Supporting Information

Auto-Oxidation Promoted Sp^3 C-H Arylation of Glycine Derivatives

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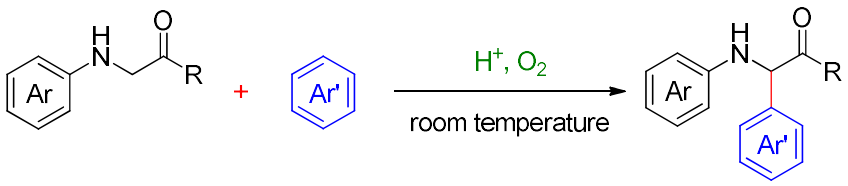

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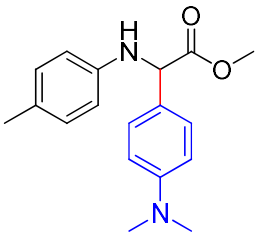
General information. The starting materials and reagents, purchased from commercial suppliers, were used without further purification. Literature procedures were used for the preparation of glycine derivatives. Solvents were purified by standard methods. Analytical TLC was performed with silica gel GF254 plates, and the products were visualized by UV detection. Flash chromatography was carried out using silica gel 200−300. ^{1}HNMR (600 MHz) and ^{13}CNMR (150 MHz) spectra were measured with $CDCl_3$ as solvent. All chemical shifts (δ) are reported in ppm and coupling constants (*J*) in Hz. High resolution mass spectra (HR-MS) were recorded under electrospray ionization (ESI) conditions.

General procedure for auto-oxidation reaction of glycine derivatives with arenes.

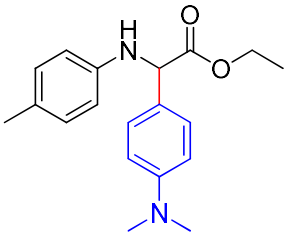
Glycine derivatives (**1**, 0.5 mmol), arenes (**2**, 0.5 mmol) and HCl (3 M, 0.125 mmol) were dissolved in MeCN (5 mL) at ambient temperature. The reactions were performed under an O_2 atmosphere (oxygen balloon) at ambient temperature and completed within 3-24 hours as monitored by TLC. The products **3** were isolated by silica gel column chromatography using petroleum ether/acetone (v/v 40:1 to 10:1).

Characterization data for all compounds



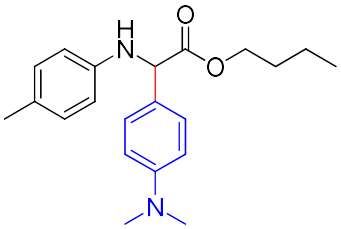
3aa

methyl 2-(4-(dimethylamino)phenyl)-2-(p-tolylamino)acetate (3aa) The desired pure product was obtained in 63% yield (93.8 mg) as a yellow liquid.^{1}H NMR (600 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.7 Hz, 2H), 6.93 (d, *J* = 8.2 Hz, 2H), 6.68 (d, *J* = 8.8 Hz, 2H), 6.49 (d, *J* = 8.3 Hz, 2H), 4.95 (d, *J* = 3.9 Hz, 1H), 4.65 (s, 1H), 3.70 (s, 3H), 2.93 (s, 6H), 2.19 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 173.1, 150.4, 144.0, 129.7, 128.0, 127.0, 124.9, 113.5, 112.6, 60.5, 52.5, 40.4, 20.4. HRMS (ESI) exact mass calcd for $C_{18}H_{23}N_2O_2$ [M+H] m/z 299.1754, found 299.1750.



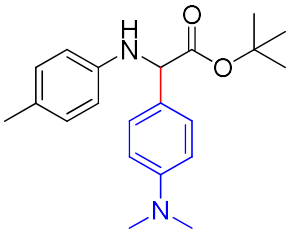
3ba

ethyl 2-(4-(dimethylamino)phenyl)-2-(p-tolylamino)acetate (3ba) The desired pure product was obtained in 61% yield (95.2 mg) as yellow brown liquid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.6 Hz, 2H), 6.93 (d, *J* = 8.3 Hz, 2H), 6.69 (d, *J* = 8.6 Hz, 2H), 6.50 (d, *J* = 8.3 Hz, 2H), 4.95 (s, 1H), 4.66 (s, 1H), 4.26 – 4.19 (m, 1H), 4.15 – 4.08 (m, 1H), 2.94 (s, 6H), 2.20 (s, 3H), 1.22 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.6, 150.4, 144.1, 129.6, 128.0, 127.0, 125.1, 113.5, 112.5, 61.4, 60.5, 40.5, 20.4, 14.1. HRMS (ESI) exact mass calcd for $C_{19}H_{25}N_2O_2$ [M+H] m/z 313.1911, found 313.1909.



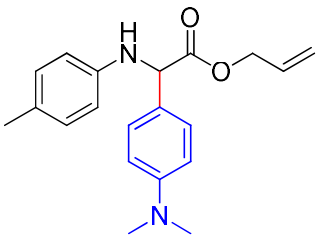
3ca

butyl 2-(4-(dimethylamino)phenyl)-2-(p-tolylamino)acetate (3ca) The desired pure product was obtained in 52% yield (88.4 mg) as a white solid, mp 90-92 °C.^{1}H NMR (600 MHz, $CDCl_3$) δ 7.32 (d, *J* = 8.8 Hz, 2H), 6.93 (d, *J* = 8.5 Hz, 2H), 6.69 (d, *J* = 8.6 Hz, 2H), 6.50 (d, *J* = 8.3 Hz, 2H), 4.95 (s, 1H), 4.67 (s, 1H), 4.18 – 4.13 (m, 1H), 4.09 – 4.04 (m, 1H), 2.93 (s, 6H), 2.20 (s, 3H), 1.58 – 1.54 (m, 2H), 1.31 – 1.24 (m, 2H), 0.87 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.7, 150.4, 144.1, 129.6, 128.0, 126.9, 125.2, 113.5, 112.6, 65.2, 60.5, 40.5, 30.5, 20.4, 18.9, 13.6. HRMS (ESI) exact mass calcd for $C_{21}H_{29}N_2O_2$ [M+H] m/z 341.2224, found 341.2231.



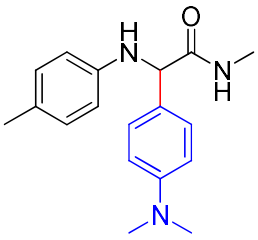
3da

tert-butyl 2-(4-isopropylphenyl)-2-(p-tolylamino)acetate (3da) The desired pure product was obtained in 46% yield (78.2 mg) as a white solid, mp 138-140 °C. ^{1}H NMR (600 MHz, $CDCl_3$)δ 7.31 (d, *J* = 8.8 Hz, 2H), 6.92 (d, *J* = 8.0 Hz, 2H), 6.69 (d, *J* = 8.8 Hz, 2H), 6.49 (d, *J* = 8.5 Hz, 2H), 4.84 (s, 1H), 4.65 (s, 1H), 2.93 (s, 6H), 2.20 (s, 3H), 1.39 (s, 9H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 167.2, 145.7, 139.7, 125.1, 123.4, 122.1, 121.2, 108.9, 108.0, 77.2, 56.4, 36.0, 23.4, 15.9. HRMS (ESI) exact mass calcd for $C_{21}H_{29}N_2O_2$ [M+H] m/z 341.2224, found 341.2229.



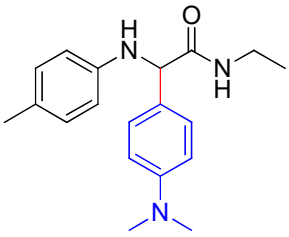
3ea

allyl 2-(4-(dimethylamino)phenyl)-2-(p-tolylamino)acetate (3ea) The desired pure product was obtained in 65% yield (105.3 mg) as a yellow solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.8 Hz, 2H), 6.93 (d, *J* = 8.0 Hz, 2H), 6.69 (d, *J* = 8.8 Hz, 2H), 6.50 (d, *J* = 8.4 Hz, 2H), 5.88 – 5.80 (m, 1H), 5.22 – 5.17 (m, 1H), 5.19 – 5.16 (m, 1H), 4.99 (d, *J* = 4.8 Hz, 1H), 4.68 – 4.63 (m, 2H), 4.59 – 4.55 (m, 1H), 2.93 (s, 6H), 2.20 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.3, 150.4, 144.0, 131.7, 129.7, 128.0, 127.0, 124.9, 118.3, 113.5, 112.6, 65.8, 60.5, 40.5, 20.4. HRMS (ESI) exact mass calcd for $C_{20}H_{25}N_2O_2$ [M+H] m/z 325.1911, found 325.1917.



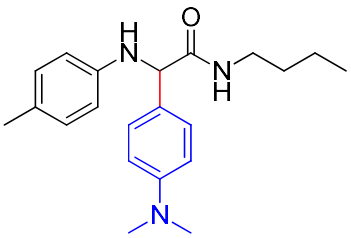
3fa

2-(4-(dimethylamino)phenyl)-N-methyl-2-(p-tolylamino)acetamide (3fa) The desired pure product was obtained in 40% yield (59.5 mg) as a white solid, mp 136-137 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.27 – 7.24 (m, 2H), 6.99 (d, *J* = 8.0 Hz, 2H), 6.76 (d, *J* = 4.6 Hz, 1H), 6.70 (d, *J* = 8.7 Hz, 2H), 6.53 (d, *J* = 8.4 Hz, 2H), 4.60 (s, 1H), 4.28 (s, 1H), 2.94 (s, 6H), 2.82 (d, *J* = 5.0 Hz, 3H), 2.24 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.7, 150.6, 144.7, 129.8, 128.2, 128.2, 126.6, 113.8, 112.9, 64.0, 40.5, 26.3, 20.4. HRMS (ESI) exact mass calcd for $C_{18}H_{24}N_3O$ [M+H] m/z 298.1914, found 298.1908.



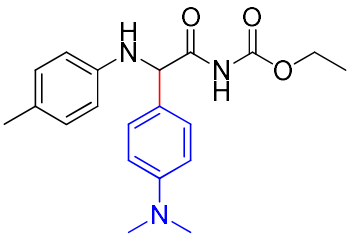
3ga

2-(4-(dimethylamino)phenyl)-N-ethyl-2-(p-tolylamino)acetamide (3ga) The desired pure product was obtained in 38% yield (60.0 mg) as a white solid, mp 128-130 °C.^{1}H NMR (600 MHz, $CDCl_3$) δ 7.27 – 7.25 (m, 2H), 6.99 (d, *J* = 8.2 Hz, 2H), 6.80 (t, *J* = 5.4 Hz, 1H), 6.72 – 6.68 (m, 2H), 6.55 – 6.52 (m, 2H), 4.57 (s, 1H), 4.24 (s, 1H), 3.40 – 3.32 (m, 1H), 3.30 – 3.23 (m, 1H), 2.94 (s, 6H), 2.24 (s, 3H), 1.10 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 173.1, 150.4, 144.0, 129.7, 128.2, 128.1, 126.6, 113.9, 112.8, 64.2, 40.5, 34.2, 20.4, 14.8. HRMS (ESI) exact mass calcd for $C_{19}H_{26}N_3O$ [M+H] m/z 312.2070, found 312.2065.



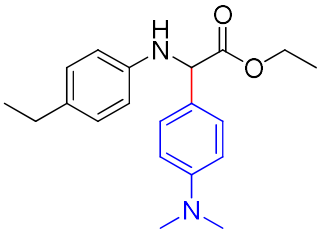
3ha

N-butyl-2-(4-(dimethylamino)phenyl)-2-(p-tolylamino)acetamide (3ha) The desired pure product was obtained in 35% yield (59.4 mg) as a brown liquid.^{1}H NMR (600 MHz, $CDCl_3$) δ 7.28 – 7.24 (m, 2H), 7.01 – 6.98 (m, 2H), 6.81 (t, *J* = 5.1 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 2H), 6.54 (d, *J* = 8.4 Hz, 2H), 4.58 (s, 1H), 4.26 (s, 1H), 3.34 – 3.27 (m, 1H), 3.25 – 3.19 (m, 1H), 2.94 (s, 6H), 2.24 (s, 3H), 1.46 – 1.41 (m, 2H), 1.29 – 1.24 (m, 2H), 0.87 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 171.9, 150.6, 144.8, 129.7, 128.1, 126.6, 113.9, 112.8, 64.2, 40.5, 39.1, 31.6, 20.4, 20.0, 13.7. HRMS (ESI) exact mass calcd for $C_{21}H_{30}N_3O$ [M+H] m/z 340.2383, found 340.2373.



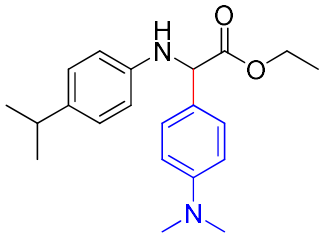
3ia

ethyl 2-((3-(4-(dimethylamino)phenyl)-2-oxo-3-(p-tolylamino)propyl)amino)acetate (3ia) The desired pure product was obtained in 40% yield (73.8 mg) as a white solid, mp 117-119 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 – 7.30 (m, 3H), 7.00 (d, *J* = 8.1 Hz, 2H), 6.71 (d, *J* = 8.8 Hz, 2H), 6.56 (d, *J* = 8.4 Hz, 2H), 4.65 (s, 1H), 4.26 – 4.19 (m, 2H), 4.19 – 4.14 (m, 2H), 3.88 (dd, *J* = 18.2, 4.6 Hz, 1H), 2.94 (s, 6H), 2.24 (s, 3H), 1.25 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.4, 169.6, 150.7, 144.6, 129.7, 128.3, 128.3, 126.1, 113.9, 112.8, 64.1, 61.4, 41.2, 40.5, 20.4, 14.1. HRMS (ESI) exact mass calcd for $C_{21}H_{28}N_3O_3$ [M+H] m/z 370.2125, found 370.2120.



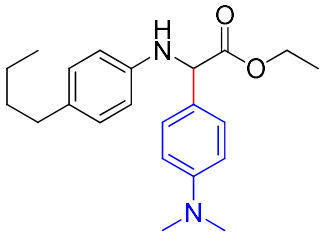
3ja

ethyl 2-(4-(dimethylamino)phenyl)-2-((4-ethylphenyl)amino)acetate (3ja) The desired pure product was obtained in 63% yield (102.7 mg) as a yellow liquid.^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.8 Hz, 2H), 6.95 (d, *J* = 8.4 Hz, 2H), 6.69 (d, *J* = 8.8 Hz, 2H), 6.52 (d, *J* = 8.5 Hz, 2H), 4.94 (d, *J* = 5.5 Hz, 1H), 4.67 (d, *J* = 5.4 Hz, 1H), 4.25 – 4.20 (m, 1H), 4.13 – 4.09 (m, 1H), 2.93 (s, 6H), 2.50 (q, *J* = 7.6 Hz, 2H), 1.21 (t, *J* = 7.1 Hz, 3H), 1.15 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.6, 150.4, 144.3, 133.6, 128.5, 128.0, 125.2, 113.5, 112.6, 61.4, 60.6, 40.4, 27.9, 15.8, 14.1. HRMS (ESI) exact mass calcd for $C_{20}H_{27}N_2O_2$ [M+H] m/z 327.2067, found 327.2073.



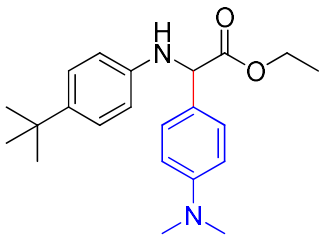
3ka

ethyl 2-(4-(dimethylamino)phenyl)-2-((4-isopropylphenyl)amino)acetate (3ka) The desired pure product was obtained in 68% yield (115.7 mg) as a yellow liquid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.7 Hz, 2H), 7.00 (d, *J* = 8.5 Hz, 2H), 6.71 (d, *J* = 8.6 Hz, 2H), 6.54 (d, *J* = 8.2 Hz, 2H), 4.95 (d, *J* = 4.0 Hz, 1H), 4.71 (s, 1H), 4.29 – 4.20 (m, 1H), 4.16 – 4.08 (m, 1H), 2.95 (s, 6H), 2.82 – 2.73 (m, 1H), 1.23 (t, *J* = 7.1 Hz, 3H), 1.18 (d, *J* = 6.9 Hz, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.6, 150.4, 144.4, 138.2, 128.0, 127.0, 125.3, 113.3, 112.6, 61.4, 60.6, 40.5, 33.1, 24.2, 24.1, 14.1. HRMS (ESI) exact mass calcd for $C_{21}H_{29}N_2O_2$ [M+H] m/z 341.2224, found 341.2222.



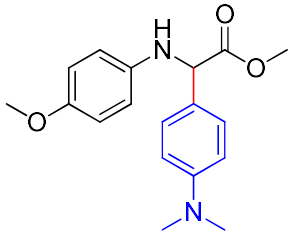
3la

ethyl 2-((4-butylphenyl)amino)-2-(4-(dimethylamino)phenyl)acetate (3la) The desired pure product was obtained in 58% yield (102.7 mg) as a yellow liquid.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.8 Hz, 2H), 6.93 (d, *J* = 8.3 Hz, 2H), 6.68 (d, *J* = 8.8 Hz, 2H), 6.50 (d, *J* = 8.4 Hz, 2H), 4.93 (d, *J* = 5.5 Hz, 1H), 4.67 (d, *J* = 5.6 Hz, 1H), 4.26 – 4.18 (m, 1H), 4.13 – 4.07 (m, 1H), 2.92 (s, 6H), 2.45 (t, *J* = 7.7 Hz, 2H), 1.54 – 1.46 (m, 2H), 1.34 – 1.27 (m, 2H), 1.20 (t, *J* = 7.1 Hz, 3H), 0.89 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 172.6, 150.3, 144.2, 132.1, 129.0, 127.9, 125.2, 113.3, 112.5, 61.3, 60.5, 40.4, 34.6, 33.8, 22.3, 14.0, 13.9. HRMS (ESI) exact mass calcd for $C_{22}H_{31}N_2O_2$ [M+H] m/z 355.2380, found 355.2371.



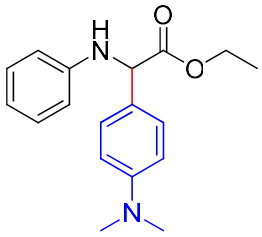
3ma

ethyl 2-((4-(tert-butyl)phenyl)amino)-2-(4-(dimethylamino)phenyl)acetate (3ma) The desired pure product was obtained in 65% yield (115.1 mg) as a yellow liquid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.7 Hz, 2H), 7.16 (d, *J* = 8.6 Hz, 2H), 6.70 (d, *J* = 8.8 Hz, 2H), 6.54 (d, *J* = 8.6 Hz, 2H), 4.94 (s, 1H), 4.71 (s, 1H), 4.28 – 4.20 (m, 1H), 4.16 – 4.09 (m, 1H), 2.94 (s, 6H), 1.25 (s, 9H), 1.22 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.6, 150.4, 144.0, 140.5, 128.0, 125.9, 125.3, 113.0, 112.6, 61.4, 60.5, 40.5, 33.8, 31.5, 14.1. HRMS (ESI) exact mass calcd for $C_{22}H_{31}N_2O_2$ [M+H] m/z 355.2380, found 355.2384.



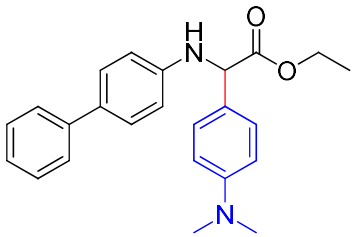
3na

methyl 2-(4-(dimethylamino)phenyl)-2-((4-methoxyphenyl)amino)acetate (3na) The desired pure product was obtained in 55% yield (86.4 mg) as a brown liquid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.7 Hz, 2H), 6.72 (d, *J* = 8.9 Hz, 2H), 6.69 (d, *J* = 8.8 Hz, 2H), 6.54 (d, *J* = 8.9 Hz, 2H), 4.92 (d, *J* = 4.7 Hz, 1H), 4.52 (d, *J* = 3.8 Hz, 1H), 3.70 (s, 6H), 2.94 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 173.2, 152.4, 150.4, 140.5, 128.0, 125.0, 114.8, 114.7, 112.5, 61.1, 55.7, 52.5, 40.4. HRMS (ESI) exact mass calcd for $C_{18}H_{23}N_2O_3$ [M+H] m/z 315.1703, found 315.1696.



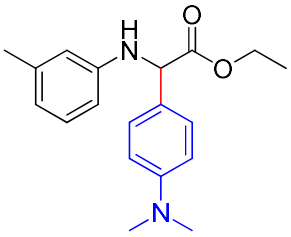
3oa

ethyl 2-(4-(dimethylamino)phenyl)-2-(phenylamino)acetate (3oa) The desired pure product was obtained in 40% yield (59.7 mg) as a yellow brown liquid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.8 Hz, 2H), 7.11 (dd, *J* = 8.5, 7.4 Hz, 2H), 6.70 – 6.67 (m, 3H), 6.57 (d, *J* = 7.7 Hz, 2H), 4.96 (d, *J* = 5.6 Hz, 1H), 4.79 (d, *J* = 5.4 Hz, 1H), 4.24 – 4.21 (m, 1H), 4.13 – 4.09 (m, 1H), 2.93 (s, 6H), 1.21 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.4, 150.4, 146.3, 129.1, 128.0, 124.9, 117.8, 113.3, 112.5, 61.5, 60.2, 40.4, 14.1. HRMS (ESI) exact mass calcd for $C_{18}H_{22}N_2O_2$ [M+H] m/z 299.1754, found 299.1760.



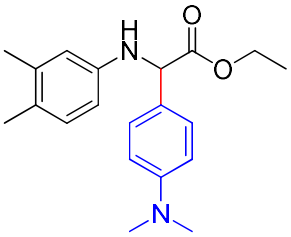
3pa

methyl 2-([1,1'-biphenyl]-4-ylamino)-2-(4-(dimethylamino)phenyl)acetate (3pa) The desired pure product was obtained in 61% yield (111.8 mg) as a yellow liquid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.49 (d, *J* = 7.1 Hz, 2H), 7.39 – 7.33 (m, 6H), 7.23 (t, *J* = 7.4 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 2H), 6.64 (d, *J* = 8.6 Hz, 2H), 5.00 (d, *J* = 6.0 Hz, 1H), 4.91 (d, *J* = 5.9 Hz, 1H), 4.28 – 4.21 (m, 1H), 4.16 – 4.10 (m, 1H), 2.94 (s, 6H), 1.23 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.9, 145.9, 141.2, 136.7, 126.1, 124.1, 123.5, 123.4, 121.8, 121.5, 120.3, 109.1, 108.0, 57.1, 55.7, 36.0, 9.6. HRMS (ESI) exact mass calcd for $C_{24}H_{27}N_2O_2$ [M+H] m/z 375.2067, found 375.2055.



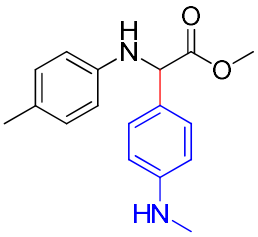
3qa

ethyl 2-(4-(dimethylamino)phenyl)-2-(m-tolylamino)acetate (3qa) The desired pure product was obtained in 40% yield (62.5 mg) as a yellow brown liquid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.8 Hz, 2H), 7.01 (t, *J* = 7.7 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 2H), 6.51 (d, *J* = 7.4 Hz, 1H), 6.43 (s, 1H), 6.37 (d, *J* = 8.0 Hz, 1H), 4.96 (d, *J* = 5.5Hz, 1H), 4.72 (d, *J* = 5.1 Hz, 1H), 4.27 – 4.20 (m, 1H), 4.14 – 4.08 (m, 1H), 2.94 (s, 6H), 2.23 (s, 3H), 1.22 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.5, 150.4, 146.4, 138.9, 129.0, 128.0, 125.1, 118.8, 114.2, 112.6, 110.3, 61.4, 60.3, 40.5, 21.6, 14.1. HRMS (ESI) exact mass calcd for $C_{19}H_{25}N_2O_2$ [M+H] m/z 313.1911, found 313.1922.



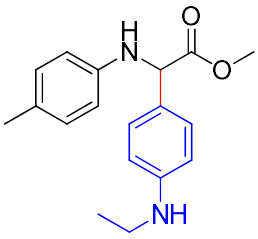
3ra

ethyl 2-(4-(dimethylamino)phenyl)-2-((3,4-dimethylphenyl)amino)acetate (3ra) The desired pure product was obtained in 54% yield (88.1 mg) as a yellow liquid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (d, *J* = 8.8 Hz, 2H), 6.87 (d, *J* = 8.0 Hz, 1H), 6.71 – 6.66 (m, 2H), 6.44 (d, *J* = 2.3 Hz, 1H), 6.35 – 6.30 (m, 1H), 4.94 (d, *J* = 6.0 Hz, 1H), 4.58 (d, *J* = 5.9 Hz, 1H), 4.26 – 4.20 (m, 1H), 4.13 – 4.07 (m, 1H), 2.93 (s, 6H), 2.13 (d, *J* = 14.4 Hz, 6H), 1.21 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.7, 150.4, 144.5, 137.2, 130.2, 128.0, 125.8, 125.2, 115.3, 112.6, 110.6, 61.3, 60.5, 40.5, 20.0, 18.7, 14.1. HRMS (ESI) exact mass calcd for $C_{20}H_{27}N_2O_2$ [M+H] m/z 327.2067, found 327.2072.



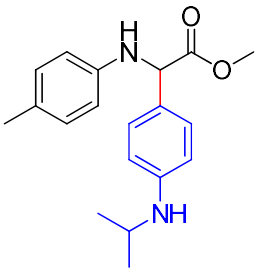
3ab

methyl 2-(4-(methylamino)phenyl)-2-(p-tolylamino)acetate (3ab) The desired pure product was obtained in 49% yield (97.5 mg) as a yellow squild. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.28 (d, *J* = 8.5 Hz, 2H), 6.94 (d, *J* = 8.0 Hz, 2H), 6.57 (d, *J* = 8.6 Hz, 2H), 6.50 (d, *J* = 8.4 Hz, 2H), 4.95 (s, 1H), 4.65 (s, 1H), 3.73 (s, 1H), 3.71 (s, 3H), 2.81 (s, 3H), 2.20 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 173.1, 149.3, 144.0, 129.7, 128.2, 127.1, 125.8, 113.5, 112.5, 60.6, 52.5, 30.6, 20.4. HRMS (ESI) exact mass calcd for $C_{17}H_{21}N_2O_2$ [M+H] m/z 285.1598, found 285.1595.



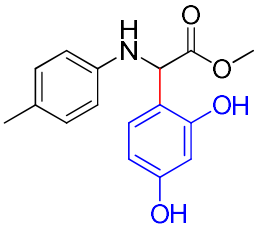
3ac

methyl 2-(4-(ethylamino)phenyl)-2-(p-tolylamino)acetate (3ac) The desired pure product was obtained in 50% yield (74.5 mg) as a yellow squild. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.26 (d, *J* = 8.6 Hz, 2H), 6.94 (d, *J* = 8.2 Hz, 2H), 6.56 (d, *J* = 8.6 Hz, 2H), 6.51 (d, *J* = 8.4 Hz ,2H), 4.94 (d, *J* = 3.9 Hz, 1H), 4.65 (s, 1H), 3.71 (s, 3H), 3.61 (s, 1H), 3.14 (q, *J* = 7.1Hz, 2H), 2.21 (s, 3H), 1.24 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 173.1, 148.4, 144.0, 129.7, 128.2, 127.1, 125.8, 113.5, 112.8, 60.6, 52.5, 38.4, 20.4, 14.8. HRMS (ESI) exact mass calcd for $C_{18}H_{23}N_2O_2$ [M+H] m/z 299.1754, found 299.1761.



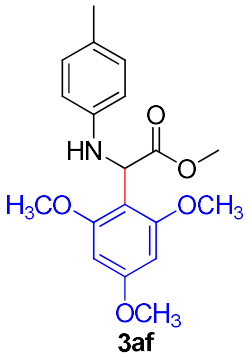
3ad

methyl 2-(4-(isopropylamino)phenyl)-2-(p-tolylamino)acetate (3ad) The desired pure product was obtained in 42% yield (65.6 mg) as a yellow squild. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.29 – 7.24 (m, 2H), 6.96 (d, *J* = 7.9 Hz, 2H), 6.55 (d, *J* = 8.5 Hz, 2H), 6.53 – 6.50 (m, 2H), 4.95 (s, 1H), 4.66 (s, 1H), 3.72 (s, 3H), 3.65 – 3.58 (m, 1H), 3.54 (s, 1H), 2.22 (s, 3H), 1.21 (d, *J* = 1.5 Hz, 3H), 1.20 (d, *J* = 1.4 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 173.2, 147.5, 144.1, 129.7, 128.3, 127.1, 125.4, 113.5, 113.2, 60.6, 52.5, 44.1, 23.0, 23.0, 20.4. HRMS (ESI) exact mass calcd for $C_{19}H_{25}N_2O_2$ [M+H] m/z 313.1911, found 313.1919.



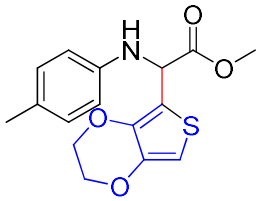
3ae

methyl 2-(2,4-dihydroxyphenyl)-2-(p-tolylamino)acetate (3ae) The desired pure product was obtained in 52% yield (74.6 mg) as a brown solid, mp 74-75 °C.^{1}H NMR (600 MHz, $CDCl_3$) δ 9.03 (s, 2H), 7.07 (d, *J* = 8.3 Hz, 1H), 6.99 (d, *J* = 8.3 Hz, 2H), 6.68 (d, *J* = 8.3 Hz, 2H), 6.39 (dd, *J* = 8.3, 2.5 Hz, 1H), 6.34 (d, *J* = 2.5 Hz, 1H), 5.03 (s, 1H), 4.97 (s, 1H), 4.77 (s, 1H), 3.77 (s, 3H), 2.23 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 172.2, 157.6, 157.1, 142.9, 130.5, 130.3, 129.9, 116.2, 113.5, 107.7, 104.5, 61.5, 53.2, 20.5. HRMS (ESI) exact mass calcd for $C_{16}H_{18}NO_4$ [M+H] m/z 288.1230, found 288.1237.



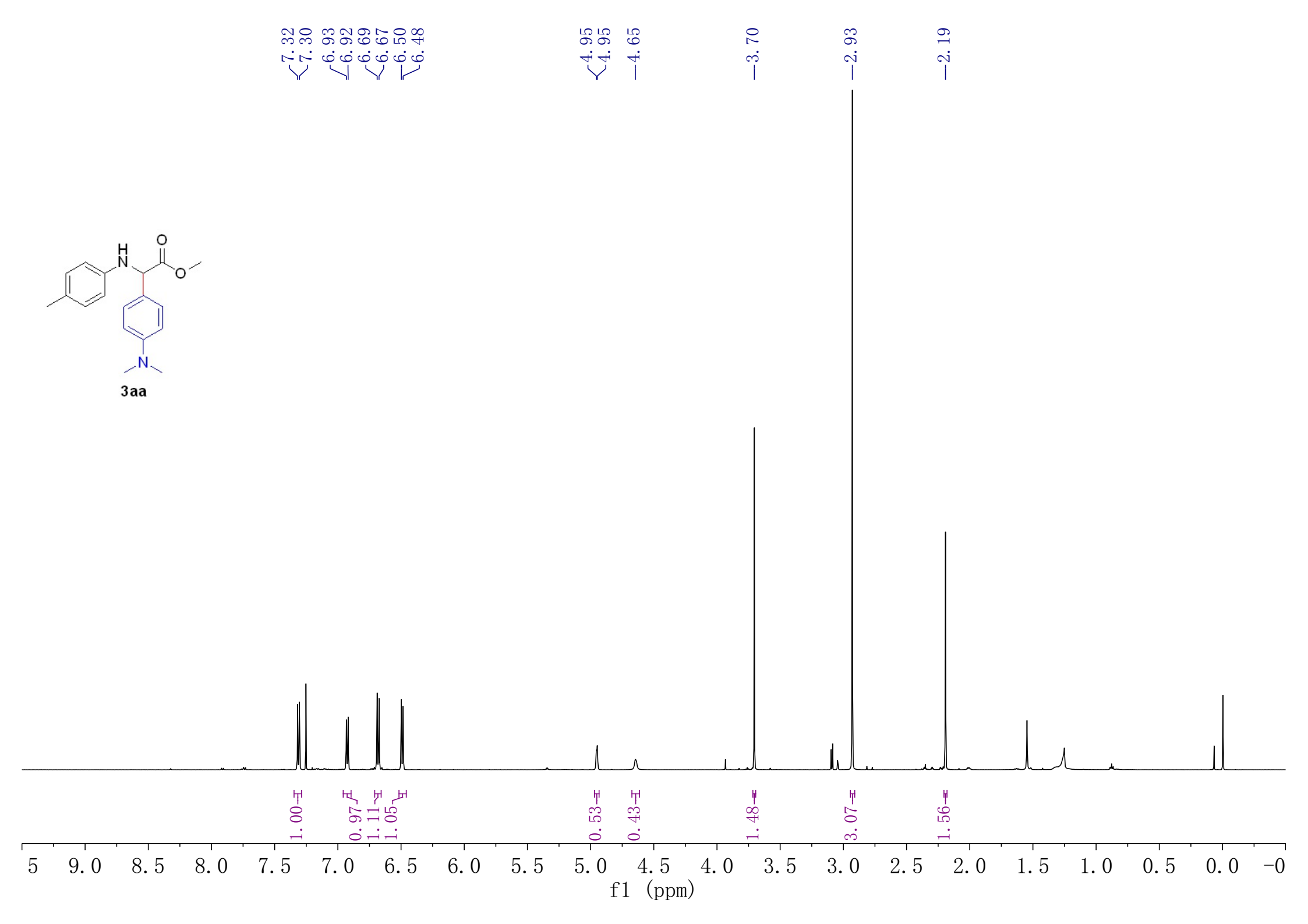
3af

methyl 2-(p-tolylamino)-2-(2,4,6-trimethoxyphenyl)acetate (3ag) The desired pure product was obtained in 76% yield (131.2mg) as a white solid, mp 164-166 °C.^{1}H NMR (600 MHz, $CDCl_3$) δ 6.93 (d, *J* = 8.3 Hz, 2H), 6.67 – 6.63 (m, 2H), 6.11 (s, 2H), 5.67 (s, 1H), 4.76 (s, 1H), 3.83 (s, 6H), 3.78 (s, 3H), 3.67 (s, 3H), 2.19 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 173.6, 160.9, 158.7, 144.9, 129.5, 126.9, 114.0, 108.4, 91.0, 55.9, 55.3, 52.3, 51.2, 20.4. HRMS (ESI) exact mass calcd for $C_{19}H_{24}NO_5$ [M+H] m/z 346.1649, found 346.1641.



3ag

methyl 2-(2,3-dihydrothieno[3,4-b][1,4]dioxin-5-yl)-2-(p-tolylamino)acetate (3ag) The desired pure product was obtained in 72% yield (115.2mg) as a white solid, mp 128-129 °C.^{1}H NMR (600 MHz, $CDCl_3$) δ 6.97 (d, *J* = 8.4 Hz, 2H), 6.58 (d, *J* = 8.4 Hz, 2H), 6.25 (s, 1H), 5.32 (s, 1H), 4.66 (s, 1H), 4.27 – 4.24 (m, 2H), 4.22 – 4.19 (m, 2H), 3.76 (s, 3H), 2.22 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 171.5, 143.4, 141.2, 139.6, 129.7, 127.9, 113.9, 113.9, 98.8, 64.9, 64.6, 53.5, 52.8, 20.4. HRMS (ESI) exact mass calcd for $C_{16}H_{18}NO_4S$ [M+H] m/z 320.0951, found 320.0943.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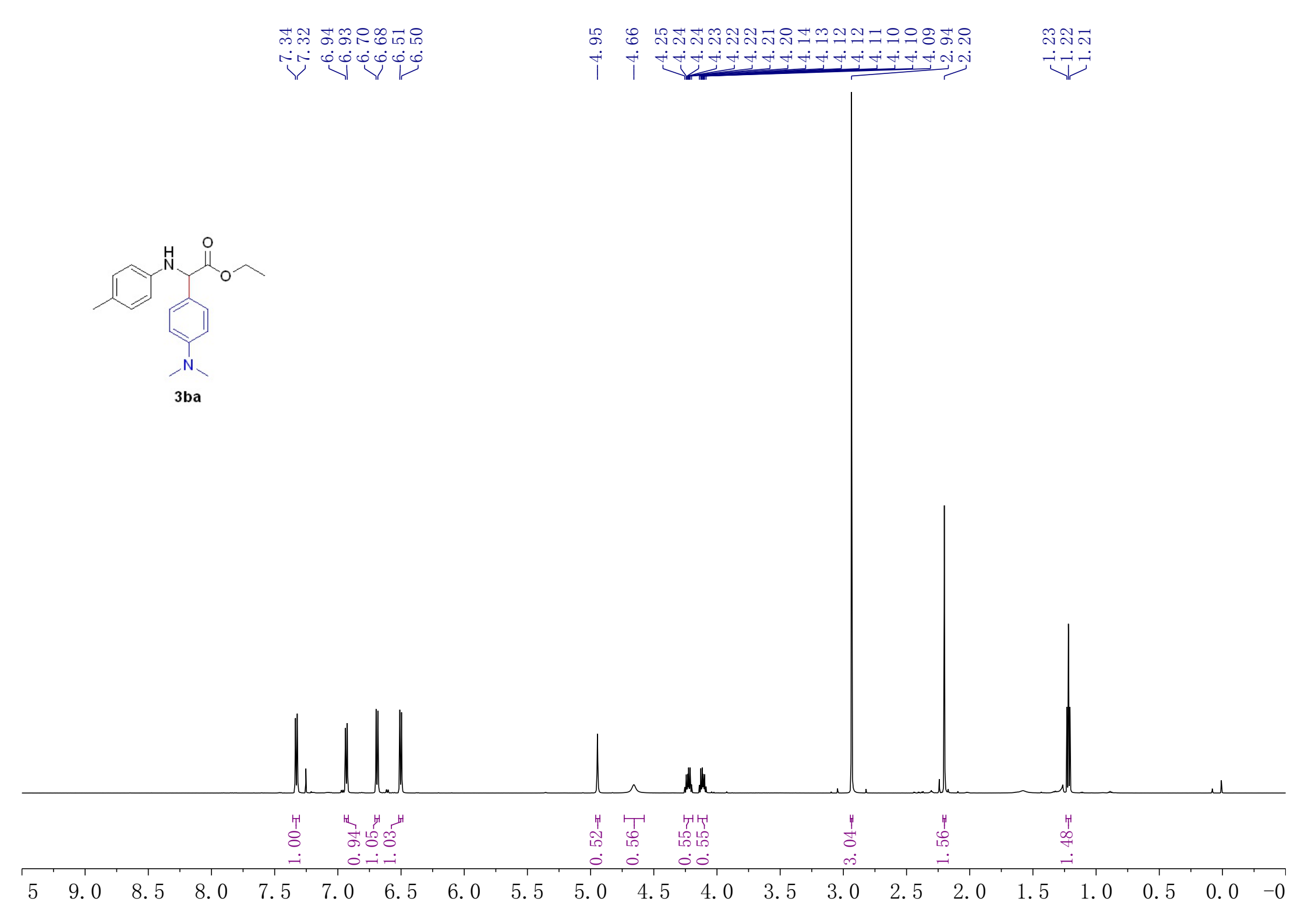
3aa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O
O
N
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0.56
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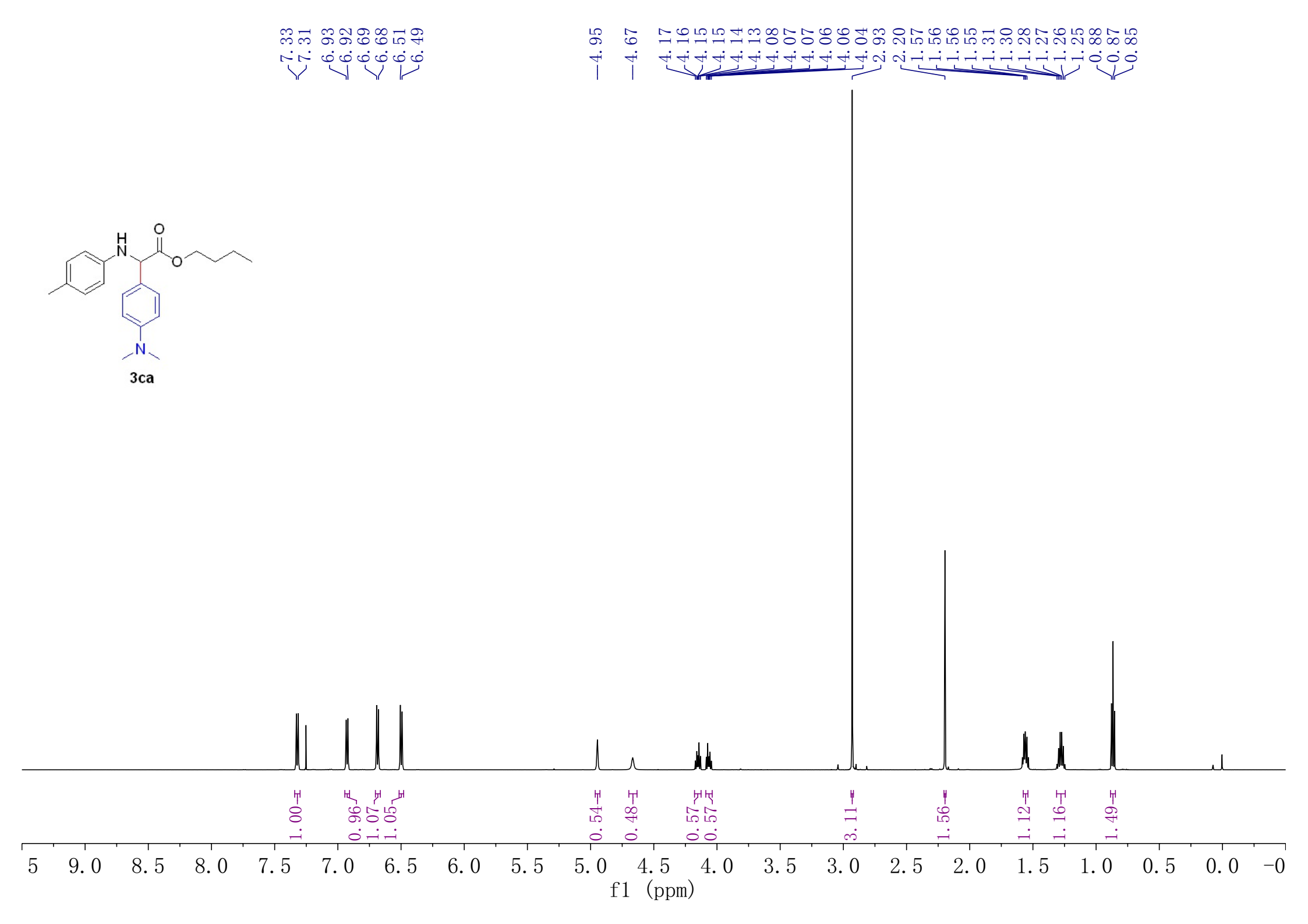
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f1 (ppm)

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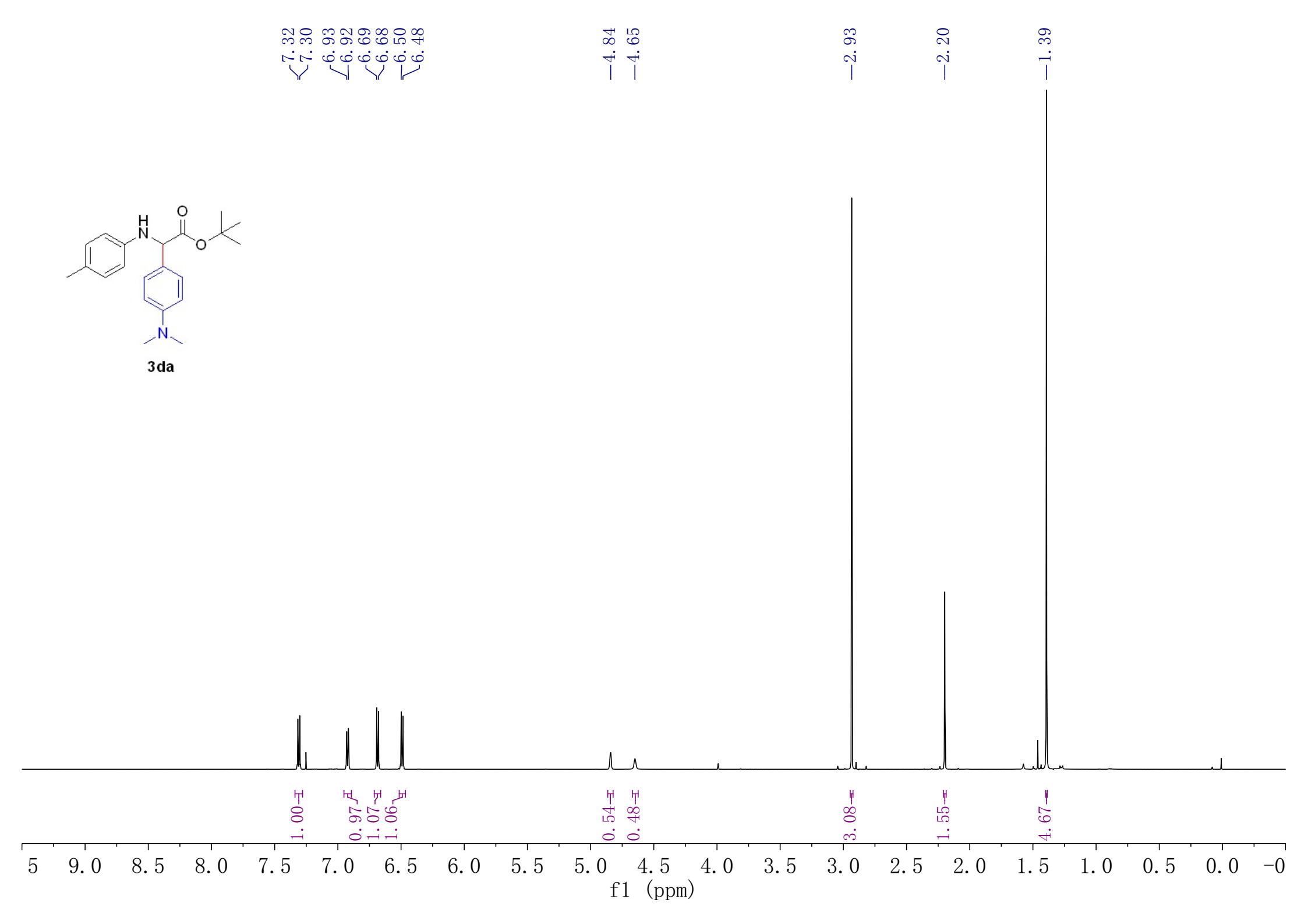
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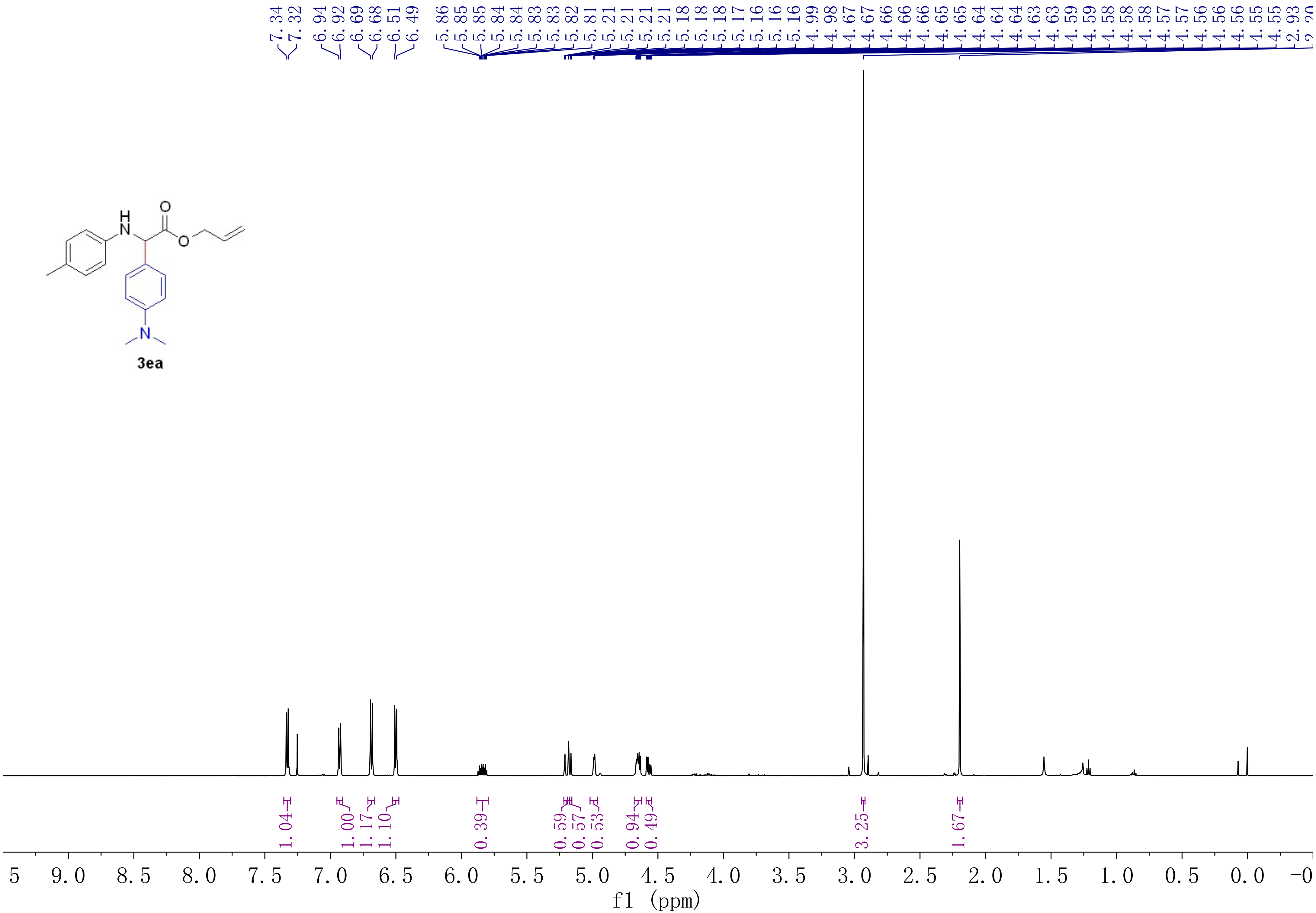
f1 (ppm)

3da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0.94
0.49
3.25
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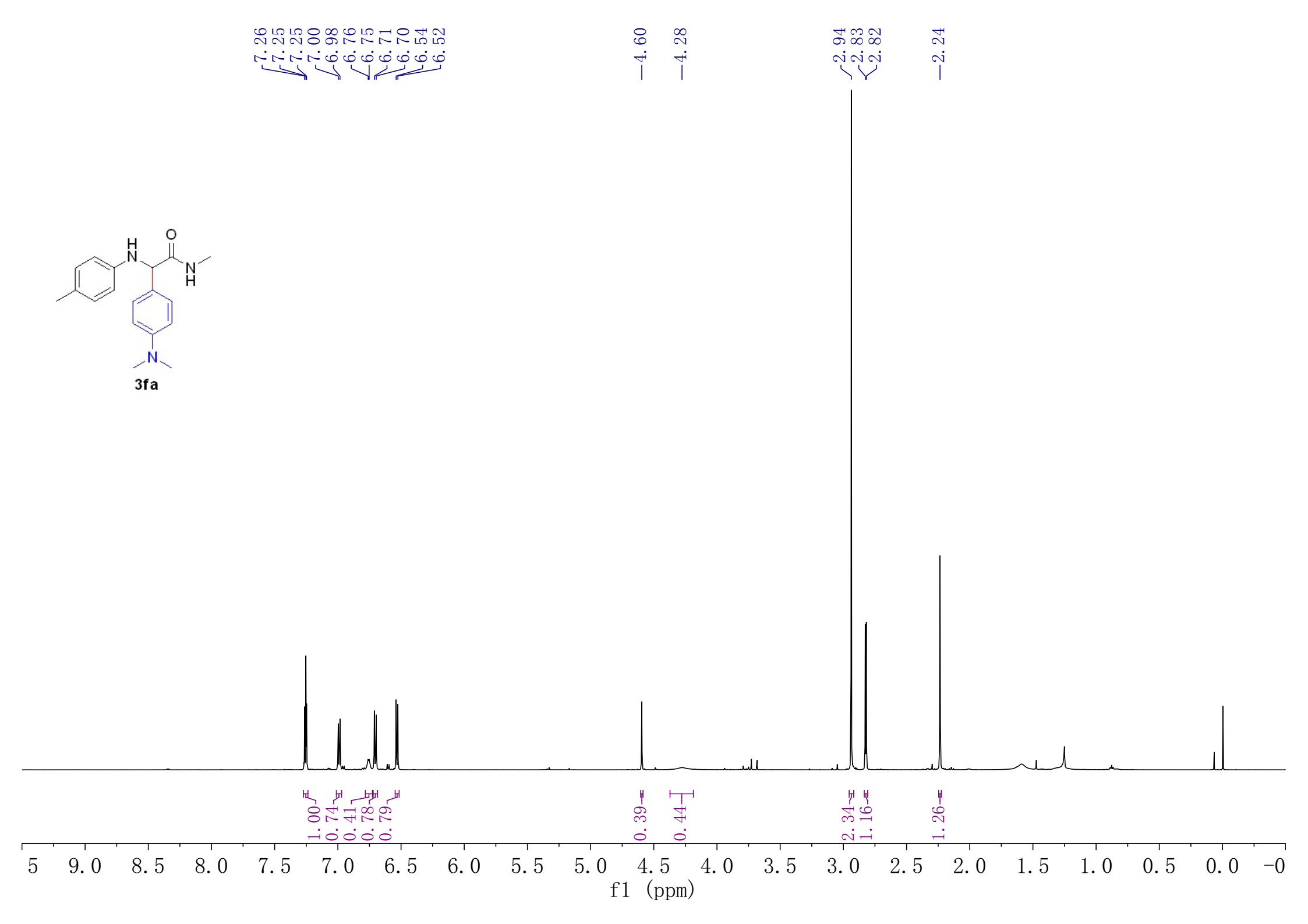
f1 (ppm)

3ea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f1 (ppm)

3fa

H
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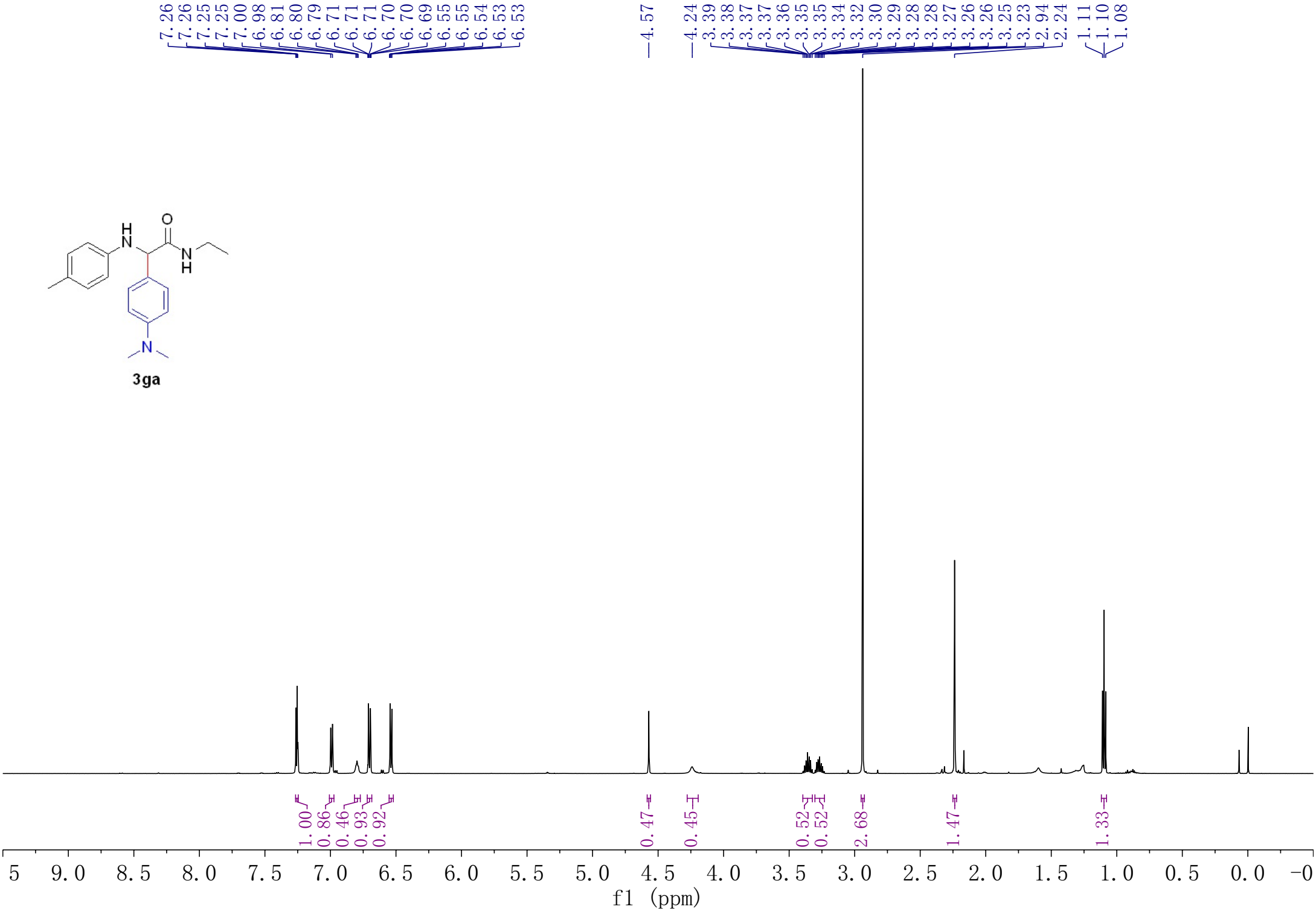
N
H
N

3ga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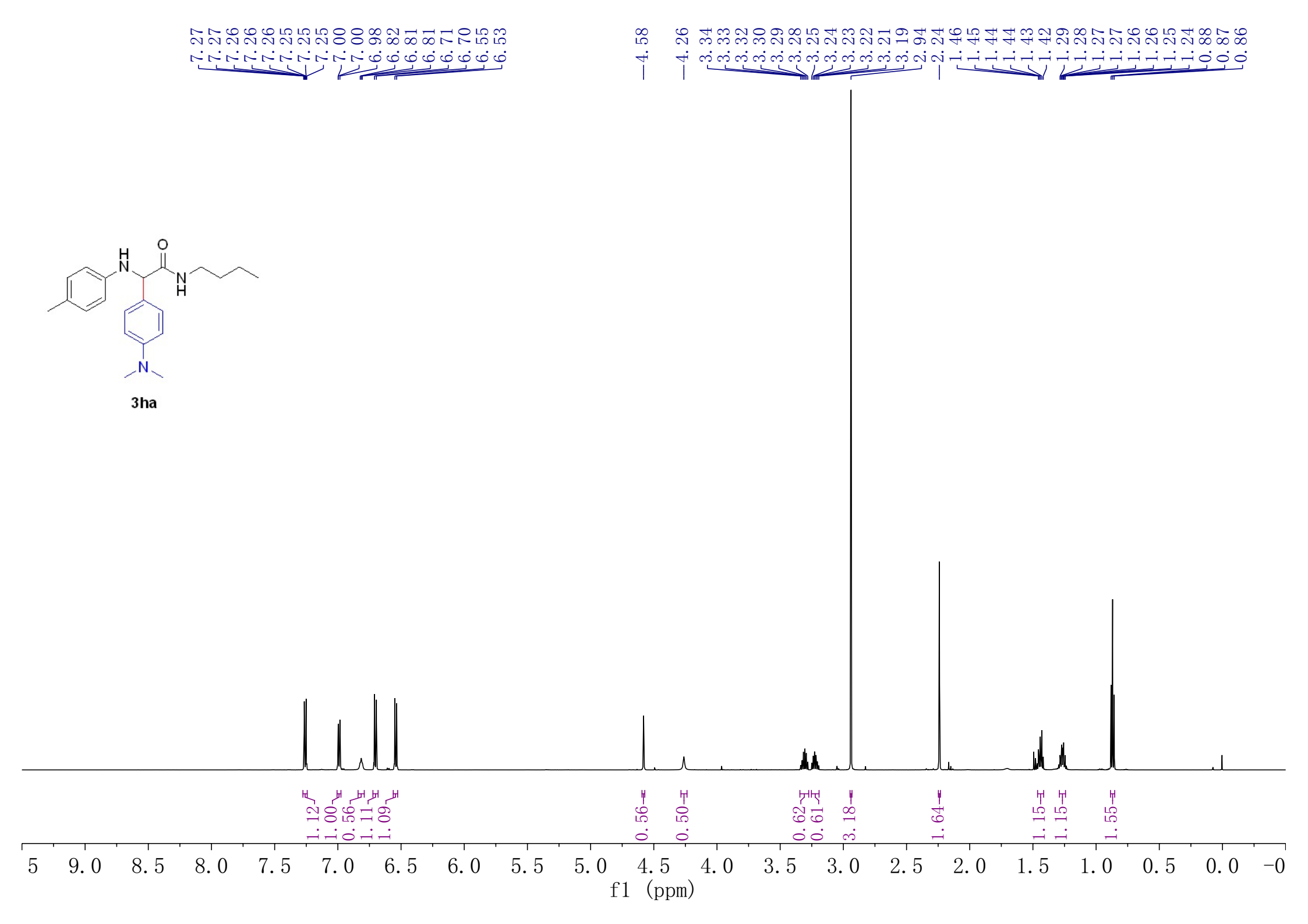
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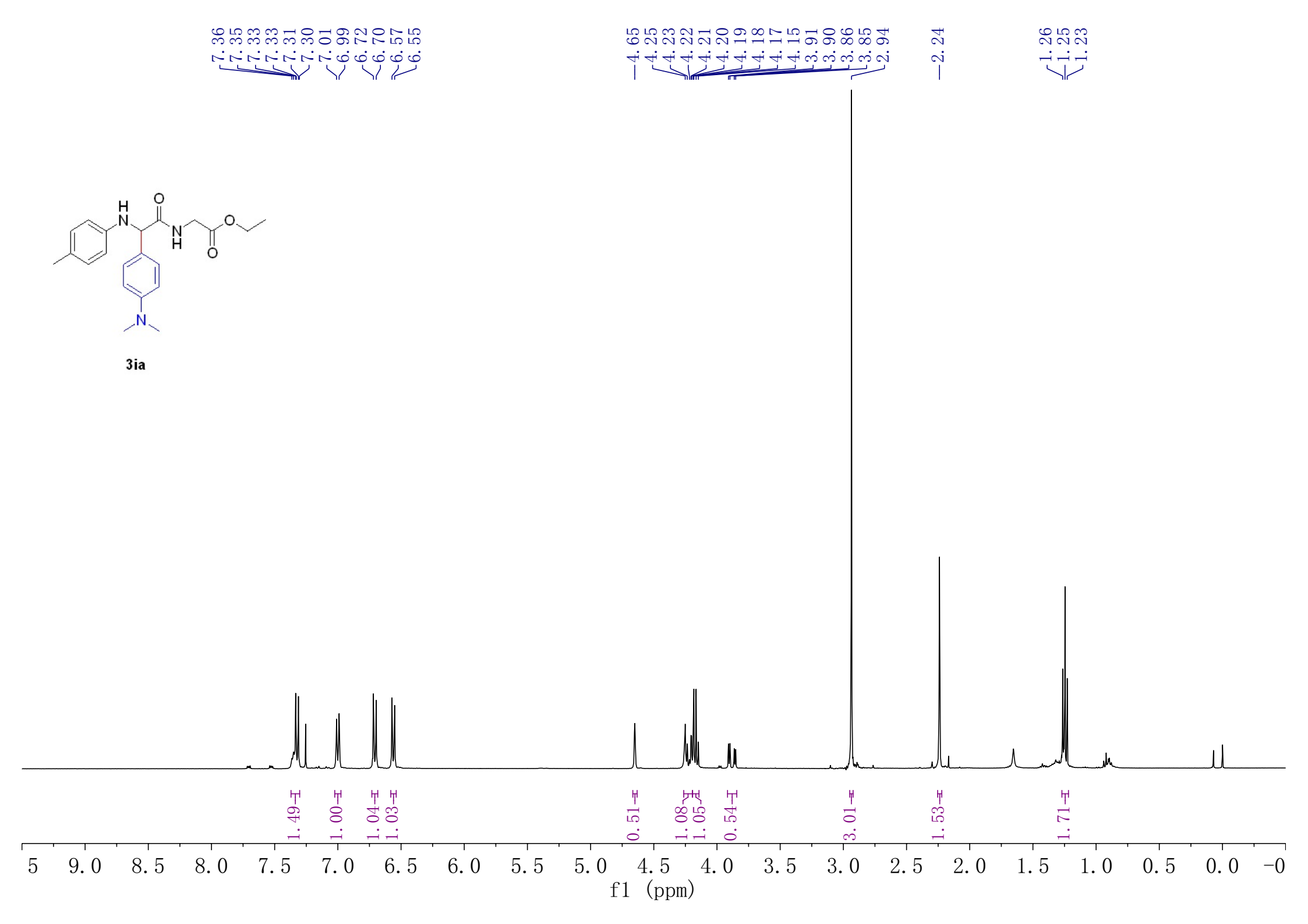
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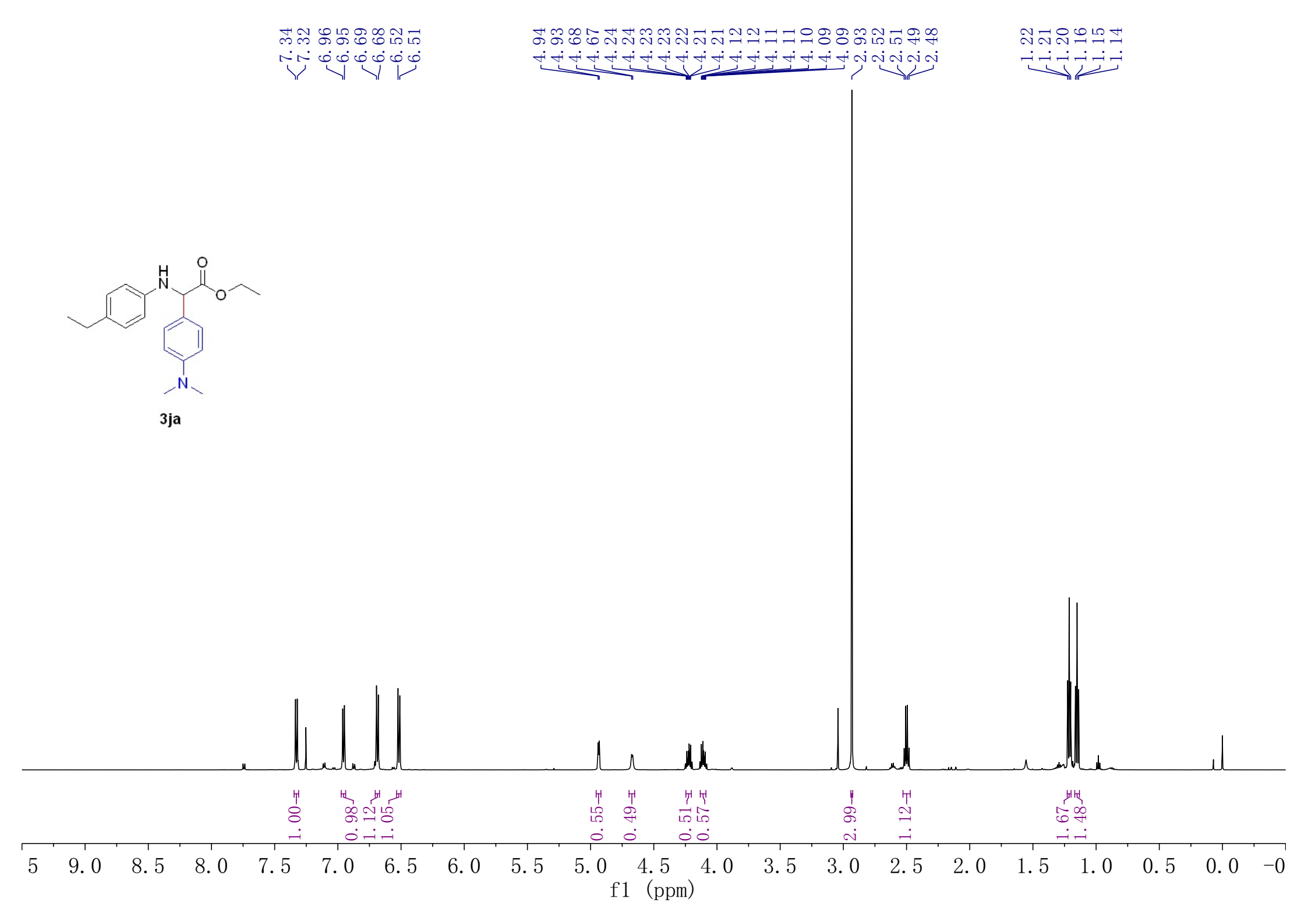
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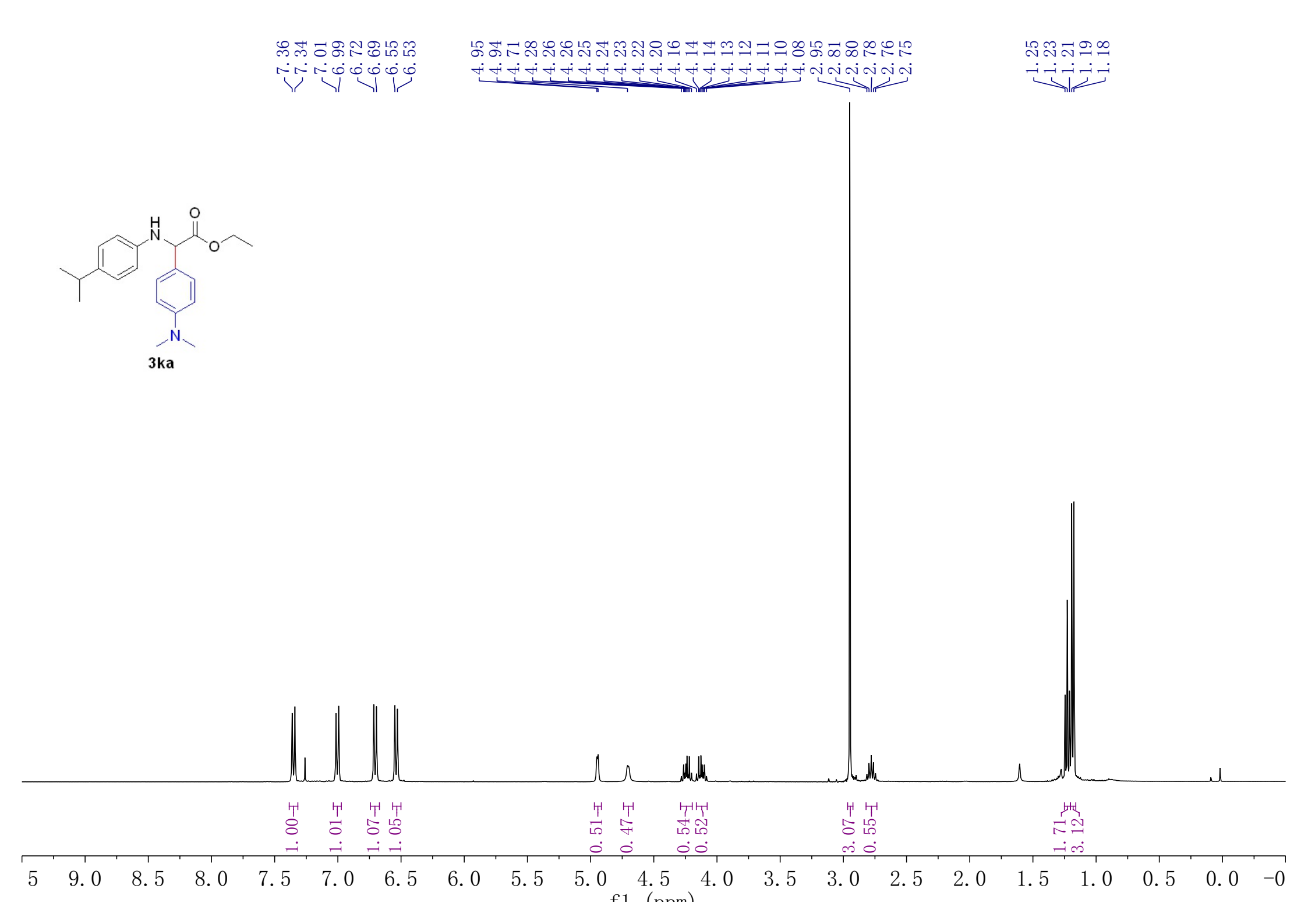
f1 (ppm)

3ja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2.81
2.80
2.78
2.76
2.75
1.25
1.23
1.21
1.19
1.18
H
N
O
O
N
3ka
1.00
1.01
1.07
1.05
0.51
0.47
0.54
0.52
3.07
0.55
1.71
3.12
5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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2.0
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1.0
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0.0
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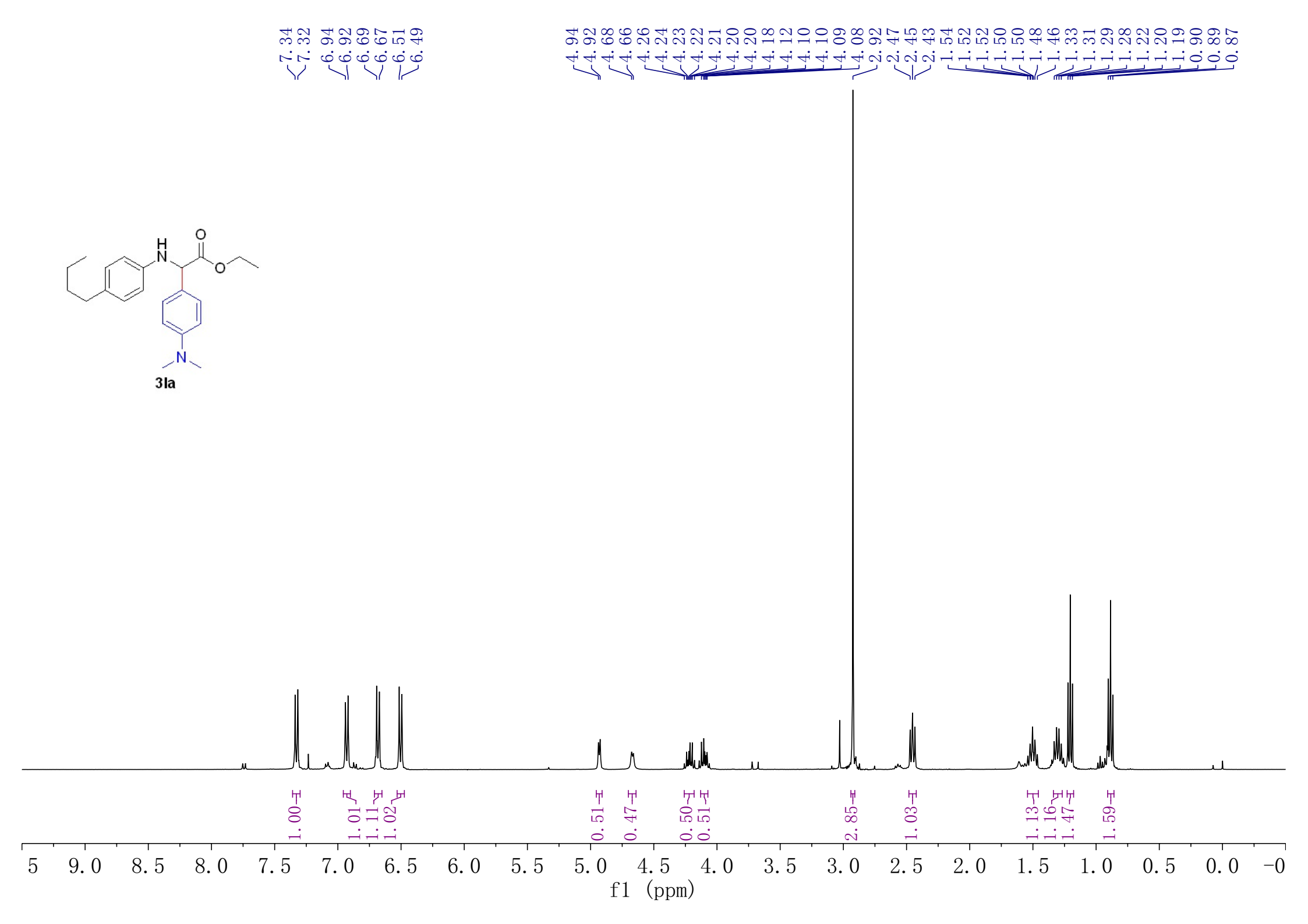
f1 (ppm)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6.49
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4.92
4.68
4.66
4.26
4.24
4.23
4.22
4.21
4.20
4.20
4.18
4.12
4.10
4.10
4.09
4.08
2.92
2.47
2.45
2.43
1.54
1.52
1.52
1.50
1.50
1.48
1.46
1.33
1.31
1.29
1.28
1.22
1.20
1.19
0.90
0.89
0.87
H
N
O
O
N
3la
1.00
1.01
1.11
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0.50
0.51
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1.16
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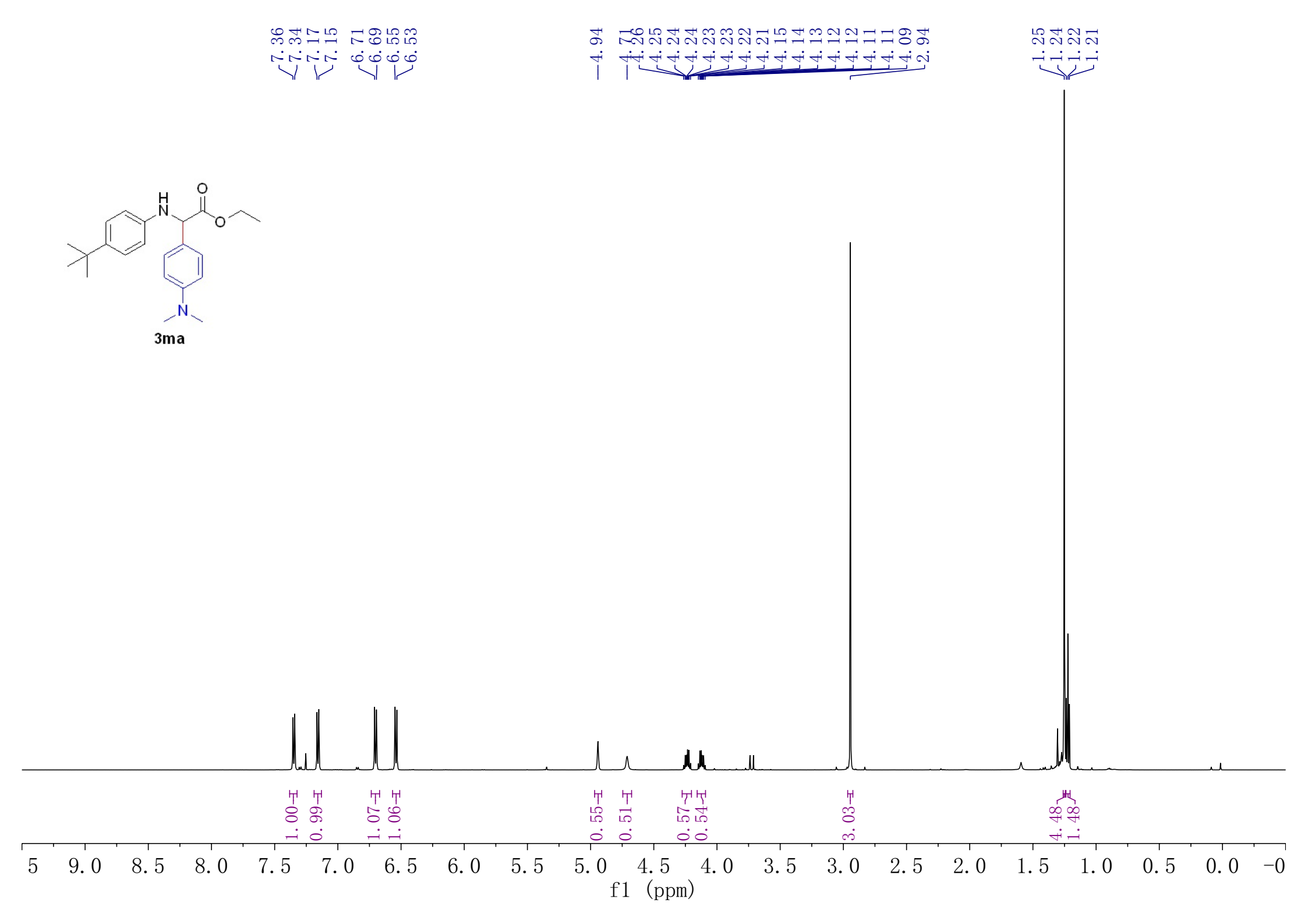
f1 (ppm)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6.55
6.53
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4.71
4.26
4.25
4.24
4.24
4.23
4.23
4.22
4.21
4.15
4.14
4.13
4.12
4.12
4.11
4.11
4.09
2.94
1.25
1.24
1.22
1.21
H
N
O
O
N
3ma
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0.51
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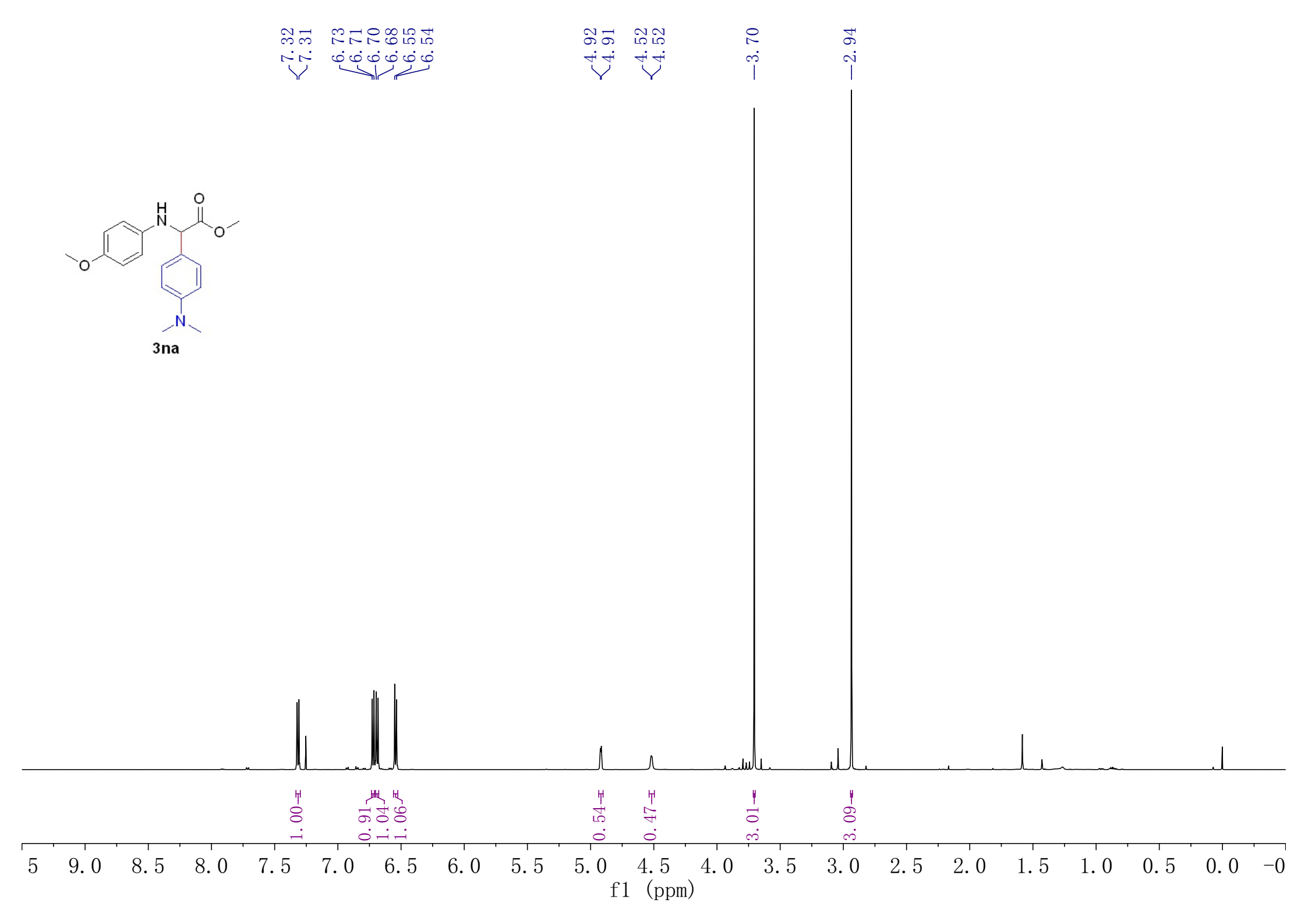
0.54
3.03
4.48
1.48
f1 (ppm)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6.54
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4.91
4.52
4.52
3.70
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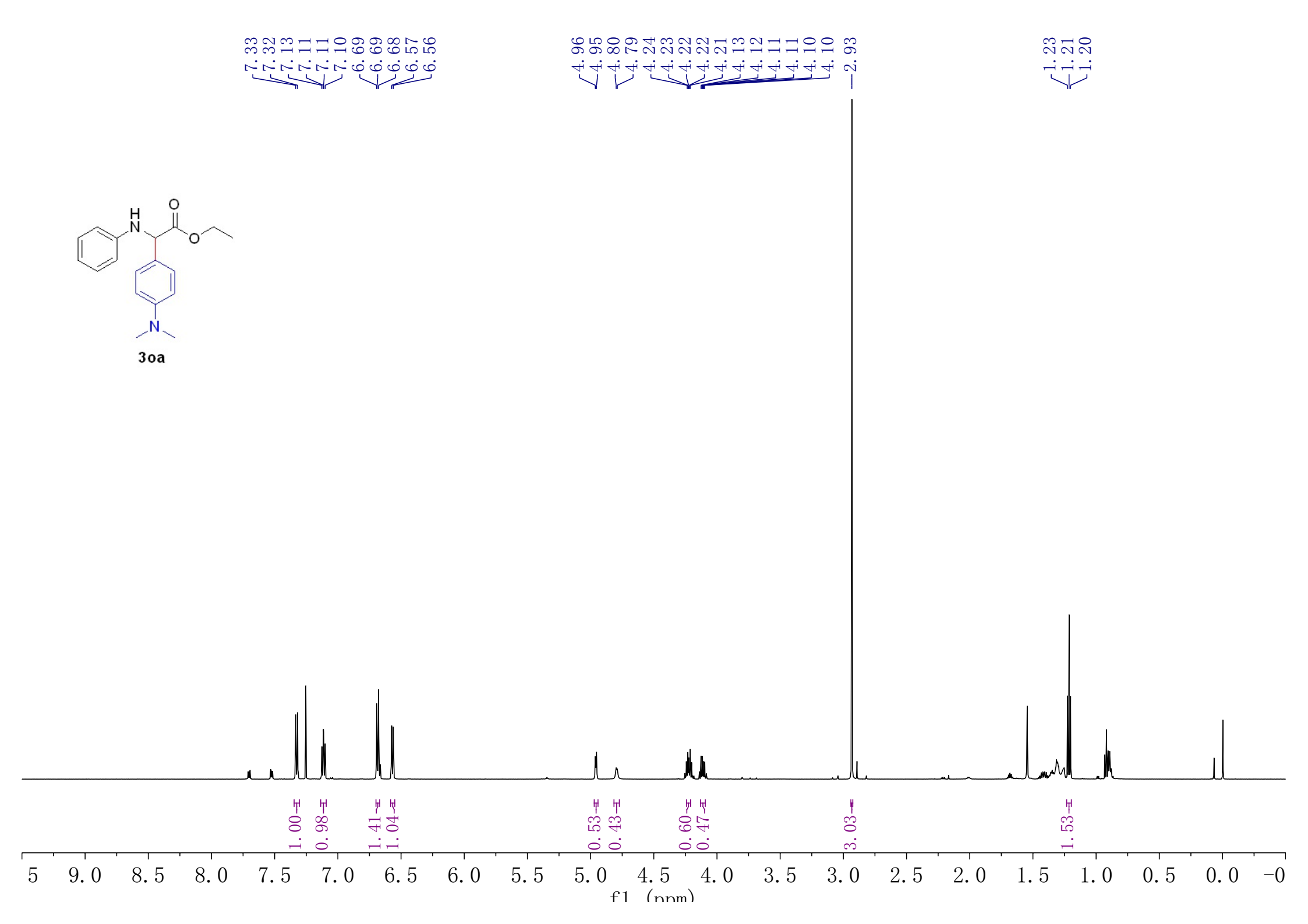
0.91
1.04
1.06
0.54
0.47
3.01
3.09
f1 (ppm)

3na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6.69
6.68
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6.56
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4.95
4.80
4.79
4.24
4.23
4.22
4.22
4.21
4.13
4.12
4.11
4.11
4.10
4.10
2.93
1.23
1.21
1.20
H
N
O
O
N
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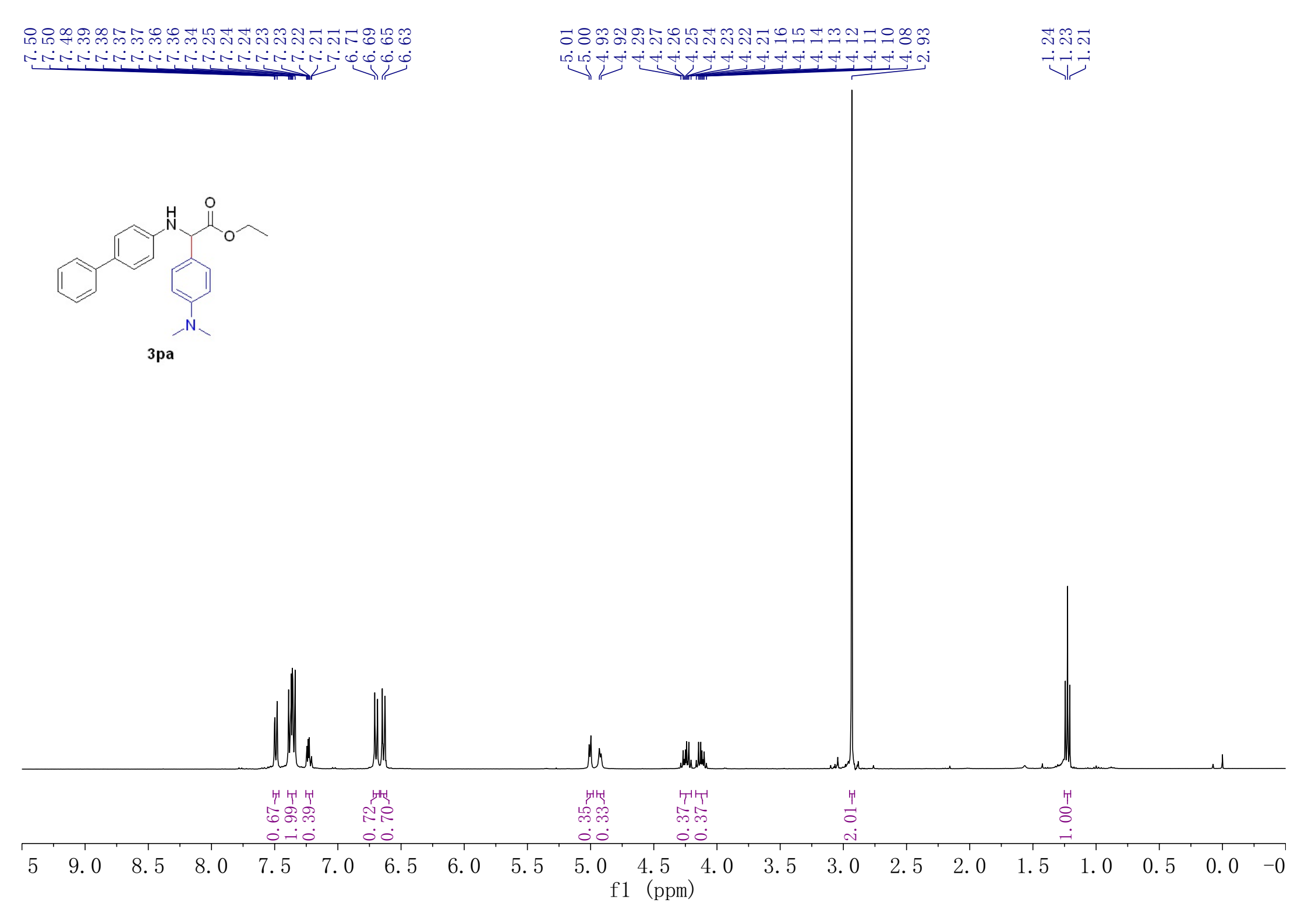
0.53
0.43
0.60
0.47
3.03
1.53
f1 (ppm)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7.25
7.24
7.24
7.23
7.23
7.22
7.21
7.21
6.71
6.69
6.65
6.63
5.01
5.00
4.93
4.92
4.29
4.27
4.26
4.25
4.24
4.23
4.22
4.21
4.16
4.15
4.14
4.13
4.12
4.11
4.10
4.08
2.93
1.24
1.23
1.21
H
N
O
O
N
3pa
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0.35
0.33
0.37
0.37
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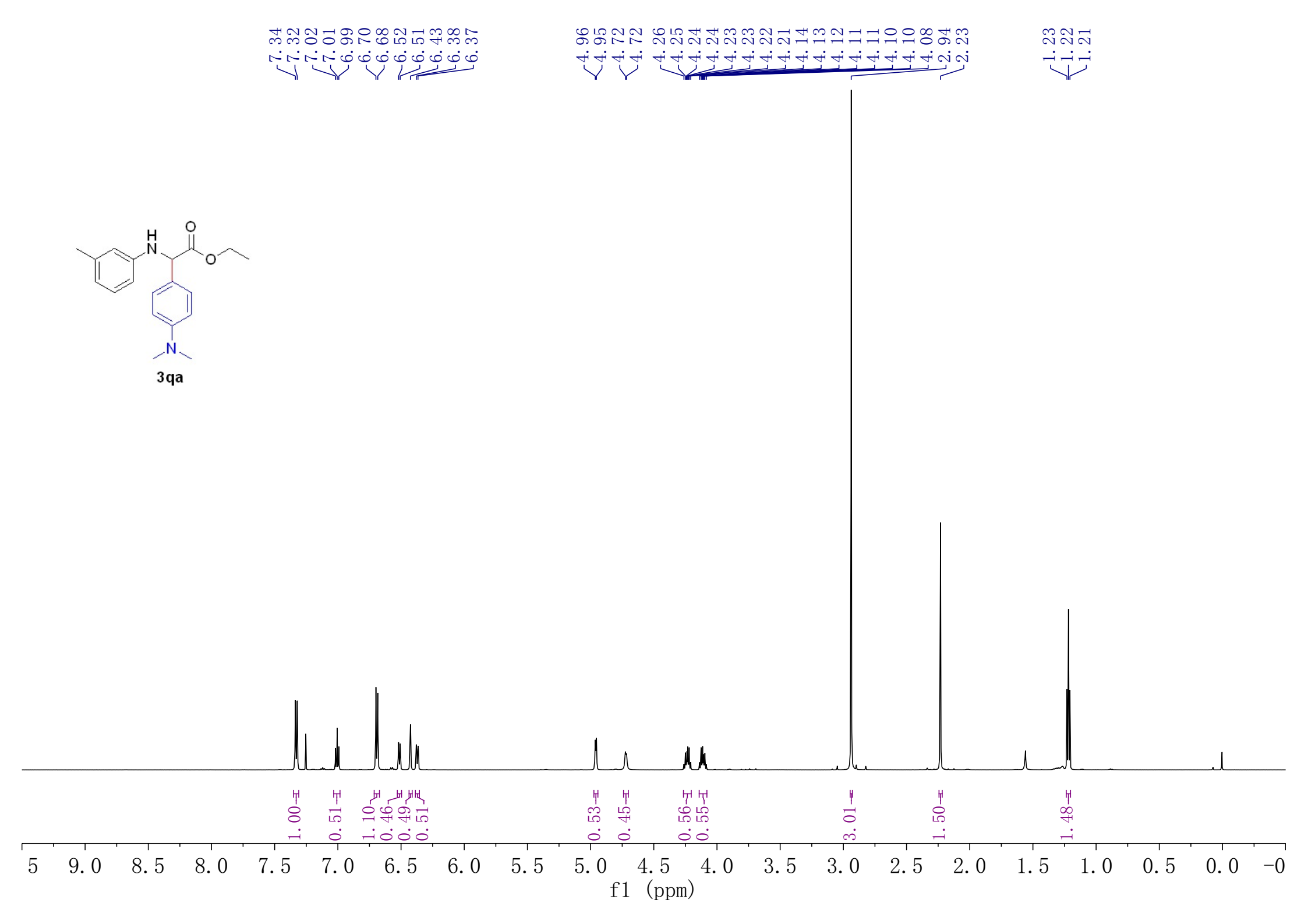
1.00
f1 (ppm)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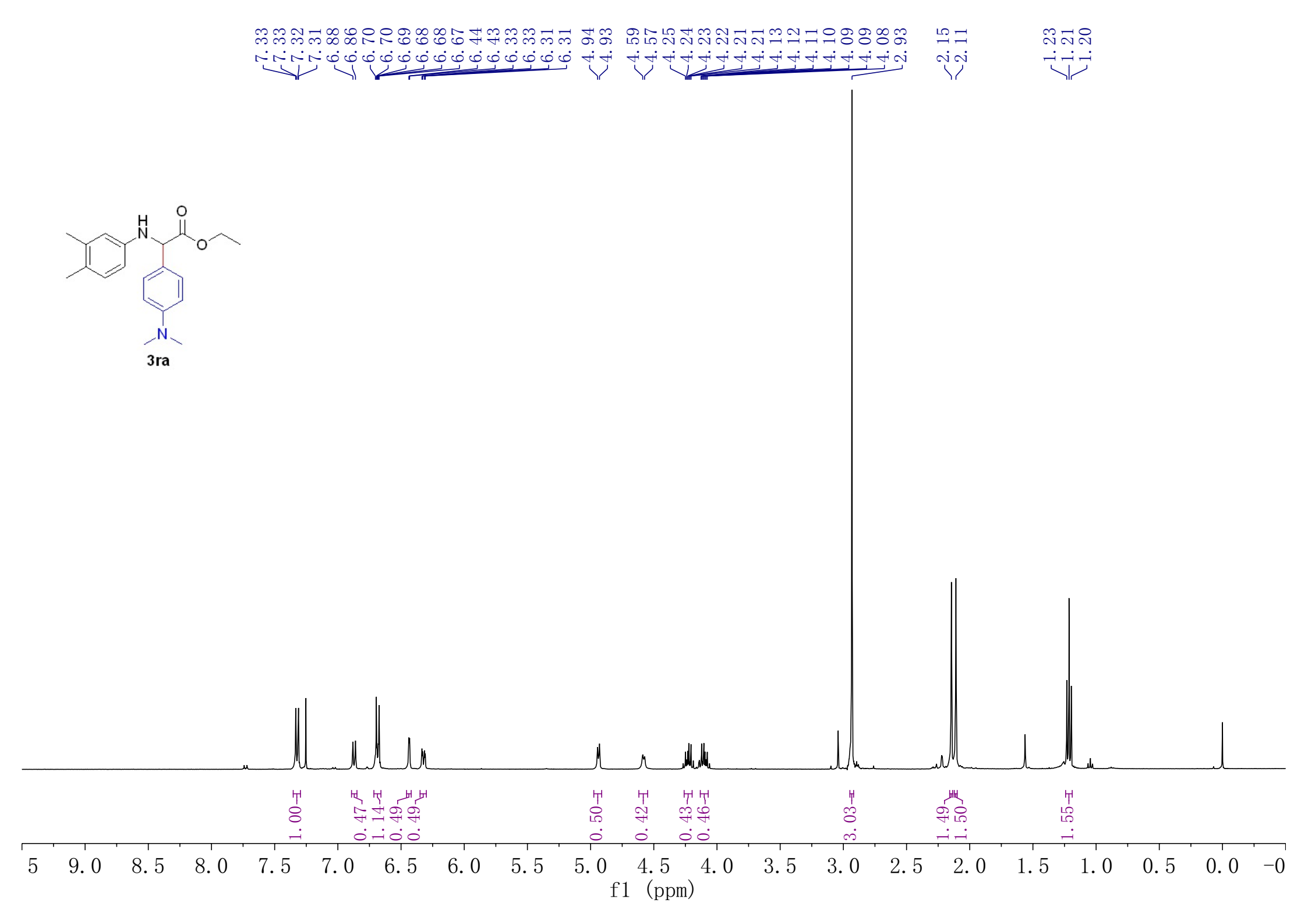
6.52
6.51
6.43
6.38
6.37
4.96
4.95
4.72
4.72
4.26
4.25
4.24
4.24
4.23
4.23
4.22
4.21
4.14
4.13
4.12
4.11
4.11
4.10
4.10
4.08
2.94
2.23
1.23
1.22
1.21
H
N
O
O
N
3qa
1.00
0.51
1.10
0.46
0.49
0.51
0.53
0.45
0.56
0.55
3.01
1.50
1.48
f1 (ppm)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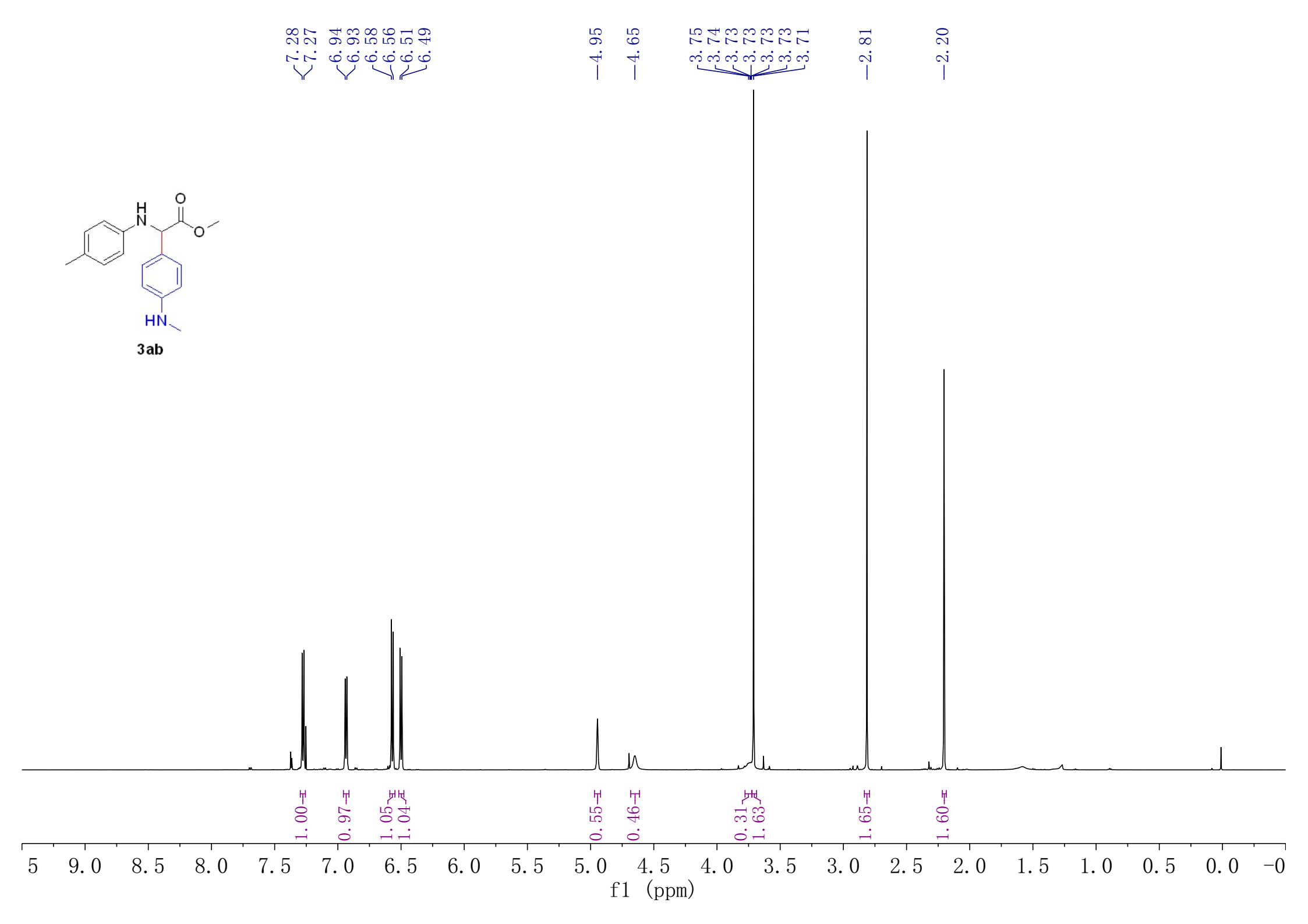
6.69
6.68
6.68
6.67
6.44
6.43
6.33
6.33
6.31
6.31
4.94
4.93
4.59
4.57
4.25
4.24
4.23
4.22
4.21
4.21
4.13
4.12
4.11
4.10
4.09
4.09
4.08
2.93
2.15
2.11
1.23
1.21
1.20
H
N
O
O
N
3ra
1.00
0.47
1.14
0.49
0.49
0.50
0.42
0.43
0.46
3.03
1.49
1.50
1.55
f1 (ppm)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7.27
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6.51
6.49
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4.65
3.75
3.74
3.73
3.73
3.73
3.73
3.71
2.81
2.20
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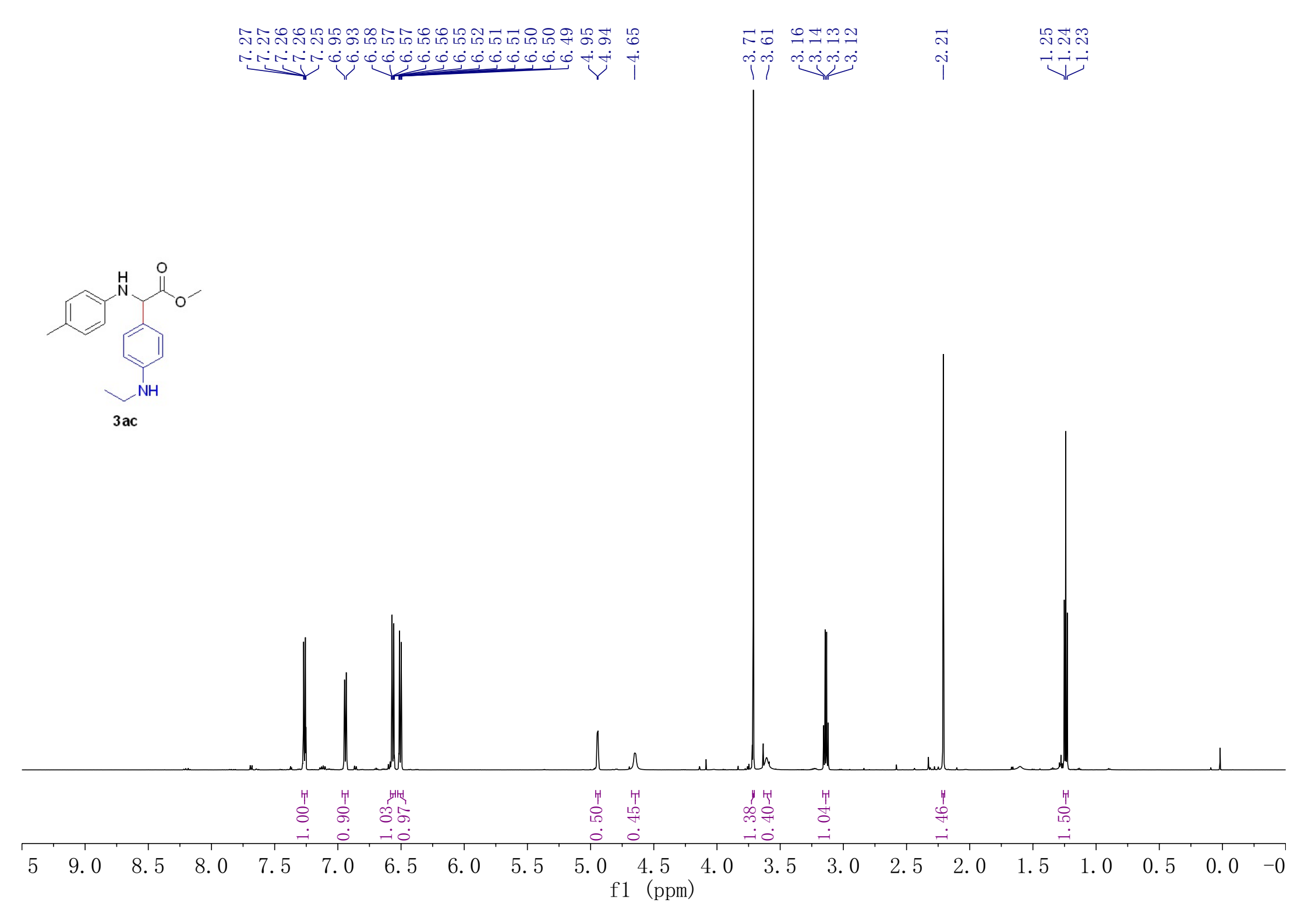
1.04
0.55
0.46
0.31
1.63
1.65
1.60
f1 (ppm)

3ab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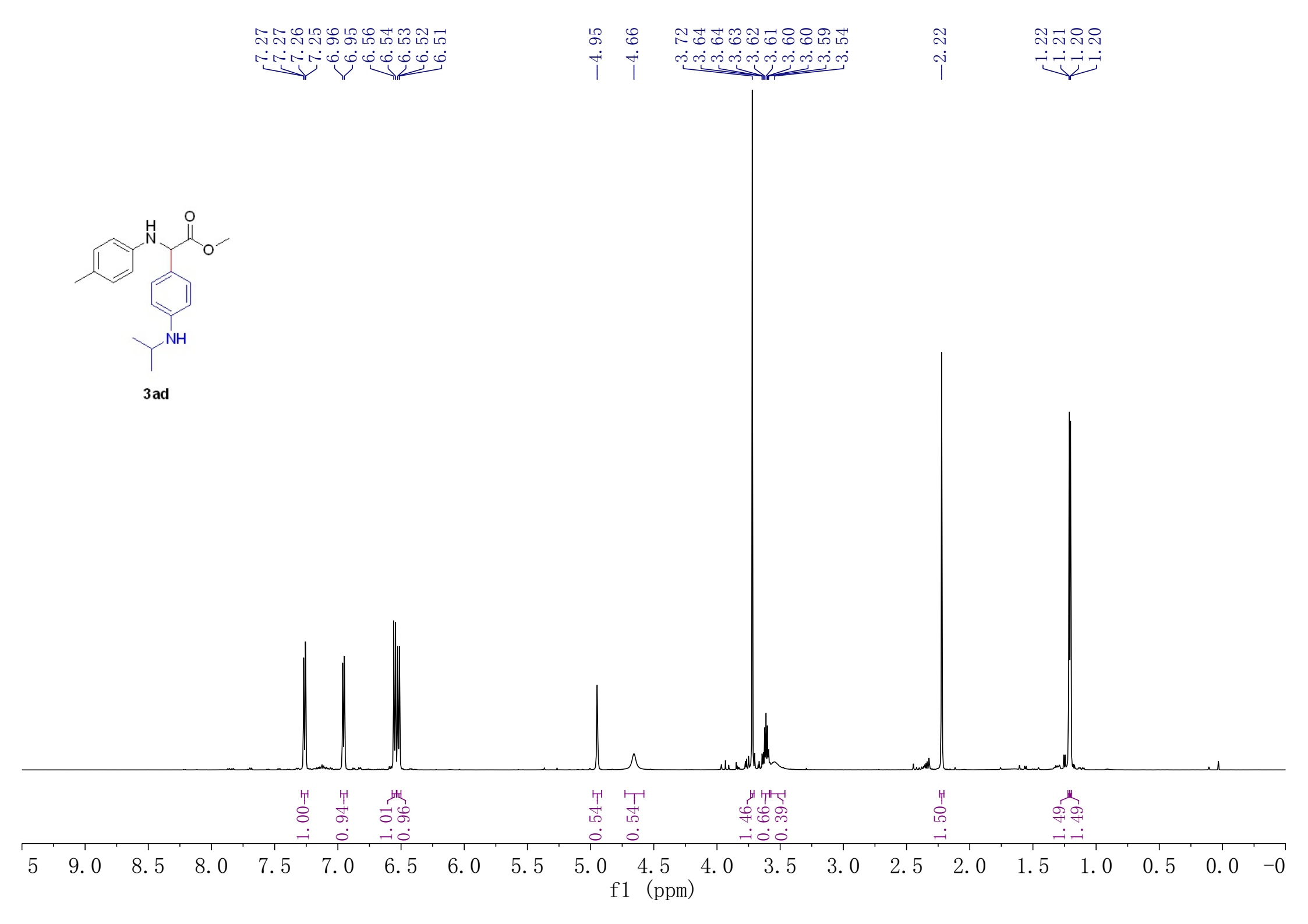
7.27
7.26
7.26
7.25
6.95
6.93
6.58
6.57
6.57
6.56
6.56
6.55
6.52
6.51
6.51
6.50
6.50
6.49
4.95
4.94
4.65
3.71
3.61
3.16
3.14
3.13
3.12
2.21
1.25
1.24
1.23
H
N
O
O
NH
3ac
1.00
0.90
1.03
0.97
0.50
0.45
1.38
0.40
1.04
1.46
1.50
f1 (ppm)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7.27
7.26
7.25
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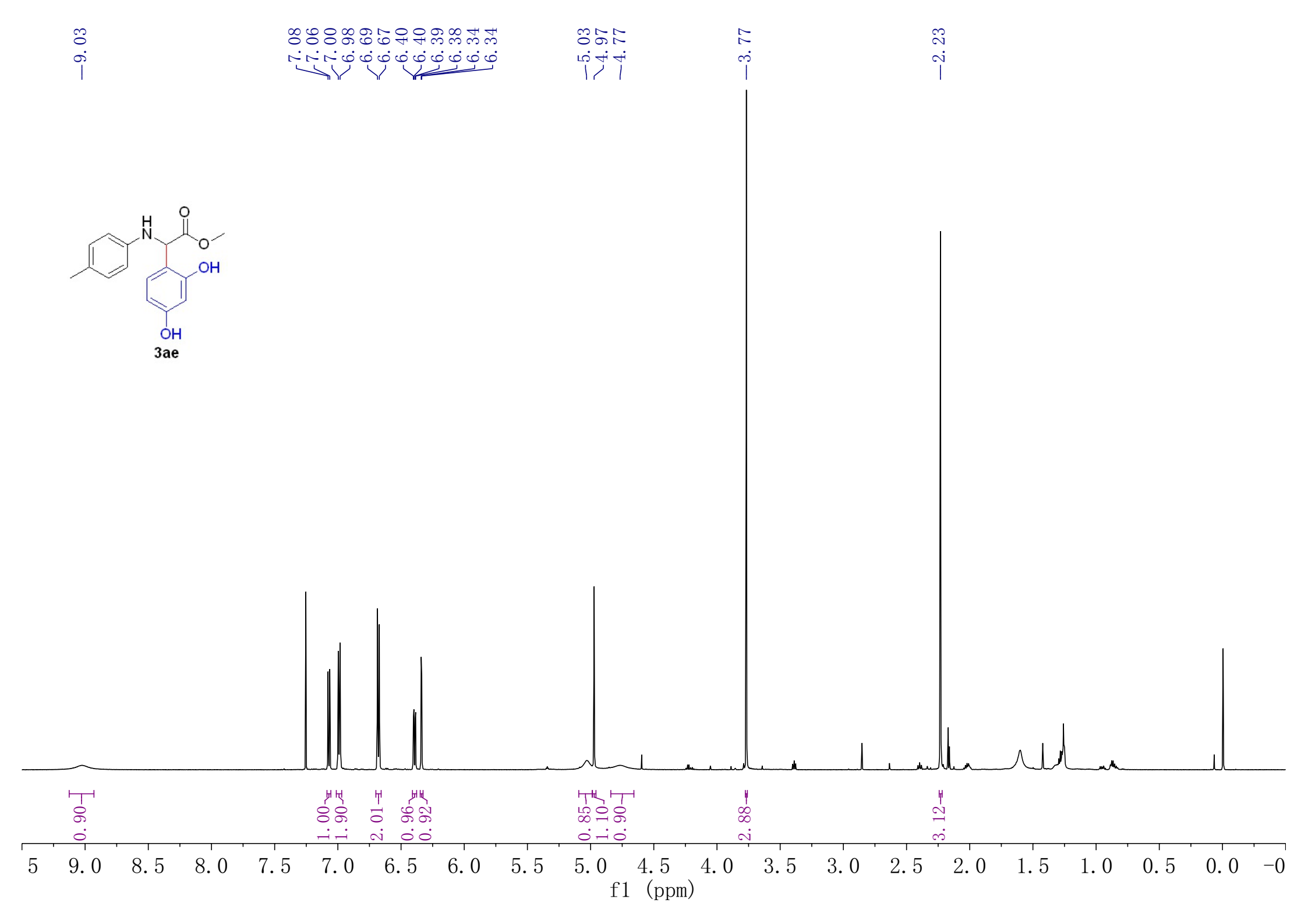
6.95
6.56
6.54
6.53
6.52
6.51
4.95
4.66
3.72
3.64
3.64
3.63
3.62
3.61
3.60
3.60
3.59
3.54
2.22
1.22
1.21
1.20
1.20
H
N
O
O
NH
3ad
1.00
0.94
1.01
0.96
0.54
0.54
1.46
0.66
0.39
1.50
1.49
1.49
f1 (ppm)


9.03
7.08
7.06
7.00
6.98
6.69
6.67
6.40
6.40
6.39
6.38
6.34
6.34
5.03
4.97
4.77
3.77
2.23
H
N
O
O
OH
OH
3ae
0.90
1.00
1.90
2.01
0.96
0.92
0.85
1.10
0.90
2.88
3.12
5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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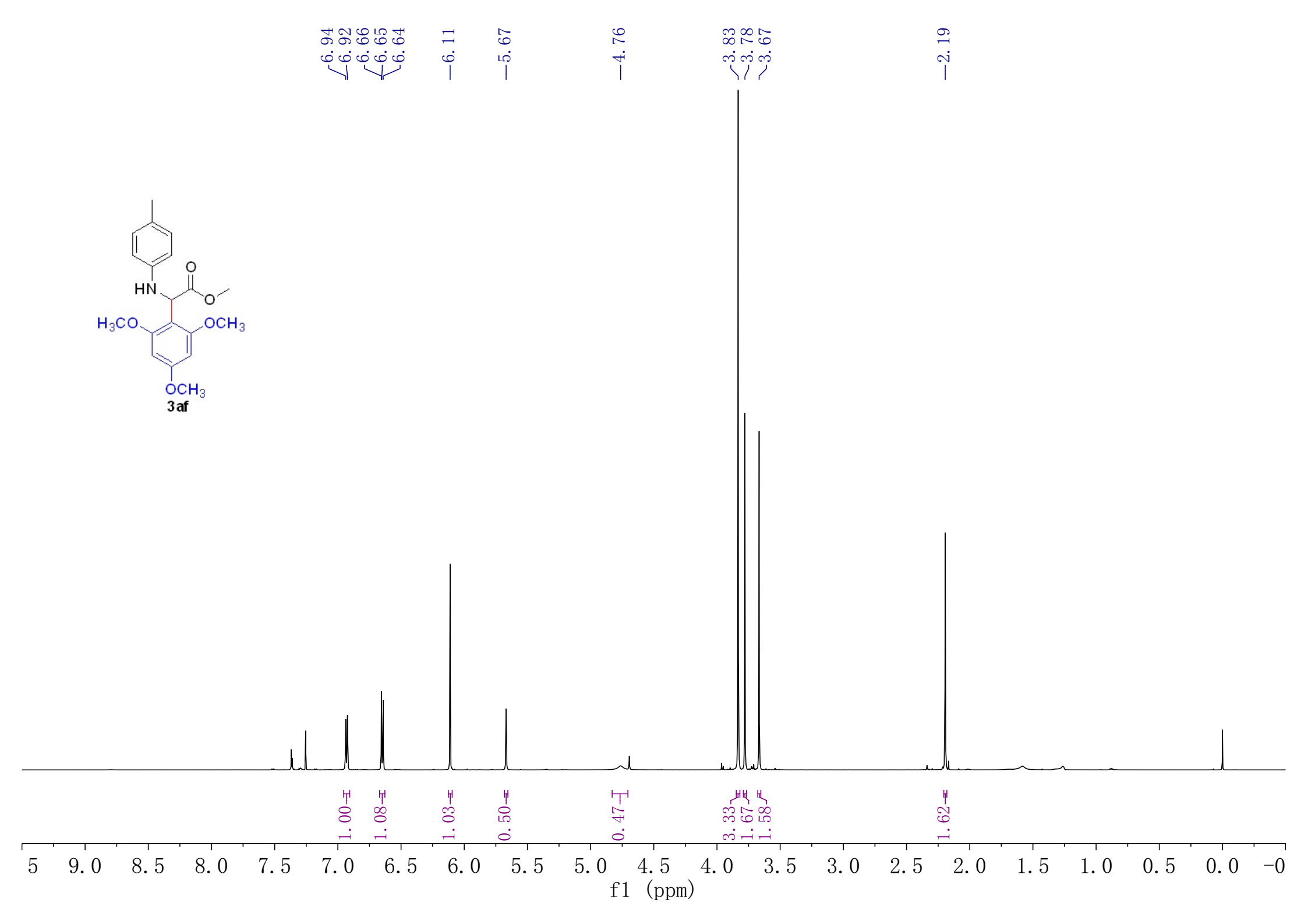
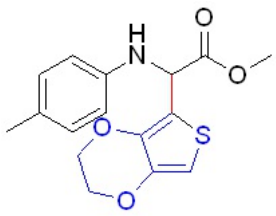
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
f1 (ppm)


6.94
6.92
6.66
6.65
6.64
6.11
5.67
4.76
3.83
3.78
3.67
2.19
HN
O
O
H3CO
OCH3
OCH3
3af
1.00
1.08
1.03
0.50
0.47
3.33
1.67
1.58
1.62
f1 (ppm)

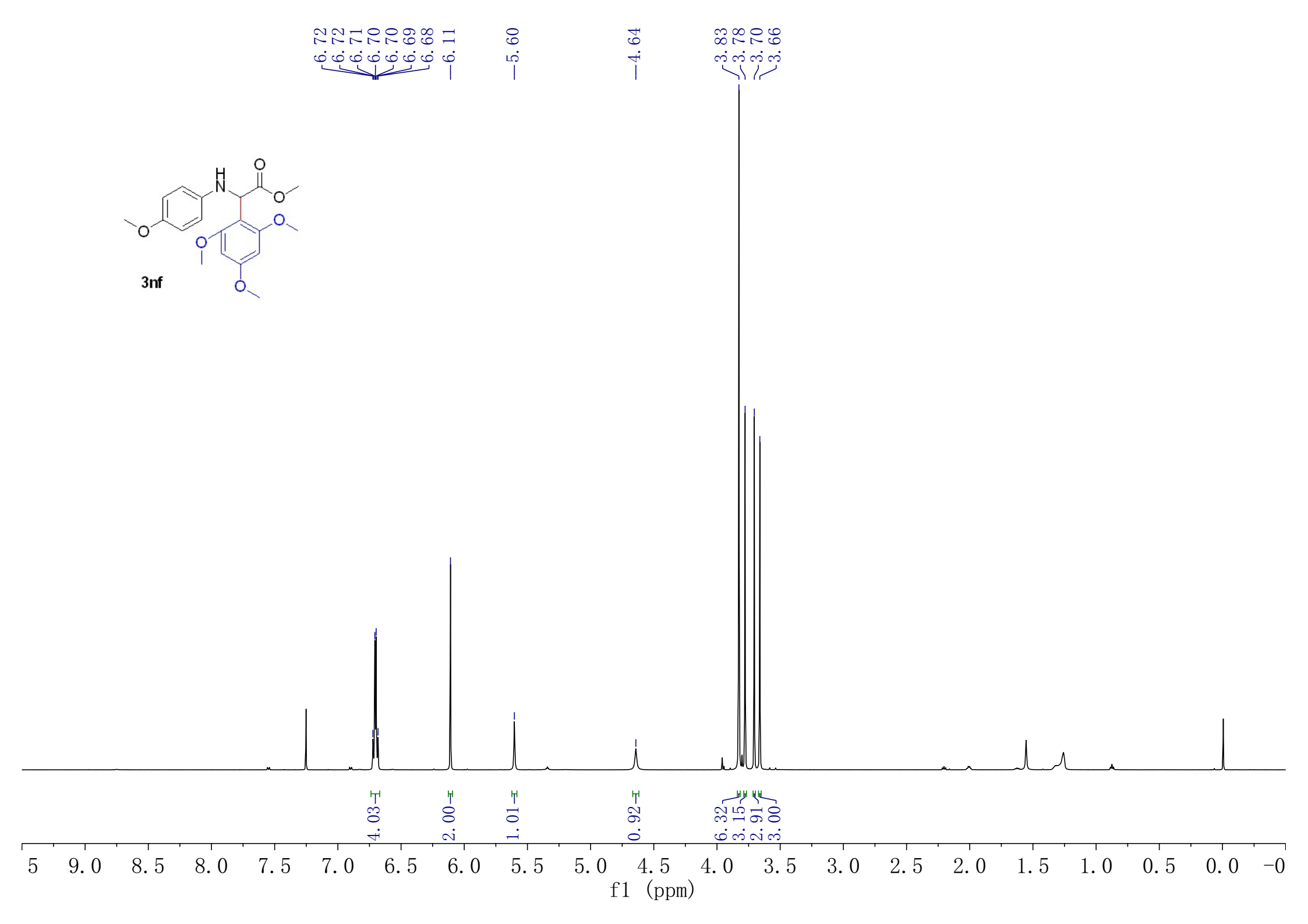


3ag

6.97
6.96
6.59
6.57
6.25
5.32
4.66
4.27
4.26
4.26
4.25
4.25
4.22
4.21
4.21
4.20
4.20
3.76
2.22

1.00
1.10
0.35
0.53
0.47
0.87
1.11
1.60
1.59

f1 (ppm)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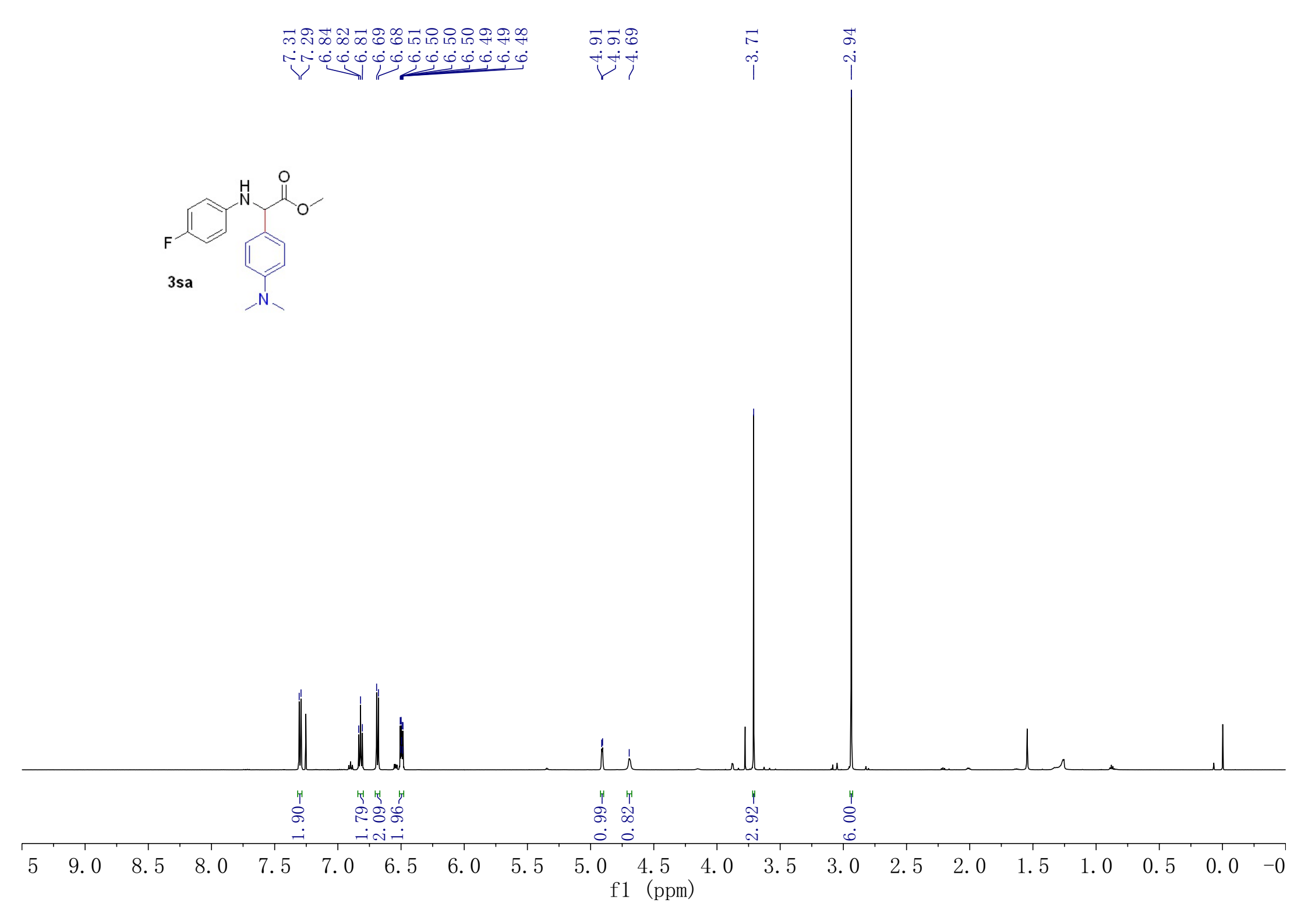
6.72
6.71
6.70
6.70
6.69
6.68
6.11
5.60
4.64
3.83
3.78
3.70
3.66
3nf
4.03
2.00
1.01
0.92
6.32
3.15
2.91
3.00
f1 (ppm)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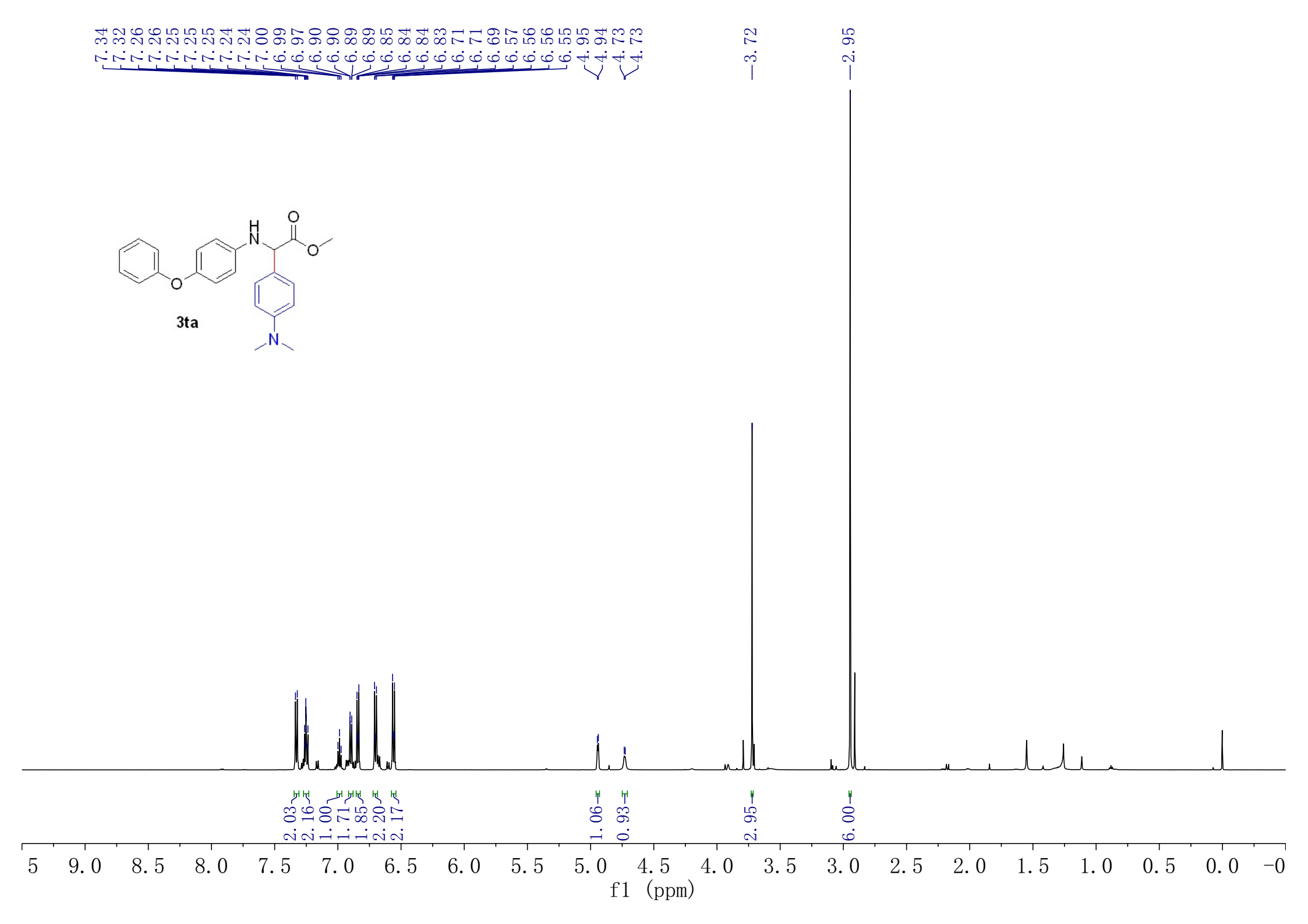
6.81
6.69
6.68
6.51
6.50
6.50
6.50
6.49
6.49
6.48
4.91
4.91
4.69
3.71
2.94
H
N
O
O
F
3sa
N
1.90
1.79
2.09
1.96
0.99
0.82
2.92
6.00
5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0
f1 (ppm)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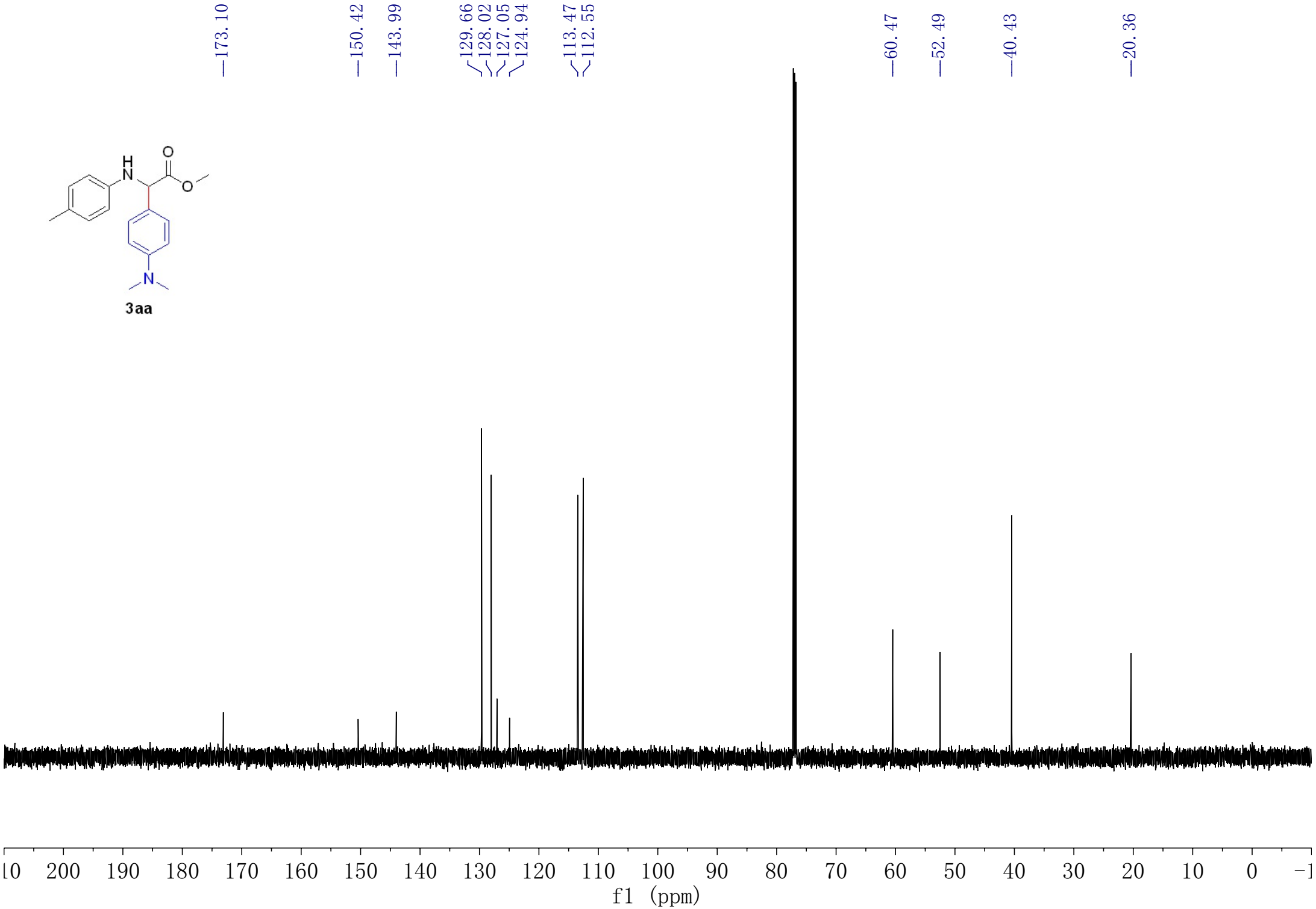
7.32
7.26
7.26
7.25
7.25
7.25
7.24
7.24
7.00
6.99
6.97
6.90
6.90
6.89
6.89
6.85
6.84
6.84
6.83
6.71
6.71
6.69
6.57
6.56
6.56
6.55
4.95
4.94
4.73
4.73
3.72
2.95
3ta
2.03
2.16
1.00
1.71
1.85
2.20
2.17
1.06
0.93
2.95
6.00
f1 (ppm)


173.10
150.42
143.99
129.66
128.02
127.05
124.94
113.47
112.55
60.47
52.49
40.43
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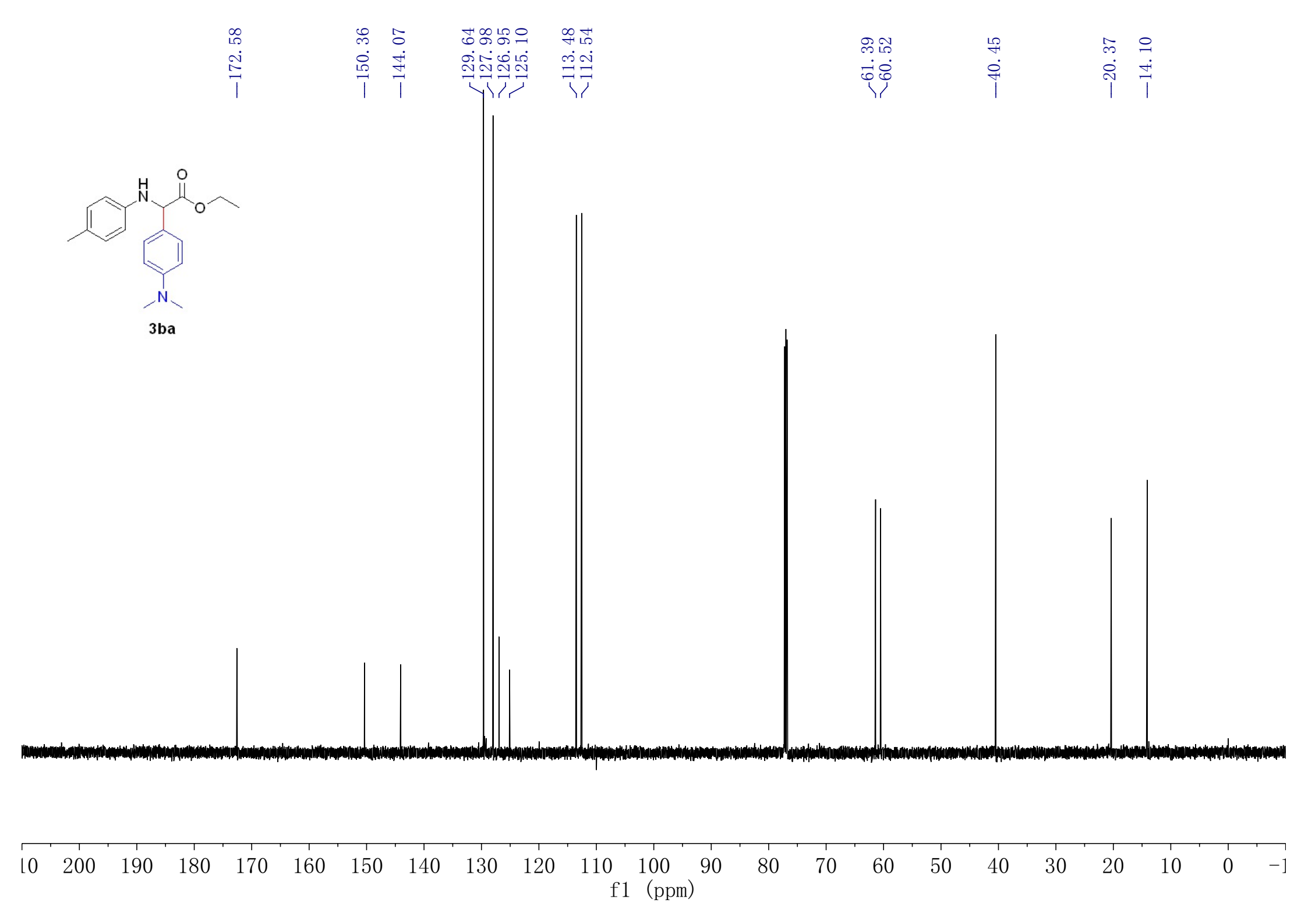
H
N
O
O
N
3aa
f1 (ppm)


172.58
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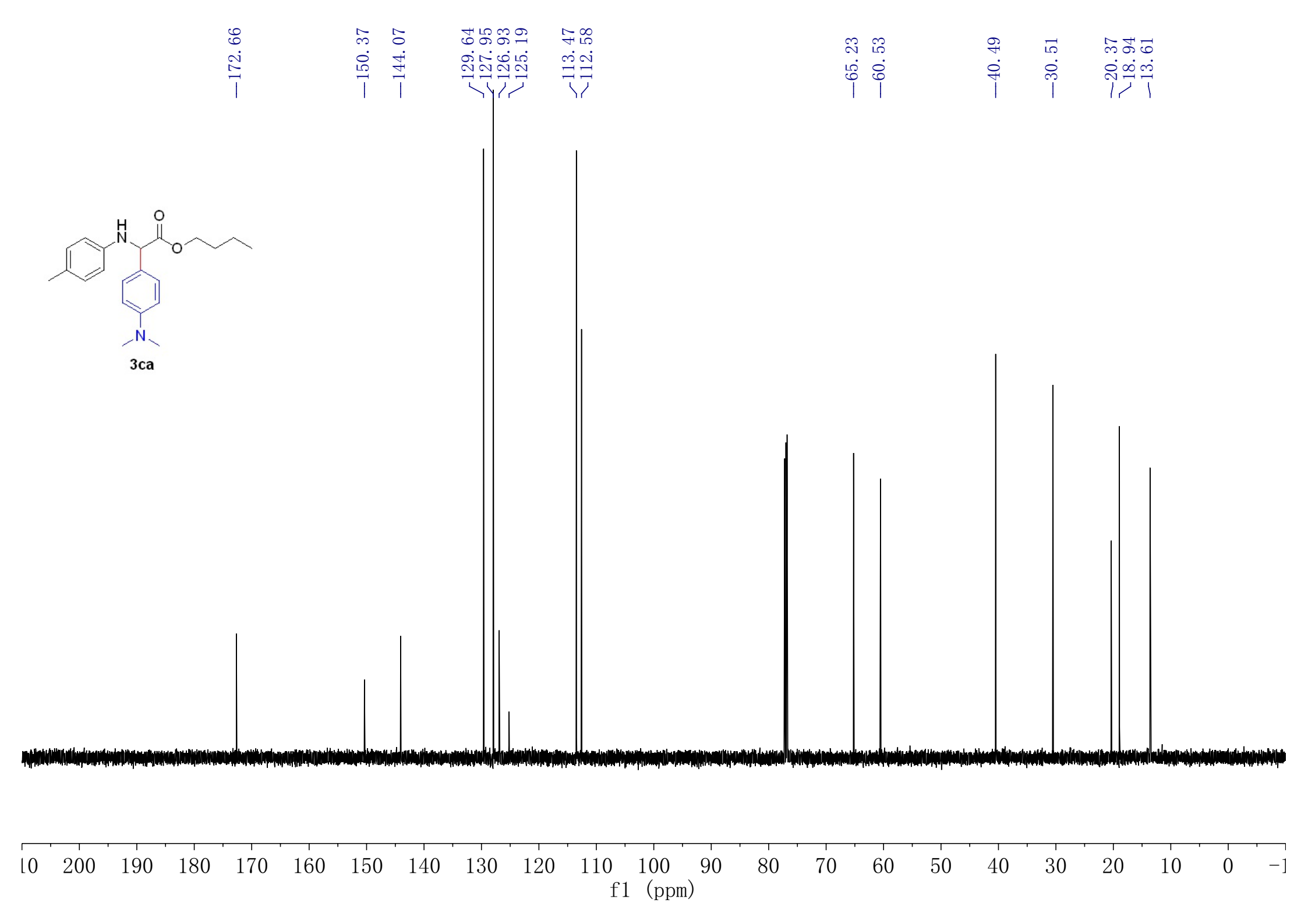
144.07
129.64
127.98
126.95
125.10
113.48
112.54
61.39
60.52
40.45
20.37
14.10
H
N
O
O
N
3ba
f1 (ppm)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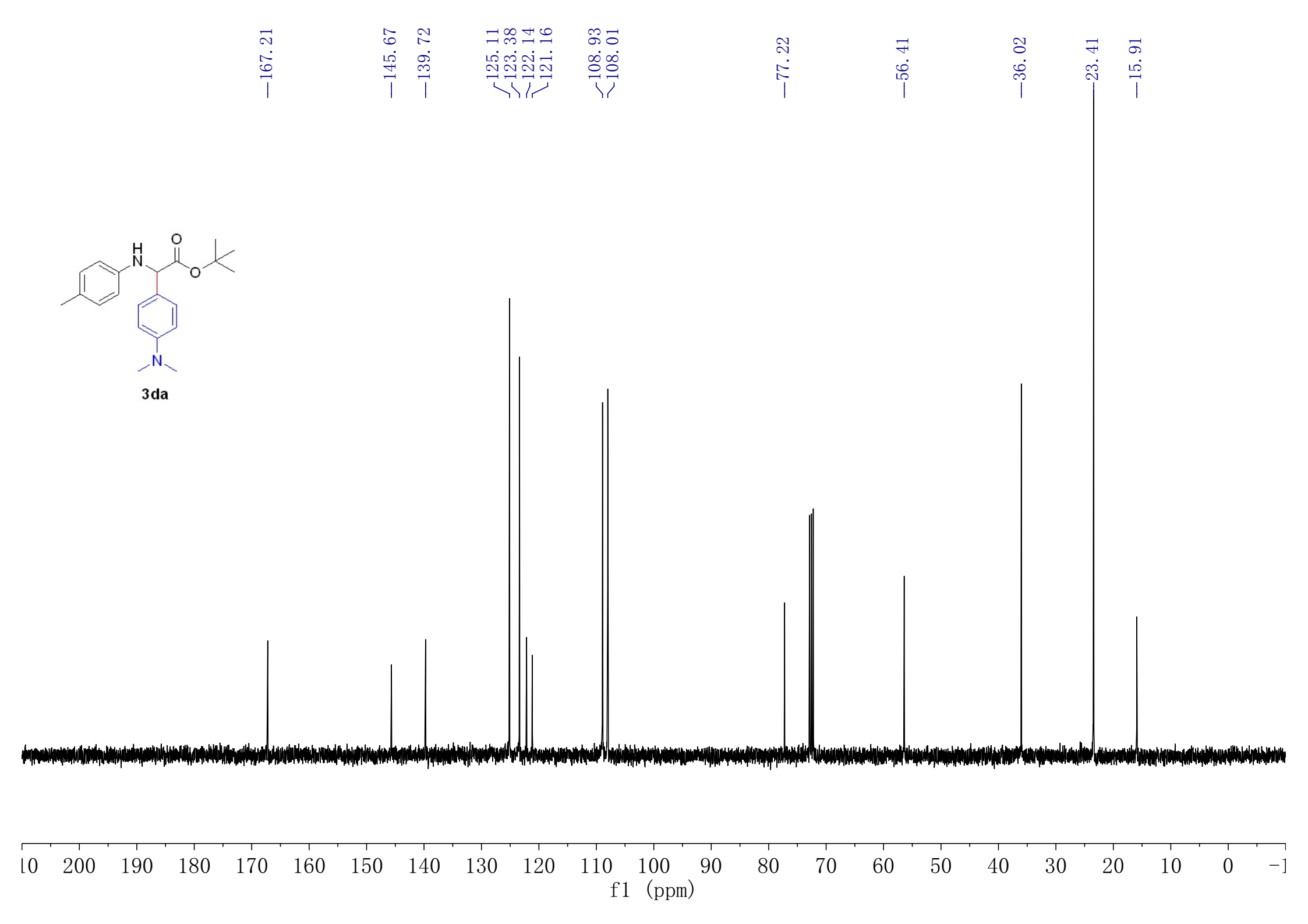
129.64
127.95
126.93
125.19
113.47
112.58
65.23
60.53
40.49
30.51
20.37
18.94
13.61
3ca
f1 (ppm)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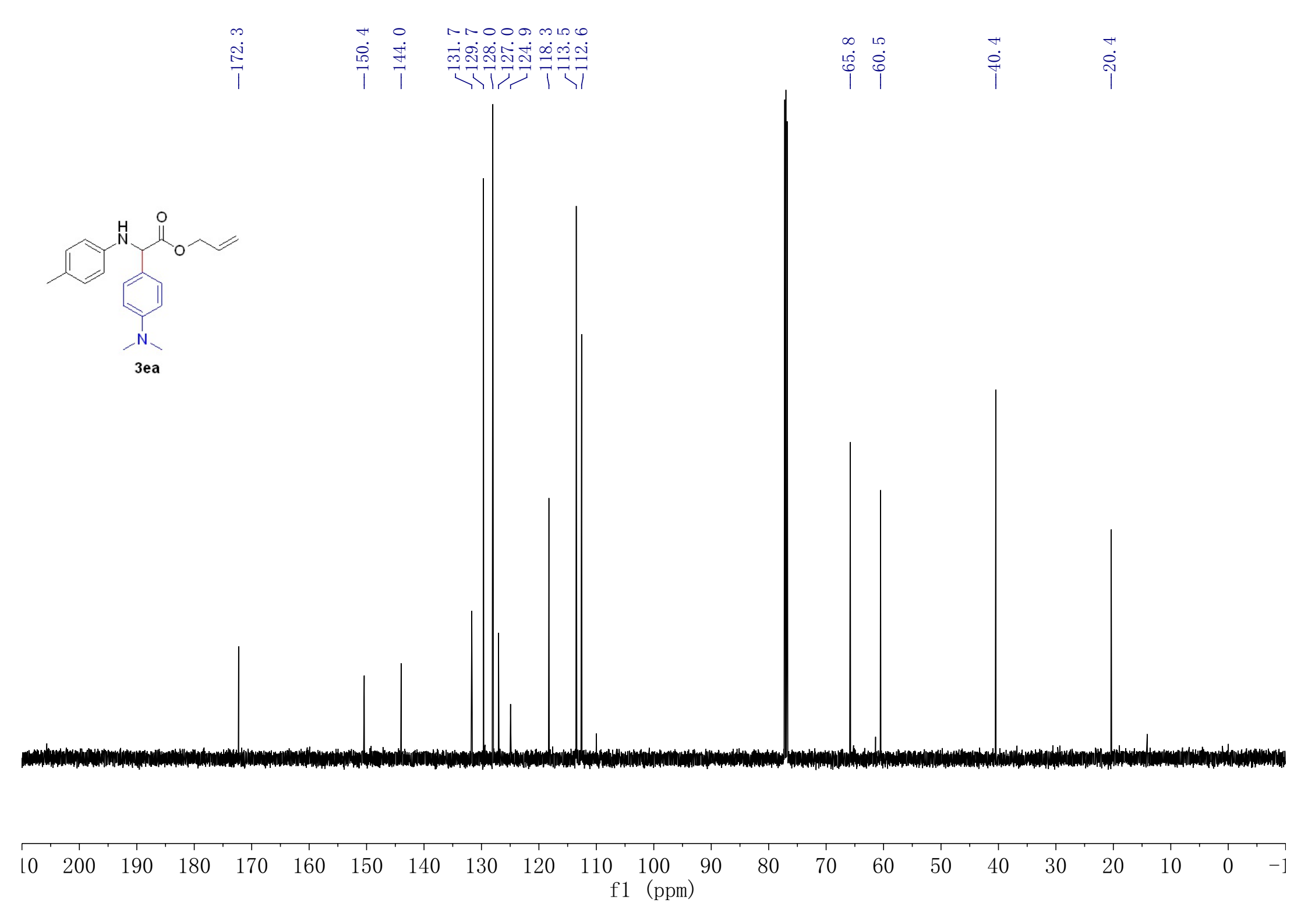
122.14
121.16
108.93
108.01
77.22
56.41
36.02
23.41
15.91
H
N
O
O
N
3da
f1 (ppm)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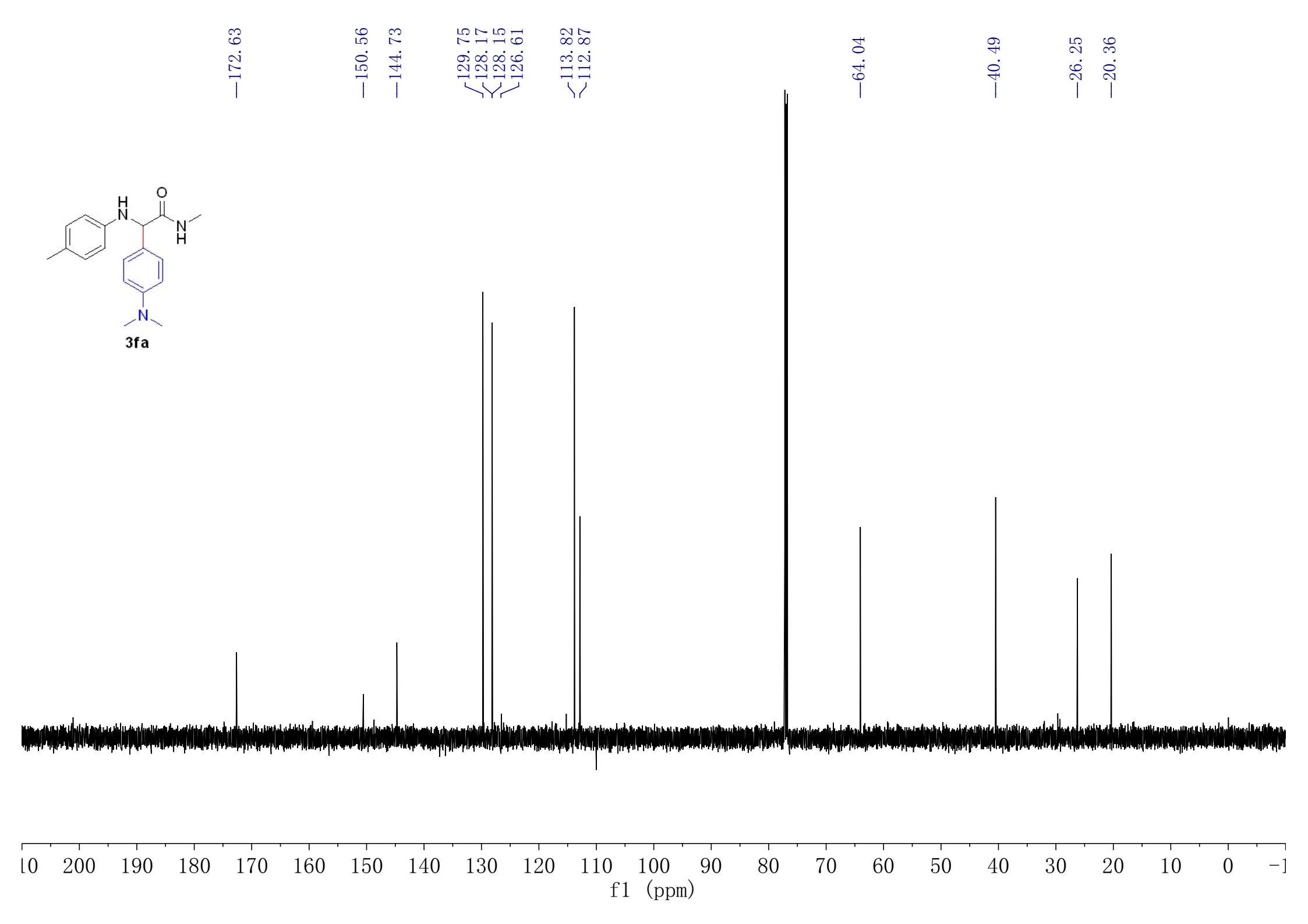
131.7
129.7
128.0
127.0
124.9
118.3
113.5
112.6
65.8
60.5
40.4
20.4
3ea
f1 (ppm)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144.73
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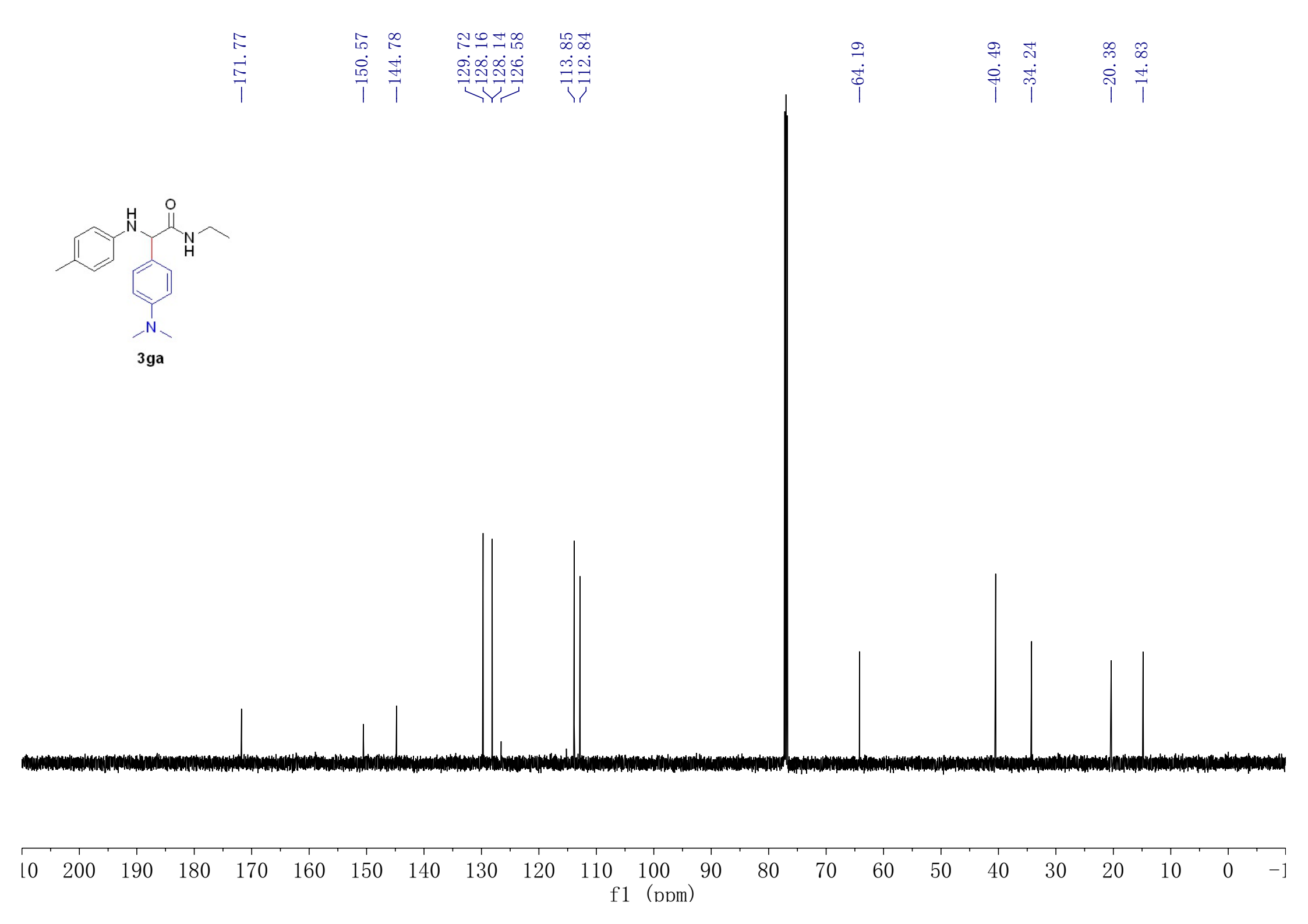
128.15
126.61
113.82
112.87
64.04
40.49
26.25
20.36
3fa
f1 (ppm)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144.78
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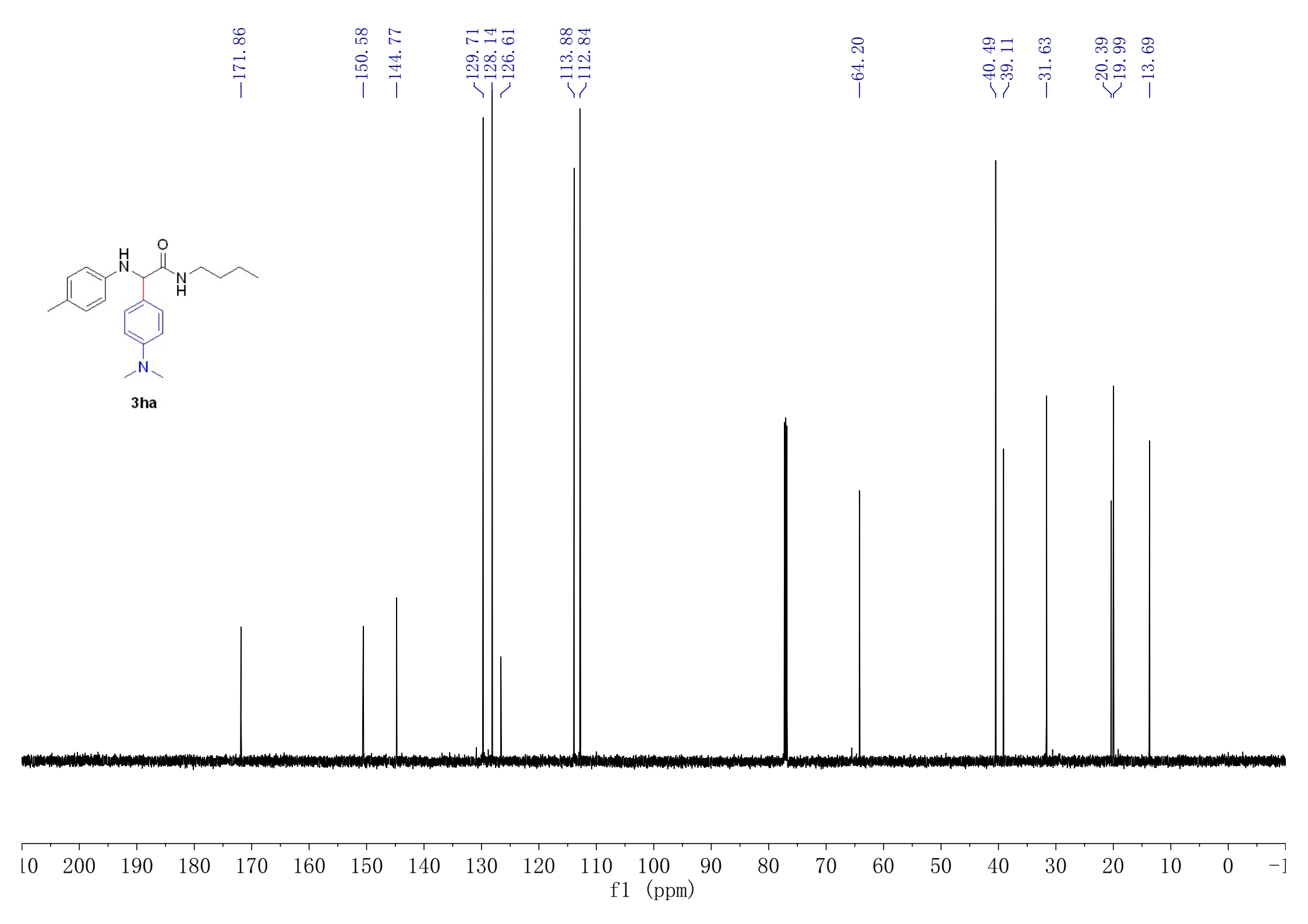
128.14
126.58
113.85
112.84
64.19
40.49
34.24
20.38
14.83
3ga
f1 (ppm)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126.61
113.88
112.84
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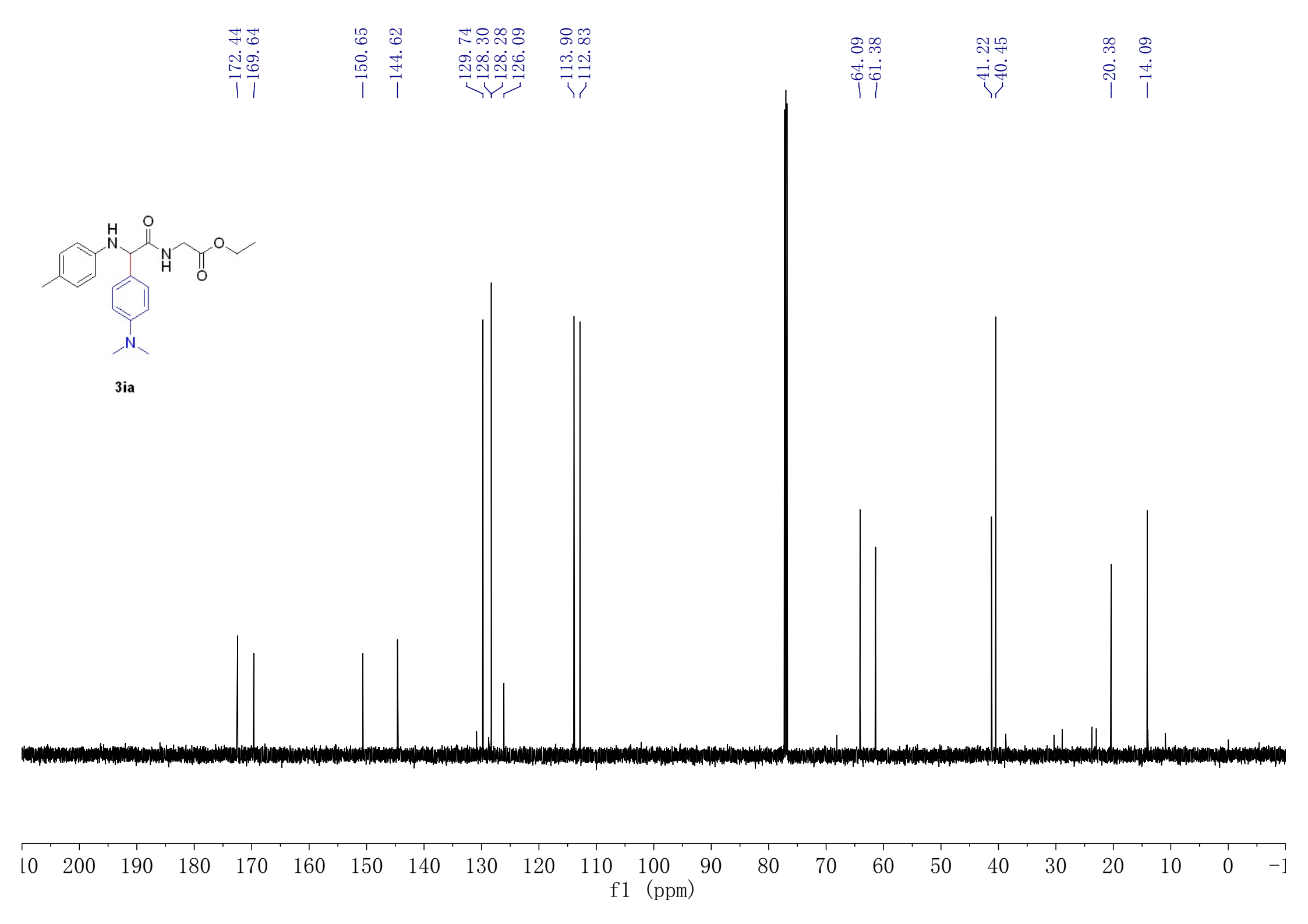
39.11
31.63
20.39
19.99
13.69
3ha
f1 (ppm)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144.62
129.74
128.30
128.28
126.09
113.90
112.83
64.09
61.38
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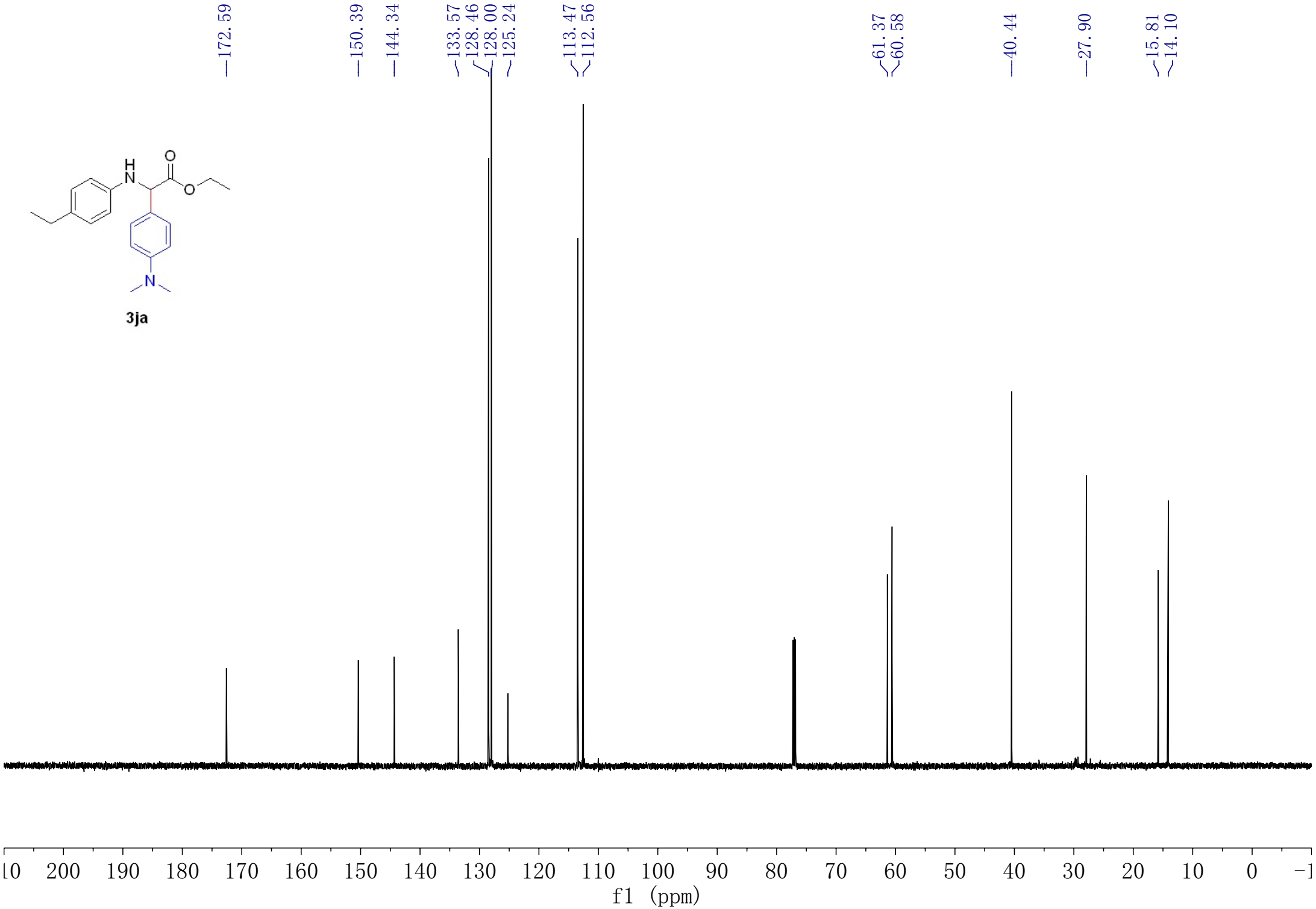
40.45
20.38
14.09
3ia
f1 (ppm)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133.57
128.46
128.00
125.24
113.47
112.56
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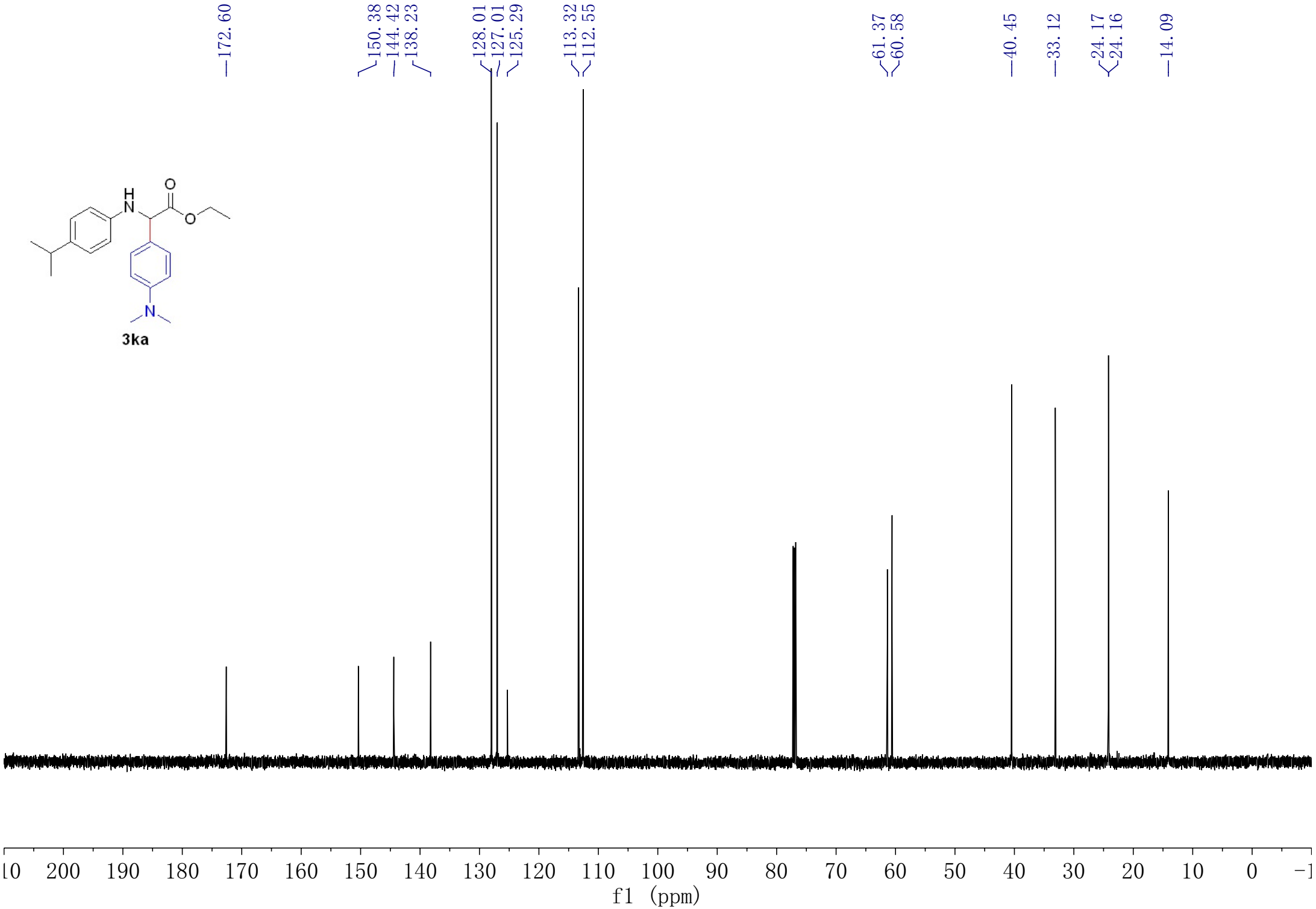
60.58
40.44
27.90
15.81
14.10
H
N
O
O
N
3ja
f1 (ppm)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127.01
125.29
113.32
112.55
61.37
60.58
40.45
33.12
24.17
24.16
14.09
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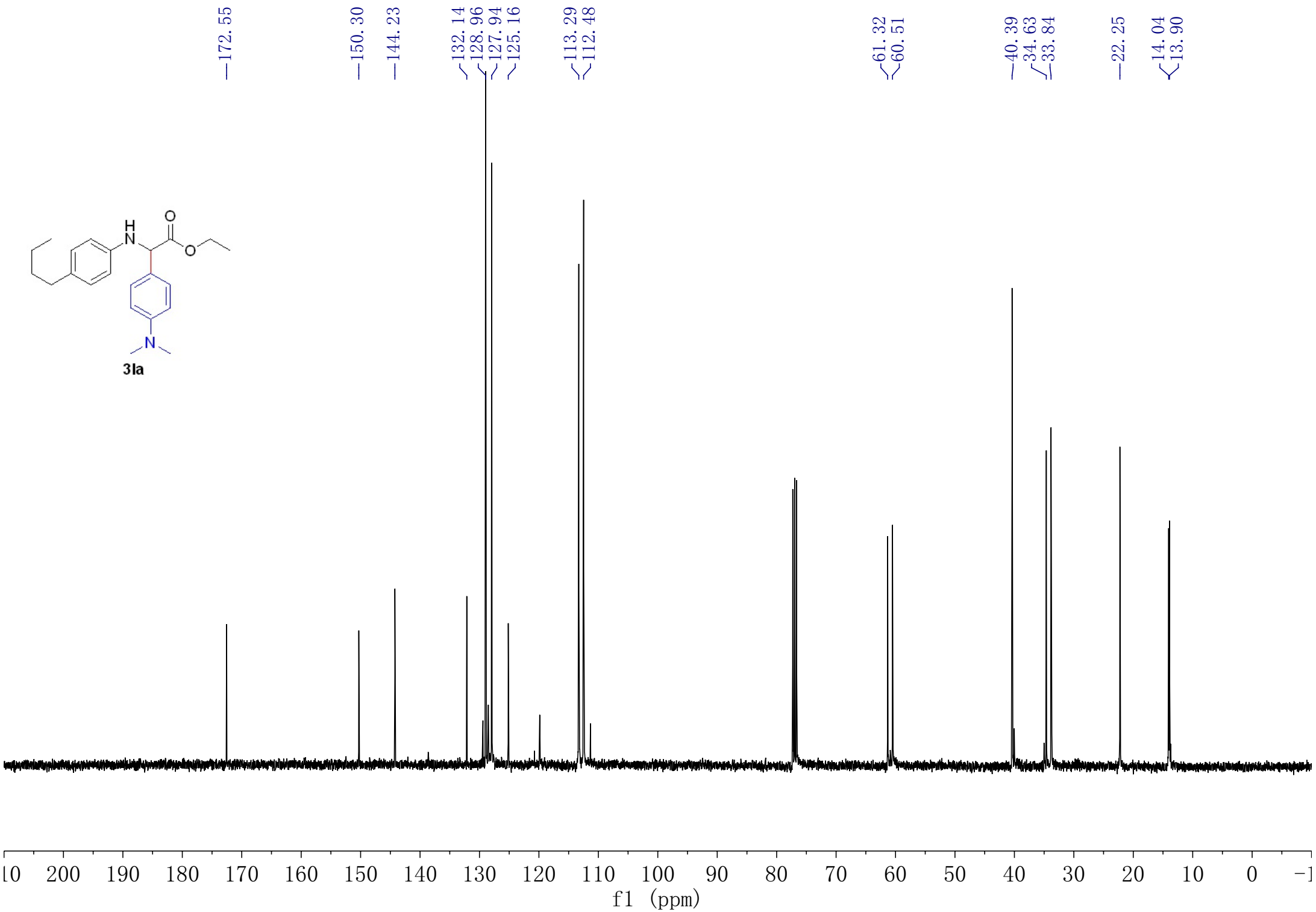
O
N
3ka
f1 (ppm)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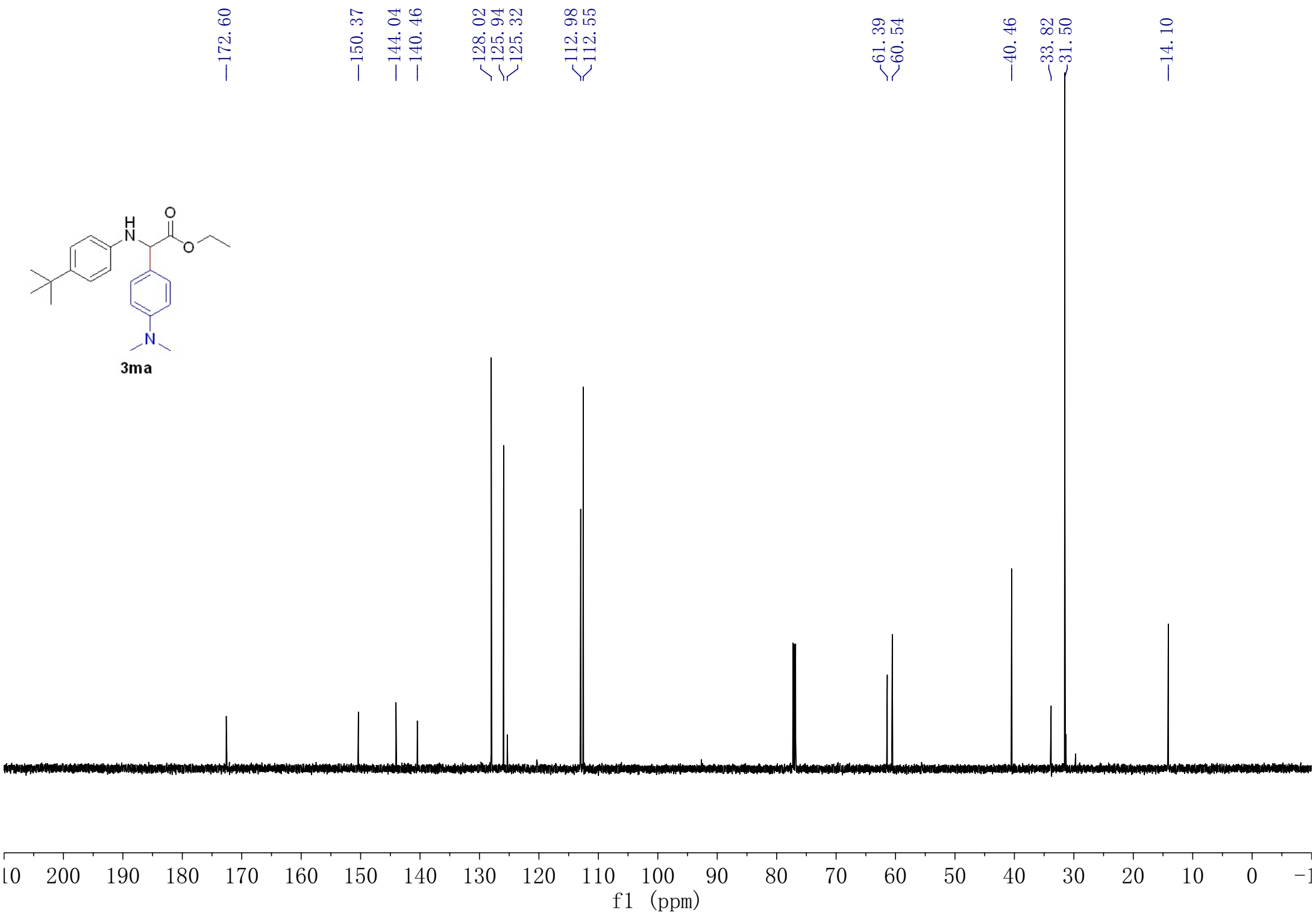
132.14
128.96
127.94
125.16
113.29
112.48
61.32
60.51
40.39
34.63
33.84
22.25
14.04
13.90
H
N
O
O
N
3la
f1 (ppm)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144.04
140.46
128.02
125.94
125.32
112.98
112.55
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60.54
40.46
33.82
31.50
14.10
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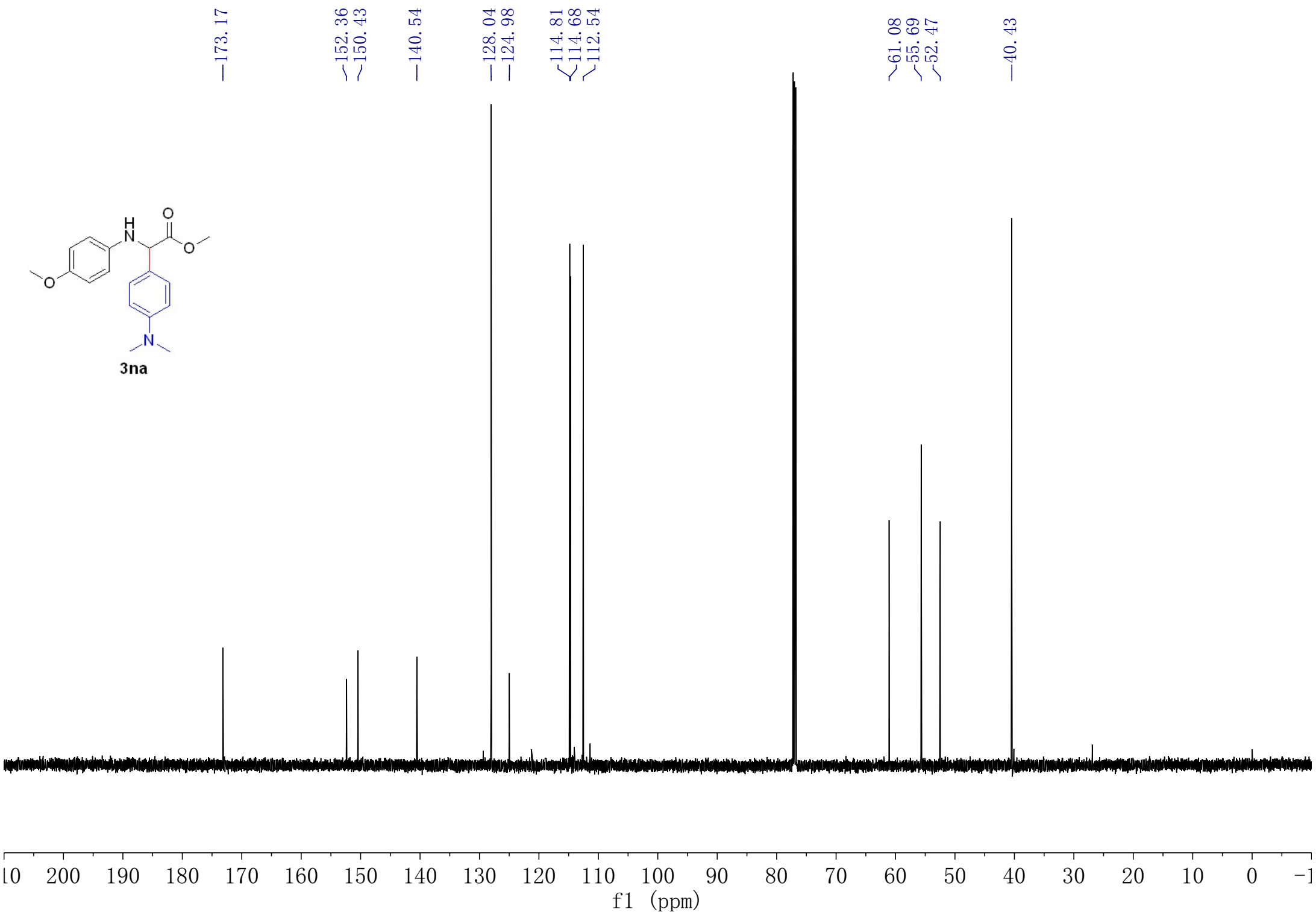
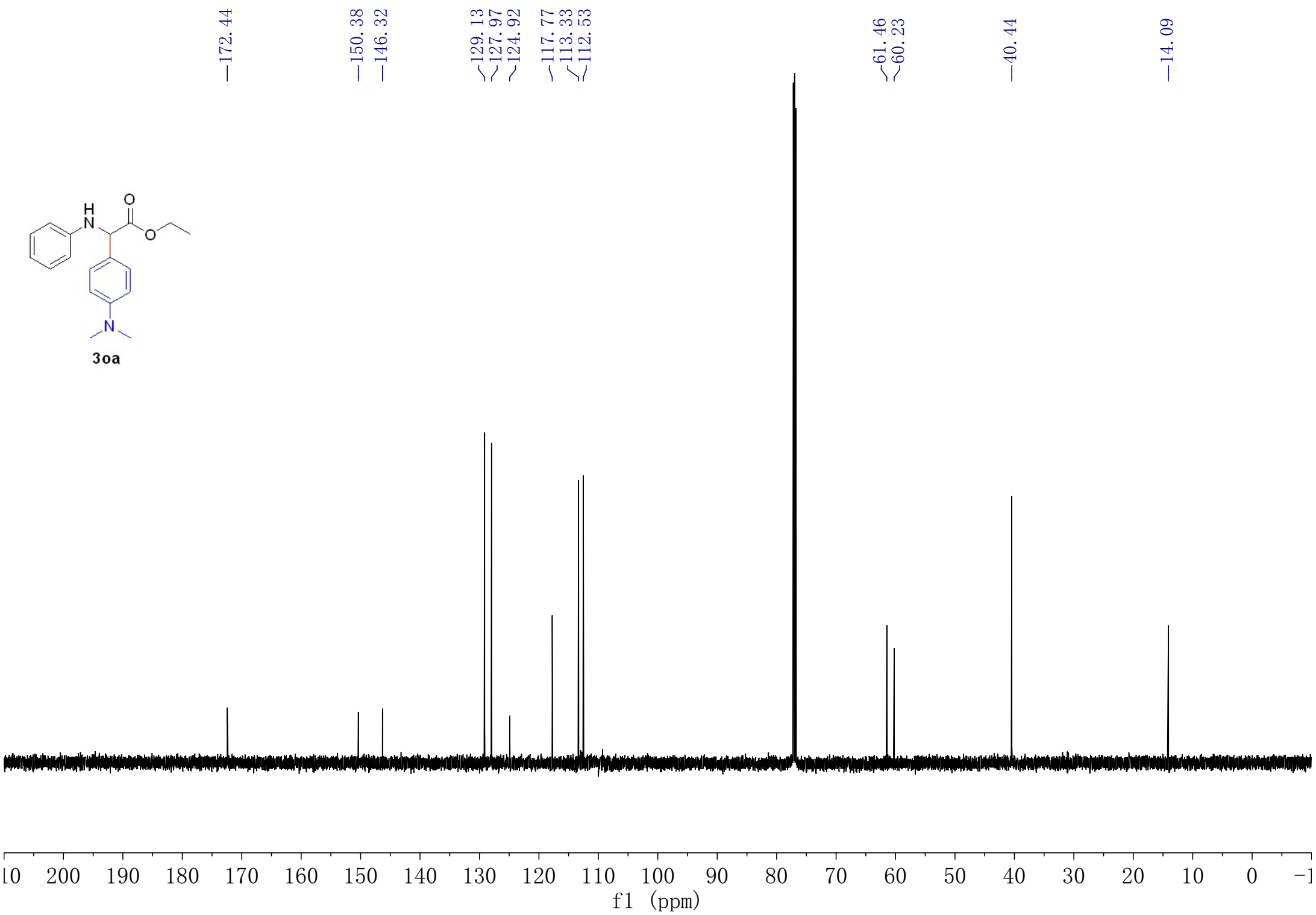
O
O
N
3ma
f1 (ppm)


173.17
152.36
150.43
140.54
128.04
124.98
114.81
114.68
112.54
61.08
55.69
52.47
40.43
H
N
O
O
O
N
3na
f1 (ppm)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146.32
129.13
127.97
124.92
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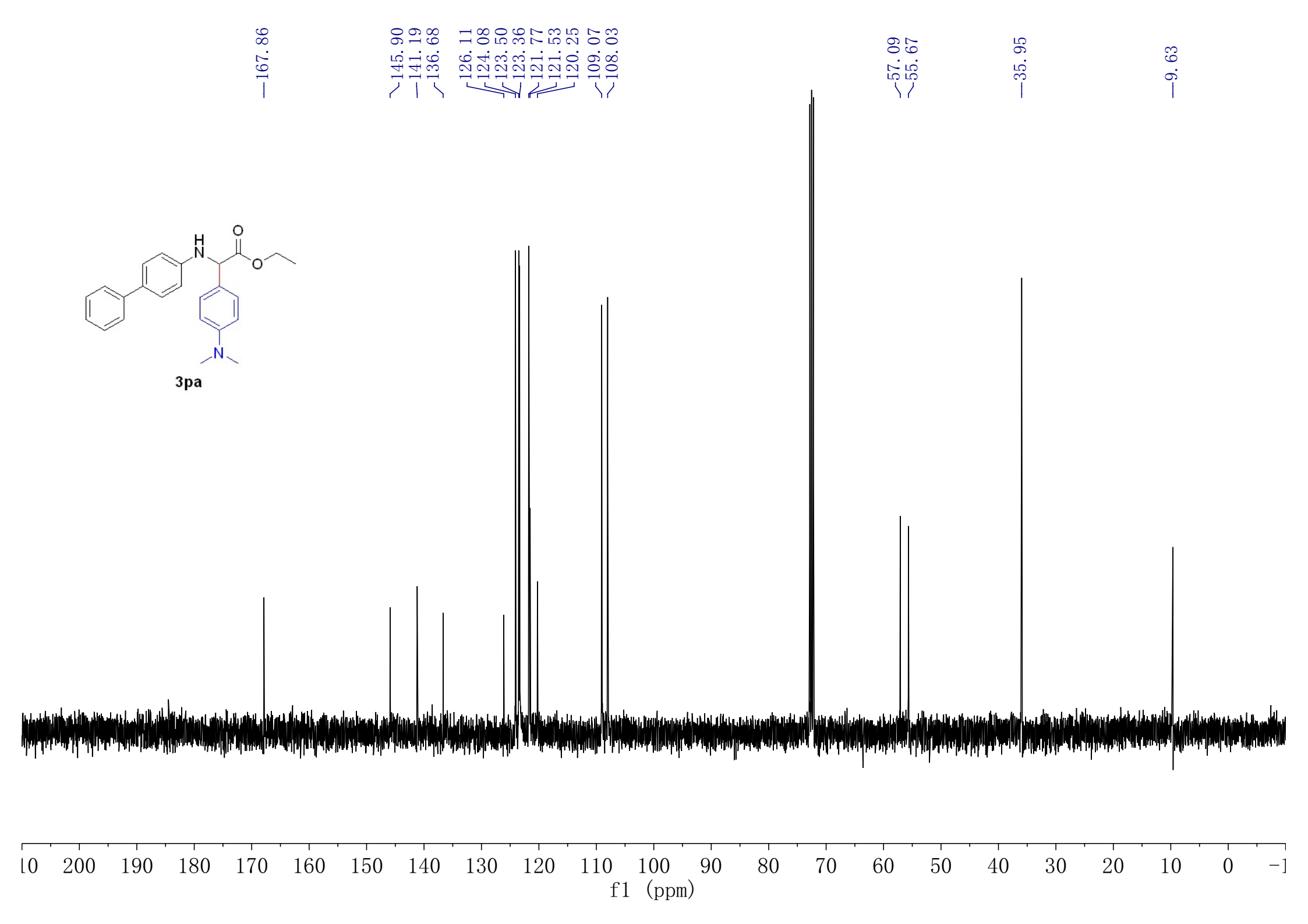
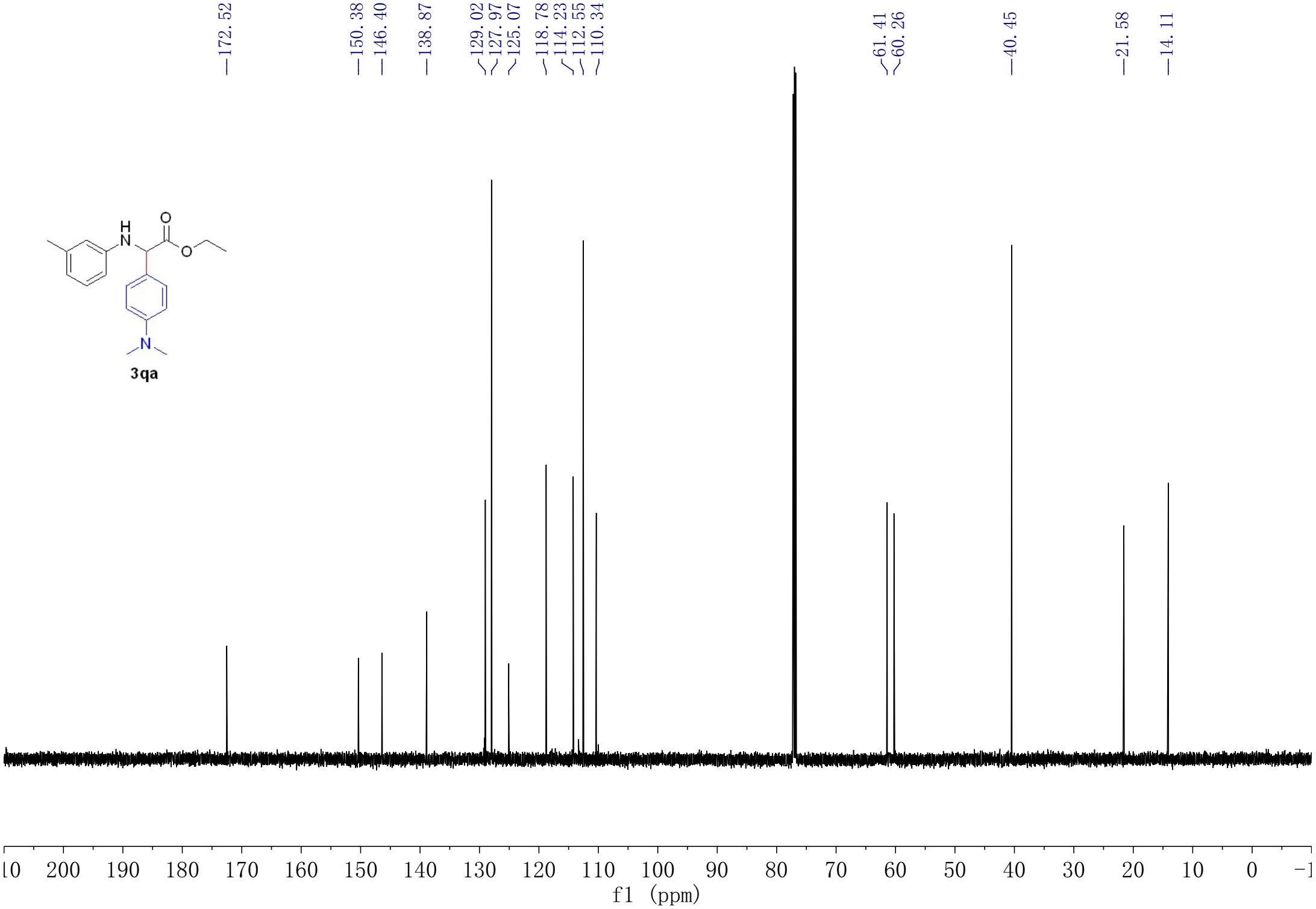
113.33
112.53
61.46
60.23
40.44
14.09
H
N
O
O
N
3oa
f1 (ppm)


167.86
145.90
141.19
136.68
126.11
124.08
123.50
123.36
121.77
121.53
120.25
109.07
108.03
57.09
55.67
35.95
9.63
H
N
O
O
N
3pa
f1 (ppm)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129.02
127.97
125.07
118.78
114.23
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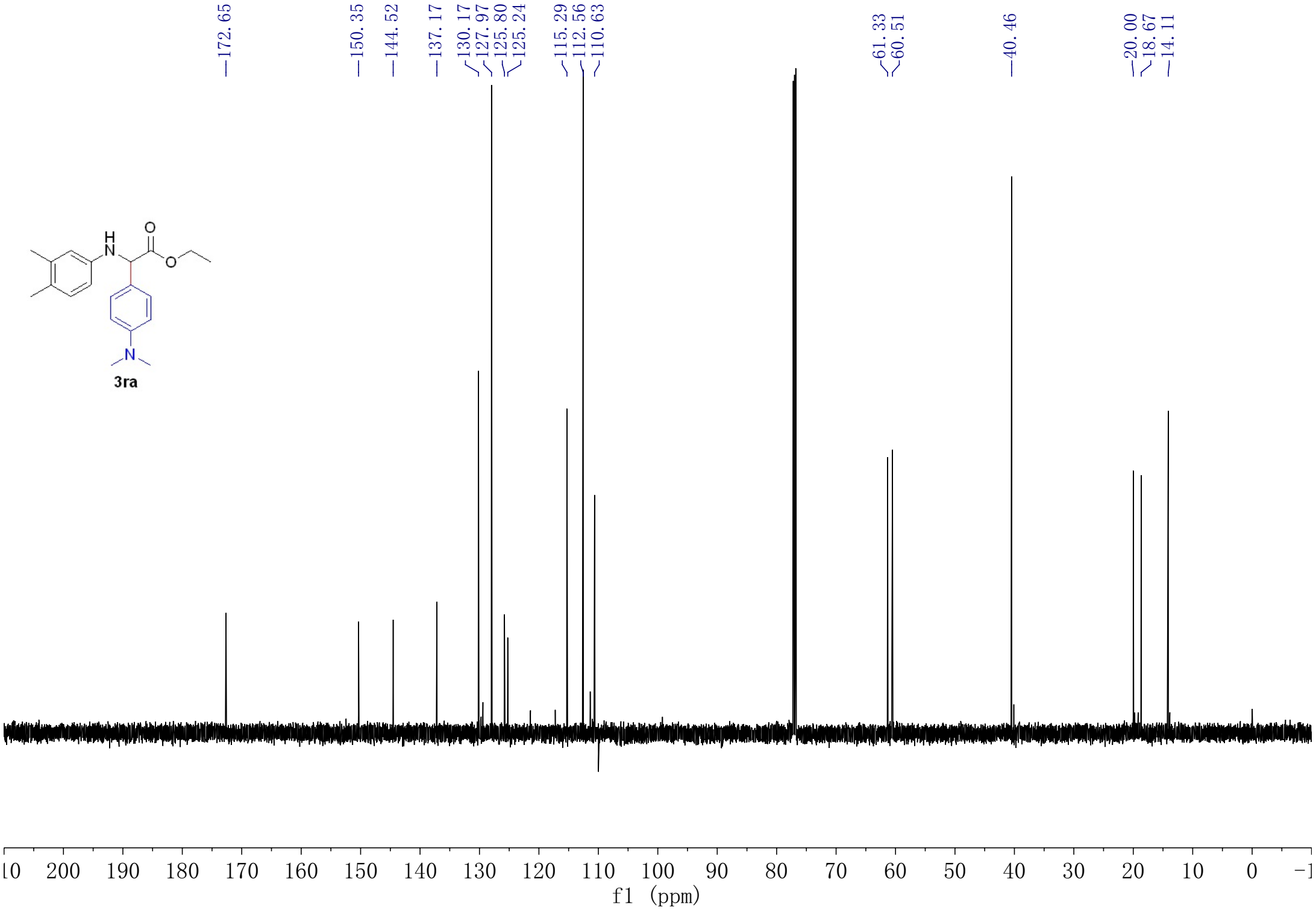
60.26
40.45
21.58
14.11
H
N
O
O
N
3qa
f1 (ppm)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125.24
115.29
112.56
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40.46
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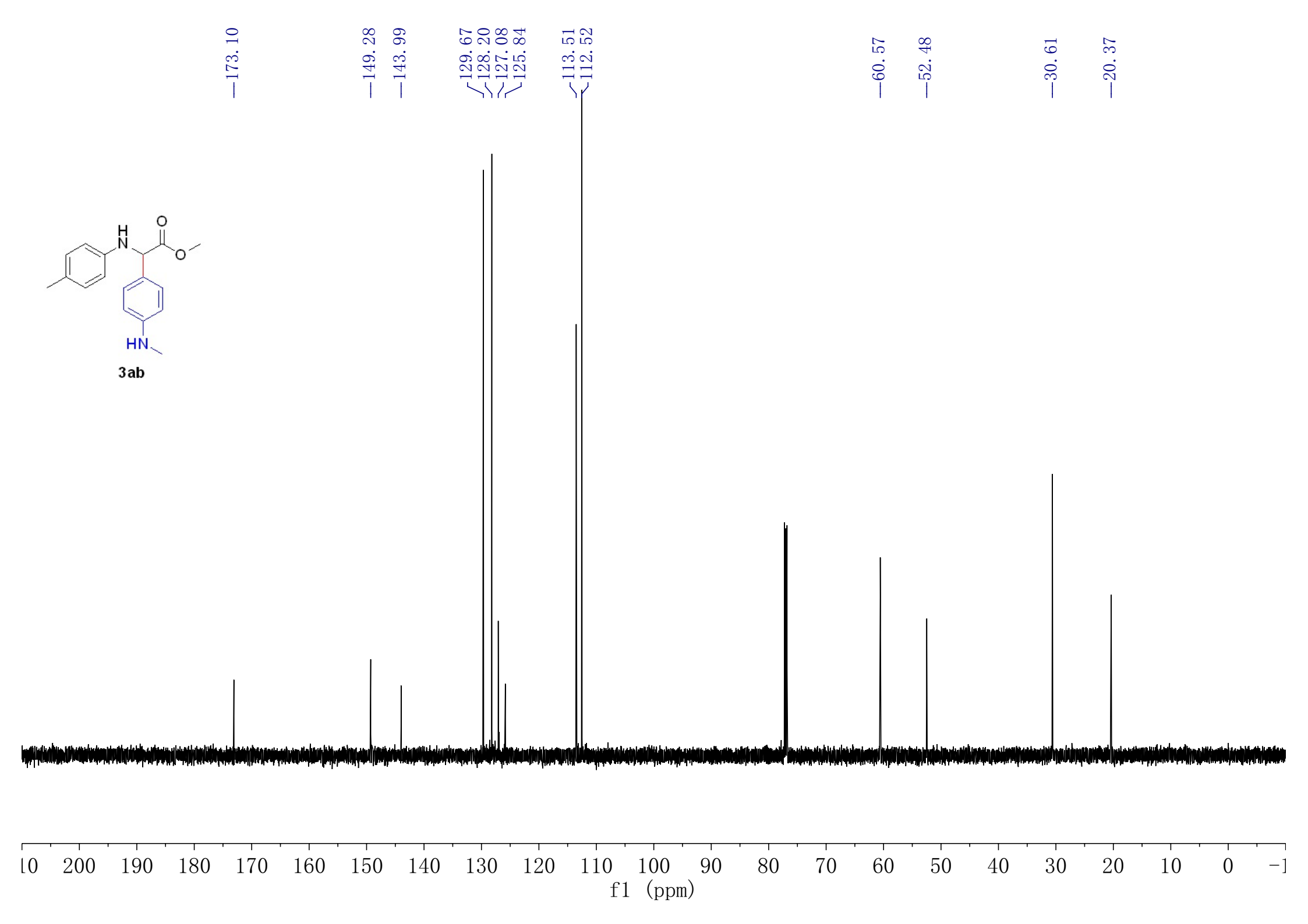
18.67
14.11
H
N
O
O
N
3ra
f1 (ppm)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143.99
129.67
128.20
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112.52
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52.48
30.61
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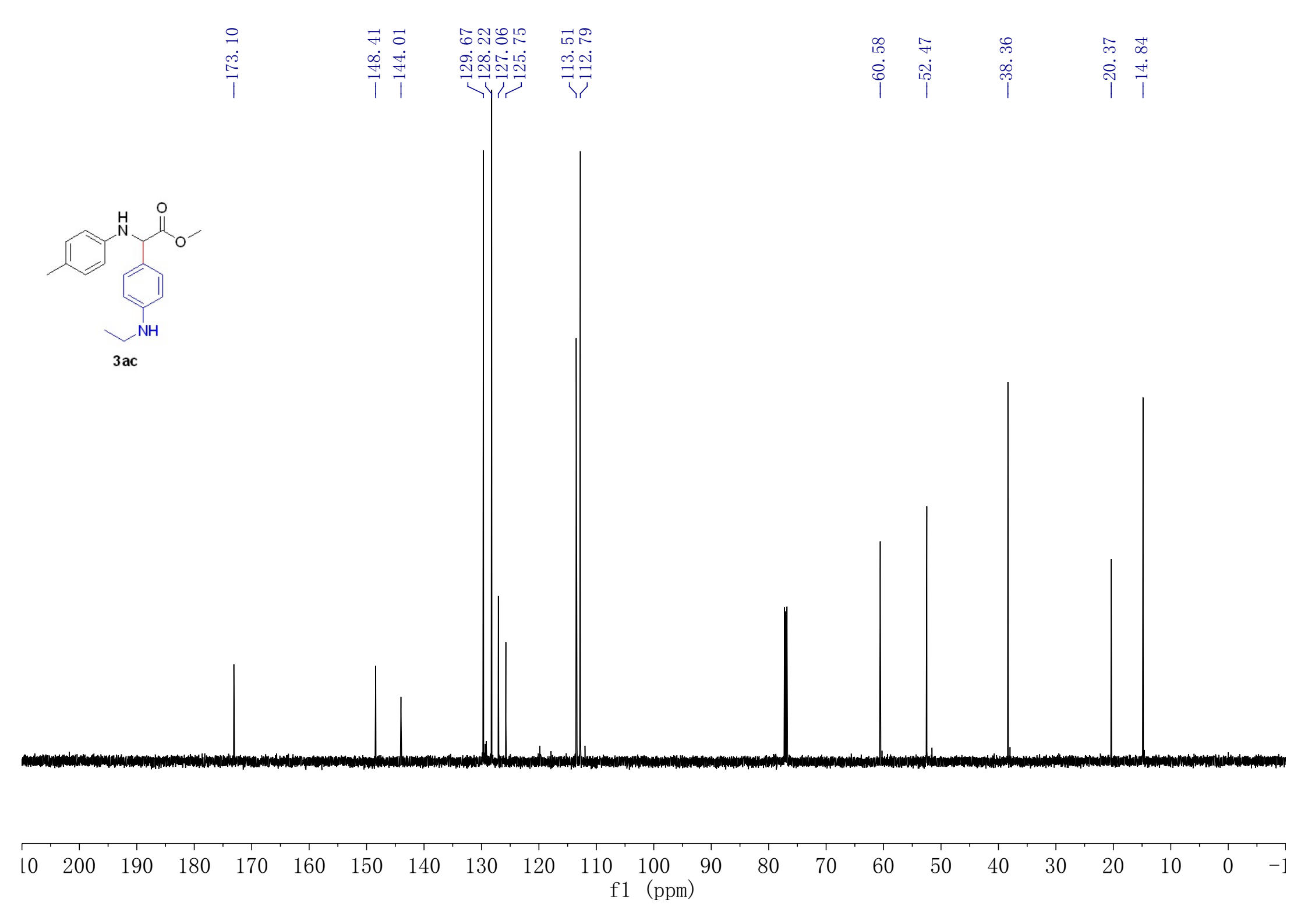
HN
O
O
HN
3ab
f1 (ppm)


173.10
148.41
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129.67
128.22
127.06
125.75
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112.79
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52.47
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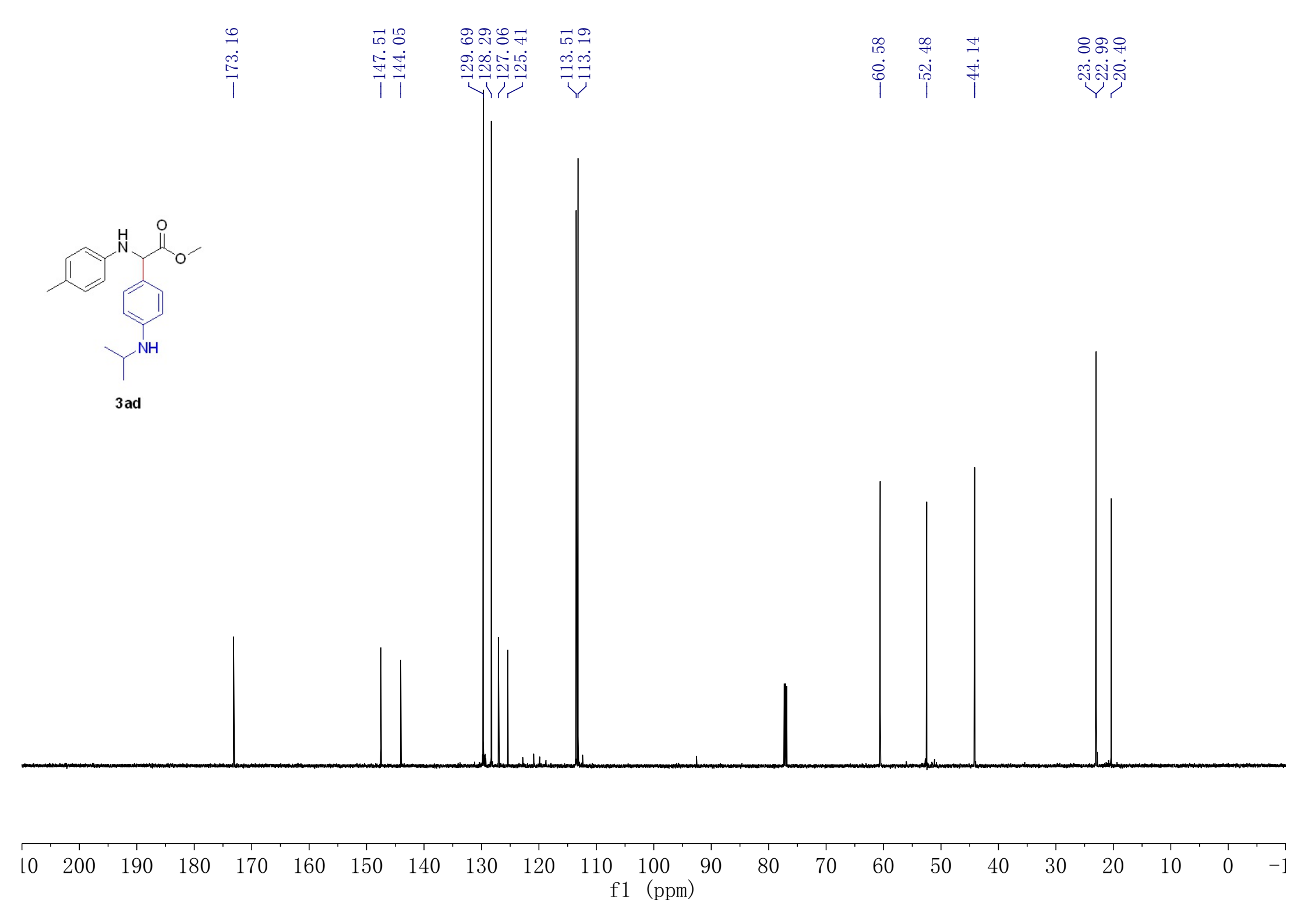
20.37
14.84
H
N
O
O
NH
3ac
f1 (ppm)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144.05
129.69
128.29
127.06
125.41
113.51
113.19
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44.14
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22.99
20.40
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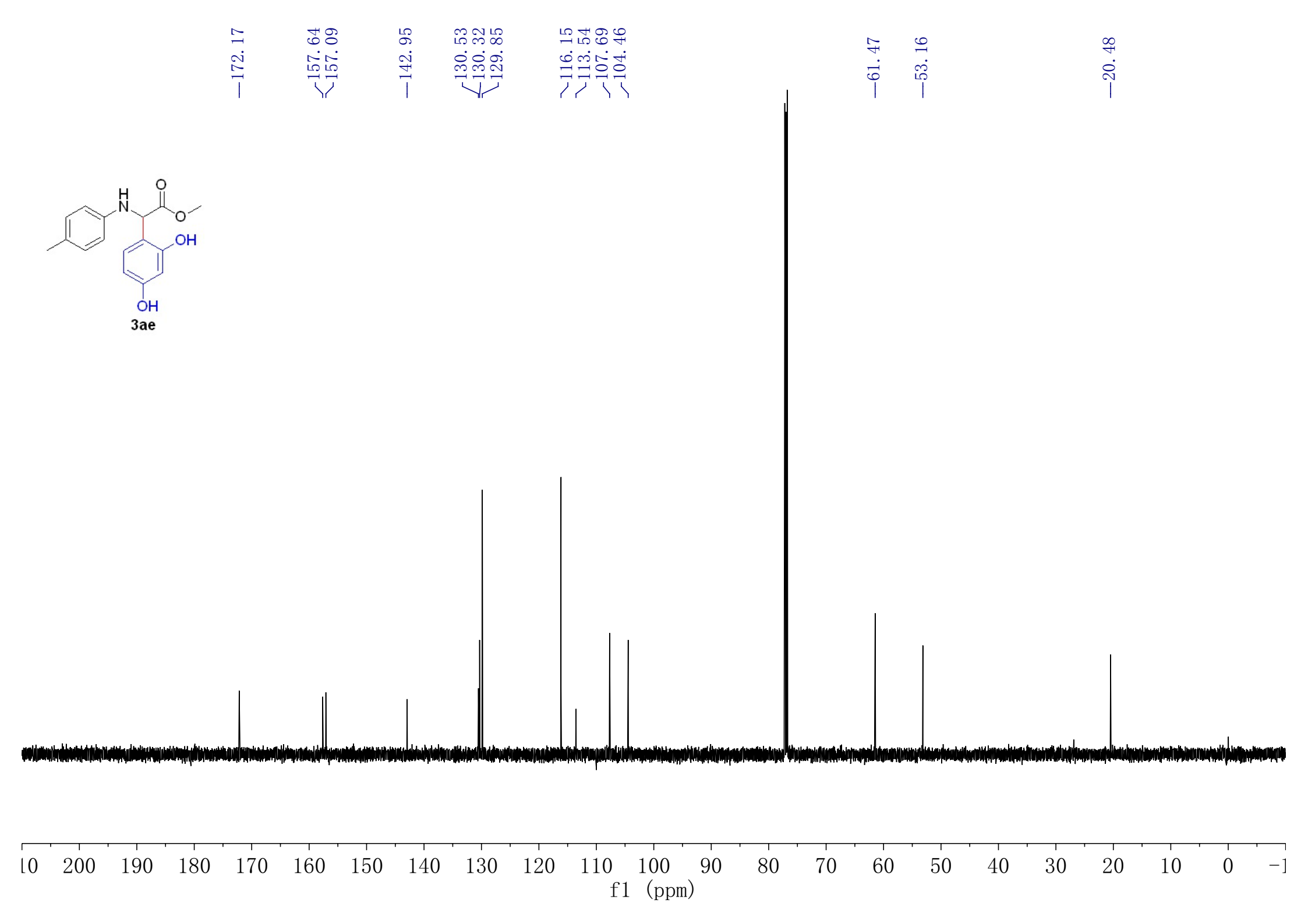
N
O
O
NH
3ad
f1 (ppm)


172.17
157.64
157.09
142.95
130.53
130.32
129.85
116.15
113.54
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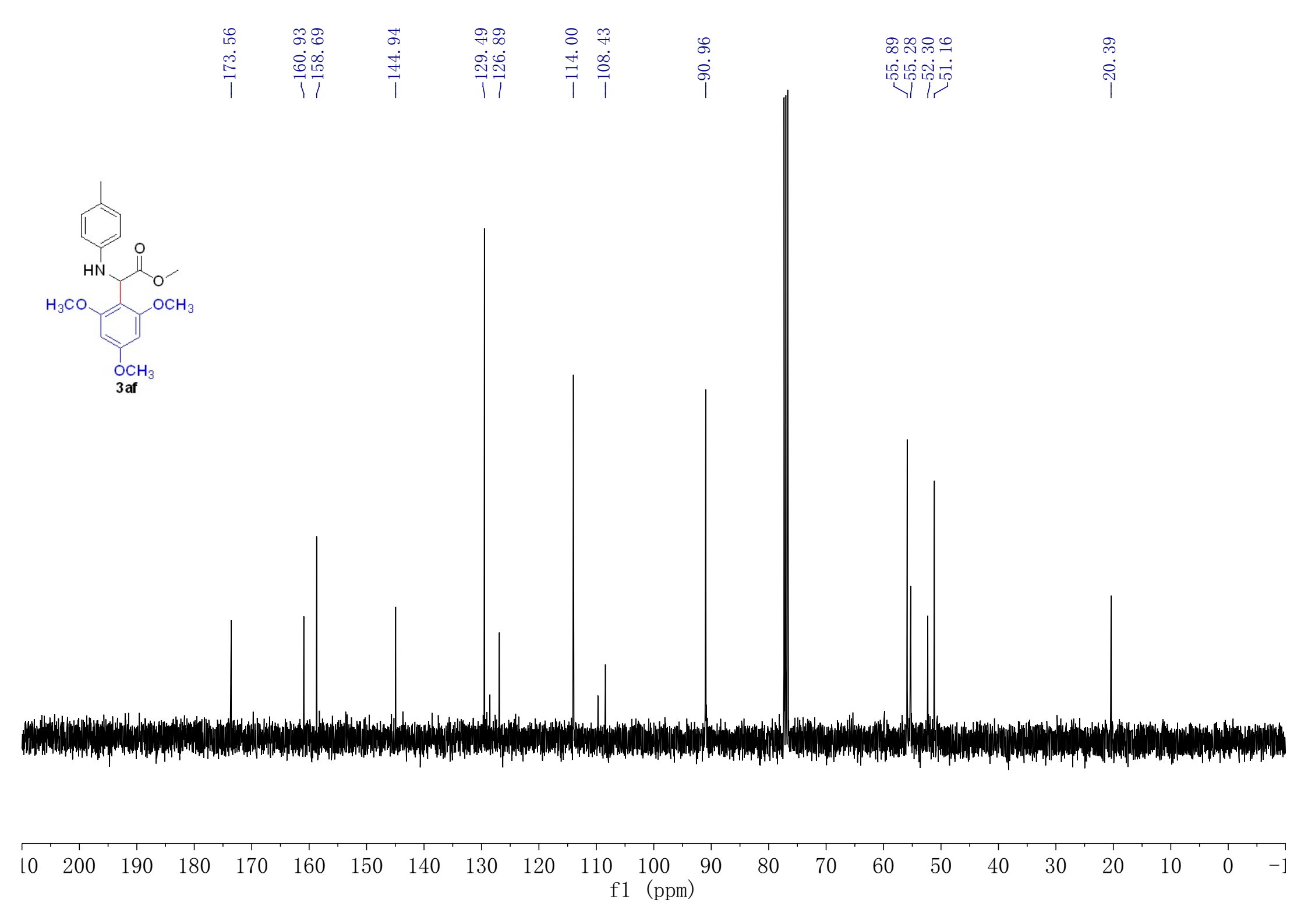
104.46
61.47
53.16
20.48
H
N
O
O
OH
OH
3ae
f1 (ppm)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108.43
90.96
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51.16
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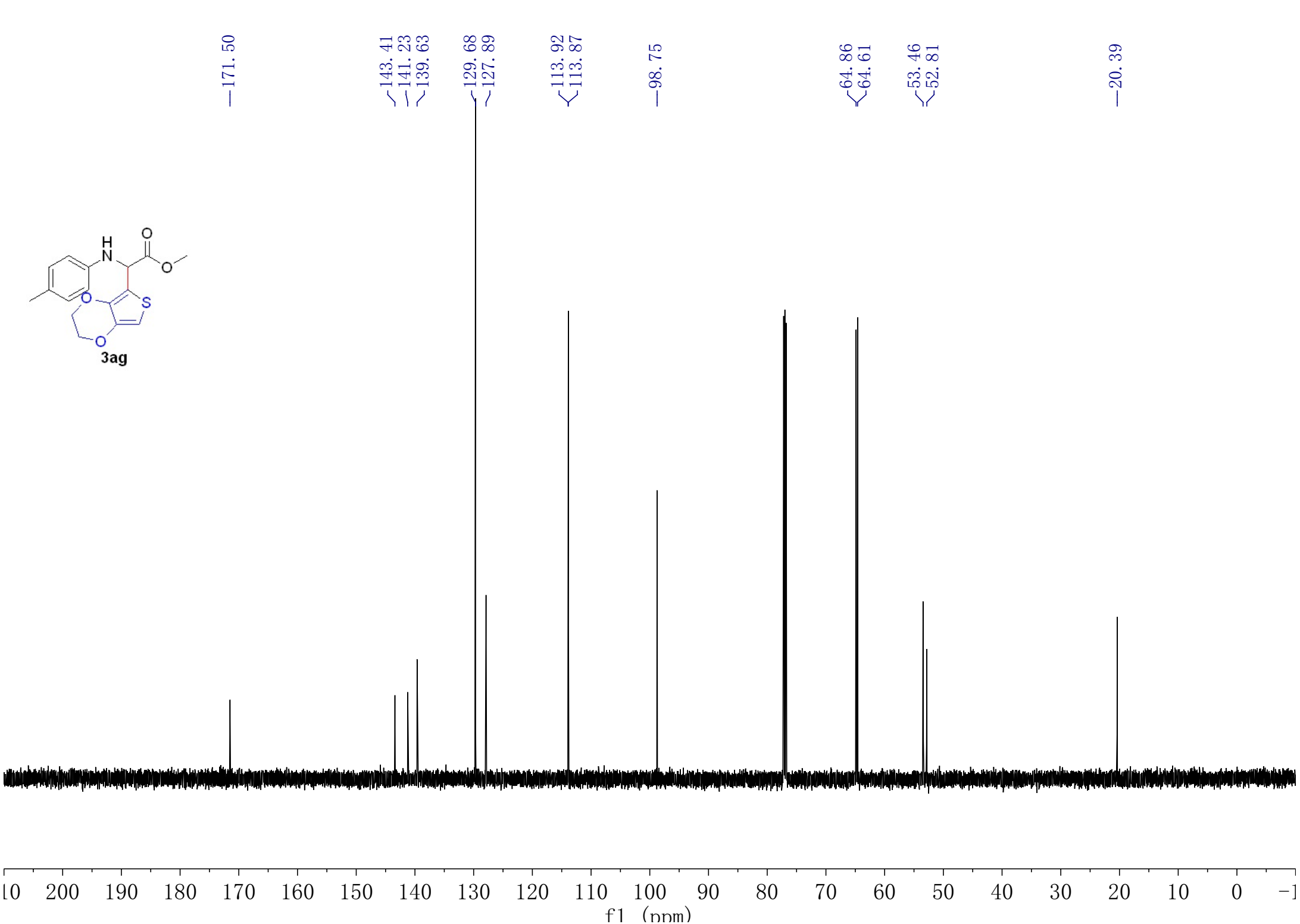
O
H3CO
OCH3
OCH3
3af
f1 (ppm)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143.41
141.23
139.63
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64.61
53.46
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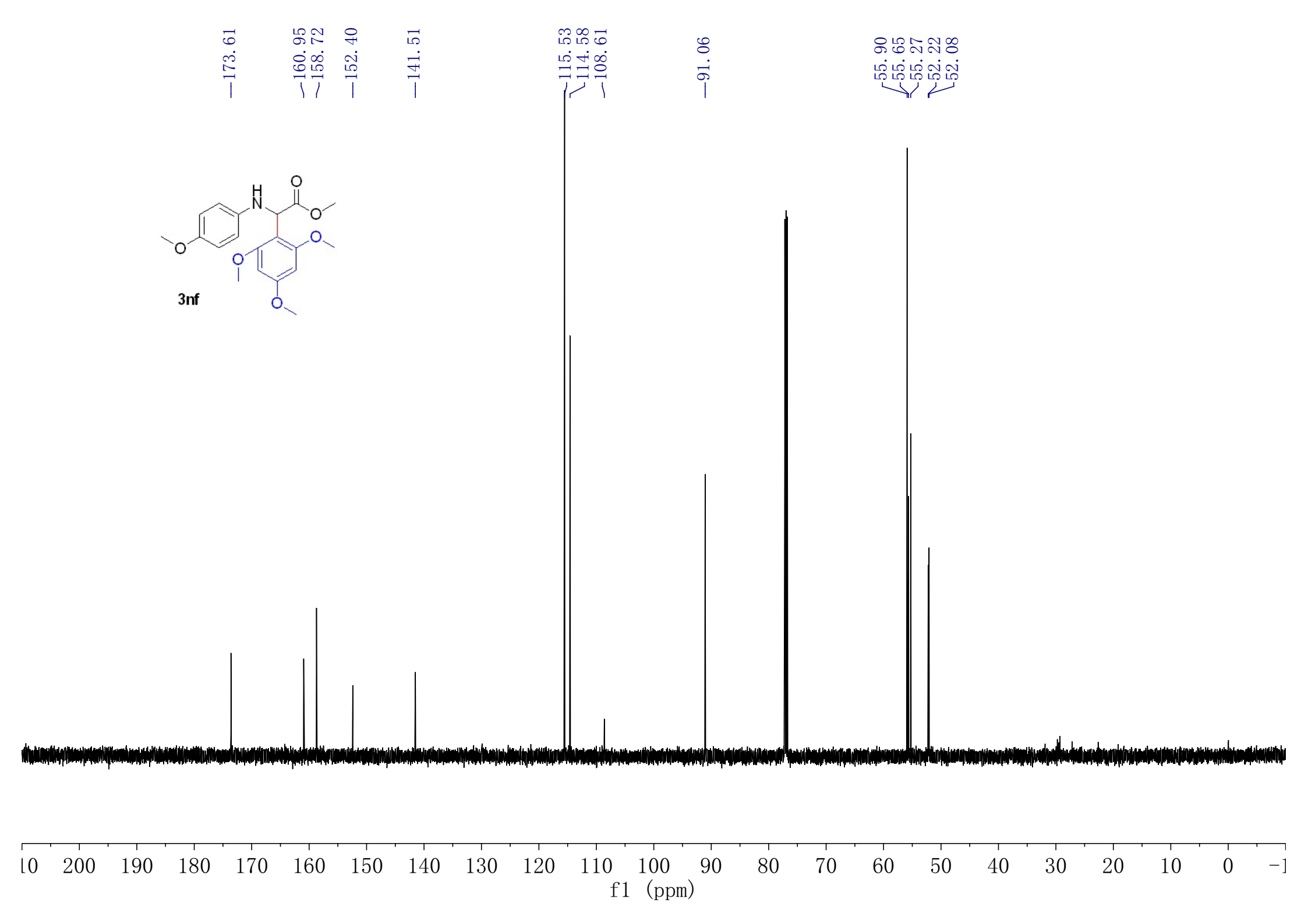
20.39
3ag
f1 (ppm)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160.95
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114.58
108.61
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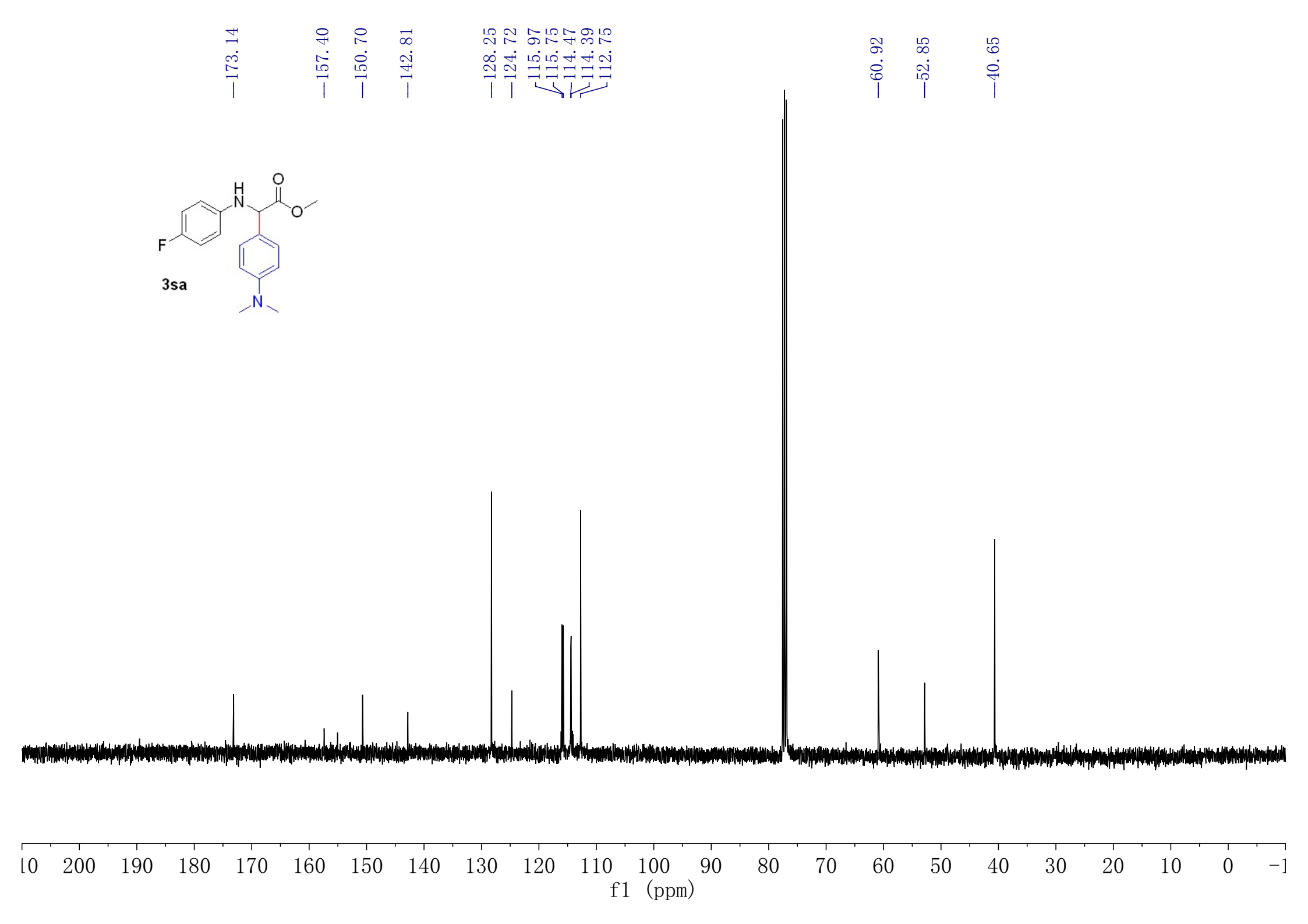
52.22
52.08
3nf
f1 (ppm)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115.75
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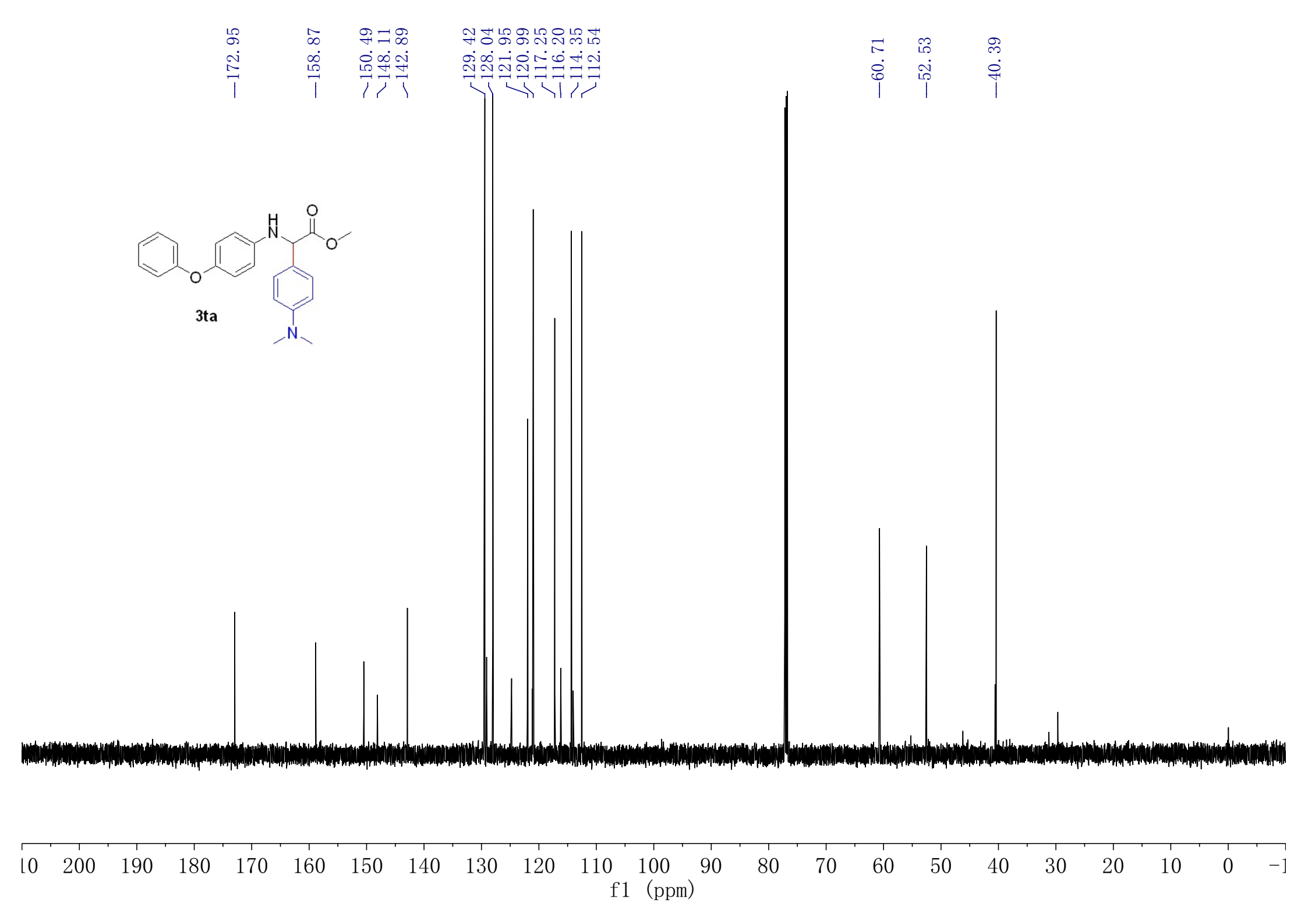
H
N
O
O
F
3sa
N
f1 (ppm)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60.71
52.53
40.39
3ta
f1 (ppm)