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A Highly Enantioselective Brønsted Acid Catalyzed Cascade Reaction – Organocatalytic Transfer Hydrogenation of Quinolines and the Application in the Synthesis of Alkaloids

Magnus Rueping,[*] Andrey P. Antonchick and Thomas Theissmann

General: Unless otherwise noted, all commercially available compounds were used as provided without further purification. Solvents for chromatography were technical grade and distilled prior to use. Benzene used in reactions was reagent grade and distilled from P_2O_5. Analytical thin-layer chromatography (TLC) was performed on Merck silica gel aluminium plates with F-254 indicator, visualised by irradiation with UV light. Column chromatography was performed using silica gel Merck 60 (particle size 0.040-0.063 mm). Solvent mixtures are understood as volume/volume.

^{1}H-NMR and ^{13}C-NMR were recorded on a Bruker AM 250 spectrometer in $CDCl_3$. Data are reported in the following order: chemical shift (δ) in ppm; multiplicities are indicated br s (broadened singlet), s (singlet), d (doublet), t (triplet), m (multiplet)); coupling constants (J) are in Hertz (Hz). Mass spectra (MS-ESI) were conducted on Micromass/ Waters Qtof Ultima 3 instrument. IR spectra were recorded on a Jasco FT/IR-420 spectrometer and are reported in terms of frequency of absorption (cm^{-1}). Optical rotations were measured on a Perkin Elmer 241 polarimeter. The enantiomeric excesses were determined by HPLC analysis using a chiral stationary phase column (column, Daicel Co. CHIRALCEL OD-H; eluent: hexane/2-propanol). The chiral HPLC method were calibrated with the corresponding racemic mixtures. Chemical yields refer to pure isolated substances. The yields and enantiomeric excesses are given in table.

[*] E-mail: M.rueping@chemie.uni-frankfurt.de

General procedure: Quinoline (20 mg), phosphoric acid **1f** (1-5 mol%) and Hantzsch dihydropyridine **4** (2.4 equiv.) were suspended in benzene (2 mL) in a screw-capped vial and flushed with argon. The resulting mixture was allowed to stir at 60°C for 12-60 h. The solvent was removed under reduced pressure and purification of the crude product by column chromatography on silica gel (ethyl acetate/hexane) afforded the pure 1,2,3,4-tetrahydro-quinoline.

Physical data:

(*S*)-2-Phenyl-1,2,3,4-tetrahydroquinoline [Table 3, entry 1]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.40-7.14 (m, 5H, Ph), 7.01-6.86 (m, 2H, 5-H and 7-H), 6.57 (td, J(H,H)=7.4, 0.9 Hz, 1H, 6-H), 6.46 (dd, J(H,H)=1.0, 8.0 Hz, 1H, 8-H), 4.36 (dd, J(H,H)=3.4, 9.2 Hz, 1H, 2-H), 3.96 (br s, 1H, 1-H), 2.94-2.75 (m, 1H, 4-H), 2.66 (dt, J(H,H)=16.4, 4.8 Hz, 1H, 4-H), 2.12-1.82 ppm (m, 2H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=144.80, 144.72, 129.29, 128.56, 127.43, 126.89, 126.53, 120.87, 117.15, 113.96, 56.25, 30.97, 26.38 ppm; IR (KBr): $\tilde{\nu}$=3352, 2945, 2921, 1478, 1309, 1254, 762, 702 cm^{-1}; MS-ESI: m/z(%): 210.1 $[M+H]^+$; $[\alpha]_D^{RT}$=-37.7 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 95/5, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=18,98 min; minor enantiomer: t_R=25,43 min.

(*S*)-2-(2-Fluorophenyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 2]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=6.57 (td, J(H,H)=7.6, 1.7 Hz, 1H, Ar), 7.23-7.11 (m, 1H, Ar), 7.08-6.87 (m, 4H, Ar), 6.58 (td, J(H,H)=7.4, 0.9 Hz, 1H, 6-H), 6.49 (d, J(H,H)=7.9 Hz, 1H, 8-H), 4.77 (dd, J(H,H)=3.6, 8.1 Hz, 1H, 2-H), 3.93 (br s, 1H, 1-H), 2.91-2.73 (m, 1H, 4-H), 2.61 (dt, J(H,H)=16.4, 5.5 Hz, 1H, 4-H), 2.17-2.03 (m, 1H, 3-H), 2.01-1.84 ppm (m, 1H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=161.96, 158.05, 144.51, 131.76, 131.56, 129.34, 128.67, 128.54, 127.88, 127.81, 126.96, 124.29, 124.24, 120.89, 117.34, 115.50, 115.16, 114.09, 48.78, 48.73, 28.81, 25.70 ppm; IR (KBr): $\tilde{\nu}$=3406, 2925, 1607, 1585, 1483, 750 cm^{-1}; MS-ESI: m/z: 228.2 $[M+H]^+$; $[\alpha]_D^{RT}$=-31.0 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=13,10 min; minor enantiomer: t_R=14,95 min.

(*S*)-2-(2-Methylphenyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 3]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.47-7.37 (m, 1H, Ar), 7.19-7.05 (m, 3H, Ar), 6.99-6.88 (m,2H, 5-H and 7-H), 6.58 (td, J(H,H)=7.4, 0.9 Hz, 1H, 6-H), 6.50 (dd, J(H,H)= 1.0, 8.0 Hz, 1H, 8-H), 4.60 (dd, J(H,H)=3.1, 9.1 Hz, 1H, 2-H), 3.86 (br s, 1H, 1-H), 2.95-2.77 (m, 1H, 4-H), 2.68 (dt, J(H,H)=16.3, 4.8 Hz, 1H, 4-H), 2.31 (s, 3H, CH_3), 2.11-1.97 (m, 1H, 3-H), 1.93-1.75 ppm (m, 1H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=145.05,

142.55, 134.74, 130.49, 129.30, 127.03, 126.88, 126.40, 125.98, 120.83, 117.06, 113.98, 52.15, 29.19, 26.54, 19.04 ppm; IR (KBr): $\tilde{\nu}$=3412, 2963, 2921, 2850, 1607, 1497, 1314, 1275, 760, 745 cm^{-1}; MS-ESI: m/z: 224.2 $[M+H]^+$; $[\alpha]_D^{RT}$=-31.0 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=17,26 min; minor enantiomer: t_R=20,37 min.

(*S*)-2-(2,4-Dimethylphenyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 4]

^1H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.33-7.27 (m, 1H, Ar), 6.99-6.88 (m, 4H, Ar), 6.56 (td, J(H,H)=7.4, 1.0 Hz, 1H, 6-H), 6.48 (dd, J(H,H)=8.0, 1.0 Hz, 1H, 8-H), 4.33 (dd, J(H,H)=3.2, 9.2 Hz, 1H, 2-H), 3.82 (br s, 1H, 1-H), 2.94-2.77 (m, 1H, 4-H), 2.68 (dt, J(H,H)=16.3, 4.7 Hz, 1H, 4-H), 2.27 (s, 3H, CH_3), 2.24 (s, 3H, CH_3), 2.08-1.93 (m, 1H, 3-H), 1.92-1.74 ppm (m, 1H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=145.12, 139.57, 136.62, 134.64, 131.28, 129.30, 127.05, 126.85, 125.99, 120.84, 116.99, 113.96, 52.00, 29.32, 26.65, 20.95, 18.97 ppm; IR (KBr): $\tilde{\nu}$=3349, 2957, 2925, 2854, 1604, 1583, 1304, 1097, 829, 753 cm^{-1}; MS-ESI: m/z: 238.2 $[M+H]^+$; $[\alpha]_D^{RT}$=-28.4 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=15,17 min; minor enantiomer: t_R=16,87 min.

(*S*)-2-(2-Naphthyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 5]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.80-7.69 (m, 4H, Ar), 7.47-7.34 (m, 3H, Ar), 7.00-6.91 (m, 2H, 5-H and 7-H), 6.59 (td, J(H,H)=7.4, 1.0 Hz, 1H, 6-H), 6.50 (d, J(H,H)=7.6 Hz, 1H, 8-H), 4.52 (dd, J(H,H)=3.5, 9.0 Hz, 1H, 2-H), 4.05 (br s, 1H, 1-H), 2.96-2.79 (m, 1H, 4-H), 2.68 (dt, J(H,H)=16.3, 4.8 Hz, 1H, 4-H), 2.18-1.91 ppm (m, 2H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=144.72, 142.24, 133.44, 132.99, 129.35, 128.37, 127.87, 127.70, 126.98, 126.18, 125.79, 125.12, 124.89, 120.99, 117.26, 114.06, 56.38, 30.98, 26.45 ppm; IR (KBr): $\tilde{\nu}$=3364, 2918, 2852, 1604, 1581, 1502, 1482, 824, 748 cm^{-1}; MS-ESI: m/z: 260.2 $[M+H]^+$; $[\alpha]_D^{RT}$=-26.1 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=24,87 min; minor enantiomer: t_R=47,63 min.

(*S*)-2-(3-Bromophenyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 6]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.50-7.45 (m, 1H, Ar), 7.37-7.29 (m, 1H, Ar), 7.27-7.20 (m, 1H, Ar), 7.19-7.08 (m, 1H, Ar), 6.99-6.87 (m,2H, 5-H and 7-H), 6.59 (td, J(H,H)=7.4, 1.0 Hz, 1H, 6-H), 6.48 (d, J(H,H)=8.0 Hz, 1H, 8-H), 4.33 (dd, J(H,H)=3.4, 9.1 Hz, 1H, 2-H), 3.94 (br s, 1H, 1-H), 2.92-2.74 (m, 1H, 4-H), 2.63 (dt, J(H,H)=16.3, 4.8 Hz, 1H, 4-H), 2.10-1.79 ppm (m, 2H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=147.27, 144.32, 130.53, 130.18, 129.67, 129.32, 127.01,

125.25, 122.70, 120.81, 117.49, 114.12, 55.77, 31.00, 26.17 ppm; IR (KBr): $\tilde{\nu}$=3387, 2923, 1607, 1585, 1475, 1310, 783, 748, 696 cm^{-1}; MS-ESI: m/z: 290.1 $[M+H]^+$ ($C_{15}H_{15}{}^{81}BrN$), 288.1 $[M+H]^+$ ($C_{15}H_{15}{}^{79}BrN$); $[\alpha]_D^{RT}$=-46.6 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=18,28 min; minor enantiomer: t_R=30,48 min.

(*S*)-2-[4-(Trifluoromethyl)phenyl]-1,2,3,4-tetrahydroquinoline [Table 3, entry 7]

^1H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.58-7.48 (m, 2H, Ar), 7.47-7.38 (m, 2H, Ar), 7.02-6.88 (m,2H, 5-H and 7-H), 6.63 (td, J(H,H)=7.4, 1.0 Hz, 1H, 6-H), 6.50 (d, J(H,H)= 7.7 Hz, 1H, 8-H), 4.44 (dd, J(H,H)=3.3, 8.8 Hz, 1H, 2-H), 4.04 (br s, 1H, 1-H), 2.92-2.73 (m, 1H, 4-H), 2.62 (dt, J(H,H)=16.4, 5.0 Hz, 1H, 4-H), 2.15-1.80 ppm (m, 2H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=148.90, 144.17, 129.36, 127.06, 126.90, 125.63, 125.57, 125.51, 125.45, 120.83, 117.64, 114.19, 55.81, 30.85, 25.95 ppm; IR (KBr): $\tilde{\nu}$=3406, 2925, 1497, 1326, 1166, 1123, 1067, 749 cm^{-1}; MS-ESI: m/z: 278.2 $[M+H]^+$; $[\alpha]_D^{RT}$=-31.8 (c=1 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=17,83 min; minor enantiomer: t_R=33,32 min.

(*S*)-2-(1,1'-Biphenyl-4-yl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 8]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.55-7.47 (m, 4H, Ar), 7.42-7.22 (m, 5H, Ar), 7.00-6.90 (m, 2H, 5-H and 7-H), 6.59 (td, J(H,H)=7.3, 1.0 Hz, 1H, 6-H), 6.48 (dd, J(H,H)=8.1, 1.0 Hz, 1H, 8-H), 4.41 (dd, J(H,H)=3.4, 9.1 Hz, 1H, 2-H), 3.99 (br s, 1H, 1-H), 2.96-2.79 (m, 1H, 4-H), 2.68 (dt, J(H,H)=16.3, 4.8 Hz, 1H, 4-H), 2.16-1.87 ppm (m, 2H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=144.70, 143.90, 140.87, 140.44, 129.34, 128.81, 127.33, 127.29, 127.10, 127.01, 126.95, 120.91, 117.24, 114.03, 55.99, 30.98, 26.40 ppm; IR (KBr): $\tilde{\nu}$=3364, 3029, 2961, 2925, 2853, 1604, 1581, 1483, 1311, 766, 747, 692 cm^{-1}; MS-ESI: m/z: 285.9 $[M]^+$; $[\alpha]_D^{RT}$=-13.8 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 80/20, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=22,26 min; minor enantiomer: t_R=36,93 min.

(*S*)-2-(4-Methoxyphenyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 9]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.27-7.18 (m, 2H, Ar), 6.98-6.87 (m, 2H, 5-H and 7-H), 6.85-6.76 (m, 2H, Ar), 6.56 (td, J(H,H)=7.3, 0.7 Hz, 1H, 6-H), 6.44 (dd, J(H,H)=8.2, 0.9 Hz, 1H, 8-H), 4.30 (dd, J(H,H)=3.4, 9.4 Hz, 1H, 2-H), 3.92 (br s, 1H, 1-H), 3.73 (s, 3H, CH_3), 2.93-2.76 (m, 1H, 4-H), 2.65 (dt, J(H,H)=16.4, 4.6 Hz, 1H, 4-H), 2.07-1.79 ppm (m, 2H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=158.95, 144.82, 136.88, 129.28, 127.63, 126.85, 120.87, 117.10, 113.95, 113.91, 55.72,

55.32, 31.10, 26.55 ppm; IR (KBr): $\tilde{\nu}$=3365, 2924, 2839, 1604, 1516, 1485, 1250, 1032, 831, 746 cm^{-1}; MS-ESI: m/z: 239.8 $[M]^+$; $[\alpha]_D^{RT}$=-18.6 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=16,06 min; minor enantiomer: t_R=26,44 min.

(*S*)-2-(2-Furyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 10]

^1H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.31-7.26 (m, 1H, Ar), 6.98-6.85 (m,2H, 5-H and 7-H), 6.57 (t, J(H,H)=7.4 Hz, 1H, 6-H), 6.47 (d, J(H,H)= 7.8 Hz, 1H, 8-H), 6.28-6.22 (m, 1H, Ar), 6.15-6.09 (m, 1H, Ar),4.45 (dd, J(H,H)=3.7, 8.0 Hz, 1H, 2-H), 4.04 (br s, 1H, 1-H), 2.87-2.60 (m, 2H, 4-H), 2.20-1.97 ppm (m, 2H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=156.97, 143.78, 141.64, 129.28, 126.90, 120.99, 117.58, 114.37, 110.19, 105.22, 49.71, 26.92, 25.55 ppm; IR (KBr): $\tilde{\nu}$=3401, 2925, 2852, 1607, 1586, 1484, 1311, 1011, 746 cm^{-1}; MS-ESI: m/z: 220.1 $[M+H]^+$; $[\alpha]_D^{RT}$=+39.8 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=14,19 min; minor enantiomer: t_R=15,45 min.

(*S*)-2-(Chloromethyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 11]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=6.98-6.85 (m, 2H, 5-H and 7-H), 6.58 (td, J(H,H)=7.3, 0.9 Hz, 1H, 6-H), 6.47 (d, J(H,H)=7.9 Hz, 1H, 8-H), 4.18 (br s, 1H, 1-H), 3.61-3.36 (m, 3H, 2-H and CH_2Cl), 2.86-2.59 (m, 2H, 4-H), 2.00-1.85 (m, 1H, 3-H), 1.79-1.61 ppm (m, 1H, 3-H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=143.50, 129.19, 127.01, 120.88, 117.71, 114.50, 52.51, 48.92, 25.89, 25.39 ppm; IR (KBr): $\tilde{\nu}$=3396, 2945, 2925, 2844, 1606, 1487, 1309, 750 cm^{-1}; MS-ESI: m/z: 183.7 $[M]^+$ ($C_{10}H_{13}{}^{37}ClN$), 181.6 $[M]^+$($C_{10}H_{13}{}^{35}ClN$); $[\alpha]_D^{RT}$=+73.2 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=13,35 min; minor enantiomer: t_R=15,50 min.

(*R*)-2-Butyl-1,2,3,4-tetrahydroquinoline

[Table 3, entry 12]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=6.94-6.82 (m, 2H, 5-H and 7-H), 6.52 (td, J(H,H)=7.4, 1.0 Hz, 1H, 6-H), 6.39 (dd, J(H,H)=1.1, 8.2 Hz, 1H, 8-H), 3.68 (br s, 1H, 1-H), 3.22-3.09 (m, 1H, 2-H), 2.82-2.57 (m, 2H, 4-H), 1.95-1.83 (m, 1H), 1.62-1.15 (m, 7H), 0.86 ppm (t, J(H,H)=6.8 Hz,3H, CH_3); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=144.76, 129.26, 126.71, 121.41, 116.89, 114.04, 51.60, 36.45, 28.15, 27.94, 26.46, 22.87, 14.11 ppm; IR (KBr): $\tilde{\nu}$=3408, 2926, 2855, 1607, 1486, 1310, 745 cm^{-1}; MS-ESI: m/z(%): 190.2 $[M+H]^+$; $[\alpha]_D^{RT}$=+71.1 (c=1.0 in $CHCl_3$); HPLC

conditions: n-hexane/2-propanol = 95/5, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=9,66 min; minor enantiomer: t_R=10,79 min.

(*R*)-2-Pentyl-1,2,3,4-tetrahydroquinoline

[Table 3, entry 13]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=6.93-6.82 (m, 2H, 5-H and 7-H), 6.52 (t, J(H,H)=7.3 Hz, 1H, 6-H), 6.40 (d, J(H,H)=8.1 Hz, 1H, 8-H), 3.68 (br s, 1H, 1-H), 3.22-3.10 (m, 1H, 2-H), 2.82-2.58 (m, 2H, 4-H), 1.95-1.83 (m, 1H), 1.63-1.14 (m, 9H), 0.84 ppm (t, J(H,H)=6.6 Hz,3H, CH_3); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=144.76, 129.26, 126.70, 121.41, 116.88, 114.03, 51.61, 36.71, 31.98, 28.15, 26.46, 25.42, 22.67, 14.07 ppm; IR (KBr): $\tilde{\nu}$=3408, 2925, 2853, 1607, 1585, 1485,1310, 745 cm^{-1}; MS-ESI: m/z: 204.2 $[M+H]^+$; $[\alpha]_D^{RT}$=+51.4 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 95/5, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=8,63 min; minor enantiomer: t_R=9,41 min.

(*R*)-2-(2-Phenylethyl)-1,2,3,4-tetrahydroquinoline

[Table 3, entry 14]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.27-7.07 (m, 5H, Ph), 6.94-6.83 (m, 2H, 5-H and 7-H), 6.53 (t, J(H,H)=7.3 Hz, 1H, 6-H), 6.37 (d, J(H,H)=8.1 Hz, 1H, 8-H), 3.68 (br s, 1H, 1-H), 3.29-3.17 (m, 1H, 2-H), 2.79-2.58 (m, 4H), 1.99-1.85 (m, 1H), 1.82-1.70 (m, 2H), 1.69-1.50 ppm (m, 1H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=144.54, 141.87, 129.27, 128.51, 128.38, 126.76, 126.00, 121.31, 117.05, 114.15, 51.15, 38.29, 32.21,

28.02, 26.24 ppm; IR (KBr): $\tilde{\nu}$=3405, 2923, 2848, 1605, 1495, 1309, 747, 699 cm^{-1}; MS-ESI: m/z: 238.2 $[M+H]^+$; $[\alpha]_D^{RT}$=+63.9 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 90/10, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=17,24 min; minor enantiomer: t_R=18,31 min.

(*R*)-2-[2-(1,3-Benzodioxol-5-yl)ethyl]-1,2,3,4-tetrahydroquinoline [Table 3, entry 15]

^1H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=6.93-6.83 (m, 2H, 5-H and 7-H), 6.70-6.47 (m, 4H, Ar), 6.38 (dd, J(H,H)=8.0, 1.1 Hz, 1H, 8-H), 5.84 (s, 2H, O-CH_2-O),3.68 (br s, 1H, 1-H), 3.27-3.14 (m, 1H, 2-H), 2.82-2.53 (m, 4H), 1.97-1.84 (m, 1H), 1.76-1.65 (m, 2H), 1.64-1.49 ppm (m, 1H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=147.67, 145.72, 144.50, 135.64, 129.26, 126.74, 121.29, 121.02, 117.05, 114.14, 108.79, 108.23, 100.82, 50.97, 38.48, 31.87, 27.97, 26.21 ppm; IR (KBr): $\tilde{\nu}$=3408, 2922, 2850, 1502, 1487, 1246, 1038, 748 cm^{-1}; MS-ESI: m/z: 281.8 $[M]^+$; $[\alpha]_D^{RT}$=+50.7 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 80/20, flow rate = 0.6 mL min^{-1}, major enantiomer: t_R=18,96 min; minor enantiomer: t_R=24,20 min.

(*R*)-2-[2-(3,4-Dimethoxyphenyl)ethyl]-1,2,3,4-tetrahydroquinoline [Table 3, entry 16]

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=6.93-6.84 (m, 2H, 5-H and 7-H), 6.76-6.63 (m, 3H, Ar), 6.53 (td, J(H,H)=7.4, 0.8 Hz, 1H, 6-H), 6.37 (dd, J(H,H)=8.1, 1.1 Hz, 1H, 8-H), 3.80 (s, 3H, CH_3), 3.79 (s, 3H, CH_3), 3.70 (br s, 1H, 1-H), 3.30-3.17 (m, 1H, 2-H), 2.82-2.55 (m, 4H), 1.99-1.85 (m, 1H), 1.81-1.67 (m, 2H), 1.68-1.51 ppm (m, 1H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=148.93, 147.29, 144.50, 134.45, 129.25, 126.74, 121.28, 120.11, 117.03, 114.12, 111.61, 111.30, 55.95, 55.85, 51.21, 38.43, 31.83, 28.02, 26.20 ppm; IR (KBr): $\tilde{\nu}$=3390, 2931, 2837, 1606, 1516, 1500, 1259, 1236, 1030, 746 cm^{-1}; MS-ESI: m/z: 297.3 $[M]^+$; $[\alpha]_D^{RT}$=+40.0 (c=1.0 in $CHCl_3$); HPLC conditions: n-hexane/2-propanol = 65/35, flow rate = 1.0 mL min^{-1}, major enantiomer: t_R=11,44 min; minor enantiomer: t_R=12,81 min.

(*R*)-1-Methyl-2-pentyl-1,2,3,4-tetrahydroquinoline

^{1}H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.16 (t, J(H,H)=7.8 Hz, 1H, 7-H), 7.04 (d, J(H,H)=7.3 Hz, 1H, 5-H), 6.65 (t, J(H,H)=7.3 Hz, 1H, 6-H), 6.60 (d, J(H,H)=8.2 Hz, 1H, 8-H),3.37-3.23 (m, 1H, 2-H), 3.00 (s, 3H, N-CH_3), 2.97-2.78 (m, 1H, 4-H), 2.72 (td, J(H,H)=16.2, 4.3 Hz, 1H, 4-H), 2.02-1.87 (m, 2H), 1.78-1.57 (m, 1H), 1.57-1.25 (m, 7H), 0.98 ppm (t, J(H,H)=6.6 Hz,3H, CH_3); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=145.44, 128.68, 127.10, 121.87, 115.23, 110.44, 59.00, 38.01, 32.11, 31.24, 25.82, 24.46, 23.63, 22.75, 14.13 ppm; IR (KBr): $\tilde{\nu}$=2927, 2856, 1603,

1500, 1215, 742 cm^{-1}; MS-ESI: m/z: 217.8 $[M]^+$; $[\alpha]_D^{RT}$=-6.9 (c=1.0 in $CHCl_3$).

(*R*)-2-[2-(3,4-Dimethoxyphenyl)ethyl]-1-methyl-1,2,3,4-tetrahydroquinoline

^1H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.13 (t, J(H,H)=7.7 Hz, 1H, 7-H), 7.03 (d, J(H,H)=7.1 Hz, 1H, 5-H), 6.88-6.73 (m, 3H, Ar), 6.64 (t, J(H,H)=7.3 Hz, 1H, 6-H), 6.58 (d, J(H,H)=8.1 Hz, 1H, 8-H), 3.92 (s, 3H, CH_3), 3.90 (s, 3H, CH_3), 3.40-3.28 (m, 1H, 2-H), 2.97 (s, 3H, N-CH_3), 2.94-2.82 (m, 1H), 2.80-2.50 (m, 3H), 2.07-1.88 (m, 3H), 1.87-1.69 ppm (m, 1H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=148.93, 147.25, 145.35, 134.69, 128.75, 127.18, 121.76, 120.12, 115.45, 111.62, 111.32, 110.66, 58.46, 55.98, 55.92, 38.16, 33.13, 31.98, 24.45, 23.64 ppm; IR (KBr): $\tilde{\nu}$=2933, 2835, 1603, 1516, 1498, 1261, 1236, 1155, 1030, 746 cm^{-1}; MS-ESI: m/z: 311.9 $[M]^+$; $[\alpha]_D^{RT}$=+22.0 (c=1.0 $CHCl_3$).

(*R*)-2-[2-(1,3-Benzodioxol-5-yl)ethyl]-1-methyl-1,2,3,4-tetrahydroquinoline

^1H NMR (250 MHz, $CDCl_3$, 25 °C, TMS): δ=7.14 (t, J(H,H)=7.7 Hz, 1H, 7-H), 7.03 (d, J(H,H)=7.3 Hz, 1H, 5-H), 6.81-6.61 (m, 4H, Ar and 6-H), 6.58 (d, J(H,H)=8.1 Hz, 1H, 8-H),5.97 (s, 2H, O-CH_2-O), 3.39-3.27 (m, 1H, 2-H), 2.97 (s, 3H, N-CH_3), 2.95-2.47 (m, 4H), 2.05-1.85 (m, 3H), 1.84-1.66 ppm (m, 1H); ^{13}C NMR (62.5 MHz, $CDCl_3$, 25 °C, TMS): δ=147.66, 145.66, 145.34, 135.88, 128.72, 127.16, 121.76, 120.99, 115.46, 110.66, 108.76, 108.21, 100.82,

58.26, 38.09, 33.18, 32.07, 24.41, 23.59 ppm; IR (KBr): $\tilde{\nu}$=2933, 2891, 1603, 1500, 1442, 1244, 1039, 935, 808, 746 cm^{-1}; MS-ESI: *m/z*: 295.9 $[M]^+$; $[\alpha]_D^{RT}$=+26.4 (*c*=1.0 in $CHCl_3$).

Determination of Configuration:

The absolute (*S*)-configuration of the 2-aryl tetrahydro-quinolines are based on an X-ray crystal structure of 2-(3-Bromophenyl)-tetrahydroquinoline (See Figure 1).

Our corresponding optical rotation data are not in agreement with the previously reported data (W.-B. Wang, S.-M. Lu, P.-Y. Yang, X.-W. Han, Y.-G. Zhou, *J. Am. Chem. Soc.* **2003**, *125*, 10536) suggesting that the earlier reported data *not* correct.

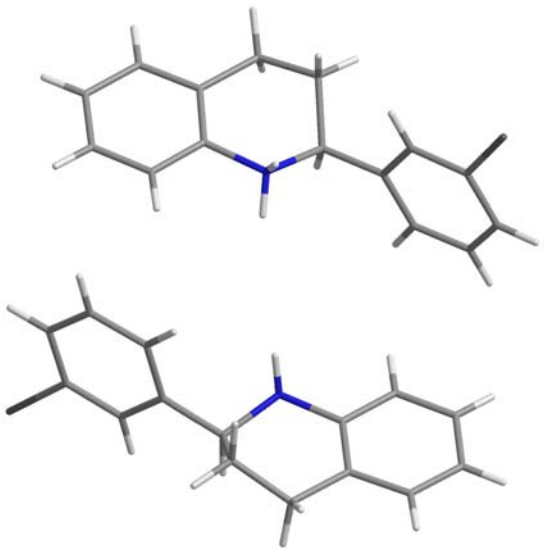
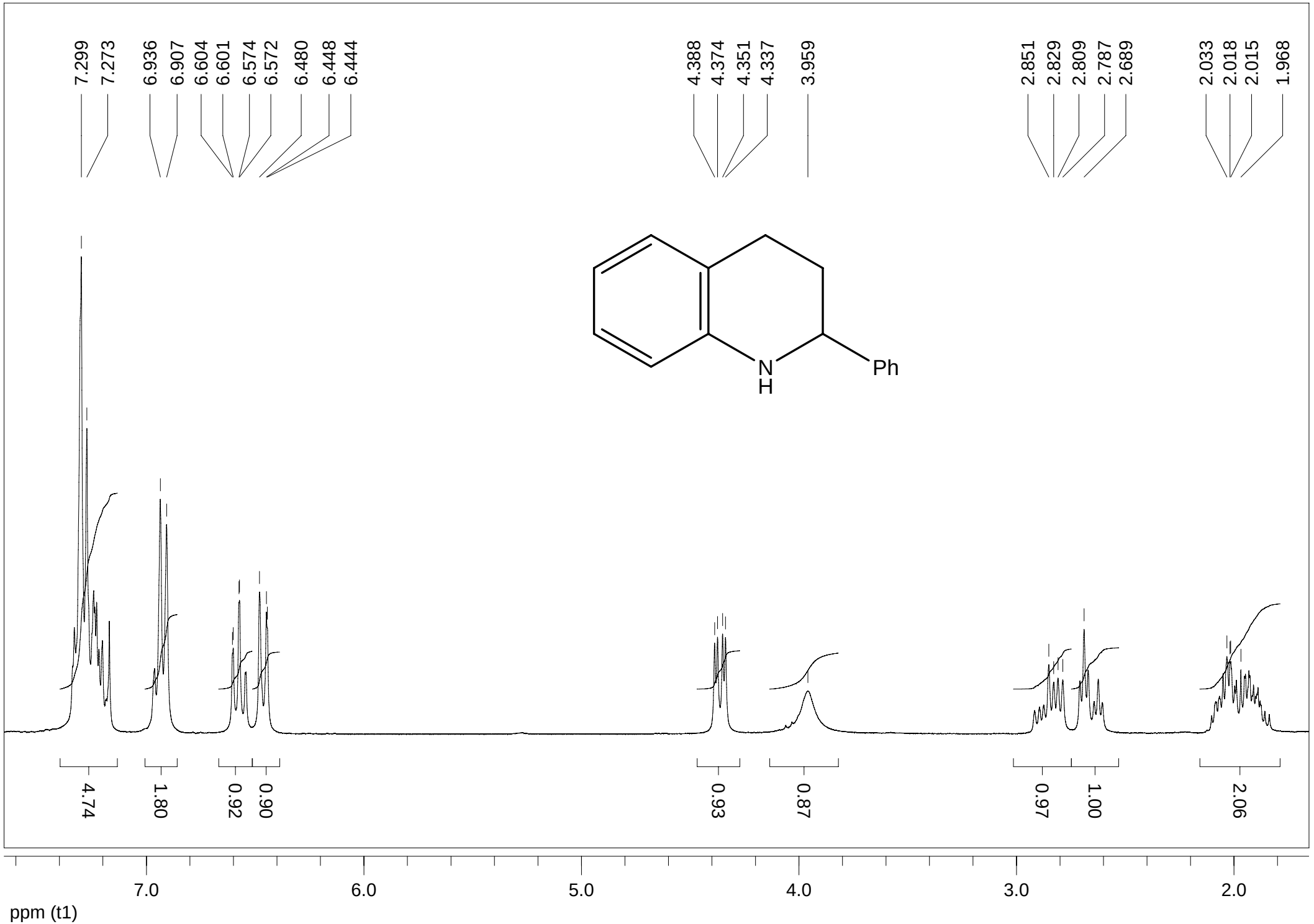
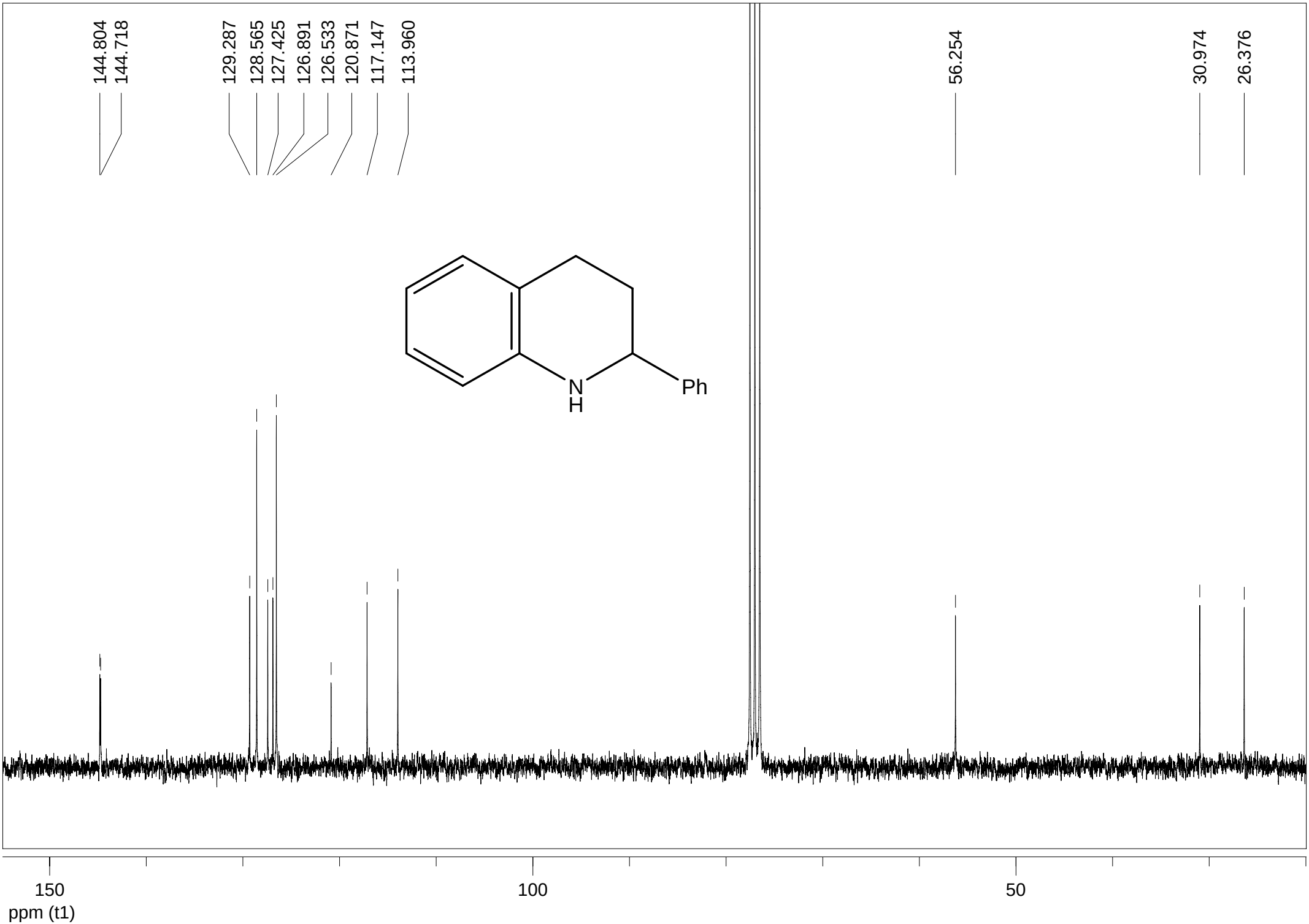


Figure 1. X-ray crystal structure of 2-(3-Bromophenyl)-tetrahydroquinoline

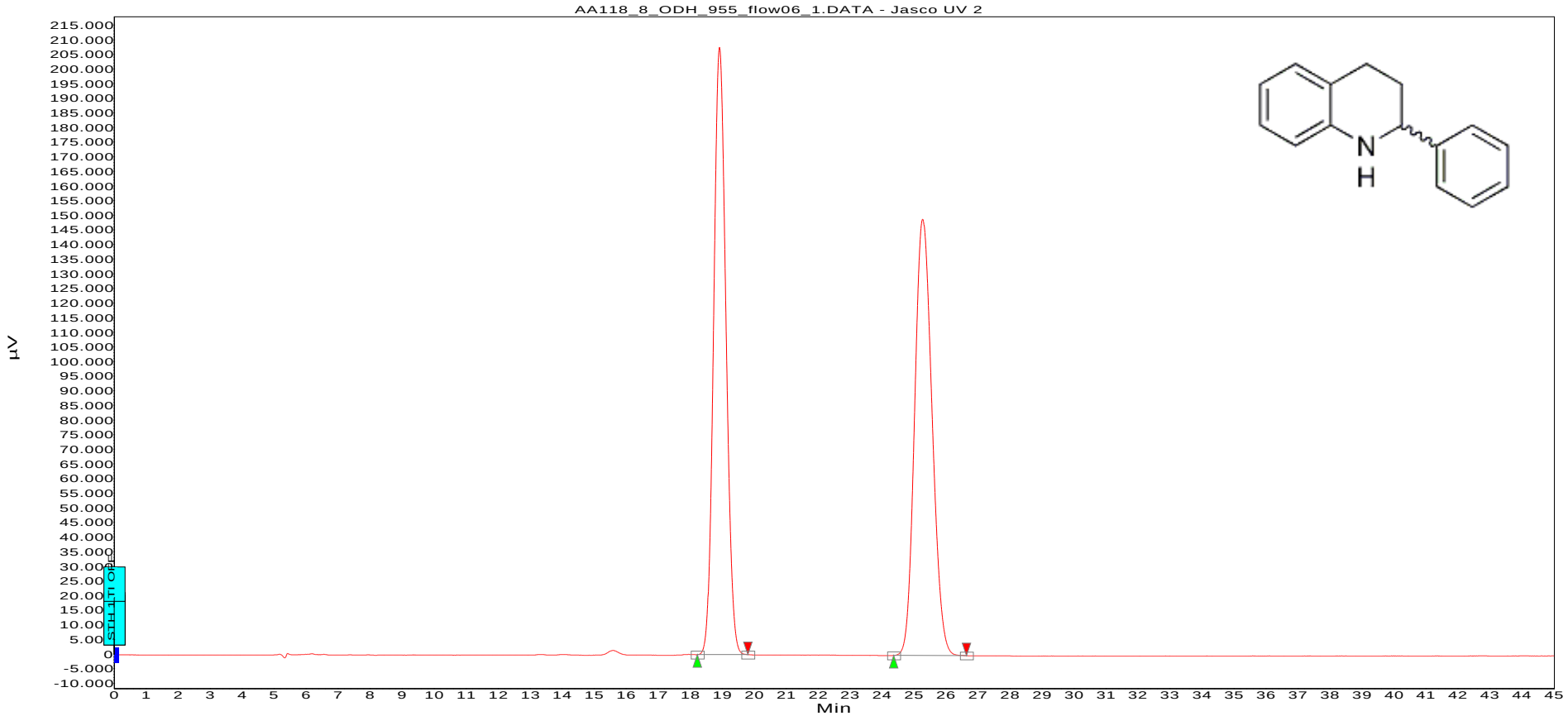

7.299
7.273
6.936
6.907
6.604
6.601
6.574
6.572
6.480
6.448
6.444
4.388
4.374
4.351
4.337
3.959
2.851
2.829
2.809
2.787
2.689
2.033
2.018
2.015
1.968
N
H
Ph
4.74
1.80
0.92
0.90
0.93
0.87
0.97
1.00
2.06
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


144.804
144.718
129.287
128.565
127.425
126.891
126.533
120.871
117.147
113.960
56.254
30.974
26.376
N
H
Ph
150
100
50
ppm (t1)

2-Phenyl-1,2,3,4-tetrahydroquinoline

Method: ODH_955_flow06_acq45
Data file: AA118_8_ODH_955_flow06_1.DATA
Date: 09.11.2005 22:48:06

Column: ODH
Flow: 0.6 mL/min
Run time: 45,00 min

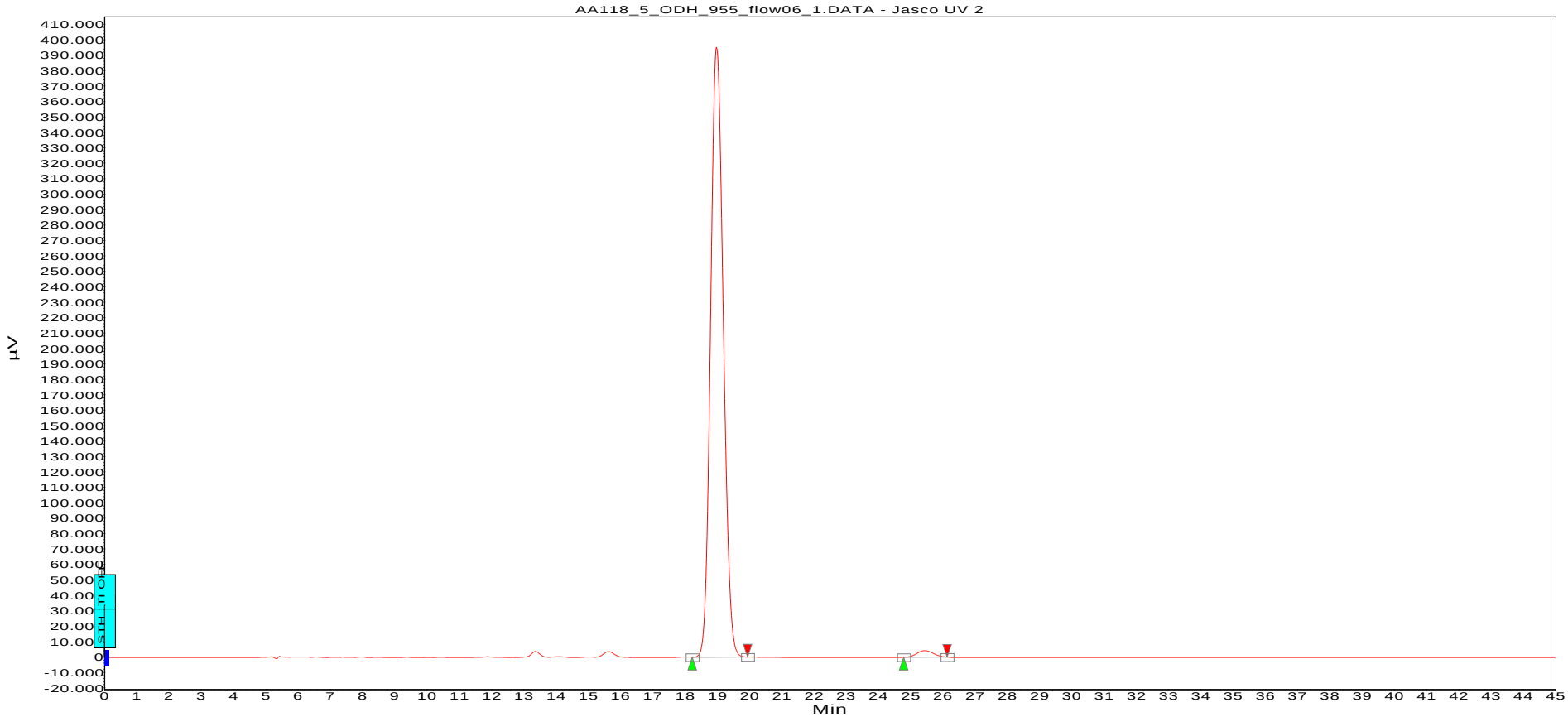


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	18,223	18,917	19,804	49,857
2	24,360	25,267	26,637	50,143
Total				100,000

2-Phenyl-1,2,3,4-tetrahydroquinoline

Method: ODH_955_flow06_acq45
Data file: AA118_5_ODH_955_flow06_1.DATA
Date: 09.11.2005 23:35:51

Column: ODH
Flow: 0.6 mL/min
Run time: 45,00 min



Index	Start	Time	End	Area %
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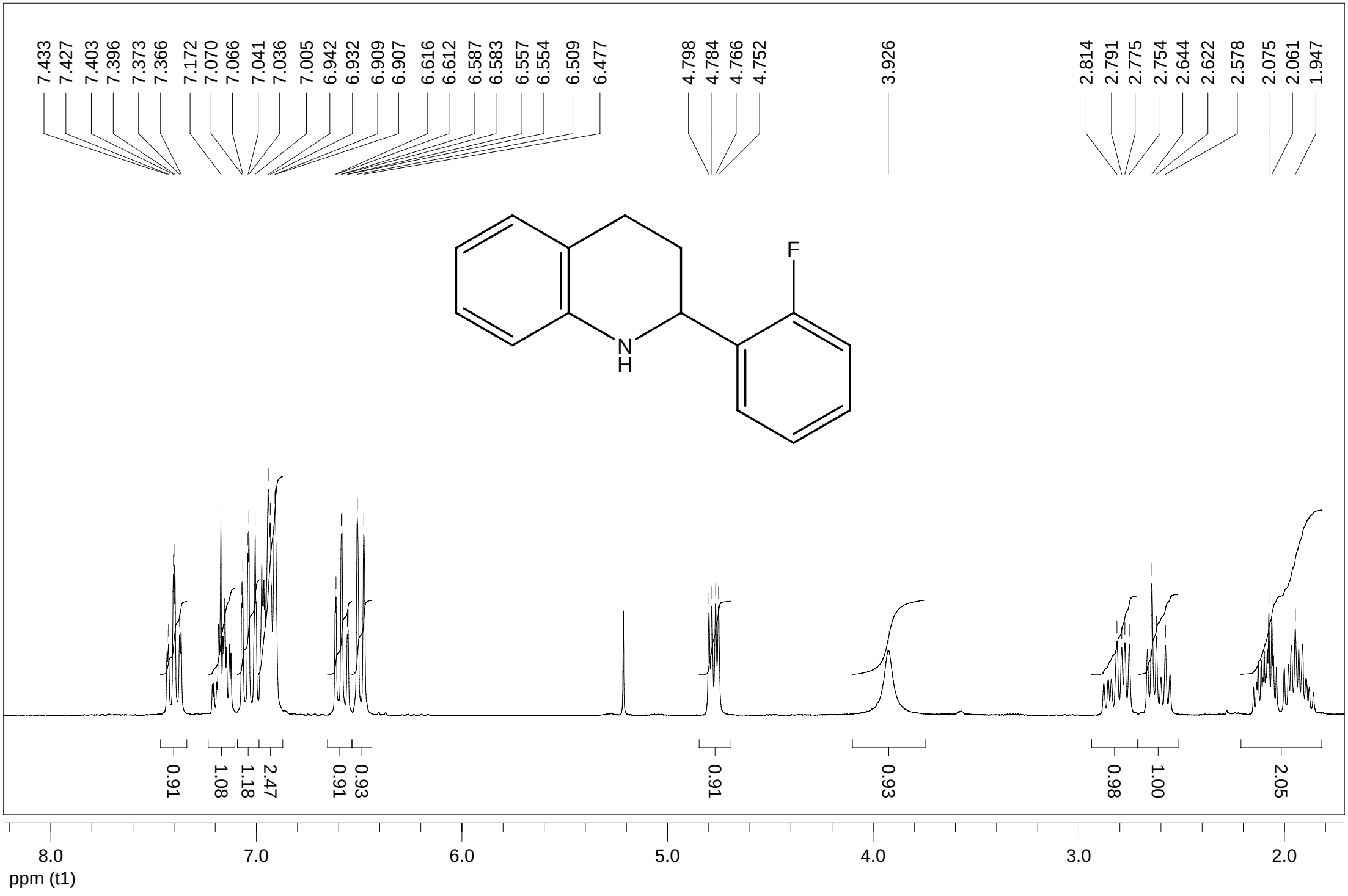
2	24,778	25,433	26,126	1,411
Total				100,000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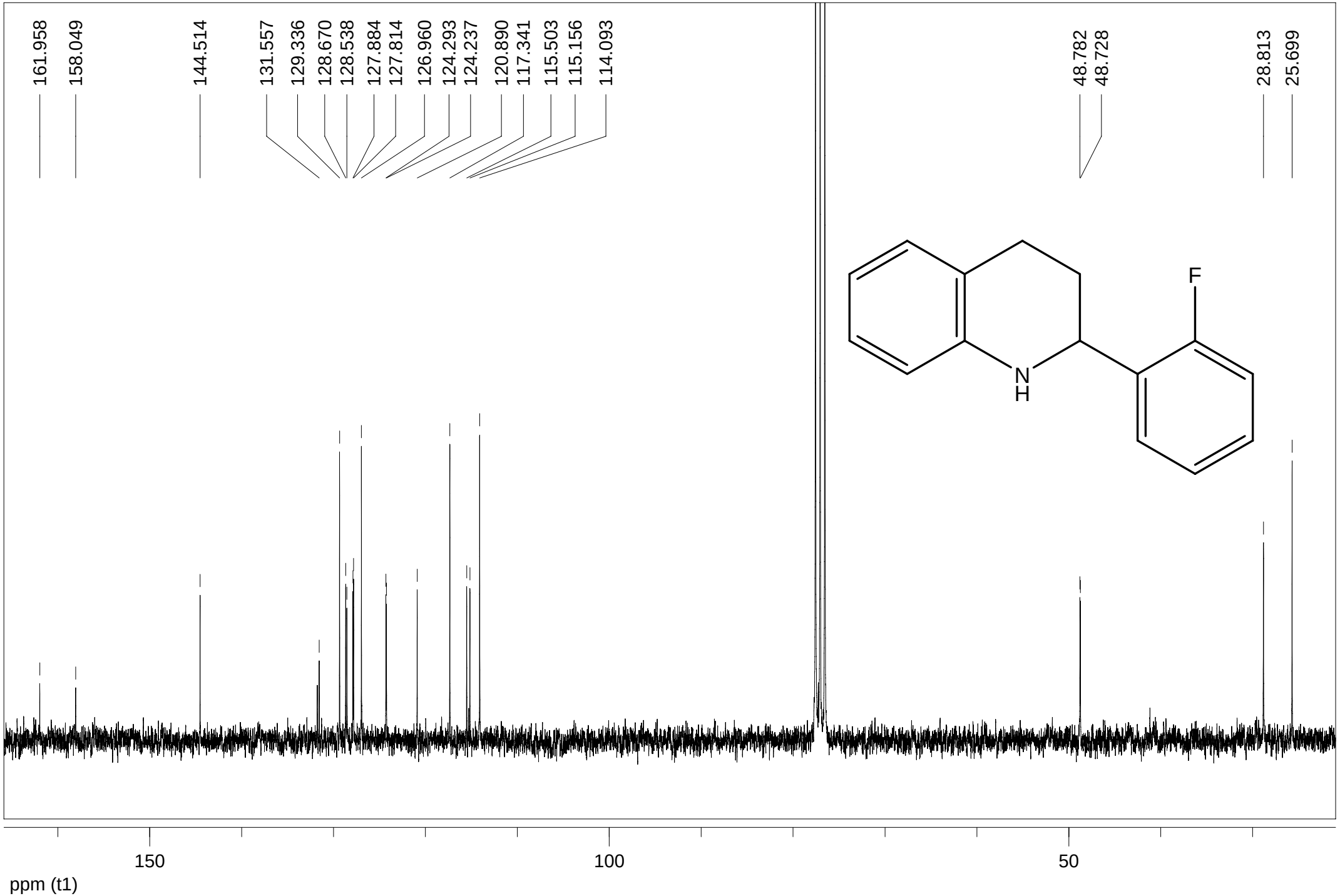
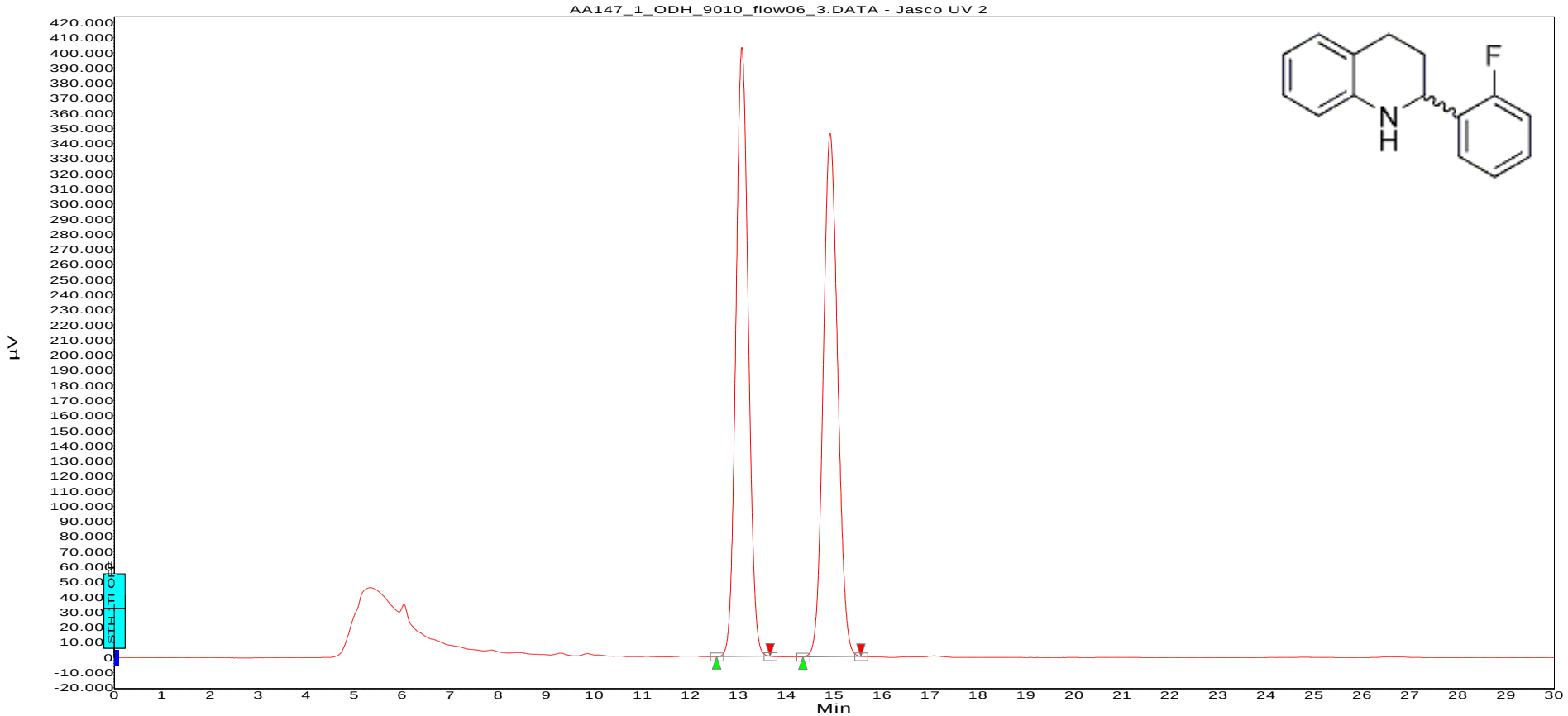
7.403
7.396
7.373
7.366
7.172
7.070
7.066
7.041
7.036
7.005
6.942
6.932
6.909
6.907
6.616
6.612
6.587
6.583
6.557
6.554
6.509
6.477
4.798
4.784
4.766
4.752
3.926
2.814
2.791
2.775
2.754
2.644
2.622
2.578
2.075
2.061
1.947
F
N
H
0.91
1.08
1.18
2.47
0.91
0.93
0.91
0.93
0.98
1.00
2.05
8.0
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


161.958
158.049
144.514
131.557
129.336
128.670
128.538
127.884
127.814
126.960
124.293
124.237
120.890
117.341
115.503
115.156
114.093
48.782
48.728
28.813
25.699
F
N
H
150
100
50
ppm (t1)

2-(2-Fluorophenyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq30
Data file: AA147_1_ODH_9010_flow06_3.DATA
Date: 18.11.2005 00:38:28

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min

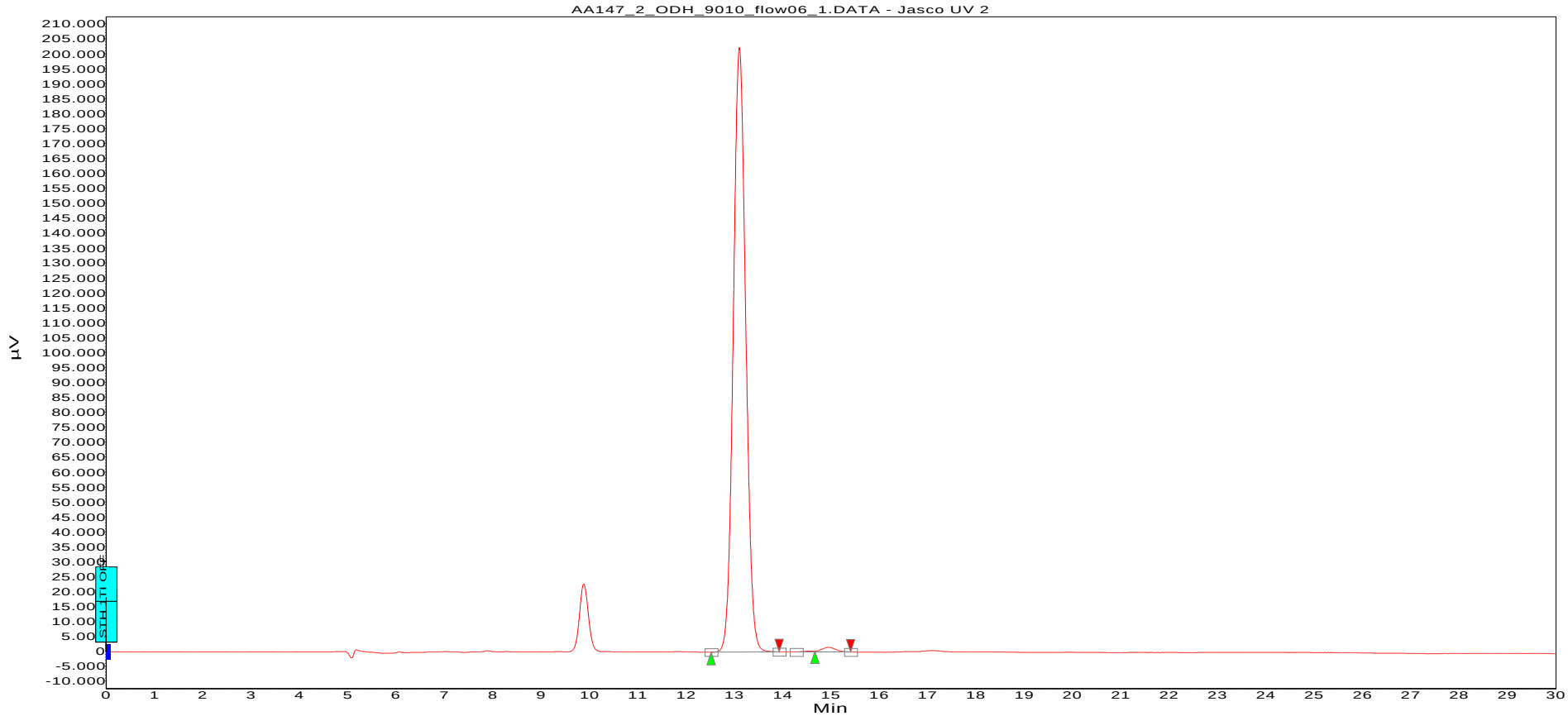


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	12,552	13,075	13,667	49,957
2	14,349	14,917	15,558	50,043
Total				100,000

2-(2-Fluorophenyl)-1,2,3,4-tetrahydroquinoline

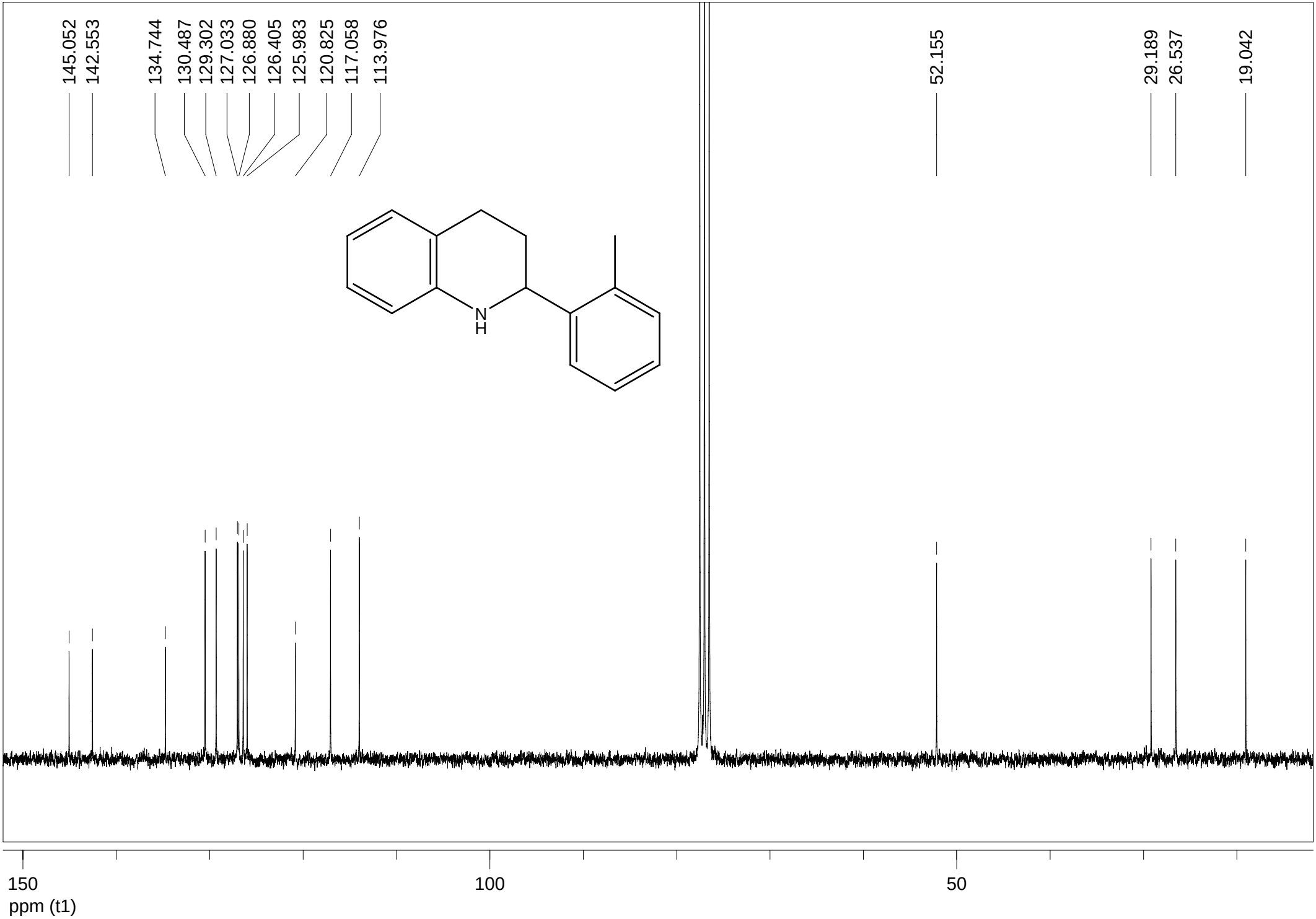
Method: ODH_9010_flow06_acq30
Data file: AA147_2_ODH_9010_flow06_1.DATA
Date: 18.11.2005 00:05:45

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	12,519	13,108	13,927	99,123
2	14,669	14,950	15,411	0,877
Total				100,000

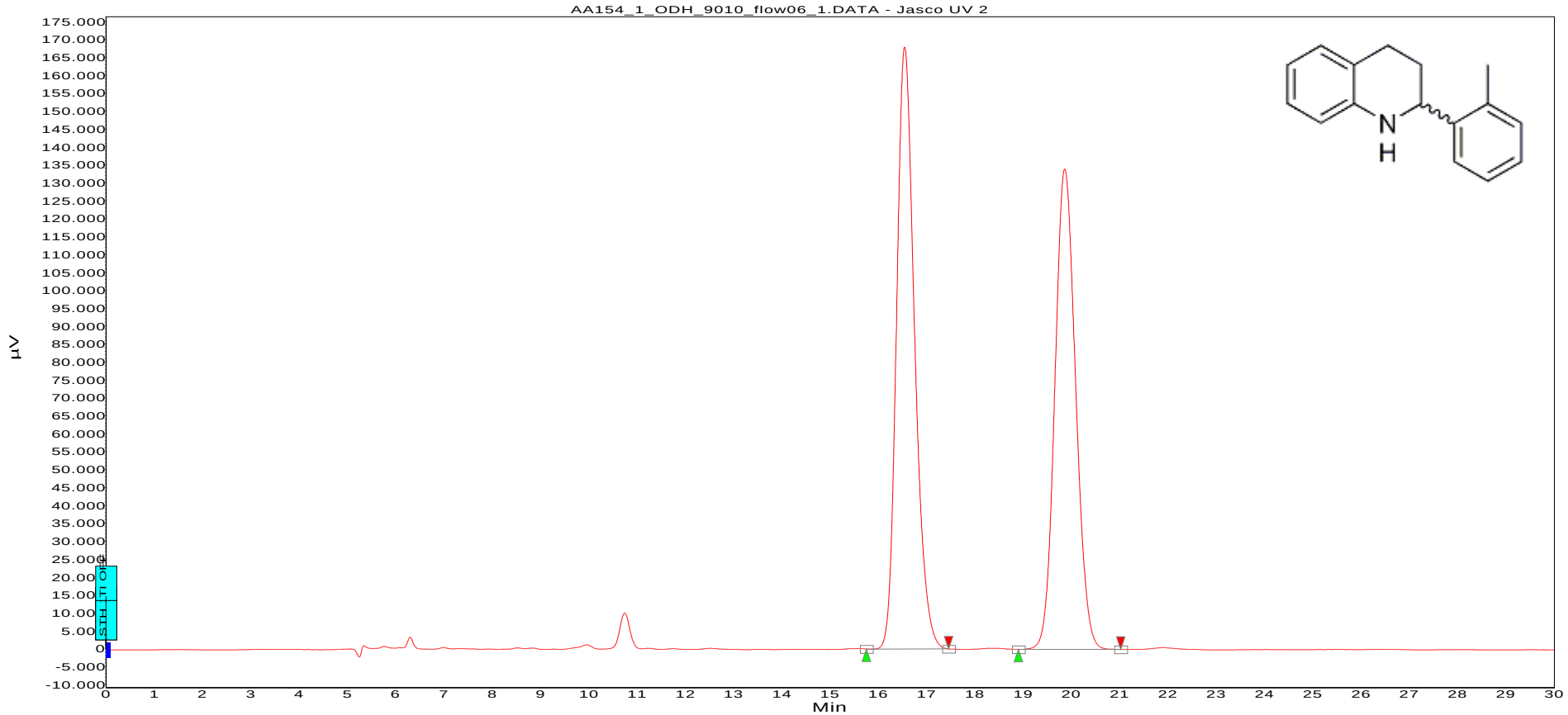

7.435
7.412
7.111
7.104
6.941
6.924
6.575
6.488
6.456
6.452
4.625
4.612
4.589
4.576
3.859
2.863
2.716
2.697
2.307
2.033
2.015
1.999
1.875
1.860
N
H
1.01
3.19
1.99
0.98
1.00
1.00
0.97
1.03
1.08
3.02
1.12
1.14
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


145.052
142.553
134.744
130.487
129.302
127.033
126.880
126.405
125.983
120.825
117.058
113.976
52.155
29.189
26.537
19.042
N
H
150
100
50
ppm (t1)

2-(2-Methylphenyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA154_1_ODH_9010_flow06_1.DATA
Date: 15.11.2005 05:04:34

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

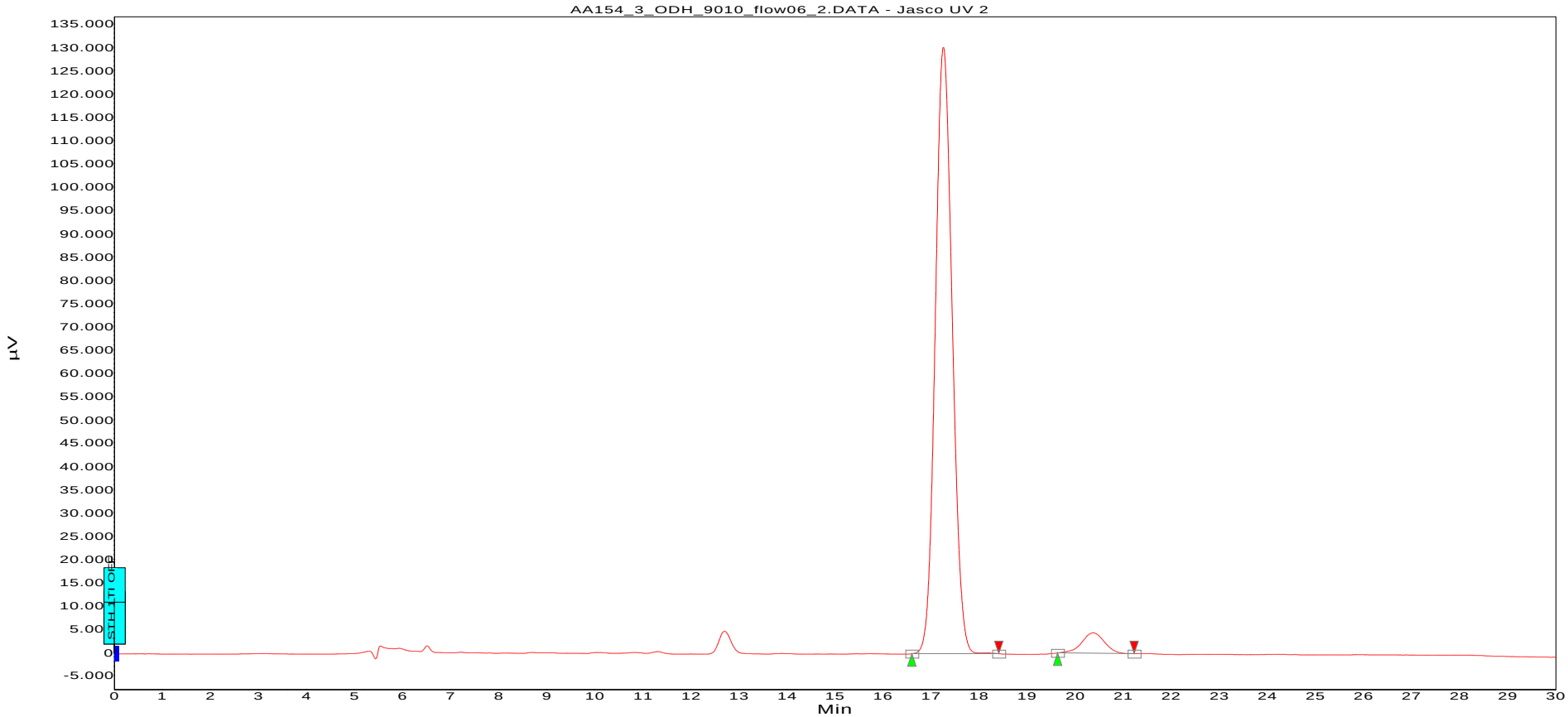


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	15,754	16,542	17,459	52,108
2	18,905	19,858	21,023	47,892
Total				100,000

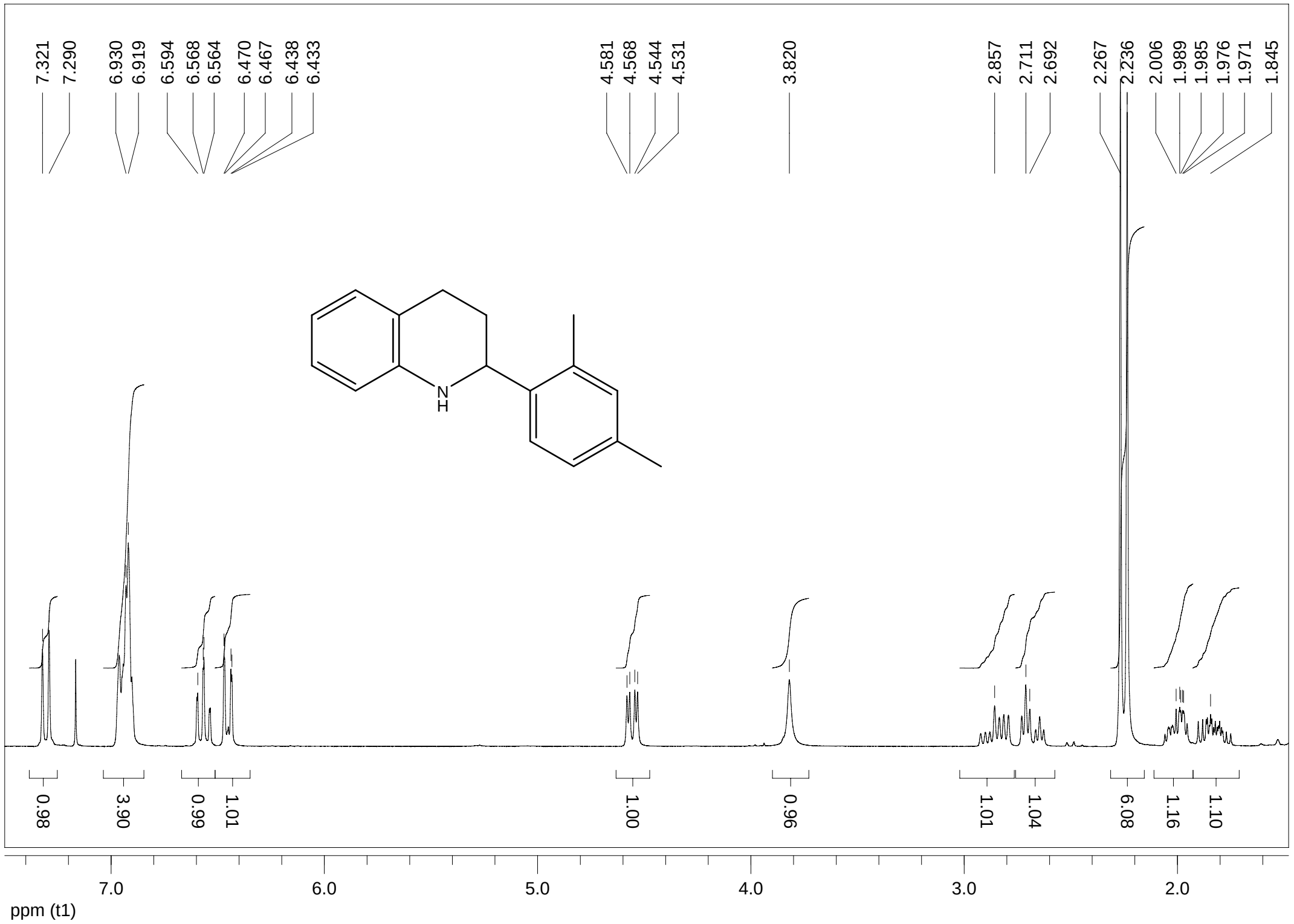
2-(2-Methylphenyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq30
Data file: AA154_3_ODH_9010_flow06_2.DATA
Date: 03.12.2005 21:07:38

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	16,597	17,258	18,407	95,647
2	19,634	20,367	21,229	4,353
Total				100,000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6.594
6.568
6.564
6.470
6.467
6.438
6.433
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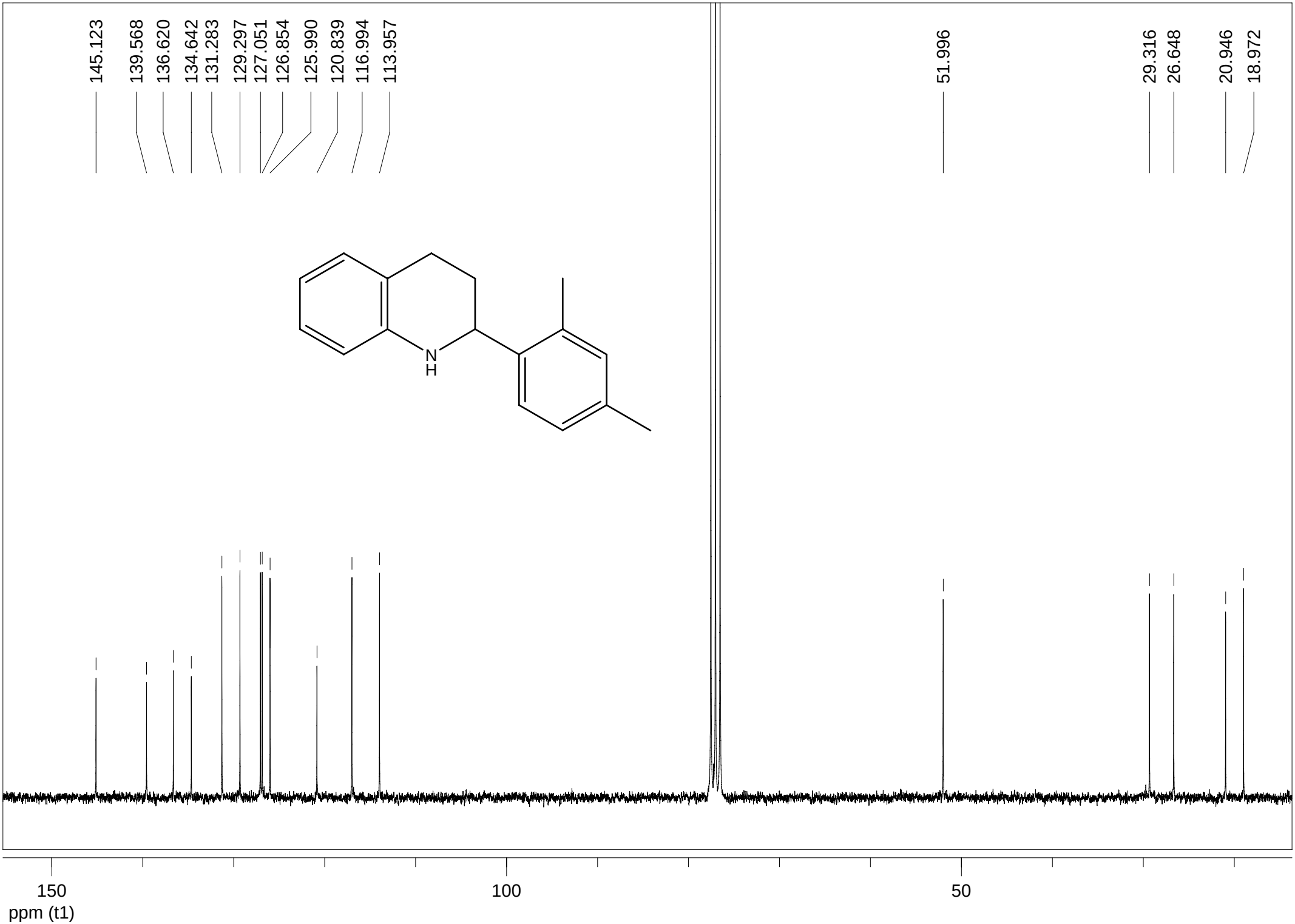
4.544
4.531
3.820
2.857
2.711
2.692
2.267
2.236
2.006
1.989
1.985
1.976
1.971
1.845
NH
0.98
3.90
0.99
1.01
1.00
0.96
1.01
1.04
6.08
1.16
1.10
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


145.123
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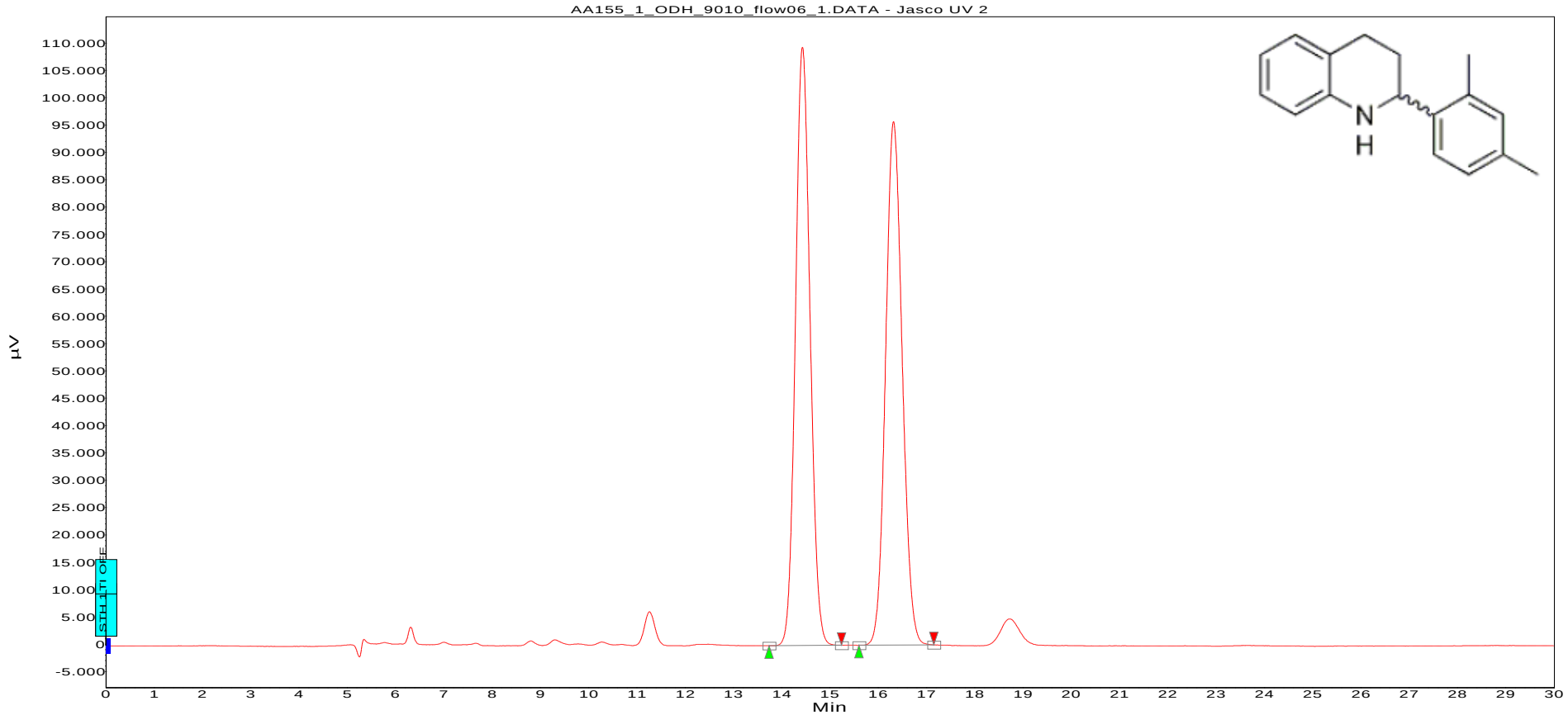
136.620
134.642
131.283
129.297
127.051
126.854
125.990
120.839
116.994
113.957
51.996
29.316
26.648
20.946
18.972
N
H
150
100
50
ppm (t1)

2-(2,4-Dimethylphenyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA155_1_ODH_9010_flow06_1.DATA
Date: 15.11.2005 05:57:20

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

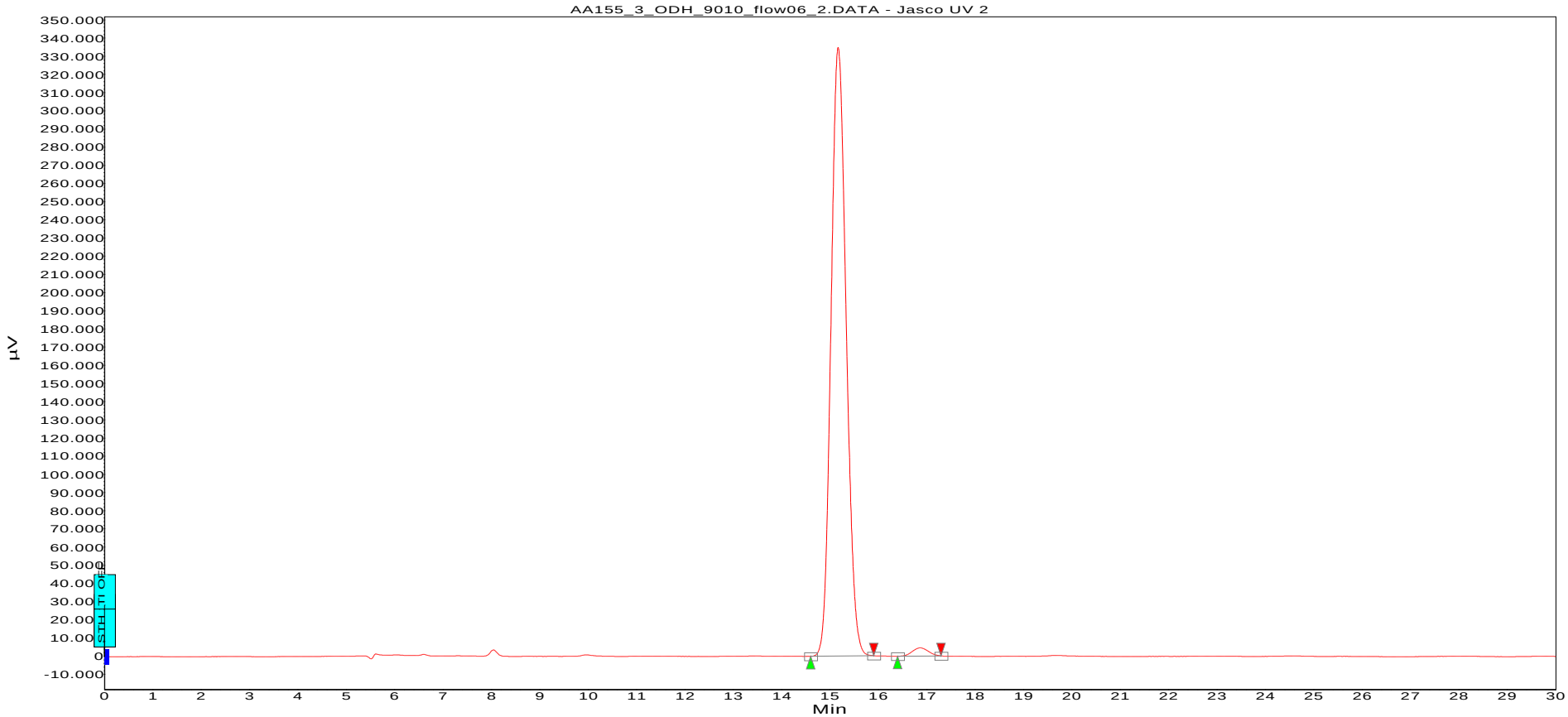


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	13,740	14,425	15,238	50,146
2	15,599	16,317	17,149	49,854
Total				100,000

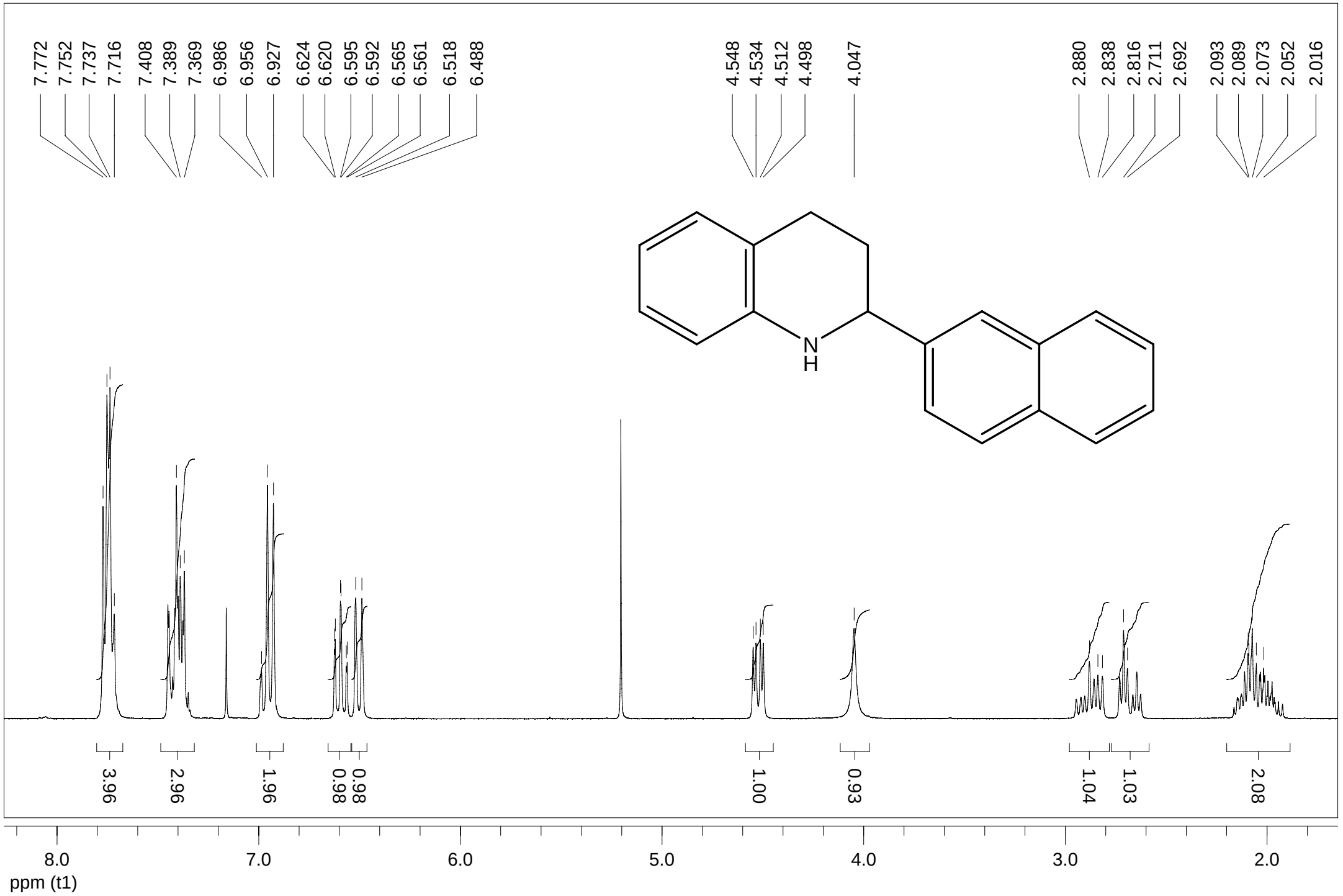
2-(2,4-Dimethylphenyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq30
Data file: AA155_3_ODH_9010_flow06_2.DATA
Date: 03.12.2005 21:40:24

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	14,597	15,167	15,899	98,586
2	16,395	16,867	17,293	1,414
Total				100,000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7.389
7.369
6.986
6.956
6.927
6.624
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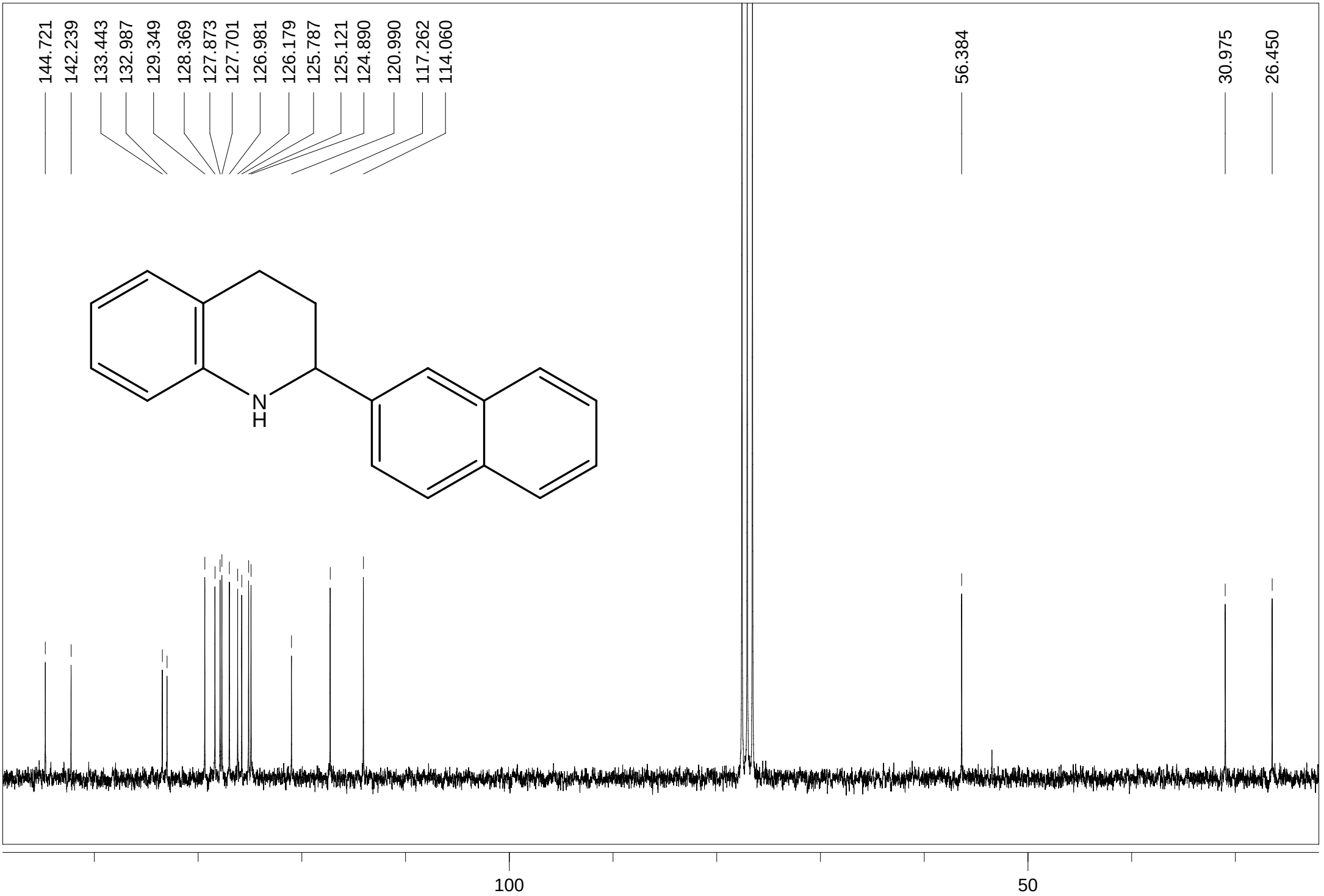
6.592
6.565
6.561
6.518
6.488
4.548
4.534
4.512
4.498
4.047
2.880
2.838
2.816
2.711
2.692
2.093
2.089
2.073
2.052
2.016
N
H
3.96
2.96
1.96
0.98
0.98
1.00
0.93
1.04
1.03
2.08
8.0
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)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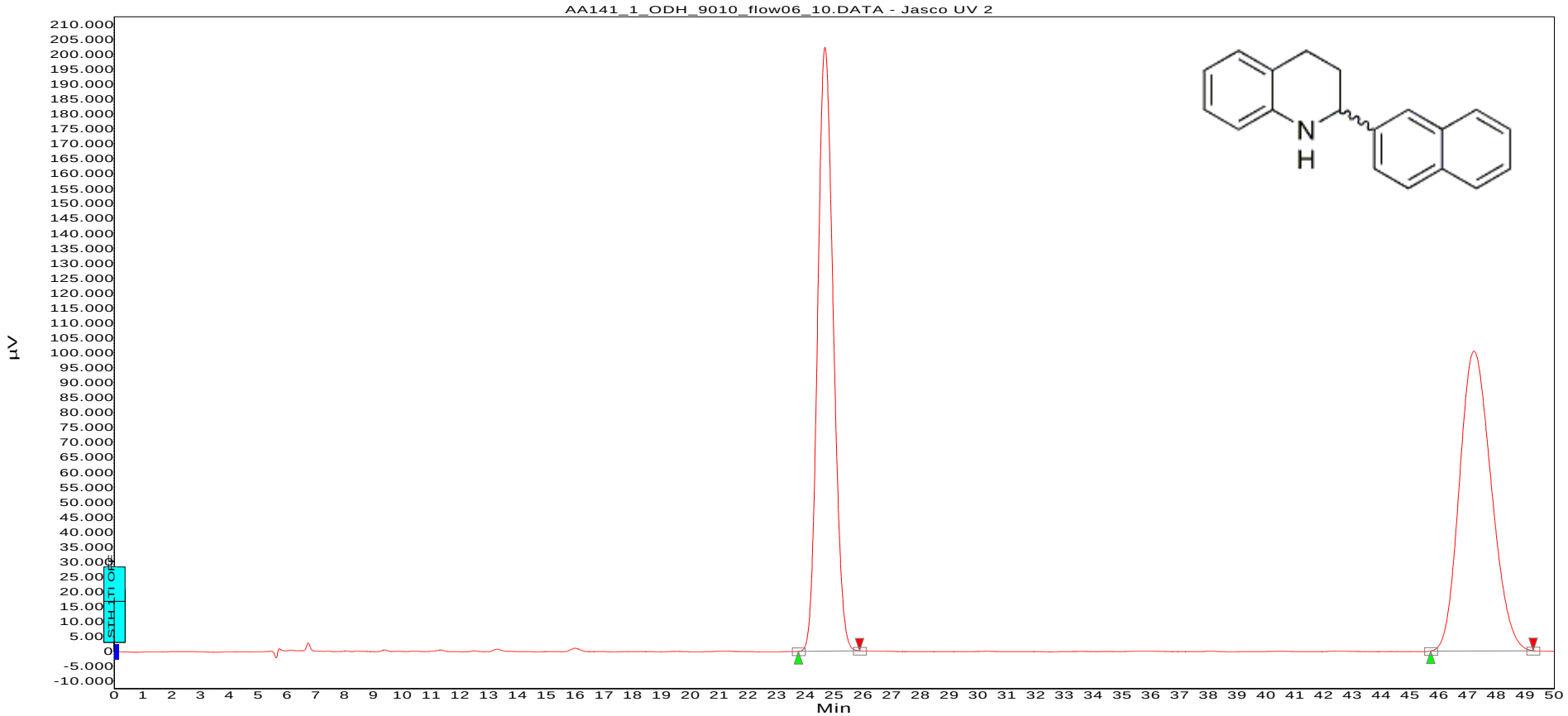
129.349
128.369
127.873
127.701
126.981
126.179
125.787
125.121
124.890
120.990
117.262
114.060
56.384
30.975
26.450
N
H
100
50
ppm (t1)

2-(2-Naphthyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA141_1_ODH_9010_flow06_10.DATA
Date: 16.11.2005 23:31:25

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

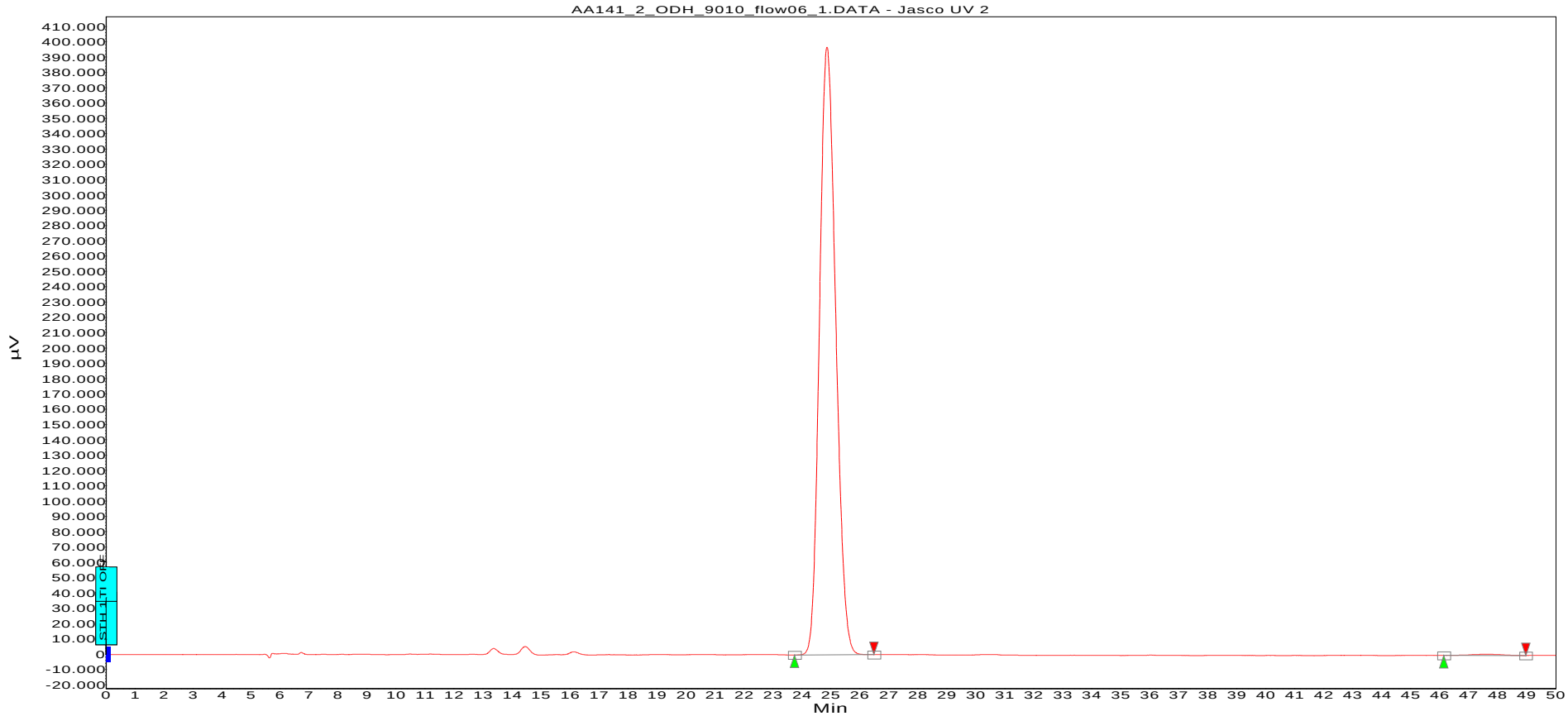


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	23,760	24,683	25,878	49,787
2	45,713	47,208	49,277	50,213
Total				100,000

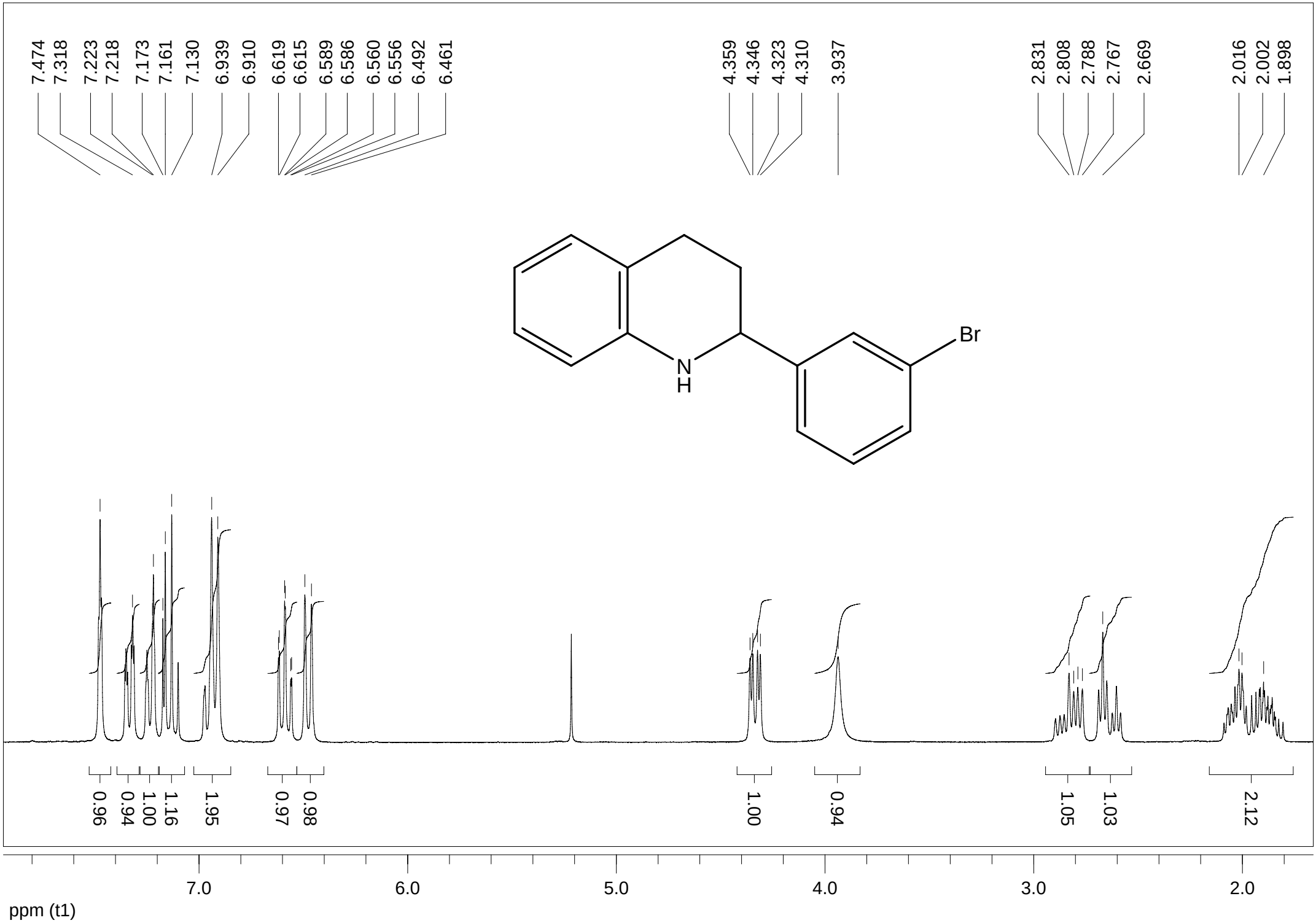
2-(2-Naphthyl)-1,2,3,4-tetrahydroquinoline

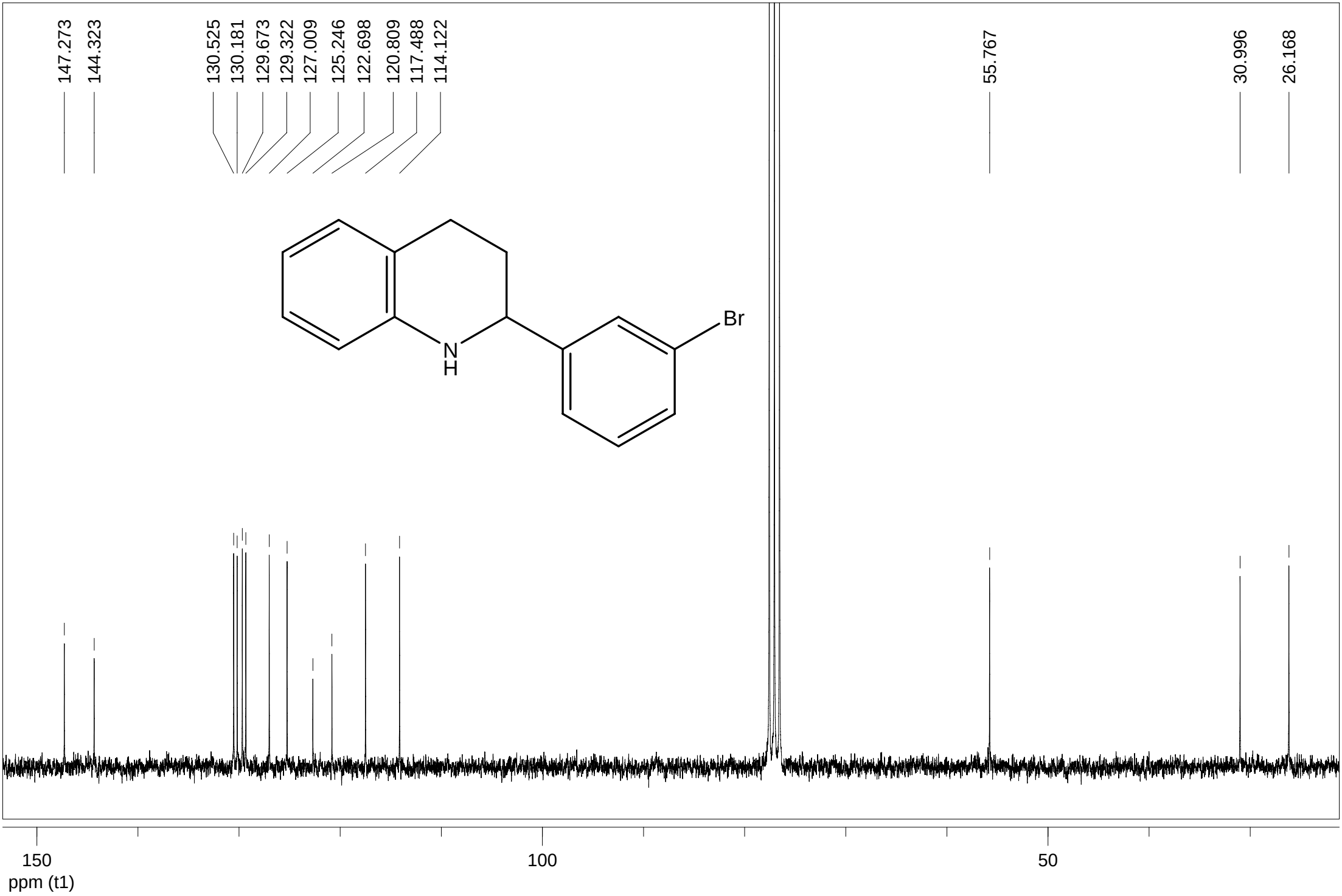
Method: ODH_9010_flow06_acq50
Data file: AA141_2_ODH_9010_flow06_1.DATA
Date: 16.11.2005 22:38:41

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	23,747	24,867	26,487	99,612
2	46,137	47,633	48,966	0,388
Total				100,000

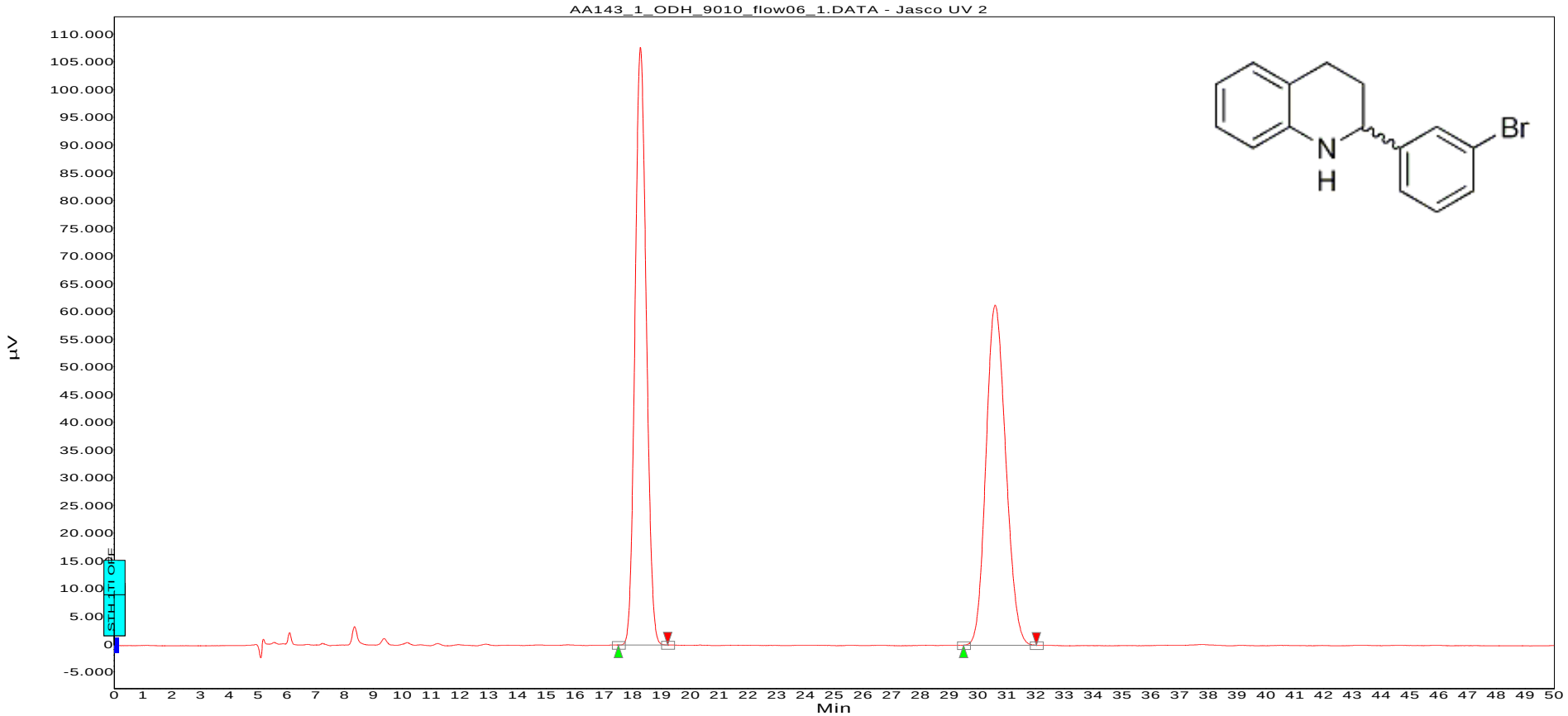

7.474
7.318
7.223
7.218
7.173
7.161
7.130
6.939
6.910
6.619
6.615
6.589
6.586
6.560
6.556
6.492
6.461
4.359
4.346
4.323
4.310
3.937
2.831
2.808
2.788
2.767
2.669
2.016
2.002
1.898
Br
N
H
0.96
0.94
1.00
1.16
1.95
0.97
0.98
1.00
0.94
1.05
1.03
2.12
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


147.273
144.323
130.525
130.181
129.673
129.322
127.009
125.246
122.698
120.809
117.488
114.122
55.767
30.996
26.168
Br
N
H
150
100
50
ppm (t1)

2-(3-Bromophenyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA143_1_ODH_9010_flow06_1.DATA
Date: 11.11.2005 00:21:33

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

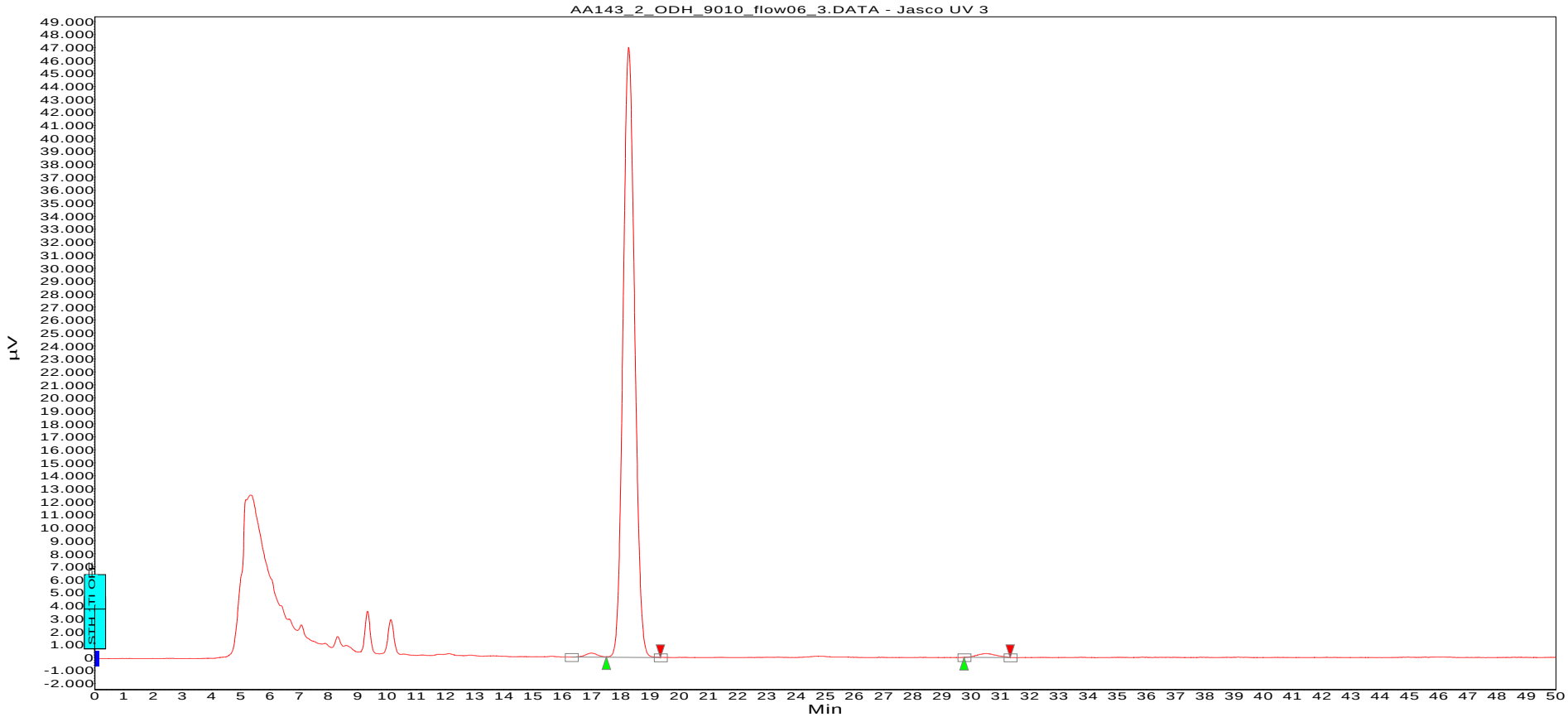


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	17,510	18,275	19,215	50,024
2	29,494	30,592	32,025	49,976
Total				100,000

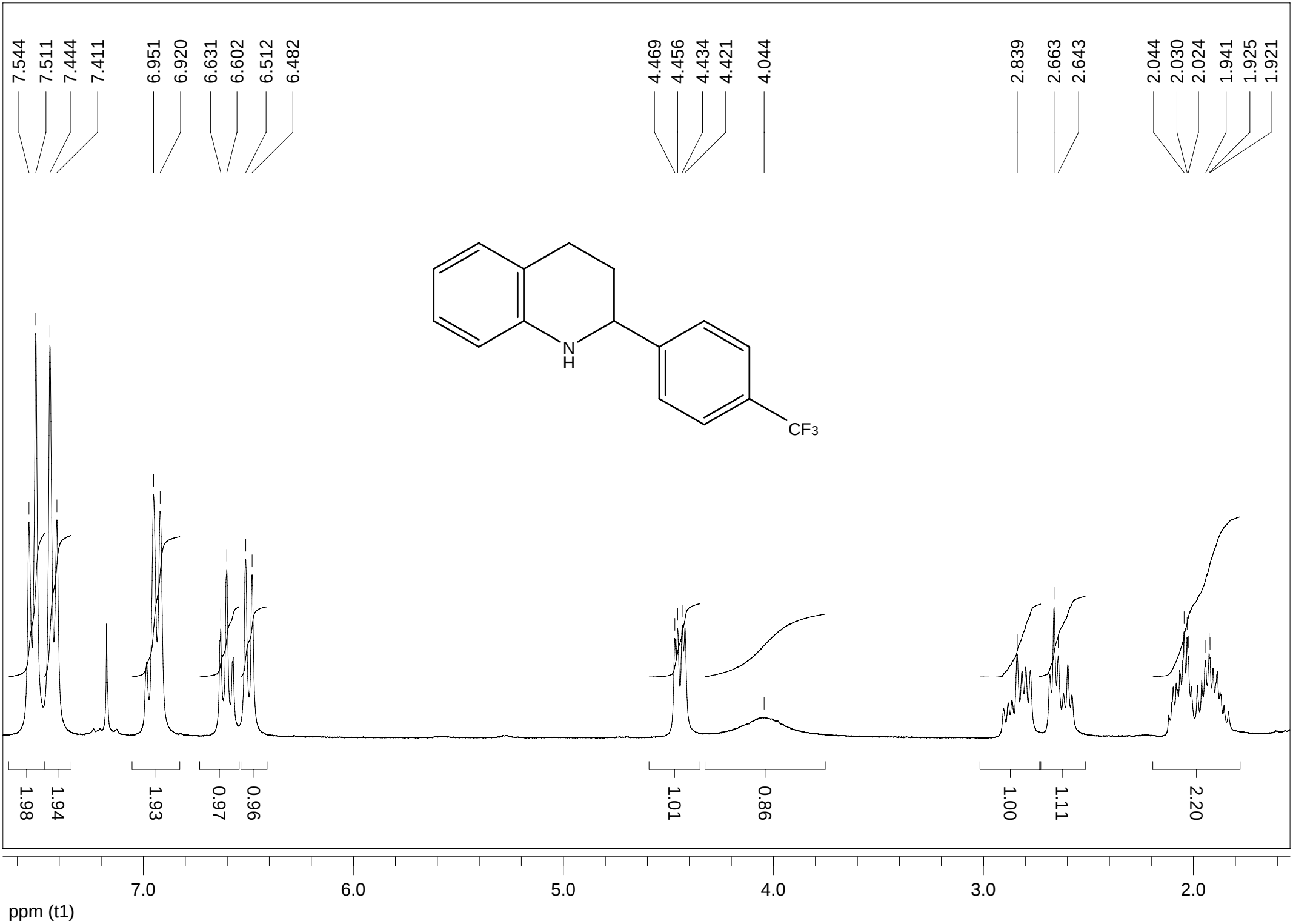
2-(3-Bromophenyl)-1,2,3,4-tetrahydroquinoline

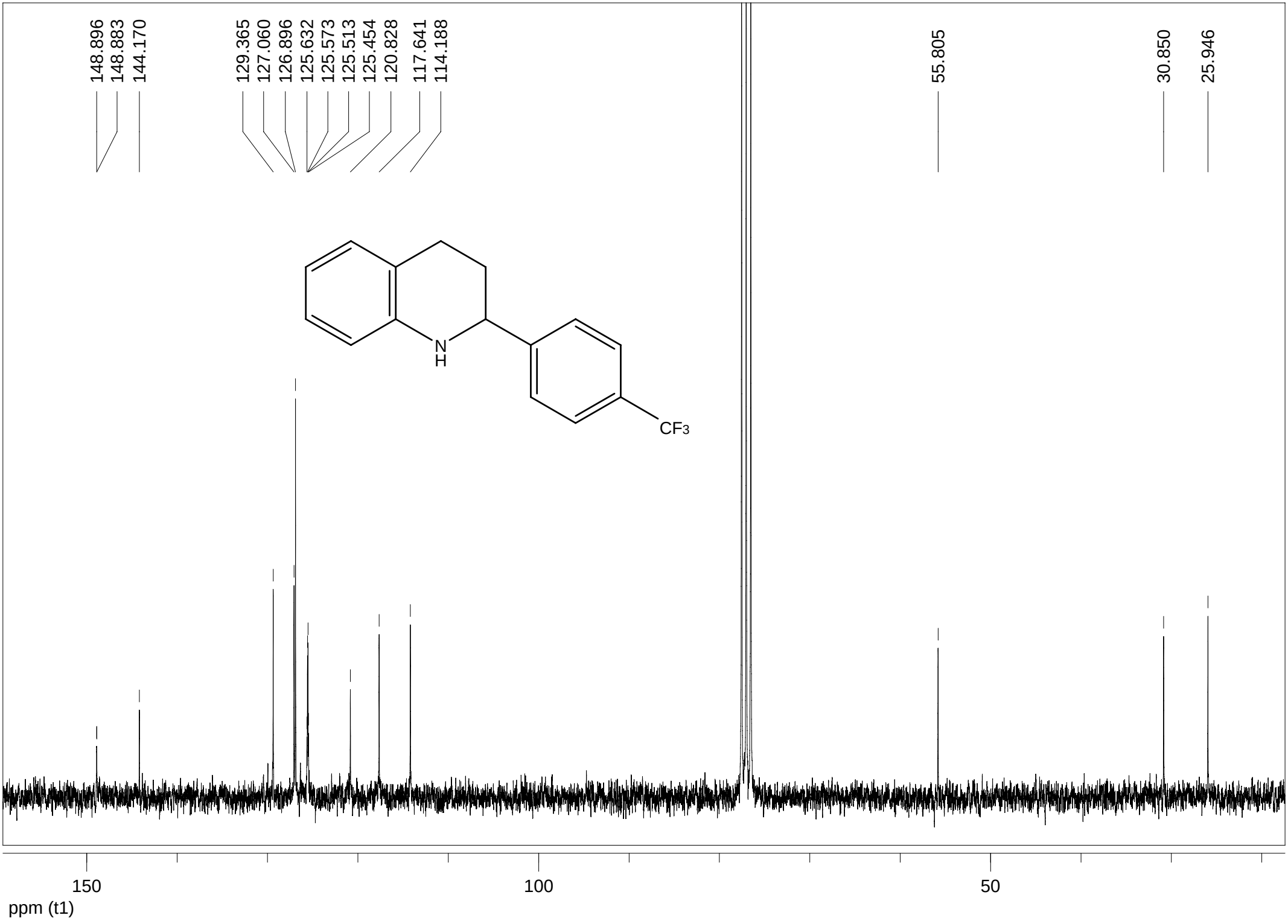
Method: ODH_9010_flow06_acq50
Data file: AA143_2_ODH_9010_flow06_3.DATA
Date: 30.11.2005 03:13:10

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
2	17,505	18,275	19,362	99,001
1	29,748	30,475	31,332	0,999
Total				100,000

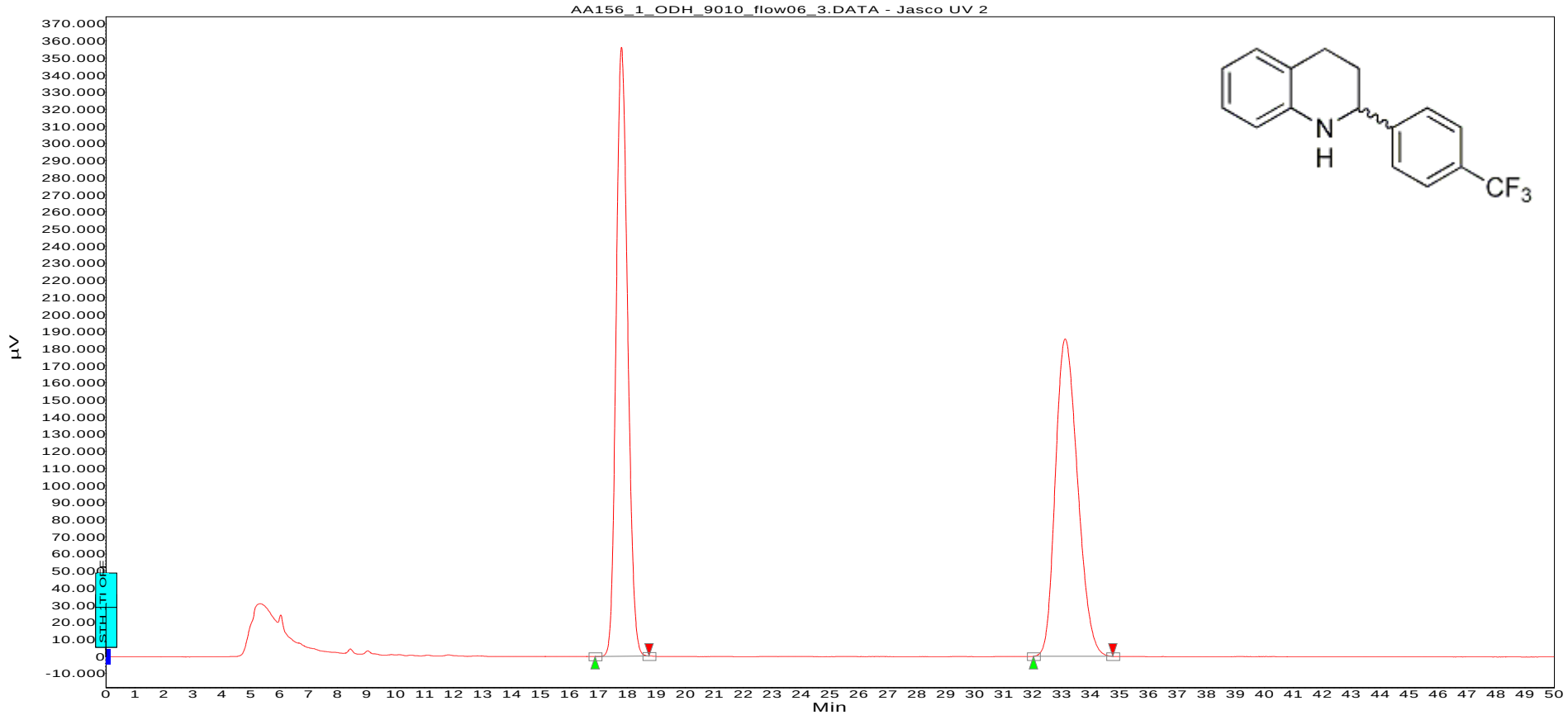

7.544
7.511
7.444
7.411
6.951
6.920
6.631
6.602
6.512
6.482
4.469
4.456
4.434
4.421
4.044
2.839
2.663
2.643
2.044
2.030
2.024
1.941
1.925
1.921
N
H
CF3
1.98
1.94
1.93
0.97
0.96
1.01
0.86
1.00
1.11
2.20
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


148.896
148.883
144.170
129.365
127.060
126.896
125.632
125.573
125.513
125.454
120.828
117.641
114.188
55.805
30.850
25.946
N
H
CF3
150
100
50
ppm (t1)

2-[4-(Trifluoromethyl)phenyl]-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA156_1_ODH_9010_flow06_3.DATA
Date: 18.11.2005 02:03:57

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

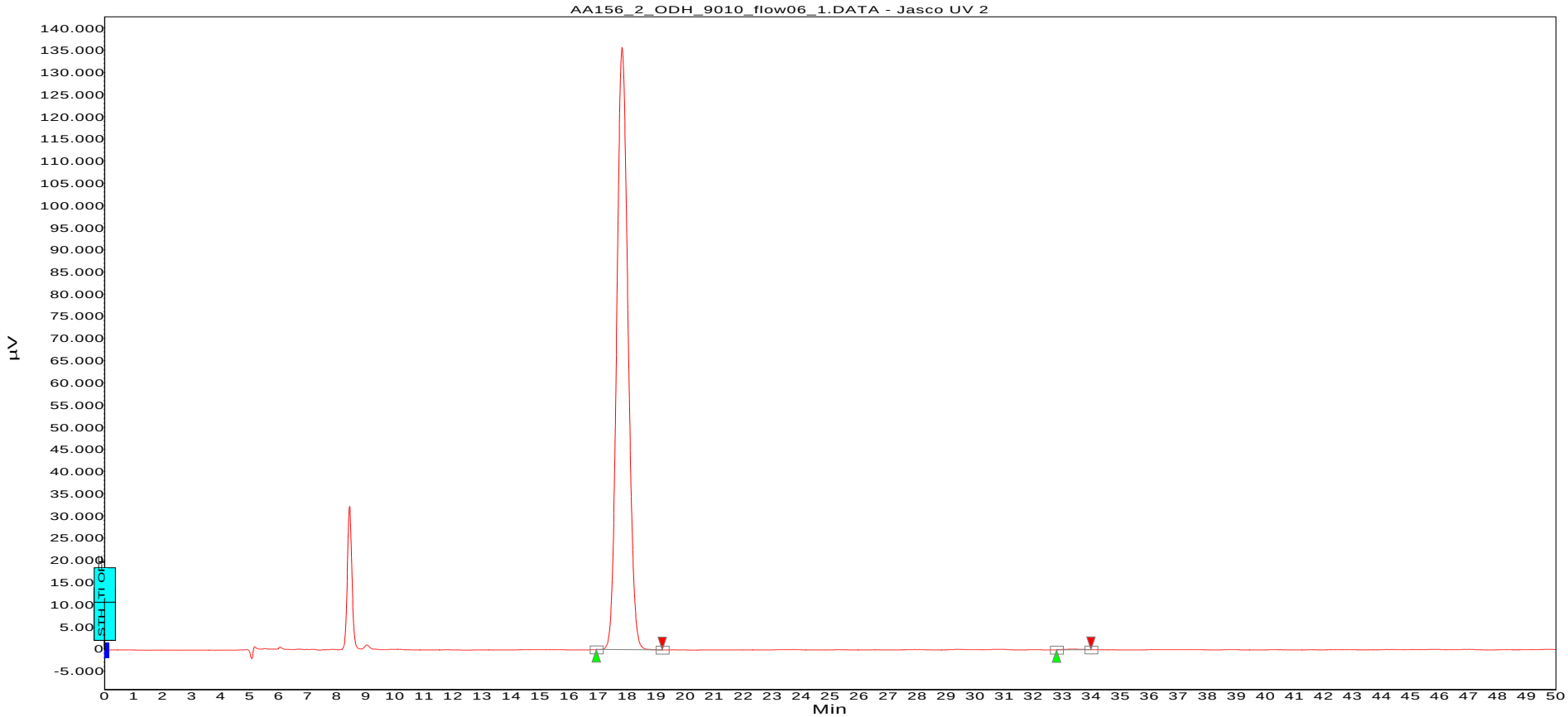


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	16,890	17,800	18,750	49,872
2	32,025	33,117	34,762	50,128
Total				100,000

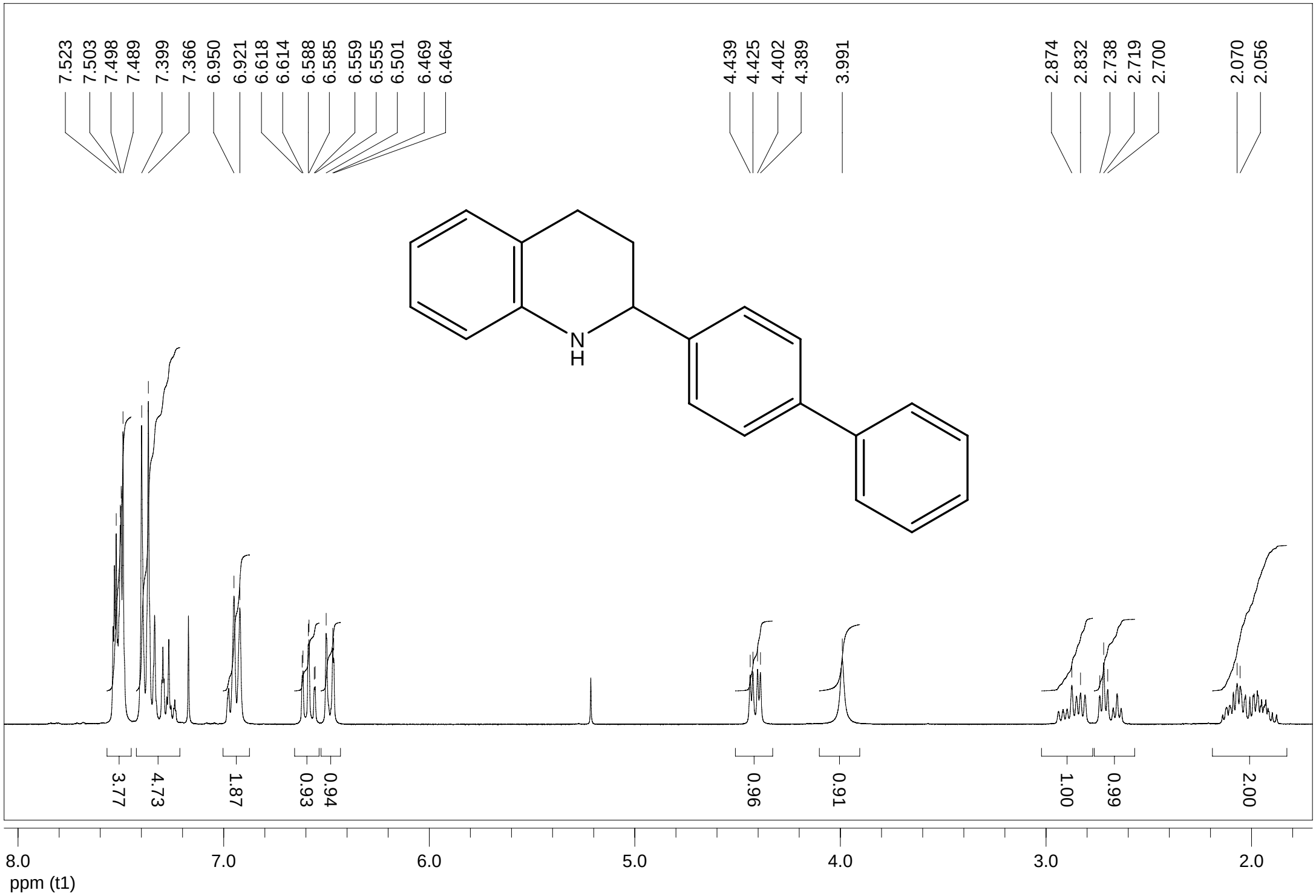
2-[4-(Trifluoromethyl)phenyl]-1,2,3,4-tetrahydroquinoline

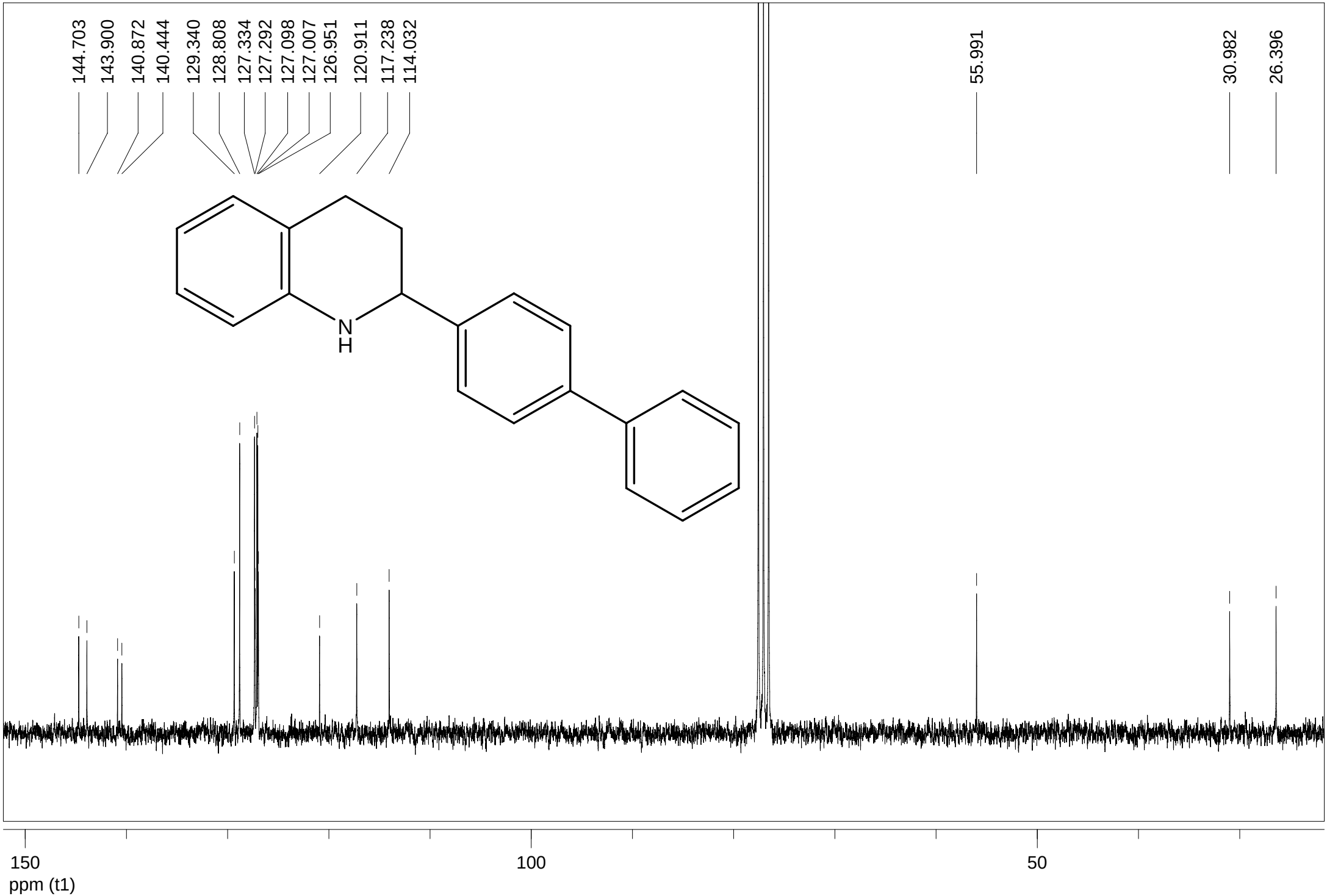
Method: ODH_9010_flow06_acq50
Data file: AA156_2_ODH_9010_flow06_1.DATA
Date: 18.11.2005 01:11:14

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	16,942	17,833	19,215	99,862
2	32,800	33,317	33,988	0,138
Total				100,000

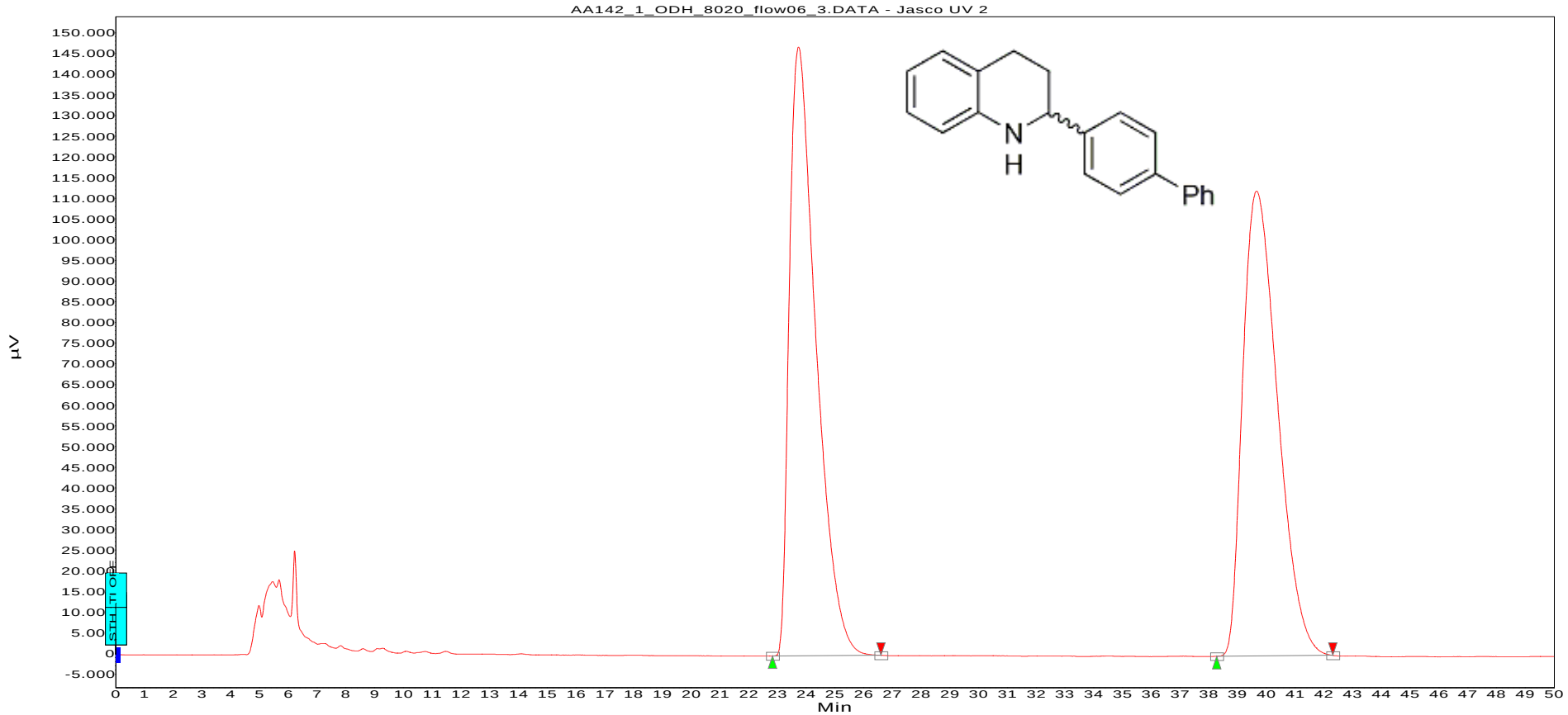

7.523
7.503
7.498
7.489
7.399
7.366
6.950
6.921
6.618
6.614
6.588
6.585
6.559
6.555
6.501
6.469
6.464
4.439
4.425
4.402
4.389
3.991
2.874
2.832
2.738
2.719
2.700
2.070
2.056
N
H
3.77
4.73
1.87
0.93
0.94
0.96
0.91
1.00
0.99
2.00
8.0
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


144.703
143.900
140.872
140.444
129.340
128.808
127.334
127.292
127.098
127.007
126.951
120.911
117.238
114.032
55.991
30.982
26.396
N
H
150
100
50
ppm (t1)

2-(1,1'-Biphenyl-4-yl)-1,2,3,4-tetrahydroquinoline

Method: ODH_8020_flow06_acq50
Data file: AA142_1_ODH_8020_flow06_3.DATA
Date: 15.11.2005 08:15:24

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

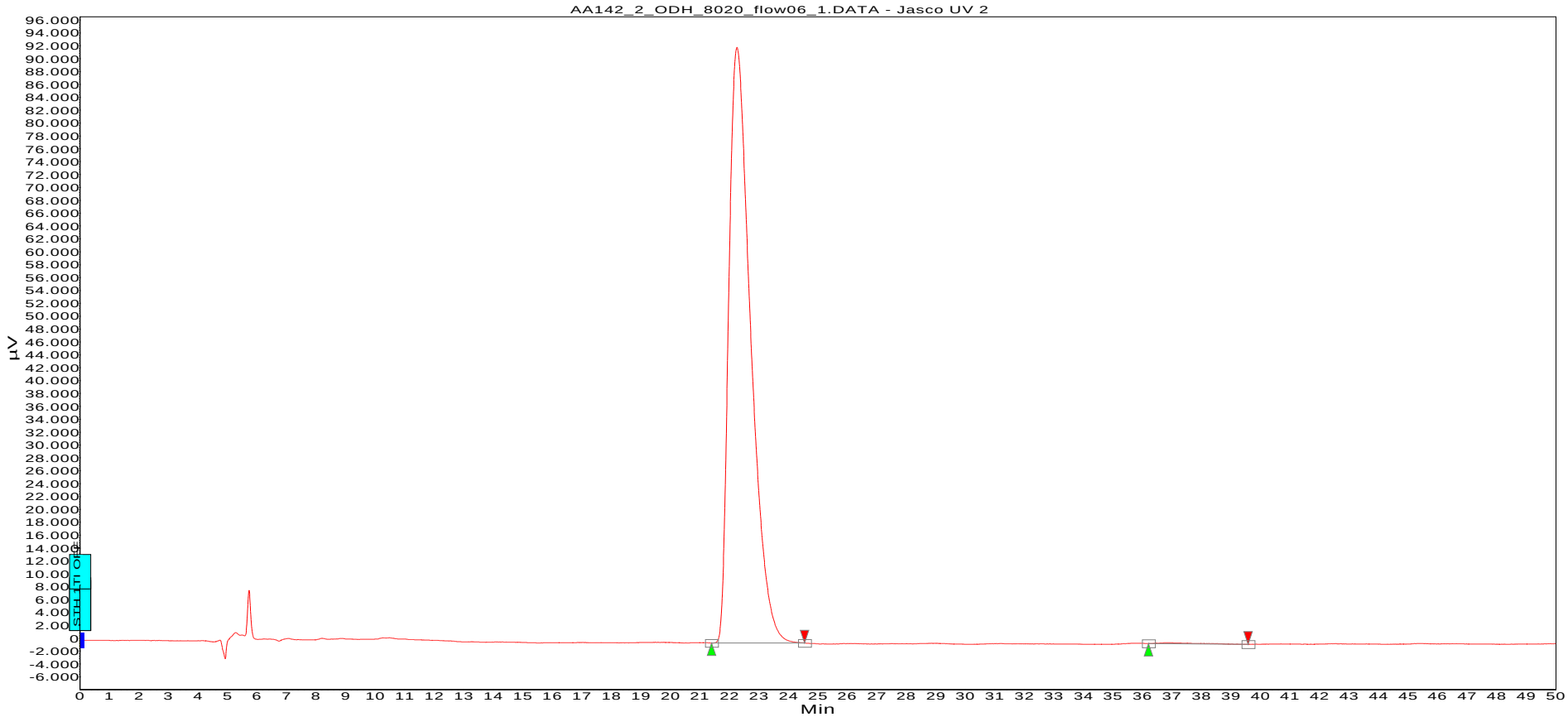


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	22,831	23,733	26,601	50,093
2	38,275	39,658	42,304	49,907
Total				100,000

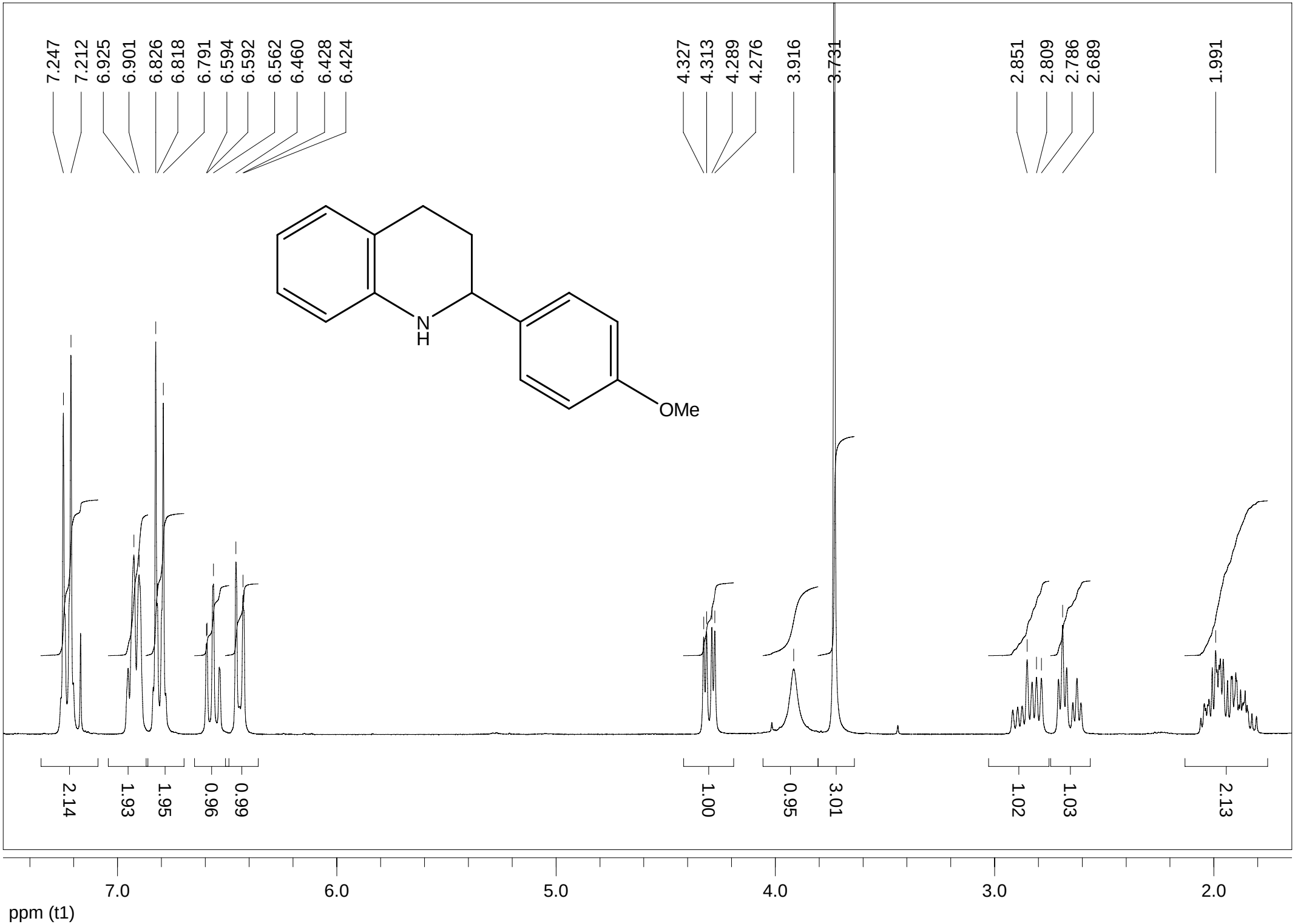
2-(1,1'-Biphenyl-4-yl)-1,2,3,4-tetrahydroquinoline

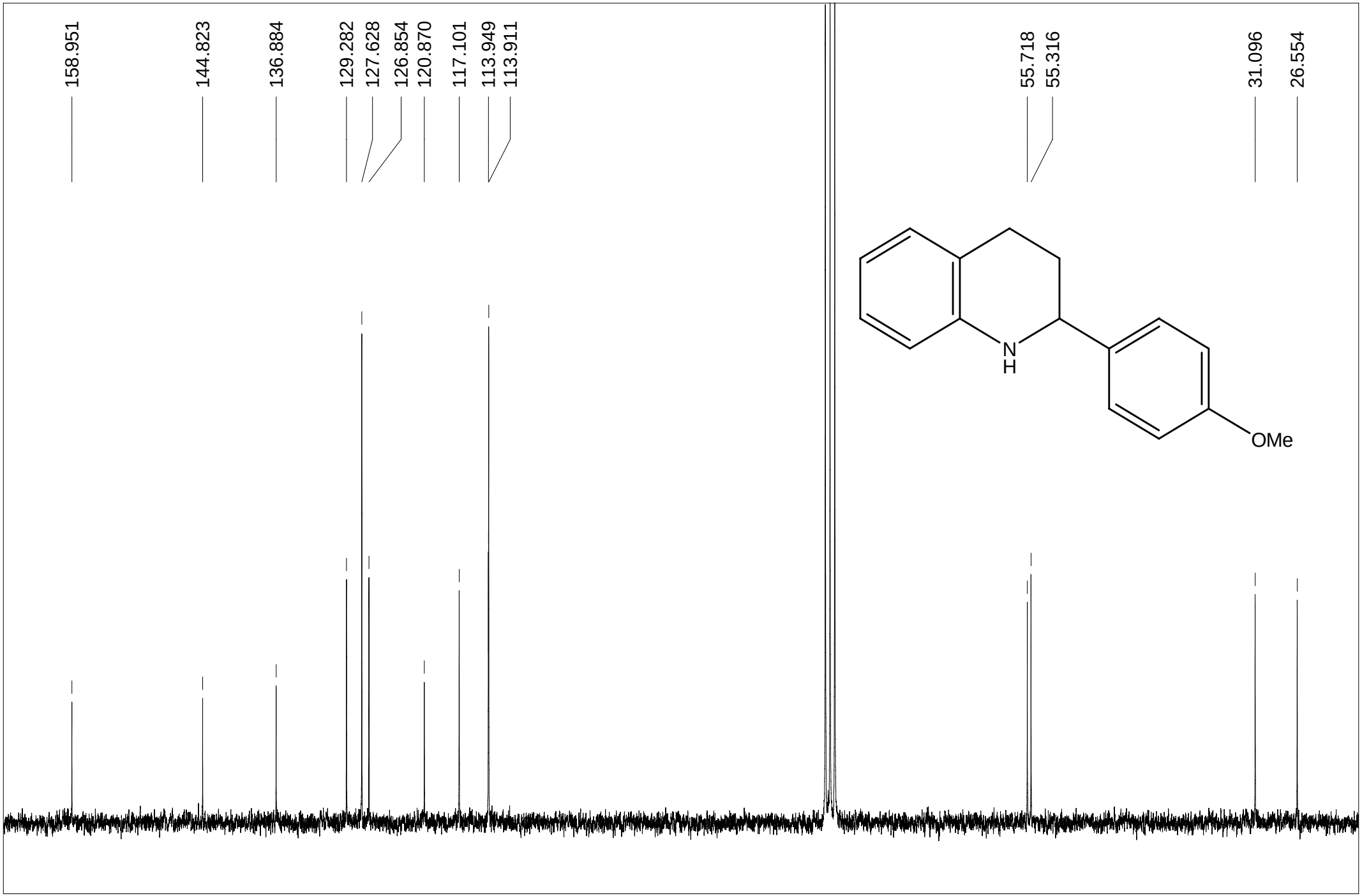
Method: ODH_8020_flow06_acq50
Data file: AA142_2_ODH_8020_flow06_1.DATA
Date: 30.11.2005 05:31:11

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
2	21,405	22,258	24,550	99,769
1	36,203	36,925	39,579	0,231
Total				100,000

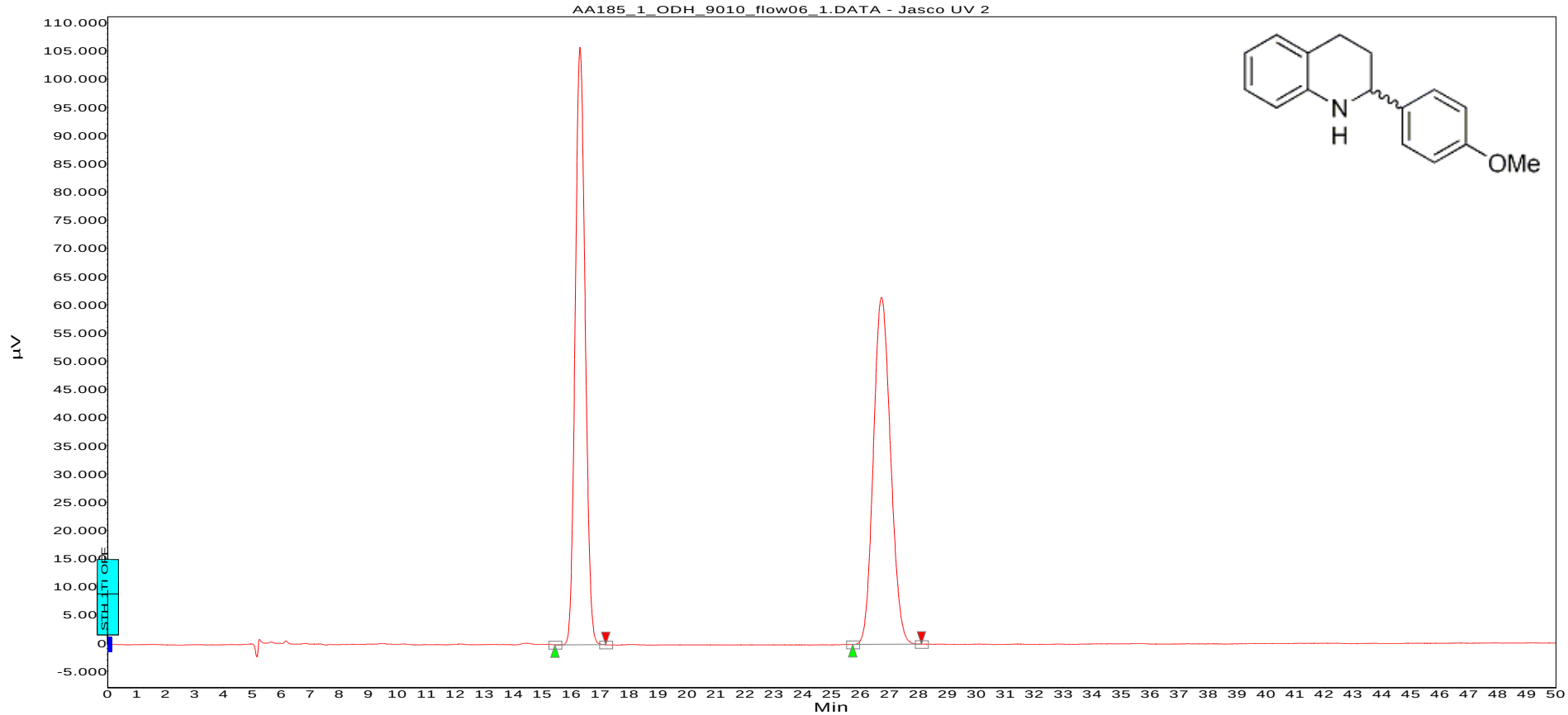

7.247
7.212
6.925
6.901
6.826
6.818
6.791
6.594
6.592
6.562
6.460
6.428
6.424
4.327
4.313
4.289
4.276
3.916
3.731
2.851
2.809
2.786
2.689
1.991
N
H
OMe
2.14
1.93
1.95
0.96
0.99
1.00
0.95
3.01
1.02
1.03
2.13
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


158.951
144.823
136.884
129.282
127.628
126.854
120.870
117.101
113.949
113.911
55.718
55.316
31.096
26.554
N
H
OMe
150
100
50
ppm (t1)

2-(4-Methoxyphenyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA185_1_ODH_9010_flow06_1.DATA
Date: 15.12.2005 08:41:46

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

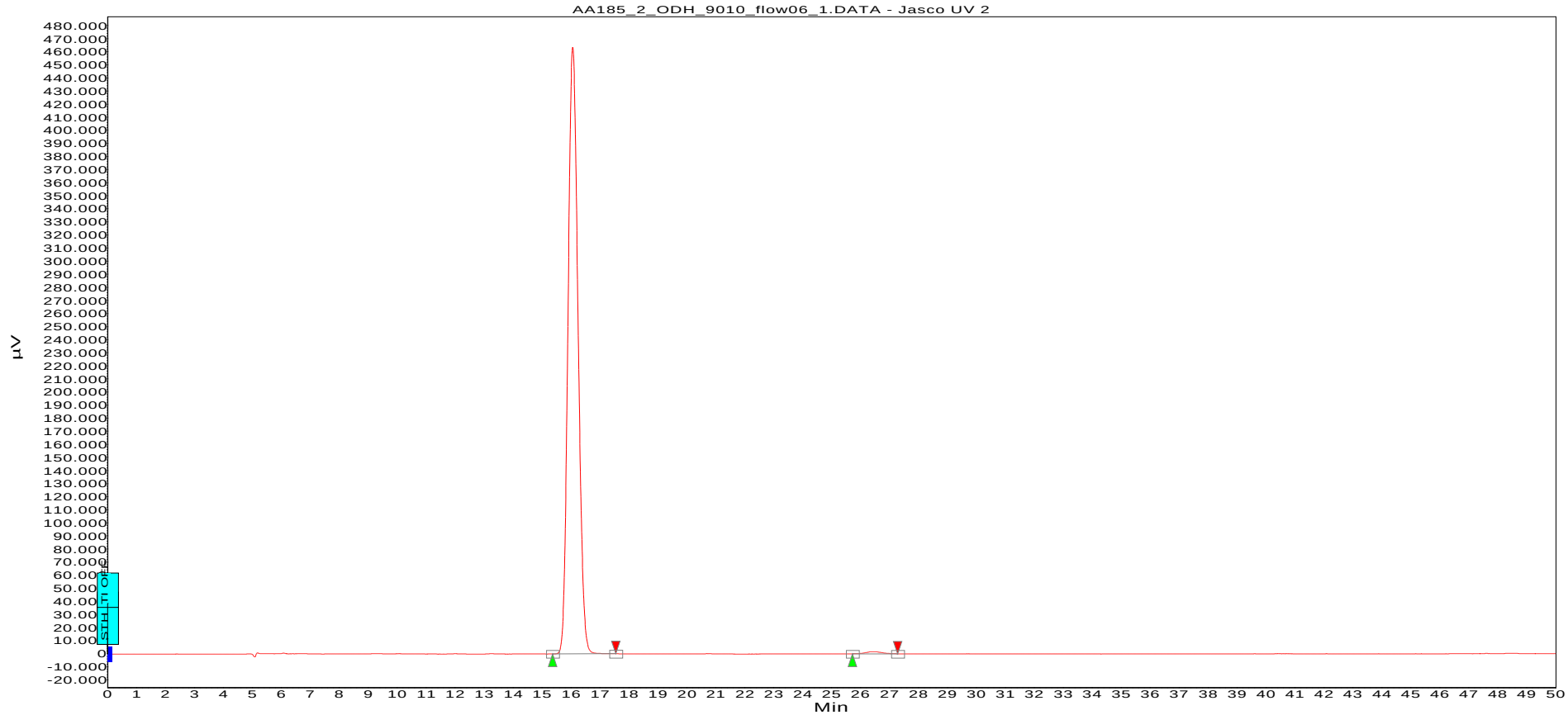


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	15,444	16,308	17,200	49,919
2	25,723	26,717	28,099	50,081
Total				100,000

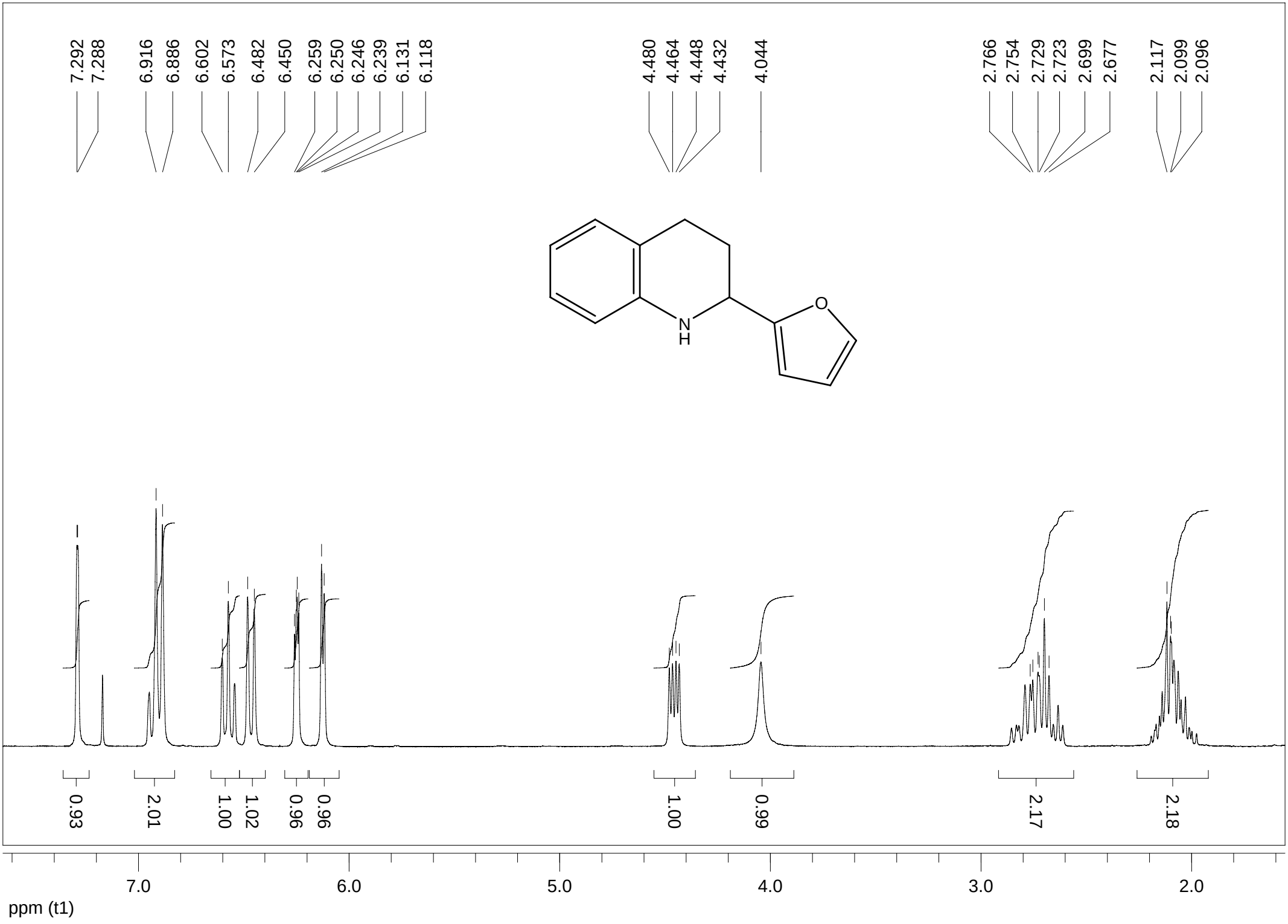
2-(4-Methoxyphenyl)-1,2,3,4-tetrahydroquinoline

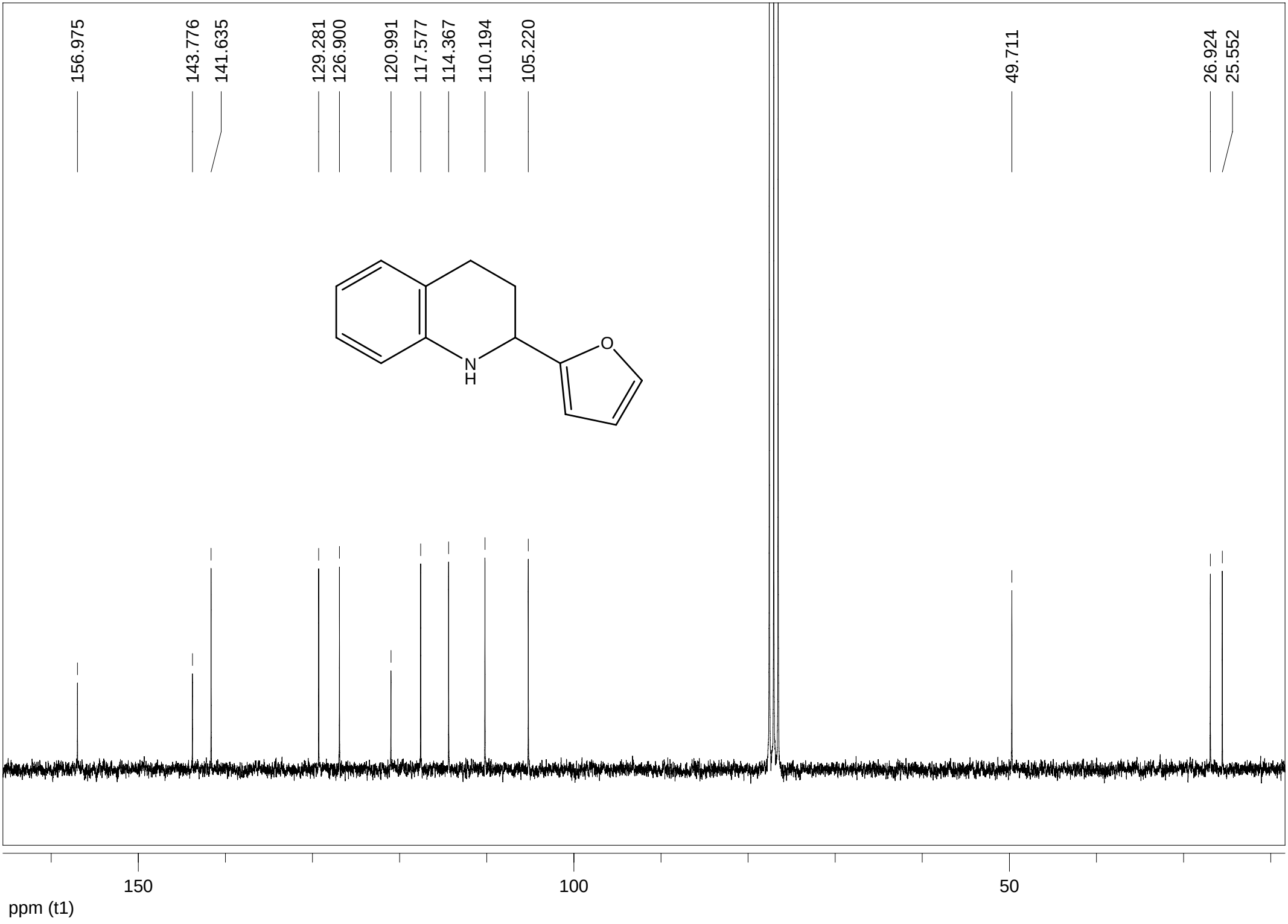
Method: ODH_9010_flow06_acq50
Data file: AA185_2_ODH_9010_flow06_1.DATA
Date: 15.12.2005 07:49:03

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	15,362	16,058	17,549	99,418
2	25,718	26,442	27,282	0,582
Total				100,000

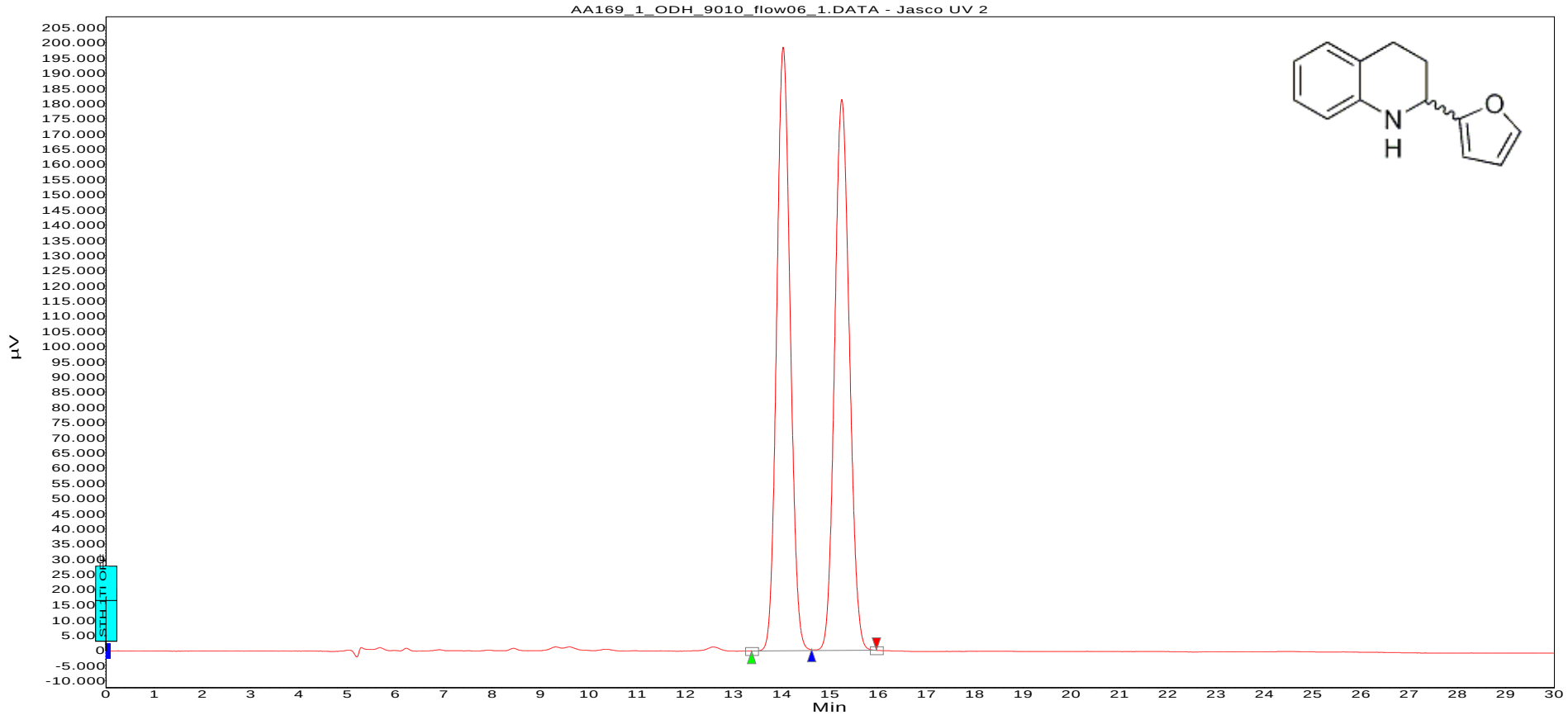

7.292
7.288
6.916
6.886
6.602
6.573
6.482
6.450
6.259
6.250
6.246
6.239
6.131
6.118
4.480
4.464
4.448
4.432
4.044
2.766
2.754
2.729
2.723
2.699
2.677
2.117
2.099
2.096
NH
O
0.93
2.01
1.00
1.02
0.96
0.96
1.00
0.99
2.17
2.18
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


156.975
143.776
141.635
129.281
126.900
120.991
117.577
114.367
110.194
105.220
49.711
26.924
25.552
O
N
H
150
100
50
ppm (t1)

2-(2-Furyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA169_1_ODH_9010_flow06_1.DATA
Date: 25.11.2005 01:49:22

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

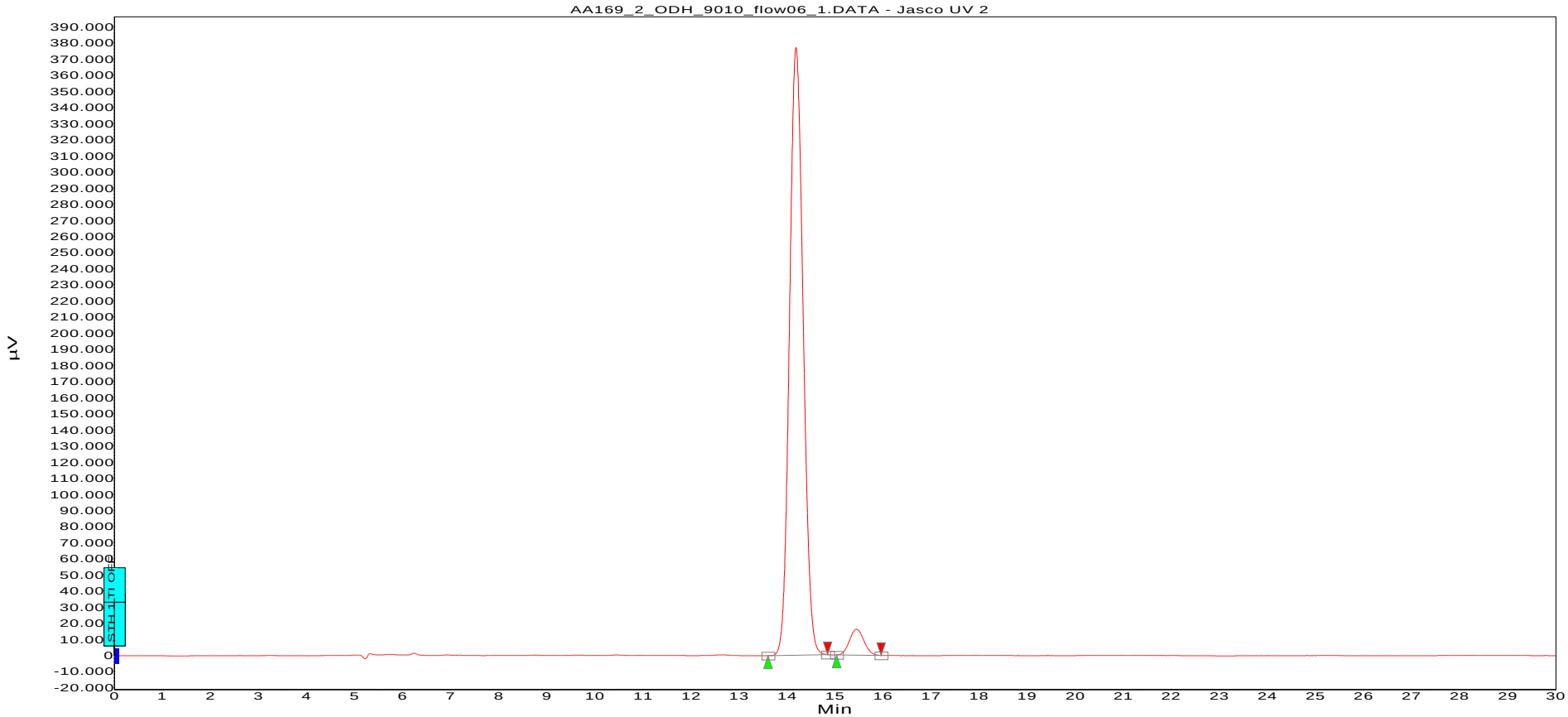


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	13,378	14,033	14,618	50,111
2	14,618	15,242	15,961	49,889
Total				100,000

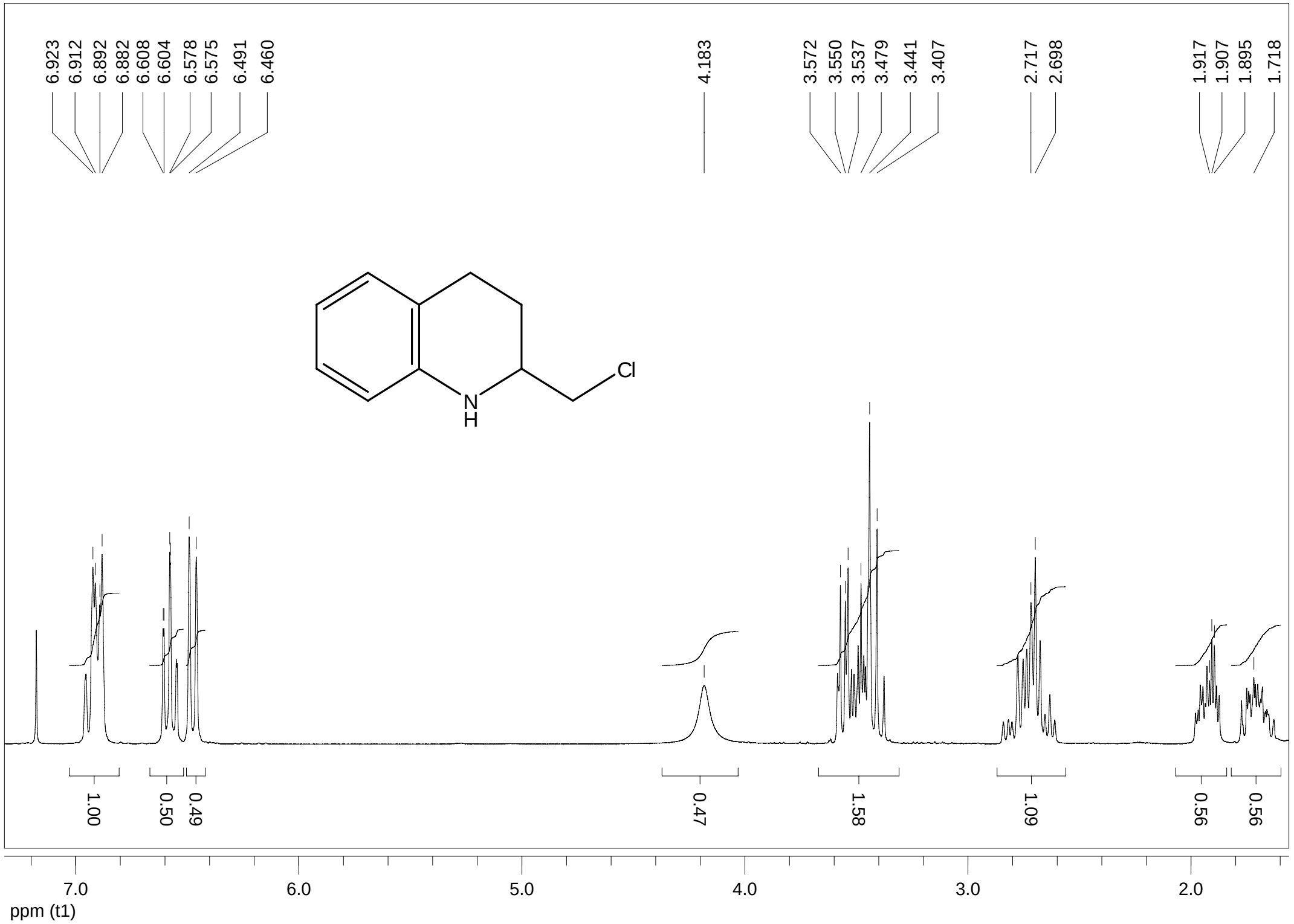
2-(2-Furyl)-1,2,3,4-tetrahydroquinoline

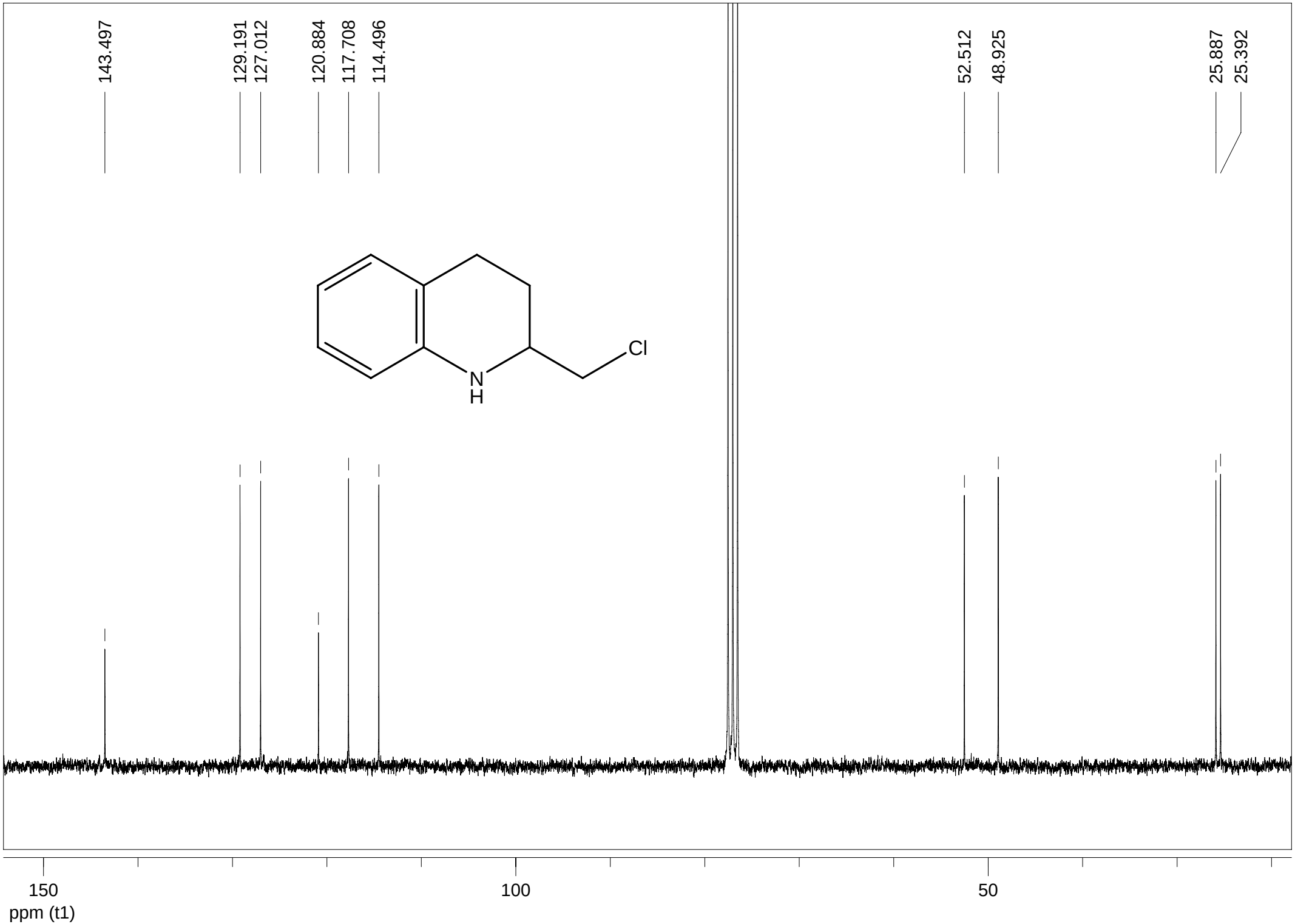
Method: ODH_9010_flow06_acq30
Data file: AA169_2_ODH_9010_flow06_1.DATA
Date: 26.11.2005 00:42:17

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	13,605	14,192	14,845	95,688
2	15,031	15,450	15,961	4,312
Total				100,000

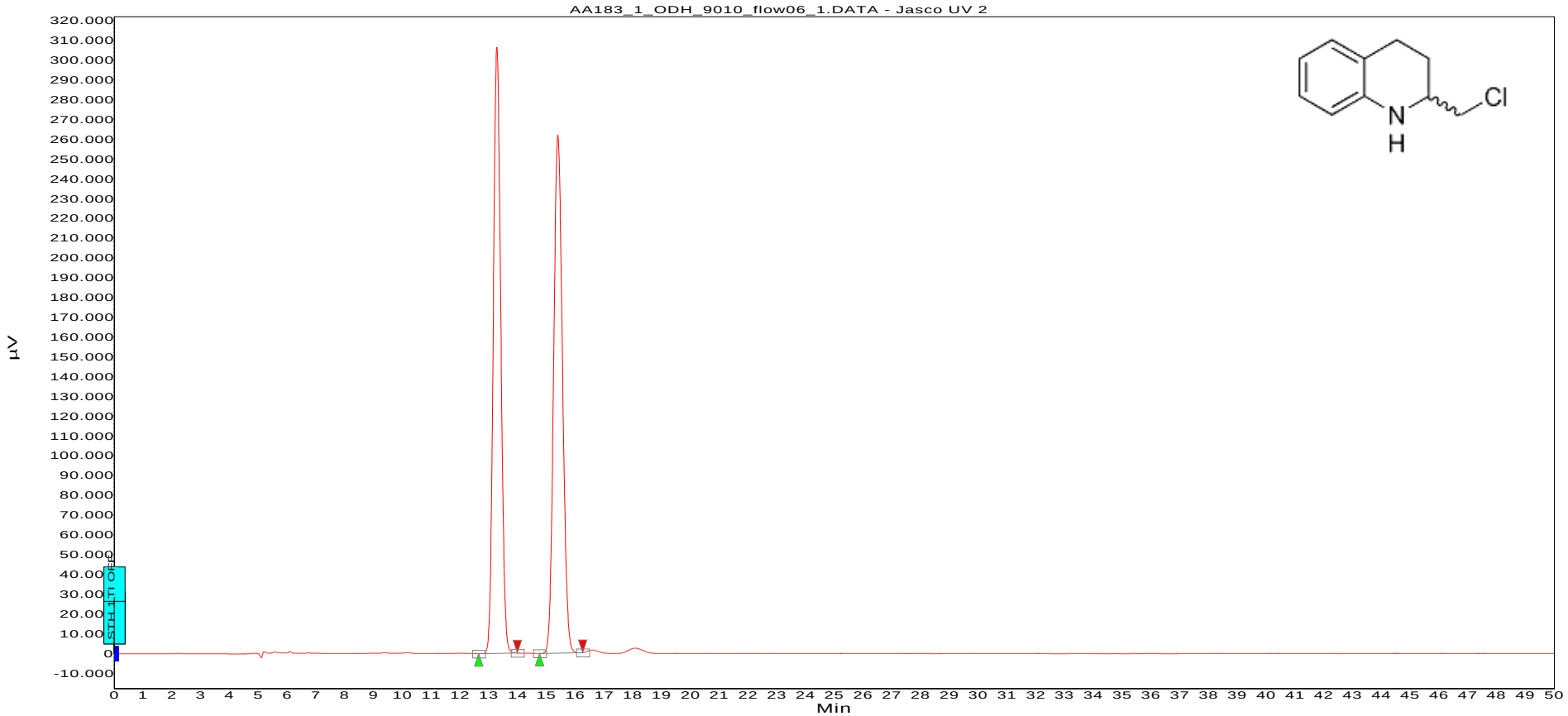

6.923
6.912
6.892
6.882
6.608
6.604
6.578
6.575
6.491
6.460
4.183
3.572
3.550
3.537
3.479
3.441
3.407
2.717
2.698
1.917
1.907
1.895
1.718
Cl
N
H
1.00
0.50
0.49
0.47
1.58
1.09
0.56
0.56
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


143.497
129.191
127.012
120.884
117.708
114.496
52.512
48.925
25.887
25.392
Cl
N
H
150
100
50
ppm (t1)

2-(Chloromethyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA183_1_ODH_9010_flow06_1.DATA
Date: 15.12.2005 06:56:22

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

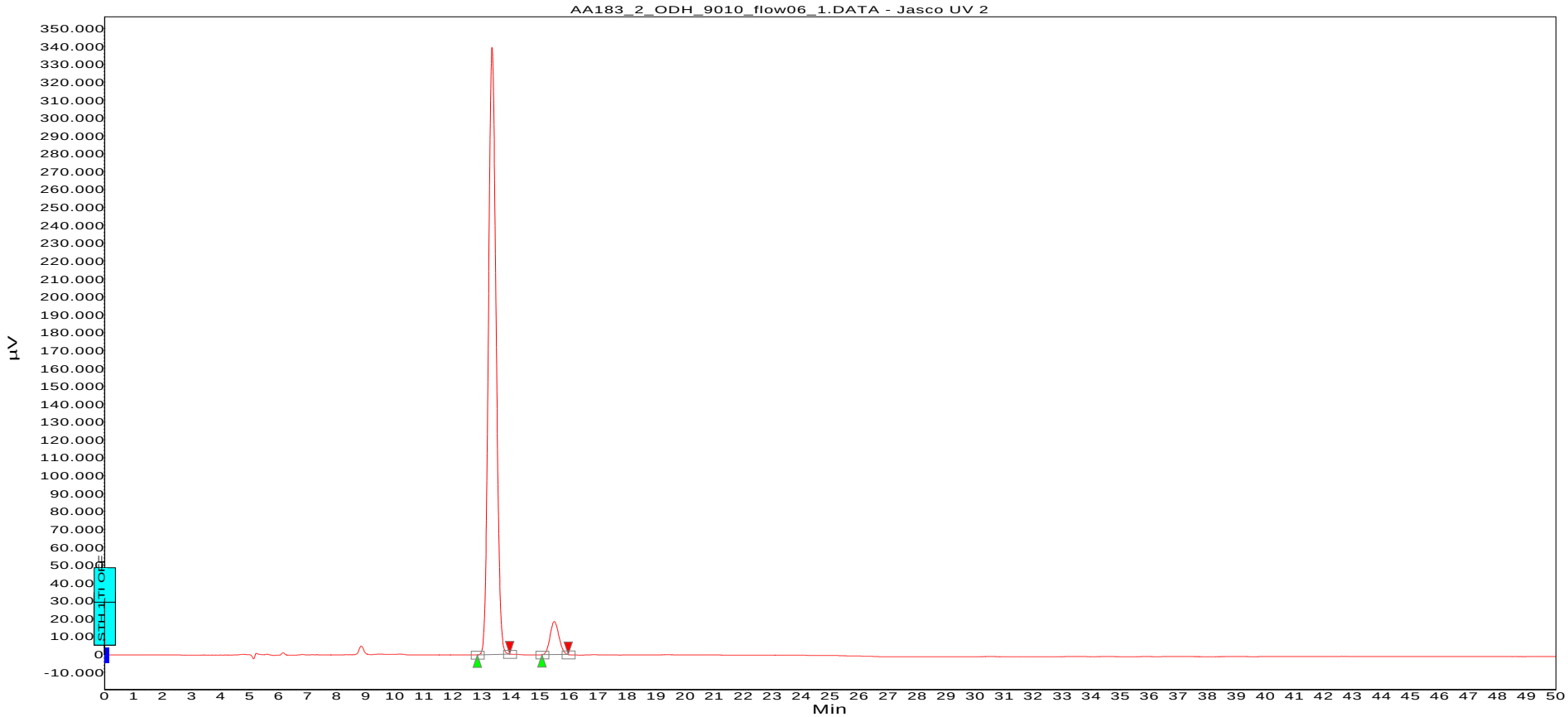


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	12,655	13,292	13,998	49,725
2	14,773	15,408	16,271	50,275
Total				100,000

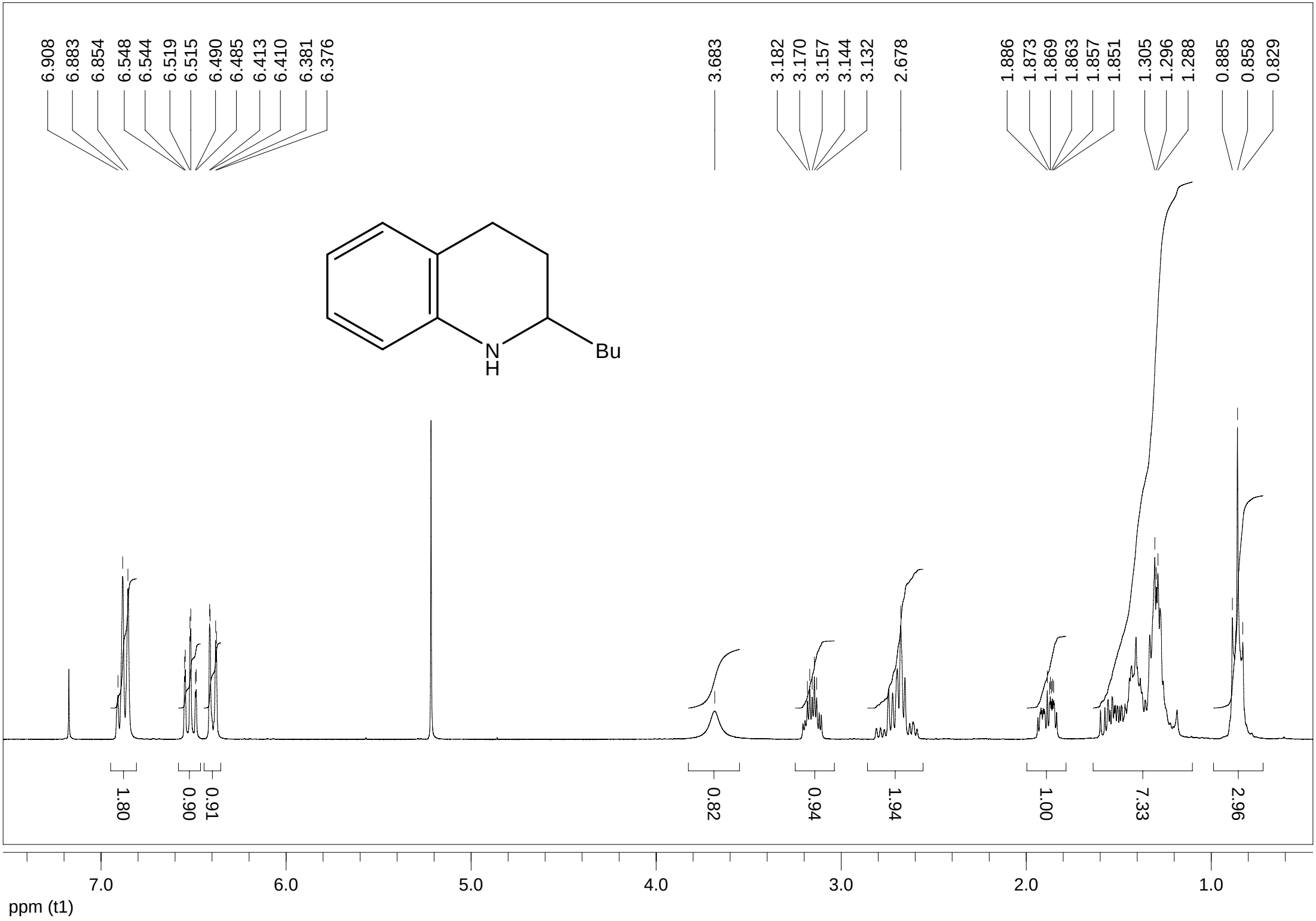
2-(Chloromethyl)-1,2,3,4-tetrahydroquinoline

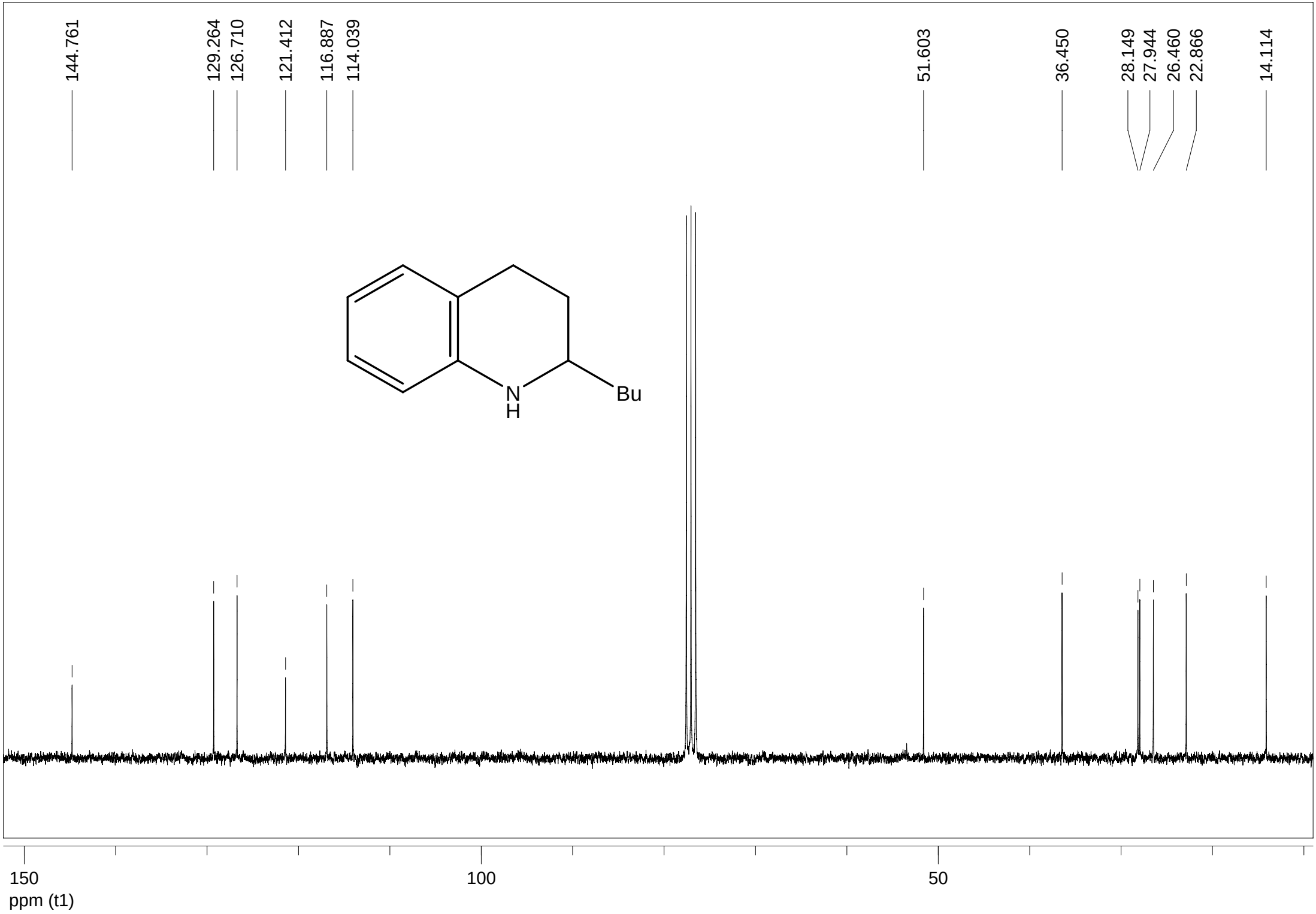
Method: ODH_9010_flow06_acq50
Data file: AA183_2_ODH_9010_flow06_1.DATA
Date: 15.12.2005 06:03:39

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
2	12,842	13,350	13,958	94,017
1	15,068	15,500	15,975	5,983
Total				100,000

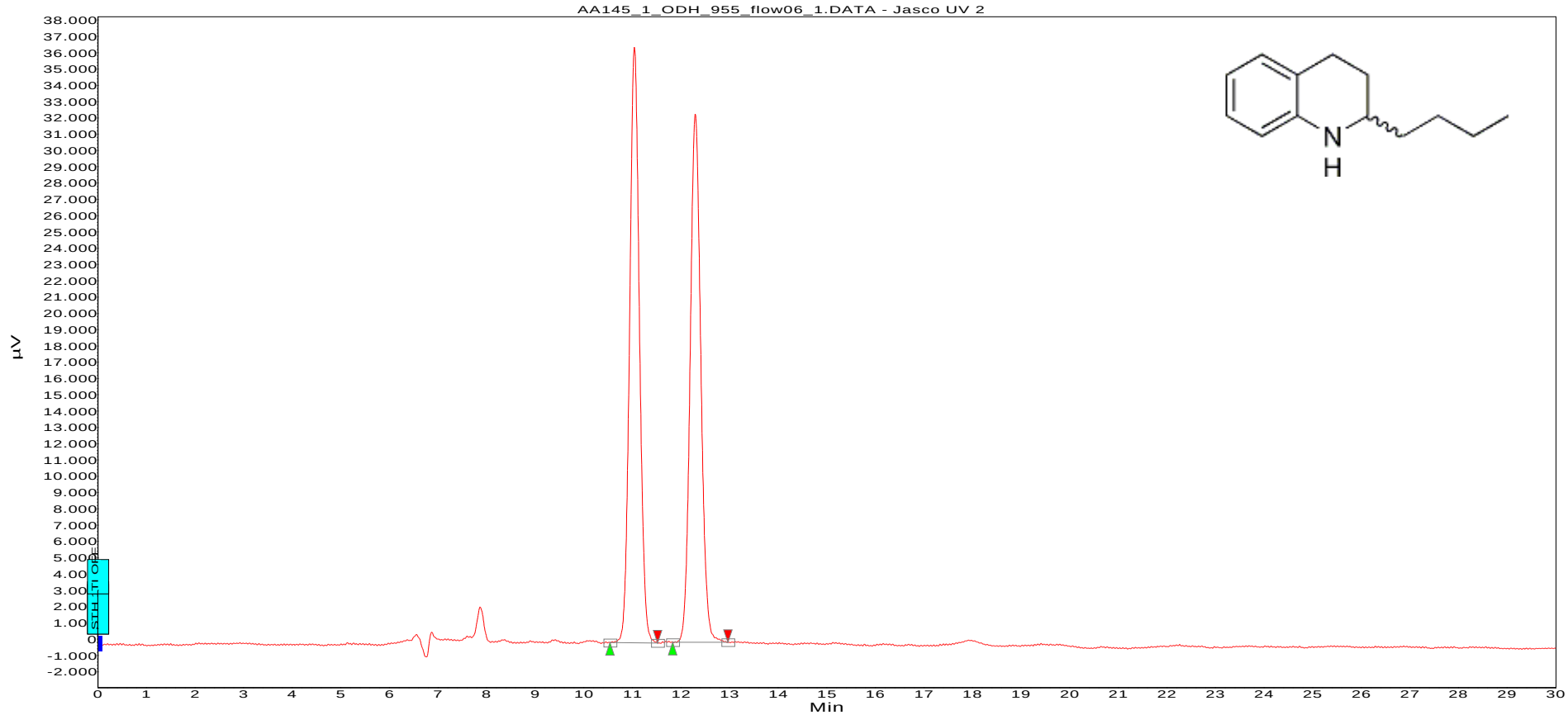

6.908
6.883
6.854
6.548
6.544
6.519
6.515
6.490
6.485
6.413
6.410
6.381
6.376
3.683
3.182
3.170
3.157
3.144
3.132
2.678
1.886
1.873
1.869
1.863
1.857
1.851
1.305
1.296
1.288
0.885
0.858
0.829
N
H
Bu
1.80
0.90
0.91
0.82
0.94
1.94
1.00
7.33
2.96
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm (t1)


144.761
129.264
126.710
121.412
116.887
114.039
51.603
36.450
28.149
27.944
26.460
22.866
14.114
N
H
Bu
150
100
50
ppm (t1)

2-Butyl-1,2,3,4-tetrahydroquinoline

Method: ODH_955_flow06_acq50
Data file: AA145_1_ODH_955_flow06_1.DATA
Date: 11.11.2005 23:58:52

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

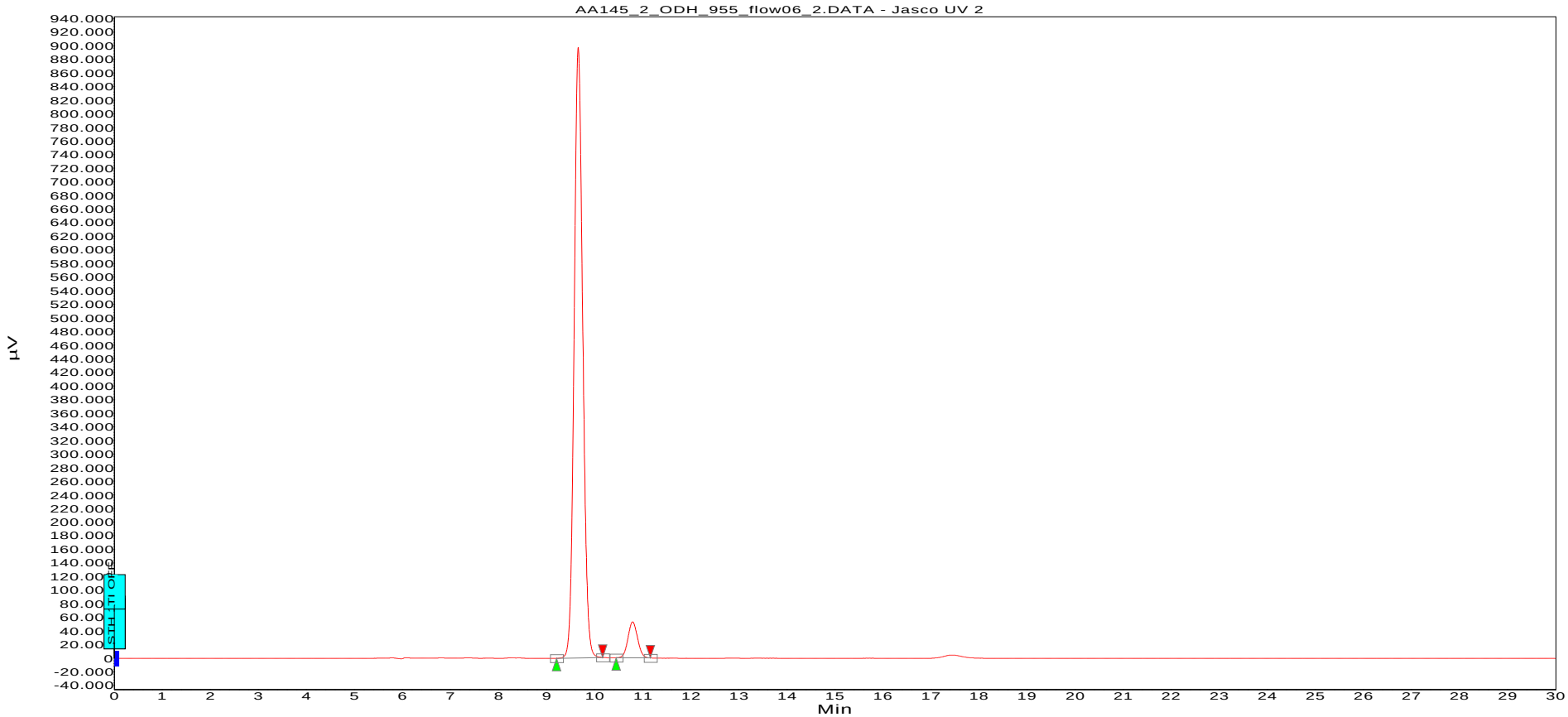


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	10,537	11,042	11,519	51,009
2	11,829	12,292	12,965	48,991
Total				100,000

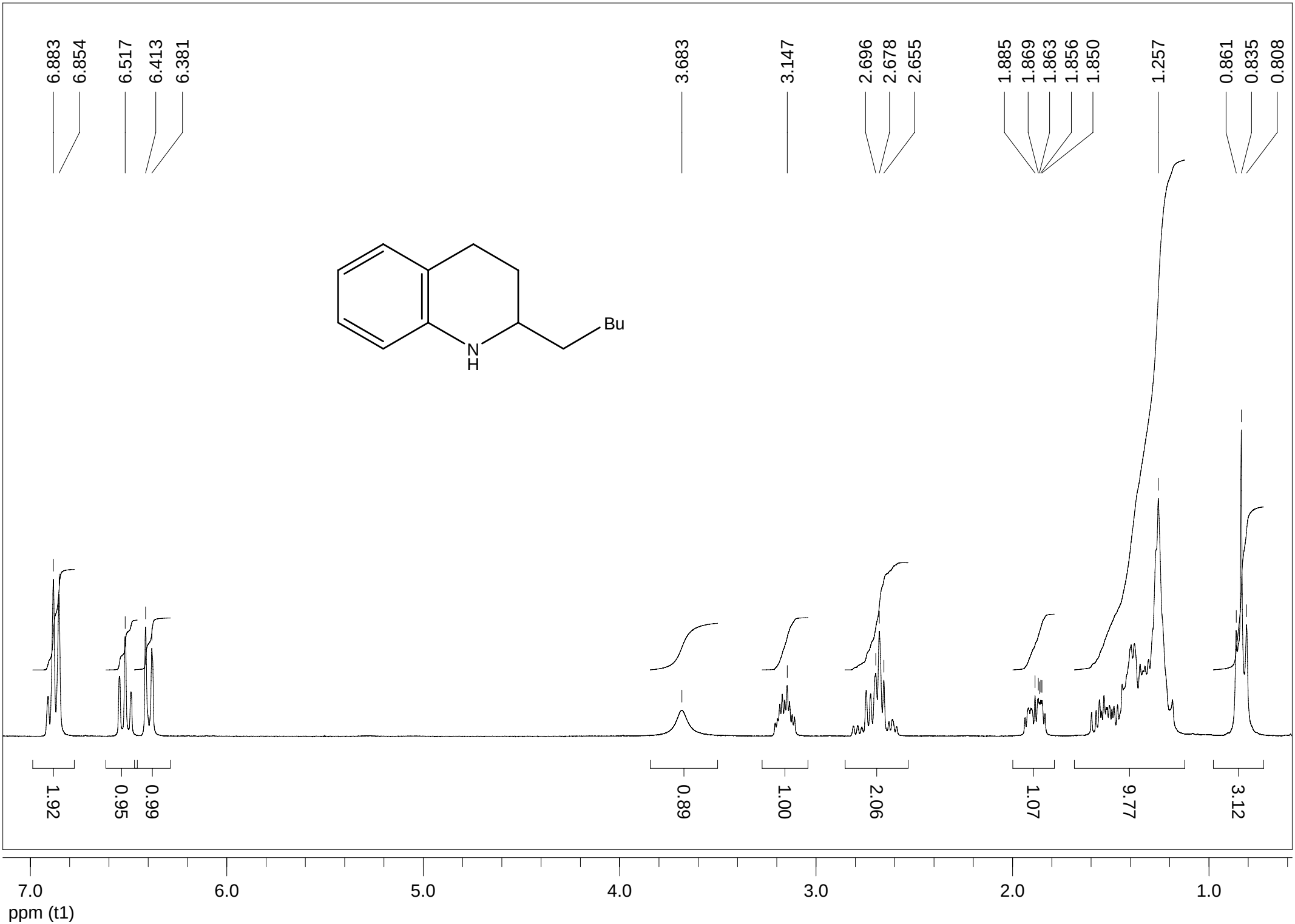
2-Butyl-1,2,3,4-tetrahydroquinoline

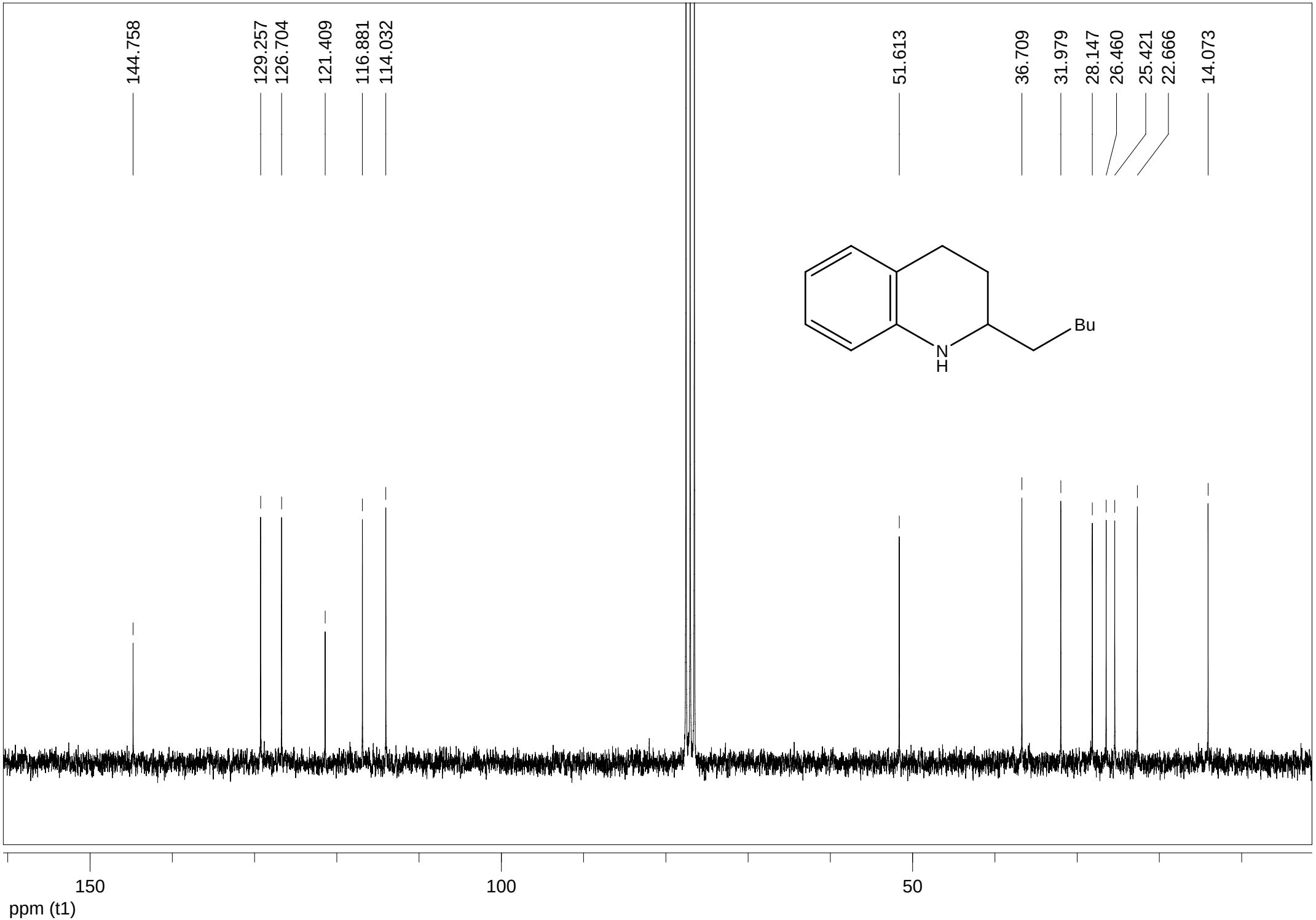
Method: ODH_955_flow06_acq30
Data file: AA145_2_ODH_955_flow06_2.DATA
Date: 16.11.2005 21:33:19

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	9,205	9,658	10,165	93,833
2	10,444	10,792	11,157	6,167
Total				100,000

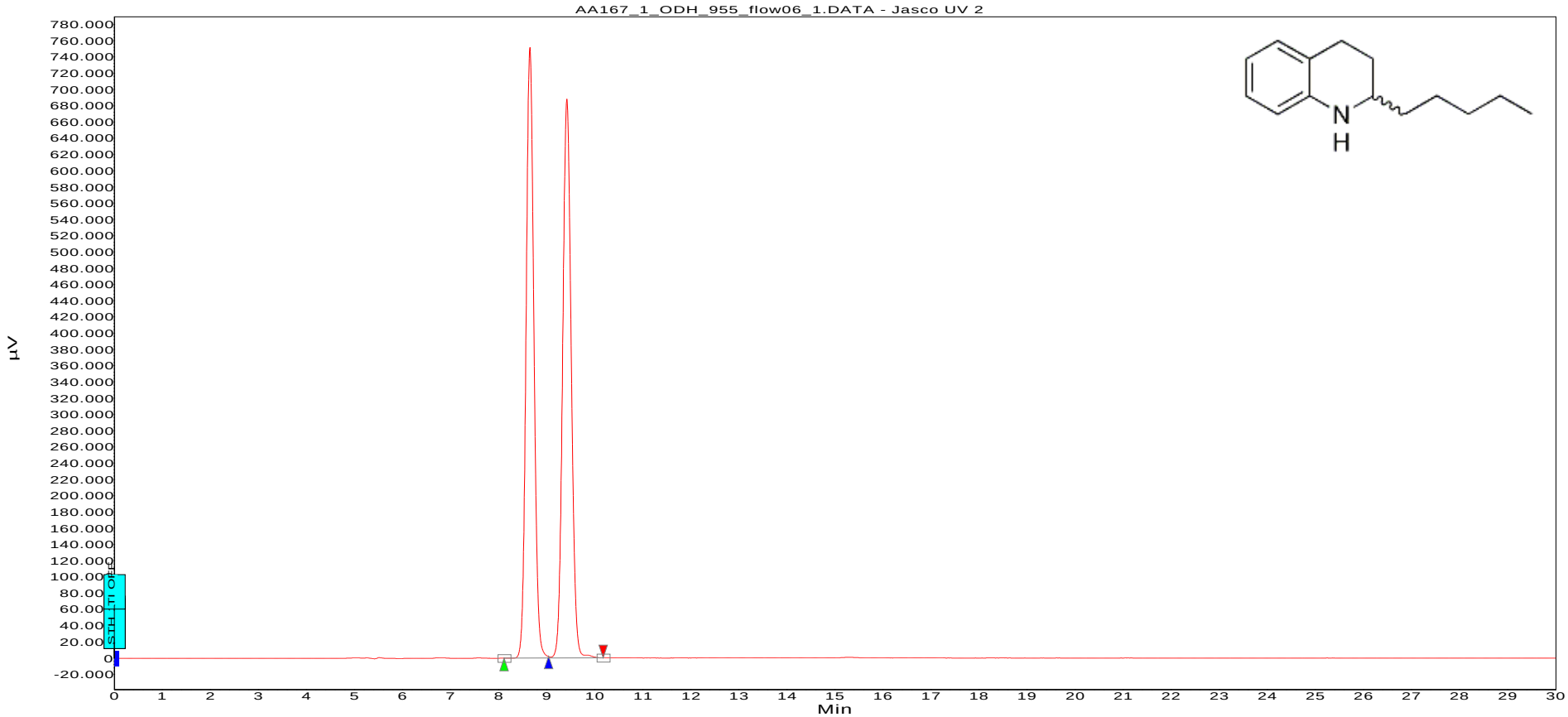

6.883
6.854
6.517
6.413
6.381
3.683
3.147
2.696
2.678
2.655
1.885
1.869
1.863
1.856
1.850
1.257
0.861
0.835
0.808
Bu
N
H
1.92
0.95
0.99
0.89
1.00
2.06
1.07
9.77
3.12
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm (t1)


144.758
129.257
126.704
121.409
116.881
114.032
51.613
36.709
31.979
28.147
26.460
25.421
22.666
14.073
Bu
N
H
150
100
50
ppm (t1)

2-Pentyl-1,2,3,4-tetrahydroquinoline

Method: ODH_955_flow06_acq50
Data file: AA167_1_ODH_955_flow06_1.DATA
Date: 24.11.2005 23:31:12

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

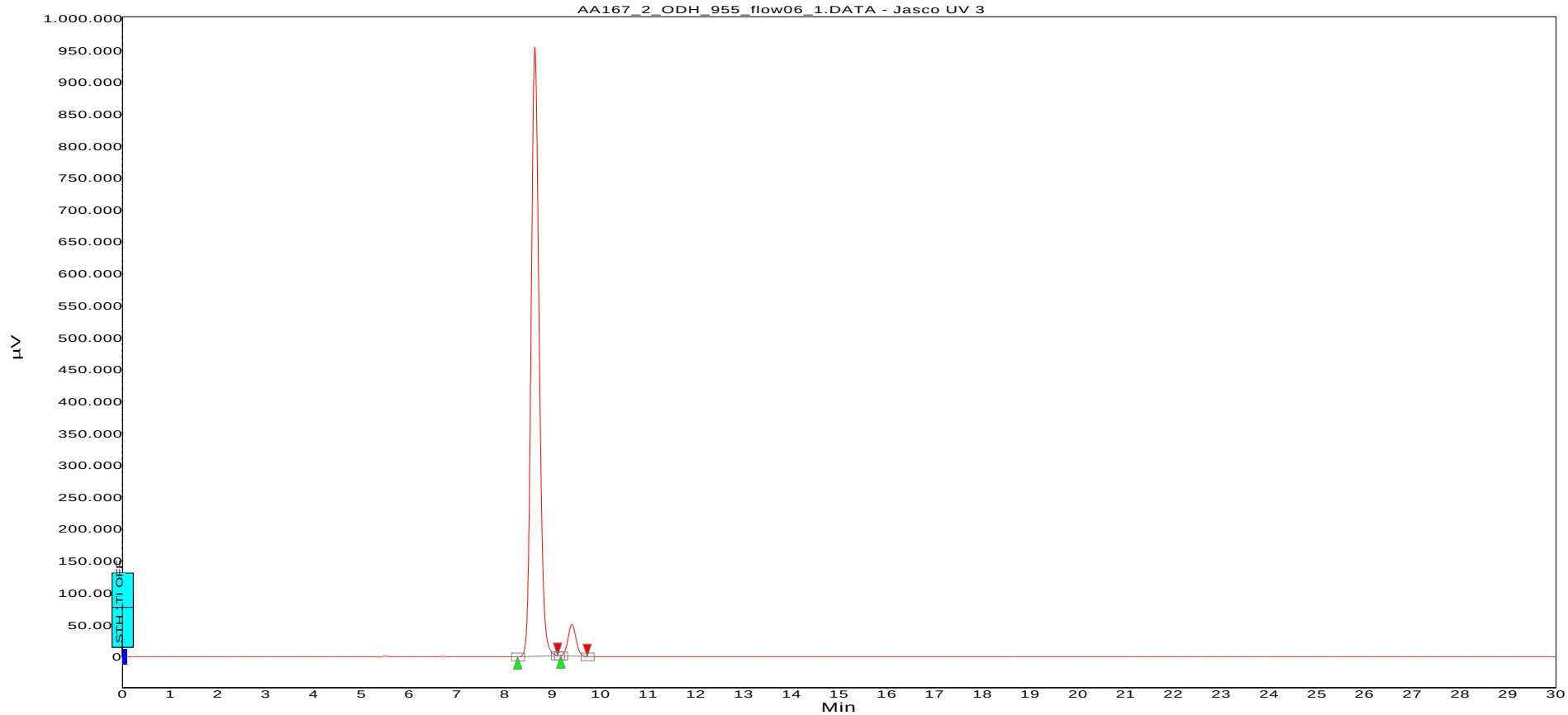


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	8,110	8,650	9,039	49,834
2	9,039	9,417	10,176	50,166
Total				100,000

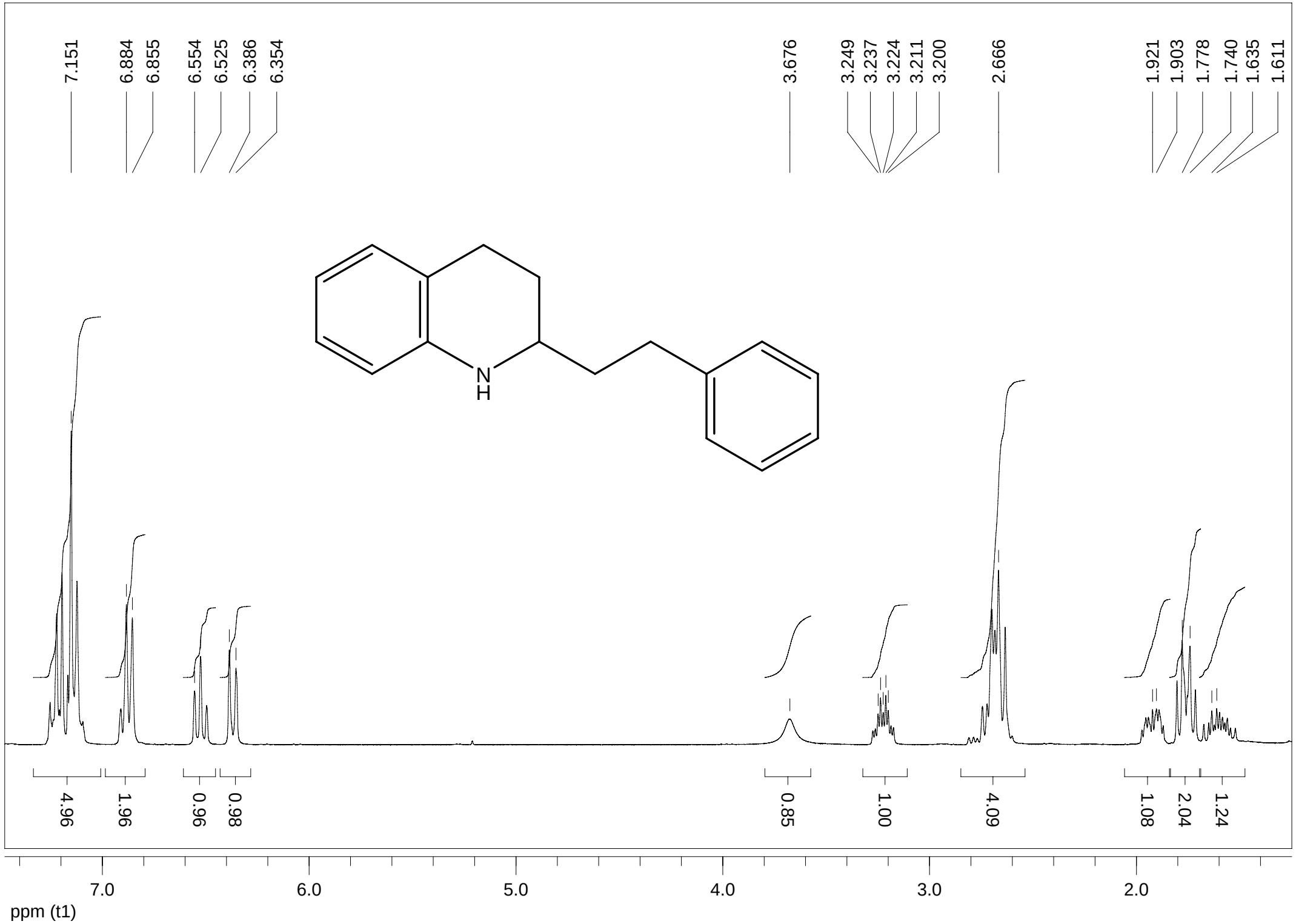
2-Pentyl-1,2,3,4-tetrahydroquinoline

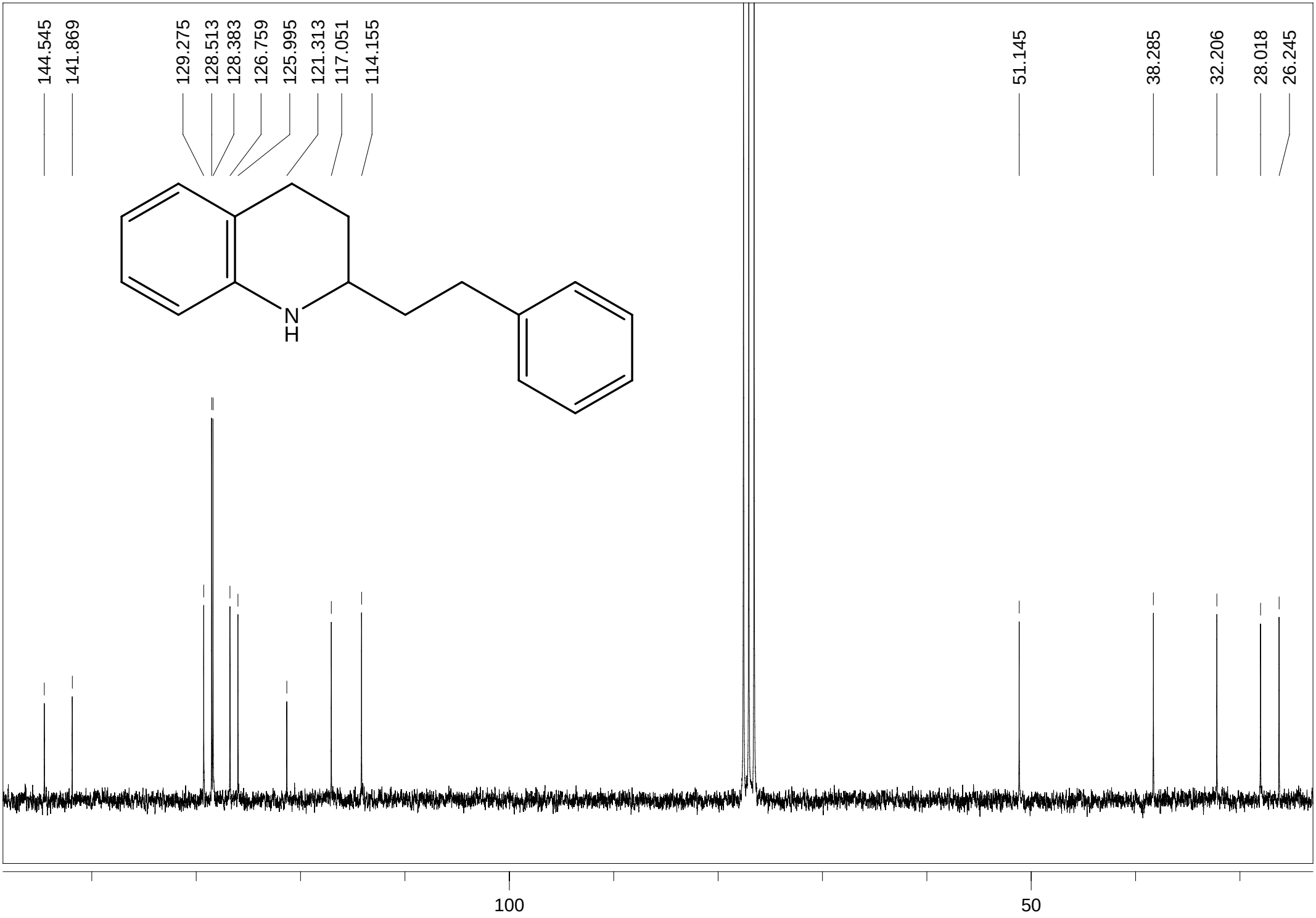
Method: ODH_955_flow06_acq30
Data file: AA167_2_ODH_955_flow06_1.DATA
Date: 25.11.2005 22:31:25

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	8,275	8,633	9,112	95,038
2	9,174	9,408	9,731	4,962
Total				100,000

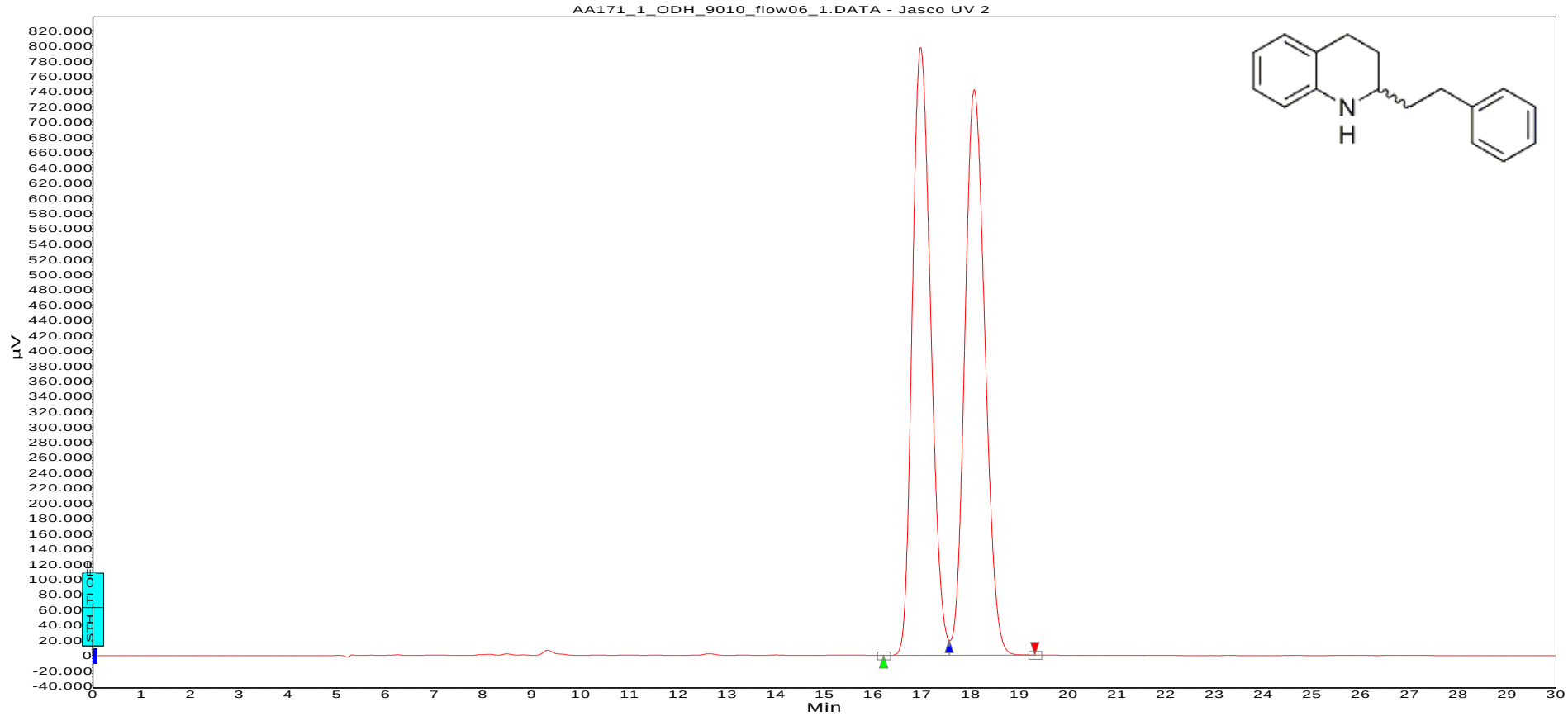

7.151
6.884
6.855
6.554
6.525
6.386
6.354
3.676
3.249
3.237
3.224
3.211
3.200
2.666
1.921
1.903
1.778
1.740
1.635
1.611
N
H
4.96
1.96
0.96
0.98
0.85
1.00
4.09
1.08
2.04
1.24
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


144.545
141.869
129.275
128.513
128.383
126.759
125.995
121.313
117.051
114.155
51.145
38.285
32.206
28.018
26.245
N
H
100
50
ppm (t1)

2-(2-Phenylethyl)-1,2,3,4-tetrahydroquinoline

Method: ODH_9010_flow06_acq50
Data file: AA171_1_ODH_9010_flow06_1.DATA
Date: 25.11.2005 02:42:05

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

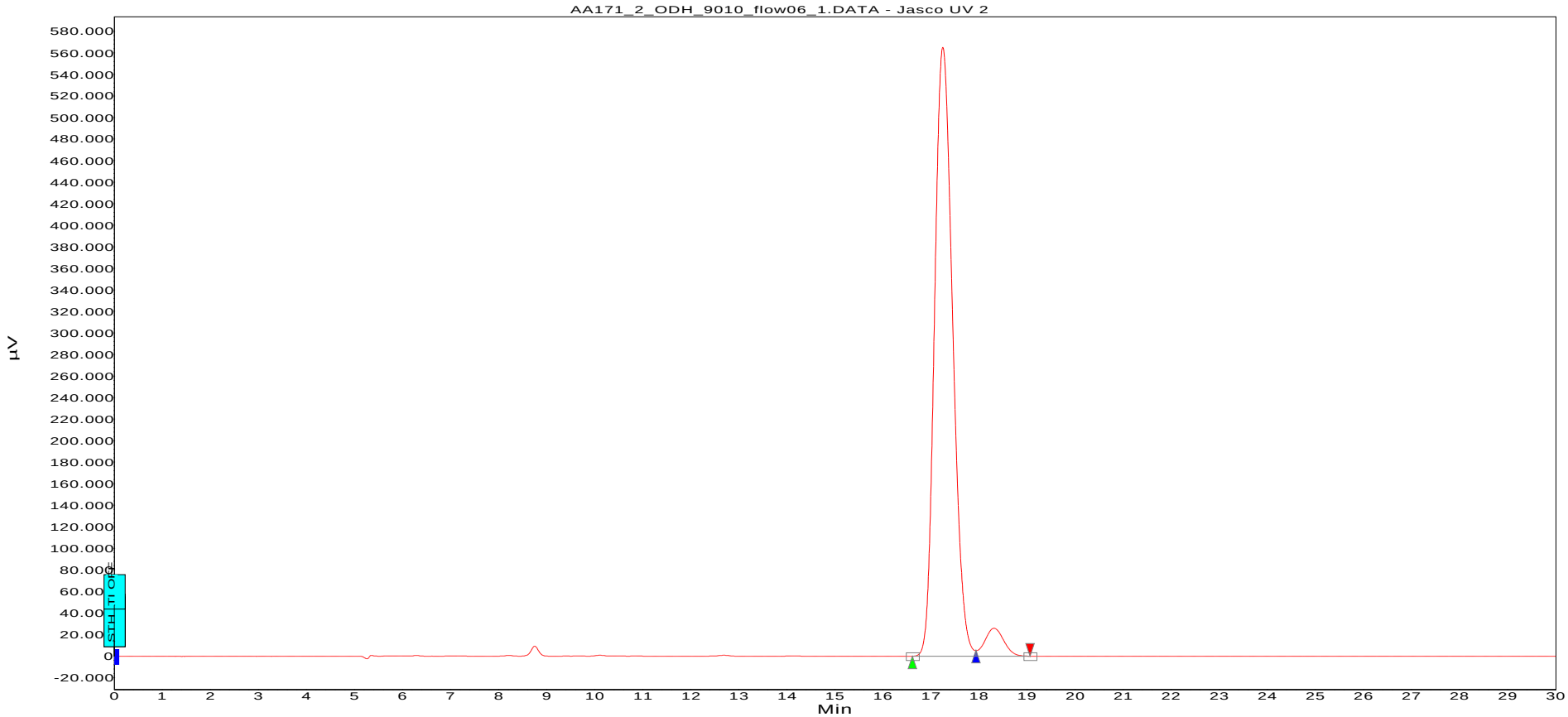


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	16,219	16,975	17,562	49,550
2	17,562	18,075	19,318	50,450
Total				100,000

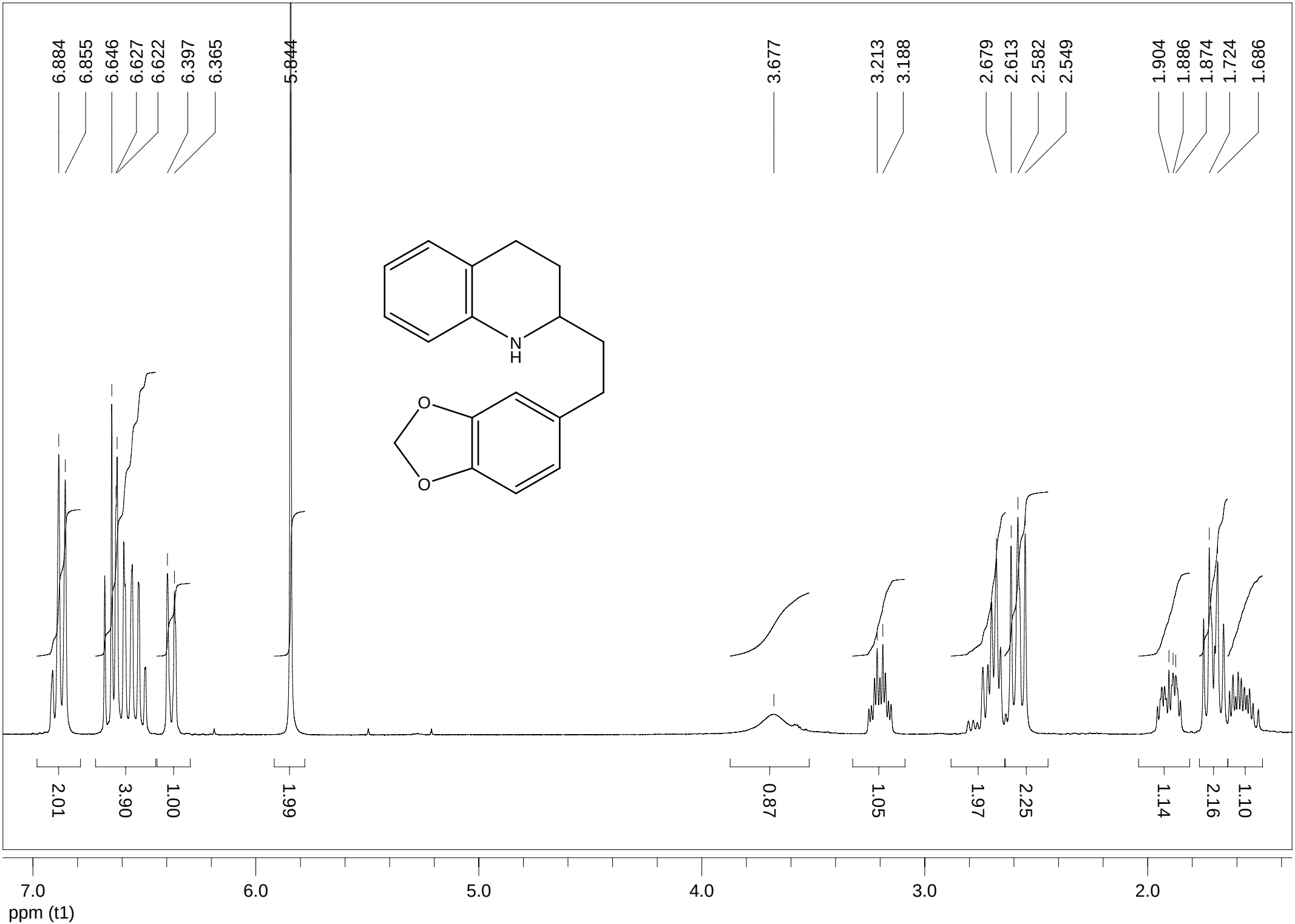
2-(2-Phenylethyl)-1,2,3,4-tetrahydroquinoline

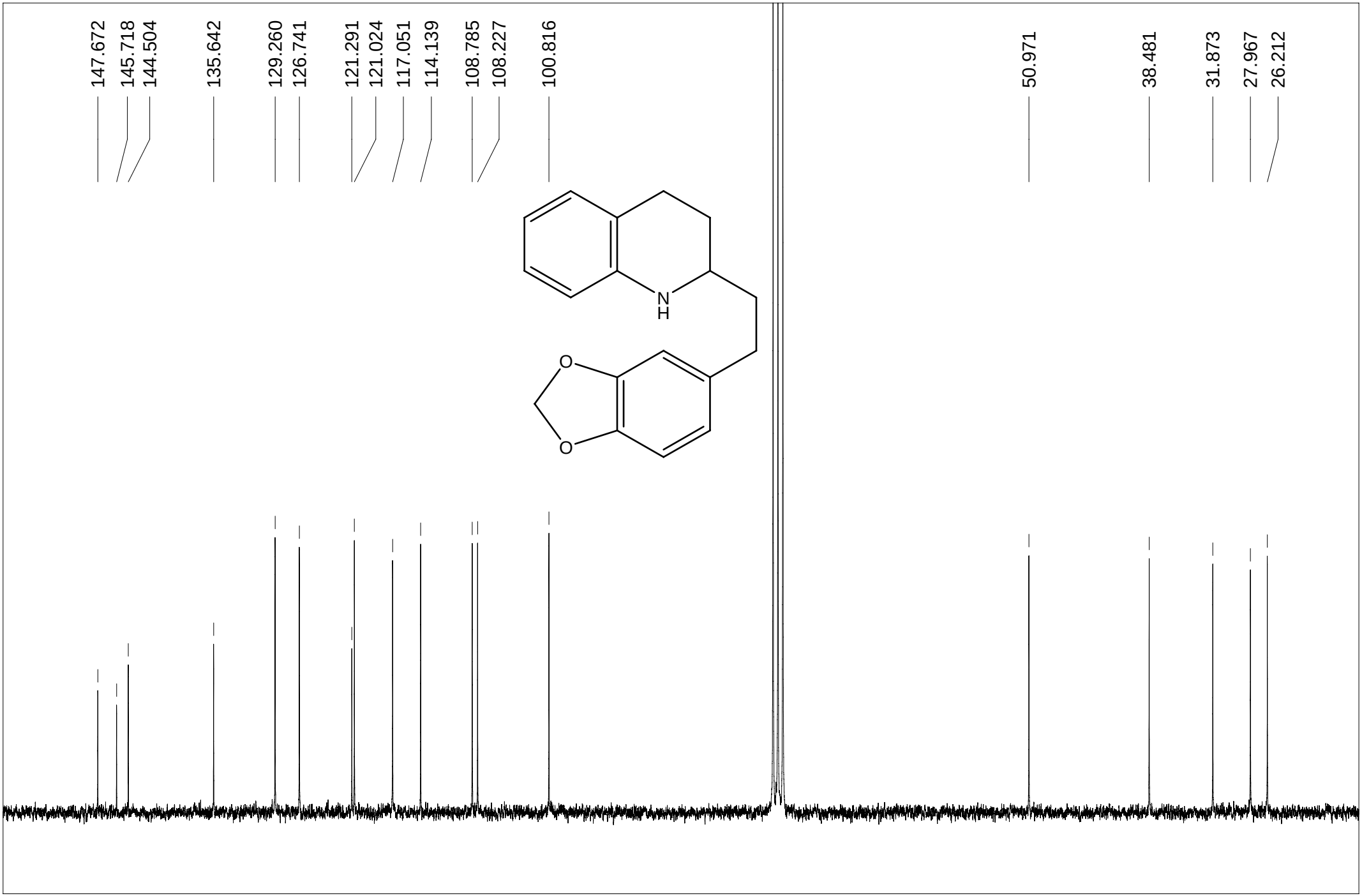
Method: ODH_9010_flow06_acq30
Data file: AA171_2_ODH_9010_flow06_1.DATA
Date: 26.11.2005 01:15:01

Column: ODH
Flow: 0.6 mL/min
Run time: 30,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	16,612	17,242	17,934	95,402
2	17,934	18,308	19,060	4,598
Total				100,000

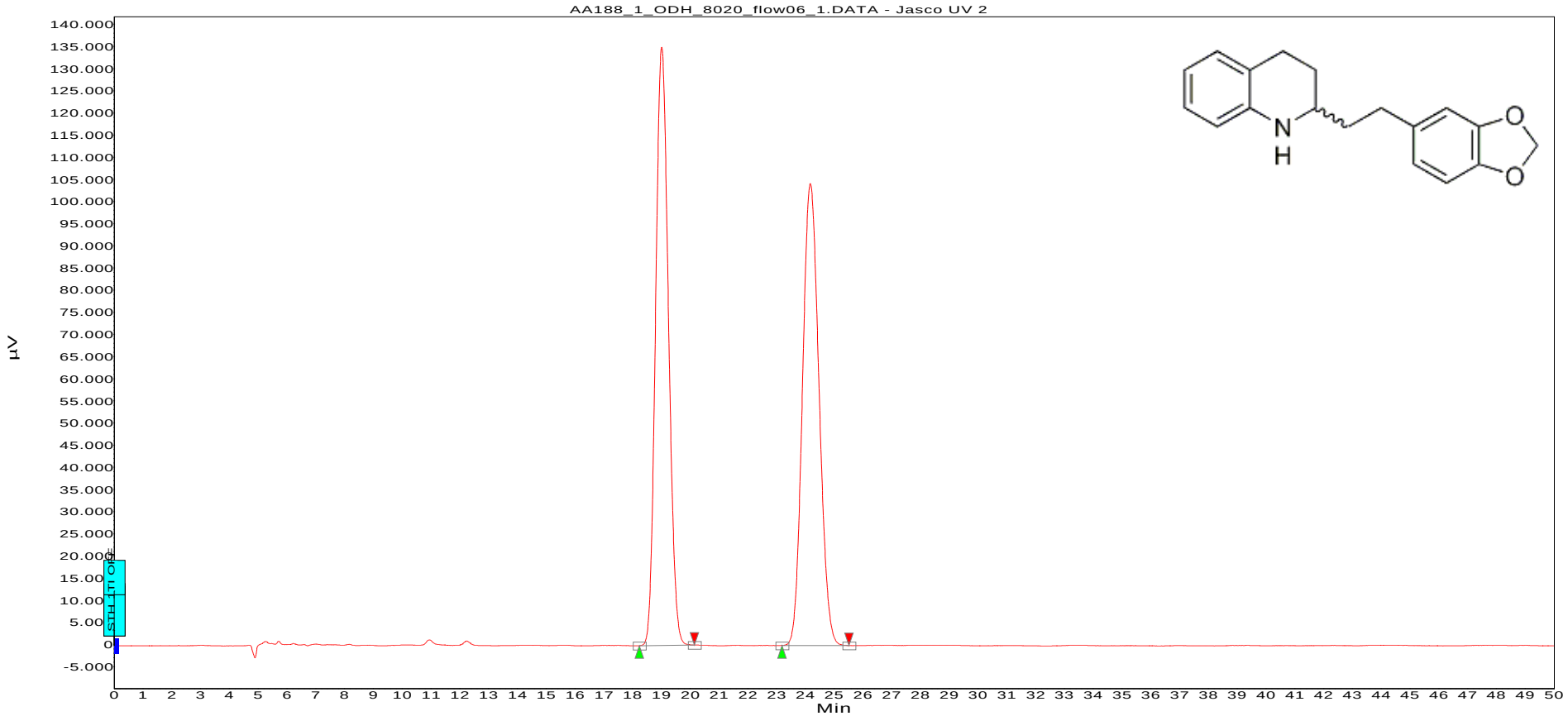

6.884
6.855
6.646
6.627
6.622
6.397
6.365
5.844
3.677
3.213
3.188
2.679
2.613
2.582
2.549
1.904
1.886
1.874
1.724
1.686
N
H
O
O
2.01
3.90
1.00
1.99
0.87
1.05
1.97
2.25
1.14
2.16
1.10
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


147.672
145.718
144.504
135.642
129.260
126.741
121.291
121.024
117.051
114.139
108.785
108.227
100.816
50.971
38.481
31.873
27.967
26.212
N
H
O
O
150
100
50
ppm (t1)

2-[2-(1,3-Benzodioxol-5-yl)ethyl]-1,2,3,4-tetrahydroquinoline

Method: ODH_8020_flow06_acq50
Data file: AA188_1_ODH_8020_flow06_1.DATA
Date: 15.12.2005 04:38:17

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min

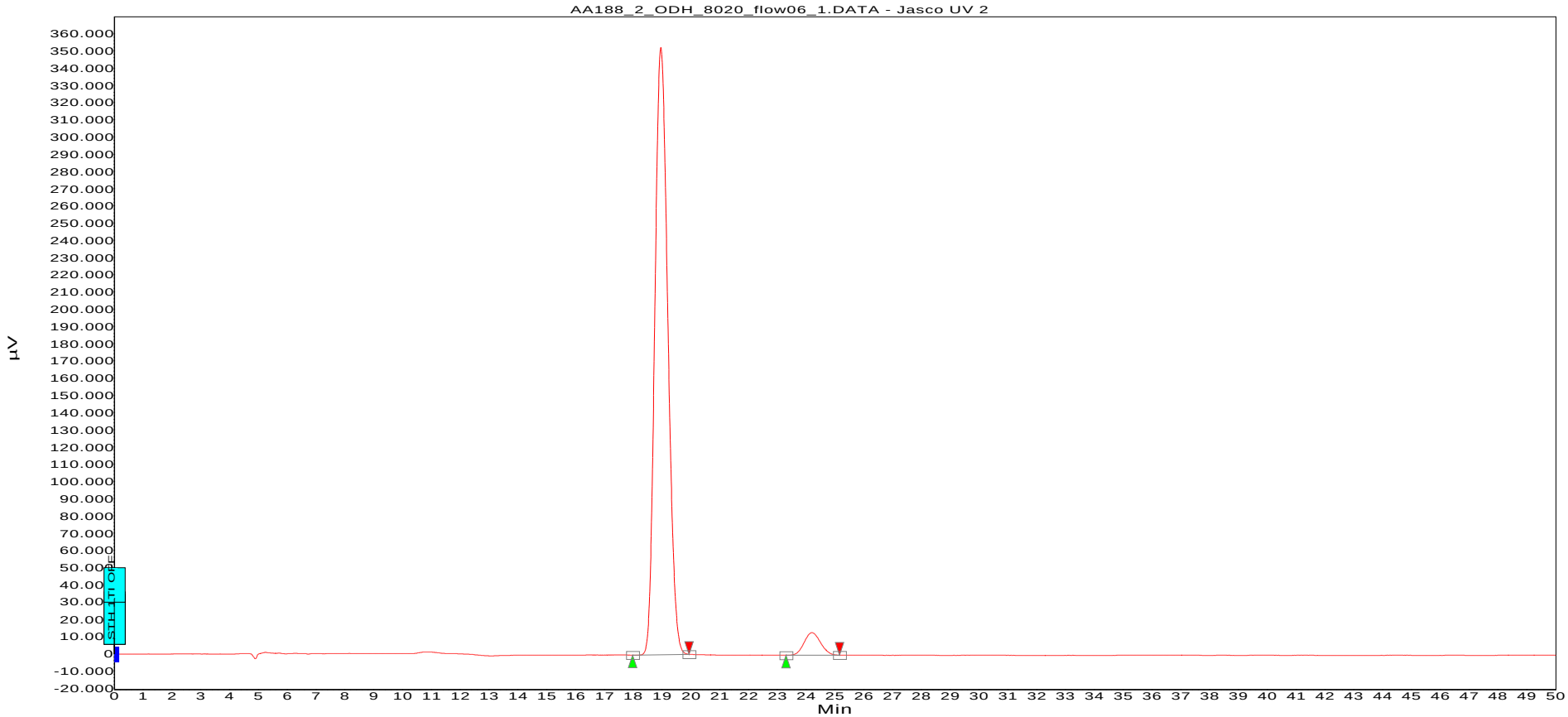


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	18,233	19,008	20,145	50,068
2	23,192	24,175	25,517	49,932
Total				100,000

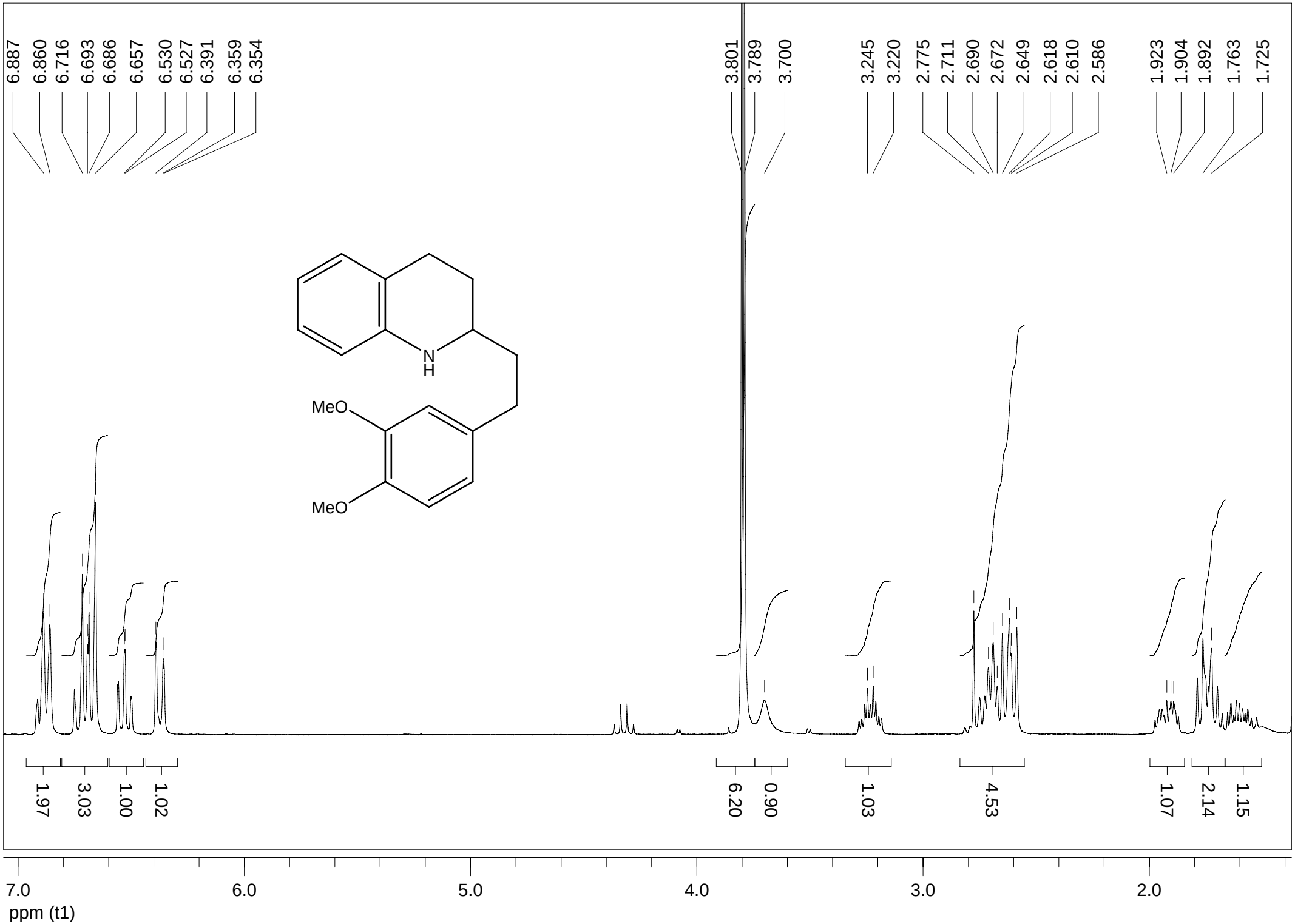
2-[2-(1,3-Benzodioxol-5-yl)ethyl]-1,2,3,4-tetrahydroquinoline

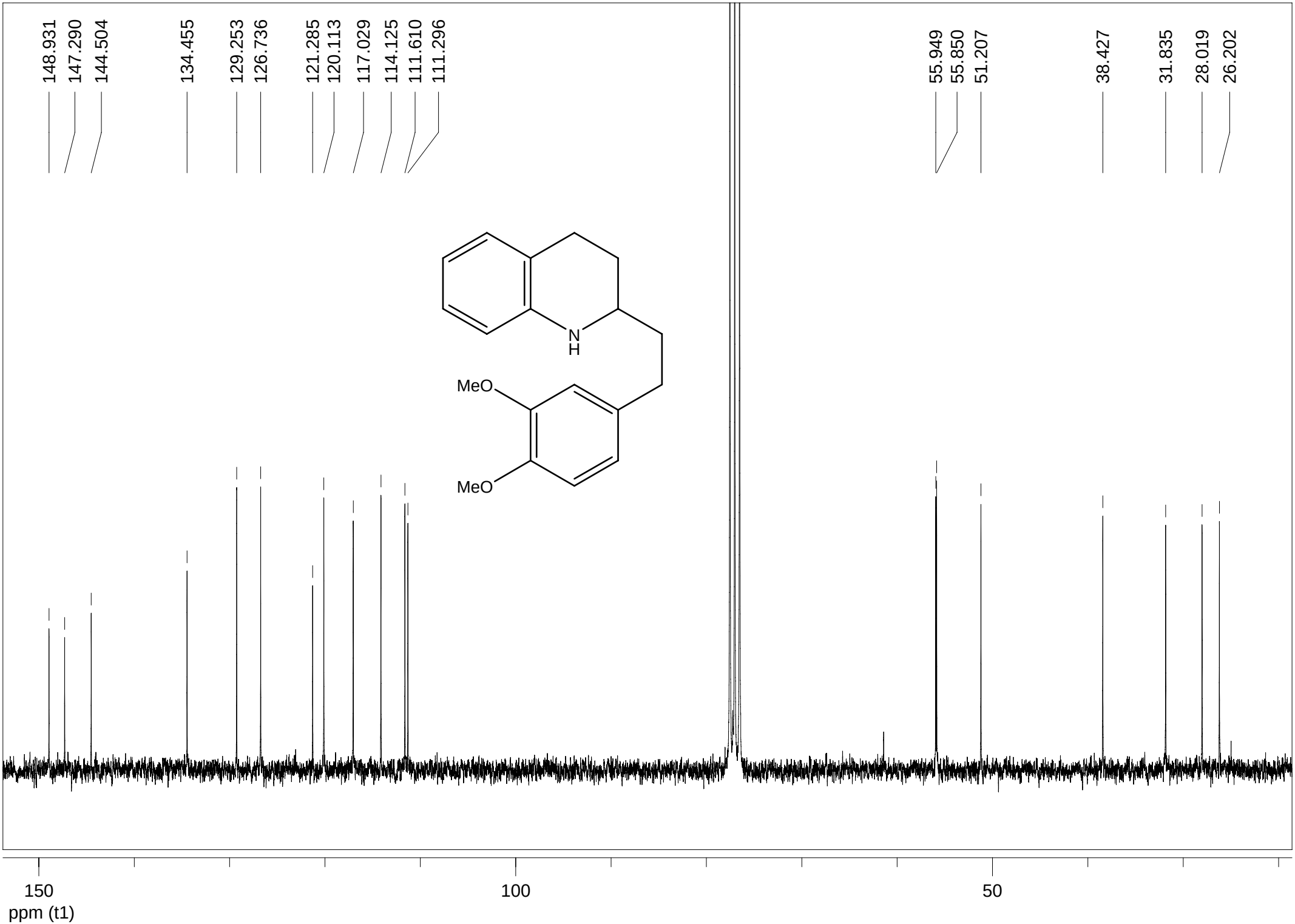
Method: ODH_8020_flow06_acq50
Data file: AA188_2_ODH_8020_flow06_1.DATA
Date: 15.12.2005 03:45:31

Column: ODH
Flow: 0.6 mL/min
Run time: 50,00 min



Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	17,975	18,958	19,938	95,492
2	23,295	24,200	25,155	4,508
Total				100,000

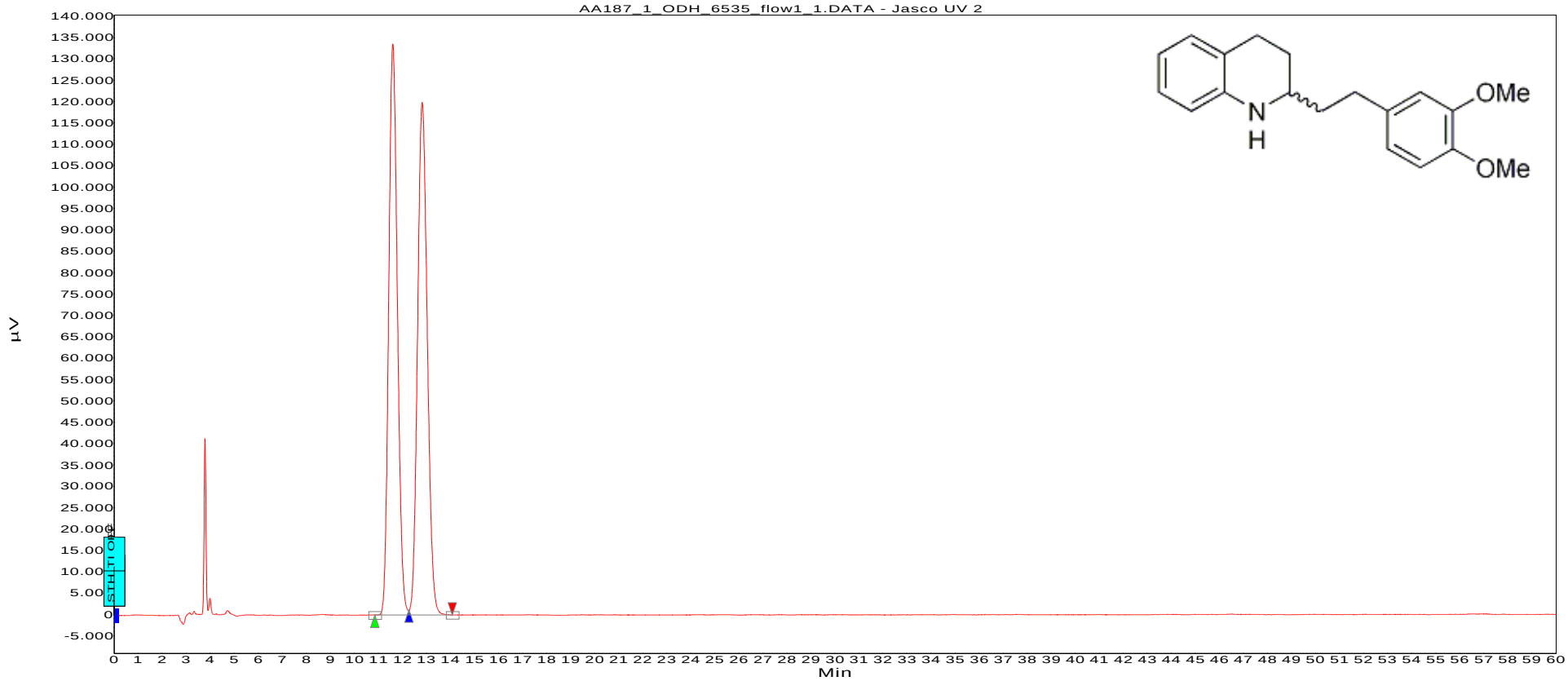

6.887
6.860
6.716
6.693
6.686
6.657
6.530
6.527
6.391
6.359
6.354
3.801
3.789
3.700
3.245
3.220
2.775
2.711
2.690
2.672
2.649
2.618
2.610
2.586
1.923
1.904
1.892
1.763
1.725
N
H
MeO
MeO
1.97
3.03
1.00
1.02
6.20
0.90
1.03
4.53
1.07
2.14
1.15
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


148.931
147.290
144.504
134.455
129.253
126.736
121.285
120.113
117.029
114.125
111.610
111.296
55.949
55.850
51.207
38.427
31.835
28.019
26.202
N
H
MeO
MeO
150
100
50
ppm (t1)

2-[2-(3,4-Dimethoxyphenyl)ethyl]-1,2,3,4-tetrahydroquinoline

Method: ODH_6535_flow1_acq60
Data file: AA187_1_ODH_6535_flow1_1.DATA
Date: 15.12.2005 02:10:08

Column: ODH
Flow: 1.0 mL/min
Run time: 60,00

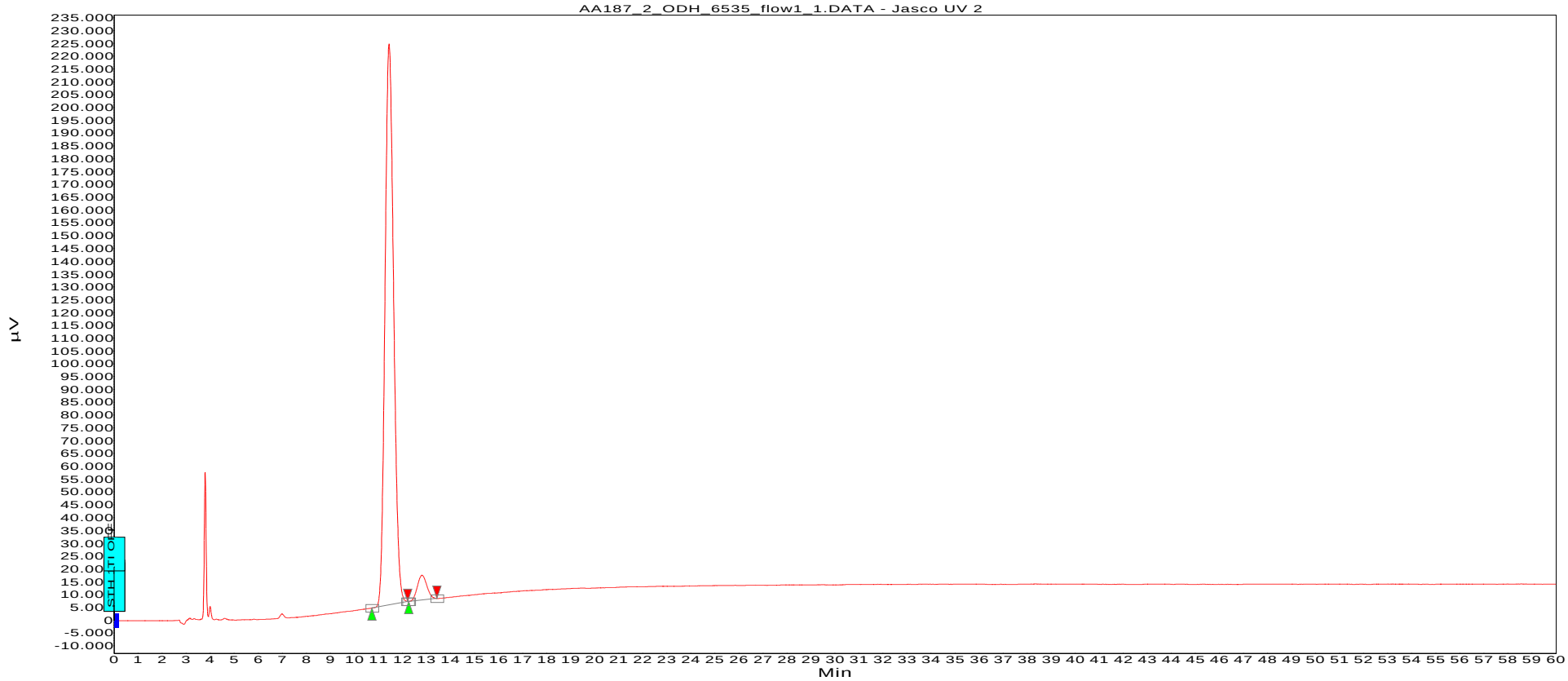


Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	10,847	11,600	12,273	49,912
2	12,273	12,817	14,070	50,088
Total				100,000

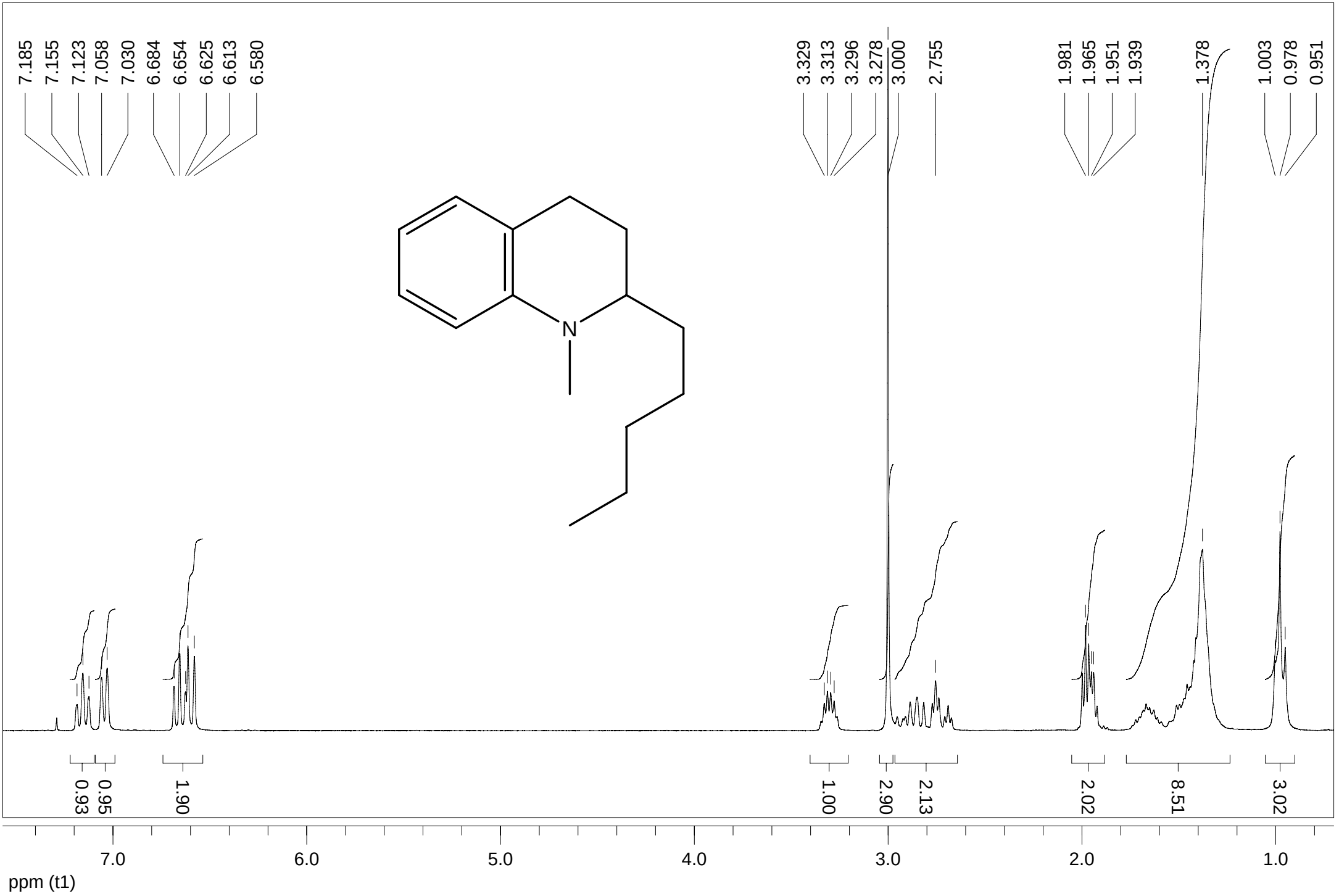
2-[2-(3,4-Dimethoxyphenyl)ethyl]-1,2,3,4-tetrahydroquinoline

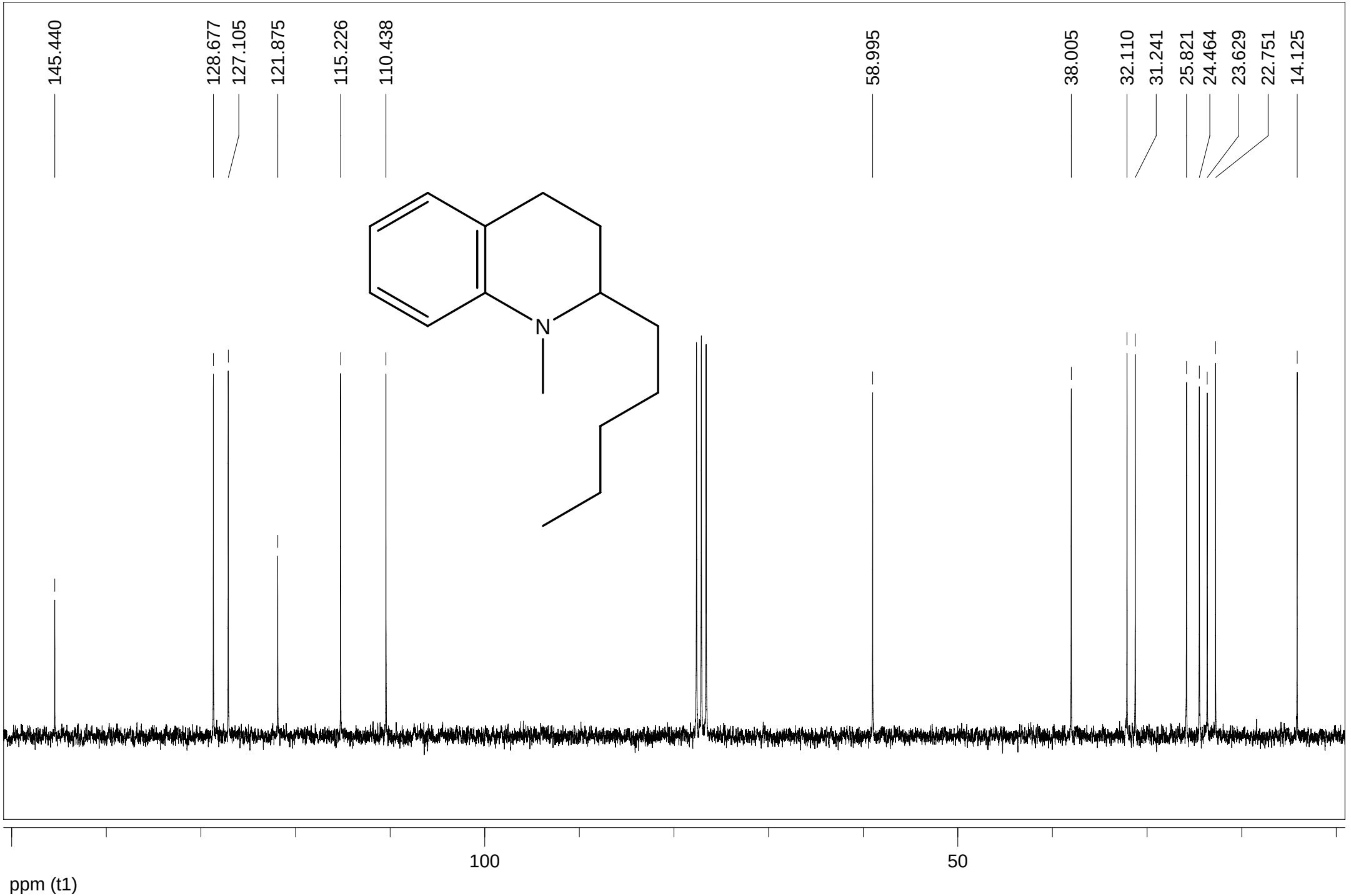
Method: ODH_6535_flow1_acq60
Data file: AA187_2_ODH_6535_flow1_1.DATA
Date: 15.12.2005 01:07:26

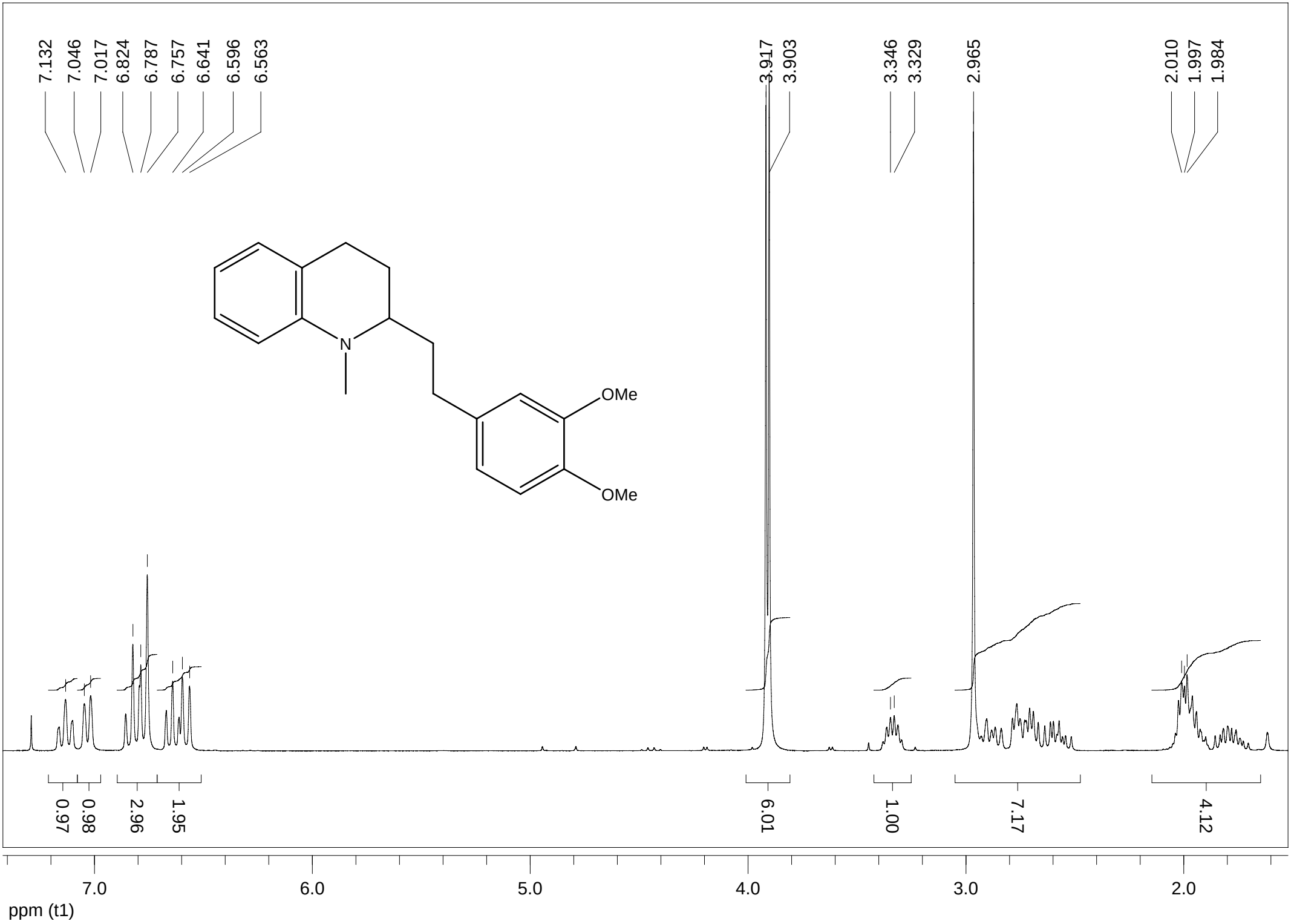
Column: ODH
Flow: 1.0 mL/min
Run time: 60,00

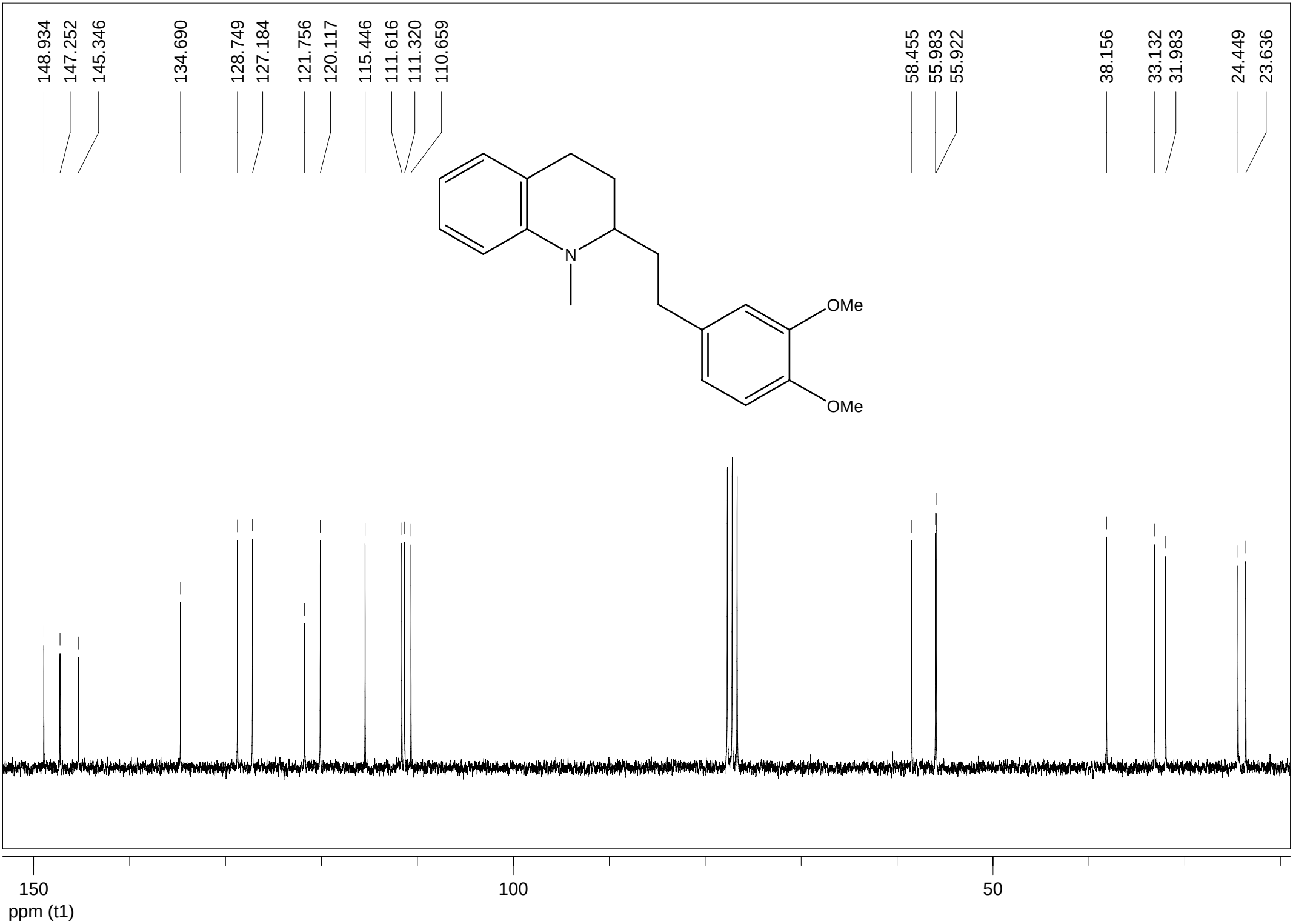


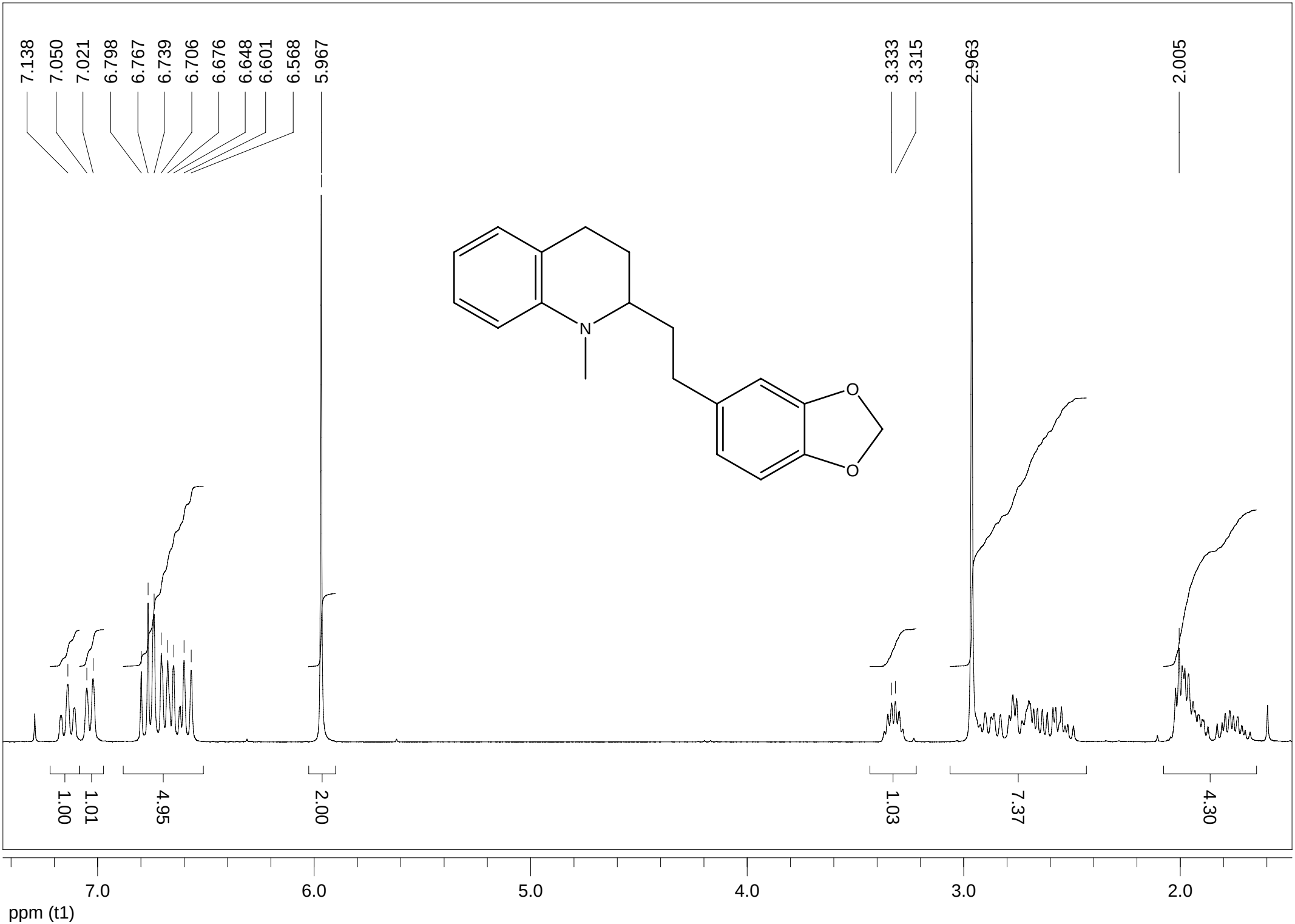
Index	Start	Time	End	Area %
	[Min]	[Min]	[Min]	[%]
1	10,723	11,442	12,211	95,371
2	12,257	12,808	13,426	4,629
Total				100,000

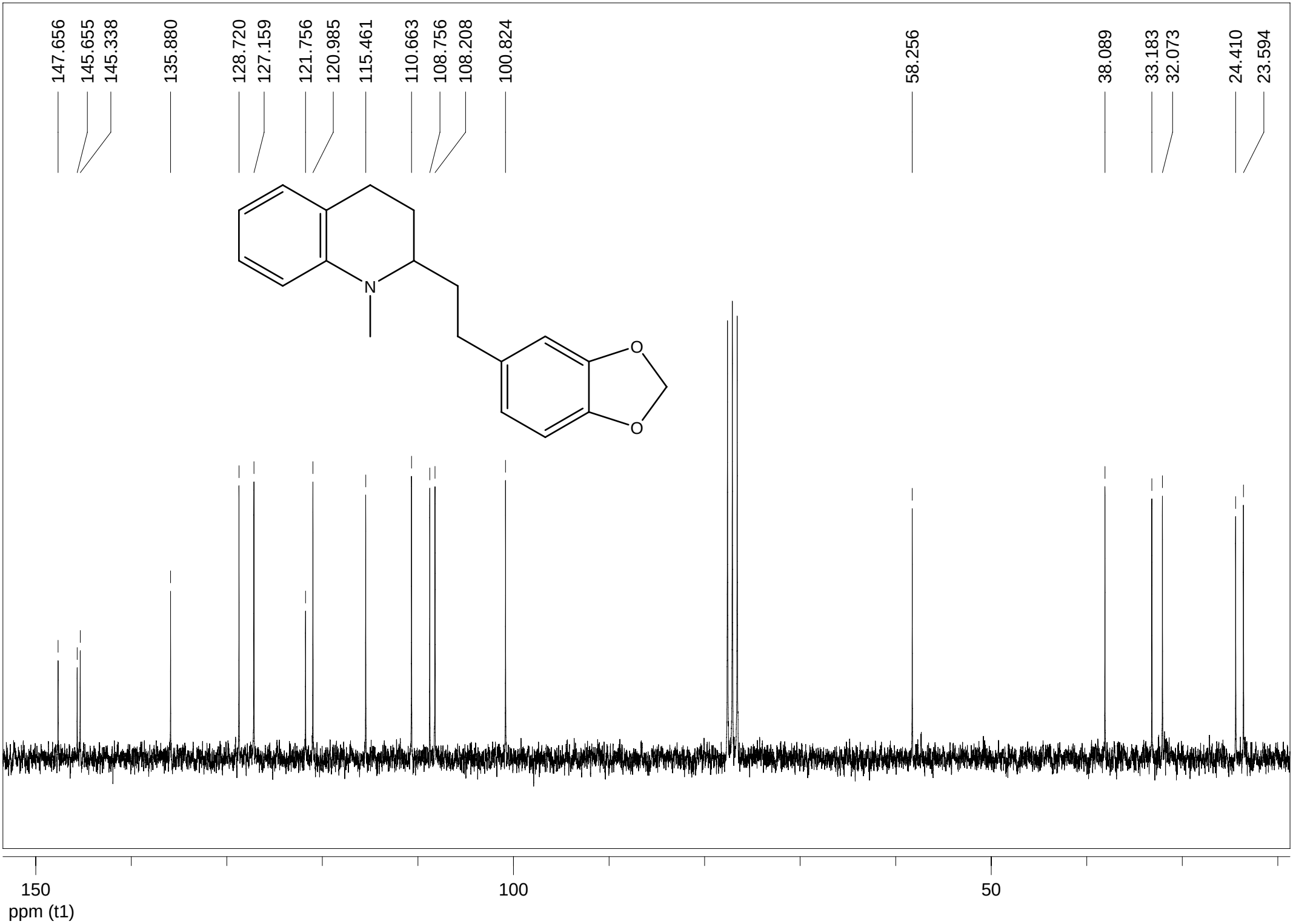

7.185
7.155
7.123
7.058
7.030
6.684
6.654
6.625
6.613
6.580
3.329
3.313
3.296
3.278
3.000
2.755
1.981
1.965
1.951
1.939
1.378
1.003
0.978
0.951
N
0.93
0.95
1.90
1.00
2.90
2.13
2.02
8.51
3.02
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm (t1)


145.440
128.677
127.105
121.875
115.226
110.438
58.995
38.005
32.110
31.241
25.821
24.464
23.629
22.751
14.125
N
100
50
ppm (t1)


7.132
7.046
7.017
6.824
6.787
6.757
6.641
6.596
6.563
3.917
3.903
3.346
3.329
2.965
2.010
1.997
1.984
N
OMe
OMe
0.97
0.98
2.96
1.95
6.01
1.00
7.17
4.12
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


148.934
147.252
145.346
134.690
128.749
127.184
121.756
120.117
115.446
111.616
111.320
110.659
58.455
55.983
55.922
38.156
33.132
31.983
24.449
23.636
N
OMe
OMe
150
100
50
ppm (t1)


7.138
7.050
7.021
6.798
6.767
6.739
6.706
6.676
6.648
6.601
6.568
5.967
3.333
3.315
2.963
2.005
N
O
O
1.00
1.01
4.95
2.00
1.03
7.37
4.30
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


147.656
145.655
145.338
135.880
128.720
127.159
121.756
120.985
115.461
110.663
108.756
108.208
100.824
58.256
38.089
33.183
32.073
24.410
23.594
N
O
O
150
100
50
ppm (t1)