Supporting Information

Tandem addition/cyclization for synthesis of 2-aroyl benzofurans and 2-aroyl indoles by carbopalladation of nitriles

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Table of Contents

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1. Analytical Data for Products

*Benzofuran-2-yl(p-tolyl)methanone (**3a**):* White solid (86.9 mg, 92%), mp 65-66 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 2H), 7.72 (d, *J* = 8.0 Hz, 1H), 7.64 (d, *J* = 8.5 Hz, 1H), 7.52-7.48 (m, 2H), 7.34-7.48 (m, 3H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.0, 156.0, 152.5, 143.8, 134.6, 129.7, 129.3, 128.2, 127.1, 123.9, 123.2, 116.0, 112.5, 21.7.

*(5-Methoxybenzofuran-2-yl)(p-tolyl)methanone (**3b**):* Pale-yellow solid (96.9 mg, 91%), mp 114-115 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 2H), 7.53-7.51 (m, 1H), 7.46 (s, 1H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.11-7.10 (m, 2H), 3.86 (s, 3H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.9, 156.7, 153.3, 151.2, 143.7, 134.6, 129.7, 129.2, 127.6, 118.3, 116.0, 113.2, 104.0, 55.9, 21.7.

*(6-Methoxybenzofuran-2-yl)(p-tolyl)methanone (**3c**):* Pale-yellow solid (104.3 mg, 98%), mp 133-134 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (d, *J* = 8.0 Hz, 2H), 7.57 (d, *J* = 8.5 Hz, 1H), 7.45 (s, 1H), 7.32 (d, *J* = 8.0 Hz, 2H), 7.10 (s, 1H), 6.96 (dd, *J* = 2.0, 8.5 Hz, 1H), 3.89 (s, 3H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.6, 161.2, 157.6, 152.2, 143.4, 134.9, 129.5, 129.2, 123.5, 120.4, 116.7, 114.4, 95.7, 55.7, 21.6.

*(5-Methylbenzofuran-2-yl)(p-tolyl)methanone (**3d**):* Pale-yellow solid (76.1 mg, 76%), mp 121-122 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 2H), 7.52-7.49 (m, 2H), 7.44 (s, 1H), 7.34-7.29 (m, 3H), 2.46 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.1, 154.5, 152.7, 143.7, 134.7, 133.5, 129.8, 129.7, 129.2, 127.2, 122.7, 115.9, 112.0, 21.7, 21.3.

*(6-Methylbenzofuran-2-yl)(p-tolyl)methanone (**3e**):* Pale-yellow solid (87.0 mg,

87%), mp 77-78 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.4 Hz, 2H), 7.59 (d, *J* = 8.0 Hz, 1H), 7.47 (d, *J* = 0.8 Hz, 1H), 7.43 (s, 1H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.15 (dd, *J* = 0.8, 8.0 Hz, 1H), 2.51 (s, 3H), 2.46 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 184.0, 156.4, 152.0, 143.6, 139.1, 134.6, 129.5, 129.1, 125.6, 124.5, 122.6, 116.3, 112.3, 22.0, 21.6.

*(5-Fluorobenzofuran-2-yl)(p-tolyl)methanone (**3g**):* Pale-yellow solid (83.3 mg, 82%), mp 131-132 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 7.5 Hz, 2H), 7.58-7.56 (m, 1H), 7.48 (s, 1H), 7.37-7.33 (m, 3H), 7.21 (t, *J* = 9.0 Hz, 1H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.7, 159.6 (d, *J* = 238.8 Hz), 154.1, 152.1, 144.1, 134.3, 129.7, 129.3, 127.7 (d, *J* = 11.3 Hz), 116.4 (d, *J* = 26.3 Hz), 115.5 (d, *J* = 3.8 Hz), 113.4 (d, *J* = 8.8 Hz), 108.1 (d, *J* = 25.0 Hz), 21.7.

*(5-Chlorobenzofuran-2-yl)(p-tolyl)methanone (**3h**):* Pale-yellow solid (97.2 mg, 90%), mp 161-162 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 2H), 7.69-7.68 (m, 1H), 7.56 (d, *J* = 9.0 Hz, 1H), 7.45-7.43 (m, 2H), 7.34 (d, *J* = 7.5 Hz, 2H), 2.47 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.6, 154.2, 153.7, 144.1, 134.3, 129.7, 129.6, 129.3, 128.4, 128.3, 122.5, 114.9, 113.6, 21.7.

*(6-Chlorobenzofuran-2-yl)(p-tolyl)methanone (**3i**):* Pale-yellow solid (88.6 mg, 82%), mp 159-160 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.0 Hz, 2H), 7.63 (d, *J* = 8.0 Hz, 1H), 7.48 (s, 1H), 7.33 (t, *J* = 8.0 Hz, 3H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.6, 155.9, 153.3, 144.1, 134.3, 134.1, 129.6, 129.3, 125.7, 125.0, 123.8, 115.4, 112.9, 21.7.

*(5,7-Dichlorobenzofuran-2-yl)(p-tolyl)methanone (**3j**):* Pale-yellow solid (113.1 mg,

93%), mp 137-138 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.0 Hz, 2H), 7.59 (d, *J* = 1.5 Hz, 1H), 7.50 (s, 1H), 7.47 (d, *J* = 1.5 Hz, 1H), 7.35 (d, *J* = 8.0 Hz, 2H), 2.47 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 182.8, 154.5, 150.3, 144.5, 133.8, 129.9, 129.7, 129.4, 129.2, 127.9, 121.1, 118.6, 114.7, 21.8.

*(5-Bromobenzofuran-2-yl)(p-tolyl)methanone (**3k**):* Pale-yellow solid (107.7 mg, 86%), mp 102-103 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.4 Hz, 2H), 7.85 (d, *J* = 2.0 Hz, 1H), 7.57 (dd, *J* = 2.0, 8.8 Hz, 1H), 7.51 (d, *J* = 8.8 Hz, 1H), 7.44 (s, 1H), 7.34 (d, *J* = 8.0 Hz, 2H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.6, 154.5, 153.4, 144.1, 134.2, 131.1, 129.7, 129.3, 128.9, 125.7, 117.0, 114.7, 114.0, 21.7.

*(6-Bromobenzofuran-2-yl)(p-tolyl)methanone (**3l**):* Pale-yellow solid (90.4 mg, 72%), mp 177-178 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.0 Hz, 2H), 7.80 (s, 1H), 7.58 (d, *J* = 8.4 Hz, 1H), 7.47-7.43 (m, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.6, 156.0, 153.1, 144.1, 134.3, 129.7, 129.3, 127.6, 126.1, 124.1, 121.7, 115.9, 115.4, 21.7.

*(5-Nitrobenzofuran-2-yl)(p-tolyl)methanone (**3m**):* Pale-yellow solid (60.7 mg, 54%), mp 114-115 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.69 (d, *J* = 2.0 Hz, 1H), 8.41 (dd, *J* = 2.0, 9.0 Hz, 1H), 7.98 (d, *J* = 8.0 Hz, 2H), 7.75 (d, *J* = 9.0 Hz, 1H), 7.63 (s, 1H), 7.37 (d, *J* = 7.5 Hz, 1H), 2.49 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.2, 158.3, 155.1, 144.9, 144.7, 133.8, 129.7, 129.5, 127.3, 123.3, 119.8, 115.5, 113.1, 21.8.

*Naphtho[2,1-b]furan-2-yl(p-tolyl)methanone (**3n**);* Pale-yellow solid (100.7 mg, 88%), mp 133-134 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (d, *J* = 8.4 Hz, 1H),

8.04-8.00 (m, 3H), 7.97 (d, *J* = 8.0 Hz, 1H), 7.90 (d, *J* = 8.8 Hz, 1H), 7.73 (d, *J* = 9.2 Hz, 1H), 7.67-7.62 (m, 1H), 7.57-7.53 (m, 1H), 7.37 (d, *J* = 7.6 Hz, 2H), 2.49 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.5, 154.5, 152.3, 143.7, 134.8, 130.6, 129.9, 129.7, 129.3, 129.1, 128.2, 127.4, 125.5, 123.4, 122.9, 115.1, 112.9, 21.7.

*Benzofuran-2-yl(m-tolyl)methanone (**3o**):* Pale-yellow solid (73.7 mg, 78%), mp 62-63 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.83 (d, *J* = 6.5 Hz, 1H), 7.73 (d, *J* = 8.0 Hz, 1H), 7.64 (d, *J* = 8.5 Hz, 1H), 7.51-7.48 (m, 2H), 7.45-7.40 (m, 2H), 7.33 (t, *J* = 8.0 Hz, 1H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.6, 156.0, 152.4, 138.5, 137.4, 133.7, 129.9, 128.4, 128.3, 127.1, 126.7, 123.9, 123.3, 116.3, 112.6, 21.4.

*Benzofuran-2-yl(o-tolyl)methanone (**3p**):* Yellow oil (61.4 mg, 65%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.68 (d, *J* = 8.0 Hz, 1H), 7.62 (d, *J* = 8.5 Hz, 1H), 7.56 (d, *J* = 7.5 Hz, 1H), 7.49 (t, *J* = 8.0 Hz, 1H), 7.44 (t, *J* = 7.5 Hz, 1H), 7.33-7.28 (m, 4H), 2.44 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 187.0, 156.3, 152.8, 137.5, 137.4, 131.3, 128.7, 128.6, 125.3, 124.0, 123.4, 117.3, 112.6, 19.7.

*Benzofuran-2-yl(4-(tert-butyl)phenyl)methanone (**3q**):* Pale-yellow solid (82.3 mg, 74%), mp 118-119 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.0 Hz, 2H), 7.72 (d, *J* = 7.5 Hz, 1H), 7.63 (d, *J* = 8.5 Hz, 1H), 7.56 (s, 1H), 7.54 (d, *J* = 5.0 Hz, 2H), 7.48 (t, *J* = 7.5 Hz, 1H), 7.32 (t, *J* = 7.5 Hz, 1H), 1.38 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.9, 156.7, 156.0, 152.6, 134.6, 129.5, 128.2, 127.1, 125.5, 123.9, 123.2, 116.0, 112.5, 35.2, 31.1.

*Benzofuran-2-yl(4-methoxyphenyl)methanone (**3r**):* Pale-yellow solid (85.7 mg, 85%), mp 87-88 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.10 (d, *J* = 8.5 Hz, 2H), 7.71 (d, *J*

= 8.0 Hz, 1H), 7.61 (d, *J* = 8.5 Hz, 1H), 7.51 (s, 1H), 7.47 (t, *J* = 7.5 Hz, 1H), 7.31 (t, *J* = 7.5 Hz, 1H), 7.00 (d, *J* = 8.5 Hz, 2H), 3.89 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 182.9, 163.7, 155.9, 152.7, 132.0, 129.8, 128.0, 127.1, 123.9, 123.2, 115.5, 113.9, 112.4, 55.5.

*Benzofuran-2-yl(4-phenoxyphenyl)methanone (**3s**):* Pale-yellow solid (108 mg, 86%), mp 99-100 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.11 (d, *J* = 8.5 Hz, 2H), 7.72 (d, *J* = 8.0 Hz, 1H), 7.62 (d, *J* = 8.5 Hz, 1H), 7.54 (s, 1H), 7.48 (t, *J* = 7.5 Hz, 1H), 7.41 (t, *J* = 8.0 Hz, 2H), 7.32 (t, *J* = 7.5 Hz, 1H), 7.22 (t, *J* = 7.5 Hz, 1H), 7.13-7.08 (m, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 182.7, 162.1, 155.9, 155.5, 152.6, 132.0, 131.5, 130.1, 128.2, 127.1, 124.7, 124.0, 123.2, 120.3, 117.4, 115.8, 112.5.

*(4-Hydroxyphenyl)(6-methoxybenzofuran-2-yl)methanone (**3t**):* White solid (95.4 mg, 89%), mp 121-122 ^{o}C. ^{1}H NMR (500 MHz, DMSO-d_6) δ 10.54 (s, 1H), 7.97-7.95 (m, 2H), 7.64-7.61 (m, 2H) , 7.26-7.27 (m, 1H) , 7.13-7.10 (m, 1H), 6.97-6.95 (m, 2H), 3.79 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6) δ 181.5, 162.3, 156.2, 152.8, 150.1, 131.9, 127.8, 127.4, 117.7, 115.5, 115.4, 112.8, 104.4, 55.6.

*Benzofuran-2-yl(4-fluorophenyl)methanone (**3u**):* Pale-yellow solid (50.9 mg, 53%), mp 129-130 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.14-8.11 (m, 2H), 7.73 (d, *J* = 7.5 Hz, 1H), 7.63 (d, *J* = 8.5 Hz, 1H), 7.54 (s, 1H), 7.50 (t, *J* = 7.5 Hz, 1H), 7.34 (t, *J* = 7.5 Hz, 1H), 7.21 (t, *J* = 8.5 Hz, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 182.6, 165.7 (d, *J* = 253.8 Hz), 156.0, 152.3, 133.4 (d, *J* = 2.5 Hz), 132.2 (d, *J* = 8.8 Hz), 128.4, 127.0, 124.1, 123.3, 116.2, 115.7 (d, *J* = 21.3 Hz), 112.5.

*Benzofuran-2-yl(4-chlorophenyl)methanone (**3v**):* Pale-yellow solid (42 mg, 41%), mp 145-146 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.0 Hz, 2H), 7.73 (d, *J* = 8.0 Hz, 1H), 7.63 (d, *J* = 8.5 Hz, 1H), 7.55 (s, 1H), 7.52-7.49 (m, 3H), 7.34 (t, *J* = 6.5 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 182.8, 156.0, 152.2, 139.4, 135.4, 130.9, 128.9, 128.5, 126.9, 124.1, 123.3, 116.3, 112.5.

*Benzofuran-2-yl(phenyl)methanone (**3w**):* White solid (55.1 mg, 62%), mp 89-90 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.04 (d, *J* = 8.0 Hz, 2H), 7.73 (d, *J* = 7.5 Hz, 1H), 7.63 (t, *J* = 8.0 Hz, 2H), 7.55-7.48 (m, 4H), 7.33 (t, *J* = 7.5 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.3, 156.0, 152.4, 137.3, 132.9, 129.5, 128.5, 128.3, 127.0, 124.0, 123.3, 116.4, 112.6.

*[1,1'-Biphenyl]-4-yl(benzofuran-2-yl)methanone (**3x**):* Pale-yellow solid (87 mg, 73%), mp 98-99 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16 (d, *J* = 8.0 Hz, 2H), 7.78-7.75 (m, 3H), 7.69-7.66 (m, 3H), 7.60 (s, 1H), 7.54-7.49 (m, 3H), 7.43 (t, *J* = 7.2 Hz, 1H), 7.37-7.34 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 183.8, 156.0, 152.5, 145.8, 139.9, 135.9, 130.2, 129.0, 128.3, 128.2, 127.3, 127.1, 124.0, 123.3, 116.2, 112.6.

*Benzofuran-2-yl(naphthalen-2-yl)methanone (**3y**):* Yellow oil (89.2 mg, 82%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.27-8.25 (m, 1H), 8.00-7.97 (m, 1H), 7.88-7.87 (m, 1H), 7.62-7.59 (m, 2H), 7.51-7.44 (m, 4H), 7.28-7.23 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 186.3, 156.4, 153.1, 135.1, 133.8, 132.2, 130.8, 128.8, 128.5, 128.0, 127.6, 127.1, 126.7, 125.3, 124.3, 124.1, 123.5, 117.8, 112.6.

*(6-Hydroxybenzofuran-2-yl)(p-tolyl)methanone (**3z**):* White solid (41.6 mg, 61%). ^{1}H NMR (500 MHz, DMSO-d_6) δ 10.21 (s, 1H), 7.86 (d, *J* = 8.0 Hz, 2H), 7.65-7.63

(m, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 7.03 (s, 1H), 6.85 (dd, *J* = 2.0 Hz, 8.5 Hz, 1H), 2.42 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6) δ 182.4, 159.2, 157.1, 150.6, 143.1, 134.5, 129.2, 129.1, 124.3, 119.0, 117.7, 117.6, 97.5, 21.1.

*(3-Methylbenzofuran-2-yl)(phenyl)methanone (**4a**):* Yellow oil (68 mg, 72%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.12 (d, *J* = 8.0 Hz, 2H), 7.71 (d, *J* = 8.0 Hz, 1H), 7.61 (t, *J* = 7.5 Hz, 1H), 7.54 (t, *J* = 8.0 Hz, 3H), 7.49 (t, *J* = 8.0 Hz, 1H), 7.34 (t, *J* = 7.5 Hz, 1H), 2.66 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.9, 154.3, 148.4, 137.9, 132.6, 129.8, 129.3, 128.3, 128.2, 126.8, 123.3, 121.4, 112.2, 10.0.

*(3-Methylbenzofuran-2-yl)(p-tolyl)methanone (**4b**):* Yellow oil (85 mg, 85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 8.0 Hz, 2H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.54 (d, *J* = 8.4 Hz, 1H), 7.50-7.46 (m, 1H), 7.35-7.32 (m, 3H), 2.65 (s, 3H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.5, 154.3, 148.6, 143.4, 135.3, 130.0, 129.3, 129.1, 128.0, 126.4, 123.3, 121.4, 112.2, 21.7, 10.0.

*(3-Methylbenzofuran-2-yl)(m-tolyl)methanone (**4c**):* Yellow oil (81 mg, 81%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (m, 2H), 7.71 (d, *J* = 8.0 Hz, 1H), 7.55 (d, *J* = 8.0 Hz, 1H), 7.49 (t, *J* = 8.0 Hz, 1H), 7.43-7.40 (m, 2H), 7.34 (t, *J* = 7.5 Hz, 1H), 2.65 (s, 3H), 2.47 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 186.2, 154.3, 148.5, 138.1, 138.0, 133.4, 130.1, 129.3, 128.2, 128.1, 127.0, 126.5, 123.3, 121.4, 112.2, 21.4, 10.0.

*(3-Methylbenzofuran-2-yl)(o-tolyl)methanone (**4d**):* Yellow oil (50 mg, 50%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.68 (d, *J* = 7.5 Hz, 1H), 7.51-7.42 (m, 4H), 7.34-7.29 (m, 3H), 2.47 (s, 3H), 2.41 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 189.0, 154.6, 148.4, 138.8, 136.6, 131.0, 130.6, 129.4, 128.5, 128.3, 125.5, 123.3, 121.6, 112.4, 19.6, 9.7.

(4-Methoxyphenyl)(3-methylbenzofuran-2-yl)methanone ***(4f)****:* Pale-yellow solid (104.3 mg, 98%), mp 90-91 ^{o}C.. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.17-8.15 (m, 2H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.54 (d, *J* = 8.5 Hz, 1H), 7.50-7.46 (m, 1H), 7.35-7.31 (m, 1H), 7.03-7.00 (m, 2H), 3.90 (s, 3H), 2.64 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.4, 163.4, 154.2, 148.7, 132.3, 130.6, 129.3, 127.9, 126.1, 123.2, 121.3, 113.7, 112.1, 55.46, 9.95.

(3-Methylbenzofuran-2-yl)(4-phenoxyphenyl)methanone ***(4g)****:* Yellow oil (129.9 mg, 99%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.16 (d, *J* = 8.5 Hz, 2H), 7.70 (d, *J* =8.0 Hz, 1H), 7.55-7.47 (m, 2H), 7.42 (t, *J* = 8.0 Hz, 2H), 7.34 (t, *J* = 7.5 Hz, 1H), 7.23-7.20 (m, 1H), 7.13-7.07 (m, 4H), 2.66 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.3, 161.8, 155.6, 154.2, 148.5, 132.2, 132.2, 130.1, 129.2, 128.1, 126.6, 124.6, 123.3, 121.4, 120.3, 117.2, 112.2, 10.0.

(4-Fluorophenyl)(3-methylbenzofuran-2-yl)methanone ***(4h)****:* Yellow oil (46.7 mg, 46%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.19-8.16 (m, 2H), 7.70 (d, *J* = 8.0 Hz, 1H), 7.54-7.48 (m, 2H), 7.34 (t, *J* = 7.5 Hz, 1H), 7.19 (t, *J* = 8.0 Hz, 2H), 2.66 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.0, 166.5 (d, *J* = 253.8 Hz), 154.3, 148.2, 134.1 (d, *J* = 2.5 Hz), 132.5 (d, *J* = 8.8 Hz), 129.2, 128.3, 127.2, 123.4, 121.4, 115.4 (d, *J* = 22.5 Hz), 112.2, 10.0.

[1,1'-Biphenyl]-4-yl(3-methylbenzofuran-2-yl)methanone ***(4i)****:* Pale-yellow solid (84.9 mg, 68%), mp 67-68 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.24 (d, *J* = 8.0 Hz, 2H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.74-7.69 (m, 3H), 7.59 (d, *J* = 8.5 Hz, 1H), 7.54-7.49 (m, 3H), 7.44 (t, *J* = 6.0 Hz, 1H), 7.37 (t, *J* = 6.5 Hz, 1H), 2.71 (s, 3H); ^{13}C NMR (125

MHz, $CDCl_3$) δ 185.3, 154.3, 148.5, 145.4, 140.1, 136.6, 130.5, 129.0, 128.8, 128.2, 128.1, 127.4, 127.0, 123.4, 121.5, 112.3, 10.1.

(3-Methylbenzofuran-2-yl)(naphthalen-1-yl)methanone ***(4j)****:* Pale-yellow solid (85.8 mg, 75%), mp 68-69 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.18 (d, *J* = 8.0 Hz, 1H), 8.04 (d, *J* = 8.5 Hz, 1H), 7.93 (d, *J* = 7.5 Hz, 1H), 7.79 (d, *J* = 7.0 Hz, 1H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.59-7.53 (m, 3H), 7.48-7.47 (m, 2H), 7.35-7.32 (m, 1H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 188.2, 154.7, 148.8, 136.3, 133.8, 131.6, 130.6, 129.4, 128.6, 128.5, 127.5, 127.4, 127.0, 126.5, 125.2, 124.6, 123.4, 121.6, 112.4, 10.0.

(3,5-Dimethylbenzofuran-2-yl)(p-tolyl)methanone ***(4l)****:* Pale-yellow solid (102.5 mg, 97%), mp 65-66 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.0 Hz, 2H), 7.47 (s, 1H), 7.42 (d, *J* = 8.5 Hz, 1H), 7.34-7.29 (m, 1H), 2.62 (s, 2H), 2.49 (s, 3H), 2.46 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.6, 152.8, 148.7, 143.3, 135.4, 132.8, 129.9, 129.6, 129.0, 126.3, 120.9, 111.7, 21.7, 21.4, 10.0.

(5-Methoxy-3-methylbenzofuran-2-yl)(p-tolyl)methanone ***(4m)****:* Pale-yellow solid (99.7 mg, 89%), mp 65-66 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.0 Hz, 2H), 7.42 (d, *J* = 9.0 Hz, 1H), 7.32 (d, *J* = 8.0 Hz, 2H), 7.10 (d, *J* = 9.0 Hz, 1H), 7.06 (s, 1H), 3.89 (s, 3H), 2.62 (s, 3H), 2.45 (s, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.5, 156.4, 149.4, 149.3, 143.3, 135.3, 130.0, 129.7, 129.0, 126.4, 118.1, 112.9, 102.3, 55.9, 35.3, 21.7, 17.8, 10.0.

(5-Fluoro-3-methylbenzofuran-2-yl)(p-tolyl)methanone ***(4n)****:* Pale-yellow solid (104 mg, 97%), mp 118-119 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.0 Hz, 2H), 7.48-7.45 (m, 1H), 7.33-7.31 (m, 3H), 7.22-7.18 (m, 1H), 2.59 (s, 3H), 2.46 (s,

3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.3, 159.4 (d, *J* = 240.0 Hz), 150.4, 150.0, 143.6, 135.0, 130.1 (d, *J* = 8.8 Hz), 129.9, 129.1, 126.1, 116.2 (d, *J* = 26.3 Hz), 113.1 (d, *J* = 8.8 Hz), 106.4 (d, *J* = 25.0 Hz), 21.7, 9.9.

*(5-Chloro-3-methylbenzofuran-2-yl)(p-tolyl)methanone (**4o**):* Pale-yellow solid (112.5 mg, 99%), mp 97-98 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.0 Hz, 2H), 7.64 (s, 1H), 7.46-7.40 (m, 2H), 7.32 (d, *J* = 7.5 Hz, 2H), 2.59 (s, 3H), 2.45 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.2, 152.4, 149.6, 143.7, 134.9, 130.6, 129.9, 129.1, 129.0, 128.2, 125.5, 120.9, 113.3, 21.7, 9.9.

*(5-Bromo-3-methylbenzofuran-2-yl)(p-tolyl)methanone (**4p**):* Pale-yellow solid (128.6 mg, 98%), mp 65-66 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, *J* = 8.0 Hz, 2H), 7.78 (s, 1H), 7.52 (d, *J* = 8.5 Hz, 1H), 7.38 (d, *J* = 9.0 Hz, 1H), 7.31 (d, *J* = 8.0 Hz, 2H), 2.57 (s, 3H), 2.45 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.1, 152.8, 149.4, 143.7, 134.9, 131.2, 130.9, 129.9, 129.1, 125.3, 124.0, 116.4, 113.7, 21.7, 9.9.

*Phenyl(3-phenylbenzofuran-2-yl)methanone (**4q**):* Pale-yellow solid (116.9 mg, 98%), mp 143-144 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 8.0 Hz, 2H), 7.73 (d, *J* = 7.6 Hz, 1H), 7.66 (d, *J* = 8.4 Hz, 1H), 7.56-7.47 (m, 4H), 7.42-7.33 (m, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.8, 154.7, 147.2, 137.2, 132.7, 131.0, 130.1, 129.9, 129.4, 128.5, 128.4, 128.3, 128.1, 124.0, 122.4, 112.4.

*(3-Phenylbenzofuran-2-yl)(p-tolyl)methanone (**4r**):* Pale-yellow solid (118.6 mg, 95%), mp 122-123 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 8.0 Hz, 2H), 7.73 (d, *J* = 7.6 Hz, 1H), 7.66 (d, *J* = 8.4 Hz, 1H), 7.57-7.51 (m, 3H), 7.44-7.34 (m, 4H) , 7.18 (d, *J* = 8.0 Hz, 2H) , 2.39 (s, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 185.4, 154.6, 147.5,

143.6, 134.7, 131.1, 130.1, 128.9, 128.4, 128.3, 128.2, 128.0, 123.9, 122.3, 112.4, 21.7.

*(4-Methoxyphenyl)(3-phenylbenzofuran-2-yl)methanone (**4s**):* Pale-yellow solid (127.3 mg, 97%), mp 143-144 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.94 (d, *J* = 9.0 Hz, 2H), 7.72 (d, *J* = 8.0 Hz, 1H), 7.65 (d, *J* = 8.0 Hz, 1H), 7.53-7.51 (m, 3H), 7.42-7.34 (m, 4H) 6.85 (d, *J* = 9.0 Hz, 2H), 3.84 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 184.2, 163.5, 154.5, 147.5, 132.4, 131.1, 130.0, 128.4, 128.2, 128.1, 127.8, 123.8, 122.2, 113.5, 112.3, 55.5.

*(4-Fluorophenyl)(6-methoxybenzofuran-2-yl)methanone (**5a**):* White solid (48.6 mg, 45%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.07 (m, 2H), 7.59 (d, *J* = 8.8 Hz, 1H), 7.48 (s, 1H), 7.23-7.19 (m, 2H), 7.11-7.10 (m, 1H) , 6.99-6.96 (m, 1H) 3.90 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 182.2, 165.6 (d, *J* = 252.5 Hz), 161.4, 157.7, 151.9, 133.8, 132.0 (d, *J* = 8.8 Hz), 123.7, 120.4, 117.0, 115.7 (d, *J* = 21.3 Hz), 114.7, 95.7, 55.8.

*(4-Fluorophenyl)(6-methoxybenzofuran-2-yl)methanol (**6a**):* Pale Yellow oil (148.6 mg, 91%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49-7.45 (m, 2H), 7.37 (d, *J* = 8.4 Hz, 1H), 7.08 (d, *J* = 8.4 Hz, 2H), 6.98 (d, *J* = 2.0 Hz, 1H), 6.85 (dd, J_1 = 2.0 Hz, J_2 = 8.4 Hz 1H), 6.43 (s, 1H), 5.91 (s, 1H), 3.83 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 162.6 (d, *J* = 245.0 Hz), 158.1, 157.6, 156.2, 136.4, 128.6 (d, *J* = 8.8 Hz), 121.3, 115.4 (d, *J* = 22.5 Hz), 112.0, 104.0, 96.1, 69.8, 55.7.

*1-((4-Fluorophenyl)(6-methoxybenzofuran-2-yl)methyl)-1H-1,2,4-triazole (**7a**):* White solid (140.4 mg, 79%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (s, 1H), 8.03 (s,

2H), 7.39 (d, *J* = 8.8 Hz, 1H), 7.29-7.26 (m, 2H), 7.11-7.06 (m, 2H), 6.98 (s, 1H), 6.90-6.87 (m, 1H), 6.80 (s, 1H), 3.81 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 160.0 (d, *J* = 247.5 Hz), 158.8, 156.5, 152.3, 151.2, 143.2, 131.8 (d, *J* = 2.5 Hz), 129.5 (d, *J* = 8.8 Hz), 121.7, 120.5, 116.1 (d, *J* = 22.5 Hz), 112.7, 107.9, 96.0, 61.5, 55.7.

*Phenyl(3-phenyl-1H-indol-2-yl)methanone (**9a**):* Pale-yellow solid (63.0 mg, 53%), mp 133-134 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.42 (s, 1H), 7.72 (d, *J* = 8.0 Hz, 1H), 7.51 (t, *J* = 7.5 Hz, 2H), 7.40 (t, *J* = 7.5 Hz, 1H), 7.24-7.23 (m, 2H) , 7.19-7.16 (m, 3H), 7.13-7.10 (m, 3H), 7.06 (t, *J* = 7.5 Hz, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 189.6, 137.6, 136.4, 133.7, 131.7, 130.9, 129.5, 128.0, 127.8, 127.6, 127.7, 126.9, 126.6, 125.4, 122.2, 121.2, 112.0.

*(3-Phenyl-1H-indol-2-yl)(p-tolyl)methanone (**9b**):* Pale-yellow solid (107.0 mg, 86%), mp 156-158 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.43 (s, 1H), 7.75 (d, *J* = 8.0 Hz, 1H), 7.52-7.39 (m, 4H), 7.25-7.14 (m, 6H), 6.88 (d, *J* = 7.5 Hz, 2H) , 2.25 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 189.3, 142.4, 136.4, 134.9, 133.9, 131.1, 130.9, 129.8, 128.3, 127.9, 127.7, 126.7, 126.4, 124.9, 122.1, 121.1, 112.0, 21.5.

*(4-(tert-Butyl)phenyl)(3-phenyl-1H-indol-2-yl)methanone (**9e**):* Pale-yellow solid (99.4 mg, 76%), mp 127-128 ^{o}C. ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.35 (s, 1H), 7.76 (d, *J* = 9.0 Hz, 2H), 7.51 (d, *J* = 8.5 Hz, 1H), 7.42-7.39 (m, 1H), 7.20-7.13 (m, 4H), 3.74 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 188.2, 162.7, 136.4, 134.7, 133.9, 131.2, 130.9, 129.4, 127.9, 127.8, 126.6, 126.5, 125.4, 124.5, 122.2, 121.1, 112.0, 34.8, 31.0.

2. NMR Spectra for 8a

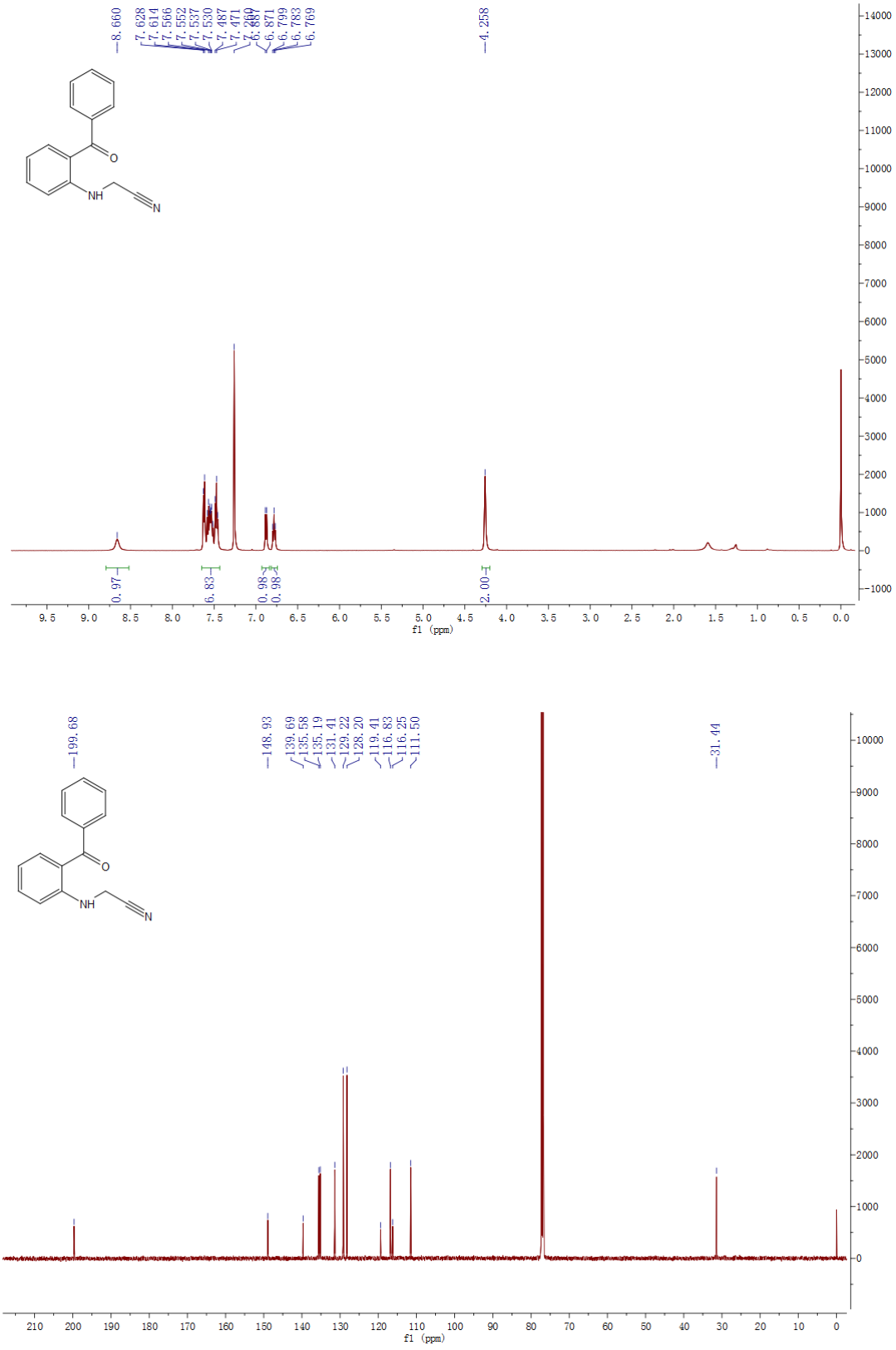


Figure S1. ^{1}H NMR of **8a** (500 MHz, $CDCl_3$) and ^{13}C NMR of **8a** (125 MHz, $CDCl_3$).

3. NMR Spectra for All Products

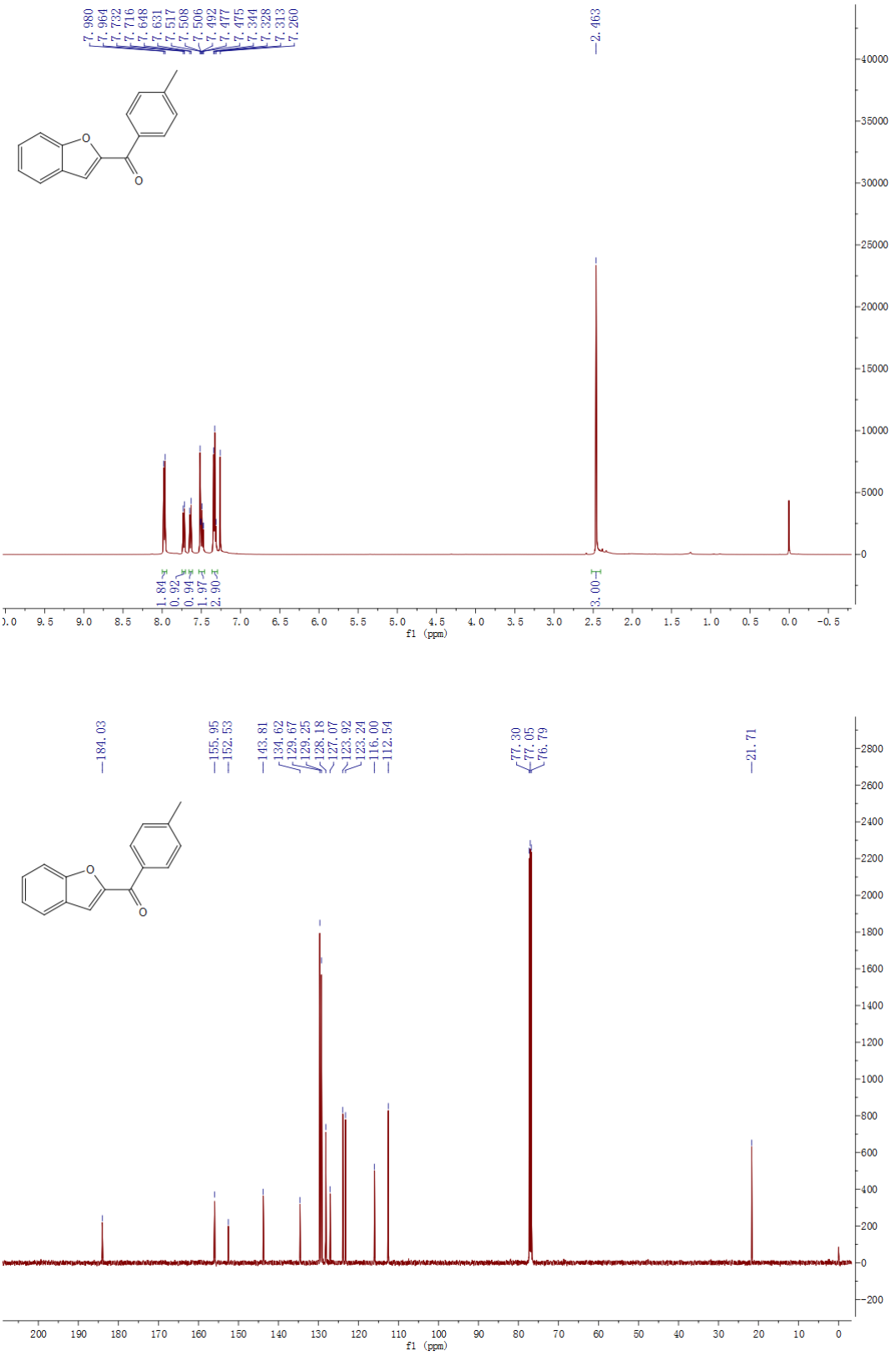


Figure S2. ^{1}H NMR of **3a** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3a** (125 MHz, $CDCl_3$).

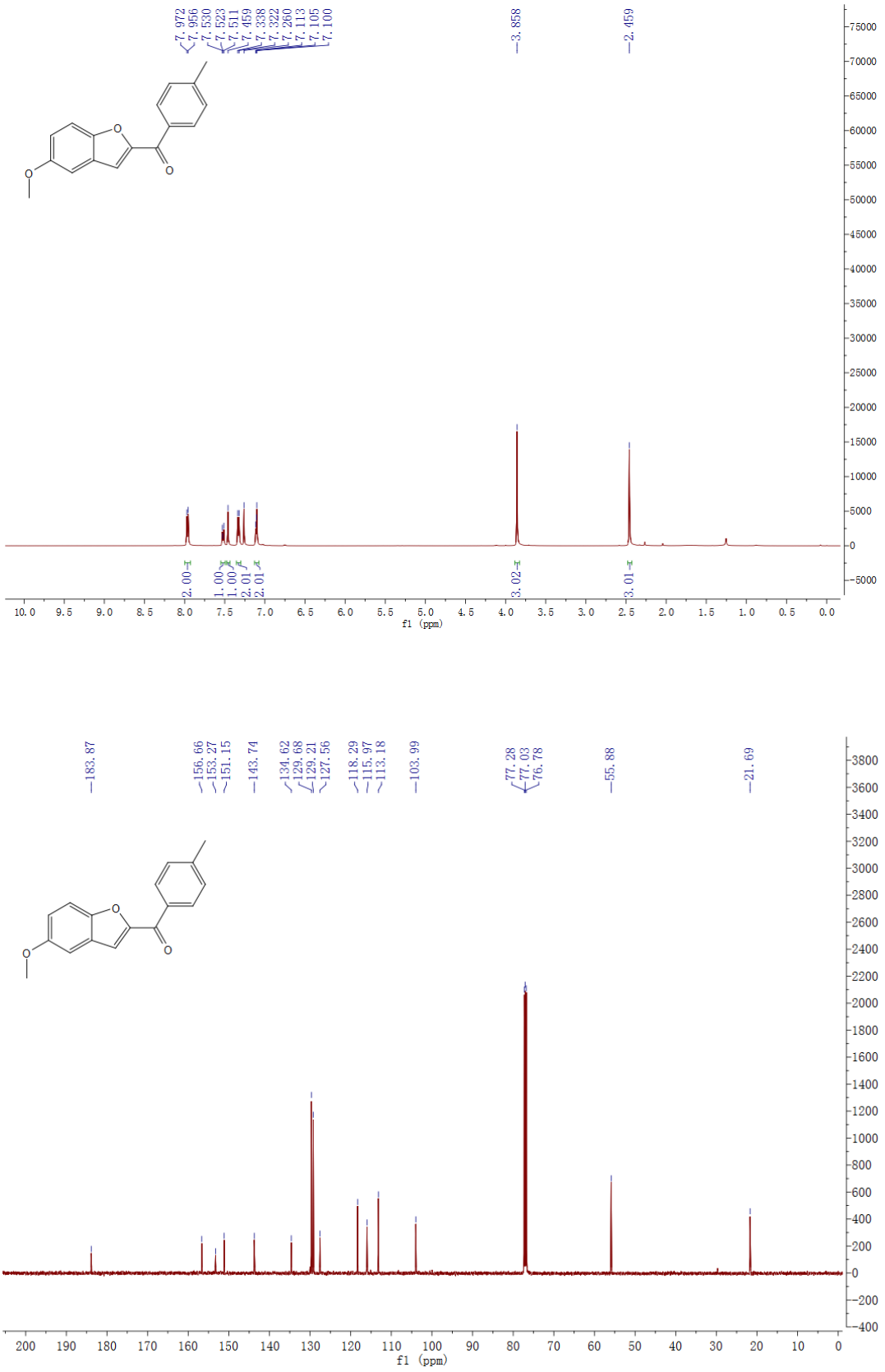


Figure S3. ^{1}H NMR of **3b** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3b** (125 MHz, $CDCl_3$).

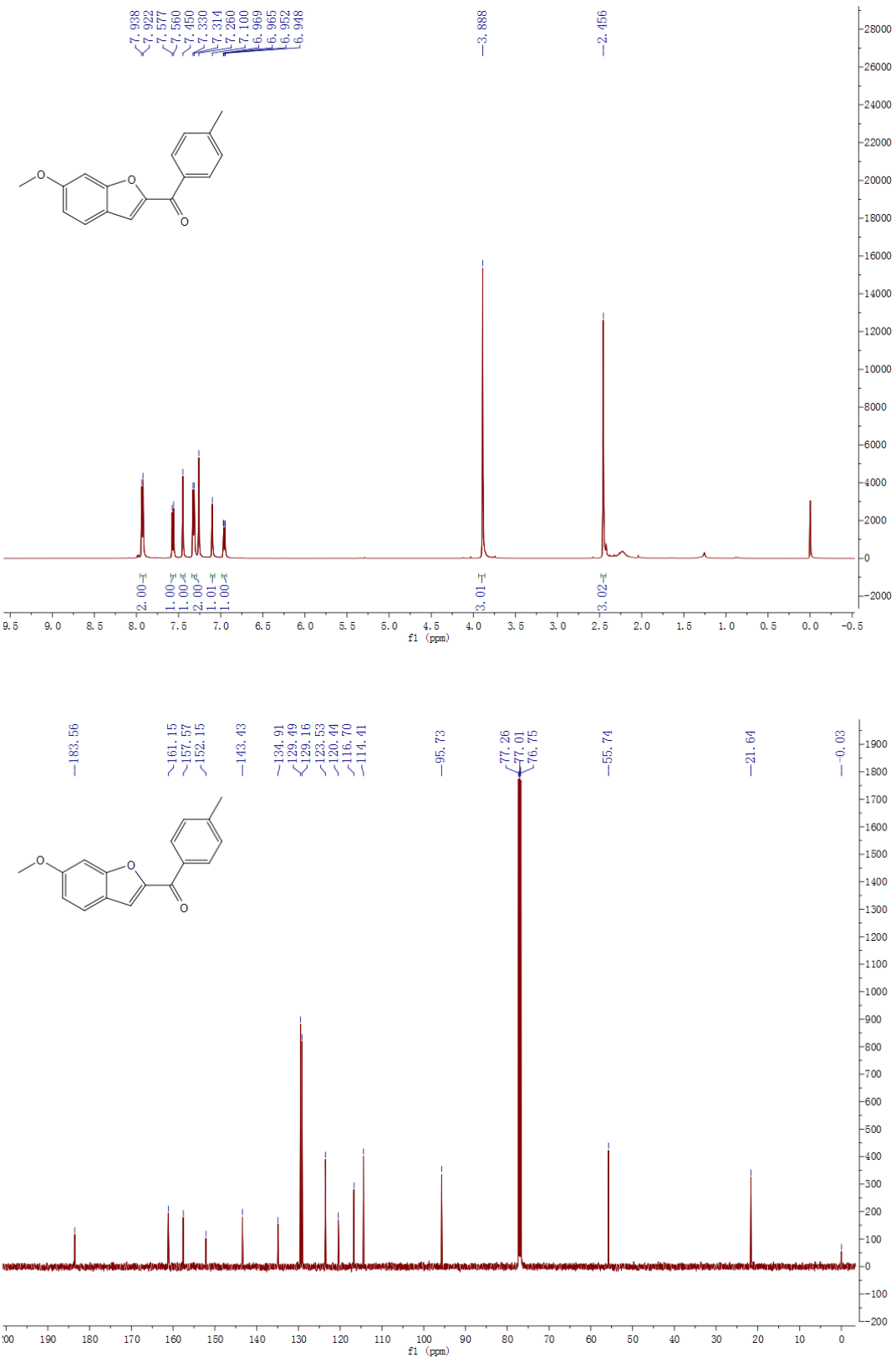


Figure S4. ^{1}H NMR of **3c** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3c** (125 MHz, $CDCl_3$).

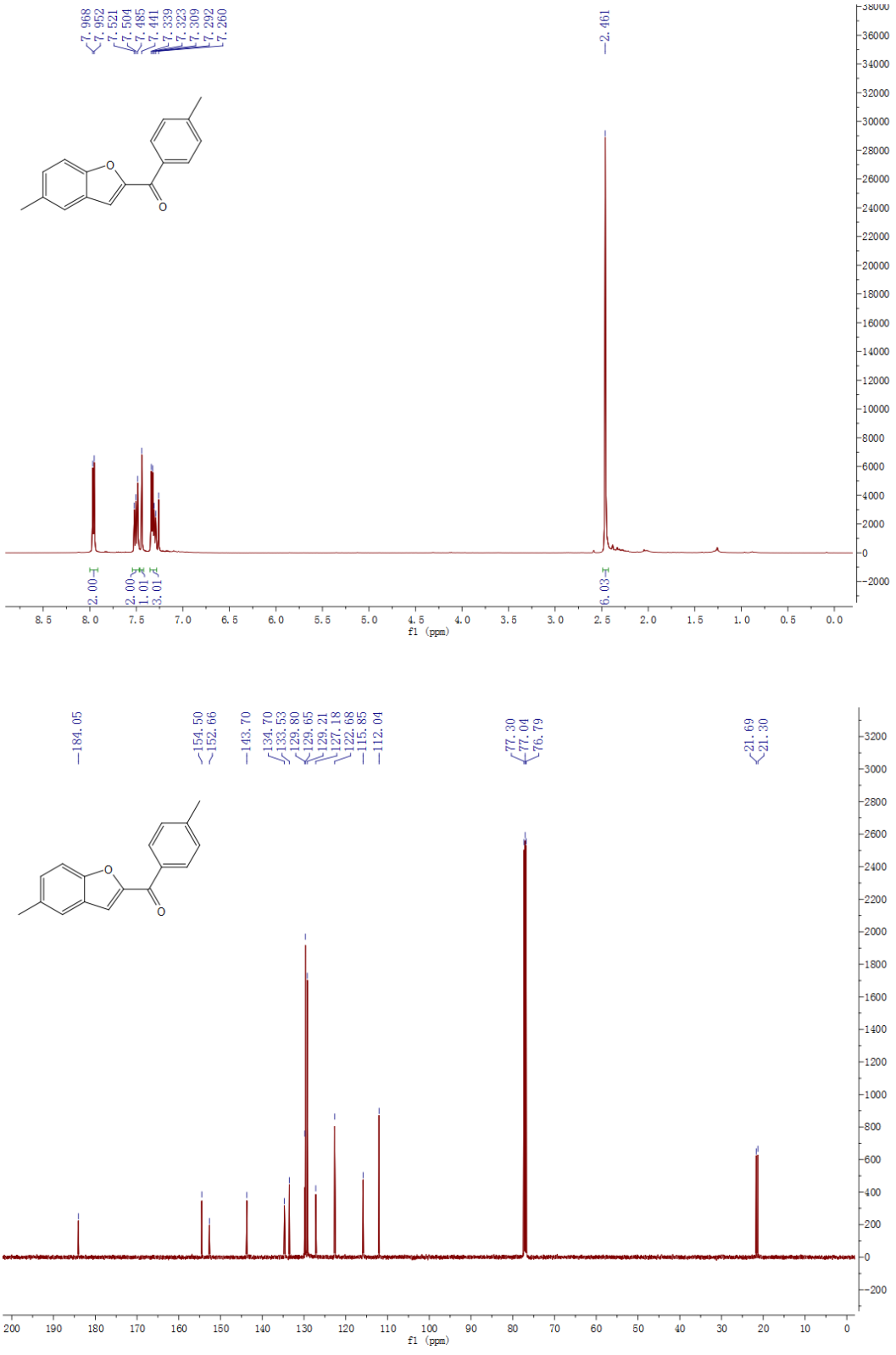


Figure S5. ^{1}H NMR of **3d** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3d** (125 MHz, $CDCl_3$).

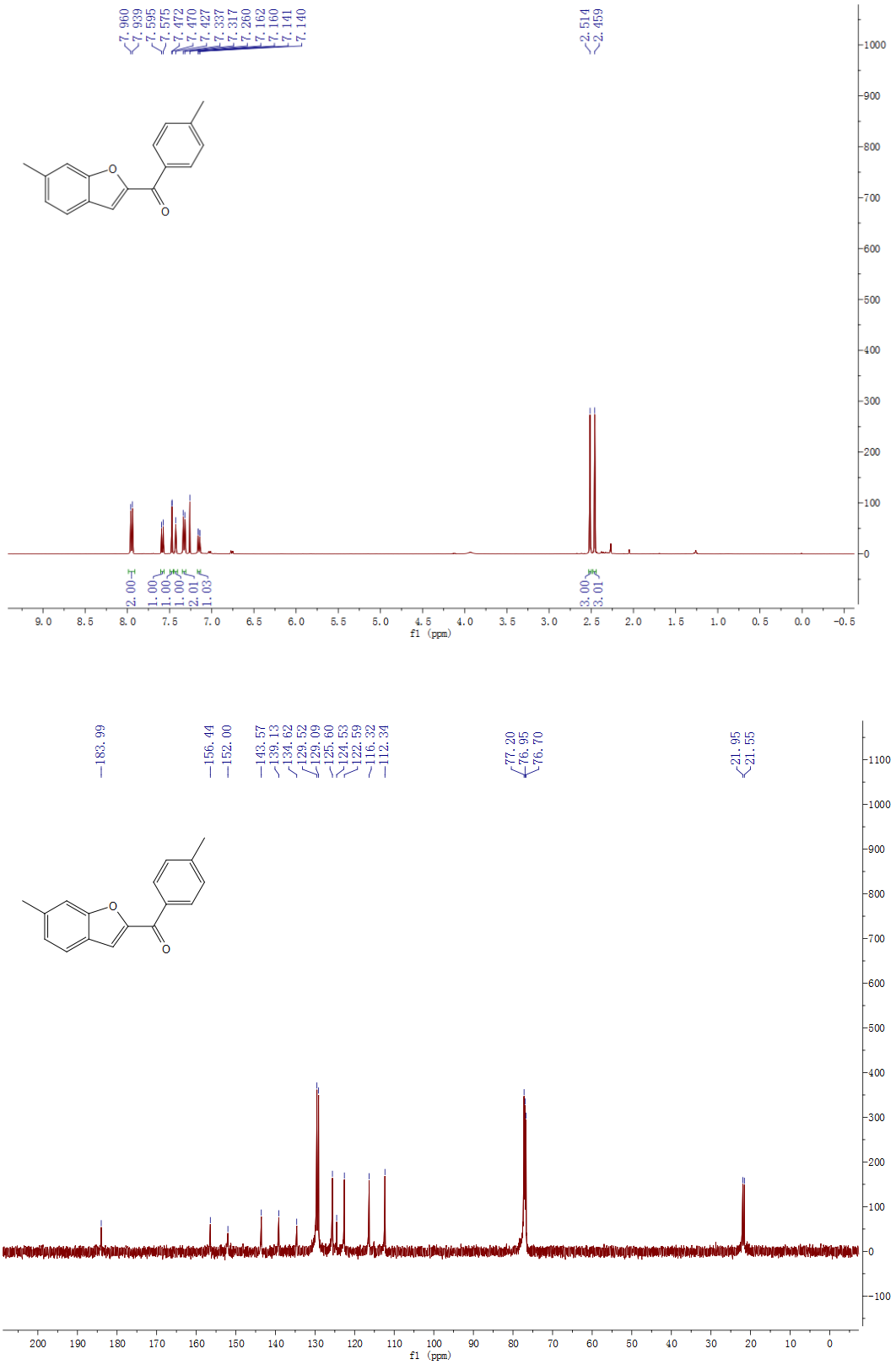


Figure S6. ^{1}H NMR of **3e** (400 MHz, $CDCl_3$) and ^{13}C NMR of **3e** (100 MHz, $CDCl_3$).

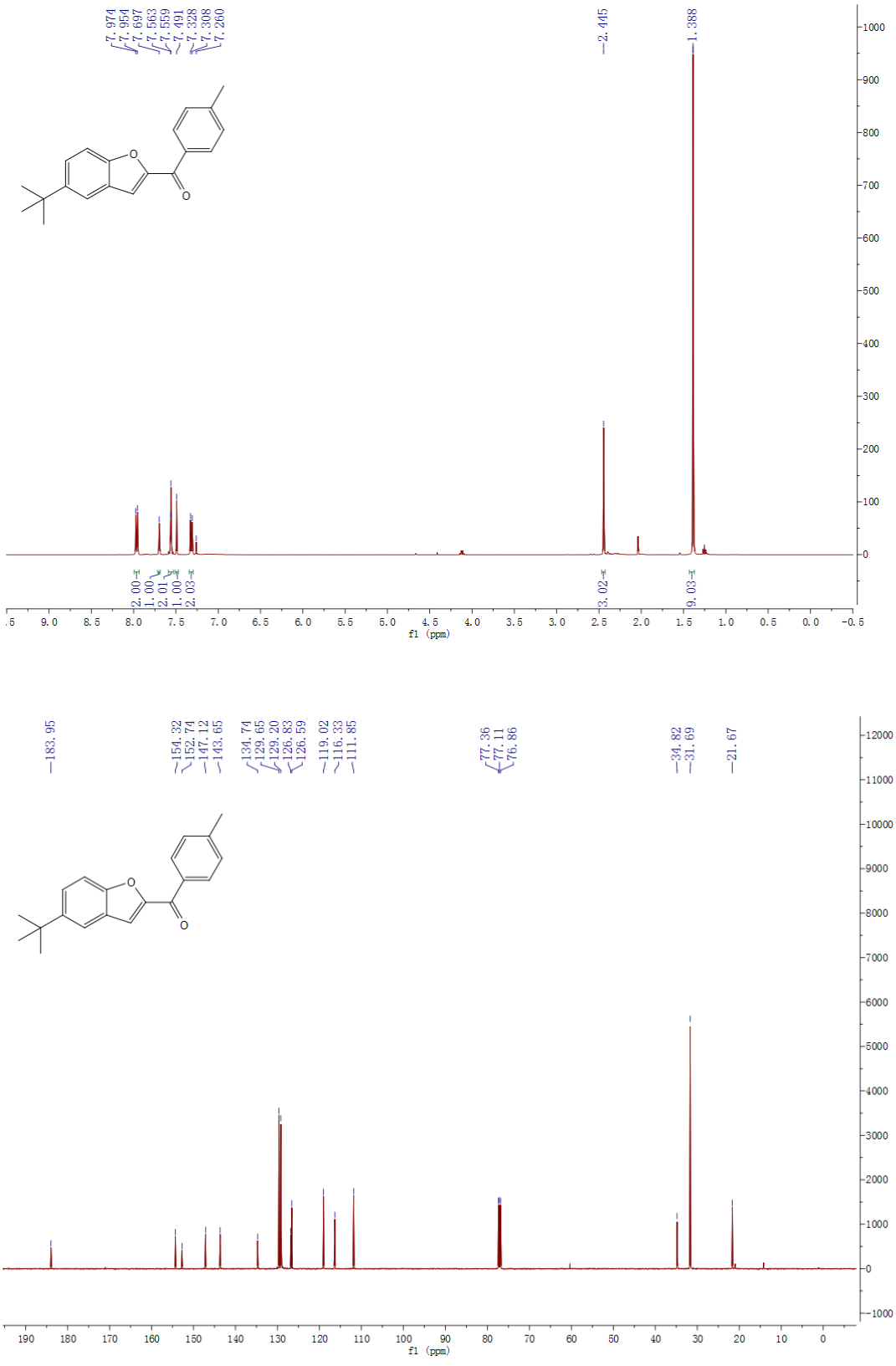


Figure S7. ^{1}H NMR of **3f** (400 MHz, $CDCl_3$) and ^{13}C NMR of **3f** (125 MHz, $CDCl_3$).

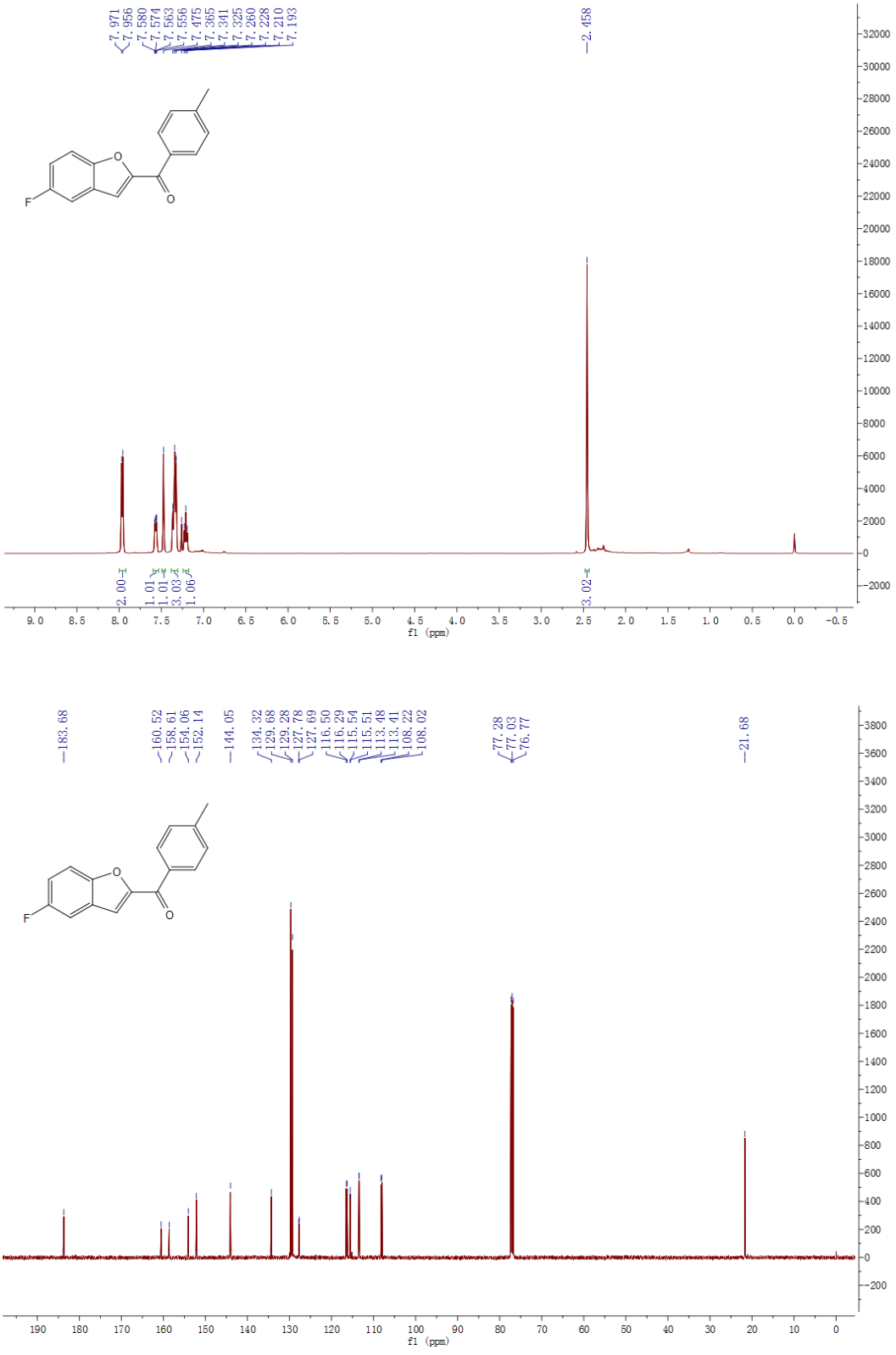


Figure S8. ^{1}H NMR of **3g** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3g** (125 MHz, $CDCl_3$).

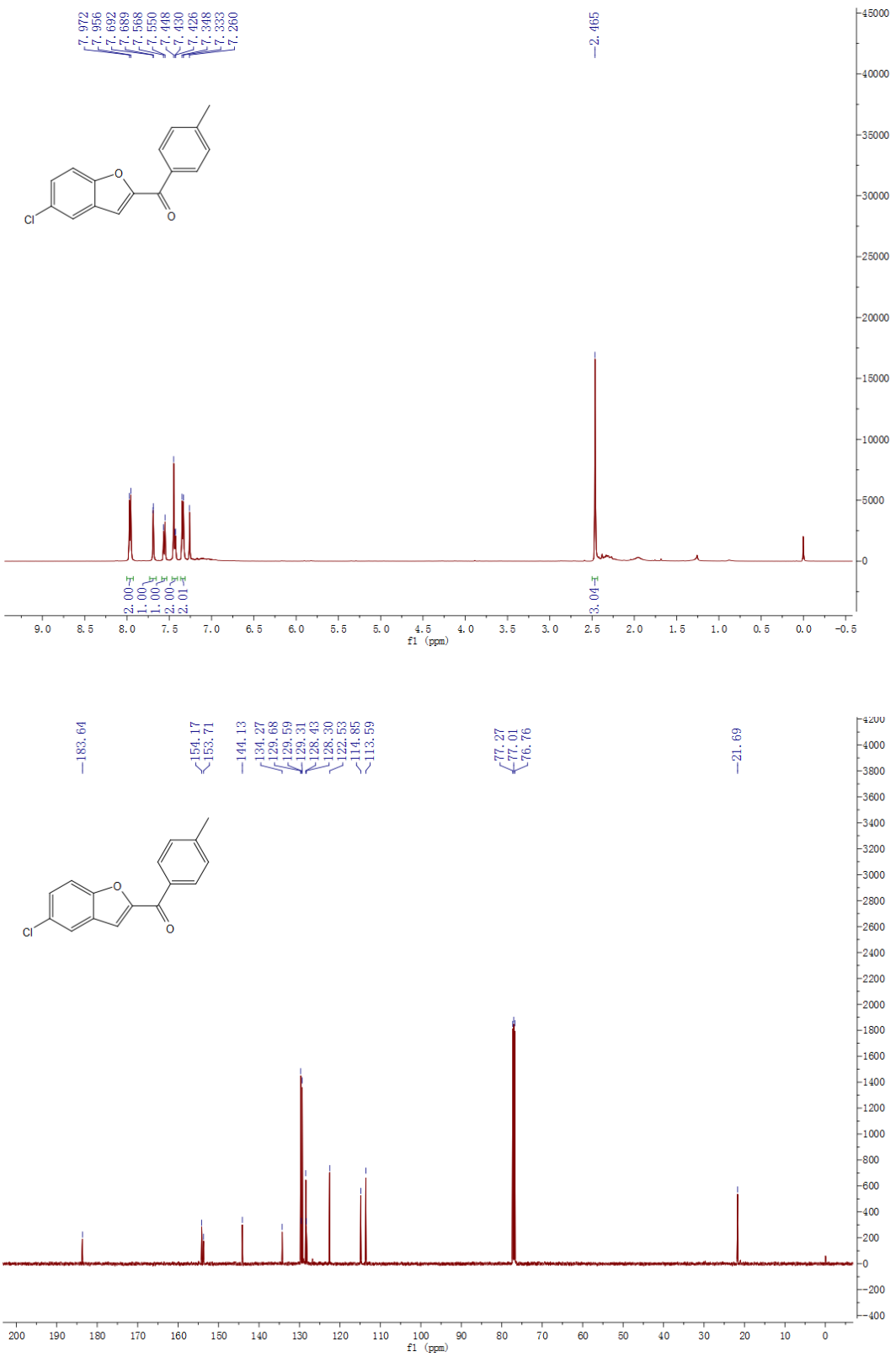


Figure S9. ^{1}H NMR of **3h** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3h** (125 MHz, $CDCl_3$).

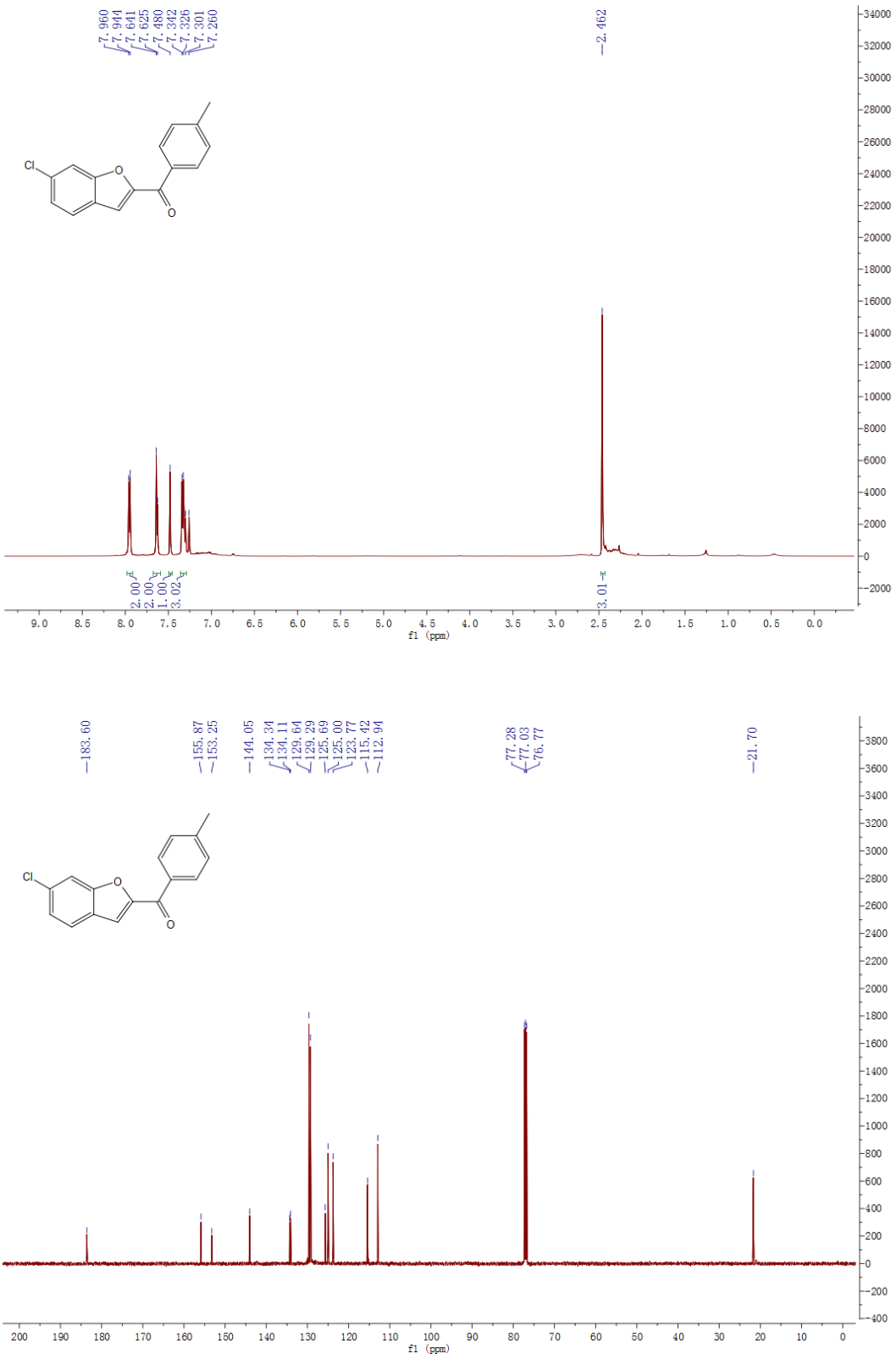


Figure S10. ^{1}H NMR of **3i** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3i** (125 MHz, $CDCl_3$).

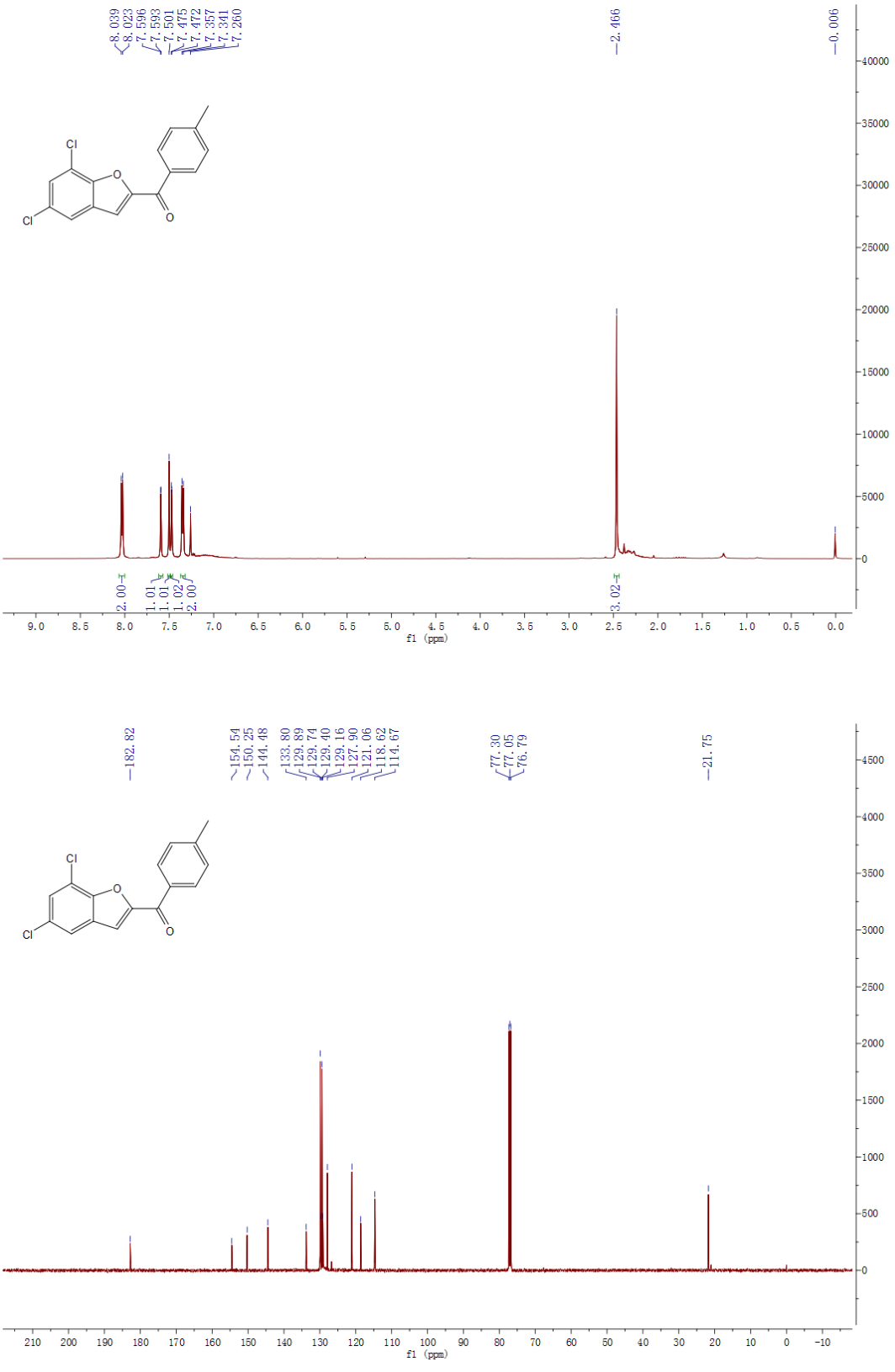


Figure S11. ^{1}H NMR of **3j** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3j** (125 MHz, $CDCl_3$).

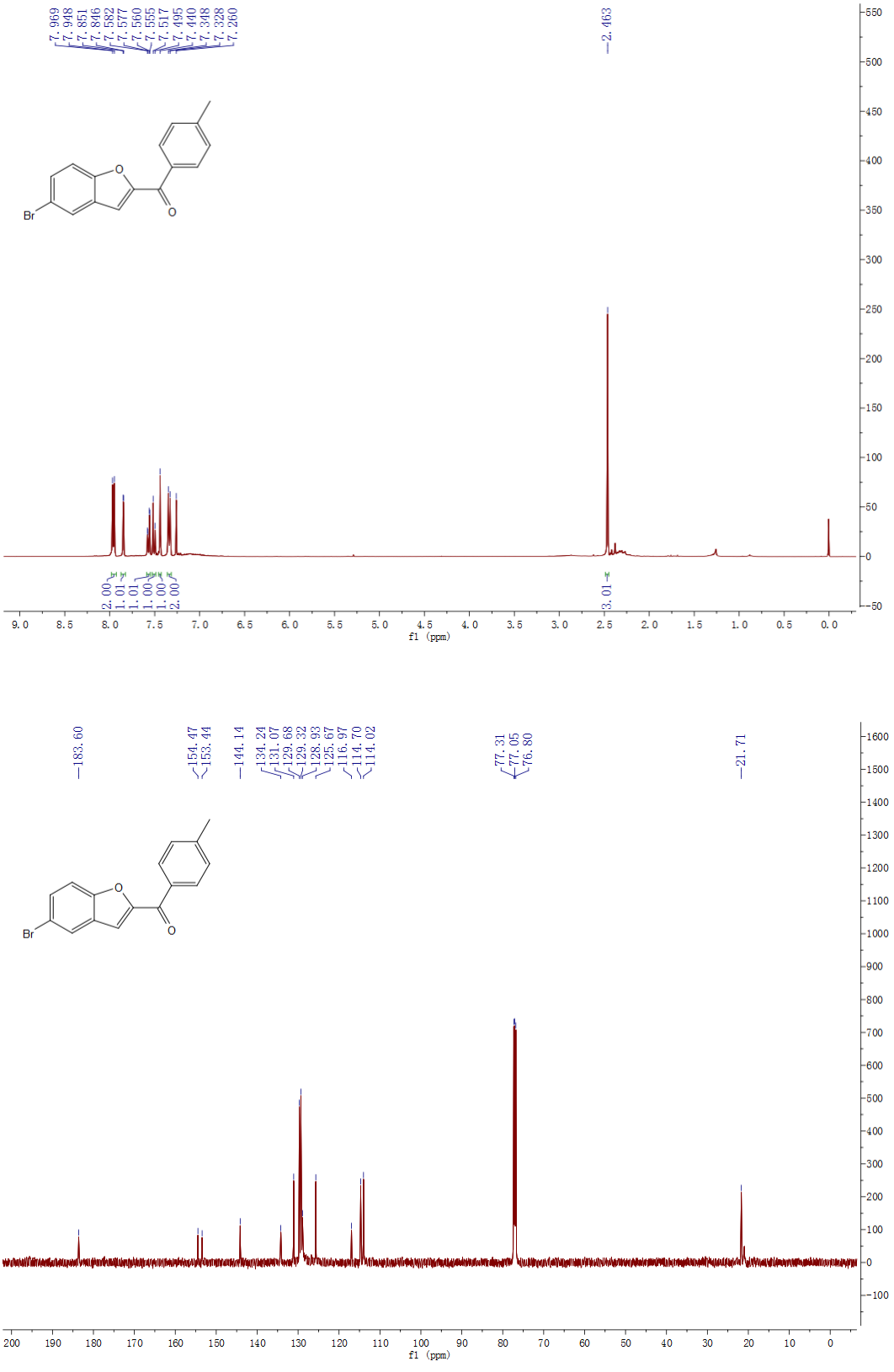


Figure S12. ^{1}H NMR of **3k** (400 MHz, $CDCl_3$) and ^{13}C NMR of **3k** (125 MHz, $CDCl_3$).

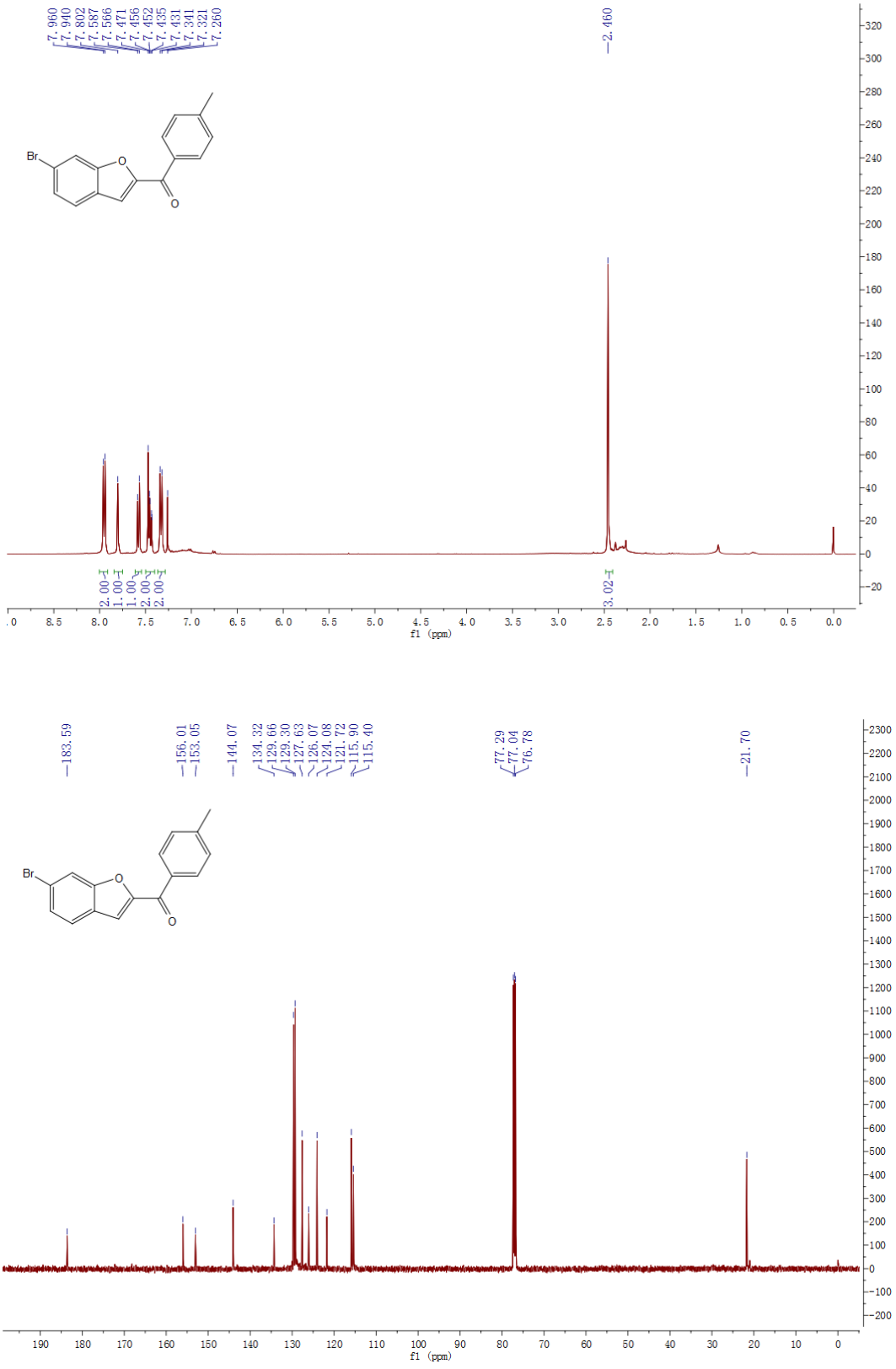


Figure S13. ^{1}H NMR of **3l** (400 MHz, $CDCl_3$) and ^{13}C NMR of **3l** (125 MHz, $CDCl_3$).

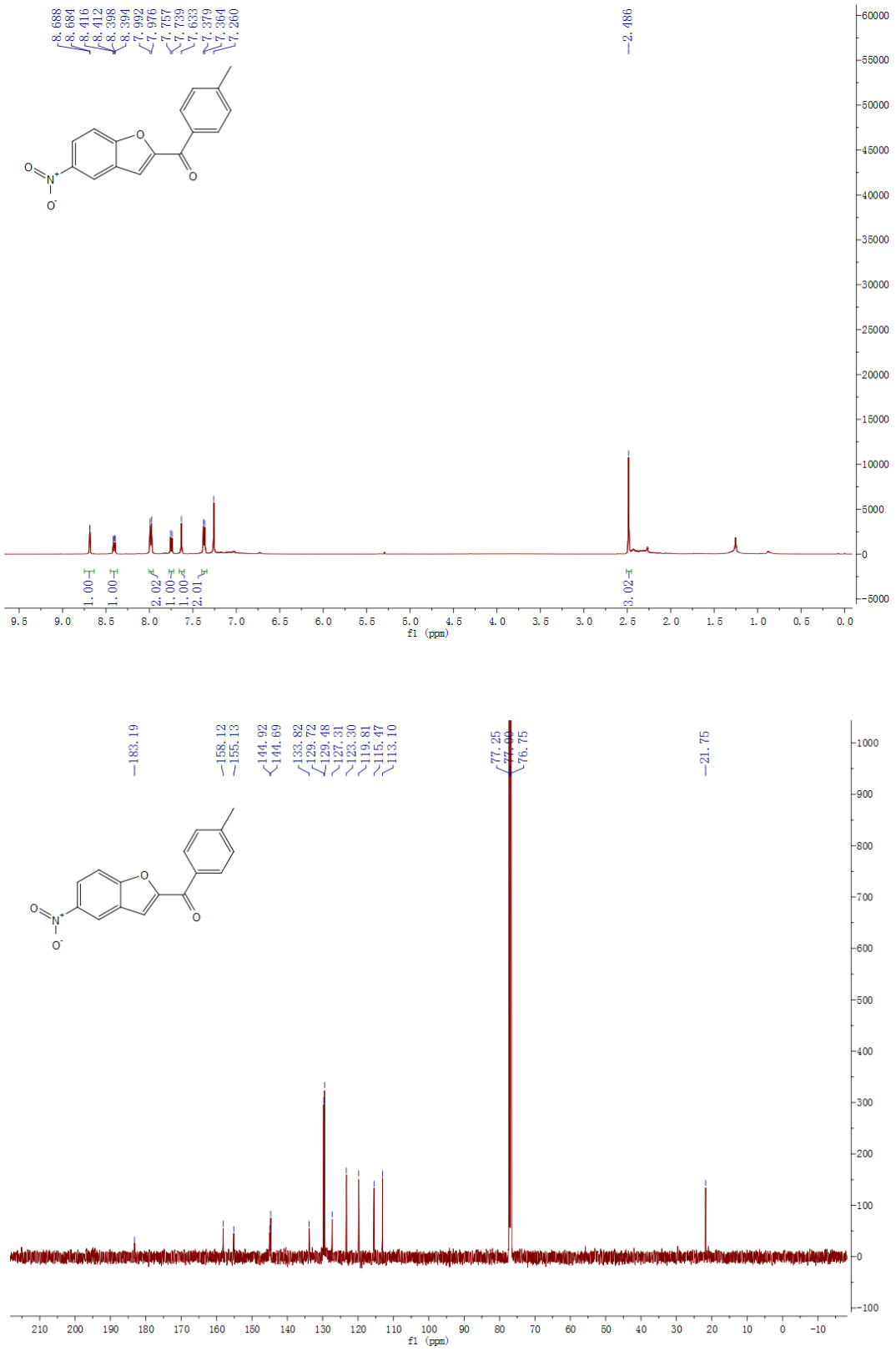


Figure S14. ^{1}H NMR of **3m** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3m** (125 MHz, $CDCl_3$).

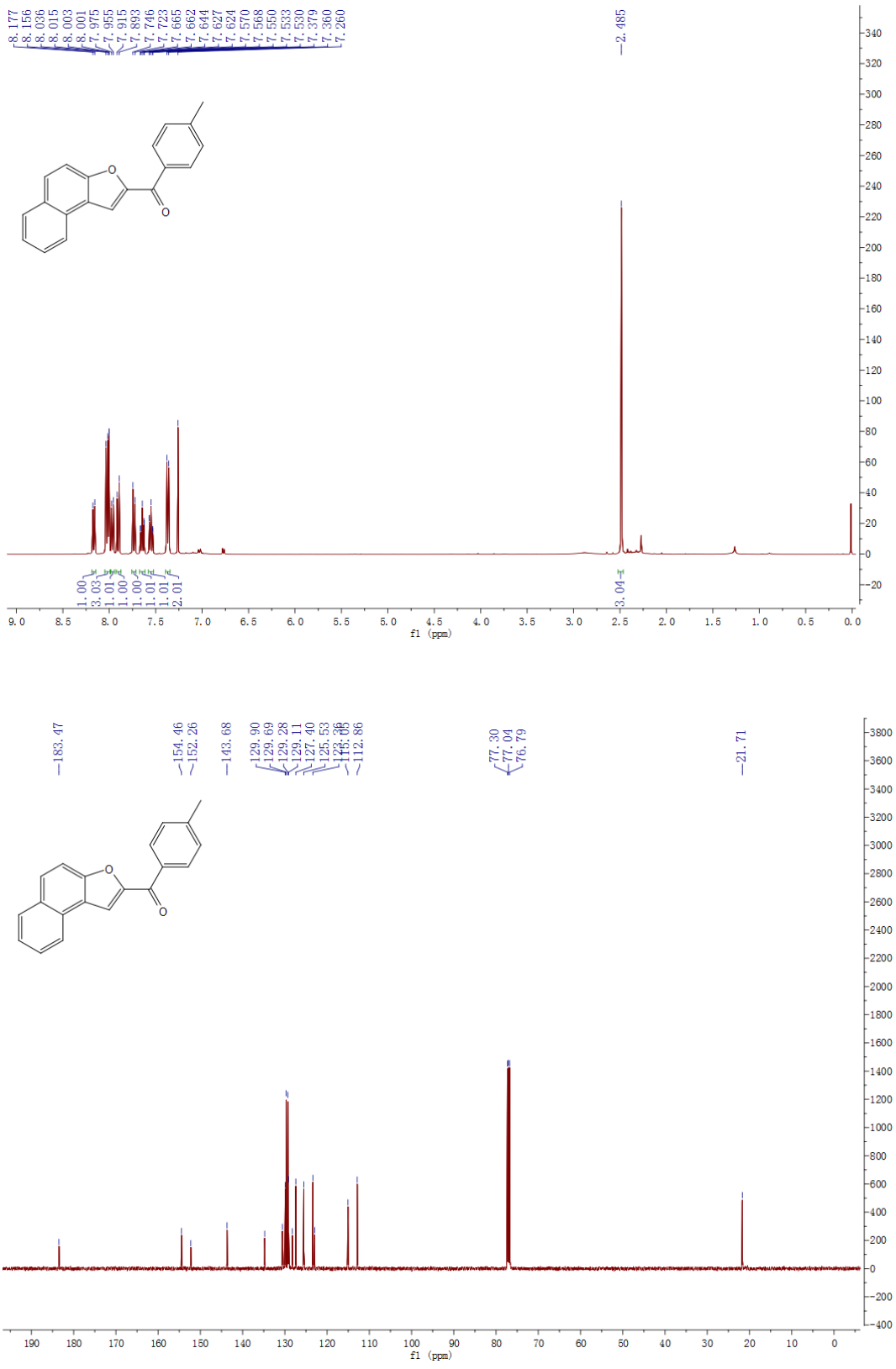


Figure S15. ^{1}H NMR of **3n** (400 MHz, $CDCl_3$) and ^{13}C NMR of **3n** (125 MHz, $CDCl_3$).

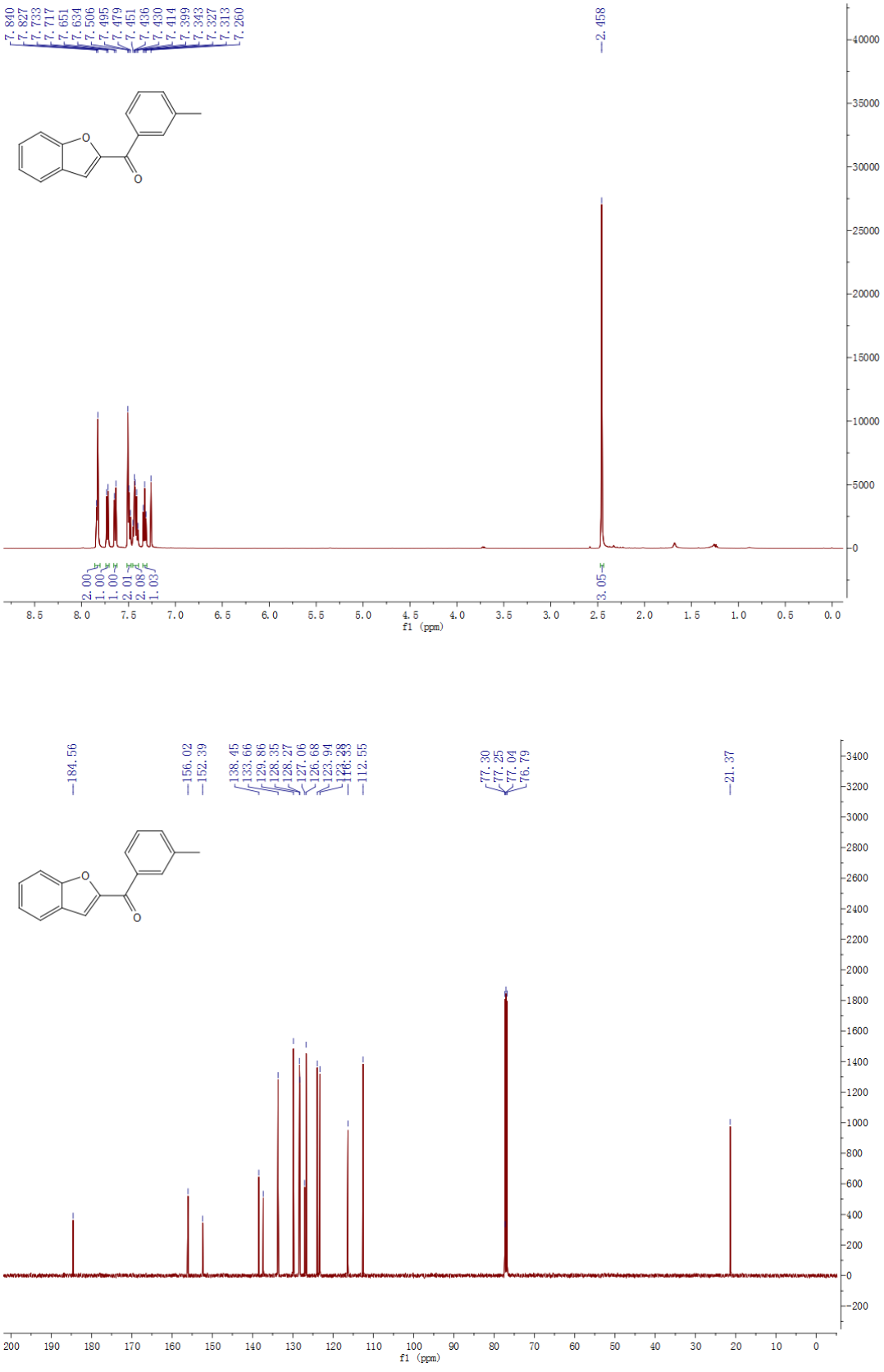


Figure S16. ^{1}H NMR of **3o** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3o** (125 MHz, $CDCl_3$).

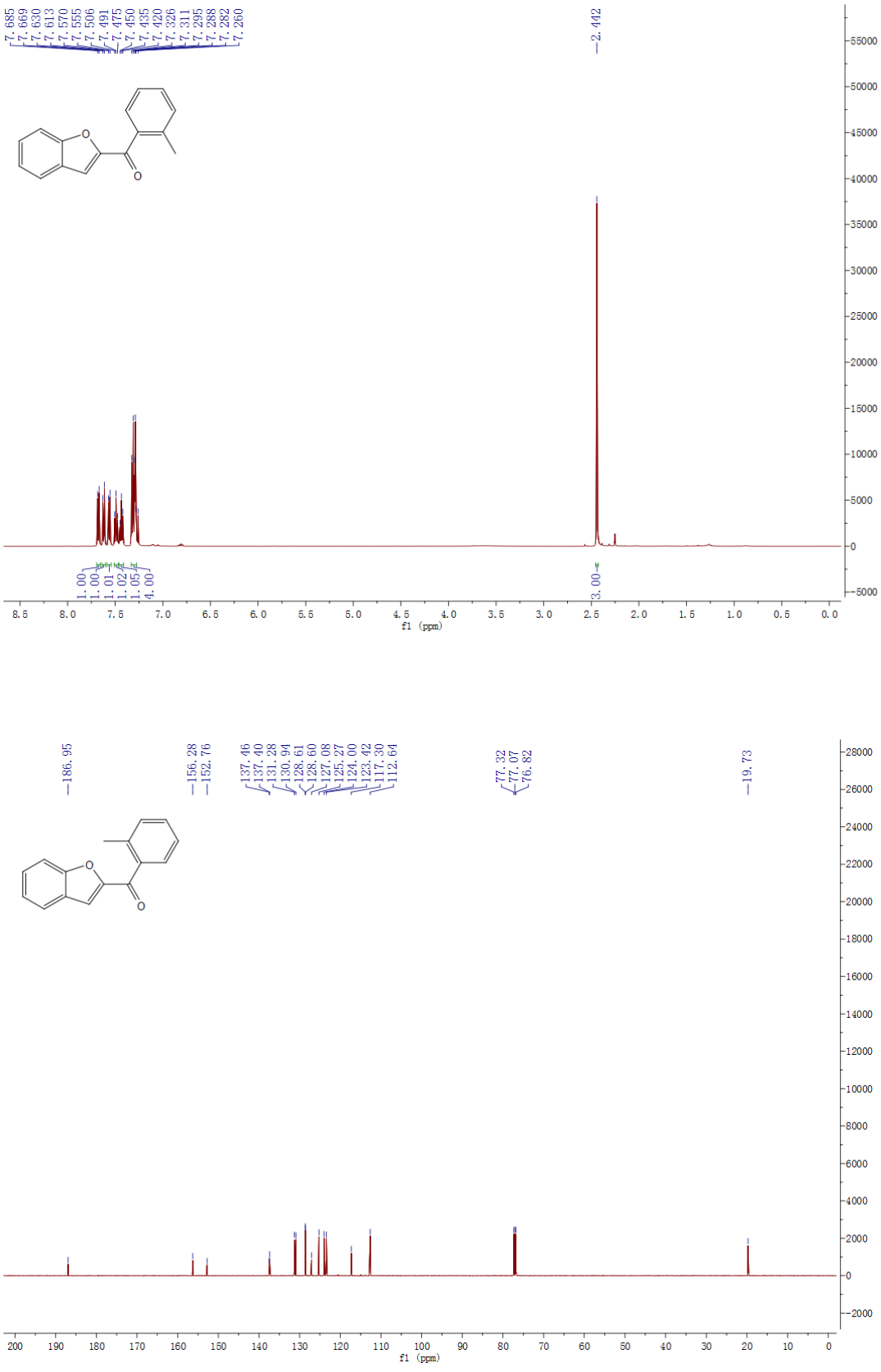


Figure S17. ^{1}H NMR of **3p** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3p** (125 MHz, $CDCl_3$).

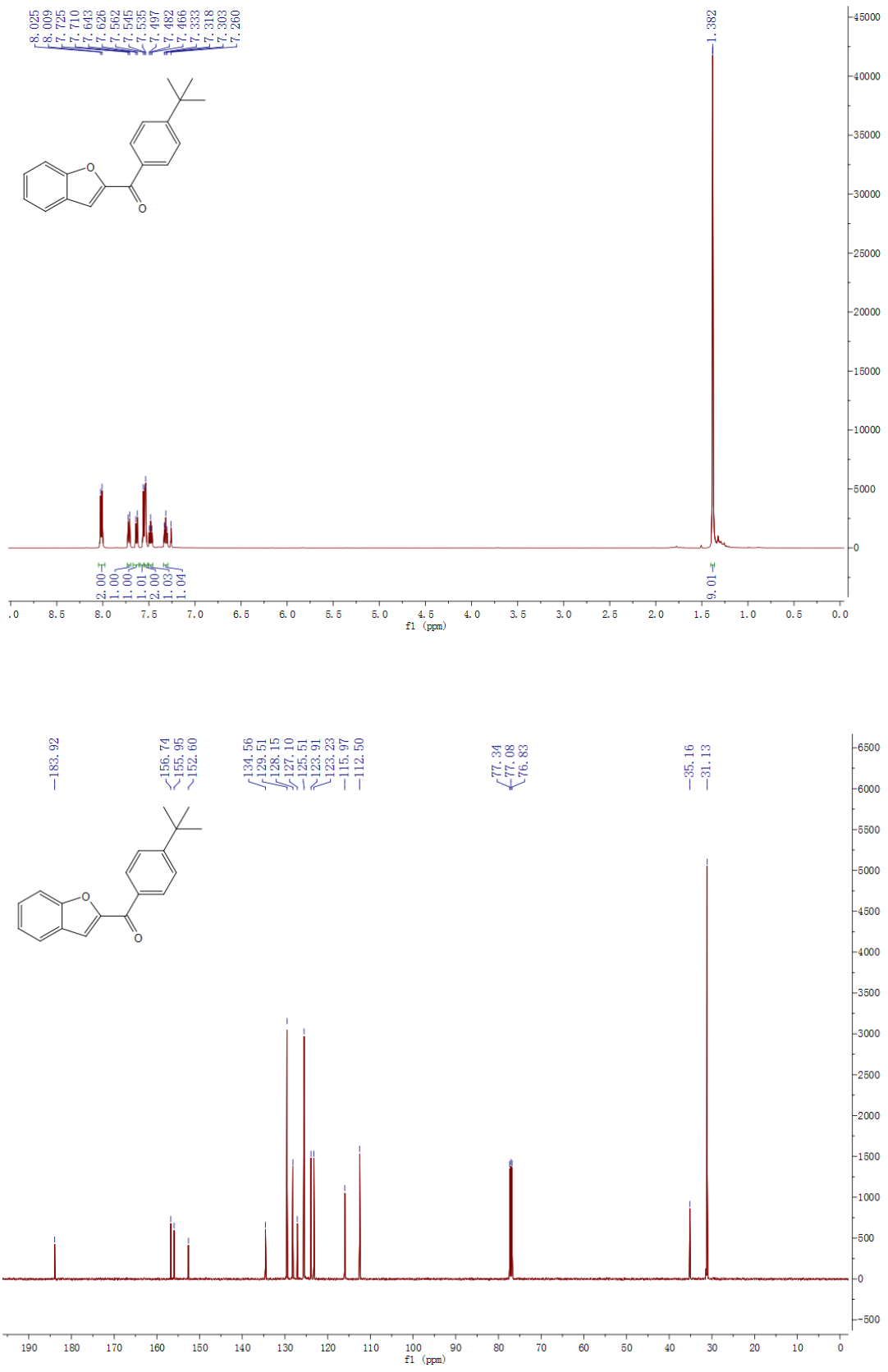


Figure S18. ^{1}H NMR of **3q** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3q** (125 MHz, $CDCl_3$).

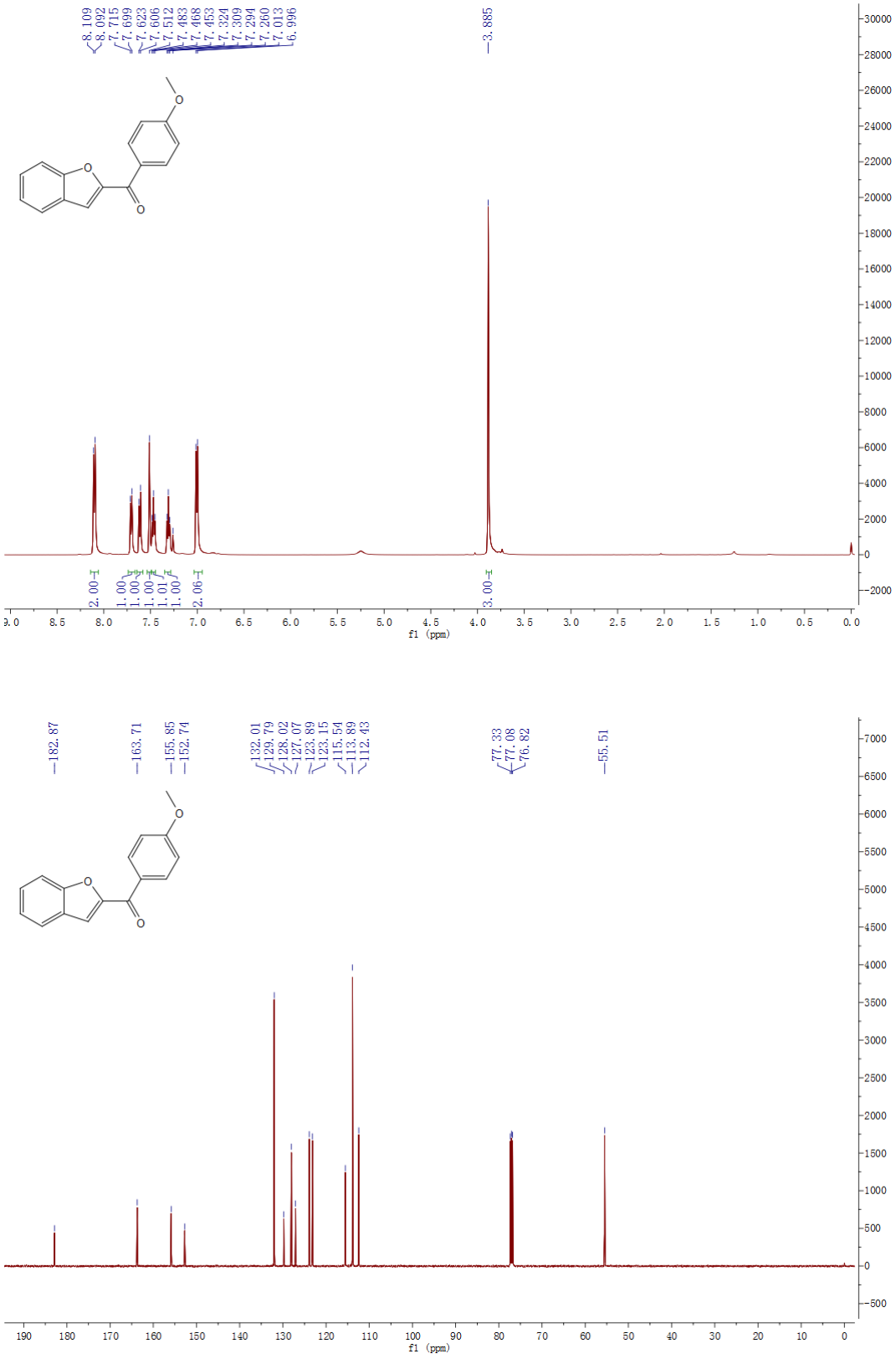
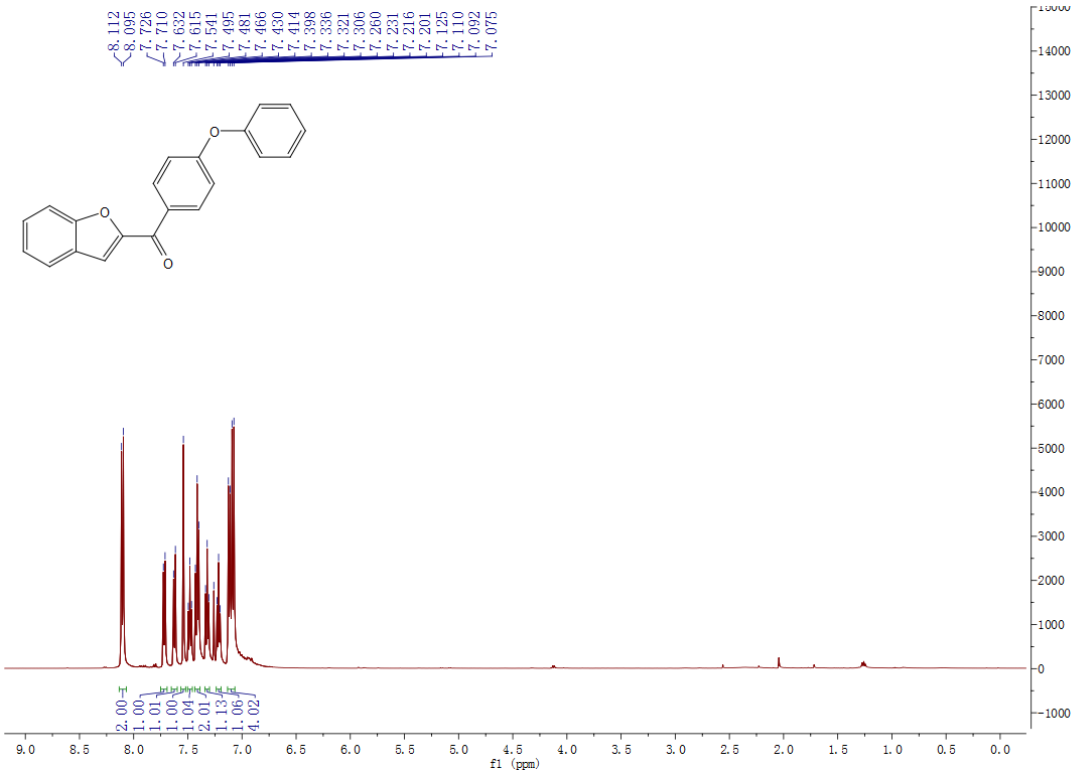


Figure S19. ^{1}H NMR of **3r** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3r** (125 MHz, $CDCl_3$).



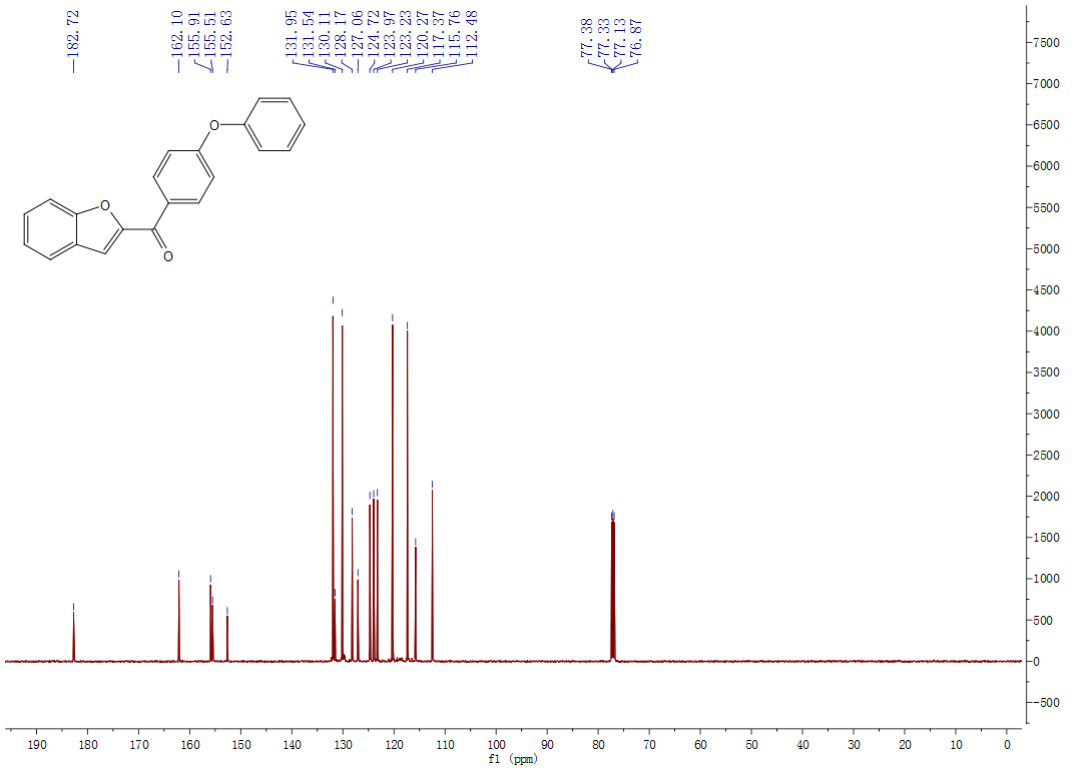
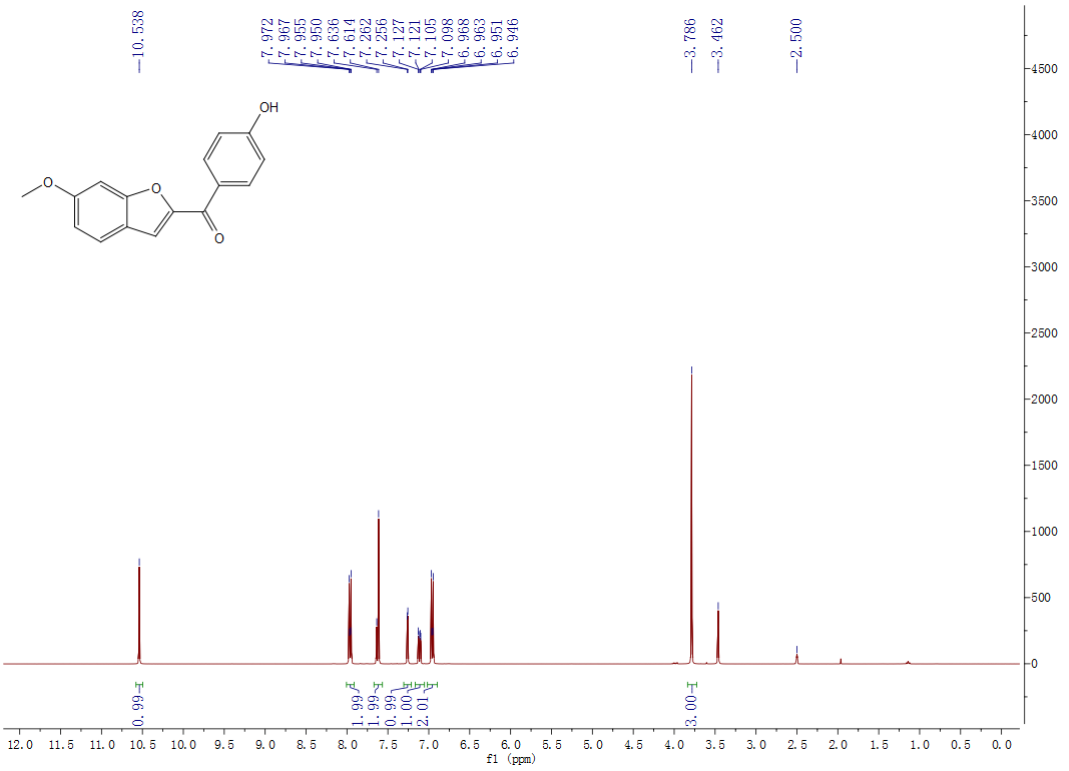


Figure S20. ^{1}H NMR of **3s** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3s** (125 MHz, $CDCl_3$).



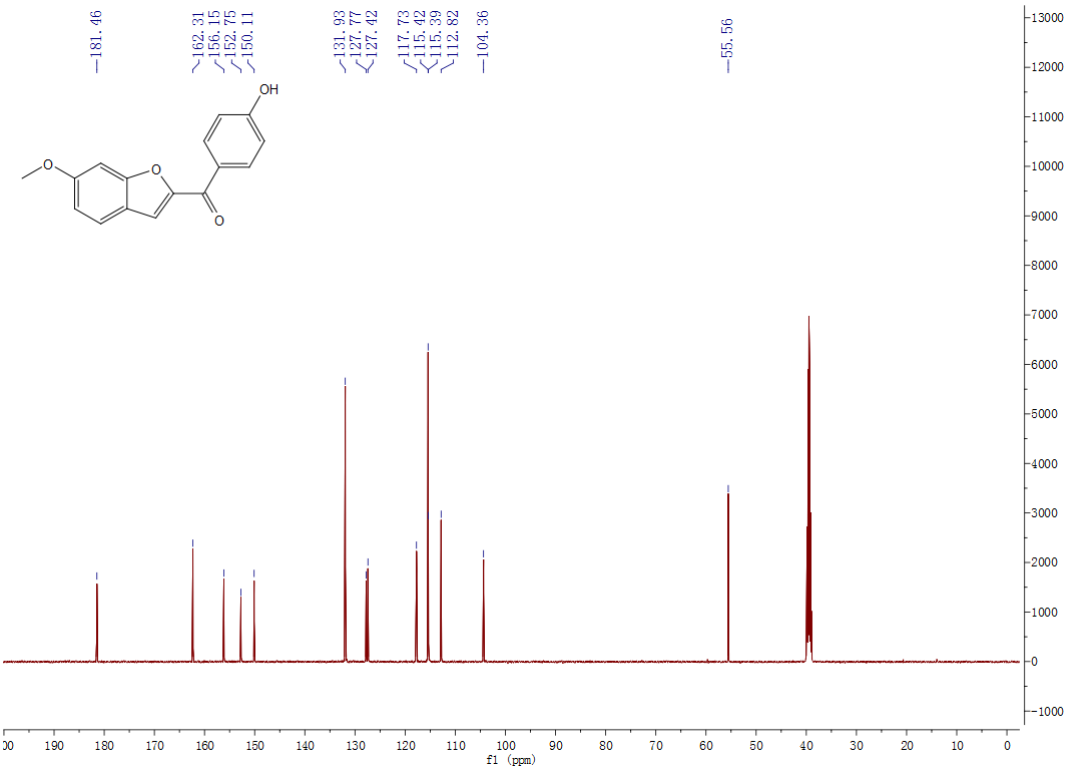


Figure S21. ^{1}H NMR of **3t** (500 MHz, DMSO-d_6) and ^{13}C NMR of **3t** (125 MHz, DMSO-d_6).

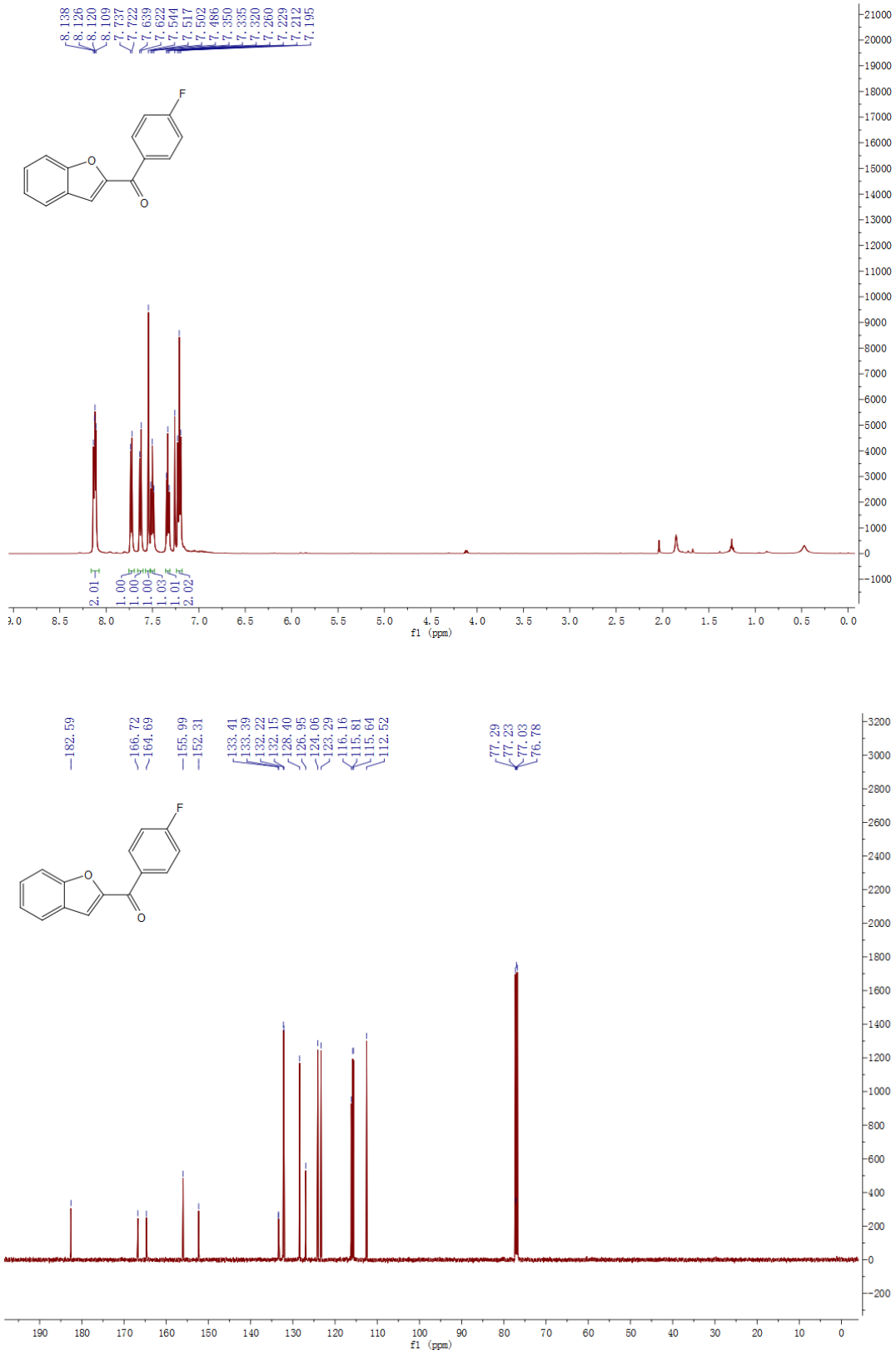


Figure S22. ^{1}H NMR of **3u** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3u** (125 MHz, $CDCl_3$).

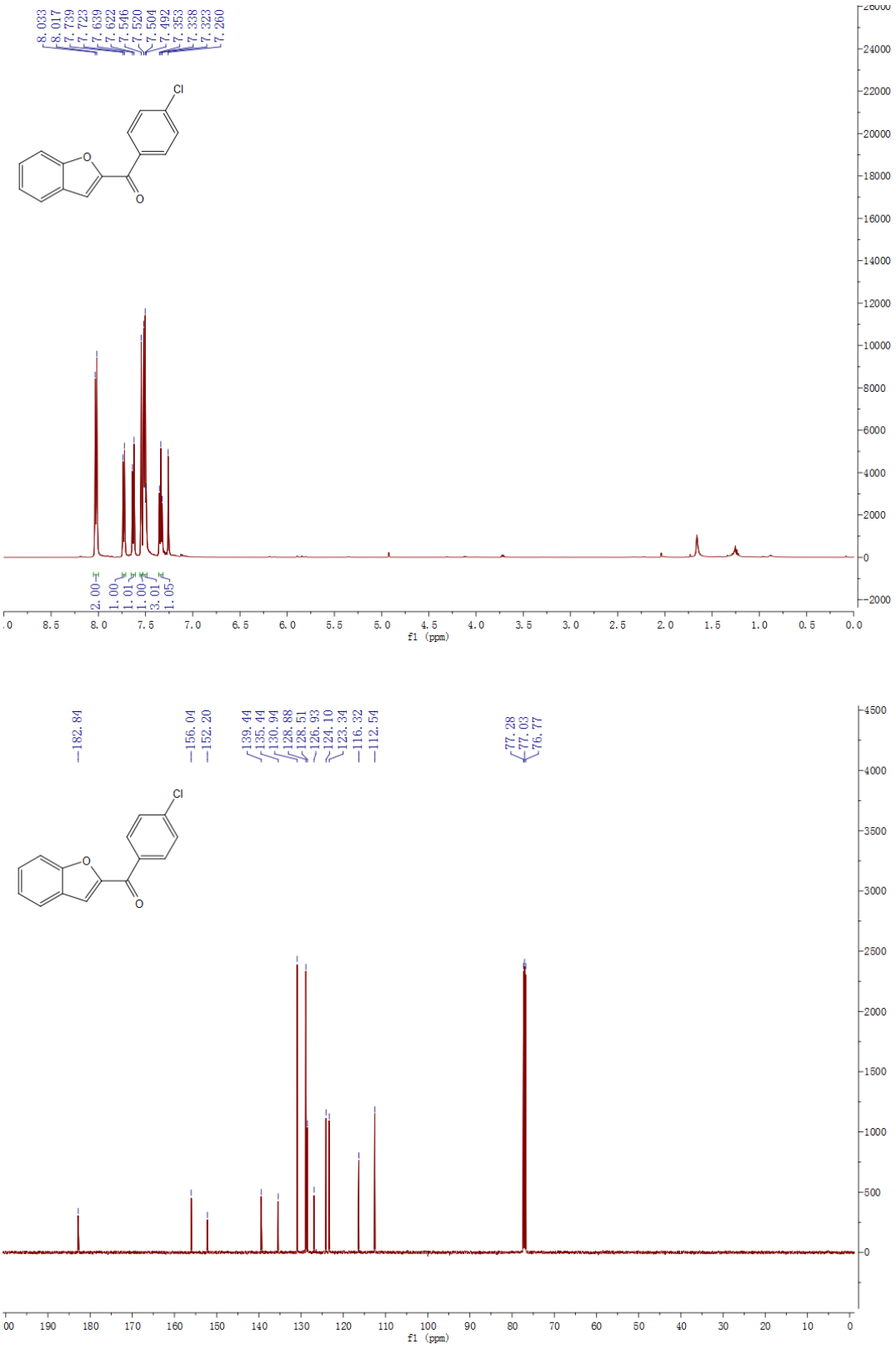


Figure S23. ^{1}H NMR of **3v** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3v** (125 MHz, $CDCl_3$).

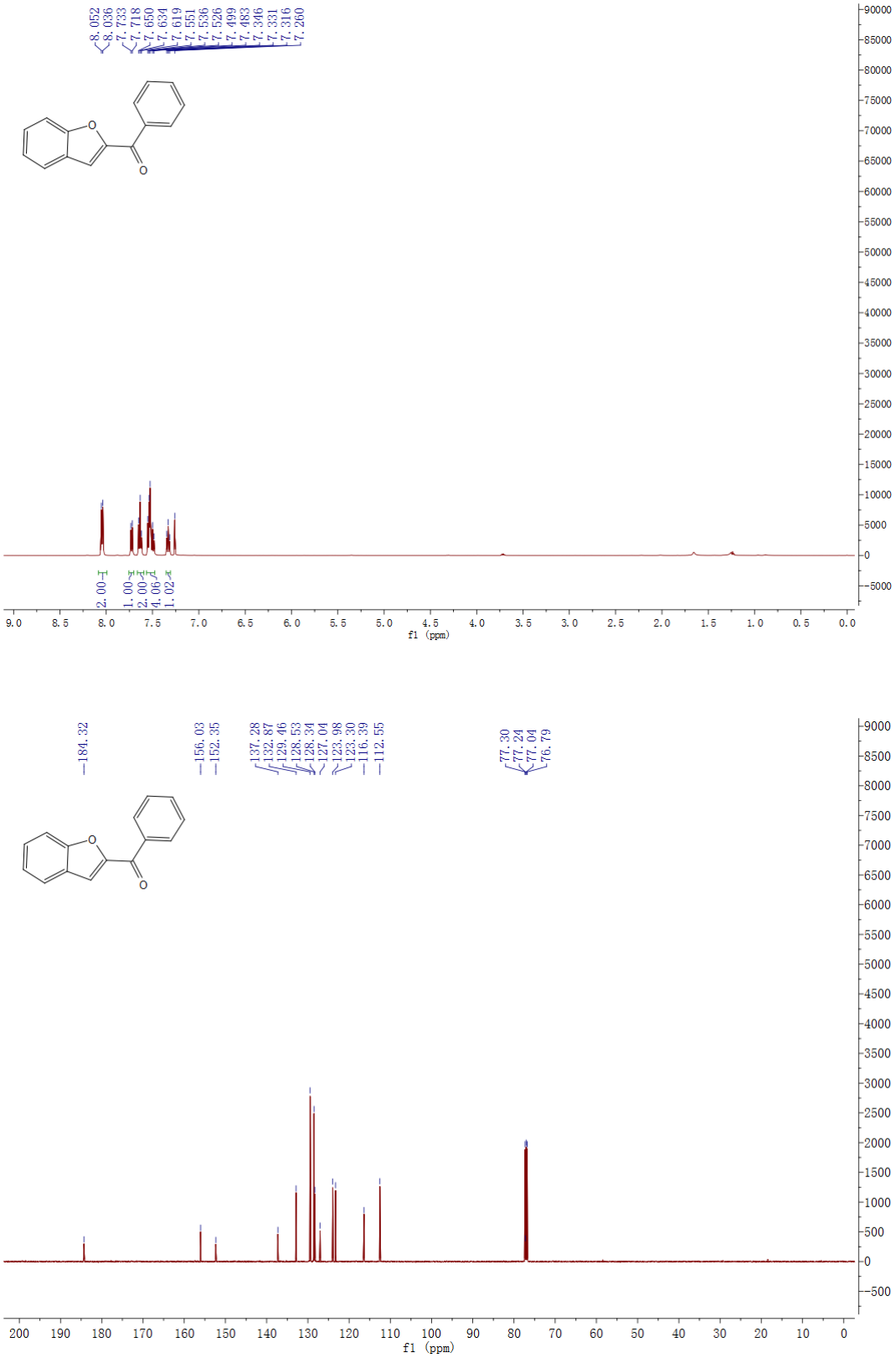


Figure S24. ^{1}H NMR of **3w** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3w** (125 MHz, $CDCl_3$).

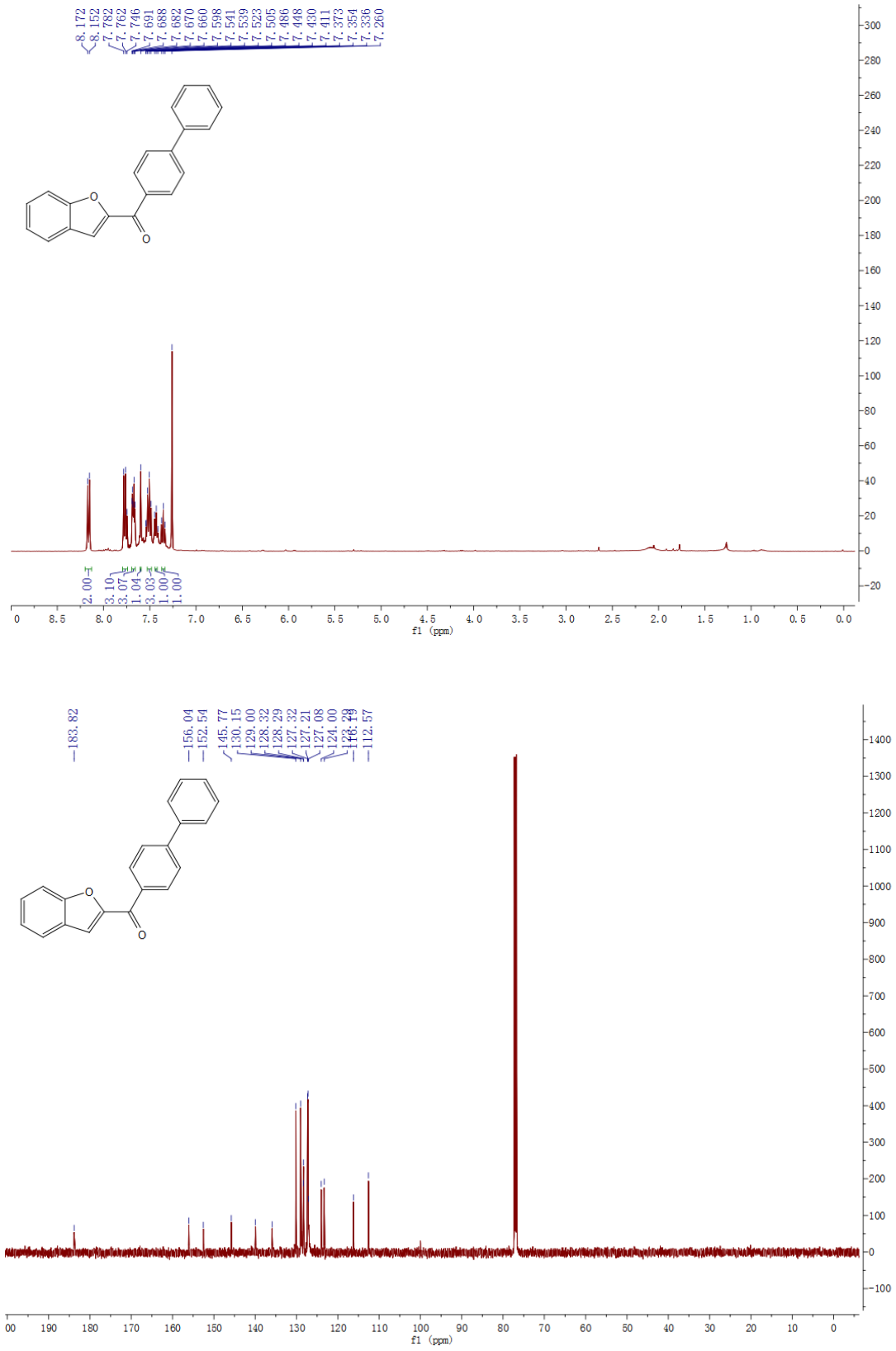


Figure S25. ^{1}H NMR of **3x** (400 MHz, $CDCl_3$) and ^{13}C NMR of **3x** (125 MHz, $CDCl_3$).

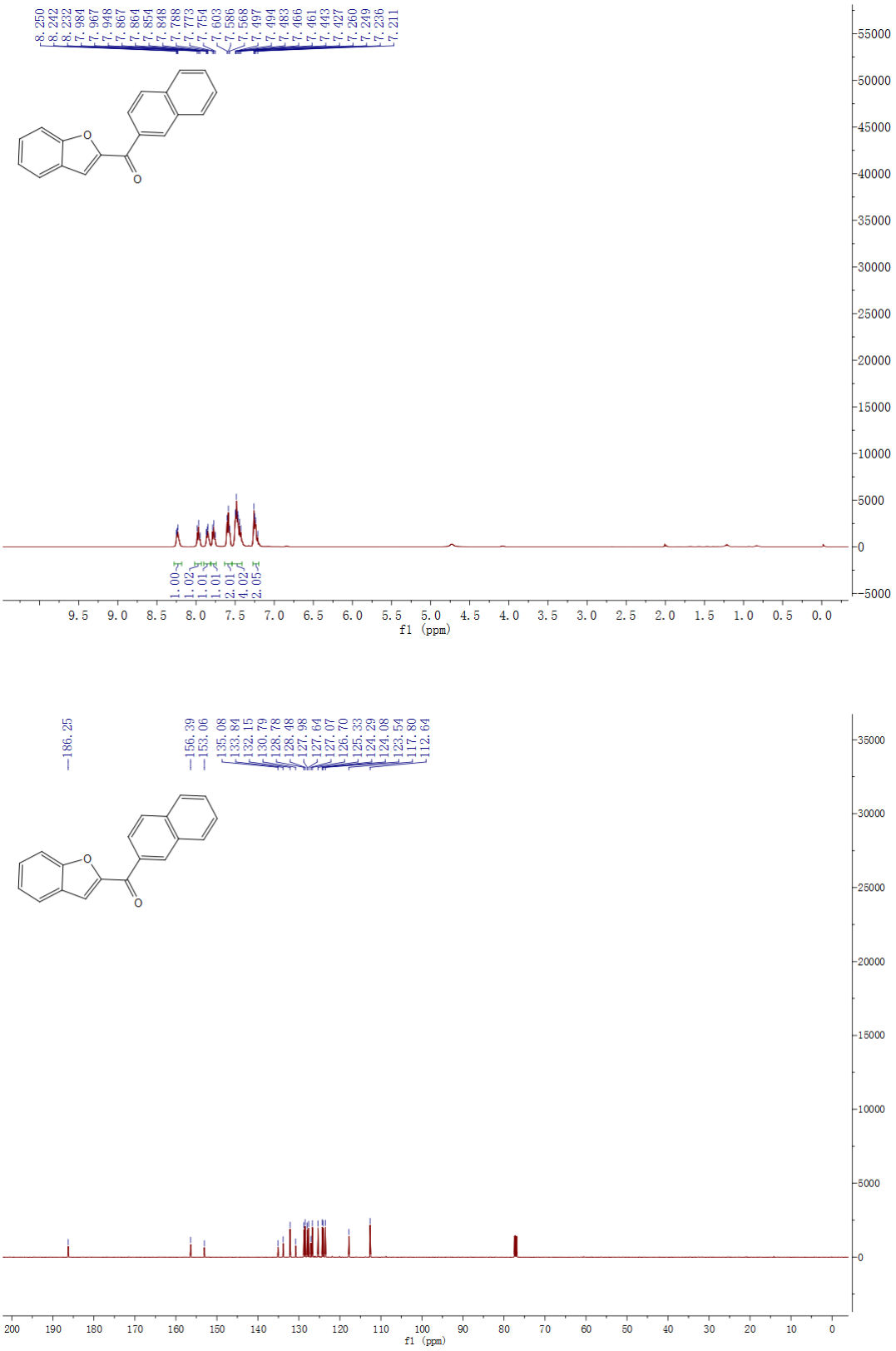


Figure S26. ^{1}H NMR of **3y** (500 MHz, $CDCl_3$) and ^{13}C NMR of **3y** (125 MHz, $CDCl_3$).

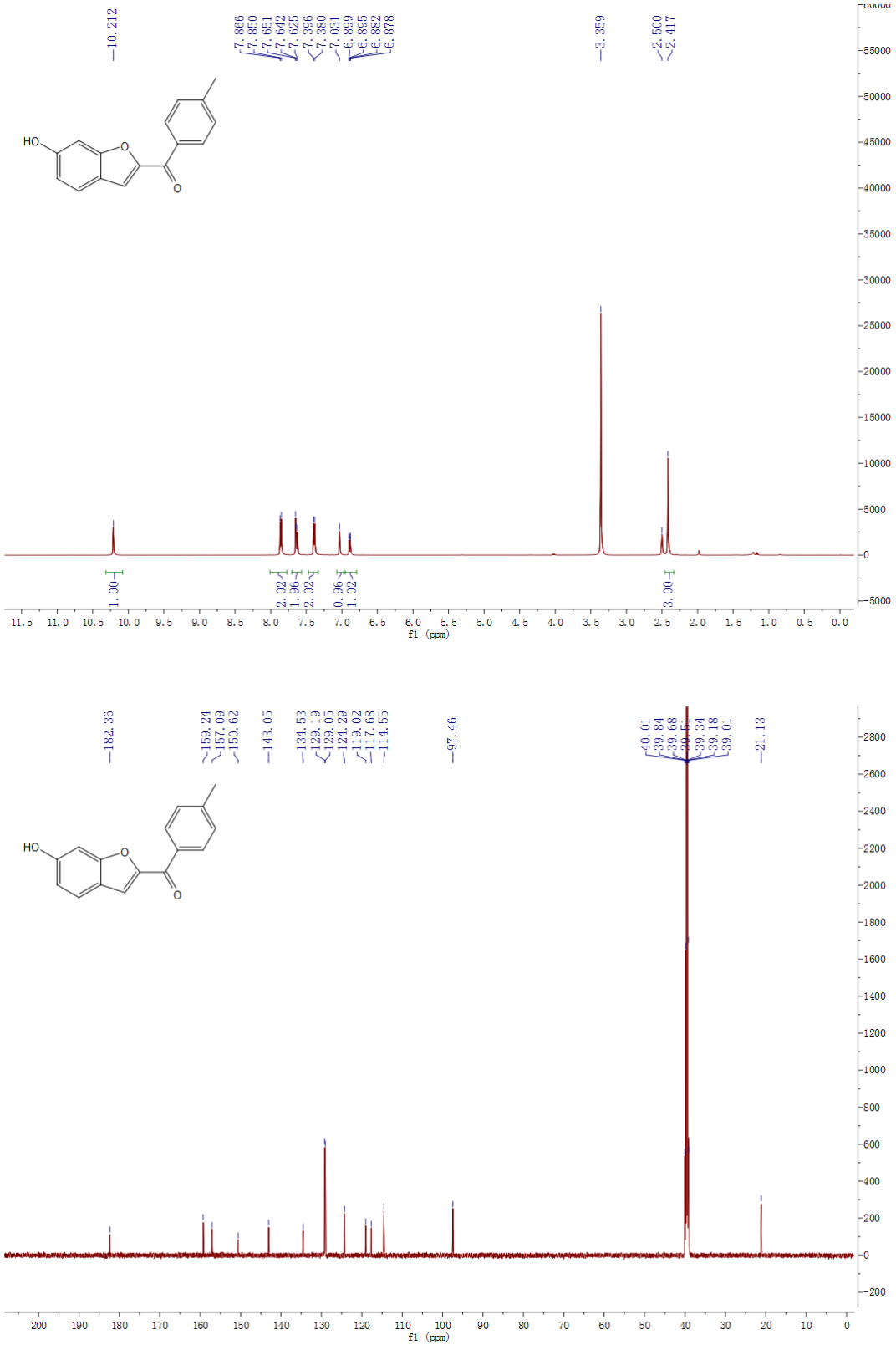


Figure S27. ^{1}H NMR of **3z** (500 MHz, DMSO-d_6) and ^{13}C NMR of **3z** (125 MHz, DMSO-d_6).

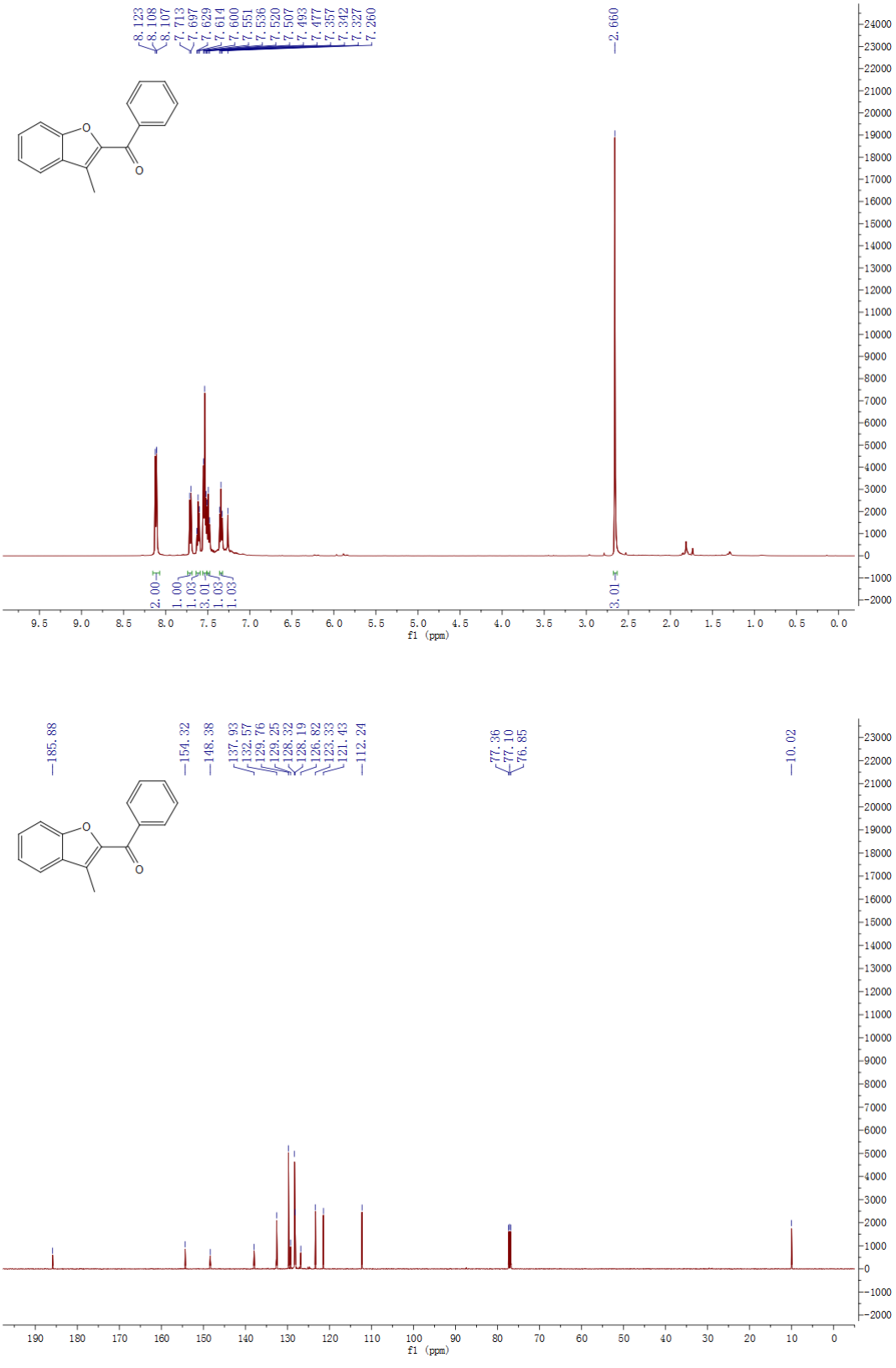


Figure S28. ^{1}H NMR of **4a** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4a** (125 MHz, $CDCl_3$).

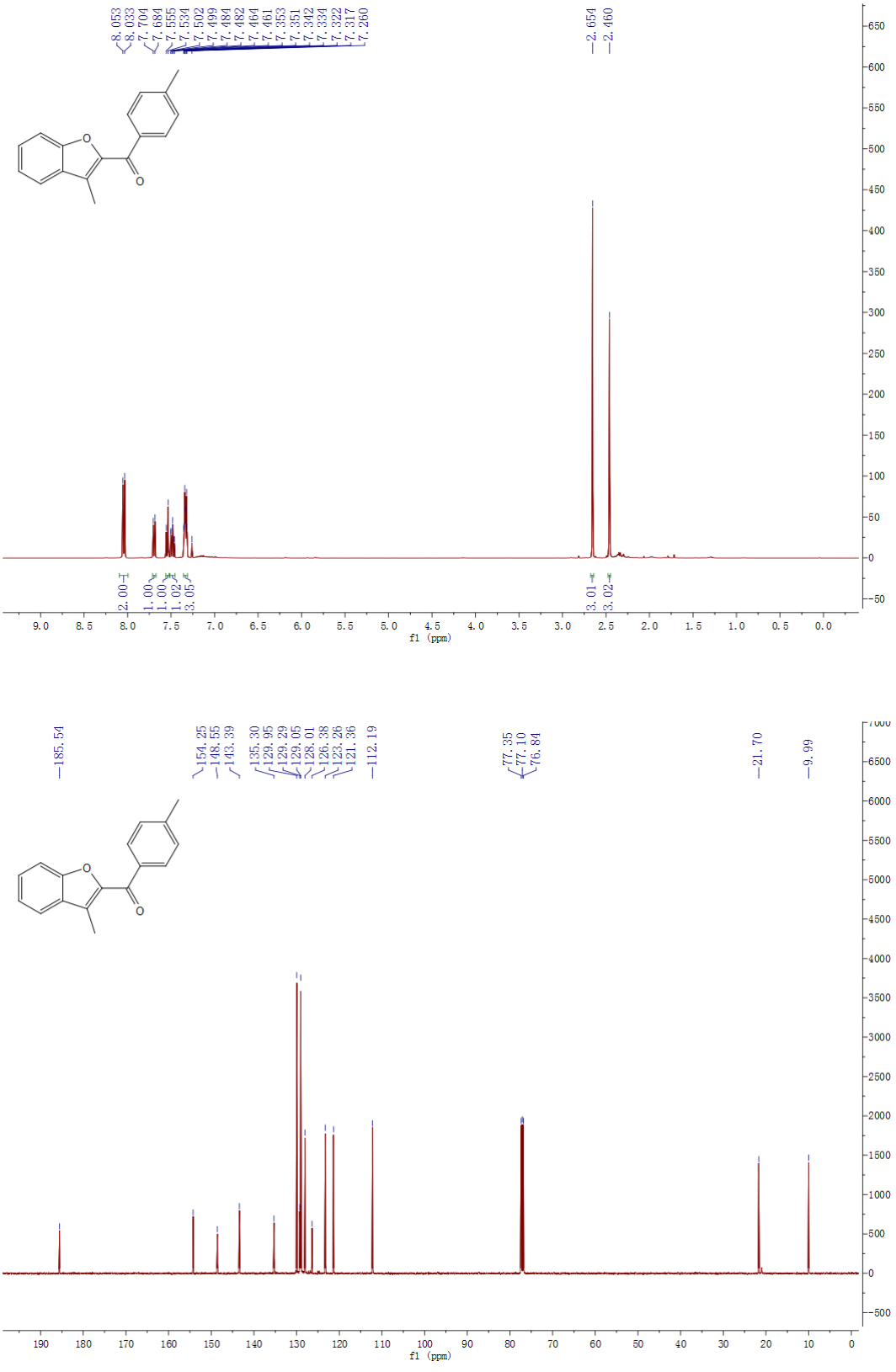


Figure S29. ^{1}H NMR of **4b** (400 MHz, $CDCl_3$) and ^{13}C NMR of **4b** (125 MHz, $CDCl_3$).

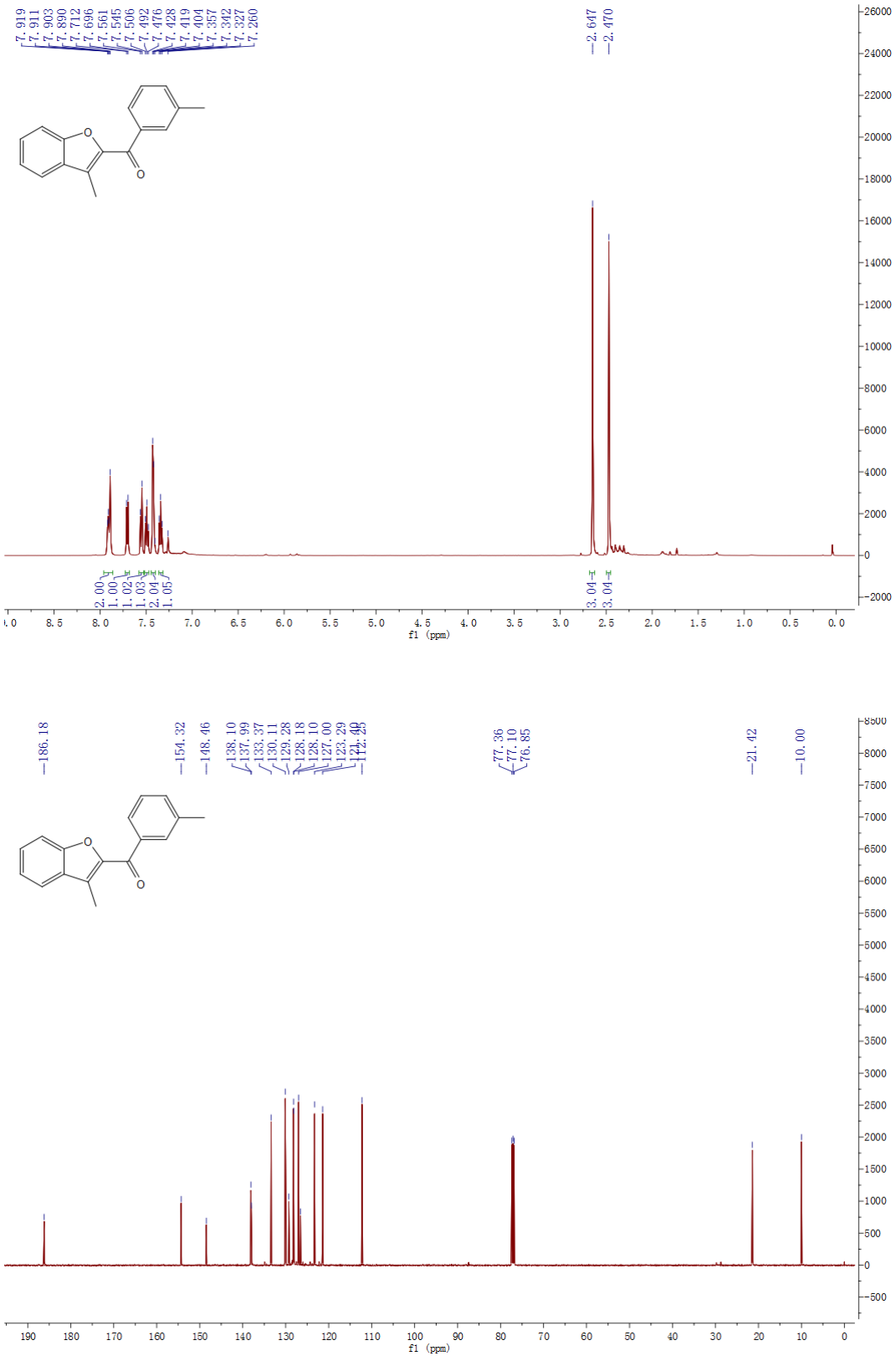


Figure S30. ^{1}H NMR of **4c** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4c** (125 MHz, $CDCl_3$).

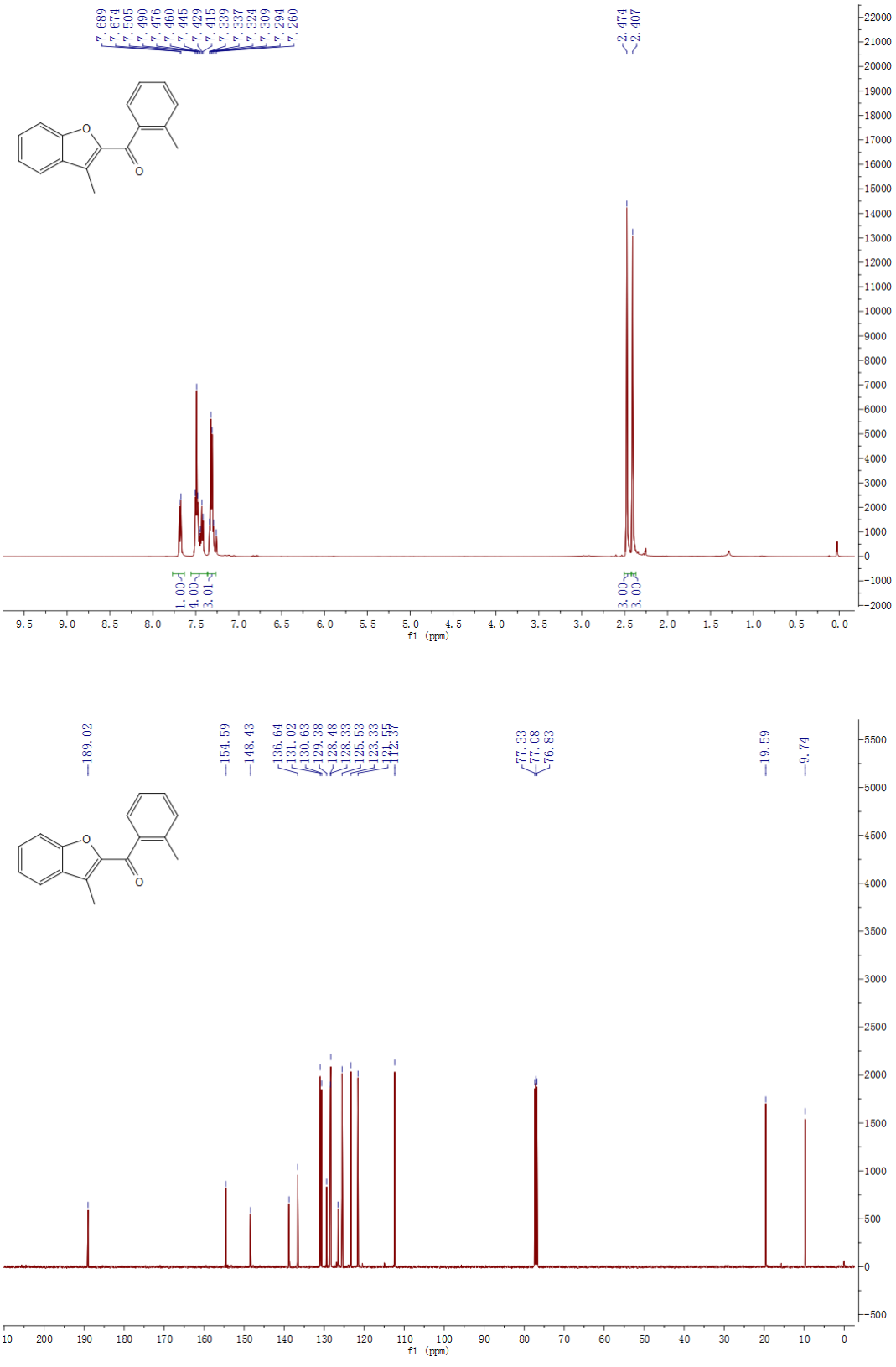


Figure S31. ^{1}H NMR of **4d** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4d** (125 MHz, $CDCl_3$).

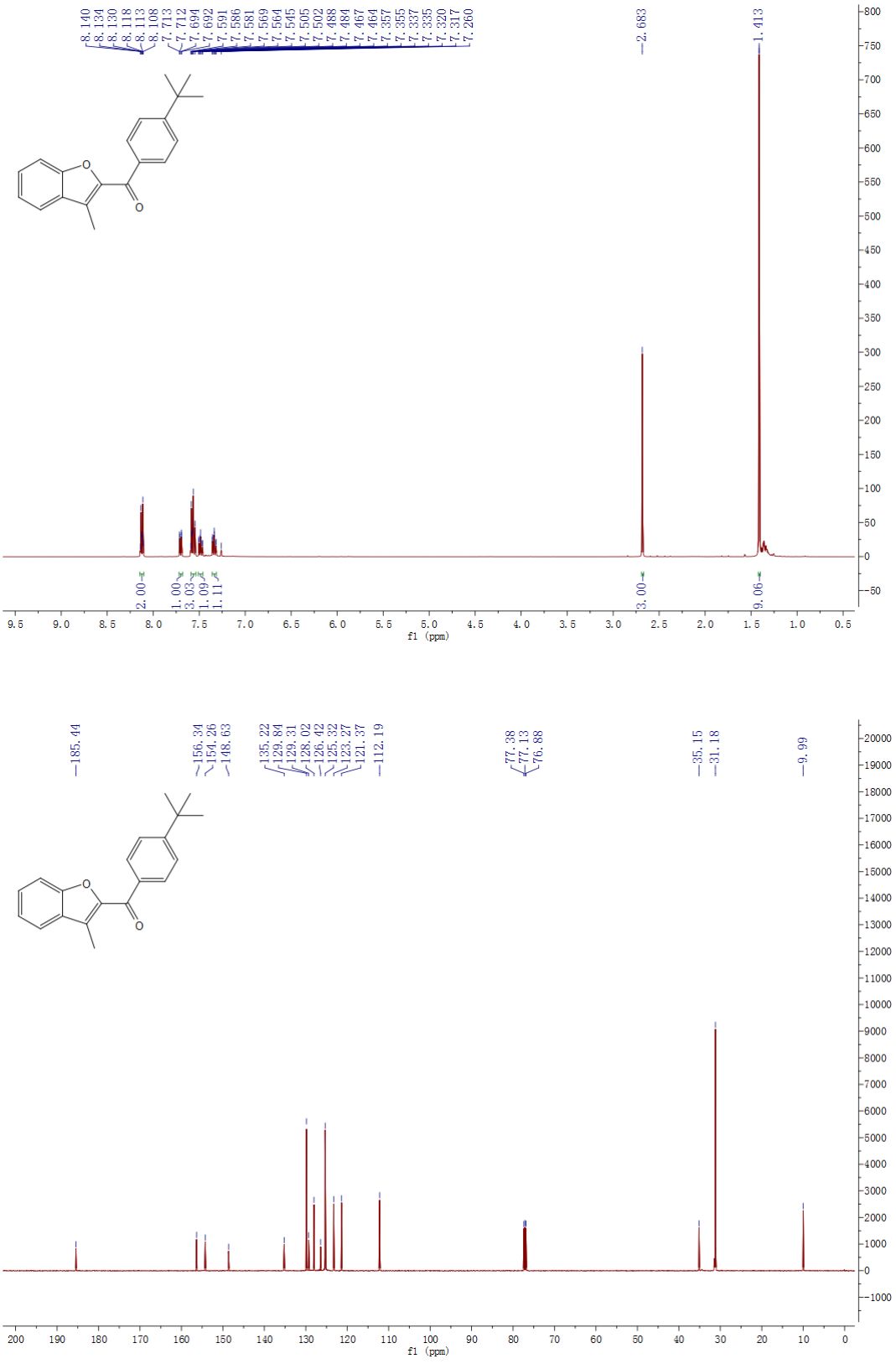


Figure S32. ^{1}H NMR of **4e** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4e** (125 MHz, $CDCl_3$).

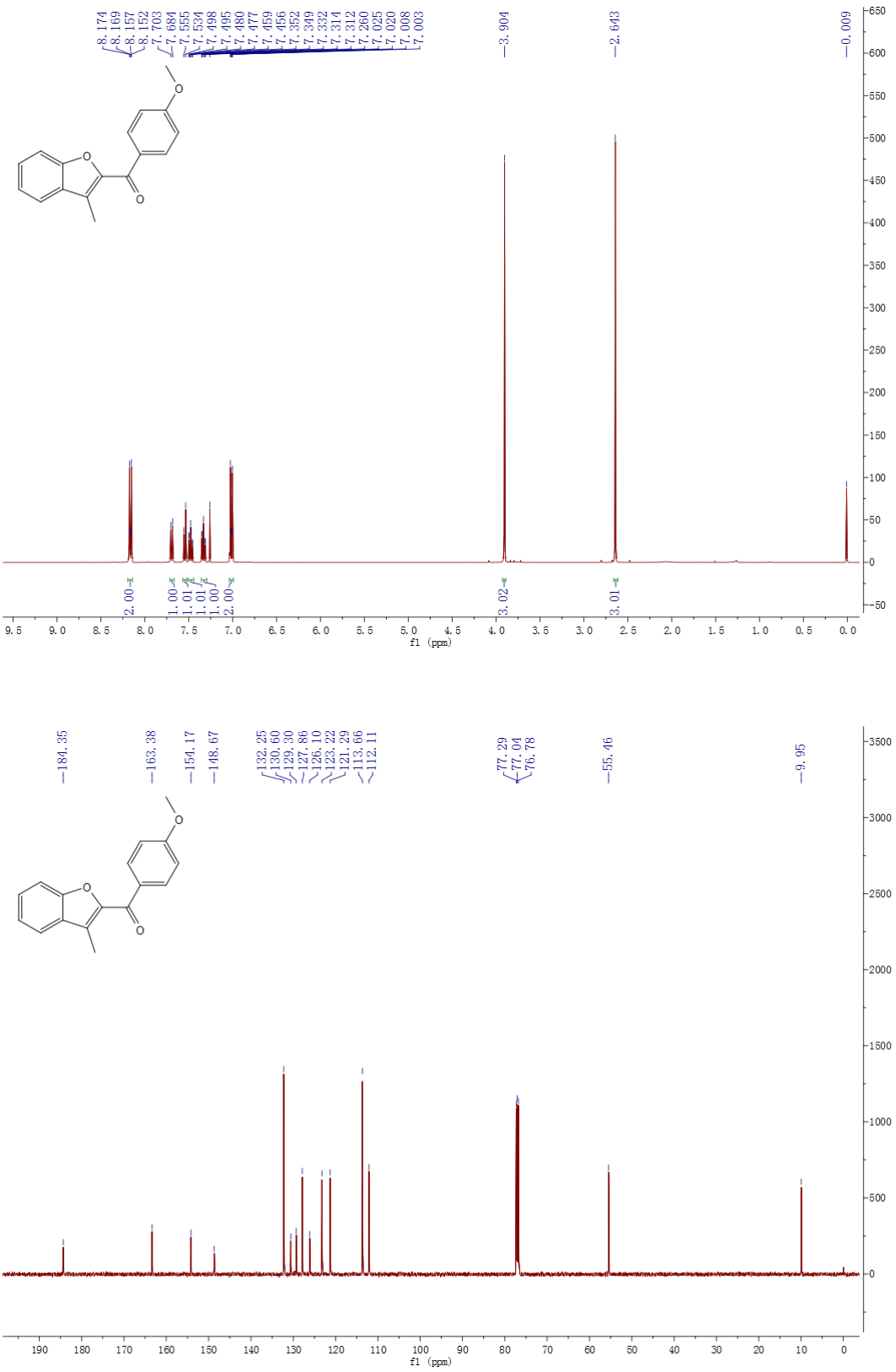


Figure S33. ^{1}H NMR of **4f** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4f** (125 MHz, $CDCl_3$).

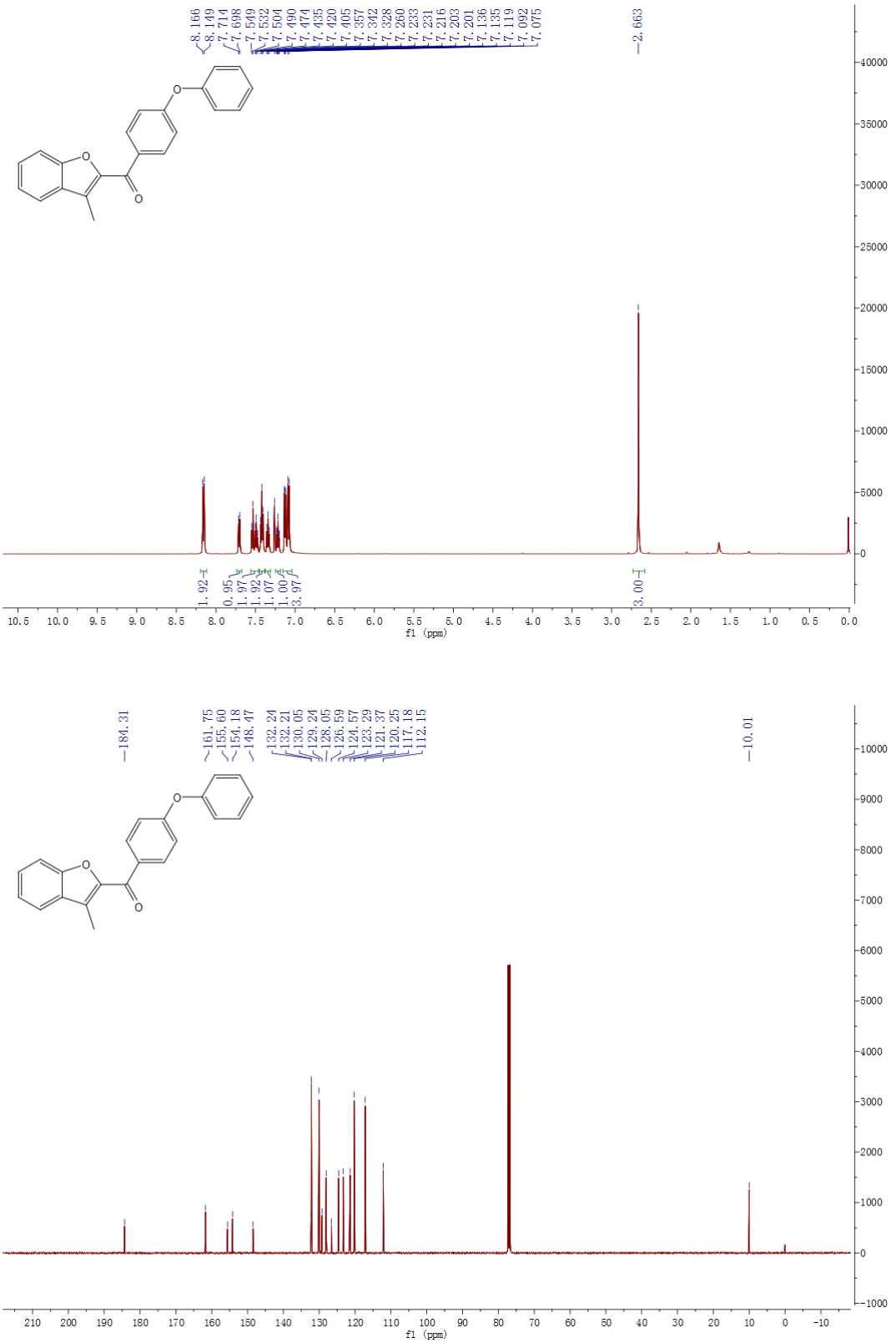


Figure S34. ^{1}H NMR of **4g** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4g** (125 MHz, $CDCl_3$).

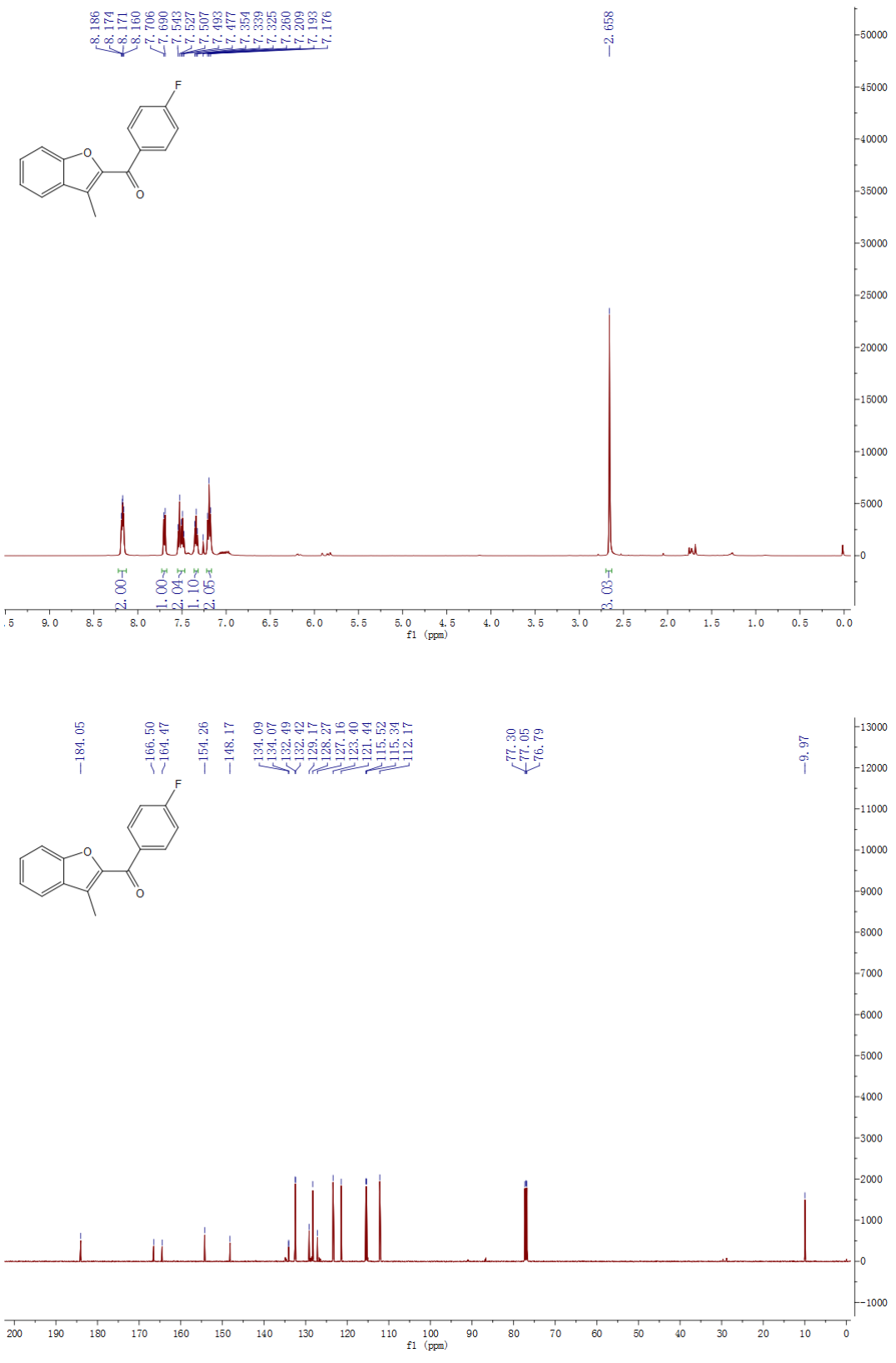


Figure S35. ^{1}H NMR of **4h** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4h** (125 MHz, $CDCl_3$).

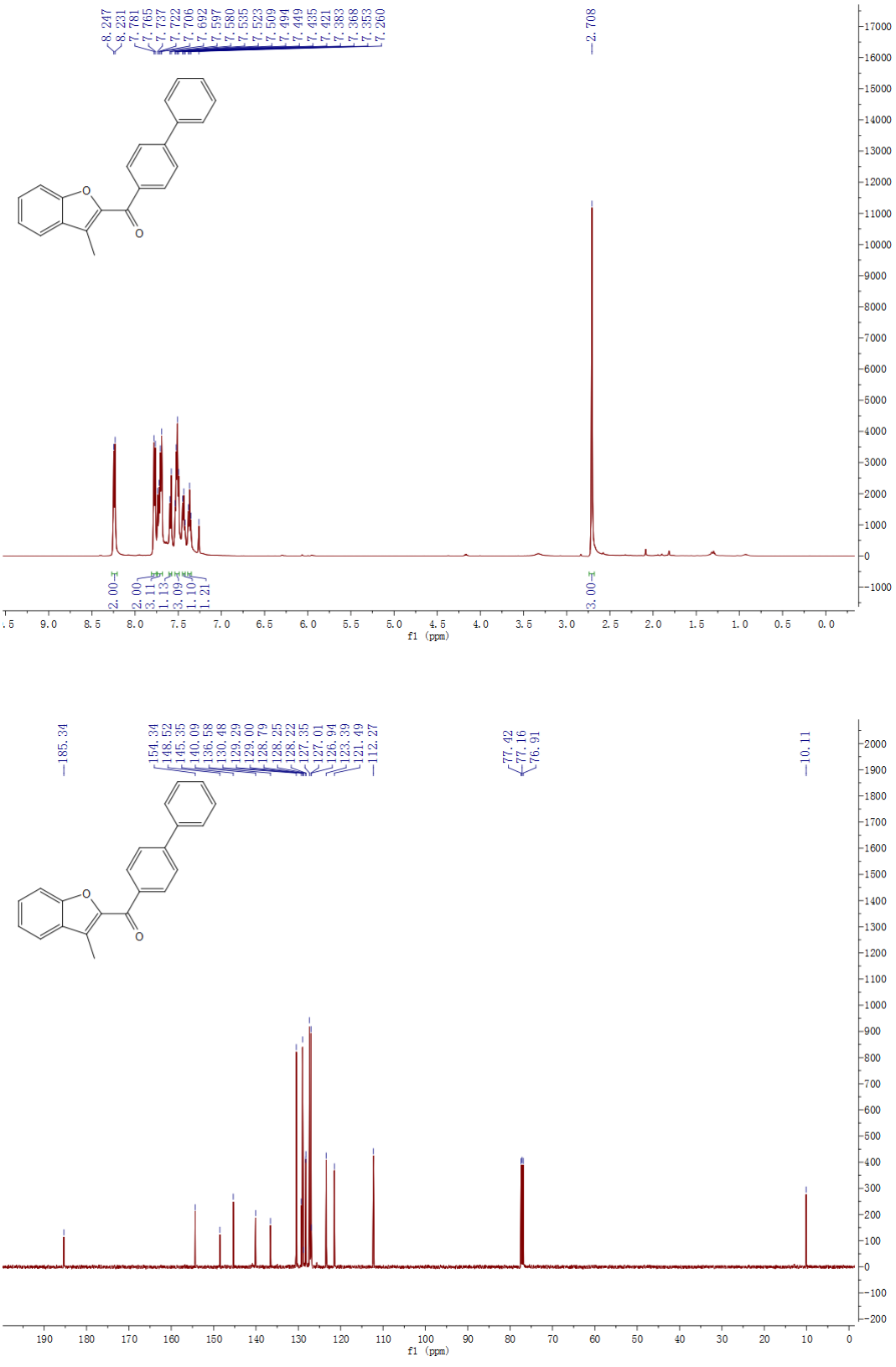


Figure S36. ^{1}H NMR of **4i** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4i** (125 MHz, $CDCl_3$).

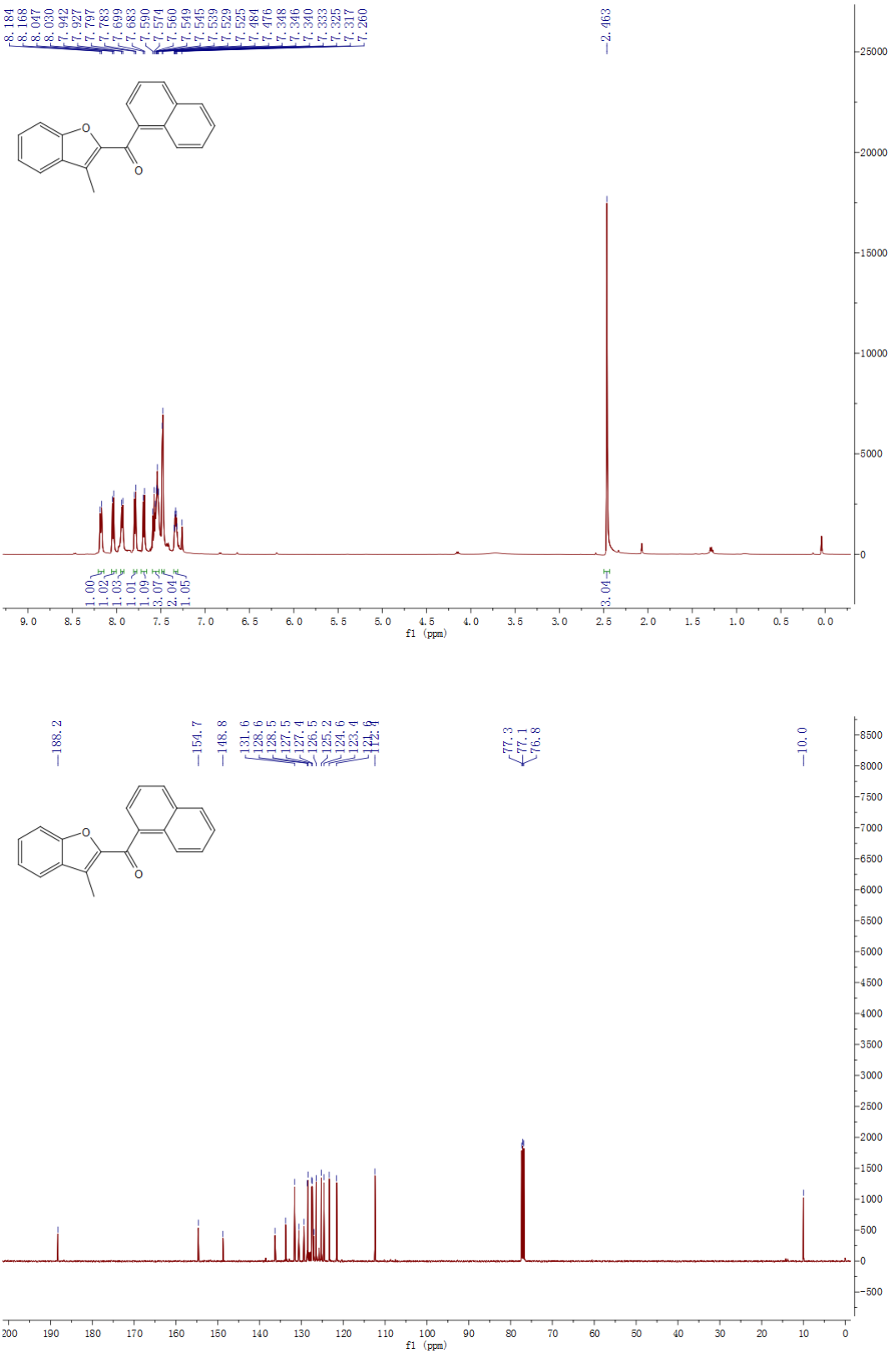


Figure S37. ^{1}H NMR of **4j** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4j** (125 MHz, $CDCl_3$).

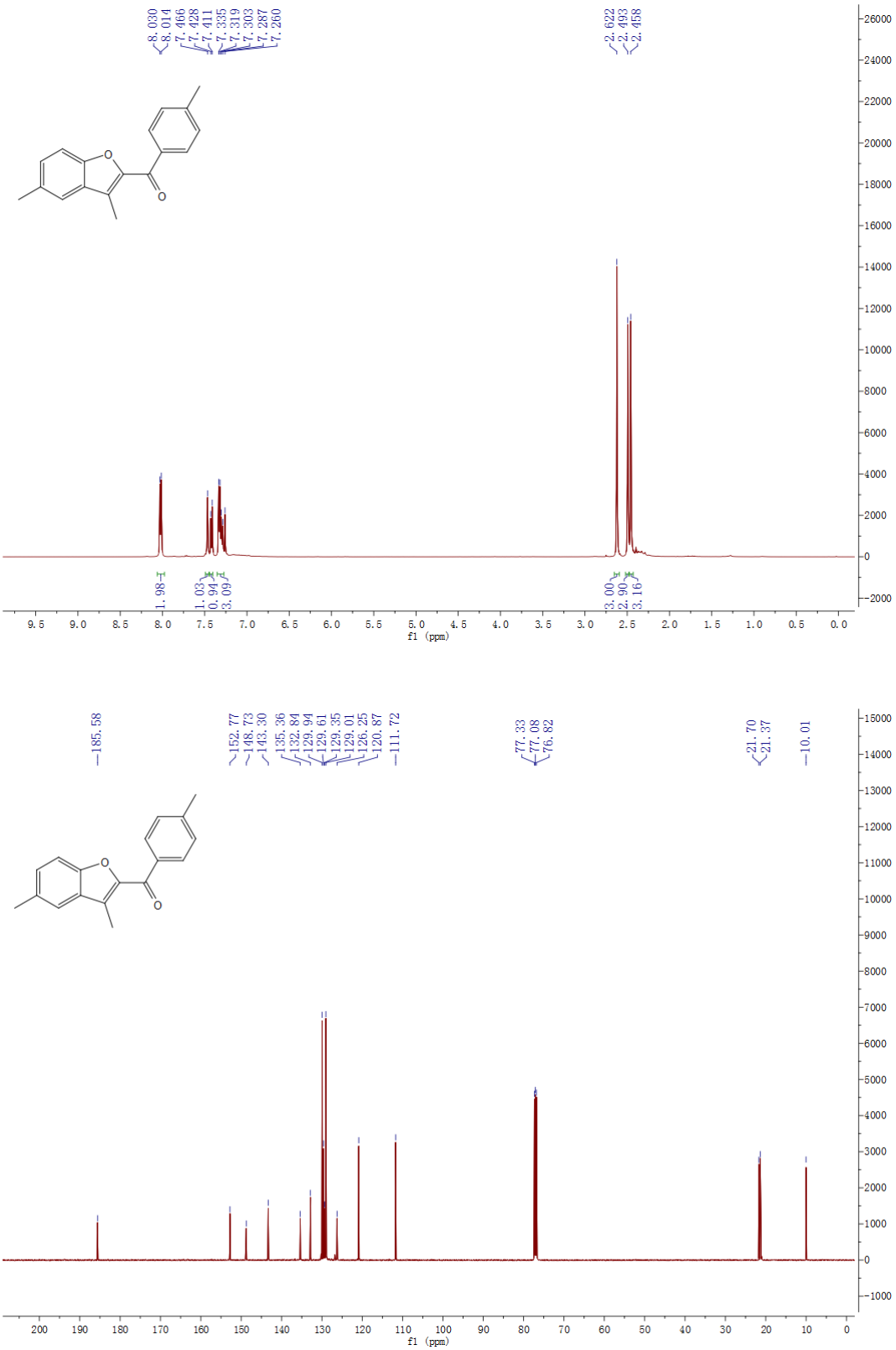


Figure S38. ^{1}H NMR of **4l** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4l** (125 MHz, $CDCl_3$).

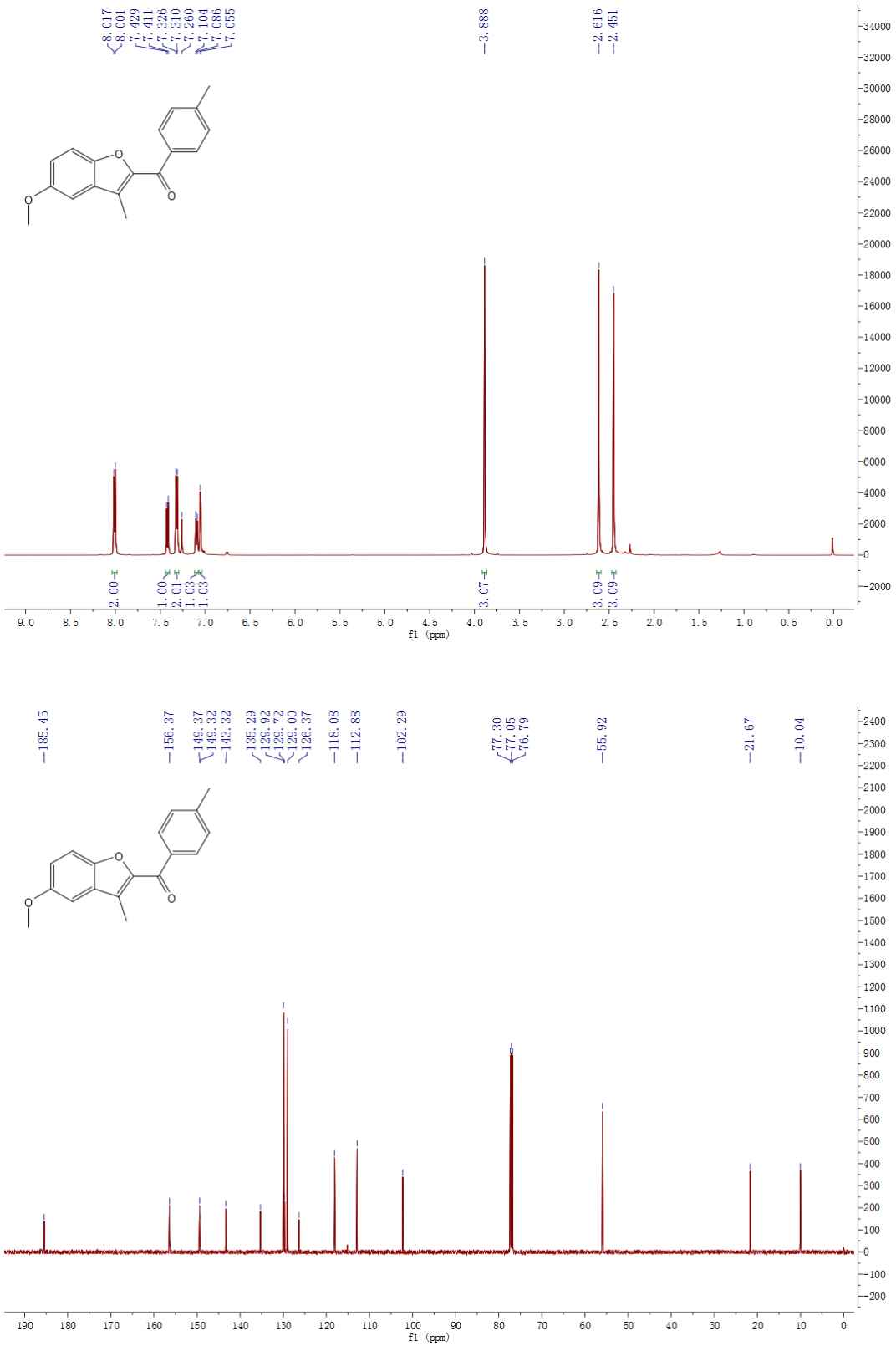


Figure S39. ^{1}H NMR of **4m** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4m** (125 MHz, $CDCl_3$).

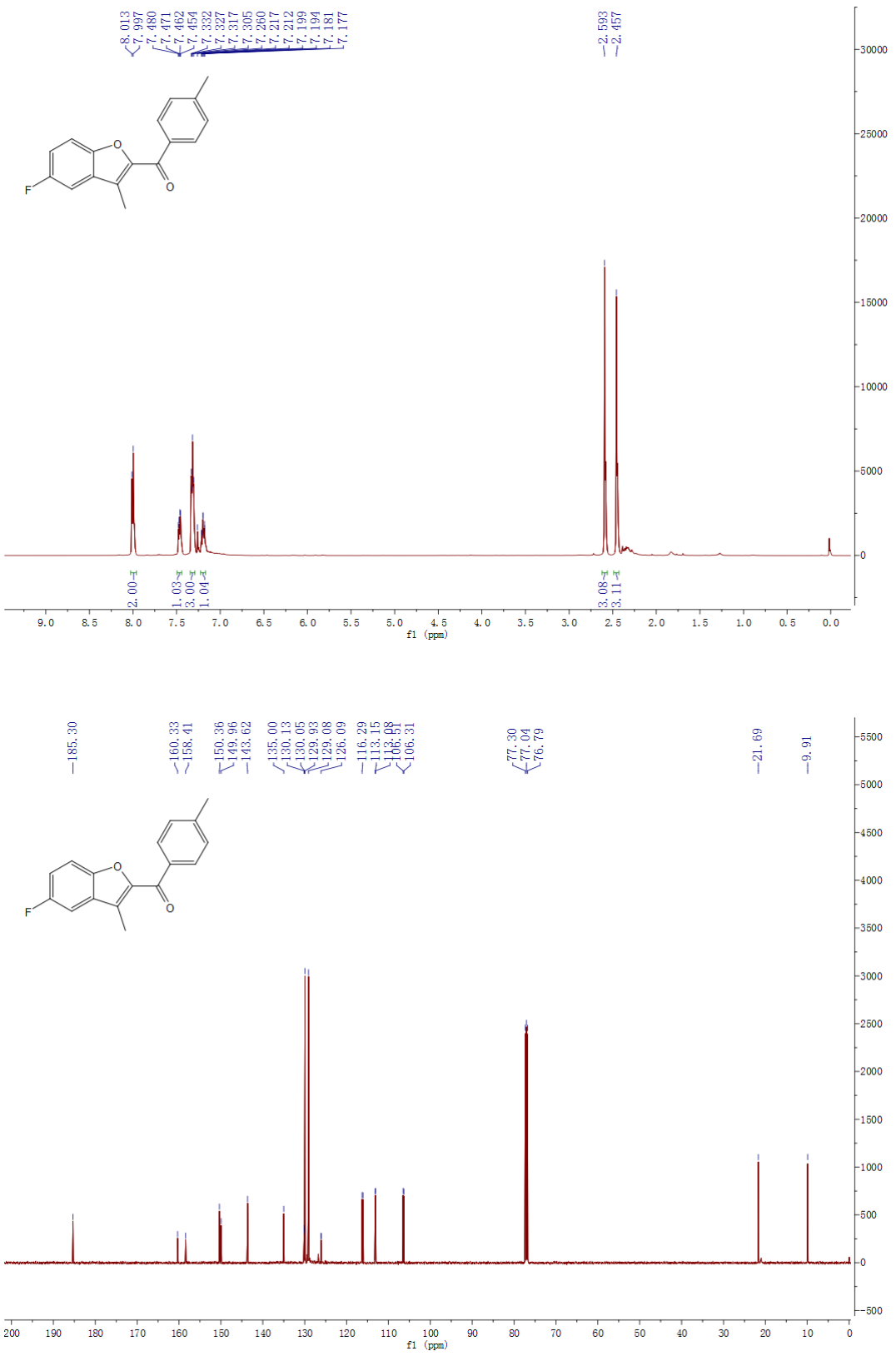


Figure S40. ^{1}H NMR of **4n** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4n** (125 MHz, $CDCl_3$).

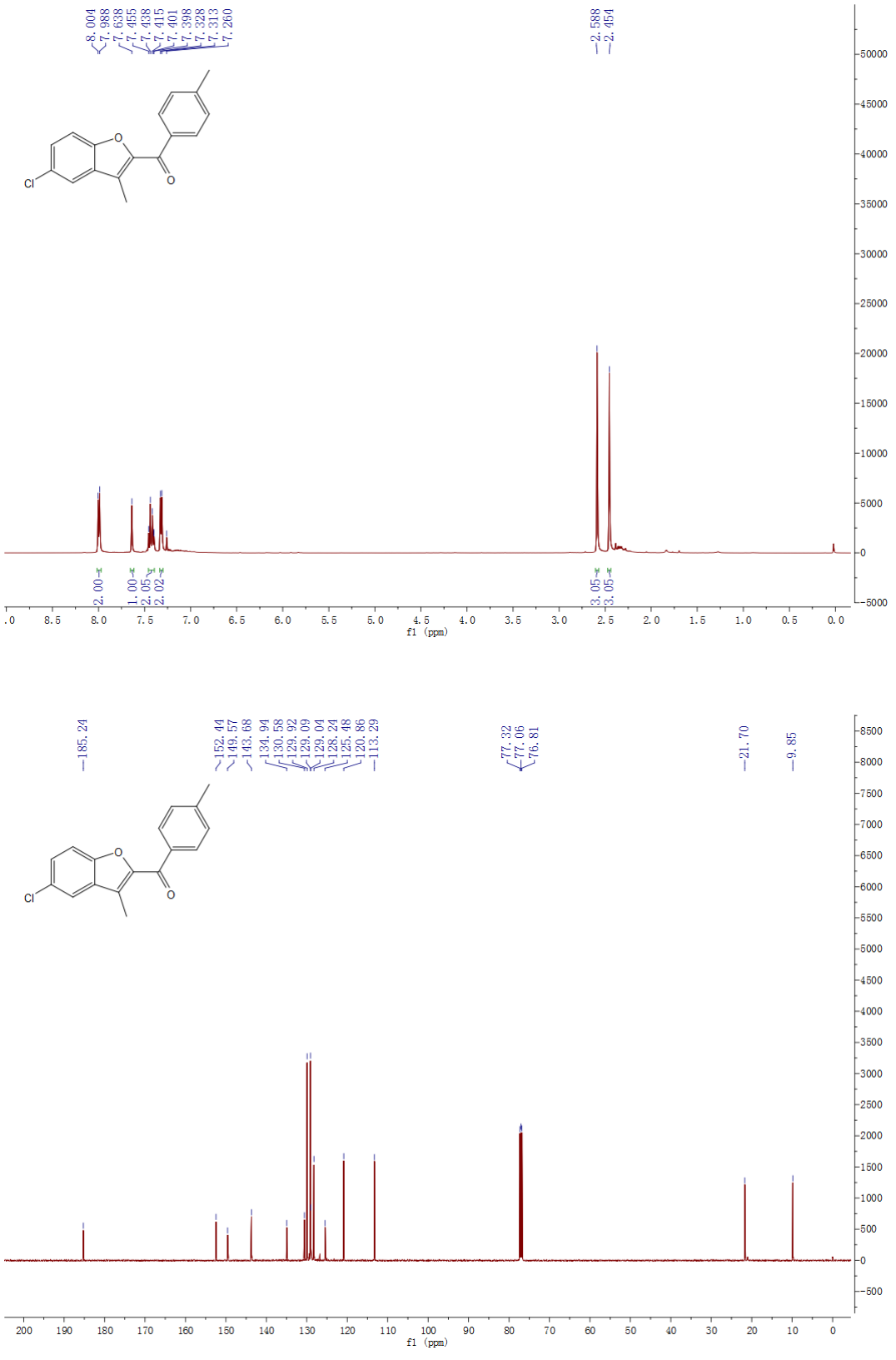


Figure S41. ^{1}H NMR of **4o** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4o** (125 MHz, $CDCl_3$).

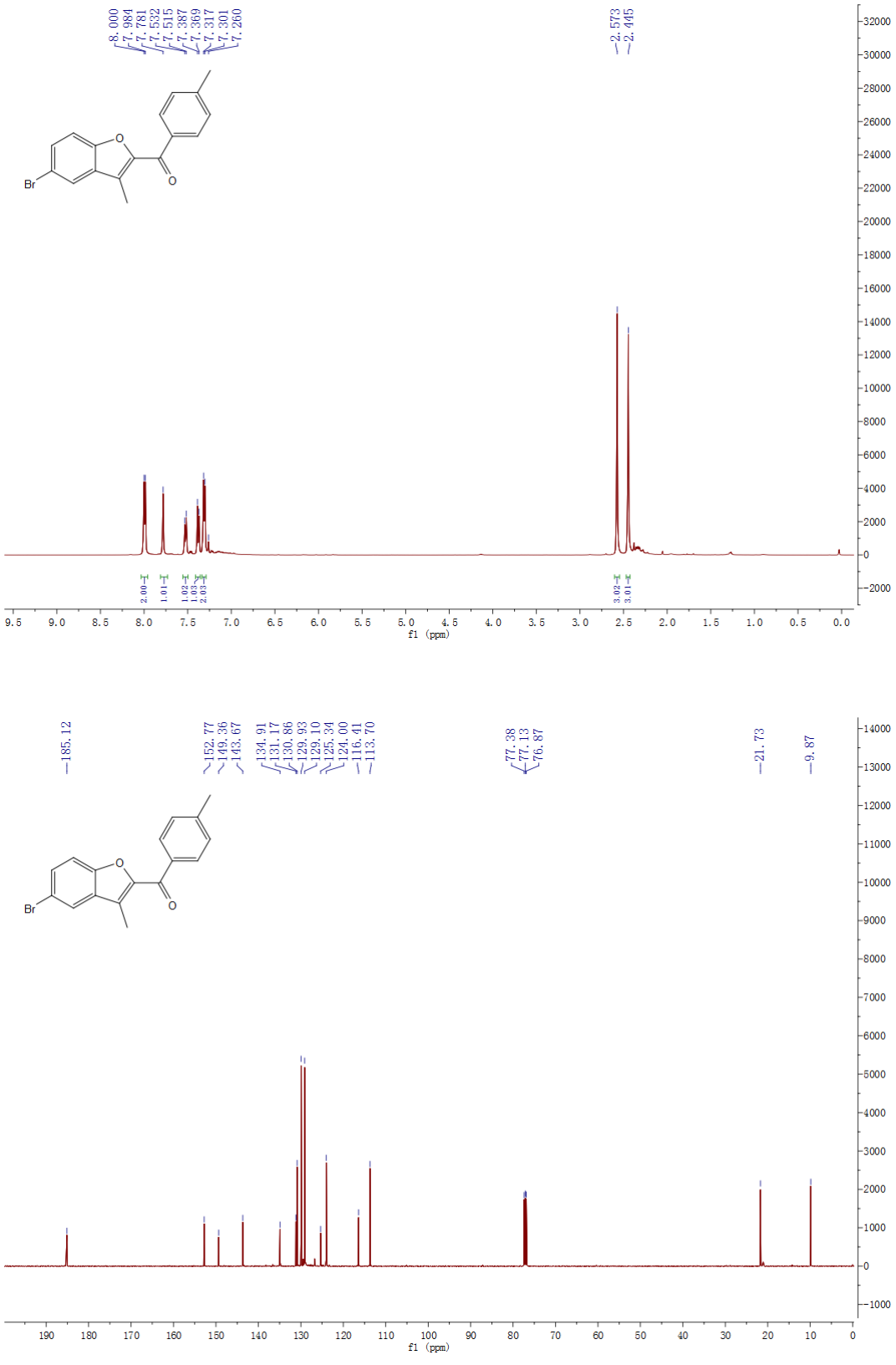


Figure S42. ^{1}H NMR of **4p** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4p** (125 MHz, $CDCl_3$).

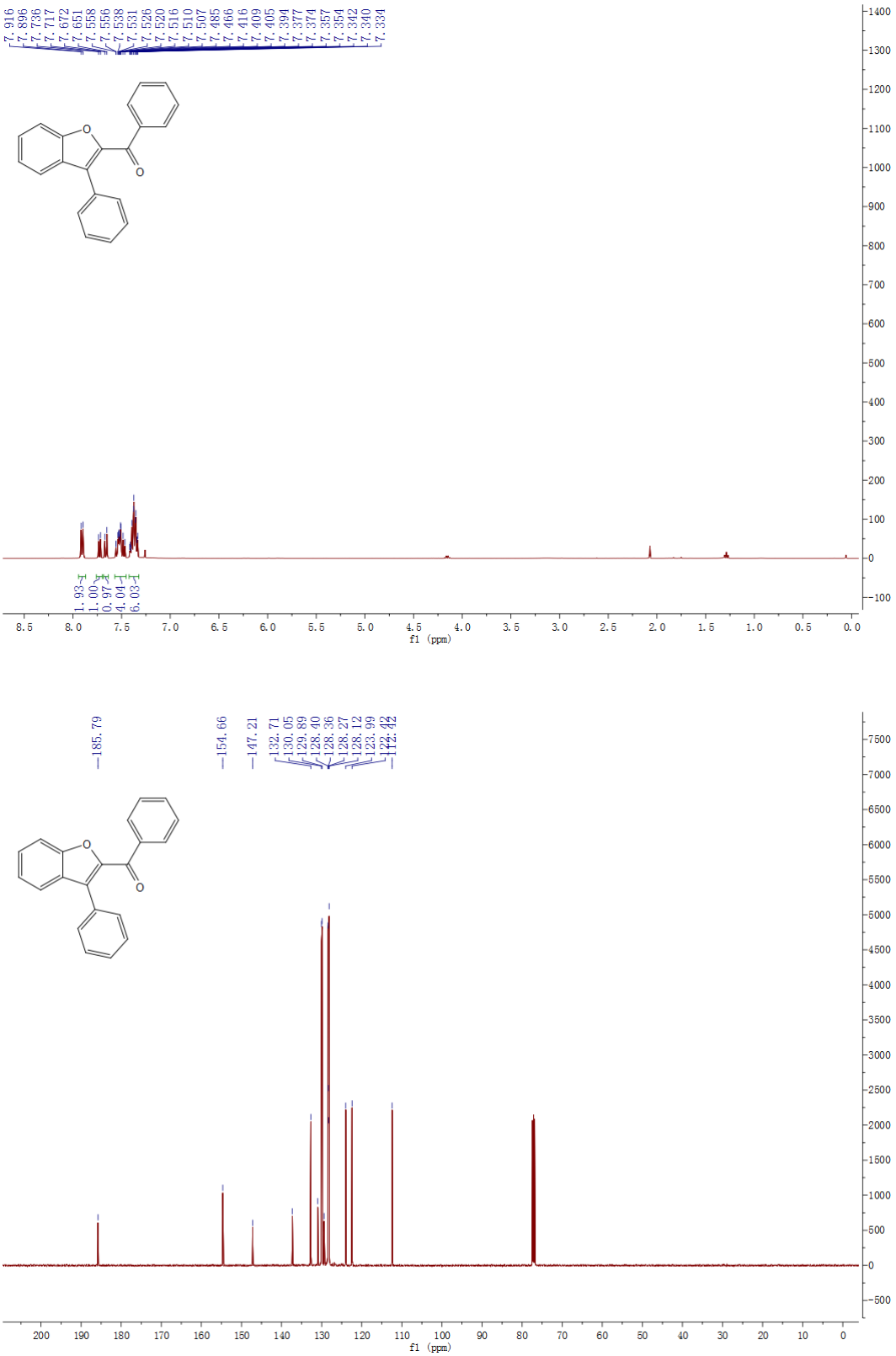


Figure S43. ^{1}H NMR of **4q** (400 MHz, $CDCl_3$) and ^{13}C NMR of **4q** (125 MHz, $CDCl_3$).

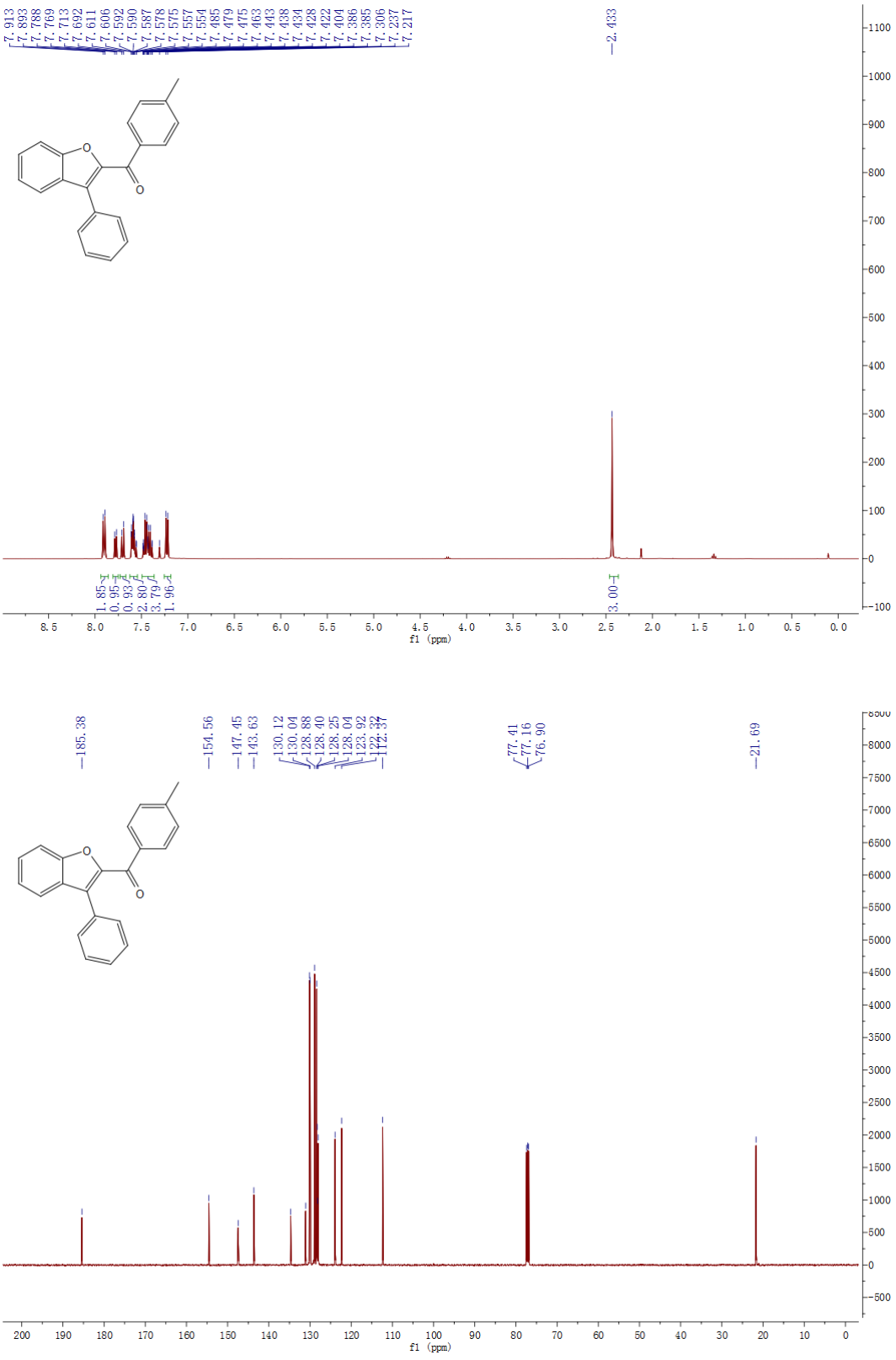
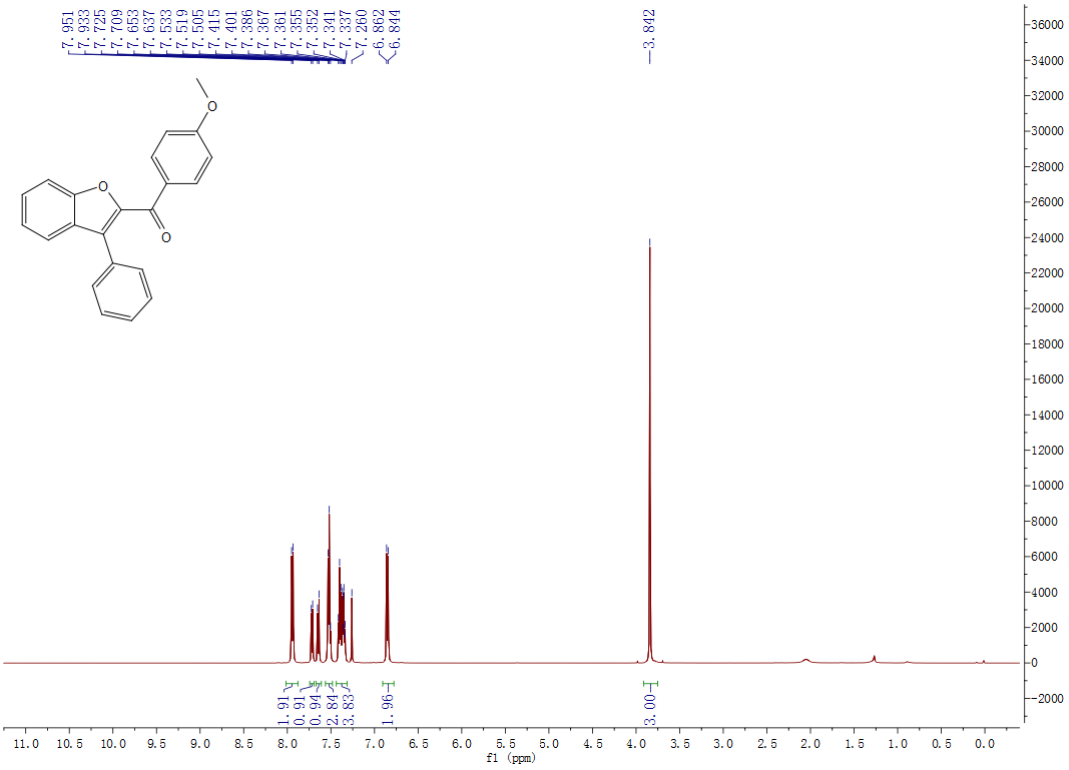


Figure S44. ^{1}H NMR of **4r** (400 MHz, $CDCl_3$) and ^{13}C NMR of **4r** (125 MHz, $CDCl_3$).



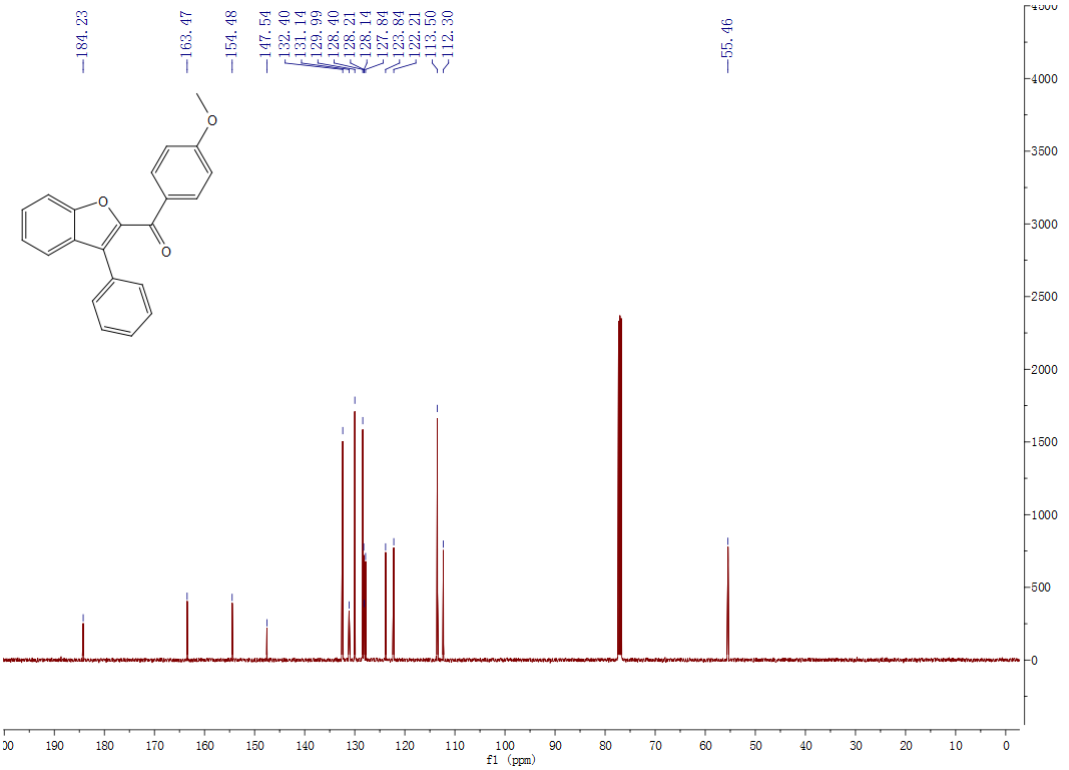


Figure S45. ^{1}H NMR of **4s** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4s** (125 MHz, $CDCl_3$).

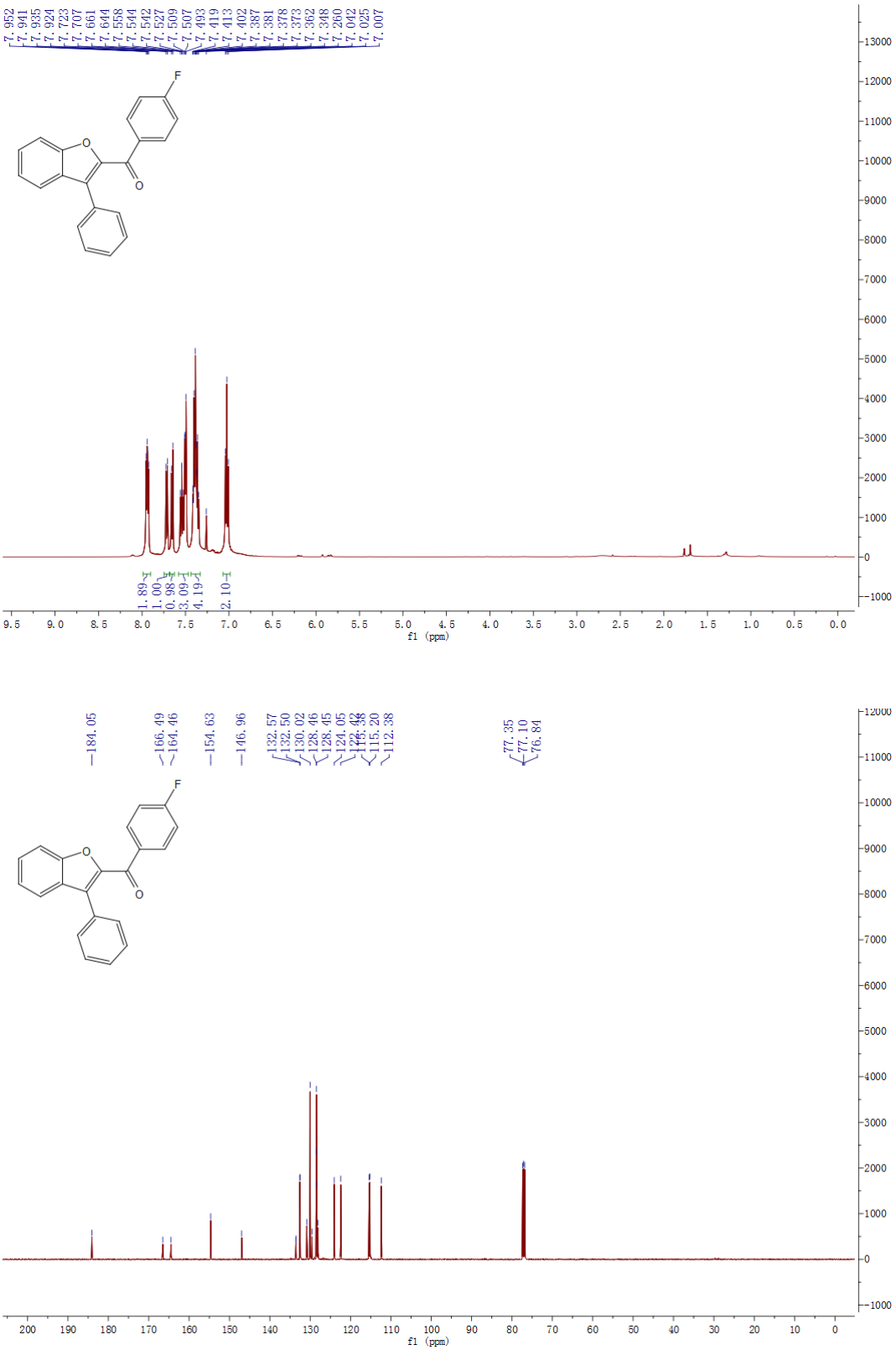


Figure S46. ^{1}H NMR of **4t** (500 MHz, $CDCl_3$) and ^{13}C NMR of **4t** (125 MHz, $CDCl_3$).

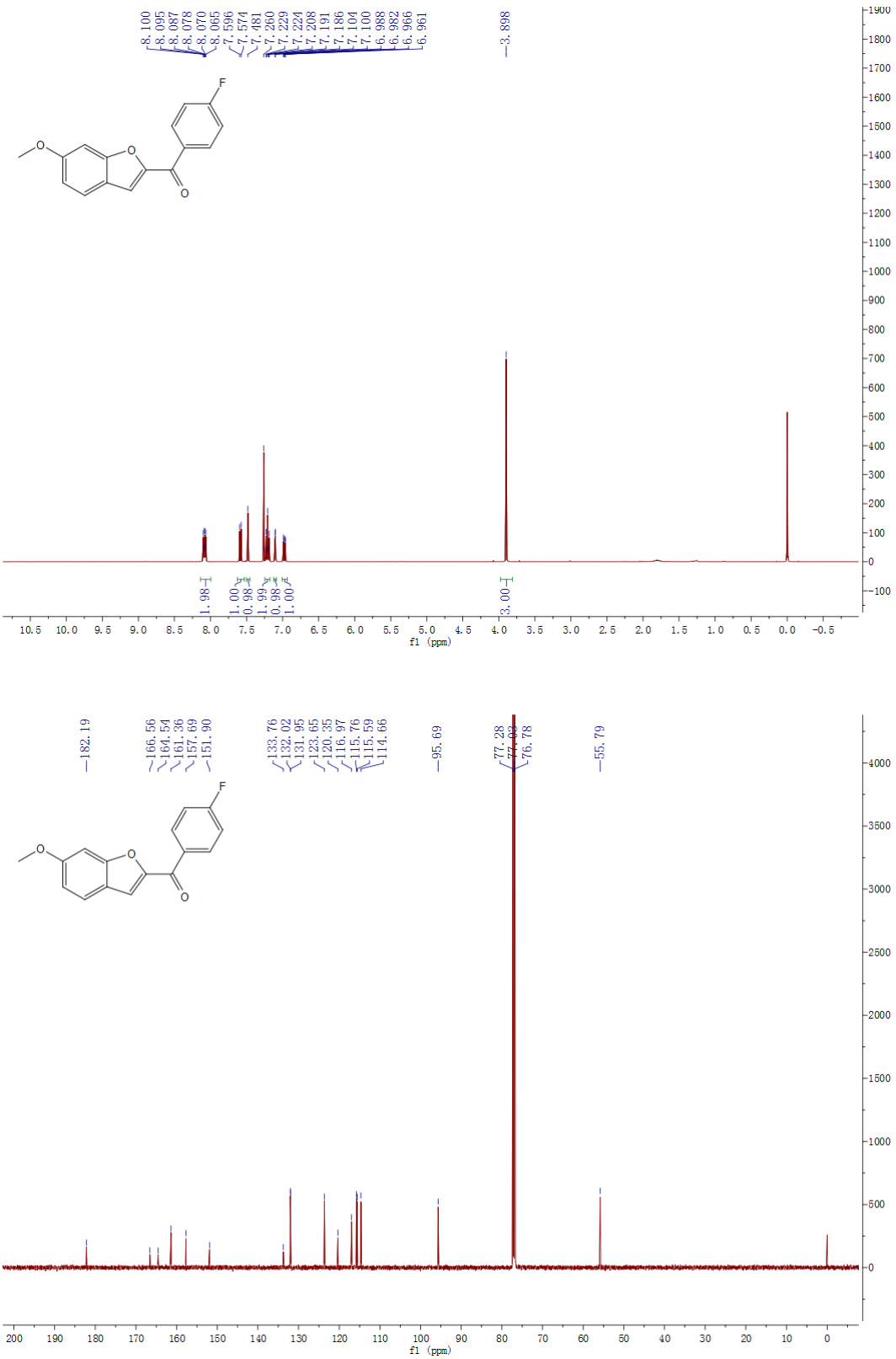


Figure S47. ^{1}H NMR of **5a** (400 MHz, $CDCl_3$) and ^{13}C NMR of **5a** (125 MHz, $CDCl_3$).

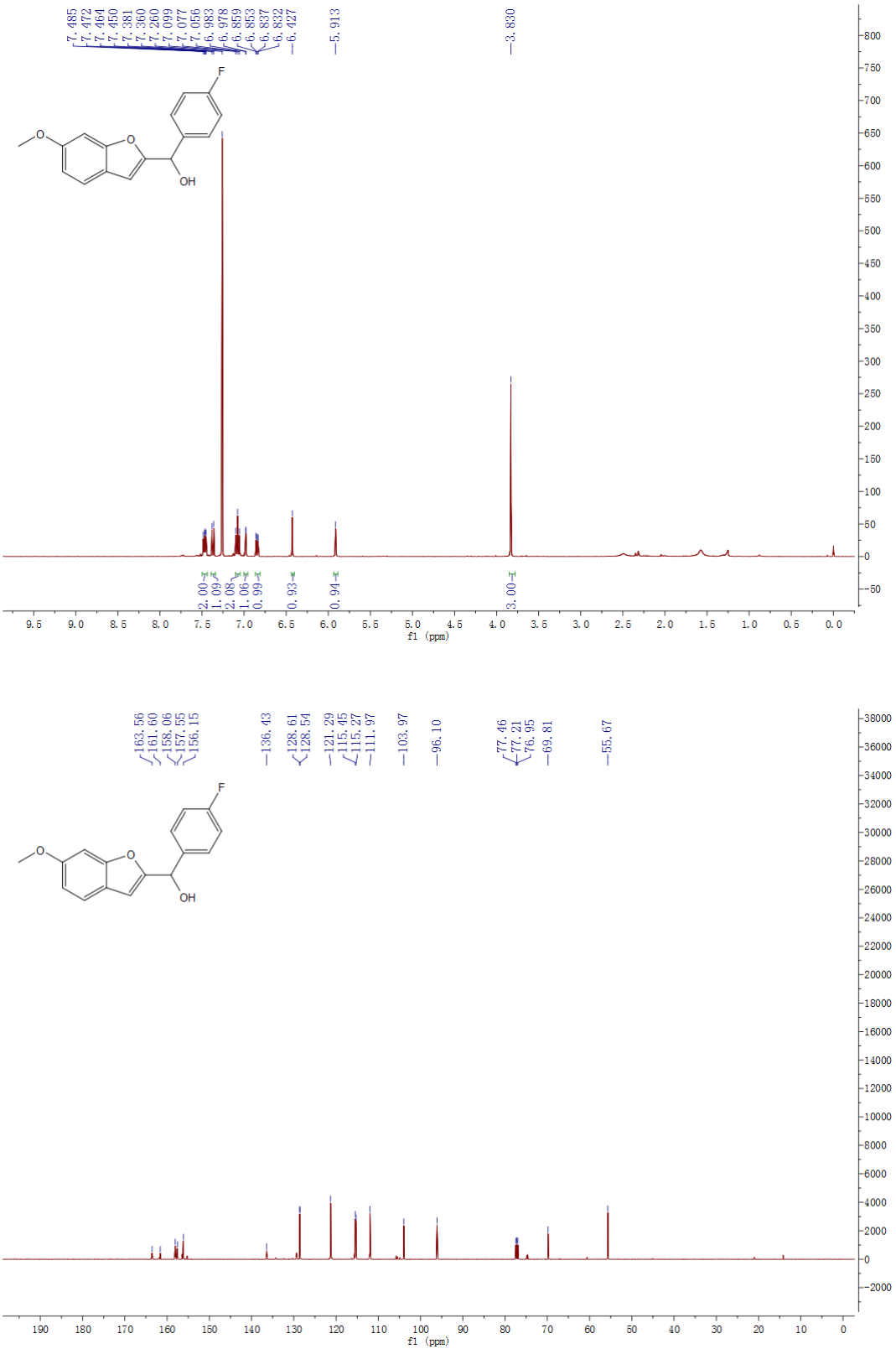
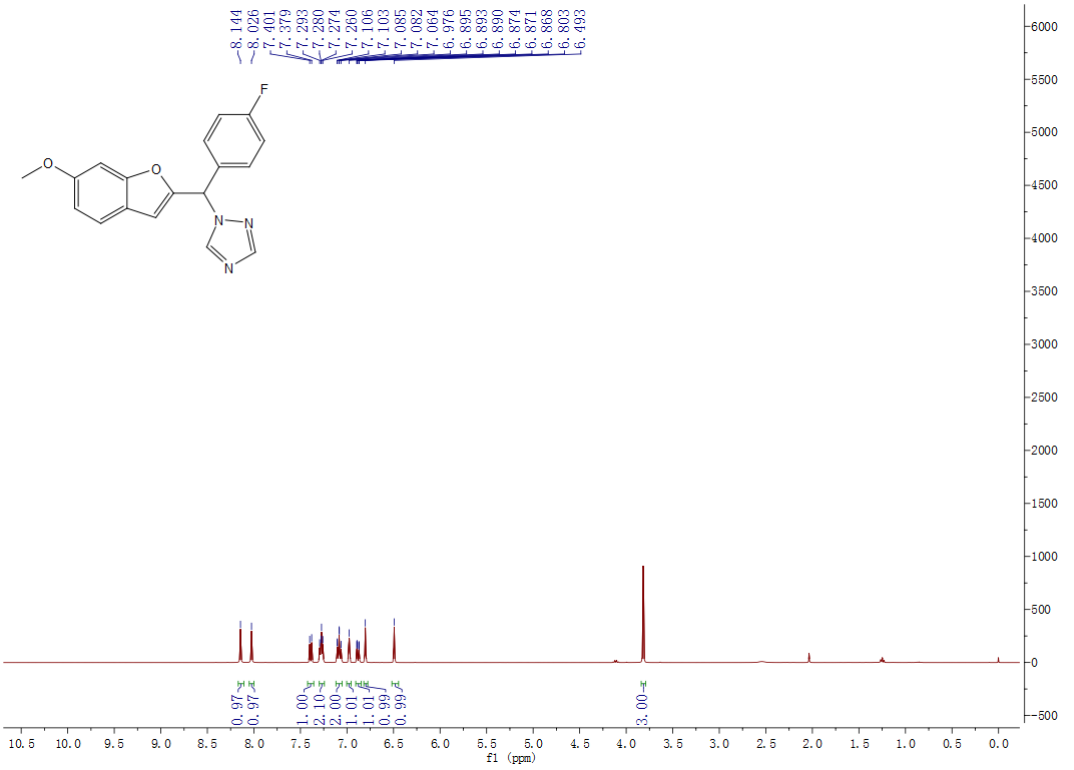


Figure S48. ^{1}H NMR of **6a** (400 MHz, $CDCl_3$) and ^{13}C NMR of **6a** (125 MHz, $CDCl_3$).



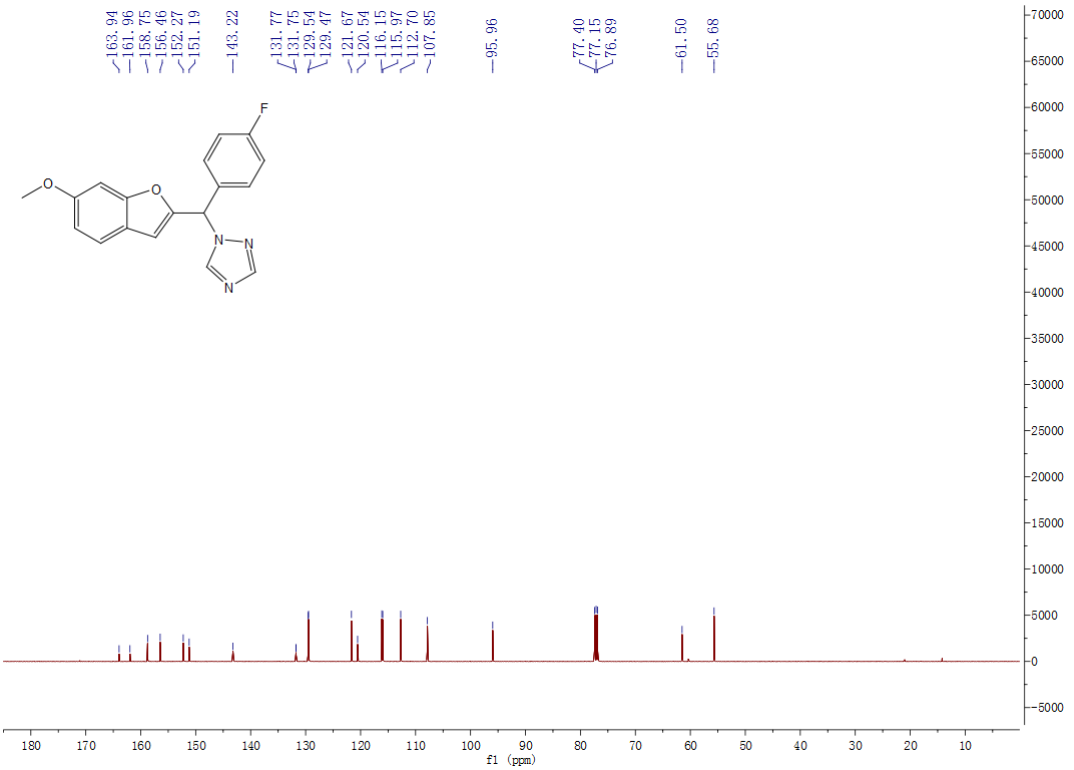


Figure S49. ^{1}H NMR of **7a** (400 MHz, $CDCl_3$) and ^{13}C NMR of **7a** (125 MHz, $CDCl_3$).

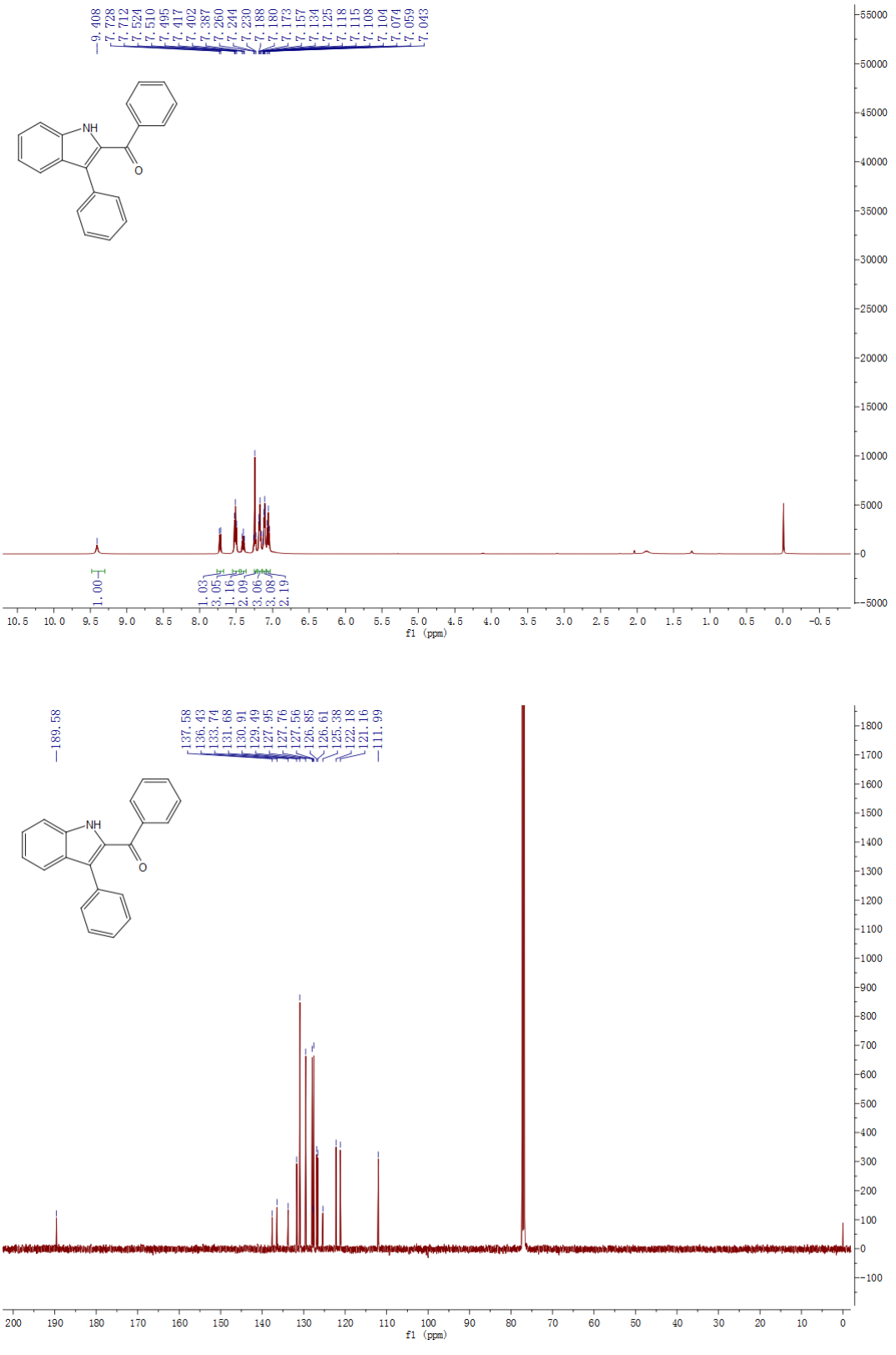


Figure S50. ^{1}H NMR of **9a** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9a** (125 MHz, $CDCl_3$).

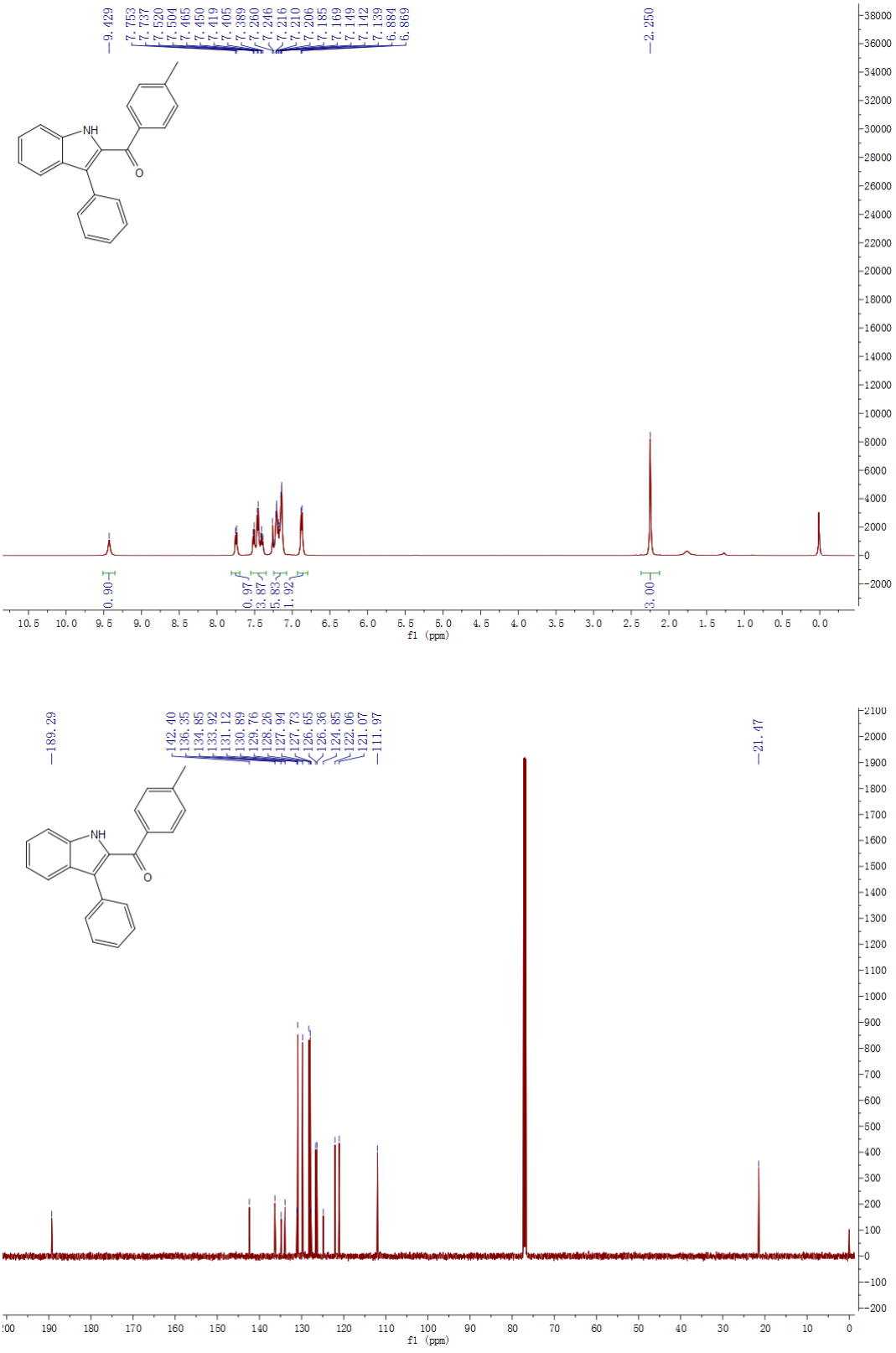


Figure S51. ^{1}H NMR of **9b** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9b** (125 MHz, $CDCl_3$).

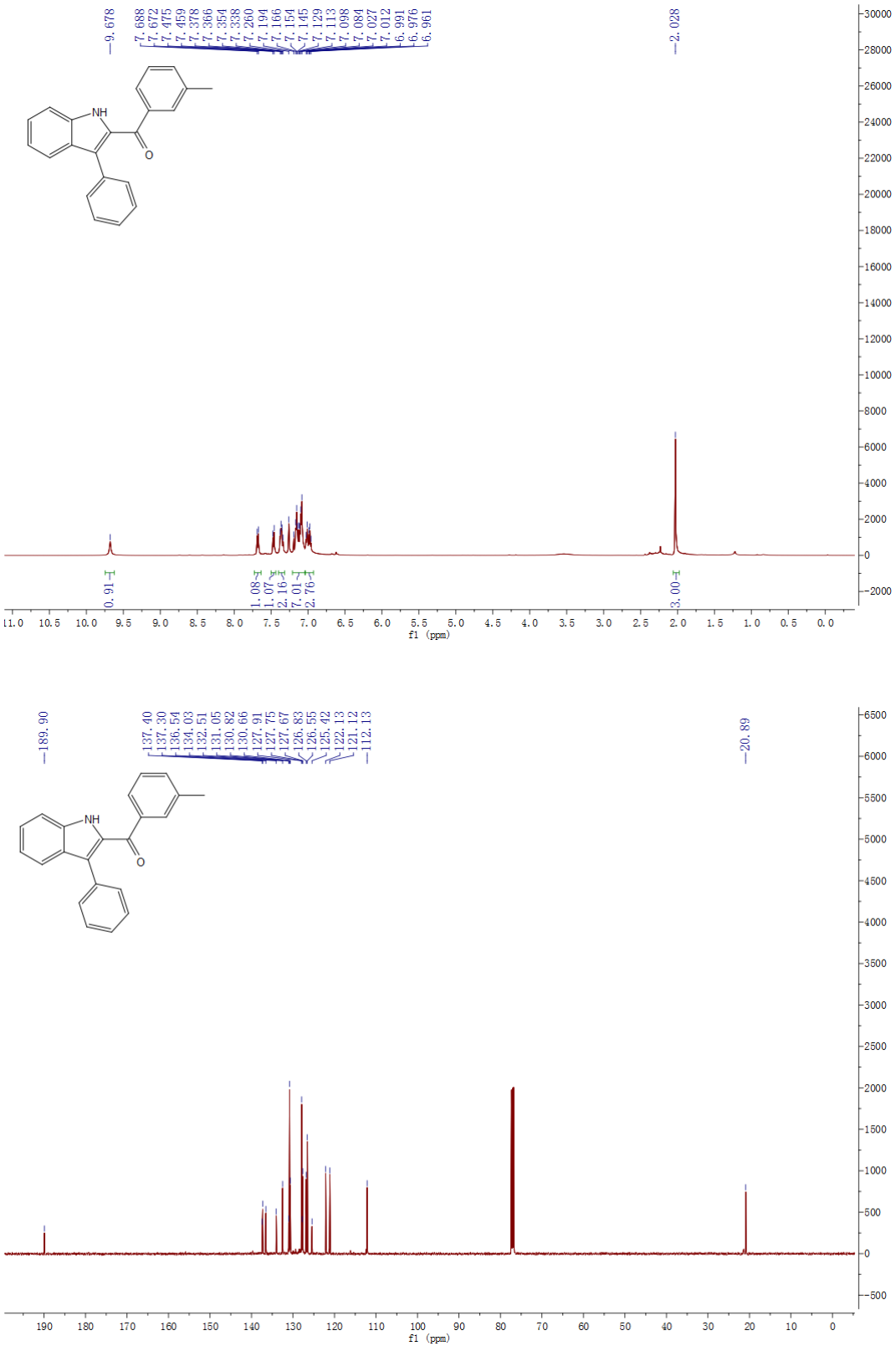


Figure S52. ^{1}H NMR of **9c** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9c** (125 MHz, $CDCl_3$).

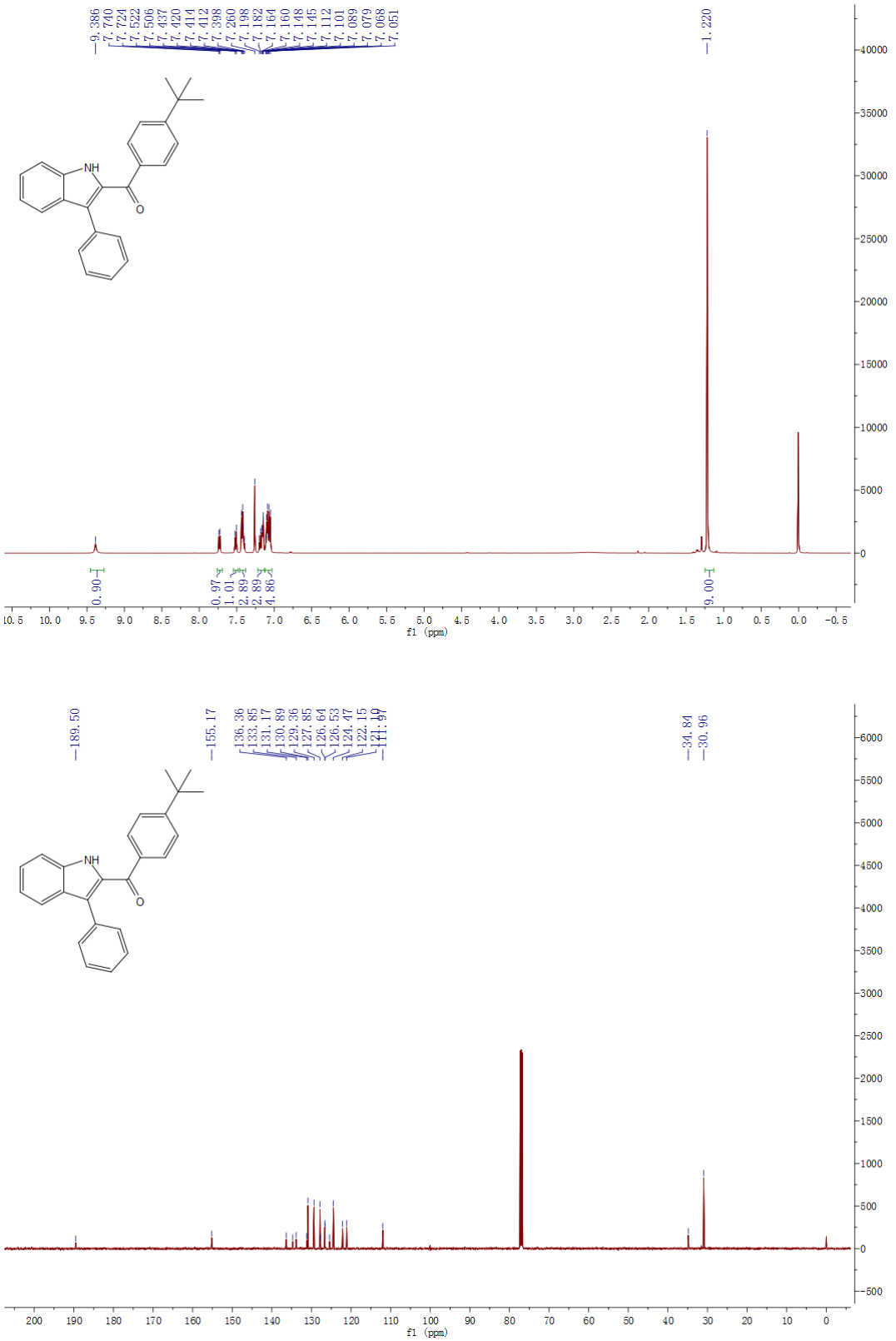
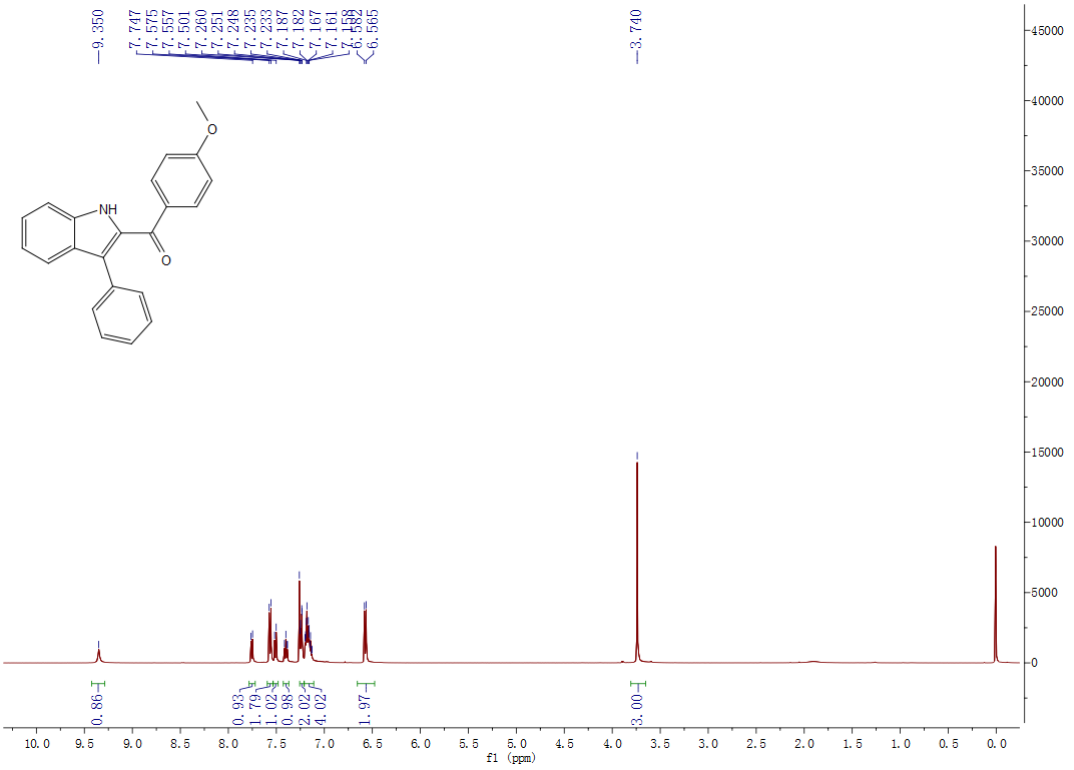


Figure S53. ^{1}H NMR of **9d** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9d** (125 MHz, $CDCl_3$).



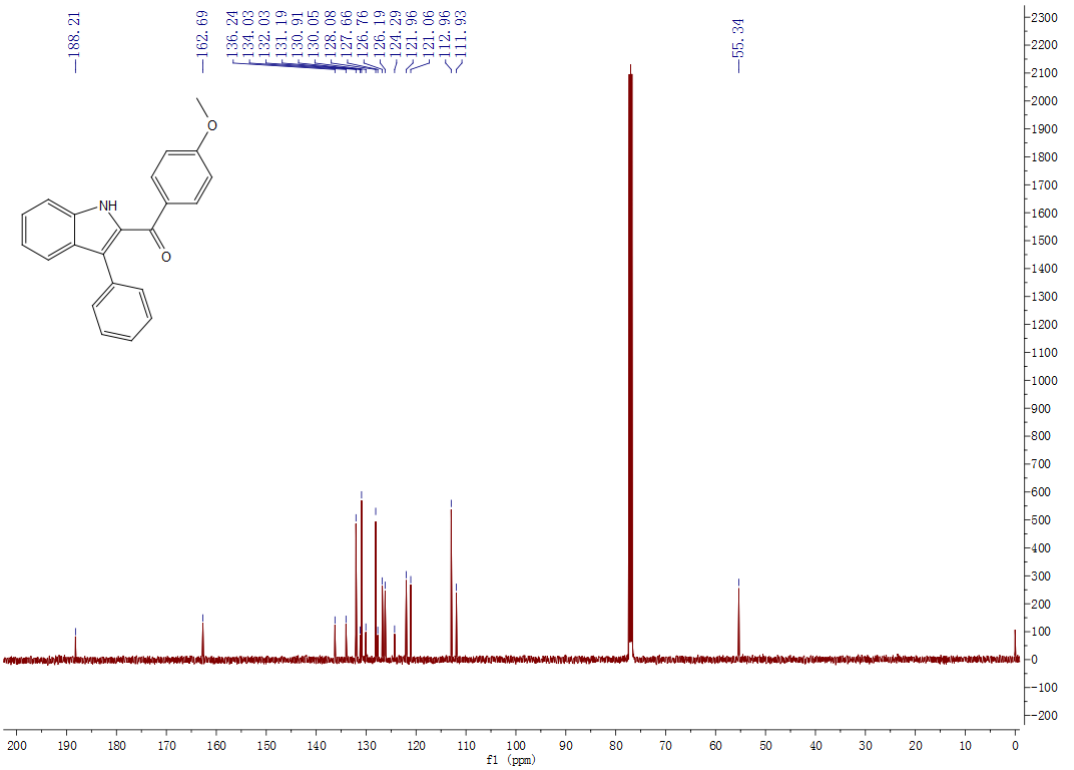
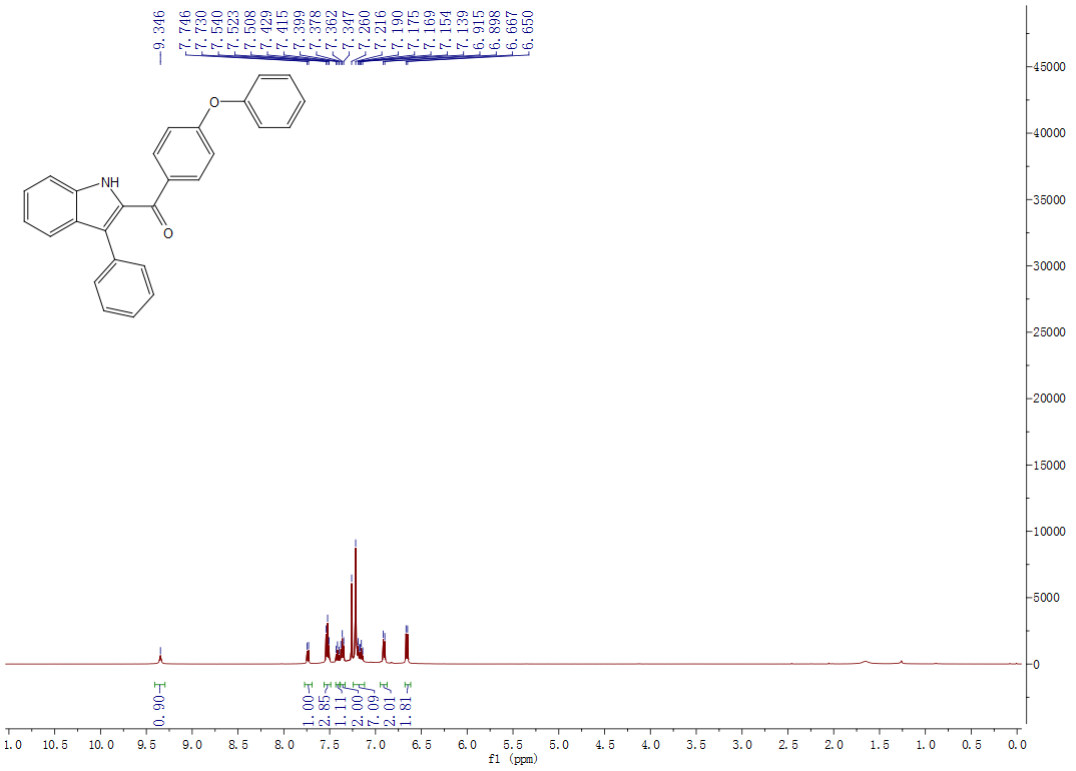


Figure S54. ^{1}H NMR of **9e** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9e** (125 MHz, $CDCl_3$).



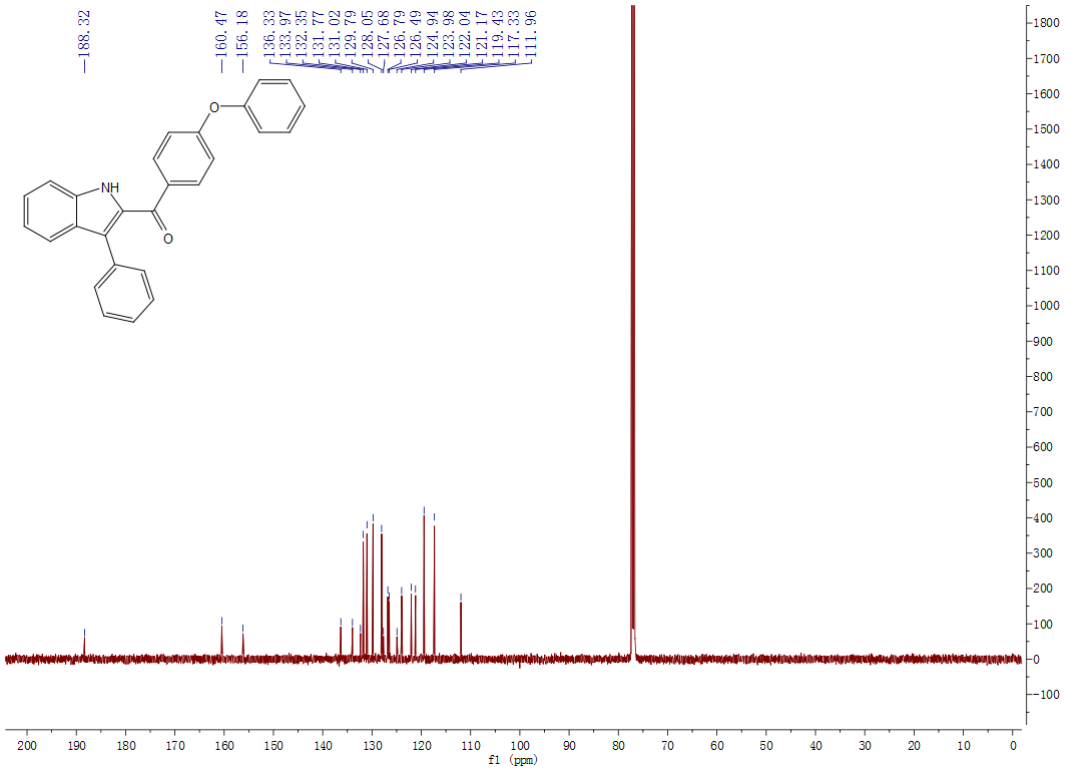
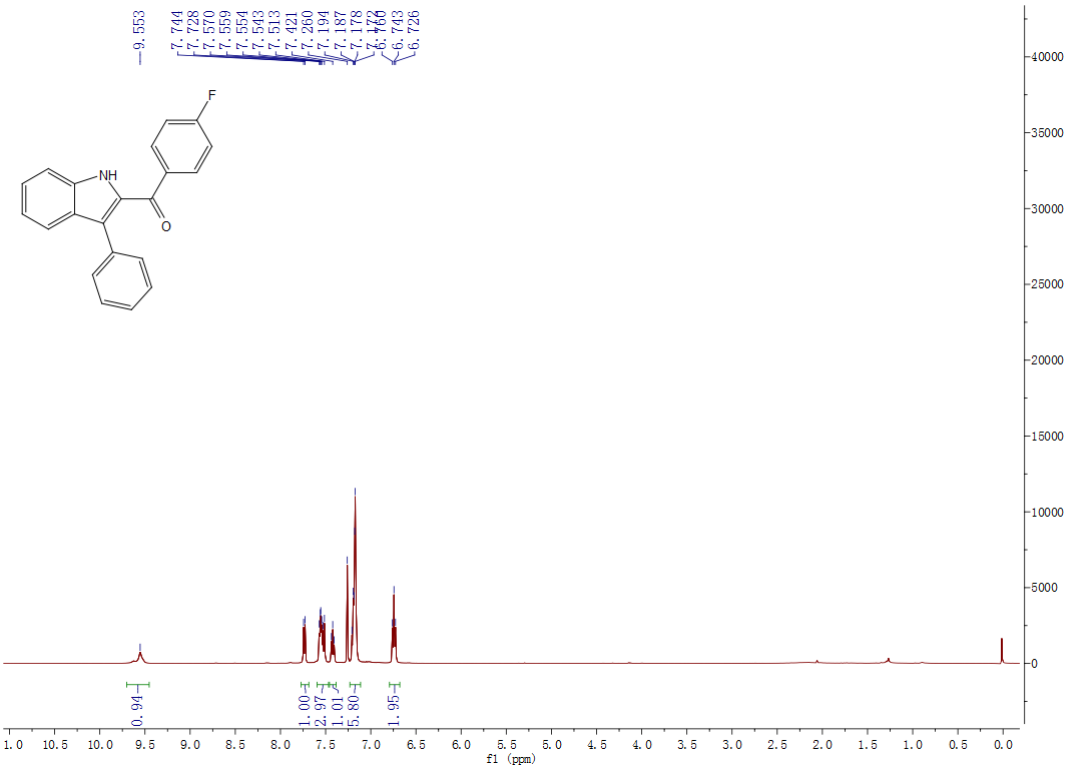


Figure S55. ^{1}H NMR of **9f** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9f** (125 MHz, $CDCl_3$).



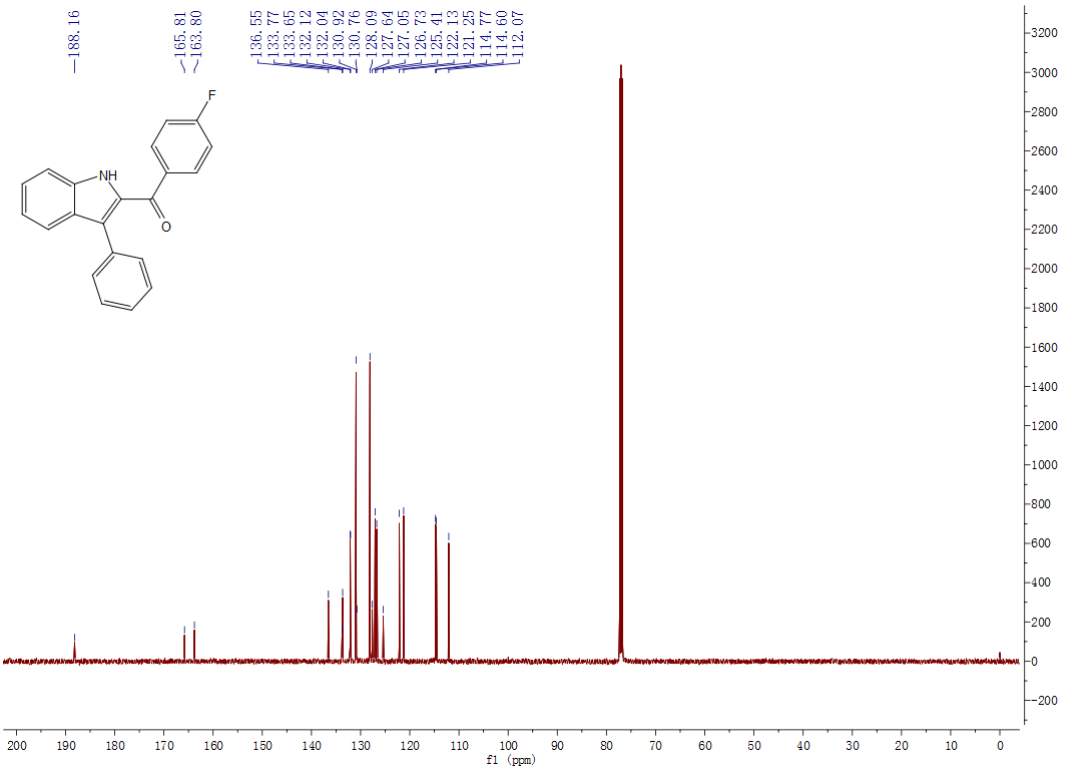
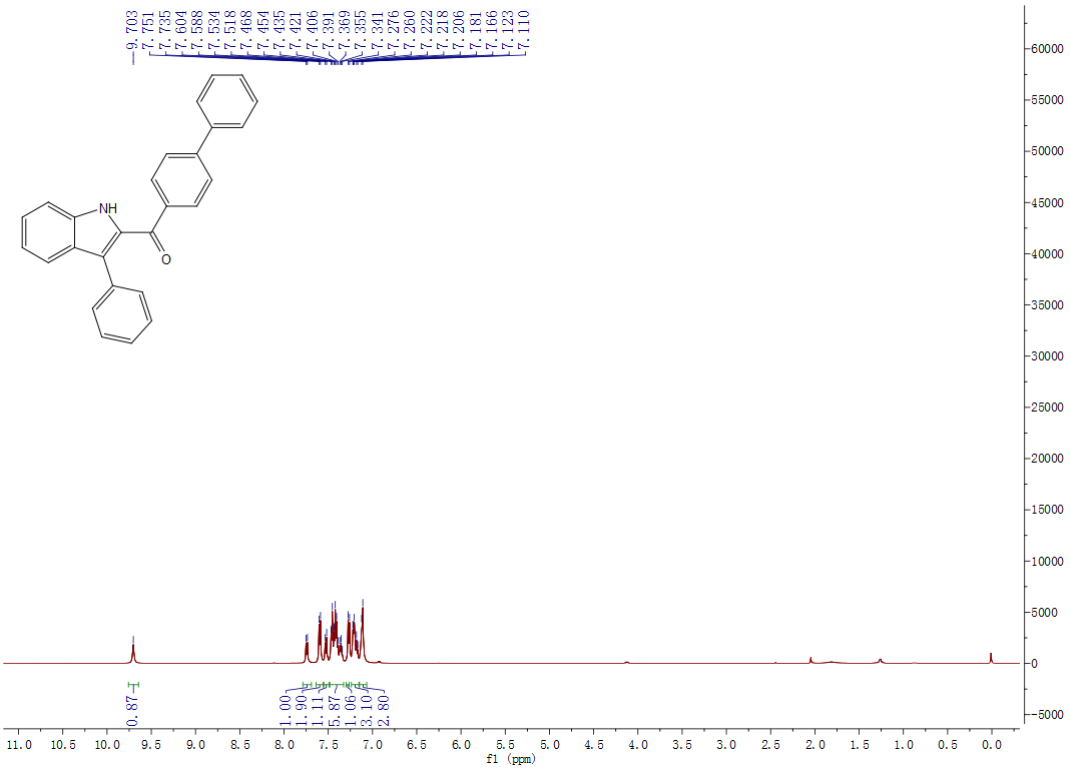


Figure S56. ^{1}H NMR of **9g** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9g** (125 MHz, $CDCl_3$).



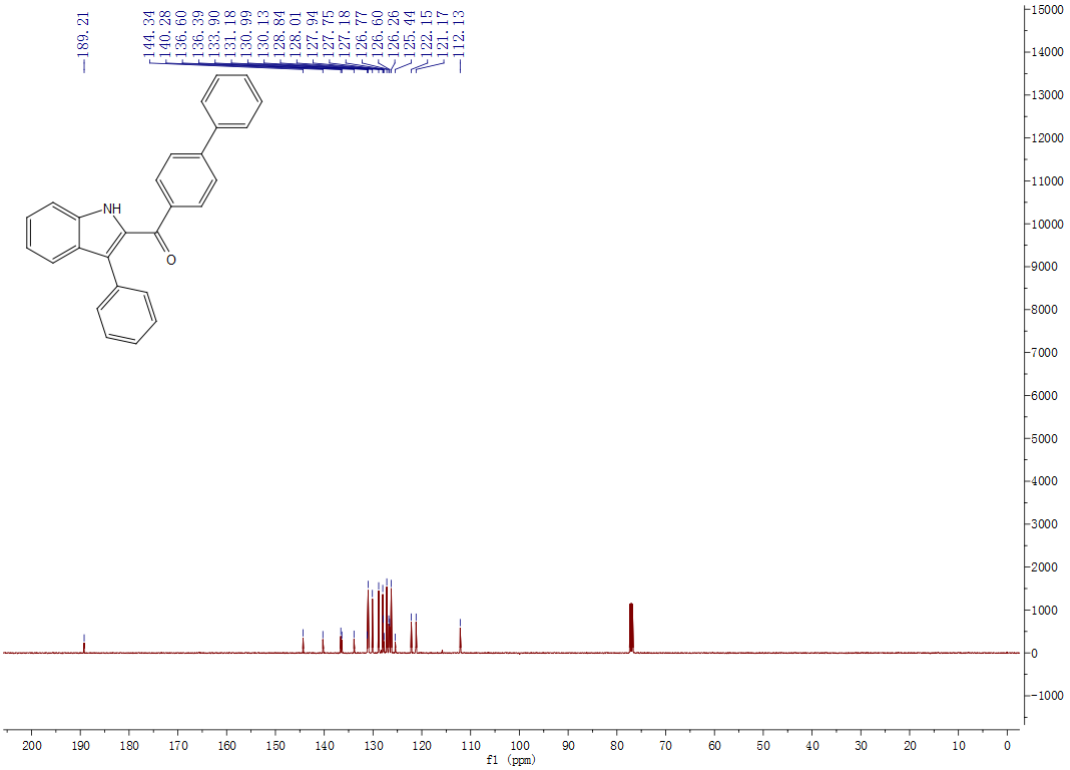


Figure S57. ^{1}H NMR of **9h** (500 MHz, $CDCl_3$) and ^{13}C NMR of **9h** (125 MHz, $CDCl_3$).