Supporting Information for:

Palladium-Catalyzed Markovnikov Hydroaminocarbonylation of 1,1-Disubstituted and 1,1,2-Trisubstituted Alkenes for Formation of Amides with Quaternary Carbon

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1. General information.

Chemicals

Chemicals were commercially purchased from Adamas-beta, Energy Chemical, Aladdin, etc, and directly used without further purification unless otherwise stated. $PdCl_2$, $PdBr_2$, PdI_2, $Pd(PPh_3)_4$ and $Pd(PPh_3)_2Cl_2$ were purchased from Adamas-beta. THF used in the reaction was purchased from Shanghai Titan Scientific Co., Ltd. ($H_2O \leqslant 0.1\%$) and without further purification. Anhydrous THF used in mechanistic studies was distilled from sodium/benzophenone until the indicator had turned a persistent blue color. There is still contained 43 ppm of water in anhydrous THF according to *J. Org. Chem.* **2010**, *75*, 8351–8354.

Chromatography

Analytical thin-layer chromatography (TLC) was carried out with silica gel pre-coated glass plates (TLC-Silica gel GF254, coating thickness: 0.20-0.25 mm, particle size: 10-40 μm) purchased from Xinnuo Chemical (Yantai, China). The TLC was visualized with a UV lamp (254 or 365 nm). Flash Column chromatography was carried out on silica gel (60 Å, 200-300 mesh) purchased from Xinnuo Chemicals (Yantai, China) with technical grade solvents as the eluent. All the yields referred to spectroscopically and chromatographically pure compounds.

Nuclear Magnetic Resonance (NMR) Spectroscopy

^{1}H NMR spectra were recorded on Bruker AVANCE III-400 instrument (400 MHz spectrometer). The analytical sample was dissolved in an appropriate deuterated solvent. The employed deuterated solvent and the measuring frequency are indicated in each ^{1}H NMR data. Chemical shifts are reported in parts per million (ppm) with the solvent resonance as the internal reference ($CDCl_3$ δ 7.26, d^6-DMSO δ 2.50). The following abbreviations (or combinations thereof) were used to explain multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, b = broad. Coupling constants, J were reported in Hertz unit (Hz).

^{13}C NMR spectra were recorded on Bruker AVANCE III - 400 instrument (101 MHz spectrometer). The employed deuterated solvent and the measuring frequency are both indicated in each ^{13}C NMR data. Chemical shifts are reported in ppm with the solvent resonance as the internal reference ($CDCl_3$ δ 77.16). ^{19}F NMR data were recorded on Bruker AVANCE III - 400 instrument (376 MHz spectrometer).

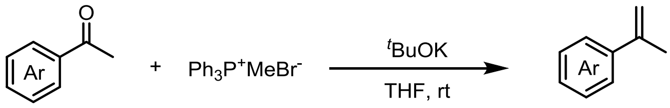
High Resolution Mass Spectrometry (HRMS)

HRMS were recorded on a liquid chromatography/quadrupole time-of-flight mass spectrometer (MicroTof-Q II mass spectrometer, Bruker Daltonics) using electrospray ionization-time of flight (ESI-TOF) at Instrumental Analysis Center of Northwest University. The calculated values are based on the most abundant isotope.

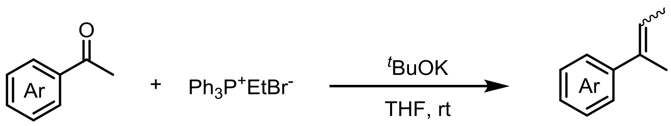
X-ray crystallography

X-ray crystallography was performed on a BRUKERSMA RTAPEXIICCD diffractometer at Instrumental Analysis Center of Northwest University.

2. Preparation of 1,1-disubstituted alkenes, and 1,1,2-trisubstituted alkenes

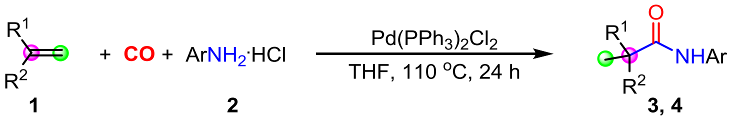


To a 25 ml round bottomed flask were added methyl triphenylphosphonium bromide (7.5 mmol, 1.5 equiv) and ^{t}BuOK (7.5 mmol, 1.5 equiv). Adding 10 mL of dry THF under argon, the mixture was stirred at room temperature for 1 hour. After that diluted ketone (5 mmol, 1.0 equiv) in dry THF (3 mL) was added, then the reaction was stirred at room temperature for overnight. The mixture was diluted with CH_2Cl_2 (25 mL), washed with brine (3×15 mL), dried with Na_2SO_4, filtered and concentrated in vacuum. The crude material was purified by column chromatography (hexanes as the eluent) to afford the 1,1-disubstituted alkenes.

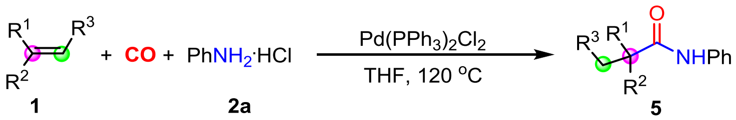


To a 25 ml round bottomed flask were added ethyl triphenylphosphonium bromide (7.5 mmol, 1.5 equiv) and ^{t}BuOK (7.5 mmol, 1.5 equiv). Adding 10 mL of dry THF under argon, the mixture was stirred at room temperature for 1 hour. After that diluted ketone (5 mmol, 1.0 equiv) in dry THF (3 mL) was added, then the reaction was stirred at room temperature for overnight. The mixture was diluted with CH_2Cl_2 (25 mL), washed with brine (3×15 mL), dried with Na_2SO_4, filtered and concentrated in vacuum. The crude material was purified by column chromatography (hexanes as the eluent) to afford the 1,1,2-trisubstituted alkenes.

3. Typical procedure for the palladium-catalyzed Markovnikov hydroaminocarbonylation

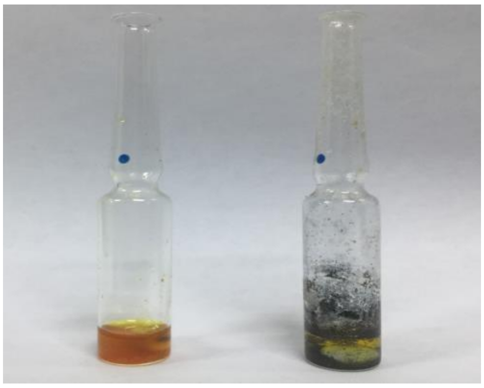


For Table 2: A mixture of 1,1-disubstituted alkenes **1** (0.24 mmol, 1.2 equiv), aniline hydrochloride salts **2** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivities were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the product **3** and **4**.



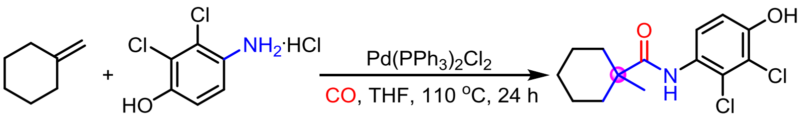
For Table 3: A mixture of 1,1,2-trisubstituted alkenes **1** (0.24 mmol, 1.2 equiv), aniline hydrochloride salt **2a** (0.2 mmol, 1.0 equiv), Pd $(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (0.3 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 65 atm of CO. The reaction mixture in autoclave was reacted at 120 °C for 96-144 hours without stirring. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivities were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the products **5**.

Notably, we found that the stirring played an important role in the reaction. Only trace of product was observed when the reaction was stirring at 500 rpm (lots of palladium black formed, as following Figure, right). However, the reaction goes well when it was performed without stirring (as following Figure, left). The detailed mechanism remains unclear.



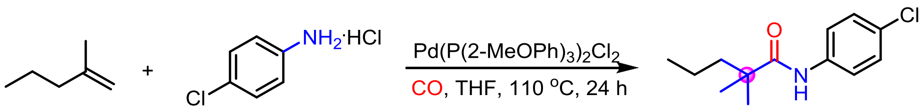
For left reaction, without stirring; for right reaction, stirring at 500 rpm

4. Synthetic applications of the reaction



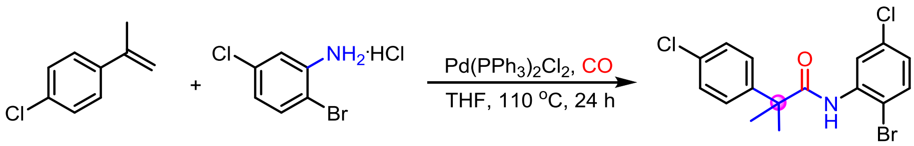
Fenhexamid, **6a**, 62% yield

A mixture of 1-methylenecyclohexane (0.24 mmol, 1.2 equiv), 2,3-dichloro-4-aminophenol hydrochloride (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 ^{o}C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b/l=95:5) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 6/1) to give the fenhexamid **6a** in 62% yield.



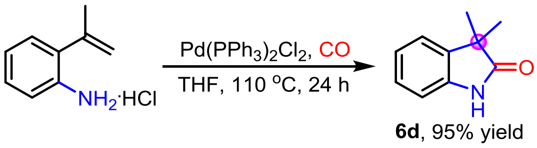
1x **2j** Monalide, **6b**, 71% yield

A mixture of **1x** (0.24 mmol, 1.2 equiv), **2j** (0.2 mmol, 1.0 equiv), $Pd(P(2\text{-}MeOPh)_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 ^{o}C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b:l=95:5) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **6b** in 71% yield.



1j **2o** **6c**, 62% yield

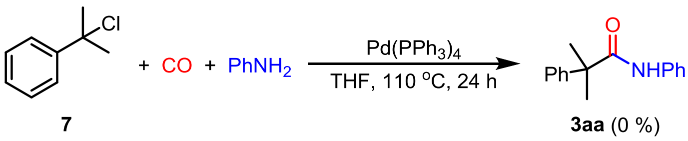
A mixture of **1j** (0.24 mmol, 1.2 equiv), **2o** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 ^{o}C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b/l=97:3) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **6c** in 62% yield.



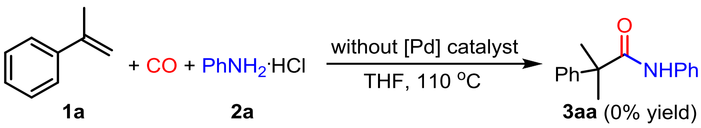
A mixture of 2-(prop-1-en-2-yl)aniline hydrochloride (0.20 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b:l>99:1) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **6d** in 95% yield.

5. Mechanistic studies

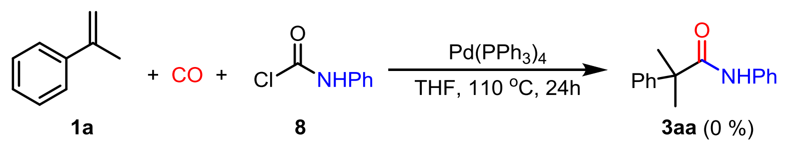
5.1 Control experiments (Scheme 3 in maintext)



A mixture of (2-chloropropan-2-yl)benzene **7** (0.24 mmol, 1.2 equiv), aniline (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_4$ (0.01 mmol, 5 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. No desired **3aa** was detected by GC-MS.



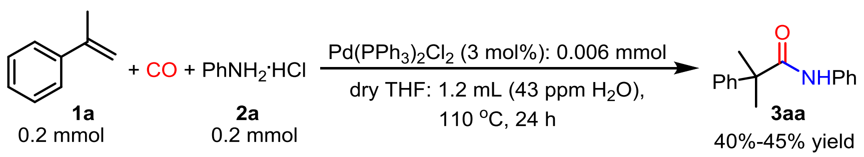
A mixture of α-methyl styrene **1a** (0.24 mmol, 1.2 equiv), aniline hydrochloride salt **2a** (0.2 mmol, 1.0 equiv), THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. No desired **3aa** was detected by GC-MS.



A mixture of α-methyl styrene **1a** (0.24 mmol, 1.2 equiv), phenylcarbamic chloride **8** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_4$ (0.01 mmol, 5 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. No desired **3aa** was detected by GC-MS.

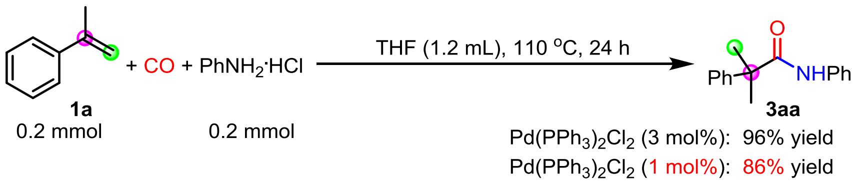
5.2 Anhydrous studies

Anhydrious THF was distilled from sodium/benzophenone once the indicator had turned a persistent blue color. There is still contained 43 ppm of water in anhydrous THF according to *J. Org. Chem.* **2010**, *75*, 8351–8354. Before they were used in the reaction, anilines hydrochloride, palladium catalyst, glass tube and autoclave were dried in a drying box at 120 °C for 3h.



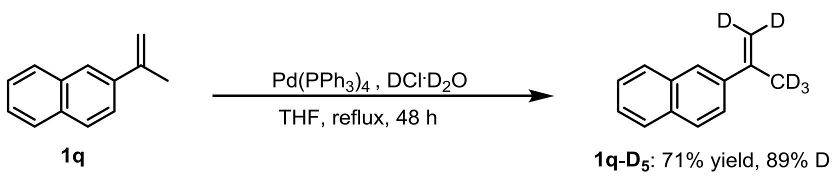
A mixture of **1a** (0.24 mmol, 1.2 equiv), **2a** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and anhydrious THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the product **3aa**.

Above anhydrous reaction was run 3 times, 40-45% yield of **3aa** was obtained. There is still 0.003 mmol water in 1.2 mL anhydrous THF (43 ppm), which is 0.5 equiv for $Pd(PPh_3)_2Cl_2$ catalyst (3 mol%). Further control experiment in the presence of 1 mol% of $Pd(PPh_3)_2Cl_2$ catalyst in 1.2 mL commercially purchased THF resulted in 86% yield of **3aa**. These experiments suggested water played an important role in the reaction.

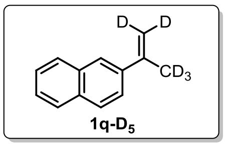


5.3 Deuterium-Labeling studies

5.3.1 Preparation of 1q-D$_5$

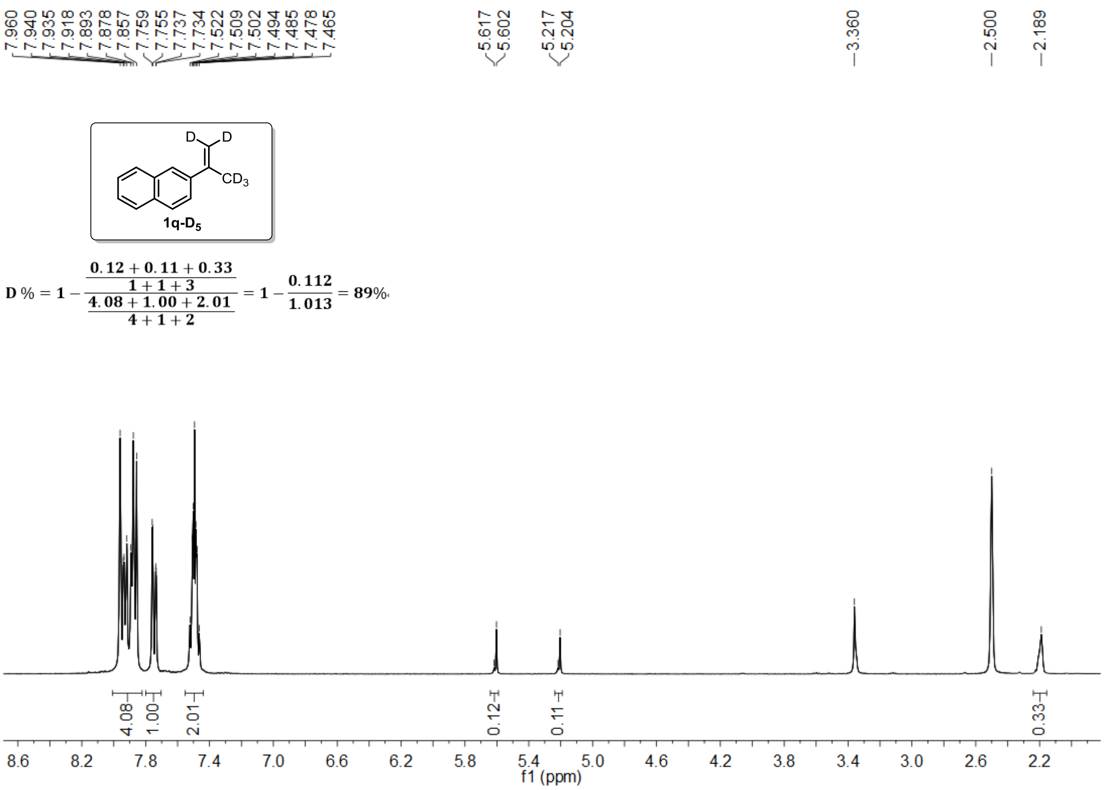


A mixture of 2-isopropenylnaphthalene **1q** (0.2 mmol, 1.0 equiv), $DCl \cdot D_2O$ (93.6 mg, 20.0 equiv), $Pd(PPh_3)_4$ (0.006 mmol, 3 mol%), and anhydrous THF (1.2 mL) were added into a round bottomed flask which was reflux under argon in an oil bath for 48 hours. After completion, the reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 100/1) to give the **1q-D$_5$** in 71% yield with 89% D.



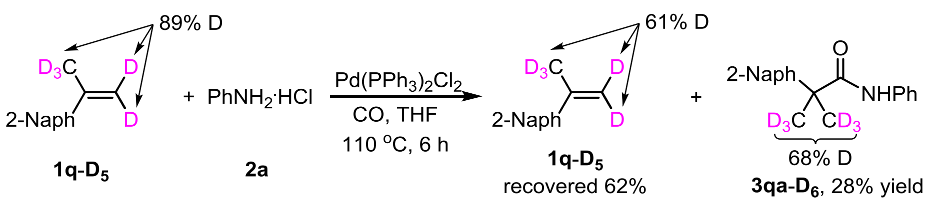
1q-D$_5$: ^{1}H NMR (400 MHz, d^6-DMSO) δ 7.96-7.86 (m, 4H), 7.75 (dd, J = 8.8, 1.4 Hz, 1H), 7.52-7.47 (m, 2H), 5.61 (d, J = 6.0 Hz, 0.12 H), 5.21 (d, J = 5.2 Hz, 0.11 H), 2.19 (s, 0.33 H).

^{1}H NMR (400 MHz, d^6-DMSO) of compound **1q-D$_5$**



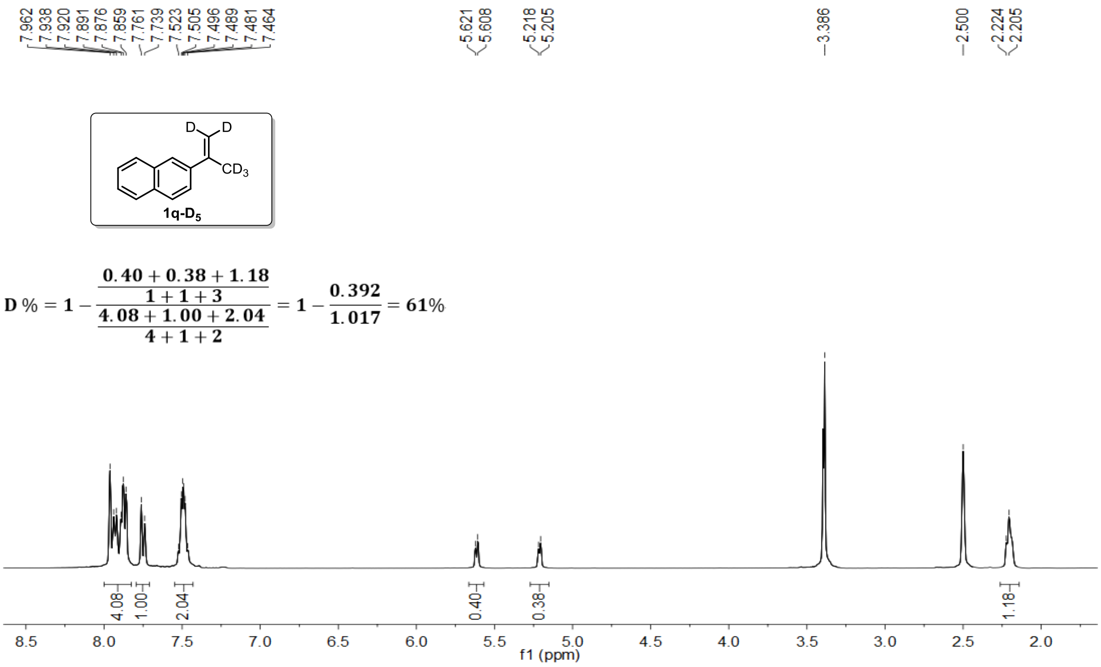
$$\mathrm{D}\,\% = 1 - \frac{\frac{0.12+0.11+0.33}{1+1+3}}{\frac{4.08+1.00+2.01}{4+1+2}} = 1 - \frac{0.112}{1.013} = 89\%$$

5.3.2 Deuterium-labeling studies with 1q-D$_5$ and 2a

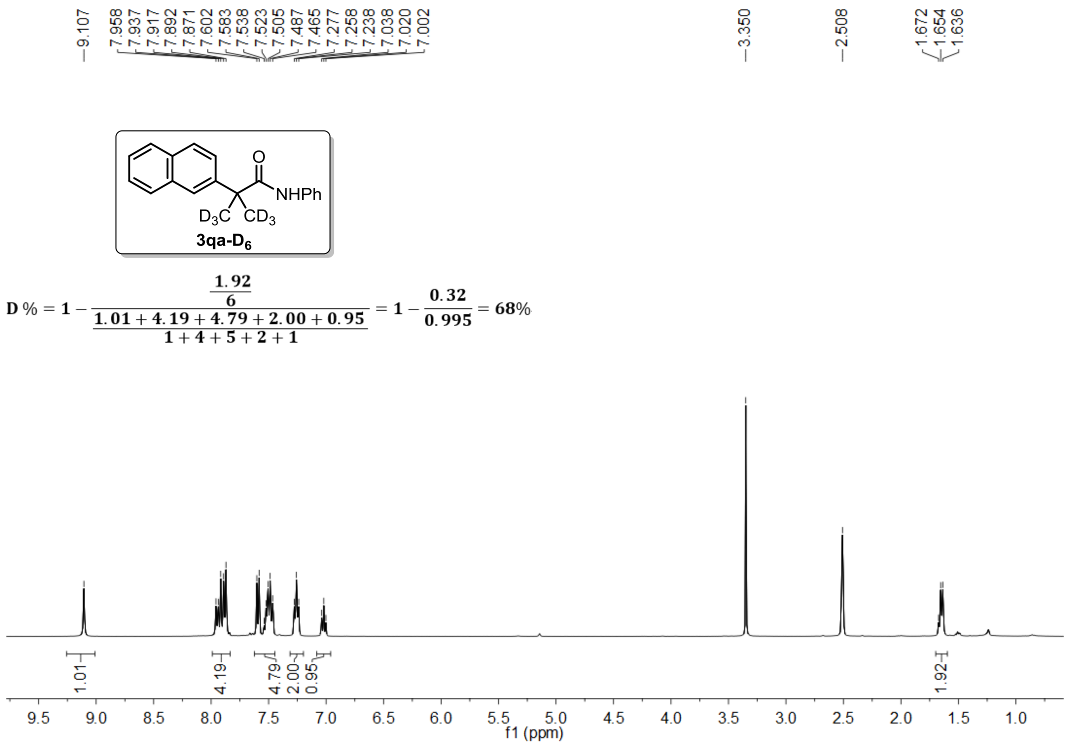


A mixture of **1q-D$_5$** (0.2 mmol, 1.0 equiv, 89% D), **2a** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and anhydrous THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 ^{o}C for 6 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the product **3qa-D$_6$** in 28% yield (68 atom % D in **3qa-D$_6$** was determined by ^{1}H NMR), and the **1q-D$_5$** was recovered in 62% yield (61 atom % D in **1q-D$_5$** was determined by ^{1}H NMR).

^{1}H NMR (400 MHz, d^6-DMSO) of **1q-D$_5$**

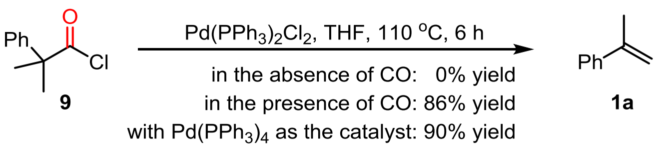


[1]H NMR (400 MHz, d^6-DMSO) of compound **3qa-D$_6$**



$$D\,\% = 1 - \frac{\frac{1.92}{6}}{\frac{1.01+4.19+4.79+2.00+0.95}{1+4+5+2+1}} = 1 - \frac{0.32}{0.995} = 68\%$$

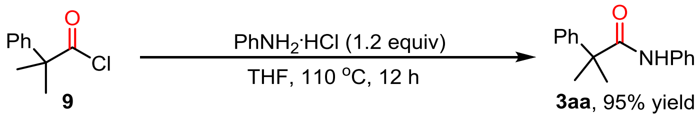
5.4 Control experiments



The 2-methyl-2-phenylpropanoyl chloride **9** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and anhydrous THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with Ar for three times in a well-ventilated fume hood, and then pressurized to 10 atm of Ar. The reaction mixture in autoclave was stirred at 110 °C for 6 hours under Ar. After completion, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of Ar. The alkene **1a** was not observed.

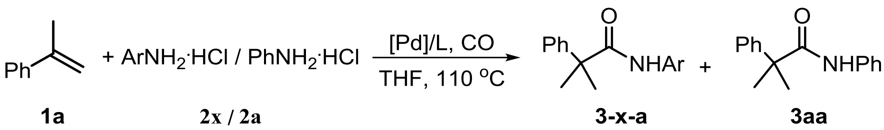
When the autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The alkene **1a** was obtained in 86% yield.

When $Pd(PPh_3)_4$ was used as catalyst, the autoclave was evacuated and backfilled with Ar for three times, and then pressurized to 10 atm of Ar. After reaction, the **1a** was obtained in 90% yield.



A mixture of 2-methyl-2-phenylpropanoyl chloride **9** (0.20 mmol, 1.0 equiv), aniline hydrochloride salt **2a** (0.24 mmol, 1.2 equiv) and anhydrous THF (1.2 mL) were added to a 10 ml round bottomed flask under argon, the mixture was stirred at 110 °C for 12 hours. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **3aa** in 95% yield.

5.5 Hammett plot analysis



A mixture of α-methyl styrene **1a** (0.2 mmol, 1.0 equiv), $ArNH_2 \cdot HCl$ **2x** (0.2 mmol, 1.0 equiv), $PhNH_2.HCl$ **2a** (0.2 mmol, 1.0 equiv), $PdCl_2(PPh_3)_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the mixture products. The ratio of different products was determined by the ^1H NMR analysis. See following table.

$ArNH_2·HCl$	σ	Conv. of **1a**	Ratio of $Y_{3\text{-}x\text{-}a}$: Y_{3aa}	k_x/k_H	log (k_x/k_H)
p-OMe	-0.268	86%	25% : 61%	0.41	-0.387
p-Me	-0.170	82%	28% : 54%	0.51	-0.292
p-Cl	0.227	77%	47% : 30%	1.57	0.196
p-Br	0.232	83%	51% : 32%	1.59	0.201

Figure S1 Hammett plot. The conversion of **1a** was calculated based on mixture products, the ratio of $Y_{3\text{-}x\text{-}a}/Y_{3aa}$ was determined by ^{1}H NMR.

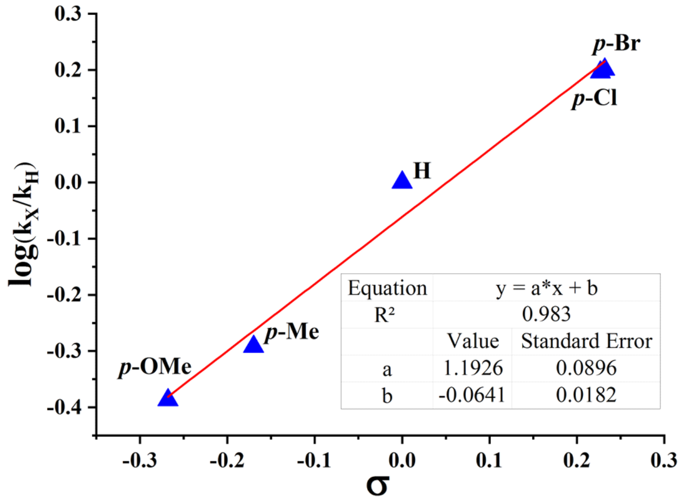
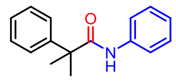


Figure S2. Hammett plot for the reaction using *para*-substituted anilines hydrochloride. Logarithm of the ratio of rate constant (log(k_X/k_H) versus σ p for the hydroaminocarbonylation reaction of *p*-substituted anilines hydrochloride with α-methyl styrene.

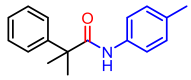
6. Characterization data of products



3aa

2-methyl-*N*,2-diphenylpropanamide (3aa)

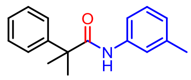
Yield = 96%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45-7.37 (m, 4H), 7.36-7.29 (m, 3H), 7.26-7.22 (m, 2H), 7.06-7.02 (m 1H), 6.81 (s, 1H), 1.66 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.6, 144.7, 138.1, 128.9, 129.0, 127.5, 126.6, 124.2, 119.8, 48.1, 27.1. HRMS calcd. (ESI) m/z for $C_{16}H_{17}NNaO$ $[M+Na]^+$: 262.1202, found: 262.1202.



3ab

2-methyl-2-phenyl-*N*-(*p*-tolyl)propanamide (3ab)

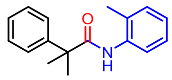
Yield = 85%, b/l = 98:2; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45-7.37 (m, 4H), 7.30 (t, *J* = 7.0 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 2H), 7.05 (d, *J* = 8.4 Hz, 2H), 6.77 (s, 1H), 2.26 (s, 3H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.5, 144.8, 135.5, 133.8, 129.4, 129.0, 127.4, 126.5, 119.8, 48.0, 27.1, 20.9. HRMS calcd (ESI) m/z for $C_{17}H_{19}NNaO$ $[M+Na]^+$: 273.1358, found: 276.1359.



3ac

2-methyl-2-phenyl-*N*-(*m*-tolyl)propanamide (3ac)

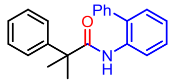
Yield = 92%, b/l = 98:2; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45-7.37 (m, 4H), 7.33-7.28 (m, 1H), 7.23 (d, *J* = 1.6 Hz, 1H), 7.13-7.11 (m, 2H), 6.87-6.85 (m, 1H), 6.78 (s, 1H), 2.28 (s, 3H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.6, 144.7, 138.9, 138.0, 129.1, 128.8, 127.4, 126.5, 125.0, 120.4, 116.8, 48.1, 27.1, 21.5. HRMS calcd. (ESI) m/z for $C_{17}H_{19}NNaO$ $[M+Na]^+$: 273.1358, found: 273.1358.



3ad

2-methyl-2-phenyl-*N*-(*o*-tolyl)propanamide (3ad)

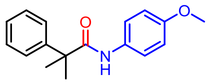
Yield = 76%, b/l = 97:3, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.0 Hz, 1H), 7.51-7.48 (m, 2H), 7.44-7.40 (m, 2H), 7.34-7.31 (m, 1H), 7.17 (t, *J* = 7.6 Hz, 1H), 7.05 (d, *J* = 7.2 Hz, 1H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.69 (s, 1H), 1.78 (s, 3H), 1.70 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.7, 144.8, 136.0, 130.3, 129.1, 128.0, 127.6, 126.9, 126.8, 124.7, 121.9, 48.2, 27.0, 17.1. HRMS calcd (ESI) m/z for $C_{17}H_{19}NO$: $[M+Na]^+$ 273.1358, found: 276.1353.



3ae

***N*-([1,1'-biphenyl]-2-yl)-2-methyl-2-phenylpropanamide (3ae)**

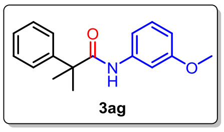
Yield = 91%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 (d, *J* = 8.4 Hz, 1H), 7.36-7.26 (m, 2H), 7.25-7.17 (m, 7H), 7.13-7.07 (m, 2H),7.01 (s, 1H), 6.97-6.94(m, 2H) 1.51 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.4, 144.0, 137.7, 135.3, 131.9, 130.0 129.0, 128.9, 128.8, 128.5, 127.6, 127.2, 126.2, 123.8, 120.3, 48.1, 26.8. HRMS calcd. (ESI) m/z for $C_{22}H_{21}NNaO$ $[M+Na]^+$: 338.1515, found: 338.1515.



3af

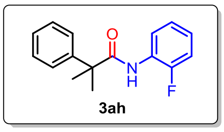
***N*-(4-methoxyphenyl)-2-methyl-2-phenylpropanamide (3af)**

Yield = 67%, b/l > 99:1; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50-7.37 (m, 4H), 7.33-7.29 (m, 1H), 7.28-7.14 (m, 2H), 6.83-6.76 (m, 2H), 6.71 (s, 1H), 3.76 (s, 3H), 1.66 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.6, 156.4, 144.9, 131.2, 129.1, 127.5, 126.6, 121.7, 114.1, 55.6, 48.0, 27.2. HRMS calcd. (ESI) m/z for $C_{17}H_{19}NNaO_2$ $[M+Na]^+$: 292.1308, found: 292.1311.



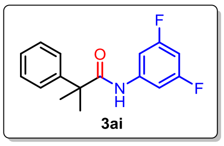
***N*-(3-methoxyphenyl)-2-methyl-2-phenylpropanamide (3ag)**

Yield = 83%, b/l = 96:4, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45-7.37 (m, 4H), 7.31 (t, *J* = 7.0 Hz, 1H), 7.24 (t, *J* = 2.2 Hz, 1H), 7.11 (t, *J* = 8.2 Hz, 1H), 6.83 (s, 1H), 6.74-6.71 (m, 1H), 6.62-6.59 (m, 1H), 3.76 (s, 3H), 1.66 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.7, 160.2, 144.6, 139.3, 129.5, 129.1, 127.5, 126.5, 111.7, 110.3, 105.2, 55.3, 48.2, 27.1. HRMS calcd. (ESI) m/z for $C_{17}H_{19}NNaO_2$ $[M+Na]^+$: 292.1308, found: 292.1312.



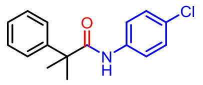
***N*-(2-fluorophenyl)-2-methyl-2-phenylpropanamide (3ah)**

Yield = 90%, b/l = 90:10, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.30-8.25 (m, 1H), 7.47-7.44 (m, 2H), 7.42-7.38 (m, 2H), 7.32-7.29 (m, 1H), 7.13-7.06 (m, 2H), 6.99-6.93 (m, 2H), 1.68 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.8, 153.7, 151.3, 144.2, 129.1, 127.6, 126.5, 124.6 (d, *J* = 3.3 Hz), 124.2 (d, *J* = 7.6 Hz), 121.6, 114.7 (d, *J* = 19.1 Hz), 48.3, 27.0; ^{19}F NMR (376 MHz, $CDCl_3$) δ -114.9. HRMS calcd. (ESI) m/z for $C_{16}H_{16}FNNaO$ $[M+Na]^+$: 280.1108, found: 280.1119.



***N*-(3,5-difluorophenyl)-2-methyl-2-phenylpropanamide (3ai)**

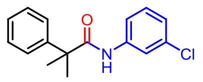
Yield = 88%, b/l = 95:5, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41-7.29 (m, 5H), 7.00-6.95 (m, 3H), 6.49-6.44 (m, 1H), 1.64 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.9, 163.1 (dd, *J* = 244.7, 14.6 Hz), 144.0, 140.2 (t, *J* = 13.3 Hz), 129.2, 127.7, 126.4, 102.7 (dd, *J* = 20.6, 8.4 Hz), 99.3 (t, *J* = 25.4 Hz), 48.3, 26.9; ^{19}F NMR (376 MHz, $CDCl_3$) δ -109.0. HRMS calcd (ESI) m/z for $C_{16}H_{15}F_2NNaO$ $[M+Na]^+$: 298.1013, found: 298.0998.



3aj

N-(4-chlorophenyl)-2-methyl-2-phenylpropanamide (3aj)

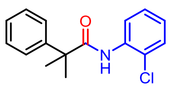
Yield = 94%, b/l > 99:1; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44-7.38 (m, 4H), 7.34-7.27 (m, 3H), 7.21-7.17 (m, 2H), 6.83 (s, 1H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.0, 143.3, 137.9, 133.4, 129.2, 129.0, 128.0, 124.4, 119.9, 47.8, 27.1. HRMS calcd. (ESI) m/z for $C_{16}H_{16}ClNNaO$ $[M+Na]^+$: 296.0812, found: 296.0798.



3ak

N-(3-chlorophenyl)-2-methyl-2-phenylpropanamide (3ak)

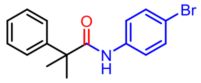
Yield = 93%, b/l = 98:2; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, *J* = 2.0 Hz, 1H), 7.43-7.38 (m, 4H), 7.36-7.29 (m, 1H), 7.18-7.11 (m, 2H), 7.02-6.99 (m, 1H), 6.87 (s, 1H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.8, 144.3, 139.2, 134.6, 129.9, 129.2, 127.6, 126.5, 124.2, 119.9, 117.7, 48.2, 27.0. HRMS calcd. (ESI) m/z for $C_{16}H_{16}ClNNaO$ $[M+Na]^+$: 296.0812, found: 296.0810.



3al

N-(2-chlorophenyl)-2-methyl-2-phenylpropanamide (3al)

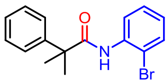
Yield = 95%, b/l = 96:4; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (dd, *J* = 9.6, 1.4 Hz, 1H), 7.49-7.47 (m, 3H), 7.43-7.39 (m, 2H), 7.36-7.29 (m, 1H), 7.24-7.20 (m, 2H), 6.97-6.93 (m, 1H), 1.70 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.8, 144.1, 134.9, 129.1, 128.9, 127.7, 127.6, 126.6, 124.4, 122.9, 121.2, 48.4, 26.9. HRMS calcd. (ESI) m/z for $C_{16}H_{16}ClNNaO$ $[M+Na]^+$: 296.0812, found: 296.0822.



3am

***N*-(4-chlorophenyl)-2-methyl-2-phenylpropanamide (3am)**

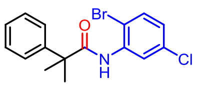
Yield = 93%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44-7.38 (m, 4H), 7.36-7.29 (m, 3H), 7.26-7.22 (m, 2H), 6.82 (s, 1H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.7, 144.4, 137.1, 131.9, 129.2, 127.6, 126.5, 121.4, 116.8, 48.2, 27.1. HRMS calcd. (ESI) m/z for $C_{16}H_{16}BrNNaO$ $[M+Na]^+$: 340.0307, found: 340.0307.



3an

***N*-(2-bromophenyl)-2-methyl-2-phenylpropanamide (3an)**

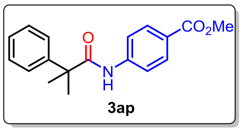
Yield = 64%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (dd, *J* = 8.4, 1.6 Hz, 1H), 7.50-7.47 (m, 3H), 7.44-7.39 (m, 3H), 7.34-7.25 (m, 2H), 6.92-6.88 (m, 1H), 1.71 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.9, 144.1, 136.0, 132.2, 129.2, 128.3, 127.6, 126.7, 124.9, 121.4, 113.4, 48.4, 26.9. HRMS calcd. (ESI) m/z for $C_{16}H_{16}BrNNaO$ $[M+Na]^+$: 340.0307, found: 340.0298.



3ao

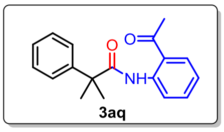
***N*-(2-bromo-4-chlorophenyl)-2-methyl-2-phenylpropanamide (3ao)**

Yield = 72%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 2.4 Hz, 1H), 7.49-7.40 (m, 5H), 7.35-7.30 (m, 2H), 6.88 (dd, *J* = 8.8, 2.4 Hz, 1H), 1.70 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.0, 143.7, 136.8, 134.3, 132.7, 129.3, 127.8, 126.7, 124.8, 121.1, 110.8, 48.5, 26.8. HRMS calcd (ESI) m/z for $C_{16}H_{15}BrClNNaO$ $[M+Na]^+$: 373.9917, found: 373.9916.



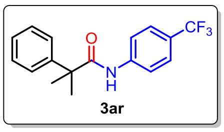
methyl 4-(2-methyl-2-phenylpropanamido)benzoate (3ap)

Yield = 84%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.8 Hz, 2H), 7.46-7.36 (m, 6H), 7.32-7.27 (m, 1H), 7.18 (s, 1H), 3.82 (s, 3H), 1.66 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.9, 166.6, 144.2, 142.3, 130.7, 129.1, 127.5, 126.4, 125.3, 118.8, 51.9, 48.2, 26.9. HRMS calcd. (ESI) m/z for $C_{18}H_{19}NNaO_3$ $[M+Na]^+$: 320.1257, found: 320.1266.



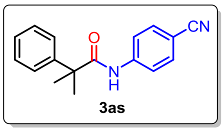
***N*-(2-acetylphenyl)-2-methyl-2-phenylpropanamide (3aq)**

Yield = 91%, b/l = 93:7, ^{1}H NMR (400 MHz, $CDCl_3$) δ 11.56 (s, 1H), 8.79 (dd, *J* = 8.4, 0.8 Hz, 1H), 7.81 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.54-7.46 (m, 3H), 7.39-7.35 (m, 2H), 7.29-7.25 (m, 1H), 7.07-7.03 (m, 1H), 2.54 (s, 3H), 1.70 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 202.4, 176.8, 144.7, 141.3, 135.0, 131.6, 128.7, 127.0, 126.2, 122.1, 121.8, 120.5, 48.4, 28.5, 26.8. HRMS calcd (ESI) m/z for $C_{18}H_{19}NNaO_2$ $[M+Na]^+$: 304.1308, found: 304.1318.



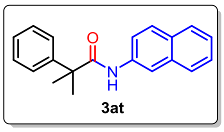
2-methyl-2-phenyl-*N*-(4-(trifluoromethyl)phenyl)propanamide (3ar)

Yield = 84%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50-7.39 (m, 8H) 7.35-7.30 (m, 1H), 7.02 (s, 1H), 1.66 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.0, 144.2, 141.1, 129.2, 127.7, 126.5, 126.2 (q, *J* = 7.5Hz, 3.7Hz), 125.6 (d, *J* = 25.7Hz), 122.8, 119.3, 48.3, 27.0. ^{19}F NMR (376 MHz, $CDCl_3$) δ -32.6. HRMS calcd. (ESI) m/z for $C_{17}H_{16}F_3NNaO$ $[M+Na]^+$: 330.1076, found: 330.1080.



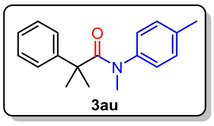
N-(4-cyanophenyl)-2-methyl-2-phenylpropanamide (3as)

Yield = 58%, b/l = 97:3, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54-7.48 (m, 4H), 7.42 (d, J = 4.4 Hz, 4H), 7.37-7.31 (m, 1H), 7.05 (s, 1H), 1.67 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.1, 143.9, 142.1, 133.1, 129.2, 127.7, 126.4, 119.5, 118.9, 106.8, 48.3, 26.9. HRMS calcd. (ESI) m/z for $C_{17}H_{16}N_2NaO$ $[M+Na]^+$: 287.1154, found: 287.1165.



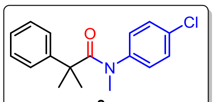
2-methyl-N-(naphthalen-2-yl)-2-phenylpropanamide (3at)

Yield = 78%, b/l = 90:10, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10 (s, 1H), 7.73-7.67 (m, 3H), 7.46 (d, J = 7.6 Hz, 2H), 7.40-7.30 (m, 5H), 7.21 (dd, J = 8.8, 2.0 Hz, 1H), 6.99 (s, 1H), 1.69 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.9, 144.6, 135.5, 133.9, 130.6, 129.1, 128.6, 127.7, 127.6, 127.5, 126.6, 126.5, 125.0, 119.9, 116.4, 48.2, 27.2. HRMS calcd. (ESI) m/z for $C_{20}H_{19}NNaO$ $[M+Na]^+$: 312.1358, found: 312.1359.



***N*,2-dimethyl-2-phenyl-*N*-(*p*-tolyl)propenamide (3au)**

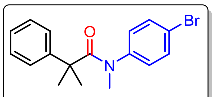
Yield = 70%, b/l = 93:7, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.18-6.46 (m, 9H), 3.10 (m, 3H), 2.26 (s, 3H), 1.45 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.4, 146.4, 141.3, 136.8, 129.2, 128.4, 126.2, 125.4, 47.6, 40.8, 28.7, 21.1. HRMS calcd. (ESI) m/z for $C_{18}H_{21}NNaO$ $[M+Na]^+$: 390.1515, found: 290.1515.



3av

***N*-(4-chlorophenyl)-*N*,2-dimethyl-2-phenylpropanamide (3av)**

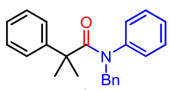
Yield = 71%, b/l = 90:10, ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.22-7.04 (m, 7H), 6.57 (m, 2H), 3.06 (s, 3H), 1.47 (s, 6H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 176.3, 146.0 142.5, 132.7, 129.8, 128.8, 128.6, 126.5, 125.4, 47.7, 40.6, 29.8, 28.6. HRMS calcd. (ESI) m/z for $C_{17}H_{18}ClNNaO$ $[M+Na]^+$: 310.0969, found: 310.0969.



3aw

***N*-(4-bromophenyl)-*N*,2-dimethyl-2-phenylpropanamide (3aw)**

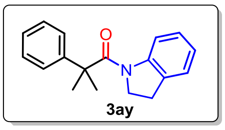
Yield = 75%, b/l = 88:12, ^{1}H NMR (600 MHz, *d*^{6}-DMSO) δ 7.34-7.22 (m, 5H), 7.09 (s, 2H), 6.80 (s, 2H), 2.90 (s, 3H), 1.39 (s, 6H); ^{13}C NMR (151 MHz, *d*^{6}-DMSO) δ 174.9, 145.8, 143.5, 131.5, 130.1, 128.6, 126.4, 125.0, 119.5, 47.0, 28.4. HRMS calcd. (ESI) m/z for $C_{17}H_{18}BrNNaO$ $[M+Na]^+$: 354.0463, found: 354.0461.



3ax

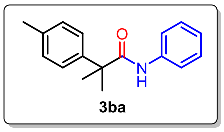
***N*-benzyl-2-methyl-*N*,2-diphenylpropanamide (3ax)**

Yield = 61%, b/l = 86:14, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34-6.89 (m, 14H), 6.29 (s, 2H), 4.79 (s, 2H), 1.45 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.1, 146.2, 141.8, 137.9, 130.2, 129.0, 128.3, 128.3, 128.1, 127.3, 127.1, 126.2, 125.6, 56.1, 47.9, 29.0. HRMS calcd. (ESI) m/z for $C_{23}H_{23}NNaO$ $[M+Na]^+$: 352.1671, found: 352.1666.



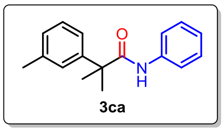
1-(indolin-1-yl)-2-methyl-2-phenylpropan-1-one (3ay)

Yield = 52%, b/l = 83:17, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (d, J = 8.0 Hz, 1H), 7.35-7.29 (m, 4H), 7.26-7.20 (m, 3H), 7.11 (d, J = 6.8 Hz, 1H), 7.00 (t, J = 7.6 Hz, 1H), 3.37 (t, J = 8.0 Hz, 2H), 2.78 (t, J = 8.0 Hz, 2H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.0, 145.6, 144.5, 131.2, 129.1, 127.5, 126.7, 125.5, 124.4, 123.9, 118.4, 49.0, 48.7, 28.9, 27.8. HRMS calcd. (ESI) m/z for $C_{18}H_{19}NNaO$ $[M+Na]^+$: 288.1358 found: 288.1356.



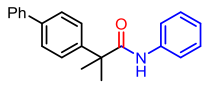
2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (3ba)

Yield = 89% b/l = 98:2, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35-7.30 (m, 4H), 7.23-7.17 (m, 4H), 7.00 (t, J = 7.6 Hz, 1H), 6.89 (s, 1H), 2.34 (s, 3H), 1.62 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.8, 144.6, 138.7, 138.1, 129.0, 128.2, 127.3, 124.2, 123.6, 119.7, 48.0, 27.1, 21.7. HRMS calcd. (ESI) m/z for $C_{16}H_{17}NO$ $[M+Na]^+$: 262.1202, found: 262.1211.



2-methyl-*N*-phenyl-2-(*m*-tolyl)propanamide (3ca)

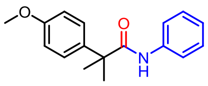
Yield = 78%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) 7.35 (d, J = 7.6 Hz, 2H), 7.30-7.21 (m, 5H), 7.12 (d, J = 7.2 Hz, 1H), 7.06-7.02 (m, 1H), 6.83 (s, 1H), 2.37 (s, 3H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.8, 144.6, 138.7, 138.1, 128.9, 128.2, 127.3, 124.2, 123.6, 119.7, 48.0, 27.1, 21.7. HRMS calcd. (ESI) m/z for $C_{17}H_{19}NNaO$ $[M+Na]^+$: 276.1358, found: 276.1370.



3da

2-([1,1'-biphenyl]-4-yl)-2-methyl-*N*-phenylpropanamide (3da)

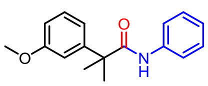
Yield = 95%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64-7.60 (m, 4H), 7.53-7.50 (m, 2H), 7.47-7.43 (m, 2H), 7.39-7.33 (m, 3H), 7.28-7.24 (m, 2H), 7.07-7.03 (m, 1H), 6.88 (s, 1H), 1.70 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.6, 143.7, 140.4, 140.3, 138.1, 129.0, 129.0, 127.7, 127.6, 127.1, 127.1, 124.3, 119.8, 48.0, 27.2. HRMS calcd. (ESI) m/z for $C_{22}H_{21}NNaO$ $[M+Na]^+$: 338.1515, found: 338.1515.



3ea

2-(4-methoxyphenyl)-2-methyl-*N*-phenylpropanamide (3ea)

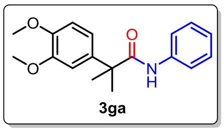
Yield = 84%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.34 (m, 4H), 7.24 (t, J = 7.2 Hz, 2H), 7.06-7.02 (m, 1H), 6.94-6.89 (m, 3H), 3.81 (s, 3H), 1.63 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.0, 158.8, 138.1, 136.5, 128.9, 127.7, 124.1, 119.7, 114.3, 55.3, 47.4, 27.2. HRMS calcd. (ESI) m/z for $C_{17}H_{19}NNaO_2$ $[M+Na]^+$: 292.1308, found: 292.1308.



3fa

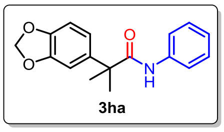
2-(3-methoxyphenyl)-2-methyl-*N*-phenylpropanamide (3fa)

Yield = 91%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.35 (m, 4H), 7.27-7.23 (m, 2H), 7.04 (t, J = 2.8 Hz, 1H), 6.95-6.91 (m, 2H), 6.85 (s, 1H), 3.82 (s, 3H), 1.64 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.5, 160.1, 146.3, 138.1, 130.1, 128.9, 124.2, 119.8, 119.0, 113.0, 112.2, 55.4, 48.1, 27.1. HRMS calcd. (ESI) m/z for $C_{17}H_{19}NNaO_2$ $[M+Na]^+$: 292.1308, found: 292.1306.



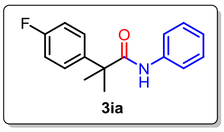
2-(3,4-dimethoxyphenyl)-2-methyl-*N*-phenylpropanamide (3ga)

Yield = 95%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 (d, *J* = 8.0 Hz, 2H), 7.27-7.23 (m, 2H), 7.06-6.99 (m, 2H), 6.90 (d, *J* = 2.4 Hz, 2H), 6.88 (s, 1H), 3.89 (s, 3H), 3.86 (s, 3H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.9, 149.3, 148.4, 138.0, 137.1, 128.9, 124.2, 119.7, 118.5, 111.3, 110.1, 56.0, 55.9, 47.7, 27.2. HRMS calcd. (ESI) m/z for $C_{18}H_{21}NNaO_3$ $[M+Na]^+$: 322.1412, found: 322.1412.



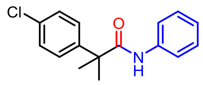
2-(benzo[d][1,3]dioxol-5-yl)-2-methyl-*N*-phenylpropanamide (3ha)

Yield = 83%, b/l > 99:1; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (d, *J* = 8.0 Hz, 2H), 7.26 (t, *J* = 7.6 Hz, 2H), 7.05 (t, *J* = 7.4 Hz, 1H), 6.91-6.89 (m, 3H), 6.83-6.81 (m, 1H), 5.97 (s, 2H), 1.62 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.6, 148.3, 146.9, 138.6, 138.1, 129.0, 124.2, 119.7, 119.6, 108.5, 107.4, 101.4, 47.9, 27.3. HRMS calcd. (ESI) m/z for $C_{17}H_{17}NNaO_3$ $[M+Na]^+$: 306.1100, found: 306.1114.



2-(4-fluorophenyl)-2-methyl-*N*-phenylpropanamide (3ia)

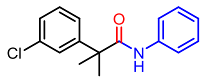
Yield = 70%, b/l = 94:6, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42-7.34 (m, 4H), 7.27-7.23 (m, 2H), 7.09-7.03 (m, 3H), 6.87 (s, 1H), 1.63 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.3, 161.9 (d, *J* = 245.2 Hz), 140.5, 137.9, 129.0, 128.2 (d, *J* = 7.8 Hz), 124.3, 119.8, 115.8 (d, *J* = 21.1 Hz), 47.6, 27.2; ^{19}F NMR (376 MHz, $CDCl_3$) δ -131.8. HRMS calcd. (ESI) m/z for $C_{16}H_{16}FNNaO$ $[M+Na]^+$: 280.1108, found: 280.1109.



3ja

2-(4-chlorophenyl)-2-methyl-*N*-phenylpropanamide (3ja)

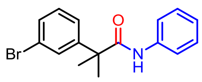
Yield = 73%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.35 (m, 6H), 7.28-7.24 (m, 2H), 7.07 (t, *J* = 7.2 Hz, 1H), 6.81 (s, 1H), 1.64 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.0, 143.3, 137.9, 133.4, 129.2, 129.0, 128.0, 124.4, 119.9, 47.8, 27.1. HRMS calcd. (ESI) m/z for $C_{16}H_{16}ClNNaO$ $[M+Na]^+$: 296.0812, found: 296.0812.



3ka

2-(3-chlorophenyl)-2-methyl-*N*-phenylpropanamide (3ka)

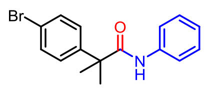
Yield = 86%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (s, 1H), 7.37 (d, *J* = 8.0 Hz, 2H), 7.32-7.24 (m, 5H), 7.06 (t, *J* = 7.2 Hz, 1H), 6.84 (s, 1H), 1.64 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.0, 146.2, 137.9, 135.0, 130.3, 129.0, 127.7, 126.6, 124.9, 124.5, 119.9, 48.1, 27.0. HRMS calcd. (ESI) m/z for $C_{16}H_{16}ClNNaO$ $[M+Na]^+$: 296.0812, found: 296.0824.



3la

2-(4-bromophenyl)-2-methyl-*N*-phenylpropanamide (3la)

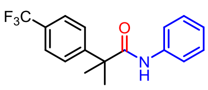
Yield = 92%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (t, *J* = 1.6 Hz 1H), 7.44 (d, *J* = 8.0 Hz, 1H), 7.37 (t, *J* = 8.0 Hz, 3H), 7.29-7.24 (m, 3H), 7.07 (t, *J* = 7.2 Hz, 1H), 6.82 (s, 1H), 1.64 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.7, 147.1, 137.8, 130.6, 129.4, 129.0, 125.4, 124.4, 123.2, 119.9, 48.0, 27.0. HRMS calcd. (ESI) m/z for $C_{16}H_{16}BrNNaO$ $[M+Na]^+$: 340.0307, found: 340.0317.



3ma

2-(3-bromophenyl)-2-methyl-*N*-phenylpropanamide (3ma)

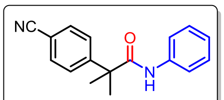
Yield = 72%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) 7.51-7.48 (m, 2H), 7.37-7.34 (m, 2H), 7.30-7.03 (m, 4H), 7.08-7.03 (m, 1H), 6.87 (s, 1H), 1.61 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.9, 143.8, 137.9, 132.2, 129.0, 128.3, 124.4, 121.5, 119.9, 47.9, 27.1. HRMS calcd. (ESI) m/z for $C_{16}H_{16}BrNNaO$ $[M+Na]^+$: 340.0307, found: 340.0319.



3na

2-methyl-*N*-phenyl-2-(4-(trifluoromethyl)phenyl)propanamide (3na)

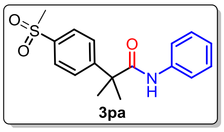
Yield = 73%, b/l = 97:3, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.0 Hz, 2H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.38-7.36 (m, 2H), 7.28-7.24 (m, 2H), 7.10-7.054 (m, 1H), 6.86 (s, 1H), 1.67 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.5, 149.0, 137. 8, 130.2, 129.6 (d, *J* = 32.4 Hz), 129.0, 126.9, 126.0 (d, *J* = 32.4 Hz), 125.5, 124.4 (d, *J* = 170.3 Hz), 120.0, 48.2, 27.0; ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.42. HRMS calcd. (ESI) m/z for $C_{17}H_{16}F_3NNaO$ [M+Na]+: 330.1076, found: 330.1085.



3oa

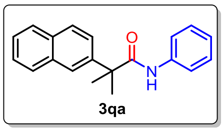
2-(4-cyanophenyl)-2-methyl-*N*-phenylpropanamide (3oa)

Yield = 94%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 8.4 Hz, 2H), 7.55 (d, *J* = 8.4 Hz, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 7.30-7.26 (m, 2H), 7.09 (t, *J* = 7.4 Hz, 1H), 6.86 (s, 1H), 1.67 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 173.9, 150.3, 137.7, 132.8, 129.1, 127.3, 124.7, 120.0, 118.6, 111.3, 48.4, 26.9. HRMS calcd. (ESI) m/z for $C_{17}H_{16}N_2NaO$ $[M+Na]^+$: 287.1154, found: 287.1157.



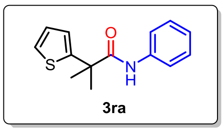
2-methyl-2-(4-(methylsulfonyl)phenyl)-*N*-phenylpropanamide (3pa)

Yield = 93%, b/l > 99:1; ^{1}H NMR (400 MHz, d^{6}-DMSO) δ 9.24 (s, 1H), 7.93 (d, *J* = 8.4 Hz, 2H), 7.65-7.60 (m, 4H), 7.28 (t, *J* = 7.8 Hz, 2H), 7.04 (t, *J* = 7.4 Hz, 1H), 3.21 (s, 3H), 1.61 (s, 6H); ^{13}C NMR (101 MHz, d^{6}-DMSO) δ 173.9, 151.7, 139.1, 138.9, 128.5, 127.1, 127.0, 123.5, 120.4, 47.8, 43.6, 26.6. HRMS calcd. (ESI) m/z for $C_{17}H_{19}N_3NaOS$ [M+Na]$^+$: 340.0977, found: 340.0977.



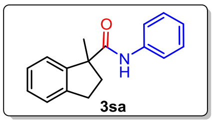
2-methyl-2-(naphthalen-2-yl)-*N*-phenylpropanamide (3qa)

Yield = 95%, b/l > 99:1; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69-7.82 (m, 4H), 7.52-7.45 (m, 3H),7.32 (d, *J* = 8.0 Hz, 2H) 7.20 (t, *J* = 7.2 Hz, 2H), 7.01 (t, *J* = 7.2Hz, 2H), 6.86 (s, 1H), 1.74 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.5, 142.1, 138.0, 133.4, 132.8, 128.9, 128.2, 127.7, 126.7, 126.4, 125.4, 124.6, 124.2, 119.8, 48.4, 27.1. HRMS calcd. (ESI) m/z for $C_{20}H_{19}NNaO$ [M+Na]$^+$: 312.1358, found: 312.1351.



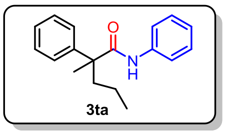
2-methyl-*N*-phenyl-2-(thiophen-2-yl)propanamide (3ra)

Yield = 48%, b/l > 99:1; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 4.8 Hz, 1H), 7.28-7.25 (m, 2H), 7.18 (s, 1H), 7.10 (d, *J* = 2.8 Hz, 1H), 7.08-7.05 (m, 2H), 1.75 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.2, 149.6, 137.9, 129.0, 127.5, 125.5, 125.1, 124.4, 119.8, 46.4, 28.3. HRMS calcd. (ESI) m/z for $C_{14}H_{15}NNaOS$ [M+Na]$^+$: 268.0766, found: 268.0766.



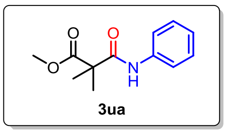
N,1-dimethyl-N-phenyl-2,3-dihydro-1H-indene-1-carboxamide (3sa)

Yield = 75%, b/l > 99:1, ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36-7.31 (m, 6H), 7.26-7.24 (m, 2H), 7.06 (t, J = 6.0 Hz, 2H), 3.03-2.96 (m, 2H), 2.73-2.70 (m, 1H), 2.14-2.09 (m, 1H), 1.65 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 174.9, 145.7, 144.9, 137.8, 129.0, 128.4, 127.5, 125.7, 124.3, 123.7, 119.7, 56.7, 40.2, 30.6, 24.5. HRMS calcd. (ESI) m/z for $C_{17}H_{17}NNaO$ $[M+Na]^+$: 288.1358, found: 288.1358.



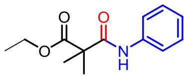
2-methyl-N,2-diphenylpentanamide (3ta)

Yield = 51%, b/l = 88:12, ^{1}H NMR (400 MHz, $CDCl_3$)δ 7.41-7.34 (m, 5H), 7.32-7.29 (m, 1H), 7.28-7.24 (m, 3H), 7.07-7.03 (m, 1H), 6.79 (s, 1H), 2.11-1.98 (m, 2H), 1.62 (s, 3H), 1.32-1.26 (m, 1H), 1.20-1.12 (m, 1H), 0.92 (t, J = 6.8 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.4, 143.9, 138.1, 129.1, 129.0, 127.4, 127.1, 124.2, 119.8, 51.8, 41.3, 24.1, 17.9, 14.8. HRMS calcd. (ESI) m/z for $C_{17}H_{17}NNaO$ $[M+Na]^+$: 290.1515, found: 290.1515.



methyl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (3ua)

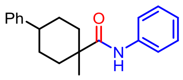
Yield = 86%, b/l > 99:1; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.55 (s, 1H), 7.53 (d, J = 7.6 Hz, 2H), 7.32 (t, J = 7.6 Hz, 2H), 7.11 (t, J = 7.2 Hz, 1H), 3.79 (s, 3H), 1.56 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.1, 169.7, 137.9, 129.1, 124.5, 120.1, 53.1, 50.6, 24.0. HRMS calcd. (ESI) m/z for $C_{12}H_{15}NNaO_3$ $[M+Na]^+$: 244.0944, found: 244.0954.



3va

ethyl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (3va)

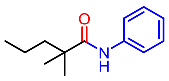
Yield = 85%, b/l > 99:1, ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.63 (s, 1H), 7.53 (d, 4.0Hz, 2H), 7.32 (t, *J* = 8.1 Hz, 2H), 7.10 (t, *J* = 10.5 Hz, 1H), 4.24 (q, *J* = 6.6 Hz, 2H), 1.55 (s, 6H), 1.30 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 175.6, 169.2, 137.9, 129.0, 124.4, 120.0, 62.1, 50.5, 24.0, 14.1. HRMS calcd. (ESI) m/z for $C_{13}H_{17}NNaO_3$ [M+Na]+: 258.1100, found:258.1101.



3wa

methyl-*N*,4-diphenylcyclohexane-1-carboxamide (3wa)

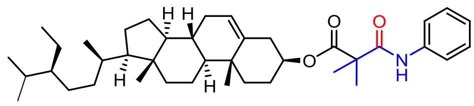
Yield = 52%, b/l = 95:5, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 8.0 Hz, 2H), 7.39 (s, 1H), 7.34-7.30 (m, 4H), 7.25-7.16 (m, 3H), 7.10 (t, *J* = 7.6 Hz, 1H), 2.59-2.48 (m, 1H), 1.95-1.86 (m, 5H), 1.78-1.67 (m, 3H), 1.41 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.1, 146.7, 138.2, 129.1, 128.5, 126.9, 126.3, 124.4, 120.2, 43.8, 42.2, 34.5, 29.3, 20.8. HRMS calcd. (ESI) m/z for $C_{20}H_{23}NNaO$ $[M+Na]^+$: 316.1671, found: 316.1677.



3xa

2,2-dimethyl-*N*-phenylpentanamide (3xa)

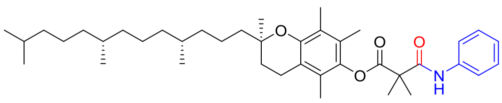
Yield = 60%, b/l = 94:6; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 8.0 Hz, 2H), 7.38 (s, 1H), 7.29 (t, *J* = 7.8 Hz, 2H), 7.08 (t, *J* = 7.2 Hz, 1H), 1.60-1.55 (m, 2H), 1.37-1.29 (m, 2H), 1.27 (s, 6H), 0.91 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.2, 138.1, 129.1, 124.3, 120.1, 44.0, 43.2, 25.7, 18.3, 14.7. HRMS calcd. (ESI) m/z for $C_{13}H_{19}NNaO$ $[M+Na]^+$: 228.1358, found: 228.1358.



4a

(3*S*,8*S*,9*S*,10*R*,13*R*,14*S*,17*R*)-17-((2*R*,5*S*)-5-ethyl-6-methylheptan-2-yl)-10,13-dimethyl-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4a)

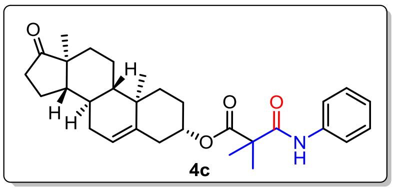
Yield = 65%, b/l > 20:1 (based on ^{1}H NMR), ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.65 (s, 1H), 7.54-7.51 (m, 2H), 7.34-7.29 (m, 2H), 7.12-7.08 (m, 1H), 5.39 (d, *J* = 4.4 Hz, 1H), 4.74-4.66 (m, 1H), 2.35 (d, *J* = 7.2 Hz, 2H), 2.03-1.95 (m, 2H), 1.90-1.82 (m, 3H), 1.69-1.62 (m, 2H), 1.59-1.57 (m, 1H), 1.54 (s, 6H), 1.51-1.43 (m, 4H), 1.37-1.30 (m, 2H), 1.28-1.19 (m, 3H), 1.20-1.10 (m, 6H), 1.02 (s, 3H), 0.96 (d, *J* = 6.0 Hz, 1H), 0.92 (d, *J* = 6.4 Hz, 3H), 0.86-0.81 (m, 10H), 0.68 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.0, 170.0, 139.3, 138.0, 129.1, 124.4, 123.2, 120.0, 75.8, 56.8, 56.2, 50.6, 50.1, 45.9, 42.4, 39.8, 37.9, 37.0, 36.7, 36.3, 34.0, 32.0, 31.9, 29.3, 28.4, 27.7, 26.2, 24.4, 24.1, 24.0, 23.2, 21.2, 20.0, 19.4, 19.2, 18.9, 12.1, 12.0. $C_{39}H_{59}NNaO_3$ $[M+Na]^+$: 626.4543, found: 626.4513.



4b

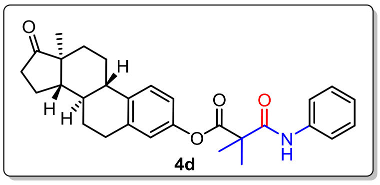
(*R*)-2,5,7,8-tetramethyl-2-((4*R*,8*R*)-4,8,12-trimethyltridecyl)chroman-6-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4b)

Yield = 89%, b/l > 20:1 (based on ^{1}H NMR), ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.80 (s, 1H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.32 (t, *J* = 7.5 Hz, 2H), 7.11 (t, *J* = 7.2 Hz, 1H), 2.59 (t, *J* = 6.6 Hz, 2H), 2.09 (s, 3H), 2.00 (s, 3H), 1.95 (s, 3H), 1.78 (s, 6H), 1.58-1.50 (m, 3H), 1.37 (s, 3H), 1.26-1.22 (m, 11H), 1.14-1.06 (m, 7H), 0.87-0.84 (m, 14H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 174.8, 169.4, 149.8 140.2, 137.8, 129.1, 126.5, 124.8, 124.6, 123.5, 120.1, 117.7, 75.3, 50.7, 40.6, 39.5, 37.5, 37.4, 32.9, 32.9, 32.8, 31.3, 31.0, 28.0, 24.9, 24.6, 24.4, 23.7, 22.9, 22.8, 21.1, 20.7, 19.9, 19.8, 13.0, 12.1, 12.0. HRMS calcd. (ESI) m/z for $C_{40}H_{61}NNaO_4$ $[M+Na]^+$: 642.4492, found: 642.4463.



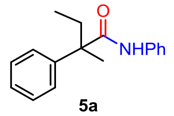
(3*S*,8*R*,9*S*,10*R*,13*S*,14*S*)-10,13-dimethyl-17-oxo-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4c)

Yield = 86%, b/l > 20:1 (based on ^{1}H NMR), ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.60 (s, 1H), 7.53 (d, *J* = 8.0 Hz, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.11 (t, *J* = 7.6 Hz, 1H), 5.43 (d, *J* = 4.4 Hz, 1H), 4.71-7.66 (m, 1H), 2.46 (dd, *J* = 19.2, 8.8 Hz, 1H), 2.37 (d, *J* = 7.6 Hz, 2H), 2.14-2.05 (m, 2H), 1.99-1.84 (m, 4H), 1.69-1.65 (m, 4H), 1.55 (s, 4H), 1.33-1.26 (m, 4H), 1.20-1.14 (m, 2H), 1.06 (s, 3H), 0.89 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.0, 169.9, 139.6, 137.9, 129.1, 124.4, 122.4, 120.0, 75.5, 51.8, 50.6, 50.2, 47.6, 37.9, 36.9, 36.8, 35.9, 31.5, 31.5, 30.9, 29.8, 27.6, 24.0, 24.0, 22.0, 20.4, 19.5, 13.6. $C_{29}H_{37}NNaO_4$ $[M+Na]^+$: 500.2771, found: 500.2762.



(8*R*,9*S*,13*S*,14*S*)-13-methyl-17-oxo-7,8,9,11,12,13,14,15,16,17-decahydro-6H-cyclopenta[a]phenanthren-3-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4d)

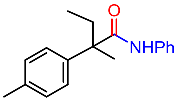
Yield = 61%, b/l > 20:1 (based on ^{1}H NMR), ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.52 (s, 1H), 7.54 (d, *J* = 8.0 Hz, 2H), 7.35-7.30 (m, 3H), 7.12 (t, *J* = 7.2 Hz 1H), 6.86 (d, *J* = 8.4 Hz, 1H), 6.82 (s, 1H), 3.48 (d, *J* =0.4 Hz, 1H) 2.92-2.90 (m, 2H), 2.51 (dd, *J* = 18.8, 8.8Hz, 1H), 2.42-2.38 (m, 1H), 2.30-2.26 (m, 1H), 2.19-2.12 (m, 1H), 2.10-1.95 (m, 3H), 1.71 (s, 6H), 1.66-1.60 (m, 2H), 1.57-1.42 (m, 4H), 0.91 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 221.0, 174.7, 169.4, 148.4, 138.4, 138.1, 137.8, 129.1, 126.7, 124.6, 121.3, 120.1, 118.4, 50.8, 50.4, 48.0, 44.2, 38.0, 35.9, 31.6, 29.5, 26.4, 25.8, 24.0, 21.7, 13.9. HRMS calcd. (ESI) m/z for $C_{29}H_{33}NNaO_4$ $[M+Na]^+$: 482.2301, found: 482.2295.



5a

2-methyl-*N*,2-diphenylbutanamide (5a)

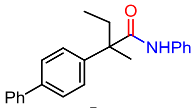
Yield = 56%, b/l = 98:2, ^{1}H NMR (600 MHz, d^{6}-DMSO) δ 9.06 (s, 1H), 7.58 (d, *J* = 8.4 Hz, 2H), 7.34-7.33 (m, 4H), 7.27-7.24 (m, 3H), 7.01 (t, *J* = 6.6 Hz, 1H), 2.17-2.14 (m, 1H), 1.94-1.90 (m, 1H), 1.50 (s, 3H), 0.78 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.3, 143.5, 138.1, 129.0, 129.0, 127.4, 127.1, 124.2, 119.8, 52.0, 31.6, 23.4, 9.0. HRMS calcd. (ESI) m/z for $C_{17}H_{19}NNaO$ $[M+H]^{+}$: 254.1539, found: 254.1539



5b

2-methyl-*N*-phenyl-2-(*p*-tolyl)butanamide (5b)

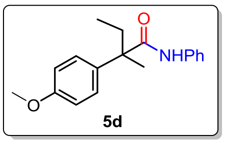
Yield = 66%, b/l = 85:15, ^{1}H NMR (600 MHz, d^{6}-DMSO) δ 8.99 (s, 1H), 7.57 (d, *J* = 7.8 Hz, 2H), 7.26-7.23 (m, 2H), 7.20 (d, *J* = 8.4 Hz, 2H), 7.14 (d, *J* = 7.8 Hz, 2H), 7.01 (t, *J* = 7.2 Hz, 1H), 2.27 (s, 3H), 2.15-2.10 (m, 1H), 1.96-1.87 (m, 1H), 1.48 (s, 3H), 0.77 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, d^{6}-DMSO) δ 174.3, 142.1, 139.3, 135.4, 128.9, 128.4, 126.1, 123.2, 120.3, 50.7, 31.01, 22.7, 20.6 9.1. HRMS calcd. (ESI) m/z for $C_{18}H_{21}NNaO$ $[M+Na]^{+}$: 290.1515, found: 250.1513.



5c

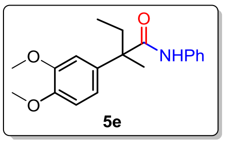
2-([1,1'-biphenyl]-4-yl)-2-methyl-*N*-phenylbutanamide (5c)

Yield = 60%, b/l >99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63-7.60 (m, 4H), 7.48-7.43 (m, 4H), 7.40-7.34 (m, 3H), 7.28-7.24 (m, 2H), 7.05 (t, *J* = 7.6 Hz, 1H), 6.89 (s, 1H), 2.24-2.09 (m, 2H), 1.64 (s, 3H), 0.88 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.2, 142.6, 140.4, 140.1, 138.0, 129.0, 129.0, 127.6, 127.6, 127.1, 124.3, 119.8, 51.8, 31.7, 23.5, 8.9. HRMS calcd. (ESI) m/z for $C_{23}H_{23}NNaO$ $[M+Na]^{+}$: 352.1671, found: 352.1659.



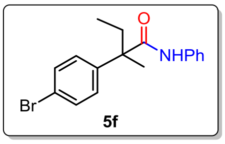
2-(4-methoxyphenyl)-2-methyl-*N*-phenylbutanamide (5d)

Yield = 74%, b/l = 87:13, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.35 (m, 2H), 7.33-7.30 (m, 2H), 7.27-7.23 (m, 2H), 7.06-7.02 (m, 1H), 6.94-6.91 (m, 2H), 6.86 (s, 1H), 3.278 (s, 3H), 1.92-1.86 (m, 1H), 2.18-2.04 (m, 2H), 1.58 (s, 3H), 0.83 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.7, 158.7, 138.1, 135.3, 128.9, 128.3, 124.1, 119.7, 114.3, 55.4, 51.3, 31.6, 23.5, 8.9. HRMS calcd. (ESI) m/z for $C_{18}H_{21}NNaO_2$ $[M+Na]^+$: 306.1464, found: 306.1464.



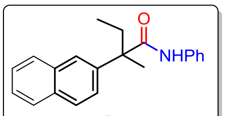
2-(3,4-dimethoxyphenyl)-2-methyl-*N*-phenylbutanamide (5e)

Yield = 76%, b/l = 88:12, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 (d, *J* = 7.6 Hz, 2H), 7.25 (t, *J* = 7.2 Hz, 2H), 7.04 (t, *J* = 7.2 Hz, 1H), 6.97 (dd, *J* = 7.4, 2.0 Hz, 1H), 6.92 (s, 1H), 6.89-6.86 (m, 2H), 3.90 (s, 3H), 3.85 (s, 3H), 2.20-2.04 (m, 2H), 1.59 (s, 3H), 0.83 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.6, 149.2, 148.2, 138.0, 135.8, 128.9, 124.1, 119.6, 119.0, 111.0, 110.3, 56.0, 55.9, 51.5, 31.5, 23.3, 8.9. HRMS calcd. (ESI) m/z for $C_{19}H_{23}NNaO_3$ $[M+Na]^+$: 336.1570, found: 336.1570.



2-(4-bromophenyl)-2-methyl-*N*-phenylbutanamide (5f)

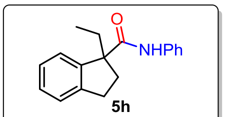
Yield = 51%, b/l = 96:4, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.8 Hz, 2H), 7.37 (d, *J* = 8.0 Hz, 2H), 7.29-7.25 (m, 4H), 7.07 (t, *J* = 7.2 Hz, 1H), 6.78 (s, 1H), 2.17-2.00 (m, 2H), 1.58 (s, 3H), 0.84 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.5, 142.8, 137.9, 132.1, 129.1, 128.9, 124.4, 121.4, 119.9, 51.7, 31.7, 23.3, 8.9. HRMS calcd. (ESI) m/z for $C_{17}H_{18}BrNNaO3$ $[M+Na]^+$: 354.0463, found: 354.0462.



5g

2-methyl-2-(naphthalen-2-yl)-*N*-phenylbutanamide (5g)

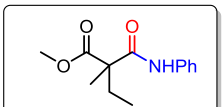
Yield = 57%, b/l > 99:1, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88-7.83 (m, 4H), 7.54-7.44 (m, 3H), 7.34-7.32 (m, 2H), 7.24-7.20 (m, 2H), 7.05-7.01 (m, 1H), 6.83 (s, 1H), 2.30-2.20 (m, 2H), 1.70 (s, 3H), 0.85 (t, *J* = 7.6Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.2, 141.0, 138.0, 133.4, 132.5, 129.0, 128.9, 128.2, 127.7, 126.6, 126.4, 125.7, 125.5, 124.2, 119.8, 52.1, 31.4, 23.3, 8.9. HRMS calcd. (ESI) m/z for $C_{21}H_{21}NNaO$ $[M+Na]^+$: 326.1515, found: 326.1515.



5h

1-ethyl-*N*-phenyl-2,3-dihydro-1H-indene-1-carboxamide (5h)

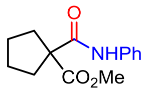
Yield = 61%, b/l = 87:13, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39-7.36 (m, 2H), 7.31-7.30 (m, 3H), 7.29-7.24 (m, 3H), 7.19 (s, 1H), 7.06 (t, *J* = 7.2 Hz, 1H), 3.04-2.91 (m, 2H), 2.65-2.58 (m, 1H), 2.24-2.17 (m, 1H), 2.12-2.06 (m, 2H), 0.91 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.3, 145.6, 144.1, 139.0, 129.0, 128.3, 127.2, 125.7, 124.4, 124.3, 119.8, 61.4, 36.7, 30.5, 30.0, 9.6. HRMS calcd. (ESI) m/z for $C_{18}H_{19}NNaO$ $[M+Na]^+$: 288.1358, found: 288.1358.



5i

methyl 2-methyl-2-(phenylcarbamoyl)butanoate (5i)

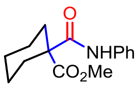
Yield = 63%, b/l = 97:3,^{1}H NMR (400 MHz, $CDCl_3$) δ 9.18 (s, 1H), 7.57-7.55 (m, 2H), 7.33 (t, *J* = 7.6 Hz, 2H), 7.11 (t *J* = 7.6 Hz, 1H), 3.80 (s, 3H), 2.15-2.60 (m, 1H), 1.98-1.89 (m, 1H), 1.52 (s, 3H), 0.91 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.4, 169.3, 137.9, 129.1, 124.4, 120.1, 54.9, 53.0, 32.2, 20.6, 9.7. HRMS calcd. (ESI) m/z for $C_{13}H_{17}NNaO_3$ $[M+Na]^+$: 258.1100, found:258.1100.



5j

methyl 1-(phenylcarbamoyl)cyclopentane-1-carboxylate (5j)

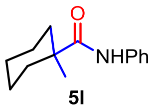
Yield = 65%, b/l = 86:14,[1]H NMR (400 MHz, $CDCl_3$) δ 8.23 (s, 1H), 7.53-7.51 (m, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.10 (t, *J* = 7.2 Hz, 1H), 3.78 (s, 3H), 2.33-2.27 (m, 4H), 1.81-1.67 (m, 4H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.7, 169.0, 138.0, 129.1, 124.4, 119.9, 61.8, 53.2, 35.1, 25.5, 19.3. HRMS calcd. (ESI) m/z for $C_{14}H_{17}NNaO_3$ $[M+Na]^+$: 270.1100, found: 270.1100.



5k

methyl 1-(phenylcarbamoyl)cyclohexane-1-carboxylate (5k)

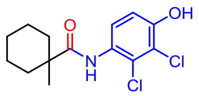
Yield = 61%, b/l = 89:11,[1]H NMR (400 MHz, $CDCl_3$) δ 7.79 (s, 1H), 7.52-7.49 (m, 2H), 7.31 (t, *J* = 7.6 Hz, 2H), 7.10 (t, *J* = 7.2 Hz, 1H), 3.79 (s, 3H), 2.28-2.24 (m, 2H) 1.96-1.89 (m, 2H), 1.76-1.60 (m, 2H), 1.54-1.45 (m, 2H), 1.38-1.32 (m, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.4, 168.6, 137.8, 129.1, 124.6, 119.9, 56.2, 53.0, 32.1, 25.3, 23.4. HRMS calcd. (ESI) m/z for $C_{15}H_{19}NNaO$ $[M+Na]^+$: 284.1257, found: 284.1257.



5l

1-methyl-*N*-phenylcyclohexane-1-carboxamide (5l)

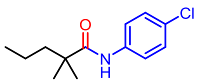
Yield = 55%, b/l = 80:20, [1]H NMR (600 MHz, $CDCl_3$) δ 7.54 (d, *J* = 7.2 Hz, 2H), 7.37 (s, 1H), 7.33-7.30 (m, 2H), 7.10 (t, *J* = 7.2 Hz, 1H), 2.03-2.01 (m, 2H), 1.62-1.58 (m, 2H), 1.54-1.47 (m, 3H), 1.45-1.41 (m, 2H), 1.39-1.36 (m, 1H), 1.26 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 174.0, 138.2, 129.1, 124.2, 120.1, 43.7, 35.8, 26.6, 25.9, 23.0. HRMS calcd. (ESI) m/z for $C_{14}H_{19}NNaO$ $[M+Na]^+$: 240.1358, found: 240.1357.



6a

***N*-(2,3-dichloro-4-hydroxyphenyl)-1-methylcyclohexane-1-carboxamide (6a)**

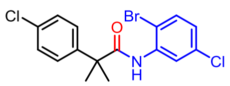
Yield = 62%, b/l = 95:5,^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 9.2 Hz, 1H), 7.75 (s, 1H), 6.94 (d, *J* = 9.2 Hz, 1H), 5.93 (s, 1H), 2.06-2.02 (m, 2H), 1.65-1.60 (m, 2H), 1.57-1.52 (m, 4H), 1.46-1.37 (m, 2H), 1.29 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 176.5, 149.4, 128.9, 123.3, 122.1, 119.1, 114.8, 44.2, 35.8,26.7, 25.8, 23.0. HRMS calcd. (ESI) m/z for $C_{14}H_{17}Cl_2NNaO_2$ $[M+Na]^+$: 324.0528, found: 324.0529.



6b

***N*-(4-chlorophenyl)-2,2-dimethylpentanamide (6b)**

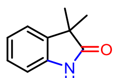
Yield = 71%, b/l = 95:5, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47-7.43 (m, 3H), 7.27-7.23 (m, 2H), 1.58-1.54 (m, 2H), 1.35-1.26 (m, 8H), 0.90 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.3, 136.7, 129.2, 128.9, 121.6, 43.9, 43.2, 25.5, 18.2, 14.7. HRMS calcd. (ESI) m/z for $C_{13}H_{18}ClNNaO$ $[M+Na]^+$: 262.0969, found: 262.0969.



6c

***N*-(2-bromo-5-chlorophenyl)-2-(4-chlorophenyl)-2-methylpropanamide (6c)**

Yield = 62%, b/l = 97:3, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 2.4 Hz, 1H), 7.47 (s, 1H), 7.42-7.37 (m, 4H), 7.33 (d, *J* = 8.4 Hz, 1H), 6.90 (dd, *J* = 8.6, 2.4 Hz, 1H), 1.68 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.2, 142.4, 136.5, 134.3, 133.7, 132.7, 129.3, 128.1, 125.0, 121.2, 111.0, 48.2, 26.8. HRMS calcd. (ESI) m/z for $C_{16}H_{15}BrClNNaO$ $[M+Na]^+$: 409.9504, found: 409.9514.

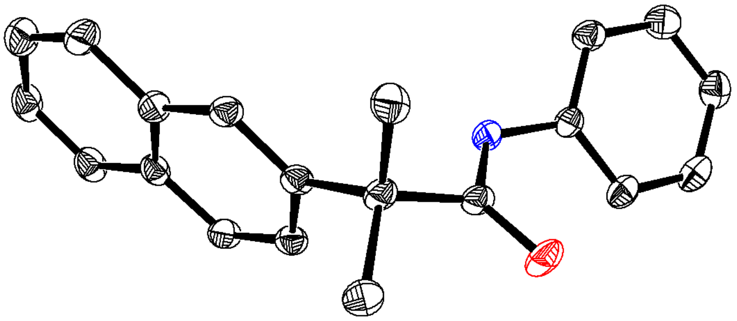


6d

3,3-dimethylindolin-2-one (6d)

Yield = 95%, b/l > 99:1; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.81 (s, 1H), 7.22-7.21 (m, 2H), 7.06-7.02 (m, 1H), 6.96-6.93 (m,1H), 1.41 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 184.3, 140.0, 136.1, 127.8, 122.7, 122.6, 110.0, 44.8, 24.5. HRMS calcd. (ESI) m/z for $C_{10}H_{11}NNaO$ $[M+Na]^+$: 184.0732, found: 184.0728.

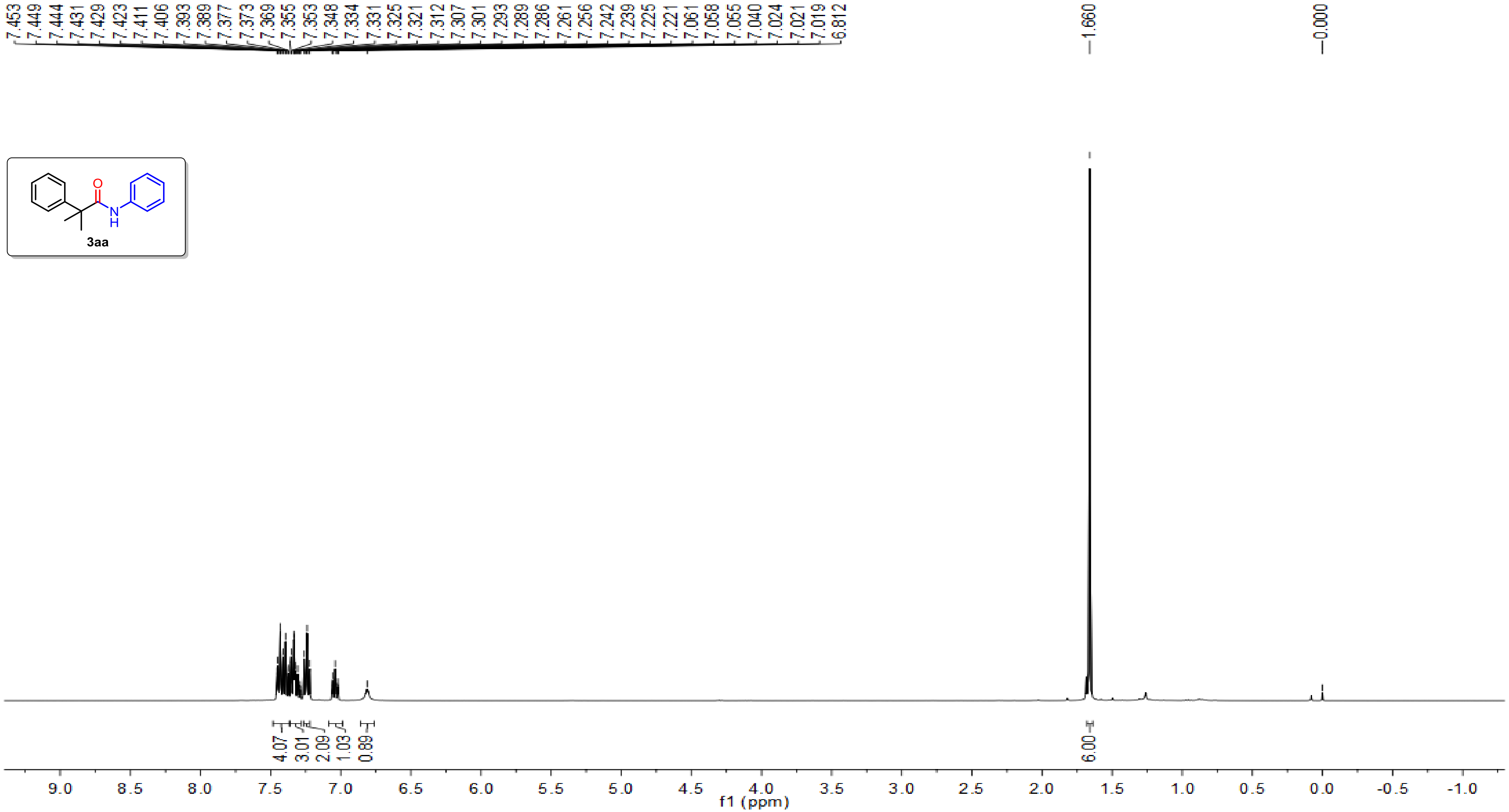
7. X-Ray Structure of 3qa.



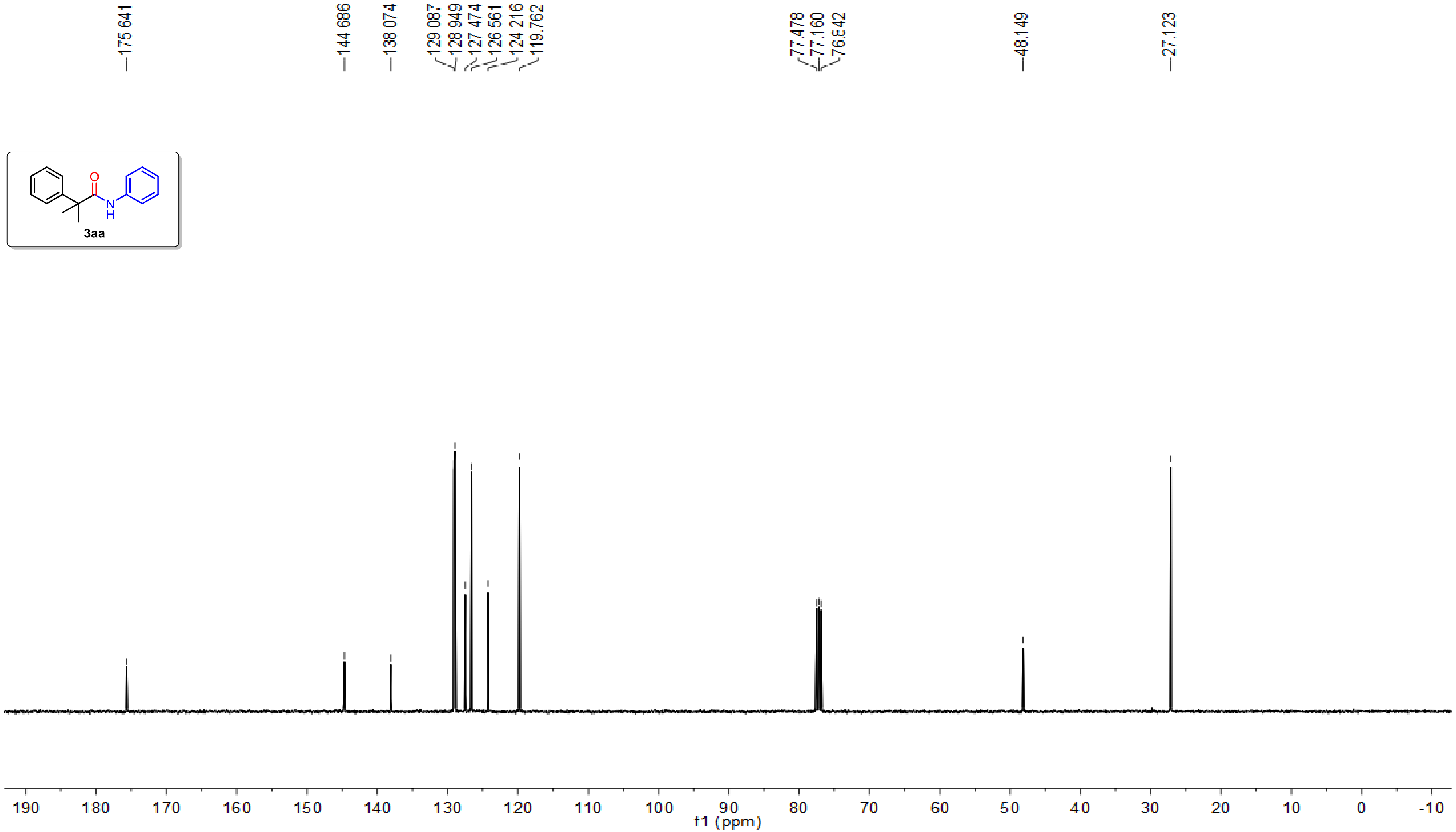
Bond precision	C-C = 0.0021 A	
	Wavelength = 1.34139	
Cell	a = 9.145 (3)	α = 90
	b = 18.331 (6)	β = 110.206 (12)
	c = 10.162 (3)	γ = 90
Temperature	150 K	
Volume	1598.7 (9)	
Space group	P 21/c	
Sum formula	C20 H19 N O	
Mr	289.36	
Dx, g cm^{-3}	1.202	
Z	4	
Mu (mm-1)	0.364	
F000	616.0	
h,k,lmax	11,22,12	
Nref	3032	
Tmin,Tmax	0.950,0.957	
Correction method= # Reported T Limits	Not given	
AbsCorr = MULTT-SCAN		
Data completeness	0.985	
Theta(max)	54.802	
R(reflections)	0.0539 (2495)	
wR2(reflections)	0.1982 (2988)	
S	0.864	
Npar	201	

8. Copies of ^{1}H , ^{13}C, and ^{19}F NMR Spectra

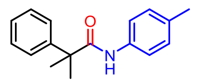
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3aa**



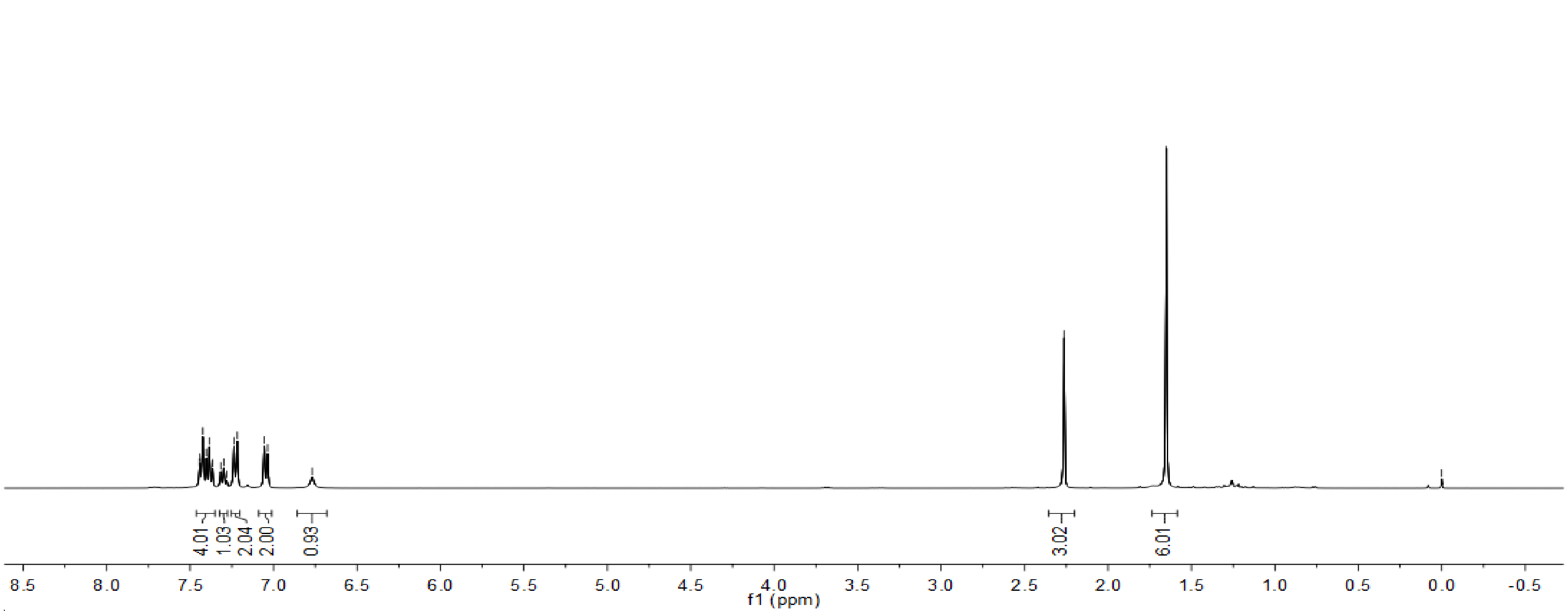
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3aa**



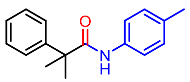
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ab**



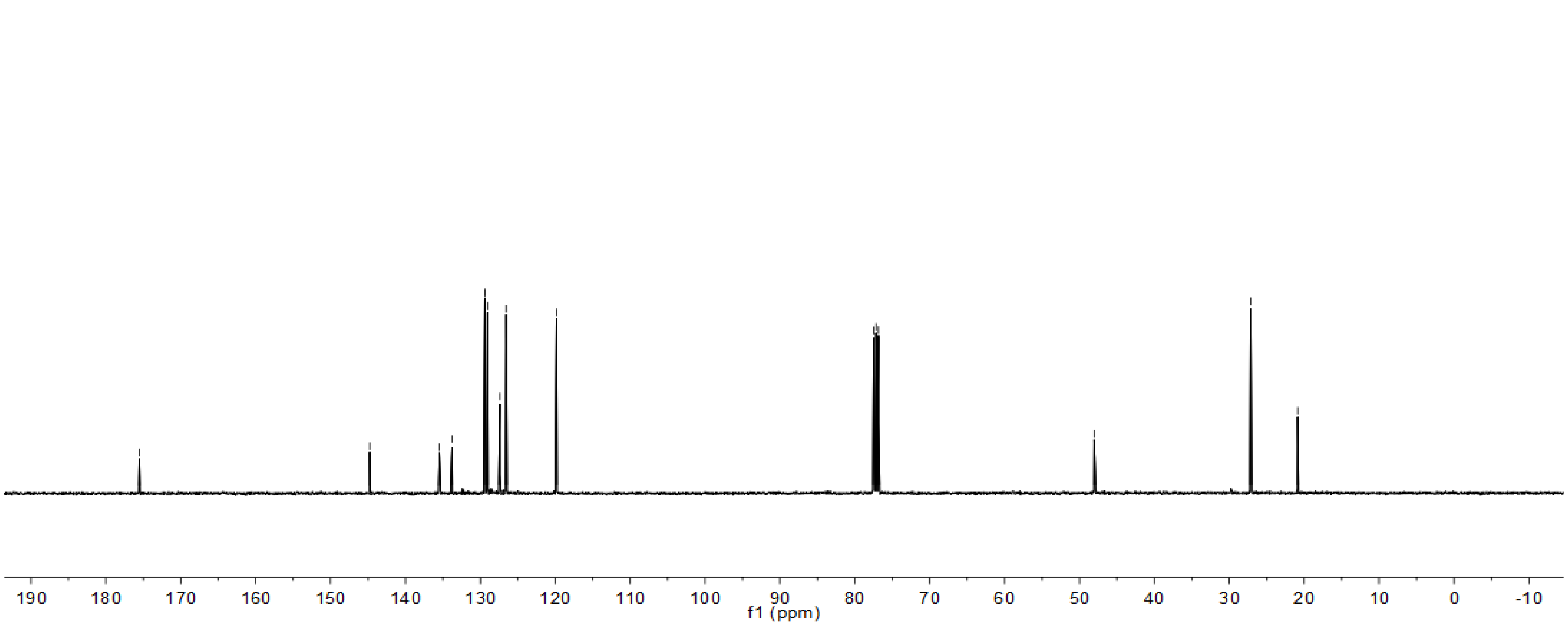
3ab



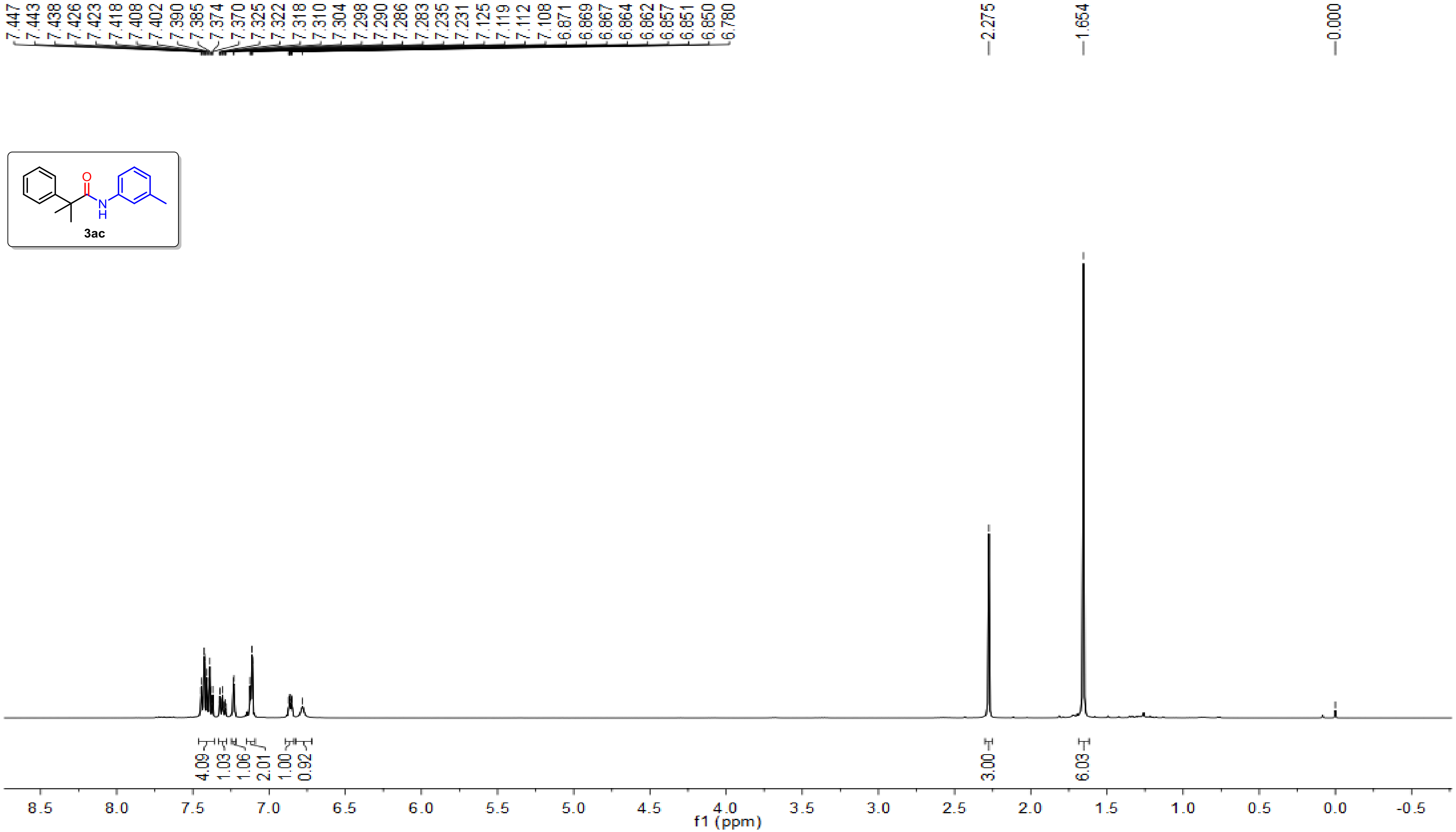
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ab**



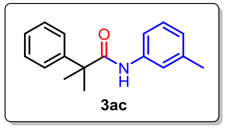
3ab

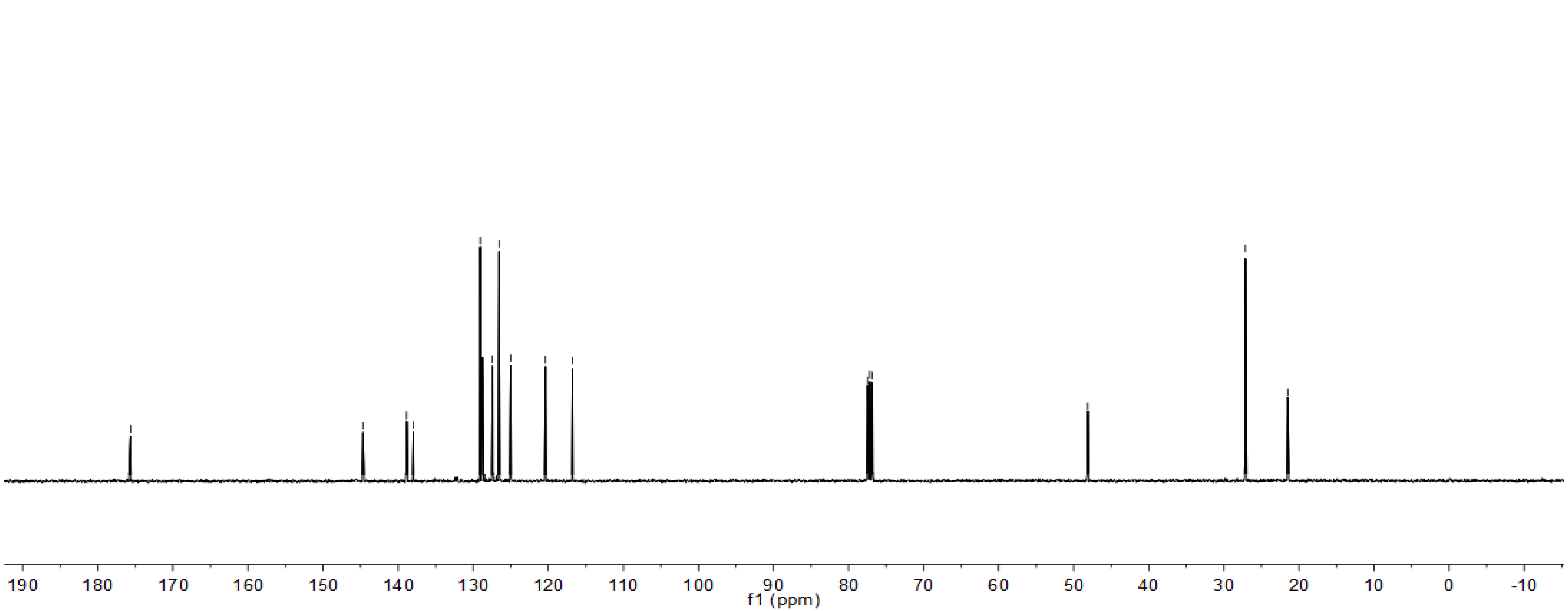


^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ac**

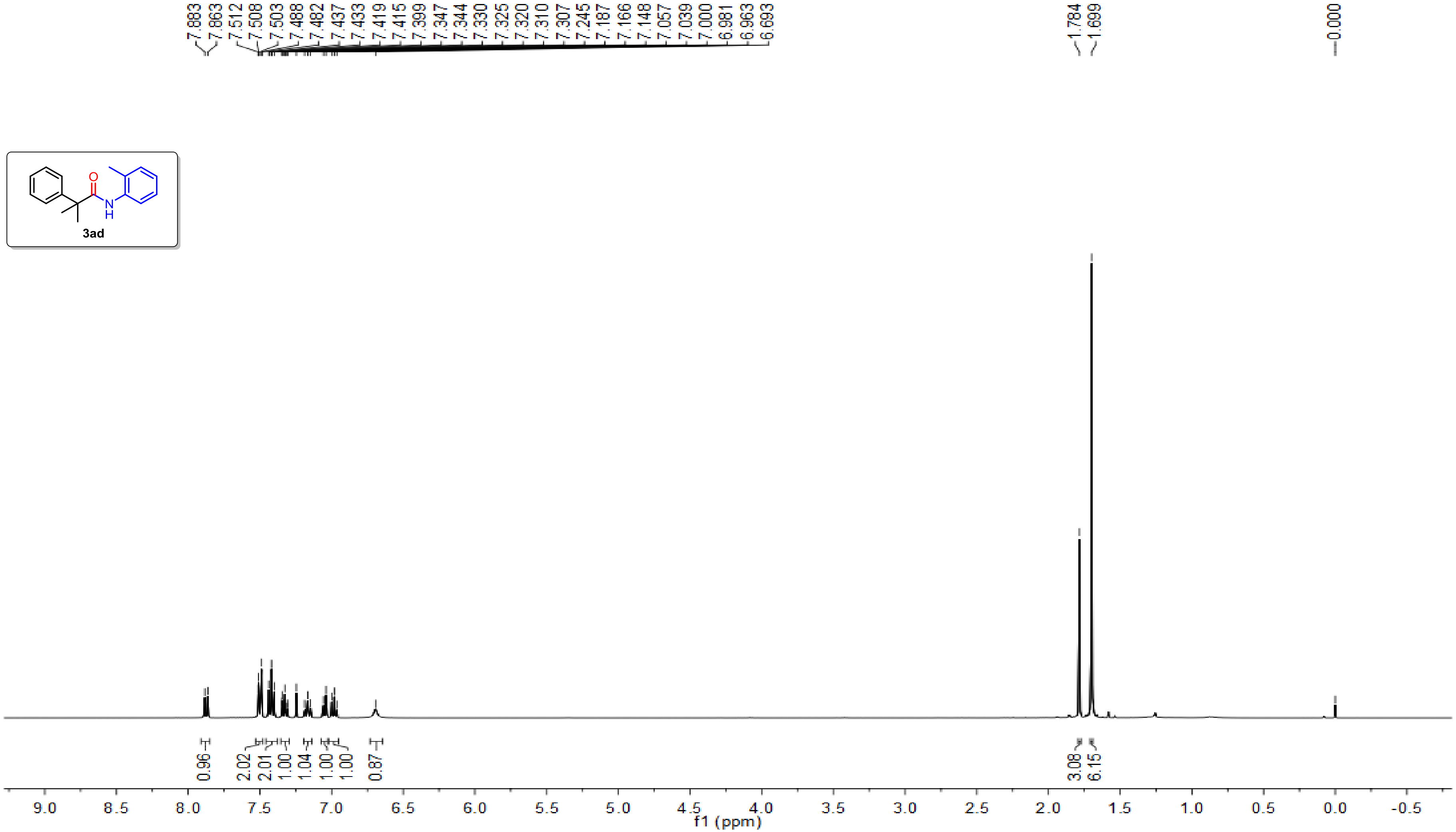


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3a**

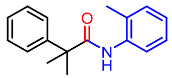




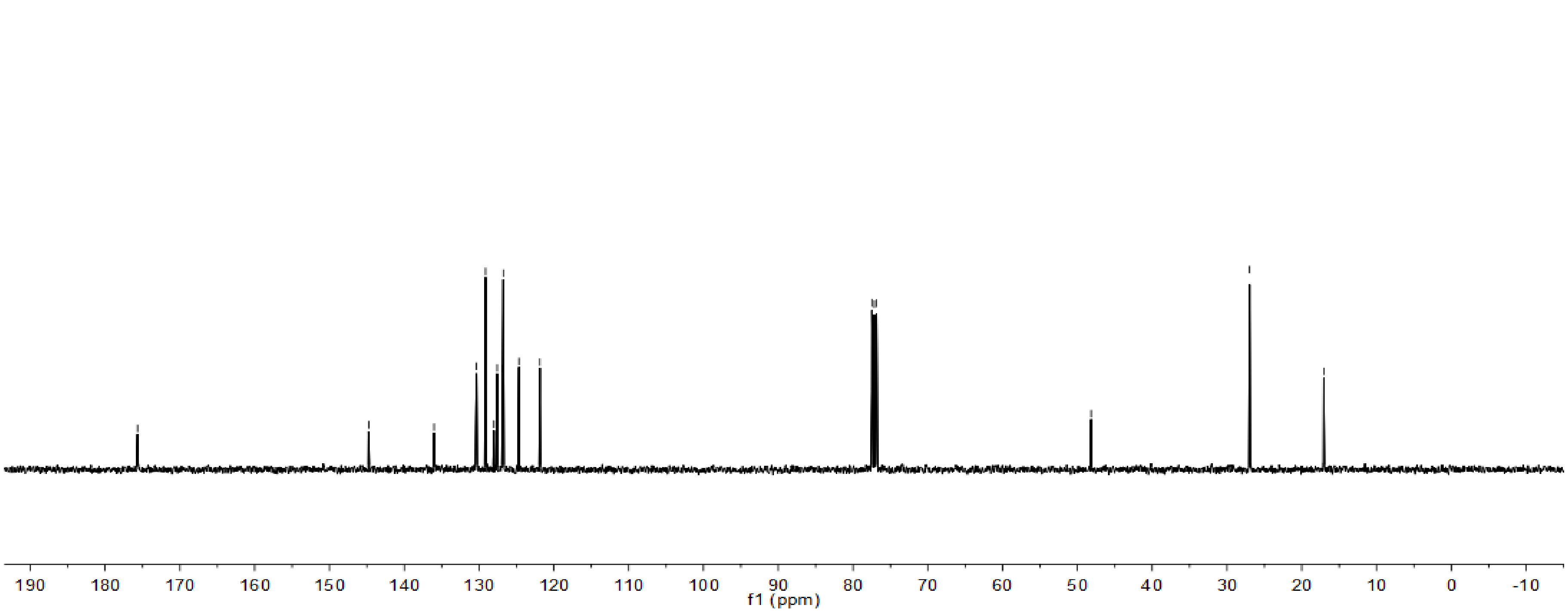
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ad**



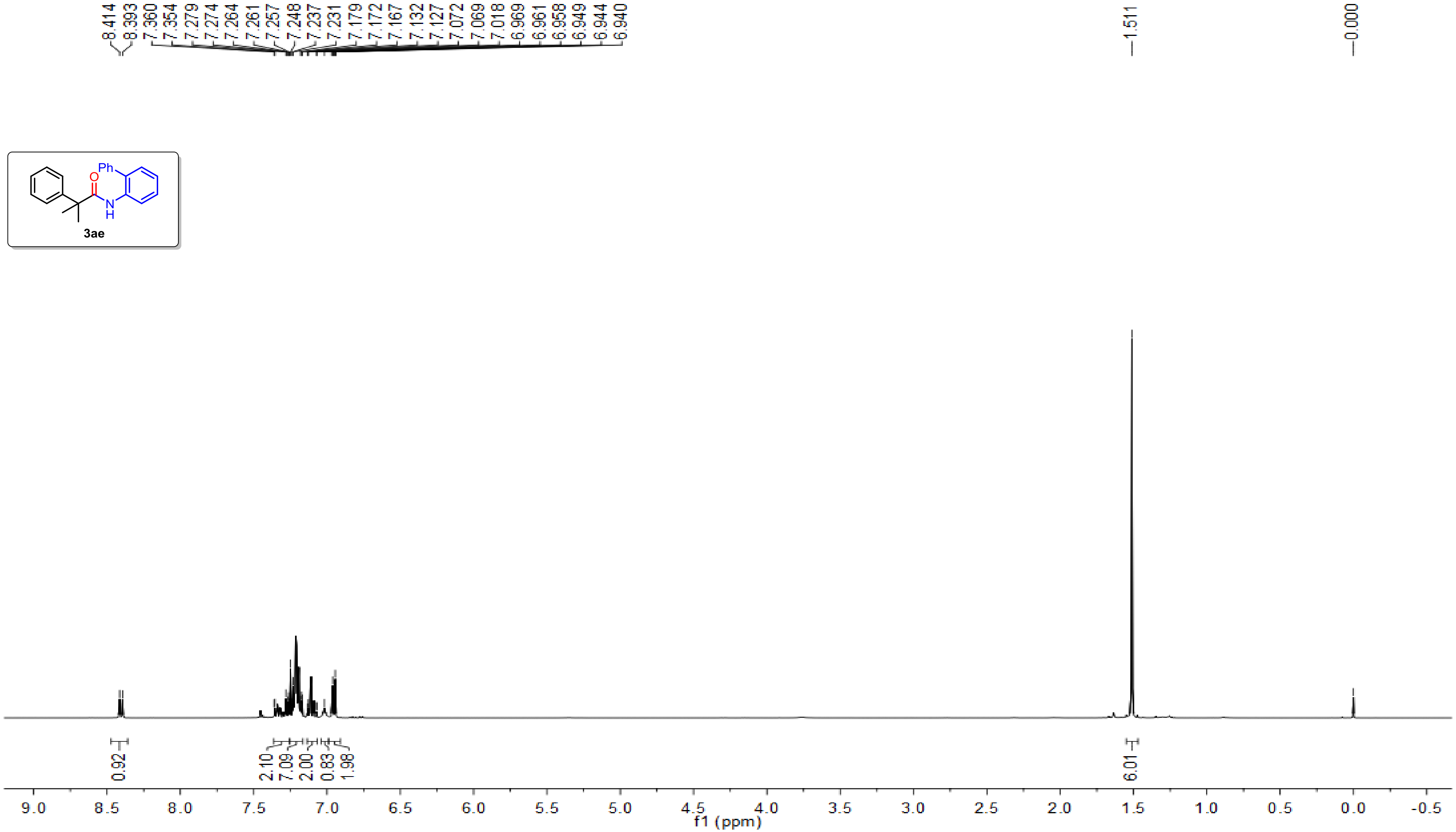
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ad**



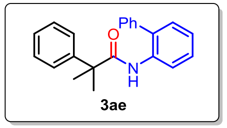
3ad

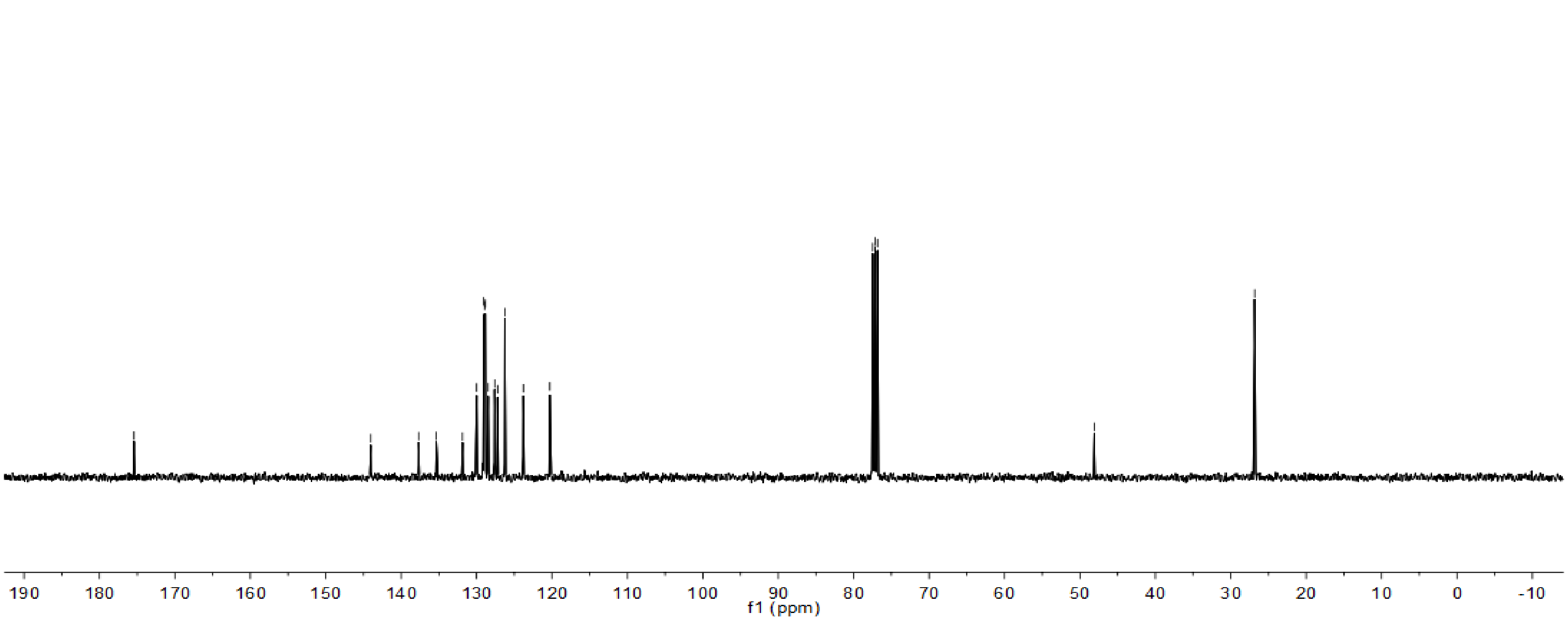


^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ae**

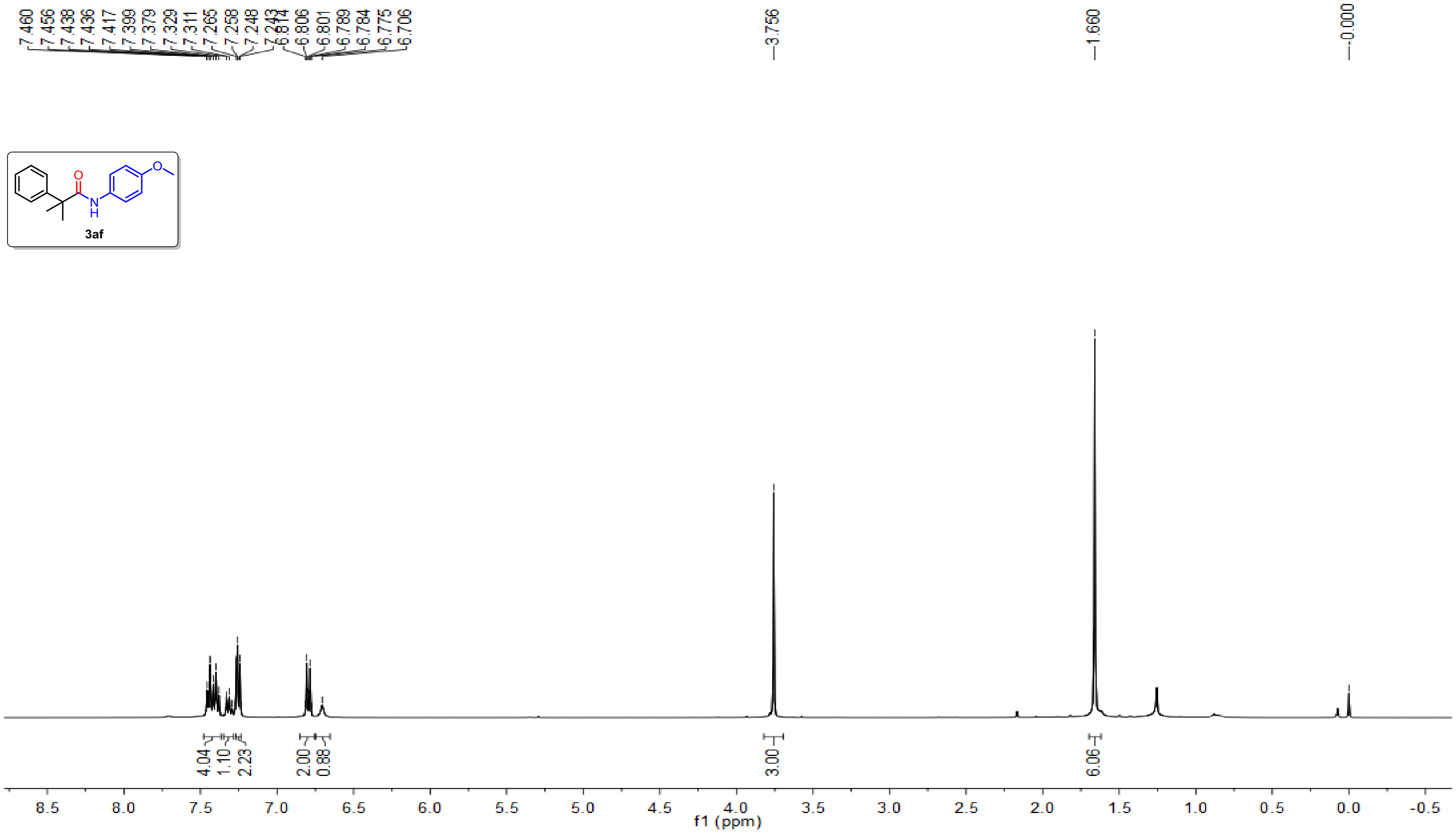


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ae**

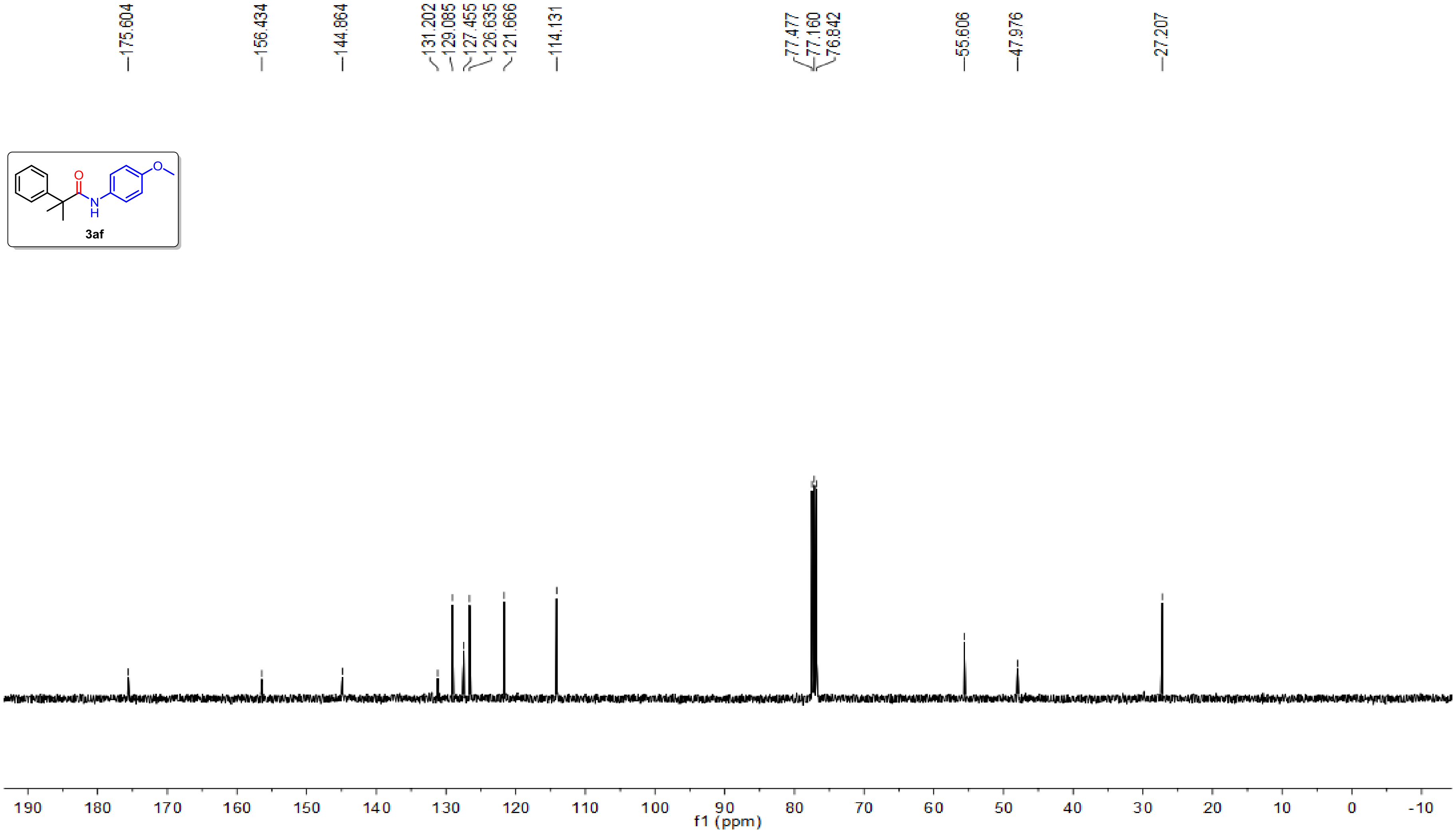




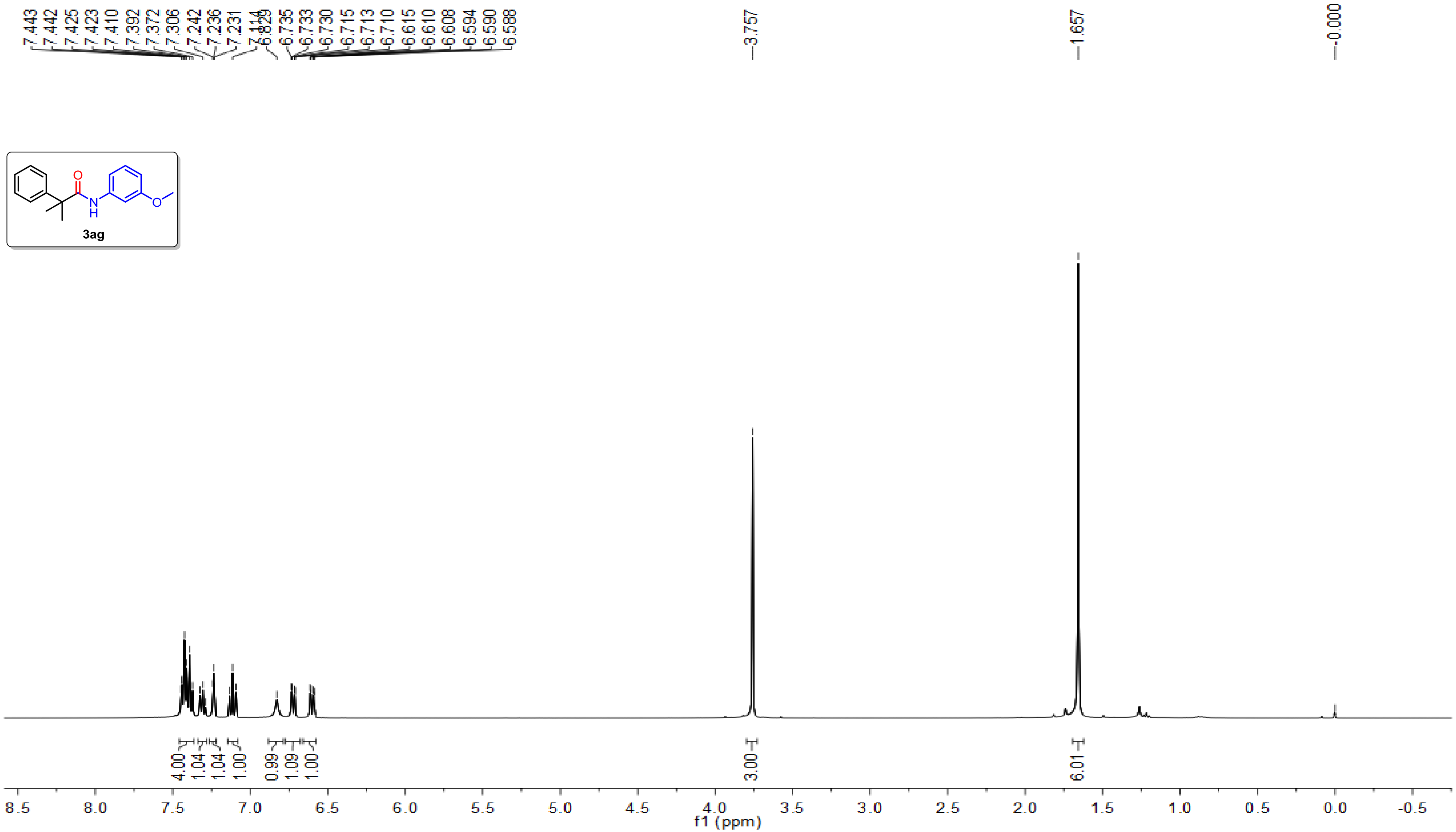
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3af**



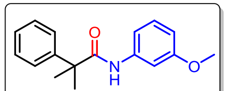
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3af**



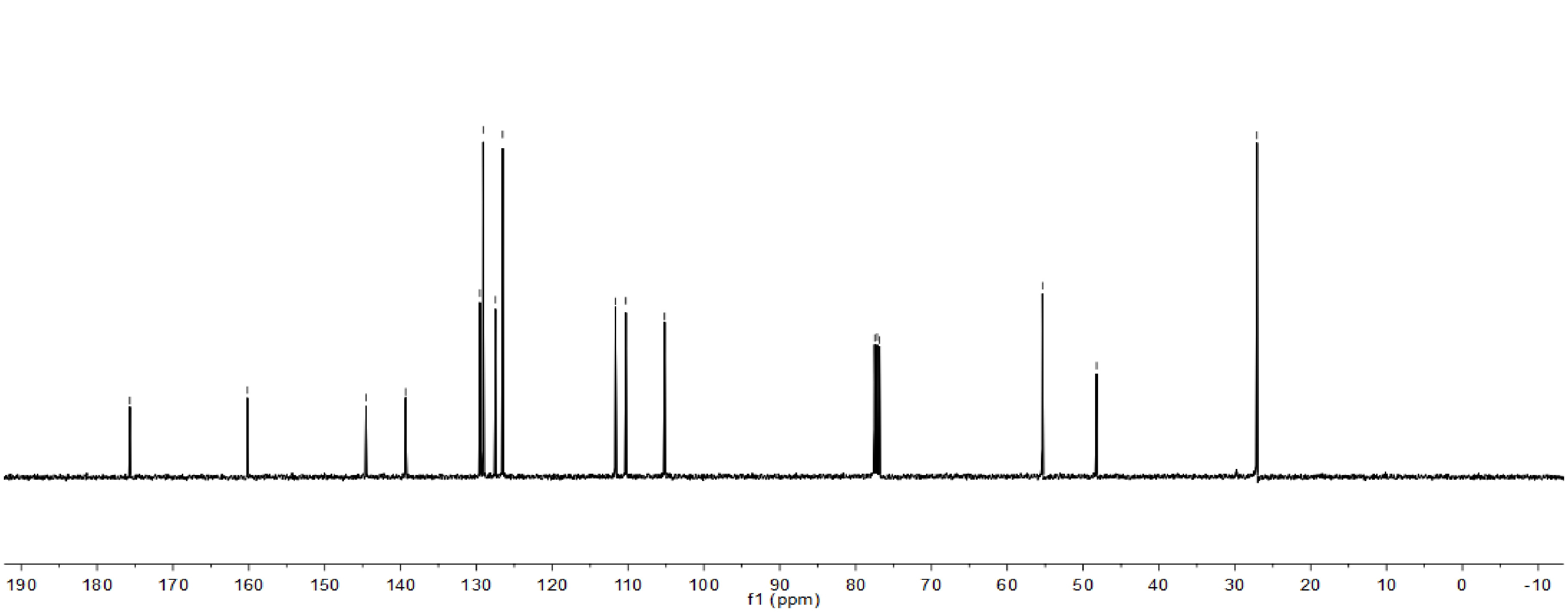
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ag**



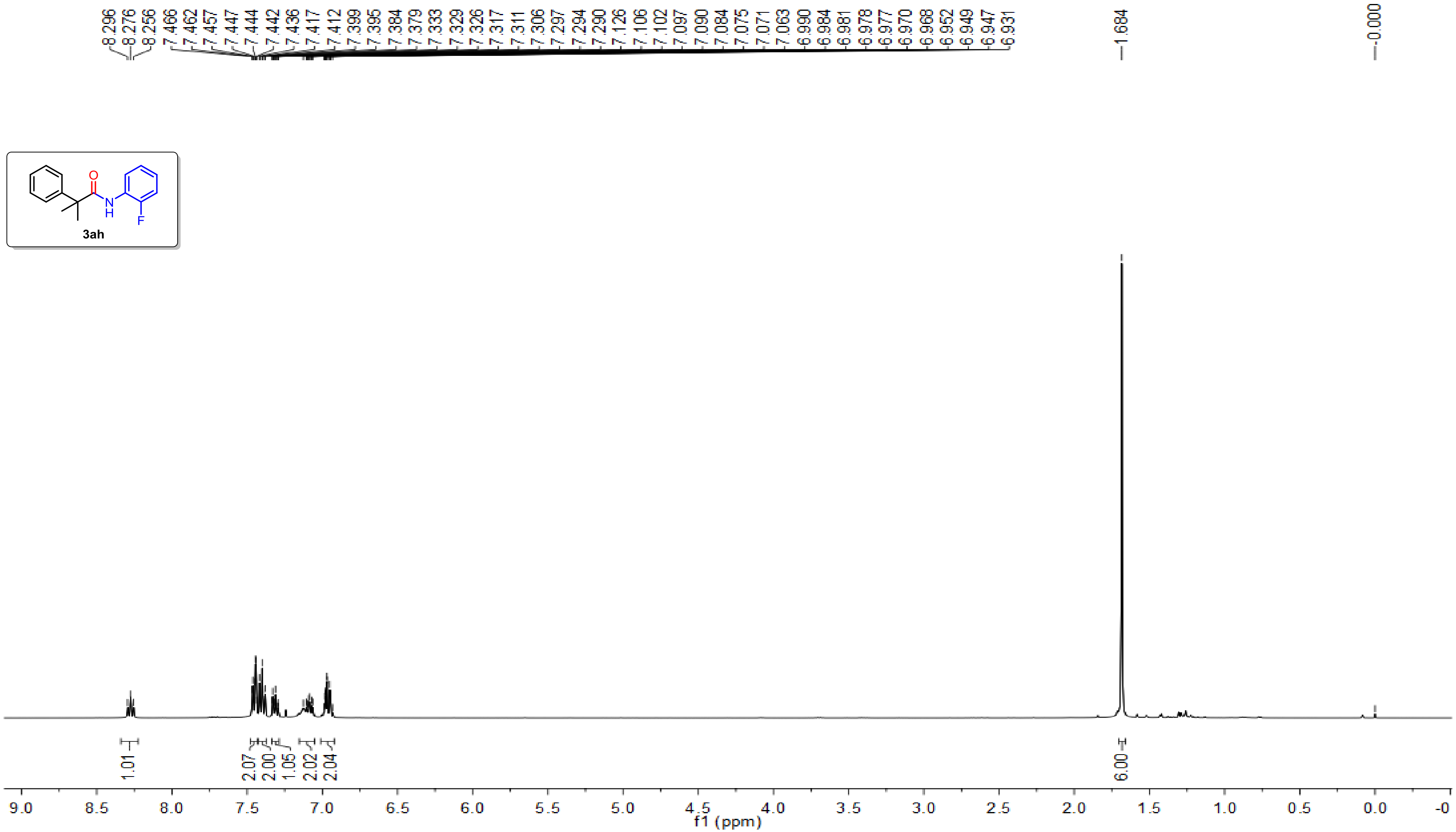
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ag**



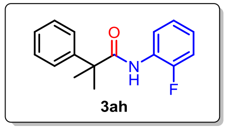
3ag

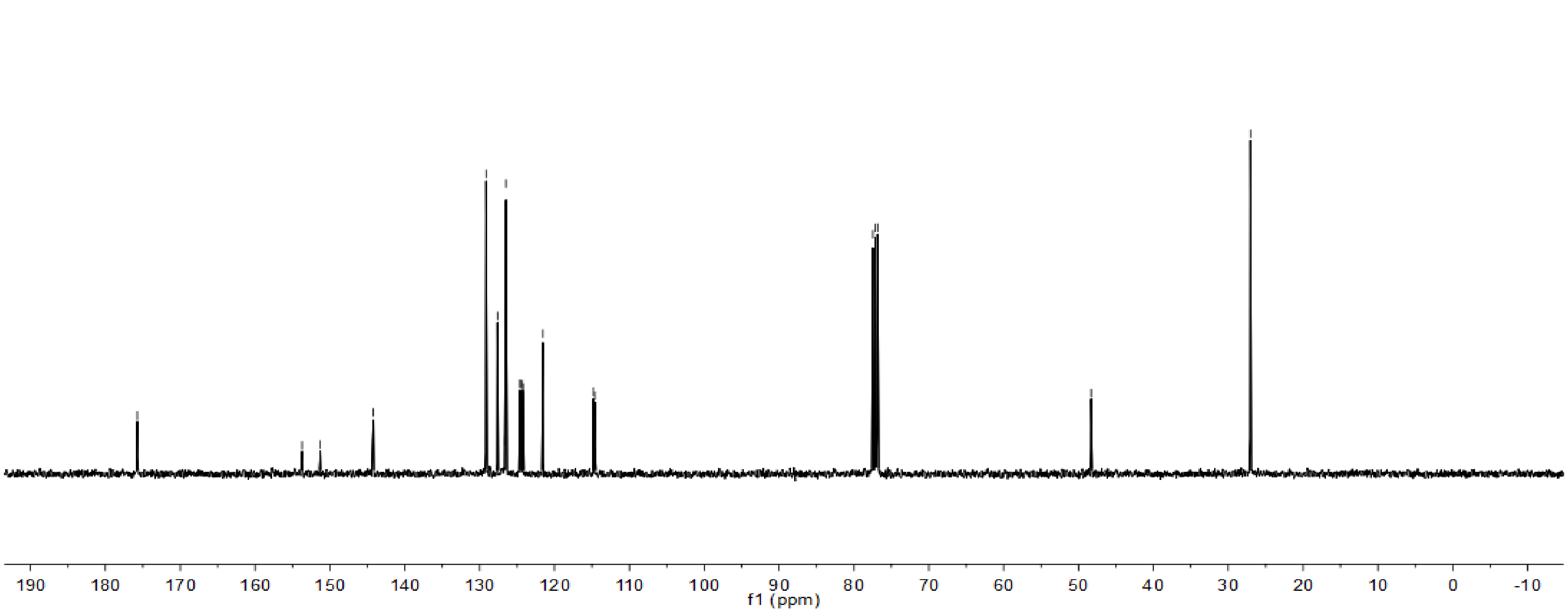


^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ah**

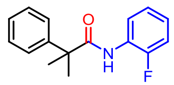


[13]C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ah**

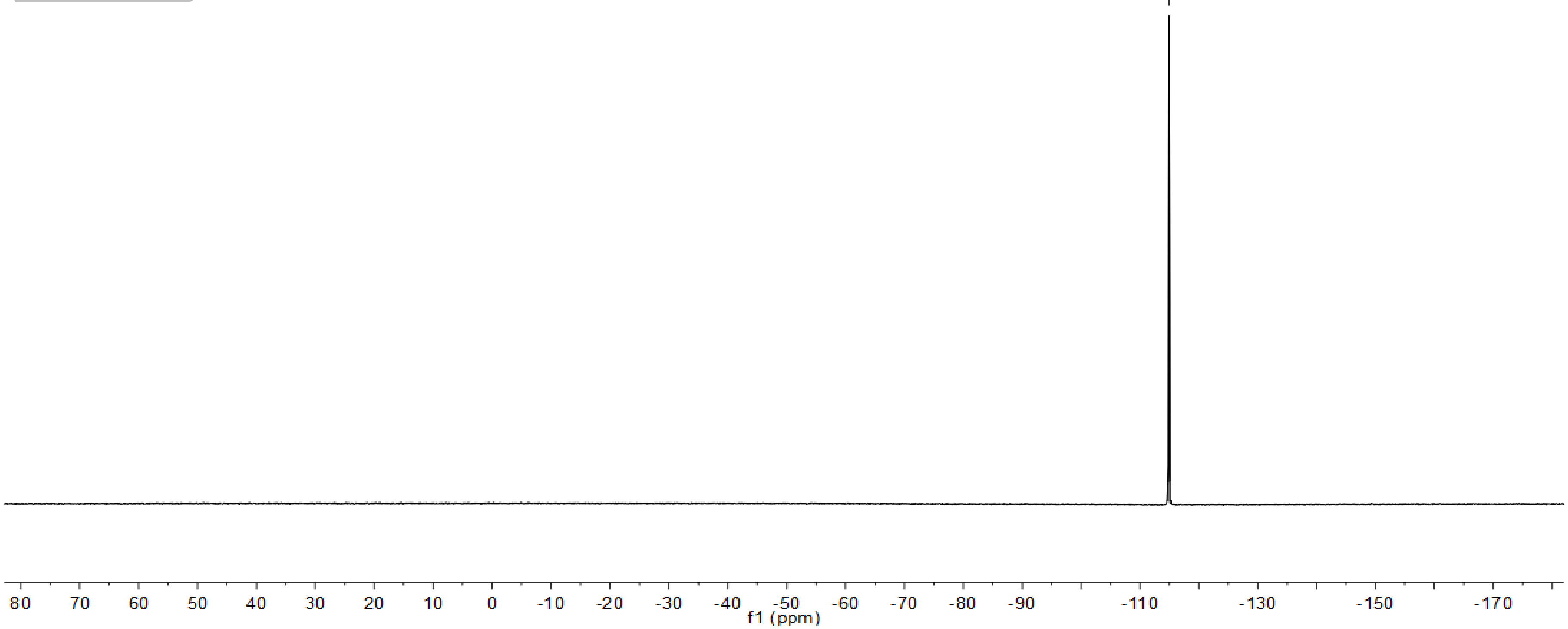




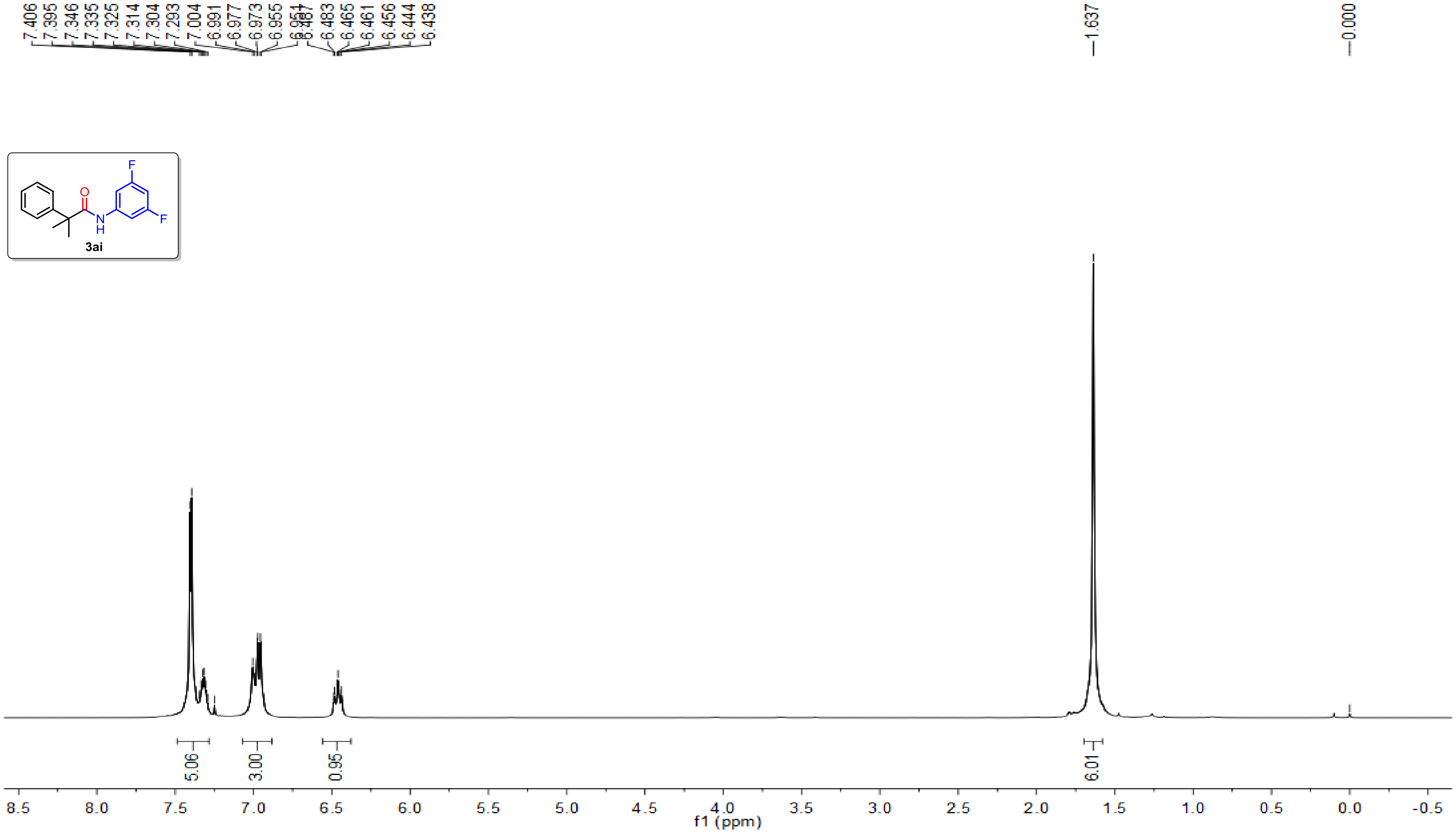
^{19}F NMR Spectra (375 MHz, $CDCl_3$) of compound **3ah**



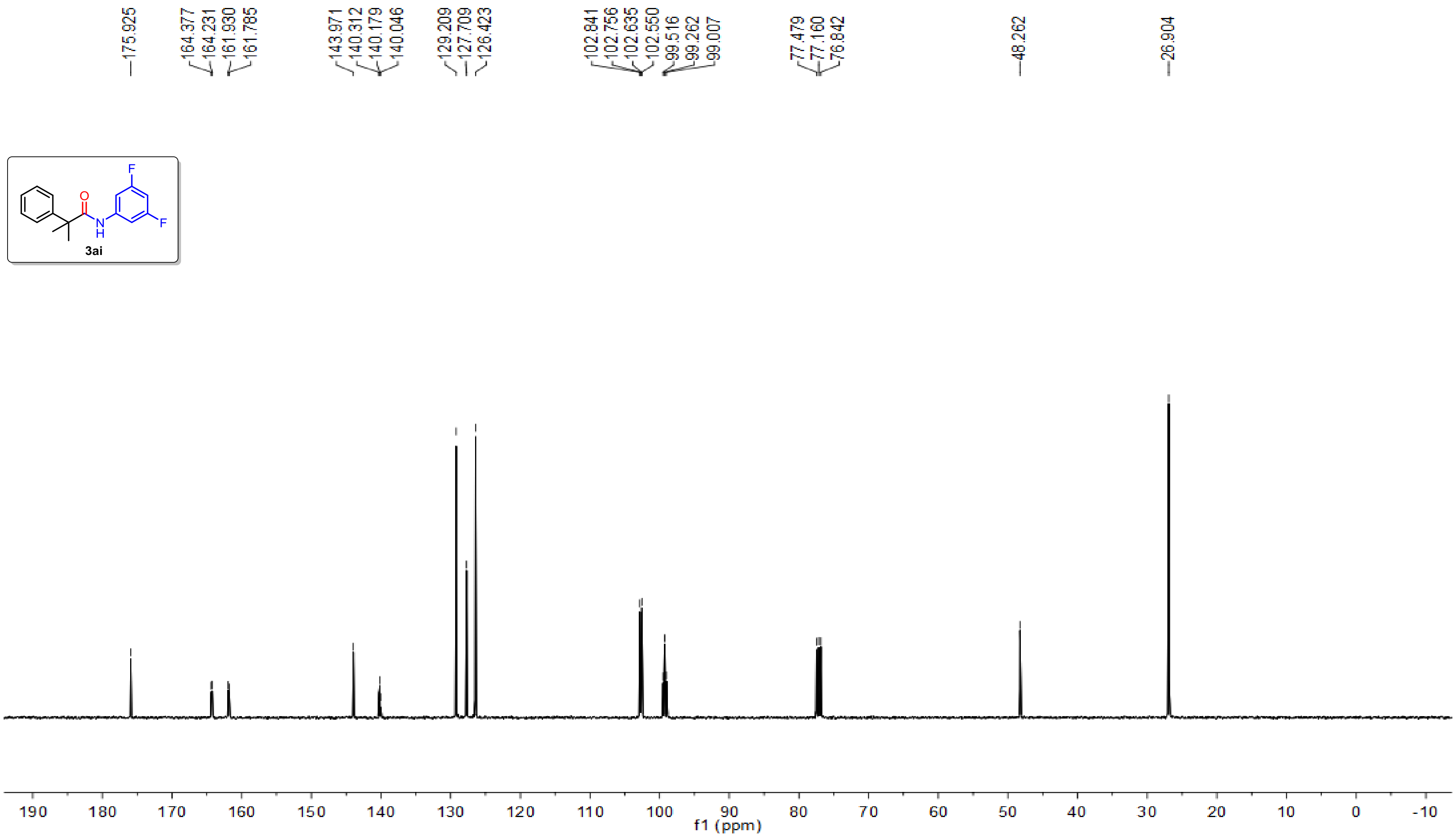
3ah



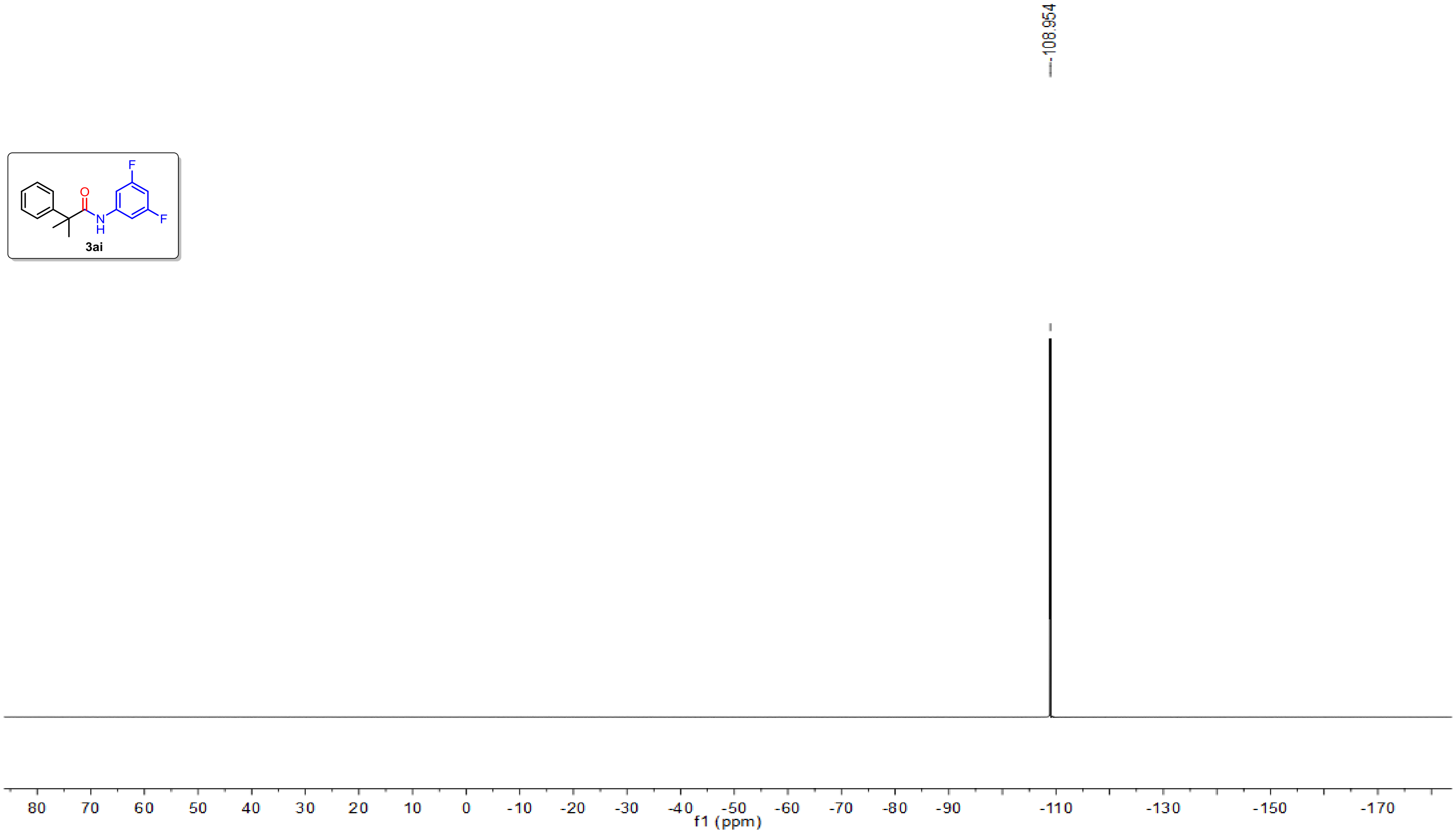
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ah**



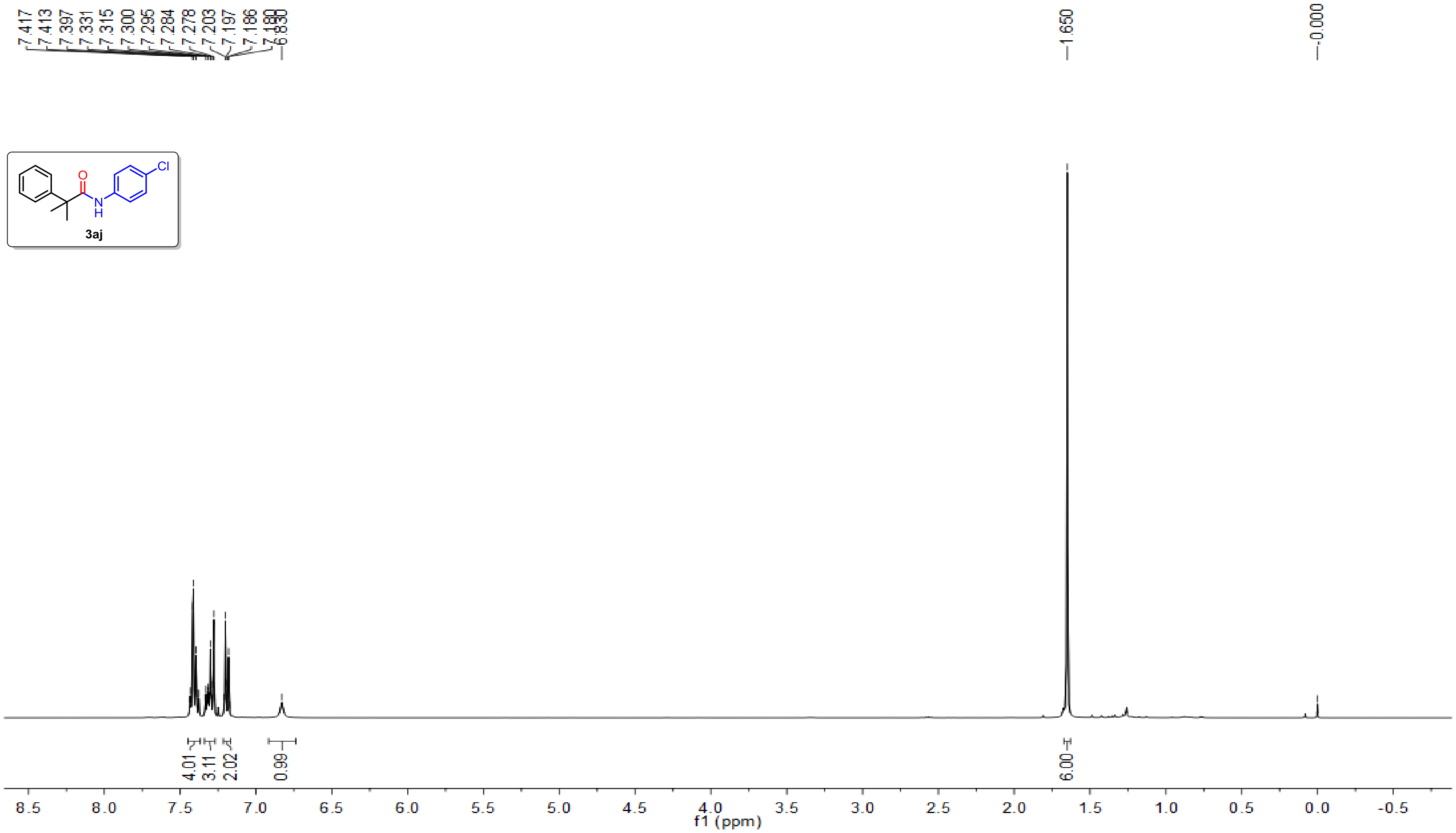
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ai**



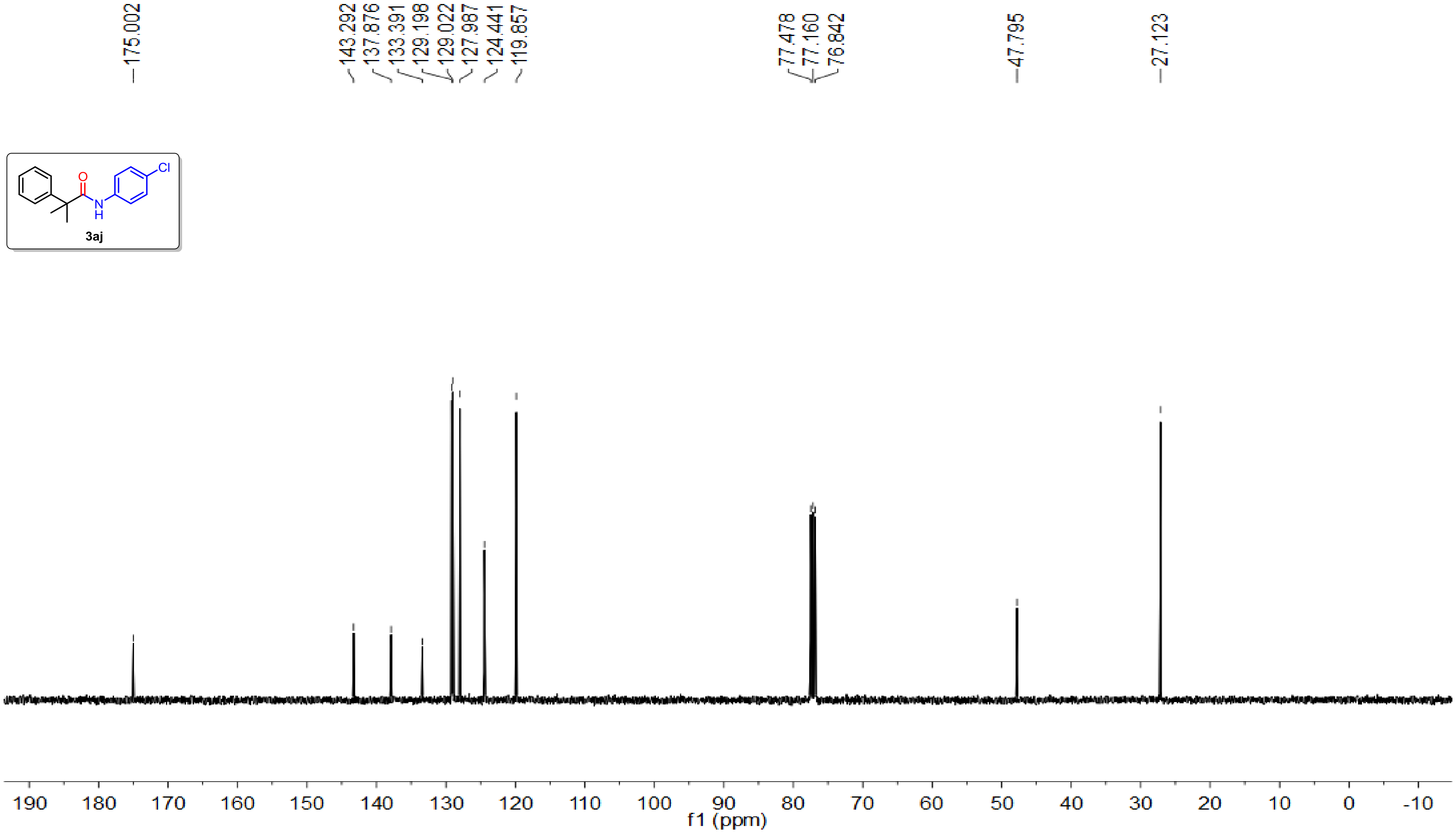
^{19}F NMR Spectra (375 MHz, $CDCl_3$) of compound **3ai**



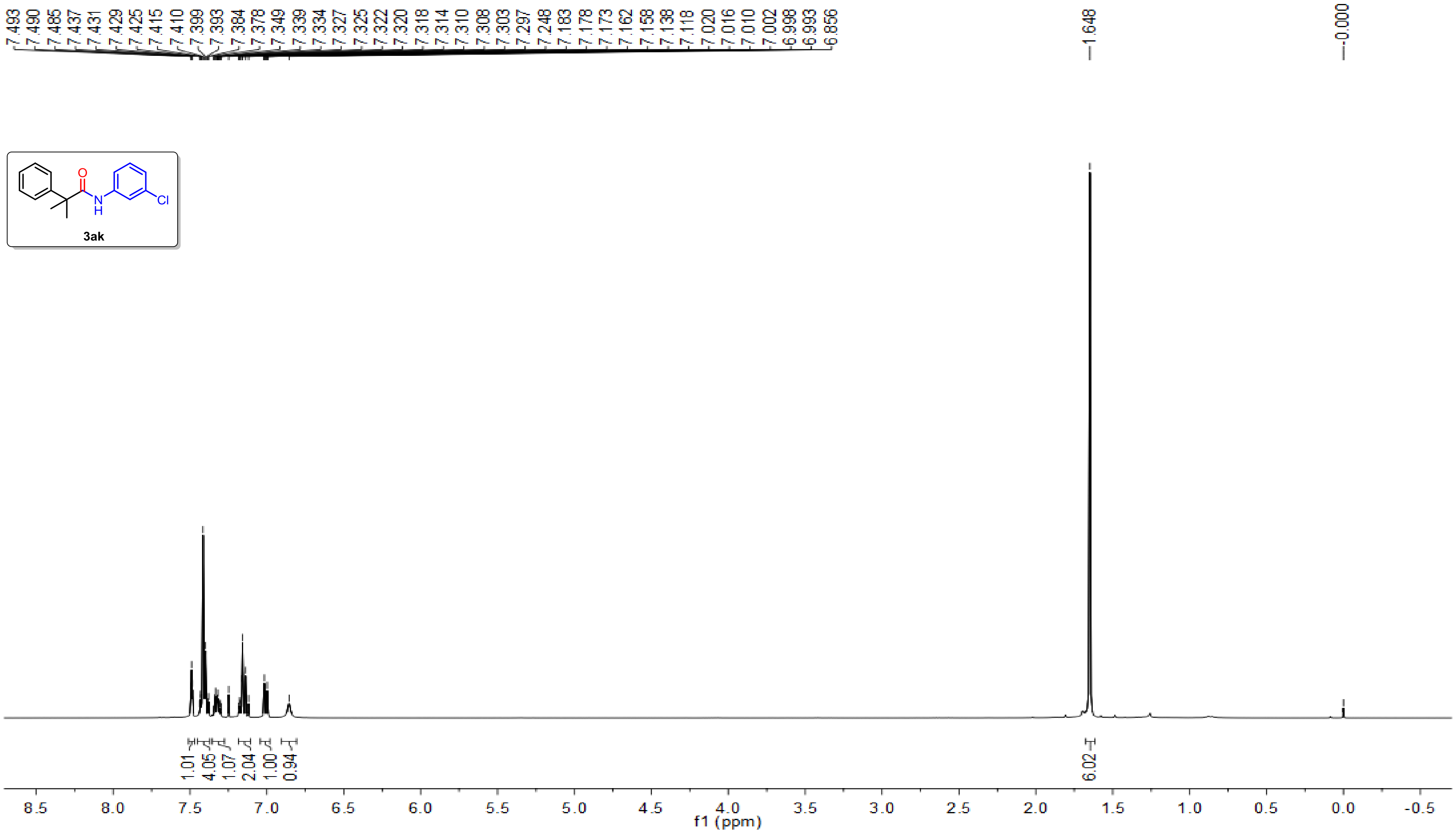
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3aj**



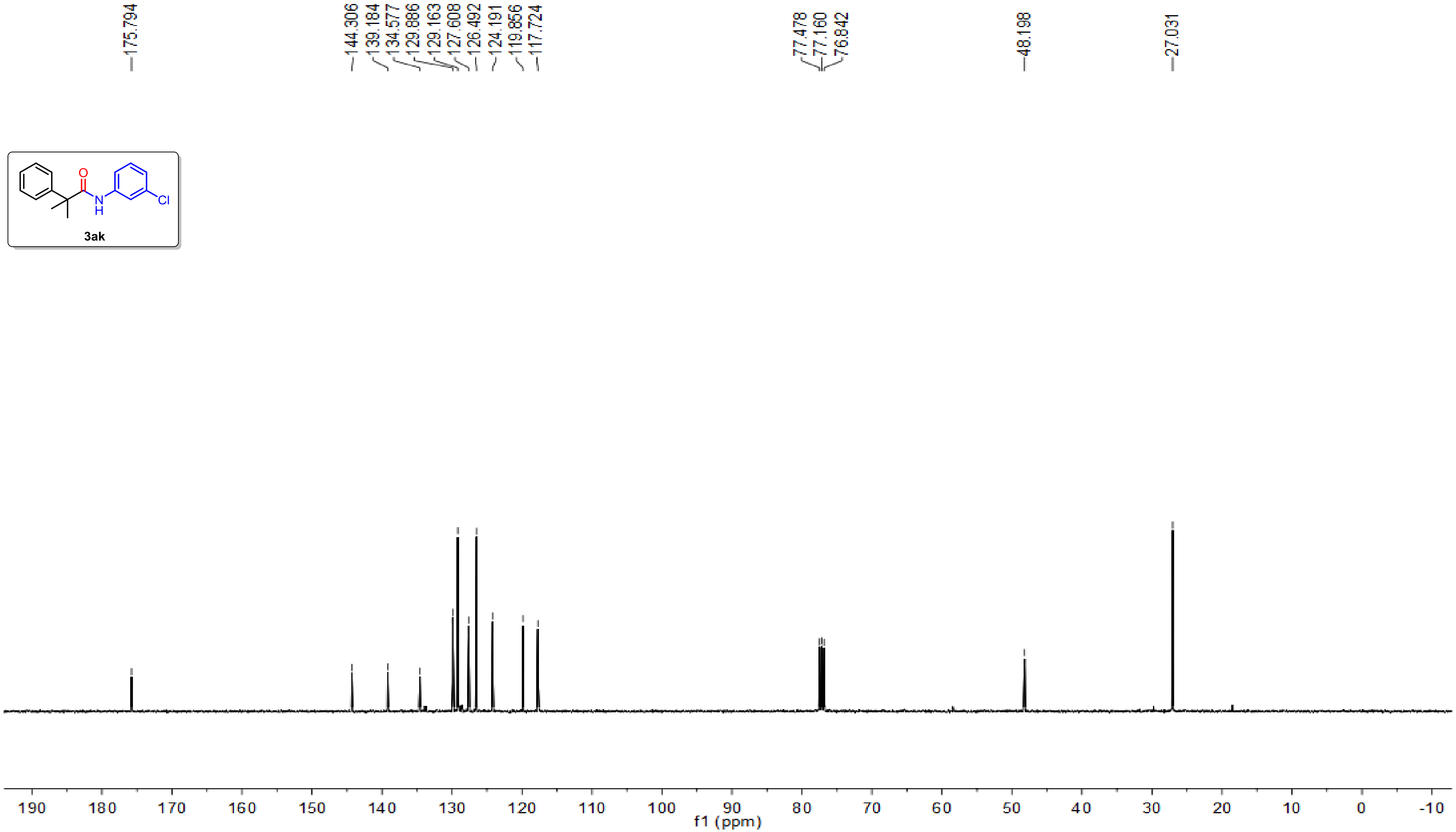
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3aj**



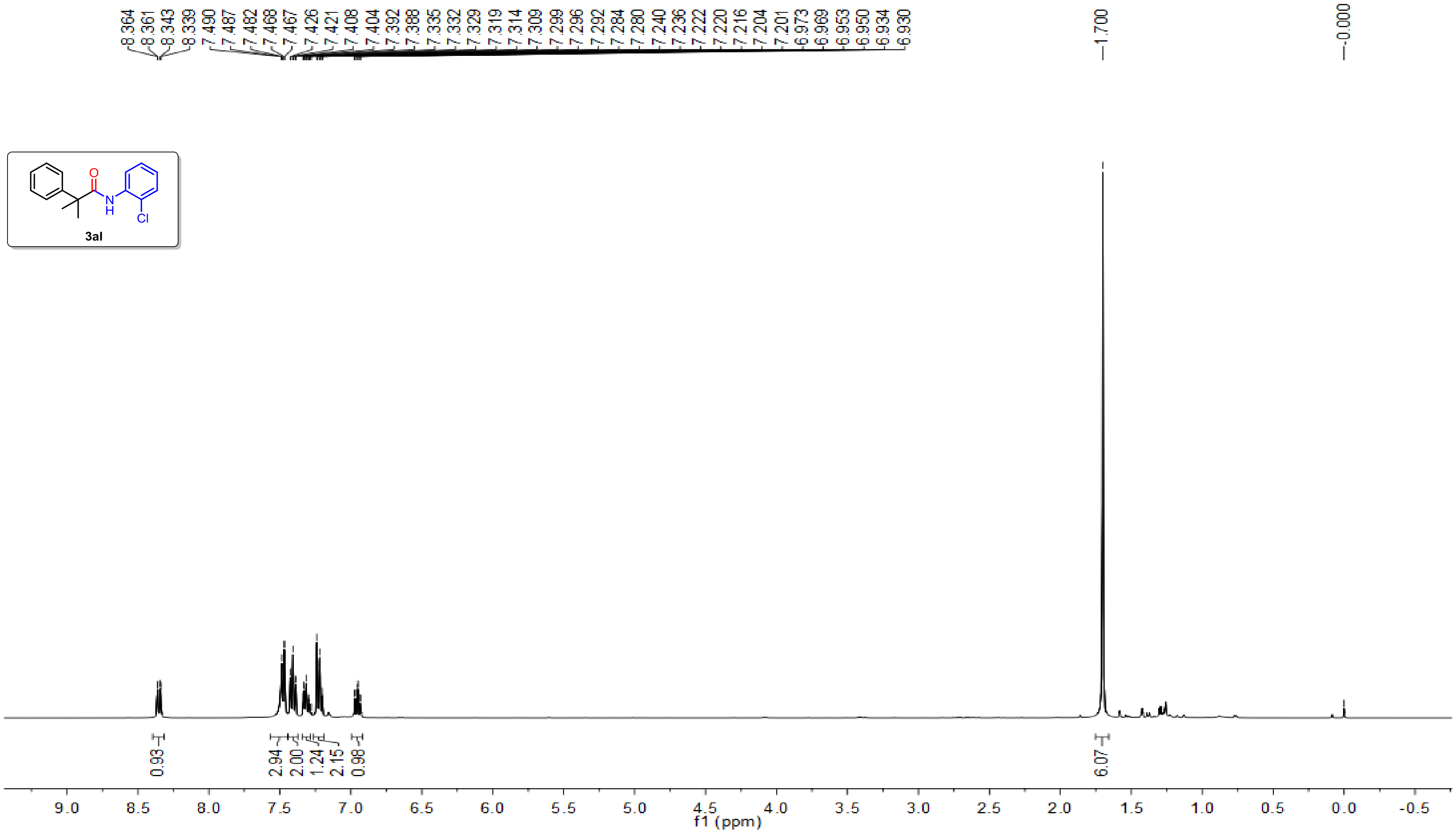
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ak**



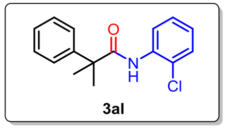
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ak**

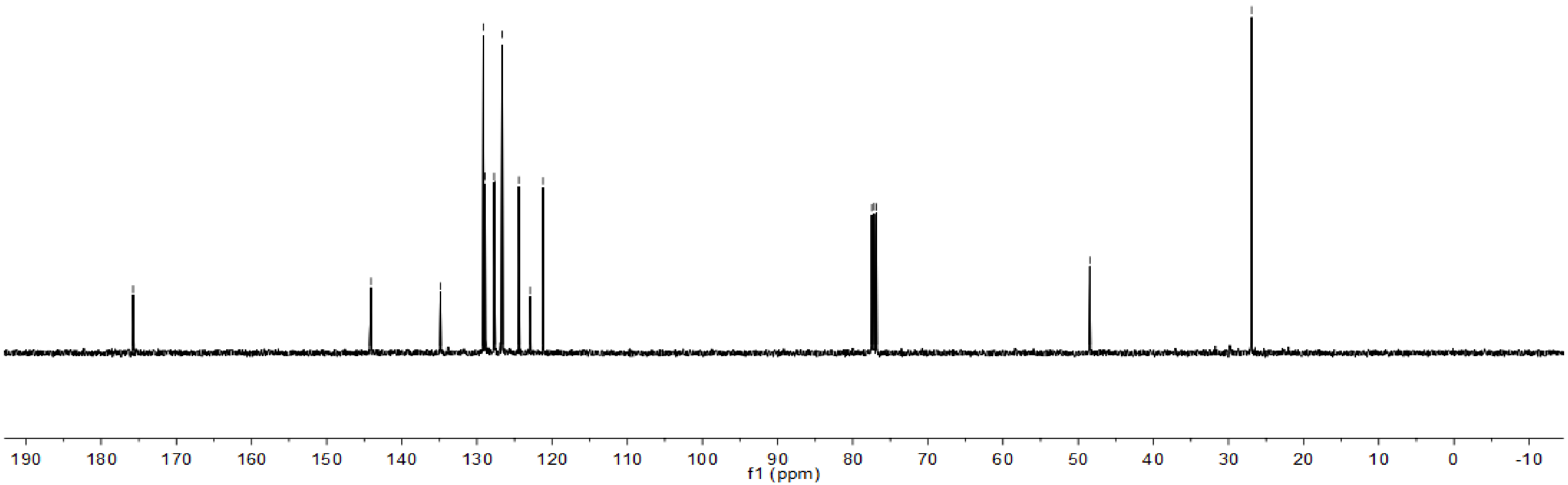


^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3al**

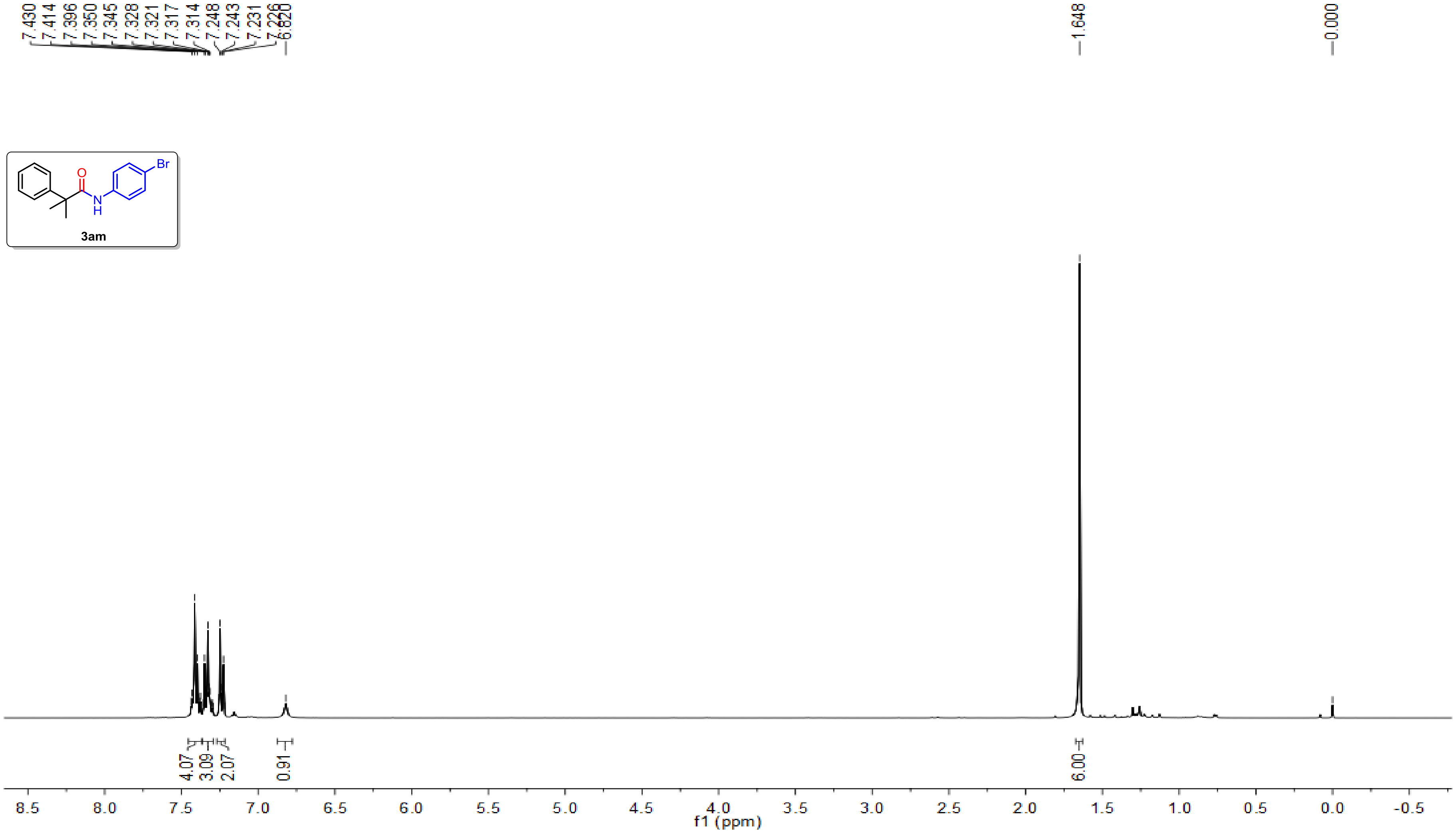


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3al**

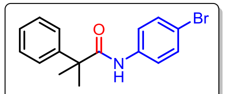




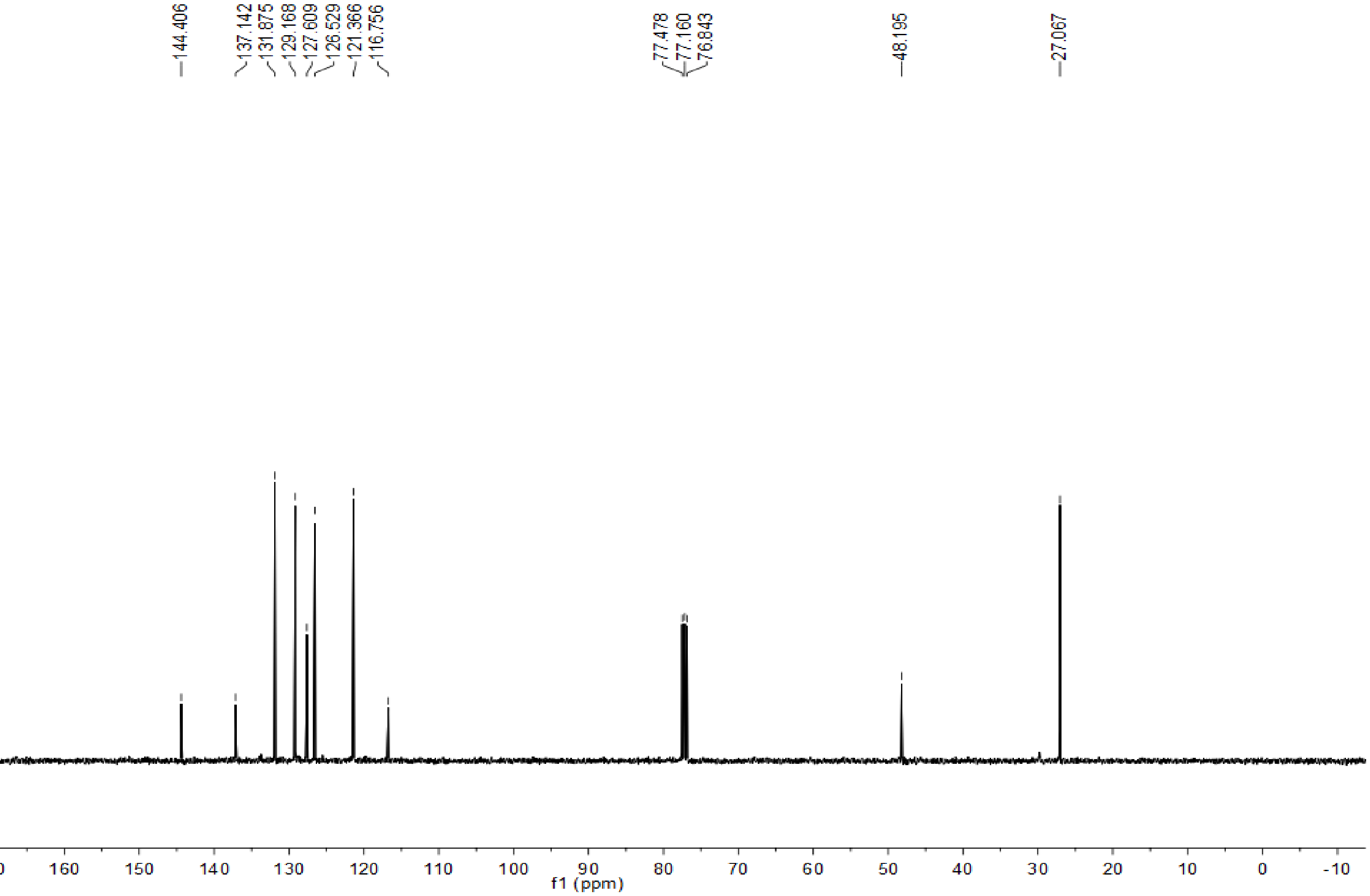
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3am**



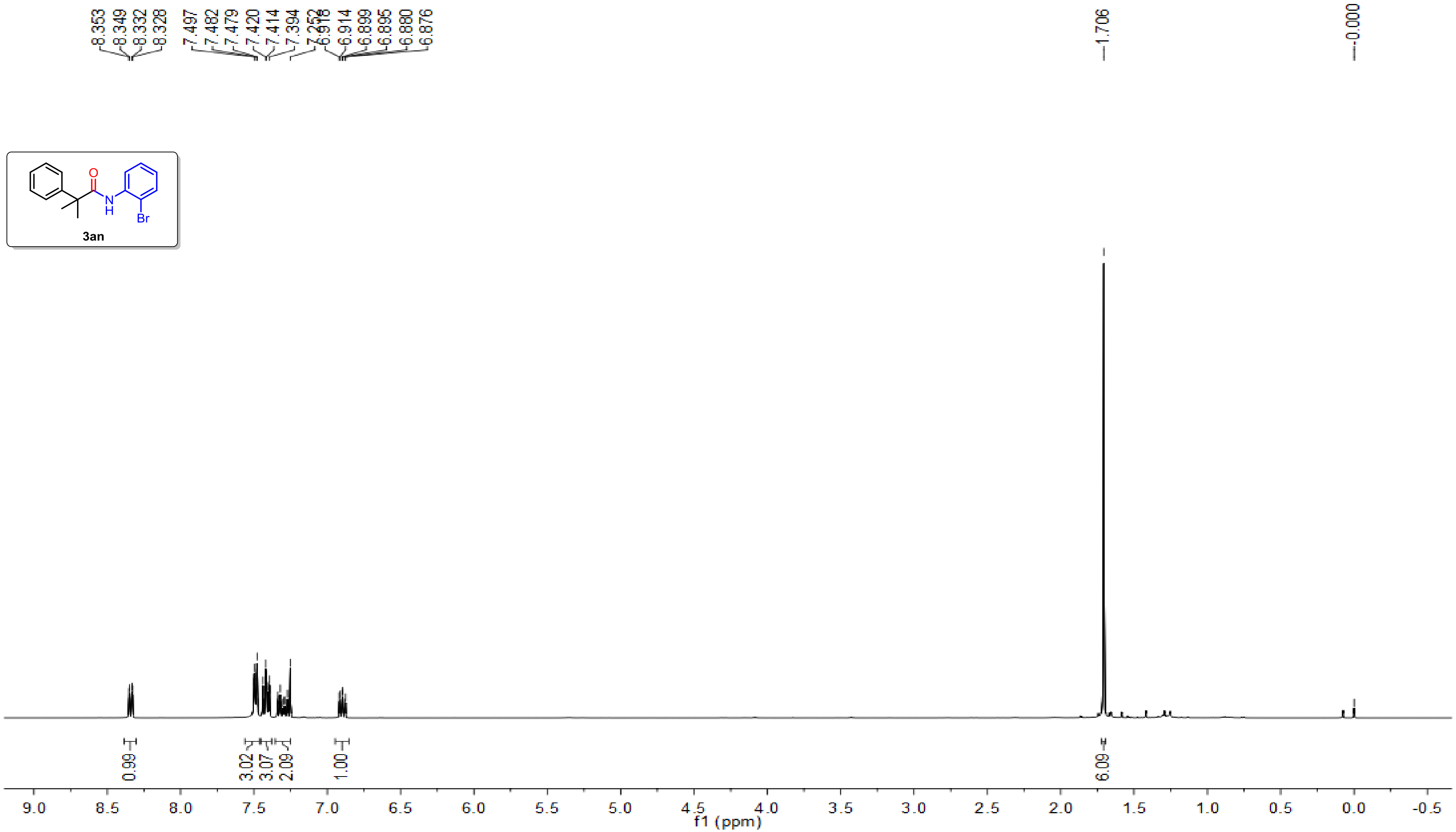
[13]C NMR Spectra (101 MHz, CDCl$_3$) of compound **3am**



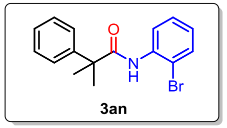
3am

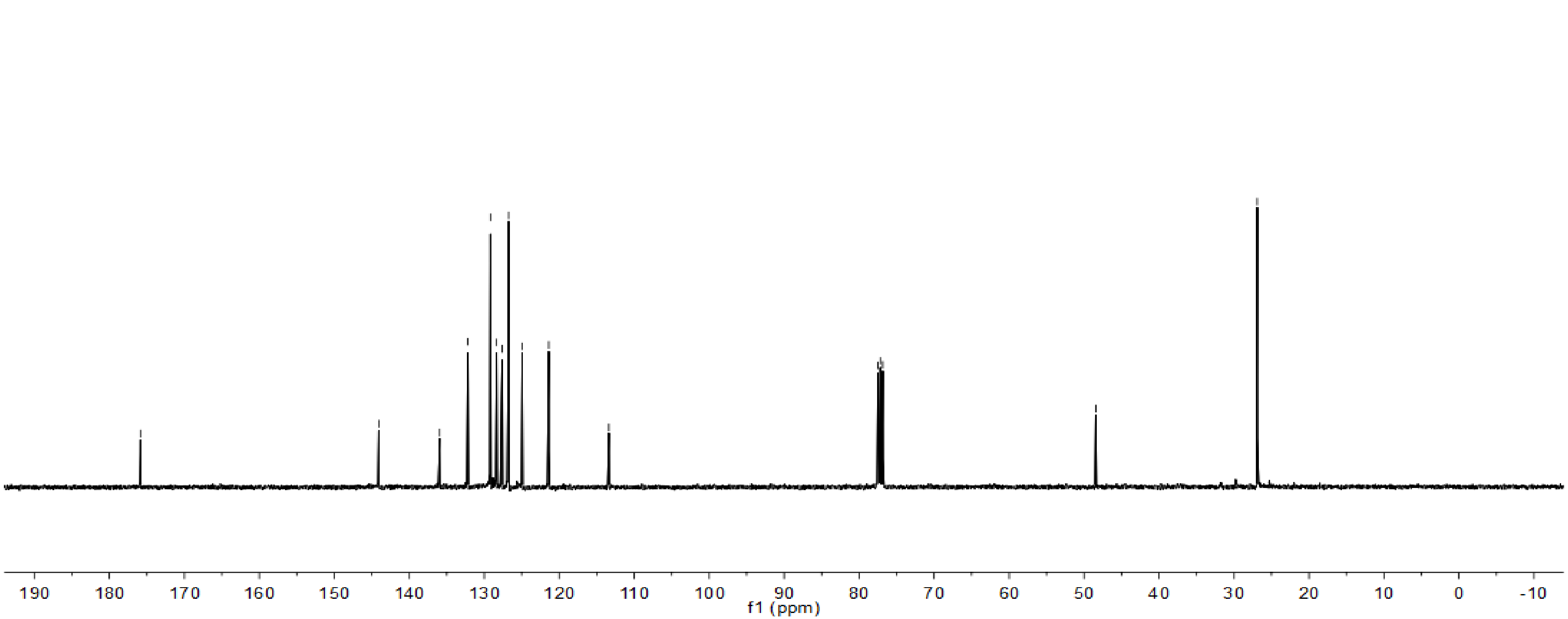


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3an**

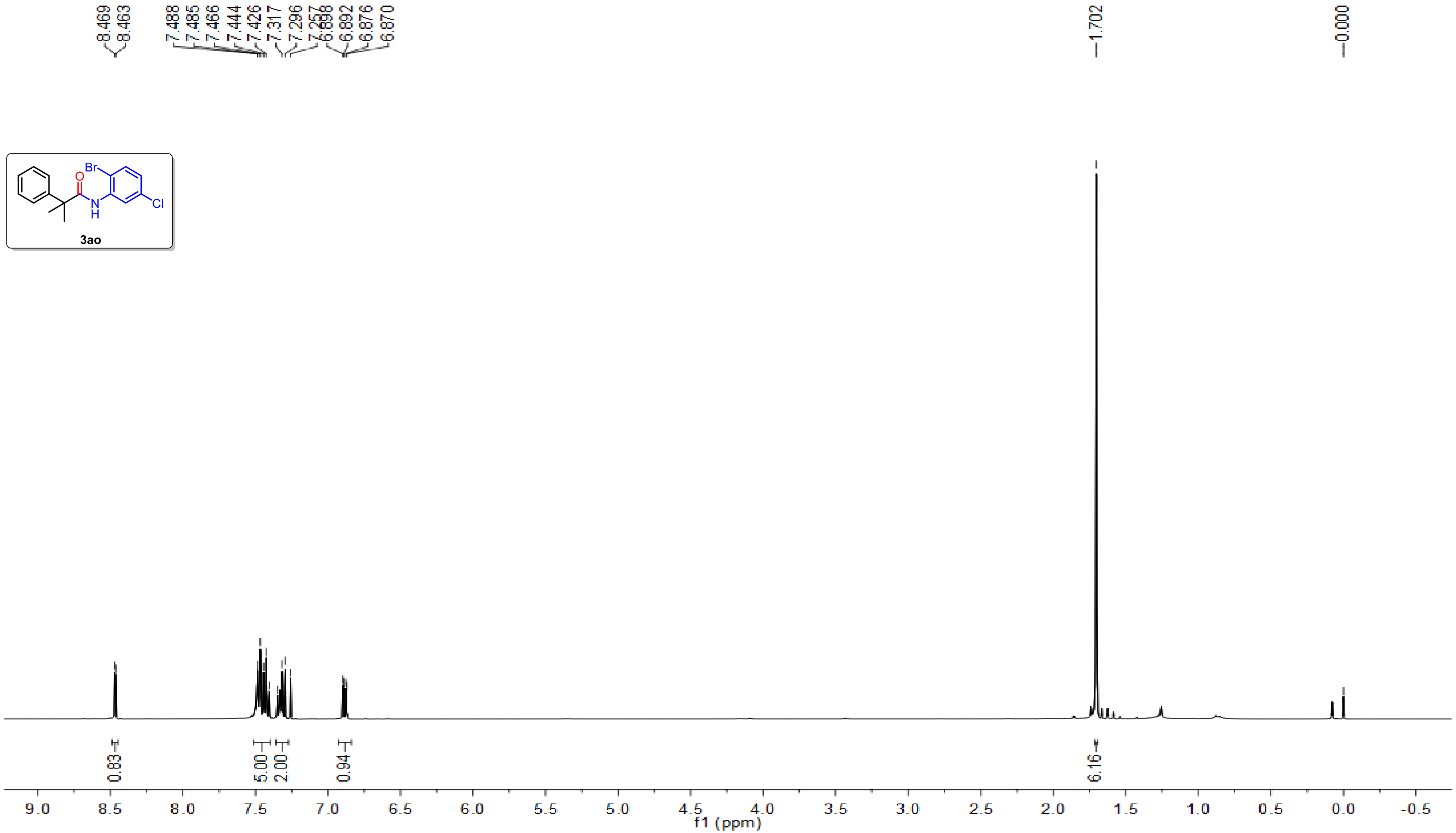


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3an**

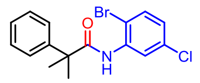




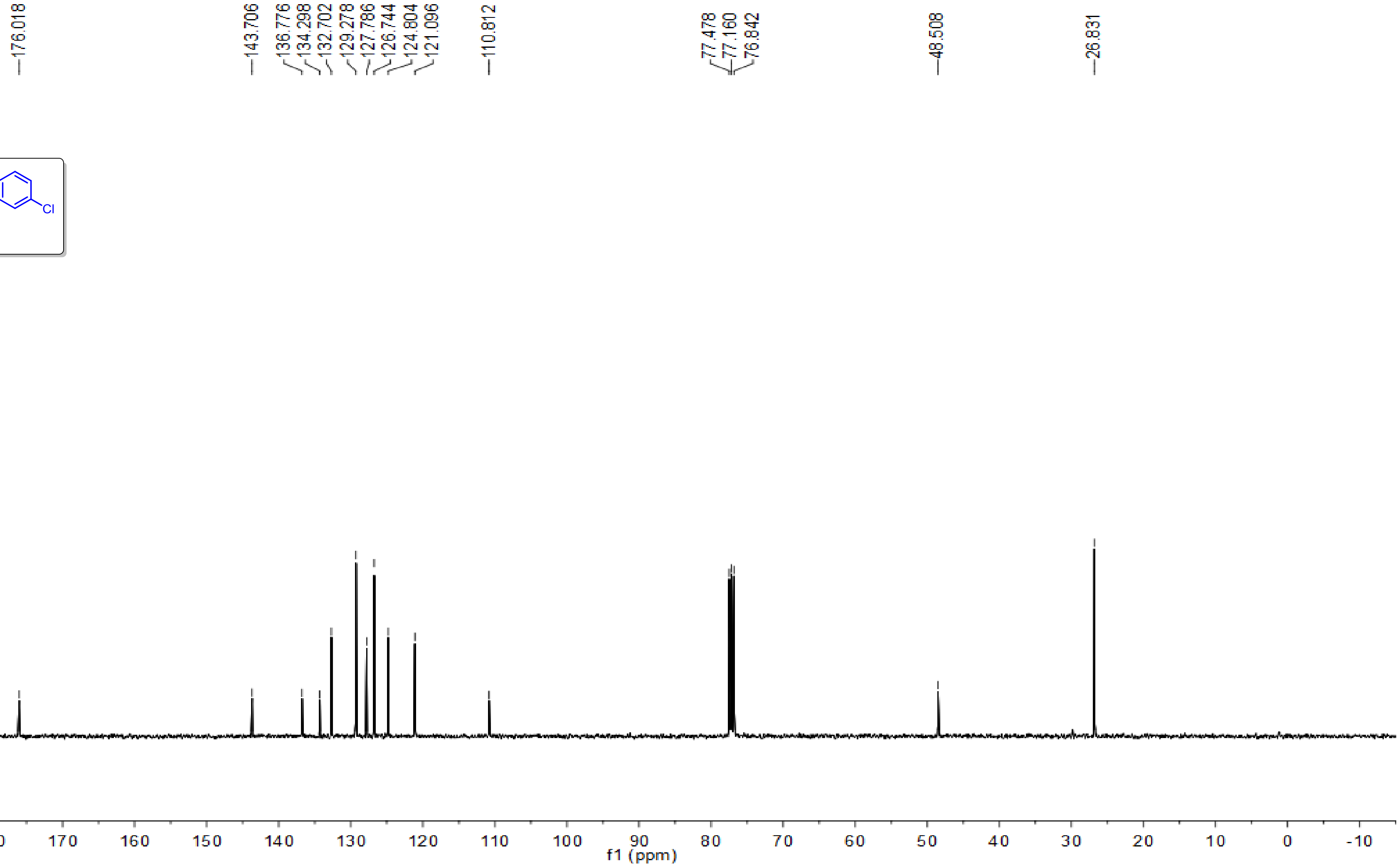
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ao**



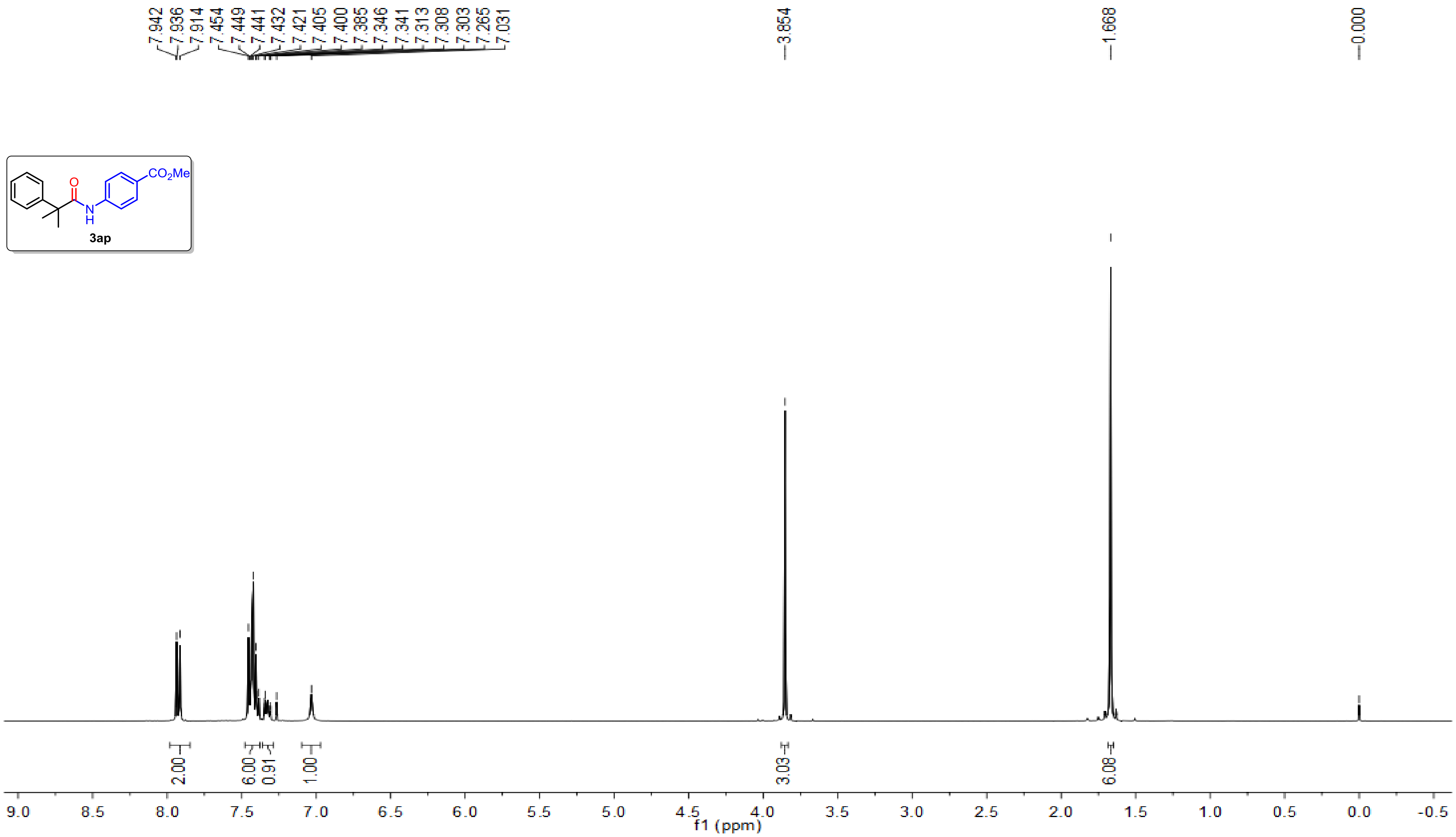
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ao**



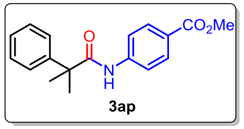
3ao

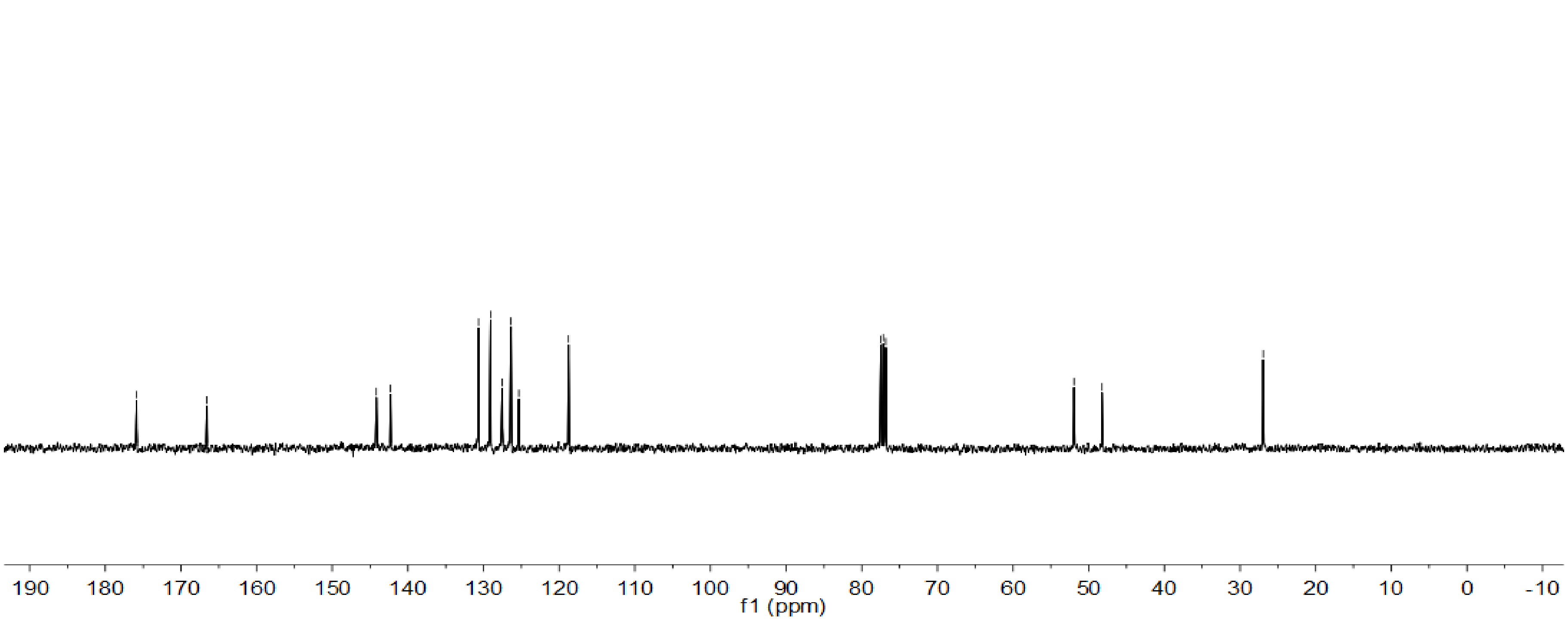


^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ap**

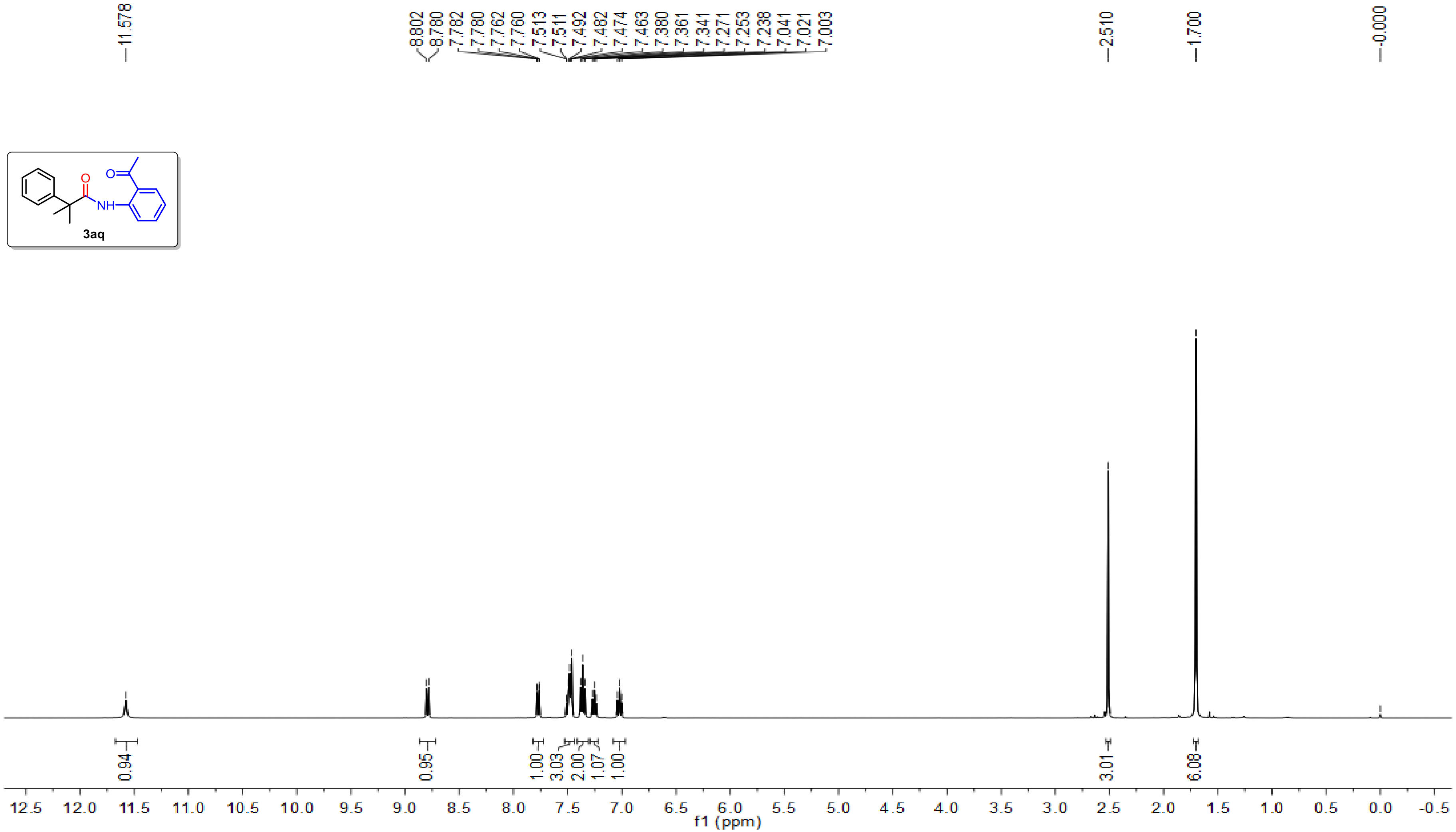


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ap**

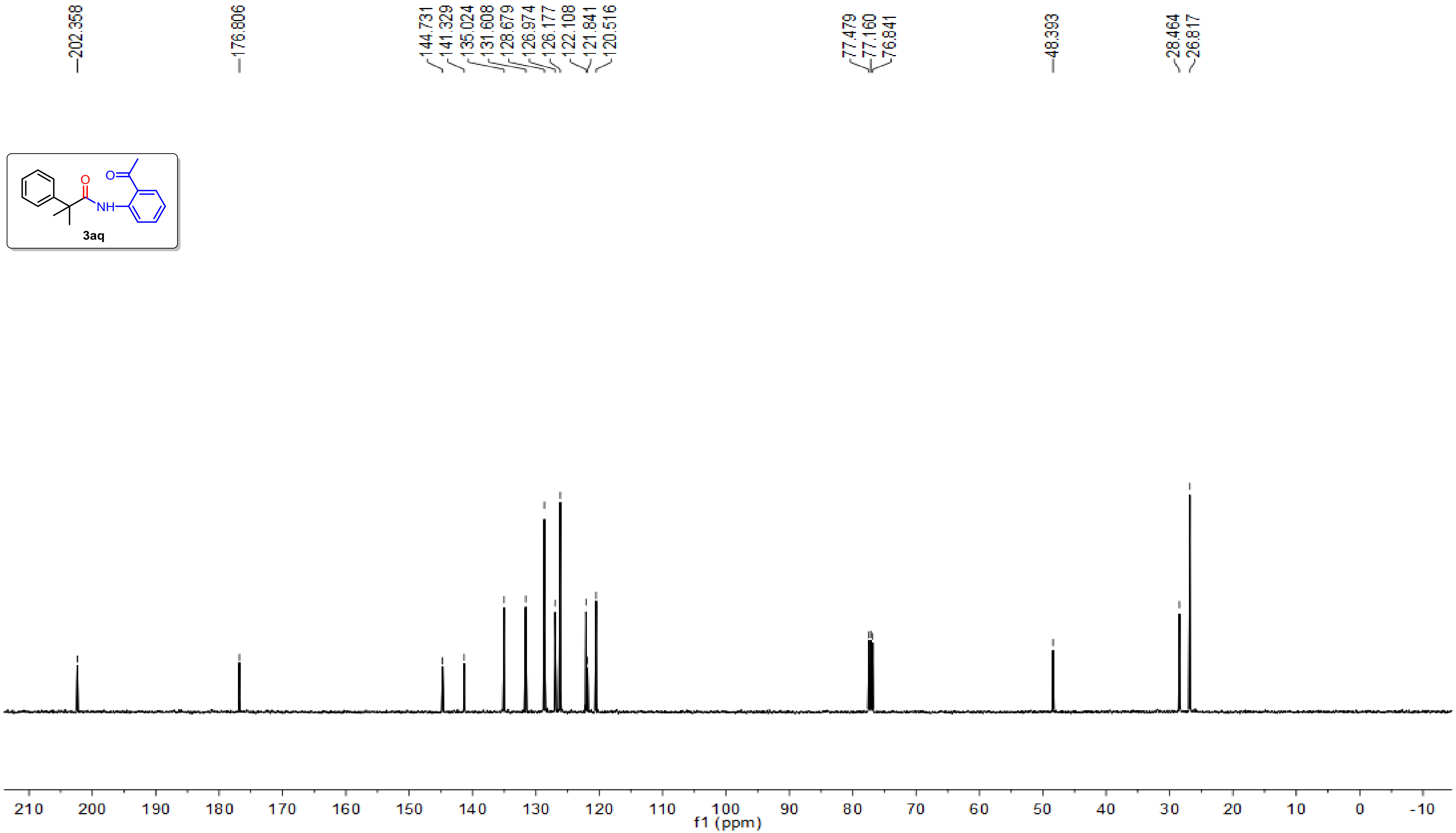




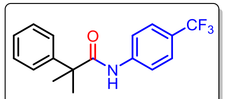
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3aq**



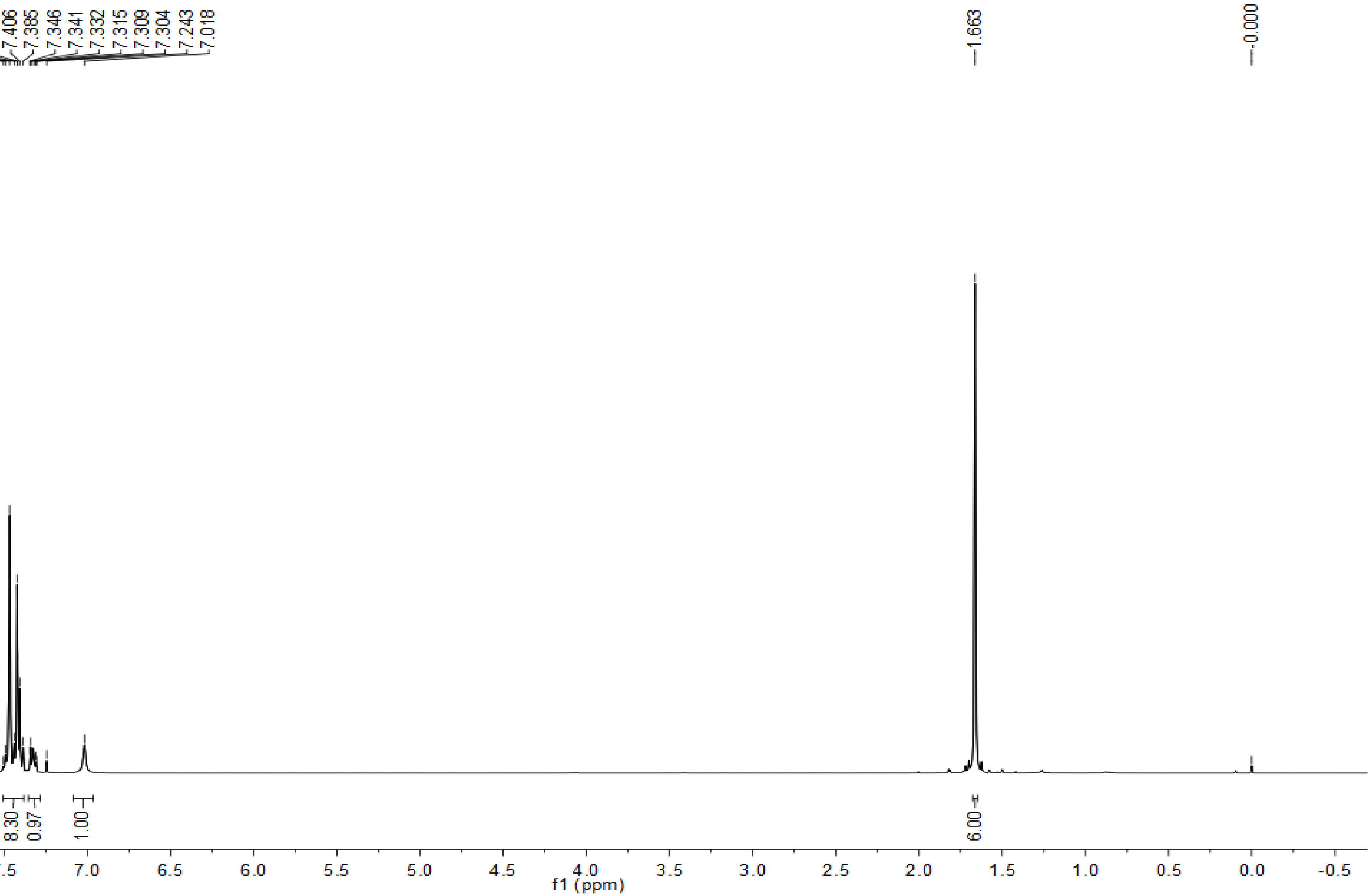
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3aq**



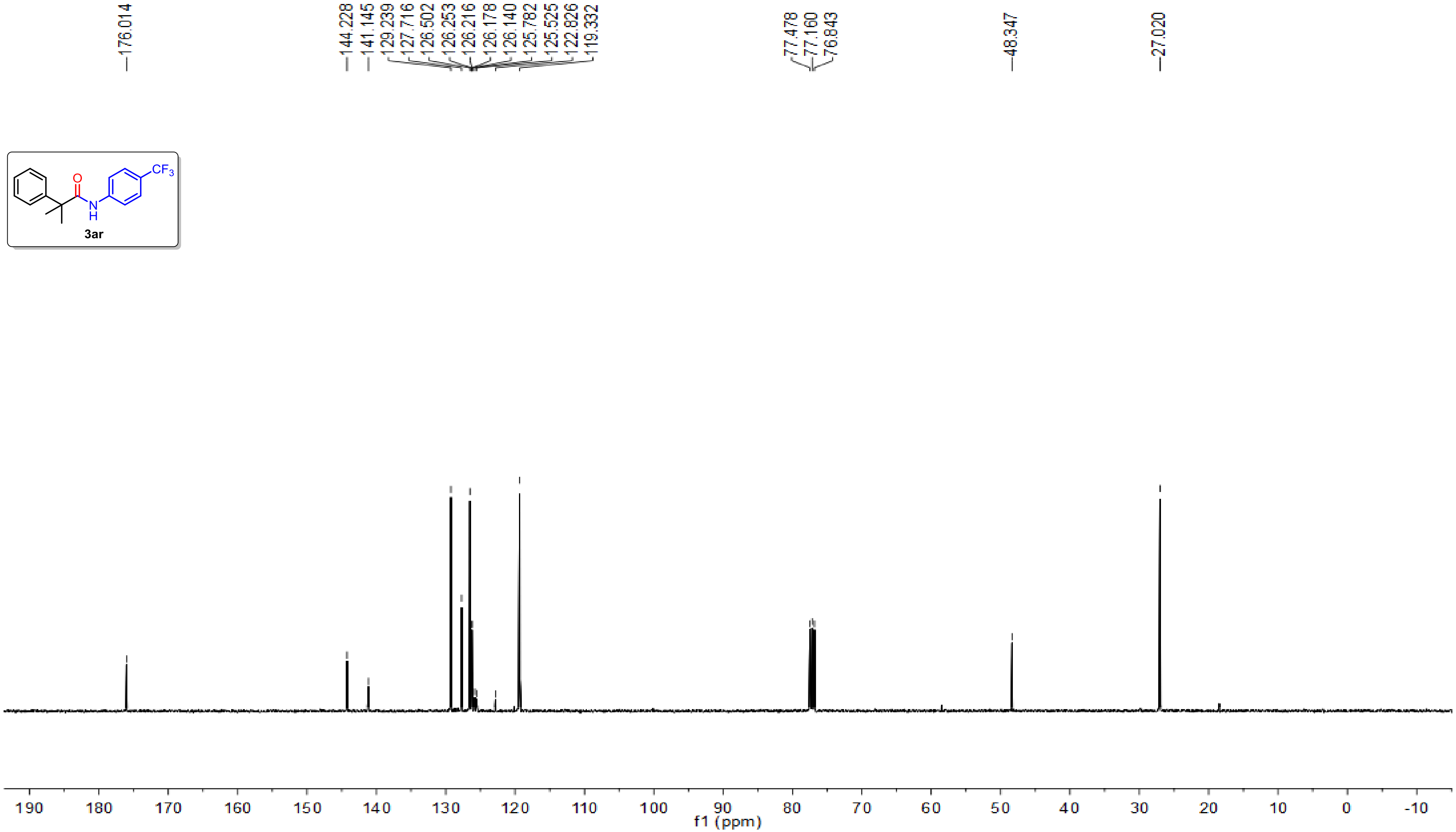
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ar**



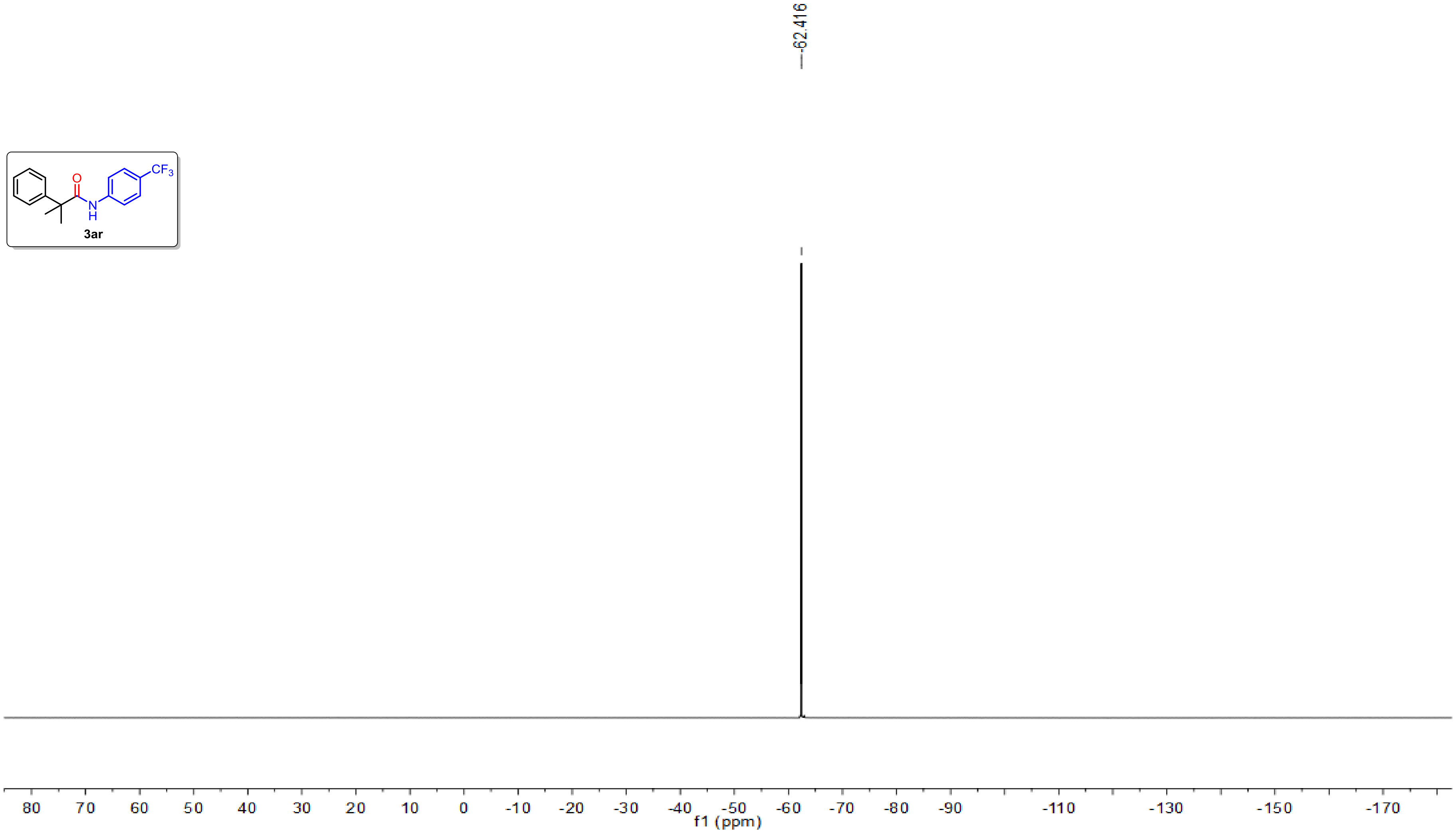
3ar



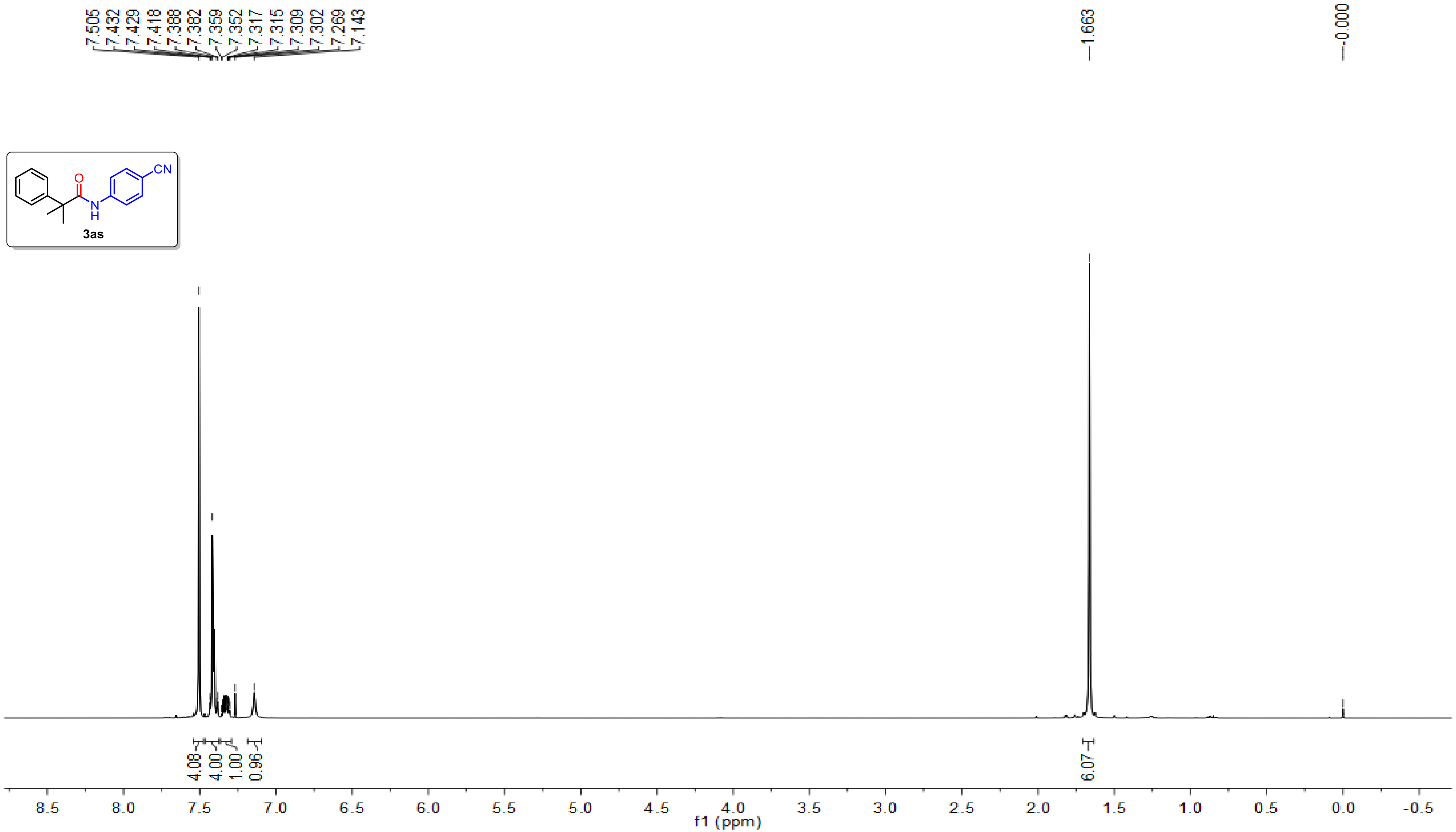
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ar**



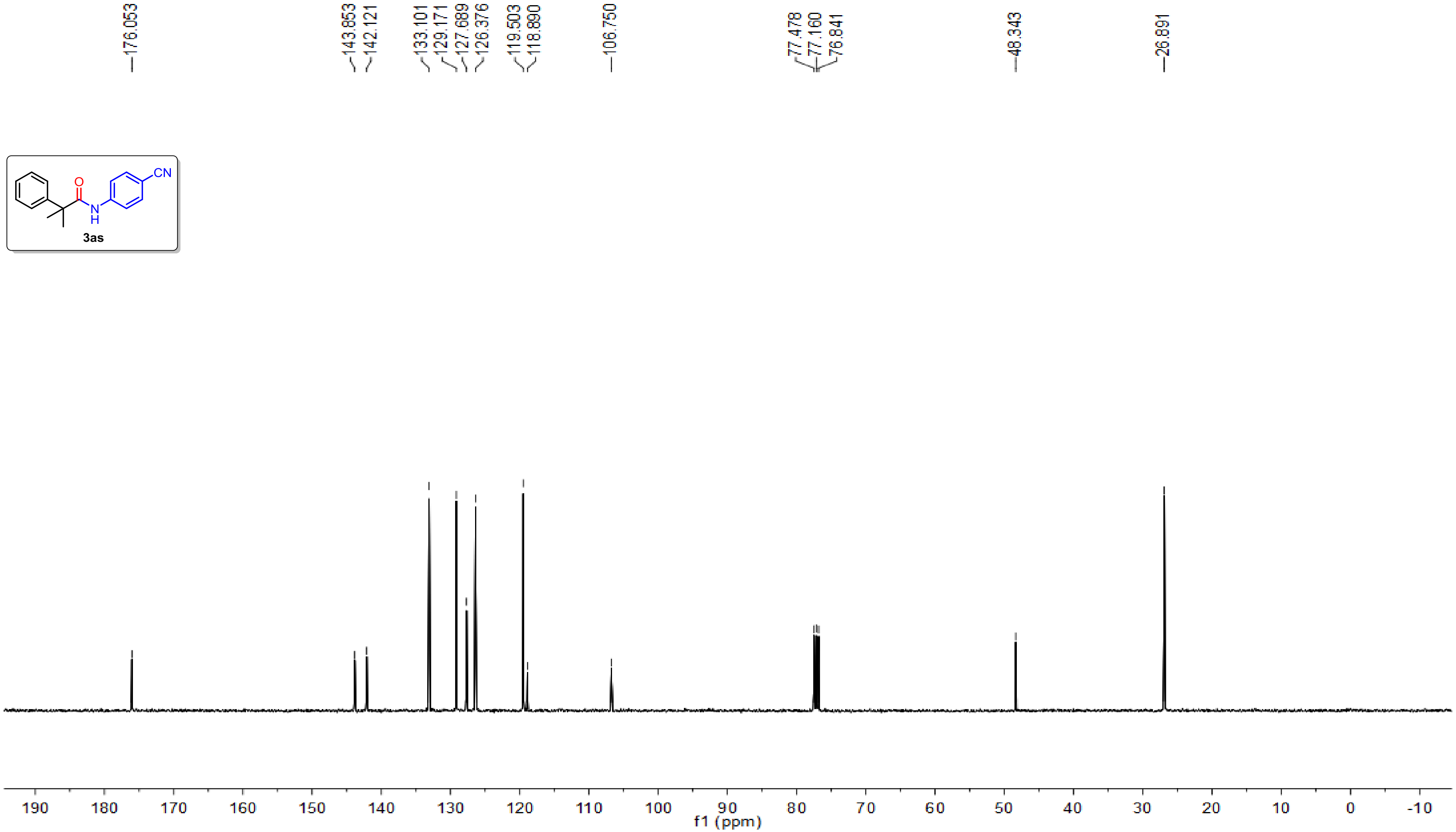
^{19}F NMR Spectra (375 MHz, $CDCl_3$) of compound **3ar**



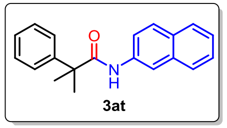
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3as**

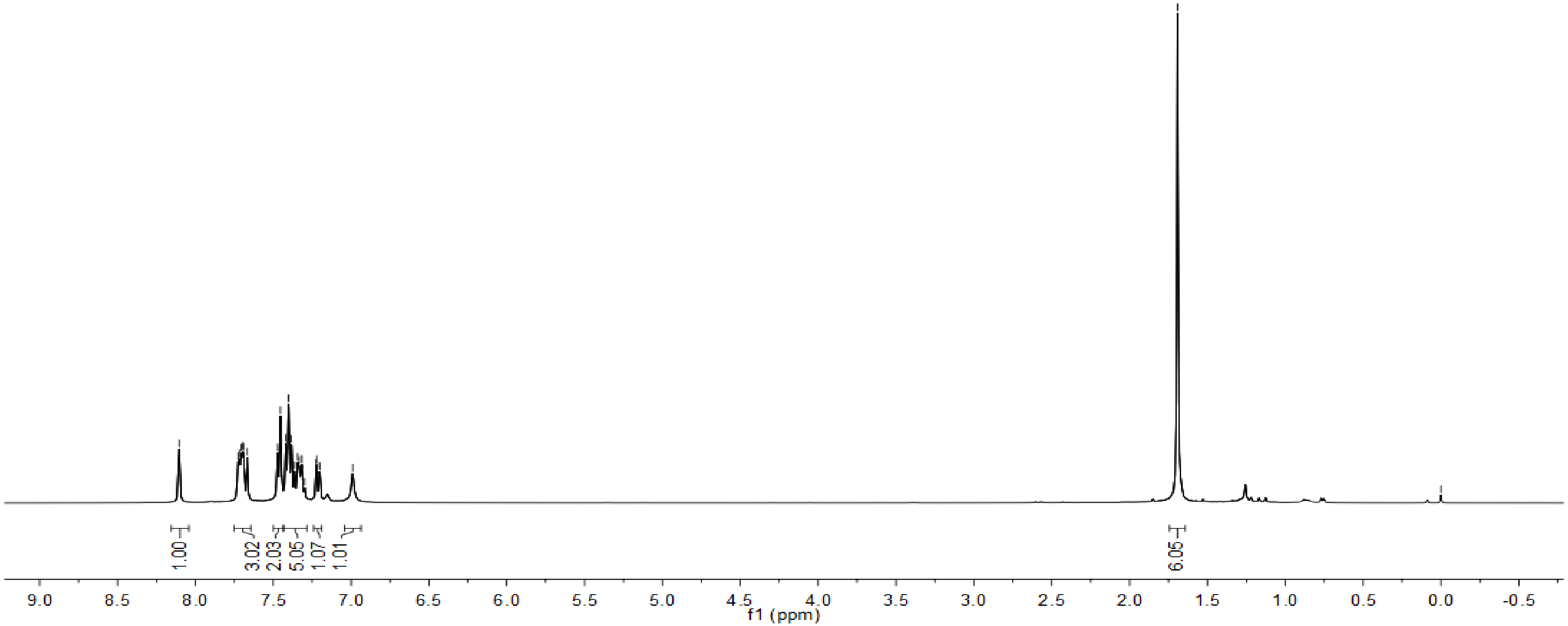


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3as**

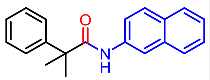


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3at**

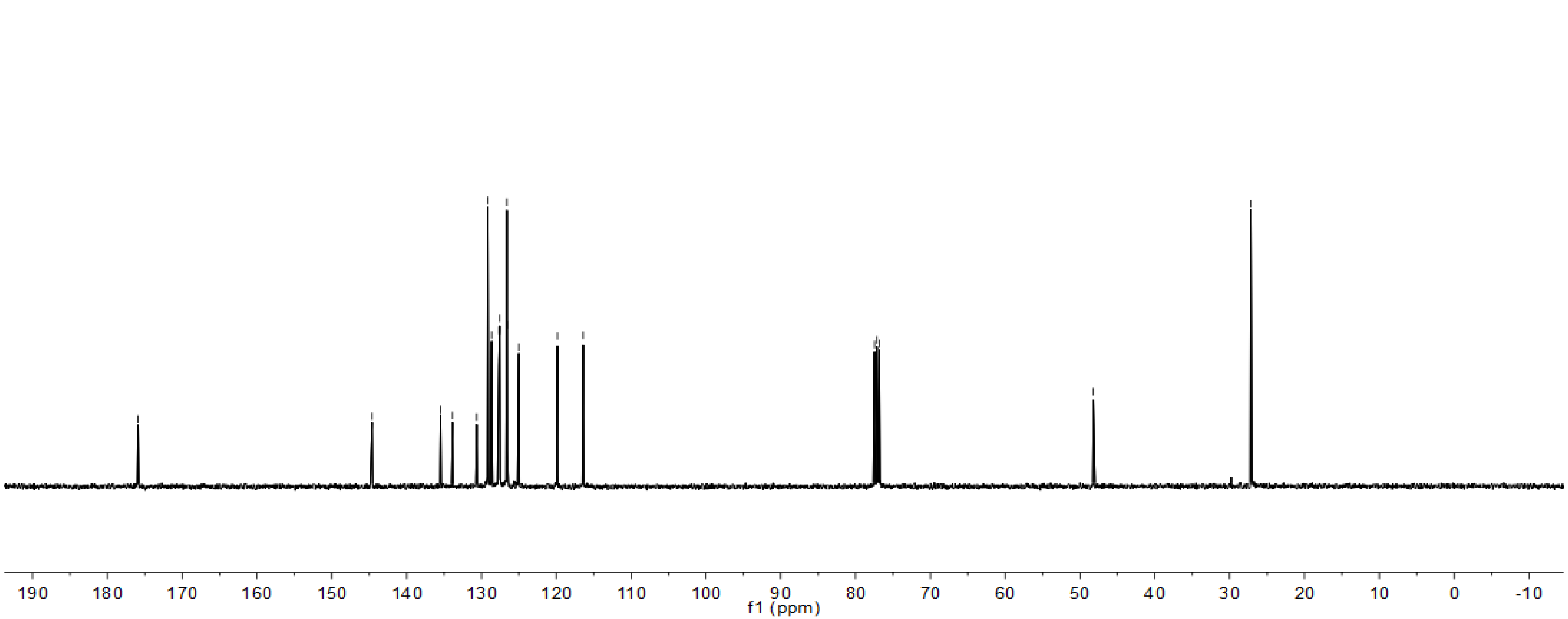




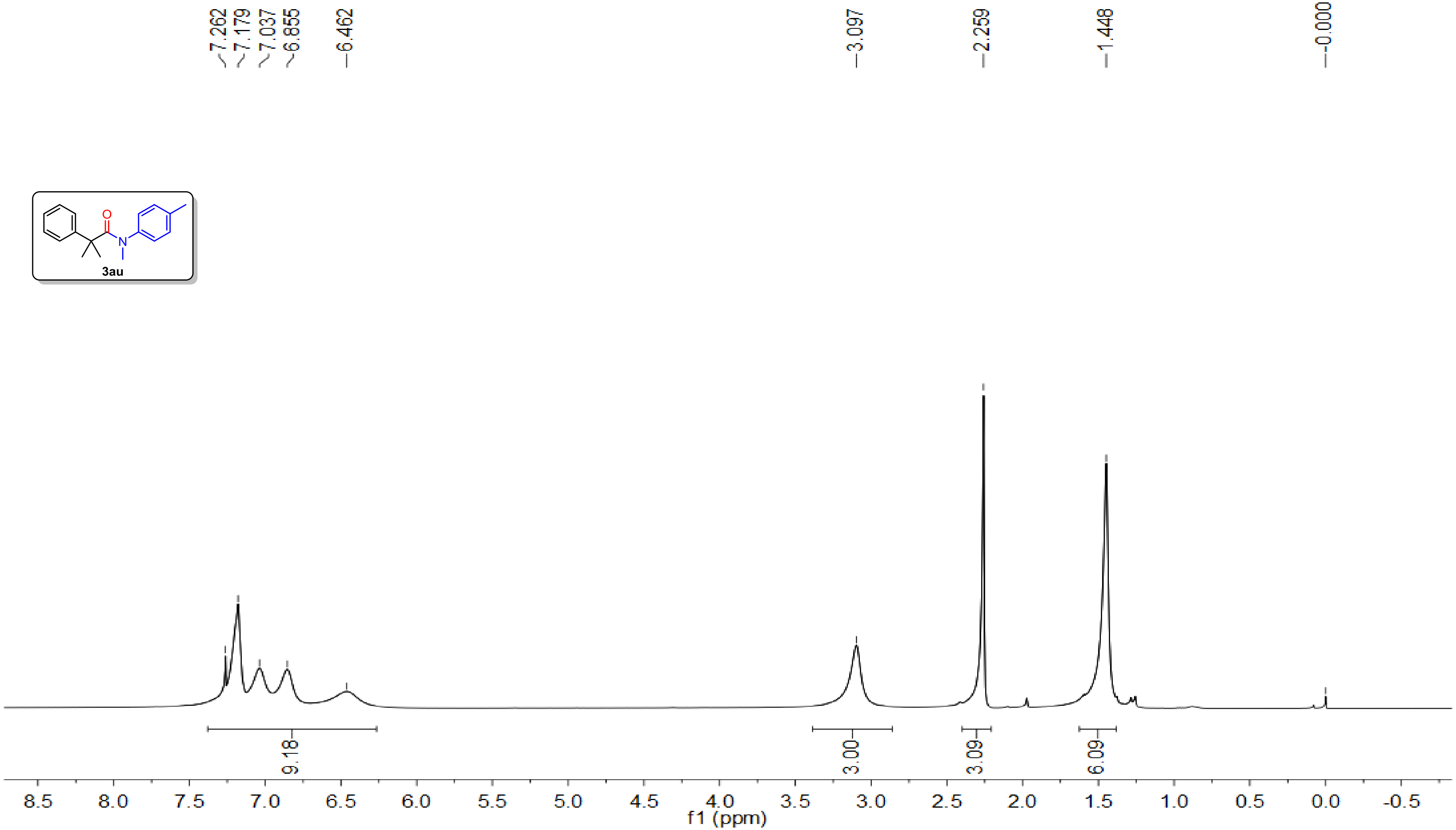
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3at**



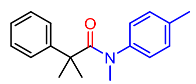
3at



[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3au**



^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3au**



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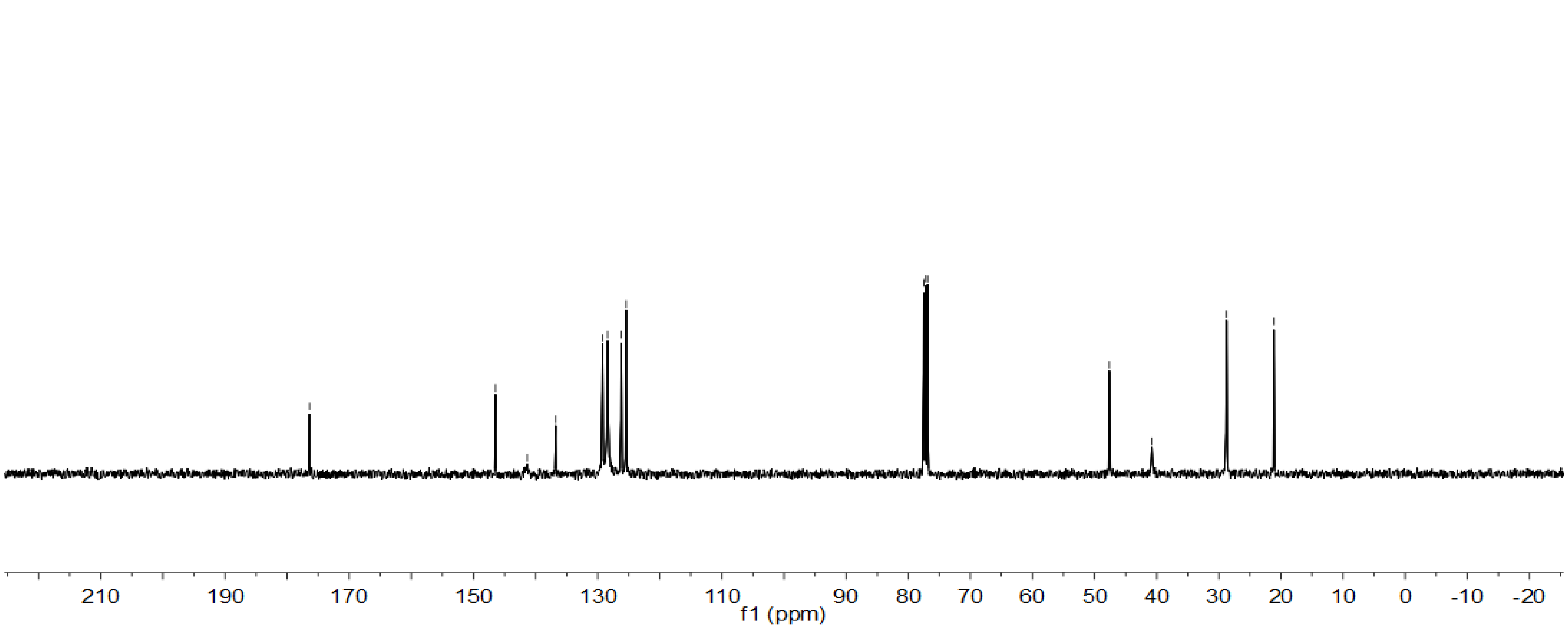
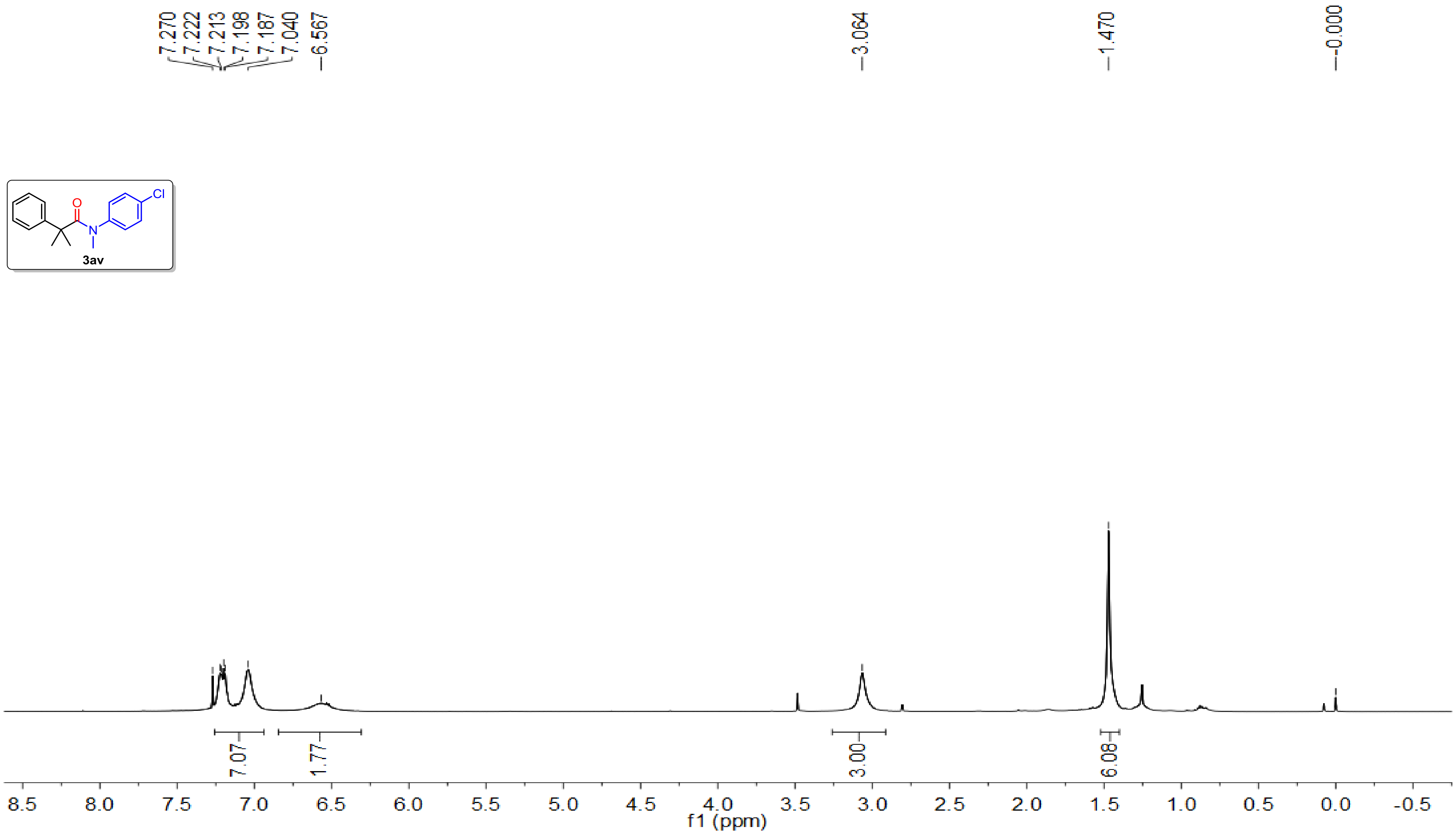
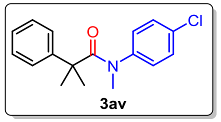
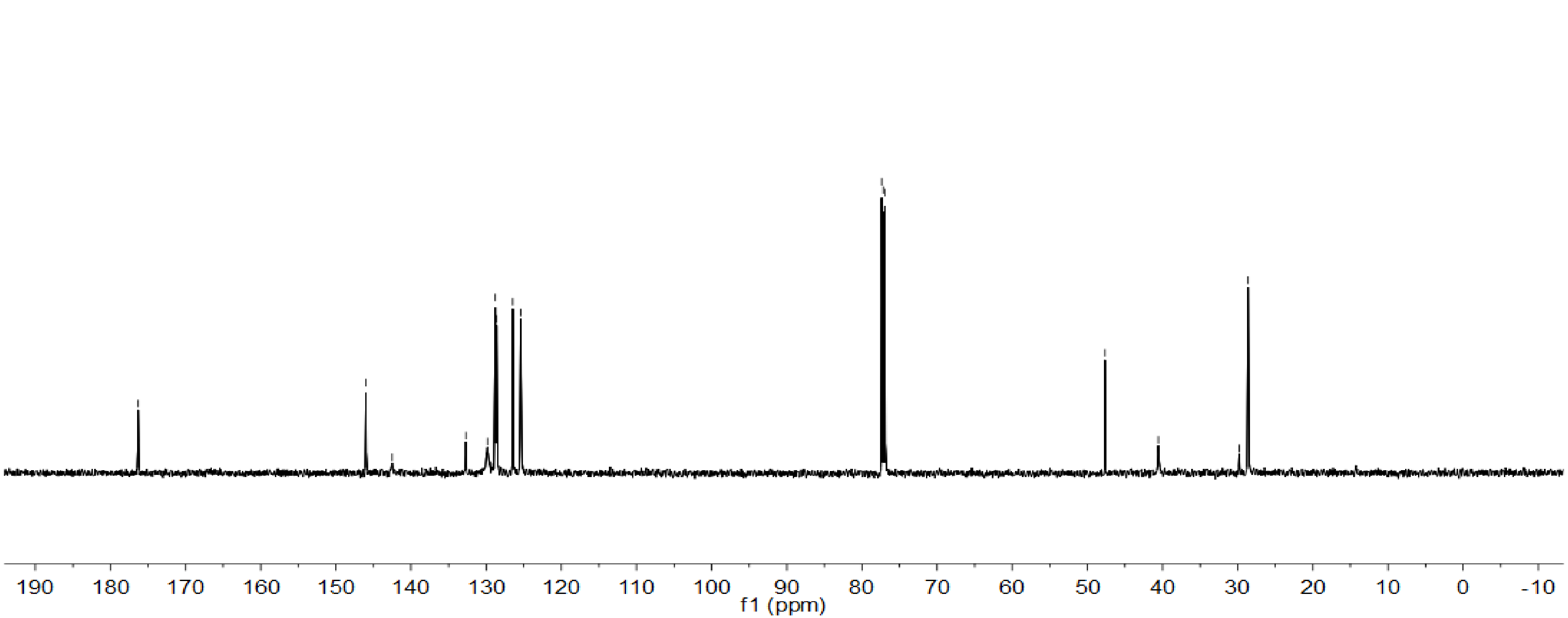


[1]H NMR Spectra (600 MHz, $CDCl_3$) of compound **3av**

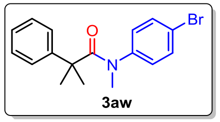


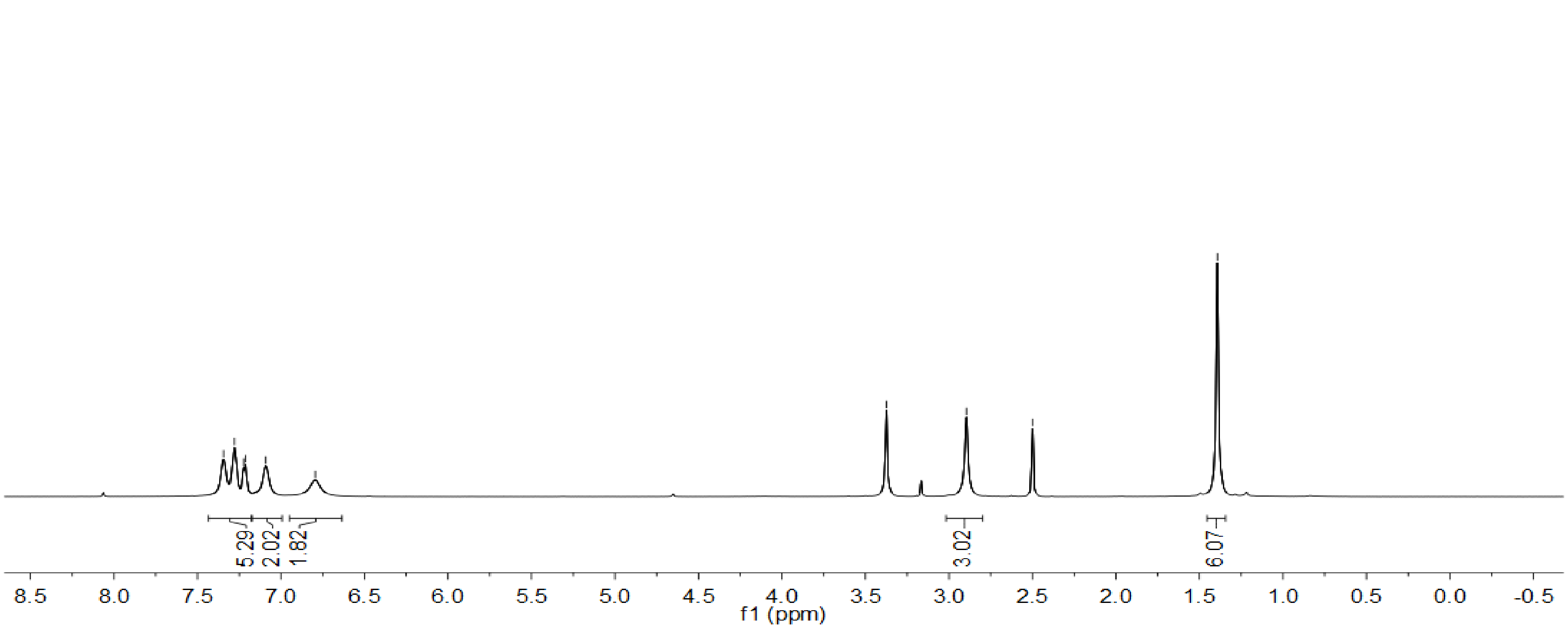
^{13}C NMR Spectra (151 MHz, $CDCl_3$) of compound **3av**



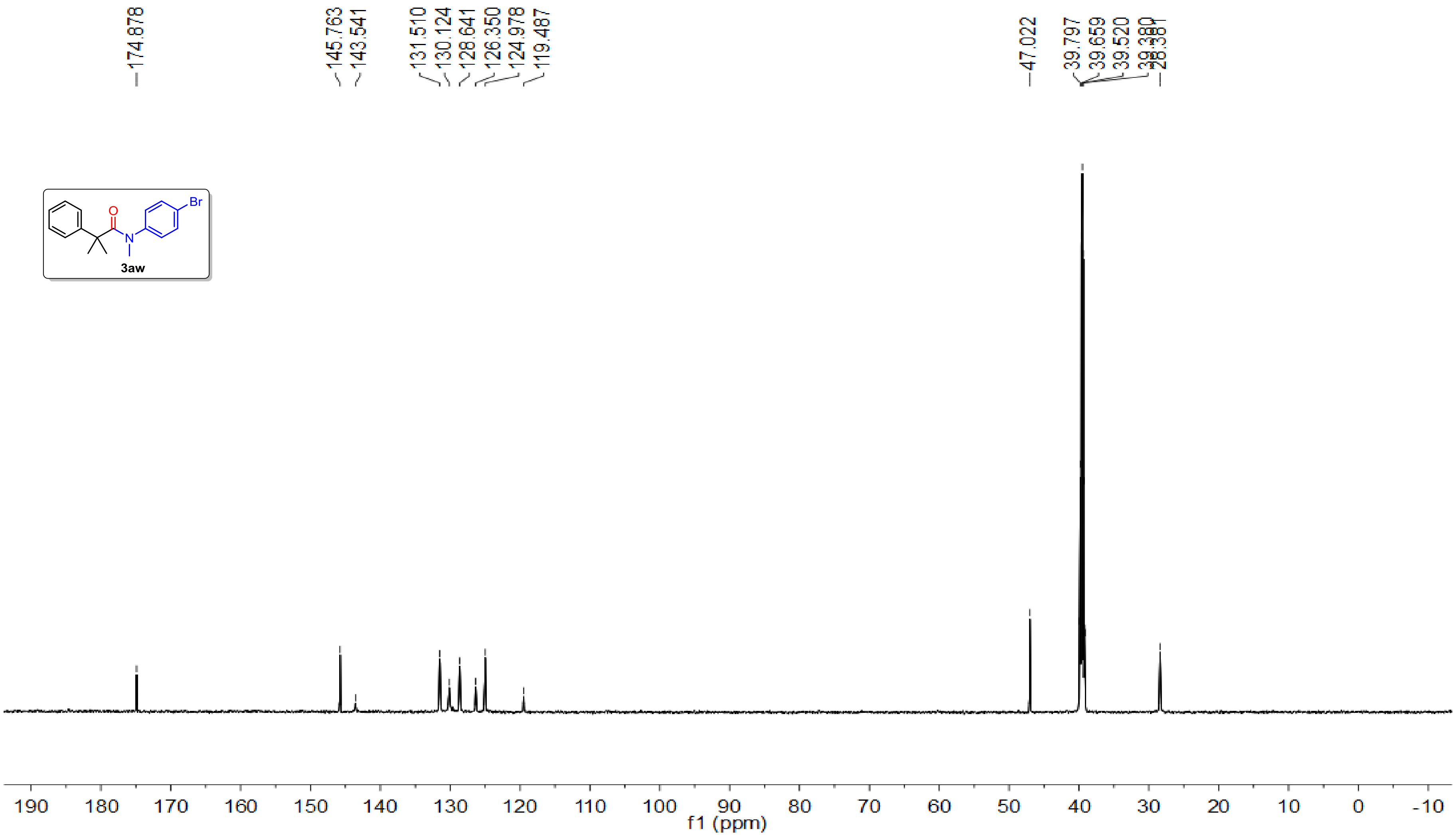


^{1}H NMR Spectra (600 MHz, d^{6}-DMSO) of compound **3aw**

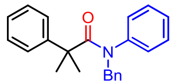




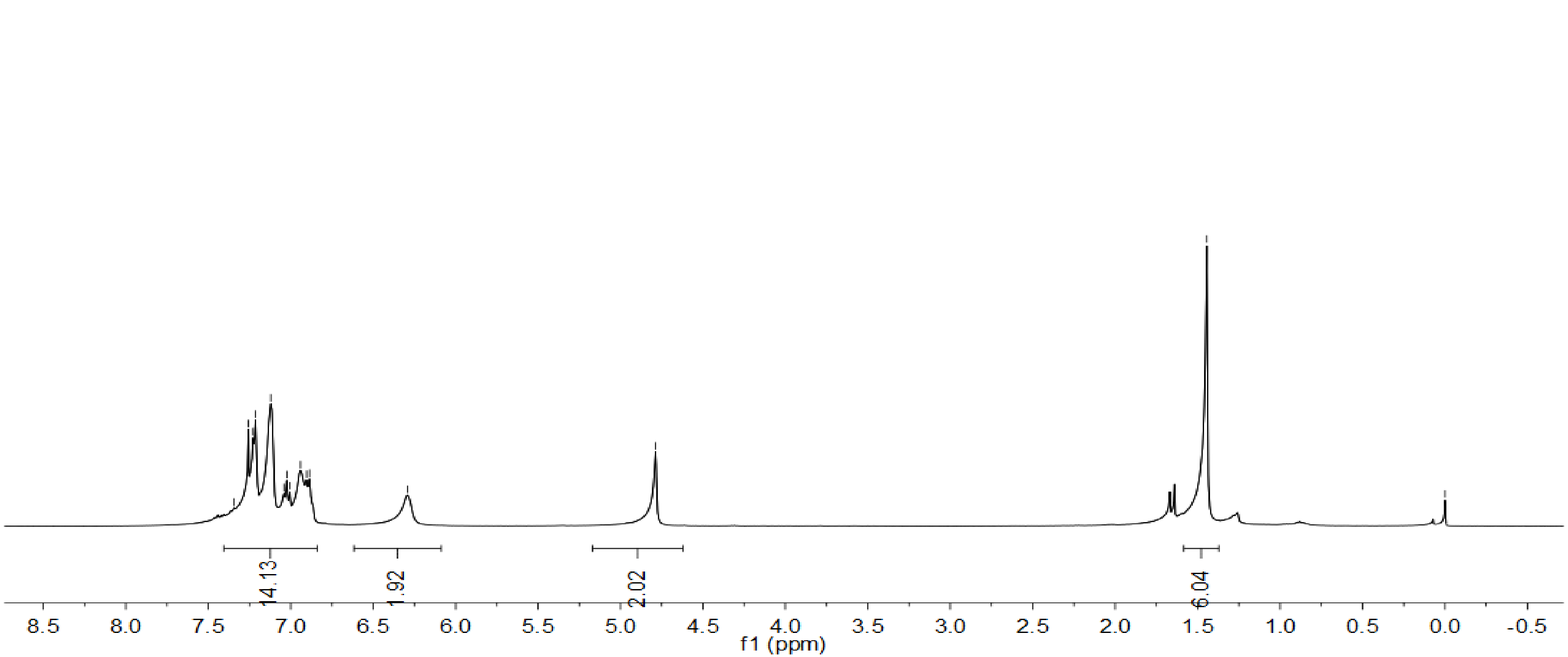
^{13}C NMR Spectra (151 MHz, d^6-DMSO) of compound **3aw**



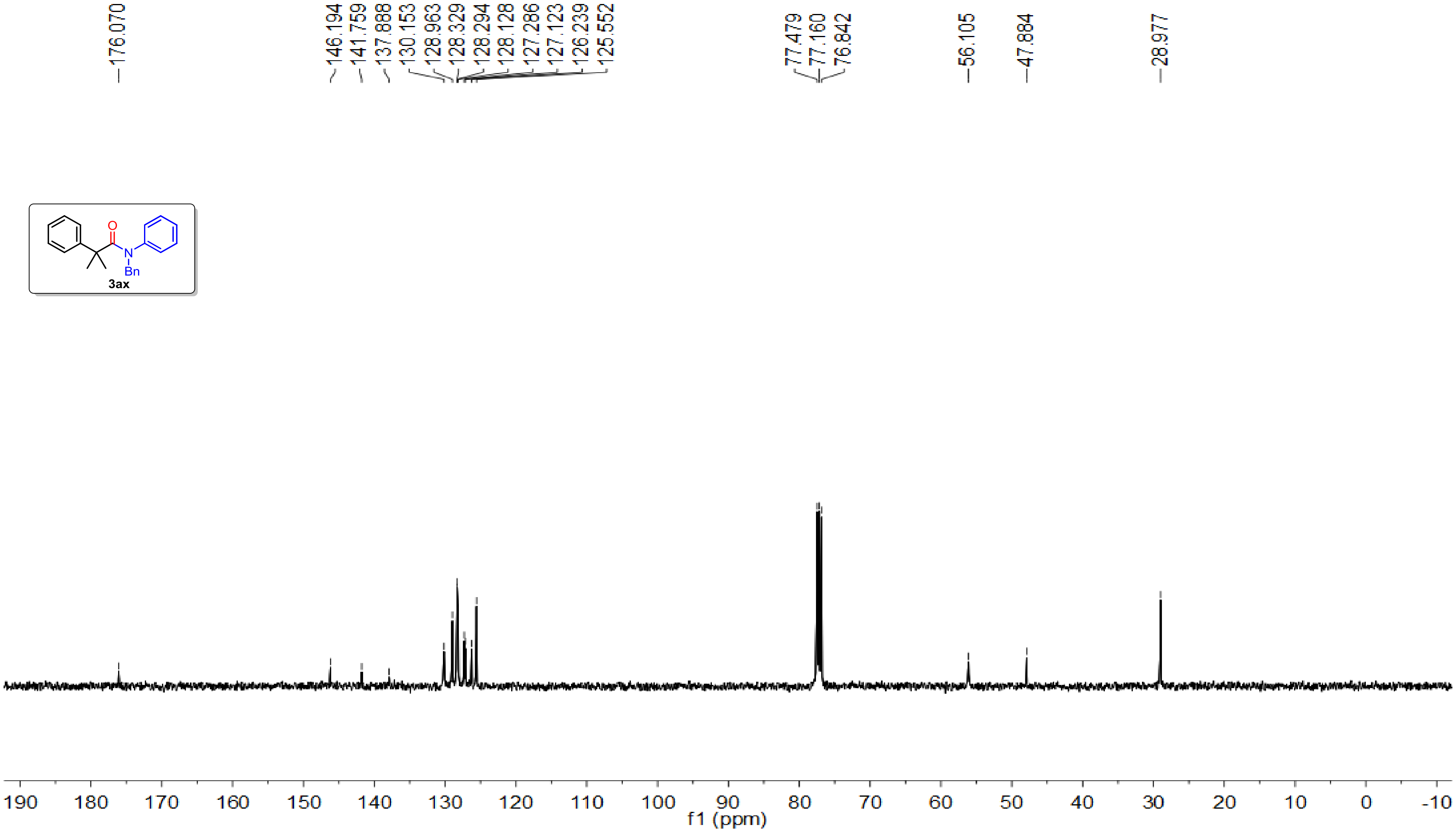
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ax**



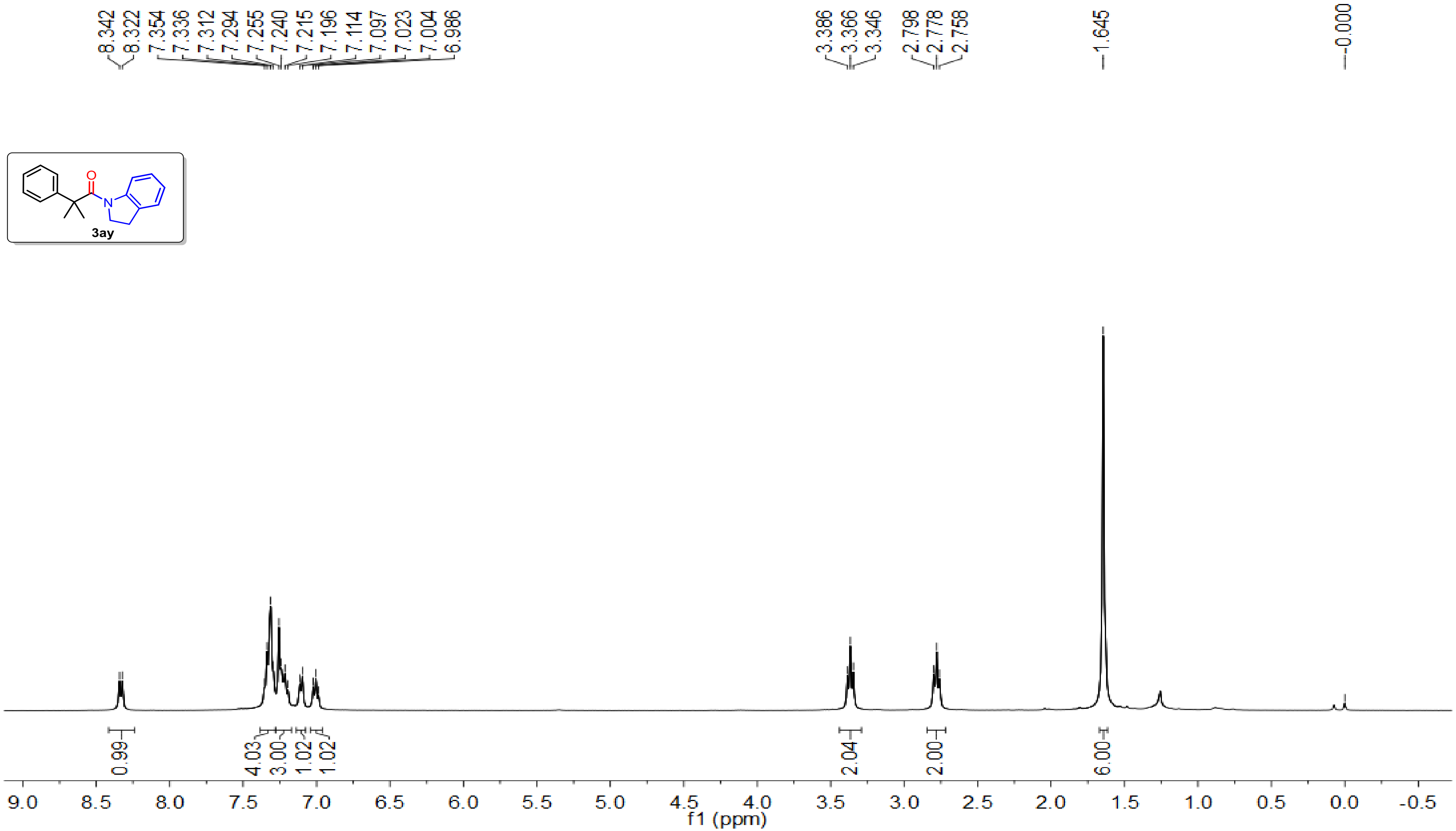
3ax



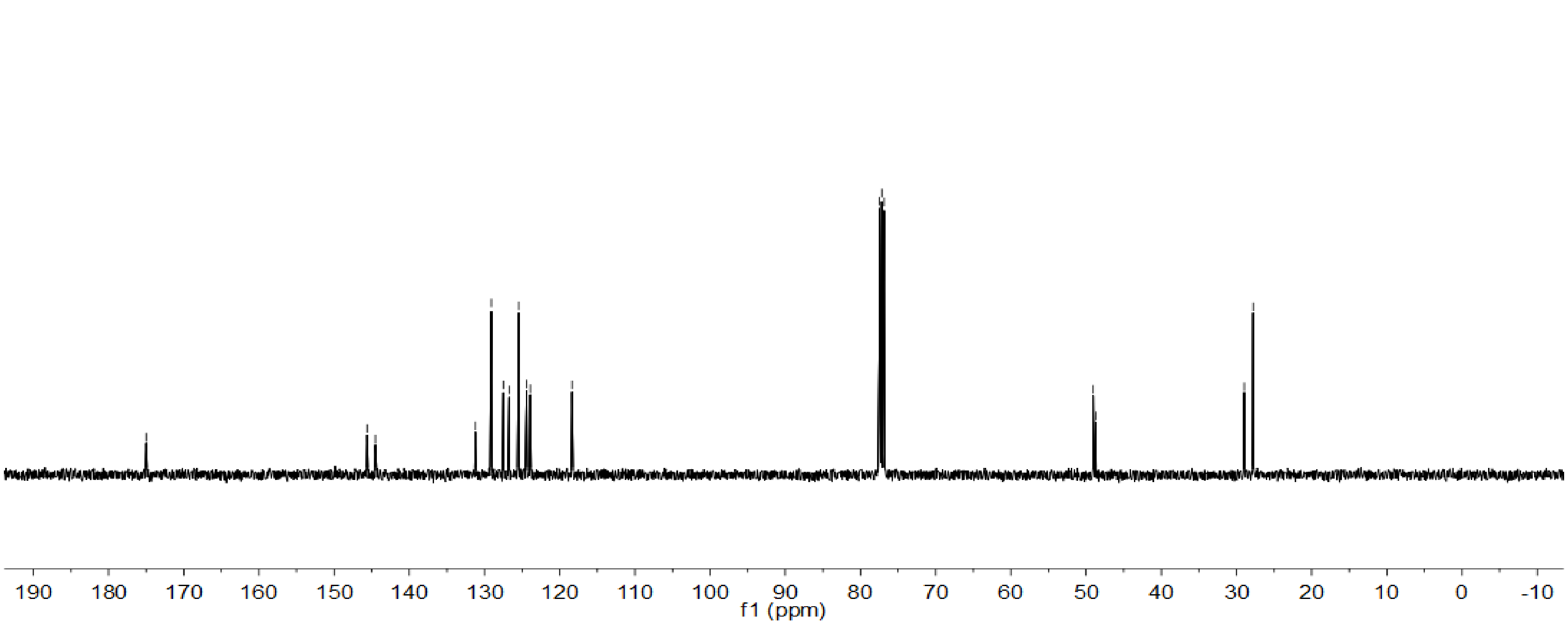
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ax**

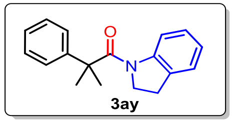


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ay**

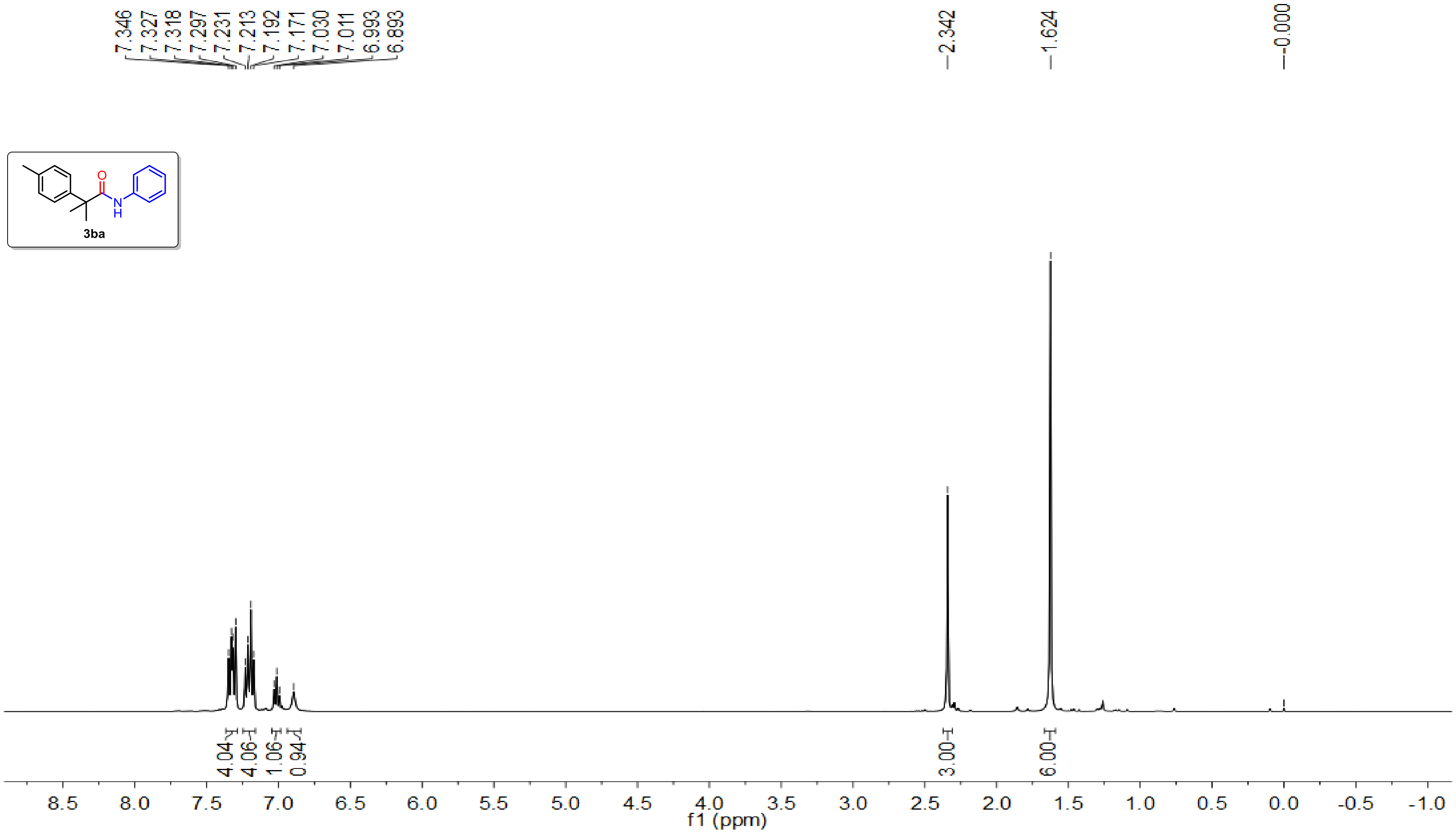


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ay**

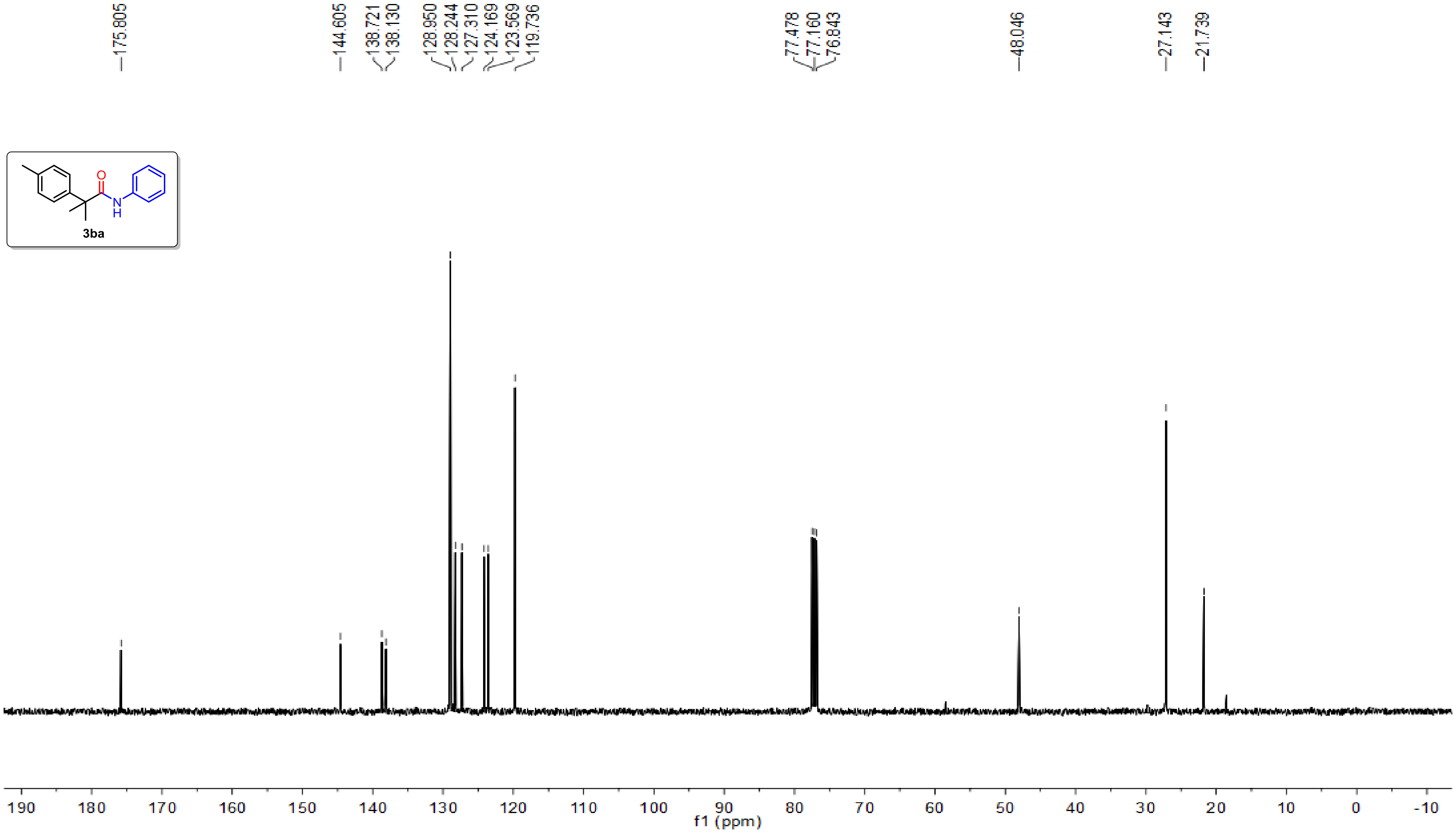




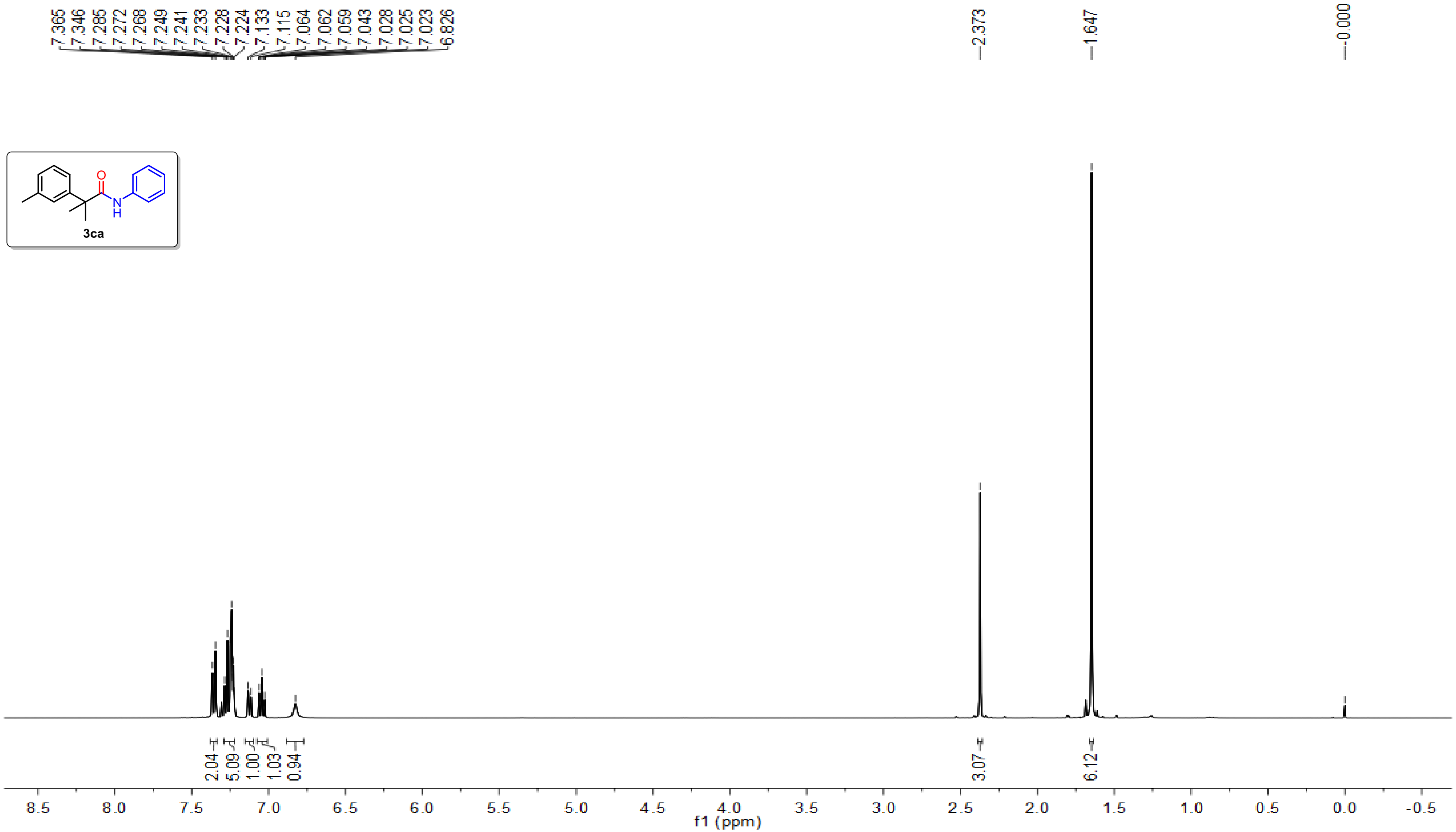
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ba**



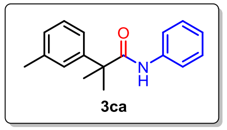
[13]C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ba**

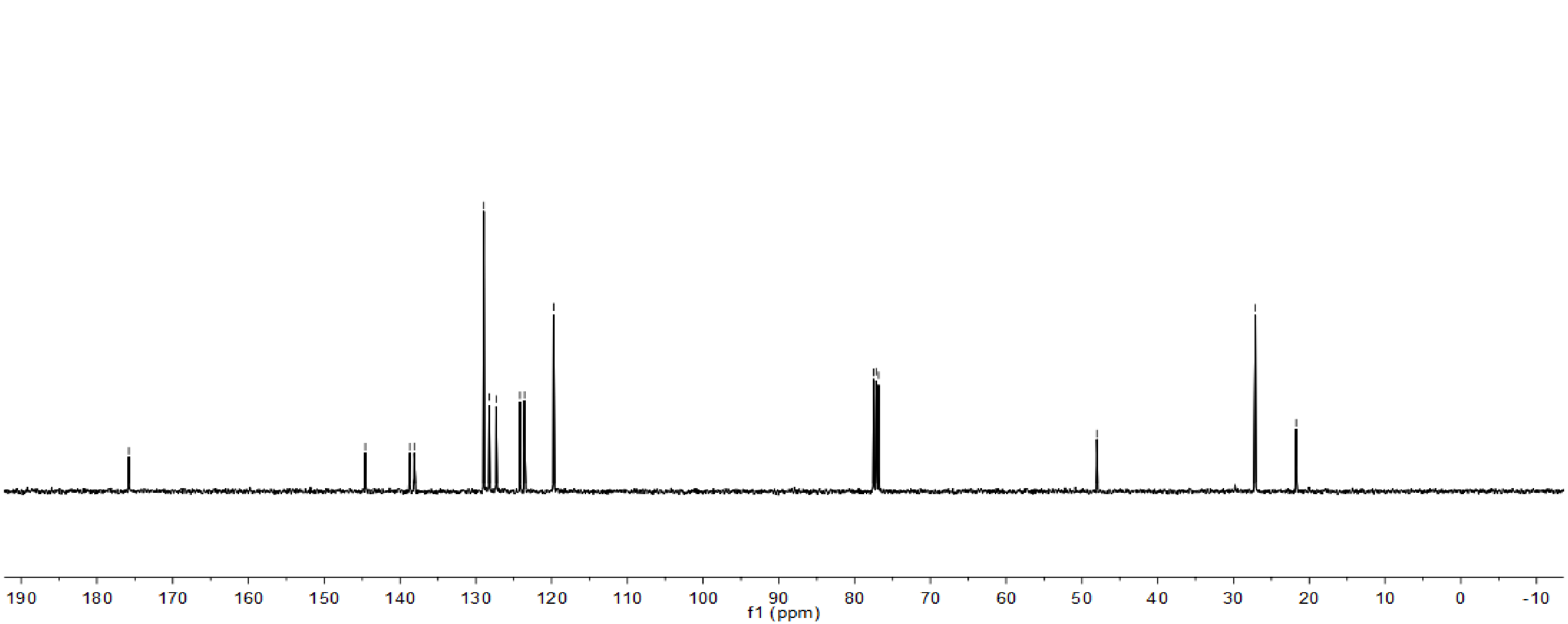


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ca**

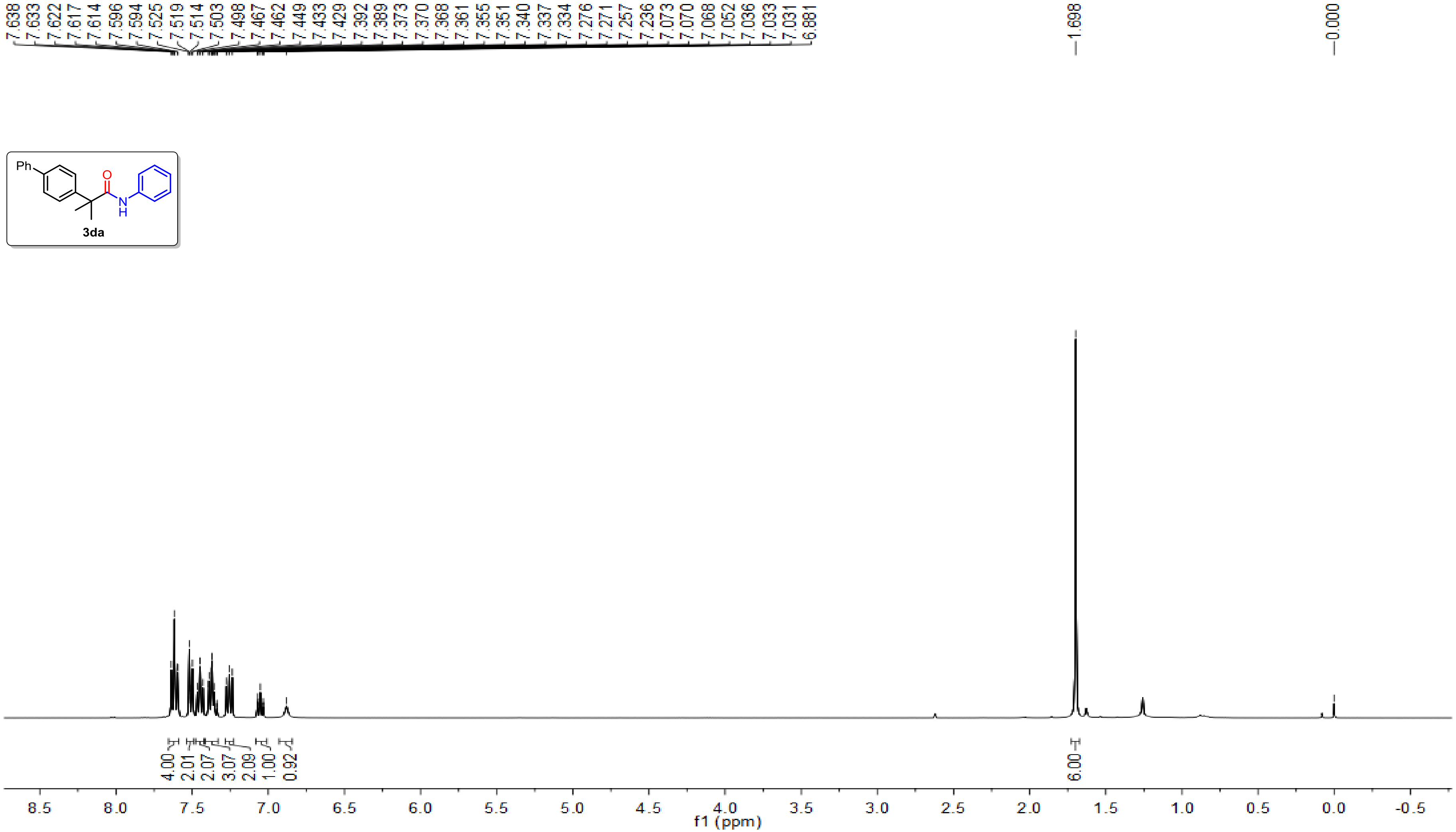


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ca**

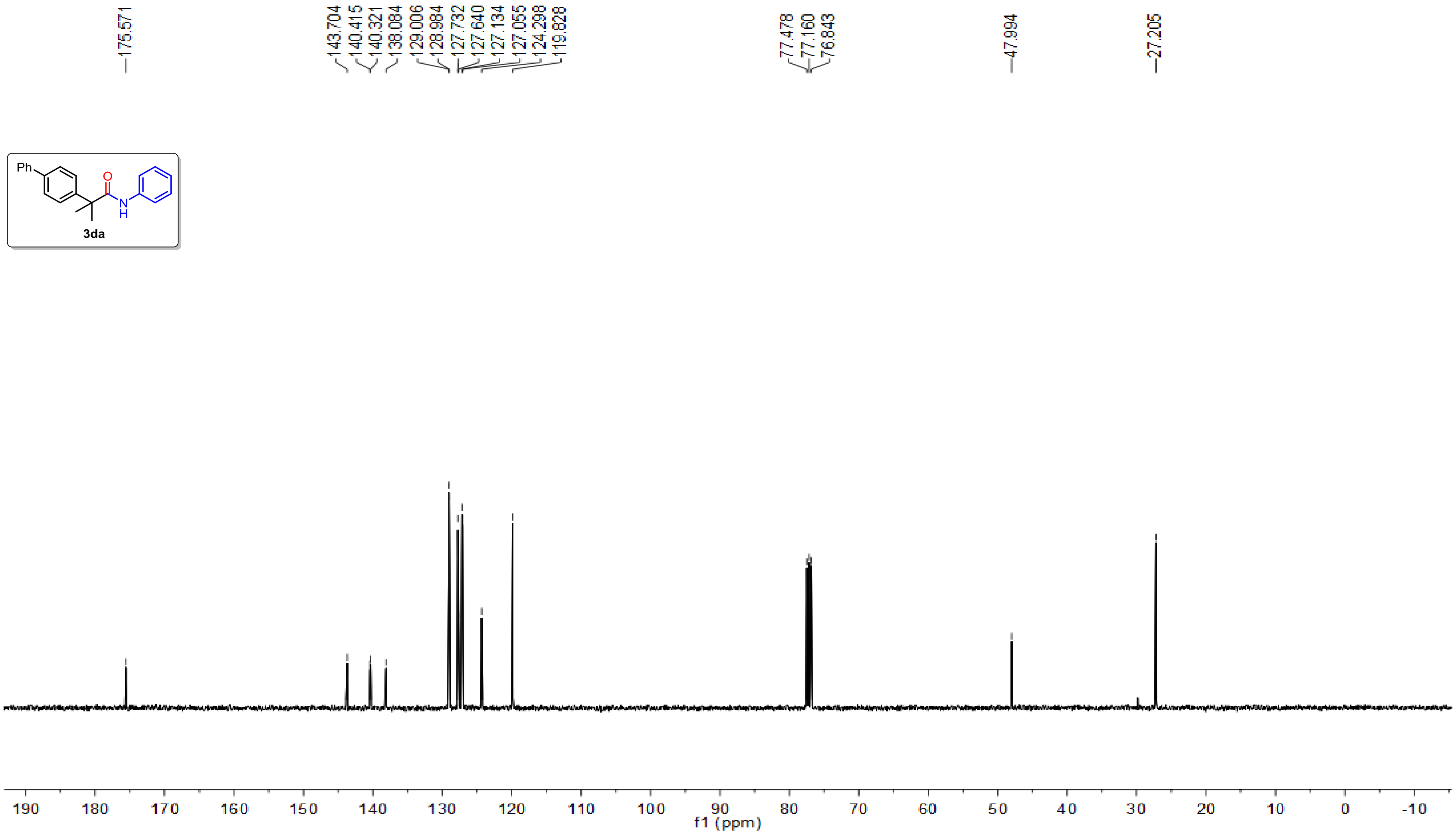




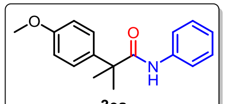
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ca**



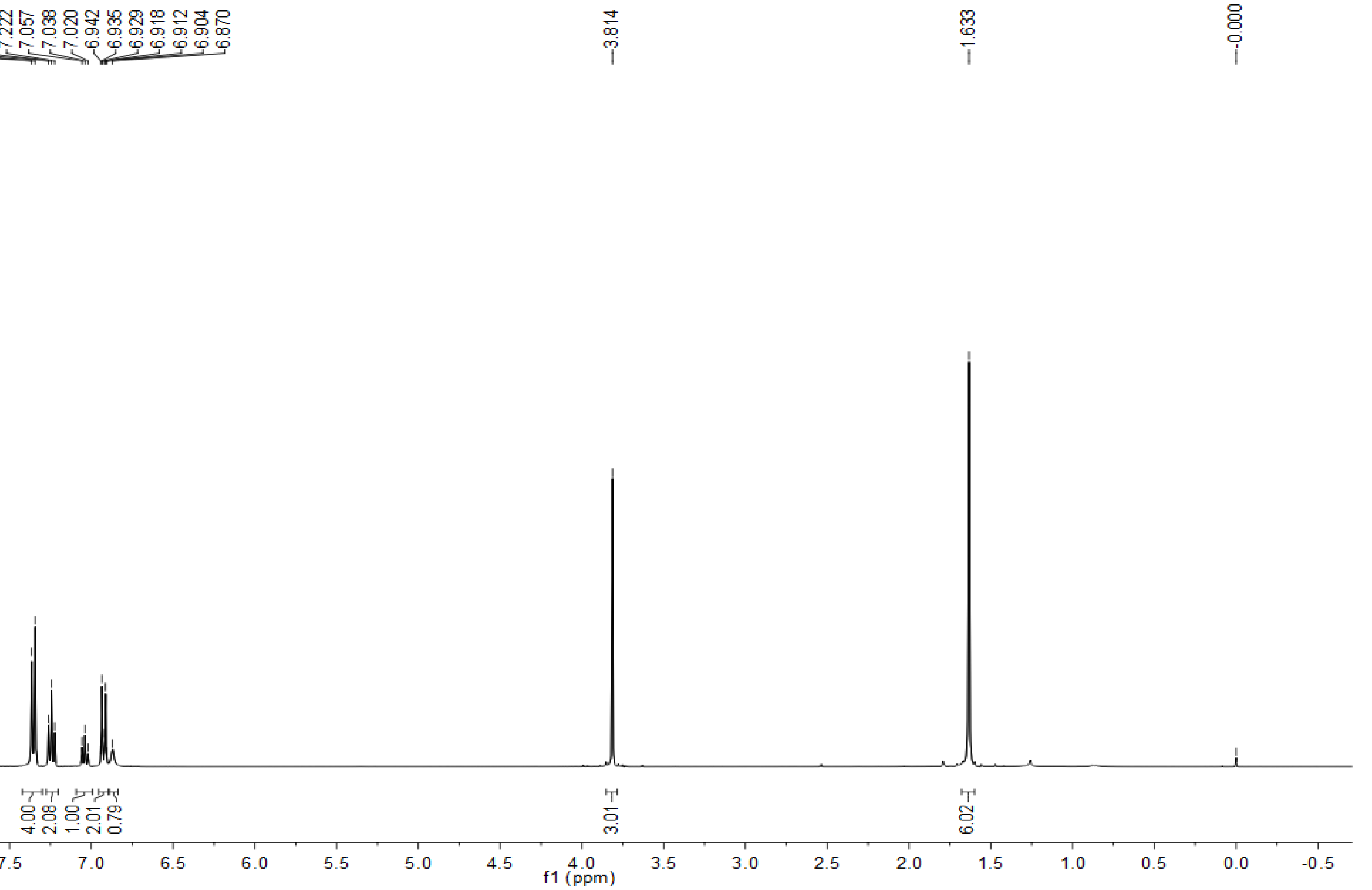
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3da**



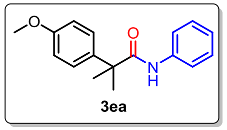
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ea**



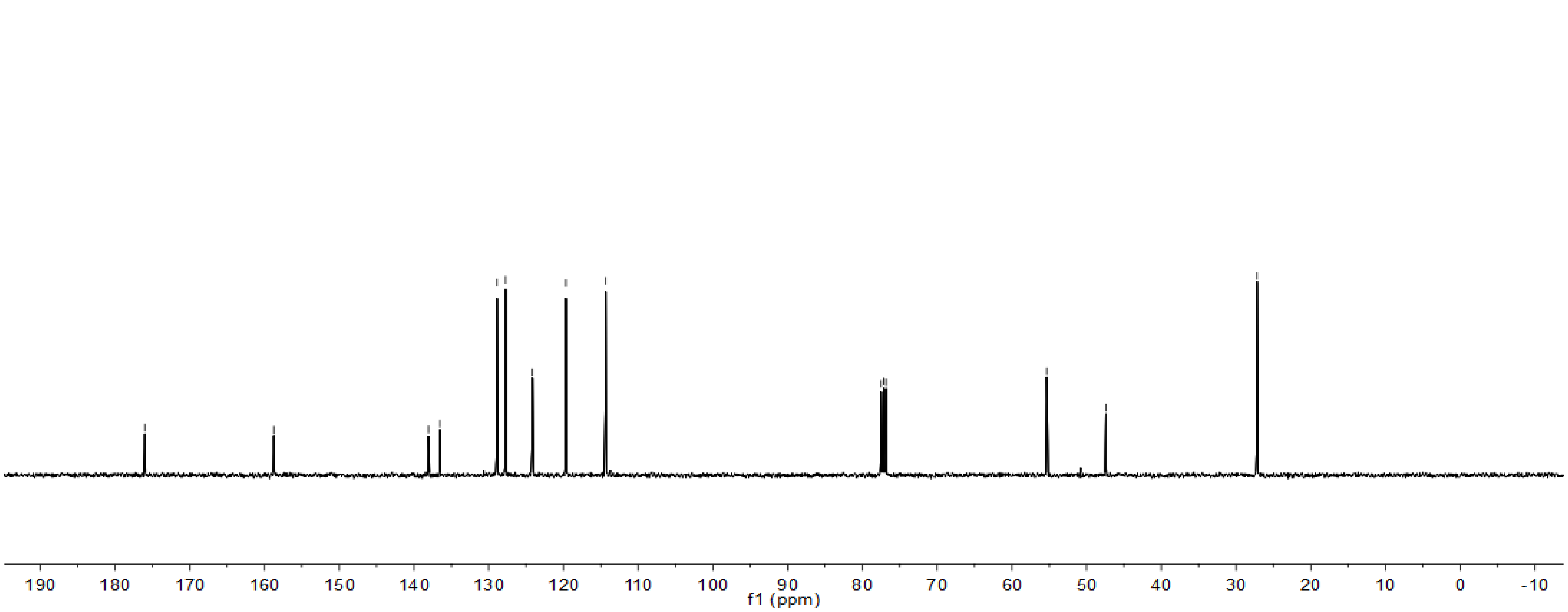
3ea



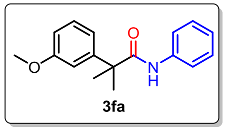
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ea**



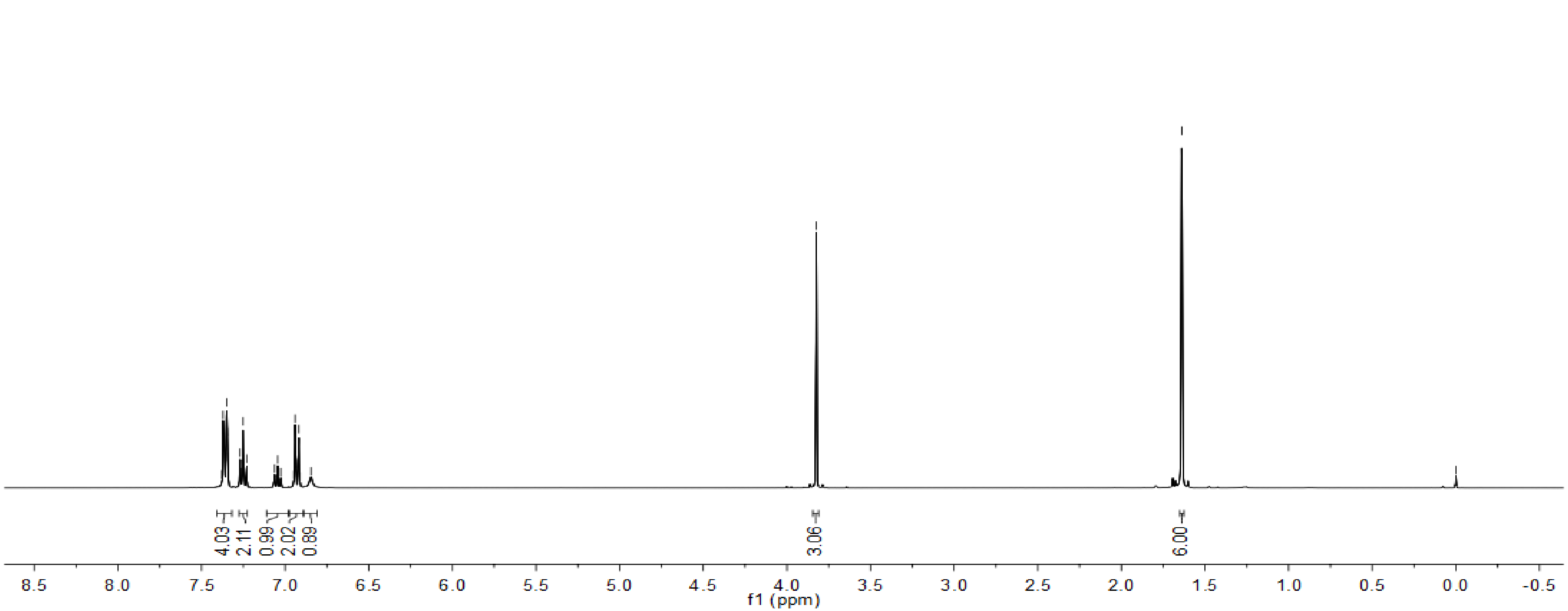
3ea



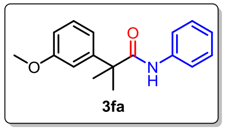
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3fa**

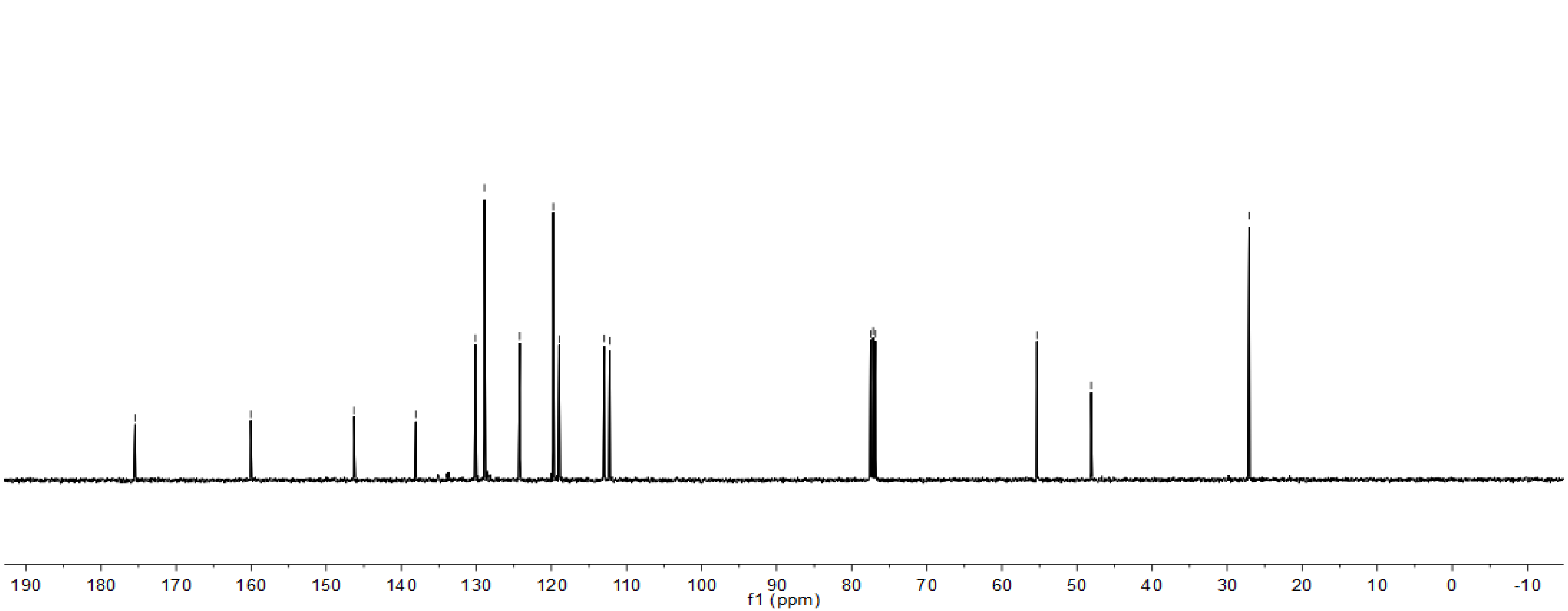


3fa

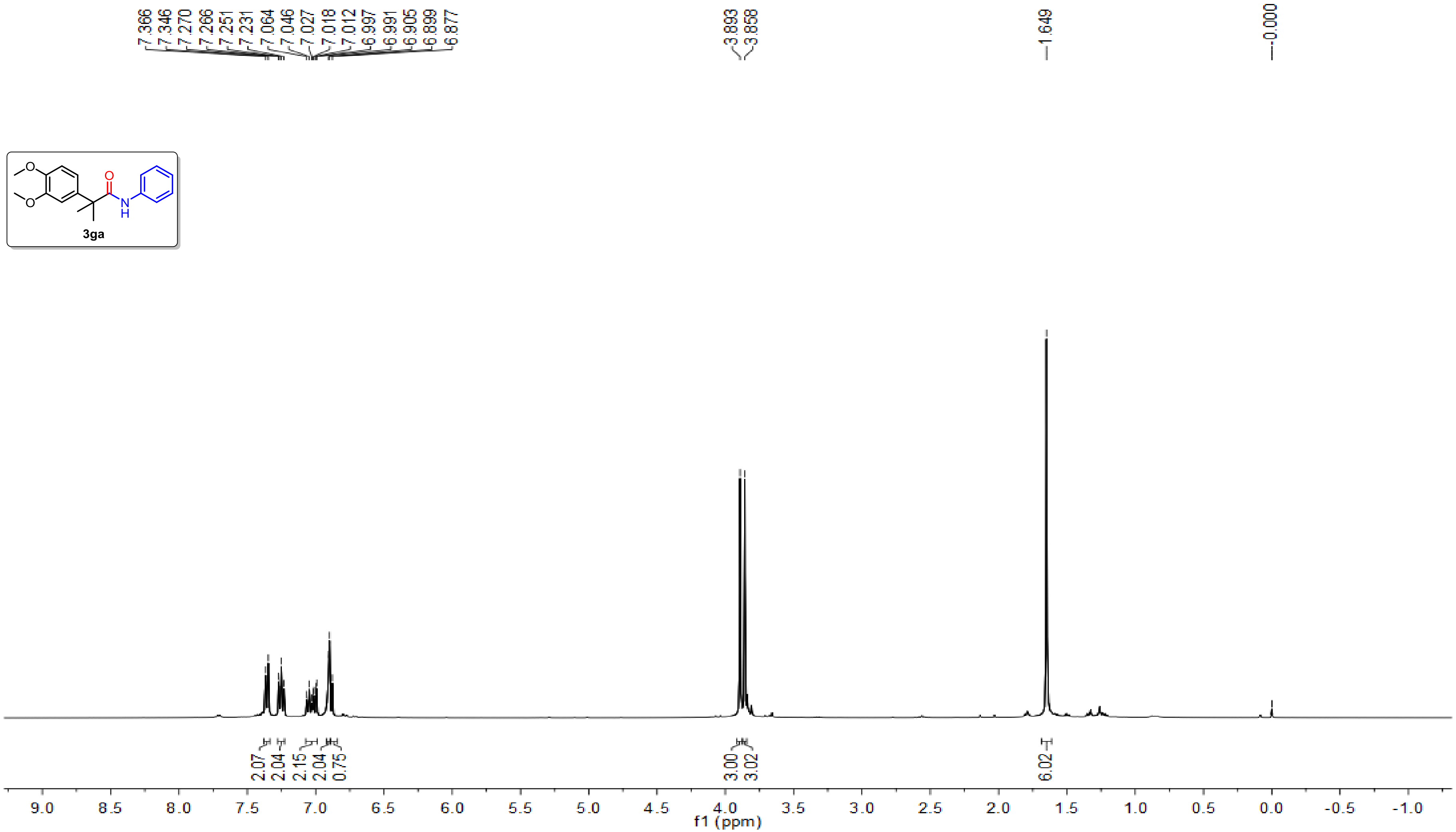


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3fa**

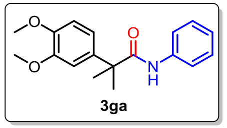


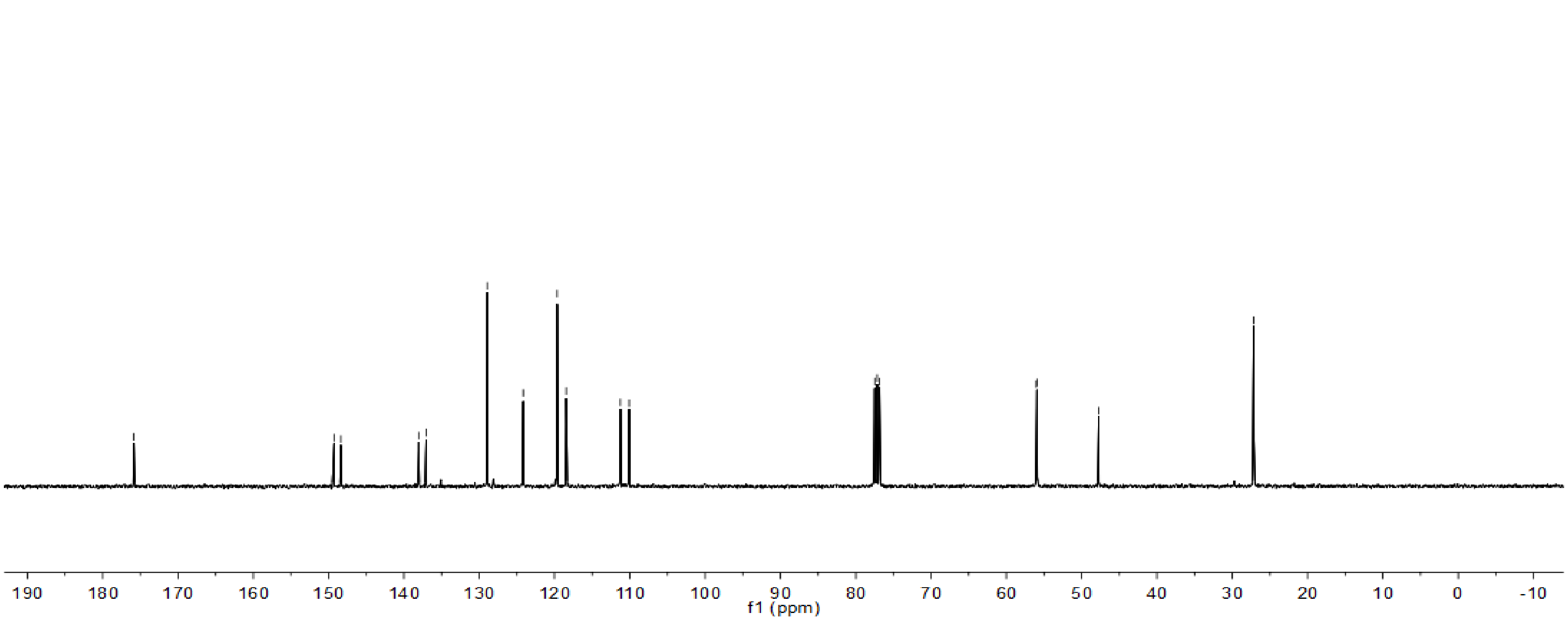


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ga**

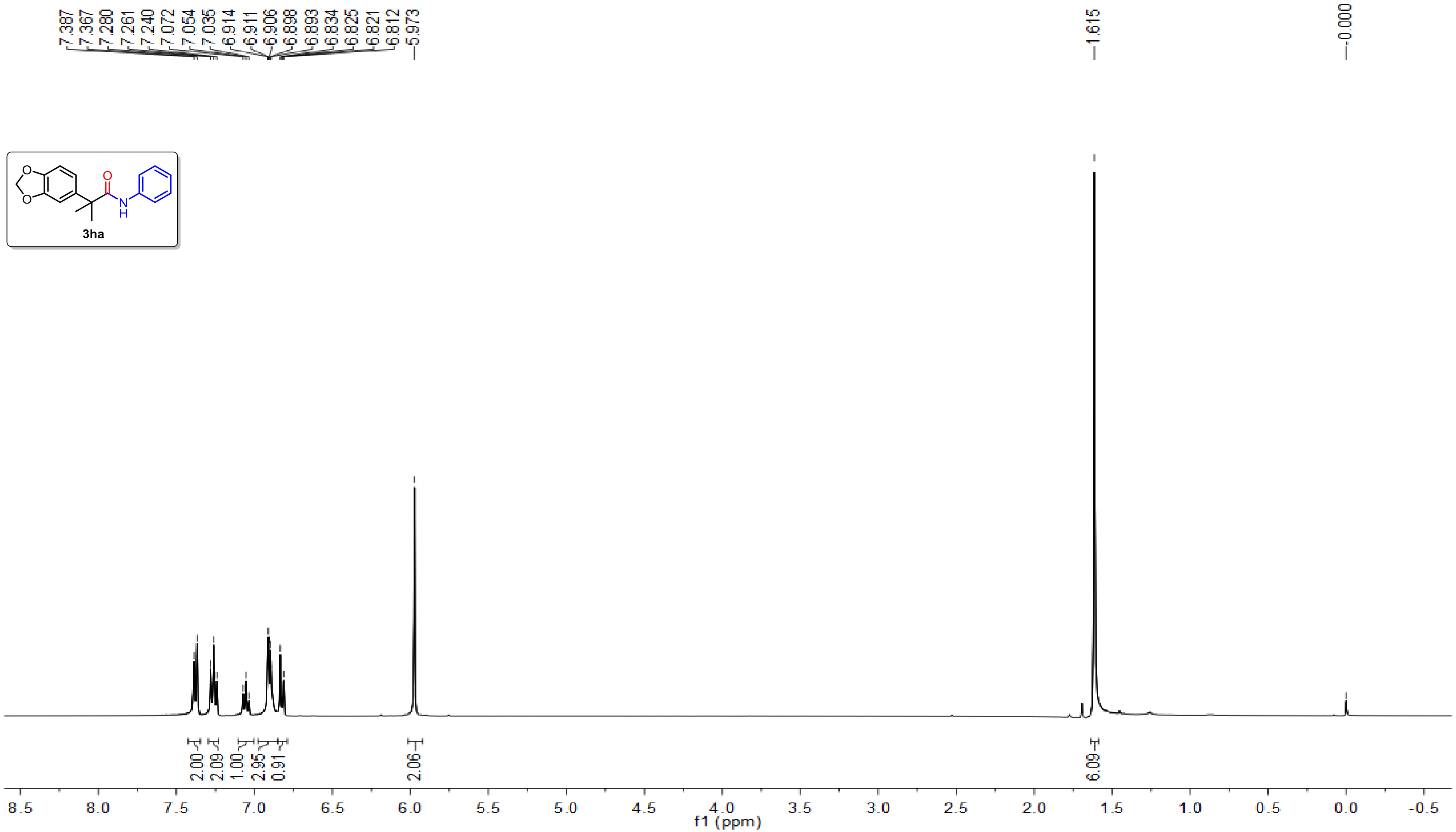


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ga**

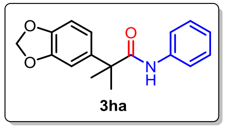


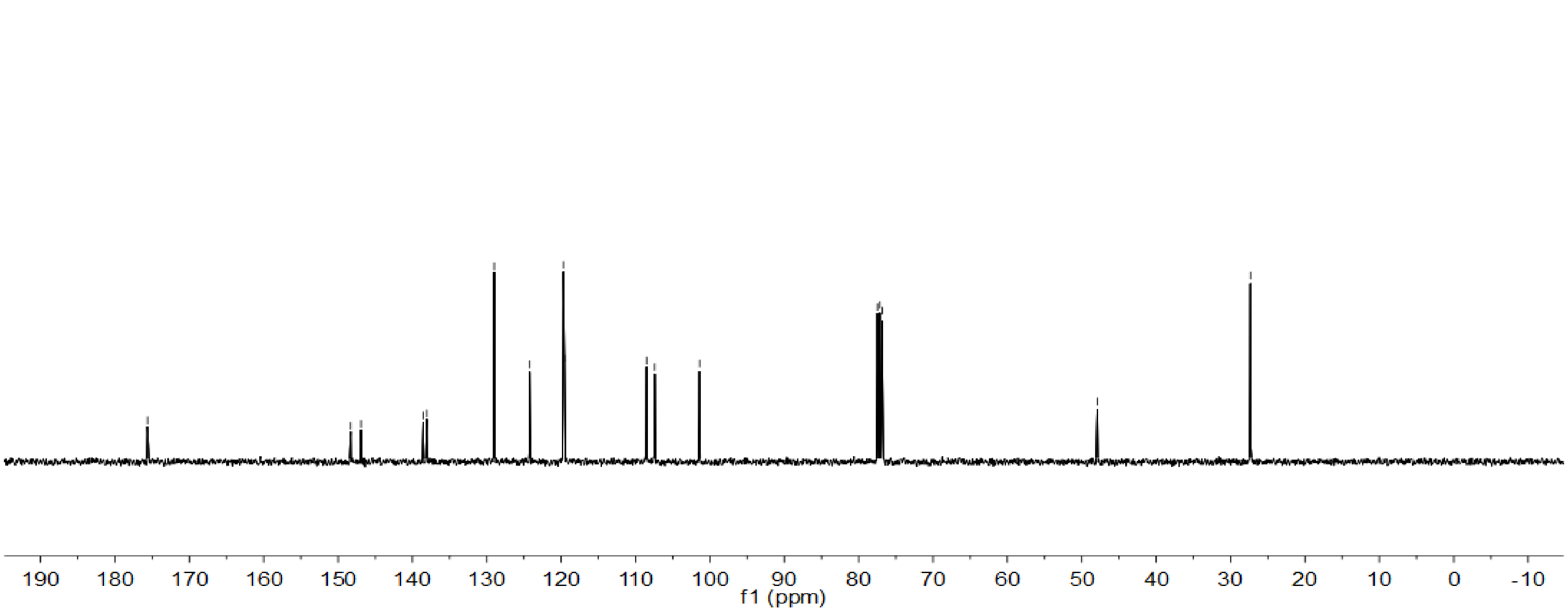


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ha**

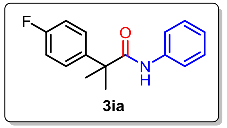


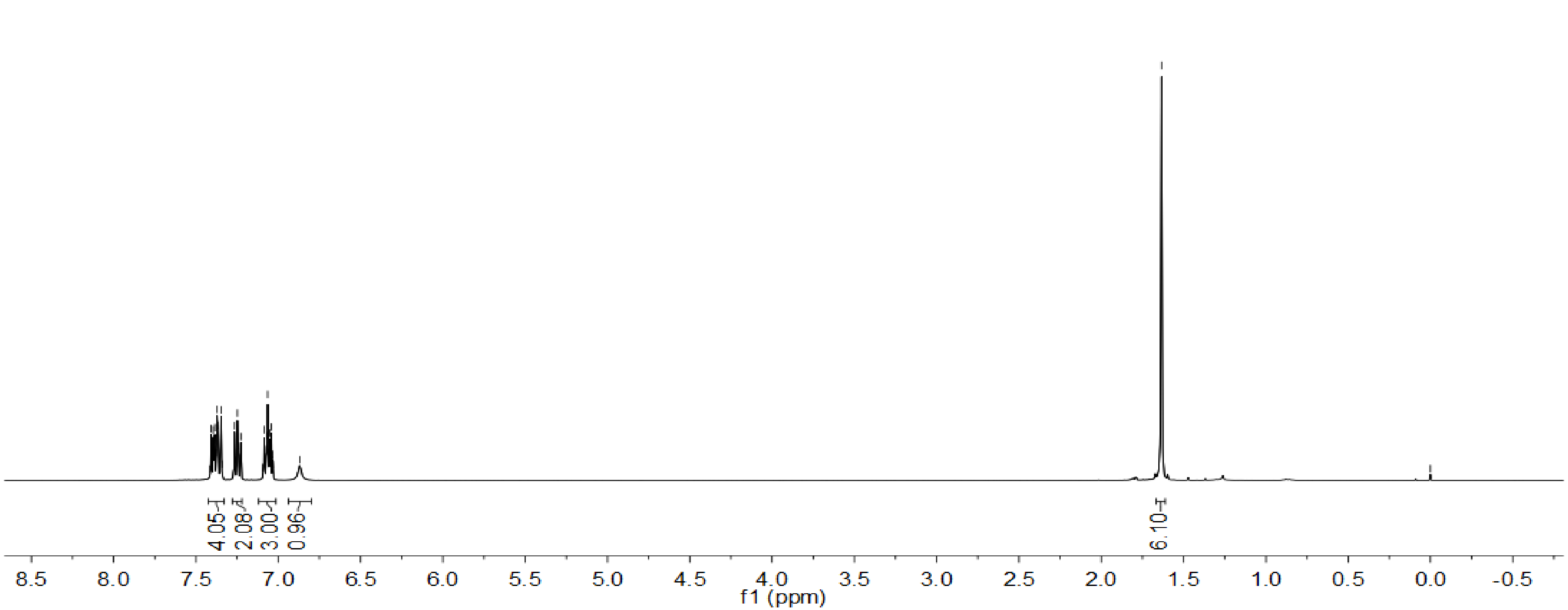
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ha**



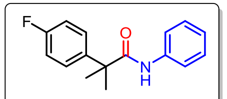


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ia**

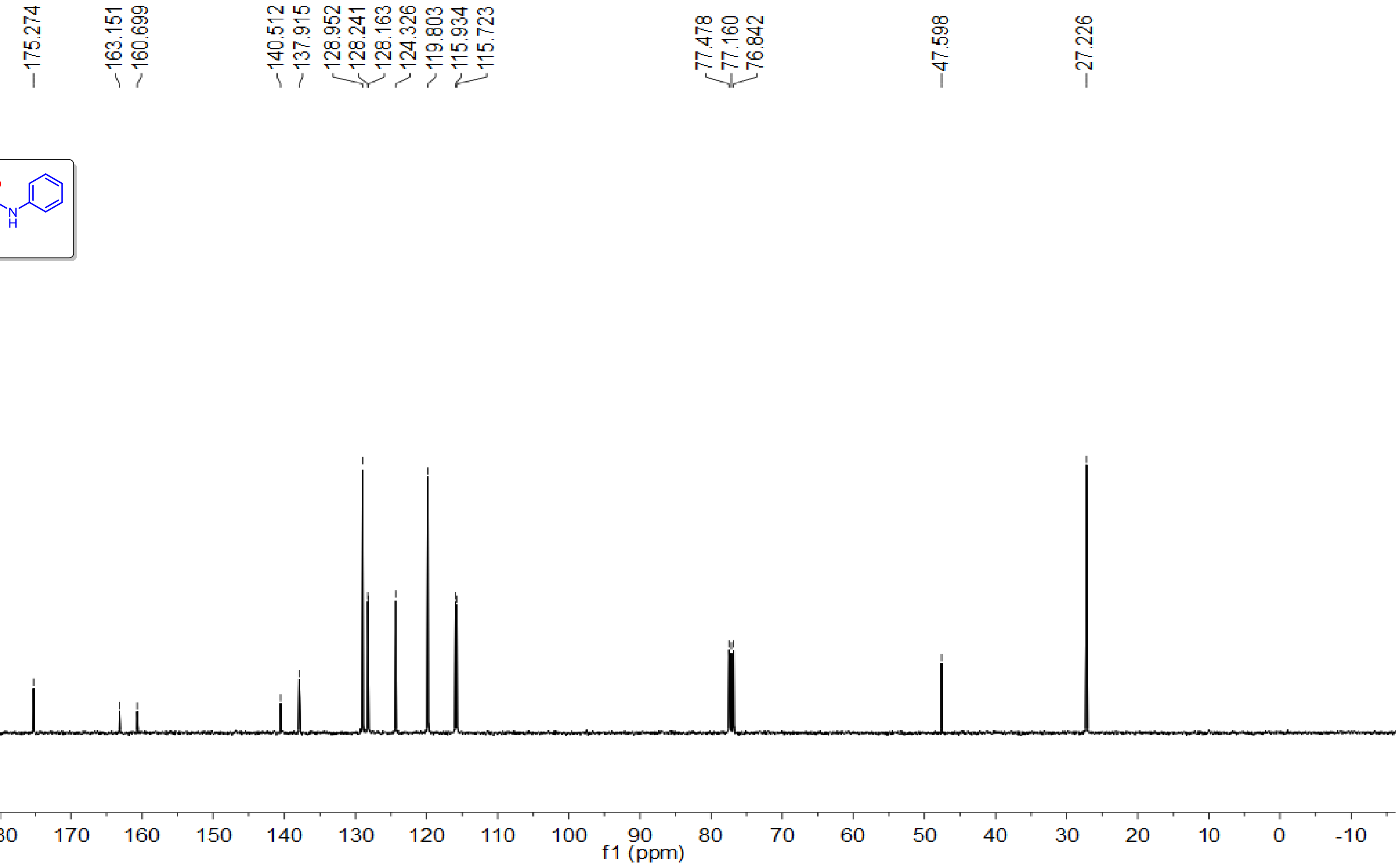




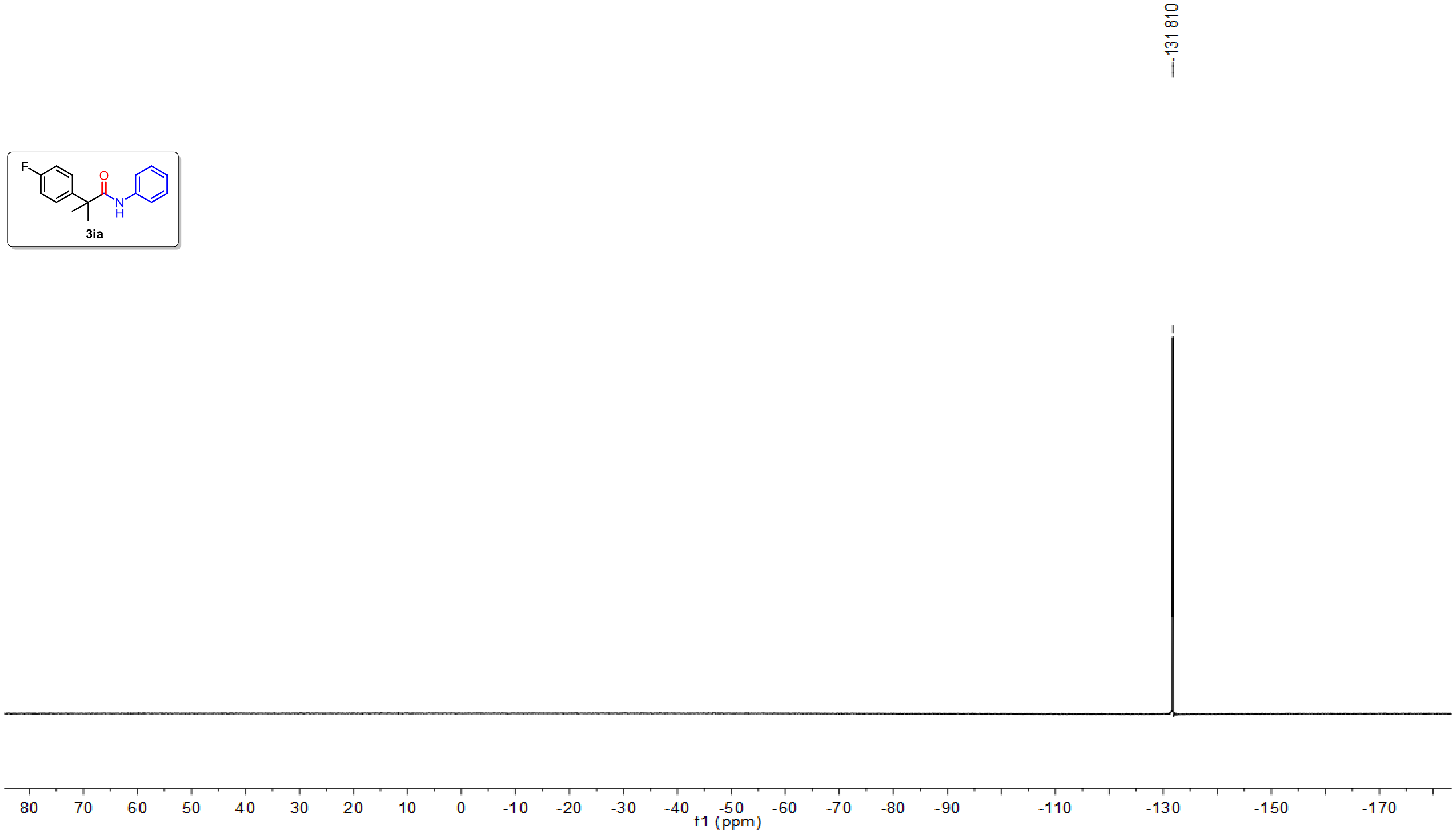
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ia**



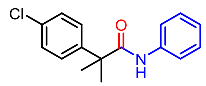
3ia



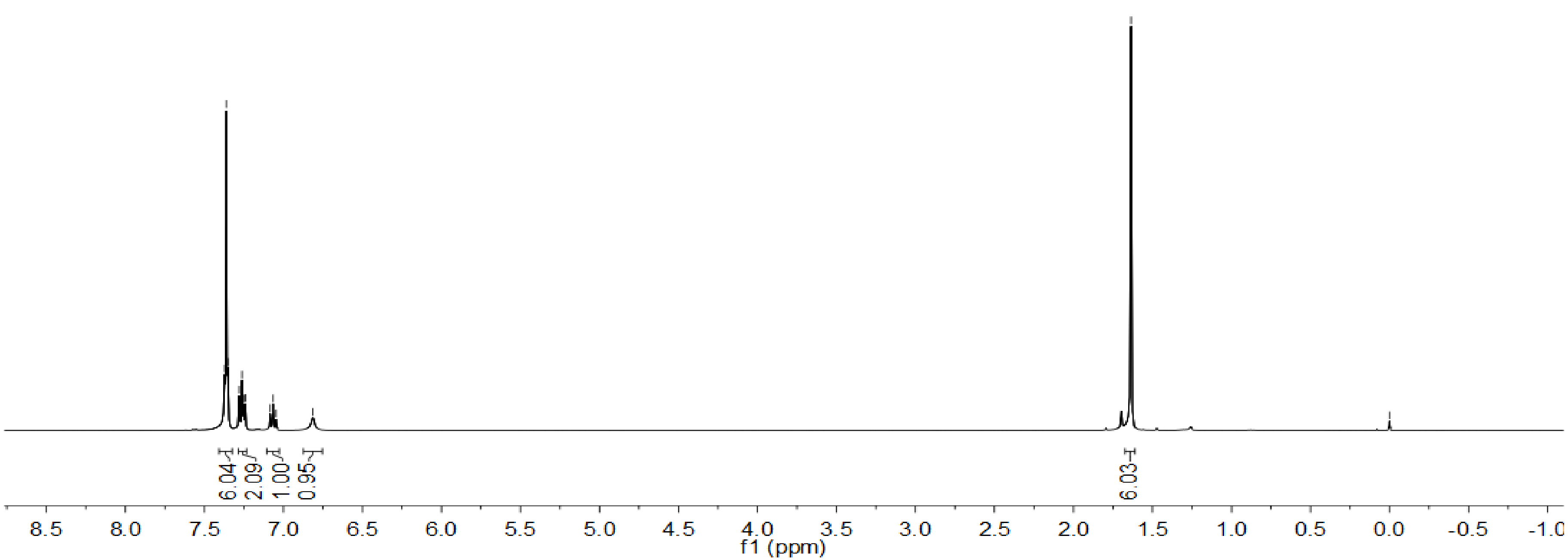
^{19}F NMR Spectra (375 MHz, $CDCl_3$) of compound **3ia**



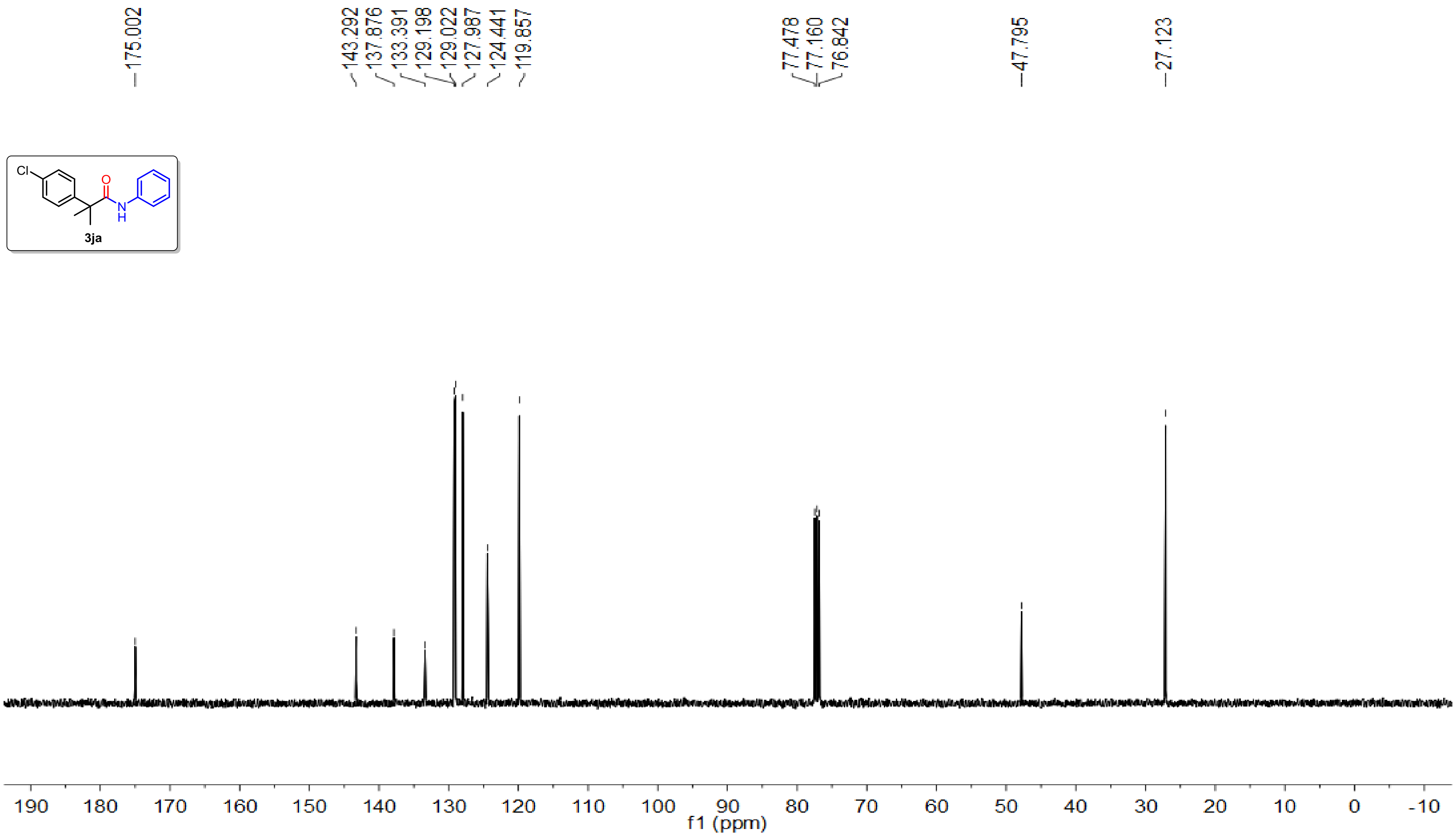
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ja**



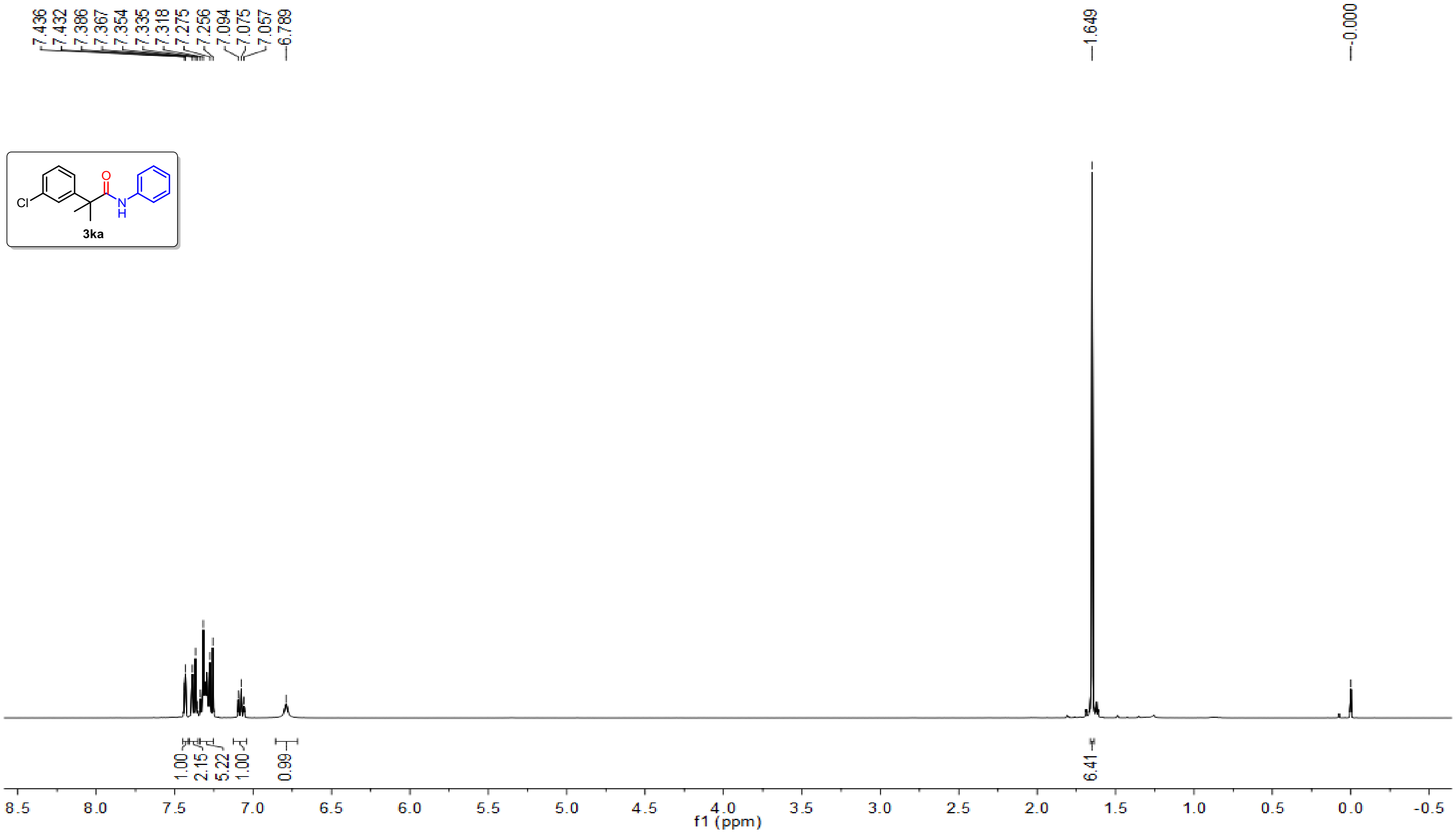
3ja



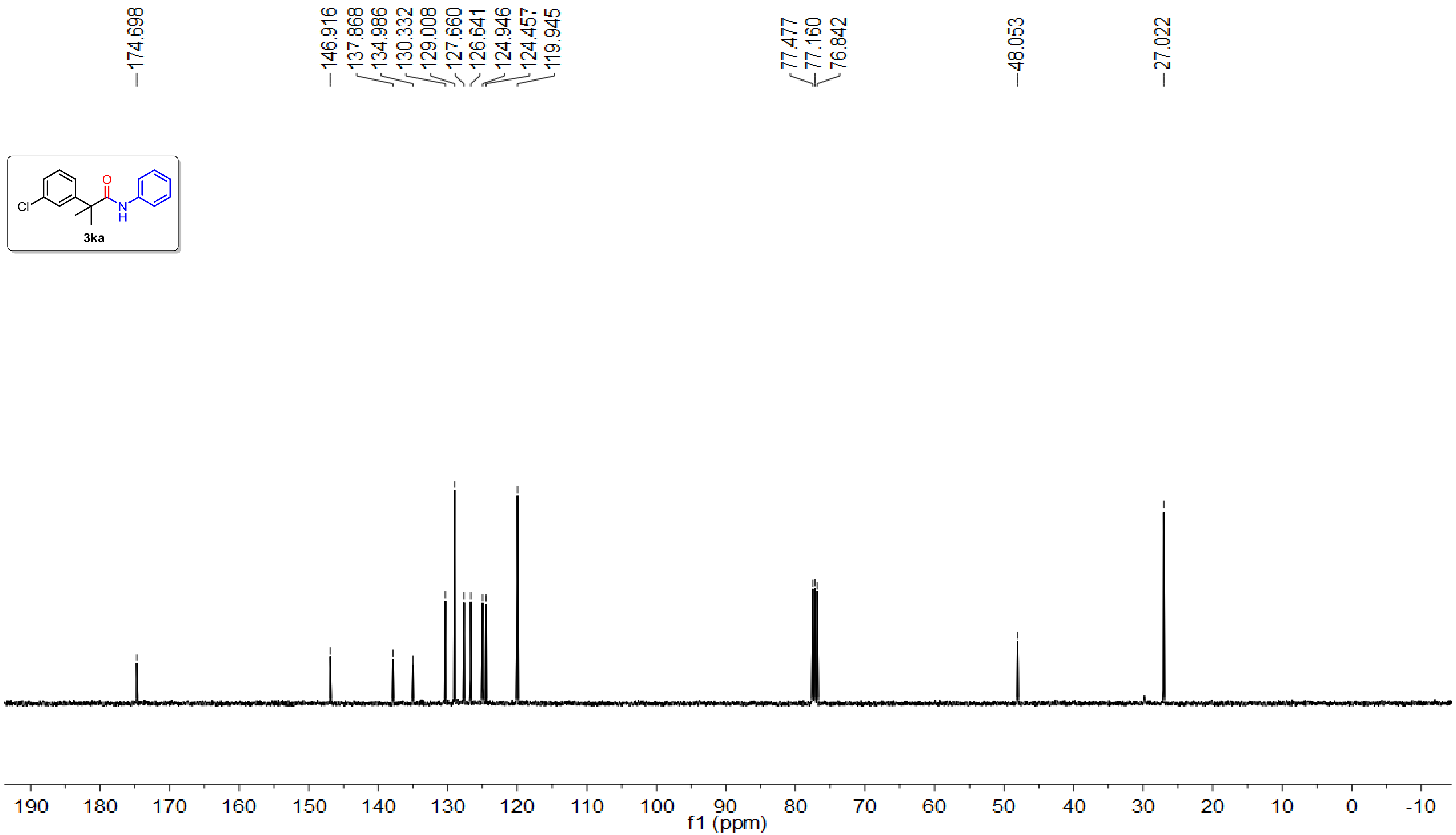
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ja**



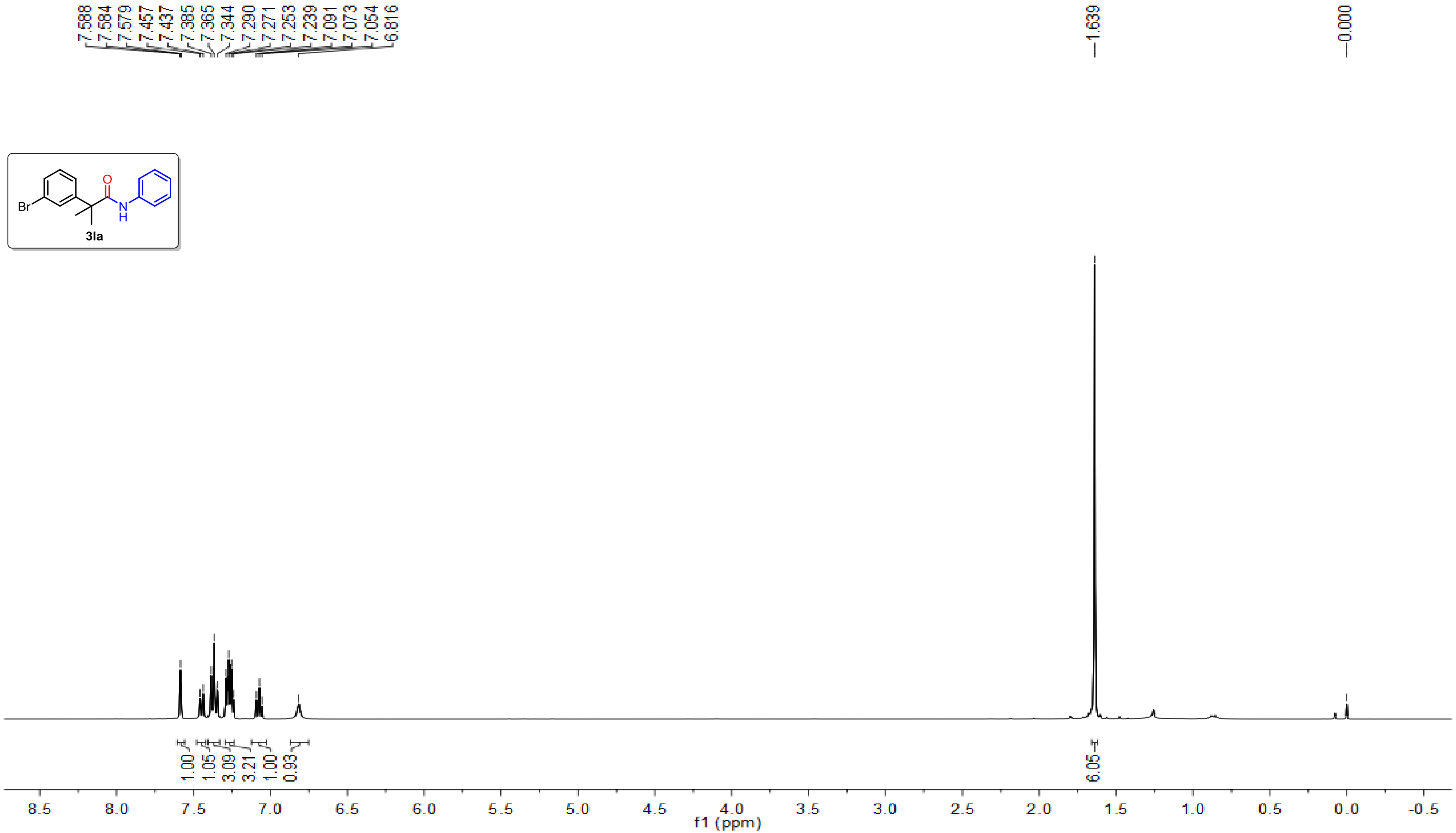
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ka**



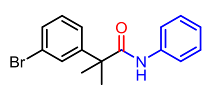
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ka**



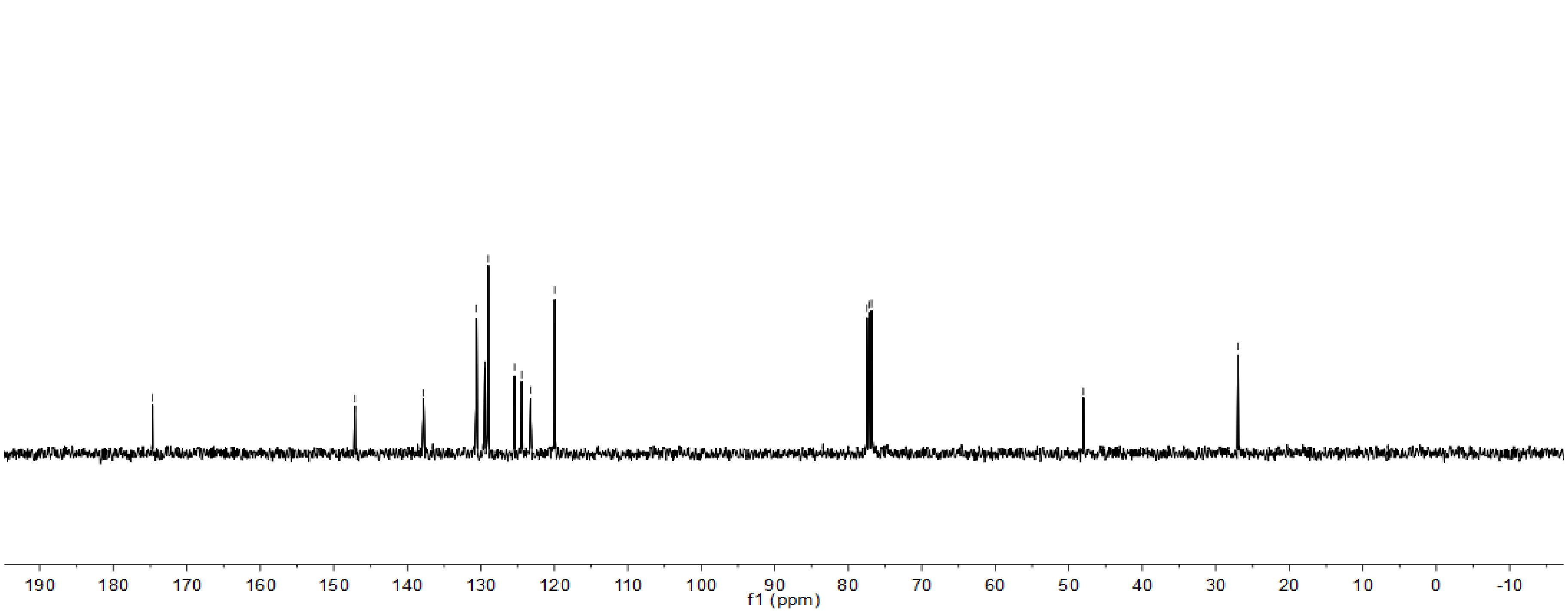
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3la**



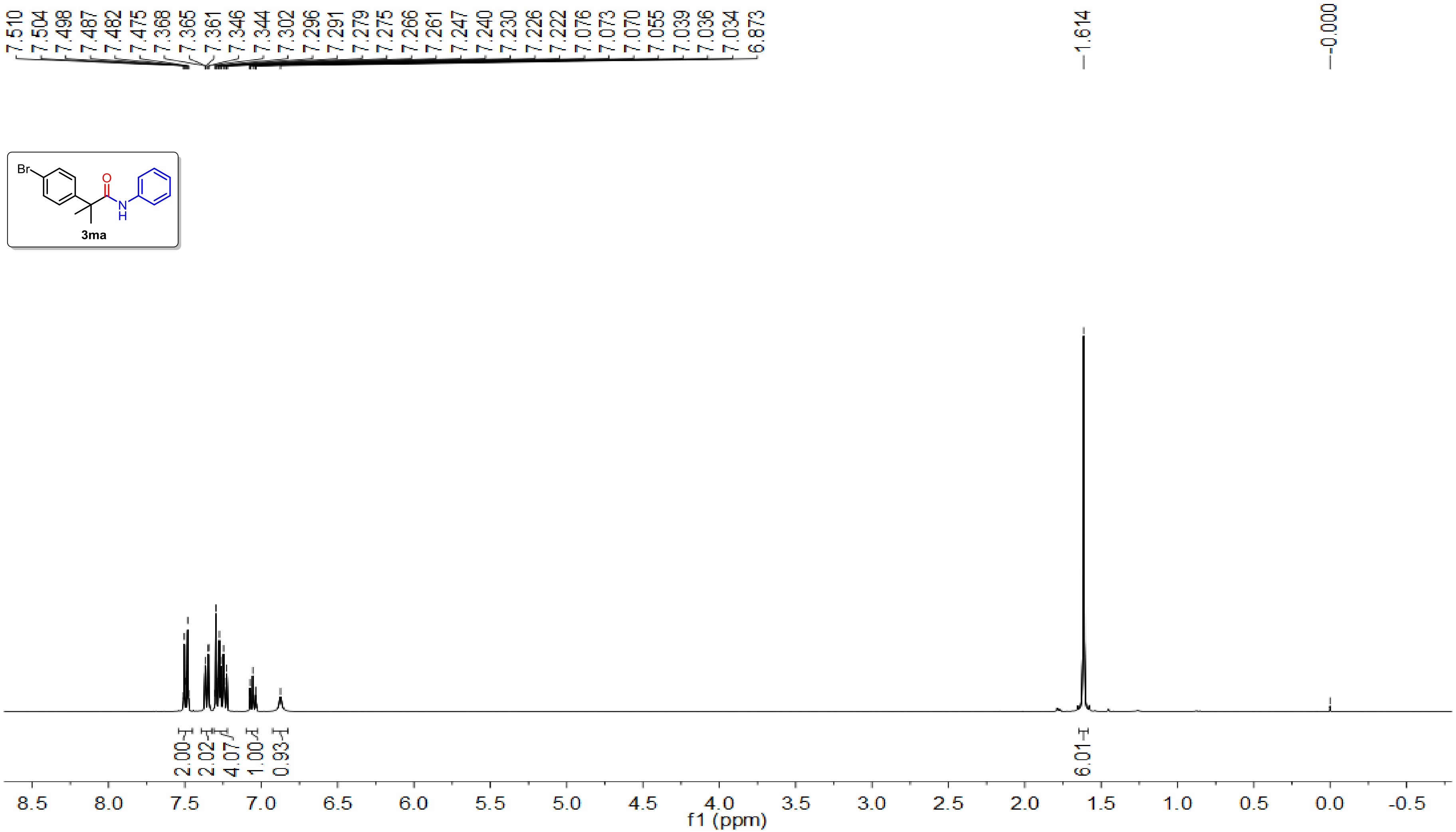
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3la**



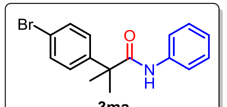
3la



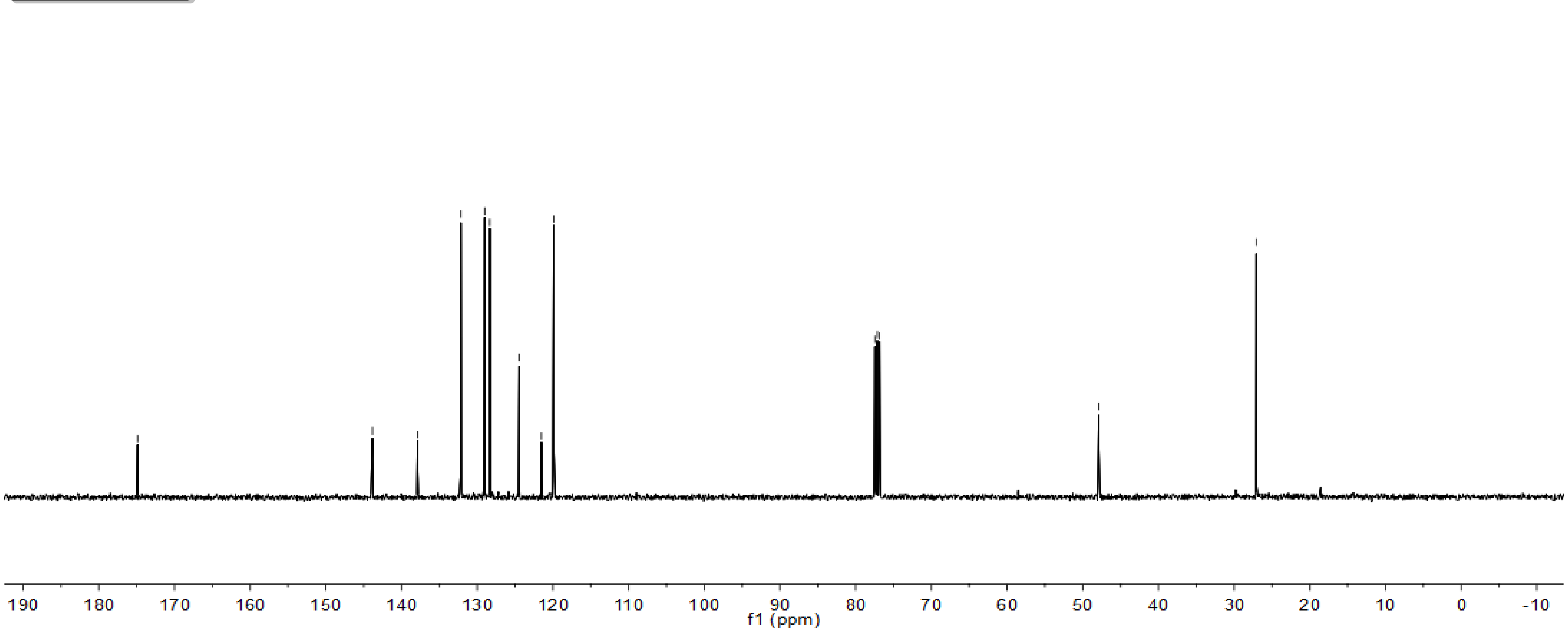
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ma**



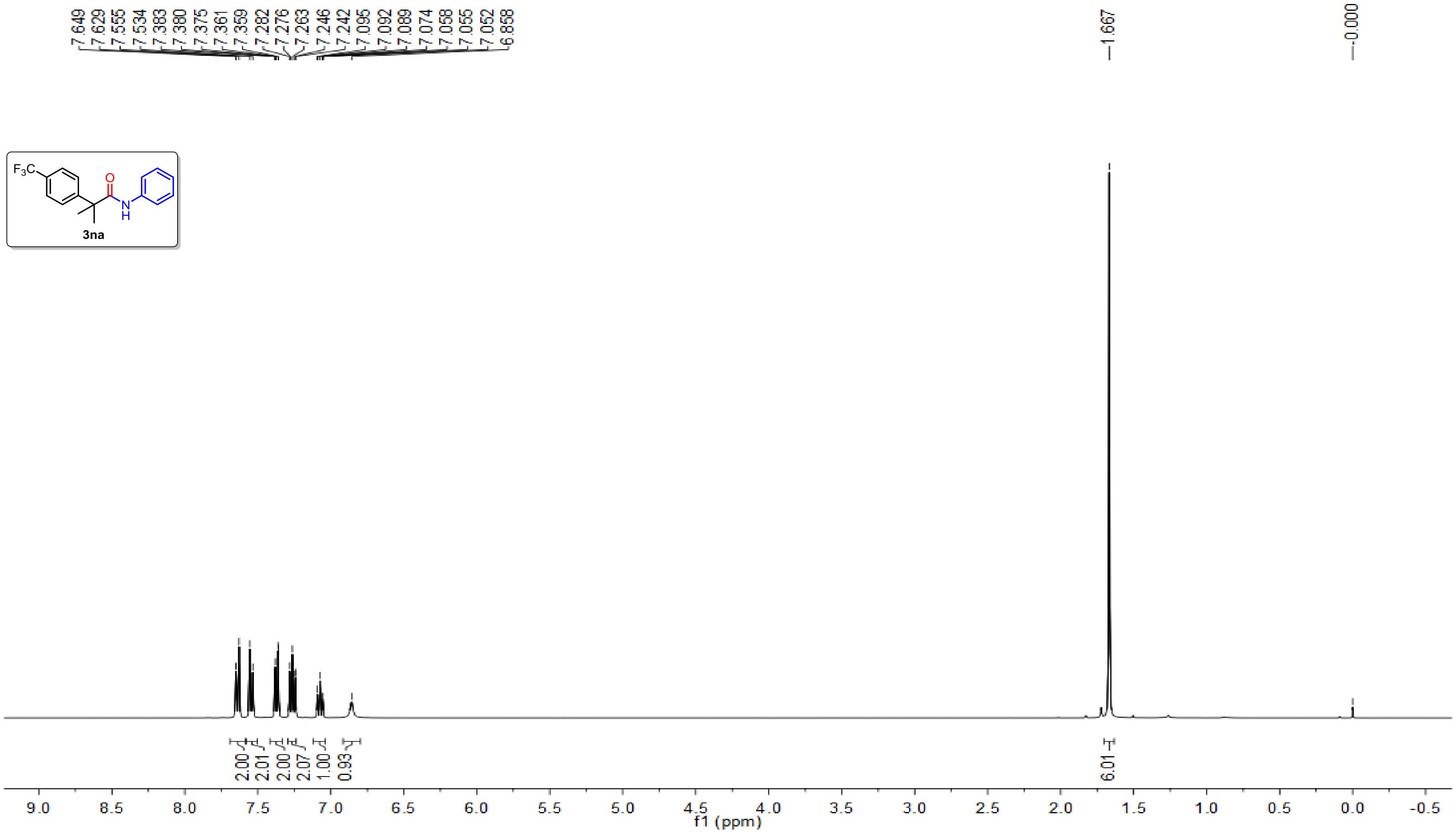
^{13}C NMR Spectra (101 MHz, CDCl$_3$) of compound **3ma**



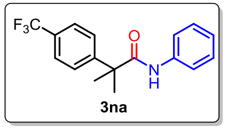
3ma

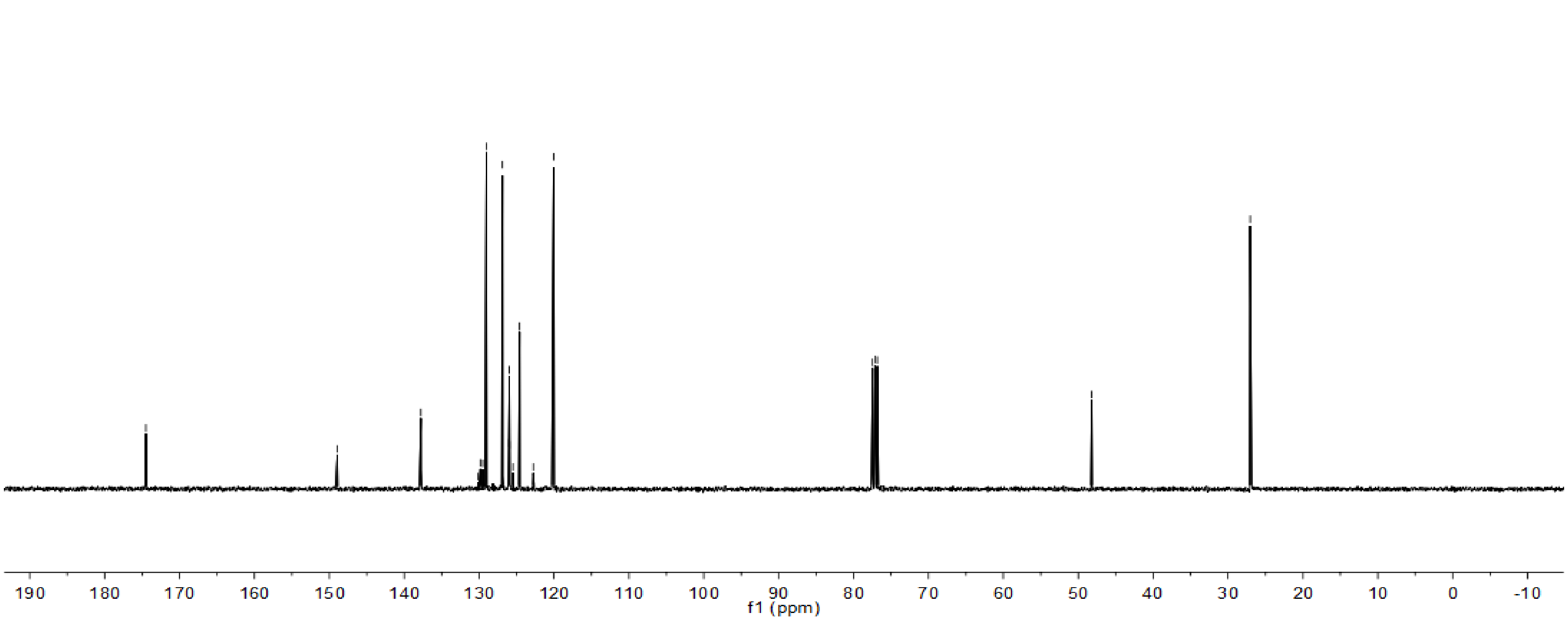


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3na**

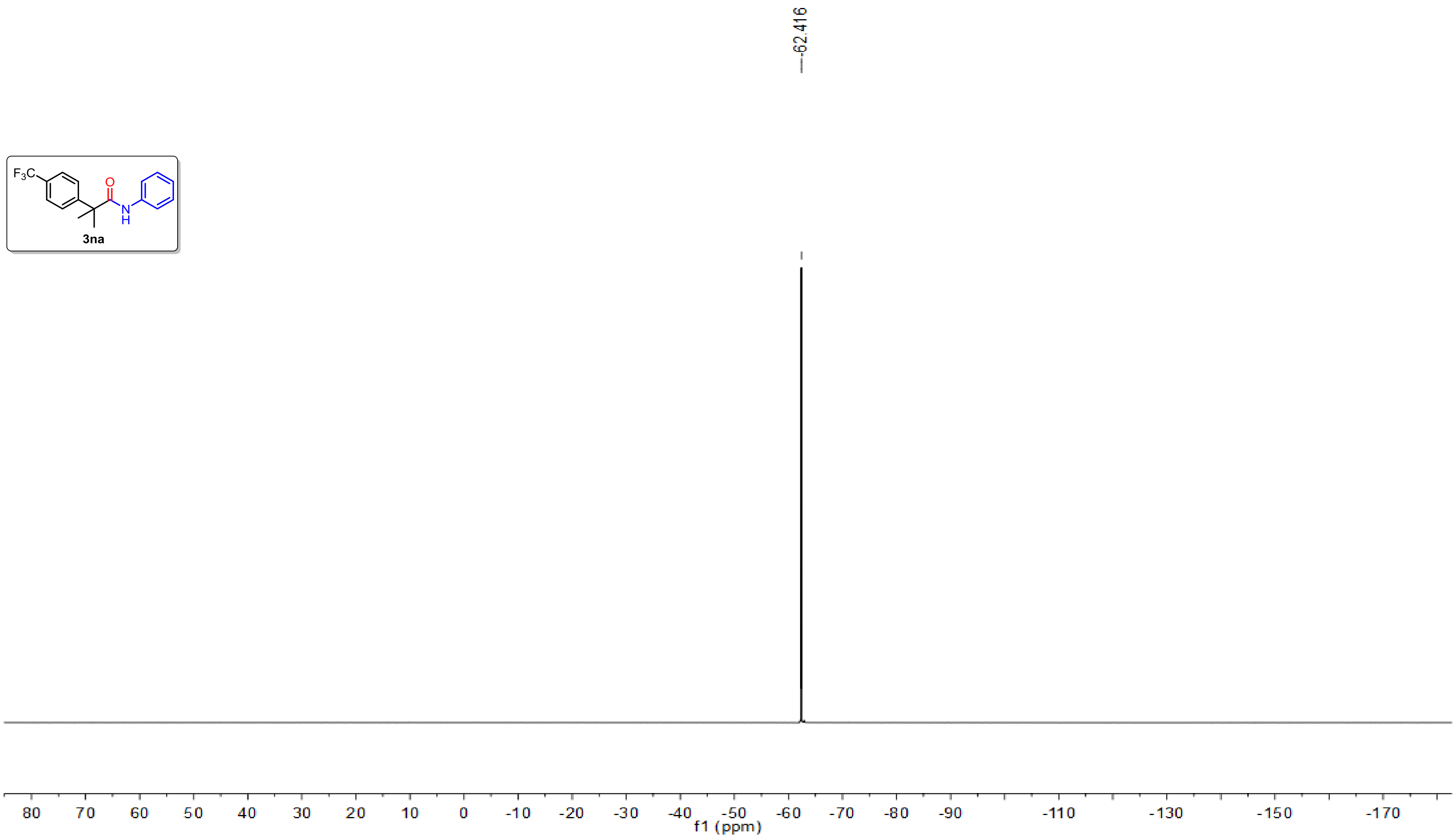


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3na**

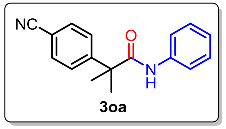


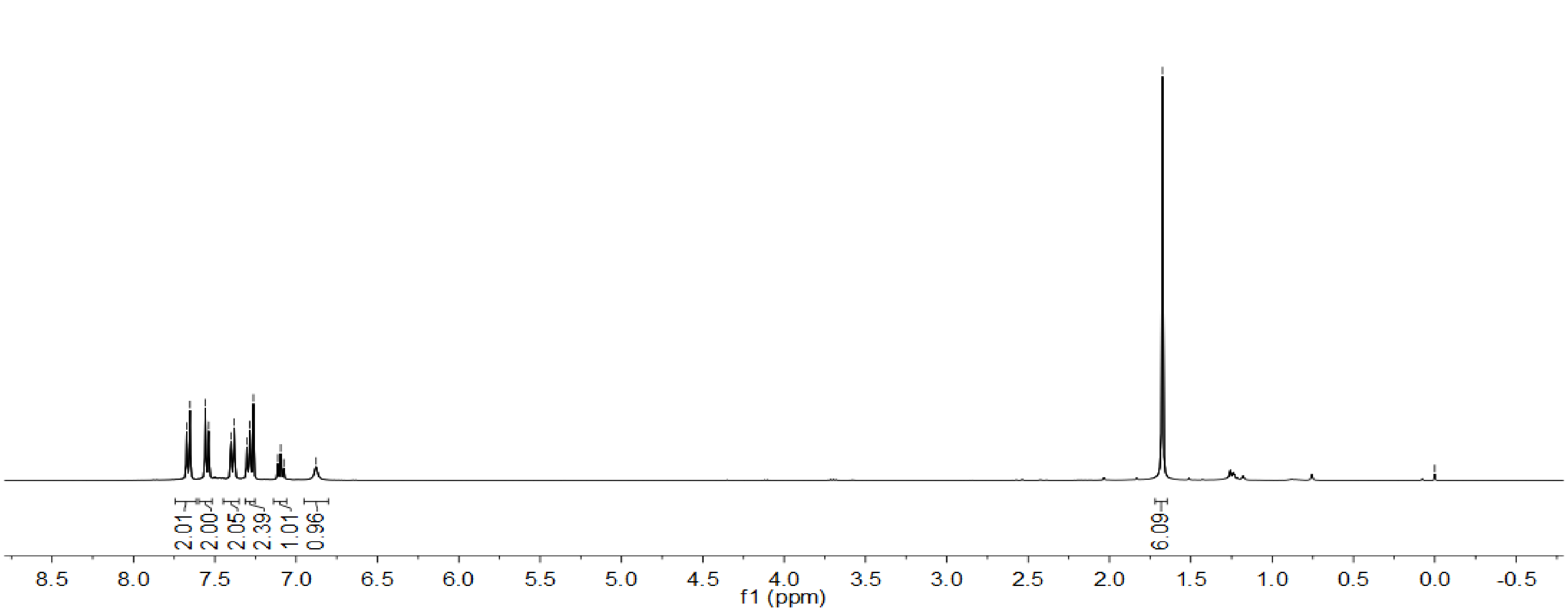


^{19}F NMR Spectra (375 MHz, $CDCl_3$) of compound **3na**

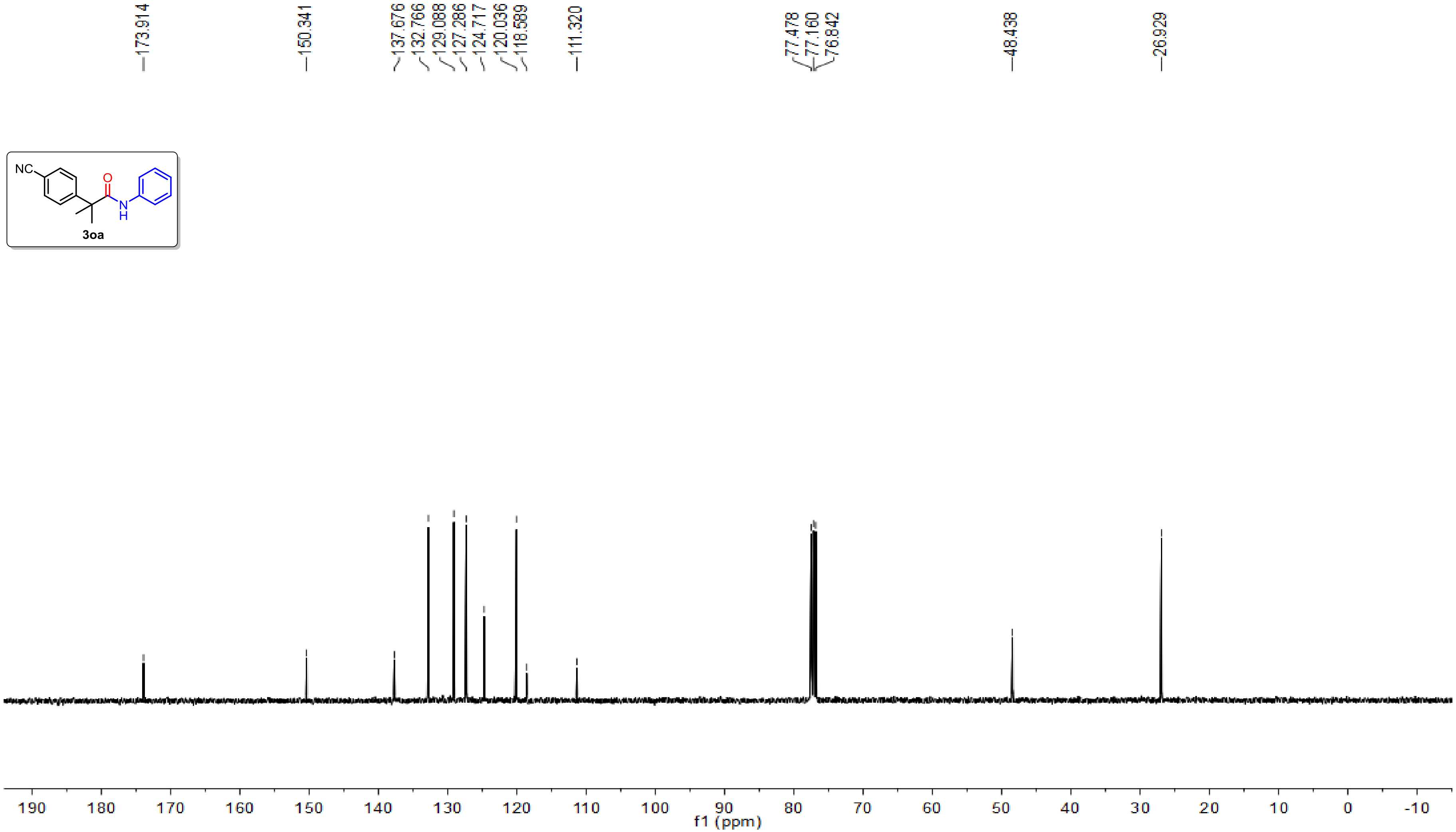


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3oa**

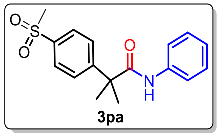


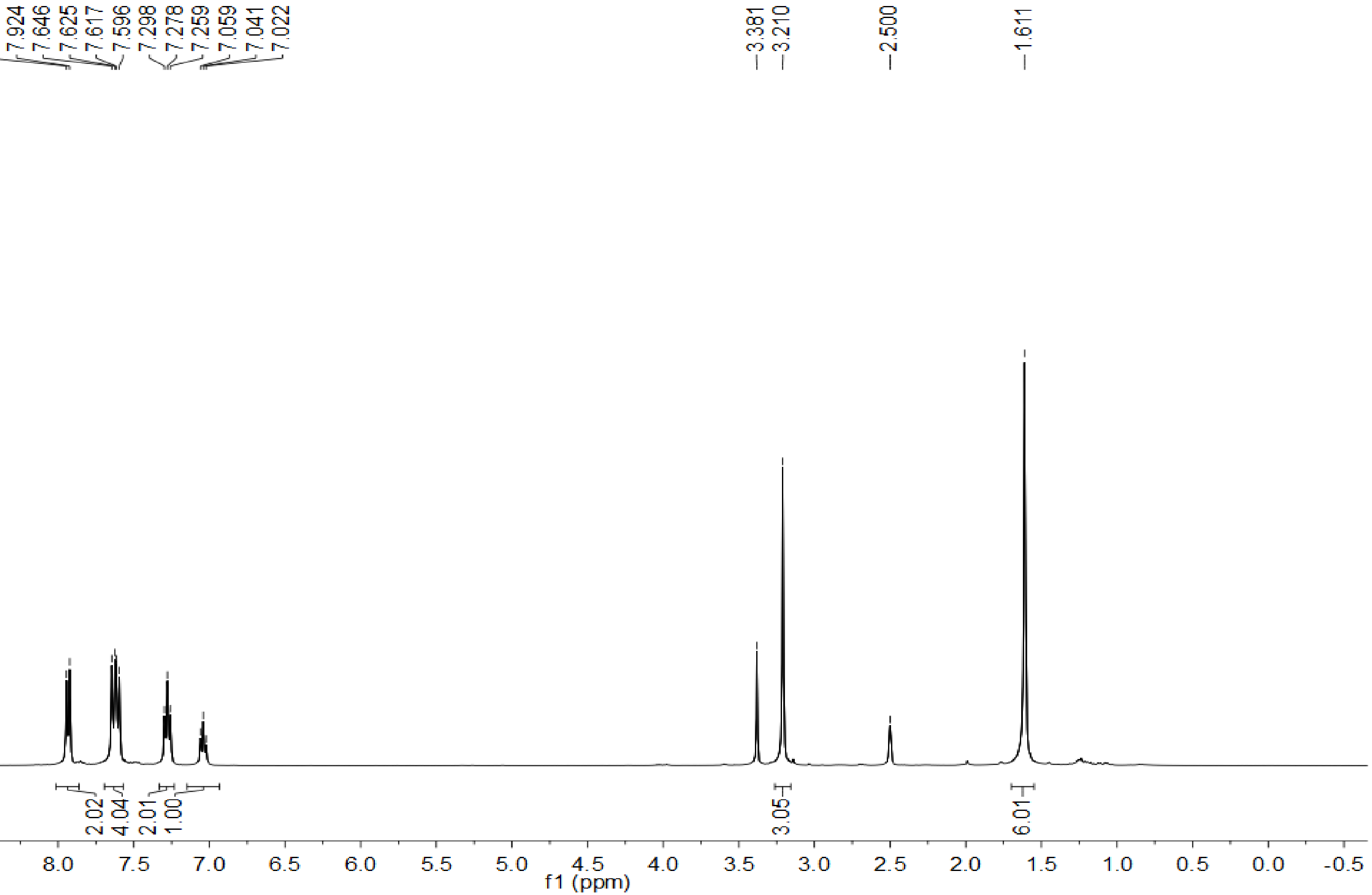


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3oa**

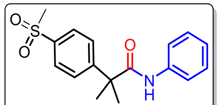


^{1}H NMR Spectra (400 MHz, d^{6}-DMSO) of compound **3pa**

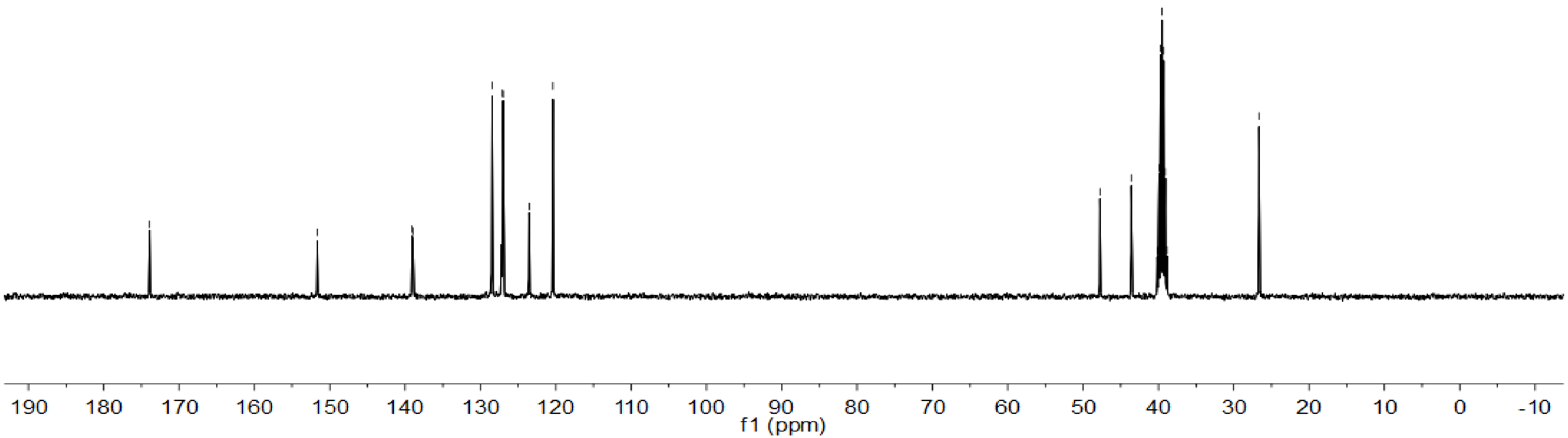




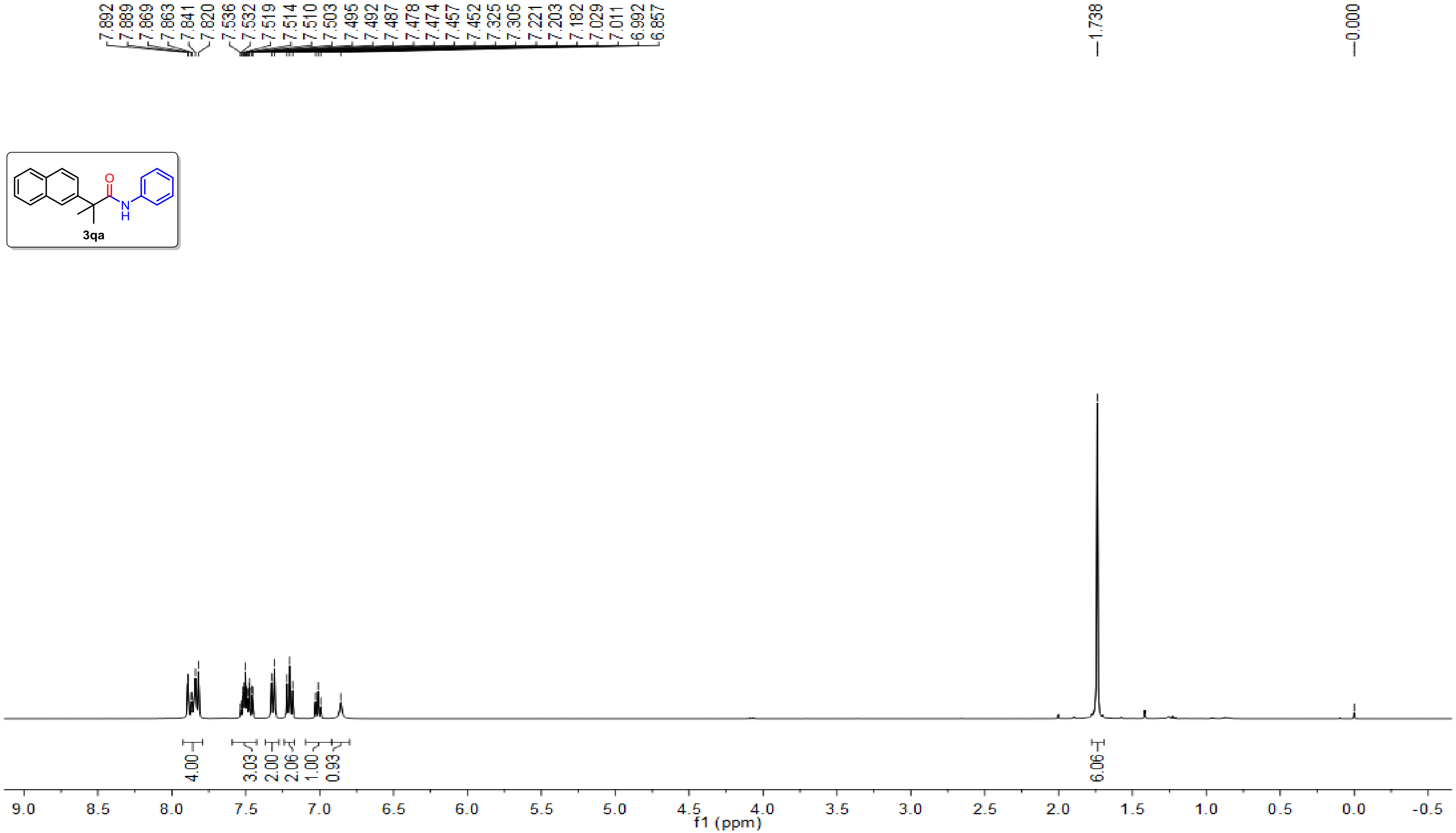
^{13}C NMR Spectra (101 MHz, C d^6-DMSO) of compound **3pa**



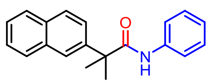
3pa



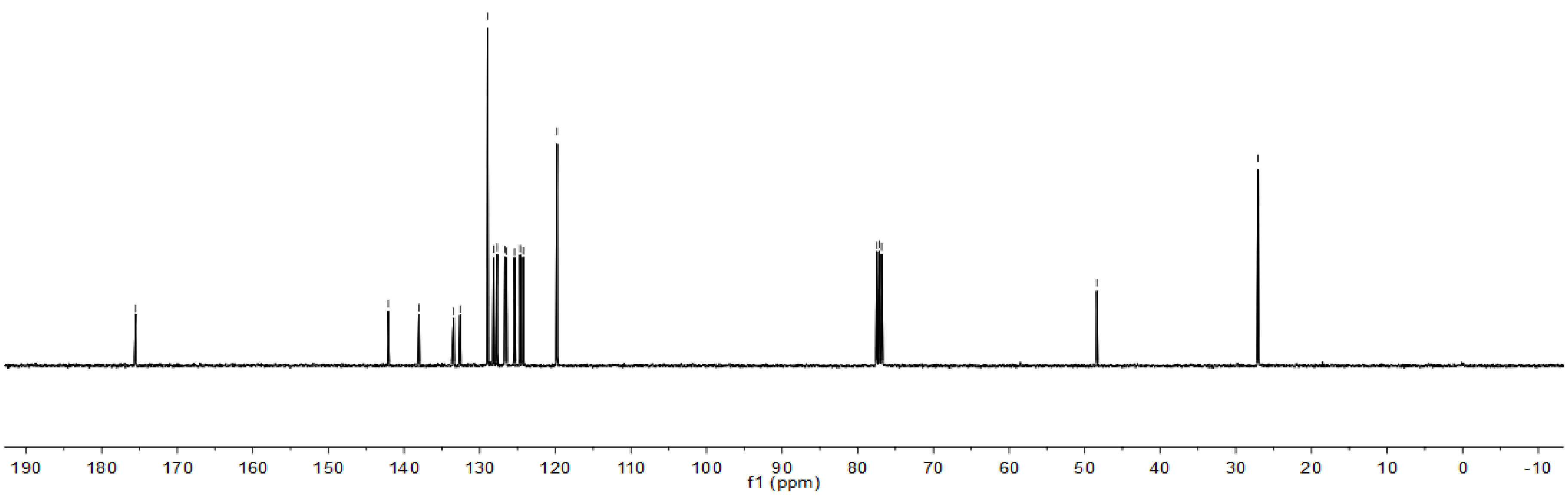
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3qa**



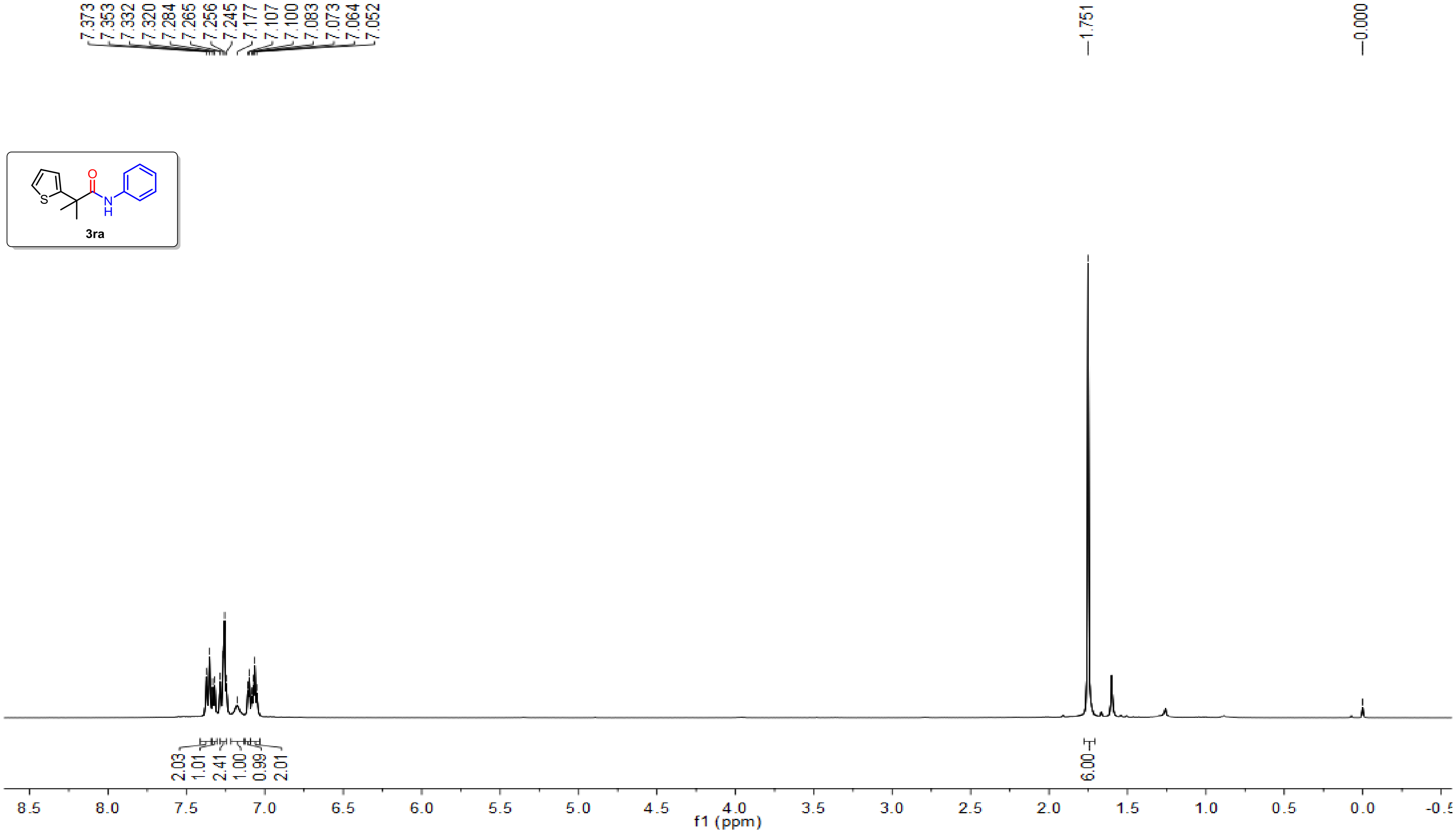
^{13}C NMR Spectra (101 MHz, CDCl$_3$) of compound **3qa**



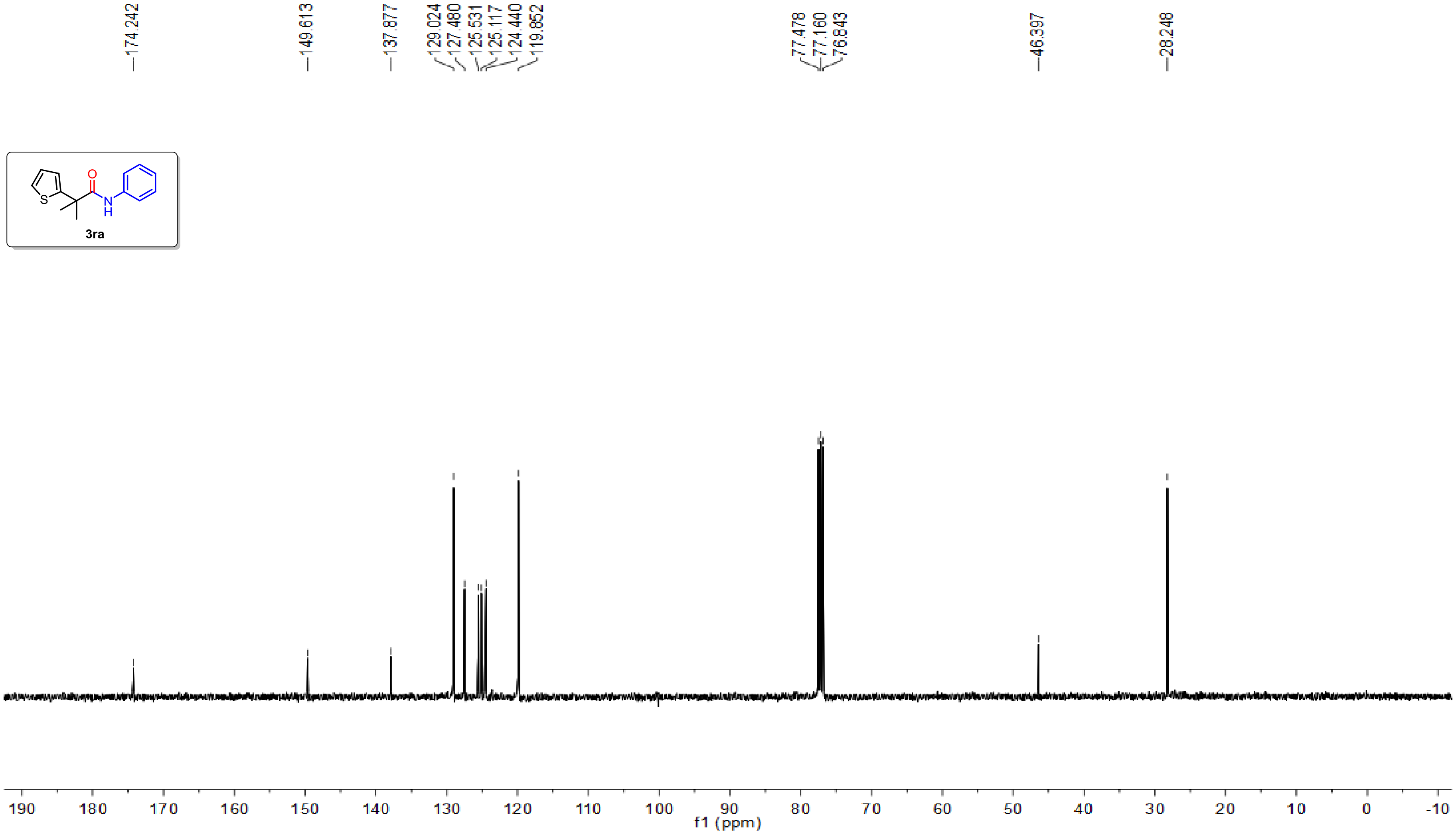
3qa



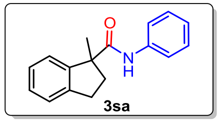
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ra**

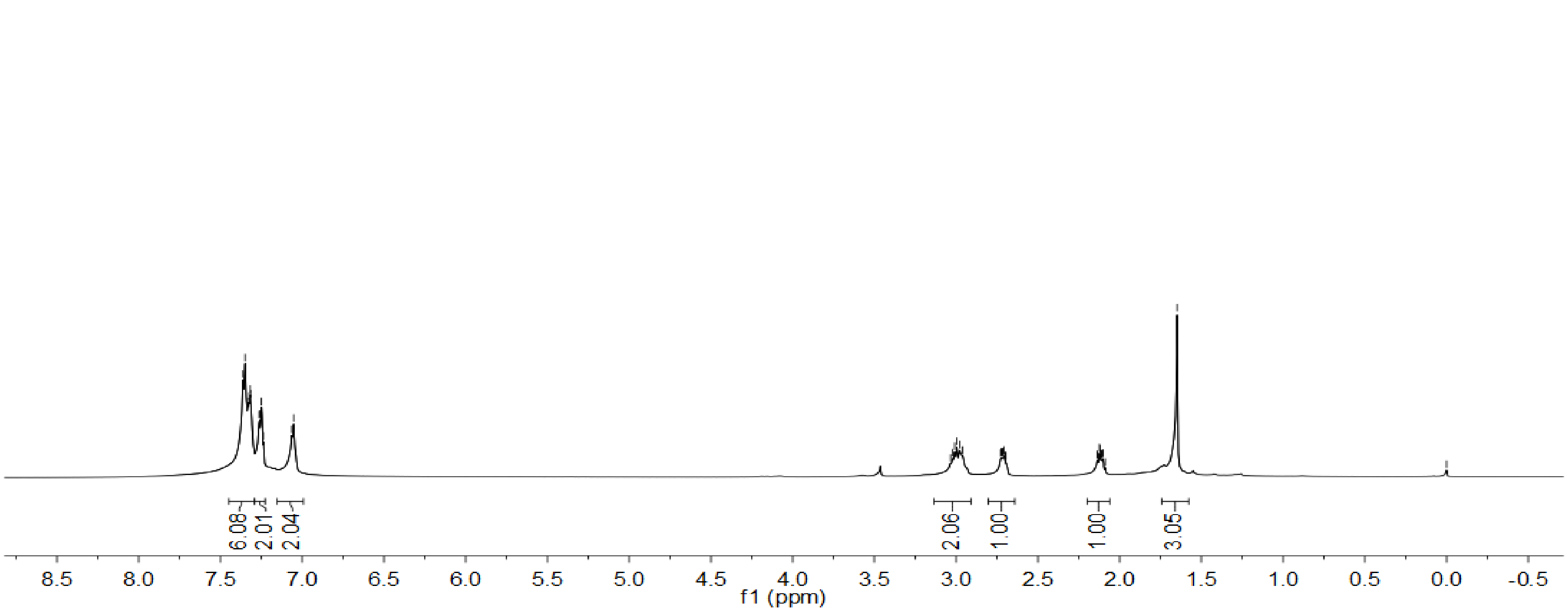


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ra**

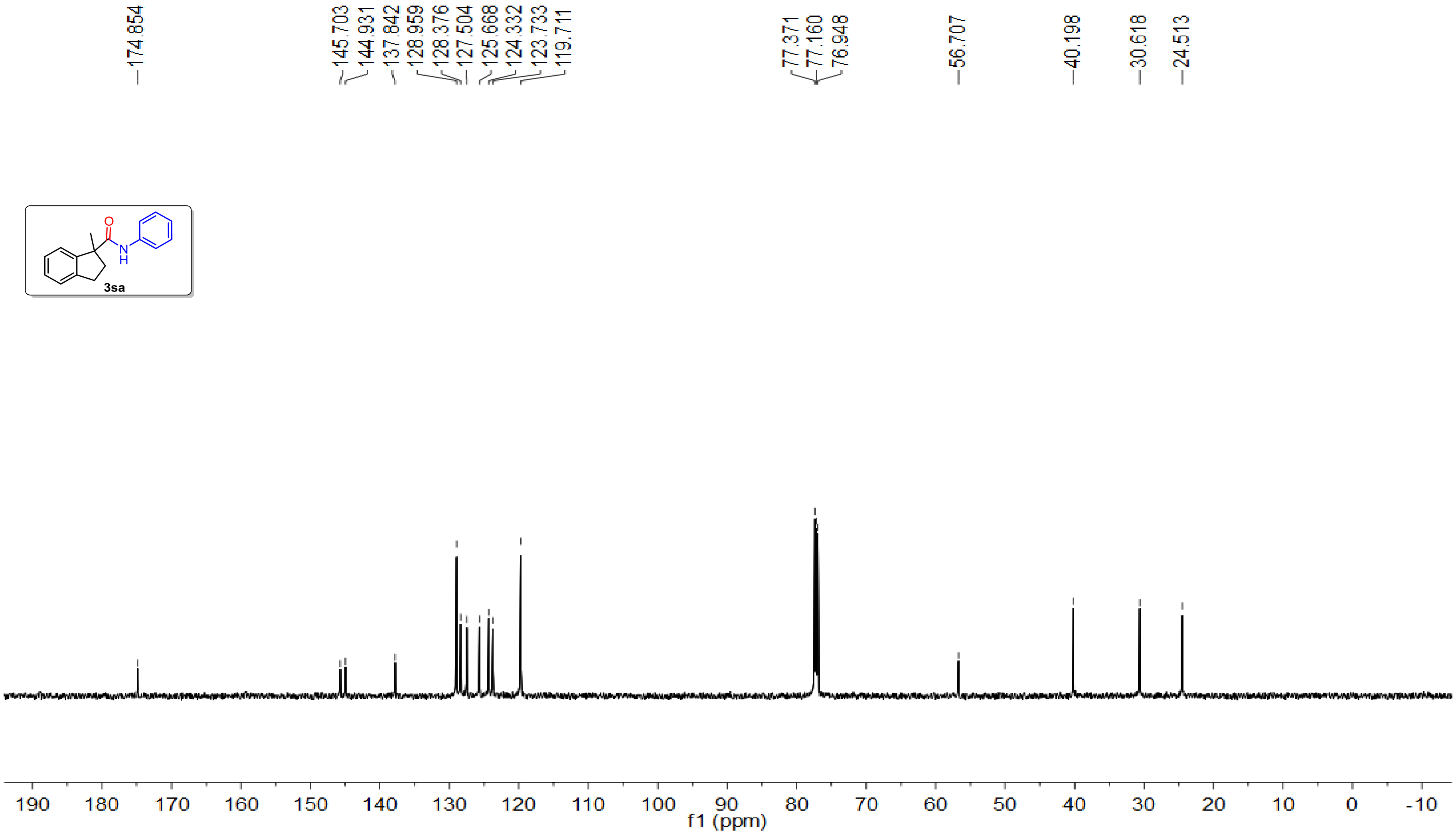


^{1}H NMR Spectra (600 MHz, $CDCl_3$) of compound **3sa**

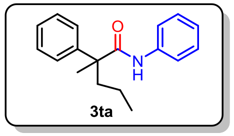


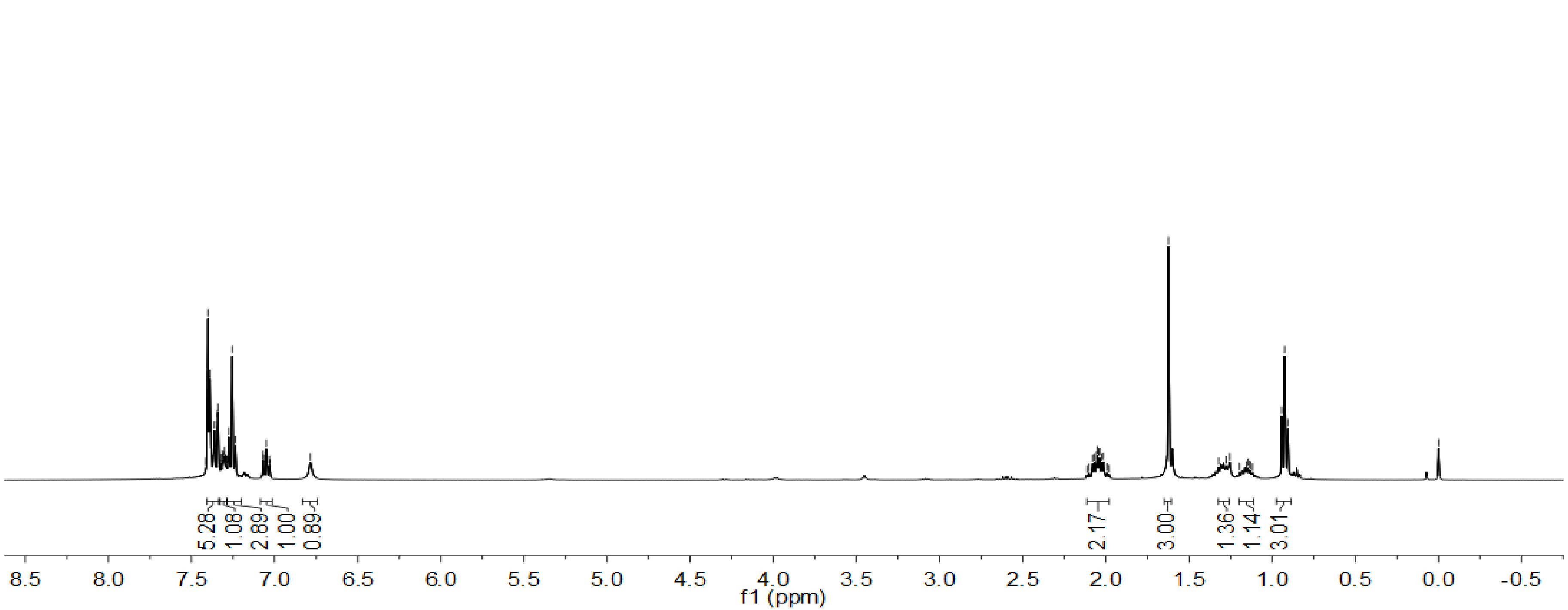


^{13}C NMR Spectra (151 MHz, $CDCl_3$) of compound **3sa**

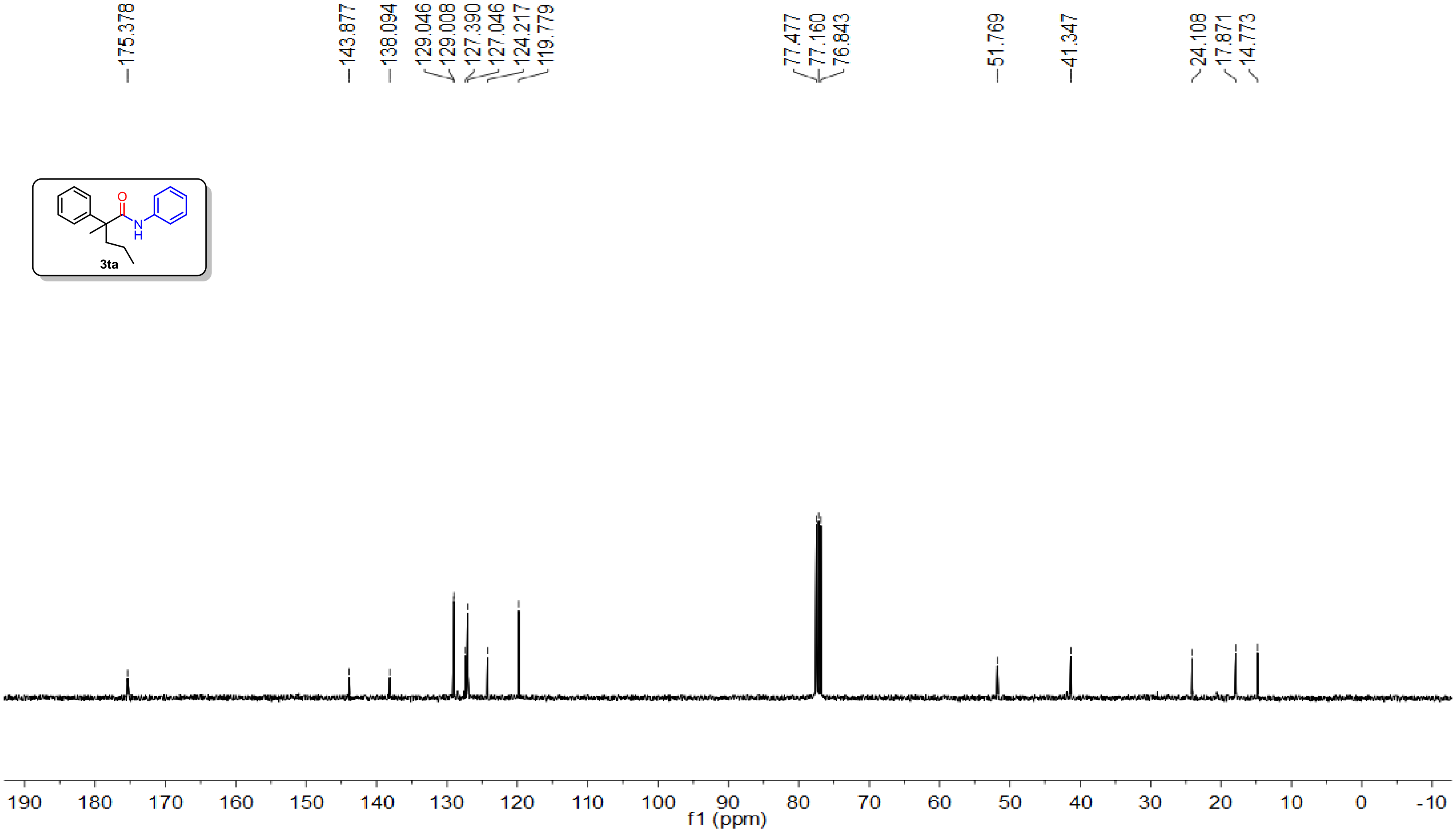


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ta**

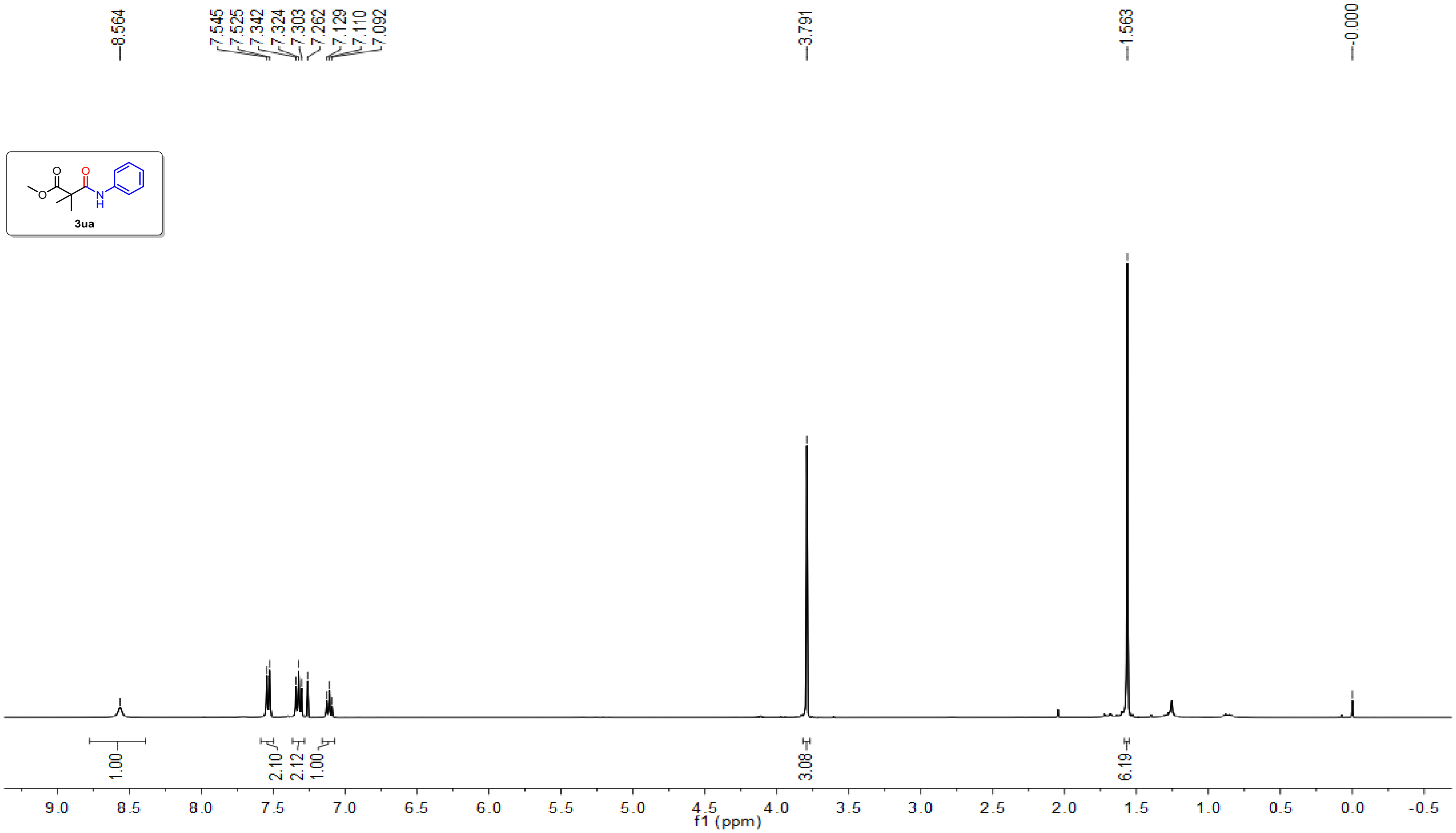




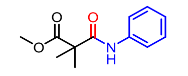
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ta**



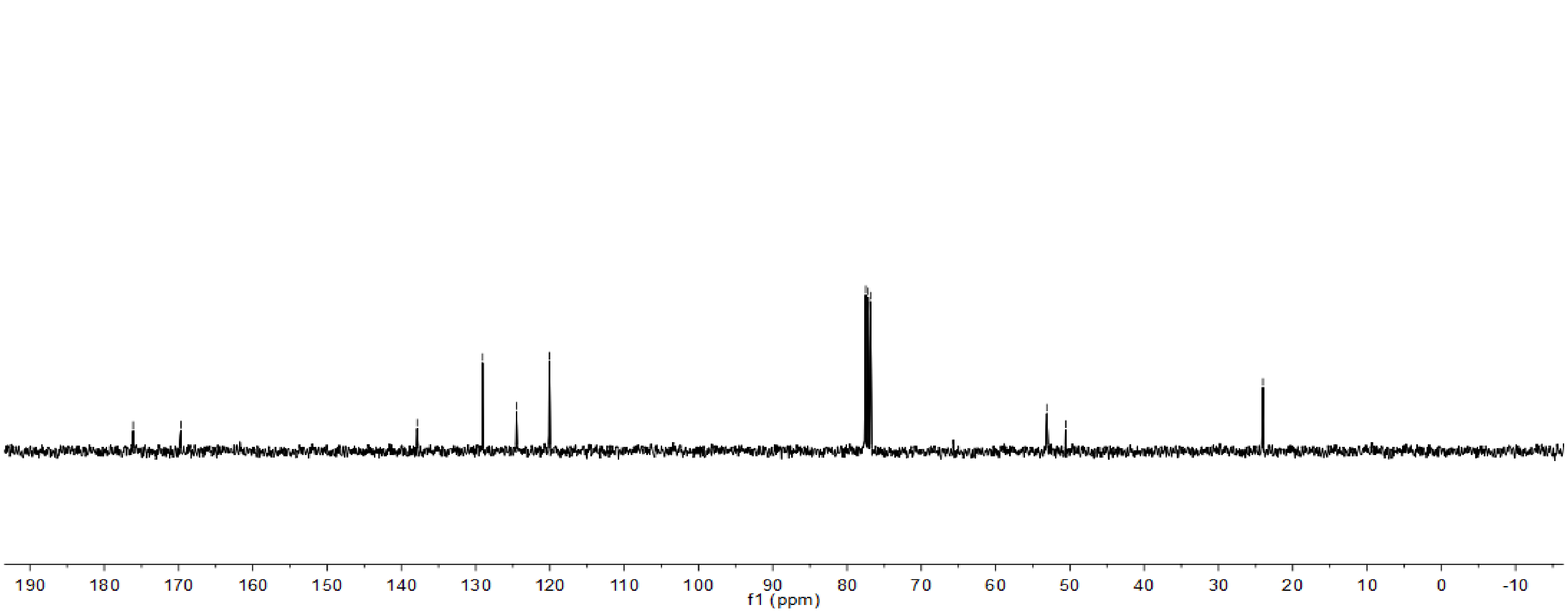
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **3ua**



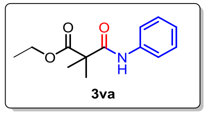
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3ua**

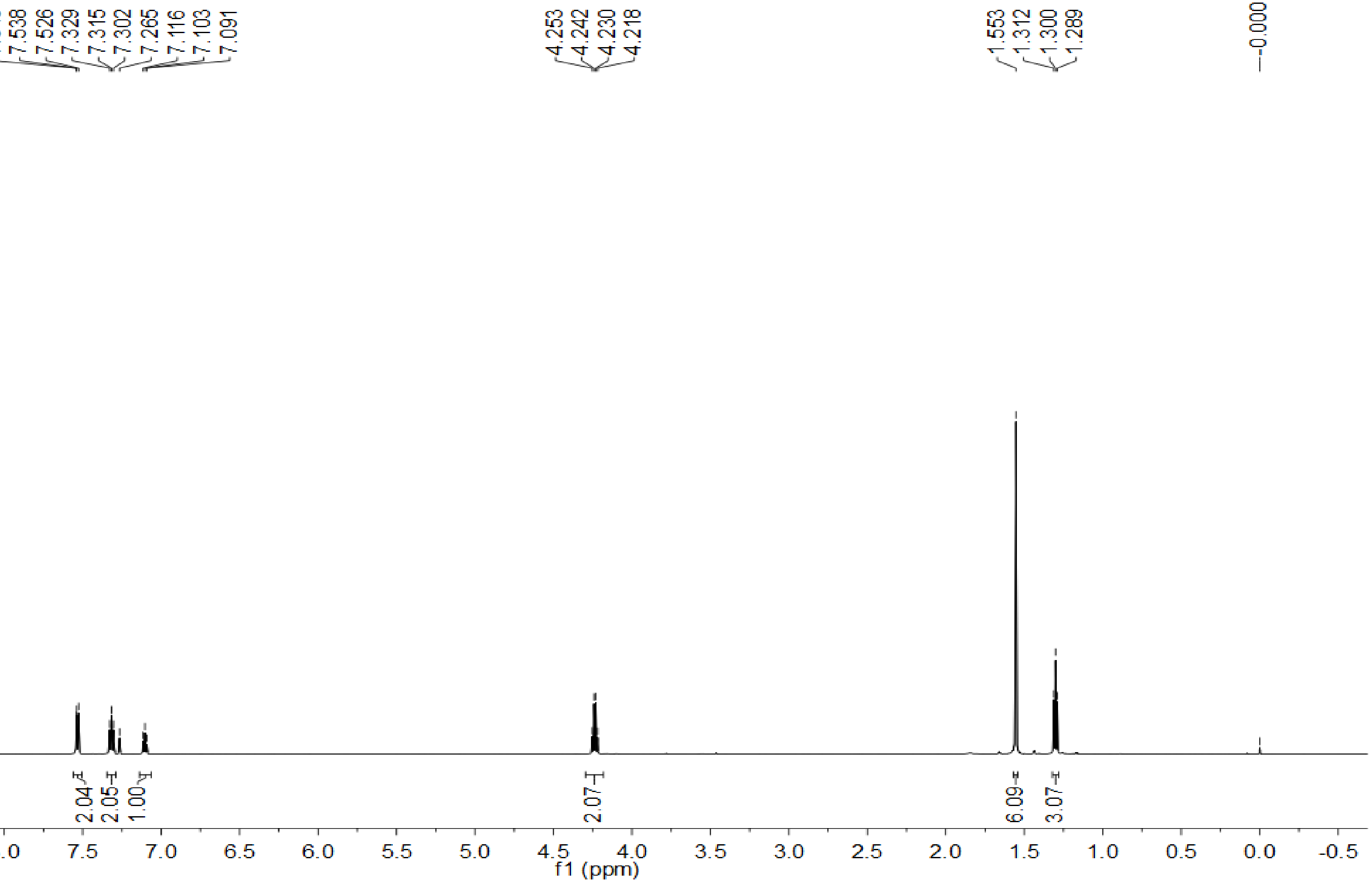


3ua

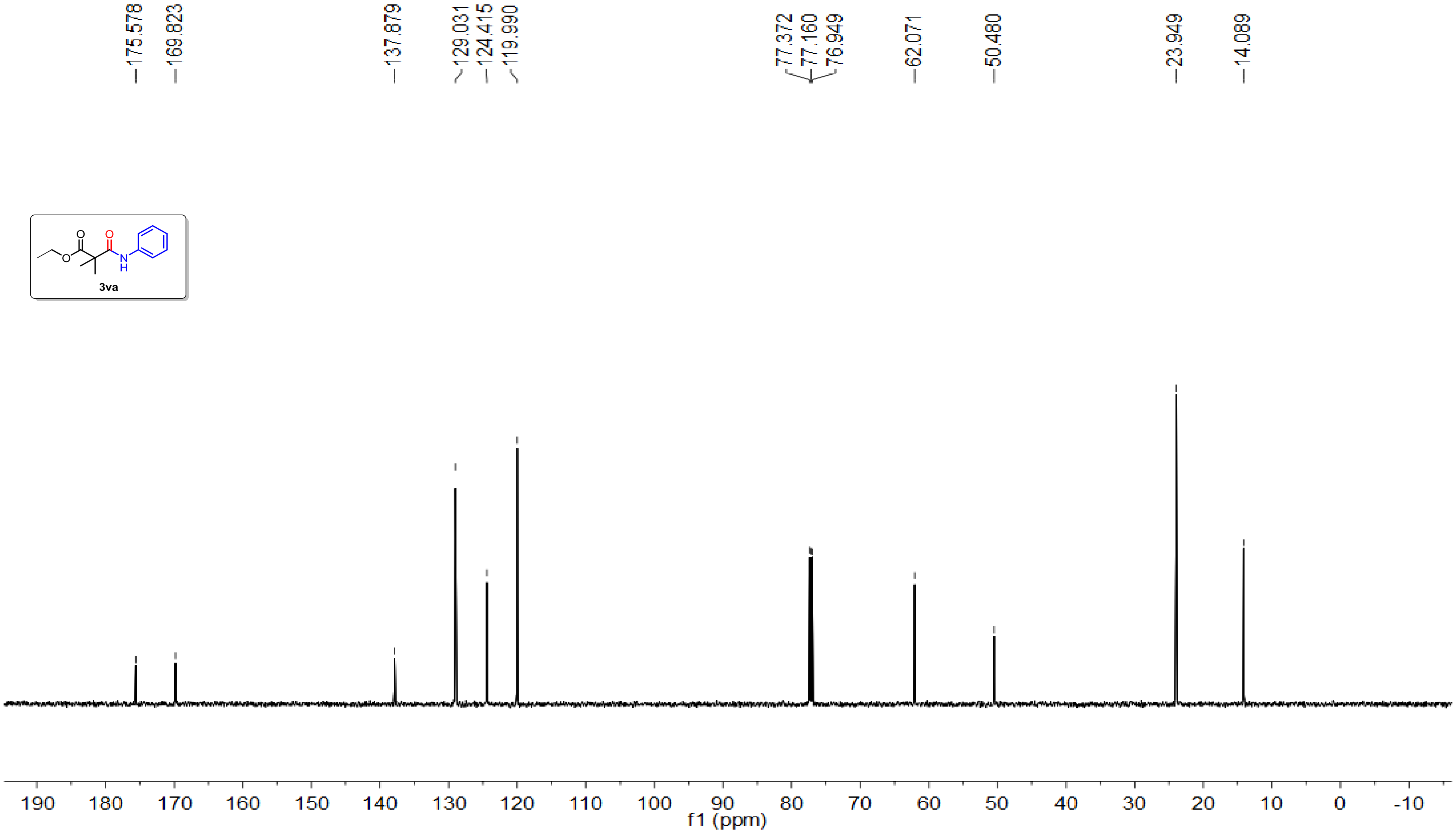


^{1}H NMR Spectra (600 MHz, $CDCl_3$) of compound **3ve**

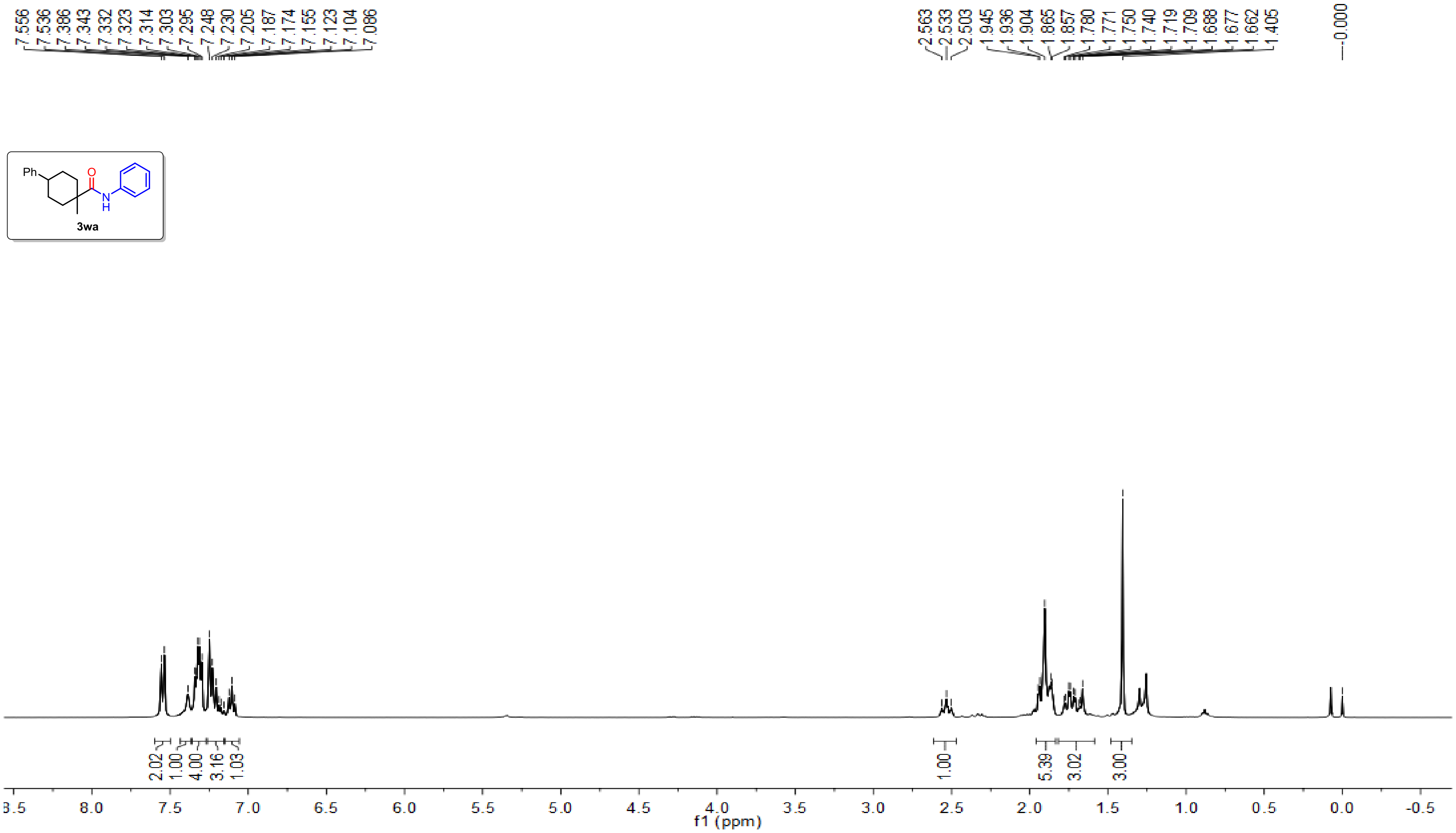




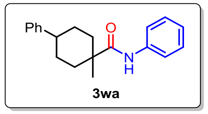
^{13}C NMR Spectra (151 MHz, $CDCl_3$) of compound **3va**

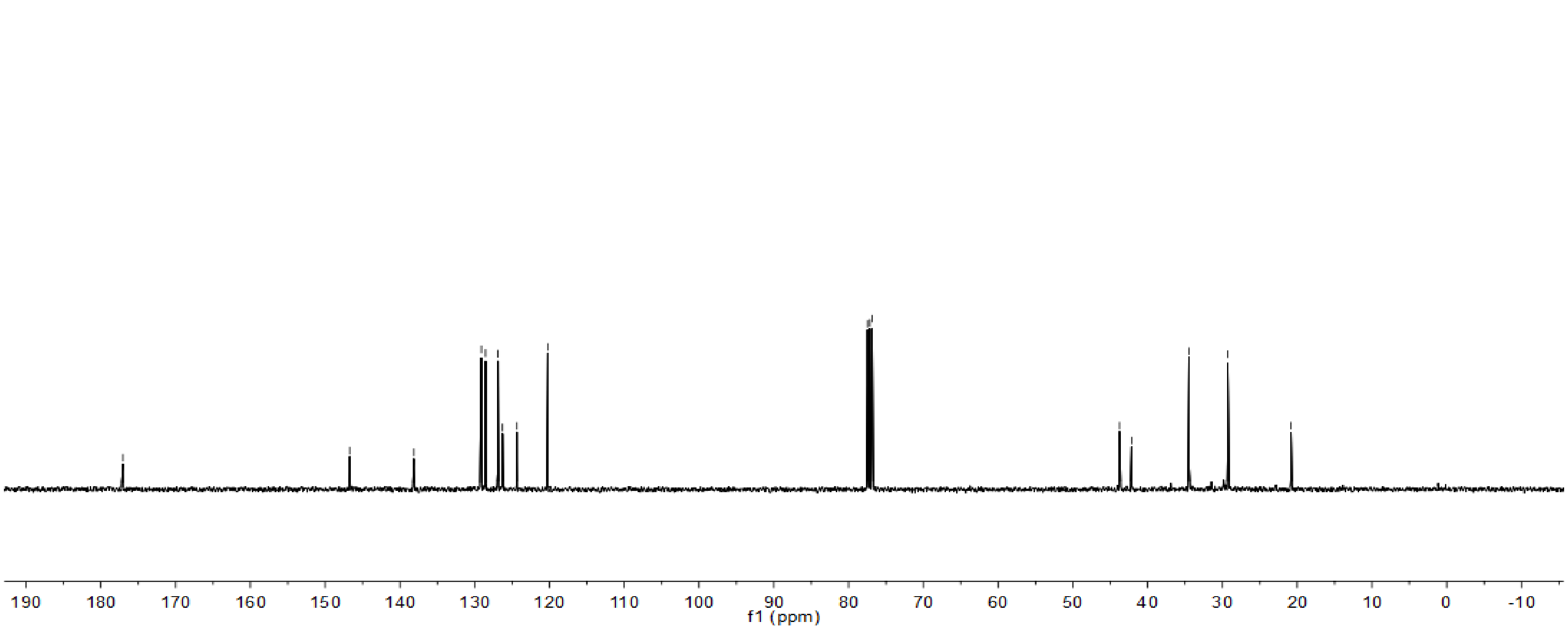


^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3wa**

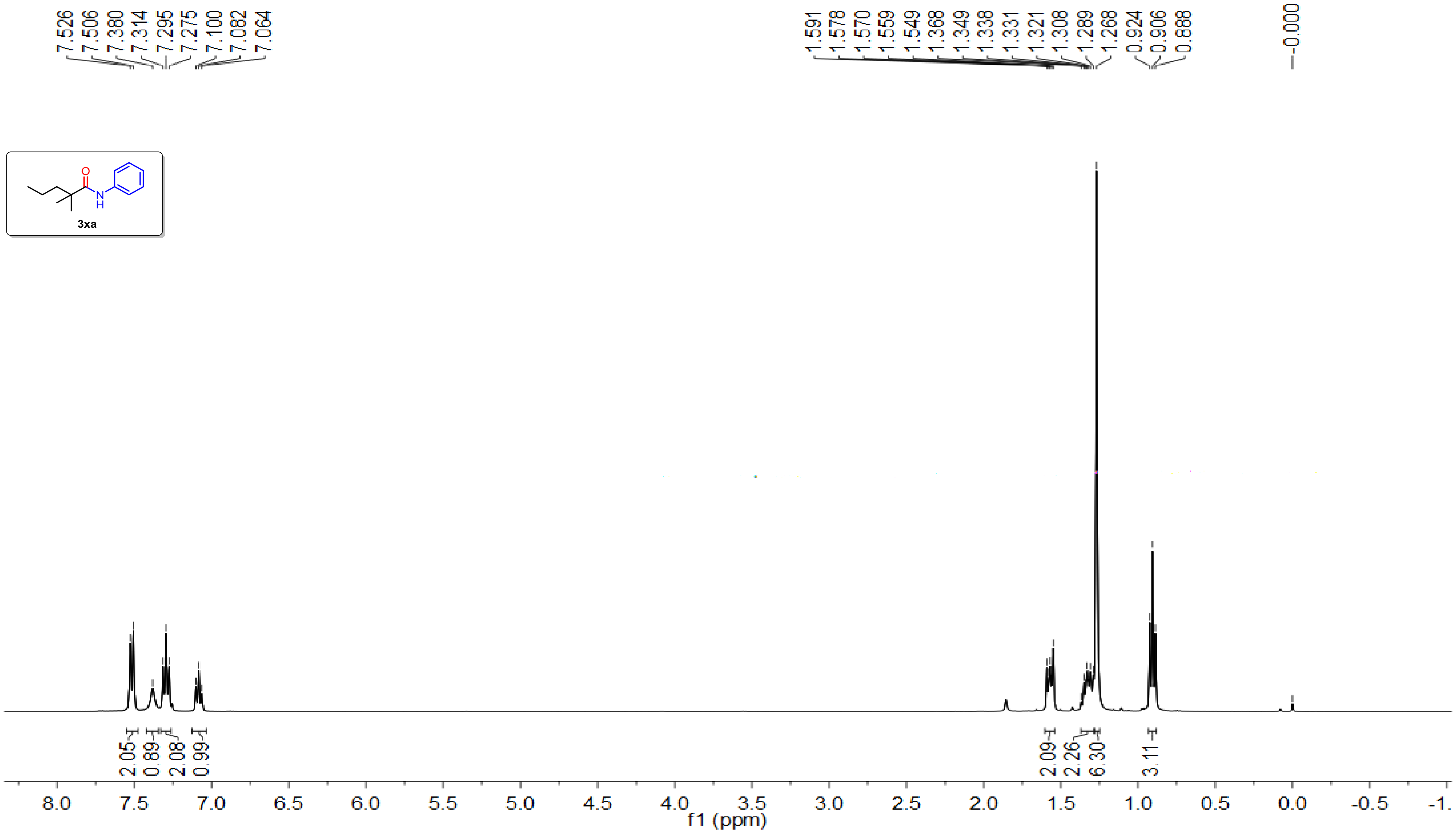


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3wa**

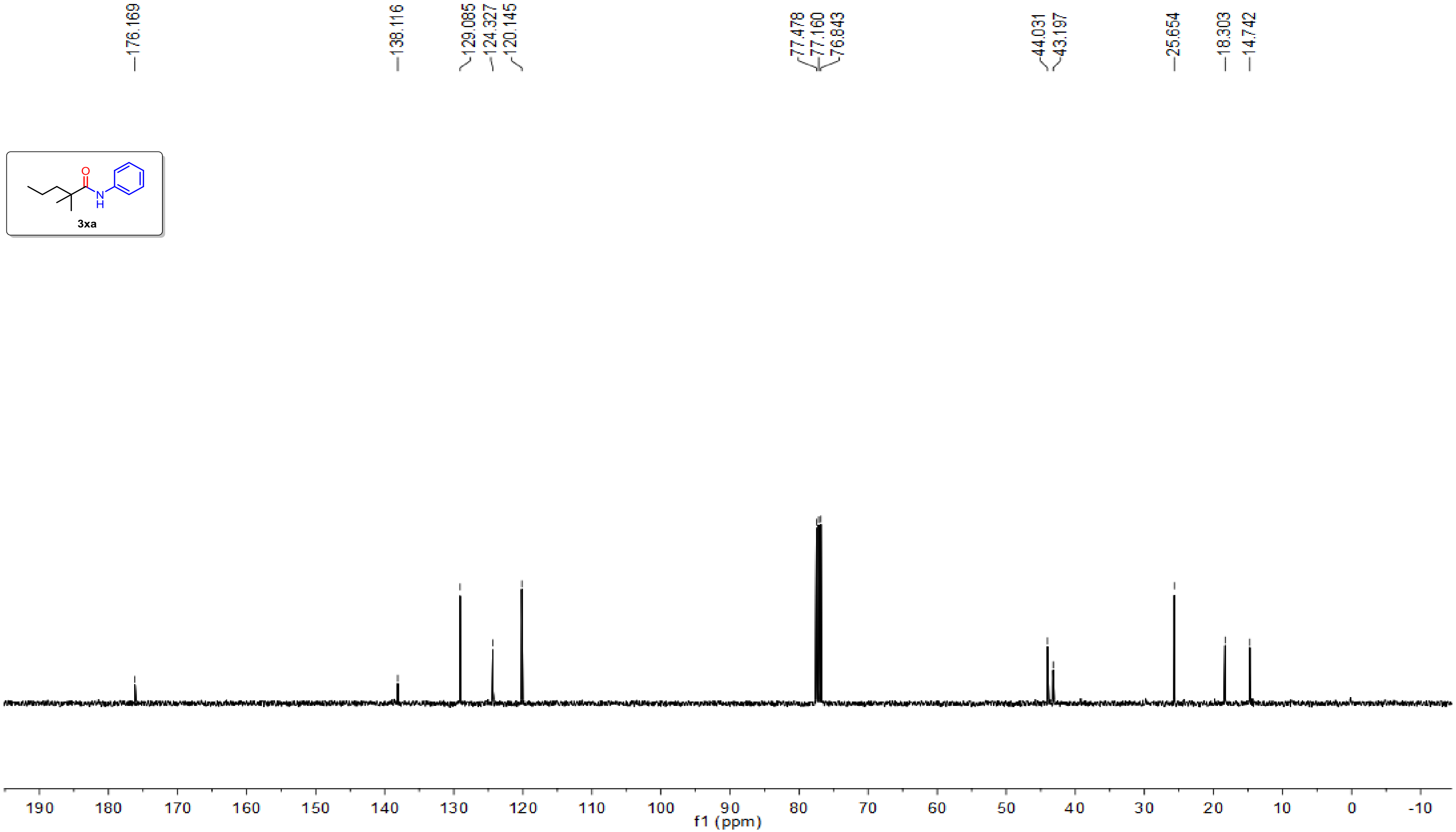




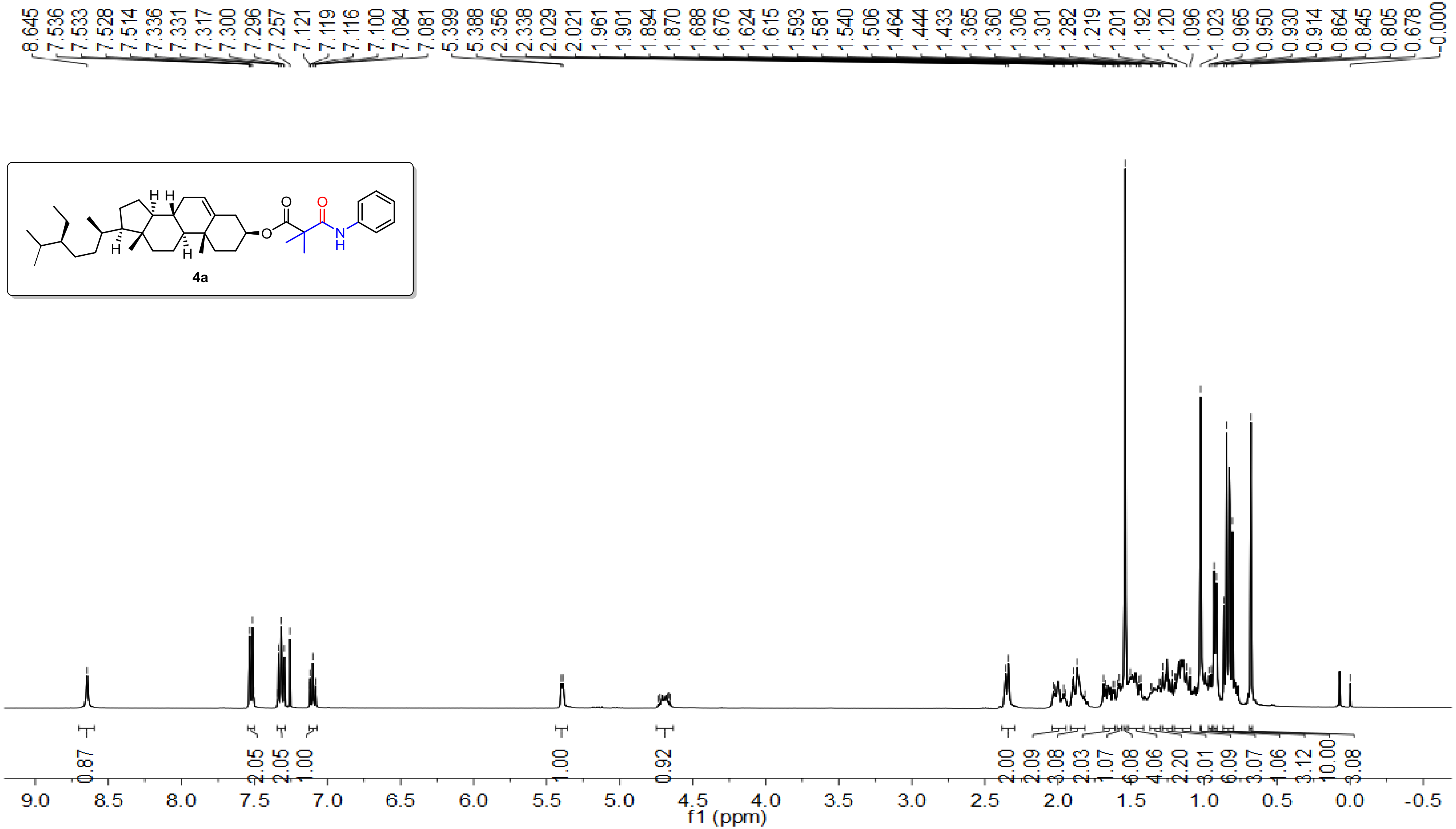
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **3xa**



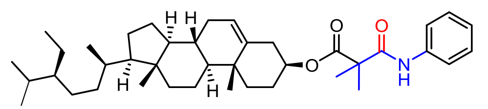
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **3xa**



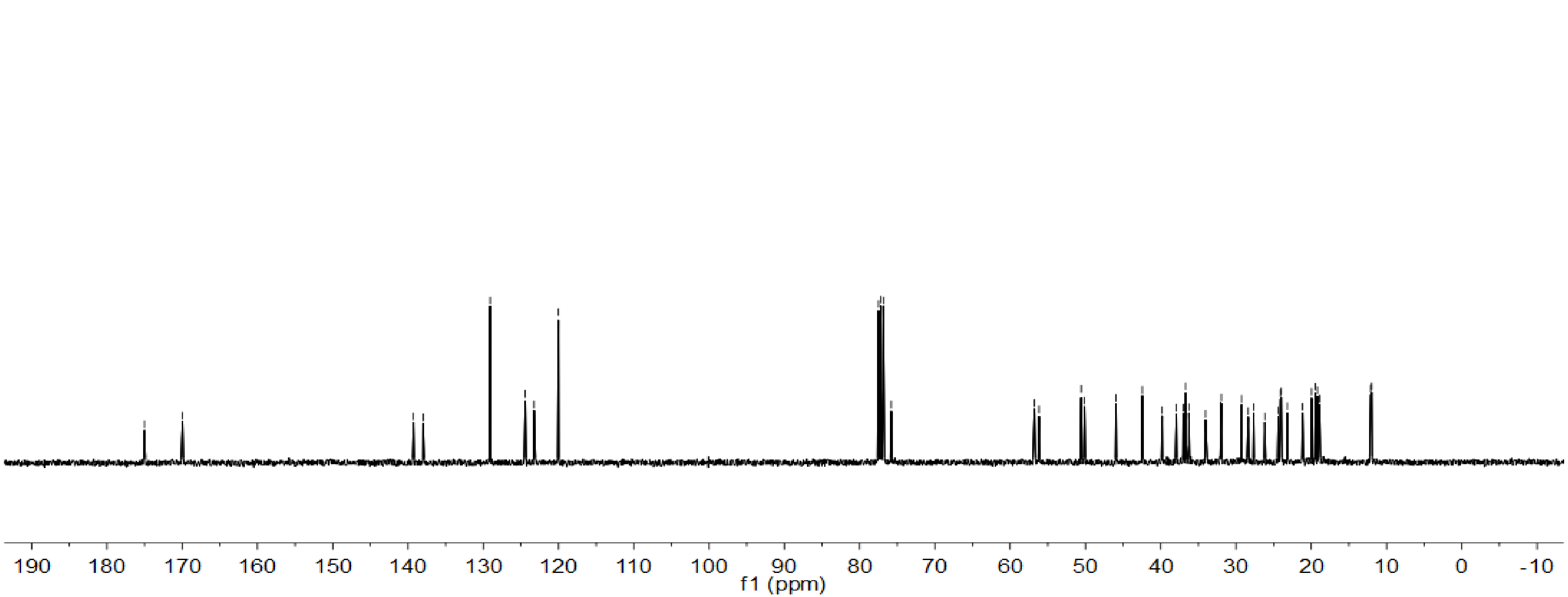
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **4a**



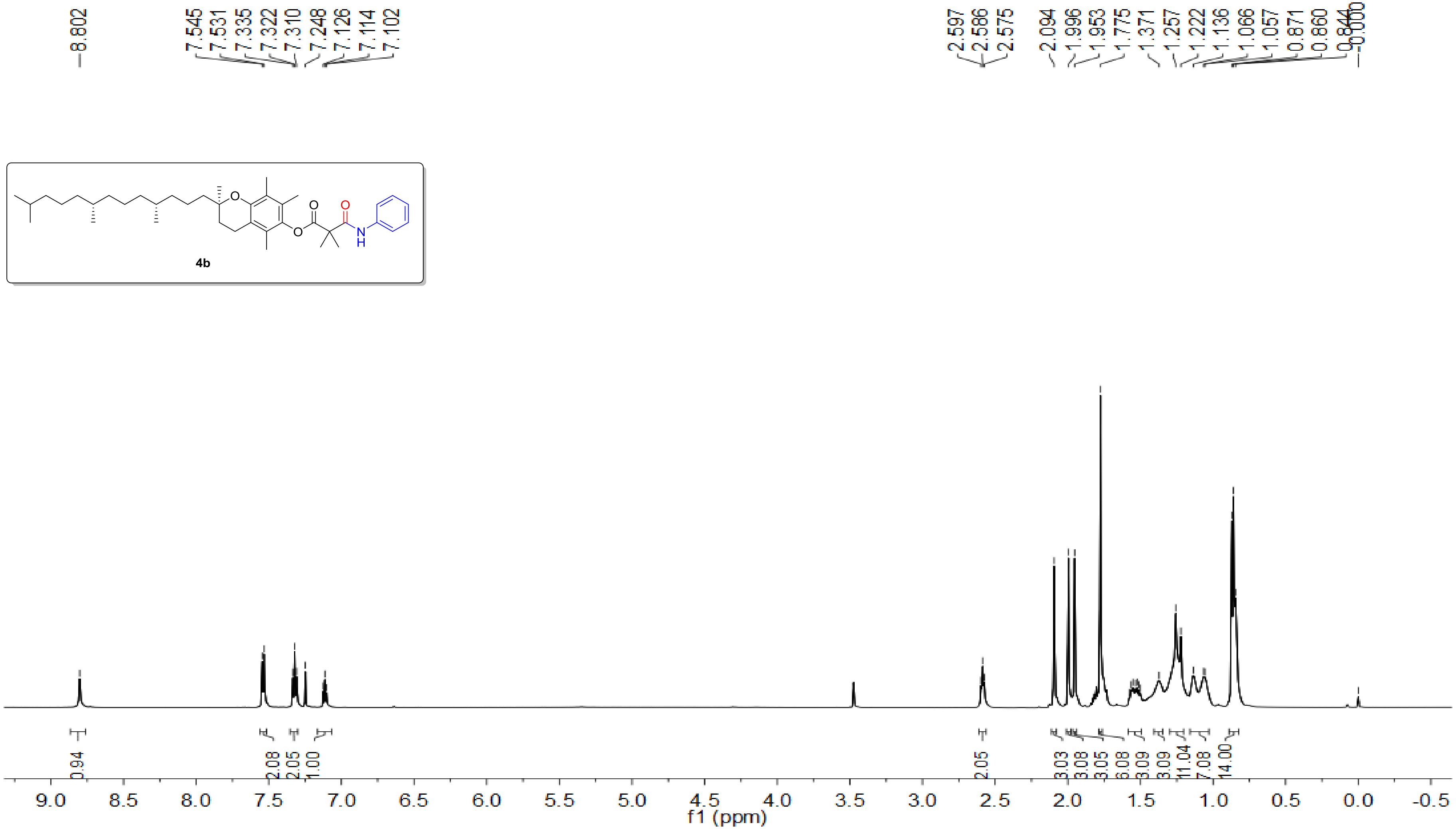
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **4a**



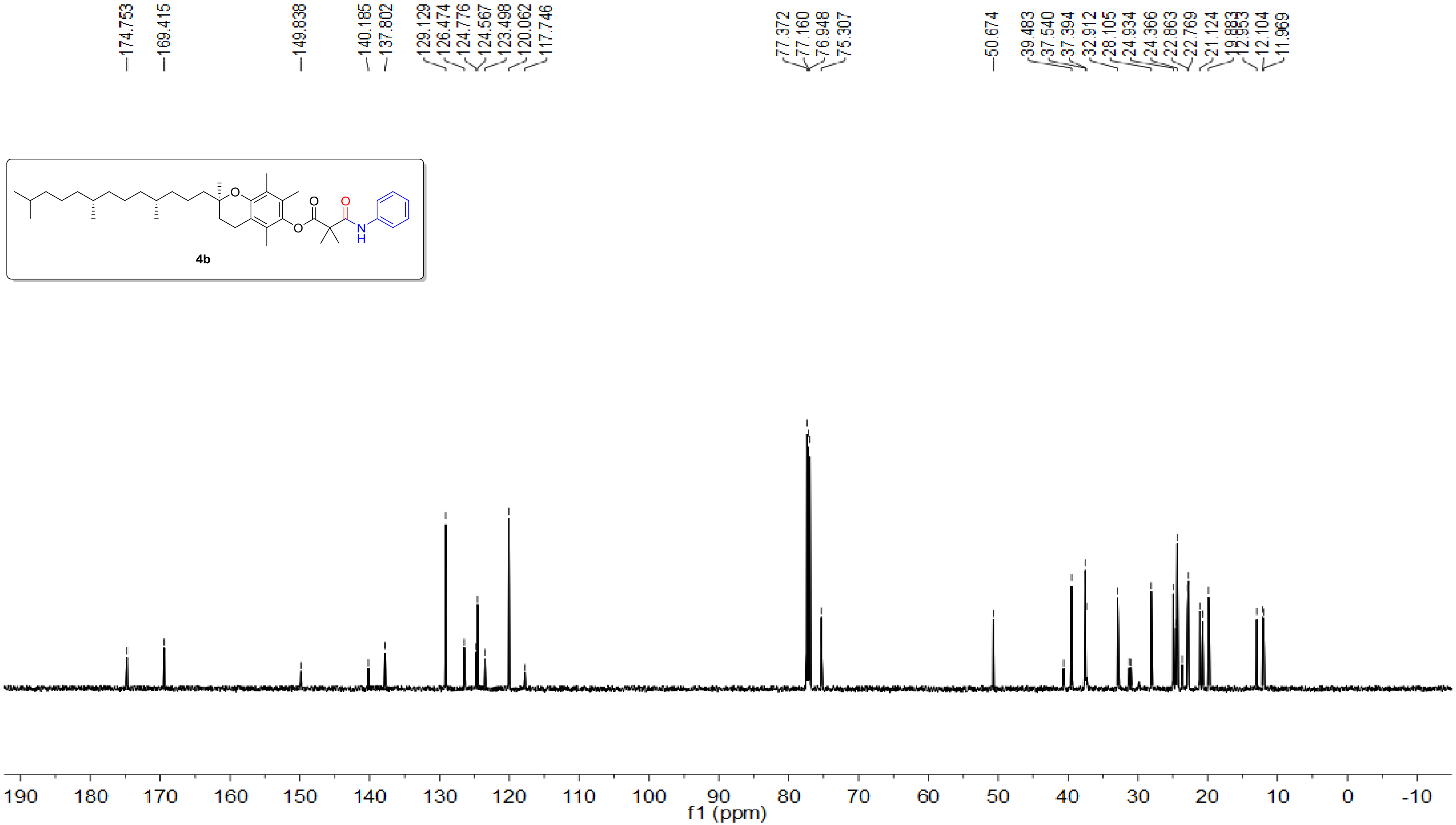
4a



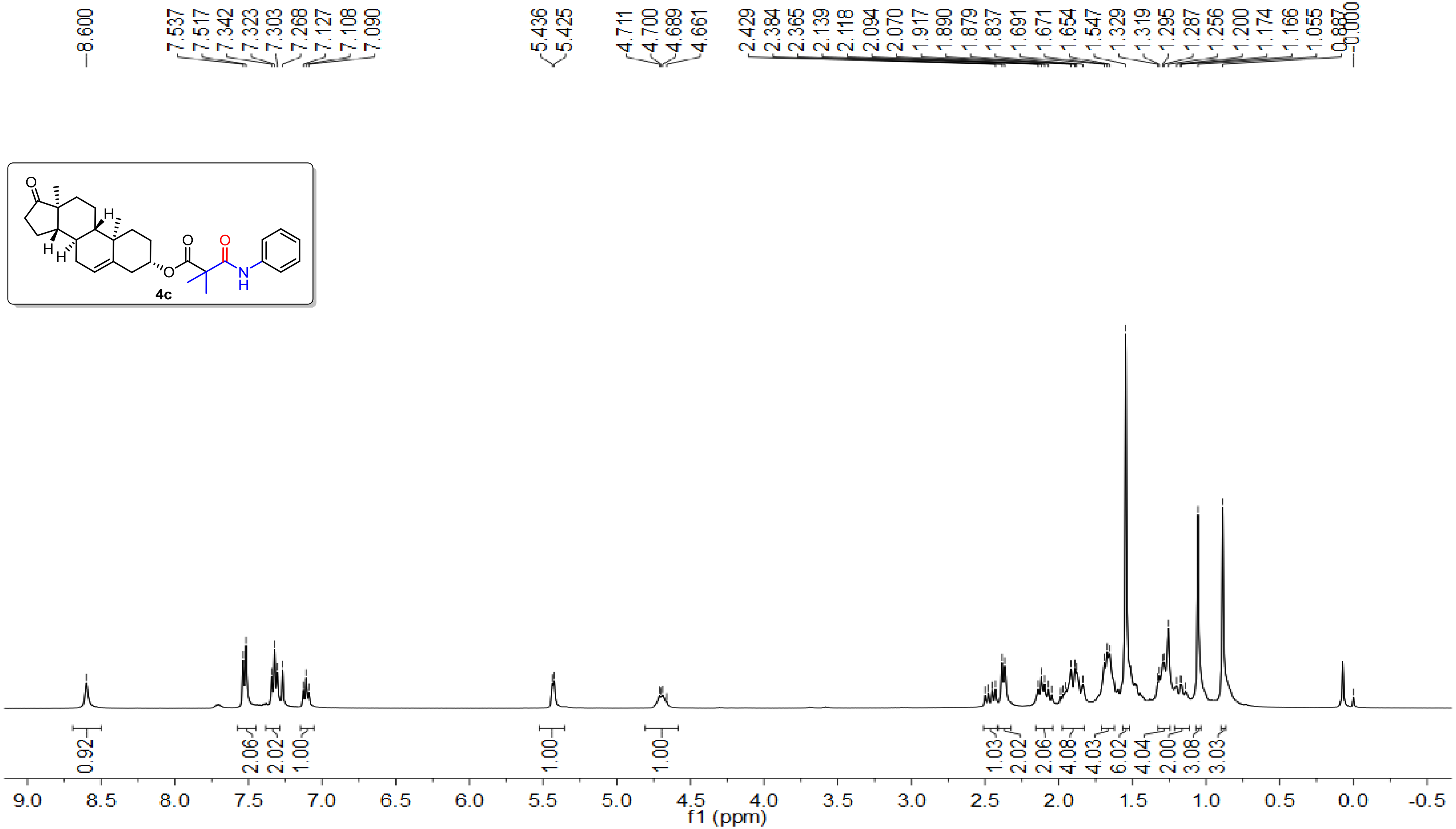
[1]H NMR Spectra (600 MHz, $CDCl_3$) of compound **4b**



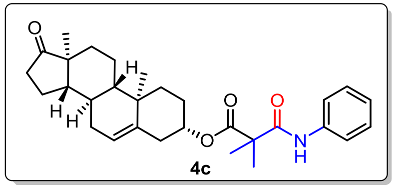
^{13}C NMR Spectra (151 MHz, $CDCl_3$) of compound **4b**

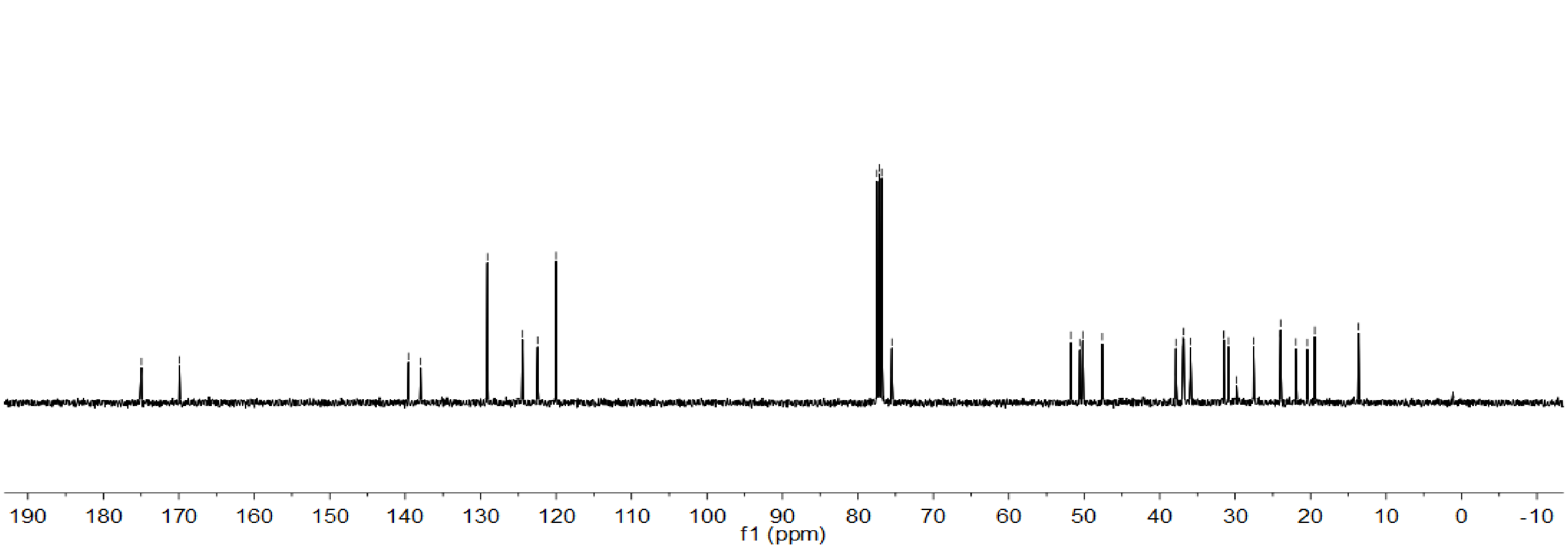


^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **4c**

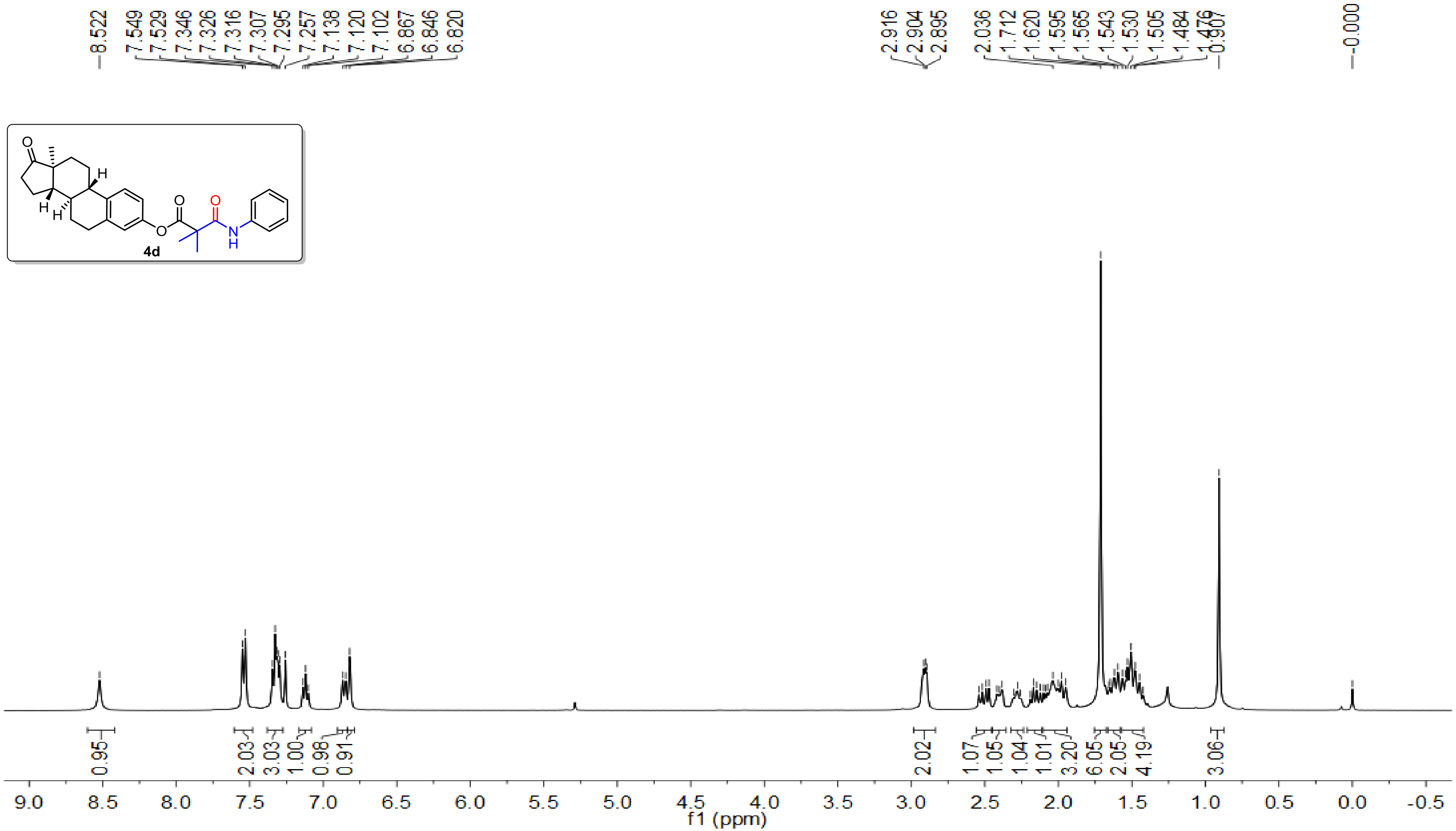


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **4c**

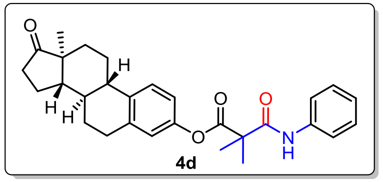


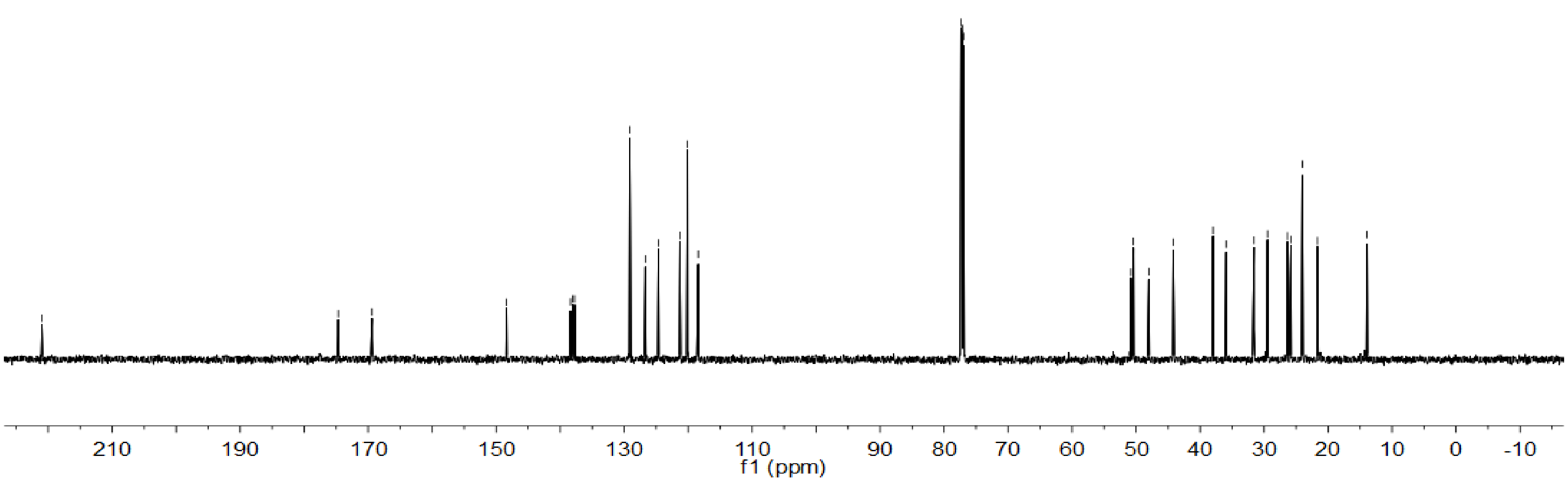


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **4d**

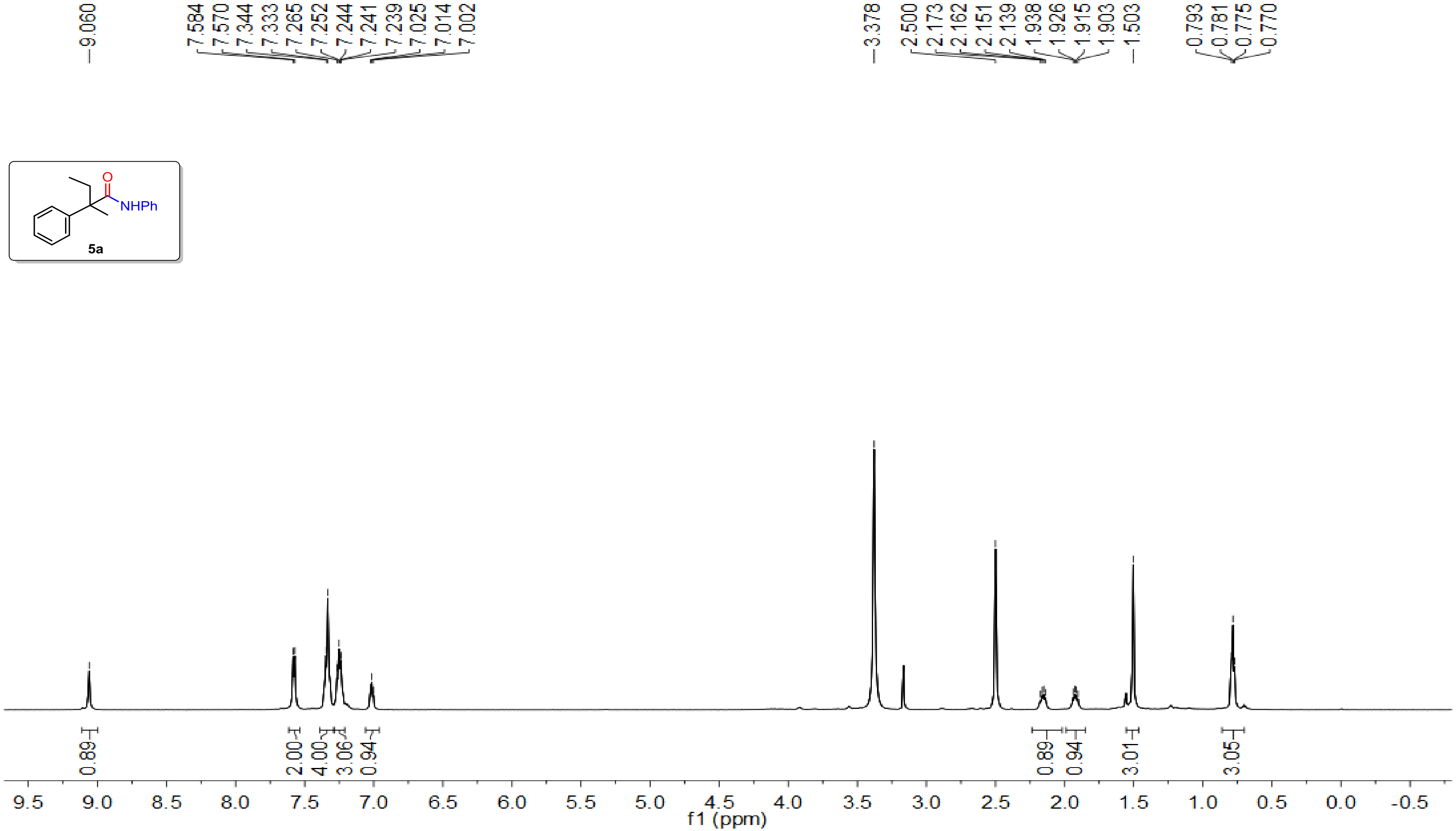


^{13}C NMR Spectra (151 MHz, $CDCl_3$) of compound **4d**

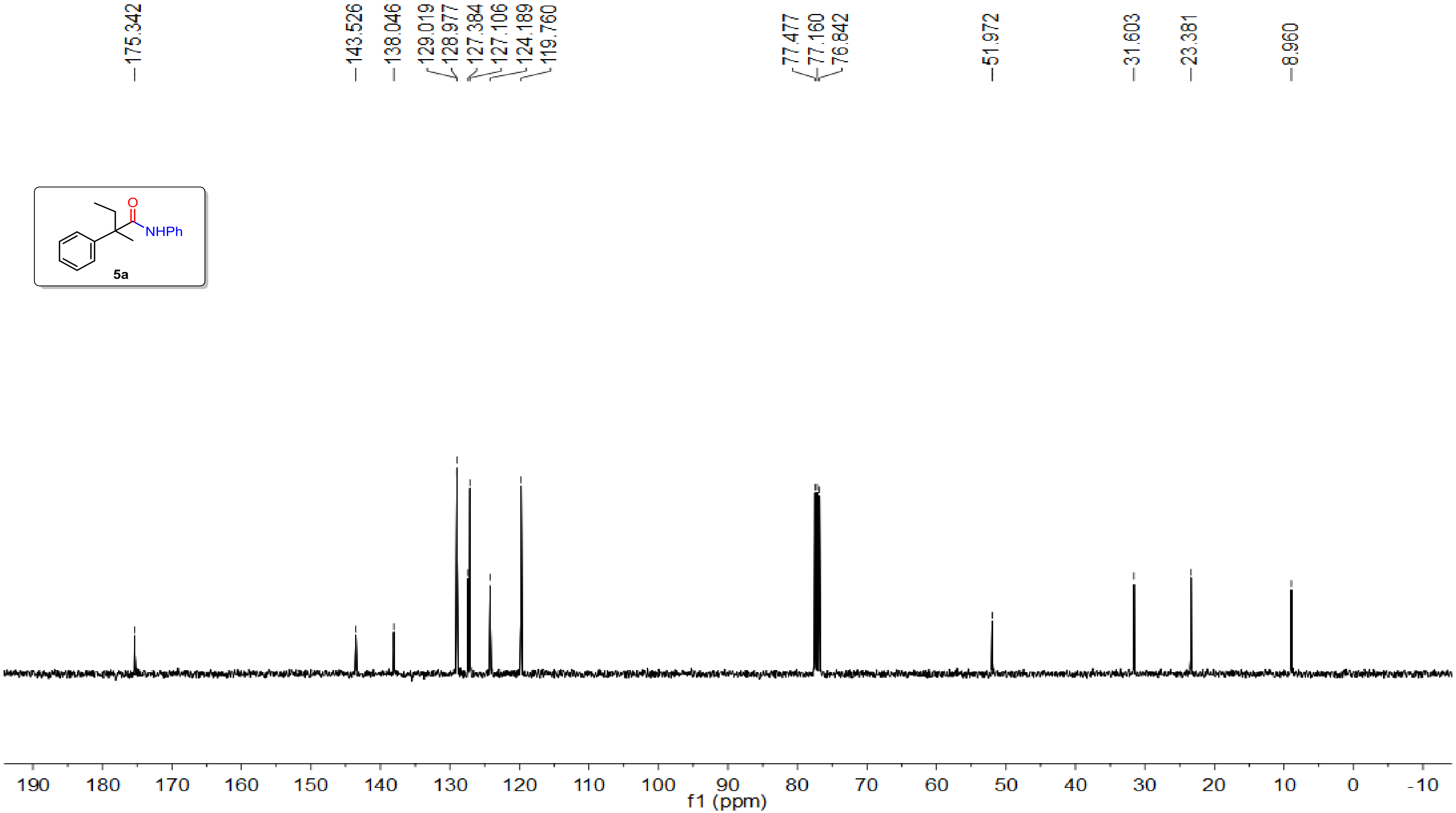




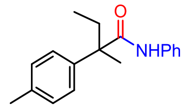
[1]H NMR Spectra (600 MHz, *d*[6]-DMSO) of compound **5a**



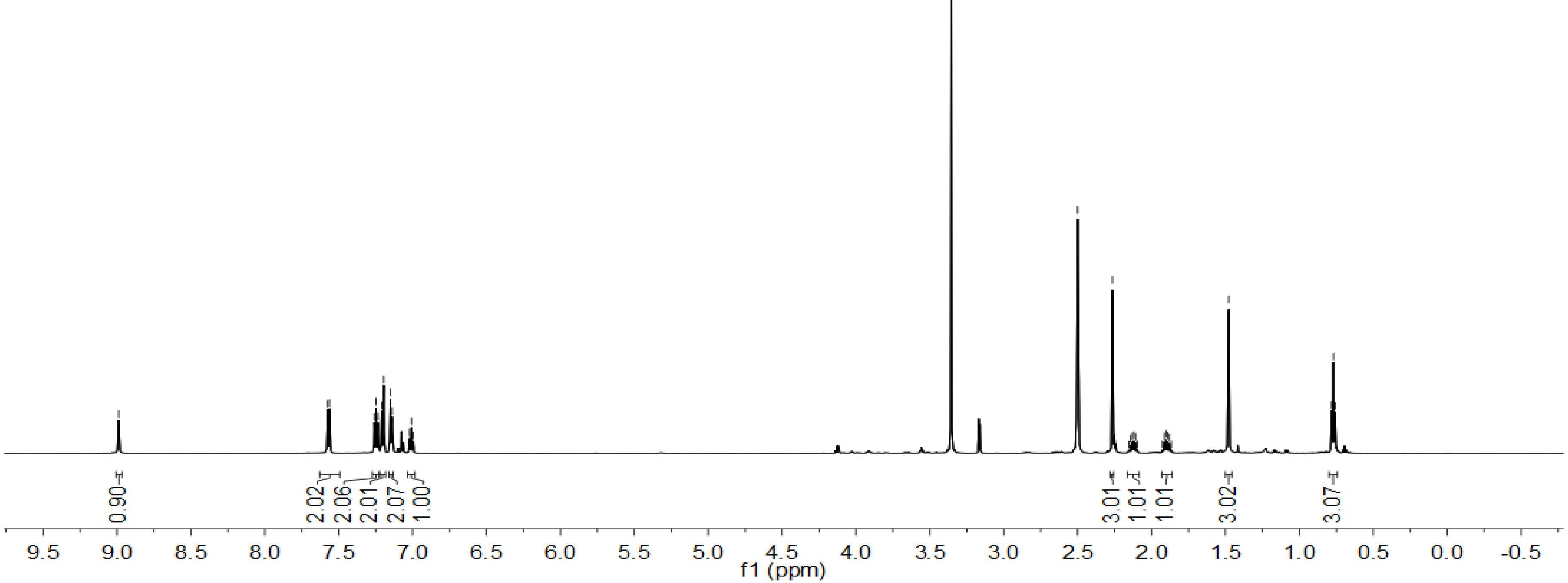
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5a**



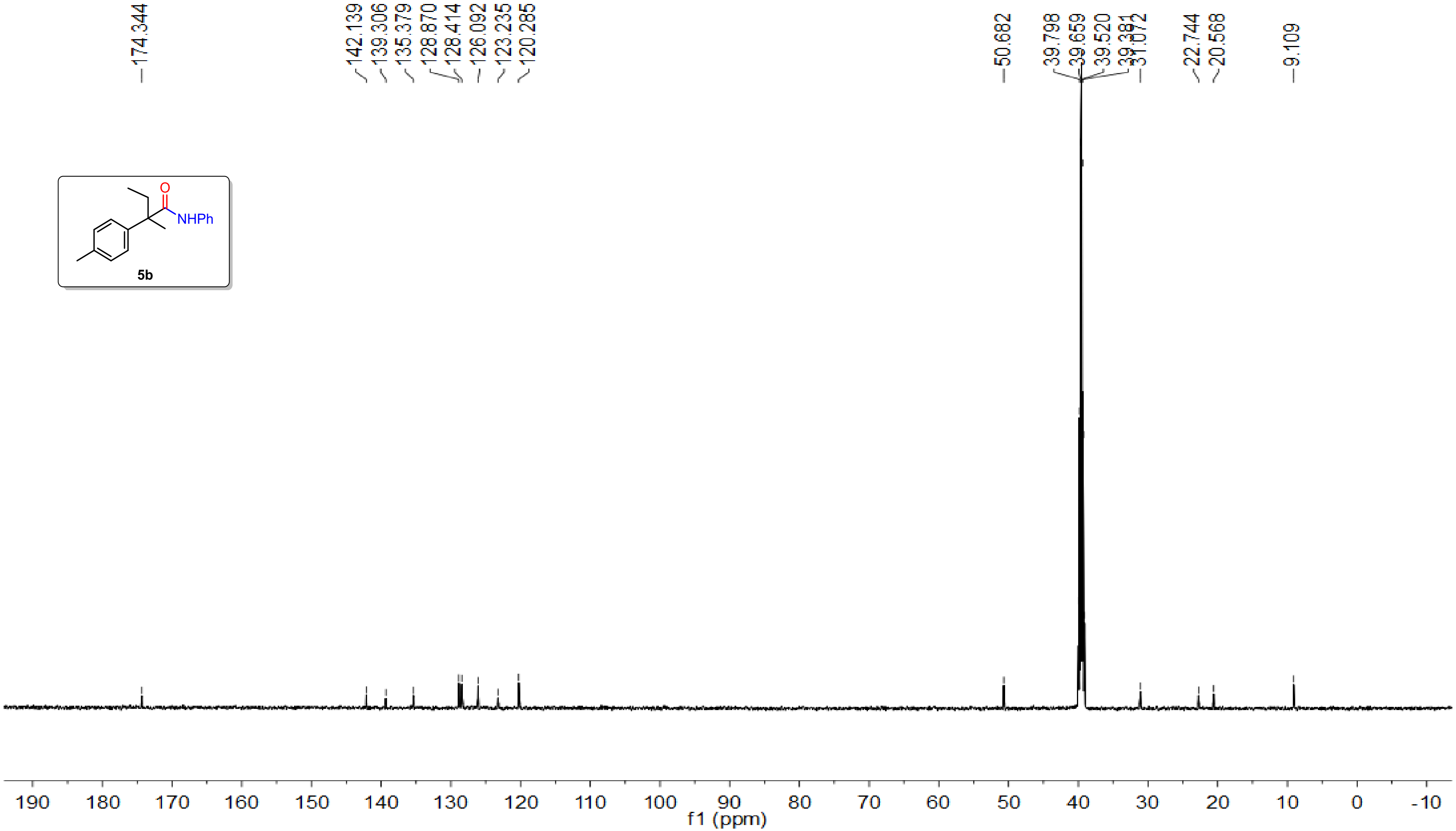
[1]H NMR Spectra (600 MHz, DMSO-d^6) of compound **5b**



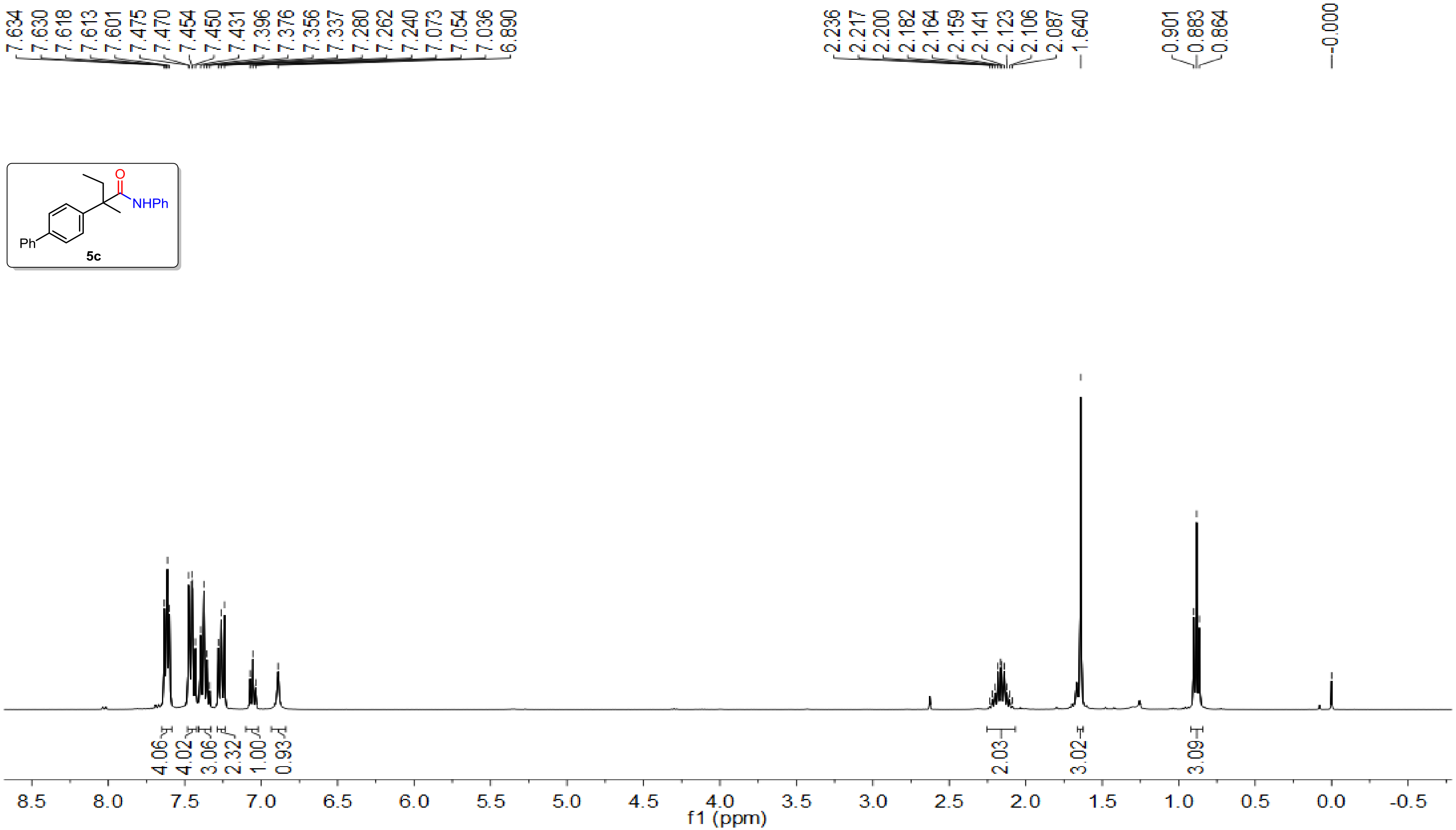
5b



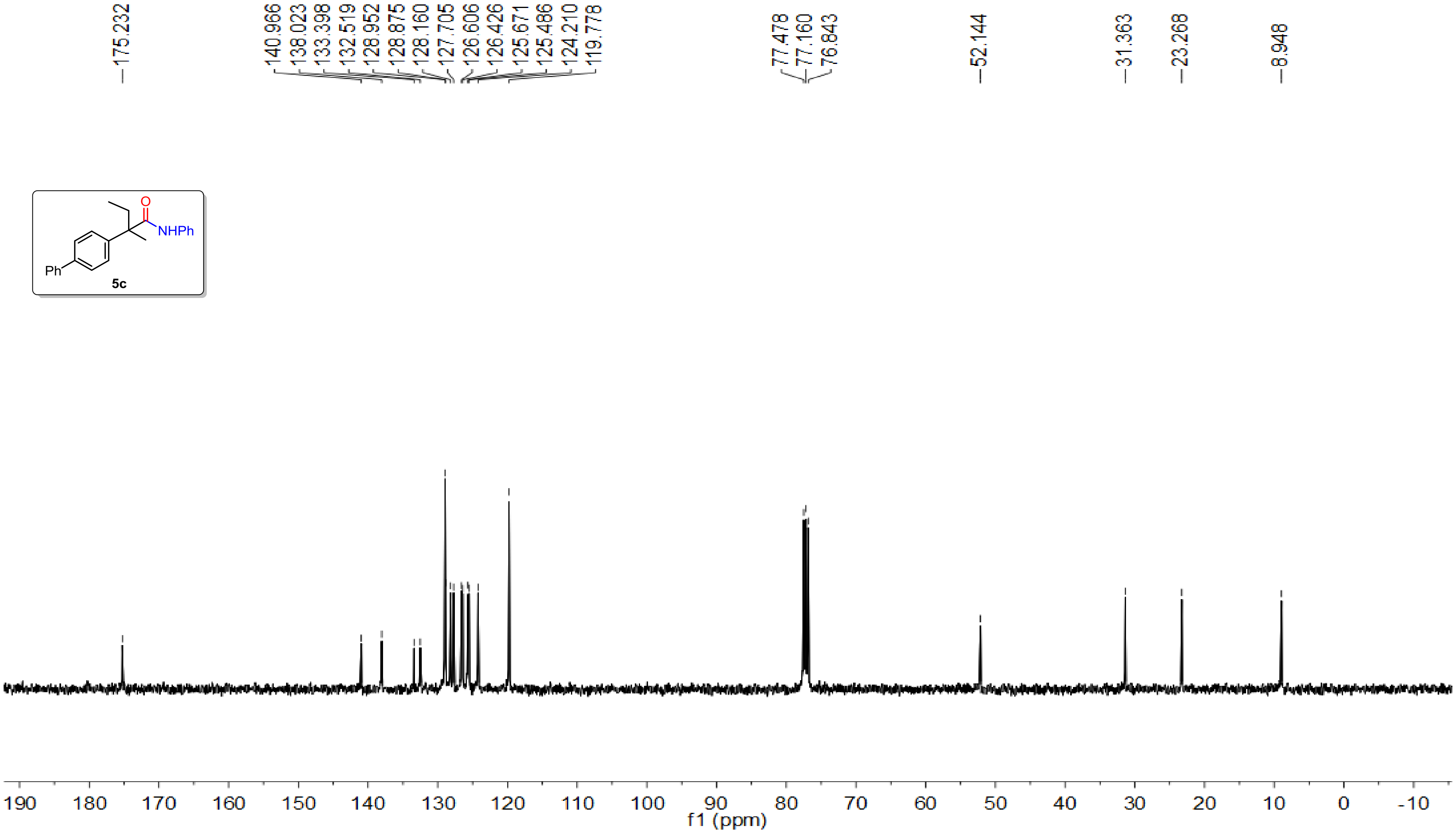
^{13}C NMR Spectra (151 MHz, DMSO-d^6) of compound **5b**



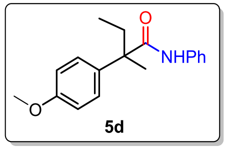
^{1}H NMR Spectra (400 MHz, CDCl$_3$) of compound **5c**



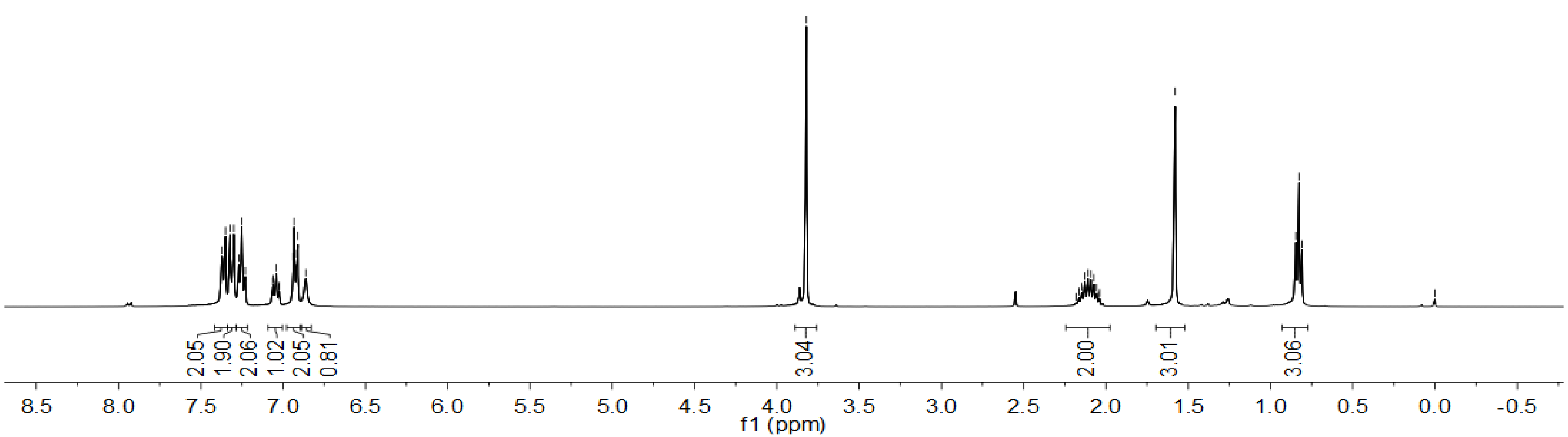
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5c**



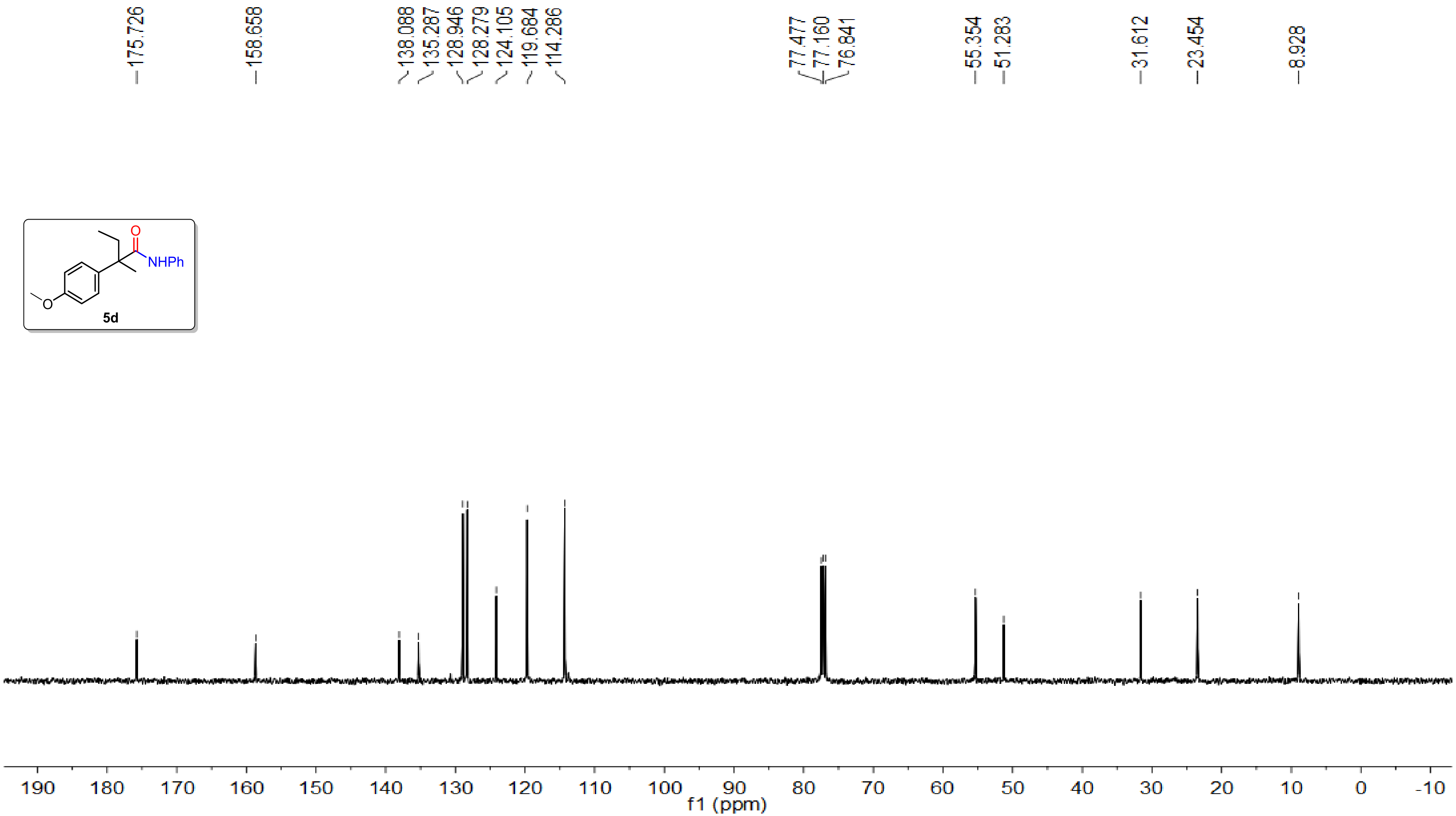
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **5d**



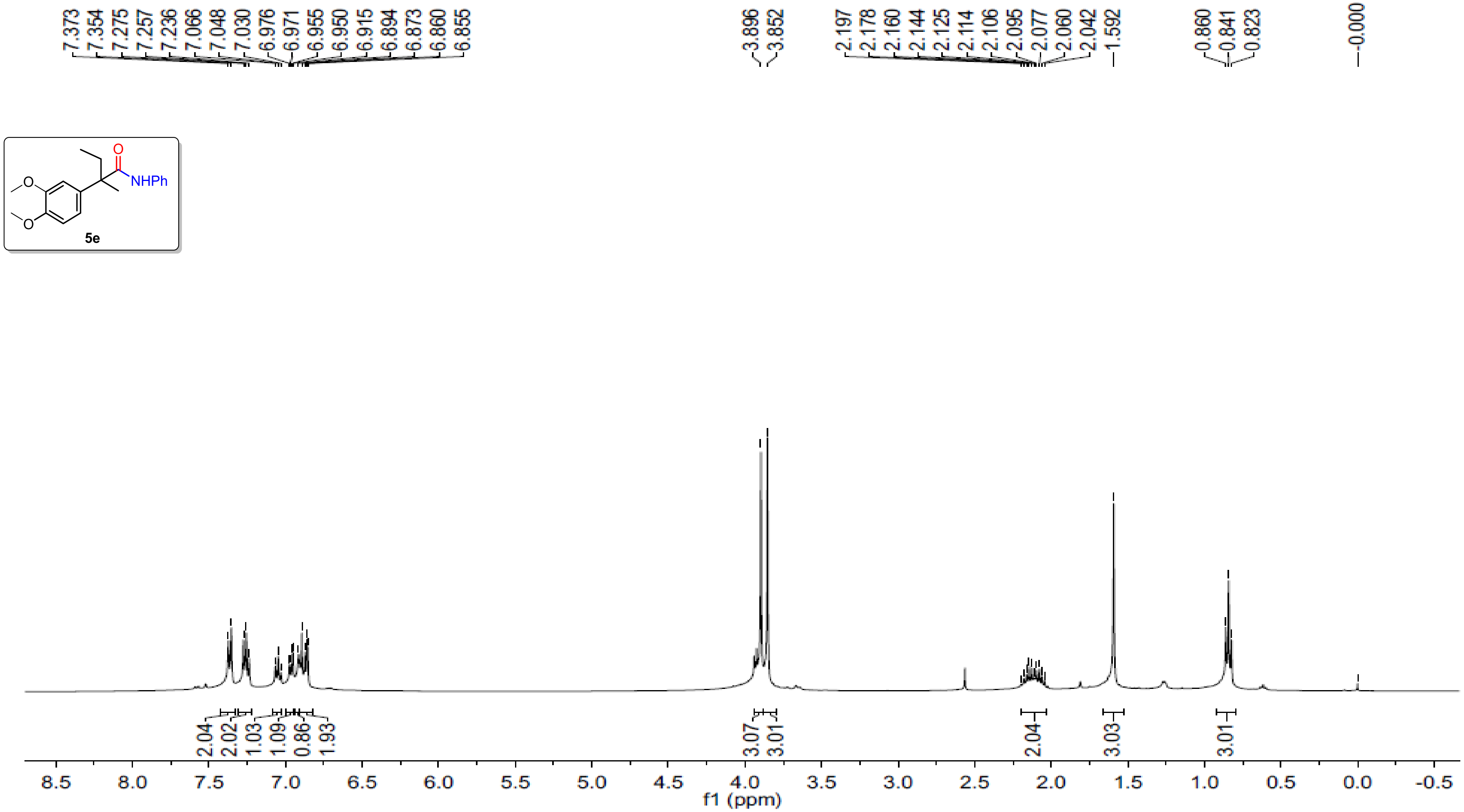
5d



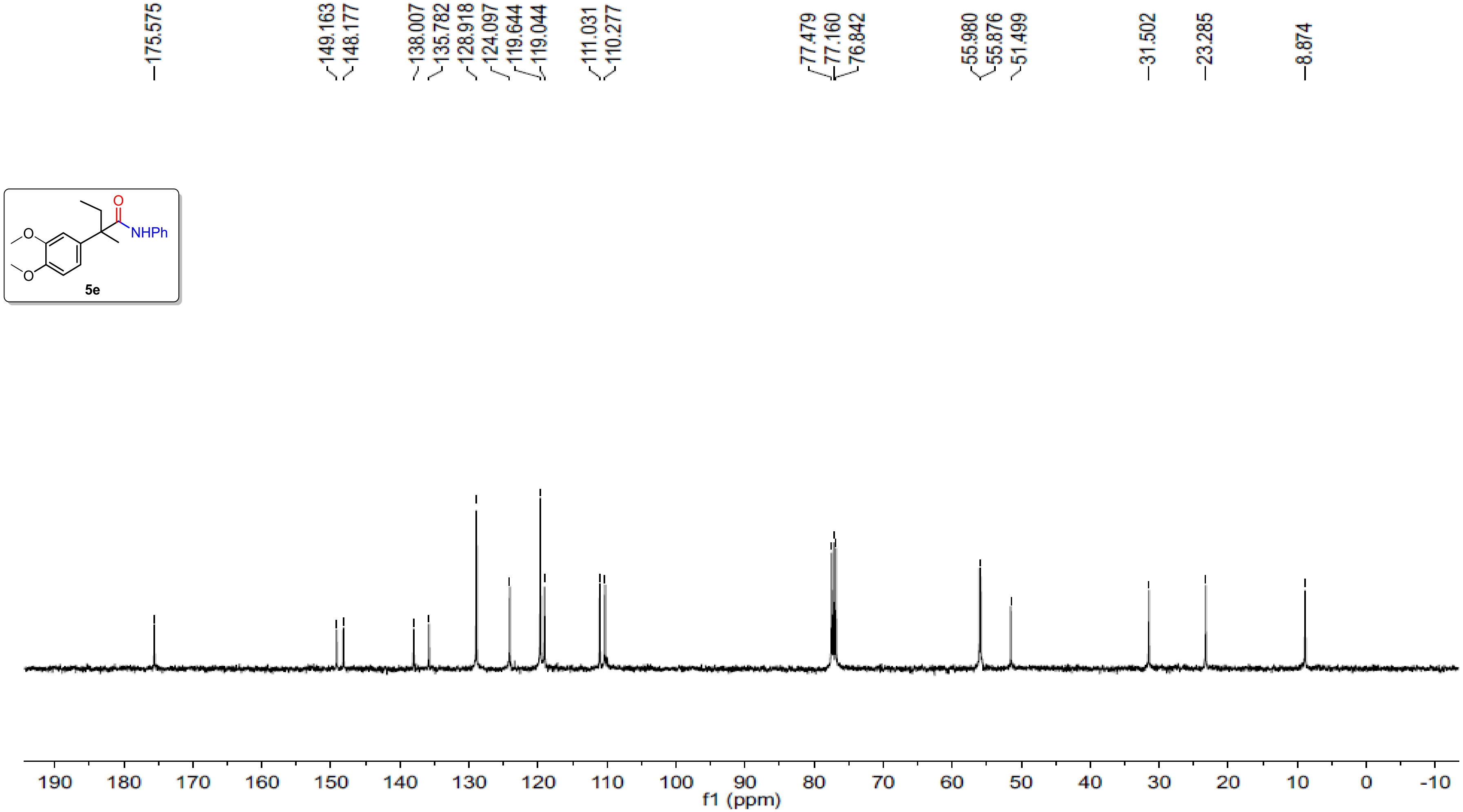
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5d**



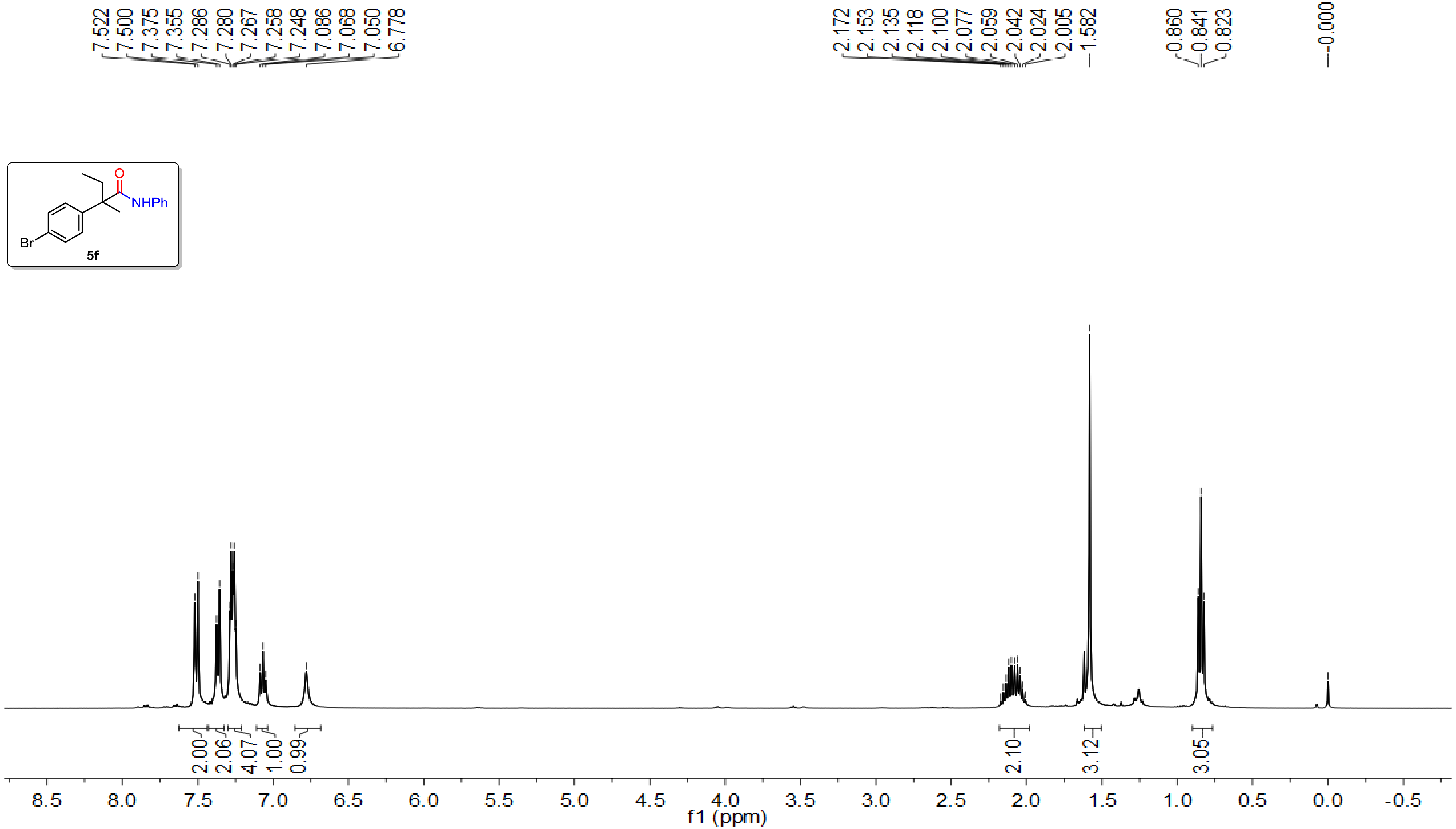
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **5e**



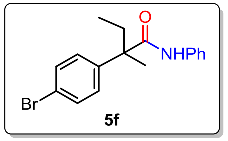
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5e**

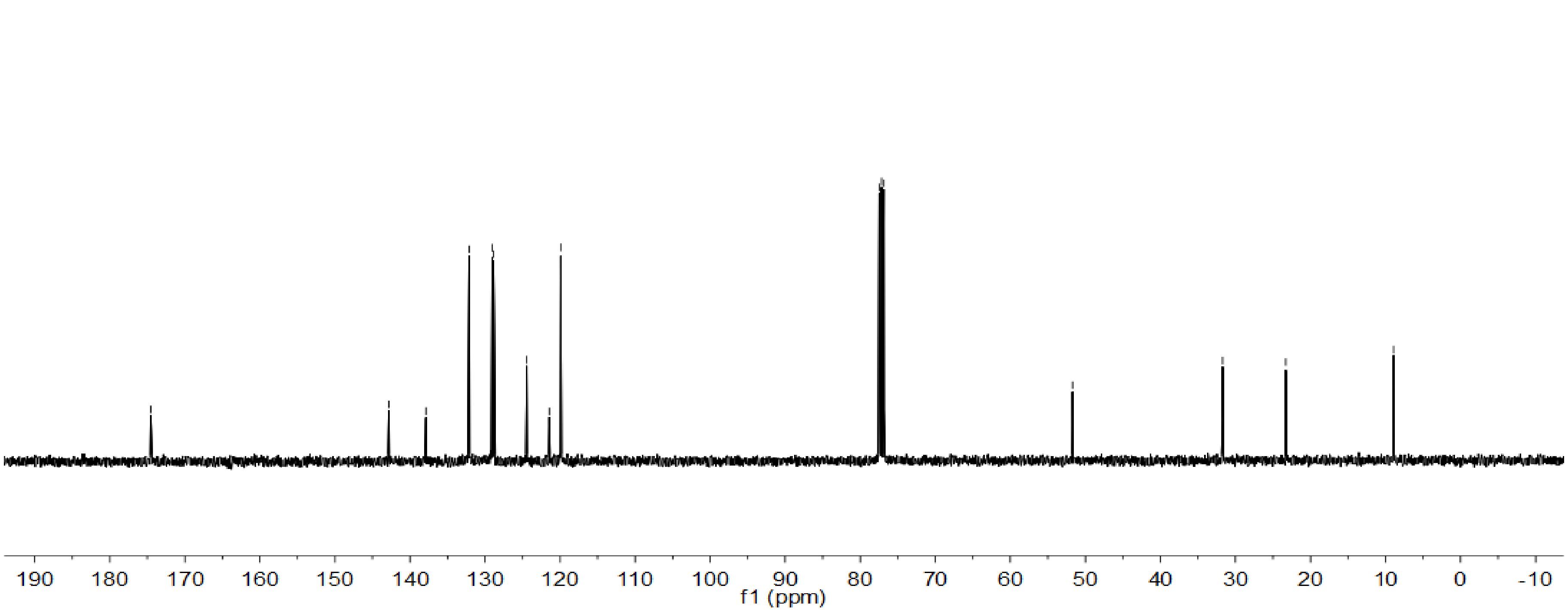


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **5f**

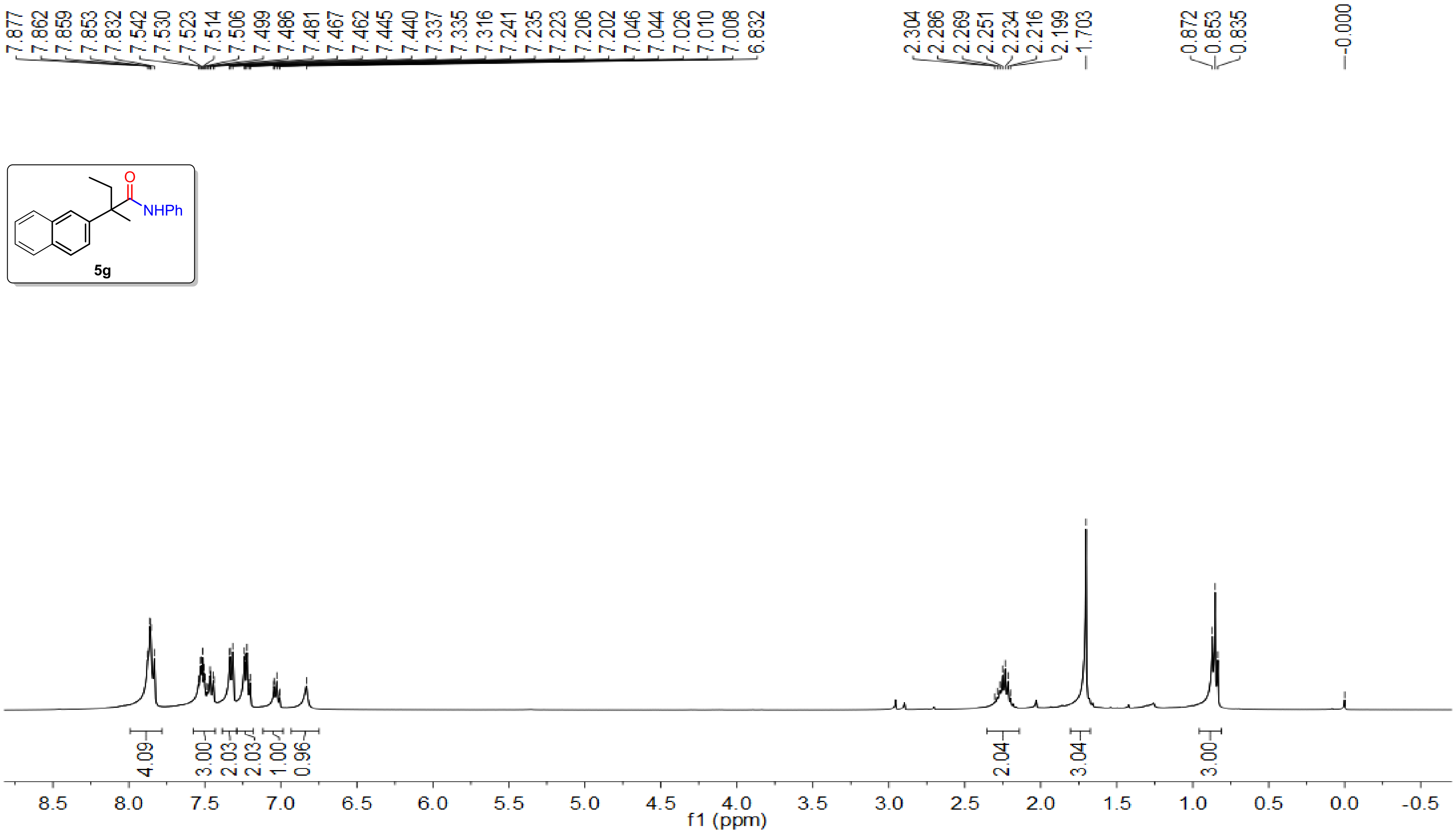


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5f**

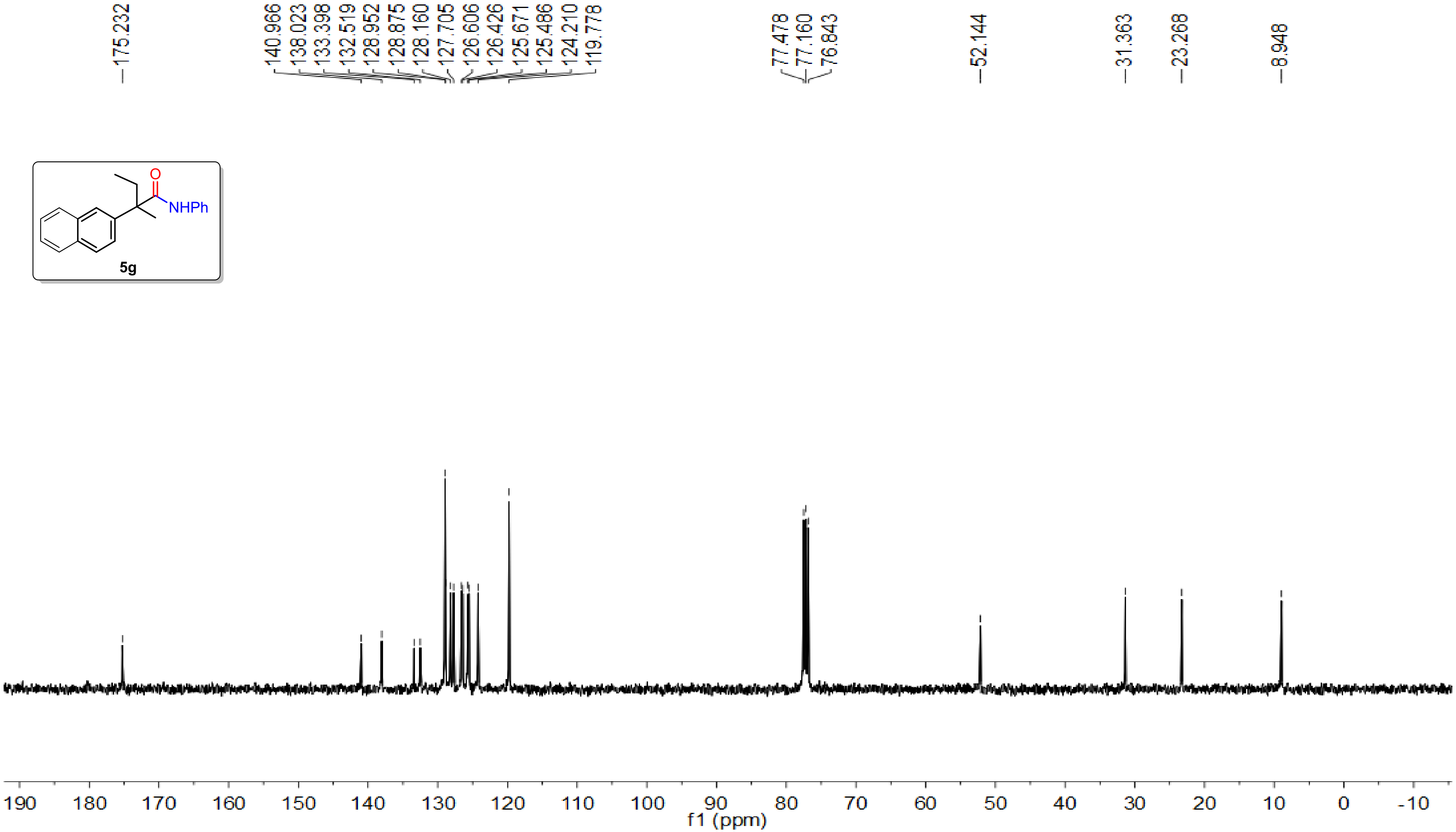




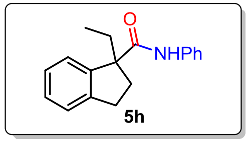
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **5g**

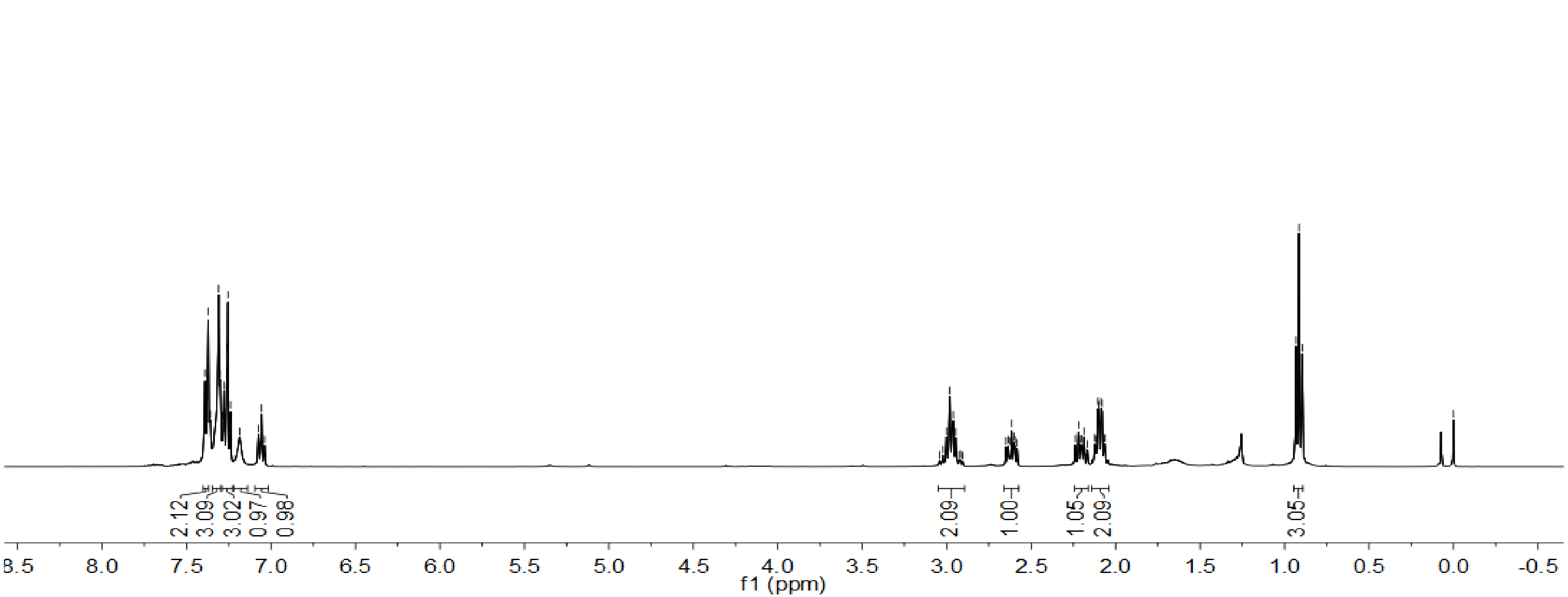


^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5g**

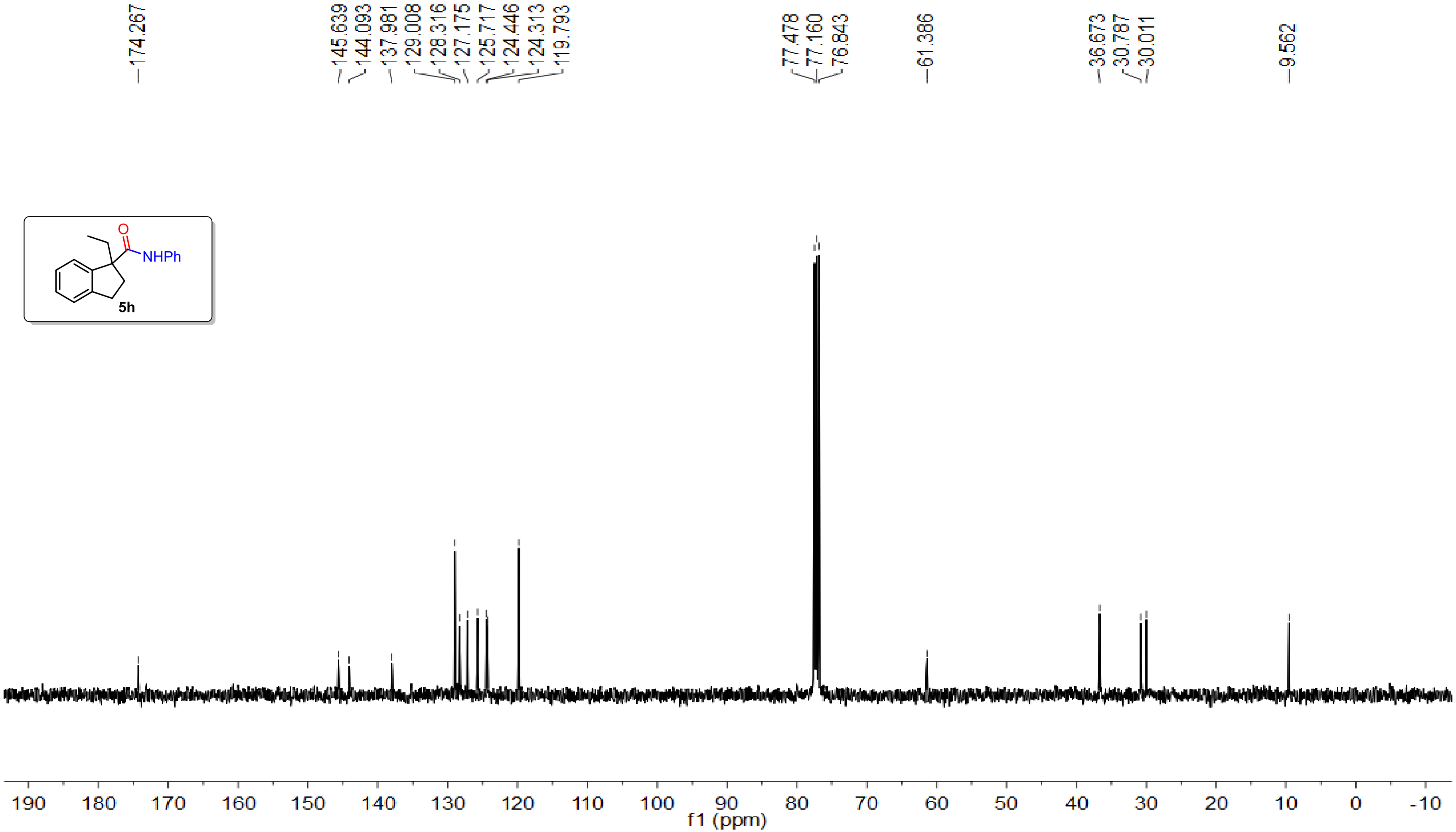


[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **5h**

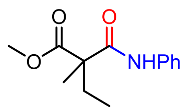




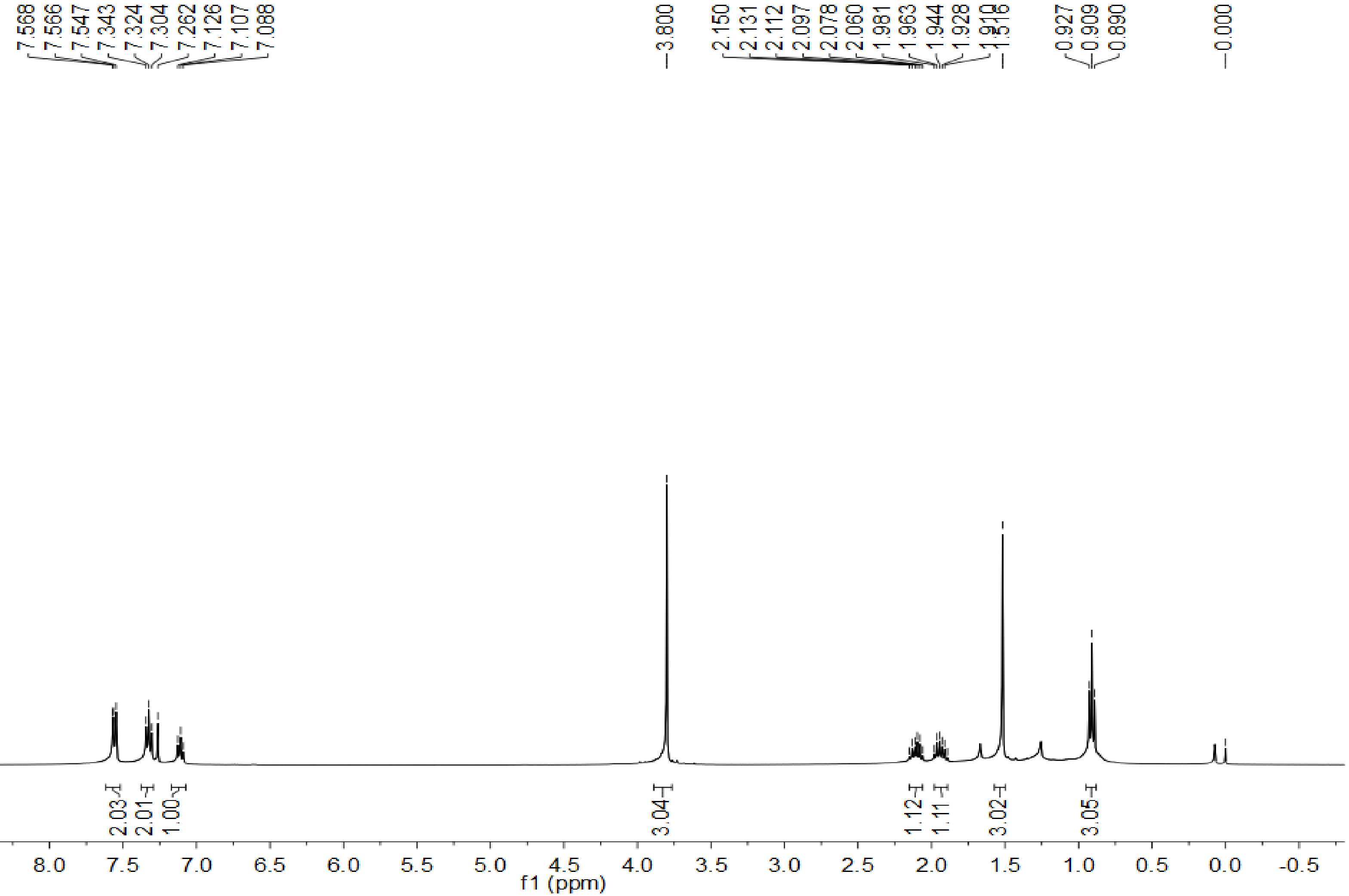
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5h**



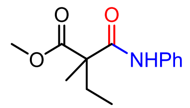
[1]H NMR Spectra (600 MHz, $CDCl_3$) of compound **5i**



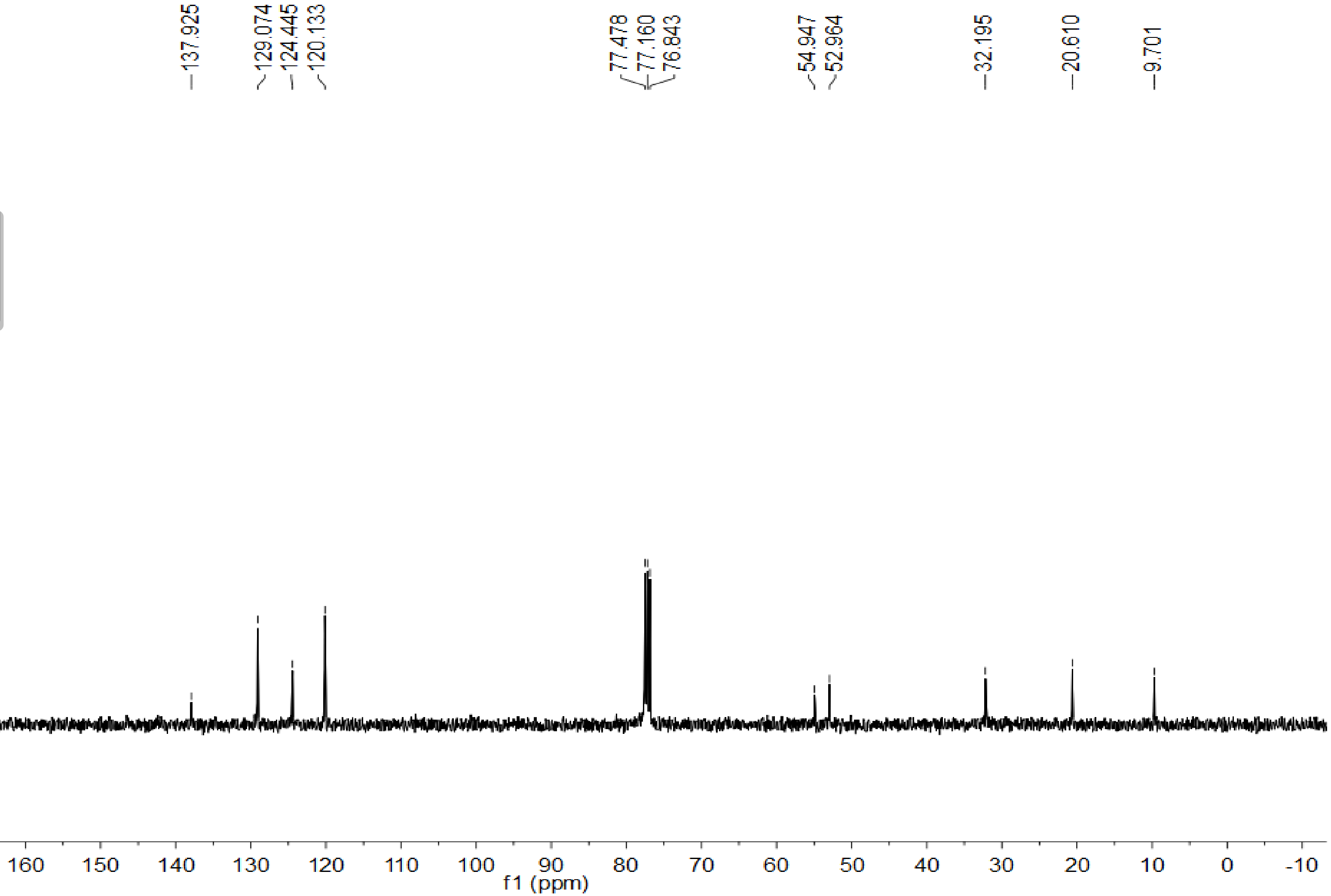
5i



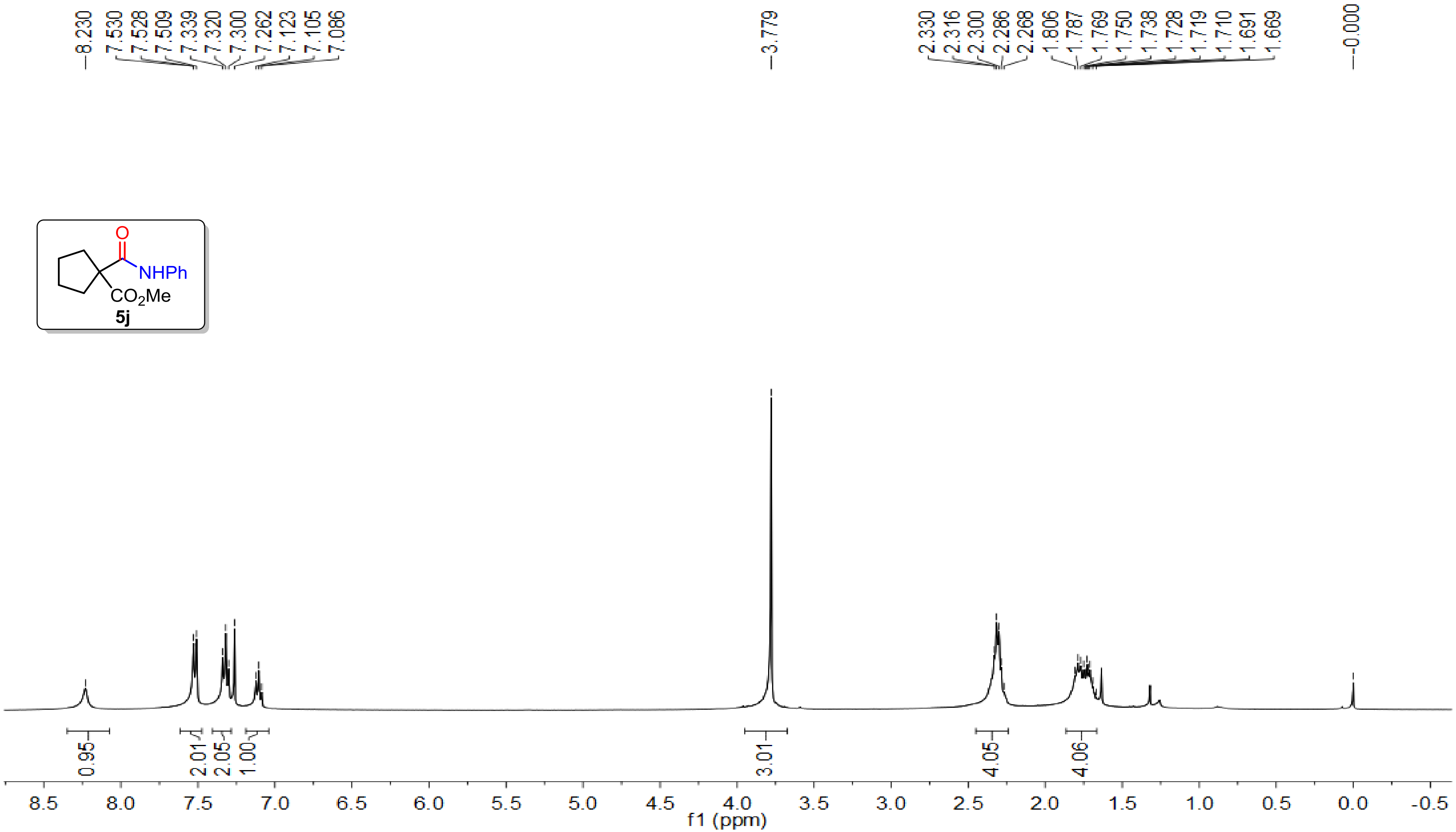
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5i**



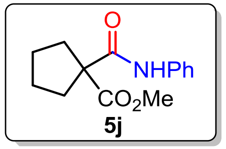
5i



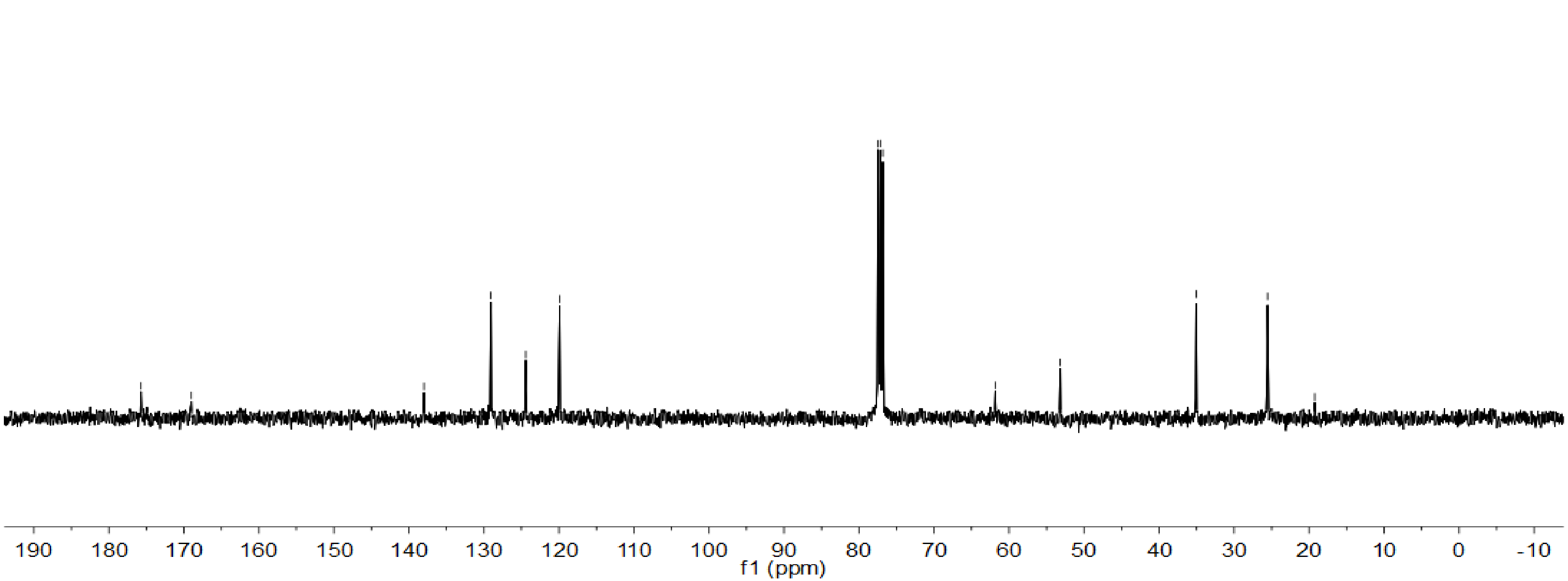
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **5j**



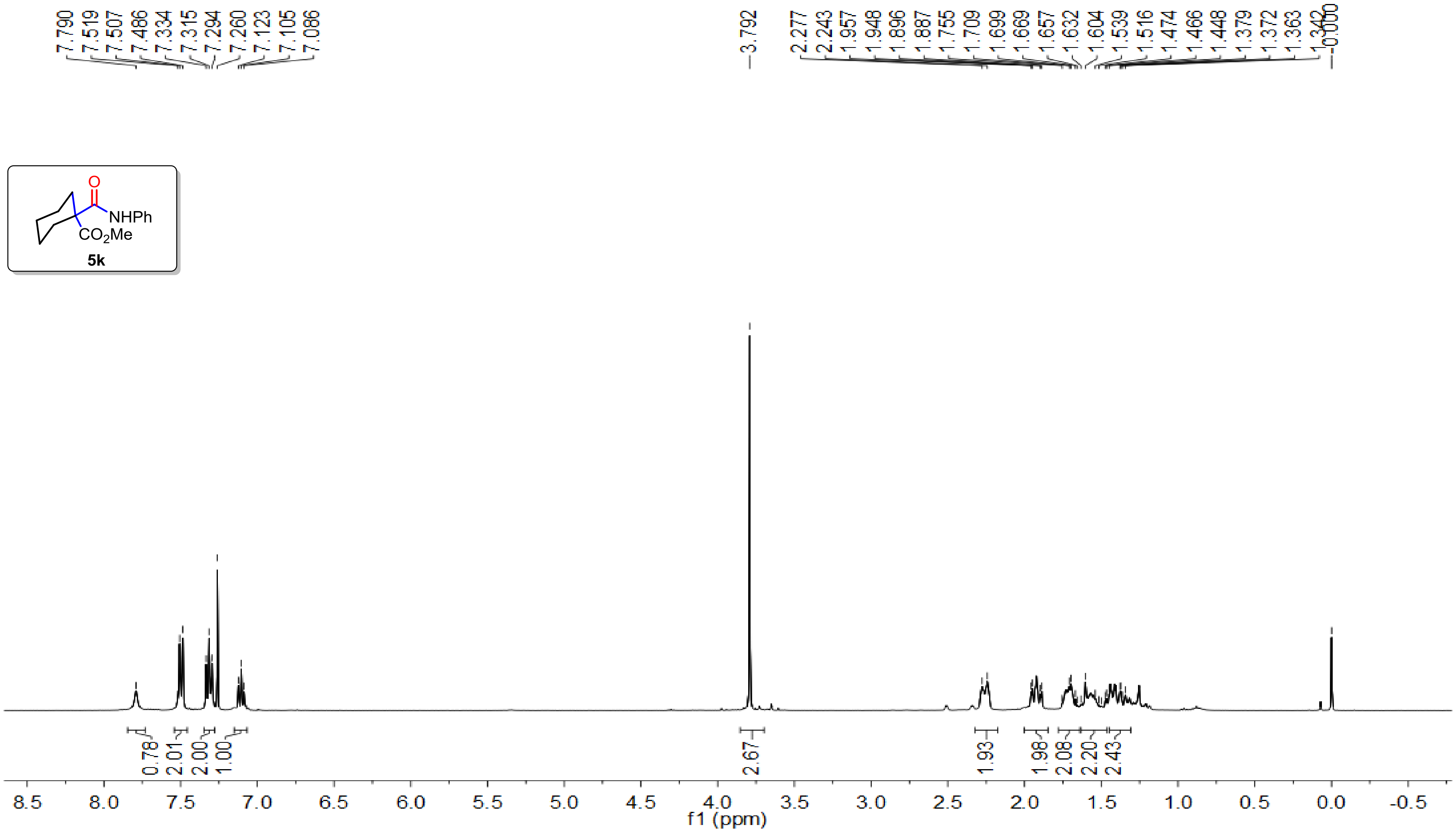
[13]C NMR Spectra (101 MHz, $CDCl_3$) of compound **5j**



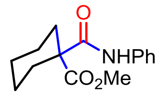
5j



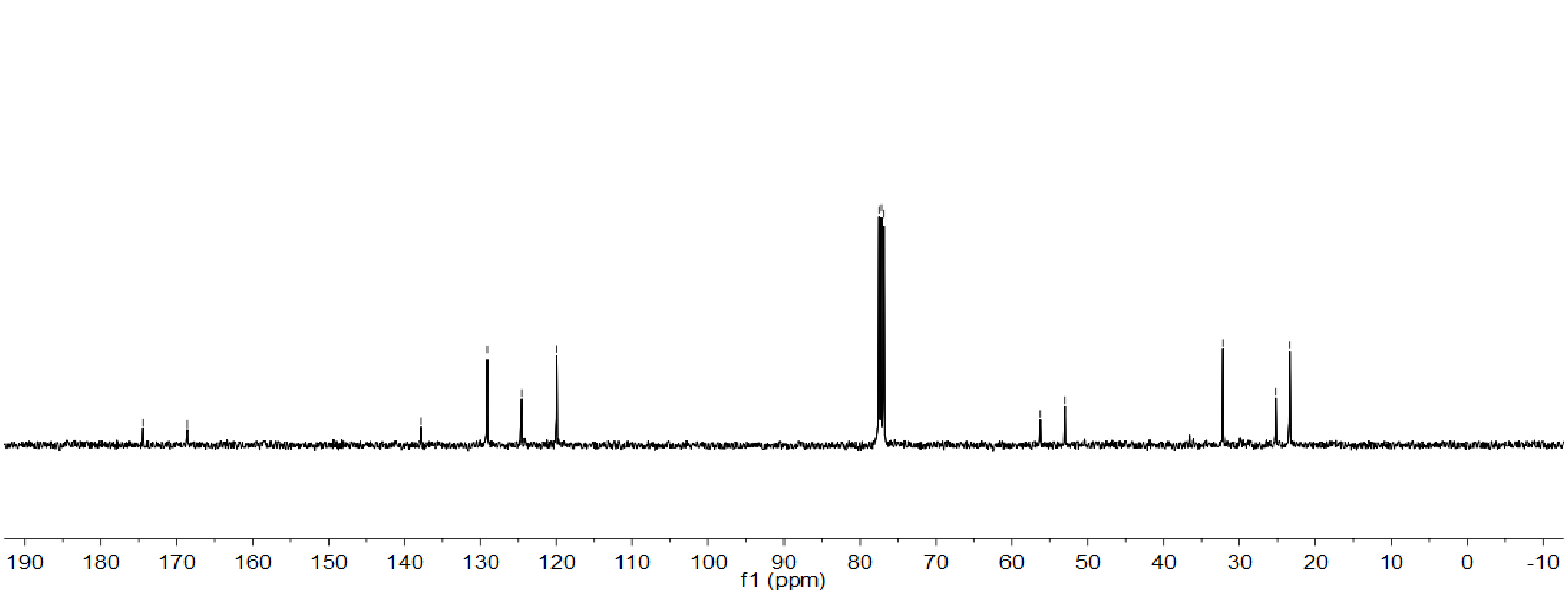
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **5k**



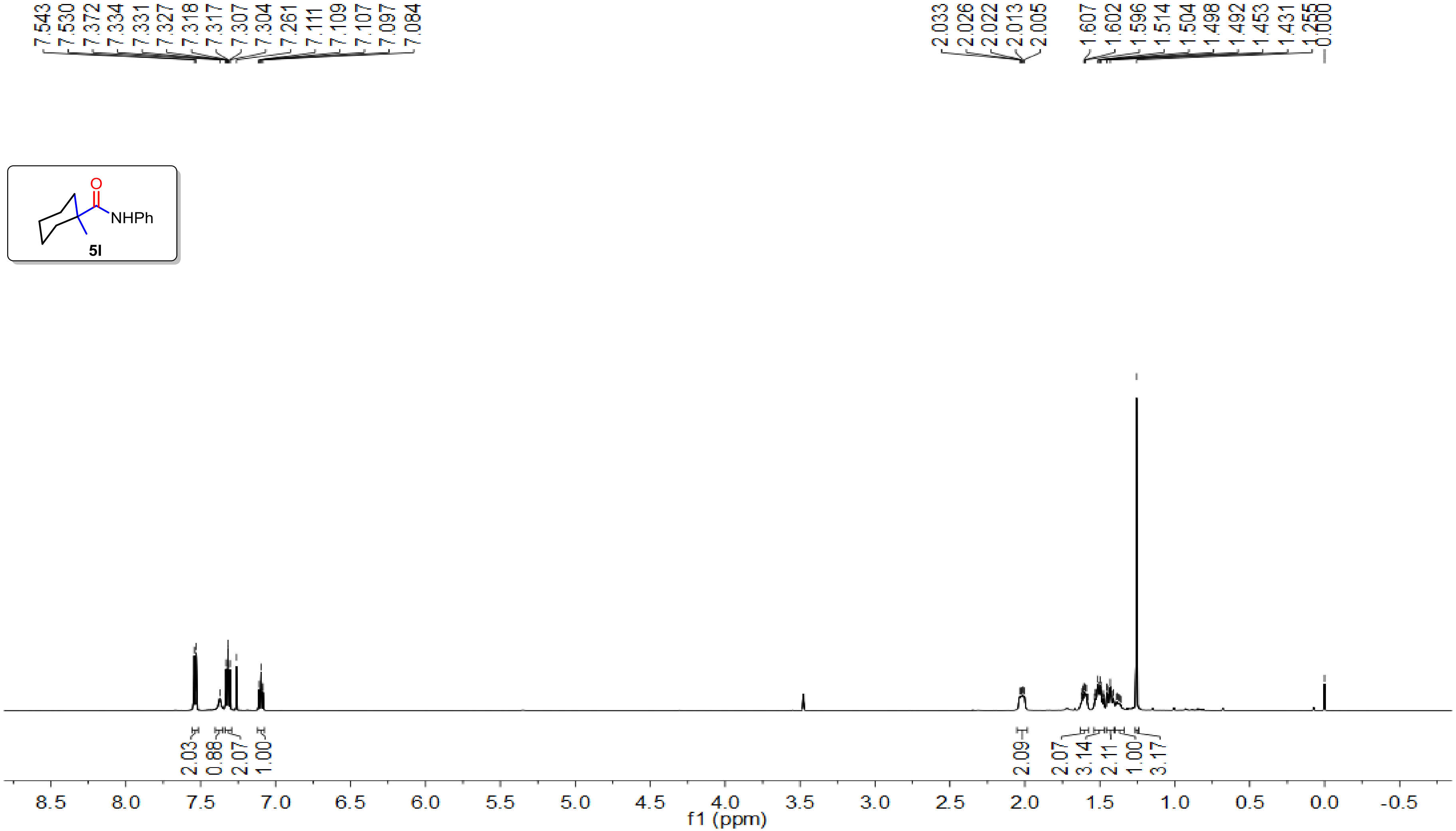
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5k**



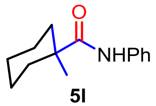
5k



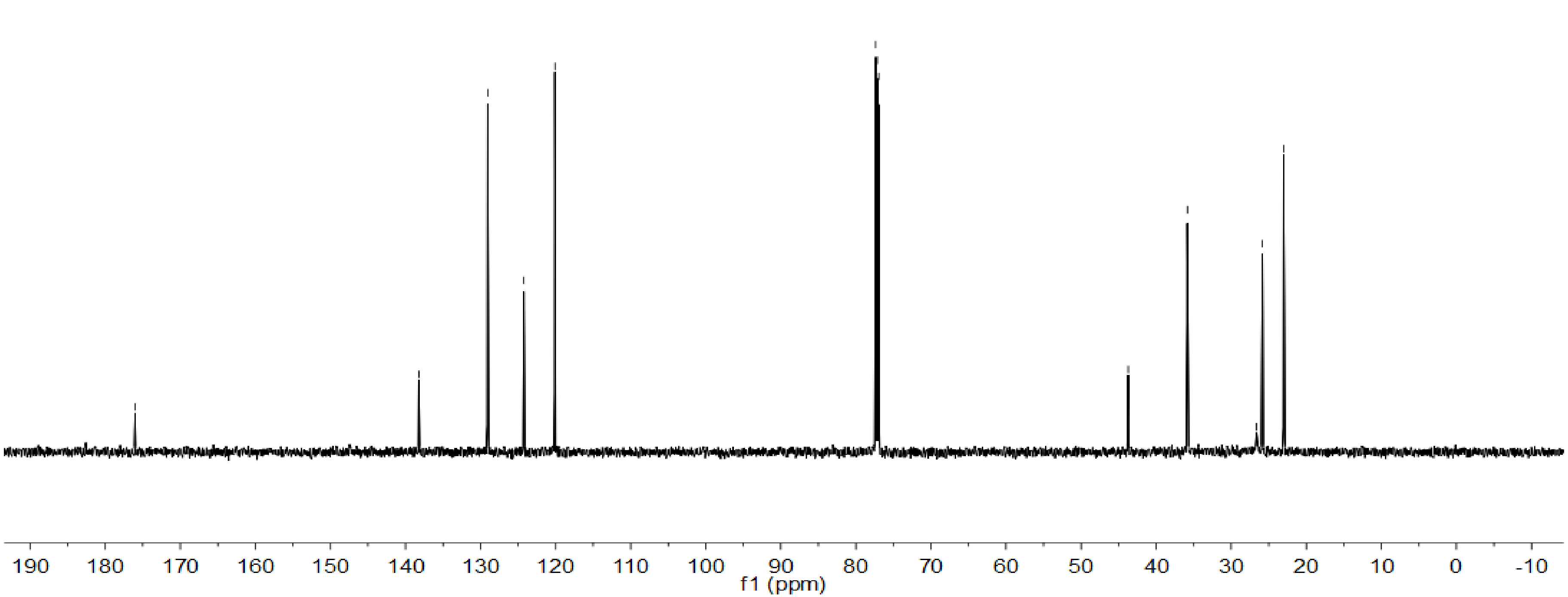
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **5l**



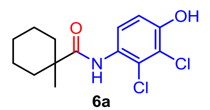
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **5l**



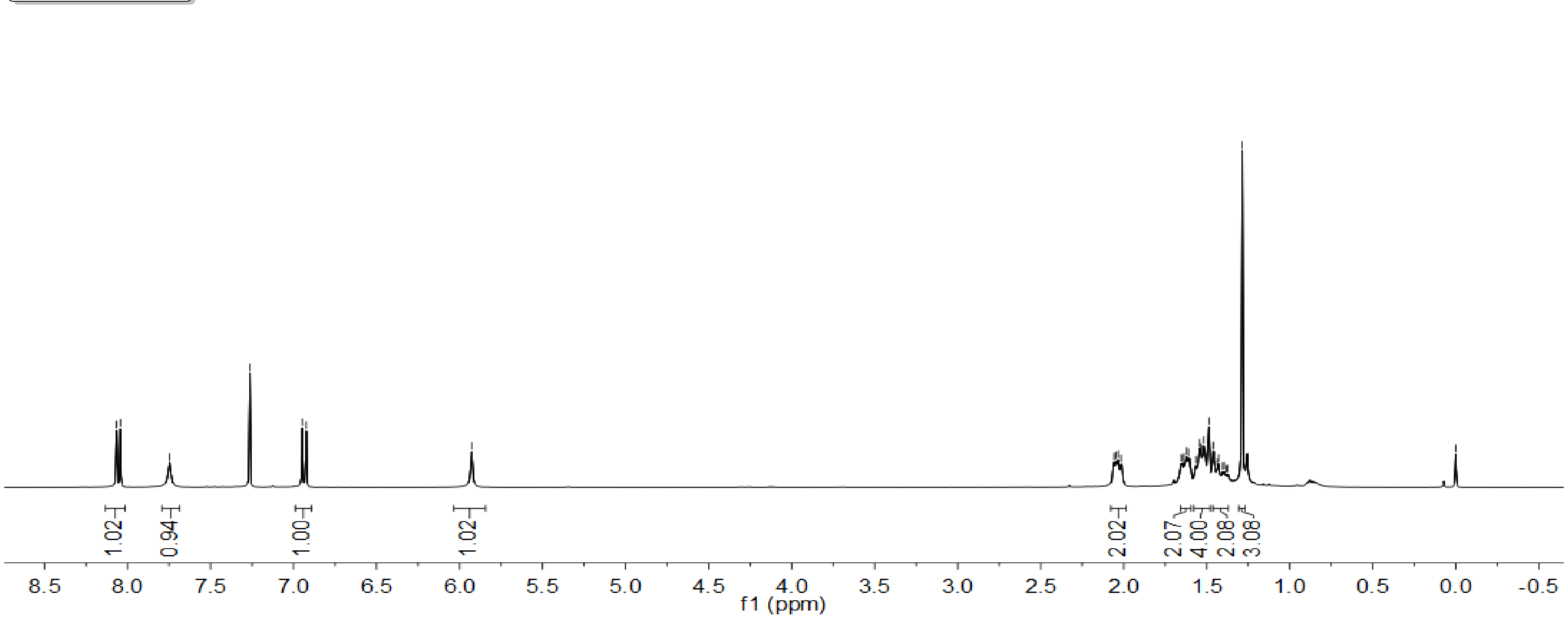
5l



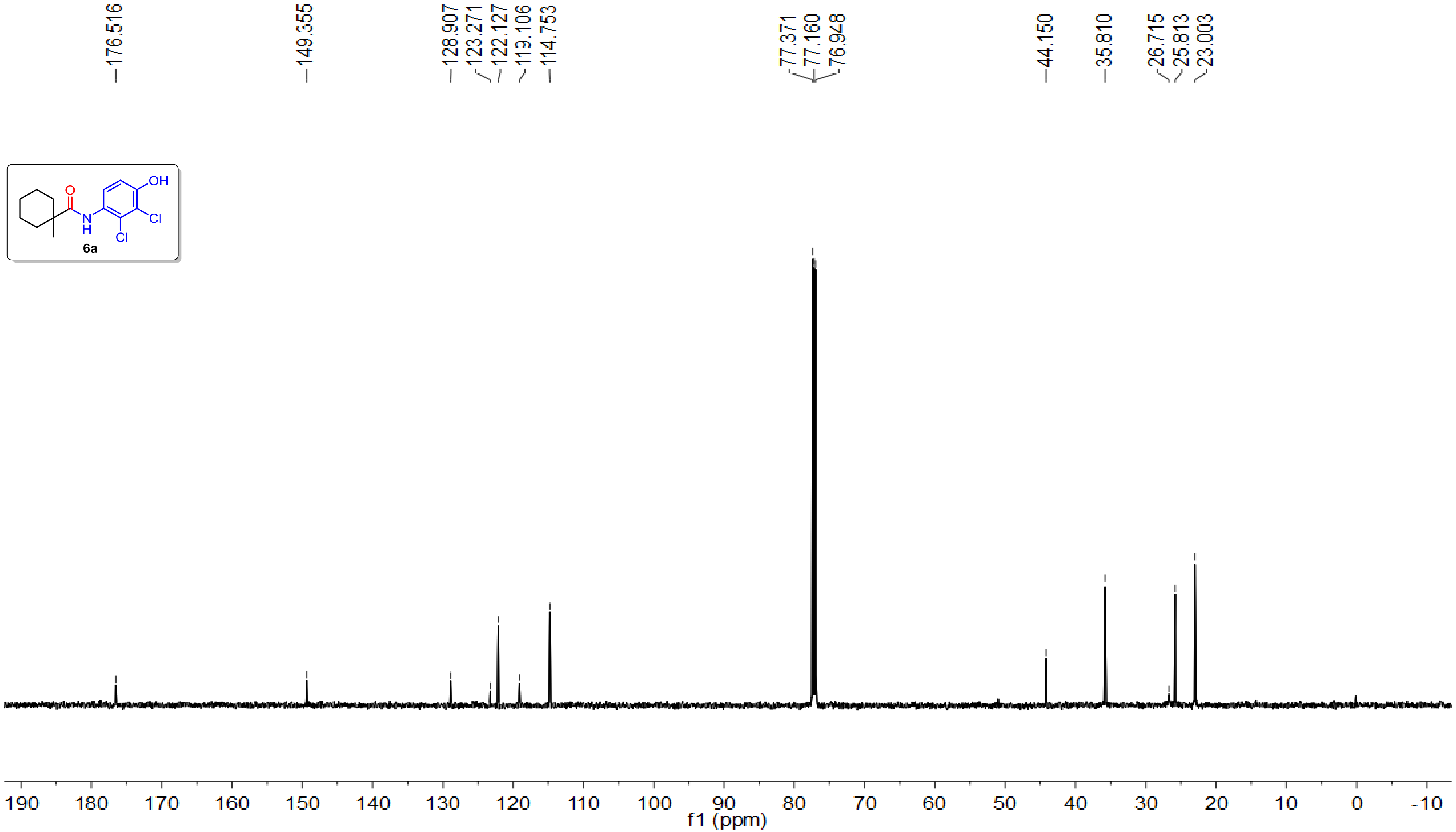
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **6a**



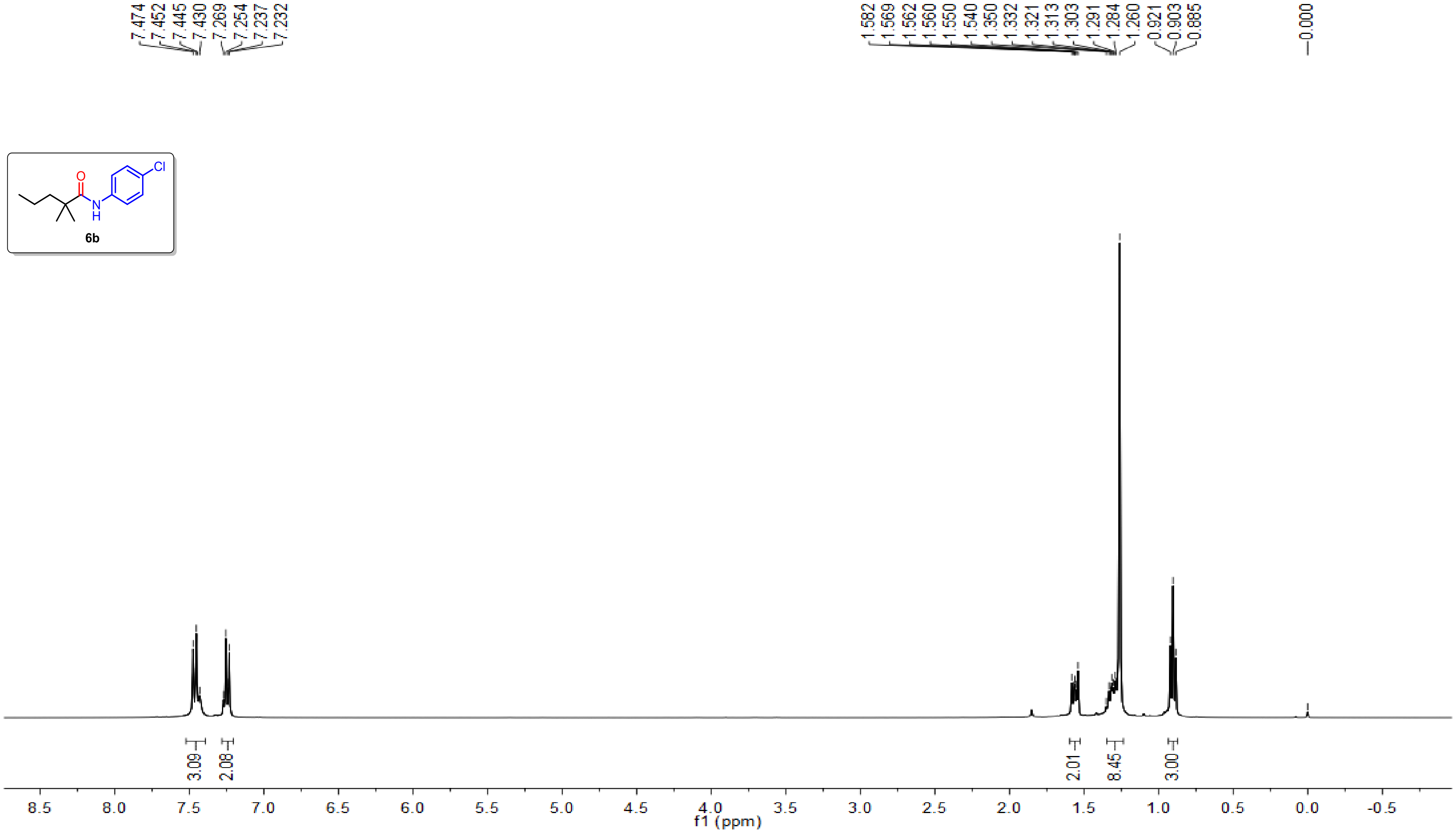
6a



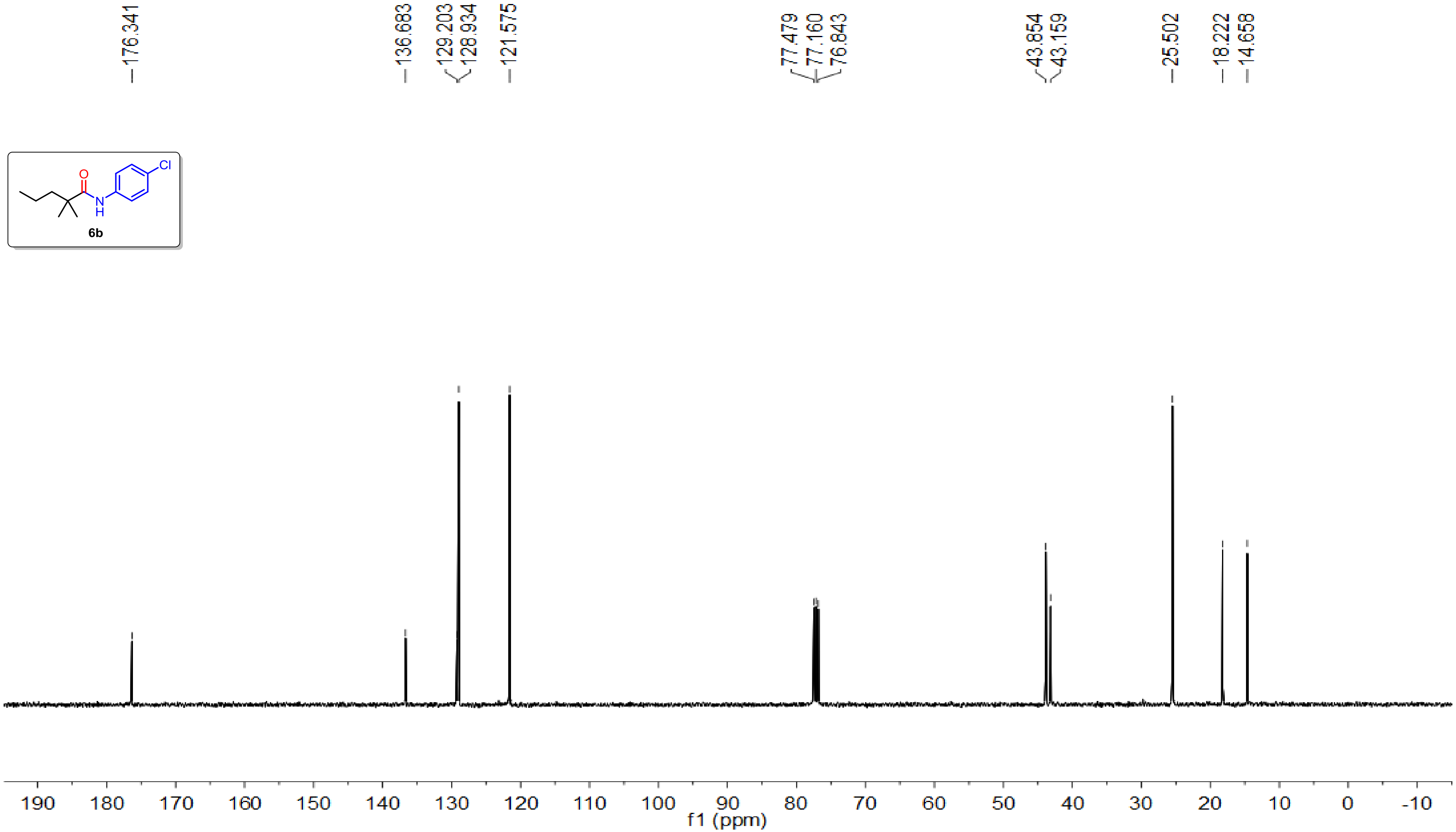
^{13}C NMR Spectra (151 MHz, $CDCl_3$) of compound **6a**



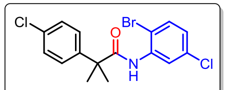
^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **6b**



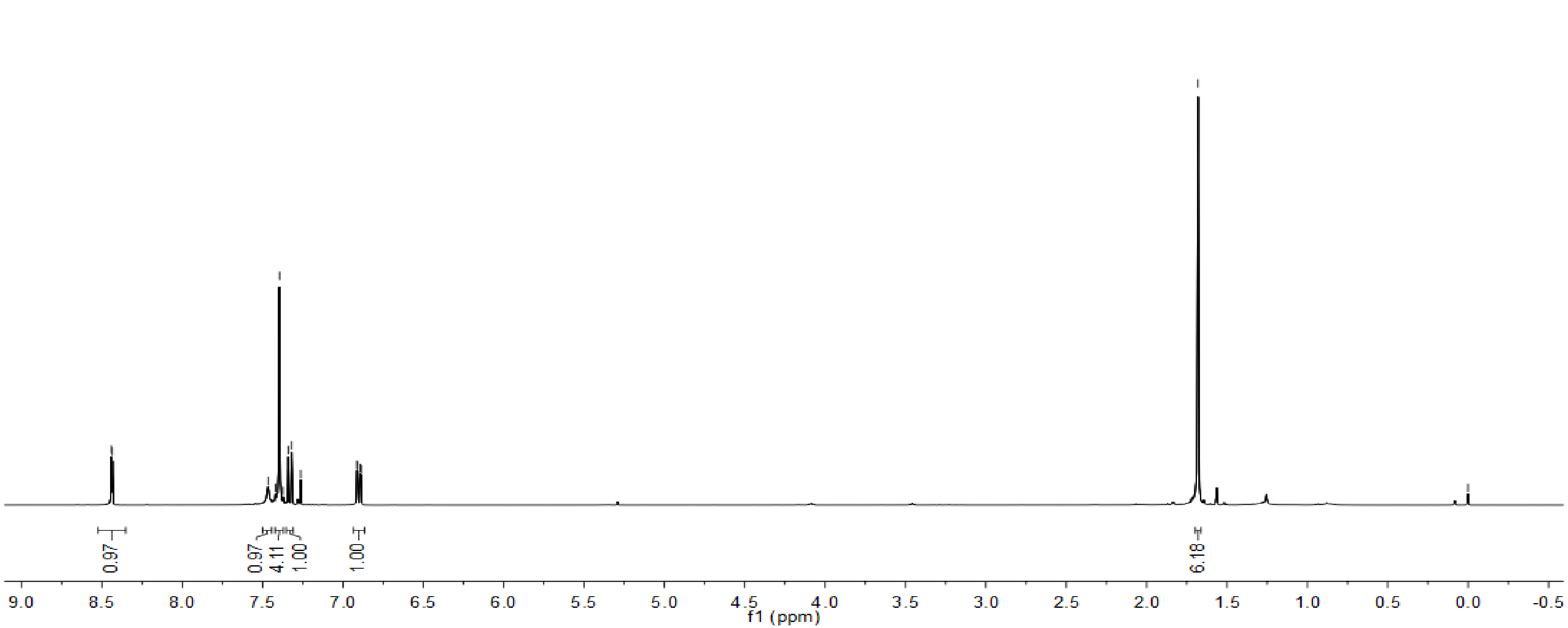
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **6b**



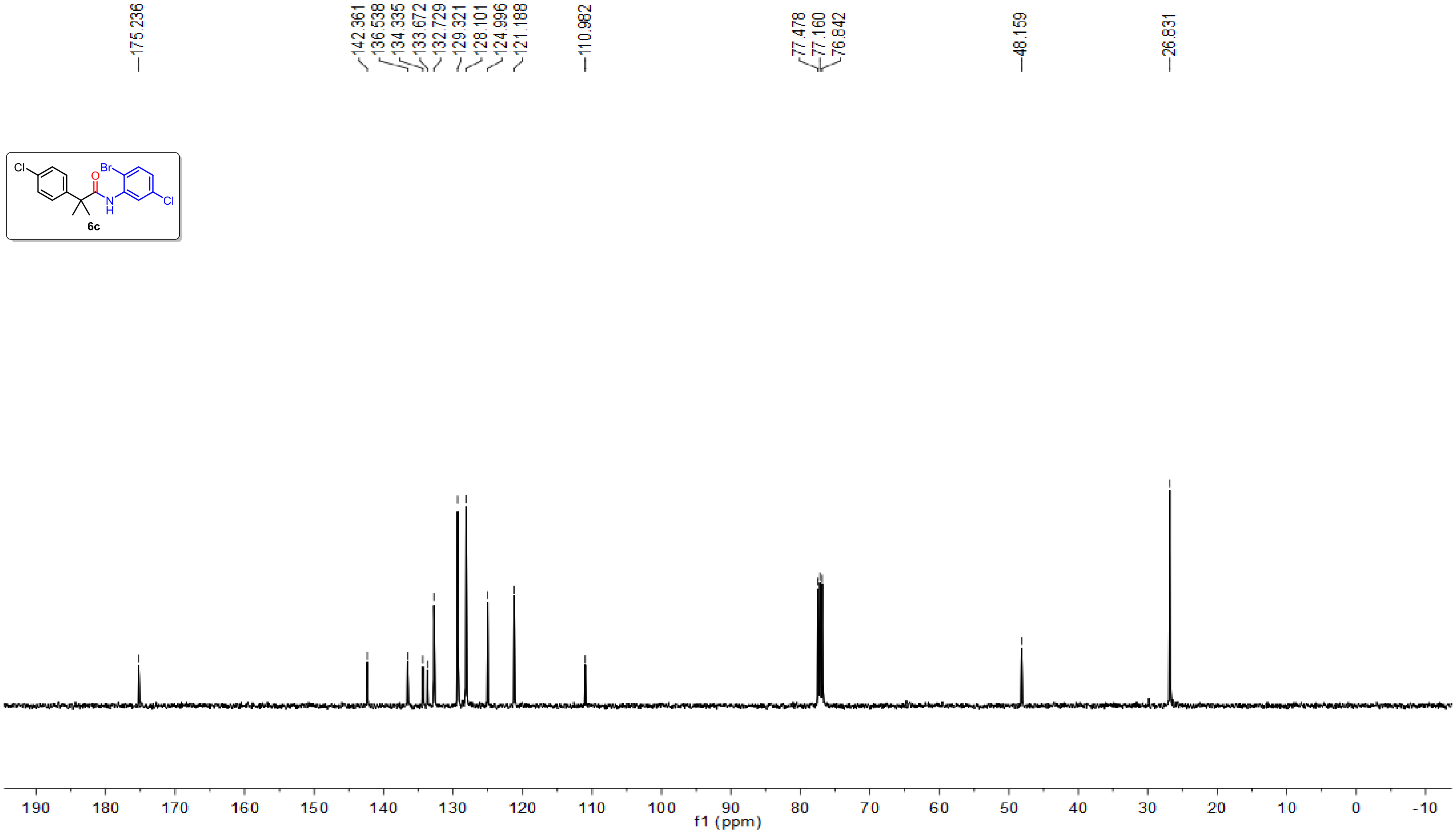
[1]H NMR Spectra (400 MHz, $CDCl_3$) of compound **6c**



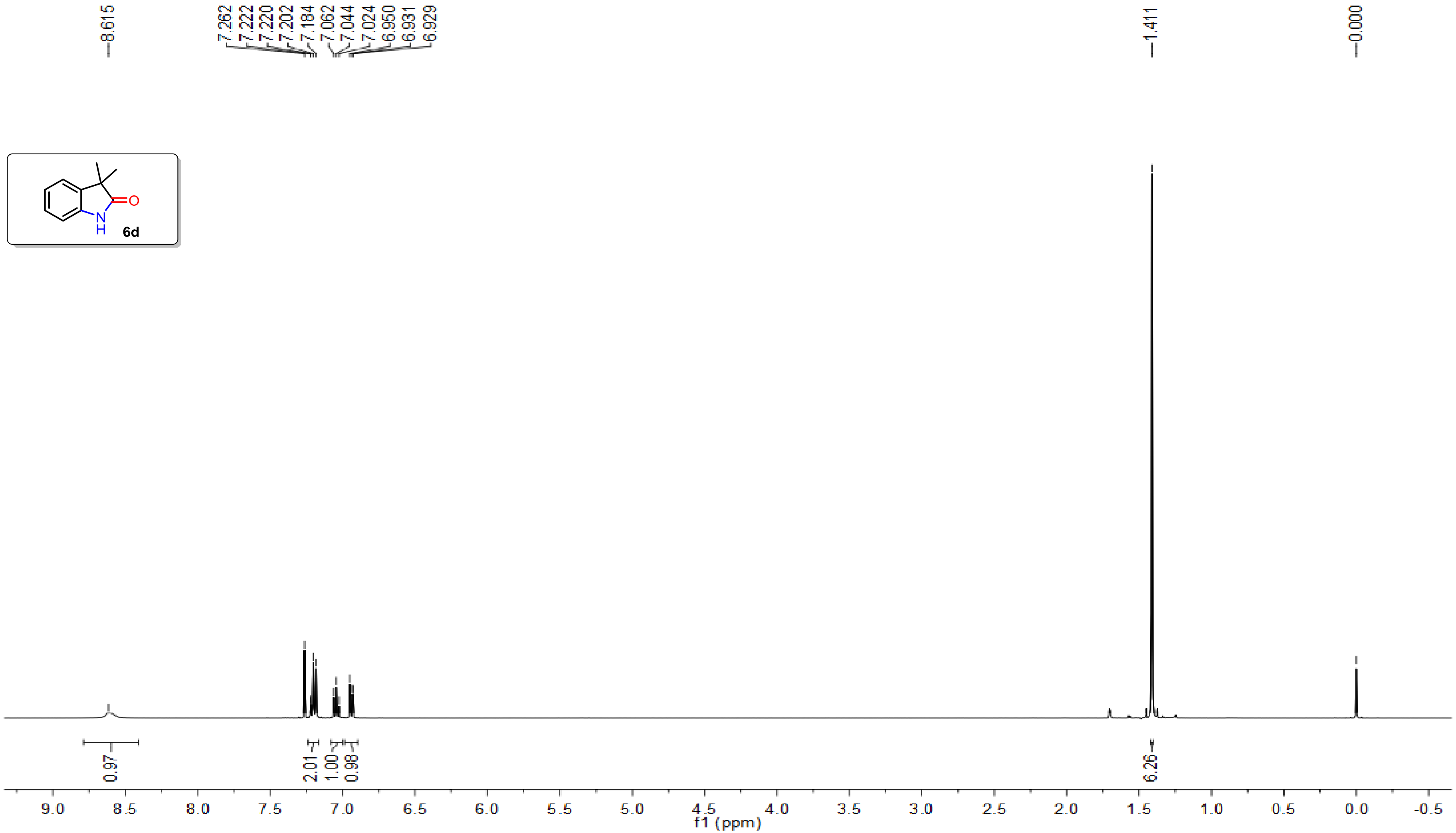
6c



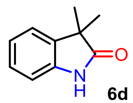
^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **6c**



^{1}H NMR Spectra (400 MHz, $CDCl_3$) of compound **6d**



^{13}C NMR Spectra (101 MHz, $CDCl_3$) of compound **6d**



6d