Supporting Information

Rhodium-Catalysed Additive-Free Carbonylation of Benzamides with Diethyl Dicarbonate as a Carbonyl Source

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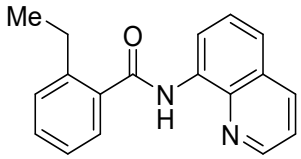
1. General Information

All reactions were performed in an oven-dried glassware using Schlenk techniques under argon atmosphere, unless otherwise noted. ^{1}H, ^{13}C NMR, and ^{19}F NMR spectra were recorded on a JEOL ECA 500II (500 MHz for ^{1}H, 125 MHz for ^{13}C, and 470 MHz for ^{19}F) spectrometer in $CDCl_3$. Tetramethylsilane (TMS) served as an internal standard (for ^{1}H, $\delta = 0$), $CDCl_3$ served as an internal standard (for ^{13}C, $\delta = 77.0$), and fluorobenzene served as an internal standard (for ^{19}F, $\delta = -113.2$). IR spectra were recorded on an FT/IR-4600 (JASCO Co., Ltd.). ESI-MS were measured on a Bruker ESI-TOF-MS. Preparative thin-layer chromatography (PTLC) was performed on Wakogel® B-5F. Flash column chromatography was performed on Wakogel® C-200 (75-150 μm).

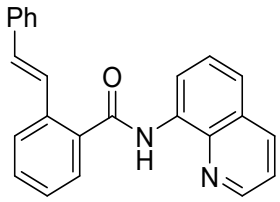
Materials. Tetrahydrofuran (THF) was purchased from Kanto Chemical as "Dehydrated Solvent System". *N*-methylpyrrolidone (NMP) was purchased from FUJIFILM Wako Pure Chemicals Corporation. Other solvents were purchased from Nacalai Tesque Inc.. $Rh(acac)(CO)_2$ was purchased from Sigma-Aldrich. Diethyl dicarbonate was purchased from FUJIFILM Wako Pure Chemicals Corporation. NH_3 in MeOH, EtOD were purchased from Tokyo Chemical Industry Co, Ltd. Diethyl carbonate **7** was purchased from Nacalai Tesque Inc. All regents were used without further purification. $[RhOPiv(cod)]_2$,[1] $[Rh(OAc)(cod)]_2$[2] and $[RhCl(cod)]_2$[3] were synthesised according to the literature. Benzamides **1** and **6** were synthesised according to the literature.[4–6] Benzamide **5** was synthesised according to the literature.[7]

2. Characterisation of New Benzamides 1



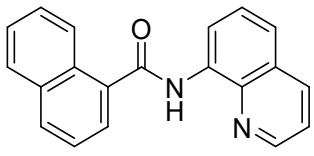
2-Ethyl-*N*-(quinolin-8-yl)benzamide (1b):

The title compound was obtained as a white solid; mp: 63.1–64.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.18 (s, 1H), 8.95 (d, *J* = 8.0 Hz, 1H), 8.76 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.17 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.64 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.60 (t, *J* = 7.7 Hz, 1H), 7.55 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.44–7.43 (m, 2H), 7.35 (d, *J* = 6.9 Hz, 1H), 7.32 (td, *J* = 7.4, 1.1 Hz, 1H), 2.95 (q, *J* = 7.6 Hz, 2H), 1.31 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.4, 148.2, 142.8, 138.6, 136.5, 136.3, 134.8, 130.4, 129.7, 128.0, 127.4, 127.2, 126.0, 121.8, 121.6, 116.5, 26.5, 16.0; IR (neat): 3347, 2968, 1676, 1531, 1483, 1464, 1457, 1389, 1329, 1266, 820, 787, 760, 747, 678, 606 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{16}N_2NaO^+$: $[M + Na]^+$ = 299.1155, found 299.1146.



(*E*)-*N*-(Quinolin-8-yl)-2-styrylbenzamide (1f):

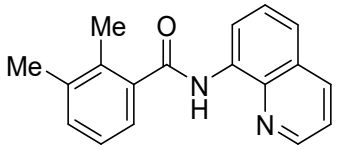
The title compound was obtained as a brown solid; mp: 117.4–118.3 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.32 (s, 1H), 8.98 (d, *J* = 7.4 Hz, 1H), 8.48 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.12 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.79 (dd, *J* = 13.7, 8.0 Hz, 2H), 7.68 (d, *J* = 16.0 Hz, 1H), 7.60 (t, *J* = 8.0 Hz, 1H), 7.52 (dd, *J* = 14.9, 7.4 Hz, 2H), 7.46 (d, *J* = 7.4 Hz, 2H), 7.41 (t, *J* = 7.4 Hz, 1H), 7.35 (dd, *J* = 8.6, 4.0 Hz, 1H), 7.29–7.23 (m, 2H), 7.21 (t, *J* = 7.2 Hz, 1H), 7.15 (d, *J* = 16.6 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.5, 148.2, 138.6, 137.1, 136.3, 136.2, 135.5, 134.7, 132.1, 130.7, 128.5, 128.3, 127.9, 127.8, 127.6, 127.4, 126.9, 126.7, 126.2, 121.9, 121.6, 116.7; IR (neat): 3353, 3069, 3013, 1680, 1594, 1524, 1486, 1426, 1387, 1327, 1249, 982, 972, 828, 793, 770, 689 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{24}H_{18}N_2NaO^+$: $[M + Na]^+$ = 373.1311, found 373.1329.



***N*-(Quinolin-8-yl)-1-naphthamide (1g):**

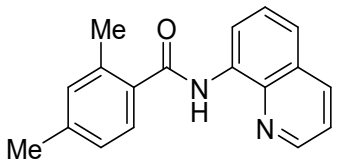
The title compound was obtained as a white solid; mp: 144.3–145.3 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.88 (s, 1H), 8.99 (d, *J* = 7.4 Hz, 1H), 8.87 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.59 (s, 1H), 8.21–8.09 (m, 2H), 8.06–7.96 (m, 2H), 7.90 (dd, *J*

= 6.9, 2.3 Hz, 1H), 7.64–7.52 (m, 4H), 7.50–7.44 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.4, 148.3, 138.8, 136.4, 134.9, 134.6, 132.7, 132.3, 129.2, 128.7, 128.0, 127.9, 127.8, 127.8, 127.5, 126.8, 123.7, 121.7, 121.7, 116.6; IR (neat): 3356, 3071, 3048, 1668, 1531, 1487, 1457, 1428, 1388, 1325, 910, 836, 828, 770 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{20}H_{14}N_2NaO^+$: $[M + Na]^+$ = 321.0998, found 321.0990.



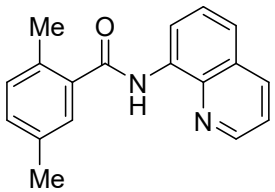
2,3-Dimethyl-*N*-(quinolin-8-yl)benzamide (1h):

The title compound was obtained as a white solid; mp: 136.0–137.0 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.13 (s, 1H), 8.96 (d, *J* = 7.4 Hz, 1H), 8.74 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.15 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.59 (t, *J* = 8.0 Hz, 1H), 7.53 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.47 (d, *J* =7.4 Hz, 1H), 7.42 (dd, *J* = 8.0, 4.0 Hz, 1H), 7.28 (d, *J* = 7.4 Hz, 1H), 7.21 (t, *J* = 7.4 Hz, 1H), 2.45 (s, 3H), 2.35 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.0, 148.2, 138.5, 138.1, 137.6, 136.3, 134.7, 134.5, 131.5, 127.9, 127.4, 125.6, 124.7, 121.7, 121.6, 116.5, 20.3, 16.4; IR (neat): 3351, 3011, 2948, 1669, 1523, 1485, 1459, 1386, 1326, 830, 797, 689 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{16}N_2NaO^+$: $[M + Na]^+$ = 299.1155, found 299.1155.



2,4-Dimethyl-*N*-(quinolin-8-yl)benzamide (1i):

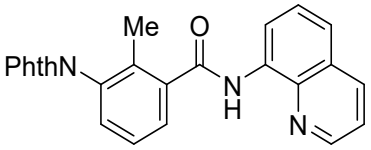
The title compound was obtained as a white solid; mp: 76.0–76.9 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.66 (s, 1H), 8.94 (d, *J* = 7.4 Hz, 1H), 8.86 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.19–8.15 (m, 1H), 7.67 (s, 2H), 7.59 (t, *J* = 8.0 Hz, 1H), 7.53 (d, *J* = 8.0 Hz, 1H), 7.46 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.20 (s, 1H), 2.45–2.43 (m, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.9, 148.3, 138.8, 138.4, 136.3, 135.2, 134.7, 133.5, 128.0, 128.0, 127.5, 125.0, 121.6, 121.5, 116.5, 116.5, 21.4, 21.3; IR (neat): 3366, 3019, 2921, 1682, 1533, 1486, 1427, 1390, 1331, 1263, 885, 823, 767, 666 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{16}N_2NaO^+$: $[M + Na]^+$ = 299.1155, found 299.1152.



2,5-Dimethyl-*N*-(quinolin-8-yl)benzamide (1j):

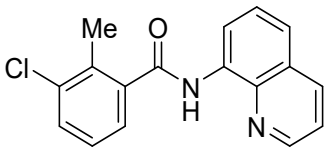
The title compound was obtained as a brown solid; mp: 84.1–85.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.17 (s, 1H), 8.94 (d, *J* = 7.4 Hz, 1H), 8.78 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.17 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.59 (t, *J* = 7.7 Hz, 1H), 7.54 (dd, *J* =

8.3, 1.4 Hz, 1H), 7.48 (s, 1H), 7.44 (dd, *J* = 8.0, 4.0 Hz, 1H), 7.20 (t, *J* = 9.5 Hz, 2H), 2.55 (s, 3H), 2.39 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.4, 148.2, 138.6, 136.6, 136.3, 135.6, 134.8, 133.3, 131.2, 131.0, 128.0, 127.8, 127.4, 121.7, 121.6, 116.5, 20.9, 19.7; IR (neat): 3353, 3044, 2924, 1683, 1539, 1505, 1486, 1386, 1330, 822, 790, 677 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{16}N_2NaO^+$: $[M + Na]^+$ = 299.1155, found 299.1152.



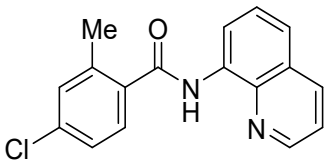
3-(1,3-Dioxoisoindolin-2-yl)-2-methyl-*N*-(quinolin-8-yl)benzamide (1l):

The title compound was obtained as a white solid; mp: 238.9–239.2 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.24 (s, 1H), 8.94 (d, *J* = 7.4 Hz, 1H), 8.80 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.19 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.98 (dd, *J* = 5.4, 3.2 Hz, 2H), 7.85–7.77 (m, 3H), 7.63–7.55 (m, 2H), 7.52–7.45 (m, 2H), 7.38 (d, *J* = 8.0 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.3, 167.2, 148.4, 138.8, 138.5, 136.3, 135.5, 134.5, 134.5, 131.9, 131.9, 130.9, 128.3, 128.0, 127.3, 127.0, 123.9, 122.0, 121.7, 116.6, 15.2; IR (neat): 3359, 3064, 1677, 1534, 1488, 1429, 1393, 1332, 823, 790, 775, 764, 747, 667 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{25}H_{17}N_3NaO_3^+$: $[M + Na]^+$ = 430.1162, found 430.1180.



3-Chloro-2-methyl-*N*-(quinolin-8-yl)benzamide (1m):

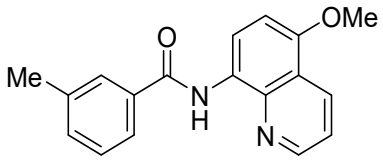
The title compound was obtained as a white solid; mp: 160.5–161.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.13 (s, 1H), 8.92 (dd, *J* = 7.4, 1.1 Hz, 1H), 8.77 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.18 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.63–7.55 (m, 2H), 7.53 (d, *J* = 7.4 Hz, 1H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.46 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.26 (t, *J* = 7.7 Hz, 1H), 2.59 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.4, 148.3, 139.1, 138.5, 136.4, 136.0, 134.4, 134.4, 131.0, 128.0, 127.4, 127.0, 125.5, 122.1, 121.7, 116.7, 17.2; IR (neat): 3359, 3064, 1676, 1534, 1488, 1429, 1393, 1332, 823, 790, 775, 764, 747, 667 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{17}H_{13}ClN_2NaO^+$: $[M + Na]^+$ = 319.0609, found 319.0595.



4-Chloro-2-methyl-*N*-(quinolin-8-yl)benzamide (1n):

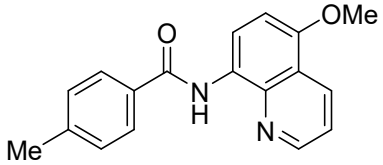
The title compound was obtained as a white solid; mp: 99.1–100.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.19 (s, 1H), 8.91 (d, *J* = 6.9 Hz, 1H), 8.79 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.19 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.65–7.55 (m, 3H), 7.47 (dd, *J* =

8.0, 4.0 Hz, 1H), 7.33–7.29 (m, 2H), 2.59 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.1, 148.3, 138.8, 138.6, 136.4, 136.1, 134.5, 131.3, 128.7, 128.0, 127.4, 126.2, 122.0, 122.0, 121.7, 116.6, 20.1; IR (neat): 3393, 3345, 3058, 3048, 2930, 1684, 1596, 1569, 1534, 1490, 1483, 1427, 1383, 1331, 1115, 907, 824, 788 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{17}H_{13}ClN_2NaO^+$: $[M + Na]^+$ = 319.0609, found 319.0602.



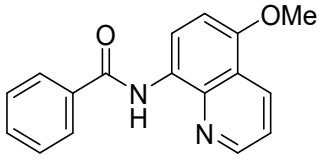
***N*-(5-Methoxyquinolin-8-yl)-3-methylbenzamide (1o):**

The title compound was obtained as a white solid; mp: 124.2–125.0 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.46 (s, 1H), 8.88–8.85 (m, 2H), 8.60 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.86 (t, *J* = 8.0 Hz, 2H), 7.49–7.44 (m, 1H), 7.42 (t, *J* = 7.4 Hz, 1H), 7.37 (d, *J* = 8.0 Hz, 1H), 6.90 (d, *J* = 8.6 Hz, 1H), 4.01 (s, 3H), 2.48 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.3, 150.4, 148.7, 139.5, 138.6, 135.4, 132.3, 131.3, 128.6, 128.1, 127.9, 124.1, 120.7, 120.5, 116.7, 104.4, 55.8, 21.5; IR (neat): 3362, 2933, 1658, 1598, 1587, 1538, 1497, 1487, 1399, 1266, 1091, 826, 815, 793, 731 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{16}N_2NaO_2^+$: $[M + Na]^+$ = 315.1104, found 315.1108.



***N*-(5-Methoxyquinolin-8-yl)-4-methylbenzamide (1p):**

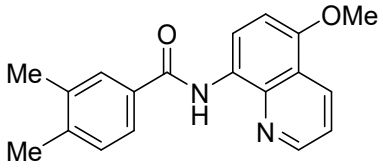
The title compound was obtained as a white solid; mp: 142.3–143.2 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.47 (s, 1H), 8.87–8.84 (m, 2H), 8.60 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.97 (d, *J* = 8.0 Hz, 2H), 7.46 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.34 (d, *J* = 8.0 Hz, 2H), 6.90 (d, *J* = 8.6 Hz, 1H), 4.01 (s, 3H), 2.45 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.1, 150.3, 148.7, 142.0, 139.5, 132.5, 131.3, 129.4, 128.1, 127.2, 120.7, 120.5, 116.6, 104.4, 55.8, 21.5; IR (neat): 3381, 2993, 2950, 1675, 1596, 1551, 1498, 1398, 1280, 1266, 1189, 1091, 834, 783 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{16}N_2NaO_2^+$: $[M + Na]^+$ = 315.1104, found 315.1113.



***N*-(5-Methoxyquinolin-8-yl)benzamide (1q):**

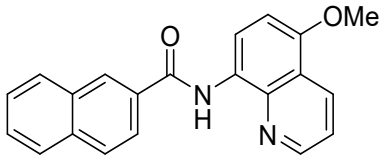
The title compound was obtained as a yellow solid; mp: 153.6–154.6 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.50 (s, 1H), 8.88–8.84 (m, 2H), 8.59 (dd, *J* = 8.3, 1.4 Hz, 1H), 8.07 (dd, *J* = 7.7, 1.4 Hz, 2H), 7.57–7.51 (m, 3H), 7.46 (dd, *J* = 8.6,

4.0 Hz, 1H), 6.89 (d, J = 8.6 Hz, 1H), 4.01 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.1, 150.4, 148.7, 139.5, 135.4, 131.6, 131.3, 128.7, 128.0, 127.2, 120.8, 120.5, 116.7, 104.4, 55.8; IR (neat): 3381, 3059, 1675, 1596, 1584, 1548, 1494, 1397, 1279, 1263, 1092, 883, 786, 696, 685 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{17}H_{14}N_2NaO_2^+$: $[M + Na]^+$ = 301.0947, found 301.0935.



***N*-(5-Methoxyquinolin-8-yl)-3,4-dimethylbenzamide (1r):**

The title compound was obtained as a yellow solid; mp: 151.0–151.6 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 9.95 (s, 1H), 8.84 (d, J = 8.6 Hz, 1H), 8.74 (dd, J = 4.0, 1.7 Hz, 1H), 8.53 (dd, J = 8.0, 1.7 Hz, 1H), 7.58 (d, J = 8.6 Hz, 1H), 7.38 (dd, J = 8.3, 4.3 Hz, 1H), 7.09 (d, J = 5.2 Hz, 2H), 6.84 (d, J = 8.6 Hz, 1H), 3.96 (s, 3H), 2.58 (s, 3H), 2.35 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.7, 150.2, 148.5, 140.1, 139.2, 136.6, 133.8, 132.0, 131.1, 128.2, 127.2, 126.5, 120.6, 120.3, 116.4, 104.2, 55.6, 21.2, 20.1; IR (neat): 3377, 2998, 1675, 1596, 1540, 1498, 1397, 1277, 1259, 1156, 1089, 826, 787, 653 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{19}H_{18}N_2NaO_2^+$: $[M + Na]^+$ = 329.1260, found 329.1249.

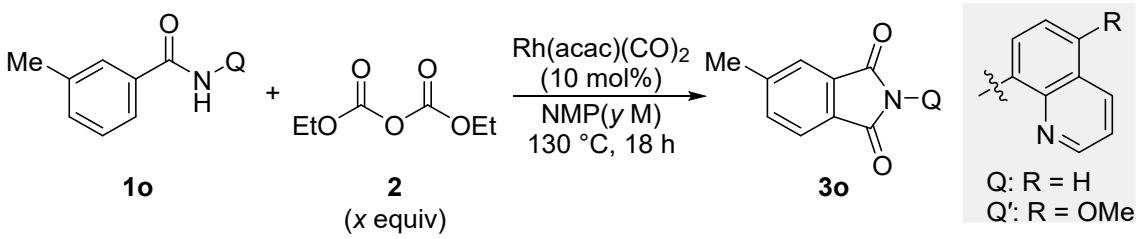


***N*-(5-Methoxyquinolin-8-yl)-2-naphthamide (1s):**

The title compound was obtained as a brown solid; mp: 161.2–162.2 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.65 (s, 1H), 8.94–8.87 (m, 2H), 8.62 (dd, J = 8.6, 1.7 Hz, 1H), 8.60–8.58 (m, 1H), 8.13 (dd, J = 8.6, 1.7 Hz, 1H), 8.04 (dd, J = 6.6, 2.6 Hz, 1H), 7.99 (d, J = 8.6 Hz, 1H), 7.92 (dd, J = 6.6, 2.6 Hz, 1H), 7.63–7.55 (m, 2H), 7.48 (dd, J = 8.6, 4.0 Hz, 1H), 6.92 (d, J = 8.6 Hz, 1H), 4.03 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.1, 150.5, 148.8, 139.5, 134.8, 132.8, 132.6, 131.3, 129.2, 128.6, 128.1, 127.8, 127.8, 127.7, 126.7, 123.7, 120.8, 120.5, 116.8, 104.4, 55.8; IR (neat): 3366, 3055, 1652, 1539, 1498, 1442, 1395, 1276, 1265, 1089, 861, 842, 770 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{21}H_{16}N_2NaO_2^+$: $[M + Na]^+$ = 351.1104, found 351.1109.

3. Rhodium-Catalysed Carbonylation of Benzamides 1

3.1. Optimisation of Reaction Conditions for Rhodium-Catalysed Carbonylation of Benzamide 1o[a]



1o **2** (*x* equiv) **3o**

Entry	*x*	*y*	R	Time of slow addition (h)	Yield of **3o** (%)[b]
1	1.5	0.3	H	0	26
2[c]	1.5	0.2	H	6.0	29
3[c]	2.5	0.2	H	6.0	36
4[c]	2.5	0.2	OMe	6.0	49
5[c]	2.5	0.2	OMe	16.0	40

[a] Reaction conditions: **1a** (0.2 mmol), **2**, Rh(acac)$(CO)_2$ (10 mol%) were reacted in NMP at 130 °C for 18 h, unless otherwise noted. [b] Isolated yield. [c] Reaction time was 24 h.

3.2. General Procedure for the Carbonylation of Benzamides 1

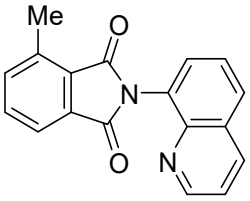
To an oven-dried test tube equipped with a stirring bar charged with benzamide **1** (0.3 mmol) and $Rh(acac)(CO)_2$ (7.7 mg, 3.0×10^{-2} mmol) was added NMP (0.6 mL). Subsequently, diethyl dicarbonate (**2**, 0.45 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the residue was purified by preparative thin-layer chromatography.

3.3. General Procedure for the Carbonylation of *meta*- or *para*-Substituted Benzamides 1

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1** (0.2 mmol) and $Rh(acac)(CO)_2$ (5.2 mg, 2.0×10^{-2} mmol) was added NMP (1.0 mL). After heating the reaction mixture at 130 °C, diethyl dicarbonate (**2**, 0.5 mmol) was injected over 6 h into the solution using a syringe pump, and the solution was stirred at 130 °C for the next 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the residue was purified by preparative thin-layer chromatography.

3.4. Procedure for a Large-Scale Reaction

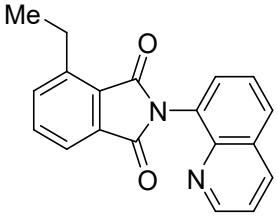
To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (262.3 mg, 1.00 mmol) and $Rh(acac)(CO)_2$ (25.8 mg, 1.00×10^{-1} mmol) was added NMP (2.0 mL). Subsequently, diethyl dicarbonate (**2**, 248.4 mg, 1.53 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the residue was purified by preparative thin-layer chromatography (THF/toluene = 1/4) to give the product **3a** (231.8 mg, 0.804 mmol, 80%).



4-Methyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3a):

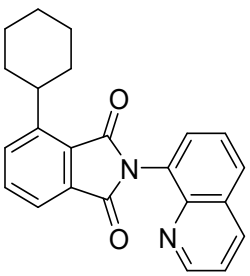
The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 204.0–205.0 °C;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.87 (dd, *J* = 4.6, 1.7 Hz, 1H), 8.22 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.95 (d, *J* = 8.6 Hz, 1H), 7.82 (d, *J* = 7.4 Hz, 1H), 7.74 (dd, *J* = 7.4, 1.1 Hz, 1H) 7.69–7.62 (m, 2H), 7.54 (d, *J* = 8.0 Hz, 1H), 7.43 (dd, *J* = 8.3, 4.3 Hz, 1H), 2.76 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.6, 167.9, 150.8, 144.3, 138.4, 136.5, 136.1, 133.6, 132.8, 130.2, 129.8, 129.5, 129.2, 129.0, 126.0, 121.8, 121.4, 17.7; IR (neat): 3463, 3068, 3012, 2960, 2925, 2857, 1771, 1715, 1591, 1501, 1474, 1396, 1241, 1107, 931, 879, 825, 790, 737, 624 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{13}N_2O_2^+$: $[M + H]^+$ = 281.0972, found 289.0981. The spectral data matched those reported in the literature.[8]



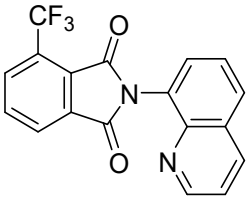
4-Ethyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3b):

The title compound was obtained as a brown solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 182.3–183.3 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.86 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.22 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.95 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.83 (d, *J* = 7.4 Hz, 1H), 7.74 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.71–7.65 (m, 2H), 7.59 (d, *J* = 8.0 Hz, 1H), 7.43 (dd, *J* = 8.3, 4.3 Hz, 1H), 3.28–3.12 (m, 2H), 1.33 (t, *J* = 7.7 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.5, 168.0, 150.9, 144.9, 144.4, 136.1, 134.9, 134.0, 133.0, 130.3, 129.9, 129.5, 129.3, 128.5, 126.1, 121.8, 121.5, 24.6, 14.8; IR (neat): 3067, 2945, 2934, 2874, 1779, 1766, 1716, 1595, 1502, 1474, 1427, 1395, 1379, 1249, 1109, 884, 825, 791, 765, 742, 624 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{19}H_{15}N_2O_2^+$: $[M + H]^+$ = 303.1128, found 303.1115.



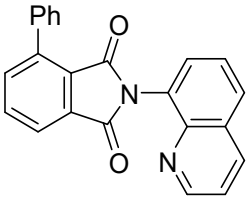
4-Cyclohexyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3c):

The title compound was obtained as a white solid; purified by preparative TLC (EtOAc/hexane = 1/3); mp: 157.9–158.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.86 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.20 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.93 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.82 (dd, *J* = 6.0, 2.0 Hz, 1H), 7.74 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.72–7.63 (m, 3H), 7.42 (dd, *J* = 8.3, 4.3 Hz, 1H), 3.83–3.77 (m, 1H), 2.01–1.93 (m, 2H), 1.87–1.80 (m, 2H), 1.76 (d, *J* = 8.0 Hz, 1H), 1.58–1.40 (m, 4H), 1.32–1.22 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.7, 167.9, 150.9, 148.8, 144.4, 136.1, 134.1, 132.9, 132.1, 130.3, 129.9, 129.5, 129.2, 127.8, 126.1, 121.8, 121.3, 38.3, 33.7, 33.1, 26.7, 26.6, 26.0; IR (neat): 3071, 2929, 2849, 1776, 1717, 1595, 1501, 1476, 1427, 1401, 1381, 1116, 880, 828, 792, 750, 627 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{23}H_{21}N_2O_2^+$: $[M + H]^+$ = 357.1598, found 357.1583.



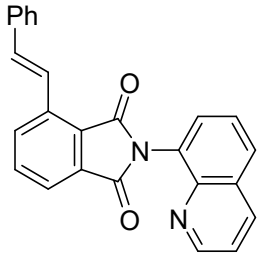
2-(Quinolin-8-yl)-4-(trifluoromethyl)isoindoline-1,3-dione (3d):

The title compound was obtained as a white solid; purified by preparative TLC (EtOAc/hexane = 1/3); mp: 187.8–188.2 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.85 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.26–8.20 (m, 2H), 8.08 (d, *J* = 7.4 Hz, 1H), 7.98 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.94 (t, *J* = 7.7 Hz, 1H), 7.77 (dd, *J* = 7.2, 1.4 Hz, 1H), 7.68 (t, *J* = 7.7 Hz, 1H), 7.45 (dd, *J* = 8.3, 4.3 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 166.4, 164.4, 151.0, 144.0, 136.2, 134.4, 134.3, 131.0 (q, $J_{C–F}$ = 5.2 Hz), 130.2, 129.9, 129.4, 129.2, 129.2, 127.4 (q, $J_{C–F}$ = 36.0 Hz), 126.9, 126.0, 122.0, 122.0 (q, $J_{C–F}$ = 273.9 Hz); ^{19}F NMR (470 MHz, $CDCl_3$) δ: –61.1; IR (neat): 3080, 1722, 1504, 1476, 1429, 1402, 1326, 1236, 1187, 1173, 1156, 1128, 905, 882, 825, 792, 747 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_9F_3N_2NaO_2^+$: $[M + Na]^+$ = 365.0508, found 365.0511.



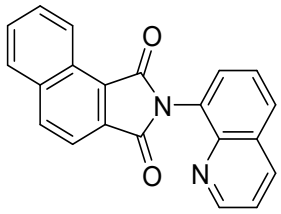
4-Phenyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3e):

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 225.4–226.4 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.84 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.17 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.99 (d, *J* = 6.9 Hz, 1H), 7.90 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.80 (t, *J* = 7.7 Hz, 1H), 7.75–7.69 (m, 2H), 7.65–7.58 (m, 3H), 7.46–7.35 (m, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.5, 167.4, 150.9, 144.2, 141.4, 136.2, 136.2, 136.2, 136.1, 134.0, 133.5, 130.2, 129.8, 129.5, 129.2, 128.5, 128.0, 127.7, 126.0, 122.7, 121.8; IR (neat): 3055, 3029, 1775, 1721, 1593, 1497, 1471, 1397, 1378, 1203, 1177, 1113, 1183, 915, 898, 879, 826, 795, 759, 742, 695 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{23}H_{15}N_2O_2^+$: $[M + H]^+$ = 351.1128, found 351.1135.



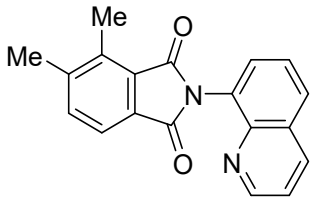
(*E*)-2-(Quinolin-8-yl)-4-styrylisoindoline-1,3-dione (3f):

The title compound was obtained as a white solid; purified by preparative TLC (EtOAc/hexane = 1/3); mp: 239.2–240.2 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.87 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.36 (d, *J* = 16.6 Hz, 1H), 8.23 (dd, *J* = 8.6, 1.7 Hz, 1H), 8.11 (d, *J* = 8.0 Hz, 1H), 7.97 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.87 (d, *J* = 6.9 Hz, 1H), 7.75 (t, *J* = 7.7 Hz, 2H), 7.68 (t, *J* = 7.7 Hz, 1H), 7.59 (d, *J* = 7.4 Hz, 2H), 7.44 (dd, *J* = 8.0, 4.0 Hz, 1H), 7.41–7.32 (m, 3H), 7.28 (t, *J* = 7.4 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.7, 167.7, 151.0, 144.4, 137.0, 136.5, 136.2, 133.9, 133.6, 133.2, 130.3, 130.0, 129.9, 129.6, 129.3, 128.7, 128.7, 127.2, 126.9, 126.1, 122.5, 122.3, 121.9; IR (neat): 3062, 2925, 1773, 1716, 1597, 1503, 1475, 1430, 1399, 1111, 967, 882, 825, 793, 758, 694, 626 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{25}H_{17}N_2O_2^+$: $[M + H]^+$ = 377.1285, found 377.1271.



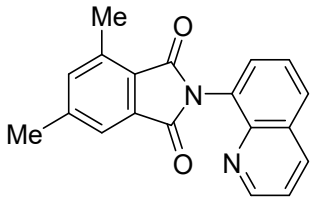
2-(Quinolin-8-yl)-1*H*-benzo[*e*]isoindole-1,3(2*H*)-dione (3g):

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 210.0–210.8 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 9.02 (d, *J* = 8.6 Hz, 1H), 8.85 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.24 (t, *J* = 8.3 Hz, 2H), 8.01 (d, *J* = 8.0 Hz, 2H), 7.97 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.81 (dd, *J* = 7.2, 1.4 Hz, 1H), 7.76–7.66 (m, 3H), 7.44 (dd, *J* = 8.3, 4.2 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.2, 168.5, 150.9, 144.5, 136.7, 136.1, 135.1, 131.6, 130.4, 129.9, 129.5, 129.4, 129.3, 128.7, 128.7, 128.3, 127.6, 126.1, 125.2, 121.8, 118.9; IR (neat): 3065, 1771, 1595, 1502, 1474, 1428, 1395, 1379, 1363, 1157, 1111, 865, 836, 800, 765, 628 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{21}H_{13}N_2O_2^+$: $[M + H]^+$ = 325.0972, found 325.0980.



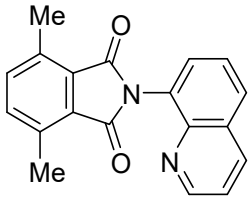
4,5-Dimethyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3h):

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 217.6–218.6 °C; ^1H NMR (500 MHz, $CDCl_3$) δ: 8.77 (dd, *J* = 4.6, 1.7 Hz, 1H), 8.12 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.86 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.74–7.71 (m, 2H), 7.57 (t, *J* = 7.7 Hz, 1H), 7.44 (d, *J* = 7.4 Hz, 1H), 7.33 (dd, *J* = 8.3, 4.3 Hz, 1H), 2.62 (s, 3H), 2.36 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.2, 167.9, 150.9, 145.1, 144.4, 137.6, 136.1, 134.7, 130.6, 130.3, 130.1, 129.4, 129.3, 129.1, 126.1, 121.8, 121.2, 20.0, 14.0; IR (neat): 3047, 3012, 2949, 2921, 1770, 1713, 1500, 1474, 1427, 1394, 1241, 1117, 797, 746, 624 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{19}H_{15}N_2O_2^+$: $[M + H]^+$ = 303.1128, found 303.1140.



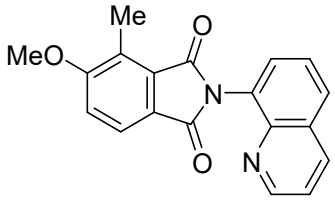
4,6-Dimethyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3i):

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 204.5–204.9 °C; ^1H NMR (500 MHz, $CDCl_3$) δ: 8.86 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.21 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.94 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.73 (dd, *J* = 7.4, 1.7 Hz, 1H), 7.66 (t, *J* = 7.7 Hz, 1H), 7.63 (s, 1H), 7.43 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.34 (s, 1H), 2.71 (s, 3H), 2.50 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.7, 168.2, 150.9, 144.8, 144.4, 138.3, 137.0, 136.1, 133.2, 130.3, 130.0, 129.4, 129.3, 126.6, 126.1, 122.1, 121.8, 21.8, 17.7; IR (neat): 3014, 2921, 1767, 1711, 1621, 1503, 1476, 1431, 1396, 1234, 1140, 1107, 878, 835, 802, 786, 751, 623 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{19}H_{15}N_2O_2^+$: $[M + H]^+$ = 303.1128, found 303.1124.



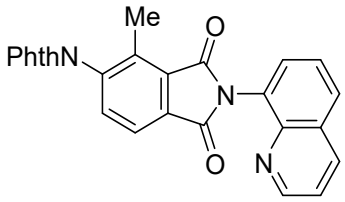
4,7-Dimethyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3j):

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 184.6–185.2 °C; ^1H NMR (500 MHz, $CDCl_3$) δ: 8.88 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.22 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.95 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.72 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.66 (t, *J* = 7.7 Hz, 1H), 7.43 (dd, *J* = 8.6, 4.3 Hz, 1H), 7.40 (s, 2H), 2.71 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.7, 151.0, 144.5, 136.3, 136.2, 135.9, 130.4, 130.1, 129.4, 129.3, 126.1, 121.8, 99.9, 17.5; IR (neat): 3010, 2925, 1766, 1711, 1595, 1503, 1476, 1403, 1381, 1232, 1117, 915, 835, 817, 788, 758, 626 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{19}H_{15}N_2O_2^+$: $[M + H]^+$ = 303.1128, found 303.1117.



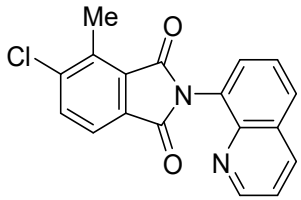
5-Methoxy-4-methyl-2-(quinolin-8-yl)isoindoline-1,3-dione (3k):

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 229.7–230.7 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.86 (dd, *J* = 4.6, 1.7 Hz, 1H), 8.19 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.93 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.80 (d, *J* = 8.6 Hz, 1H), 7.72 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.65 (t, *J* = 7.7 Hz, 1H), 7.41 (dd, *J* = 8.0, 4.0 Hz, 1H), 7.10 (d, *J* = 8.0 Hz, 1H), 3.95 (s, 3H), 2.62 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.6, 167.7, 163.0, 150.9, 144.4, 136.1, 130.6, 130.3, 130.1, 129.4, 129.2, 128.2, 126.1, 124.1, 123.0, 121.8, 113.5, 56.2, 10.6; IR (neat): 2946, 1770, 1715, 1607, 1502, 1488, 1428, 1397, 1380, 1274, 1245, 1120, 1042, 899, 793, 751, 625 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{19}H_{15}N_2O_3^+$: $[M + H]^+$ = 319.1077, found 319.1070.



3-(1,3-Dioxoisoindolin-2-yl)-2-methyl-*N*-(quinolin-8-yl)benzamide (3l):

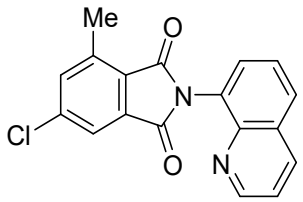
The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.88 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.21 (dd, *J* = 8.6, 1.7 Hz, 1H), 8.00–7.94 (m, 4H), 7.83 (dd, *J* = 5.2, 3.2 Hz, 2H), 7.75 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.67 (t, *J* = 7.7 Hz, 1H), 7.64 (d, *J* = 7.4 Hz, 1H), 7.44 (dd, *J* = 8.3, 4.3 Hz, 1H), 2.63 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.8, 166.9, 166.7, 166.6, 151.0, 144.2, 137.6, 137.0, 136.1, 134.7, 134.7, 134.6, 134.6, 133.3, 131.7, 130.7, 130.2, 129.6, 129.2, 126.0, 126.0, 124.1, 124.0, 122.0, 121.9, 13.3; IR (neat): 3069, 1779, 1717, 1597, 1501, 1475, 1405, 1379, 1119, 1085, 972, 818, 784, 718 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{26}H_{16}N_3O_4^+$: $[M + H]^+$ = 434.1135, found 434.1142.



3-Chloro-2-methyl-*N*-(quinolin-8-yl)benzamide (3m):

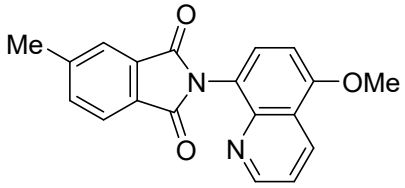
The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 194.9–195.9 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.86 (dd, *J* = 4.3, 1.4 Hz, 1H), 8.23 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.97 (dd, *J* = 8.3, 1.4

Hz, 1H), 7.79–7.72 (m, 3H), 7.67 (t, J = 7.7 Hz, 1H), 7.45 (dd, J = 8.3, 4.3 Hz, 1H), 2.81 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.9, 166.9, 151.0, 144.2, 141.9, 140.4, 137.1, 136.3, 134.3, 131.0, 130.3, 129.7, 129.6, 129.3, 126.2, 122.2, 121.9, 14.6; IR (neat): 3071, 2957, 2924, 1772, 1596, 1500, 1474, 1446, 1428, 1394, 1379, 1364, 1176, 1121, 953, 831, 793, 743, 721, 623 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{11}ClN_2NaO_2^+$: $[M + Na]^+$ = 345.0401, found 345.0405.



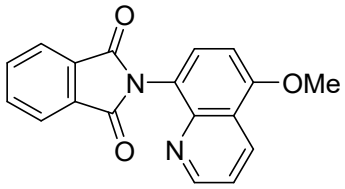
4-Chloro-2-methyl-*N*-(quinolin-8-yl)benzamide (3n):

The title compound was obtained as a colourless solid; purified by flash column chromatography (EtOAc/hexane = 1/4); mp: 230.2–231.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.85 (dd, J = 4.0, 1.7 Hz, 1H), 8.22 (dd, J = 8.3, 1.4 Hz, 1H), 7.96 (dd, J = 8.3, 1.4 Hz, 1H), 7.80 (d, J = 1.7 Hz, 1H), 7.73 (dd, J = 7.4, 1.7 Hz, 1H), 7.67 (t, J = 7.7 Hz, 1H), 7.54 (d, J = 1.1 Hz, 1H), 7.44 (dd, J = 8.3, 4.4 Hz, 1H), 2.74 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.8, 166.7, 151.0, 144.2, 140.1, 140.1, 136.2, 136.1, 134.4, 130.2, 129.7, 129.6, 129.3, 127.4, 126.1, 121.9, 121.9, 17.7; IR (neat): 3080, 3009, 2926, 1772, 1719, 1595, 1499, 1473, 1427, 1403, 1362, 1250, 1114, 897, 879, 829, 803, 768, 744, 661, 624 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{12}ClN_2O_2^+$: $[M + H]^+$ = 323.0582, found 323.0577.



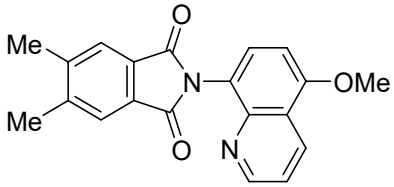
***N*-(5-Methoxyquinolin-8-yl)-3-methylbenzamide (3o):**

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 232.2–233.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.82 (dd, J = 4.0, 1.7 Hz, 1H), 8.59 (dd, J = 8.6, 1.7 Hz, 1H), 7.85 (d, J = 7.4 Hz, 1H), 7.78 (s, 1H), 7.64 (d, J = 8.0 Hz, 1H), 7.57 (d, J = 8.0 Hz, 1H), 7.39 (dd, J = 8.6, 4.0 Hz, 1H), 6.94 (d, J = 8.0 Hz, 1H), 4.03 (s, 3H), 2.54 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.5, 168.4, 156.2, 151.1, 145.3, 144.8, 134.6, 132.8, 131.0, 130.4, 129.8, 124.2, 123.6, 122.1, 121.6, 120.9, 103.7, 55.9, 22.0; IR (neat): 2933, 1776, 1723, 1621, 1592, 1505, 1485, 1415, 1391, 1306, 1270, 1227, 1156, 1132, 1111, 805, 742; HRMS (ESI-TOF): calcd for $C_{19}H_{15}N_2O_3^+$: $[M + H]^+$ = 319.1077, found 319.1065.



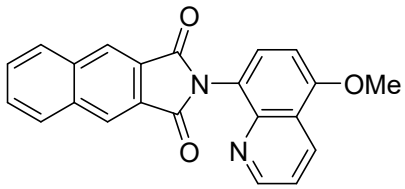
***N*-(5-Methoxyquinolin-8-yl)benzamide (3p):**

The title compound was obtained as a yellow solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 239.1–240.0 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.83 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.61 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.98 (dd, *J* = 5.7, 2.9 Hz, 2H), 7.79 (dd, *J* = 5.4, 3.2 Hz, 2H), 7.65 (d, *J* = 8.0 Hz, 1H), 7.40 (dd, *J* = 8.6, 4.0 Hz, 1H), 6.96 (d, *J* = 8.0 Hz, 1H), 4.05 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.3, 156.3, 151.1, 144.8, 134.1, 132.4, 131.1, 130.4, 123.7, 122.0, 121.6, 120.9, 103.7, 56.0; IR (neat): 2956, 2926, 1779, 1760, 1727, 1619, 1591, 1484, 1413, 1389, 1304, 1269, 1218, 1111, 1090, 814, 788, 720 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{18}H_{13}N_2O_3^+$: $[M + H]^+$ = 305.0921, found 305.0906.



***N*-(5-Methoxyquinolin-8-yl)-3,4-dimethylbenzamide (3q):**

The title compound was obtained as a white solid; purified by preparative TLC (THF/$CHCl_3$ = 1/50); mp: 247.6–248.1 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.83 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.59 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.64–7.60 (m, 2H), 7.39 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.32 (s, 1H), 6.94 (d, *J* = 8.0 Hz, 1H), 4.03 (s, 3H), 2.69 (s, 3H), 2.48 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.1, 168.6, 156.1, 151.1, 144.9, 144.7, 138.1, 136.9, 133.2, 131.0, 130.4, 126.6, 122.3, 122.0, 121.6, 120.8, 103.7, 55.9, 21.8, 17.6; IR (neat): 3080, 3001, 2961, 2933, 2853, 1770, 1717, 1620, 1591, 1480, 1410, 1389, 1305, 1266, 1213, 1112, 1092, 808, 752 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{20}H_{17}N_2O_3^+$: $[M + H]^+$ = 333.1234, found 333.1224.



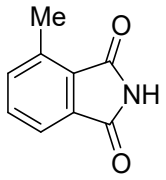
***N*-(5-Methoxyquinolin-8-yl)-2-naphthamide (3r):**

The title compound was obtained as a white solid; purified by preparative TLC (dichloromethane); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.83 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.62 (dd, *J* = 8.0, 1.7 Hz, 1H), 8.49 (s, 2H), 8.11 (dd, *J* = 6.3, 3.4 Hz, 2H), 7.74–7.69 (m, 3H), 7.41 (dd, *J* = 8.6, 4.0 Hz, 1H), 6.99 (d, *J* = 8.0 Hz, 1H), 4.07 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.1,

156.3, 151.2, 144.8, 135.7, 131.1, 130.3, 130.3, 129.1, 128.2, 125.2, 122.3, 121.7, 121.0, 103.7, 56.0; IR (neat): 3017, 2935, 1770, 1715, 1591, 1481, 1454, 1407, 1384, 1305, 1267, 1218, 1125, 1090, 798, 767 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{22}H_{15}N_2O_3^+$: $[M + H]^+$ = 355.1077, found 355.1093.

4. Deprotection of 8-Aminoquinolyl Directing Group

To an oven-dried test tube equipped with a stirring bar charged with phthalimide **3a** (1st run: 57.6 mg, 0.200 mmol; 2nd run: 57.7 mg, 0.200 mmol) was added NH_3 in MeOH (2.0 mL). The reaction mixture was stirred at 80 °C for 18 h. After cooling to room temperature, the solvent was evaporated *in vacuo*, and the residue was purified by preparative thin-layer chromatography (EtOAc/hexane = 1/5) to give the product **5** (1st run: 25.8 mg, 0.175 mmol, 87%; 2nd run: 25.3 mg, 0.172 mmol, 86%) and 8-aminoquinoline (1st run: 22.0 mg, 0.153 mmol, 76%; 2nd run: 23.0 mg, 0.160 mmol, 80%).



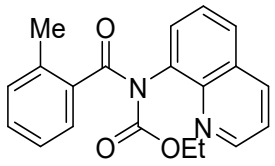
4-Methylisoindoline-1,3-dione (5):

The title compound was obtained as a white solid; mp: 188.1–189.0 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.05 (s, 1H), 7.69 (d, J = 7.4 Hz, 1H), 7.61 (t, J = 7.4 Hz, 1H), 7.50 (d, J = 8.0 Hz, 1H), 2.70 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.0, 168.2, 138.4, 136.6, 133.9, 133.1, 129.3, 121.2, 17.6; IR (neat): 3216, 3062, 1770, 1731, 1615, 1473, 1375, 1303, 1234, 1063, 807, 739, 654, 544 cm^{-1}; HRMS (ESI-TOF): calcd for $C_9H_8NO_2^+$: $[M + H]^+$ = 162.0550, found 162.0555.

5. Preliminary Mechanistic Investigations

A. Reaction without $Rh(acac)(CO)_2$

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (52.5 mg, 0.200 mmol) was added NMP (0.4 mL). Subsequently, diethyl dicarbonate (**2**, 48.8 mg, 0.301 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo,* and the residue was purified by preparative thin-layer chromatography (EtOAc/hexane= 1/1) to give the product **6** (18.4mg, 5.50×10^{-2} mmol, 27%).



Ethyl (2-methylbenzoyl)(quinolin-8-yl)carbamate (6):

The title compound was obtained as a white solid; mp: 104.7–105.2 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.92 (dd, *J* = 4.0, 1.7 Hz, 1H), 8.18 (dd, *J* = 8.6, 1.7 Hz, 1H) 7.86 (dd, *J* = 8.3, 1.4 Hz, 1H), 7.79 (d, *J* = 7.4 Hz, 1H), 7.70 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.59 (t, *J* = 7.7 Hz, 1H), 7.42 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.32 (td, *J* = 7.4, 1.1 Hz, 1H), 7.26–7.20 (m, 2H), 4.00 (q, *J* = 7.3 Hz, 2H), 2.56 (s, 3H), 0.86 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 172.9, 154.4, 150.5, 144.0, 137.4, 136.1, 136.1, 135.9, 130.4, 129.7, 129.1, 128.5, 126.8, 126.1, 125.2, 121.7, 121.7, 62.9, 19.6, 13.5; IR (neat): 3367, 3044, 2926, 1683, 1598, 1578, 1540, 1487, 1428, 1392, 1331, 1264, 1107, 901, 824, 793, 746, 667, 606 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{20}H_{19}N_2O_3^+$: $[M + H]^+$ = 335.1390, found 335.1403.

B. Reaction with *N*-(Ethoxycarbonyl)benzamide 6

To an oven-dried test tube equipped with a stirring bar charged with *N*-(ethoxycarbonyl)benzamide **6** (33.6 mg, 0.100 mmol), and $Rh(acac)(CO)_2$ (2.5 mg, 1.0×10^{-2} mmol) was added NMP (0.2 mL). The tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*.

C. Reaction under CO Atmosphere

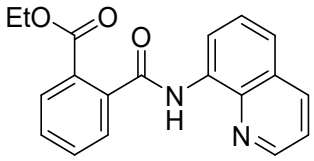
To an oven-dried test tube equipped with a stirring bar was added benzamide **1a** (52.5 mg, 0.200 mmol), and $Rh(acac)(CO)_2$ (5.2 mg, 2.0×10^{-2} mmol). The tube was evacuated again and backfilled with CO (1 atm, balloon), followed by addition of NMP (0.4 mL). The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*.

D. Reaction with *o*-(Ethoxycarbonyl)benzamide 6 in the Presence of Rh(acac)(CO)$_2$

To an oven-dried test tube equipped with a stirring bar charged with benzamide **7** (64.1 mg, 0.200 mmol), and Rh(acac)(CO)$_2$ (5.2 mg, 2.0×10^{-2} mmol) was added NMP (0.4 mL). The tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the yield of **3s** was determined by ^{1}H NMR using 1,1,2,2-tetrachloroethane as an internal standard.

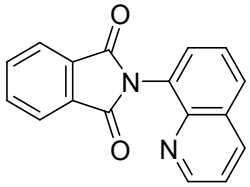
Reaction with *o*-(Ethoxycarbonyl)benzamide 6 in the Absence of Rh(acac)(CO)$_2$

To an oven-dried test tube equipped with a stirring bar charged with benzamide **7** (64.1 mg, 0.200 mmol), and NMP (0.4 mL). The tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the yield of **3s** was determined by ^{1}H NMR using 1,1,2,2-tetrachloroethane as an internal standard.



Ethyl 2-(quinolin-8-ylcarbamoyl)benzoate (7):

The title compound was obtained as a white solid; mp: 95.0–95.5 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 10.08 (s, 1H), 8.94 (d, J = 7.4 Hz, 1H), 8.75 (dd, J = 4.0, 1.7 Hz, 1H), 8.17 (dd, J = 8.0, 1.7 Hz, 1H), 8.01 (dd, J = 7.7, 1.4 Hz, 1H), 7.69 (dd, J = 7.4, 1.1 Hz, 1H), 7.66–7.53 (m, 4H), 7.44 (dd, J = 8.0, 4.0 Hz, 1H), 4.26 (q, J = 7.1 Hz, 2H), 1.14 (t, J = 7.2 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.5, 166.6, 148.2, 138.6, 138.4, 136.3, 134.7, 132.1, 130.3, 129.8, 129.5, 127.9, 127.5, 127.4, 121.8, 121.6, 116.7, 61.5, 13.8; IR (neat): 3340, 2985, 1715, 1677, 1594, 1578, 1526, 1482, 1426, 1389, 1325, 1285, 1137, 1089, 1072, 781, 763, 742 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{19}H_{16}N_2NaO_3^+$: $[M + Na]^+$ = 343.1053, found 343.1046.



2-(Quinolin-8-yl)isoindoline-1,3-dione (3s):

The title compound was obtained as a white solid; mp: 222.6–223.0 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.85 (dd, J = 4.6, 1.7 Hz, 1H), 8.22 (dd, J = 8.6, 1.7 Hz, 1H), 8.00 (dd, J = 5.4, 3.2 Hz, 2H), 7.96 (dd, J = 8.3, 1.4 Hz, 1H), 7.80 (dd, J =

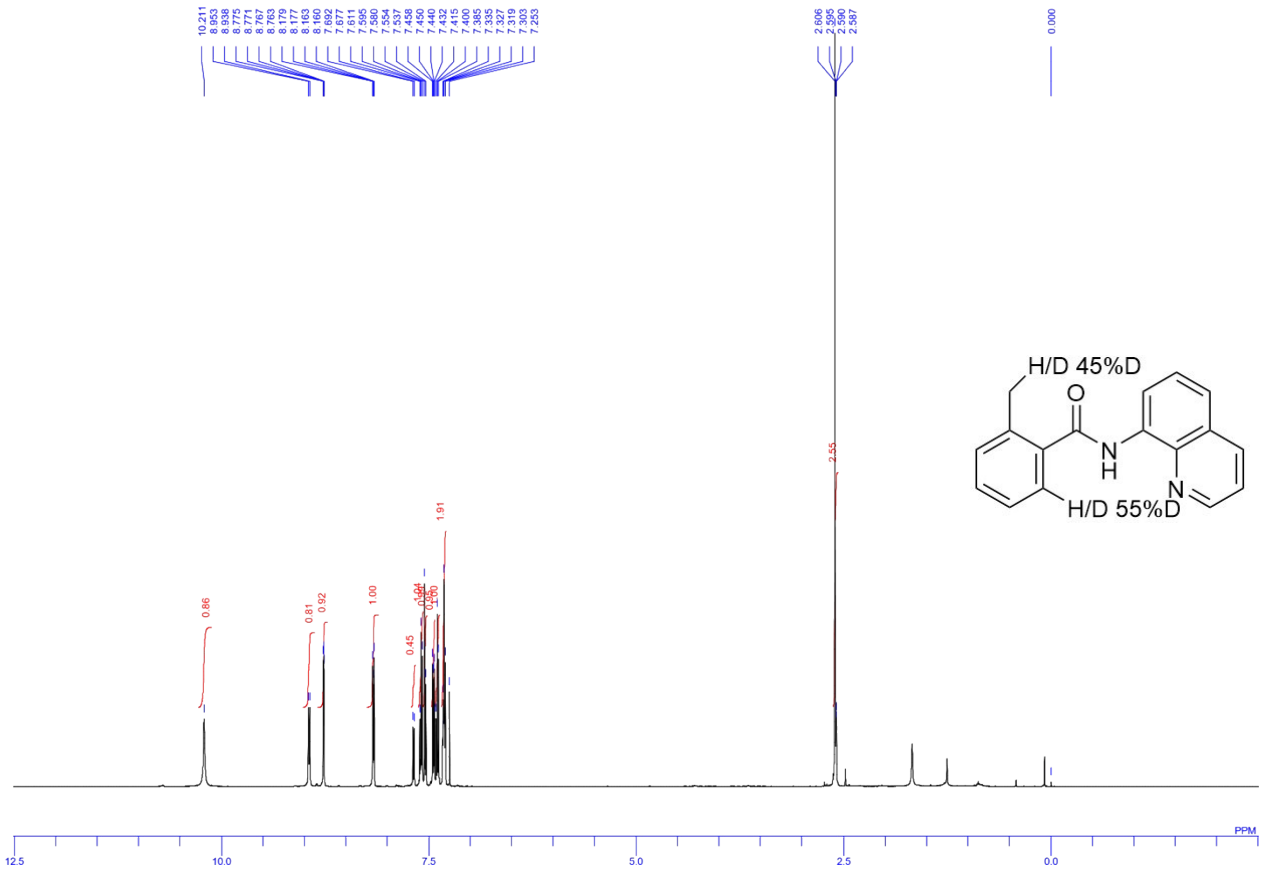
5.4, 3.2 Hz, 2H), 7.75 (dd, J = 7.4, 1.1 Hz, 1H), 7.67 (t, J = 7.7 Hz, 1H), 7.43 (dd, J = 8.3, 4.3 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 167.9, 150.8, 144.2, 136.1, 134.1, 132.3, 130.1, 129.7, 129.6, 129.2, 126.0, 123.7, 121.8; IR (neat): 3064, 3041, 1760, 1712, 1596, 1502, 1469, 1401, 1116, 1085, 884, 825, 791, 719, 625 cm^{-1}; HRMS (ESI-TOF): calcd for $C_{17}H_{10}N_2NaO_2^+$: $[M + Na]^+$ = 297.0634, found 297.0622.

E. Reaction In a Short Period of Time

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (52.5 mg, 0.200 mmol) and $Rh(acac)(CO)_2$ (5.2 mg, 2.0×10^{-2} mmol) was added NMP (0.4 mL). Subsequently, diethyl dicarbonate (**2**, 48.5 mg, 0.299 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 1 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo,* and the residue was purified by preparative thin-layer chromatography (EtOAc/hexane = 1/9) to give the product **3a** (28.0 mg, 0.971 mmol, 48%) and **4** (1.6 mg, 4.8×10^{-3} mmol, 2%).

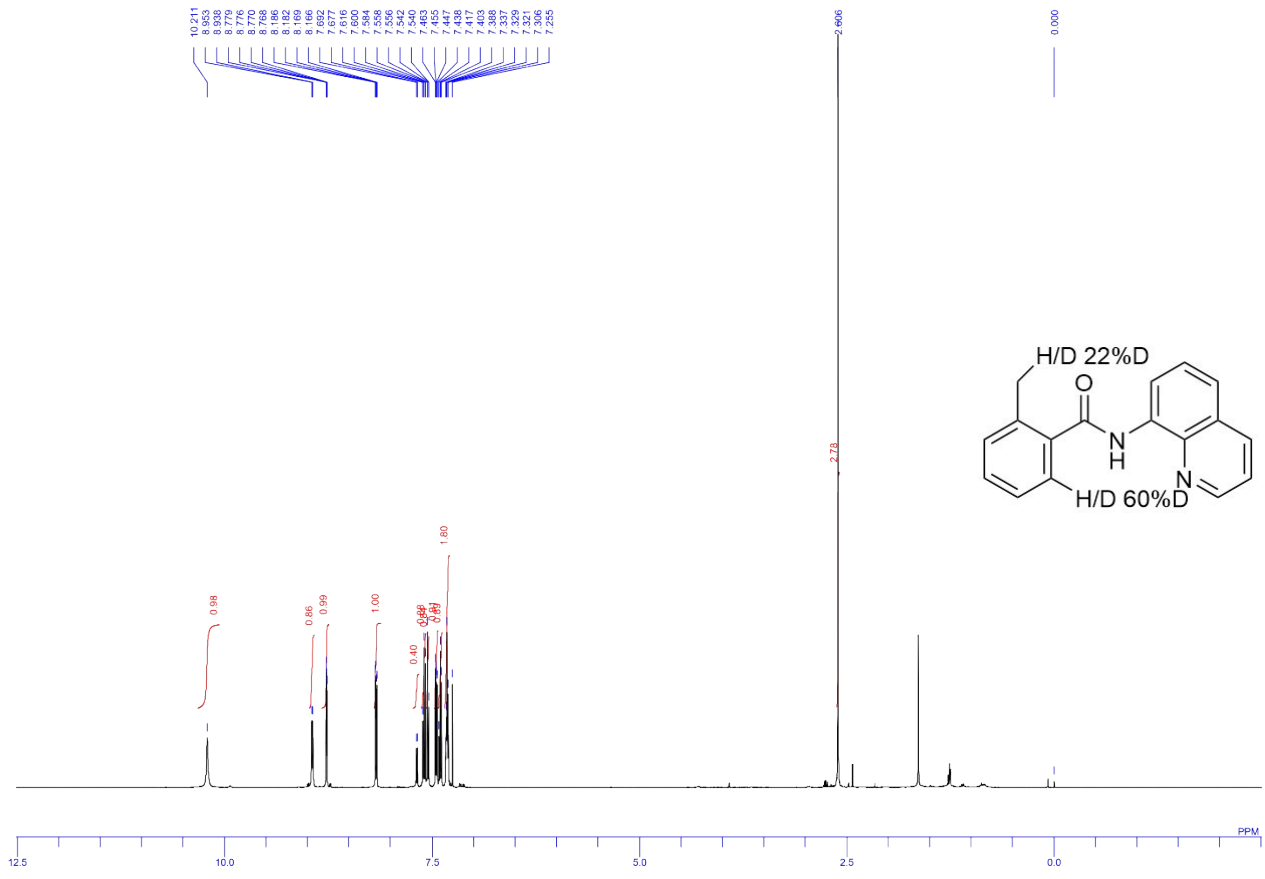
F. Deuterium Labelling Experiment without Diethyl Dicarbonate

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (52.5 mg, 0.200 mmol) and Rh(acac)$(CO)_2$ (5.2 mg, 2.0×10^{-2} mmol) was added NMP (0.4 mL). Subsequently, EtOD (46.1 mg, 0.979 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the residue was purified by preparative thin-layer chromatography ($CHCl_3$/hexane = 9/1) to give the product **1a**-d_1 (47.7 mg, 0.182 mmol, 91%).



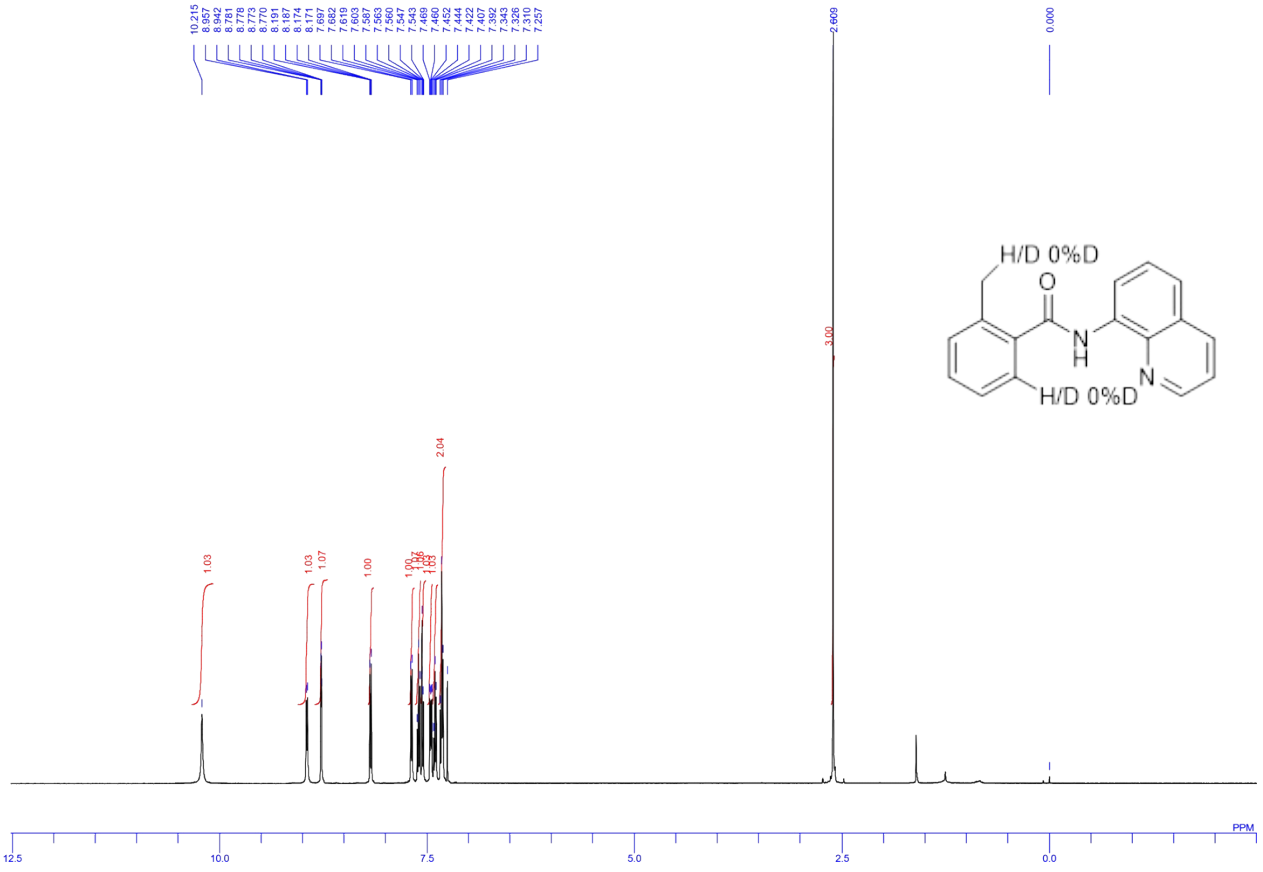
Deuterium Labelling Experiment with Diethyl Dicarbonate

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (52.5 mg, 0.200 mmol) and Rh(acac)$(CO)_2$ (5.2 mg, 2.0×10^{-2} mmol) was added NMP (0.4 mL). Subsequently, diethyl dicarbonate (**2**, 49.6 mg, 0.306 mmol) and EtOD (46.2 mg, 0.981 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 1 h. After cooling to room temperature, the resulting mixture was added EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the residue was purified by preparative thin-layer chromatography (THF/toluene = 1/4) to give the product **1a**-d_1 (34.6 mg, 0.132 mmol, 60%). The yield of **3a** was determined by ^{1}H NMR using 1,1,2,2-tetrachloroethane as an internal standard.



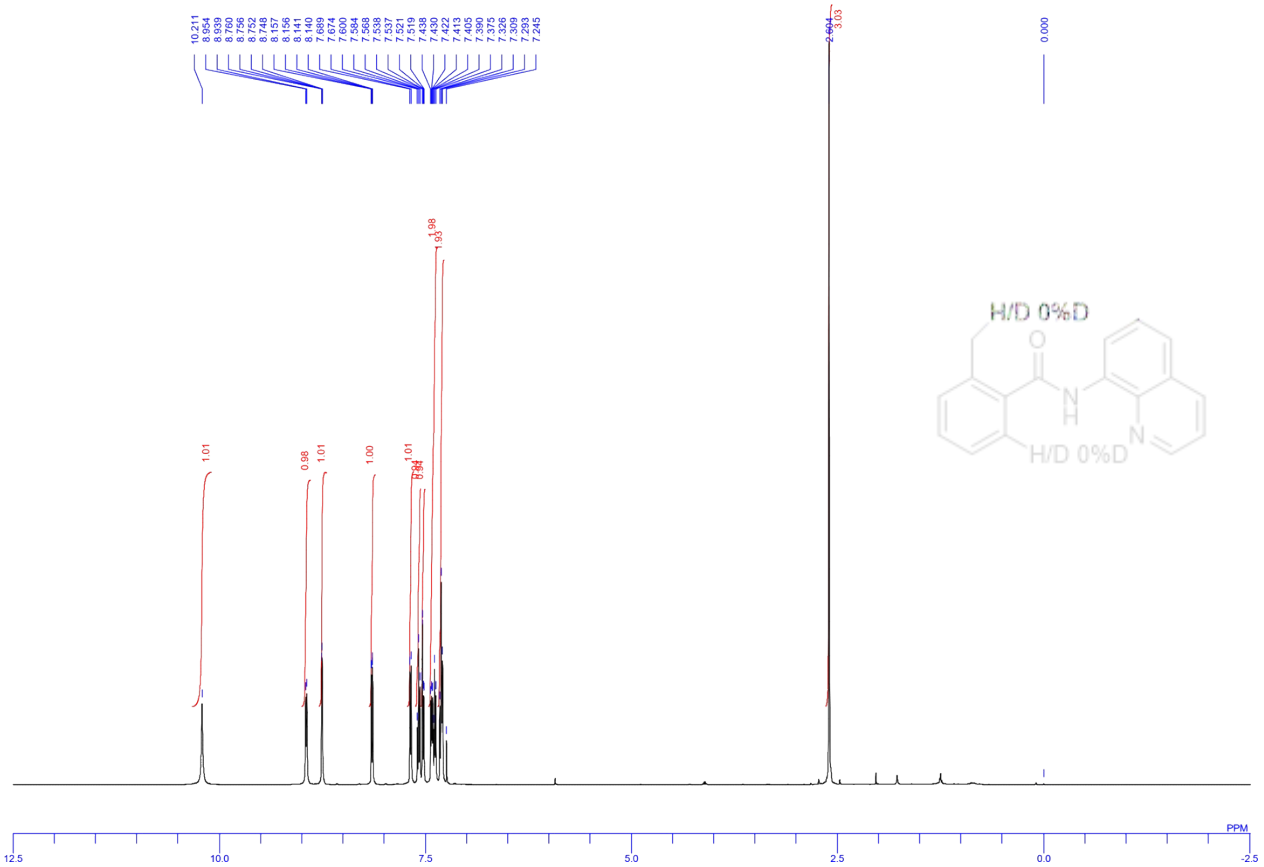
Deuterium Labelling Experiment without $Rh(acac)(CO)_2$

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (52.5 mg, 0.200 mmol) and was added NMP (0.4 mL). Subsequently, diethyl dicarbonate (**2**, 49.0 mg, 0.302 mmol) and EtOD (46.7 mg, 0.992 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 1 h. After cooling to room temperature, the resulting mixture was added EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the residue was purified by preparative thin-layer chromatography (THF/toluene = 1/4) to give the product **1a** (46.9 mg, 0.179 mmol, 90%).



Deuterium Labelling Experiment without Diethyl Dicarbonate and Rh(acac)$(CO)_2$

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (52.6 mg, 0.201 mmol) and was added NMP (0.4 mL). Subsequently, EtOD (46.8 mg, 0.994 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was added EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the residue was purified by preparative thin-layer chromatography (THF/toluene = 1/4) to give the product **1a** (52.6 mg, 0.201 mmol, quant).



G. Kinetic Isotope Effect Experiment

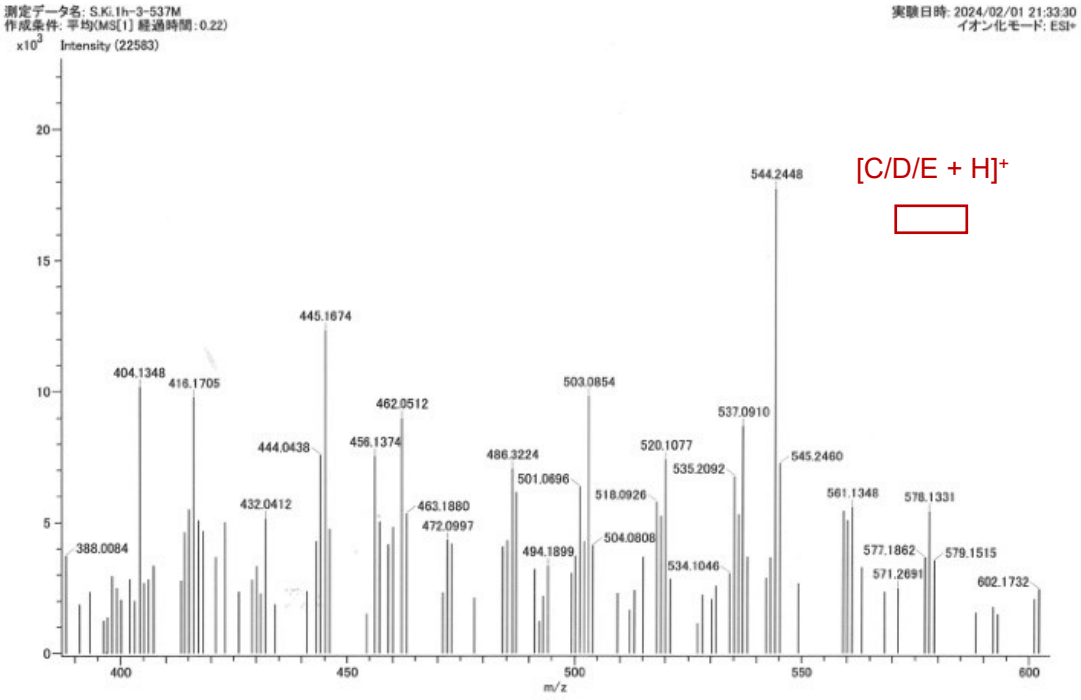
Kinetic isotope effect (KIE) was measured by two sets of parallel experiments using benzamide **1a** and **1a**-d_1. To an oven-dried test tube equipped with a stirring bar were added benzamide **1a** (26.1 mg, 0.995 mmol), Rh(acac)$(CO)_2$ (2.6 mg, 1.0×10^{-2} mmol), and NMP (0.2 mL). Subsequently, diethyl dicarbonate (**2**, 25.4 mg, 0.157 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. To another oven-dried test tube equipped with a stirring bar were added benzamide **1a**-d_1 (26.1 mg, 0.995 mmol), Rh(acac)$(CO)_2$ (2.6 mg, 1.0×10^{-2} mmol), and NMP (0.20 mL). Subsequently, diethyl dicarbonate (**2**, 25.2 mg, 0.155 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. Both reactions were allowed to stir at 130 °C in an oil bath for 2 h. After cooling to room temperature, the resulting mixtures were diluted with EtOAc, respectively. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4. The filtrate was concentrated *in vacuo*, and the yield of **3a** was determined by ^{1}H NMR using 1,1,2,2-tetrachloroethane as an internal standard. The yields were 51.9% and 42.4%, respectively, and a KIE value of 1.2 was determined on the basis of the ^{1}H NMR yields.

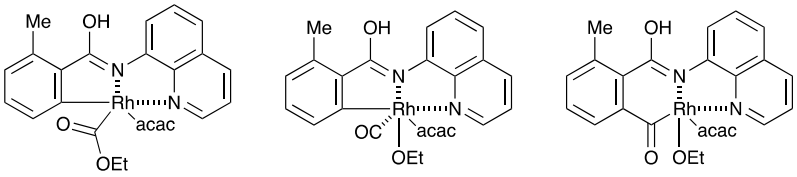
H. Reaction with Diethyl Carbonate 8

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (52.6 mg, 0.201 mmol), and $Rh(acac)(CO)_2$ (5.2 mg, 2.0×10^{-2} mmol) was added NMP (0.4 mL). Subsequently, diethyl carbonate (**8**, 35.9 mg, 0.304 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 18 h. After cooling to room temperature, the resulting mixture was diluted with EtOAc. The organic layers were washed with water and brine and dried over anhydrous Na_2SO_4.

I. Detection of Intermediates C/D/E by ESI-MS Analysis

To an oven-dried test tube equipped with a stirring bar charged with benzamide **1a** (26.5 mg, 0.101 mmol) and Rh(acac)$(CO)_2$ (2.5 mg, 9.7×10^{-3} mmol) was added NMP (0.2 mL). Subsequently, diethyl dicarbonate (**2**, 25.0 mg, 0.154 mmol) was injected to the solution via a syringe, and the tube was sealed with a PTFE-lined screw cap. The reaction mixture was stirred at 130 °C for 1 h. After cooling to room temperature, the resulting mixture was diluted with acetonitrile and subsequently analysed by ESI-MS.





HRMS (ESI-TOF): calcd for $C_{24}H_{24}N_2O_5Rh^+$: $[M + H]^+$ = 537.0891, found 537.0910.

6. References

1. Laverny, A.; Cramer, N. *Organometallics* **2020***, 39,* 4444–4456.
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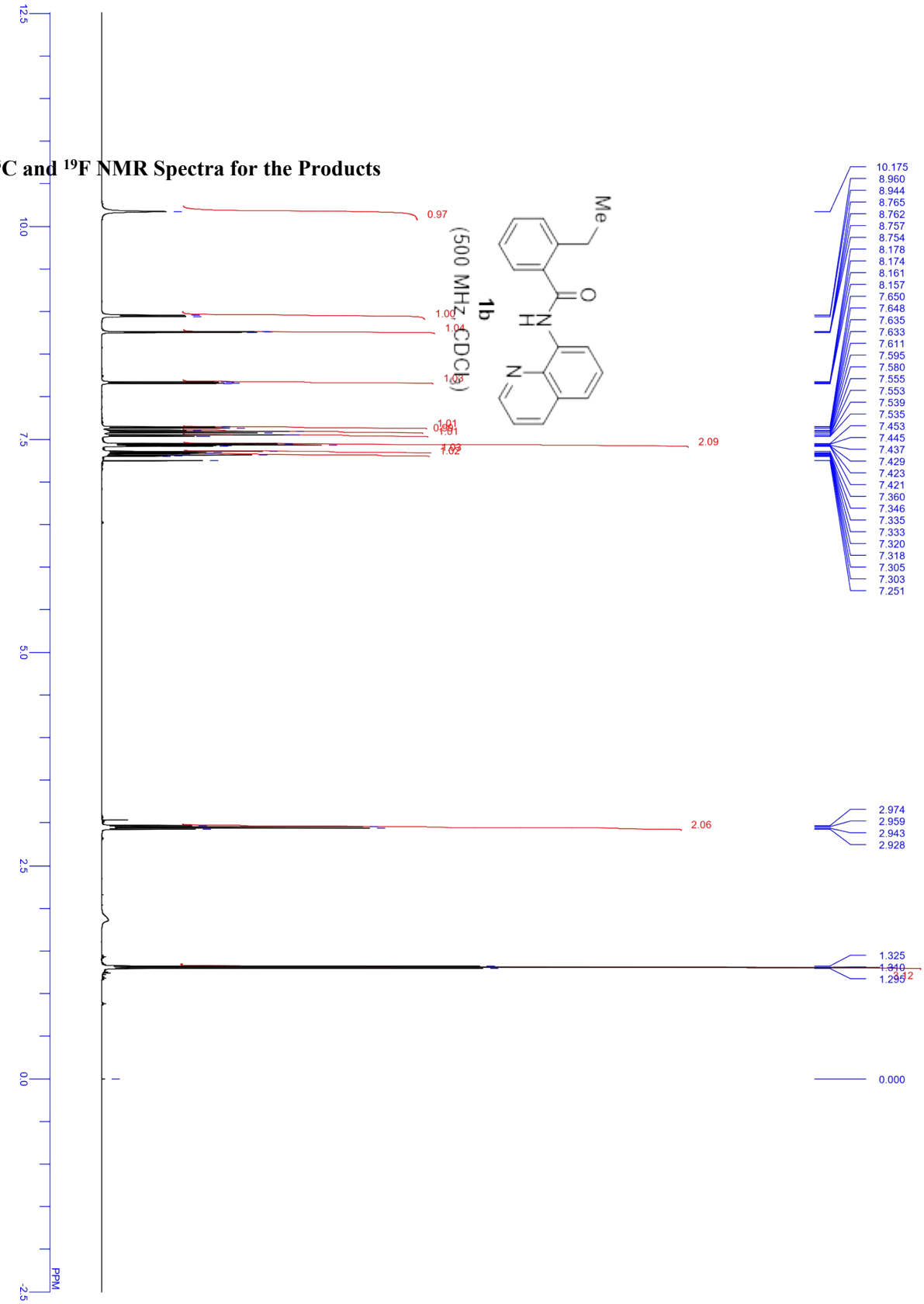
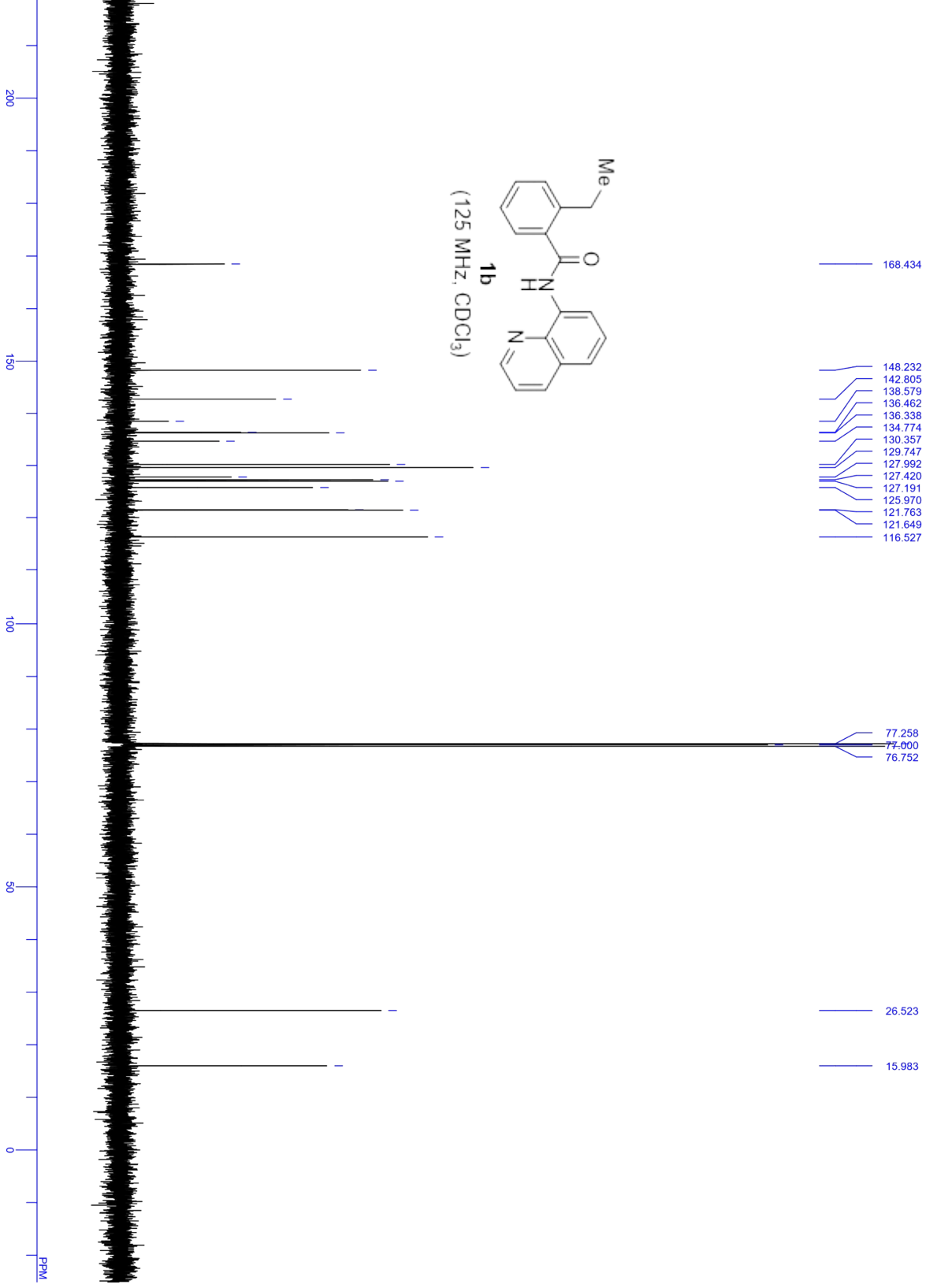
7. Verho, O.; Lati, M. P.; Oschmann, M. *J. Org. Chem.* **2018**, *83*, 4464–4476.
8. Grigorjeva, L.; Daugulis, O. *Org. Lett.* **2014**, *16*, 4688–4690.

7. Copies of ^{1}H, ^{13}C and ^{19}F NMR Spectra for the Products

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N
N
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138.579
136.462
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134.774
130.357
129.747
127.992
127.420
127.191
125.970
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116.527
77.258
77.000
76.752
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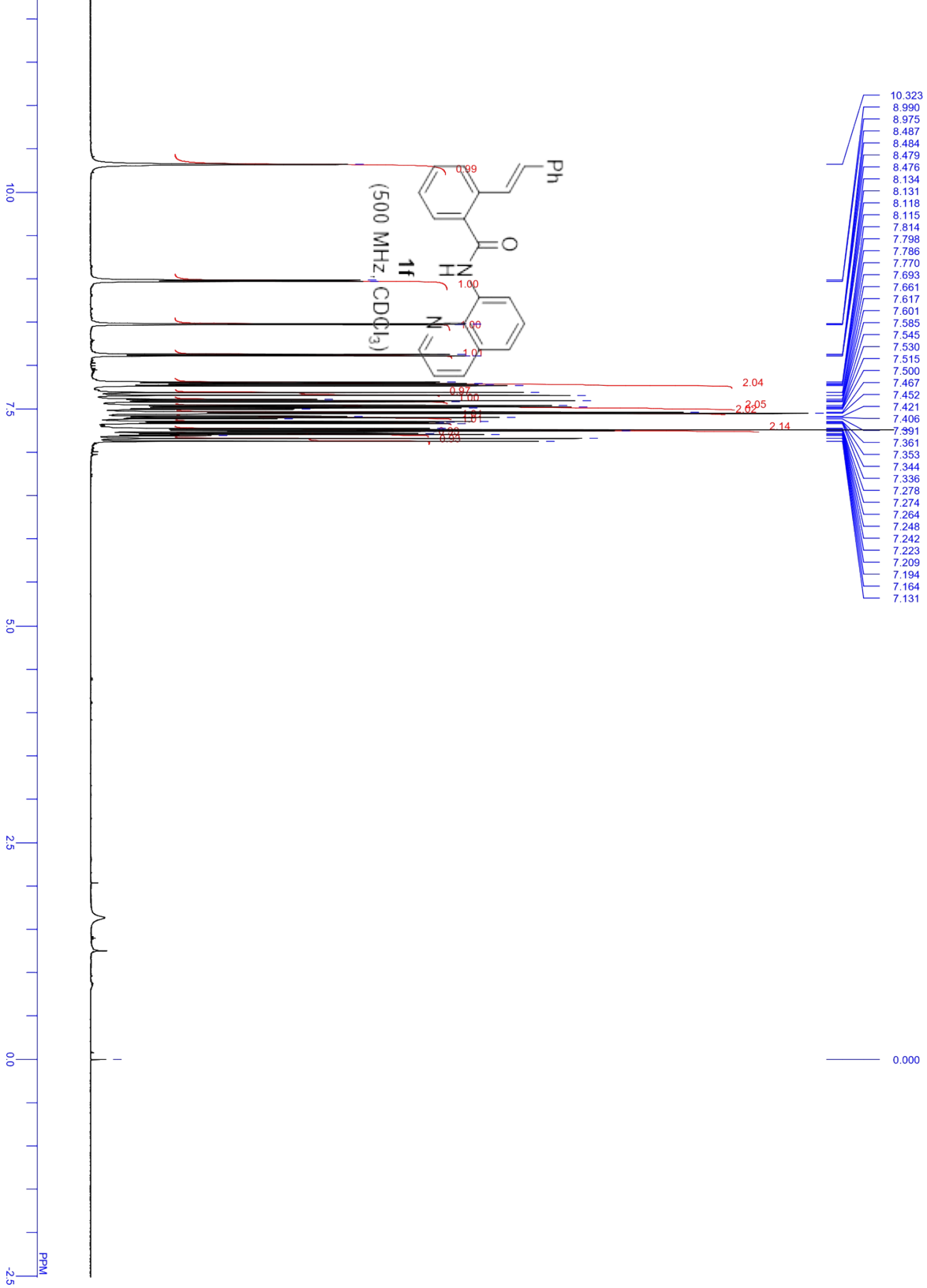
200
150
100
50
0
PPM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Ph
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N
H
N
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1.00
1.00
2.04
2.05
2.02
2.14
10.323
8.990
8.975
8.487
8.484
8.479
8.476
8.134
8.131
8.118
8.115
7.814
7.798
7.786
7.770
7.693
7.661
7.617
7.601
7.585
7.545
7.530
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7.500
7.467
7.452
7.421
7.406
7.391
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7.353
7.344
7.336
7.278
7.274
7.264
7.248
7.242
7.223
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5.0
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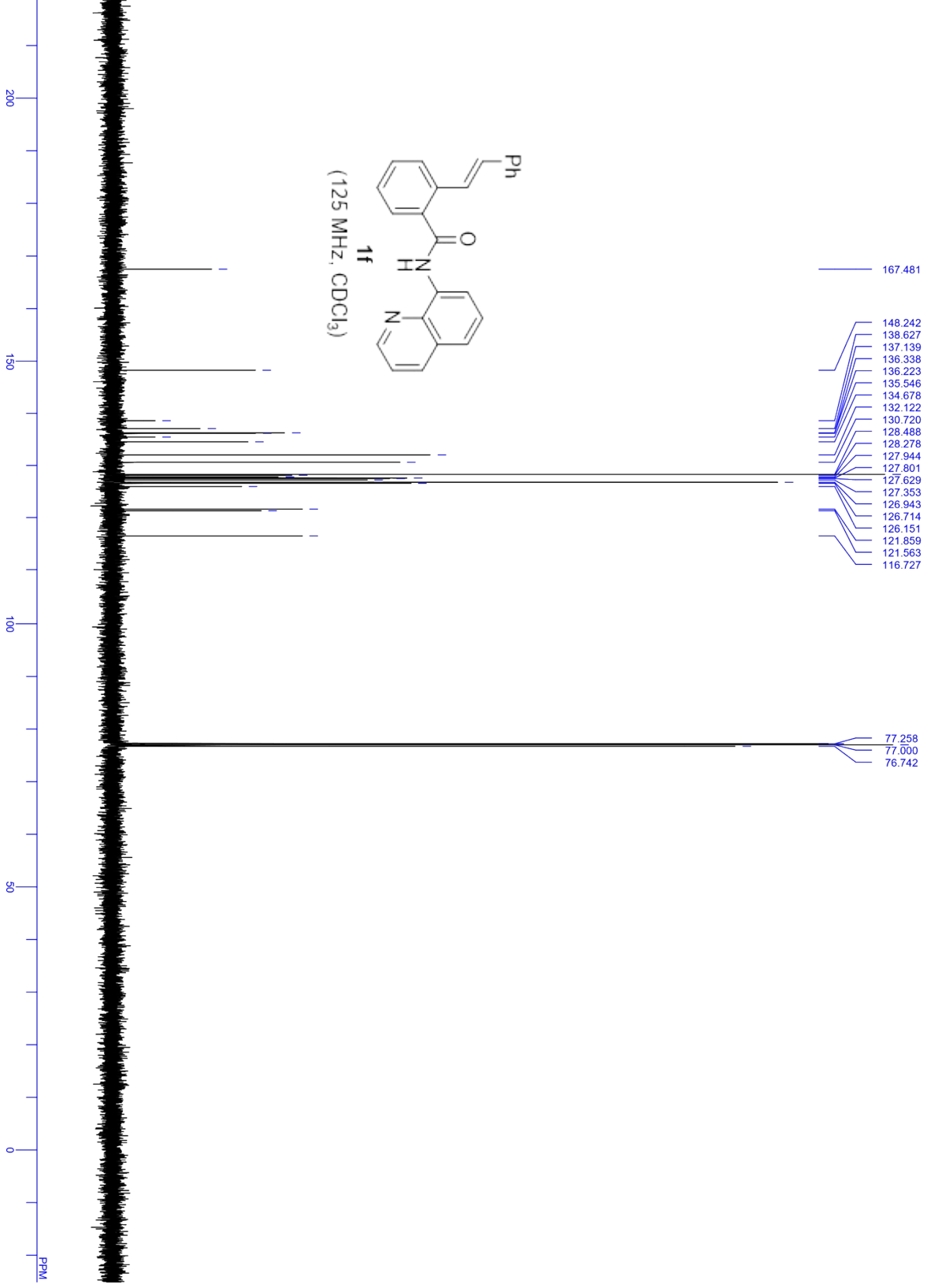
0.0
-2.5
PPM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N
N
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135.546
134.678
132.122
130.720
128.488
128.278
127.944
127.801
127.629
127.353
126.943
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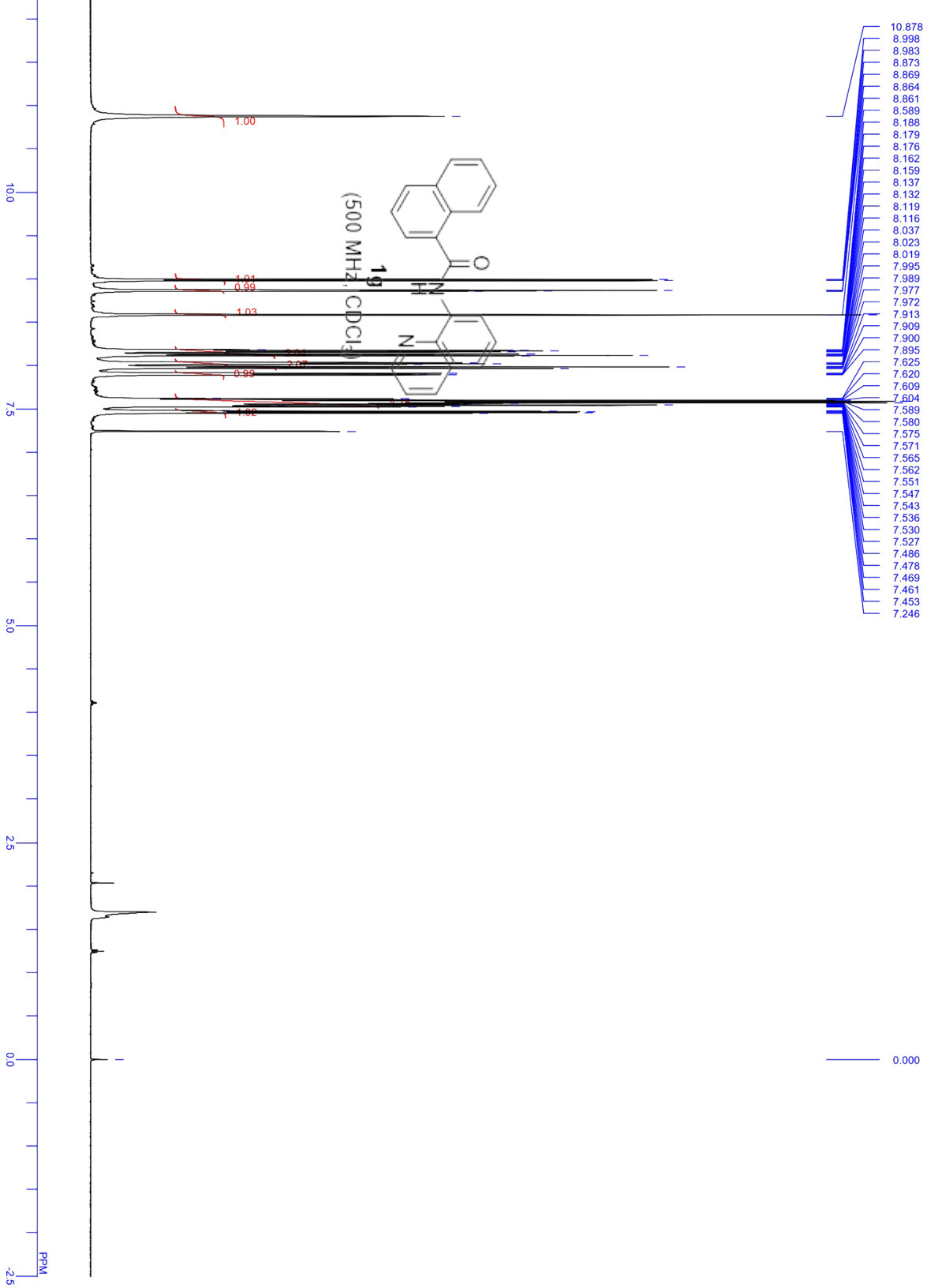
100
50
0
PPM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8.873
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8.589
8.188
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8.176
8.162
8.159
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8.132
8.119
8.116
8.037
8.023
8.019
7.995
7.989
7.977
7.972
7.913
7.909
7.900
7.895
7.625
7.620
7.609
7.604
7.589
7.580
7.575
7.571
7.565
7.562
7.551
7.547
7.543
7.536
7.530
7.527
7.486
7.478
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5.0
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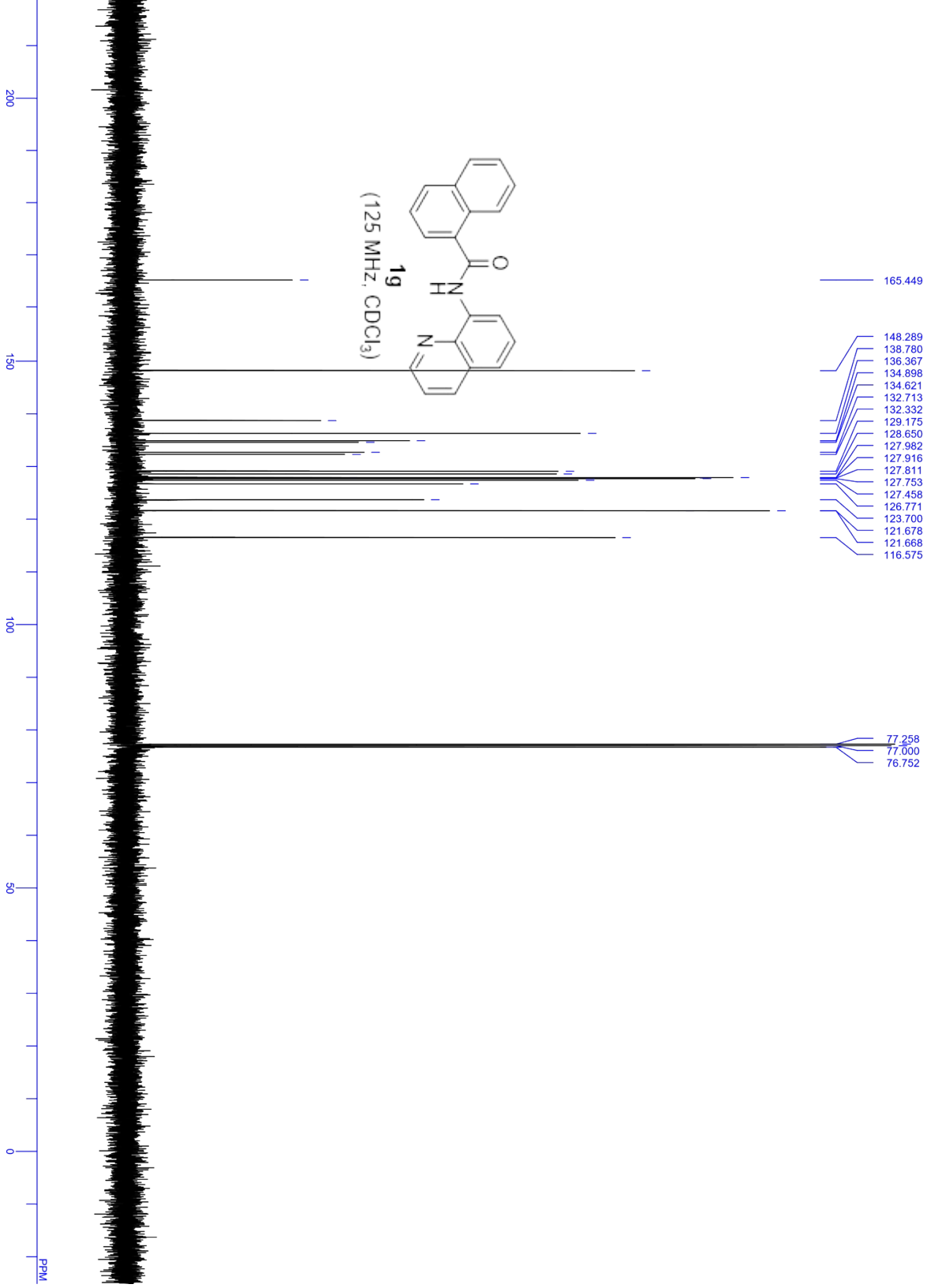
PPM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N
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128.650
127.982
127.916
127.811
127.753
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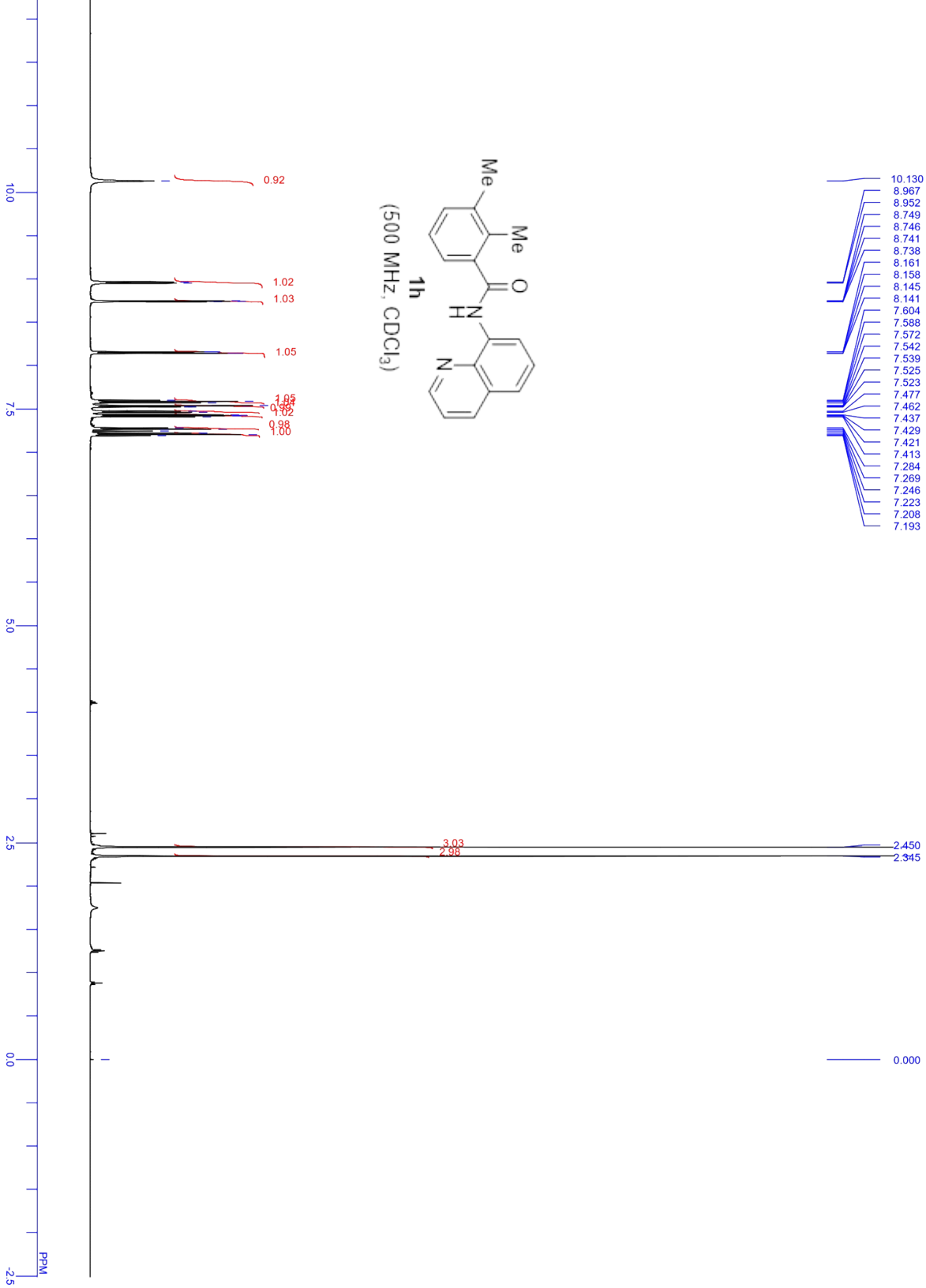
100
50
0
PPM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H
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1.02
0.98
1.00
3.03
2.98
10.130
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8.952
8.749
8.746
8.741
8.738
8.161
8.158
8.145
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7.588
7.572
7.542
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7.523
7.477
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7.413
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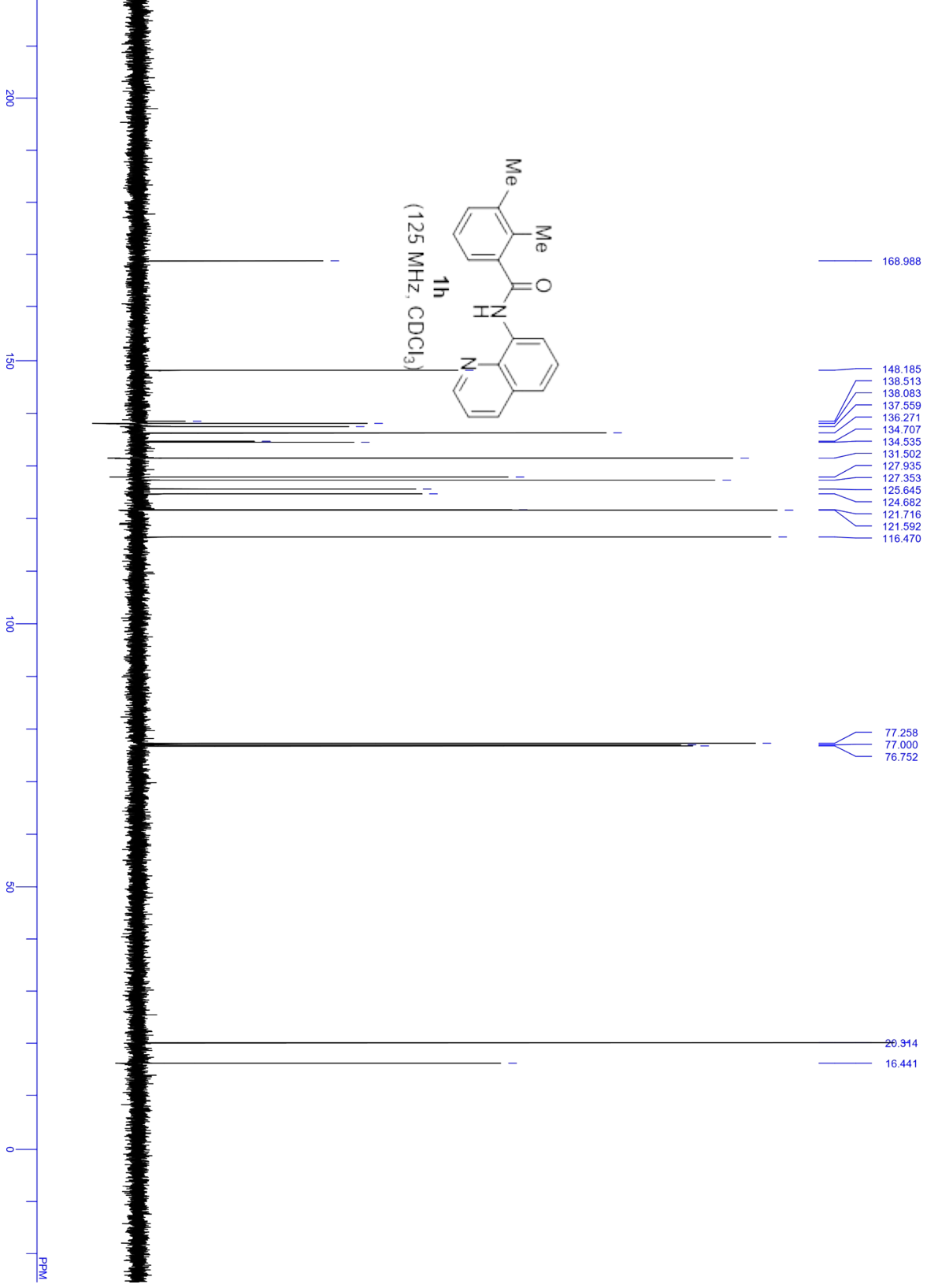
PPM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(125 MHz, CDCl3)
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134.535
131.502
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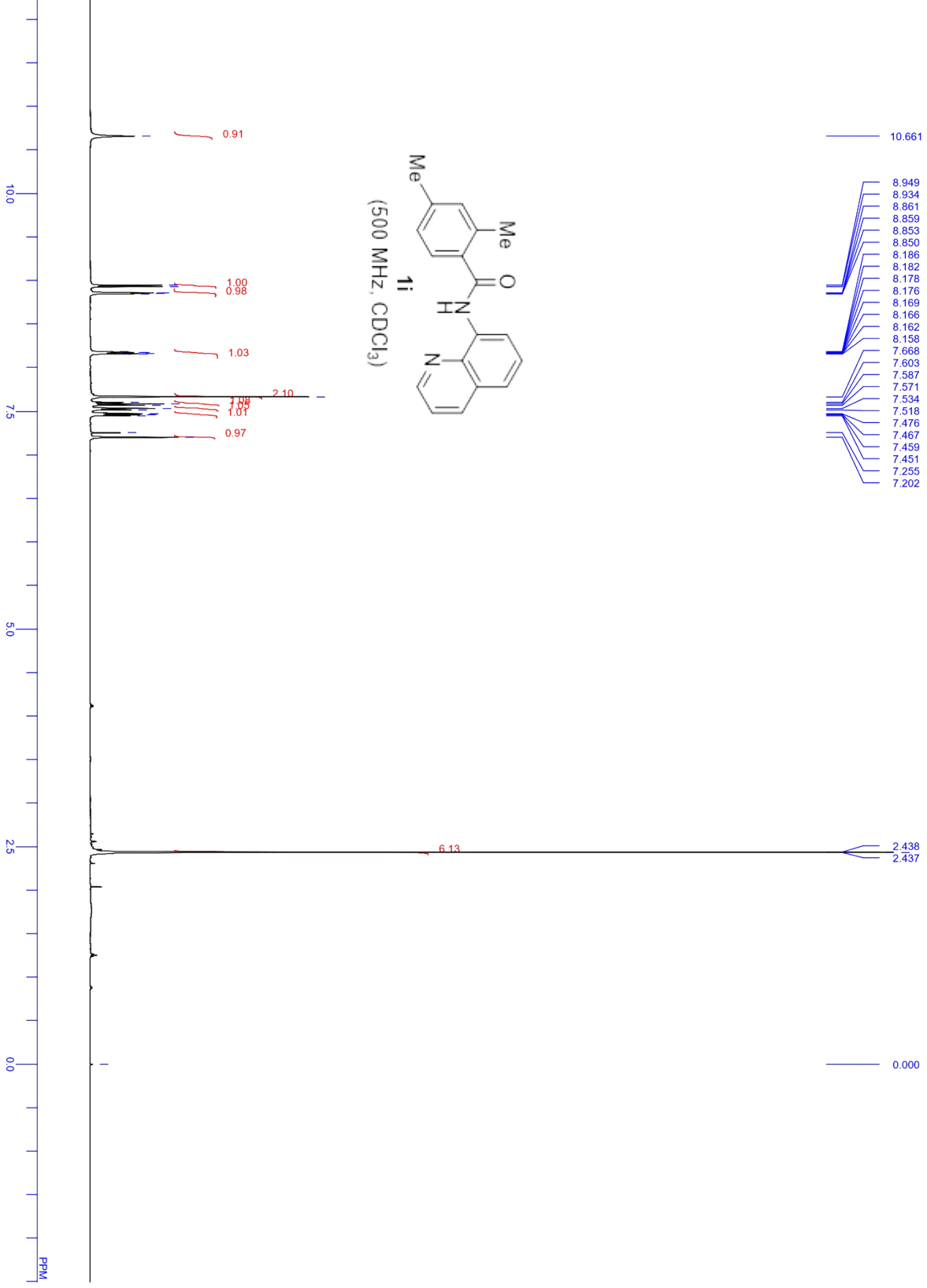
0
PPM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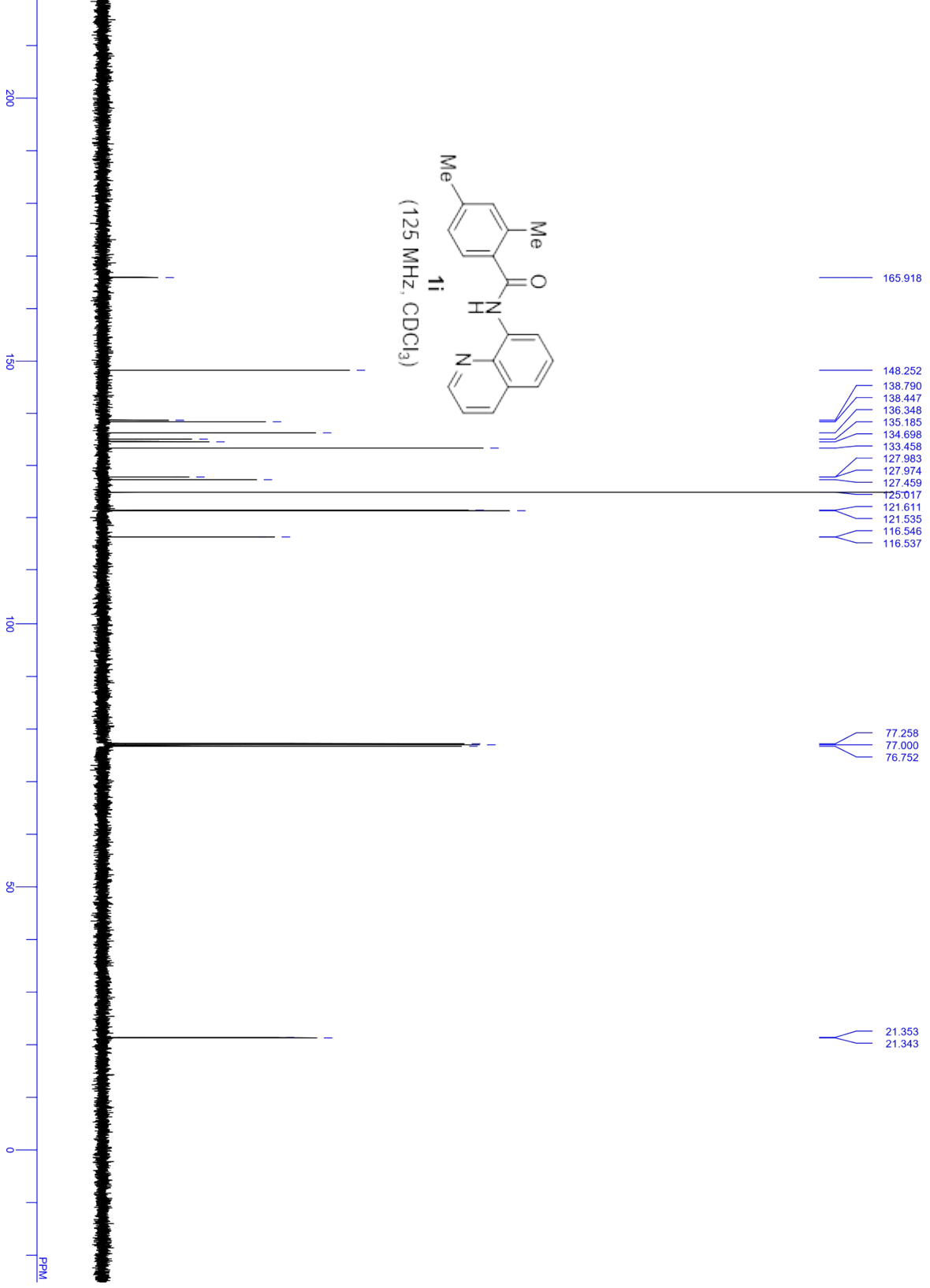
(500 MHz, CDCl3)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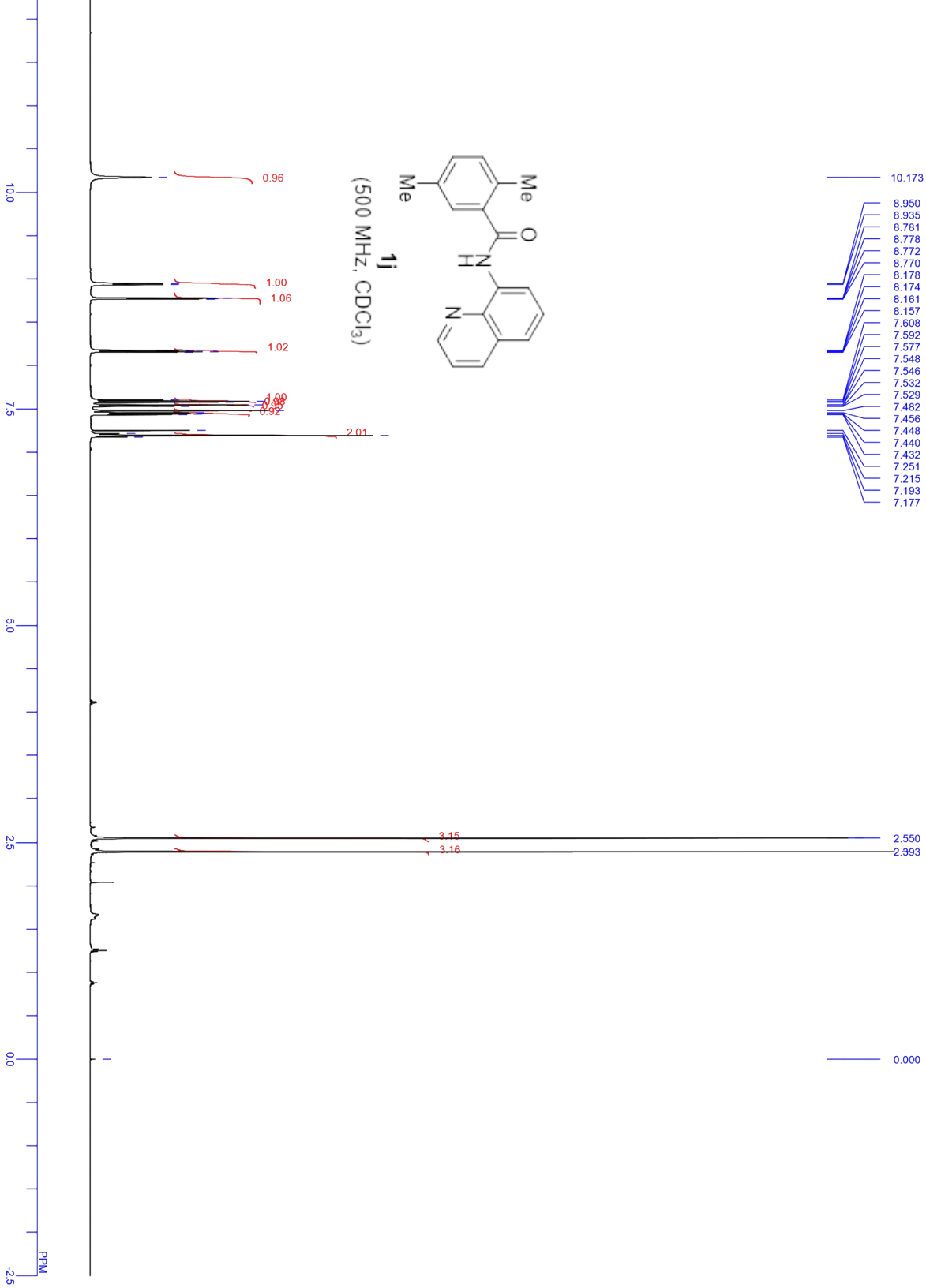
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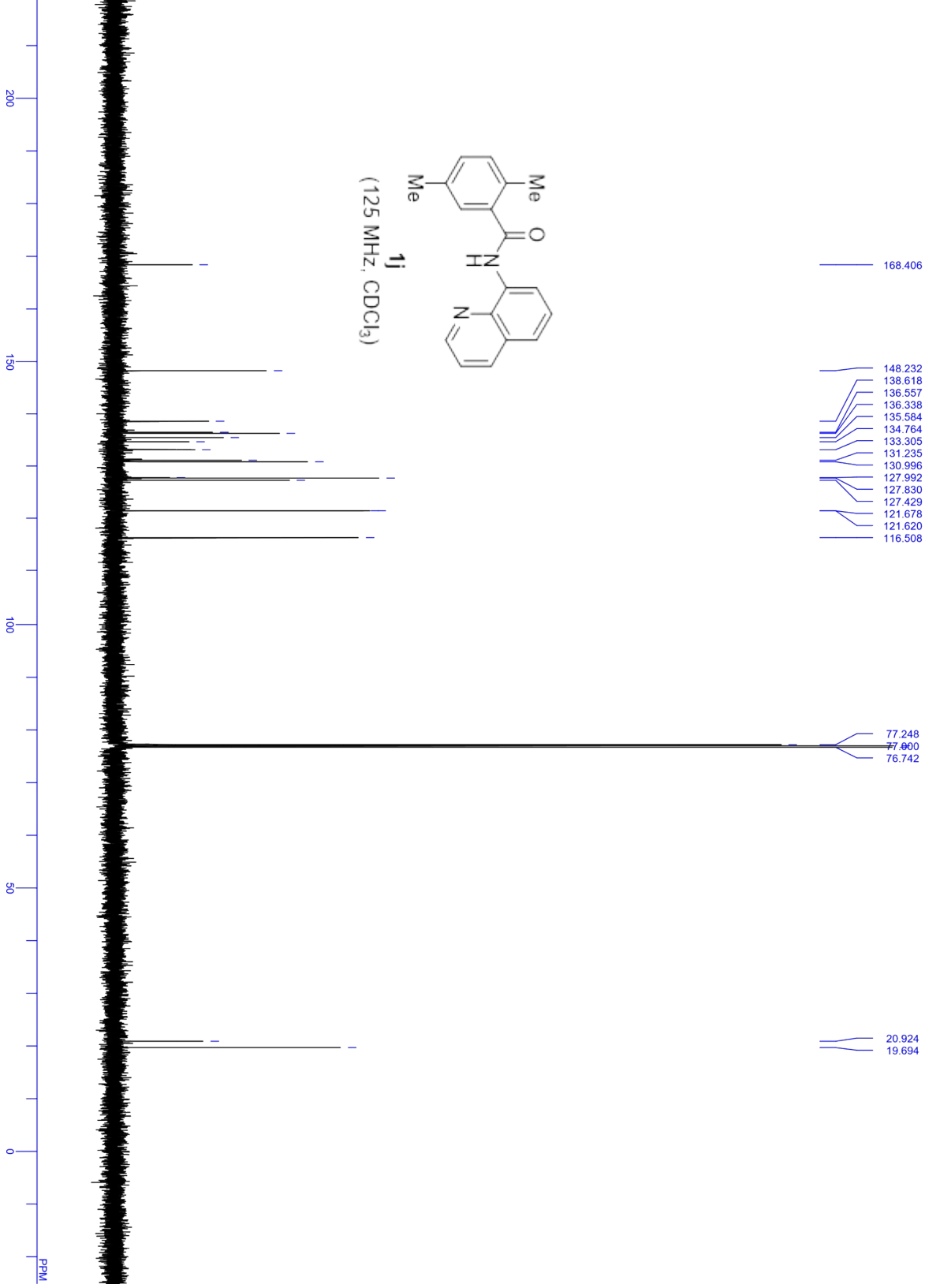
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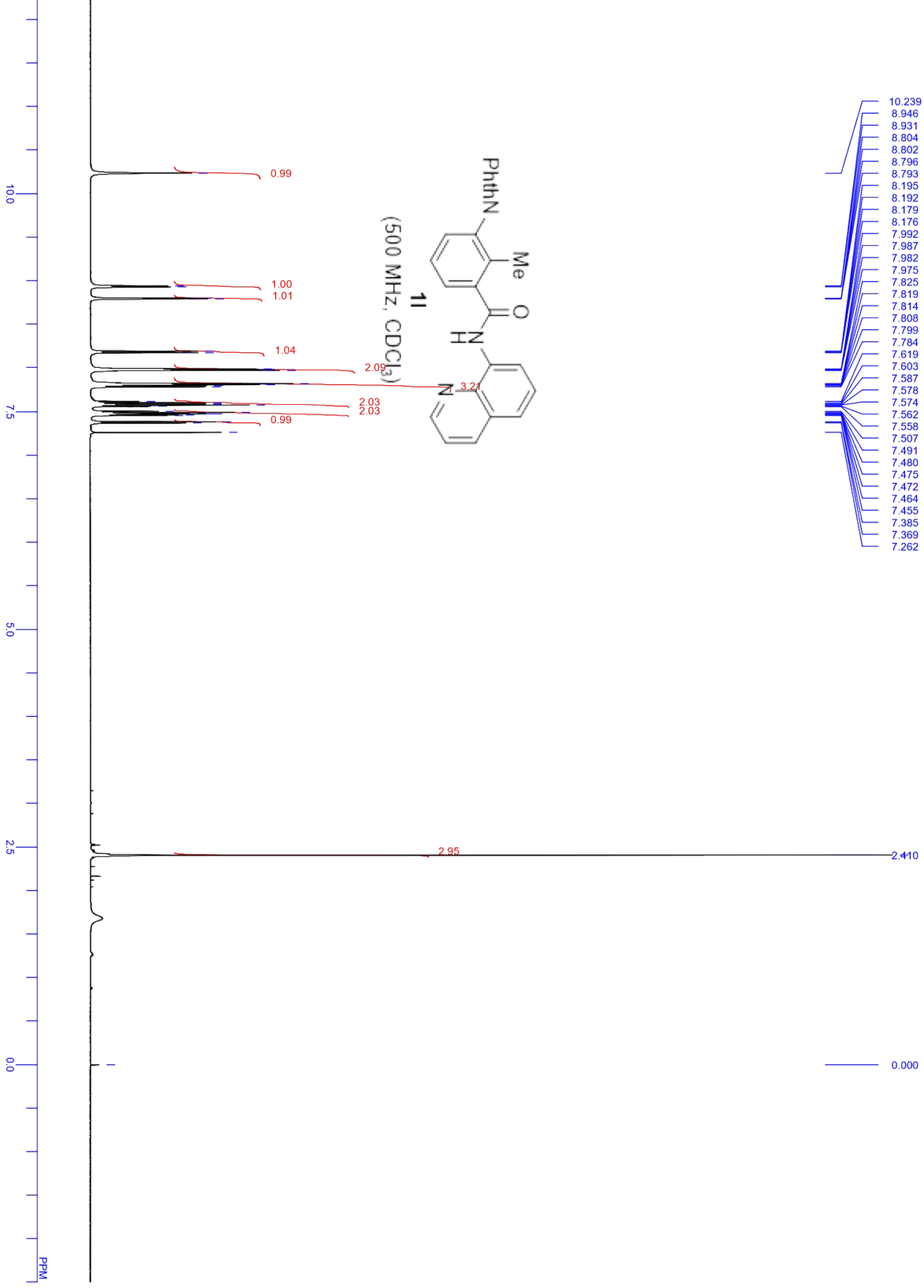
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3.21
2.03
2.03
0.99
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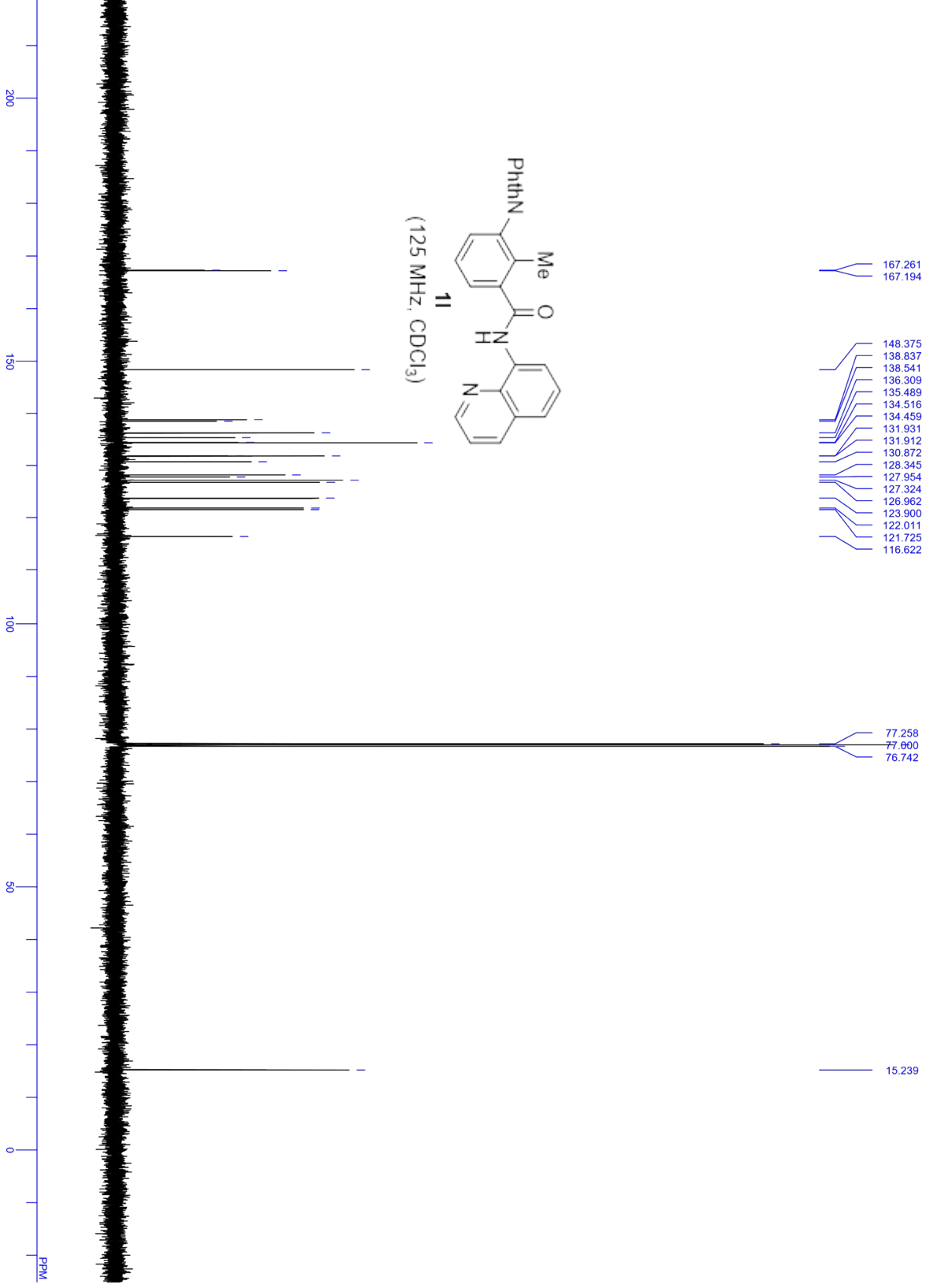
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100
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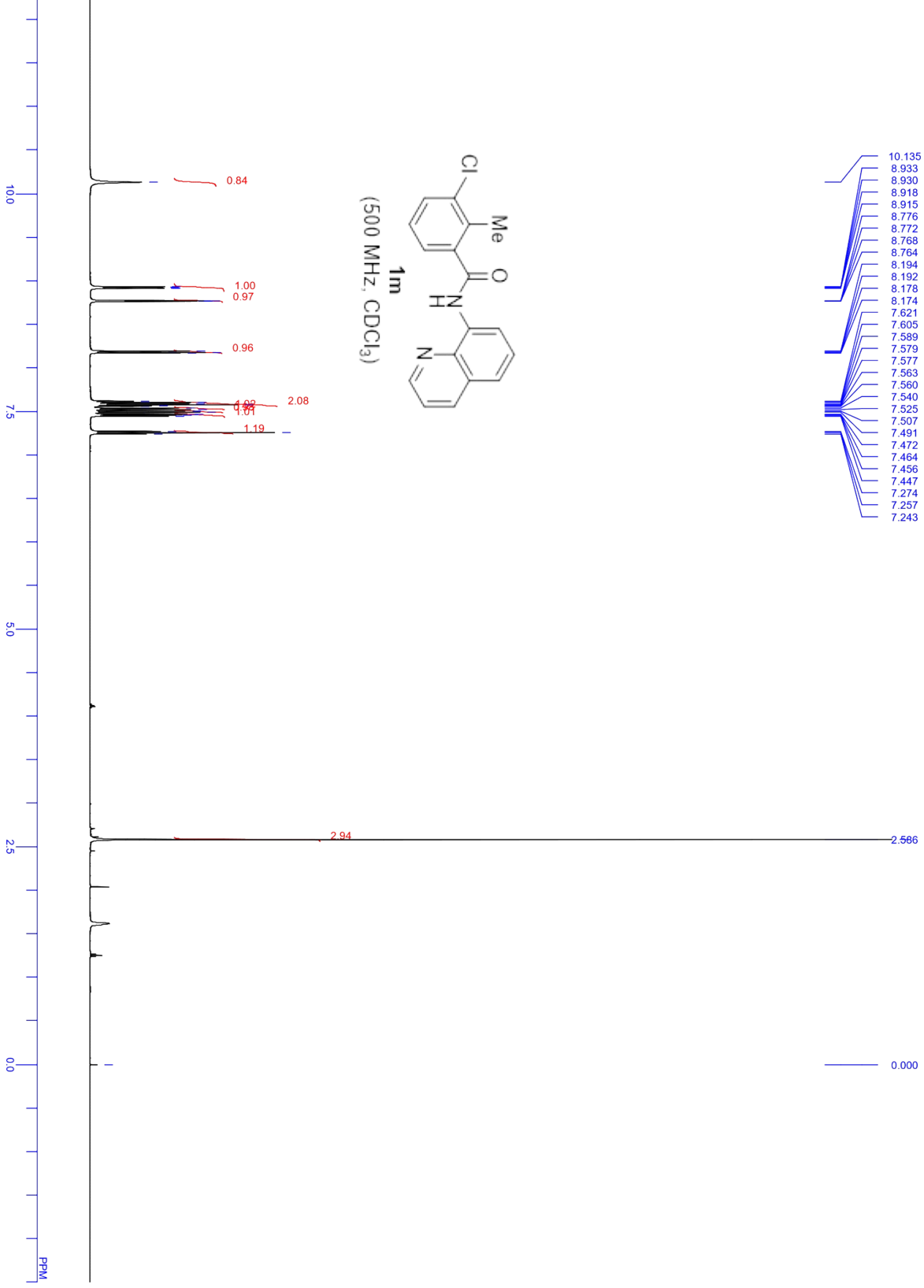
0
PPM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H
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8.768
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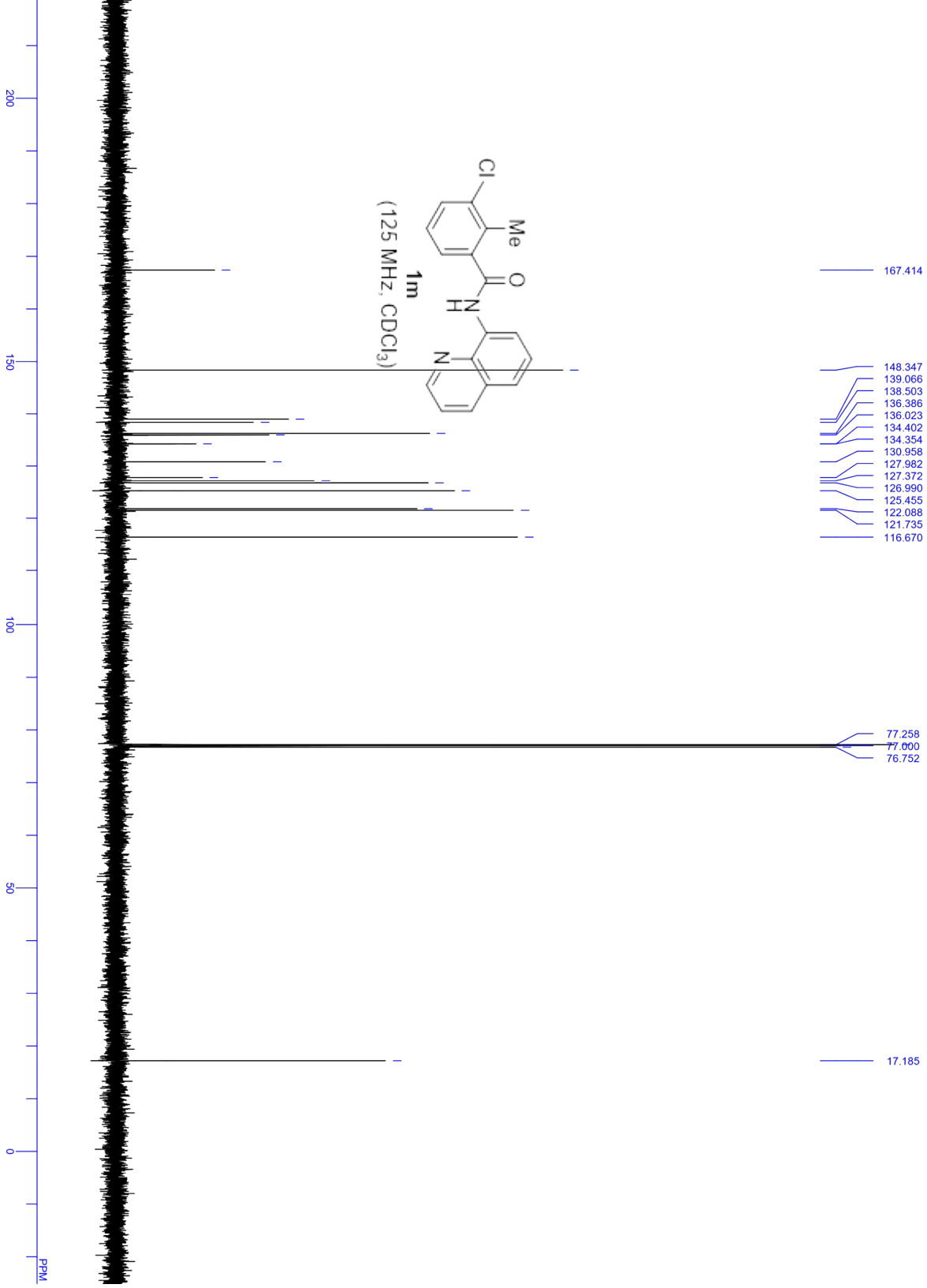
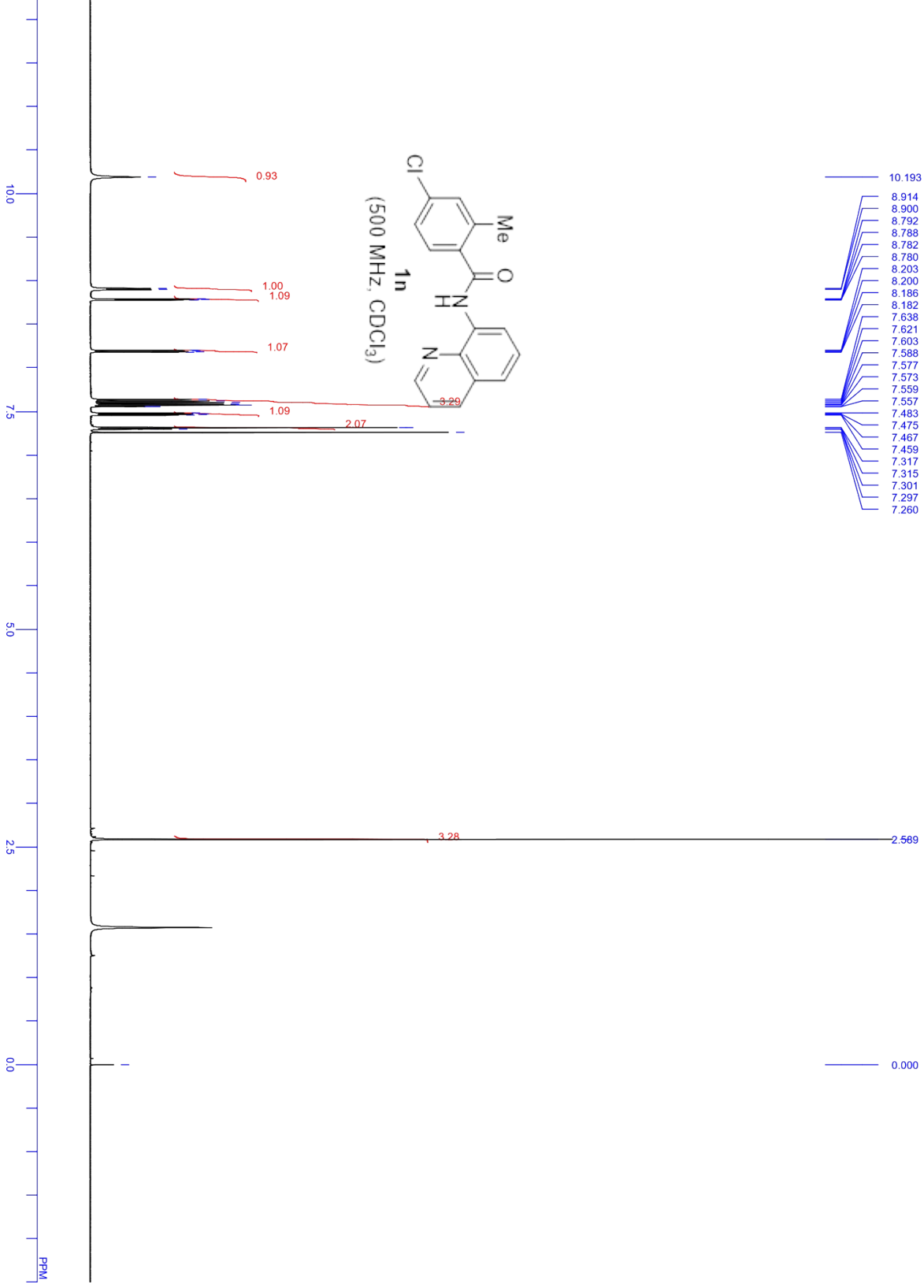
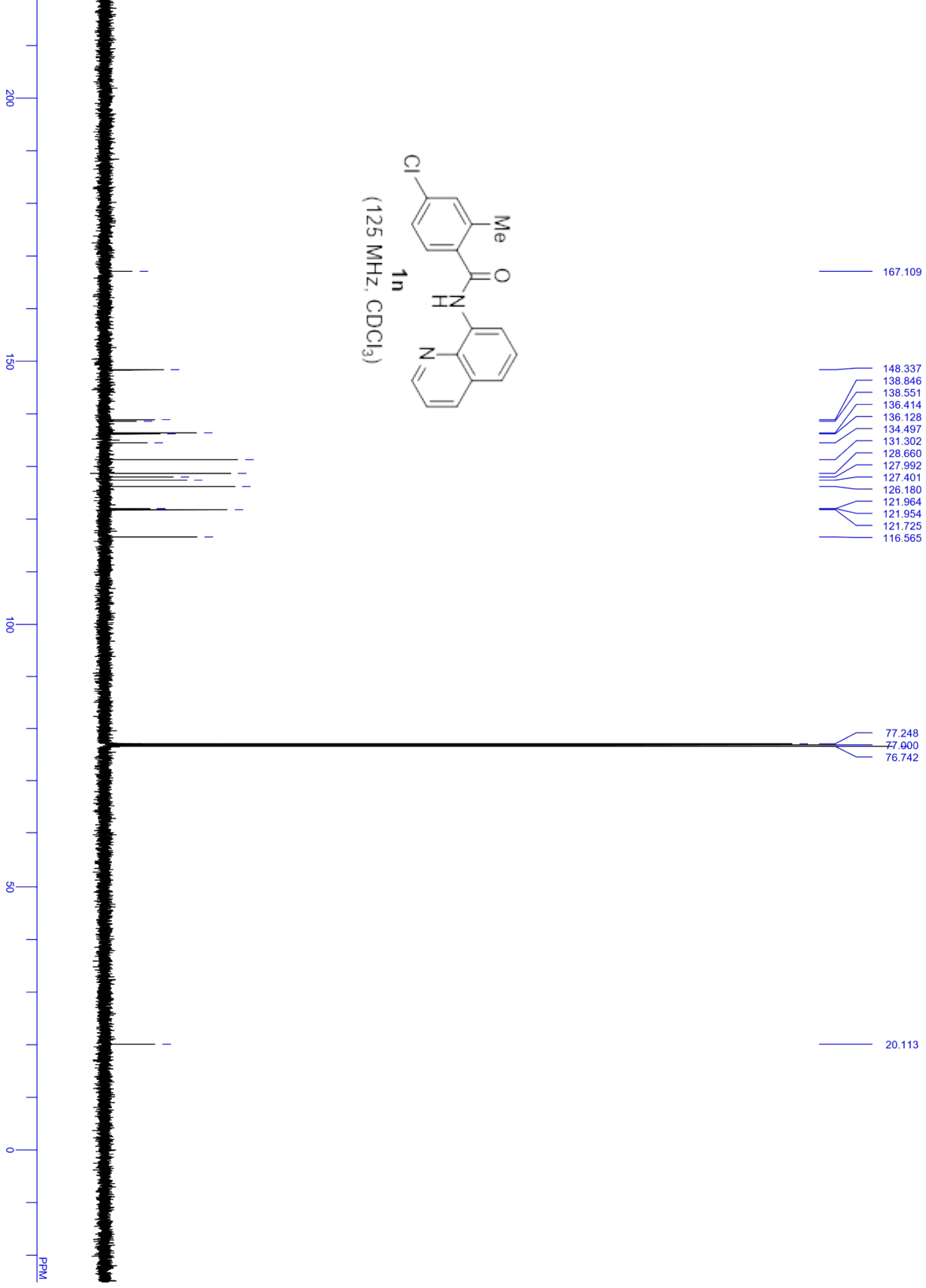
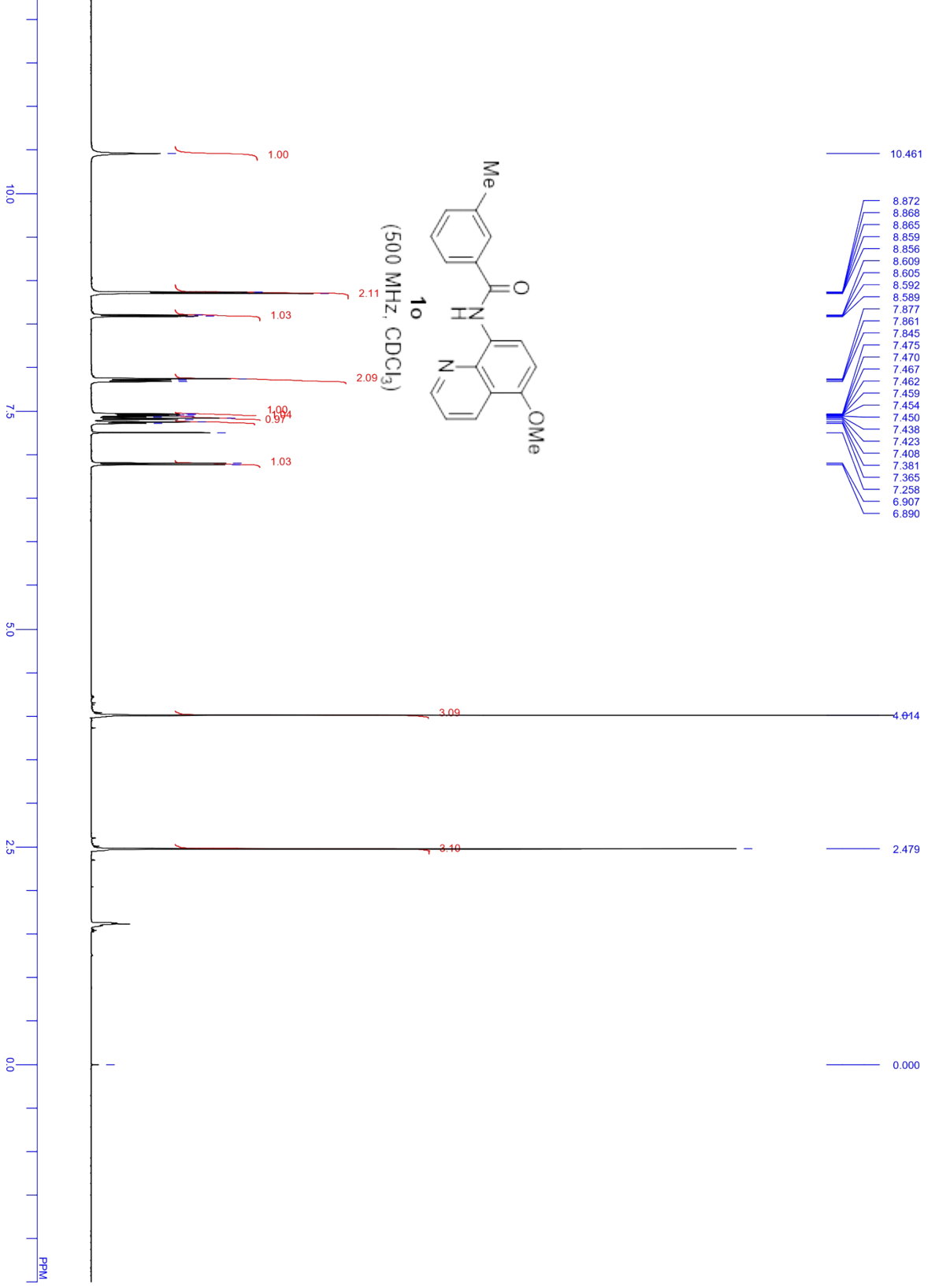
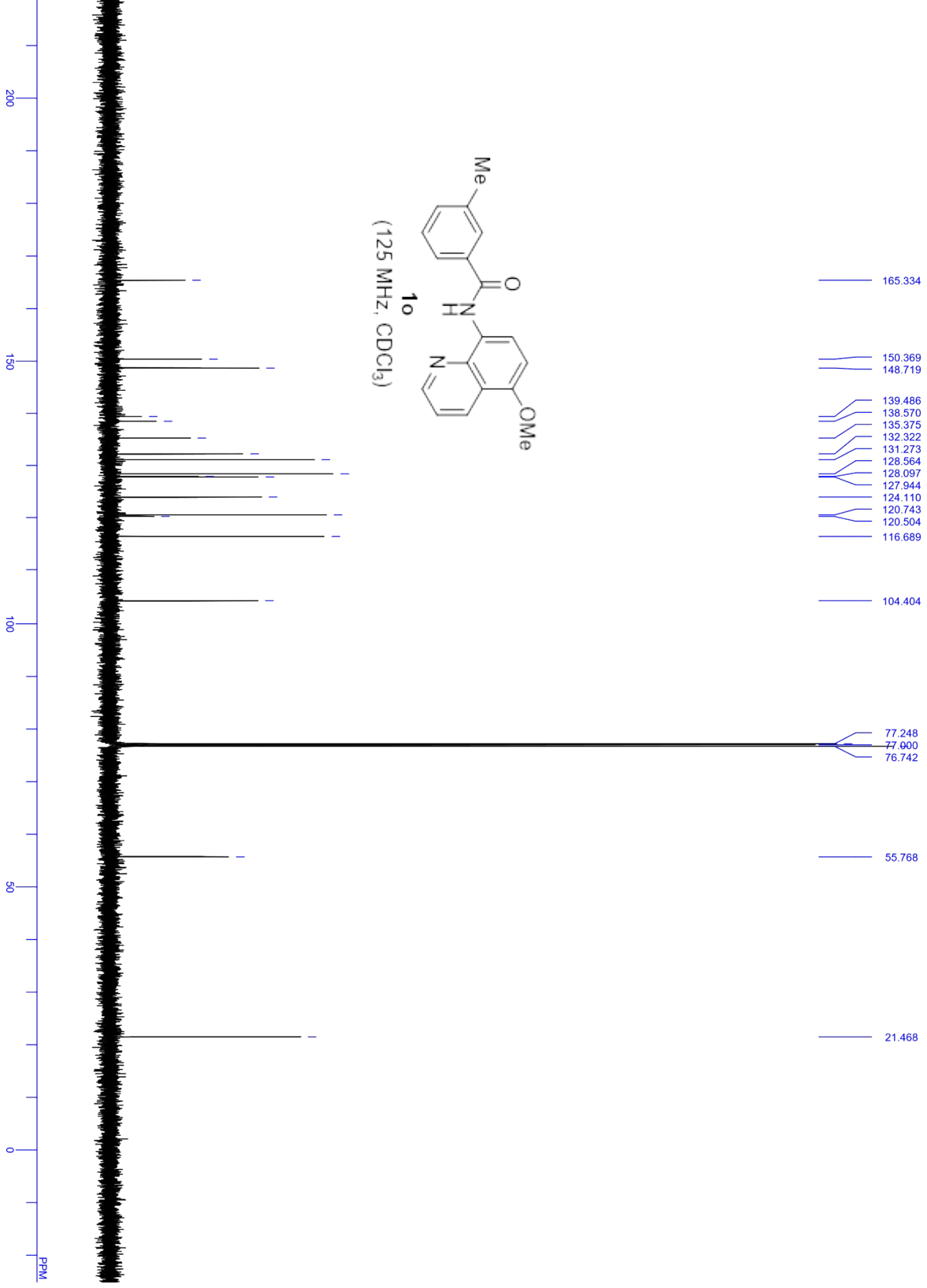
8.194
8.192
8.178
8.174
7.621
7.605
7.589
7.579
7.577
7.563
7.560
7.540
7.525
7.507
7.491
7.472
7.464
7.456
7.447
7.274
7.257
7.243
0.84
1.00
0.97
0.96
2.08
1.19
2.94
2.586
0.000
10.0
7.5
5.0
2.5
0.0
PPM

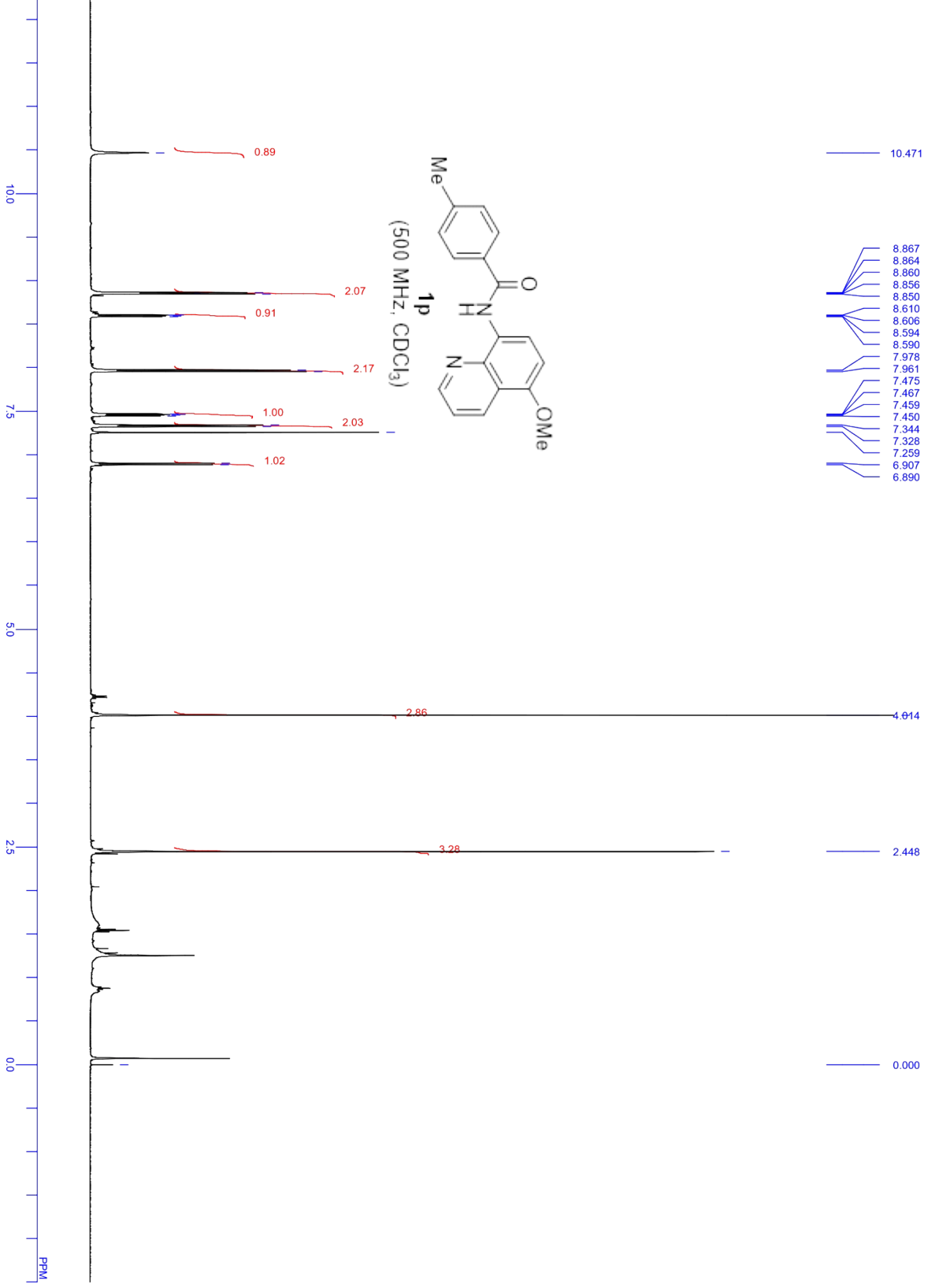

Cl
Me
O
H
N
N
1m
(125 MHz, CDCl3)
167.414
148.347
139.066
138.503
136.386
136.023
134.402
134.354
130.958
127.982
127.372
126.990
125.455
122.088
121.735
116.670
77.258
77.000
76.752
17.185
200
150
100
50
0
PPM

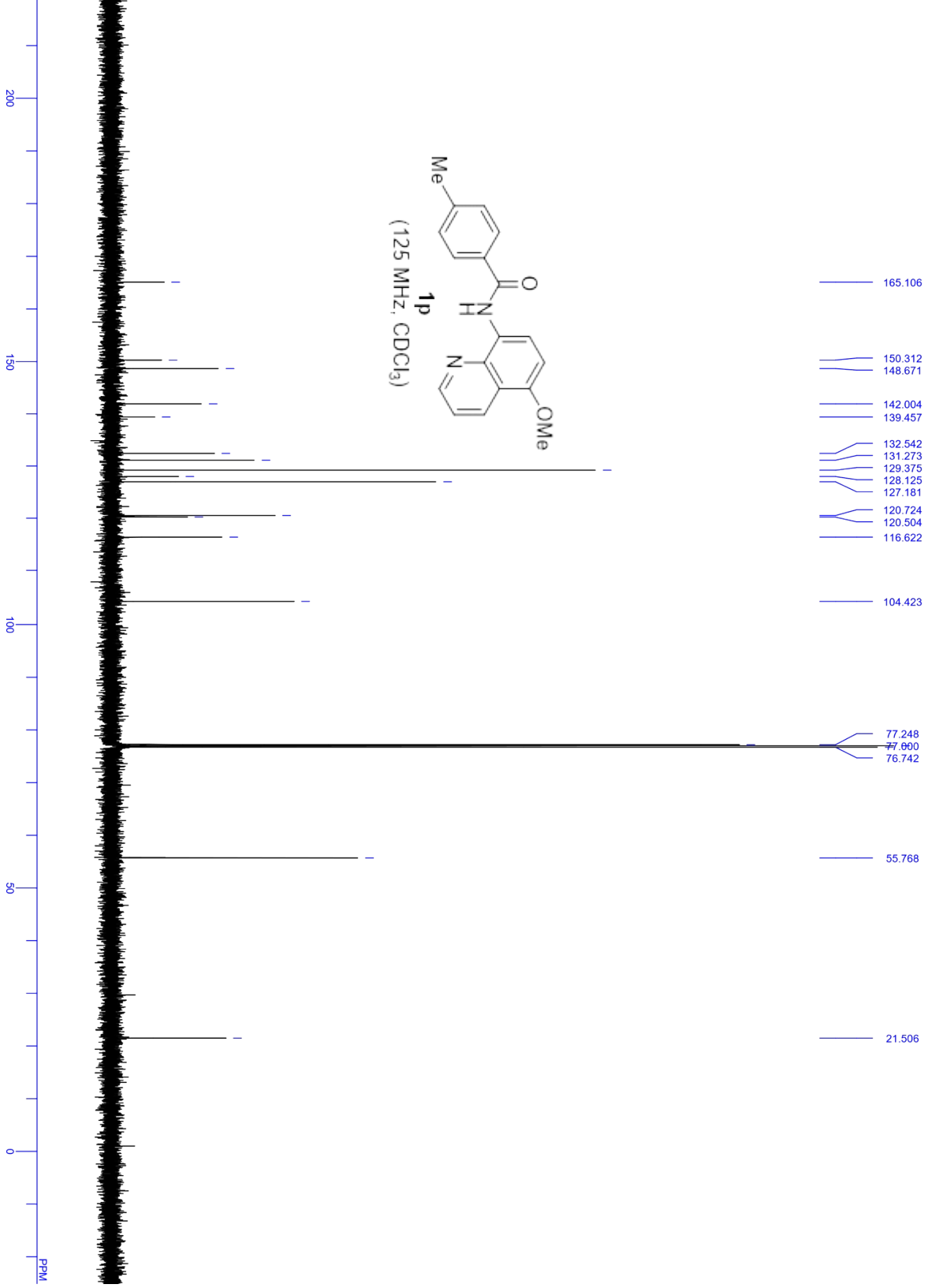

1n
(500 MHz, CDCl3)
Cl
Me
O
N
H
N
0.93
1.00
1.09
1.07
3.29
1.09
2.07
3.28
2.589
0.000
10.193
8.914
8.900
8.792
8.788
8.782
8.780
8.203
8.200
8.186
8.182
7.638
7.621
7.603
7.588
7.577
7.573
7.559
7.557
7.483
7.475
7.467
7.459
7.317
7.315
7.301
7.297
7.260
10.0
7.5
5.0
2.5
0.0
PPM

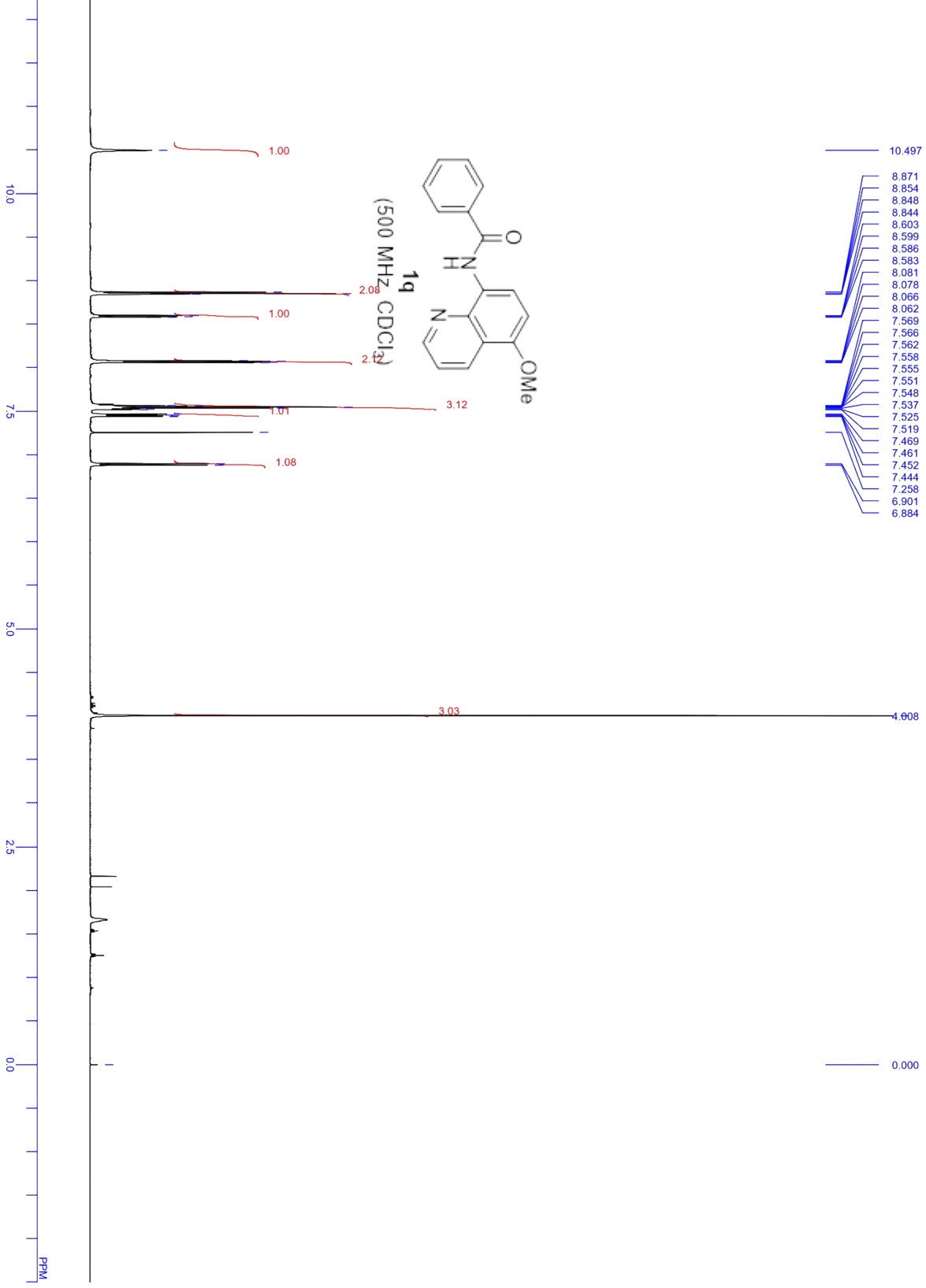

Cl
Me
O
H
N
N
1n
(125 MHz, CDCl3)
167.109
148.337
138.846
138.551
136.414
136.128
134.497
131.302
128.660
127.992
127.401
126.180
121.964
121.954
121.725
116.565
77.248
77.000
76.742
20.113
200
150
100
50
0
PPM

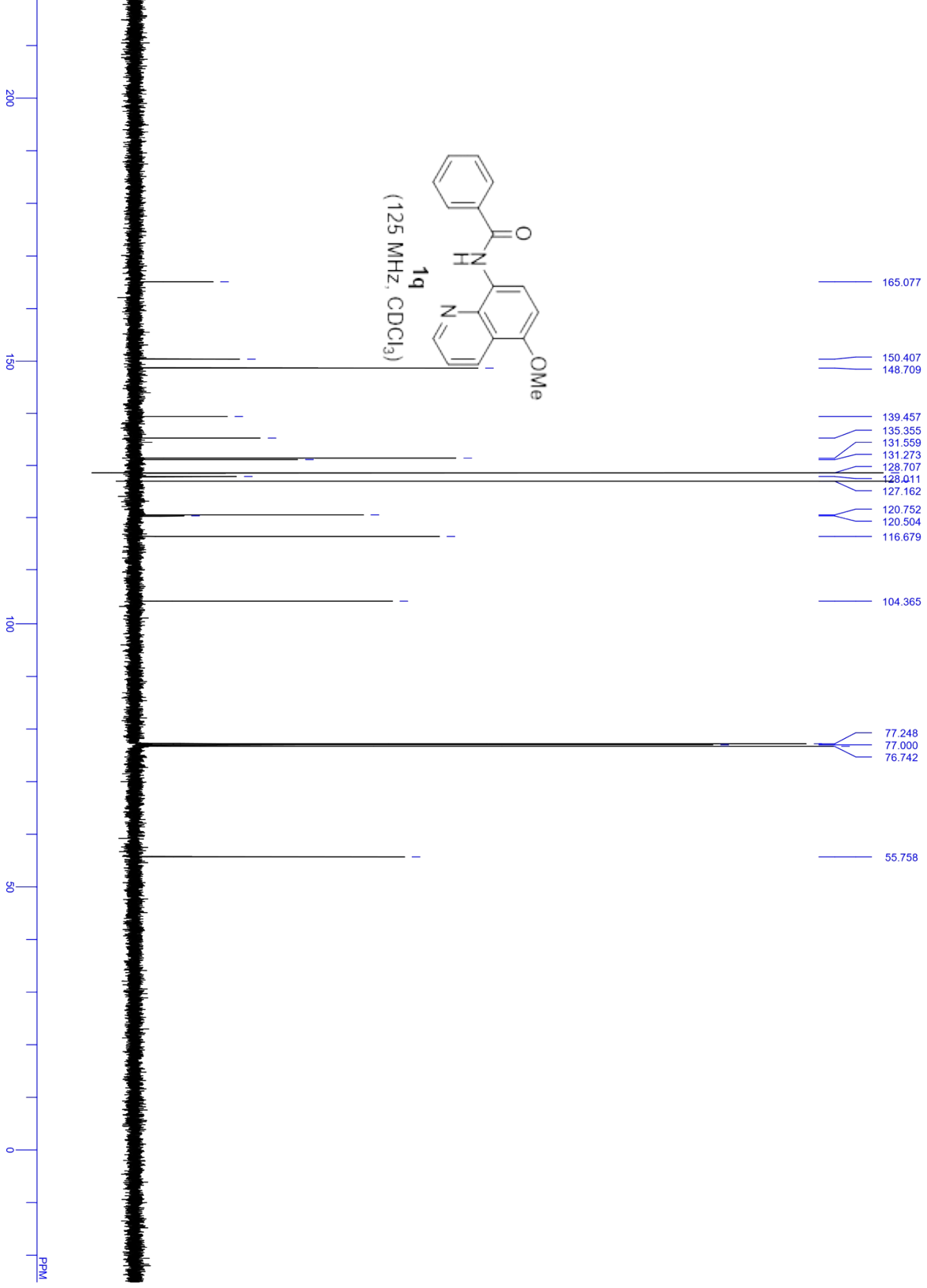

1o
(500 MHz, CDCl3)
Me
O
N
H
N
OMe
1.00
2.11
1.03
2.09
1.00
0.97
1.03
3.09
3.10
10.461
8.872
8.868
8.865
8.859
8.856
8.609
8.605
8.592
8.589
7.877
7.861
7.845
7.475
7.470
7.467
7.462
7.459
7.454
7.450
7.438
7.423
7.408
7.381
7.365
7.258
6.907
6.890
4.014
2.479
0.000
10.0
7.5
5.0
2.5
0.0
PPM

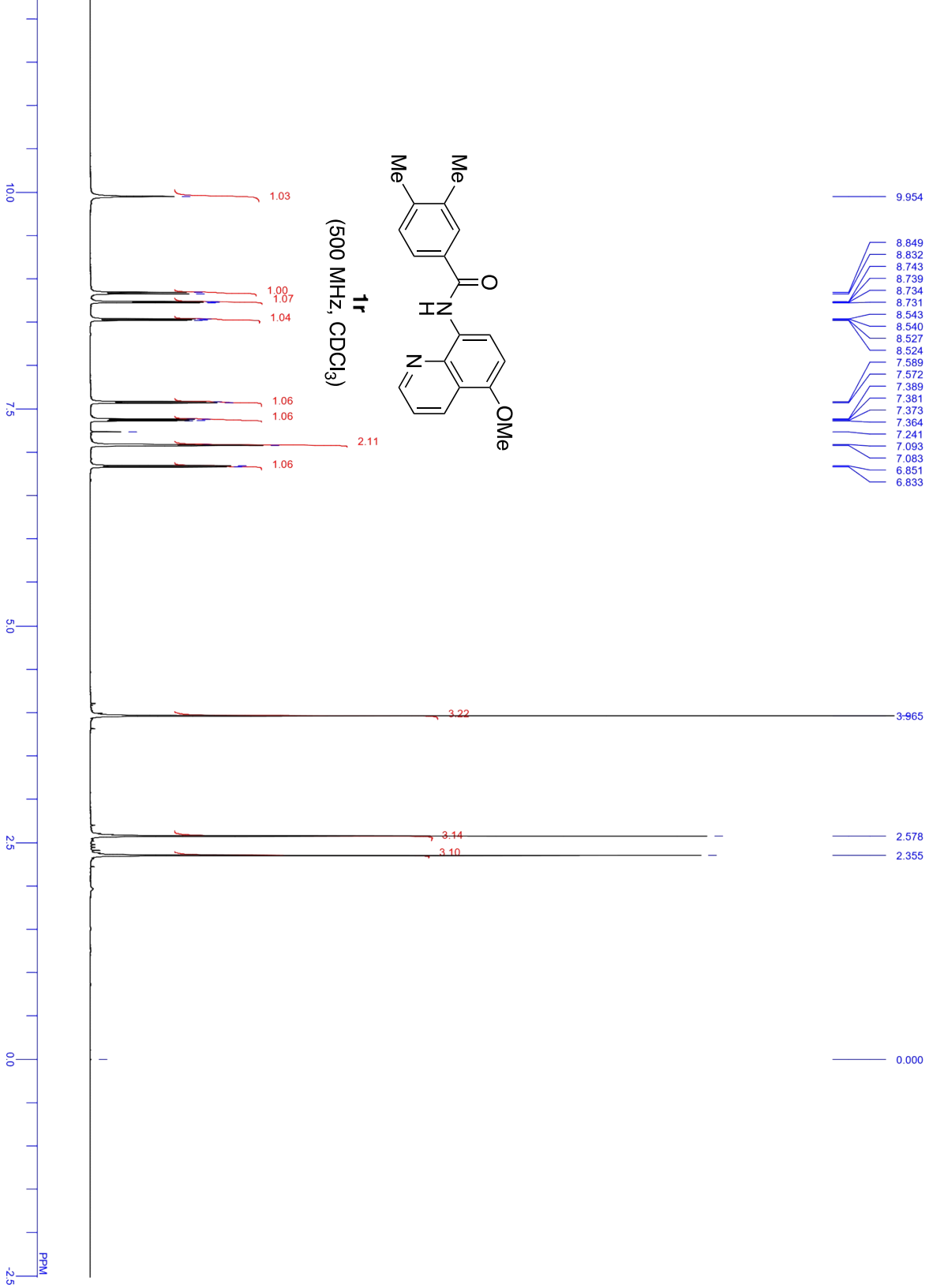

Me
O
N
H
N
OMe
1o
(125 MHz, CDCl3)
165.334
150.369
148.719
139.486
138.570
135.375
132.322
131.273
128.564
128.097
127.944
124.110
120.743
120.504
116.689
104.404
77.248
77.000
76.742
55.768
21.468
200
150
100
50
0
PPM

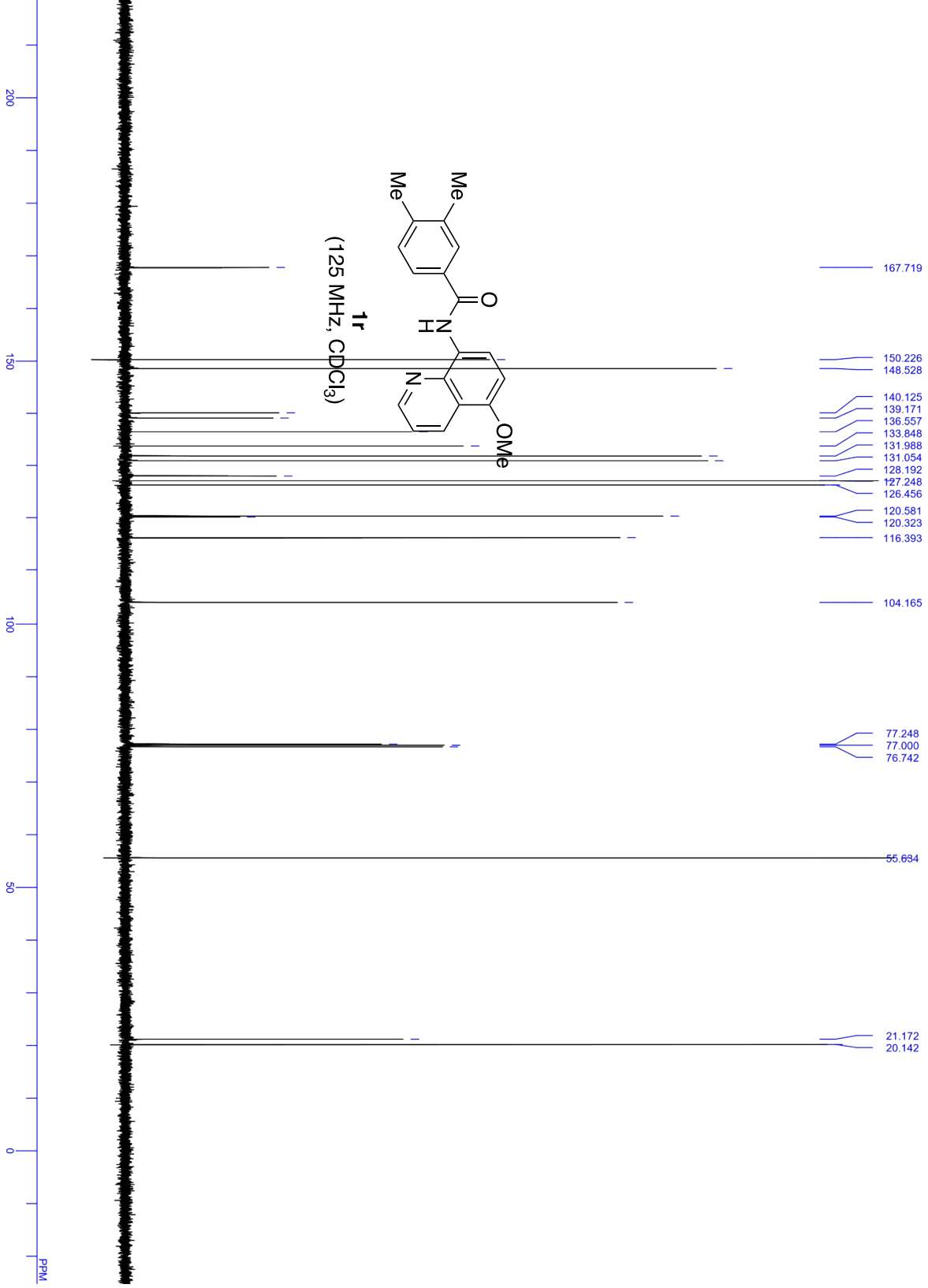

1p
(500 MHz, CDCl3)
Me
O
N
H
N
OMe
0.89
2.07
0.91
2.17
1.00
2.03
1.02
2.86
3.28
10.471
8.867
8.864
8.860
8.856
8.850
8.610
8.606
8.594
8.590
7.978
7.961
7.475
7.467
7.459
7.450
7.344
7.328
7.259
6.907
6.890
4.014
2.448
0.000
10.0
7.5
5.0
2.5
0.0
PPM

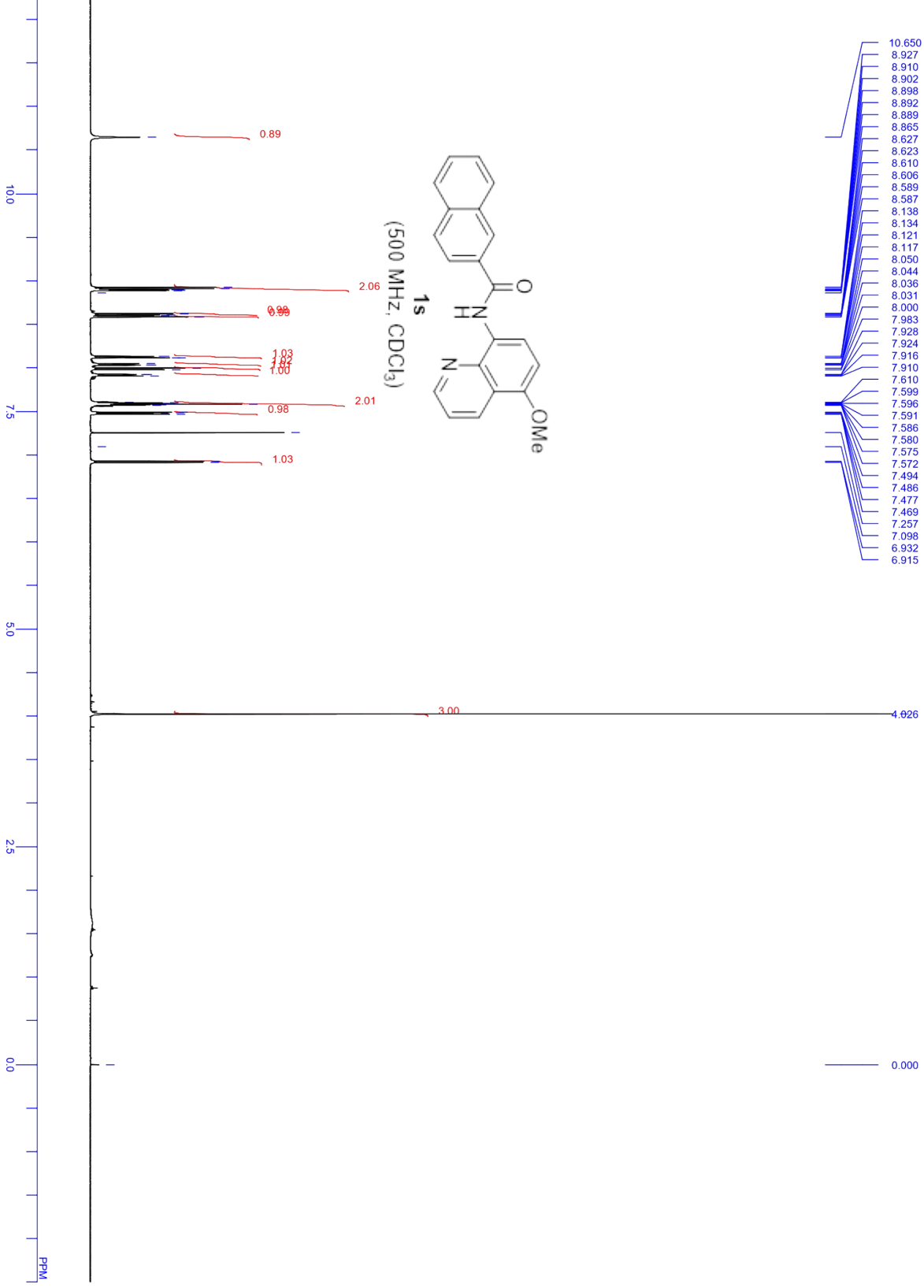

Me
O
N
H
N
OMe
1p
(125 MHz, CDCl3)
165.106
150.312
148.671
142.004
139.457
132.542
131.273
129.375
128.125
127.181
120.724
120.504
116.622
104.423
77.248
77.000
76.742
55.768
21.506
200
150
100
50
0
PPM

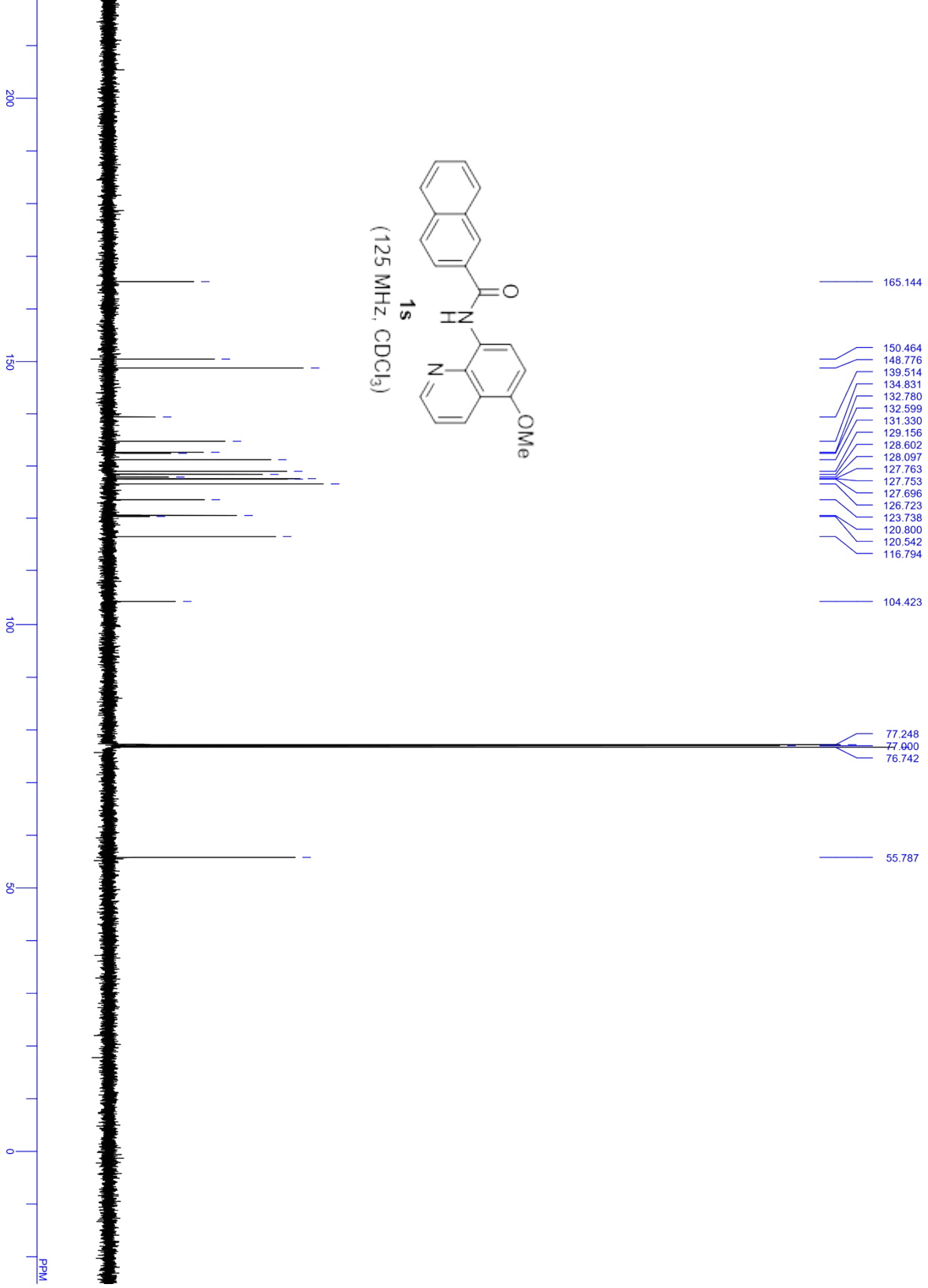

1q
(500 MHz, CDCl3)
O
H
N
N
OMe
1.00
2.08
1.00
2.12
3.12
1.01
1.08
3.03
4.008
10.497
8.871
8.854
8.848
8.844
8.603
8.599
8.586
8.583
8.081
8.078
8.066
8.062
7.569
7.566
7.562
7.558
7.555
7.551
7.548
7.537
7.525
7.519
7.469
7.461
7.452
7.444
7.258
6.901
6.884
0.000
10.0
7.5
5.0
2.5
0.0
PPM

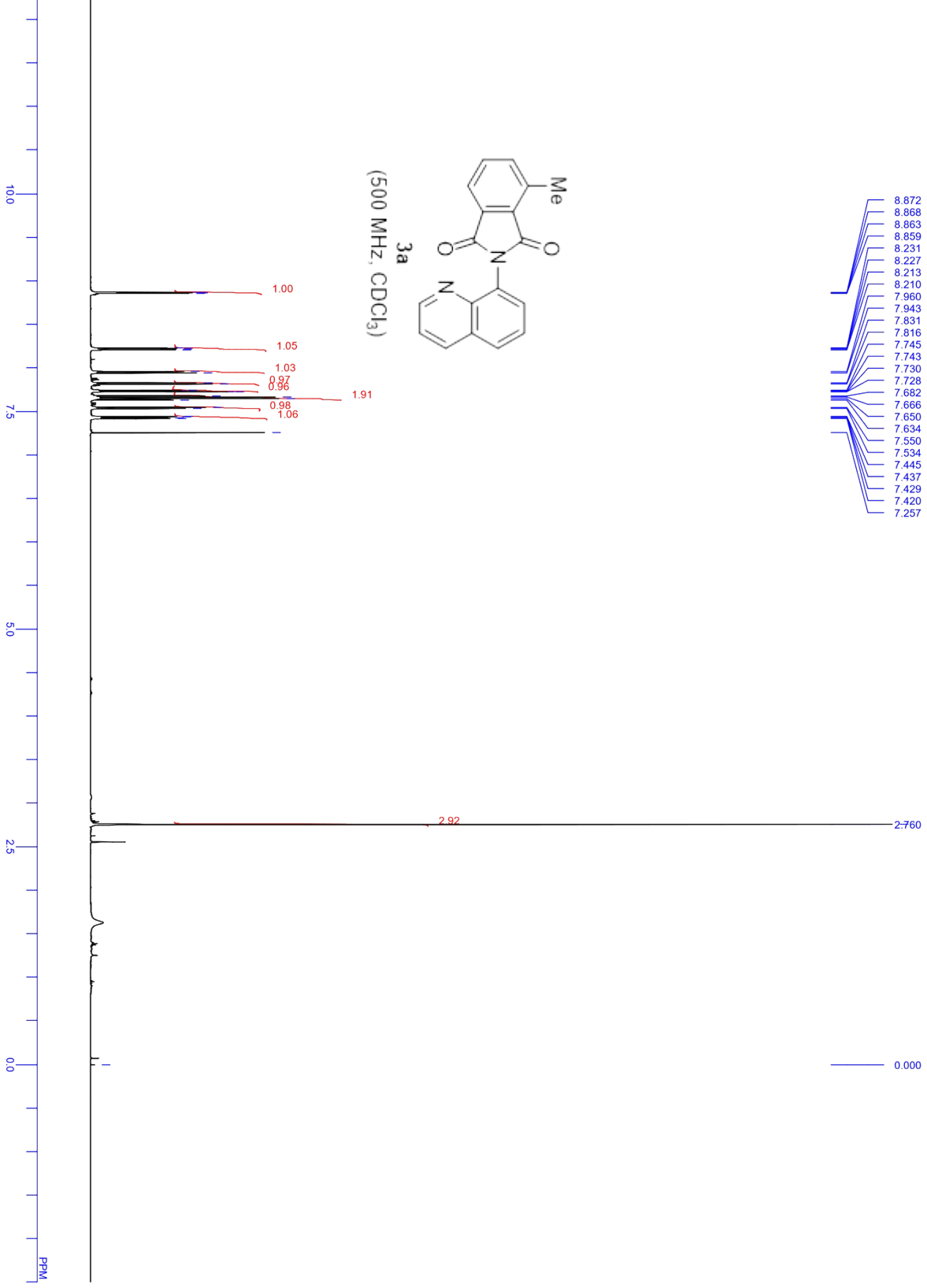

1q
(125 MHz, CDCl3)
O
H
N
N
OMe
165.077
150.407
148.709
139.457
135.355
131.559
131.273
128.707
128.011
127.162
120.752
120.504
116.679
104.365
77.248
77.000
76.742
55.758
200
150
100
50
0
PPM

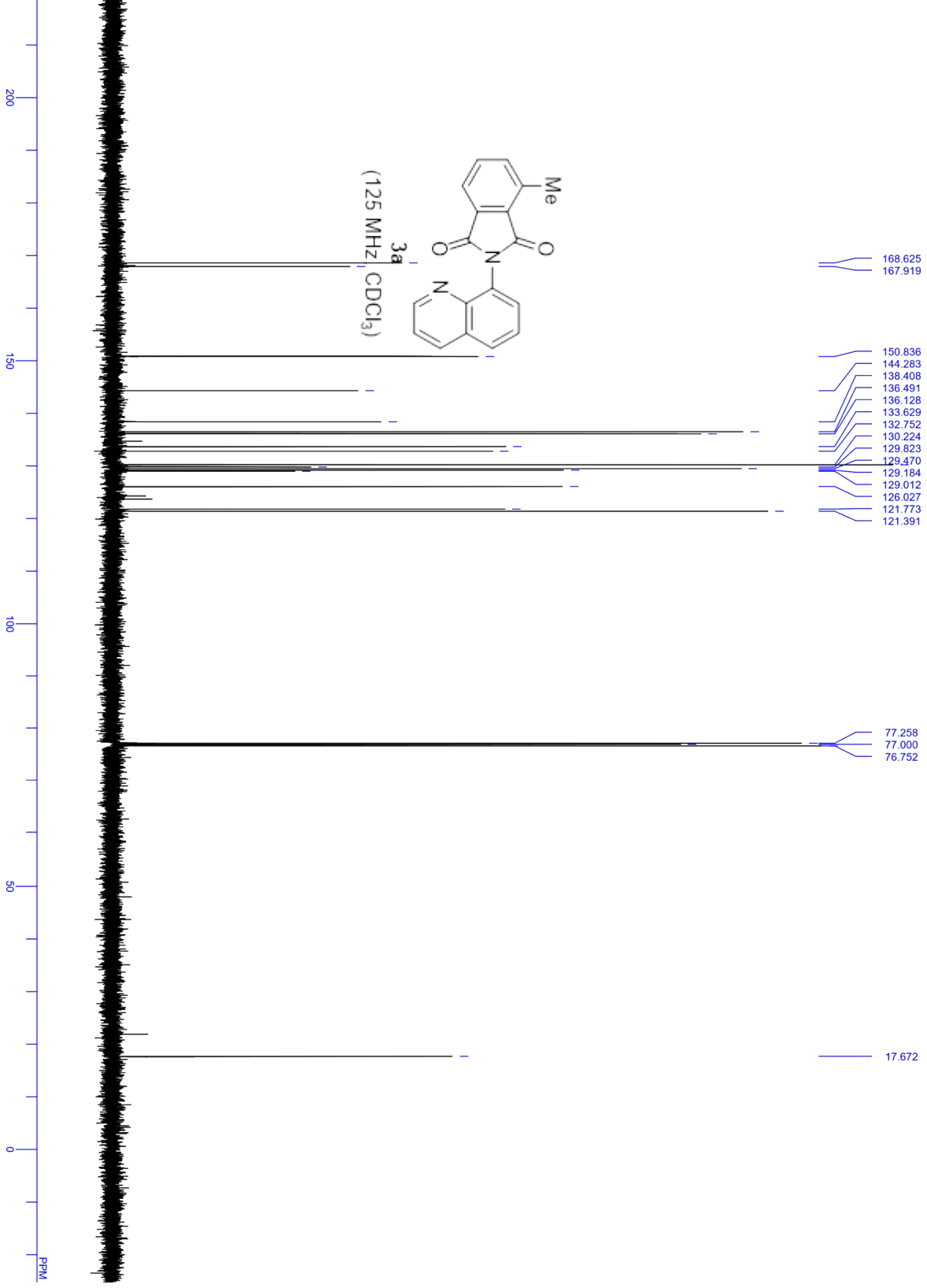

1r
(500 MHz, CDCl3)
Me
Me
O
H
N
N
OMe
1.03
1.00
1.07
1.04
1.06
1.06
2.11
1.06
3.22
3.14
3.10
9.954
8.849
8.832
8.743
8.739
8.734
8.731
8.543
8.540
8.527
8.524
7.589
7.572
7.389
7.381
7.373
7.364
7.241
7.093
7.083
6.851
6.833
3.965
2.578
2.355
0.000
10.0
7.5
5.0
2.5
0.0
-2.5
PPM

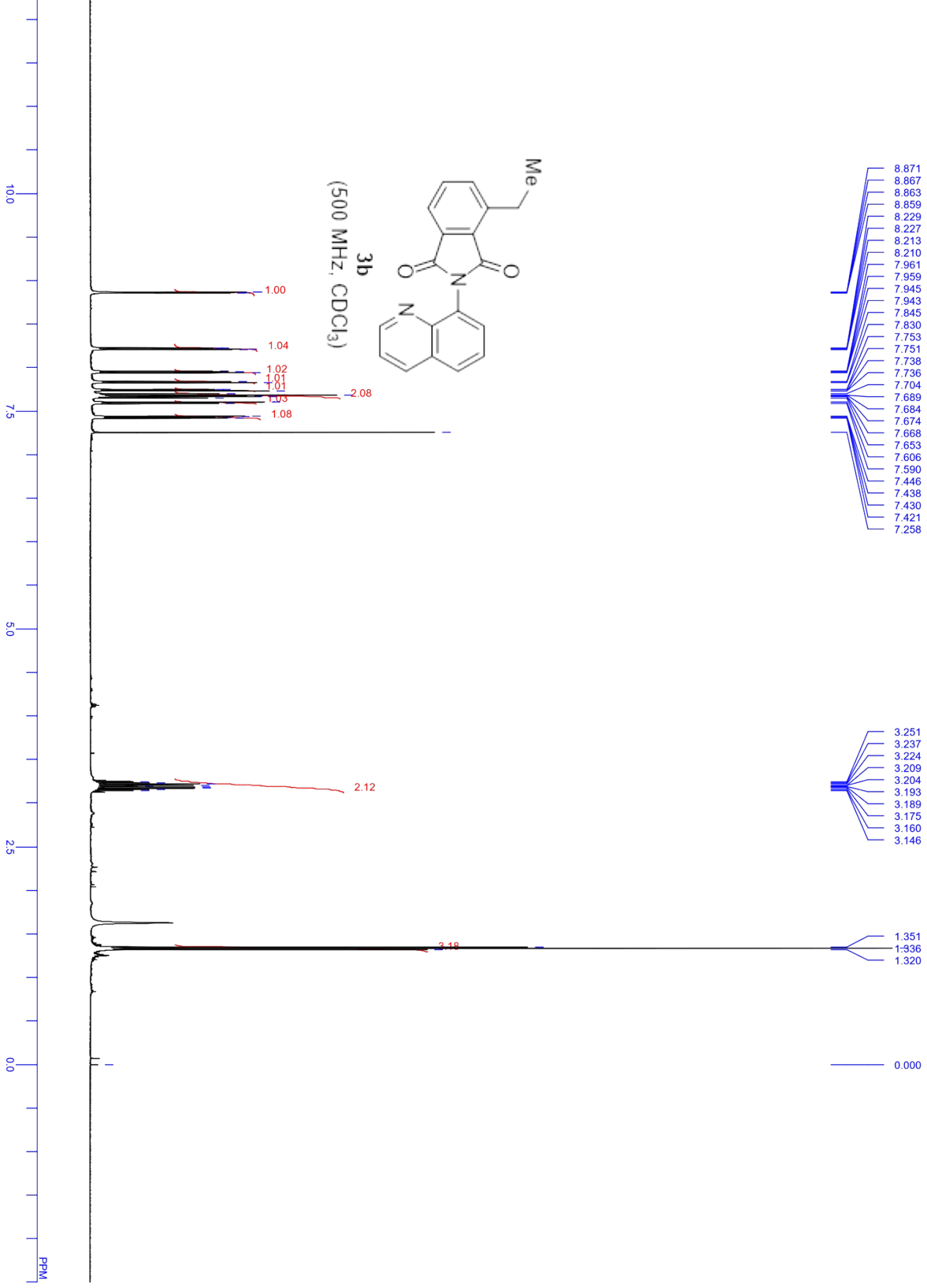

1r
(125 MHz, CDCl3)
Me
Me
O
N
H
N
OMe
167.719
150.226
148.528
140.125
139.171
136.557
133.848
131.988
131.054
128.192
127.248
126.456
120.581
120.323
116.393
104.165
77.248
77.000
76.742
55.634
21.172
20.142
200
150
100
50
0
PPM

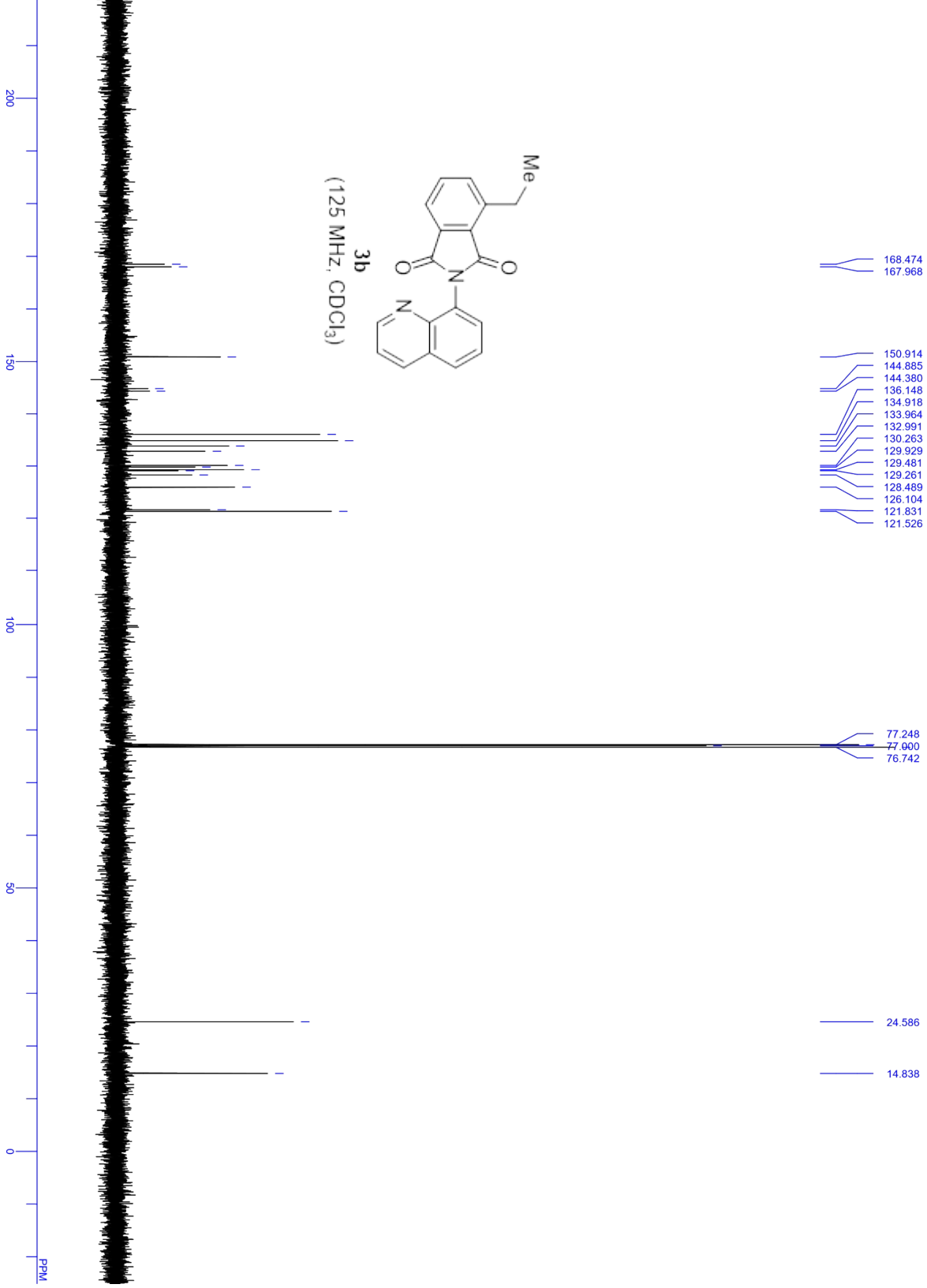

1s
(500 MHz, CDCl3)
O
N
H
N
OMe
0.89
2.06
1.03
1.00
2.01
0.98
1.03
3.00
4.026
10.650
8.927
8.910
8.902
8.898
8.892
8.889
8.865
8.627
8.623
8.610
8.606
8.589
8.587
8.138
8.134
8.121
8.117
8.050
8.044
8.036
8.031
8.000
7.983
7.928
7.924
7.916
7.910
7.610
7.599
7.596
7.591
7.586
7.580
7.575
7.572
7.494
7.486
7.477
7.469
7.257
7.098
6.932
6.915
0.000
10.0
7.5
5.0
2.5
0.0
PPM

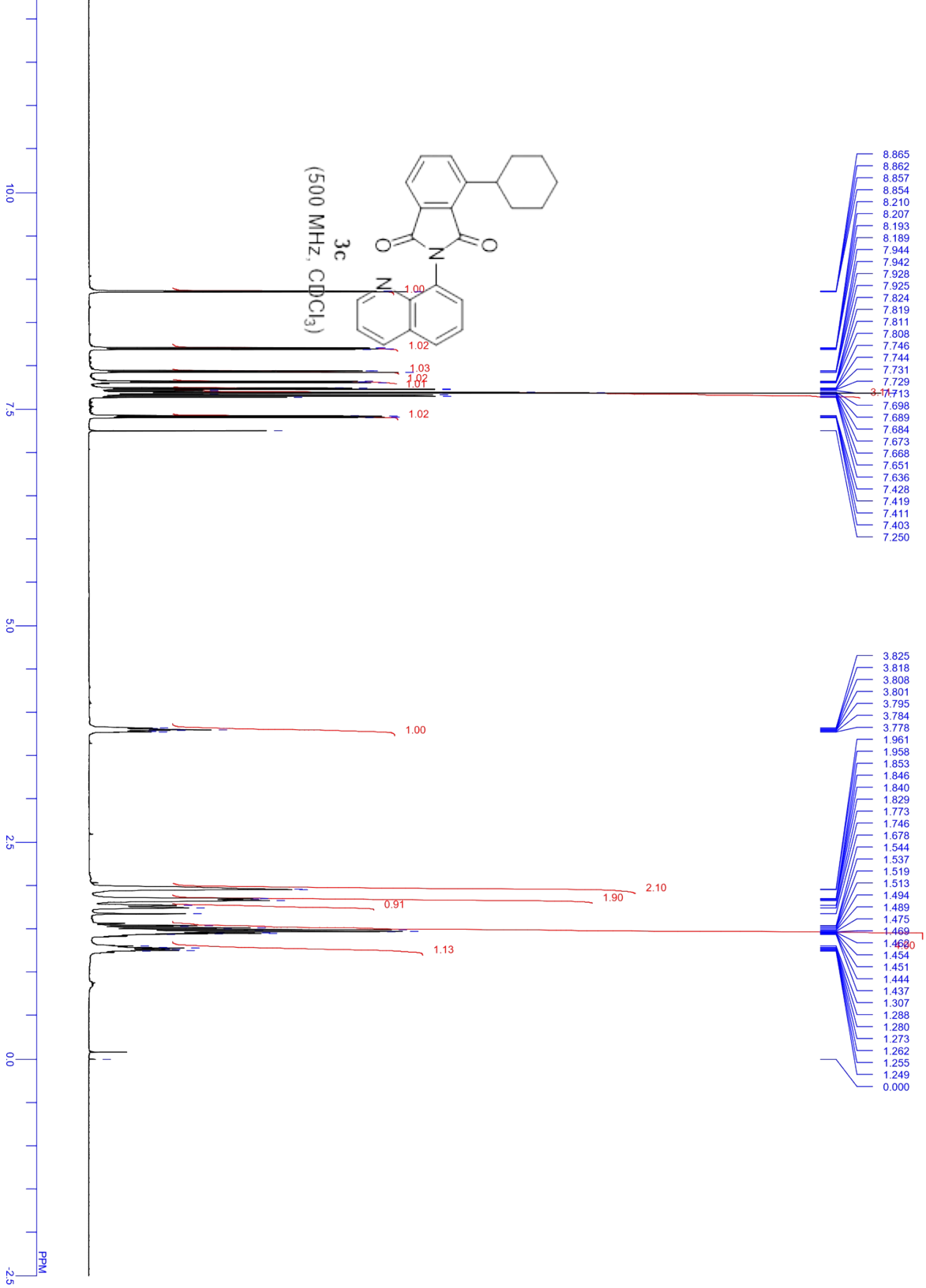

1s
(125 MHz, CDCl3)
O
N
H
N
OMe
165.144
150.464
148.776
139.514
134.831
132.780
132.599
131.330
129.156
128.602
128.097
127.763
127.753
127.696
126.723
123.738
120.800
120.542
116.794
104.423
77.248
77.000
76.742
55.787
200
150
100
50
0
PPM

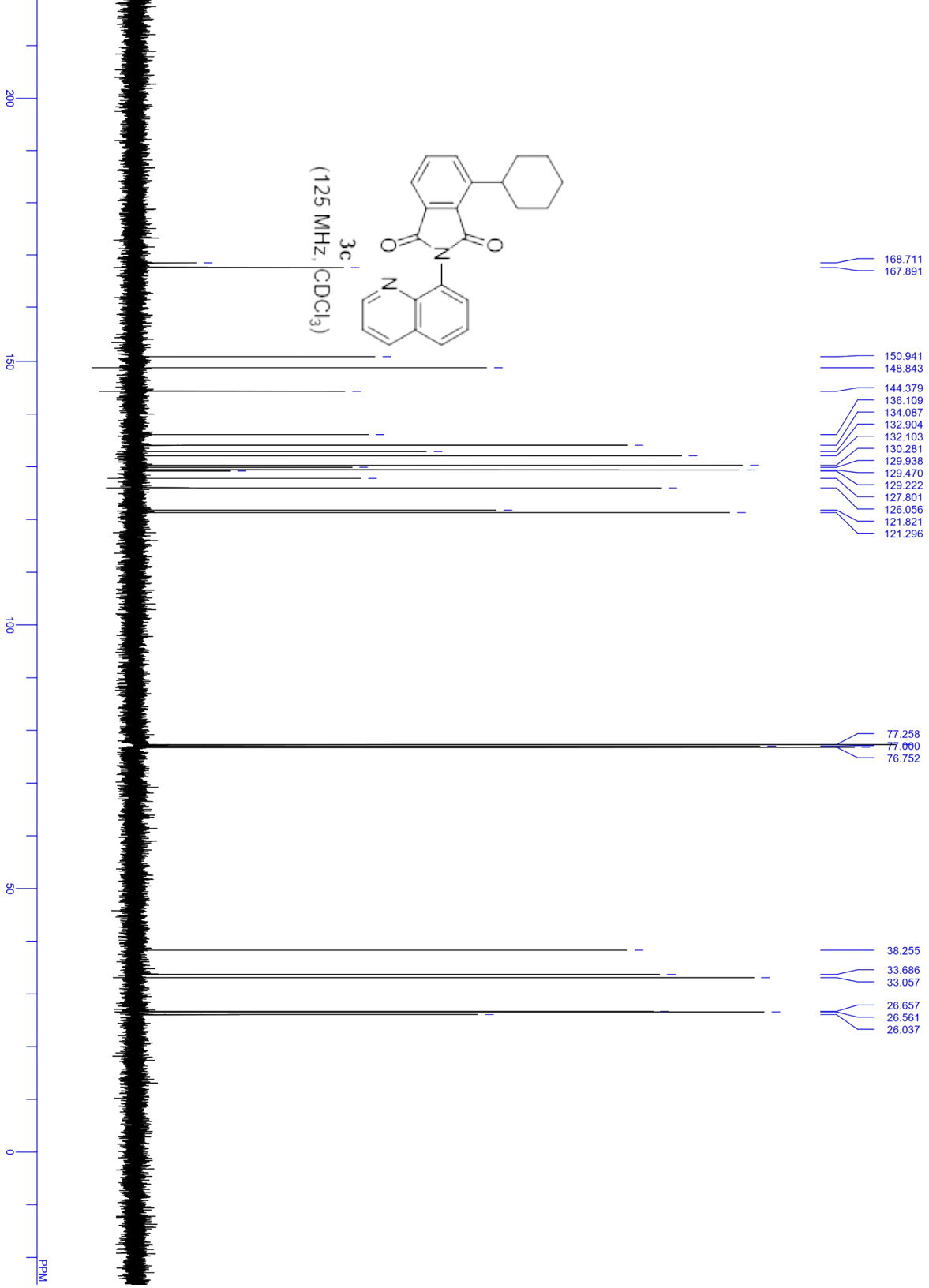

3a
(500 MHz, CDCl3)
Me
O
O
N
N
1.00
1.05
1.03
0.97
0.96
1.91
0.98
1.06
2.92
2.760
0.000
8.872
8.868
8.863
8.859
8.231
8.227
8.213
8.210
7.960
7.943
7.831
7.816
7.745
7.743
7.730
7.728
7.682
7.666
7.650
7.634
7.550
7.534
7.445
7.437
7.429
7.420
7.257
10.0
7.5
5.0
2.5
0.0
PPM

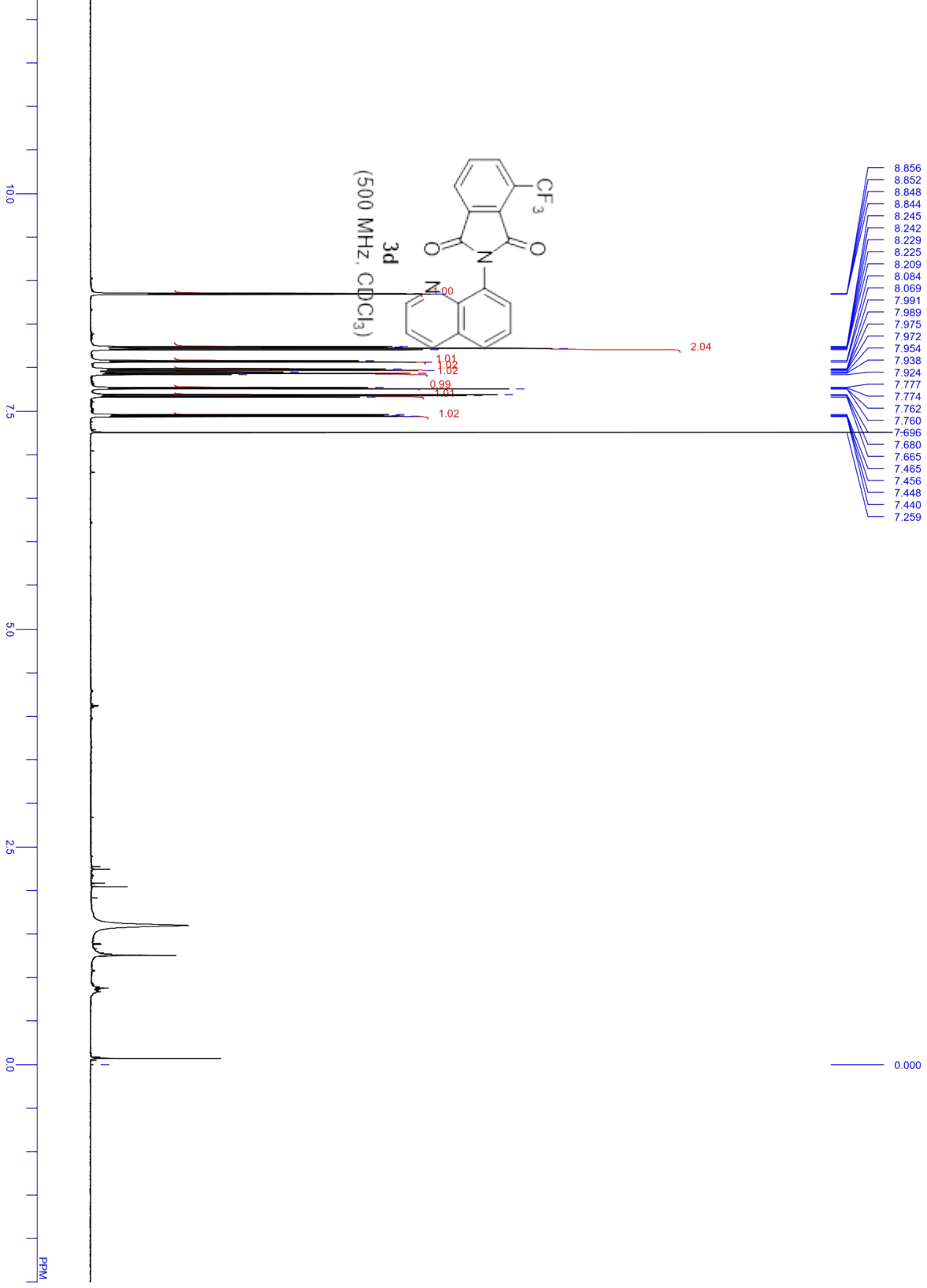

3a
(125 MHz CDCl3)
Me
O
O
N
N
168.625
167.919
150.836
144.283
138.408
136.491
136.128
133.629
132.752
130.224
129.823
129.470
129.184
129.012
126.027
121.773
121.391
77.258
77.000
76.752
17.672
200
150
100
50
0
PPM

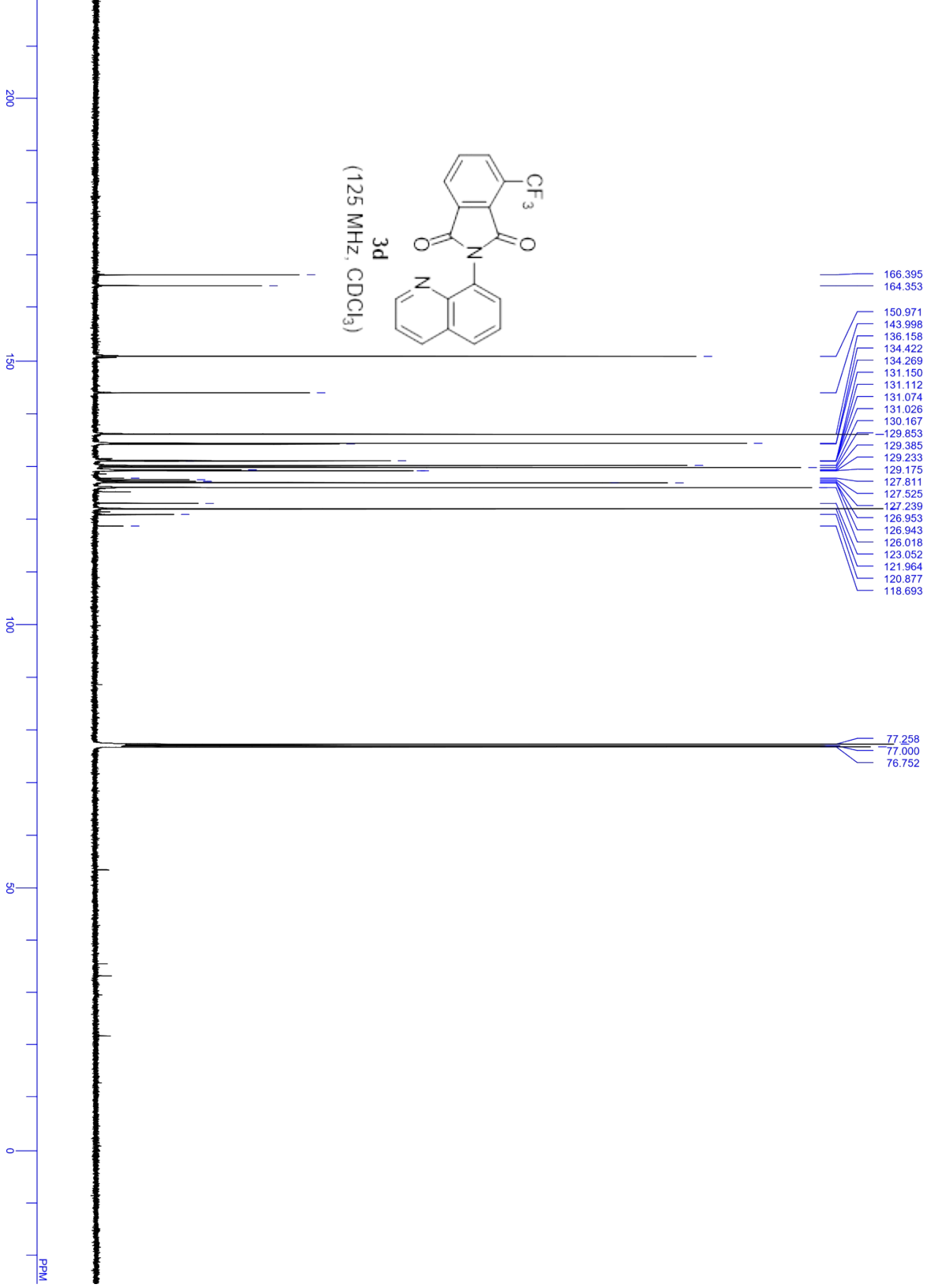

3b
(500 MHz, CDCl3)
Me
O
O
N
N
1.00
1.04
1.02
1.01
1.01
2.08
1.03
1.08
2.12
3.18
8.871
8.867
8.863
8.859
8.229
8.227
8.213
8.210
7.961
7.959
7.945
7.943
7.845
7.830
7.753
7.751
7.738
7.736
7.704
7.689
7.684
7.674
7.668
7.653
7.606
7.590
7.446
7.438
7.430
7.421
7.258
3.251
3.237
3.224
3.209
3.204
3.193
3.189
3.175
3.160
3.146
1.351
1.336
1.320
0.000
10.0
7.5
5.0
2.5
0.0
PPM

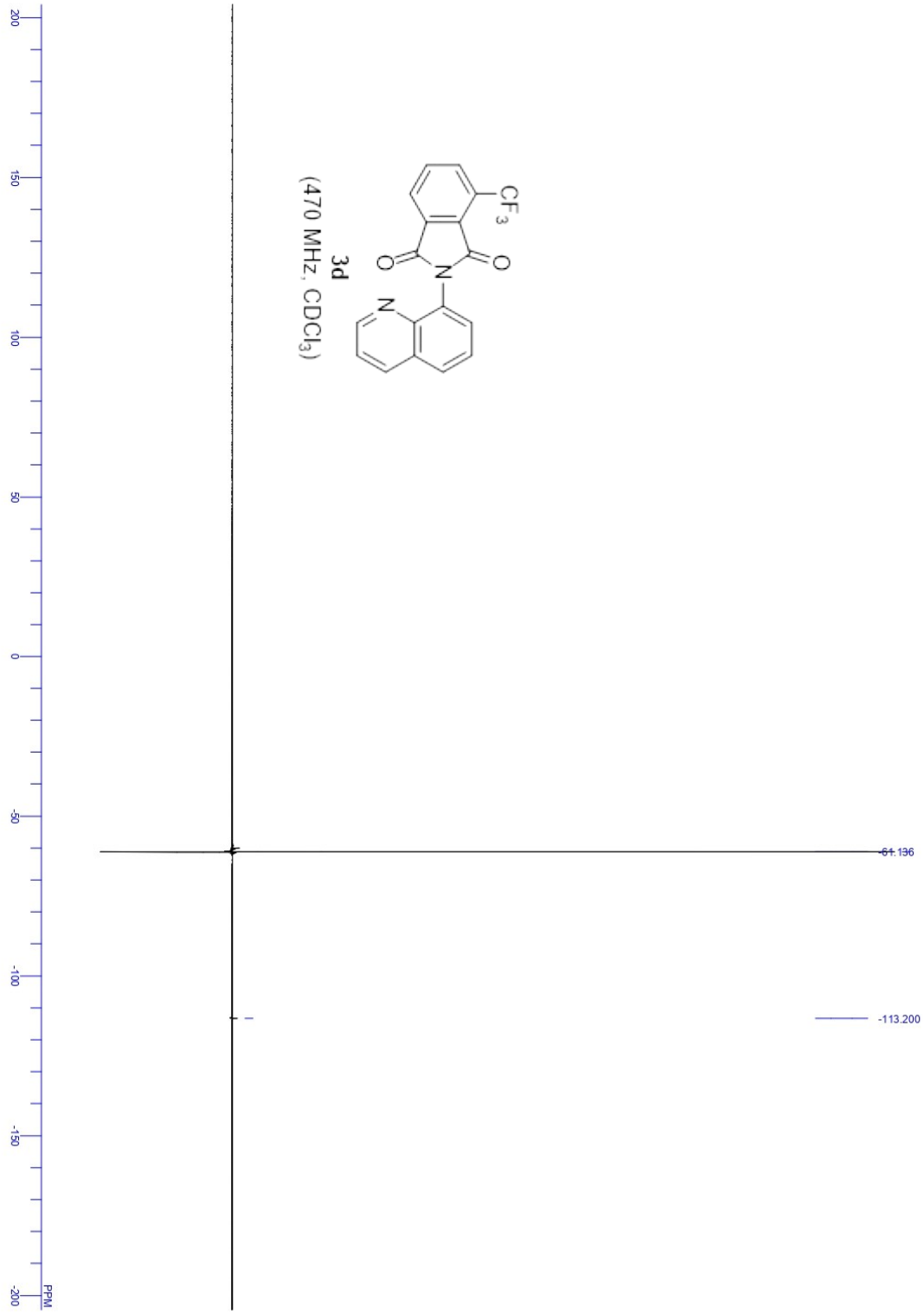

3b
(125 MHz, CDCl3)
Me
O
O
N
N
168.474
167.968
150.914
144.885
144.380
136.148
134.918
133.964
132.991
130.263
129.929
129.481
129.261
128.489
126.104
121.831
121.526
77.248
77.000
76.742
24.586
14.838
200
150
100
50
0
PPM

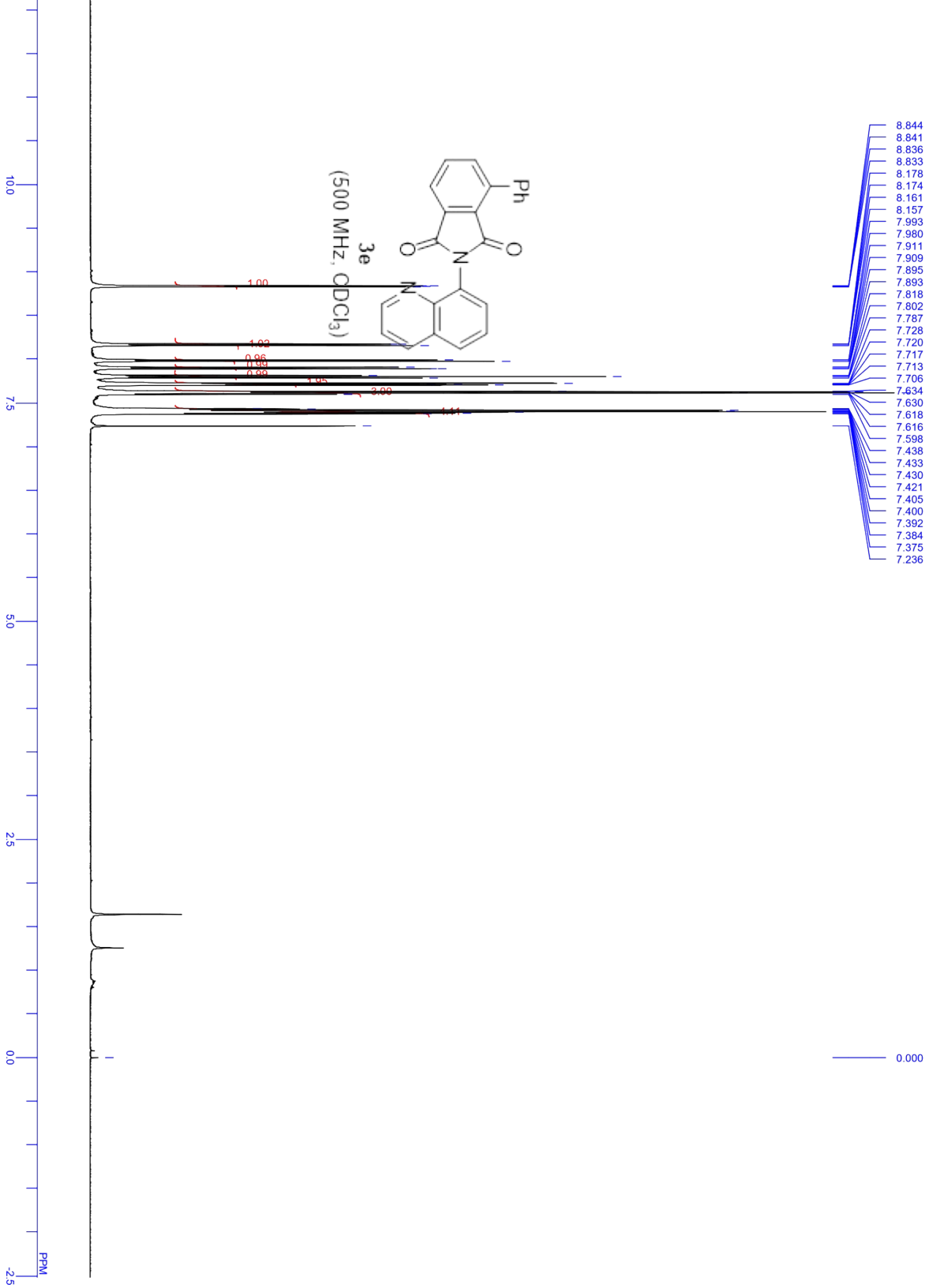

3c
(500 MHz, $CDCl_3$)
10.0
7.5
5.0
2.5
0.0
-2.5
PPM
1.00
1.02
1.03
1.02
1.01
1.02
1.00
2.10
1.90
0.91
1.13
8.865
8.862
8.857
8.854
8.210
8.207
8.193
8.189
7.944
7.942
7.928
7.925
7.824
7.819
7.811
7.808
7.746
7.744
7.731
7.729
7.713
7.698
7.689
7.684
7.673
7.668
7.651
7.636
7.428
7.419
7.411
7.403
7.250
3.825
3.818
3.808
3.801
3.795
3.784
3.778
1.961
1.958
1.853
1.846
1.840
1.829
1.773
1.746
1.678
1.544
1.537
1.519
1.513
1.494
1.489
1.475
1.469
1.454
1.451
1.444
1.437
1.307
1.288
1.280
1.273
1.262
1.255
1.249
0.000

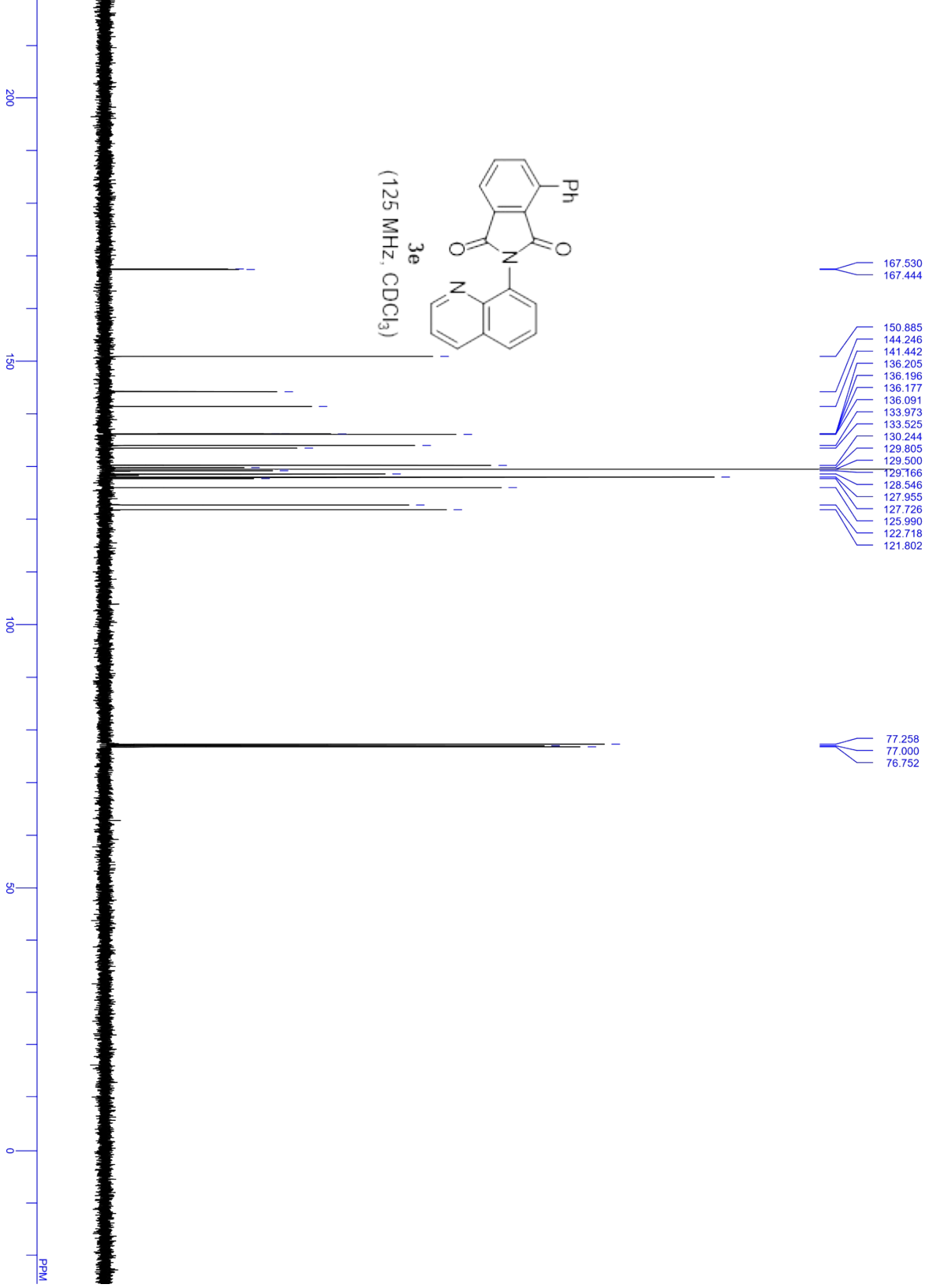

3c
(125 MHz, $CDCl_3$)
O
O
N
N
168.711
167.891
150.941
148.843
144.379
136.109
134.087
132.904
132.103
130.281
129.938
129.470
129.222
127.801
126.056
121.821
121.296
77.258
77.000
76.752
38.255
33.686
33.057
26.657
26.561
26.037
200
150
100
50
0
PPM

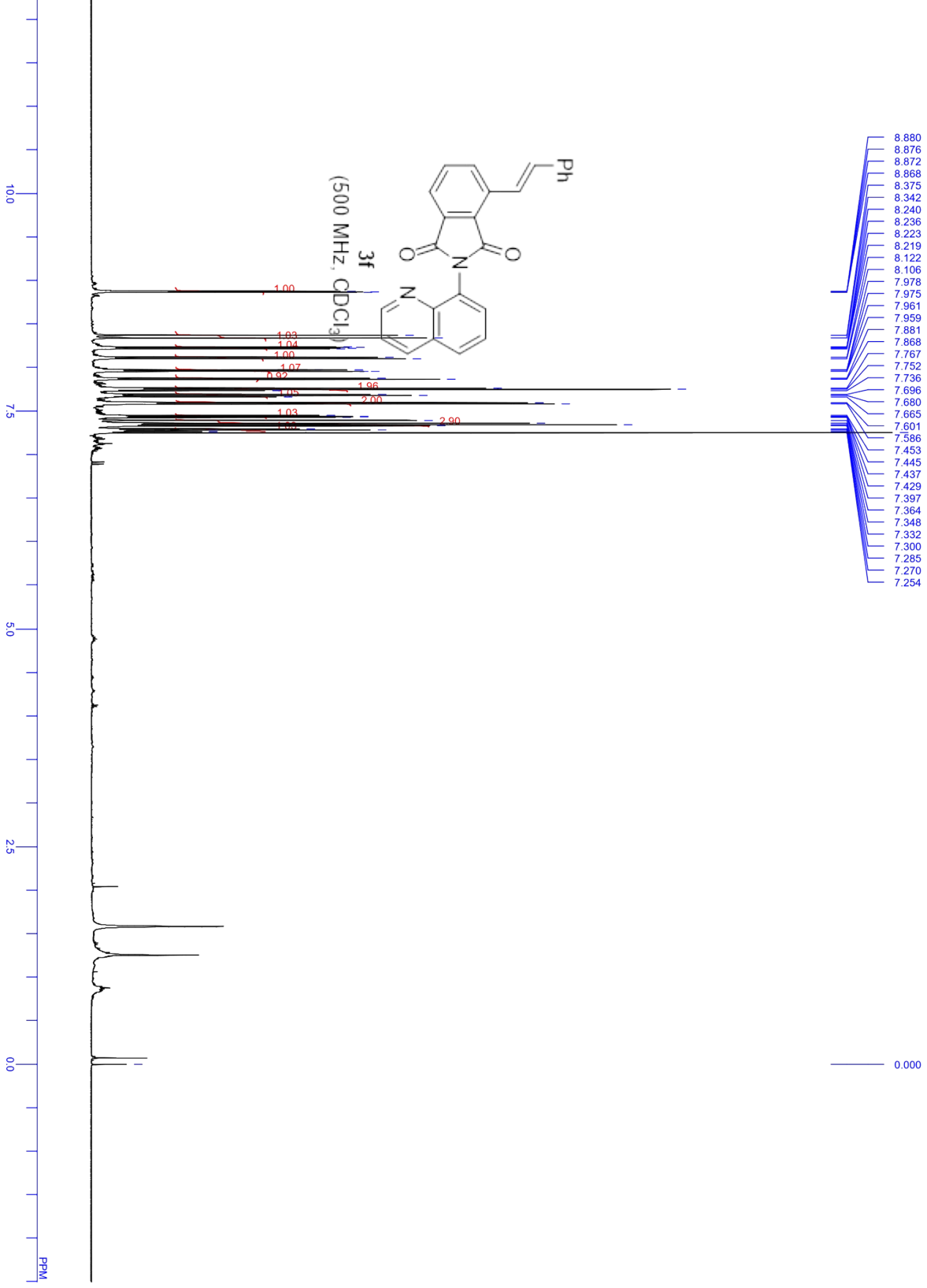

3d
(500 MHz, CDCl3)
CF3
O
O
N
N
1.00
2.04
1.01
1.02
0.99
1.01
1.02
8.856
8.852
8.848
8.844
8.245
8.242
8.229
8.225
8.209
8.084
8.069
7.991
7.989
7.975
7.972
7.954
7.938
7.924
7.777
7.774
7.762
7.760
7.696
7.680
7.665
7.465
7.456
7.448
7.440
7.259
0.000
10.0
7.5
5.0
2.5
0.0
PPM

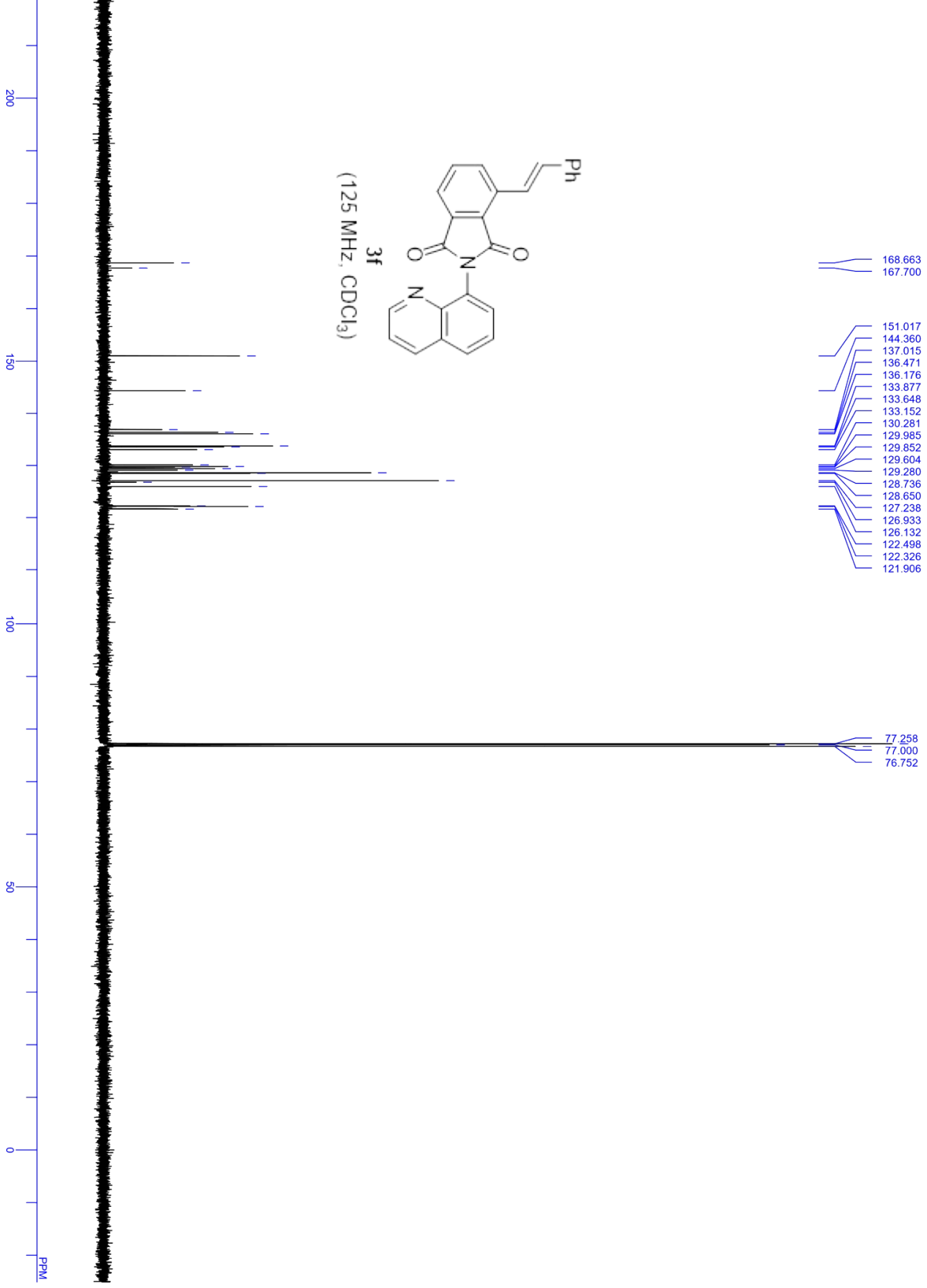

3d
(125 MHz, CDCl3)
CF3
O
O
N
N
166.395
164.353
150.971
143.998
136.158
134.422
134.269
131.150
131.112
131.074
131.026
130.167
129.853
129.385
129.233
129.175
127.811
127.525
127.239
126.953
126.943
126.018
123.052
121.964
120.877
118.693
77.258
77.000
76.752
200
150
100
50
0
PPM

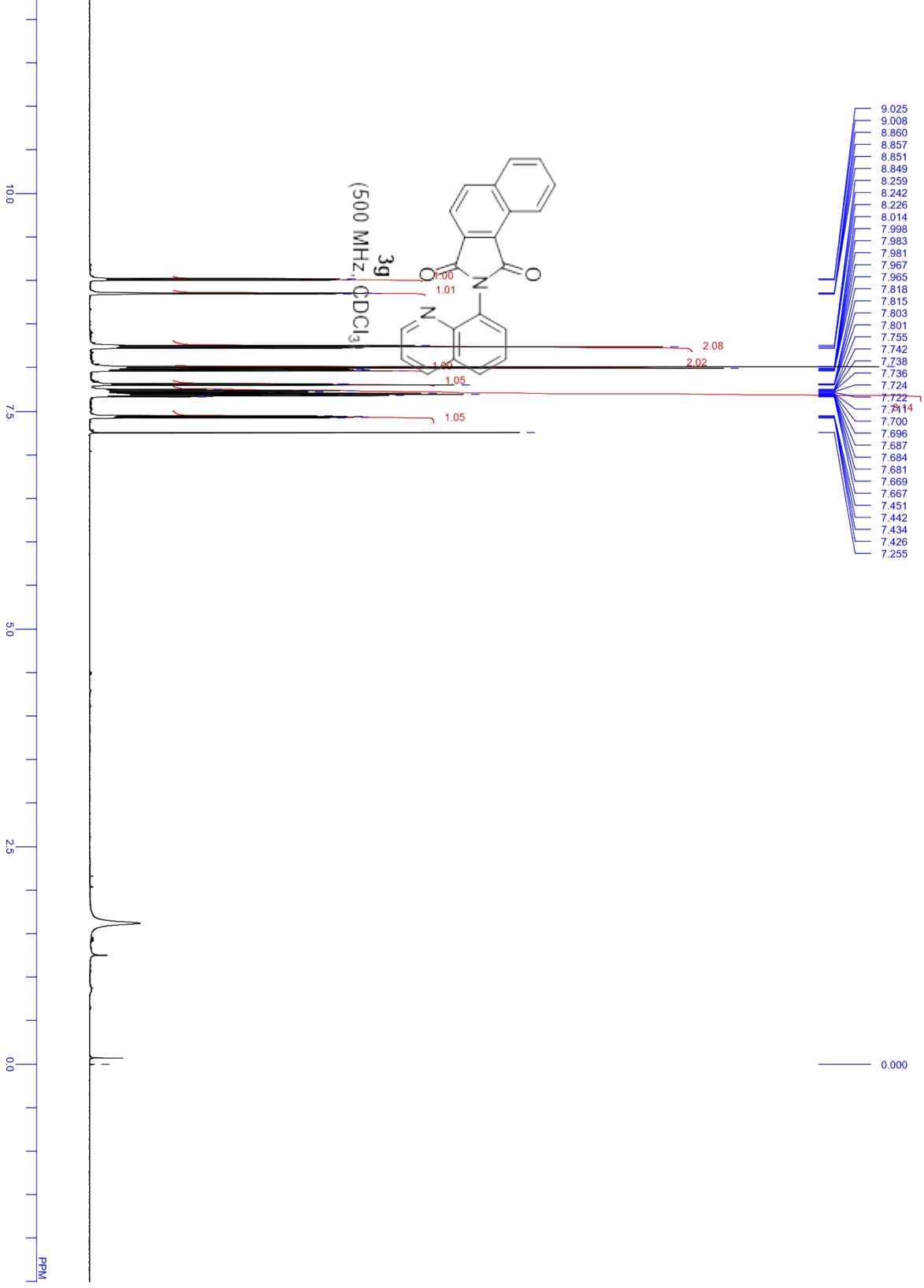

3d
(470 MHz, $CDCl_3$)
CF_3
O
O
N
N
-61.136
-113.200
200
150
100
50
0
-50
-100
-150
-200
PPM

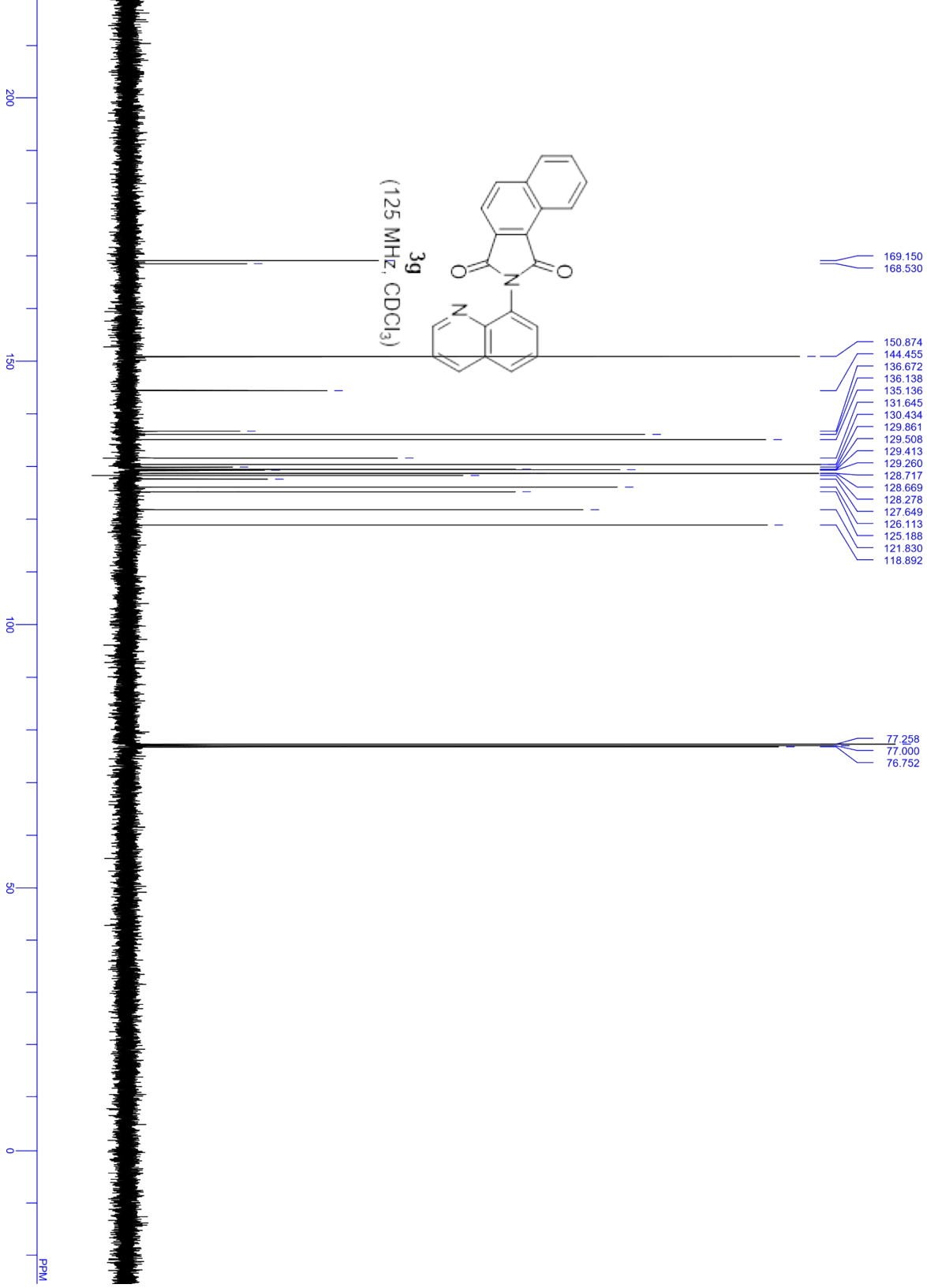

3e
(500 MHz, CDCl3)
Ph
O
O
N
N
1.00
1.02
0.96
0.99
1.05
3.00
1.11
8.844
8.841
8.836
8.833
8.178
8.174
8.161
8.157
7.993
7.980
7.911
7.909
7.895
7.893
7.818
7.802
7.787
7.728
7.720
7.717
7.713
7.706
7.634
7.630
7.618
7.616
7.598
7.438
7.433
7.430
7.421
7.405
7.400
7.392
7.384
7.375
7.236
0.000
10.0
7.5
5.0
2.5
0.0
-2.5
PPM

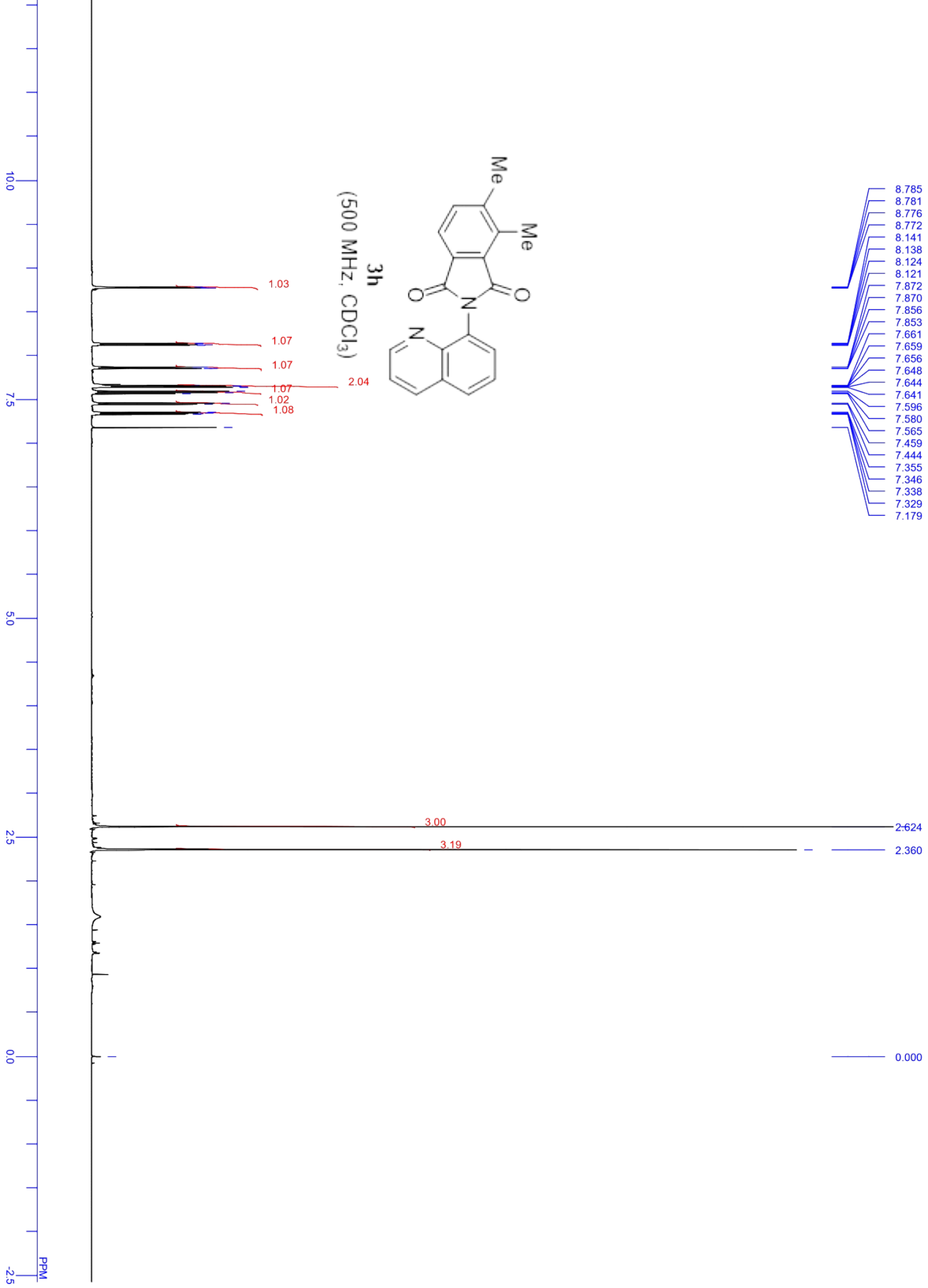

3e
(125 MHz, CDCl3)
Ph
O
O
N
N
167.530
167.444
150.885
144.246
141.442
136.205
136.196
136.177
136.091
133.973
133.525
130.244
129.805
129.500
129.166
128.546
127.955
127.726
125.990
122.718
121.802
77.258
77.000
76.752
200
150
100
50
0
PPM

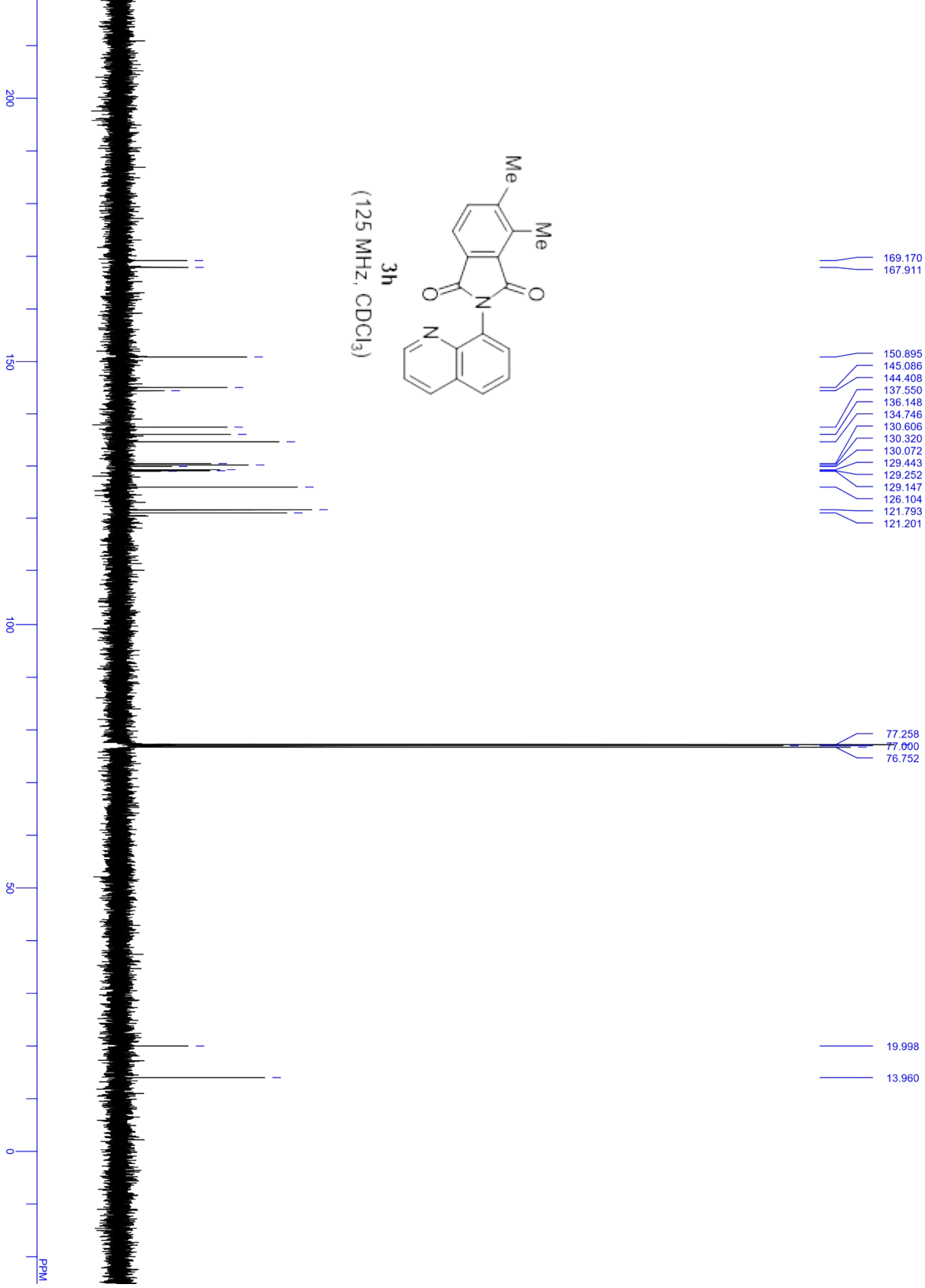

3f
(500 MHz, CDCl3)
Ph
O
N
O
N
1.00
1.03
1.04
1.00
1.07
0.92
1.96
1.05
2.00
1.03
2.90
8.880
8.876
8.872
8.868
8.375
8.342
8.240
8.236
8.223
8.219
8.122
8.106
7.978
7.975
7.961
7.959
7.881
7.868
7.767
7.752
7.736
7.696
7.680
7.665
7.601
7.586
7.453
7.445
7.437
7.429
7.397
7.364
7.348
7.332
7.300
7.285
7.270
7.254
0.000
10.0
7.5
5.0
2.5
0.0
PPM

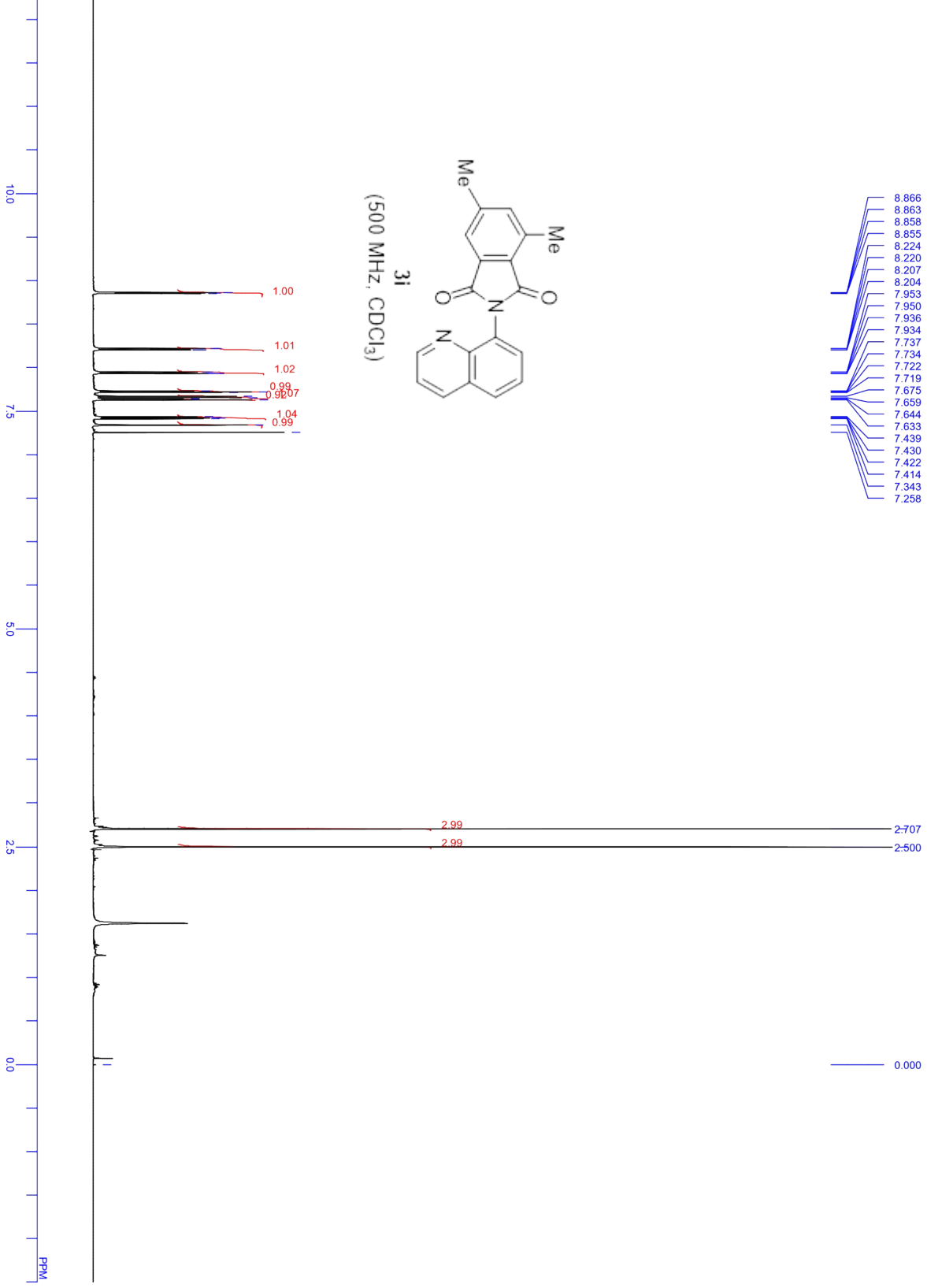

3f
(125 MHz, CDCl3)
Ph
O
O
N
N
168.663
167.700
151.017
144.360
137.015
136.471
136.176
133.877
133.648
133.152
130.281
129.985
129.852
129.604
129.280
128.736
128.650
127.238
126.933
126.132
122.498
122.326
121.906
77.258
77.000
76.752
200
150
100
50
0
PPM

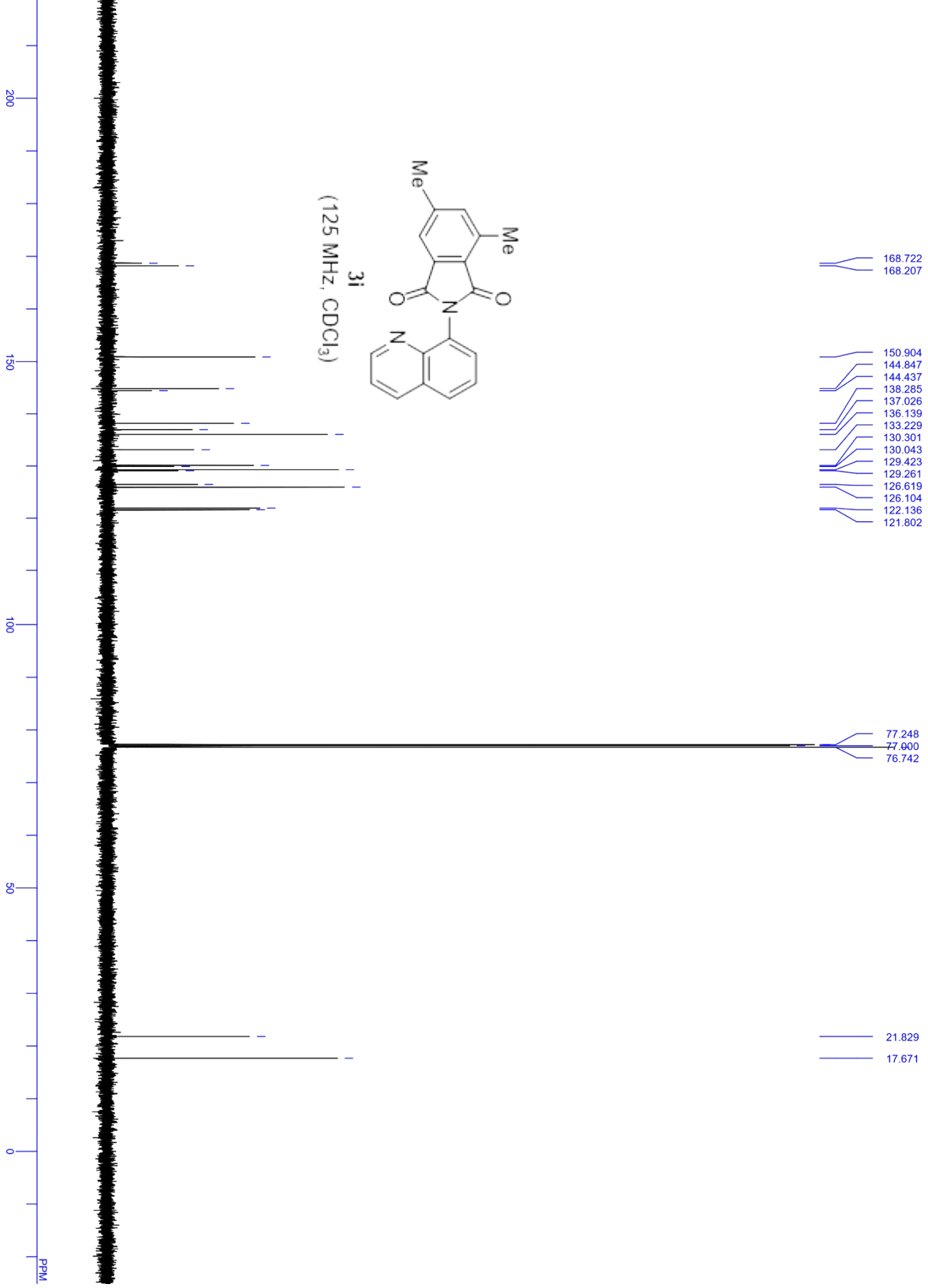

3g
(500 MHz, CDCl3)
1.00
1.01
2.08
2.02
1.00
1.05
1.05
9.025
9.008
8.860
8.857
8.851
8.849
8.259
8.242
8.226
8.014
7.998
7.983
7.981
7.967
7.965
7.818
7.815
7.803
7.801
7.755
7.742
7.738
7.736
7.724
7.722
7.714
7.700
7.696
7.687
7.684
7.681
7.669
7.667
7.451
7.442
7.434
7.426
7.255
0.000
10.0
7.5
5.0
2.5
0.0
PPM

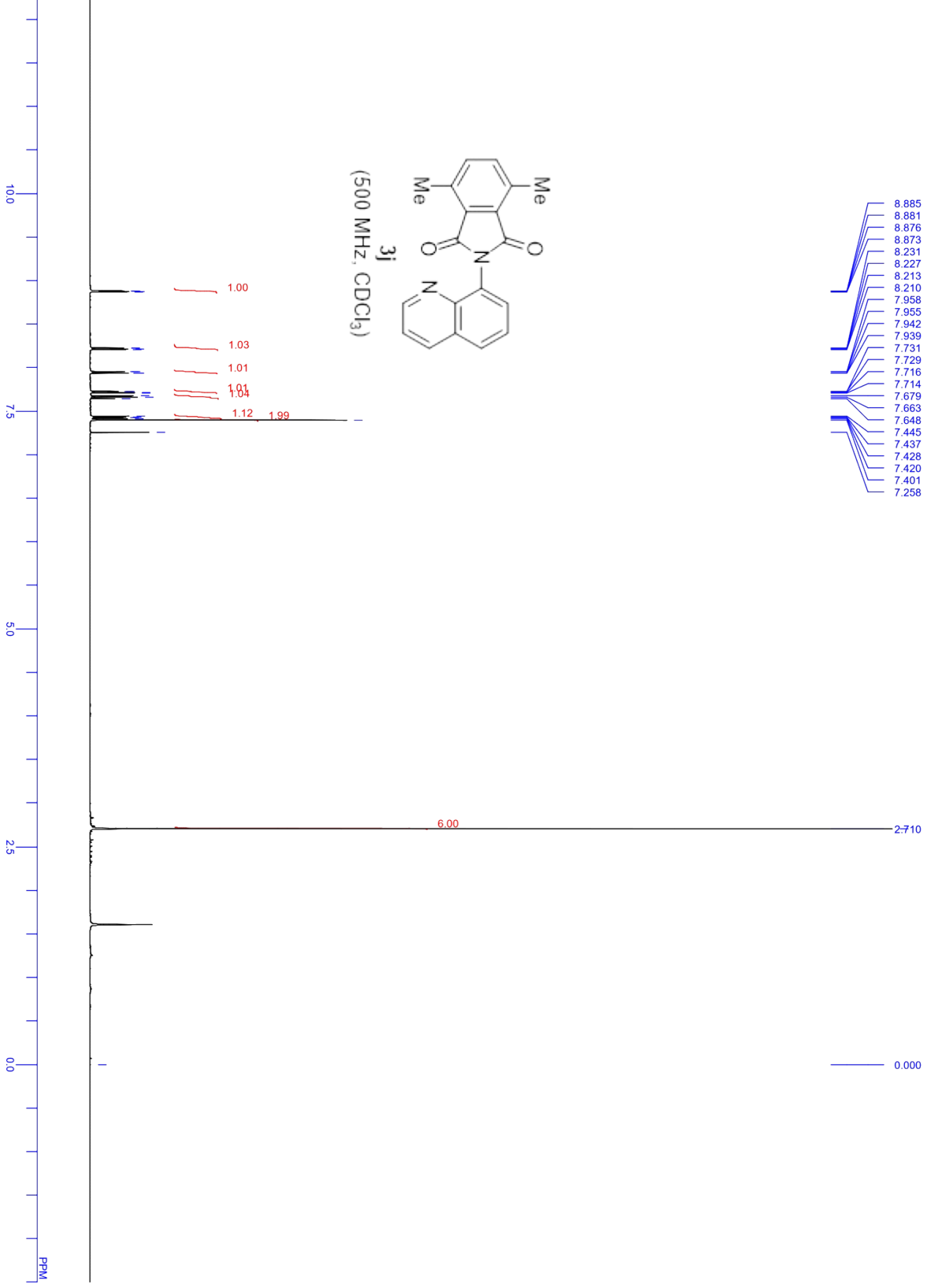

3g
(125 MHz, CDCl3)
169.150
168.530
150.874
144.455
136.672
136.138
135.136
131.645
130.434
129.861
129.508
129.413
129.260
128.717
128.669
128.278
127.649
126.113
125.188
121.830
118.892
77.258
77.000
76.752
200
150
100
50
0
PPM

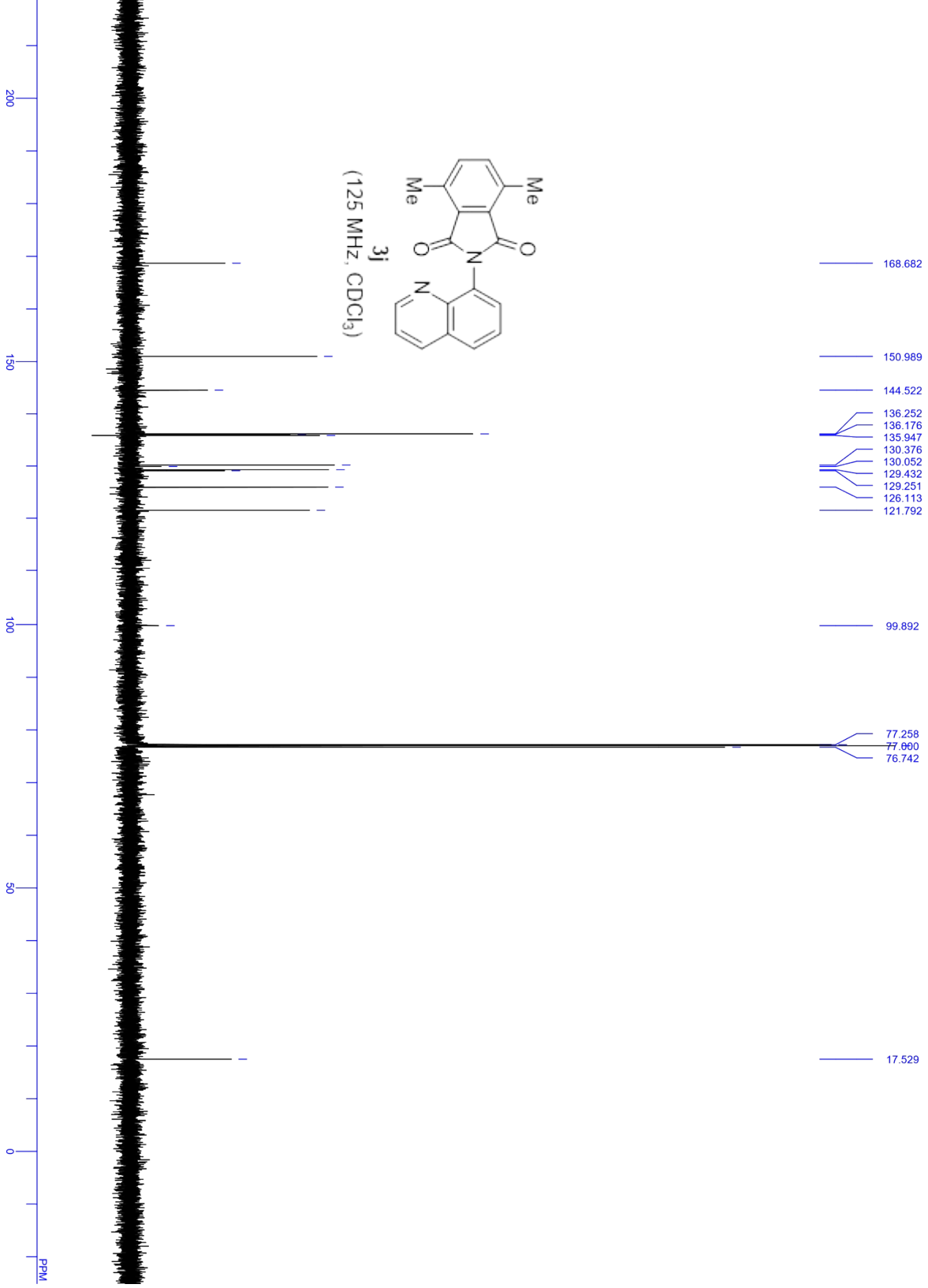

3h
(500 MHz, CDCl3)
Me
Me
O
O
N
N
1.03
1.07
1.07
1.07
2.04
1.02
1.08
3.00
3.19
8.785
8.781
8.776
8.772
8.141
8.138
8.124
8.121
7.872
7.870
7.856
7.853
7.661
7.659
7.656
7.648
7.644
7.641
7.596
7.580
7.565
7.459
7.444
7.355
7.346
7.338
7.329
7.179
2.624
2.360
0.000
10.0
7.5
5.0
2.5
0.0
-2.5
PPM

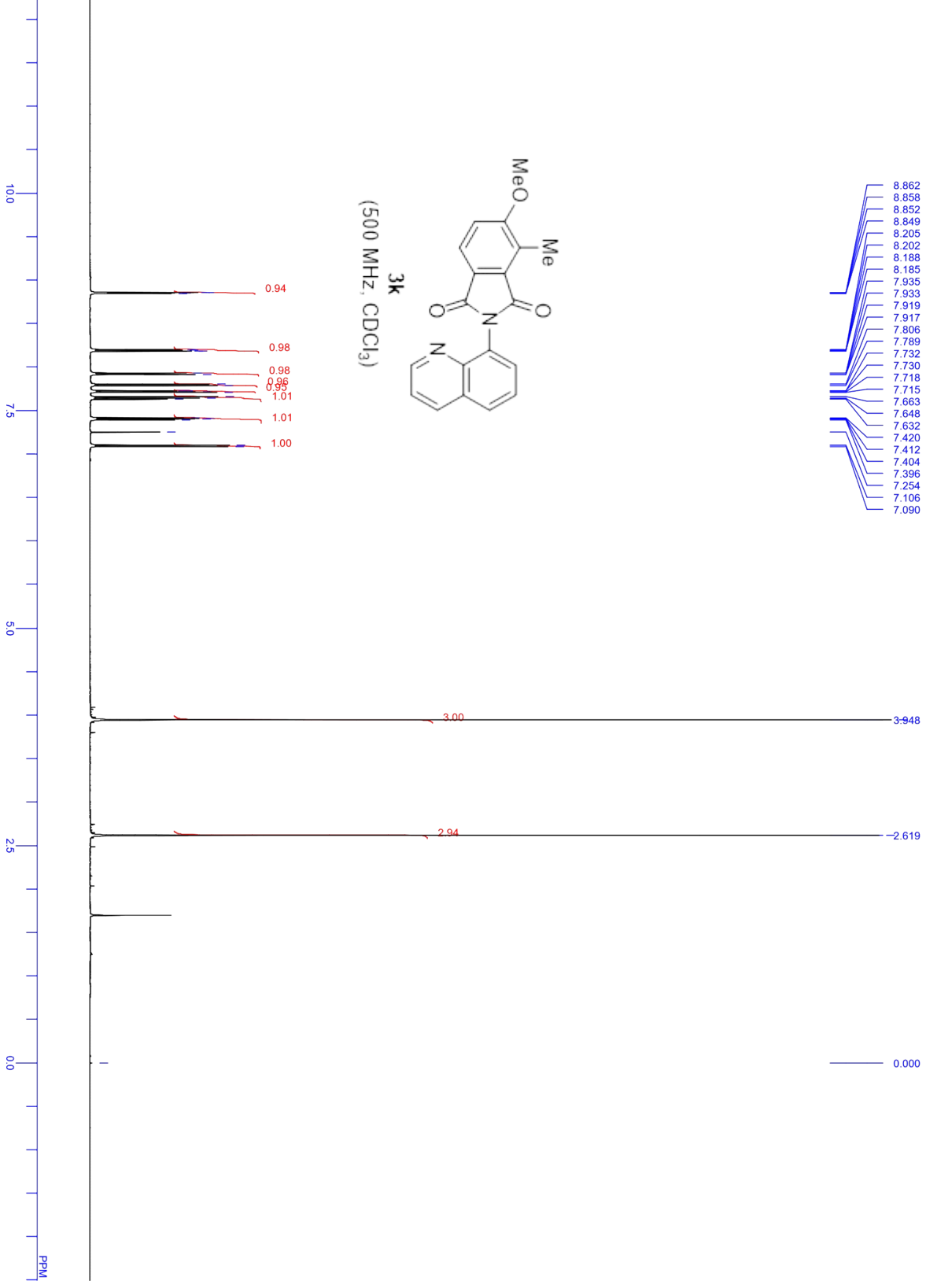

3h
(125 MHz, CDCl3)
Me
Me
O
O
N
N
169.170
167.911
150.895
145.086
144.408
137.550
136.148
134.746
130.606
130.320
130.072
129.443
129.252
129.147
126.104
121.793
121.201
77.258
77.000
76.752
19.998
13.960
200
150
100
50
0
PPM

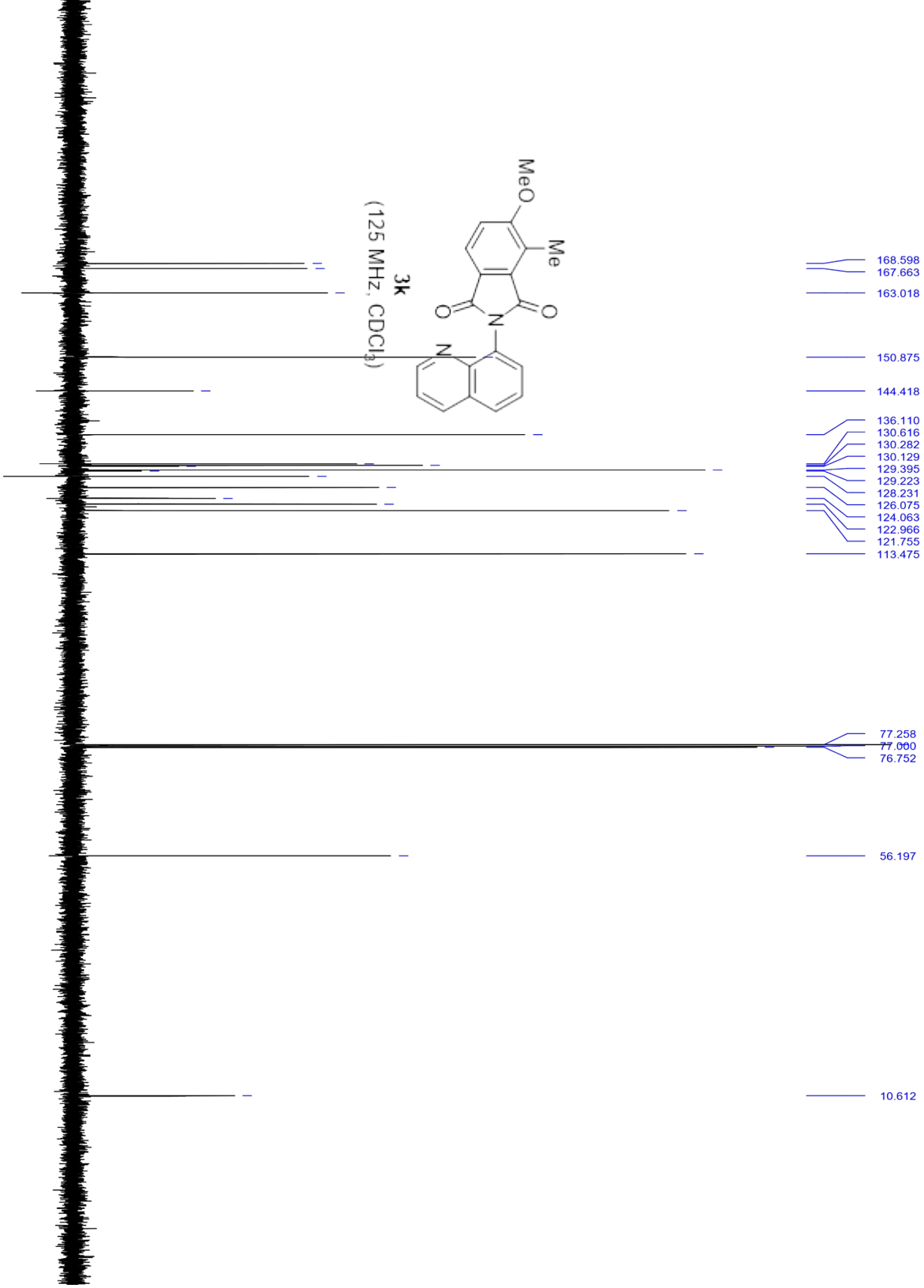

3i
(500 MHz, CDCl3)
Me
Me
O
O
N
N
1.00
1.01
1.02
0.99
0.92
0.97
1.04
0.99
2.99
2.99
8.866
8.863
8.858
8.855
8.224
8.220
8.207
8.204
7.953
7.950
7.936
7.934
7.737
7.734
7.722
7.719
7.675
7.659
7.644
7.633
7.439
7.430
7.422
7.414
7.343
7.258
2.707
2.500
0.000
10.0
7.5
5.0
2.5
0.0
PPM

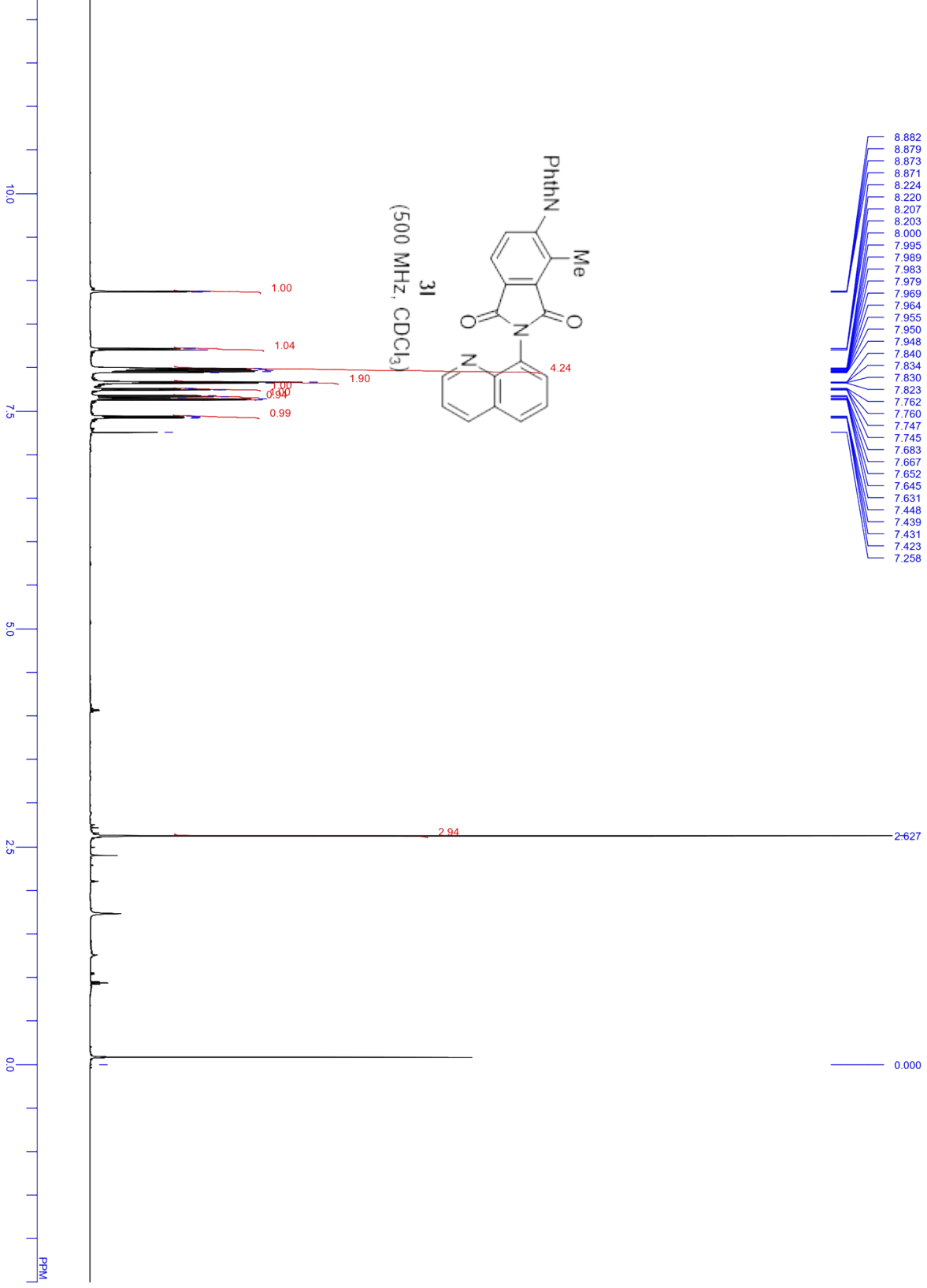

3i
(125 MHz, CDCl3)
Me
Me
O
O
N
N
168.722
168.207
150.904
144.847
144.437
138.285
137.026
136.139
133.229
130.301
130.043
129.423
129.261
126.619
126.104
122.136
121.802
77.248
77.000
76.742
21.829
17.671
200
150
100
50
0
PPM

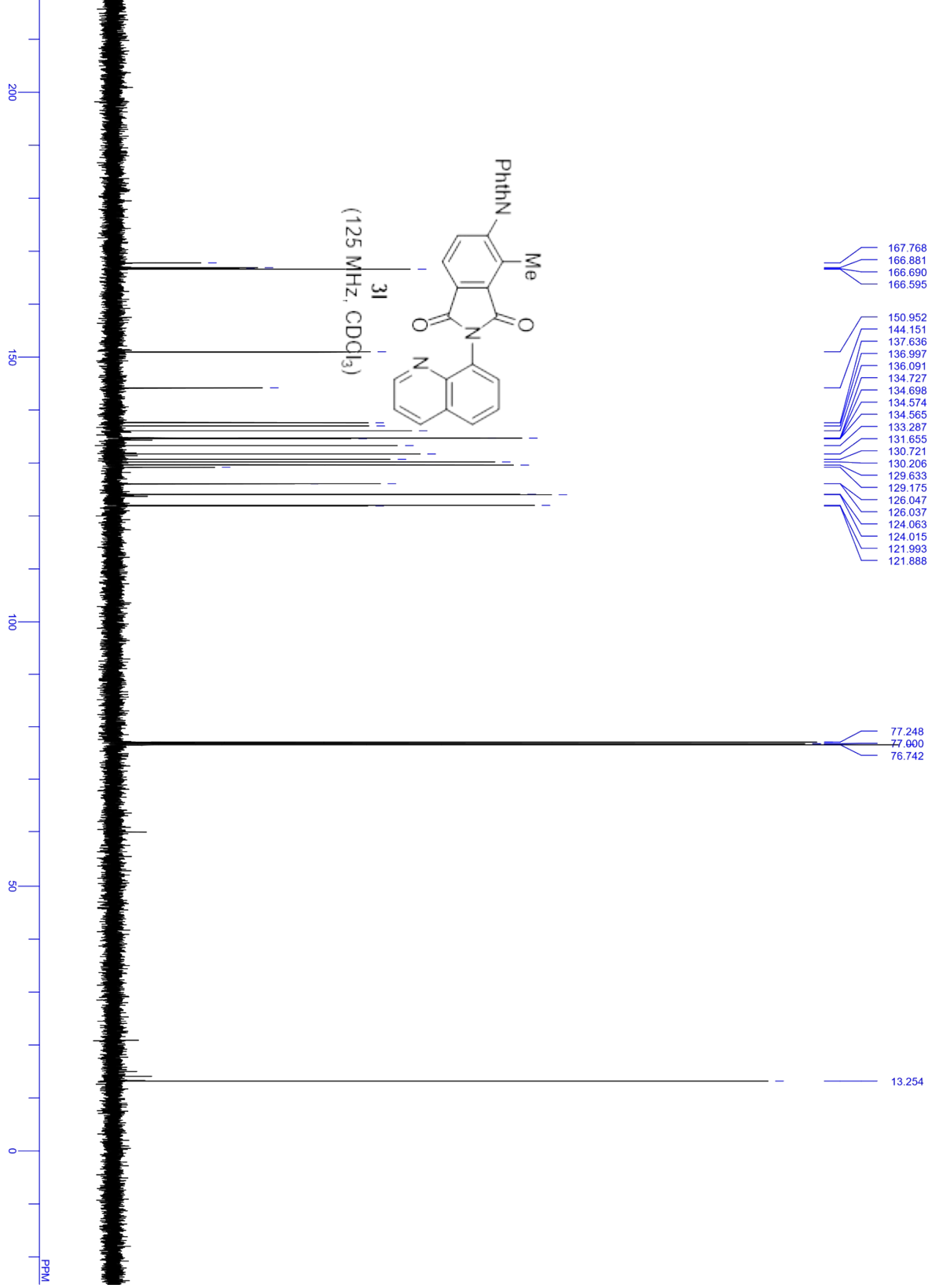

3j
(500 MHz, CDCl3)
Me
Me
O
O
N
N
1.00
1.03
1.01
1.01
1.04
1.12
1.99
6.00
2.710
0.000
8.885
8.881
8.876
8.873
8.231
8.227
8.213
8.210
7.958
7.955
7.942
7.939
7.731
7.729
7.716
7.714
7.679
7.663
7.648
7.445
7.437
7.428
7.420
7.401
7.258
10.0
7.5
5.0
2.5
0.0
PPM

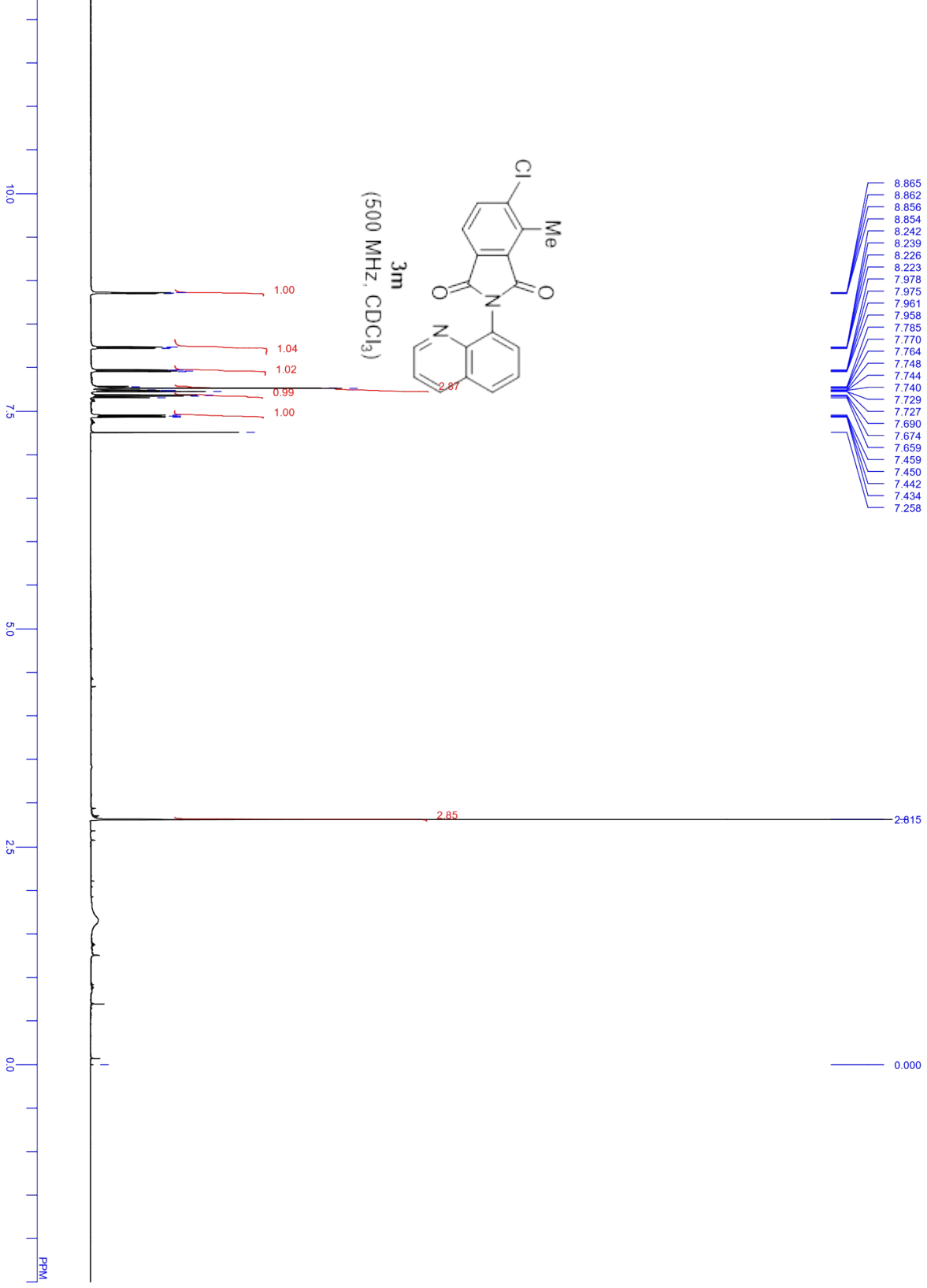

3j
(125 MHz, CDCl3)
Me
Me
O
O
N
N
168.682
150.989
144.522
136.252
136.176
135.947
130.376
130.052
129.432
129.251
126.113
121.792
99.892
77.258
77.000
76.742
17.529
200
150
100
50
0
PPM

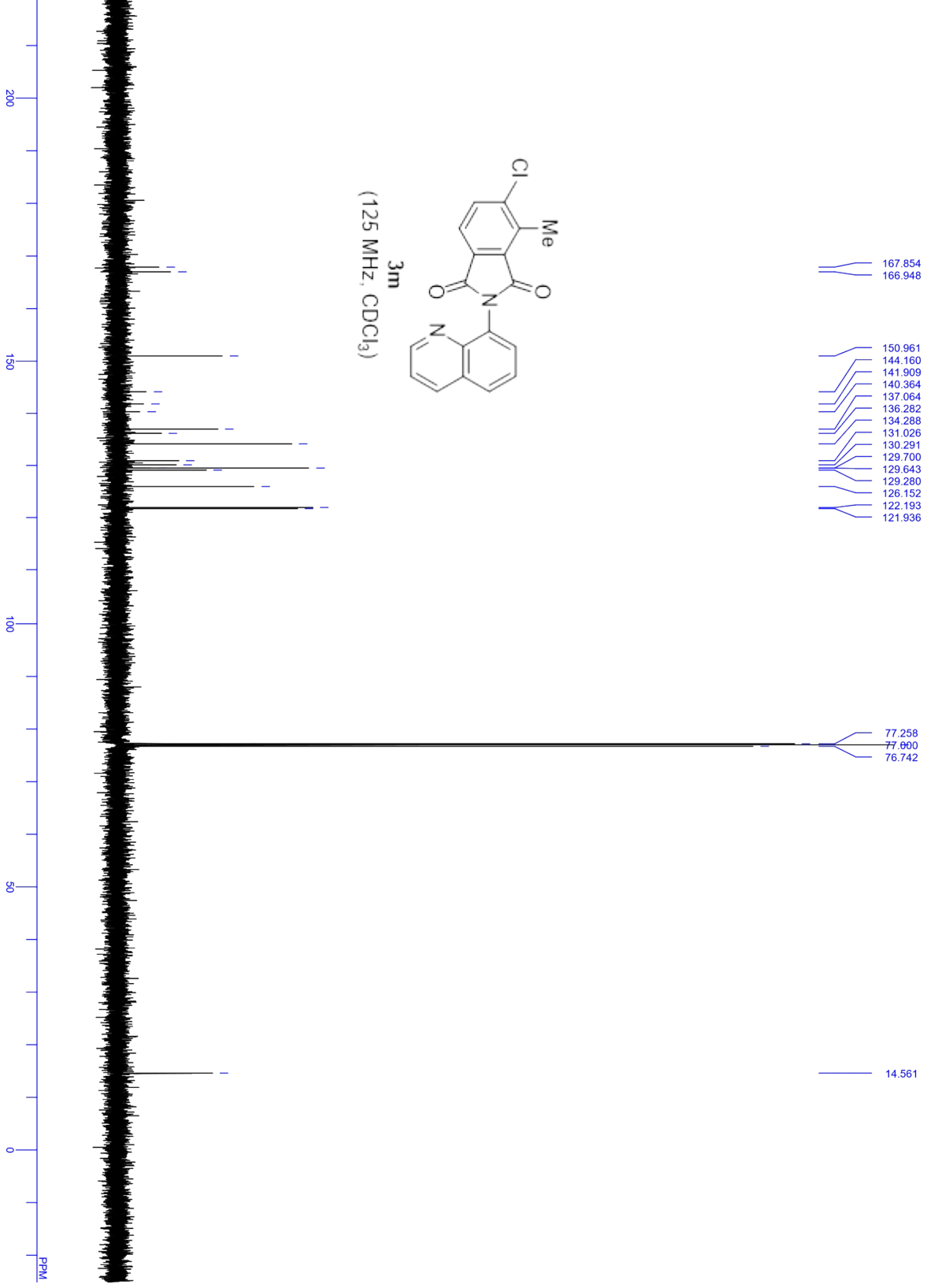

3k
(500 MHz, $CDCl_3$)
MeO
Me
O
O
N
N
0.94
0.98
0.98
0.96
0.95
1.01
1.01
1.00
3.00
2.94
8.862
8.858
8.852
8.849
8.205
8.202
8.188
8.185
7.935
7.933
7.919
7.917
7.806
7.789
7.732
7.730
7.718
7.715
7.663
7.648
7.632
7.420
7.412
7.404
7.396
7.254
7.106
7.090
3.948
2.619
0.000
10.0
7.5
5.0
2.5
0.0
PPM

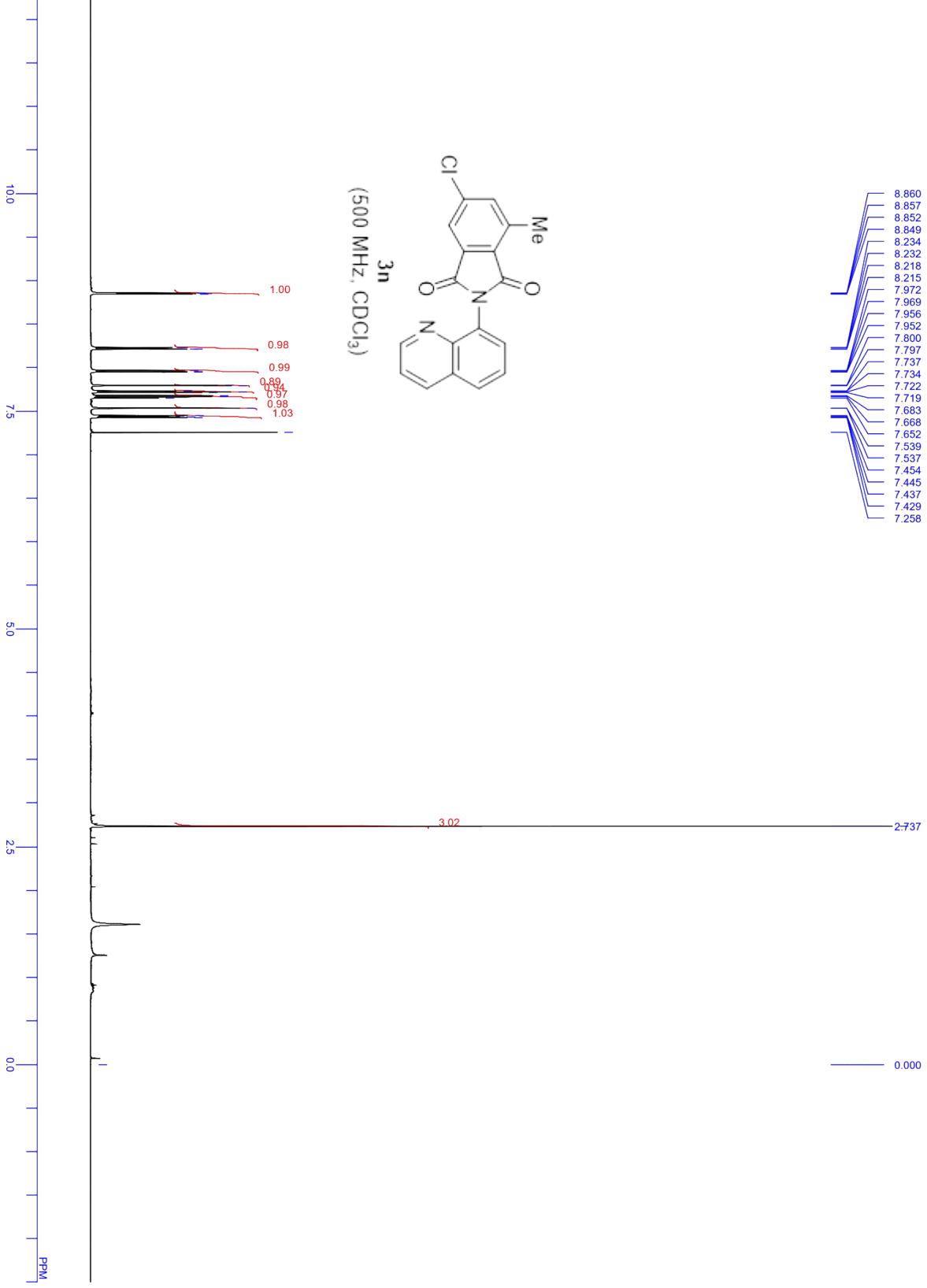

3k
(125 MHz, CDCl3)
MeO
Me
O
O
N
N
168.598
167.663
163.018
150.875
144.418
136.110
130.616
130.282
130.129
129.395
129.223
128.231
126.075
124.063
122.966
121.755
113.475
77.258
77.000
76.752
56.197
10.612

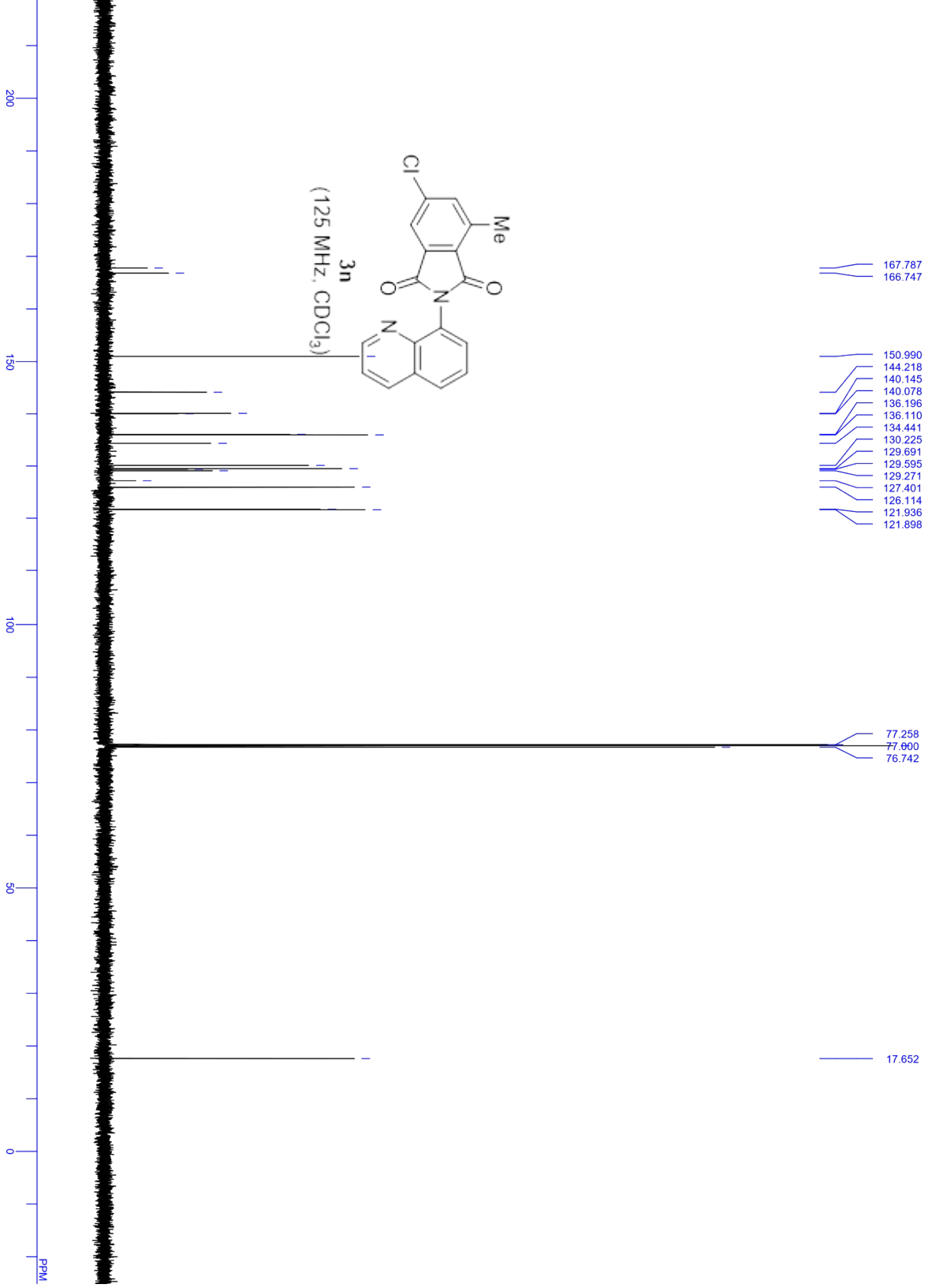

3l
(500 MHz, CDCl3)
PhthN
Me
O
O
N
N
1.00
1.04
1.90
1.00
0.94
0.99
4.24
2.94
2.627
0.000
8.882
8.879
8.873
8.871
8.224
8.220
8.207
8.203
8.000
7.995
7.989
7.983
7.979
7.969
7.964
7.955
7.950
7.948
7.840
7.834
7.830
7.823
7.762
7.760
7.747
7.745
7.683
7.667
7.652
7.645
7.631
7.448
7.439
7.431
7.423
7.258
10.0
7.5
5.0
2.5
0.0
PPM

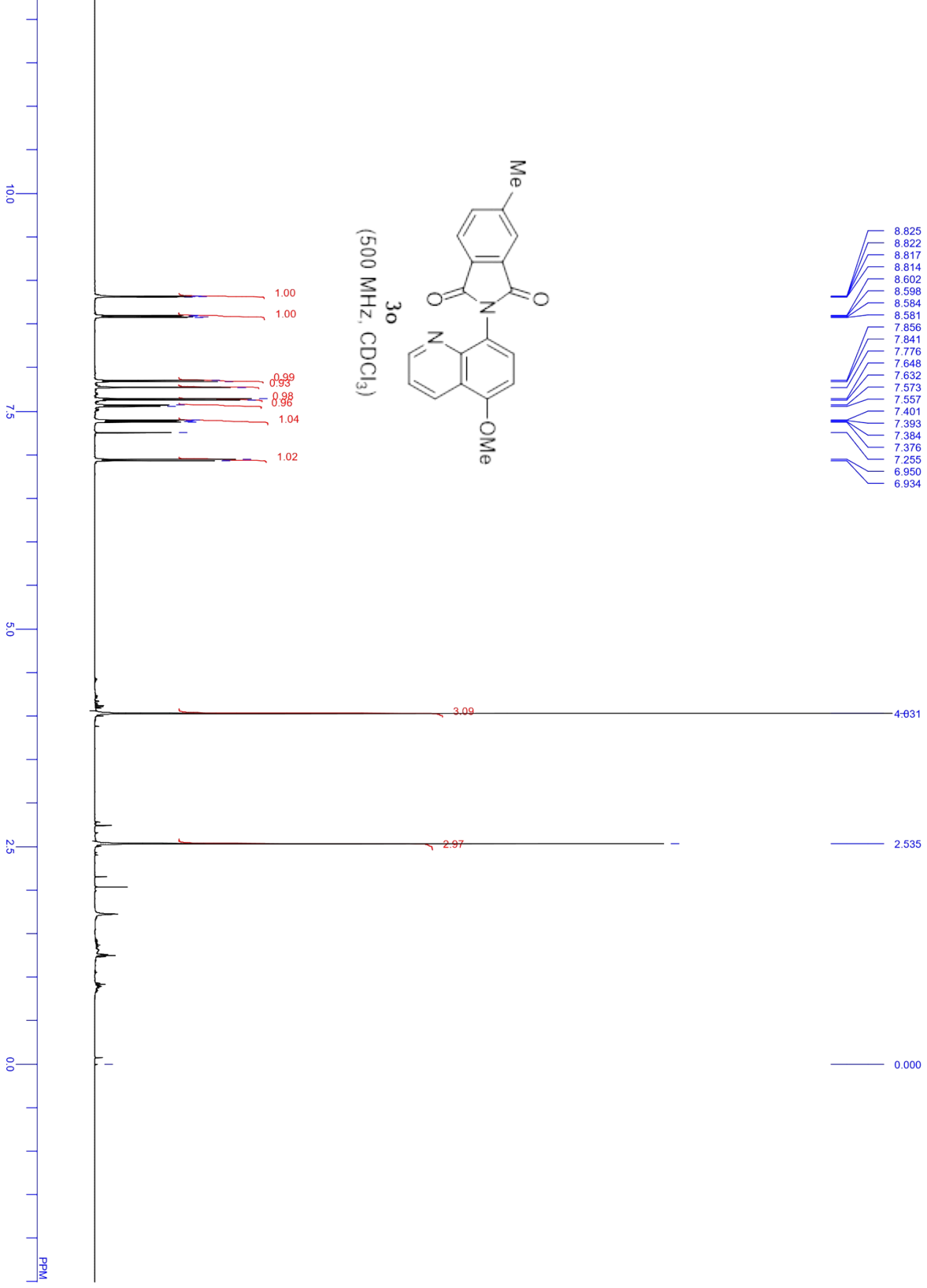

PhthN
Me
O
O
N
N
31
(125 MHz, CDCl3)
167.768
166.881
166.690
166.595
150.952
144.151
137.636
136.997
136.091
134.727
134.698
134.574
134.565
133.287
131.655
130.721
130.206
129.633
129.175
126.047
126.037
124.063
124.015
121.993
121.888
77.248
77.000
76.742
13.254
200
150
100
50
0
PPM

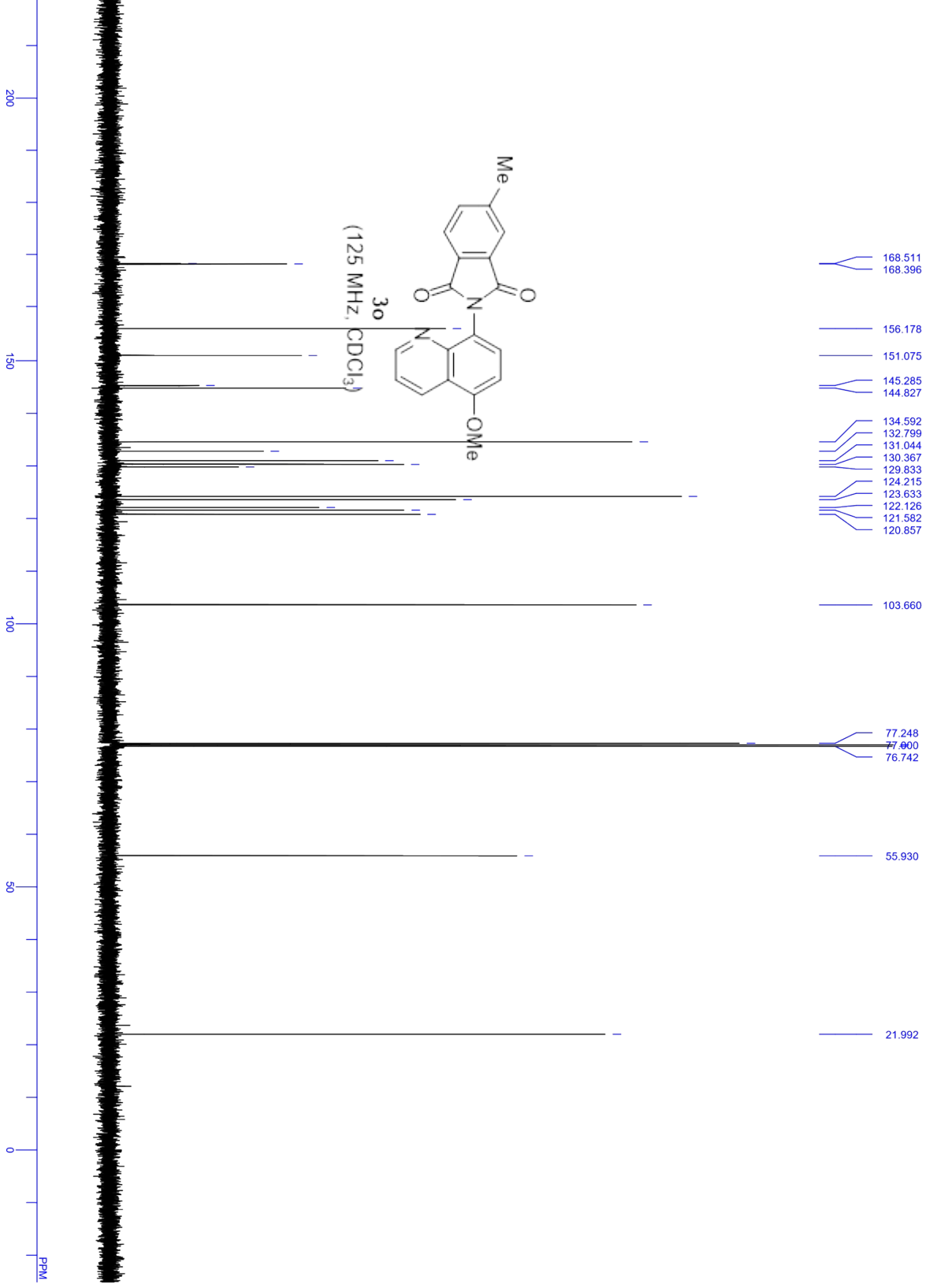

3m
(500 MHz, CDCl3)
Cl
Me
O
O
N
N
1.00
1.04
1.02
0.99
1.00
2.87
2.85
8.865
8.862
8.856
8.854
8.242
8.239
8.226
8.223
7.978
7.975
7.961
7.958
7.785
7.770
7.764
7.748
7.744
7.740
7.729
7.727
7.690
7.674
7.659
7.459
7.450
7.442
7.434
7.258
2.815
0.000
10.0
7.5
5.0
2.5
0.0
PPM

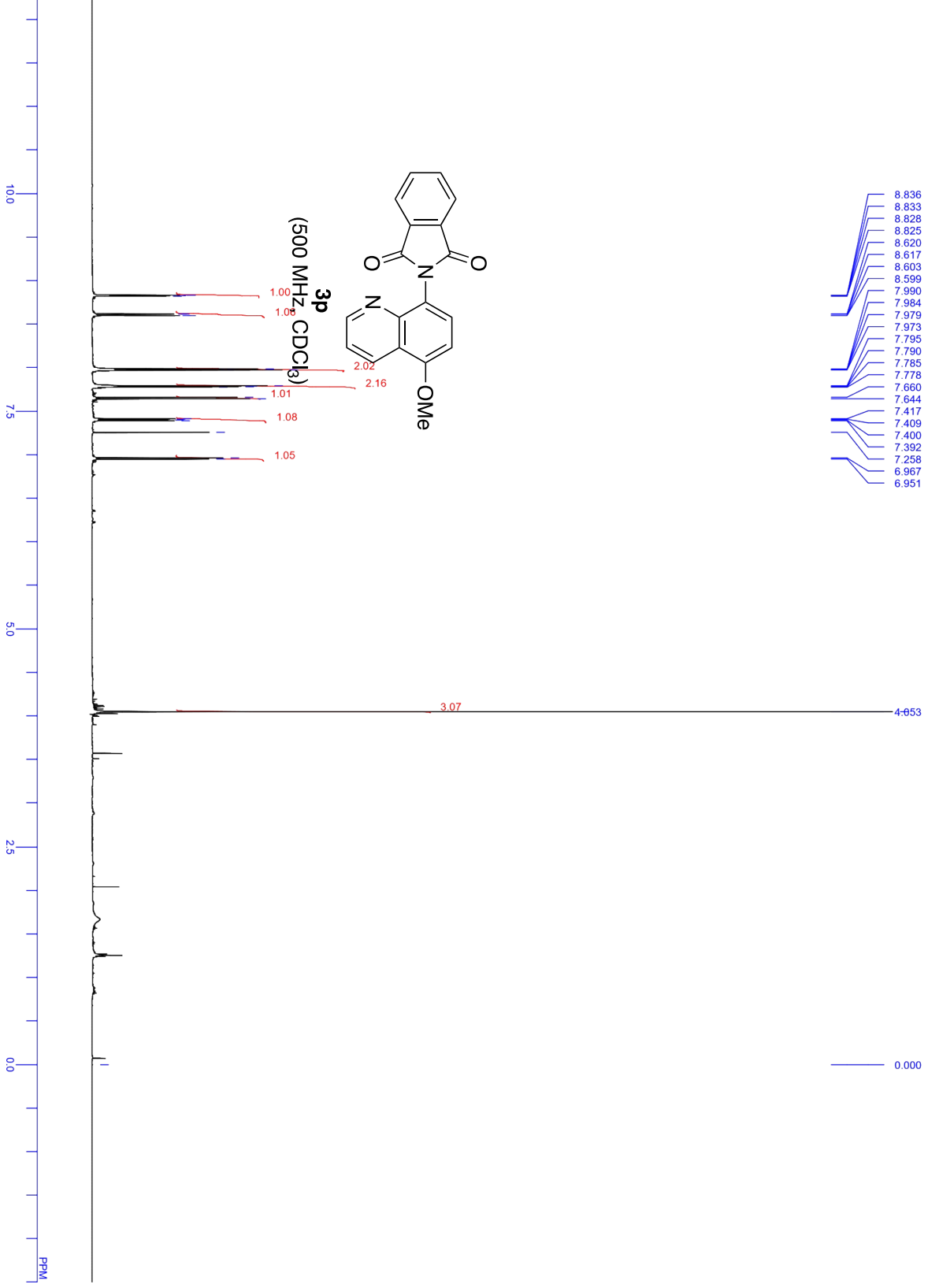

3m
(125 MHz, $CDCl_3$)
Cl
Me
O
O
N
N
167.854
166.948
150.961
144.160
141.909
140.364
137.064
136.282
134.288
131.026
130.291
129.700
129.643
129.280
126.152
122.193
121.936
77.258
77.000
76.742
14.561
200
150
100
50
0
PPM

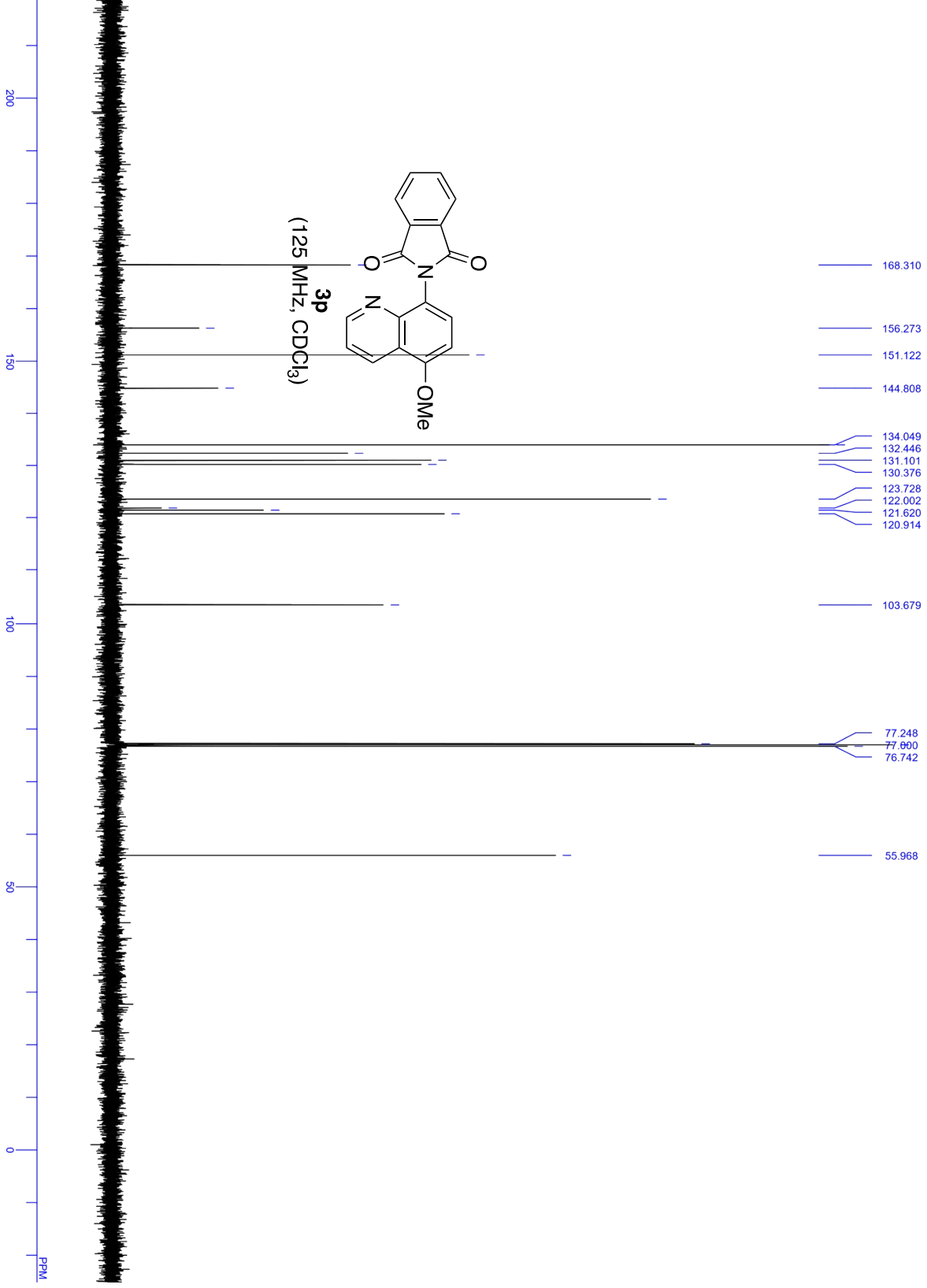

3n
(500 MHz, CDCl3)
Cl
Me
O
O
N
N
1.00
0.98
0.99
0.89
0.97
0.98
1.03
3.02
2.737
0.000
8.860
8.857
8.852
8.849
8.234
8.232
8.218
8.215
7.972
7.969
7.956
7.952
7.800
7.797
7.737
7.734
7.722
7.719
7.683
7.668
7.652
7.539
7.537
7.454
7.445
7.437
7.429
7.258
10.0
7.5
5.0
2.5
0.0
PPM

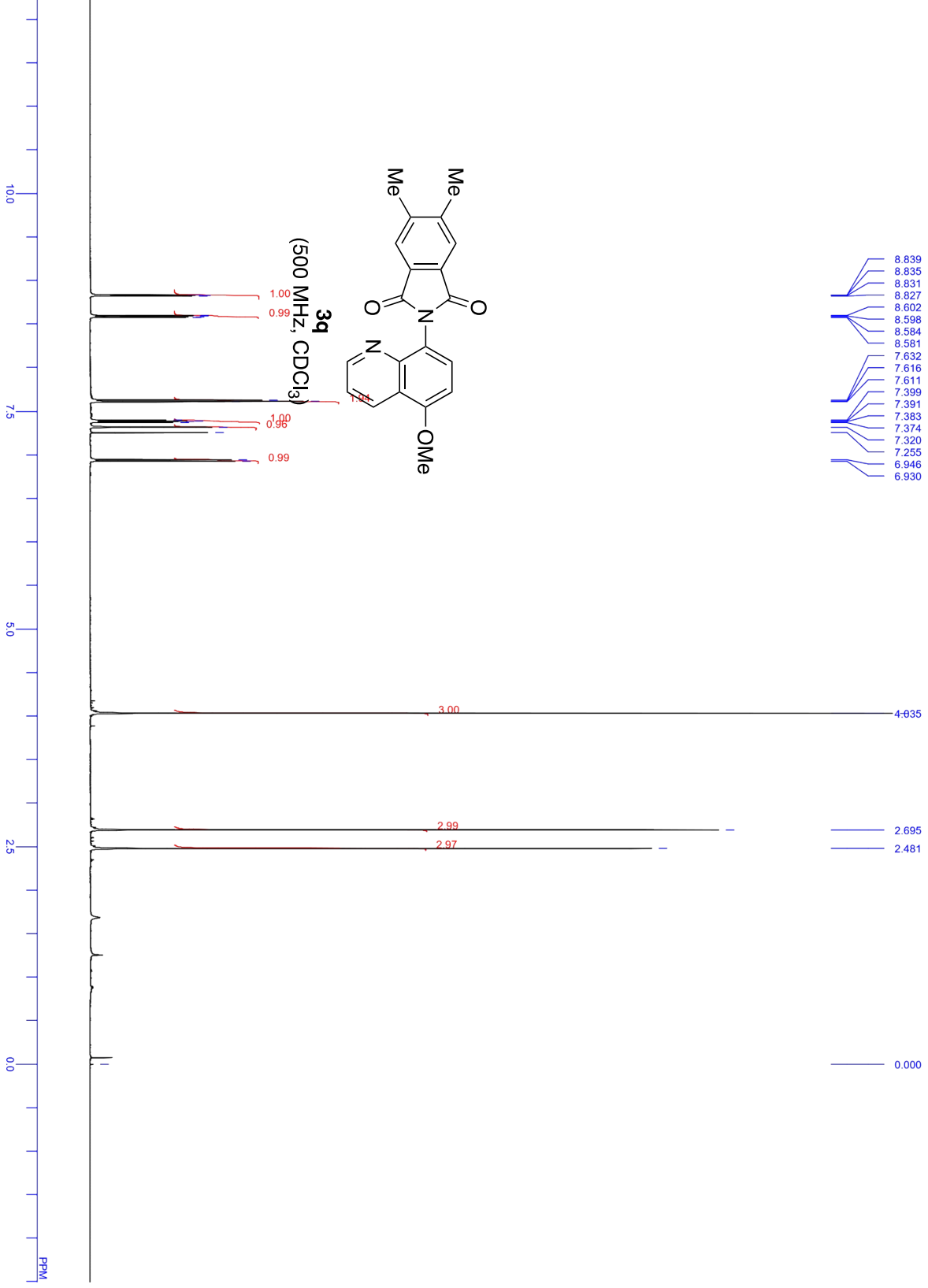

3n
(125 MHz, CDCl3)
Cl
Me
O
O
N
N
167.787
166.747
150.990
144.218
140.145
140.078
136.196
136.110
134.441
130.225
129.691
129.595
129.271
127.401
126.114
121.936
121.898
77.258
77.000
76.742
17.652
200
150
100
50
0
PPM

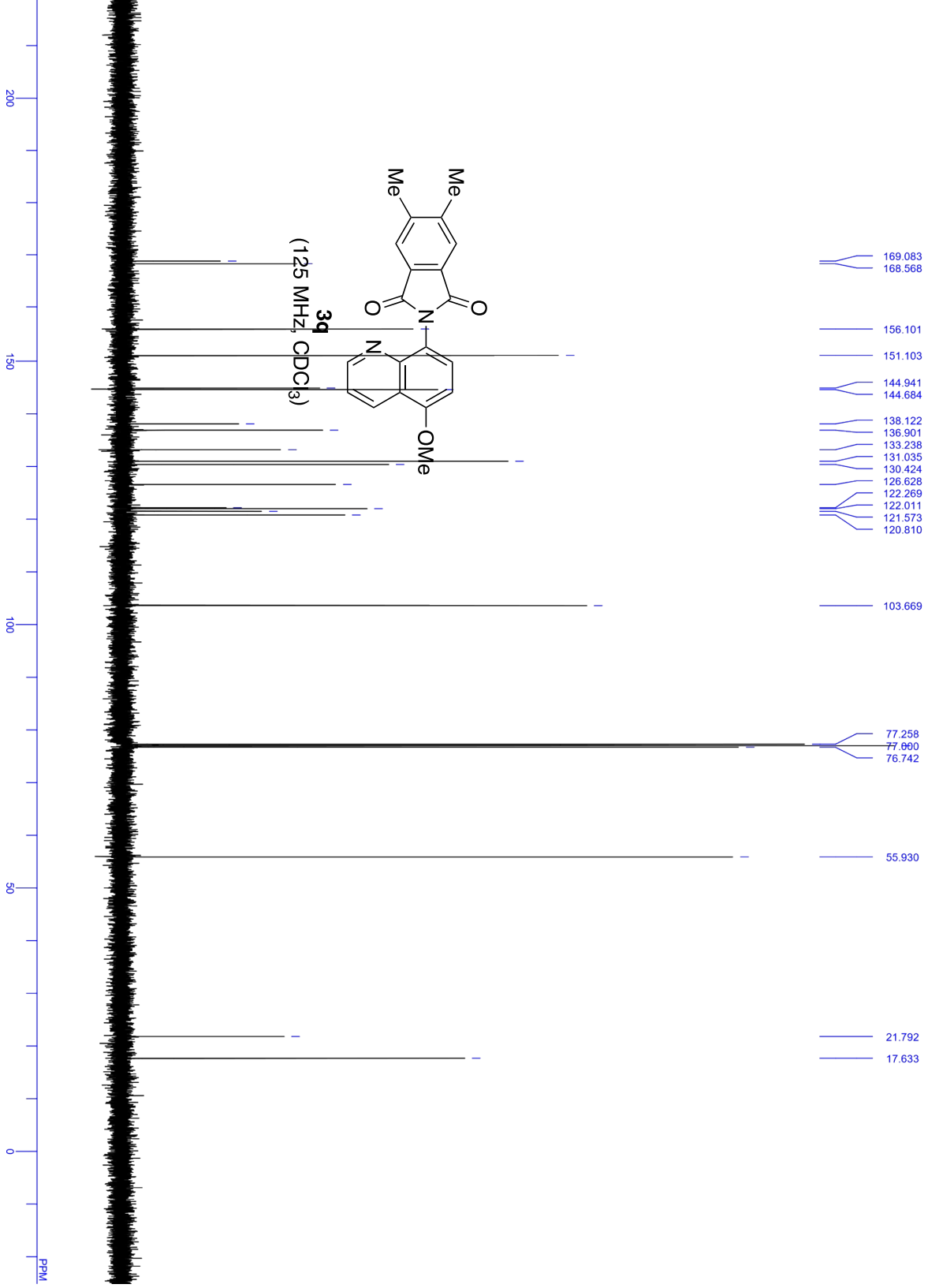

3o
(500 MHz, CDCl3)
Me
OMe
O
O
N
N
1.00
1.00
0.99
0.93
0.98
0.96
1.04
1.02
3.09
2.97
8.825
8.822
8.817
8.814
8.602
8.598
8.584
8.581
7.856
7.841
7.776
7.648
7.632
7.573
7.557
7.401
7.393
7.384
7.376
7.255
6.950
6.934
4.631
2.535
0.000
10.0
7.5
5.0
2.5
0.0
PPM

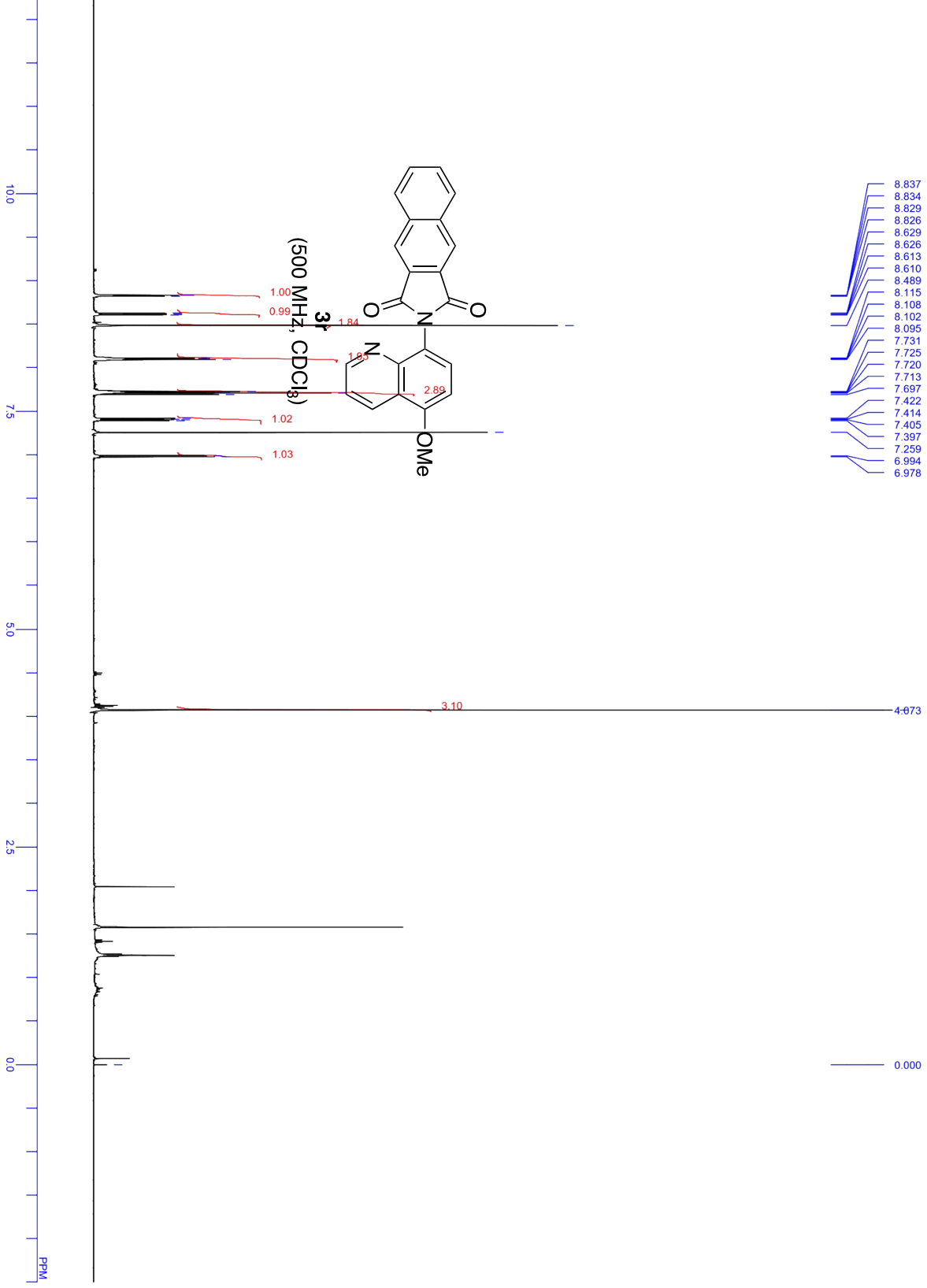

3o
(125 MHz, CDCl3)
Me
OMe
168.511
168.396
156.178
151.075
145.285
144.827
134.592
132.799
131.044
130.367
129.833
124.215
123.633
122.126
121.582
120.857
103.660
77.248
77.000
76.742
55.930
21.992
200
150
100
50
0
PPM

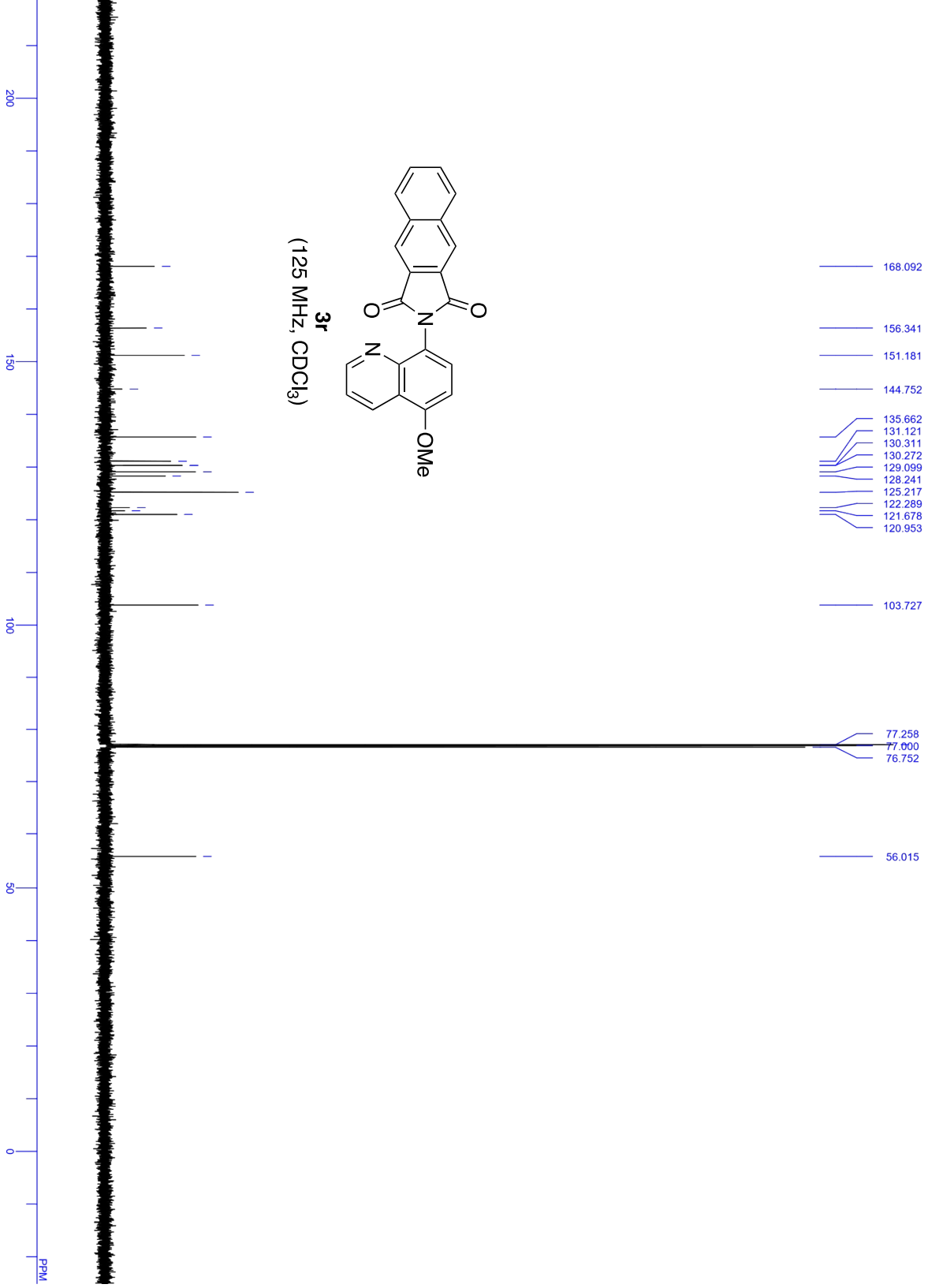

3p
(500 MHz, CDCl3)
OMe
1.00
1.08
2.02
2.16
1.01
1.08
1.05
3.07
8.836
8.833
8.828
8.825
8.620
8.617
8.603
8.599
7.990
7.984
7.979
7.973
7.795
7.790
7.785
7.778
7.660
7.644
7.417
7.409
7.400
7.392
7.258
6.967
6.951
0.000
PPM

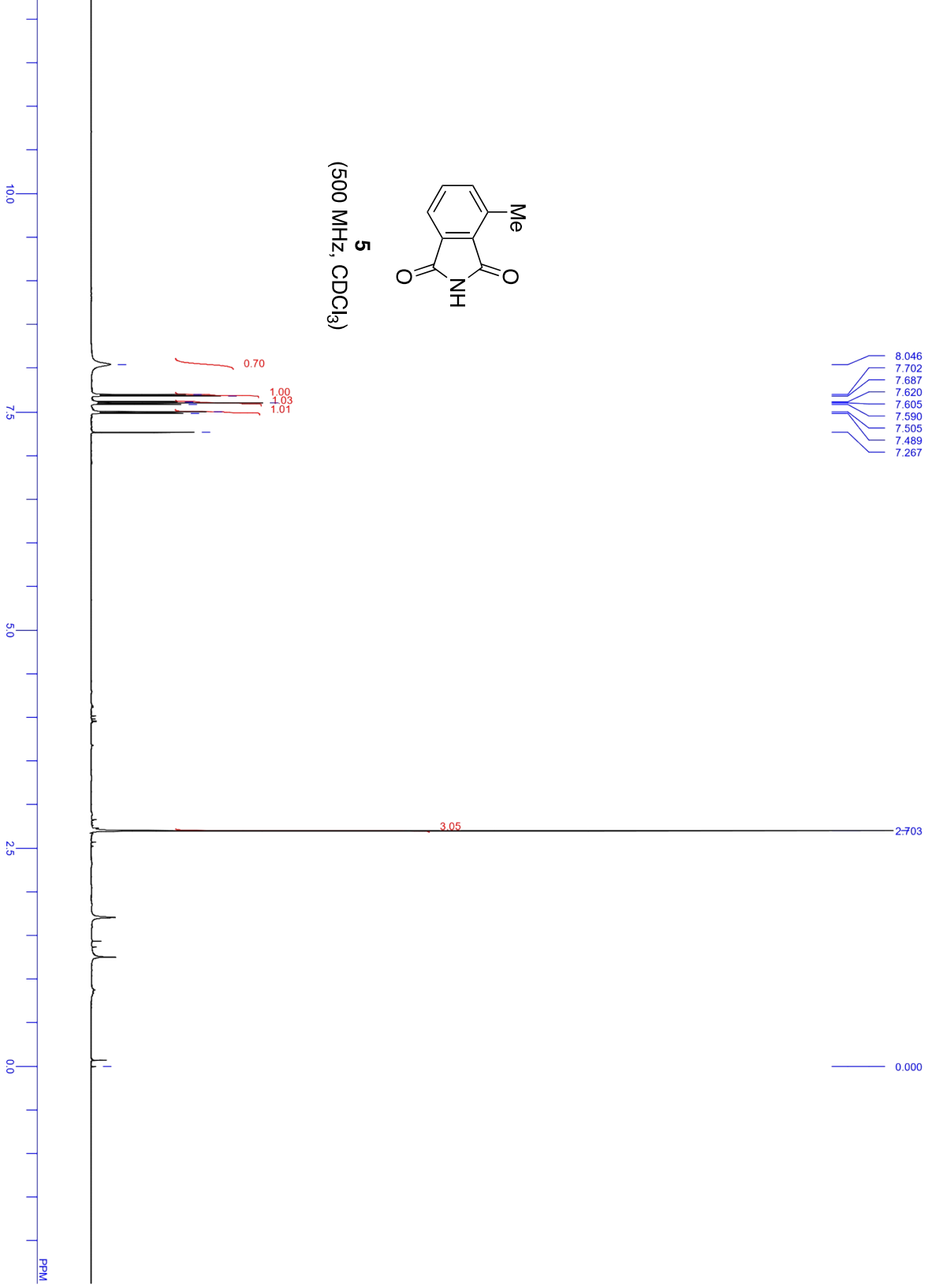

3p
(125 MHz, CDCl3)
O
O
N
N
OMe
168.310
156.273
151.122
144.808
134.049
132.446
131.101
130.376
123.728
122.002
121.620
120.914
103.679
77.248
77.000
76.742
55.968
200
150
100
50
0
PPM

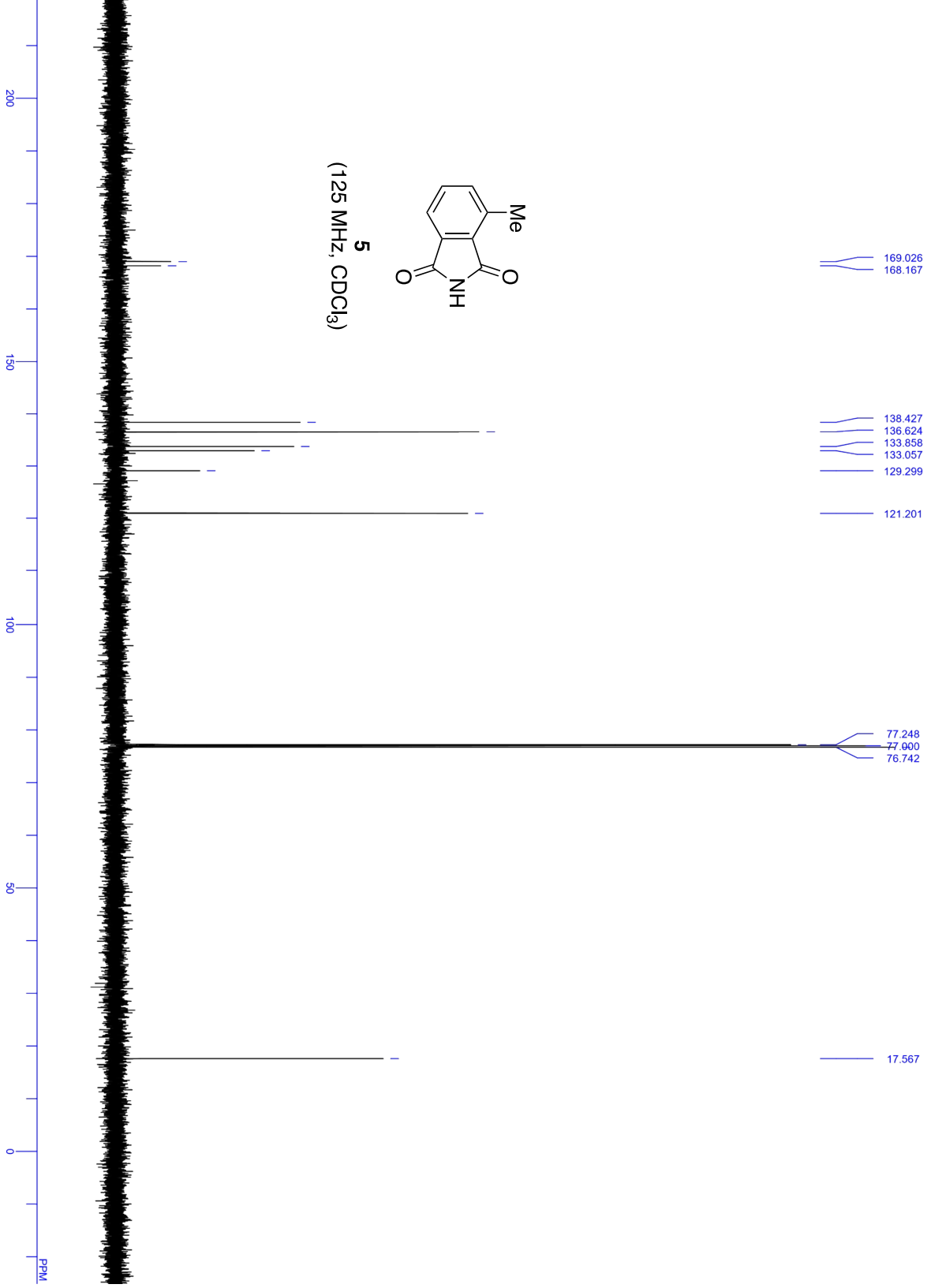

3q
(500 MHz, CDCl3)
Me
Me
O
O
N
N
OMe
1.00
0.99
1.00
0.96
0.99
1.01
3.00
2.99
2.97
8.839
8.835
8.831
8.827
8.602
8.598
8.584
8.581
7.632
7.616
7.611
7.399
7.391
7.383
7.374
7.320
7.255
6.946
6.930
4.635
2.695
2.481
0.000
10.0
7.5
5.0
2.5
0.0
PPM

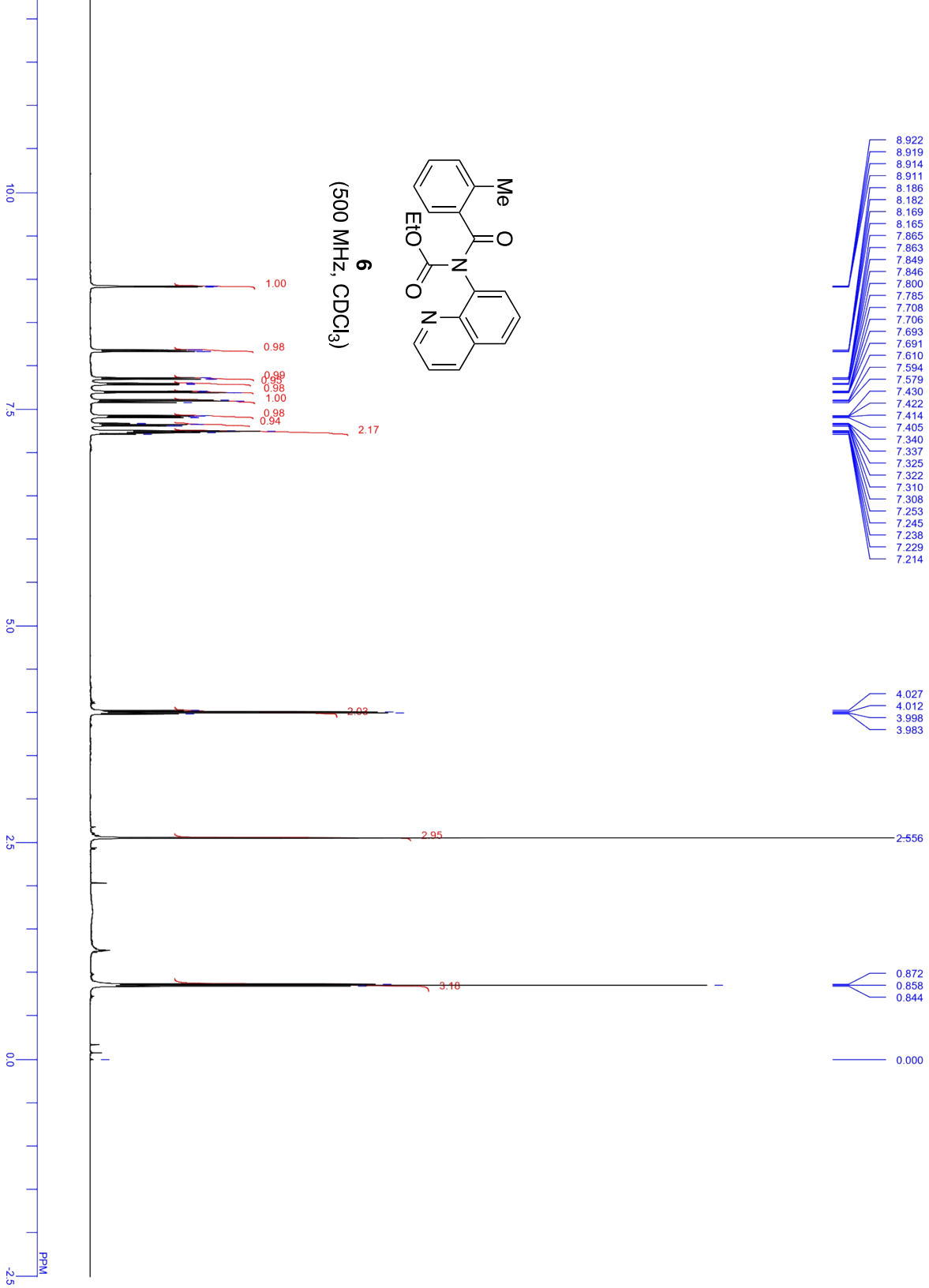

3q
(125 MHz, CDCl3)
Me
Me
O
O
N
N
OMe
169.083
168.568
156.101
151.103
144.941
144.684
138.122
136.901
133.238
131.035
130.424
126.628
122.269
122.011
121.573
120.810
103.669
77.258
77.000
76.742
55.930
21.792
17.633
200
150
100
50
0
PPM

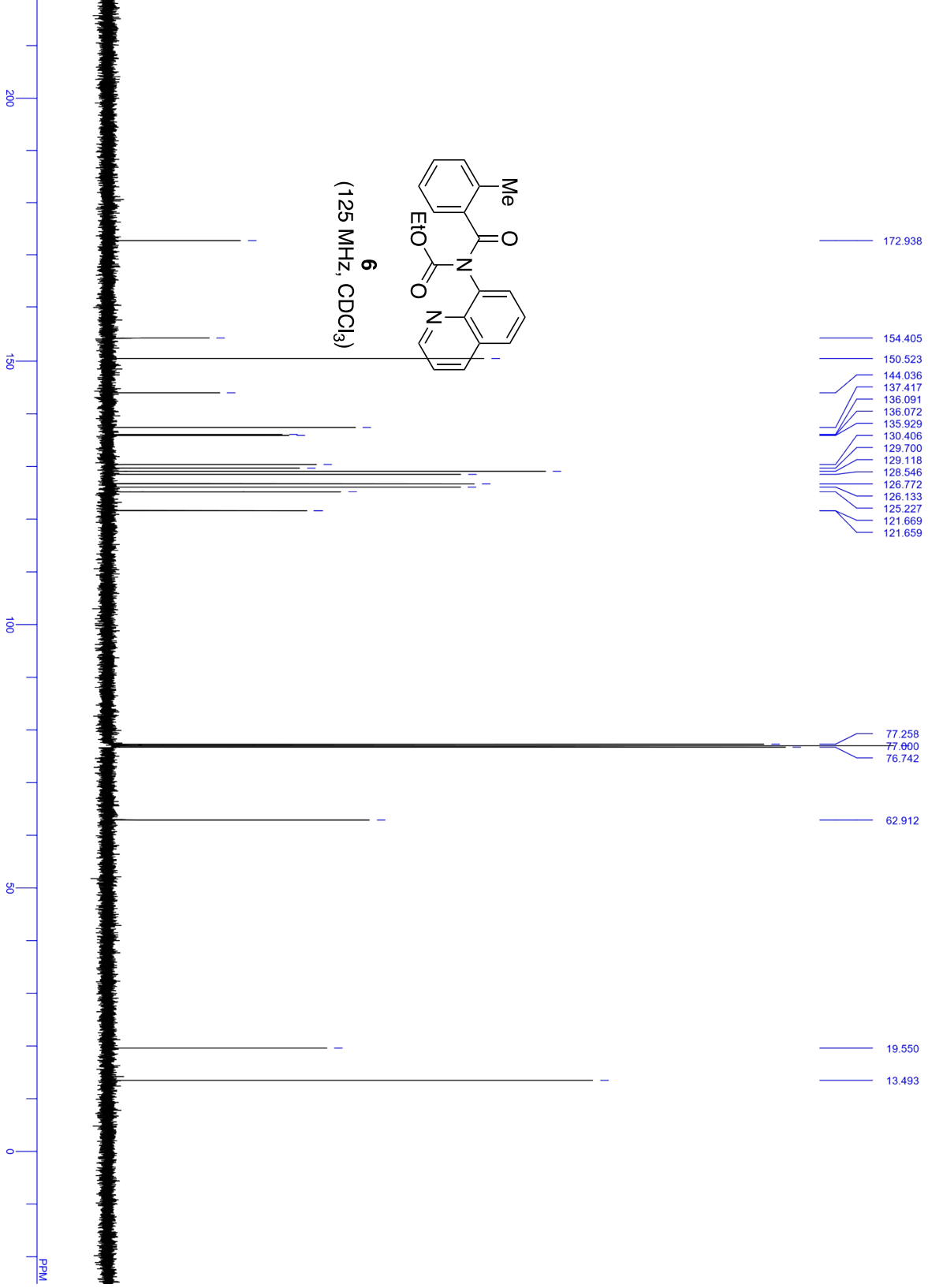

3r
(500 MHz, CDCl3)
OMe
1.00
0.99
1.84
1.85
2.89
1.02
1.03
3.10
4.673
0.000
8.837
8.834
8.829
8.826
8.629
8.626
8.613
8.610
8.489
8.115
8.108
8.102
8.095
7.731
7.725
7.720
7.713
7.697
7.422
7.414
7.405
7.397
7.259
6.994
6.978
10.0
7.5
5.0
2.5
0.0
PPM

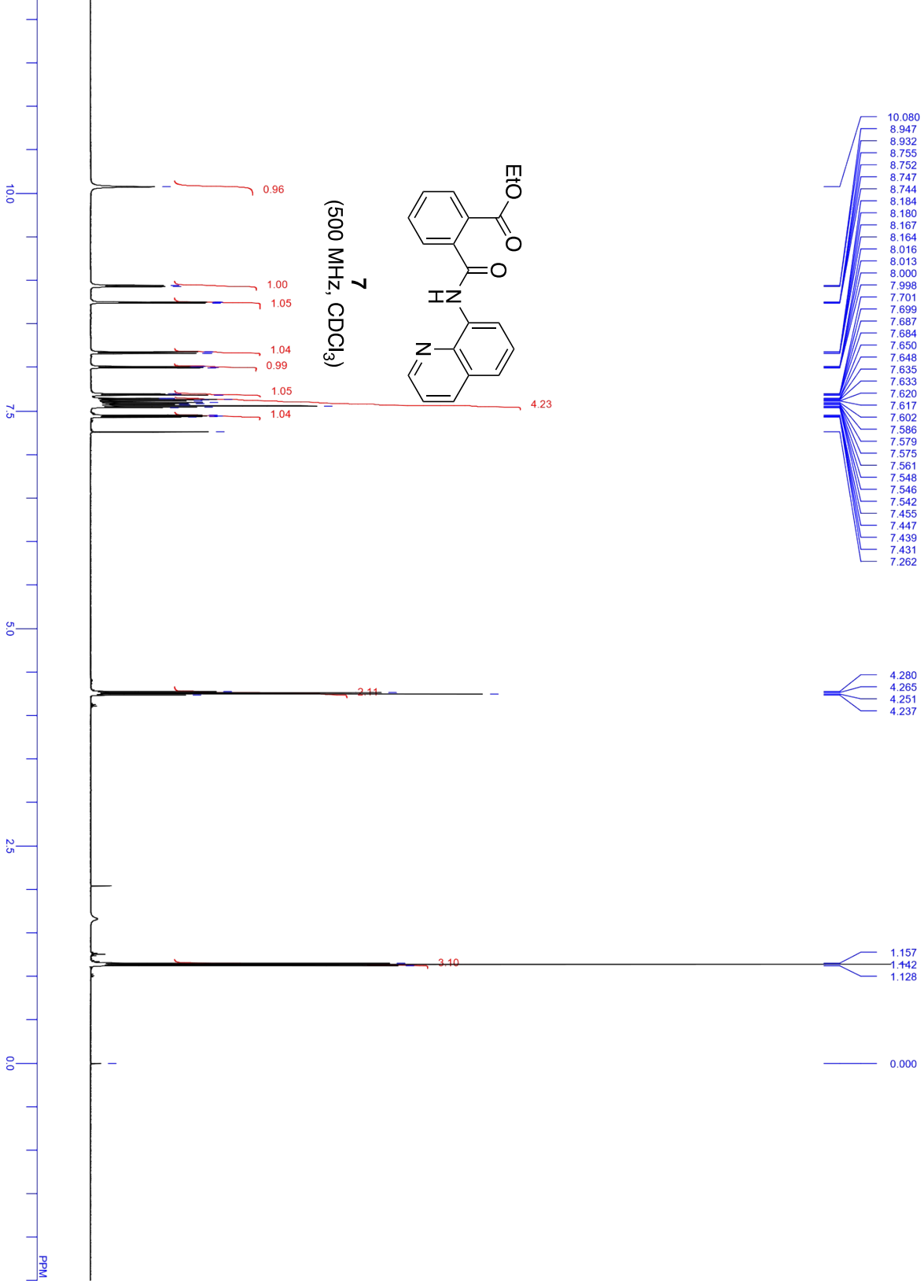

3r
(125 MHz, CDCl3)
O
N
O
N
OMe
168.092
156.341
151.181
144.752
135.662
131.121
130.311
130.272
129.099
128.241
125.217
122.289
121.678
120.953
103.727
77.258
77.000
76.752
56.015
200
150
100
50
0
PPM

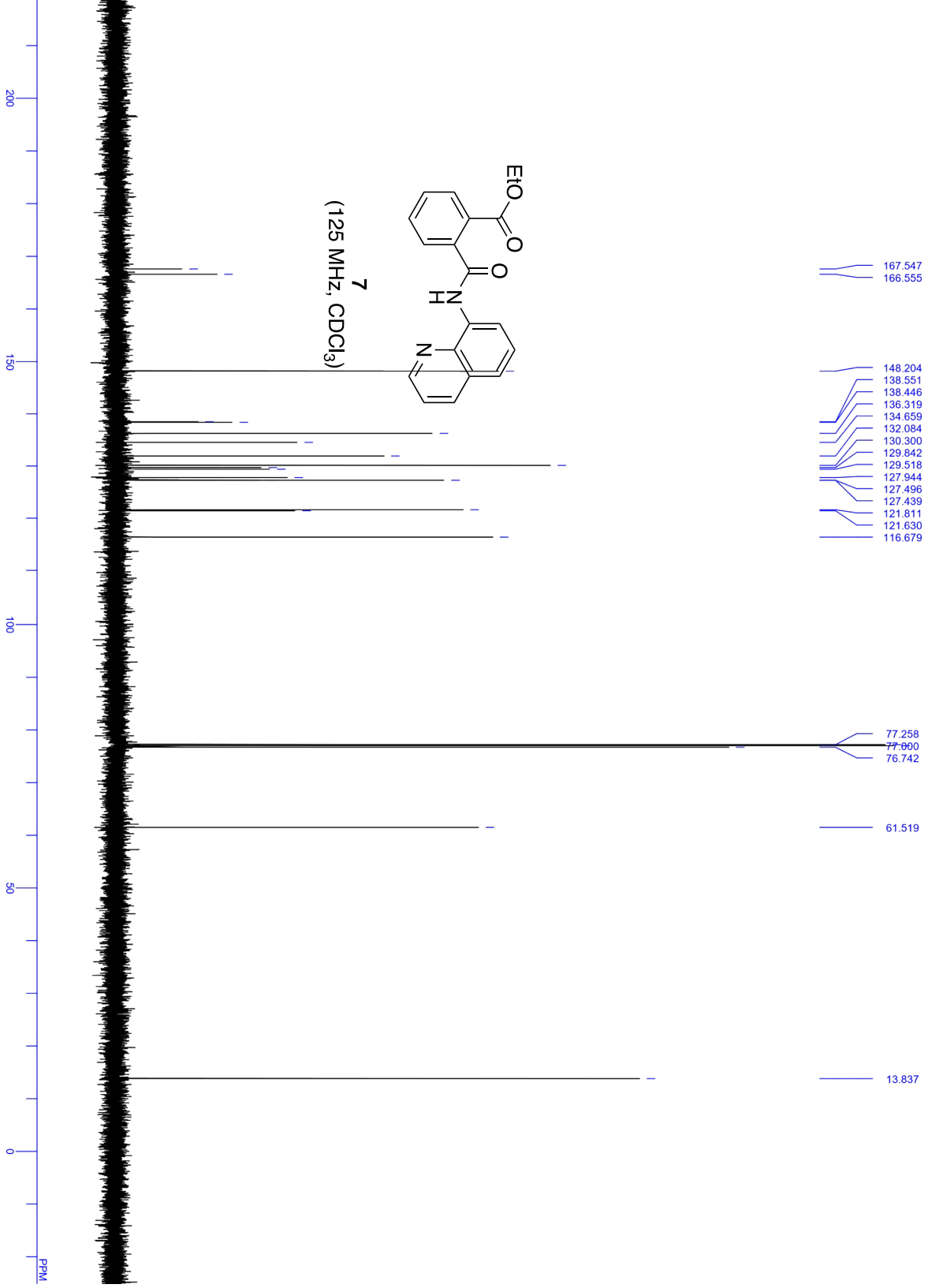

5
(500 MHz, CDCl3)
Me
O
NH
O
0.70
1.00
1.03
1.01
3.05
8.046
7.702
7.687
7.620
7.605
7.590
7.505
7.489
7.267
2.703
0.000
10.0
7.5
5.0
2.5
0.0
PPM

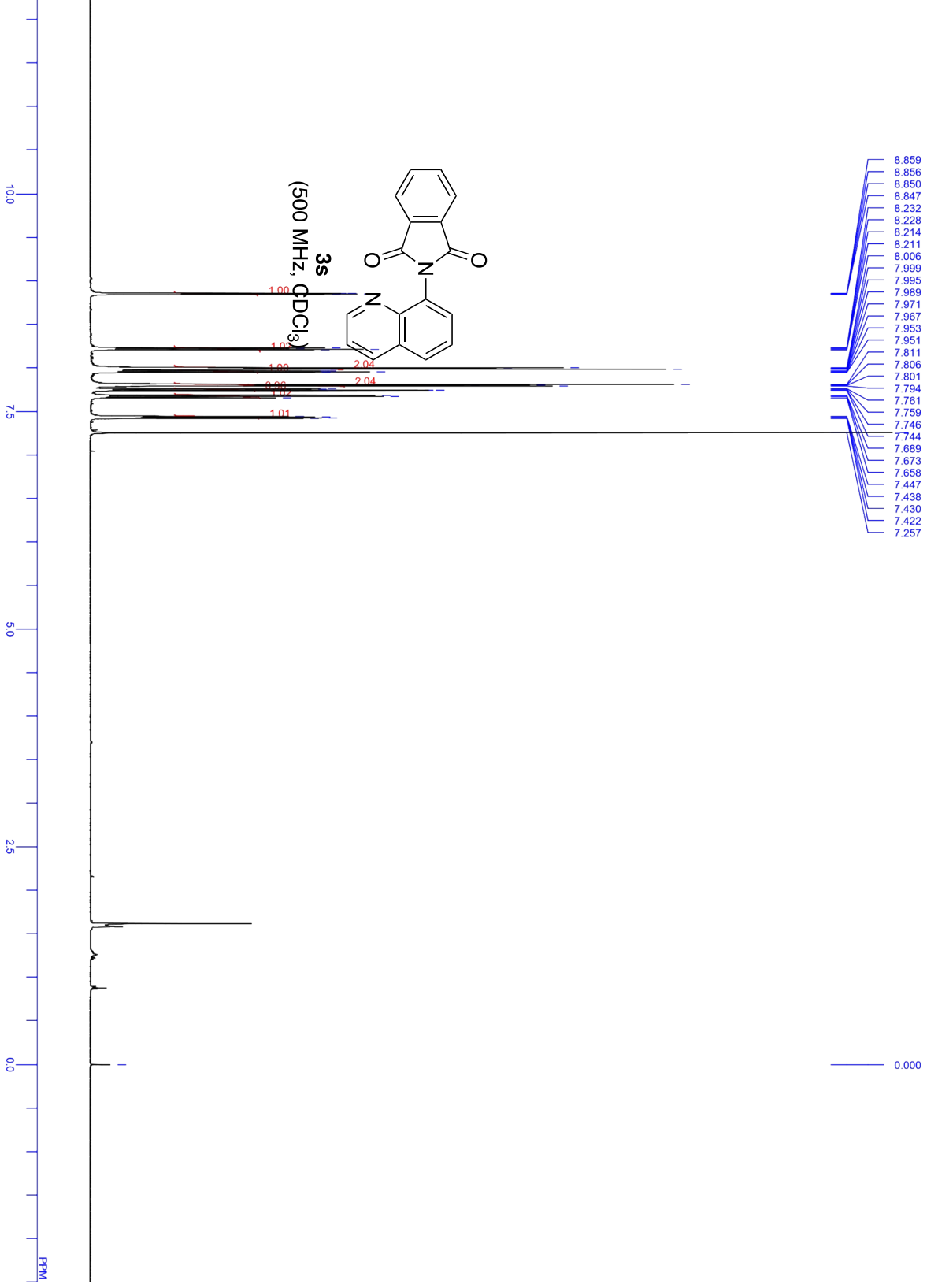

5
(125 MHz, CDCl3)
Me
O
O
NH
169.026
168.167
138.427
136.624
133.858
133.057
129.299
121.201
77.248
77.000
76.742
17.567
200
150
100
50
0
PPM

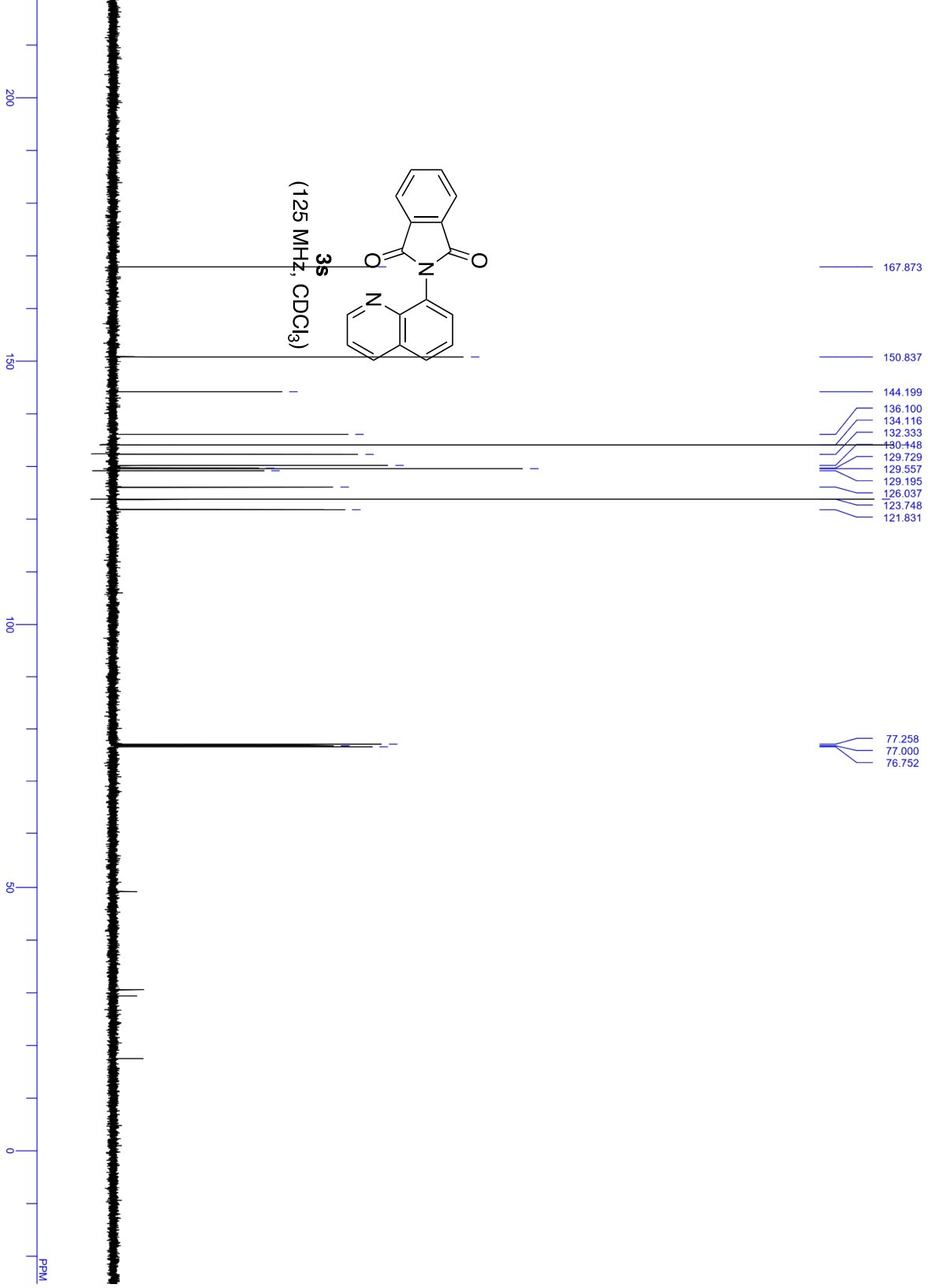

6
(500 MHz, CDCl3)
Me
O
EtO
O
N
O
N
1.00
0.98
0.99
0.99
0.98
1.00
0.98
0.94
2.17
2.03
2.95
3.18
8.922
8.919
8.914
8.911
8.186
8.182
8.169
8.165
7.865
7.863
7.849
7.846
7.800
7.785
7.708
7.706
7.693
7.691
7.610
7.594
7.579
7.430
7.422
7.414
7.405
7.340
7.337
7.325
7.322
7.310
7.308
7.253
7.245
7.238
7.229
7.214
4.027
4.012
3.998
3.983
2.556
0.872
0.858
0.844
0.000
10.0
7.5
5.0
2.5
0.0
-2.5
PPM


Me
O
EtO
N
O
N
6
(125 MHz, CDCl3)
172.938
154.405
150.523
144.036
137.417
136.091
136.072
135.929
130.406
129.700
129.118
128.546
126.772
126.133
125.227
121.669
121.659
77.258
77.000
76.742
62.912
19.550
13.493
200
150
100
50
0
PPM


7
(500 MHz, CDCl3)
EtO
O
O
H
N
N
0.96
1.00
1.05
1.04
0.99
1.05
1.04
4.23
2.11
3.10
10.080
8.947
8.932
8.755
8.752
8.747
8.744
8.184
8.180
8.167
8.164
8.016
8.013
8.000
7.998
7.701
7.699
7.687
7.684
7.650
7.648
7.635
7.633
7.620
7.617
7.602
7.586
7.579
7.575
7.561
7.548
7.546
7.542
7.455
7.447
7.439
7.431
7.262
4.280
4.265
4.251
4.237
1.157
1.142
1.128
0.000
10.0
7.5
5.0
2.5
0.0
PPM


7
(125 MHz, CDCl3)
EtO
O
O
H
N
N
167.547
166.555
148.204
138.551
138.446
136.319
134.659
132.084
130.300
129.842
129.518
127.944
127.496
127.439
121.811
121.630
116.679
77.258
77.000
76.742
61.519
13.837
200
150
100
50
0
PPM


3s
(500 MHz, CDCl3)
8.859
8.856
8.850
8.847
8.232
8.228
8.214
8.211
8.006
7.999
7.995
7.989
7.971
7.967
7.953
7.951
7.811
7.806
7.801
7.794
7.761
7.759
7.746
7.744
7.689
7.673
7.658
7.447
7.438
7.430
7.422
7.257
0.000
1.00
1.02
1.06
2.04
2.04
1.02
1.01
10.0
7.5
5.0
2.5
0.0
PPM


3s
(125 MHz, CDCl3)
O
O
N
N
167.873
150.837
144.199
136.100
134.116
132.333
130.148
129.729
129.557
129.195
126.037
123.748
121.831
77.258
77.000
76.752
200
150
100
50
0
PPM