Electronic Supplementary Material (ESI) for Chemical Communications

The asymmetric synthesis of CF_3- or -CF_2- substituted tetrahydroquinolines by employing chiral phosphoric acid as catalyst

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Contents:

General information: ^{1}H NMR spectra were recorded with a Bruker AM-300 (300 M Hz), or Varian VXR (300 MHz) spectrometer. ^{19}F NMR spectra were recorded with a Bruker AM-300 (282 MHz) with $CFCl_3$ as an external standard (negative for upfield). ^{13}C NMR spectra were recorded with a Bruker AM-400 (100 MHz) spectrometer. MS was recorded with a Hewlett–Packard HP-5989A spectrometer. Elemental analyses were obtained with a Perkin–Elmer 2400 Series II Elemental Analyzer. Infrared spectra were measured with a Perkin–Elmer 983 spectrometer. Optical rotations were measured on a JASCO P-1030 Polarimeter at λ=589 nm. Analytical high performance liquid chromatography (HPLC) was carried out on Waters 515 instrument (2487 Dual λ Absorbance Detector and 515 HPLC Pump) using chiral column. Unless otherwise noted, reagents were commercially available and used as received.

The determination of the relative configuration of 4a:

The assignment of ^{1}H NMR of **4a** was shown in Figure 1. The correlation of He and Hb would give important information for the determination of the relative configuration of **4a**. It can be seen from Figure 1 that there is overlap between He and Hf and some overlap between Ha and Hb. We could imagine it would be hard to tell if there is correlation between He and Hb from the NOESY of this sample. In order to get clear information about the correlation between He and Hb, the signal of Ha and Hf should be removed.

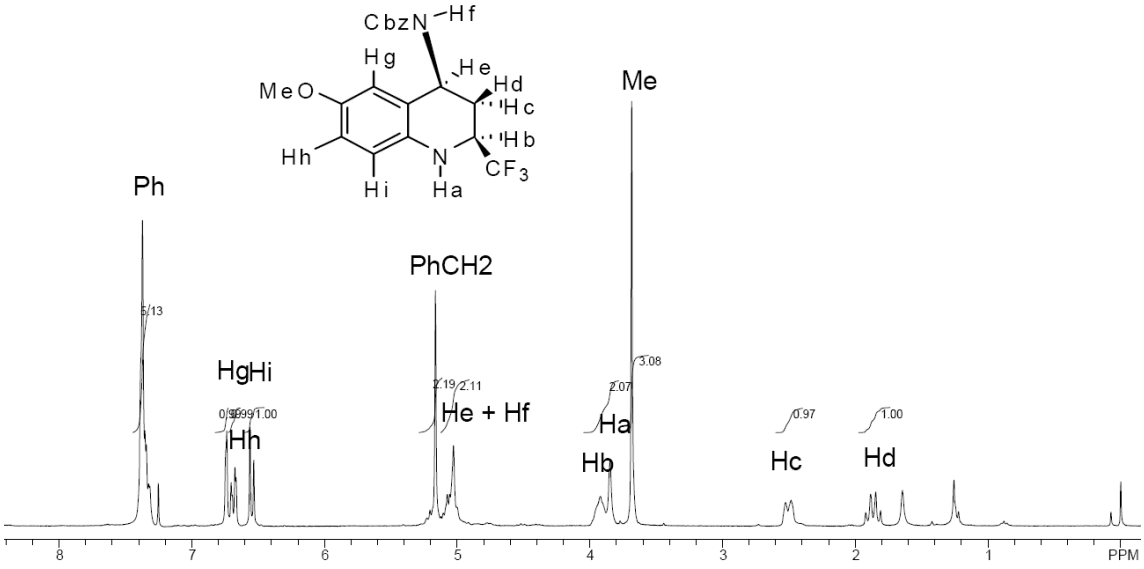


Figure 1. The assignment of of ^{1}H NMR of **4a**

We tried to use CD_3OD as the solvent so that Ha and Hf would be deuterated. But the solubility of **4a** in CD_3OD is quite bad. So we have to use $CDCl_3$ as the solvent and CD_3OD as the cosolvent. CD_3OD (0.1 mL) was added into the solution of **4a** (25 mg) in $CDCl_3$ (0.5 mL). The ^{1}H NMR of this sample was shown in Figure 2. It can be seen that Ha and Hf were almost deuterated and shifted to 3.34 ppm and 5.86 ppm respectively. It means the interferences of Ha and Hf were removed. Then the NOESY of this sample was taken (Figure 3).

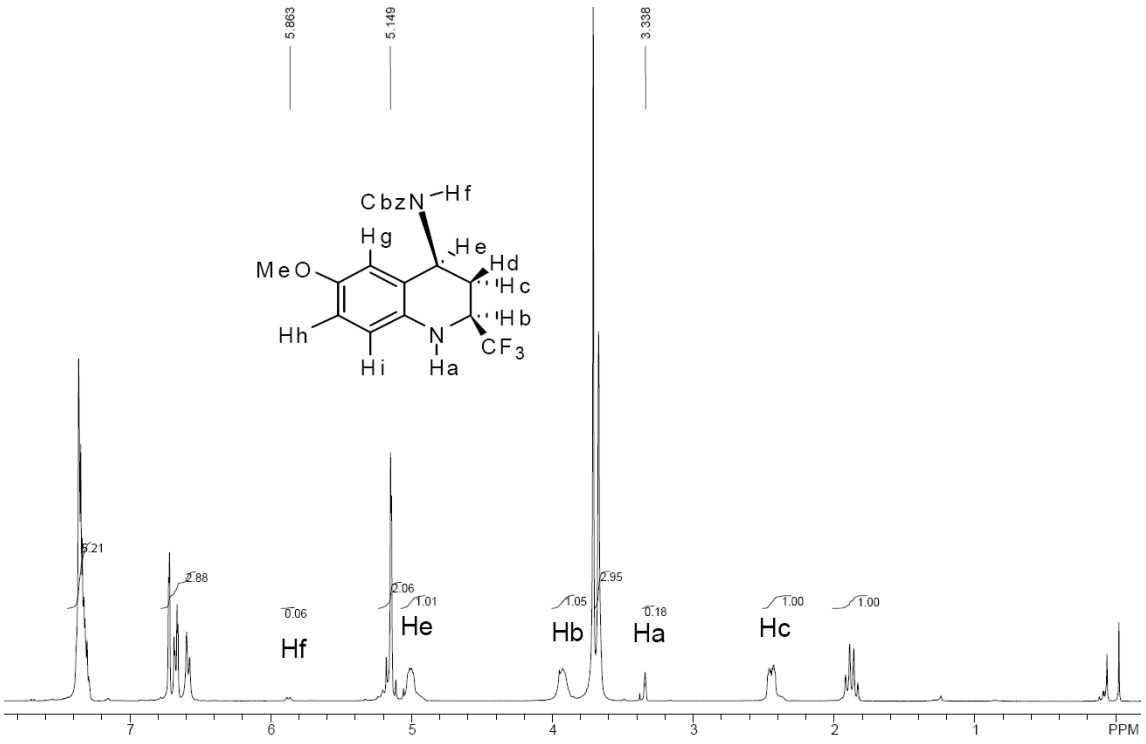


Figure 2. ^{1}H NMR of **4a** in CD_3OD (0.1 mL) and $CDCl_3$ (0.5 mL)

The NOESY experiment (Figure 3) showed a strong correlation between He and Hb, which means that the two hydrogens exist as a *cis* configuration. Besides, the correlation between He and Hc and the correlation between Hc and Hb provided further evidence for the *cis* configuration.

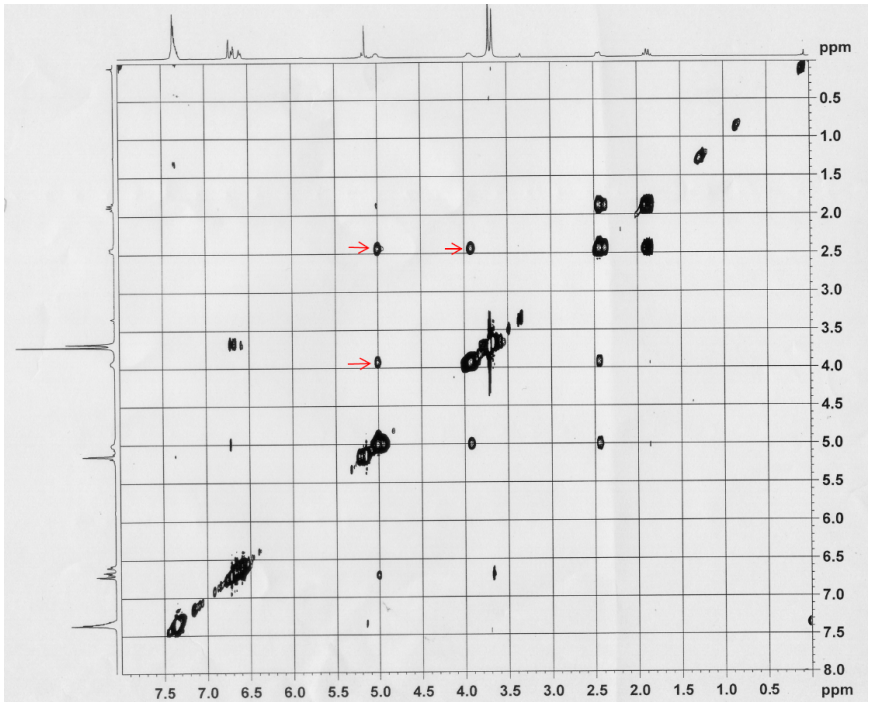
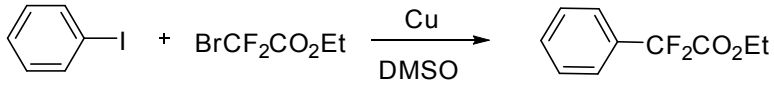


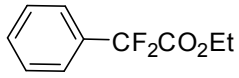
Figure 3. NOESY spectrum of **4a** in CD_3OD (0.1 mL) and $CDCl_3$ (0.5 mL)

Typical procedure for the synthesis of 5g-5k:



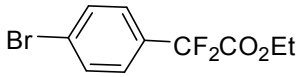
In an atmosphere of N_2, iodobenzene (10.2 g, 50 mmol) and ethyl 2-bromo-2,2-difluoroacetate (10.1 g, 50 mmol) were added to a suspension of activated Cu powder (8.5 g, 130 mmol) in DMSO (120 mL), then the mixture was stirred at 60 °C. After 12 h, the mixture was poured into a mixture of ice and saturated NH_4Cl, then extracted with Et_2O. The Et_2O layer was washed with saturated NH_4Cl and saturated NaCl, then dried over $MgSO_4$. After evaporation of the solvent, ethyl 2,2-difluoro-2-phenylacetate (**5g**) was obtained by distillation.

Ethyl 2,2-difluoro-2-phenylacetate (**5g**):



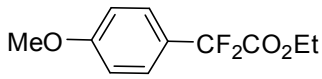
Bp. 125-126 °C (5 mmHg); 50% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61 (d, J = 7.3 Hz, 2H), 7.49 (m, 3H), 4.30 (q, J = 7.2 Hz, 2H), 1.30 (t, J = 7.2 Hz, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -103.7 (s, 2F).

Ethyl 2-(4-bromophenyl)-2,2-difluoroacetate (**5h**):



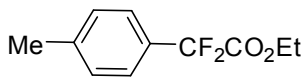
Bp. 95-96 °C (100 Pa); 65% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.60 (d, J = 8.8 Hz, 2H), 7.49 (d, J = 8.8 Hz, 2H), 4.30 (q, J = 7.0 Hz, 2H), 1.31 (t, J = 7.0 Hz, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -104.6 (s, 2F).

Ethyl 2,2-difluoro-2-(4-methoxyphenyl)acetate (**5i**):



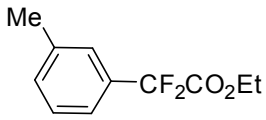
Bp. 115-117 °C (100 Pa); 70% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.54 (d, J = 8.9 Hz, 2H), 6.95 (d, J = 8.9 Hz, 2H), 4.29 (q, J = 7.2 Hz, 2H), 3.84 (s, 3H), 1.31 (t, J = 7.2 Hz, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -103.0 (s, 2F).

Ethyl 2,2-difluoro-2-p-tolylacetate (**5j**):



Bp. 88-90 °C (100 Pa); 84% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.0 Hz, 2H), 7.25 (d, *J* = 8.0 Hz, 2H), 4.29 (q, *J* = 7.3 Hz, 2H), 2.39 (s, 3H), 1.30 (t, *J* = 7.3 Hz, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -103.1 (s, 2F).

Ethyl 2,2-difluoro-2-m-tolylacetate (**5k**):

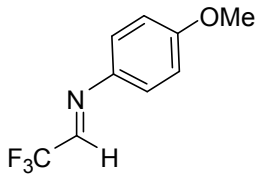


The reaction was performed at 125 °C for 5h. Bp. 85-86 °C (100 Pa); 37% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.43-7.25 (m, 2H), 4.29 (q, *J* = 7.4 Hz, 2H), 2.39 (s, 3H), 1.30 (t, *J* = 7.4 Hz, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -104.2 (s, 2F).

Typical procedure for the synthesis of 1a-1l:

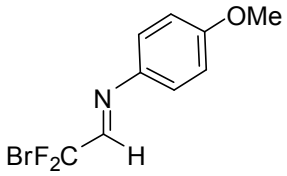
A solution of ethyl 2,2,2-trifluoroacetate (14.2 g, 0.1 mol) in Et_2O (20 mL) was added dropwisely into a solution of $LiAlH_4$ (1.14 g, 30 mmol) in Et_2O (60 mL) at -78 °C. The reaction mixture was stirred at this temperature for 3 h. H_2SO_4 (1M, 80 mL) was then added slowly. The mixture was stirred for a while and then the upper layer was separated. The aqueous solution was extracted with Et_2O (60 mL × 2). The organic phase was dried over $MgSO_4$. The crude 1-ethoxy-2,2,2-trifluoroethanol was obtained after the solvent was removed under normal pressure. A solution of 1-ethoxy-2,2,2-trifluoroethanol and *p*-methoxyaniline (7.38 g, 60 mmol) in toluene (60 mL) was refluxed under N_2 for 1.5 h. The solvent was removed under reduced pressure. The resulting residue was then purified by distillation or by chromatography to get the pure product.

4-Methoxy-*N*-(2,2,2-trifluoroethylidene)aniline (**1a**)



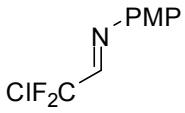
B.p. 86-88 °C (100 Pa); 48% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.83(q, *J* = 3.7 Hz, 1H), 7.29 (d, *J* = 9.0 Hz, 2H), 6.94 (d, *J* = 9.0 Hz, 2H), 3.84 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -71.33 (d, *J* = 3.7 Hz, 3F).

N-(2-bromo-2,2-difluoroethylidene)-4-methoxyaniline (**1b**)



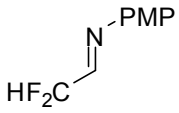
B.p. 120-121 °C (100 Pa); 69% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.85(t, *J* = 5.2 Hz, 1H), 7.28 (d, *J* = 8.7 Hz, 2H), 6.94 (d, *J* = 8.7 Hz, 2H), 3.84 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -55.01 (d, *J* = 5.2 Hz, 2F).

(*E*)-*N*-(2-chloro-2,2-difluoroethylidene)-4-methoxyaniline (**1c**)



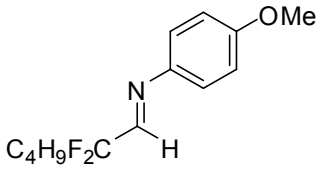
B.p. 100-101 °C (100 Pa); 30% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.88 (t, *J* = 4.6 Hz, 1H), 7.28 (d, *J* = 8.6 Hz, 2H), 6.94 (d, *J* = 8.6 Hz, 2H), 3.84 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -58.73 (d, *J* = 4.6 Hz, 2F).

(*E*)-*N*-(2,2-difluoroethylidene)-4-methoxyaniline (**1d**)



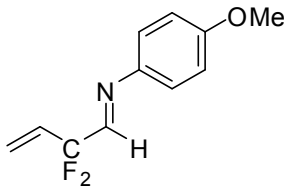
B.p. 70-71 °C (100 Pa); 44% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.90-7.81 (m, 1H), 7.22 (d, *J* = 8.8 Hz, 2H), 6.92 (d, *J* = 8.8 Hz, 2H), 6.15 (td, *J* = 55.1, 5.2 Hz, 1H), 3.83 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -118.97 (d, *J* = 55.1 Hz, 2F).

N-(2,2-difluorohexylidene)-4-methoxyaniline (**1e**)



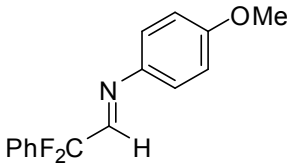
36% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.78 (t, *J* = 4.1 Hz, 1H), 7.12 (d, *J* = 8.9 Hz, 2H), 6.84 (d, *J* = 8.9 Hz, 2H), 3.75 (s, 3H), 2.22 -1.98 (m, 2H), 1.57-1.21 (m, 4H), 0.87 (t, *J* = 7.2 Hz, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -100.26 (td, *J* = 17.1, 4.1 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.5, 153.8 (t, *J* = 36.1 Hz), 141.9, 122.6, 120.1 (t, *J* = 239.0 Hz), 114.5, 55.5, 34.0 (t, *J* = 24.2 Hz), 23.7 (t, *J* = 4.1 Hz), 22.5, 13.8; IR (film, cm^{-1}): 2961, 2936, 2874, 2839, 1602, 1581, 1510, 1466, 1355, 1297, 1250, 1157, 1034, 832; HRMS for $C_{13}H_{18}NOF_2^+$(M+1)$^+$, calcd. 242.13510, found 242.13502.

N-(2,2-difluorobut-3-enylidene)-4-methoxyaniline (**1f**)



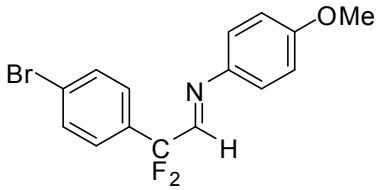
B.p. 118-119 °C (100 Pa); 40% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.91 (t, *J* = 4.0 Hz, 1H), 7.21 (d, *J* =9.0 Hz, 2H), 6.92 (d, *J* =9.0 Hz, 2H), 6.31-6.13 (m, 1H), 5.84 (dt, *J* =17.4, 2.4 Hz, 1H), 5.64 (d, *J* =11.1 Hz, 1H), 3.83 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -100.75 (dd, *J* = 7.8, 4.0 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.7, 152.9 (t, *J* = 36.2 Hz), 141.7, 130.2 (t, *J* = 26.0 Hz), 122.7, 121.2 (t, *J* = 10.3 Hz), 115.8 (t, *J* = 237 Hz), 114.5, 55.5; IR (film, cm^{-1}): 3004, 2954, 2910, 2839, 1655, 1601, 1582, 1505, 1465, 1443, 1421, 1346, 1300, 1249, 1161, 1034, 833; HRMS for $C_{11}H_{11}NOF_2$, calcd. 211.0809, found 211.0808.

N-(2,2-difluoro-2-phenylethylidene)-4-methoxyaniline (**1g**)



30% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.94 (t, *J* = 5.4 Hz, 1H), 7.55 (t, *J* = 3.6 Hz, 2H), 7.46-7.34 (m, 3H), 7.12 (d, *J* = 9.0 Hz, 2H), 6.82 (d, *J* = 9.0 Hz, 2H), 3.74 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -99.32 (d, *J* = 5.4 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.6, 153.3 (t, *J* = 35.1 Hz), 141.8, 134.3 (t, *J* = 27.7 Hz), 130.4, 128.6, 125.9 (t, *J* = 6.2 Hz), 122.7, 117.2 (t, *J* = 240.3 Hz), 114.5, 55.5; IR (film, cm^{-1}): 3067, 3005, 2953, 2906, 2838, 1653, 1601, 1581, 1505, 1453, 1443, 1346, 1298, 1252, 1034, 1010, 833, 763, 698; HRMS for $C_{15}H_{14}NOF_2^{+}$(M+1)$^{+}$, calcd. 262.10380, found 262.1035.

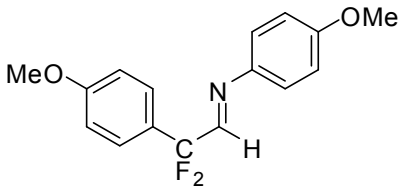
N-(2-(4-bromophenyl)-2,2-difluoroethylidene)-4-methoxyaniline (**1h**)



33% yield; m.p. 75-76 °C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.00 (t, *J* = 5.0 Hz, 1H), 7.61 (d, *J* = 8.4 Hz, 2H), 7.45 (d, *J* = 8.4 Hz, 2H), 7.18 (d, *J* = 9.0 Hz, 2H), 6.89 (d, *J* = 9.0 Hz, 2H), 3.82 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -98.6 (d, *J* = 5.0 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ159.7, 152.7 (t, *J* = 36.1 Hz), 141.5, 133.3 (t, *J* = 27.4 Hz), 131.8, 127.7 (t, *J* = 5.9 Hz), 125.0, 122.7, 117.0 (t, *J* = 241.8 Hz), 114.5, 55.5; IR (film, cm^{-1}): 2972, 2934, 2894, 2844, 1659, 1598, 1578, 1504, 1444, 1399, 1345, 1287, 1253, 1143, 1073, 1051, 1028, 1010, 838,

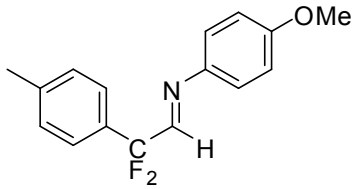
770, 721; HRMS for $C_{15}H_{13}NOF_2Br^+(M+1)^+$, calcd. 340.01431, found 340.0140.

N-(2,2-difluoro-2-(4-methoxyphenyl)ethylidene)-4-methoxyaniline (**1i**)



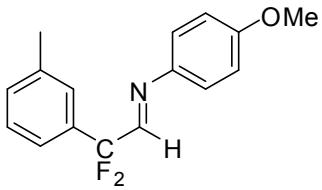
35% yield; m.p. 63-64 °C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.99 (t, *J* = 5.6 Hz, 1H), 7.55 (d, *J* = 8.4 Hz, 2H), 7.19 (d, *J* = 8.4 Hz, 2H), 6.97 (d, *J* = 8.4 Hz, 2H), 6.89 (d, *J* = 8.4 Hz, 2H), 3.84 (s, 3H), 3.82 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -97.82 (d, *J* = 5.6 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ161.2, 159.5, 153.5 (t, *J* = 35.6 Hz), 141.9, 127.4 (t, *J* = 6.0 Hz), 126.4 (t, *J* = 26.7 Hz), 122.7, 117.3 (t, *J* = 241.5 Hz), 114.4, 114.0, 55.5, 55.4; IR (film, cm^{-1}): 2945, 2899, 2838, 1659, 1604, 1580, 1505, 1461, 1439, 1415, 1350, 1316, 1290, 1254, 1209, 1177, 1167, 1136, 1022, 834, 767, 697, 635; HRMS for $C_{16}H_{15}NO_2F_2$, calcd. 291.1071, found 291.1074.

N-(2,2-difluoro-2-p-tolylethylidene)-4-methoxyaniline (**1j**)



32% yield; m.p. 58-59 °C ; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.99 (t, *J* = 5.4 Hz, 1H), 7.51 (d, *J* = 8.2 Hz, 2H), 7.27 (d, *J* = 8.2 Hz, 2H), 7.18 (d, *J* = 8.8 Hz, 2H), 6.89 (d, *J* = 8.8 Hz, 2H), 3.81 (s, 3H), 2.39 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -99.0 (d, *J* = 5.4 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.5, 153.5 (t, *J* = 35.6 Hz), 141.9, 140.6, 131.4 (t, *J* = 26.4 Hz), 129.3, 125.8 (t, *J* = 5.7 Hz), 122.7, 117.3 (t, *J* = 241.8 Hz), 114.4, 114.0, 55.5, 21.3; IR (film, cm^{-1}): 2893, 2843, 1656, 1599, 1579, 1503, 1460, 1443, 1345, 1314, 1289, 1253, 1141, 1043, 838, 821, 762, 728, 697; HRMS for $C_{16}H_{15}NOF_2$, calcd. 275.1122, found 275.1126.

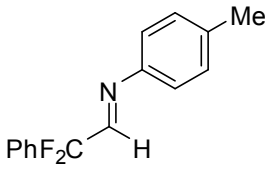
N-(2,2-difluoro-2-m-tolylethylidene)-4-methoxyaniline (**1k**)



32% yield; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.99 (t, *J* = 5.8 Hz, 1H), 7.45-7.26 (m, 4H), 7.20 (d, *J* = 8.8 Hz, 2H), 6.89 (d, *J* = 8.8 Hz, 2H), 3.82 (s, 3H), 2.41 (s, 3H); ^{19}F NMR (282 MHz,

$CDCl_3$) δ -100.2 (d, *J* = 5.8 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ159.5, 153.4 (t, *J* = 35.3 Hz), 141.9, 138.5, 134.2 (t, *J* = 26.1 Hz), 131.2, 128.6, 126.4 (t, *J* = 5.8 Hz), 122.9 (t, *J* = 5.9 Hz), 122.7, 117.2 (t, *J* = 242.5 Hz), 114.4, 55.5, 21.5; IR (film, cm^{-1}): 3036, 3004, 2909, 2838, 1652, 1600, 1581, 1504, 1463, 1442, 1345, 1294, 1250, 1142, 1036, 875, 833, 763, 702; HRMS for $C_{16}H_{15}NOF_2$, calcd. 275.1122, found 275.1124.

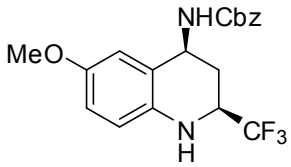
N-(2,2-difluoro-2-phenylethylidene)-4-methylaniline (**1l**)



B.p. 141-142°C (100 Pa); 31% yield; ^1H NMR (300 MHz, $CDCl_3$) δ 8.28 (t, *J* = 5.4 Hz, 1H), 7.91(t, *J* = 4.2 Hz, 2H), 7.80-7.69 (m, 3H), 7.45 (d, *J* = 8.1 Hz, 2H), 7.35 (d, *J* = 8.1 Hz, 2H), 2.63 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -99.5 (d, *J* = 5.4 Hz, 2F); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.8 (t, *J* = 35.4 Hz), 146.6, 137.7, 134.2 (t, *J* = 26.7 Hz), 130.5, 129.9, 128.7, 125.9 (t, *J* = 5.9 Hz), 121.0, 117.0 (t, *J* = 243.8 Hz), 21.0; IR (film, cm^{-1}): 3035, 2922, 1658, 1616, 1506, 1453, 1344, 1264, 1058, 1010, 821, 763, 697; HRMS for $C_{15}H_{14}NF_2^+$ $(M+1)^+$, calcd. 246.10888, found 246.1086.

General procedure for the Brønsted acid-catalyzed enantioselective reaction:
To a solution of imine (0.2 mmol) in CH_2Cl_2 (2 mL), phosphoric acid catalyst **3d** (0.03mmol) and benzyl vinylcarbamate **2a** (0.4 mmol) were added. The resultant reaction solution was stirred at room temperature for the indicated period of time. Solvents were removed in vacuo and the residue was purified by flash chromatography on silica gel to afford the corresponding pure product.

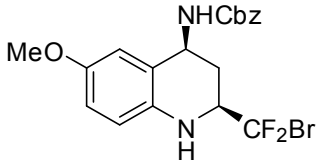
Benzyl (2S,4S)-6-methoxy-2-(trifluoromethyl)-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4a**)



82% yield; $[\alpha]_D^{26}$ = 0.33 (*c* = 1.00, CH_2Cl_2); 99% ee ; m.p. 138-139 °C; ^1H NMR (300 MHz, $CDCl_3$) δ 7.42-7.28 (m, 5H), 6.74 (d, *J* = 2.5 Hz, 1H), 6.68 (dd, *J* = 8.5, 2.5 Hz, 1H), 6.54 (d, *J* = 8.5 Hz, 1H), 5.16 (s, 2H), 5.10-4.93 (m, 2H), 4.00-3.78 (m, 2H), 3.68 (s, 3H), 2.56-2.39 (m, 1H), 1.94-1.78 (m, 1H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -77.98 (d, *J* = 6.3 Hz, 3F); IR (film, cm^{-1}): 3345, 3303, 2919, 1687, 1537, 1506, 1284, 1167, 1127, 907, 816, 694; HRMS for $C_{19}H_{19}N_2F_3O_3Na^+$ $(M+Na)^+$, calcd. 403.12400, found 403.12421; Enantiomeric excess

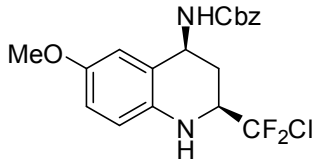
was determined by HPLC with a Chiralpak Phenomenex Lux 5µ Cellulose-2 column (8:2 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 14.58 min, minor enantiomer tr = 17.65 min.

Benzyl (2S,4S)-2-(bromodifluoromethyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4b**):



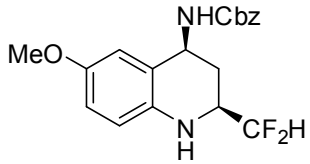
84% yield; $[\alpha]_D^{24}$ = 19.7 (*c* = 0.37, CH_2Cl_2), 99% ee; m.p. 138-139 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.48-7.28 (m, 5H), 6.78-6.62 (m, 4H), 5.30-4.98 (m, 4H), 4.17-4.04 (m, 1H), 3.63 (s, 3H), 2.47-2.37 (m, 1H), 2.02-1.85 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -56.02 (dd, *J* = 166.8, 10.2 Hz, 1F), -57.08 (dd, *J* = 166.8, 6.2 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 156.56, 152.96, 137.73, 136.84, 128.38, 127.82, 125.88 (t, *J* = 306.4 Hz), 124.02, 116.70, 114.23, 111.14, 65.84, 59.70 (t, *J* = 23.6 Hz), 54.91, 46.68, 30.91; IR (film, cm^{-1}): 3350, 2936, 1684, 1519, 1503, 1334, 1277, 1228, 1109, 1023, 980, 825, 695; HRMS for $C_{19}H_{19}BrN_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 463.04393, found 463.04610; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5µ Cellulose-2 column (8:2 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 14.32 min, minor enantiomer tr = 17.92 min.

Benzyl 2-(chlorodifluoromethyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4c**)



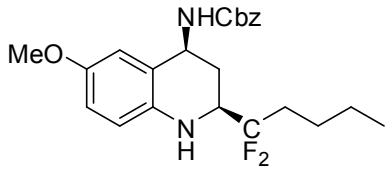
82% yield; $[\alpha]_D^{25}$ = 9.63 (*c* = 0.54, CH_2Cl_2), 98% ee; m.p. 130-131 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.35-7.15 (m, 5H), 6.65-6.48 (m, 4H), 5.15-4.84 (m, 4H), 4.19-4.05 (m, 1H), 3.51 (s, 3H), 2.34-2.23 (m, 1H), 1.88-1.73 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -63.11--63.31 (m, 2F); ^{13}C NMR (100 MHz, d-acetone) δ 156.52, 152.83, 137.51, 137.00, 130.57 (t, *J* = 293.6 Hz), 128.34, 127.77, 123.87, 116.60, 114.20, 111.12, 65.89, 58.31 (t, *J* = 26.9 Hz), 54.86, 46.89, 30.02; IR (film, cm^{-1}): 3350, 2934, 2839, 1788, 1686, 1522, 1504, 1335, 1278, 1247, 1203, 1111, 1206, 985, 859; HRMS for $C_{19}H_{19}ClN_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 419.09445, found 419.09484; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5µ Cellulose-2 column (7:3 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 10.44 min, minor enantiomer tr = 13.02 min.

Benzyl 2-(difluoromethyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4d**)



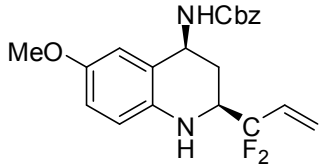
84% yield; $[\alpha]_D^{24}$ = 8.62 (*c* = 0.38, CH_2Cl_2), 89% ee ; m.p. 120-121 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.50-7.28 (m, 5H), 6.74-6.58 (m, 4H), 5.87 (td, *J* = 56.7, 5.4 Hz, 1H), 5.19, 5.13 (AB, J_{AB} = 12.5 Hz, 2H), 5.03-4.91 (m, 2H), 3.83-3.67 (m, 1H), 3.62 (s, 3H), 2.30-2.21 (m, 1H), 1.91-1.75 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -127.92 - -128.43 (m, 2F); ^{13}C NMR (100 MHz, d-acetone) δ 156.60, 152.49, 137.75, 137.61, 128.37, 127.77, 123.16, 117.20 (t, *J* = 241.6 Hz), 116.25, 114.41, 111.74, 65.69, 54.92, 53.28 (t, *J* = 22.9 Hz), 47.03; IR (film, cm^{-1}): 3354, 3291, 3033, 2962, 1682, 1538, 1505, 1305, 1246, 1066, 970, 815; HRMS for $C_{19}H_{20}N_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 385.13342, found 385.13385; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Cellulose-2 column (8:2 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 18.68 min, minor enantiomer tr = 22.11 min.

Benzyl 2-(1,1-difluoropentyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4e**)



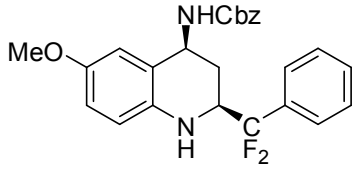
91% yield; $[\alpha]_D^{24}$ = 10.61 (*c* = 0.50, CH_2Cl_2), 97% ee ; m.p. 112-113 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.46-7.27 (m, 5H), 6.71-6.57 (m, 4H), 5.05, 4.98 (AB, J_{AB} = 12.5 Hz, 2H), 5.05-4.95 (m, 1H), 4.83-4.79 (br, 1H), 3.89-3.74 (m, 1H), 3.62 (s, 3H), 2.30-2.22 (m, 1H), 2.04-1.56 (m, 3H), 1.58-1.45 (m, 2H), 1.45-1.30 (m, 2H), 0.92 (t, *J* = 7.1 Hz, 3H); ^{19}F NMR (282 MHz, d-acetone) δ -109.83 - -110.03 (m, 2F); ^{13}C NMR (100 MHz, d-acetone) δ 156.70, 152.46, 138.24, 137.53, 128.38, 127.83, 127.80, 124.57 (t, *J* = 241.1 Hz), 123.80, 116.35, 114.23, 111.48, 65.87, 55.82 (t, *J* = 27.3 Hz), 54.93, 47.72, 31.67 (t, *J* = 25.2 Hz), 29.84, 23.35 (t, *J* = 4.2 Hz), 22.31, 13.29; IR (film, cm^{-1}): 3354, 2956, 1687, 1524, 1505, 1466, 1277, 1245, 1206, 1053, 998, 905; HRMS for $C_{23}H_{28}N_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 441.19602, found 441.19709; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Cellulose-2 column (9:1 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 27.82 min, minor enantiomer tr = 30.69 min.

Benzyl 2-(1,1-difluoroallyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4f**)



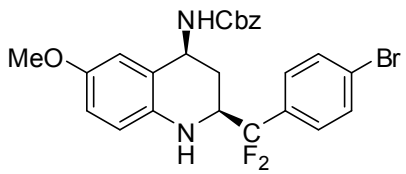
81% yield; $[\alpha]_D^{26}$ = 7.12 (*c* = 0.28, CH_2Cl_2), 99% ee ; m.p. 137-138 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.47-7.28 (m, 5H), 6.74-6.55 (m, 4H), 6.23-6.02 (m, 1H), 5.73 (d, *J* = 18.2 Hz, 1H), 5.60 (d, *J* = 11.2 Hz, 1H), 5.19, 5.13 (AB, J_{AB} = 12.6 Hz, 2H), 5.06-4.93 (m, 1H), 4.85 (s, 1H), 3.96-3.79 (m, 1H), 3.62 (s, 3H), 2.30-2.18 (m, 1H), 1.81-1.63 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -107.23 (dt, *J* = 248.6, 10.8Hz, 1F), 110.80 (ddd, *J* = 248.6, 14.0, 8.2 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 156.57, 152.44, 137.95, 137.53, 130.10 (t, *J* = 26.2 Hz), 128.34, 127.79, 127.76, 123.53, 120.86 (t, *J* = 9.3 Hz), 120.80 (t, *J* = 244.5 Hz), 116.28, 114.15, 111.34, 65.83, 55.88 (t, *J* = 28.3 Hz), 54.86, 47.40, 29.67; IR (film, cm^{-1}): 3337, 3033, 2934, 2834, 1709, 1505, 1277, 1238, 1043, 988, 698; HRMS for $C_{21}H_{22}N_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 411.14907, found 411.14895; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Cellulose-2 column (5:5 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 8.45 min, minor enantiomer tr = 9.84 min.

Benzyl 2-(difluoro(phenyl)methyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4g**)



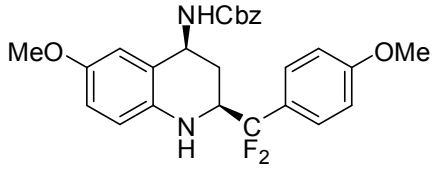
97% yield; $[\alpha]_D^{26}$ = 2.92 (*c* = 0.57, CH_2Cl_2), 98% ee ; m.p. 118-119 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.62-7.47 (m, 5H), 7.44-7.29 (m, 5H), 6.70-6.53 (m, 4H), 5.17, 5.09 (AB, J_{AB} = 12.2 Hz, 2H), 5.02-4.90 (m, 2H), 4.23-4.09 (m, 1H), 3.59 (s, 3H), 2.19-2.10 (m, 1H), 1.69-1.51 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -104.52 (dd, *J* = 247.8, 9.0 Hz, 1F), 106.37 (dd, *J* = 247.8, 11.6 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 156.58, 152.47, 137.99, 137.57, 134.31 (t, *J* = 25.8 Hz), 130.20, 128.38, 128.30, 127.82, 127.80, 126.15 (t, *J* = 6.6 Hz), 123.56, 122.24 (t, *J* = 244.4 Hz), 116.29, 114.21, 111.40, 65.88, 56.94 (t, *J* = 28.8 Hz), 54.94, 47.47, 29.85; IR (film, cm^{-1}): 3315, 3033, 2938, 1686, 1529, 1503, 1292, 1241, 1197, 1047, 1011, 804; HRMS for $C_{25}H_{24}N_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 461.16472, found 461.16428; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Amylose-2 column (7:3 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 52.78 min, minor enantiomer tr = 77.48 min.

Benzyl 2-((4-bromophenyl)difluoromethyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4h**)



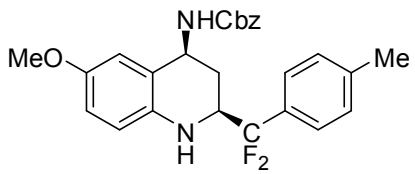
96% yield; $[\alpha]_D^{26}$ = 9.59 (*c* = 0.48, CH_2Cl_2), 97% ee ; m.p. 104-105 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.69 (d, *J* = 8.7 Hz, 2H), 7.56 (d, *J* = 8.7 Hz, 2H), 7.44-7.26 (m, 5H), 6.69-6.50 (m, 4H), 5.17, 5.10 (AB, J_{AB} = 12.6 Hz, 2H), 5.06-4.89 (m, 2H),4.23-4.06 (m, 1H), 3.59 (s, 3H), 2.25-2.14 (m, 1H), 1.61-1.46 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -105.16 (dd, *J* = 250.1, 10.4 Hz, 1F), -106.72 (dd, *J* = 250.1, 8.8 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 156.59, 152.57, 137.81, 137.54, 133.47 (t, *J* = 26.2 Hz), 131.46, 128.39, 128.36 (*J* = 6.2 Hz), 127.84, 127.82, 124.21, 123.65, 122.03 (*J* = 244.9 Hz), 116.45, 114.22, 111.38, 65.91, 56.72 (*J* = 29.6 Hz), 54.94, 47.37, 29.77; IR (film, cm^{-1}): 3300, 2943, 2830, 1685, 1537, 1501, 1291, 1245, 1064, 1044, 1011, 985, 824; HRMS for $C_{25}H_{23}BrN_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 539.07523, found 539.07569; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Cellulose -2 column (5:5 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 10.35 min, minor enantiomer tr = 15.35 min.

Benzyl 2-(difluoro(4-methoxyphenyl)methyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4i**)



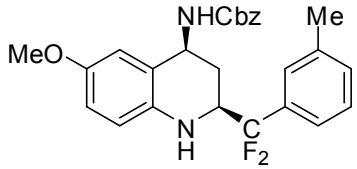
93% yield; $[\alpha]_D^{25}$ = 4.76 (*c* = 0.57, CH_2Cl_2), 97% ee ; m.p. 110-111 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.52 (d, *J* = 8.8 Hz, 2H), 7.44-7.28 (m, 5H), 7.01 (d, *J* = 8.8 Hz, 2H), 6.70-6.52 (m, 4H), 5.17, 5.09 (AB, J_{AB} = 12.6 Hz, 2H), 5.01-4.88 (m, 2H), 4.19-4.01 (m, 1H), 3.84 (s, 3H), 3.60 (s, 3H), 2.19-2.10 (m, 1H), 1.69-1.51 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -105.21 (dd, *J* = 248.4, 8.5 Hz, 1F), -105.01 (dd, *J* = 248.4, 9.3 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 161.09, 156.55, 152.35, 138.02, 137.52, 128.36, 127.80, 127.77, 127.59 (t, *J* = 6.3 Hz), 126.26 (t, *J* = 26.6 Hz), 123.45, 122.39 (t, *J* = 244.2 Hz), 116.20, 114.14, 113.56, 111.35, 65.85, 56.98 (t, *J* = 29.5 Hz), 54.89, 54.82, 47.46, 29.86; IR (film, cm^{-1}): 3380, 3315, 2937, 2836, 1693, 1615, 1505, 1253, 1179, 1038, 984, 833; HRMS for $C_{26}H_{26}N_2F_2O_4Na^+$ $(M+Na)^+$, calcd. 491.17529, found 491.1766; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Cellulose -2 column (5:5 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 12.35 min, minor enantiomer tr = 17.69 min.

Benzyl 2-(difluoro(p-tolyl)methyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4j**)



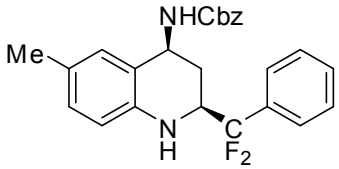
94% yield; $[\alpha]_D^{25}$ = 5.77 (*c* = 0.50, CH_2Cl_2), 98% ee; m.p. 95-96 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.51-7.26 (m, 9H), 6.70-6.52 (m, 4H), 5.17, 5.09 (AB, J_{AB} = 12.5 Hz, 2H), 5.00-4.89 (m, 2H), 4.20-4.03 (m, 1H), 3.60 (s, 3H), 2.37 (s, 3H), 2.18-2.09 (m, 1H), 1.66-1.49 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -105.05 (dd, *J* = 247.4, 8.0 Hz, 1F), -106.96 (dd, *J* = 247.4, 10.3 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 156.54,152.36, 140.14, 137.99, 137.52, 131.42 (t, *J* = 26.3 Hz), 128.85, 128.35, 127.79, 127.76, 126.04 (t, *J* = 6.2 Hz), 123.45, 122.36 (t, *J* = 244.2 Hz), 116.19, 114.13, 111.34, 65.83, 56.91 (t, *J* = 28.4 Hz), 54.88, 47.44, 29.84, 20.36; IR (film, cm^{-1}): 3317, 2949, 2833, 1693, 1547, 1509, 1277, 1256, 1173, 1146, 1055, 1022, 984, 817, 697; HRMS for $C_{26}H_{26}N_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 475.18037, found 475.1806; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Cellulose -2 column (5:5 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 9.42 min, minor enantiomer tr = 13.02 min.

Benzyl 2-(difluoro(m-tolyl)methyl)-6-methoxy-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4k**)



89% yield; $[\alpha]_D^{26}$ = 1.17 (*c* = 0.53, CH_2Cl_2), 98% ee; m.p. 119-120 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.46-7.26 (m, 9H), 6.70-6.52 (m, 4H), 5.17, 5.09 (AB, J_{AB} = 12.5, 2H), 5.04-4.84 (m, 2H), 4.21-4.04 (m, 1H), 3.60 (s, 3H), 2.38 (s, 3H), 2.22-2.09 (m, 1H), 1.71-1.55 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -105.24 (dd, *J* = 247.4, 8.7 Hz, 1F), -107.54 (dd, *J* = 247.4, 11.7 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 156.53,152.36, 138.02, 137.98, 137.51, 134.28 (t, *J* = 25.3 Hz), 130.82, 128.34, 128.21, 127.79, 127.76, 126.54 (t, *J* = 6.3 Hz), 123,49, 123.19 (t, *J* = 6.3 Hz), 122.20 (t, *J* = 244.3 Hz), 116.19, 114.12, 111.33, 65.83, 56.89 (t, *J* = 29.8 Hz), 54.88, 47.44, 29.77, 20.57; IR (film, cm^{-1}): 3336, 3033, 2934, 2833, 1708, 1505, 1273, 1235, 1200, 1043, 699; HRMS for $C_{26}H_{26}N_2F_2O_3Na^+$ $(M+Na)^+$, calcd. 475.18037, found 475.18053; Enantiomeric excess was determined by HPLC with a Chiralpak Phenomenex Lux 5μ Cellulose -2 column (5:5 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 9.21 min, minor enantiomer tr = 11.07 min.

Benzyl 2-(difluoro(phenyl)methyl)-6-methyl-1,2,3,4-tetrahydroquinolin-4-ylcarbamate (**4l**)



90% yield; $[\alpha]_D^{25}$ = -1.81 (*c* = 0.50, CH_2Cl_2), 98% ee; m.p. 138-139 °C; ^{1}H NMR (300 MHz, d-acetone) δ 7.65-7.28 (m, 10H), 6.84 (s, 1H), 6.78 (d, *J* = 8.2 Hz, 1H), 6.63 (d, *J* = 8.2 Hz,

1H), 6.50 (d, *J* = 9.2 Hz, 1H), 5.19-5.05 (m, 3H), 4.99-4.88 (m, 1H), 4.25-4.10 (m, 1H), 2.18-2.09 (m, 4H), 1.65-1.46 (m, 1H); ^{19}F NMR (282 MHz, d-acetone) δ -105.09 (dd, *J* = 248.4, 8.4 Hz, 1F), -107.58 (dd, *J* = 248.4, 11.4 Hz, 1F); ^{13}C NMR (100 MHz, d-acetone) δ 156.53, 141.74, 137.54, 134.21 (t, *J* = 26.0 Hz), 130.19, 128.45, 128.35, 128.29, 127.79, 127.77, 126.41, 126.26, 126.10 (t, *J* = 6.6 Hz), 123.23, 122.23 (t, *J* = 247.8 Hz), 115.18, 65.82, 56.72 (t, *J* = 29.4 Hz), 47.20, 29.86, 19.79; IR (film, cm^{-1}): 3318, 3057, 2923, 1692, 1544, 1511, 1452, 1278, 1255, 1179, 1142, 1055, 1015, 983, 806; HRMS for $C_{25}H_{24}N_2F_2O_2Na^+$ $(M+Na)^+$, calcd. 445.16981, found 445.1698; Enantiomeric excess was determined by HPLC with a Chiralpak IC column (7:3 of hexane:2-propanol), 214 nm, 0.7 mL/min; major enantiomer tr = 8.00 min, minor enantiomer tr = 10.84 min.

Cartesian coordinates from density functional theory calculations:

1. Reactant of Pathway 1

C	-1.64164	6.48375	0.70116
C	-1.00440	5.35874	0.19683
C	0.35805	5.10575	0.58512
C	1.04451	6.11134	1.35190
C	0.34163	7.24789	1.82571
C	-0.99090	7.41431	1.53791
H	-2.67010	6.66911	0.40571
C	1.10082	3.92814	0.26089
C	2.43031	5.96268	1.61743
H	0.88046	7.98012	2.42151
H	-1.53787	8.27413	1.91375
C	3.12250	4.87091	1.16512
C	2.46640	3.80119	0.49274
H	2.94123	6.74691	2.16973
H	4.19292	4.80046	1.32928
C	-1.78974	4.59483	-0.83110
C	-2.08175	5.21797	-2.09252
C	-2.34068	3.35591	-0.56336
C	-1.50172	6.45182	-2.50206
C	-2.97390	4.55768	-2.99924
C	-3.26682	2.69850	-1.42574
C	-1.79822	7.00366	-3.72915
H	-0.80884	6.95682	-1.83889
C	-3.27045	5.16262	-4.25146
C	-3.56138	3.32717	-2.62245
C	-2.69715	6.35951	-4.61250
H	-1.33573	7.94218	-4.02253
H	-3.95805	4.65360	-4.92263
H	-4.28371	2.86977	-3.29290
H	-2.92735	6.80953	-5.57427
O	0.43474	2.82574	-0.27269
O	-1.94515	2.71461	0.61517
P	-0.56051	1.87395	0.59091
O	-0.63100	0.52388	-0.00096
O	-0.13850	2.00249	2.10331
H	0.36946	1.26393	2.54303
C	-3.93881	1.42101	-1.07598
C	-4.51170	1.20739	0.18882
C	-4.09584	0.41884	-2.04733
C	-5.22508	0.04408	0.46155
H	-4.42005	1.96994	0.95567

C	-4.80837	-0.74460	-1.77157
H	-3.63154	0.54368	-3.02144
C	-5.39099	-0.95712	-0.51099
H	-5.68791	-0.07954	1.43621
H	-4.88806	-1.51331	-2.53519
C	3.26184	2.61203	0.09001
C	4.29479	2.13920	0.92059
C	3.07590	1.96981	-1.14797
C	5.11270	1.08307	0.52825
H	4.45780	2.60196	1.88984
C	3.89765	0.91694	-1.54081
H	2.28186	2.29793	-1.80880
C	4.93609	0.45164	-0.71423
H	5.91517	0.75802	1.18444
H	3.71148	0.43084	-2.49444
C	5.81349	-0.66758	-1.13826
C	6.25563	-0.76281	-2.49173
C	6.22610	-1.63935	-0.24068
C	7.07475	-1.78794	-2.90277
H	5.95981	0.00866	-3.19674
C	7.06631	-2.71362	-0.63328
H	5.87896	-1.60482	0.78899
C	7.50493	-2.79353	-1.99491
H	7.41607	-1.83313	-3.93457
C	-6.15835	-2.19290	-0.21876
C	-7.01481	-2.75962	-1.20891
C	-6.06858	-2.82041	1.01347
C	-7.74202	-3.89789	-0.95510
H	-7.10947	-2.26232	-2.17011
C	-6.80502	-3.99731	1.30703
H	-5.38969	-2.42929	1.76686
C	-7.66420	-4.55235	0.30366
H	-8.39826	-4.30823	-1.71937
C	7.48492	-3.71903	0.28113
C	8.34867	-3.86681	-2.38559
H	8.68124	-3.92181	-3.41961
C	8.73968	-4.82322	-1.47459
H	9.38497	-5.64041	-1.78527
C	8.30222	-4.74869	-0.12870
H	7.14824	-3.65947	1.31345
H	8.61618	-5.50980	0.58052
C	-6.71515	-4.64993	2.56735
C	-8.40186	-5.72886	0.60147
H	-9.05394	-6.14518	-0.16312

C	-8.29533	-6.33509	1.83372
H	-8.86417	-7.23554	2.04955
C	-7.44258	-5.79005	2.82589
H	-6.05975	-4.23000	3.32682
H	-7.36519	-6.27771	3.79402
C	1.51493	-1.23564	2.80443
C	2.12134	-1.07605	1.54627
C	2.48980	-2.18368	0.80014
C	2.21466	-3.47731	1.27337
C	1.58149	-3.64599	2.51534
C	1.24239	-2.52920	3.27372
H	2.31532	-0.07943	1.16546
H	2.96213	-2.06773	-0.16861
H	1.31949	-4.63249	2.87772
H	0.70554	-2.67009	4.20683
O	2.57840	-4.49866	0.45671
C	2.17256	-5.82528	0.79243
H	2.54146	-6.45621	-0.01721
H	2.62576	-6.15023	1.73743
H	1.08019	-5.89128	0.84791
N	1.16976	-0.06664	3.52204
C	1.16772	-0.06511	4.79304
H	1.46374	-0.91883	5.40918
C	0.75912	1.15404	5.58955
F	-0.43372	0.94788	6.19521
F	1.66243	1.37131	6.57577
F	0.66800	2.26520	4.86131
C	-2.49280	-1.56253	2.54327
H	-2.96173	-1.84141	3.48046
H	-2.40979	-0.50449	2.31648
C	-2.05698	-2.51494	1.70675
H	-2.16061	-3.57163	1.93070
N	-1.43891	-2.28213	0.48212
H	-1.23766	-1.32249	0.18781
C	-0.98457	-3.30565	-0.30069
O	-1.06404	-4.49461	-0.03666
O	-0.41790	-2.81297	-1.42646
C	0.09953	-3.78964	-2.36049
H	-0.74876	-4.32461	-2.80200
H	0.71401	-4.50984	-1.81532
C	0.90384	-3.05960	-3.40311
C	0.26875	-2.40535	-4.46669
C	2.30061	-3.02122	-3.31867
C	1.01522	-1.71933	-5.42449

H	-0.81584	-2.43319	-4.53955
C	3.05231	-2.33913	-4.27830
H	2.80001	-3.53102	-2.49804
C	2.40937	-1.68585	-5.33202
H	0.51134	-1.21494	-6.24476
H	4.13584	-2.31989	-4.19917
H	2.99143	-1.15680	-6.08236

2. Transition state of Pathway 1, TS1

C	1.81663	6.20331	-0.99580
C	1.08701	5.11519	-0.53495
C	-0.16930	4.80776	-1.16751
C	-0.67095	5.72744	-2.15460
C	0.12062	6.82379	-2.58033
C	1.36013	7.04314	-2.03207
H	2.76451	6.42732	-0.51549
C	-0.98110	3.66477	-0.86903
C	-1.97624	5.54618	-2.67830
H	-0.27865	7.48601	-3.34448
H	1.97634	7.87463	-2.36242
C	-2.76547	4.51134	-2.25459
C	-2.28336	3.52381	-1.34912
H	-2.35392	6.26745	-3.39838
H	-3.78655	4.43332	-2.61312
C	1.68194	4.43925	0.66755
C	1.78028	5.15615	1.90793
C	2.27216	3.19181	0.57033
C	1.13063	6.40197	2.13745
C	2.53484	4.58095	2.98291
C	3.09212	2.63776	1.59891
C	1.23026	7.04335	3.35290
H	0.54003	6.84285	1.34230
C	2.62992	5.27677	4.21899
C	3.19959	3.34754	2.78028
C	1.99274	6.48181	4.40485
H	0.71670	7.98881	3.50603
H	3.21552	4.83165	5.02012
H	3.83442	2.96196	3.57390
H	2.06883	7.00128	5.35625
O	-0.46687	2.66269	-0.06882
O	2.02809	2.45122	-0.57602
P	0.64100	1.55466	-0.58118
O	0.69901	0.49136	0.46947
O	0.39152	1.18627	-2.02842

H	0.61405	-0.19195	-2.58317
C	3.87896	1.39242	1.40937
C	4.66929	1.20116	0.26366
C	3.93903	0.41705	2.41696
C	5.50123	0.09175	0.14447
H	4.64974	1.94176	-0.52924
C	4.76183	-0.69985	2.29045
H	3.31361	0.52492	3.29853
C	5.56634	-0.88677	1.15286
H	6.13525	-0.00061	-0.73275
H	4.75604	-1.45158	3.07469
C	-3.19914	2.42030	-0.95669
C	-4.15363	1.93162	-1.86984
C	-3.23239	1.89461	0.34797
C	-5.10407	0.98565	-1.49513
H	-4.15837	2.30167	-2.89104
C	-4.17880	0.94359	0.71883
H	-2.51052	2.23378	1.08095
C	-5.13882	0.46443	-0.18993
H	-5.84827	0.66900	-2.22117
H	-4.15161	0.55588	1.73226
C	-6.14063	-0.55536	0.20992
C	-6.63886	-0.59871	1.54767
C	-6.61694	-1.49392	-0.69343
C	-7.56218	-1.54013	1.93634
H	-6.29488	0.13995	2.26463
C	-7.57178	-2.47617	-0.32576
H	-6.23785	-1.51314	-1.71112
C	-8.05855	-2.50702	1.02088
H	-7.93444	-1.54623	2.95832
C	6.44482	-2.07512	1.01654
C	7.06922	-2.64975	2.16406
C	6.68315	-2.65935	-0.21817
C	7.88253	-3.75248	2.05875
H	6.91669	-2.18653	3.13433
C	7.51973	-3.79598	-0.36315
H	6.20587	-2.25654	-1.10817
C	8.13435	-4.36247	0.80044
H	8.35561	-4.16721	2.94600
C	-8.06071	-3.43815	-1.25324
C	-9.01127	-3.49463	1.38680
H	-9.37972	-3.51279	2.41001
C	-9.46451	-4.41368	0.46590
H	-10.19404	-5.16414	0.75807

C	-8.98465	-4.38420	-0.86755
H	-7.69713	-3.40454	-2.27794
H	-9.35477	-5.11004	-1.58691
C	7.76424	-4.39905	-1.62784
C	8.96848	-5.50240	0.65422
H	9.43417	-5.92715	1.54063
C	9.18648	-6.06249	-0.58531
H	9.82678	-6.93482	-0.68478
C	8.57791	-5.50457	-1.73733
H	7.29928	-3.96741	-2.51153
H	8.75843	-5.95355	-2.71042
C	-0.55435	-1.93989	-2.83168
C	-1.72322	-1.15759	-2.76898
C	-2.96176	-1.77136	-2.73566
C	-3.06362	-3.17304	-2.74531
C	-1.89965	-3.95498	-2.80950
C	-0.65248	-3.33801	-2.85445
H	-1.64212	-0.07617	-2.72501
H	-3.86521	-1.17688	-2.67141
H	-1.95155	-5.03680	-2.80903
H	0.23065	-3.96689	-2.88317
O	-4.32025	-3.67643	-2.68584
C	-4.49791	-5.08134	-2.52495
H	-5.57023	-5.22765	-2.39296
H	-4.15629	-5.62832	-3.41259
H	-3.96714	-5.44395	-1.63676
N	0.67965	-1.25355	-2.85474
C	1.84381	-1.81505	-2.97463
H	1.92949	-2.85819	-3.24917
C	3.07794	-0.98616	-3.27530
F	4.18837	-1.73068	-3.09854
F	3.05697	-0.62734	-4.58170
F	3.18330	0.11958	-2.54902
C	2.63026	-2.47804	-0.59763
H	3.40620	-3.15069	-0.94368
H	2.89917	-1.44039	-0.43028
C	1.49469	-2.99940	-0.05908
H	1.28624	-4.06554	-0.07994
N	0.51901	-2.26255	0.55155
H	0.59198	-1.22460	0.60276
C	-0.59999	-2.87057	1.09095
O	-0.84315	-4.05979	1.04107
O	-1.36488	-1.94106	1.68494
C	-2.55982	-2.37694	2.35041

H	-2.40796	-3.39355	2.72665
H	-3.36873	-2.41033	1.60973
C	-2.88898	-1.41325	3.46933
C	-2.10920	-0.28233	3.73704
C	-4.02070	-1.66753	4.25684
C	-2.45905	0.57815	4.78239
H	-1.23909	-0.07340	3.12367
C	-4.36599	-0.80779	5.29901
H	-4.63536	-2.54178	4.05202
C	-3.58403	0.31978	5.56566
H	-1.84620	1.45368	4.97984
H	-5.24362	-1.01934	5.90443
H	-3.85209	0.99062	6.37748

3. Reactant of Pathway 2

C	-1.96500	-1.62950	-5.27348
C	-1.08255	-1.77873	-4.21111
C	0.13102	-1.00123	-4.21300
C	0.42340	-0.19838	-5.37314
C	-0.51423	-0.10422	-6.43198
C	-1.70439	-0.78526	-6.37171
H	-2.88289	-2.20931	-5.26411
C	1.09052	-0.95510	-3.15470
C	1.65813	0.49613	-5.45681
H	-0.27108	0.52258	-7.28598
H	-2.43542	-0.70144	-7.17051
C	2.57946	0.42924	-4.44562
C	2.30798	-0.28888	-3.24877
H	1.86745	1.07433	-6.35290
H	3.53535	0.93429	-4.54257
C	-1.49748	-2.82607	-3.21419
C	-1.61148	-4.19678	-3.63378
C	-1.92279	-2.49903	-1.93982
C	-1.11823	-4.66754	-4.88331
C	-2.21416	-5.14731	-2.74474
C	-2.57545	-3.40832	-1.05764
C	-1.22807	-5.99448	-5.23740
H	-0.63827	-3.96873	-5.55882
C	-2.32651	-6.50588	-3.14910
C	-2.70850	-4.71427	-1.49084
C	-1.84567	-6.92457	-4.36778
H	-0.83407	-6.33058	-6.19268
H	-2.79646	-7.21126	-2.46802
H	-3.22039	-5.43203	-0.85550

H	-1.93235	-7.96677	-4.66237
O	0.80400	-1.57939	-1.94323
O	-1.66452	-1.20048	-1.48130
P	-0.20033	-0.97529	-0.82390
O	0.06055	-1.59484	0.48676
O	-0.16934	0.60732	-0.90925
H	0.48828	1.11695	-0.35489
C	-3.12716	-2.98215	0.25379
C	-3.90800	-1.82056	0.37721
C	-2.92853	-3.76676	1.40007
C	-4.46593	-1.46103	1.59972
H	-4.09707	-1.20341	-0.49550
C	-3.48305	-3.40227	2.62432
H	-2.30321	-4.65291	1.33758
C	-4.26050	-2.23891	2.75320
H	-5.09126	-0.57508	1.65687
H	-3.27845	-4.01102	3.50056
C	3.30986	-0.27309	-2.15081
C	3.99967	0.91320	-1.84204
C	3.64206	-1.42893	-1.42254
C	4.97021	0.94567	-0.84404
H	3.75169	1.82960	-2.37080
C	4.61634	-1.39497	-0.43010
H	3.14089	-2.36455	-1.64307
C	5.30136	-0.20859	-0.11414
H	5.45786	1.88742	-0.60793
H	4.86665	-2.31426	0.09121
C	6.33314	-0.17909	0.95153
C	6.18181	-0.98090	2.12272
C	7.46344	0.61512	0.84164
C	7.12811	-0.97162	3.12033
H	5.28919	-1.58868	2.23480
C	8.45650	0.65284	1.85442
H	7.61965	1.21166	-0.05384
C	8.29080	-0.15919	3.02353
H	6.99146	-1.59109	4.00394
C	-4.83983	-1.83875	4.05919
C	-5.31574	-2.82509	4.97361
C	-4.93088	-0.50440	4.42307
C	-5.85452	-2.47115	6.18749
H	-5.27371	-3.87248	4.68862
C	-5.48255	-0.10578	5.66794
H	-4.54584	0.26604	3.75920
C	-5.95592	-1.10808	6.57585

H	-6.22172	-3.23810	6.86585
C	9.61888	1.46484	1.74478
C	9.28775	-0.12385	4.03455
H	9.15919	-0.74458	4.91849
C	10.40092	0.67650	3.89959
H	11.15809	0.69357	4.67877
C	10.56747	1.47832	2.74293
H	9.74655	2.07784	0.85552
H	11.45057	2.10407	2.64624
C	-5.57542	1.26182	6.04759
C	-6.50656	-0.70498	7.82133
H	-6.86666	-1.46924	8.50650
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H	-7.00790	0.92467	9.11491
C	-6.11411	1.62076	7.26293
H	-5.21537	2.02057	5.35684
H	-6.18166	2.66946	7.53983
C	2.05469	1.79138	1.90125
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C	2.23398	0.02415	3.54781
C	3.26740	0.72013	4.19472
C	3.71040	1.94667	3.67595
C	3.10289	2.47268	2.54007
H	0.87471	-0.02965	1.89987
H	1.91647	-0.93323	3.94773
H	4.53748	2.48001	4.12892
H	3.49002	3.39839	2.12482
O	3.79298	0.12077	5.29450
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H	5.09896	0.11122	6.82570
H	5.74149	0.86424	5.33710
H	4.55719	1.74686	6.35773
N	1.42103	2.28765	0.73558
C	1.37075	3.54095	0.52321
H	1.72260	4.29807	1.22886
C	0.82484	4.12512	-0.75970
F	-0.27737	4.86806	-0.52297
F	1.75151	4.96523	-1.29016
F	0.52285	3.21633	-1.68619
C	-2.62181	2.46070	2.74932
H	-2.32133	2.01598	3.69207
H	-3.16129	3.39799	2.76322
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H	-5.08123	4.40307	-1.79990
C	-3.78242	4.47150	-3.52563
C	-2.48520	4.59789	-4.04314
C	-4.86013	4.37559	-4.41159
C	-2.27414	4.62594	-5.42041
H	-1.64193	4.66670	-3.36099
C	-4.65185	4.41240	-5.79266
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C	-3.35819	4.53712	-6.29913
H	-1.26397	4.72221	-5.80951
H	-5.49929	4.34013	-6.46923
H	-3.19311	4.56513	-7.37308

4. Transition state of Pathway 2, TS2

C	-4.79288	-3.38620	-3.83689
C	-4.15674	-3.19605	-2.61666
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C	-2.97459	-4.68022	-4.72832
C	-4.20839	-4.10350	-4.90045
H	-5.79396	-2.98490	-3.96244
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C	-0.99572	-5.12361	-3.34227
H	-2.51830	-5.27164	-5.51805
H	-4.75023	-4.21552	-5.83524
C	-0.28201	-4.96243	-2.18444
C	-0.75569	-4.12753	-1.13541
H	-0.60463	-5.73982	-4.14759
H	0.66970	-5.46830	-2.05567
C	-5.01136	-2.52177	-1.57840
C	-6.21831	-3.16488	-1.13396
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C	-7.13581	-2.42925	-0.31342
C	-5.67385	-0.46424	-0.36556
C	-7.69209	-5.10318	-0.97735
H	-5.84046	-5.09994	-2.03818

C	-8.33087	-3.05724	0.13310
C	-6.84749	-1.08455	0.02050
C	-8.60746	-4.36528	-0.18967
H	-7.90354	-6.14184	-1.21691
H	-9.02082	-2.48070	0.74473
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H	-9.52121	-4.83566	0.16308
O	-2.41220	-2.64091	-0.30838
O	-3.51813	-0.67160	-1.45285
P	-2.30666	-1.01885	-0.42370
O	-2.39001	-0.42036	0.92211
O	-1.07567	-0.67364	-1.32987
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C	-5.70971	1.42297	1.28379
C	-4.78173	3.22139	-0.61703
H	-4.72683	1.55332	-1.96253
C	-5.53881	2.76309	1.61852
H	-6.04033	0.72006	2.04304
C	-5.06967	3.69319	0.67578
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H	-5.73754	3.08424	2.63717
C	0.09874	-3.91584	0.06232
C	1.48981	-3.76819	-0.08508
C	-0.42406	-3.89510	1.36740
C	2.32002	-3.59884	1.01970
H	1.92235	-3.74976	-1.08133
C	0.40801	-3.72690	2.47001
H	-1.49009	-4.01818	1.52020
C	1.79759	-3.57199	2.32377
H	3.38598	-3.45268	0.86728
H	-0.02791	-3.74092	3.46487
C	2.67798	-3.38225	3.50276
C	2.23499	-2.60361	4.61384
C	3.94151	-3.94810	3.55926
C	3.03541	-2.41360	5.71548
H	1.25761	-2.13273	4.57055
C	4.79371	-3.77091	4.67982
H	4.29166	-4.56959	2.73864
C	4.33415	-2.98669	5.78762
H	2.67925	-1.81176	6.54856
C	-4.88208	5.12103	1.03251
C	-5.78752	5.76824	1.92562

C	-3.83178	5.86176	0.51411
C	-5.63166	7.09032	2.26703
H	-6.62987	5.20670	2.31899
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H	-3.11070	5.38541	-0.14546
C	-4.56043	7.86257	1.74271
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H	4.83287	-2.21799	7.74883
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H	7.08107	-3.24983	7.80631
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H	-3.17867	10.98914	1.80401
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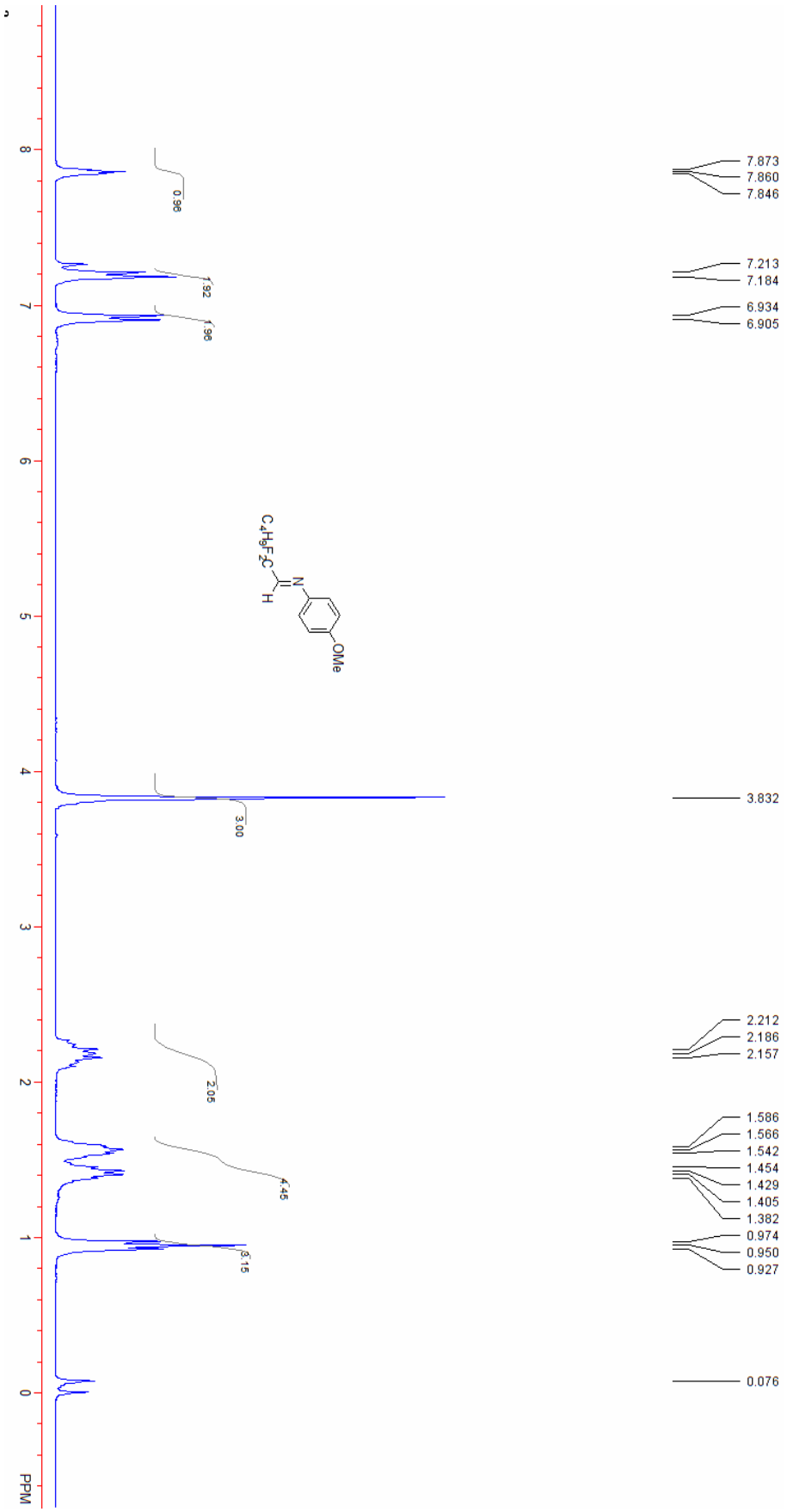
H	-1.57572	9.88778	0.24653
C	1.65202	0.48620	0.83252
C	0.60266	0.52032	1.80666
C	0.85576	0.94117	3.08258
C	2.16996	1.33801	3.48269
C	3.20520	1.32488	2.57500
C	2.95422	0.96428	1.21587
H	-0.40175	0.21524	1.52664
H	0.06419	0.97697	3.82462
H	4.21863	1.58303	2.85855
H	3.82621	0.66450	0.64699
O	2.27953	1.67954	4.79294
C	3.55932	2.04992	5.28981
H	3.41114	2.28933	6.34341
H	4.27206	1.22142	5.19507
H	3.94769	2.93108	4.76349
N	1.34773	0.18618	-0.44976
C	2.29712	0.32832	-1.37336
H	3.33864	0.07595	-1.16793
C	1.90798	-0.00779	-2.79785
F	2.94331	0.25253	-3.64258
F	1.60495	-1.31185	-2.96148

F	0.85711	0.70849	-3.23599
C	2.88741	2.74140	0.00405
H	1.95918	3.10702	0.42503
H	3.79898	3.11042	0.45329
C	2.88884	2.41197	-1.36557
H	2.01744	2.66906	-1.95641
N	4.07238	2.46273	-2.14619
H	3.95857	2.48179	-3.15115
C	5.34366	2.19733	-1.71272
O	5.66910	1.94062	-0.56746
O	6.20037	2.26874	-2.75586
C	7.59784	1.99710	-2.45353
H	7.66624	0.98957	-2.03254
H	7.92878	2.70980	-1.69286
C	8.38631	2.12884	-3.72689
C	8.52782	1.03504	-4.59044
C	8.98582	3.34750	-4.06784
C	9.25117	1.15817	-5.77679
H	8.06940	0.08395	-4.32974
C	9.71124	3.47350	-5.25317
H	8.88474	4.19947	-3.39947
C	9.84436	2.37837	-6.10941
H	9.35552	0.30277	-6.43856
H	10.17431	4.42328	-5.50627
H	10.41179	2.47408	-7.03118

Copies of ^{1}H NMR, ^{19}F NMR and ^{13}C NMR of Compounds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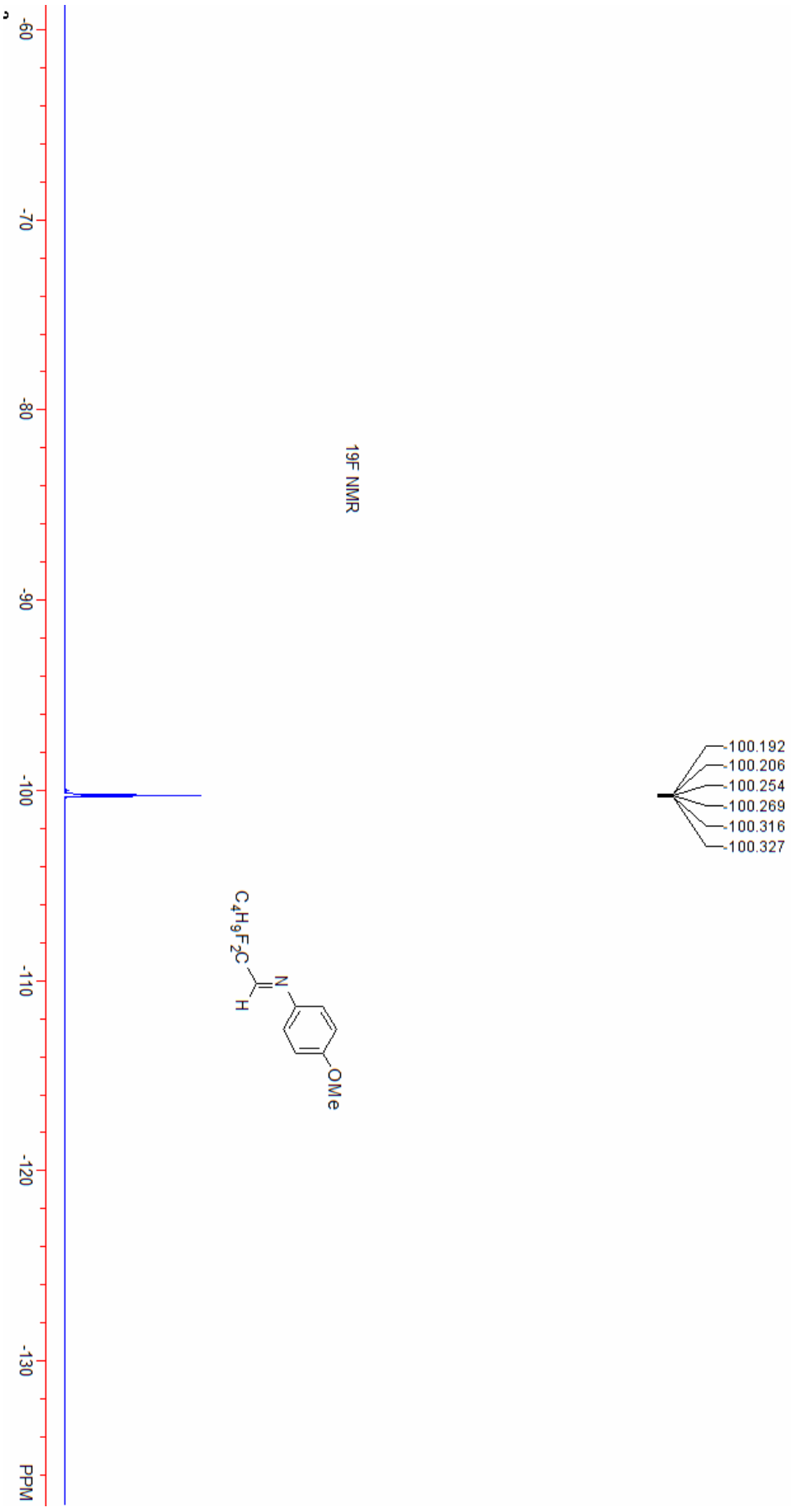
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N
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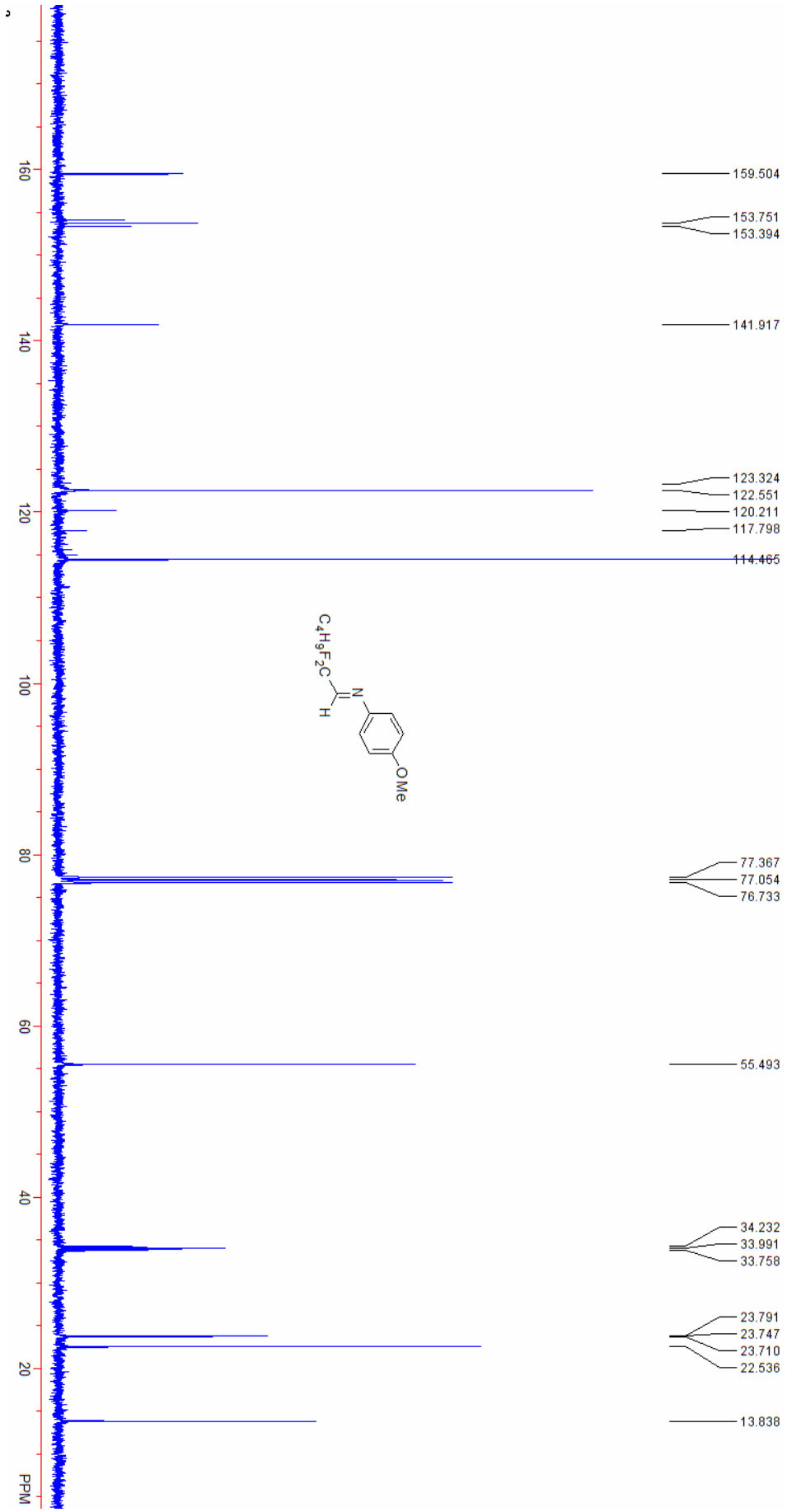
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55.493
34.232
33.991
33.758
23.791
23.747
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140
120
100
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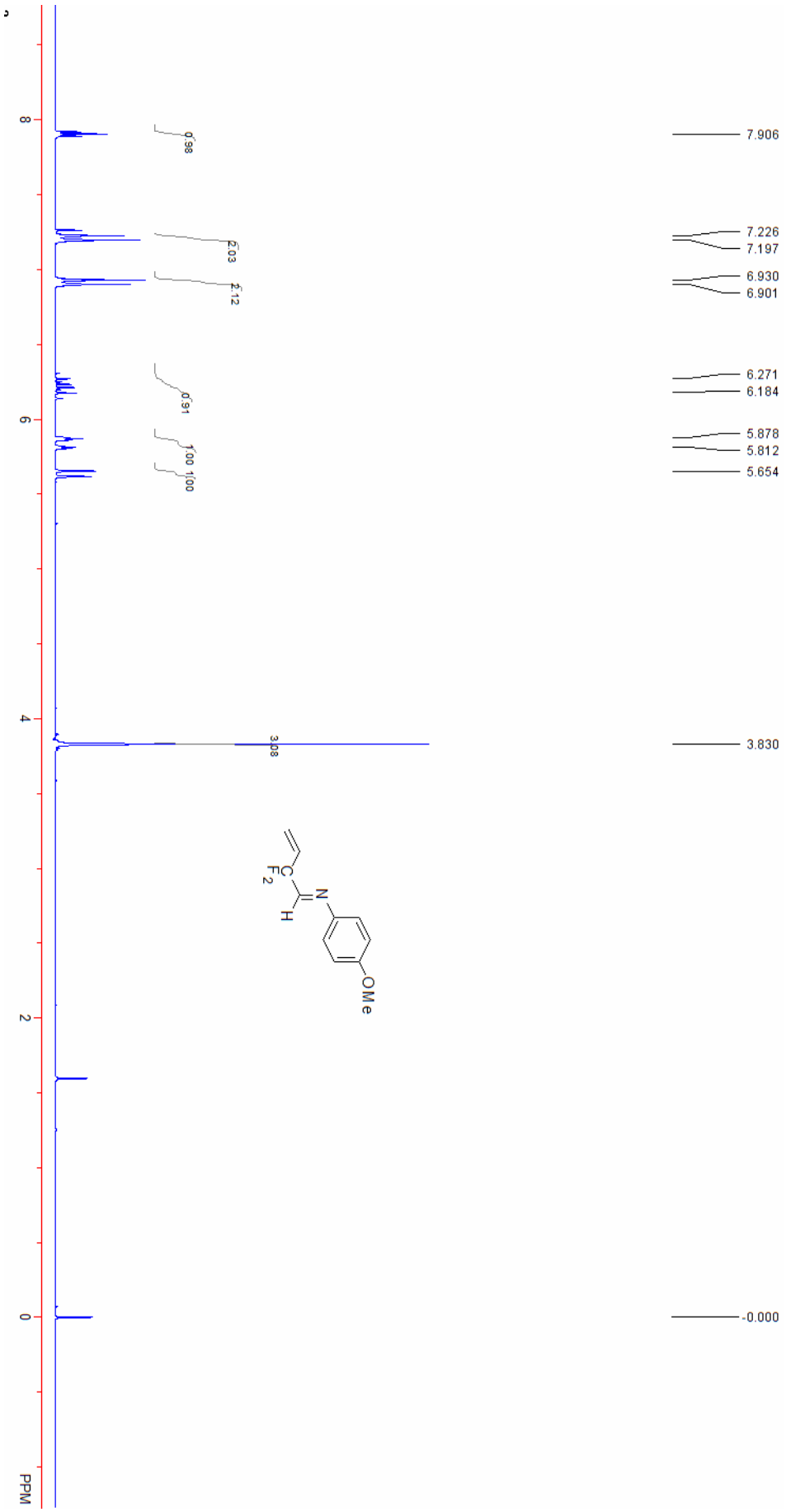
N
H
OMe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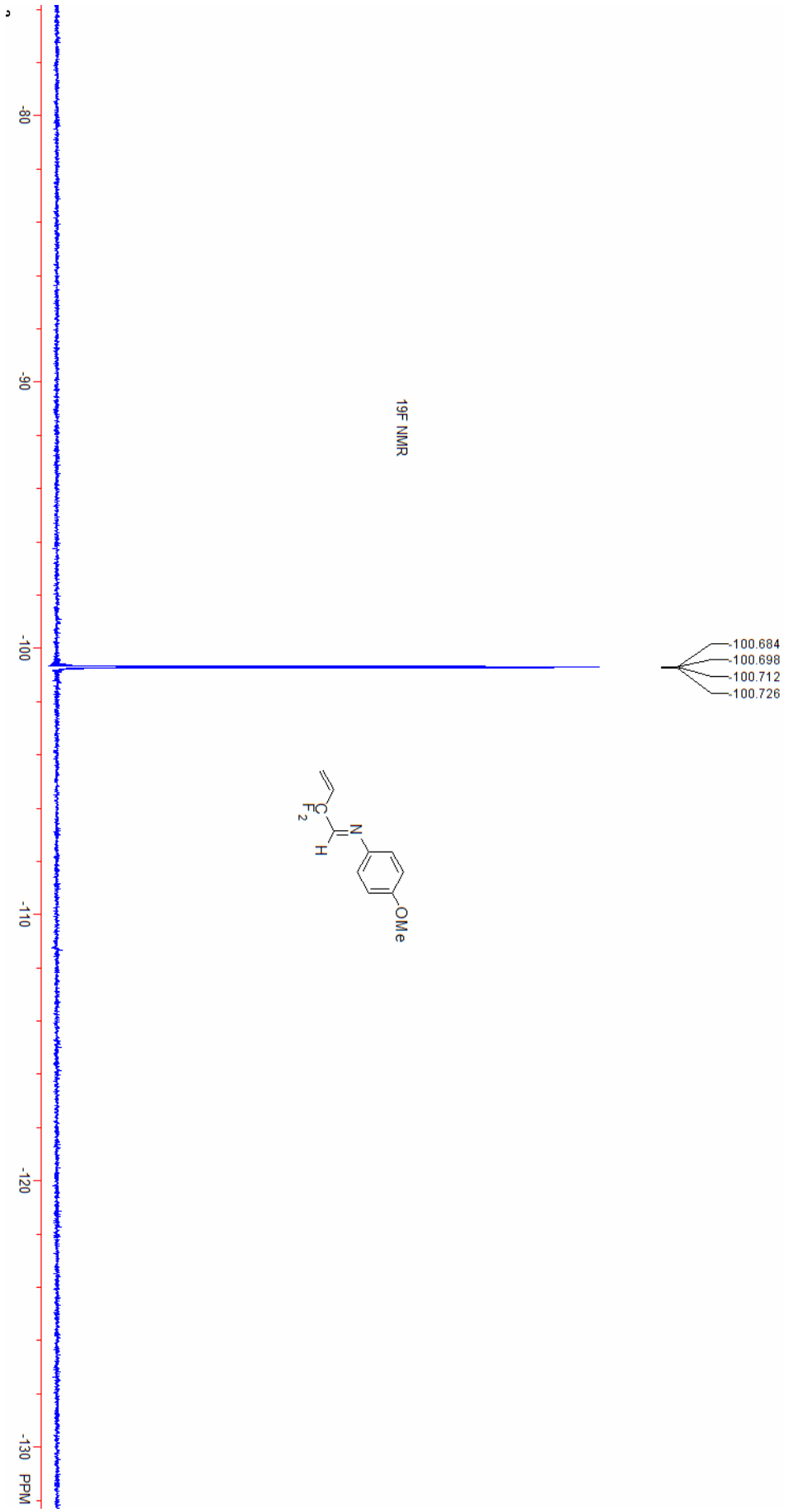
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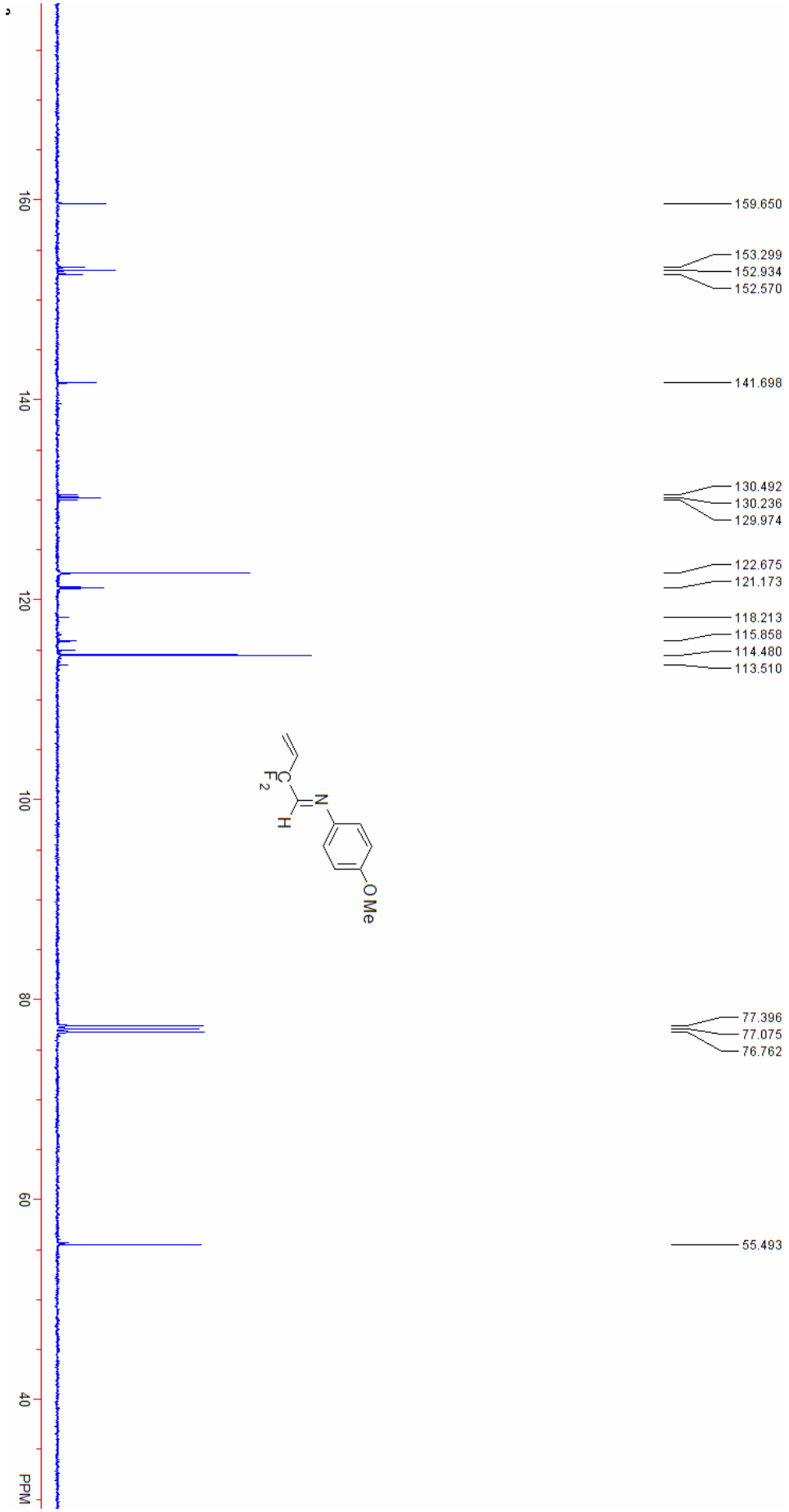
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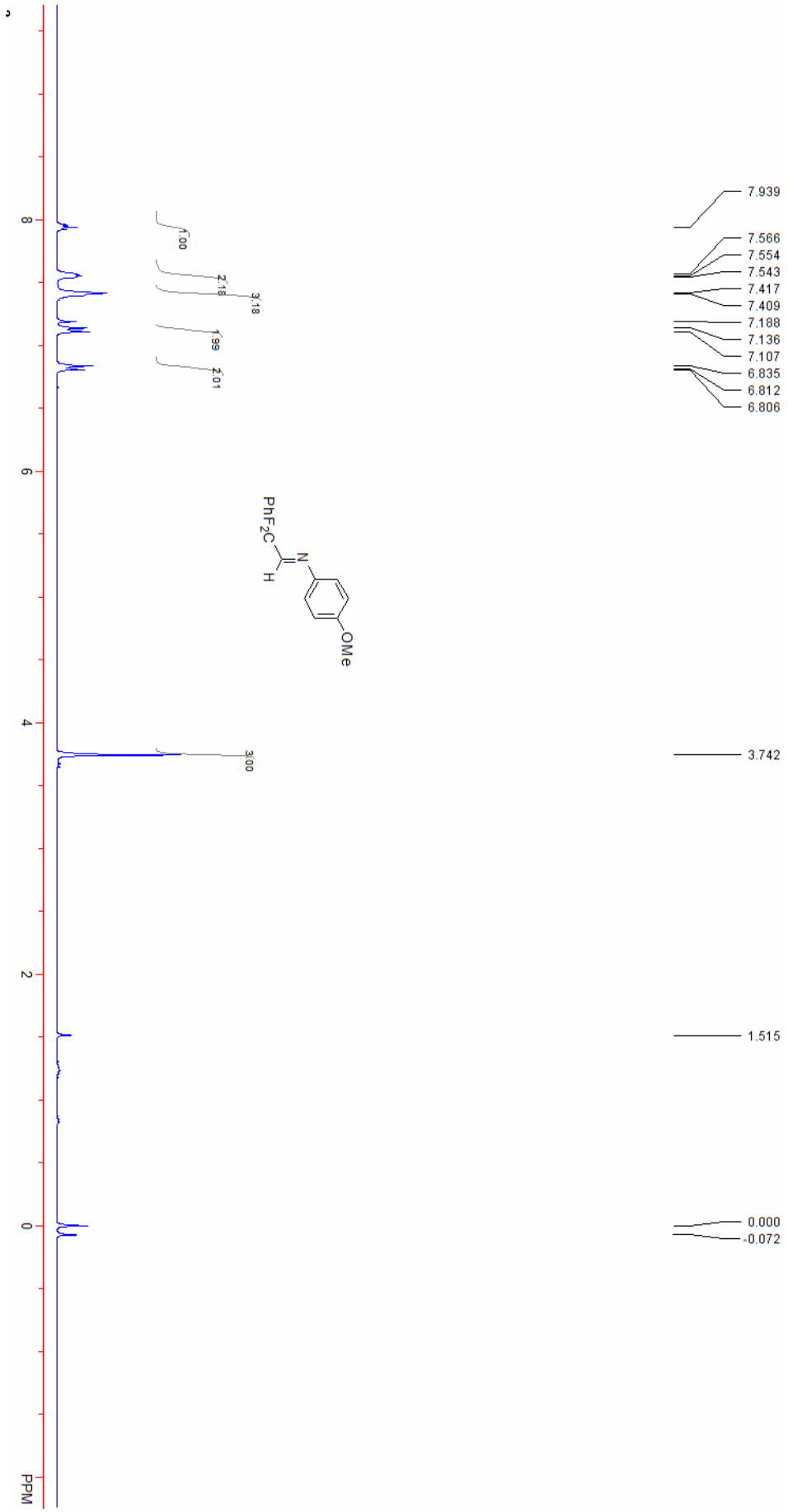
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6.806
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1.00
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3.00
PhF2C
N
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OMe
8
6
4
2
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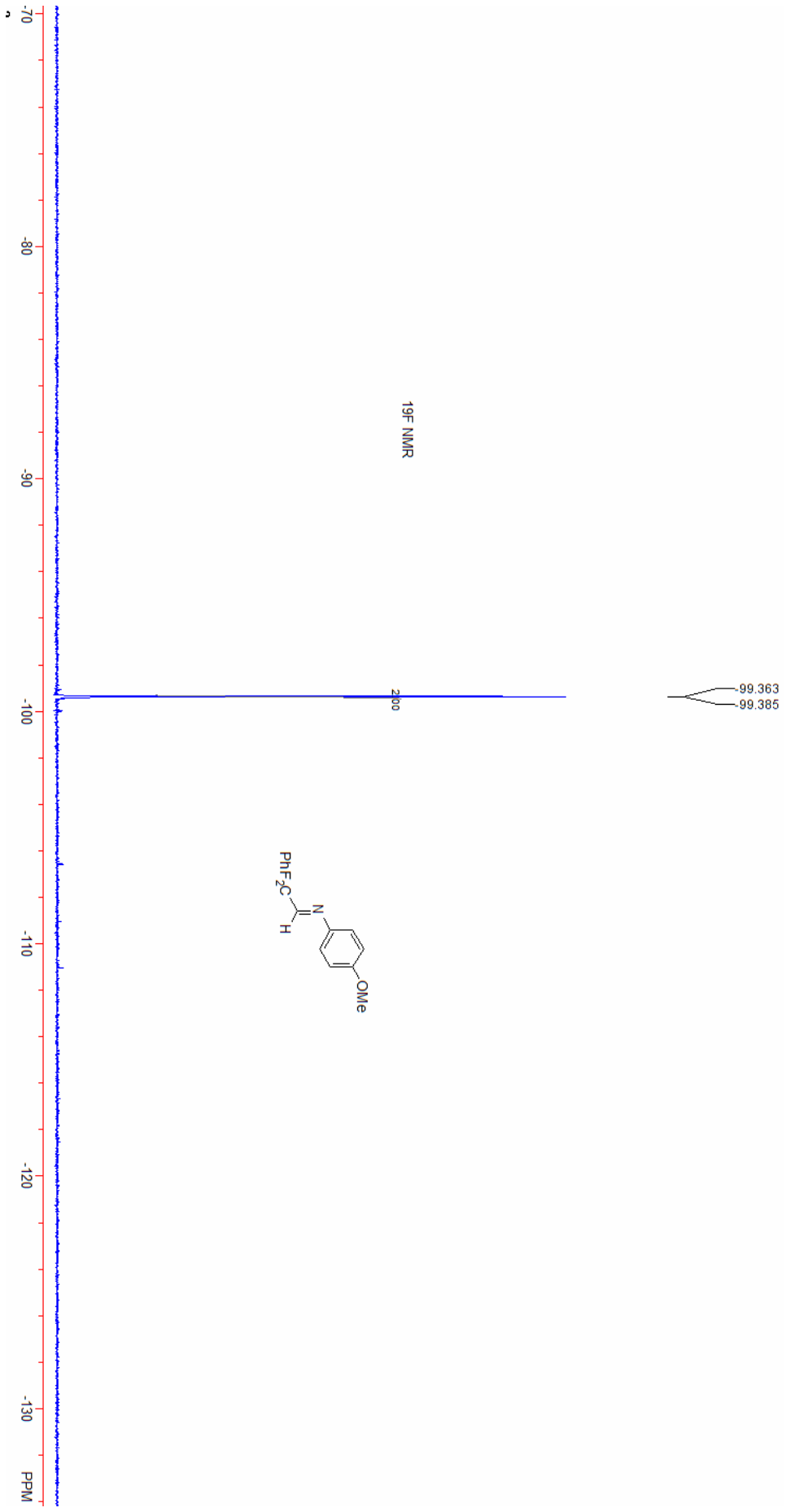
PPM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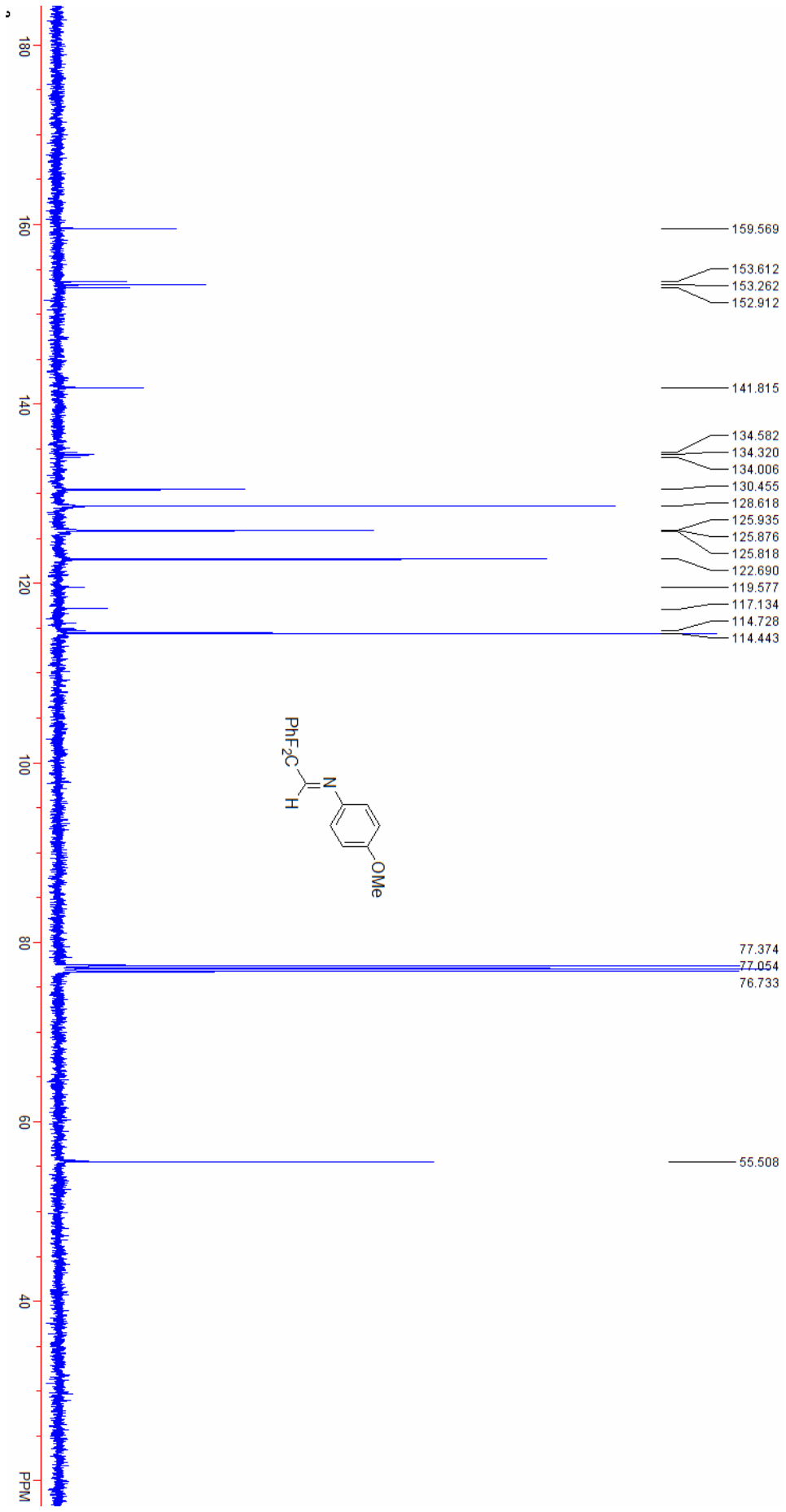
PPM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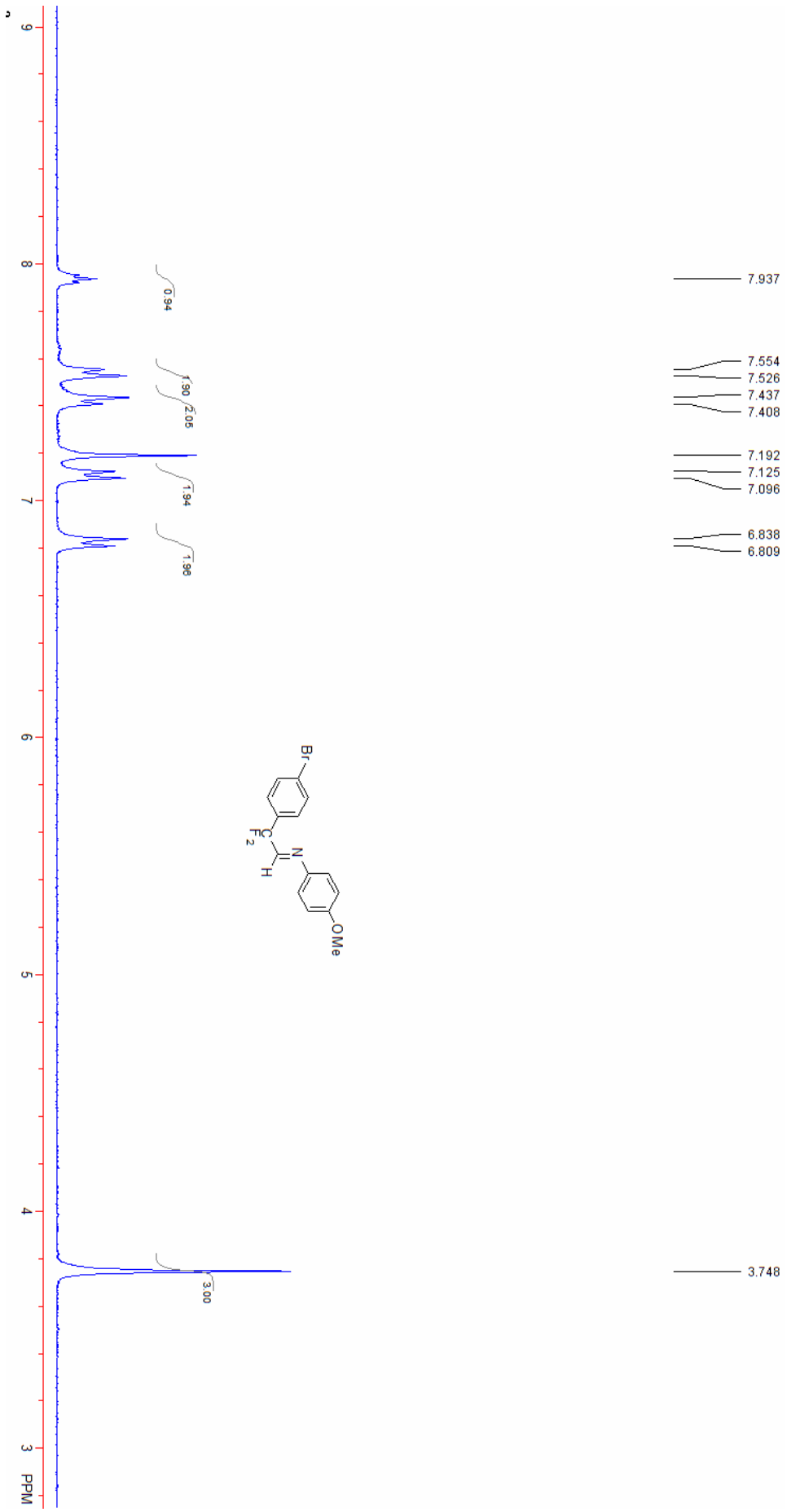
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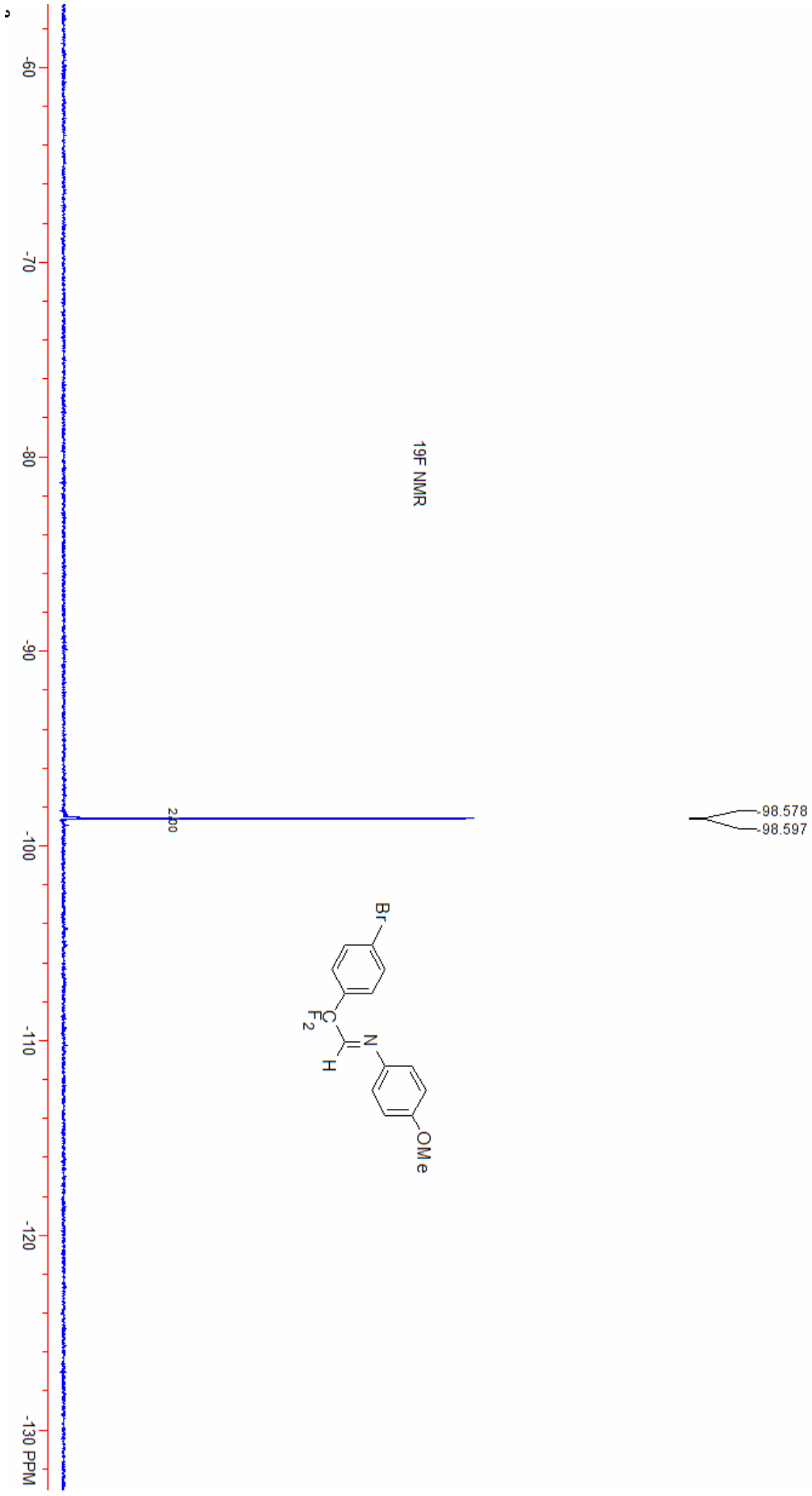
Br
F2C
N
H
OMe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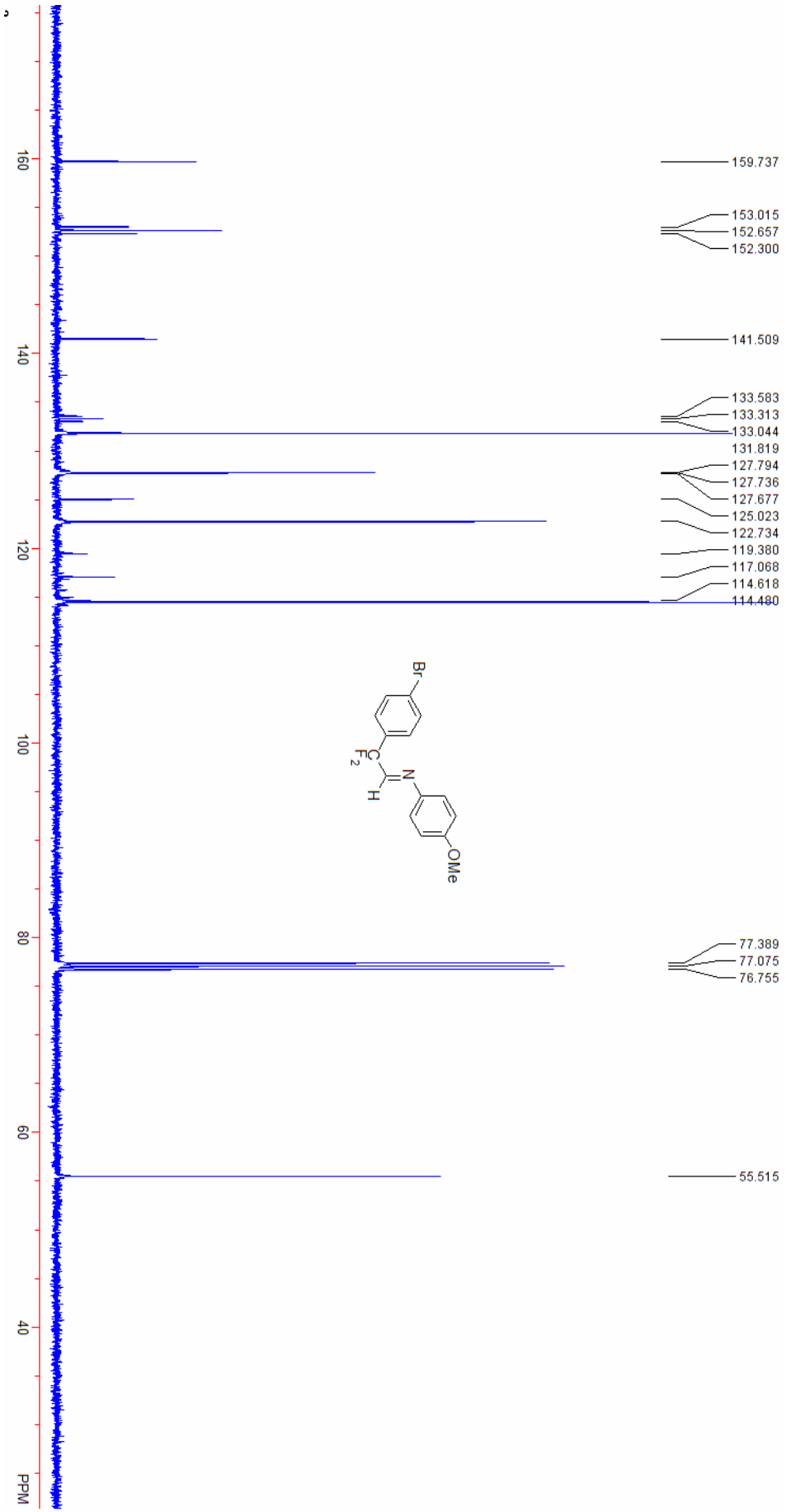
F2C
N
H
OMe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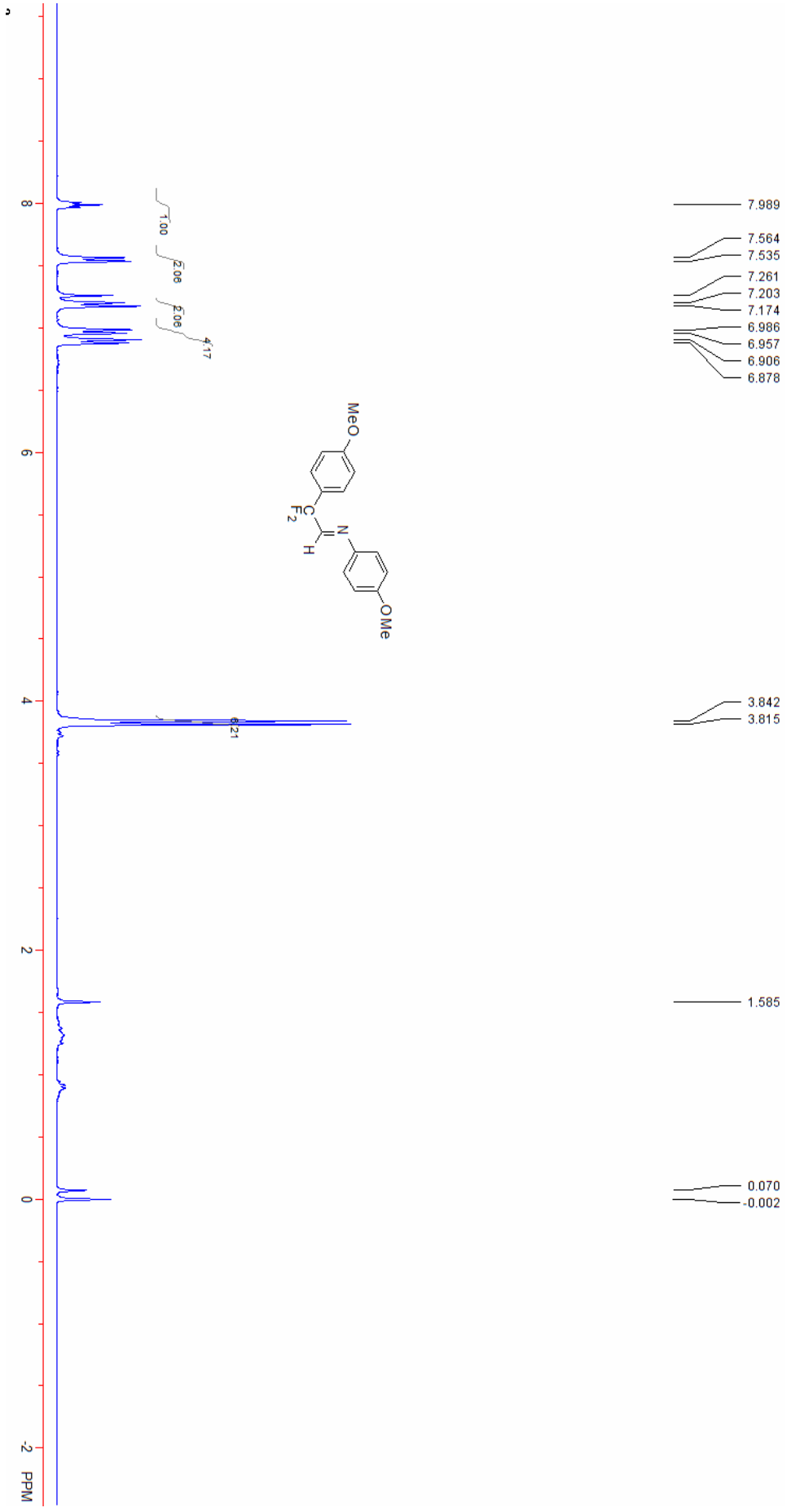
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MeO
OMe
F2C
N
H
8
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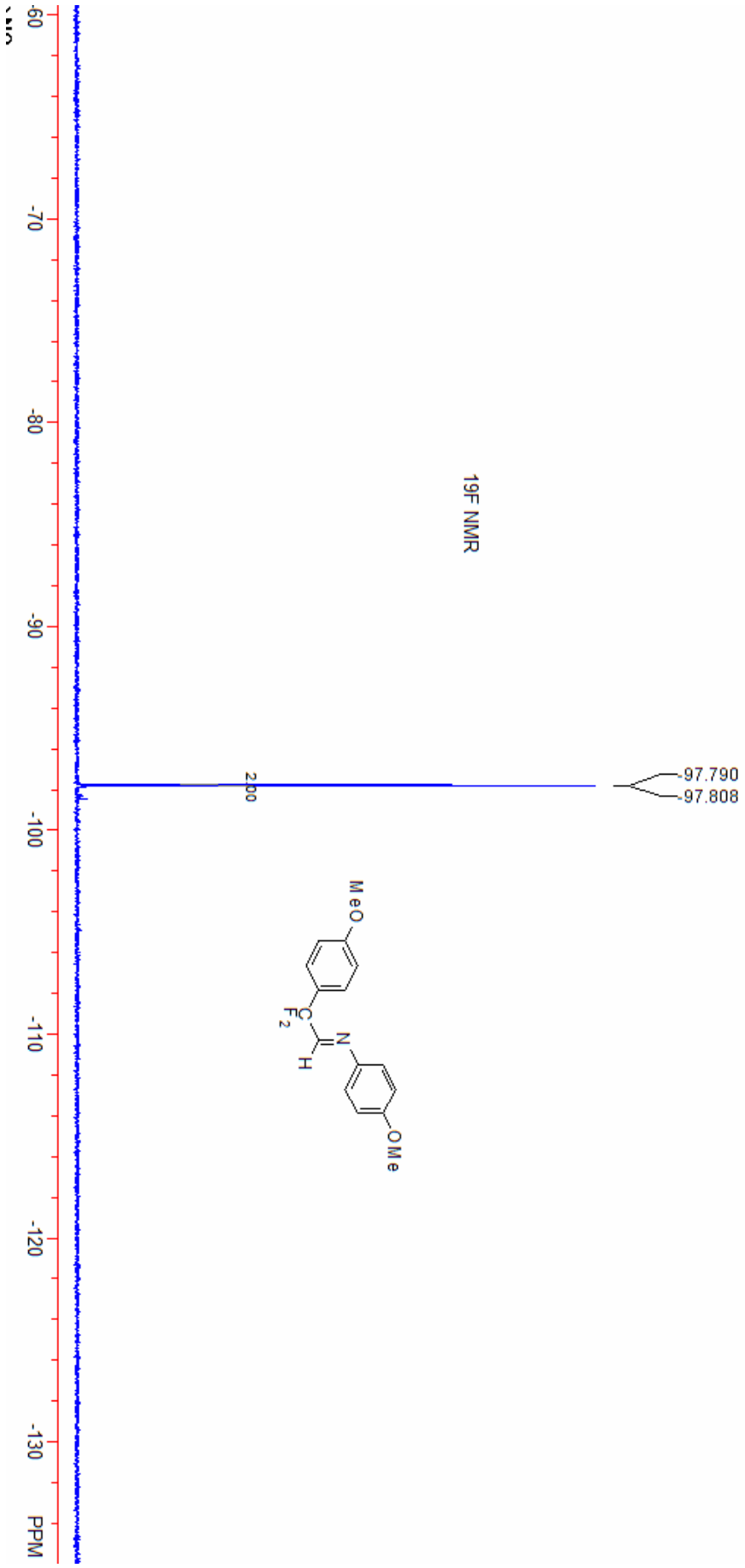
PPM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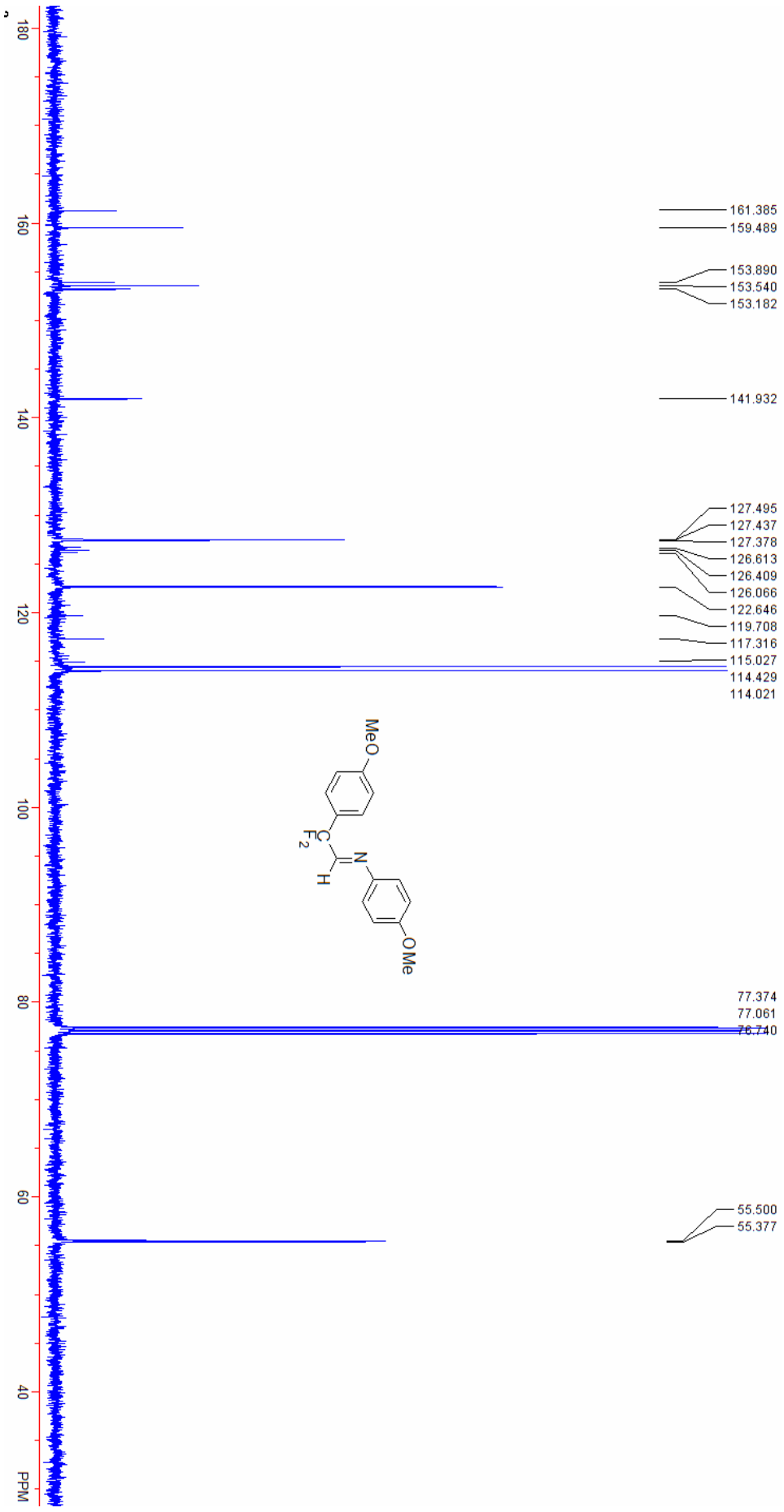

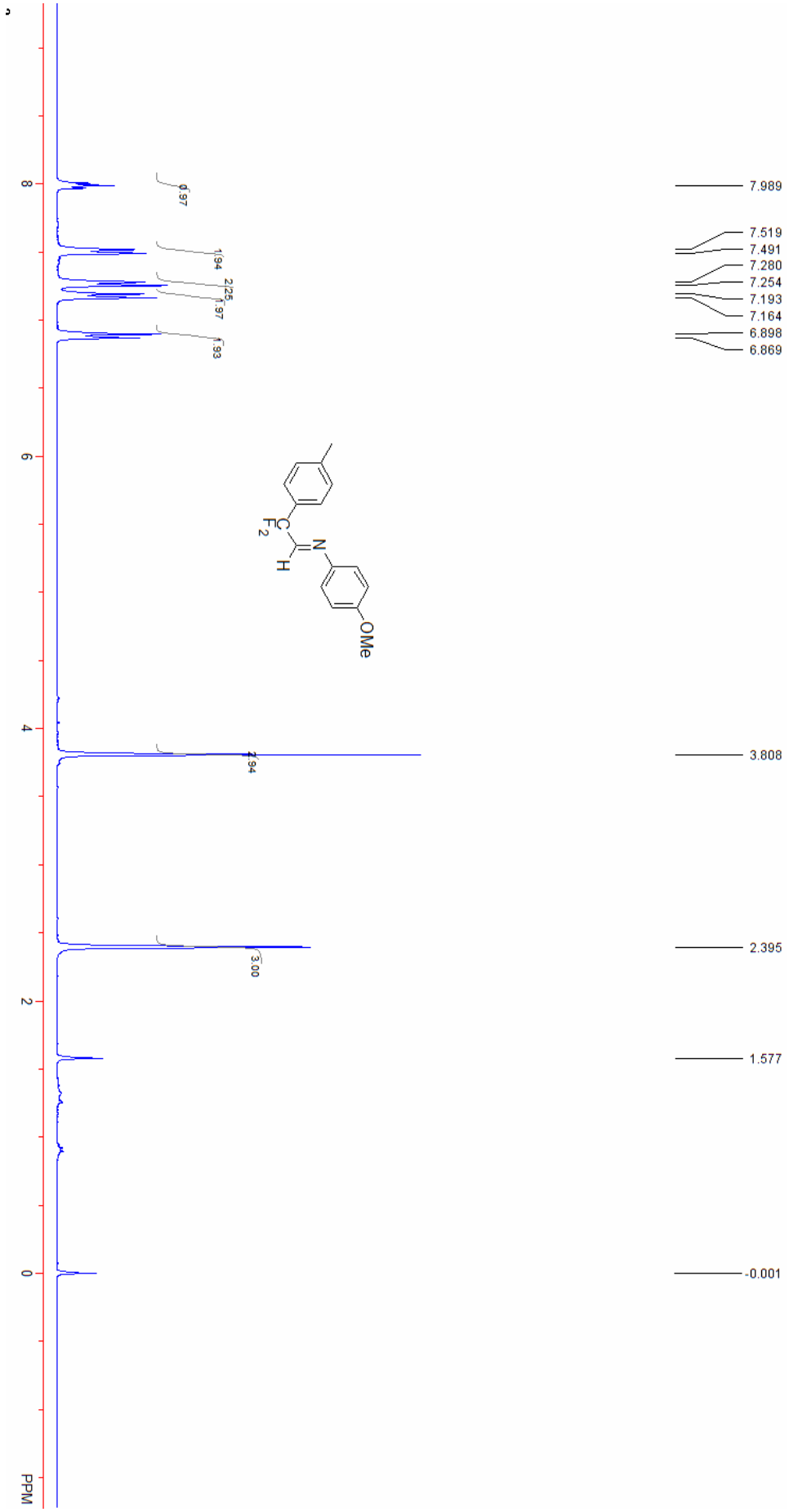
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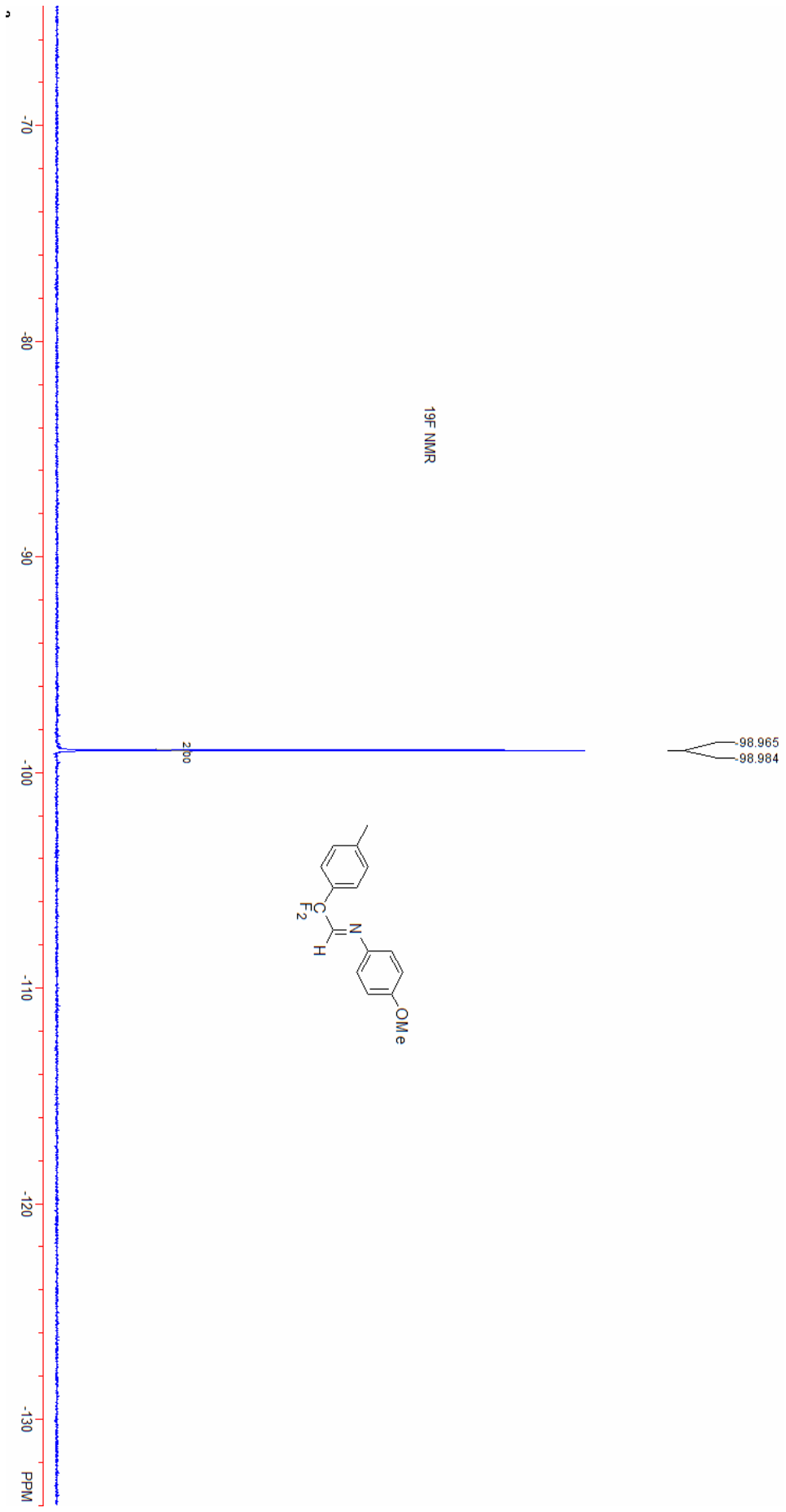
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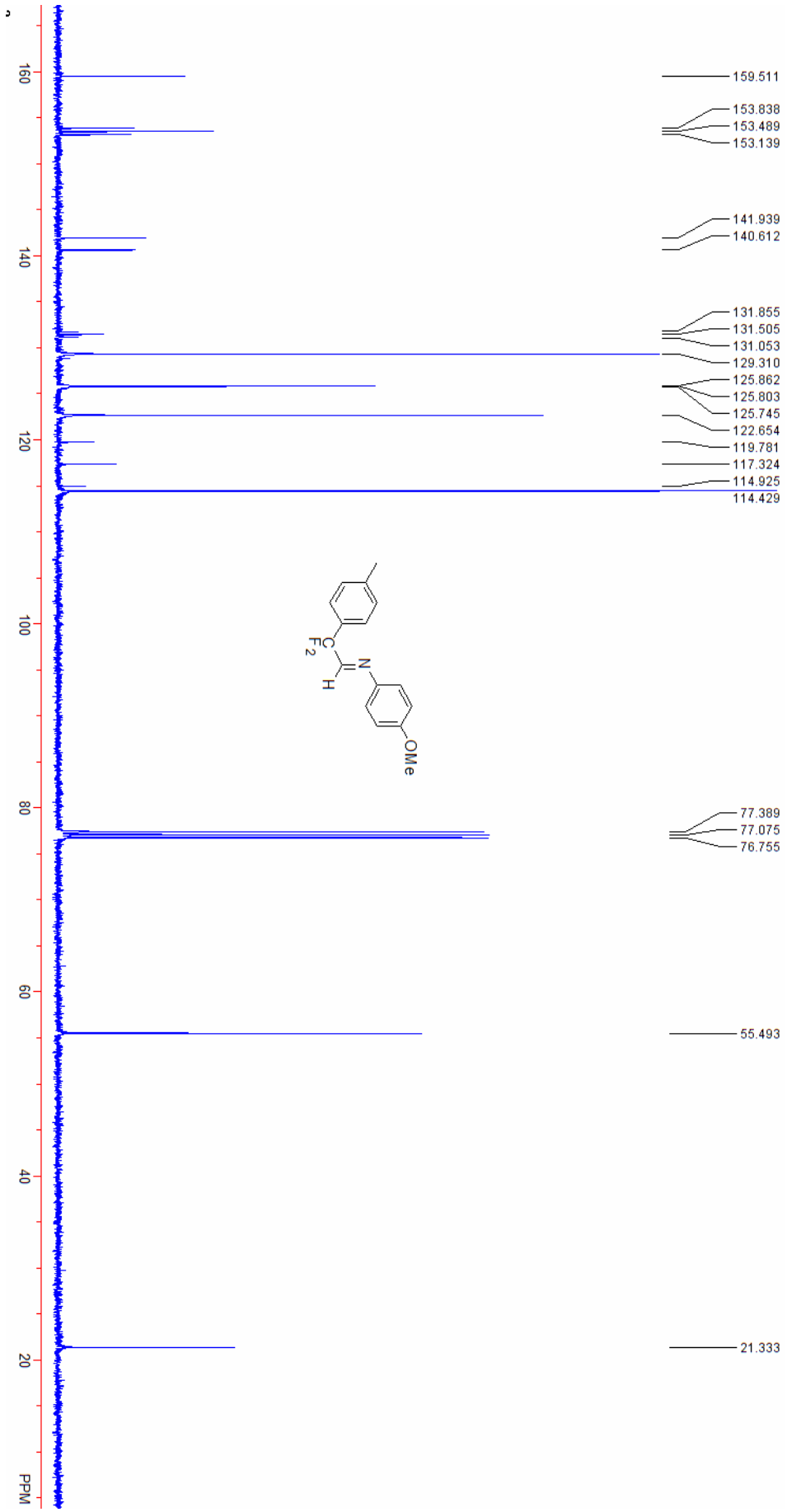
N
H
OMe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125.745
122.654
119.781
117.324
114.925
114.429
77.389
77.075
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20
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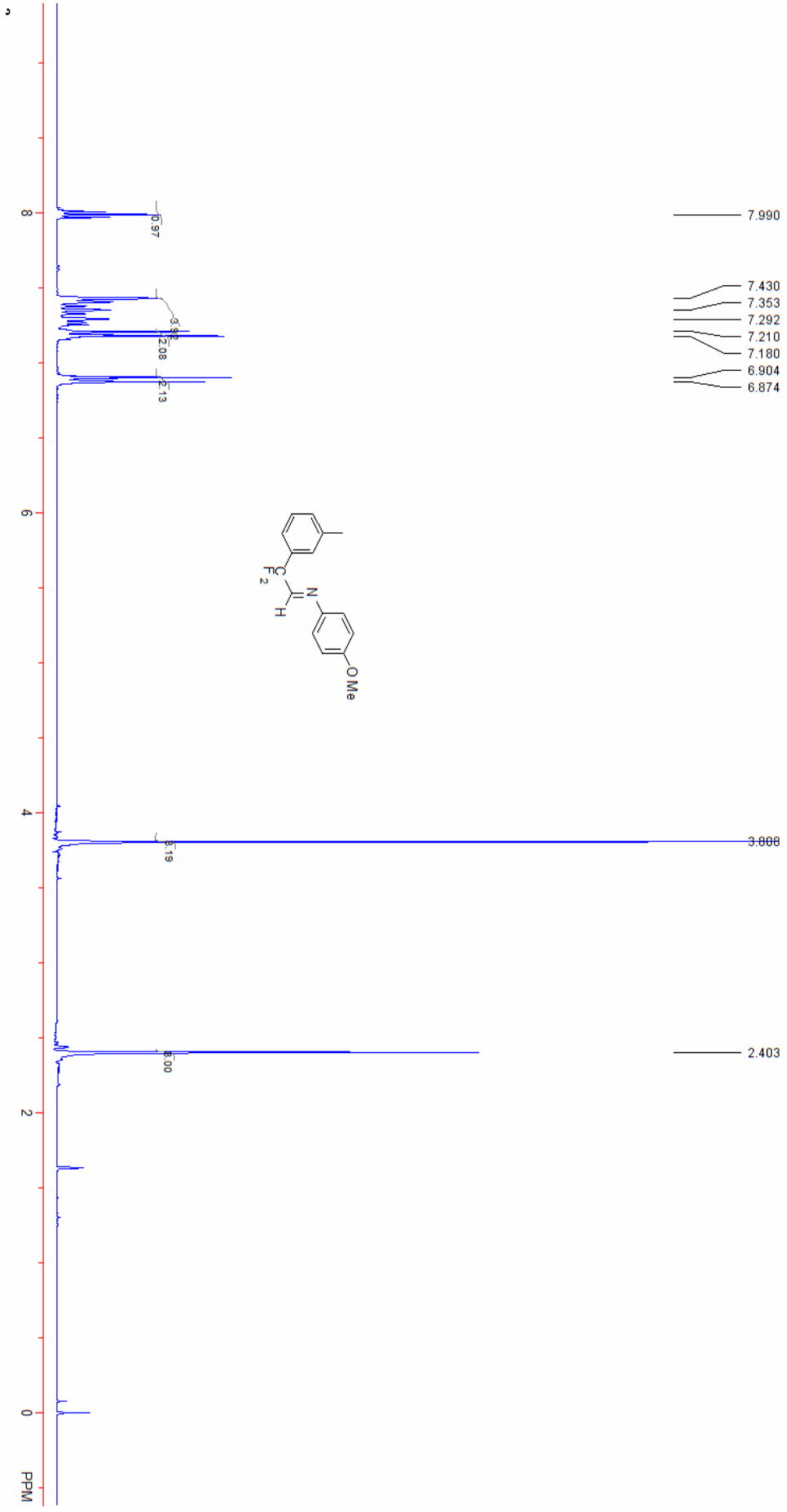
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6.874
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3.19
3.00
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H
N
OMe
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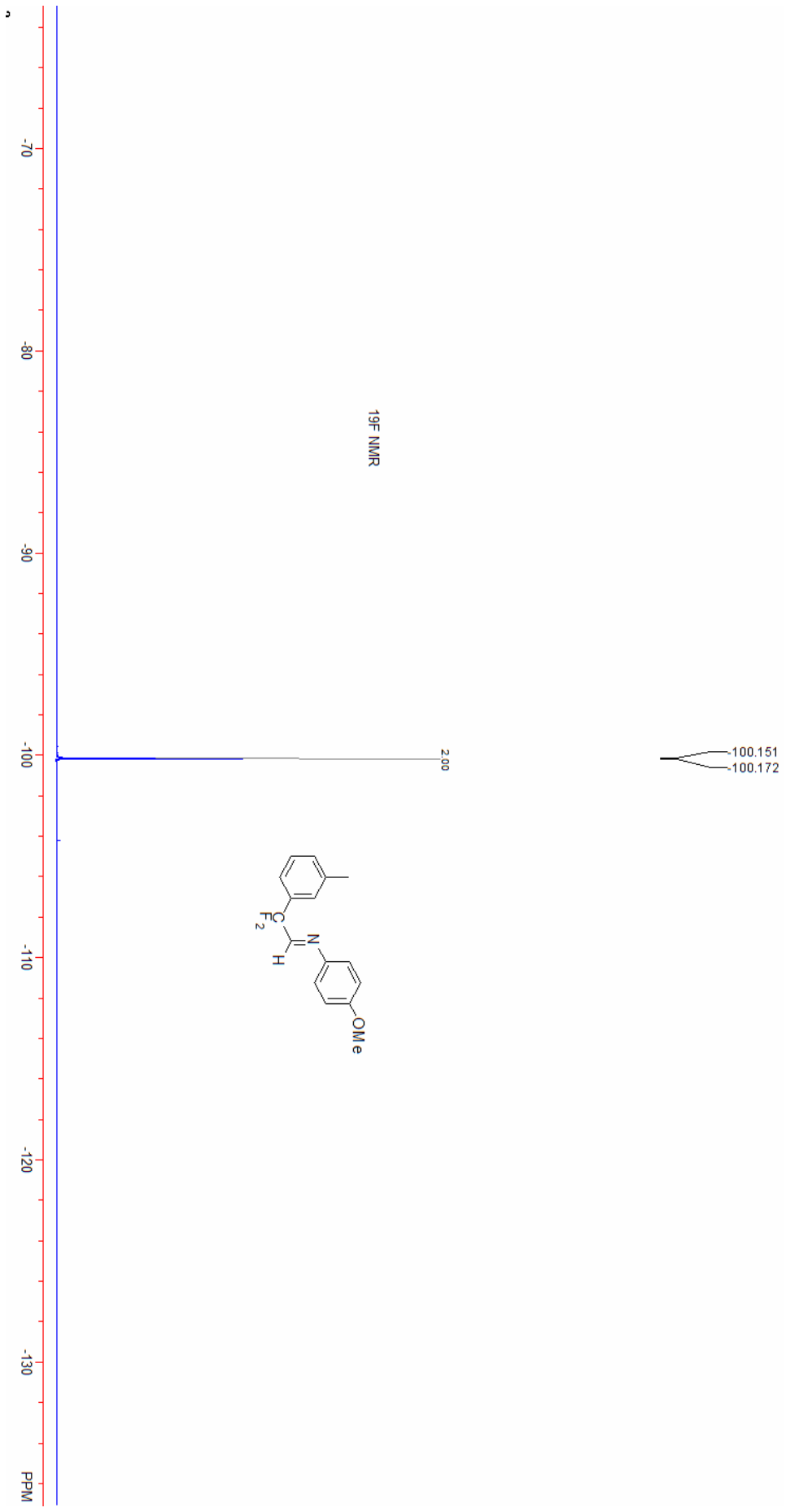
PPM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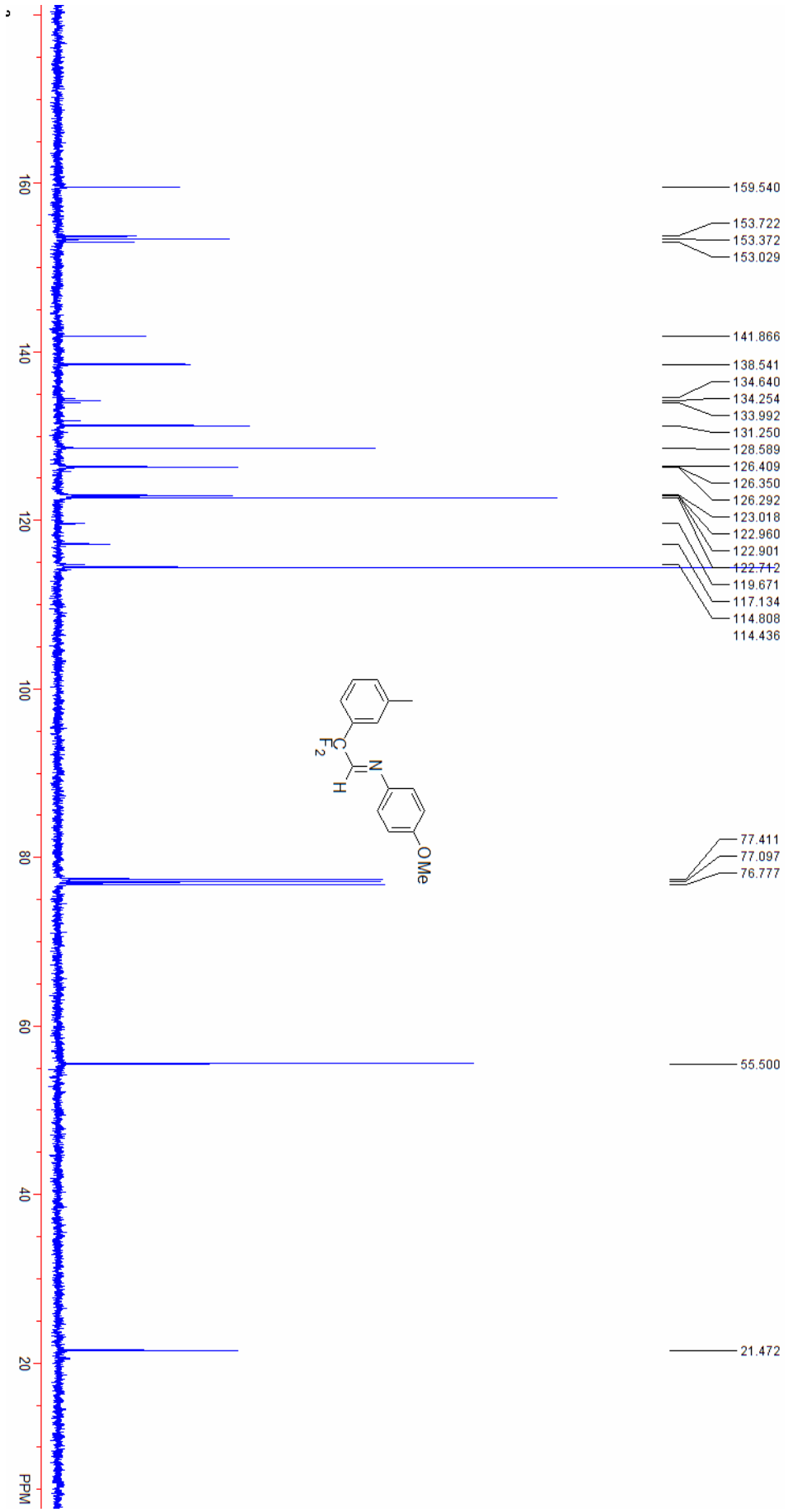
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H
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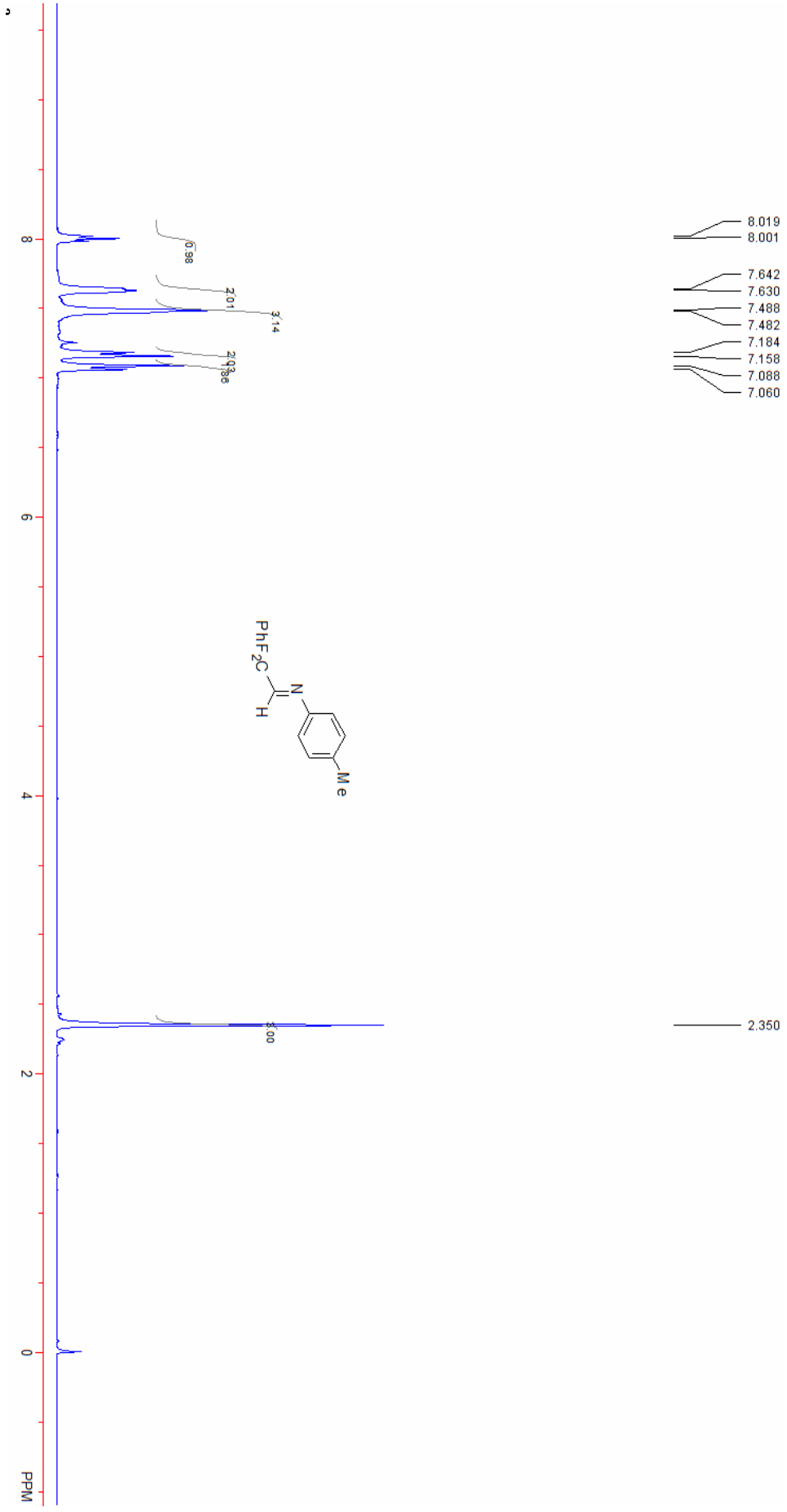
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Me
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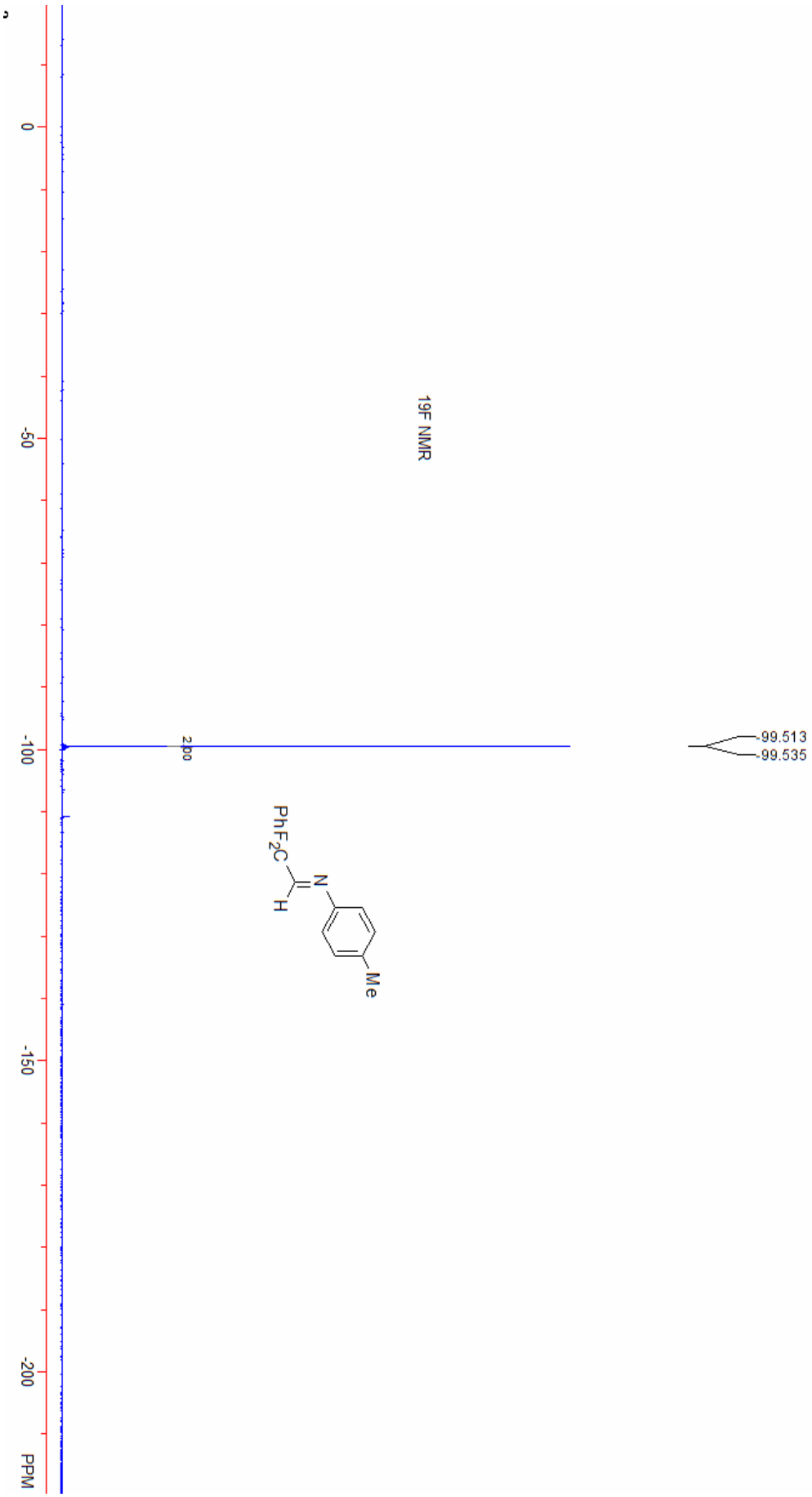
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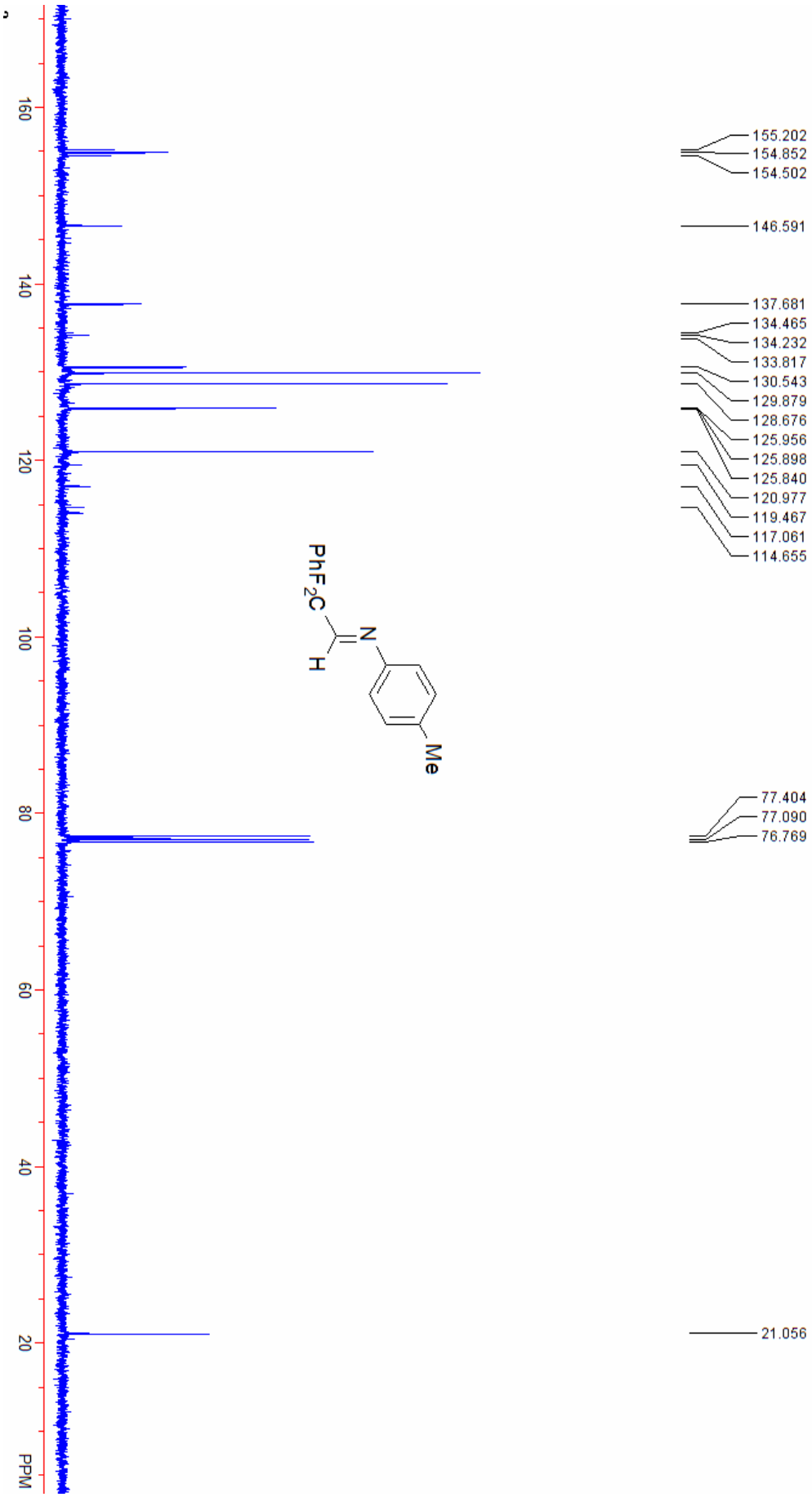
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125.898
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117.061
114.655
77.404
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H
N
Me
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140
120
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60
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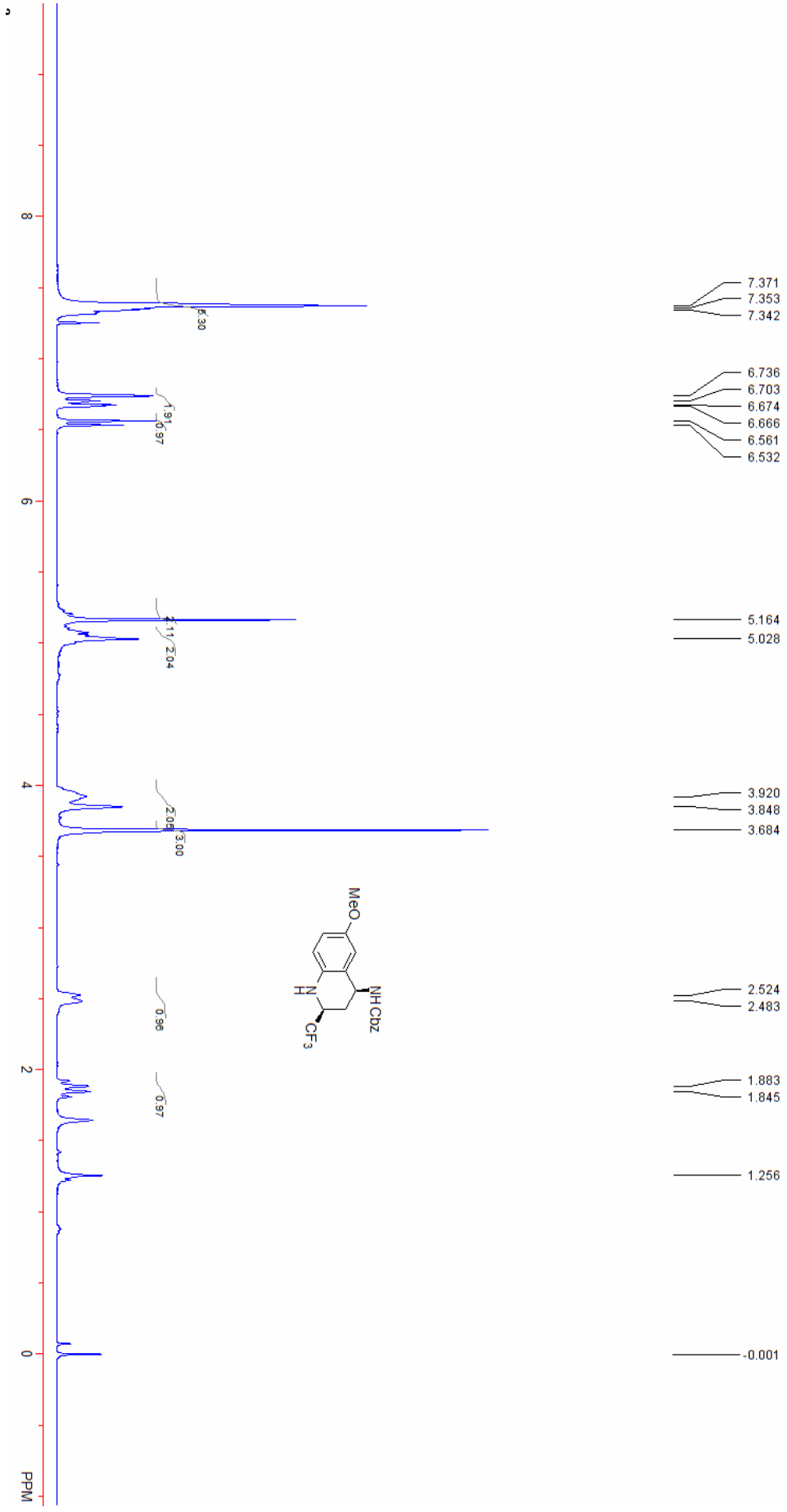
PPM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3.684
2.524
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1.91
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2.11
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H
CF3
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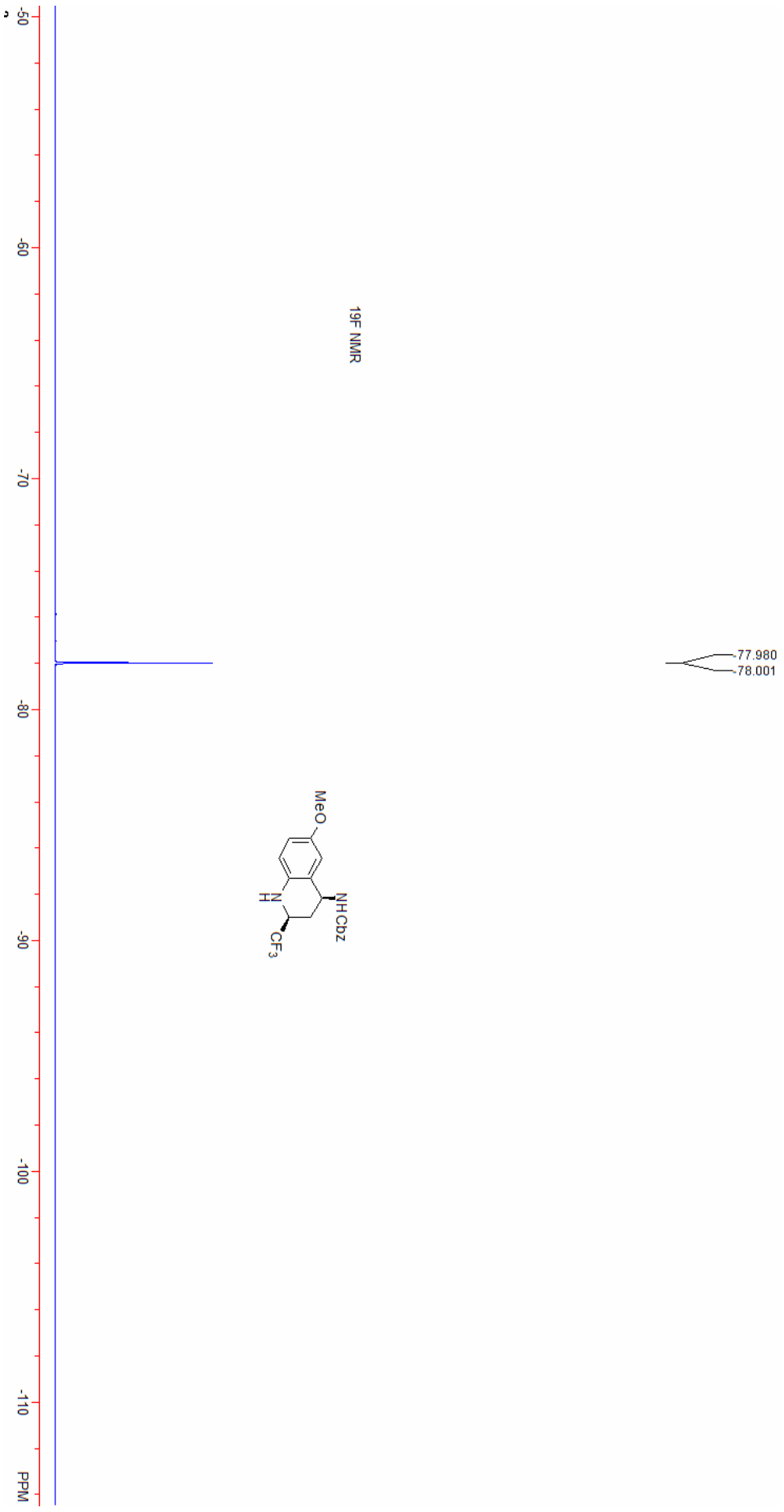
4
2
0
PPM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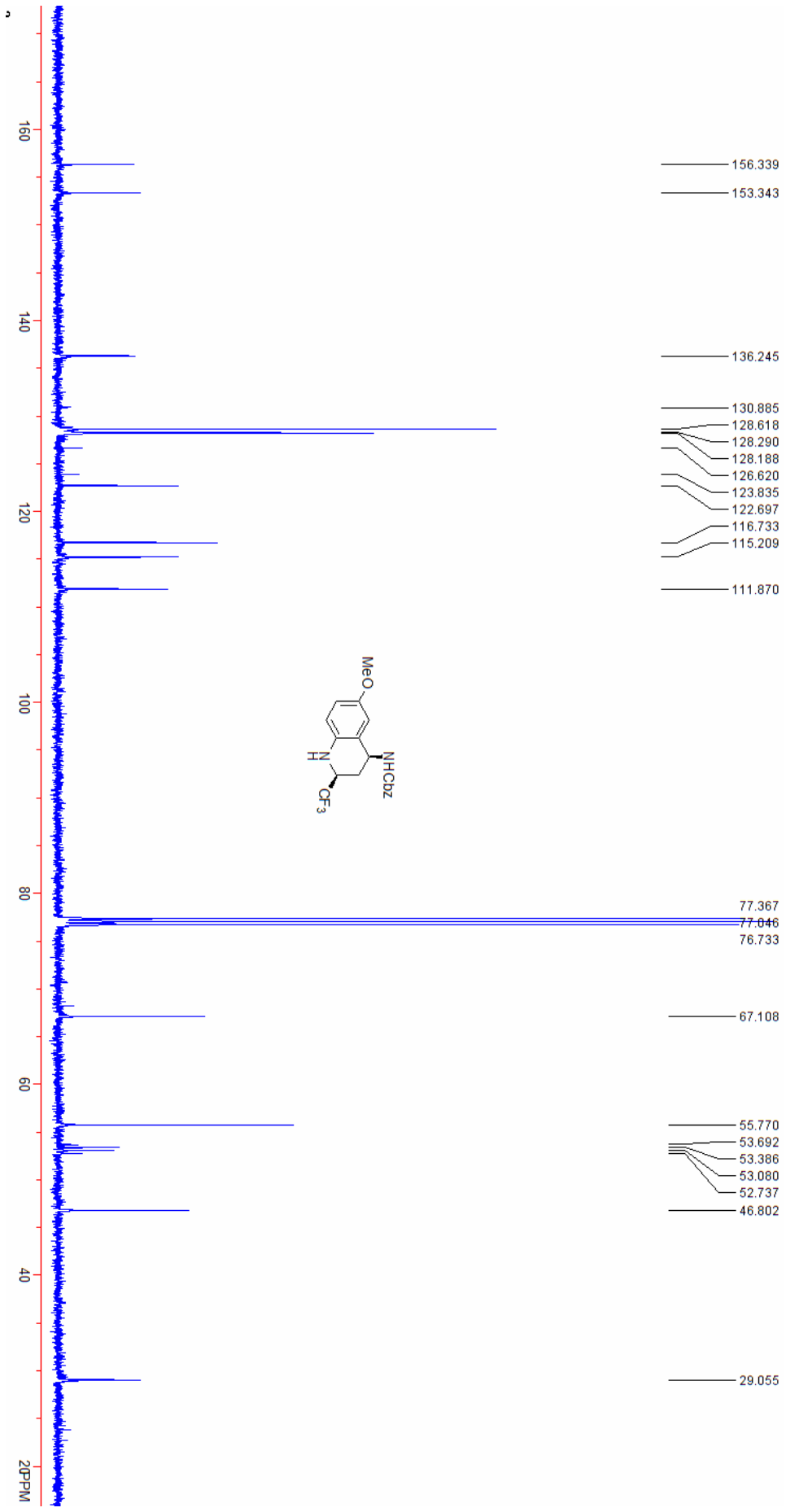
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77.046
76.733
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55.770
53.692
53.386
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NHCbz
CF3
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140
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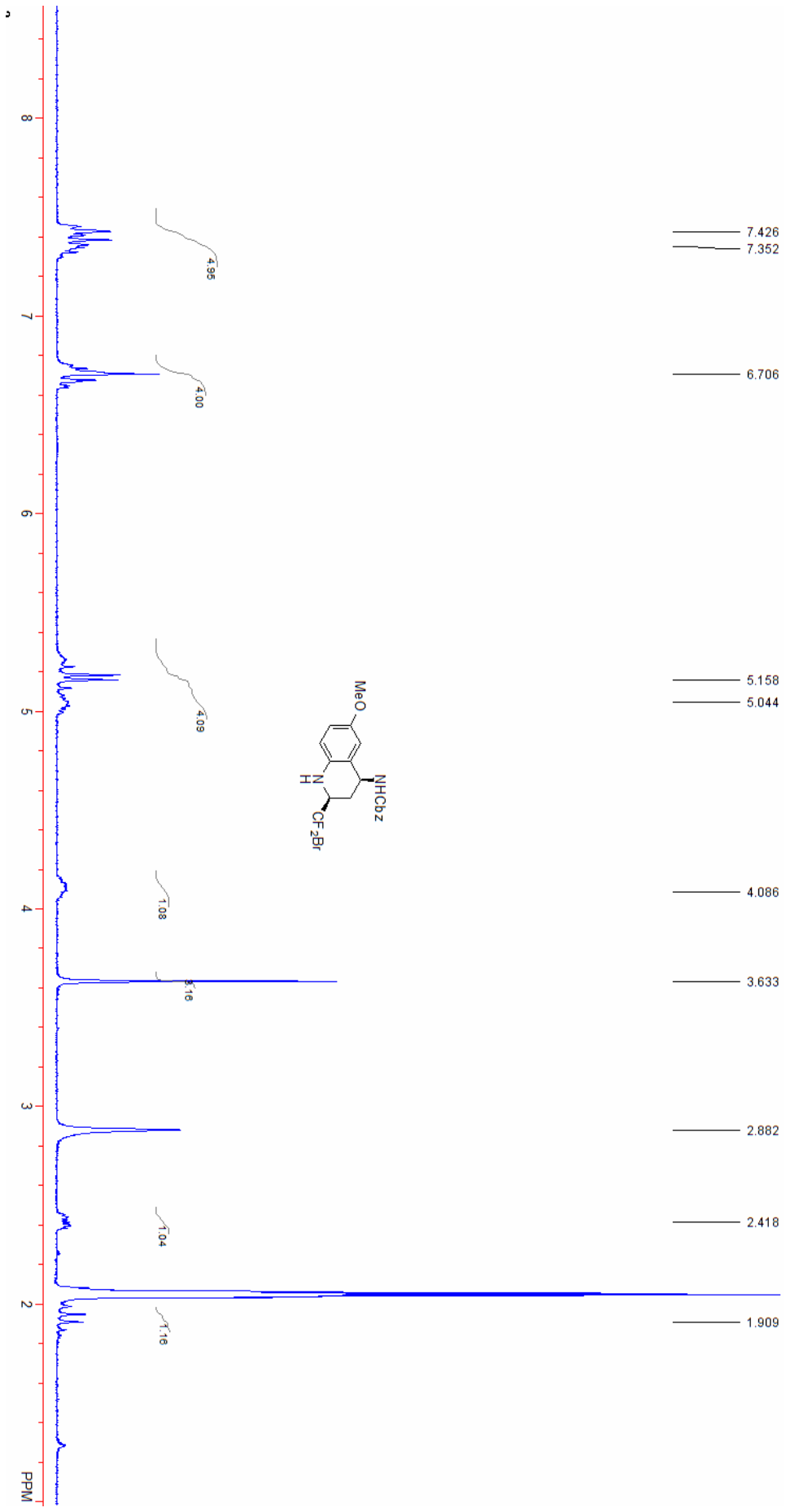
80
60
40
20PPM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1.08
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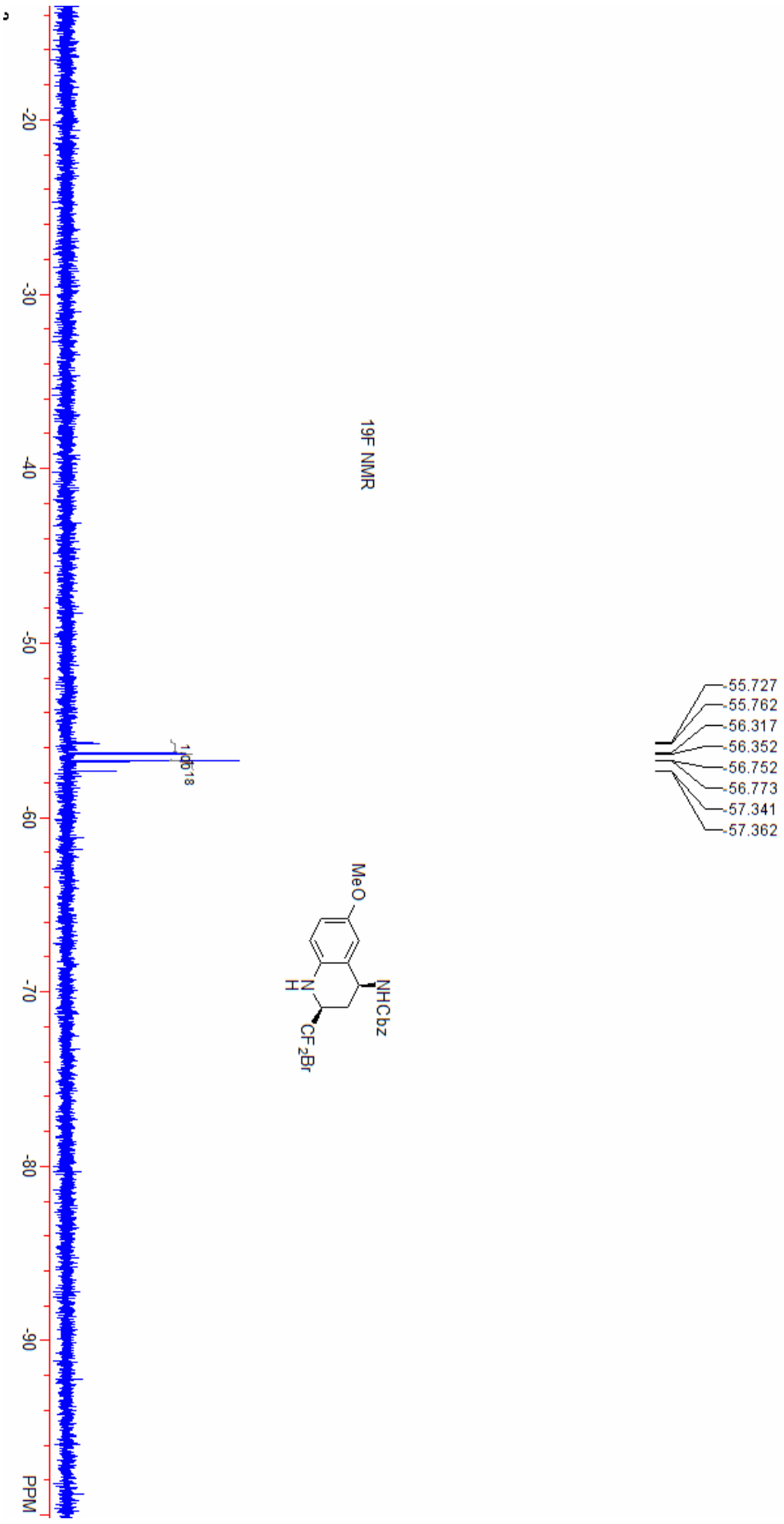
N
H
CF2Br
PPM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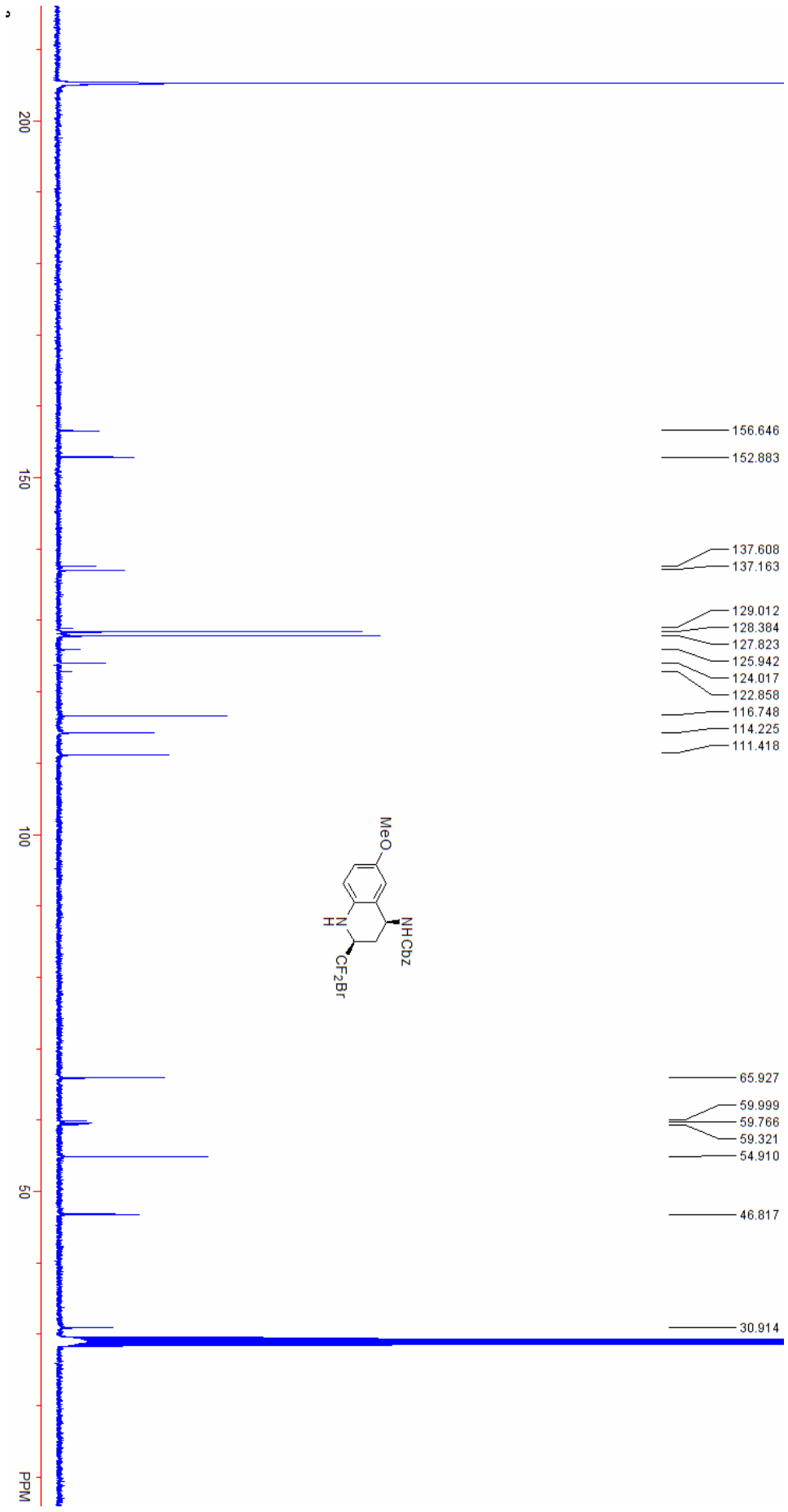
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114.225
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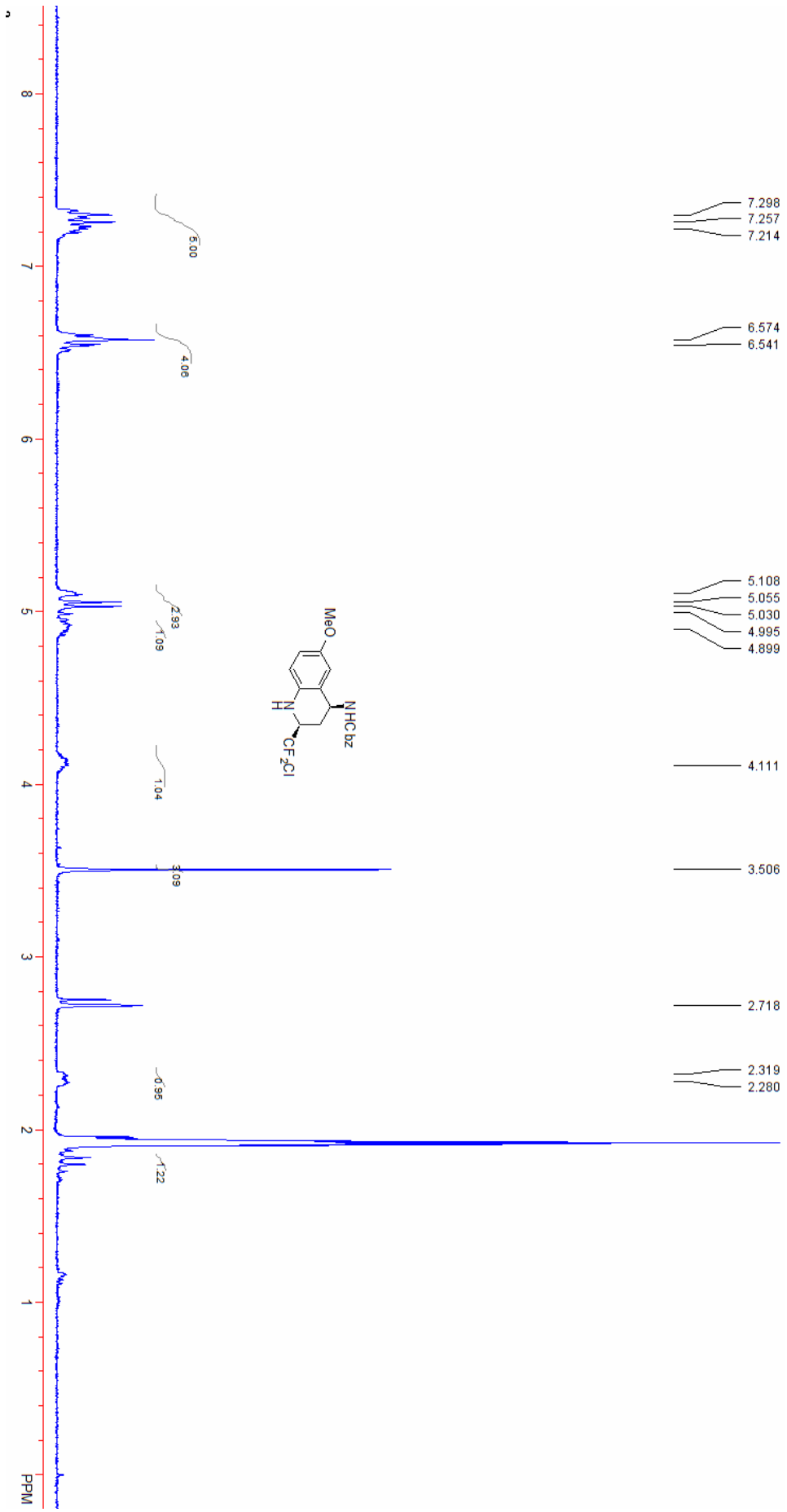
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2.319
2.280
5.00
4.06
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1.04
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6
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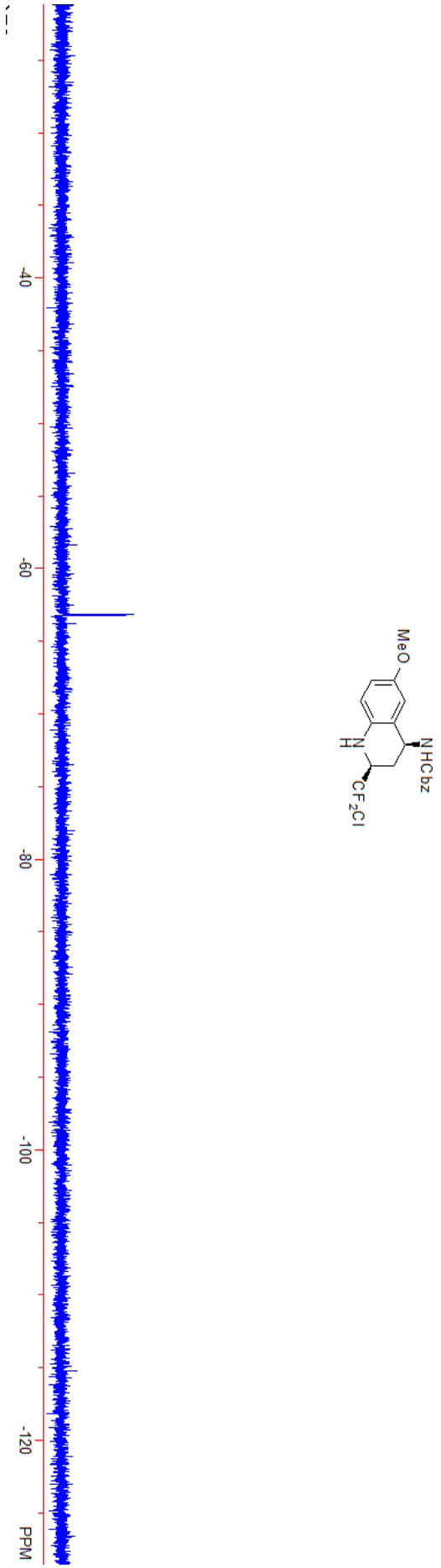
4
3
2
1
PPM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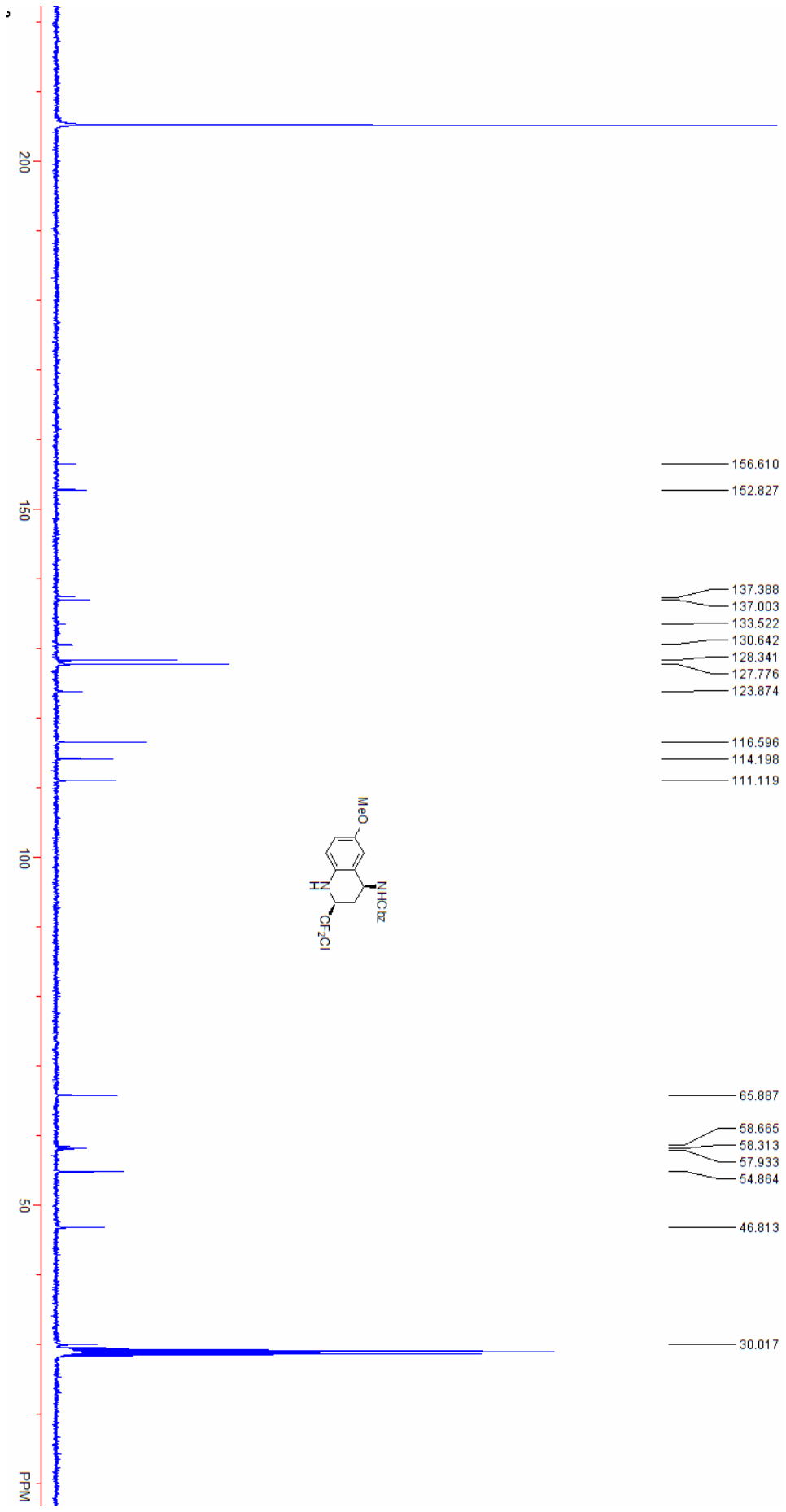
PPM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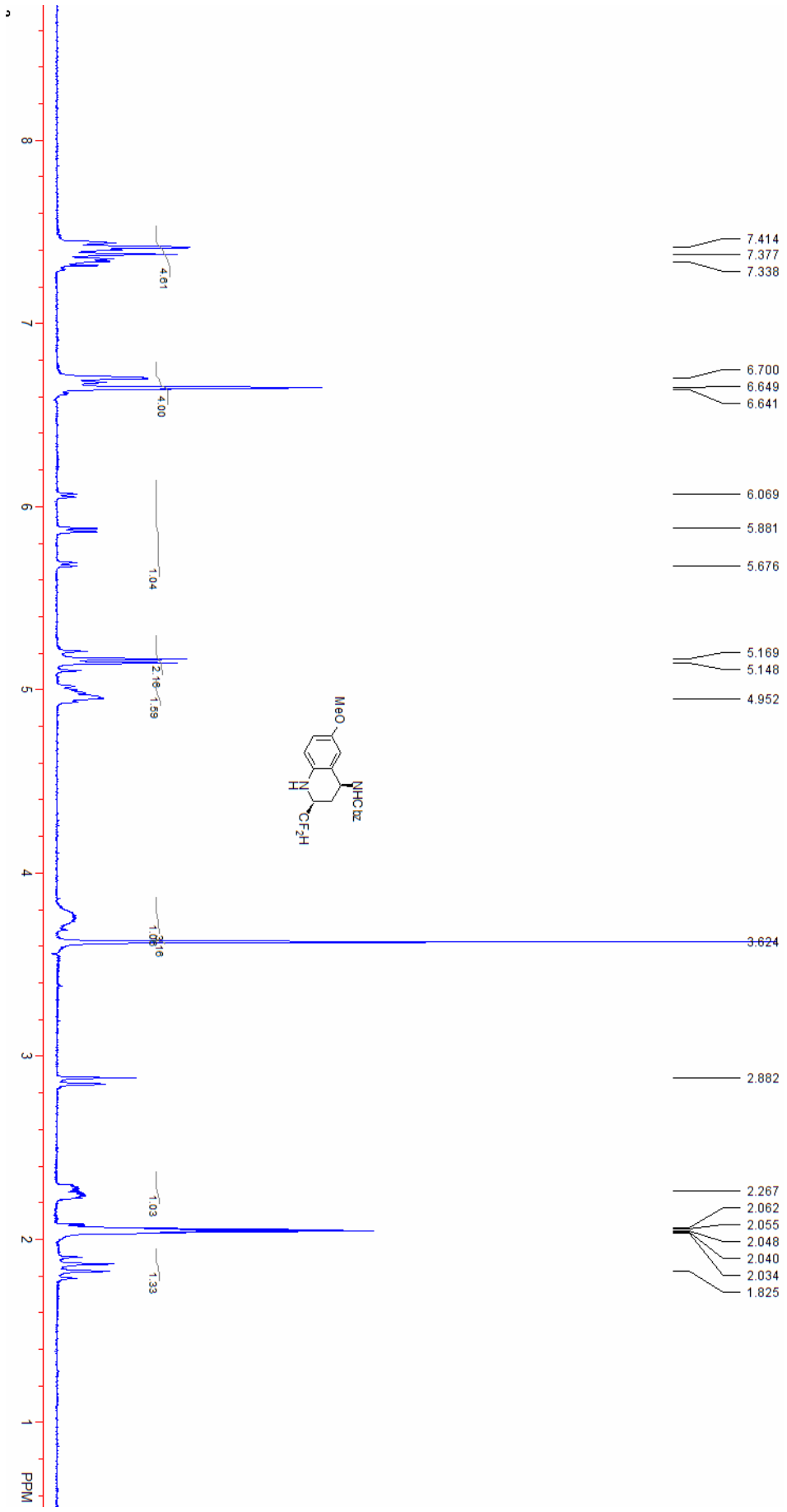

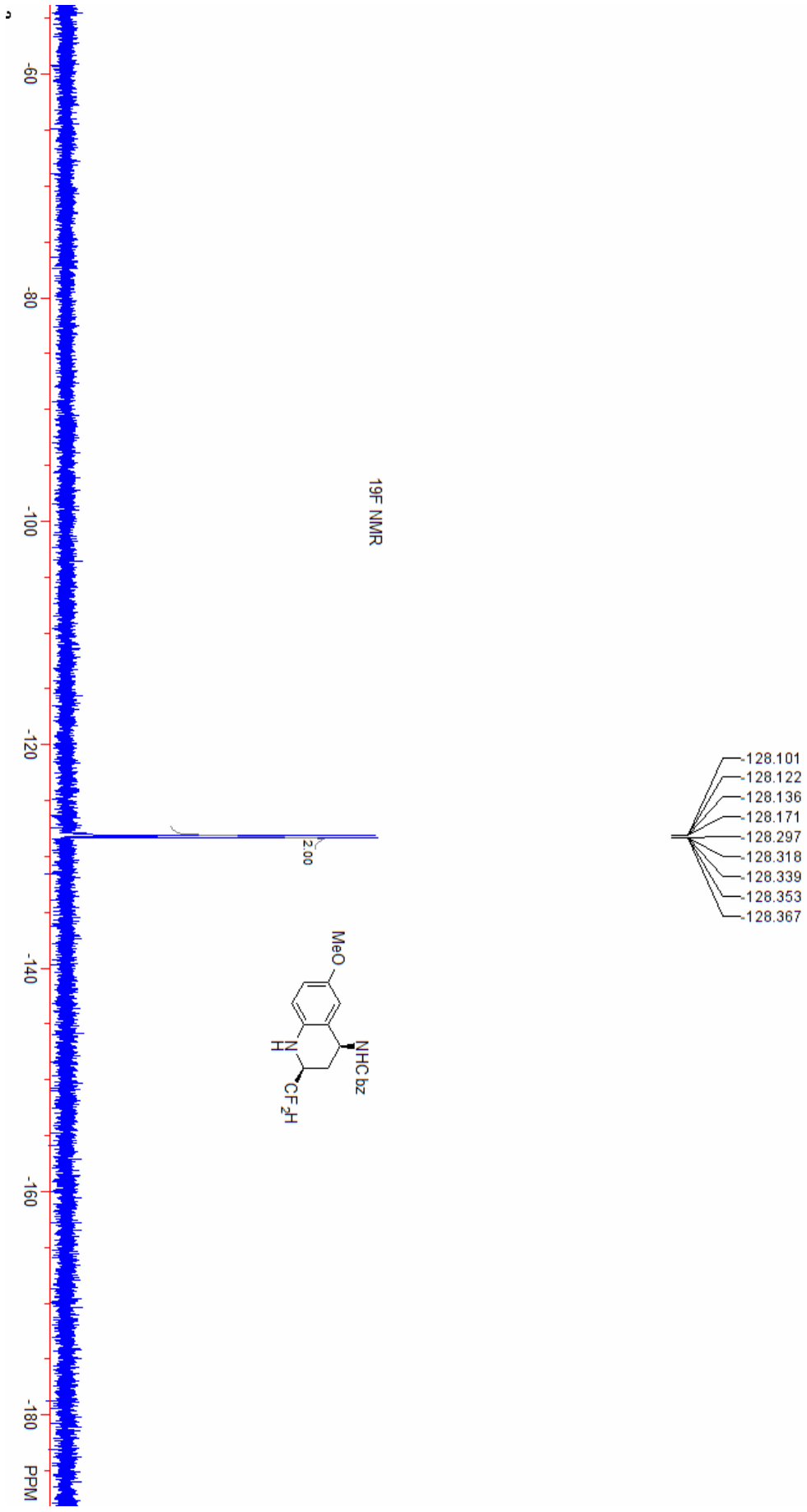
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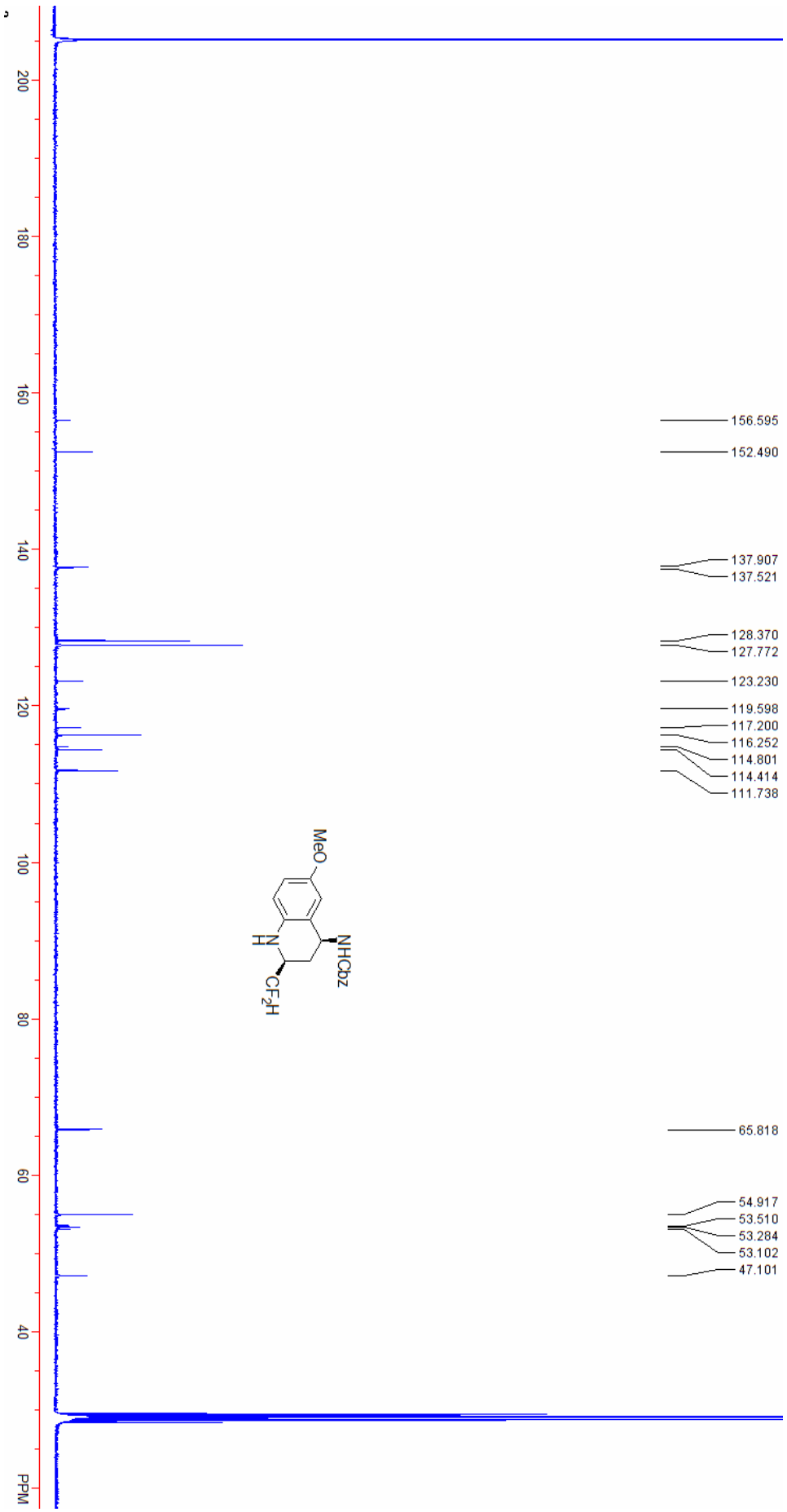
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CF2H
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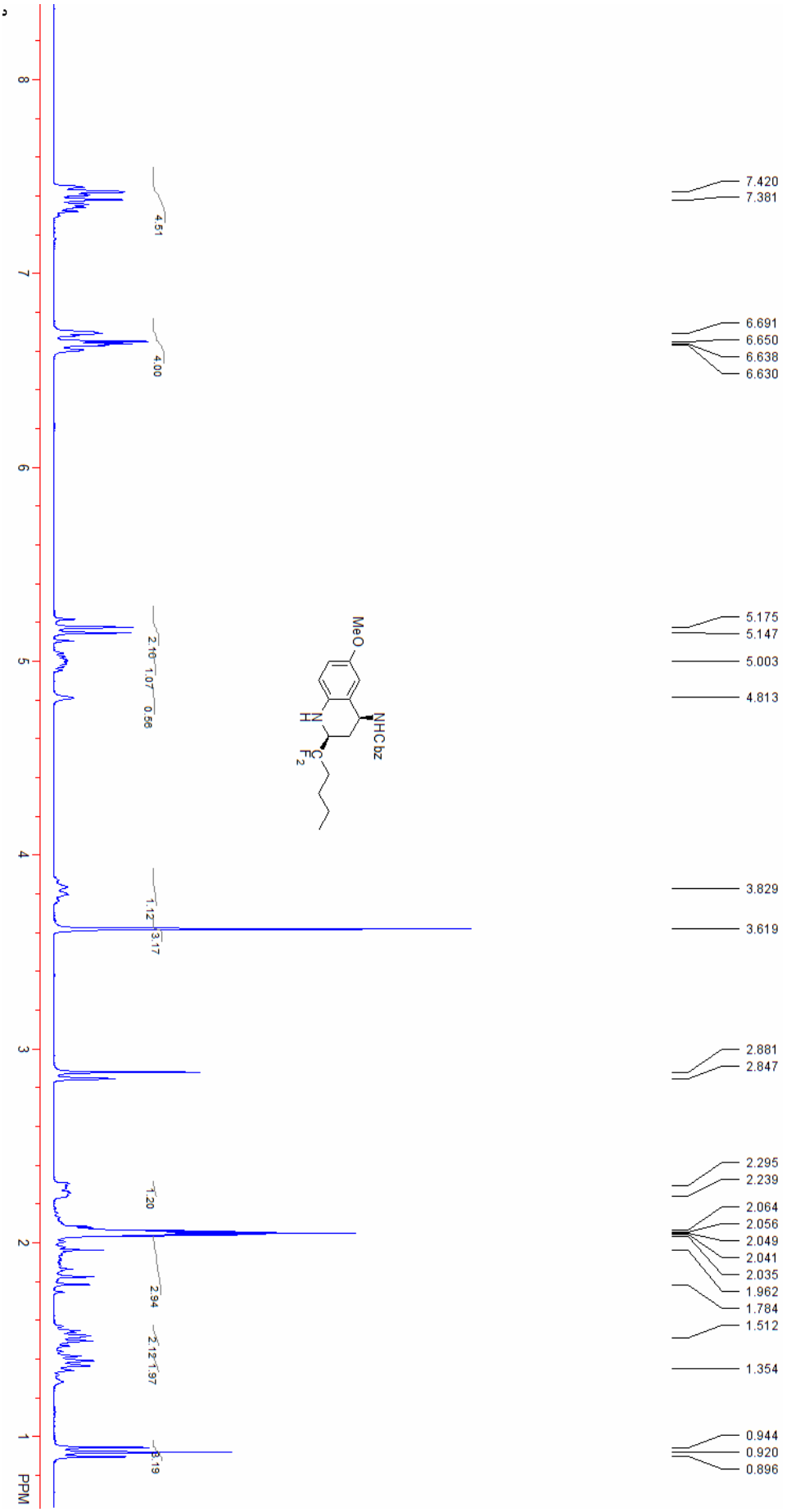
PPM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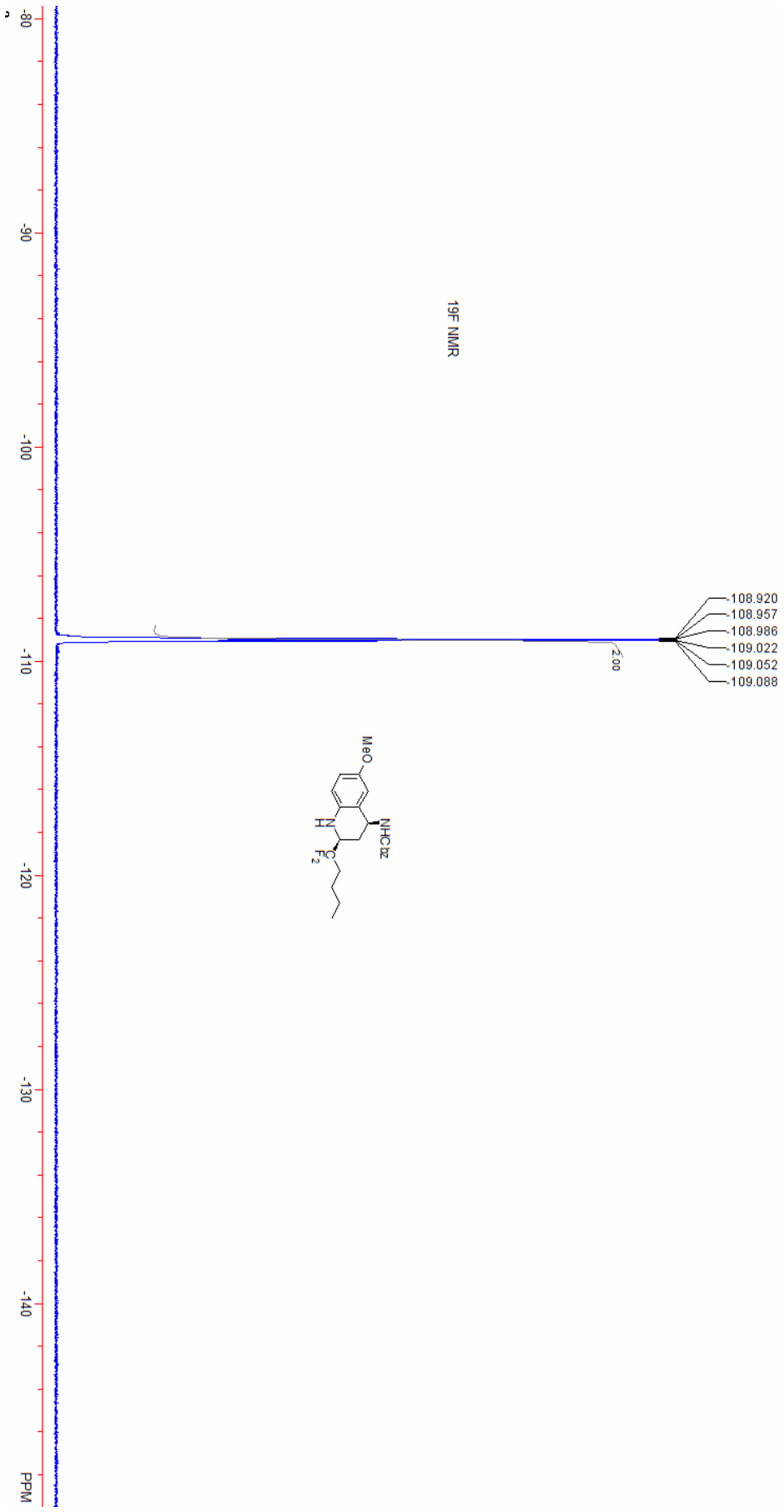
F2
PPM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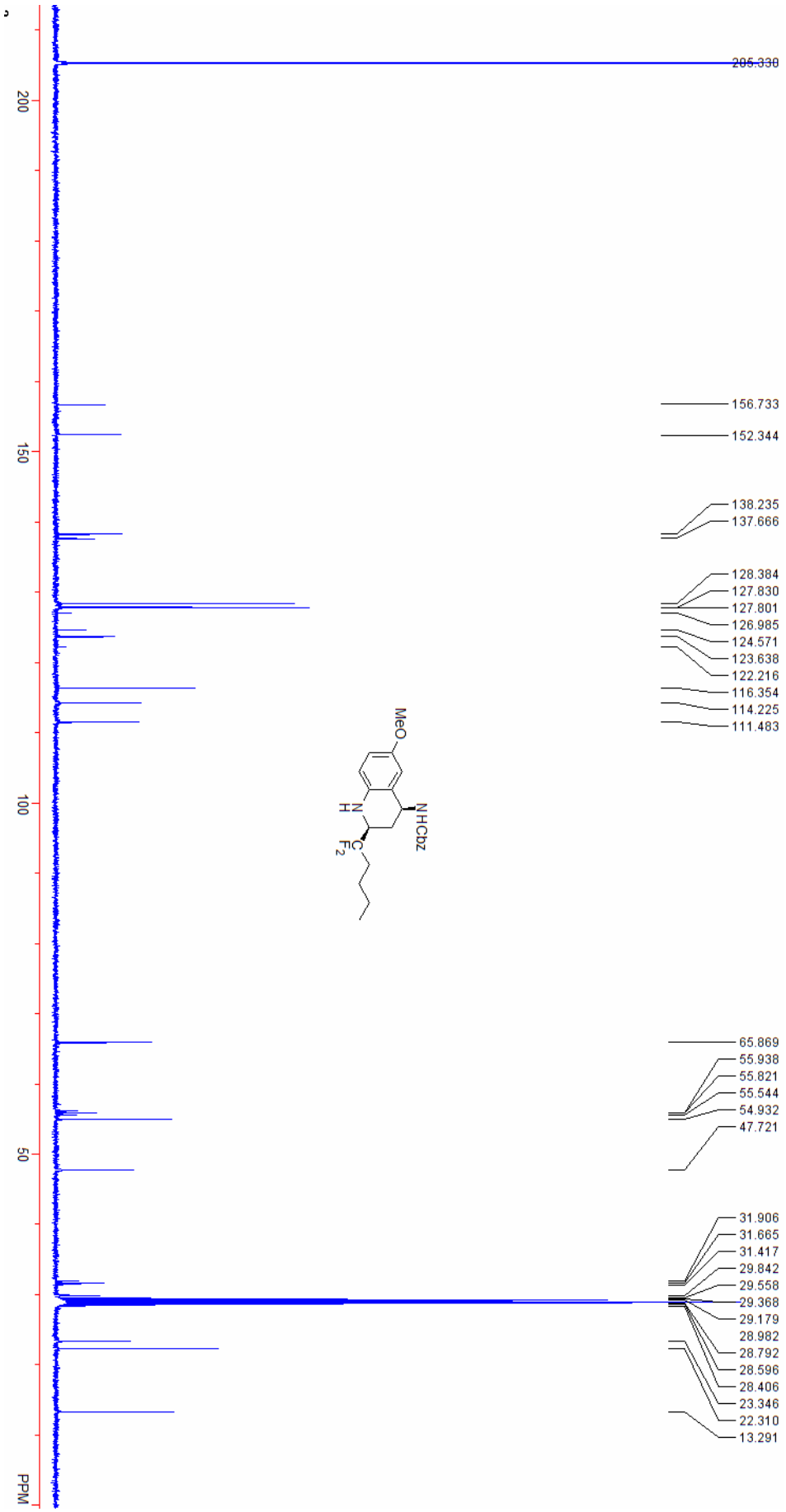
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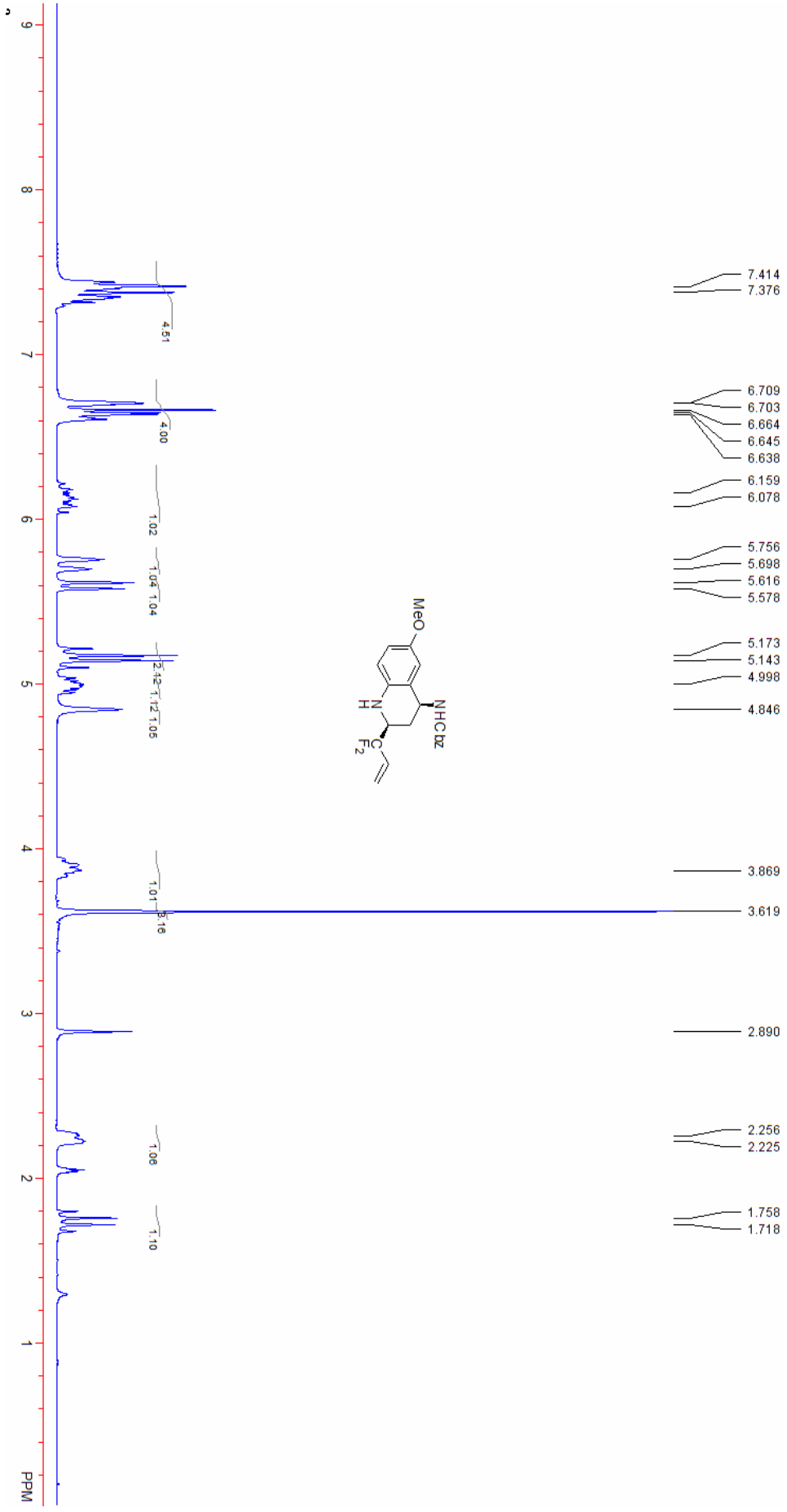
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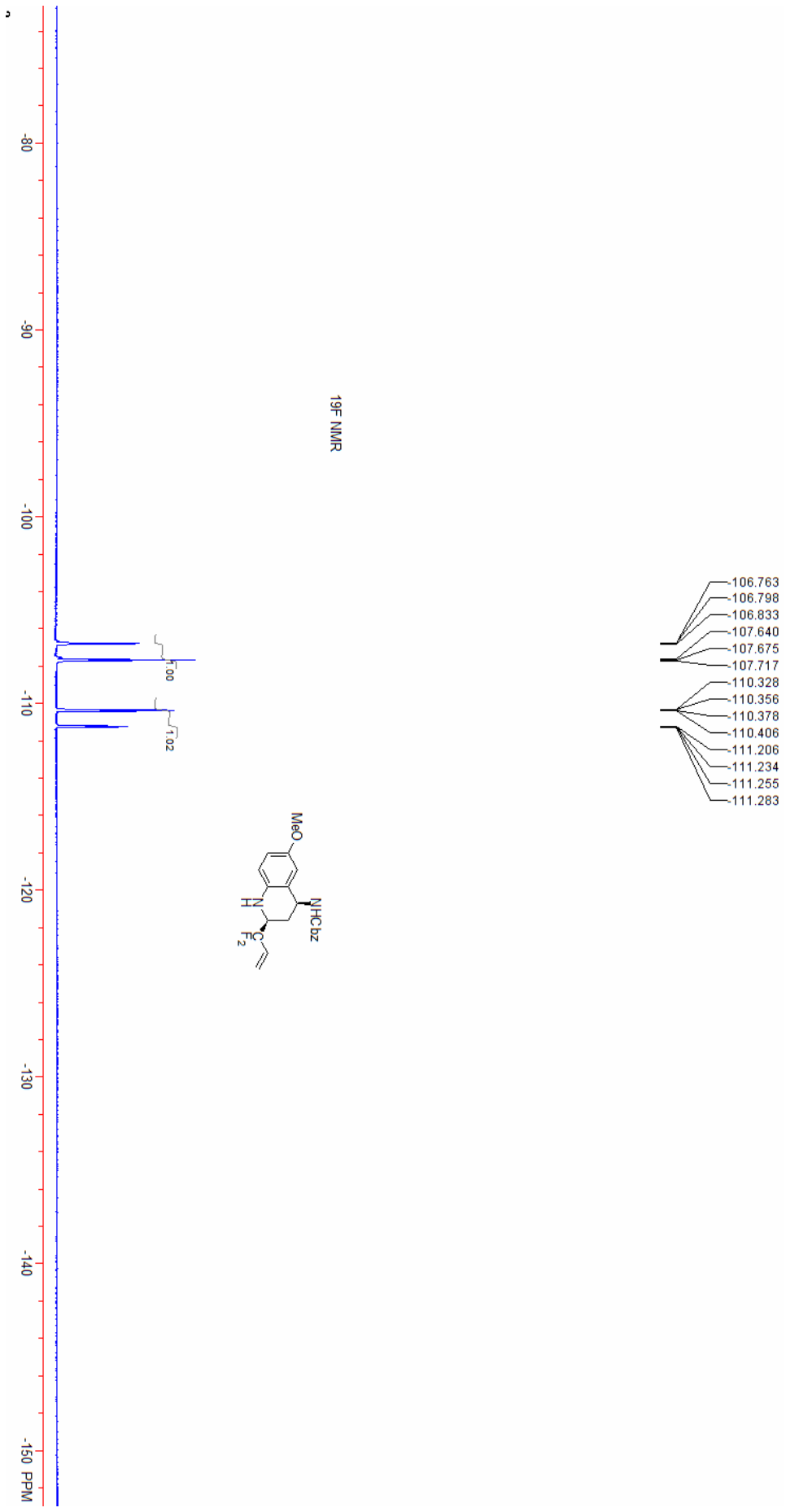
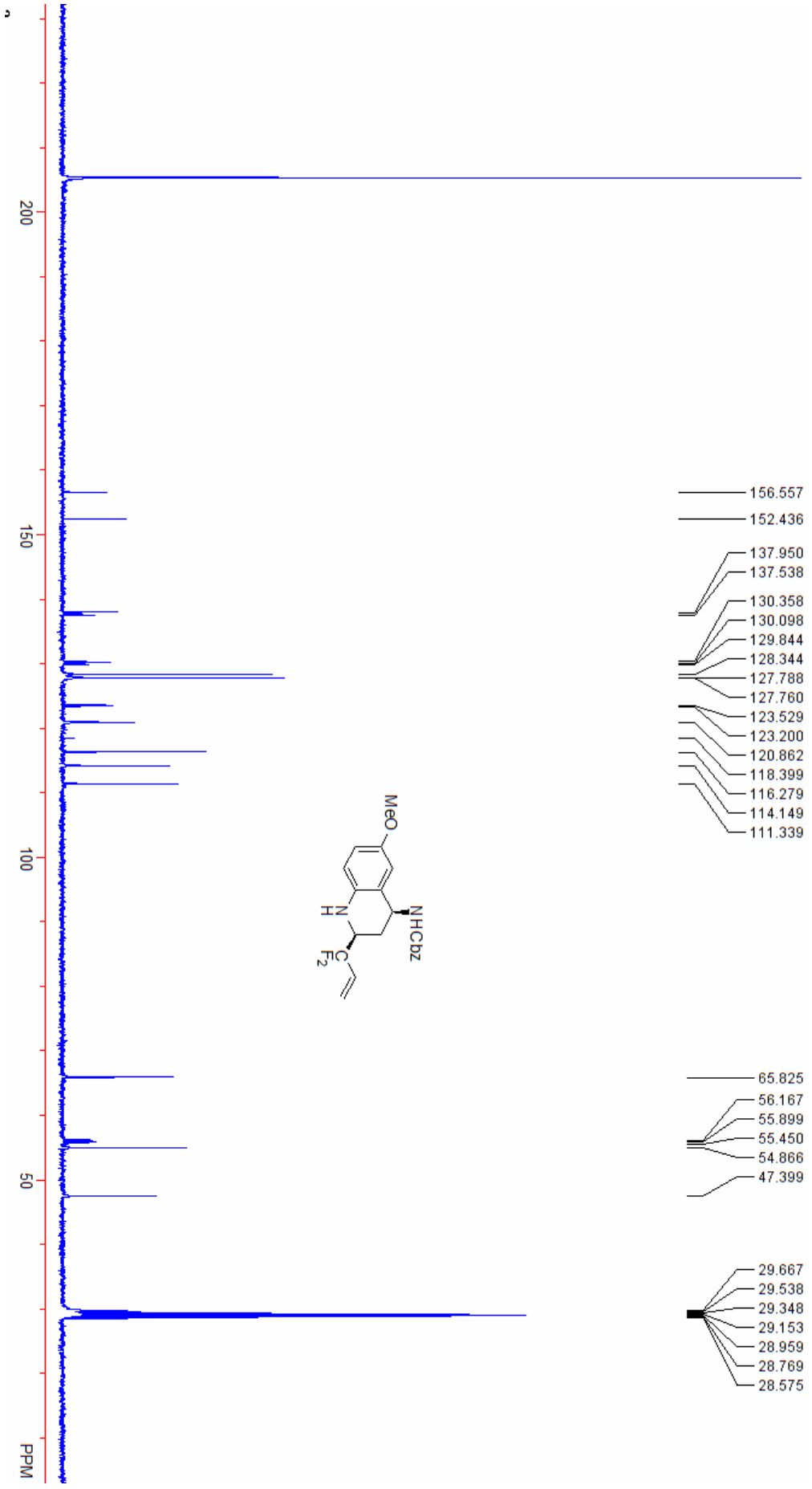
H
F2
PPM

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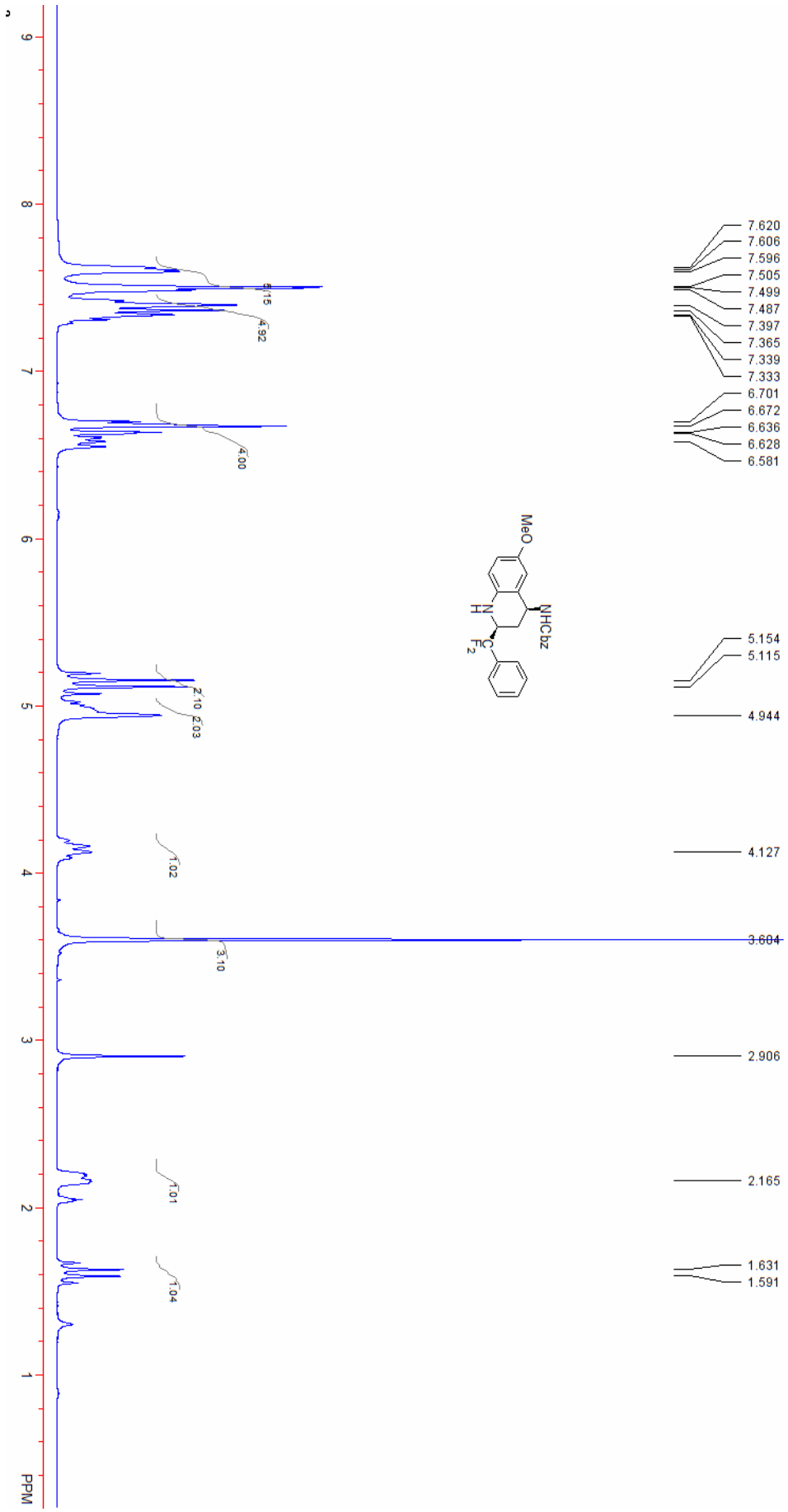
F2
C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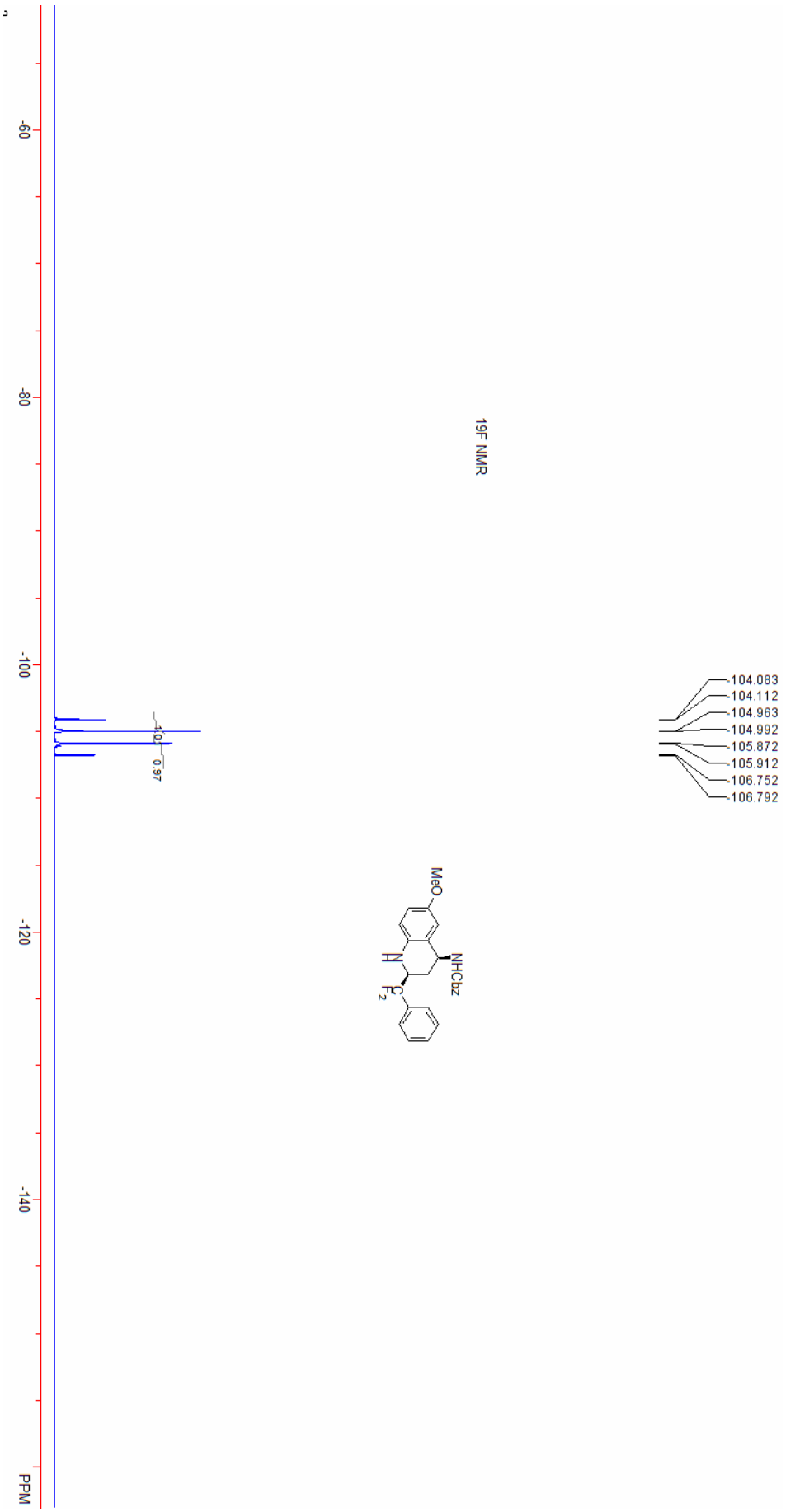
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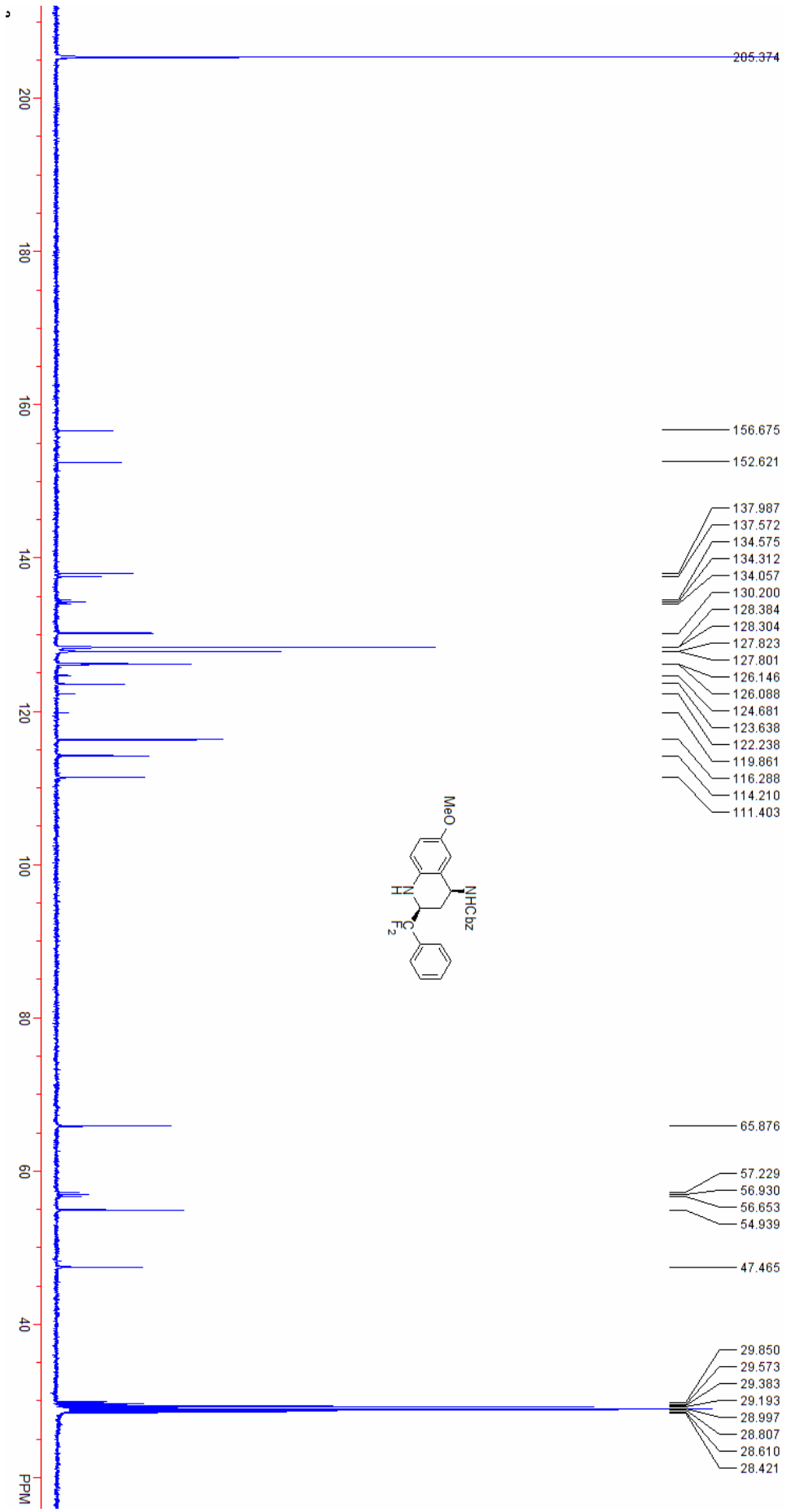
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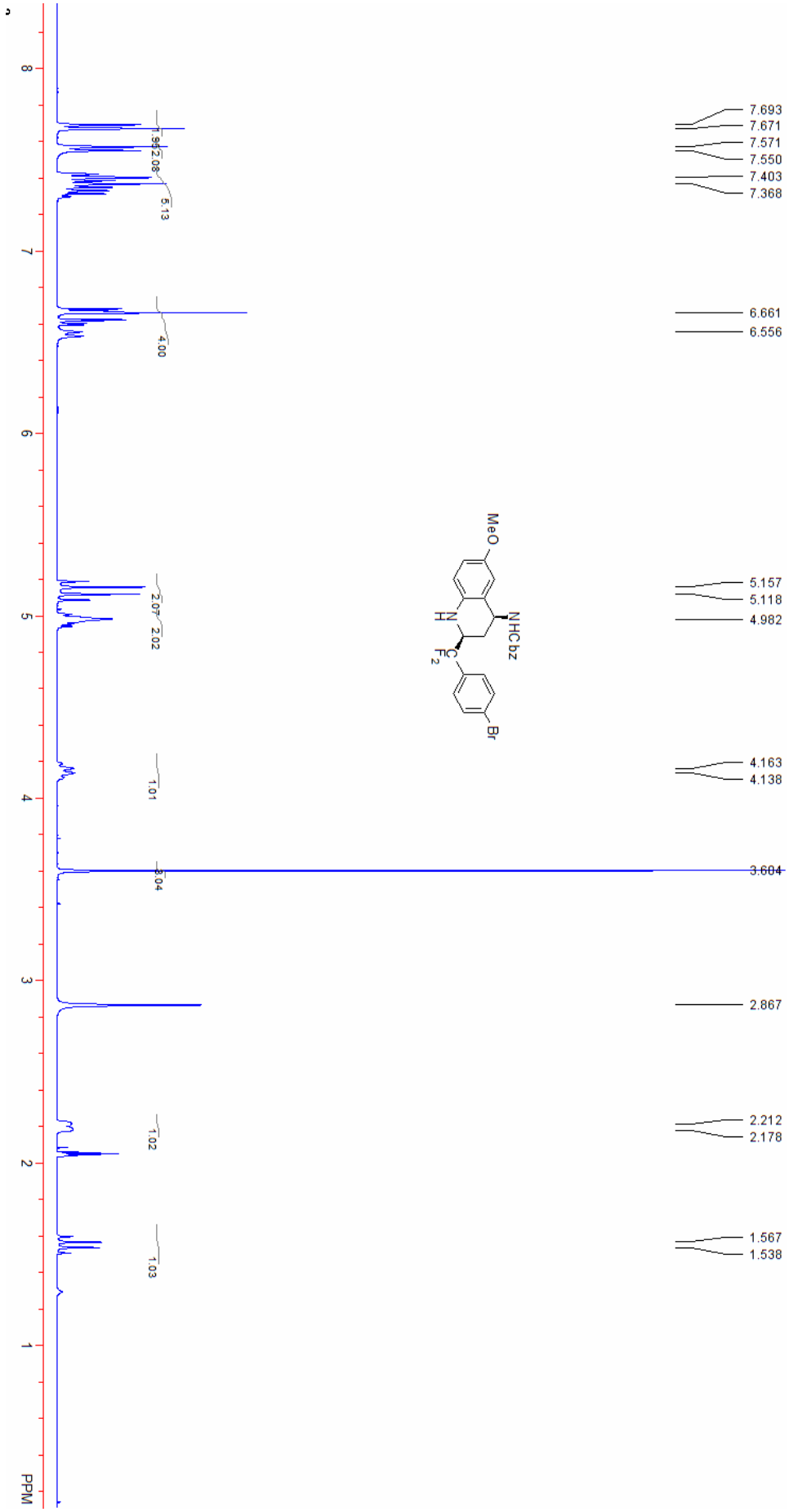
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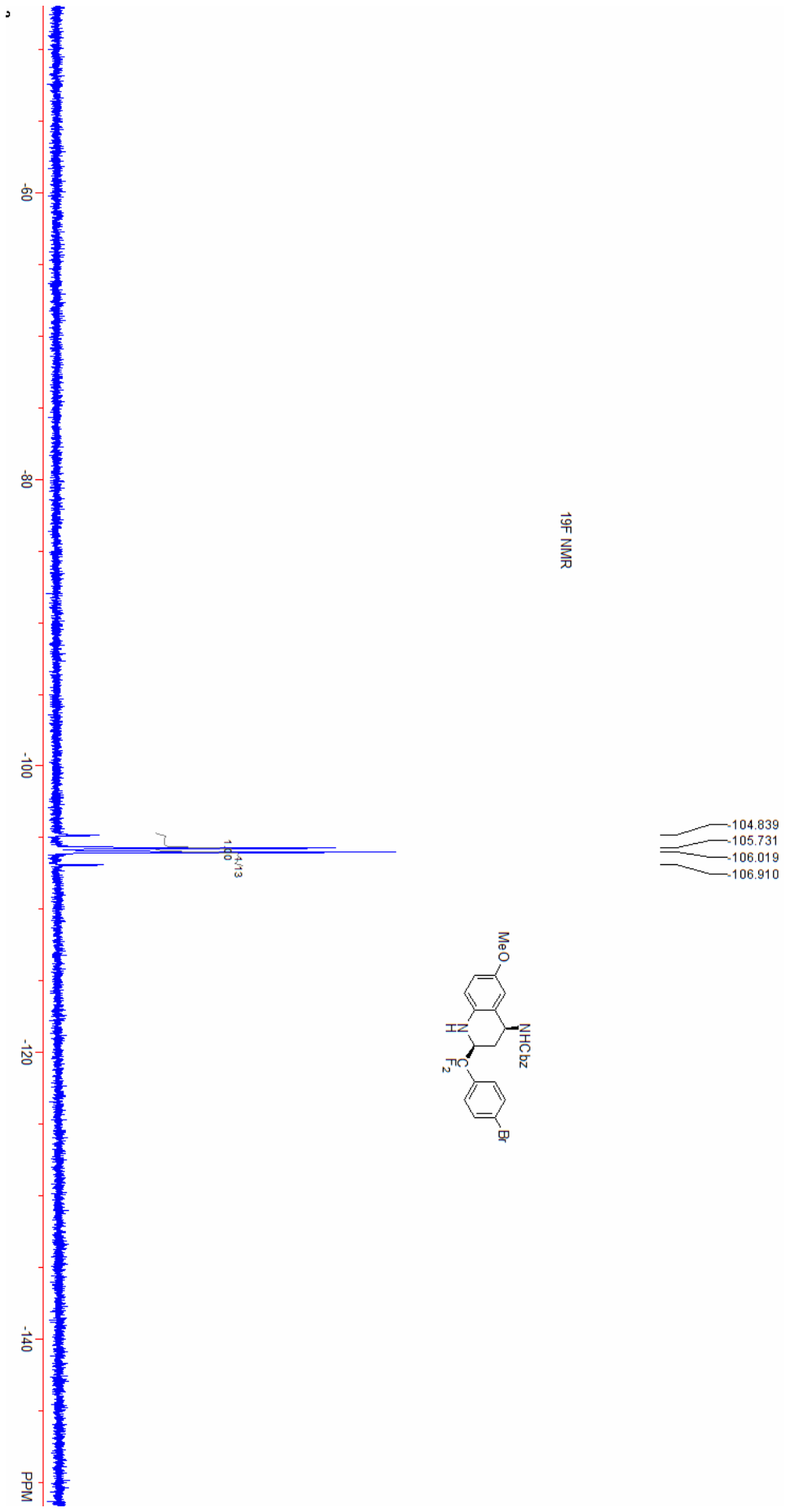
2.02
1.01
3.04
1.02
1.03
MeO
NHCbz
Br
PPM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-106.910
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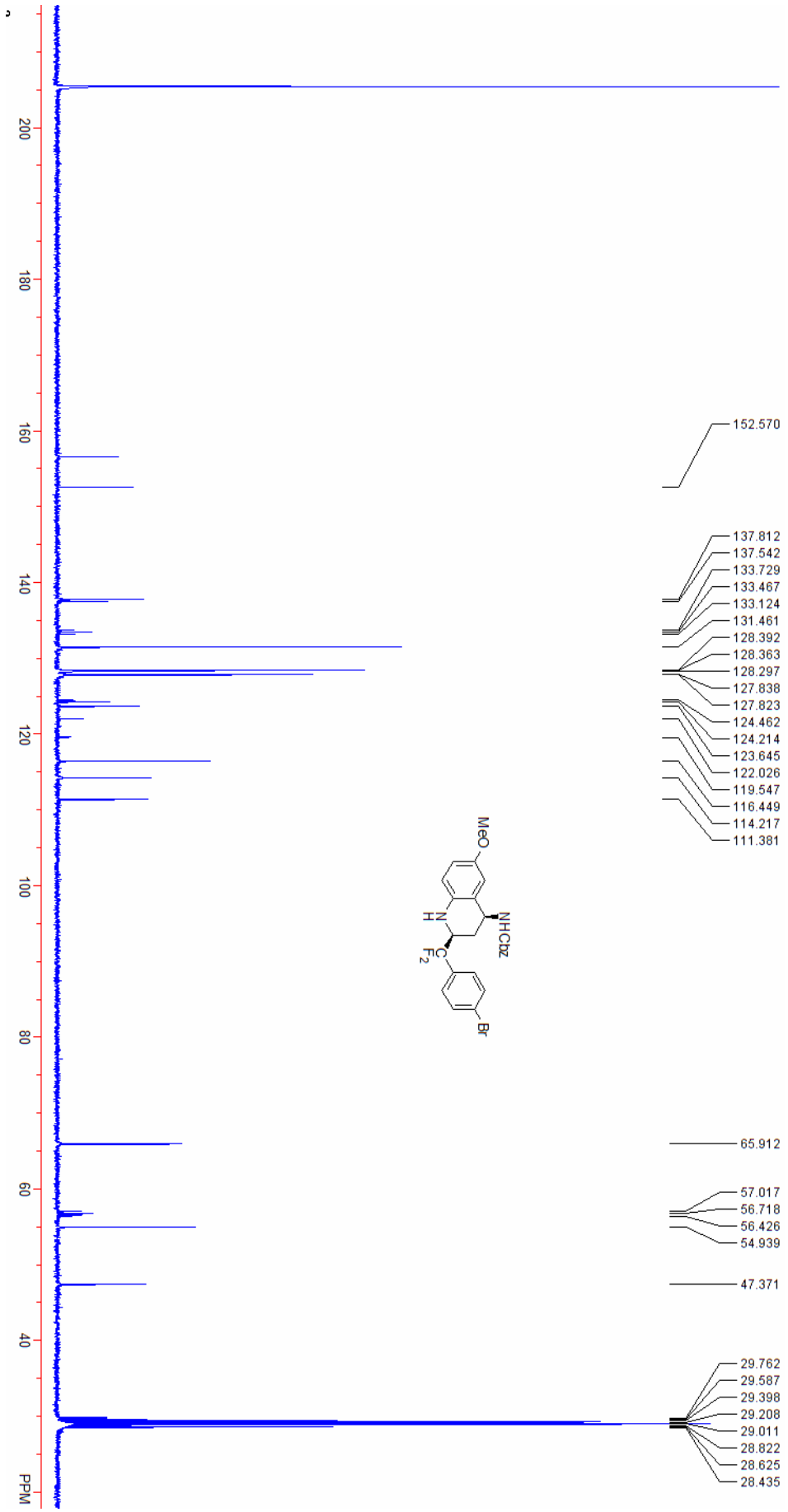
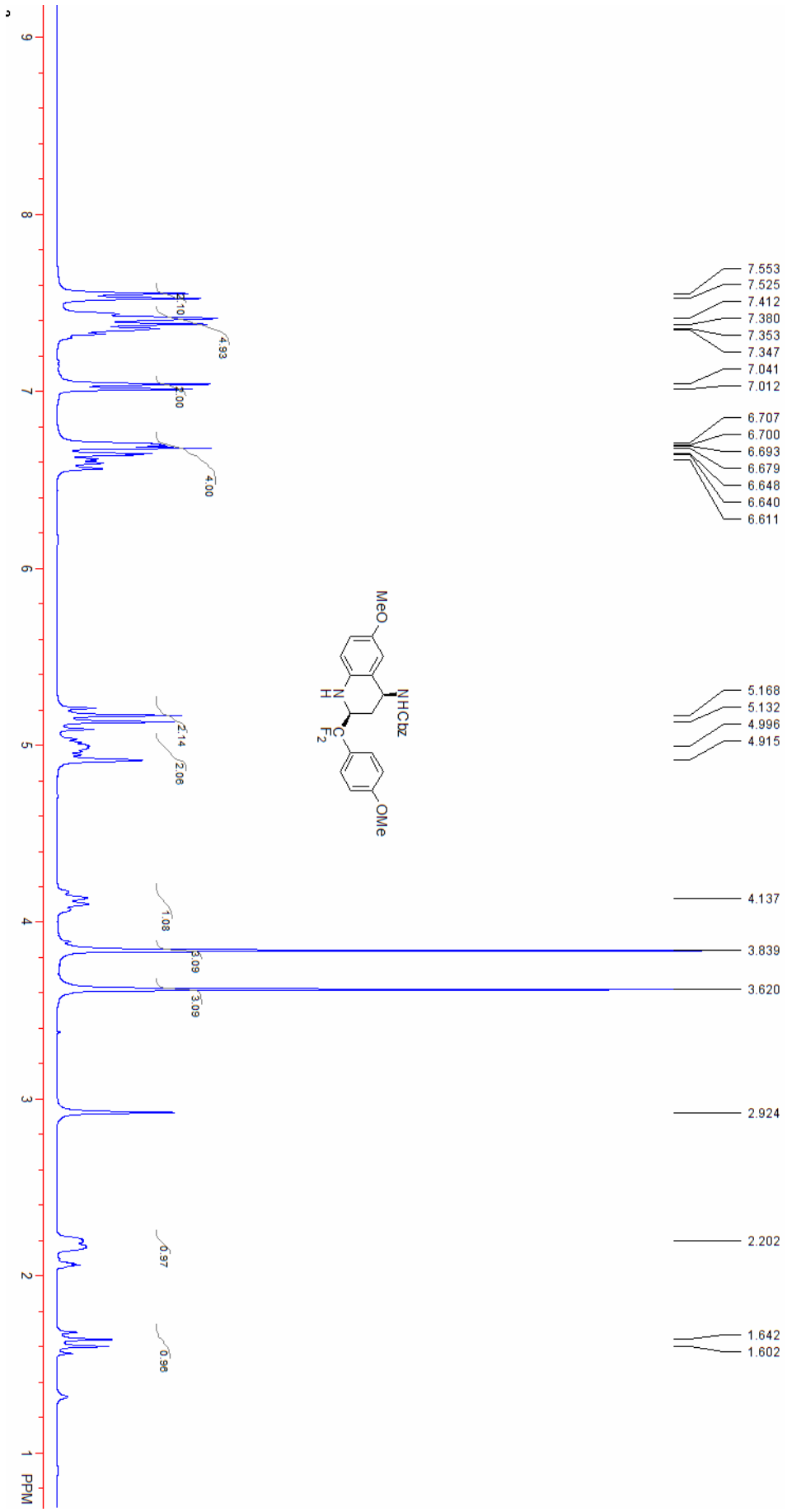
N
H
F2
Br

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1.602
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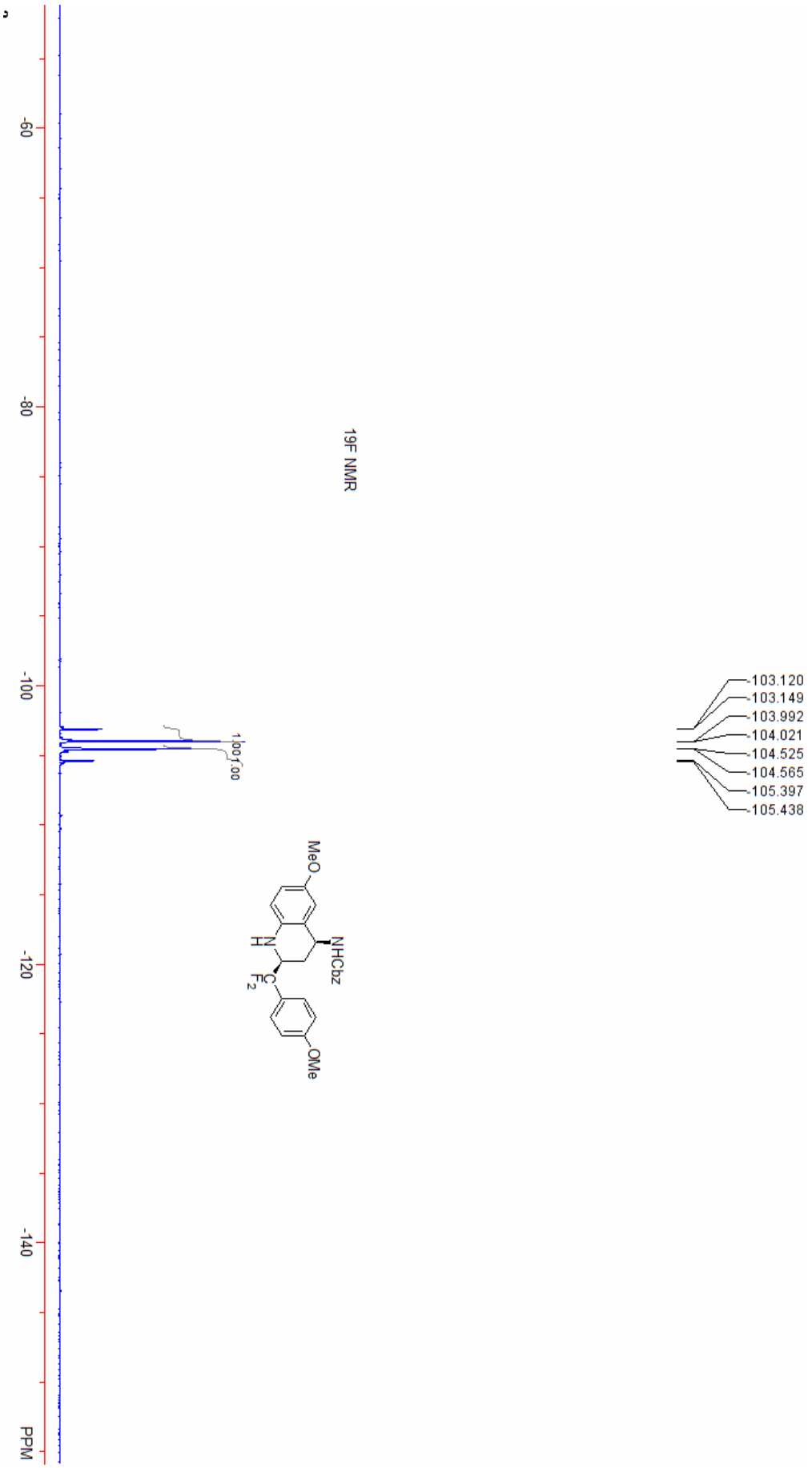
NHCbz
OMe
PPM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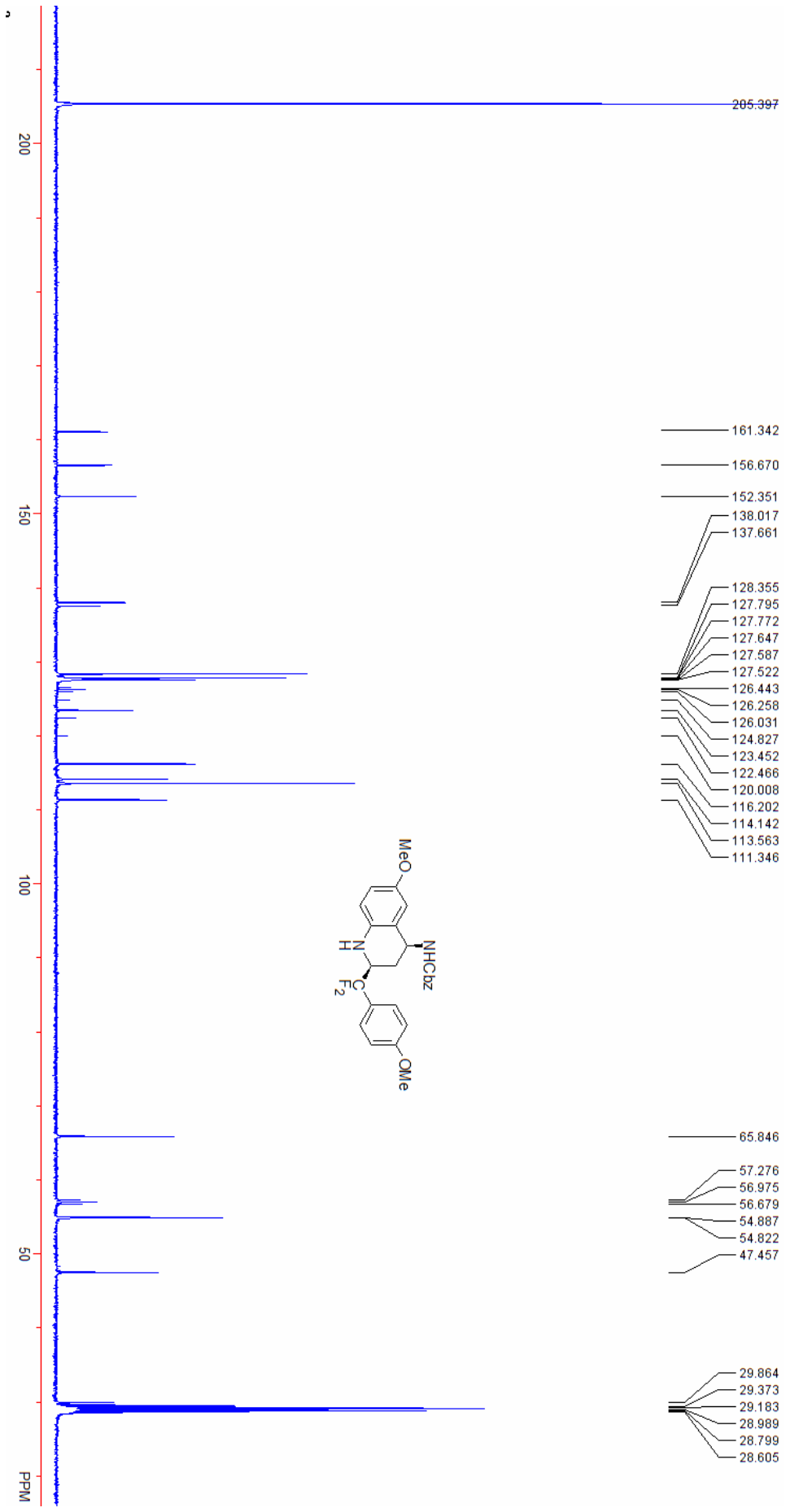
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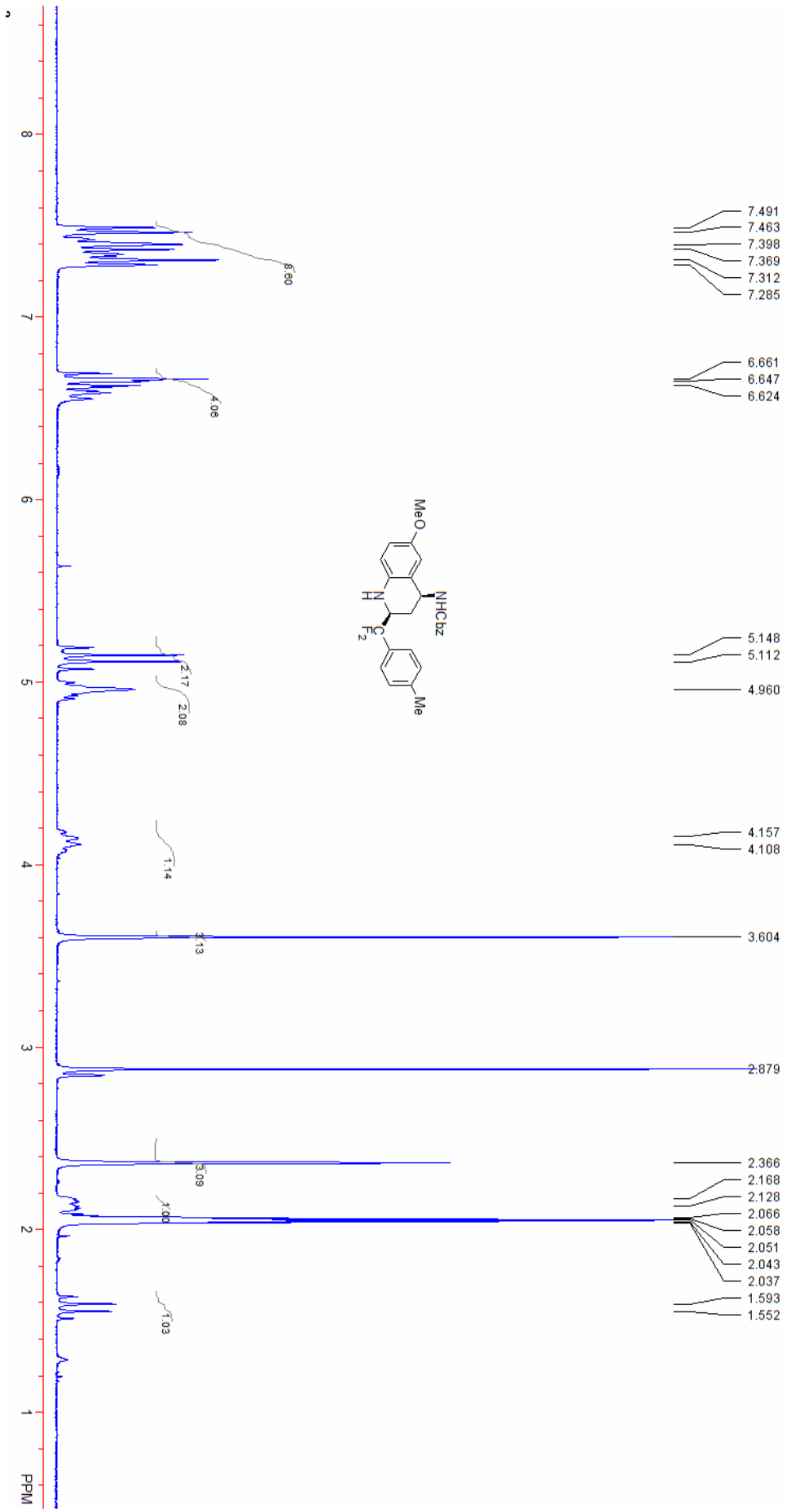
C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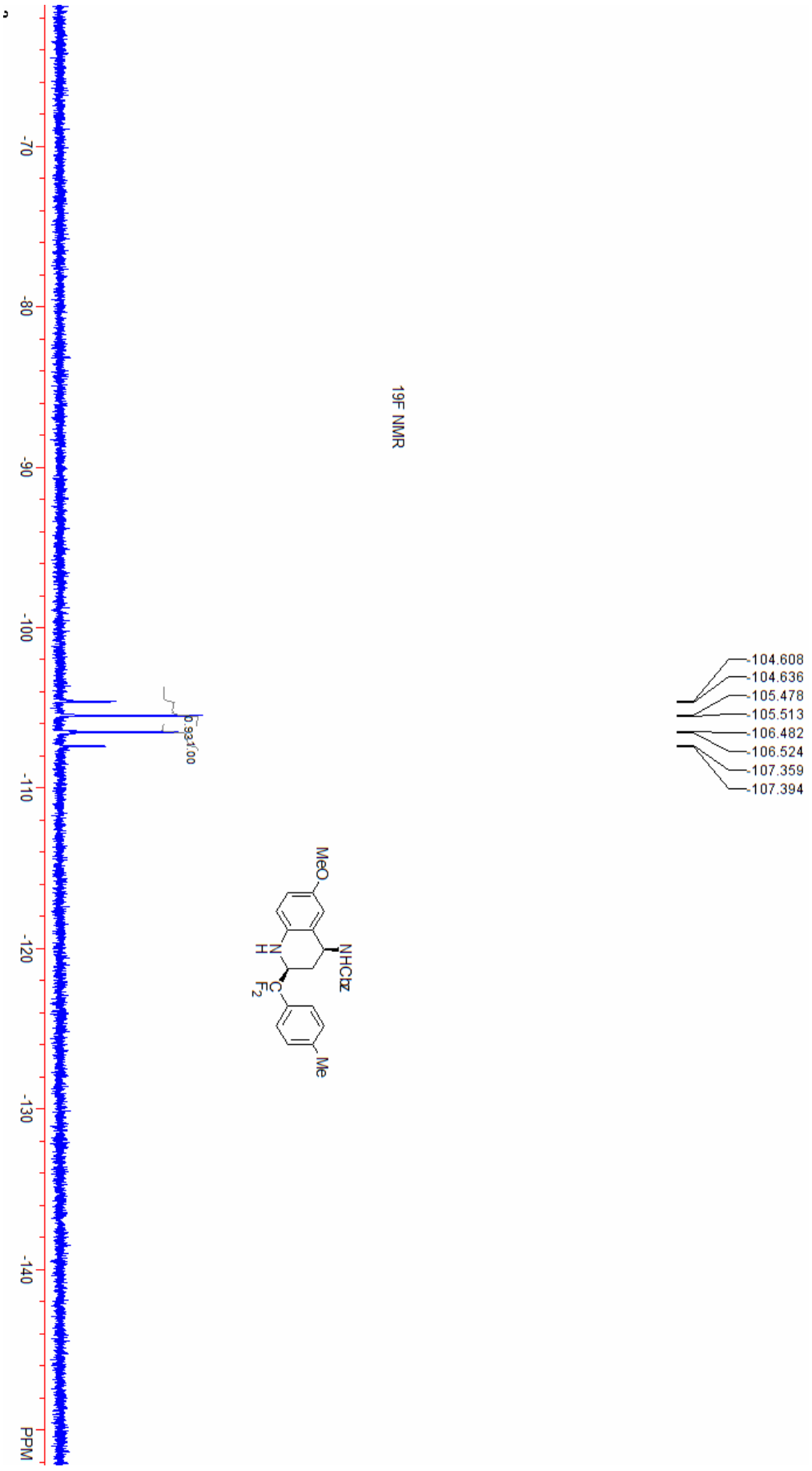
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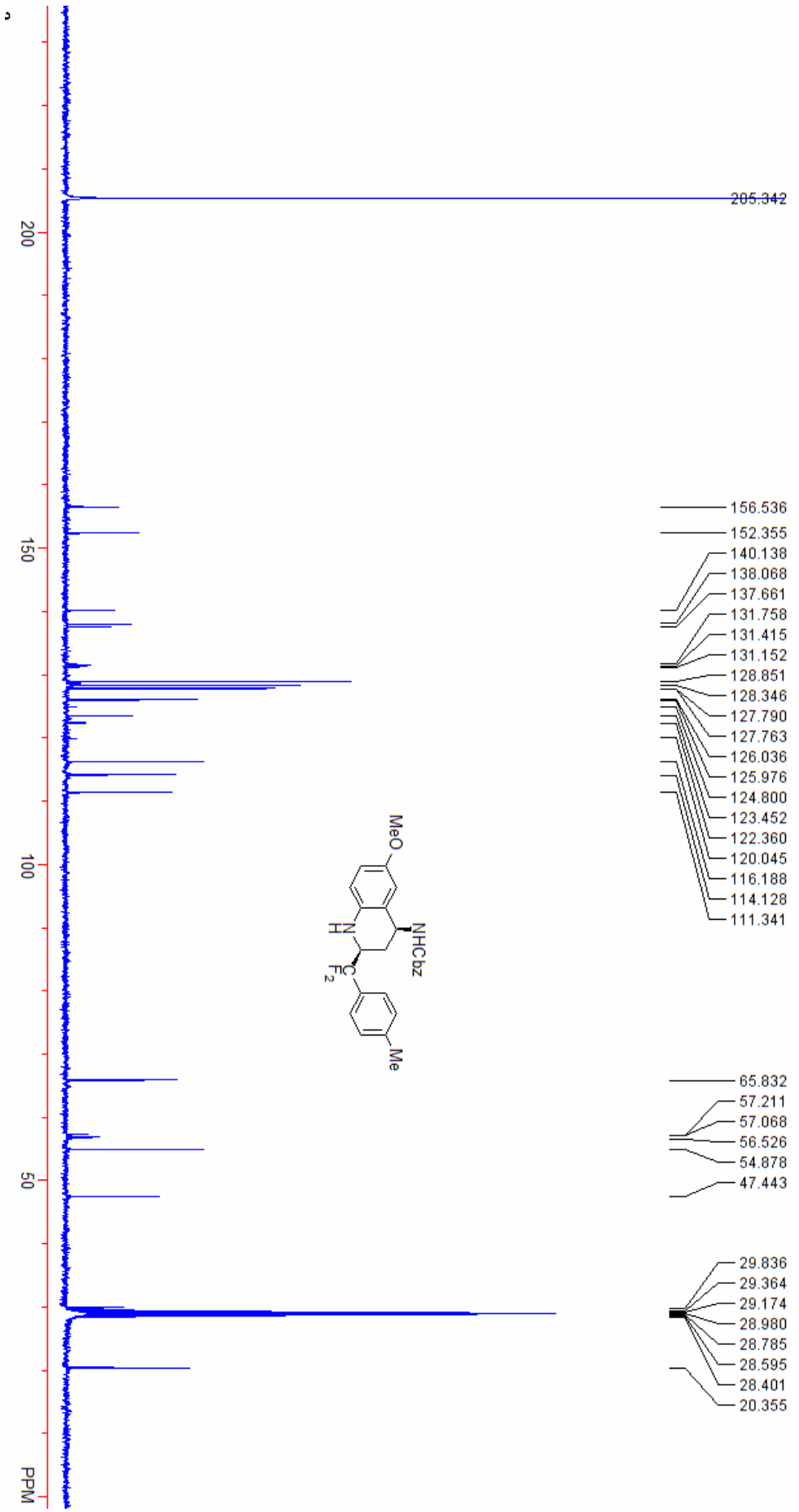
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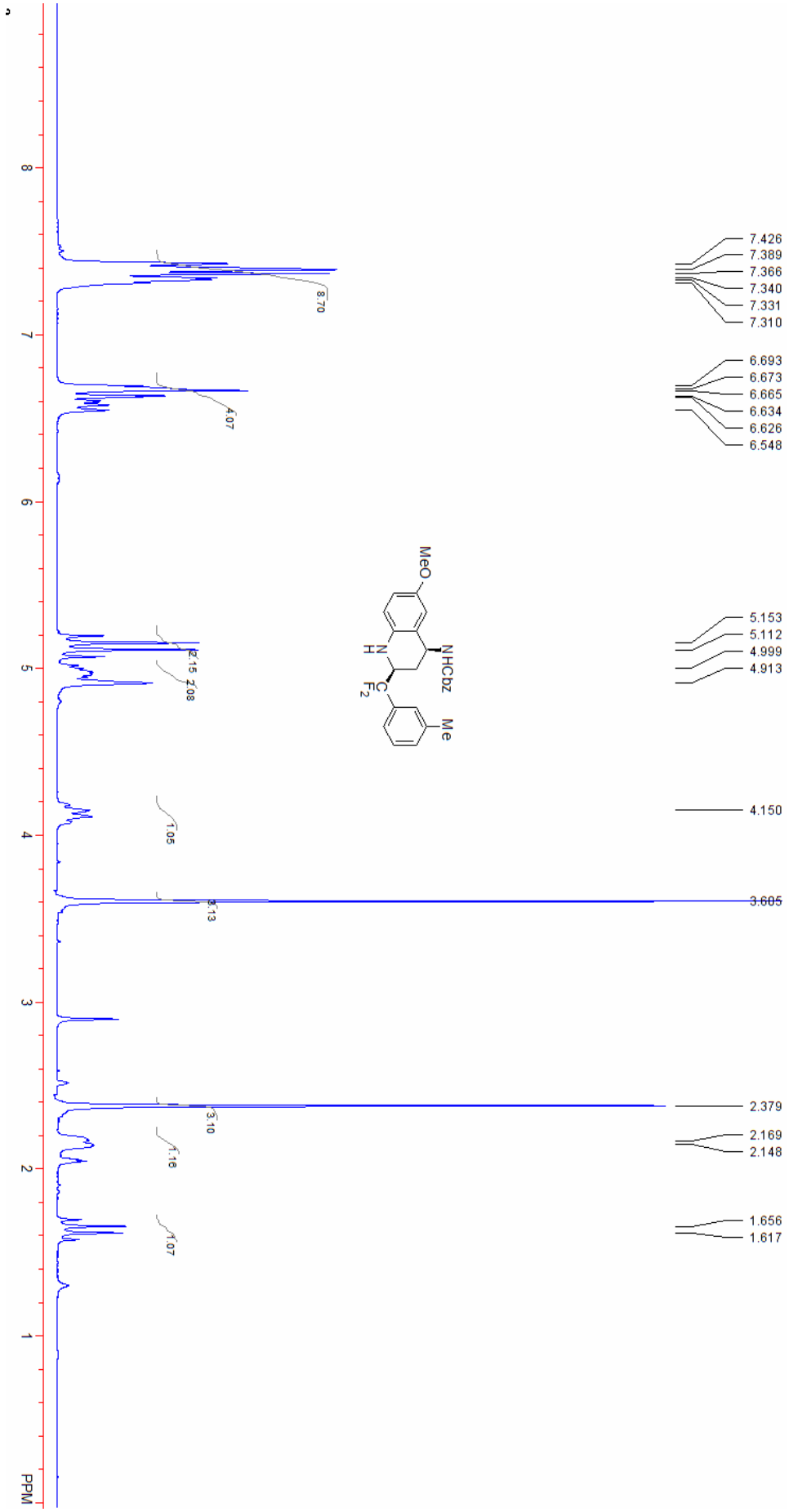
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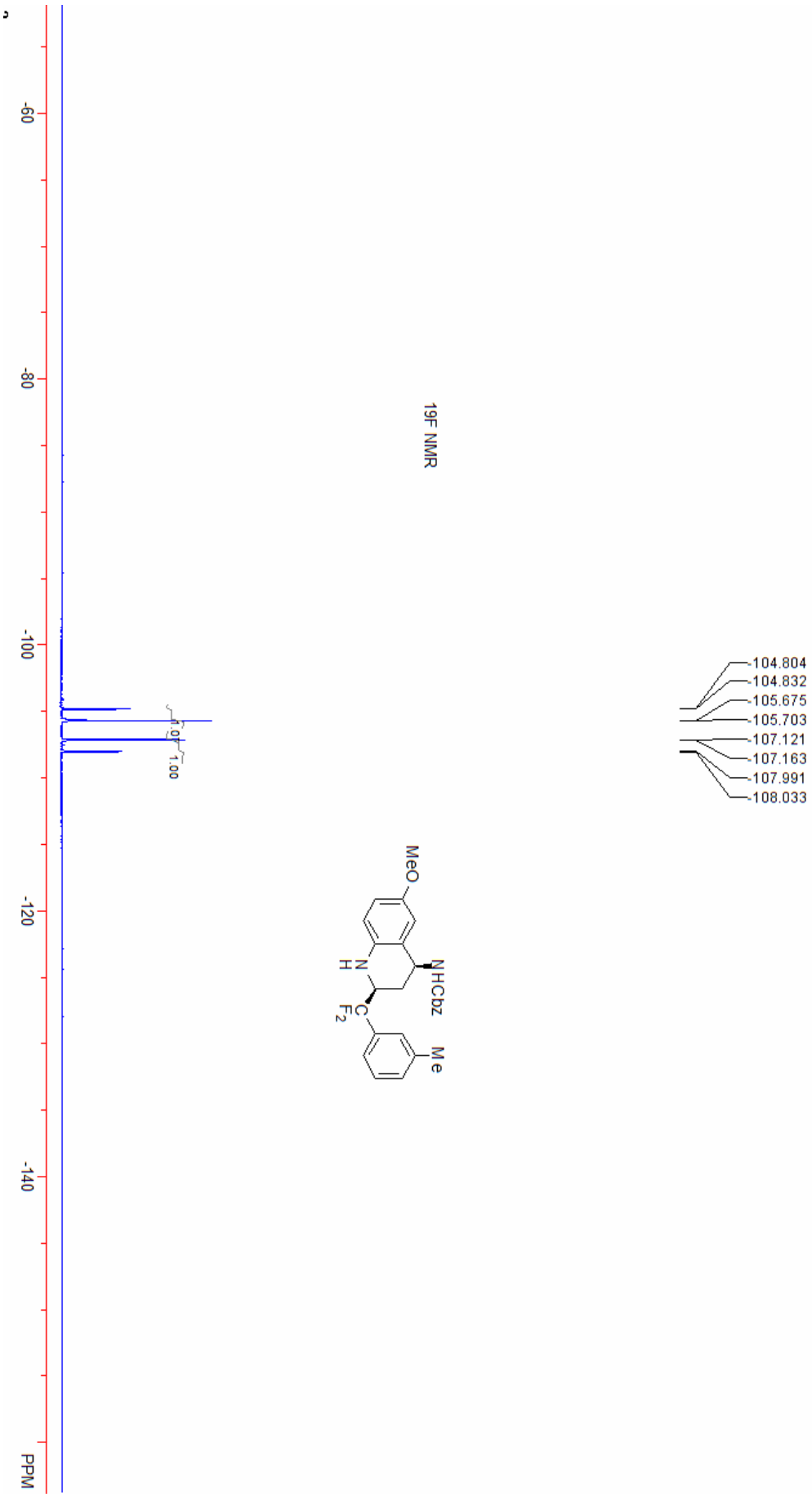
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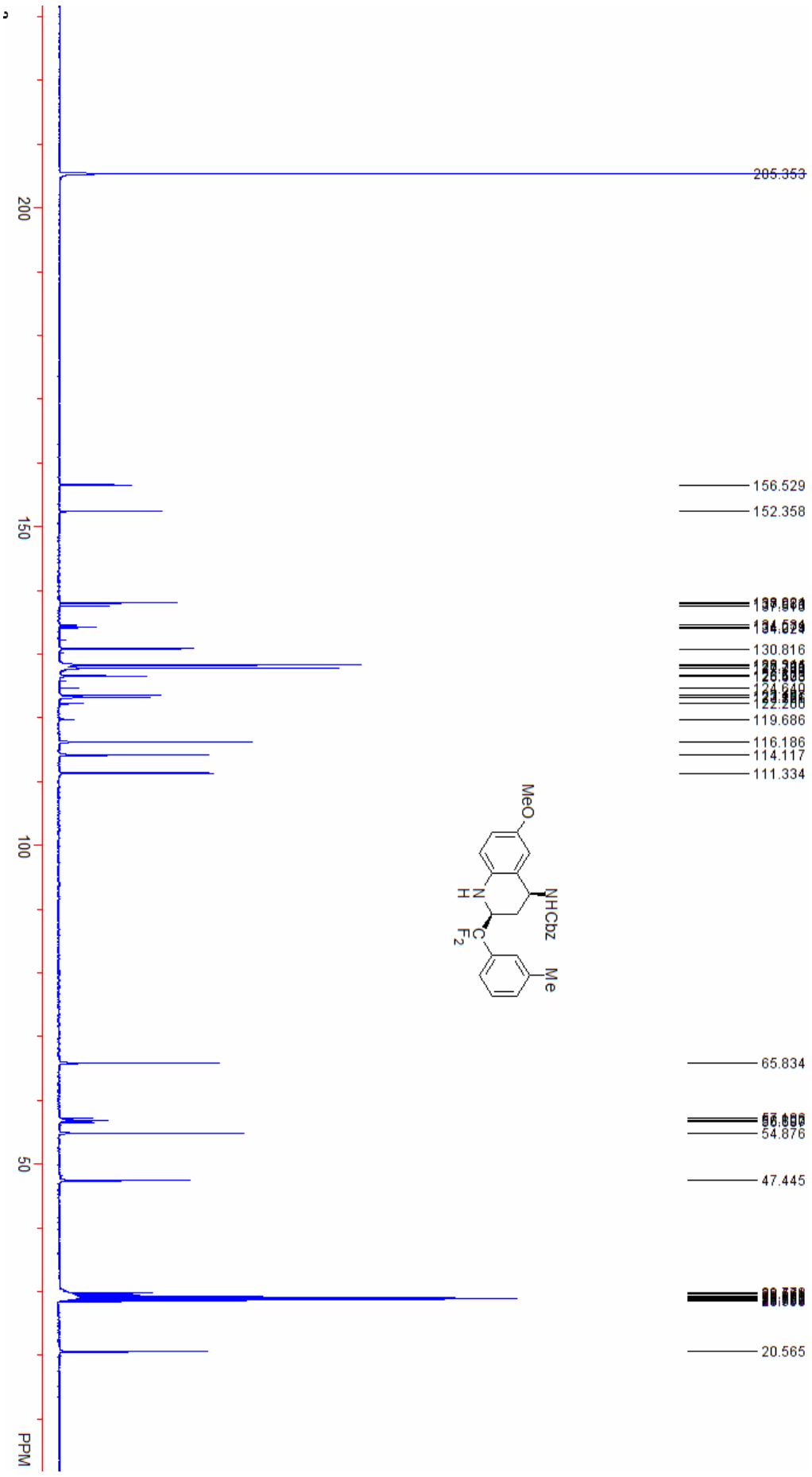
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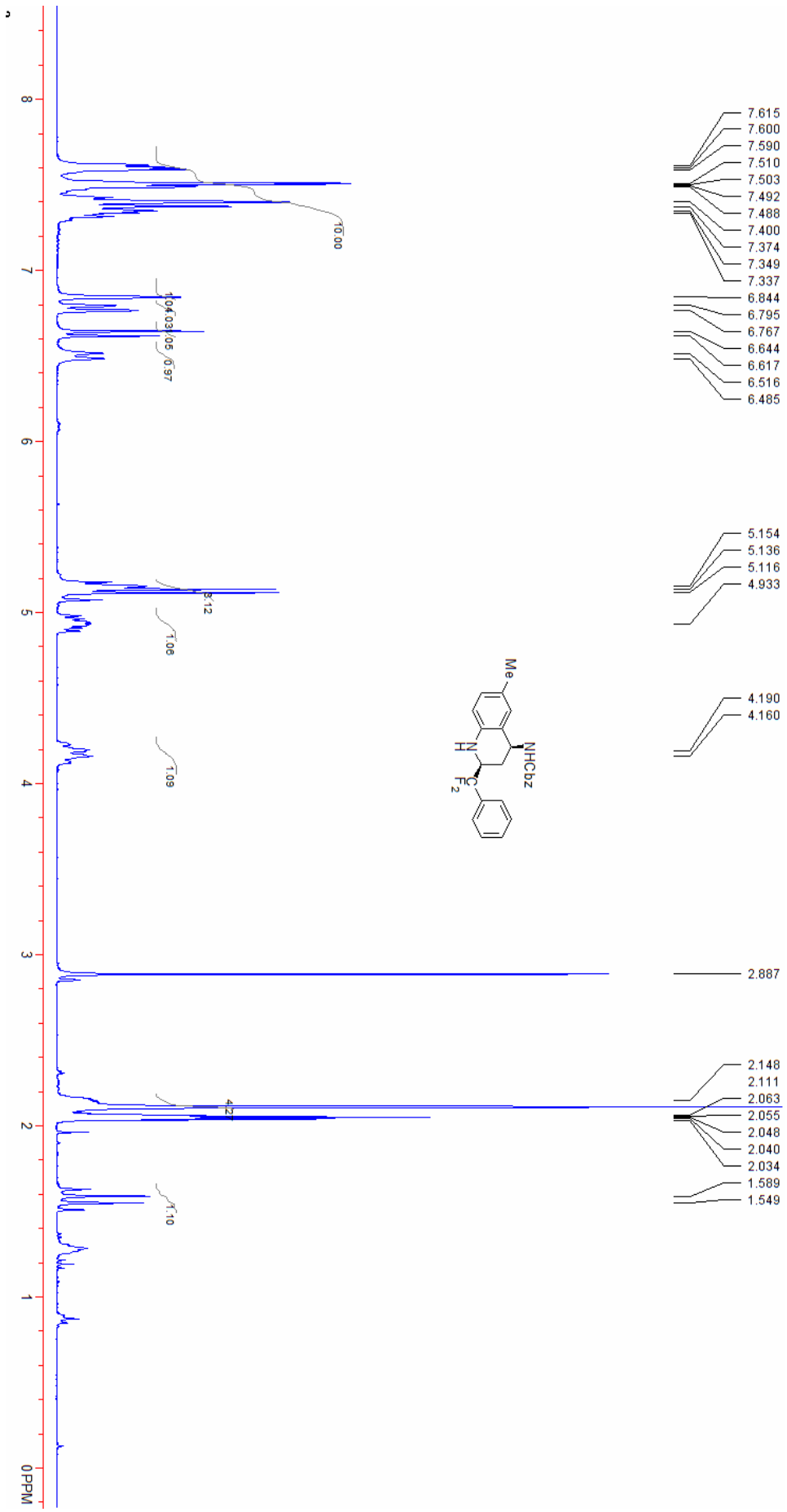
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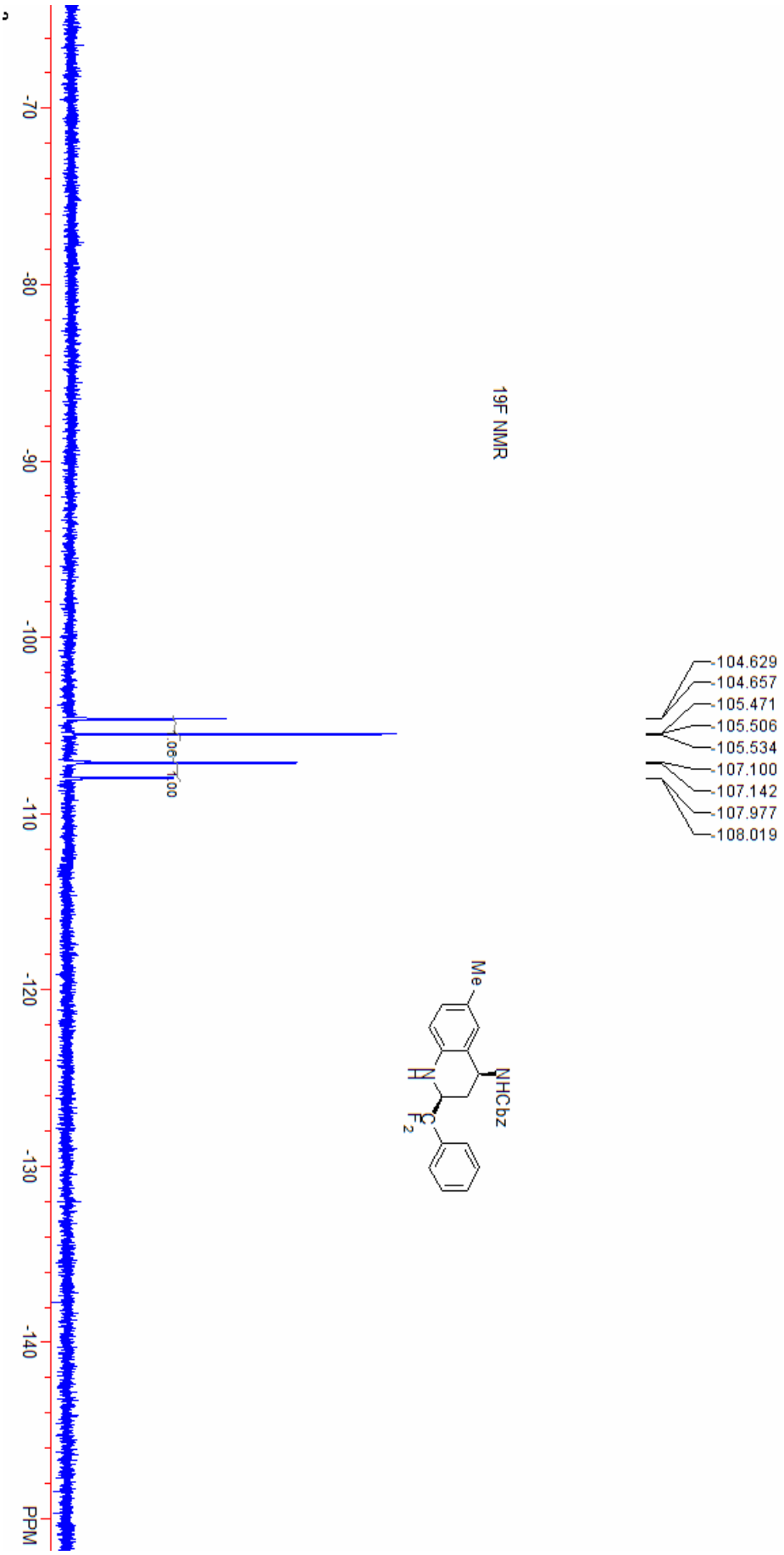

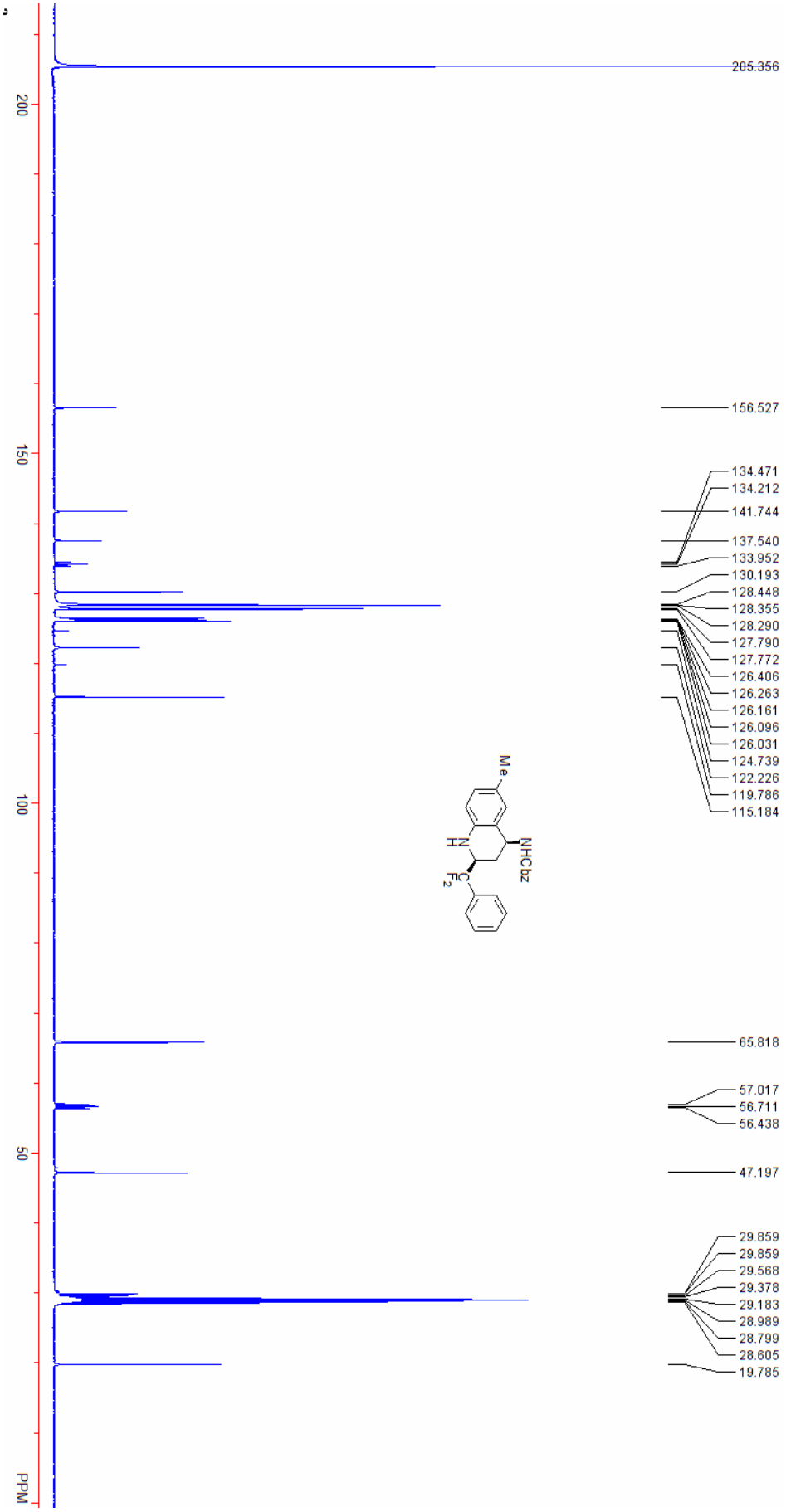
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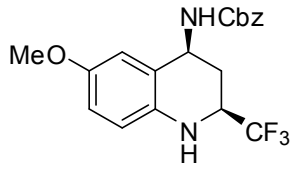
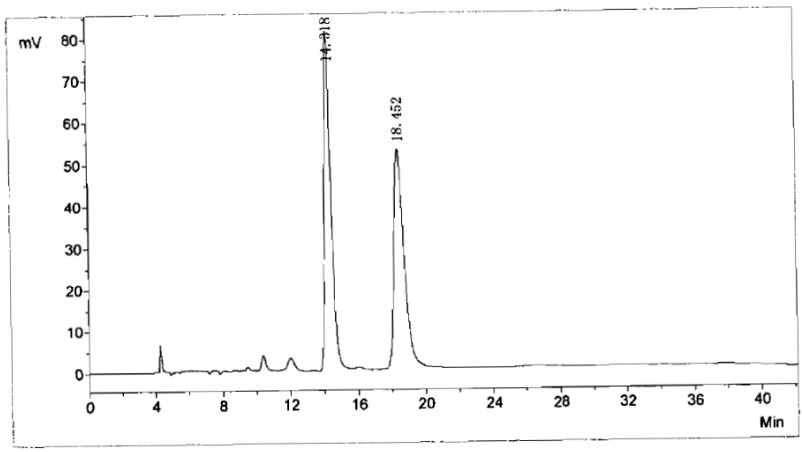
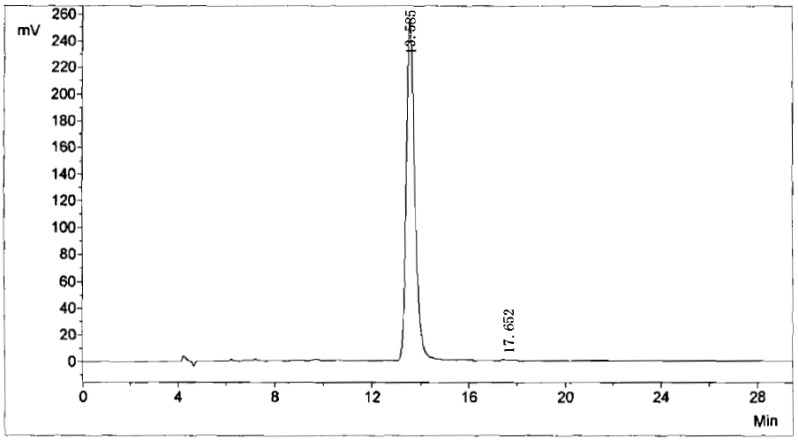
NHCbz
N
H
F2

Copies of HPLC Spectra of tetrahydroquinolines:

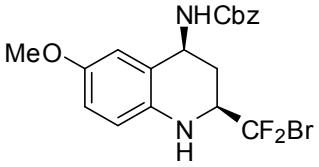


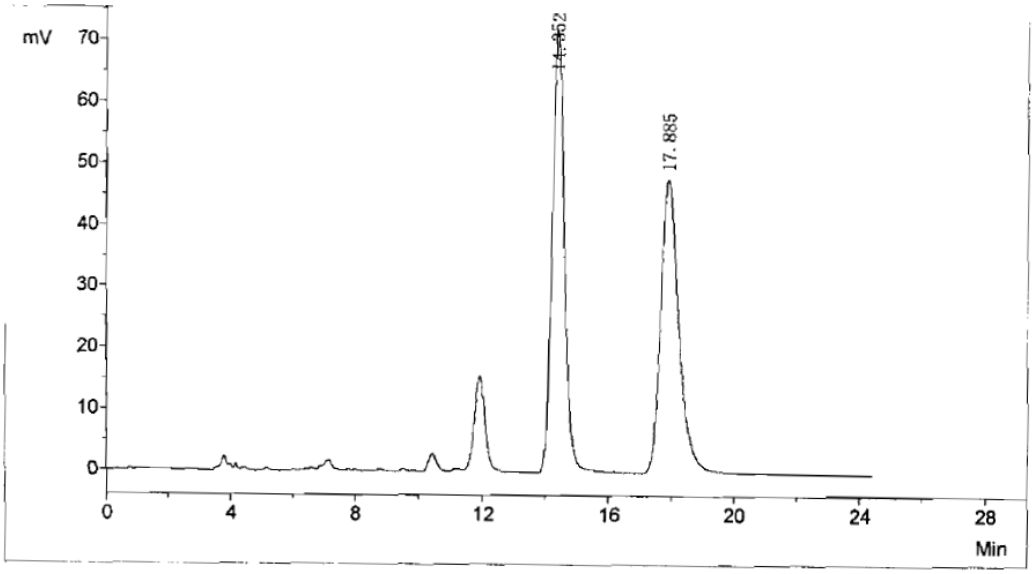


序号	峰号	组份名	保留时间	峰高	峰面积	面积百分比(%)
1	1		14.318	81236.8	2206483.5	49.8635
2	2		18.452	52684.3	2218560.3	50.1365
合计:				133921.1	4425043.8	100.0000

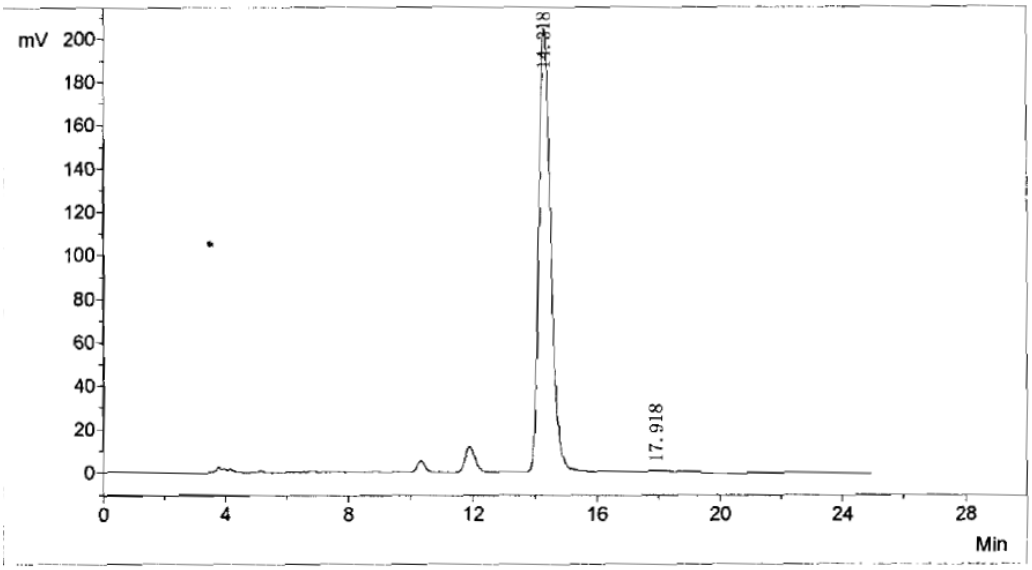


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		13.585	252423.4	6288731.6	99.7111
2	2		17.652	508.8	18221.7	0.2889
Total				252932.2	6306953.2	100.0000

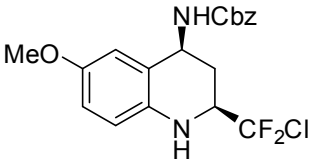


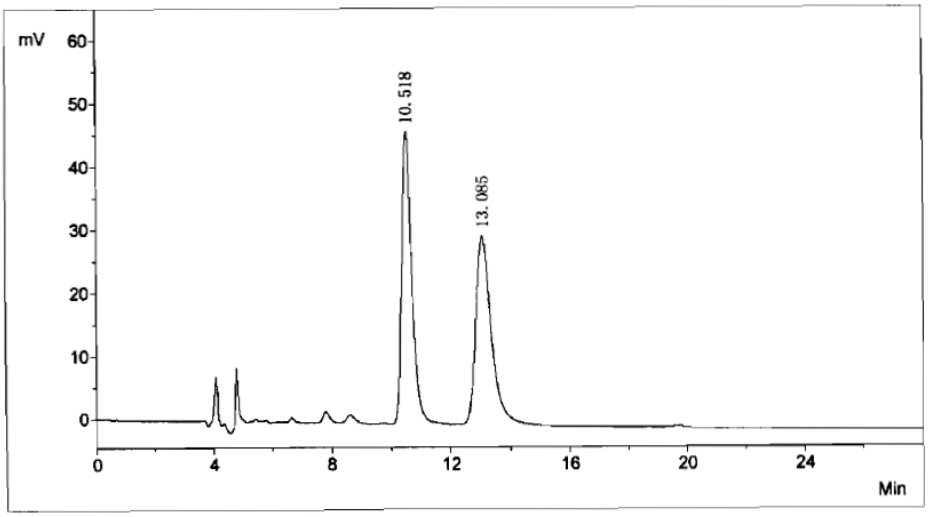


序号	峰号	组份名	保留时间	峰高	峰面积	面积百分比(%)
1	1		14.352	71792.4	1951553.1	50.4201
2	2		17.885	47720.8	1919033.3	49.5799

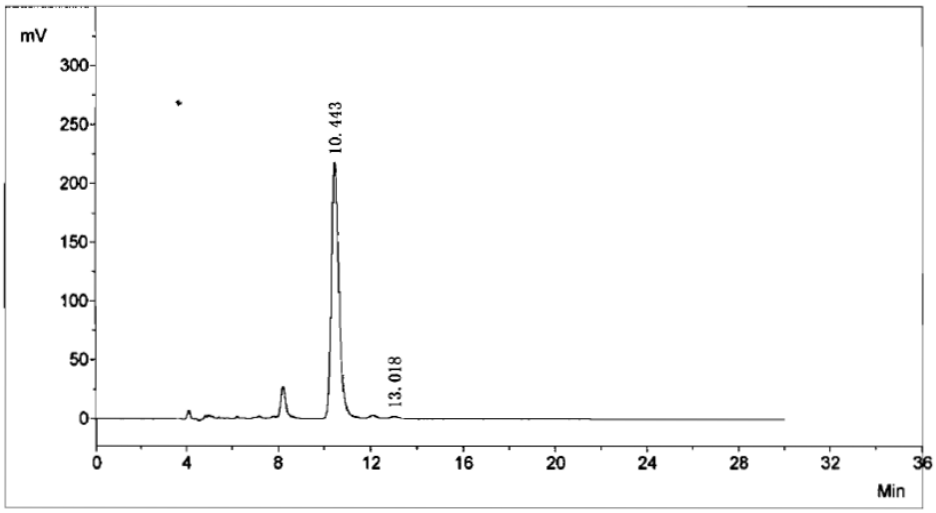


序号	峰号	组份名	保留时间	峰高	峰面积	面积百分比(%)
1	1		14.318	204291.9	5503587.1	99.3865
2	2		17.918	637.6	33973.6	0.6135
合计:				204929.4	5537560.7	100.0000

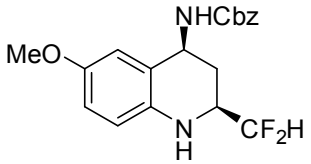


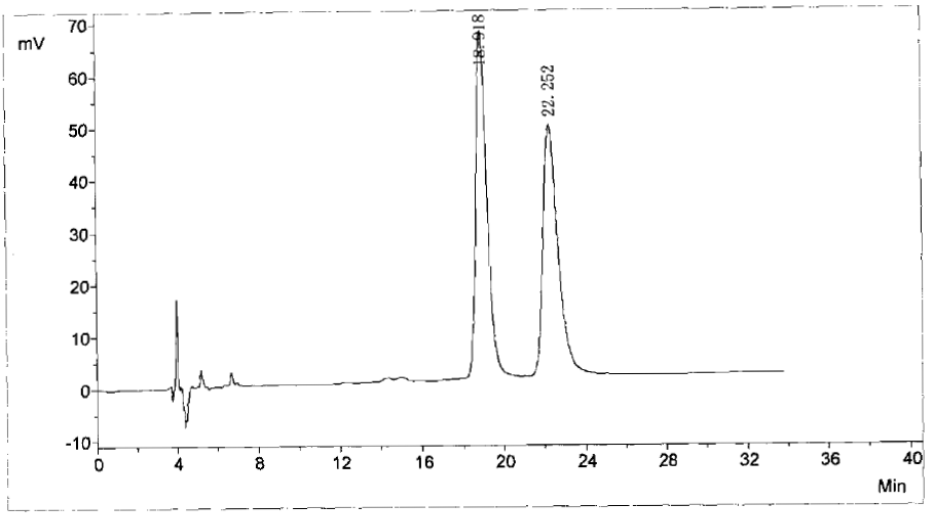


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		10.518	46349.0	1104296.6	49.8947
2	2		13.085	29982.0	1108957.9	50.1053
Total				76331.0	2213254.5	100.0000

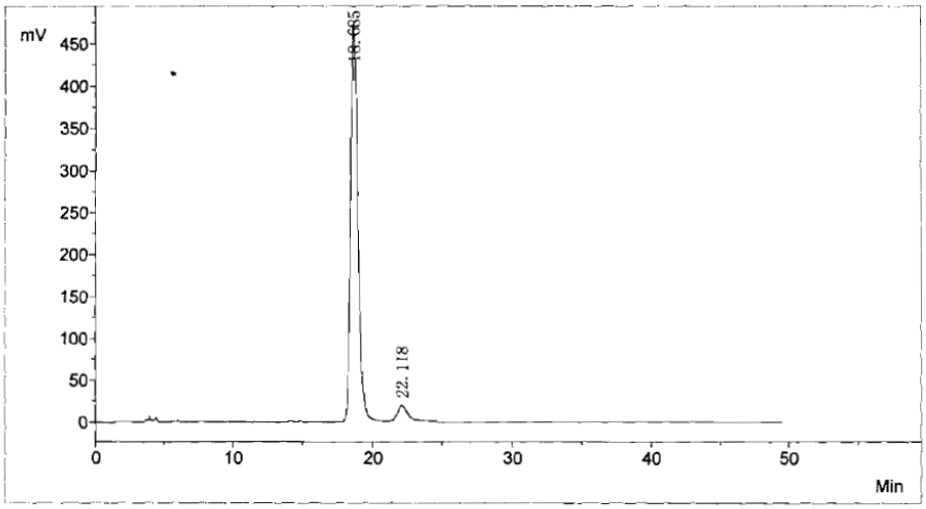


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		10.443	217711.2	4934505.8	99.0547
2	2		13.018	1559.4	47091.9	0.9453
Total				219270.6	4981597.7	100.0000

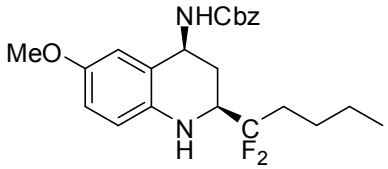


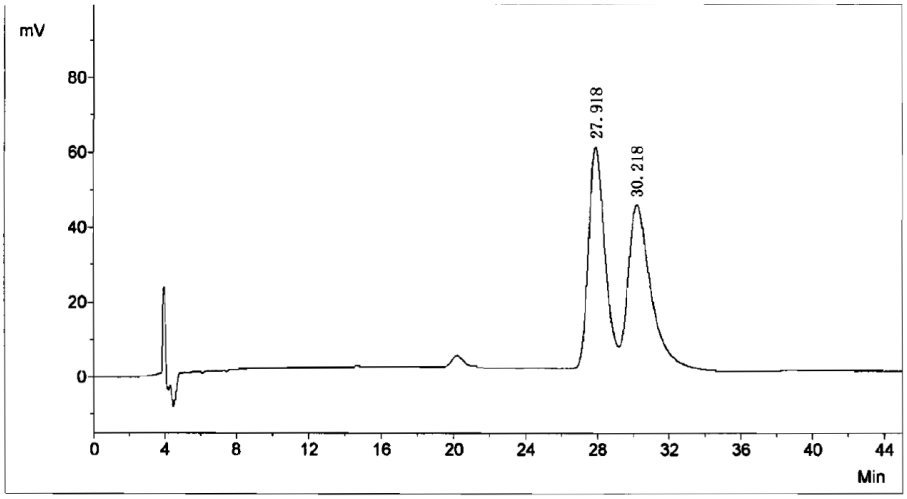


序号	峰号	组份名	保留时间	峰高	峰面积	面积百分比(%)
1	1		18.918	66649.7	2529327.3	50.4516
2	2		22.252	48106.1	2484048.2	49.5484
合计:				114755.8	5013375.6	100.0000

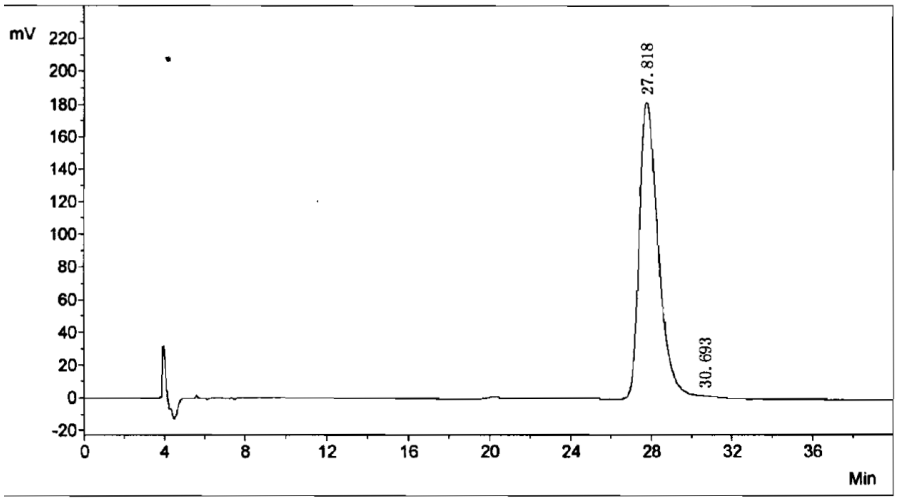


序号	峰号	组份名	保留时间	峰高	峰面积	面积百分比(%)
1	1		18.685	470265.7	17131705.3	94.3897
2	2		22.118	18726.7	1018264.3	5.6103
合计:				488992.4	18149969.6	100.0000

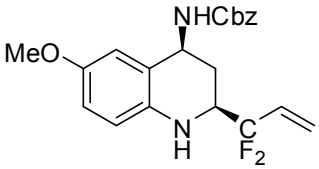


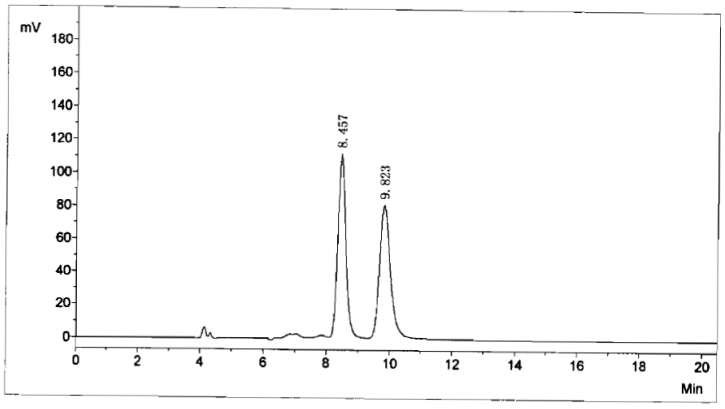


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		27.918	59456.8	3798621.8	49.0066
2	2		30.218	44130.9	3952618.7	50.9934
Total				103587.8	7751240.6	100.0000



No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		27.818	182125.8	11911032.7	98.7977
2	2		30.693	1739.6	144953.9	1.2023
`otal				183865.4	12055986.6	100.0000





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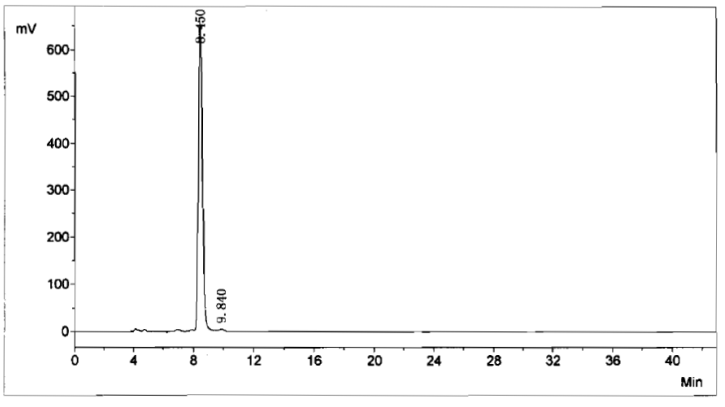
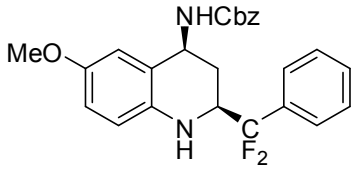
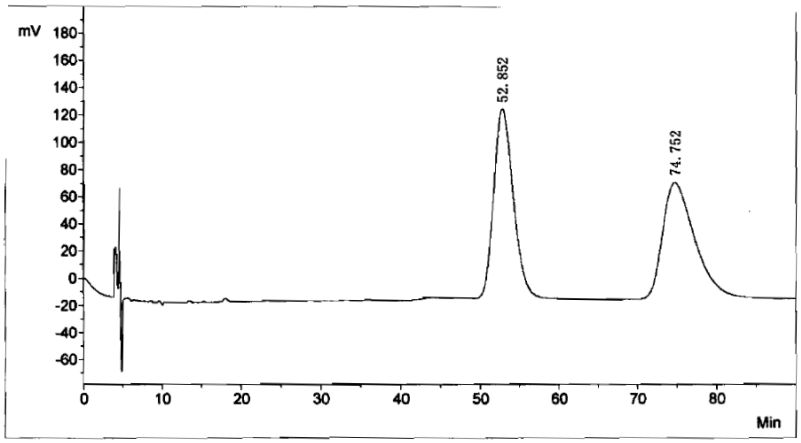
1	1		8.457	111142.3	1956693.8	50.1223
2	2		9.823	80761.7	1947143.2	49.8777
Total				191904.0	3903837.1	100.0000

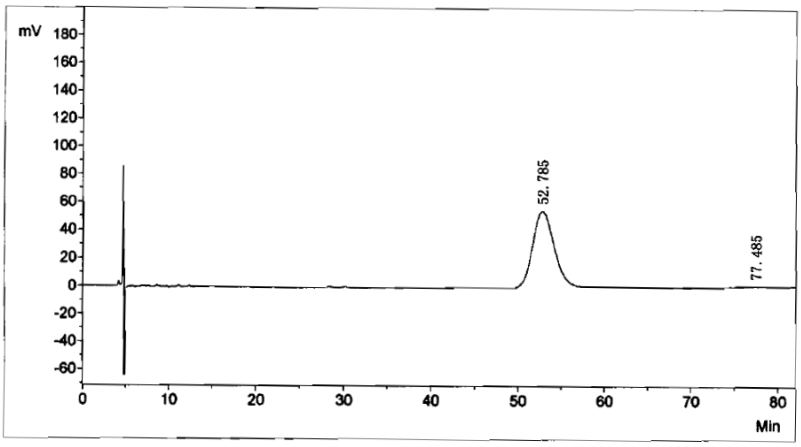


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		8.450	656259.8	11905188.2	99.3460
2	2		9.840	3516.8	78373.3	0.6540
Total				659776.5	11983561.5	100.0000

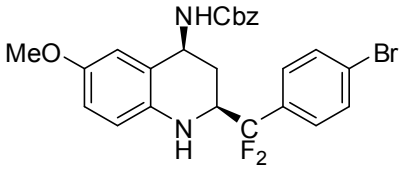


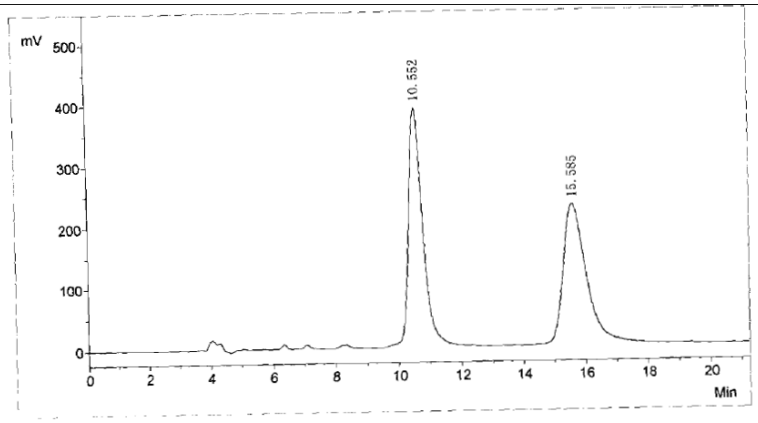


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		52.852	139399.8	24120009.0	49.8951
2	2		74.752	85700.8	24221469.3	50.1049
Total				225100.6	48341478.4	100.0000

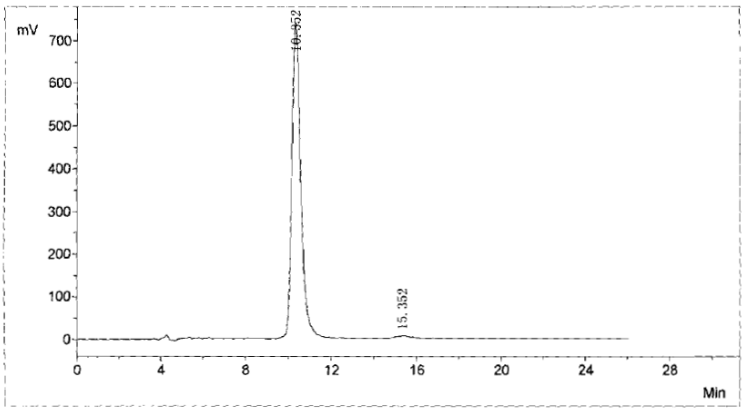


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		52.785	54675.5	9454704.7	98.9759
2	2		77.485	364.7	97832.1	1.0241
Total				55040.3	9552536.9	100.0000

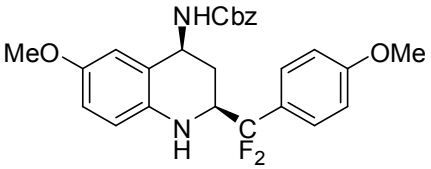


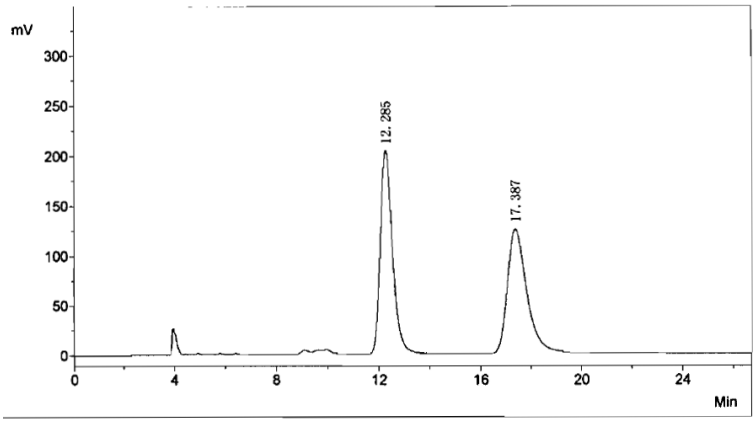


No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		10.552	390971.9	12241774.5	50.6826
2	2		15.585	229641.9	11912020.3	49.3174
Total				620613.8	24153794.7	100.0000

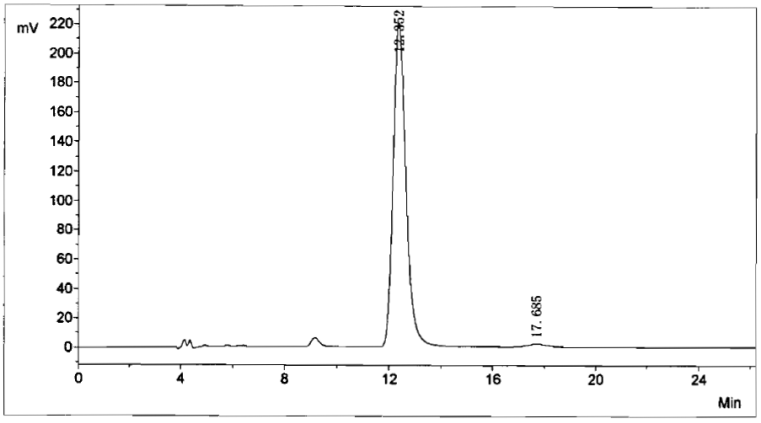


No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		10.352	741379.9	21866437.8	98.7098
2	2		15.352	5894.7	285802.9	1.2902
Total				747274.6	22152240.7	100.0000

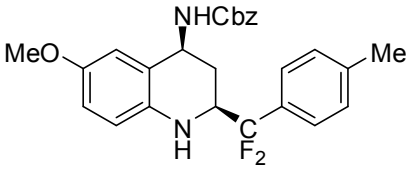


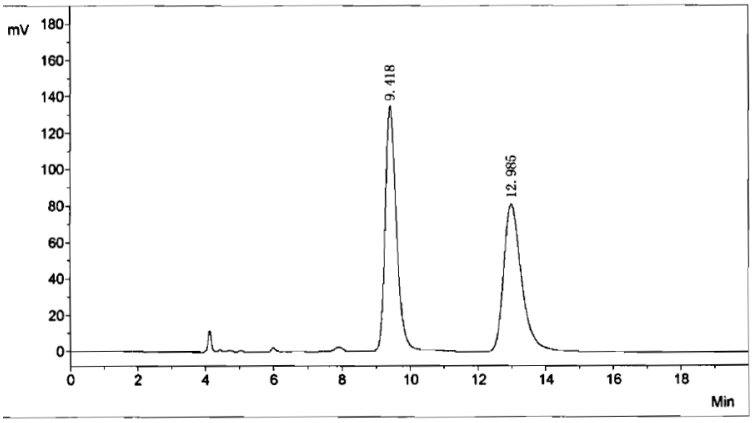


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		12.285	204193.4	6829489.3	50.6046
2	2		17.387	124985.8	6666292.6	49.3954
Total				329179.1	13495781.9	100.0000

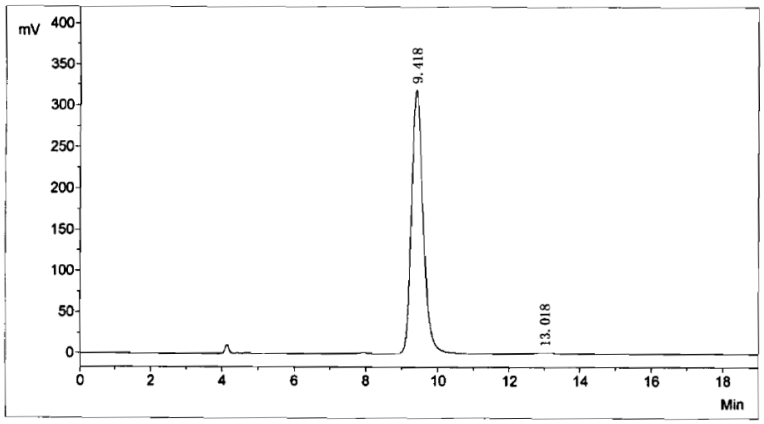


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		12.352	220764.1	7597183.9	98.5006
2	2		17.685	2028.0	115649.5	1.4994
Total				222792.1	7712833.4	100.0000

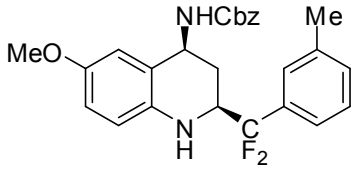


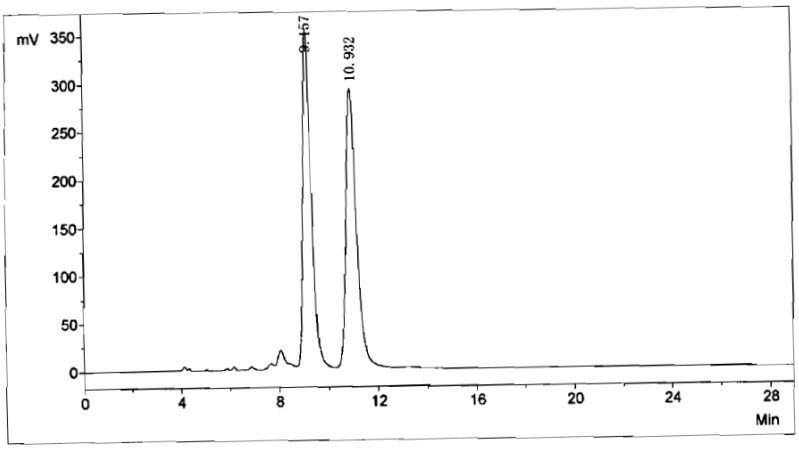


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		9.418	134363.5	3120473.2	50.8740
2	2		12.985	81090.2	3013257.0	49.1260
Total				215453.7	6133730.2	100.0000

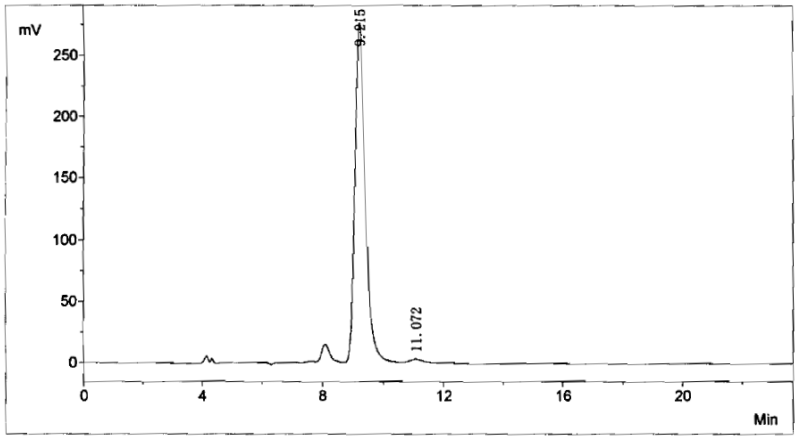


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		9.418	319171.0	7268272.4	99.0220
2	2		13.018	1984.6	71787.8	0.9780
Total				321155.6	7340060.2	100.0000

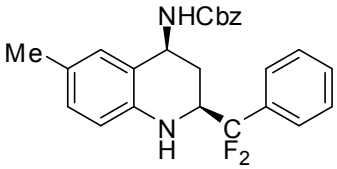


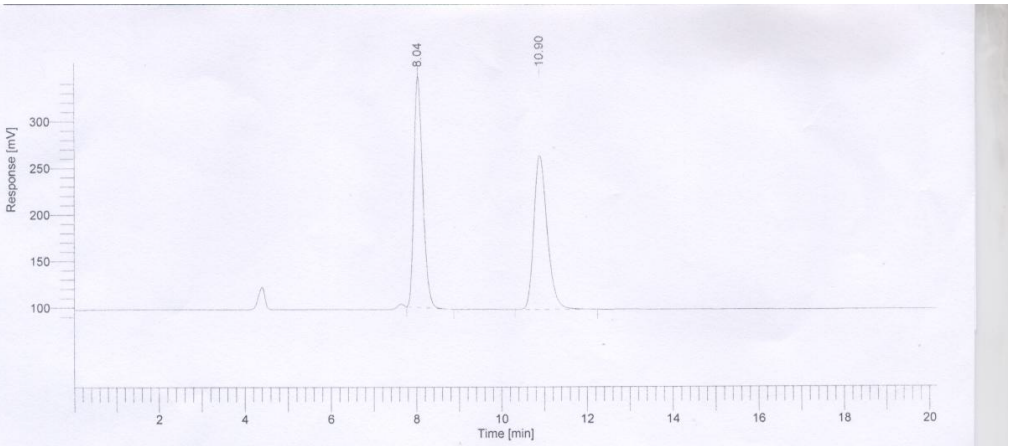


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		9.157	352961.2	8236055.5	48.7811
2	2		10.932	291972.9	8647646.3	51.2189
Total				644934.1	16883701.8	100.0000



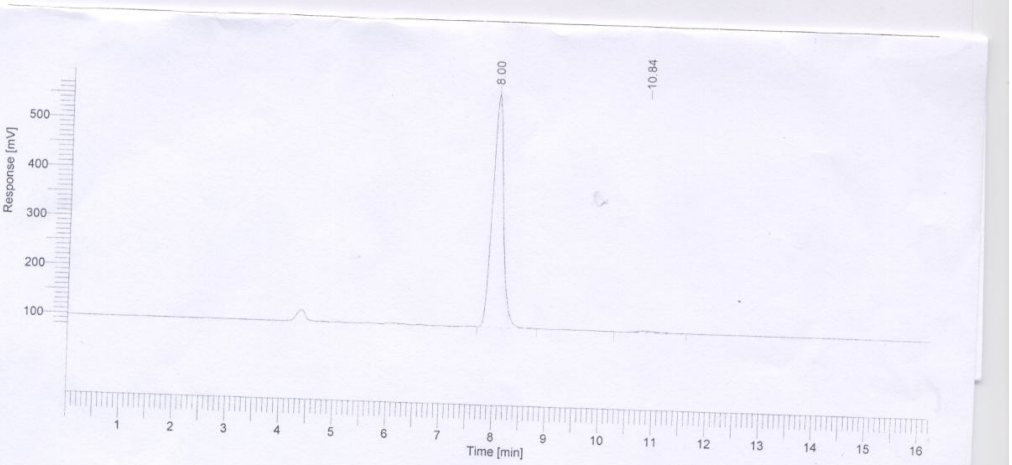
No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		9.215	275902.2	6638865.9	98.9879
2	2		11.072	2568.4	67878.1	1.0121
Total				278470.6	6706744.0	100.0000





DEFAULT REPORT

Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]
1	8.042	3554047.31	248171.36	49.74
2	10.902	3590702.68	165838.96	50.26
		7144749.99	414010.32	100.00



DEFAULT REPORT

Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]
1	8.005	6796397.78	473520.86	98.92
2	10.841	73966.74	3302.09	1.08
		6870364.53	476822.95	100.00