Supporting Information

Ni(II)-Catalyzed Mono-Selective *ortho*-Arylation of Unactivated Aryl C-H Bonds Utilizing Amino Acid as A Directing Group

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Table of Contents

1. General Information

Unless otherwise noted, the reagents (chemicals) were purchased from commercial sources, and used without further purification. Water was deionized before used. Analytical thin layer chromatography (TLC) was HSGF 254 (0.15-0.2 mm thickness). Compound spots were visualized by UV light (254 nm). Column chromatography was performed on silica gel FCP 200-300. NMR spectra were run on 500 MHz instrument. Chemical shifts were reported in parts per million (ppm, δ) downfield from tetramethylsilane. Proton coupling patterns are described as singlet (s), doublet (d), triplet (t), quartet (q), multiplet (m), and broad (br). Low- and high-resolution mass spectra (LRMS and HRMS) were measured on spectrometer. Melting points were measured on melting point apparatus.

2. Experimental Procedures

General procedure for synthesis of 2-benzamido-2-methylpropanoic acid[1]

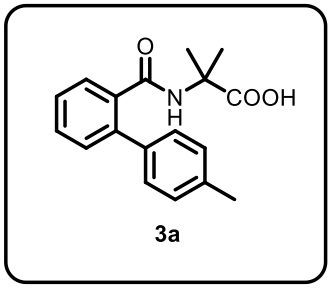
General Procedure for the Synthesis of Substrates **1a**. 2-Amino-2-methylpropionic acid (2 g, 19.4 mmol) was dissolved in 1M NaOH aqueous solution (20 mL). The mixture was cooled to 0 °C, andthen benzoyl chloride (2.30 mL, 19.4 mmol) and 1M NaOH aqueous solution (20 mL) were added dropwise simultaneously. The resulting mixture was stirred for 5 h at room temperature. Then 1 M HCl (60 mL)was added to the reaction mixture and stirred for 10 min. The resulting solid was collected by filtration and washed with water and Et_2O. The desired product 1a was obtained as a white solid (3.02 g, 72%).

General procedures for Ni(II)-Catalyzed Mono-Selective ortho-Arylation of Unactivated Aryl C-H Bonds

Synthesis of **3a** is representative. A 25 mL tube equipped with a magnetic stir bar was charged with 2-amino-2-methylpropionic acid **1a** (0.2 mmol), 1-iodo-4-methylbenzene **2a** (0.60 mmol), $Ni(OTf)_2$ (10 mol%), MesCOOH (20 mol%),TBAI (0.6mmol) and Na_2CO_3 (0.6mmol). 2 mL of DMSO was charged, and then the resulting mixture was stirred in a pre-heated oil bath at 140 °C for 16 h. After the reaction was completed, 1 M HCl (4 mL)was added to the reaction, the mixture was extracted with Et_2O (30mL) three times and the organic solvent was removed under vacuum. The residue was purified by silica gel column using 2% methanol in DCM as eluent to afford desired arylation product **3a** as a white solid.

2-methyl-2-(4'-methyl-[1,1'-biphenyl]-2-carboxamido)propanoic acid (3a)

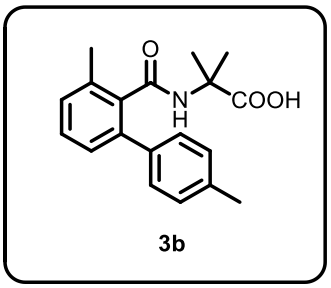
Compound **3a** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 48.6 mg, 81% yield. Mp: 177-181°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.41 (s, 1H), 7.50 – 7.46 (m, 1H), 7.40 – 7.37 (m, 3H), 7.34 (d, J = 8.0 Hz, 2H), 7.18 (d, J = 7.9 Hz, 2H), 2.33 (s, 3H), 1.31 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.4, 168.4, 139.1, 137.0, 136.6, 136.2, 129.6, 129.3, 128.6, 128.4, 128.0, 126.6, 55.1, 24.5, 20.7. **HRMS** (ESI)$[M+Na]^+$calcd for $C_{18}H_{19}NNaO_3$:320.1257, found:320.1266.



3a

2-(3,4'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3b)

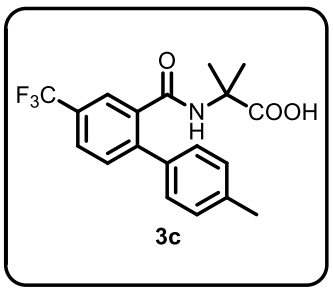
Compound **3b** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 40.2 mg, 64% yield. Mp: 195-197°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.34 (s, 1H), 7.32 (dd, J = 7.8, 6.4 Hz, 3H), 7.22 – 7.11 (m, 4H), 2.36 (s, 3H), 2.32 (s, 3H), 1.16 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.9, 168.2, 139.3, 137.8, 137.3, 136.5, 135.5, 129.1, 129.0, 128.8, 128.6, 127.2, 55.33, 24.8, 21.1, 19.4.**HRMS** (ESI)[M+H]$^{+}$calcd for $C_{19}H_{22}NO_3$: 312.1594, found: 312.1589.



3b

2-methyl-2-(4'-methyl-4-(trifluoromethyl)-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (3c)

Compound **3c** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 50.2 mg, 68% yield. Mp: 242-245°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.72 (s, 1H), 7.86 (d, J = 8.2 Hz, 1H), 7.66 – 7.63 (m, 2H), 7.40 (d, J = 8.0 Hz, 2H), 7.24 (d, J = 7.9 Hz, 2H), 2.35 (s, 3H), 1.35 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ175.6, 167.5, 143.8, 137.8, 137.7, 136.0, 131.2, 129.3, 128.9, 127.5 (q, J = 32.2 Hz), 126.5, 125.0, 124.5 (q, J = 272.2 Hz), 55.8, 24.9, 21.2.**HRMS** (ESI)[M+H]$^{+}$calcd for $C_{19}H_{19}F_3NO_3$: 366.1312, found: 366.1320.

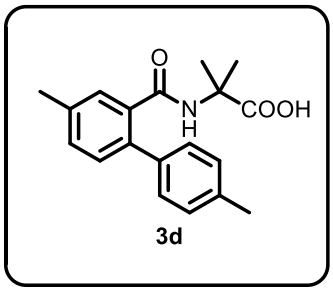


3c

2-(4,4'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3d)

Compound **3d** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 49.1 mg, 78% yield. Mp:

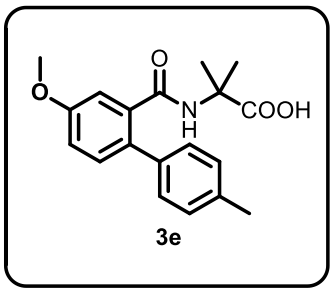
197-201°C.**^{1}H NMR** (500 MHz, DMSO-d_6)δ 8.37 (s, 1H), 7.28 (dd, J = 13.6, 6.0 Hz, 4H), 7.18 (s, 1H), 7.14 (d, J = 7.9 Hz, 2H), 2.35 (s, 3H), 2.30 (s, 3H), 1.30 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.5, 168.4, 136.9, 136.5, 136.3, 136.0, 135.9, 129.9, 129.6, 128.4, 128.4, 128.4, 55.1, 24.5, 20.7, 20.4. **HRMS** (ESI)[M+H]$^{+}$calcd for $C_{19}H_{22}NO_3$: 312.1594, found: 312.1593.



3d

2-(4-methoxy-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3e)

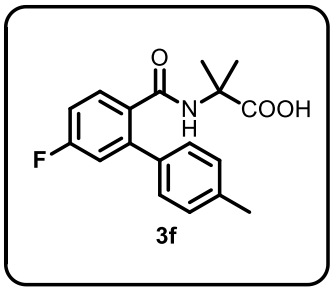
Compound **3e** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 33.7 mg, 51% yield. Mp: 203-205°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.34 (s, 1H), 7.31 (d, J = 8.6 Hz, 1H), 7.28 (d, J = 7.9 Hz, 2H), 7.15 (d, J = 7.9 Hz, 2H), 7.06 (dd, J = 8.5, 2.5 Hz, 1H), 6.91 (d, J = 2.5 Hz, 1H), 3.82 (s, 3H), 2.31 (s, 3H), 1.32 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.9, 168.4, 158.3, 138.1, 137.2, 136.1, 132.11, 131.4, 129.0, 128.8, 115.2, 114.0, 55.8, 55.7, 24.9, 21.1. **HRMS** (ESI)[M-H]$^{-}$calcd for$C_{19}H_{20}NO_4$: 326.1398, found: 326.1395.



3e

2-(5-fluoro-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3f)

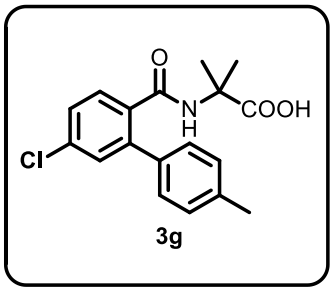
Compound **3f** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 49.1 mg, 77% yield. Mp: 193-195°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.44 (s, 1H), 7.43 (dd, J = 7.9, 6.4 Hz, 1H), 7.35 (d, J = 8.0 Hz, 2H), 7.23 (dd, J = 13.3, 5.9 Hz, 2H), 7.19 (d, J = 7.9 Hz, 2H), 2.33 (s, 3H), 1.31 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.8, 168.0, 162.6 (d, J = 246.2 Hz), 142.4 (d, J = 8.1 Hz), 137.4, 136.3, 133.6 (d, J = 2.7 Hz), 130.8 (d, J = 8.7 Hz), 129.2, 128.9, 116.6 (d, J = 21.8 Hz), 113.8 (d, J = 21.3 Hz), 55.6, 24.9, 21.2. **HRMS** (ESI)[M-H]$^{-}$calcd for$C_{18}H_{17}FNO_3$: 314.1198, found: 314.1197.



3f

2-(5-chloro-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3g)

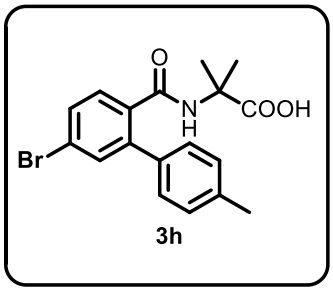
Compound **3g** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 44.2 mg, 66% yield. Mp: 167-170°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.52 (s, 1H), 7.47 (dd, J = 8.1, 2.1 Hz, 1H), 7.43 (d, J = 2.1 Hz, 1H), 7.40 (d, J = 8.2 Hz, 1H), 7.35 (d, J = 8.1 Hz, 2H), 7.19 (d, J = 7.9 Hz, 2H), 2.33 (s, 3H), 1.30 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 137.0, 129.9, 129.1, 128.8, 128.4, 126.5, 55.1, 24.5, 20.7. **HRMS** (ESI)[M-H]$^-$calcd for$C_{18}H_{17}ClNO_3$: 330.0902, found: 330.0901.



3g

2-(5-bromo-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3h)

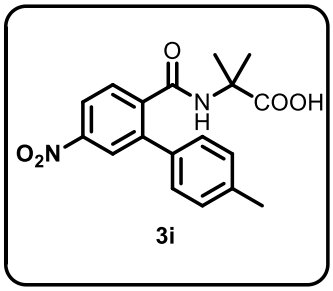
Compound **3h** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 48.5 mg, 64% yield. Mp: 177-179°C.**^{1}H NMR** (500 MHz, DMSO-d_6)δ 8.51 (s, 1H), 7.61 (dd, J = 8.1, 2.0 Hz, 1H), 7.56 (d, J = 2.0 Hz, 1H), 7.34 (dd, J = 8.1, 5.0 Hz, 3H), 7.19 (d, J = 7.9 Hz, 2H), 2.33 (s, 3H), 1.30 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.3, 167.5, 141.5, 137.0, 135.7, 135.5, 131.9, 130.1, 129.5, 128.8, 128.4, 122.4, 55.2, 24.5, 20.7. **HRMS** (ESI)[M+H]$^+$calcd for$C_{18}H_{19}BrNO_3$: 376.0543, found: 376.0541.



3h

2-methyl-2-(4'-methyl-5-nitro-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (3i)

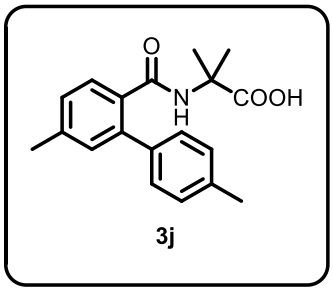
Compound **3i** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 51.9 mg, 75% yield. Mp: 206-208°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.28 (s, 1H), 7.80 (dd, J = 8.3, 1.9 Hz, 1H), 7.70 (d, J = 1.8 Hz, 1H), 7.18 (d, J = 8.4 Hz, 1H), 6.98 (d, J = 7.9 Hz, 2H), 6.79 (d, J = 7.8 Hz, 2H), 1.90 (s, 3H), 0.88 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.6, 167.2, 148.2, 142.9, 141.0, 138.0, 135.3, 130.0, 129.4, 128.9, 124.5, 122.2, 55.9, 24.9, 21.2. **HRMS** (ESI)[M+H]$^+$calcd for$C_{18}H_{19}N_2O_5$: 343.1288, found: 343.1290.



3i

2-(4',5-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3j)

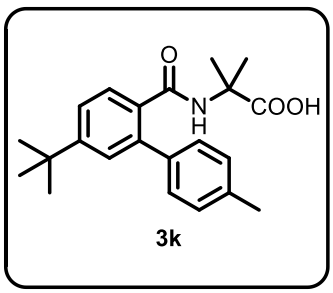
Compound **3j** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 48.4 mg, 77% yield. Mp: 192-194°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.30 (s, 1H), 7.31 (dd, J = 8.0, 6.2 Hz, 3H), 7.18 (dd, J = 13.9, 6.7 Hz, 4H), 2.37 (s, 3H), 2.32 (s, 3H), 1.31 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.5, 168.4, 139.2, 138.9, 137.1, 136.1, 133.9, 130.2, 128.6, 128.4, 128.1, 127.1, 55.0, 24.5, 20.8, 20.7. **HRMS** (ESI)[M+H]$^+$calcd for$C_{19}H_{22}NO_3$: 312.1594, found: 312.1594.



3j

2-(5-(tert-butyl)-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3k)

Compound **3j** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 54.3 mg, 76% yield. Mp: 199-202°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.31 (s, 1H), 7.42 (dd, J = 8.1, 1.9 Hz, 1H), 7.33 (dd, J = 5.0, 2.9 Hz, 4H), 7.18 (d, J = 7.9 Hz, 2H), 2.33 (s, 3H), 1.32 (s, 9H), 1.30 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.9, 168.9, 152.3, 139.3, 137.9, 136.6, 134.6, 129.1, 129.0, 128.3, 126.9, 124.0, 55.5, 34.9, 31.4, 25.0, 21.1.**HRMS** (ESI)[M+H]$^+$calcd for$C_{22}H_{28}NO_3$: 354.2064, found: 354.2067.

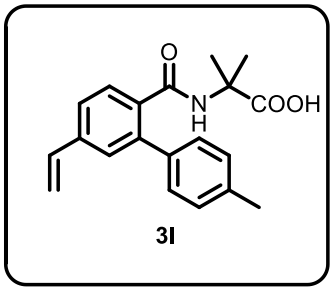


3k

2-methyl-2-(4'-methyl-5-vinyl-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (3l)

Compound **3l** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 49.7 mg, 76% yield. Mp: 123-126°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.39 (s, 1H), 7.51 (d, J = 7.9 Hz, 1H), 7.45 (d, J = 1.5 Hz, 1H), 7.37 (dd, J = 15.3, 8.0 Hz, 3H), 7.19 (d, J = 7.9 Hz, 2H), 6.81 (dd, J = 17.7, 11.0 Hz, 1H), 5.94 (d, J = 17.6 Hz, 1H), 5.34 (d, J = 11.5 Hz, 1H), 2.33 (s, 3H), 1.31 (s, 6H).

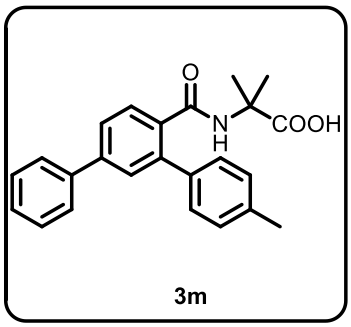
^{13}C NMR (126 MHz, DMSO-d_6) δ 175.4, 168.2, 139.6, 138.1, 136.9, 136.4, 136.0, 136.0, 128.6, 128.5, 128.4, 127.6, 124.0, 115.6, 55.1, 24.5, 20.7.**HRMS** (ESI)[M+H]$^+$calcd for$C_{20}H_{22}NO_3$: 324.1594, found: 324.1599.



3l

2-methyl-2-(4''-methyl-[1,1':3',1''-terphenyl]-4'-ylcarboxamido)propanoic acid (3m)

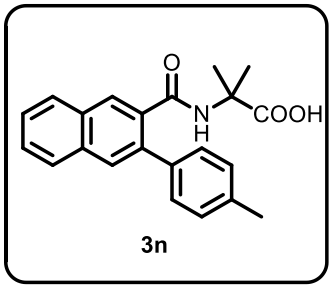
Compound **3m** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 55.8 mg, 74% yield. Mp: 188-191°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.46 (s, 1H), 7.74 (d, J = 7.4 Hz, 2H), 7.68 (dd, J = 7.9, 1.5 Hz, 1H), 7.62 (s, 1H), 7.52 – 7.47 (m, 3H), 7.44 (d, J = 8.0 Hz, 2H), 7.40 (t, J = 7.3 Hz, 1H), 7.20 (d, J = 7.8 Hz, 2H), 2.34 (s, 3H), 1.34 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.9, 168.7, 141.7, 140.3, 139.9, 137.4, 136.9, 136.1, 129.5, 129.3, 129.1, 129.0, 128.4, 128.3, 127.4, 125.4, 55.6, 25.0, 21.2. **HRMS** (ESI)[M-H]$^-$calcd for$C_{24}H_{24}NO_3$:372.1605, found: 372.1595.



3m

2-methyl-2-(3-(p-tolyl)-2-naphthamido)propanoic acid (3n)

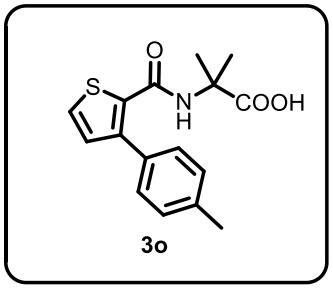
Compound **3n** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 42.1 mg, 60% yield. Mp: 247-250°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.70 (s, 1H), 8.27 – 8.24 (m, 1H), 8.00 (d, J = 8.4 Hz, 1H), 7.99 – 7.96 (m, 1H), 7.57 – 7.54 (m, 2H), 7.50 (d, J = 8.5 Hz, 1H), 7.45 (d, J = 8.1 Hz, 2H), 7.23 (d, J = 7.9 Hz, 2H), 2.35 (s, 3H), 1.23 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.5, 167.5, 137.2, 136.5, 135.6, 133.9, 131.8, 130.5, 128.9, 128.6, 128.4, 127.9, 127.6, 126.6, 126.0, 125.9, 55.1, 20.7, 19.3. **HRMS** (ESI)[M+H]$^+$calcd for$C_{22}H_{22}NO_3$:348.1594, found: 348.1596.



3n

2-methyl-2-(3-(p-tolyl)thiophene-2-carboxamido)propanoic acid (3o)

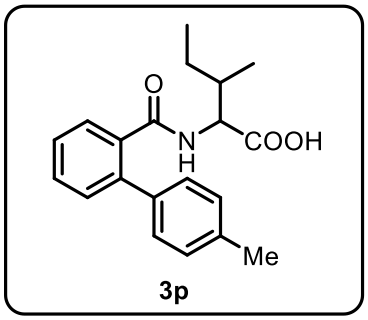
Compound **3o** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 25.8 mg, 42% yield. Mp: 140-142°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 7.91 (s, 1H), 7.68 (d, J = 5.1 Hz, 1H), 7.41 (d, J = 8.1 Hz, 2H), 7.21 (s, 1H), 7.19 (d, J = 5.0 Hz, 2H), 2.33 (s, 3H), 1.32 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.2, 161.8, 141.3, 136.9, 132.6, 131.9, 129.6, 128.9, 128.5, 127.1, 55.6, 24.4, 20.7. **HRMS** (ESI)[M+H]$^{+}$calcdfor $C_{16}H_{18}NO_3S$: 304.1002, found: 304.1009.



3o

3-methyl-2-(4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)pentanoic acid（3p）

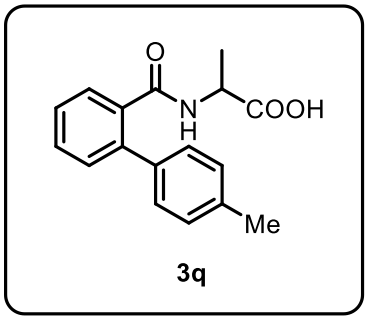
Compound **3p** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 19.6 mg, 30% yield. Mp: 97-101°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ7.48 (ddd, J = 8.8, 4.6, 2.9 Hz, 1H), 7.39 (d, J = 3.9 Hz, 2H), 7.35 (d, J = 7.6 Hz, 1H), 7.30 (d, J = 8.0 Hz, 2H), 7.16 (d, J = 7.8 Hz, 2H), 4.08 (dd, J = 8.0, 6.2 Hz, 1H), 2.31 (s, 3H), 1.75 – 1.71 (m, 1H), 1.30 – 1.25 (m, 2H), 0.77 (d, J = 7.4 Hz, 3H), 0.75 (d, J = 4.6 Hz, 3H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ172.9, 169.0, 139.1, 137.3, 136.9, 136.3, 129.6, 129.3, 128.7, 128.3, 127.9, 127.8, 126.7, 57.1, 36.0, 24.6, 20.6, 19.3, 15.5, 11.2. **HRMS** (ESI)[M-H]$^{-}$calcdfor $C_{20}H_{22}NO_3$: 324.1605, found: 324.1601.



3p

2-(4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid（3q）

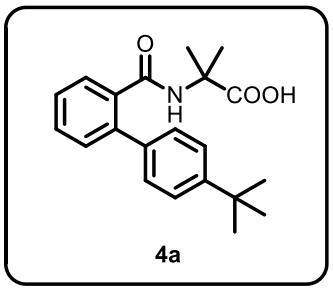
Compound **3q** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 19.6 mg, 30% yield. Mp: 97-101°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ7.51 – 7.47 (m, 1H), 7.44 – 7.36 (m, 3H), 7.32 (d, J = 8.0 Hz, 2H), 7.17 (d, J = 7.9 Hz, 2H), 4.20 – 4.13 (m, 1H), 2.32 (s, 3H), 1.20 (d, J = 7.3 Hz, 3H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ173.8, 168.6, 139.2, 137.1, 136.5, 136.2, 129.7, 129.4, 128.6, 128.3, 127.9, 126.6, 48.0, 20.6, 16.9. **HRMS** (ESI)[M-H]$^{-}$calcdfor $C_{17}H_{16}NO_3$Ion(M-H): 282.1136, found: 282.1132.



3q

2-(4'-(tert-butyl)-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4a)

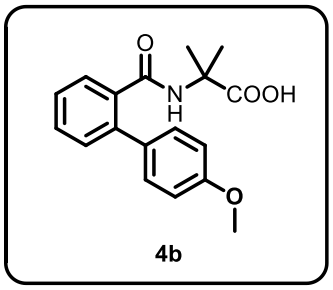
Compound **4a** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 54.8 mg, 80% yield. Mp: 181-184°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.34 (s, 1H), 7.51 – 7.46 (m, 1H), 7.42 – 7.37 (m, 7H), 1.32 (s, 9H), 1.30 (s, 6H).**^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.9, 168.8, 149.9, 139.6, 137.4, 137.1, 130.1, 129.8, 128.7, 128.5, 127.1, 125.2, 55.5, 34.6, 31.6, 24.9.**HRMS** (ESI)[M+H]$^{+}$calcdfor $C_{21}H_{26}NO_3$: 340.1907, found: 340.1905.



4a

2-(4'-methoxy-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4b)

Compound **4b** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 41.8 mg, 66% yield. Mp: 177-180°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 7.49 – 7.45 (m, 1H), 7.40 – 7.35 (m, 5H), 6.93 (d, J = 8.6 Hz, 2H), 3.78 (s, 3H), 1.32 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.9, 168.9, 168.8, 159.0, 139.3, 137.0, 137.0, 132.6, 130.2, 130.0, 129.8, 128.5, 126.8, 114.2, 55.5, 55.4, 25.0. **HRMS** (ESI)[M+H]$^{+}$calcdfor $C_{18}H_{20}NO_4$: 314.1387, found: 314.1391.

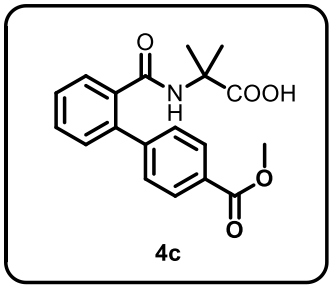


4b

2-(4'-(methoxycarbonyl)-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4c)

Compound **4c**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 52.4 mg, 76% yield. Mp: 178-180°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.55 (s, 1H), 7.96 (d, J = 8.4 Hz, 2H), 7.58 (d, J = 8.4 Hz, 2H), 7.56 – 7.52 (m, 1H), 7.49 – 7.45 (m, 3H), 3.87 (s, 3H), 1.31 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.4, 168.0, 166.1, 144.8, 144.7, 138.2, 136.8, 129.8, 129.6, 129.0, 128.9, 128.2, 128.1,

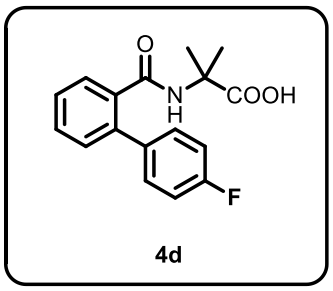
127.7, 55.2, 52.1, 24.5. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{19}H_{20}NO_5$: 342.1336, found: 342.1334.



4c

2-(4'-fluoro-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4d)

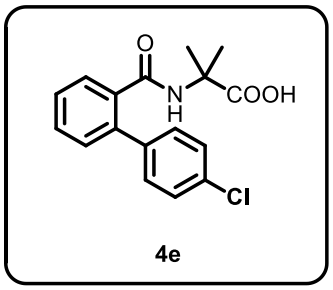
Compound **4d**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 45.1 mg, 74% yield. Mp: 198-201°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.43 (s, 1H), 7.52 – 7.38 (m, 6H), 7.19 (t, J = 8.9 Hz, 2H), 1.30 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ175.8, 168.6, 162.1 (d, J = 243.7 Hz), 138.6, 137.3, 136.7 (d, J = 2.8 Hz), 131.0 (d, J = 8.2 Hz),130.1, 129.9, 128.4, 127.5, 115.3 (d, J = 21.3 Hz), 55.6, 24.9. **HRMS**(ESI)[M+H]$^+$calcdfor $C_{17}H_{17}FNO_3$: 302.1187, found: 302.1192.



4d

2-(4'-chloro-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4e)

Compound **4e**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 42.3 mg, 66% yield. Mp: 212-214°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.50 (s, 1H), 7.51 (ddd, J = 7.6, 6.2, 2.8 Hz, 1H), 7.46 – 7.40 (m, 7H), 1.32 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.8, 168.5, 139.2, 138.4, 137.2, 132.5, 130.8, 130.1, 130.0, 128.6, 128.5, 127.7, 55.7, 24.9. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{17}H_{17}ClNO_3$: 318.0891, found:318.0889.

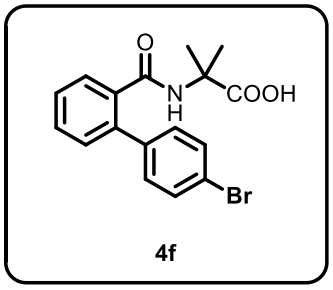


4e

2-(4'-bromo-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4f)

Compound **4f**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 50.4 mg, 69% yield. Mp: 222-225°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 7.57 – 7.55 (m, 2H), 7.53 – 7.50 (m, 1H), 7.46 – 7.40

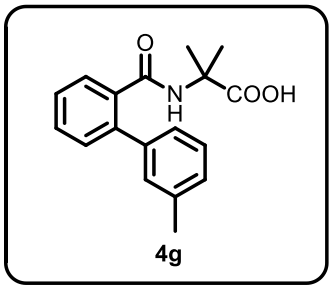
(m, 3H), 7.40 – 7.37 (m, 2H), 1.32 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.3, 168.1, 139.1, 138.1, 136.6, 136.5, 130.9, 130.7, 129.6, 128.2, 127.3, 120.6, 55.1, 24.5. **HRMS** (ESI)[M-H]$^-$calcdfor $C_{17}H_{15}BrNO_3$: 360.0241, found:360.0237.



4f

2-methyl-2-(3'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (4g)

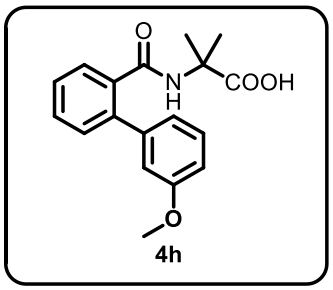
Compound **4g**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 45.1 mg, 75% yield. Mp: 178-181 °C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.33 (s, 1H), 7.48 (dd, J = 7.5, 4.0 Hz, 1H), 7.39 (t, J = 6.7 Hz, 3H), 7.26 (dd, J = 15.6, 8.2 Hz, 3H), 7.14 (d, J = 7.2 Hz, 1H), 2.32 (s, 3H), 1.29 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.8, 168.7, 140.3, 139.7, 137.4, 137.3, 130.1, 129.8, 129.6, 128.5, 128.4, 128.2, 127.3, 126.1, 55.6, 24.9, 21.4. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{18}H_{20}NO_3$: 298.1438, found:298.1440.



4g

2-(3'-methoxy-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4h)

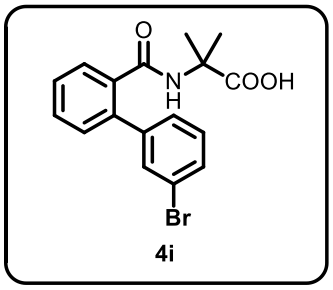
Compound **4h**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 43.7 mg, 69% yield. Mp: 196-198°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.37 (s, 1H), 7.49 (dd, J = 10.2, 4.6 Hz, 1H), 7.41 (dd, J = 15.1, 7.9 Hz, 3H), 7.28 (t, J = 7.9 Hz, 1H), 6.99 (d, J = 7.7 Hz, 1H), 6.96 (s, 1H), 6.90 (dd, J = 8.2, 2.1 Hz, 1H), 3.77 (s, 3H), 1.27 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6)δ 175.4, 168.2, 158.9, 141.3, 139.1, 136.8, 129.7, 129.3, 129.0, 127.9, 127.0, 121.0, 114.0, 112.7, 55.0, 55.0, 24.5. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{18}H_{20}NO_4$: 314.1387, found:314.1393.



4h

2-(3'-bromo-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4i)

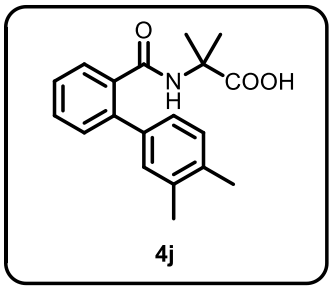
Compound **4i**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 46.7 mg, 64% yield. Mp: 202-205°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.47 (s, 1H), 7.57 (s, 1H), 7.52 (dd, J = 14.6, 7.6 Hz, 2H), 7.44 (dd, J = 21.0, 7.2 Hz, 4H), 7.35 (t, J = 7.8 Hz, 1H), 1.31 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.7, 168.4, 142.8, 138.0, 137.3, 131.4, 130.7, 130.4, 130.1, 130.0, 128.4, 128.2, 128.0, 121.8, 55.7, 25.0. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{17}H_{17}BrNO_3$: 362.0386, found:362.0390.



4i

2-(3',4'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4j)

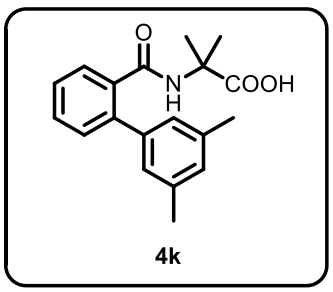
Compound **4j**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 50.3 mg, 80% yield. Mp: 203-205°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.35 (s, 1H), 7.49 – 7.44 (m, 1H), 7.39 – 7.35 (m, 3H), 7.20 (s, 1H), 7.15 (dd, J = 17.7, 8.0 Hz, 2H), 2.24 (s, 3H), 2.23 (s, 3H), 1.31 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.9, 168.8, 139.6, 137.9, 137.2, 136.1, 135.4, 130.0, 129.7, 129.7, 128.4, 127.0, 126.3, 55.6, 24.9, 19.8, 19.5. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{19}H_{22}NO_3$: 312.1594, found:312.1602.



4j

2-(3',5'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4k)

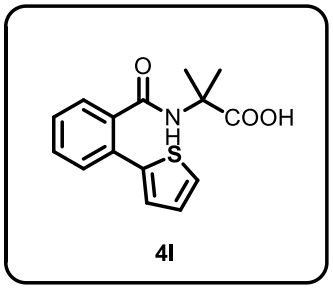
Compound **4j**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 47.8 mg, 76% yield. Mp: 194-197°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.31 (s, 1H), 7.49 – 7.45 (m, 1H), 7.40 – 7.36 (m, 3H), 7.03 (s, 2H), 6.96 (s, 1H), 2.28 (s, 6H), 1.31 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.8, 168.7, 140.3, 139.8, 137.4, 137.2, 130.1, 129.7, 128.9, 128.4, 127.2, 126.8, 55.6, 24.9, 21.3. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{19}H_{22}NO_3$: 312.1594, found:312.1599.



4k

2-methyl-2-(2-(thiophen-2-yl)benzamido)propanoic acid (4l)

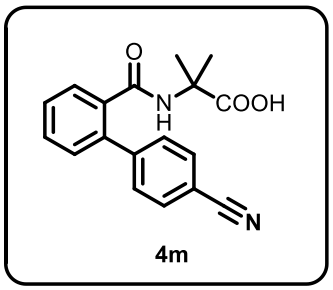
Compound **4l**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 46.1 mg, 79% yield. Mp: 181-183°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ8.54 (s, 1H), 7.55 (dd, J = 5.1, 0.8 Hz, 1H), 7.51 (d, J = 7.0 Hz, 1H), 7.46 (td, J = 7.5, 1.4 Hz, 1H), 7.39 (ddd, J = 4.3, 1.1, 0.6 Hz, 1H), 7.34 (dd, J = 7.5, 1.1 Hz, 1H), 7.30 (dd, J = 3.6, 1.0 Hz, 1H), 7.06 (dd, J = 5.0, 3.6 Hz, 1H), 1.36 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ175.8, 168.7, 141.3, 137.0, 131.7, 129.8, 128.6, 128.1, 127.7, 127.2, 126.7, 55.7, 25.0. **HRMS** (ESI)[M+H]$^{+}$calcdfor $C_{15}H_{16}NO_3S$: 290.0845, found:290.0852.



4l

2-(4'-cyano-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4m)

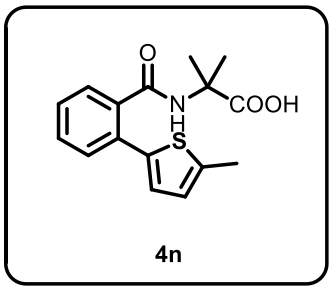
Compound **4m**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 21.2 mg, 34% yield. Mp: 219-222°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ8.60 (s, 1H), 7.83 (d, J = 8.1 Hz, 2H), 7.61 (d, J = 8.2 Hz, 2H), 7.55 (t, J = 7.3 Hz, 1H), 7.48 (dt, J = 14.9, 7.4 Hz, 3H), 1.31 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.7, 168.3, 145.3, 138.2, 137.2, 132.4, 130.3, 130.2, 130.0, 128.7, 128.4, 119.3, 110.2, 55.7, 25.0. **HRMS** (ESI)[M+H]$^{+}$calcdfor $C_{18}H_{17}N_2O_3$: 309.1234, found:309.1232.



4m

2-methyl-2-(2-(5-methylthiophen-2-yl)benzamido)propanoic acid (4n)

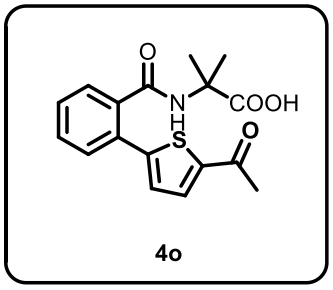
Compound **4n**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 41.0 mg, 67% yield. Mp: 167-170°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.55 (s, 1H), 7.43 (t, J = 6.6 Hz, 2H), 7.37 – 7.33 (m, 1H), 7.30 (d, J = 7.4 Hz, 1H), 7.10 (d, J = 3.4 Hz, 1H), 6.74 (d, J = 2.2 Hz, 1H), 2.45 (s, 3H), 1.37 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 175.8, 168.8, 140.1, 138.9, 136.6, 131.8, 129.7, 129.4, 128.6, 127.3, 127.0, 126.6, 55.6, 25.0, 15.3. **HRMS** (ESI)[M-H]$^{-}$calcdfor $C_{16}H_{16}NO_3S$: 302.0856, found:302.0853.



4n

2-(2-(5-acetylthiophen-2-yl)benzamido)-2-methylpropanoic acid (4o)

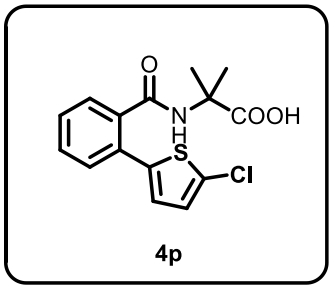
Compound **4o**was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 48.8 mg, 73% yield. Mp: 222-224°C.**^{1}H NMR** (500 MHz, DMSO-d_6)δ 8.64 (s, 1H), 7.85 (d, J = 3.9 Hz, 1H), 7.57 (dd, J = 7.6, 1.0 Hz, 1H), 7.50 (dtd, J = 16.3, 7.3, 1.3 Hz, 3H), 7.40 (dd, J = 7.4, 1.3 Hz, 1H), 7.35 (d, J = 3.9 Hz, 1H), 2.53 (s, 3H), 1.37 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6)δ 191.1, 175.8, 168.2, 149.8, 144.0, 137.3, 134.5, 130.8, 130.1, 130.0, 129.1, 128.7, 128.5, 55.9, 26.8, 25.0. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{17}H_{18}NO_4S$: 332.0951, found:332.0955.



4o

2-(2-(5-(chlorocarbonyl)thiophen-2-yl)benzamido)-2-methylpropanoic acid (4p)

Compound **4p** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 43.9 mg, 62% yield. Mp: 175-178°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.63 (s, 1H), 7.48 (d, J = 4.0 Hz, 2H), 7.45 – 7.41 (m, 1H), 7.36 (d, J = 7.4 Hz, 1H), 7.13 (d, J = 3.9 Hz, 1H), 7.07 (d, J = 3.9 Hz, 1H), 1.37 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6)δ 175.8, 168.3, 140.3, 136.9, 130.7, 130.0, 129.7, 128.7, 128.5, 128.3, 127.7, 127.0, 55.7, 25.0. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{16}H_{15}ClNO_4S$: 324.0456, found:324.0457.

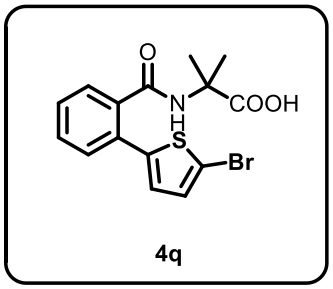


4p

2-(2-(5-bromothiophen-2-yl)benzamido)-2-methylpropanoic acid (4q)

Compound **4q** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 57.3 mg, 72% yield. Mp: 185-188°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.65 (s, 1H), 7.48 (d, J = 3.7 Hz, 2H), 7.45 – 7.41 (m, 1H), 7.35 (d, J = 7.3 Hz, 1H), 7.17 (d, J = 3.9 Hz, 1H), 7.11 (d, J = 3.9 Hz, 1H), 1.37 (s, 6H). **^{13}C NMR**

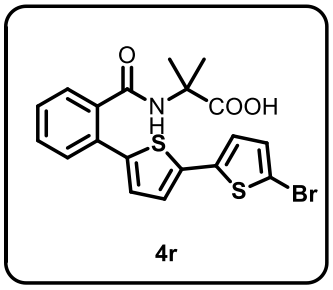
(126 MHz, DMSO-d_6)δ 175.3, 167.9, 142.6, 136.4, 130.8, 130.3, 129.5, 129.2, 128.2, 127.9, 127.5, 111.3, 55.2, 24.6. **HRMS** (ESI)[M-H]$^-$calcdfor $C_{15}H_{13}BrNO_3S$: 365.9805, found:365.9805.



4q

2-(2-(5'-bromo-[2,2'-bithiophen]-5-yl)benzamido)-2-methylpropanoic acid (4r)

Compound **4r** was prepared as described in general procedure for Ni(II)-catalyzed mono-selective ortho-arylation of unactivated aryl C-H bonds. White solid, 65.2 mg, 72% yield. Mp: 206-209°C.**^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.67 (s, 1H), 7.54 (d, J = 7.7 Hz, 1H), 7.48 (t, J = 7.5 Hz, 1H), 7.42 (t, J = 7.4 Hz, 1H), 7.36 (d, J = 7.5 Hz, 1H), 7.26 (d, J = 3.8 Hz, 1H), 7.25 – 7.23 (m, 2H), 7.16 (d, J = 3.8 Hz, 1H), 1.39 (s, 6H). **^{13}C NMR** (126 MHz, DMSO-d_6)δ 175.8, 168.5, 141.0, 138.4, 136.8, 135.7, 132.1, 130.9, 130.0, 129.5, 128.8, 128.2, 128.1, 125.5, 125.0, 110.7, 55.7, 25.1. **HRMS** (ESI)[M+H]$^+$calcdfor $C_{19}H_{17}BrNO_3S_2$: 449.9828, found:449.9839.

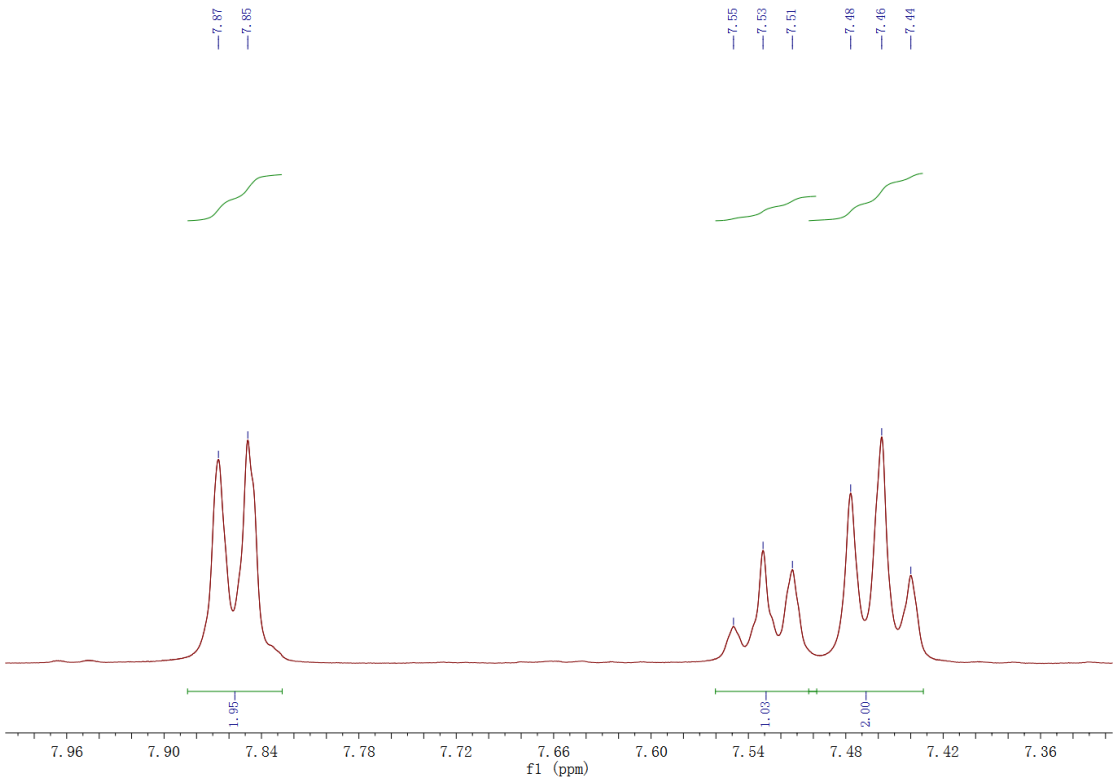


4r

3. Mechanistic Investigations

H/D exchange experiments

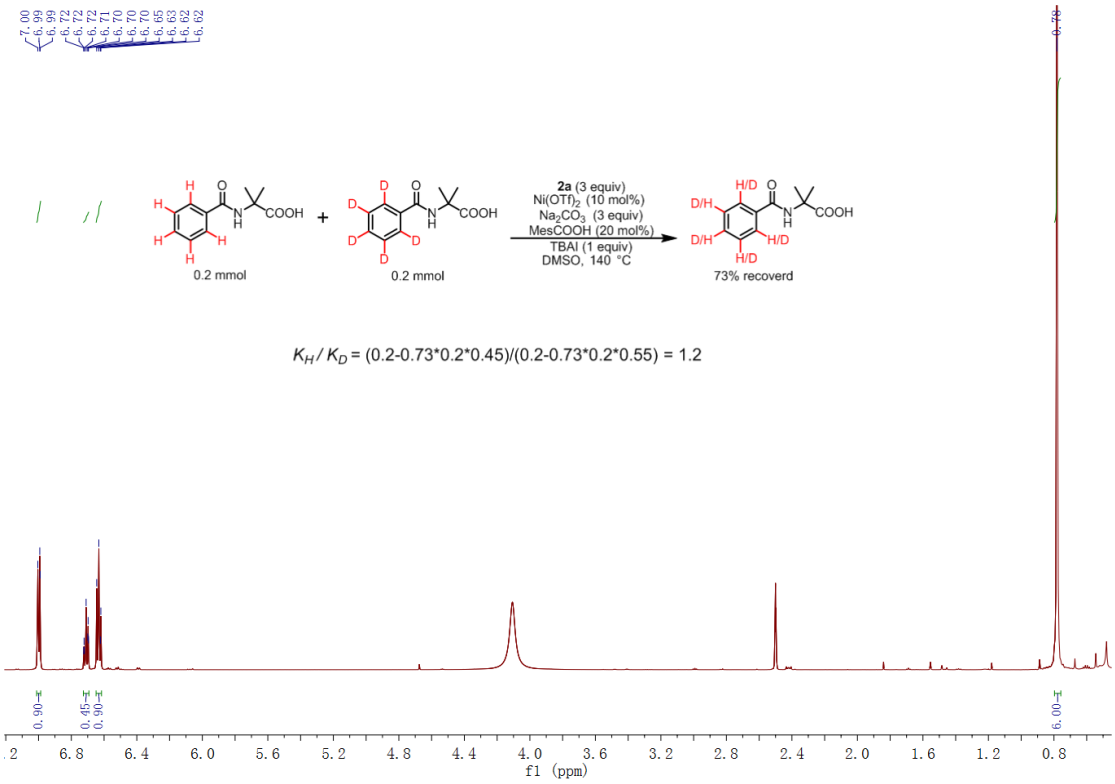
The dry tube was charged with **1a** (0.2 mmol), $Ni(OTf)_2$ (10 mol%), MesCOOH (20 mol%),TBAI (0.6mmol),Na_2CO_3(0.6mmol) and D_2O (2mmol) were dissolved in DMSO (2mL).The resulting mixture was stirred at 140 °C for 16 h. Then the solvent was removed under vacuum and ^{1}H NMR indicated that the H/D rate was greater than 95%



Scheme S1 H/D exchange experiment

KIE experiments

A mixture of 2-benzamido-2-methylpropanoic acid**1a** (0.2 mmol) or deuterium-labeled compound[D_5]-**1a** (0.2 mmol), **2a** (0.6mmol), $Ni(OTf)_2$ (10 mol%), MesCOOH (20 mol%),TBAI (0.6mmol) and Na_2CO_3(0.6mmol)and DMSO (2mL) were added into a dry tube. The reactions were stirred at 140°C in parallel for 50 min. After cooling to room temperature, these two reactions were combined and the solvent was removed under vacuum.The residue was purified by flash chromatography using 2% methanol in DCM as eluent. 73% starting material was recovered and the KIE value was determined to be 1.2



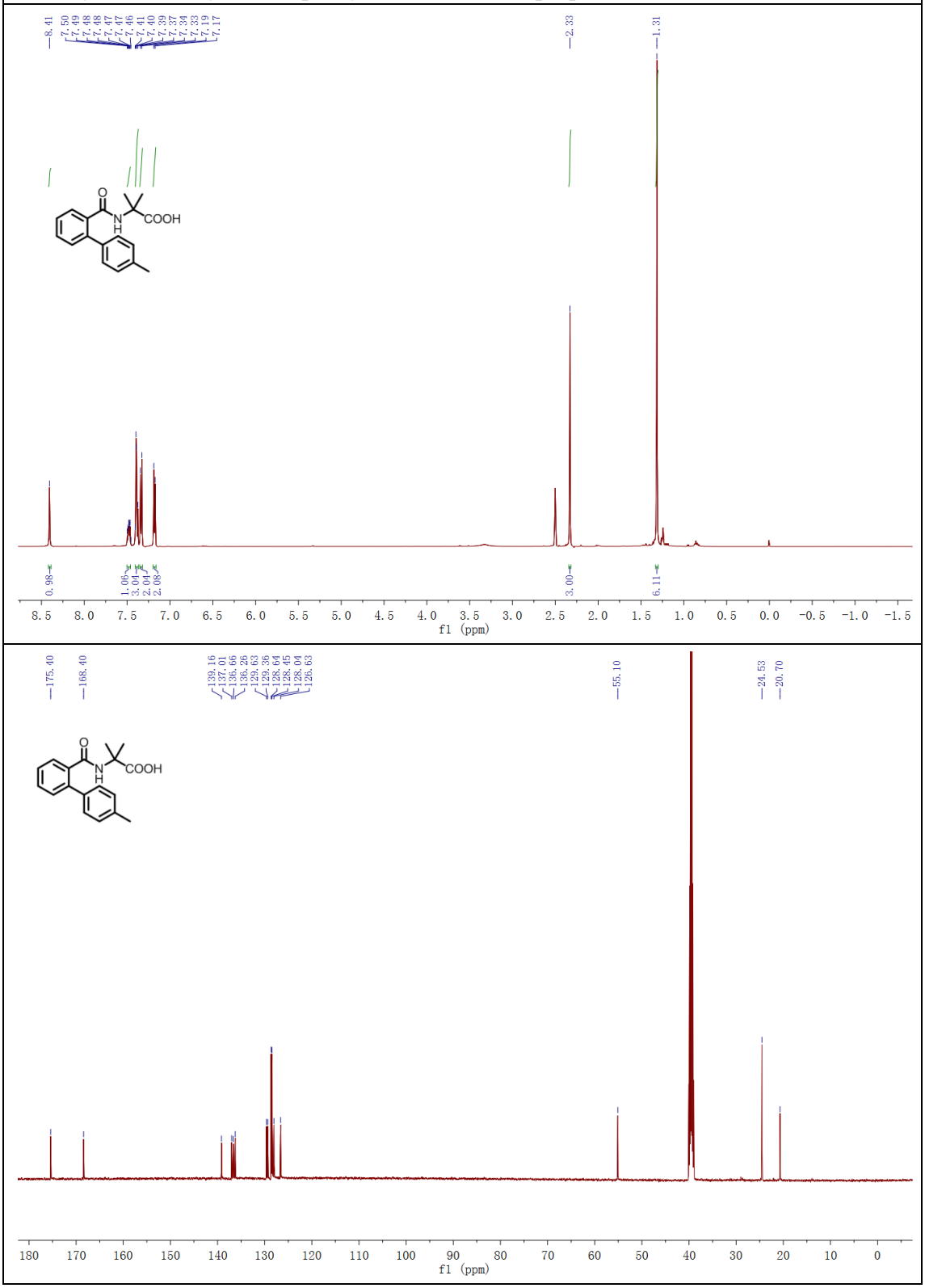
Scheme S2KIE experiment

4. References

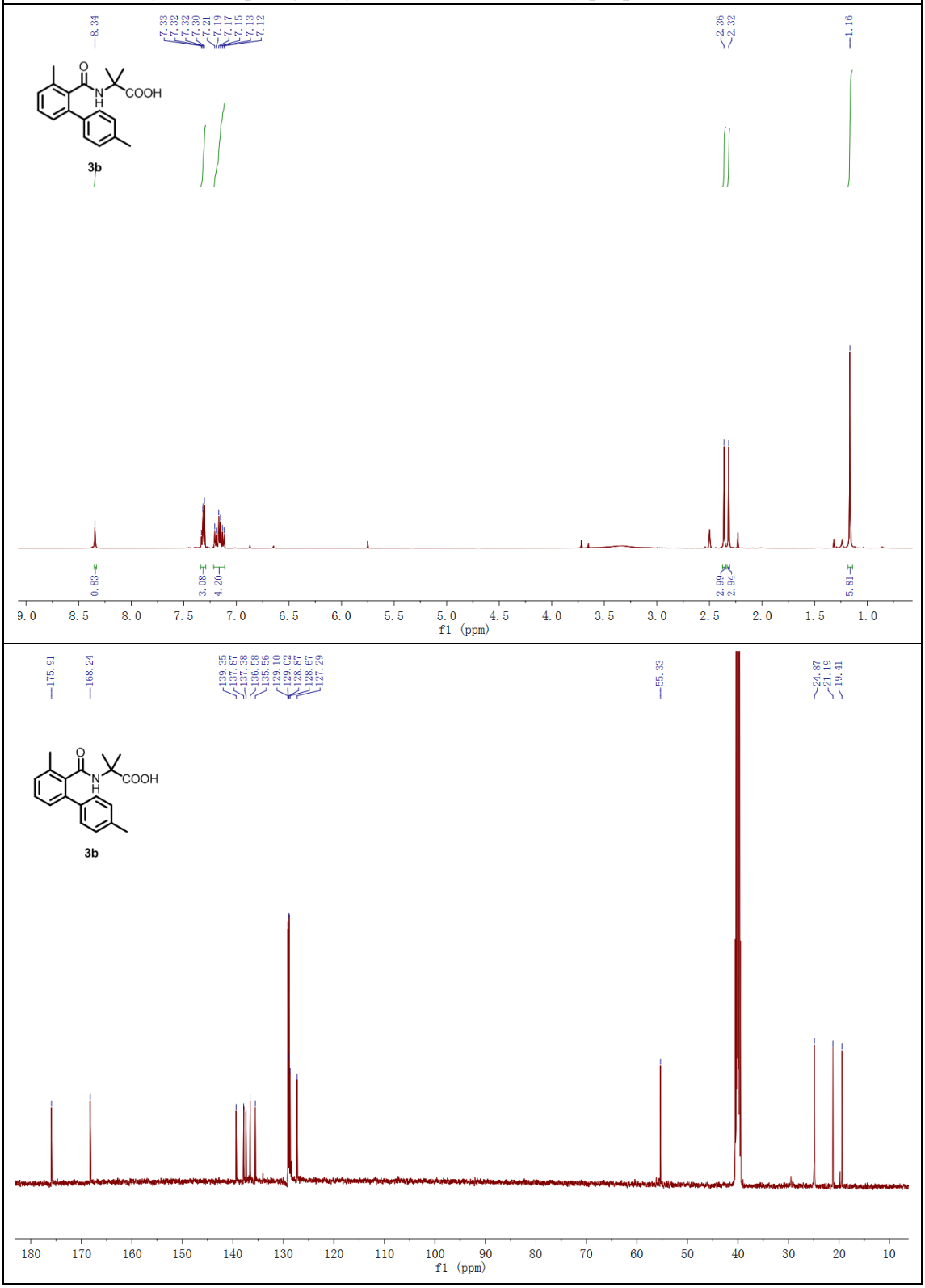
(1) S. Li, W.Zhu, F.Gao, C.Li, J.Wang, H.Liu,*J.Org. Chem.,***2017**, *82*, 126.

5. NMR spectra

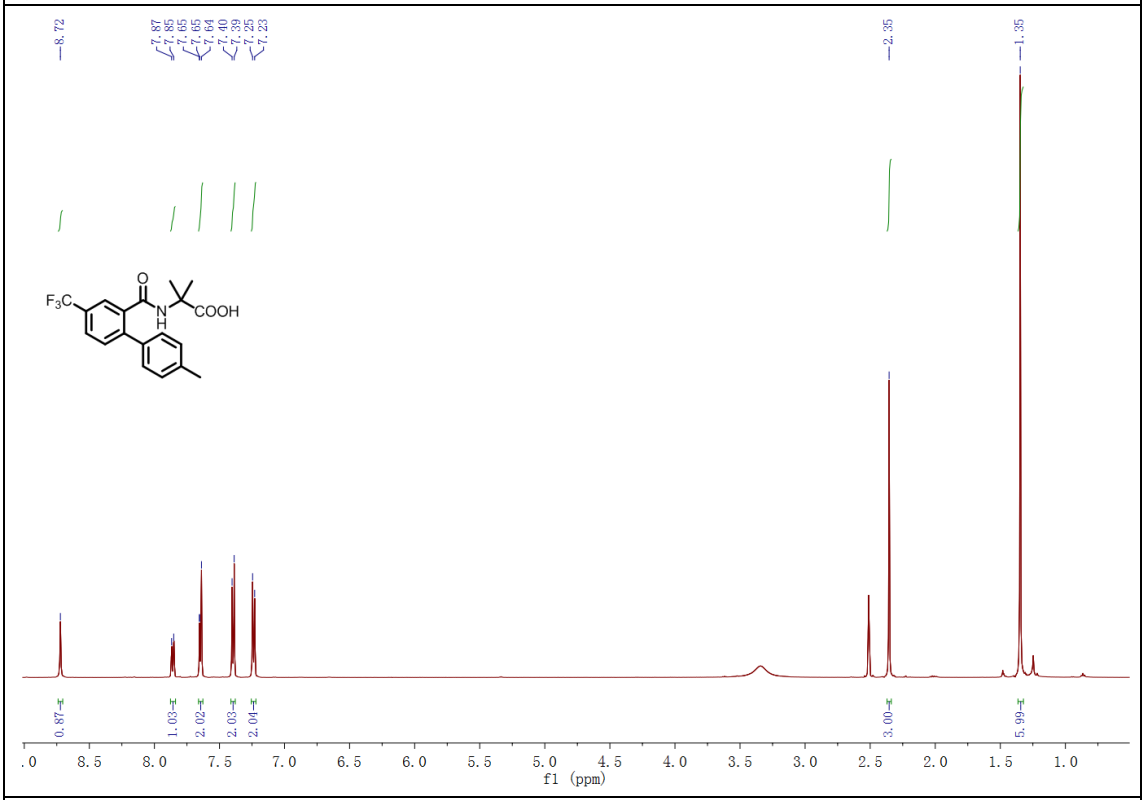
2-methyl-2-(4'-methyl-[1,1'-biphenyl]-2-carboxamido)propanoic acid (3a)

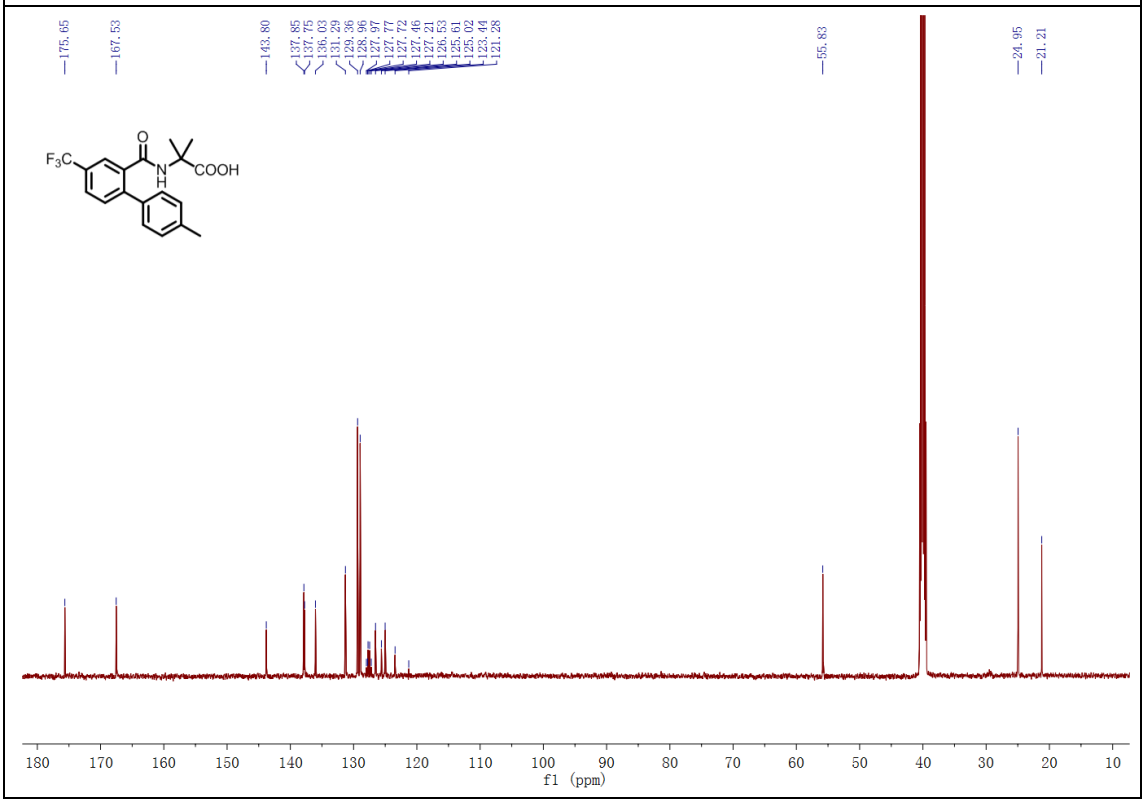


2-(3,4'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3b)

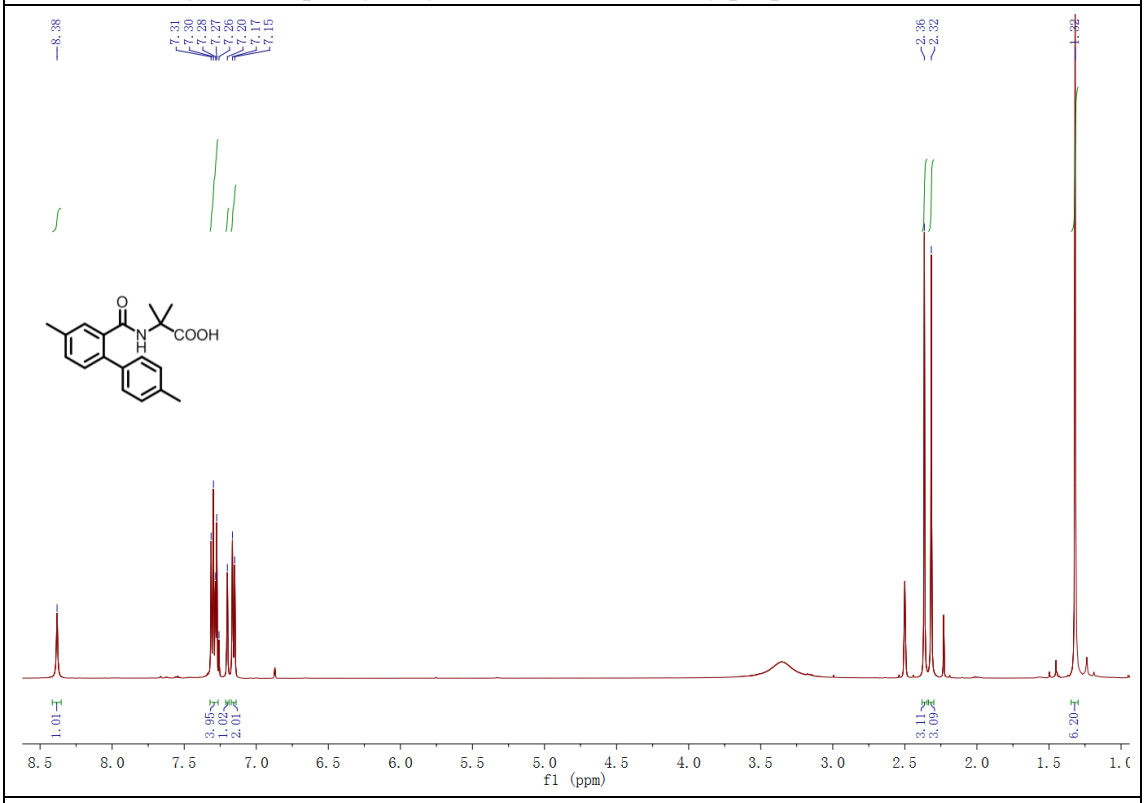


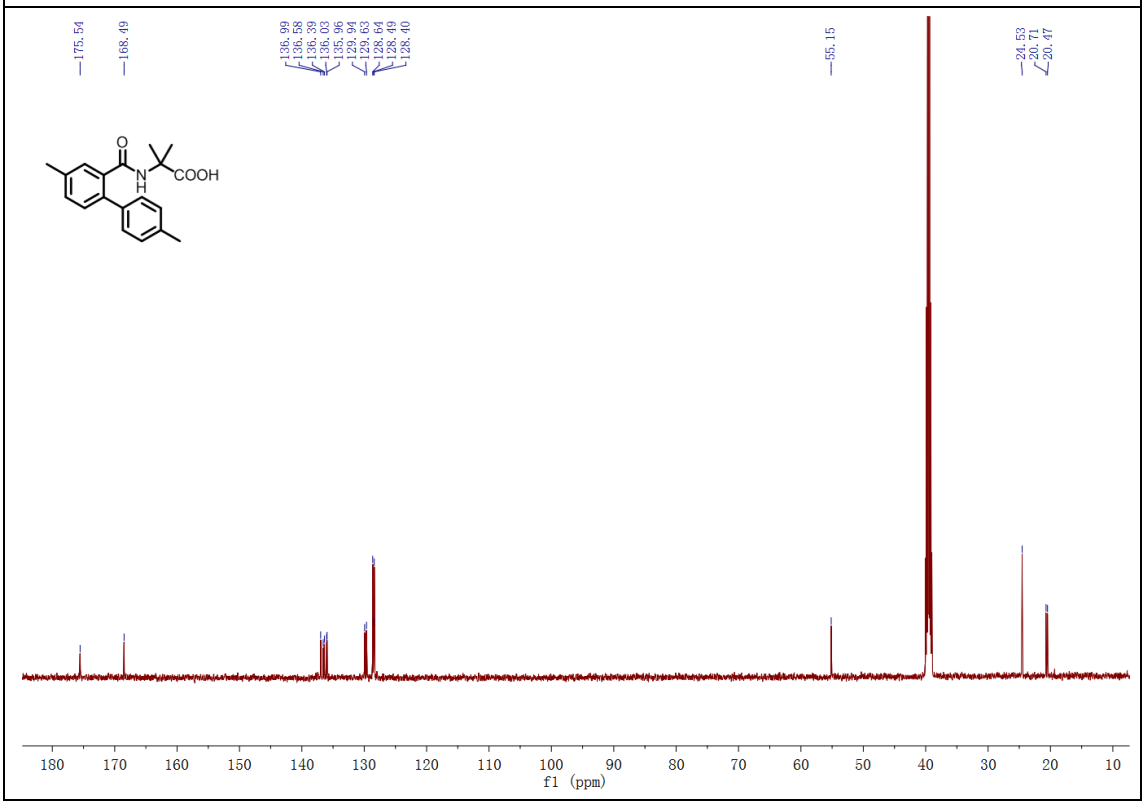
2-methyl-2-(4'-methyl-4-(trifluoromethyl)-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (3c)



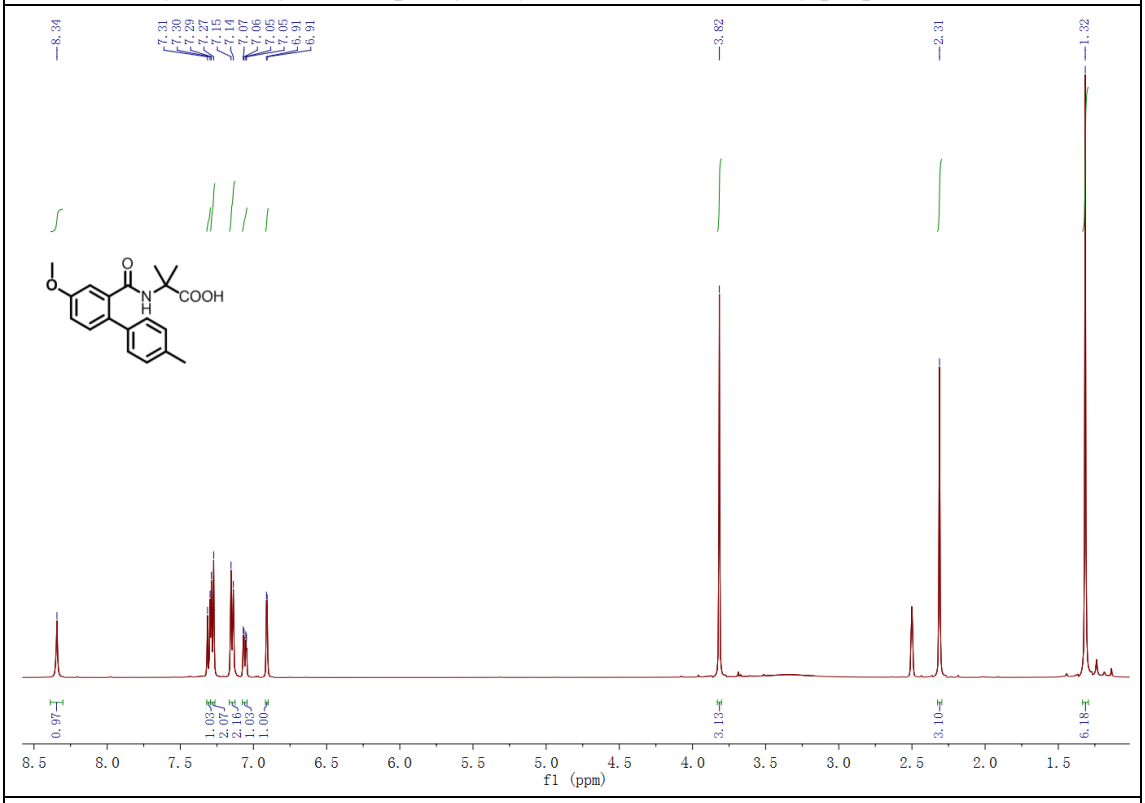


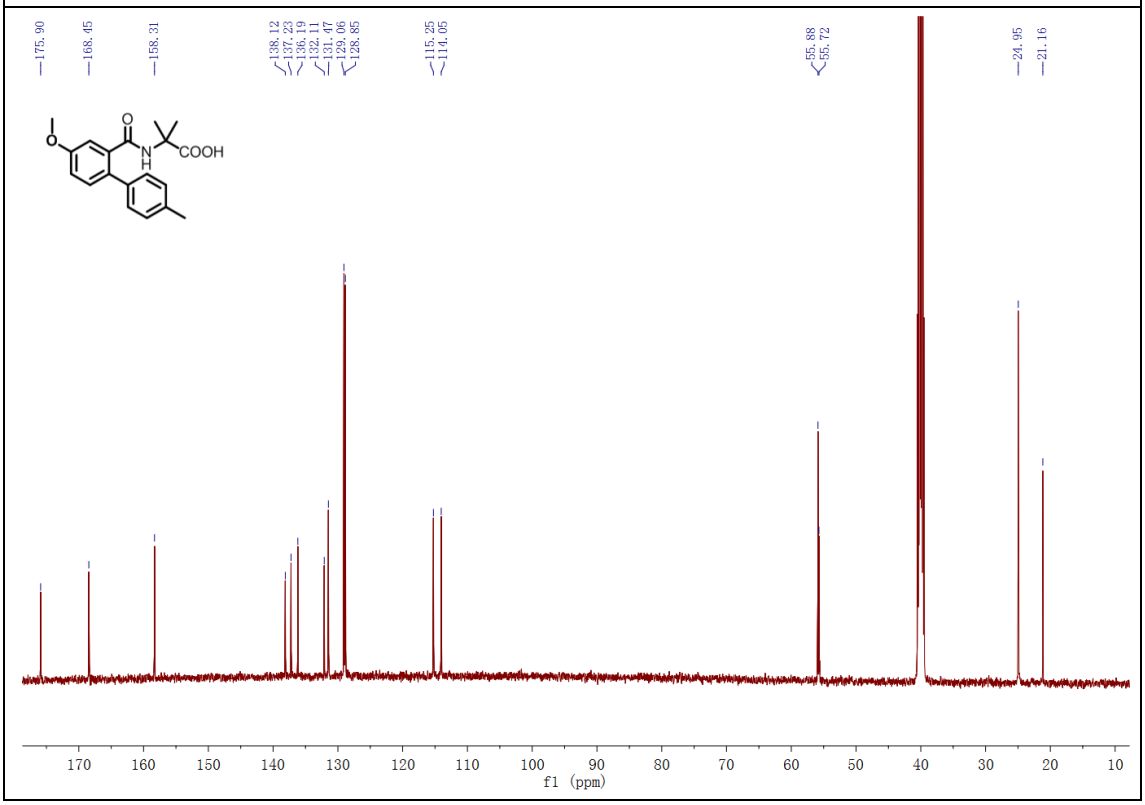
2-(4,4'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3d)



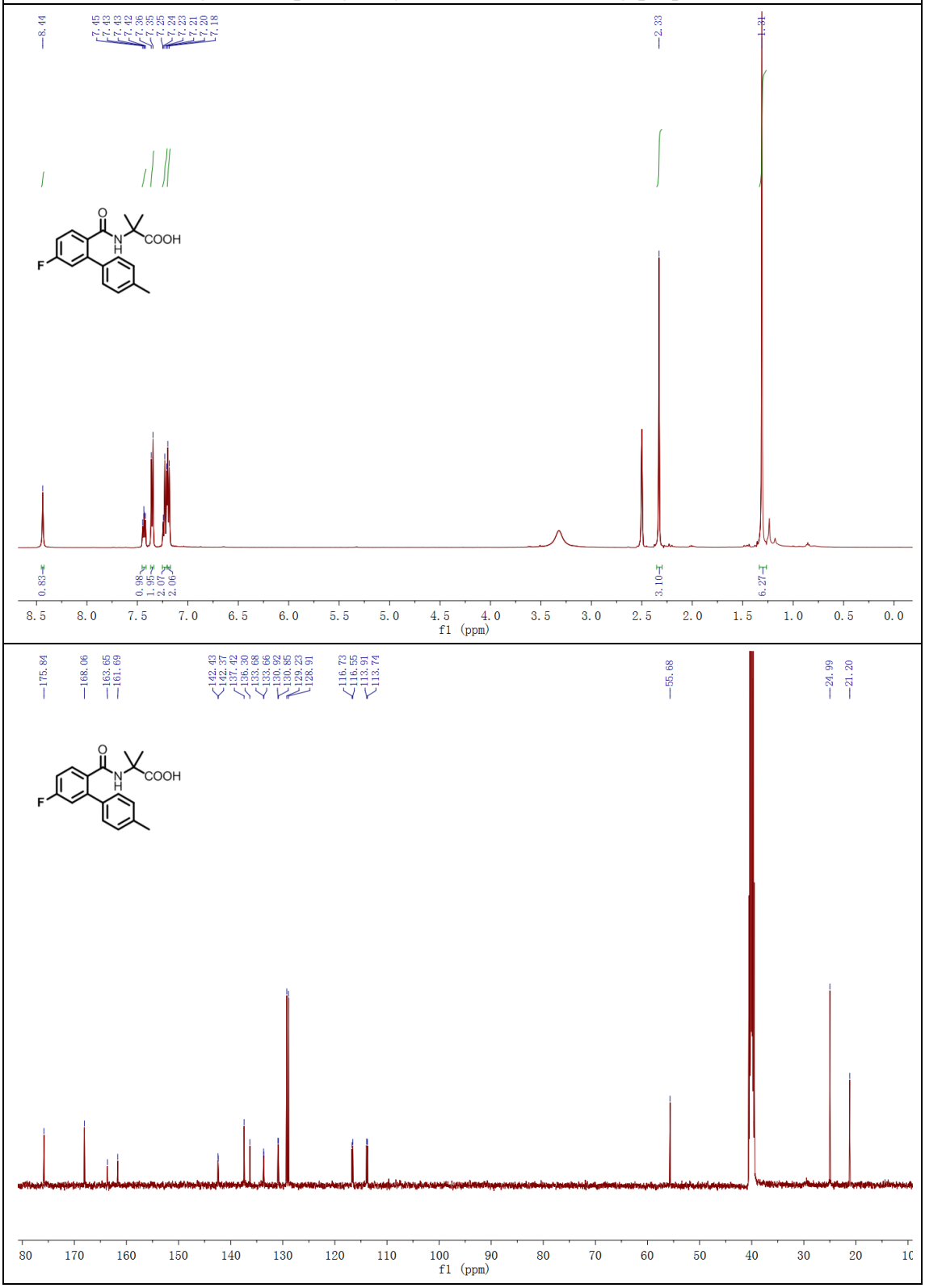


2-(4-methoxy-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3e)

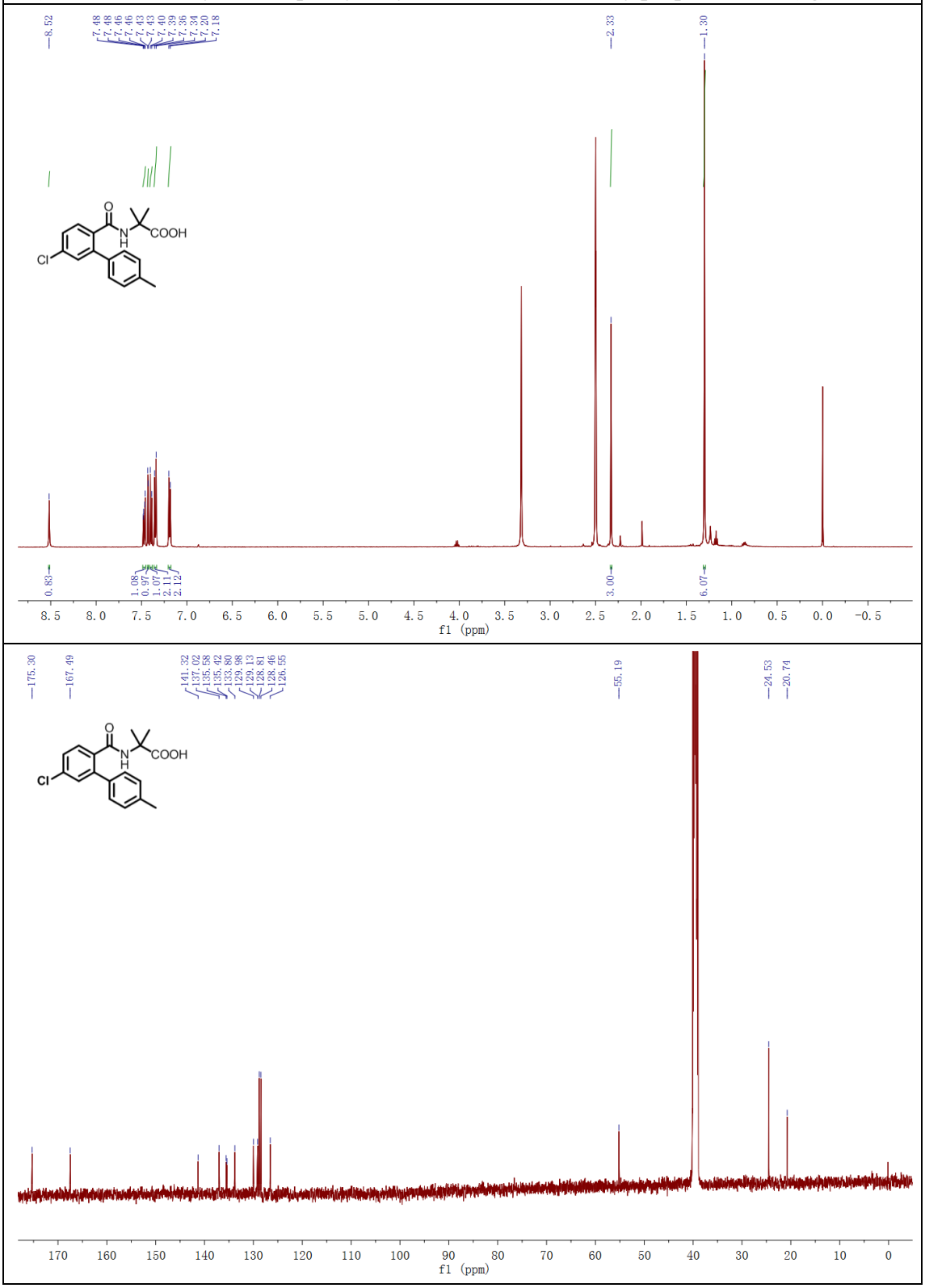




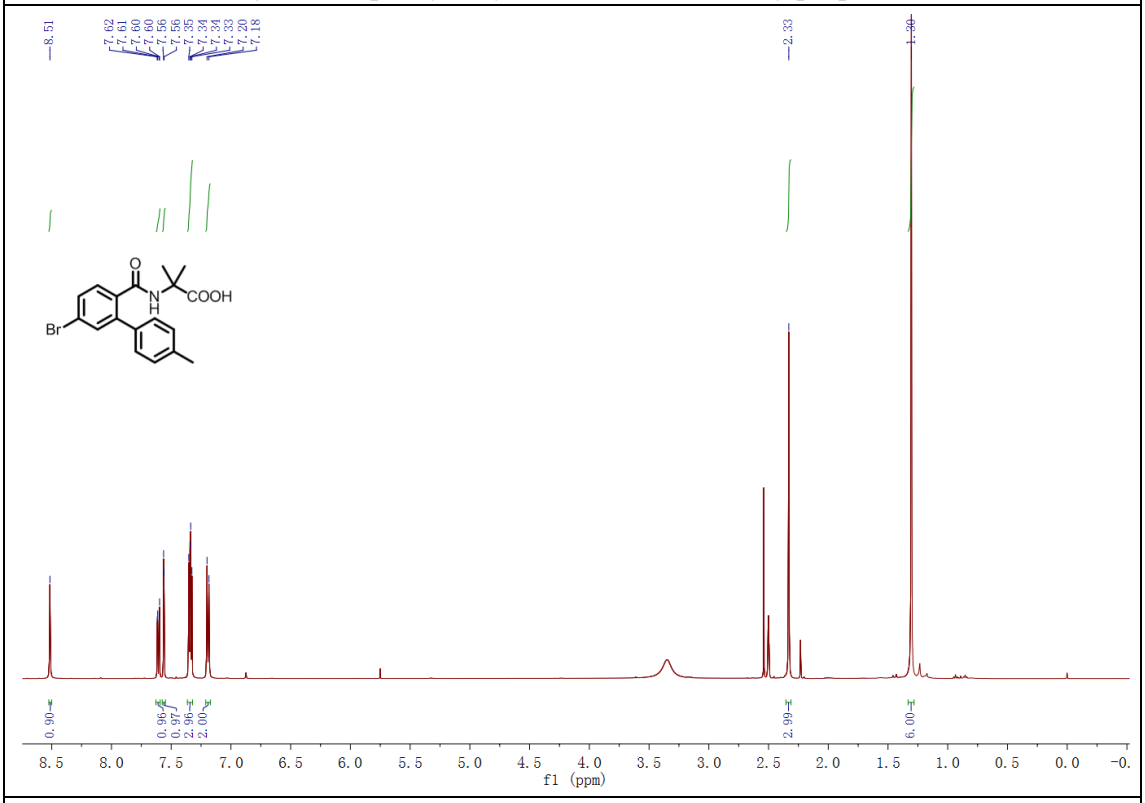
2-(5-fluoro-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3f)

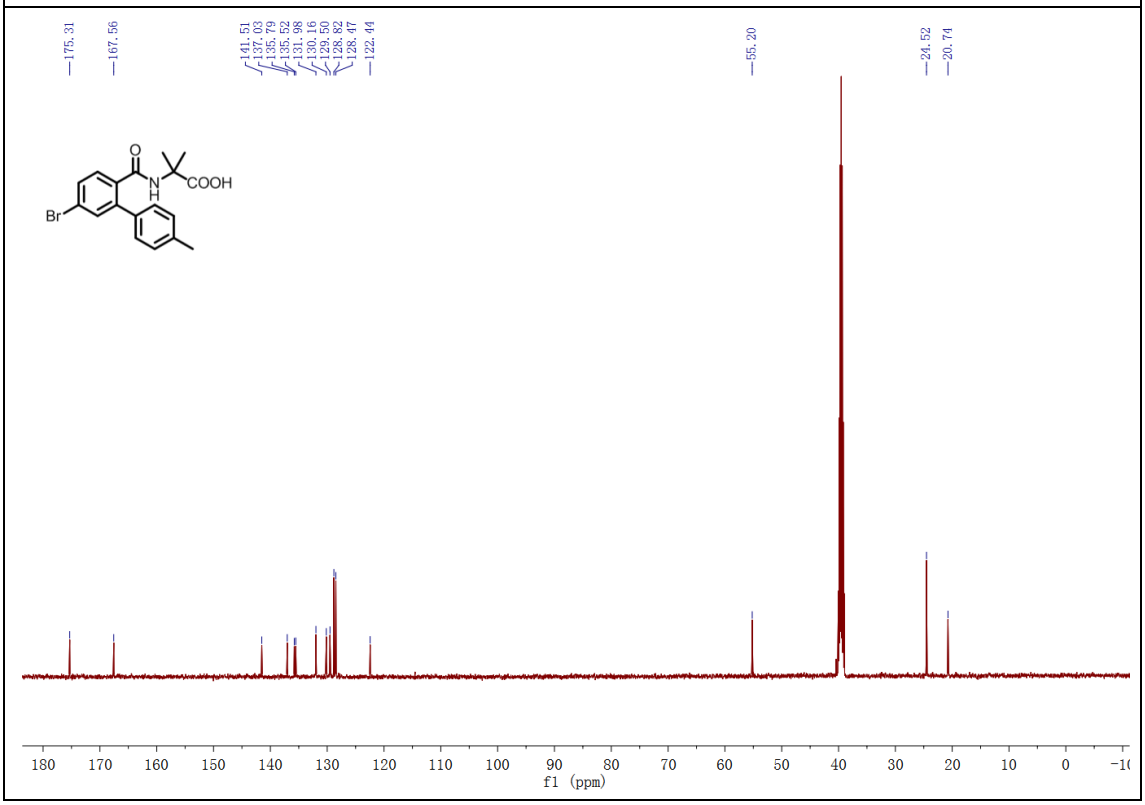


2-(5-chloro-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3g)

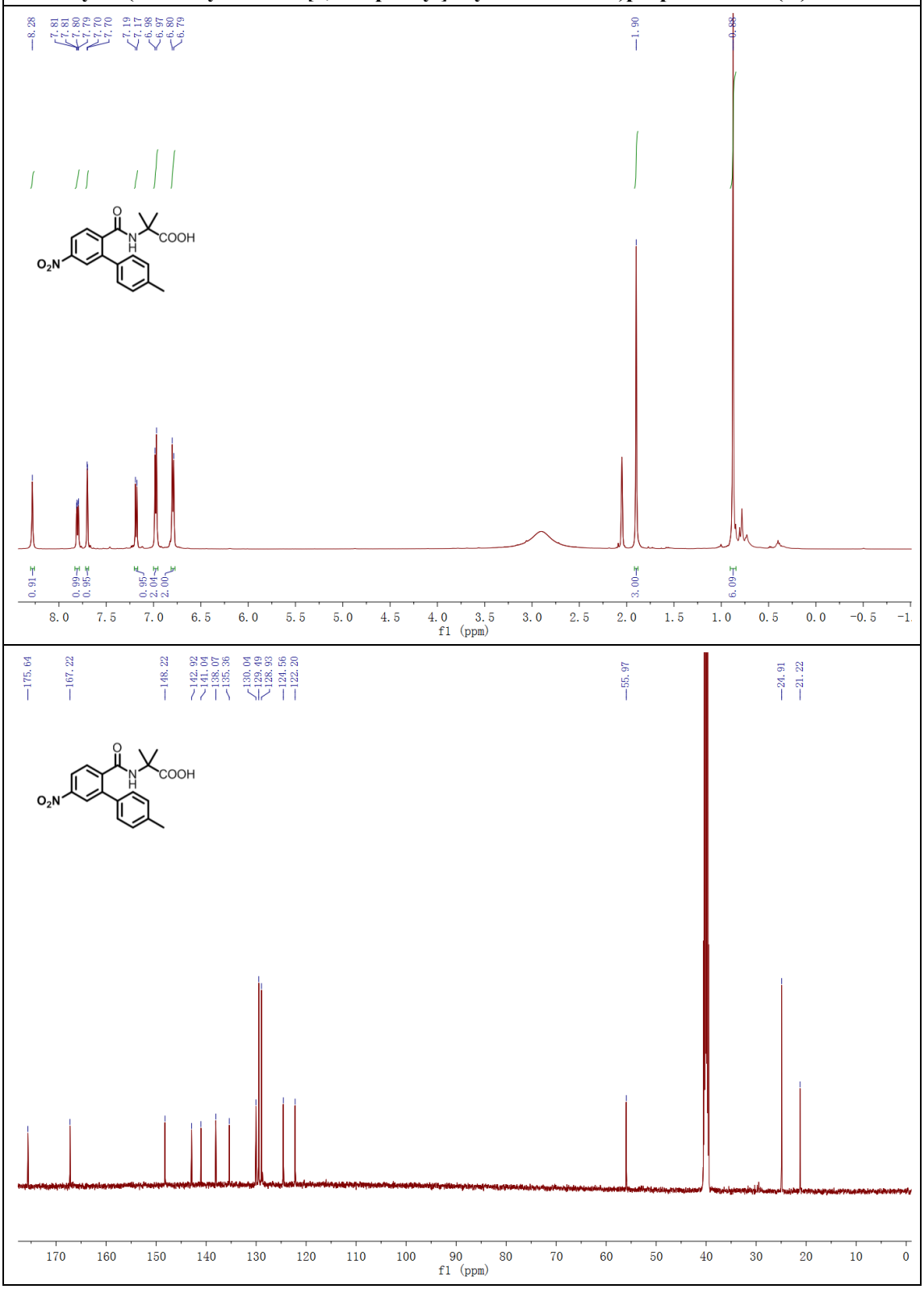


2-(5-bromo-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3h)

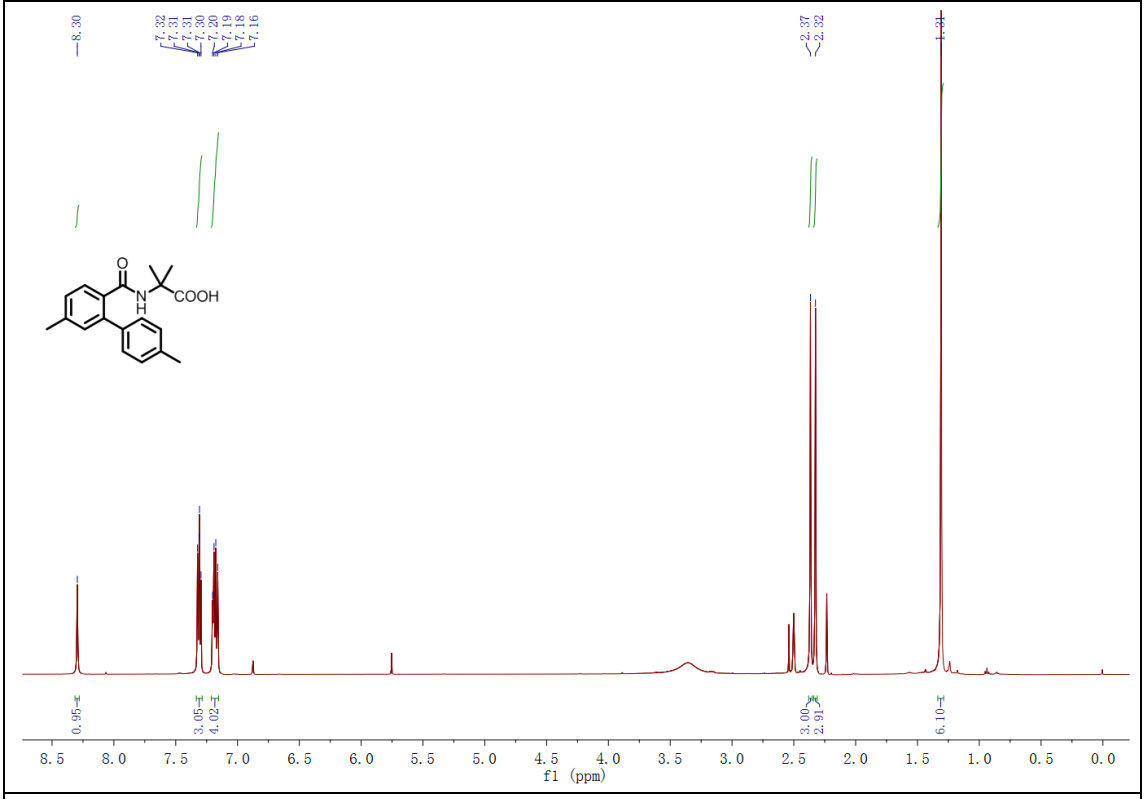


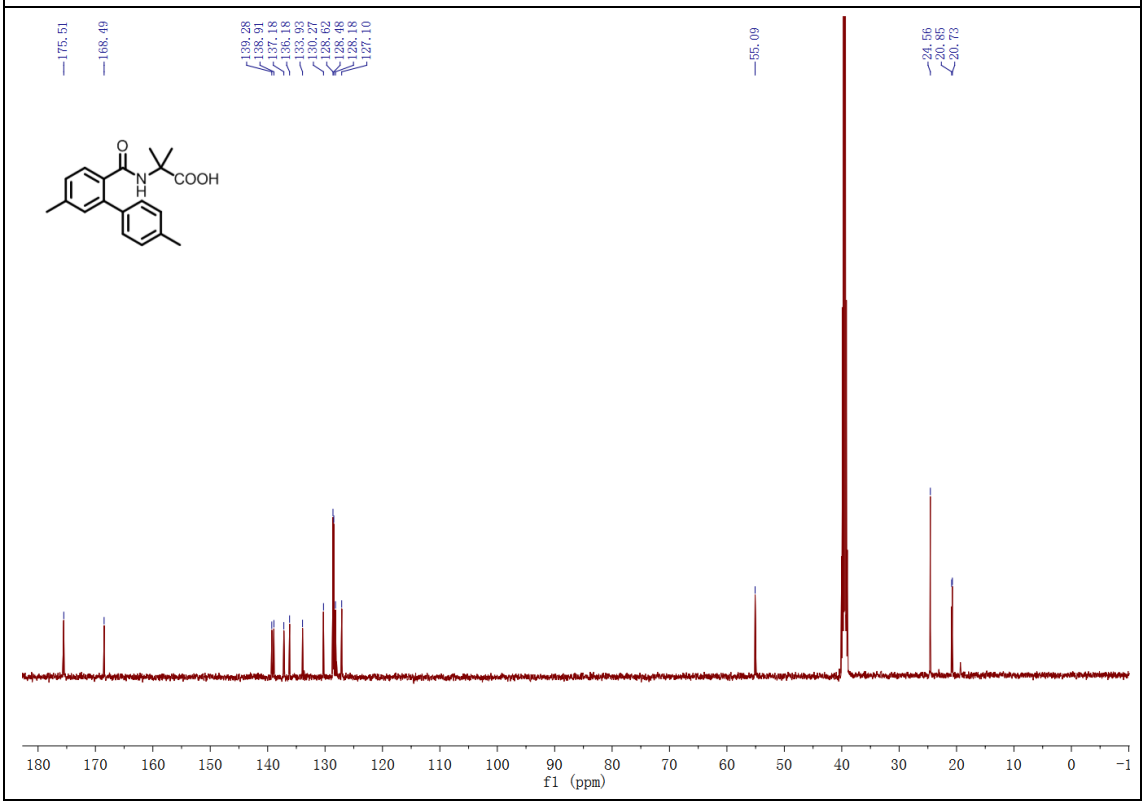


2-methyl-2-(4'-methyl-5-nitro-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (3i)

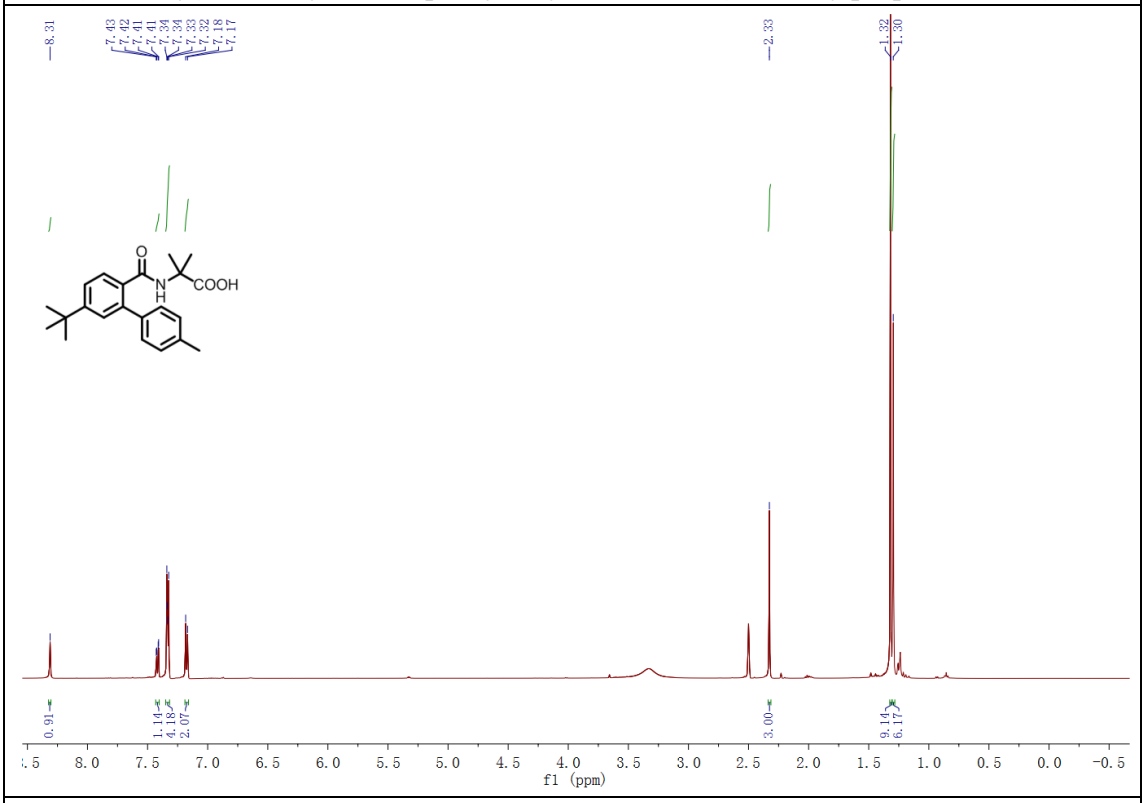


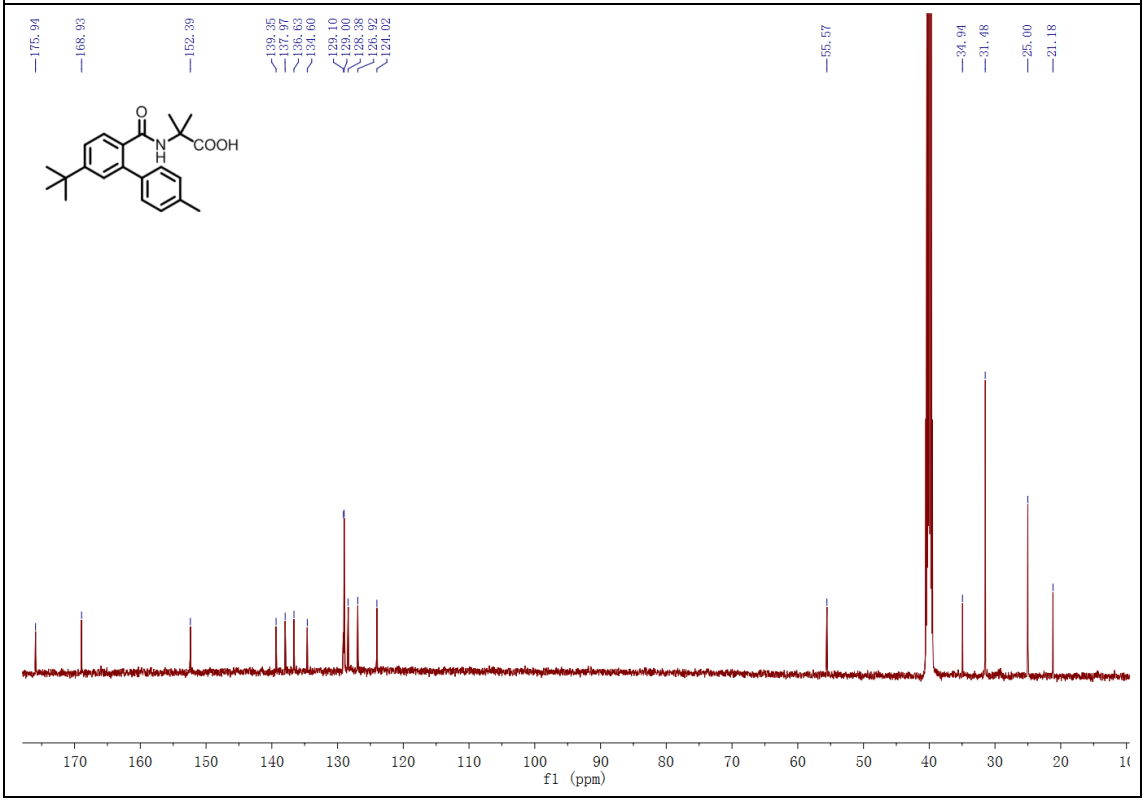
2-(4',5-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3j)



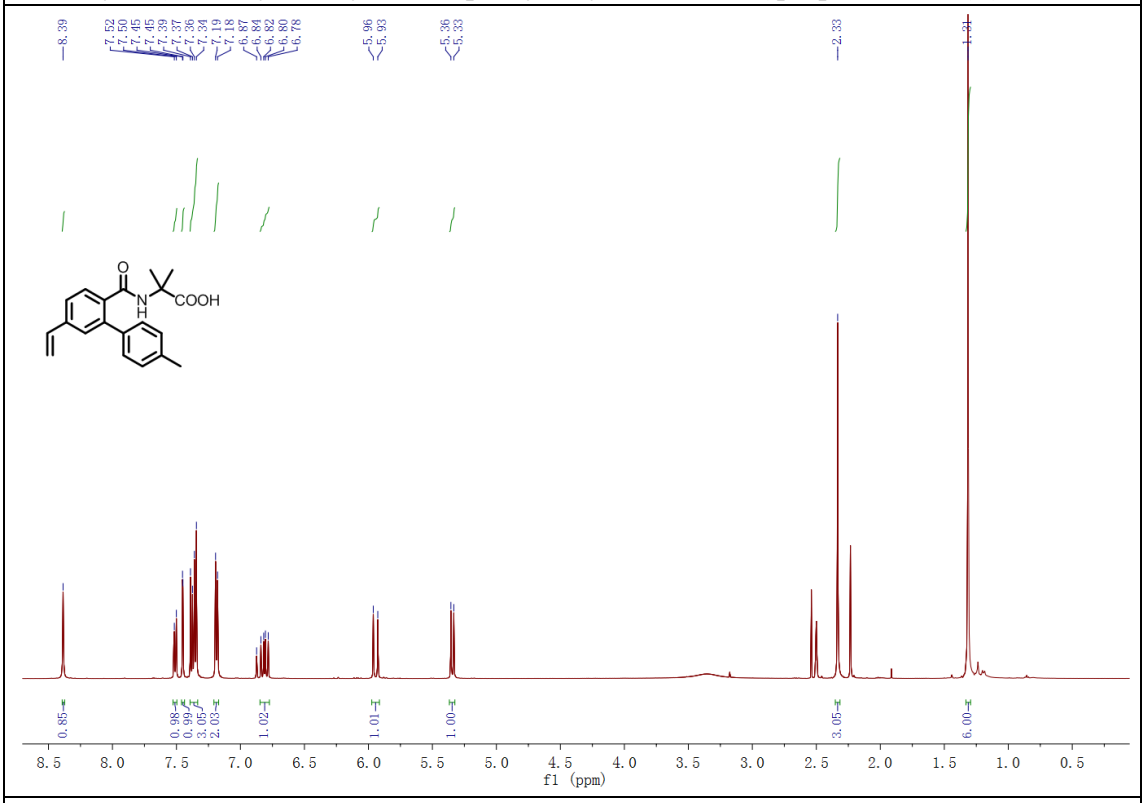


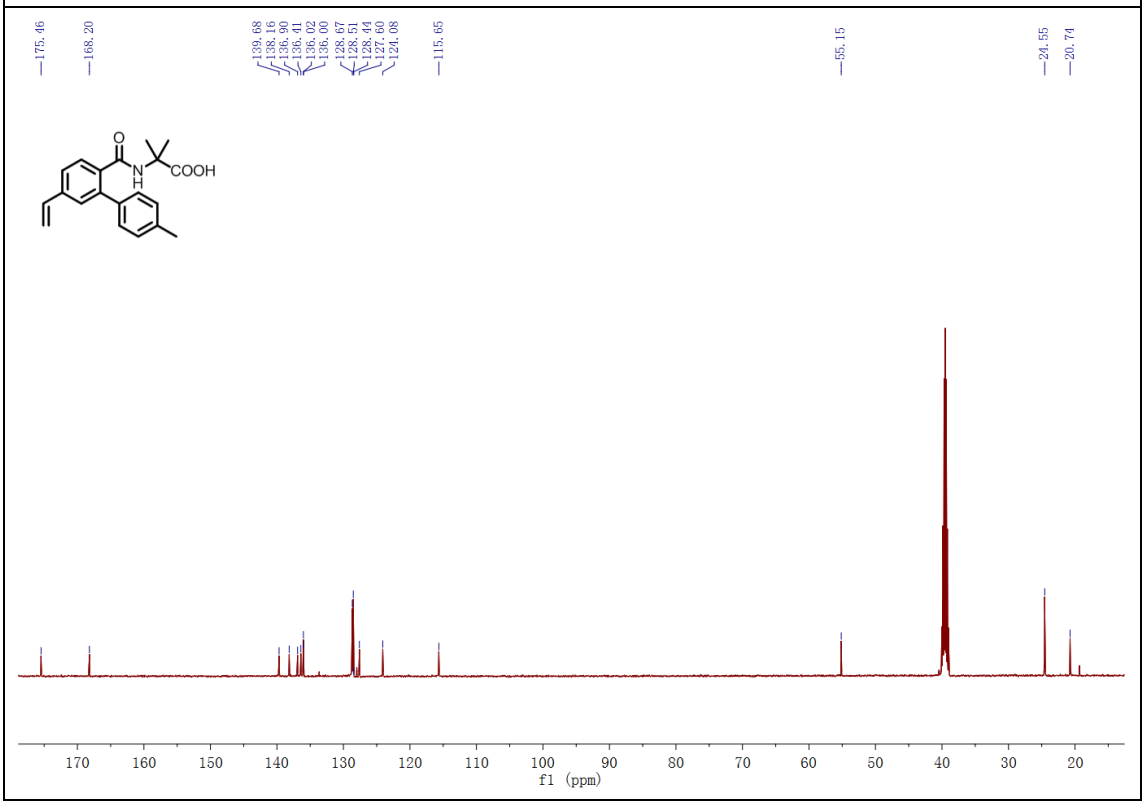
2-(5-(tert-butyl)-4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (3k)



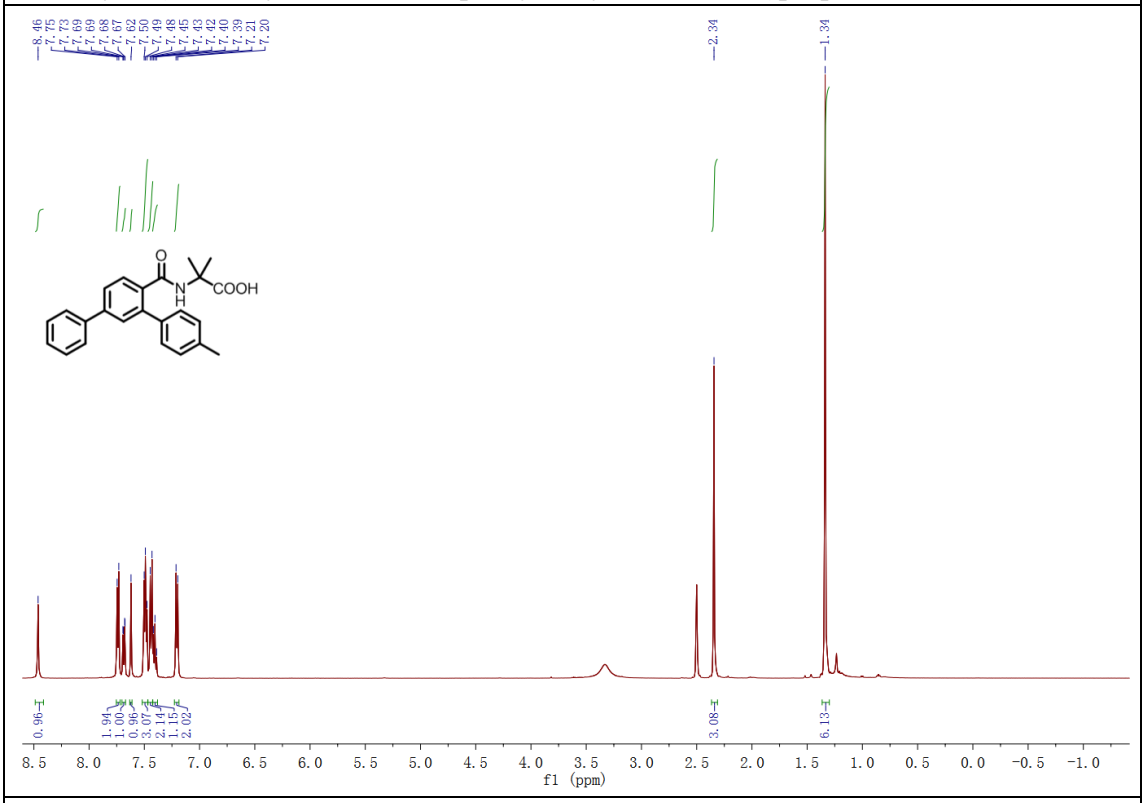


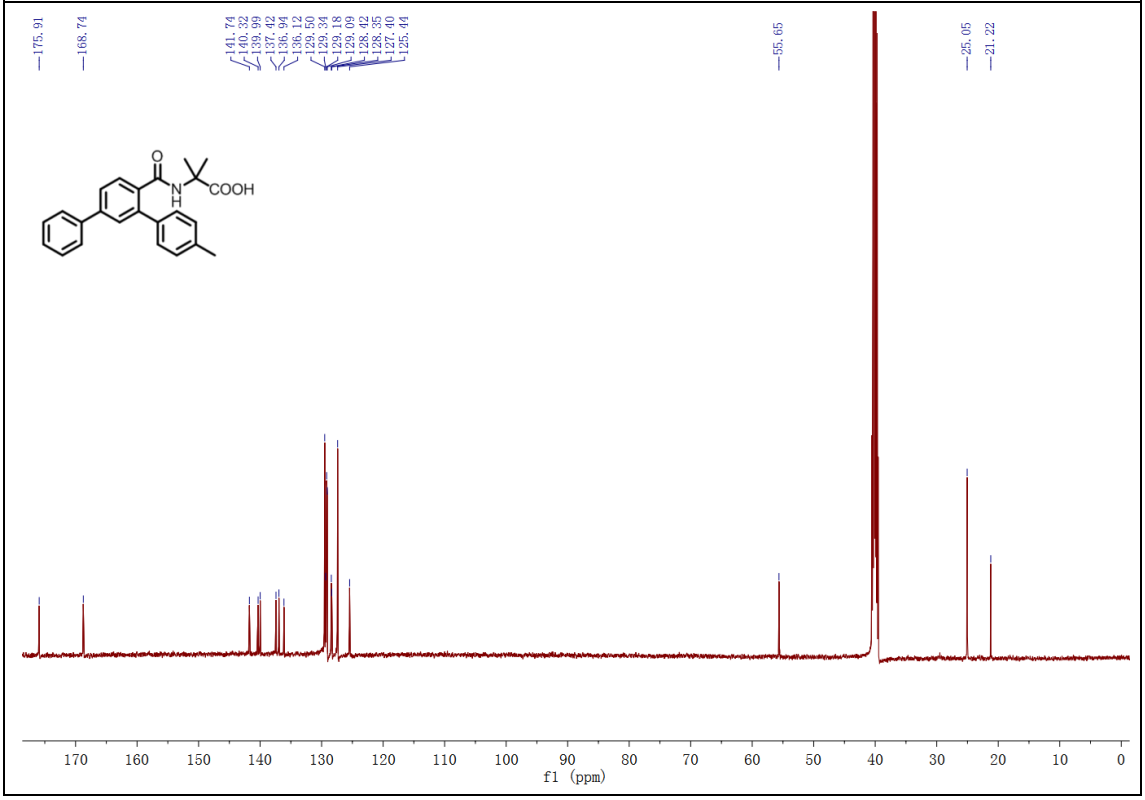
2-methyl-2-(4'-methyl-5-vinyl-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (3l)



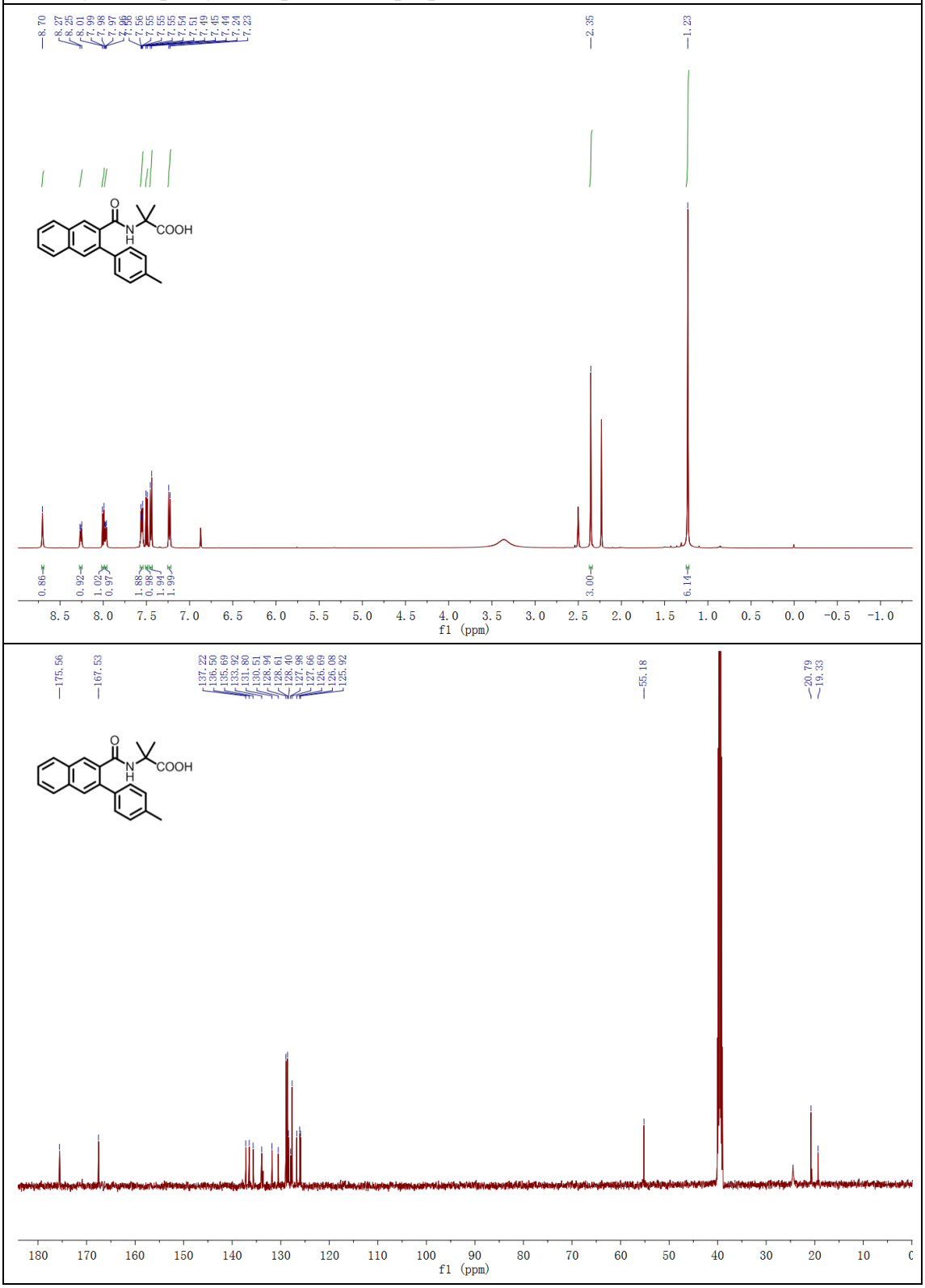


2-methyl-2-(4''-methyl-[1,1':3',1''-terphenyl]-4'-ylcarboxamido)propanoic acid (3m)

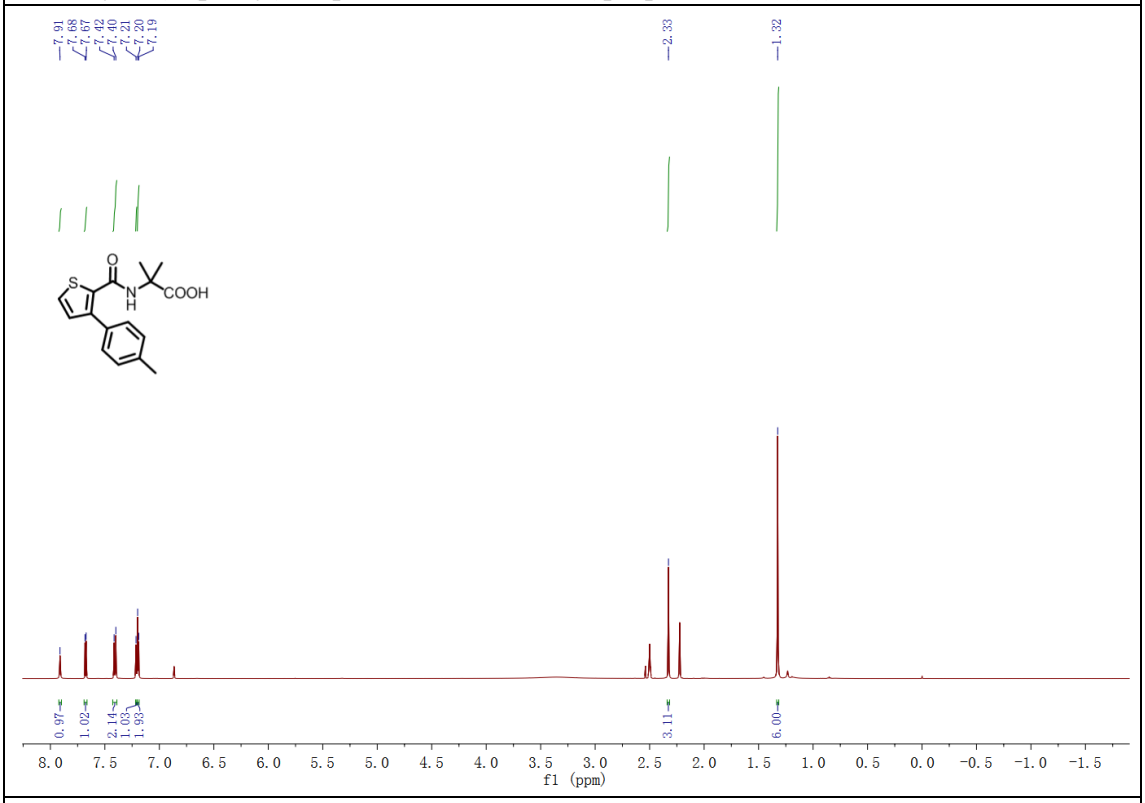


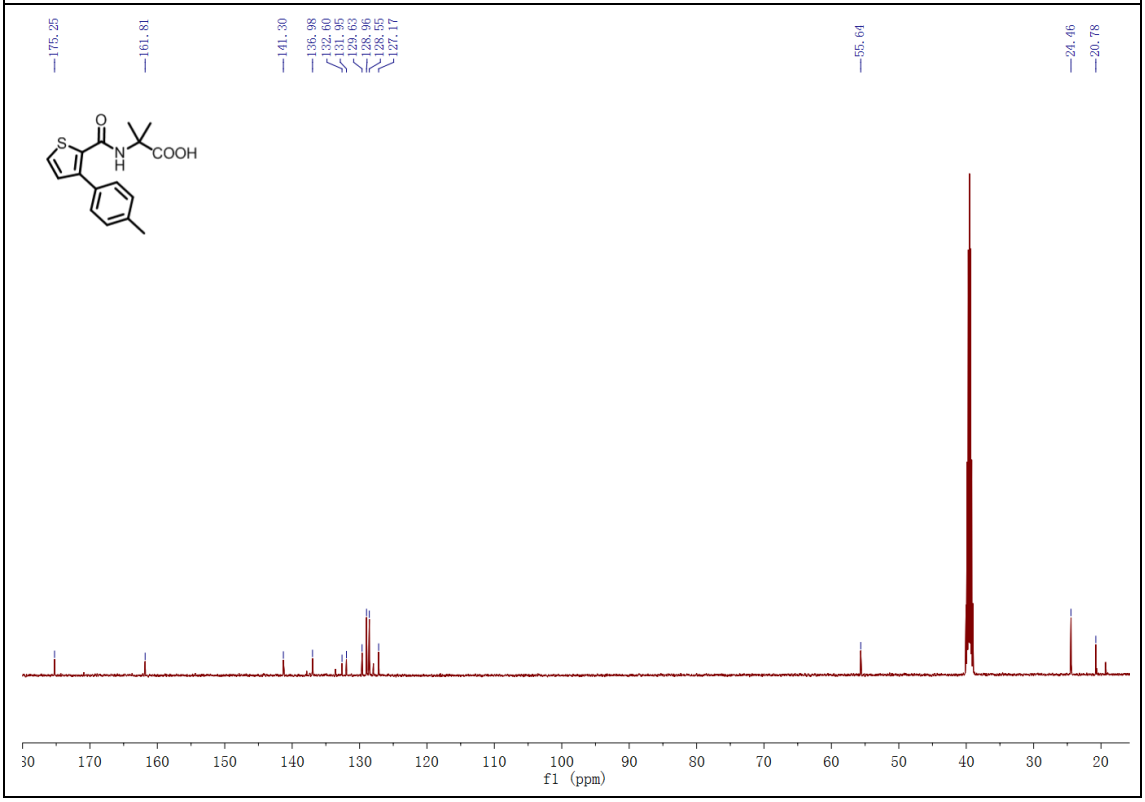


2-methyl-2-(3-(p-tolyl)-2-naphthamido)propanoic acid (3n)

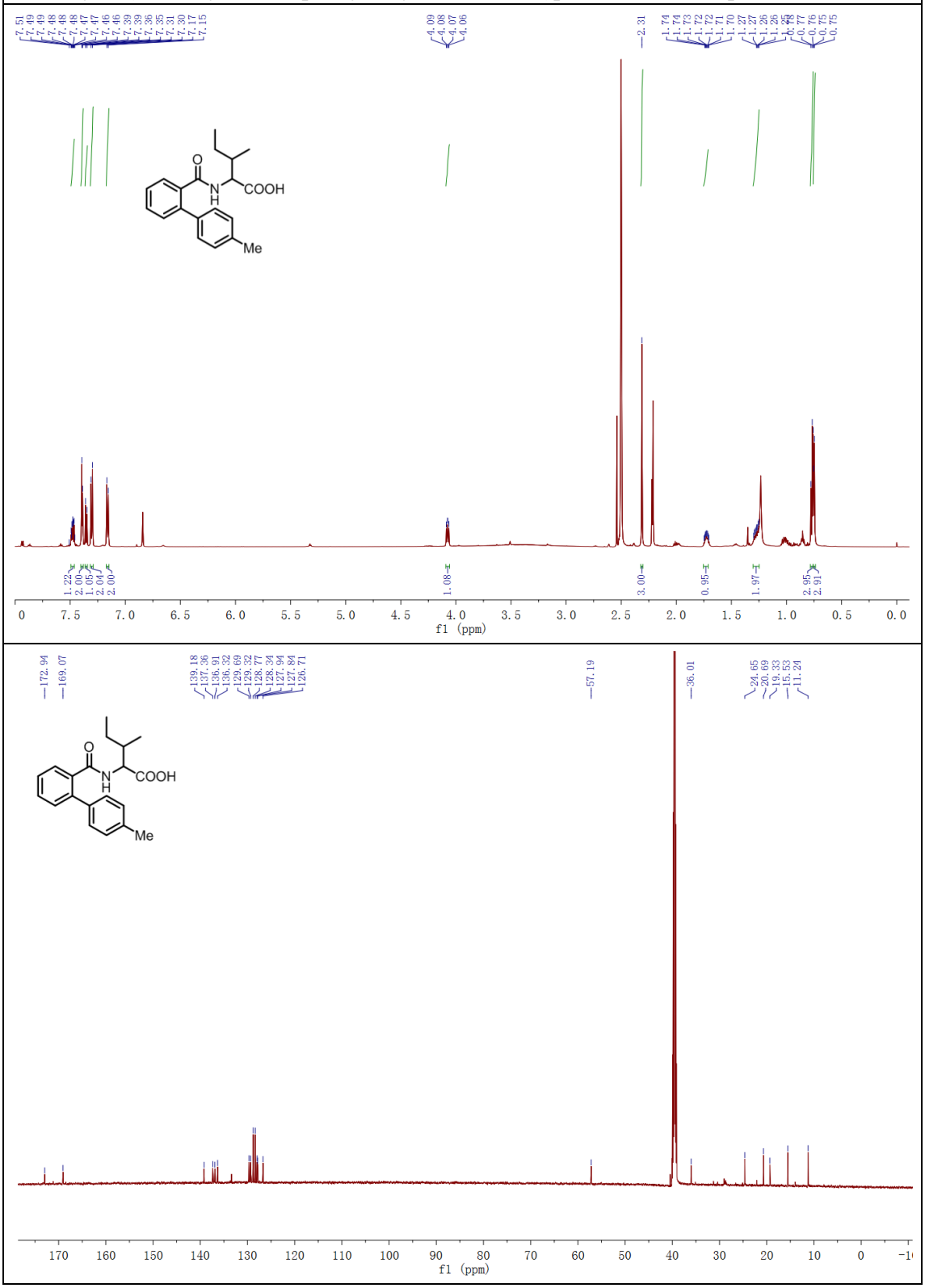


2-methyl-2-(3-(p-tolyl)thiophene-2-carboxamido)propanoic acid (3o)

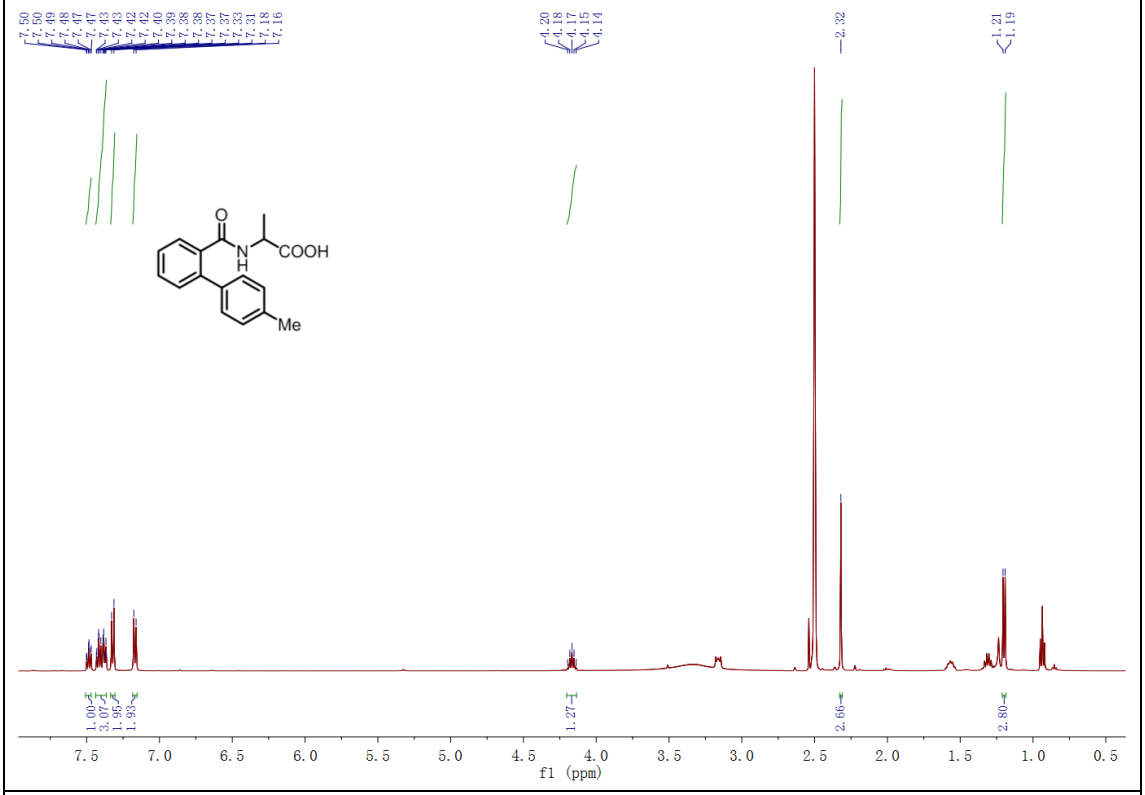


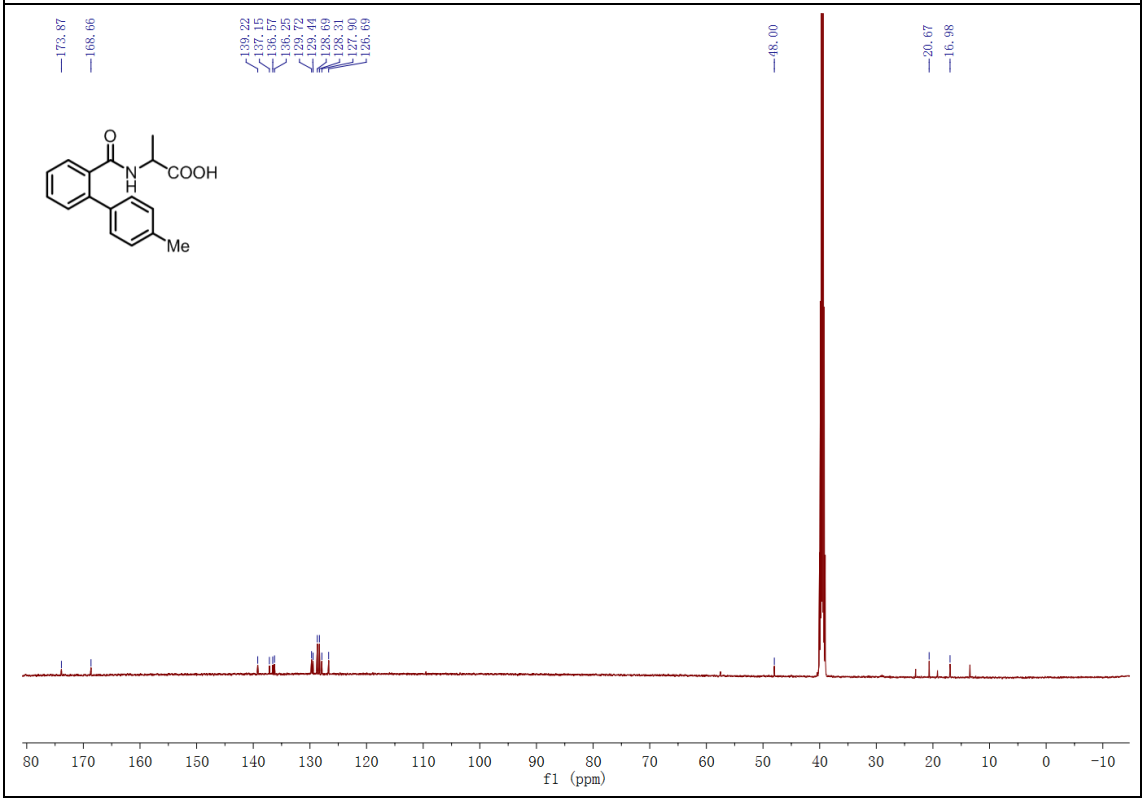


3-methyl-2-(4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)pentanoic acid（3p）

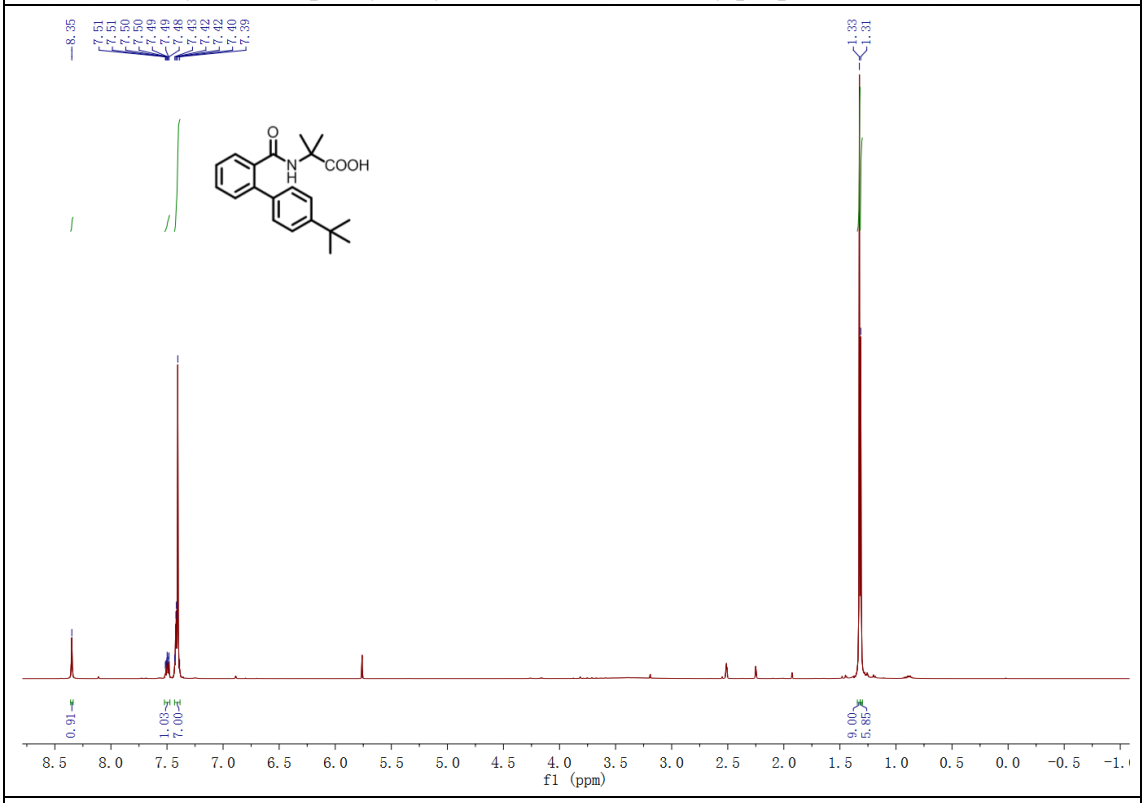


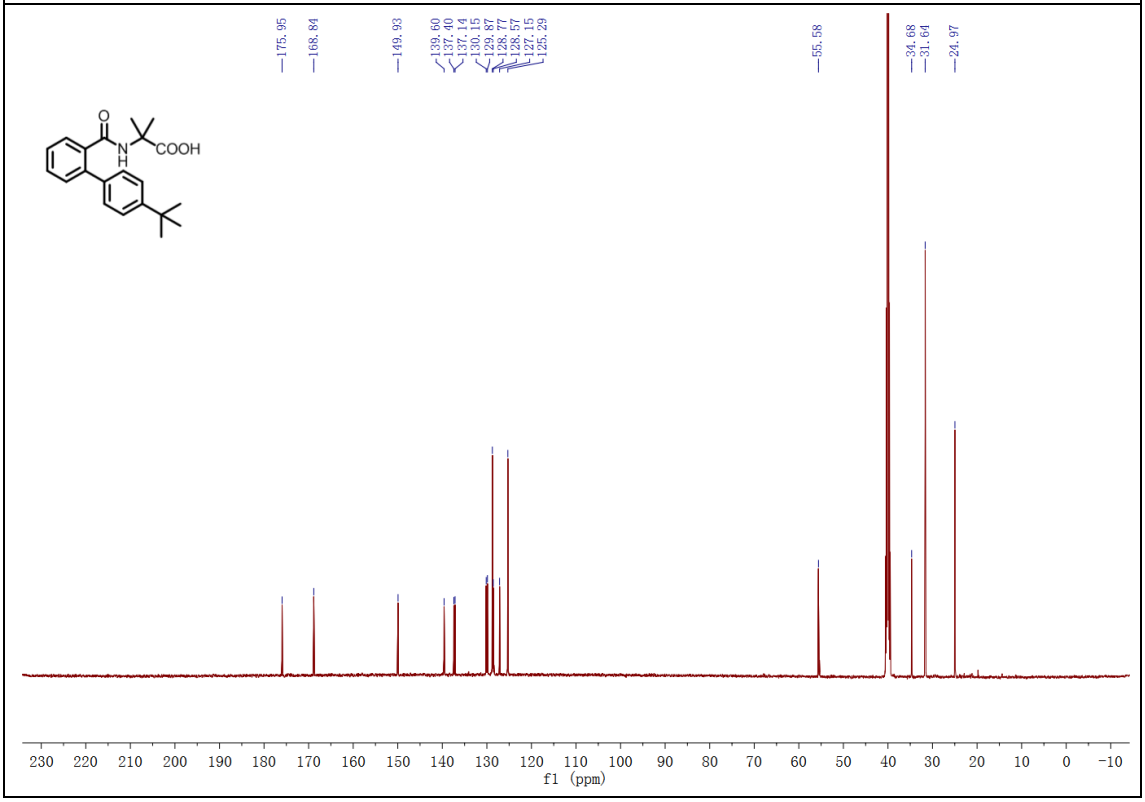
2-(4'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid（3q）



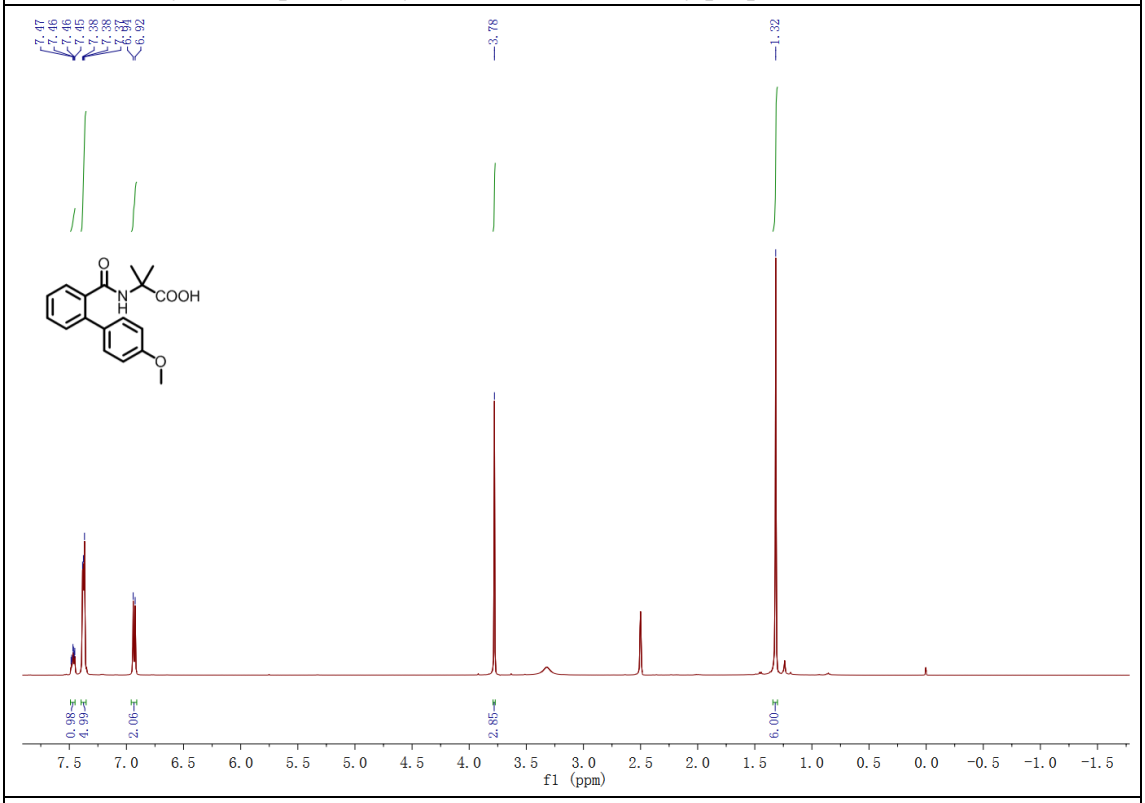


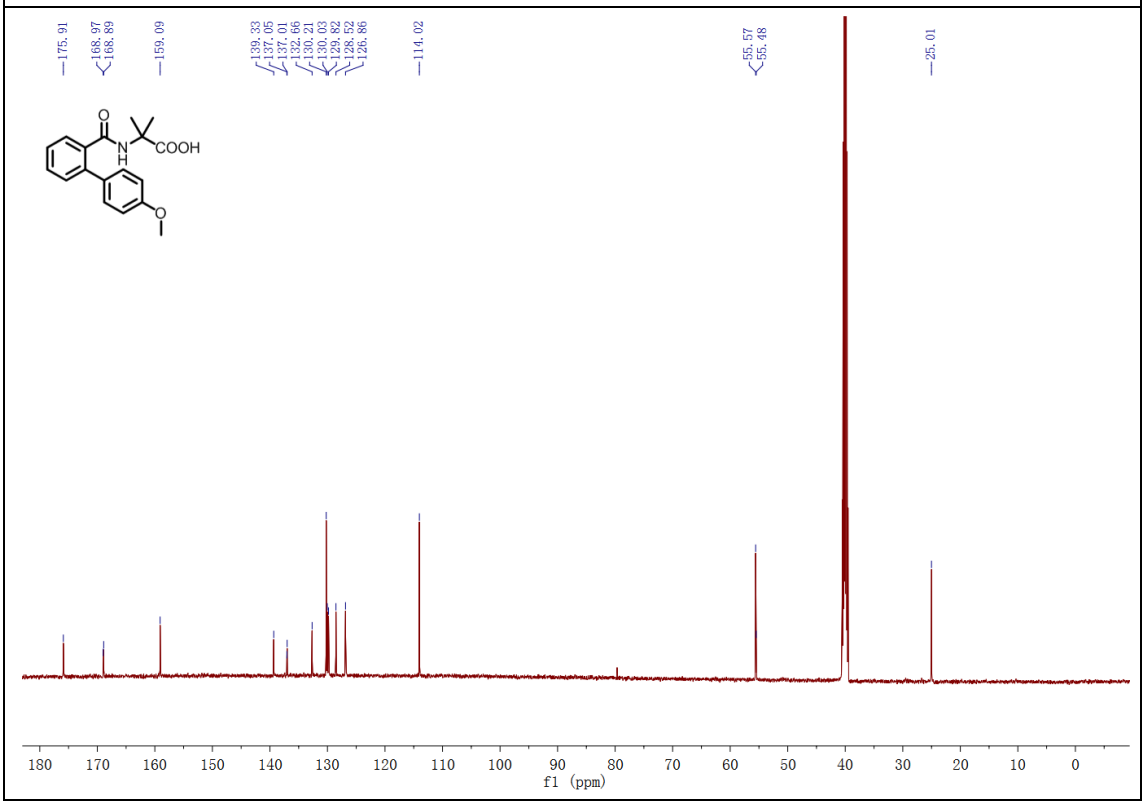
2-(4'-(tert-butyl)-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4a)



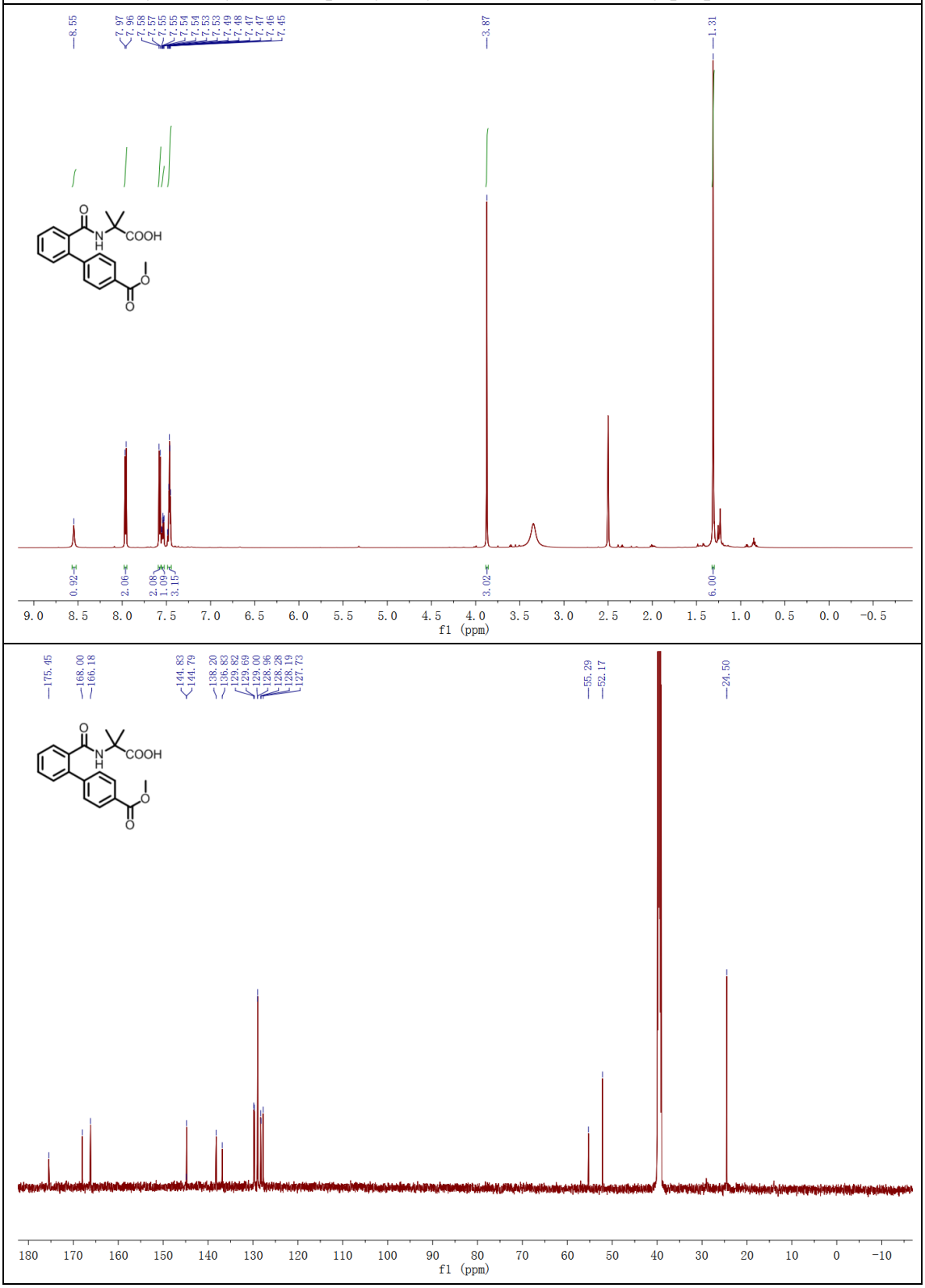


2-(4'-methoxy-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4b)

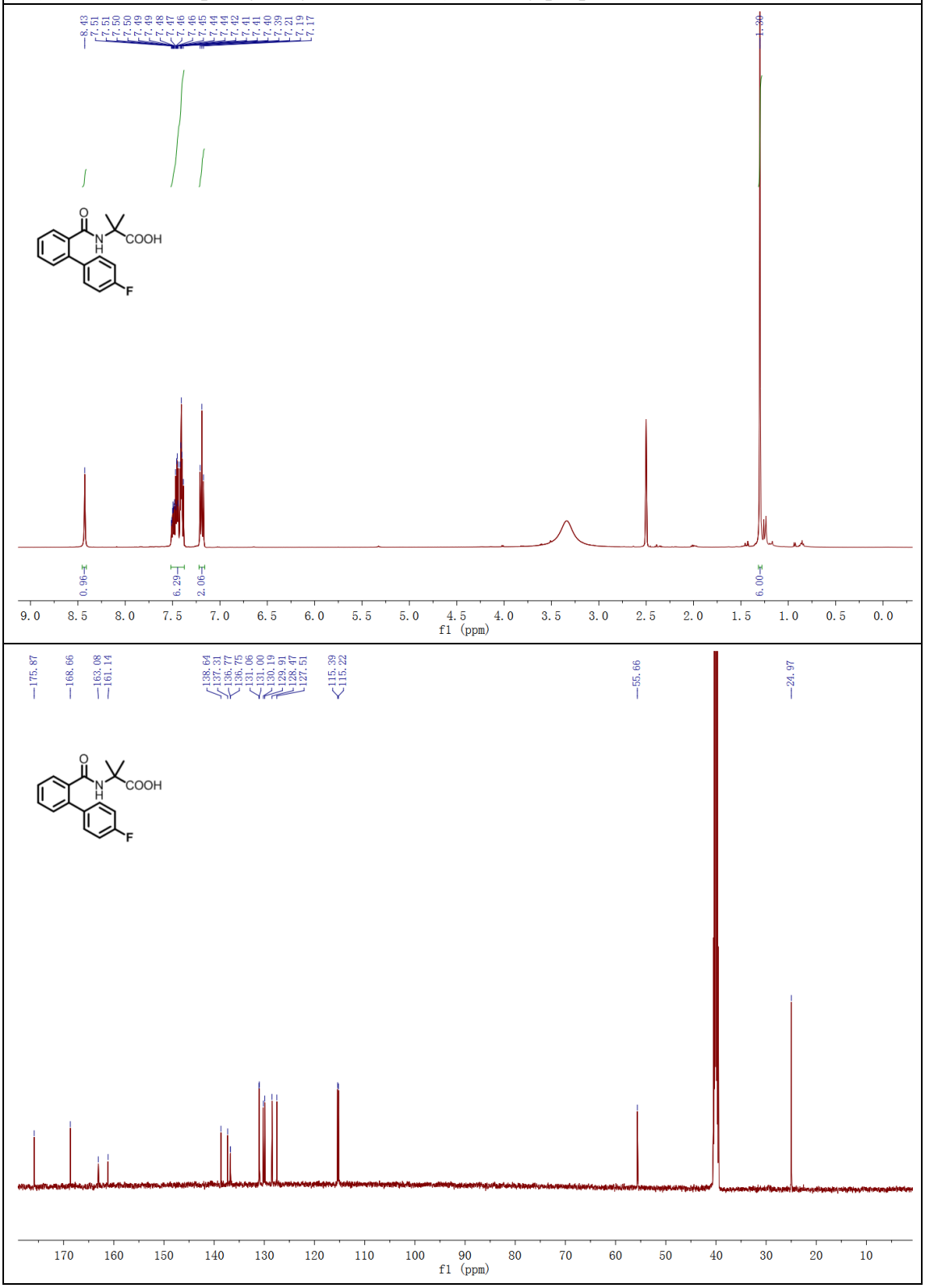




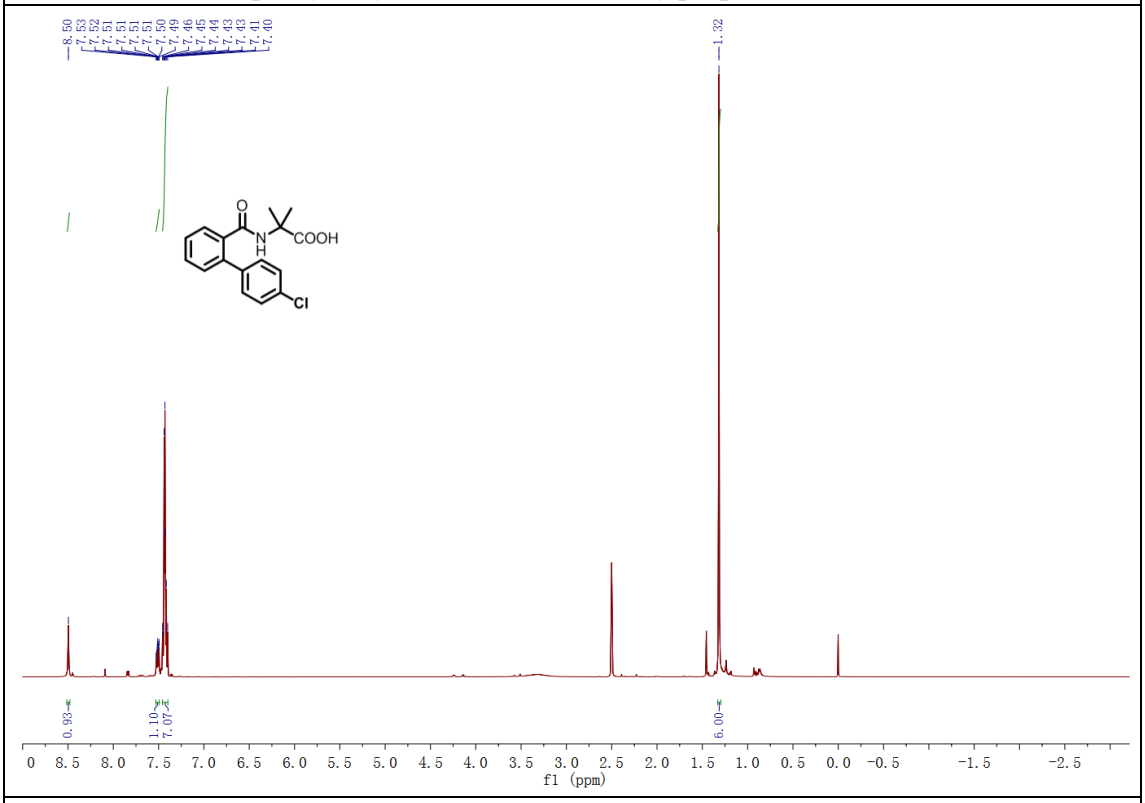
2-(4'-(methoxycarbonyl)-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4c)

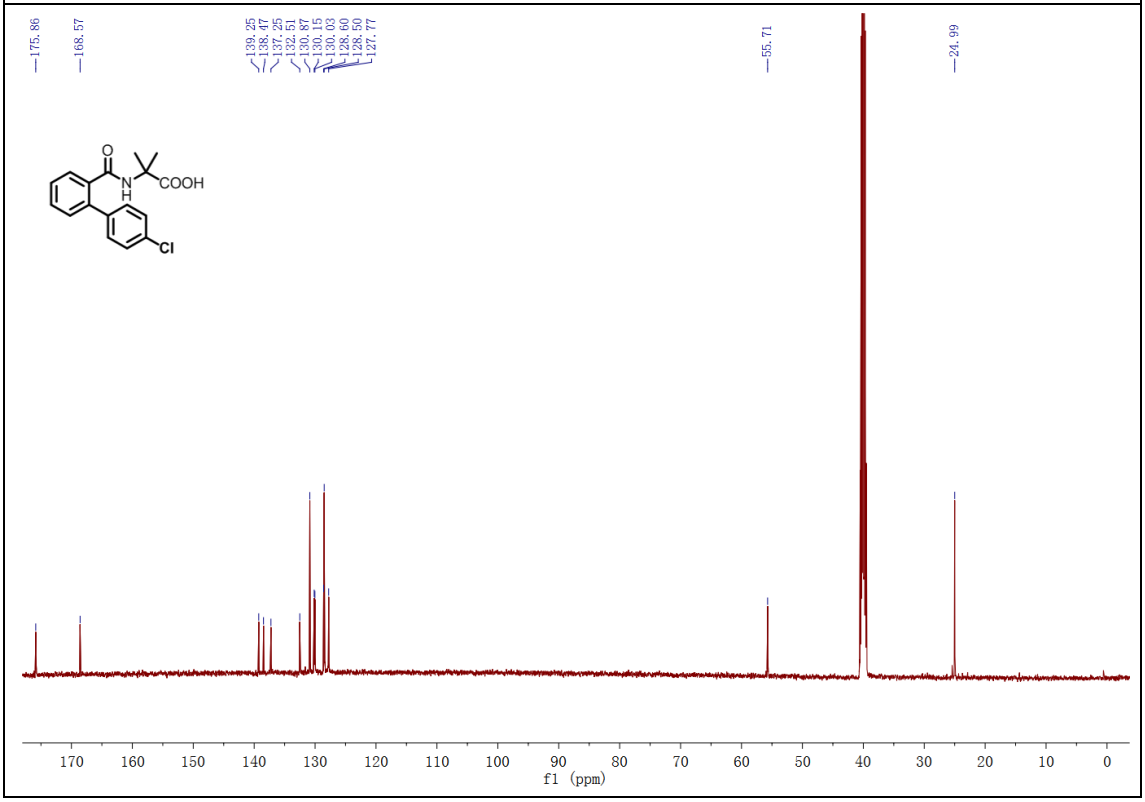


2-(4'-fluoro-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4d)

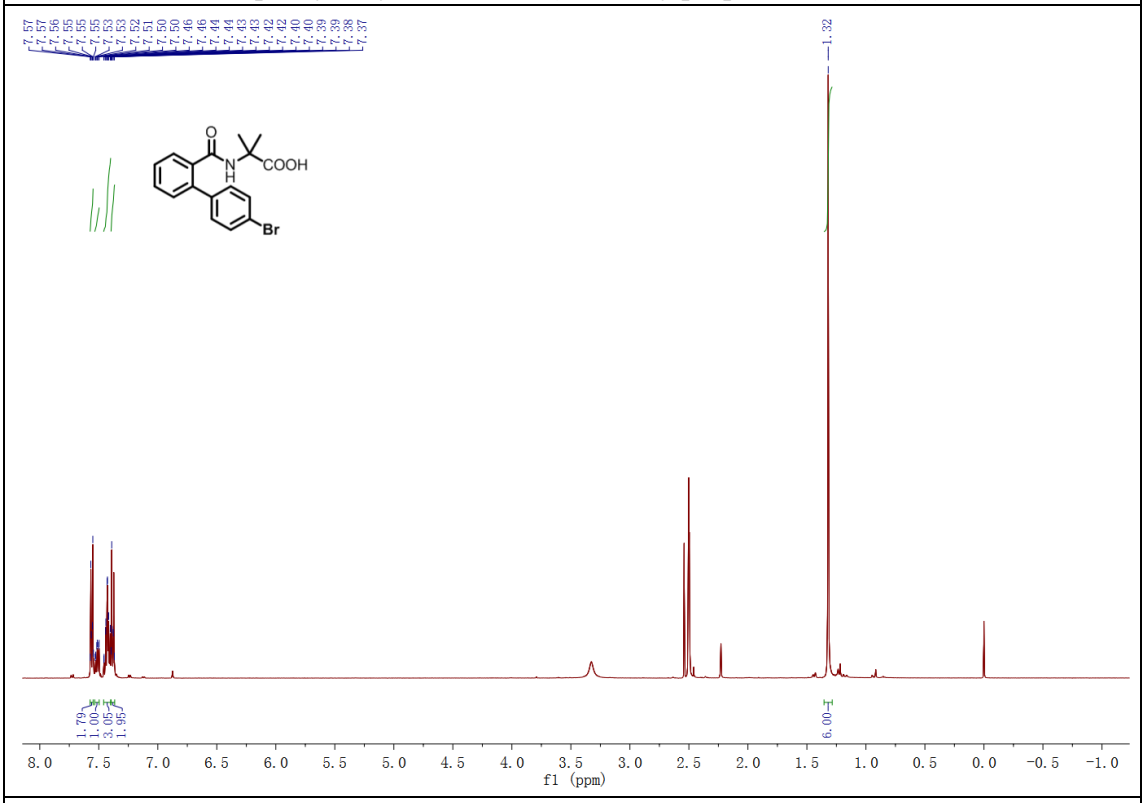


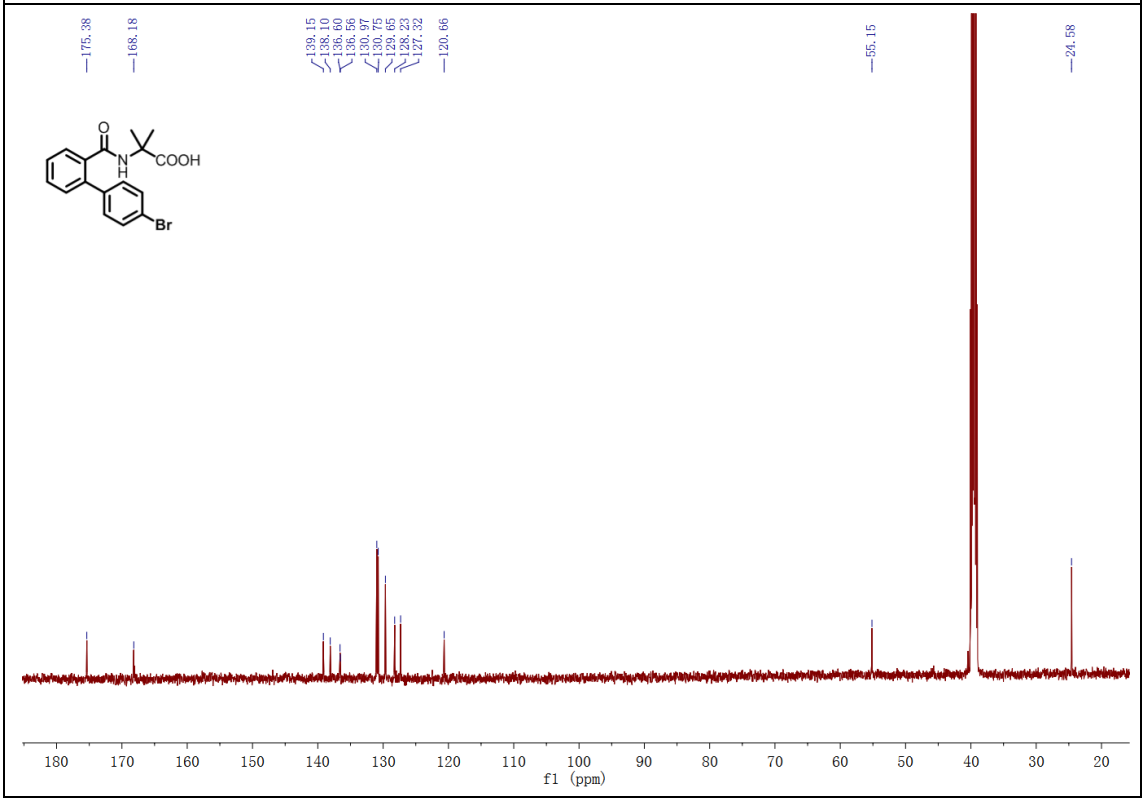
2-(4'-chloro-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4e)



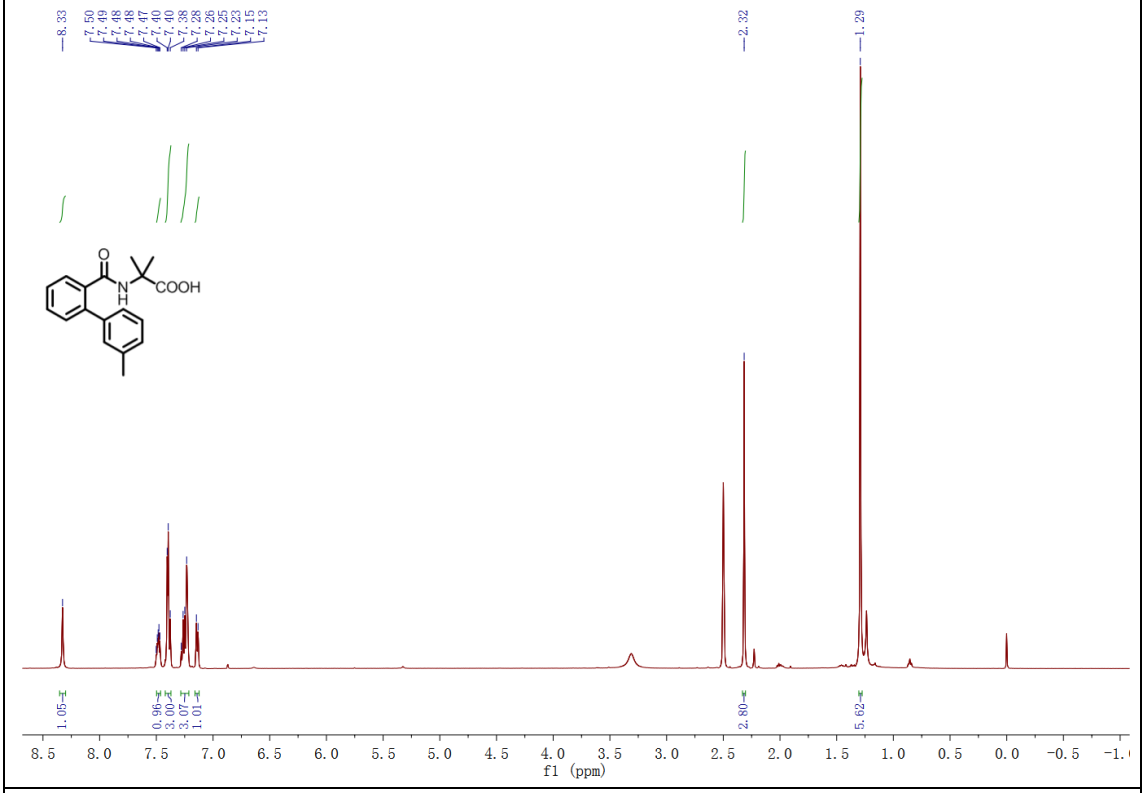


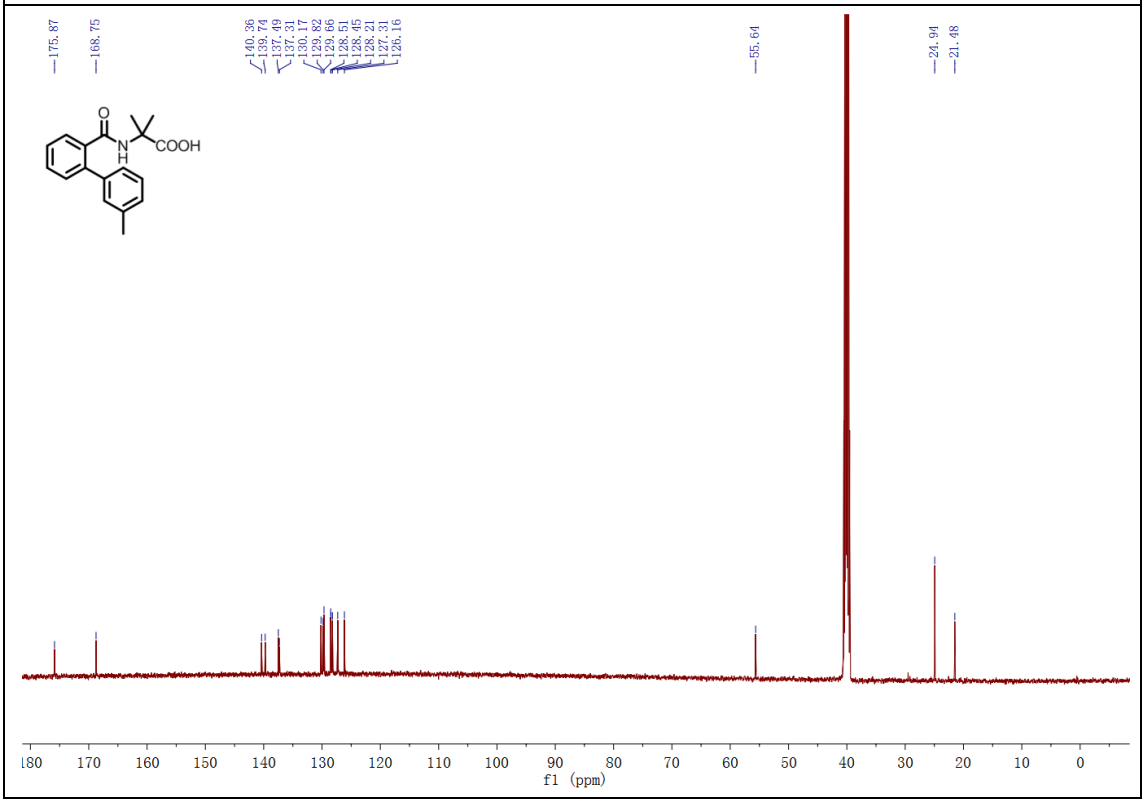
2-(4'-bromo-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4f)



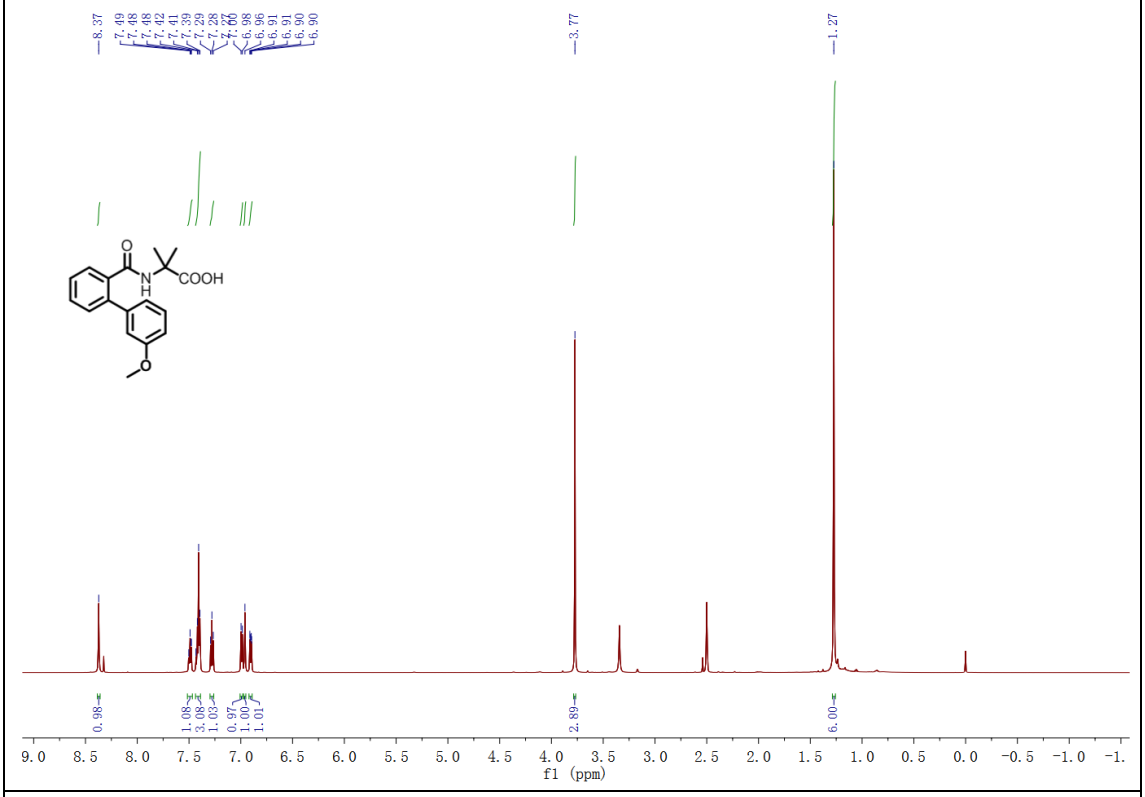


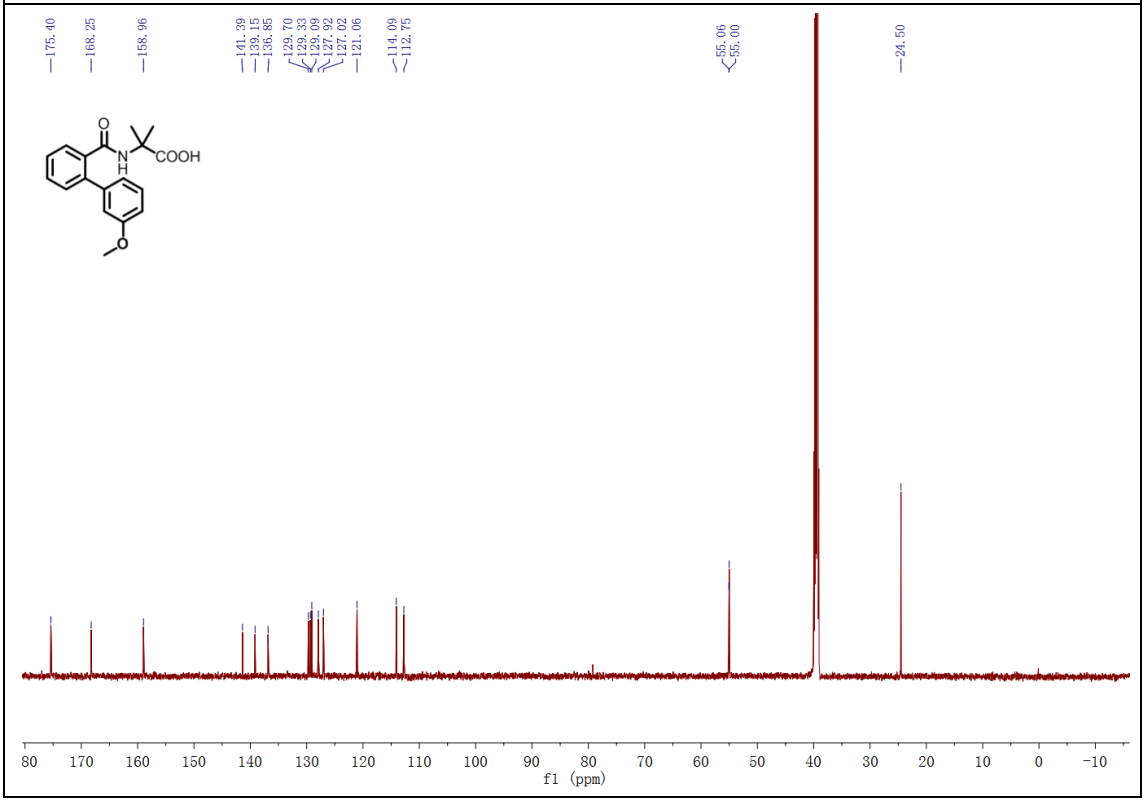
2-methyl-2-(3'-methyl-[1,1'-biphenyl]-2-ylcarboxamido)propanoic acid (4g)



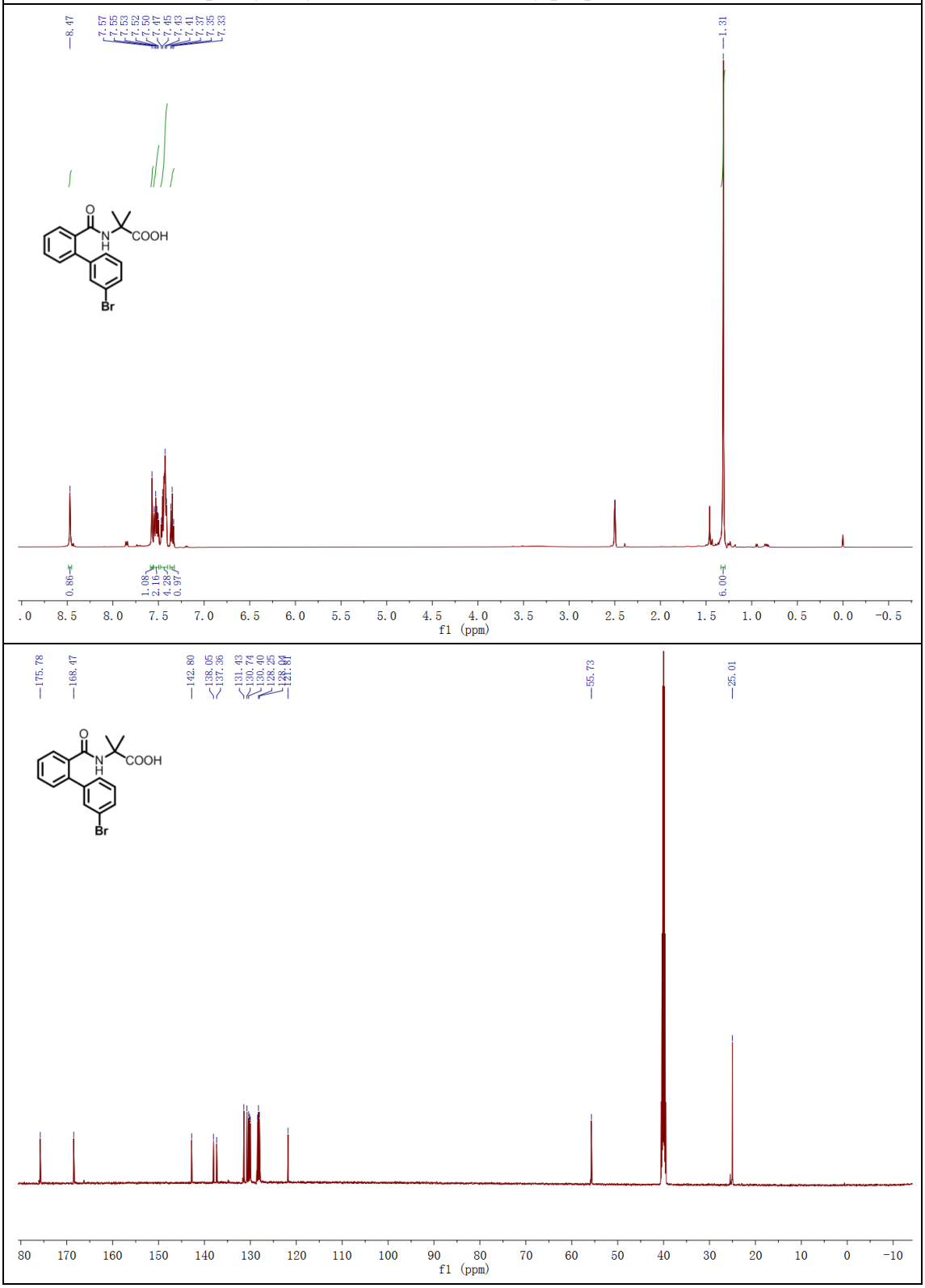


2-(3'-methoxy-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4h)

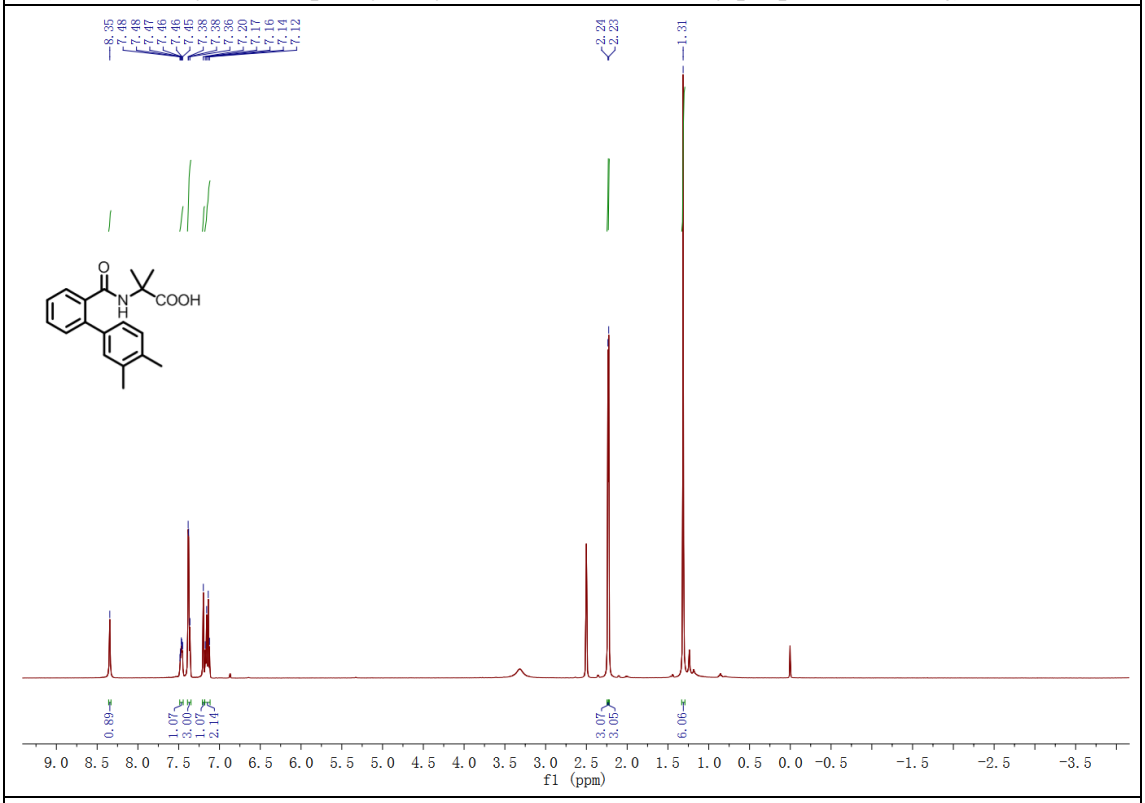


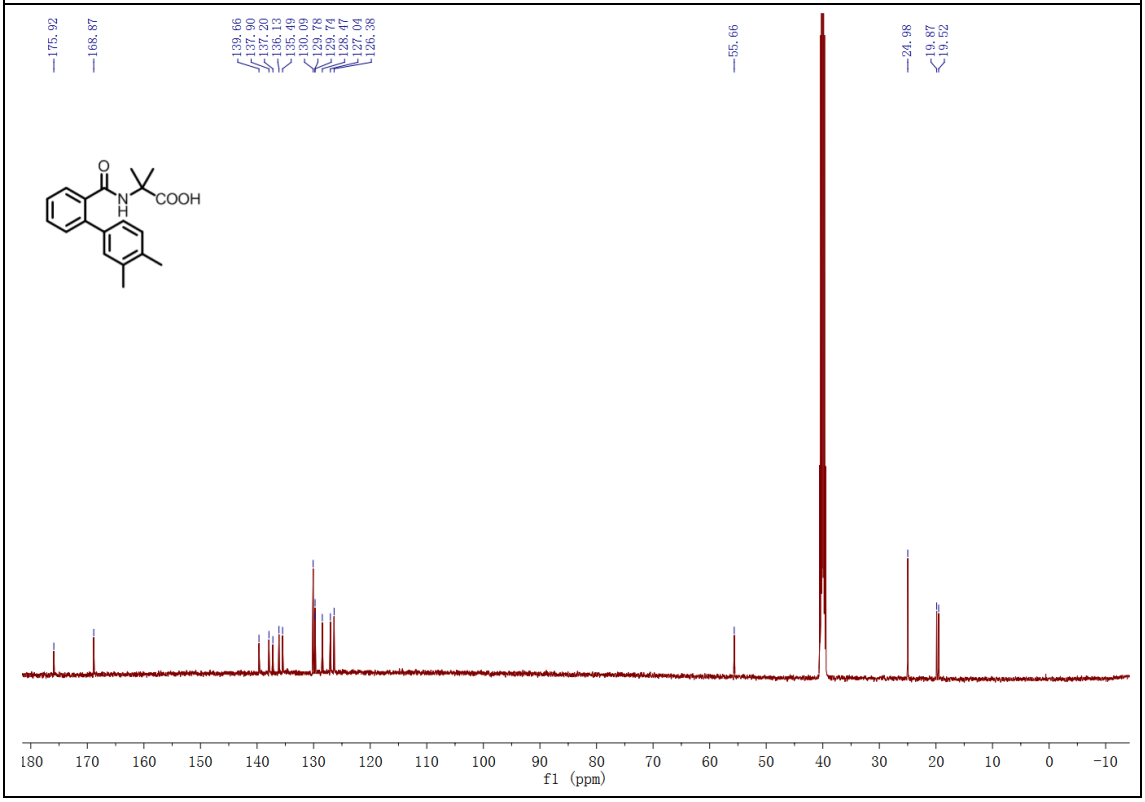


2-(3'-bromo-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4i)

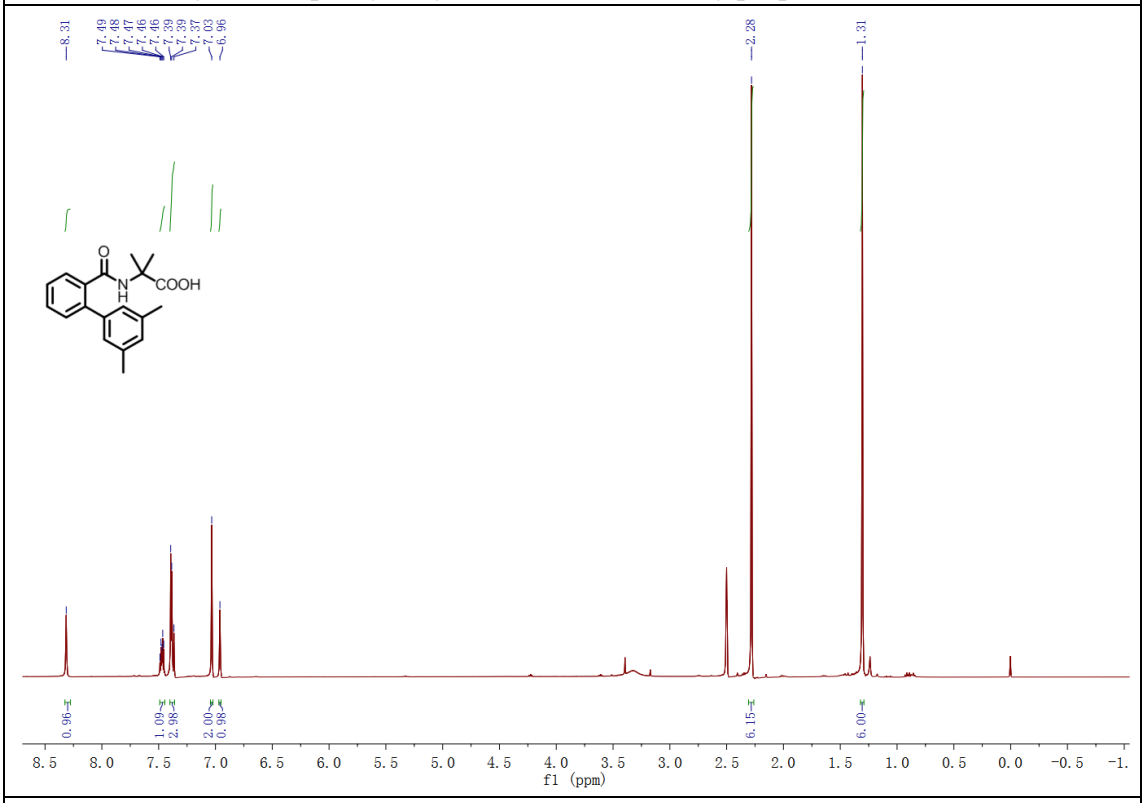


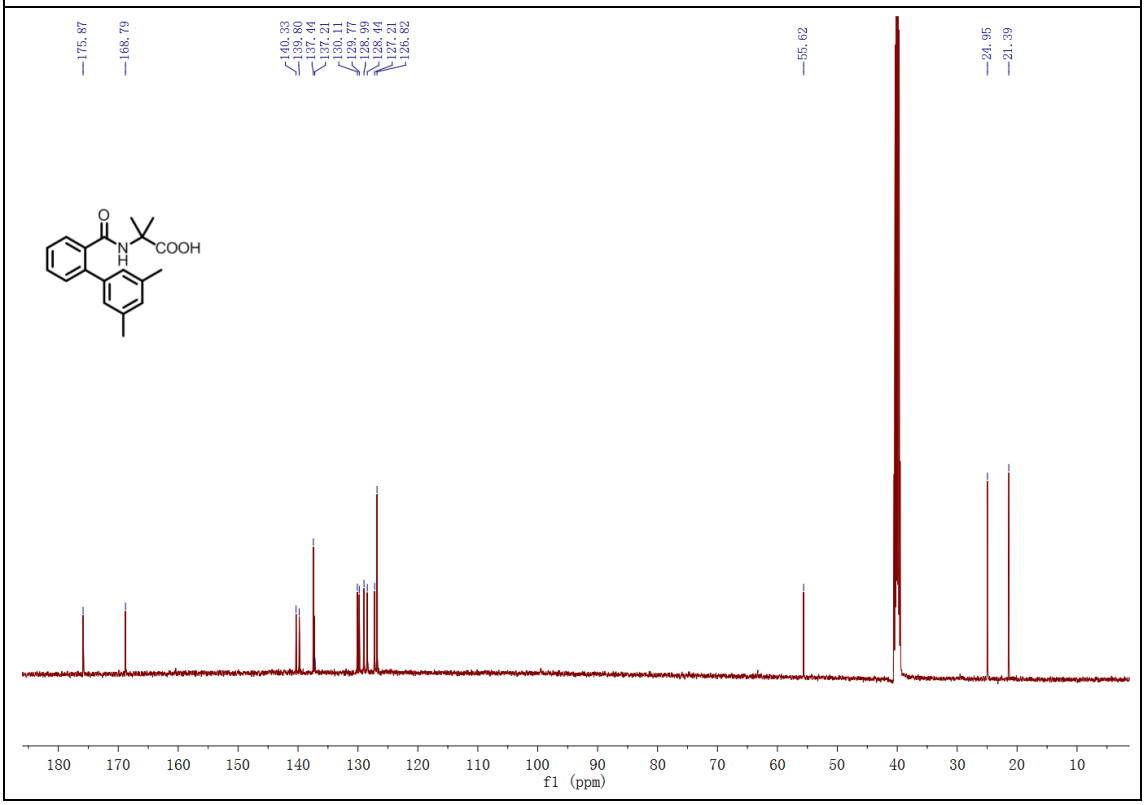
2-(3',4'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4j)



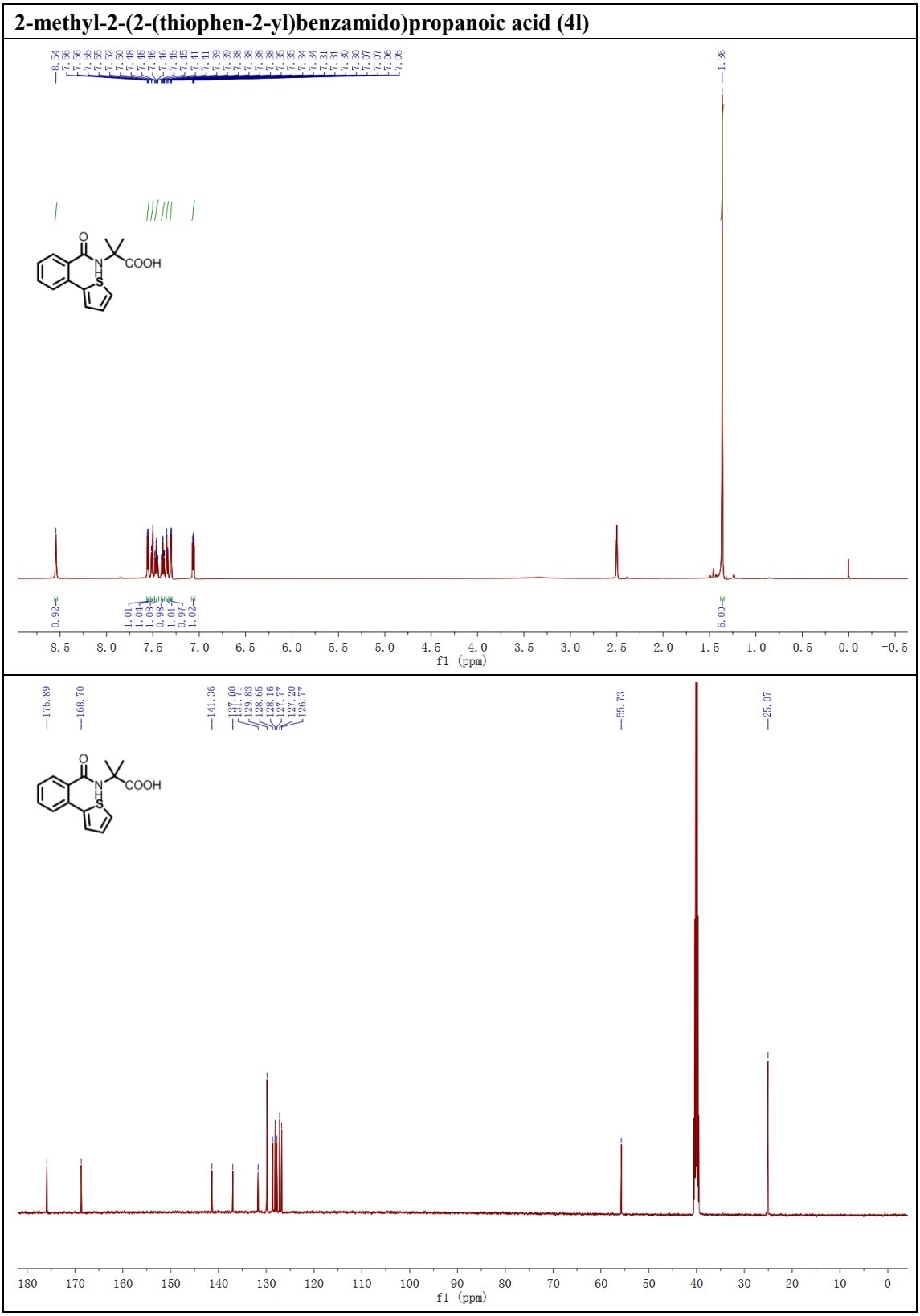


2-(3',5'-dimethyl-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4k)

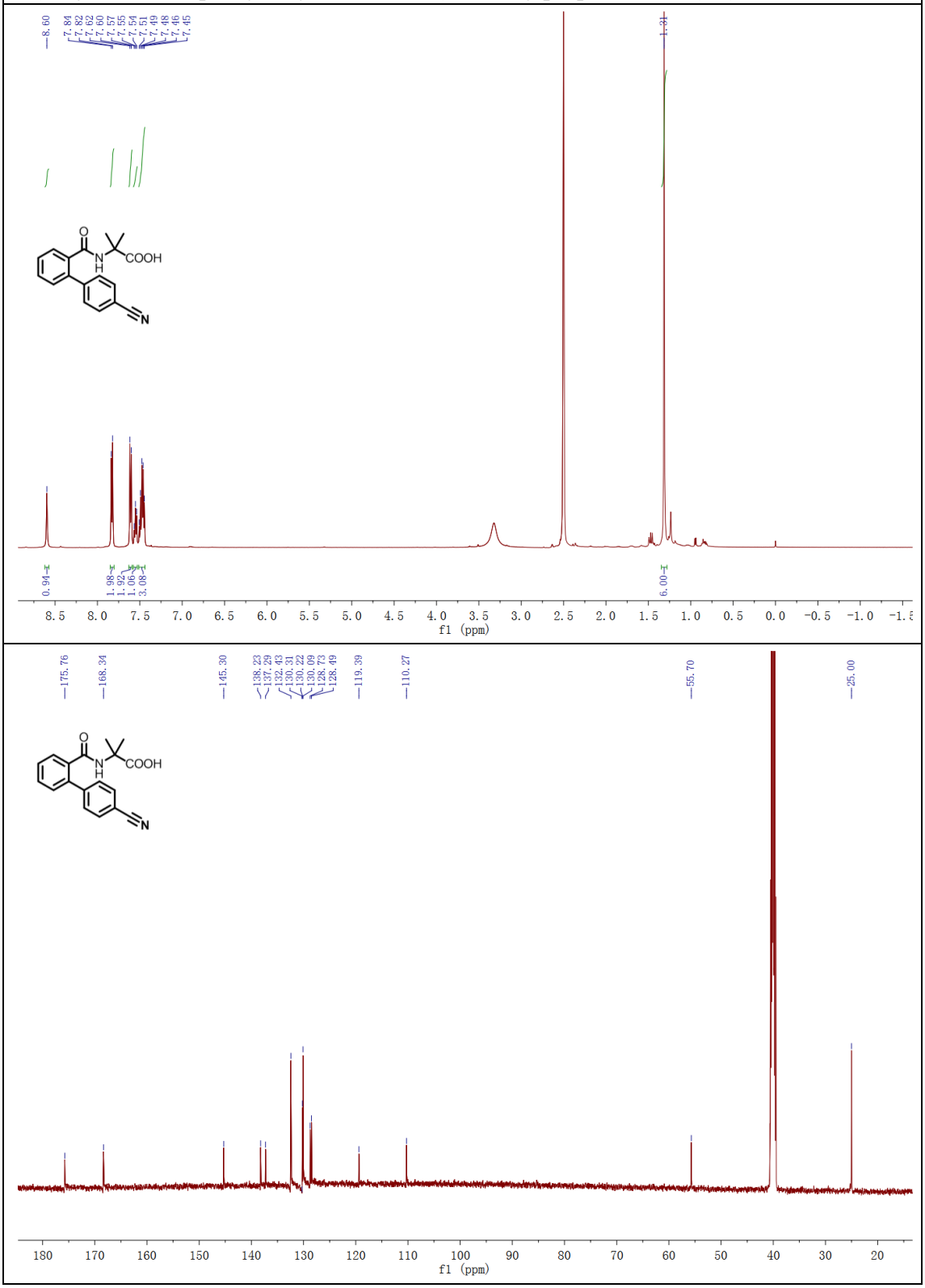




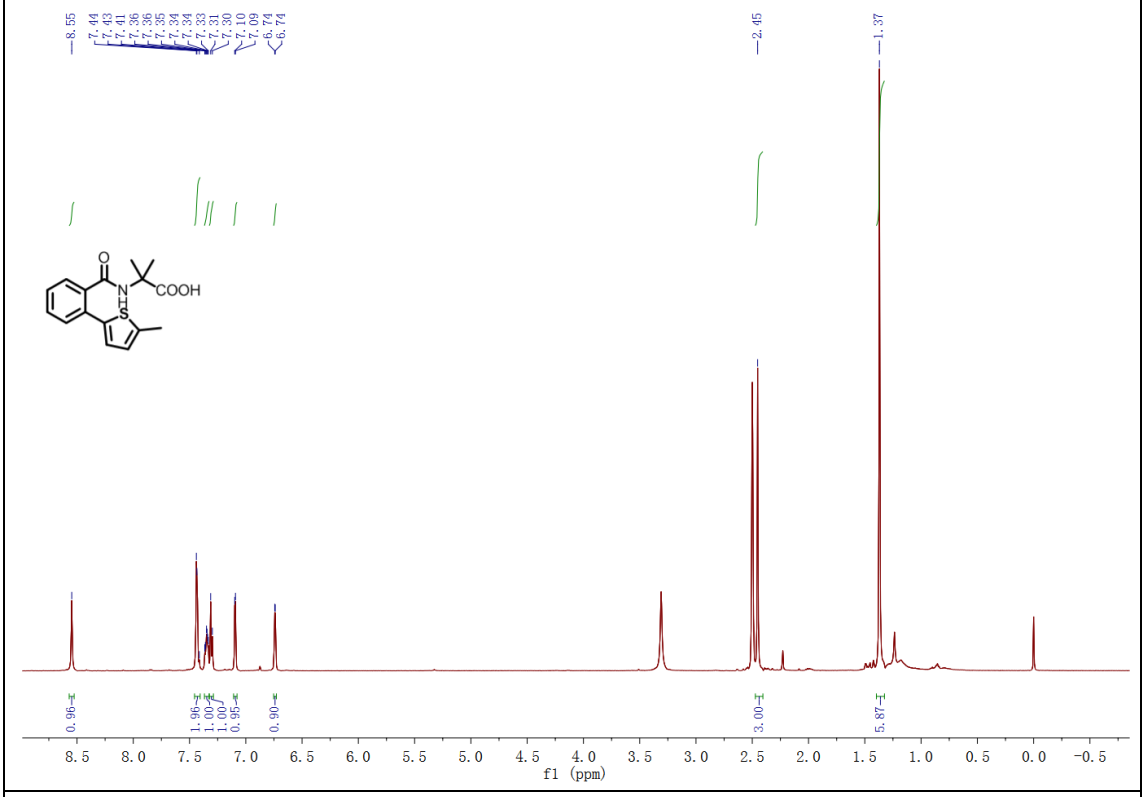
2-methyl-2-(2-(thiophen-2-yl)benzamido)propanoic acid (4l)

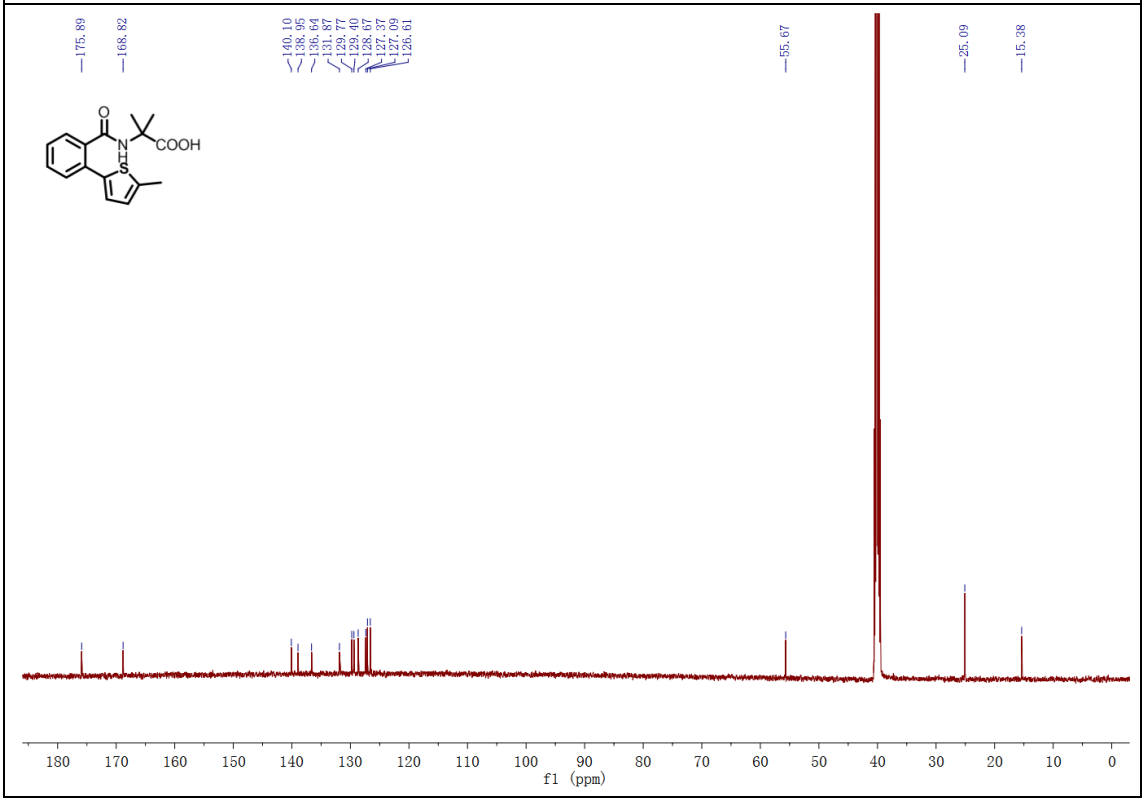


2-(4'-cyano-[1,1'-biphenyl]-2-ylcarboxamido)-2-methylpropanoic acid (4m)

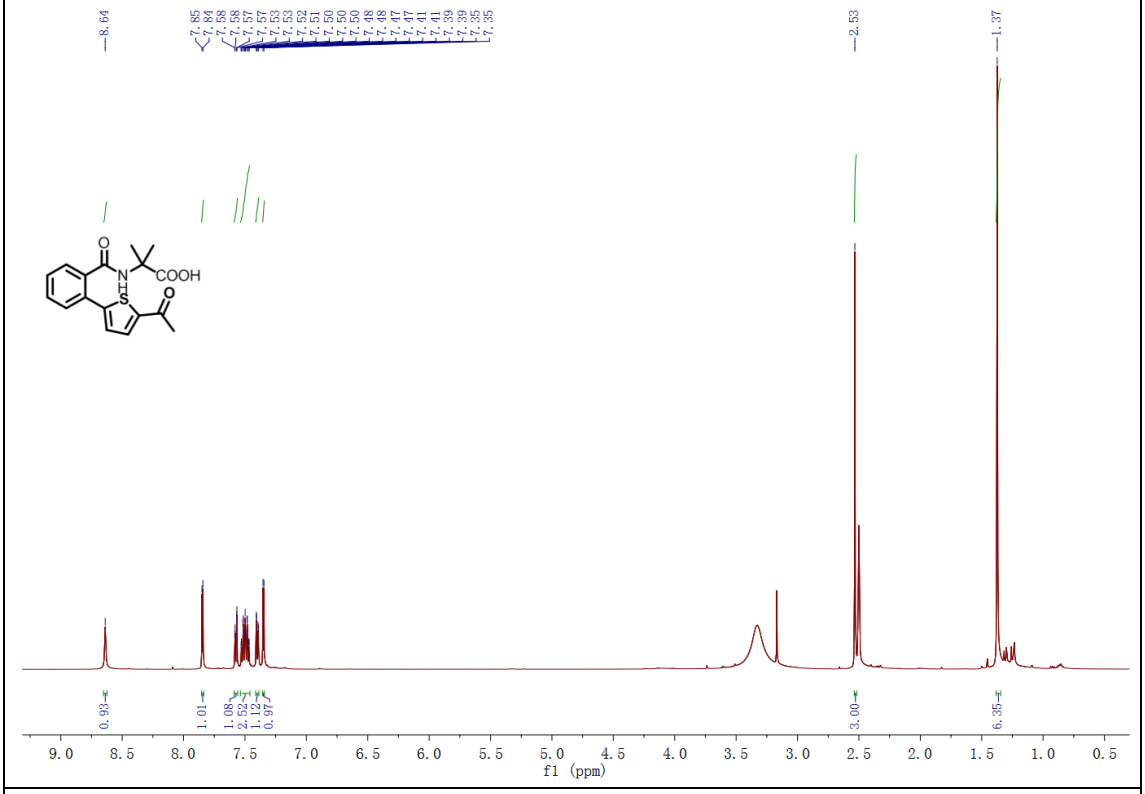


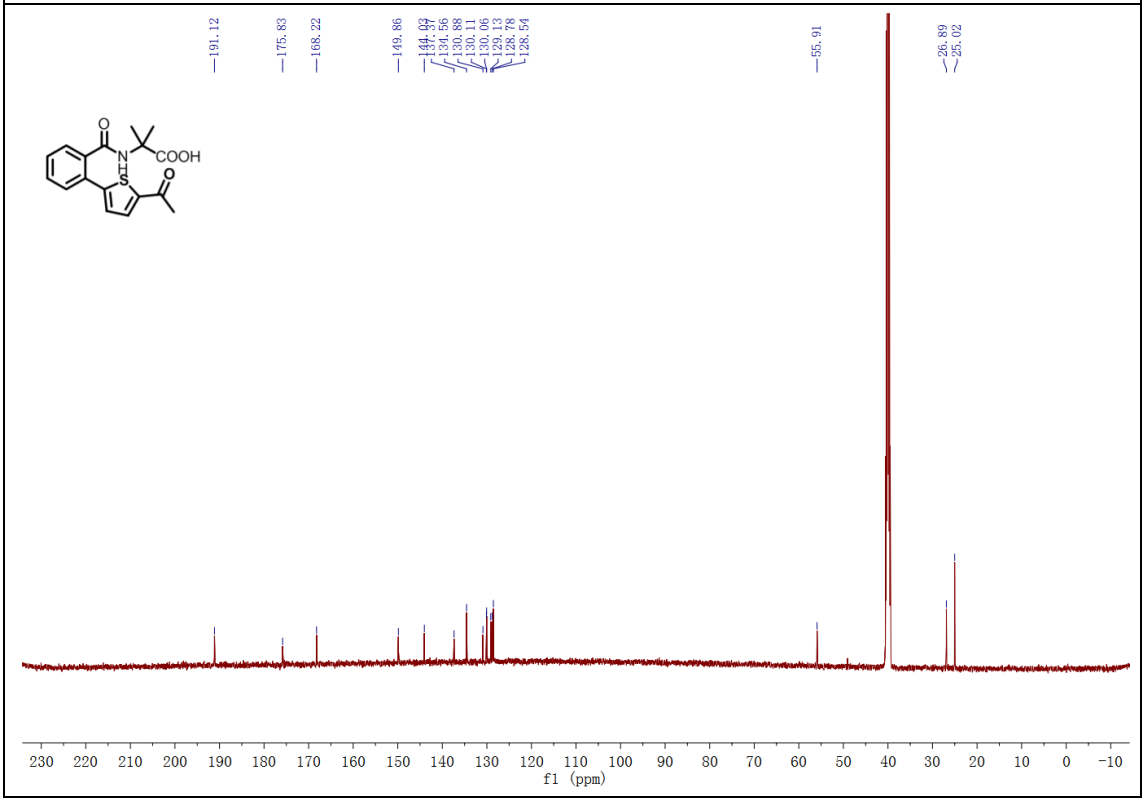
2-methyl-2-(2-(5-methylthiophen-2-yl)benzamido)propanoic acid (4n)



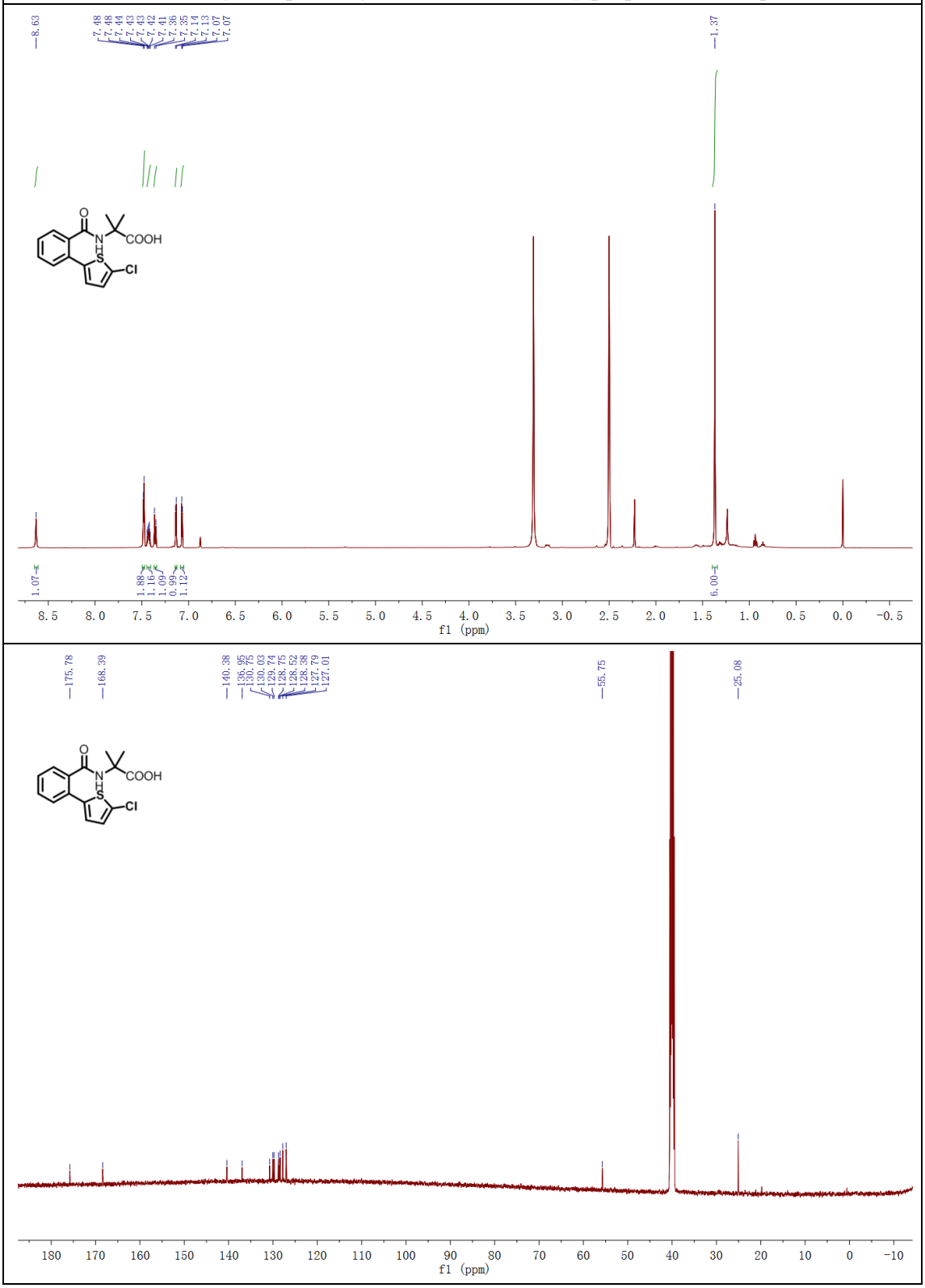


2-(2-(5-acetylthiophen-2-yl)benzamido)-2-methylpropanoic acid (4o)

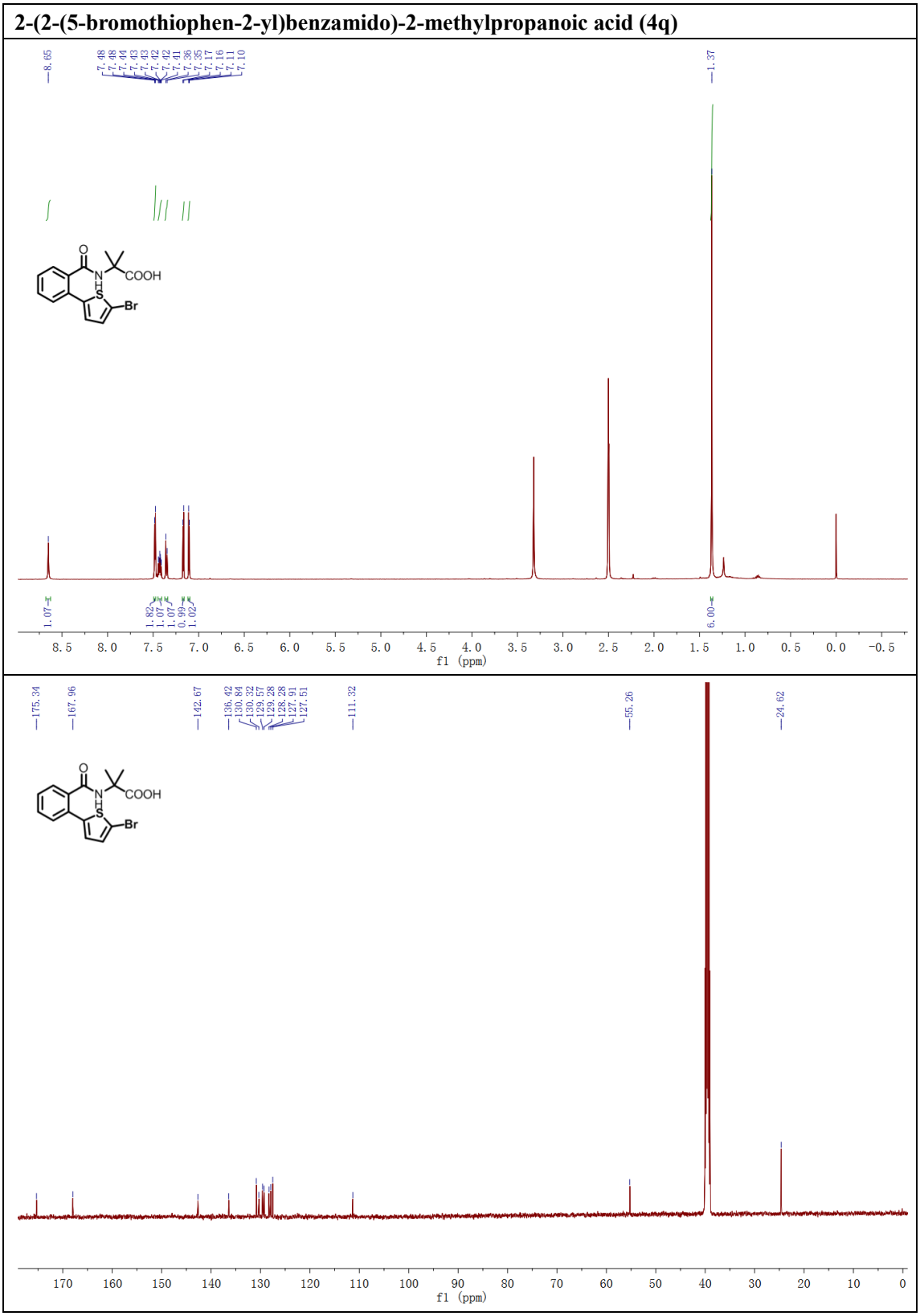




2-(2-(5-(chlorocarbonyl)thiophen-2-yl)benzamido)-2-methylpropanoic acid (4p)



2-(2-(5-bromothiophen-2-yl)benzamido)-2-methylpropanoic acid (4q)



2-(2-(5'-bromo-[2,2'-bithiophen]-5-yl)benzamido)-2-methylpropanoic acid (4r)