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Supporting Information

Copper-catalyzed radical process of site selective C-N bond cleavage in twisted amides: Batch and continuous flow method

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1. General Information:

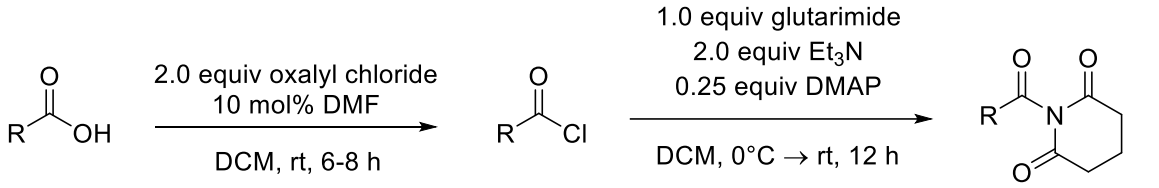
All chemicals were purchased from commercial providers (Sigma Aldrich, Alfa Aesar, TCI, and matrix scientific) and used directly without further purification, unless otherwise noted. Well cleaned and oven dried glassware were used for the experiments. Reaction was monitored by Thin Layer Chromatography (TLC), purchased as pre-coated with silica gel 60 F254 from Merck. Column chromatography was carried out using the silica gel 230-400 mesh (purchased from Merck) with mixture of ethyl acetate/hexane or hexane as the eluent. ^{1}H NMR spectra were recorded on 400 MHz, ^{13}C-NMR spectra were recorded on 100 MHz, Varian mercury spectrometer using $CDCl_3$ or DMSO-d_6 as solvent. The spectra were recorded and presented in chemical shifts (ppm) with tetramethylsilane (TMS) used as internal standard. Multiplicities were provided in s (singlet), d (doublet), t (triplet), q (quartet), bs (broad single), m (multiplet), dt (doublet of triplet), td (triplet of doublet), dd (doublet of doublet) and ddd (doublet of doublet of doublet). Coupling constants (J) were reported in Hz. All the compounds were characterized by ESI mass on Thermo Finnigan (TRACEGC- POLARISQ) and HRMS (ESI+ or FAB+ mode) on JMS-700 spectrometer. Melting points were determined using Fargo instruments.

2. Experimental Procedures

2.1 Preparation of Starting Materials

All starting materials **1a-1z, 1aa-1aj**, **3a-g, 3e', 3i** were synthesized on 2 mmol scale, according to literature procedure and obtained in 60-88% yield, unless otherwise noted. The ^{1}H-NMR spectra of all compounds **1a-z, 1aa-1ae & 1ai-aj, 3a-g, 3e', 3i** were matched with previous literature. [1-11] The rest of new compounds **1ag, 1ah** were characterized and the data presented as followed.

Procedure for the synthesis of amide substrates 1af, 1ag and 1ah.



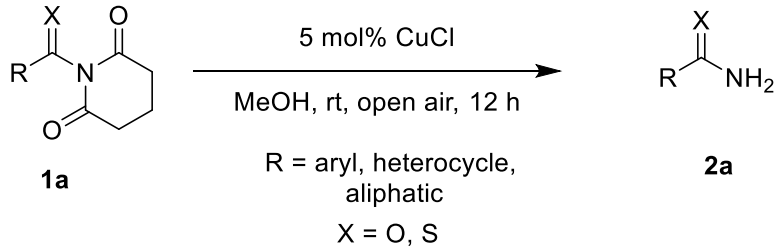
Scheme S1 General procedures for the synthesis of amide substrates

1) A 100 mL round-bottom flask was charged with acid (1.0 equiv, 10.0 mmol), dry CH_2Cl_2 (20.0 mL) and 10 mol% of DMF. The reaction mixture was cooled to 0 ^{o}C and stirred for 5 minutes. Then oxalyl chloride (2.0 equiv) was added dropwise to the reaction mixture and stirred at rt for 6-8 h. The resulting mixture was concentrated under reduced pressure to afford acid chloride quantitatively which was used directly without further purification for the next step.

2) An oven-dried round-bottomed flask (50 mL) equipped with a stir bar was charged with amine (5 mmol, 1.0 equiv), triethylamine (typically, 2.0 equiv), 4-dimethylaminopyridine (typically, 0.25 equiv) and dichloromethane (typically, 20 mL), placed under a positive

pressure of argon, and subjected to three evacuation/backfilling cycles under high vacuum. Acyl chloride (typically, 1.5 equiv) was added dropwise to the reaction mixture with vigorous stirring at 0 °C, and the reaction mixture was stirred overnight at room temperature. After the indicated time, the reaction mixture was diluted with Et_2O (10 mL) and filtered. The organic layer was washed with HCl (1.0 N, 10 mL), brine (10 mL), dried, and concentrated. Unless stated otherwise, the crude product was purified by recrystallization (toluene) to give analytically pure product.

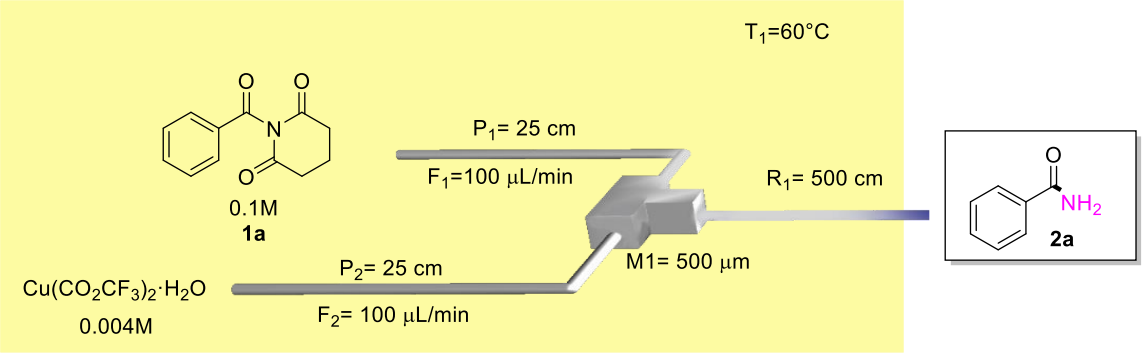
2.2 General experimental procedure for selective C-N bond cleavage in batch



Scheme S2 General procedures for the synthesis of primary amides in batch

An oven-dried vial was charged with **1a-1z, 1aa-1aj**, **3e'** (0.2 mmol, 1.0 equiv) and copper (I) chloride (0.01 mmol, 0.05 equiv) in methanol (0.2M). The resulting mixture was allowed to stir at room temperature in an open air for 12h. After completion of reaction extracted with ethyl acetate (3 mL x 5), organic layer combined and washed with brine solution (5 mL). The organic layer was dried over anhydrous $MgSO_4$, filtered and concentrated under vacuum. The crude product was purified by column chromatography (Hexane/EtOAc, 6/4, silica gel) and obtained as solid up to 35-99% yields. Further, the obtained desired products were characterized by NMR the data were shown given below.

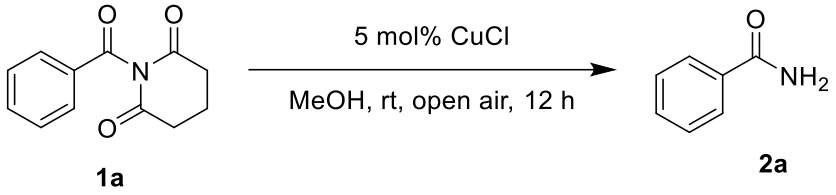
2.3 General experimental procedure for selective C-N bond cleavage in continuous flow method



Scheme S3 General procedures for the synthesis of primary amides in continuous flow method

The flow microreactor system of one T-shaped micromixer (**M_1** 500 μm), one microtube reaction (**R_1**), and two reagents delivering units **P_1** (inner diameter = 800 μm, length L = 25 cm), **P_2** (inner diameter = 800 μm, length L= 25 cm). A solution of **1a** (0.1 M in methanol) and a solution of Cu $(CO_2CF_3)_2{\cdot}XH_2O$ (0.004 M in methanol) was introduced to **M_1** (M_1, Φ = 500 μm) by syringe pumps. The resulting solution was passed through **R_1** (Φ = 800 μm, L = 500 cm) at 60 °C. After a steady state was reached (after 1 min), the final product solution was collected for 15 minutes in the vial. The reaction mixture was analysed by GC with 99 % conversion, the solution was extracted with ethyl acetate. The organic phase was dried with $MgSO_4$, and the solvent was removed by vacuum. The crude product was purified by column chromatography (Hexane/EtOAc,6/1, silica gel) and obtained **2a** (17.3 mg, 95%).

2.4 Experimental procedure for selective C-N bond cleavage in Gram-scale synthesis

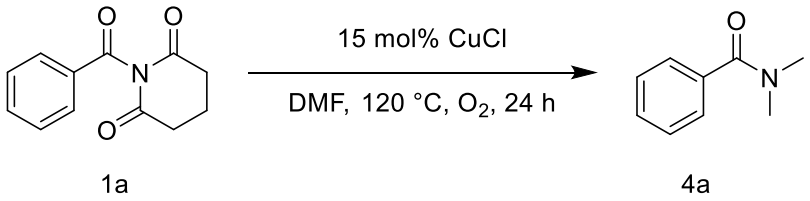


1a **2a**

Scheme S4 Experimental procedure for the synthesis of primary amide in gram-scale

An oven-dried vial was charged with **1a** (9.21 mmol, 1.0 equiv) and copper (I) chloride (0.4605 mmol, 0.05 equiv) in methanol (0.2M). The resulting mixture was allowed to stir at room temperature in an open air for 12h. After completion of reaction extracted with ethyl acetate (150 mL x 5), organic layer combined and washed with brine solution (50 mL). The organic layer was dried over anhydrous $MgSO_4$, filtered and concentrated under vacuum. The crude product was purified by column chromatography (Hexane/EtOAc, 6/4, silica gel) and obtained as white solid to 89% yield. Further, the obtained desired product was characterized by NMR the data were shown given below

2.5 Experimental procedure for copper-catalyzed C-N bond cleavage



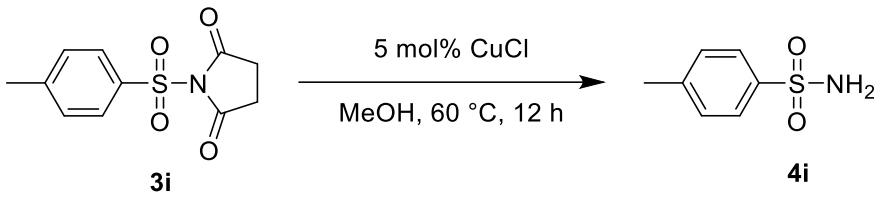
1a 4a

Scheme S5 Experimental procedure for the synthesis of dimethyl benzamide

An oven-dried vial was charged with **1a** (0.2 mmol, 1.0 equiv) and copper (I) chloride (0.03 mmol, 0.15 equiv) in DMF (0.1M). The resulting mixture was allowed to stir at 120 ℃ in seal tube under O_2 for 24h. After completion of reaction extracted with ethyl acetate (3 mL x 5), organic layer combined and washed with brine solution (5 mL). The organic layer was dried over anhydrous $MgSO_4$, filtered and concentrated under vacuum. The crude product was

purified by column chromatography (Hexane/EtOAc, 9/1, silica gel) and obtained as solid to 58% yield. Further, the obtained desired product was characterized by NMR the data were shown given below.

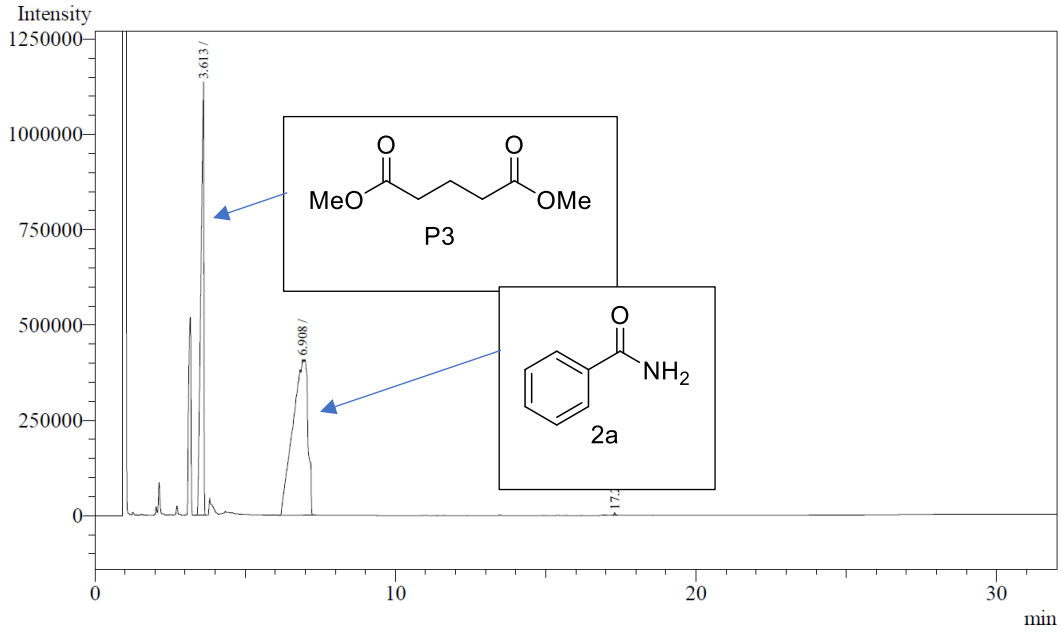
2.6 Experimental procedure for sulfonamide synthesis



Scheme S6 Experimental procedure for the synthesis of sulfonamide

An oven-dried vial was charged with **3i** (0.2 mmol, 1.0 equiv) and copper (I) chloride (0.01 mmol, 0.05 equiv) in methanol (0.2M). The resulting mixture was allowed to stir at 60 ℃ in open air for 12h. After completion of reaction extracted with ethyl acetate (3 mL x 5), organic layer combined and washed with brine solution (5 mL). The organic layer was dried over anhydrous $MgSO_4$, filtered and concentrated under vacuum. The crude product was purified by column chromatography (Hexane/EtOAc, 9/1, silica gel) and obtained as white solid to 80% yield. Further, the obtained desired product was characterized by NMR the data were shown given below

3. Mechanistic evidence for byproduct or intermediates (GC and HRMS data)



Peak#	Ret.Time	Area	Height	Conc.	Unit	Mark	ID#	Cmpd Name
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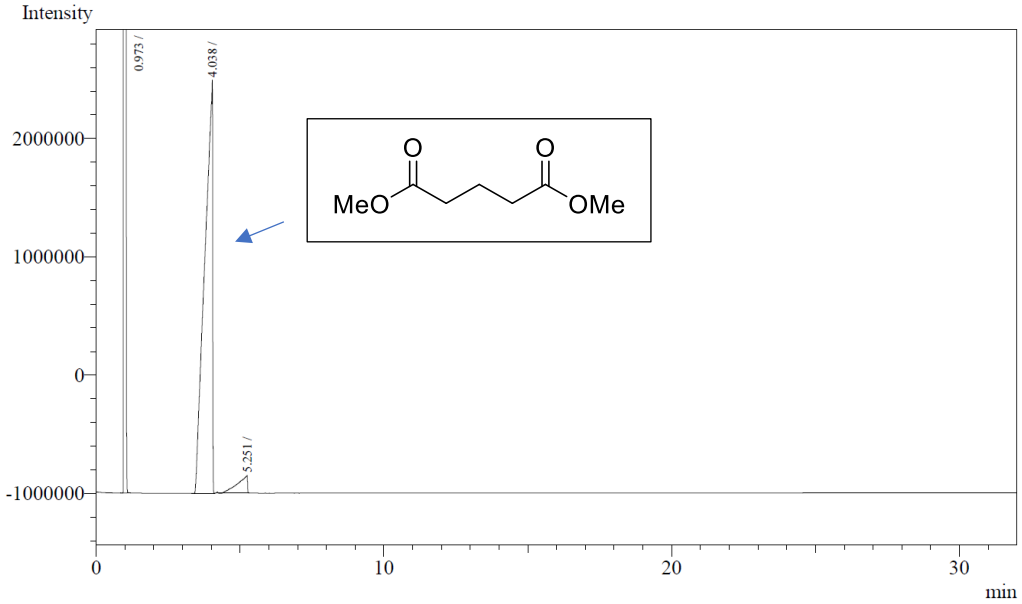
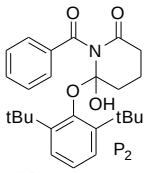
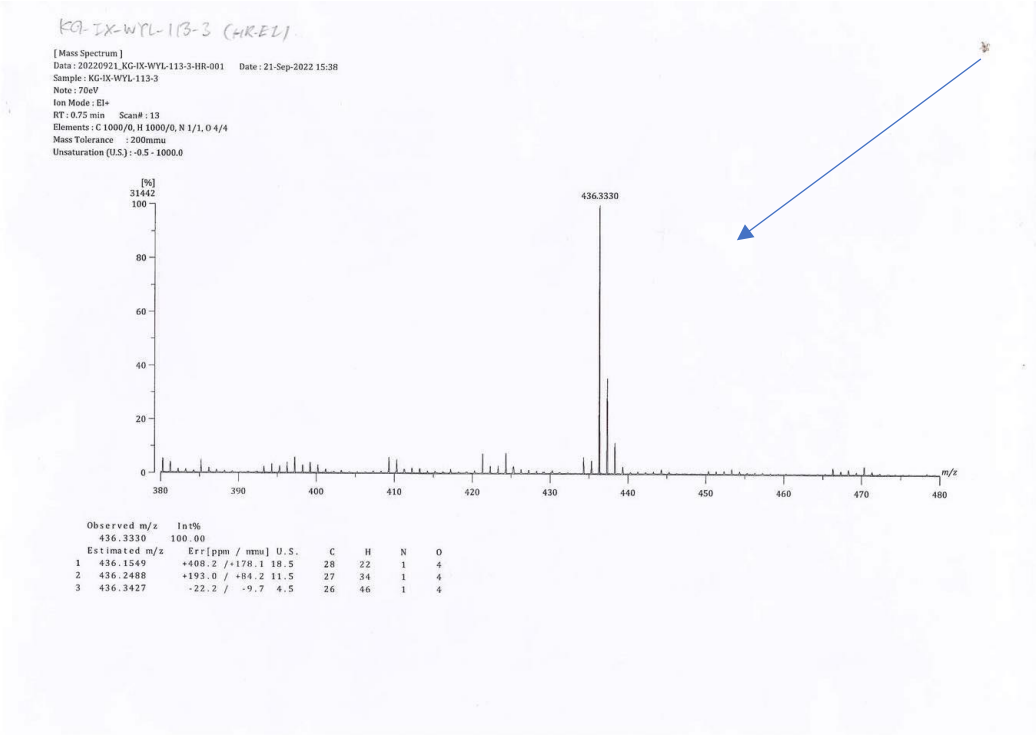
2	6.908	14293736	409082	65.258				
3	17.286	21682	7180	0.099				
Total		21903509	1548649					



Peak#	Ret.Time	Area	Height	Conc.	Unit	Mark	ID#	Cmpd Name
1	0.973	814973241	233896438	92.210				
2	4.038	65264919	3472118	7.384				
3	5.251	3581636	149211	0.405				
Total		883819796	237517767					

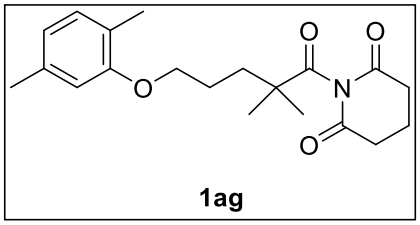




4. Characterization data:

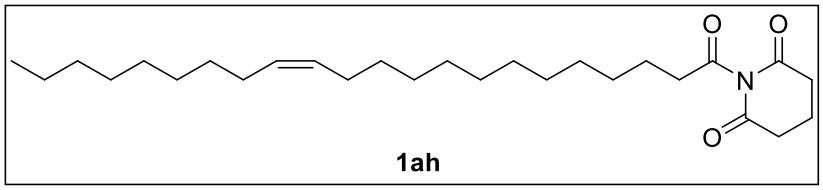
4.1. Characterization data of starting materials (1ag, 1ah):

1-(5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoyl)piperidine-2,6-dione (1ag): Title compound was synthesized according to the general procedure (Scheme S1), and obtained as semi liquid (570 mg, 55%), [Hexane/EtOAc, 1/1]; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 6.70 (d, *J* =7.2 Hz, 1H), 6.65 (d, *J* = 8.0 Hz, 1H), 6.62 (s, 1H), 3.94 (t, *J* =4.8 Hz, 2H), 2.65 (t, *J* =5.2 Hz, 4H), 2.30 (s, 3H), 2.17 (s, 3H), 2.02 (q, *J* = 6.4 Hz,2H), 1.87-1.81 (m, 4H), 1.27 (s, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 184.9, 172.0, 157.0,



136.4, 130.24, 123.6, 120.6, 112.0, 67.9, 46.9, 36.5, 32.3, 24.5, 24.2, 21.4, 17.4, 15.8. HRMS (m/z, ESI+) calcd $[C_{20}H_{27}NO_4Na]$ + $[M+Na]^+$ 368.1798, observed 368.1828.

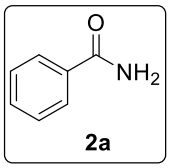
(Z)-1-(docos-13-enoyl)piperidine-2,6-dione (1ah): Title compound was synthesized according to the general procedure (Scheme S1), and obtained as semi liquid (781 mg, 60%), [Hexane/EtOAc, 1/1]; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 5.30 (t, *J* =4.8 Hz, 2H), 2.64-2.57 (m, 5H), 2.49-2.47 (m, 1H), 1.98-1.94 (m, 4H), 1.87 (q, *J* = 4.0 Hz, 2H), 1.53-1.46 (m,2H), 1.22 (s, 28H), 0.84 (t, *J* =8.0 Hz, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 179.9, 172.7, 130.0, 31.9, 31.7, 29.5, 29.4, 29.3, 29.2, 29.0, 28.4, 27.0, 23.5, 22.5 ,17.0, 14.4. HRMS (m/z, ESI-) calcd $[C_{27}H_{46}NO_3]$ + $[M-H]^-$ 432.3522, observed 432.3123.



1ah

4.2. Characterization data of products:

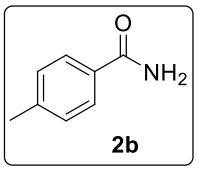
Benzamide (2a) [12]



2a

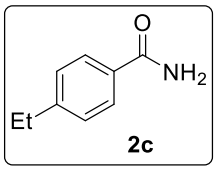
Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (22.3 mg, 92%), [Hexane/EtOAc, 1/1]; Mp.127-129 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.02 (bs, 1H), 7.95-7.92 (m, 2H), 7.60-7.55 (m, 1H), 7.52-7.48 (m, 2H), 7.41 (bs, 1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 168.8, 135.1, 132.1, 129.1, 128.4.

4-Methyl benzamide (2b) [13]



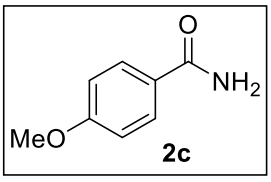
Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (24.3 mg, 90%), [Hexane/EtOAc, 1/1]; Mp.154-156 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.93 (bs, 1H), 7.83 (d, *J* = 8.4 Hz, 2H), 7.31-7.23 (m, 3H), 2.40 (s, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 168.7, 142.0, 132.4, 129.7, 128.4, 21.9.

4-Ethyl benzamide (2c) [14]



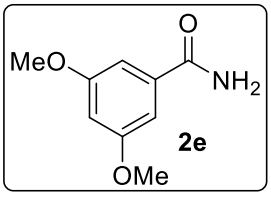
Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (24.7 mg, 82%), [Hexane/EtOAc, 1/1]; Mp.175-176 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.88 (bs, 1H), 7.79 (d, *J* = 8 Hz, 2H), 7.27 (d, *J* = 8 Hz, 3H) 2.64 (q, *J* = 8.0 Hz, 2H), 1.19 (t, *J* = 8Hz, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 168.2,147.6, 132.2, 28.4, 15.8.

4-Methoxy benzamide (2d) [12]



Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (28.7 mg, 95%), [Hexane/EtOAc, 1/1]; Mp.161-163 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.85–7.83 (m, 3H), 7.17 (bs, 1H), 6.97 (d, *J* = 8.8 Hz, 2H), 3.80 (s, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.4, 161.6, 129.3, 126.5, 113.4, 55.3

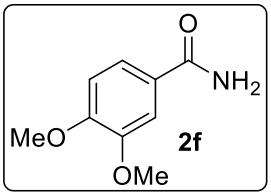
3,5-dimethoxy benzamide (2e) [15]



Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (33 mg, 91%), [Hexane/EtOAc, 1/1]; Mp.169-170 °C; ^{1}H-NMR (400 MHz, DMSO-d_6)

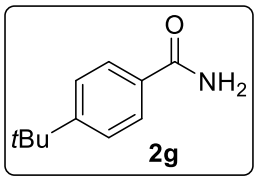
δ 7.93 (bs, 1H), 7.35 (bs, 1H), 7.03 (d, *J* = 2.0 Hz, 2H), 6.63 (t, *J* = 2.0 Hz, 1H), 3.77 (s, 6H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.9, 160.7, 136.9, 105.9, 103.6, 55.8.

3,4-dimethoxy benzamide (2f) [16]



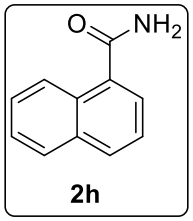
Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (32.2 mg, 89%), [Hexane/EtOAc, 1/1]; Mp.162-163 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.85 (bs, 1H), 7.51-7.45 (m, 2H), 7.18 (bs, 1H), 6.99 (d, *J* = 8.4 Hz, 1H), 3.79 (d, *J* = 3.6 Hz, 6H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.9, 151.7, 148.6, 127.0, 121.2, 111.4, 111.3, 56.0.

4-(*tert*-butyl) benzamide (2g) [17]



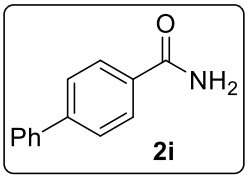
Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (33.3 mg, 94%), [Hexane/EtOAc, 1/1]; Mp.165-167 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.95 (bs, 1H), 7.86 (d, *c*), 7.51 (d, *J* = 8.4 Hz, 2H), 7.32 (bs, 1H), 1.35 (s, 9H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 168.8, 154.9, 132.5, 128.3, 125.9, 35.5, 31.9.

1-Napthamide (2h) [18]



Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (33.9 mg, 99%), [Hexane/EtOAc, 1/1]; Mp.200-201 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.32 – 8.29 (m, 1H), 8.01–7.95 (m, 3H), 7.63 (dd, *J* = 7.2 Hz, 1.2 Hz, 1H), 7.59–7.51 (m, 4H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 171.0, 135.1, 133.6, 130.2, 130.1, 128.6, 127.0, 126.5, 126.0, 125.6, 125.4.

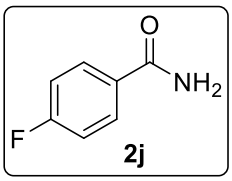
[1,1'-biphenyl]-4-carboxamide (2i) [19]



2i

Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (36.3 mg, 92%), [Hexane/EtOAc, 1/1]; Mp.220-221 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.98 (bs, 1H), 7.93-7.92 (m, 2H), 7.72-7.68 (m, 4H), 7.48-7.45 (2H, m), 7.37-7.34 (m, 2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 168.0, 143.2, 139.7, 133.6, 129.5, 128.6, 128.5, 127.4, 127.0.

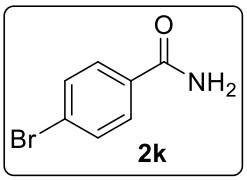
4-Fluoro benzamide (2j) [13]



2j

Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (23.1 mg, 83%), [Hexane/EtOAc, 1/1]; Mp.138-140 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.98 (bs, 1H), 7.96 – 7.91 (m, 2H), 7.38 (bs, 1H), 7.31 – 7.25 (m, 2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 166.8, 165.1 (d, ^{1}J = 247 Hz), 130.7, 130.1 (d, ^{3}J = 8.6 Hz), 115.2 (d, ^{2}J = 22 Hz).

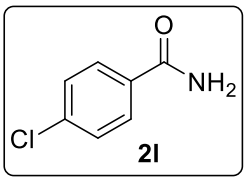
4-Bromo benzamide (2k) [20]



2k

Title compound was synthesized according to the general procedure (Scheme S2), and obtained as white solid (32.2 mg, 81%), [Hexane/EtOAc, 1/1]; Mp.208-209 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.04 (bs, 1H), 8.02-7.97 (m, 2H), 7.44 (bs, 1H), 7.36-7.31 (m, 2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 166.9, 133.4, 131.2, 129.6, 125.0.

4-Chloro benzamide (2l) [20]

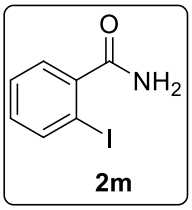


2l

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (24.2 mg, 78%), [Hexane/EtOAc, 1/1]; Mp.192-194 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.10 (bs, 1H),

7.95 (d, *J* = 8.0 Hz, 2H), 7.59-7.56 (m, 2H), 7.51 (bs, 1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.8, 137.0, 134.0, 130.3, 129.2.

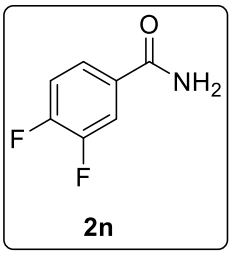
2-Iodo benzamide (2m) [17]



2m

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (49.4 mg, 97%), [Hexane/EtOAc, 1/1]; Mp.192-194 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.87 (dd, *J* = 0.8Hz, *J* = 8Hz, 1H), 7.81(bs, 1H), 7.50 (bs, 1H), 7.42 (td, *J* = 7.2 Hz, *J = 0.*8Hz, 1H), 7.33 (td, *J* = 7.6 Hz, *J* =1.6Hz,1H) , 7.14 (td, *J* = 7.6 Hz, *J* = 1.6Hz,1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 170.7, 143.1, 139.1, 130.6, 127.9, 127.8, 93.1.

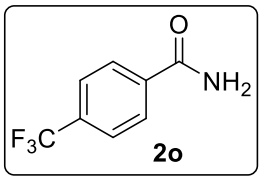
3,4-Difluoro benzamide (2n) [21]



2n

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (23 mg, 73%), [Hexane/EtOAc, 1/1]; Mp.150-152 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.12 (bs, 1H), 7.99-7.93 (m, 1H), 7.84-7.81 (m, 1H), 7.62-7.55 (m, 2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.6, 139.0, 132.1 (q, *J* = 63.9 Hz), 129.1 (d, *J* = 28.6 Hz), 126.2 (d, *J* = 2.9 Hz), 122.2 (d, *J* = 270.7 Hz).

4-(trifluoromethyl) benzamide (2o) [21]

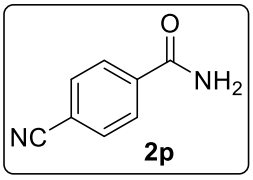


2o

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (35.2 mg, 93%), [Hexane/EtOAc, 1/1]; Mp.206-208 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.24 (bs, 1H), 8.12 (d, *J* = 8.4 Hz, 2H), 7.89 (d, *J* = 8.4 Hz, 2H), 7.67 (bs, 1H); ^{13}C-NMR (100

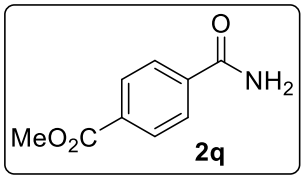
MHz, DMSO-d_6) δ 167.6, 139.0, 132.1 (q, *J* = 63.9 Hz), 129.1 (d, *J* = 28.6 Hz), 126.2 (d, *J* = 2.9 Hz), 122.2 (d, *J* = 270.7 Hz).

4-Cyano benzamide (2p) [17]



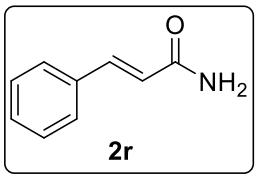
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (22.8 mg, 78%), [Hexane/EtOAc, 1/1]; Mp.224-226 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.26 (bs, 1H), 8.09-8.07 (m, 2H), 8.02-7.99 (m, 2H), 7.72 (bs, 1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.3, 139.2, 133.3, 129.2, 119.3, 114.6.

Methyl 4-carbamoylbenzoate (2q) [22]



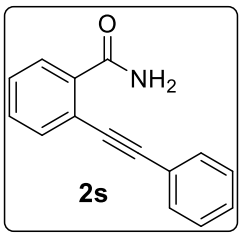
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (28.6 mg, 80%), [Hexane/EtOAc, 1/1]; Mp.201-203 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.14(bs, 1H), 8.03– 7.97(m, 4H), 7.56 (bs, 1H), 3.88 (s, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.0, 165.7, 138.4, 131.8, 129.0, 127.8, 52.4.

Cinnamamide (2r) [13]



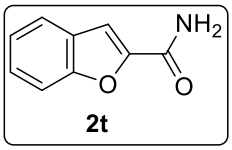
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (28.5 mg, 97%), [Hexane/EtOAc, 3/2]; Mp.146-148 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.57 – 7.54 (m, 3H), 7.43 – 7.35 (m, 4H), 7.10 (bs, 1H), 6.61 (d, *J* = 16.0 Hz, 1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 166.6, 139.1, 134.9, 129.4, 128.9, 127.5, 122.3.

2-(phenyl ethynyl) benzamide (2s) [23] [24]



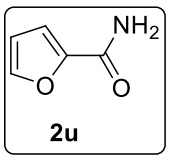
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (43.8 mg, 99%), [Hexane/EtOAc, 3/2]; Mp.146-148 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.81 (bs, 1H), 7.59–7.48 (m, 4H), 7.46–7.40 (m, 4H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 169.1,139.5, 132.4, 131.3, 129.6, 128.9, 128.7, 128.5, 127.7, 122.5, 119.7, 92.7, 88.1.

Benzofuran-2-carboxamide (2t) [19]



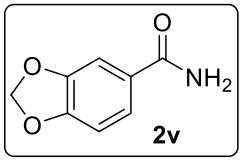
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (24.8 mg, 77%), [Hexane/EtOAc, 3/2]; Mp.186-188 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.17 (bs, 1H), 7.82 (d, J = 8.0 Hz, 1H), 7.74 (bs, 1H), 7.70 (d, J = 8.8 Hz, 1H), 7.60 (s, 1H), 7.51 (t, J = 7.8 Hz, 1H), 7.38 (t, J = 7.4 Hz, 1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 160.7, 155.2, 150.3, 128.1, 127.7, 124.5, 123.6, 112.7, 110.5.

Furan-2-carboxamide (2u) [25]



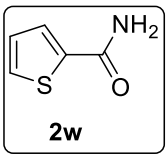
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (19.5 mg, 88%), [Hexane/EtOAc, 3/2]; Mp.140-142 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.85 (bs, 1H), 7.80 (bs, 1H), 7.41 (s, 1H), 7.15 (d, J = 3.2 Hz, 1H), 6.66-6.64 (m, 1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 160.3, 149.0, 145.9, 114.5, 112.7.

Benzo[d] [1,3] dioxole-5-carboxamide (2v) [22]



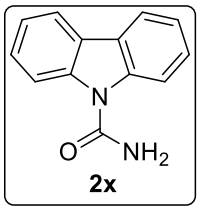
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (27.4 mg, 83%), [Hexane/EtOAc, 3/2]; Mp.189-190 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.81 (bs, 1H), 7.46 (dd, *J* = 8.0 Hz, *J* = 1.6 Hz, 1H), 7.40 (d, *J* = 1.2 Hz, 1H), 7.23 (bs, 1H), 6.96 (d, *J* = 8.0 Hz, 1H), 6.08 (s, 2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.5, 150.2, 147.7, 128.8, 123.0, 108.2, 108.0, 102.1.

Thiophene-2-carboxamide (2w) [20]



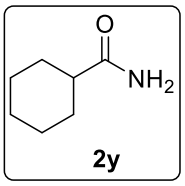
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (24.1 mg, 95%), [Hexane/EtOAc, 3/2]; Mp.197-199 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.95 (bs, 1H), 7.74–7.73 (m, 2H), 7.36 (bs, 1H), 7.13(dd, *J* = 0.8Hz, *J* = 4.8Hz, 1H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 162.9, 140.3, 131.0, 128.6, 127.9.

9*H*-carbazole-9-carboxamide (2x) [26]



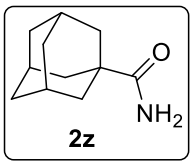
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (26 mg, 62%), [Hexane/EtOAc, 3/2]; Mp.248-250 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.17 (d, *J* = 7.6 Hz, 2H), 8.01 (d, *J* = 8.4 Hz, 2H), 7.74 (bs, 2H), 7.51-7.47 (m, 2H), 7.35-7.31 (m, 2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 153.8, 138.5, 127.1, 124.5, 122.2, 120.6, 114.6.

Cyclohexane carboxamide (2y) [12]



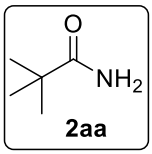
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (17.8 mg, 70%), [Hexane/EtOAc, 3/2]; Mp.183-185 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.12 (bs, 1H), 6.60 (bs, 1H), 2.08-2.00 (m, 1H), 1.70-1.58 (m, 5H), 1.33-1.07 (m, 5H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 177.8, 44.1, 29.6, 26.0, 25.8.

Adamantane-1-carboxamide (2z) [27]



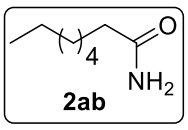
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (25.8 mg, 72%), [Hexane/EtOAc, 3/2]; Mp.187-188 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 6.90 (bs, 1H), 6.63 (bs, 1H), 1.92 (s, 3H), 1.73–1.72 (m, 6H), 1.67–1.59 (m, 6H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 179.7, 36.6, 28.1.

Pivalamide (2aa) [28]



Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (12.7 mg, 63%), [Hexane/EtOAc, 3/2]; Mp.153-154 °C; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 5.6 (bs, 2H), 1.22 (s, 9H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 181.3, 38.6, 27.6.

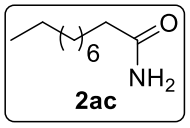
Octanamide (2ab) [29]



Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (19.5 mg, 68%), [Hexane/EtOAc, 3/2]; Mp.110-111 °C; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 6.59 (bs, 1H), 5.63 (bs, 1H), 2.31 (t, J = 7.2

Hz, 1H), 2.21 (t, *J* = 7.2 Hz, 1H), 1.70-1.58 (m, 2H), 1.30-1.24 (m, 8H), 0.88-0.82 (m, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 177.1, 36.0, 31.6, 29.1, 25.5, 24.8, 22.6, 14.0.

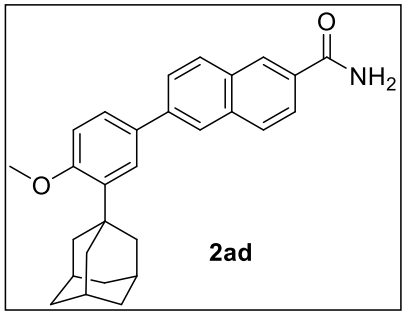
Decanamide (2ac) [30]



2ac

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (24.3 mg, 71%), [Hexane/EtOAc, 3/2]; Mp.100-102 °C; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 5.64 (bs, 1H), 5.42 (bs, 1H), 2.22 (t, *J* = 7.8 Hz, 2H), 1.67-1.60 (m, 2H), 1.30-1.27 (m, 12H), 0.89-0.86 (m, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 175.8, 36.0, 31.8, 29.4, 29.3, 29.2, 25.5, 24.8, 22.6, 14.1.

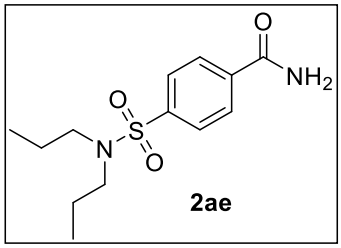
6-(3-((3r, 5r, 7r)-adamantan-1-yl)-4-methoxyphenyl)-2-napthamide (2ad) [31]



2ad

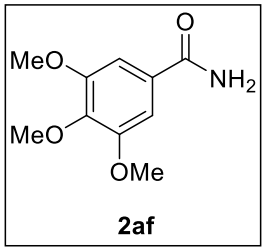
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (49.3 mg, 60%), [Hexane/EtOAc, 3/2]; Mp.100-102 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.48 (s, 1H), 8.19 (s, 1H), 8.11 (bs, 1H), 8.06-8.03 (m, 2H), 7.96 (dd, *J*= 8.4 Hz, *J* = 1.6 Hz, 1H), 7.87 (dd, *J* = 8.4 Hz, *J* = 1.6 Hz, 1H), 7.64 (dd, *J* = 8.4 Hz, *J* = 2.4 Hz, 1H), 7.57 (d, *J* = 2.4 Hz, 1H), 7.44 (bs, 1H), 7.12 (d, *J* = 8.8 Hz, 1H), 3.87 (s, 3H), 2.14 (s, 6H), 2.07 (s, 3H), 1.76 (s, 6H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 168.36, 158.94, 139.91, 138.47, 135.12, 132.09, 131.68, 131.36, 129.87, 128.40, 127.98, 126.23, 126.09, 125.45, 125.15, 124.47, 113.18, 55.81, 49.30, 37.06, 37.01, 28.85.

4-(*N, N*-dipropylsulfamoyl) benzamide (2ae) [31]



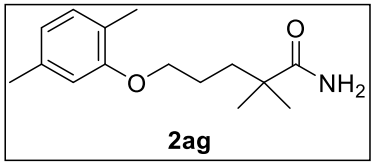
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (28.4 mg, 50%), [Hexane/EtOAc, 3/2]; Mp.100-102 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.17 (bs, 1H), 8.03 (d, *J* = 8.4 Hz, 2H), 7.86 (d, *J* = 8.4 Hz, 2H), 7.60 (bs, 1H), 3.04 (t, *J* = 7.6 Hz, 3H), 1.49-1.44 (m, 4H), 0.81 (t, *J* = 7.2 Hz, 6H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.11, 142.17, 138.28, 128.85, 127.18, 50.07, 31.77, 22.06, 11.41.

3, 4, 5-trimethoxybenzamide (2af) [22]



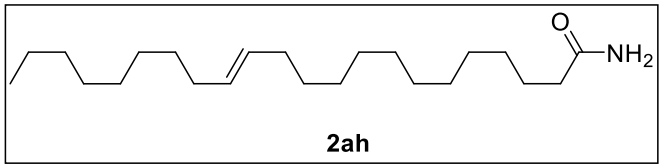
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (23.6 mg, 56%), [Hexane/EtOAc, 3/2]; Mp.100-102 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.95(bs, 1H), 7.32(bs, 1H), 7.21 (s, 2H), 3.81 (s, 6H), 3.69 (d, *J* = 0.4 Hz, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 167.3, 152.5, 139.9, 129.4, 105.1, 60.0, 56.0.

5-(2,5-dimethylphenoxy)-2,2-dimethylpentanamide (2ag) [31]



Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (36.4 mg, 73%), [Hexane/EtOAc, 3/2]; Mp.100-102 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.02(bs, 1H), 6.97 (d, *J* = 7.6 Hz, 1H), 6.77 (bs, 1H), 6.70 (s, 1H), 6.61 (d, *J* = 7.6 Hz,1H), 3.87 (t, *J* = 6.0 Hz,2H), 2.24 (s,3H), 2.07 (s, 3H), 1.65-1.54 (m, 4H), 1.08 (s, 6H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 179.3, 157.0, 136.5, 130.5, 122.9, 120.9, 112.5, 68.2, 41.5, 37.3, 25.8, 25.2, 21.5, 16.0.

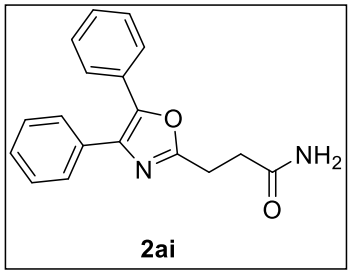
(E)-docos-13-enamide (2ah) [32]



2ah

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (41.8 mg, 62%), [Hexane/EtOAc, 3/2]; Mp.100-102 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.18(bs, 1H), 6.63 (bs, 1H), 5.33-5.31 (m, 2H), 2.02-1.96 (m, 4H), 1.46 (t, J = 4.8 Hz,2H), 1.31-1.23 (m, 24H), 0.86-0.84 (m, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 174.19, 129.57, 35.07, 31.22, 29.03, 28.97, 28.92, 28.81, 28.77, 28.69, 28.63, 28.52, 26.50, 25.05, 22.03, 13.87. HRMS (m/z, ESI-) calcd [$C_{22}H_{42}NO$] + [M-H] $^{-}$ 336.3222, observed 336.5433.

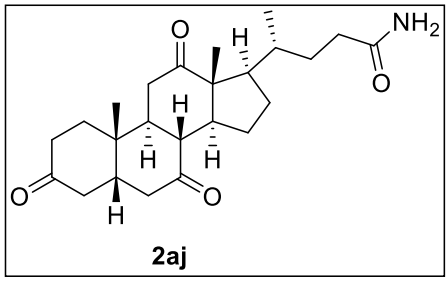
3-(4,5-diphenyloxazol-2-yl) propanamide (2ai) [33]



2ai

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (26.3 mg, 45%), [Hexane/EtOAc, 3/2]; Mp.100-102 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.57-7.55 (m, 2H), 7.54-7.52 (m, 2H), 7.45-7.42 (m, 3H), 7.41-7.38 (m, 2H), 7.37-7.34 (m, 1H), 6.87 (bs, 1H), 3.03 (t, J = 4.8 Hz, 2H), 2.62 (t, J = 5.0 Hz,2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 172.92, 163.26, 144.92, 134.76, 132.51, 129.37, 129.20, 129.06, 128.93, 128.55, 127.79, 126.76, 31.82, 23.61. HRMS (m/z, ESI+) calcd [$C_{18}H_{17}N_2O_2$] + [M+H] $^{+}$ 293.1278, observed 293.2138.

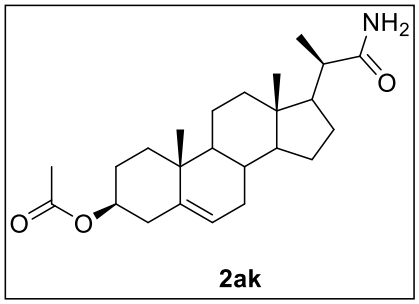
(R)-4-((5S,8R,9S,10S,13R,14S,17R)-10,13-dimethyl-3,7,12-trioxohexadecahydro-1H-cyclopenta[a]phenanthren-17-yl) pentanamide (2aj) [2] [3]



2aj

Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (43.3 mg, 54%); Mp.228-230 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.18 (bs, 1H), 6.60 (bs, 1H), 3.04-2.92 (m, 2H), 2.83-2.77 (m, 1H), 2.43-2.39 (m, 1H), 2.33-2.06 (m, 5H), 1.95-1.66 (m, 9H), 1.50-1.42 (m, 1H), 1.29-1.13 (m, 8H), 0.97 (s, 3H), 0.73-0.70 (m, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 212.4, 210.1, 210.0, 175.3, 56.7, 51.7, 48.4, 46.5, 45.9, 45.0, 44.5, 43.0, 36.6, 36.1, 35.5, 35.1, 31.6, 30.9, 27.7, 25.1, 21.6, 19.2, 1.

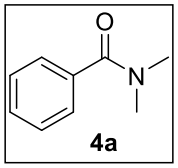
(3S,10R,13S)-17-((R)-1-amino-1-oxopropan-2-yl)-10,13-dimethyl-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl acetate (2ak) [34]



2ak

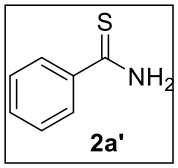
Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (55 mg, 71%); Mp.236-238 °C; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 5.37-5.36 (m, 3H), 2.32-2.31 (m, 2H), 2.21-2.17 (m, 1H), 2.02 (s, 3H), 1.97-1.94 (m, 2H), 1.86-1.83 (m, 3H), 1.66-1.53 (m, 6H), 1.47-1.41 (m, 2H), 1.29-1.21 (m, 5H), 1.13-1.06 (m, 3H), 1.01-0.97 (m, 4H), 0.70 (s, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 179.1, 170.5, 139.6, 122.5, 73.9, 56.2, 52.8, 49.9, 44.1, 42.3, 39.5, 38.1, 36.9, 36.6, 31.9, 31.8, 29.7, 27.7, 27.6, 24.3, 21.4, 20.9, 19.3, 17.7, 12.0.

***N, N*-dimethyl benzamide (4a)** [35]



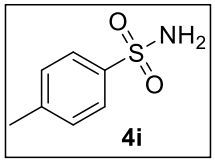
Title compound was synthesized according to the general procedure (Scheme S5), and obtain as white solid (17.3 mg, 58%), [Hexane/EtOAc, 3/2]; Mp.43-44 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.44–7.37 (m, 5H), 2.98 (s, 3H), 2.89 (s, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 170.1, 136.5, 129.3, 128.3, 126.9, 34.7.

Thiobenzamide (2a') [36]



Title compound was synthesized according to the general procedure (Scheme S2), and obtain as white solid (16.4 mg, 60%), [Hexane/EtOAc, 3/2]; Mp.114-115 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 9.87 (bs, 1H), 9.49 (bs, 1H), 7.89–7.87 (m, 2H), 7.52–7.48 (m, 1H), 7.43–7.39 (m, 2H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 200.2, 139.5, 131.1, 127.9, 127.3.

4-methylbenzenesulfonamide (4i) [37]



Title compound was synthesized according to the general procedure (Scheme S6), and obtain as white solid (27.4 mg, 80%), [Hexane/EtOAc, 3/2]; Mp.137-138 °C; ^{1}H-NMR (400 MHz, DMSO-d_6) δ 7.71–7.69 (m, 2H), 7.37–7.35 (m, 2H), 7.26 (bs, 2H), 2.37 (s, 3H); ^{13}C-NMR (100 MHz, DMSO-d_6) δ 142.3, 141.9, 129.7, 126.0, 21.4.

5. References

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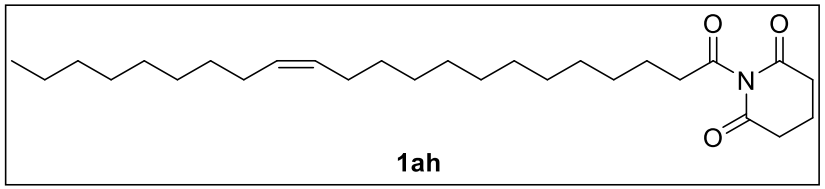
^{1}H and ^{13}C NMR spectra

Solvent : DMSO $-d_6$

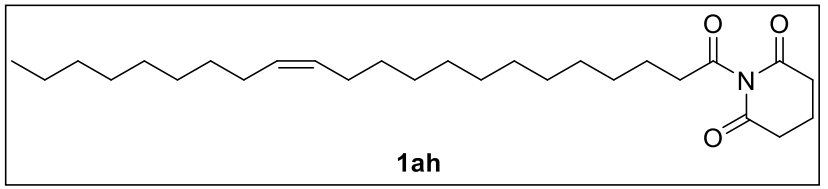
Spectrometer Frequency : 400 MHz



1ah

Solvent : DMSO $-d_6$

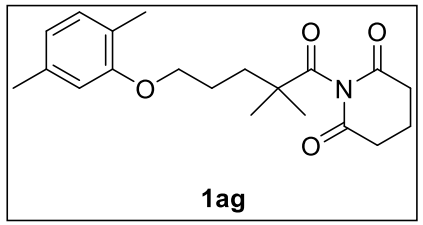
Spectrometer Frequency : 100 MHz



1ah

Solvent : $CDCl_3$

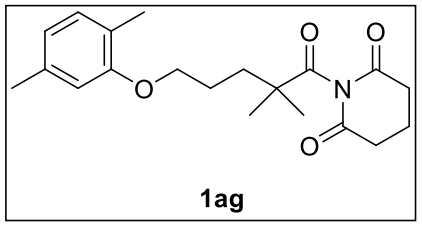
Spectrometer Frequency : 400 MHz



1ag

Solvent : $CDCl_3$

Spectrometer Frequency : 100 MHz



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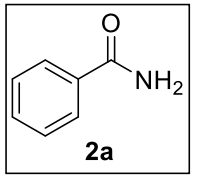
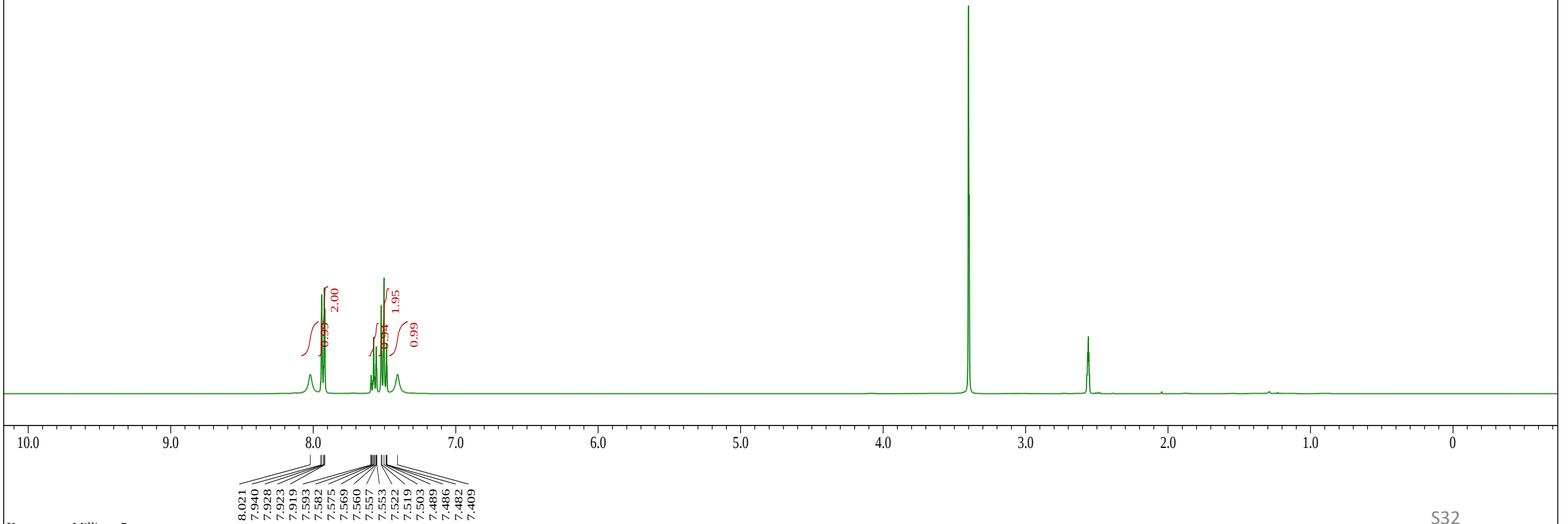
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

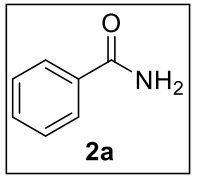


2a



X : parts per Million : Proton

Solvent : DMSO $-d_6$
Spectrometer Frequency : 100 MHz

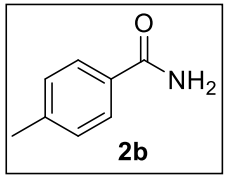


2a

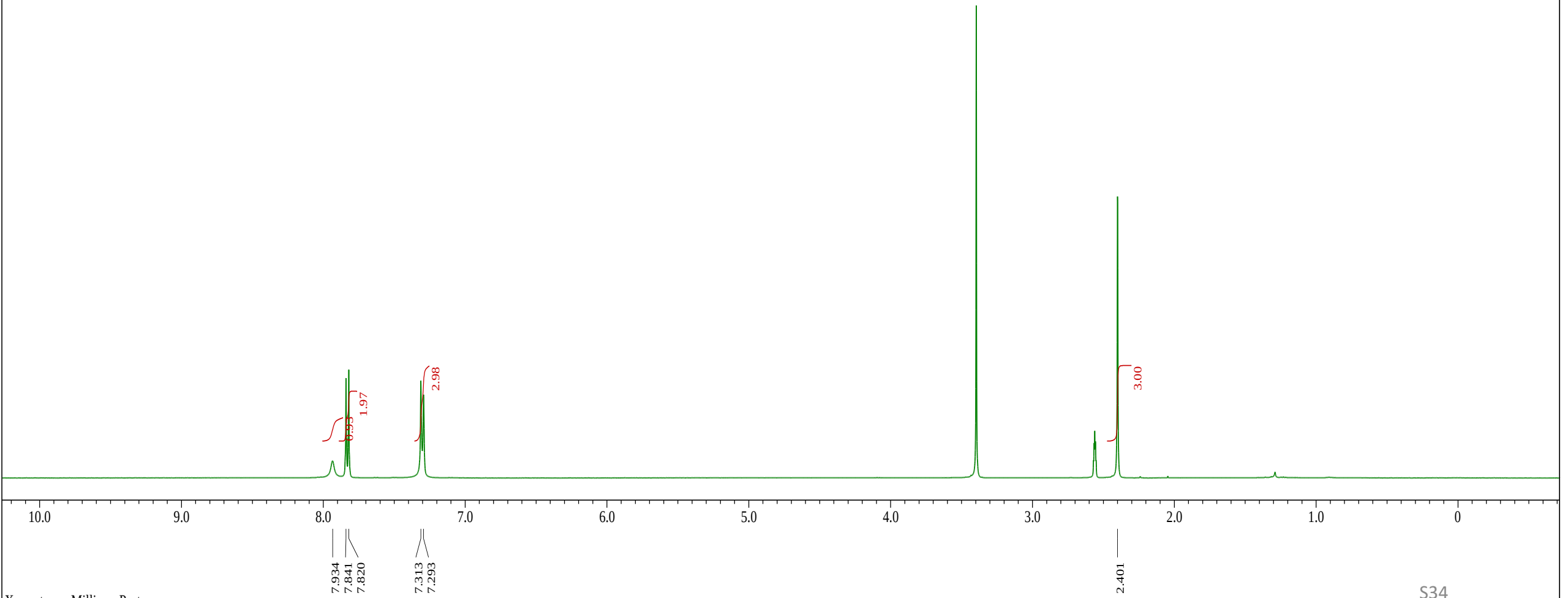
X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



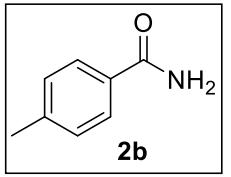
2b



X : parts per Million : Proton

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

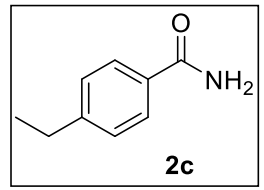


2b

X : parts per Million : Carbon13

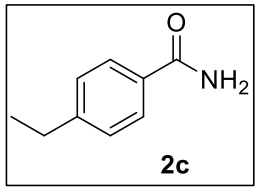
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

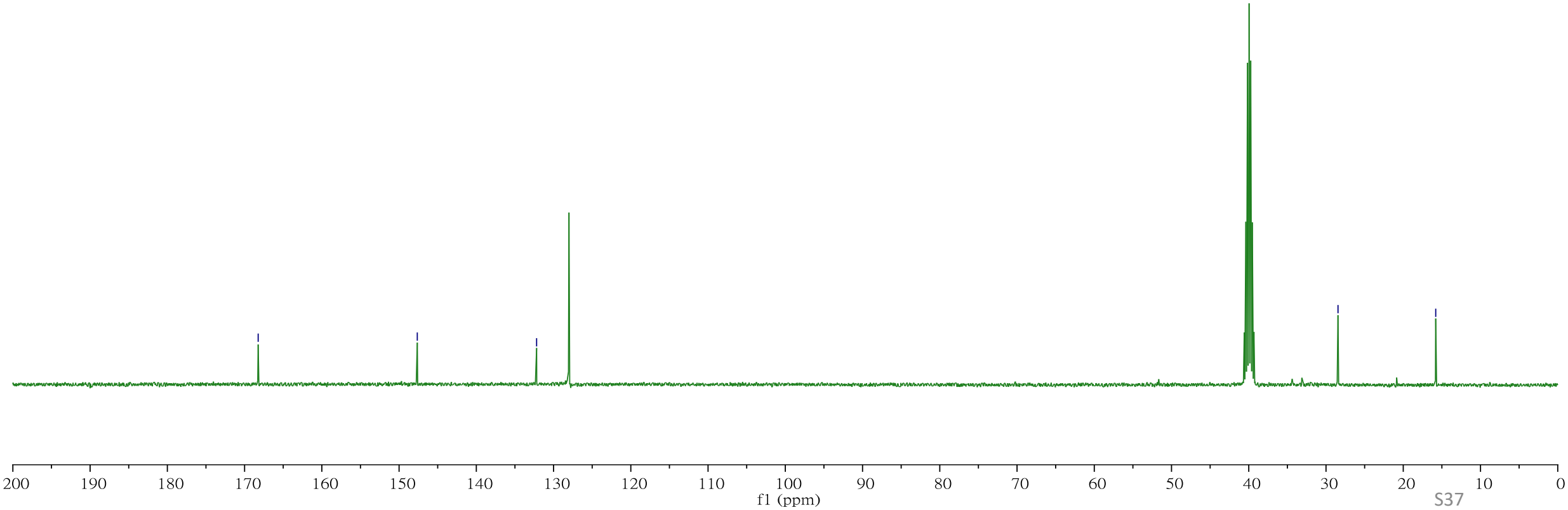


168.242
147.642
132.195
28.446
15.797

Solvent : DMSO $-d_6$
Spectrometer Frequency : 100 MHz

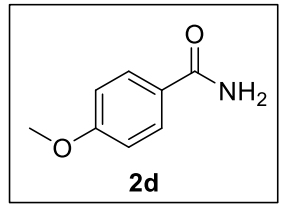


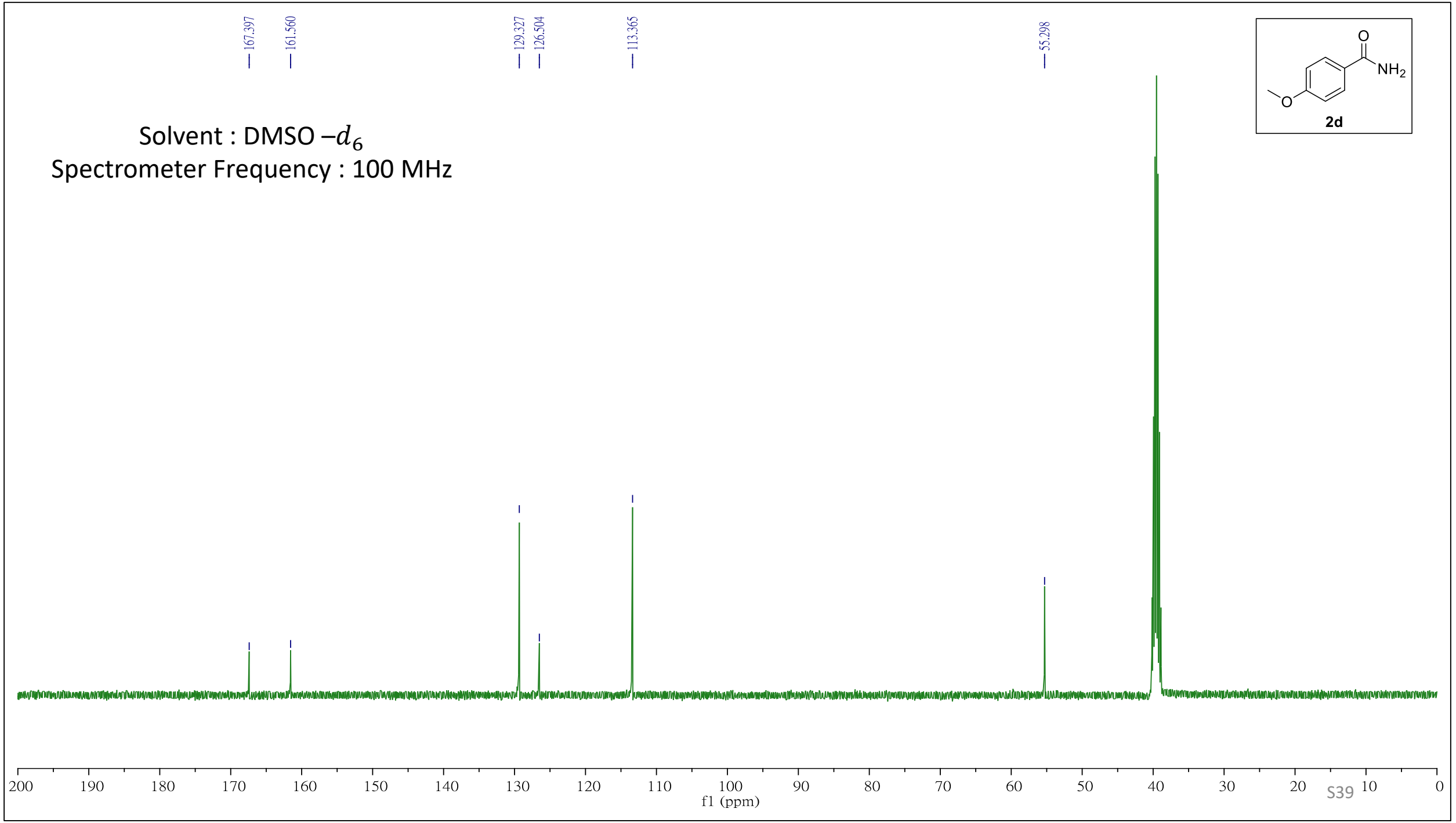
2c



Solvent : DMSO $-d_6$

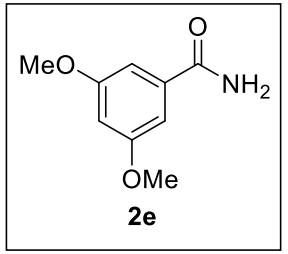
Spectrometer Frequency : 400 MHz




167.397
161.560
129.327
126.504
113.365
55.298
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
O
NH2
O
2d
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Solvent : DMSO $-d_6$

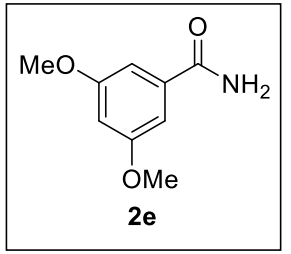
Spectrometer Frequency : 400 MHz



2e

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

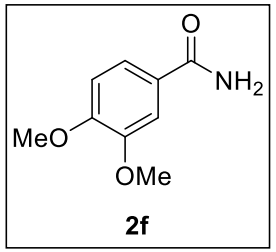


2e

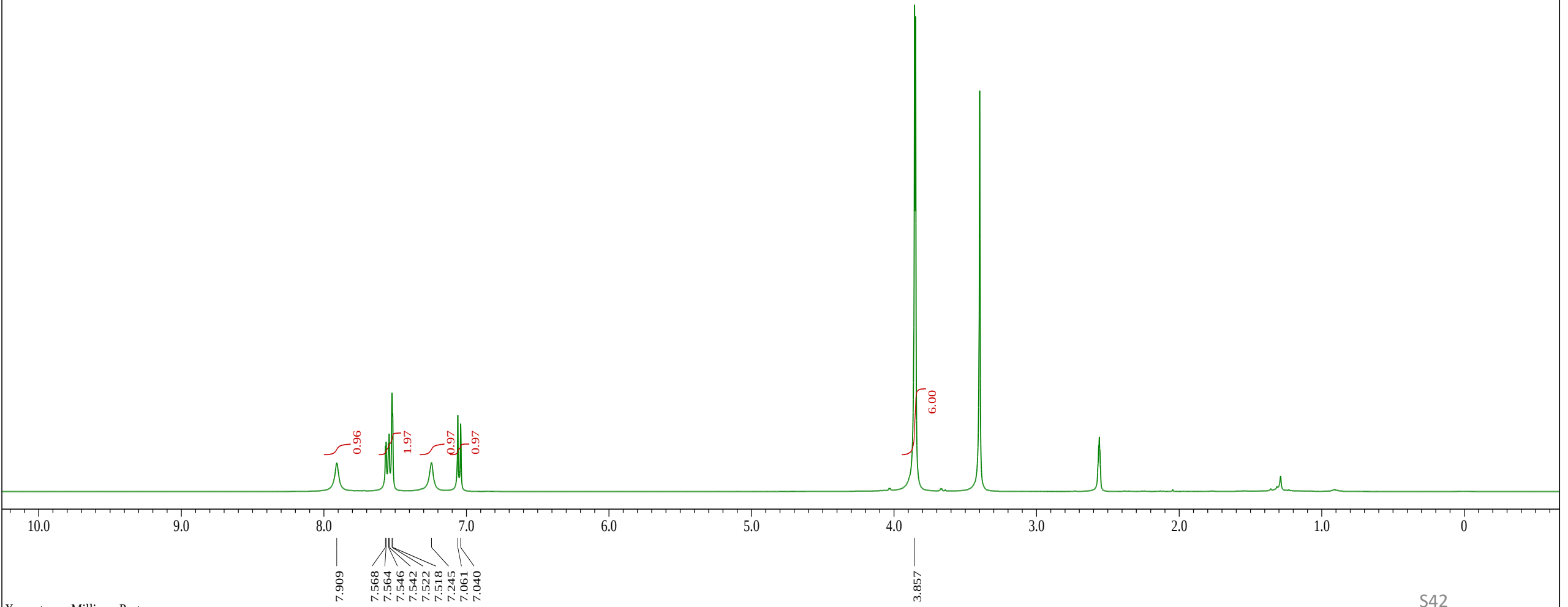
X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



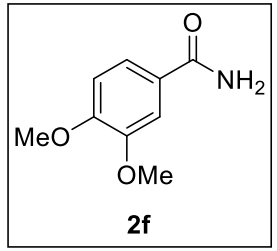
2f



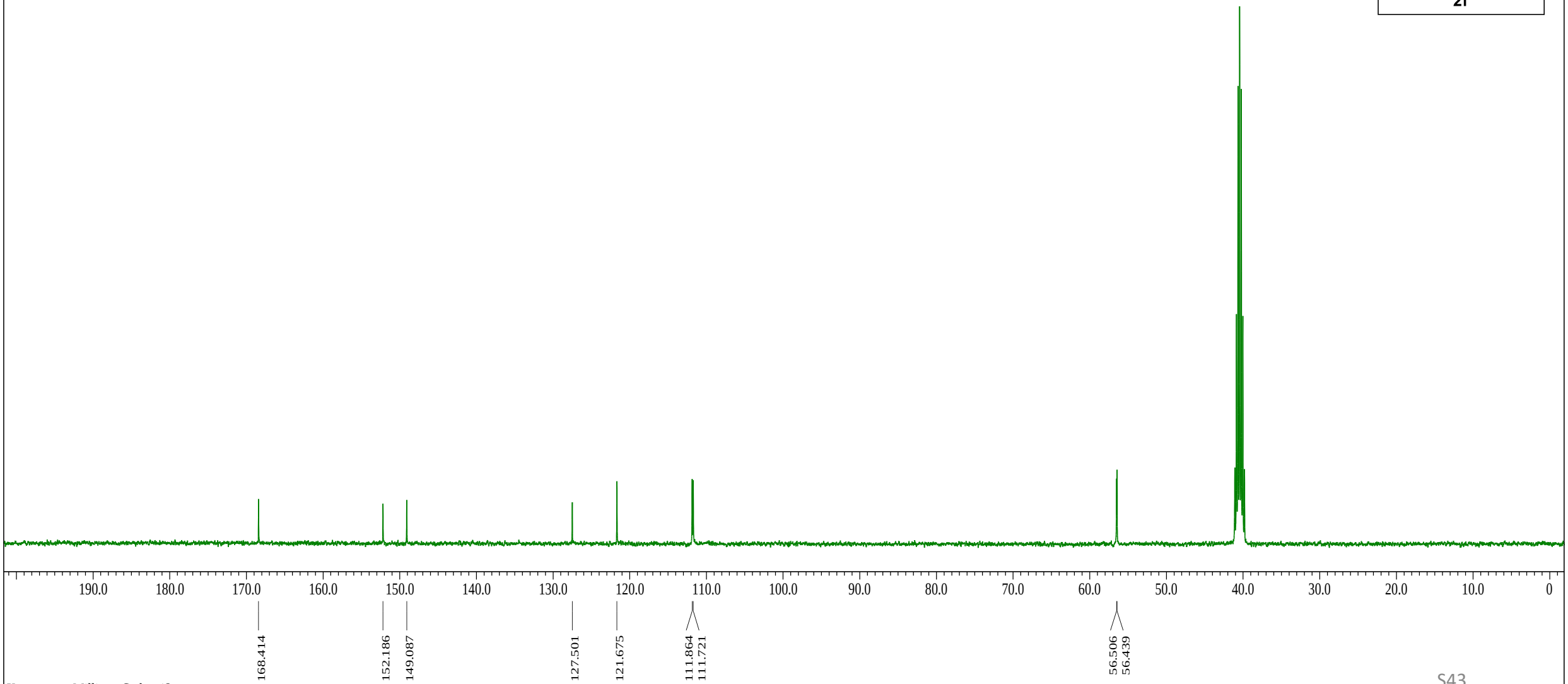
X : parts per Million : Proton

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz



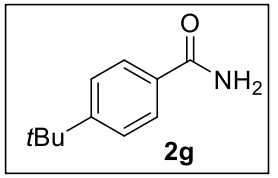
2f



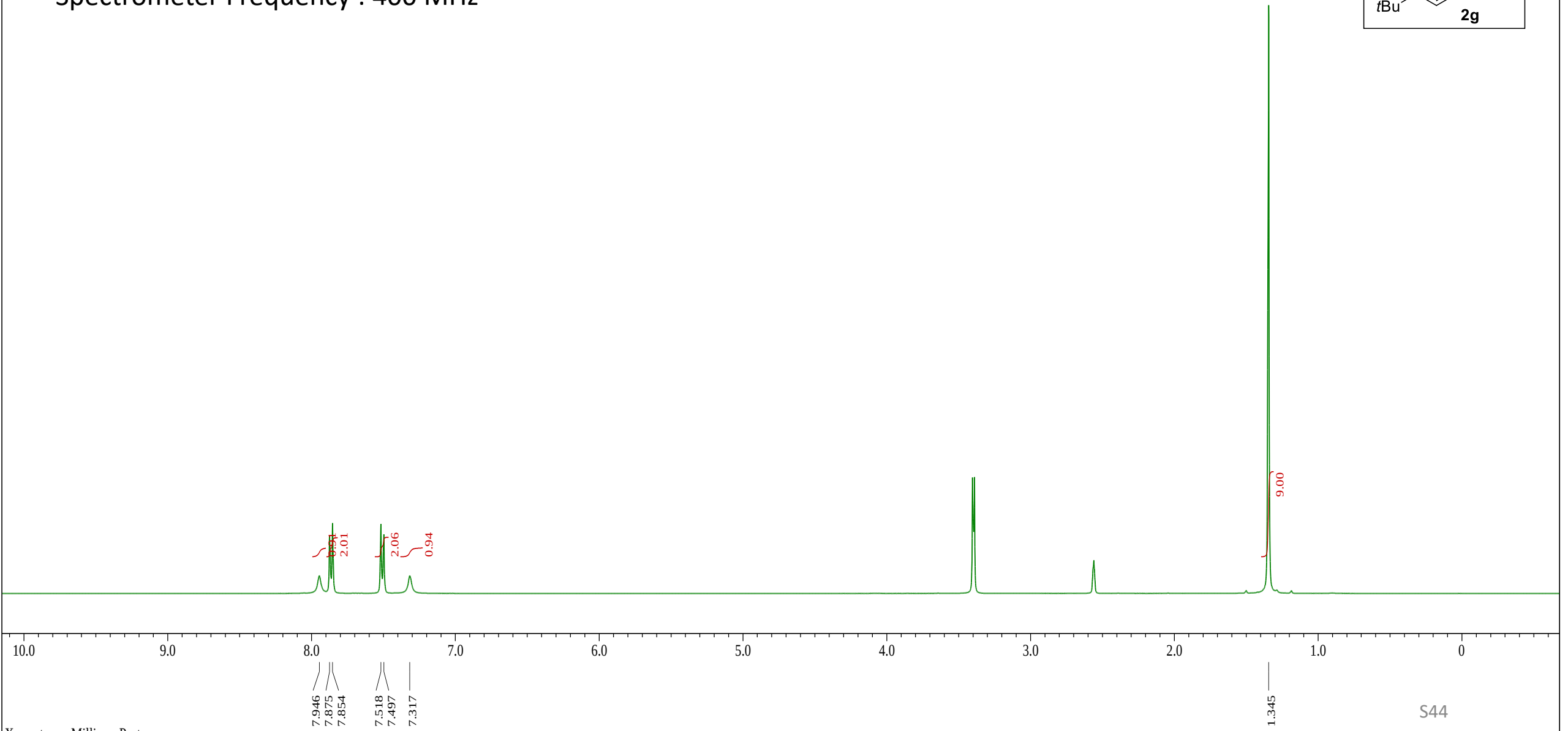
X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



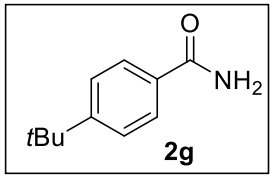
2g



X : parts per Million : Proton

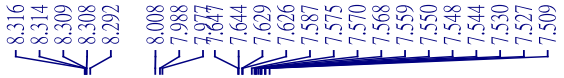
Solvent : DMSO $-d_6$

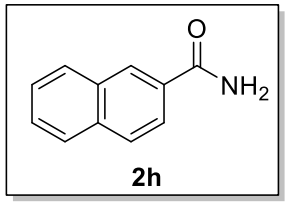
Spectrometer Frequency : 100 MHz



2g

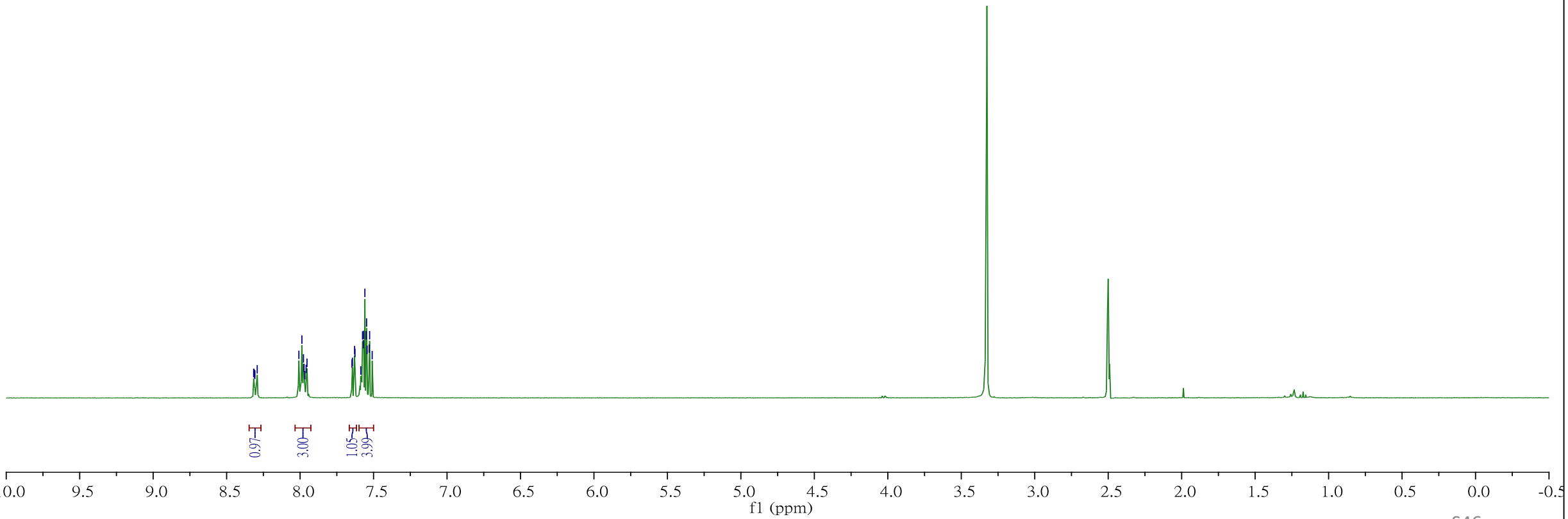
X : parts per Million : Carbon13





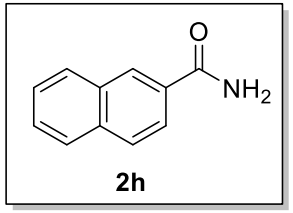
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



Solvent : DMSO $-d_6$

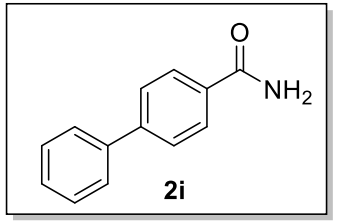
Spectrometer Frequency : 100 MHz

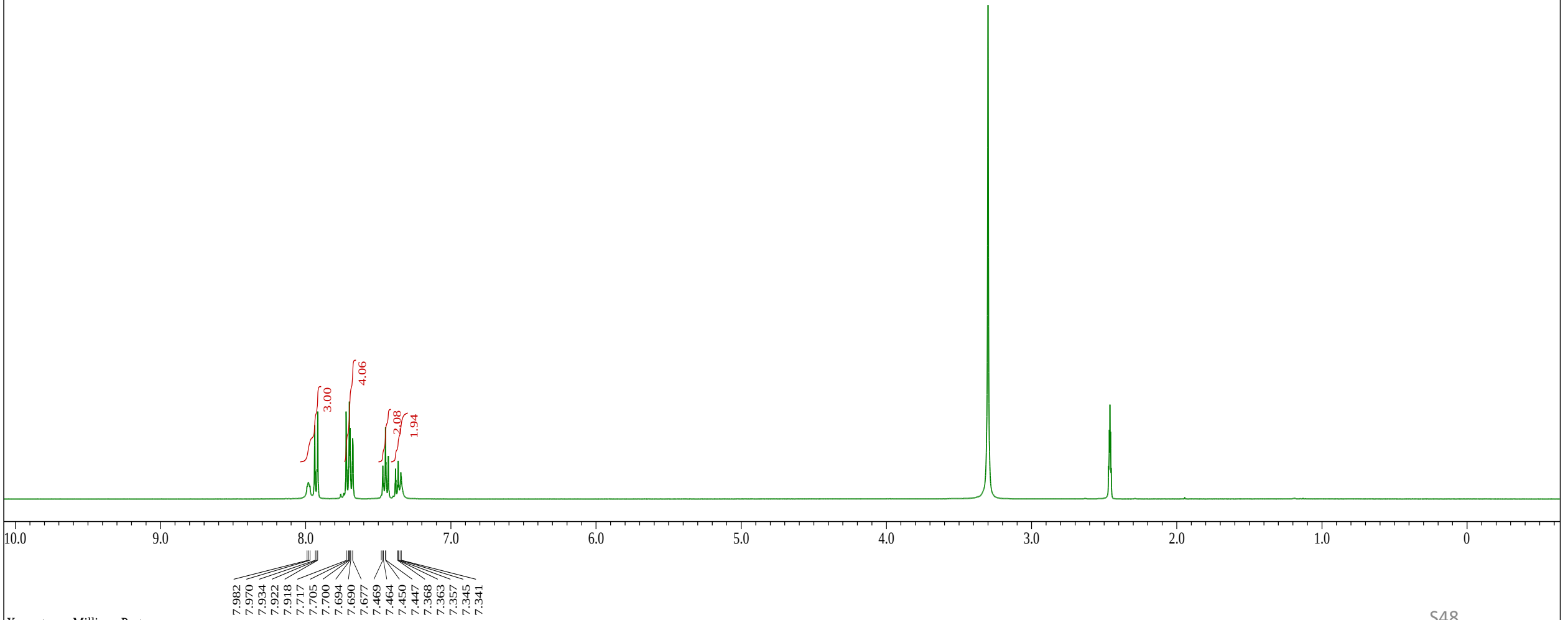


2h

Solvent : DMSO $-d_6$

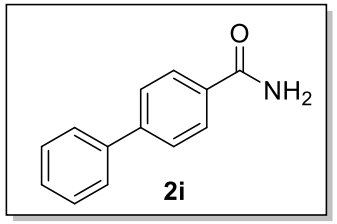
Spectrometer Frequency : 400 MHz





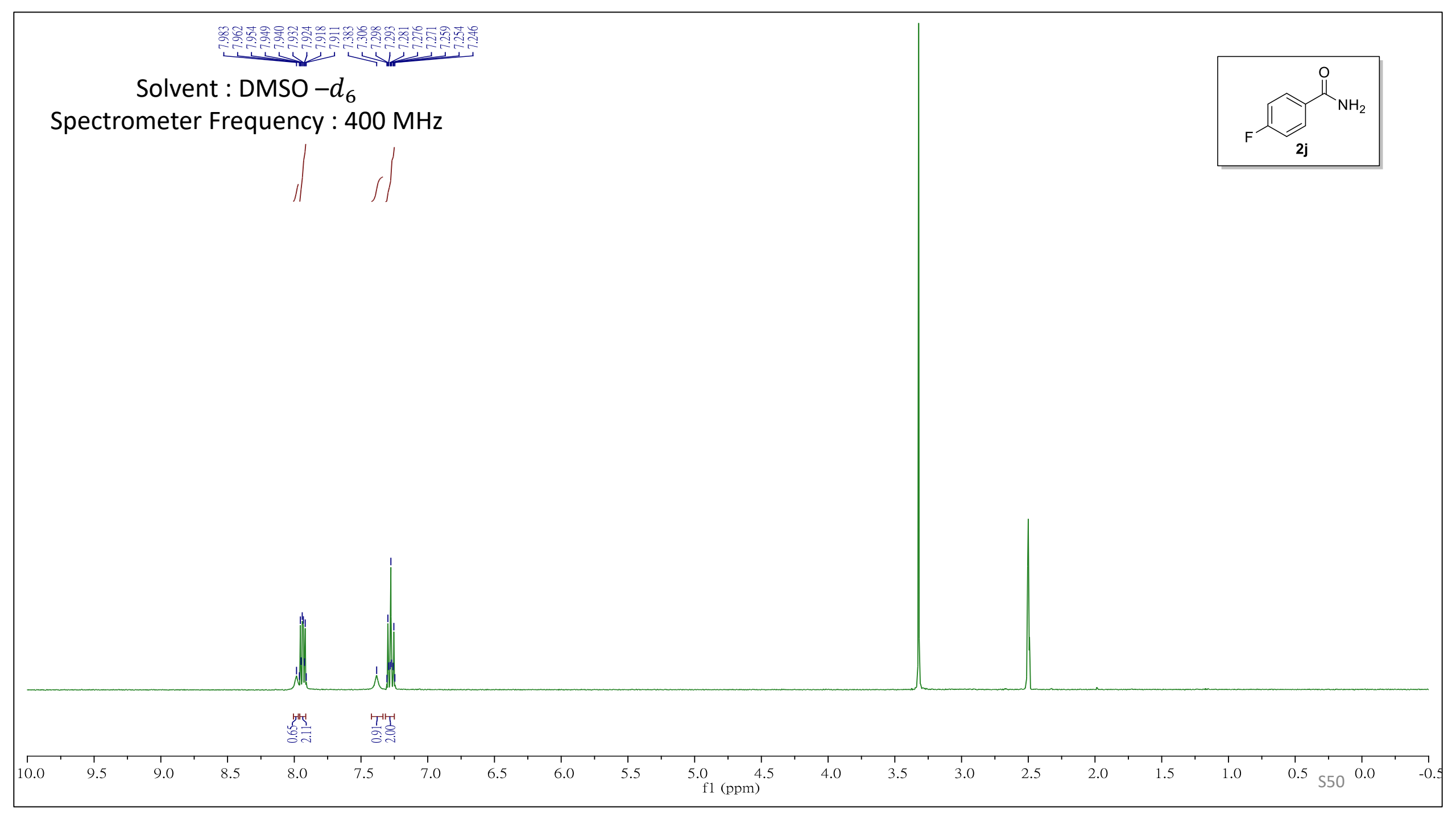
Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz



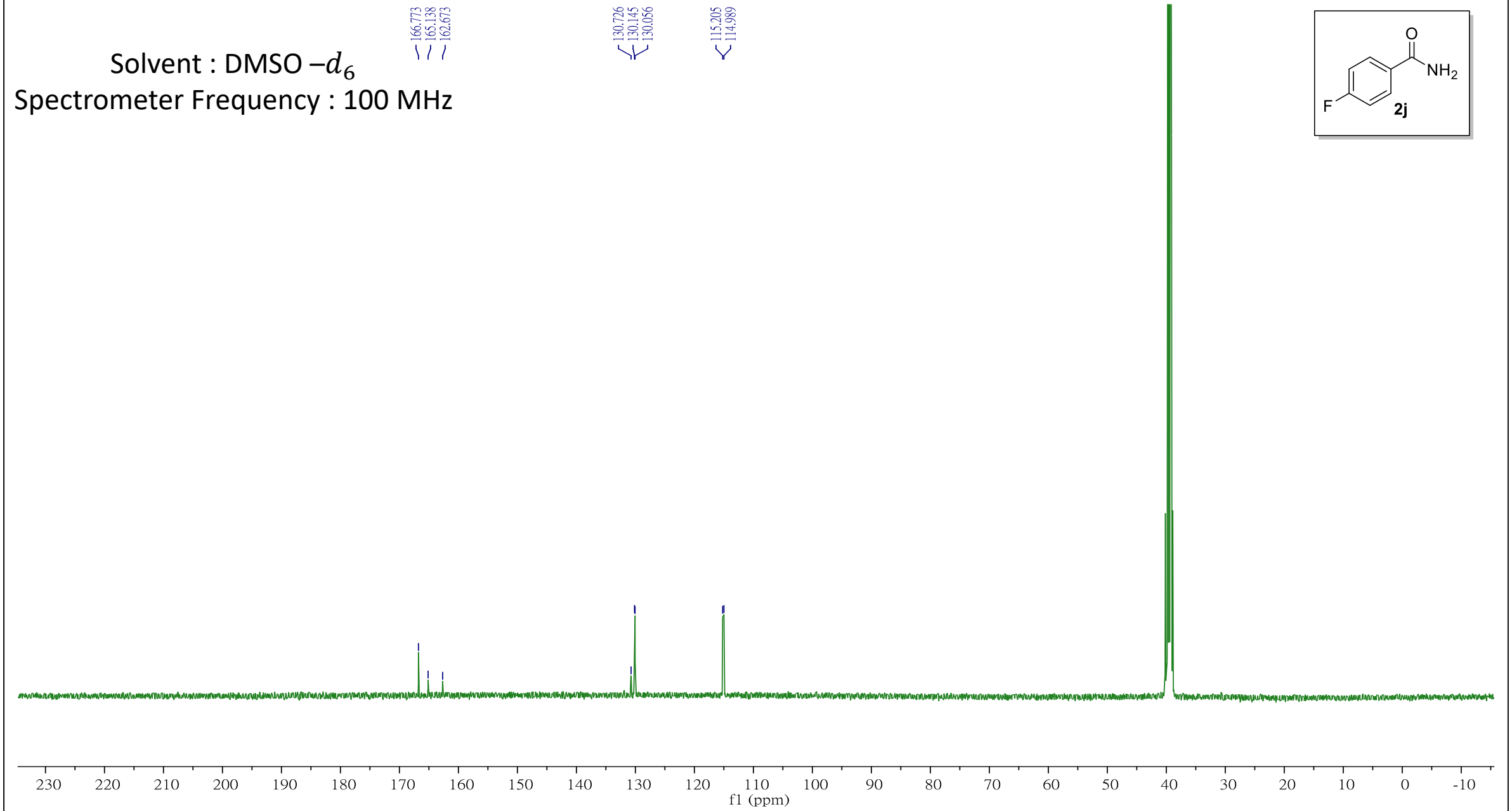
2i

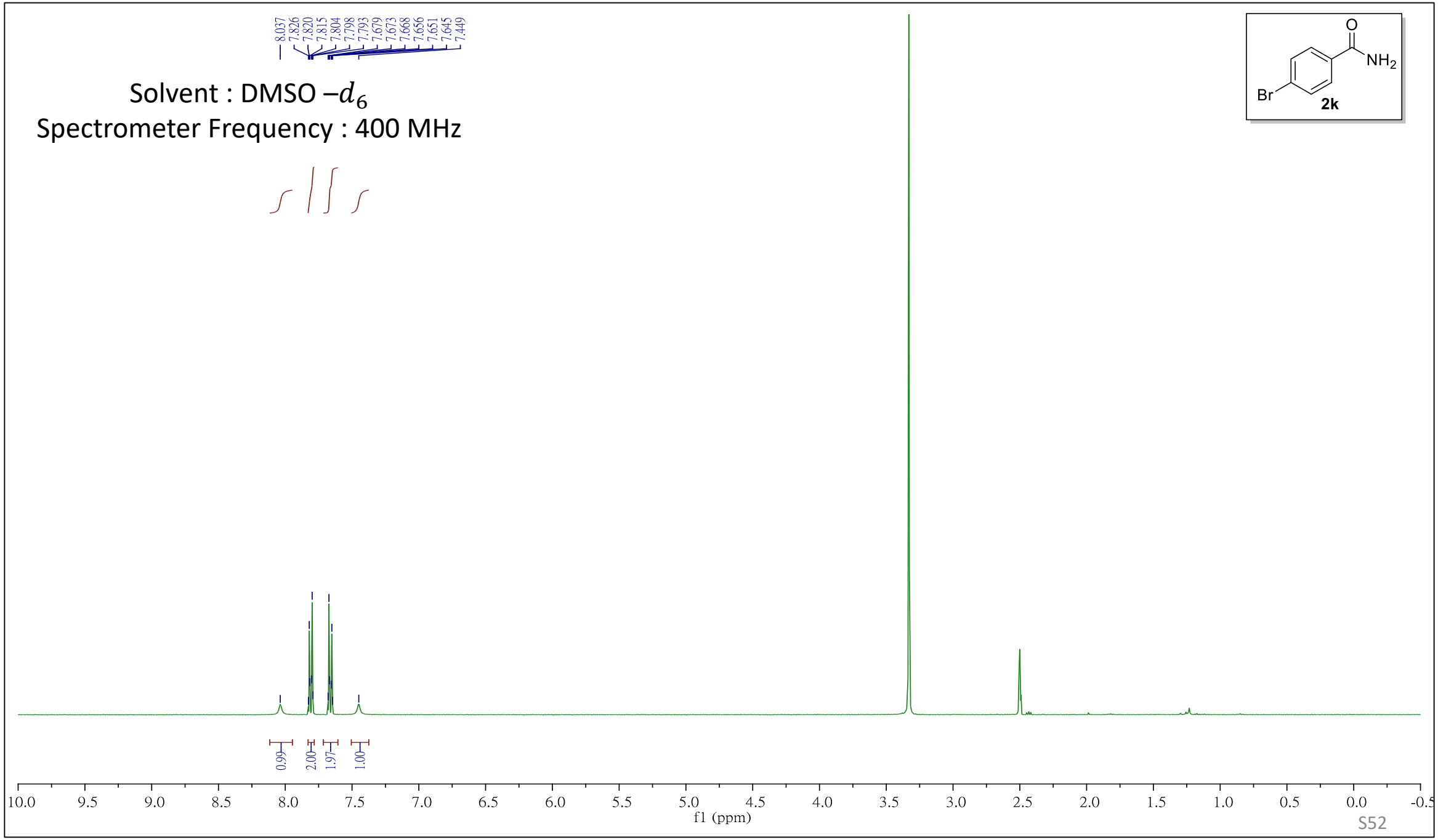
X : parts per Million : Carbon13

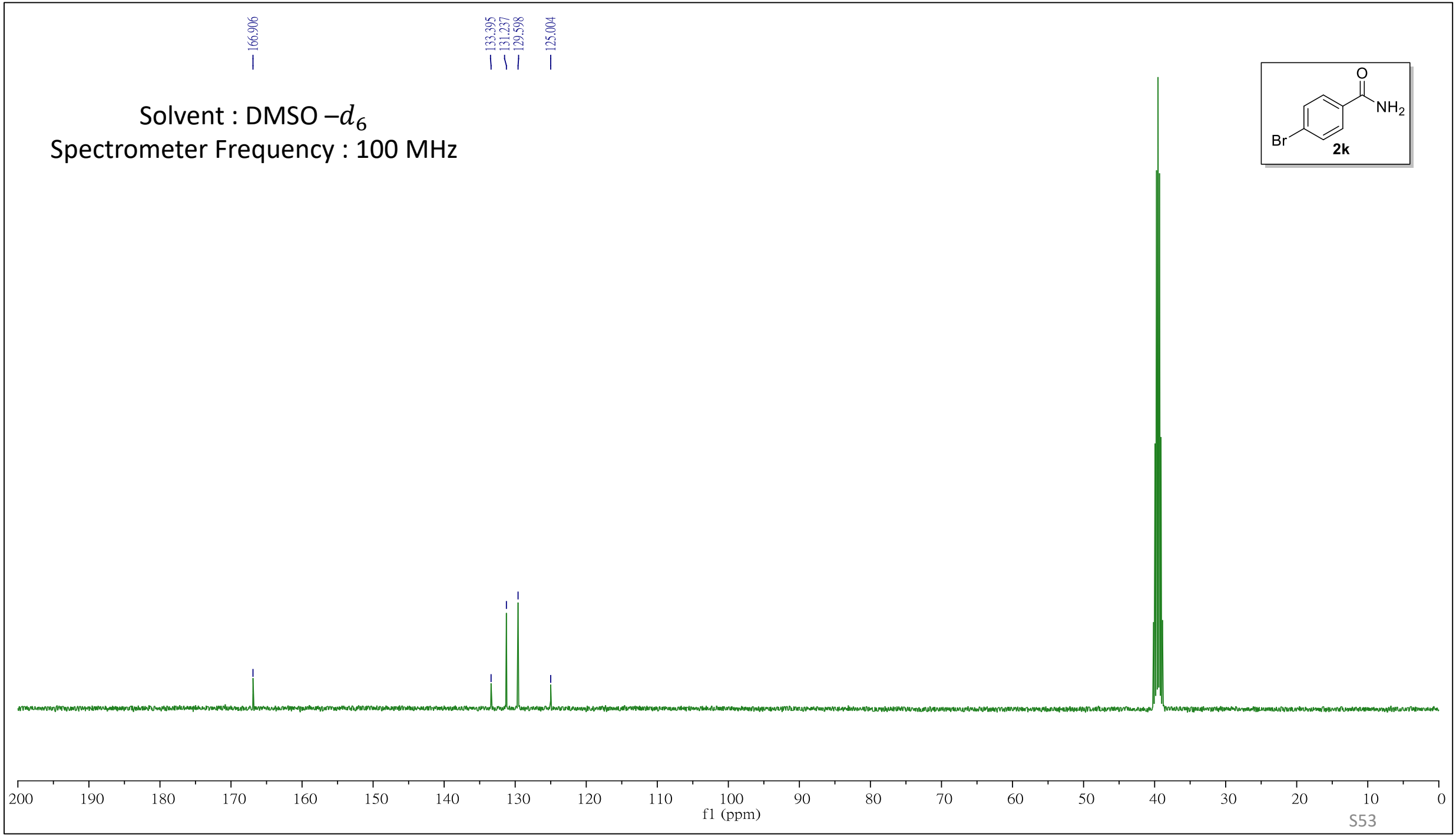

7.983
7.962
7.954
7.949
7.940
7.932
7.924
7.918
7.911
7.383
7.306
7.298
7.293
7.281
7.276
7.271
7.259
7.254
7.246
Solvent : DMSO –d_6
Spectrometer Frequency : 400 MHz
O
NH2
F
2j
0.65
2.11
0.91
2.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

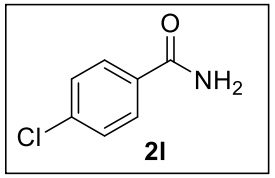



8.037
7.826
7.820
7.815
7.804
7.798
7.793
7.679
7.673
7.668
7.656
7.651
7.645
7.449
Solvent : DMSO –d_6
Spectrometer Frequency : 400 MHz
O
NH2
Br
2k
0.99
2.00
1.97
1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

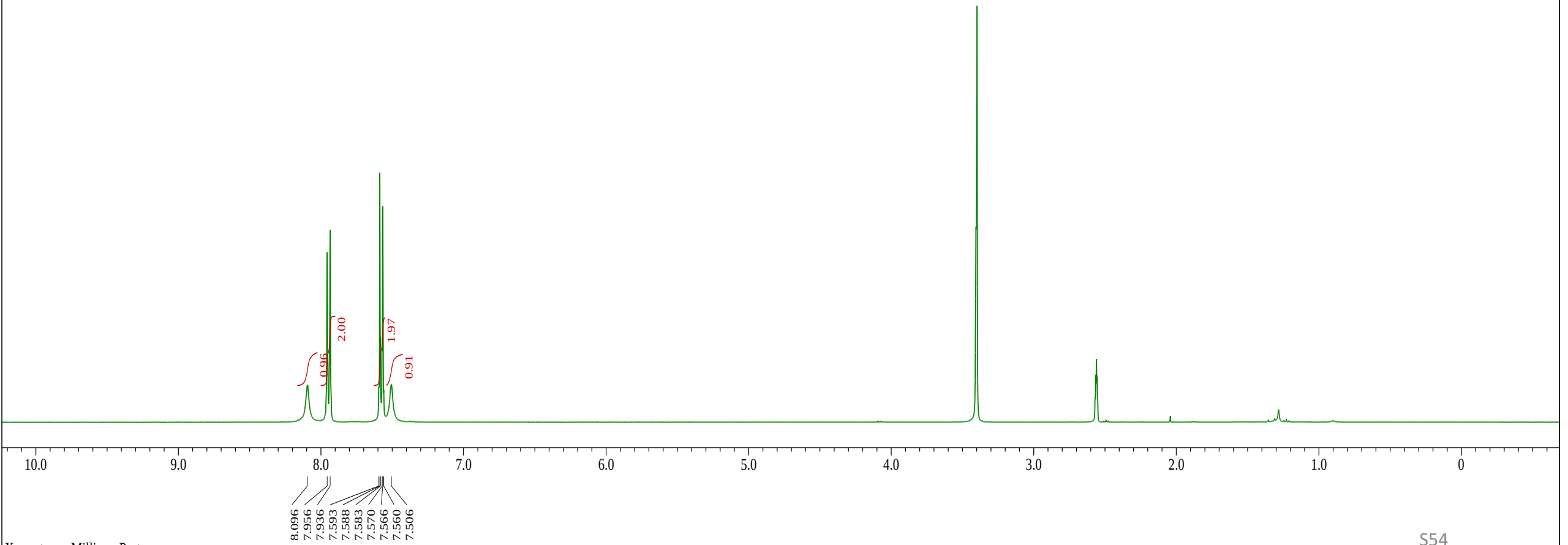

166.906
133.395
131.237
129.598
125.004
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
O
NH2
Br
2k
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



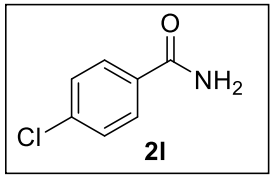
2l



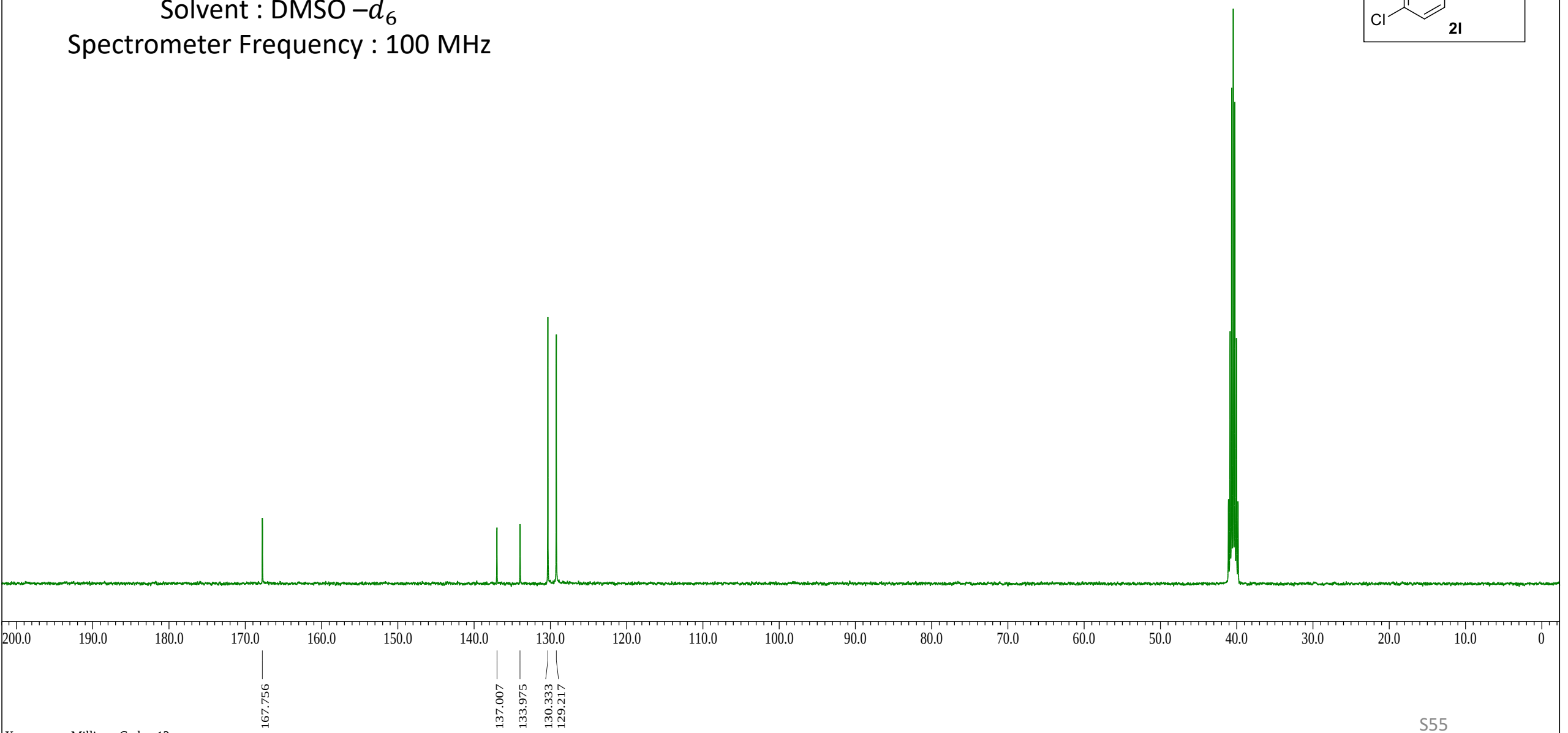
X : parts per Million : Proton

Solvent : DMSO $-d_6$

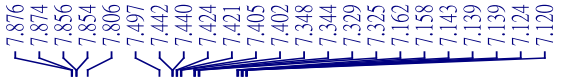
Spectrometer Frequency : 100 MHz



2l

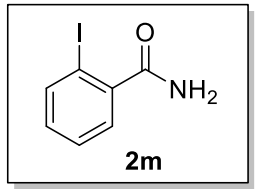


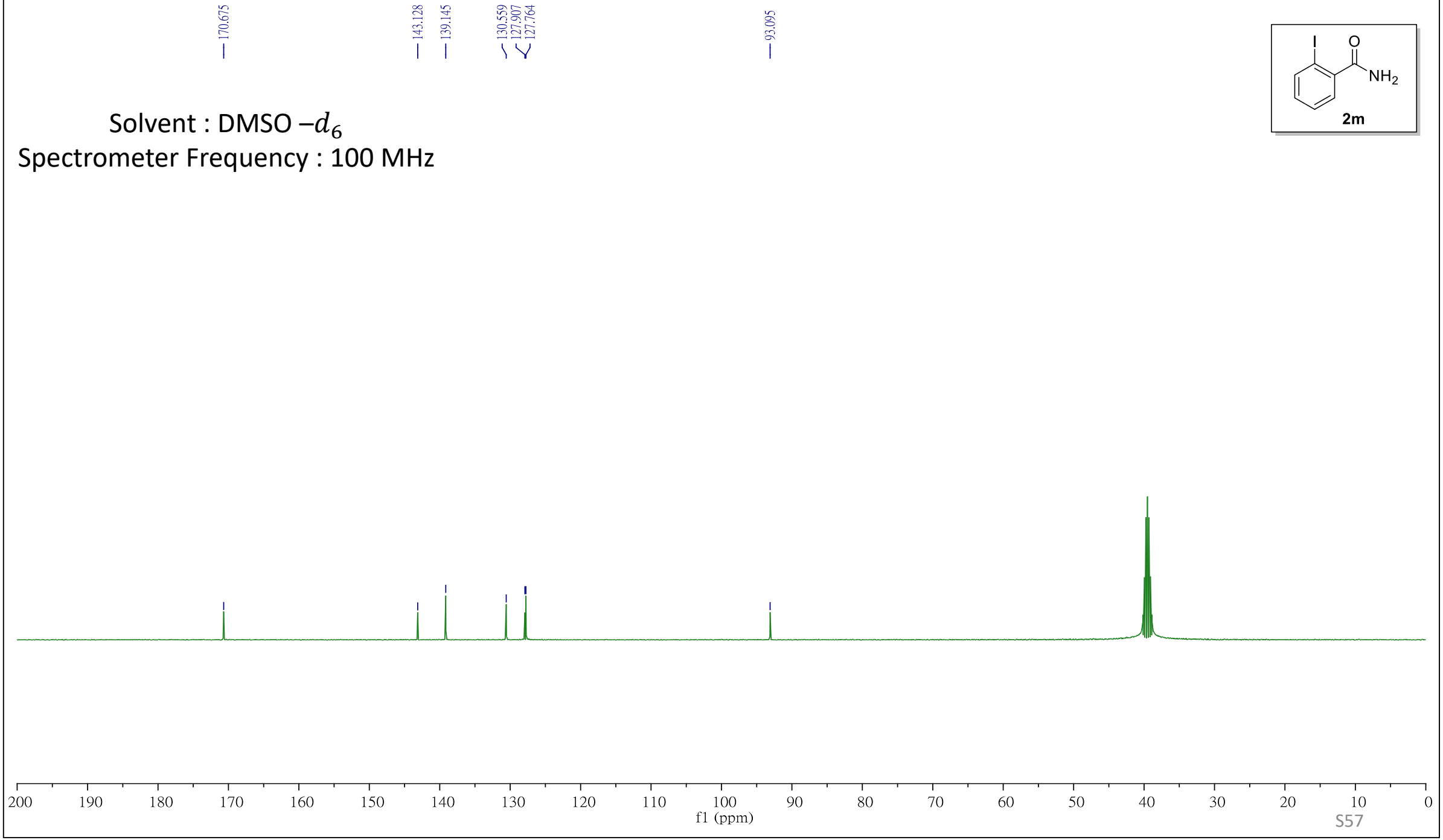
X : parts per Million : Carbon13



Solvent : DMSO $-d_6$

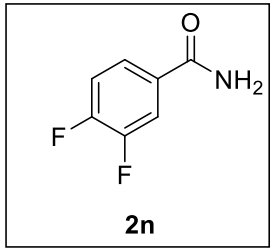
Spectrometer Frequency : 400 MHz




170.675
143.128
139.145
130.559
127.907
127.764
93.095
I
O
NH2
2m
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

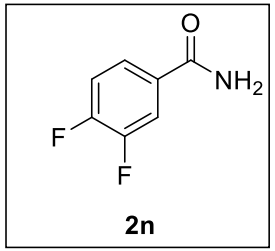


2n

X : parts per Million : Proton

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

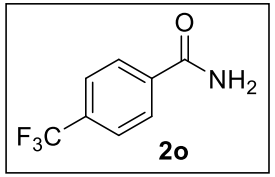


2n

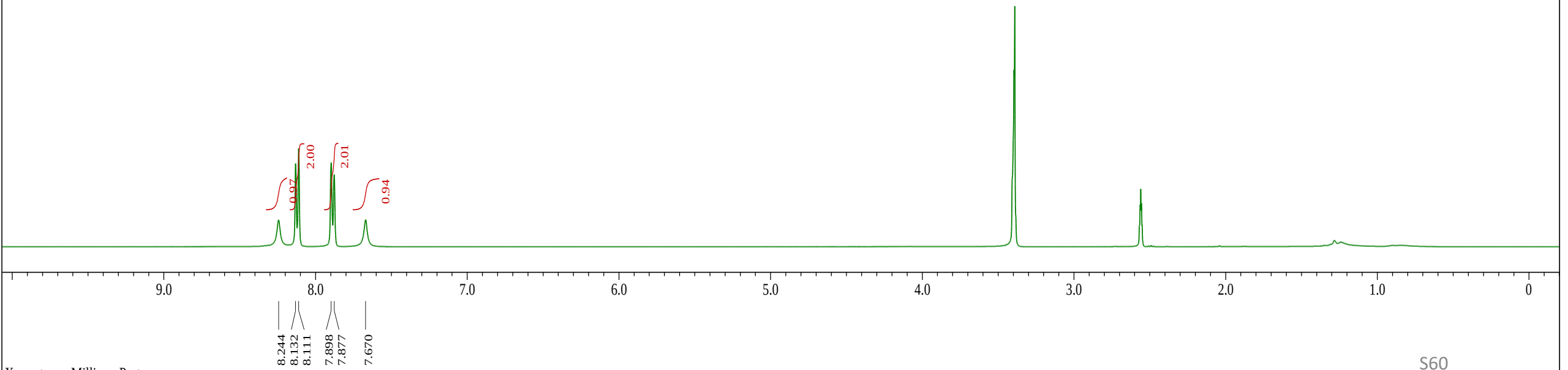
X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



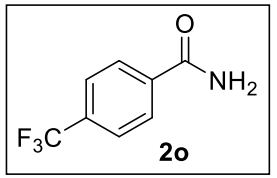
2o



X : parts per Million : Proton

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

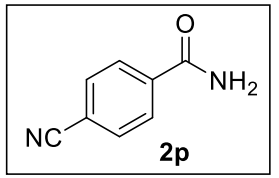


2o

X : parts per Million : Carbon13

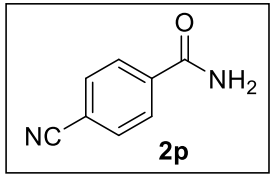
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

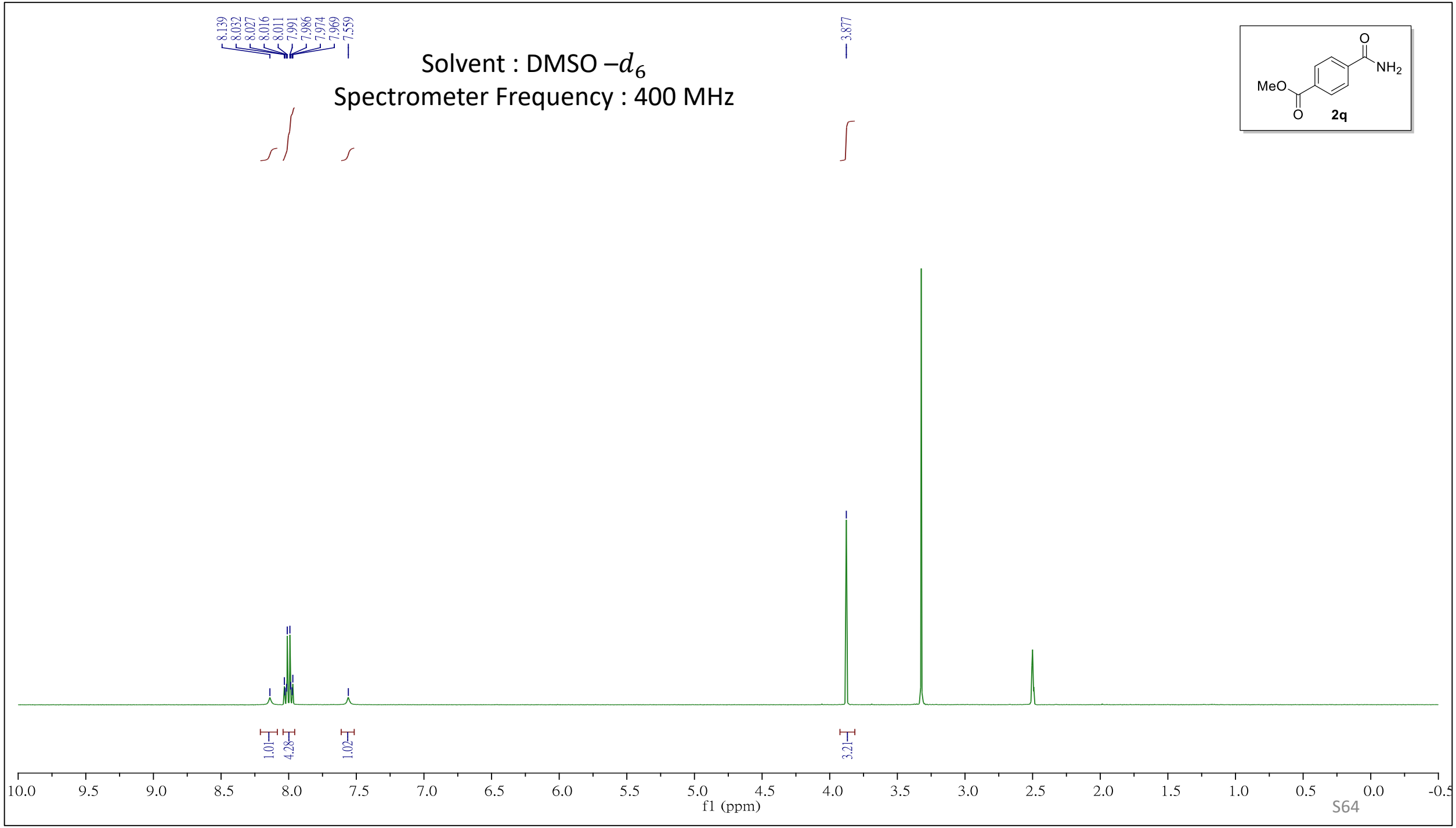


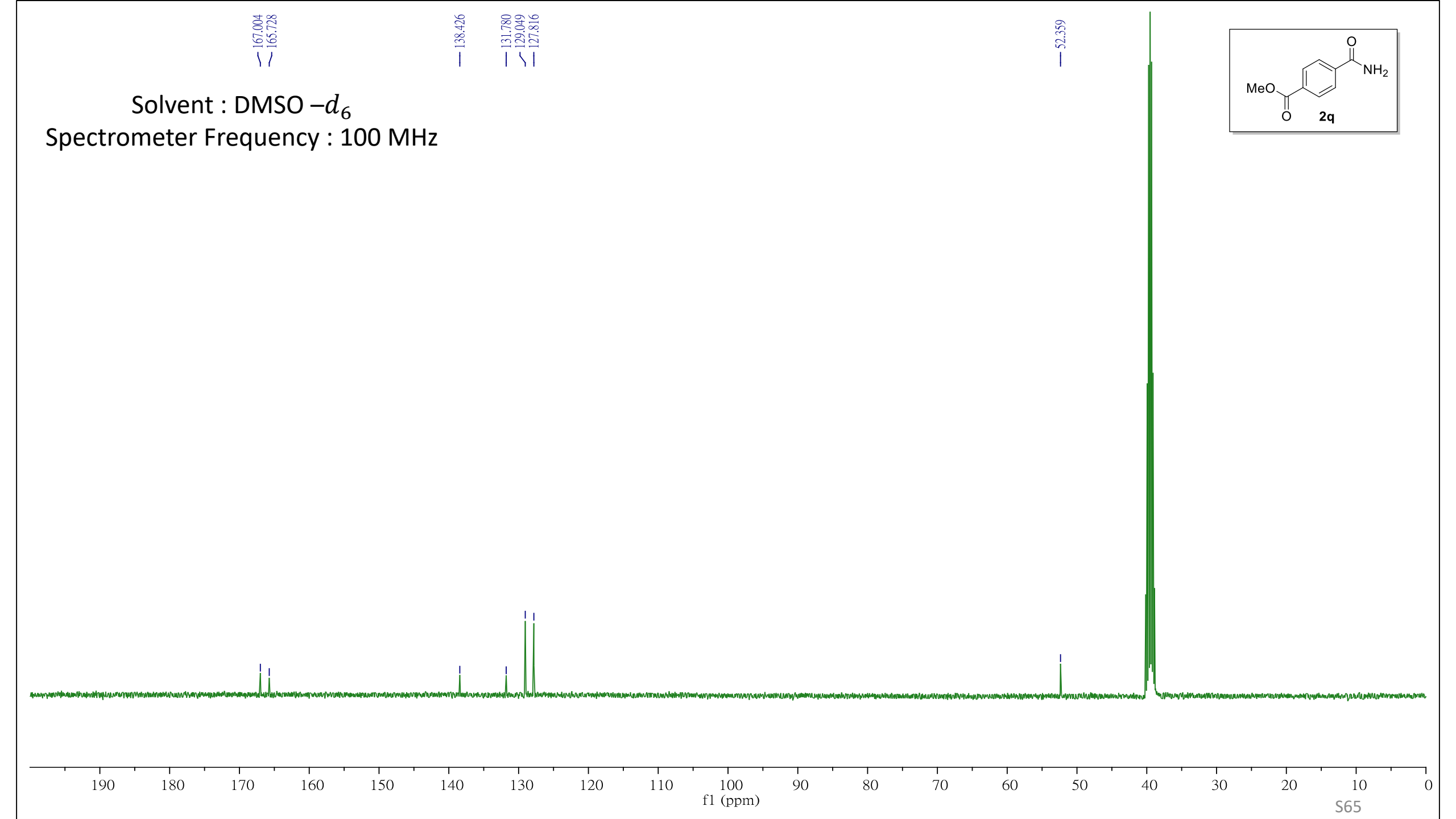
Solvent : DMSO $-d_6$

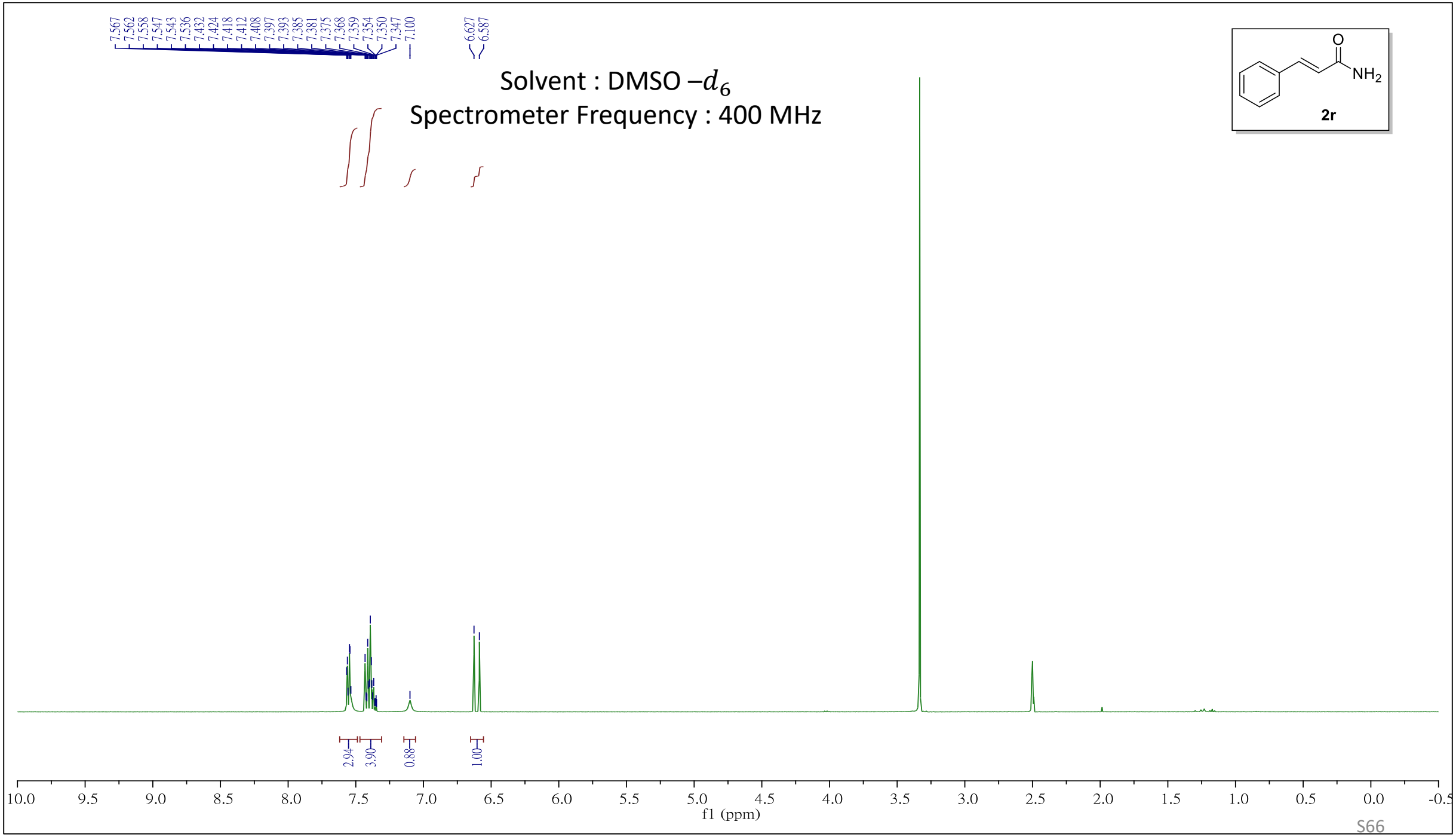
Spectrometer Frequency : 100 MHz



X : parts per Million : Carbon13


8.139
8.032
8.027
8.016
8.011
7.991
7.986
7.974
7.969
7.559
3.877
Solvent : DMSO –d_6
Spectrometer Frequency : 400 MHz
MeO
O
O
NH2
2q
1.01
4.28
1.02
3.21
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

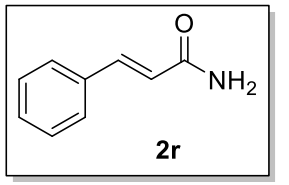

167.004
165.728
138.426
131.780
129.049
127.816
52.359
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
O
NH2
MeO
O
2q
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.567
7.562
7.558
7.547
7.543
7.536
7.432
7.424
7.418
7.412
7.408
7.397
7.393
7.385
7.381
7.375
7.368
7.359
7.354
7.350
7.347
7.100
6.627
6.587
Solvent : DMSO –d_6
Spectrometer Frequency : 400 MHz
O
NH2
2r
2.94
3.90
0.88
1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

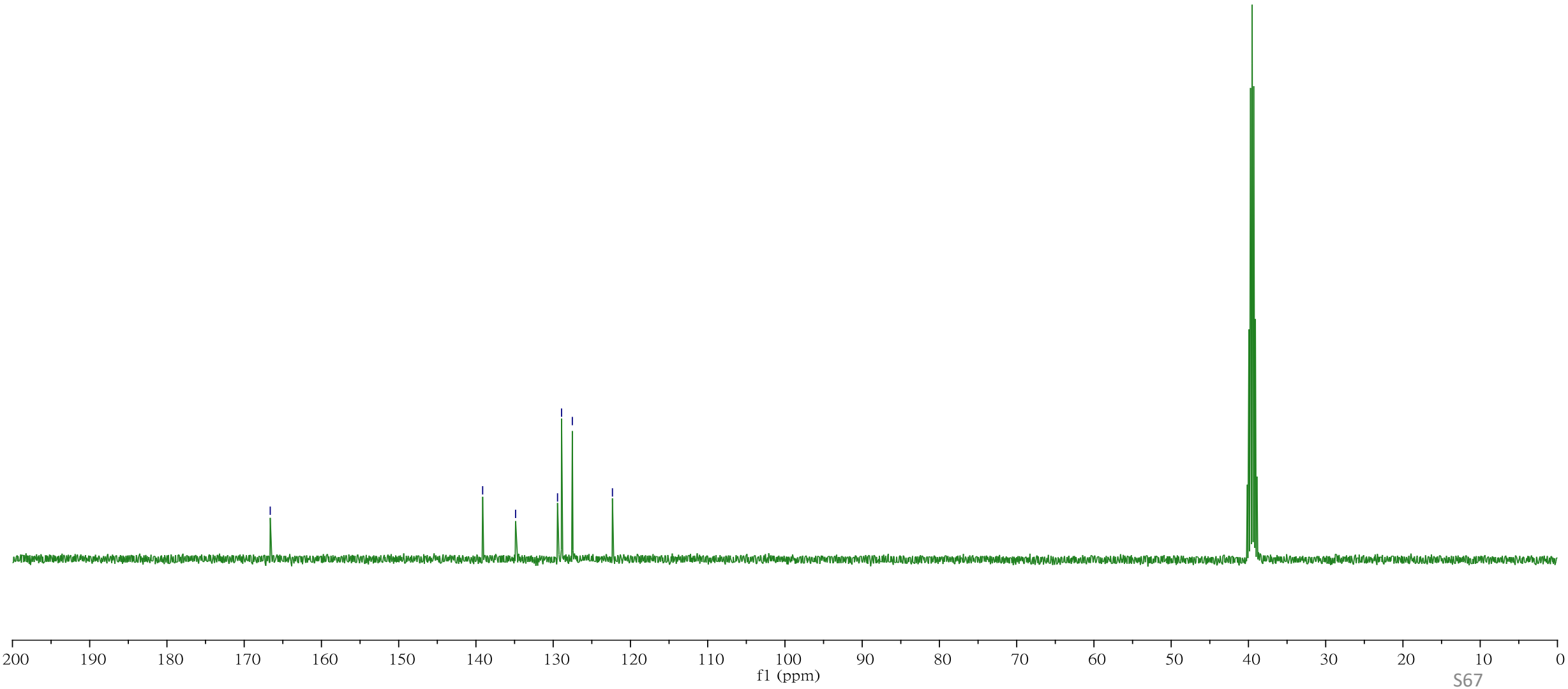
166.629
139.130
134.870
129.437
128.918
127.522
122.328

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

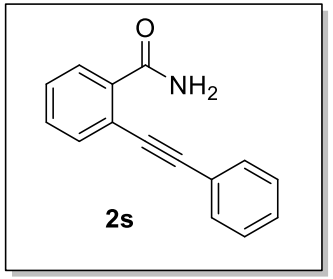


2r



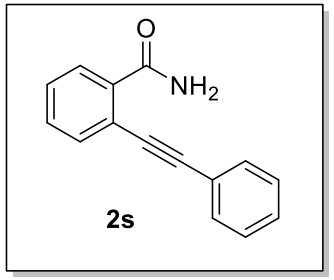
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



Solvent : DMSO $-d_6$

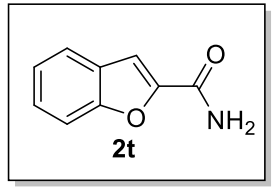
Spectrometer Frequency : 100 MHz



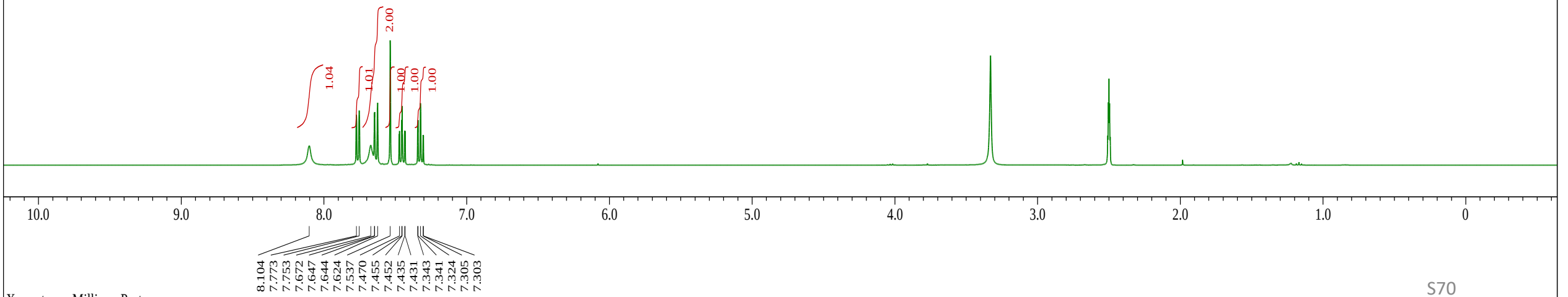
2s

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



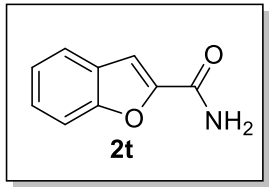
2t



X : parts per Million : Proton

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

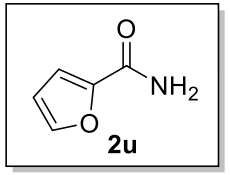


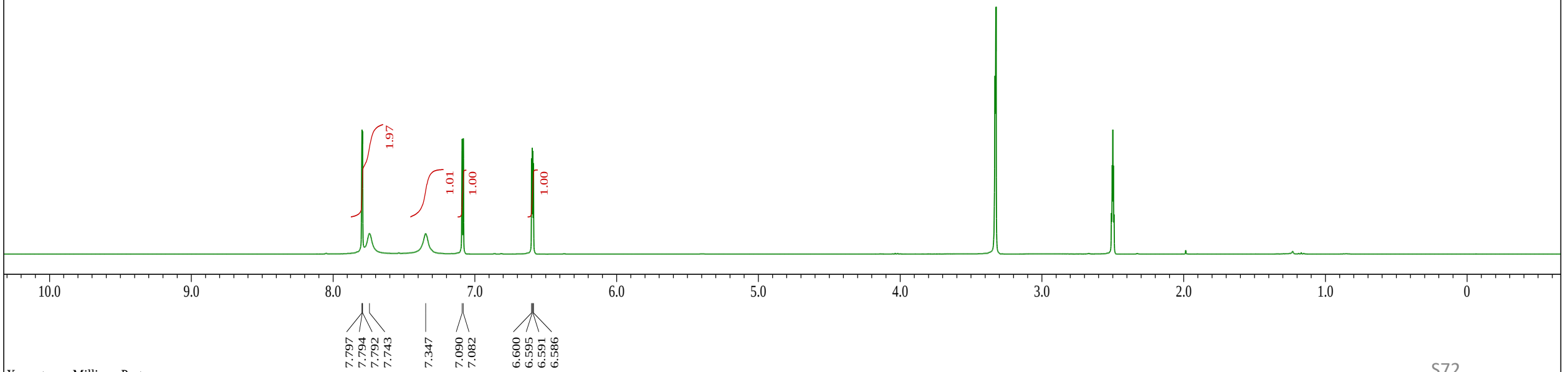
2t

X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

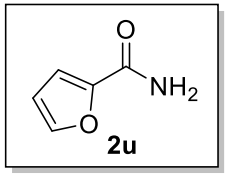




X : parts per Million : Proton

Solvent : DMSO $-d_6$

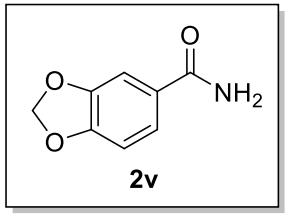
Spectrometer Frequency : 100 MHz



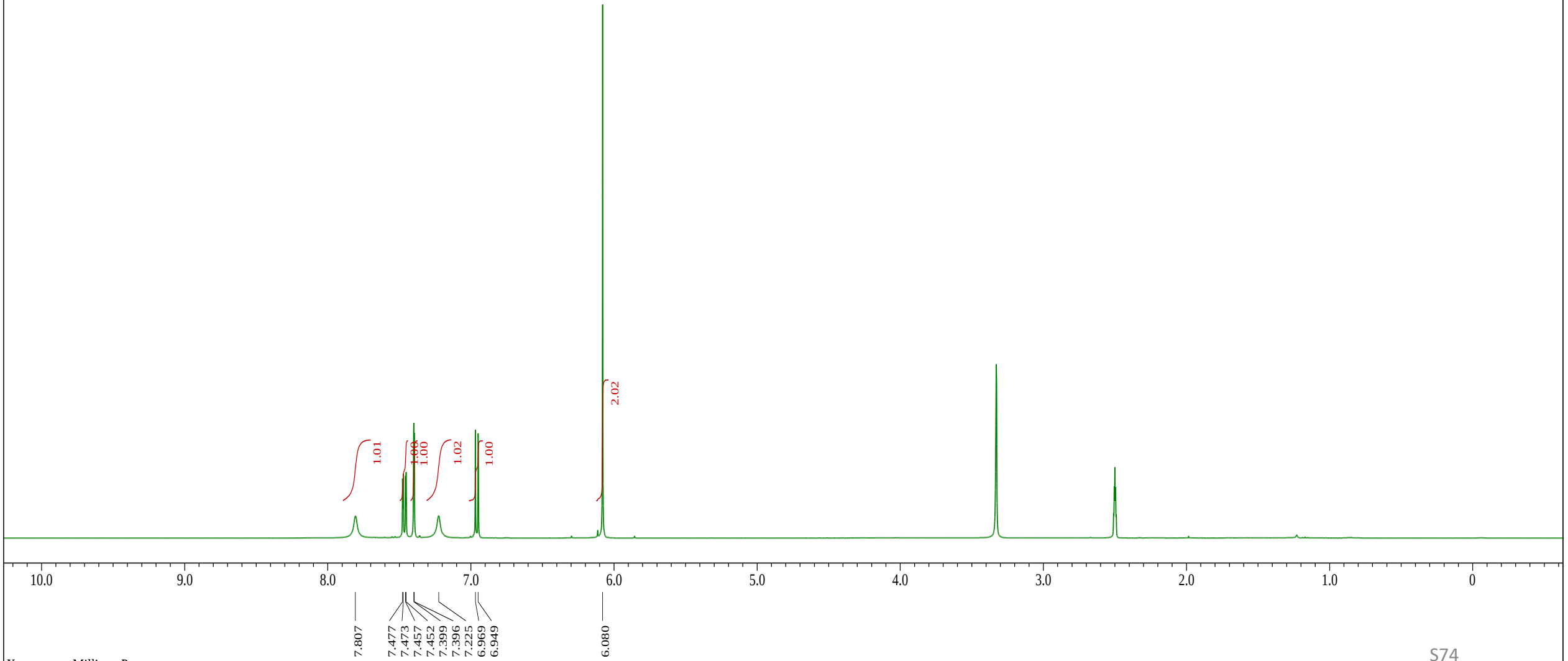
X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



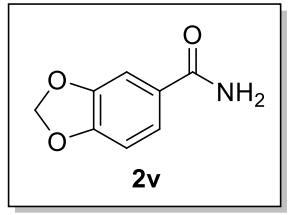
2v



X : parts per Million : Proton

Solvent : DMSO $-d_6$

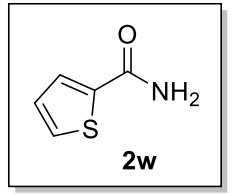
Spectrometer Frequency : 100 MHz



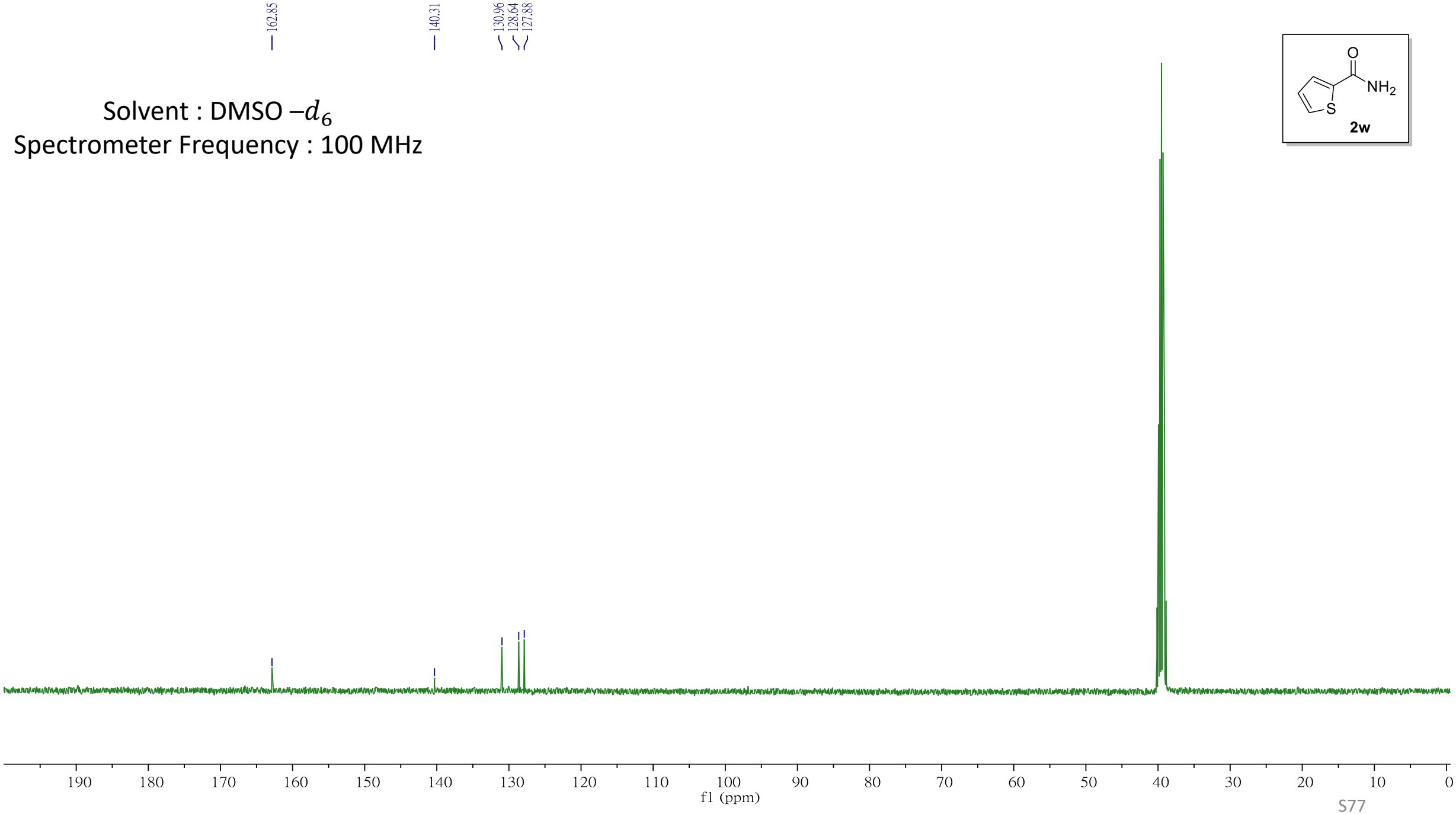
2v

X : parts per Million : Carbon13

Solvent : DMSO $-d_6$
Spectrometer Frequency : 400 MHz

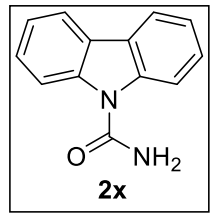


2w

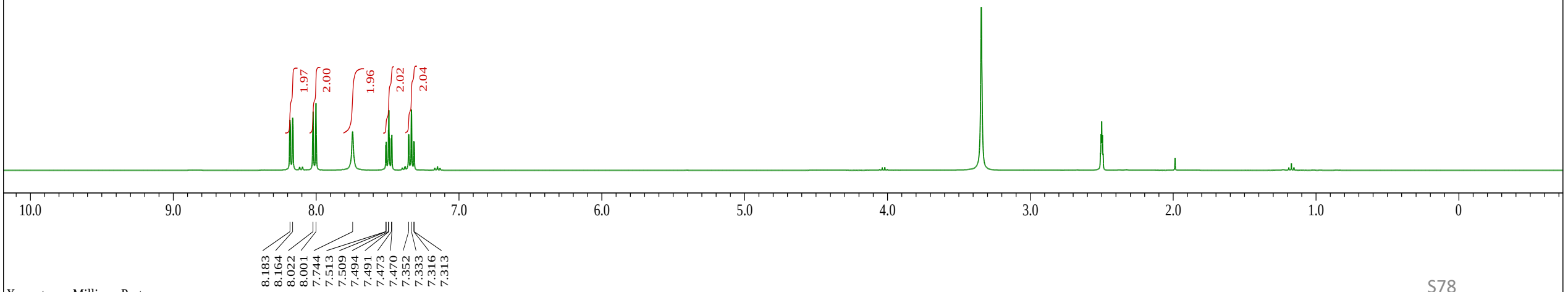

162.85
140.31
130.96
128.64
127.88
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
O
NH2
S
2w
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



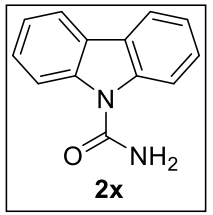
2x



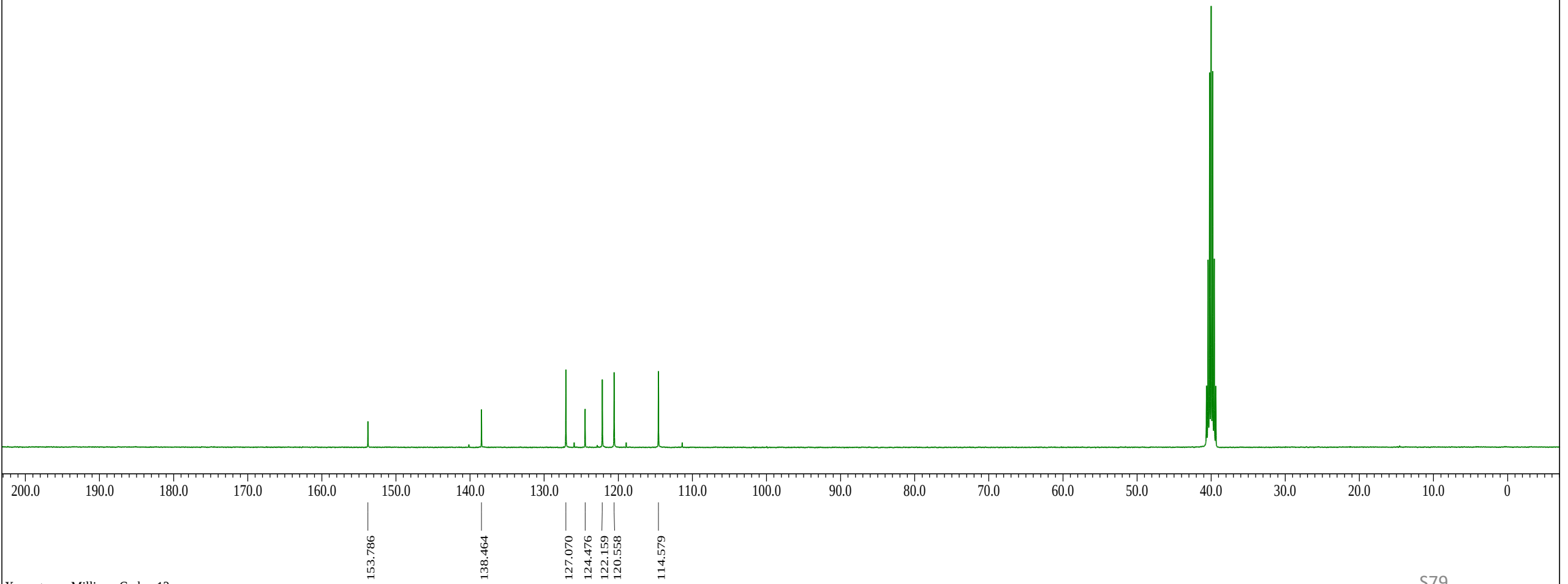
X : parts per Million : Proton

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz



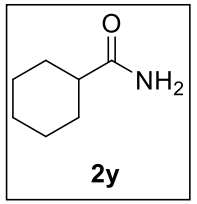
2x



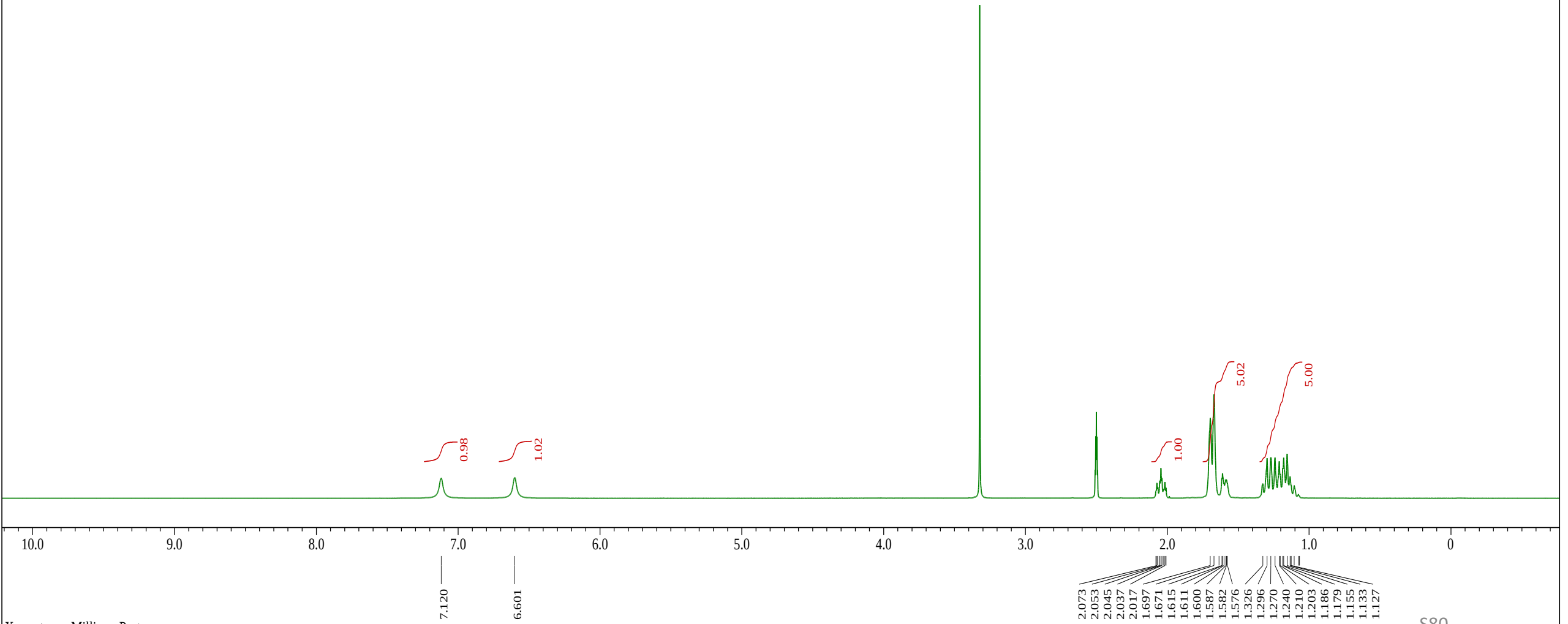
X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



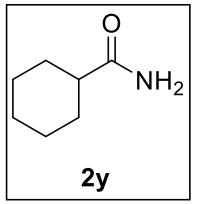
2y



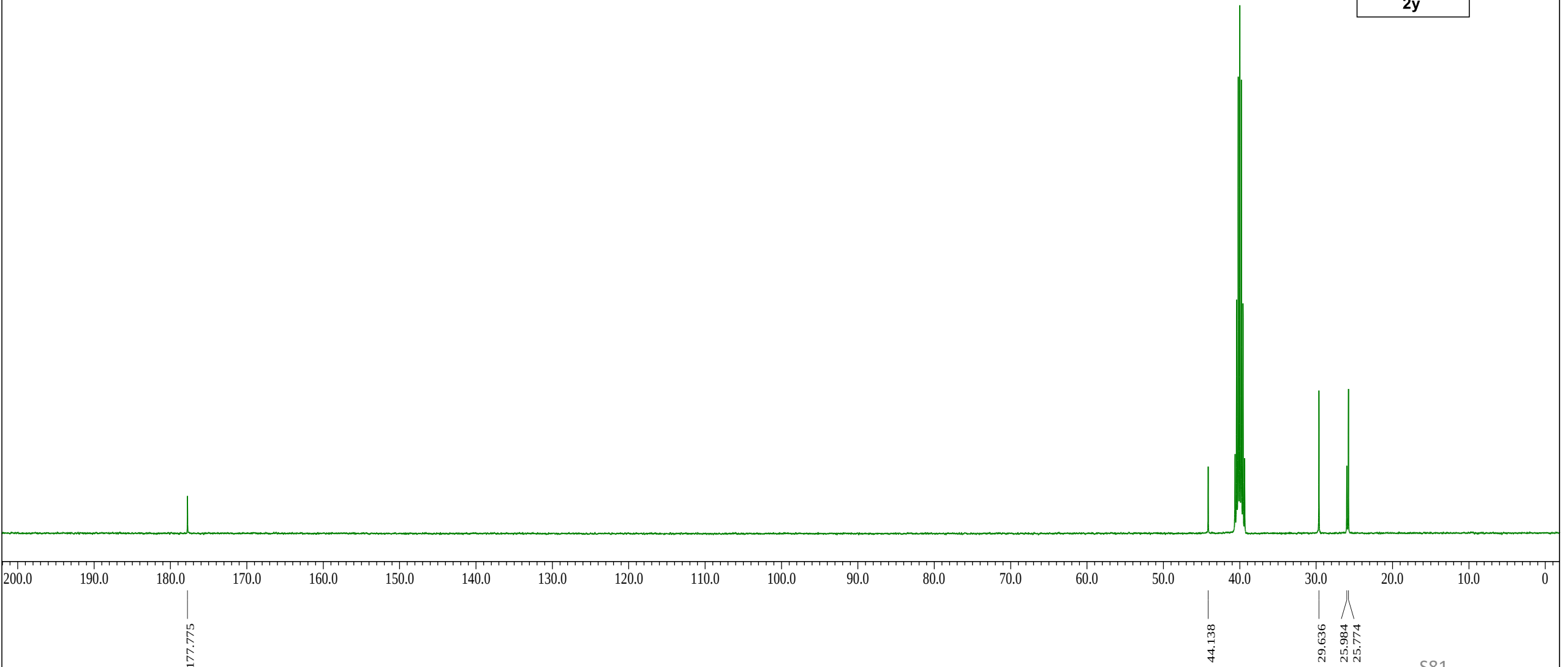
X : parts per Million : Proton

Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

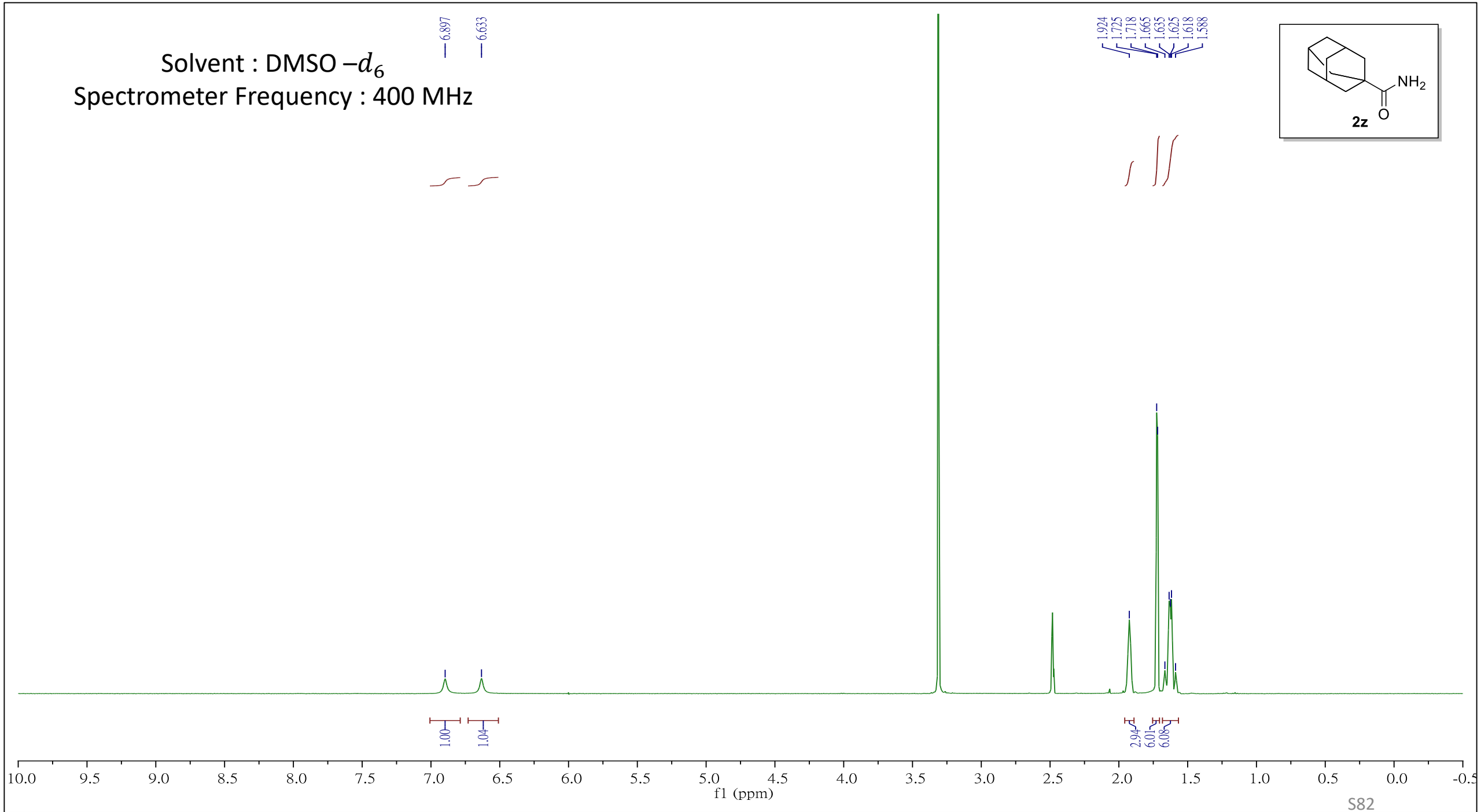


2y



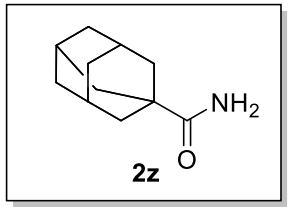
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

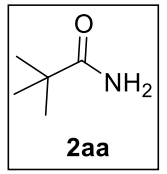


Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

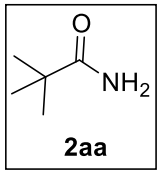


Solvent : $CDCl_3$
Spectrometer Frequency : 400 MHz

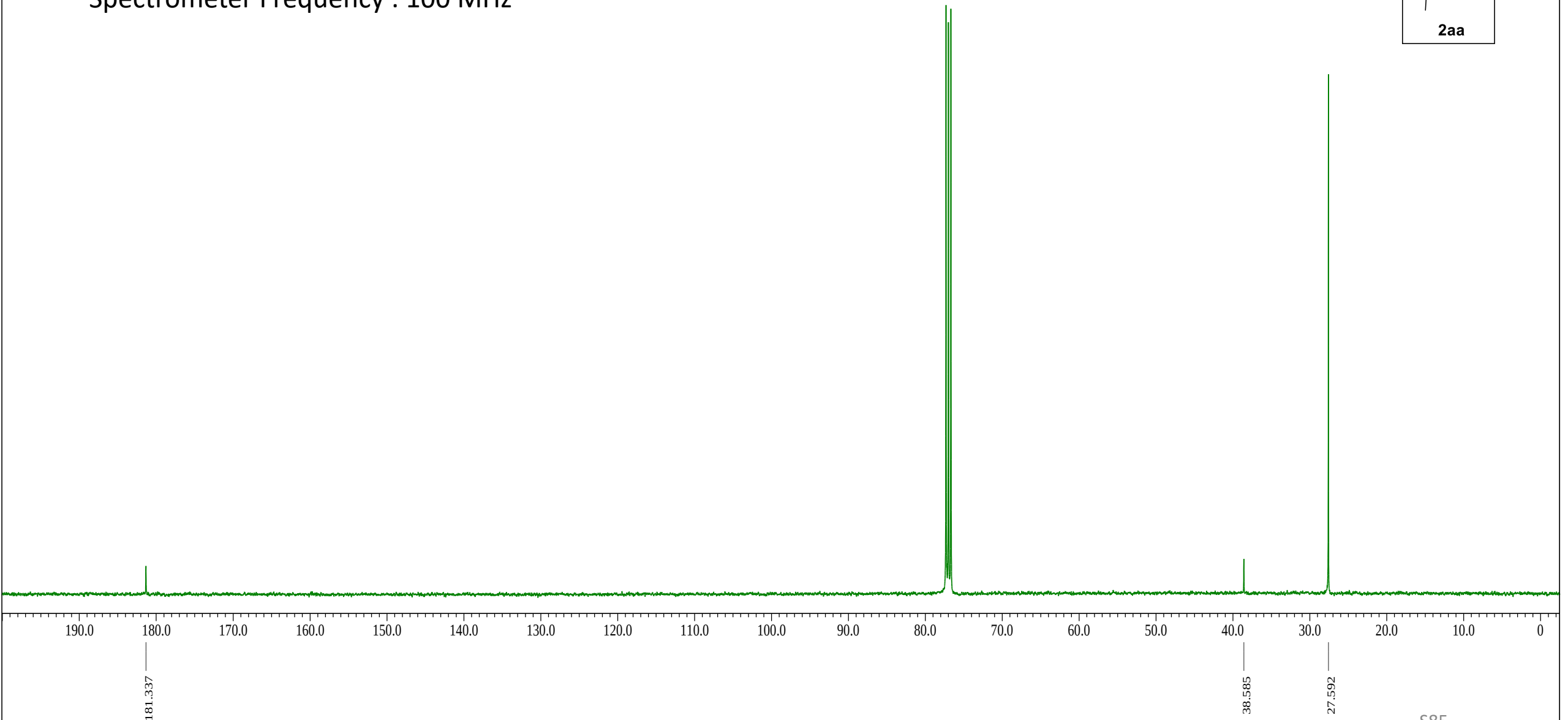


2aa

Solvent : $CDCl_3$
Spectrometer Frequency : 100 MHz

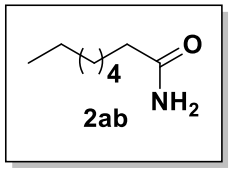


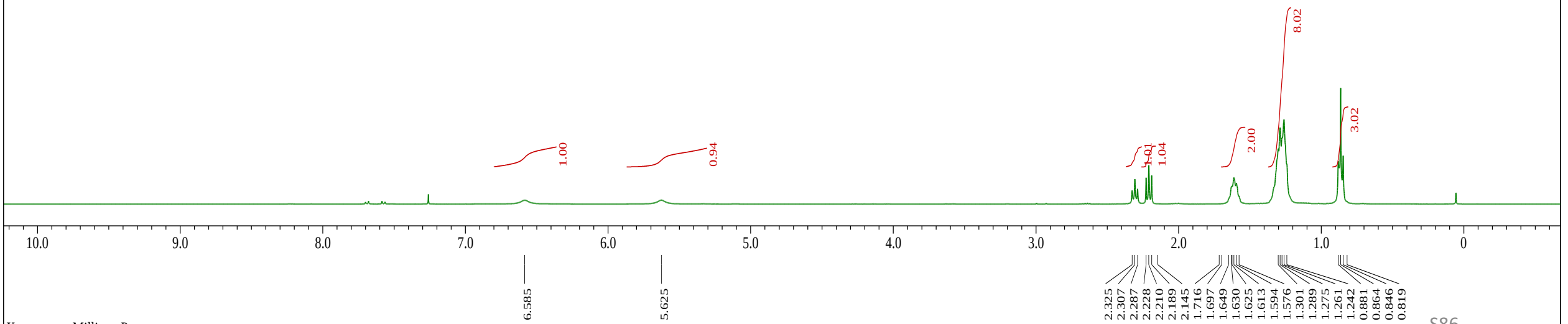
2aa



X : parts per Million : Carbon13

Solvent : $CDCl_3$
Spectrometer Frequency : 400 MHz

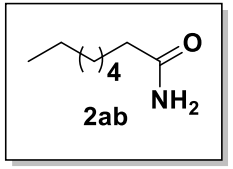




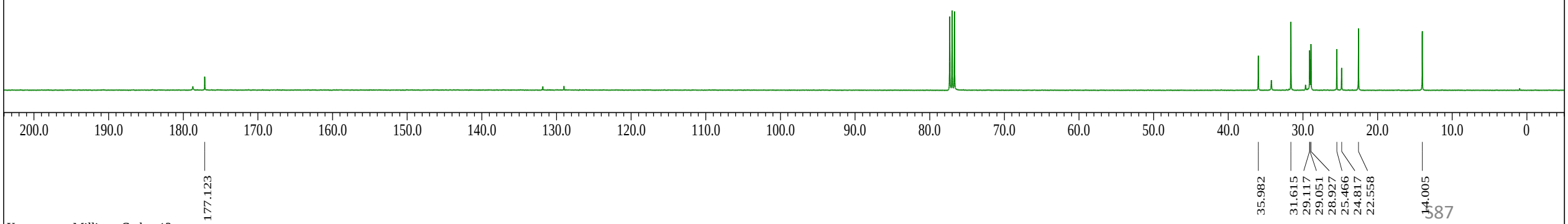
X : parts per Million : Proton

Solvent : $CDCl_3$

Spectrometer Frequency : 100 MHz

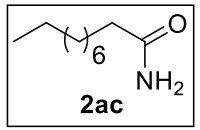


2ab

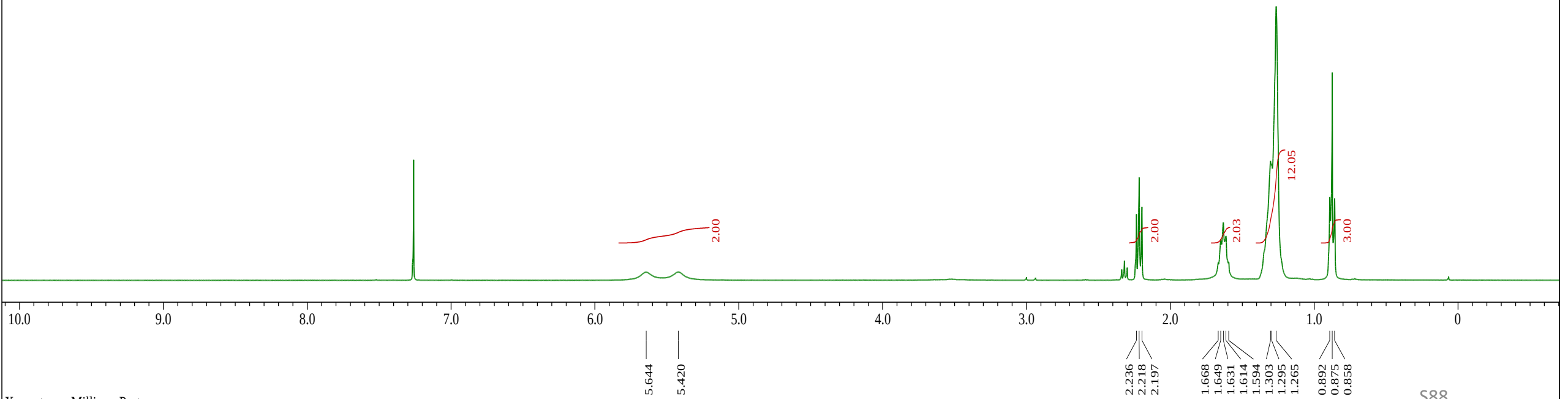


X : parts per Million : Carbon13

Solvent : $CDCl_3$
Spectrometer Frequency : 400 MHz

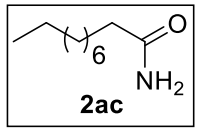


2ac

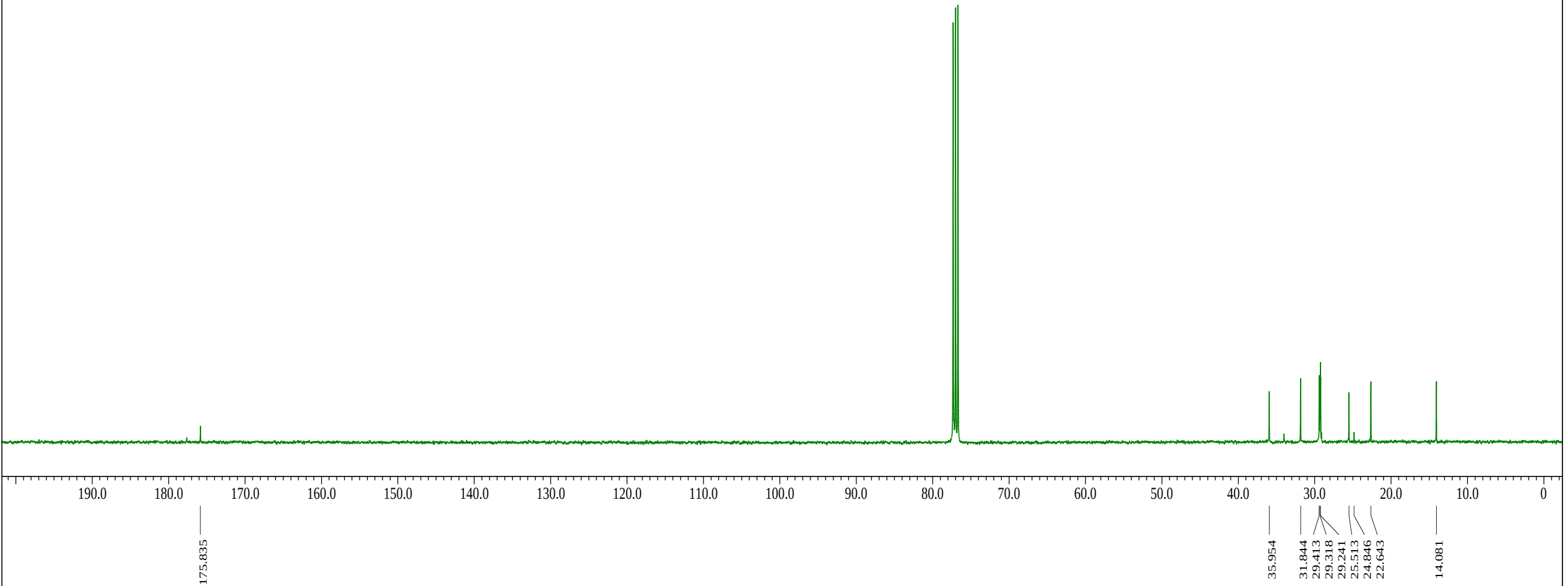


X : parts per Million : Proton

Solvent : $CDCl_3$
Spectrometer Frequency : 100 MHz



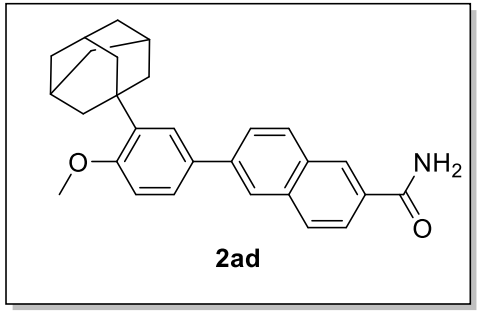
2ac



X : parts per Million : Carbon13

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

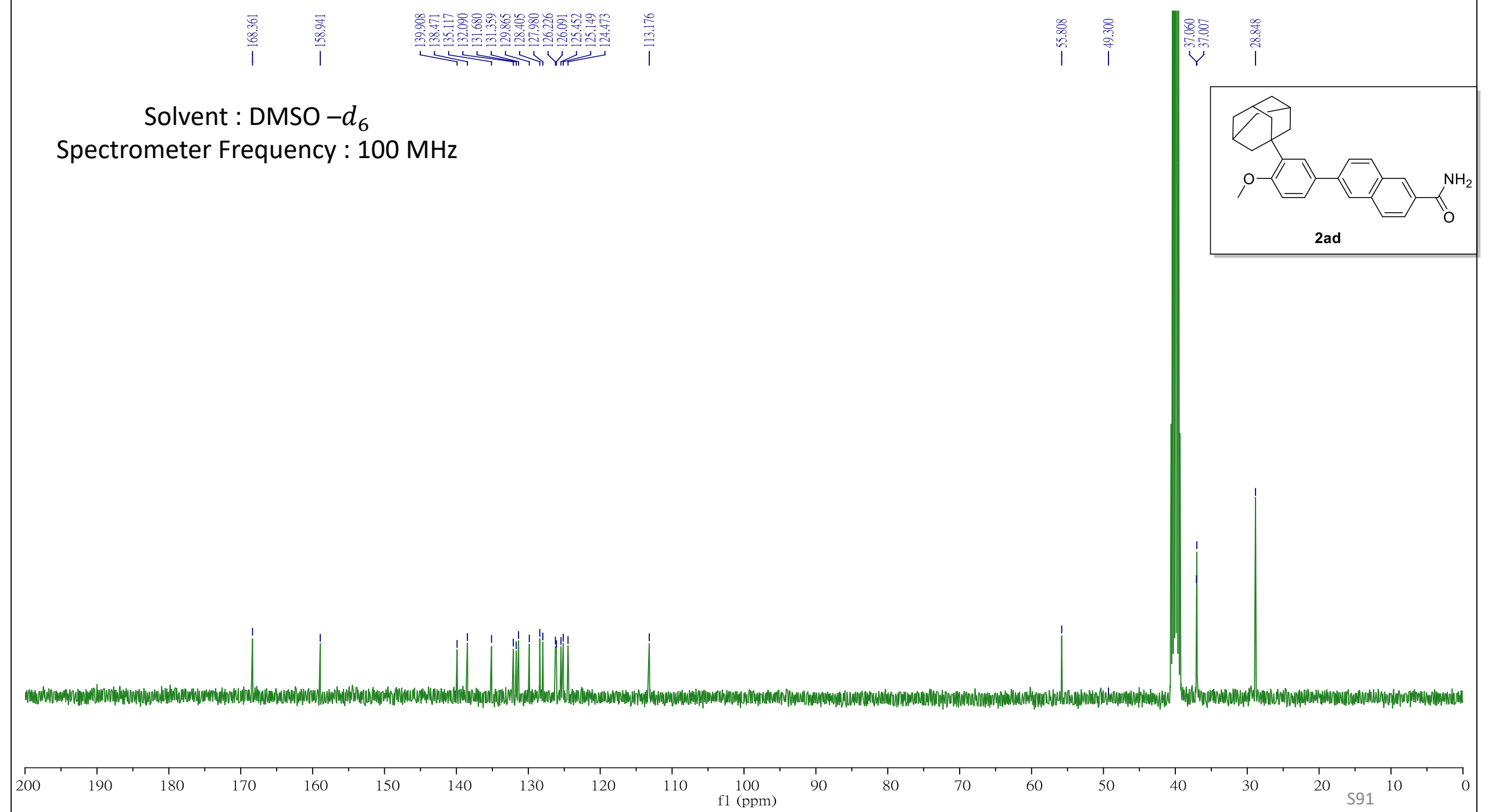


2ad

f1 (ppm)

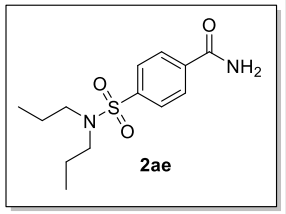
Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz



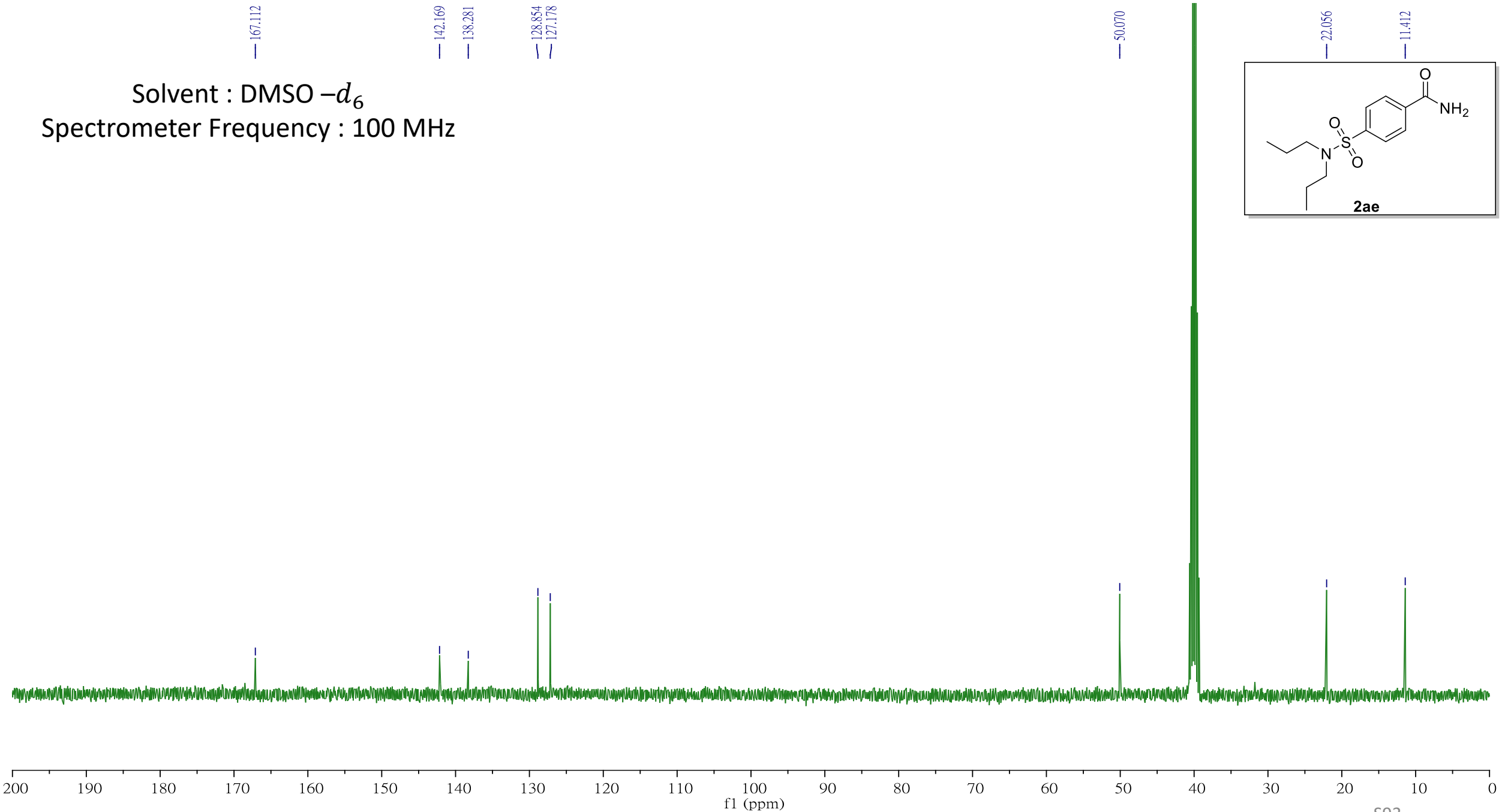
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



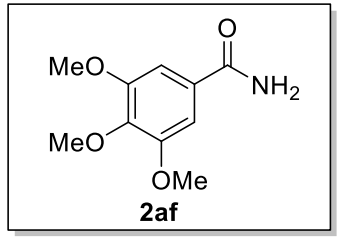
Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

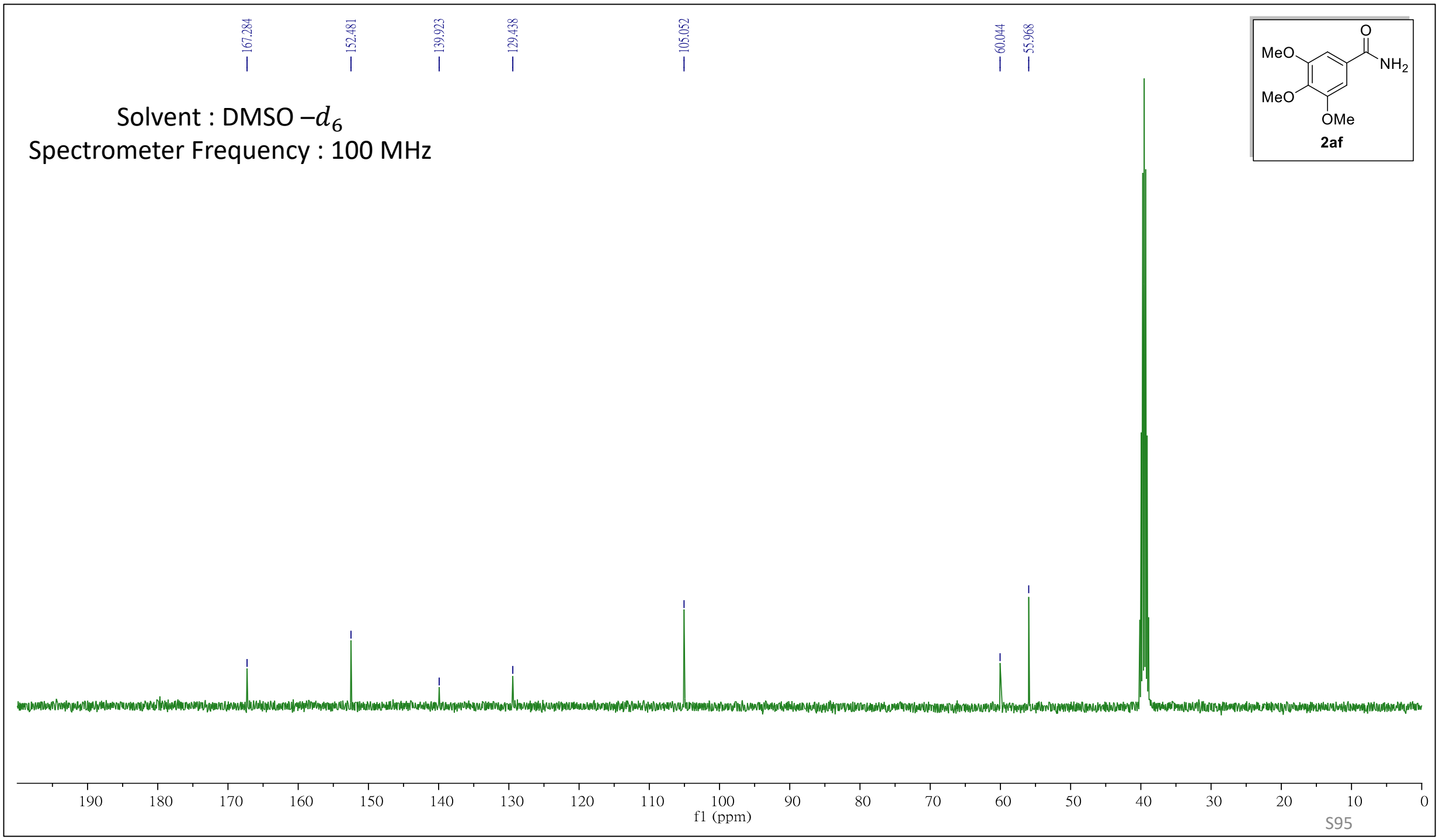


Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

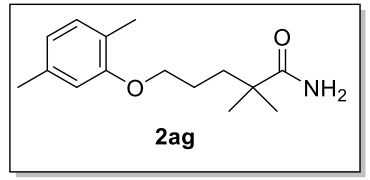


2af

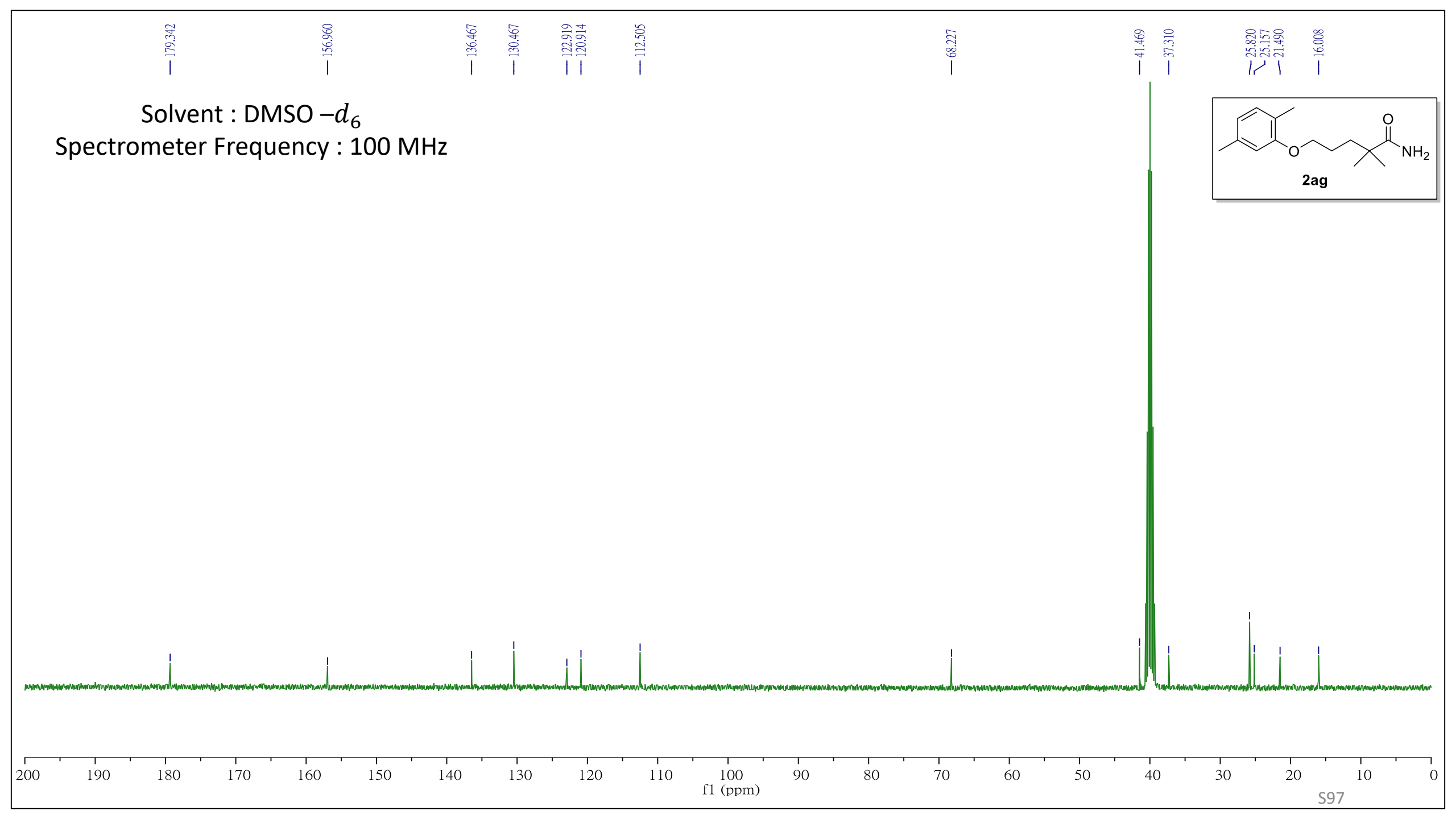

167.284
152.481
139.923
129.438
105.052
60.044
55.968
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
MeO
MeO
OMe
O
NH2
2af
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz

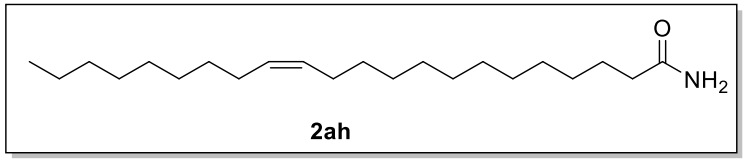


2ag


179.342
156.960
136.467
130.467
122.919
120.914
112.505
68.227
41.469
37.310
25.820
25.157
21.490
16.008
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
O
NH2
2ag
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Solvent : DMSO $-d_6$

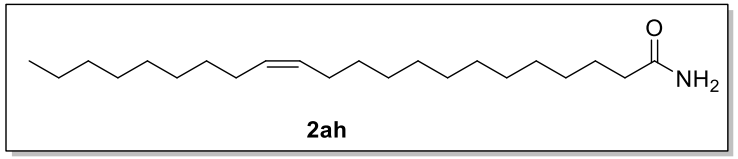
Spectrometer Frequency : 400 MHz



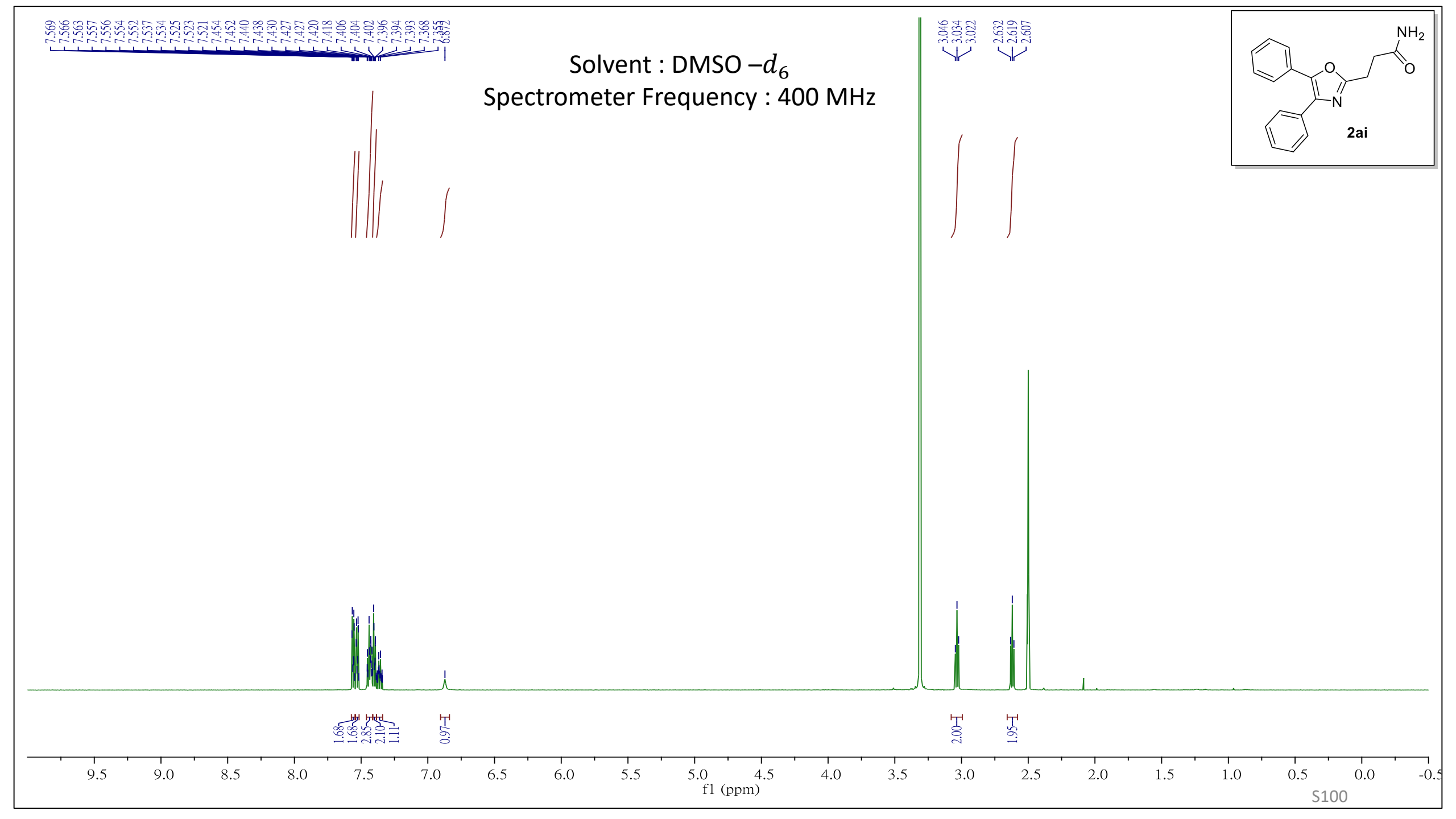
2ah

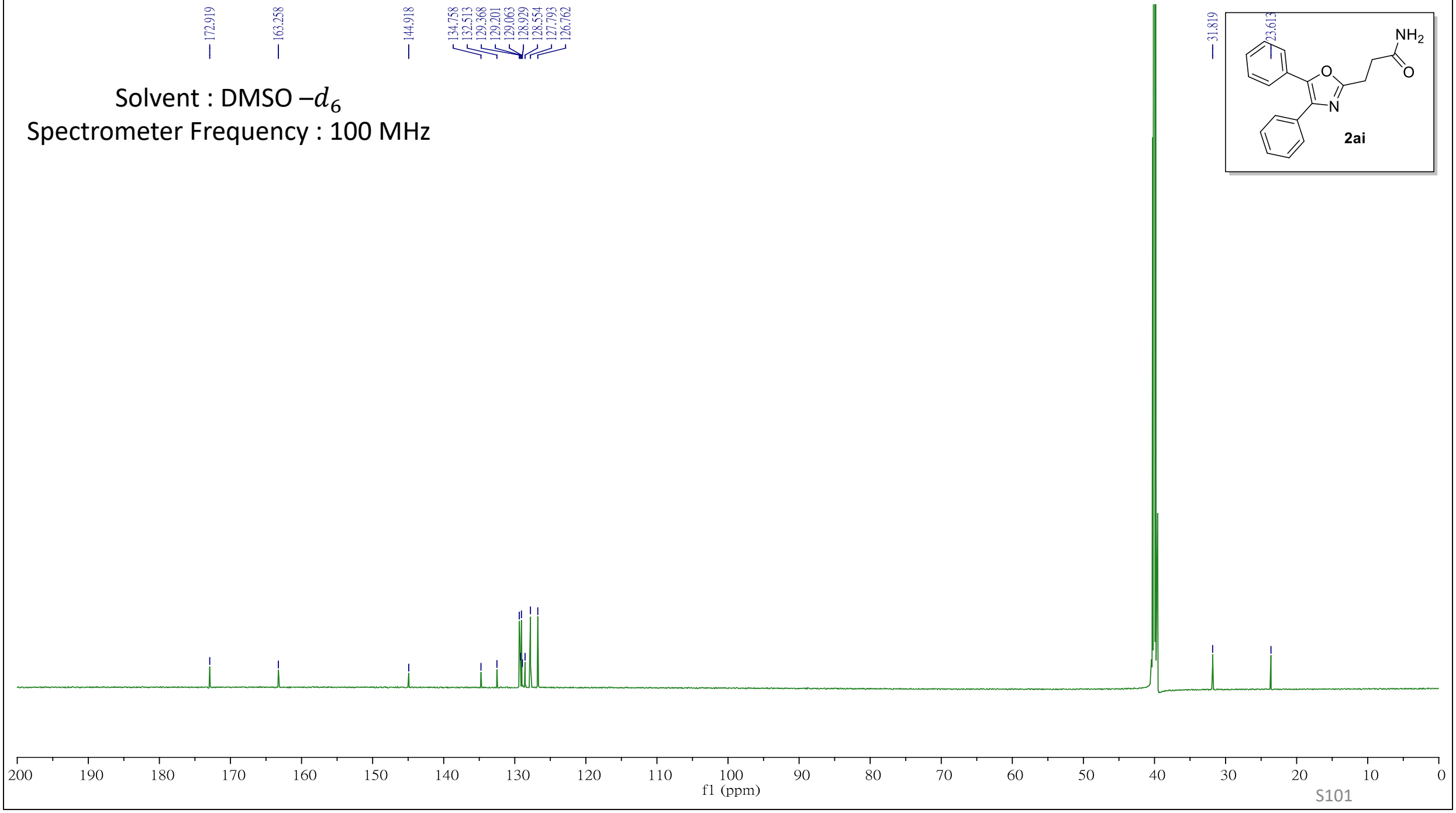
Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz

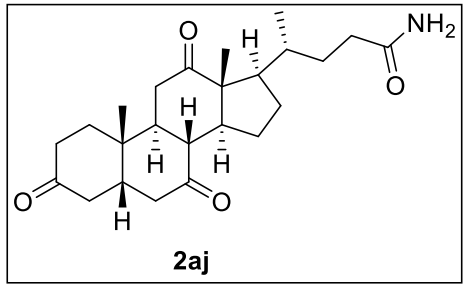


2ah


Solvent : DMSO –d_6
Spectrometer Frequency : 400 MHz
2ai
f1 (ppm)


172.919
163.258
144.918
134.758
132.513
129.368
129.201
129.063
128.929
128.554
127.793
126.762
31.819
23.613
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
NH2
O
O
N
2ai
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Solvent : DMSO $-d_6$
Spectrometer Frequency : 400 MHz

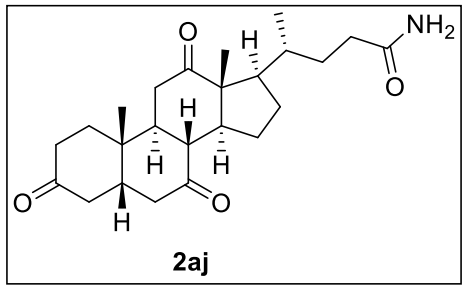


2aj

X : parts per Million : Proton

Solvent : DMSO $-d_6$

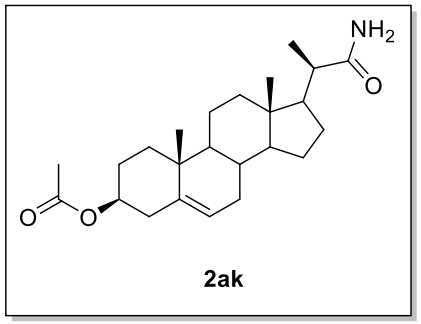
Spectrometer Frequency : 100 MHz



2aj

X : parts per Million : Carbon13

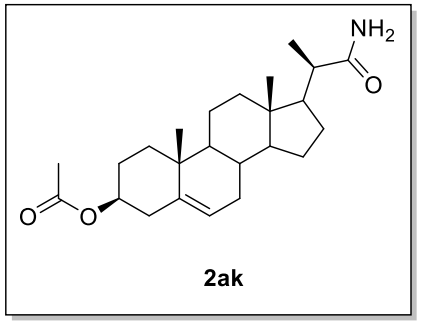
Solvent : $CDCl_3$
Spectrometer Frequency : 400 MHz



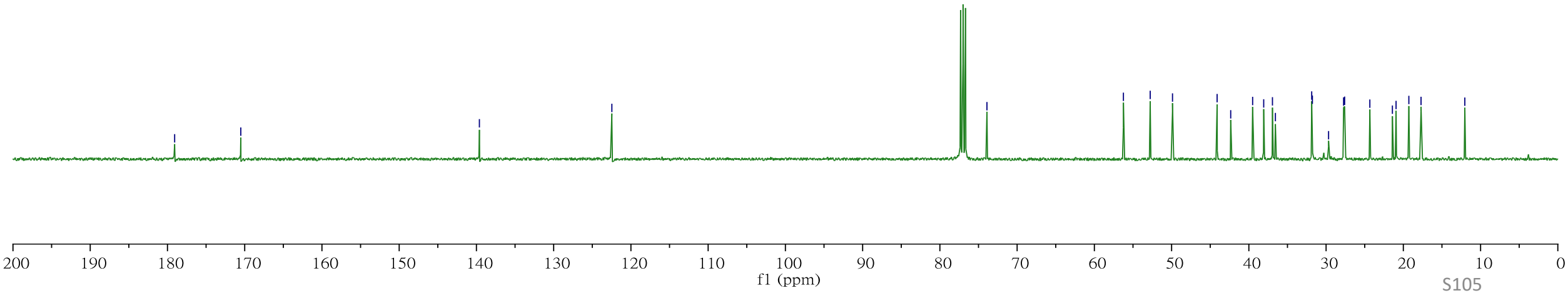
2ak

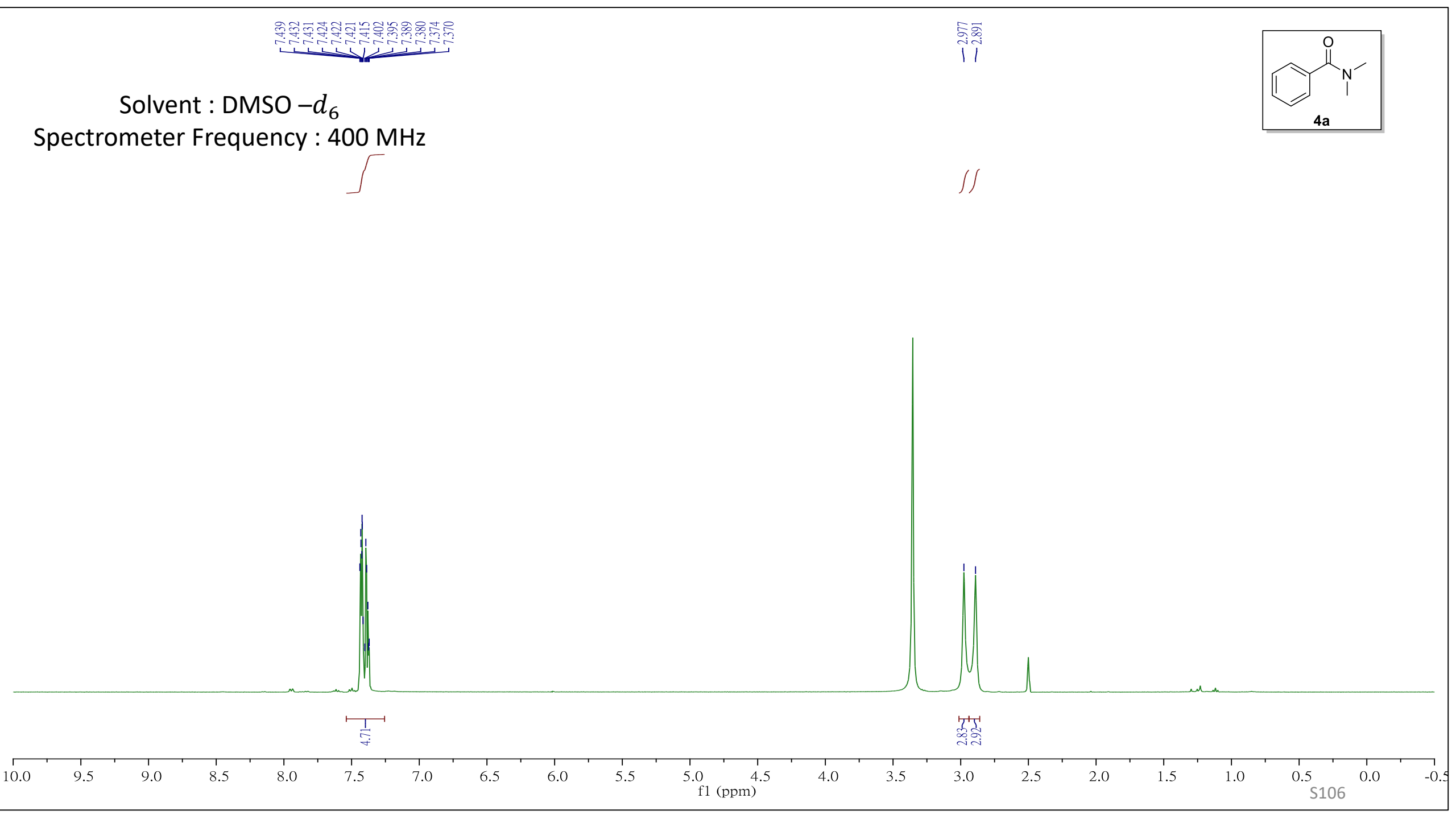
179.070
170.507
139.615
122.467
73.908
56.238
52.771
49.883
44.109
42.348
39.511
38.077
36.944
36.563
31.862
31.773
29.678
27.732
27.601
24.335
21.416
20.941
19.285
17.708
12.040

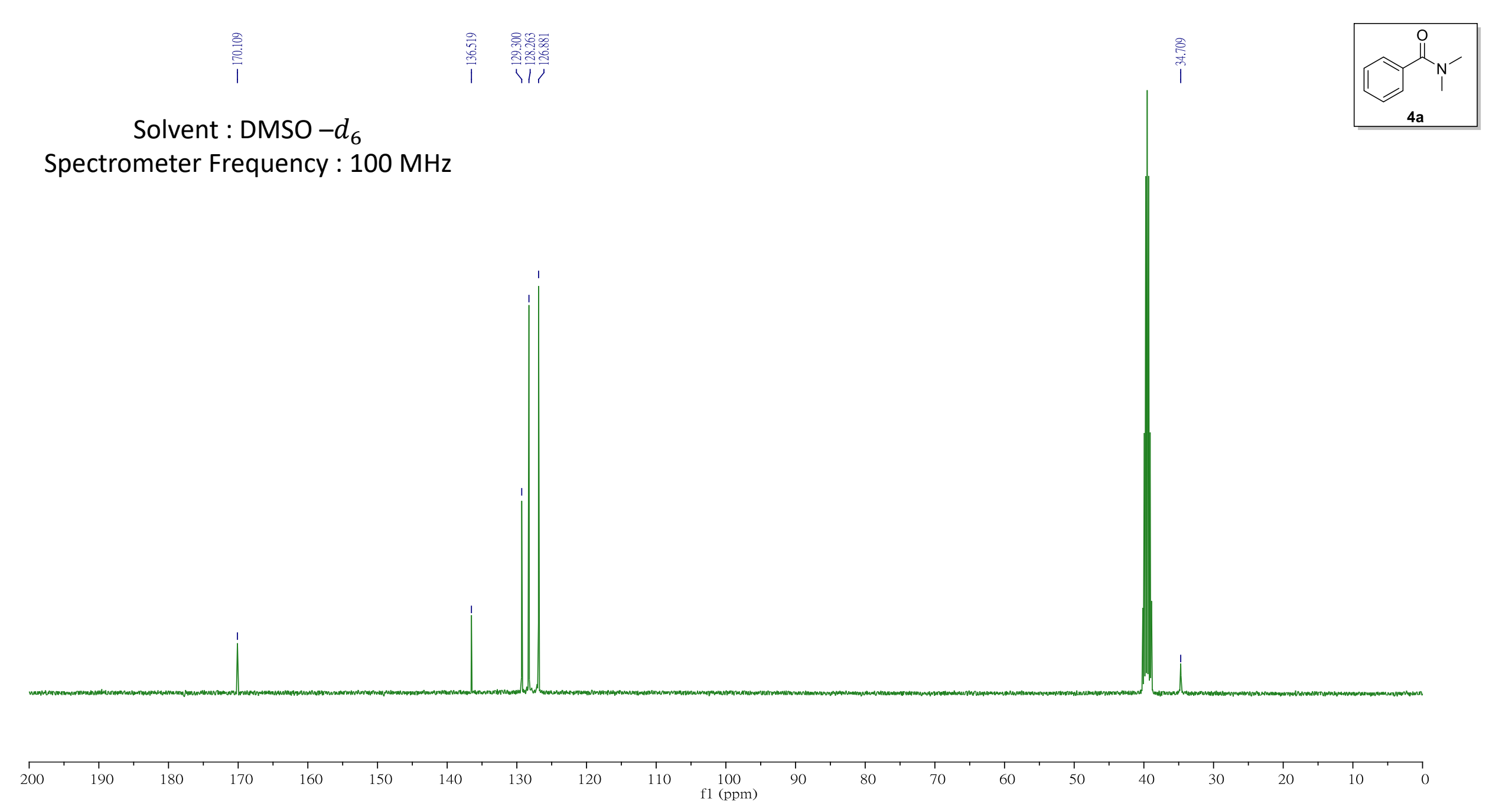
Solvent : $CDCl_3$
Spectrometer Frequency : 100 MHz

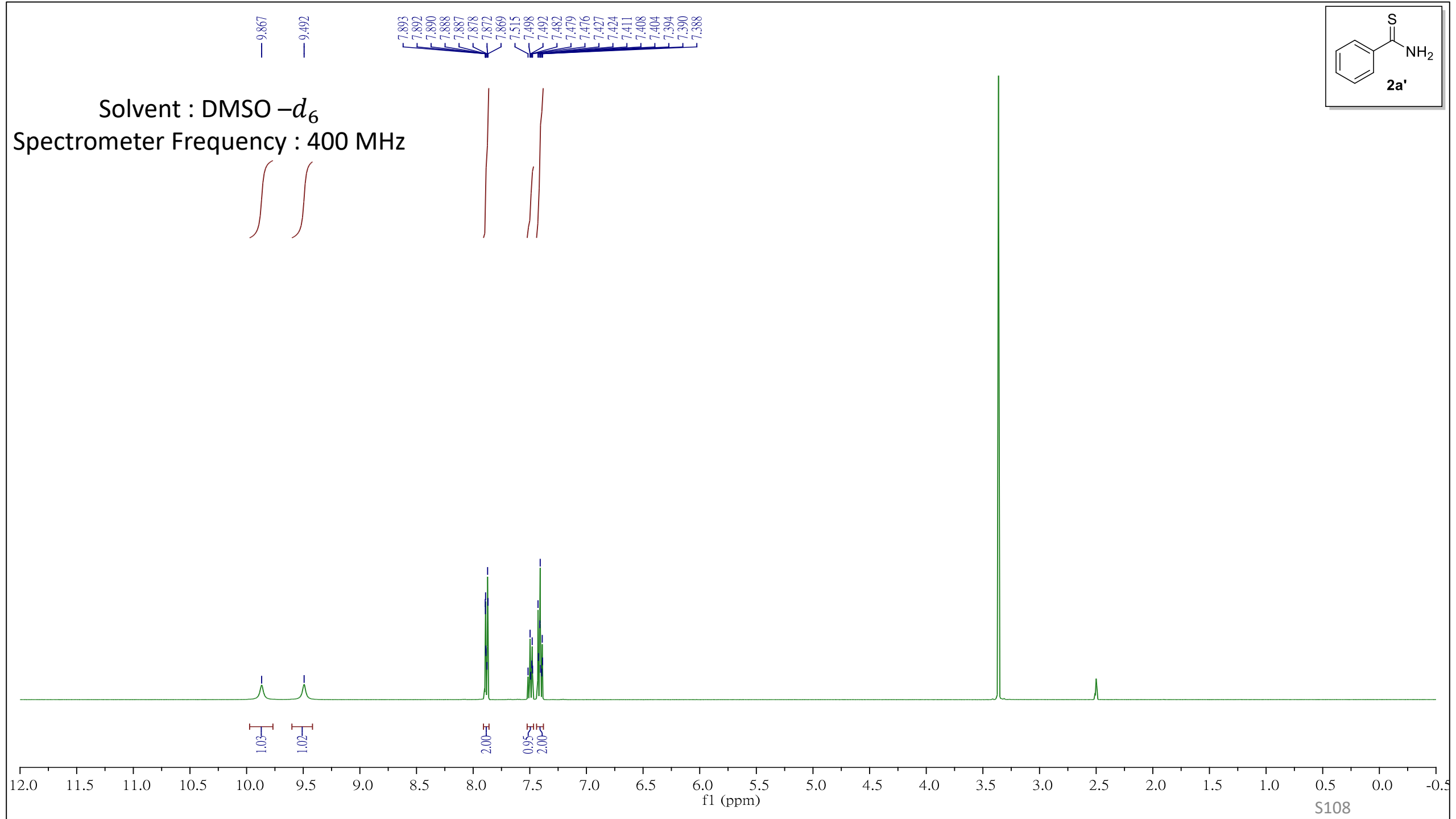


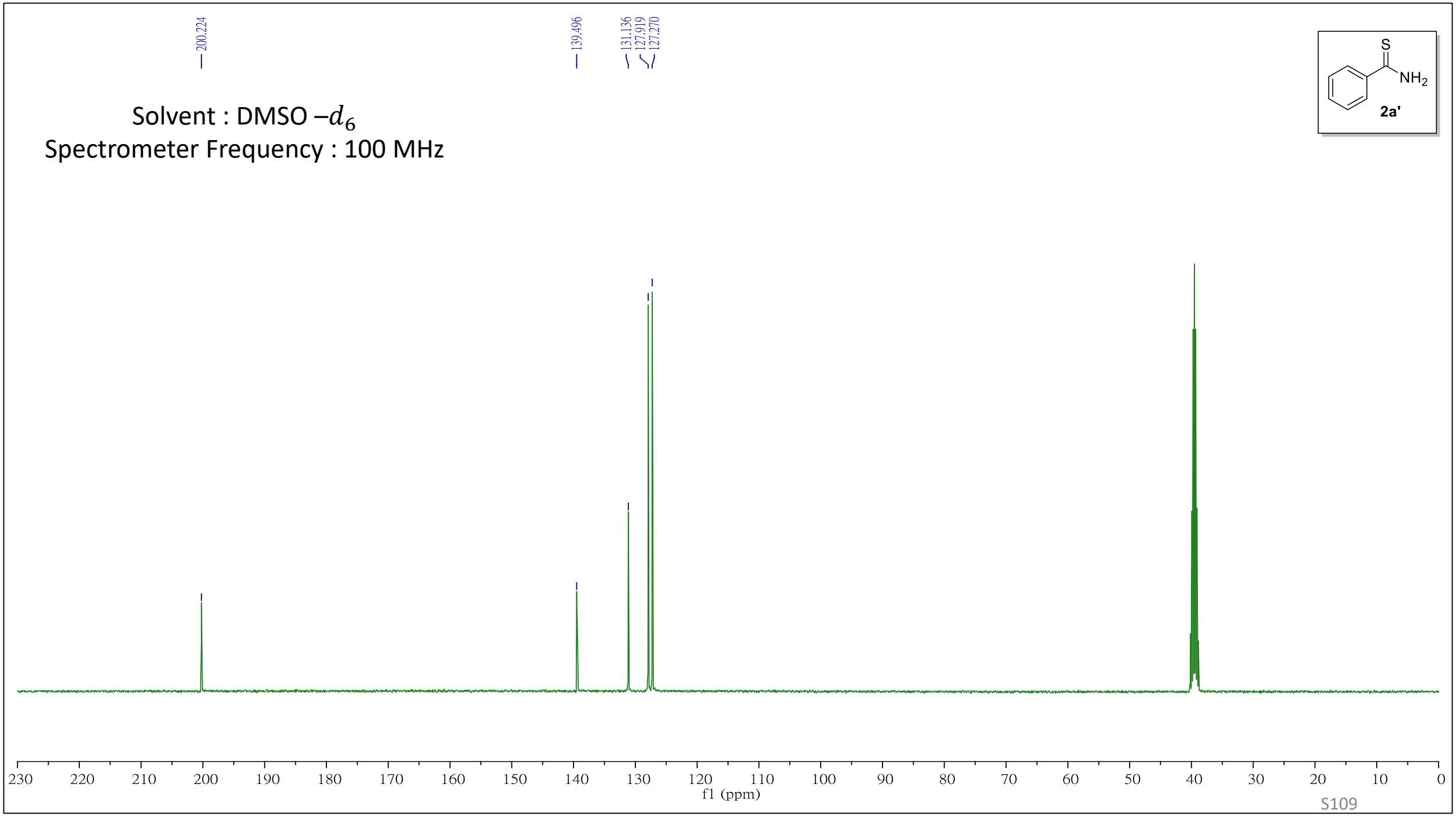
2ak




7.439
7.432
7.431
7.424
7.422
7.421
7.415
7.402
7.395
7.389
7.380
7.374
7.370
2.977
2.891
Solvent : DMSO –d_6
Spectrometer Frequency : 400 MHz
O
N
4a
4.71
2.83
2.92
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

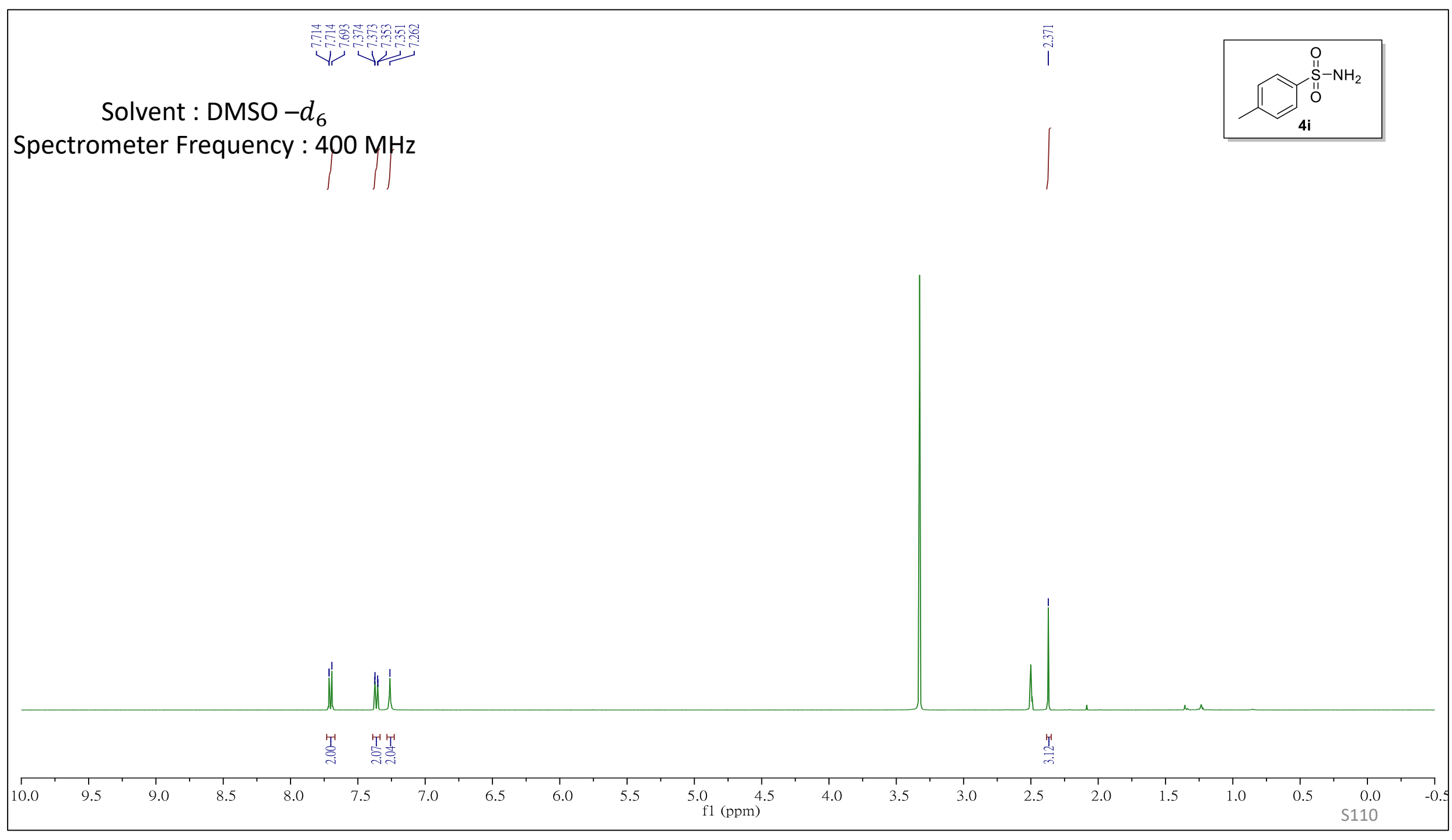

170.109
136.519
129.300
128.263
126.881
34.709
O
N
4a
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


9.867
9.492
7.893
7.892
7.890
7.888
7.887
7.878
7.872
7.869
7.515
7.498
7.492
7.482
7.479
7.476
7.427
7.424
7.411
7.408
7.404
7.394
7.390
7.388
Solvent : DMSO –d_6
Spectrometer Frequency : 400 MHz
S
NH2
2a'
1.03
1.02
2.00
0.95
2.00
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


200.224
139.496
131.136
127.919
127.270
Solvent : DMSO –d_6
Spectrometer Frequency : 100 MHz
S
NH2
2a'
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

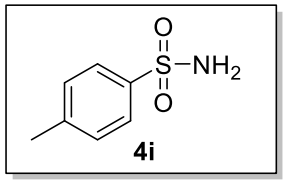
Solvent : DMSO $-d_6$

Spectrometer Frequency : 400 MHz



Solvent : DMSO $-d_6$

Spectrometer Frequency : 100 MHz



4i