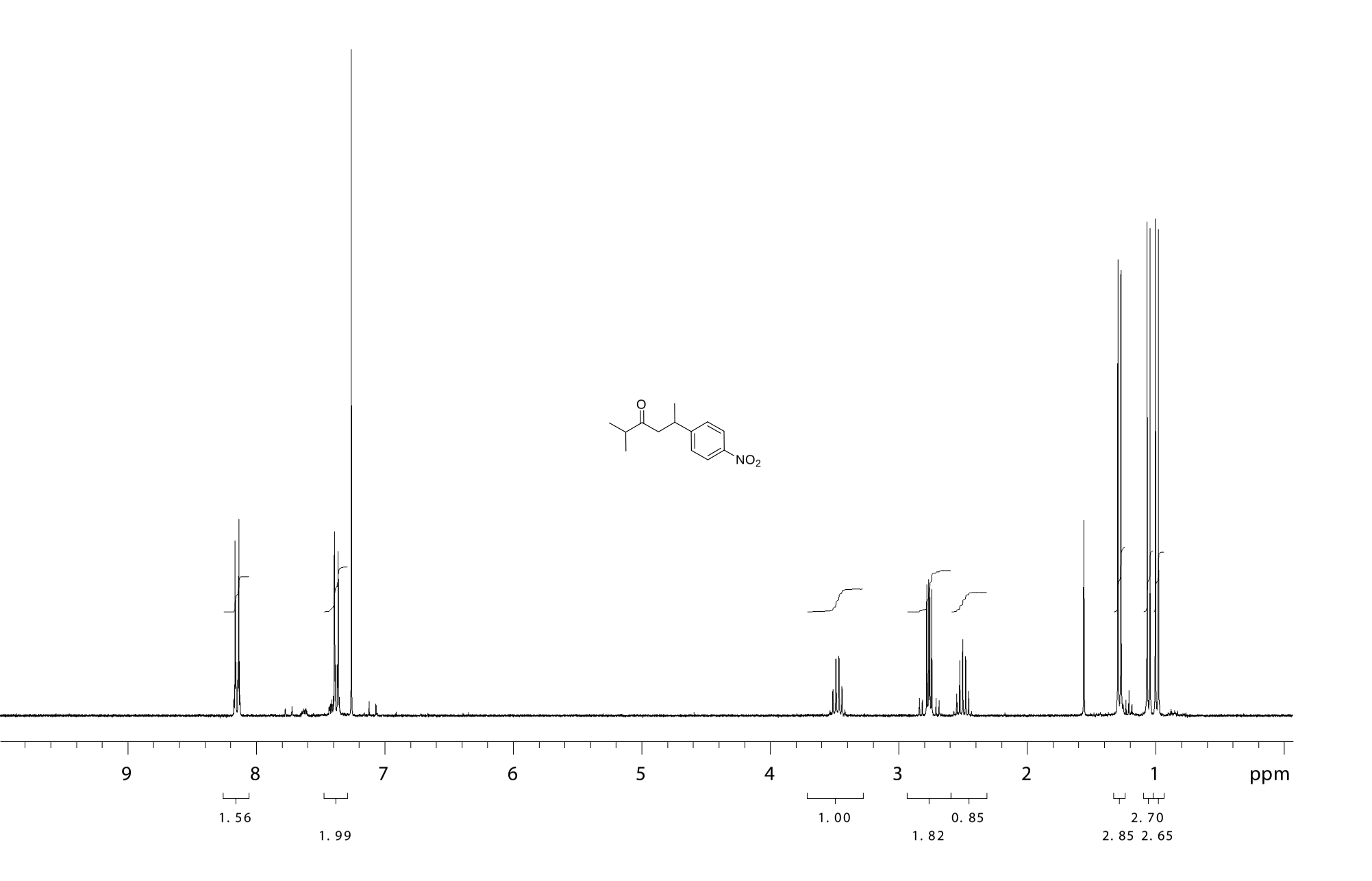

O
CO2Me
200
180
160
140
120
100
80
60
40
20
ppm

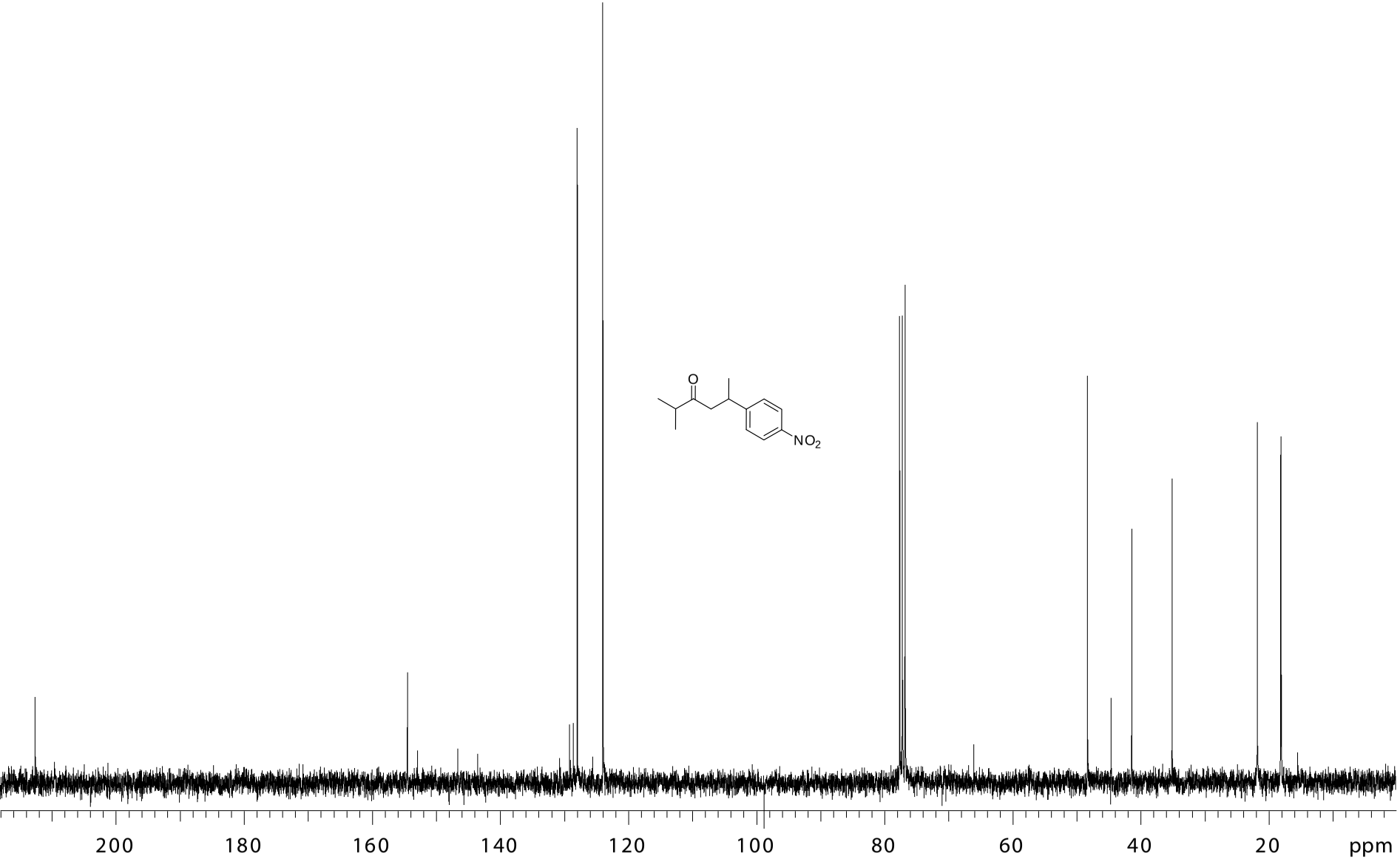

CO2Me
O
OH
9
8
7
6
5
4
3
2
1
ppm
1. 83
2. 84
3. 00
1. 86
0. 99
1. 76
2. 59
4. 01
2. 86
5. 57

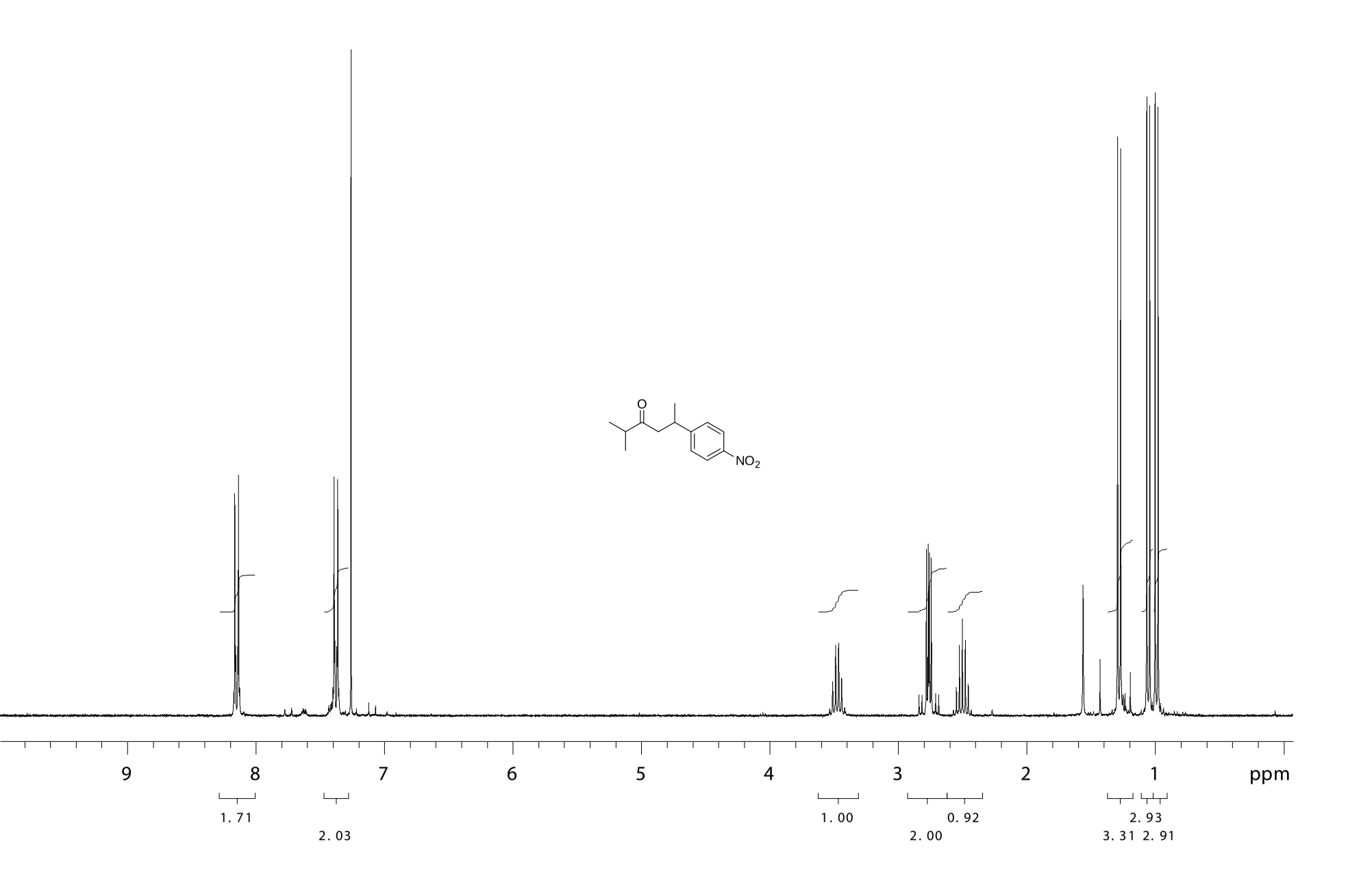

CO2Me
O
OH
200
180
160
140
120
100
80
60
40
20
ppm

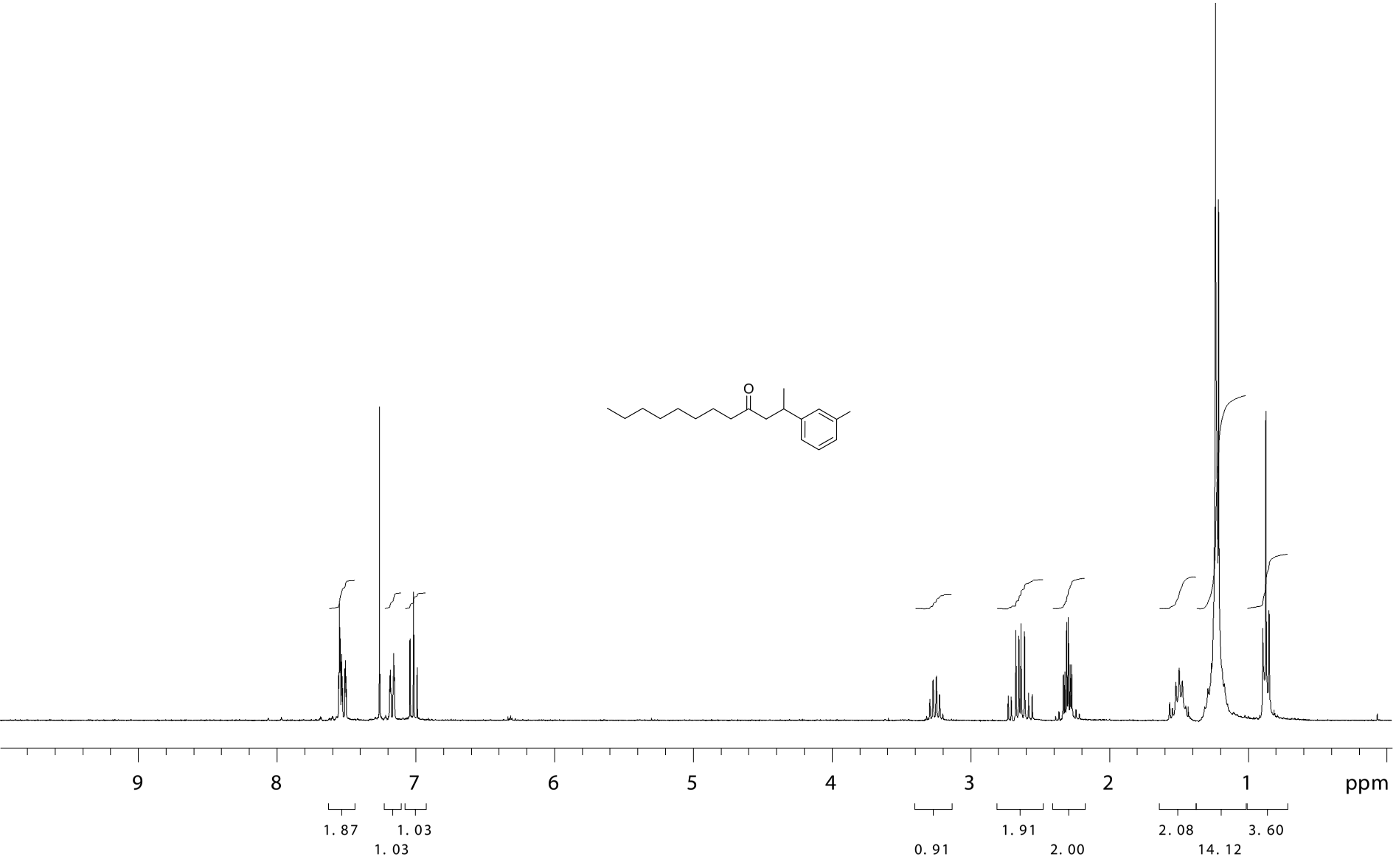

CO2Me
O
9
8
7
6
5
4
3
2
1
ppm
1. 87
3. 27
3. 00
1. 04
2. 03
2. 05
4. 49
8. 23
6. 02

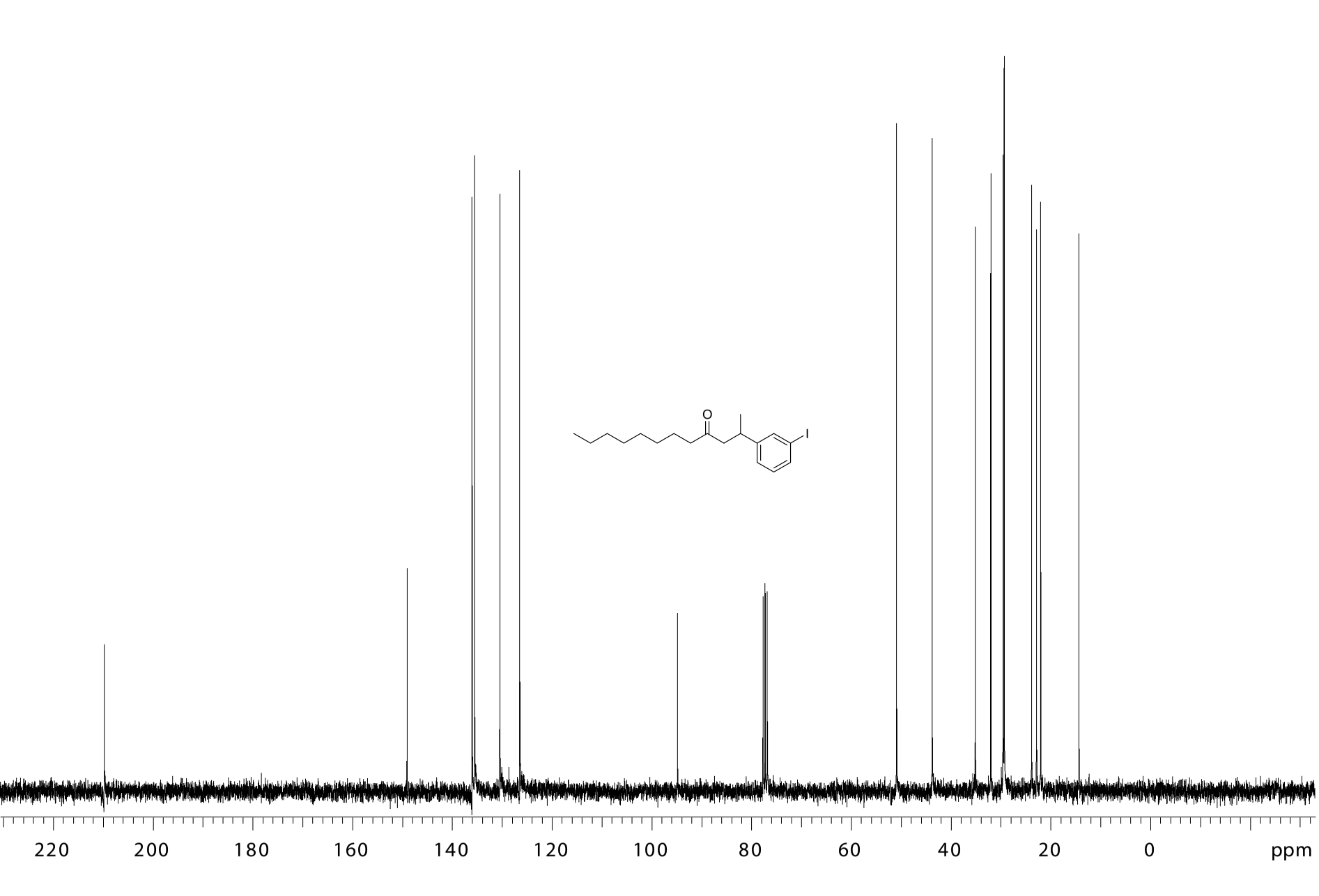

CO2Me
O
200
180
160
140
120
100
80
60
40
20
ppm

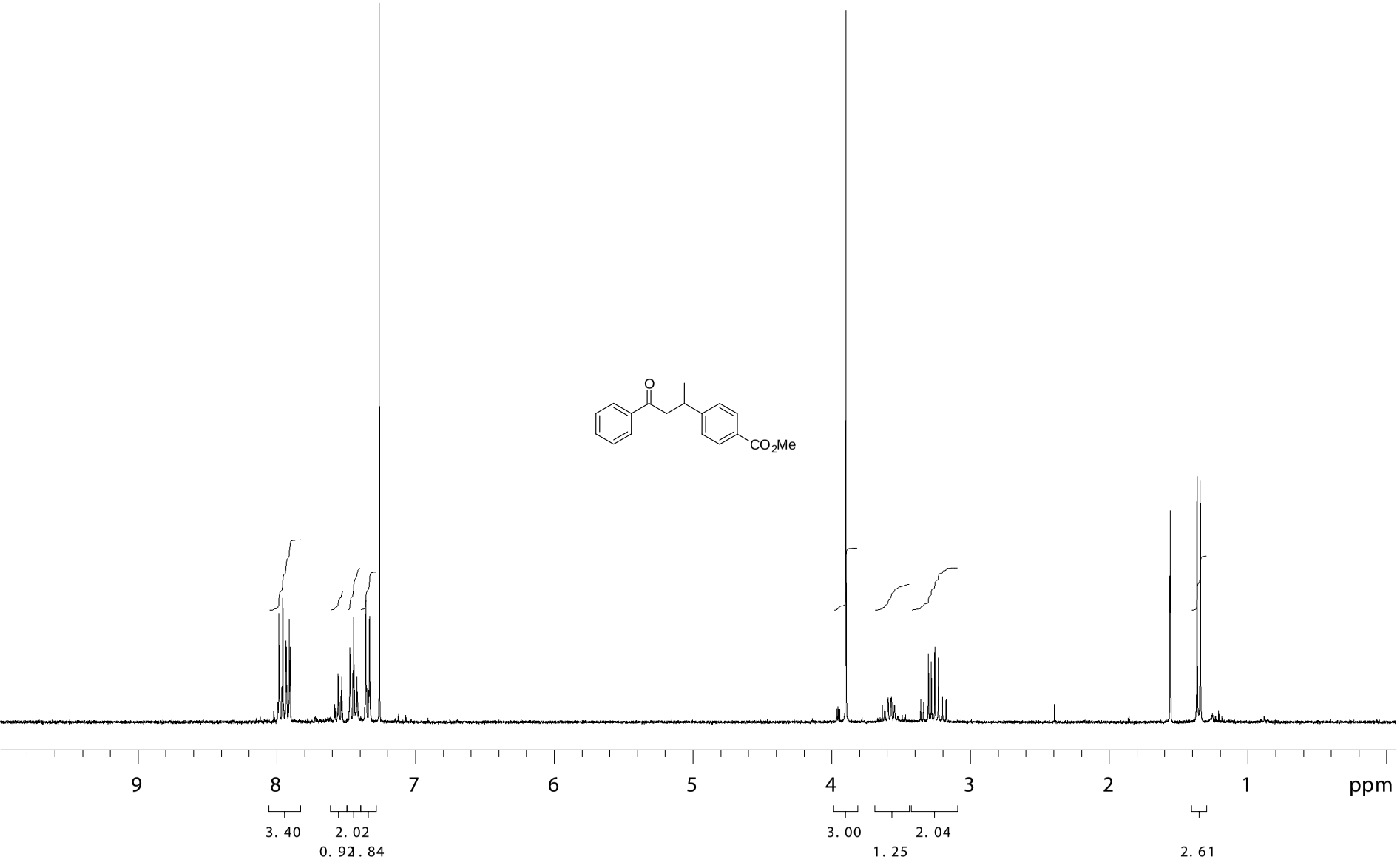

O
NO2
9
8
7
6
5
4
3
2
1
ppm
1. 56
1. 99
1. 00
0. 85
1. 82
2. 85
2. 65
2. 70

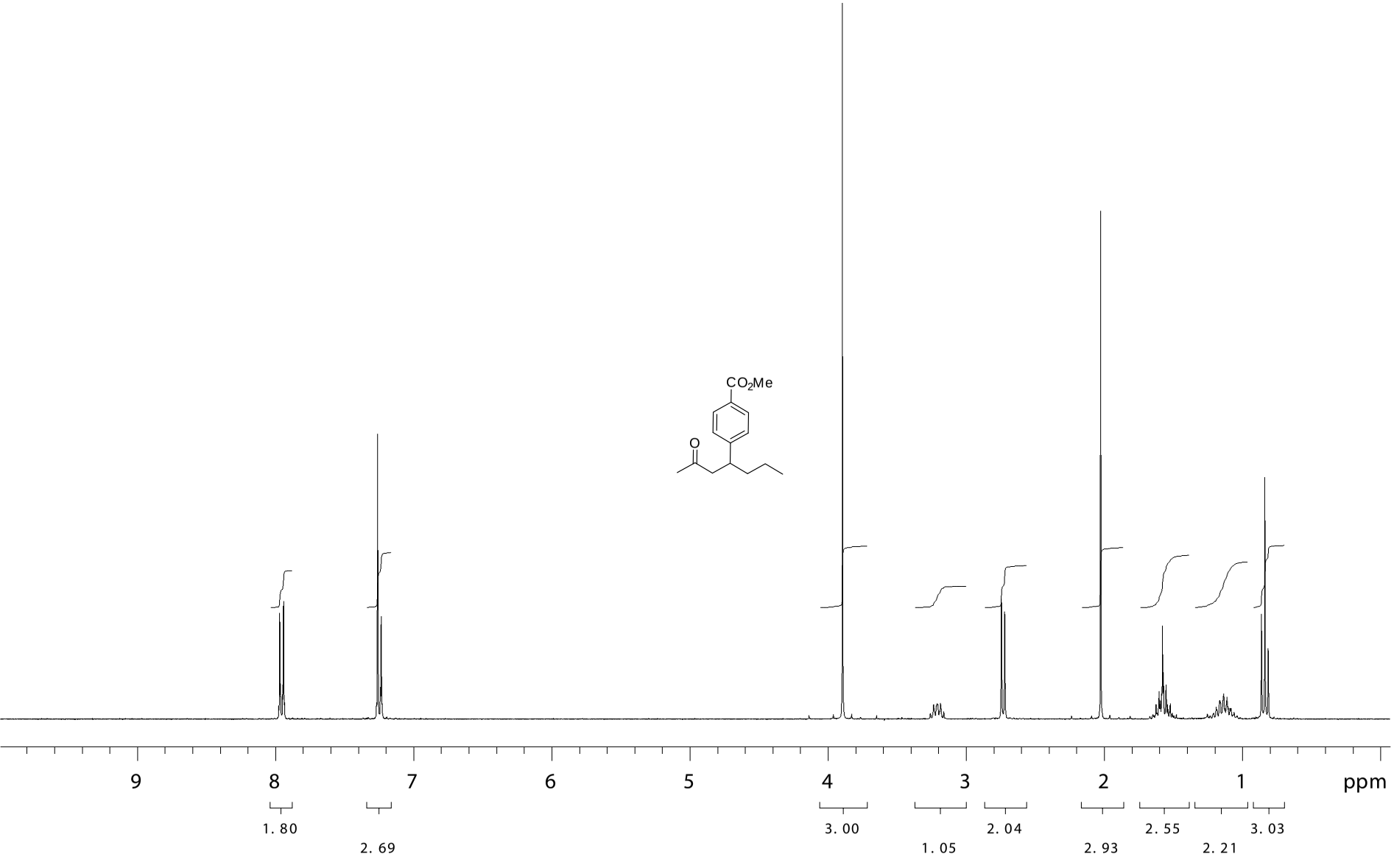

O
NO2
200
180
160
140
120
100
80
60
40
20
ppm

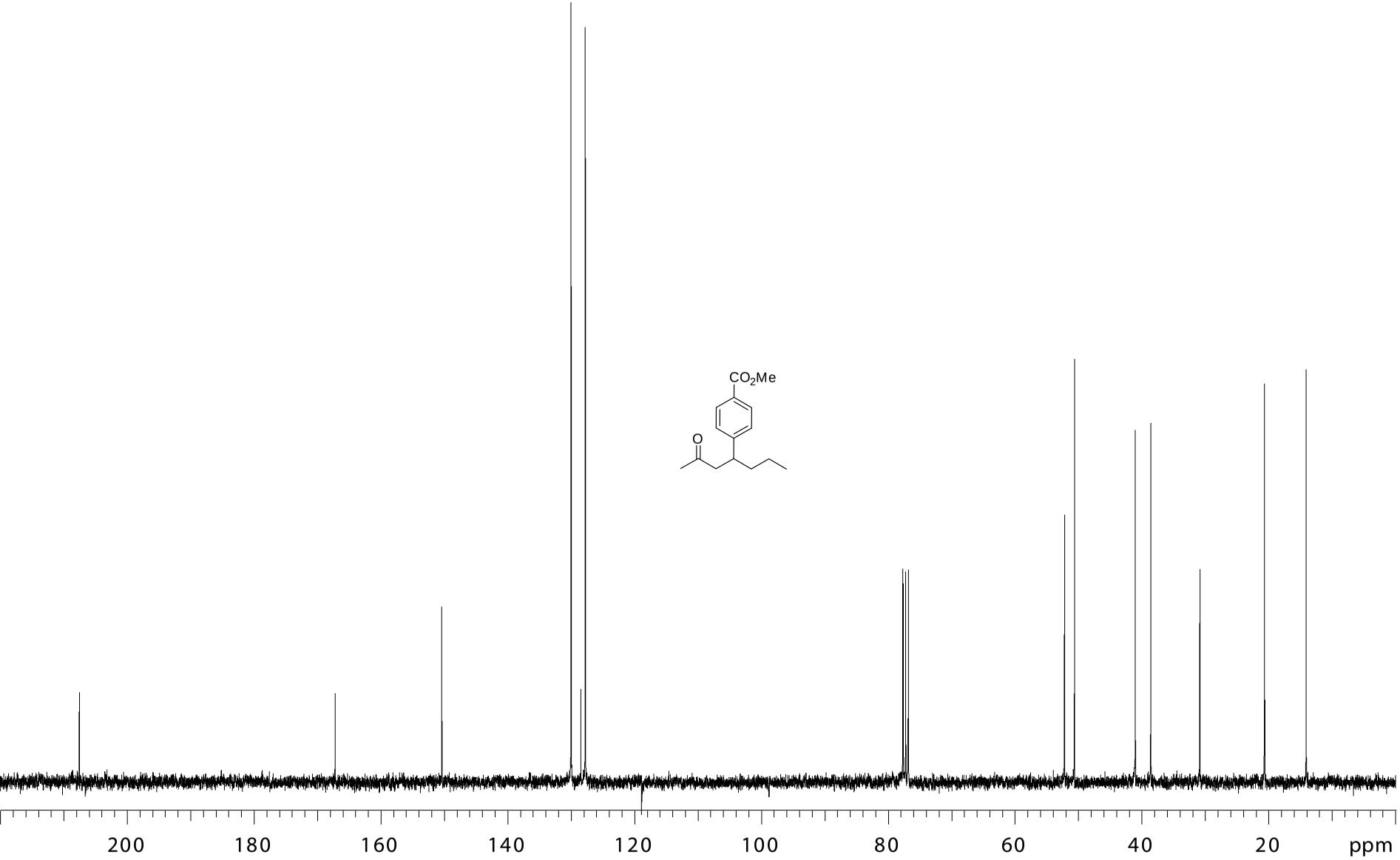

O
NO2
9
8
7
6
5
4
3
2
1
ppm
1. 71
2. 03
1. 00
2. 00
0. 92
3. 31
2. 91
2. 93

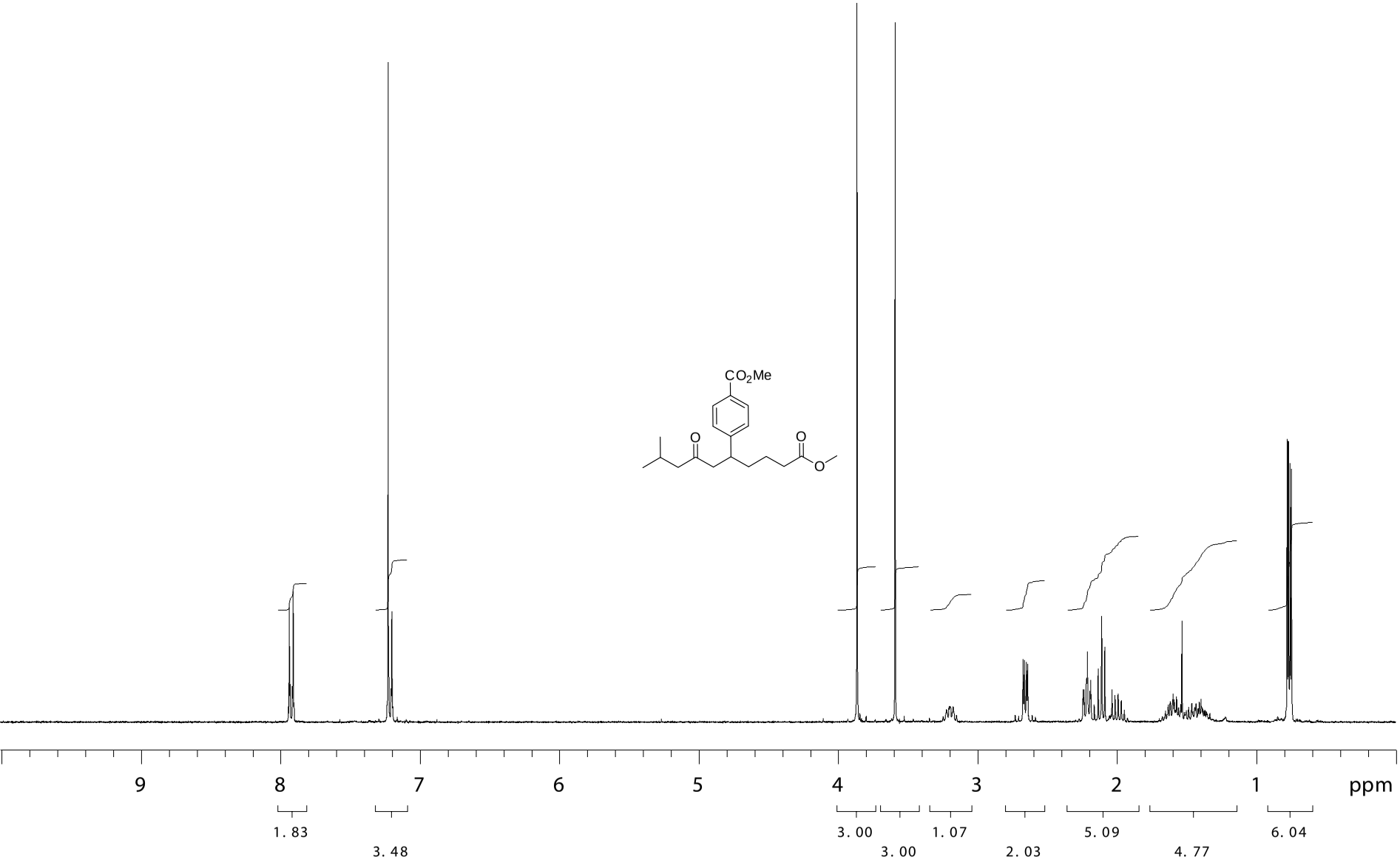

O
9
8
7
6
5
4
3
2
1
ppm
1. 87
1. 03
1. 03
0. 91
1. 91
2. 00
2. 08
14. 12
3. 60

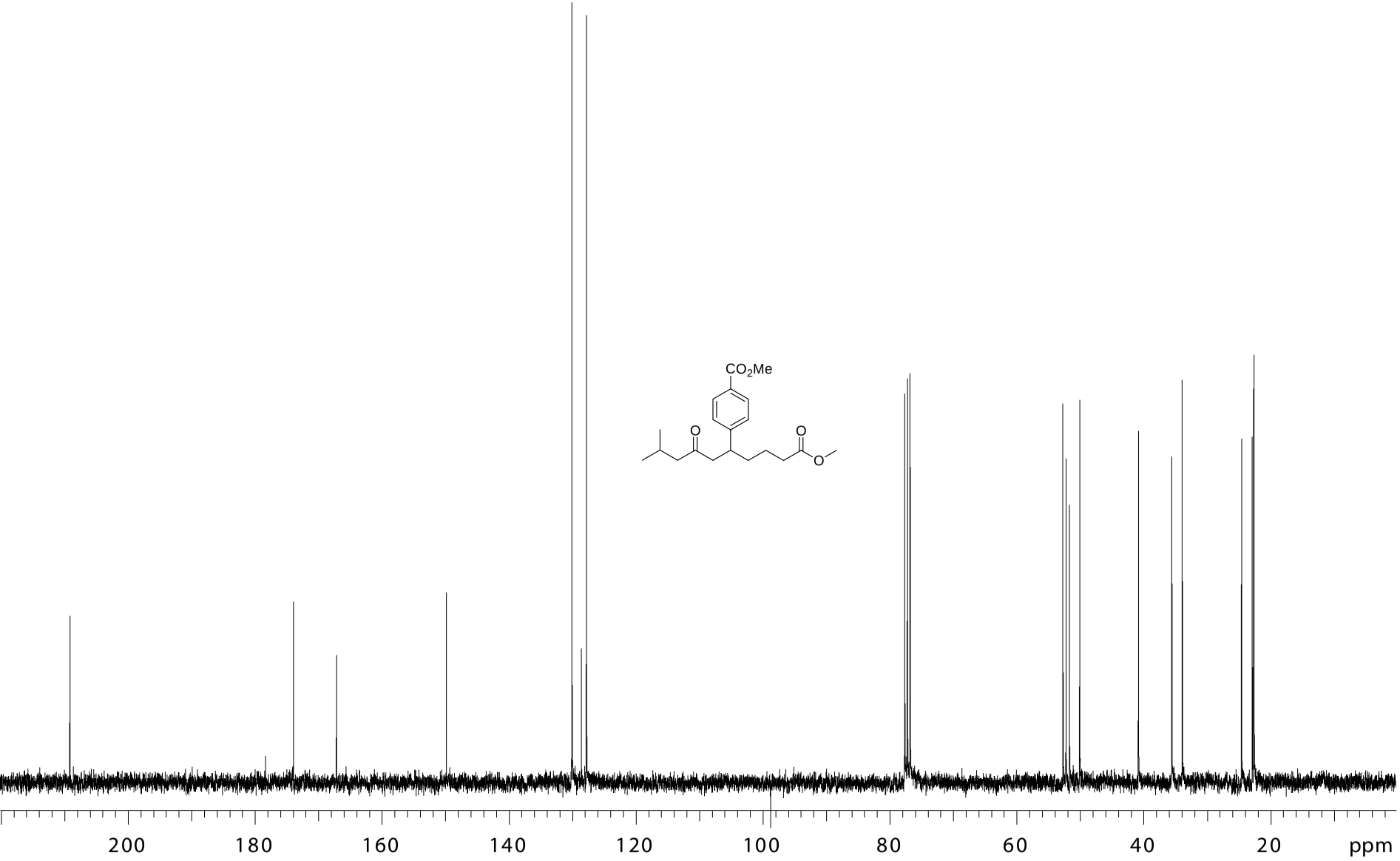

O
I
220
200
180
160
140
120
100
80
60
40
20
0
ppm

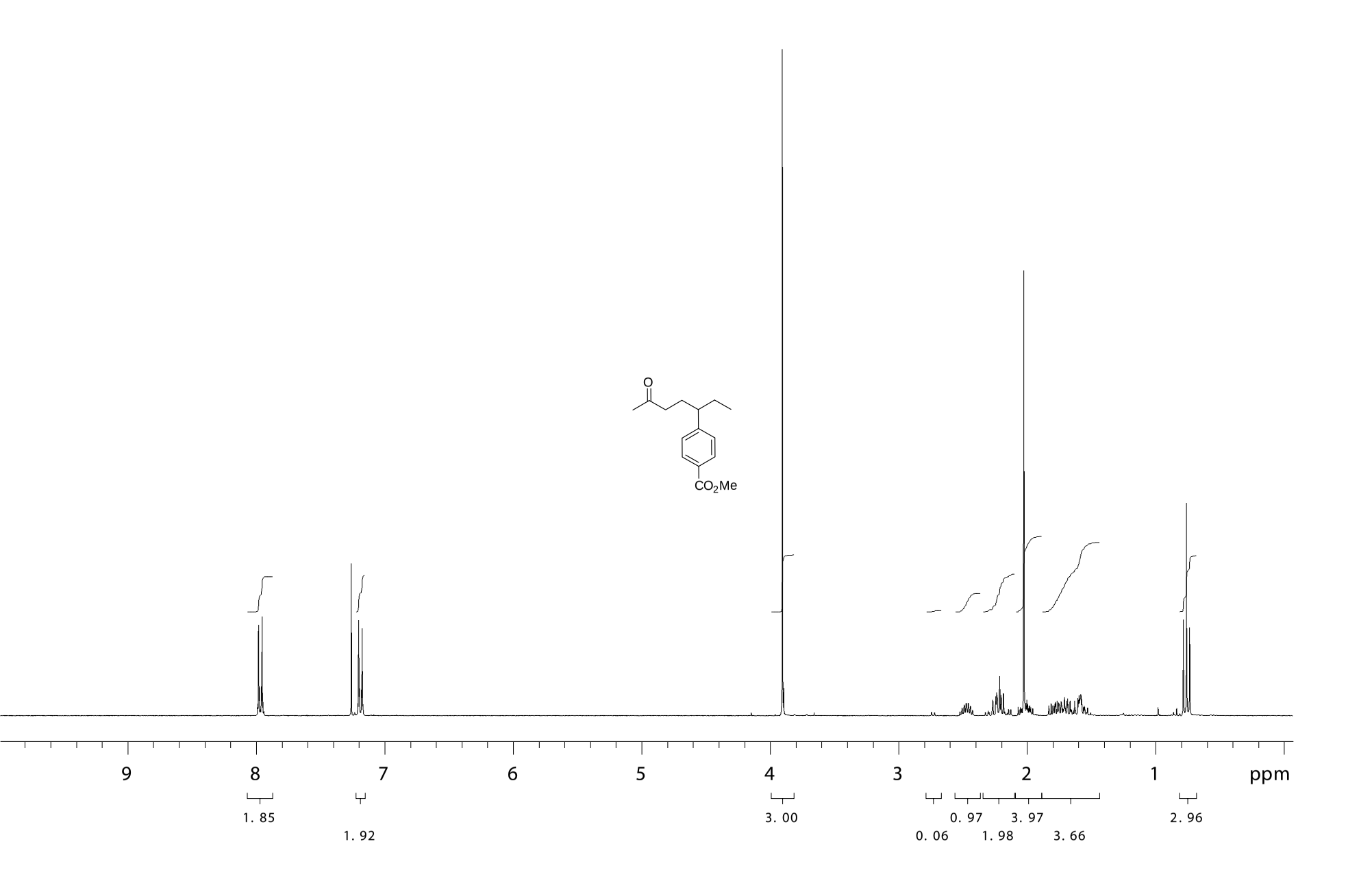

O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
3. 40
2. 02
0. 92
1. 84
3. 00
1. 25
2. 04
2. 61

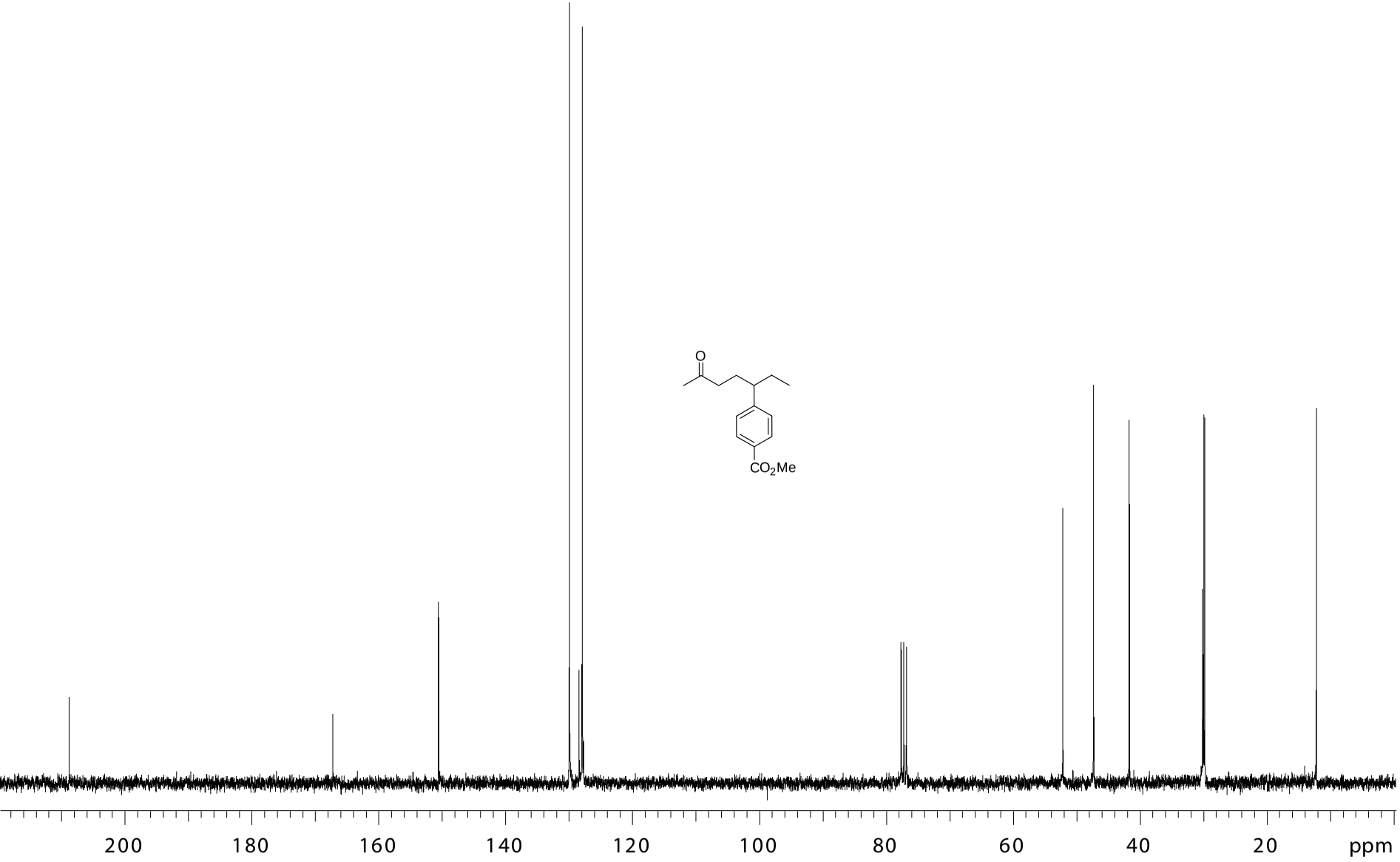

CO2Me
O
9
8
7
6
5
4
3
2
1
ppm
1. 80
2. 69
3. 00
1. 05
2. 04
2. 93
2. 55
2. 21
3. 03

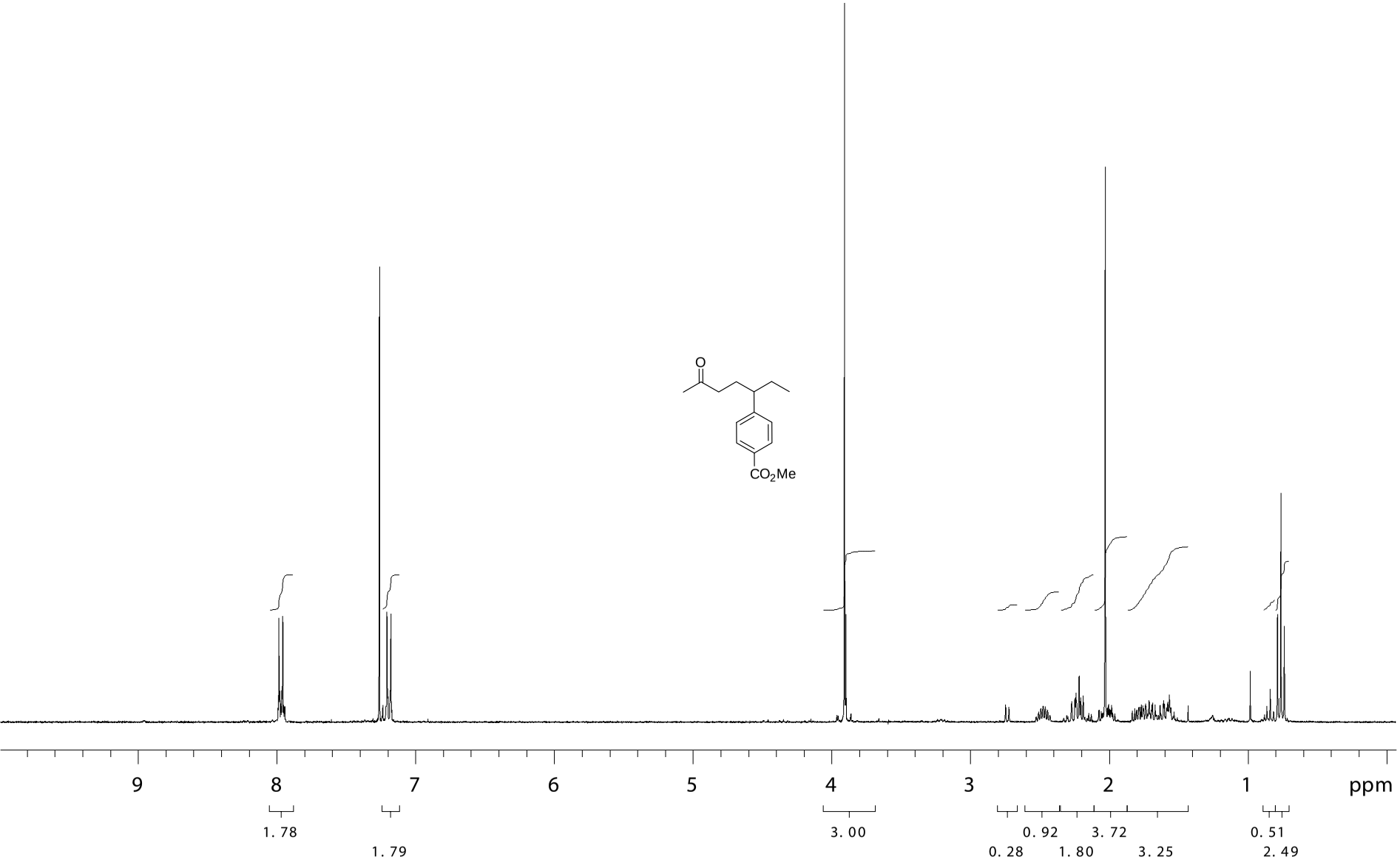

CO2Me
O
200
180
160
140
120
100
80
60
40
20
ppm

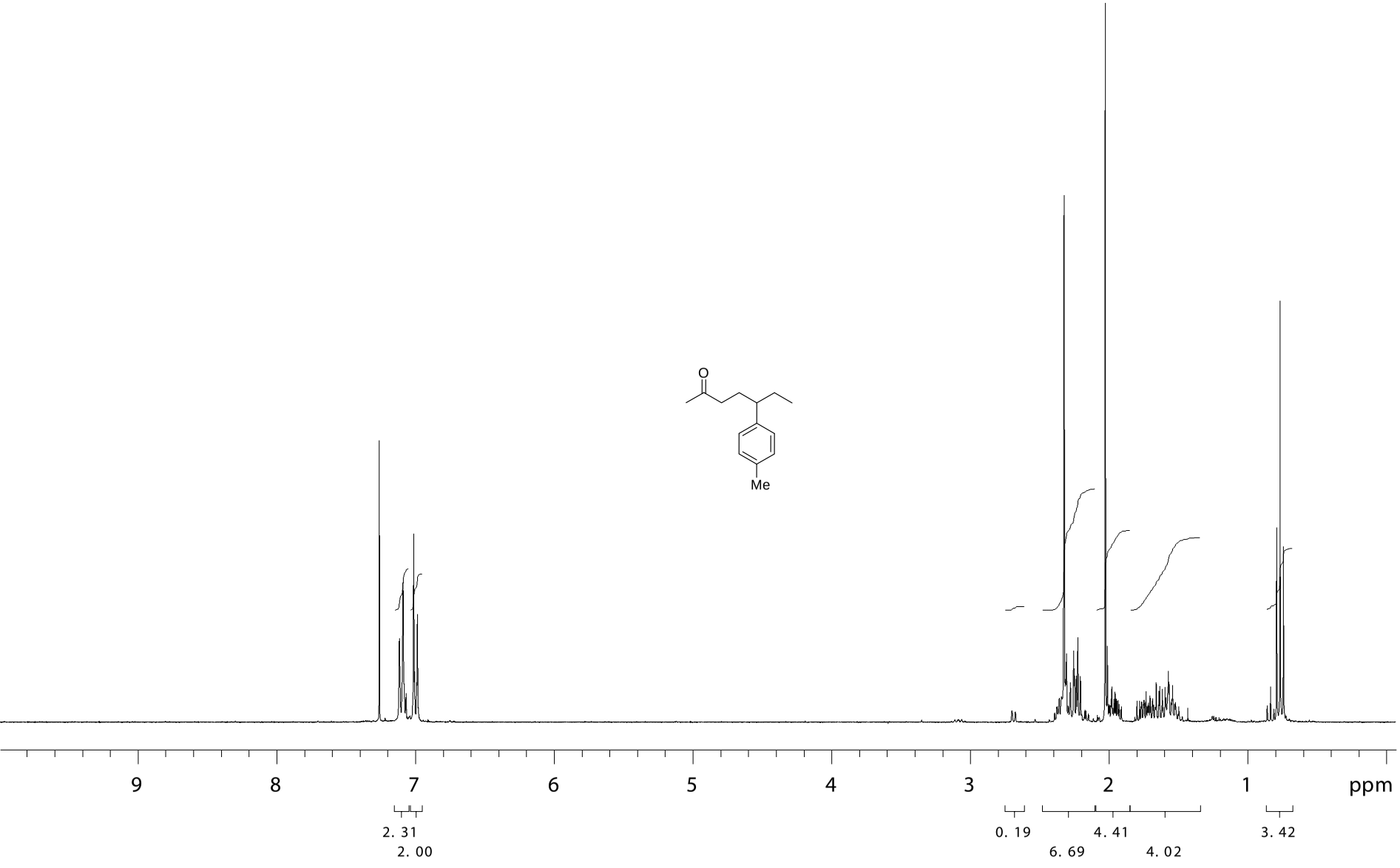

CO2Me
O
O
O
9
8
7
6
5
4
3
2
1
ppm
1. 83
3. 48
3. 00
3. 00
1. 07
2. 03
5. 09
4. 77
6. 04

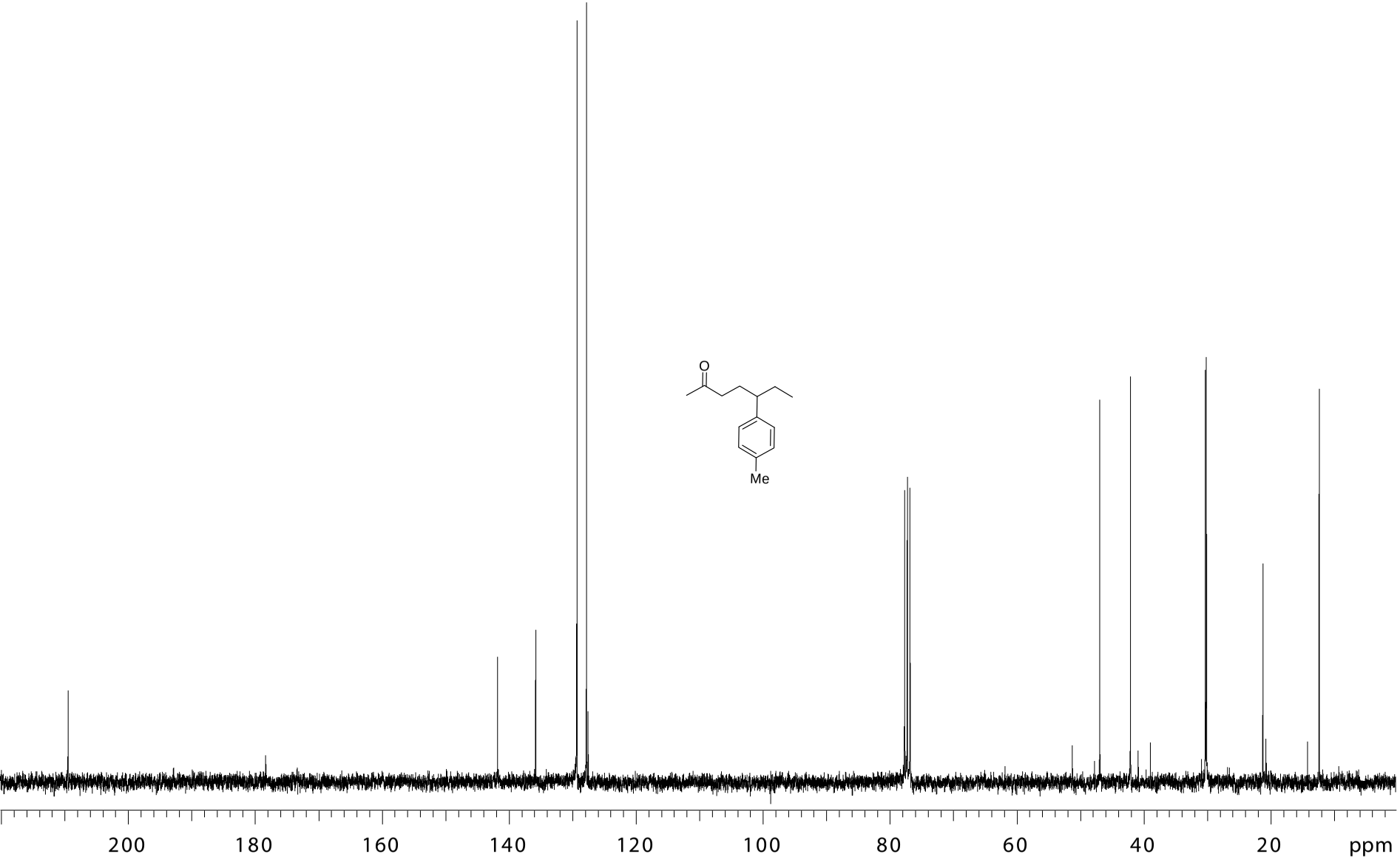

CO2Me
O
O
O
200
180
160
140
120
100
80
60
40
20
ppm

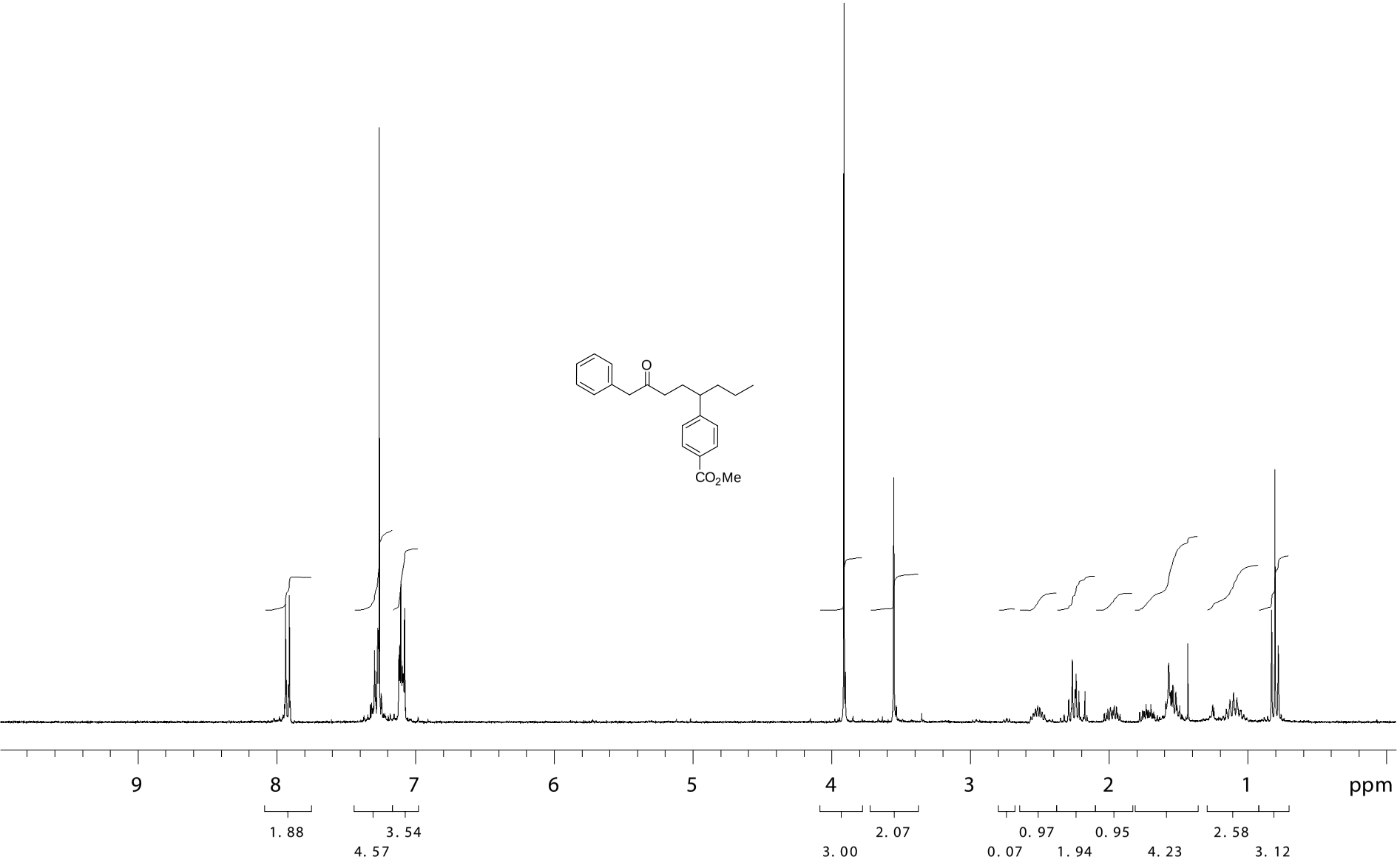

O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
1. 85
1. 92
3. 00
0. 06
0. 97
1. 98
3. 97
3. 66
2. 96

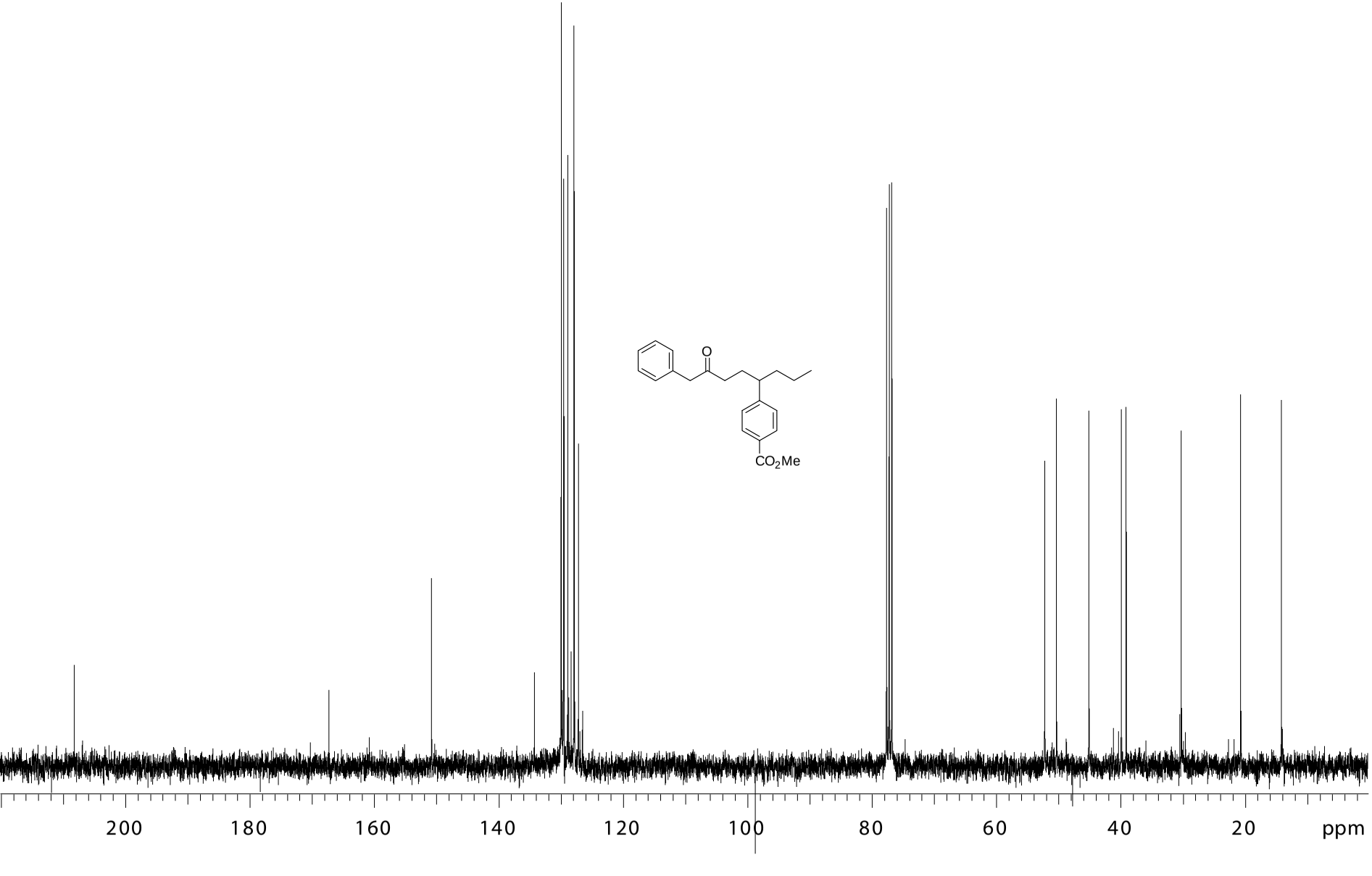

O
CO2Me
200
180
160
140
120
100
80
60
40
20
ppm

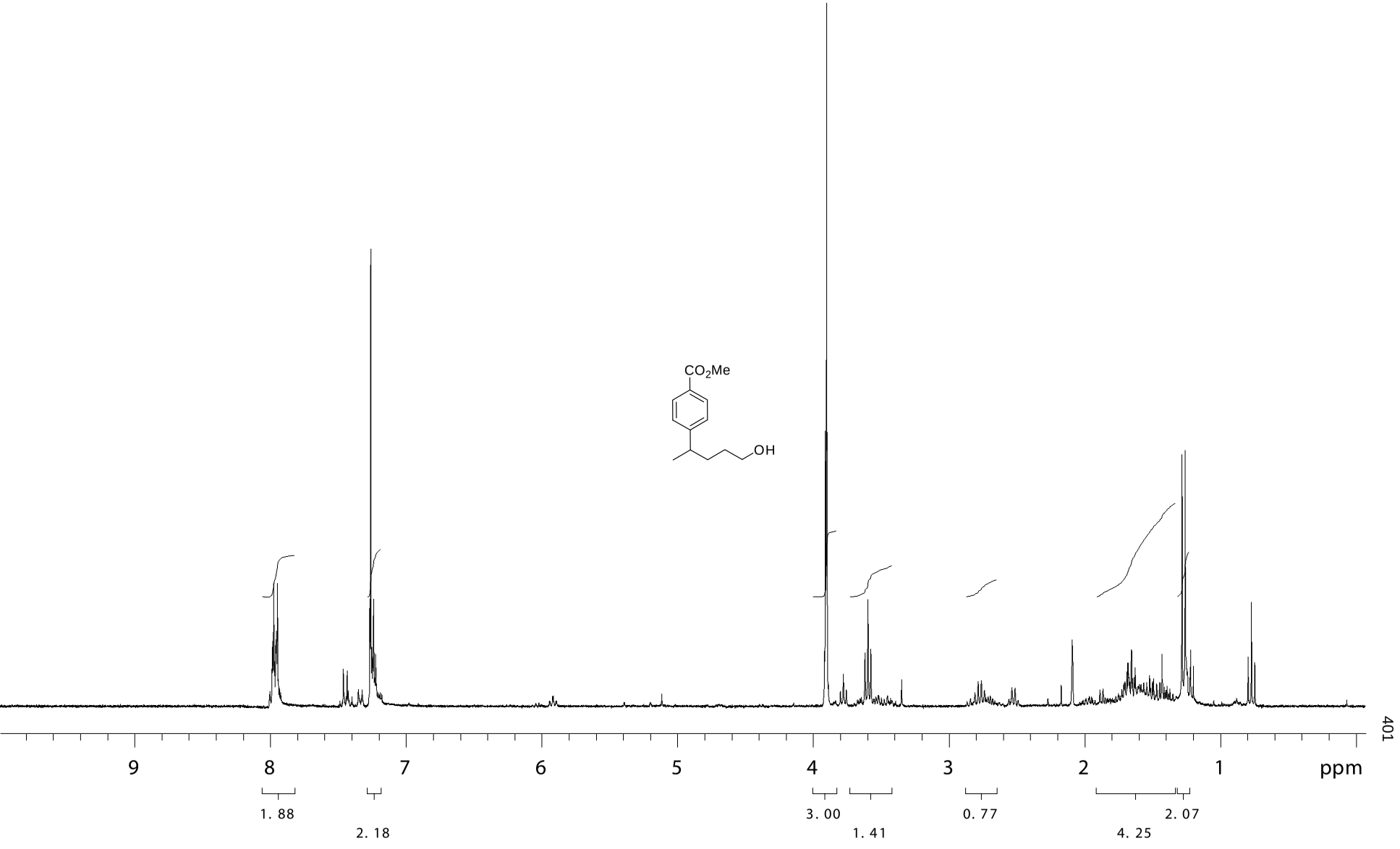

O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
1. 78
1. 79
3. 00
0. 28
0. 92
1. 80
3. 72
3. 25
0. 51
2. 49

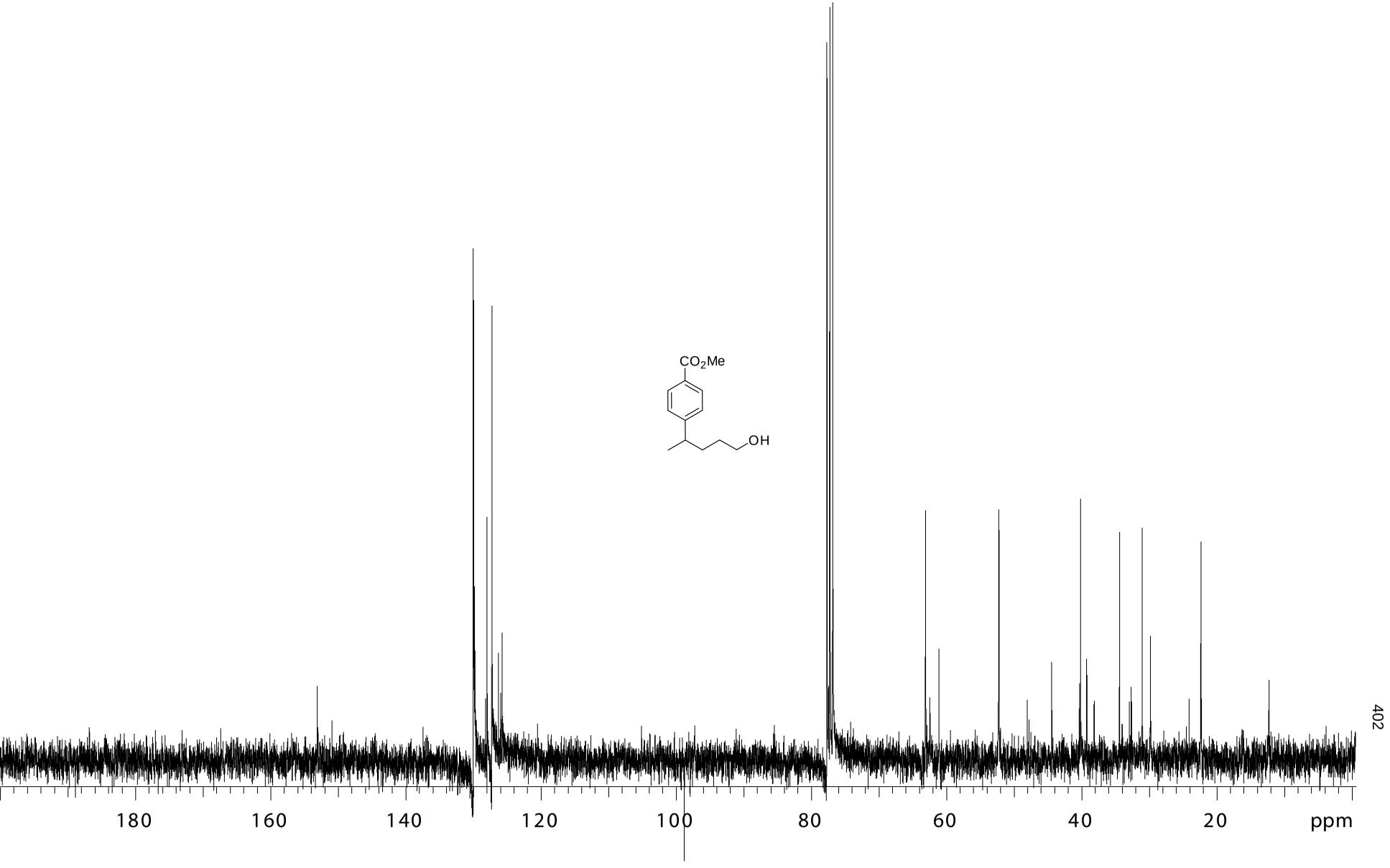

O
Me
9
8
7
6
5
4
3
2
1
ppm
2. 31
2. 00
0. 19
6. 69
4. 41
4. 02
3. 42


O
Me
200
180
160
140
120
100
80
60
40
20
ppm


O
CO2Me
9
8
7
6
5
4
3
2
1
ppm
1. 88
4. 57
3. 54
3. 00
2. 07
0. 07
0. 97
1. 94
0. 95
4. 23
2. 58
3. 12


O
CO2Me
200
180
160
140
120
100
80
60
40
20
ppm


CO2Me
OH
9
8
7
6
5
4
3
2
1
ppm
1. 88
2. 18
3. 00
1. 41
0. 77
2. 07
4. 25
401


CO2Me
OH
180
160
140
120
100
80
60
40
20
ppm
402

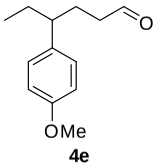
mei-03-2-OMe-H

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-03-2-OMe-H

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-2-OMe-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
41 repetitions
OBSERVE H1, 300.0771288 MH
DATA PROCESSING
FT size 65536
Total time 27 hr, 49 min, 37 sec



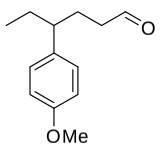
4e

mei-03-2-p-OMe-C

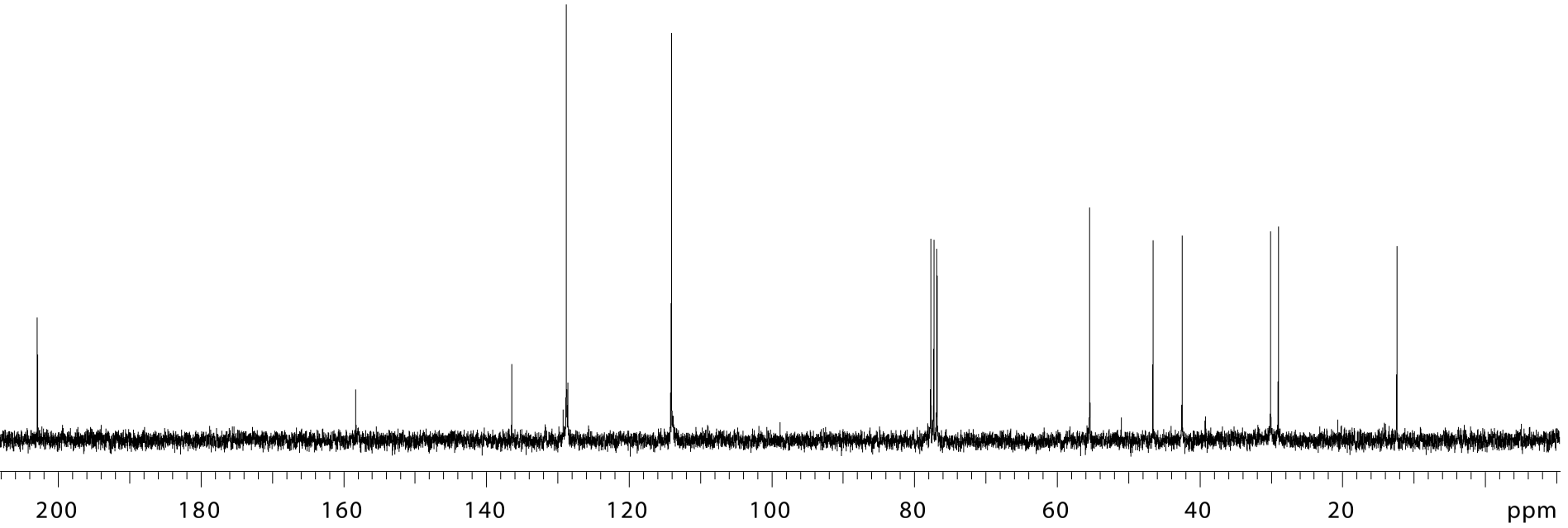
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-2-p-OMe-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
287 repetitions
OBSERVE C13, 75.45442385 MH
DECOUPLE H1, 300.07821256 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 10 hr, 7 min, 58 sec



4e



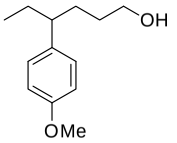
mei-3-2-ol-2

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-03-2-ol-pure-H

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-2-ol-pure-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
37 repetitions
OBSERVE H1, 300.0771875 MH
DATA PROCESSING
FT size 65536
Total time 2 hr, 46 min, 57 sec



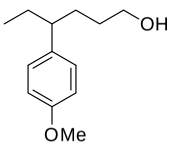
4ea

mei-03-2-ol-C

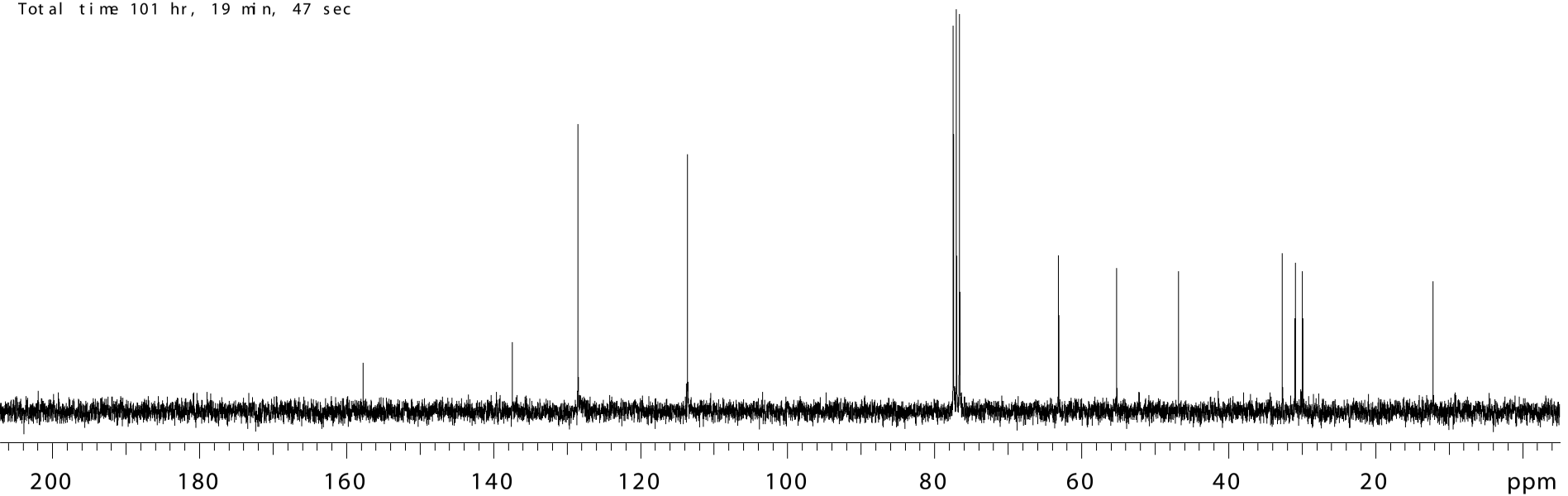
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-2-ol-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
989 repetitions
OBSERVE C13, 75.4544571 MH
DECOUPLE H1, 300.0782156 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 101 hr, 19 min, 47 sec



4ea



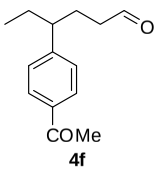
mei-03-4-acetyl-H

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-03-4-acetyl-H

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-4-acetyl-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
83 repetitions
OBSERVE H1, 300.0771870 MH
DATA PROCESSING
FT size 65536
Total time 27 hr, 49 min, 37 sec



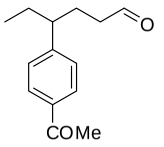
4f

mei-03-4-acetyl-C

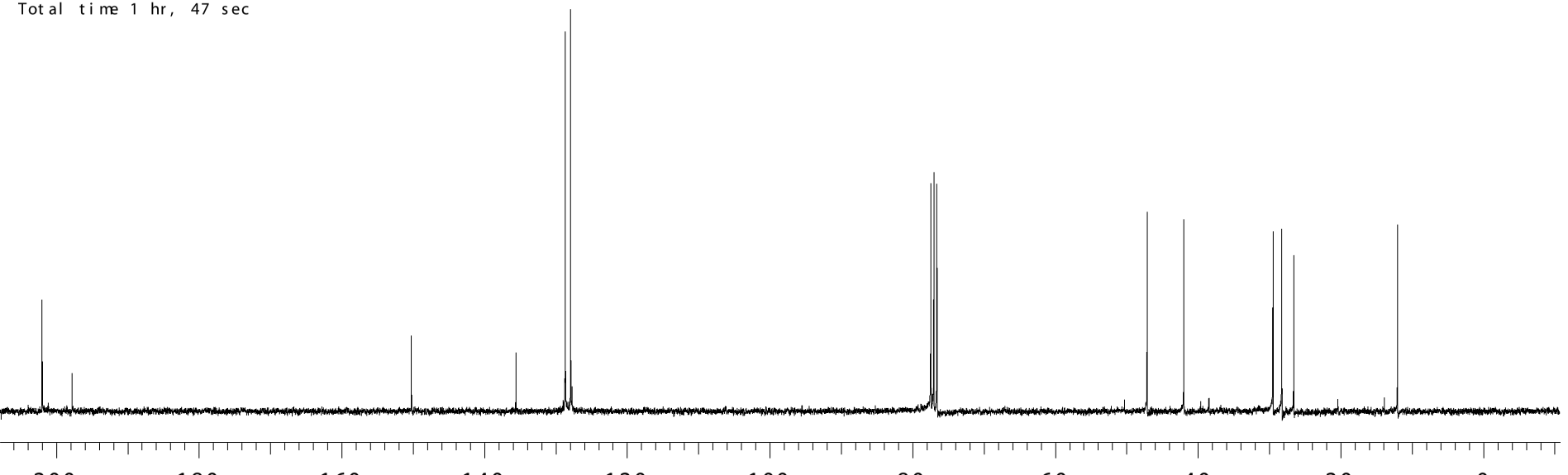
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-4-acetyl-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
1758 repetitions
OBSERVE C13, 75.4544581 MH
DECOUPLE H1, 300.0782156 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 1 hr, 47 sec



4f



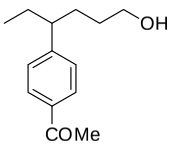
mei-03-4-acetlyl-ol-H

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-03-4-acetyl-ol-H

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-4-acetyl-ol-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
31 repetitions
OBSERVE H1, 300.0771829 MH
DATA PROCESSING
FT size 65536
Total time 2 hr, 46 min, 57 sec



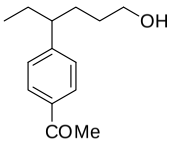
4fa

13C OBSERVE

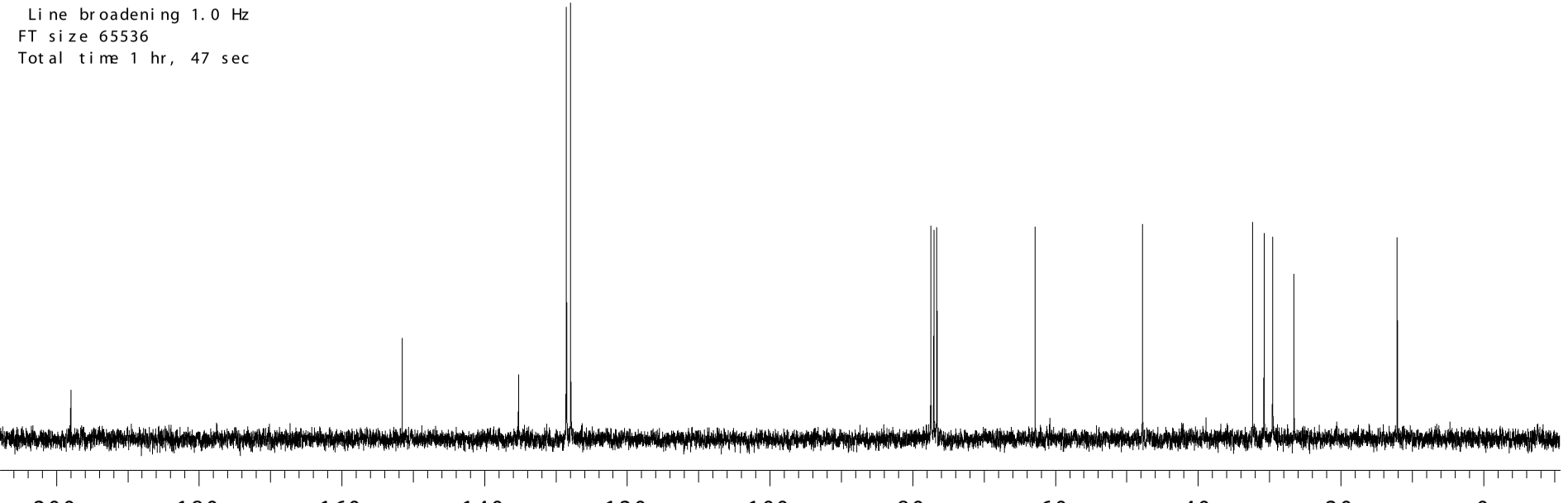
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-03-4-acetyl-ol-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
394 repetitions
OBSERVE C13, 75.4544581 MH
DECOUPLE H1, 300.0782156 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 1 hr, 47 sec



4fa



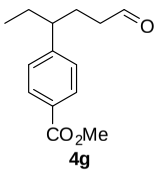
mei-02-184-ester-H

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-02-184-ester-H

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-184-ester-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
44 repetitions
OBSERVE H1, 300.0771871 MH
DATA PROCESSING
FT size 65536
Total time 2 hr, 46 min, 57 sec



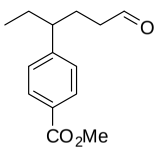
4g

mei-02-184-ester-C

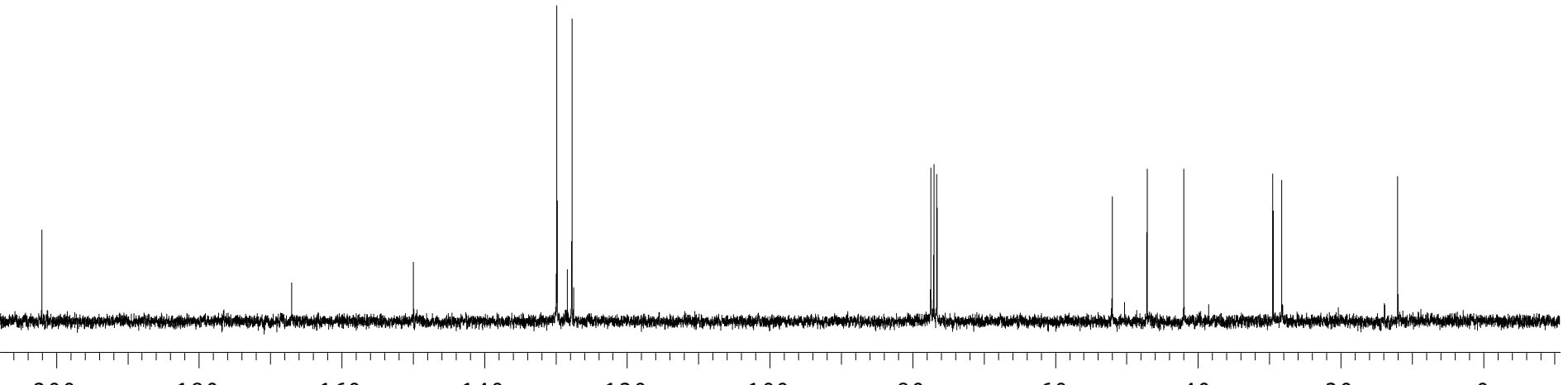
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-184-ester-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
499 repetitions
OBSERVE C13, 75.4544581 MH
DECOUPLE H1, 300.0782156 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 1 hr, 47 sec



4g



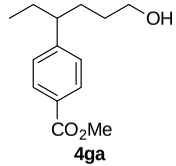
mei-02-184-ester-ol-H

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-02-184-ester-ol-H

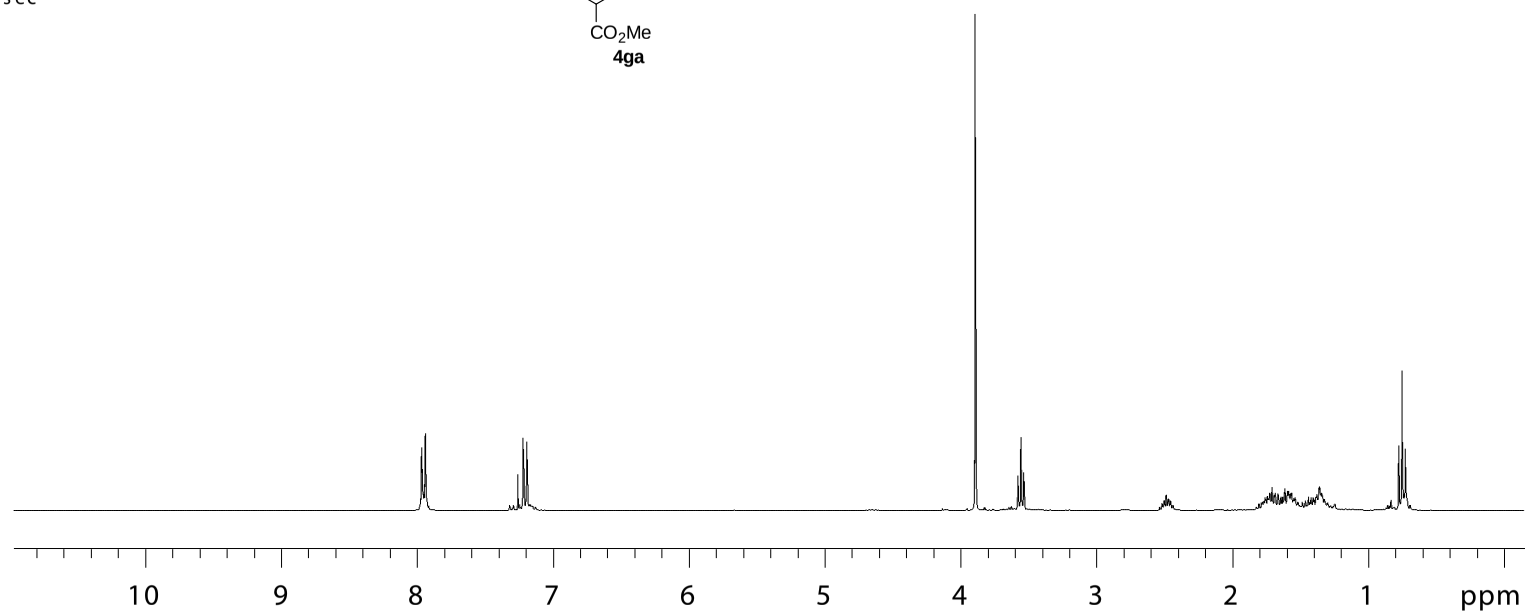
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-184-ester-ol-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
30 repetitions
OBSERVE H1, 300.0771371 MH
DATA PROCESSING
FT size 65536
Total time 2 hr, 46 min, 57 sec



4ga

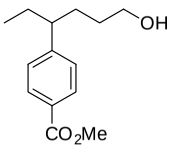


mei-02-184-ester-ol-C

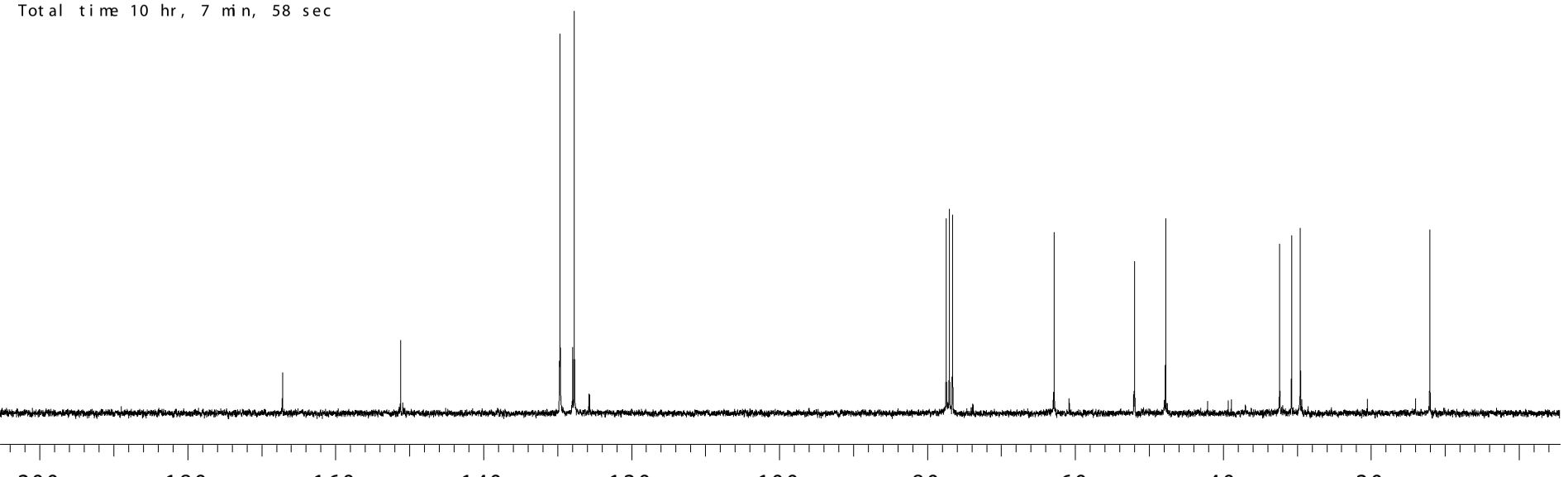
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-184-ester-ol-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
1412 repetitions
OBSERVE C13, 75.45445581 MH
DECOUPLE H1, 300.07821256 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 10 hr, 7 min, 58 sec



4ga



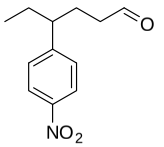
mei-02-188-pure-H

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-02-188-pure-H

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-188-pure-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
20 repetitions
OBSERVE H1, 300.0771288 MH
DATA PROCESSING
FT size 65536
Total time 2 hr, 46 min, 57 sec



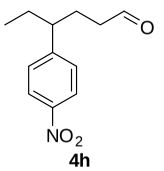
4h

mei-02-188-pure-C

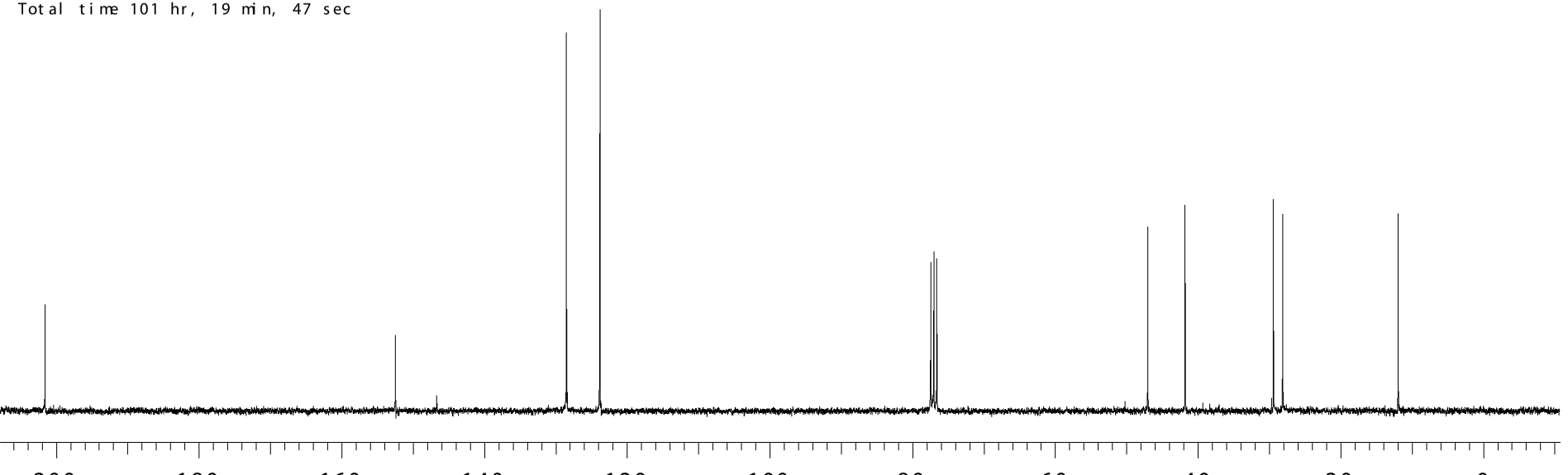
Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-188-pure-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
3374 repetitions
OBSERVE C13, 75.4544z586 MH
DECOUPLE H1, 300.07821z56 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 101 hr, 19 min, 47 sec



4h



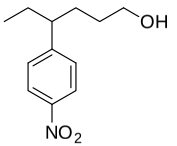
mei-02-188-ol-pure-H

Archive directory: /home/nmr/vnmr1/vnmrsys/data
File: mei-02-188-ol-pure-H

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-188-ol-pure-H
INOVA-500 "nmr-sun"

Relax. delay 1.000 sec
Pulse 46.7 degrees
Acq. time 4.000 sec
Width 4499.9 Hz
31 repetitions
OBSERVE H1, 300.0771288 MH
DATA PROCESSING
FT size 65536
Total time 2 hr, 46 min, 57 sec



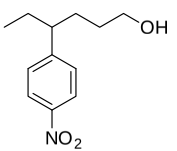
4ha

mei-02-188-ol-pure-C

Pulse Sequence: s2pul

Solvent: CDCl3
Ambient temperature
File: mei-02-188-ol-pure-C
INOVA-500 "nmr-sun"

Pulse 41.7 degrees
Acq. time 1.815 sec
Width 16501.7 Hz
1181 repetitions
OBSERVE C13, 75.4544591 MH
DECOUPLE H1, 300.0782156 MH
Power 37 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 65536
Total time 101 hr, 19 min, 47 sec



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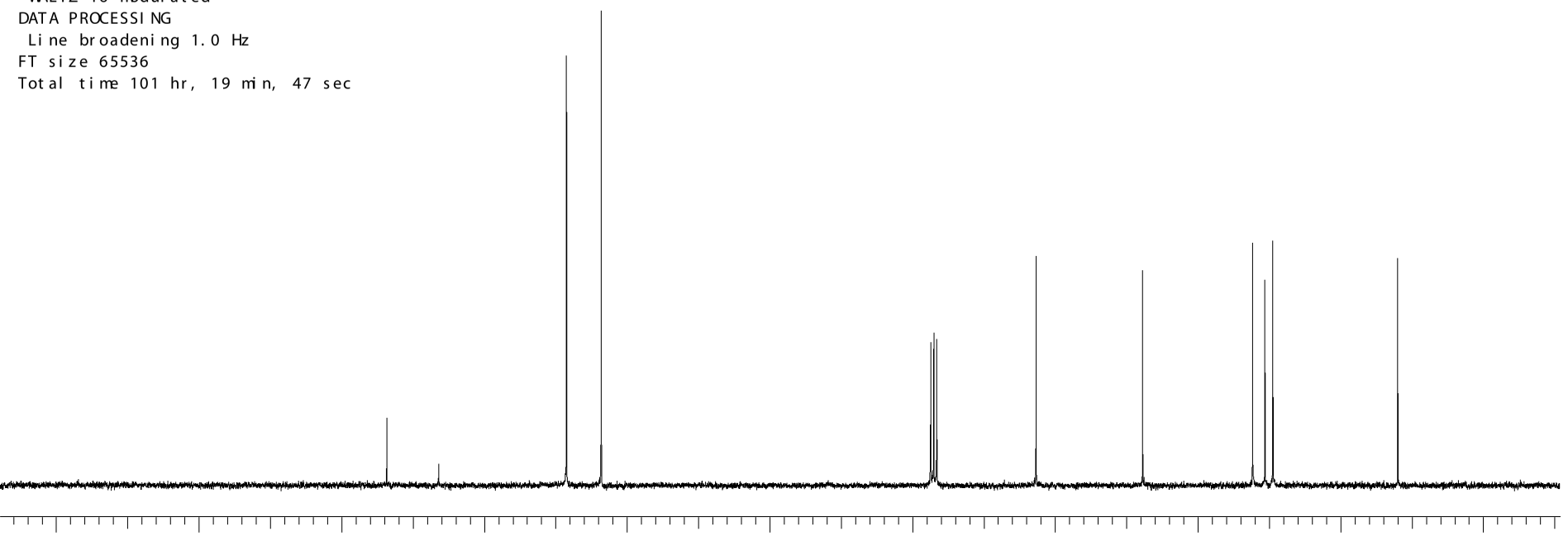

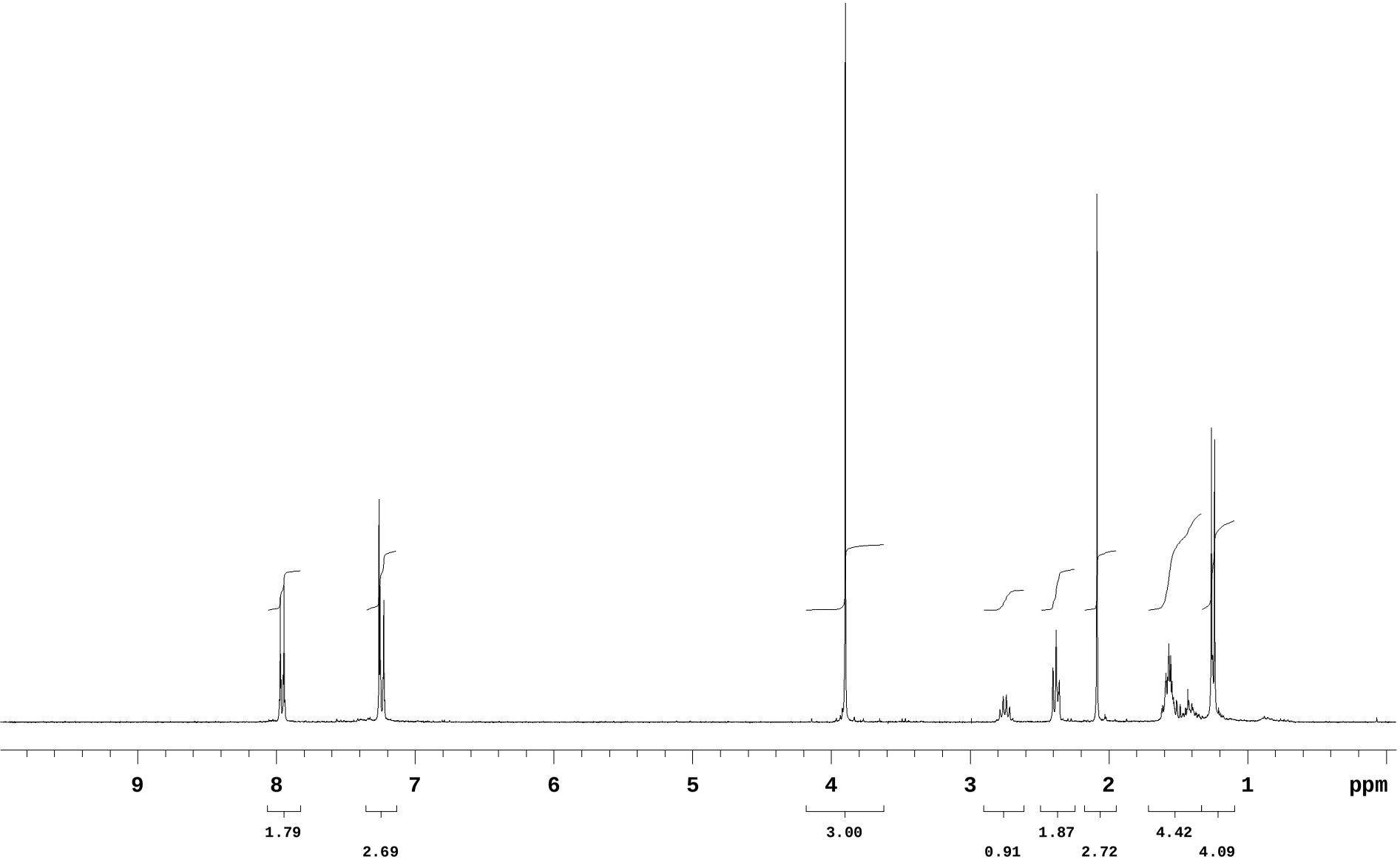
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7
6
5
4
3
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1
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3.00
0.91
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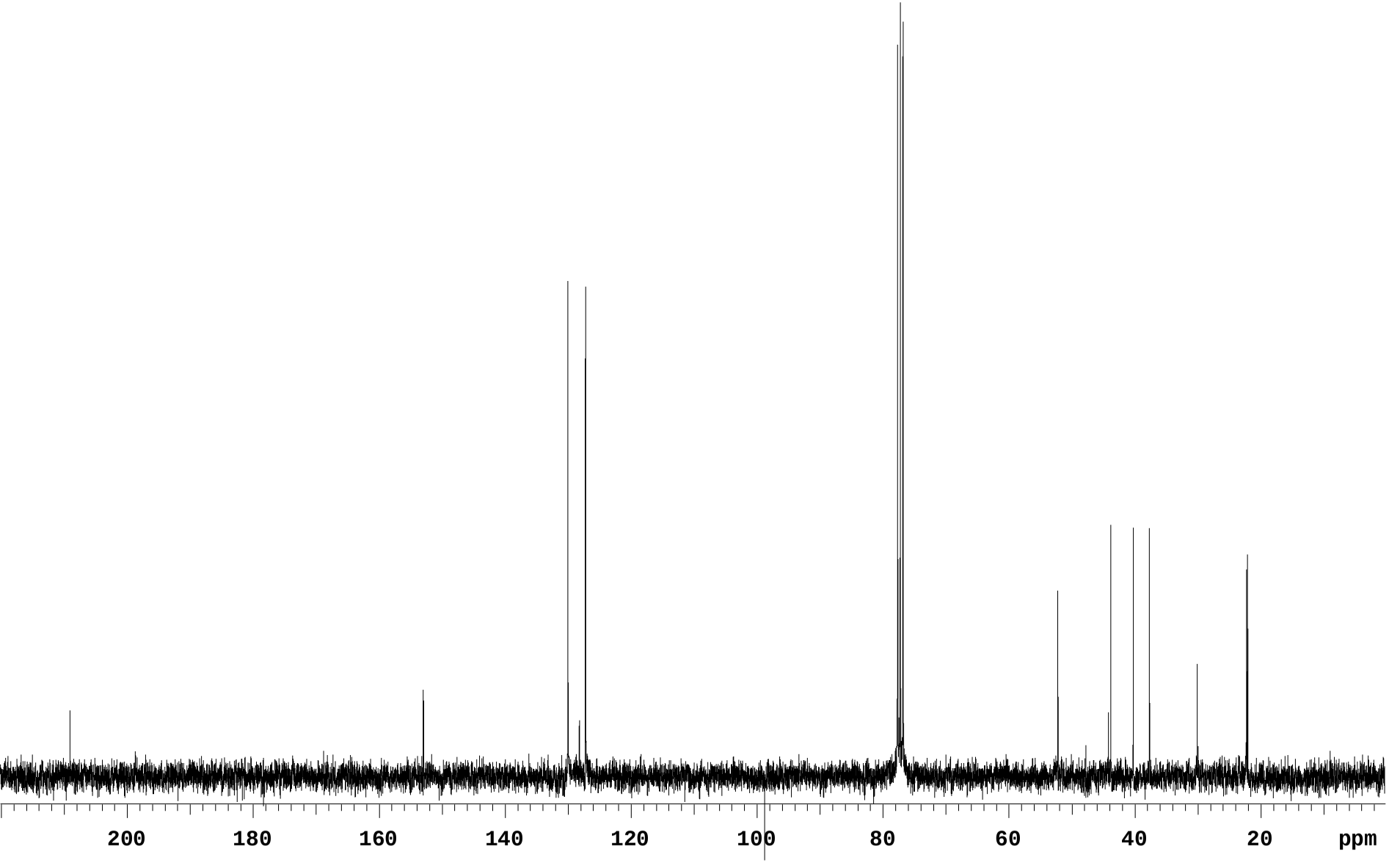
2.72
4.42
4.09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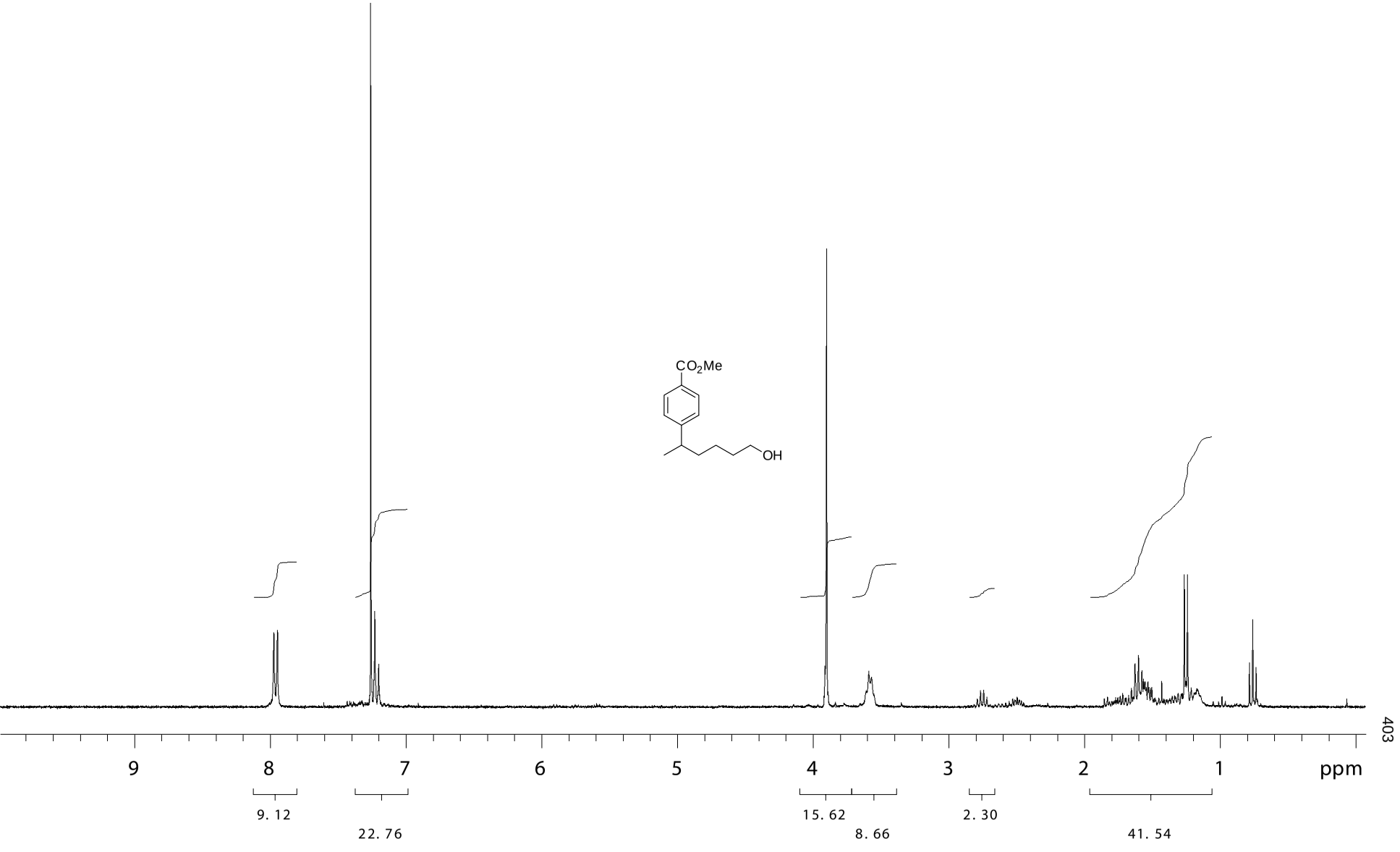
20
ppm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8
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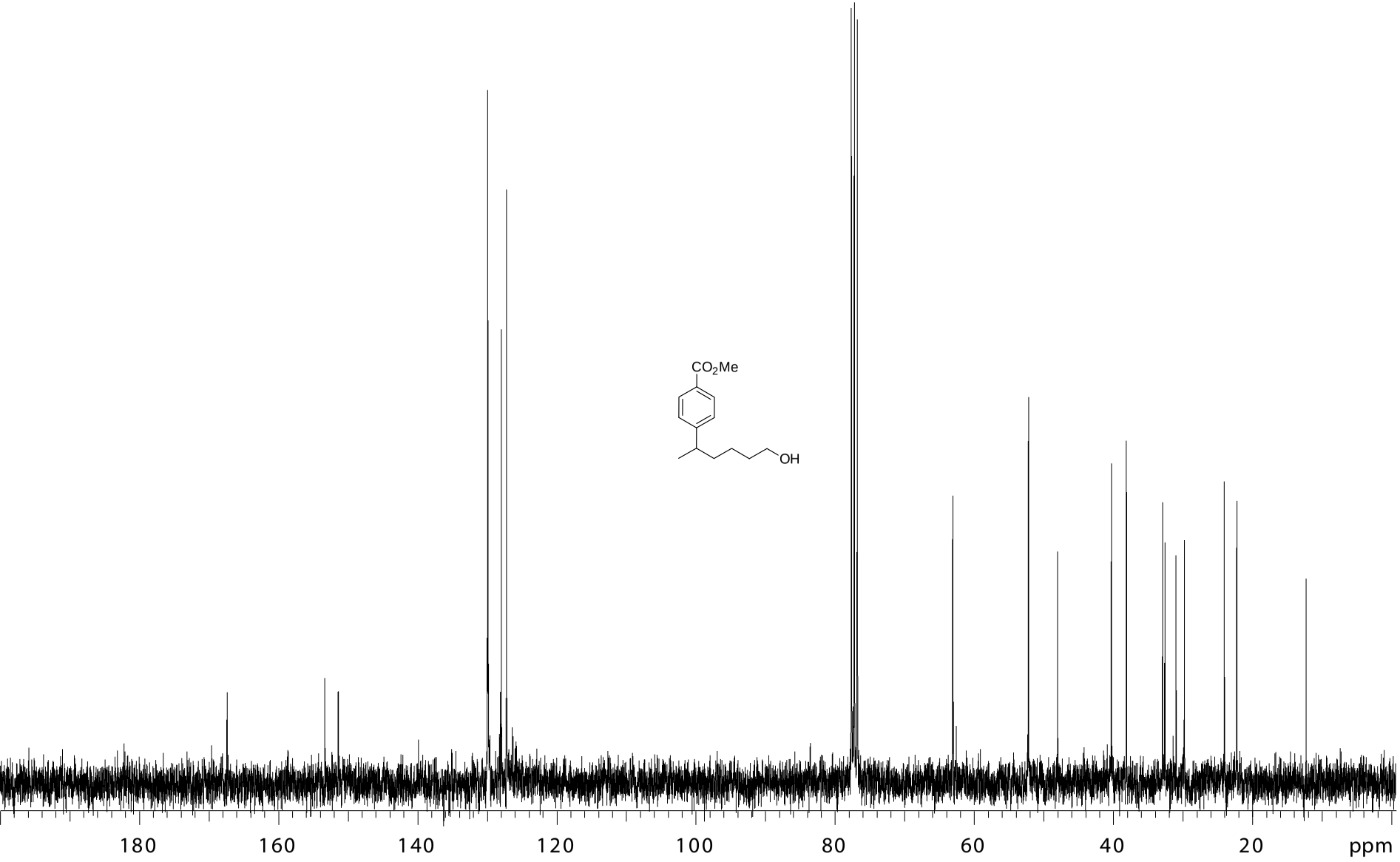
2
1
ppm
9. 12
22. 76
15. 62
8. 66
2. 30
41. 54


CO2Me
OH
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160
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120
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80
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20
ppm

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