Supporting Information

One-Step Synthesis of Zolpidem and Its Analogues via Visible Light Induced Coupling of Imidazo[1,2-α]pyridines with 2-Bromoacetamides

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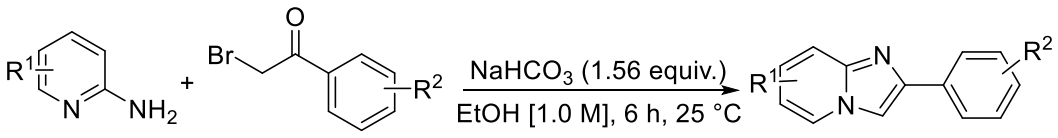
1. General information

Unless otherwise noted, all reagents were obtained from commercial suppliers and used without further purification. Products were purified by column chromatography on 200-300 mesh silica gel, SiO_2. ^1H and ^{13}C NMR spectra were measured on a 400 MHz NMR spectrometer using $CDCl_3$ as the solvent. The chemical shifts are given in δ relative to TMS, and the coupling constants are given in Hertz. The peak patterns are indicated as follows: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet; qui, quintet; sxt, sextet. The high-resolution mass spectra (HRMS) analyses were conducted by using a TOF MS instrument with an ESI or APCI source.

2. General procedure for the synthesis of substrates

All the imidazopyridine derivatives were prepared according to previous literature.[1]



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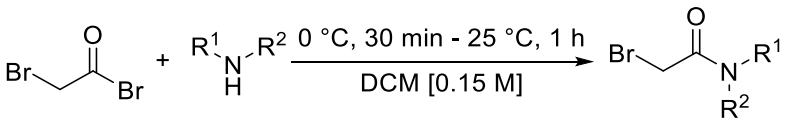
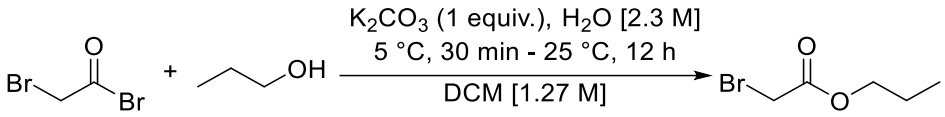
2-Aminopyridine derivatives and 2-bromoacetophenone derivatives (1.0 equiv.) were weighed and added to a round-bottom flask containing a magnetic stir bar. Ethanol and $NaHCO_3$ were introduced, and the mixture was stirred at 25°C for 6 h. After completion of the reaction, the mixture was diluted with water, extracted with ethyl acetate, and the organic phase was dried. The product was isolated by column chromatography.



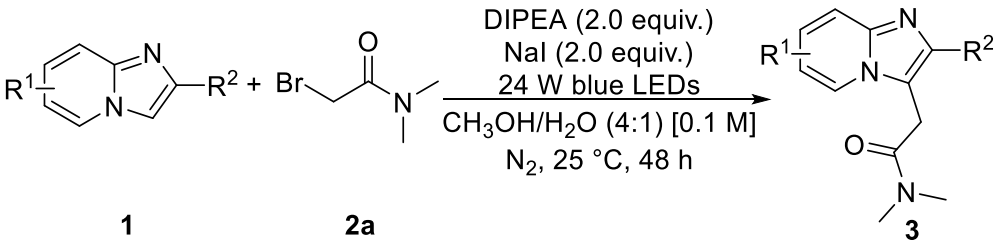
Bromoacetyl bromide was slowly added dropwise to a dichloromethane solution of the amine at 0 °C. The mixture was stirred at this temperature for 30 minutes, then allowed to warm to 25 °C and reacted for an additional 1 h. Upon successful completion of the reaction, the mixture was extracted with dichloromethane, separated, dried over anhydrous Na_2SO_4, and the product was

isolated by silica gel column chromatography.



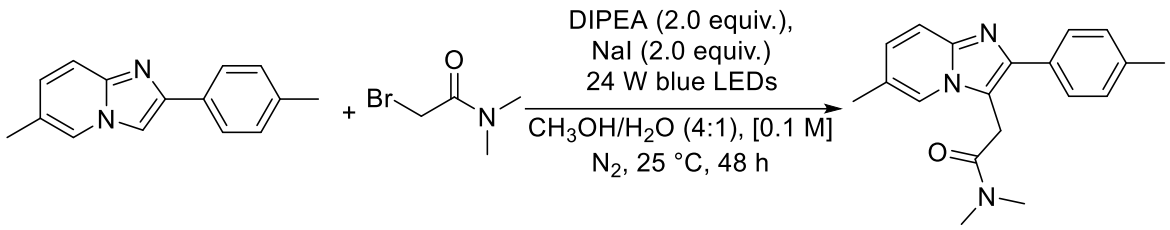
K_2CO_3 was dissolved in distilled water and added to a solution of half of the DCM (dichloromethane) dissolved in *n*-propanol. The reaction mixture was cooled to 5 °C, and a DCM solution of bromoacetyl bromide was slowly added to the above mixture. The mixture was stirred at 5 °C for 30 minutes, then allowed to react at 25 °C for 12 h. After the reaction was completed, the mixture was extracted with DCM, and the organic phase was washed with brine, dried over anhydrous Na_2SO_4, and concentrated under reduced pressure to afford the product.

3. General procedure for the synthesis of products



The imidazo[1,2-α]pyridine compound (**1**, 0.2 mmol, 1.0 equiv.) and NaI (0.4 mmol, 2.0 equiv.) were added to a Schlenk tube equipped with a magnetic stir bar. The tube was evacuated and backfilled with nitrogen three times. Then, DIPEA (*N,N*-diisopropylethylamine) (0.4 mmol, 2.0 equiv.), 2-bromo-*N,N*-dimethylacetamide (**2a**, 0.5 mmol, 2.5 equiv.), and solvent (2.0 ml) were added. The tube was again evacuated and backfilled with nitrogen three times before sealing. The Schlenk tube was irradiated with blue LEDs equipped with a cooling fan at 25°C for 48 h. After completion of the reaction, the mixture was extracted with ethyl acetate, dried over anhydrous Na_2SO_4, and purified by silica gel column chromatography to afford the purified product **3**.

4. Gram-scale reaction



1b 3.0 mmol

2a 7.5 mmol

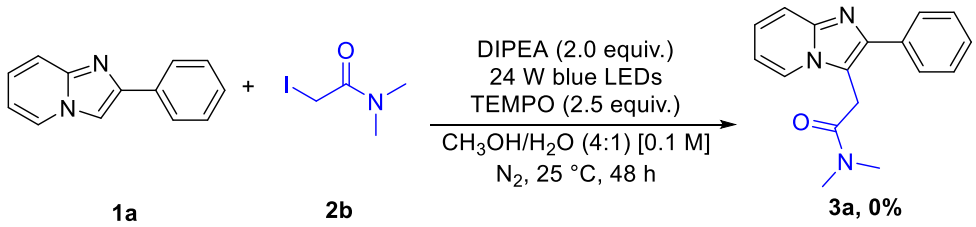
Zolpidem 630.4 mg, 68% Yield

Note: The zolpidem synthesis was conducted by Xiao Yuanjiu during our group's collaborative process development project with Hunan Asia-Pacific Pharmaceutical Co., Ltd., in compliance with legal regulations. 3 mmol of 6-methyl-2-(*p*-tolyl)imidazo[1,2-α]pyridine (**1b**) was reacted with 2.5 equiv. of 2-bromo-*N,N*-dimethylacetamide (**2a**) under standard conditions. Following completion, the product was purified by column chromatography to afford 630.4 mg of the desired **3ba** in 68% yield.

5. Mechanistic studies

5.1 Radical Trapping Experiments

The reaction was conducted under standard conditions with the addition of the radical scavenger TEMPO (2,2,6,6-tetramethylpiperidine-1-oxide). The formation of the target product **3a** was completely blocked, indicating that the reaction proceeds via a radical pathway.



1a **2b** **3a, 0%**

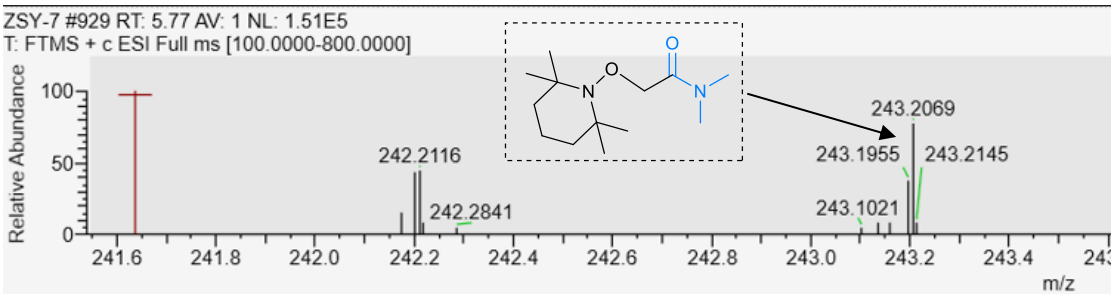


Figure S1 GC-MS spectrum of TEMPO with **2b** .

Since no adduct between TEMPO and any reactant was detected, 1,1-diphenylethylene was employed as an alternative radical scavenger (Figure S1). GC-MS analysis of the reaction mixture after completion revealed the presence of species **5**, demonstrating the formation of an *N,N*-dimethylacetamide radical in the system, which subsequently couples with **1a**.

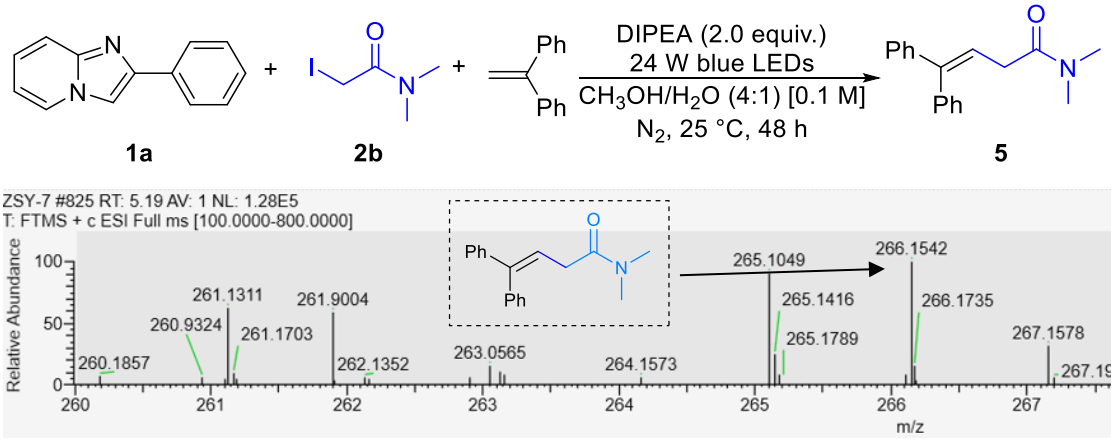
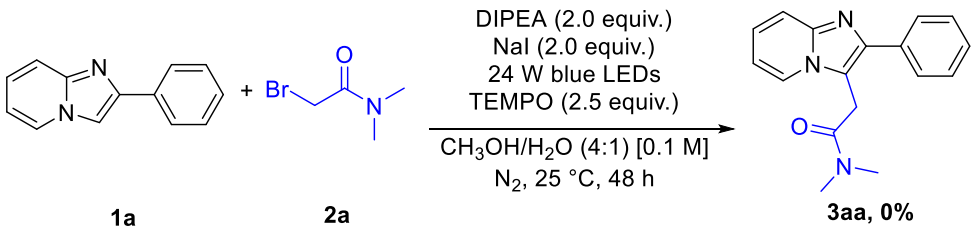
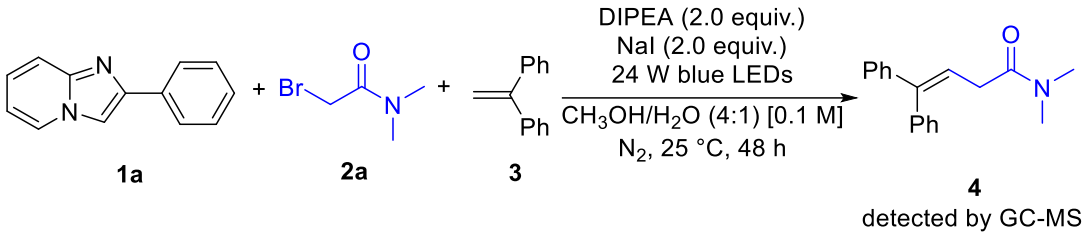


Figure S2 GC-MS spectrum of TEMPO with **5** .



The reaction was conducted under standard conditions with the addition of the radical scavenger TEMPO (2,2,6,6-tetramethylpiperidine-1-oxide). The formation of the target product **3aa** was completely blocked, indicating that the reaction proceeds via a radical pathway.



Since no adduct between TEMPO and any reactant was detected, 1,1-diphenylethylene (**3**) was employed as an alternative radical scavenger (Figure S1). GC-MS analysis of the reaction mixture after completion revealed the presence of species **4**, demonstrating the formation of an *N,N*-dimethylacetamide radical in the system, which subsequently couples with **1a**.

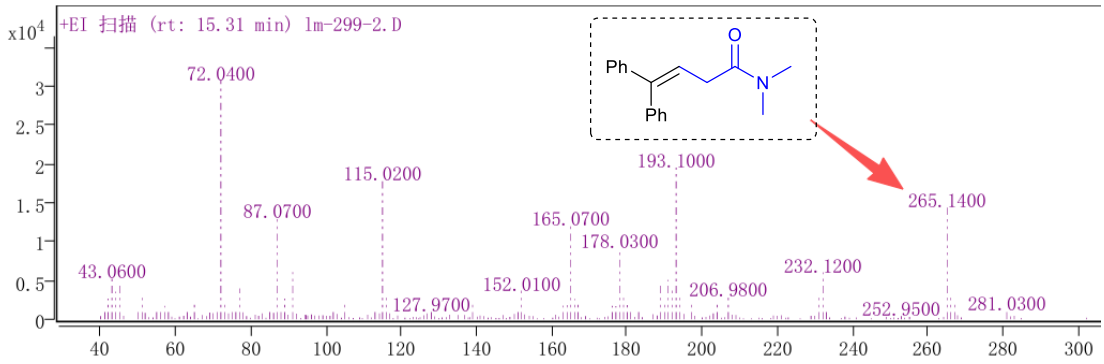
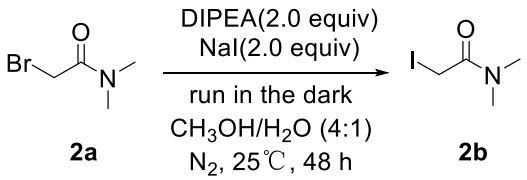


Figure S3 GC-MS spectrum of **4** .

Furthermore, we performed an experiment to investigate whether nucleophilic substitution of bromine with iodine occurs within the reaction time under standard but dark conditions. The results show that nucleophilic substitution of bromine with iodine does take place under these conditions, and most of the bromine is substituted.



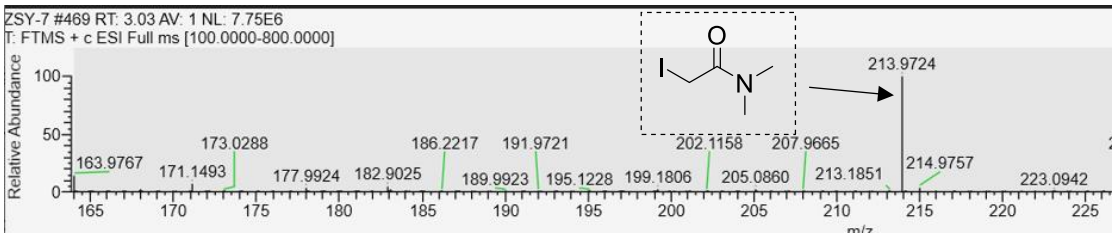


Figure S4 GC-MS spectrum of **2b** .

5.2 UV Spectroscopic Analysis of Possible EDA Complexes

The UV-vis absorption spectra of CH_3OH solutions of 2-phenylimidazo[1,2-α]pyridine **1a** (0.05 M), 2-bromo-*N,N*-dimethyl acetamide **2a** (0.05 M), DIPEA **c** (0.05 M) , NaI **d** (0.05 M)and their mixtures (0.05 M) are shown in Figure S2.

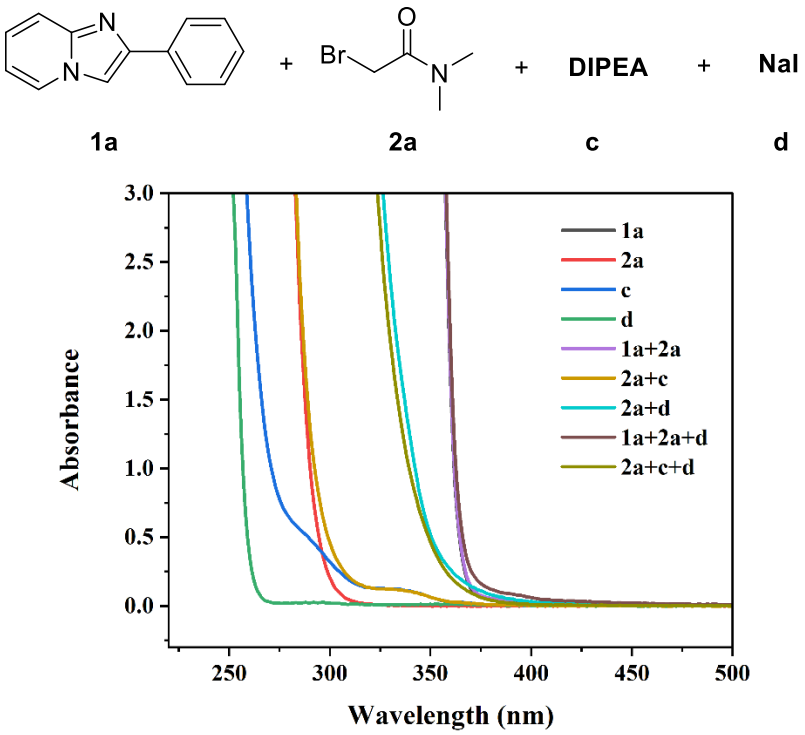


Figure S5 UV-vis spectra of **1a**, **2a**, **c**, **d** and their mixtures for [0.05 M] solutions in CH_3OH.

UV-vis absorption spectra of individual components and their mixtures indicate that the reaction does not involve the formation of EDA (electron donor-acceptor) complexes through interactions between electron donors and acceptors.

5.3 On/off LED irradiation experiments

Reactants 2-phenylimidazo[1,2-α]pyridine (**1a**, 1.0 mmol, 1.0 equiv.) and NaI (2.0 mmol, 2.0 equiv.) were added to a sealed tube with a magnetic stir bar. The tube was evacuated and backfilled with nitrogen three times, followed by adding *N,N*-diisopropylethylamine (DIPEA, 2.0 mmol, 2.0 equiv.), 2-bromo-*N,N*-dimethylacetamide (**2a**, 2.5 mmol, 2.5 equiv.) and solvent (10.0 ml) under a nitrogen atmosphere. After another three cycles of evacuation and nitrogen backfilling, the tube was sealed. The reaction mixture was stirred under blue visible light irradiation for 6 h, then 0.5 ml of

the sample was withdrawn with a syringe under nitrogen, concentrated under reduced pressure, and quantified by ^{1}H NMR using dibromomethane as an internal standard. The tube was then wrapped in aluminum foil to exclude light, reacted for an additional 3 h, and sampled again for analysis. This cycle was repeated, and the yield of **3a** was plotted against time.

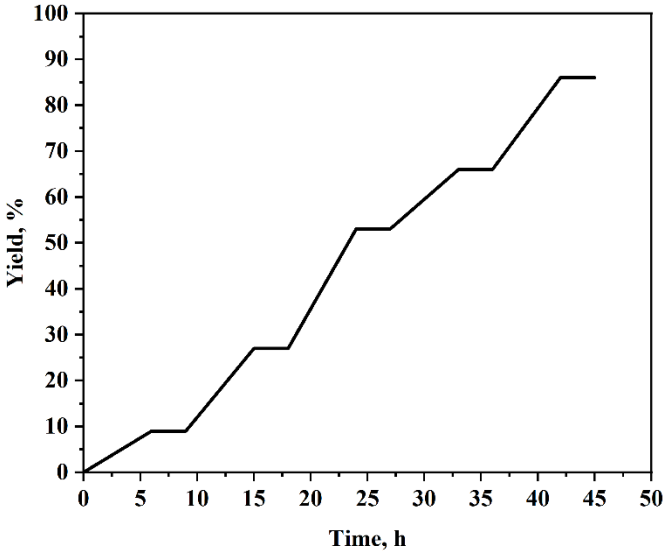
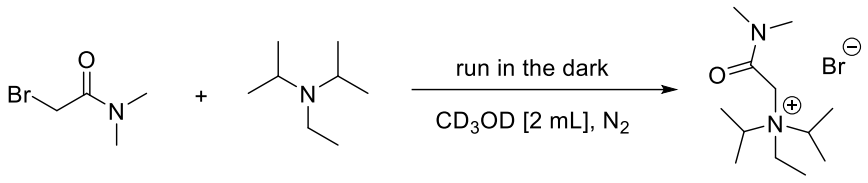


Figure S6 On/off LED irradiation experiments.

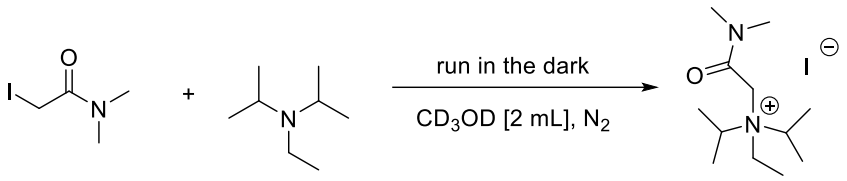
The experimental results confirm that this reaction proceeds only under visible blue light irradiation, as the yield of target product **3a** did not go up during the time without the light irradiation. This indicates that visible blue light is essential for initiating the reaction and suggests a non-radical chain mechanism.

5.4 Reactions of 2a and 2b with DIPEA under Dark Conditions

Each group of experiments was conducted in three parallel runs with reaction durations of 3 h, 12 h, and 24 h, respectively. Methanol-d_4 was used as the reaction solvent, allowing direct NMR testing after the reaction. After the reaction, the reaction mixture was processed, and 1 equivalent of 1,3,5-trimethoxybenzene was added as the internal standard.



2a 0.4 mmol 0.4 mmol

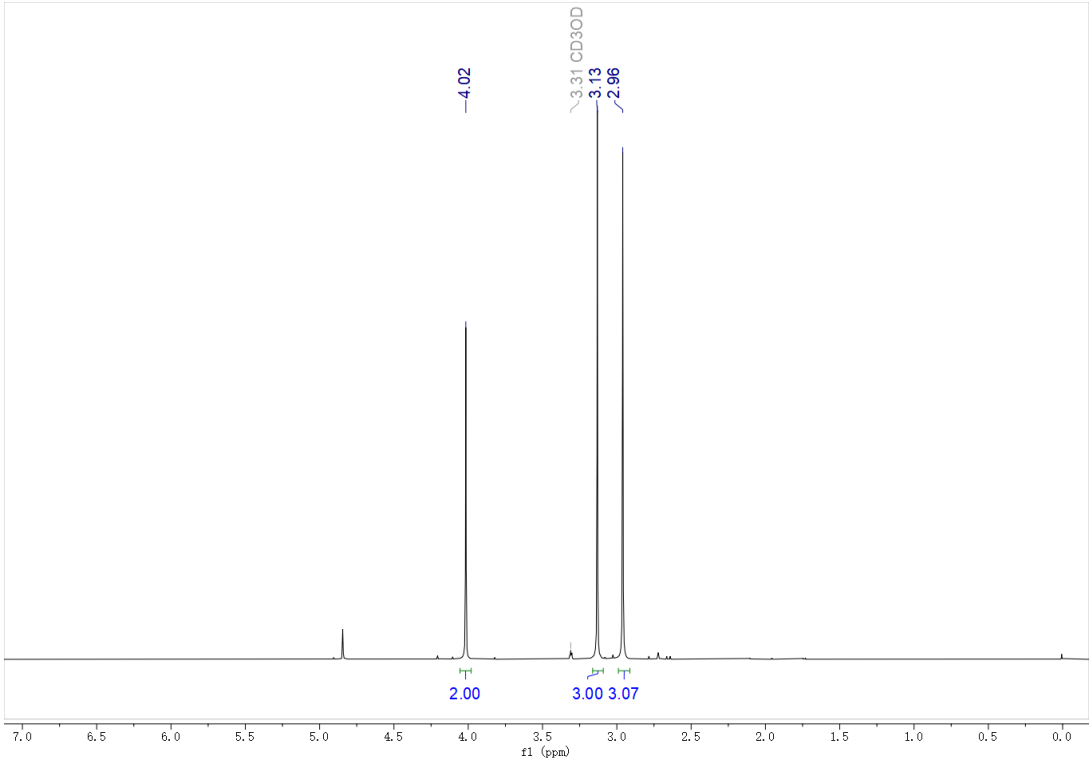


2b 0.4 mmol 0.4 mmol

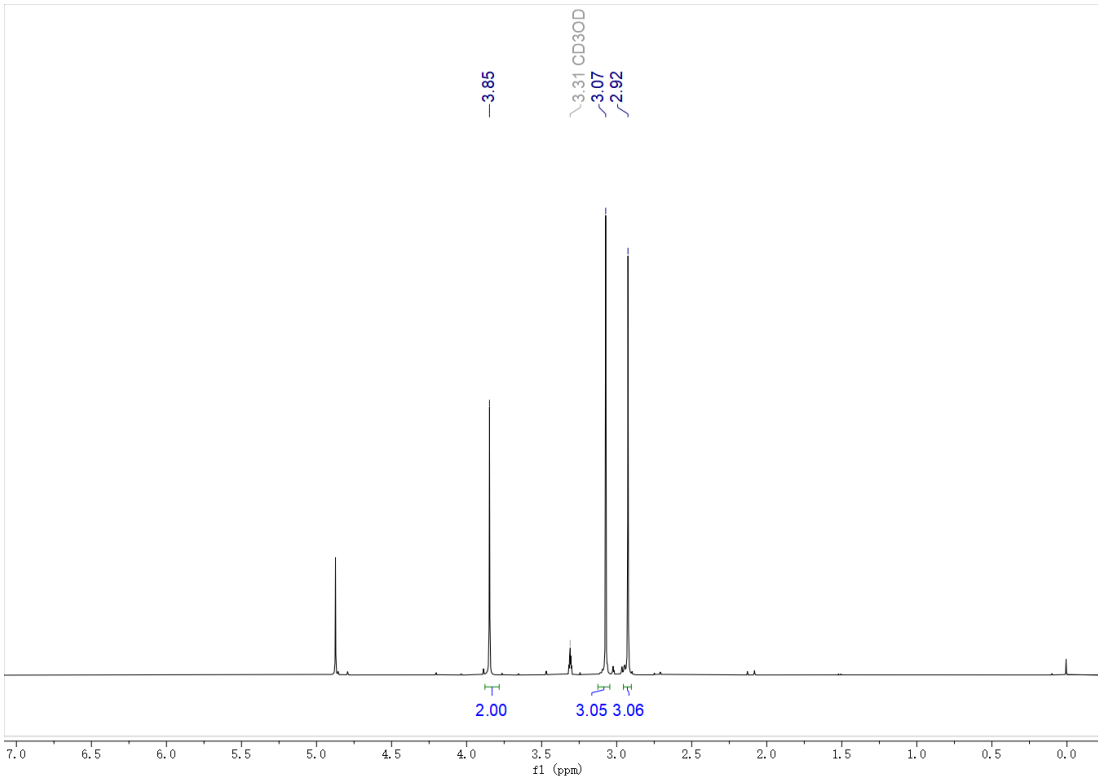
As shown in the following ^{1}H NMR spectra, both **2a** and **2b** exhibit low reactivity toward DIPEA under dark conditions. Most of the starting materials remain unconsumed after 12 hours of reaction, and only a small fraction undergoes conversion within 24 hours. Although **2b** displays a slightly higher reaction rate than **2a,** the majority of both substrates still remain in the reaction system throughout the whole process. From the data, we can conclude that the reaction of **2a** or **2b** with DIPEA should not interfere with our main alkylation reaction with the imidazo[1,2-α]pyridine core.

The detailed NMR data are listed below:

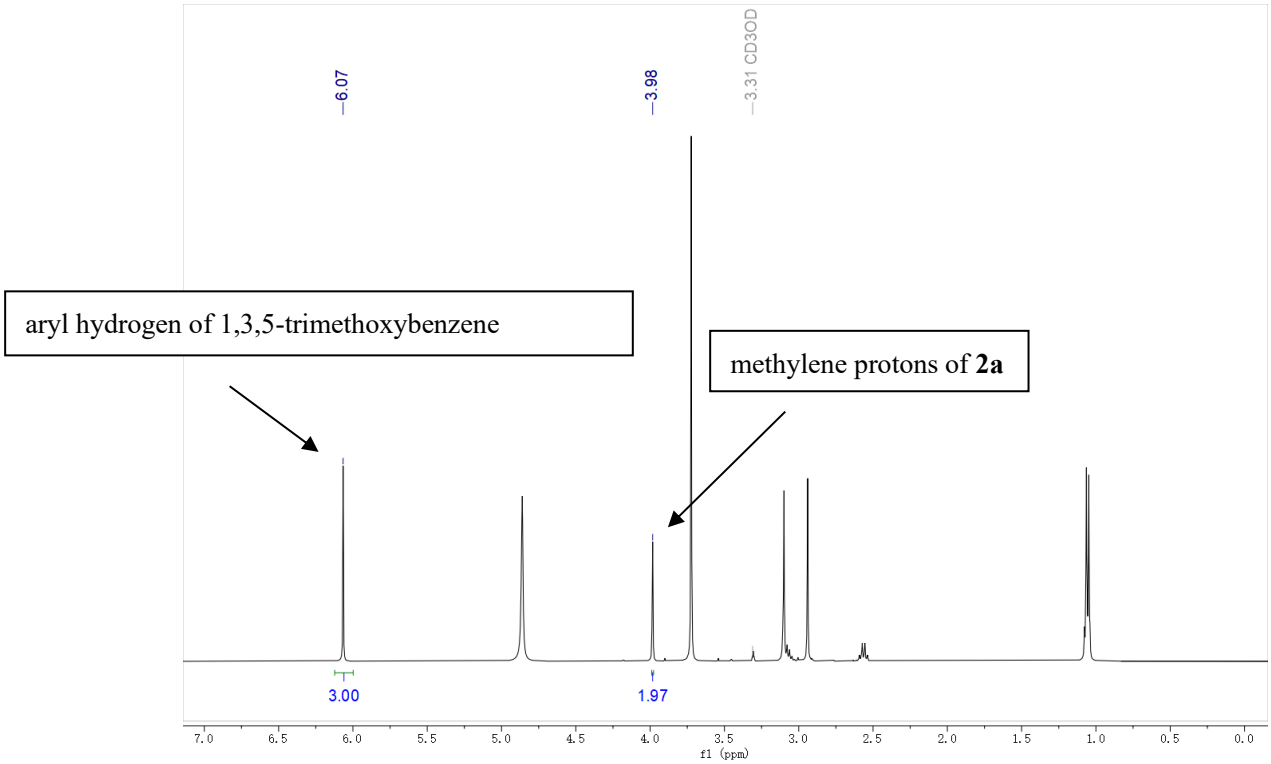
^{1}H NMR spectrum of **2a**



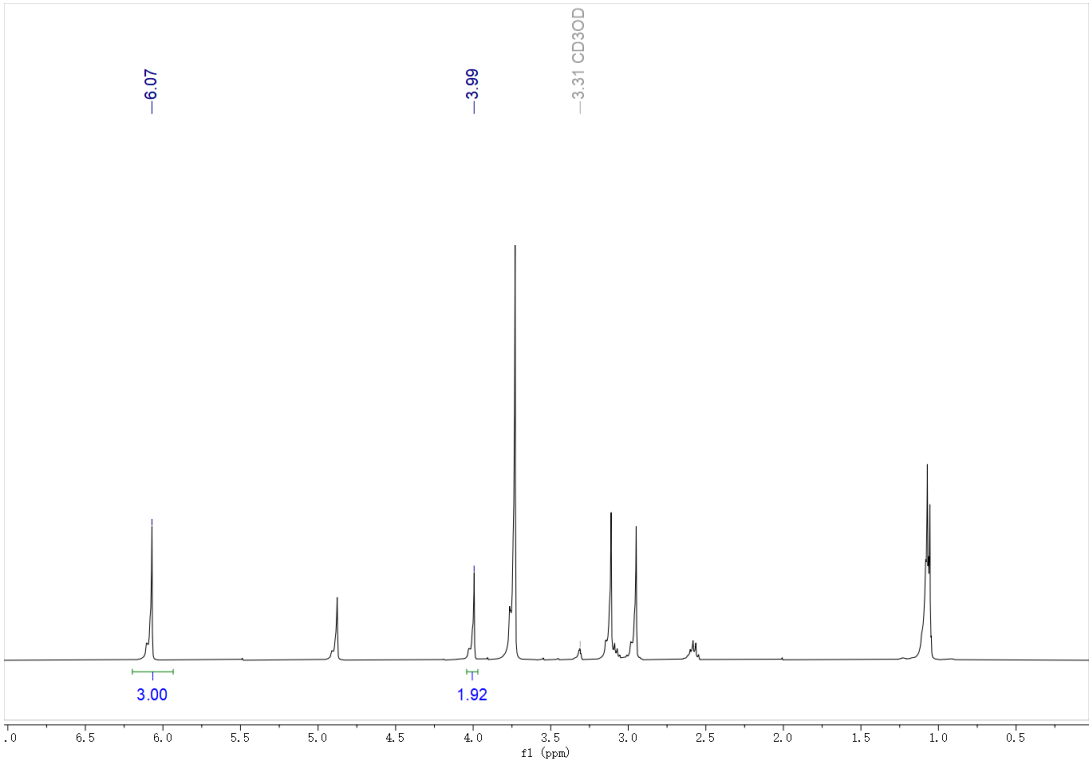
^{1}H NMR spectrum of **2b**



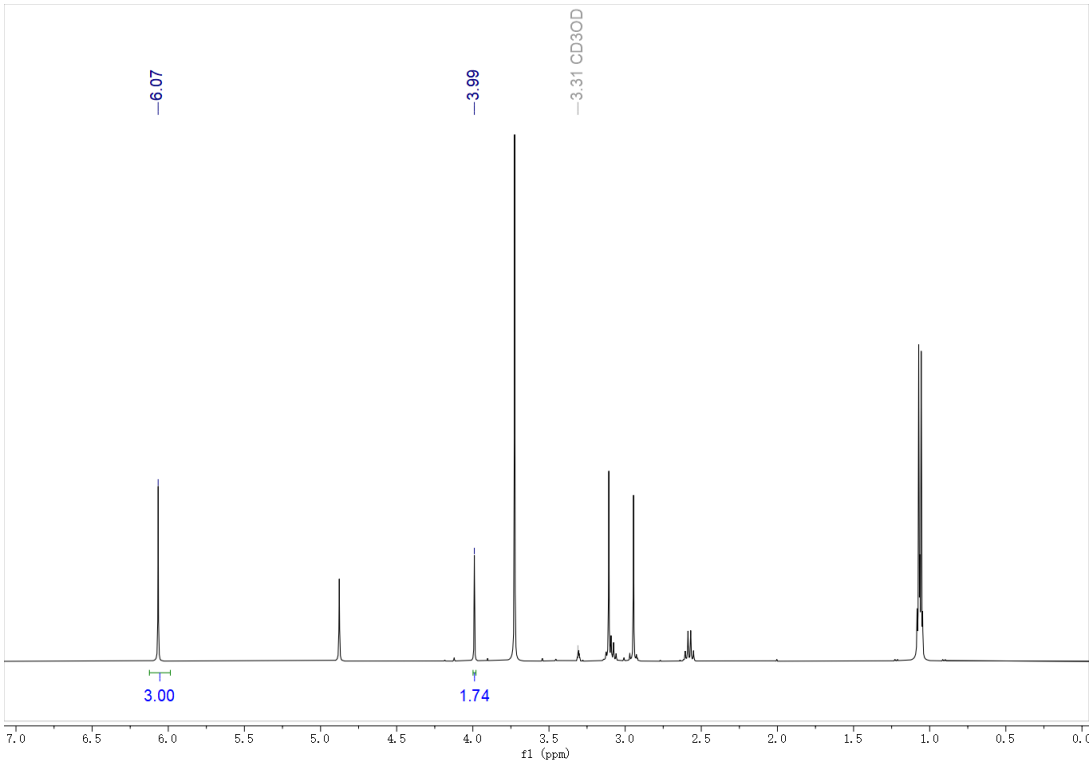
2a-3h



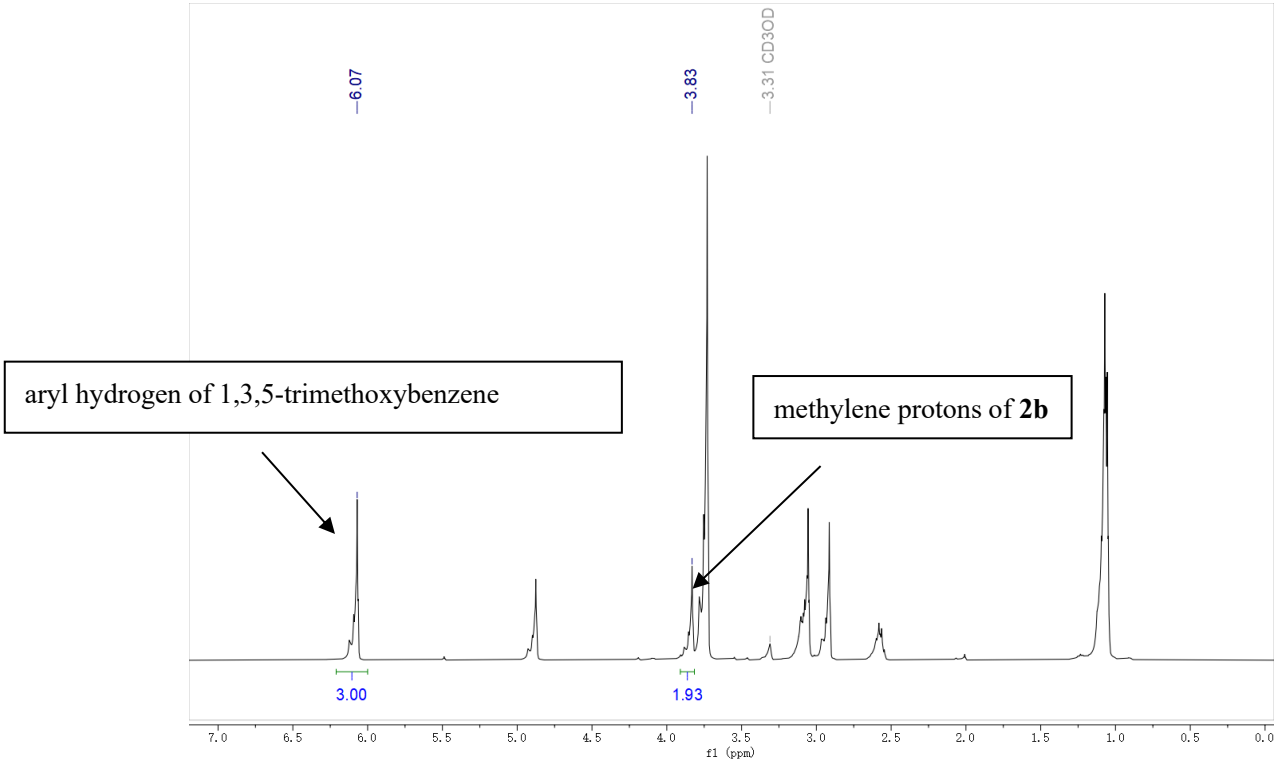
2a-12h


6.07
3.99
3.31 CD3OD
3.00
1.92
f1 (ppm)

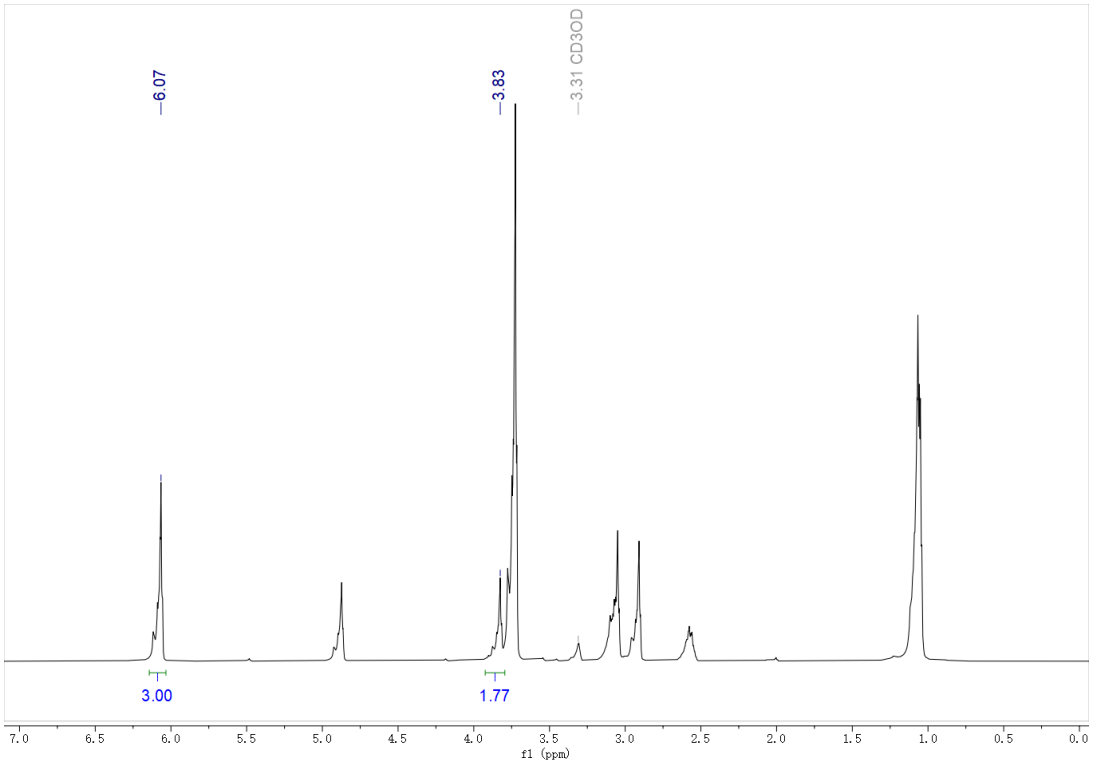
2a-24h


6.07
3.99
3.31 CD3OD
3.00
1.74
f1 (ppm)

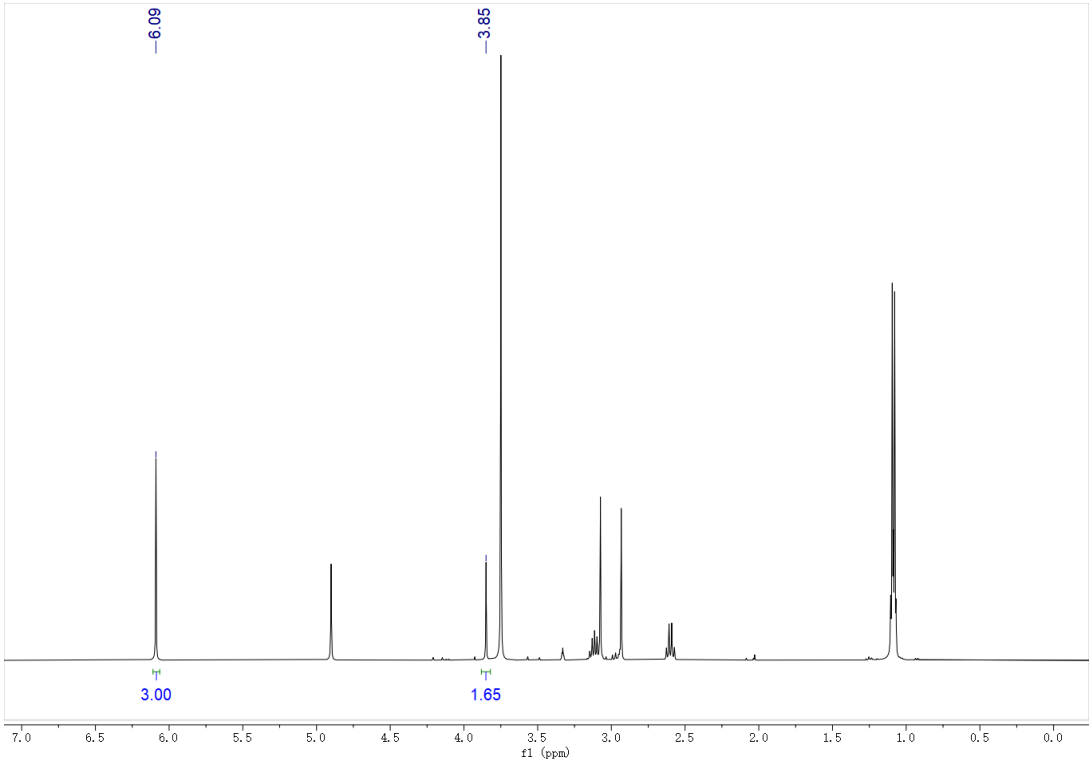
2b-3h


6.07
3.83
3.31 CD3OD
aryl hydrogen of 1,3,5-trimethoxybenzene
methylene protons of **2b**
3.00
1.93
7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

2b-12h

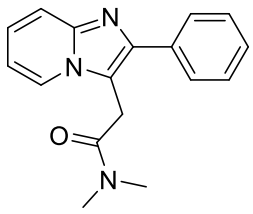

6.07
3.83
3.31 CD3OD
3.00
1.77
7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

2b-24h



6. Characterization Data of Products

***N,N*-Dimethyl-2-(2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3a

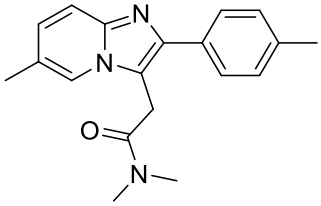
After purification, **3a** was obtained as white solid (49.3 mg, 88% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 98-100 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (d, *J* = 6.9 Hz, 1H), 7.64 (d, *J* = 7.2 Hz, 2H), 7.60 (d, *J* = 9.1 Hz, 1H), 7.44 (t, *J* = 7.6 Hz, 2H), 7.34 (t, *J* = 7.4 Hz, 1H), 7.17 (dd, *J* = 8.3, 7.4 Hz, 1H), 6.79 (t, *J* = 6.8 Hz, 1H), 4.09 (s, 2H), 2.91 (s, 3H), 2.84 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.19, 145.16, 144.02, 134.63, 128.69, 128.67, 127.85, 124.73, 124.47, 117.33, 114.27, 112.22, 37.50, 35.85, 30.17.

The spectral data were in accordance with the literature.[2]

***N,N*-Dimethyl-2-(6-methyl-2-(*p*-tolyl)imidazo[1,2-*α*]pyridin-3-yl)acetamide (Zolpidem).**



3b

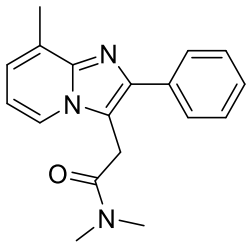
After purification, **3b** was obtained as yellow solid (43.1 mg, 70% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 186-188 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (s, 1H), 7.56 (t, *J* = 8.1 Hz, 3H), 7.29 (d, *J* = 7.6 Hz, 2H), 7.07 (d, *J* = 9.2 Hz, 1H), 4.10 (s, 2H), 2.97 (s, 3H), 2.91 (s, 3H), 2.43 (s, 3H), 2.37 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.44, 144.25, 143.94, 137.50, 131.93, 129.41, 128.51, 127.54, 122.28, 121.77, 116.65, 113.71, 37.58, 35.93, 30.36, 21.35, 18.53.

The spectral data were in accordance with the literature.[2]

***N,N*-Dimethyl-2-(8-methyl-2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3c

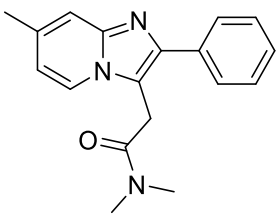
After purification, **3c** was obtained as white solid (40.0 mg, 68% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 163-165 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (d, *J* = 6.3 Hz, 1H), 7.64 (d, *J* = 6.0 Hz, 2H), 7.43 (dd, *J* = 7.1, 5.0 Hz, 2H), 7.37 – 7.29 (m, 1H), 6.96 (d, *J* = 5.8 Hz, 1H), 6.70 (dd, *J* = 6.7, 4.9 Hz, 1H), 4.05 (s, 2H), 2.88 (d, *J* = 2.4 Hz, 3H), 2.81 (d, *J* = 2.9 Hz, 3H), 2.62 (d, *J* = 2.0 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.31, 145.59, 143.62, 134.91, 128.89, 128.67, 127.74, 127.21, 123.26, 122.54, 114.57, 112.25, 37.48, 35.84, 30.35, 17.17.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{20}N_3O$ 294.1601, found 294.1600.

***N,N*-Dimethyl-2-(7-methyl-2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3d

After purification, **3d** was obtained as yellow solid (42.44 mg, 72% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 183-185 ºC.

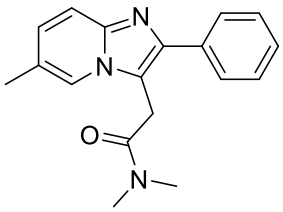
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 6.6 Hz, 1H), 7.62 (d, *J* = 7.4 Hz, 2H), 7.40 (d, *J* = 6.6

Hz, 2H), 7.33 (d, *J* = 5.7 Hz, 2H), 6.60 (d, *J* = 6.7 Hz, 1H), 4.04 (s, 2H), 2.87 (s, 3H), 2.80 (s, 3H), 2.35 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.31, 145.58, 143.60, 135.38, 134.79, 128.62, 128.59, 127.69, 123.97, 115.66, 114.81, 113.58, 37.45, 35.81, 30.21, 21.31.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{20}N_3O$ 294.1601, found 294.1600.

***N,N*-Dimethyl-2-(6-methyl-2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3e

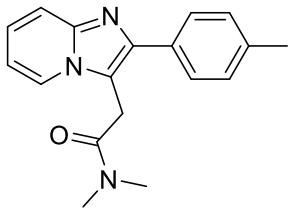
After purification, **3e** was obtained as yellow solid (37.7 mg, 64% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 204-209 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (s, 1H), 7.63 (d, *J* = 7.6 Hz, 2H), 7.51 (d, *J* = 9.1 Hz, 1H), 7.43 (t, *J* = 7.1 Hz, 2H), 7.34 (t, *J* = 7.4 Hz, 1H), 7.03 (d, *J* = 9.2 Hz, 1H), 4.06 (s, 2H), 2.93 (s, 3H), 2.87 (s, 3H), 2.32 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.36, 144.31, 143.89, 134.86, 128.69, 128.66, 127.76, 127.68, 122.30, 121.89, 116.74, 113.98, 37.56, 35.94, 30.27, 18.54.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{20}N_3O$ 294.1601, found 294.1600.

***N,N*-Dimethyl-2-(2-(*p*-tolyl)imidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3f

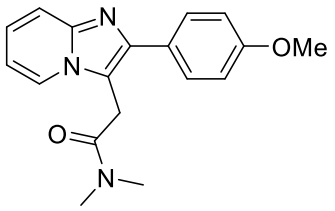
After purification, **3f** was obtained as yellow solid (34.7 mg, 59% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 184-190 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 6.4 Hz, 1H), 7.62 (d, *J* = 8.9 Hz, 1H), 7.56 (d, *J* = 7.5 Hz, 2H), 7.28 (d, *J* = 7.4 Hz, 2H), 7.20 (t, *J* = 7.5 Hz, 1H), 6.82 (t, *J* = 6.2 Hz, 1H), 4.12 (s, 2H), 2.94 (s, 3H), 2.88 (s, 3H), 2.41 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.28, 145.07, 143.98, 137.72, 131.61, 129.48, 128.57, 124.82, 124.52, 117.22, 114.05, 112.25, 37.60, 35.89, 30.39, 21.38.

The spectral data were in accordance with the literature.[3]

2-(2-(4-Methoxyphenyl)imidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3g

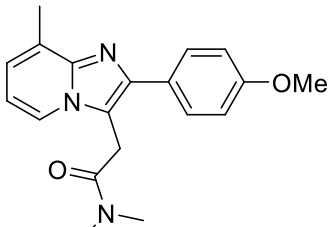
After purification, **3g** was obtained as yellow solid (47.1 mg, 76% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 149-151 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 – 8.08 (m, 1H), 7.65 – 7.40 (m, 3H), 7.13 (dd, *J* = 8.4, 7.3 Hz, 1H), 7.03 – 6.91 (m, 2H), 6.75 (t, *J* = 6.8 Hz, 1H), 4.04 (s, 2H), 3.80 (s, 3H), 2.88 (s, 3H), 2.82 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.25, 159.41, 145.03, 143.85, 129.82, 127.13, 124.63, 124.27, 117.12, 114.15, 113.67, 112.06, 55.32, 37.50, 35.82, 30.25.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{20}N_3O_2$ 310.1550, found 310.1549.

2-(2-(4-Methoxyphenyl)-8-methylimidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3h

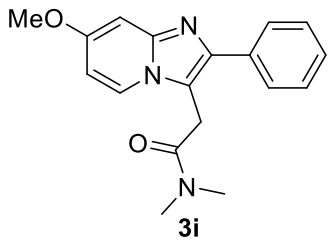
After purification, **3h** was obtained as yellow solid (44.1 mg, 68% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 102-103 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (d, *J* = 6.8 Hz, 1H), 7.56 (d, *J* = 8.7 Hz, 2H), 6.98 – 6.95 (m, 3H), 6.70 (t, *J* = 6.8 Hz, 1H), 4.03 (s, 2H), 3.82 (s, 3H), 2.89 (s, 3H), 2.82 (s, 3H), 2.61 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.46, 159.44, 145.54, 143.51, 130.14, 127.48, 127.11, 123.22, 122.57, 114.22, 114.06, 112.21, 55.42, 37.59, 35.91, 30.57, 17.23.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{19}H_{22}N_3O_2$ 324.1707, found 324.1707.

2-(7-Methoxy-2-phenylimidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.

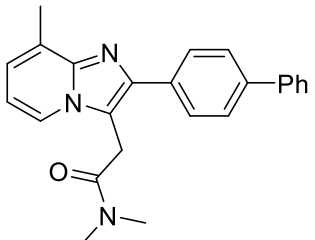


3i

After purification, **3i** was obtained as white solid (39.7 mg, 64% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 177-181 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 7.5 Hz, 1H), 7.60 (d, *J* = 7.3 Hz, 2H), 7.40 (t, *J* = 7.5 Hz, 2H), 7.31 (t, *J* = 7.4 Hz, 1H), 6.85 (d, *J* = 2.2 Hz, 1H), 6.49 (dd, *J* = 7.5, 2.4 Hz, 1H), 4.02 (s, 2H), 3.80 (s, 3H), 2.87 (s, 3H), 2.79 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 168.37, 157.89, 146.54, 143.23, 134.73, 128.60, 128.40, 127.60, 125.34, 112.99, 107.06, 94.49, 55.45, 37.43, 35.79, 30.12.
HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{20}N_3O_2$ 310.1550, found 310.1550.

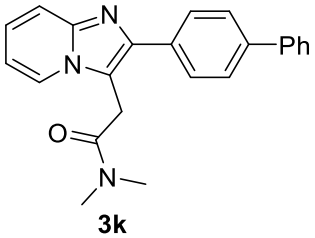
2-(2-([1,1'-Biphenyl]-4-yl)-8-methylimidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3j

After purification, **3j** was obtained as yellow solid (36.3 mg, 49% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 192-195 ºC.
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, *J* = 6.8 Hz, 1H), 7.77 – 7.70 (m, 4H), 7.65 (d, *J* = 7.4 Hz, 2H), 7.46 (t, *J* = 7.6 Hz, 2H), 7.36 (t, *J* = 7.3 Hz, 1H), 7.01 (d, *J* = 6.8 Hz, 1H), 6.76 (t, *J* = 6.8 Hz, 1H), 4.15 (s, 2H), 2.94 (s, 3H), 2.90 (s, 3H), 2.67 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 168.41, 145.79, 143.36, 140.86, 140.55, 134.00, 129.34, 128.95, 127.52, 127.47, 127.39, 127.17, 123.42, 122.63, 114.71, 112.42, 37.68, 35.99, 30.62, 17.28.
HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{24}H_{24}N_3O$ 370.1914, found 370.1914.

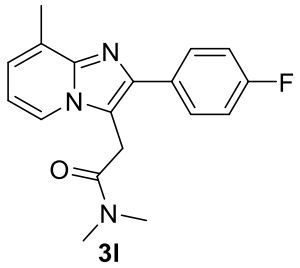
2-(2-([1,1'-Biphenyl]-4-yl)imidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3k

After purification, **3k** was obtained as yellow solid (38.7 mg, 53% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 226-227 ºC.
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (d, *J* = 6.7 Hz, 1H), 7.77 – 7.70 (m, 4H), 7.66 (d, *J* = 5.9 Hz, 3H), 7.46 (t, *J* = 6.8 Hz, 2H), 7.37 (d, *J* = 6.5 Hz, 1H), 7.22 (t, *J* = 7.7 Hz, 1H), 6.84 (t, *J* = 6.8 Hz, 1H), 4.17 (s, 2H), 2.96 (s, 3H), 2.93 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 168.29, 145.37, 143.78, 140.73, 140.65, 133.70, 129.13, 128.96, 127.57, 127.47, 127.16, 124.82, 124.64, 117.49, 114.41, 112.39, 37.70, 36.00, 30.46.
HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{23}H_{22}N_3O$ 356.1757, found 356.1758.

2-(2-(4-Fluorophenyl)-8-methylimidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3l

After purification, **3l** was obtained as white solid (38.1 mg, 61% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 150-153 ºC.

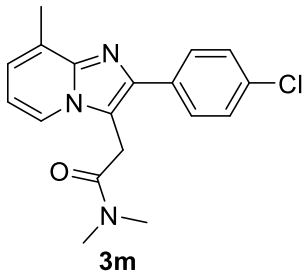
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 6.8 Hz, 1H), 7.64 – 7.61 (m, 2H), 7.13 (t, *J* = 8.7 Hz, 2H), 6.98 (d, *J* = 6.8 Hz, 1H), 6.72 (t, *J* = 6.8 Hz, 1H), 4.03 (s, 2H), 2.91 (s, 3H), 2.86 (s, 3H), 2.62 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.22, 162.65 (d, *J* = 246.9 Hz), 145.59, 142.79, 131.10 (d, *J* = 3.2 Hz), 130.61 (d, *J* = 8.1 Hz), 127.28, 123.43, 122.48, 115.67 (d, *J* = 21.5 Hz), 114.53, 112.41, 37.54, 35.91, 30.29, 17.17.

^{19}F NMR (376 MHz, $CDCl_3$) δ -114.35(s).

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}FN_3O$ 312.1507, found 312.1507.

2-(2-(4-Chlorophenyl)-8-methylimidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3m

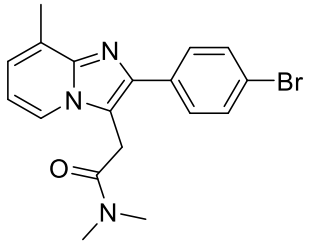
After purification, **3m** was obtained as white solid (34.8 mg, 53% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 184-185 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 6.8 Hz, 1H), 7.61 (d, *J* = 8.3 Hz, 2H), 7.42 (d, *J* = 8.3 Hz, 2H), 6.99 (d, *J* = 6.8 Hz, 1H), 6.73 (t, *J* = 6.8 Hz, 1H), 4.04 (s, 2H), 2.93 (s, 3H), 2.89 (s, 3H), 2.63 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.16, 145.73, 142.58, 133.81, 133.55, 130.18, 128.94, 127.40, 123.53, 122.49, 114.78, 112.51, 37.60, 35.96, 30.34, 17.19.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}ClN_3O$ 328.1211, found 328.1211.

2-(2-(4-Bromophenyl)-8-methylimidazo[1,2-a]pyridin-3-yl)-N,N-dimethylacetamide.



3n

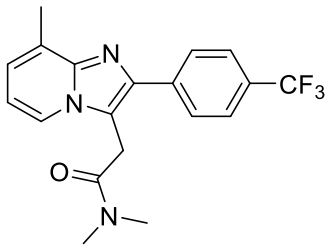
After purification, **3n** was obtained as yellow solid (42.4 mg, 57% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 174-175 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J* = 6.8 Hz, 1H), 7.58 – 7.52 (m, 4H), 6.99 (d, *J* = 6.8 Hz, 1H), 6.73 (t, *J* = 6.8 Hz, 1H), 4.03 (s, 2H), 2.93 (s, 3H), 2.89 (s, 3H), 2.62 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.11, 145.71, 142.56, 133.98, 131.84, 130.44, 127.37, 123.50, 122.44, 121.97, 114.78, 112.48, 37.58, 35.93, 30.28, 17.17.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}BrN_3O$ 372.0706, found 372.0659.

***N,N*-Dimethyl-2-(8-methyl-2-(4-(trifluoromethyl)phenyl)imidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3o

After purification, **3o** was obtained as white solid (45.6 mg, 63% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 177-178 ºC.

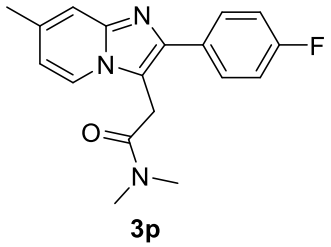
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 6.9 Hz, 1H), 7.79 (d, *J* = 8.0 Hz, 2H), 7.69 (d, *J* = 8.2 Hz, 2H), 7.00 (d, *J* = 6.8 Hz, 1H), 6.74 (t, *J* = 6.8 Hz, 1H), 4.06 (s, 2H), 2.94 (s, 3H), 2.92 (s, 3H), 2.63 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.01, 145.85, 142.27, 138.70, 129.66 (d, *J* = 32.4 Hz), 129.07, 127.57, 126.01 – 124.63 (m), 123.66, 123.02, 122.39, 115.42, 112.65, 37.54, 35.93, 30.17, 17.14 .

^{19}F NMR (376 MHz, $CDCl_3$) δ -62.42 (s).

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{19}H_{19}F_3N_3O$ 362.1475, found 362.1474.

2-(2-(4-Fluorophenyl)-7-methylimidazo[1,2-*α*]pyridin-3-yl)-*N,N*-dimethylacetamide.



3p

After purification, **3p** was obtained as white solid (38.7 mg, 62% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 114-119 ºC.

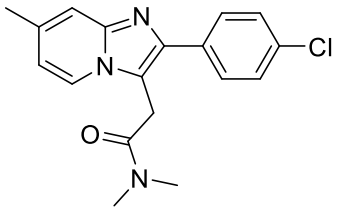
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 7.0 Hz, 1H), 7.61 – 7.58 (m, 2H), 7.29 (d, *J* = 26.0 Hz, 1H), 7.11 (t, *J* = 8.7 Hz, 2H), 6.62 (d, *J* = 7.0 Hz, 1H), 4.02 (s, 2H), 2.90 (s, 3H), 2.84 (s, 3H), 2.36 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.21, 162.55 (d, *J* = 247.0 Hz), 145.59, 142.81, 135.56, 131.00 (d, *J* = 3.2 Hz), 130.28 (d, *J* = 8.1 Hz), 123.92, 115.72 (d, *J* = 3.6 Hz), 115.53, 114.94, 113.48, 37.51, 35.87, 30.17, 21.36.

^{19}F NMR (376 MHz, $CDCl_3$) δ -114.32(s).

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}FN_3O$ 312.1507, found 312.1507.

2-(2-(4-Chlorophenyl)-7-methylimidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3q

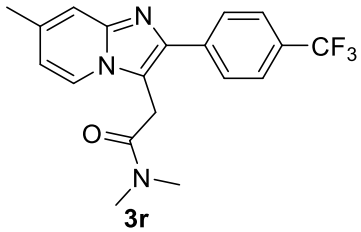
After purification, **3q** was obtained as light yellow solid (39.4 mg, 60% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 238-239 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 7.0 Hz, 1H), 7.57 (d, *J* = 8.3 Hz, 2H), 7.39 (d, *J* = 8.3 Hz, 2H), 7.33 (s, 1H), 6.63 (d, *J* = 7.0 Hz, 1H), 4.02 (s, 2H), 2.91 (s, 3H), 2.86 (s, 3H), 2.37 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.14, 145.69, 142.56, 135.69, 133.71, 133.41, 129.84, 128.89, 123.92, 115.77, 115.04, 113.79, 37.56, 35.91, 30.18, 21.39.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}ClN_3O$ 328.1211, found 328.1211.

***N*,*N*-Dimethyl-2-(7-methyl-2-(4-(trifluoromethyl)phenyl)imidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3r

After purification, **3r** was obtained as white solid (41.3 mg, 57% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 196-197 ºC.

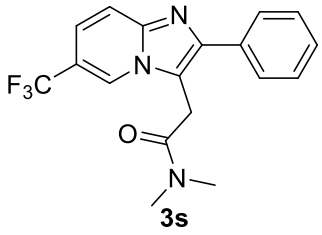
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J* = 6.8 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 2H), 7.69 (d, *J* = 7.6 Hz, 2H), 7.36 (s, 1H), 6.66 (d, *J* = 6.9 Hz, 1H), 4.06 (s, 2H), 2.94 (s, 3H), 2.92 (s, 3H), 2.39 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.03, 145.87, 142.32, 138.59, 135.98, 129.64 (d, *J* = 32.5 Hz), 128.80, 125.61 – 125.64 (m), 123.91, 123.00, 115.95, 115.27, 114.51, 37.57, 35.95, 30.13, 21.42.

^{19}F NMR (376 MHz, $CDCl_3$) δ -62.42(s).

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{19}H_{19}F_3N_3O$ 362.1475, found 362.1474.

***N,N*-Dimethyl-2-(2-phenyl-6-(trifluoromethyl)imidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3s

After purification, **3s** was obtained as white solid (41.1 mg, 59% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 190-192 ºC.

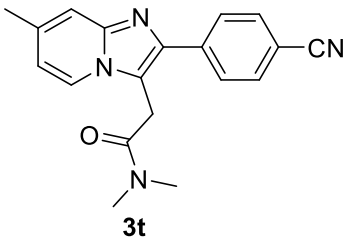
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.59 (s, 1H), 7.70 (d, *J* = 9.4 Hz, 1H), 7.64 (d, *J* = 7.2 Hz, 2H), 7.47 (t, *J* = 7.4 Hz, 2H), 7.39 (t, *J* = 7.3 Hz, 1H), 7.33 (d, *J* = 9.4 Hz, 1H), 4.12 (s, 2H), 2.97 (d, *J* = 1.2 Hz, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.80, 145.97, 144.98, 133.99, 128.89, 128.75, 128.40, 124.06 (d, *J* = 6.1 Hz), 123.86 (d, *J* = 271.7 Hz), 120.38 (d, *J* = 2.4 Hz), 118.08, 116.53 (d, *J* = 34.0 Hz), 116.14, 37.66, 36.00, 29.72.

^{19}F NMR (376 MHz, $CDCl_3$) δ -61.84(s).

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{17}F_3N_3O$ 348.1318, found 348.1318.

2-(2-(4-Cyanophenyl)-7-methylimidazo[1,2-*α*]pyridin-3-yl)-*N,N*-dimethylacetamide.



3t

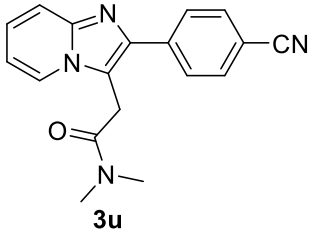
After purification, **3t** was obtained as white solid (30.6 mg, 48% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 258-261 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 7.0 Hz, 1H), 7.79 (d, *J* = 8.4 Hz, 2H), 7.72 (d, *J* = 8.4 Hz, 2H), 7.36 (s, 1H), 6.68 (dd, *J* = 7.0, 1.5 Hz, 1H), 4.07 (s, 2H), 2.97 (s, 6H), 2.40 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.83, 145.96, 141.84, 139.66, 136.27, 132.50, 129.02, 123.81, 119.05, 116.04, 115.49, 114.95, 111.16, 37.62, 36.02, 30.09, 21.46.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{19}H_{19}N_4O$ 319.1553, found 319.1553.

2-(2-(4-Cyanophenyl)imidazo[1,2-*α*]pyridin-3-yl)-*N,N*-dimethylacetamide.



3u

After purification, **3u** was obtained as white solid (34.2 mg, 56% yield), eluent: petroleum

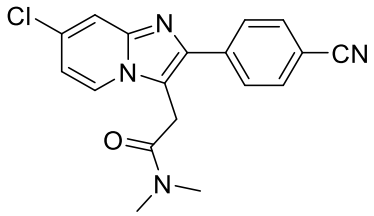
ether/ethyl acetate = 1:1, m.p. = 246-249 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 6.9 Hz, 1H), 7.79 (d, *J* = 8.2 Hz, 2H), 7.71 (d, *J* = 8.2 Hz, 2H), 7.60 (d, *J* = 9.1 Hz, 1H), 7.24 – 7.19 (m, 1H), 6.83 (t, *J* = 6.8 Hz, 1H), 4.07 (s, 2H), 2.99 (s, 3H), 2.97 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.66, 145.44, 142.17, 139.44, 132.47, 129.04, 125.16, 124.49, 118.96, 117.69, 115.61, 112.77, 111.25, 37.58, 35.98, 29.93.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{17}N_4O$ 305.1397, found 305.1396.

2-(7-Chloro-2-(4-cyanophenyl)imidazo[1,2-*α*]pyridin-3-yl)-*N*,*N*-dimethylacetamide.



3v

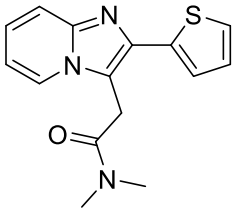
After purification, **3v** was obtained as white solid (38.6 mg, 57% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 276-281 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 6.9 Hz, 1H), 7.76 (d, *J* = 5.0 Hz, 4H), 7.61 (s, 1H), 6.83 (d, *J* = 6.2 Hz, 1H), 4.08 (s, 2H), 3.00 (s, 3H), 2.99 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.42, 145.24, 142.98, 138.98, 132.62, 131.85, 129.09, 125.12, 118.90, 116.50, 115.96, 114.43, 111.62, 37.67, 36.05, 29.89.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{16}ClN_4O$ 339.1007, found 339.1007.

***N*,*N*-Dimethyl-2-(2-(thiophen-2-yl)imidazo[1,2-*α*]pyridin-3-yl)acetamide.**



3w

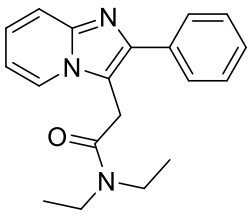
After purification, **3w** was obtained as yellow solid (33.2 mg, 58% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 156-157 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (d, *J* = 6.3 Hz, 1H), 7.58 (d, *J* = 8.9 Hz, 1H), 7.43 – 7.30 (m, 2H), 7.16 (t, *J* = 7.2 Hz, 1H), 7.10 (d, *J* = 3.3 Hz, 1H), 6.78 (t, *J* = 5.7 Hz, 1H), 4.17 (s, 2H), 2.96 (s, 3H), 2.92 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.92, 145.17, 138.09, 137.27, 127.70, 125.89, 125.23, 124.82, 124.70, 117.22, 113.90, 112.41, 37.54, 35.94, 30.42.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{15}H_{16}N_3OS$ 286.1009, found 286.1006.

***N,N*-Diethyl-2-(2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetamide.**



4b

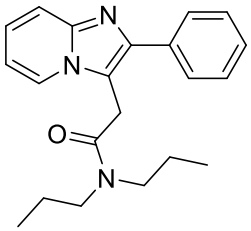
After purification, **4b** was obtained as yellow oil (40.1 mg, 65% yield), eluent: petroleum ether/ethyl acetate = 1:1.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 6.9 Hz, 1H), 7.64 (d, *J* = 8.2 Hz, 2H), 7.61 (d, *J* = 9.1 Hz, 1H), 7.44 (t, *J* = 7.7 Hz, 2H), 7.35 (t, *J* = 7.4 Hz, 1H), 7.18 (t, *J* = 8.0 Hz, 1H), 6.80 (t, *J* = 6.8 Hz, 1H), 4.09 (s, 2H), 3.32 (q, *J* = 7.1 Hz, 2H), 3.13 (q, *J* = 7.1 Hz, 2H), 1.06 (t, *J* = 7.1 Hz, 3H), 0.89 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.37, 145.19, 143.86, 134.58, 128.70, 127.93, 124.86, 124.51, 117.35, 114.61, 112.30, 42.36, 40.70, 30.50, 14.11, 13.09.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{19}H_{22}N_3O$ 308.1757, found 308.1757.

2-(2-Phenylimidazo[1,2-*α*]pyridin-3-yl)-*N,N*-dipropylacetamide.



4c

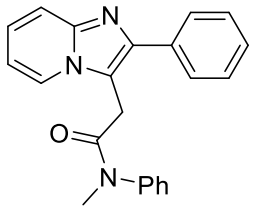
After purification, **4c** was obtained as white solid (39.0 mg, 58% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 81-82 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.32 (d, *J* = 6.9 Hz, 1H), 7.67 (d, *J* = 8.1 Hz, 2H), 7.61 (d, *J* = 9.1 Hz, 1H), 7.45 (t, *J* = 7.6 Hz, 2H), 7.36 (t, *J* = 7.3 Hz, 1H), 7.21 – 7.14 (m, 1H), 6.80 (t, *J* = 6.8 Hz, 1H), 4.12 (s, 2H), 3.23 (t, *J* = 8.0 Hz, 2H), 3.01 (t, *J* = 8.0 Hz, 2H), 1.52 – 1.43 (m, 2H), 1.42 – 1.33 (m, 2H), 0.80 (t, *J* = 7.4 Hz, 3H), 0.60 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.83, 145.26, 143.88, 134.68, 128.80, 128.76, 127.96, 125.03, 124.48, 117.39, 114.66, 112.24, 49.83, 47.97, 30.69, 22.16, 20.95, 11.35, 10.86.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{21}H_{26}N_3O$ 336.2070, found 336.2071.

***N*-Methyl-*N*-phenyl-2-(2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetamide.**



4d

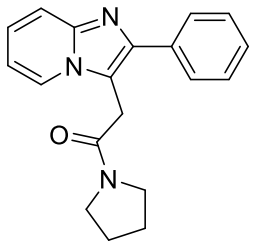
After purification, **4d** was obtained as yellow oil (40.4 mg, 59% yield), eluent: petroleum ether/ethyl acetate = 1:1.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (d, *J* = 6.8 Hz, 1H), 7.60 – 7.58 (m, 3H), 7.40 (t, *J* = 7.3 Hz, 2H), 7.36 – 7.28 (m, 4H), 7.21 – 7.16 (m, 3H), 6.83 (t, *J* = 6.8 Hz, 1H), 3.93 (s, 2H), 3.32 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.58, 144.96, 143.98, 143.16, 134.39, 130.01, 128.45, 128.38, 128.22, 127.55, 126.87, 124.30, 124.22, 117.34, 114.52, 112.00, 37.81, 30.52.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{22}H_{20}N_3O$ 342.1601, found 342.1600.

2-(2-Phenylimidazo[1,2-*α*]pyridin-3-yl)-1-(pyrrolidin-1-yl)ethan-1-one.



4e

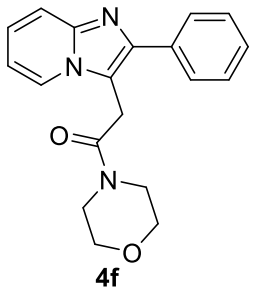
After purification, **4e** was obtained as white solid (38.0 mg, 62% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 155-157 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (d, *J* = 6.7 Hz, 1H), 7.64 (d, *J* = 7.3 Hz, 2H), 7.58 (d, *J* = 9.0 Hz, 1H), 7.41 (t, *J* = 7.5 Hz, 2H), 7.32 (t, *J* = 7.1 Hz, 1H), 7.14 (t, *J* = 7.8 Hz, 1H), 6.76 (t, *J* = 6.7 Hz, 1H), 4.01 (s, 2H), 3.40 (t, *J* = 6.3 Hz, 2H), 3.18 (t, *J* = 6.3 Hz, 2H), 1.82 – 1.74 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 166.63, 145.07, 144.08, 134.67, 128.61, 127.75, 124.76, 124.43, 117.25, 114.15, 112.14, 46.73, 46.07, 31.31, 26.15, 24.21.

The spectral data were in accordance with the literature.[4]

1-Morpholino-2-(2-phenylimidazo[1,2-*α*]pyridin-3-yl)ethan-1-one.

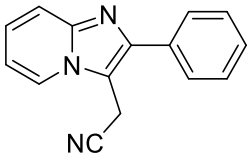


4f

After purification, **4f** was obtained as white solid (35.4 mg, 55% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 206-209 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.28 (d, *J* = 6.9 Hz, 1H), 7.64 – 7.61 (m, 3H), 7.47 – 7.43 (m, 2H), 7.39 – 7.35 (m, 1H), 7.22 – 7.18 (m, 1H), 6.83 (td, *J* = 6.8, 1.1 Hz, 1H), 4.11 (s, 2H), 3.54 (s, 4H), 3.30 – 3.19 (m, 4H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 166.85, 145.32, 143.97, 134.54, 128.91, 128.86, 128.15, 124.81, 124.71, 117.50, 113.87, 112.45, 66.86, 66.50, 46.44, 42.50, 29.98.
The spectral data were in accordance with the literature.[5]

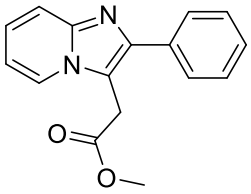
2-(2-Phenylimidazo[1,2-*α*]pyridin-3-yl)acetonitrile.



4g

After purification, **4g** was obtained as yellow solid (18.7 mg, 40% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 97-101 ºC.
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (d, *J* = 6.9 Hz, 1H), 7.73 – 7.68 (m, 3H), 7.51 (t, *J* = 7.4 Hz, 2H), 7.43 (t, *J* = 7.4 Hz, 1H), 7.34 – 7.30 (m, 1H), 6.99 (td, *J* = 6.8, 1.0 Hz, 1H), 4.15 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 145.58, 145.32, 133.25, 129.09, 128.68, 125.45, 122.98, 118.18, 115.05, 113.50, 107.87, 14.03.
The spectral data were in accordance with the literature.[2]

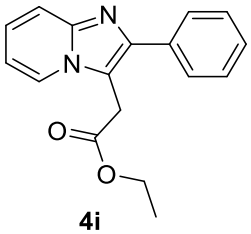
Methyl 2-(2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetate.



4h

After purification, **4h** was obtained as yellow solid (32.6 mg, 61% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 155-157 ºC.
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16 (d, *J* = 6.9 Hz, 1H), 7.89 – 7.87 (m, 2H), 7.73 (d, *J* = 9.1 Hz, 1H), 7.54 (t, *J* = 7.5 Hz, 2H), 7.44 (t, *J* = 7.4 Hz, 1H), 7.31 – 7.27 (m, 1H), 6.93 (t, *J* = 6.8 Hz, 1H), 4.13 (s, 2H), 3.82 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 170.01, 145.18, 144.79, 134.16, 128.79, 128.72, 128.08, 124.66, 123.79, 117.78, 112.88, 112.61, 52.70, 30.73.
The spectral data were in accordance with the literature.[6]

Ethyl 2-(2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetate.



4i

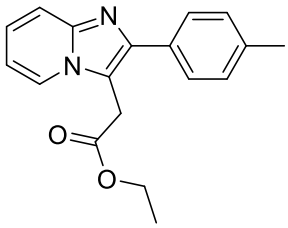
After purification, **4i** was obtained as white solid (30.4 mg, 54% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 161-162 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, *J* = 6.8 Hz, 1H), 7.84 (d, *J* = 7.9 Hz, 2H), 7.66 (d, *J* = 9.1 Hz, 1H), 7.47 (t, *J* = 7.5 Hz, 2H), 7.38 (t, *J* = 7.3 Hz, 1H), 7.22 (t, *J* = 8.0 Hz, 1H), 6.85 (t, *J* = 6.8 Hz, 1H), 4.21 (q, *J* = 7.1 Hz, 2H), 4.04 (s, 2H), 1.27 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.53, 145.12, 144.70, 134.14, 128.73, 128.69, 128.01, 124.62, 123.81, 117.67, 113.05, 112.49, 61.74, 30.92, 14.26.

The spectral data were in accordance with the literature.[6]

Ethyl 2-(2-(*p*-tolyl)imidazo[1,2-*α*]pyridin-3-yl)acetate.



4j

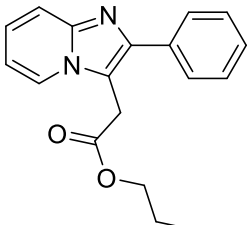
After purification, **4j** was obtained as white solid (25.4 mg, 43% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 121-123 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10 (d, *J* = 6.9 Hz, 1H), 7.73 (d, *J* = 8.1 Hz, 2H), 7.64 (d, *J* = 9.1 Hz, 1H), 7.28 (d, *J* = 8.0 Hz, 2H), 7.21 – 7.17 (m, 1H), 6.83 (t, *J* = 6.8 Hz, 1H), 4.20 (q, *J* = 7.1 Hz, 2H), 4.01 (s, 2H), 2.39 (s, 3H), 1.26 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.53, 145.01, 144.70, 137.76, 131.22, 129.41, 128.51, 124.46, 123.73, 117.53, 112.74, 112.34, 61.65, 30.91, 21.36, 14.23.

The spectral data were in accordance with the literature.[3]

Propyl 2-(2-phenylimidazo[1,2-*α*]pyridin-3-yl)acetate.



4k

After purification, **4k** was obtained as white solid (27.2 mg, 46% yield), eluent: petroleum ether/ethyl acetate = 1:1, m.p. = 162-167 ºC.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, *J* = 6.9 Hz, 1H), 7.84 (d, *J* = 7.1 Hz, 2H), 7.65 (d, *J* = 9.1

Hz, 1H), 7.47 (t, *J* = 7.5 Hz, 2H), 7.44 – 7.32 (m, 1H), 7.21 (ddd, *J* = 9.0, 6.7, 1.2 Hz, 1H), 6.85 (td, *J* = 6.8, 1.1 Hz, 1H), 4.11 (t, *J* = 6.7 Hz, 2H), 4.04 (s, 2H), 2.29 – 1.43 (m, 2H), 0.89 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.58, 145.08, 144.63, 134.11, 128.70, 128.65, 127.97, 124.59, 123.79, 117.63, 113.04, 112.45, 67.28, 30.90, 21.96, 10.40.

HRMS (EI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}N_2O_2$ 295.1441, found 295.1441.

7. References

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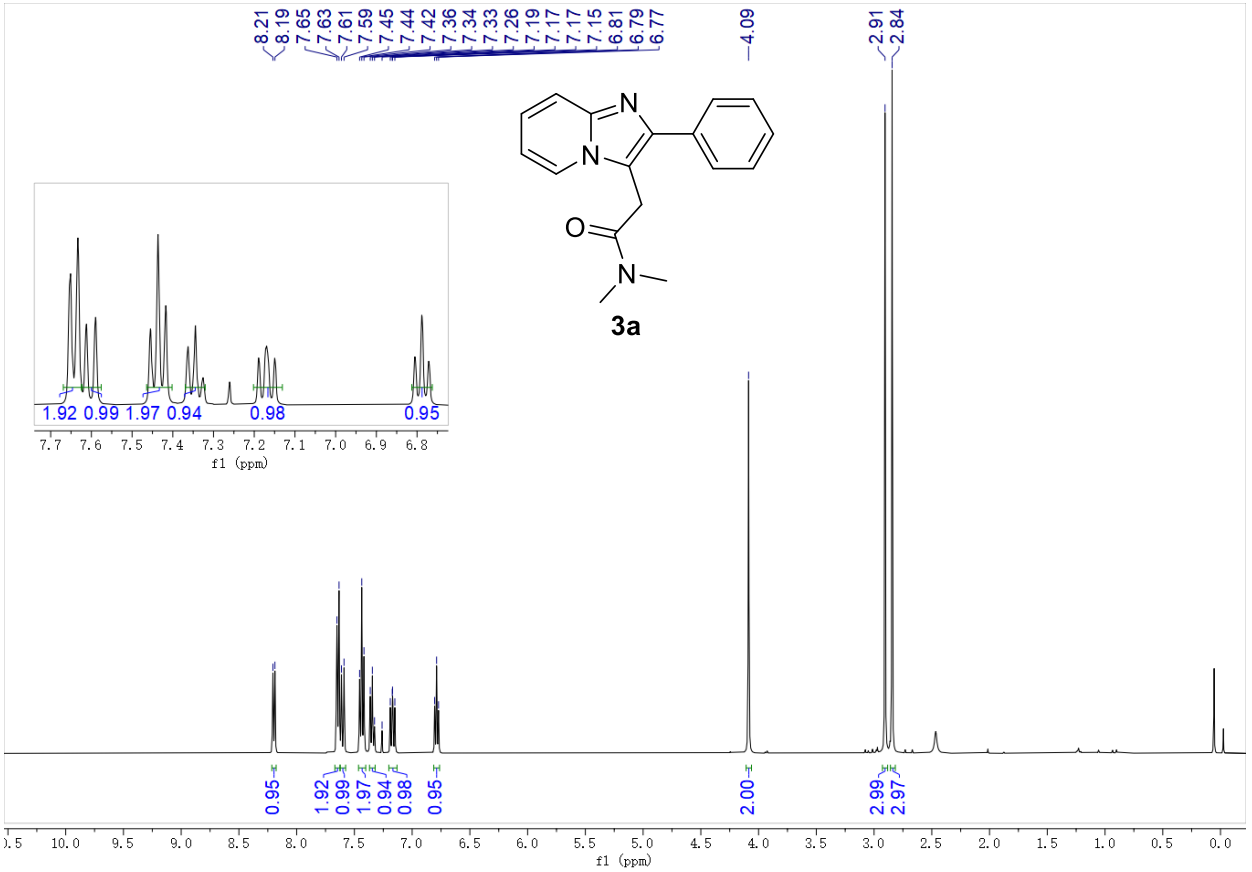
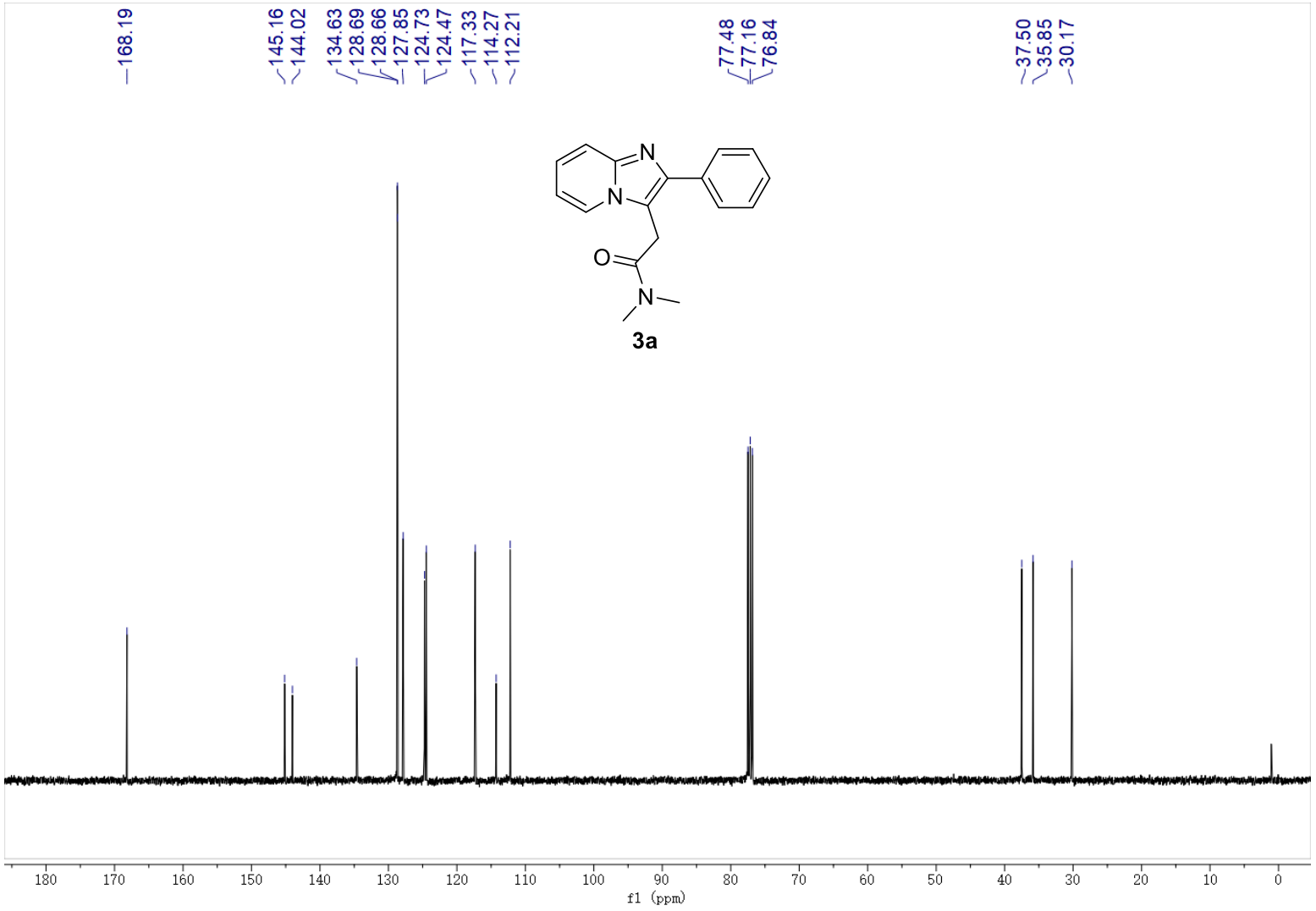
8. NMR spectra

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145.16
144.02
134.63
128.69
128.66
127.85
124.73
124.47
117.33
114.27
112.21
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77.16
76.84
37.50
35.85
30.17
N
N
O
N
3a
180
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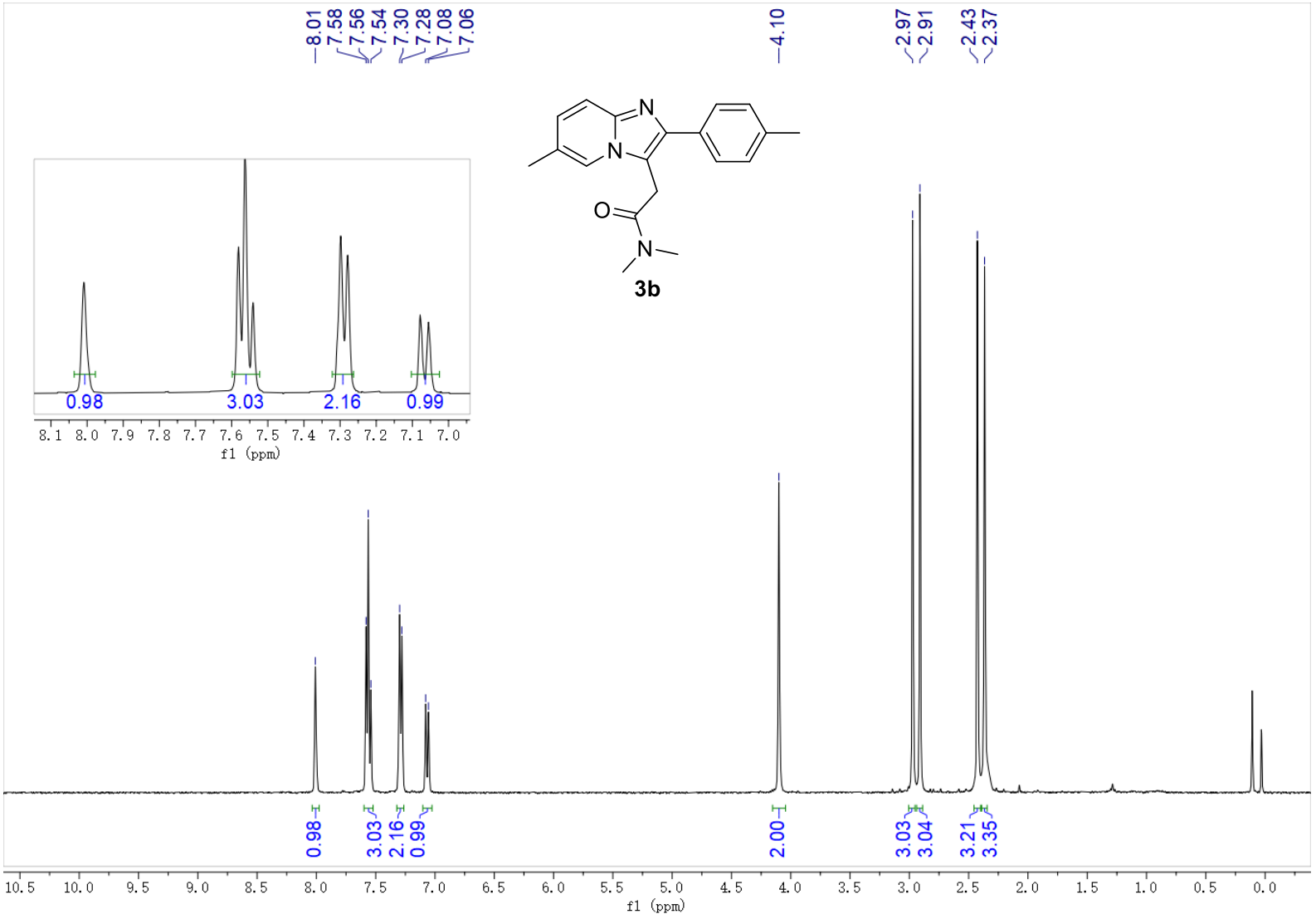
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.54
7.30
7.28
7.08
7.06
4.10
2.97
2.91
2.43
2.37
N
N
O
N
0.98
3.03
2.16
0.99
8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0
f1 (ppm)
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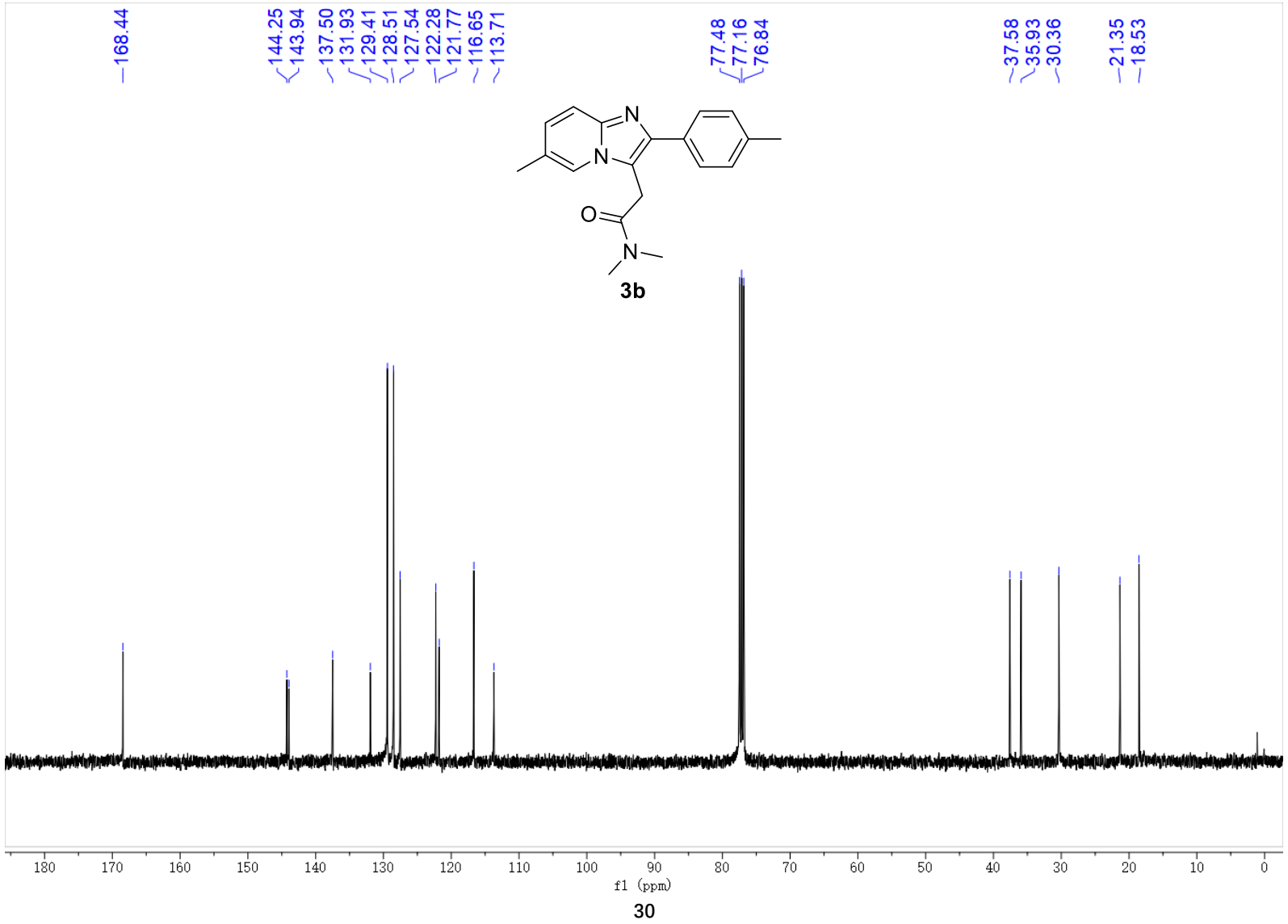
3.03
2.16
0.99
2.00
3.03
3.04
3.21
3.35
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

3b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128.51
127.54
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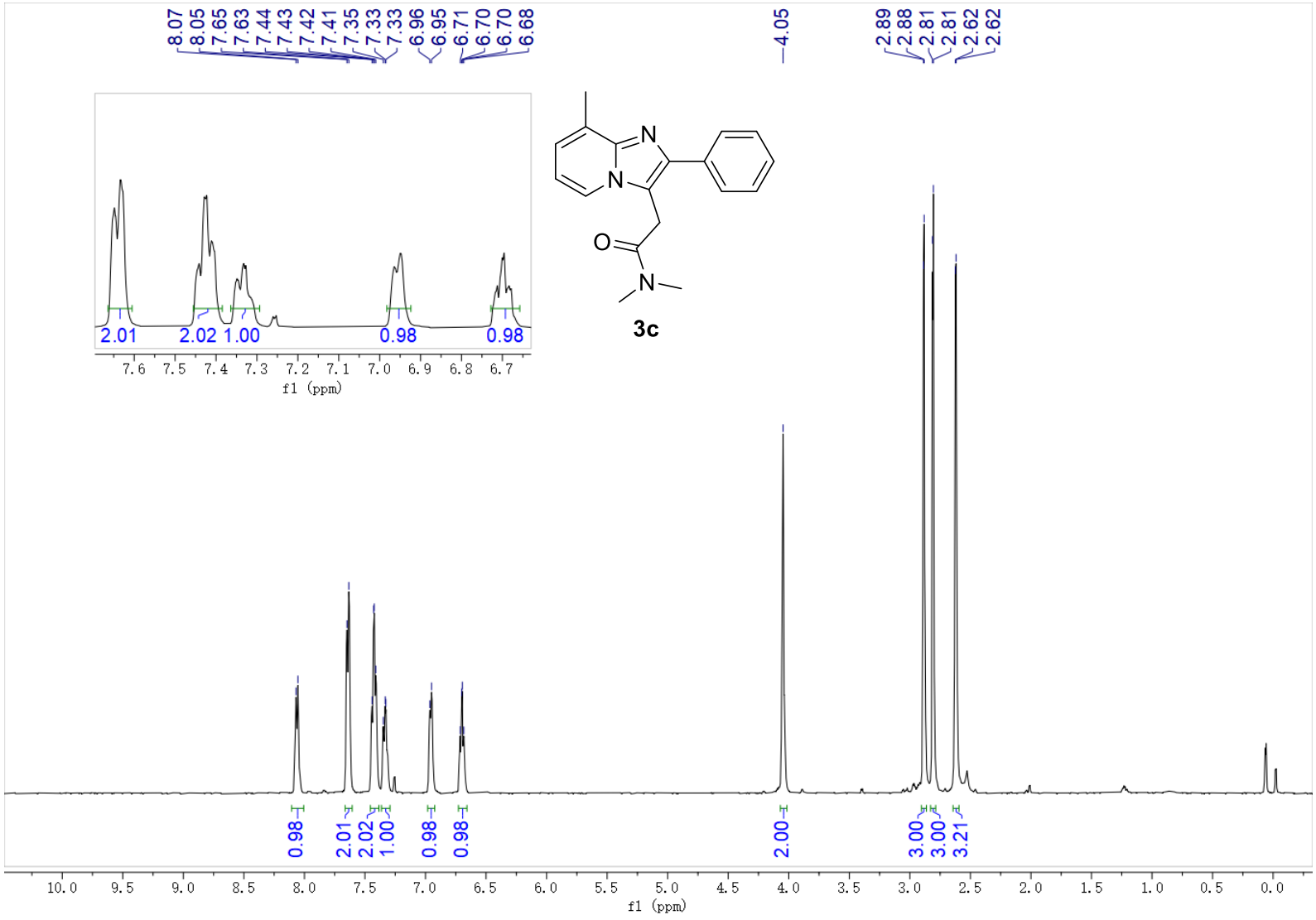
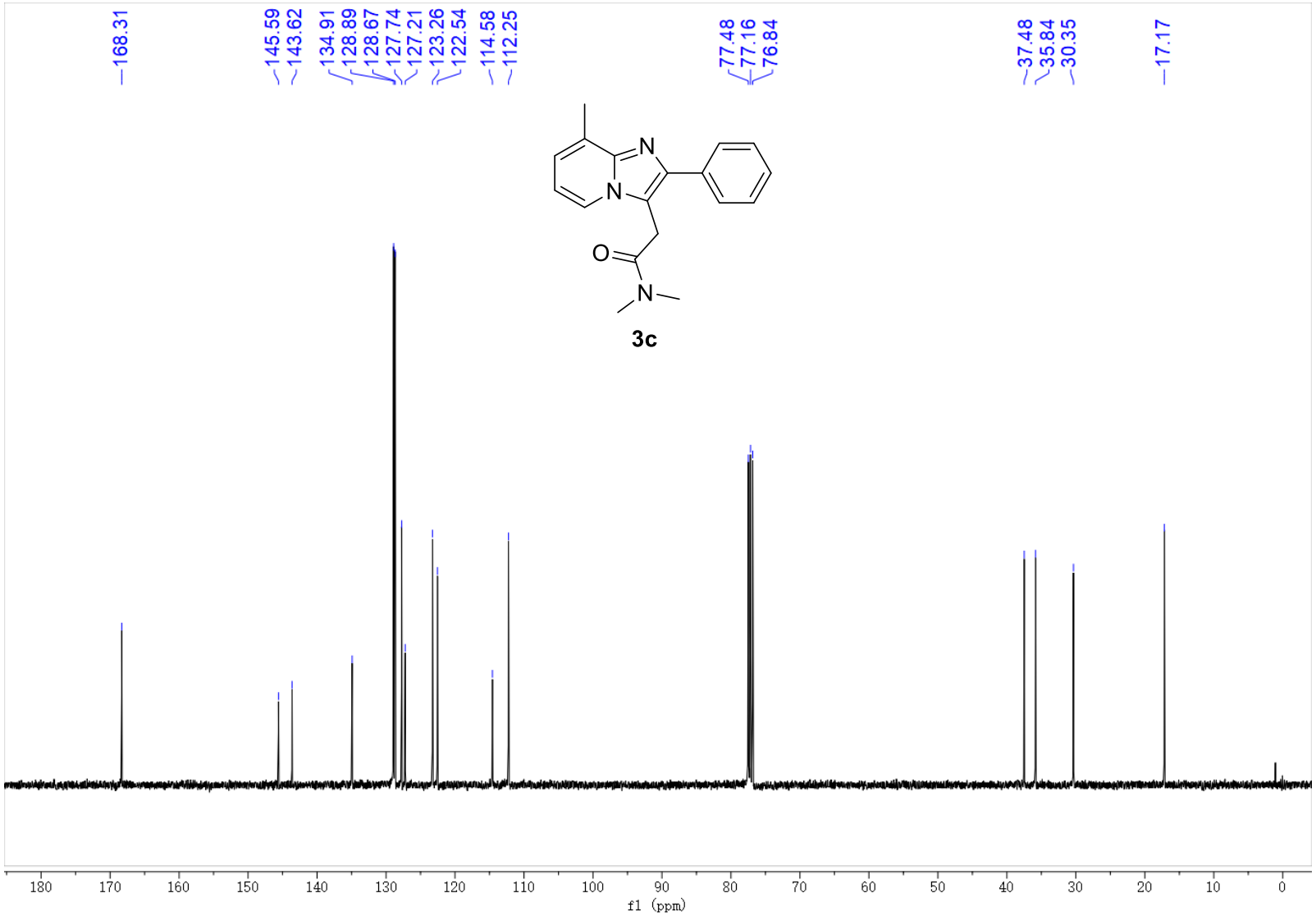
77.16
76.84
37.58
35.93
30.36
21.35
18.53
N
N
O
N
3b
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

30

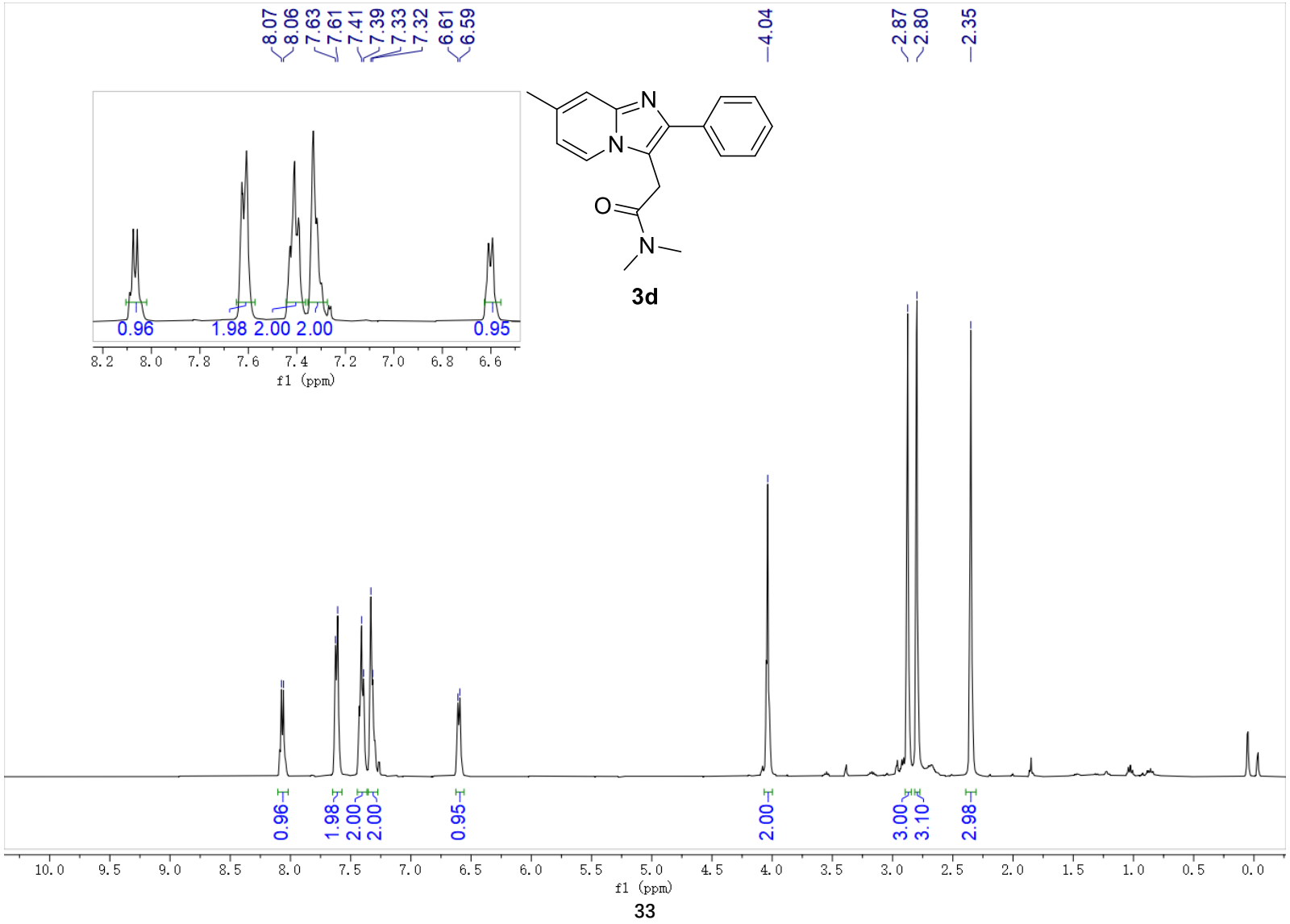

8.07
8.05
7.65
7.63
7.44
7.43
7.42
7.41
7.35
7.33
7.33
6.96
6.95
6.71
6.70
6.70
6.68
4.05
2.89
2.88
2.81
2.81
2.62
2.62
2.01
2.02
1.00
0.98
0.98
f1 (ppm)
N
N
O
N
0.98
2.01
2.02
1.00
0.98
0.98
2.00
3.00
3.00
3.21
f1 (ppm)

3c

31

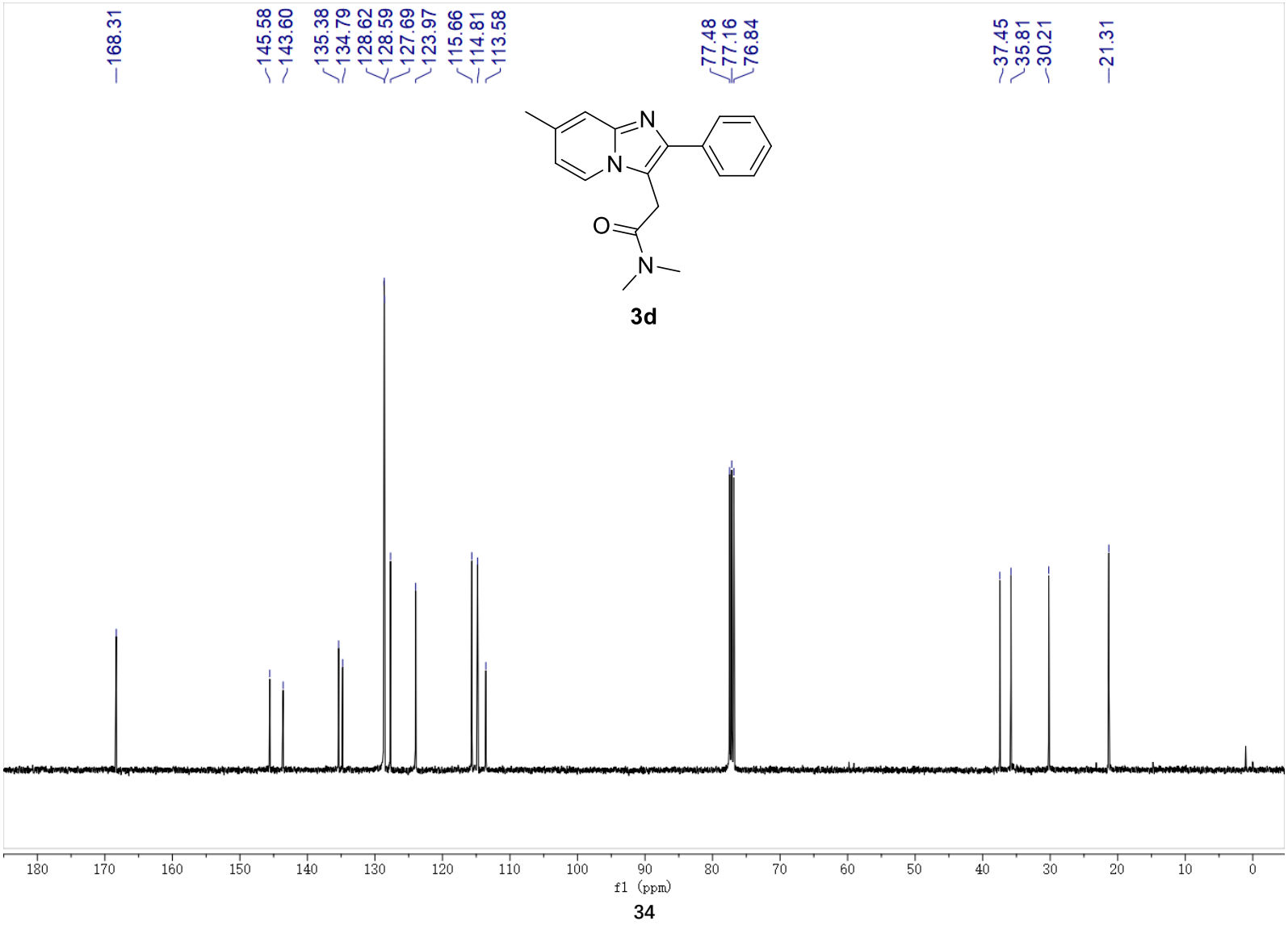

168.31
145.59
143.62
134.91
128.89
128.67
127.74
127.21
123.26
122.54
114.58
112.25
77.48
77.16
76.84
37.48
35.84
30.35
17.17
N
N
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

3c


8.07
8.06
7.63
7.61
7.41
7.39
7.33
7.32
6.61
6.59
4.04
2.87
2.80
2.35
N
N
O
N
0.96
1.98
2.00
2.00
0.95
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
f1 (ppm)
0.96
1.98
2.00
2.00
0.95
2.00
3.00
3.10
2.98
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

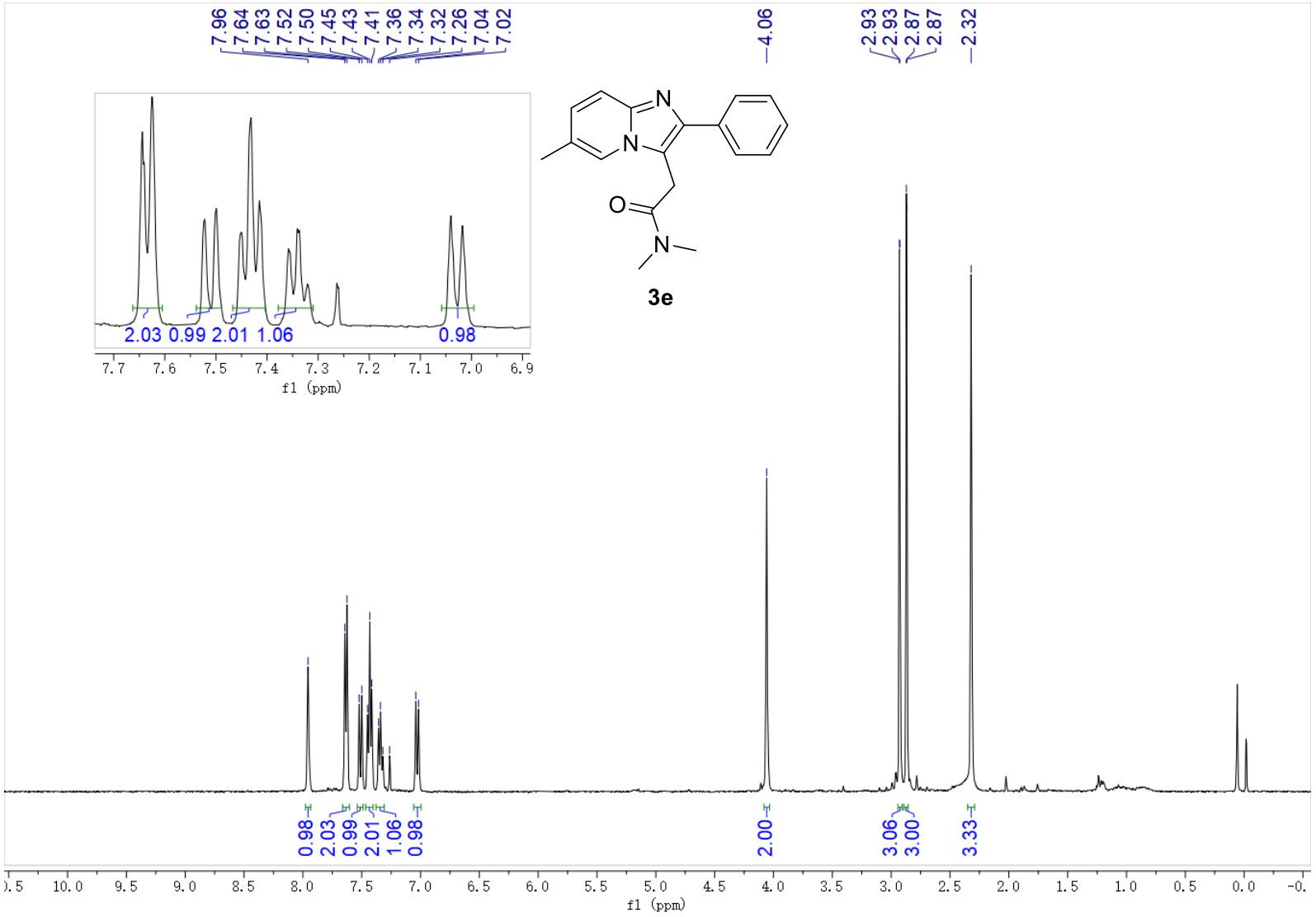
3d

33

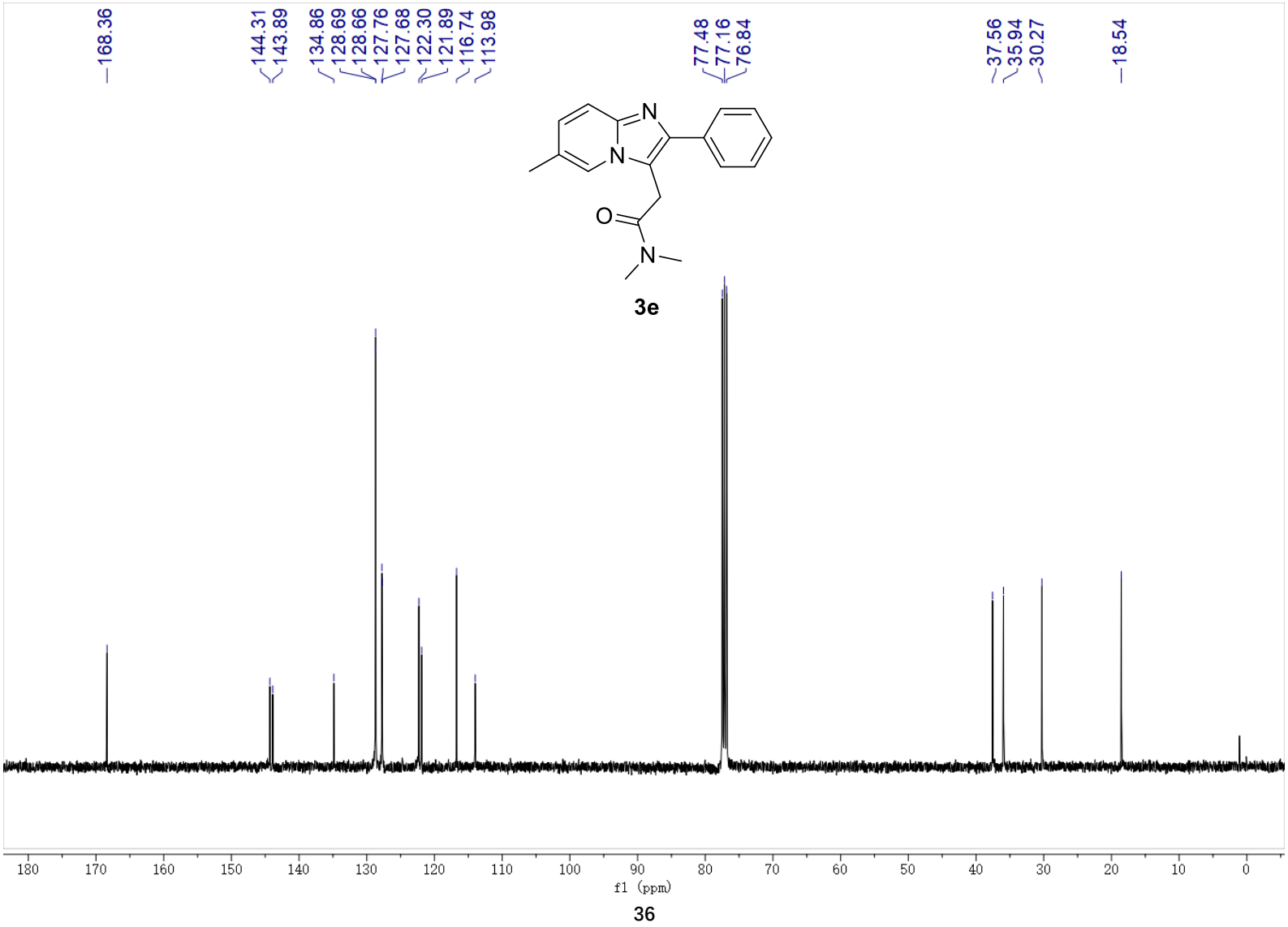

168.31
145.58
143.60
135.38
134.79
128.62
128.59
127.69
123.97
115.66
114.81
113.58
77.48
77.16
76.84
37.45
35.81
30.21
21.31
N
N
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

3d

34

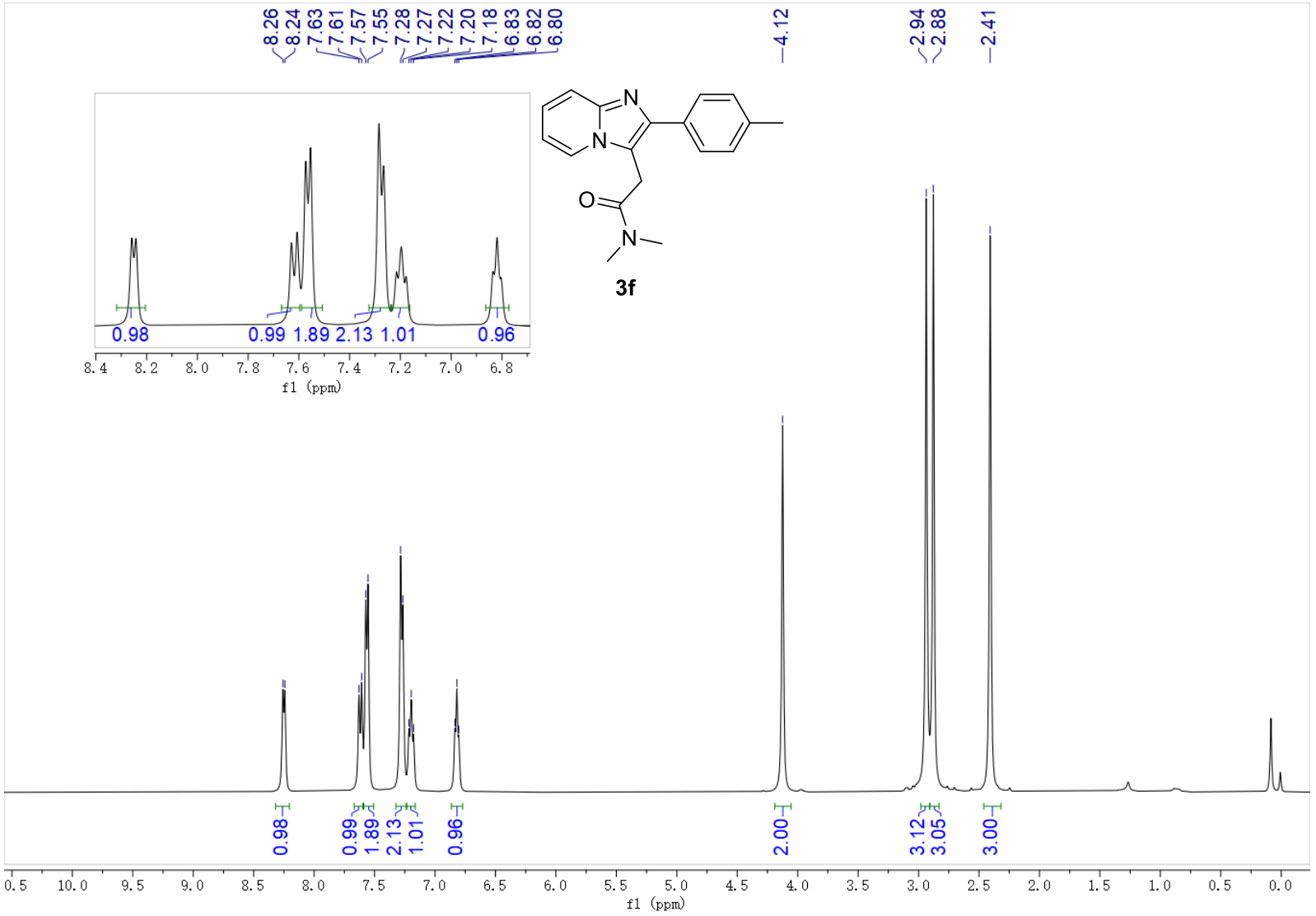

7.96
7.64
7.63
7.52
7.50
7.45
7.43
7.41
7.36
7.34
7.32
7.26
7.04
7.02
4.06
2.93
2.93
2.87
2.87
2.32
2.03 0.99 2.01 1.06
0.98
f1 (ppm)
3e
0.98
2.03
0.99
2.01
1.06
0.98
2.00
3.06
3.00
3.33
f1 (ppm)

35

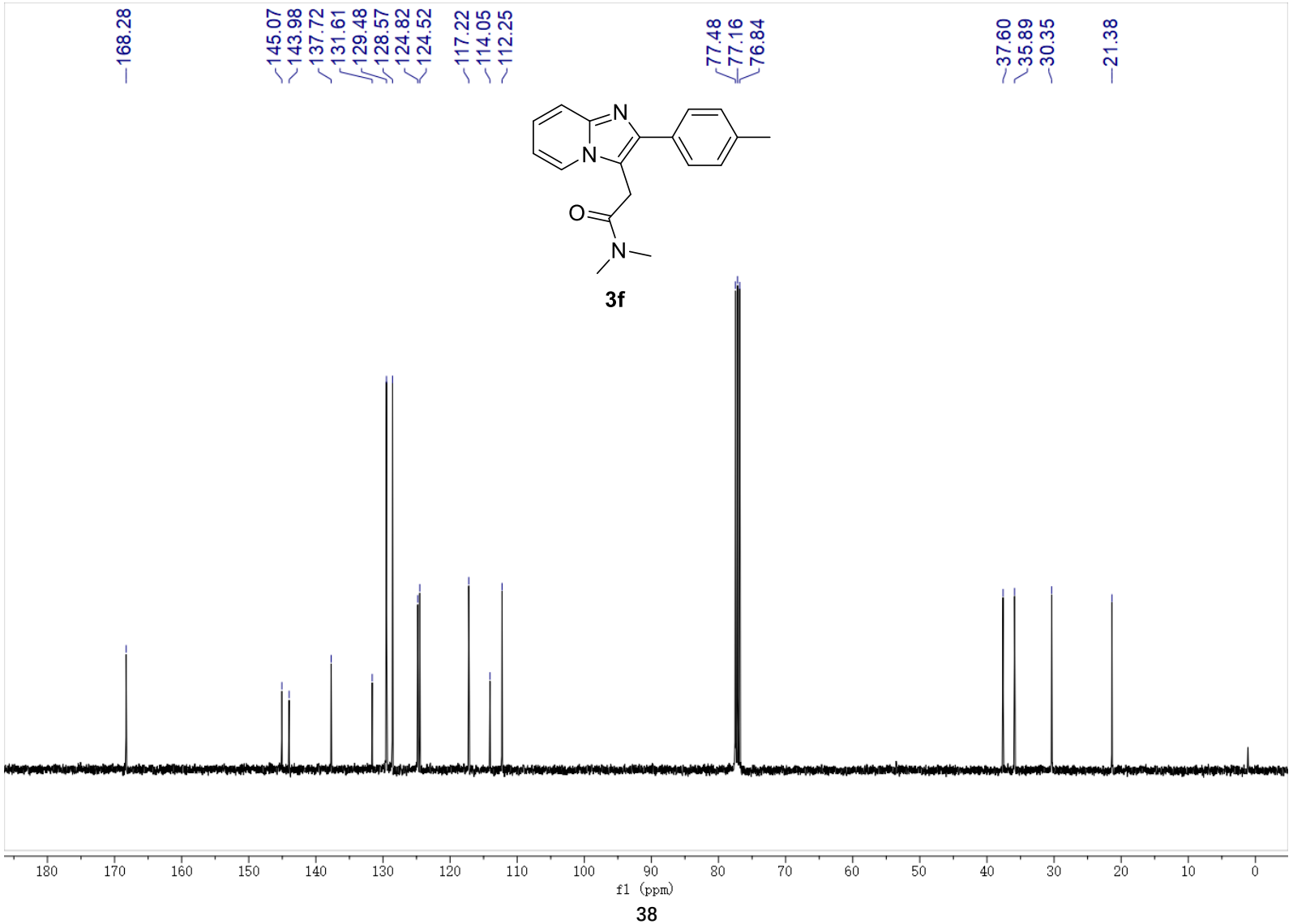

168.36
144.31
143.89
134.86
128.69
128.66
127.76
127.68
122.30
121.89
116.74
113.98
77.48
77.16
76.84
37.56
35.94
30.27
18.54
N
N
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

3e

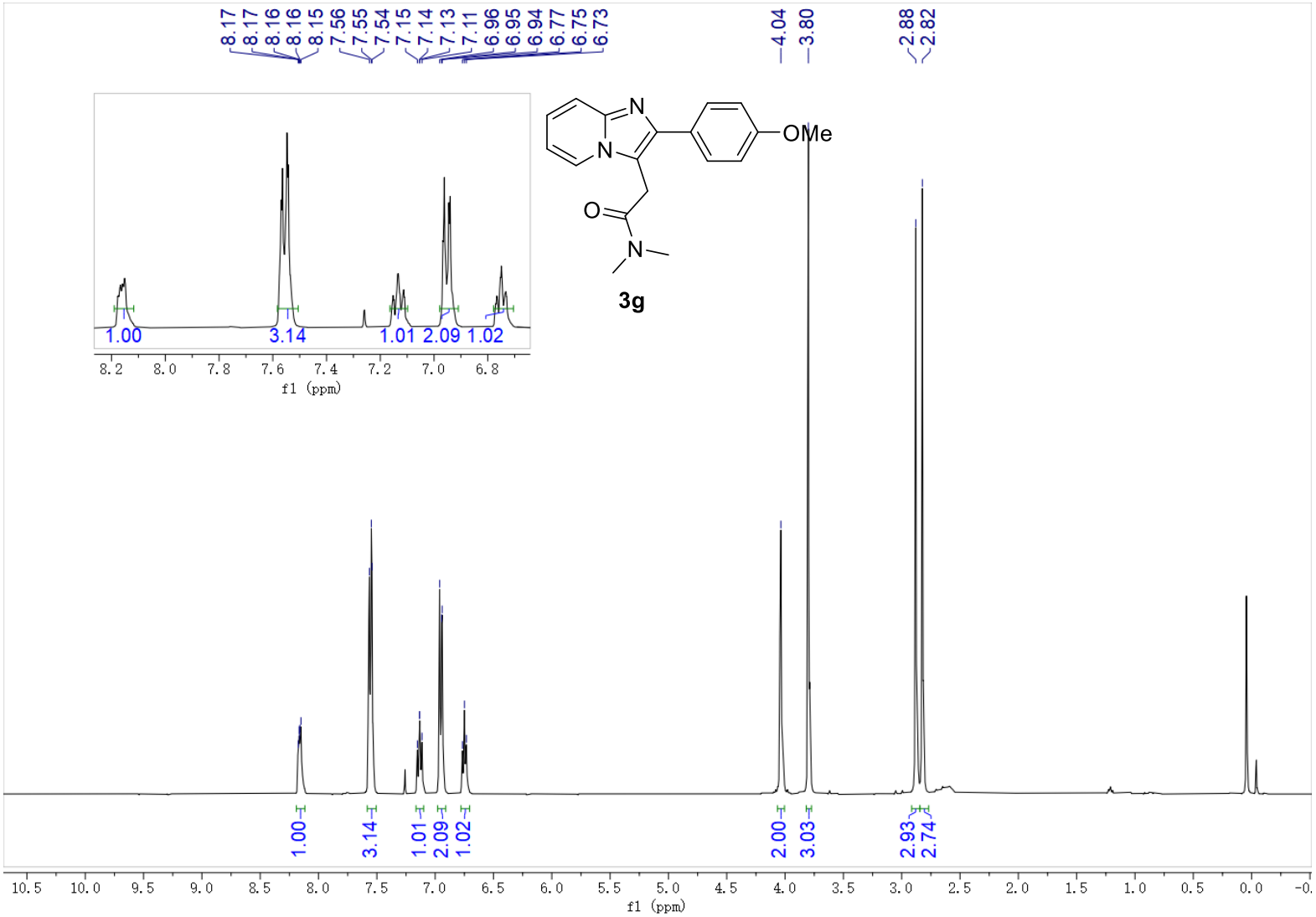
36

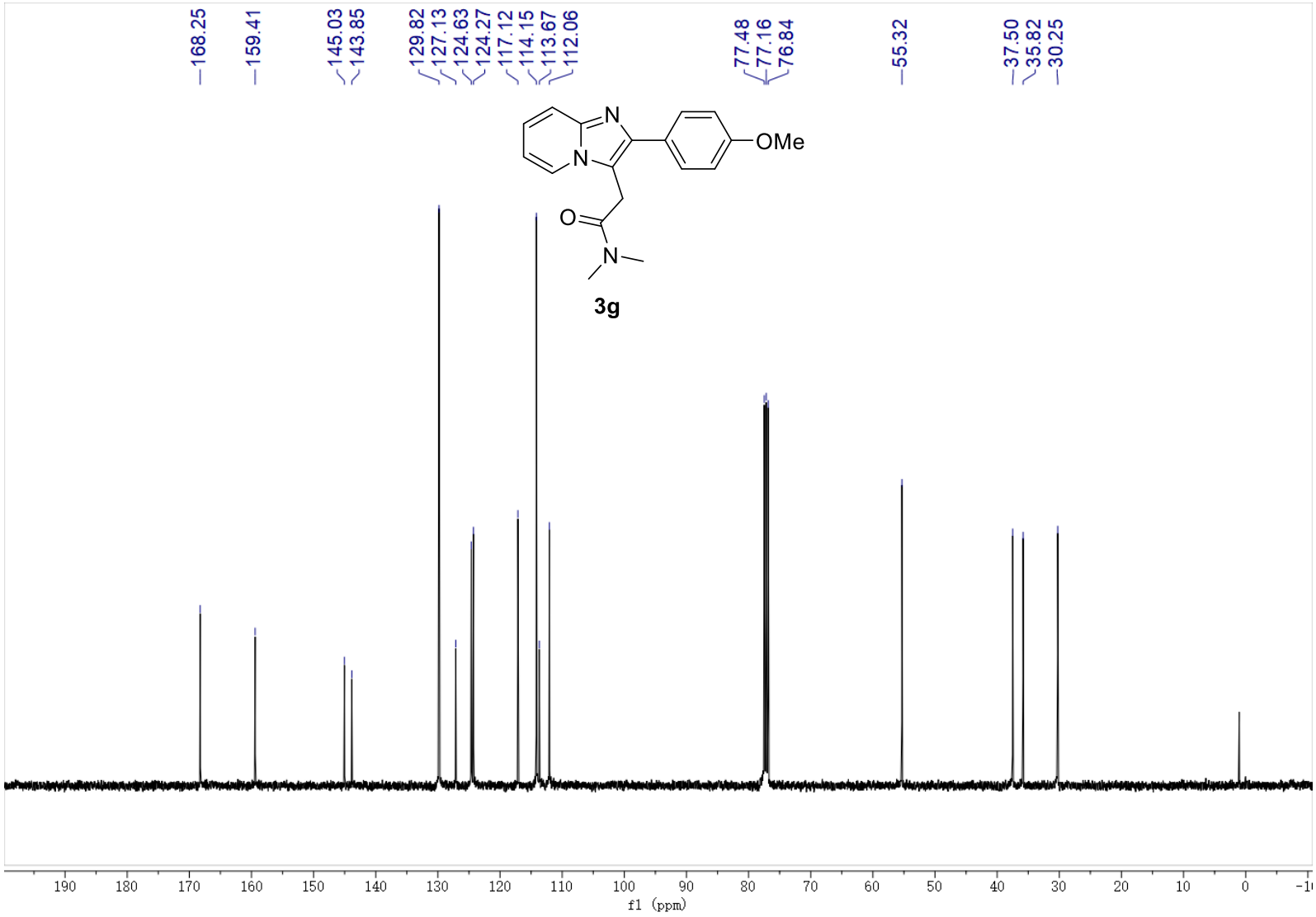

8.26
8.24
7.63
7.61
7.57
7.55
7.28
7.27
7.22
7.20
7.18
6.83
6.82
6.80
4.12
2.94
2.88
2.41
0.98
0.99 1.89 2.13 1.01
0.96
f1 (ppm)
3f
0.98
0.99
1.89
2.13
1.01
0.96
2.00
3.12
3.05
3.00
f1 (ppm)

37

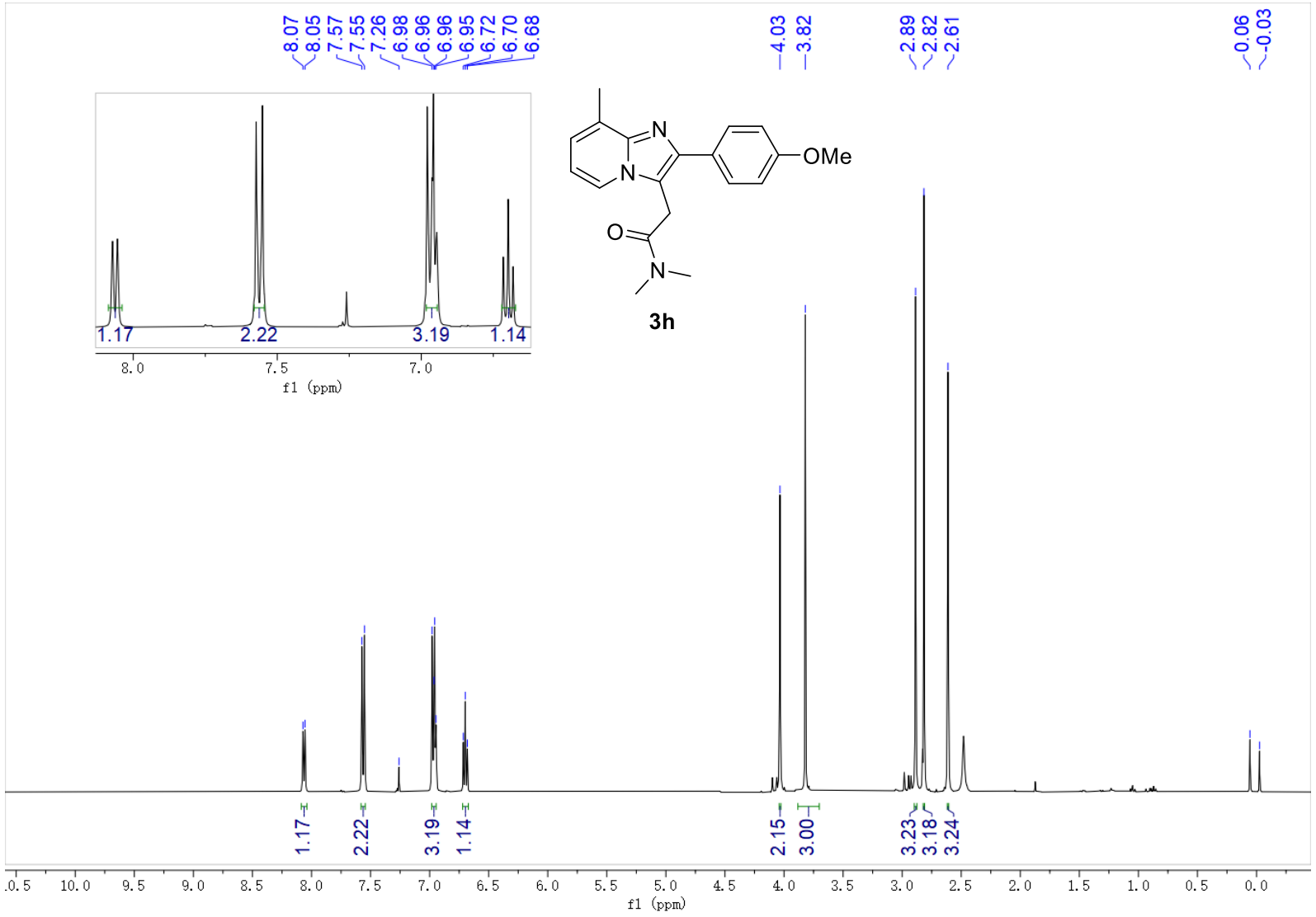

168.28
145.07
143.98
137.72
131.61
129.48
128.57
124.82
124.52
117.22
114.05
112.25
77.48
77.16
76.84
37.60
35.89
30.35
21.38
N
N
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

3f

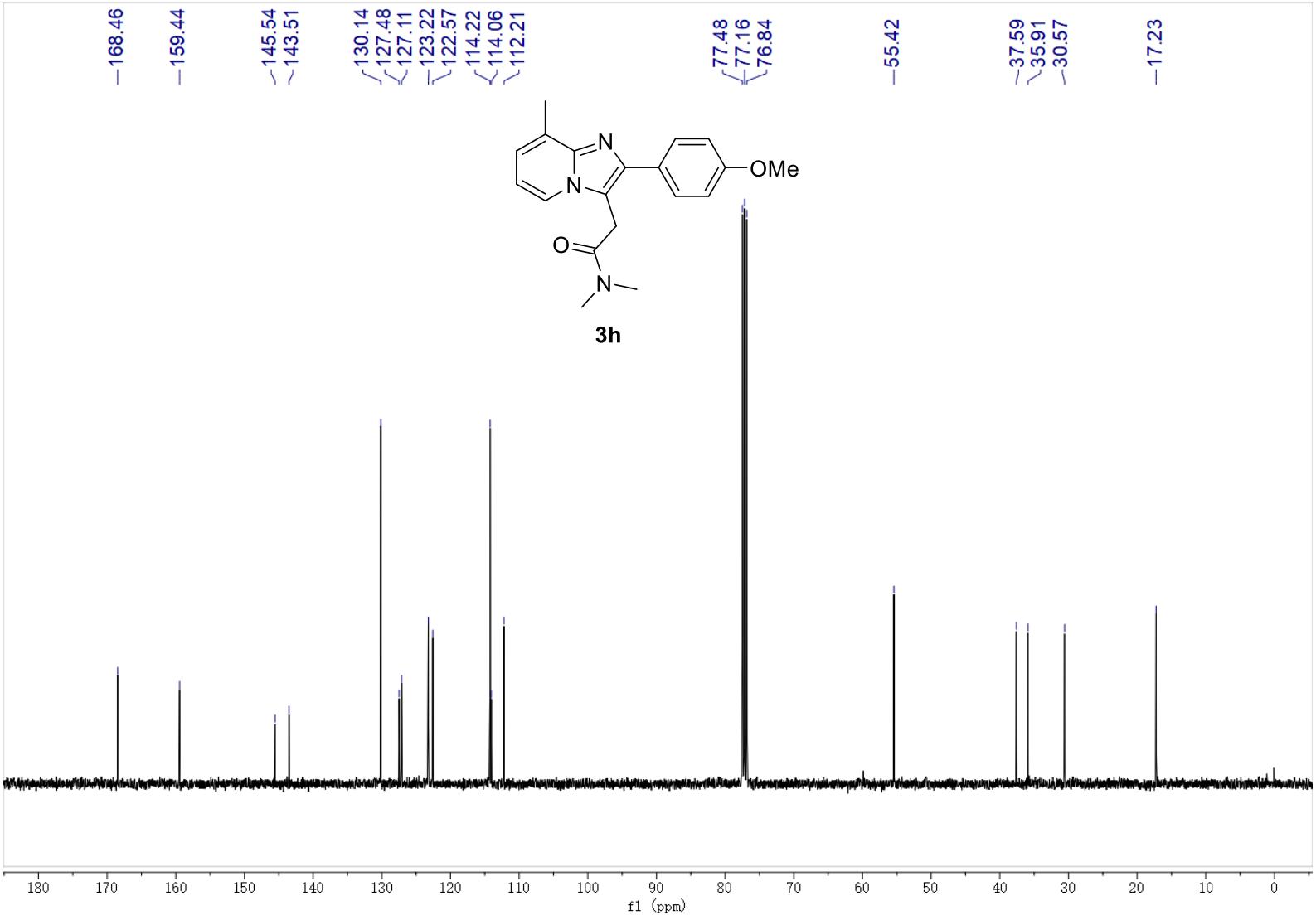

8.17
8.17
8.16
8.16
8.15
7.56
7.55
7.54
7.15
7.14
7.13
7.11
6.96
6.95
6.94
6.77
6.75
6.73
4.04
3.80
2.88
2.82
N
N
OMe
O
N
3g
1.00
3.14
1.01 2.09 1.02
8.2 8.0 7.8 7.6 7.4 7.2 7.0 6.8
f1 (ppm)
1.00
3.14
1.01
2.09
1.02
2.00
3.03
2.93
2.74
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

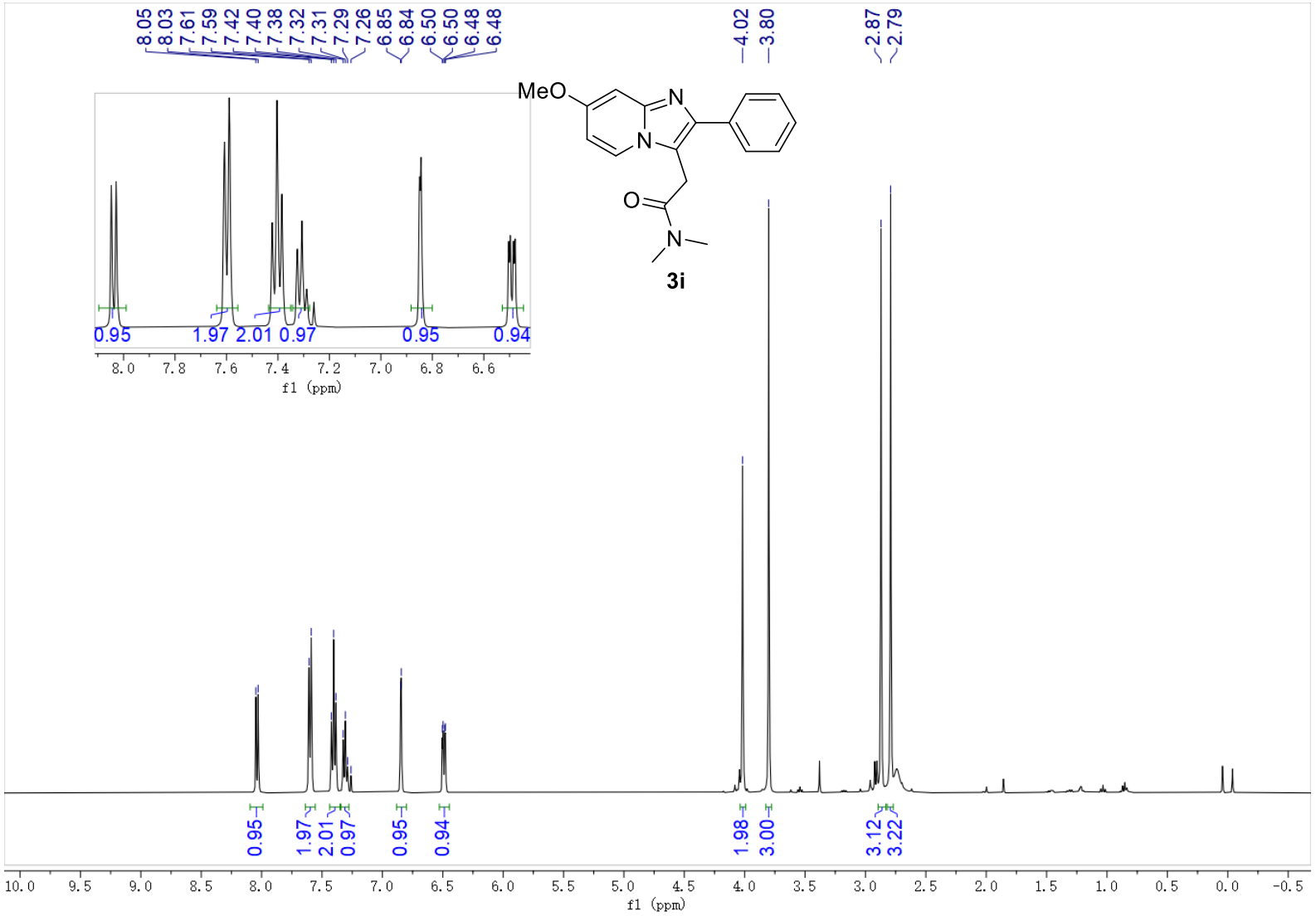

168.25
159.41
145.03
143.85
129.82
127.13
124.63
124.27
117.12
114.15
113.67
112.06
77.48
77.16
76.84
55.32
37.50
35.82
30.25
N
N
OMe
O
N
3g
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

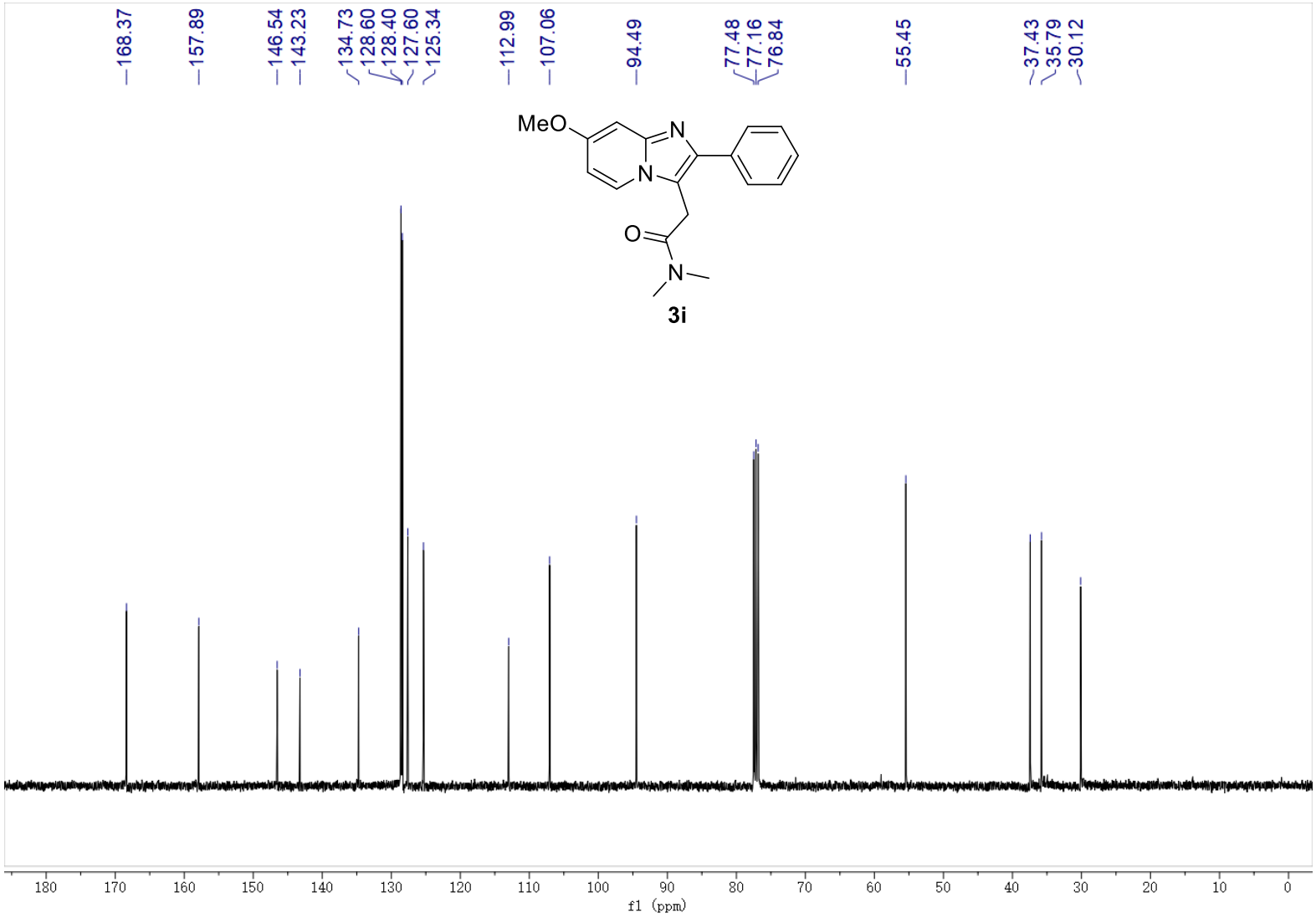
40

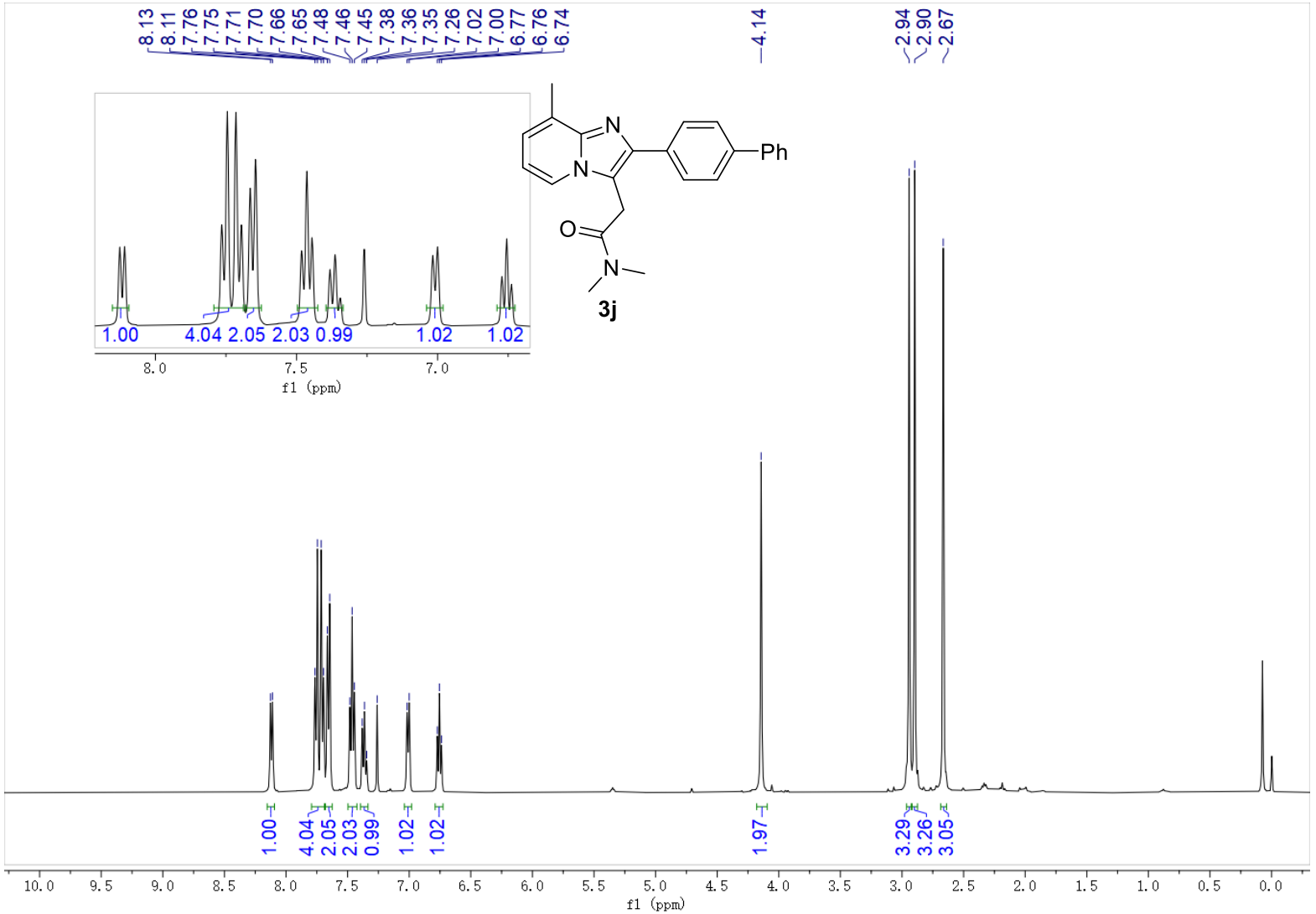

8.07
8.05
7.57
7.55
7.26
6.98
6.96
6.96
6.95
6.72
6.70
6.68
4.03
3.82
2.89
2.82
2.61
0.06
-0.03
1.17
2.22
3.19
1.14
8.0
7.5
7.0
f1 (ppm)
N
N
OMe
O
N
3h
1.17
2.22
3.19
1.14
2.15
3.00
3.23
3.18
3.24
f1 (ppm)

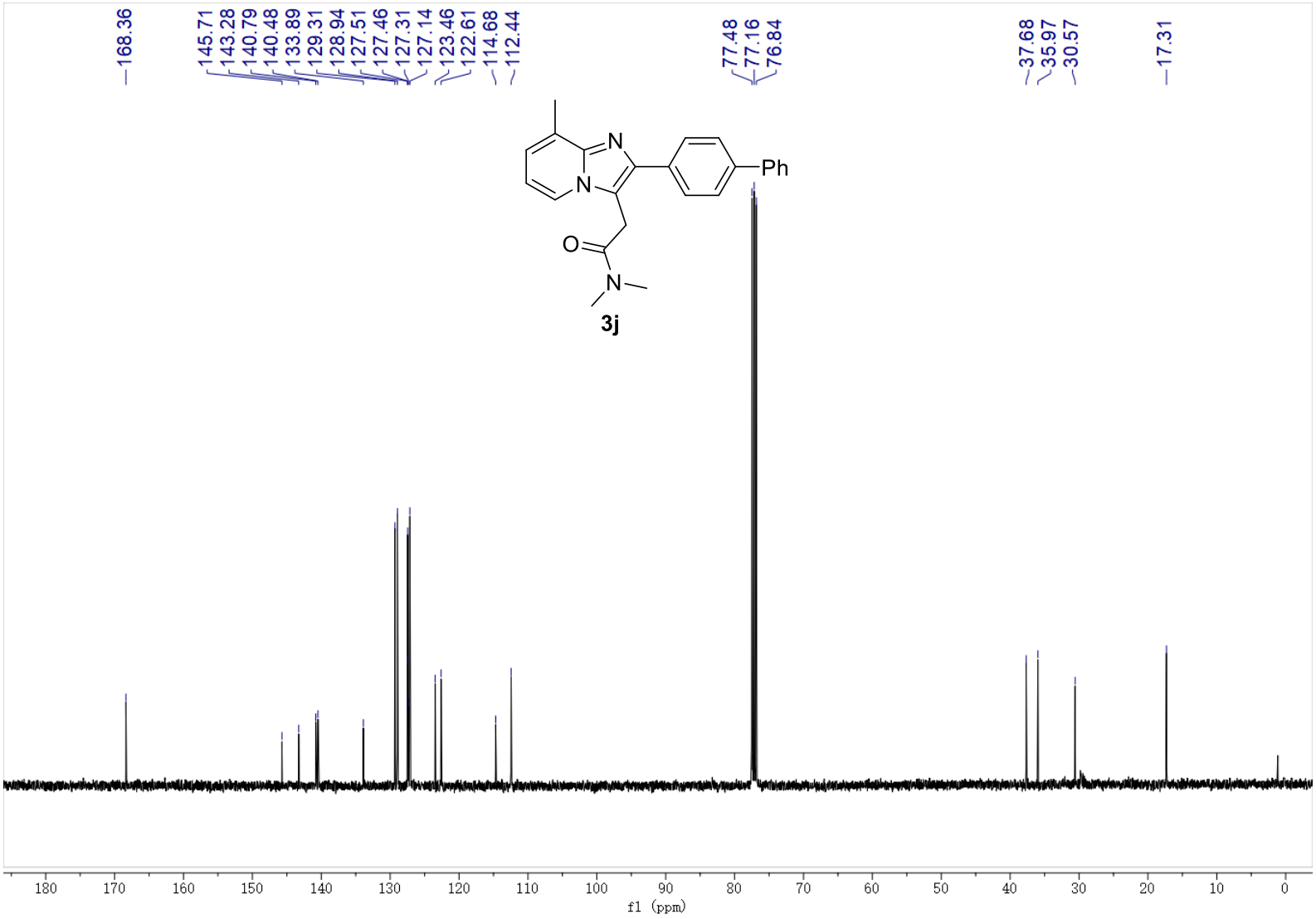
41

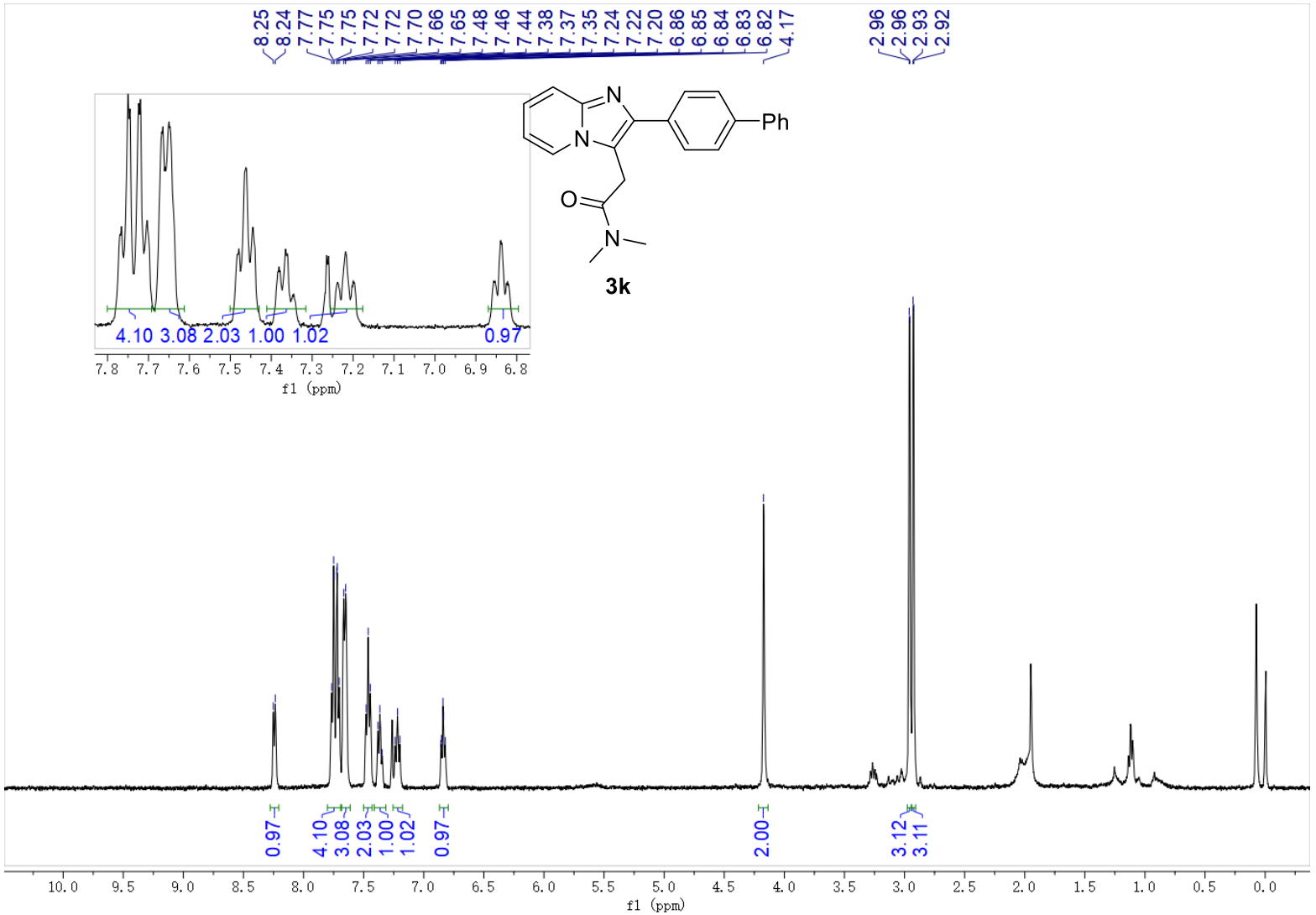

168.46
159.44
145.54
143.51
130.14
127.48
127.11
123.22
122.57
114.22
114.06
112.21
77.48
77.16
76.84
55.42
37.59
35.91
30.57
17.23
N
N
OMe
O
N
3h
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

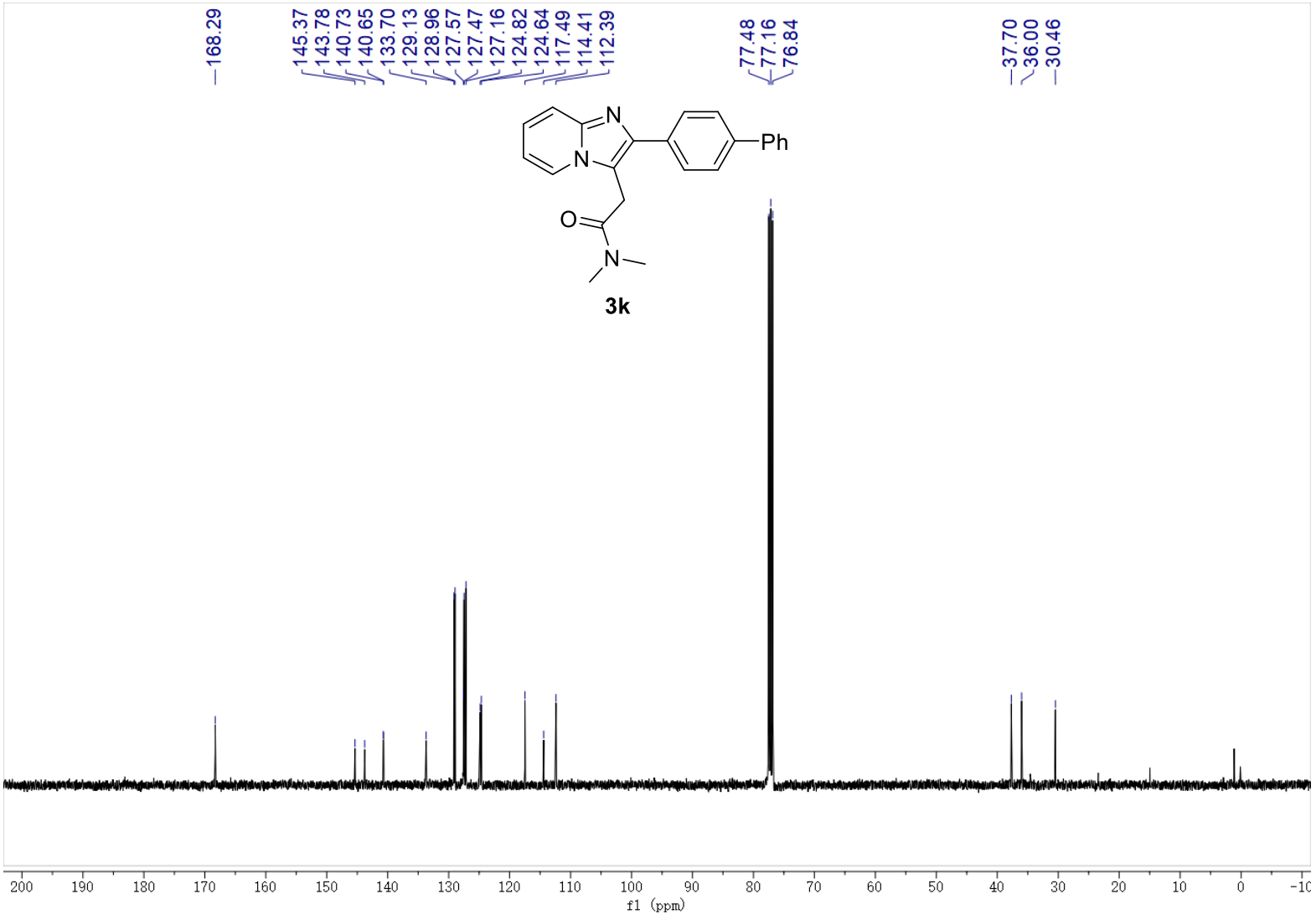

8.05
8.03
7.61
7.59
7.42
7.40
7.38
7.32
7.31
7.29
7.26
6.85
6.84
6.50
6.50
6.48
6.48
4.02
3.80
2.87
2.79
MeO
N
N
O
N
3i
0.95
1.97
2.01
0.97
0.95
0.94
f1 (ppm)
0.95
1.97
2.01
0.97
0.95
0.94
1.98
3.00
3.12
3.22
f1 (ppm)

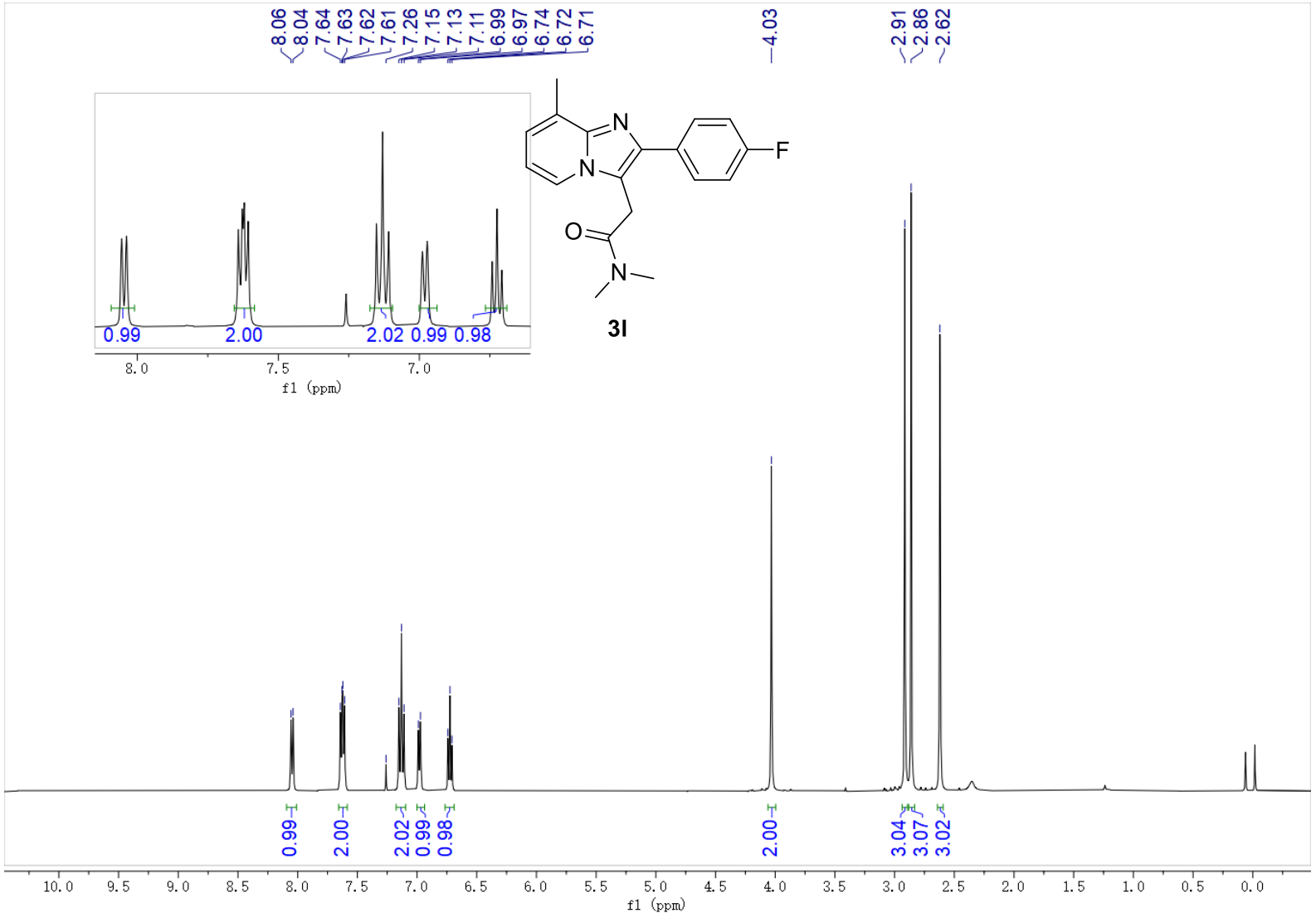

168.37
157.89
146.54
143.23
134.73
128.60
128.40
127.60
125.34
112.99
107.06
94.49
77.48
77.16
76.84
55.45
37.43
35.79
30.12
MeO
N
N
O
N
3i
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

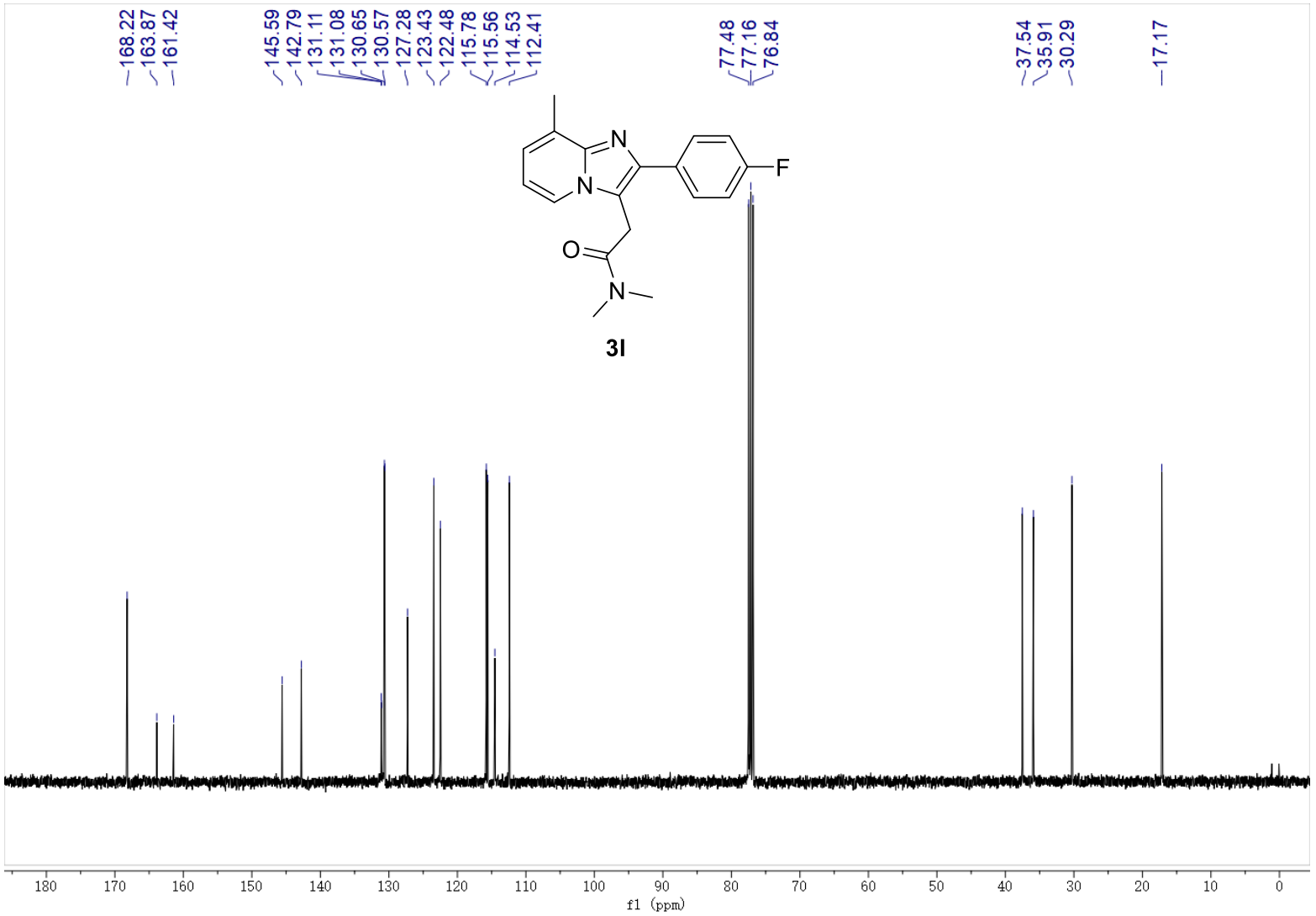

8.13
8.11
7.76
7.75
7.71
7.70
7.66
7.65
7.48
7.46
7.45
7.38
7.36
7.35
7.26
7.02
7.00
6.77
6.76
6.74
4.14
2.94
2.90
2.67
N
N
Ph
O
N
3j
1.00
4.04
2.05
2.03
0.99
1.02
1.02
8.0
7.5
7.0
f1 (ppm)
1.00
4.04
2.05
2.03
0.99
1.02
1.02
1.97
3.29
3.26
3.05
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

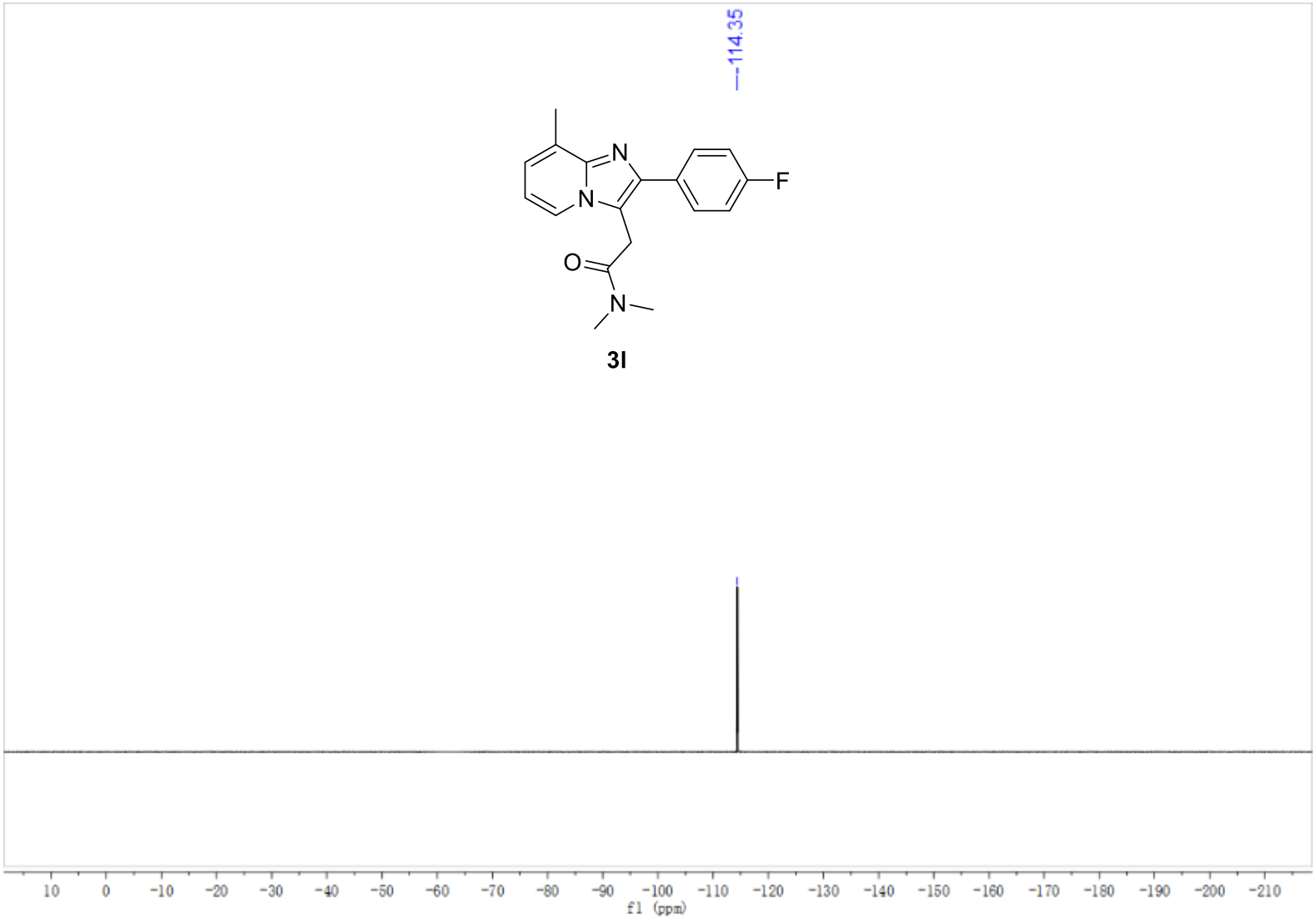

168.36
145.71
143.28
140.79
140.48
133.89
129.31
128.94
127.51
127.46
127.31
127.14
123.46
122.61
114.68
112.44
77.48
77.16
76.84
37.68
35.97
30.57
17.31
N
N
Ph
O
N
3j
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.25
8.24
7.77
7.75
7.75
7.72
7.72
7.70
7.66
7.65
7.48
7.46
7.44
7.38
7.37
7.35
7.24
7.22
7.20
6.86
6.85
6.84
6.83
6.82
4.17
2.96
2.96
2.93
2.92
N
N
Ph
O
N
3k
4.10 3.08 2.03 1.00 1.02
0.97
7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8
f1 (ppm)
0.97
4.10
3.08
2.03
1.00
1.02
0.97
2.00
3.12
3.11
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

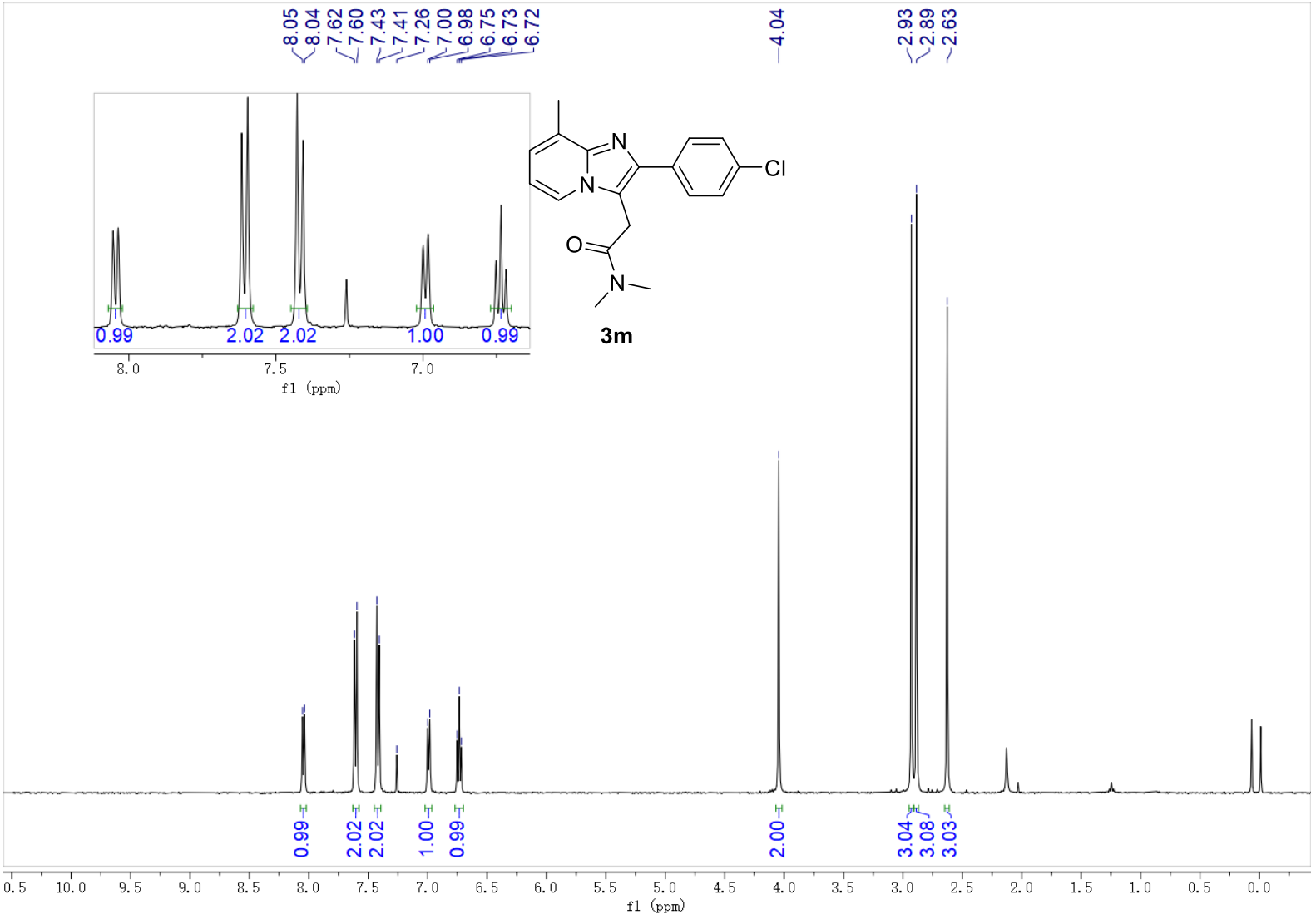

168.29
145.37
143.78
140.73
140.65
133.70
129.13
128.96
127.57
127.47
127.16
124.82
124.64
117.49
114.41
112.39
77.48
77.16
76.84
37.70
36.00
30.46
N
N
Ph
O
N
3k
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

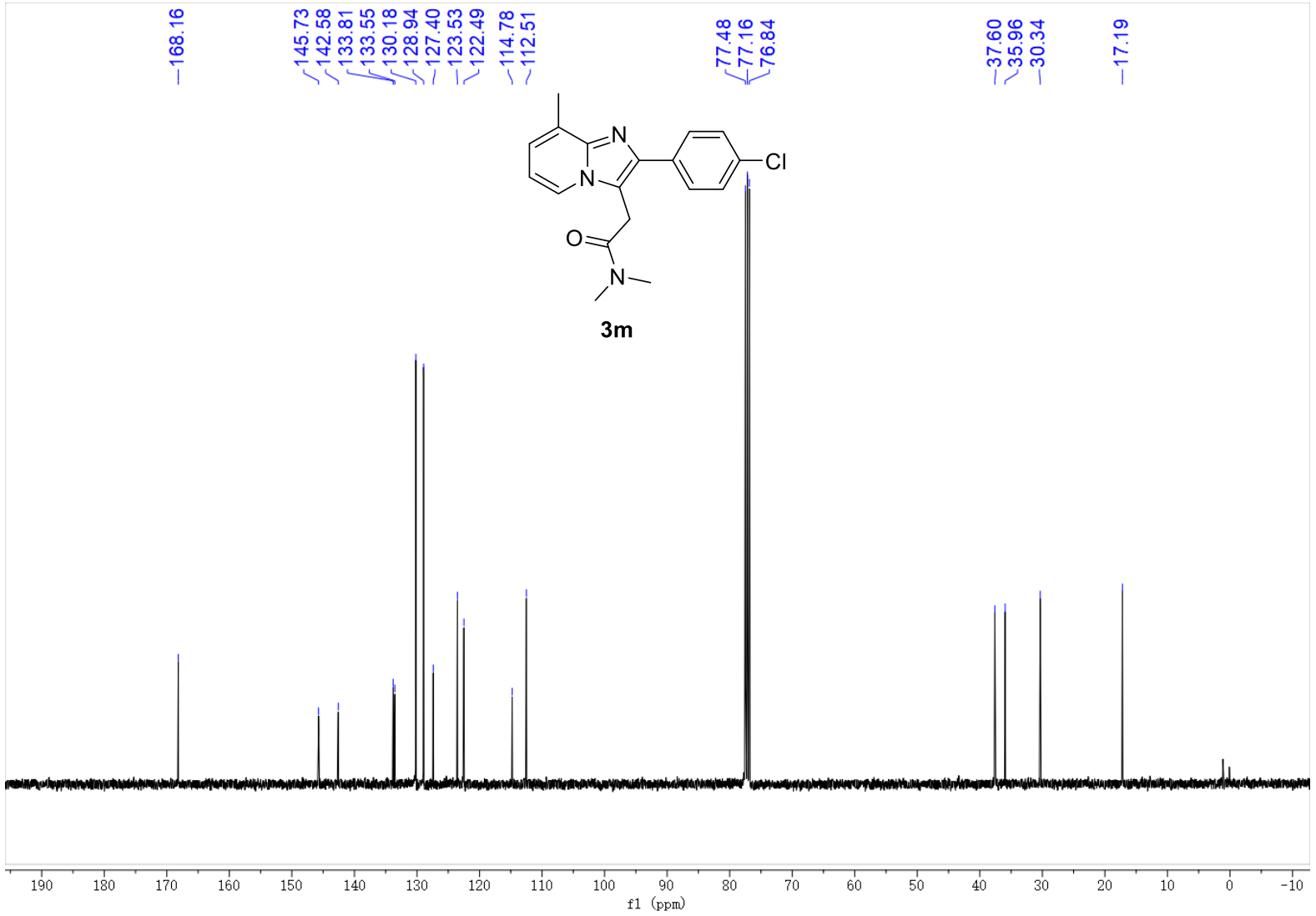

8.06
8.04
7.64
7.63
7.62
7.61
7.26
7.15
7.13
7.11
6.99
6.97
6.74
6.72
6.71
4.03
2.91
2.86
2.62
N
N
F
O
N
0.99
2.00
2.02
0.99
0.98
8.0
7.5
7.0
f1 (ppm)
3I
0.99
2.00
2.02
0.99
0.98
2.00
3.04
3.07
3.02
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

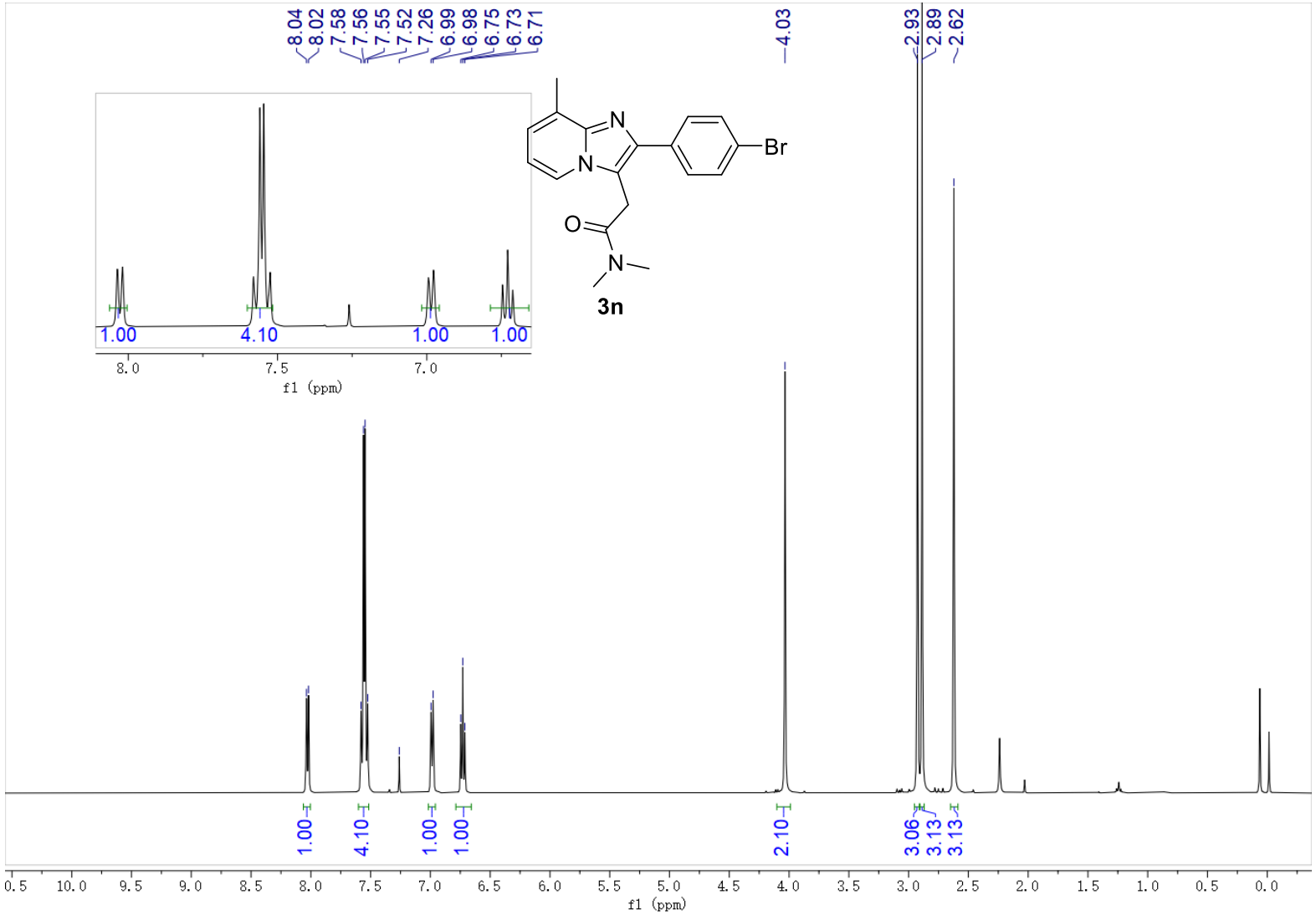

168.22
163.87
161.42
145.59
142.79
131.11
131.08
130.65
130.57
127.28
123.43
122.48
115.78
115.56
114.53
112.41
77.48
77.16
76.84
37.54
35.91
30.29
17.17
N
N
F
O
N
3l
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

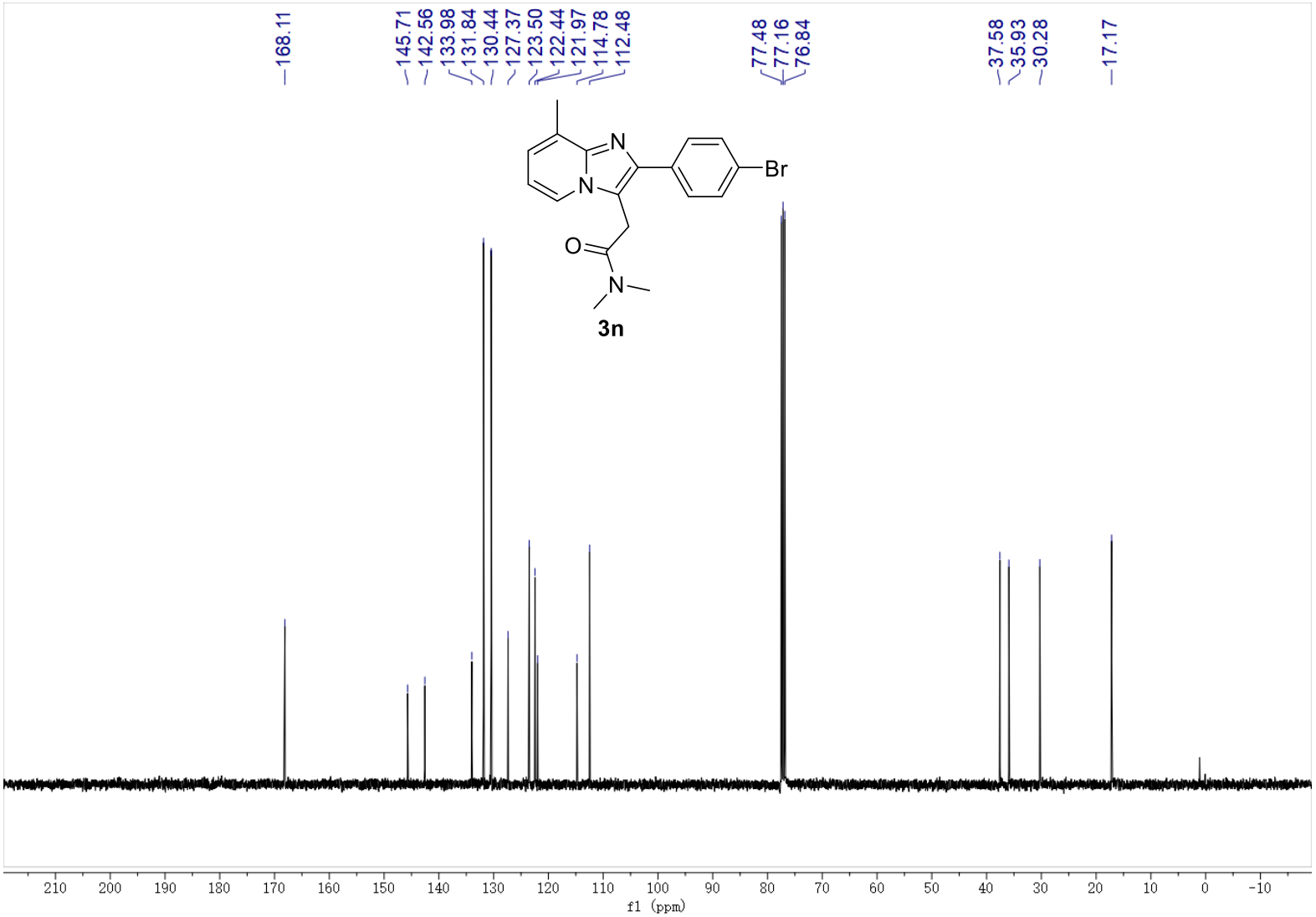

-114.35
N
N
F
O
N
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)

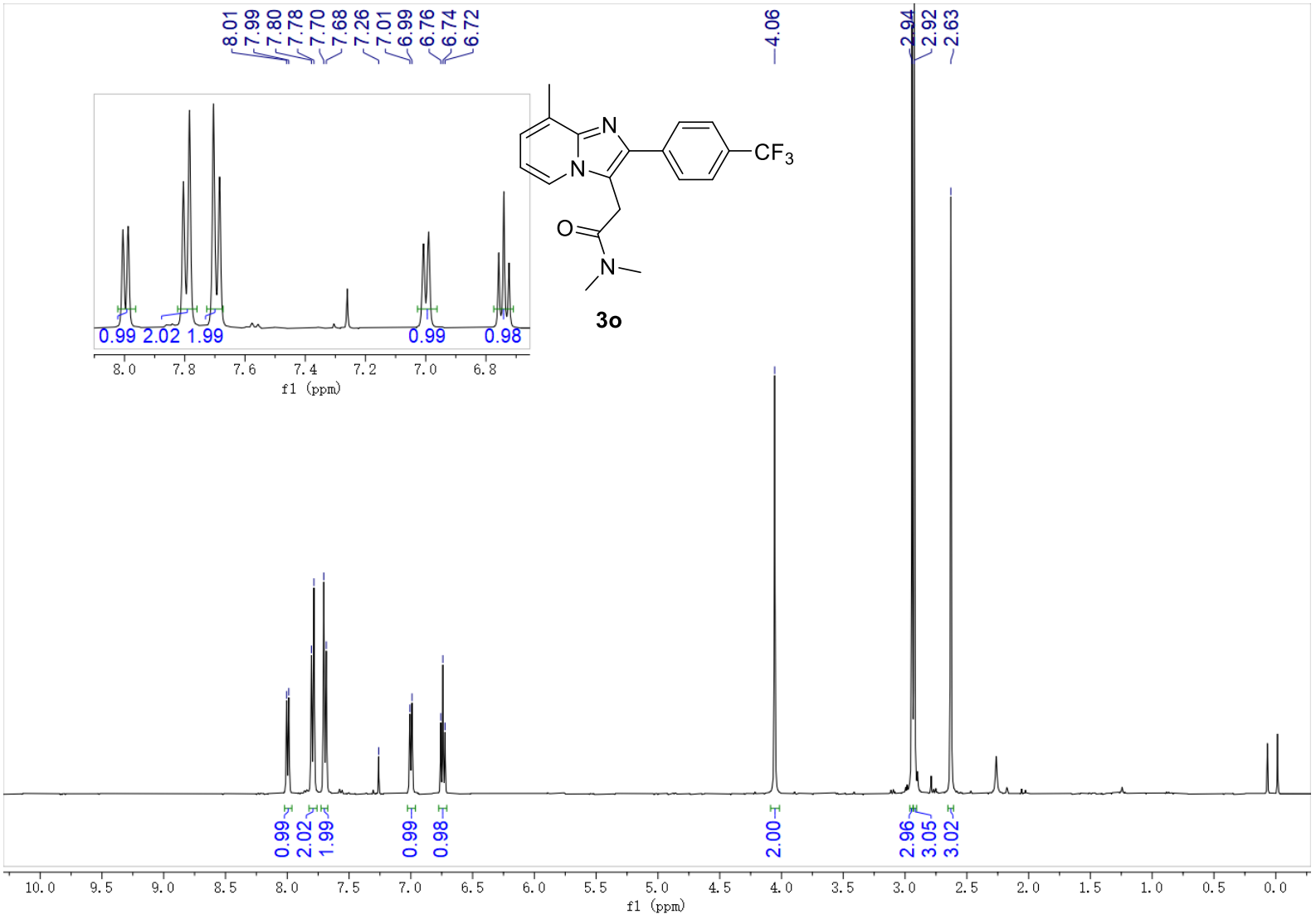
3l

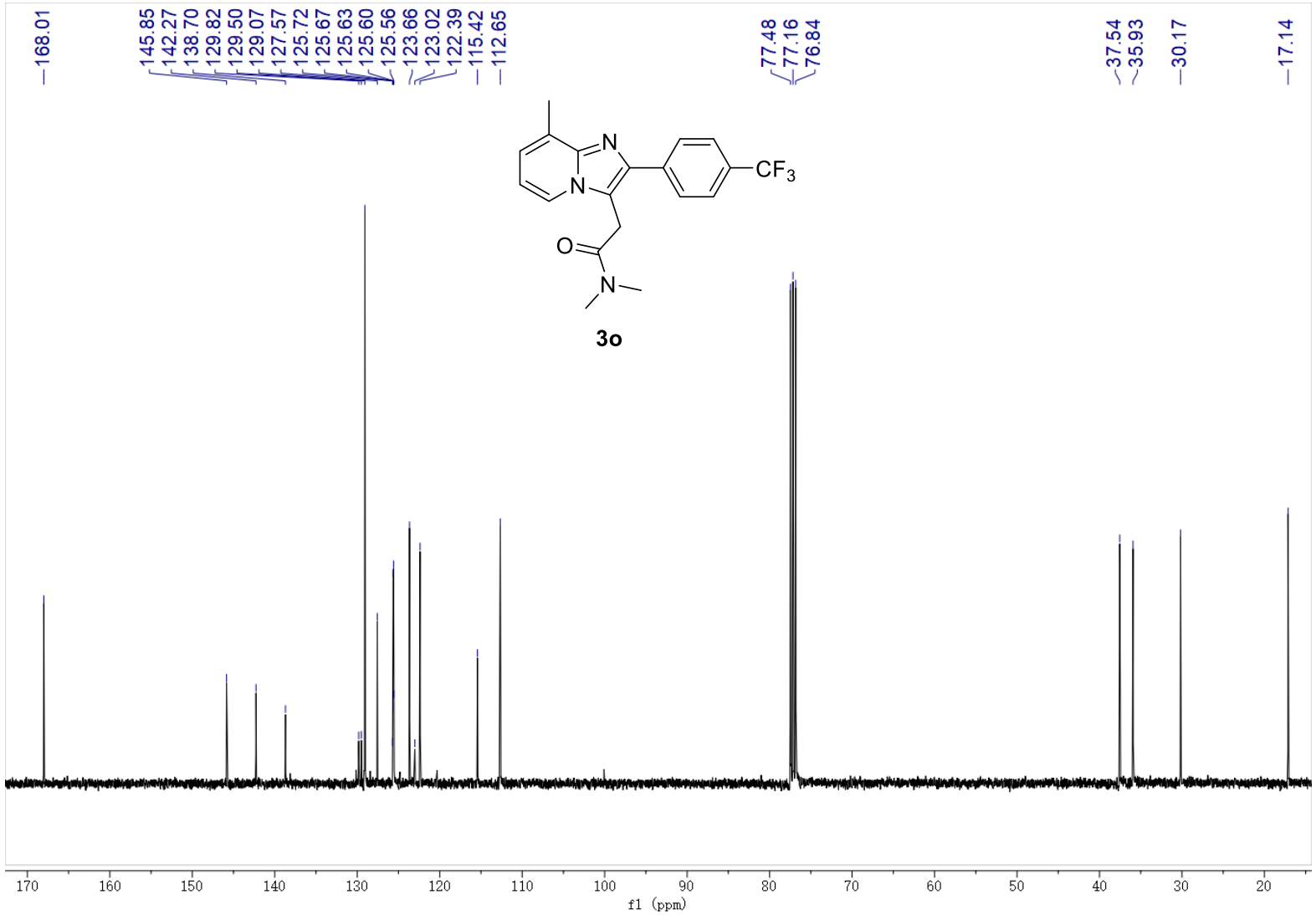

8.05
8.04
7.62
7.60
7.43
7.41
7.26
7.00
6.98
6.75
6.73
6.72
4.04
2.93
2.89
2.63
0.99
2.02
2.02
1.00
0.99
8.0
7.5
7.0
f1 (ppm)
N
N
Cl
O
N
3m
0.99
2.02
2.02
1.00
0.99
2.00
3.04
3.08
3.03
0.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

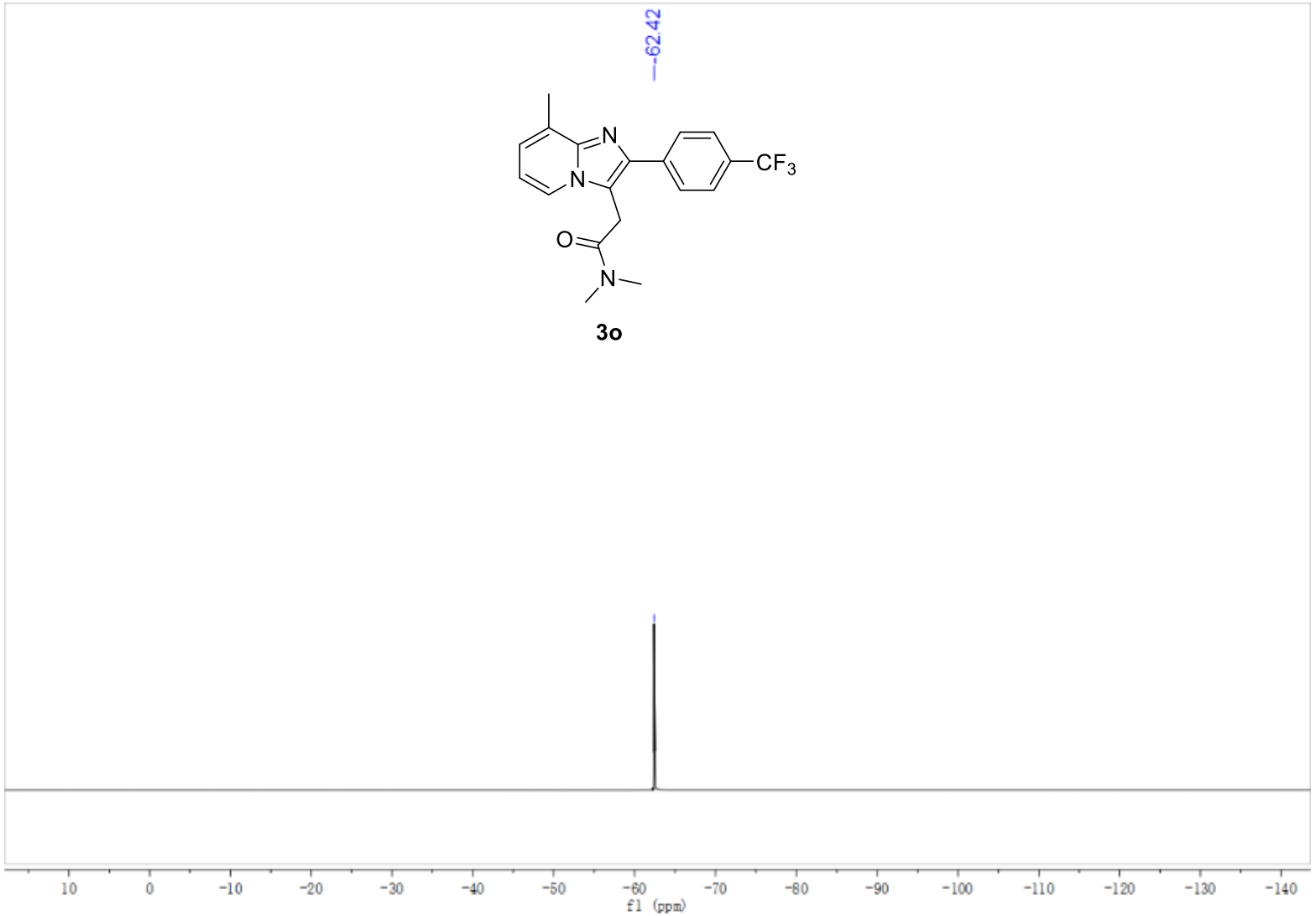

168.16
145.73
142.58
133.81
133.55
130.18
128.94
127.40
123.53
122.49
114.78
112.51
77.48
77.16
76.84
37.60
35.96
30.34
17.19
N
N
Cl
O
N
3m
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


8.04
8.02
7.58
7.56
7.55
7.52
7.26
6.99
6.98
6.75
6.73
6.71
4.03
2.93
2.89
2.62
N
N
Br
O
N
3n
1.00
4.10
1.00
1.00
f1 (ppm)
1.00
4.10
1.00
1.00
2.10
3.06
3.13
3.13
f1 (ppm)

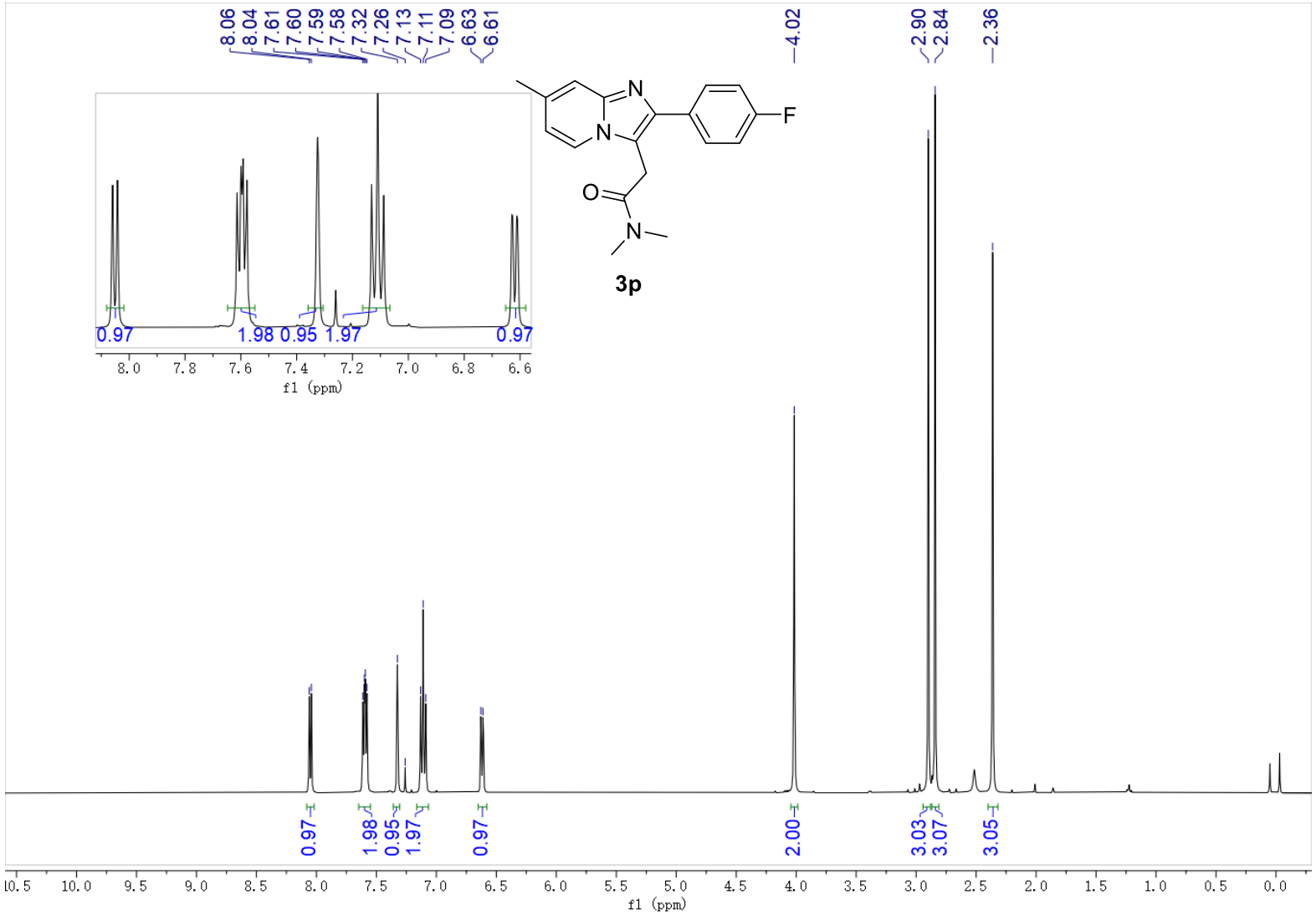

168.11
145.71
142.56
133.98
131.84
130.44
127.37
123.50
122.44
121.97
114.78
112.48
77.48
77.16
76.84
37.58
35.93
30.28
17.17
N
N
Br
O
N
3n
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

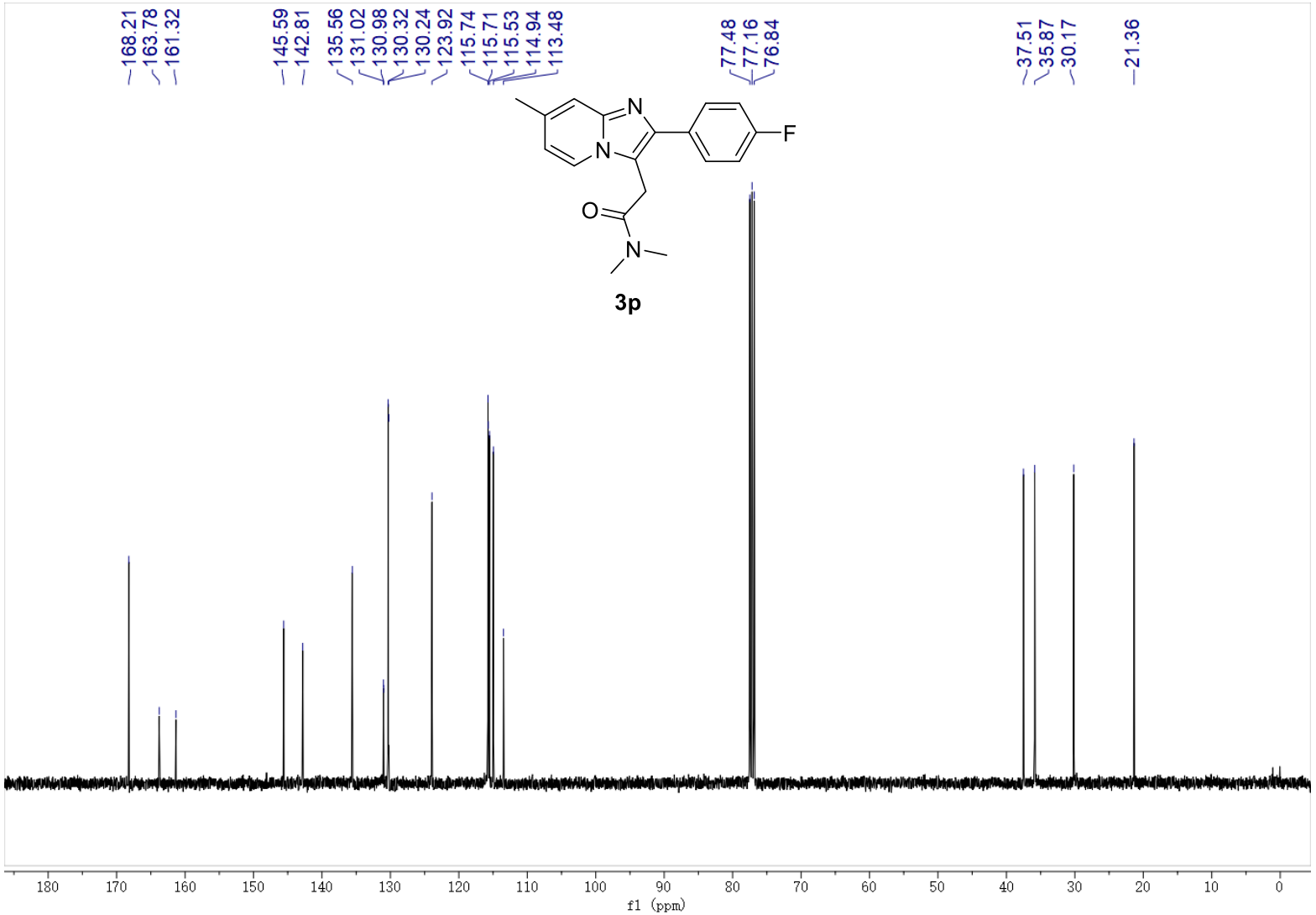

8.01
7.99
7.80
7.78
7.70
7.68
7.26
7.01
6.99
6.76
6.74
6.72
4.06
2.94
2.92
2.63
0.99 2.02 1.99
0.99
0.98
f1 (ppm)
N
N
CF3
O
N
3o
0.99
2.02
1.99
0.99
0.98
2.00
2.96
3.05
3.02
f1 (ppm)

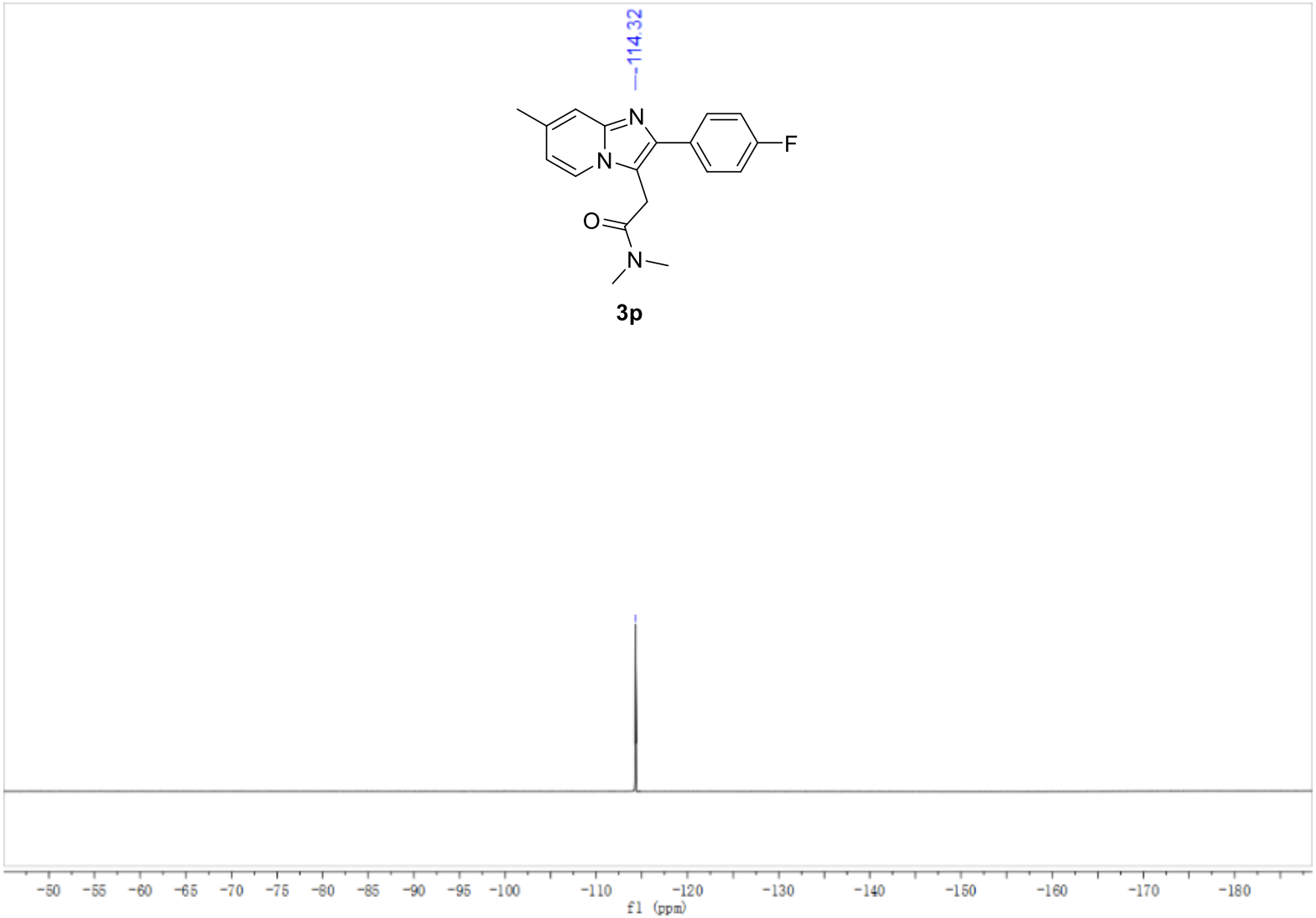

168.01
145.85
142.27
138.70
129.82
129.50
129.07
127.57
125.72
125.67
125.63
125.60
125.56
123.66
123.02
122.39
115.42
112.65
77.48
77.16
76.84
37.54
35.93
30.17
17.14
N
N
CF3
O
N
3o
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)


-62.42
N
N
CF3
O
N
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
f1 (ppm)

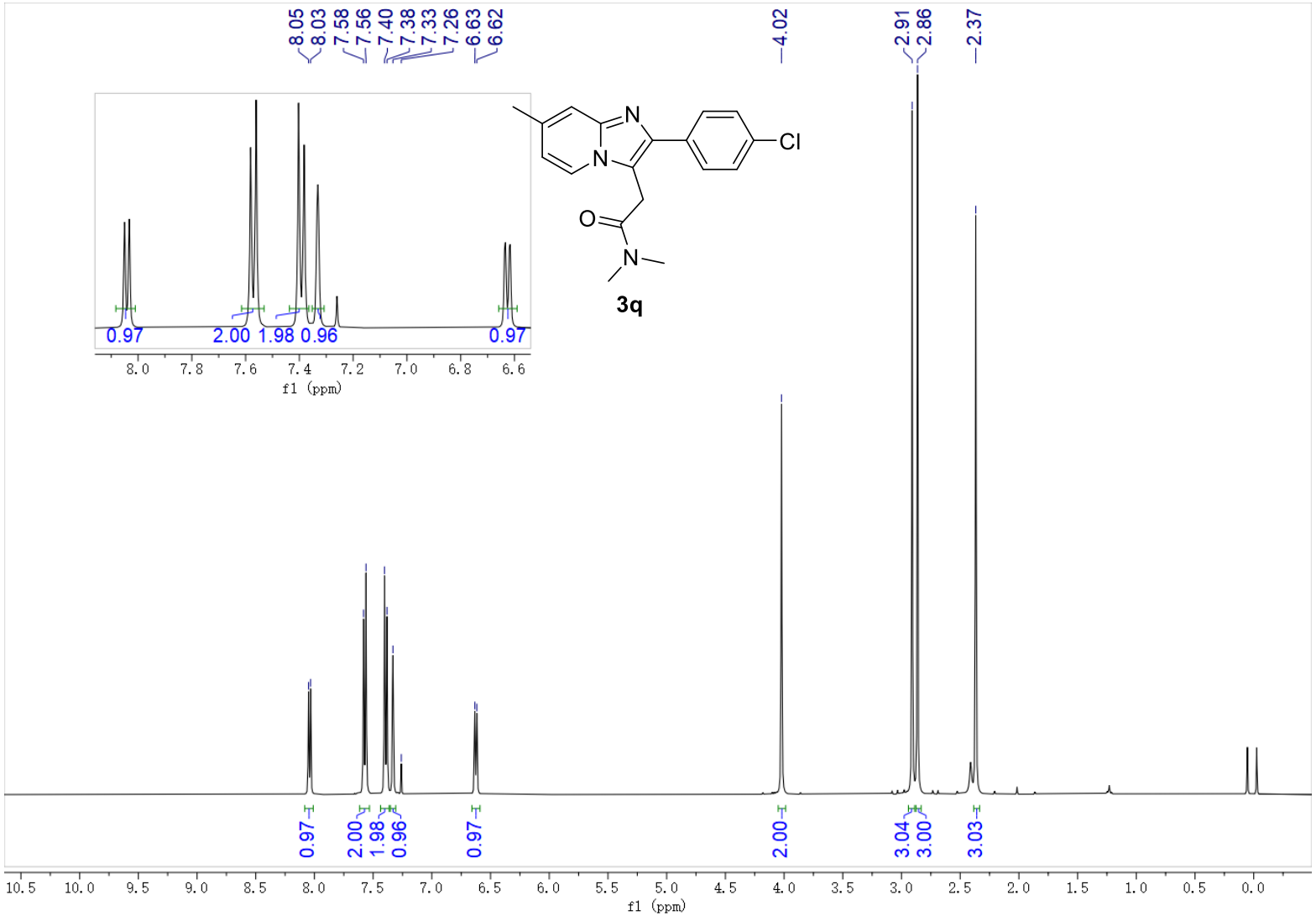
3o

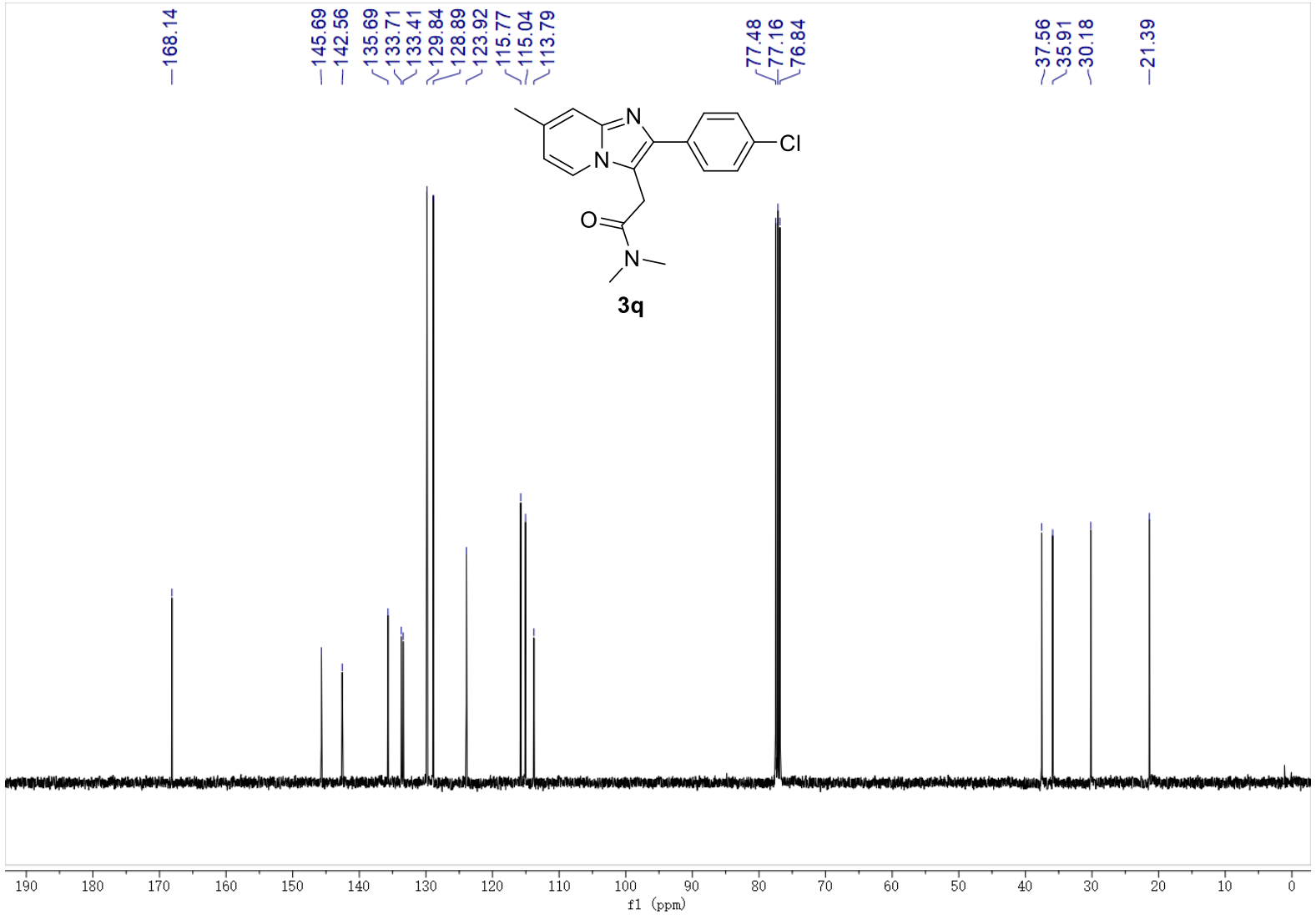

8.06
8.04
7.61
7.60
7.59
7.58
7.32
7.26
7.13
7.11
7.09
6.63
6.61
4.02
2.90
2.84
2.36
N
N
F
O
N
3p
0.97
1.98
0.95
1.97
0.97
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
f1 (ppm)
0.97
1.98
0.95
1.97
0.97
2.00
3.03
3.07
3.05
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


168.21
163.78
161.32
145.59
142.81
135.56
131.02
130.98
130.32
130.24
123.92
115.74
115.71
115.53
114.94
113.48
77.48
77.16
76.84
37.51
35.87
30.17
21.36
N
N
F
O
N
3p
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-114.32
N
N
F
O
N
-50 -55 -60 -65 -70 -75 -80 -85 -90 -95 -100 -110 -120 -130 -140 -150 -160 -170 -180
f1 (ppm)

3p


8.05
8.03
7.58
7.56
7.40
7.38
7.33
7.26
6.63
6.62
4.02
2.91
2.86
2.37
N
N
Cl
O
N
3q
0.97
2.00
1.98
0.96
0.97
f1 (ppm)
0.97
2.00
1.98
0.96
0.97
2.00
3.04
3.00
3.03
f1 (ppm)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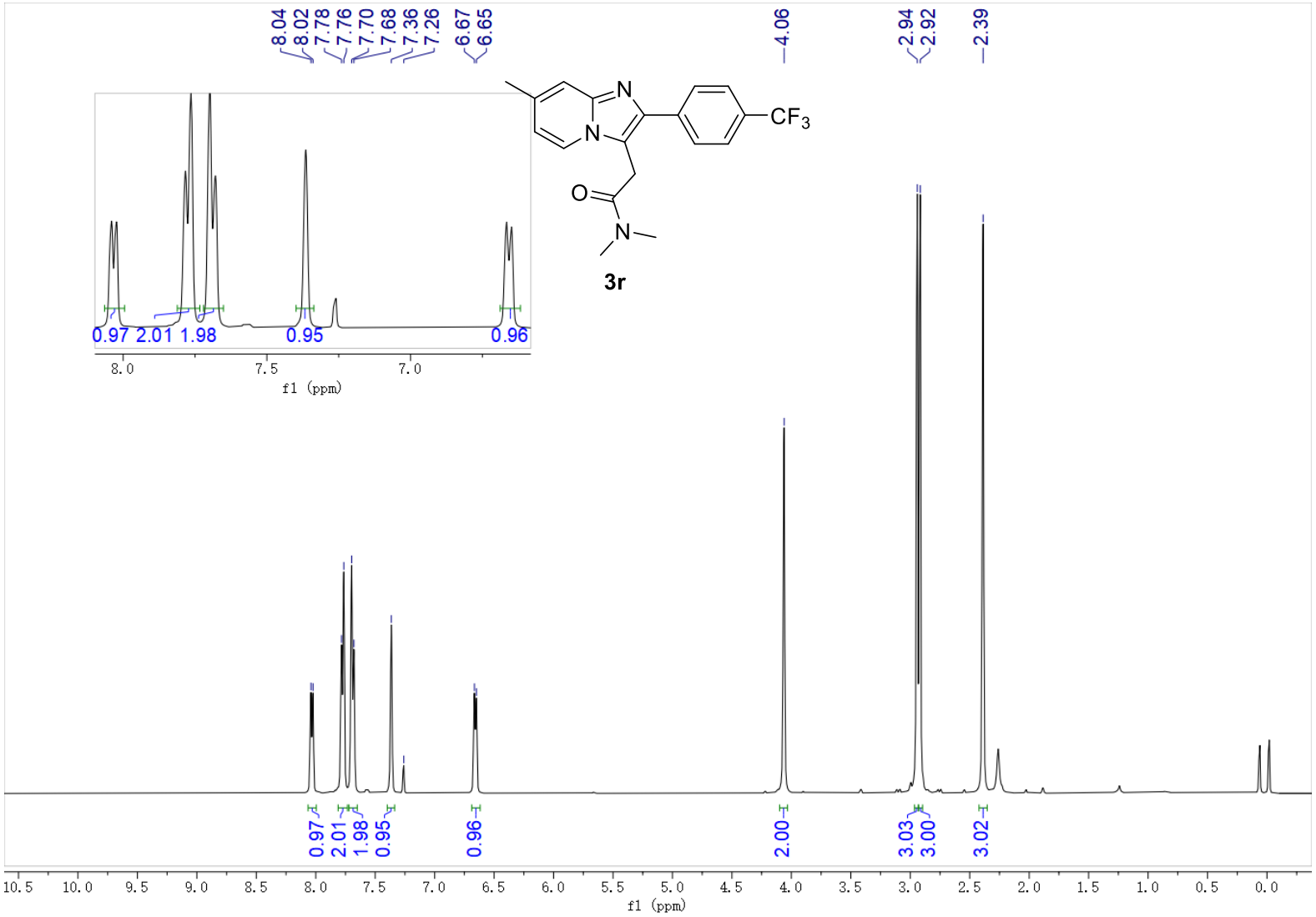
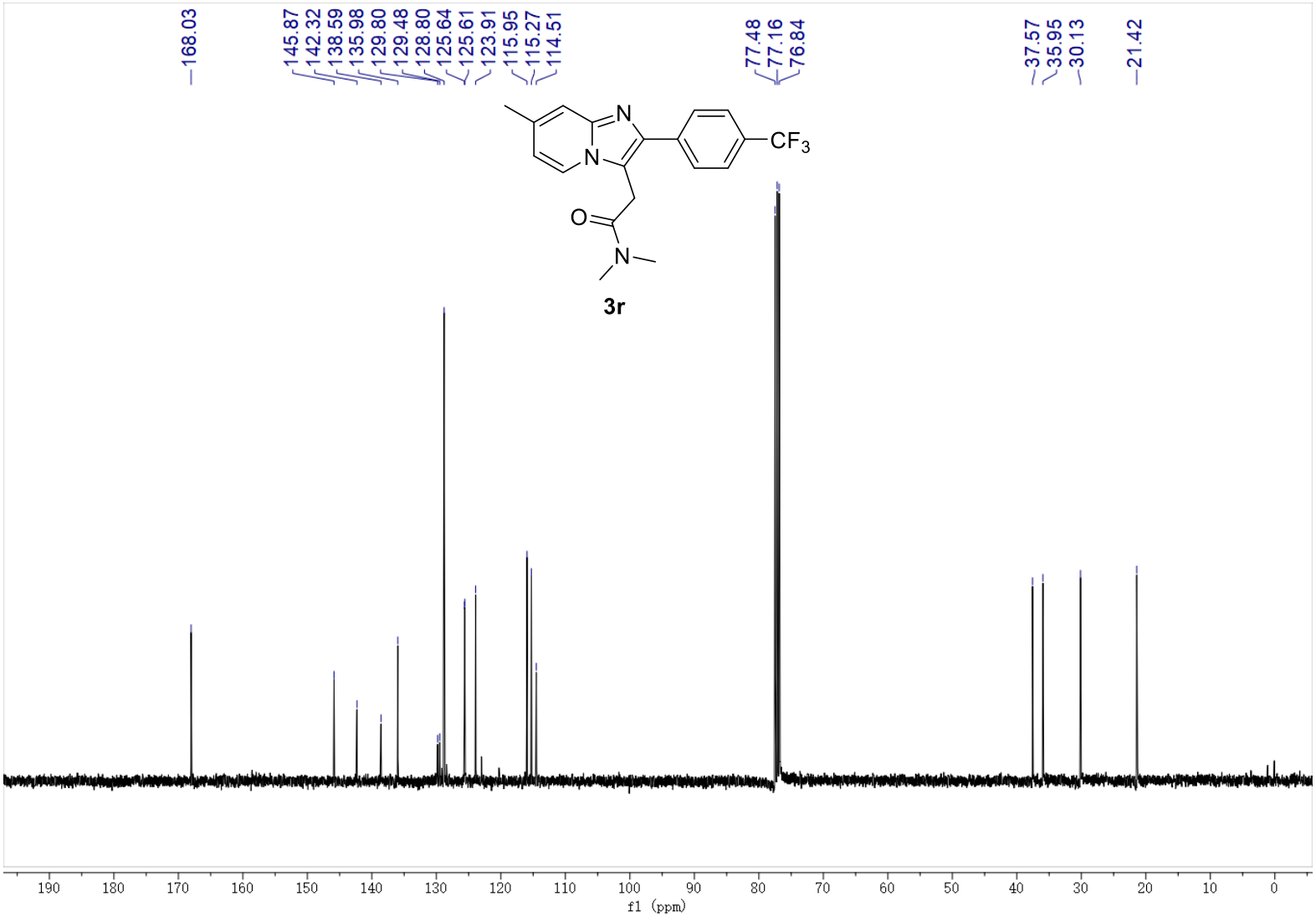
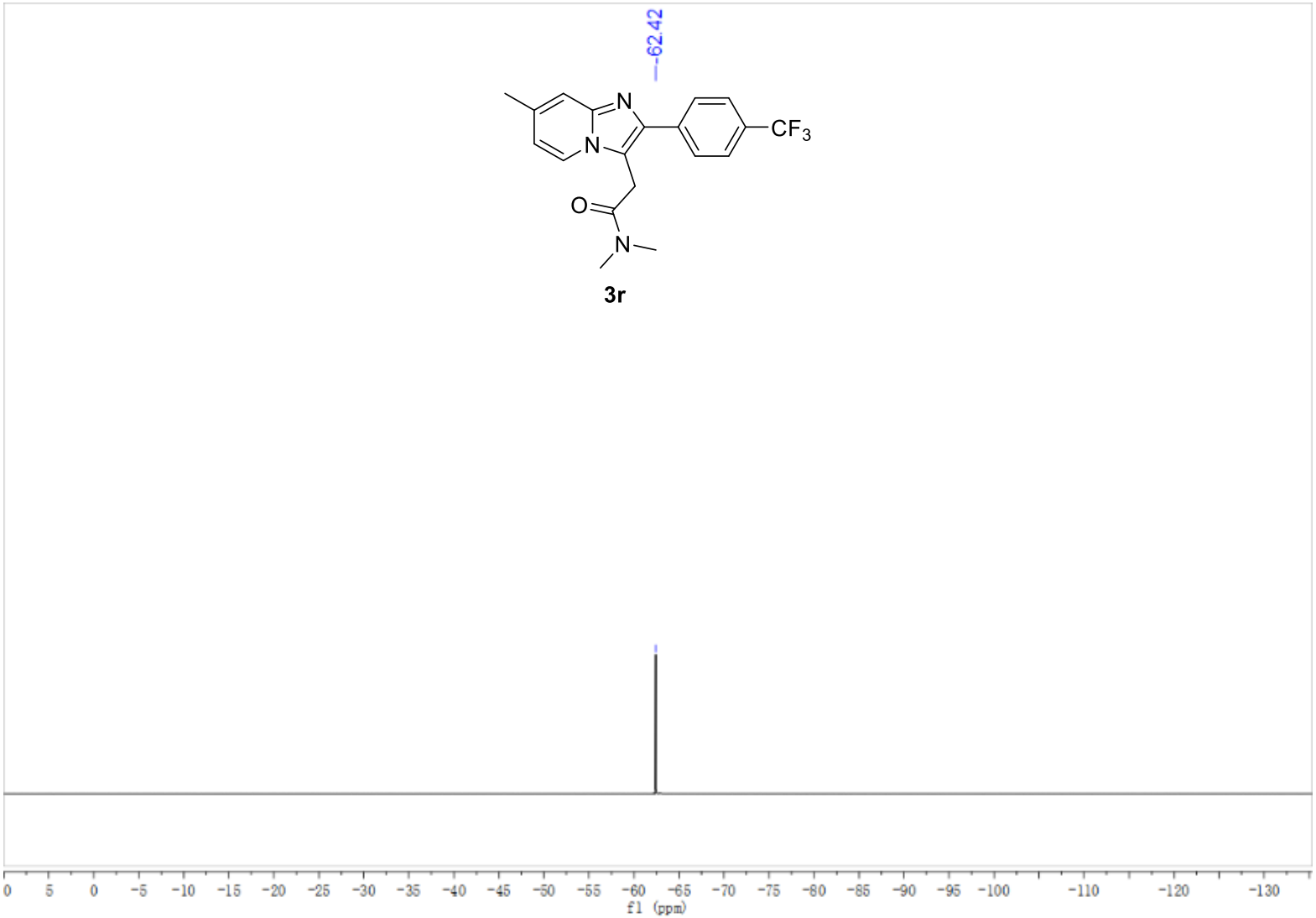
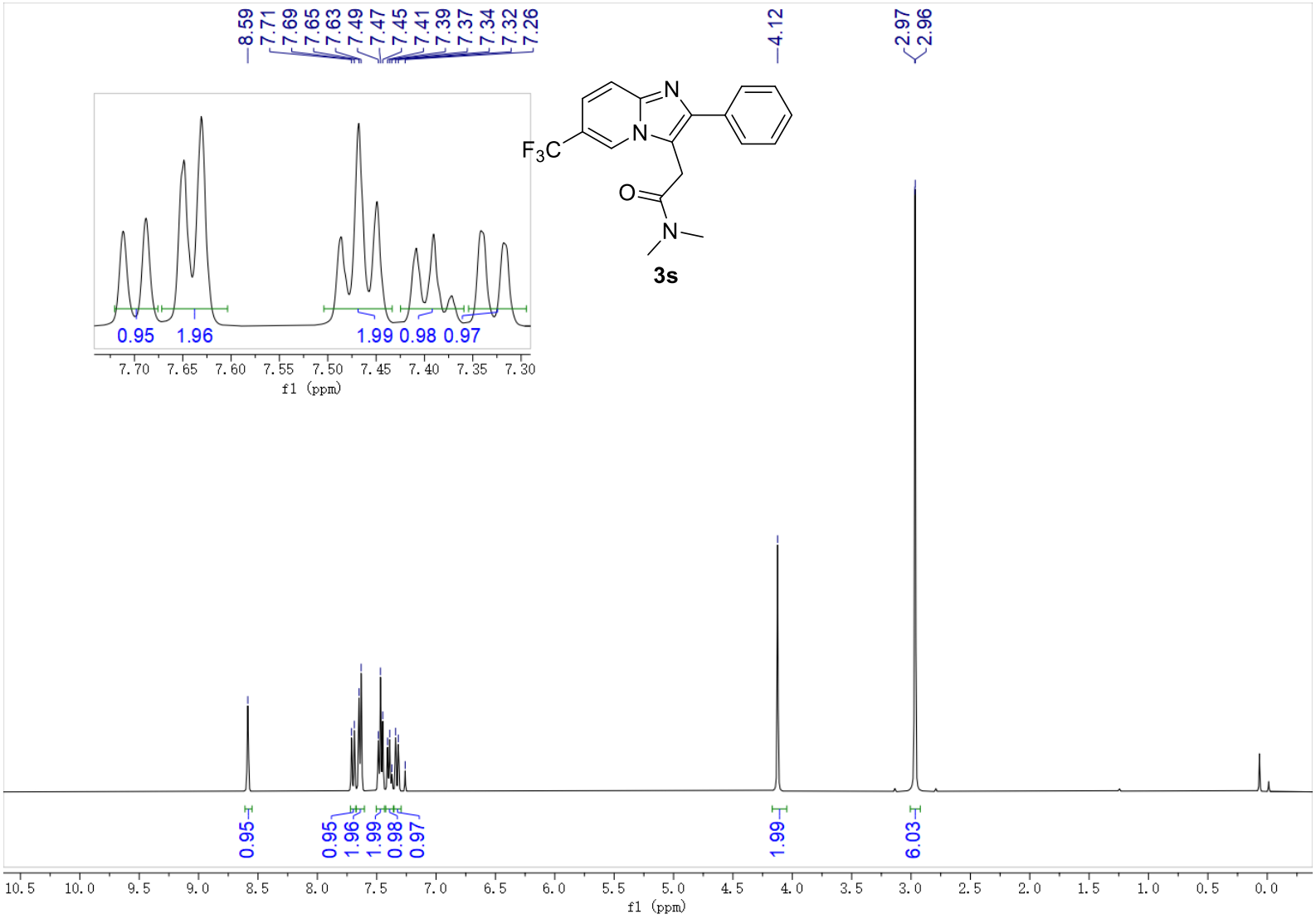
145.69
142.56
135.69
133.71
133.41
129.84
128.89
123.92
115.77
115.04
113.79
77.48
77.16
76.84
37.56
35.91
30.18
21.39
N
N
Cl
O
N
3q
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

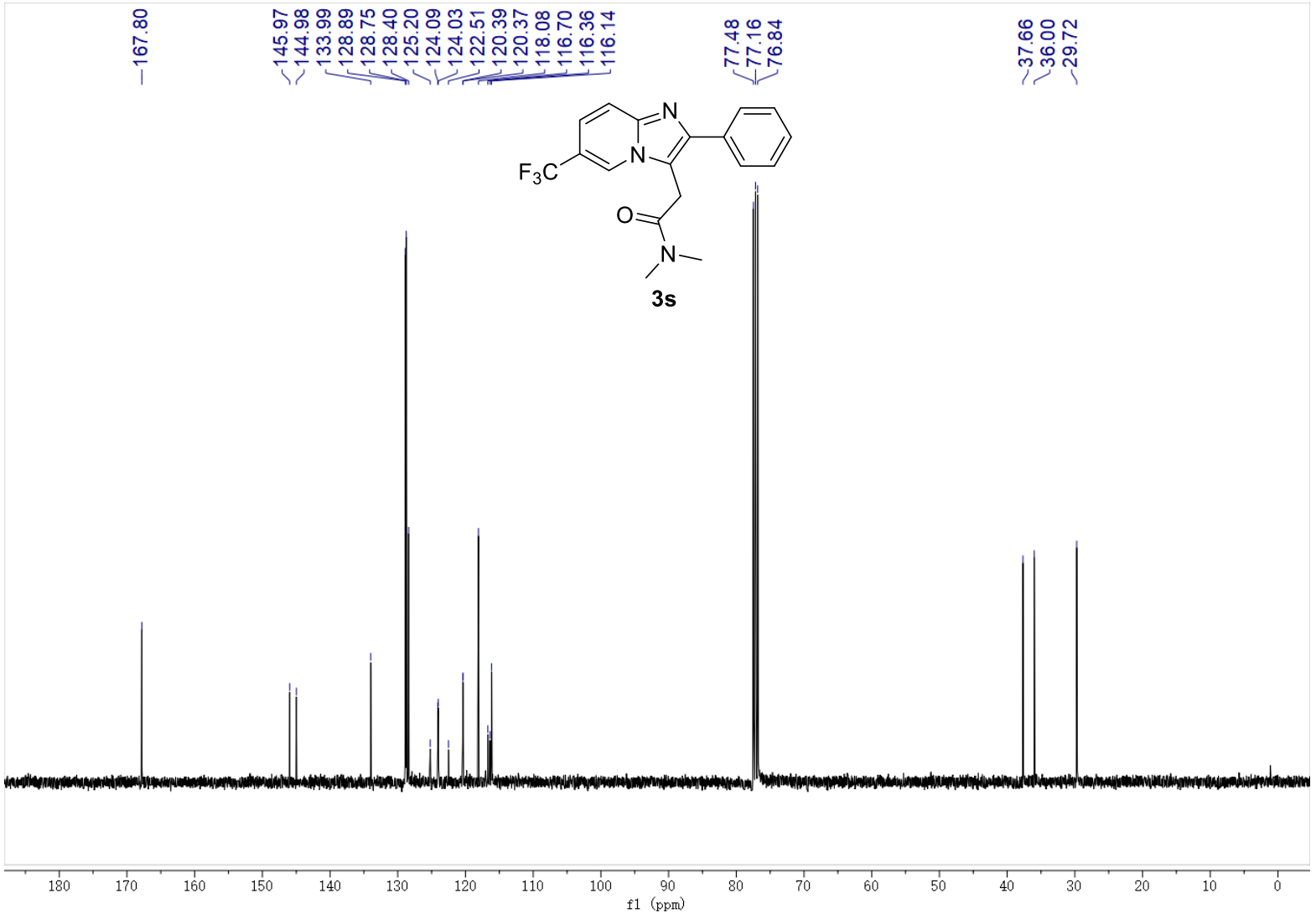

8.04
8.02
7.78
7.76
7.70
7.68
7.36
7.26
6.67
6.65
4.06
2.94
2.92
2.39
N
N
O
N
CF3
3r
0.97 2.01 1.98
0.95
0.96
8.0
7.5
7.0
f1 (ppm)
0.97
2.01
1.98
0.95
0.96
2.00
3.03
3.00
3.02
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

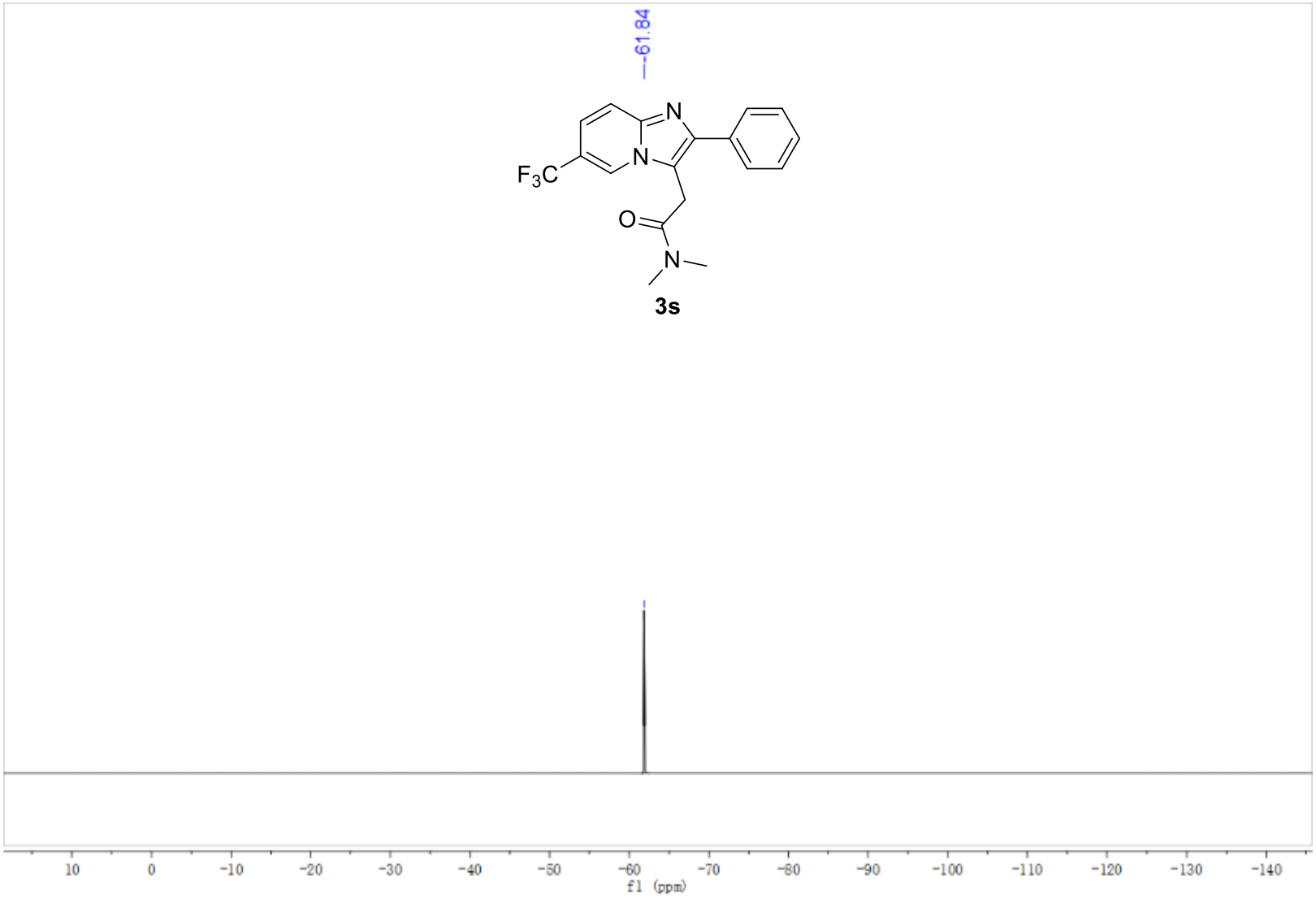

168.03
145.87
142.32
138.59
135.98
129.80
129.48
128.80
125.64
125.61
123.91
115.95
115.27
114.51
77.48
77.16
76.84
37.57
35.95
30.13
21.42
N
N
CF3
O
N
3r
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-62.42
N
N
CF3
O
N
0
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
-110
-120
-130
f1 (ppm)

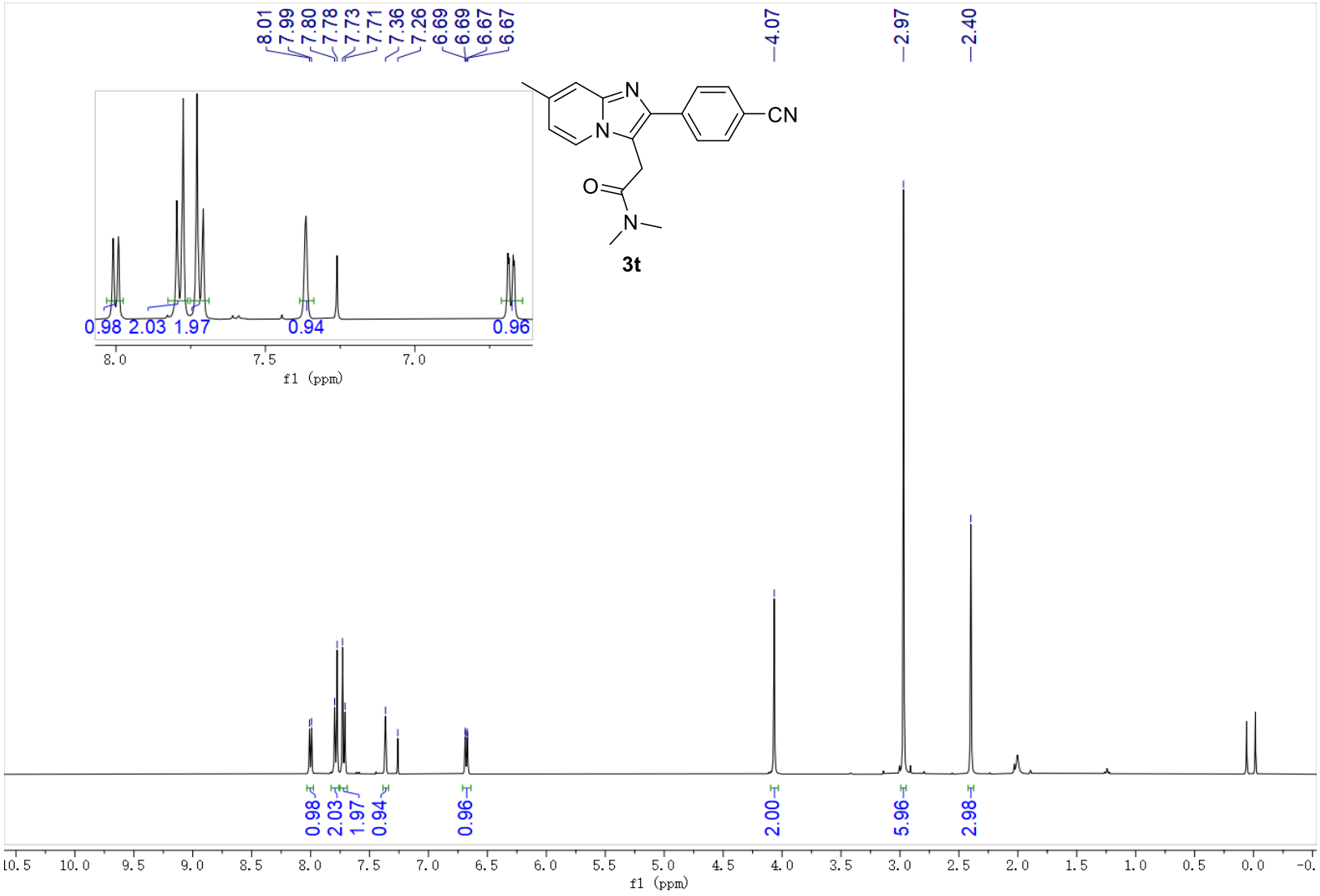
3r

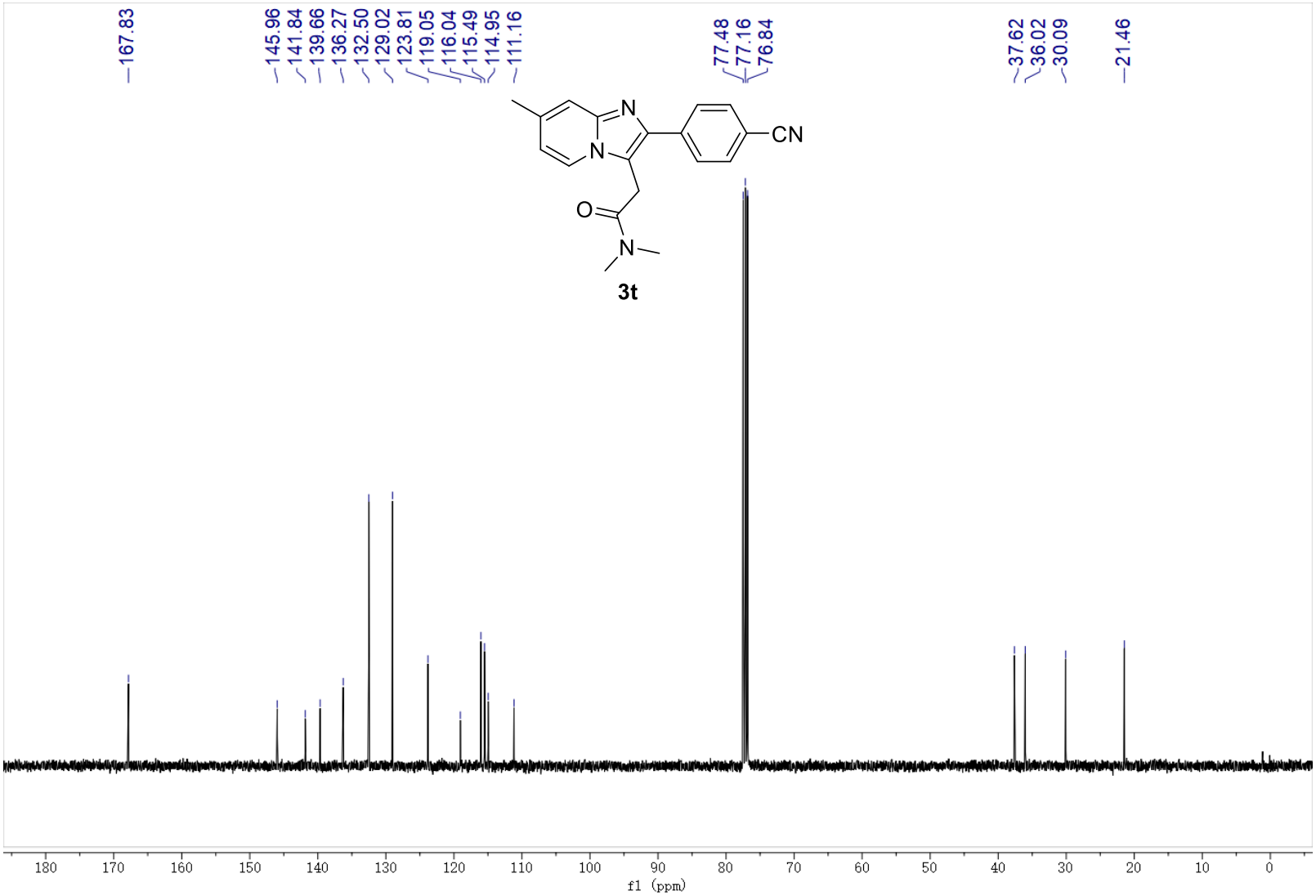

8.59
7.71
7.69
7.65
7.63
7.49
7.47
7.45
7.41
7.39
7.37
7.34
7.32
7.26
4.12
2.97
2.96
F3C
N
N
O
N
3s
0.95
1.96
1.99
0.98
0.97
f1 (ppm)
6.03
f1 (ppm)

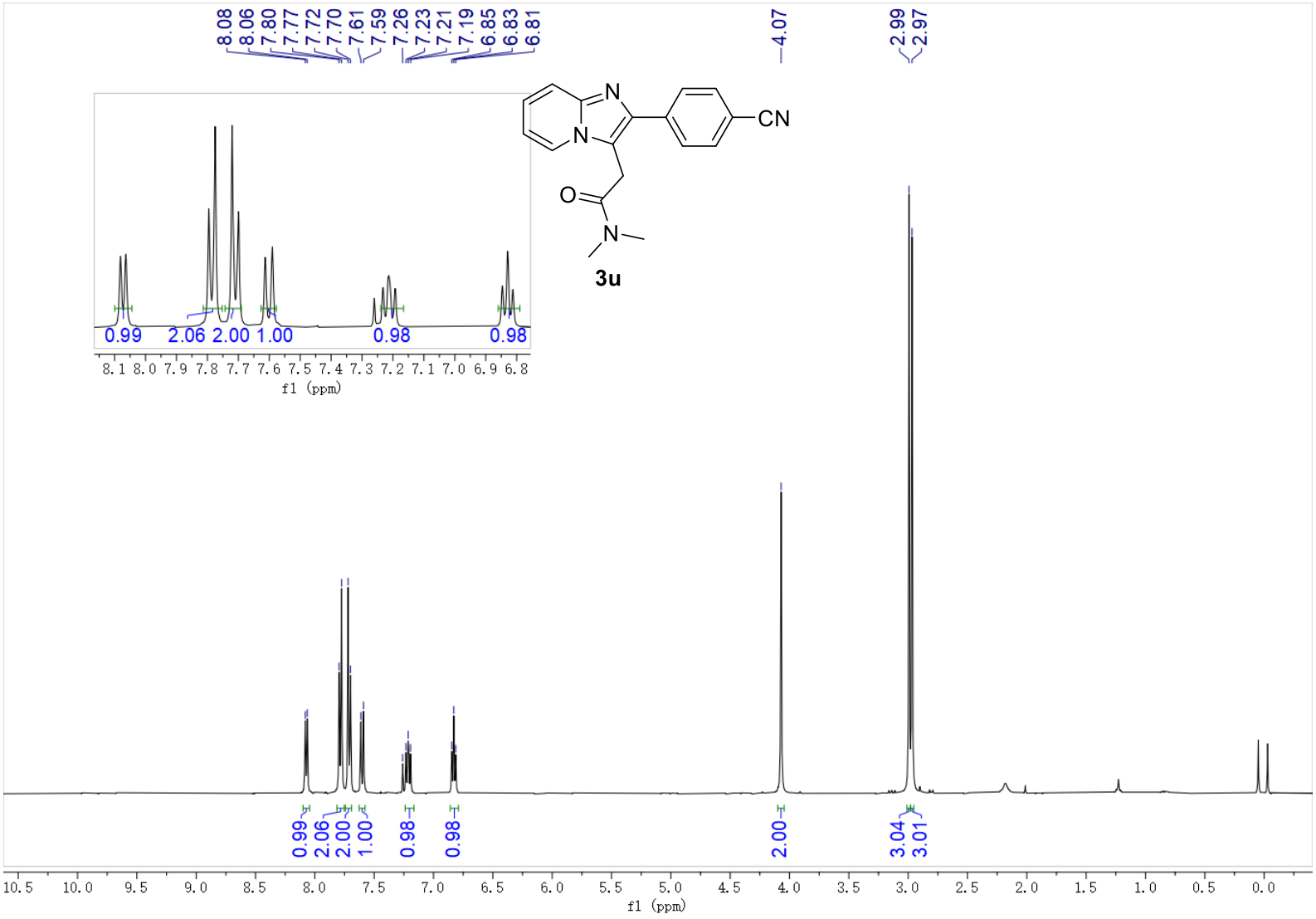

167.80
145.97
144.98
133.99
128.89
128.75
128.40
125.20
124.09
124.03
122.51
120.39
120.37
118.08
116.70
116.36
116.14
77.48
77.16
76.84
37.66
36.00
29.72
N
N
F3C
O
N
3s
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

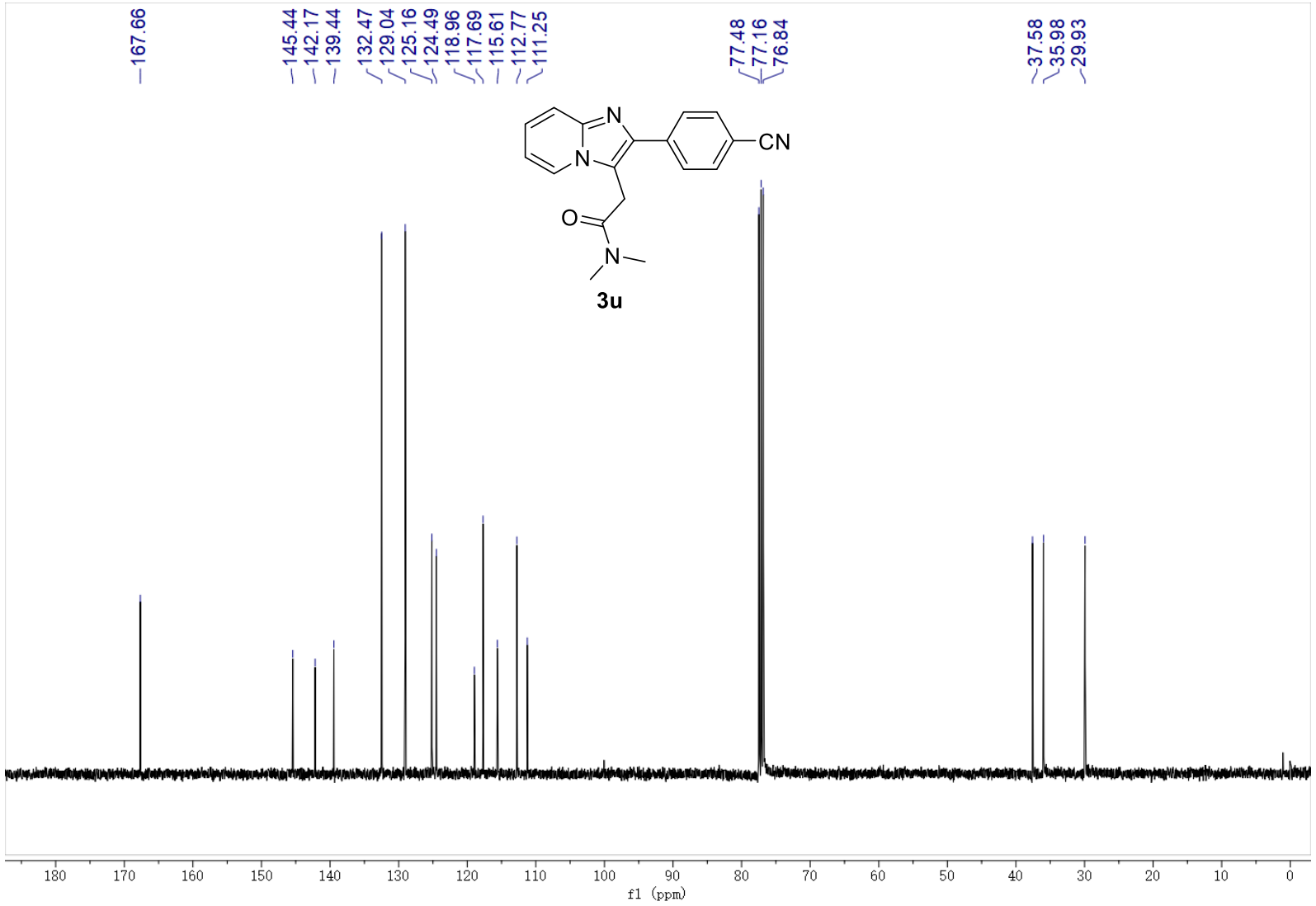

-61.84
N
N
F3C
O
N
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
f1 (ppm)

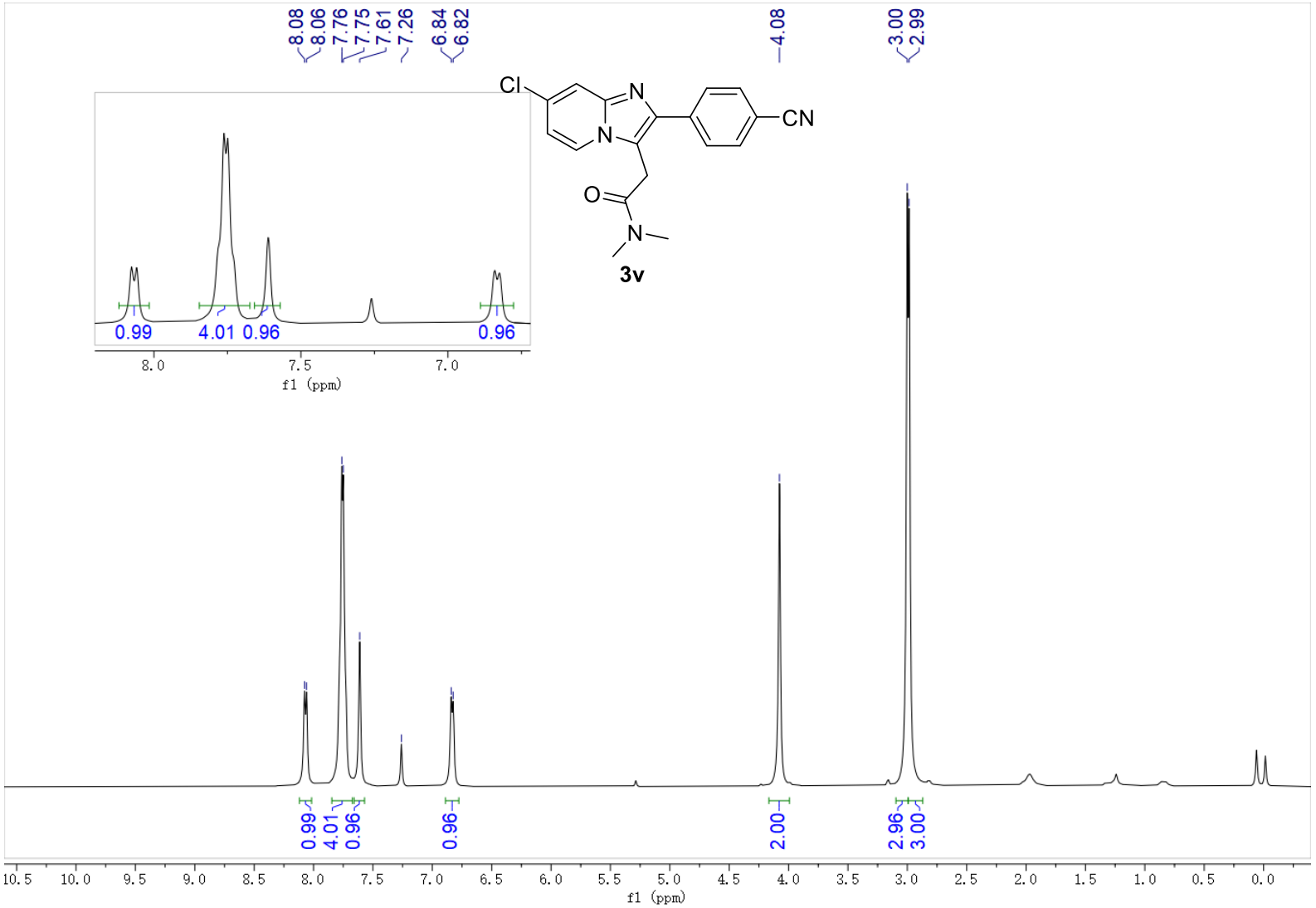
3s

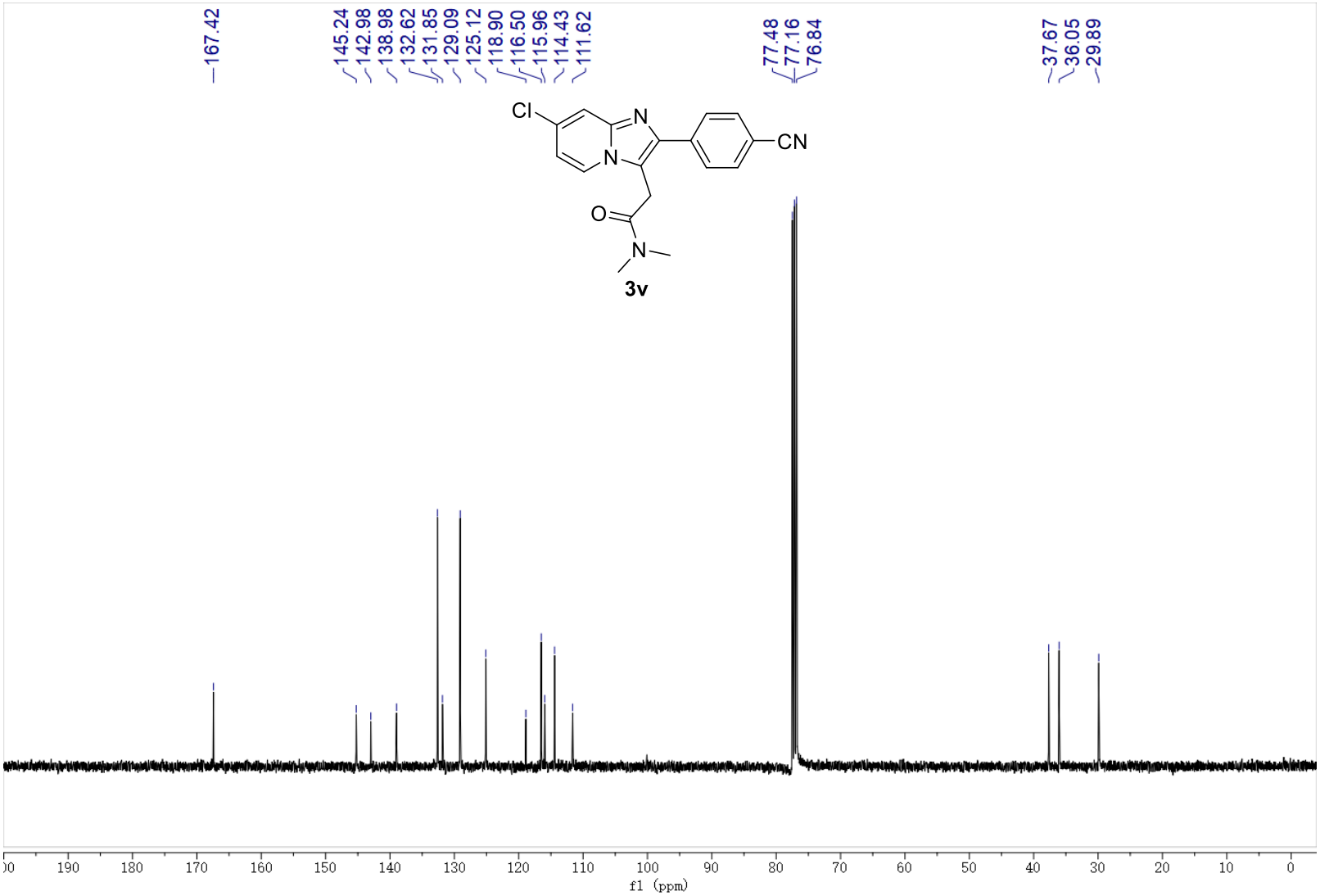

8.01
7.99
7.80
7.78
7.73
7.71
7.36
7.26
6.69
6.69
6.67
6.67
4.07
2.97
2.40
N
N
CN
O
N
3t
0.98 2.03 1.97
0.94
0.96
8.0
7.5
7.0
f1 (ppm)
0.98
2.03
1.97
0.94
0.96
2.00
5.96
2.98
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.
f1 (ppm)

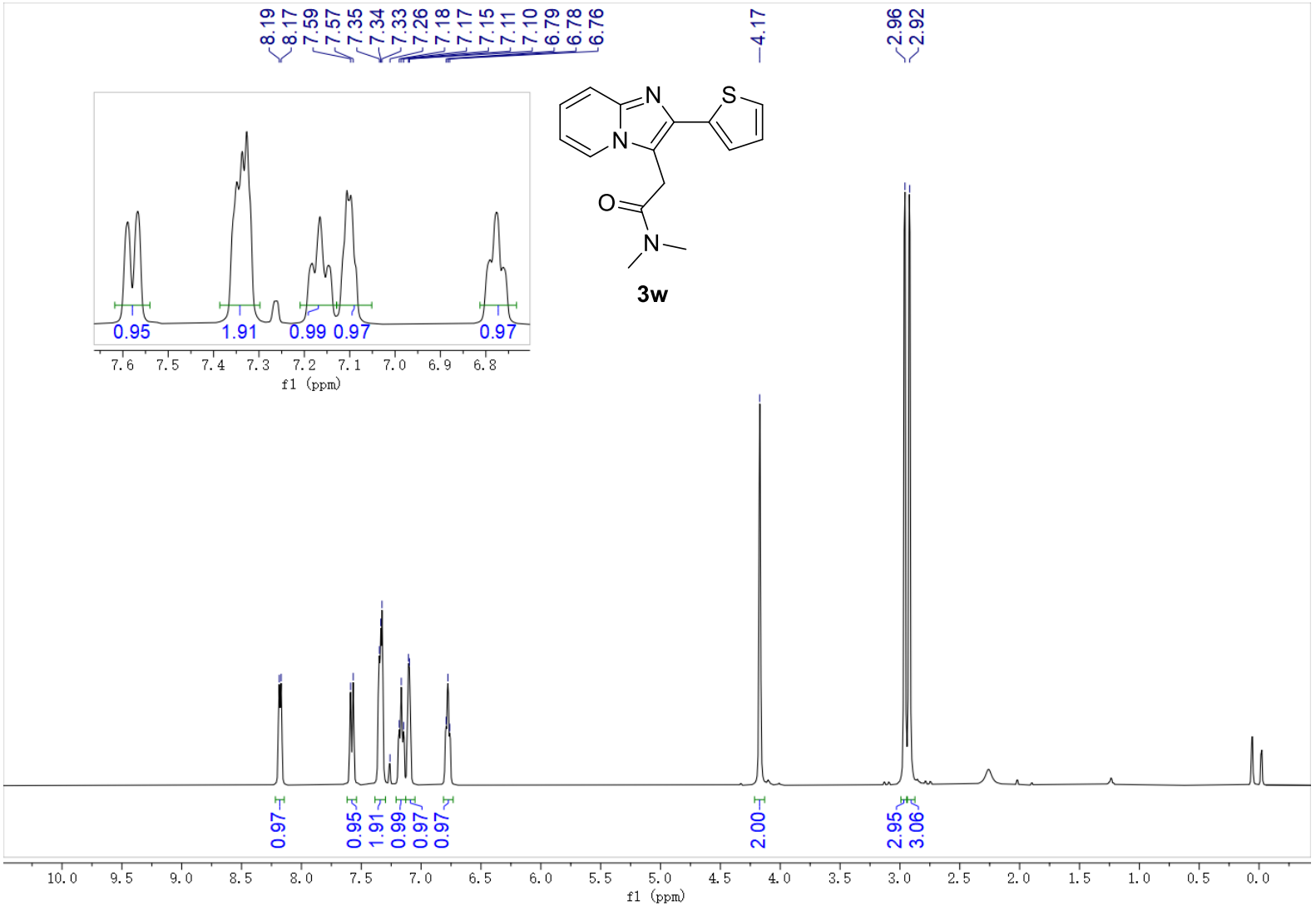

167.83
145.96
141.84
139.66
136.27
132.50
129.02
123.81
119.05
116.04
115.49
114.95
111.16
77.48
77.16
76.84
37.62
36.02
30.09
21.46
N
N
CN
O
N
3t
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

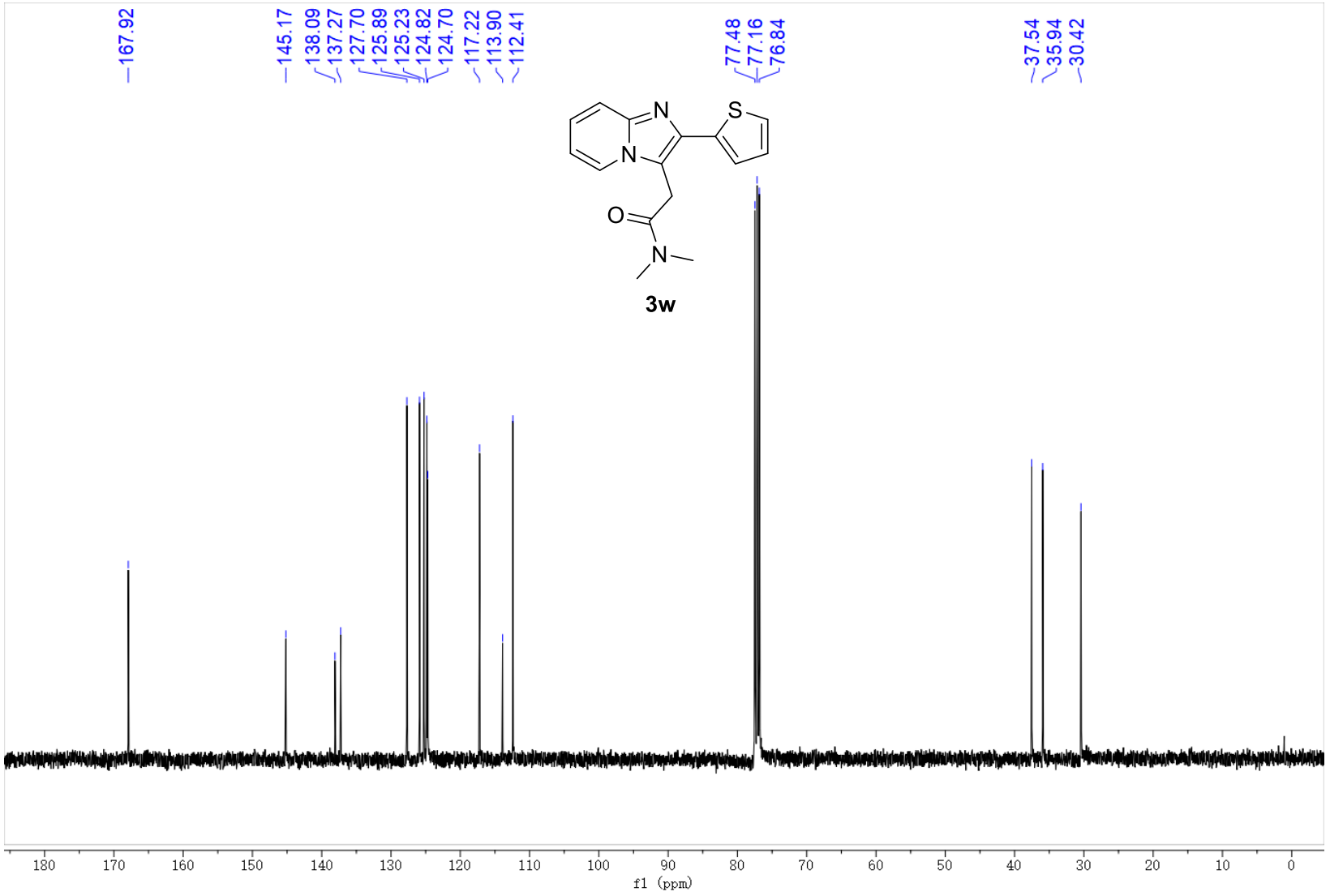

8.08
8.06
7.80
7.77
7.72
7.70
7.61
7.59
7.26
7.23
7.21
7.19
6.85
6.83
6.81
4.07
2.99
2.97
N
N
CN
O
N
3u
0.99 2.06 2.00 1.00 0.98 0.98
8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8
f1 (ppm)
0.99
2.06
2.00
1.00
0.98
0.98
2.00
3.04
3.01
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

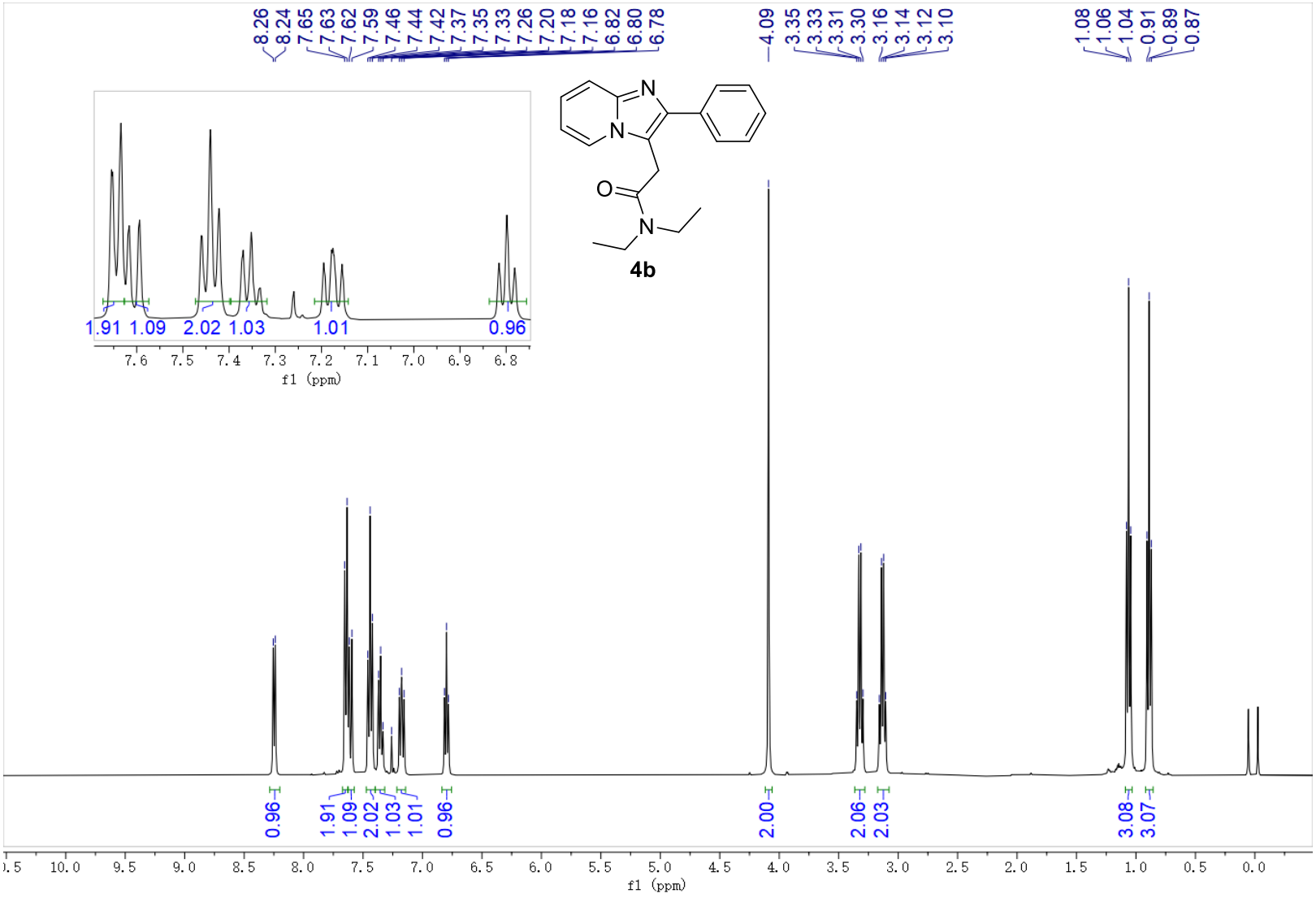

167.66
145.44
142.17
139.44
132.47
129.04
125.16
124.49
118.96
117.69
115.61
112.77
111.25
77.48
77.16
76.84
37.58
35.98
29.93
N
N
CN
O
N
3u
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

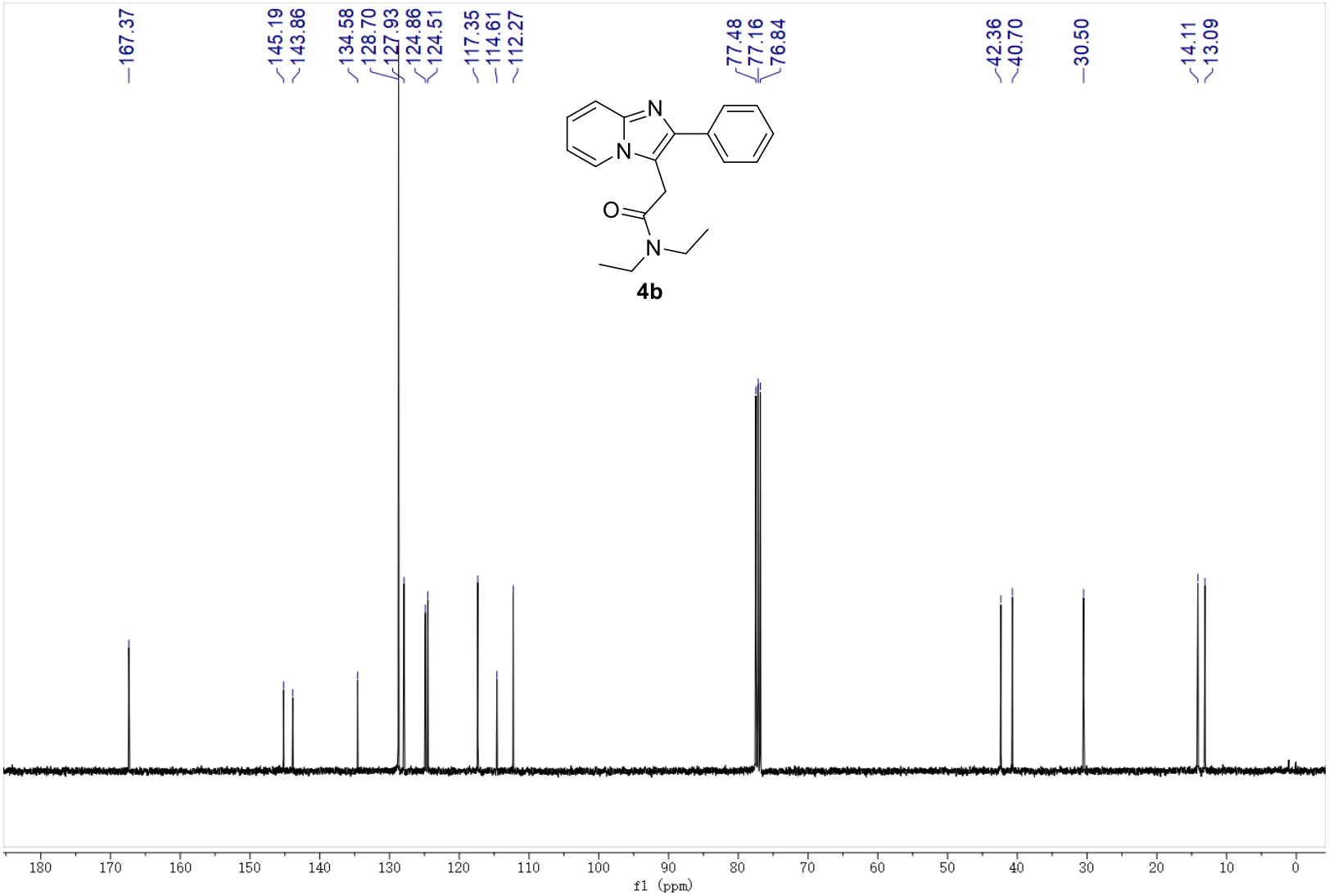

8.08
8.06
7.76
7.75
7.61
7.26
6.84
6.82
4.08
3.00
2.99
Cl
N
N
CN
O
N
3v
0.99
4.01
0.96
0.96
8.0
7.5
7.0
f1 (ppm)
0.99
4.01
0.96
0.96
2.00
2.96
3.00
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


167.42
145.24
142.98
138.98
132.62
131.85
129.09
125.12
118.90
116.50
115.96
114.43
111.62
77.48
77.16
76.84
37.67
36.05
29.89
Cl
N
N
CN
O
N
3v
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

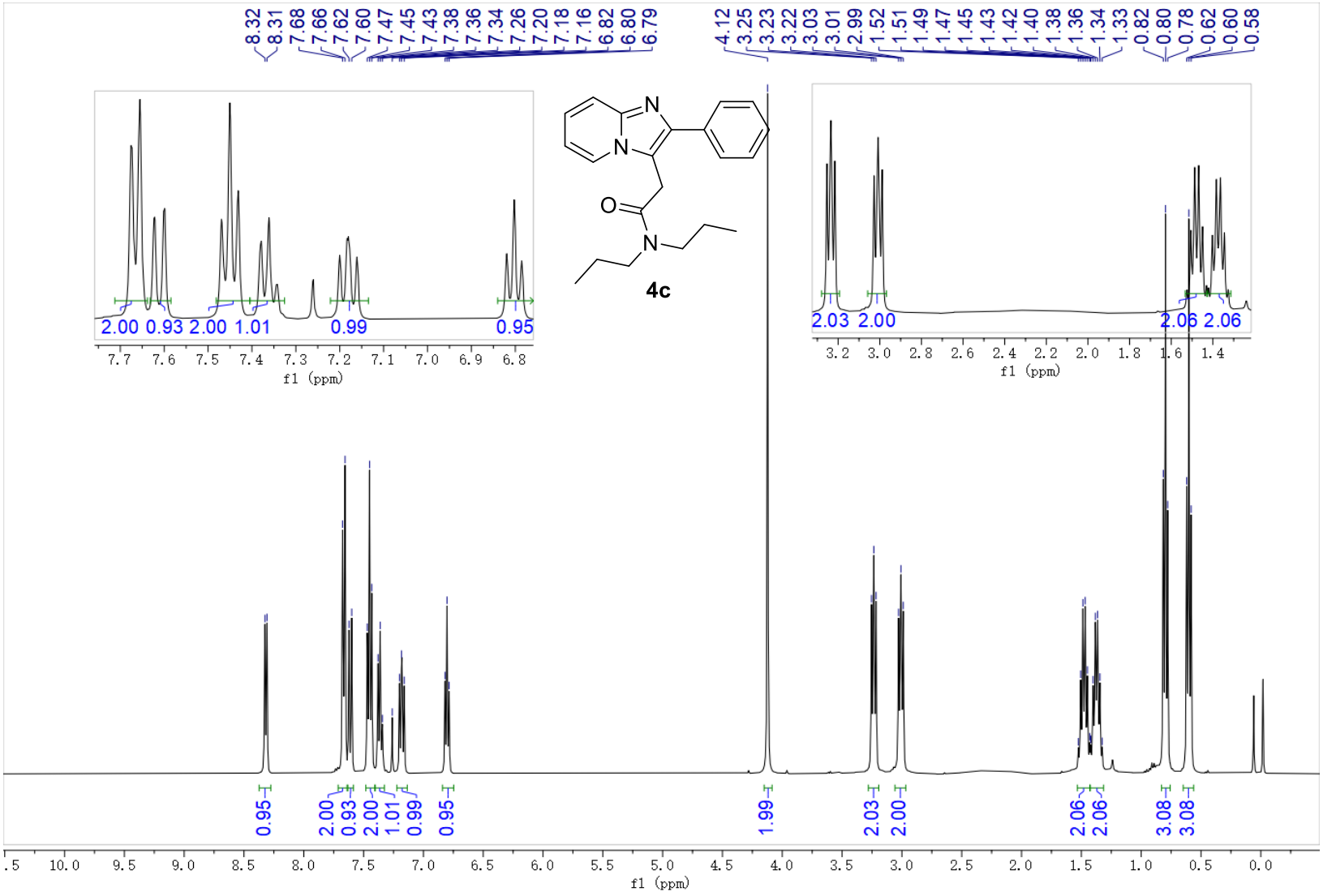

8.19
8.17
7.59
7.57
7.35
7.34
7.33
7.26
7.18
7.17
7.15
7.11
7.10
6.79
6.78
6.76
4.17
2.96
2.92
N
S
N
O
N
3w
0.95
1.91
0.99
0.97
0.97
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8
f1 (ppm)
0.97
0.95
1.91
0.99
0.97
0.97
2.00
2.95
3.06
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

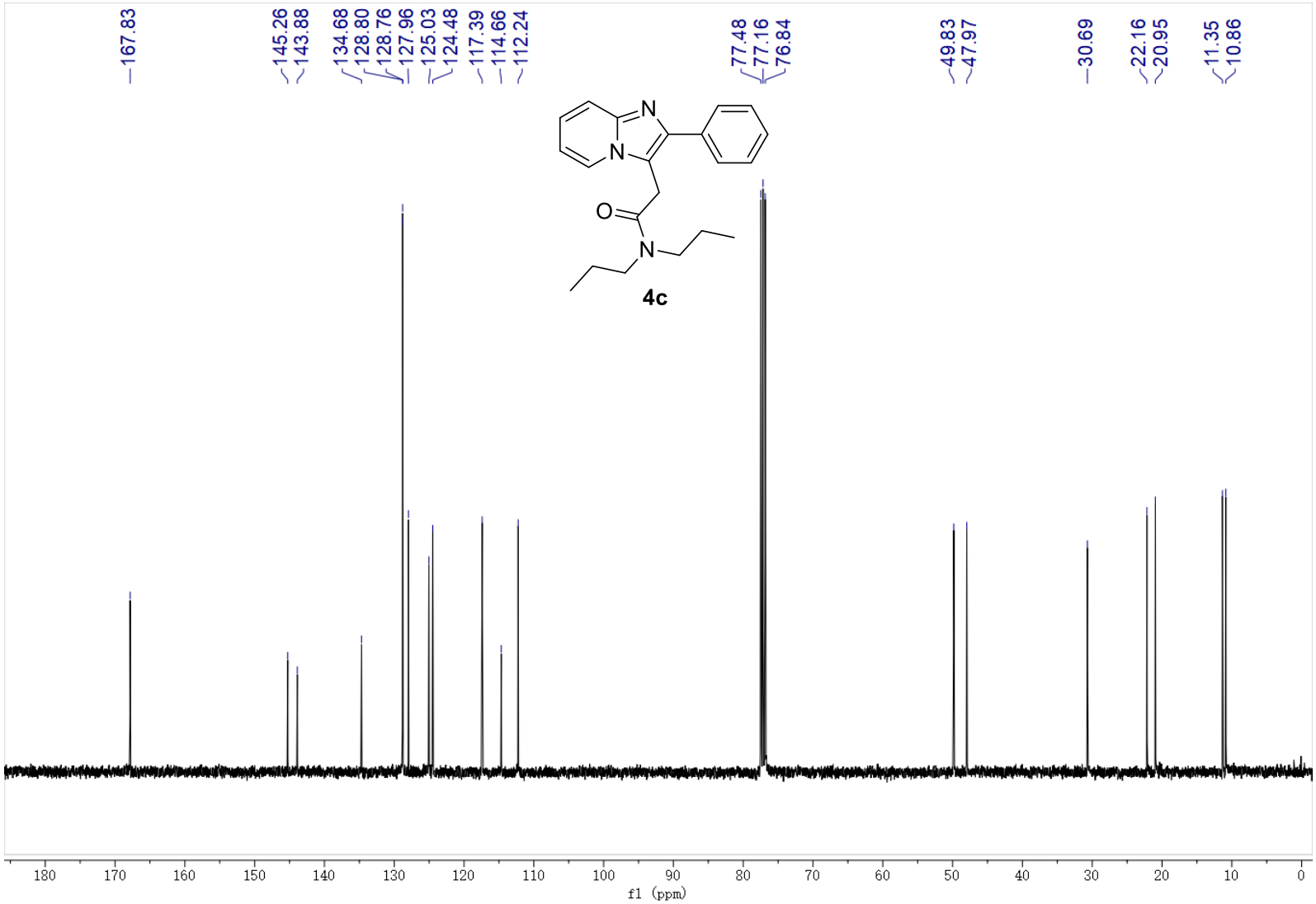

167.92
145.17
138.09
137.27
127.70
125.89
125.23
124.82
124.70
117.22
113.90
112.41
77.48
77.16
76.84
37.54
35.94
30.42
N
S
N
O
N
3w
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.26
8.24
7.65
7.63
7.62
7.59
7.46
7.44
7.42
7.37
7.35
7.33
7.26
7.20
7.18
7.16
6.82
6.80
6.78
4.09
3.35
3.33
3.31
3.30
3.16
3.14
3.12
3.10
1.08
1.06
1.04
0.91
0.89
0.87
1.91 1.09 2.02 1.03 1.01 0.96
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8
f1 (ppm)
N
N
O
N
4b
0.96 1.91 1.09 2.02 1.03 1.01 0.96 2.00 2.06 2.03 3.08 3.07
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


167.37
145.19
143.86
134.58
128.70
127.93
124.86
124.51
117.35
114.61
112.27
77.48
77.16
76.84
42.36
40.70
30.50
14.11
13.09
N
N
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

4b


8.32 8.31 7.68 7.66 7.62 7.60 7.47 7.45 7.43 7.38 7.36 7.34 7.26 7.20 7.18 7.16 6.82 6.80 6.79
4.12 3.25 3.23 3.22 3.03 3.01 2.99 1.52 1.51 1.49 1.47 1.45 1.43 1.42 1.40 1.38 1.36 1.34 1.33 0.82 0.80 0.78 0.62 0.60 0.58
2.00 0.93 2.00 1.01 0.99 0.95
f1 (ppm)
2.03 2.00 2.06 2.06
f1 (ppm)
4c
0.95 2.00 0.93 2.00 1.01 0.99 0.95 1.99 2.03 2.00 2.06 2.06 3.08 3.08
f1 (ppm)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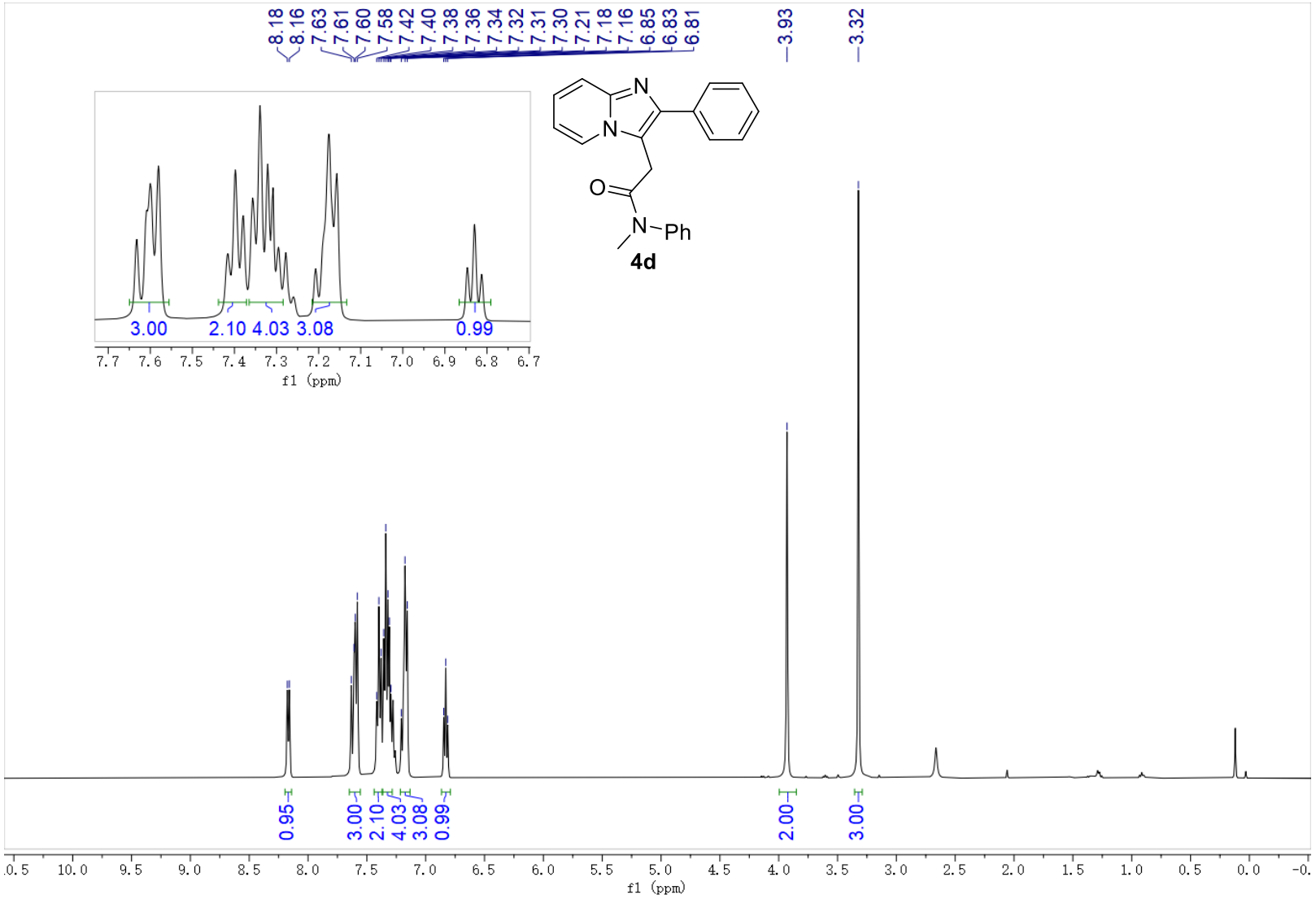
145.26
143.88
134.68
128.80
128.76
127.96
125.03
124.48
117.39
114.66
112.24
77.48
77.16
76.84
49.83
47.97
30.69
22.16
20.95
11.35
10.86
N
N
O
N
4c
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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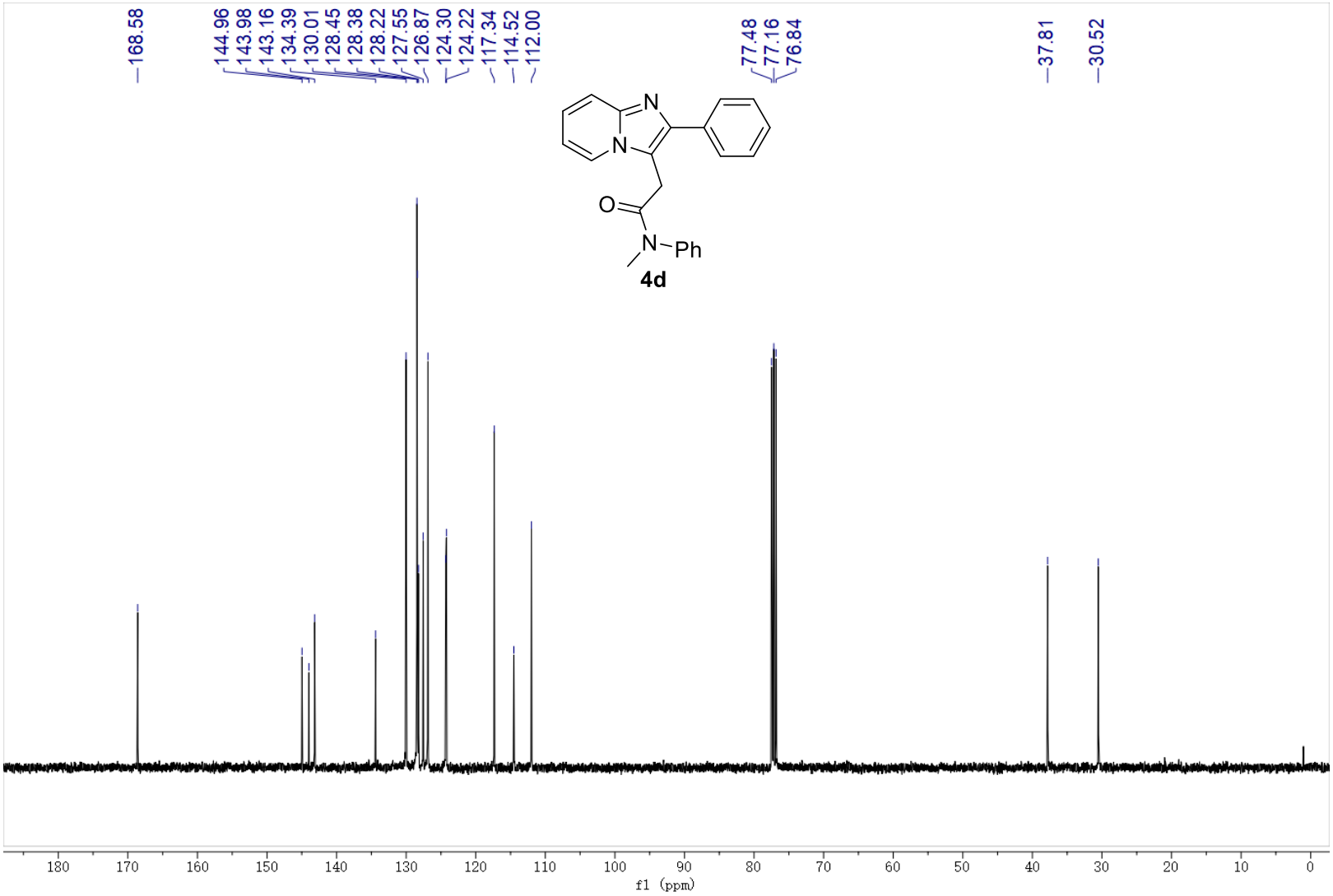
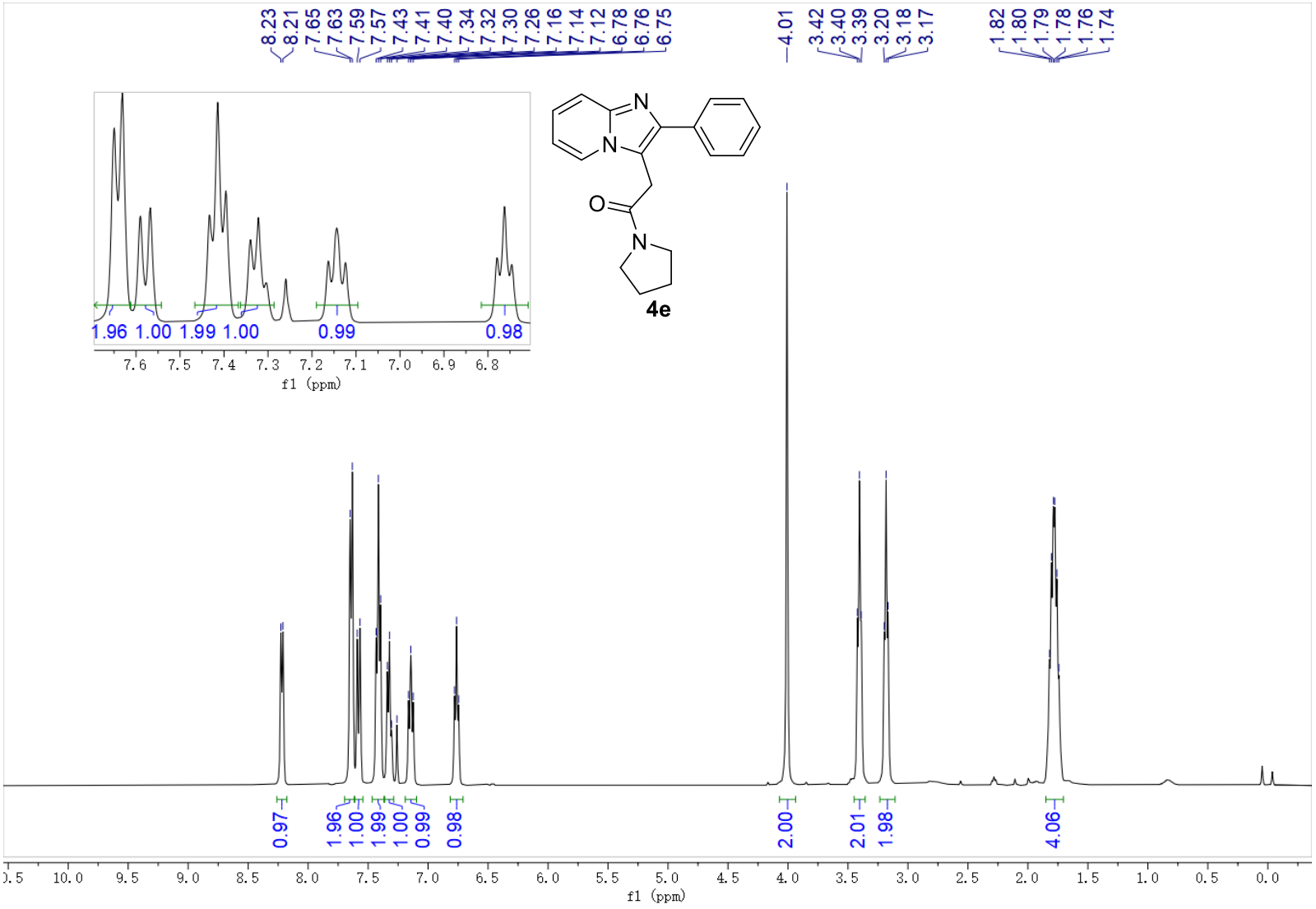
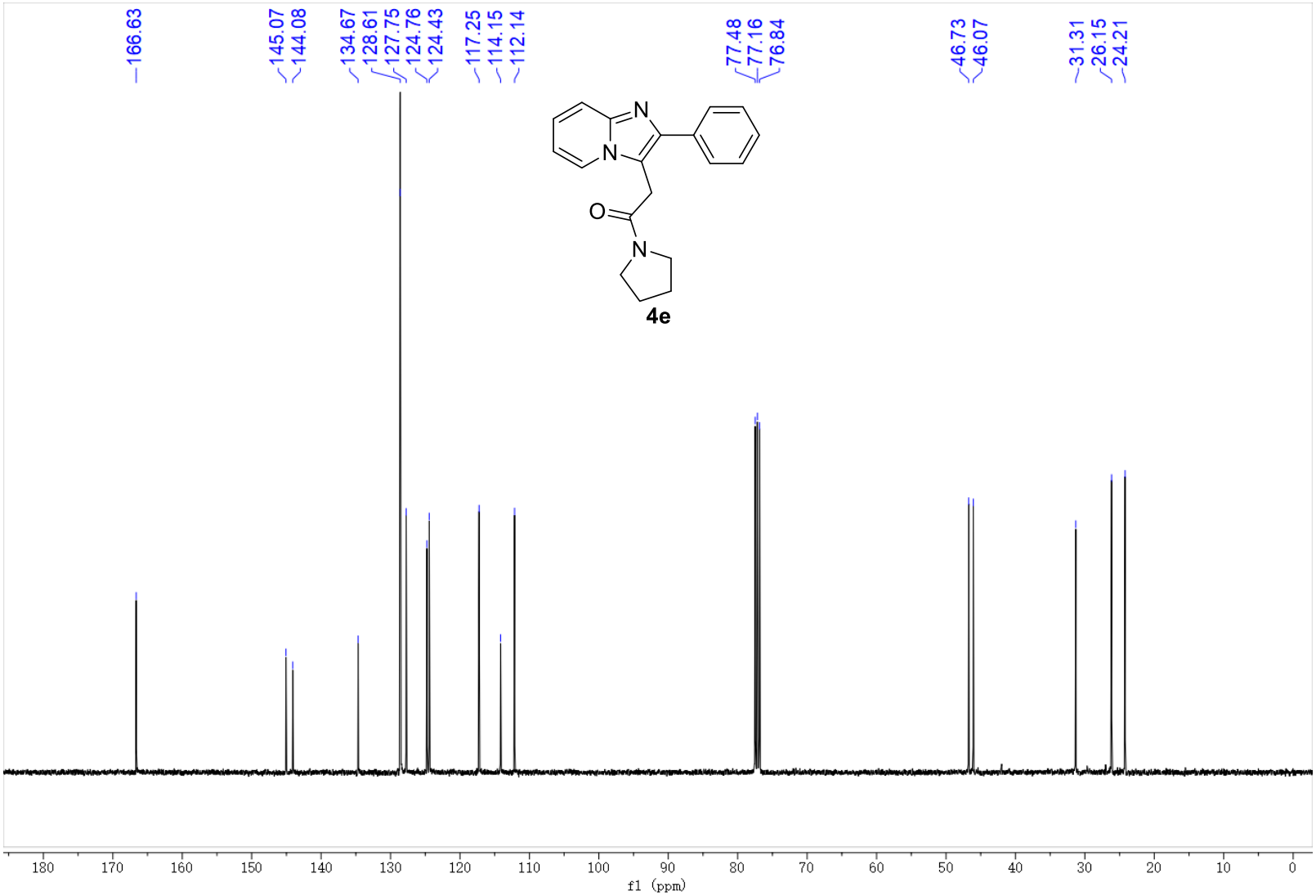
8.16
7.63
7.61
7.60
7.58
7.42
7.40
7.38
7.36
7.34
7.32
7.31
7.30
7.21
7.18
7.16
6.85
6.83
6.81
3.93
3.32
N
N
O
N
Ph
4d
3.00
2.10
4.03
3.08
0.99
f1 (ppm)
0.95
3.00
2.10
4.03
3.08
0.99
2.00
3.00
f1 (ppm)


168.58
144.96
143.98
143.16
134.39
130.01
128.45
128.38
128.22
127.55
126.87
124.30
124.22
117.34
114.52
112.00
77.48
77.16
76.84
37.81
30.52
N
N
O
N
Ph
4d
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.23
8.21
7.65
7.63
7.59
7.57
7.43
7.41
7.40
7.34
7.32
7.30
7.26
7.16
7.14
7.12
6.78
6.76
6.75
4.01
3.42
3.40
3.39
3.20
3.18
3.17
1.82
1.80
1.79
1.78
1.76
1.74
1.96 1.00 1.99 1.00 0.99 0.98
f1 (ppm)
N
N
O
N
4e
0.97
1.96
1.00
1.99
1.00
0.99
0.98
2.00
2.01
1.98
4.06
f1 (ppm)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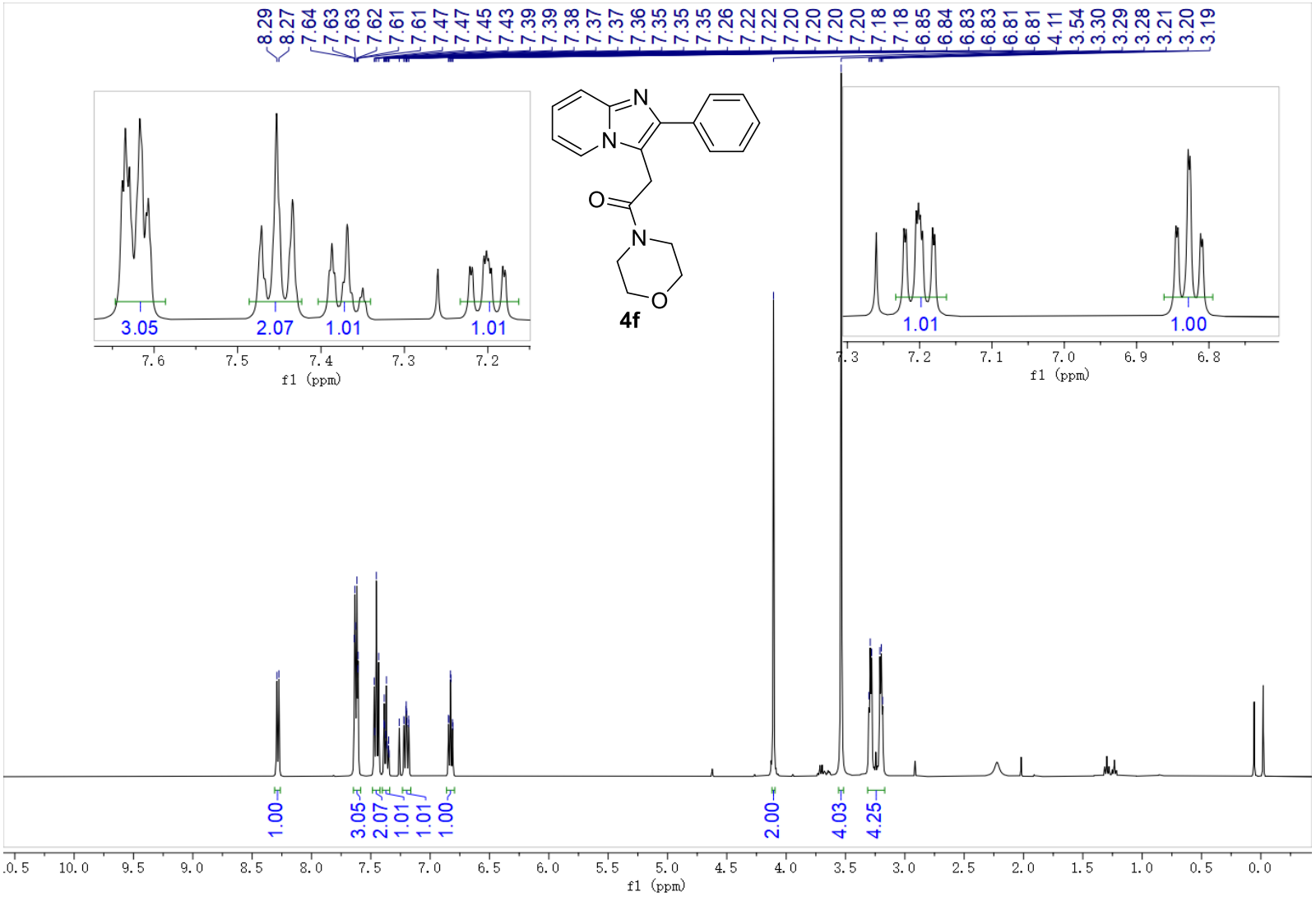
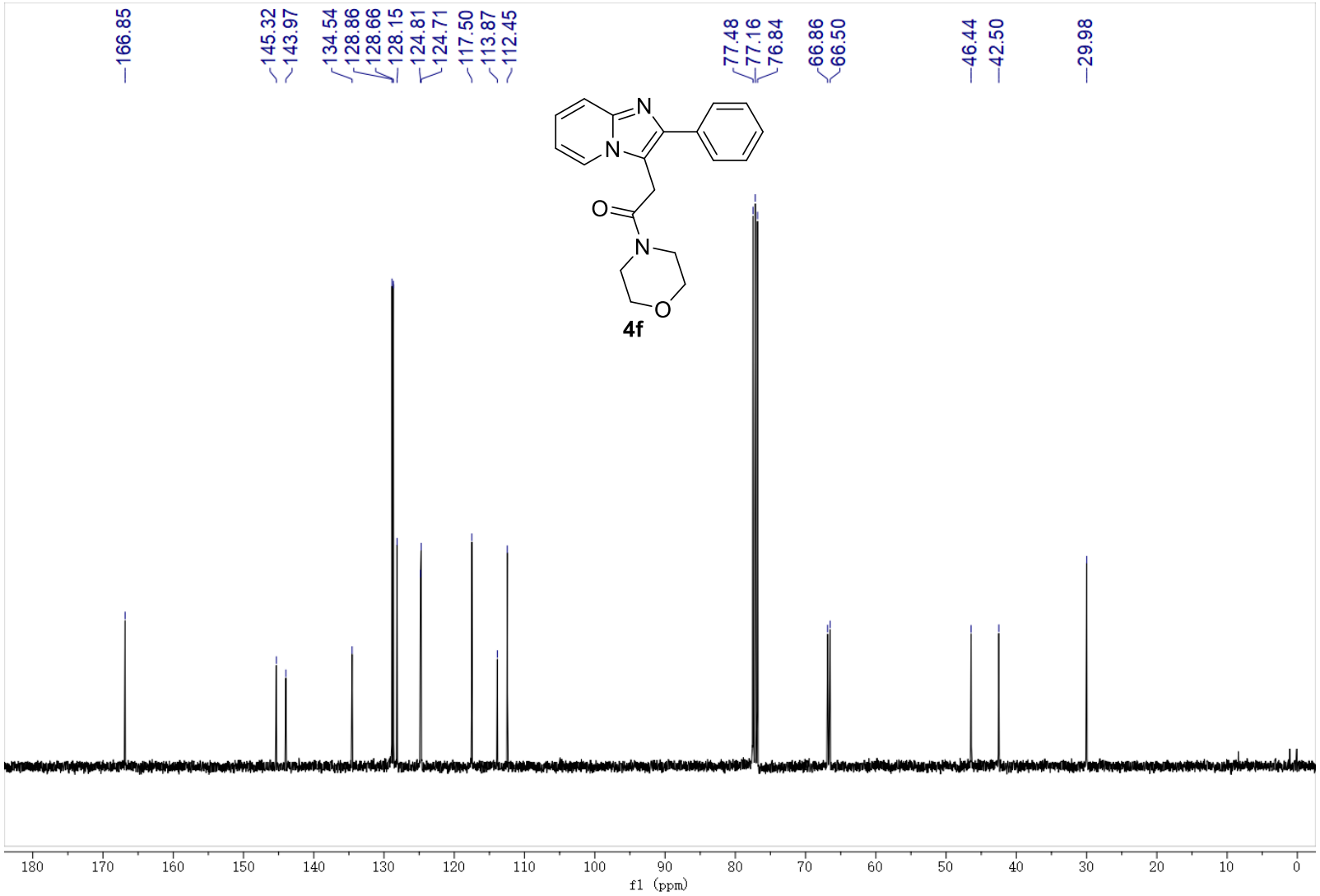
145.07
144.08
134.67
128.61
127.75
124.76
124.43
117.25
114.15
112.14
77.48
77.16
76.84
46.73
46.07
31.31
26.15
24.21
N
N
O
N
4e
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.29
8.27
7.64
7.63
7.63
7.62
7.61
7.61
7.47
7.47
7.45
7.43
7.39
7.39
7.38
7.37
7.37
7.36
7.35
7.35
7.35
7.26
7.22
7.22
7.20
7.20
7.20
7.20
7.18
7.18
6.85
6.84
6.83
6.83
6.81
6.81
4.11
3.54
3.30
3.29
3.28
3.21
3.20
3.19
N
N
O
N
O
4f
3.05
2.07
1.01
1.01
1.01
1.00
f1 (ppm)
1.00
3.05
2.07
1.01
1.01
1.00
2.00
4.03
4.25
f1 (ppm)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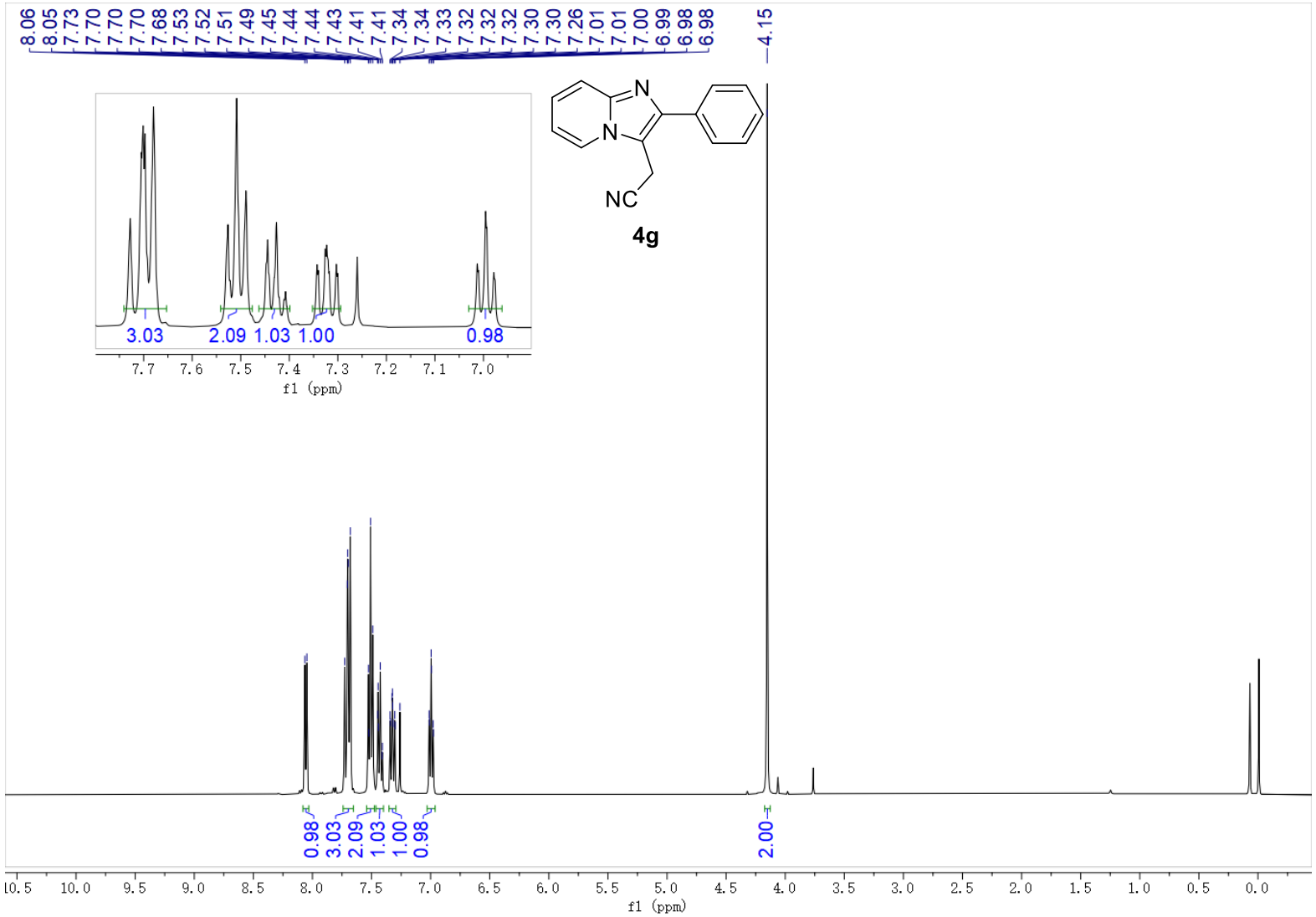
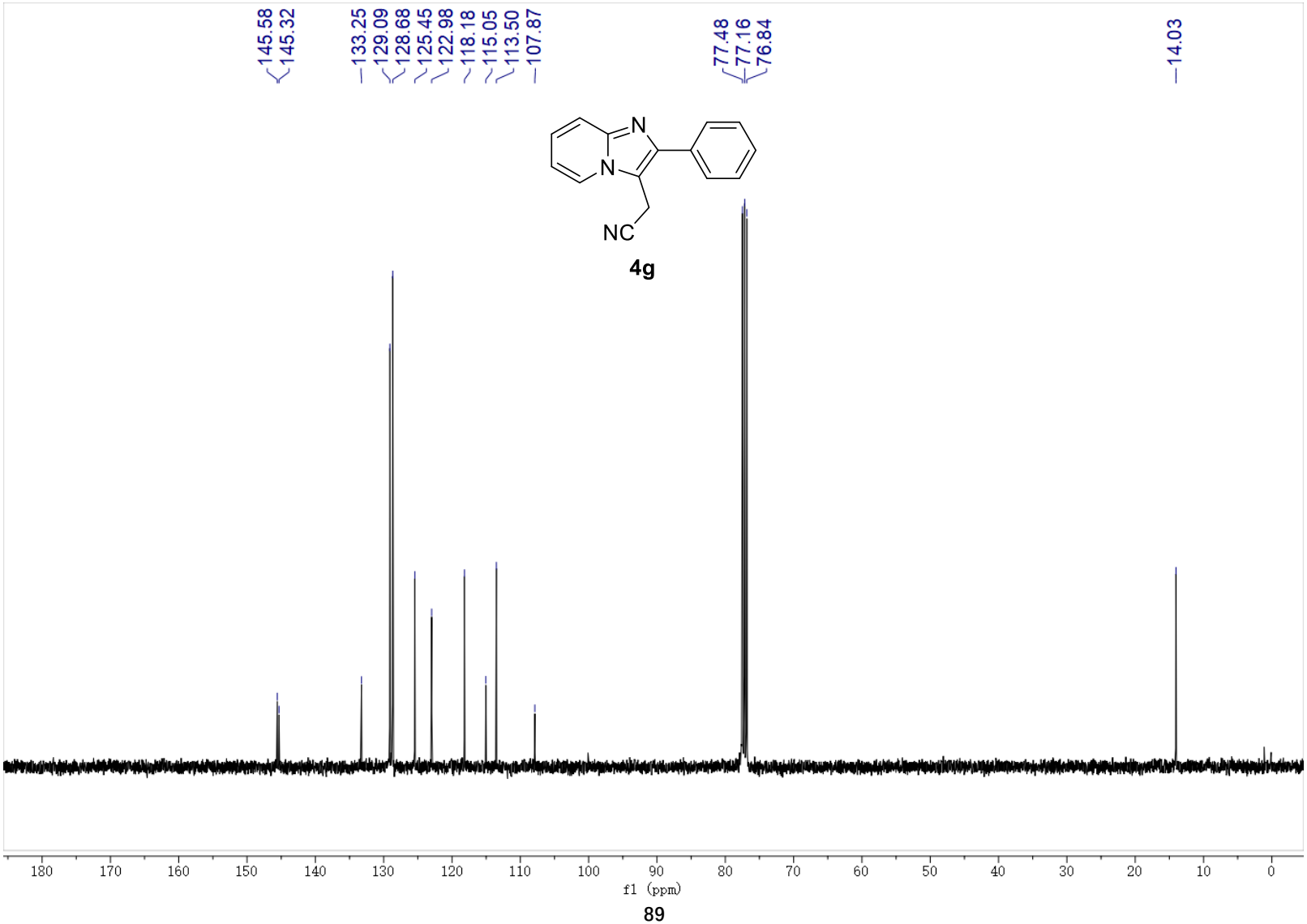
145.32
143.97
134.54
128.86
128.66
128.15
124.81
124.71
117.50
113.87
112.45
77.48
77.16
76.84
66.86
66.50
46.44
42.50
29.98
N
N
O
N
O
4f
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

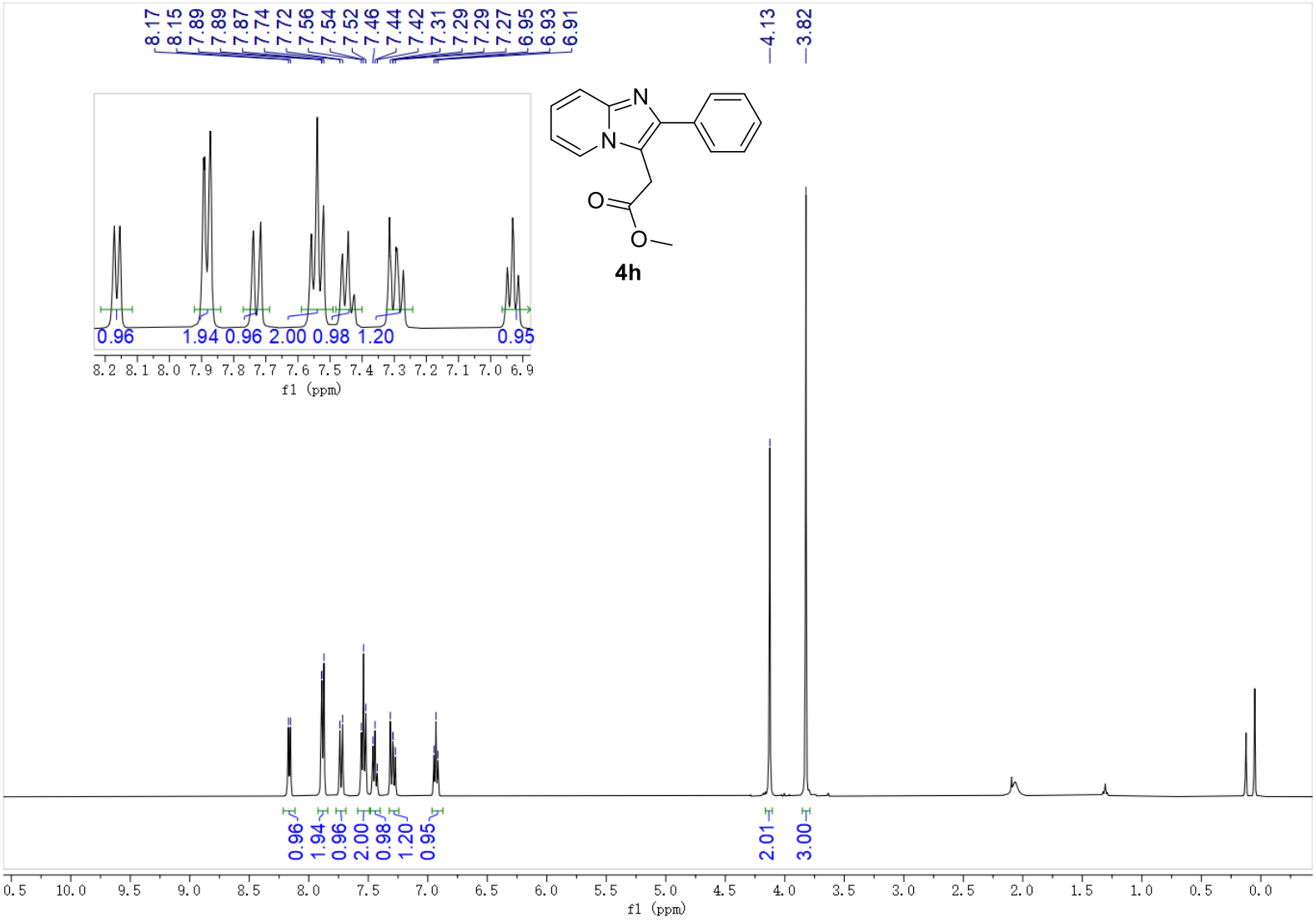

8.06
8.05
7.73
7.70
7.70
7.70
7.68
7.53
7.52
7.51
7.49
7.45
7.44
7.44
7.43
7.41
7.41
7.34
7.34
7.33
7.32
7.32
7.32
7.30
7.30
7.26
7.01
7.01
7.00
6.99
6.98
6.98
4.15
N
N
NC
3.03
2.09
1.03
1.00
0.98
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
f1 (ppm)
0.98
3.03
2.09
1.03
1.00
0.98
2.00
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

4g

88

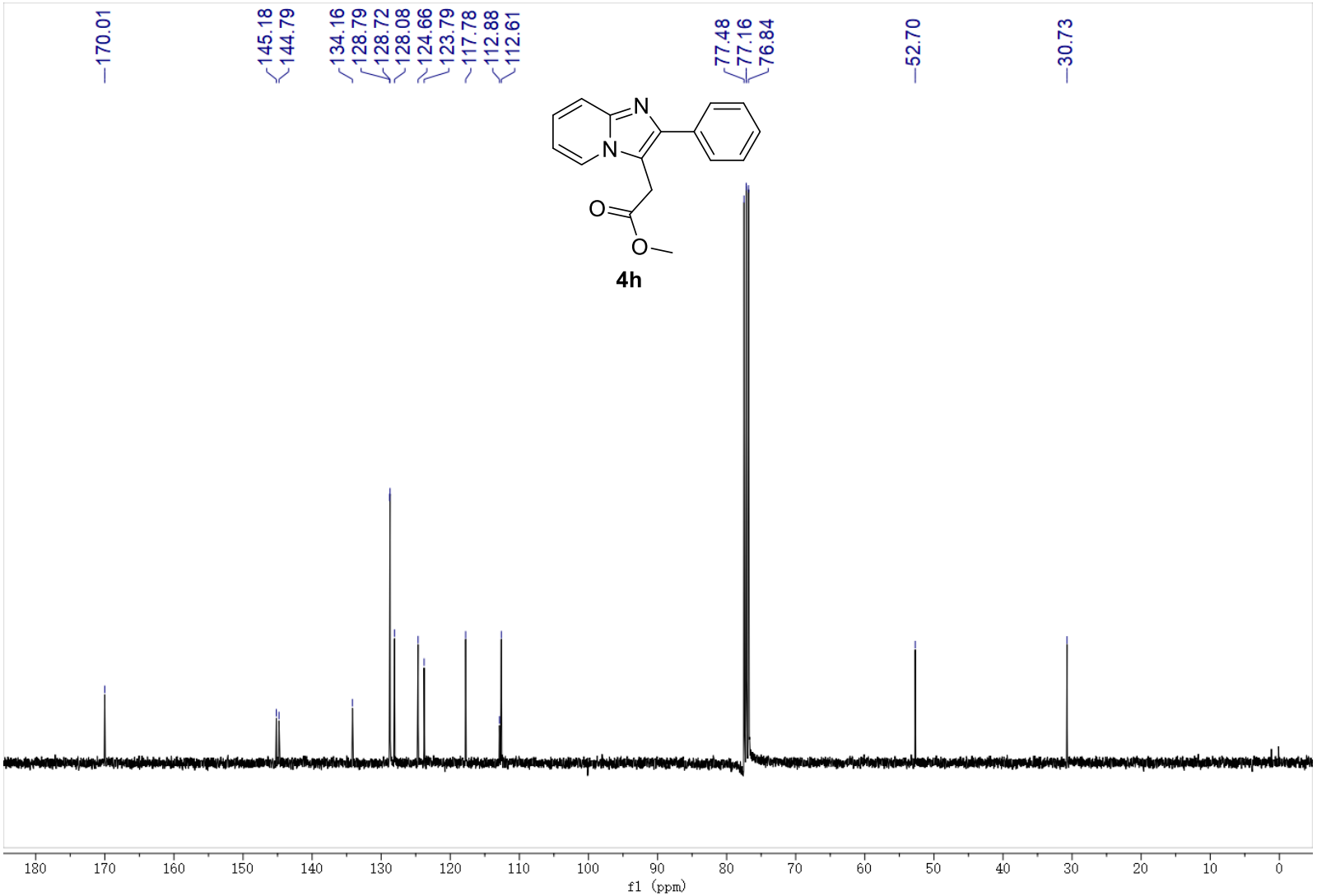

145.58
145.32
133.25
129.09
128.68
125.45
122.98
118.18
115.05
113.50
107.87
77.48
77.16
76.84
14.03
N
N
NC
4g
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

89

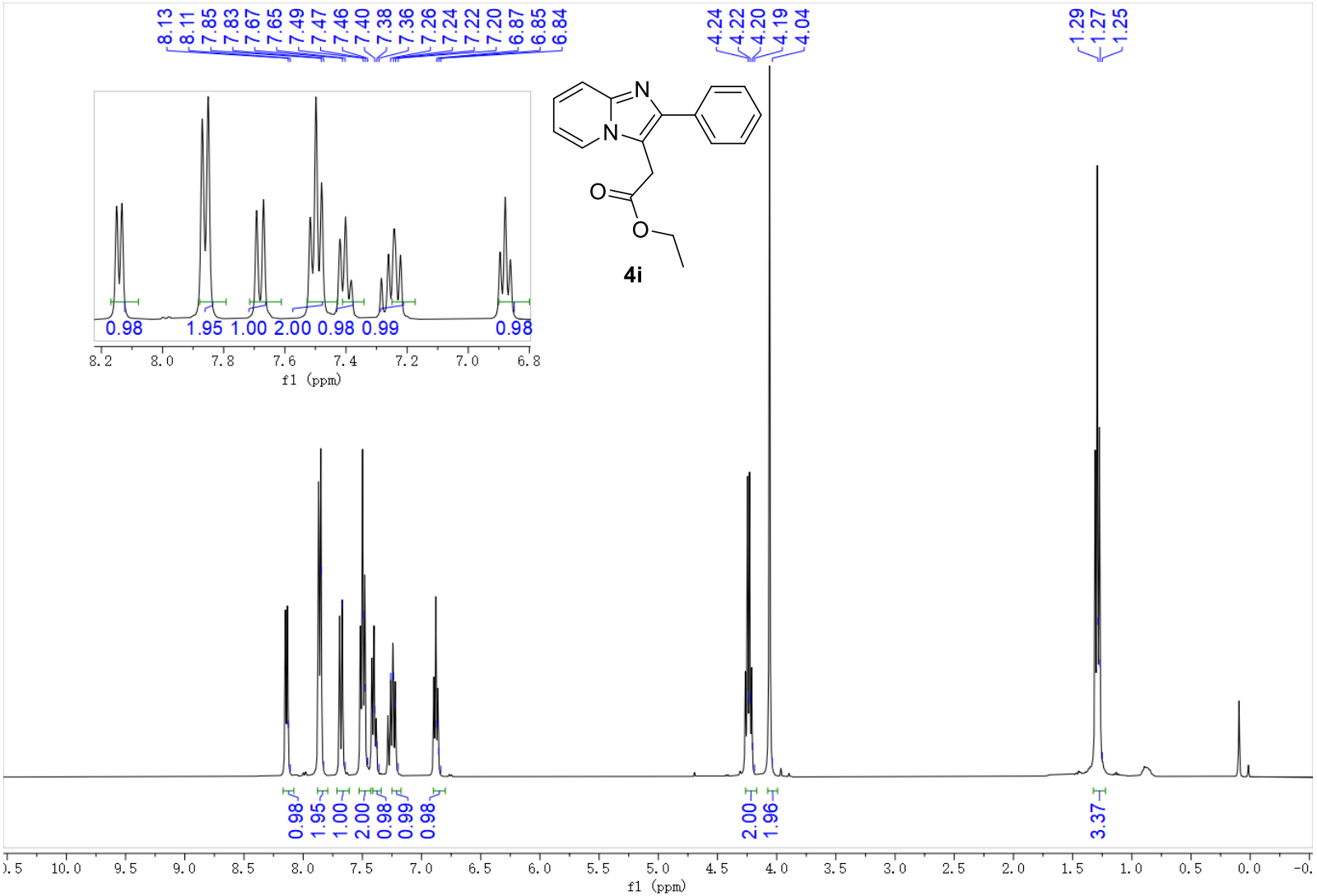

8.17
8.15
7.89
7.89
7.87
7.74
7.72
7.56
7.54
7.52
7.46
7.44
7.42
7.31
7.29
7.29
7.27
6.95
6.93
6.91
4.13
3.82
0.96
1.94
0.96
2.00
0.98
1.20
0.95
f1 (ppm)
2.01
3.00
f1 (ppm)

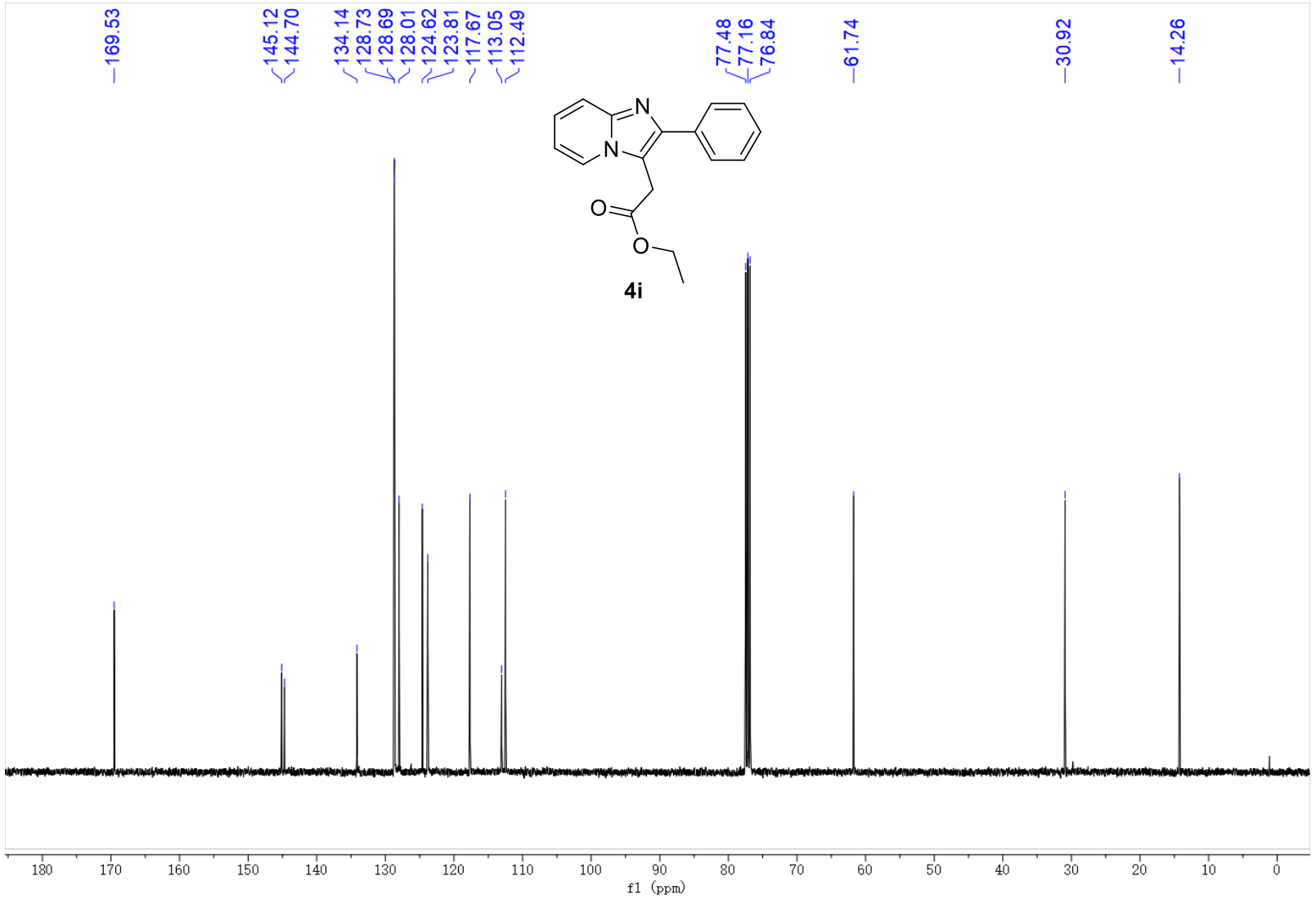
4h

90


170.01
145.18
144.79
134.16
128.79
128.72
128.08
124.66
123.79
117.78
112.88
112.61
77.48
77.16
76.84
52.70
30.73
N
N
O
O
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

4h


8.13
8.11
7.85
7.83
7.67
7.65
7.49
7.47
7.46
7.40
7.38
7.36
7.26
7.24
7.22
7.20
6.87
6.85
6.84
4.24
4.22
4.20
4.19
4.04
1.29
1.27
1.25
N
N
O
O
4i
0.98
1.95
1.00
2.00
0.98
0.99
0.98
f1 (ppm)
0.98
1.95
1.00
2.00
0.98
0.99
0.98
2.00
1.96
3.37
f1 (ppm)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145.12
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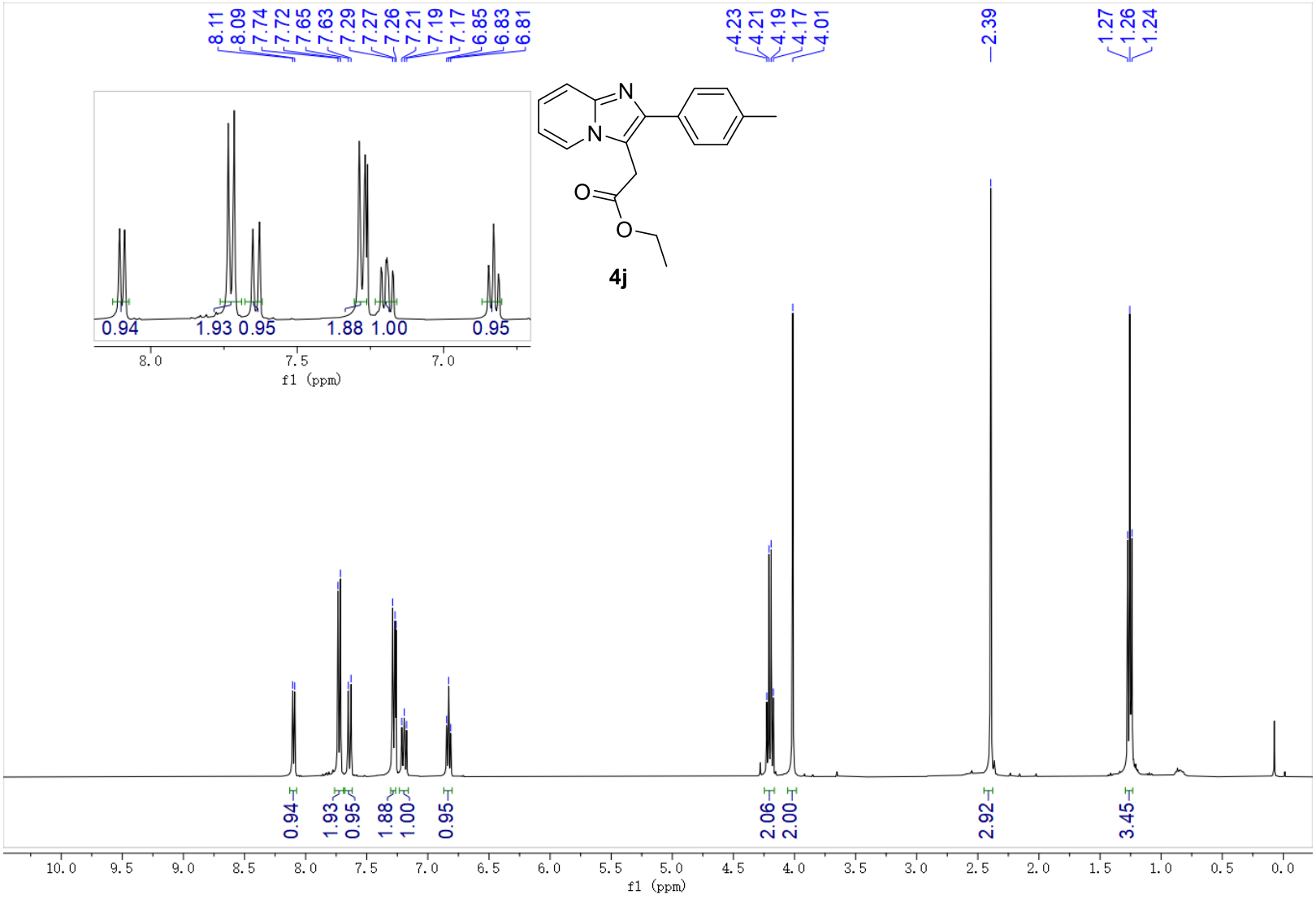
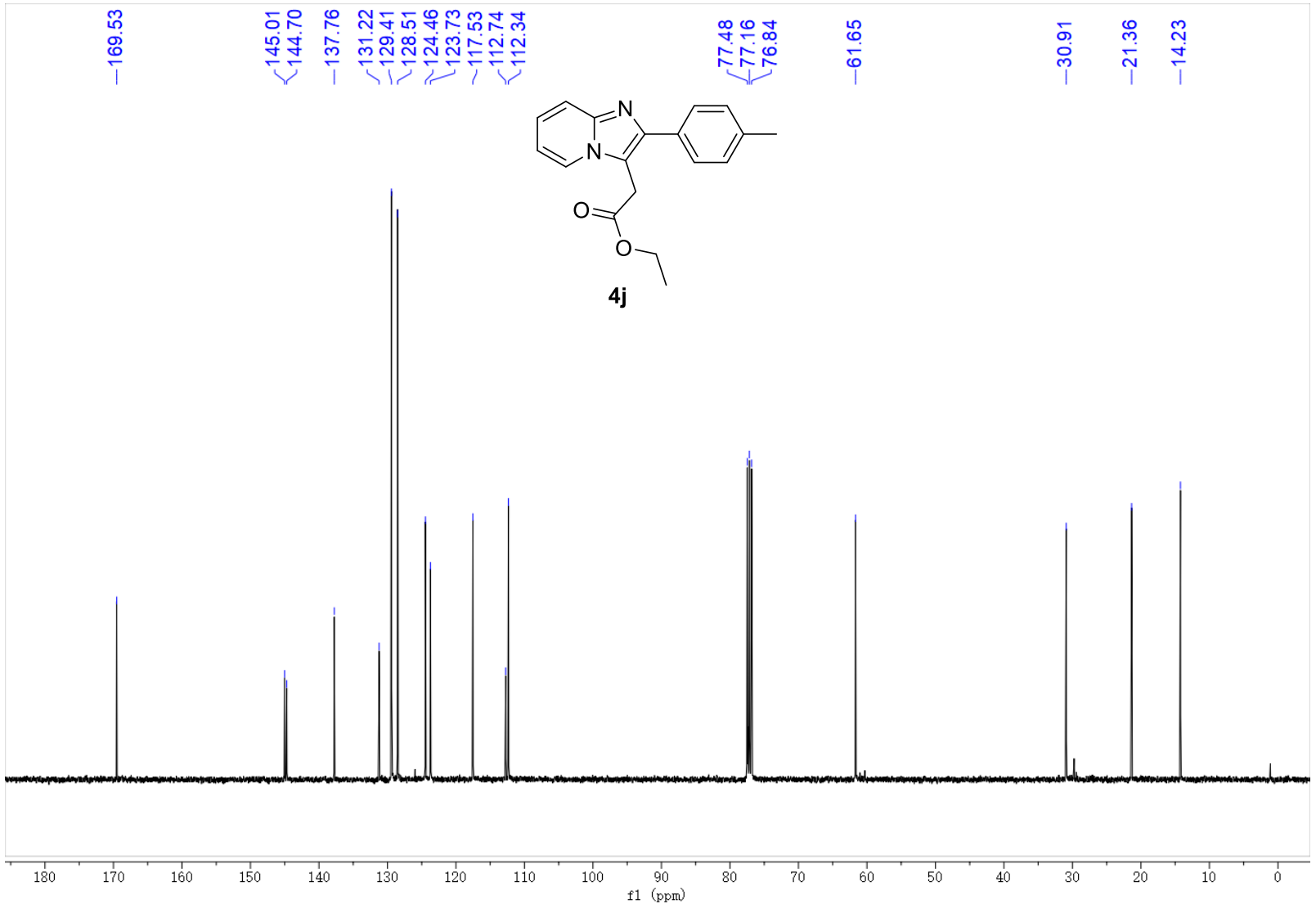
134.14
128.73
128.69
128.01
124.62
123.81
117.67
113.05
112.49
77.48
77.16
76.84
61.74
30.92
14.26
N
N
O
O
4i
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.11
8.09
7.74
7.72
7.65
7.63
7.29
7.27
7.26
7.21
7.19
7.17
6.85
6.83
6.81
4.23
4.21
4.19
4.17
4.01
2.39
1.27
1.26
1.24
0.94
1.93
0.95
1.88
1.00
0.95
2.06
2.00
2.92
3.45
f1 (ppm)

4j

94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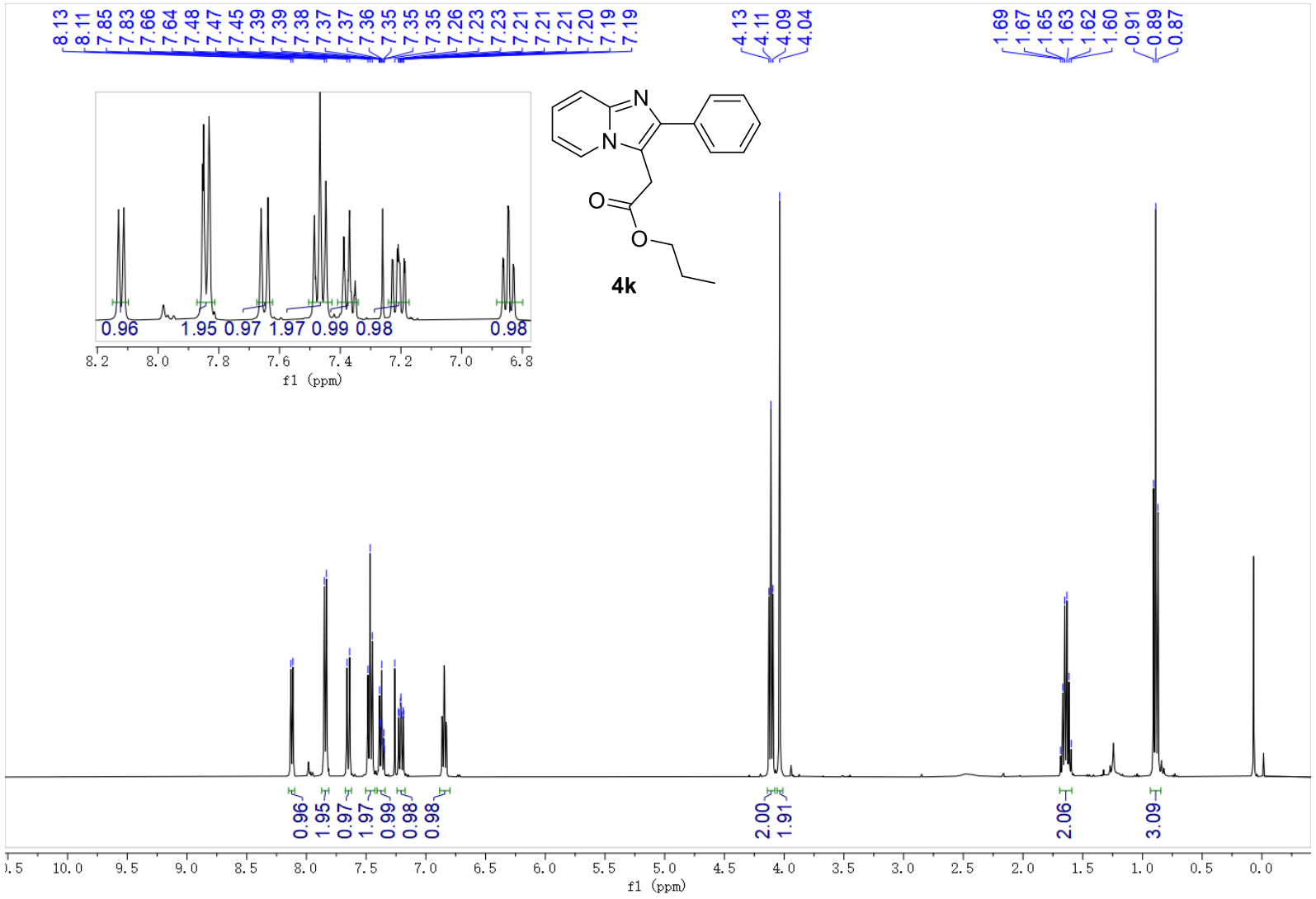
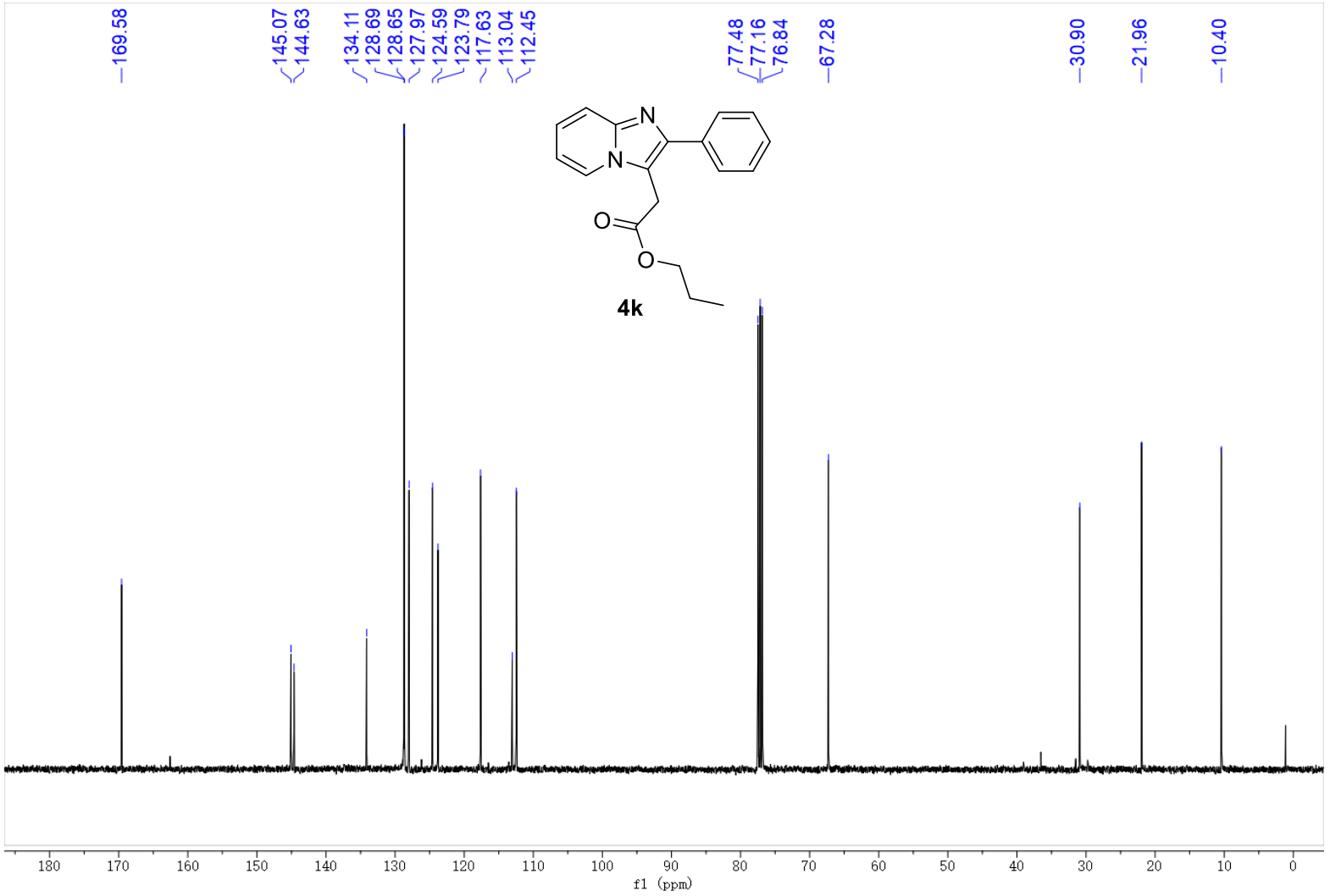
145.01
144.70
137.76
131.22
129.41
128.51
124.46
123.73
117.53
112.74
112.34
77.48
77.16
76.84
61.65
30.91
21.36
14.23
N
N
O
O
4j
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.13 8.11 7.85 7.83 7.66 7.64 7.48 7.47 7.45 7.39 7.39 7.38 7.37 7.37 7.36 7.35 7.35 7.35 7.26 7.23 7.23 7.21 7.21 7.21 7.20 7.19 7.19
4.13 4.11 4.09 4.04
1.69 1.67 1.65 1.63 1.62 1.60 0.91 0.89 0.87
N
N
O
O
4k
0.96 1.95 0.97 1.97 0.99 0.98 0.98
8.2 8.0 7.8 7.6 7.4 7.2 7.0 6.8
f1 (ppm)
0.96 1.95 0.97 1.97 0.99 0.98 0.98
2.00 1.91
2.06
3.09
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


169.58
145.07
144.63
134.11
128.69
128.65
127.97
124.59
123.79
117.63
113.04
112.45
77.48
77.16
76.84
67.28
30.90
21.96
10.40
N
N
O
O
4k
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)