Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supporting Information

Table of Contents

1. Materials and Methods

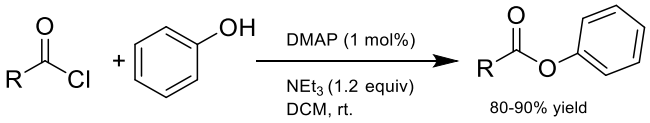
All starting materials reported in this manuscript have been previously described in the literature and prepared by the method reported previously.[1] Esters were prepared by standard method.[2] With the help of the standard method, we have prepared various substituted esters like differing *para, ortho, meta* positions of halogens, electron-withdrawing, and electron-donating functional groups, and HRMS data for the new compounds **(3l, 3q)** have been included. Solvents were purchased from commercial suppliers and stored under a protected respective atmosphere. Dry solvents were handled using standard syringe techniques. Chemicals, which were obtained from commercial suppliers TCI, Avra, and Sigma were used without further purification.

2. General information

Analytical thin layer chromatography (TLC) was performed on pre-coated silica gel plates (60 F254; MERCK). TLC plates were visualized by exposing UV light. ^{1}H NMR and ^{13}C NMR spectra were recorded with BRUKER 400 and 101 MHz, respectively, using a Bruker AVANCE III 400 (400MHz) spectrometer. Measurements were done at ambient temperature. ^{1}H NMR chemical shifts are referenced to the residual hydrogen signals of the deuterated solvent (7.26 ppm for $CDCl_3$). The ^{13}C NMR chemical shifts are referenced to the ^{13}C signals of the deuterated solvent (77 ppm for $CDCl_3$). Abbreviations used in the description of NMR data are listed as follows: singlet; d, doublet; t, triplet; m, multiplet. Product purification was accomplished by flash chromatography using 300-400 mesh silica gel.

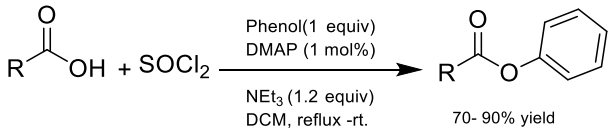
3. Experimental procedure for starting material synthesis:

Method A:



Acyl chloride (25.5 mmol) was added to DCM (5 mL), phenol (21.27 mmol) and N, N dimethyl 4-aminopyridine (DMAP, 0.85 mmol) in a round bottom flask at 0 °C. After cooling the mixture, triethylamine (31.9 mmol) was added dropwise. The mixture was allowed to stir overnight from 0 °C to room temperature. Completion of the reaction was monitored by TLC. The reaction was quenched with saturated $NaHCO_3$. The mixture was extracted with dichloromethane. Subsequent washes with $NaOH_{aq}$ (1 M) were done as necessary to remove phenol. The combined organic layers were dried over Na_2SO_4 and then filtered. The Filtrate was concentrated and purified by column chromatography (hexane: ethyl acetate) to afford the corresponding ester substrates of 80 -90% yield.

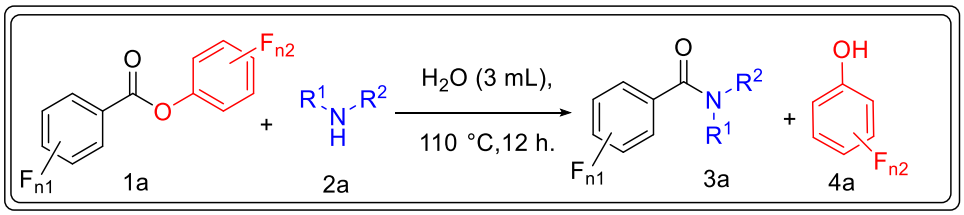
Method B:



A mixture of corresponding carboxylic acid (10 mmol) and thionyl chloride (10 mmol) was placed in a 250 mL two necked round bottomed flask fitted with a reflux condenser to which a gas-absorption trap was attached. The reaction mixture was heated to obtain acid chloride (45–60 minutes), and then allowed to cool. To a solution of the residue, THF (10 mL) and triethylamine (12 mmol) was added. Then phenol (125 mmol) and N, N dimethyl 4-aminopyridine (DMAP, 0.85 mmol) was added at 0 °C. The mixture was again heated until the evolution of hydrogen chloride ceased (about 1 hour). After completion of reaction (monitored by TLC), the reaction mixture was washed with aqueous bicarbonate (50 mL) and concentrated under reduced pressure. The Filtrate was concentrated and purified by column chromatography (hexane: ethyl acetate) to afford the corresponding ester substrates of 70 -90% yield.

4. General Procedure

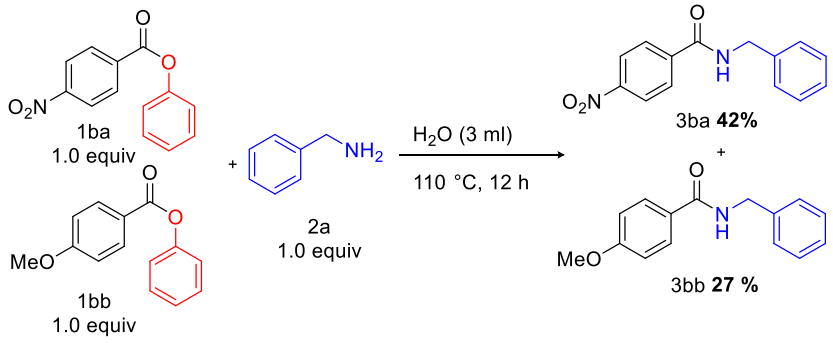
Benzylamine (0.505 mmol, 2a) and phenyl ester (0.252 mmol, 1a) were added into a 25ml vial and 2 mL water was added with a screw cap. The reaction mixture was tightly sealed and stirred at 110° C in oil bath, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was extracted with ethyl acetate (5 mL) and distilled water (10 mL) and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product (3a).



Scheme S1. General Reaction Scheme

5. Intermolecular competition experiment

Benzylamine (0.2803 mmol, 1 equiv), *p*- methoxy phenyl ester (0.283 mmol, 1 equiv), and *p*- nitro phenyl ester (0.283 mmol, 1 equiv) were added into a 25 ml reaction tube. H_2O (3 ml) was added at room temperature and the mixture was stirred at 110° C for 12 hours. The progress of the reaction was monitored by TLC and upon completion of the reaction, the mixture was diluted with Ethyl acetate (2 mL), and distilled water (10 mL). The solution was extracted with Ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The filtrate was subjected to gas chromatography to identify which ester gives a higher yield. According to the results, electron-withdrawing esters can cleave the CO bond of an ester more easily than electron-donating esters.



Scheme S2. Intermolecular competition experiment

6. Time Optimization

Under the optimised conditions, the conversion of the ester to its corresponding amide began at half an hour through the amidation reaction but at a slow rate. After 5 h, the amidation yield increased up to 51%. The product had attained a conversion of 72% after 8 h. After 12 h, the yield remained constant at 95%. As a result, we set 12h as the reaction time for the succeeding reactions. As shown in Figure 1, the reactant 1a in blue decreases with an increase in 3a production in black and the byproduct phenol in red is similar to the production yield of 3a. Summarizing, the optimal condition to achieve the maximum yield of the reaction is at 110 °C with 3 mL water for a duration of 12 h.

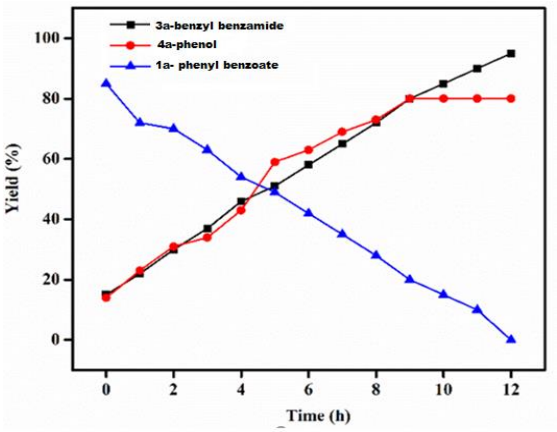
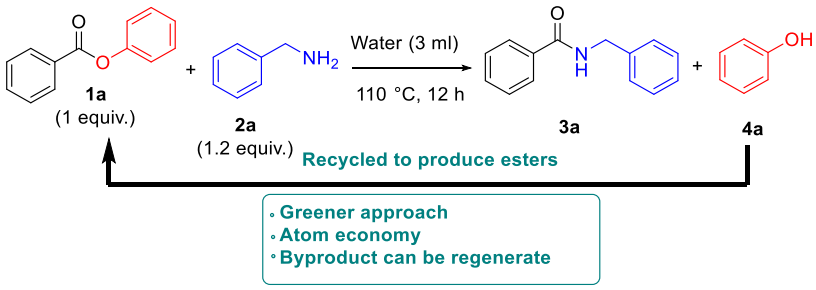


Figure 1. Time Optimization

7. Removal and recycling of side products

To prove the environment-friendly nature of the proposed methodology the corresponding side product phenol (4) was recovered purely with 60-70% yield. This could be used further in the preparation of ester derivatives (Scheme S3). The amount of phenol present in the bulk reaction has been detected by HPTLC instrumentation.



Scheme S3. Removal and recycling of side product

The recovery of phenol was done by the addition of benzylamine (0.303 mmol, 2a) and phenyl ester (0.252 mmol, 1a) into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (10 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. To that filtrate 2.5 molar of NaOH solution was added to convert phenol to sodium phenoxide. Under basic conditions, it was slowly neutralized with 5N acidic solution. Later, the crude product was checked by TLC (hexane: ethyl acetate) to confirm the presence of phenol, and it was further purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product (phenol) recovered purely with 70% yield (Figure S1).

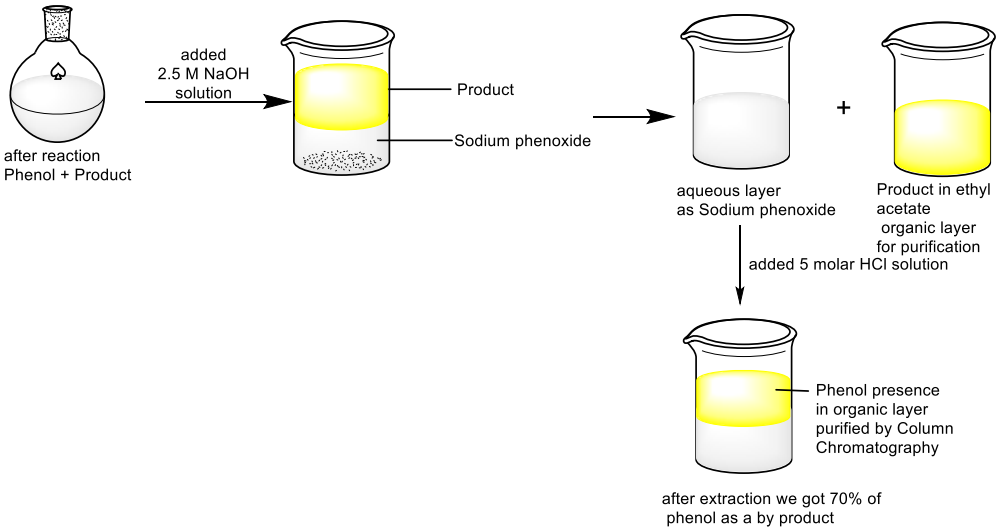


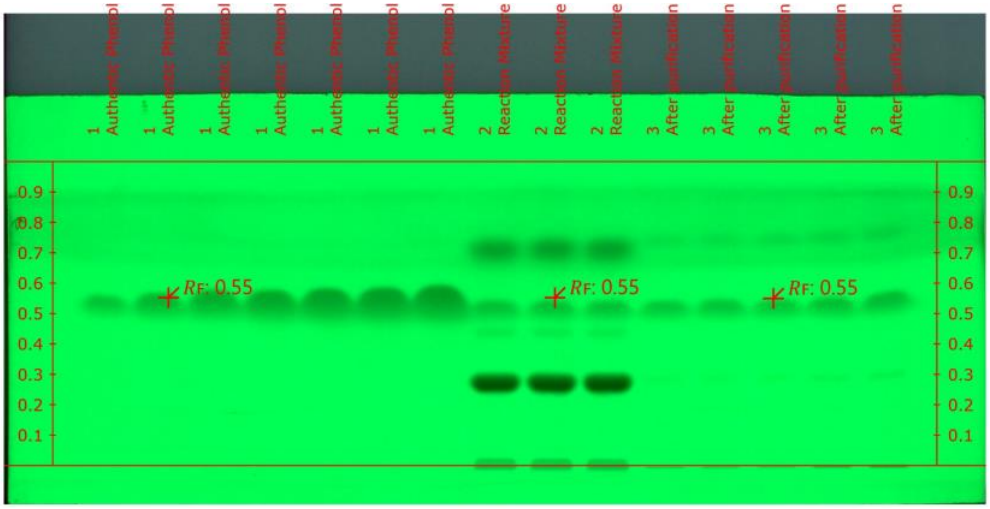
Figure S1. Recovery of Phenol

7.1 HPTLC Result

The diluted samples of the Reaction mixture (3 µl), phenol, and purified phenol after the reaction completion (4 µl,5µl) and the standard solution of commercially available phenol (1 µl to 7 µl) were sprayed as 8mm bands onto 200 × 100 mm silica gel plate, with semiautomatic TLC sampler Linomate 5 (S/N 260683), equipped with a 100 µl syringe. The application settings were 8mm from the lower edge, 20 mm initially from the left side, and the application speed was 200 nLs^{-1}. Then the plate was developed with automatic development chamber ADC 2, using hexane + ethyl acetate 16:4 (v/v) as the mobile phase. To realize standardized and repeatable separation conditions were developed for 1 min pre-drying, 20 min tank saturation time, 5 min humidity control, and 80 mm migration distance. After separation, the plate was dried at 50 °C for 5 min on a TLC plate for the removal of organic residues. After chromatography, the image of the separation result was documented on an HPTLC imaging system.

According to HPTLC data that the standard Phenol (1µl to 7 µl) Rf value is 0.551, 0.556.0.565, 0. 564, 0.568, 0.570, 0.576 and the reaction mixture sample (3 µl) Rf value is 0.554, 0.553, 0.557, finally the amount of phenol detected in the product which was purified (**4a**, 4 µl) Rf value is 0.553, 0.553, 0.557, 0.556, 0.554, 0.557. (Figure S2). All three sample exhibit nearly identical Rf and the standard phenol (7 µl) sample's end Rf value precisely matches the phenol present in the reaction mixture (3µl) end Rf value. Additionally, the beginning Rf values of Standard phenol (1µl and 2µl) and phenol detected in the reaction mixture (3µl) exactly equal the Rf value of phenol which confirms the amount of phenol (4a) detected in the reaction mixture was the same as the product (3a). However, the results of the HPTLC examination reveal that Phenol is present the same as the product. (Figure S3.).

From the report, fifteen different TLC mobile phase systems were evaluated to determine the most effective mobile phase for the analysis of the amount of phenol as a by-product. Retardation factors (RF) were recorded and the resolution was calculated for the whole reaction.



.

Figure S2. Y-axis denotes the RF value x-axis denotes mobile phases. Lanes 1 and 7: Commercially available phenol, lanes 8 to 10: reaction mixture, lanes 11 to 15: Purified phenol from the reaction mixture respectively.

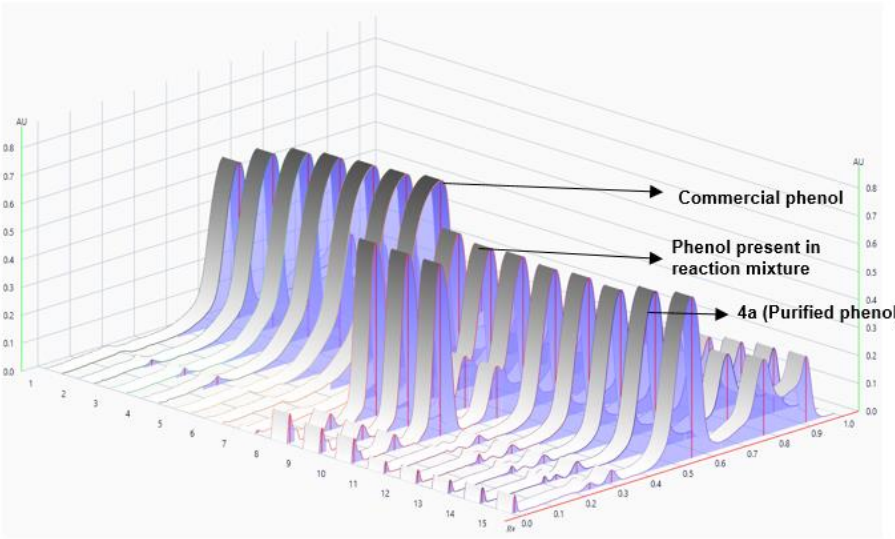
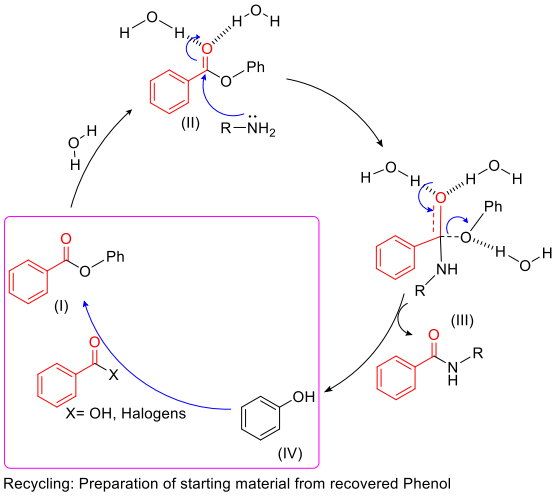


Figure S3: Pictograph of authentic phenol (commercial), reaction mixture, and purified phenol after the reaction completion.

7.2 Plausible Mechanism

Based on the results discussed above and earlier reports[22, 24], we propose a plausible mechanism for the direct amidation of esters in water as shown in Scheme 7.

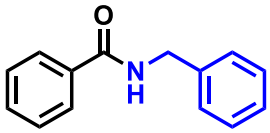


Scheme S4. Proposed Mechanism for the Cleavage of Phenyl Esters to Amides

Initially, the phenyl ester (I) involves in the hydrogen bonding interaction with water molecules thereby increasing the electrophilic nature of the carbonyl moiety of phenyl ester shown by intermediate (II). This in turn enhances the opportunity for amines to attack intermediate (II) generating intermediate (III) via a nucleophilic attack between ester and amines. Subsequently, the phenoxy group in intermediate (III) involve in hydrogen bonding interaction with water to give the desired amide product by retaining the carbon-oxygen double bond and releasing phenol (IV). The phenol moiety (IV) is then extracted via a simple extraction method, to be further used for the preparation of phenyl ester (I) through the coupling of the same with carboxylic acid or acyl halide.

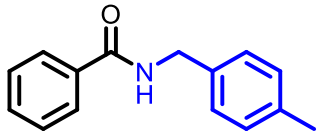
8. Characterization of the Products

3a (N-benzylbenzamide)[3]



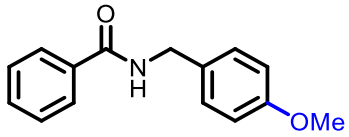
Benzylamine (0.505 mmol, 2a) and phenyl ester (0.252 mmol, 1a) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3a (45.4 mg, 95%) as a pale yellow solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.72 (d, *J* = 8.7 Hz, 2H), 7.41 (d, *J* = 7.1 Hz, 1H), 7.37 – 7.31 (m, 2H), 7.29 – 7.17 (m, 5H), 6.45 (s, 1H), 4.56 (d, *J* = 5.6 Hz, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 167.40, 138.19, 134.38, 131.56,128.80,128.60, 128.35, 127.92, 127.63, 126.98, 44.15.

3b (4-methylbenzyl benzamide)[4]



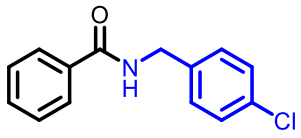
4- Methyl benzylamine (0.303 mmol, 2b) and phenyl ester (0.252 mmol, 1b) were added into a 25ml vial with a screwcap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monotored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3b (45mg, 76%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.74 – 7.66 (m, 2H), 7.42 (td, *J* = 7.3, 1.5 Hz, 1H), 7.39 – 7.30 (m, 2H), 7.17 (d, *J* = 7.7 Hz, 2H), 7.08 (d, *J* = 7.7 Hz, 2H), 6.35 (s, 1H), 4.52 (d, *J* = 5.6 Hz, 2H), 2.27 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.32, 137.38, 135.13, 134.46, 131.51, 129.46, 128.58, 127.96, 126.95, 43.95, 21.12.

3c (4- methoxy benzylbenzamide)[3]



4-Methoxy benzylamine (0.303 mmol, 2c) and phenyl ester (0.252 mmol, 1c) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monotored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3c (47mg, 89%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.73 – 7.67 (m, 2H), 7.41 (dd, J = 7.4, 1.4 Hz, 1H), 7.35 (dd, J = 7.9, 1.9 Hz, 2H), 7.24 – 7.17 (m, 2H), 6.81 (d, J = 8.6 Hz, 2H), 6.34 (s, 1H), 4.50 (d, J = 5.6 Hz, 2H), 3.73 (s, 3H).**^{13}CNMR (101MHz, $CDCl_3$)** δ 167.35, 159.15, 134.44, 131.53, 130.24, 129.33, 128.59, 126.96, 114.19, 55.26, 43.68.

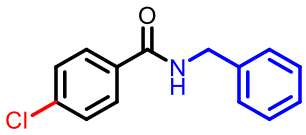
3d (4- chloro benzyl benzamide)[3]



4- chloro benzylamine (0.303 mmol, 2d) and phenyl ester (0.252 mmol, 1d) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monotored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution

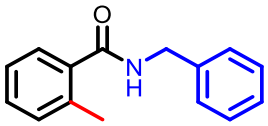
was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3d (45 mg, 84%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-d) δ** 7.77 – 7.66 (m, 2H), 7.43 (dd, J = 7.3, 1.4 Hz, 1H), 7.37 (td, J = 7.4, 1.4 Hz, 2H), 7.27 – 7.17 (m, 4H), 6.41 (s, 1H), 4.54 (d, J = 5.8 Hz, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.40, 136.77, 134.17, 133.45, 131.71, 129.23, 128.91, 128.66, 126.94, 43.41.

3e (N-benzyl-4-chlorobenzamide)[5]



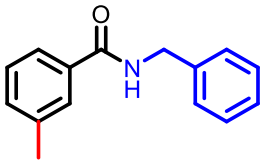
Benzylamine (0.3223 mmol, 2e) and 4- chloro phenyl benzoate (0.2149 mmol, 1e) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3e (49.6 mg, 94%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.70 – 7.61 (m, 2H), 7.36 – 7.19 (m, 7H), 6.31 (s, 1H), 4.56 (d, *J* = 5.6 Hz, 2H) **^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.28, 137.92, 137.84, 132.74, 128.87, 128.40, 127.97, 44.27.

3f (N-benzyl-4-methylbenzamide)[6]



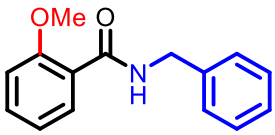
Benzylamine (0.3533 mmol, 2f) and 4- methyl phenyl benzoate (0.2355 mmol, 1f) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3f (49 mg, 94%) as a white solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.34 – 7.19 (m, 5H), 7.21 – 7.07 (m, 4H), 5.98 (s, 1H), 4.56 (dd, *J* = 5.8, 1.1 Hz, 2H), 2.40 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.93, 138.16, 136.23, 136.19, 131.07, 129.97, 128.81, 127.86, 127.64, 126.65, 125.75, 43.96, 19.86.

3g (N-benzyl-3-methylbenzamide)[7]



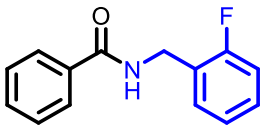
Benzylamine (0.3533 mmol, 2g) and 3-methyl phenyl ester (0.2355 mmol, 1g) was added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3g (49.6 mg, 94%) as a white solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.54 – 7.45 (m, 2H), 7.29 – 7.16 (m, 7H), 6.42 (s, 1H), 4.56 (d, *J* = 5.6 Hz, 2H), 2.30 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.66, 138.48, 138.22, 134.32, 132.32, 128.79, 128.48, 127.93, 127.74, 127.62, 123.94, 44.14, 21.35.

3h (N-benzyl-2-methoxybenzamide)[7]



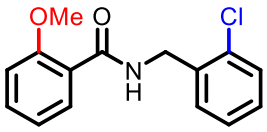
Benzylamine (0.3223 mmol, 2h and 2- methoxy phenyl ester (0.2149 mmol, 1h) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3h (39 mg, 73%) as a white solid. **NMR (400 MHz, Chloroform-*d*)** δ 8.18 (dt, *J* = 7.8, 1.4 Hz, 1H), 7.39 -7.18 (m, 7H), 7.02 (t, *J* = 7.6 Hz, 1H), 6.90 (d, *J* = 8.3 Hz, 2H), 4.62 (d, *J* = 5.6 Hz, 2H), 3.84 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 164.33, 156.48, 137.76, 131.81, 131.42, 127.62, 126.48, 126.21, 120.37, 120.34, 110.29, 54.92, 42.74.

3i (2- fluro benzylbenzamide)[3]



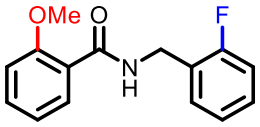
2- Fluoro benzylamine (0.303 mmol, 2i and phenyl ester (0.2525 mmol, 1i) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3i (22.54 mg, 39%) as, a brown solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.71 (d, *J* = 7.5 Hz, 2H), 7.55 – 7.48 (m, 3H), 7.44 – 7.32 (m, 3H), 7.07 – 6.95 (m, 2H), 4.61 (s, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.51, 159.90, 134.23, 131.61, 130.42 (d, *J* = 4.0 Hz), 128.49 (d, *J* = 18.3 Hz), 127.00, 125.16 (d, *J* = 14.8 Hz), 124.39 (d, *J* = 3.6 Hz), 115.52, 115.31, 38.13 (d, *J* = 3.7 Hz).

3j (N-(2-chlorobenzyl)-2-methoxybenzamide)[8]



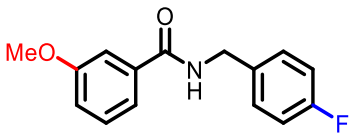
2- Chloro benzylamine (0.3223 mmol, 2j) and 2- methoxy phenyl ester (0.2149 mmol, 1j were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3j (45 mg, 79%) as, a white solid. **^{1}H NMR (400 MHz, Chloroform-d)** δ 8.51 (t, J = 5.9 Hz, 1H), 8.25 (dt, J = 7.9, 1.6 Hz, 1H), 7.54 – 7.42 (m, 2H), 7.40 (dt, J = 7.1, 1.7 Hz, 1H), 7.26 (ddd, J = 10.6, 7.3, 1.5 Hz, 2H), 7.15 – 7.05 (m, 1H), 6.99 (d, J = 8.3 Hz, 1H), 4.77 (dd, J = 6.1, 1.3 Hz, 2H), 3.98 (t, J = 1.8 Hz, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 165.29, 157.56, 136.22, 133.63, 132.90, 132.39, 130.17, 129.44, 128.70, 127.08, 121.34, 121.30, 111.35, 56.00, 41.74.

3k (N-(2-flurobenzyl)-2-methoxybenzamide)[8]



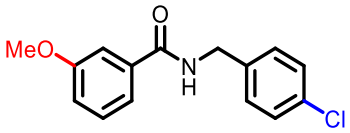
2- Fluro benzylamine (0.3223 mmol, 2k) and 2- methoxy phenyl ester (0.2149 mmol, 1k) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3k (49 mg, 96%) as, brown liquid. **^{1}H NMR** (400 MHz, **Chloroform-d)** δ 8.27 (d, J = 6.0 Hz, 1H), 8.13 (dt, J = 7.8, 1.5 Hz, 1H), 7.33 (ddq, J = 9.4, 4.0, 2.0 Hz, 2H), 7.15 (dt, J = 8.9, 5.8 Hz, 1H), 6.98 (ddd, J = 15.1, 12.1, 7.7 Hz, 3H), 6.86 (d, J = 8.3 Hz, 1H), 4.63 (d, J = 5.9 Hz, 2H), 3.83 (d, J = 1.4 Hz, 3H)**^{13}C NMR (101 MHz, $CDCl_3$)** δ 165.39, 159.86, 157.55, 132.91, 132.34, 130.04 (d, J = 4.5 Hz), 129.00 (d, J = 8.2 Hz), 125.76 (d, J = 14.7 Hz), 124.27 (d, J = 3.6 Hz), 121.30 (d, J = 3.2 Hz), 115.37, 115.16, 111.39, 55.97, 37.80 (d, J = 3.9 Hz).

[3l] (N-(4-flurobenzyl)-3-methoxybenzamide)



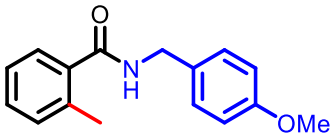
2- Fluro benzylamine (0.3223 mmol, 2l) and 3- methoxy phenyl ester (0.2149 mmol, 1l) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3l (39 mg, 77%) as, brown liquid. **^{1}H NMR (400 MHz, Chloroform-d)** δ 7.29 (d, J = 2.4 Hz, 1H), 7.25 – 7.14 (m, 4H), 6.91 (dqd, J = 10.6, 4.5, 1.7 Hz, 3H), 6.77 (s, 1H), 4.47 (t, J = 4.9 Hz, 2H), 3.71 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.34, 161.00, 159.85, 135.69, 134.03 (d, *J* = 3.1 Hz), 129.60, 118.72 (d, *J* = 1.5 Hz), 117.79, 115.66, 115.45, 112.47, 55.43, 43.38. HRMS (ES) m/z calculated for $C_{15}H_{14}FNO_2$ (M+ H^+) found 260.0971.

3m (N-(4-chlorobenzyl)-3-methoxybenzamide)[9]



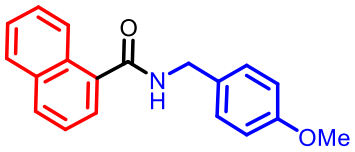
4- chloro benzylamine (0.3223 mmol, 2m) and 3- methoxy phenyl ester (0.2149 mmol, 1m) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3m (44 mg, 72%) as, a white solid. **^{1}H NMR (400 MHz, Chloroform-d)** δ 7.30 – 7.16 (m, 7H), 6.97 (dd, J = 7.3, 1.8 Hz, 1H), 6.46 (s, 1H), 4.52 (dd, J = 5.9, 1.7 Hz, 2H), 3.76 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.29, 159.91, 136.74, 135.63, 133.41, 129.63, 129.20, 128.89, 118.63, 117.88, 112.45, 55.46, 43.42.

3n (N-(4-methoxybenzyl)-2-methylbenzamide)[10]



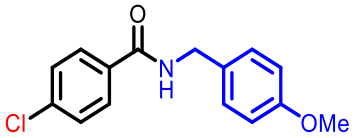
4- methoxy benzylamine (0.3223 mmol, 2n) and 2- methoxy phenyl ester (0.2149 mmol, 1n) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3n (35 mg, 55%) as, a brown solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.28 (d, *J* = 7.6 Hz, 1H), 7.25 – 7.18 (m, 2H), 7.22 – 7.07 (m, 3H), 6.85 – 6.77 (m, 2H), 5.96 (s, 1H), 4.48 (d, *J* = 5.6 Hz, 2H), 3.73 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.87, 159.12, 136.30, 136.13, 131.03, 130.26, 129.91, 129.23, 126.65, 126.66, 125.72, 114.18, 55.32, 43.44, 19.84.

3o (N-(4-methoxybenzyl)-2-naphthamide)[11]



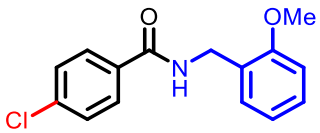
2- methoxy benzylamine (0.2418 mmol, 2o) and 1- naphthyl phenyl ester (0.2015 mmol, 1o) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3o (28 mg, 57%) as, an orange solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.27 (d, *J* = 8.1 Hz, 1H), 7.88 – 7.76 (m, 2H), 7.58 – 7.33 (m, 3H), 7.30 – 7.23 (m, 1H), 7.19 (d, *J* = 1.1 Hz, 2H), 6.84 (dd, *J* = 8.3, 1.4 Hz, 2H), 6.16 (s, 1H), 4.61 (d, *J* = 5.6 Hz, 2H), 3.74 (d, *J* = 1.2 Hz, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.33, 159.18, 134.39, 133.71, 130.69, 130.14, 129.30, 128.32, 127.17, 126.45, 125.41, 124.90, 124.69, 114.24, 55.34, 43.69.

3p (4-chloro-N-(4-methoxybenzyl) benzamide)[12]



4-methoxy benzylamine (0.3223 mmol, 2p) and 4- chloro phenyl ester (0.2149 mmol, 1p) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3p (33 mg, 55%) as a Pale brown solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.64 (dd, *J* = 8.4, 1.2 Hz, 2H), 7.36 – 7.28 (m, 2H), 7.20 (d, *J* = 7.7 Hz, 2H), 6.86 – 6.78 (m, 2H), 6.24 (s, 1H), 4.49 (d, *J* = 5.5 Hz, 2H), 3.70 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.17, 159.23, 137.75, 132.81, 129.98, 129.37, 128.83, 128.38, 114.23, 55.34, 43.77.

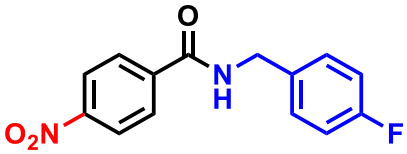
[3q] (4-chloro-N-(2-methoxybenzyl) benzamide)



2 -methoxy benzylamine (0.3223 mmol, 2q) and 4- chloro phenyl ester (0.2149 mmol, 1q) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to

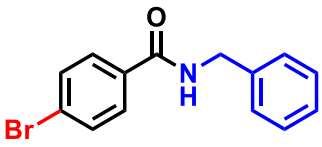
obtain the desired product 3q (29 mg, 49%) as a white solid melting point :118 °C. **^{1}H NMR (400 MHz, Chloroform-d)** δ 7.64 – 7.59 (m, 2H), 7.34 – 7.21 (m, 4H), 6.92 – 6.80 (m, 2H), 6.55 (s, 1H), 4.56 (d, J = 5.8 Hz, 2H), 3.82 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.06, 157.67, 137.53, 133.18, 130.11, 129.14, 128.76, 128.38, 125.91, 120.86, 110.46, 55.45, 40.21. **HRMS** (ES) m/z calculated for $C_{15}H_{14}ClNO_2$ (M+ Na^+) found 298.0483. **FT-IR** 3307 –N-H stretching vibrating, 3080 –C-H stretching vibrating(aromatic), 2925 – C-H stretching vibrating(alkyl), 2834 –N-H stretching (amide), 1634 –C=O stretching vibration, 1545 –C-N stretching vibration, 1479 – C=C aromatic stretching, 1226 – C-O stretching vibration, 1088 –C-O symmetric, 835- C-O stretching vibration, 754 –C-H out plane bending, 656- other ring C-H vibration, 525 –C-Cl in plane bending.

3r (N-(4-fluorobenzyl)-4-nitrobenzamide)[13]



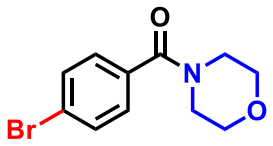
4-fluro benzylamine (0.2466 mmol, 2r) and 4-nitro phenyl ester (0.2055 mmol, 1r) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3r (42.34 mg, 73%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.25 – 8.18 (m, 2H), 7.92 – 7.84 (m, 2H), 7.27 (dd, *J* = 8.4, 5.4 Hz, 2H), 6.99 (t, *J* = 8.6 Hz, 2H), 6.44 (d, *J* = 7.5 Hz, 1H), 4.56 (d, *J* = 5.7 Hz, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 13C NMR (101 MHz, Chloroform-d) δ 165.32, 163.64, 149.69, 139.77, 133.29 (d, J = 3.3 Hz), 129.76 (d, J = 8.1 Hz), 128.18, 123.88, 115.82 (d, J = 21.6 Hz), 43.75.

3s (N-benzyl-4-bromobenzamide)[14]



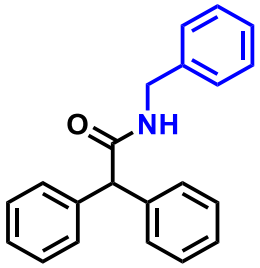
Benzylamine (0.3608 mmol, 2s) and 4- bromo phenyl ester (0.1805 mmol, 1s) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3s (55.7mg, 94%) as a Cream white, Solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.58 (s, 2H), 7.50 (s, 2H), 7.28 (s, 5H), 6.31 (s, 1H), 4.56 (d, *J* = 5.6 Hz, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.35, 137.88, 133.18, 131.85, 128.87, 128.58, 127.98, 127.78, 126.27, 44.27.

3t ((4-bromophenyl)(morpholino)methanone)[15]



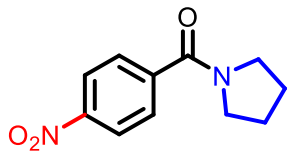
Morpholine (0.3608 mmol, 2t) and 4- bromo phenyl ester (0.1805 mmol, 1t) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3t (43 mg, 89%) as a white, Solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.44 (d, *J* = 8.4 Hz, 2H), 7.19 (d, *J* = 8.4 Hz, 2H), 3.73 – 3.22 (m, 8H).**^{13}C NMR (101 MHz, Chloroform-*d*)** δ 190.14, 131.09, 130.88, 130.61, 130.44, 127.82,57.03, 54.59, 17.19.

3u (N-benzyl-2,2-diphenylacetamide)[16]



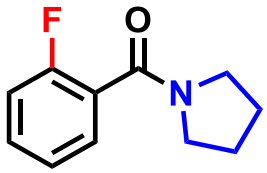
Benzylamine (0.3468 mmol, 2u) and triphenyl benzoate (0.1734 mmol, 1u) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3u (26 mg, 48%) as a Pale White. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.25 – 7.14 (m, 15H), 5.83 (s, 1H), 4.89 (s, 1H), 4.41 (d, *J* = 5.7 Hz, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 171.76, 139.33, 138.10, 128.91, 128.80, 128.69, 127.62, 127.50, 127.32, 59.23, 43.84.

3w ((4-nitrophenyl)(pyrrolidin-1-yl)methanone)[17]



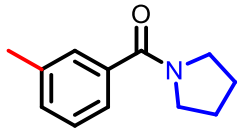
Pyrrolidine (0.2466 mmol, 2w) and 4-nitro phenyl ester (0.2055 mmol, 1w) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3w (35 mg, 78%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-d) δ** 8.20 (d, J = 8.7 Hz, 2H), 7.61 (d, J = 8.7 Hz, 3H), 3.60 (s, 2H), 3.31 (s, 2H), 1.99 – 1.80 (m, 4H)**.^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.40, 148.44, 143.12, 128.13, 123.69, 49.45, 26.38.

3x ((2-fluorophenyl)(pyrrolidin-1-yl)methanone)[18]



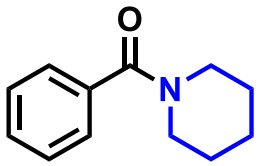
Pyrrolidine (0.2775 mmol, 2x) and 2- fluoro phenyl ester (0.2312 mmol, 1x) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3x (40.5 mg, 91%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.32 (dtd, *J* = 13.7, 8.3, 7.6, 3.8 Hz, 2H), 7.11 (t, *J* = 7.5 Hz, 1H), 7.06 – 6.97 (m, 1H), 3.60 (t, *J* = 7.0 Hz, 2H), 3.24 (t, *J* = 6.7 Hz, 2H), 1.92 – 1.75 (m, 4H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 165.15, 159.51, 131.16 (d, *J* = 8.1 Hz), 128.88 (d, *J* = 4.0 Hz), 125.72 (d, *J* = 17.9 Hz), 124.49 (d, *J* = 3.3 Hz), 115.98, 115.77, 47.85 (d, *J* = 3.8 Hz), 45.85, 24.50.

3y ((3-methylphenyl)(pyrrolidin-1-yl)methanone)[19]



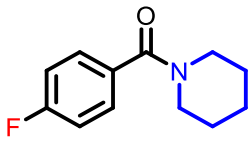
Pyrrolidine (0.2826 mmol, 2y) and 3-methyl phenyl ester (0.2355 mmol, 1y) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3y (43 mg, 94%) as a brown liquid.**^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.25 (s, 1H), 7.20 (q, *J* = 7.2 Hz, 2H), 7.14 (dd, *J* = 6.4, 2.0 Hz, 1H), 3.57 (t, *J* = 7.0 Hz, 2H), 3.34 (t, *J* = 6.6 Hz, 2H), 1.89-1.84 (s, 3H) 1.81-1.76 (m, 4H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.14, 138.06, 136.94, 130.55, 128.08, 127.70, 124.01, 49.68, 46.21, 26.33, 24.46, 21.35.

3z (phenyl(piperidin-1-yl) methanone)[16]



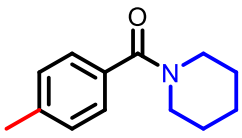
Piperidine (0.303 mmol, 2z) and phenyl benzoate (0.2525 mmol, 1z) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3z (26 mg, 48%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.20 (s, 5H), 3.64 (s, 2H), 3.26 (s, 2H), 1.64 (s, 4H), 1.44 (s, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.34, 136.47, 129.35, 128.40, 126.78, 48.76, 43.15, 29.70, 26.54, 24.60.

3aa ((4-fluorophenyl)(piperidin-1-yl)methanone)[20]



Piperidine (0.2777 mmol, 2aa) and 4-fluro phenyl benzoate (0.2314 mmol, 1aa) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3aa (28 mg, 59%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.34 (dd, J = 8.3, 5.4 Hz, 2H), 7.04 (t, J = 8.5 Hz, 2H), 3.62 (s, 2H), 3.28 (s, 2H), 1.61 (t, J = 5.3 Hz, 4H), 1.26 (s, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.48, 160.57, 132.47 (d, *J* = 3.4 Hz), 129.08 (d, *J* = 8.4 Hz), 113.65, 55.32, 29.70, 24.62.

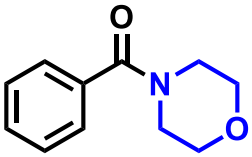
3ab ((4-methylphenyl) (piperidin-1-yl) methanone)[21]



Piperidine (0.2578 mmol, 2ab) and 4-methyl phenyl benzoate (0.2149 mmol, 1ab) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous

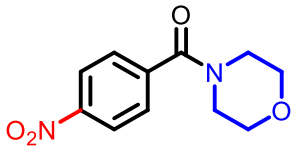
sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ab (47 mg, 98%) as a brown liquid**. ^{1}H NMR (400 MHz, Chloroform-d) δ** 7.30 (d, J = 8.7 Hz, 2H), 6.83 (d, J = 8.7 Hz, 2H), 3.76 (s, 3H), 3.45 (d, J = 62.7 Hz, 4H), 1.65 – 1.52 (m, 6H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.33, 160.54, 128.86, 128.61, 113.63, 55.33, 29.70, 26.50, 24.66.

3ac (morpholino(phenyl)methanone)[22]



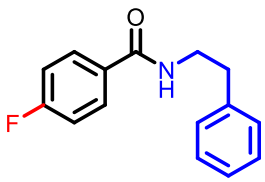
Morpholine (0.303 mmol, 2ac) and phenyl benzoate (0.252 mmol, 1ac) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ac (27 mg, 48%) as a yellow liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.34 (m, 5H), 3.68- 3.38 (m, 8H)· **^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.48, 135.30, 129.90, 128.56, 127.09, 66.93, 48.25.

3ad (2- nitro morpholino(phenyl)methanone)[22]



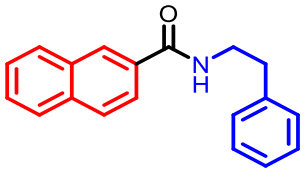
Morpholine (0.2466 mmol, 2ad) and 4-nitro phenyl benzoate (0.2052 mmol, 1ad) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ad (14 mg, 27%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.23 (d, J = 8.3 Hz, 2H), 7.52 (d, J = 8.2 Hz, 2H), 3.83 – 3.20 (m, 8H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.20, 148.68 (d, *J* = 2.3 Hz), 141.35, 128.15 (d, *J* = 19.1 Hz), 124.67, 66.74, 48.07.

3ae (4-fluoro-N-phenethylbenzamide)[23]



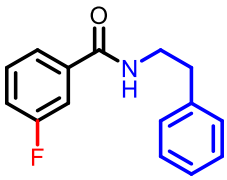
2-phenyl ethane-1-amine (0.303 mmol, 2ae) and 4-fluro phenyl benzoate (0.2312 mmol, 1ae) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ae (35 mg, 63%) as a brown, solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.66 – 7.58 (m, 2H), 7.26 (t, J = 7.3 Hz, 2H), 7.22 – 7.13 (m, 3H), 7.01 (t, J = 8.4 Hz, 2H), 6.01 (s, 1H), 3.64 (q, J = 6.6 Hz, 2H), 2.86 (t, J = 6.9 Hz, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.42, 165.93, 138.82, 130.82 (d, *J* = 3.1 Hz), 129.10 (d, *J* = 8.9 Hz), 128.78 (d, *J* = 4.8 Hz), 126.66, 115.69, 115.48, 41.18, 35.67.

3af (N-phenethyl-2-naphthamide)[24]



2-phenyl ethane-1-amine (0.2418 mmol, 2af) and 2-naphthyl phenyl benzoate (0.2015 mmol, 1af) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3af (35 mg, 63%) as a brown solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.13 (d, *J* = 1.6 Hz, 1H), 7.79 (ddd, *J* = 9.1, 7.2, 2.5 Hz, 3H), 7.68 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.53 –7.40 (m, 2H), 7.31 – 7.14 (m, 5H), 6.27 (t, *J* = 5.9 Hz, 1H), 3.70 (q, *J* = 6.6 Hz, 2H), 2.91 (t, *J* = 6.9 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.59, 138.95, 134.71, 132.61, 131.85, 128.91, 128.75, 128.48, 127.75, 127.63, 126.75, 126.64, 123.48, 41.30, 35.77.

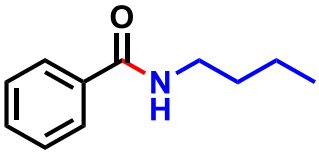
3ag (N-phenethyl-2-naphthamide)[25]



2-phenyl ethane-1-amine (0.2775 mmol, 2ag) and 3-fluro phenyl benzoate (0.2312 mmol, 1ag) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ag (45 mg, 80%) as a brown solid. **^{1}H NMR (400 MHz, Chloroform-d)** δ 7.36-7.20 (m, 5H), 7.17-7.12 (m, 3H), 7.10-7.05 (m, 1H), 6.13 (s, 1H), 3.64 (d, J = 6.0 Hz, 2H), 2.86 (s, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ

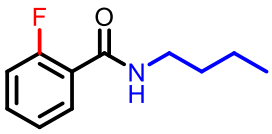
166.23 (d, *J* = 2.5 Hz), 163.98, 138.73, 136.92 (d, *J* = 6.7 Hz), 130.23 (d, *J* = 7.9 Hz), 128.78 (d, *J* = 2.8 Hz), 126.69, 122.24 (d, *J* = 3.1 Hz), 118.53, 118.32, 114.41, 114.18, 41.24, 35.61.

3ah (N-butylbenzamide)[26]



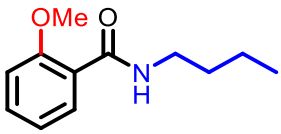
Butylamine(0.303 mmol, 2ah) and phenyl benzoate (0.252 mmol, 1ah) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ah (36 mg, 38%) as a yellow liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.72 – 7.65 (m, 2H), 7.44 – 7.35 (m, 1H), 7.37 – 7.28 (m, 2H), 6.29 (s, 1H), 3.36 (td, *J* = 7.2, 5.7 Hz, 2H), 1.58 – 1.45 (m, 2H), 1.33 (dt, *J* = 14.9, 7.3 Hz, 2H), 1.25 – 1.16 (m, 3H) **^{13}C NMR (101 MHz, $CDCl_3$)** δ 13C NMR (101 MHz, Chloroform-d) δ 166.35, 147.39, 142.13, 127.11, 122.66, 122.66, 48.42, 45.36, 25.36, 23.34.

3ai (N-butyl-2-fluorobenzamide)[22]



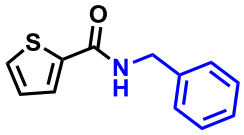
Butylamine (0.2775 mmol, 2ai) and 2-fluro phenyl benzoate (0.2312 mmol, 1ai) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ai (39 mg, 85%) as a yellow liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.00 (td, *J* = 7.9, 1.8 Hz, 1H), 7.37 (td, *J* = 7.4, 3.6 Hz, 1H), 7.21 – 7.10 (m, 1H), 7.07 – 6.97 (m, 1H), 6.79 (S, 1H), 3.41 (qd, *J* = 6.3, 5.6, 1.3 Hz, 2H), 1.58 – 1.49 (m, 2H), 1.33 (dt, *J* = 14.6, 7.4 Hz, 2H), 1.18 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.36, 147.41, 142.14, 127.12, 122.67, 48.42, 45.35, 25.36, 23.34

3aj (N-butyl-2-methoxybenzamide)[22]



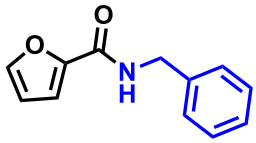
Butylamine (0.2628 mmol, 2aj) and 2-methoxy phenyl benzoate (0.2190 mmol, 1aj) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3aj (44 mg, 95%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.13 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.81 (s, 1H), 7.35 (td, *J* = 8.3, 7.9, 1.8 Hz, 1H), 7.00 (d, *J* = 7.7 Hz, 1H), 6.89 (d, *J* = 8.3 Hz, 1H), 3.88 (d, *J* = 1.0 Hz, 3H), 3.41 (d, *J* = 1.1 Hz, 2H), 1.57 – 1.48 (m, 2H), 1.40 – 1.29 (m, 2H), 0.89 (t, *J* = 7.3 Hz, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 165.33, 157.41, 132.60, 132.23, 121.65, 121.31, 111.30, 55.94, 39.51, 31.63, 20.26, 13.81.

3ak (N-benzylthiophene-2-carboxamide)[14]



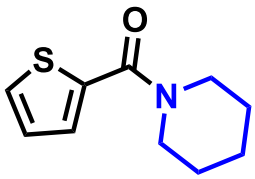
Benzylamine (0.2937 mmol, 2ak) and phenyl thiophene-2-carboxylate (0.2448 mmol, 1ak) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ak (46.5 mg, 87%) as an orange solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.45 – 7.38 (m, 2H), 7.32 – 7.17 (m, 5H), 7.00 (d, J = 4.1 Hz, 1H), 6.20 (s, 1H), 4.56 (s, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 161.73, 138.00, 130.02, 128.82, 128.14, 127.98, 127.71, 127.64, 44.05.

3al (N-benzylfuran-2-carboxamide)[14]



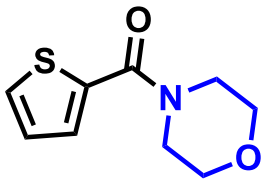
Benzylamine (0.3256 mmol, 2al) and phenyl furan-2-carboxylate (0.2713 mmol, 1al) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product3al (47.4 mg, 88%) as a pale brown.**^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.34 (d, J = 2.5 Hz, 1H), 7.30 – 7.17 (m, 5H), 7.08 (d, J = 3.2 Hz, 1H), 6.60 (s, 1H), 6.43 (d, J = 1.9 Hz, 1H), 4.55 (dd, J = 5.6, 2.5 Hz, 2H).**^{13}C NMR (101 MHz, Chloroform-*d*)** δ 158.28, 147.87, 143.91, 137.99, 128.78, 127.92, 127.65, 114.45, 112.20, 43.18.

3am (piperidine-1-yl(thiophen-2-yl) methanone)[27]



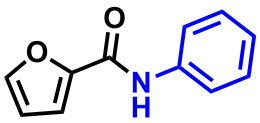
Piperidine (0.2937 mmol, 2am) and phenyl thiophene-2-carboxylate (0.2448 mmol, 1am) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3am (23.25 mg, 44%) as a dark brown liquid. **^{1}H NMR (400 MHz, Chloroform-d)** δ 7.35 (d, J = 4.9 Hz, 1H), 7.19 (d, J = 3.8 Hz, 1H), 6.96 (d, J = 4.2 Hz, 1H), 3.59 (d, J = 5.5 Hz, 4H), 1.62 – 1.53 (m, 6H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 172.31, 129.28, 127.69, 126.81, 126.48, 65.83, 36.01, 24.00

3an (morpholino(thiophen-2-yl) methanone)[15]



Morpholine (0.2937 mmol, 2an) and phenyl thiophene-2-carboxylate (0.2448 mmol, 1an) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3an (21 mg, 56%) as a mustard liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.49 (dd, *J* = 5.0, 1.1 Hz, 1H), 7.32 (dd, *J* = 3.7, 1.2 Hz, 1H), 7.08 (dd, *J* = 5.0, 3.7 Hz, 1H), 3.81 – 3.74 (m, 8H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 162.70, 135.49, 127.98, 127.85, 125.73, 65.85,28.68.

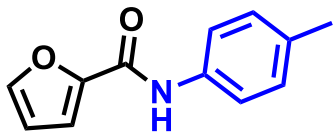
3ao (N-phenylfuran-2-carboxamide)[28]



Aniline (0.5426 mmol, 2ao) and phenyl furan-2-carboxylate (0.2713 mmol, 1ao) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ao (27 mg, 54%) as a dark brown solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.01 (s, 1H),

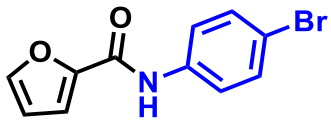
7.62 – 7.54 (m, 2H), 7.45 (s, 1H), 7.30 (s, 2H), 7.18 (d, J = 4.0 Hz, 1H), 7.08 (t, J = 7.7 Hz, 1H), 6.49 (d, J = 2.5 Hz, 1H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 156.06, 147.82, 144.16, 137.36, 129.13, 124.54, 119.91, 115.30, 112.66.

3ap (N-(p-tolyl) furan-2-carboxamide)[29]



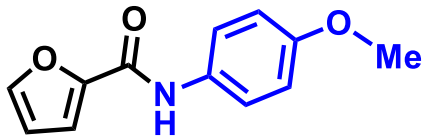
4- methyl aniline (0.5426 mmol, 2ap) and phenyl furan-2-carboxylate (0.2713 mmol, 1ap) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ap (20 mg, 30%) as a brown solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.98 (s, 1H), 7.49 – 7.38 (m, 3H), 7.17 – 7.04 (m, 3H), 6.47 (t, J = 2.2 Hz, 1H), 2.25 (s, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 156.05, 147.93, 147.15, 144.08, 134.80, 134.19, 129.60, 120.00, 115.08, 112.57, 20.91.

3aq (N-(4-bromophenyl) furan-2-carboxamide)[30]



4- bromo aniline (0.5426 mmol, 2aq) and phenyl furan-2-carboxylate (0.2713 mmol, 1aq) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3aq (24.47 mg, 40%) as a white liquid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.97 (s, 1H), 7.56 – 7.51 (m, 2H), 7.45 (d, *J* = 2.6 Hz, 1H), 7.19 (t, *J* = 3.8 Hz, 2H), 7.03 – 6.94 (m, 2H), 6.50 (s, 1H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 160.73, 147.63, 144.23, 121.74, 121.67, 115.92, 115.69, 115.41, 112.69.

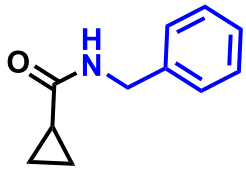
3ar (N-(4-methoxyphenyl) furan-2-carboxamide)[31]



4- methoxy aniline (0.5426 mmol, 2ar) and phenyl furan-2-carboxylate (0.2713 mmol, 1ar) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to

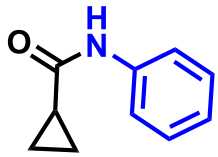
obtain the desired product 3ar (30 mg, 51%) as a black solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.90 (s, 1H), 7.48 (dd, *J* = 9.0, 2.6 Hz, 2H), 7.44 (s, 1H), 7.16 (d, *J* = 3.2 Hz, 1H), 6.84 (dd, *J* = 8.9, 2.5 Hz, 2H), 6.49 (s, 1H), 3.74 (t, *J* = 1.9 Hz, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 191.12, 171.44, 164.69, 139.78, 134.35, 132.04, 129.83,129.75,117.58, 114.31,55.53.

3as (N-benzyl cyclopropane carboxamide)[19]



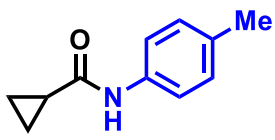
Benzylamine (0.6138 mmol, 2as) and phenyl cyclopropane carboxylate (0.3069 mmol, 1as) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3as (51.85 mg, 96%) as a white solid. **^{1}H NMR (400 MHz, Chloroform-d) δ** 7.30 – 7.19 (m, 5H), 5.84 (s, 1H), 4.39 (d, J = 5.7 Hz, 2H), 1.32 – 1.25 (m, 1H), 0.95 (dd, J = 4.5, 2.9 Hz, 2H), 0.72 – 0.63 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 173.41, 138.47, 128.71, 127.88, 127.50, 43.88, 14.81, 7.26.

3at (N-phenyl cyclopropane carboxamide)[32]



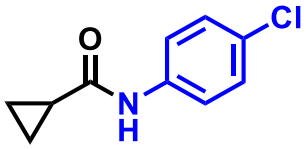
Aniline (0.6138 mmol, 2at) and phenyl cyclopropane carboxylate (0.3069 mmol, 1at) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3at (26mg, 42%) as a colorless liquid.**^{1} H NMR (400 MHz, Chloroform-d) δ** 7.56 – 7.50 (m, 2H), 7.48 (s, 1H), 7.33 (t, J = 7.7 Hz, 2H), 7.11 (s, 1H), 1.52 (d, J = 4.2 Hz, 1H), 1.11 (dd, J = 4.5, 2.9 Hz, 2H), 0.86 (dd, J = 7.7, 3.2 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 172.73, 138.46, 132.23, 128.74, 123.67, 119.92, 18.15, 7.68.

3au (N-(p-tolyl) cyclopropane carboxamide)[33]



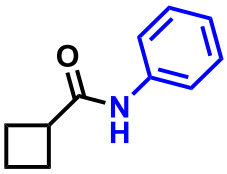
4-methyl aniline (0.6138 mmol, 2au) and phenyl cyclopropane carboxylate (0.3069 mmol, 1au) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3au (28 mg, 44%) as a yellow liquid.**^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.31 (d, *J* = 7.7 Hz, 3H), 7.03 (d, *J* = 7.9 Hz, 2H), 2.23 (s, 3H), 1.41 (tt, *J* = 8.5, 4.7 Hz, 1H),0.85 – 0.70 (m, 4H). **^{13}C NMR (101 MHz, Chloroform-d)** δ 190.05, 131.06,130.88,127.82, 113.35, 28.69,19.99,13.13.

3av (N-(4-chlorophenyl) cyclopropane carboxamide)[34]



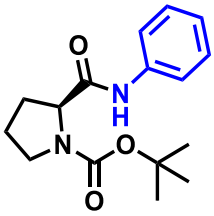
4- chloro aniline (0.6138 mmol, 2av) and phenyl cyclopropane carboxylate (0.3069 mmol, 1av) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3av (36.5 mg, 81%) as a dark brown solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.58 (s, 1H), 7.33 (dd, *J* = 8.2, 1.6 Hz, 1H), 7.28 – 7.17 (dd, *J* = 7.9, 1.6 Hz, 1H), 7.15 – 7.01 (dd, *J* = 8.2, 1.6 Hz, 1H), 6.99 (dd, *J* = 7.8, 1.7 Hz, 1H), 1.43 – 1.41 (m, 2H), 1.04 – 0.99 (m, 2H), 0.81 (dd, *J* = 7.8, 3.1 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 190.15, 163.73, 131.13, 128.93, 113.39, 113.27, 17.20, 13.13.

3aw (N-phenylcyclobutane carboxamide)[35]



Aniline (0.5674 mmol, 2aw) and phenyl cyclobutane carboxylate (0.2837 mmol, 1aw) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3aw (33.6 mg, 74%) as a black solid. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.45 (d, *J* = 7.5 Hz, 2H), 7.24 (t, *J* = 7.9 Hz, 2H), 7.03 (d, *J* = 7.3 Hz, 1H), 3.11 – .307 (m, 1H), 2.35 – 2.30 (m, 2H), 2.21 – 2.10 (m, 2H),2.02 – 1.77 (m, 2H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 173.25, 137.98, 128.99, 124.11, 119.66, 40.88, 25.32, 25.20, 18.05.

3ay (tert-butyl (S)-2-(phenyl carbamoyl) pyrrolidine-1-carboxylate)[1a]

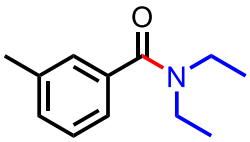


Aniline (0.6864 mmol, 2ay) and 1-(tert-butyl) 2-phenyl (S)-pyrrolidine-1,2-dicarboxylate (0.3432 mmol, 1ay) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3ay (32 mg, 52%) as a pale brown solid.

An HPLC analysis was carried out to determine the stereo-configuration of 1ay and 3ay according to the following procedure: Standard solution of 1ay and 3ay was prepared by dissolving 1 mg/ 1 mL of the same in 100 ml of mobile phase of 0.05% of DEA and 0.1% Acetic acid in *n*-Hexane: ethanol (85:15) ratio.

Enantiomeric excess of 1ay was established by HPLC analysis by using a Regis(S,S)-Whelk-01,Kromosil,250 X 4.6mm, 5.0 om column, ee > 99% (HPLC: 220 nm, n-hexane/ethanol = 85:15, flow rate 1.0 mL/min, 25°C, tR (major) = 5.10 min). Enantiomeric excess of 3ay was established by HPLC analysis by using a Regis(S,S)-Whelk-01,Kromosil,250 X 4.6mm, 5.0 om column, ee > 99% (HPLC: 220 nm, n-hexane/ethanol = 85:15, flow rate 1.0 mL/min, 25°C, tR (major) = 6.29 min). **^{1}H NMR (400 MHz, Chloroform-d)** δ 9.38 (s, 1H), 7.44 (d, J = 7.9 Hz, 2H), 7.23 (s, 2H), 7.01 (t, J = 7.4 Hz, 1H), 4.39 (s, 1H), 3.37 (s, 2H), 1.99 – 1.60 (m, 4H), 1.42 (s, 9H). **^{13}C NMR (101 MHz, Chloroform-d)** δ 190.00,131.04, 127.90,123.01,118.82, 79.93, 57.15, 46.21, 28.68, 27.36, 17.29.

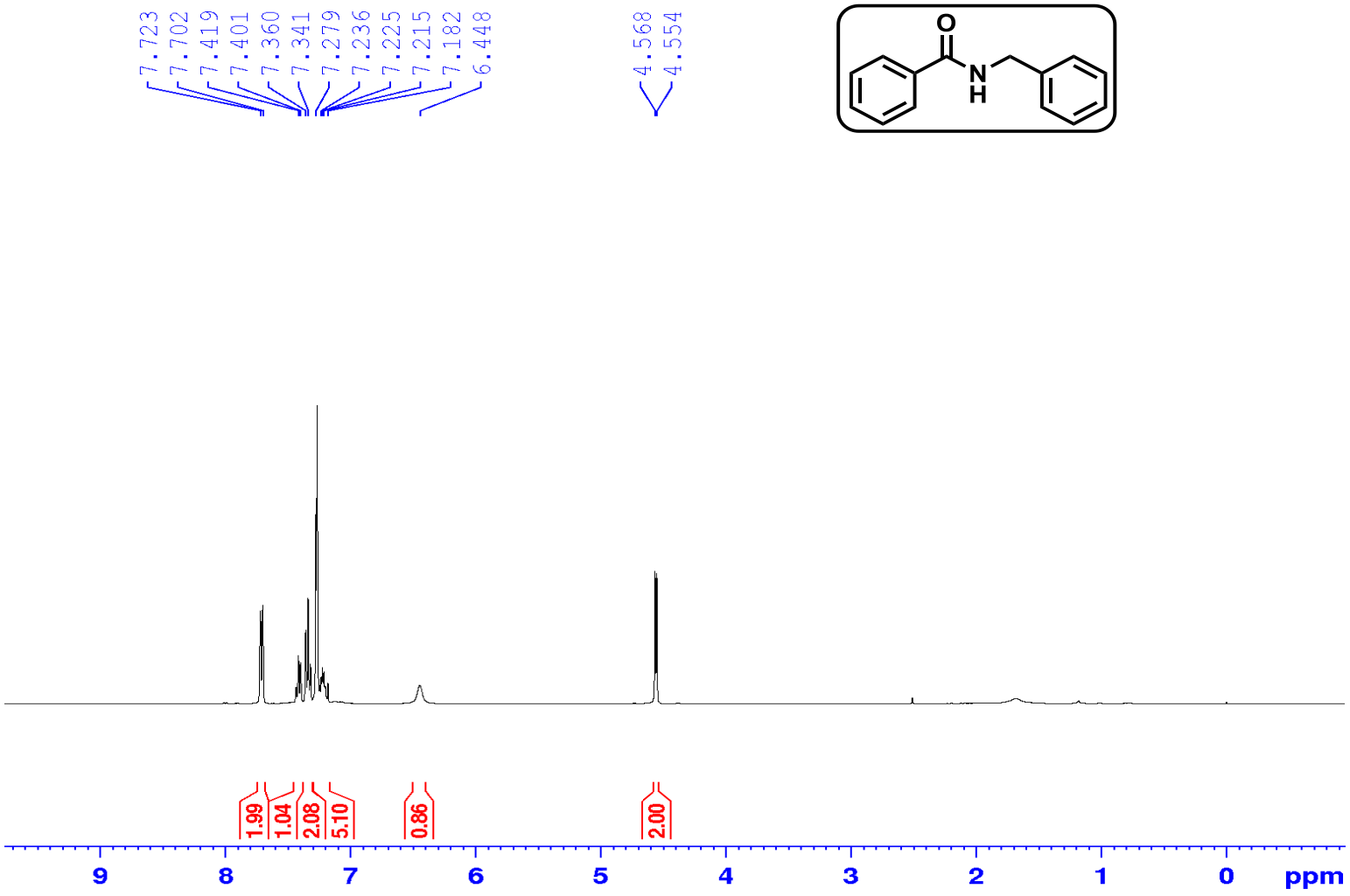
3az (N,N-diethyl-3-methylbenzamide)[36]



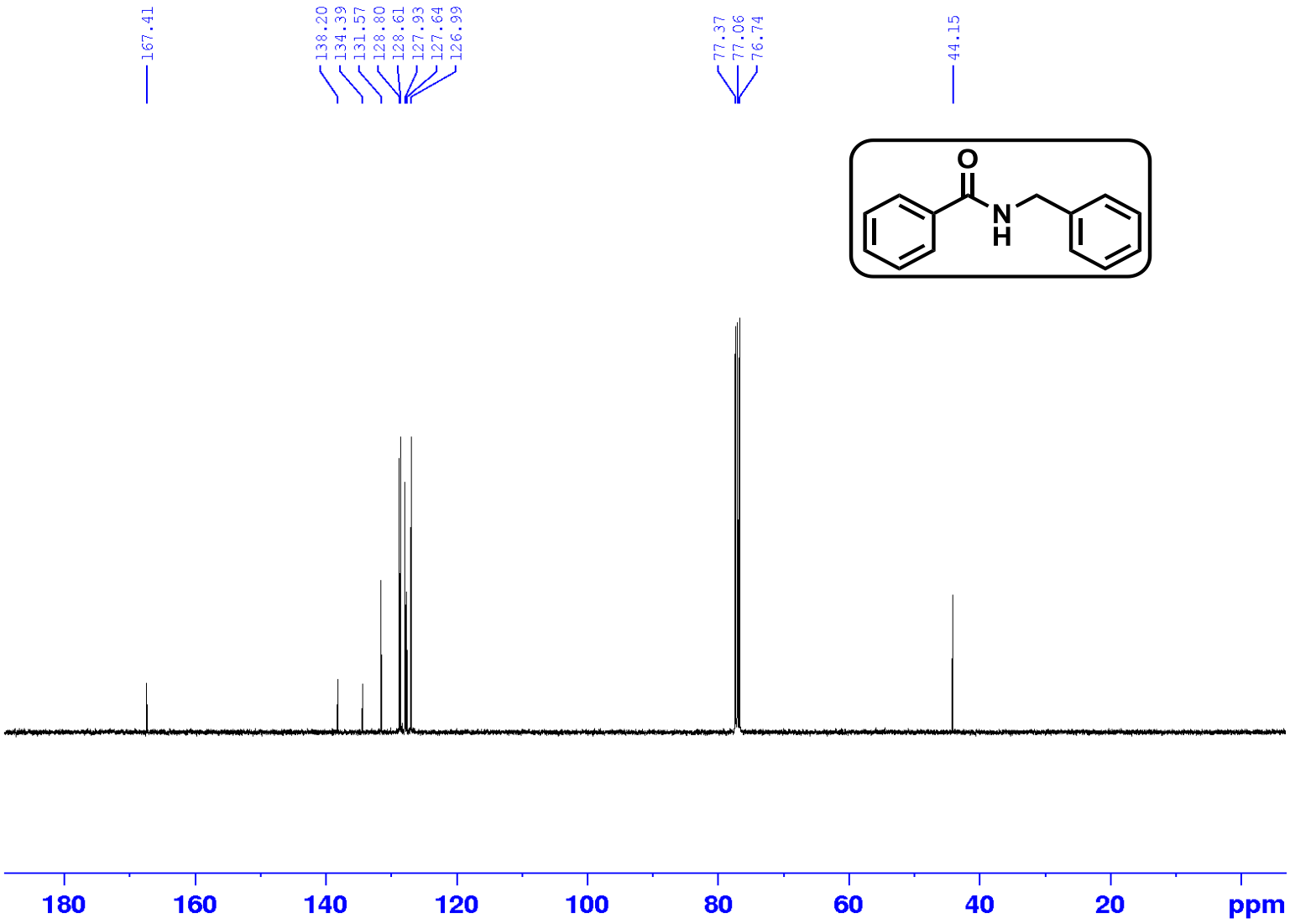
Diethylamine (0.471 mmol, 2az) and 3-methyl phenyl benzoate (0.2355 mmol, 1az) were added into a 25ml vial with a screw cap. The mixture was stirred at 110° C, for 12 hours, and the progress of the reaction was monitored by TLC. After completion of the reaction, the mixture was diluted with ethyl acetate (2 mL) and distilled water (10 mL). The solution was extracted with ethyl acetate (5 - 10 mL), and the combined organic layers were dried over anhydrous sodium sulfate and filtered. The crude product was purified by flash column chromatography (hexane: ethyl acetate) to obtain the desired product 3az (21mg, 45%) as a brown liquid. **^{1}H NMR (400 MHz, Chloroform-*d*) δ** 7.22 – 7.04 (m, 4H), 3.52 – 3.12 (m, 4H), 2.28 (s, 3H), 1.25 – 1.11 (m, 3H), 1.06 – 0.97 (m, 3H).**^{13}C NMR (101 MHz, Chloroform-*d*) δ** 171.52, 138.18, 137.17, 129.77, 128.20, 126.88, 123.13, 43.26, 21.35, 14.17, 12.88.

9. H^1 and C^{13} NMR spectra

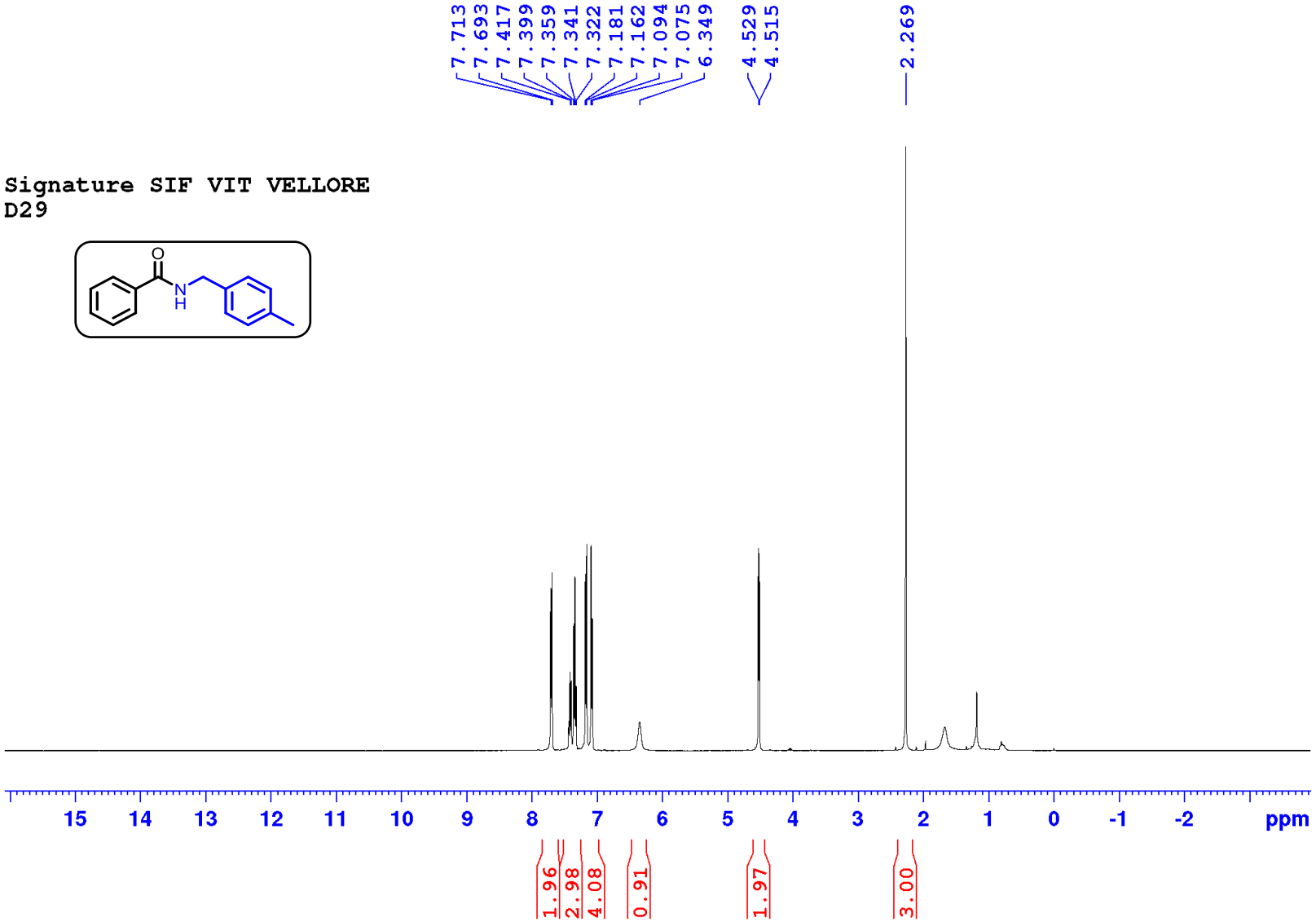
^{1}H NMR (400 MHz, Chloroform-d) of 3a



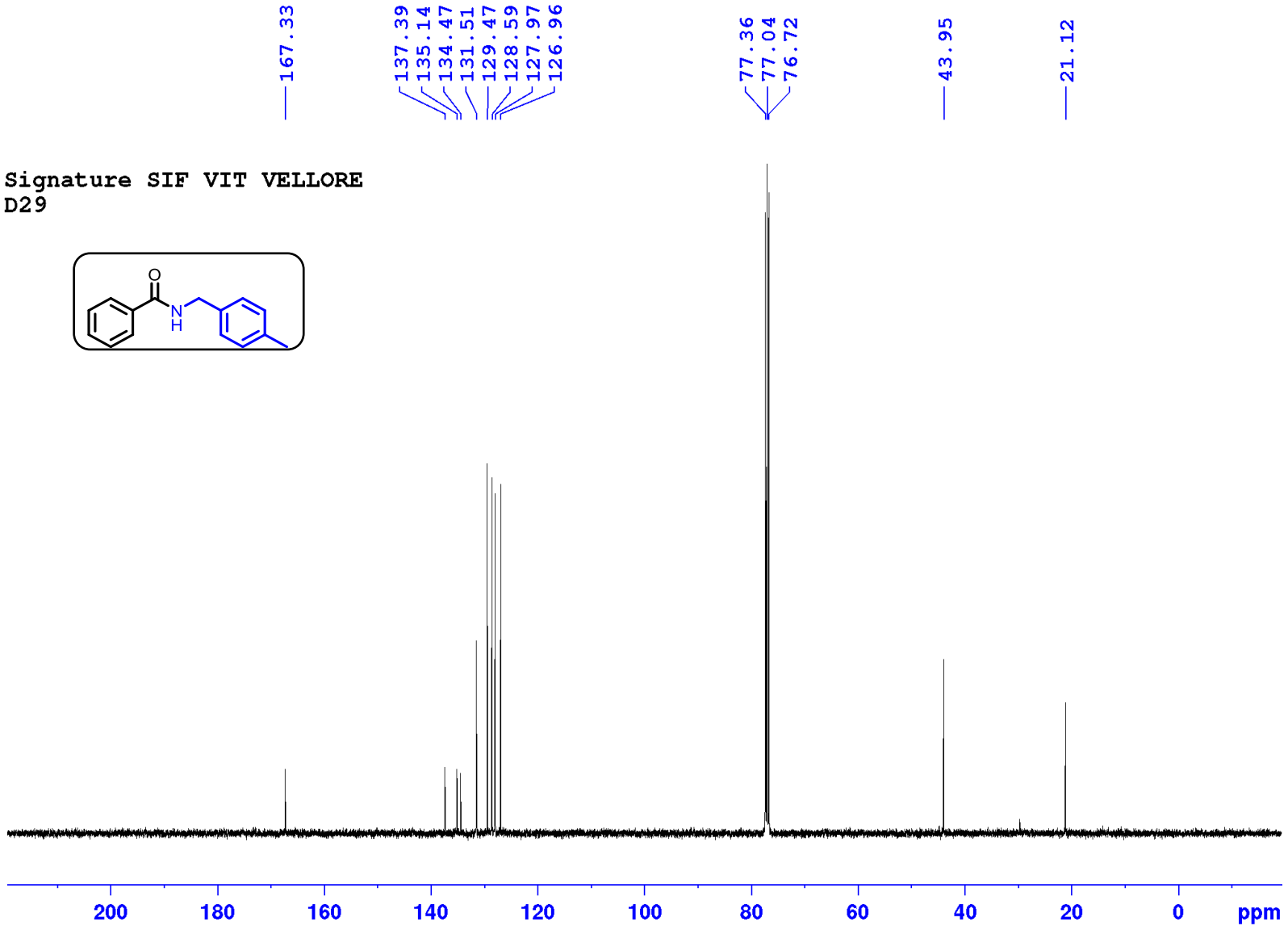
C^{13} NMR (400 MHz, Chloroform-d) of 3a



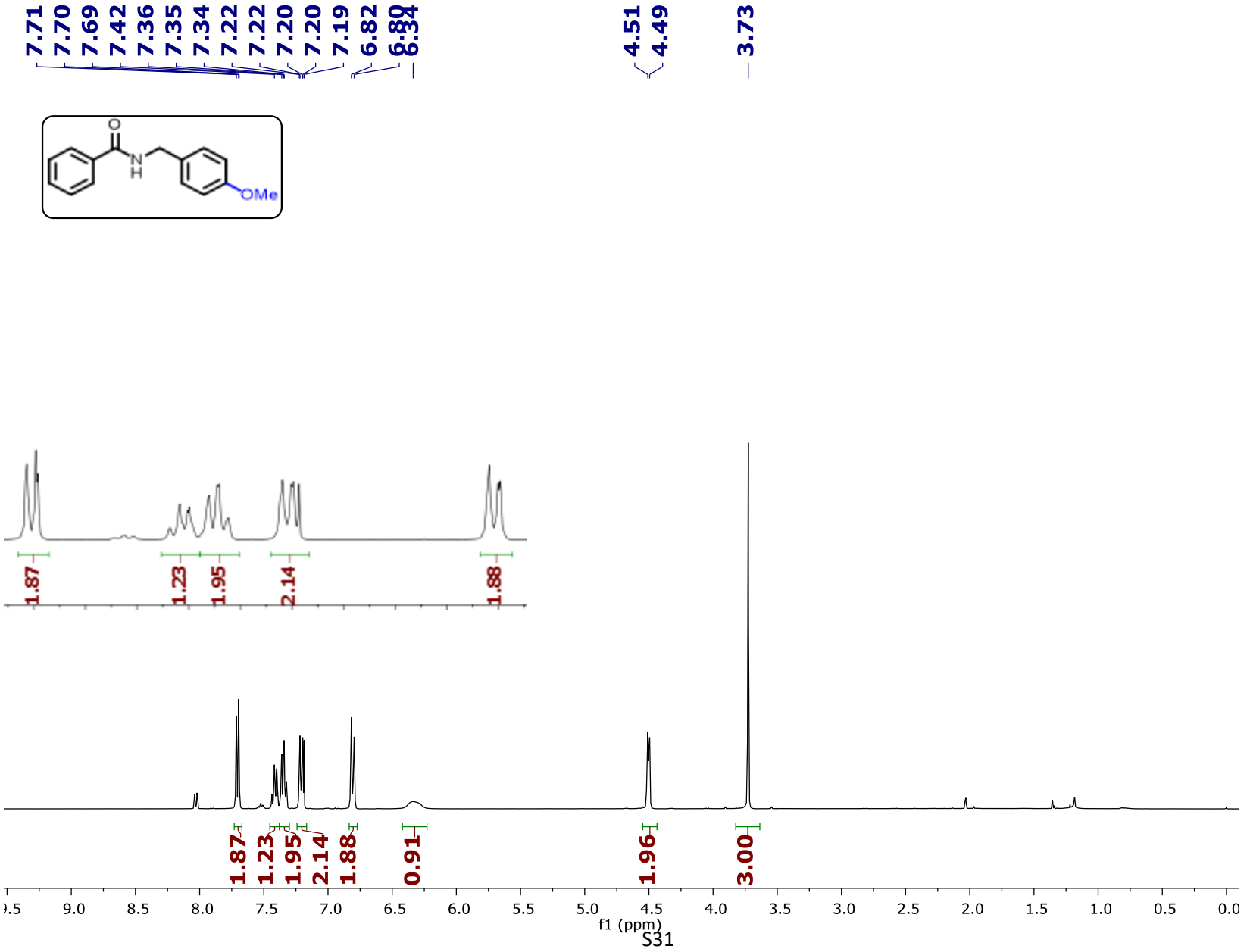
^{1}H NMR (400 MHz, Chloroform –d) of 3b



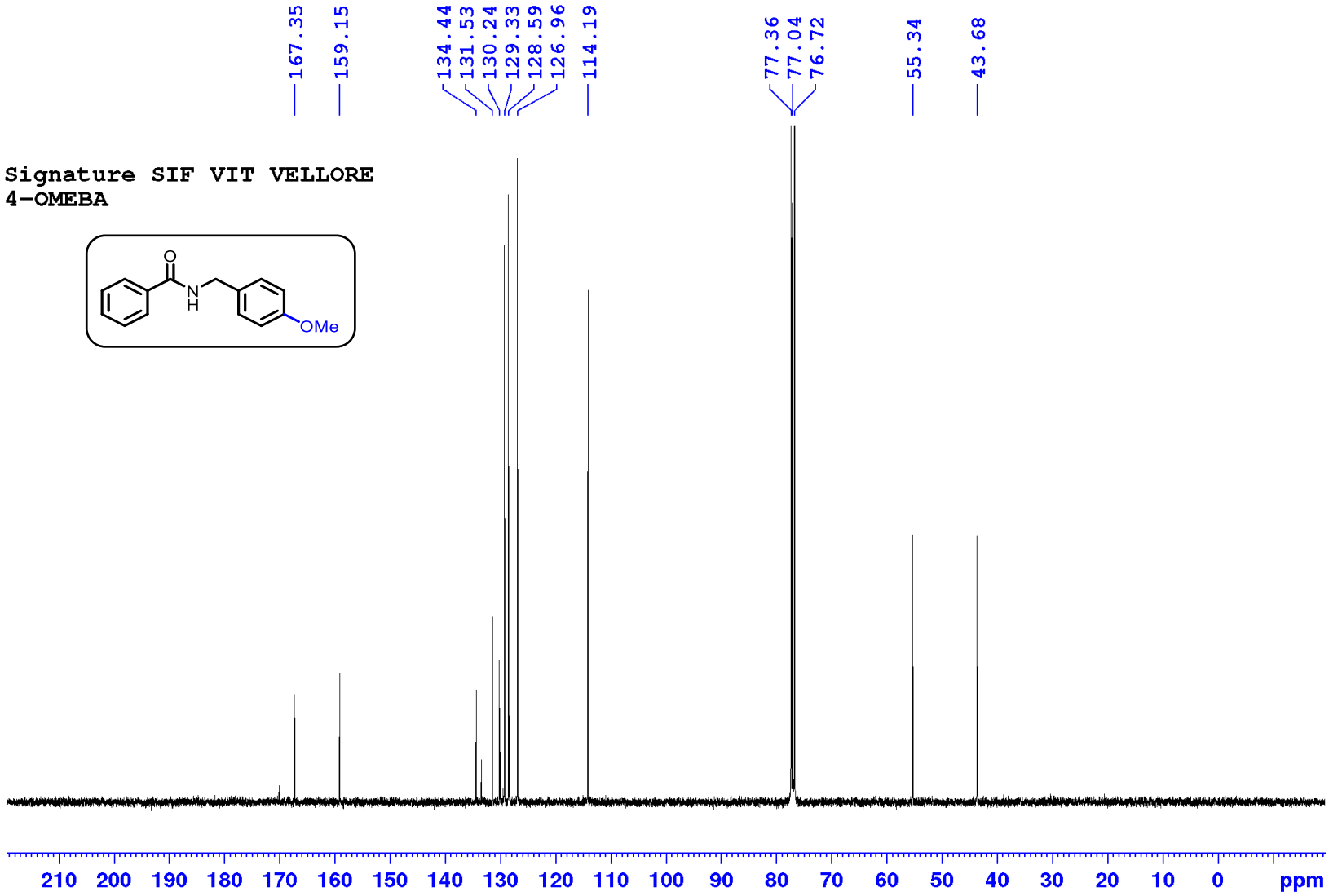
C^{13} NMR (400 MHz, Chloroform-d) of 3b



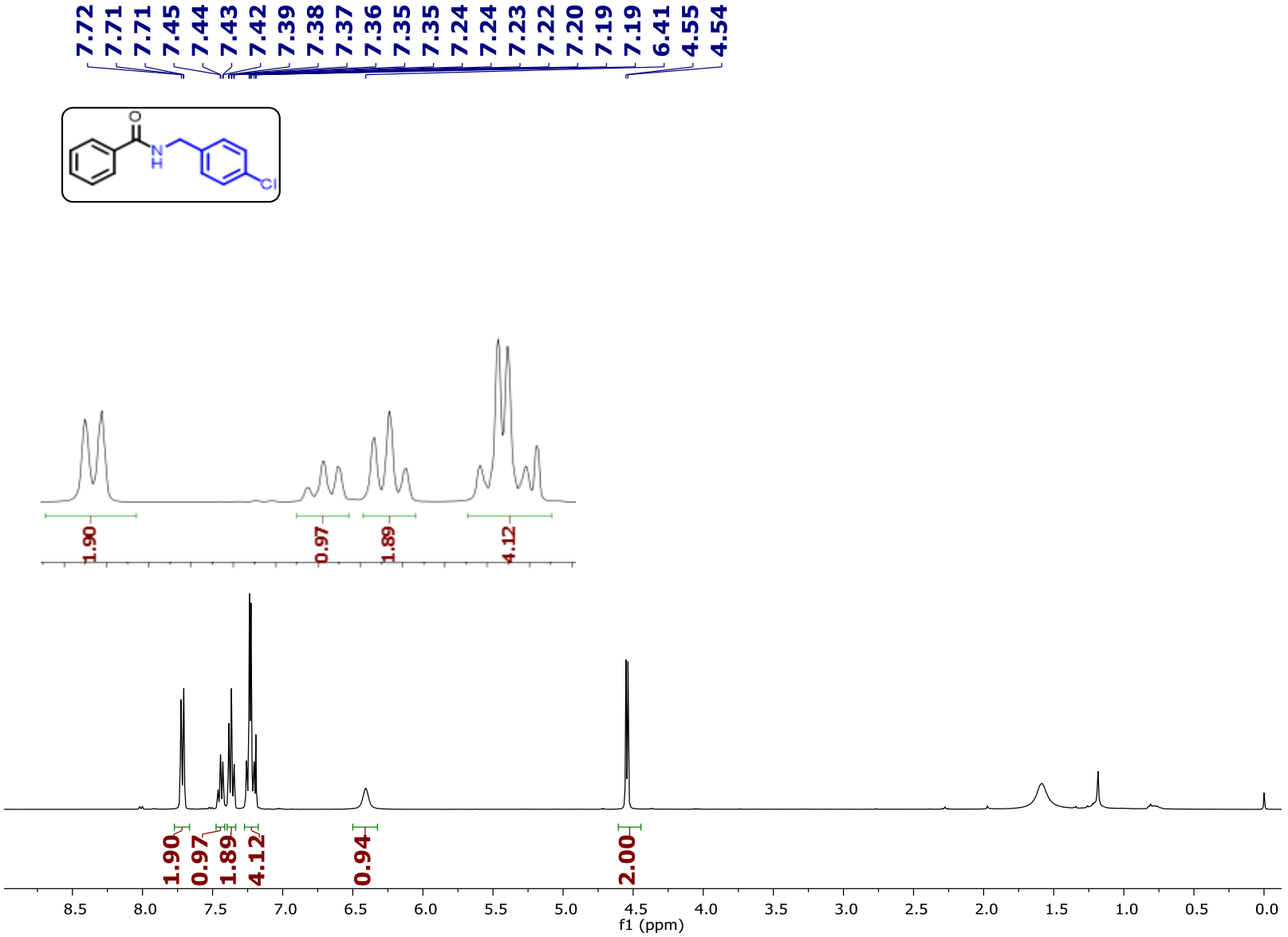
^{1}H NMR (400 MHz, Chloroform-d) of 3c



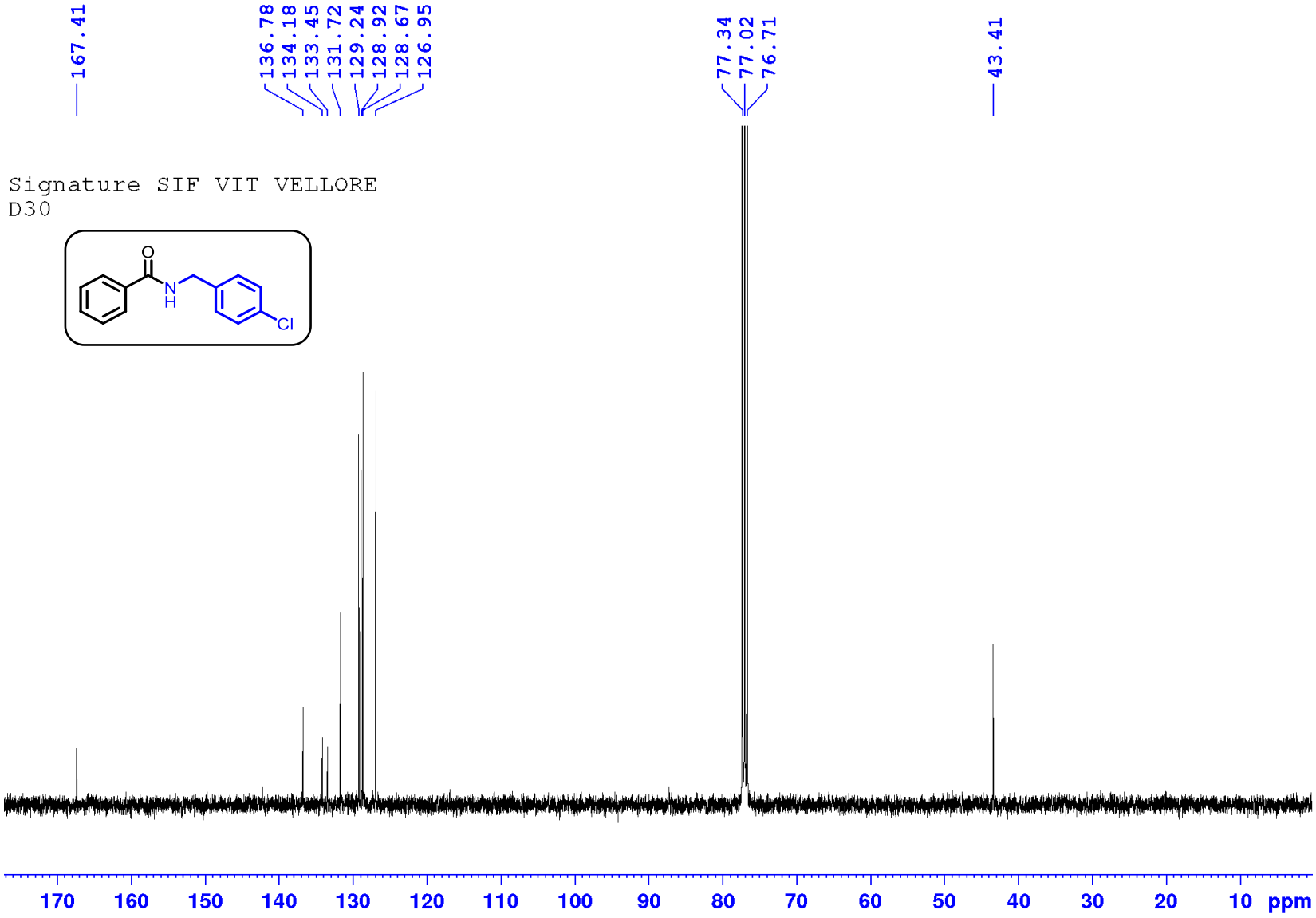
C^{13} NMR (400 MHz, Chloroform-d) of 3c



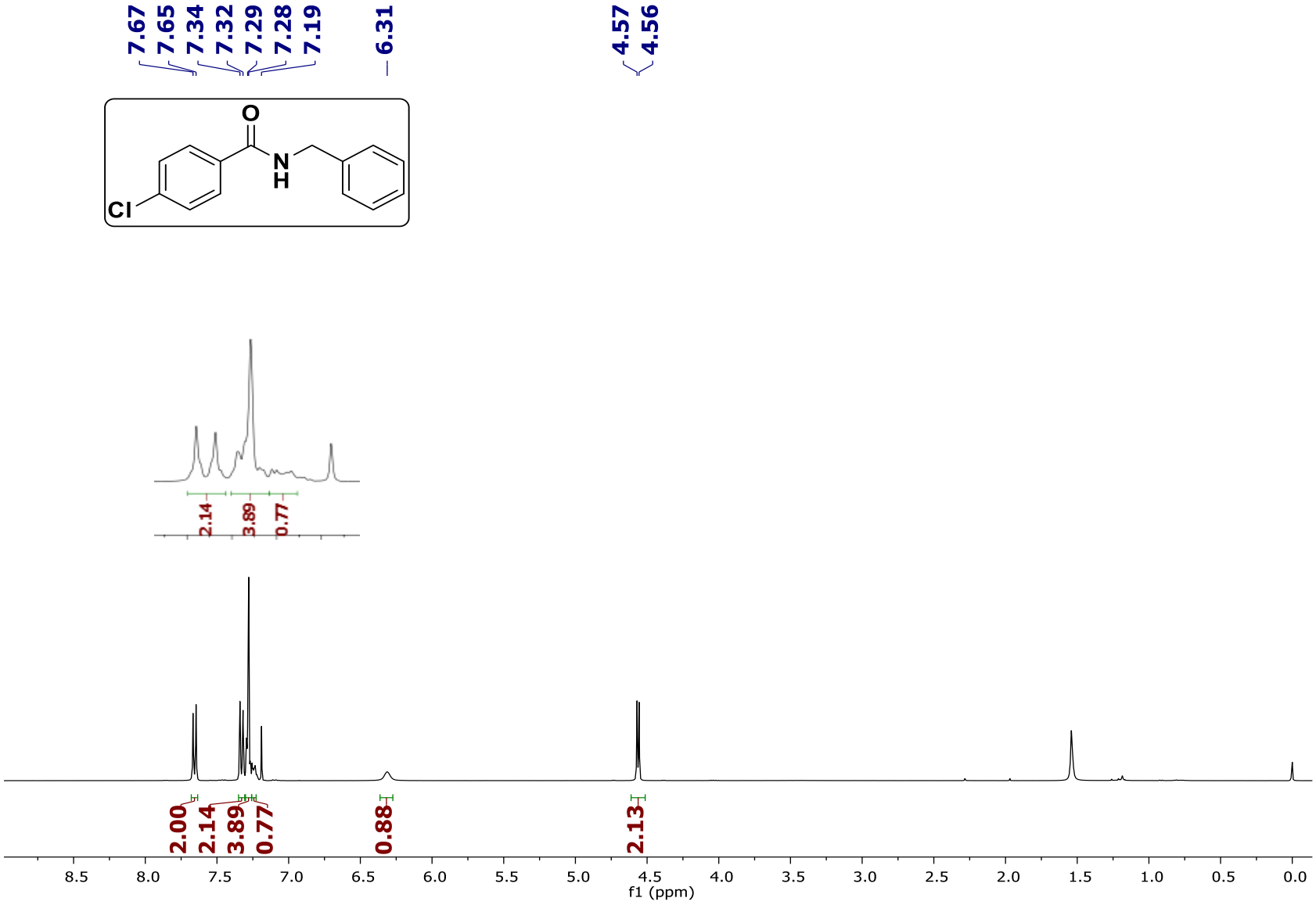
^{1}H NMR (400 MHz, Chloroform –d) of 3d



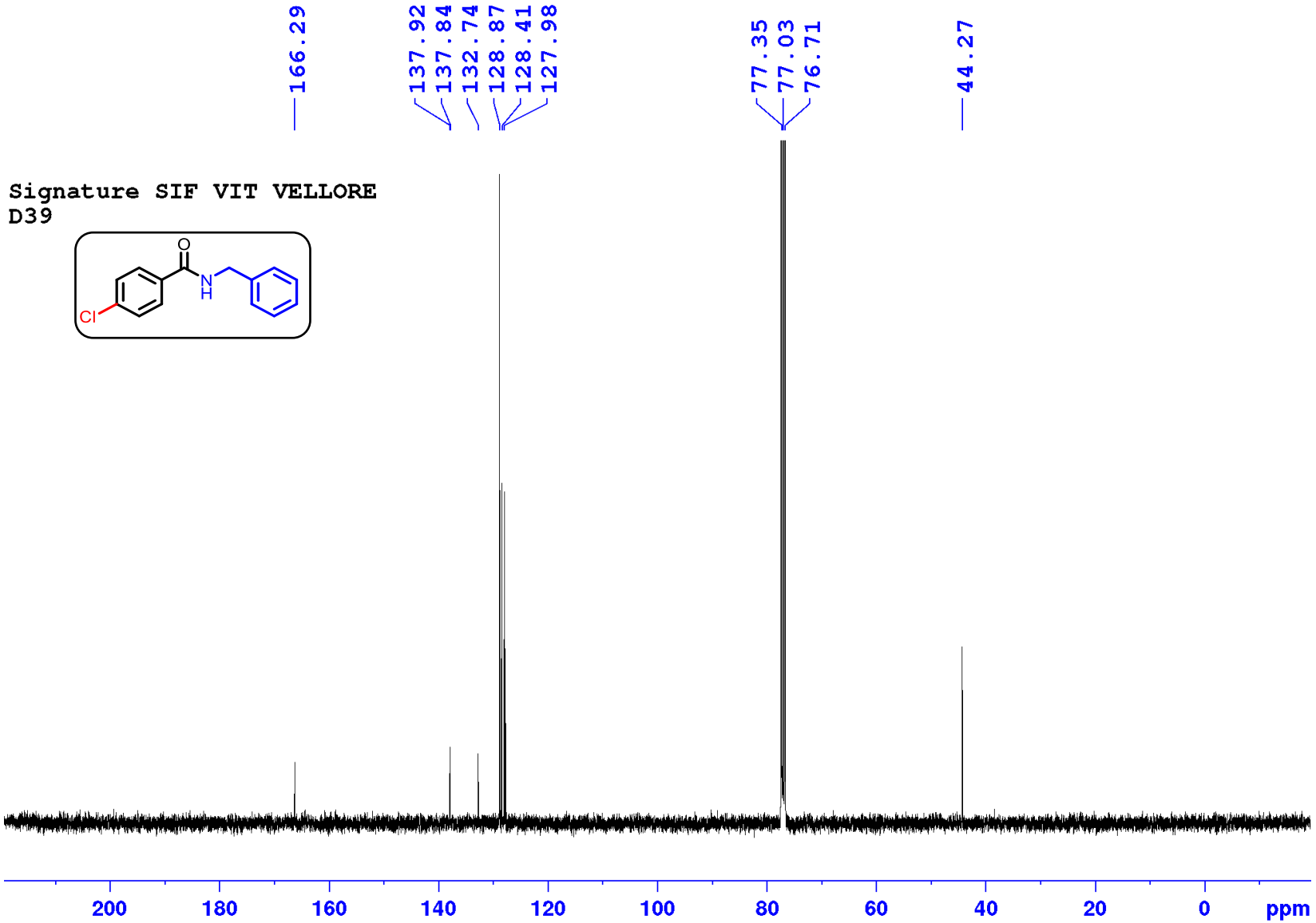
C^{13} NMR (400 MHz, Chloroform –d) of 3d



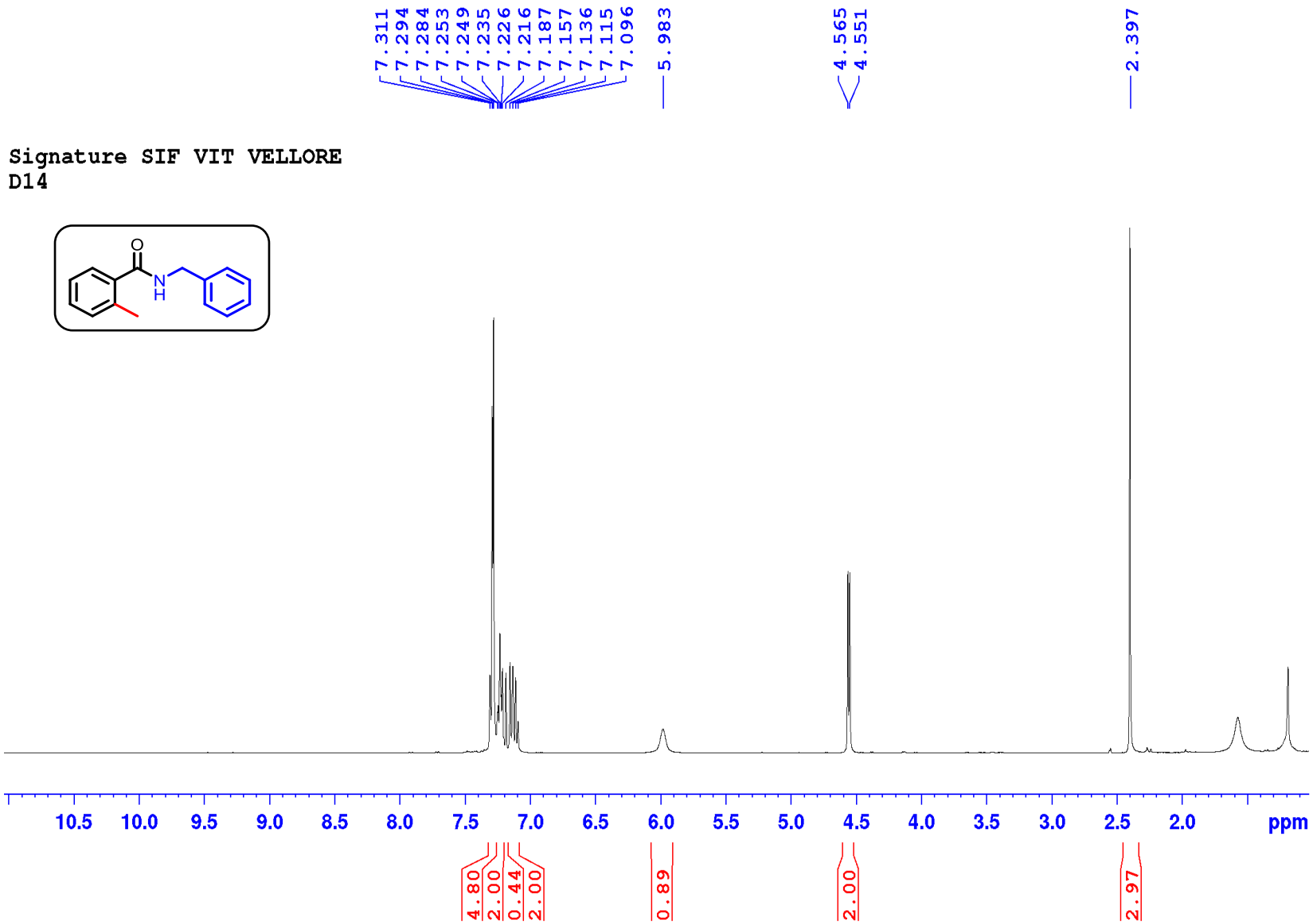
^{1}H NMR (400 MHz, Chloroform –d) of 3e



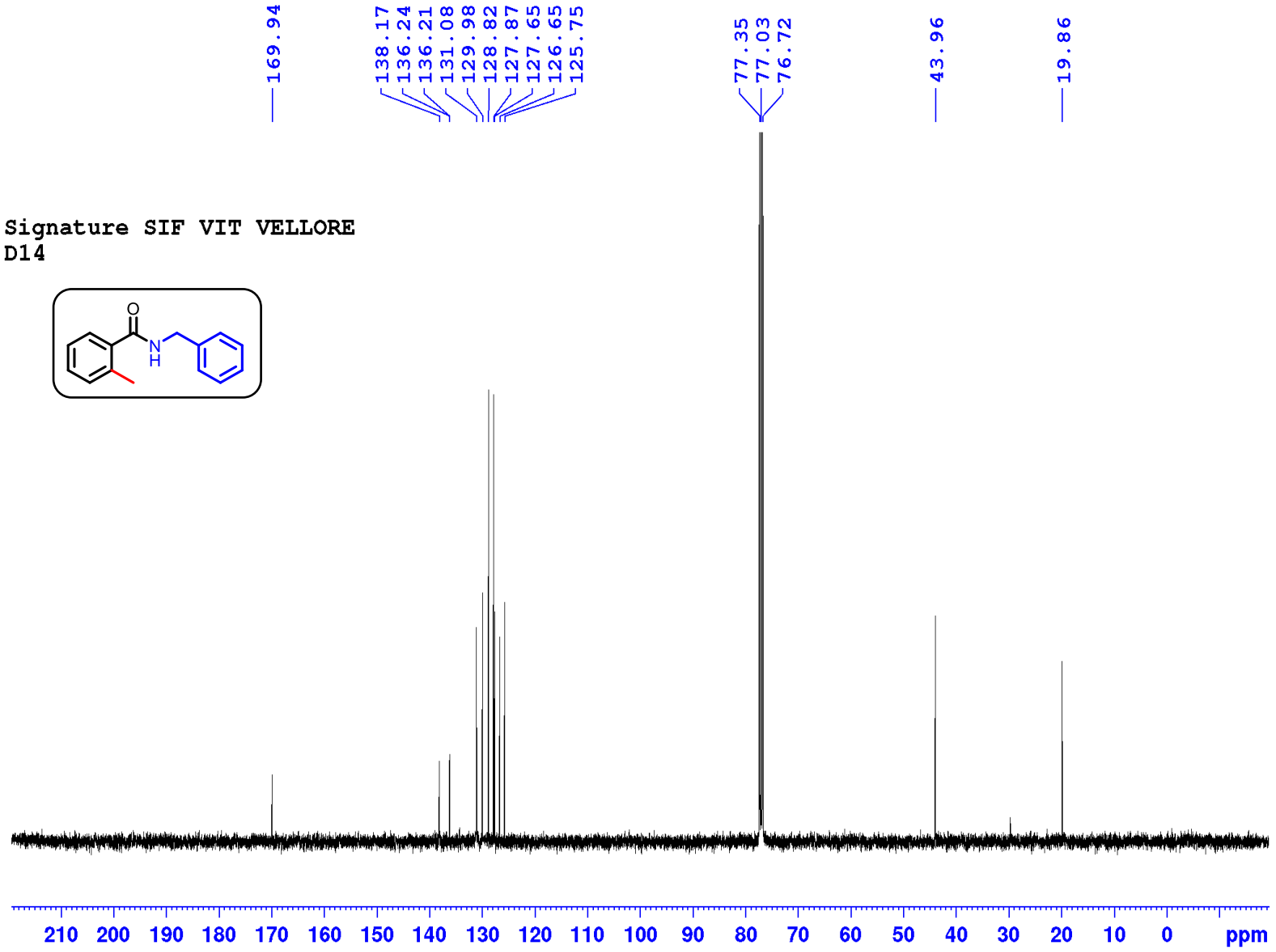
C^{13} NMR (400 MHz, Chloroform –d) of 3e



^{1}H NMR (400 MHz, Chloroform –d) of 3f

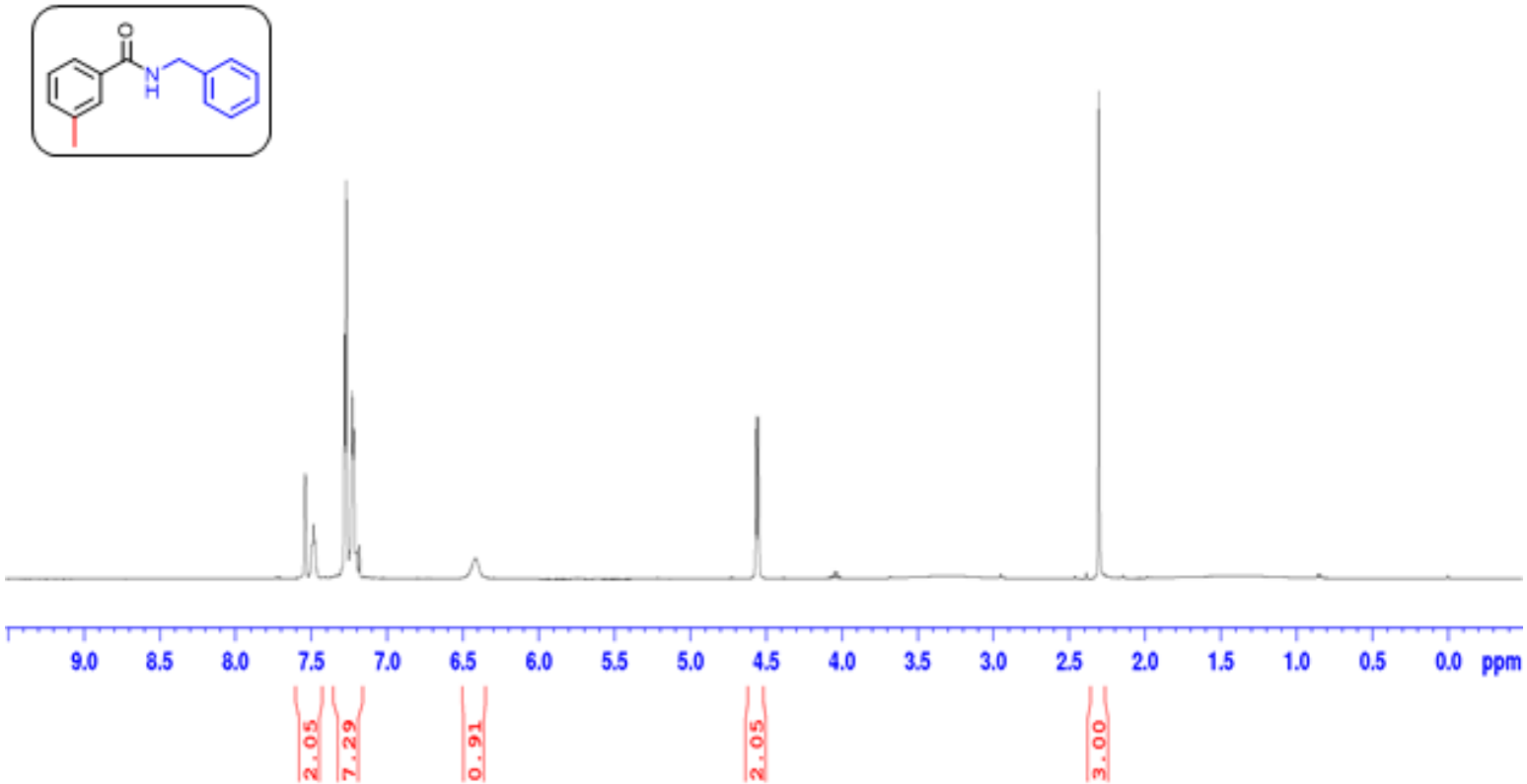


C^{13} NMR (400 MHz, Chloroform –d) of 3f

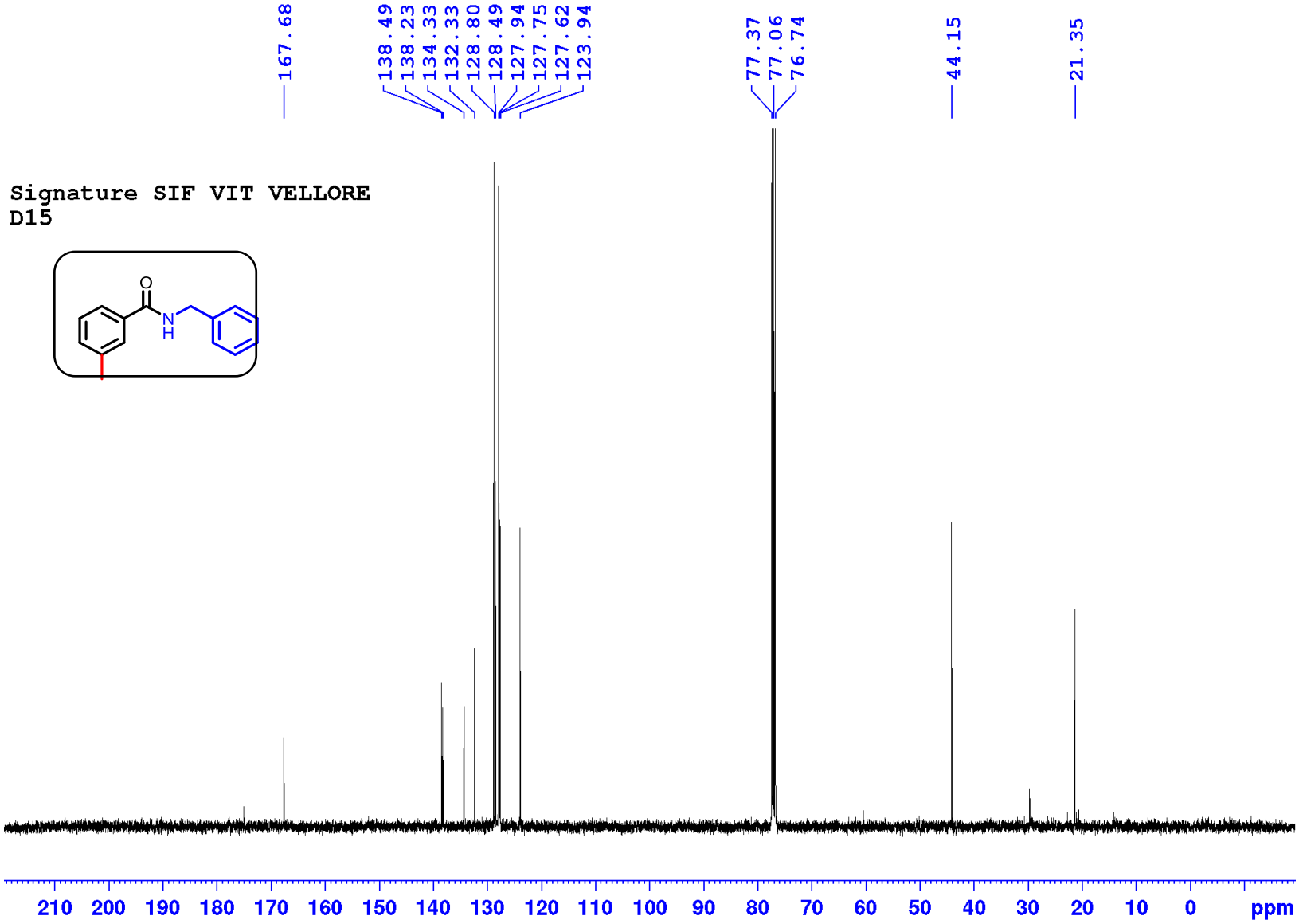


^{1}H NMR (400 MHz, Chloroform –d) of 3g

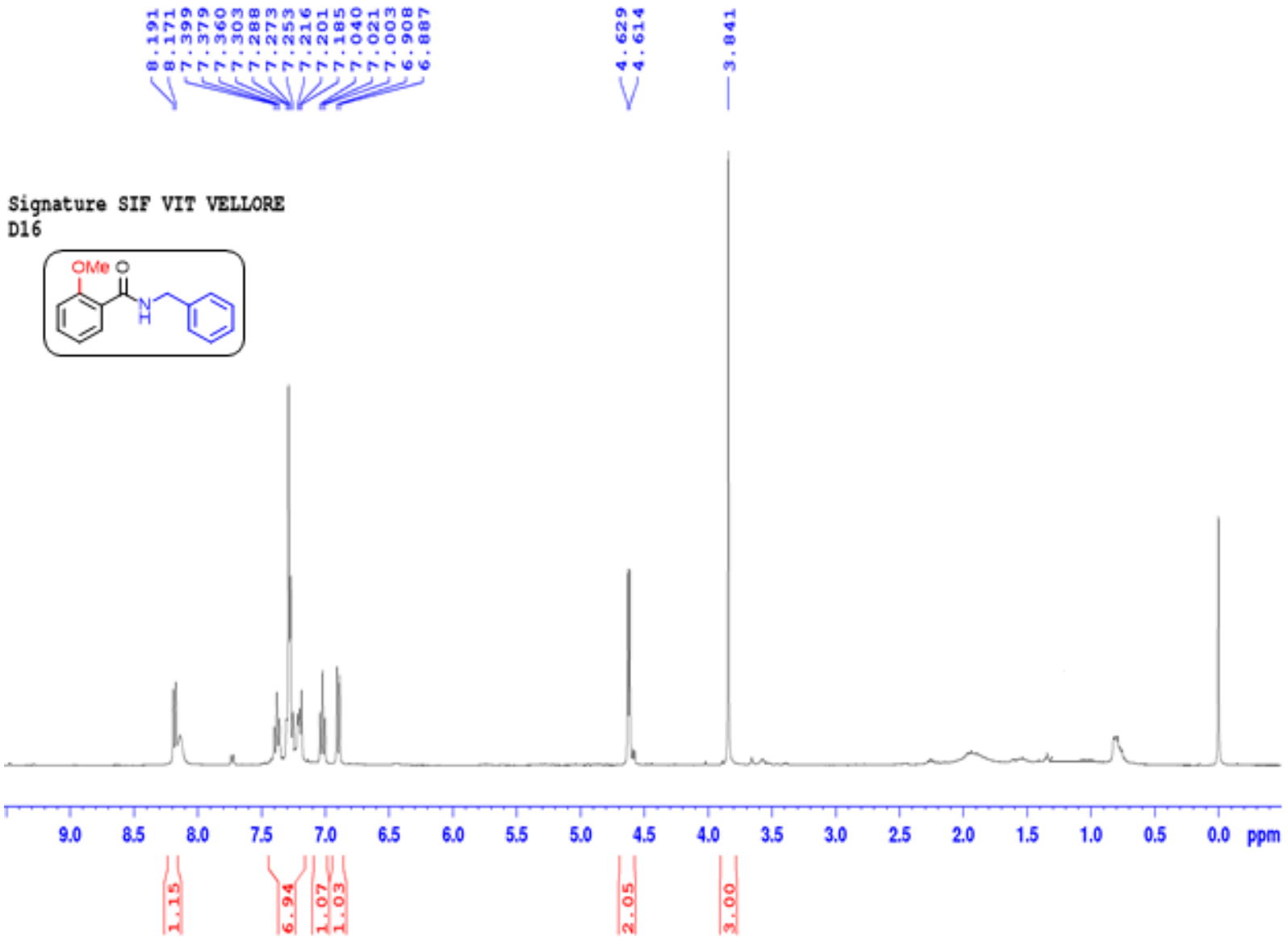
Signature SIF VIT VELLORE
D15



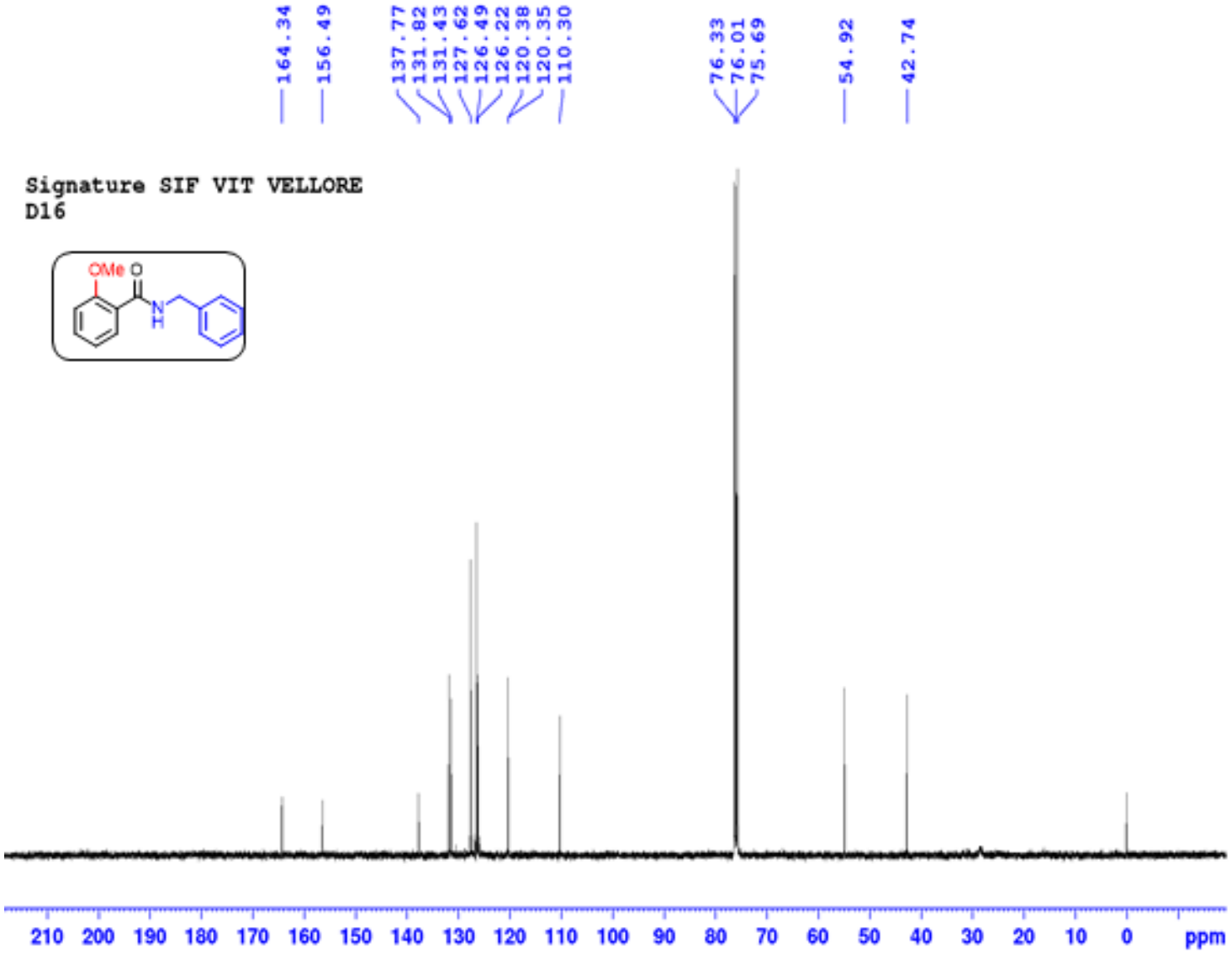
C^{13} NMR (400 MHz, Chloroform –d) of 3g



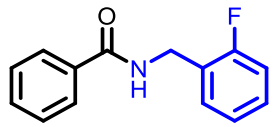
^{1}H NMR (400 MHz, Chloroform –d) of 3h

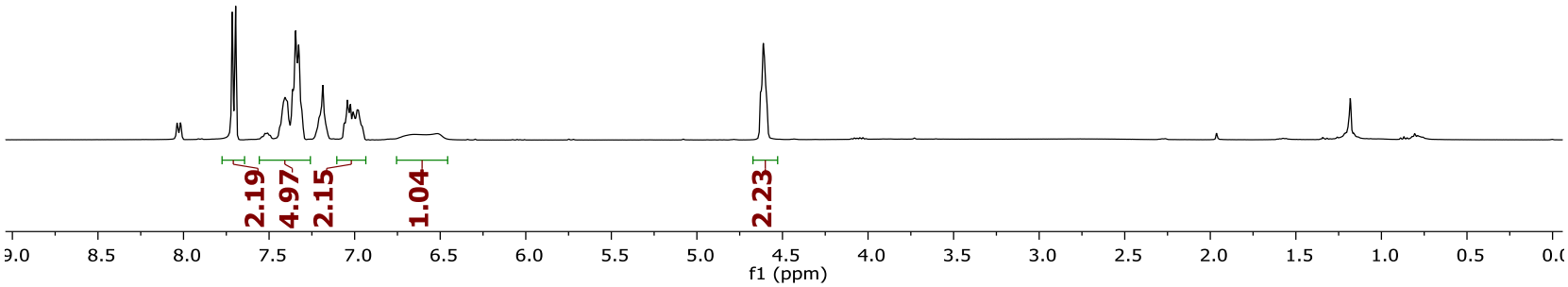


C^{13} NMR (400 MHz, Chloroform –d) of 3h

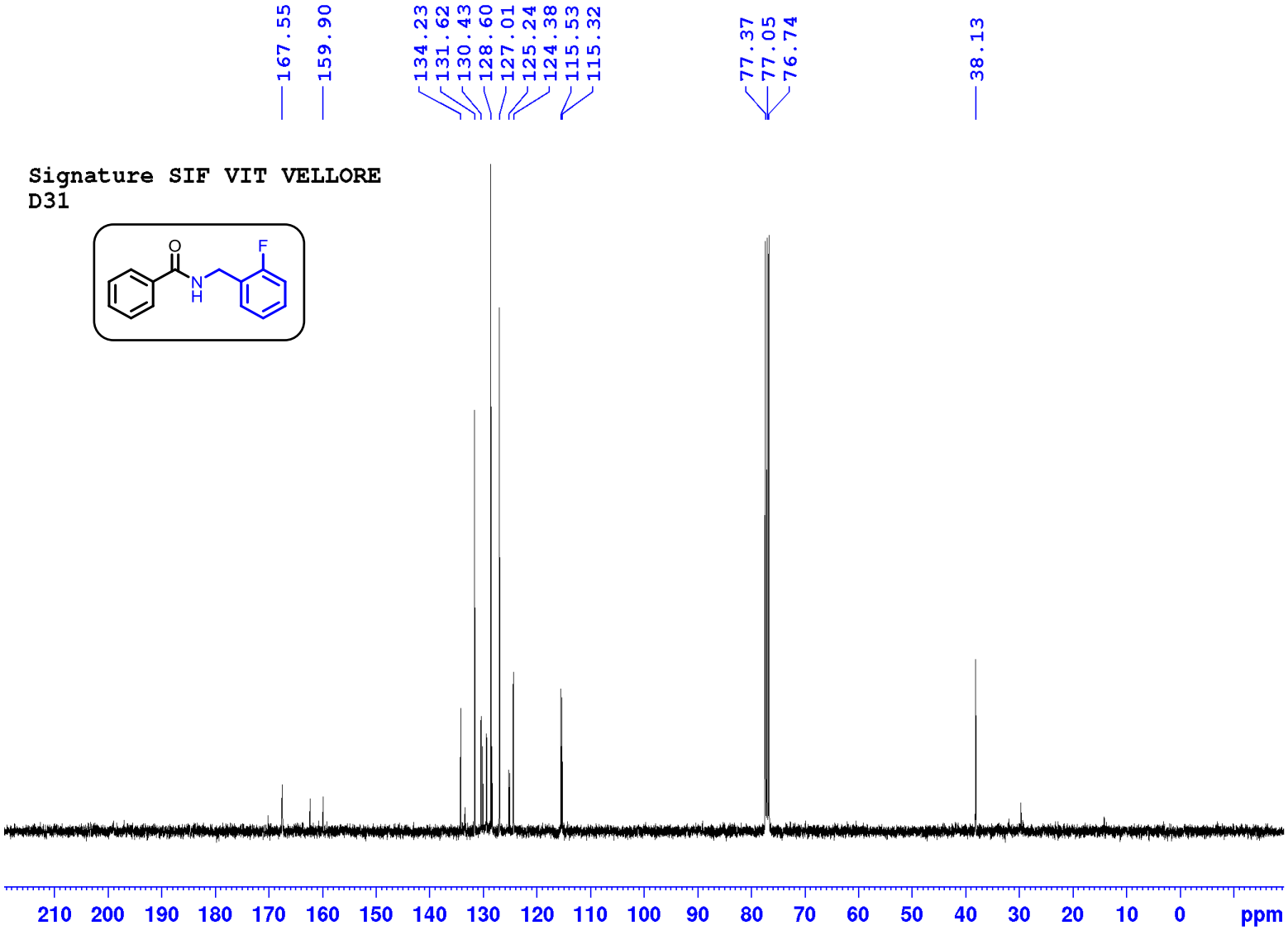


^{1}H NMR (400 MHz, Chloroform –d) of 3i

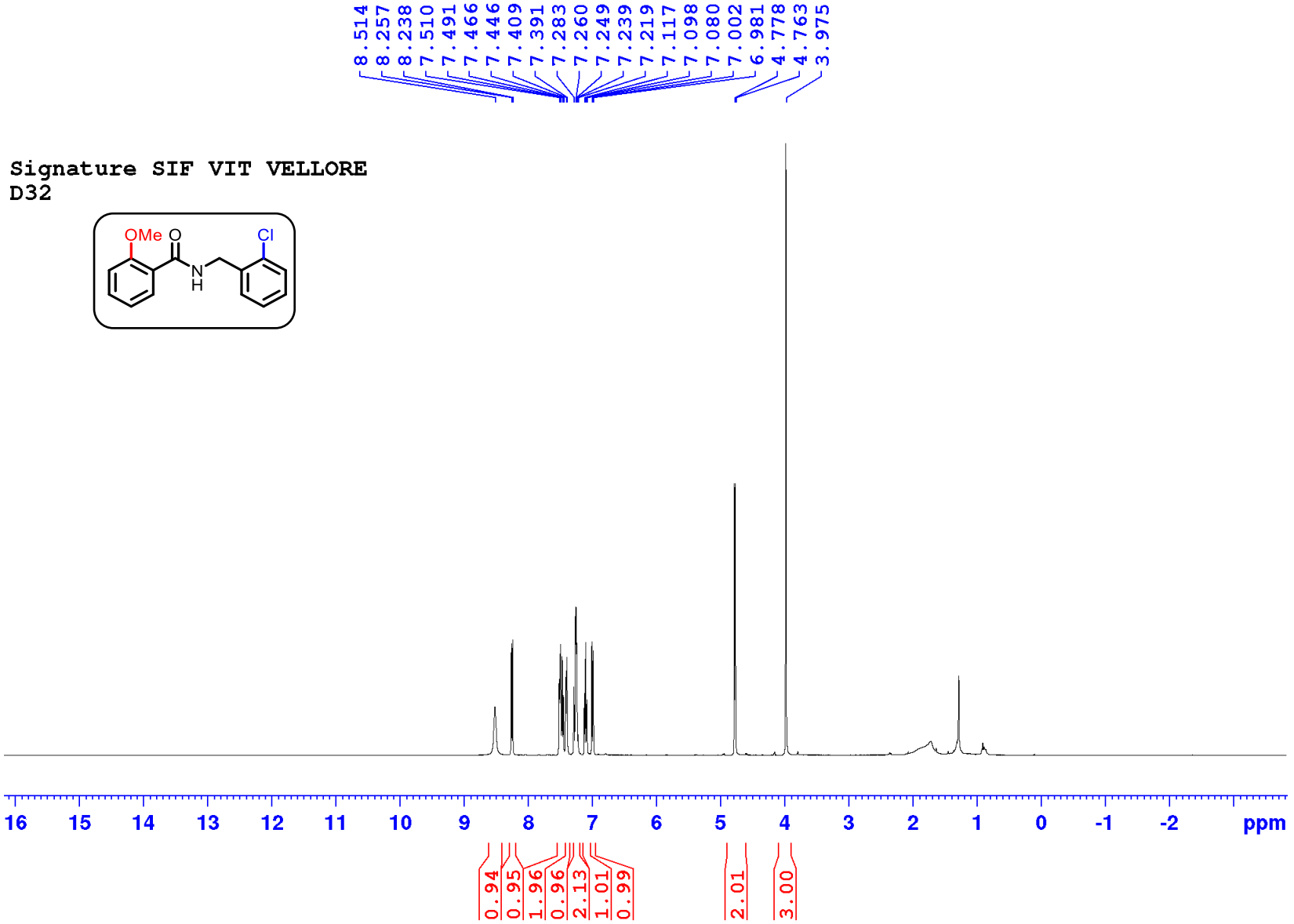




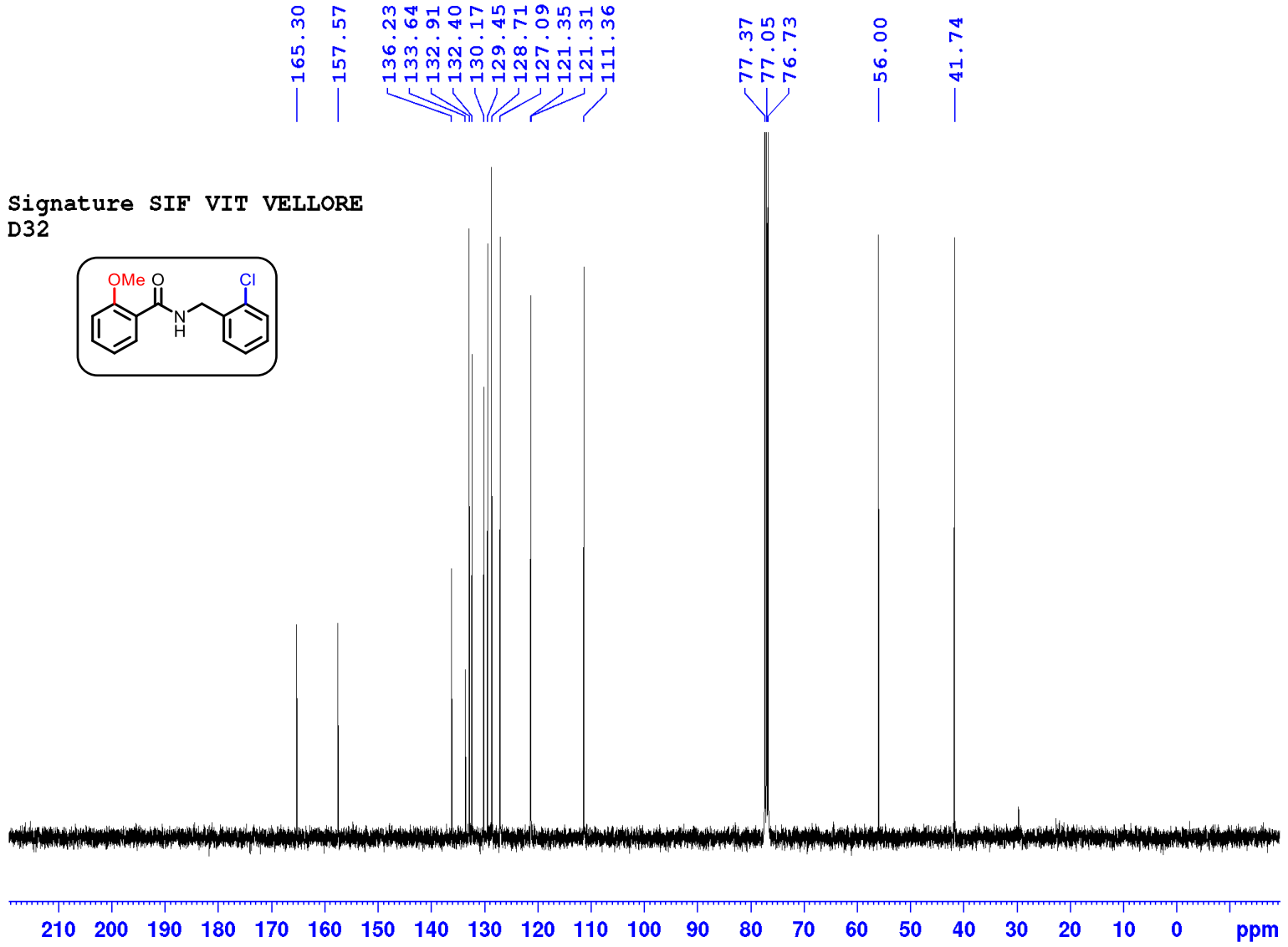
C^{13} NMR (400 MHz, Chloroform –d) of 3i



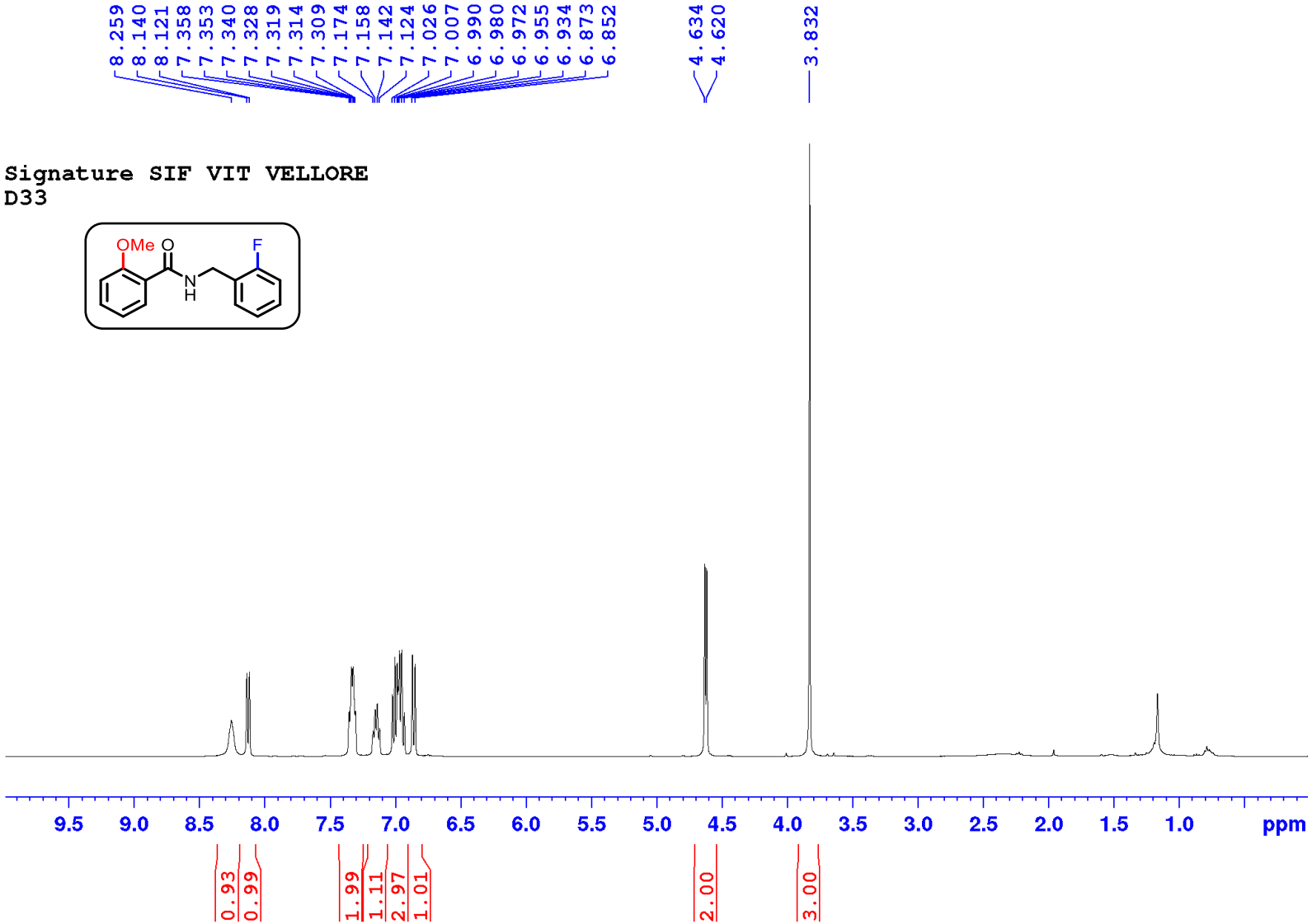
^{1}H NMR (400 MHz, Chloroform –d) of 3j



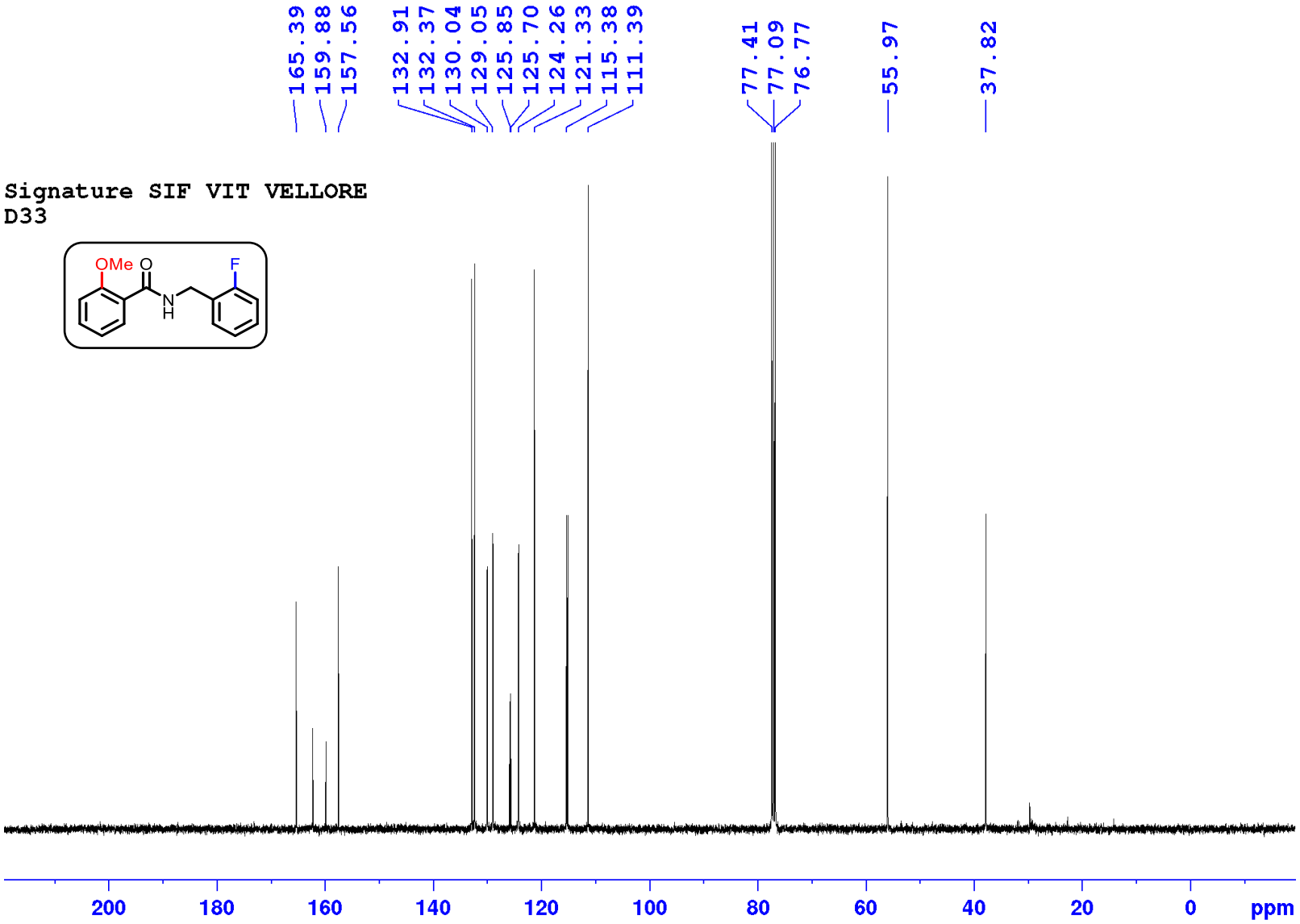
C^{13} NMR (400 MHz, Chloroform –d) of 3j



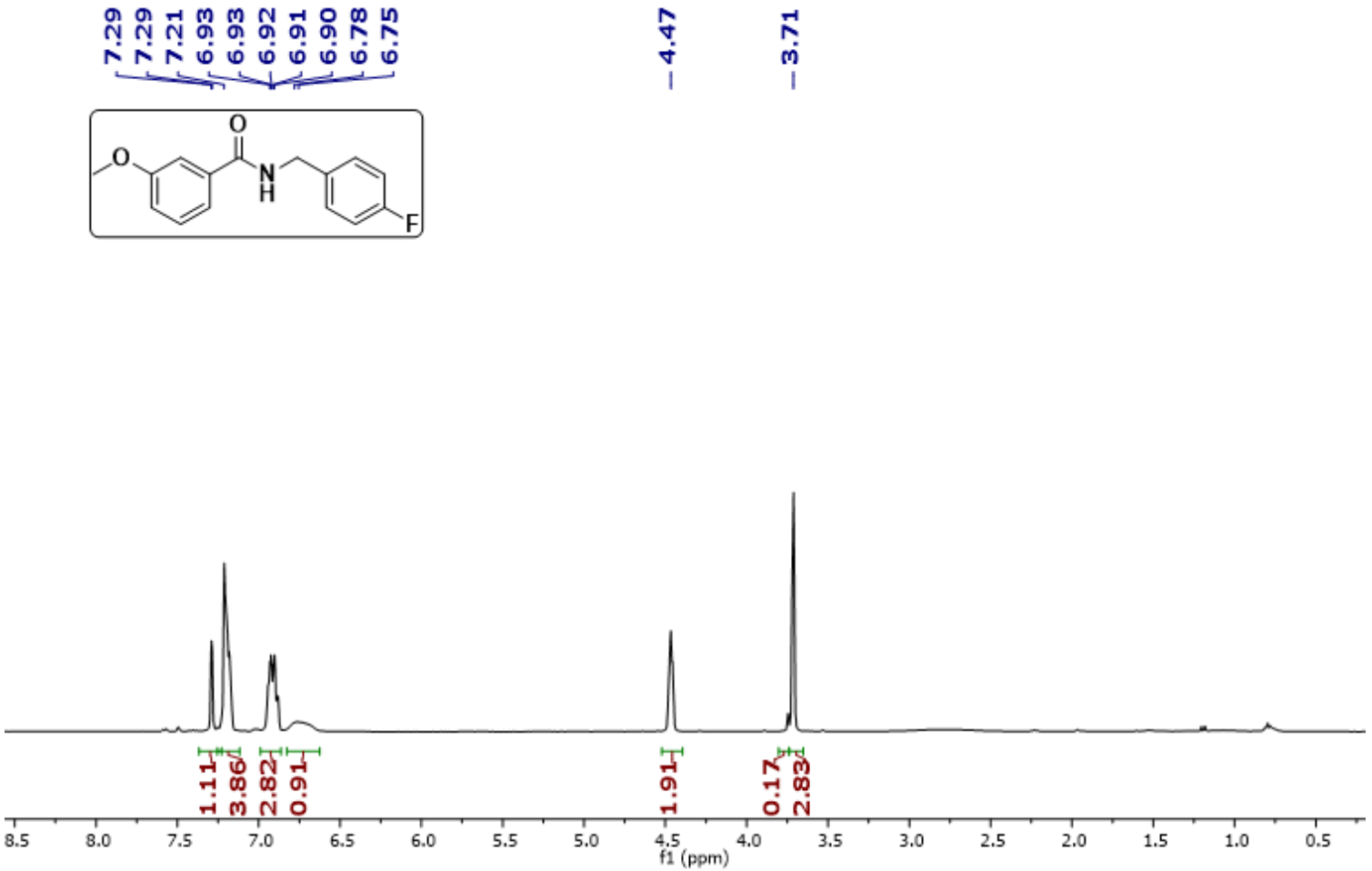
^{1}H NMR (400 MHz, Chloroform –d) of 3k



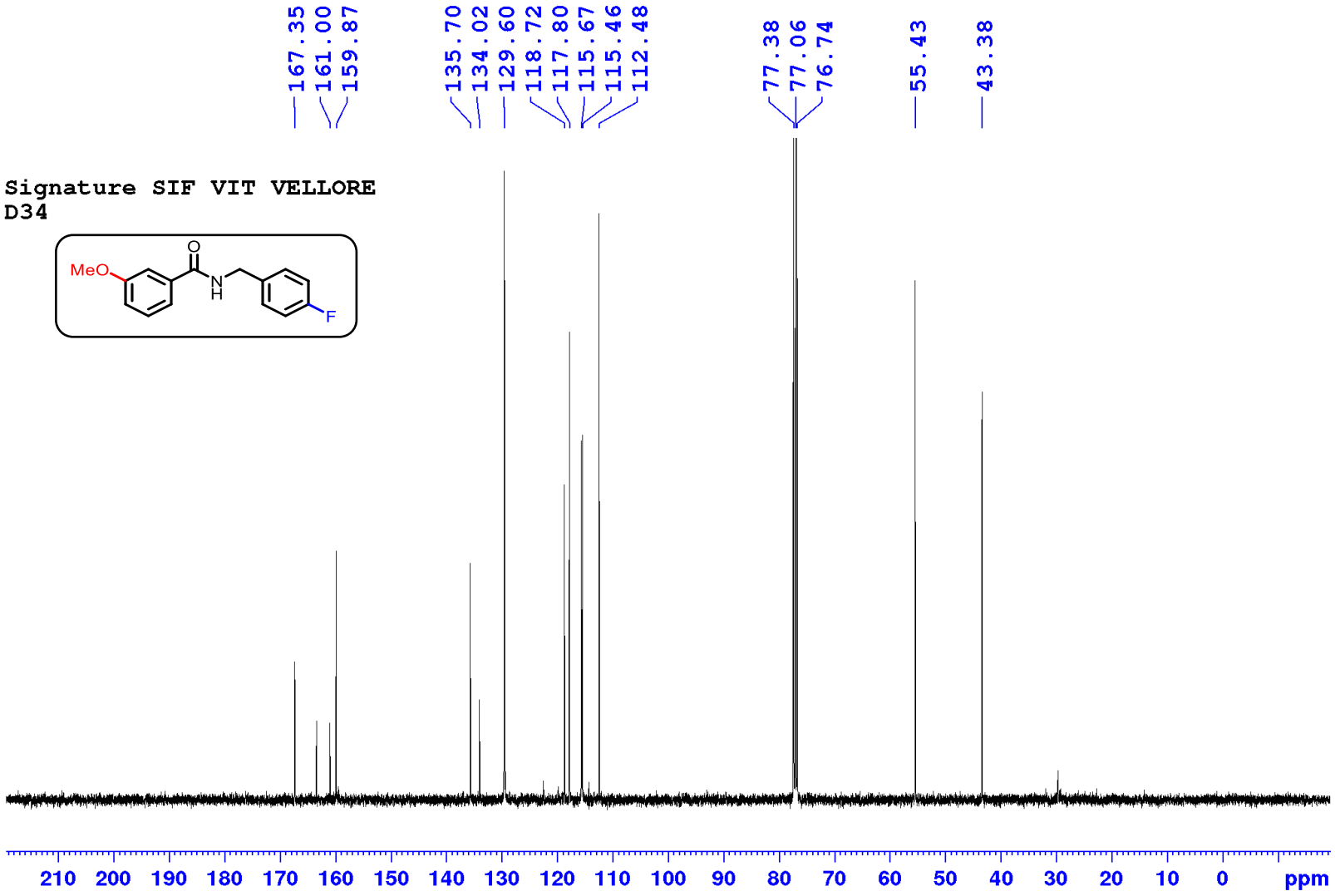
C^{13} NMR (400 MHz, Chloroform –d) of 3k



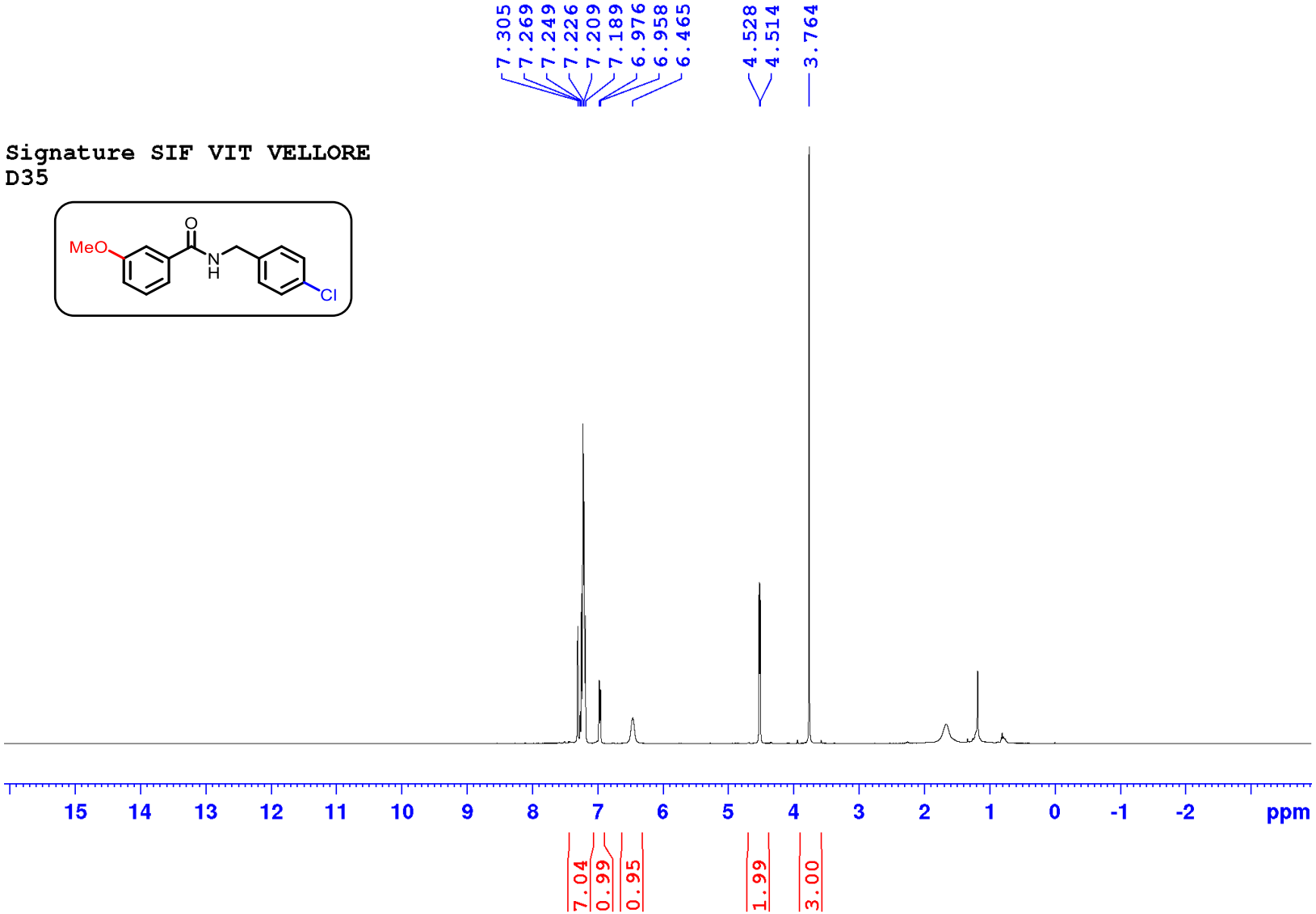
^{1}H NMR (400 MHz, Chloroform –d) of 3l



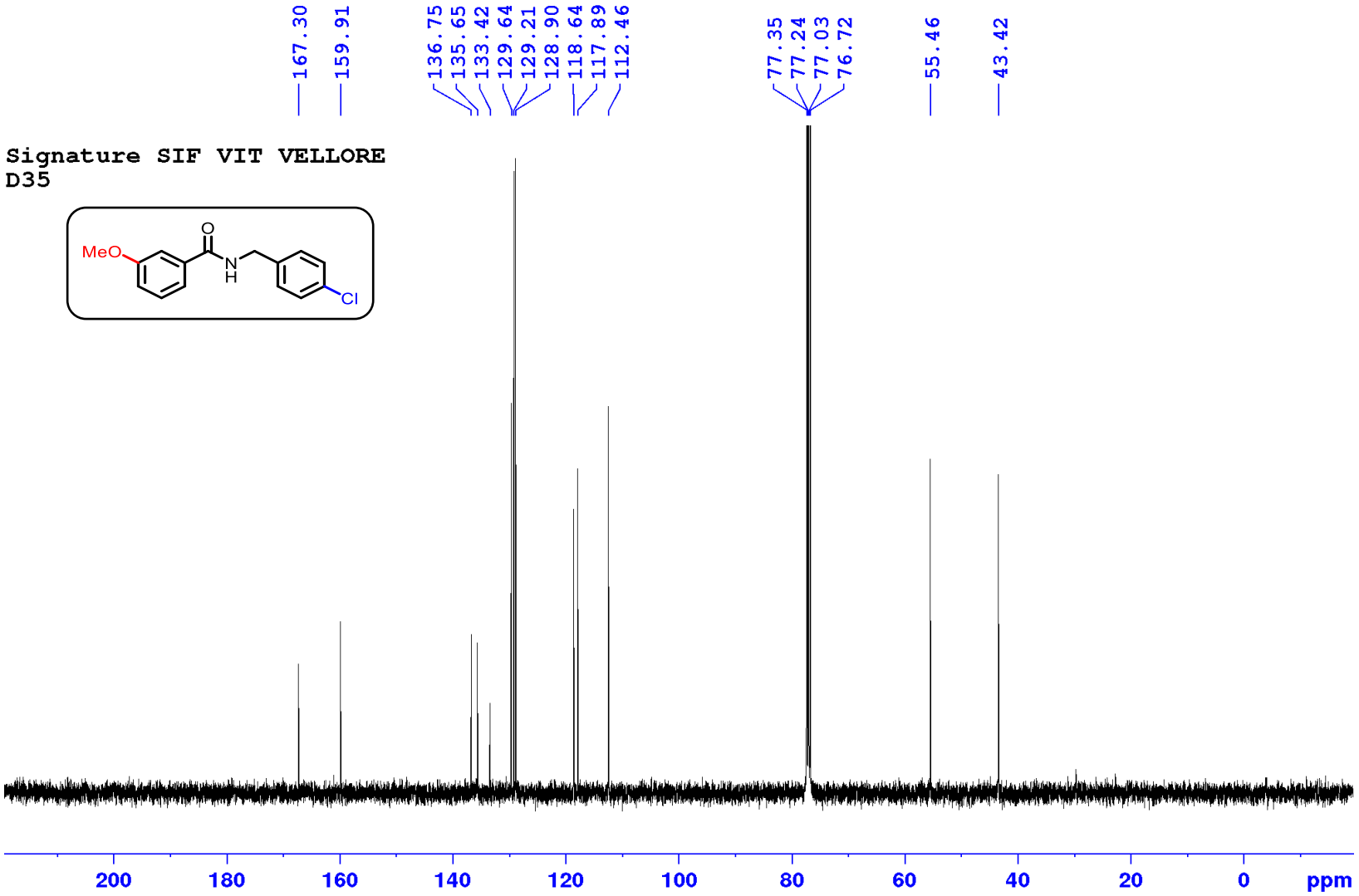
C^{13} NMR (400 MHz, Chloroform –d) of 3l



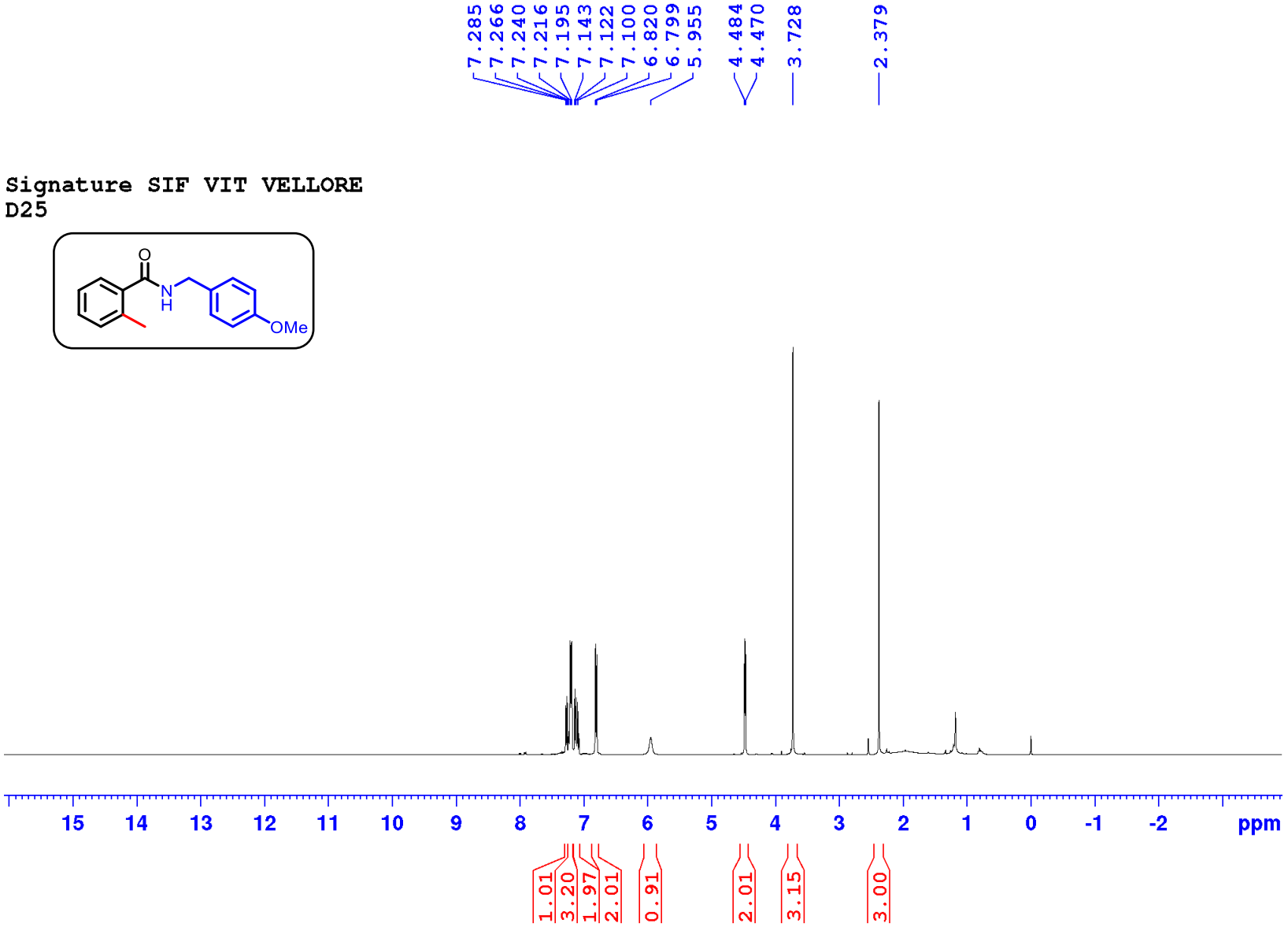
^{1}H NMR (400 MHz, Chloroform –d) of 3m



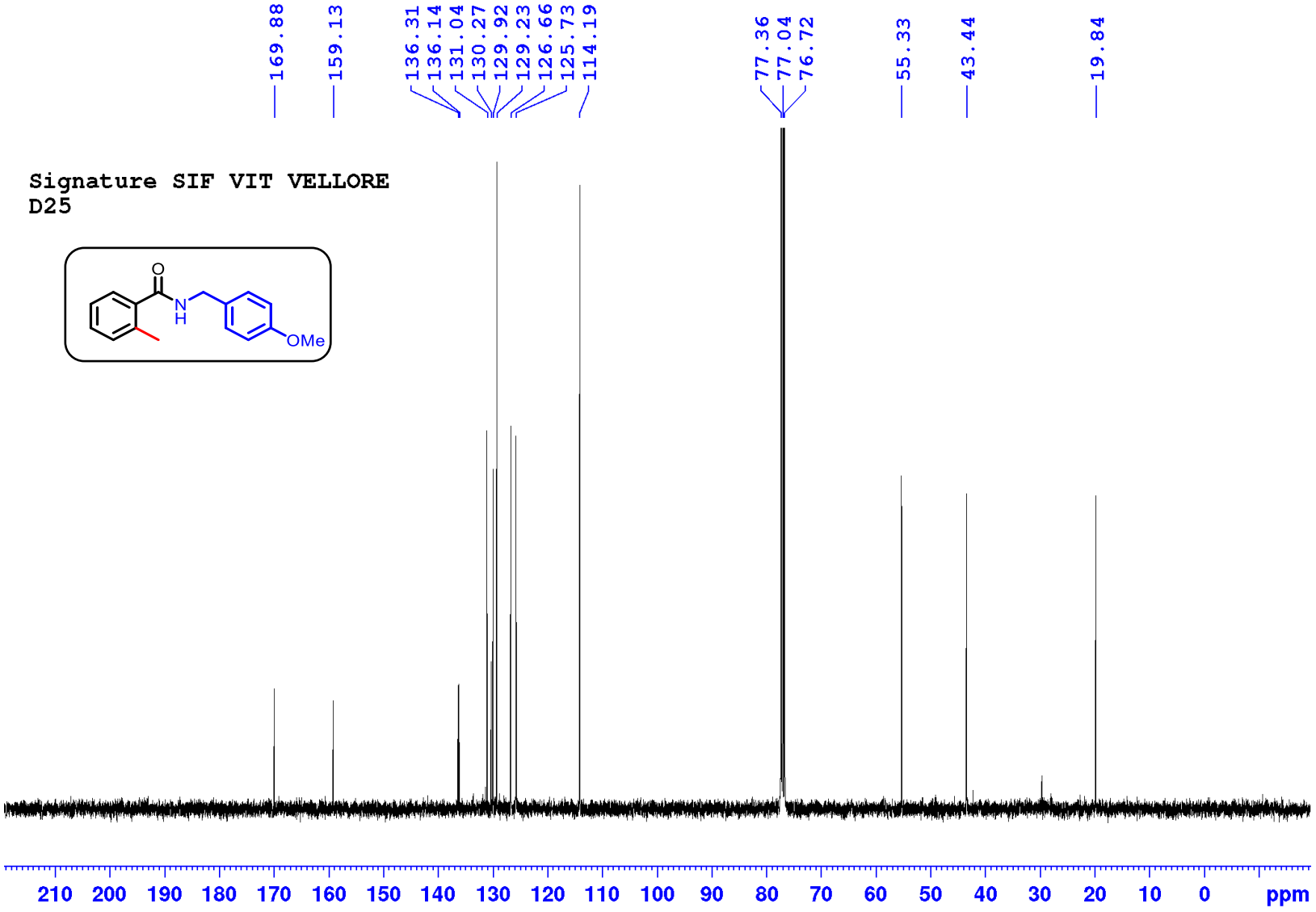
C^{13} NMR (400 MHz, Chloroform –d) of 3m



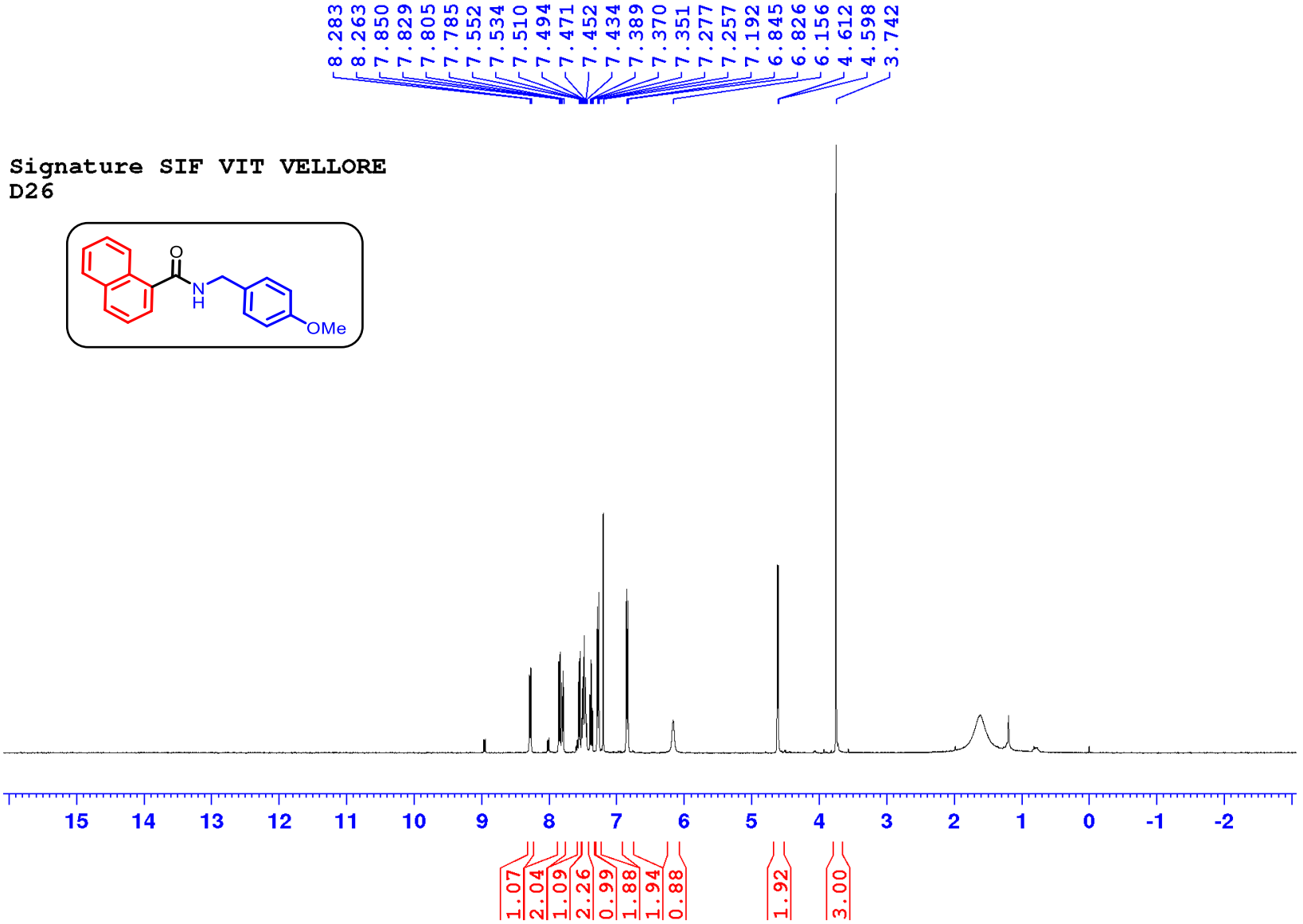
^{1}H NMR (400 MHz, Chloroform –d) of 3n



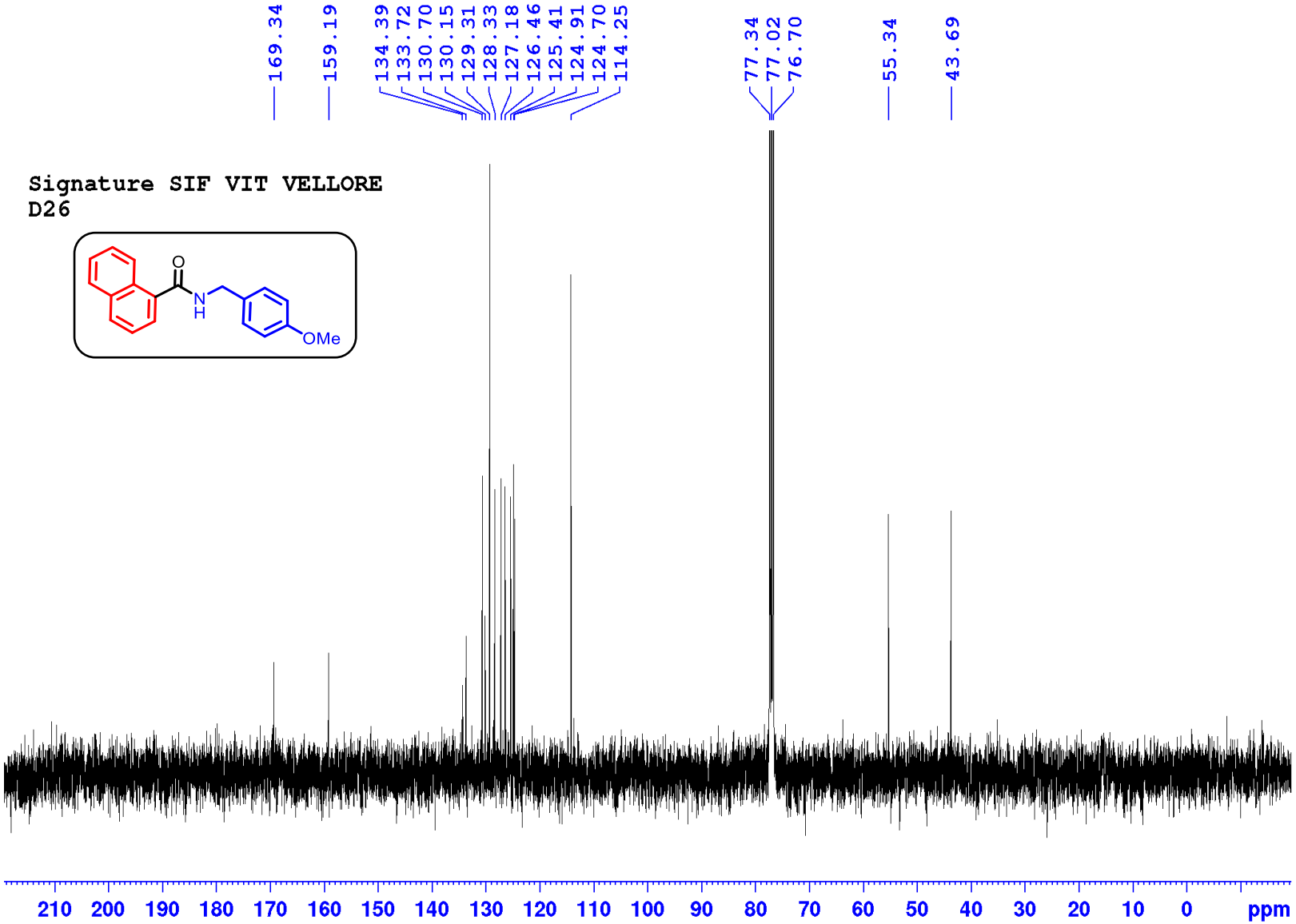
C^{13} NMR (400 MHz, Chloroform –d) of 3n



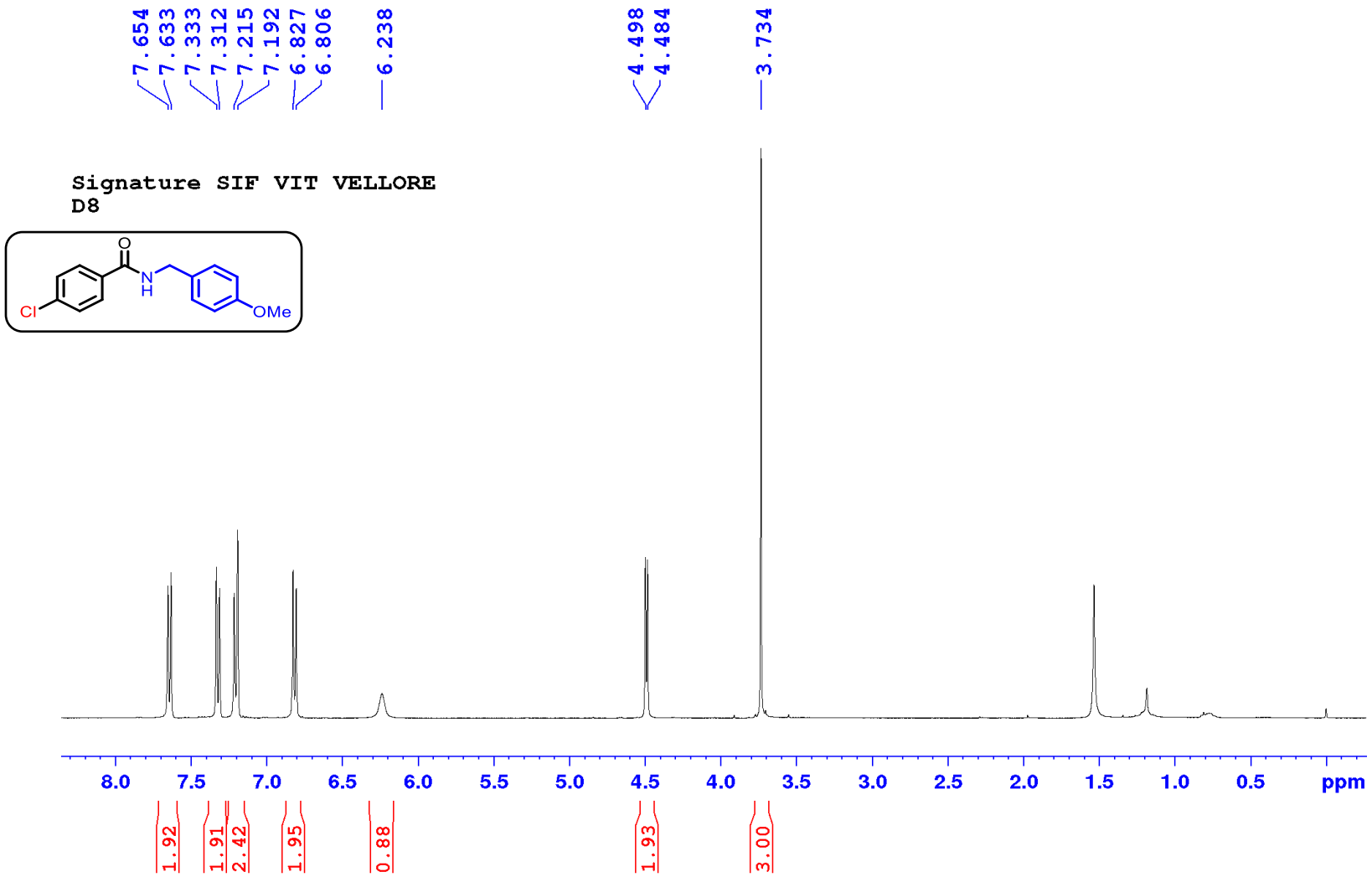
^{1}H NMR (400 MHz, Chloroform –d) of 3o



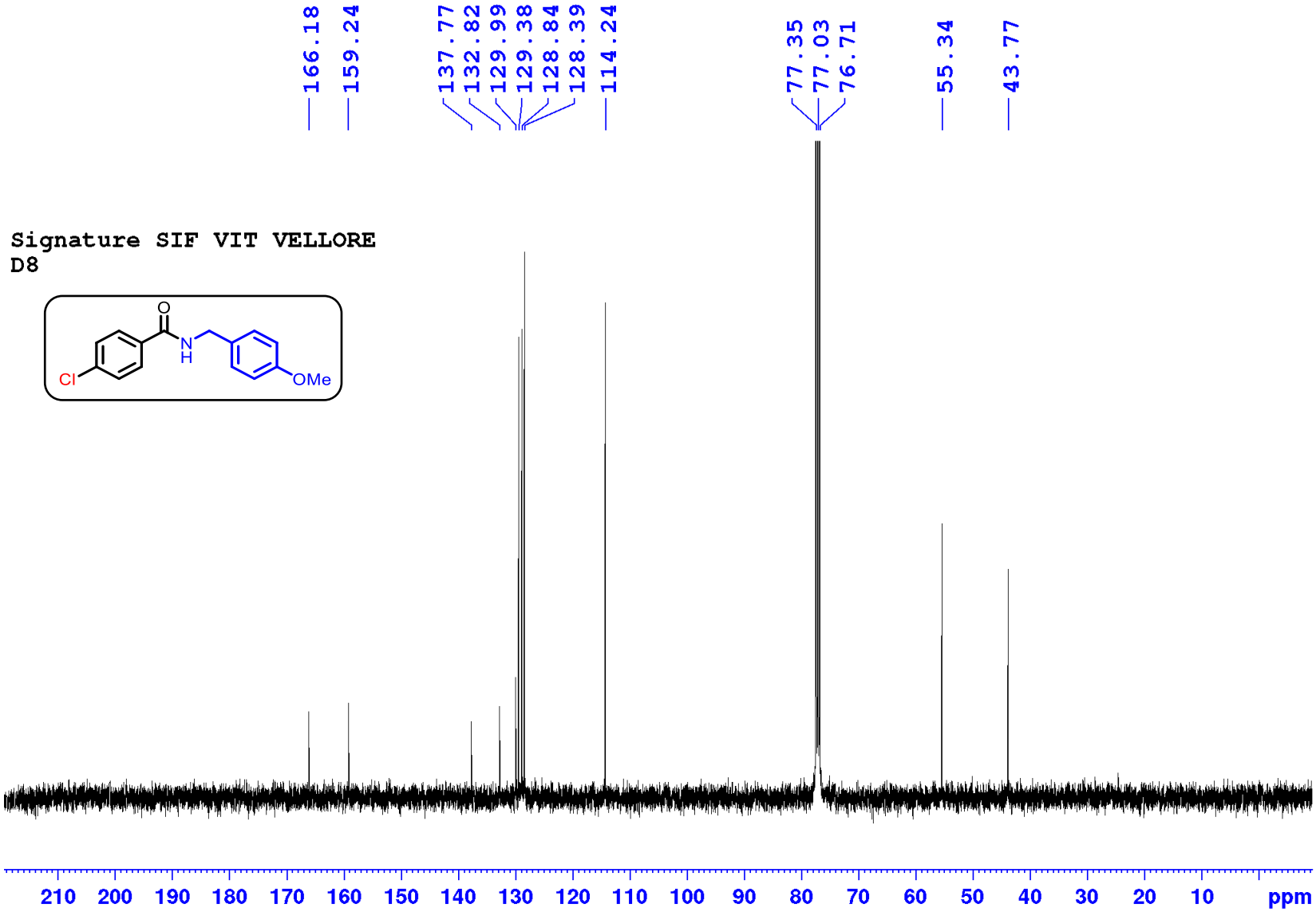
C^{13} NMR (400 MHz, Chloroform –d) of 3o



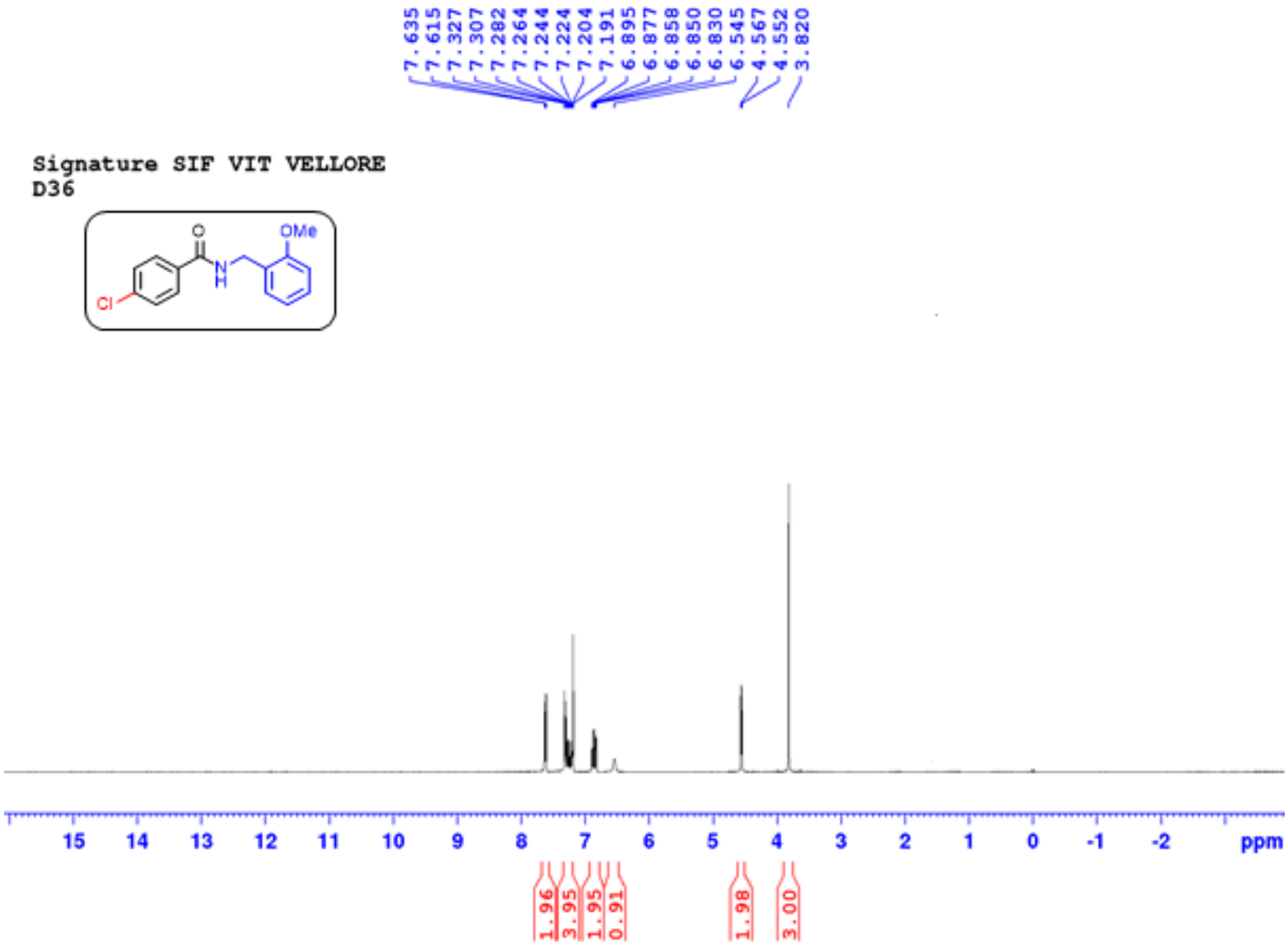
^{1}H NMR (400 MHz, Chloroform –d) of 3p



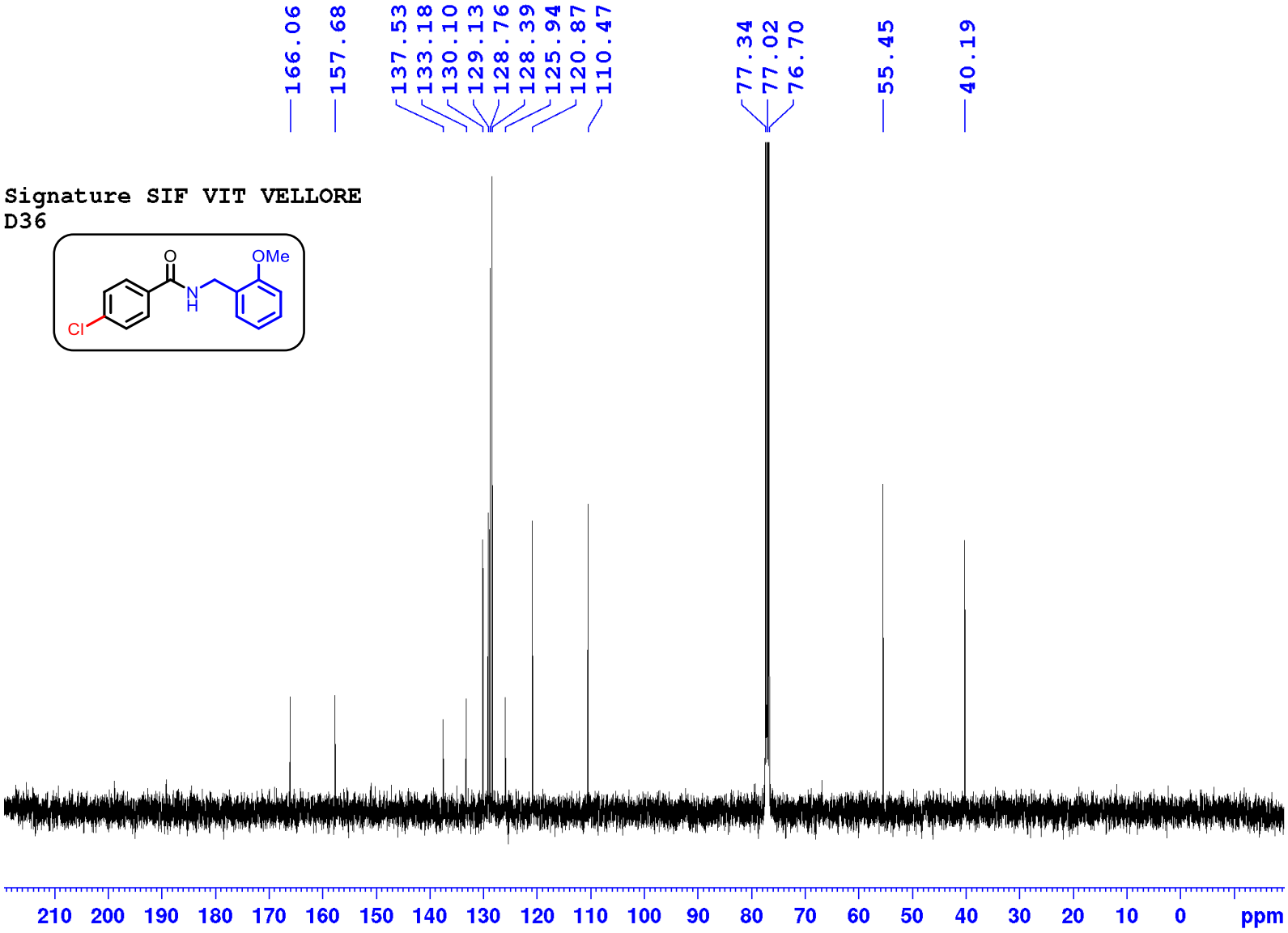
C^{13} NMR (400 MHz, Chloroform –d) of 3p



^{1}H NMR (400 MHz, Chloroform –d) of 3q

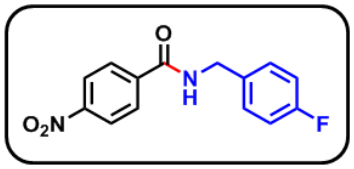


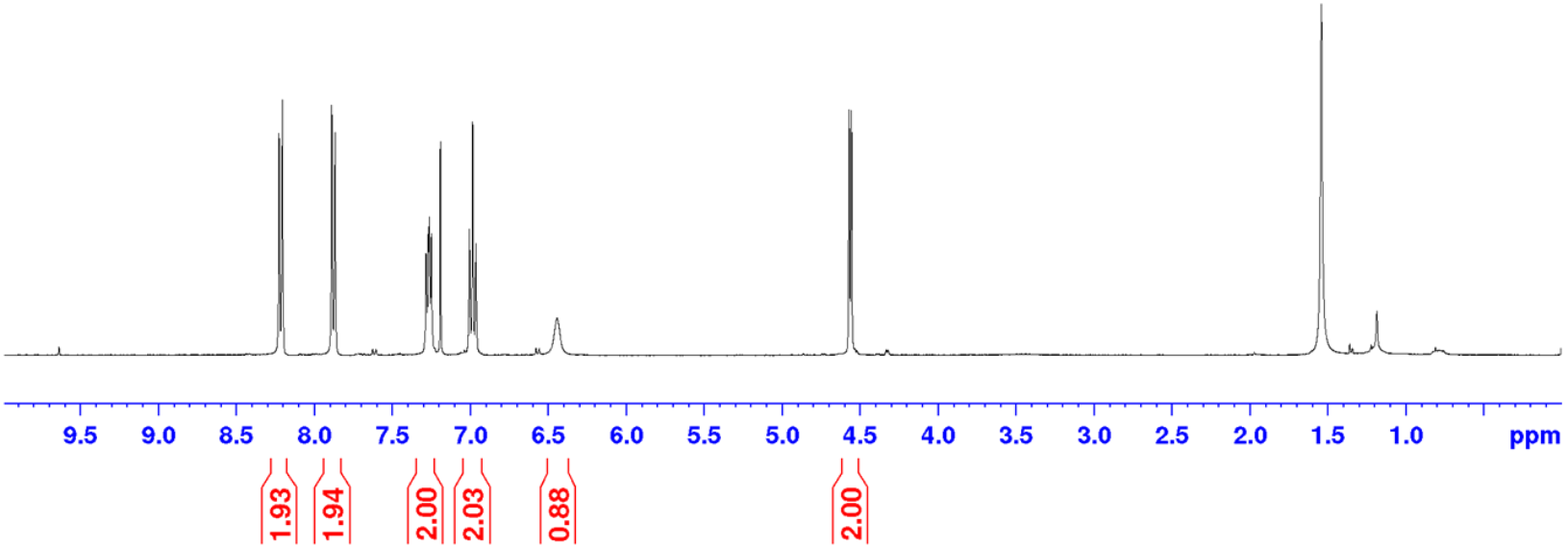
C^{13} NMR (400 MHz, Chloroform –d) of 3q



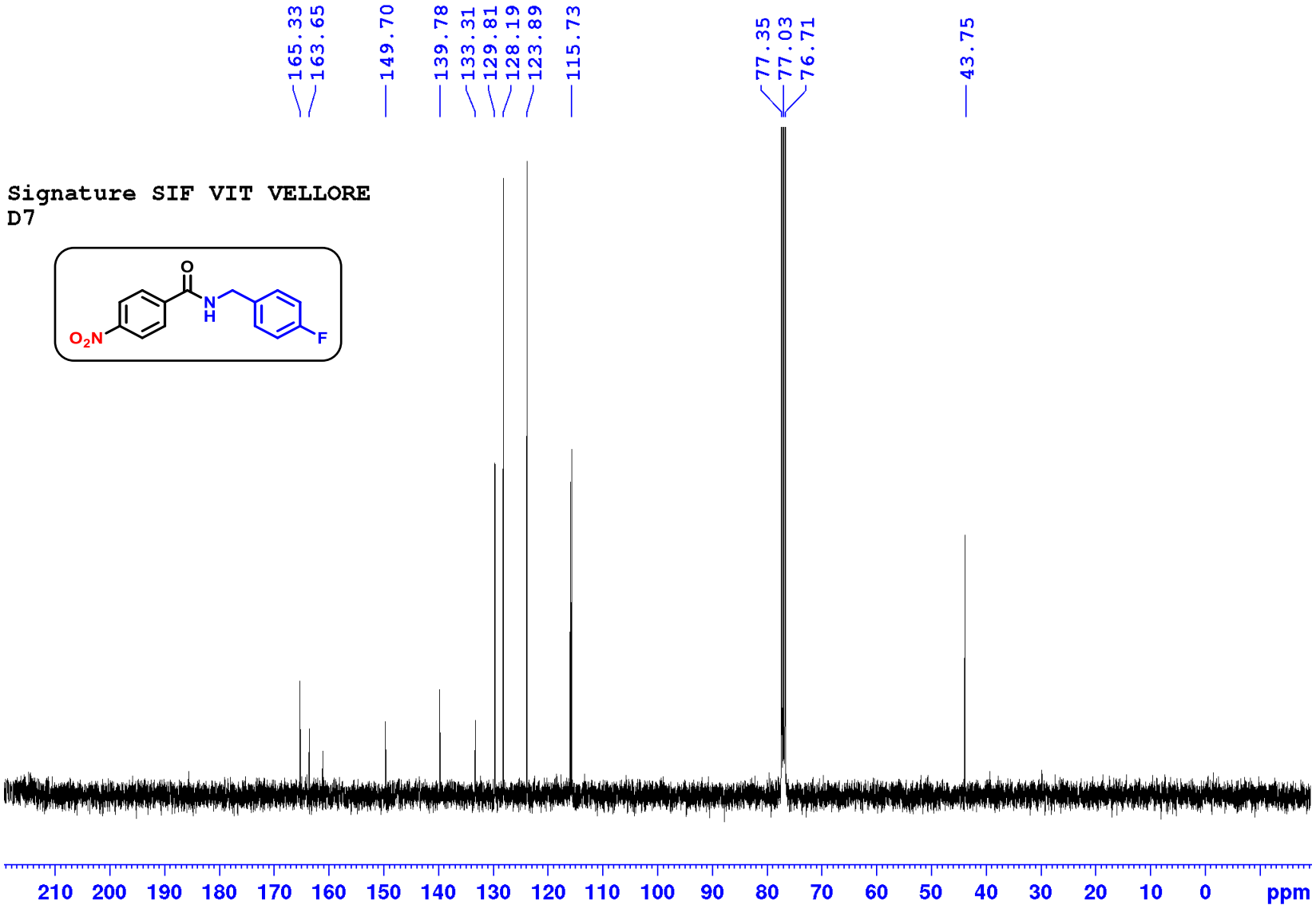
^{1}H NMR (400 MHz, Chloroform –d) of 3r

Signature SIF VIT VELLORE
D7



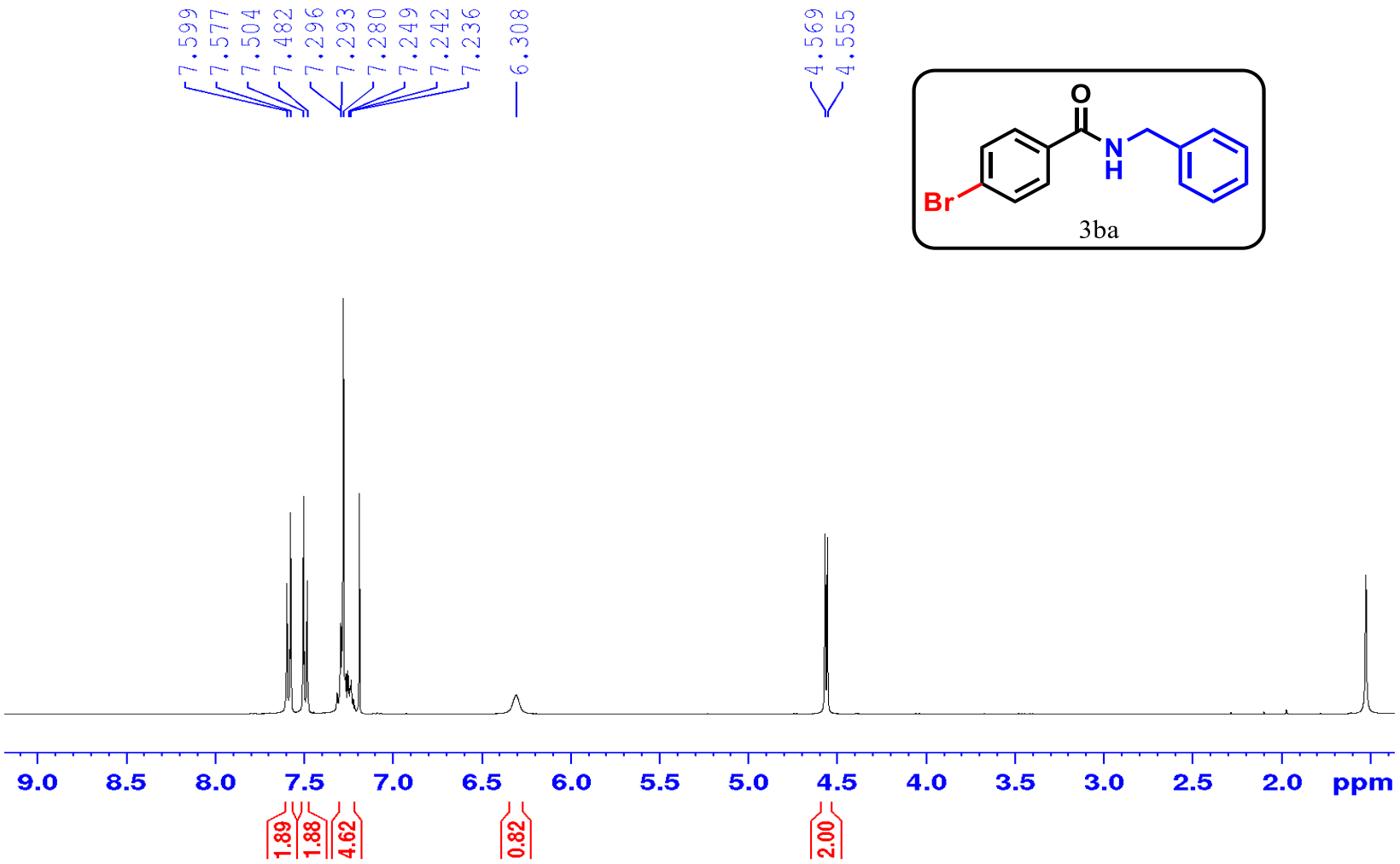


C^{13} NMR (400 MHz, Chloroform –d) of 3r



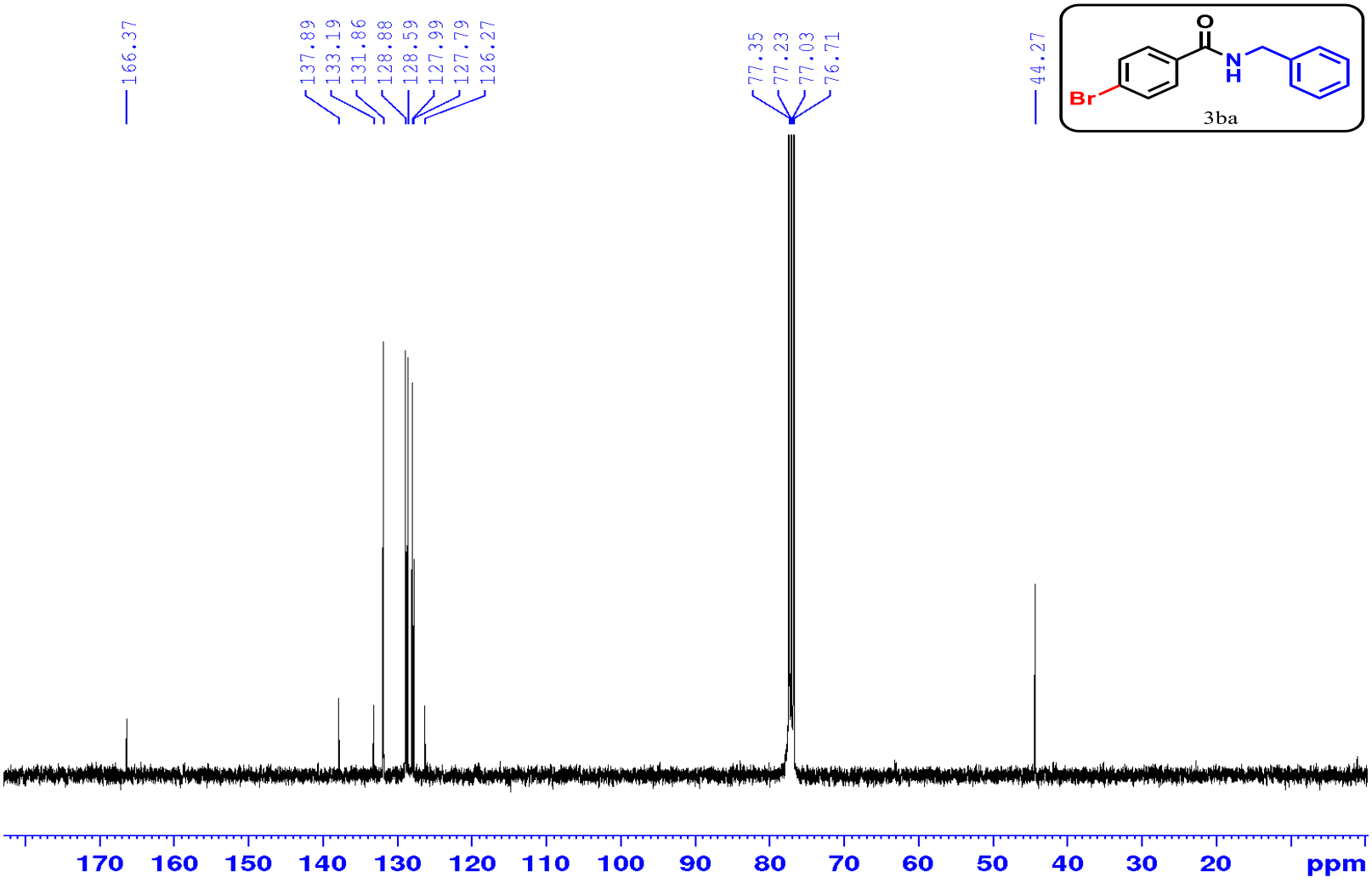
^{1}H NMR (400 MHz, Chloroform –d) of 3s

Signature SIF VIT VELLORE
3BA

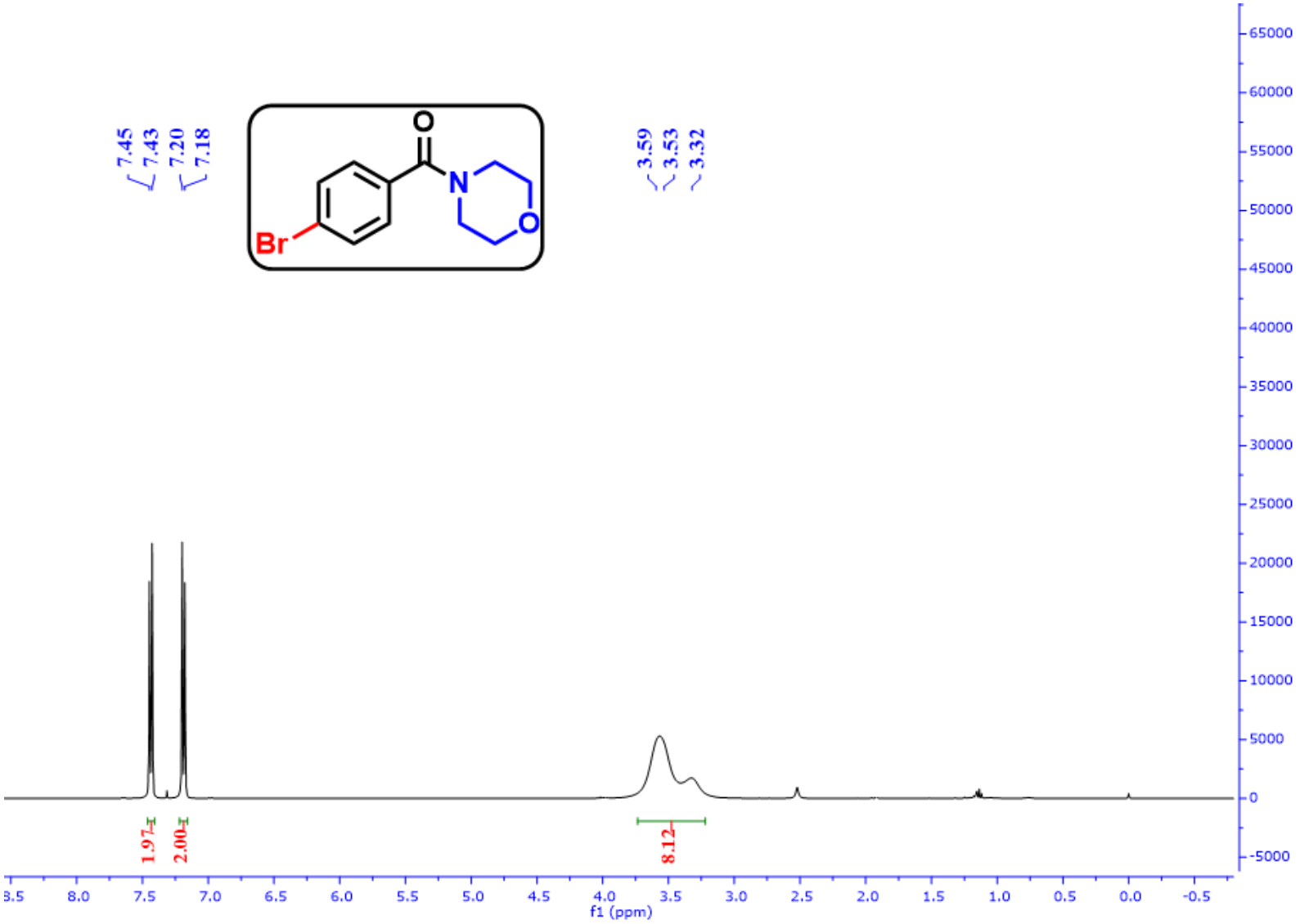


C^{13} NMR (400 MHz, Chloroform –d) of 3s

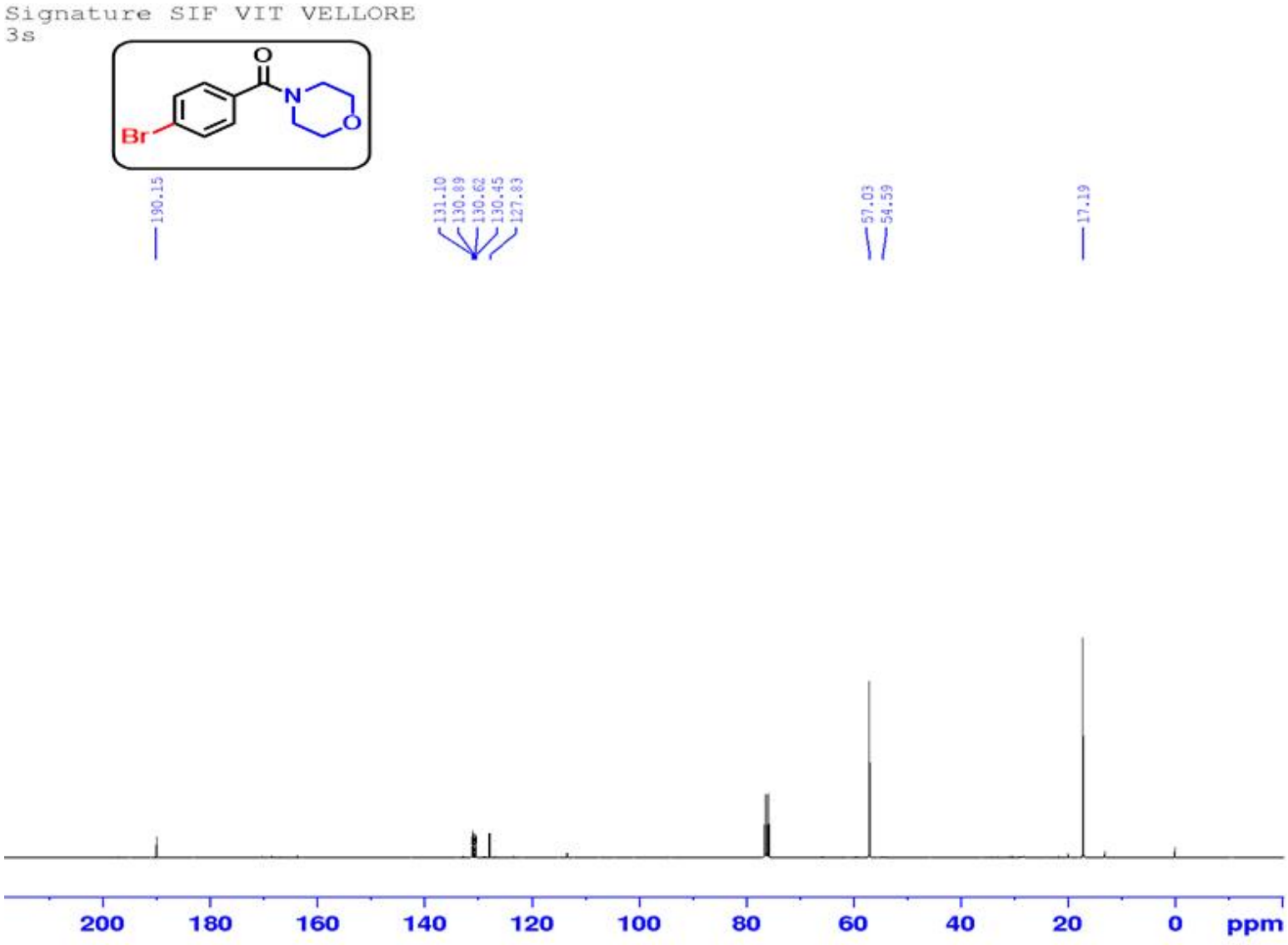
Signature SIF VIT VELLORE
3BA



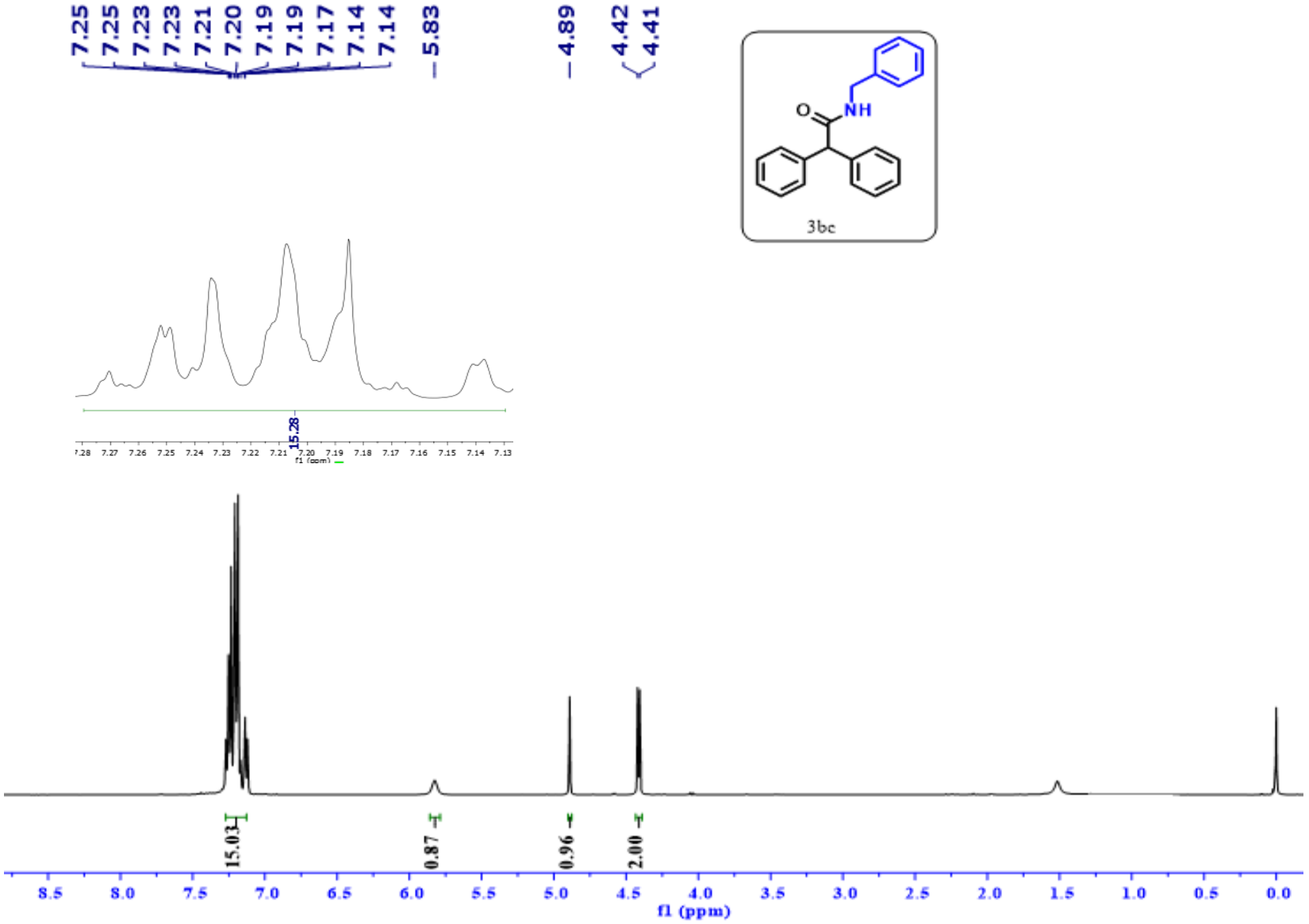
^{1}H NMR (400 MHz, Chloroform –d) of 3t



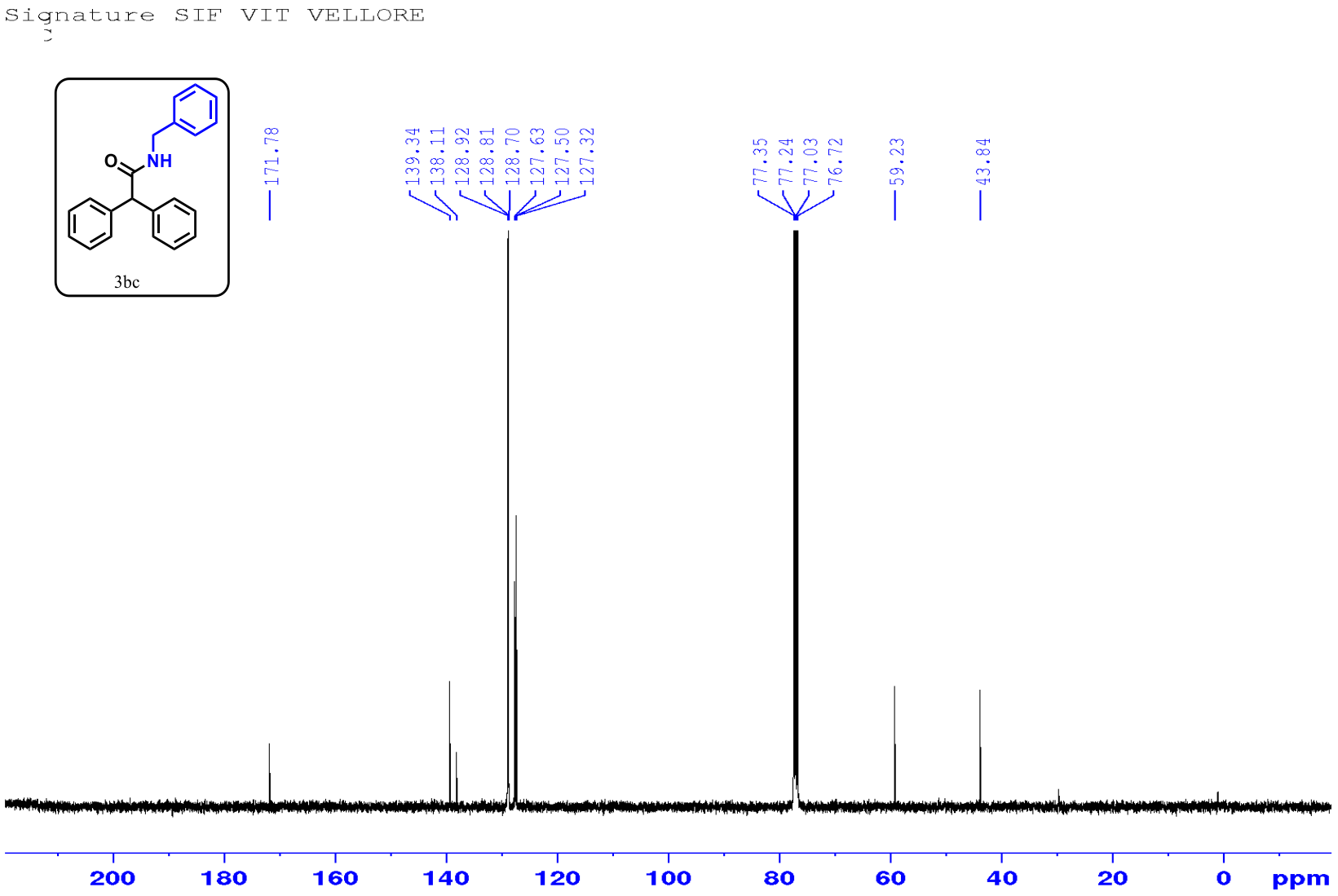
C^{13} NMR (400 MHz, Chloroform –d) of 3t



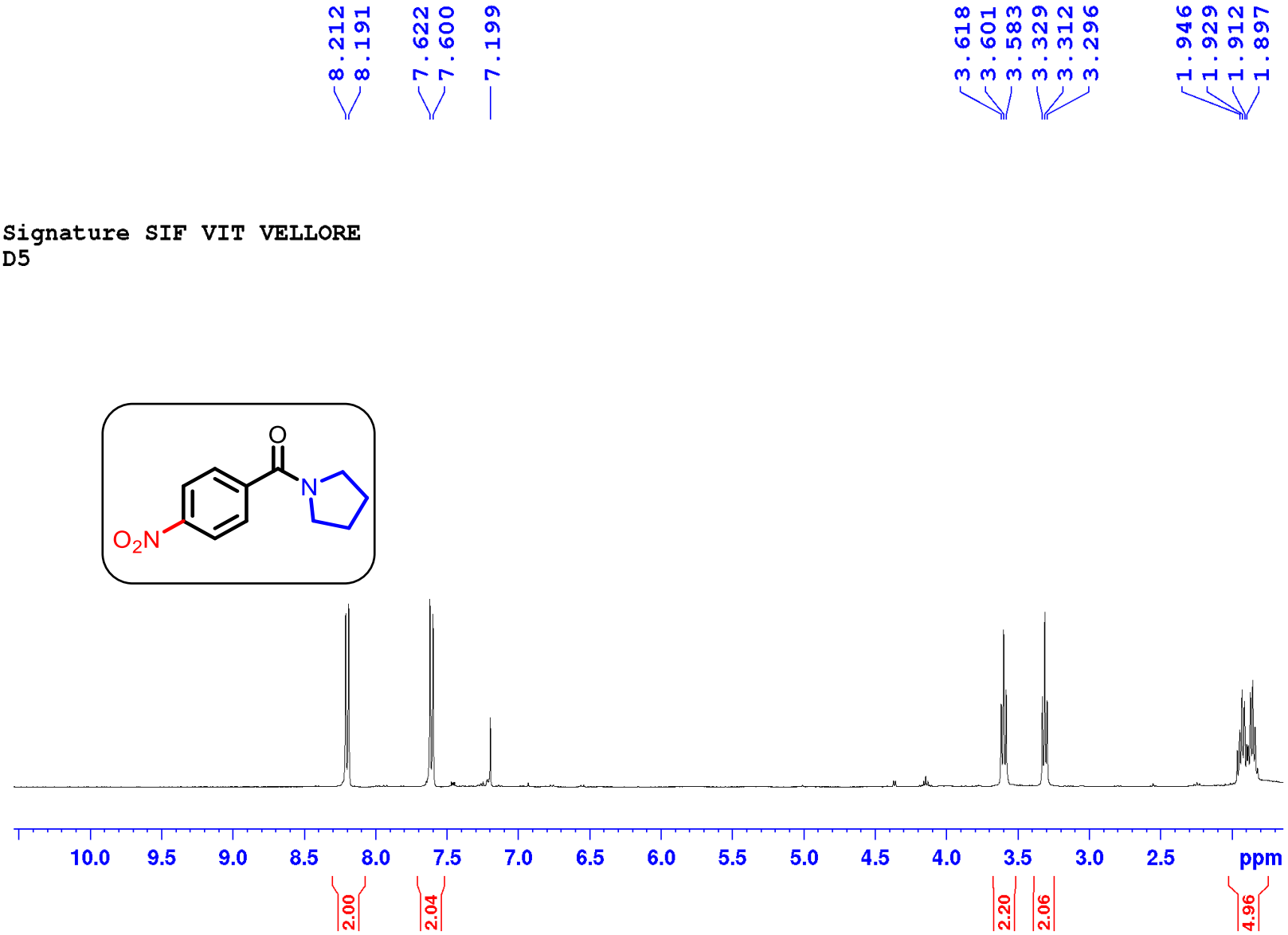
^{1}H NMR (400 MHz, Chloroform –d) of 3u



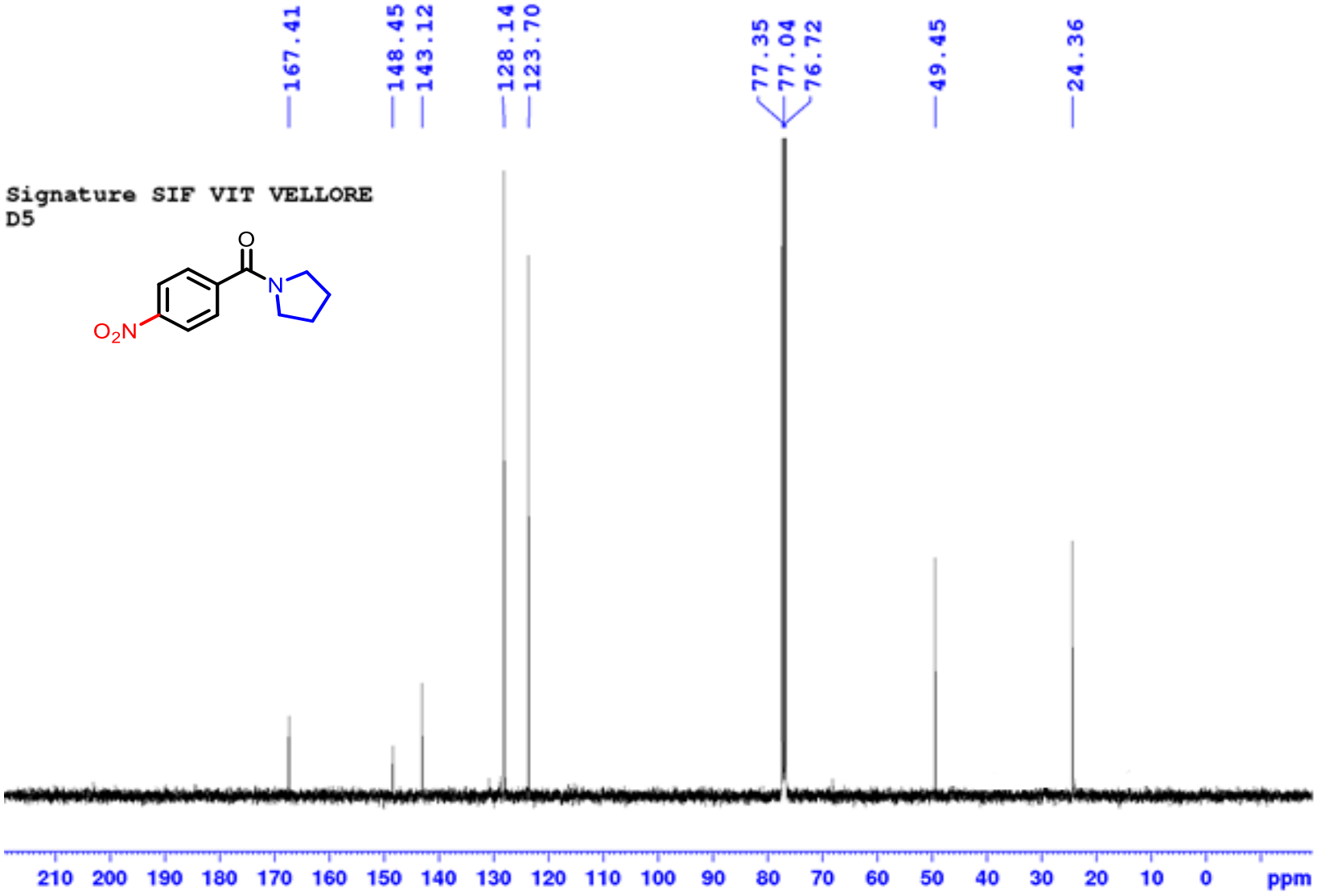
C^{13} NMR (400 MHz, Chloroform –d) of 3u



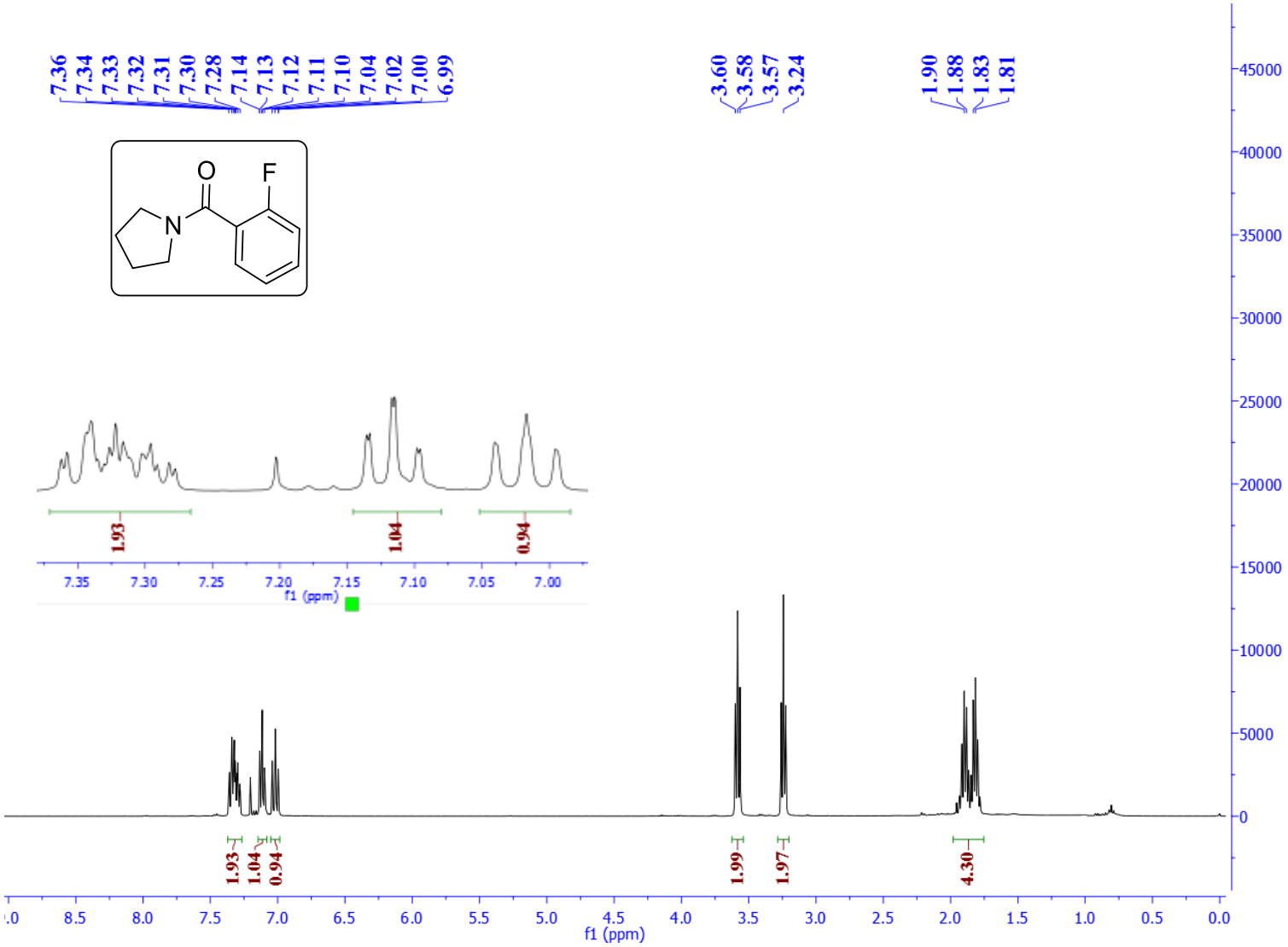
^{1}H NMR (400 MHz, Chloroform –d) of 3w



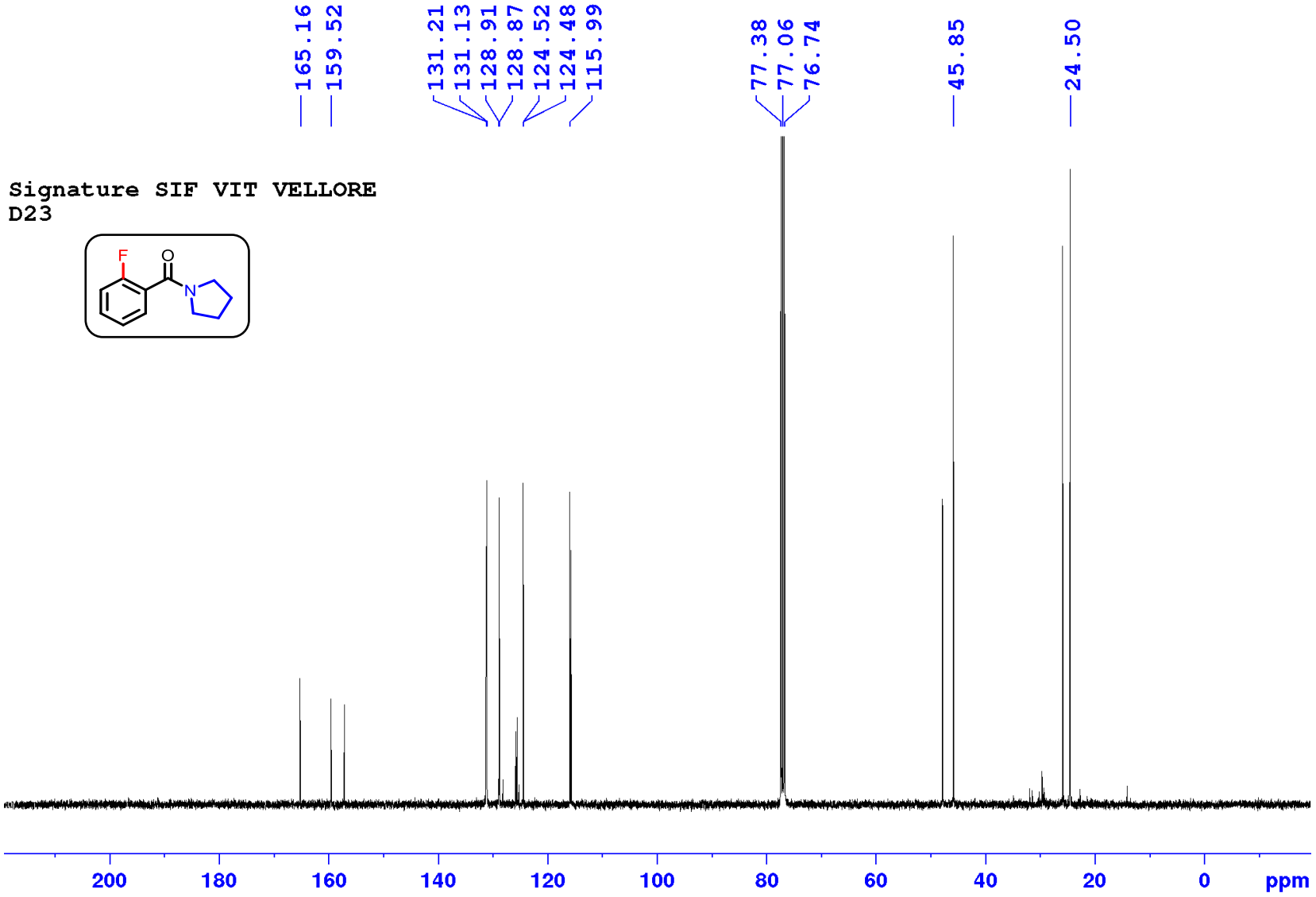
C^{13} NMR (400 MHz, Chloroform –d) of 3w



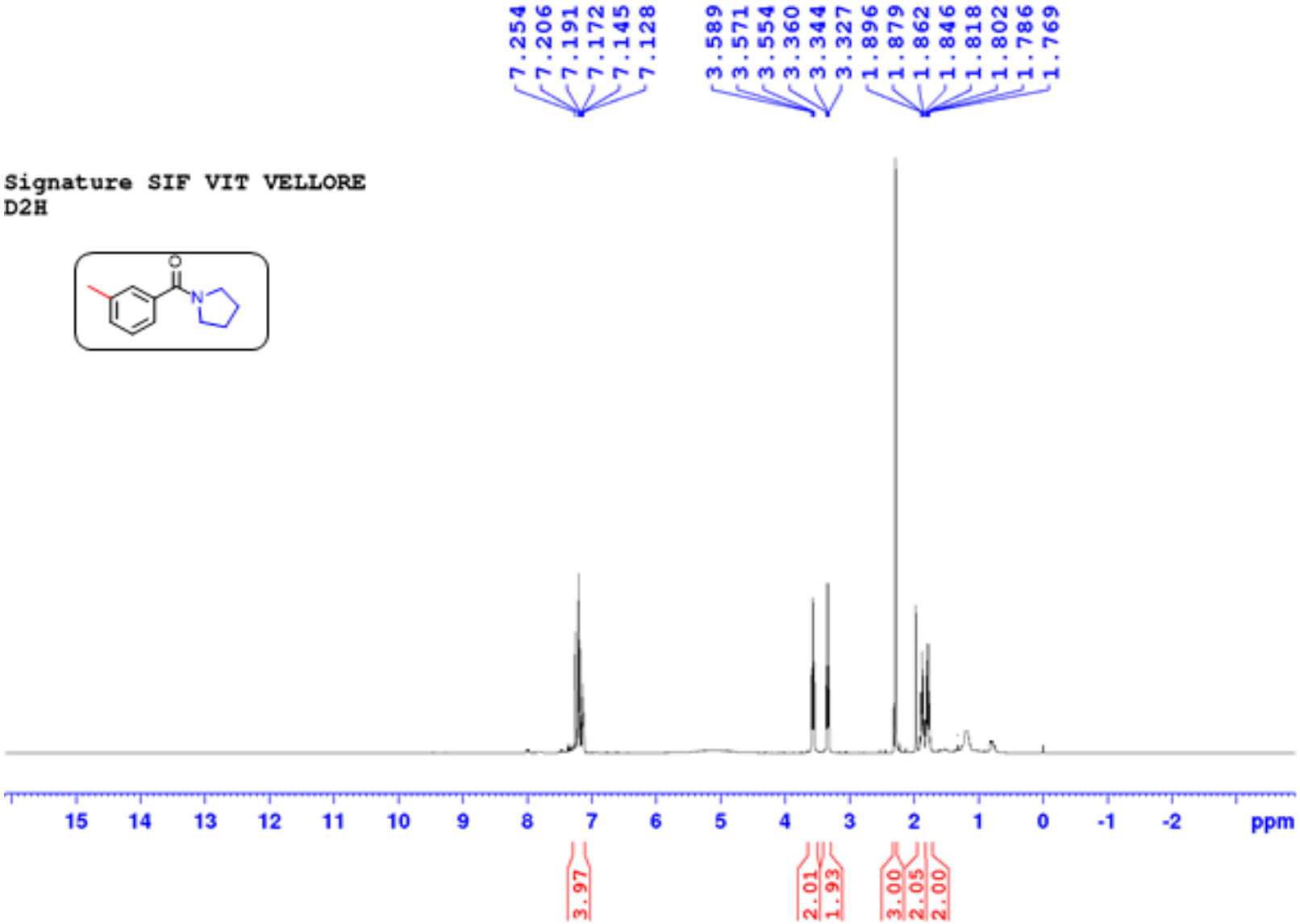
^{1}H NMR (400 MHz, Chloroform –d) of 3x



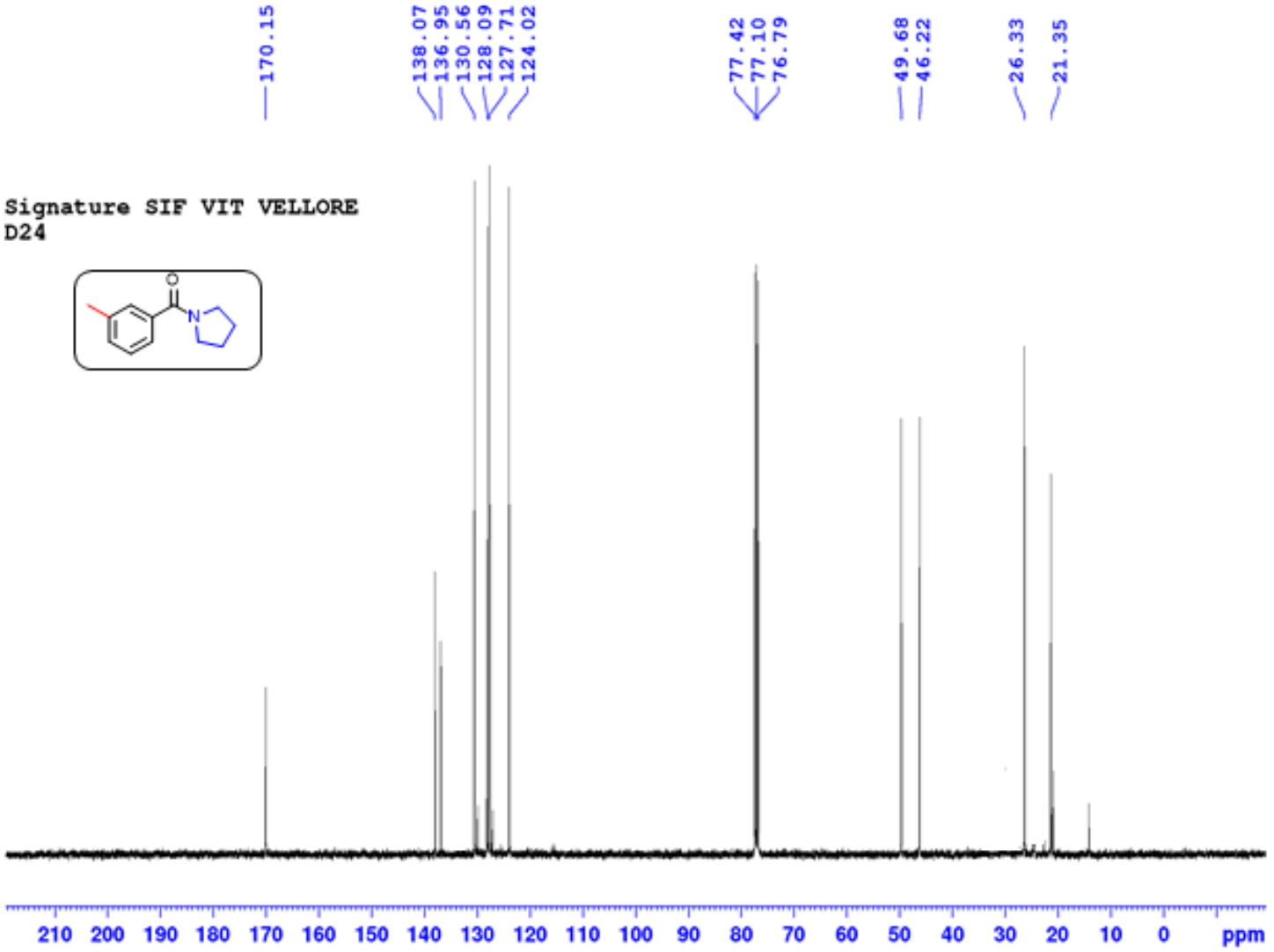
C^{13} NMR (400 MHz, Chloroform –d) of 3x



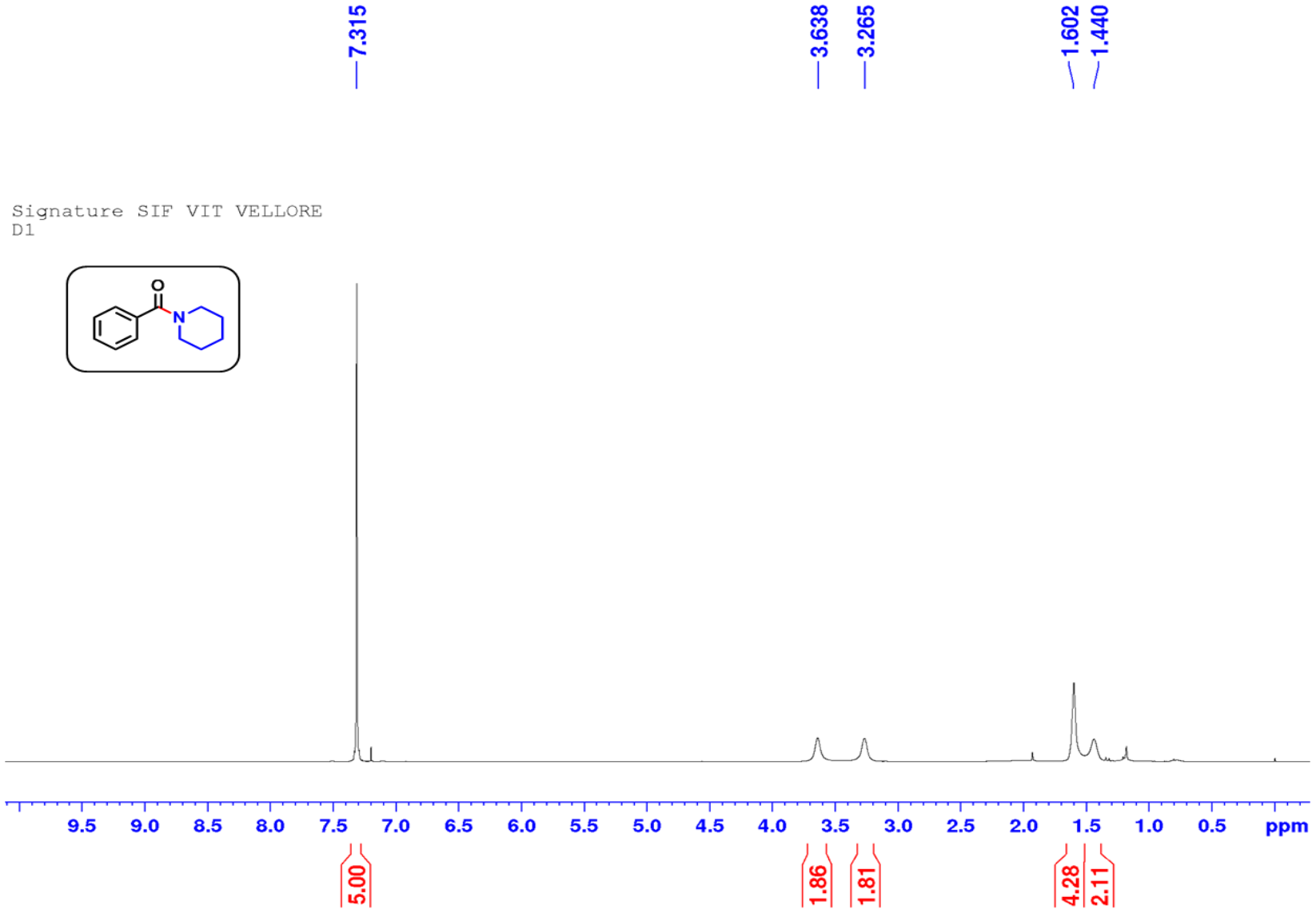
^{1}H NMR (400 MHz, Chloroform –d) of 3y



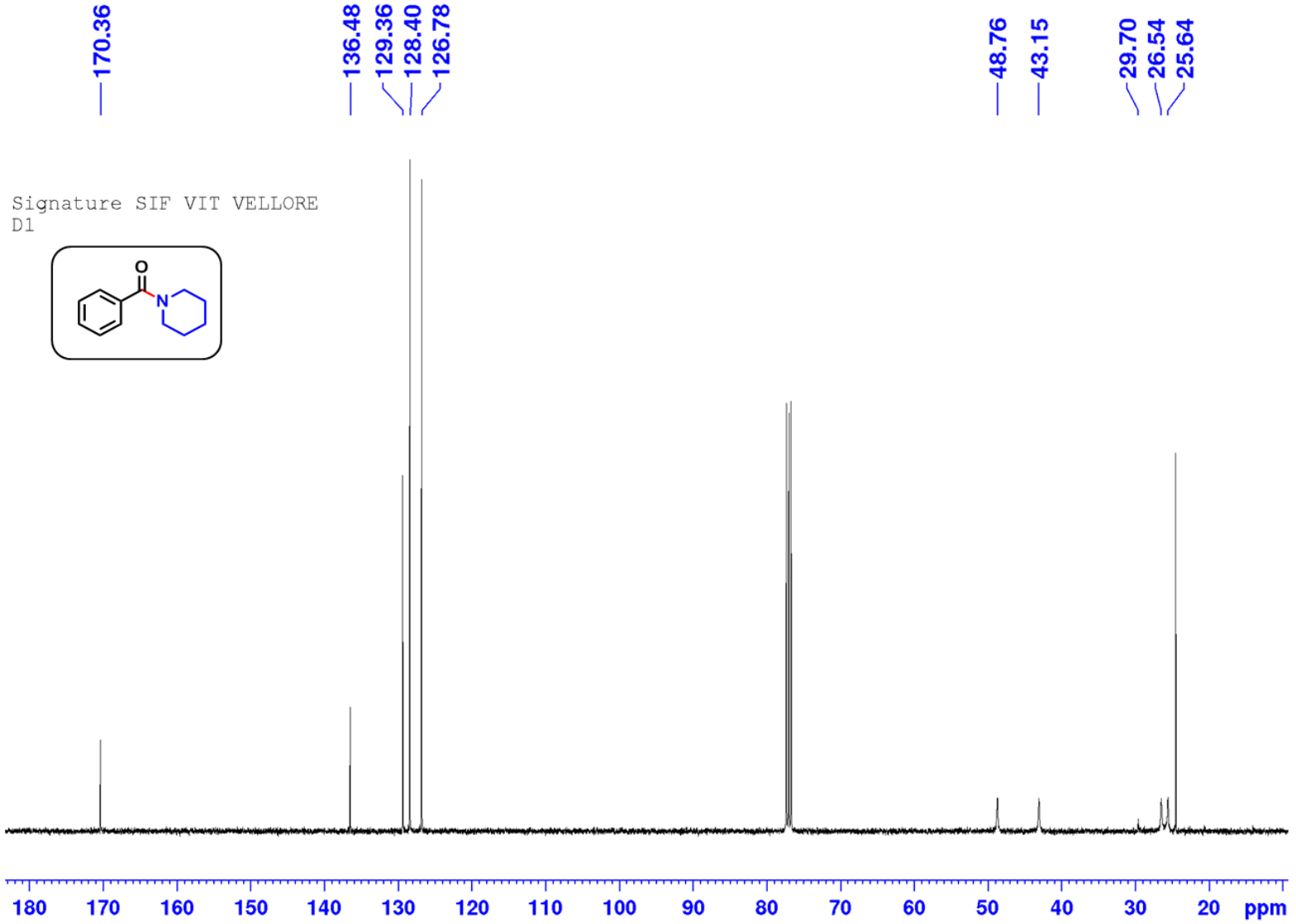
C^{13} NMR (400 MHz, Chloroform –d) of 3y



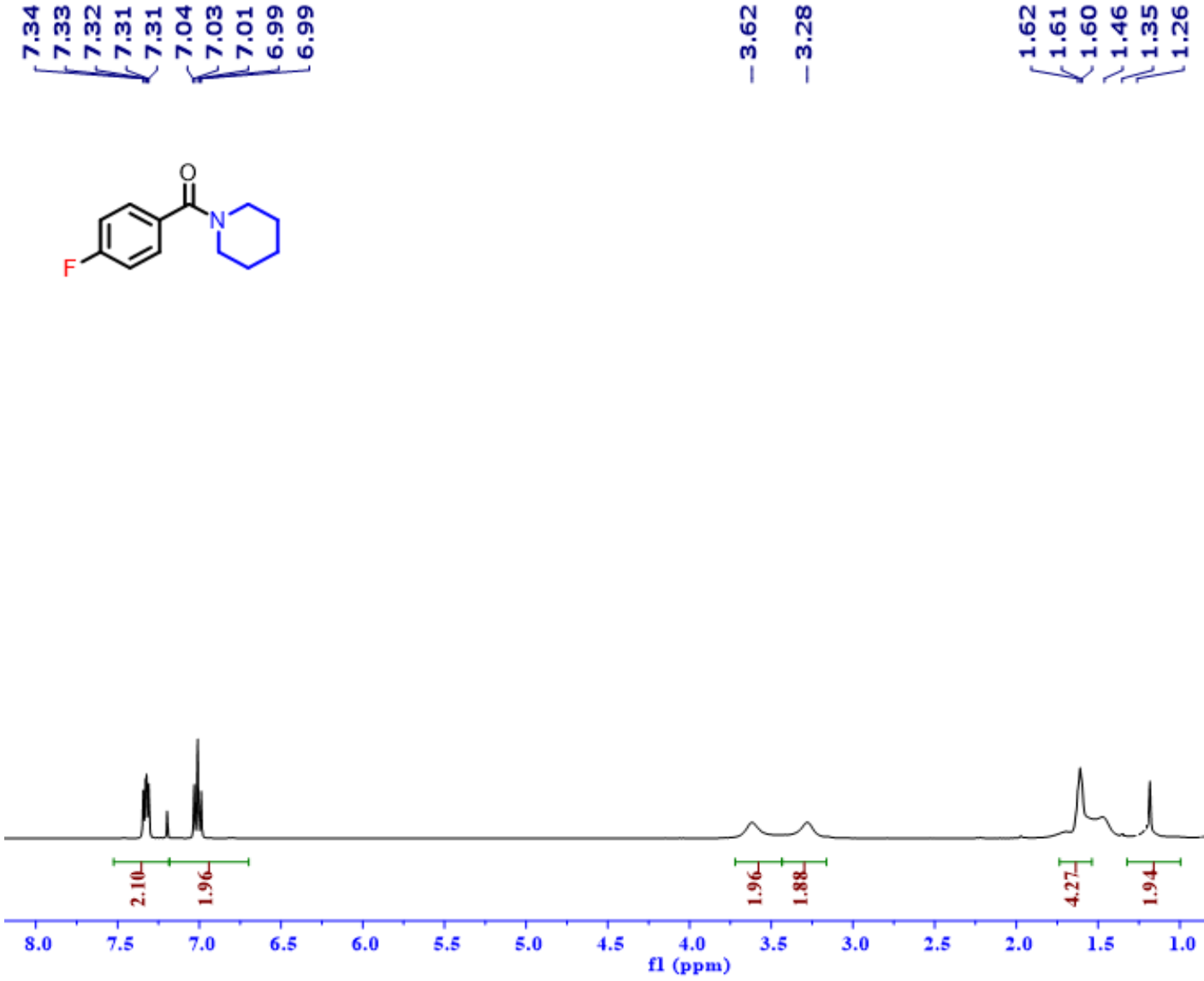
^{1}H NMR (400 MHz, Chloroform –d) of 3z



C^{13} NMR (400 MHz, Chloroform –d) of 3z

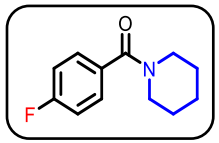


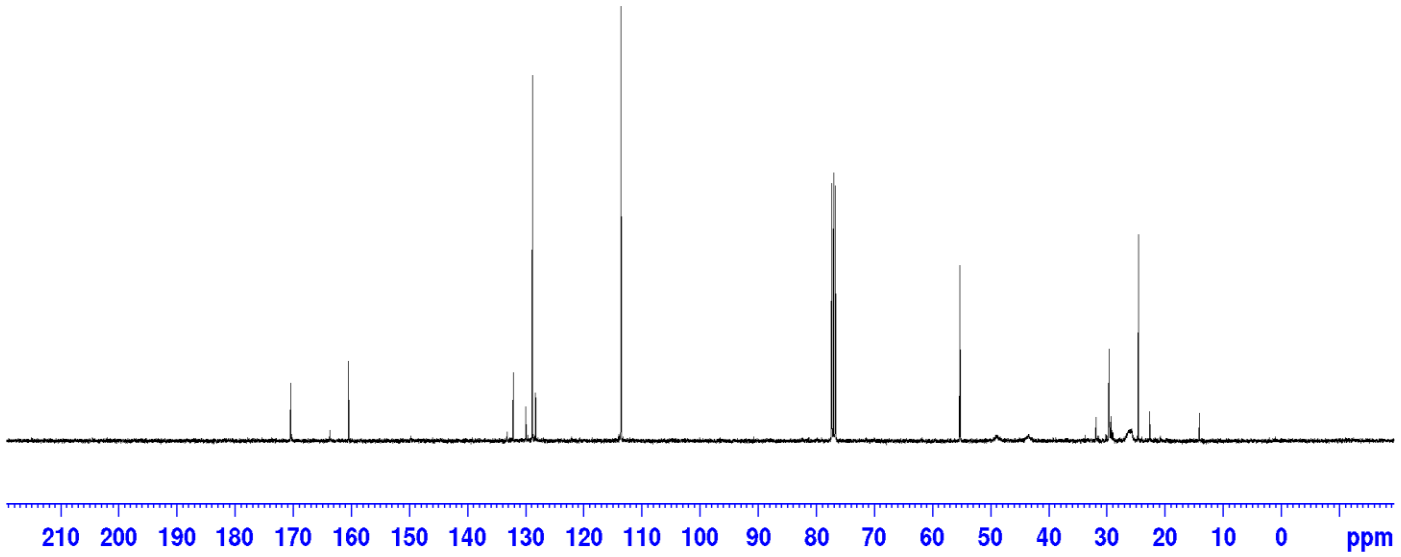
^{1}H NMR (400 MHz, Chloroform –d) of 3aa



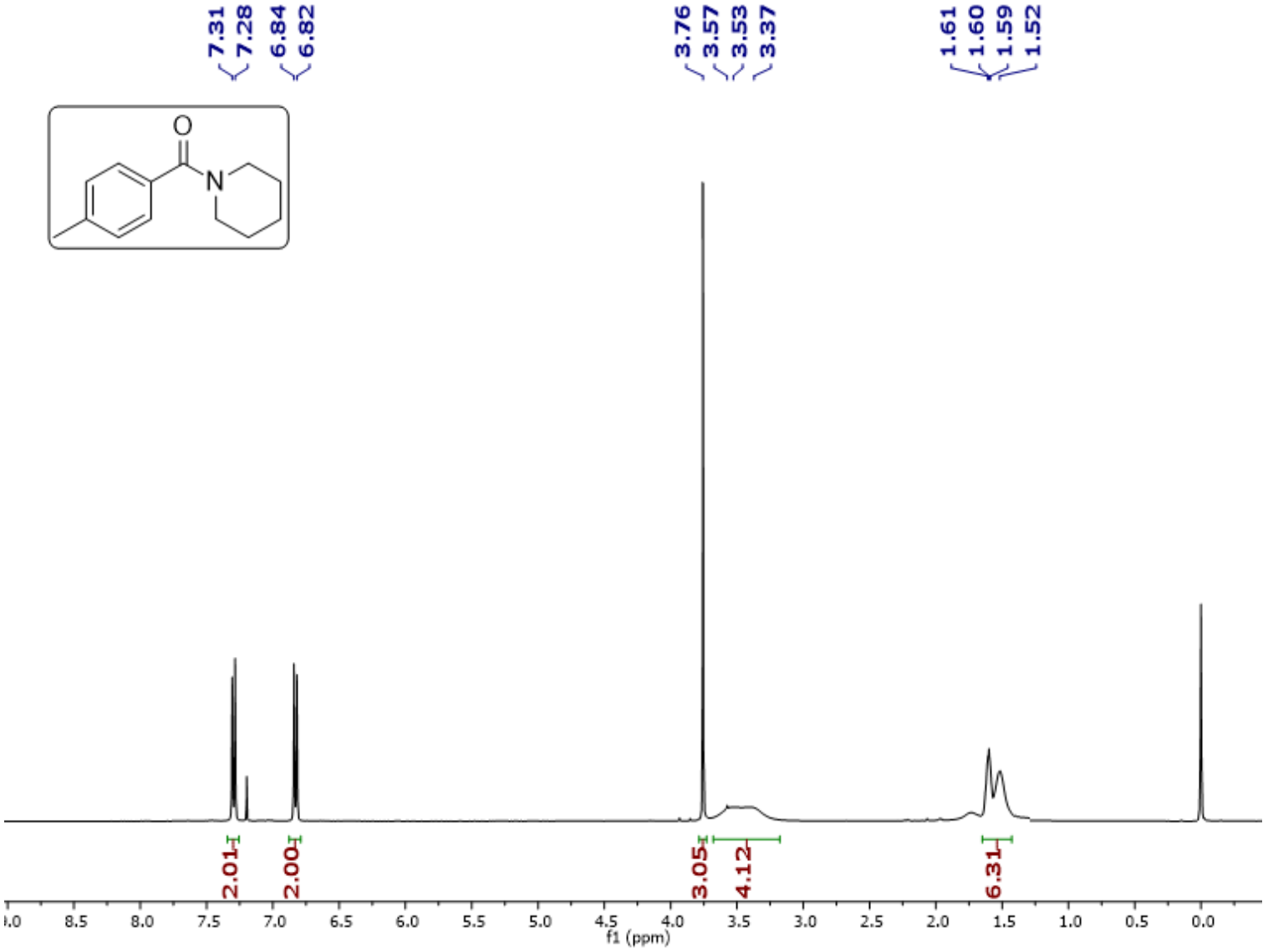
C^{13} NMR (400 MHz, Chloroform –d) of 3aa

Signature SIF VIT VELLORE
D18

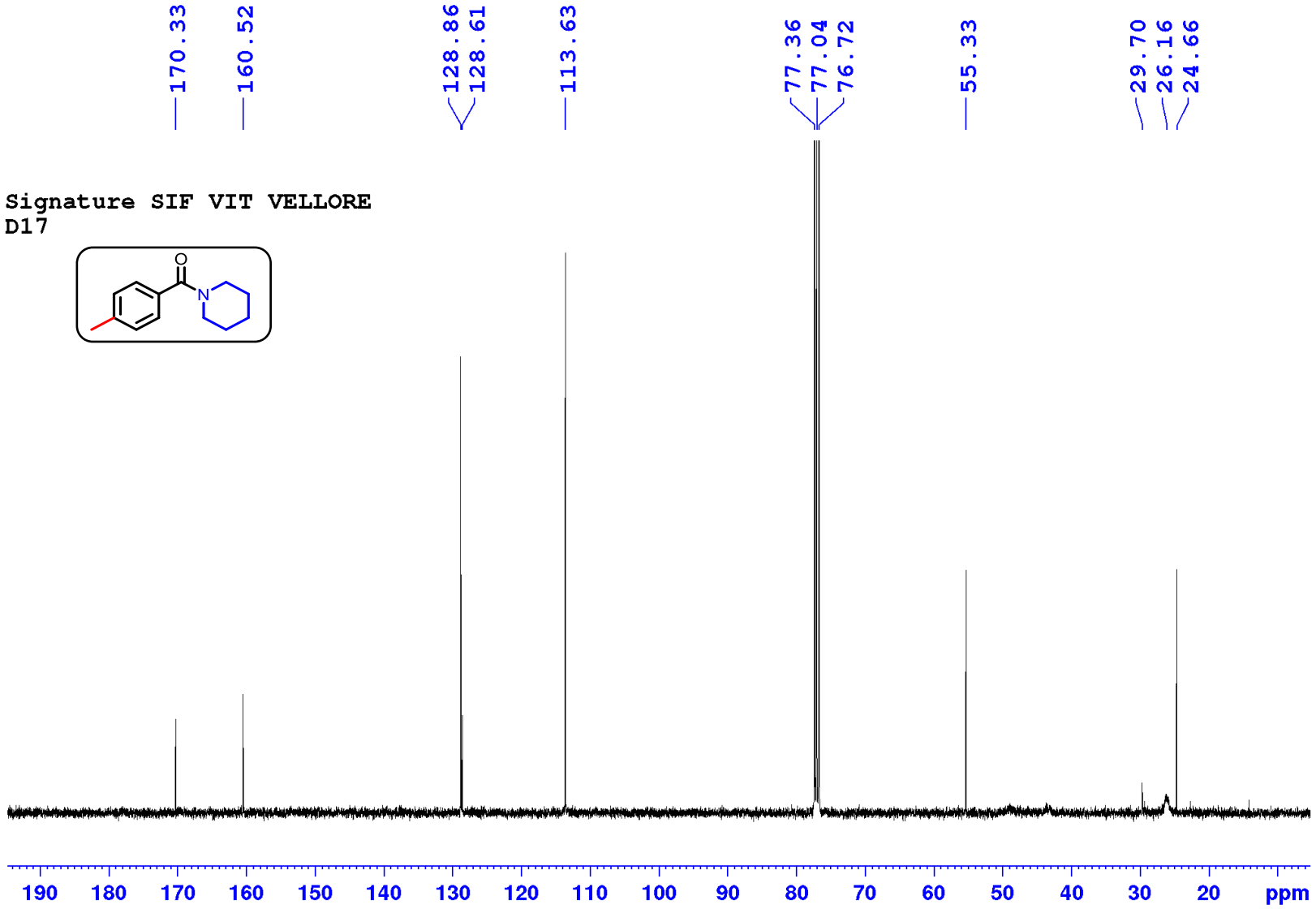




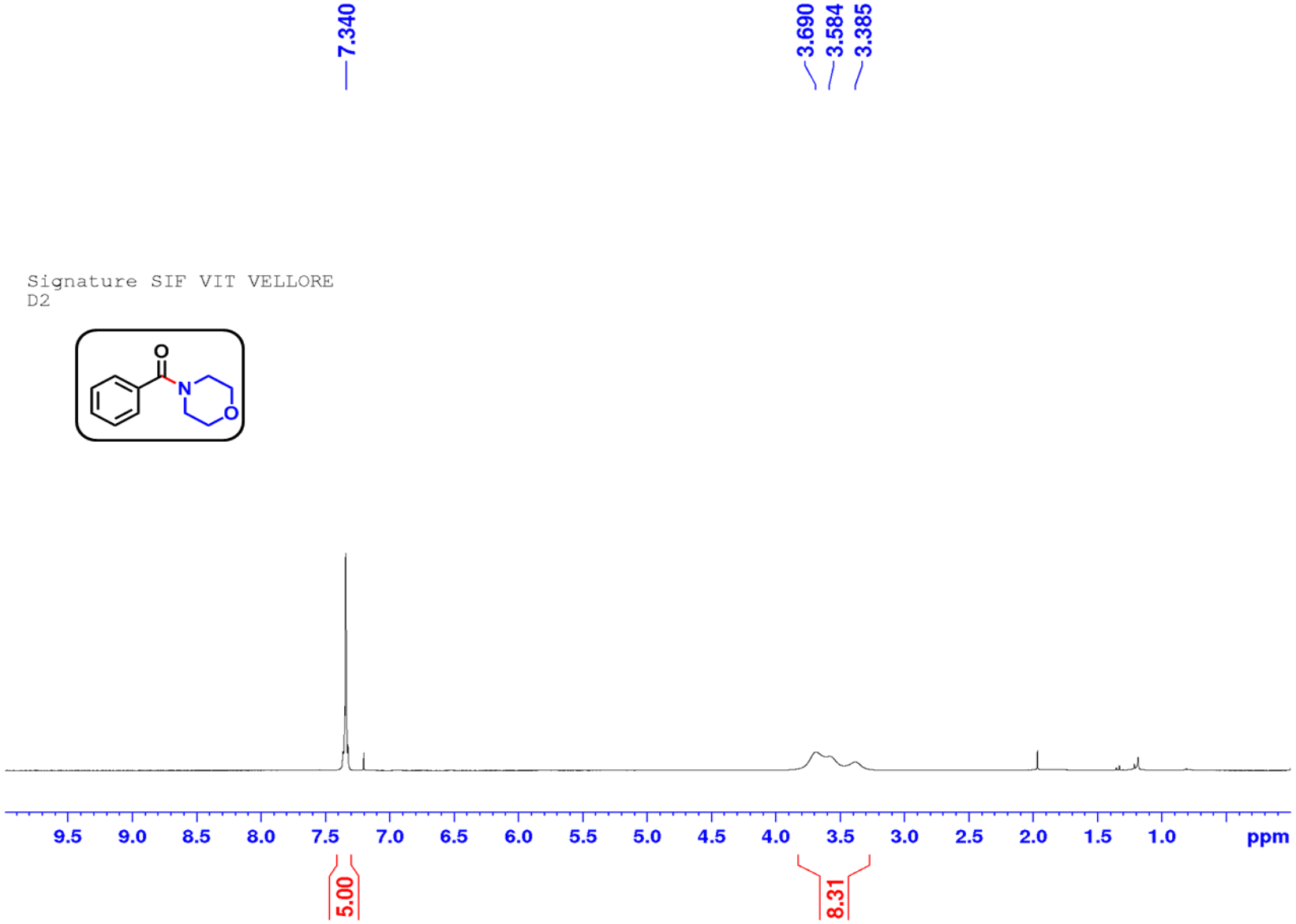
^{1}H NMR (400 MHz, Chloroform –d) of 3ab



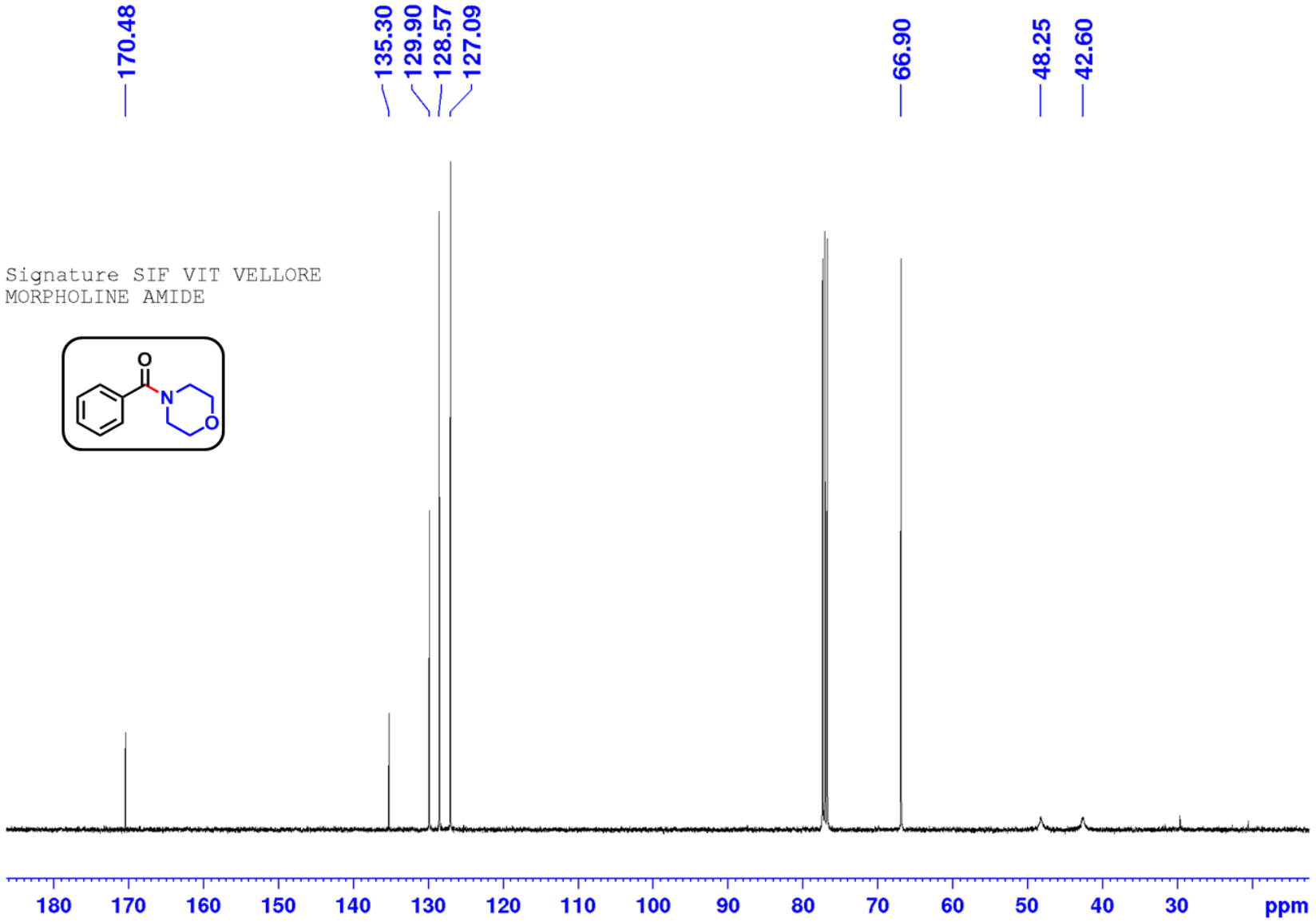
C^{13} NMR (400 MHz, Chloroform –d) of 3ab



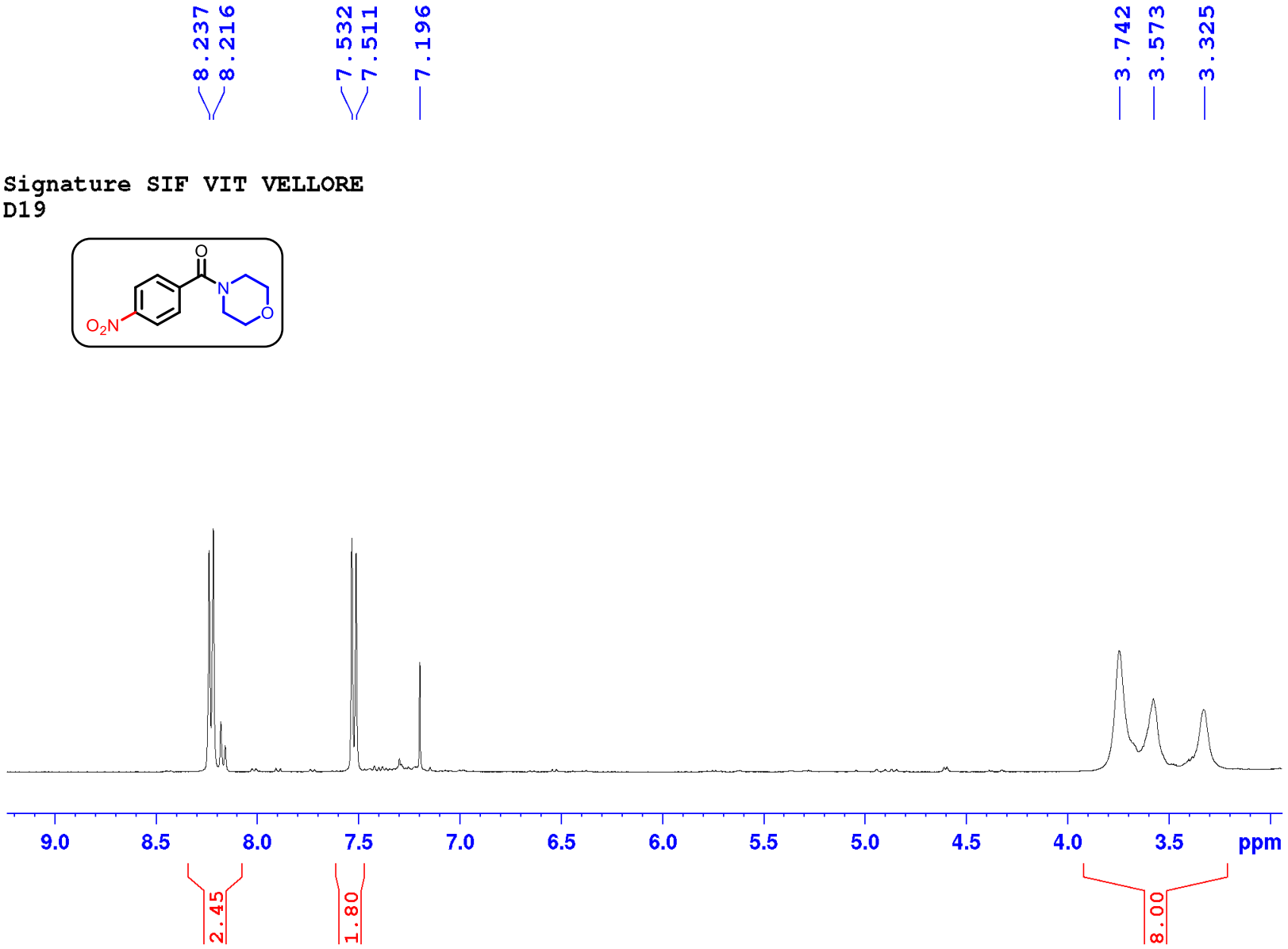
^{1}H NMR (400 MHz, Chloroform –d) of 3ac



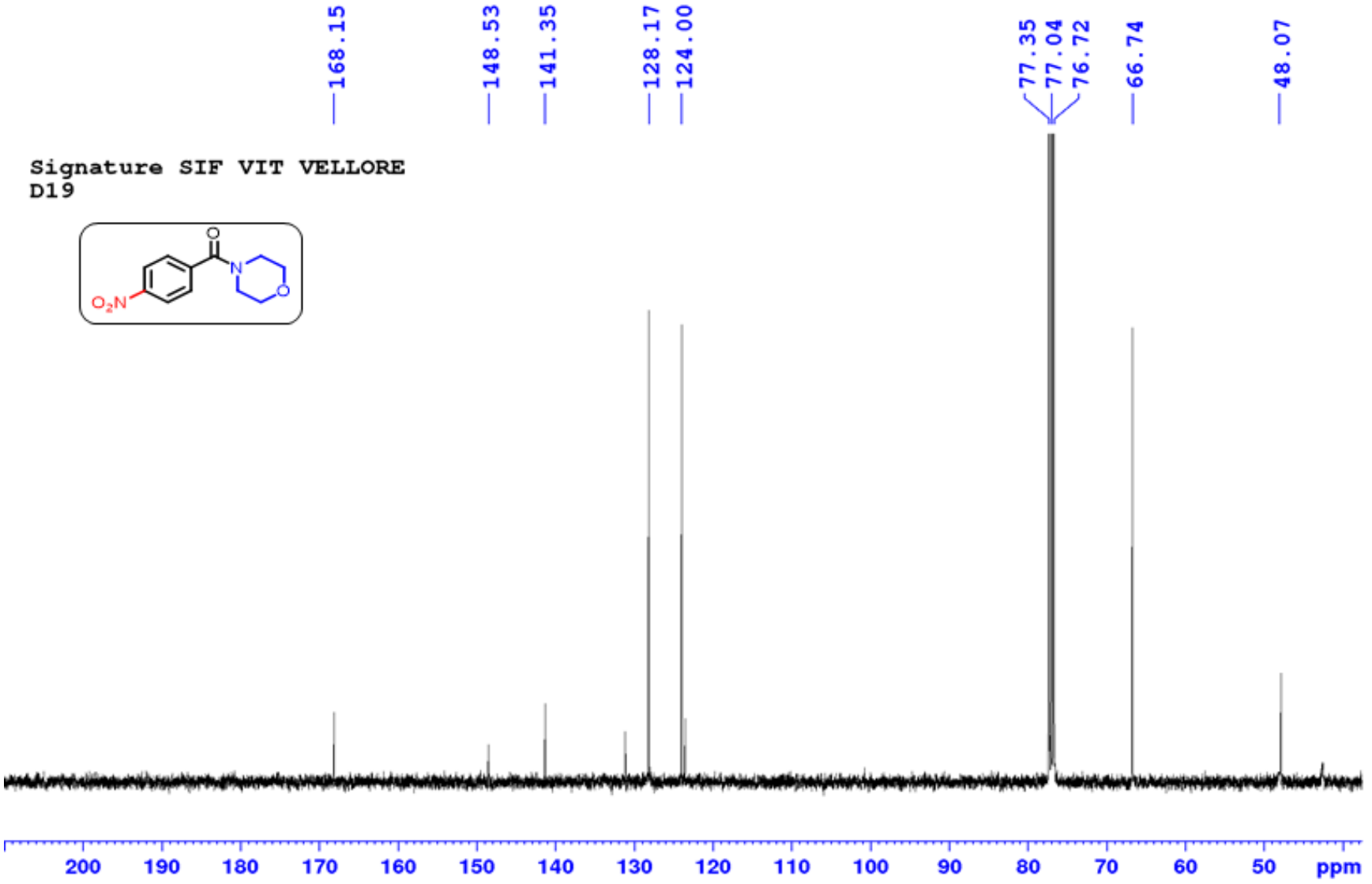
C^{13} NMR (400 MHz, Chloroform –d) of 3ac



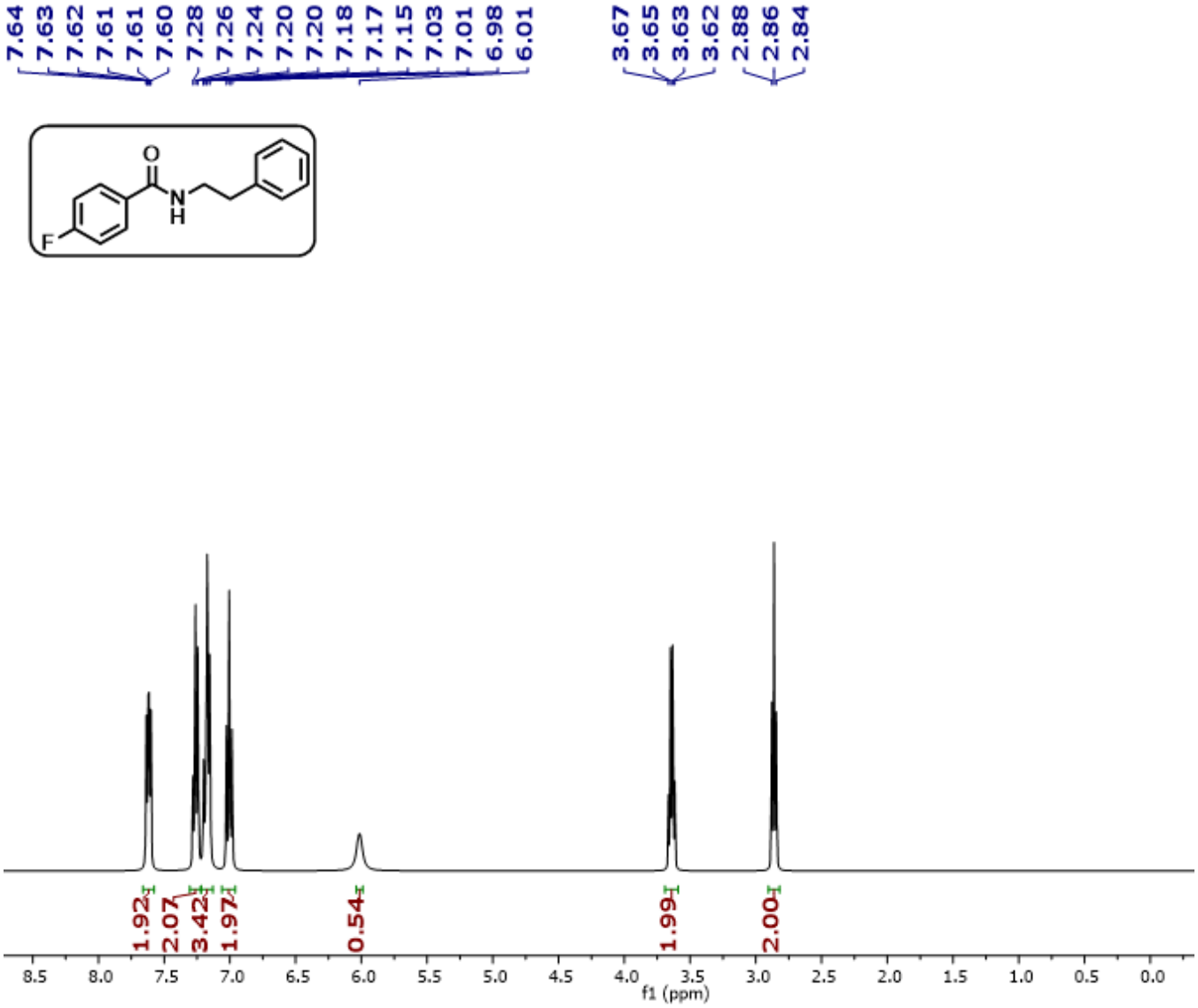
^{1}H NMR (400 MHz, Chloroform –d) of 3ad



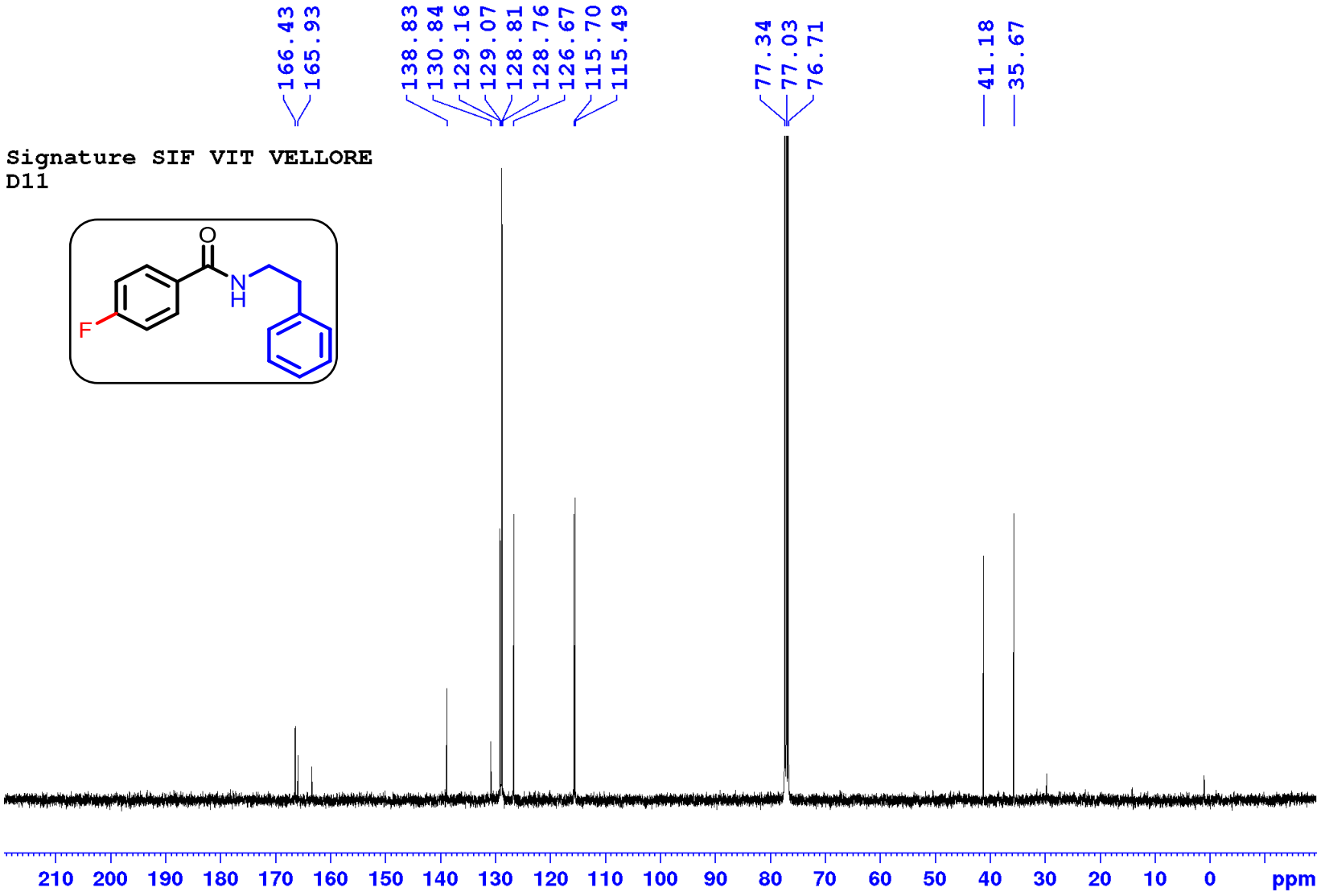
C^{13} NMR (400 MHz, Chloroform –d) of 3ad



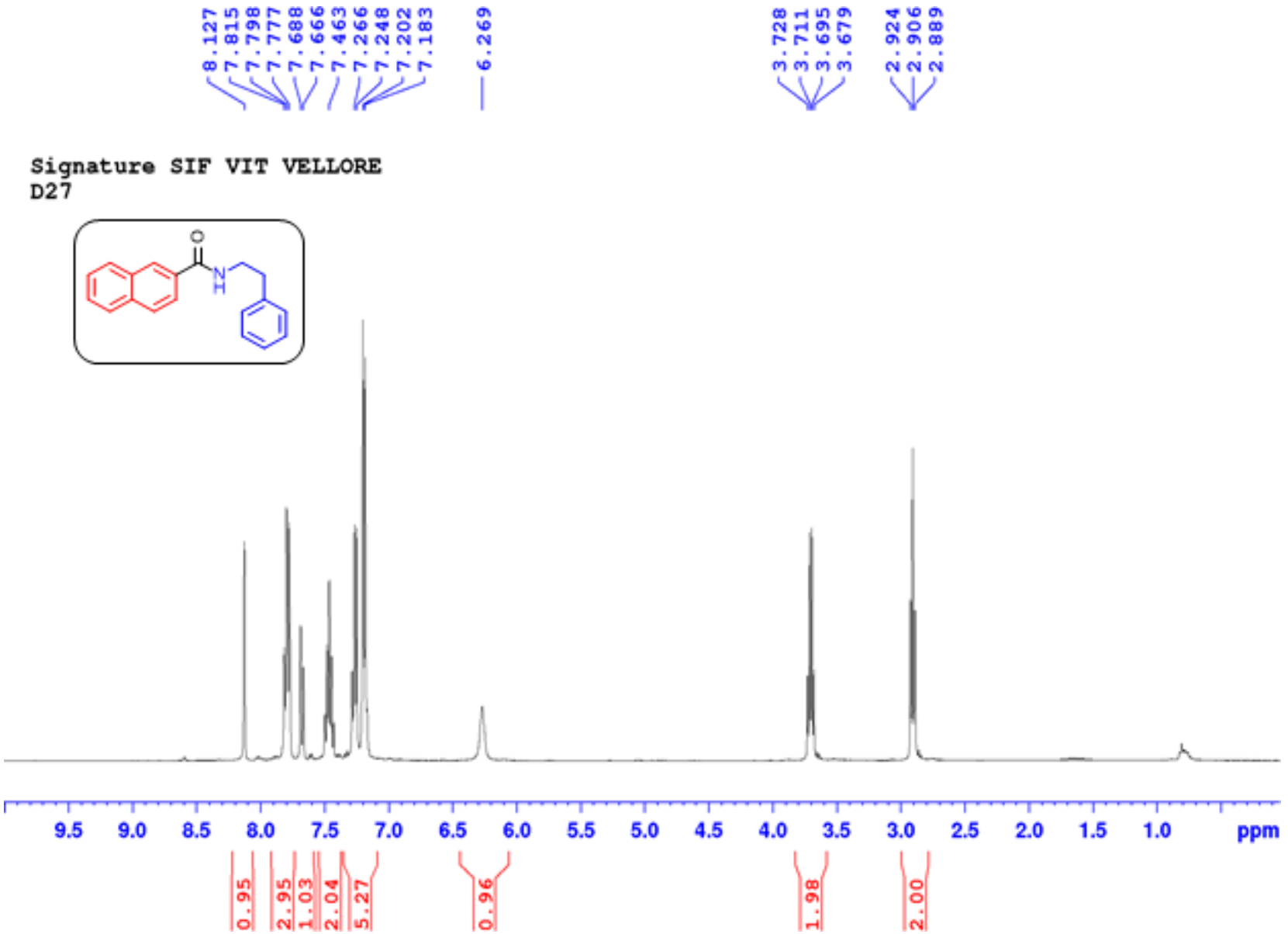
^{1}H NMR (400 MHz, Chloroform –d) of 3ae



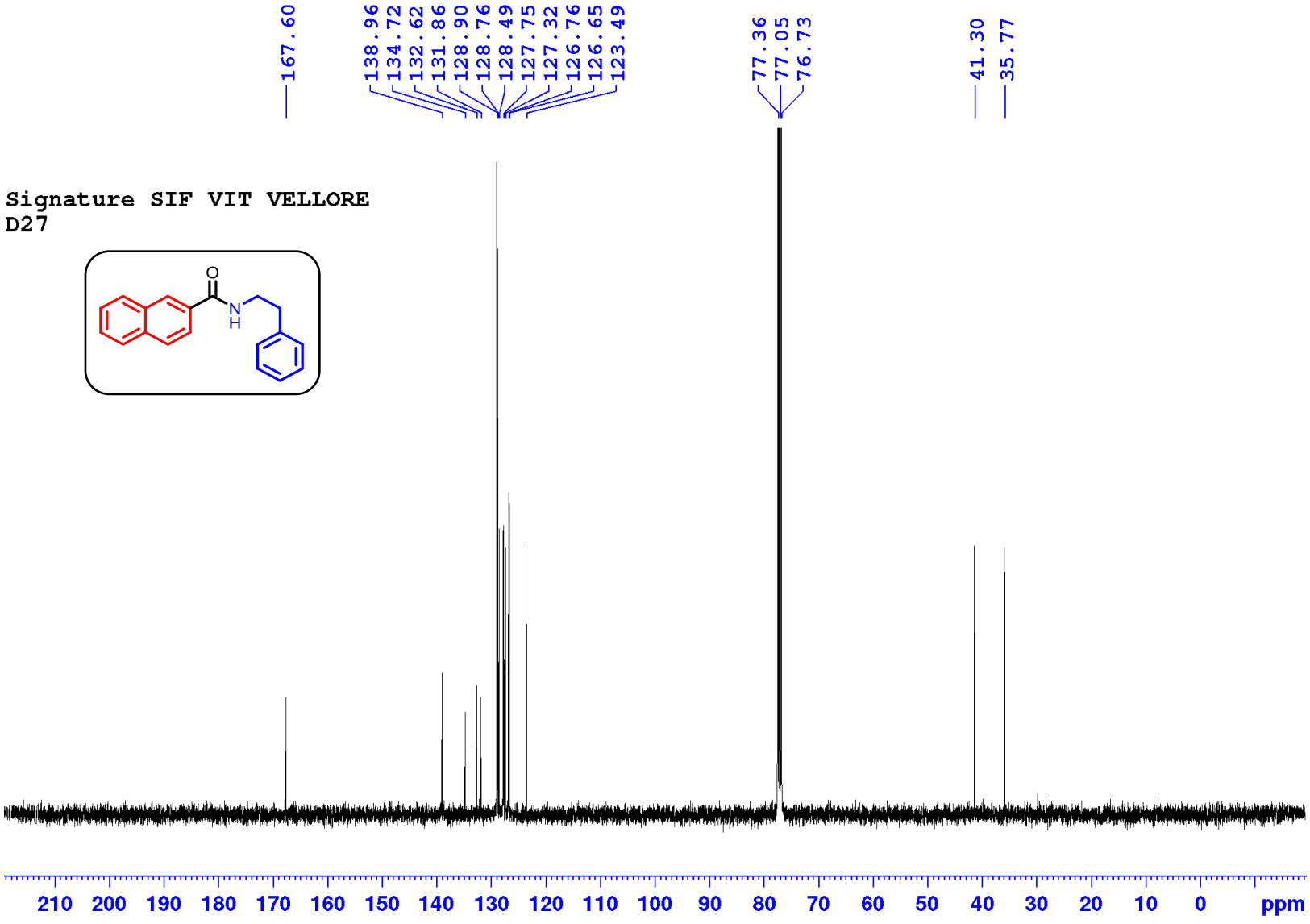
C^{13} NMR (400 MHz, Chloroform –d) of 3ae



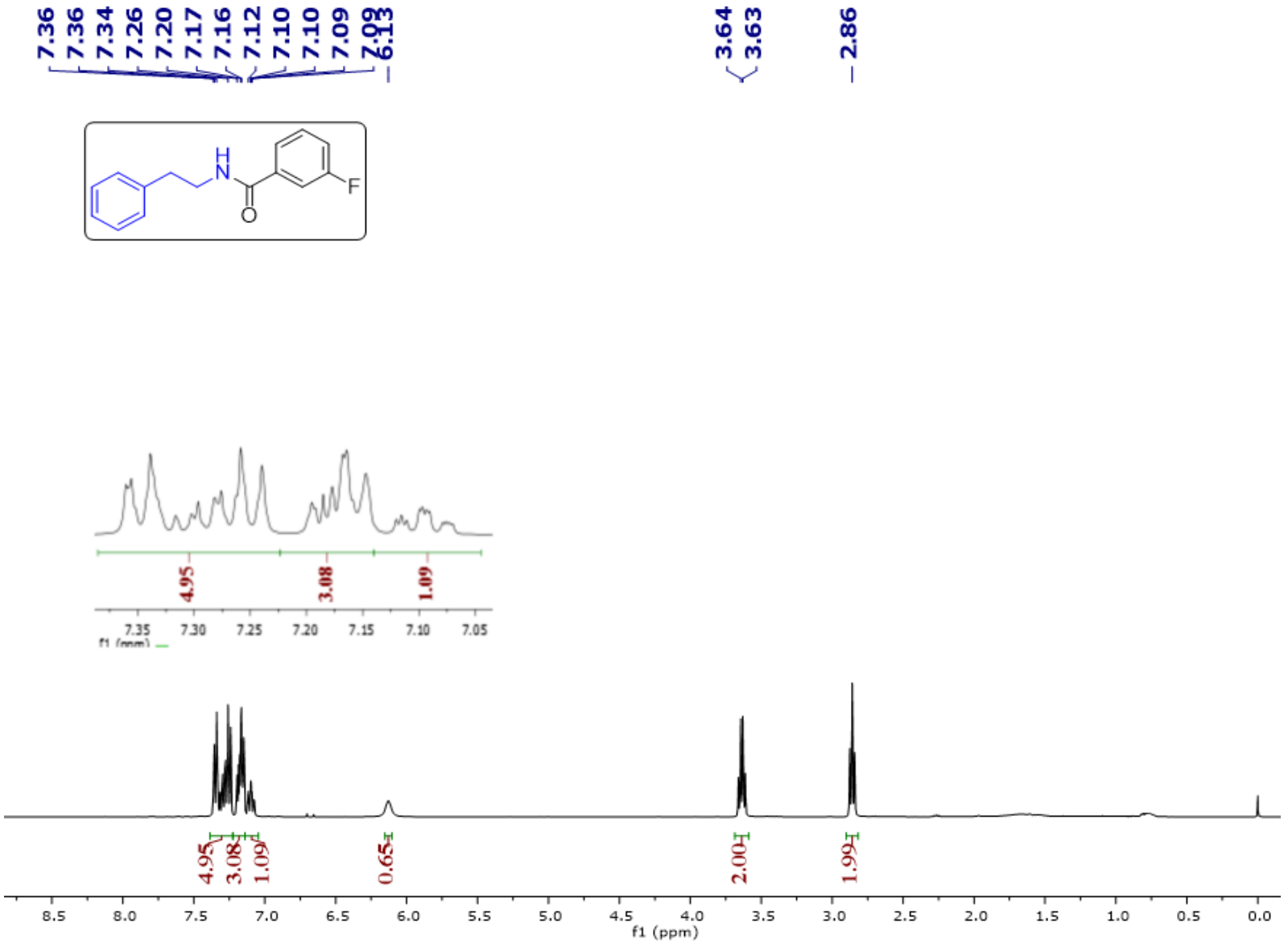
[1]H NMR (400 MHz, Chloroform –d) of 3af



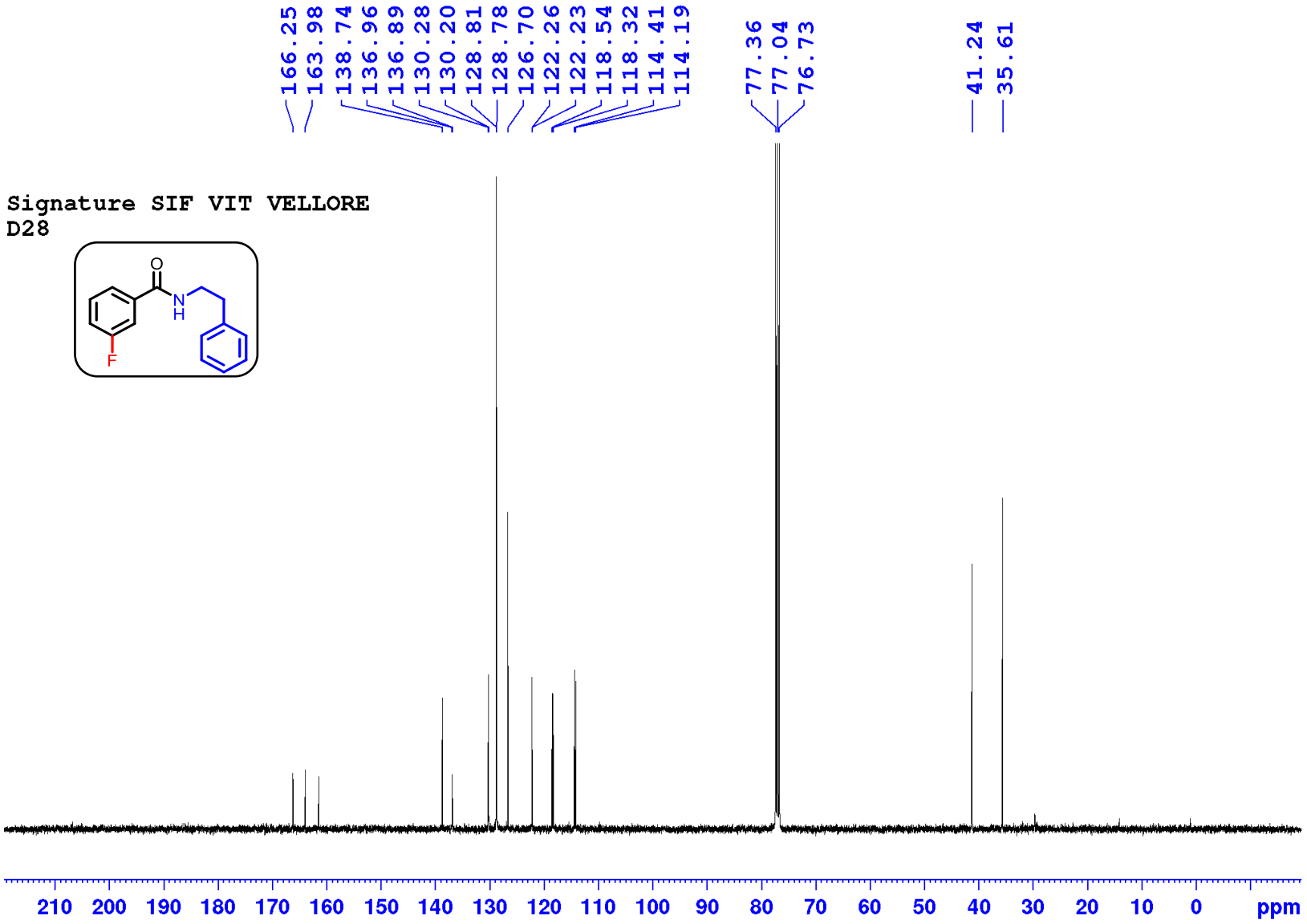
C^{13} NMR (400 MHz, Chloroform –d) of 3af



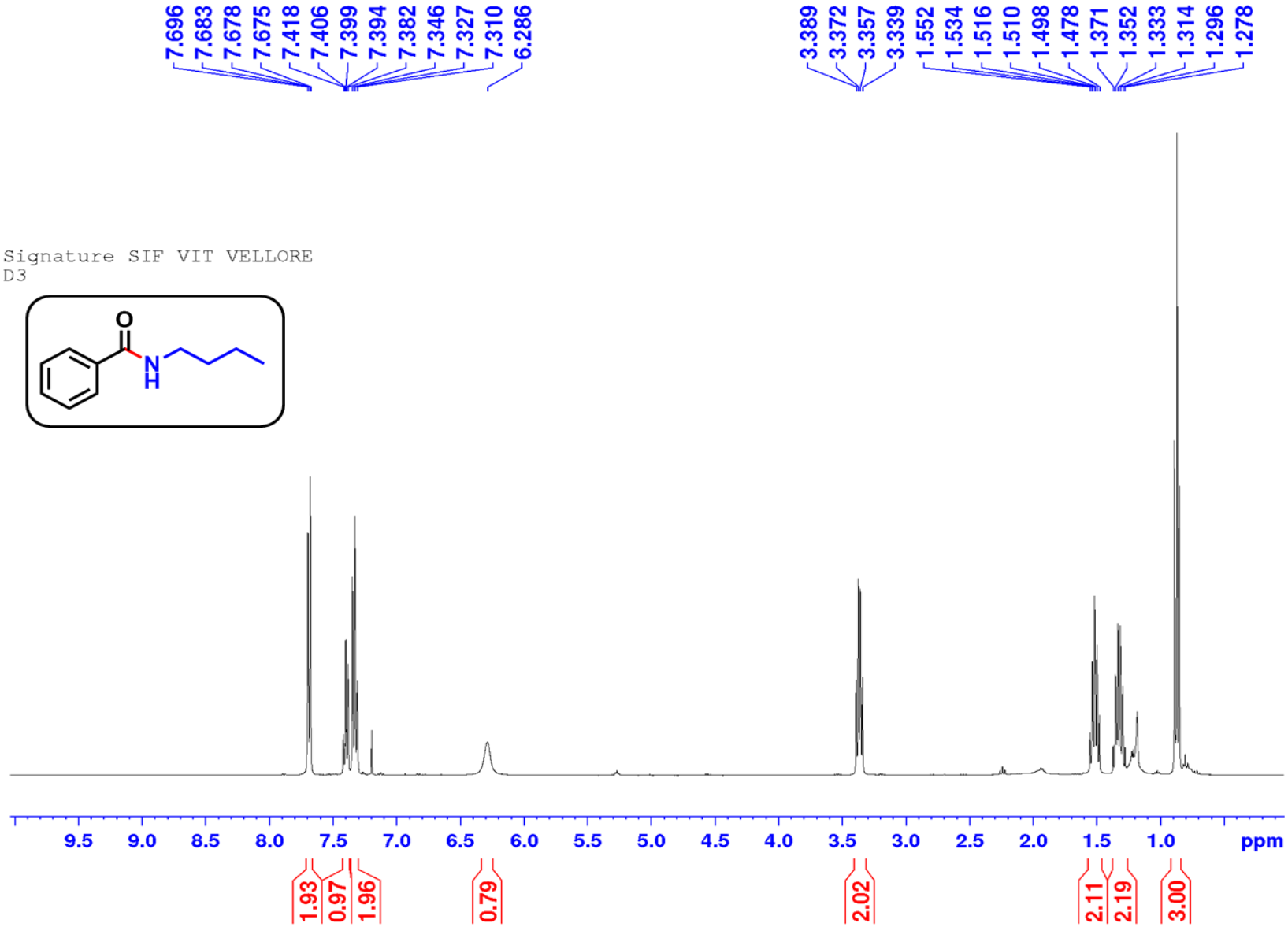
^{1}H NMR (400 MHz, Chloroform –d) of 3ag



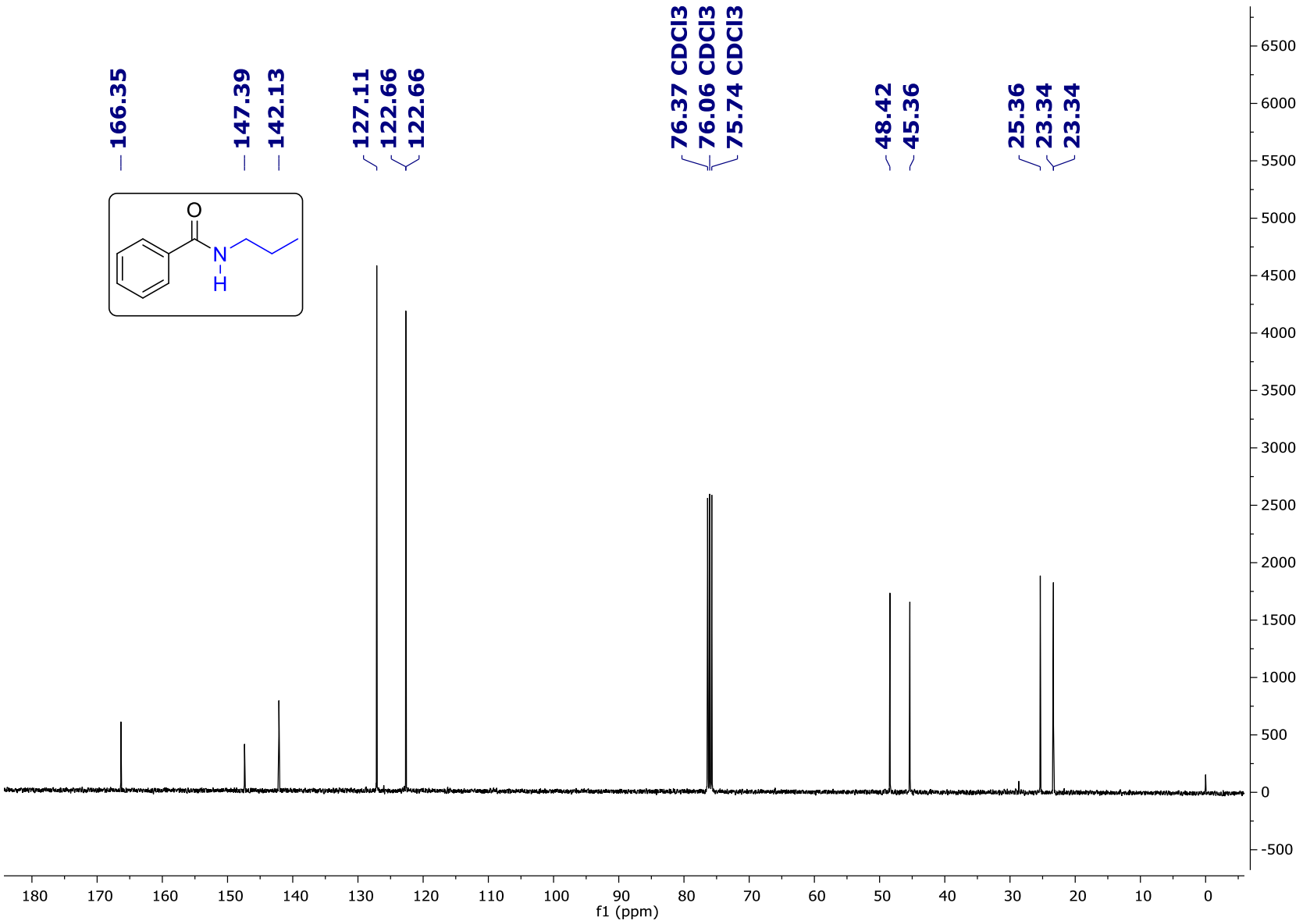
C^{13} NMR (400 MHz, Chloroform –d) of 3ag



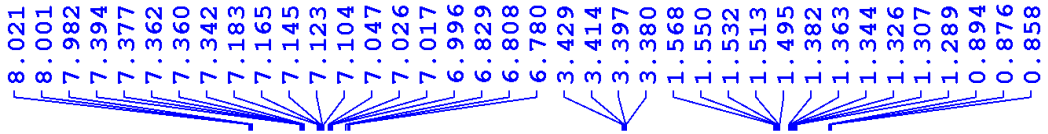
^{1}H NMR (400 MHz, Chloroform –d) of 3ah



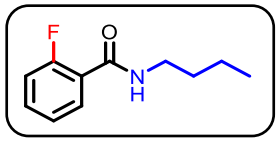
C^{13} NMR (400 MHz, Chloroform –d) of 3ah

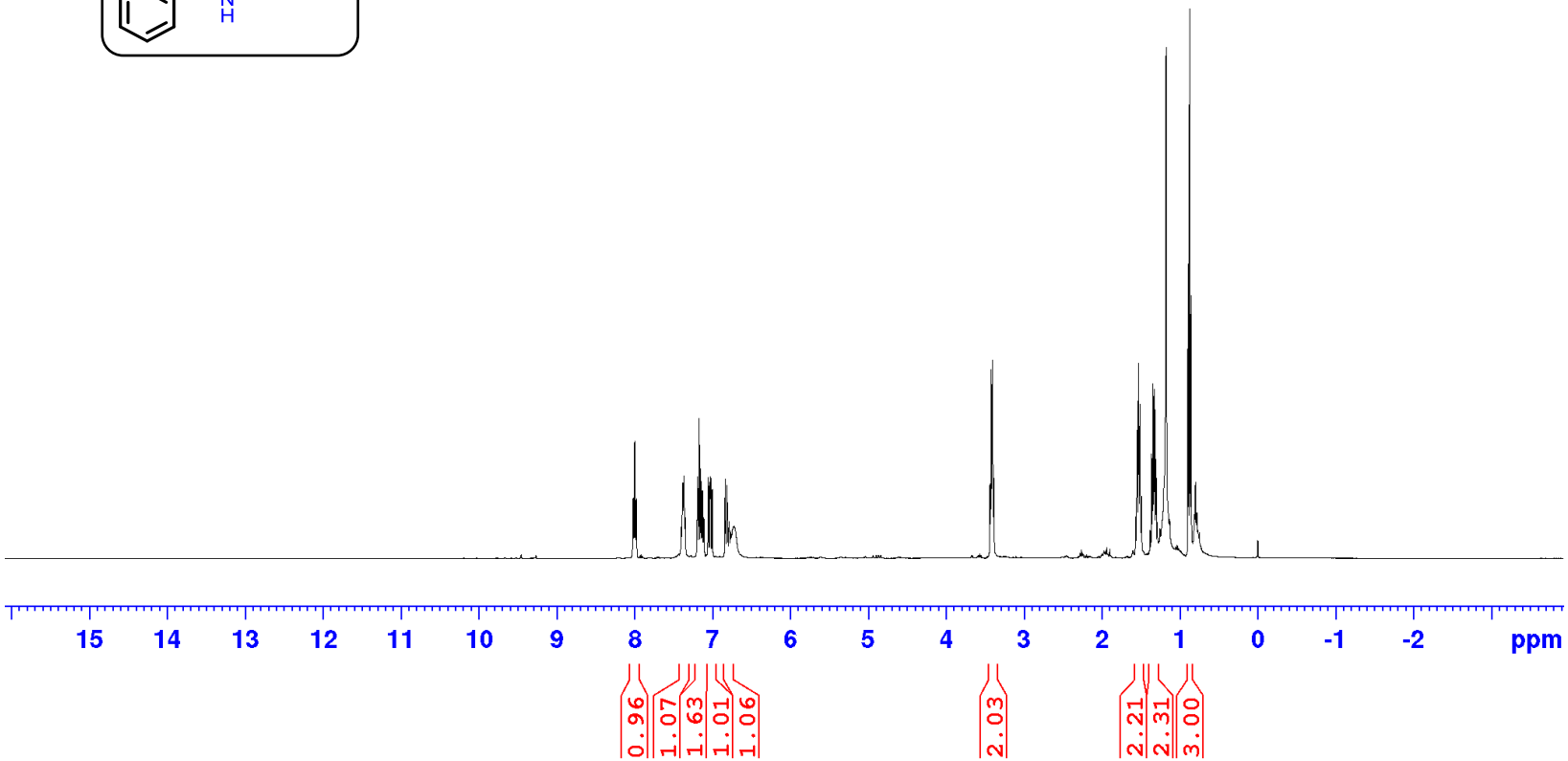


^{1}H NMR (400 MHz, Chloroform –d) of 3ai

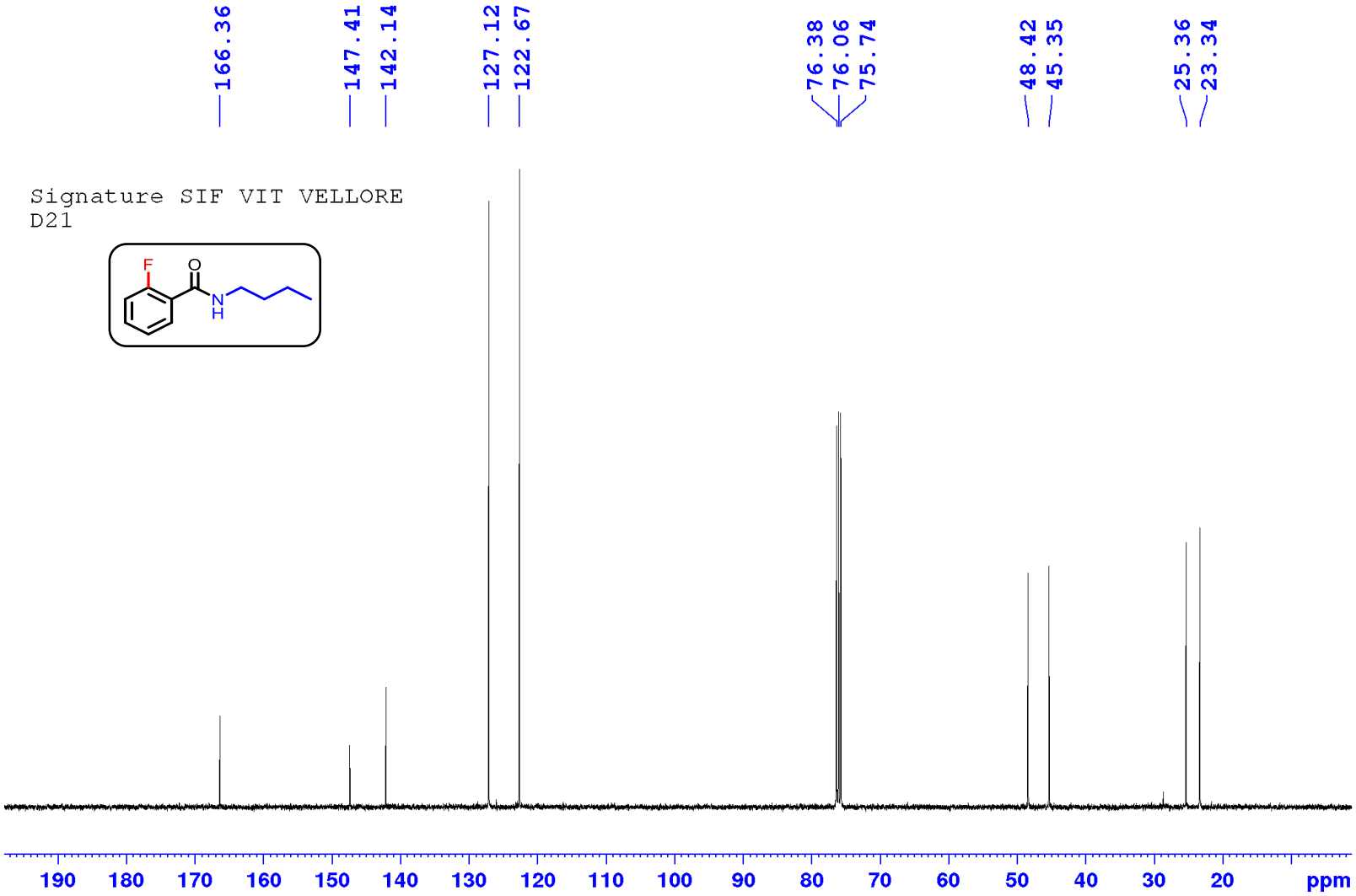


Signature SIF VIT VELLORE
D21

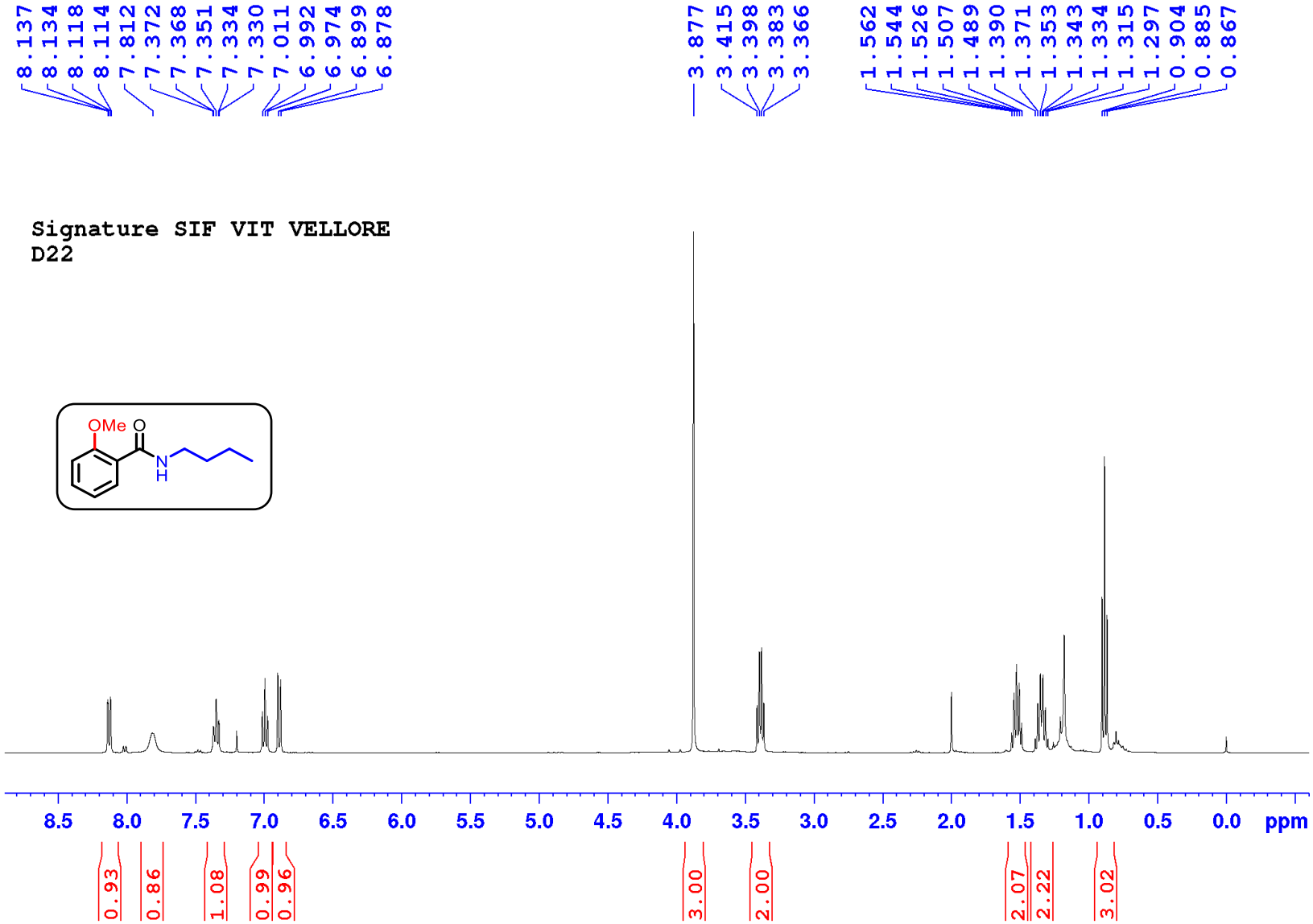




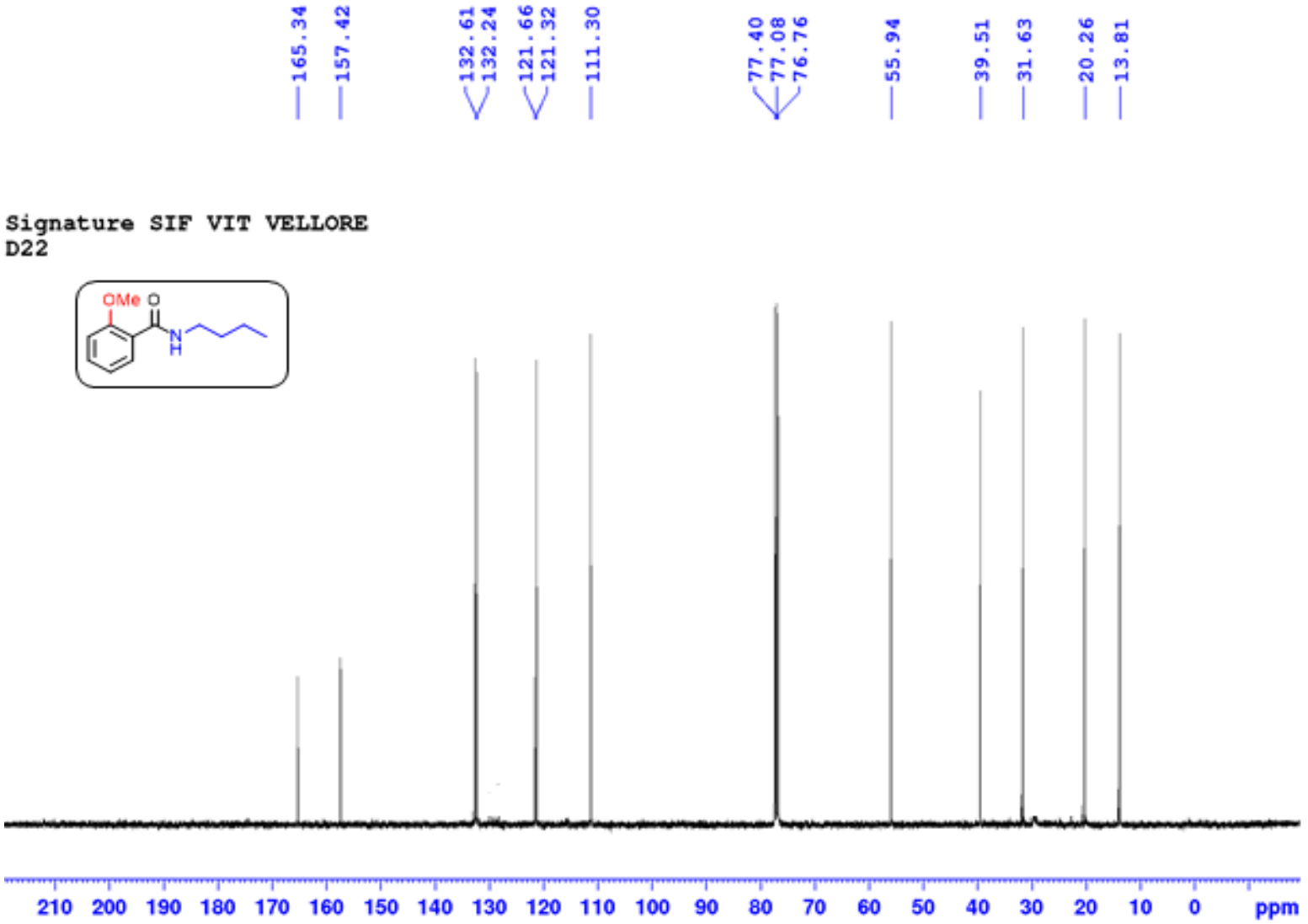
C^{13} NMR (400 MHz, Chloroform –d) of 3ai



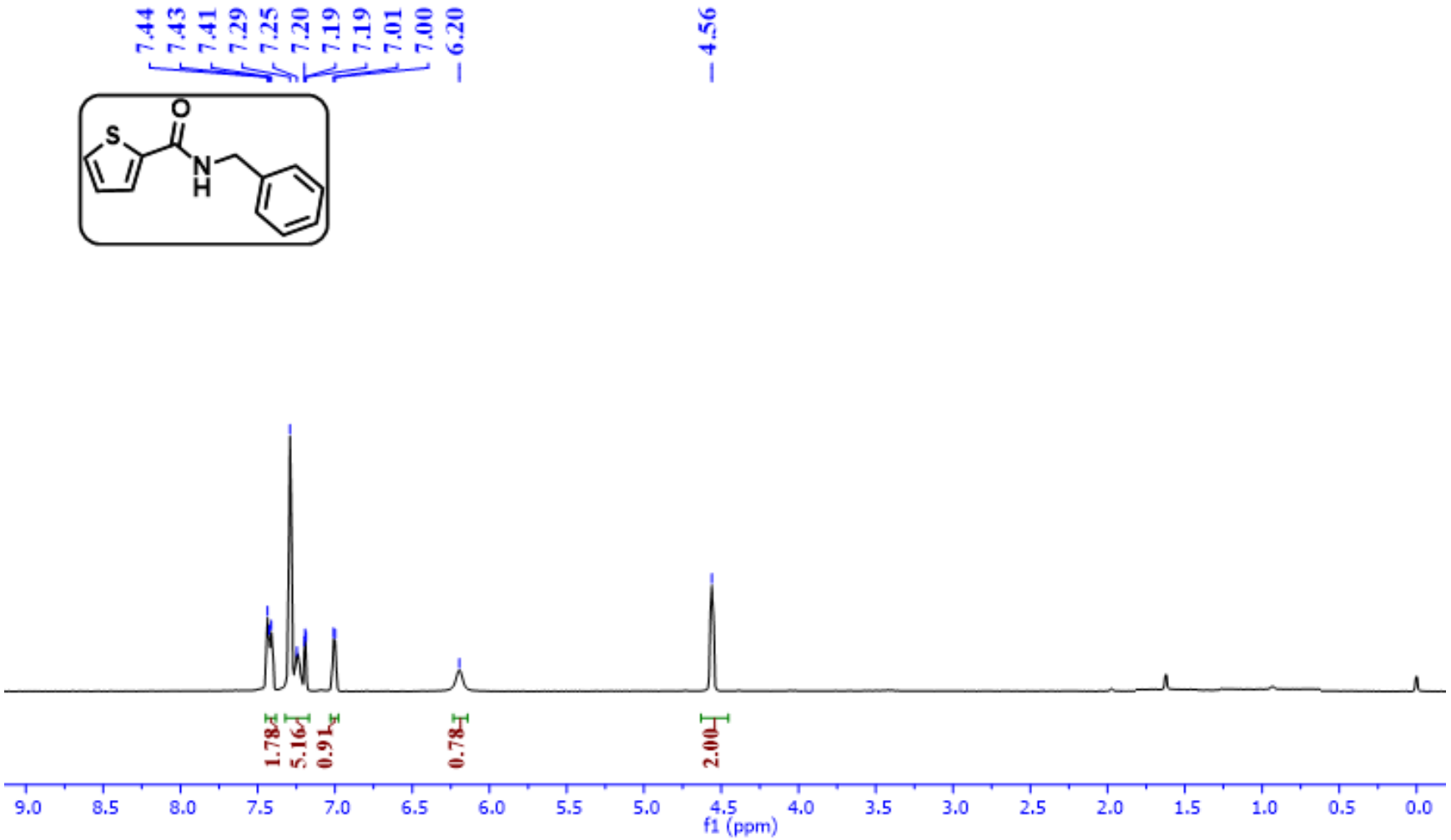
^{1}H NMR (400 MHz, Chloroform –d) of 3aj



C^{13} NMR (400 MHz, Chloroform –d) of 3aj

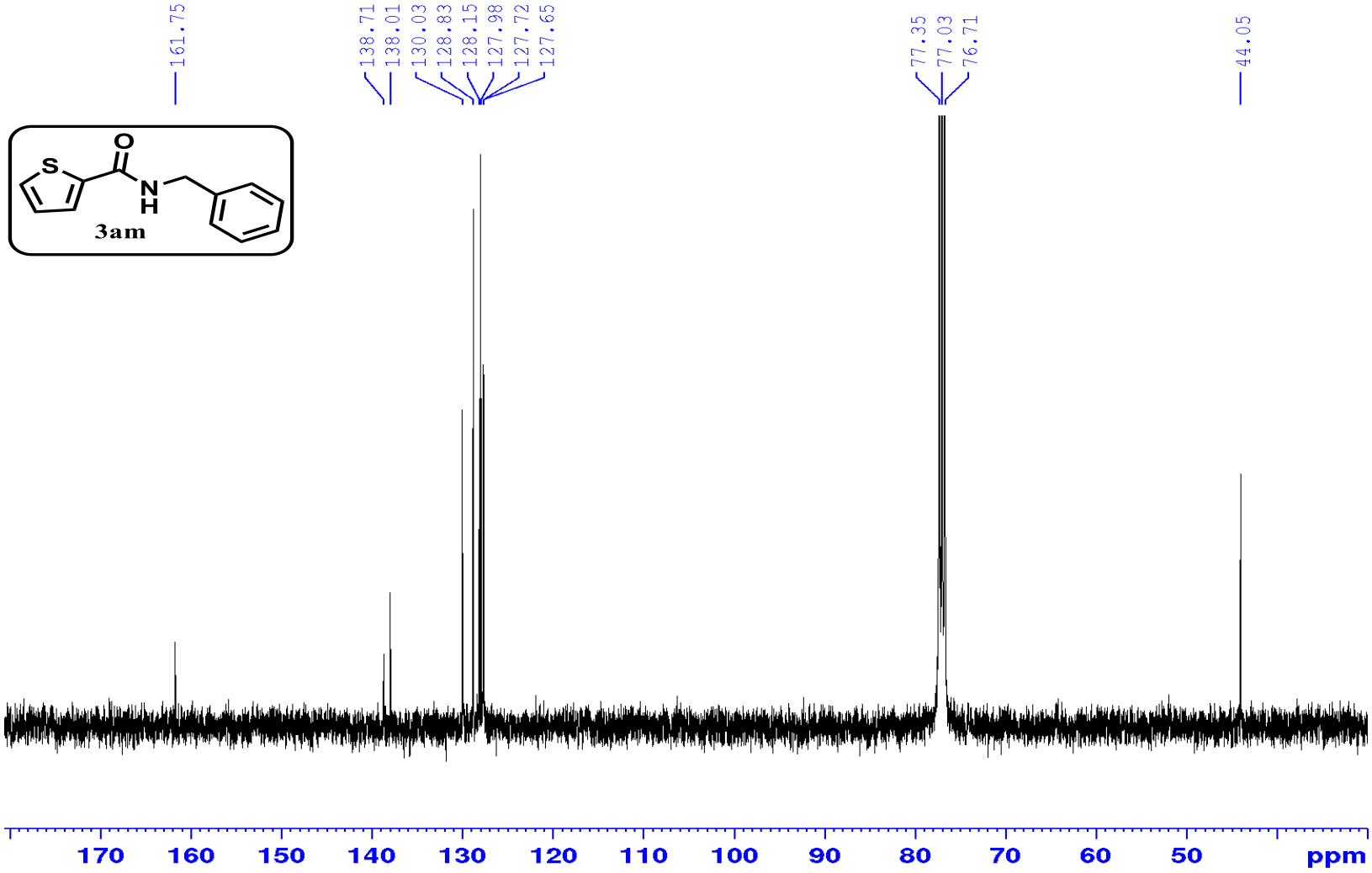


^{1}H NMR (400 MHz, Chloroform –d) of 3ak

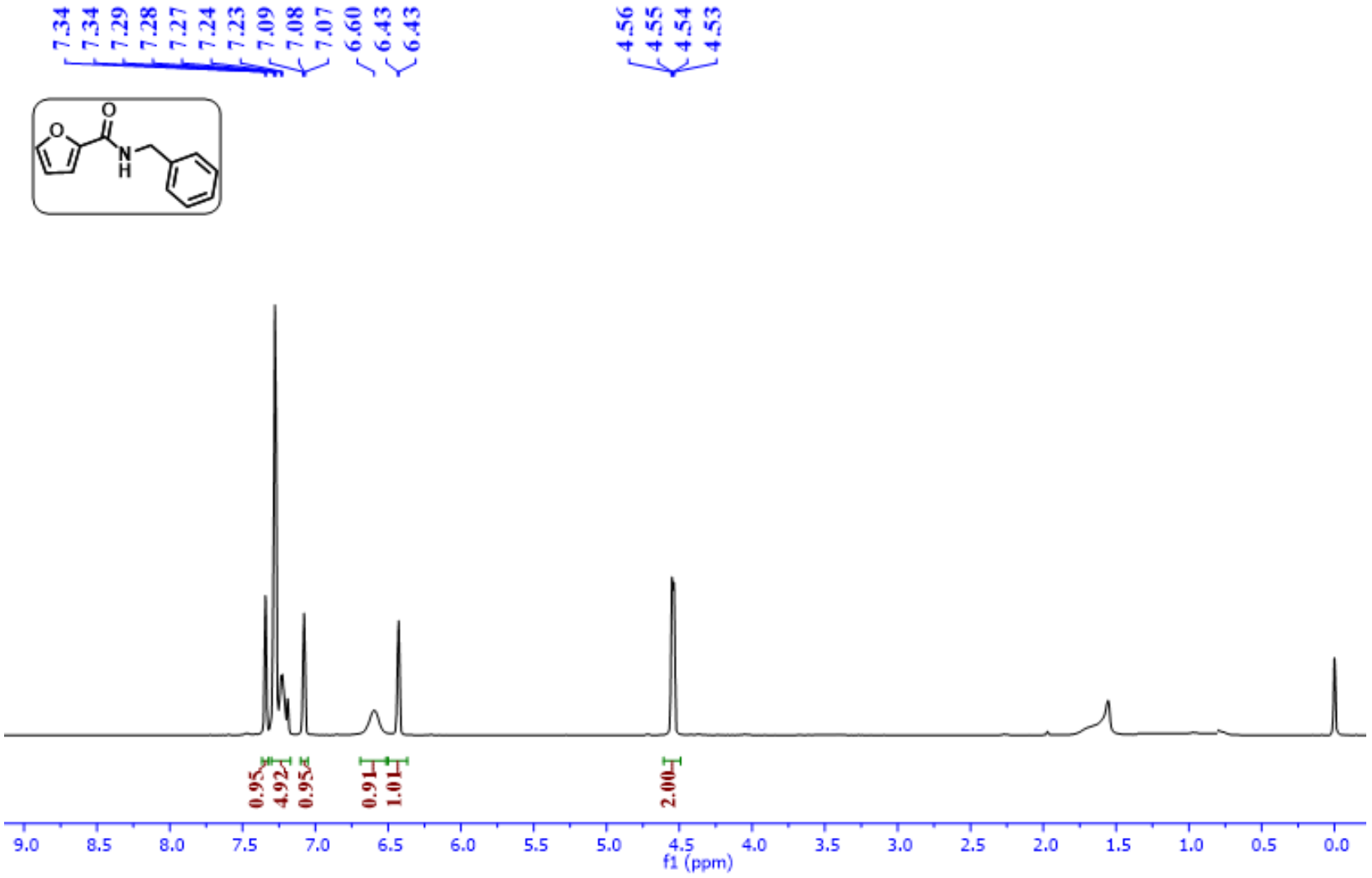


C^{13} NMR (400 MHz, Chloroform –d) of 3ak

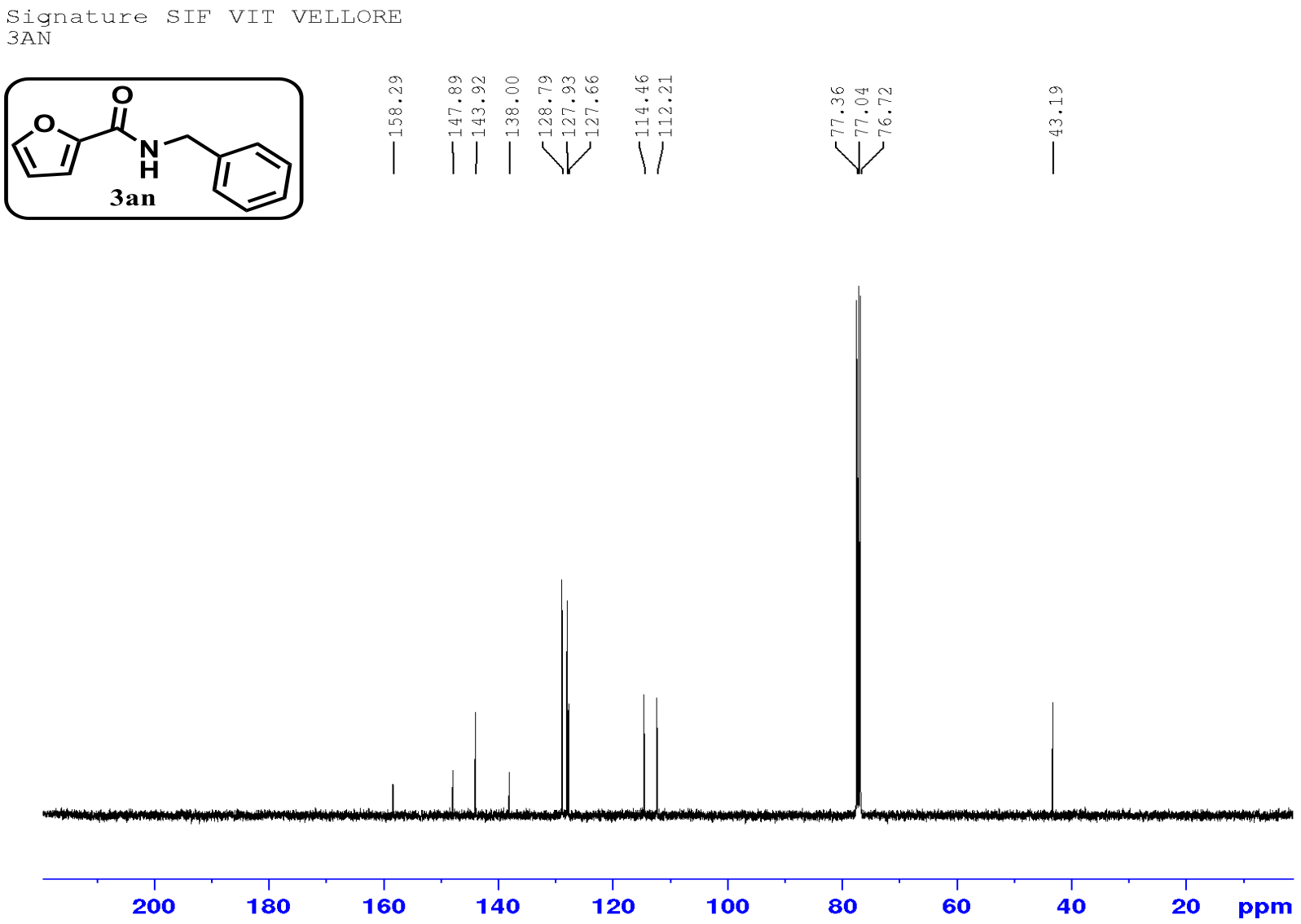
Signature SIF VIT VELLORE
3AM



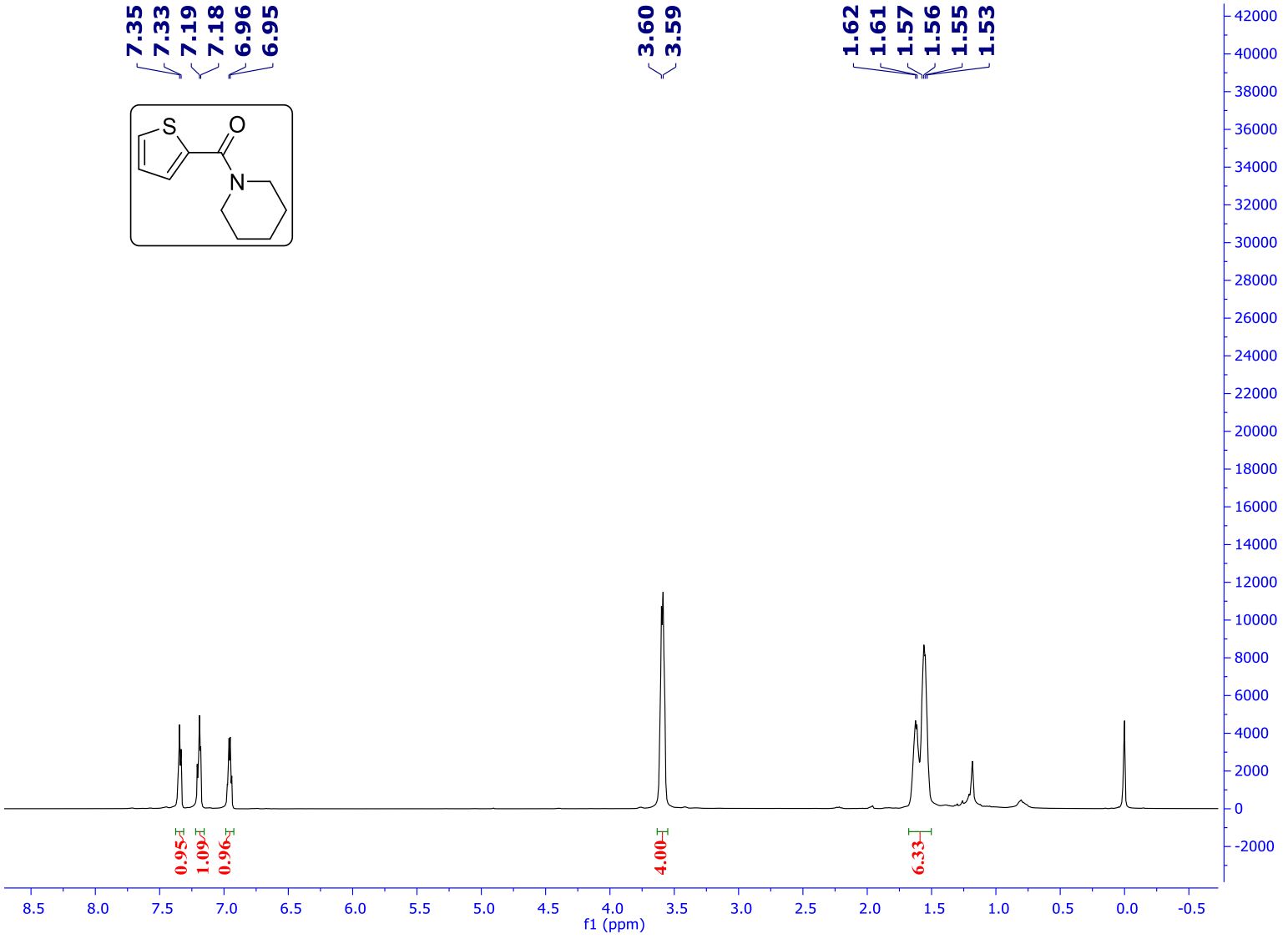
^{1}H NMR (400 MHz, Chloroform –d) of 3al



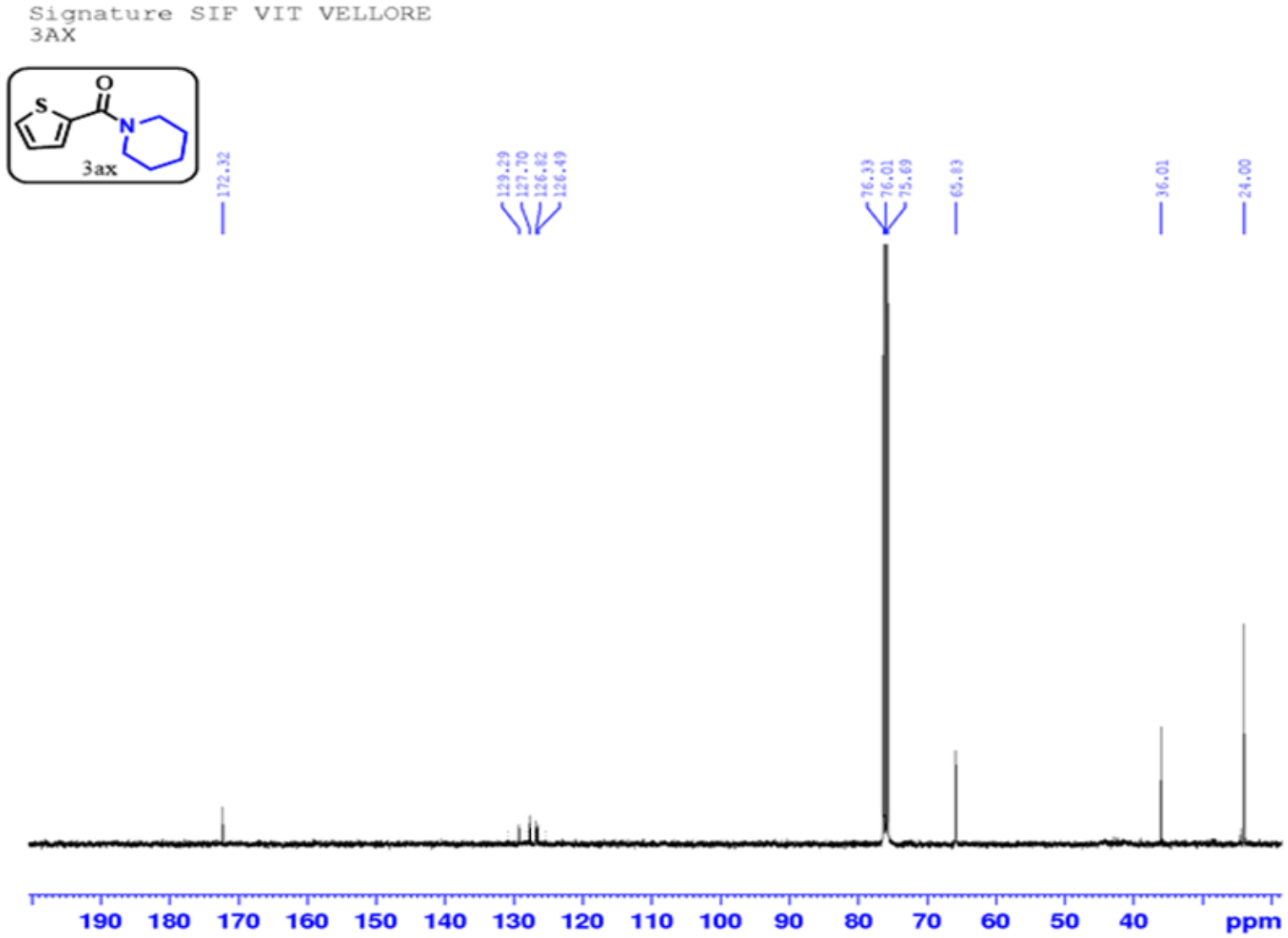
C^{13} NMR (400 MHz, Chloroform –d) of 3al



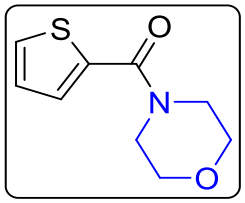
^{1}H NMR (400 MHz, Chloroform –d) of 3am

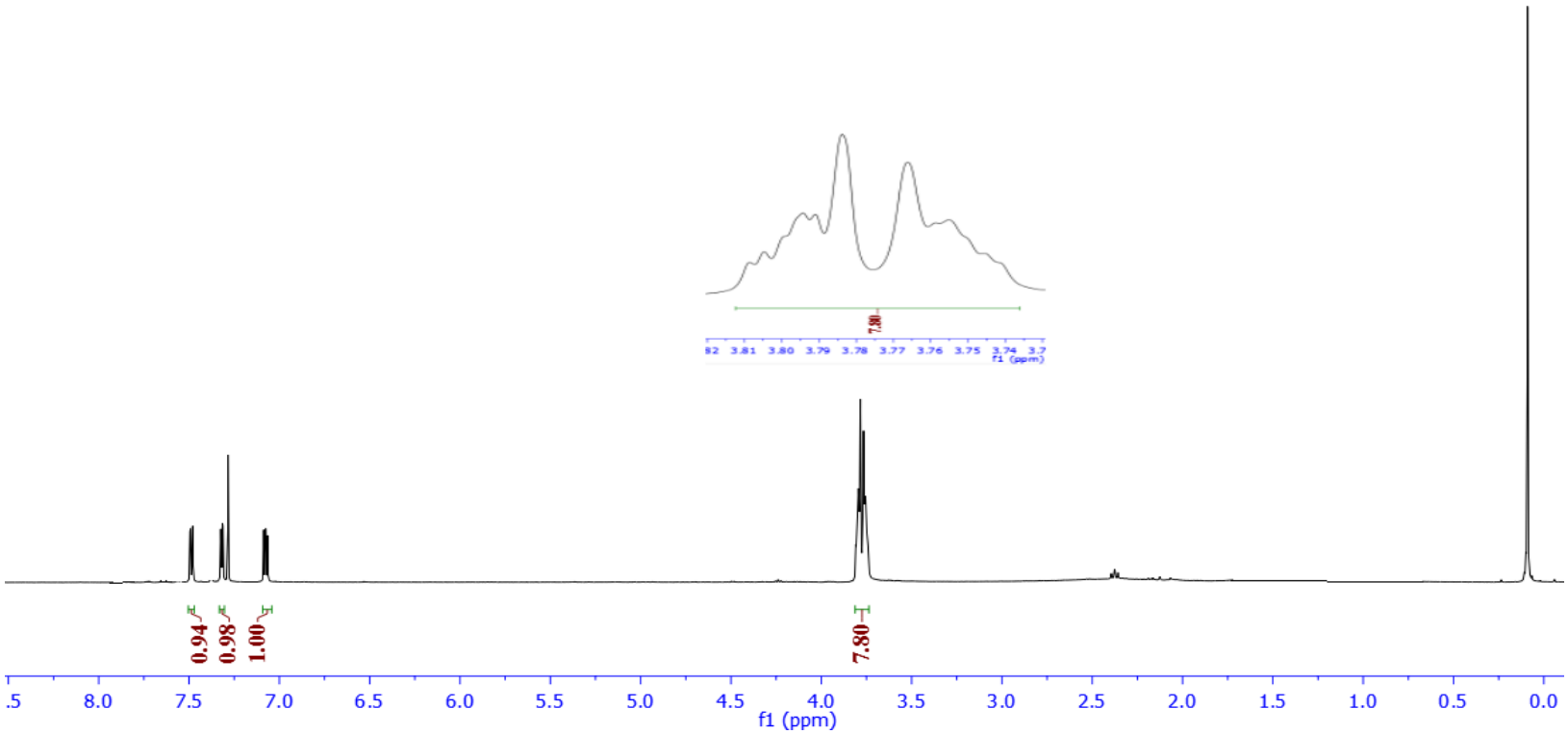


C^{13} NMR (400 MHz, Chloroform –d) of 3am

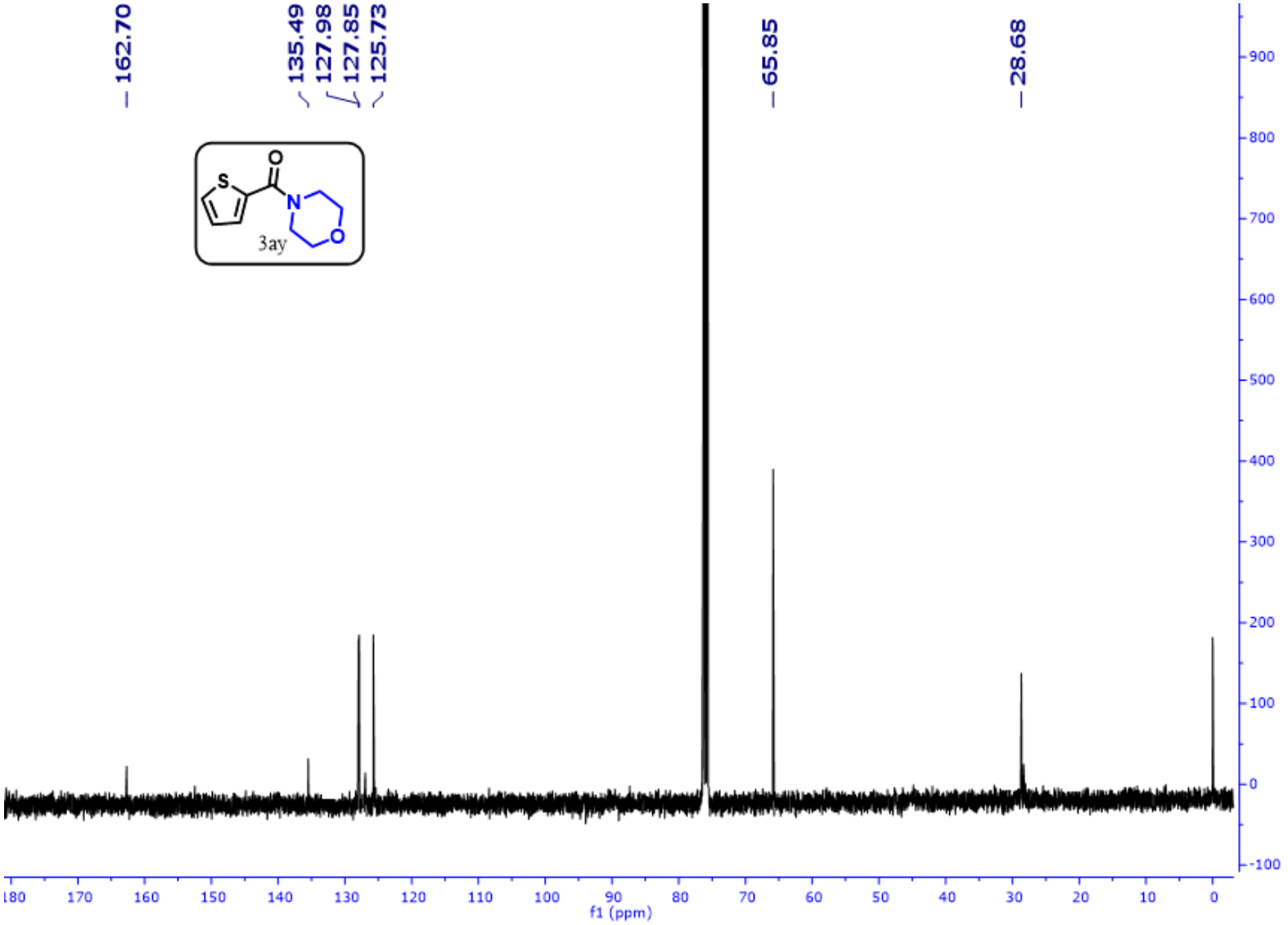


^{1}H NMR (400 MHz, Chloroform –d) of 3an

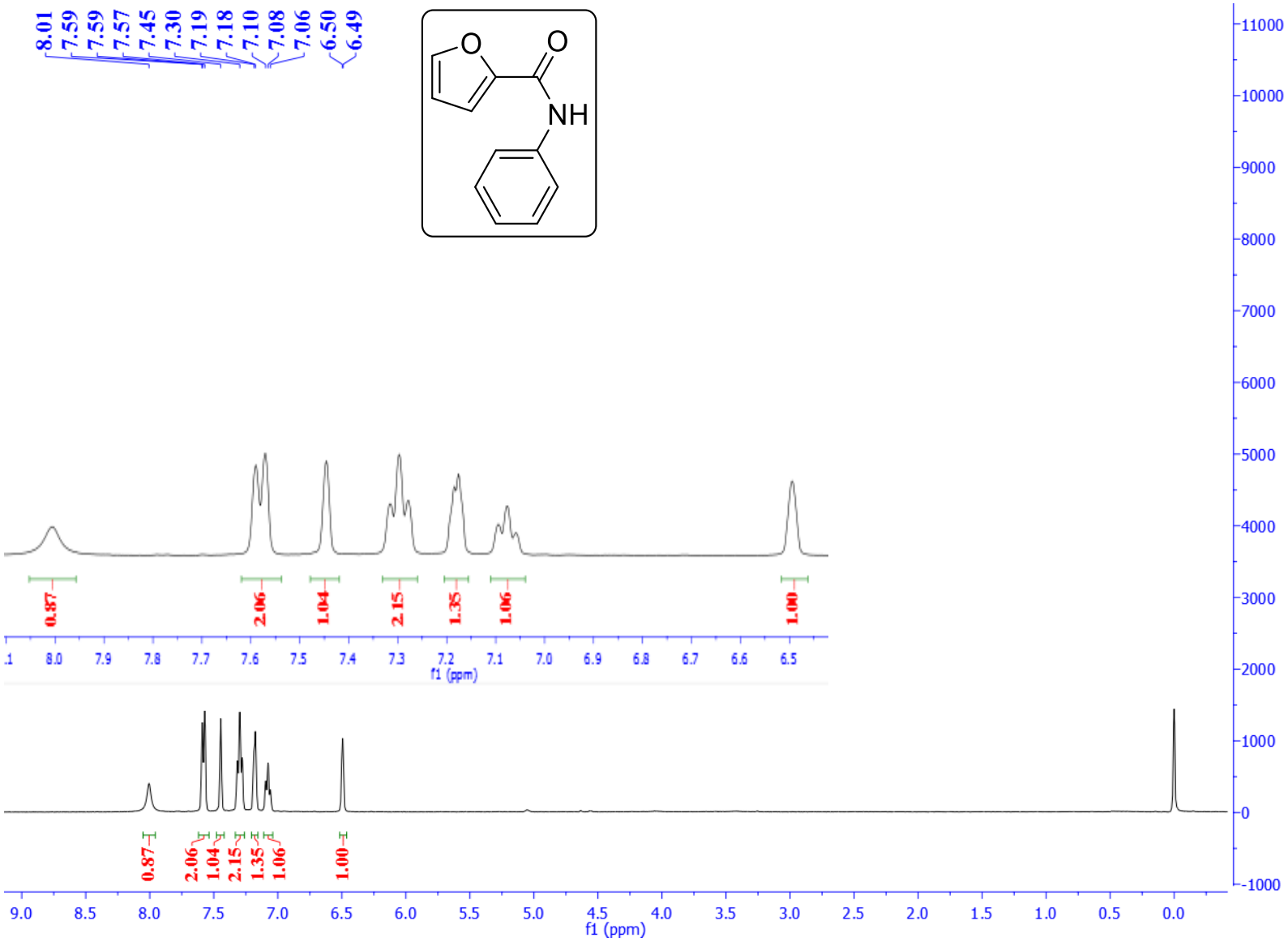




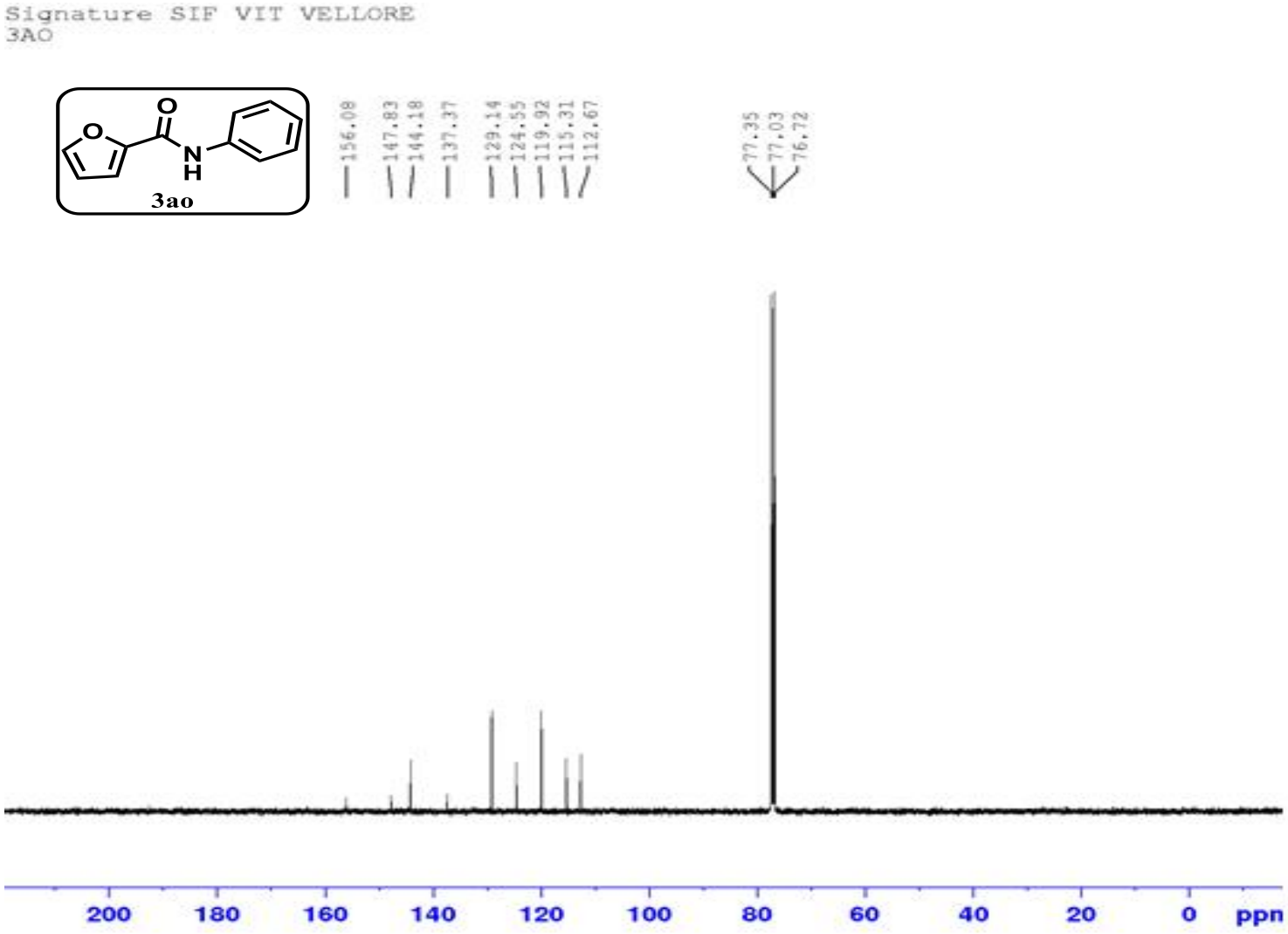
C^{13} NMR (400 MHz, Chloroform –d) of 3an



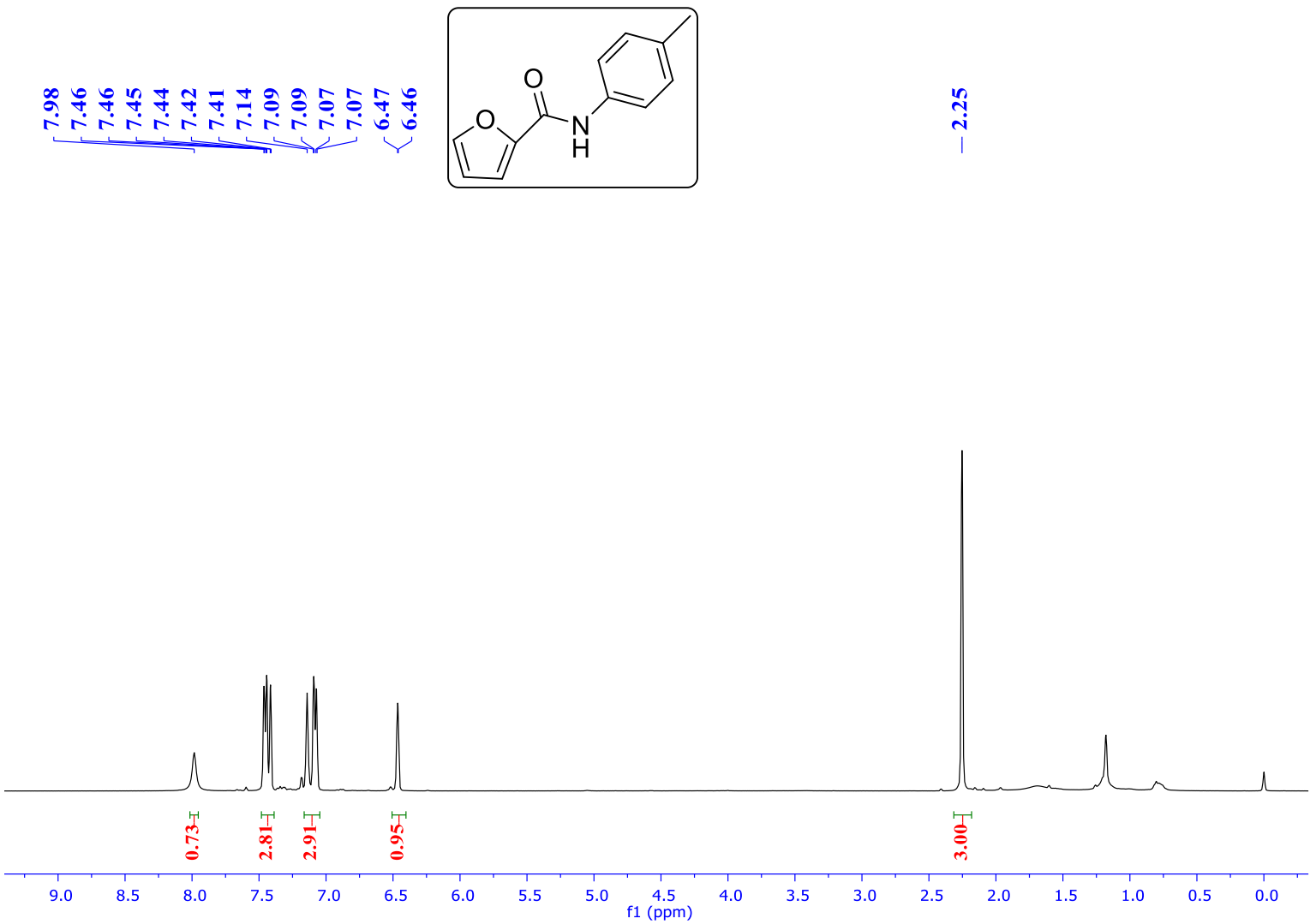
^{1}H NMR (400 MHz, Chloroform –d) of 3ao



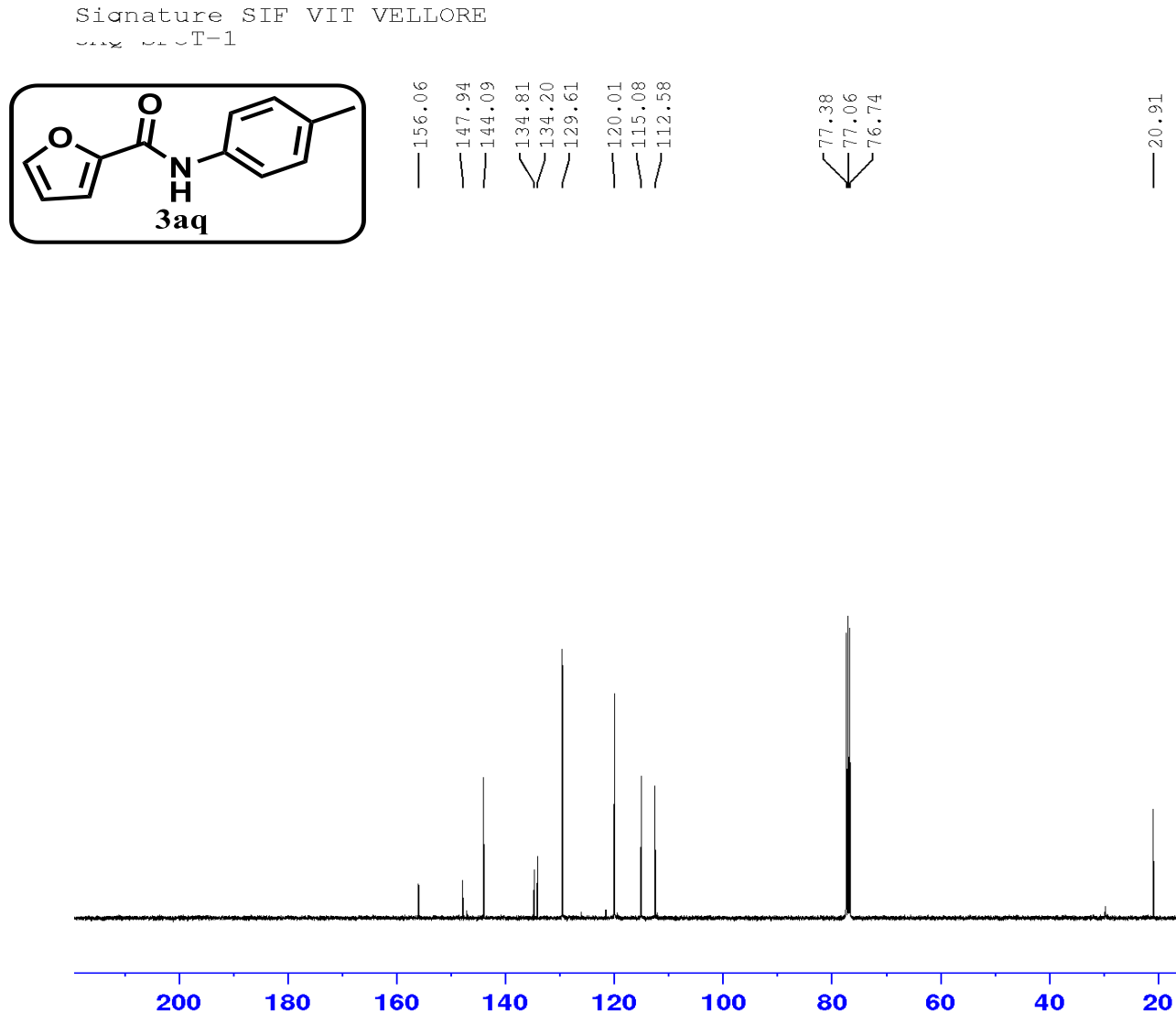
C^{13} NMR (400 MHz, Chloroform –d) of 3ao



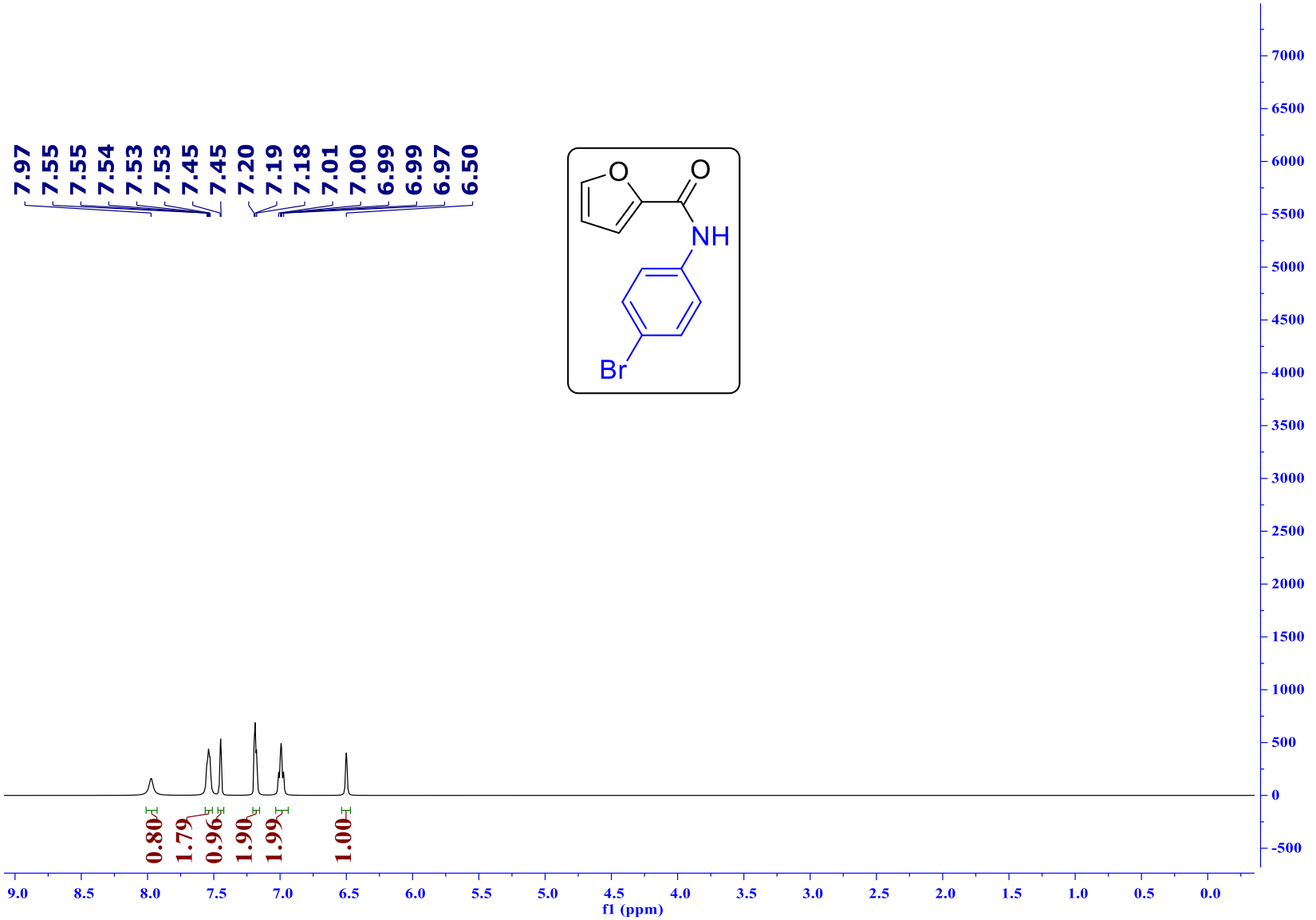
^{1}H NMR (400 MHz, Chloroform –d) of 3ap



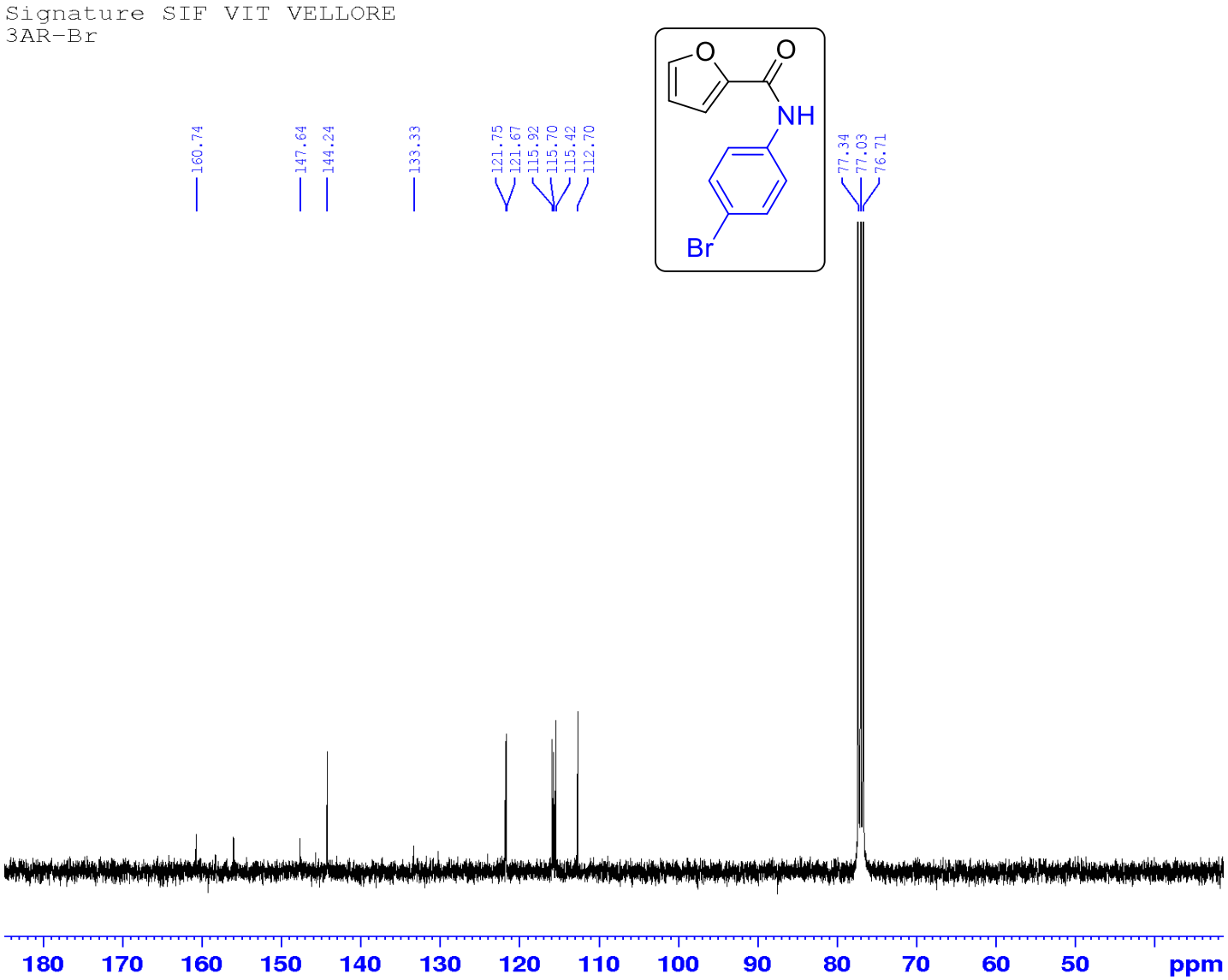
C^{13} NMR (400 MHz, Chloroform –d) of 3ap



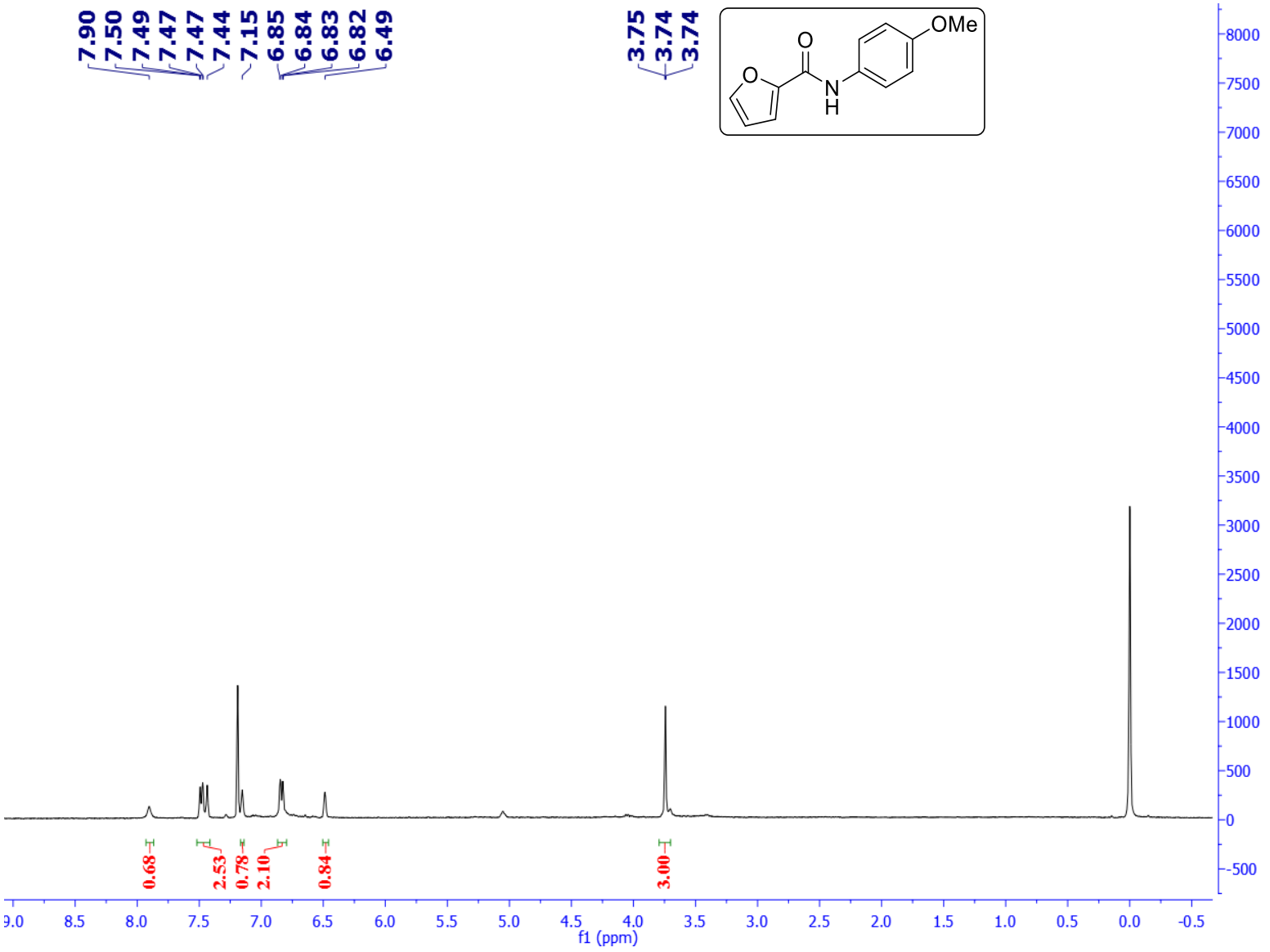
^{1}H NMR (400 MHz, Chloroform –d) of 3aq



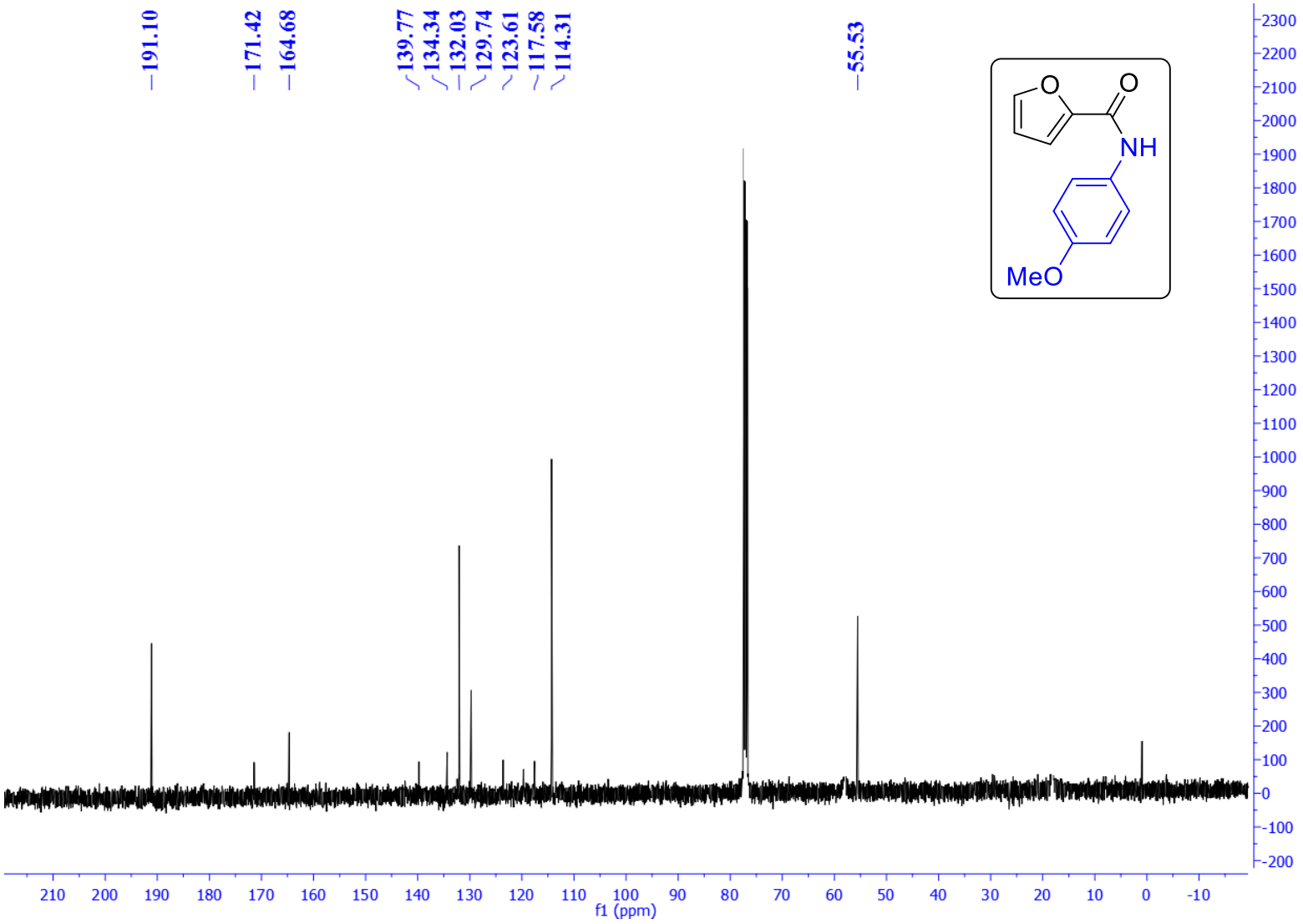
C^{13} NMR (400 MHz, Chloroform –d) of 3aq



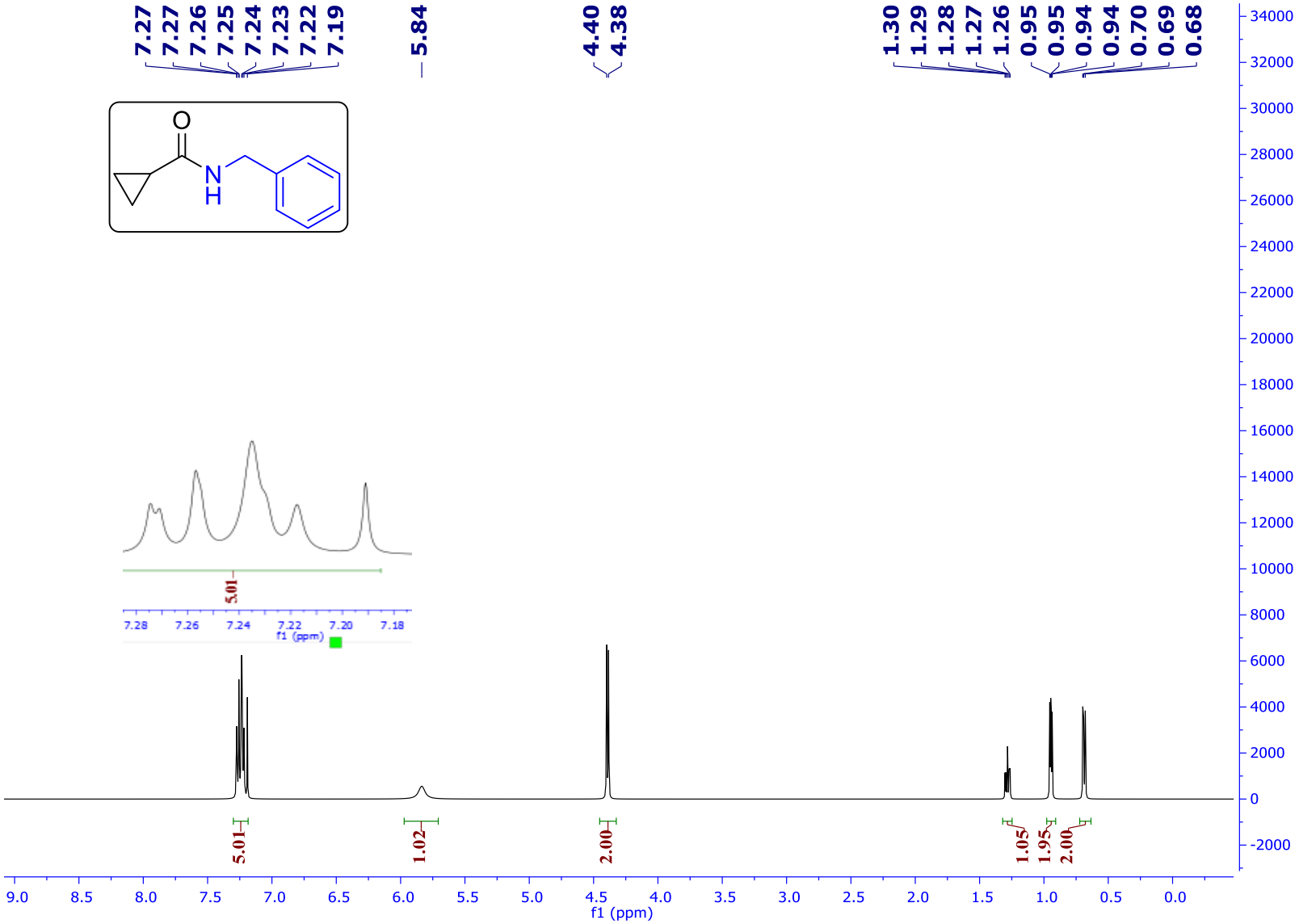
^{1}H NMR (400 MHz, Chloroform –d) of 3ar



C^{13} NMR (400 MHz, Chloroform –d) of 3ar

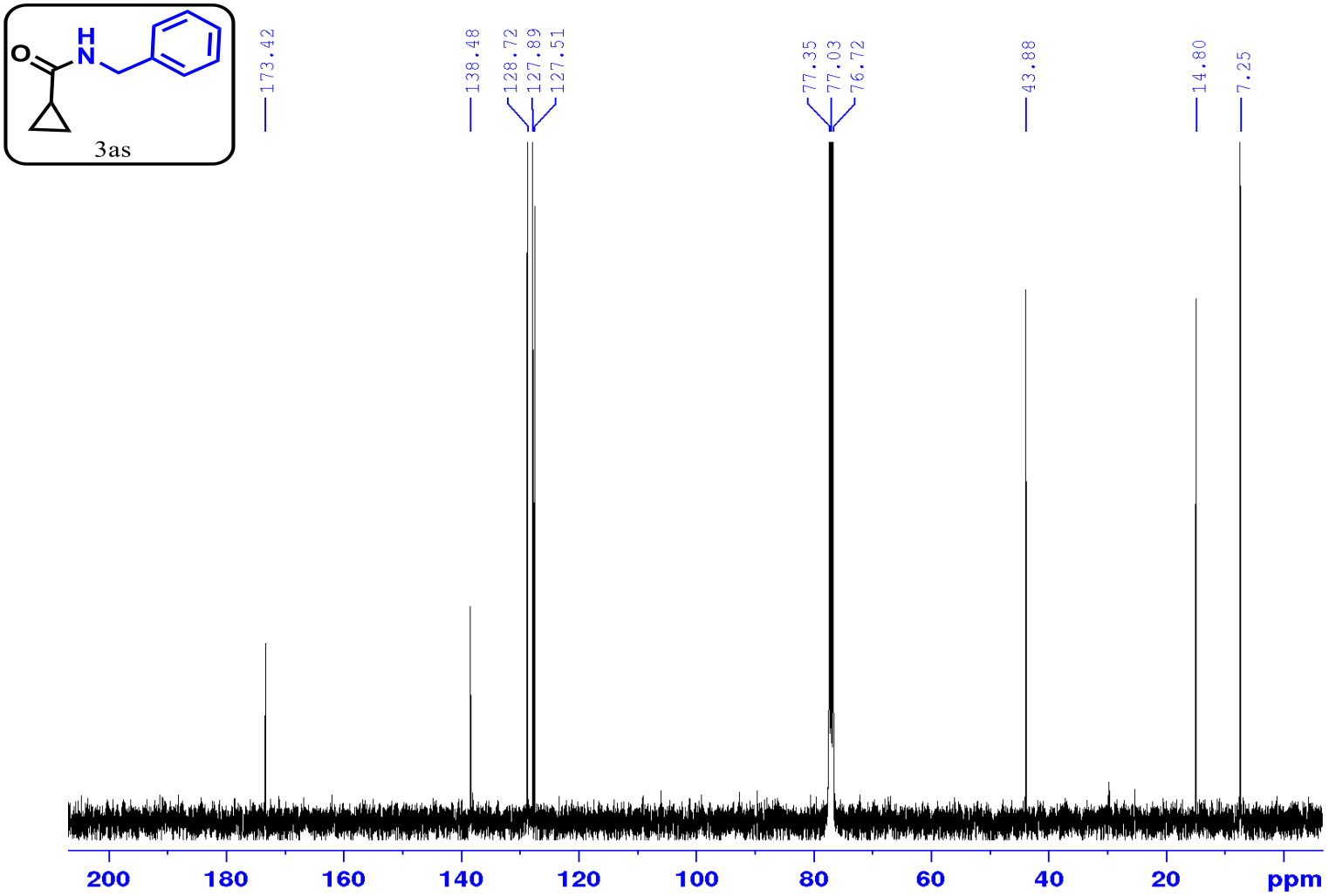


^{1}H NMR (400 MHz, Chloroform –d) of 3as

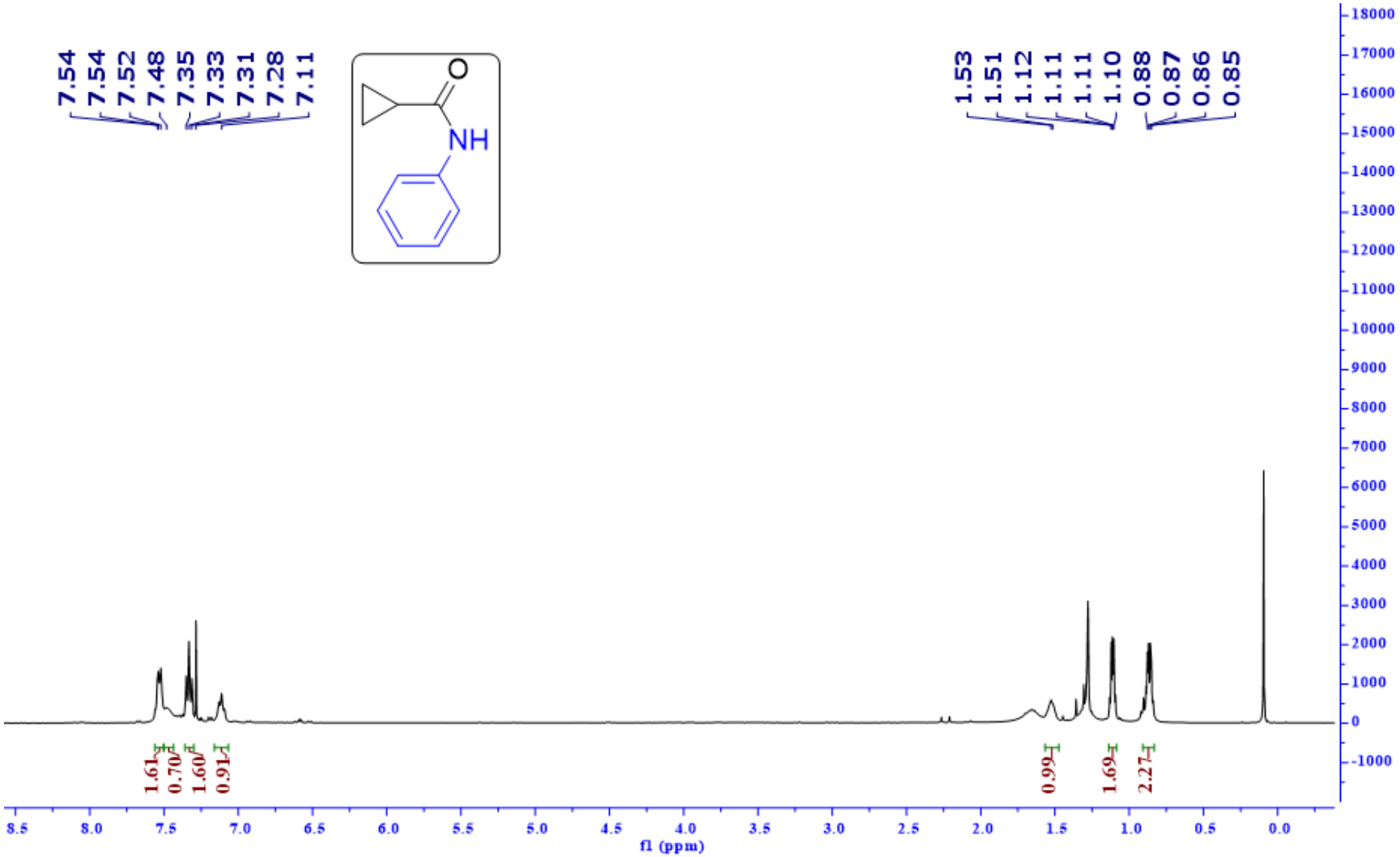


C^{13} NMR (400 MHz, Chloroform –d) of 3as

Signature SIF VIT VELLORE
cyclo-propyl amide

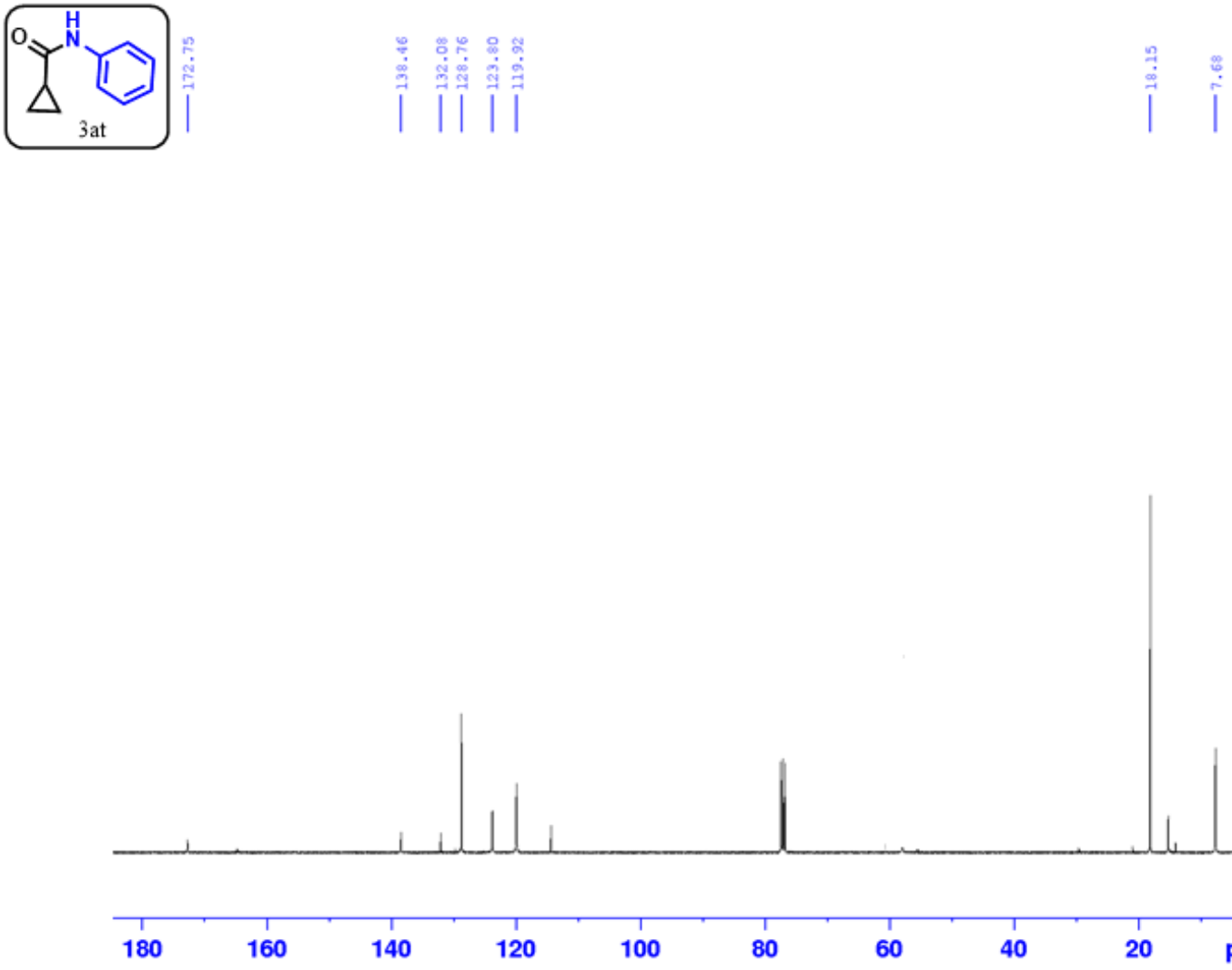


^{1}H NMR (400 MHz, Chloroform –d) of 3at



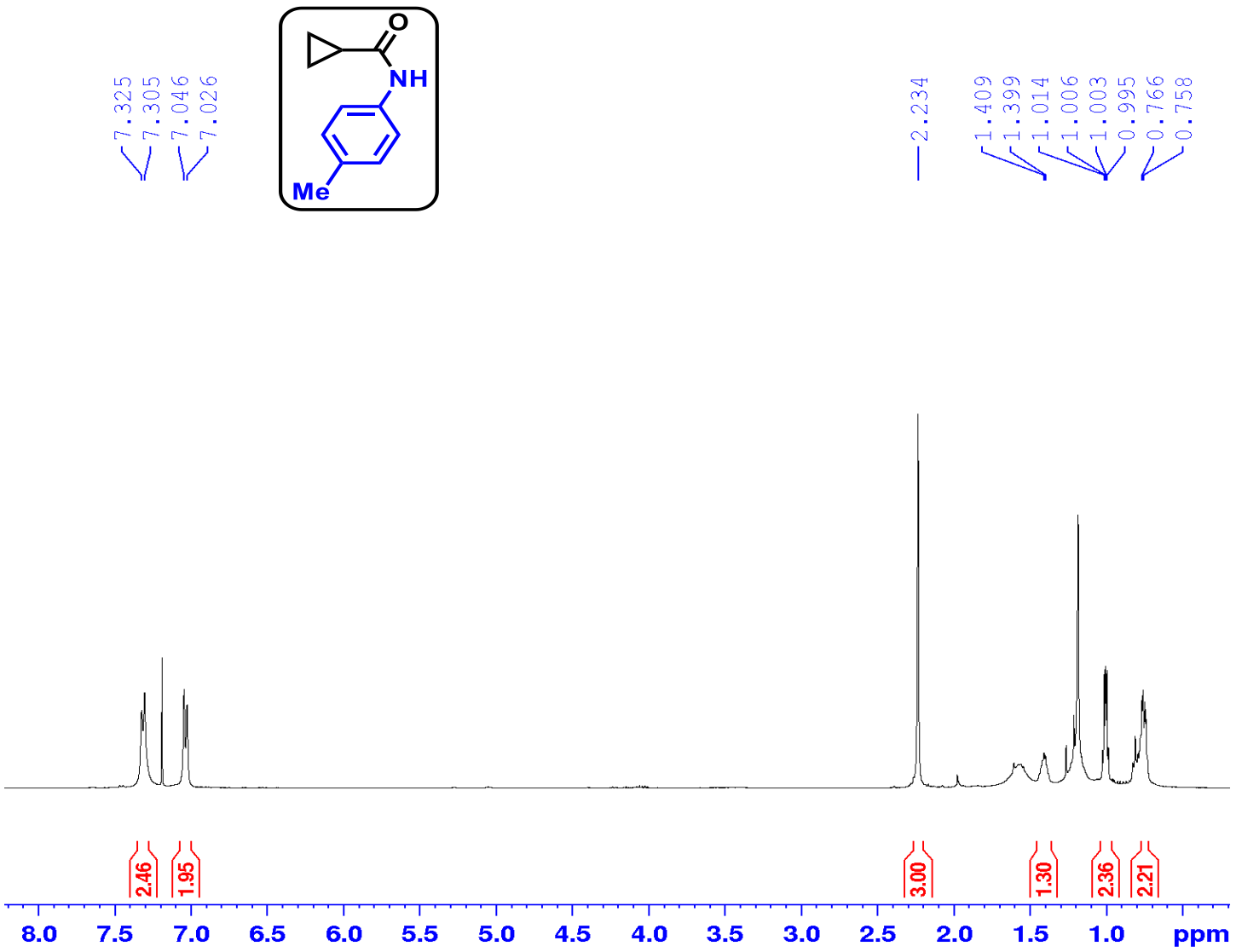
C^{13} NMR (400 MHz, Chloroform –d) of 3at

Signature SIF VIT VELLORE
3AT

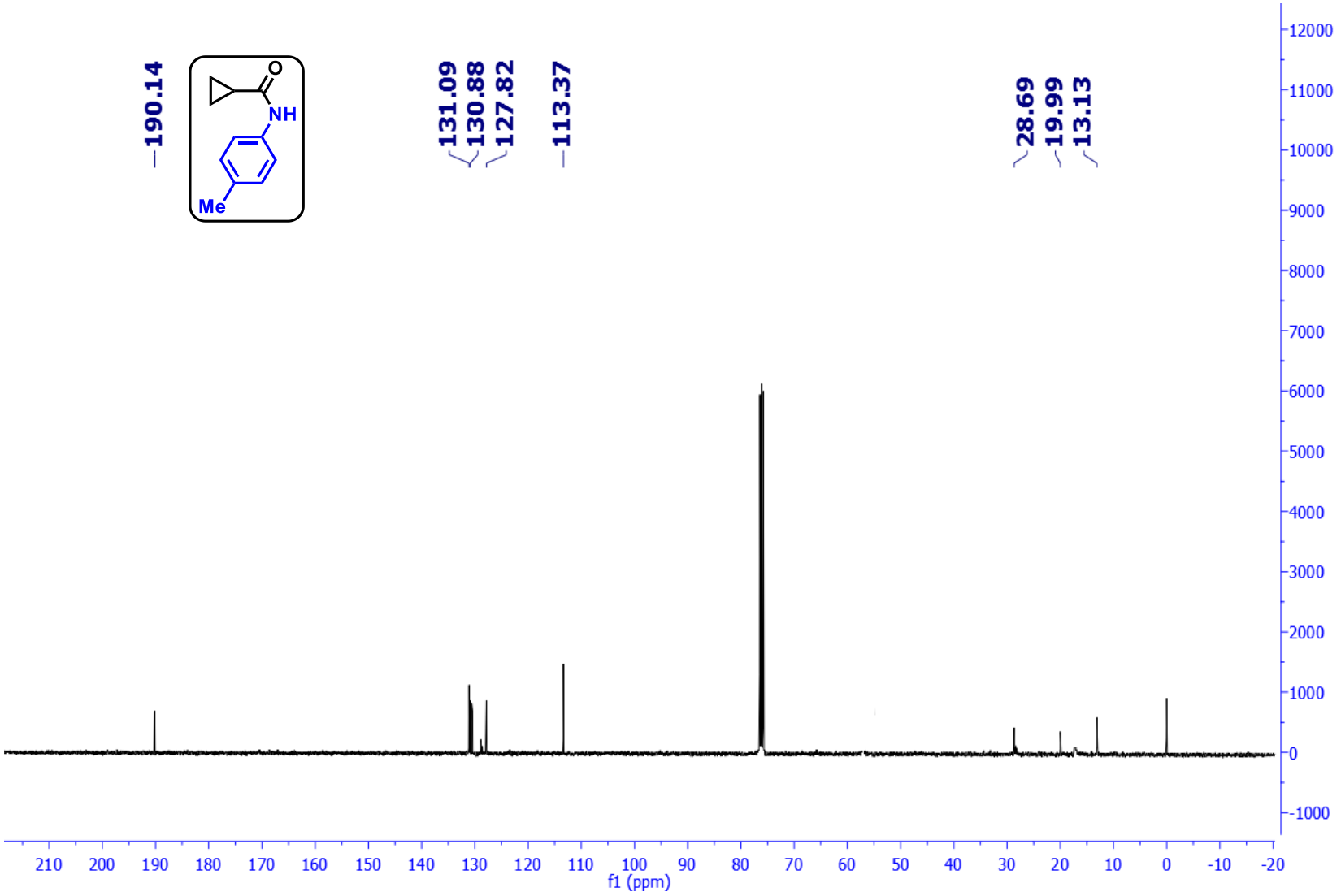


^{1}H NMR (400 MHz, Chloroform –d) of 3au

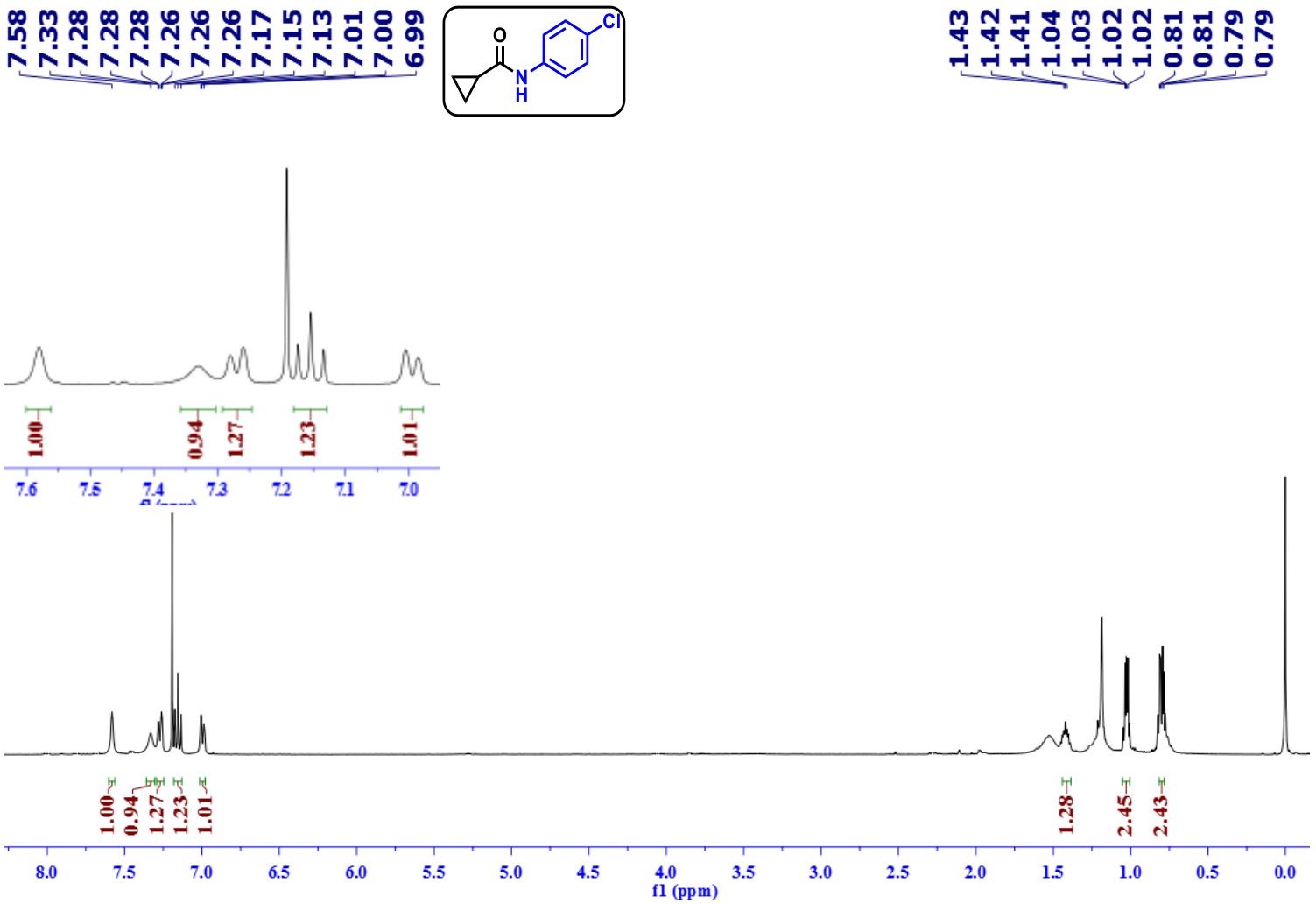
ature SIF VIT VELLORE



C^{13} NMR (400 MHz, Chloroform –d) of 3au

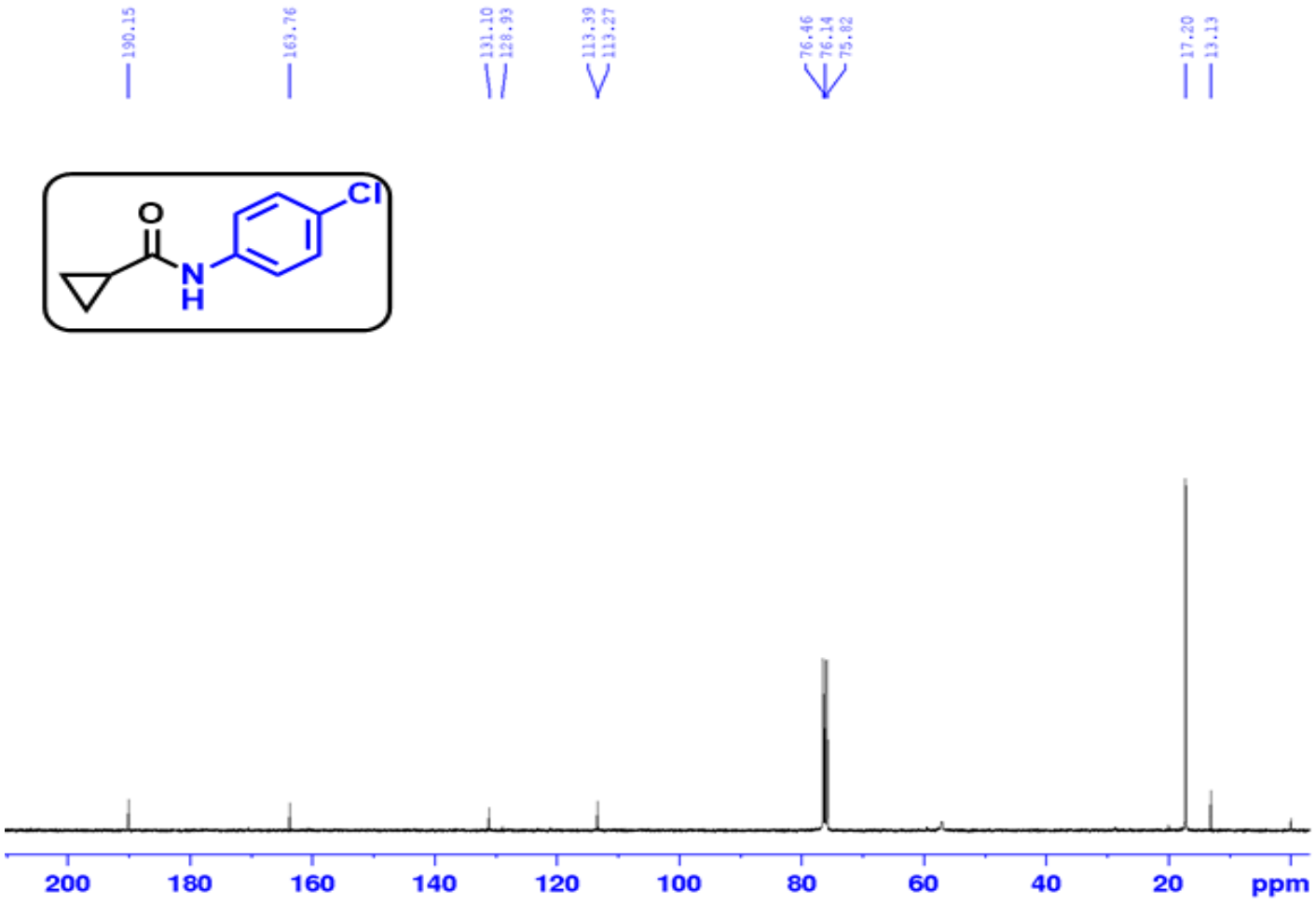


^{1}H NMR (400 MHz, Chloroform –d) of 3av

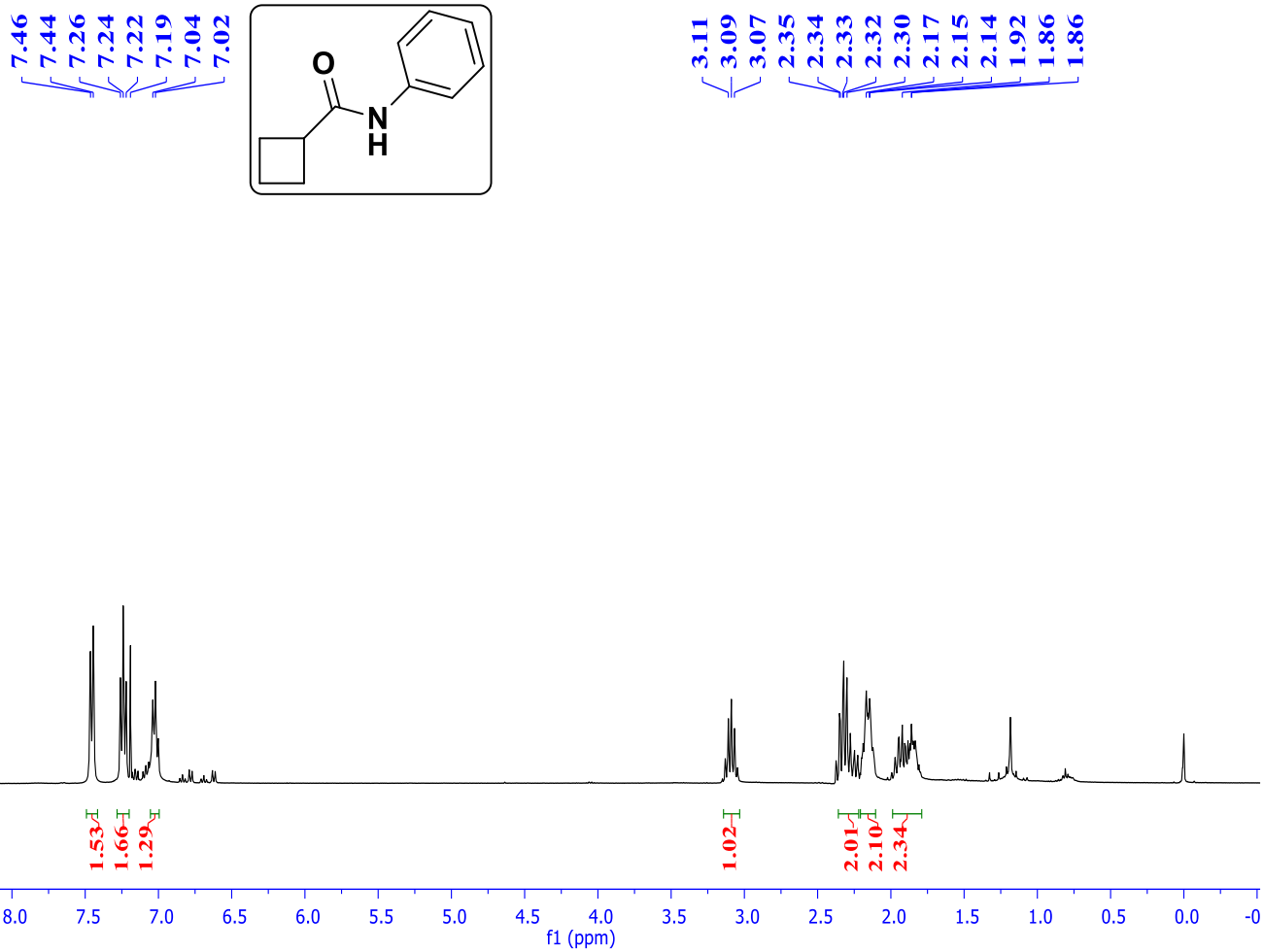


C^{13} NMR (400 MHz, Chloroform–d) of 3av

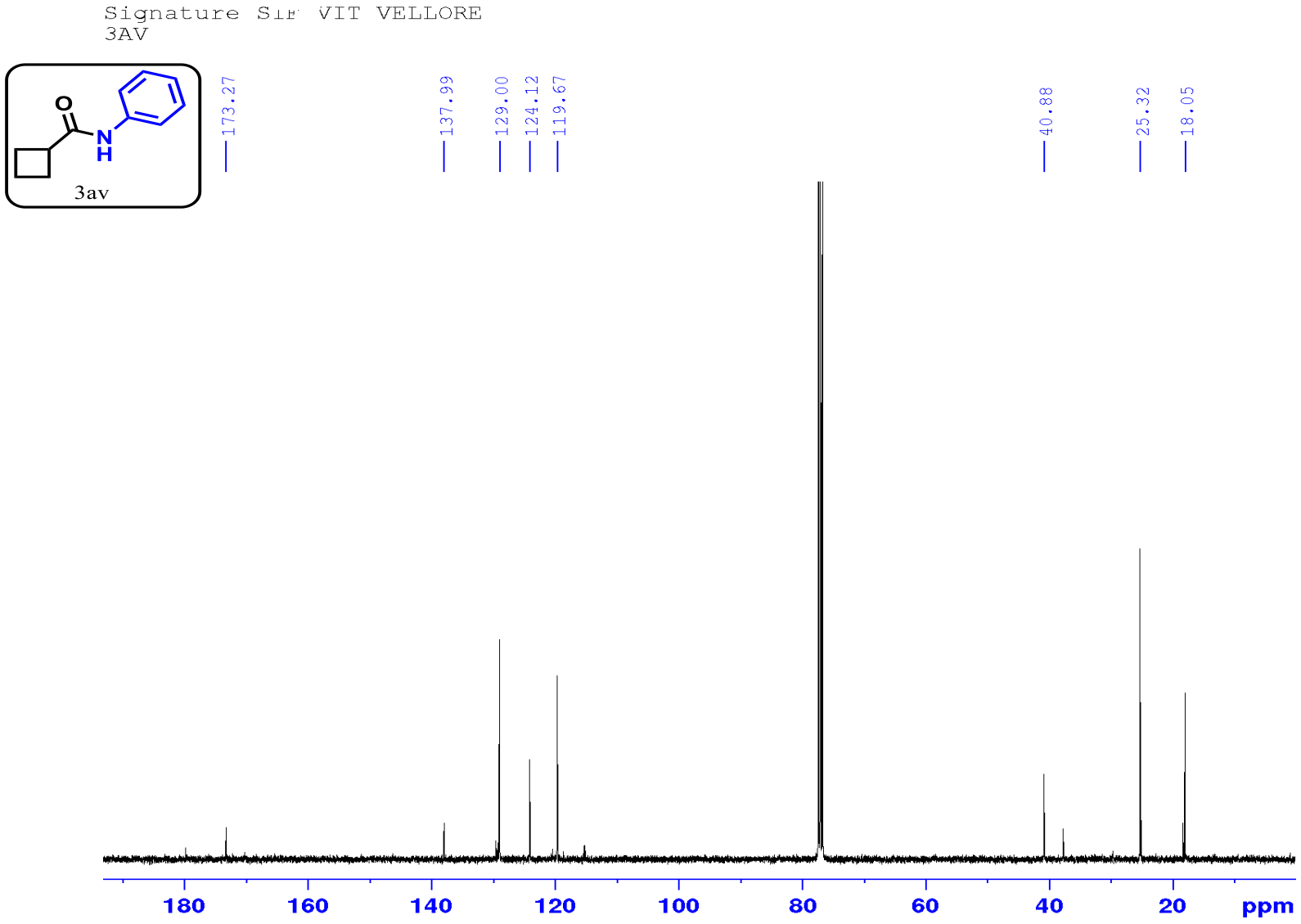
Signature SIF VIT VELLORE
3ay



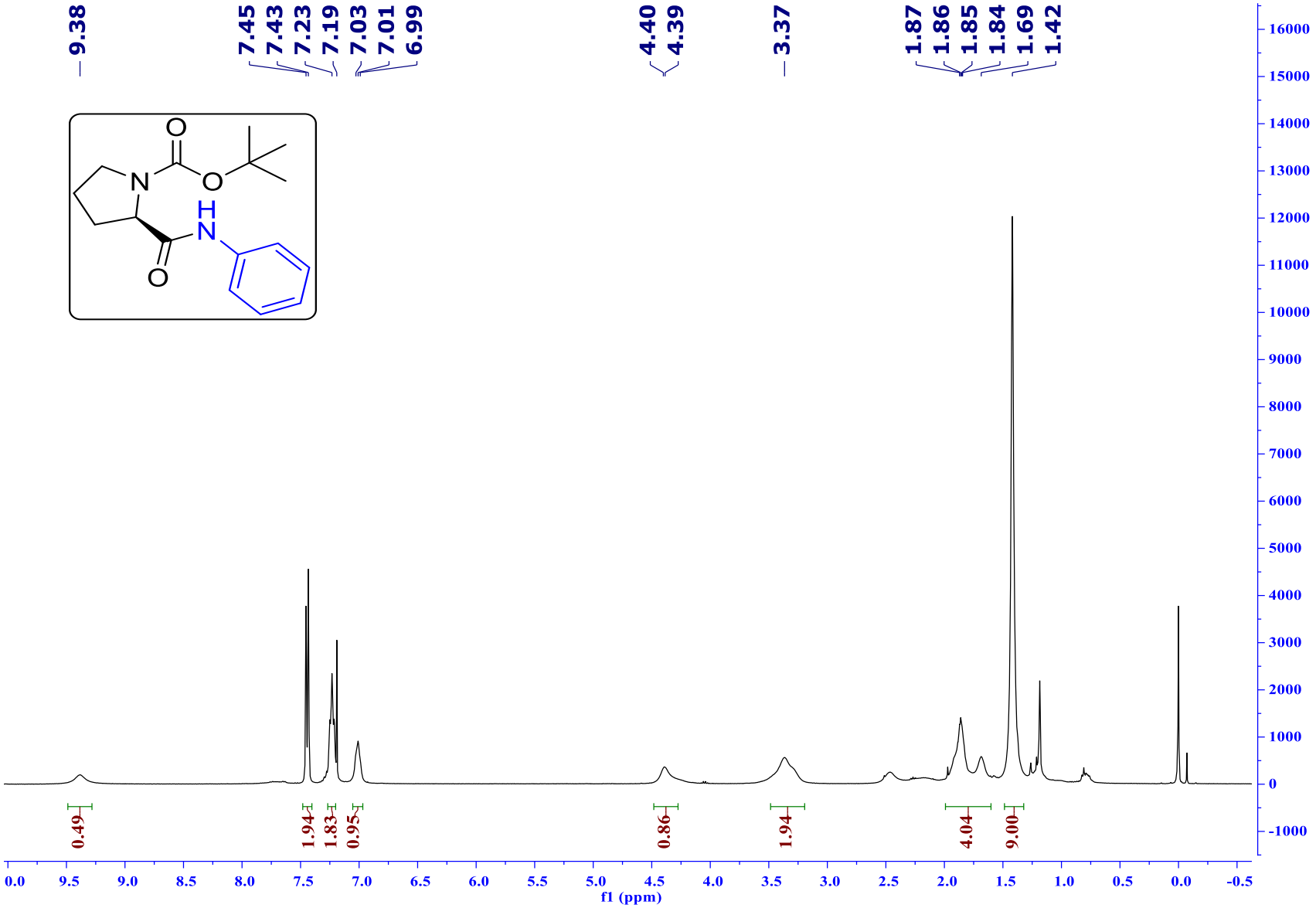
^{1}H NMR (400 MHz, Chloroform –d) of 3AW



C^{13} NMR (400 MHz, Chloroform –d) of 3aw

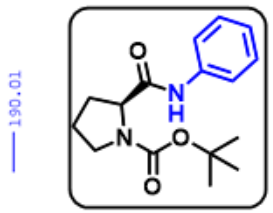


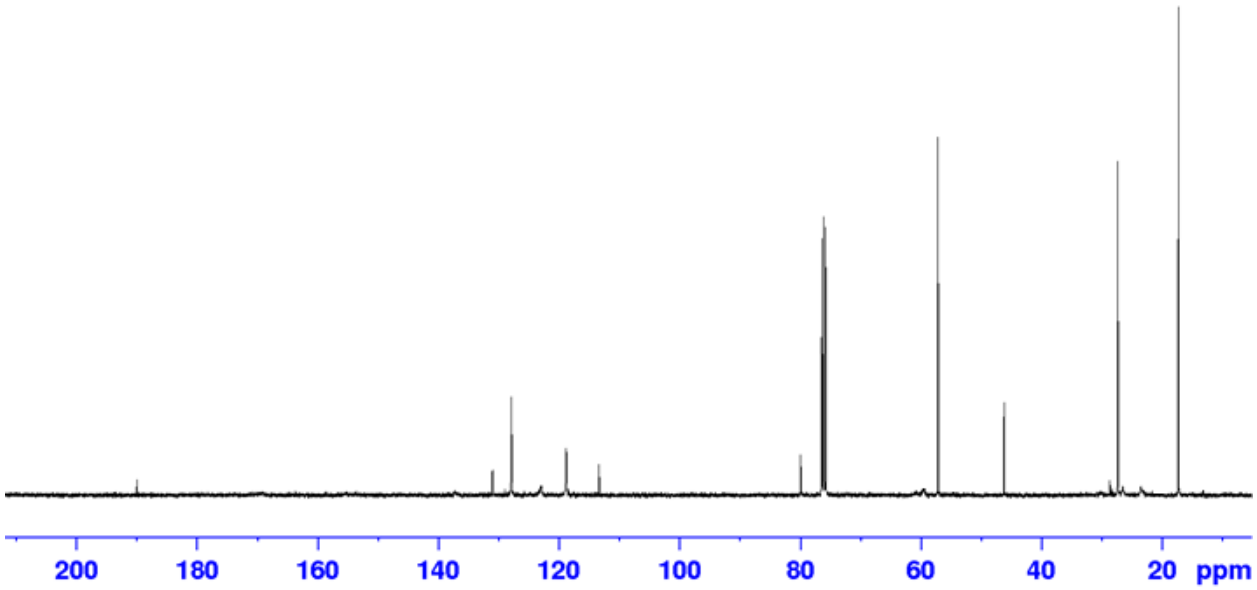
^{1}H NMR (400 MHz, Chloroform –d) of 3ay



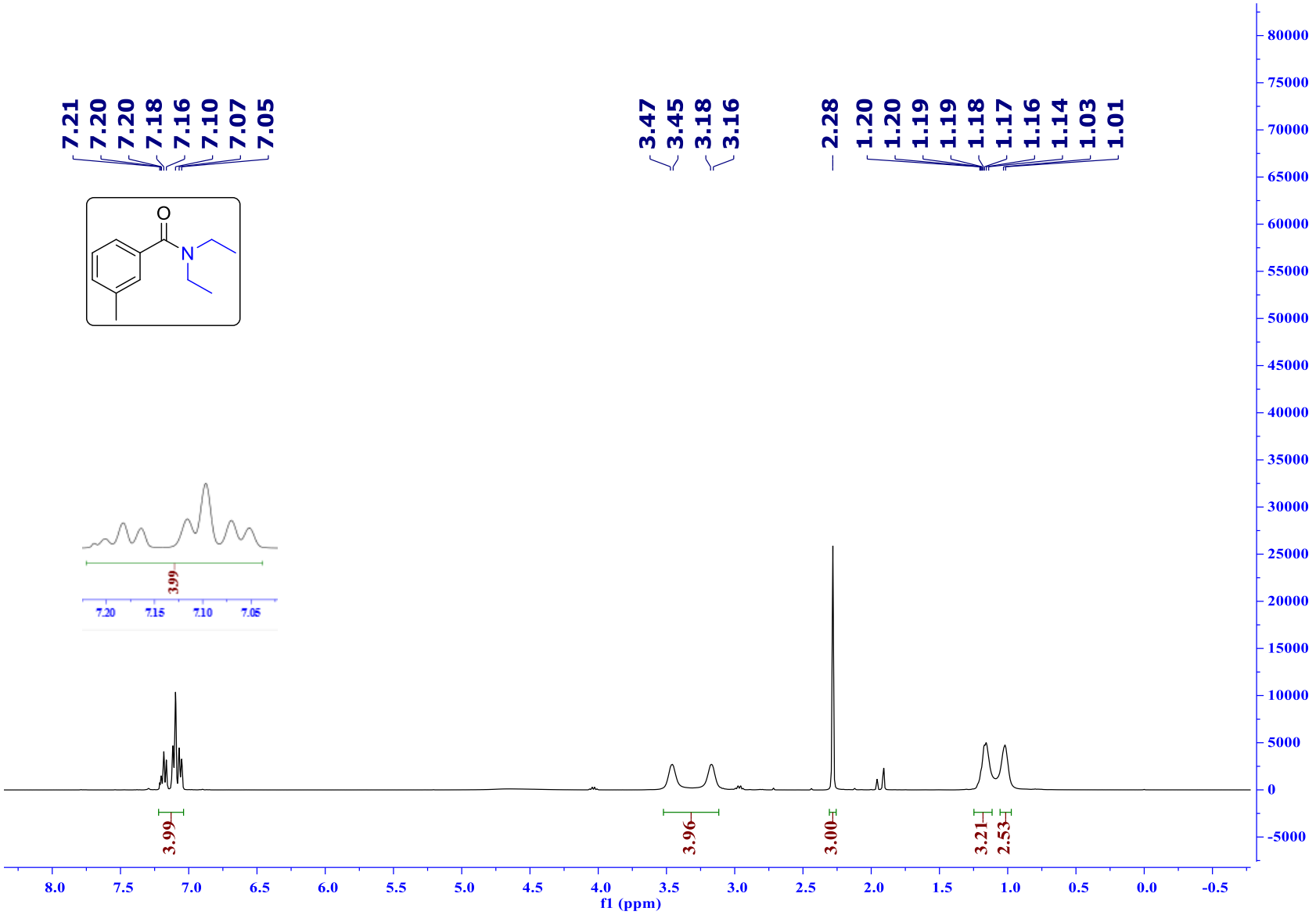
C^{13} NMR (400 MHz, Chloroform –d) of 3ay

Signature SIF VIT VELLORE
tert-butyl (S)-2-(phenylcarbamoyl)pyrrolidine-1-carboxylate

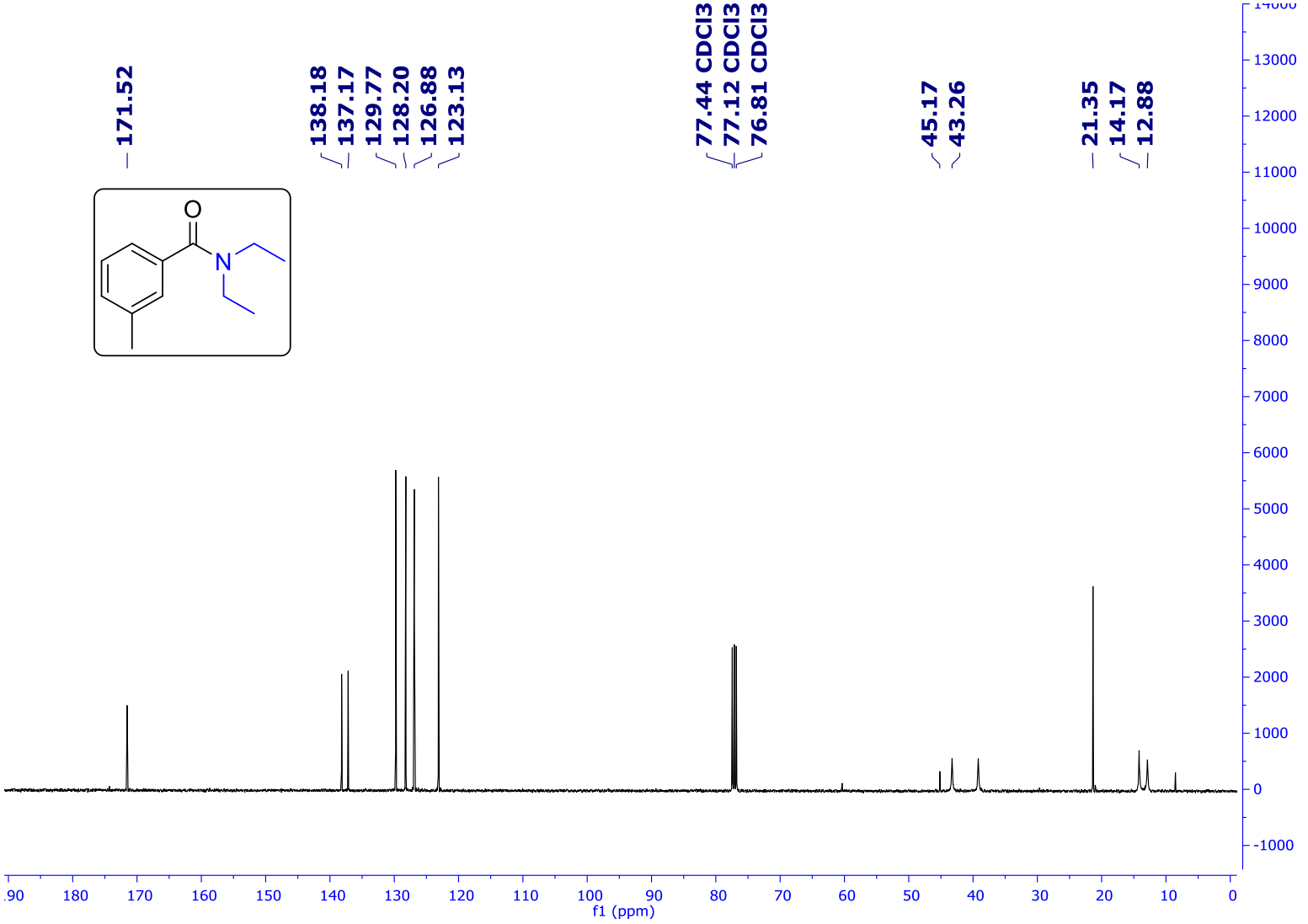




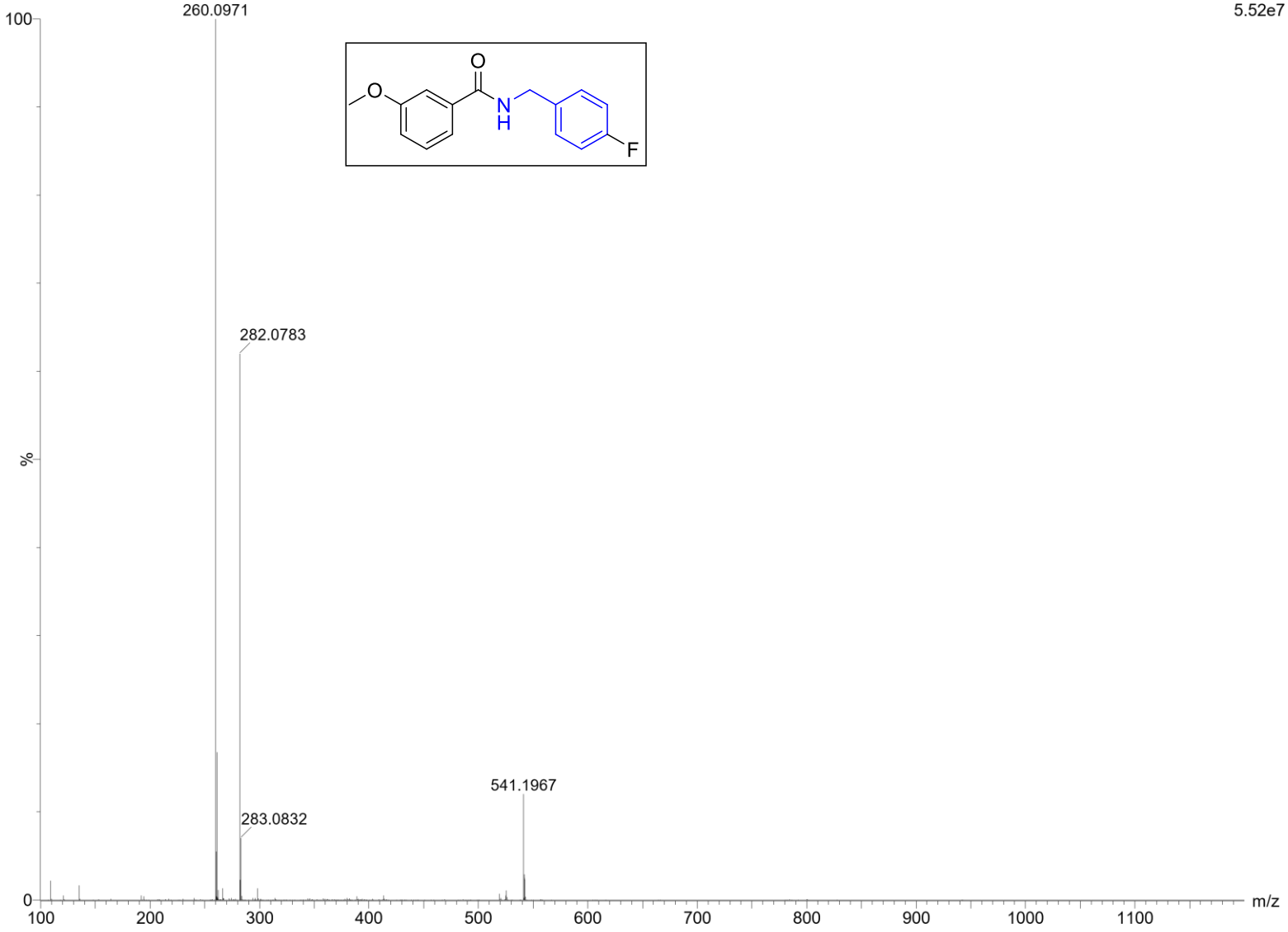
^{1}H NMR (400 MHz, Chloroform –d) of 3az



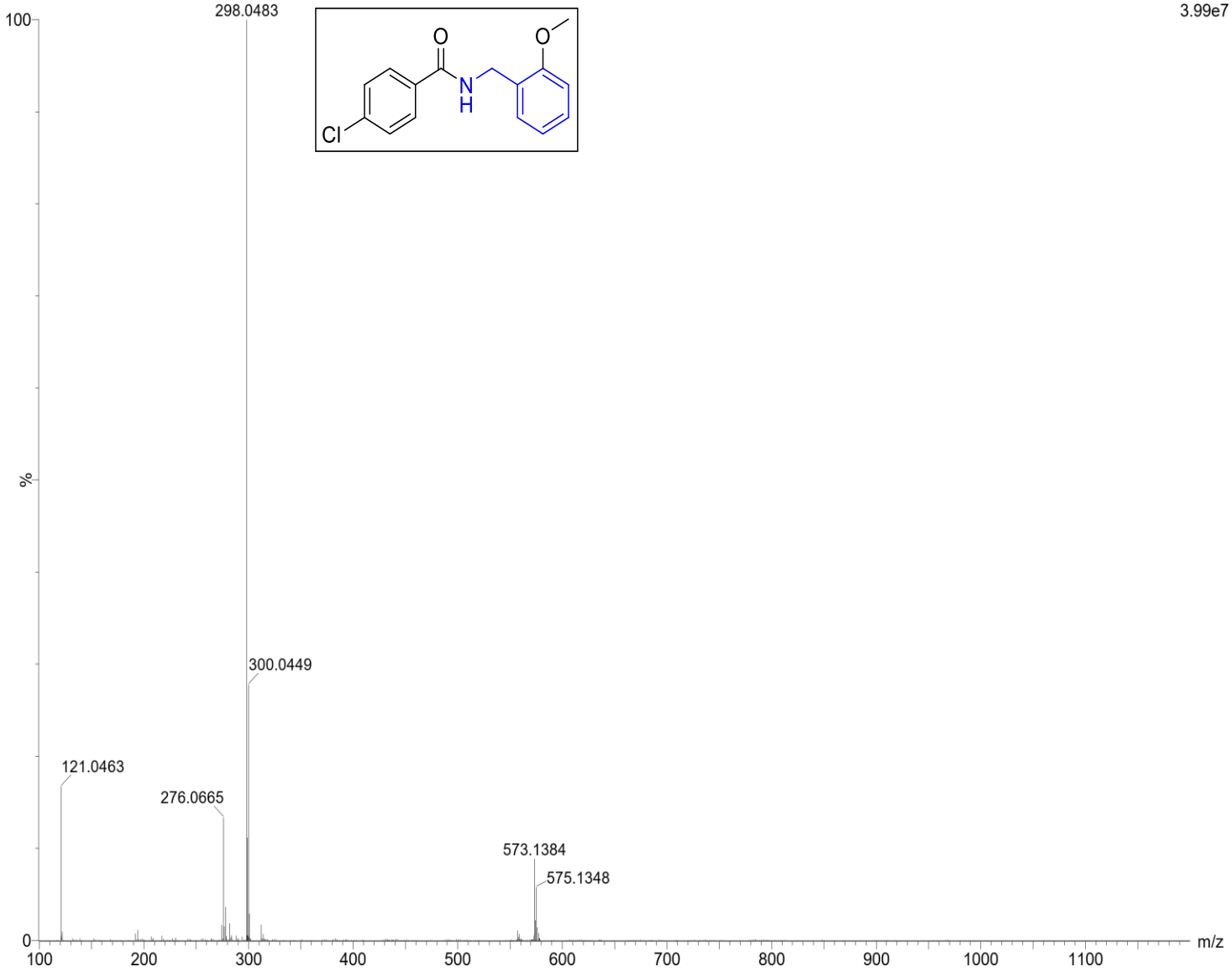
C^{13} NMR (400 MHz, Chloroform –d) of 3az



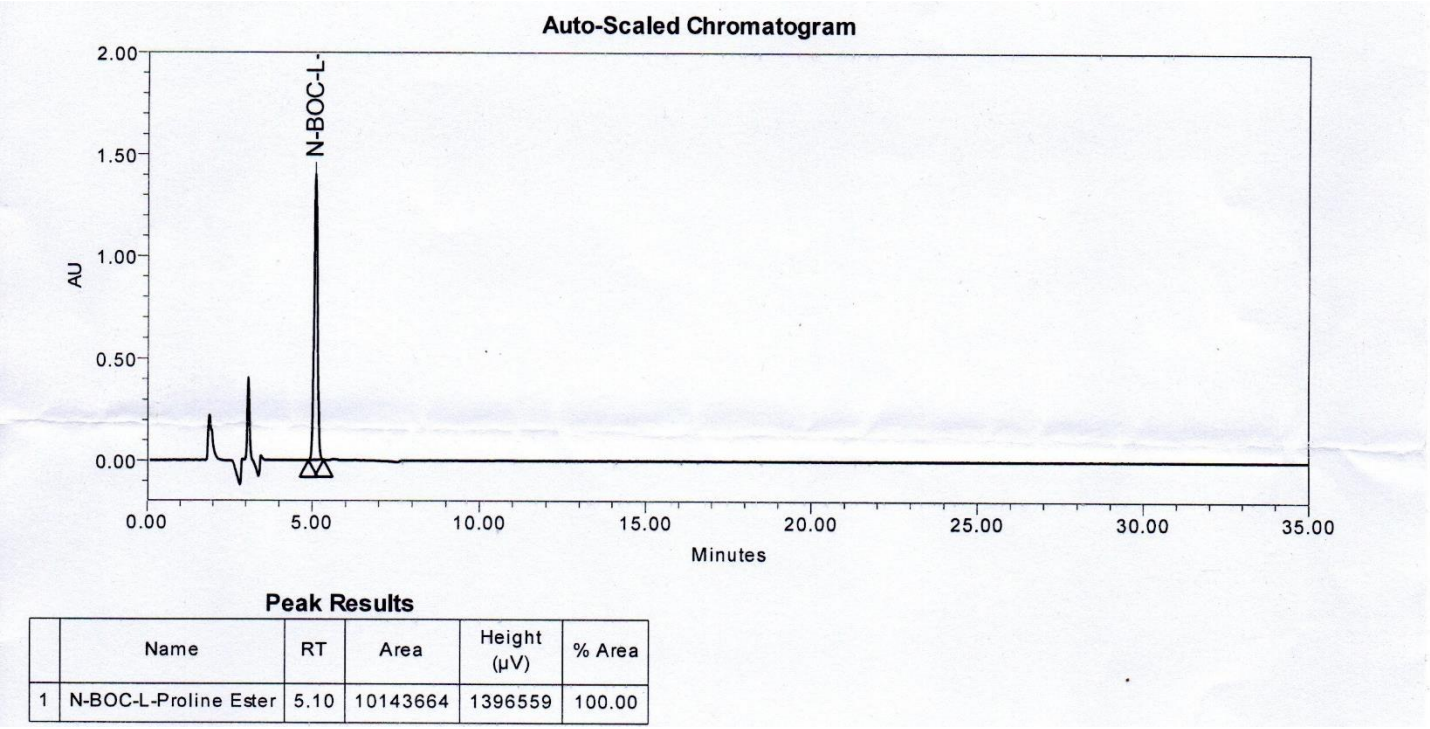
HRMS data of [3l]



HRMS data of [3q]



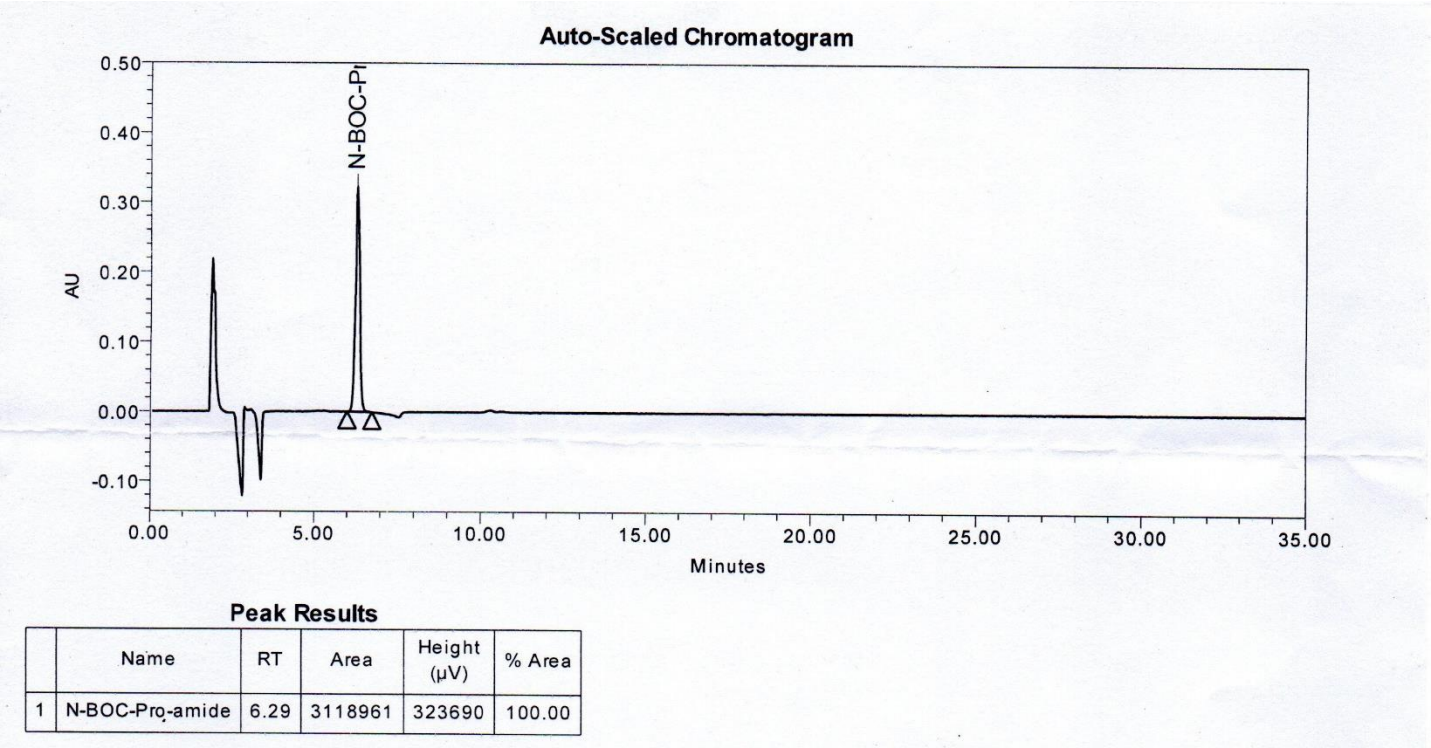
HPLC - Chiral Chromatography data of 1ay:



Peak Results

	Name	RT	Area	Height (µV)	% Area
1	N-BOC-L-Proline Ester	5.10	10143664	1396559	100.00

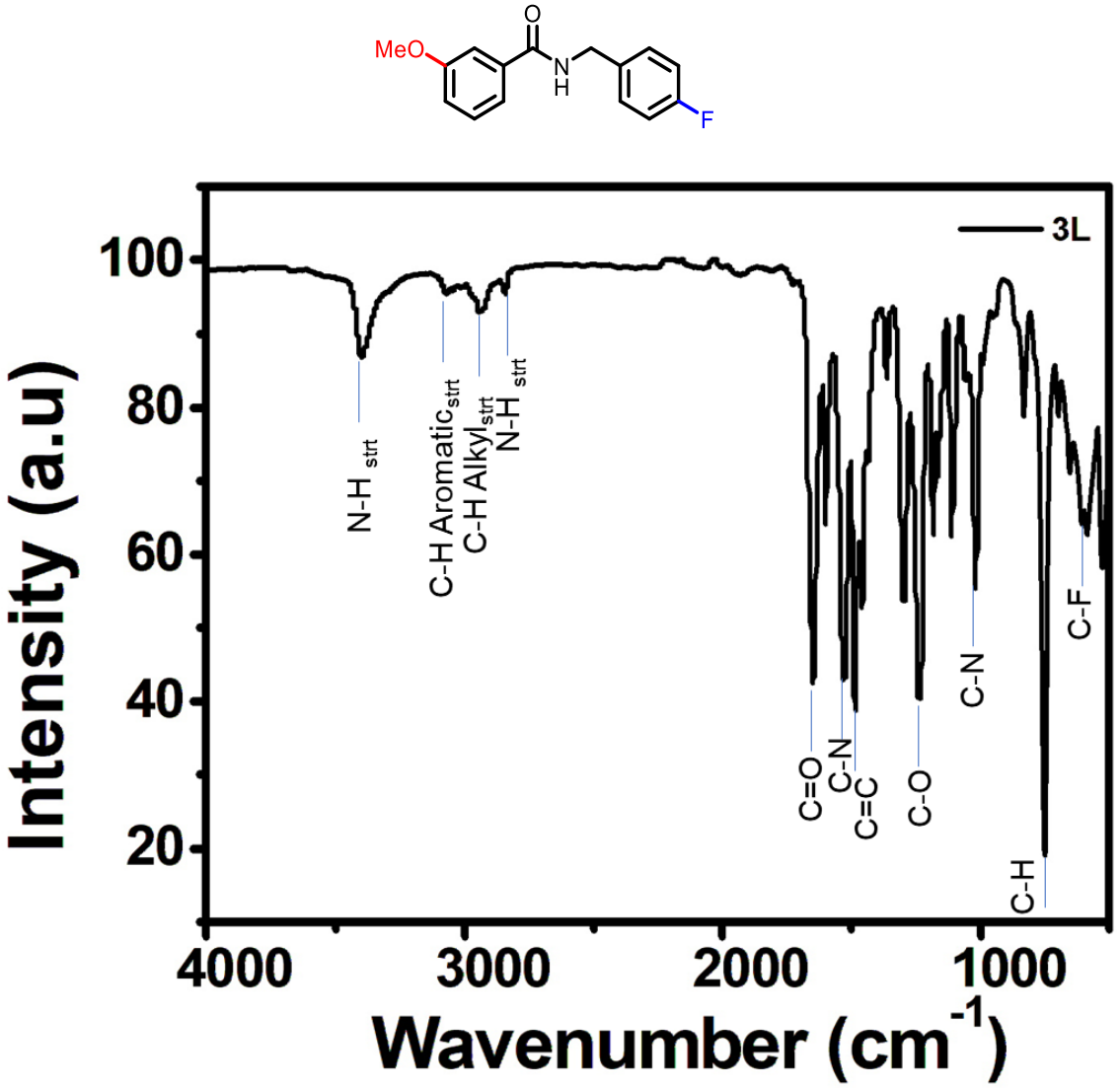
HPLC - Chiral Chromatography data of 3ay:



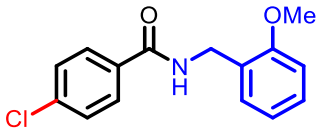
Peak Results

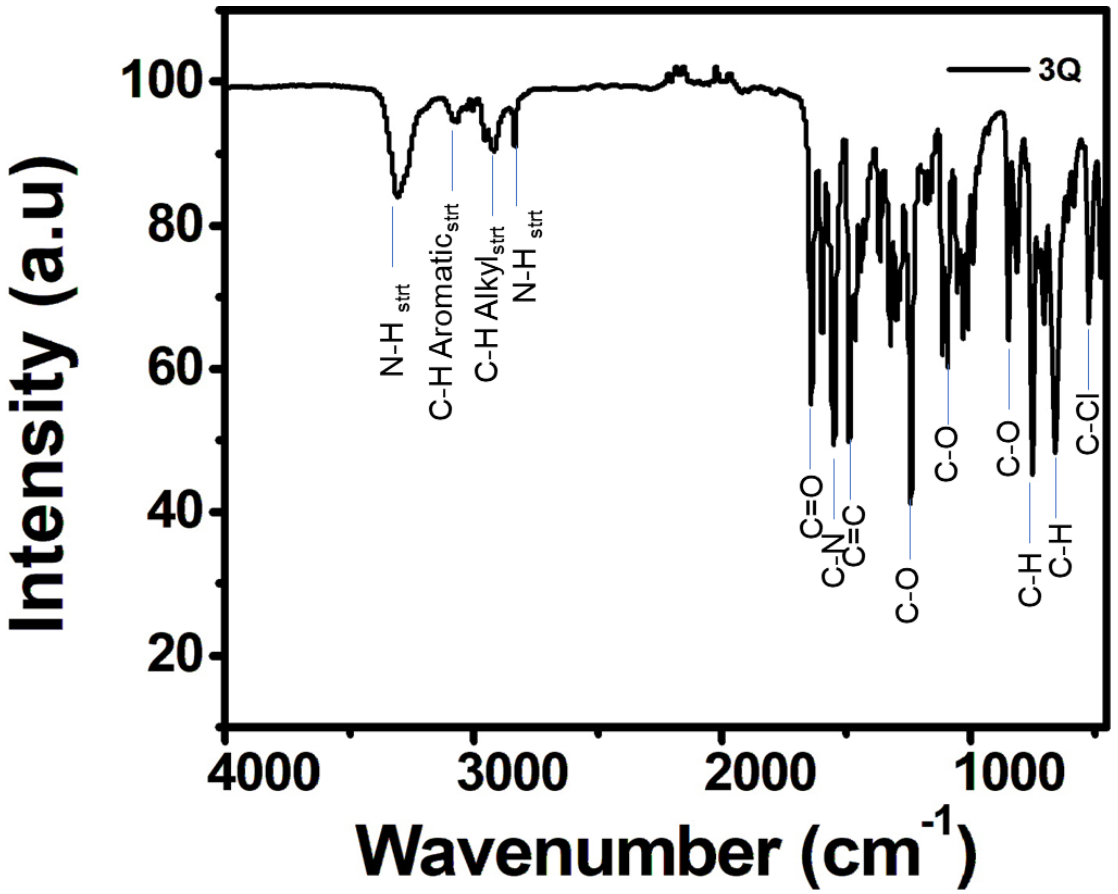
	Name	RT	Area	Height (μV)	% Area
1	N-BOC-Pro-amide	6.29	3118961	323690	100.00

IR Spectra of 3l



IR Spectra of 3q





10. References:

[1] a) T. Ben Halima, J. K. Vandavasi, M. Shkoor, S. G. Newman, *ACS Catal.* **2017**, *7*, 2176-2180; b) T. Zhou, G. Li, S. P. Nolan, M. Szostak, *Org. Lett.* **2019**, *21*, 3304-3309; c) A. H. Dardir, P. R. Melvin, R. M. Davis, N. Hazari, M. Mohadjer Beromi, *J. Org. Chem.* **2018**, *83*, 469-477.

[2] T. Ben Halima, W. Zhang, I. Yalaoui, X. Hong, Y.-F. Yang, K. N. Houk, S. G. Newman, *JACS* **2017**, *139*, 1311-1318.

[3] J.-W. Wu, Y.-D. Wu, J.-J. Dai, H.-J. Xu, *Adv. Synth. Catal.* **2014**, *356*, 2429-2436.

[4] K. Murugesan, A. M. Alenad, A. S. Alshammari, M. Sohail, R. V. Jagadeesh, *Tetrahedron* **2021**, *102*, 132526.

[5] R. A. Green, D. Pletcher, S. G. Leach, R. C. D. Brown, *Org. Lett.* **2016**, *18*, 1198-1201.

[6] B. Roberts, D. Liptrot, L. Alcaraz, T. Luker, M. J. Stocks, *Org. Lett.* **2010**, *12*, 4280-4283.

[7] J. Das, D. Banerjee, *J. Org. Chem.* **2018**, *83*, 3378-3384.

[8] H. Zhang, J. Wang, Z. Ji, X. Sun, Q. Tian, S. Wei, Z. Ji, *Pest Manag. Sci.* **2021**, *77*, 2804-2811.

[9] P.-L. Lagueux-Tremblay, A. Fabrikant, B. A. Arndtsen, *ACS Catal.* **2018**, *8*, 5350-5354.

[10] M. Chen, T. Doba, T. Sato, H. Razumkov, L. Ilies, R. Shang, E. Nakamura, *J. Am. Chem. Soc.* **2020**, *142*, 4883-4891.

[11] A. Joshi, S. Kumari, S. Kundu, *Adv. Synth. Catal.* **2022**, *364*, 4371-4383.

[12] C. N. Reddy, N. H. Krishna, V. G. Reddy, A. Alarifi, A. Kamal, *Asian J. Org. Chem.* **2017**, *6*, 1498-1504.

[13] T. Kumar Achar, P. Mal, *Adv. Synth. Catal.* **2015**, *357*, 3977-3985.

[14] Y. Liu, S. Shi, M. Achtenhagen, R. Liu, M. Szostak, *Org Lett.* **2017**, *19*, 1614-1617.

[15] W. I. Nicholson, F. Barreteau, J. A. Leitch, R. Payne, I. Priestley, E. Godineau, C. Battilocchio, D. L. Browne, *Angew. Chem. Int. Ed.* **2021**, *60*, 21868-21874.

[16] J. P. Hibbard, J. G. Yam, E. B. Alsalek, A. Bahamonde, *J. Org. Chem.* **2022**, *87*, 12036-12040.

[17] I. Mejía-Farfán, M. Solís-Hernández, P. Navarro-Santos, C. A. Contreras-Celedón, C. J. Cortés-García, L. Chacón-García, *RSC Adv.* **2019**, *9*, 18265-18270.

[18] Z. Tang, K. Mo, X. Ma, J. Huang, D. Zhao, *Angew. Chem. Int. Ed.* **2022**, *61*, e202208089.

[19] A. Rolfe, D. A. Probst, K. A. Volp, I. Omar, D. L. Flynn, P. R. Hanson, *J. Org. Chem.* **2008**, *73*, 8785-8790.

[20] S. Das, D. Addis, K. Junge, M. Beller, *Chem. Eur. J.* **2011**, *17*, 12186-12192.

[21] Y. Jo, J. Ju, J. Choe, K. H. Song, S. Lee, *J. Org. Chem.* **2009**, *74*, 6358-6361.

[22] K. R. Reddy, C. U. Maheswari, M. Venkateshwar, M. L. Kantam, *Eur. J. Org. Chem.* **2008**, *2008*, 3619-3622.

[23] L. Zhang, J. Jiang, L. Li, Q. Chen, L. Zhang, H. Sun, C. Li, *ACS Sustainable Chem. Eng.* **2022**, *10*, 8433-8442.

[24] A. Correa, R. Martin, *J. Am. Chem. Soc.* **2014**, *136*, 7253-7256.

[25] H. Nie, Y. Zhu, X. Hu, Z. Wei, L. Yao, G. Zhou, P. Wang, R. Jiang, S. Zhang, *Org. Lett.* **2019**, *21*, 8641-8645.

[26] Y. Wang, D. Zhu, L. Tang, S. Wang, Z. Wang, *Angew. Chem. Int. Ed.* **2011**, *50*, 8917-8921.

[27] O. O. Kovalenko, A. Volkov, H. Adolfsson, *Org. Lett.* **2015**, *17*, 446-449.

[28] J. M. John, R. Loorthuraja, E. Antoniuk, S. H. Bergens, *Catal. Sci. Technol.* **2015**, *5*, 1181-1186.

[29] G. Li, C.-L. Ji, X. Hong, M. Szostak, *J. Am. Chem. Soc.* **2019**, *141*, 11161-11172.

[30] B. Huang, Y. Zhao, C. Yang, Y. Gao, W. Xia, *Org. Lett.* **2017**, *19*, 3799-3802.

[31] A. Obata, Y. Ano, N. Chatani, *Chem. Sci.* **2017**, *8*, 6650-6655.
[32] A. M. Whittaker, V. M. Dong, *Angew. Chem. Int. Ed.* **2015**, *54*, 1312-1315.
[33] S. De, J. Yin, D. Ma, *Org. Lett.* **2017**, *19*, 4864-4867.
[34] J. K. Augustine, R. Kumar, A. Bombrun, A. B. Mandal, *Tetrahedron Lett.* **2011**, *52*, 1074-1077.
[35] L. Ling, C. Chen, M. Luo, X. Zeng, *Org. Lett.* **2019**, *21*, 1912-1916.
[36] D. E. Helbling, J. Hollender, H.-P. E. Kohler, H. Singer, K. Fenner, *Environ. Sci. Technol.* **2010**, *44*, 6621-6627.