Supporting Information

Hydrogenation and Dehydrogenation of *N*-Heterocycles Under Cp*Co(III)-Catalysis

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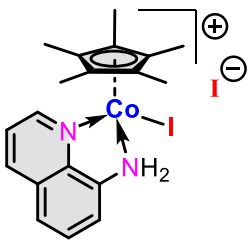
1. General Information:

Unless otherwise mentioned, all reactions were carried out under argon atmosphere. ^{1}H and ^{13}C NMR were recorded on JEOL 400 & 500 MHz spectrometers using $CDCl_3$ solvent. Chemical shifts (δ) are given in ppm relative to TMS and coupling constants (J) in Hz. The solvent signals used as references and the chemical shifts were converted to the TMS scale ($CDCl_3$, δC 77.0 ppm, δH 7.26 ppm). All the reactions were monitored by analytical thin layer chromatography (TLC) using commercial aluminum sheets precoated with silica gel. Column chromatography was conducted on silica gel (Merck, 200–400 mesh). The abbreviations used for ^{1}H NMR spectra to indicate the signal multiplicity are singlet (s), doublet (d), triplet (t), quartet (q), doublet of doublet (dd), doublet of triplet (dt), multiplet (m) etc. HRMS was recorded on Agilent 6546 LC/Q-TOF mass spectrometer. Elemental (CHN) analysis was collected on PerkinElmer 2400 Series Elemental Analyzer instrument. IR data was collected on PerkinElmer FT-IR Spectrometer. X-ray diffraction data was collected on a CCD Bruker SMART APEX diffractometer. XRD data [CCDC-2032617 (for complex **Cat D**), CCDC-2248466 (for complex **Cat E**), and CCDC-1891750 (for complex **Cat F**)] can be obtained free of charge from the Cambridge Crystallographic data centre via www.ccdc.cam.ac.uk/data_request/cif. 1,1-Dichloromthane (DCM) was dried using calcium hydride according to the established protocol. Distilled water is used for the catalytic transfer hydrogenation and oxidative dehydrogenation reactions. All other chemicals including quinolines and tetrahydroquinolines derivatives were received and used as such from various commercial sources.

Cat A-C were prepared according to the reported literature procedure.[1a-c]

2. Isolation & Characterization of Cat D, Cat E, and Cat F Complexes:

Cat D: An oven-dried Schlenk tube equipped with a magnetic stir bar was charged with



[Cp*Co(CO)I_2] (100 mg, 0.211 mmol, 1.0 equiv.), 8-aminoquinoline (30.4 mg, 0.211 mmol, 1.0 equiv.) and 5 mL DCM under Argon atmosphere. The resultant reaction mixture under argon in a closed Schlenk tube was stirred at room temperature for 24 hours. After which the solution was filtered through a pad of celite. The filtrate was concentrated under vacuum to give a black-green solid. The crude solid was further purified by column chromatography using silica gel as a stationary phase and eluted with 10% MeOH/DCM to give Cat **D** as a black-green solid in **88% (110 mg)** yield.

^{1}H NMR (400 MHz, $CDCl_3$): δ 9.40 (d, J=5.27 Hz, 1H), 8.91 (d, J=7.61 Hz, 1H), 8.65 (s, 1H), 8.35 (d, J=7.99 Hz, 1H), 7.83 (dd, J=8.37, 5.42 Hz, 1H), 7.76 (d, J=8.00 Hz, 1H), 7.61 (t, J=8.00 Hz, 1H), 4.47 (s, 1H), 1.82 (s, 15H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 155.53, 147.75, 138.54, 136.72, 130.74, 129.12, 128.18, 126.76, 124.37, 94.23, 11.54.

HRMS: Calculated for $C_{19}H_{23}CoI_2N_2$ is $[M\text{-}I]^+$ 465.0232; found 465.0227.

CHN: Anal. Calcd. for $C_{19}H_{23}CoI_2N_2$: C, 38.54%; H, 3.92%; N, 4.73%; others, 52.81%. Found: C, 37.71%; H, 3.73%; N, 4.62%, others, 53.94%.

IR (cm^{-1}): 3008, 2958, 2920, 1583, 1562, 1509, 1469, 1430, 1366, 1314, 1265, 1151, 1079, 1014, 826, 774, 728, 697, 570, 516, 431.

X-ray Crystal Structure: CCDC 2032617 data can be obtained free of charge from the Cambridge Crystallographic Data Centre.

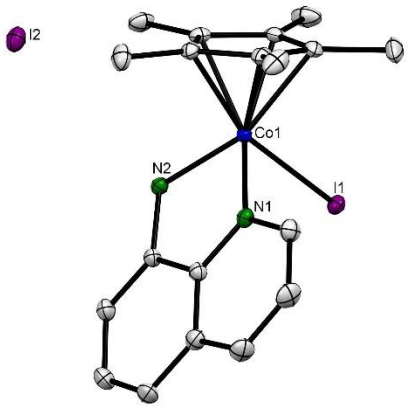
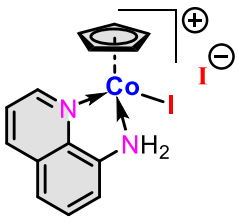


Figure-1. Structure of cobalt complex (Cat **D**) in the solid state. Hydrogen atoms are removed for clarity.

ORTEP diagram of complex Cat **D** with thermal ellipsoids are shown at the 50 % probability level and H atoms are omitted for clarity. Selected bond lengths (Å) and angles (°): Co1−I1 2.6164(3), Co1−N1 1.9609(15), Co1−N2 2.0005(15), I1−Co1−N1 88.34(5), I1−Co1−N2 92.07(5), N1−Co1−N2 83.96(6).

Cat E: An oven-dried Schlenk tube equipped with a magnetic stir bar was charged with



[CpCo(CO)I_2] (86 mg, 0.211 mmol, 1.0 equiv.), 8-aminoquinoline (30.4 mg, 0.211 mmol, 1.0 equiv.) and 5 mL DCM under Argon atmosphere. The resultant reaction mixture under argon in a closed Schlenk tube was stirred at room temperature for 24 hours. After which the solution was filtered through a pad of celite. The filtrate was concentrated under vacuum to give a black-green solid. The crude solid was further purified by column chromatography using silica gel as a stationary phase and eluted with 10% MeOH/DCM to give Cat **E** as a black-green solid in **47% (52 mg)** yield.

^{1}H NMR (400 MHz, $CDCl_3$:DMSO-d^6; 1:1): δ 8.42 (d, *J*=8.42 Hz, 1H), 7.95 (d, *J*=7.94 Hz, 1H), 7.83 (d, *J*=7.98, 1H), 7.44 (t, *J*=7.88 Hz, 1H), 7.24 (d, *J*=7.88, 1H), 6.98 (dd, *J*=7.88, 4.79 Hz, 1H), 6.47-6.38 (m, 2H), 5.88 (s, 5H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$:DMSO-d^6; 1:1): δ 150.48, 147.44, 138.87, 129.72, 120.20, 119.81, 119.51, 117.92, 115.71, 76.15.

HRMS: Calculated for $C_{14}H_{13}CoI_2N_2$ is $[M\text{-}I]^+$ 394.9455; found 394.9444.

CHN: Anal. Calcd. for $C_{14}H_{13}CoI_2N_2$: C, 32.21%; H, 2.51%; N, 5.37%; others, 59.91%. Found: C, 30.15%; H, 2.83%; N, 4.59%, others, 62.43%.

IR (cm^{-1}): 3091, 2919, 2850, 1730, 1609, 1505, 1467, 1412, 1376, 1319, 1257, 1169, 1092, 996, 844, 822, 780, 759, 738, 638, 596.

X-ray Crystal Structure: CCDC 2248466 data can be obtained free of charge from the Cambridge Crystallographic Data Centre.

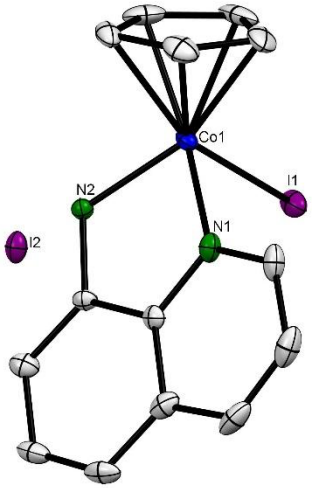
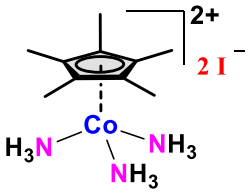


Figure-2. Structure of cobalt complex (Cat **E**) in the solid state. Hydrogen atoms are removed for clarity.

ORTEP diagram of complex Cat **E** with thermal ellipsoids are shown at the 50 % probability level and H atoms are omitted for clarity. Selected bond lengths (Å) and angles (°): Co1−I1 2.6014(6), Co1−N1 1.953(3), Co1−N2 1.980(3), I1−Co1−N1 88.81(10), I1−Co1−N2 92.88(9), N1−Co1−N2 84.26(13).

Cat F: An oven-dried Schlenk tube equipped with a magnetic stir bar was charged with



$[Cp^*CoI_2]_2$ (100 mg, 0.112 mmol, 1.0 equiv.) and 5 mL CH_3OH under Argon atmosphere. To this added ammonia (25% aqueous solution) (1.1 mL, 6.72 mmol, 60.0 equiv.) dropwise and then the resultant reaction mixture under argon in a closed Schlenk tube was stirred at room temperature for 1 hours. After which the solvent was evaporated under reduced pressure. Then the resultant purple color residue was washed several times with diethyl ether to give Cat **F** as a purple solid in **96% (108 mg)** yield.

^{1}H NMR (400 MHz, CD_3OD): δ 1.67 (s, 9H), 1.48 (s, 15H).

^{13}C {^{1}H} NMR (100 MHz, CD_3OD): δ 94.24, 9.13. (because of prolonged recording time of ^{13}C spectra, the solvent interacting with the molecule and hence providing two extra signals i.e., 92.56 and 10.25)

CHN: Anal. Calcd. for $C_{10}H_{24}CoI_2N_3$: C, 24.07%; H, 4.85%; N, 8.42%; others, 62.66%. Found: C, 21.72%; H, 4.42%; N, 8.16%, others, 65.70%.

IR (cm^{-1}): 3197, 3125, 1621, 1482, 1379, 1322, 1283, 1265, 1074, 1019, 783, 730, 712, 480, 464, 436, 405.

X-ray Crystal Structure: CCDC 1891750 data can be obtained free of charge from the Cambridge Crystallographic Data Centre.

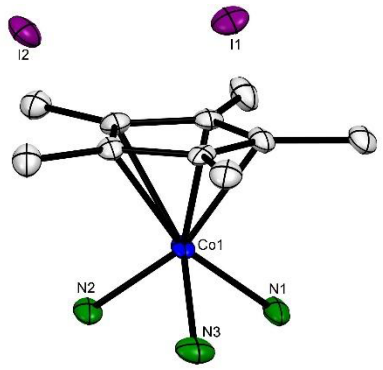


Figure-3. Structure of cobalt complex (Cat **F**) in the solid state. Hydrogen atoms are removed for clarity.

ORTEP diagram of complex Cat **F** with thermal ellipsoids are shown at the 50 % probability level and H atoms are omitted for clarity. Selected bond lengths (Å) and angles (°): Co1−N1 1.911(5), Co1−N2 1.867(5), Co1−N3 2.275(6), N1−Co1−N2 95.4(2), N1−Co1−N3 88.3(2), N2−Co1−N3 91.9(2).

X-ray Crystallographic Data for New Complexes Cat D, Cat E, and Cat F:

Complex	**Cat D**	**Cat E**	**Cat F**
CCDC deposit No.	2032617	2248466	1891750
Lattice	Monoclinic	Monoclinic	Monoclinic
Formula	$C_{19}H_{23}CoI_2N_2$	$C_{14}H_{13}CoI_2N_2$	$C_{10}H_{24}CoI_2N_3$
Formula weight	592.15	521.99	499.05
Space group	P 1 21/n 1	P 1 21/n 1	P 21/n
a/Å	14.4152(3)	9.6531(4)	18.9610
b/Å	9.1360(2)	14.3045(6)	10.6920
c/Å	15.1178(3)	11.2562(5)	17.0590
α/°	90.00	90.00	90.00
β/°	92.250(1)	91.439(1)	85.33
γ/°	90.00	90.00	90.00
V/Å^3	1989.44(7)	1553.80(11)	3447
Z	4	4	8
Temperature (K)	100 (2)	100 (2)	100 (2)
Radiation (λ, Å)	0.71073	0.71073	0.71073
ρ (calcd.), g cm^{-3}	1.977	2.231	1.923

θ max, deg.	28.310	28.351	32.643
No. of Data	4939	3858	8548
No. of Parameters	222	172	305
R_1	0.0162	0.0293	0.0430
wR_2	0.0392	0.0620	0.1574
GOF	1.051	1.079	1.106

3. Preparation of various quinolines derivatives:

The quinolines derivatives used in the present study are either purchased from various commercial sources mentioned in the general information or were synthesized from the literature reported procedure.[2a-c]

4. Preparation of various tetrahydroquinolines derivatives:

The tetrahydroquinolines derivatives used in the present study are either purchased from various commercial sources mentioned in the general information or synthesized with the methodology developed in the present study or synthesized from the literature reported procedure.[3]

5. General experimental procedure A for the catalytic transfer hydrogenation of quinoline with formic acid:

An oven-dried 15 mL Schlenk tube equipped with a magnetic stir bar was charged with catalyst Cat **D** (8.9 mg, 0.015 mmol, 3.0 mol%), quinoline (0.5 mmol, 1.0 equiv.) and HCOOH (178 µL, 4.0 mmol, 8.0 equiv.) followed by addition of 1.25 mL of water (0.4 M) under Argon atmospheres. The closed Schlenk tube containing the reaction mixture was placed in a pre-heated oil bath and stirred at 80 °C for 4 hours. After completion of the reaction time, the reaction mixture was cooled down to room temperature and then quenched with 5.0 mL aq. NaOH (5 M) under air followed by stirring at 80 °C for additional 4 hours. Subsequently, the reaction mixture was cooled down to room temperature and then extracted with ethyl acetate (3*10 mL). The combined organic layer was washed with aqu. NaCl (10 mL) and dried over Na_2SO_4. The volatiles were removed under reduced pressure, and the residue was purified by column chromatography using silica gel as stationary phase and EtOAc/Hexane as mobile phase to get analytically pure tetrahydroquinoline.

6. General experimental procedure B for the catalytic oxidative dehydrogenation of tetrahydroquinoline with molecular oxygen:

An oven-dried 15 mL pressure tube equipped with a magnetic stir bar was charged with catalyst Cat **D** (8.9 mg, 0.015 mmol, 3.0 mol%) and tetrahydroquinoline (0.5 mmol, 1.0 equiv.) followed by addition of 2.0 mL of water (0.25 M) under air. The pressure tube is caped with a screwed cap that is connected to a barometer equipped with inlet & outlet valves. Then close pressure

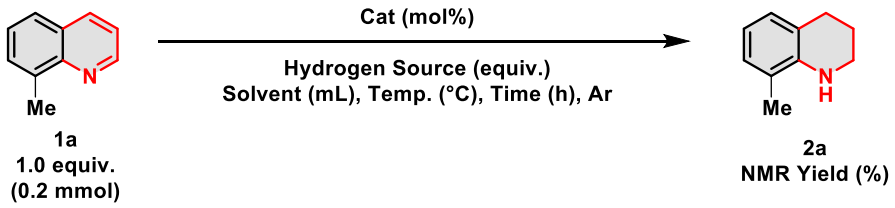
tube was quickly vacuumized and then filled with 5.0 bar of molecular oxygen pressure. The closed pressure tube containing the reaction mixture was placed in a pre-heated oil bath and stirred at 100 °C for 18 hours. After completion of the reaction time, the reaction mixture was cooled down to room temperature and then extracted with ethyl acetate (3*5 mL) and the combined organic layer was washed with aq. NaCl (5 mL) and dried over Na_2SO_4. The solvent was removed under reduced pressure, and the residue was purified by column chromatography using silica gel as stationary phase and EtOAc/Hexane as mobile phase to get analytically pure quinoline.

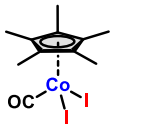
7. Experimental procedure for the gram scale catalytic transfer hydrogenation of quinoline with formic acid (P3):

An oven-dried 100 mL Schlenk tube equipped with a magnetic stir bar was charged with catalyst Cat **D** (137 mg, 0.232 mmol, 3.0 mol%), quinoline (**1b**) (1.0g, 7.74 mmol, 1.0 equiv.) and HCOOH (2.8 mL, 61.9 mmol, 8.0 equiv.) followed by addition of 20 mL of water (0.39 M) under Argon atmospheres. The closed Schlenk tube containing the reaction mixture was placed in a pre-heated oil bath and stirred at 80 °C for 4 hours. After completion of the reaction time, the reaction mixture was cooled down to room temperature and then quenched with 25 mL aq. NaOH (15 M) under air followed by stirring at 80 °C for additional 4 hours. After this the reaction mixture was cooled down to room temperature and then extracted with ethyl acetate (3*20 mL). The combined ethyl acetate extract was washed with aq. NaCl (20 mL) and dried over Na_2SO_4. The solvent was removed under reduced pressure, and the residue was purified by column chromatography using silica gel as stationary phase and 4% EtOAc/Hexane as mobile phase to get analytically pure tetrahydroquinoline (**2b**) in 76% (780 mg) yield as colorless liquid.

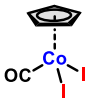
8. Reaction Optimization: Transfer hydrogenation of quinoline with formic acid:

Table-S1. Reaction Optimization: Transfer hydrogenation of quinoline with formic acid.

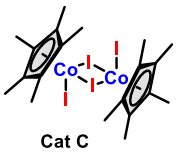




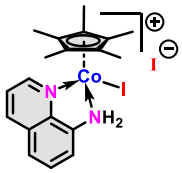
Cat A



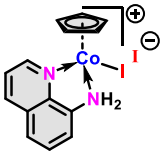
Cat B



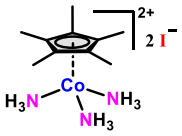
Cat C



Cat D



Cat E



Cat F

Entry[a]	Catalyst (mol%)	[H-Source] (Equiv.)	Solvent (mL)	Temp (°C)	Time (h)	NMR Yield[b] (%)
1	Cat **A** (5)	HCOOH (10)	Water (1)	80	16	n.d.
2	Cat **B** (5)	HCOOH (10)	Water (1)	80	16	n.d.
3	Cat **C** (5)	HCOOH (10)	Water (1)	80	16	n.d.
4	Cat **D** (5)	HCOOH (10)	Water (1)	80	16	>99
5	Cat **E** (5)	HCOOH (10)	Water (1)	80	16	n.d.
6	Cat **F** (5)	HCOOH (10)	Water (1)	80	16	n.d.
7	Cat **D** (5)	HCOOH (10)	Methanol (1)	80	16	n.d.
8	Cat **D** (5)	HCOOH (10)	Ethanol (1)	80	16	n.d.
9	Cat **D** (5)	HCOOH (10)	*iso*-PrOH (1)	80	16	n.d.
10	Cat **D** (5)	HCOOH (10)	Acetonitrile (1)	80	16	n.d.
11	Cat **D** (5)	HCOOH (10)	DCM (1)	80	16	n.d.
12	Cat **D** (5)	HCOOH (10)	1,1,1-TFE (1)	80	16	n.d.
13	Cat **D** (5)	HCOOH (10)	Acetone (1)	80	16	n.d.
14	Cat **D** (5)	HCOOH (10)	1,2-DCE (1)	80	16	n.d.
15	Cat **D** (5)	HCOOH (10)	DMF (1)	80	16	n.d.
16	Cat **D** (5)	HCOOH (10)	1,4-Dioxane (1)	80	16	n.d.
17	Cat **D** (5)	HCOOH (10)	THF (1)	80	16	n.d.
18	Cat **D** (5)	HCOOH (10)	Toluene (1)	80	16	n.d.

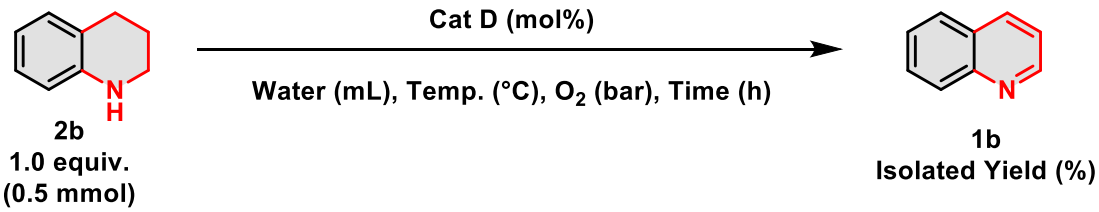
19	Cat **D** (5)	HCOOH (10)	$^{n}Bu_2O$ (1)	80	16	n.d.
20	Cat **D** (5)	$HCOOCH_3$ (10)	Water (1)	80	16	n.d.
21	Cat **D** (5)	CH_3COOH (10)	Water (1)	80	16	n.d.
22	Cat **D** (5)	$HCOONH_4$ (10)	Water (1)	80	16	6
23	Cat **D** (5)	CH_3COONH_4 (10)	Water (1)	80	16	n.d.
24	Cat **D** (5)	H_3NBH_3 (10)	Water (1)	80	16	26
25	Cat **D** (5)	H_2 (60 bar)	Water (1)	80	16	15
26[c]	Cat **D** (5)	HCOOH (10)	Water (1)	80	16	6
27	Cat **D** (5)	HCOOH (10)	Water (1)	110	16	>99
28	Cat **D** (5)	HCOOH (10)	Water (1)	70	16	91
29	Cat **D** (5)	HCOOH (10)	Water (1)	60	16	88
30	Cat **D** (5)	HCOOH (10)	Water (1)	RT	16	2
31	Cat **D** (5)	HCOOH (8)	Water (1)	80	16	>99
32	Cat **D** (5)	HCOOH (6)	Water (1)	80	16	94
33	Cat **D** (5)	HCOOH (4)	Water (1)	80	16	91
34	Cat **D** (5)	HCOOH (2)	Water (1)	80	16	89
35	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	16	>99
36	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	14	>99
37	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	12	>99
38	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	8	>99
39	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	4	>99
40	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	3	79
41	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	1.5	65
42	Cat **D** (5)	HCOOH (8)	Water (0.5)	80	0.5	25
43	Cat **D** (3)	HCOOH (8)	Water (0.5)	80	4	>99
44	Cat **D** (2)	HCOOH (8)	Water (0.5)	80	4	59
45	Cat **D** (1)	HCOOH (8)	Water (0.5)	80	4	33

46	----------	HCOOH (8)	Water (0.5)	80	4	n.d.
47	Cat **D** (3)	----------	Water (0.5)	80	4	n.d.
48	Cat **D** (3)	HCOOH (8)	----------	80	4	13
49	----------	----------	Water (0.5)	80	4	n.d.

[a]Unless otherwise stated, all reactions were performed using 8MQ (**1a**)/[**Cat**]/HCOOH in 0.2/0.006/1.6 mmol with water (0.4 M) as solvent at 80 °C for 4h under Argon atmosphere. [b]Anisole is used as the internal standard for NMR yield calculation. [c]Reaction performed under air atmosphere. N.d.=not determined.

9. Reaction optimization: Oxidative dehydrogenation of tetrahydroquinoline with molecular oxygen

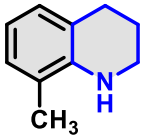
Table-2. Reaction optimization: Oxidative dehydrogenation of tetrahydroquinoline with molecular oxygen.



Entry	Catalyst (mol%)	H_2O (mL)	Temp. (°C)	Time (h)	O_2 (bar)	Isolated Yield (%)
1	3.0	1 mL	80	14	5	66
2	3.0	1 mL	100	14	5	79
3	3.0	3 mL	100	14	5	90
4	3.0	3 mL	100	04	5	46
5	3.0	3 mL	100	18	5	93
6	1.0	3 mL	100	18	5	68
7	2.0	3 mL	100	18	5	88
8	3.0	2 mL	100	18	5	94
9	3.0	1.5 mL	100	18	5	89
10	3.0	2 mL	100	18	3	74
11	3.0	2 mL	100	18	Argon	n.d.
12	3.0	2 mL	100	18	Air	n.d.

10. Analytical data of the isolated products:

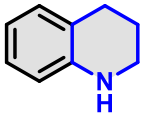
8-methyl-1,2,3,4-tetrahydroquinoline (2a): Compound **2a** was prepared according to the general procedure **P1** from its corresponding quinoline (71.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **96%** (**70.7 mg**) yield as colorless liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): *δ* 6.97-6.92 (m, 2H), 6.66-6.62 (m, 1H), 3.63 (br s, 1H), 3.46-3.43 (m, 2H), 2.87 (t, *J*=7.91 Hz, 2H), 2.16 (s, 3H), 2.05-1.99 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): *δ* 142.61, 127.75, 127.28, 121.06, 120.75, 116.30, 42.26, 27.22, 22.09, 17.05.

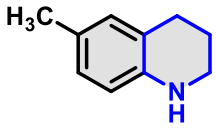
1,2,3,4-tetrahydroquinoline (2b): Compound **2b** was prepared according to the general procedure **P1** from its corresponding quinoline (64.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **90%** (**59.7 mg**) yield as colorless liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): *δ* 7.04-6.99 (m, 2H), 6.68-6.63 (m, 1H), 6.51 (d, *J*=7.84 Hz, 1H), 3.66 (s, 1H), 3.35-3.32 (m, 2H) 2.82 (t, *J*=6.08 Hz, 2H), 2.02-1.95 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): *δ* 144.68, 129.41, 126.62, 121.32, 116.82, 114.09, 41.89, 26.89, 22.09.

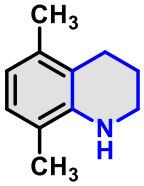
6-methyl-1,2,3,4-tetrahydroquinoline (2c): Compound **2c** was prepared according to the general procedure **P1** from its corresponding quinoline (71.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **75%** (**55.4 mg**) yield as colorless liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): *δ* 6.80 (d, *J*=5.11 Hz, 2H), 6.43 (d, *J*=8.48, 1H), 3.46 (br s, 1H), 3.29 (t, *J*=5.72 Hz, 2H), 2.76 (t, *J*=5.72 Hz, 2H), 2.23 (s, 3H), 1.98-1.92 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): *δ* 142.34, 130.02, 127.19, 126.21, 121.56, 114.42, 42.14, 26.87, 22.39, 20.36.

5,8-dimethyl-1,2,3,4-tetrahydroquinoline (2d): Compound **2d** was prepared according to the general procedure **P1** from its corresponding quinoline (78.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **90%** (**72.8 mg**) yield as colorless liquid.

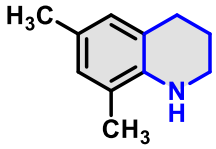


^{1}H NMR (400 MHz, $CDCl_3$): *δ* 6.83 (d, *J*=7.54 Hz, 1H), 6.50 (d, *J*=7.54 Hz, 1H), 3.67 (br s, 1H), 3.36 (t, *J*=5.65 Hz, 2H), 2.69 (t, *J*=5.65 Hz, 2H), 2.19 (s, 3H), 2.10 (s, 3H), 2.06-1.98 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.63, 134.75, 127.23, 119.70, 119.19, 118.27, 41.77, 24.36, 22.34, 19.26, 17.06.

HRMS: Calculated for $C_{11}H_{15}N$ is $[M+H]^+$ 162.1277; found 162.1270.

6,8-dimethyl-1,2,3,4-tetrahydroquinoline (2e): Compound **2e** was prepared according to the general procedure **P1** from its corresponding quinoline (78.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **93%** (**74.8 mg**) yield as colorless liquid.

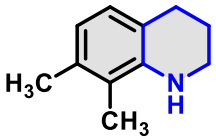


^{1}H NMR (400 MHz, $CDCl_3$): δ 6.78 (s, 1H), 6.74 (s, 1H), 3.40 (t, *J*=5.09 Hz, 2H), 2.82 (t, J=5.10 Hz, 2H), 2.26 (s, 3H), 2.12 (s, 3H), 2.02-1.96 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 140.22, 128.53, 127.76, 125.62, 121.49, 121.04, 42.45, 27.17, 22.36, 20.28, 17.02.

HRMS: Calculated for $C_{11}H_{15}N$ is $[M+H]^+$ 162.1277; found 162.1270.

7,8-dimethyl-1,2,3,4-tetrahydroquinoline (2f): Compound **2f** was prepared according to the general procedure **P1** from its corresponding quinoline (78.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **81%** (**65.4 mg**) yield as colorless liquid.

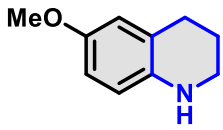


^{1}H NMR (400 MHz, $CDCl_3$): δ 6.78 (d, *J*=7.62 Hz, 1H), 6.51 (d, *J*=7.62 Hz, 1H), 3.39 (t, *J*=5.73 Hz, 2H), 2.79 (t, *J*=6.52 Hz, 2H), 2.26 (s, 3H), 2.01 (s, 3H), 1.97-1.91 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.52, 134.13, 126.50, 119.48, 118.86, 118.56, 42.47, 27.25, 22.16, 20.37, 12.33.

HRMS: Calculated for $C_{11}H_{15}N$ is $[M+H]^+$ 162.1277; found 162.1279.

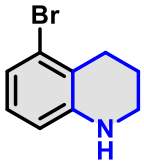
6-methoxy-1,2,3,4-tetrahydroquinoline (2g): Compound **2g** was prepared according to the general procedure **P1** from its corresponding quinoline (79.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **46%** (**37.8 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): δ 6.61-6.56 (m, 2H), 6.47 (d, *J*=7.81 Hz, 1H), 3.73 (s, 3H), 3.26 (t, *J*=5.47 Hz, 2H), 2.76 (t, *J*=6.84 Hz, 2H), 1.99-1.90 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 151.98, 138.53, 123.06, 115.74, 114.89, 112.91, 55.80, 42.34, 27.11, 22.38.

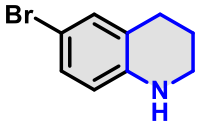
5-bromo-1,2,3,4-tetrahydroquinoline (2h): Compound **2h** was prepared according to the general procedure **P1** from its corresponding quinoline (103.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **75%** (**79.6 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[5]



^{1}H NMR (400 MHz, $CDCl_3$): δ 6.89-6.80 (m, 2H), 6.42 (d, *J*=7.49 Hz, 1H), 3.74 (s, 1H), 3.26 (t, *J*=5.71 Hz, 2H), 2.78 (t, *J*=5.71 Hz, 2H), 2.00-1.94 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 146.36, 127.49, 125.89, 120.73, 120.67, 113.14, 41.41, 27.58, 22.13.

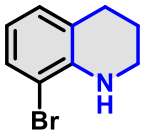
6-bromo-1,2,3,4-tetrahydroquinoline (2i): Compound **2i** was prepared according to the general procedure **P1** from its corresponding quinoline (103.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **70%** (**74.1 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.08-6.97 (m, 2H), 6.34 (d, *J*=8.56 Hz, 1H), 3.43 (br s, 1H), 3.28 (t, *J*=5.79 Hz, 2H), 2.73 (t, *J*=5.79 Hz, 2H), 1.94-1.88 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 143.62, 131.80, 129.30, 123.37, 115.50, 108.17, 41.74, 26.77, 21.62.

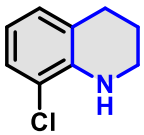
8-bromo-1,2,3,4-tetrahydroquinoline (2j): Compound **2j** was prepared according to the general procedure **P1** from its corresponding quinoline (103.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (2% EtOAc/Hexane) in **71%** (**74.9 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[6]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.24 (d, *J*=8.28 Hz, 1H), 6.90 (dd, *J*=6.67, 1.22 Hz, 1H), 6.46 (t, *J*=8.27, 1H), 4.45 (s, 1H), 3.40 (t, *J*=6.65 Hz, 2H), 2.79 (t, *J*=6.65 Hz, 2H), 1.97-1.91 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 141.64, 129.95, 128.33, 122.77, 116.84, 108.65, 41.99, 27.39, 21.65.

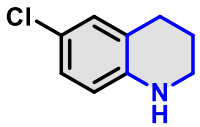
8-chloro-1,2,3,4-tetrahydroquinoline (2k): Compound **2k** was prepared according to the general procedure **P1** from its corresponding quinoline (81.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (2% EtOAc/Hexane) in **80%** (**66.7 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.08 (d, *J*=8.17 Hz, 1H), 6.87 (d, *J*=7.17 Hz, 1H), 6.53 (t, *J*=7.17 Hz, 1H), 4.43 (s, 1H), 3.40 (t, *J*=5.46 Hz, 2H), 2.79 (t, *J*=5.46 Hz, 2H), 2.01-1.89 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 140.67, 127.60, 126.71, 122.57, 117.98, 116.21, 41.74, 27.17, 21.60.

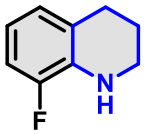
6-chloro-1,2,3,4-tetrahydroquinoline (2l): Compound **2l** was prepared according to the general procedure **P1** from its corresponding quinoline (81.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **94%** (**78.9 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): δ 6.91 (d, *J*=8.40 Hz, 2H), 6.38 (d, *J*=8.07 Hz, 1H), 3.70 (s, 1H), 3.28 (t, *J*=6.62 Hz, 2H), 2.73 (t, *J*=7.25 Hz, 2H), 1.95-1.89 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 143.23, 128.94, 126.42, 122.79, 121.04, 115.01, 41.78, 26.80, 21.67.

8-fluoro-1,2,3,4-tetrahydroquinoline (2m): Compound **2m** was prepared according to the general procedure **P1** from its corresponding quinoline (73.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **88%** (**66.9 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[4]

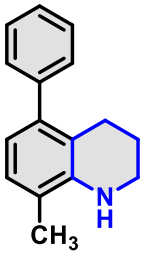


^{1}H NMR (400 MHz, $CDCl_3$): δ 6.83-6.74 (m, 2H), 6.54-6.49 (m, 1H), 4.01 (s, 1H), 3.35 (t, *J*=7.47 Hz, 2H), 2.79 (t, *J*=6.32 Hz, 2H), 2.00-1.94 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 150.87 (d, $J^{1}_{C\text{-}F}$ =237.5 Hz), 133.14 (d, $J^{2}_{C\text{-}F}$ = 12.1 Hz), 124.43 (d, $J^{4}_{C\text{-}F}$ = 2.6 Hz), 123.55 (d, $J^{3}_{C\text{-}F}$ = 3.6 Hz), 115.46 (d, $J^{3}_{C\text{-}F}$ = 7.4 Hz), 112.08 (d, $J^{2}_{C\text{-}F}$ = 18.1 Hz), 41.23, 26.51 (d, $J^{4}_{C\text{-}F}$ = 2.7 Hz), 21.76.

^{19}F NMR (377 MHz, $CDCl_3$): δ -138.92 (dd, $J^{3}_{F\text{-}H}$ = 11.2, $J^{4}_{F\text{-}H}$ = 5.2 Hz).

8-methyl-5-phenyl-1,2,3,4-tetrahydroquinoline (2n): Compound **2n** was prepared according to the general procedure **P1** from its corresponding quinoline (109.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **67%** (**74.4 mg**) yield as colorless viscous liquid.



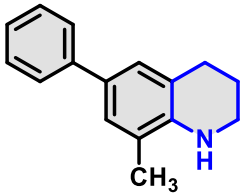
^{1}H NMR (400 MHz, $CDCl_3$): δ 7.42-7.37 (m, 2H), 7.33-7.29 (m, 3H), 6.97 (d, *J*=7.71 Hz, 1H), 6.56 (d, *J*=7.71 Hz, 1H), 3.41 (t, *J*=6.37 Hz, 2H), 2.65 (t, *J*=7.16 Hz, 2H), 2.17 (s, 3H), 1.89-1.83 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.06, 141.96, 140.59, 129.23, 127.87, 127.58, 126.48, 120.74, 118.67, 118.47, 42.11, 26.09, 21.98, 17.38.

HRMS: Calculated for $C_{16}H_{17}N$ is $[M+H]^+$ 224.1434; found 224.1433.

8-methyl-6-phenyl-1,2,3,4-tetrahydroquinoline (2o): Compound **2o** was prepared according to the general procedure **P1** from its corresponding quinoline (109.5 mg, 0.5 mmol, 1.0 equiv.) and

purified by column chromatography (4% EtOAc/Hexane) in **62%** (**72.8 mg**) yield as whitish viscous liquid.

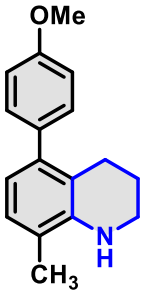


^{1}H NMR (400 MHz, $CDCl_3$): δ 7.56-7.53 (m, 2H), 7.41-7.36 (m, 2H), 7.27-7.23 (m, 1H), 7.16 (d, *J*=13.57 Hz, 2H), 3.43 (t, *J*=6.07 Hz, 2H), 2.88 (t, *J*=7.29 Hz, 2H), 2.17 (s, 3H), 2.03-1.97 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.05, 141.61, 129.52, 128.50, 126.71, 126.33, 126.03, 125.81, 121.55, 121.17, 42.38, 27.41, 22.13, 17.29.

HRMS: Calculated for $C_{16}H_{17}N$ is $[M+H]^+$ 224.1434; found 224.1427.

5-(4-methoxyphenyl)-8-methyl-1,2,3,4-tetrahydroquinoline (2p): Compound **2p** was prepared according to the general procedure **P1** from its corresponding quinoline (124.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **78%** (**98.2 mg**) yield as colorless viscous liquid.

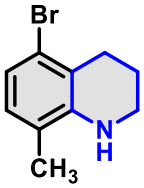


^{1}H NMR (400 MHz, $CDCl_3$): δ 7.29-7.25 (m, 2H), 6.97-6.94 (m, 3H), 6.55 (d, *J*=7.32 Hz, 1H), 3.86 (s, 3H), 3.41 (t, *J*=5.37 Hz, 2H), 2.68 (t, *J*=6.26 Hz, 2H), 2.16 (s, 3H), 1.90-1.84 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 158.32, 142.38, 140.17, 134.58, 130.25, 127.51, 120.12, 118.52, 118.24, 113.30, 55.23, 42.09, 26.20, 22.13, 17.27.

HRMS: Calculated for $C_{17}H_{19}NO$ is $[M+H]^+$ 254.1540; found 254.1549.

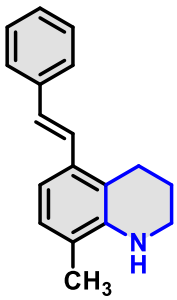
5-bromo-8-methyl-1,2,3,4-tetrahydroquinoline (2q): Compound **2q** was prepared according to the general procedure **P1** from its corresponding quinoline (110.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **83%** (**93.1 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[7]



^{1}H NMR (400 MHz, $CDCl_3$): δ 6.83 (d, *J*=8.56 Hz, 1H), 6.75 (d, *J*=8.56 Hz, 1H), 3.34 (t, *J*=4.85 Hz, 2H), 2.80 (t, *J*=6.26 Hz, 2H), 2.05 (s, 3H), 2.00-1.94 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 144.18, 128.77, 128.62, 123.24, 120.21, 120.01, 41.72, 27.90, 22.07, 16.97.

8-methyl-5-styryl-1,2,3,4-tetrahydroquinoline (2r): Compound **2r** was prepared according to the general procedure **P1** from its corresponding quinoline (122.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **67%** (**83.2 mg**) yield as colorless liquid.

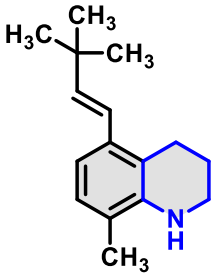


^{1}H NMR (400 MHz, $CDCl_3$): δ 7.54 (d, *J*=7.42 Hz, 2H), 7.40-7.36 (m, 2H), 7.32-7.26 (m, 2H), 7.03-6.92 (m, 3H), 3.39 (t, *J*=5.75 Hz, 2H), 2.92 (t, *J*=5.53 Hz, 2H), 2.14 (s, 3H), 2.06-2.00 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.78, 137.99, 134.98, 129.39, 128.57, 127.79, 127.23, 126.80, 126.42, 121.03, 118.84, 114.31, 41.68, 24.51, 22.24, 17.33.

HRMS: Calculated for $C_{18}H_{19}N$ is $[M+H]^+$ 250.1590; found 250.1578.

5-(3,3-dimethylbut-1-en-1-yl)-8-methyl-1,2,3,4-tetrahydroquinoline (2s): Compound **2s** was prepared according to the general procedure **P1** from its corresponding quinoline (112.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **69%** (**79.2 mg**) yield as colorless viscous liquid.

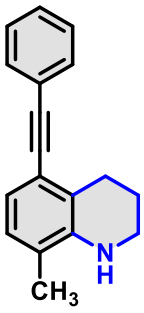


^{1}H NMR (400 MHz, $CDCl_3$): δ 6.84 (dd, *J*=14.74, 7.30 Hz, 1H), 6.73 (d, *J*=8.13 Hz, 1H), 6.43 (d, *J*=15.84 Hz, 1H), 6.04 (d, *J*=15.84 Hz, 1H), 3.36-3.32 (m, 2H), 2.85-2.72 (m, 2H), 2.09 (s, 3H), 2.04 (s, 1H), 2.01-1.93 (m, 2H), 1.12 (s, 9H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.89, 135.96, 128.63, 127.63, 122.29, 119.94, 118.53, 114.66, 41.78, 35.51, 29.70, 24.43, 22.29, 17.27.

HRMS: Calculated for $C_{16}H_{23}N$ is $[M+H]^+$ 230.1903; found 230.1904.

8-methyl-5-(phenylethynyl)-1,2,3,4-tetrahydroquinoline (2t): Compound **2t** was prepared according to the general procedure **P1** from its corresponding quinoline (121.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **62%** (**76.8 mg**) yield as colorless viscous liquid.

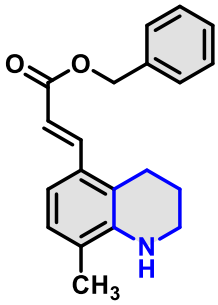


^{1}H NMR (400 MHz, $CDCl_3$): δ 7.54-7.50 (m, 2H), 7.36-7.31 (m, 3H), 6.86 (q, *J*=7.19 Hz, 2H), 3.39-3.37 (m, 2H), 3.00 (t, *J*=6.49 Hz, 2H), 2.11 (s, 3H), 2.02-1.98 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.64, 131.43, 128.26, 127.84, 127.52, 123.90, 122.77, 122.04, 120.85, 120.54, 92.64, 88.73, 41.95, 25.85, 21.91, 17.40.

HRMS: Calculated for $C_{18}H_{17}N$ is $[M+H]^+$ 248.1434; found 248.1431.

benzyl-3-(8-methyl-1,2,3,4-tetrahydroquinolin-5-yl)acrylate (2u): Compound **2u** was prepared according to the general procedure **P1** from its corresponding quinoline (151.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **64%** (**98.3 mg**) yield as yellow liquid.

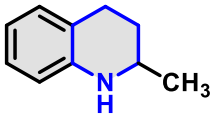


^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (d, *J*=15.63 Hz, 1H), 7.44-7.30 (m, 5H), 6.92-6.86 (m, 2H), 6.36 (d, *J*=15.63 Hz, 1H), 5.26 (s, 2H), 3.35 (t, *J*=5.19 Hz, 2H), 2.89 (t, *J*=6.81 Hz, 2H), 2.10 (s, 3H), 2.01-1.95 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 167.12, 143.31, 143.07, 136.23, 131.72, 128.52, 128.17, 128.11, 127.91, 123.51, 120.18, 117.98, 115.02, 66.13, 41.53, 24.31, 21.92, 17.49.

HRMS: Calculated for $C_{20}H_{21}NO_2$ is $[M+H]^+$ 308.1645; found 308.1647.

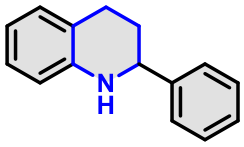
2-methyl-1,2,3,4-tetrahydroquinoline (2v): Compound **2v** was prepared according to the general procedure **P1** from its corresponding quinoline (71.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **72%** (**52.9 mg**) yield as colorless liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): δ 6.99 (t, *J*=6.25 Hz, 2H), 6.64 (t, *J*=7.42 Hz, 1H), 6.50 (d, *J*=8.36 Hz, 1H), 3.67 (br s, 1H), 3.47-3.39 (m, 1H), 2.91-2.83 (m, 1H), 2.79-2.73 (m, 1H), 1.99-1.93 (m, 1H), 1.67-1.57 (m, 1H), 1.24 (d, *J*=6.35 Hz, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 144.73, 129.21, 126.64, 121.05, 116.93, 113.96, 47.11, 30.10, 26.55, 22.56.

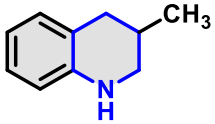
2-phenyl-1,2,3,4-tetrahydroquinoline (2w): Compound **2w** was prepared according to the general procedure **P1** from its corresponding quinoline (102.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **38%** (**39.9 mg**) yield as colorless viscous liquid. The NMR data is in accordance with the reported literature.[8]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.44-7.26 (m, 5H), 7.04 (d, *J*=7.61 Hz, 2H), 6.69 (t, *J*=7.99 Hz, 1H), 6.57 (d, *J*=8.58 Hz, 1H), 4.47 (dd, *J*=9.55, 3.41 Hz, 1H), 4.06 (s, 1H), 2.96 (ddd, *J*=16.36, 11.42, 5.86 Hz, 1H), 2.77 (dt, *J*=16.05, 4.63 Hz, 1H), 2.19-2.13 (m, 1H), 2.08-1.99 (m, 1H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 144.94, 144.85, 129.41, 128.69, 127.55, 127.02, 126.67, 120.99, 117.28, 114.10, 56.37, 31.10, 26.50.

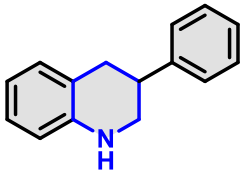
3-methyl-1,2,3,4-tetrahydroquinoline (2x): Compound **2x** was prepared according to the general procedure **P1** from its corresponding quinoline (71.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **60%** (**43.9 mg**) yield as pale-yellow liquid. The NMR data is in accordance with the reported literature.[4]



^{1}H NMR (400 MHz, $CDCl_3$): δ 6.96 (dd, *J*=13.19, 8.03 Hz, 2H), 6.61 (td, *J*=7.46, 1.29 Hz, 1H), 6.49 (d, *J*=8.03 Hz, 1H), 3.69 (br s, 1H), 3.28 (ddd, *J*=5.66, 3.69, 1.88 Hz, 1H), 2.90 (dd, *J*=11.26, 10.21 Hz, 1H), 2.79 (ddd, *J*=6.68, 5.10, 1.57 Hz, 1H), 2.44 (dd, *J*=17.41, 10.86 Hz, 1H), 2.11-2.02 (m, 1H), 1.06 (d, *J*=6.29 Hz, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 144.18, 129.51, 126.67, 121.14, 116.96, 113.89, 48.82, 35.44, 27.16, 19.01.

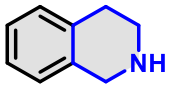
3-phenyl-1,2,3,4-tetrahydroquinoline (2y): Compound **2y** was prepared according to the general procedure **P1** from its corresponding quinoline (102.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (2% EtOAc/Hexane) in **32%** (**33.4 mg**) yield as white solid. The NMR data is in accordance with the reported literature.[9]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.39-7.35 (m, 2H), 7.29-7.26 (m, 3H), 7.03 (d, *J*=7.77 Hz, 2H), 6.70-6.65 (m, 1H), 6.58 (d, *J*=7.39 Hz, 1H), 3.48 (ddd, *J*=5.64, 3.98, 2.14 Hz, 1H), 3.36 (t, *J*=10.62 Hz, 1H), 3.21-3.13 (m, 1H), 3.09-2.96 (m, 2H). (NH peak not detected)

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 143.92, 143.79, 129.50, 128.57, 127.18, 126.94, 126.63, 121.35, 117.12, 114.06, 48.29, 38.63, 34.58.

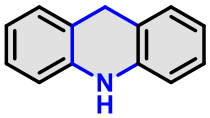
1,2,3,4-tetrahydroisoquinoline (2z): Compound **2z** was prepared according to the general procedure **P1** from its corresponding quinoline (64.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **65%** (**43.4 mg**) yield as colorless liquid. The NMR data is in accordance with the reported literature.[10]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.15-7.07 (m, 3H), 7.02-6.96 (m, 1H), 4.01 (s, 2H), 3.13 (t, *J*=6.26 Hz, 2H), 2.80 (t, *J*=5.94 Hz, 2H), 1.91 (s, 1H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 135.88, 134.69, 129.22, 126.11, 125.90, 125.61, 48.24, 43.82, 29.10.

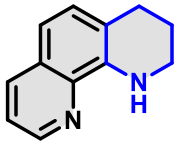
9,10-dihydroacridine (2aa): Compound **2aa** was prepared according to the general procedure **P1** from its corresponding quinoline (89.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (3% EtOAc/Hexane) in **84%** (**75.9 mg**) yield as white solid. The NMR data is in accordance with the reported literature.[10]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.14-7.09 (m, 4H), 6.90-6.87 (m, 2H), 6.68 (d, *J*=8.14 Hz, 2H), 5.95 (s, 1H), 4.08 (s, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 140.07, 128.56, 126.95, 120.58, 119.99, 113.40, 31.34.

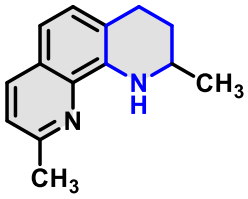
1,2,3,4-tetrahydro-1,10-phenanthroline (2ab): Compound **2ab** was prepared according to the general procedure **P1** from its corresponding quinoline (90.0 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **36%** (**33.6 mg**) yield as yellow liquid. The NMR data is in accordance with the reported literature.[11]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.68 (dd, *J*=4.34, 1.45 Hz, 1H), 8.03 (d, *J*=8.21 Hz, 1H), 7.30 (dd, *J*=8.81, 4.59 Hz, 1H), 7.17 (d, *J*=7.92 Hz, 1H), 6.98 (d, *J*=8.36 Hz, 1H), 6.00 (s, 1H), 3.54 (t, *J*=5.78 Hz, 2H), 2.93 (t, *J*=5.99 Hz, 2H), 2.10-2.02 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 146.88, 140.64, 137.41, 135.92, 129.07, 127.36, 120.51, 116.61, 113.08, 41.26, 27.03, 21.80.

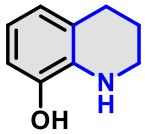
2,9-dimethyl-1,2,3,4-tetrahydro-1,10-phenanthroline (2ac): Compound **2ac** was prepared according to the general procedure **P1** from its corresponding quinoline (104.0 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **42%** (**44.8 mg**) yield as yellow liquid. The NMR data is in accordance with the reported literature. [11]



^{1}H NMR (400 MHz, $CDCl_3$): δ 7.89 (d, *J*=7.22 Hz, 1H), 7.17 (d, *J*=8.66 Hz, 1H), 7.11 (d, *J*=9.39 Hz, 1H), 6.95 (d, *J*=7.58 Hz, 1H), 5.86 (s, 1H), 3.63-3.56 (m, 1H), 3.05-2.96 (m, 1H), 2.90-2.84 (m, 1H), 2.69 (s, 3H), 2.08-2.02 (m, 1H), 1.78-1.69 (m, 1H), 1.39 (d, *J*=6.18 Hz, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 155.68, 140.00, 136.73, 135.93, 127.76, 125.26, 121.21, 116.53, 113.20, 46.57, 30.00, 26.62, 25.13, 22.46.

1,2,3,4-tetrahydroquinolin-8-ol (2ad): Compound **2ad** was prepared according to the general procedure **P1** from its corresponding quinoline (72.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (14% EtOAc/Hexane) in **69%** (**51.4 mg**) yield as yellowish solid. The NMR data is in accordance with the reported literature.[10]

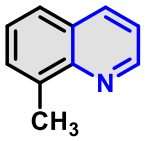


^{1}H NMR (400 MHz, $CDCl_3$): δ 6.72-6.29 (m, 3H), 4.17 (br s, 1H), 3.94 (br s, 1H), 3.42-3.23 (m, 2H), 2.85-2.73 (m, 2H), 1.99-1.90 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 142.93, 133.39, 123.43, 121.85, 116.98, 112.30, 41.76, 26.55, 22.21.

HRMS: Calculated for $C_9H_{11}NO$ is $[M+H]^+$ 150.0913; found 150.0915.

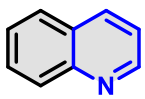
8-methylquinoline (1a): Compound **1a** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (73.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (4% EtOAc/Hexane) in **85%** (**60.5 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[12]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.95-8.94 (m, 1H), 8.13-8.10 (m, 1H), 7.65 (d, *J*=8.34 Hz, 1H), 7.56 (d, *J*=7.33 Hz, 1H), 7.45-7.36 (m, 2H), 2.83 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.16, 147.24, 136.98, 136.32, 129.61, 128.22, 126.26, 125.82, 120.77, 18.12.

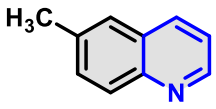
Quinoline (1b): Compound **1b** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (66.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **94%** (**60.5 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[12]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.92-8.89 (m, 1H), 8.13 (t, *J*=9.75 Hz, 2H), 7.80 (d, *J*=8.06 Hz, 1H), 7.73-7.69 (m, 1H), 7.53 (t, *J*=8.06 Hz, 1H), 7.38 (dd, *J*=8.44, 4.45 Hz, 1H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 150.23, 148.08, 136.12, 129.46, 129.28, 128.24, 127.73, 126.52, 121.01.

6-methylquinoline (1c): Compound **1c** was prepared according to the general procedure **P2**

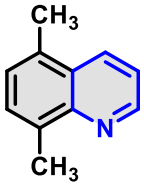


from its corresponding tetrahydroquinoline (73.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **90%** (**64.2 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[12]

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.84-8.81 (m, 1H), 8.06-7.97 (m, 2H), 7.55-7.50 (m, 2H), 7.35-7.30 (m, 1H), 2.52 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.36, 146.73, 136.31, 135.33, 131.68, 128.95, 128.23, 126.49, 120.96, 21.47.

5,8-dimethylquinoline (1d): Compound **1d** was prepared according to the general procedure **P2**

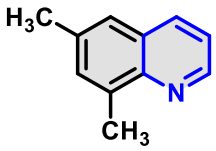


from its corresponding tetrahydroquinoline (80.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **89%** (**69.7 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[13]

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.94 (dd, *J*=4.18, 1.72 Hz, 1H), 8.29 (dd, *J*=8.39, 1.61 Hz, 1H), 7.45-7.39 (m, 2H), 7.25 (d, *J*=7.17 Hz, 1H), 2.78 (s, 3H), 2.63 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 148.60, 147.47, 134.85, 132.65, 132.19, 129.20, 127.56, 126.66, 120.30, 18.40, 18.11.

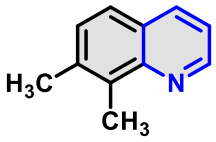
6,8-dimethylquinoline (1e): Compound **1e** was prepared according to the general procedure **P2**



from its corresponding tetrahydroquinoline (80.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **84%** (**65.7 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[13]

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.87 (dd, *J*=4.13, 1.68 Hz, 1H), 8.02 (dd, *J*=8.42, 1.78 Hz, 1H), 7.40 (S, 2H), 7.34 (dd, *J*=8.21, 4.19 Hz, 1H), 2.79 (s, 3H), 2.48 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 148.28, 145.86, 136.51, 135.99, 135.63, 131.98, 128.33, 124.59, 120.79, 21.48, 18.00.

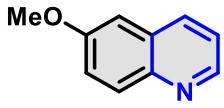


7,8-dimethylquinoline (1f): Compound **1f** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (80.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **83%** (**65.3 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[13]

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.93-8.91 (m, 1H), 8.07 (dd, *J*=8.29, 1.79 Hz, 1H), 7.56 (d, *J*=8.47 Hz, 1H), 7.37-7.30 (m, 2H), 2.77 (s, 3H), 2.51 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.04, 147.20, 137.14, 136.16, 134.19, 129.43, 126.57, 124.74, 119.79, 20.68, 13.31.

6-methoxyquinoline (1g): Compound **1g** was prepared according to the general procedure **P2**

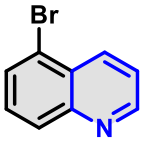


from its corresponding tetrahydroquinoline (81.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (10% EtOAc/Hexane) in **57%** (**45.2 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[12]

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.75 (dd, *J*=4.21, 1.66 Hz, 1H), 8.03-7.98 (m, 2H), 7.37-7.30 (m, 2H), 7.04 (d, *J*=2.83 Hz, 1H), 3.91 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 157.65, 147.85, 144.35, 134.71, 130.77, 129.23, 122.20, 121.28, 105.04, 55.45.

5-bromoquinoline (1h): Compound **1h** was prepared according to the general procedure **P2**

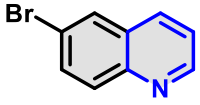


from its corresponding tetrahydroquinoline (105.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **70%** (**72.7 mg**) yield as yellowish viscous liquid. The NMR data is in accordance with the reported literature.[14]

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.93-8.92 (m, 1H), 8.53 (d, *J*=9.03 Hz, 1H), 8.08 (d, *J*=9.03 Hz, 1H), 7.82 (d, *J*=7.49 Hz, 1H), 7.58-7.54 (m, 1H), 7.51-7.48 (m, 1H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 150.98, 148.90, 135.48, 130.32, 129.66, 129.40, 127.68, 122.20, 121.87.

6-bromoquinoline (1i): Compound **1i** was prepared according to the general procedure **P2** from

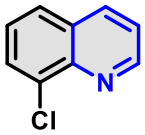


its corresponding tetrahydroquinoline (105.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **66%** (**68.4 mg**) yield as yellowish viscous liquid. The NMR data is in accordance with the reported literature.[12]

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.89 (s, 1H), 8.01-7.99 (m, 1H), 7.95-7.92 (m, 2H), 7.73 (dd, *J*=9.08, 2.58 Hz, 1H), 7.37 (dd, *J*=8.51, 4.30 Hz, 1H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 150.62, 146.72, 134.99, 132.88, 131.13, 129.72, 129.29, 121.83, 120.40.

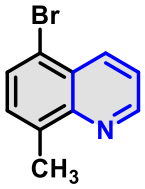
8-chloroquinoline (1k): Compound **1k** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (83.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **73%** (**60.1 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[15]



^{1}H NMR (400 MHz, $CDCl_3$): δ 9.03-9.00 (m, 1H), 8.15 (t, *J*=7.89 Hz, 1H), 7.81 (t, *J*=7.55 Hz, 1H), 7.71 (t, *J*=8.25 Hz, 1H), 7.46-7.40 (m, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 150.91, 144.36, 136.44, 133.36, 129.52, 126.90, 126.41, 121.84. (one carbon peak is merged)

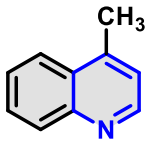
5-bromo-8-methylquinoline (1q): Compound **1q** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (112.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **88%** (**96.9 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[13]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.92 (dd, *J*=4.46, 1.67 Hz, 1H), 8.48 (dd, *J*=8.55, 1.95 Hz, 1H), 7.67 (d, *J*=7.63 Hz, 1H), 7.50-7.44 (m, 1H), 7.40-7.37 (m, 1H), 2.75 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.69, 147.90, 137.26, 135.66, 129.94, 129.76, 127.41, 121.87, 119.19, 18.03.

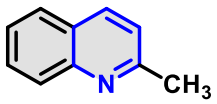
4-methylquinoline (1v'): Compound **1v'** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (73.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **92%** (**65.6 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[12]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.76-8.73 (m, 1H), 8.10 (d, *J*=9.09 Hz, 1H), 7.96 (d, *J*=8.42 Hz, 1H), 7.68 (t, *J*=6.68 Hz, 1H), 7.54 (t, *J*=7.89 Hz, 1H), 7.20 (d, *J*=3.61, 1H), 2.67 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.97, 147.76, 144.33, 129.81, 129.06, 128.18, 126.22, 123.72, 121.76, 18.56.

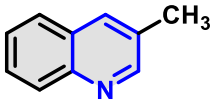
2-methylquinoline (1v): Compound **1v** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (73.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (6% EtOAc/Hexane) in **49%** (**34.9 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[12]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.05 (dd, *J*=8.69, 4.56 Hz, 2H), 7.77 (d, *J*=8.37 Hz, 1H), 7.70-7.66 (m, 1H), 7.48 (t, *J*=7.71 Hz, 1H), 7.29 (d, *J*=8.69 Hz, 1H), 2.76 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 158.92, 147.61, 136.34, 129.51, 128.42, 127.46, 126.47, 125.73, 122.00, 25.21.

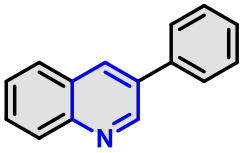
3-methylquinoline (1x): Compound **1x** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (73.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **78%** (**55.5 mg**) yield as yellowish liquid. The NMR data is in accordance with the reported literature.[12]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.76 (d, *J*=2.92 Hz, 1H), 8.06 (d, *J*=8.58 Hz, 1H), 7.90 (s, 1H), 7.73 (d, *J*=8.58 Hz, 1H), 7.63 (ddd, *J*=8.29, 6.91, 1.32 Hz, 1H), 7.52-7.48 (m, 1H), 2.50 (s, 3H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 152.33, 146.48, 134.63, 130.41, 129.09, 128.38, 128.09, 127.07, 126.49, 18.69.

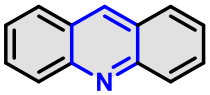
3-phenylquinoline (1y): Compound **1y** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (104.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **46%** (**47.1 mg**) yield as yellowish viscous liquid. The NMR data is in accordance with the reported literature.[16]



^{1}H NMR (400 MHz, $CDCl_3$): δ 9.19 (s, 1H), 8.31-8.30 (m, 1H), 8.17 (d, *J*=8.93 Hz, 1H), 7.88 (d, *J*=8.21 Hz, 1H), 7.75-7.70 (m, 3H), 7.60-7.51 (m, 3H), 7.46-7.42 (m, 1H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.73, 147.09, 137.73, 138.81, 133.32, 129.52, 129.42, 129.13, 129.02, 128.08, 127.96, 127.36, 127.01.

Acridine (1aa): Compound **1aa** was prepared according to the general procedure **P2** from its corresponding tetrahydroquinoline (90.5 mg, 0.5 mmol, 1.0 equiv.) and purified by column chromatography (8% EtOAc/Hexane) in **92%** (**82.3 mg**) yield as yellowish viscous liquid. The NMR data is in accordance with the reported literature.[12]



^{1}H NMR (400 MHz, $CDCl_3$): δ 8.74 (s, 1H), 8.24 (d, *J*=9.56 Hz, 2H), 7.97 (d, *J*=8.96 Hz, 2H), 7.77 (ddd, *J*=8.31, 6.71, 1.47 Hz, 2H), 7.52 (ddd, *J*=8.04, 6.71, 0.93 Hz, 2H).

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.02, 135.99, 130.23, 129.35, 128.14, 126.53, 125.62.

11. References:

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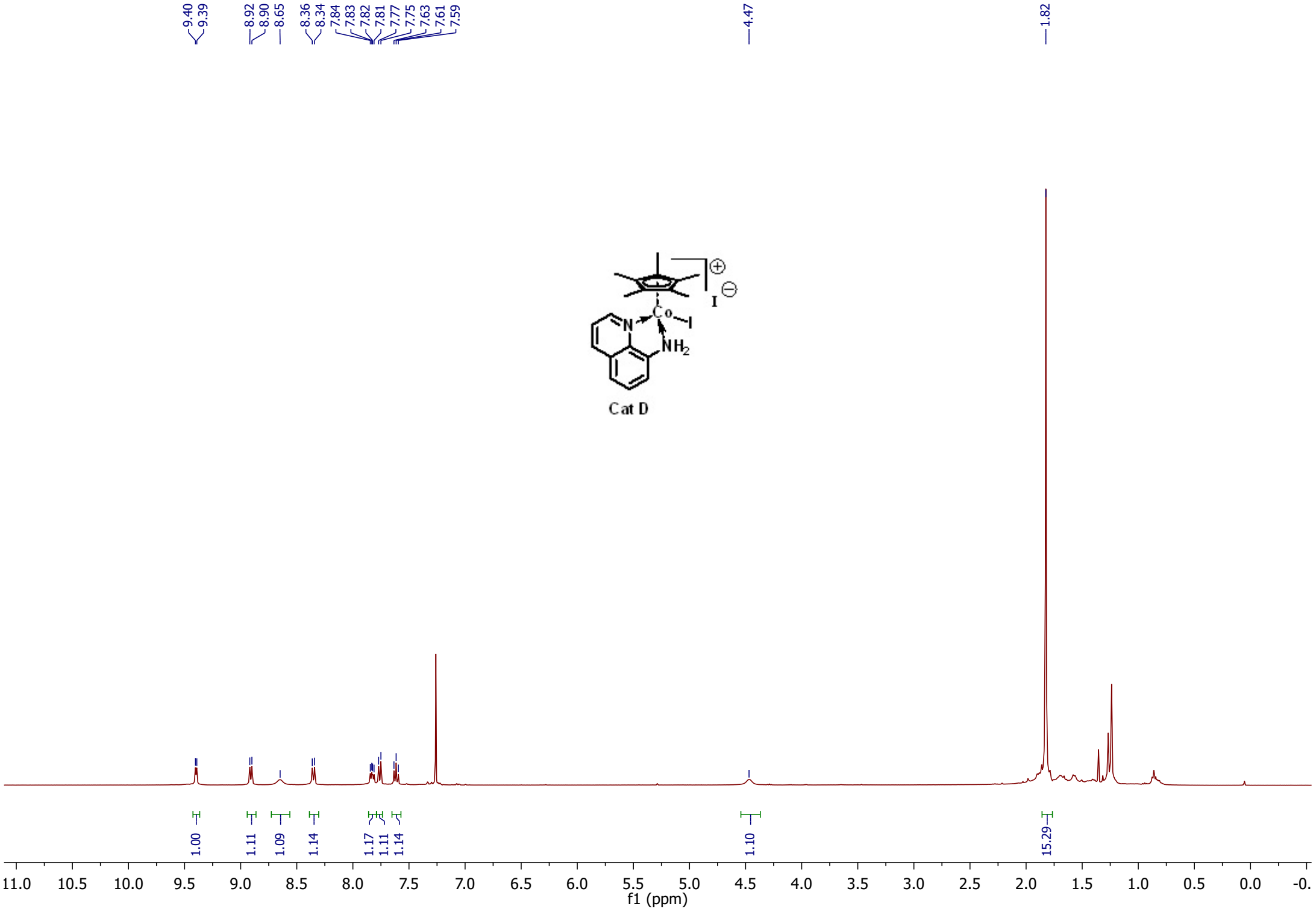
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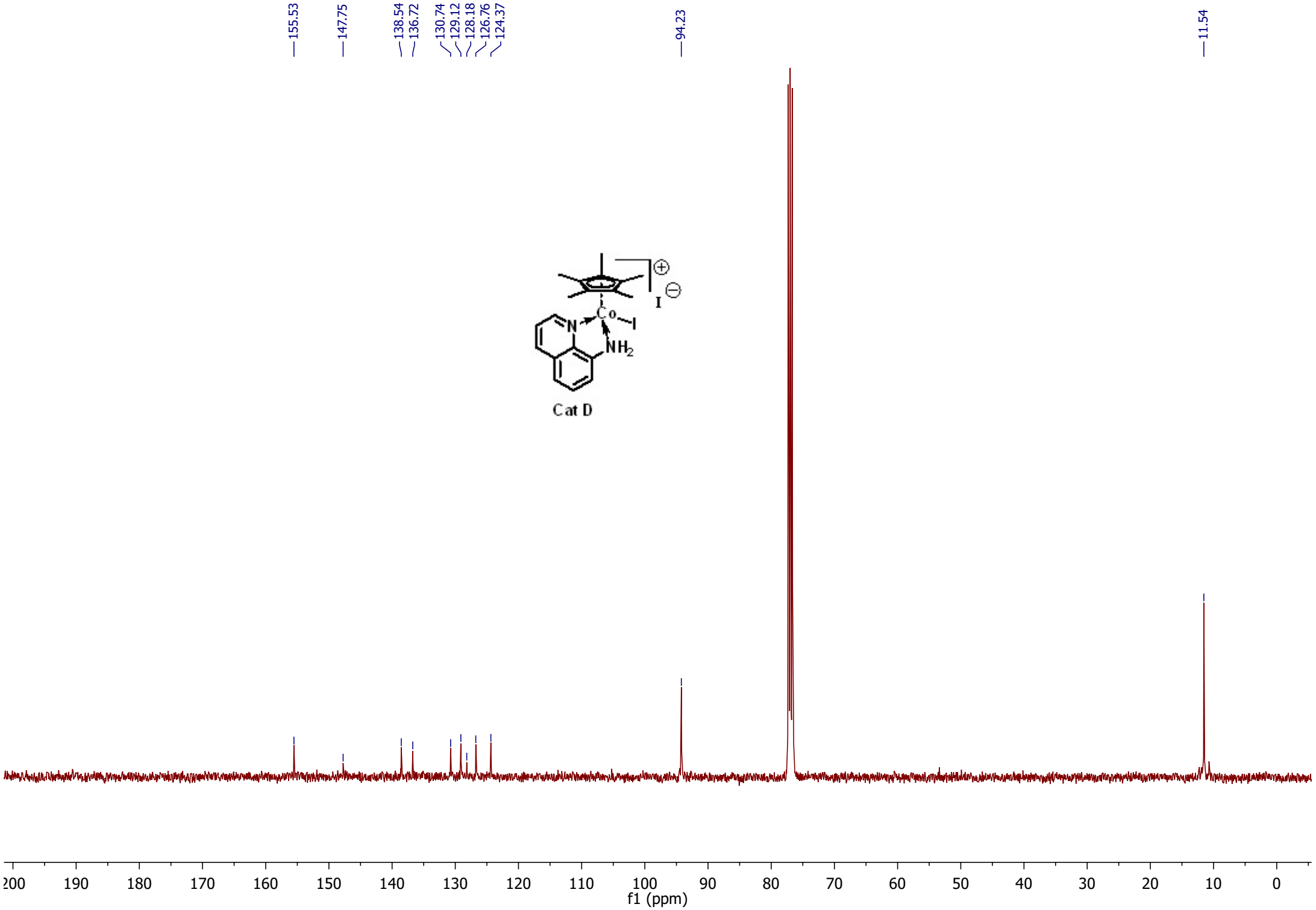
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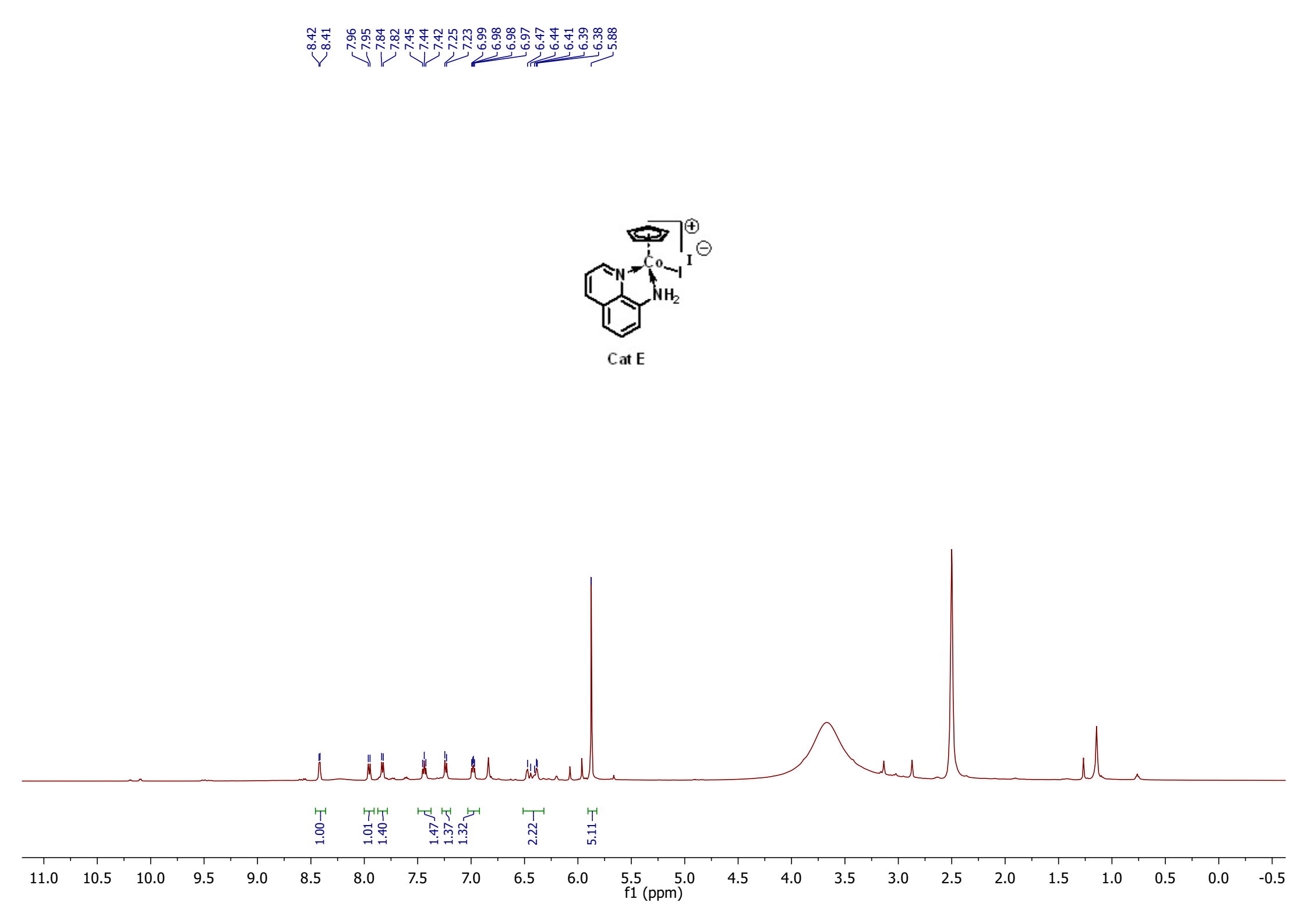
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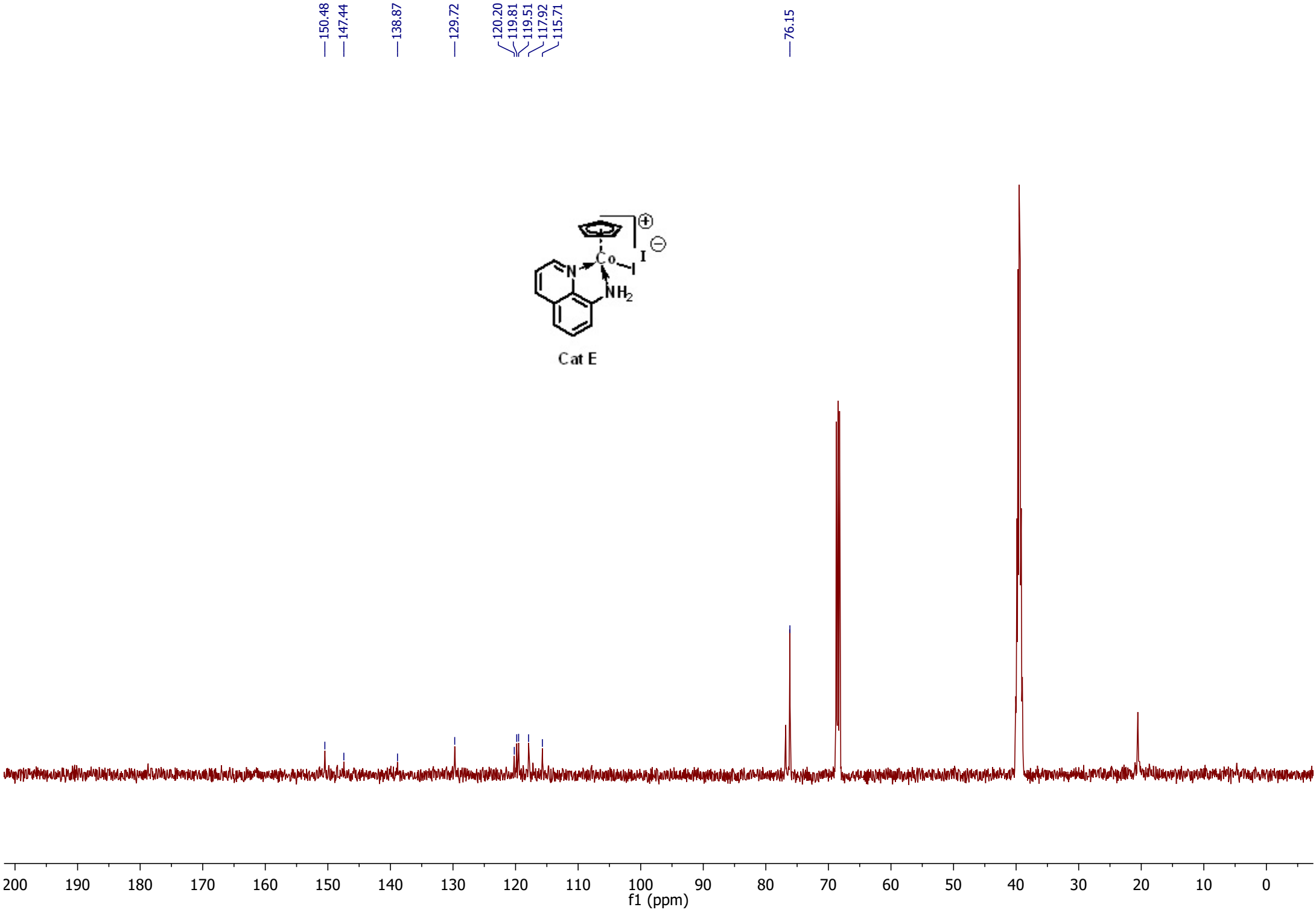
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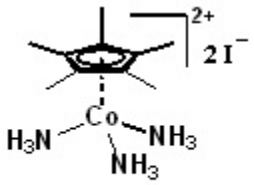
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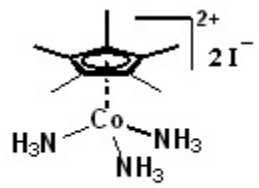

Cat F

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10.25
9.13

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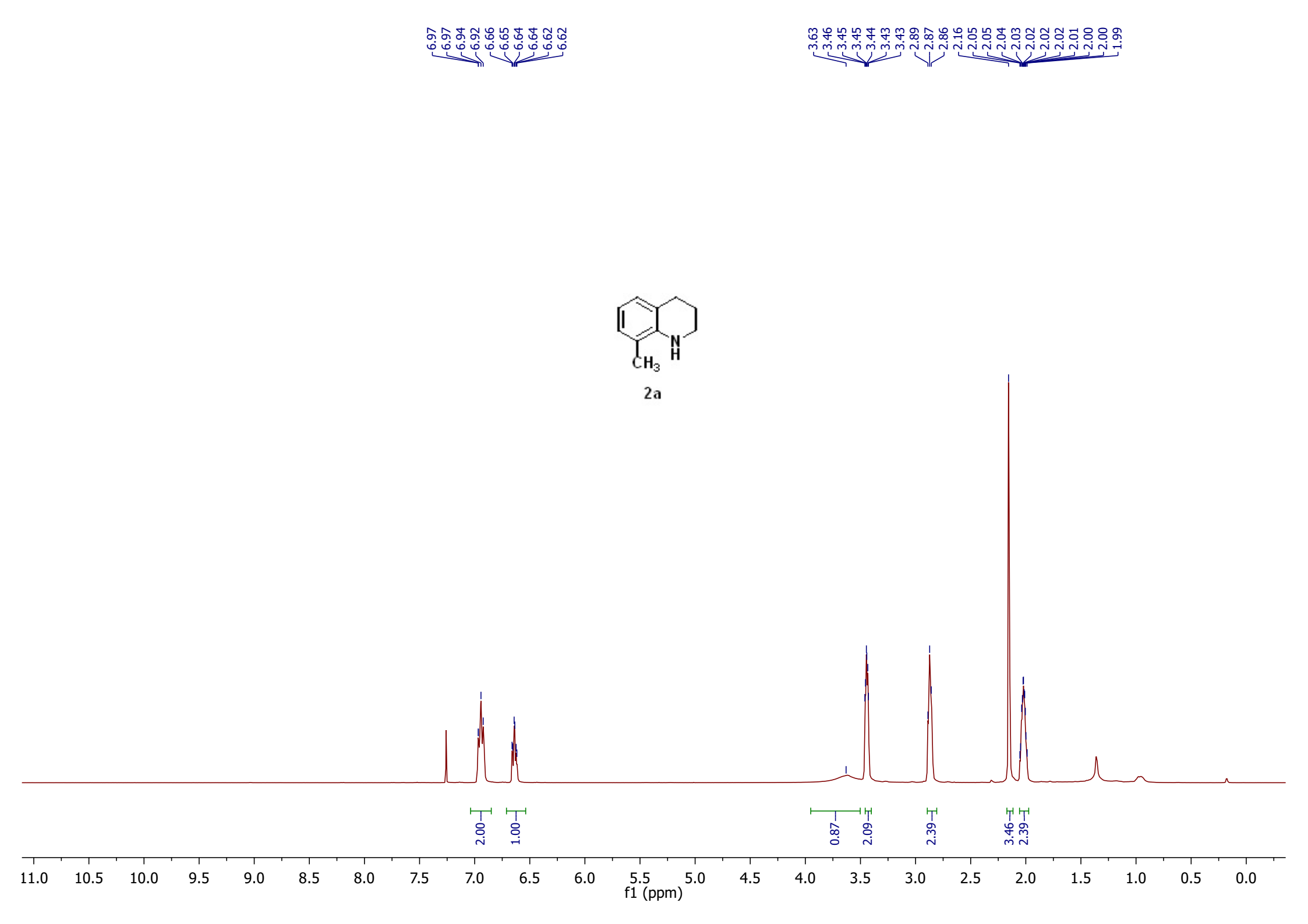
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8.5
8.0
7.5
7.0
6.5
6.0
5.5
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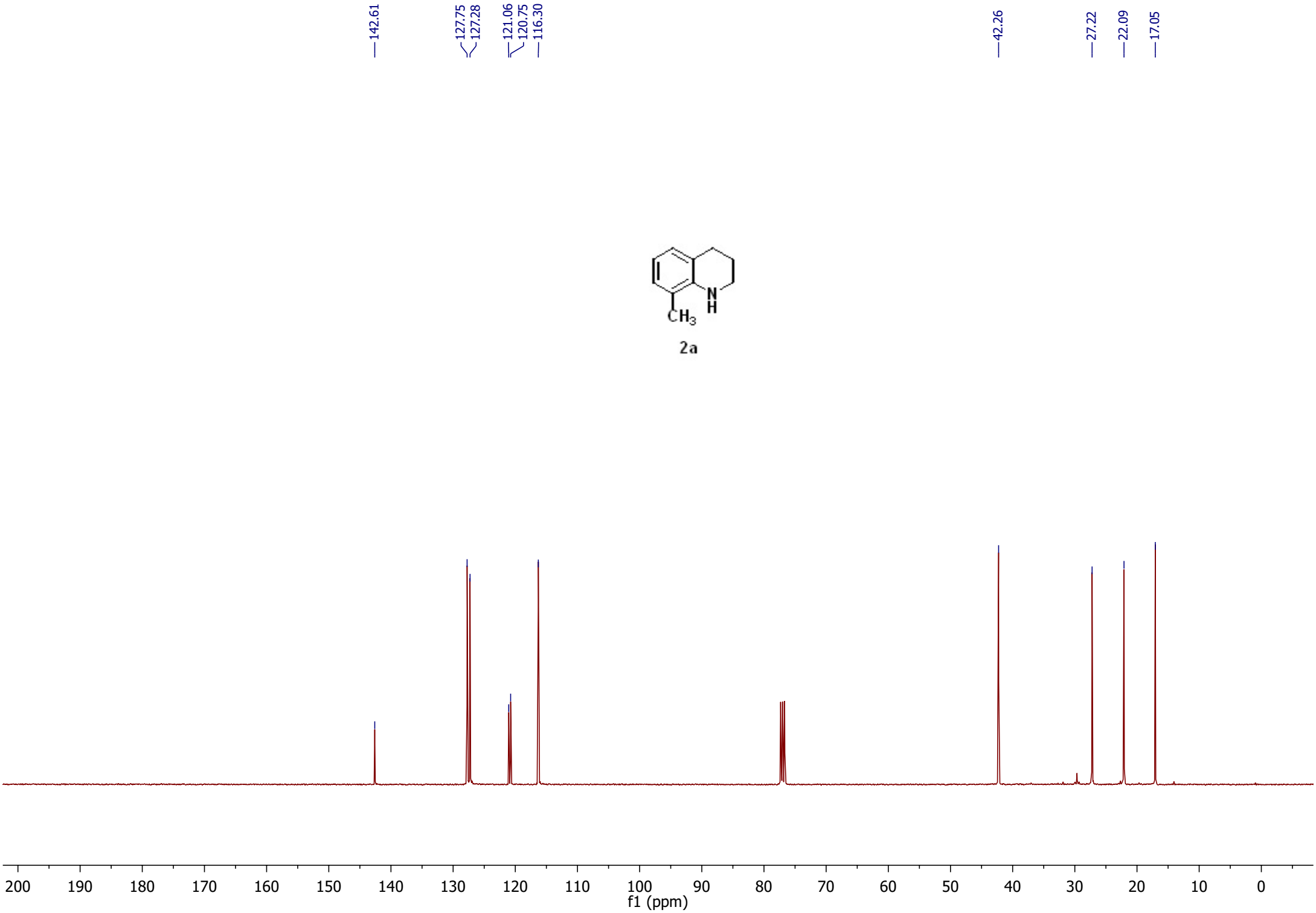
f1 (ppm)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127.28
121.06
120.75
116.30
42.26
27.22
22.09
17.05
N
H
CH3
2a
200
190
180
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150
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130
120
110
100
90
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70
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50
40
30
20
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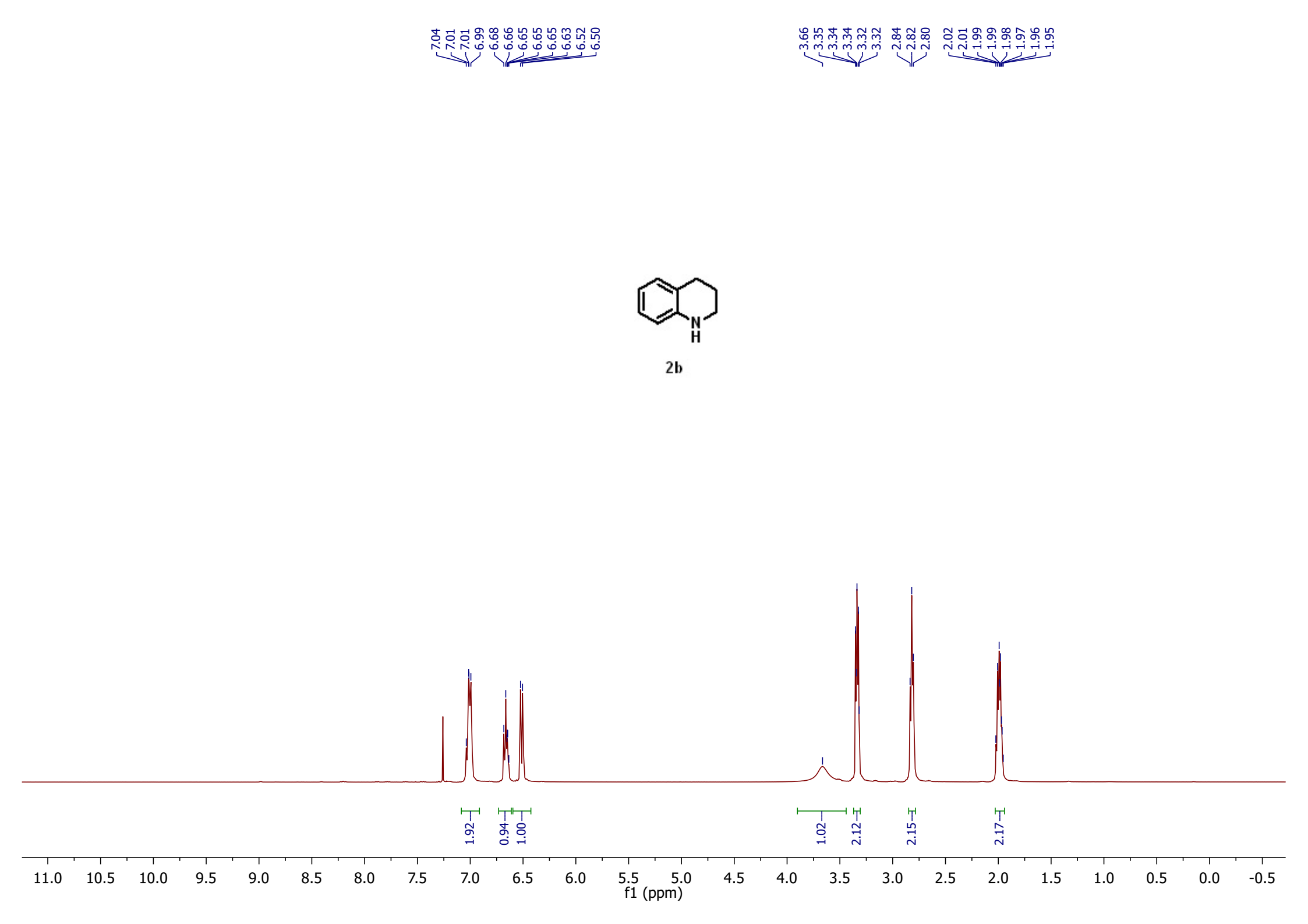
f1 (ppm)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7.01
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6.65
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6.52
6.50
3.66
3.35
3.34
3.34
3.32
3.32
2.84
2.82
2.80
2.02
2.01
1.99
1.99
1.98
1.97
1.96
1.95
N
H
2b
1.92
0.94
1.00
1.02
2.12
2.15
2.17
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
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3.0
2.5
2.0
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1.0
0.5
0.0
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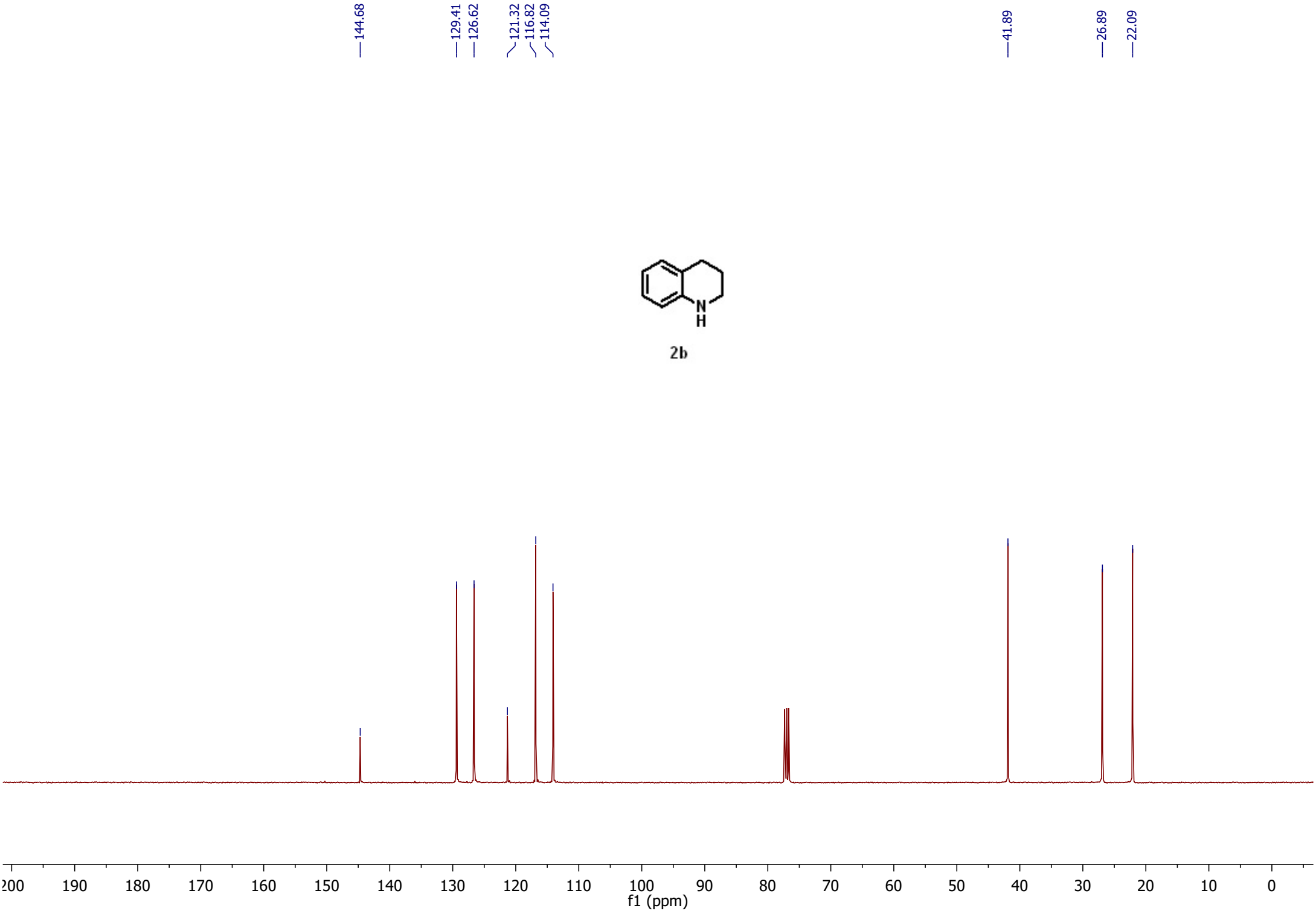
f1 (ppm)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121.32
116.82
114.09
41.89
26.89
22.09
N
H
2b
200
190
180
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130
120
110
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90
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70
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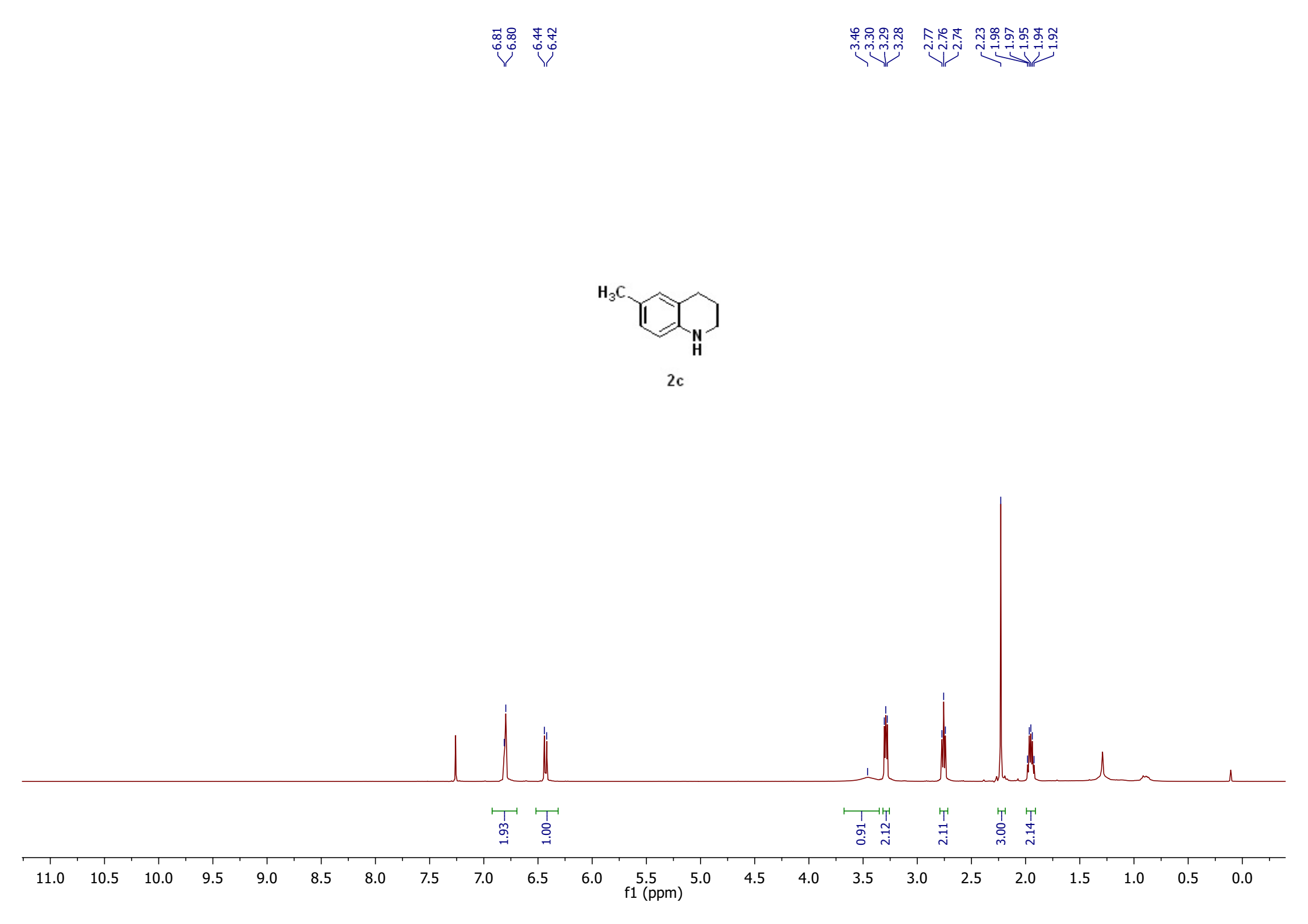
50
40
30
20
10
0
f1 (ppm)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3.28
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2.76
2.74
2.23
1.98
1.97
1.95
1.94
1.92
H3C
N
H
2c
1.93
1.00
0.91
2.12
2.11
3.00
2.14
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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3.0
2.5
2.0
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1.0
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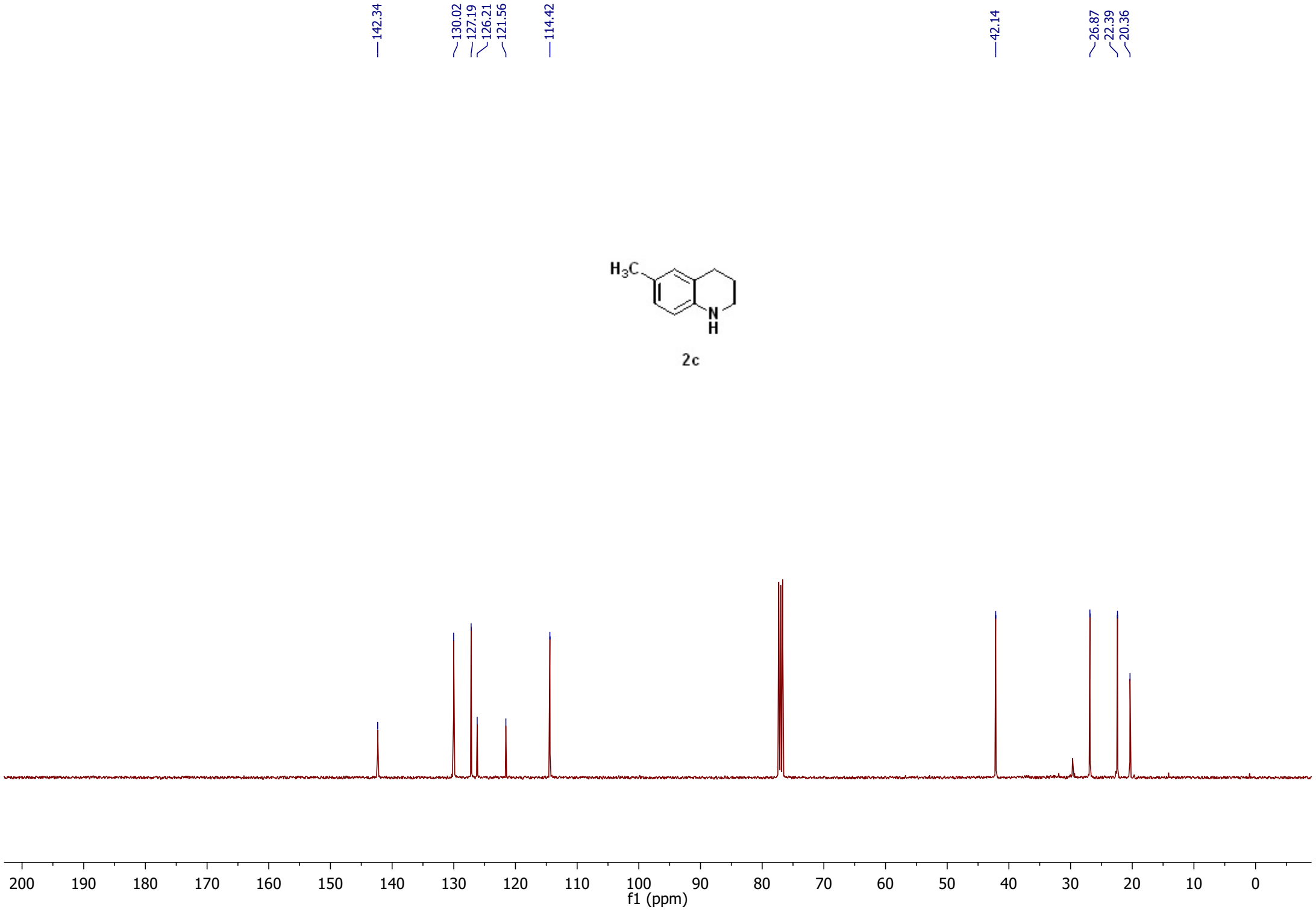
0.0
f1 (ppm)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130.02
127.19
126.21
121.56
114.42
42.14
26.87
22.39
20.36
H3C
N
H
2c
200
190
180
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150
140
130
120
110
100
90
80
70
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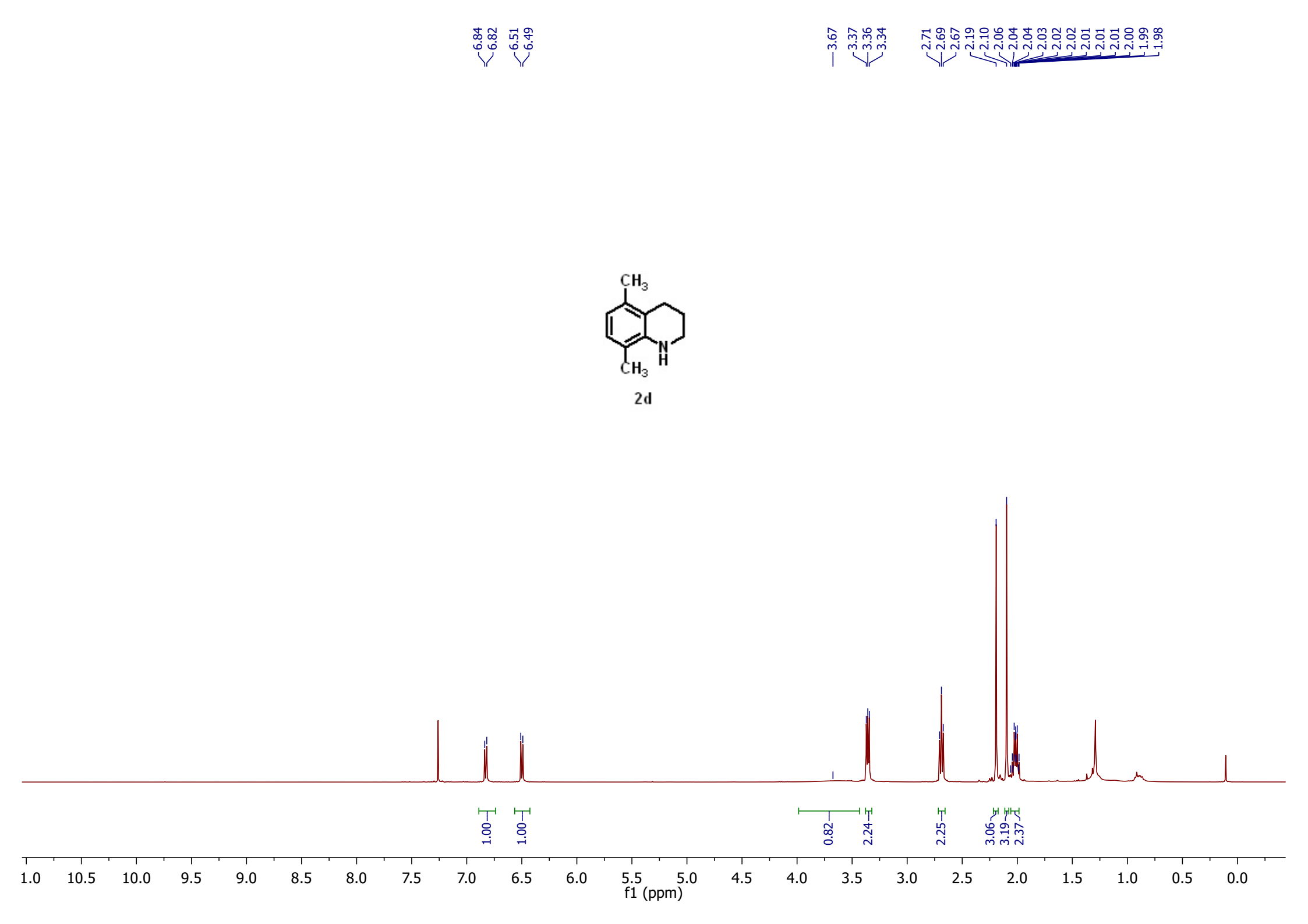
50
40
30
20
10
0
f1 (ppm)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3.34
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2.67
2.19
2.10
2.06
2.04
2.04
2.03
2.02
2.02
2.01
2.01
2.01
2.00
1.99
1.98
CH3
N
H
CH3
2d
1.00
1.00
0.82
2.24
2.25
3.06
3.19
2.37
1.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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3.0
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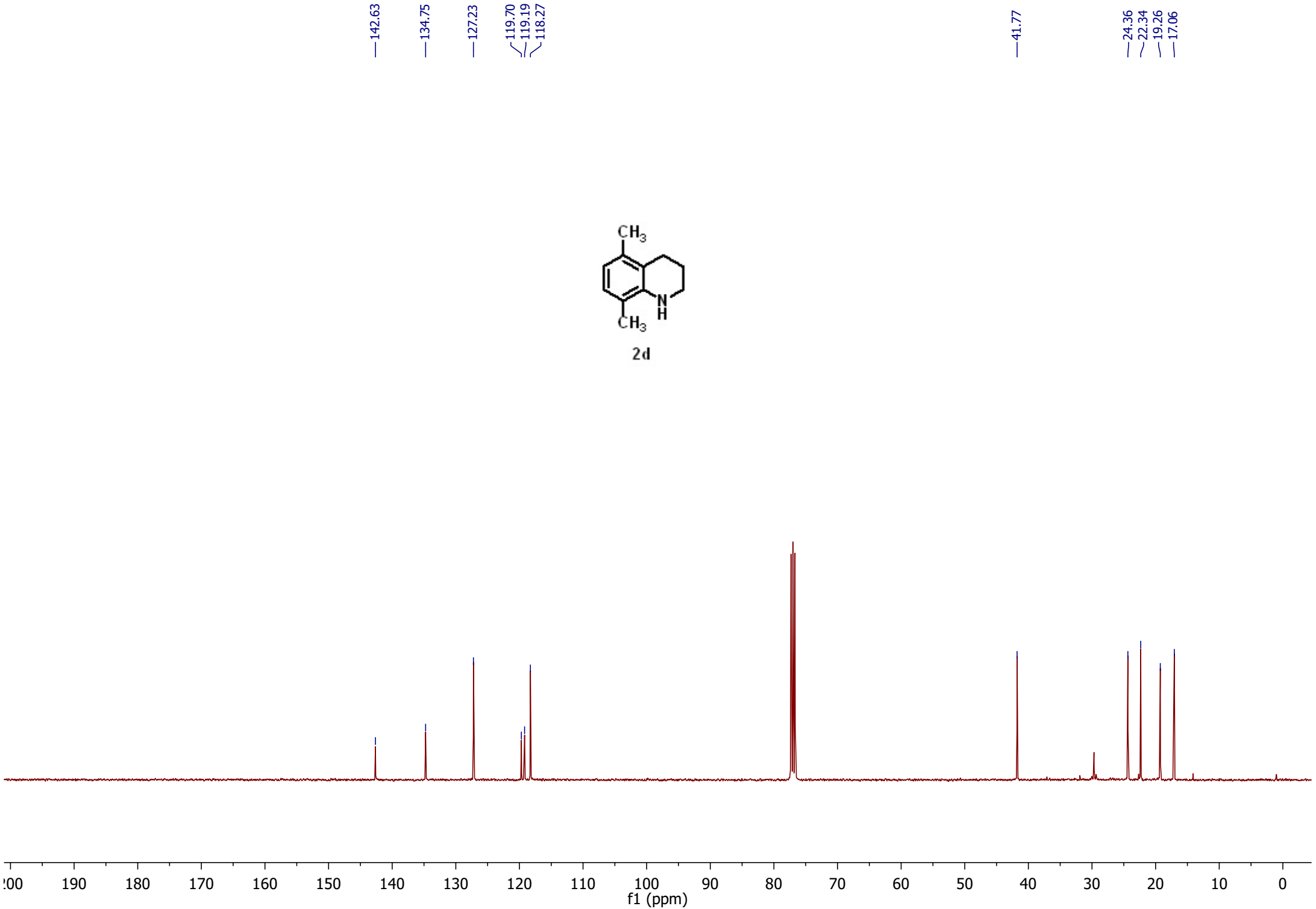
1.0
0.5
0.0
f1 (ppm)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134.75
127.23
119.70
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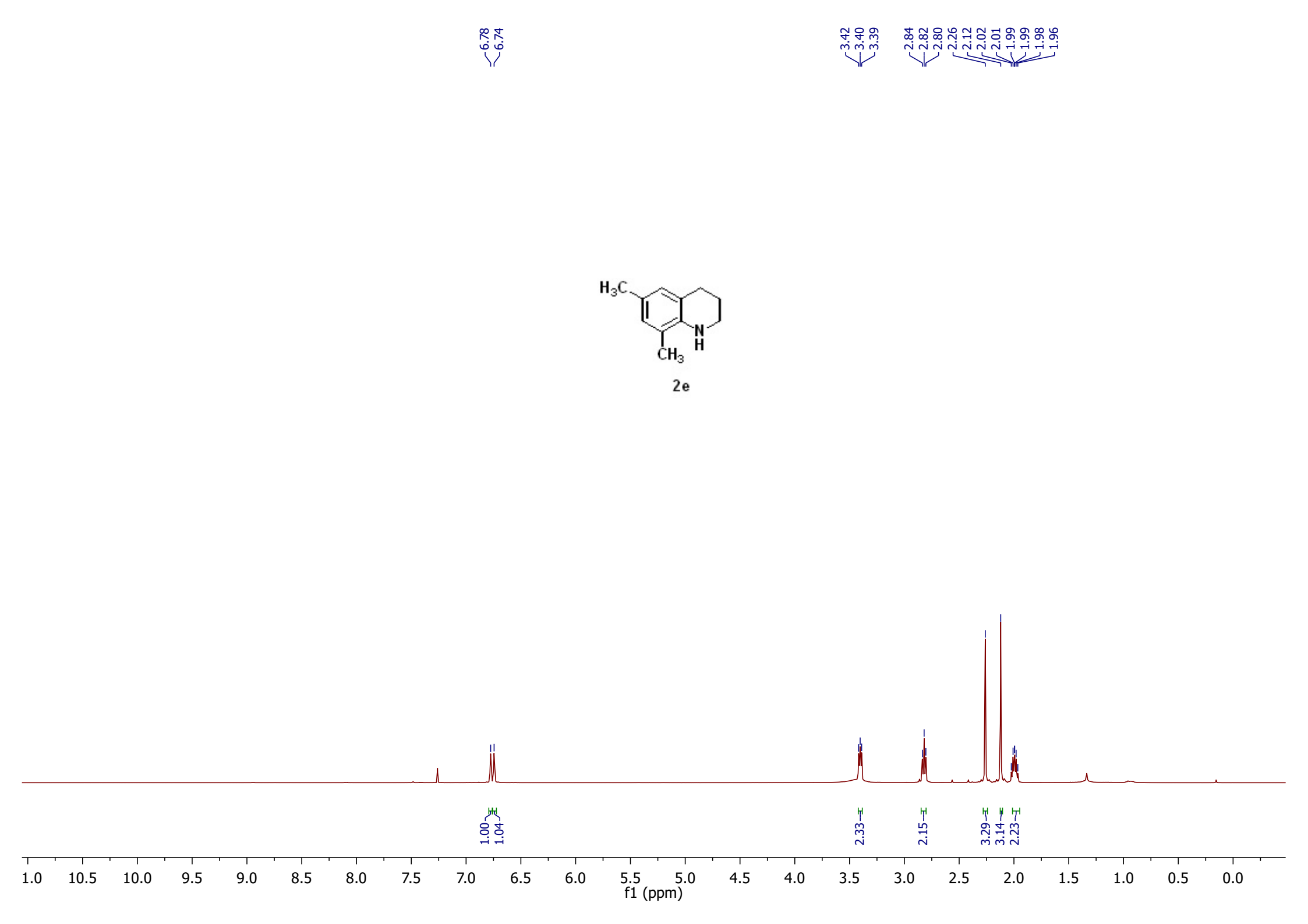
118.27
41.77
24.36
22.34
19.26
17.06
CH3
N
H
CH3
2d
f1 (ppm)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6.74
3.42
3.40
3.39
2.84
2.82
2.80
2.26
2.12
2.02
2.01
1.99
1.99
1.98
1.96
H3C
N
H
CH3
2e
1.00
1.04
2.33
2.15
3.29
3.14
2.23
1.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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4.5
4.0
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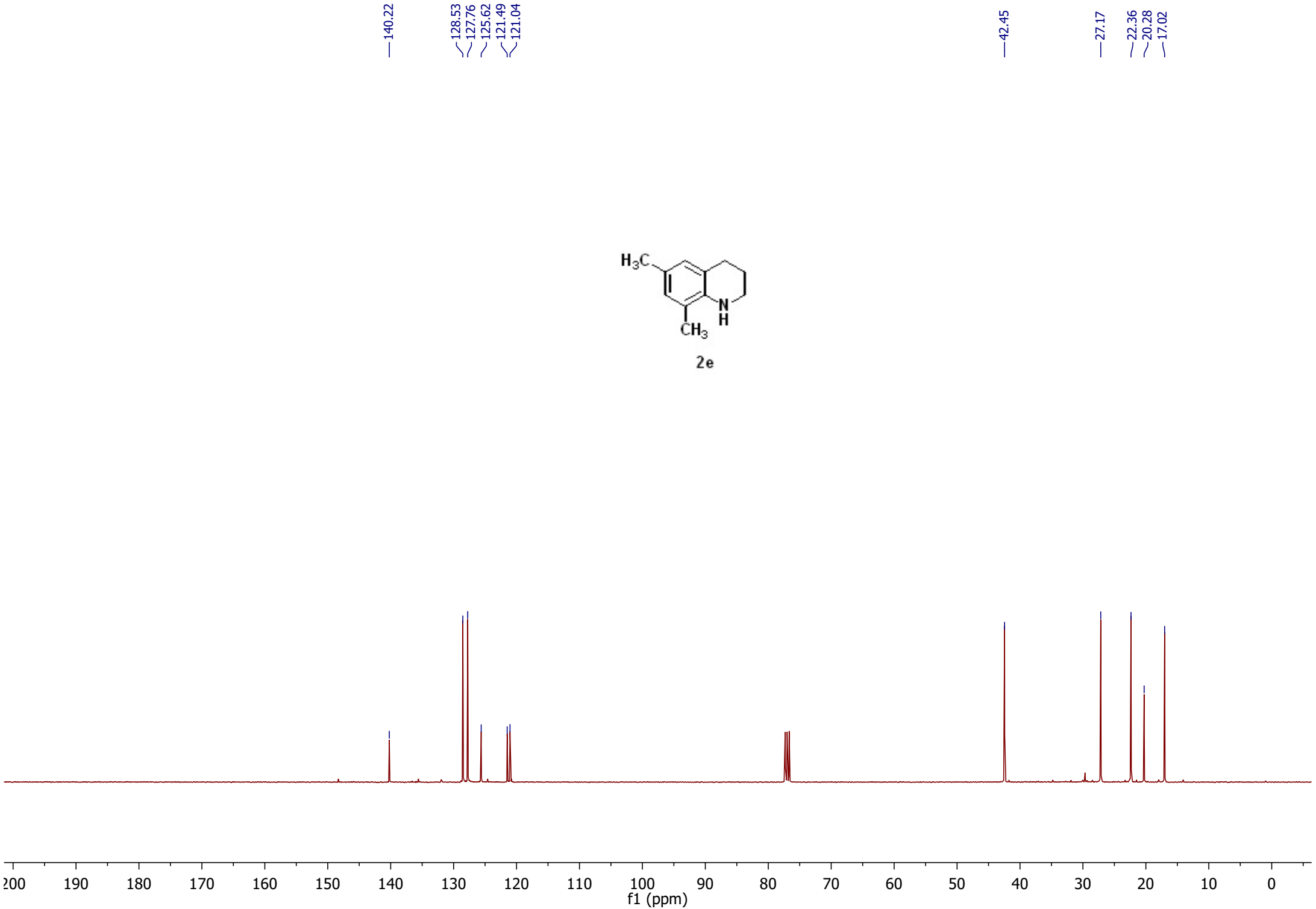
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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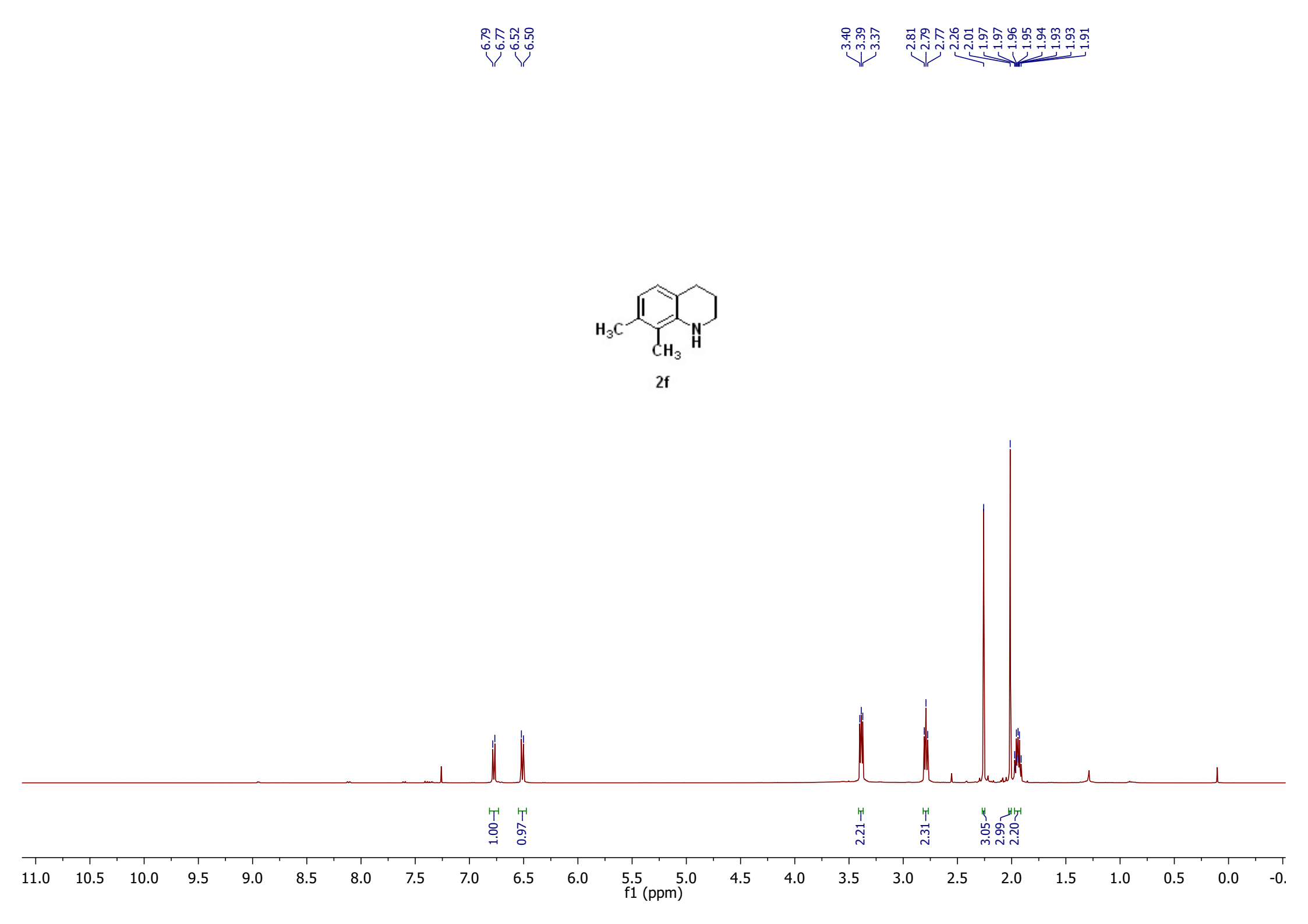
128.53
127.76
125.62
121.49
121.04
42.45
27.17
22.36
20.28
17.02
H3C
N
H
CH3
2e
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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6.77
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3.39
3.37
2.81
2.79
2.77
2.26
2.01
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1.97
1.96
1.95
1.94
1.93
1.93
1.91
H3C
CH3
N
H
2f
1.00
0.97
2.21
2.31
3.05
2.99
2.20
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
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6.5
6.0
5.5
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4.5
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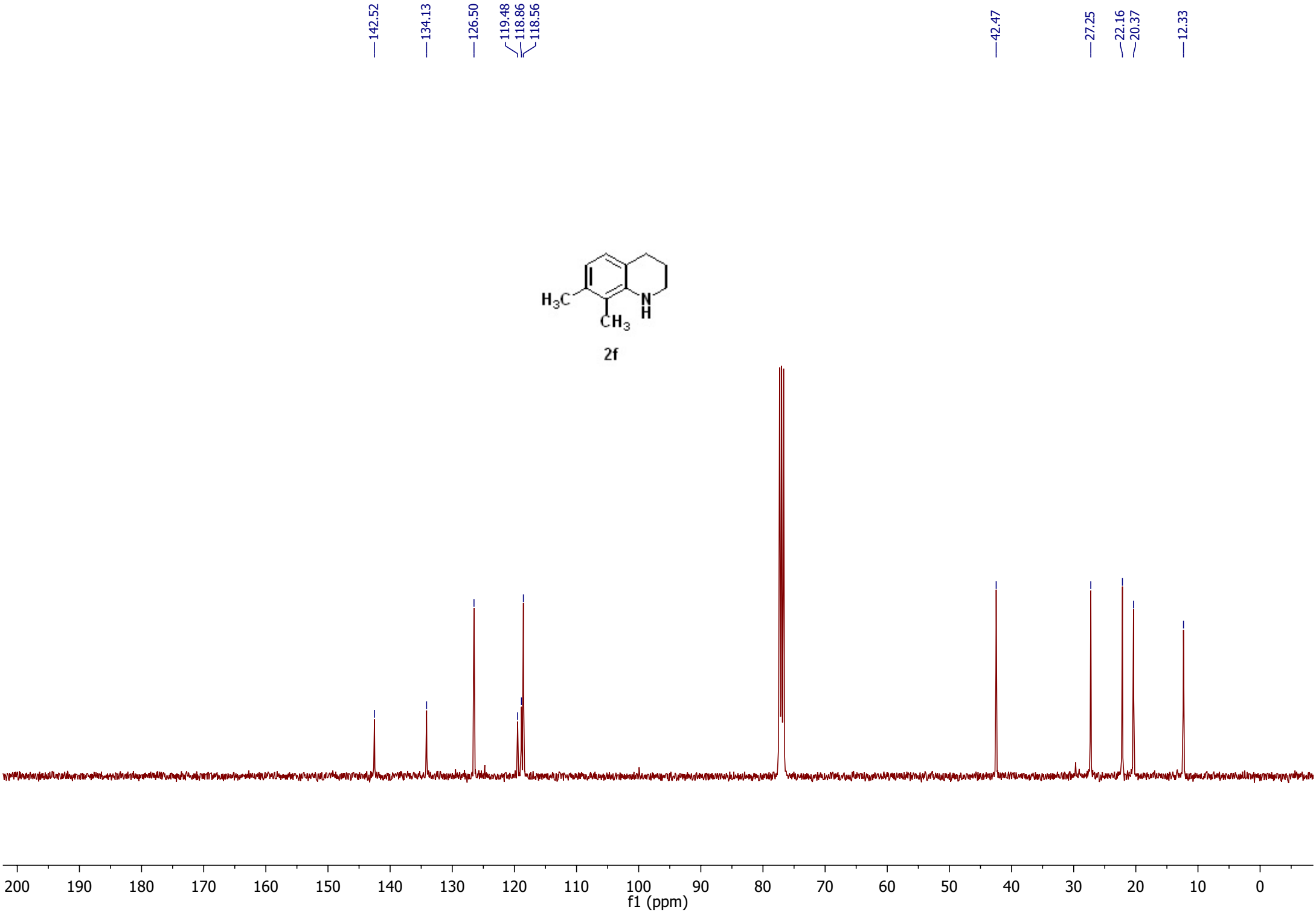
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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118.56
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27.25
22.16
20.37
12.33
H3C
CH3
N
H
2f
200
190
180
170
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150
140
130
120
110
100
90
80
70
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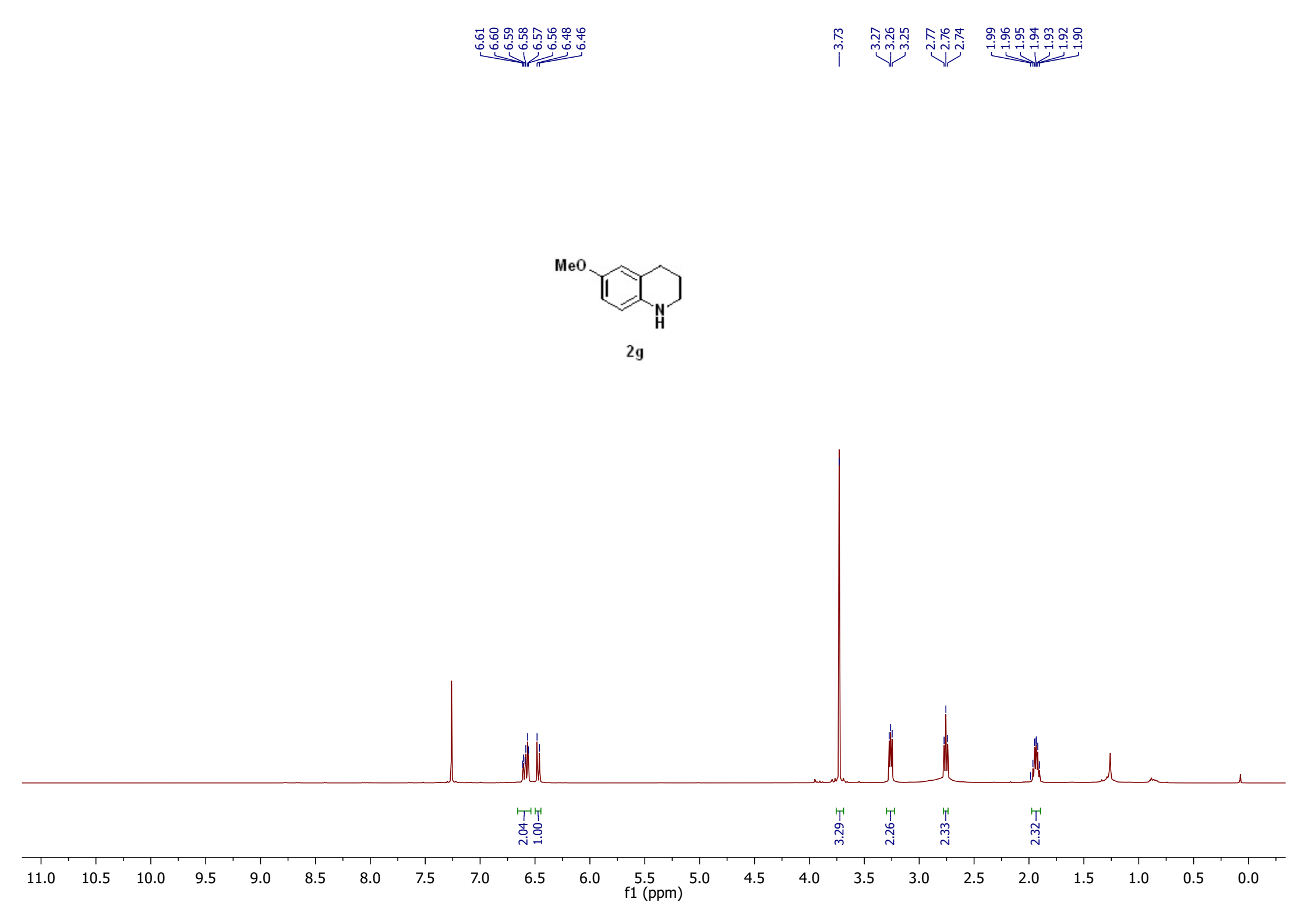
50
40
30
20
10
0
f1 (ppm)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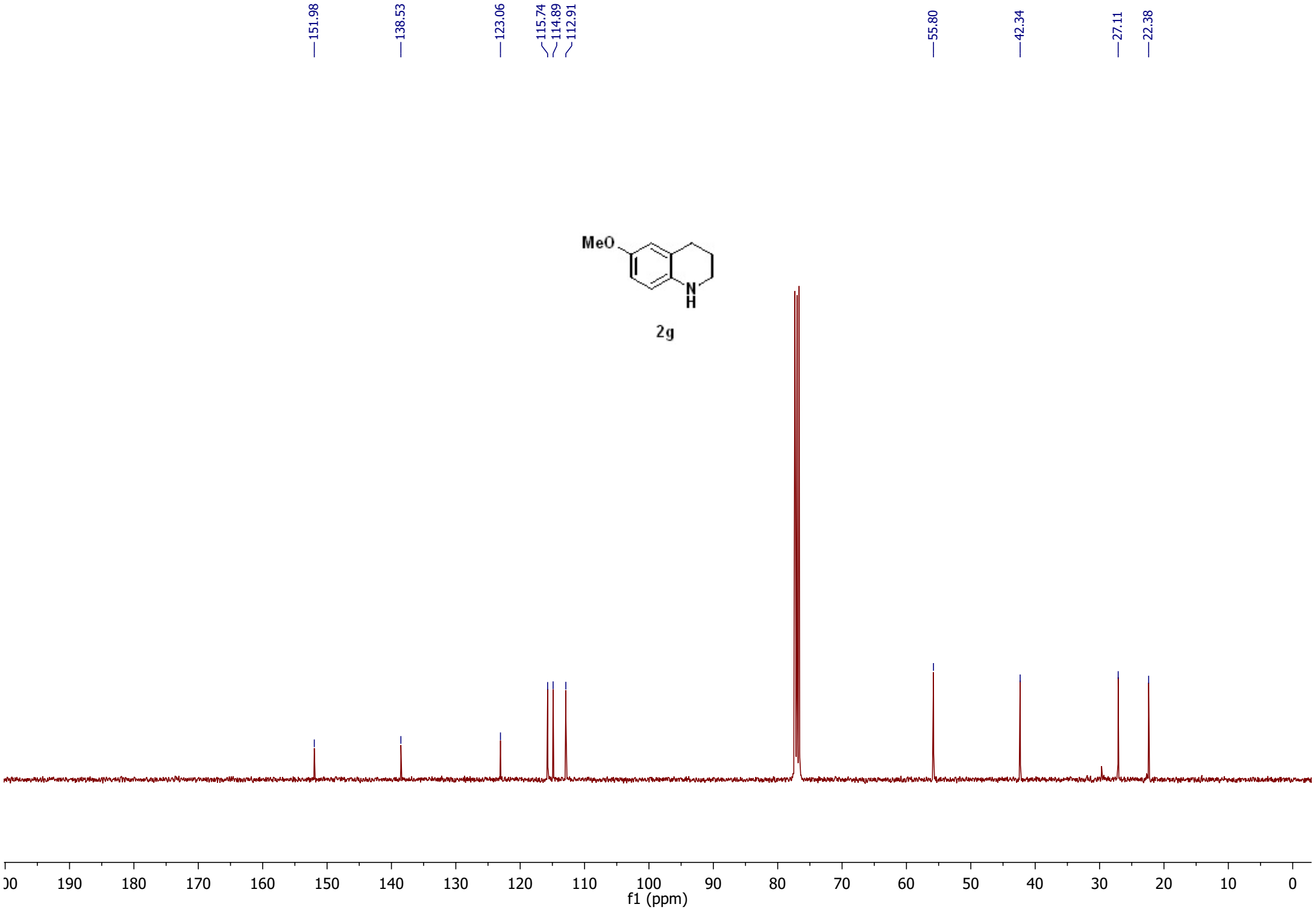
6.58
6.57
6.56
6.48
6.46
3.73
3.27
3.26
3.25
2.77
2.76
2.74
1.99
1.96
1.95
1.94
1.93
1.92
1.90
MeO
N
H
2g
2.04
1.00
3.29
2.26
2.33
2.32
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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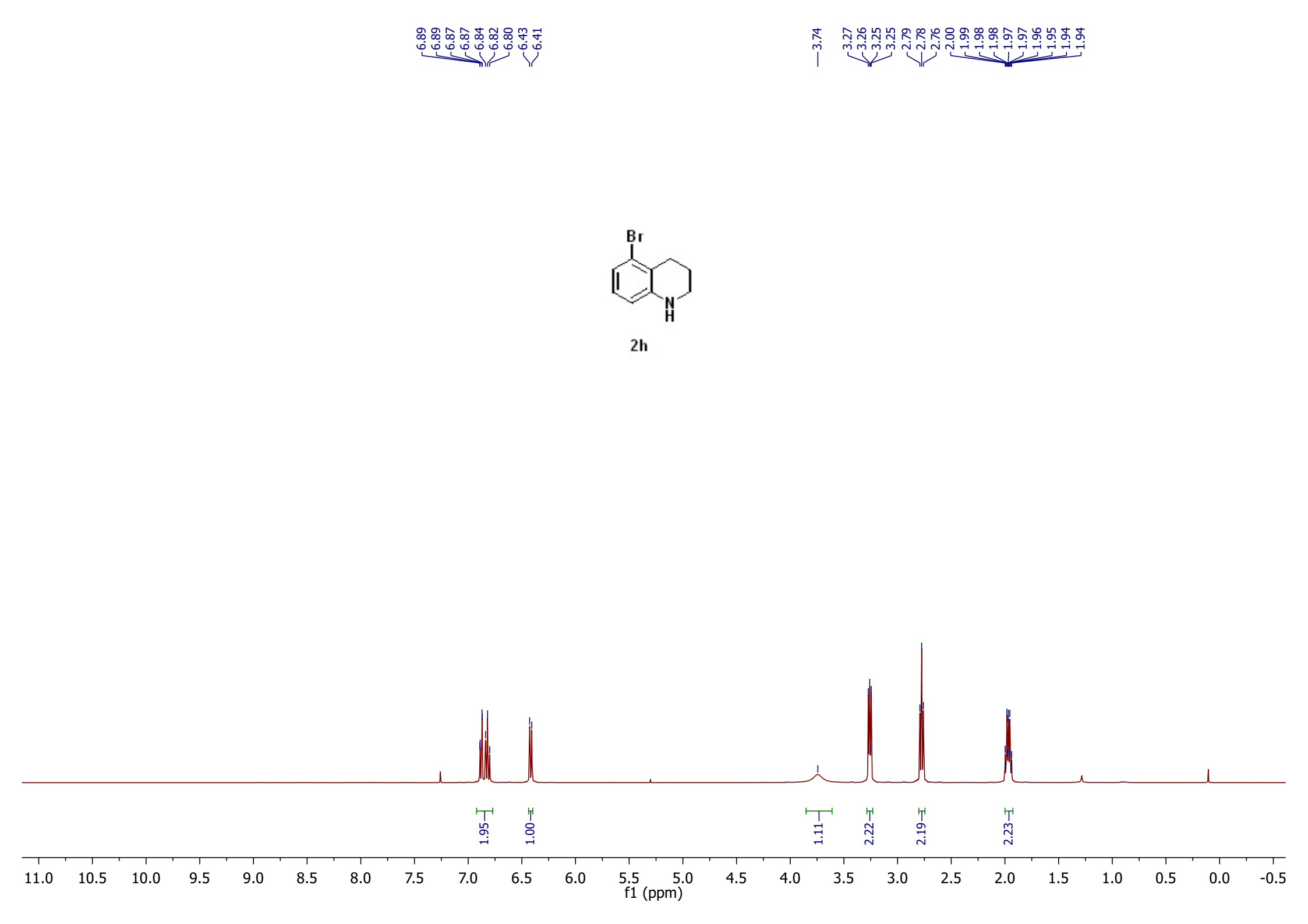
138.53
123.06
115.74
114.89
112.91
55.80
42.34
27.11
22.38
MeO
N
H
2g
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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6.89
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6.87
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6.80
6.43
6.41
3.74
3.27
3.26
3.25
3.25
2.79
2.78
2.76
2.00
1.99
1.98
1.98
1.97
1.97
1.96
1.95
1.94
1.94
Br
N
H
2h
1.95
1.00
1.11
2.22
2.19
2.23
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
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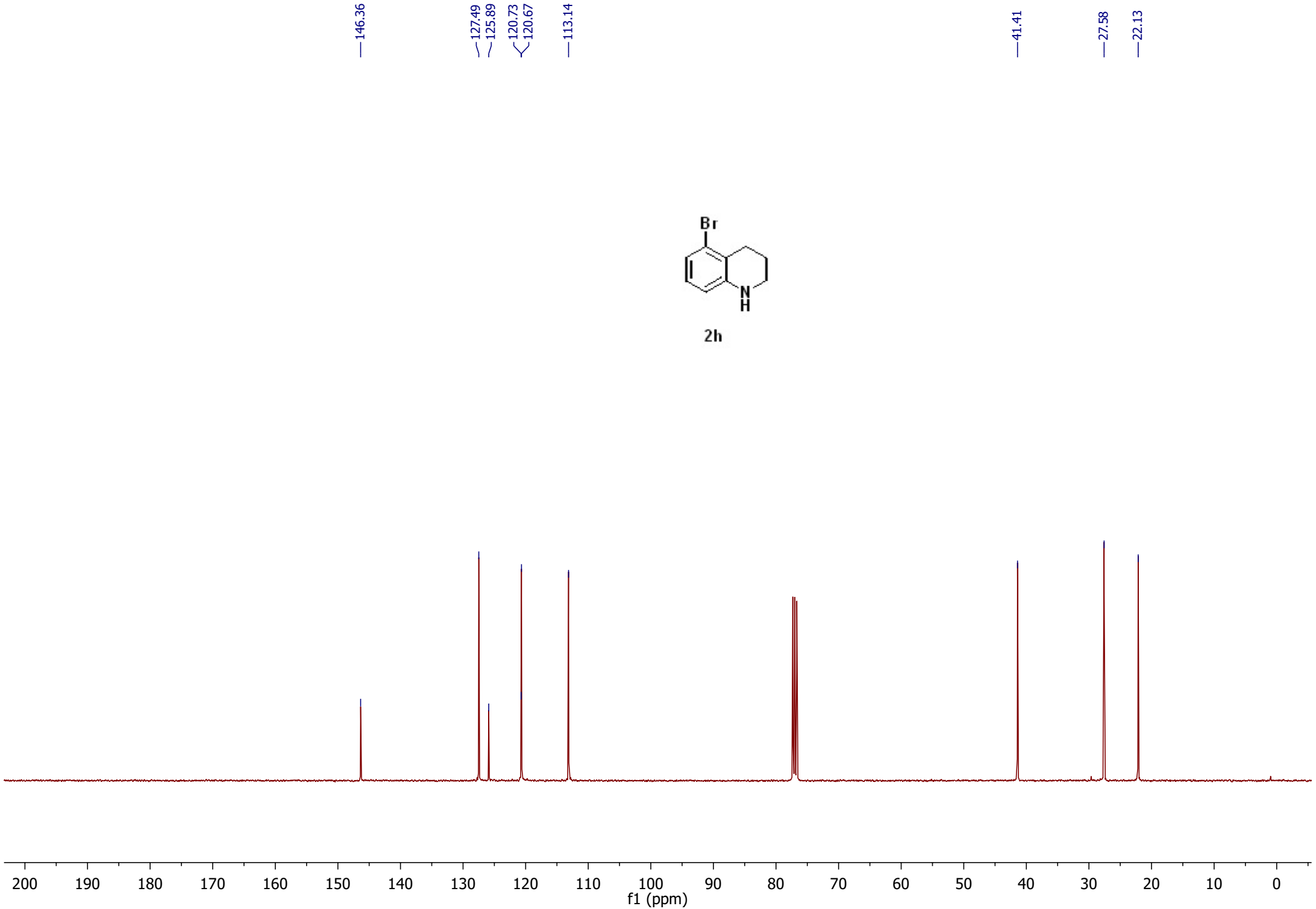
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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127.49
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120.67
113.14
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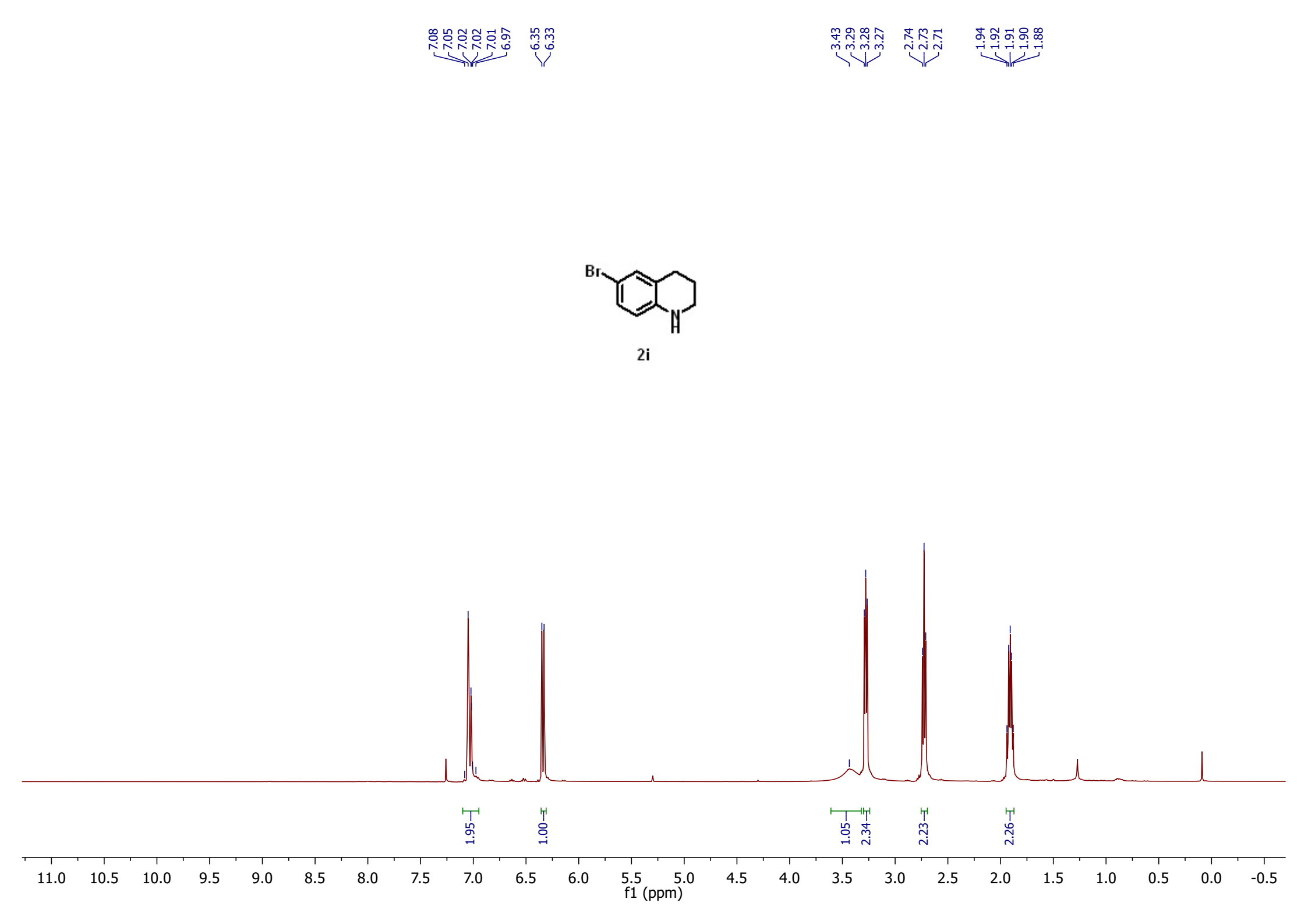
27.58
22.13
Br
N
H
2h
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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3.29
3.28
3.27
2.74
2.73
2.71
1.94
1.92
1.91
1.90
1.88
Br
N
H
2i
1.95
1.00
1.05
2.34
2.23
2.26
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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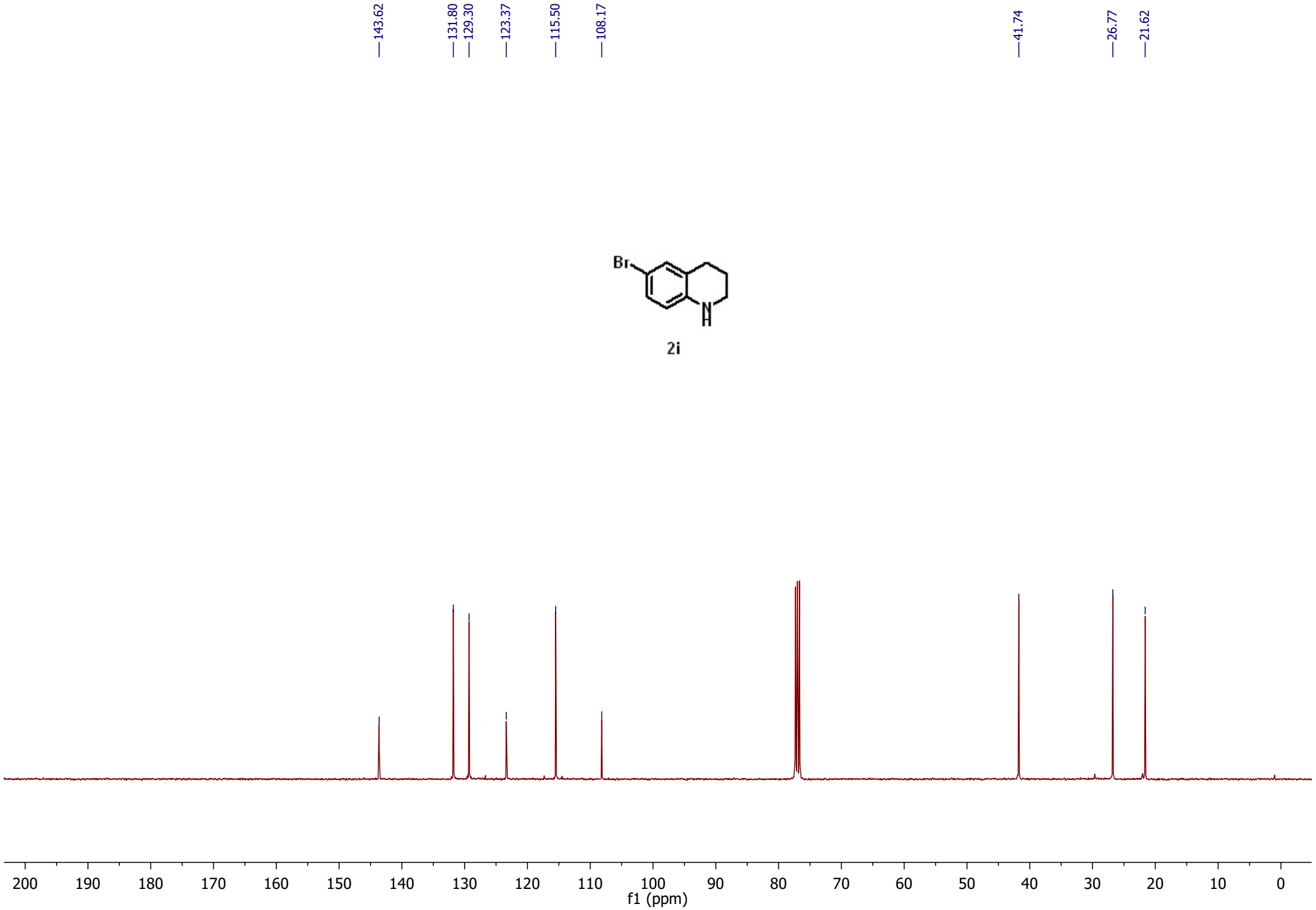
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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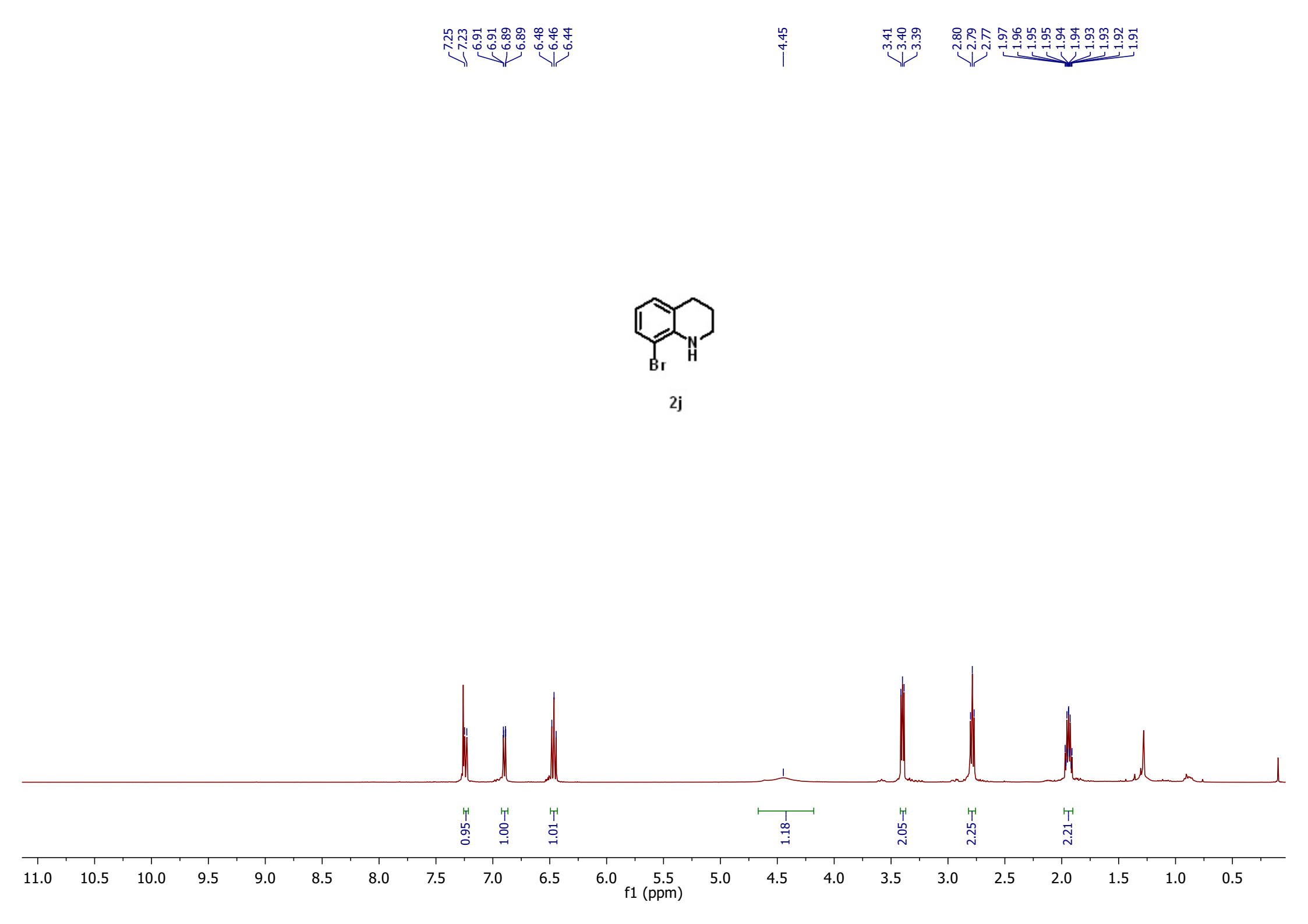
131.80
129.30
123.37
115.50
108.17
41.74
26.77
21.62
Br
N
H
2i
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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6.44
4.45
3.41
3.40
3.39
2.80
2.79
2.77
1.97
1.96
1.95
1.95
1.94
1.94
1.93
1.93
1.92
1.91
Br
N
H
2j
0.95
1.00
1.01
1.18
2.05
2.25
2.21
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
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6.5
6.0
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5.0
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4.0
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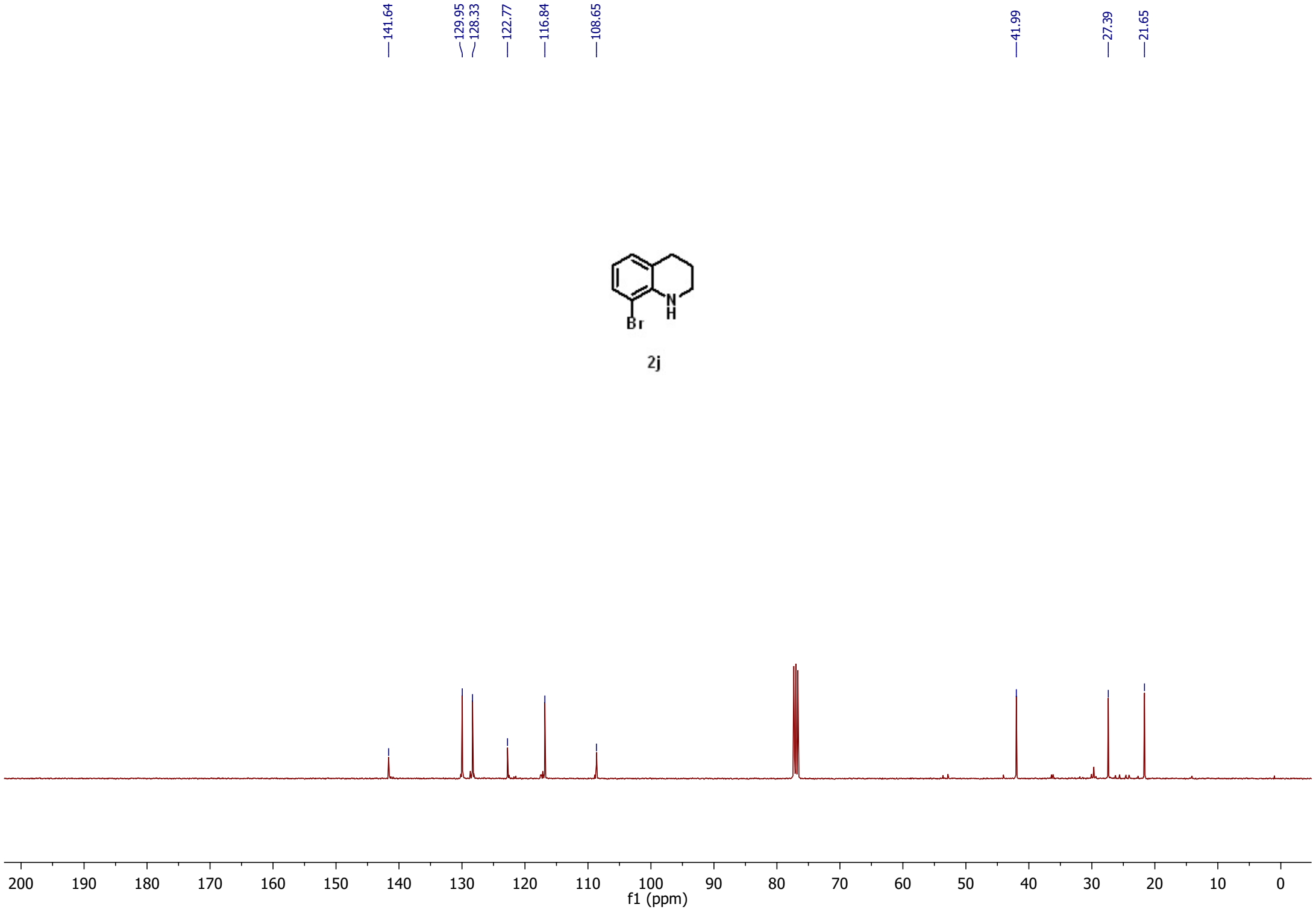
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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122.77
116.84
108.65
41.99
27.39
21.65
Br
N
H
2j
200
190
180
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160
150
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130
120
110
100
90
80
70
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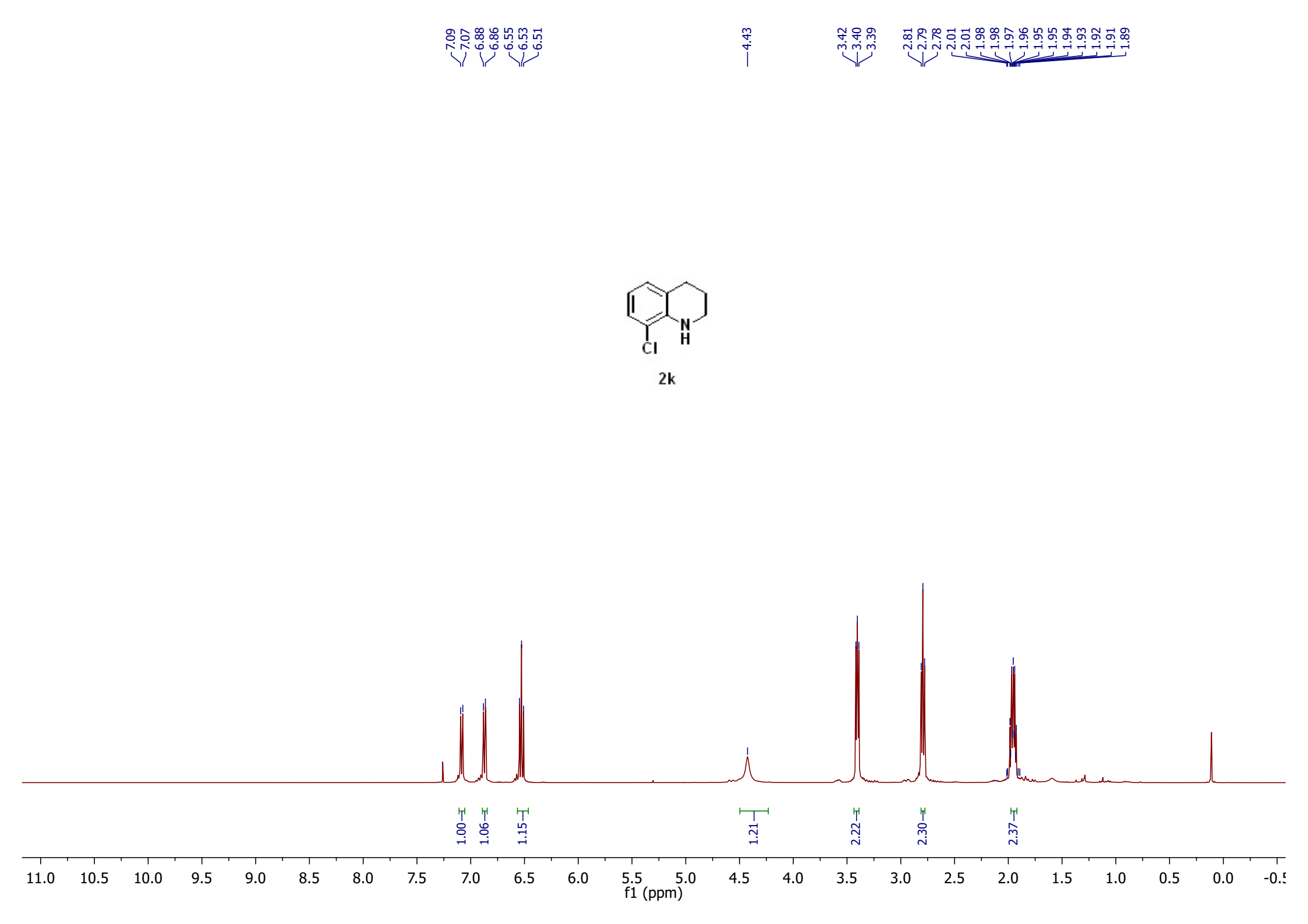
50
40
30
20
10
0
f1 (ppm)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3.42
3.40
3.39
2.81
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2.78
2.01
2.01
1.98
1.98
1.97
1.96
1.95
1.95
1.94
1.93
1.92
1.91
1.89
N
H
Cl
2k
1.00
1.06
1.15
1.21
2.22
2.30
2.37
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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3.0
2.5
2.0
1.5
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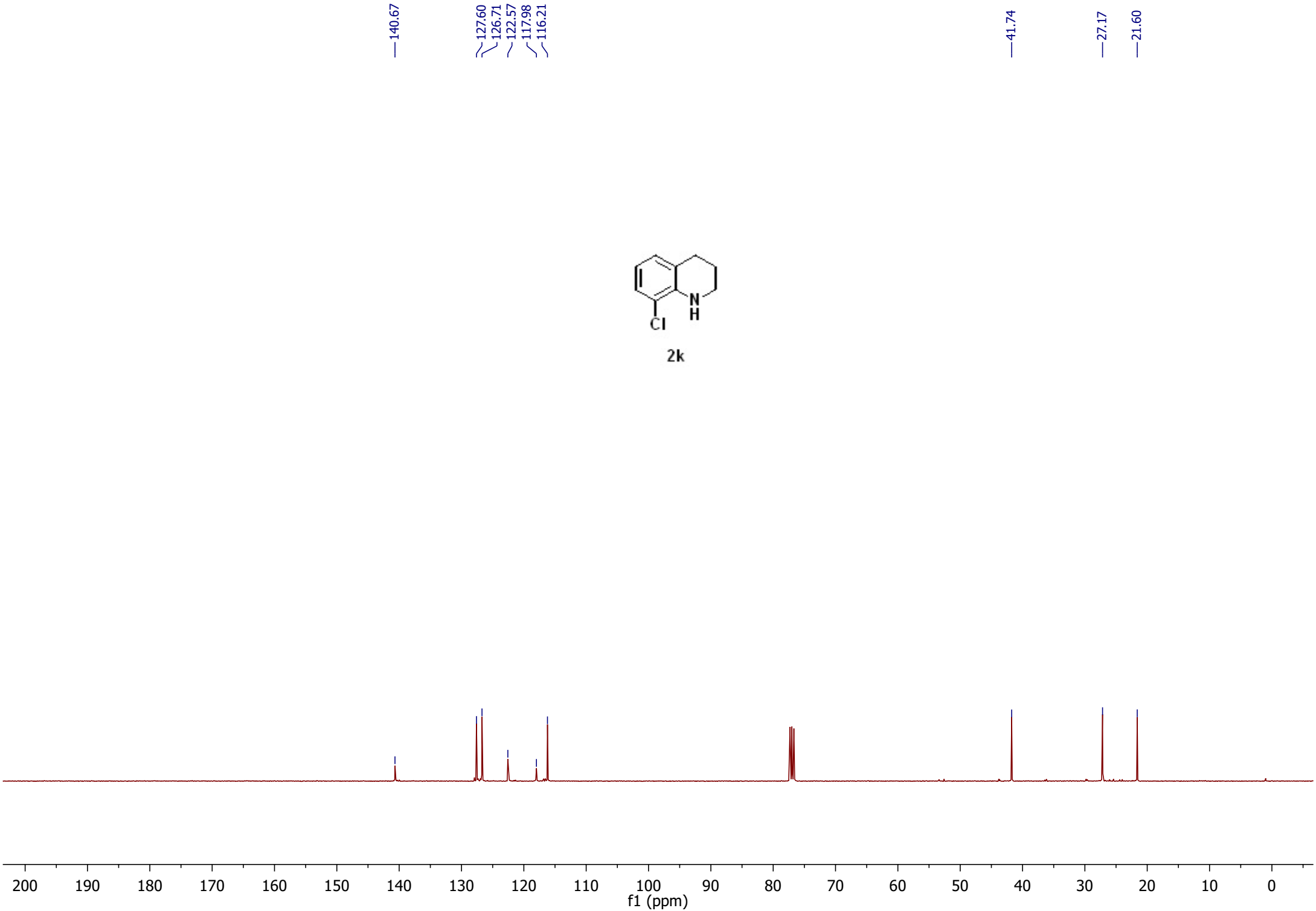
0.5
0.0
-0.5
f1 (ppm)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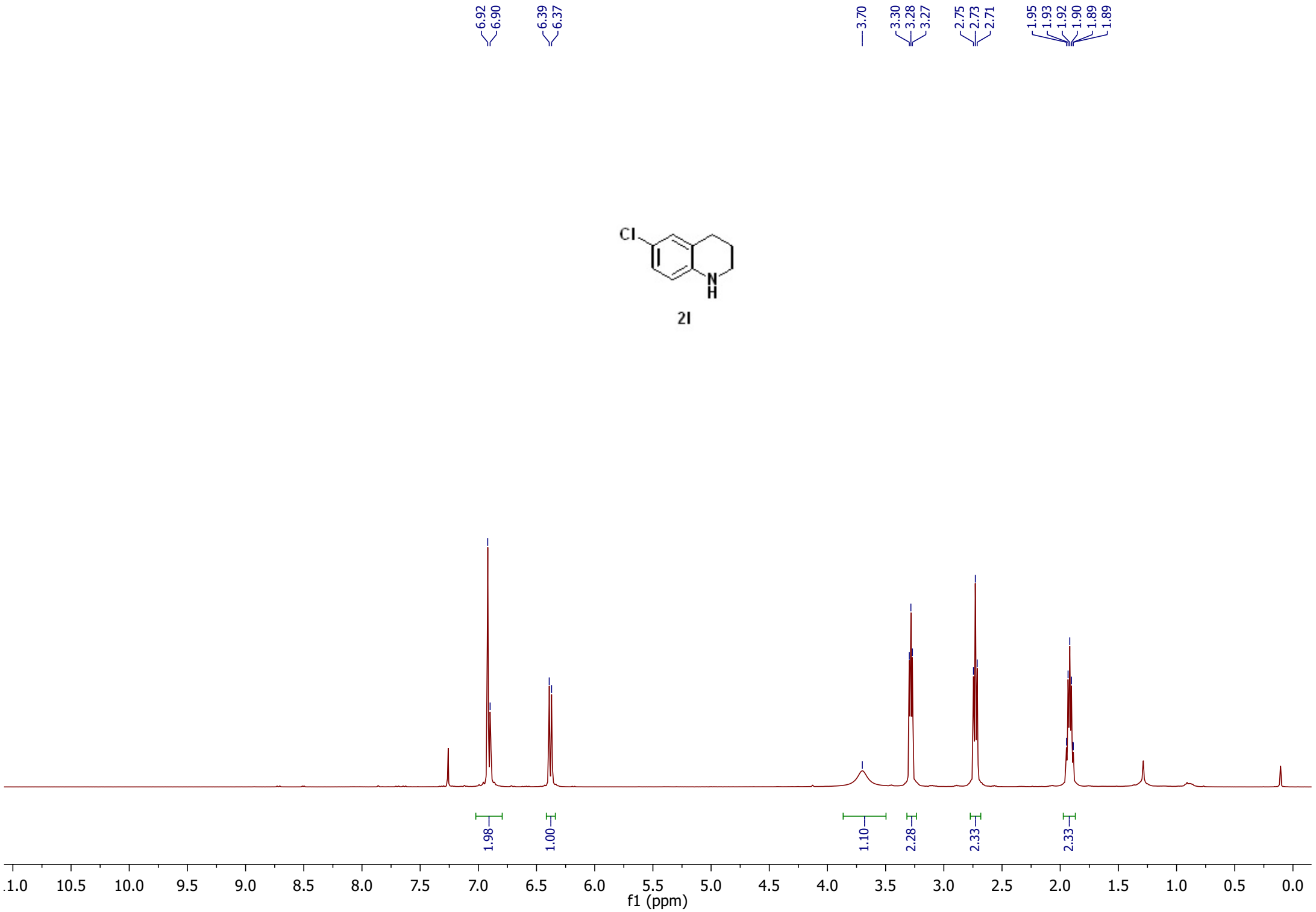
122.57
117.98
116.21
41.74
27.17
21.60
N
H
Cl
2k
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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3.30
3.28
3.27
2.75
2.73
2.71
1.95
1.93
1.92
1.90
1.89
1.89
Cl
N
H
2l
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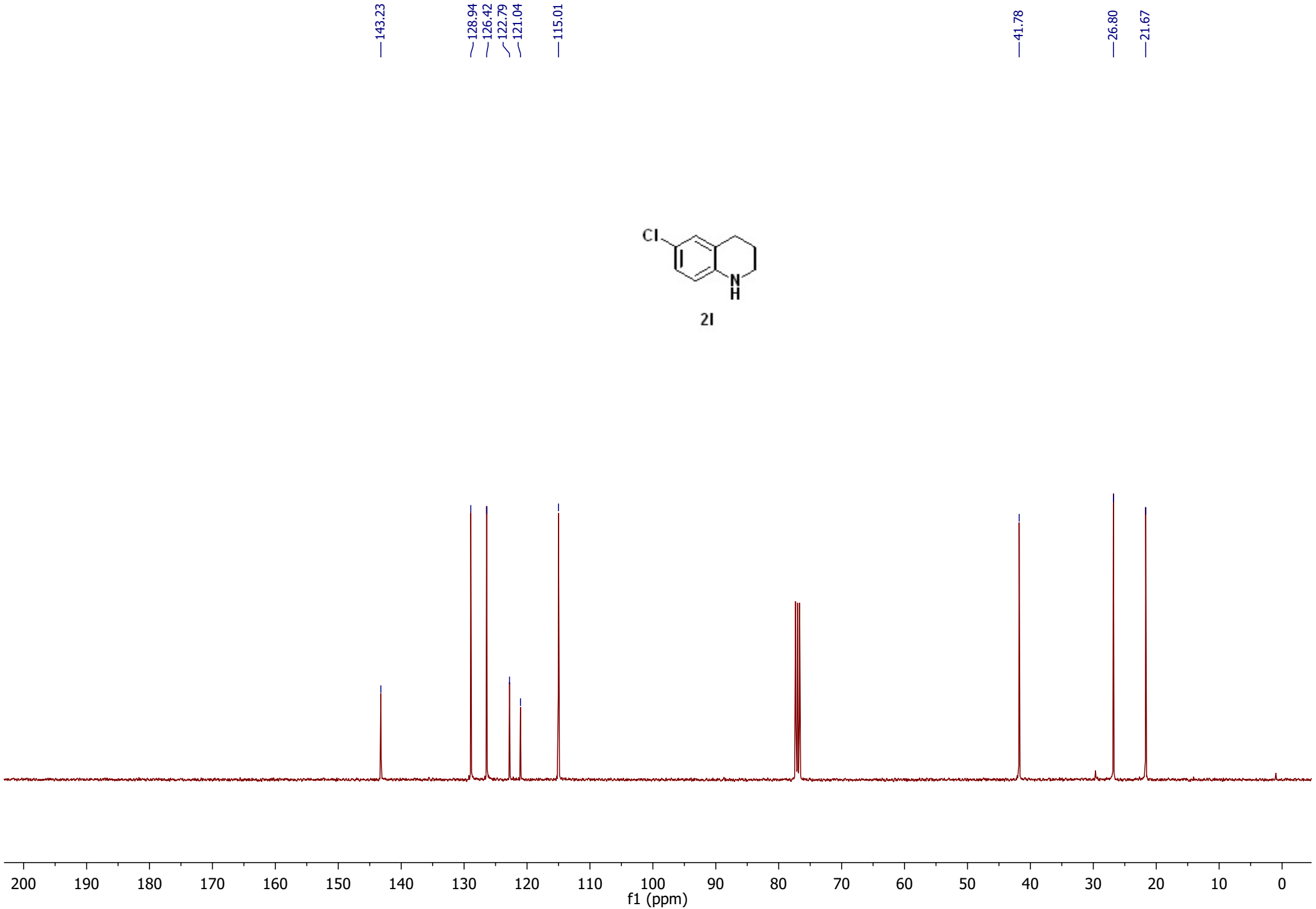
1.00
1.10
2.28
2.33
2.33
f1 (ppm)


143.23
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121.04
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26.80
21.67
Cl
N
H
2l
200
190
180
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90
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70
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50
40
30
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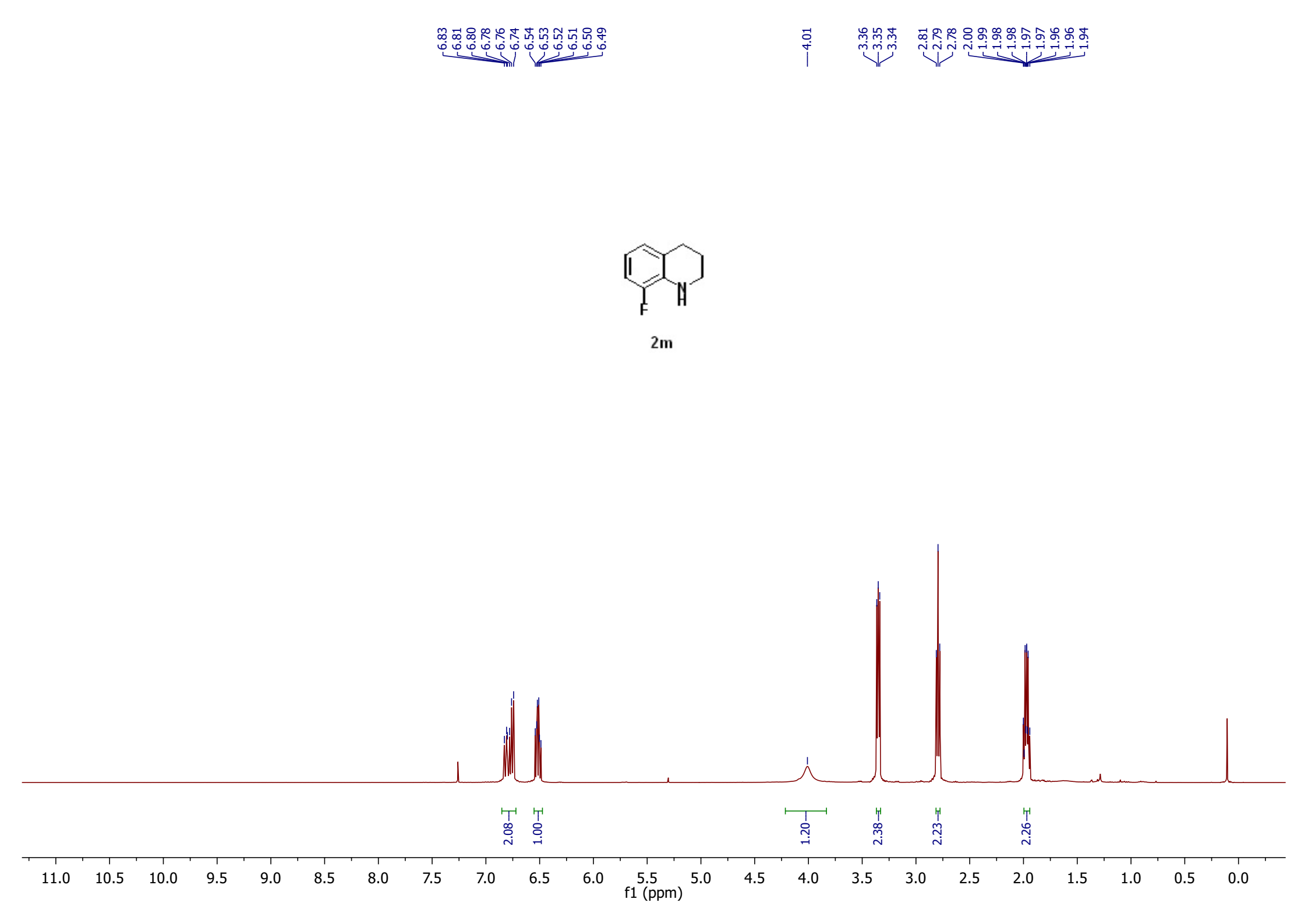
10
0
f1 (ppm)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6.50
6.49
4.01
3.36
3.35
3.34
2.81
2.79
2.78
2.00
1.99
1.98
1.98
1.97
1.97
1.96
1.96
1.94
N
H
F
2m
2.08
1.00
1.20
2.38
2.23
2.26
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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2.5
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1.0
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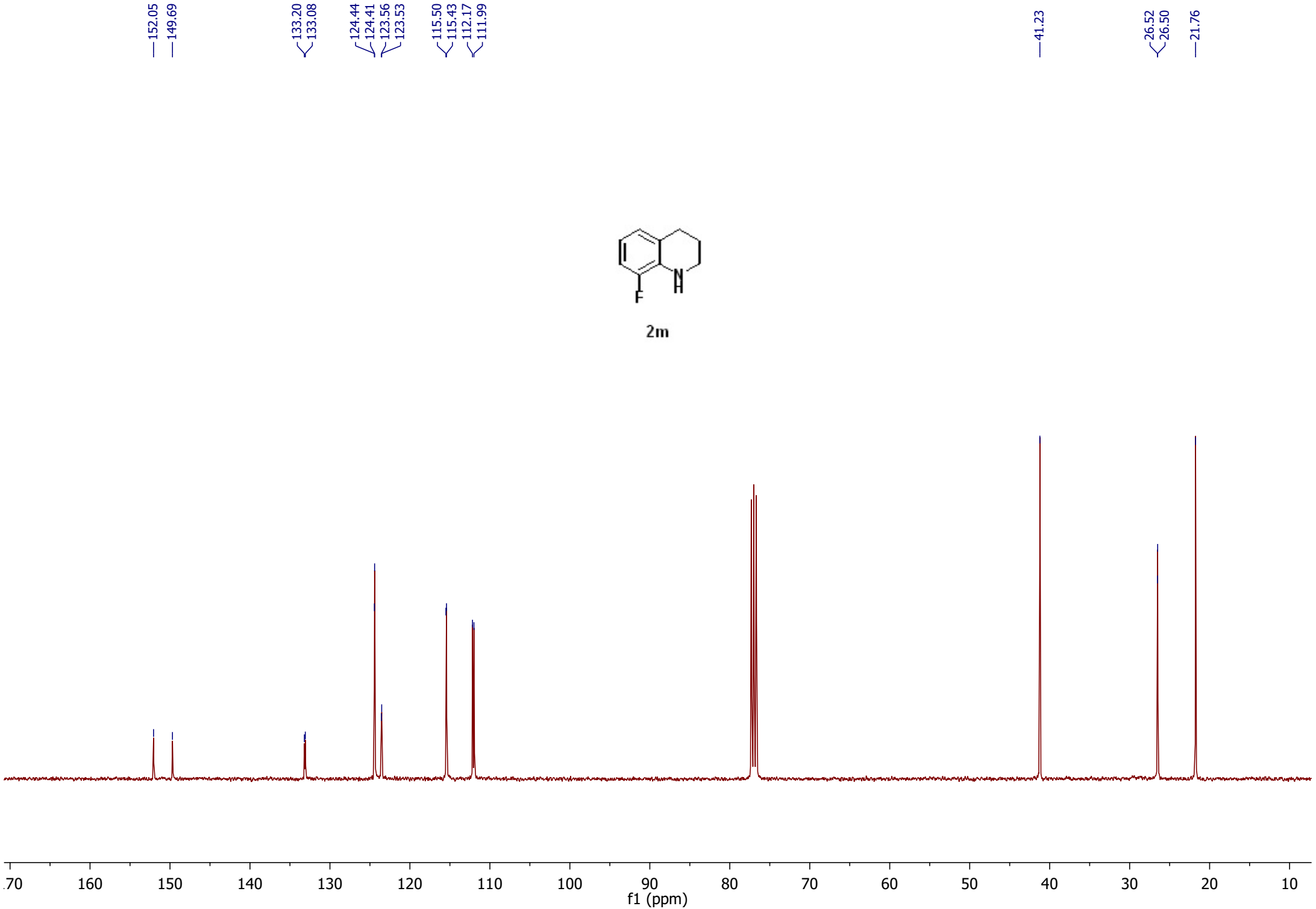
0.0
f1 (ppm)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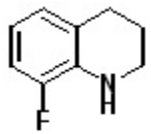
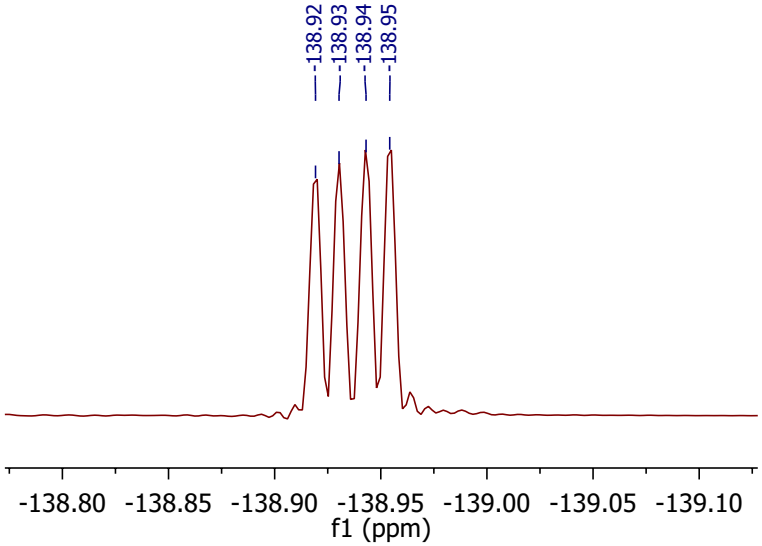
149.69
133.20
133.08
124.44
124.41
123.56
123.53
115.50
115.43
112.17
111.99
41.23
26.52
26.50
21.76
F
N
H
2m
70
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)



2m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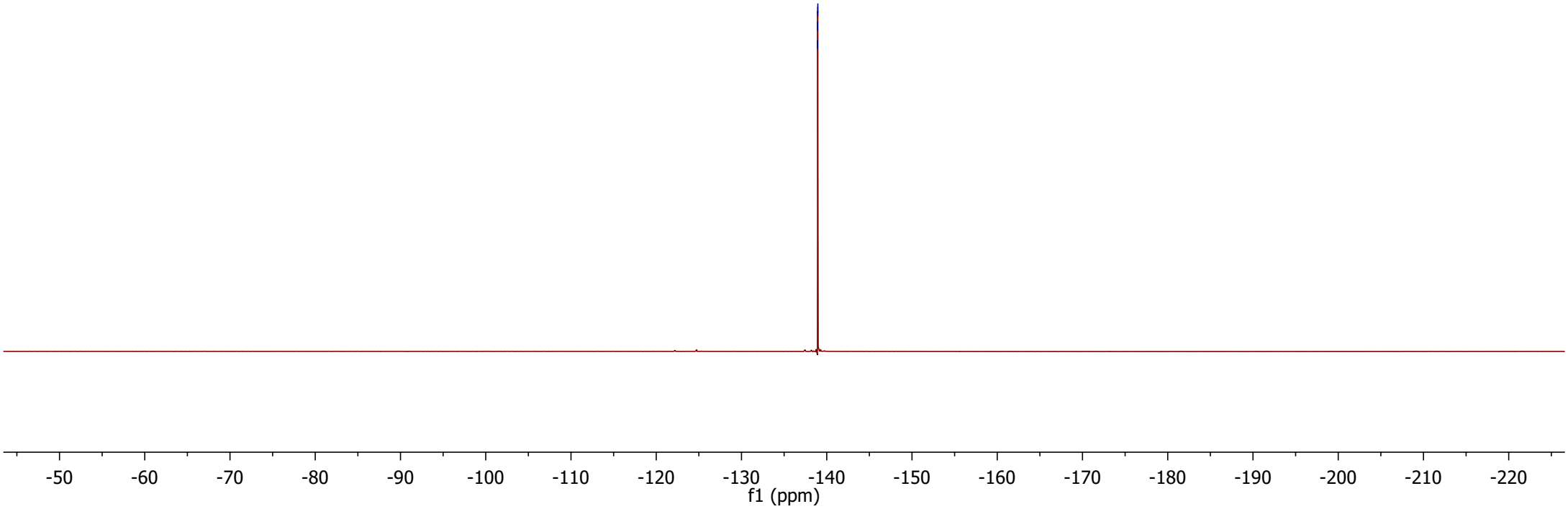
-138.93
-138.94
-138.95
-138.80
-138.85
-138.90
-138.95
-139.00
-139.05
-139.10
f1 (ppm)


-138.92
-138.93
-138.94
-138.95
-50
-60
-70
-80
-90
-100
-110
-120
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-140
-150
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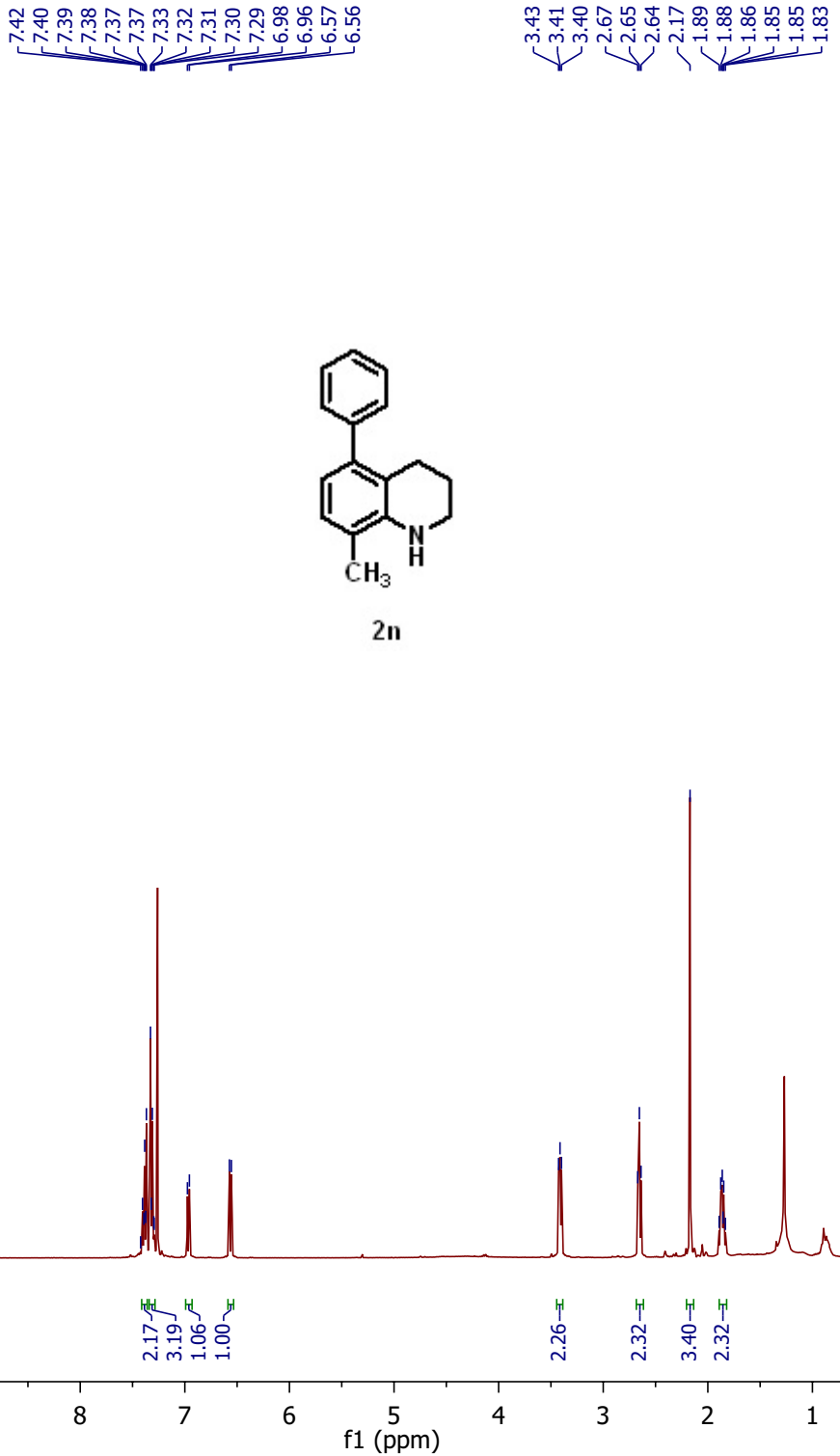
-170
-180
-190
-200
-210
-220
f1 (ppm)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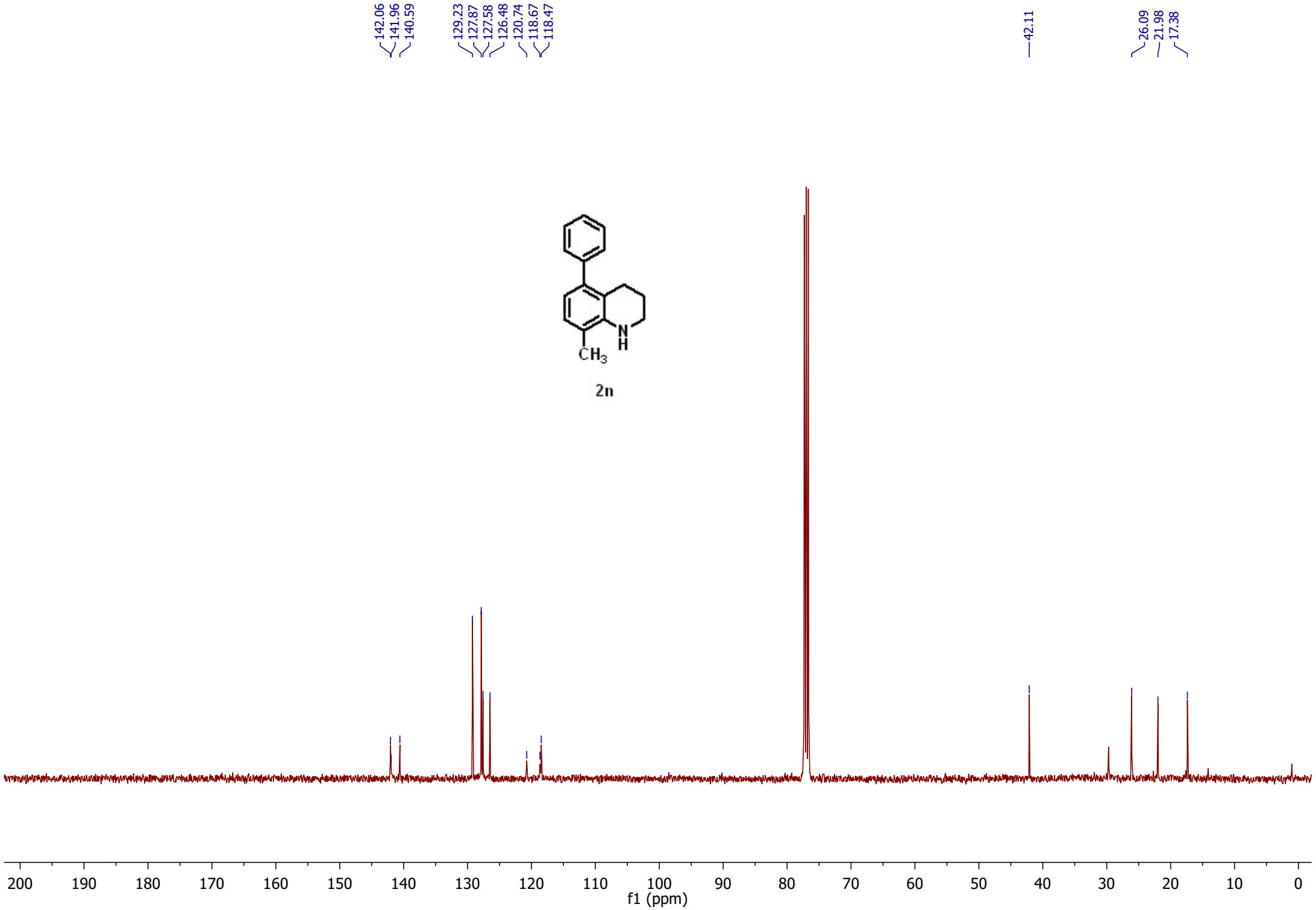
7.32
7.31
7.30
7.29
6.98
6.96
6.57
6.56
3.43
3.41
3.40
2.67
2.65
2.64
2.17
1.89
1.88
1.86
1.85
1.85
1.83
N
H
CH3
2n
2.17
3.19
1.06
1.00
2.26
2.32
3.40
2.32
f1 (ppm)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141.96
140.59
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127.87
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120.74
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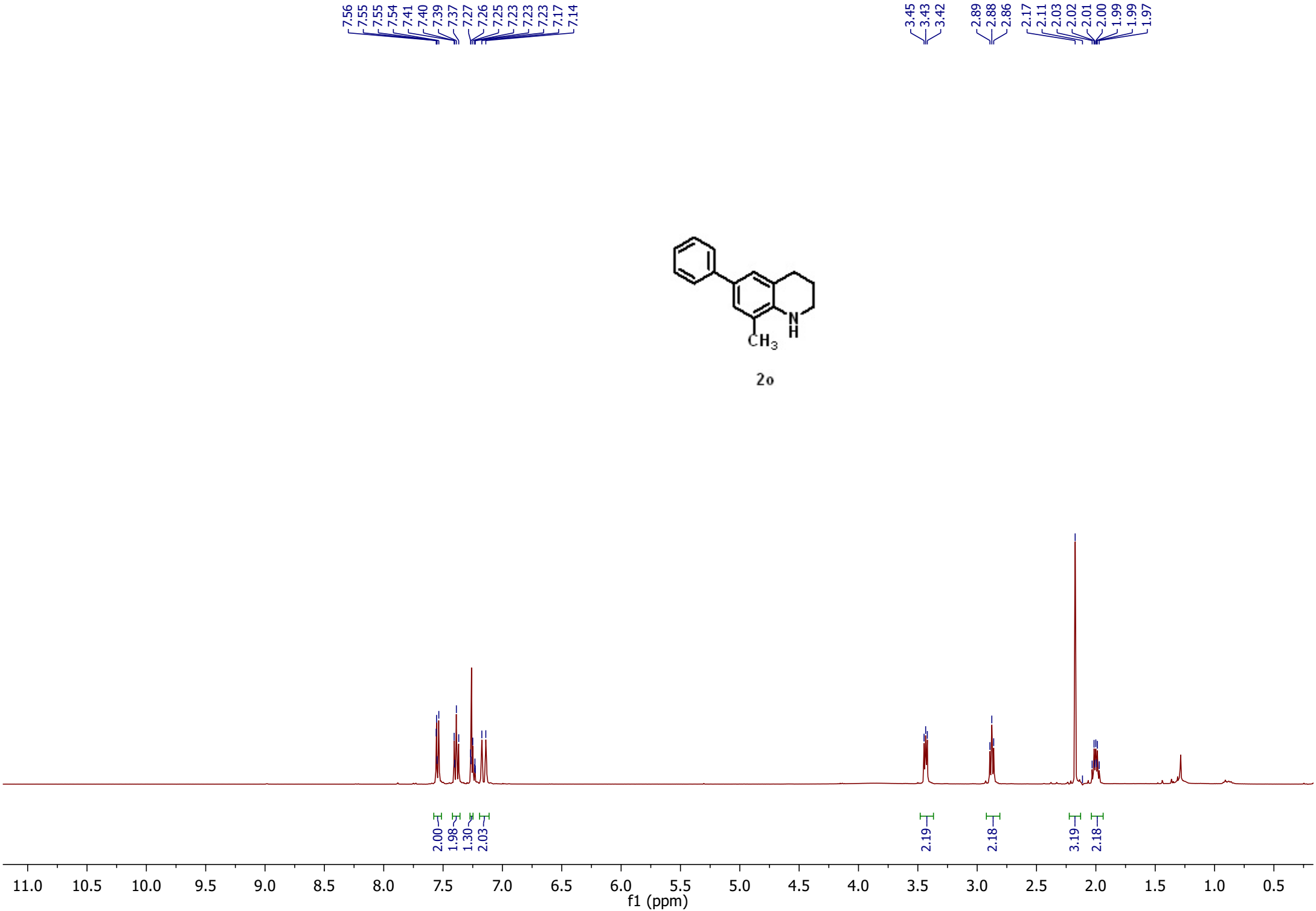
118.47
42.11
26.09
21.98
17.38
N
H
CH3
2n
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.55
7.54
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7.37
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7.26
7.25
7.23
7.23
7.23
7.17
7.14
3.45
3.43
3.42
2.89
2.88
2.86
2.17
2.11
2.03
2.02
2.01
2.00
1.99
1.99
1.97
N
H
CH3
2o
2.00
1.98
1.30
2.03
2.19
2.18
3.19
2.18
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
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5.0
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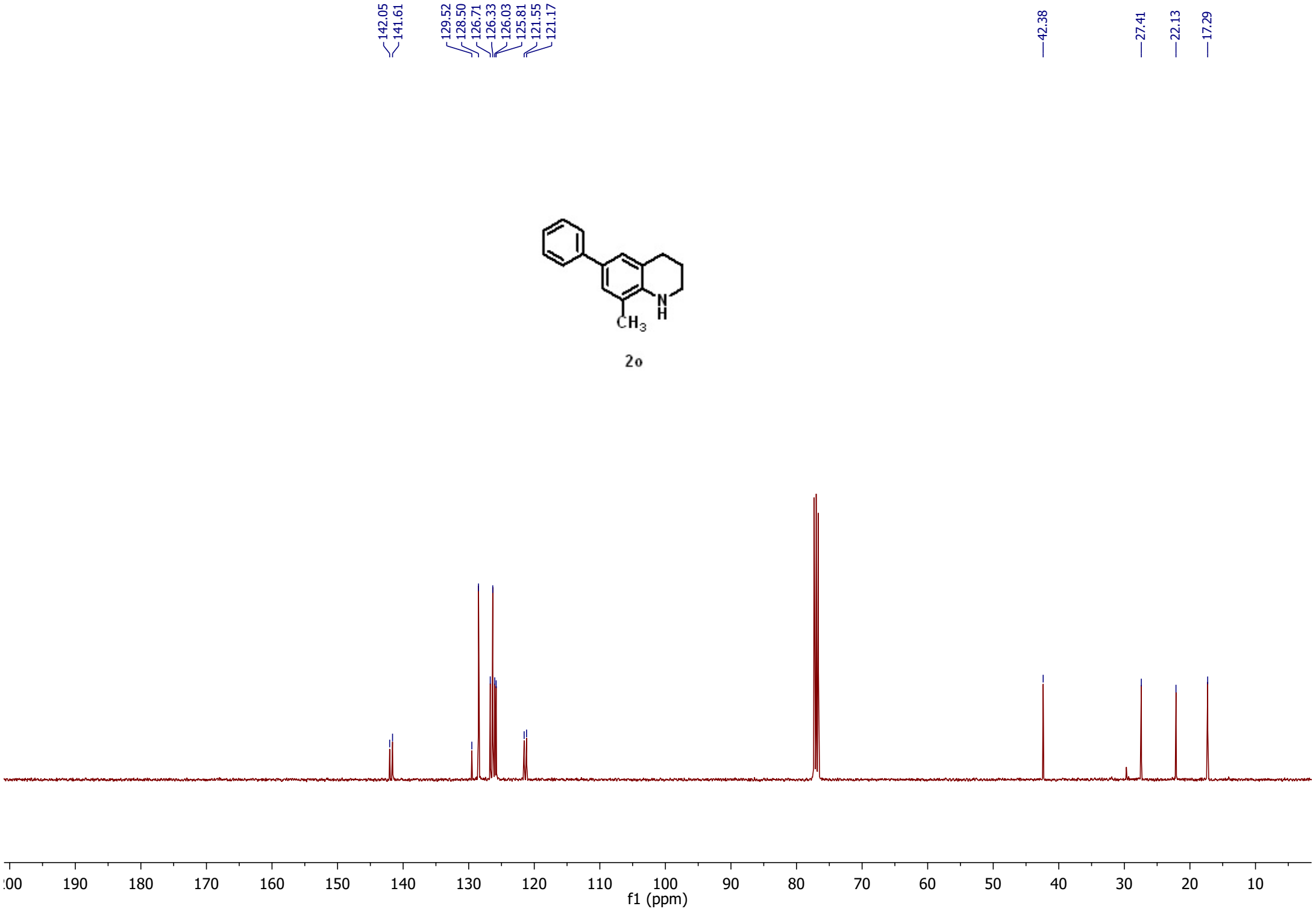
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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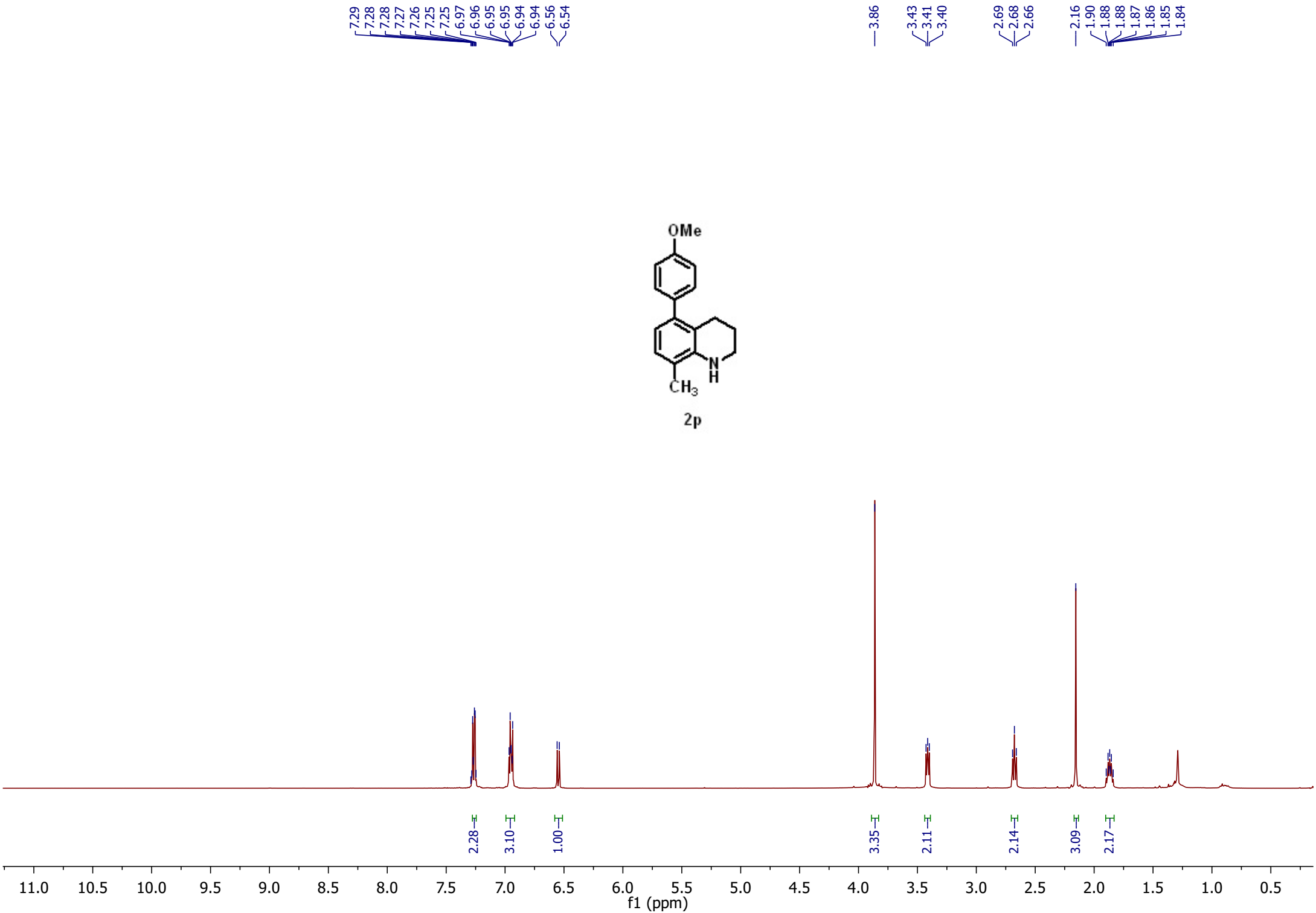
141.61
129.52
128.50
126.71
126.33
126.03
125.81
121.55
121.17
42.38
27.41
22.13
17.29
N
H
CH3
f1 (ppm)

2o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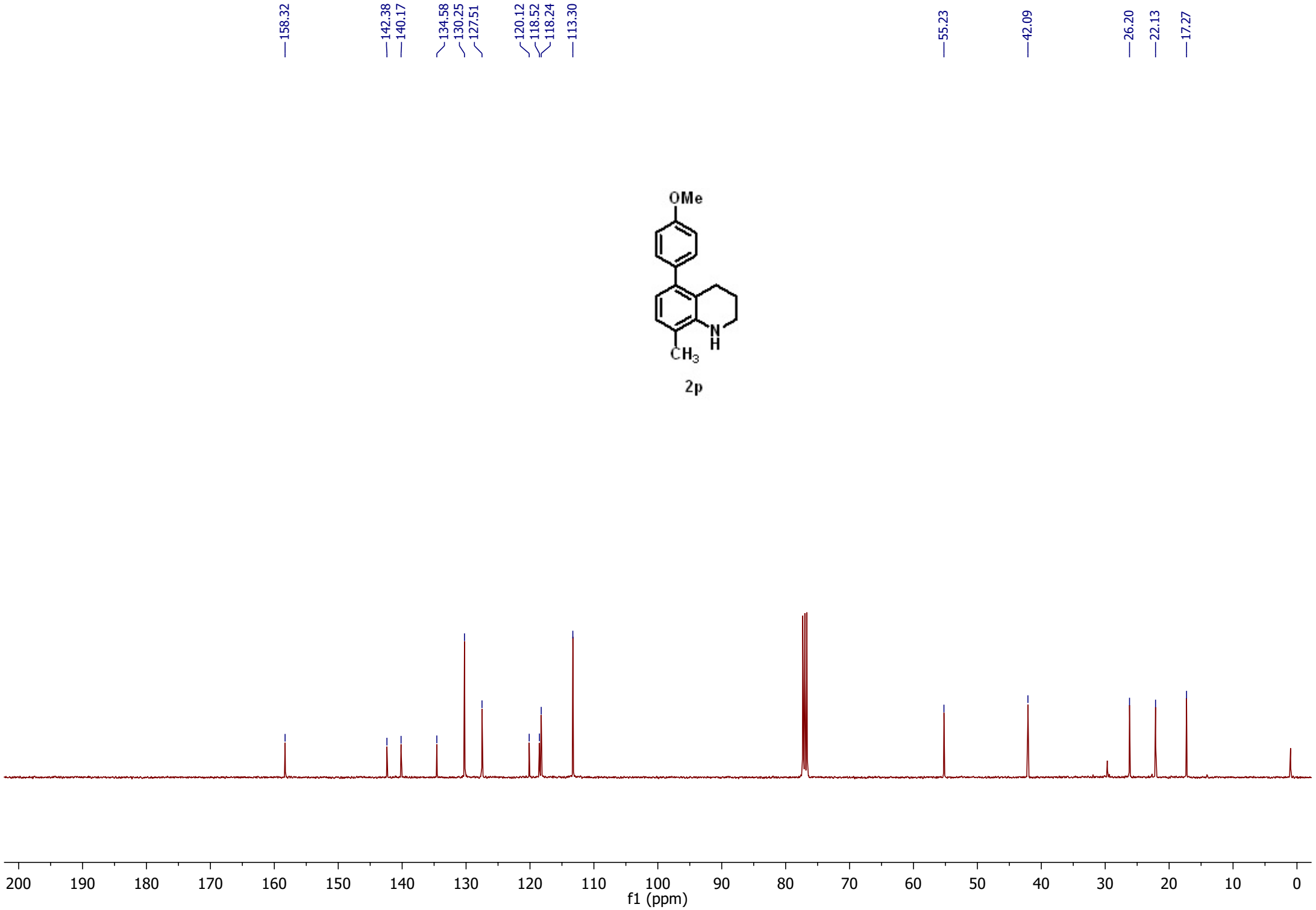
7.28
7.28
7.27
7.26
7.25
7.25
6.97
6.96
6.95
6.95
6.94
6.94
6.56
6.54
3.86
3.43
3.41
3.40
2.69
2.68
2.66
2.16
1.90
1.88
1.88
1.87
1.86
1.85
1.84
OMe
N
H
CH3
2p
2.28
3.10
1.00
3.35
2.11
2.14
3.09
2.17
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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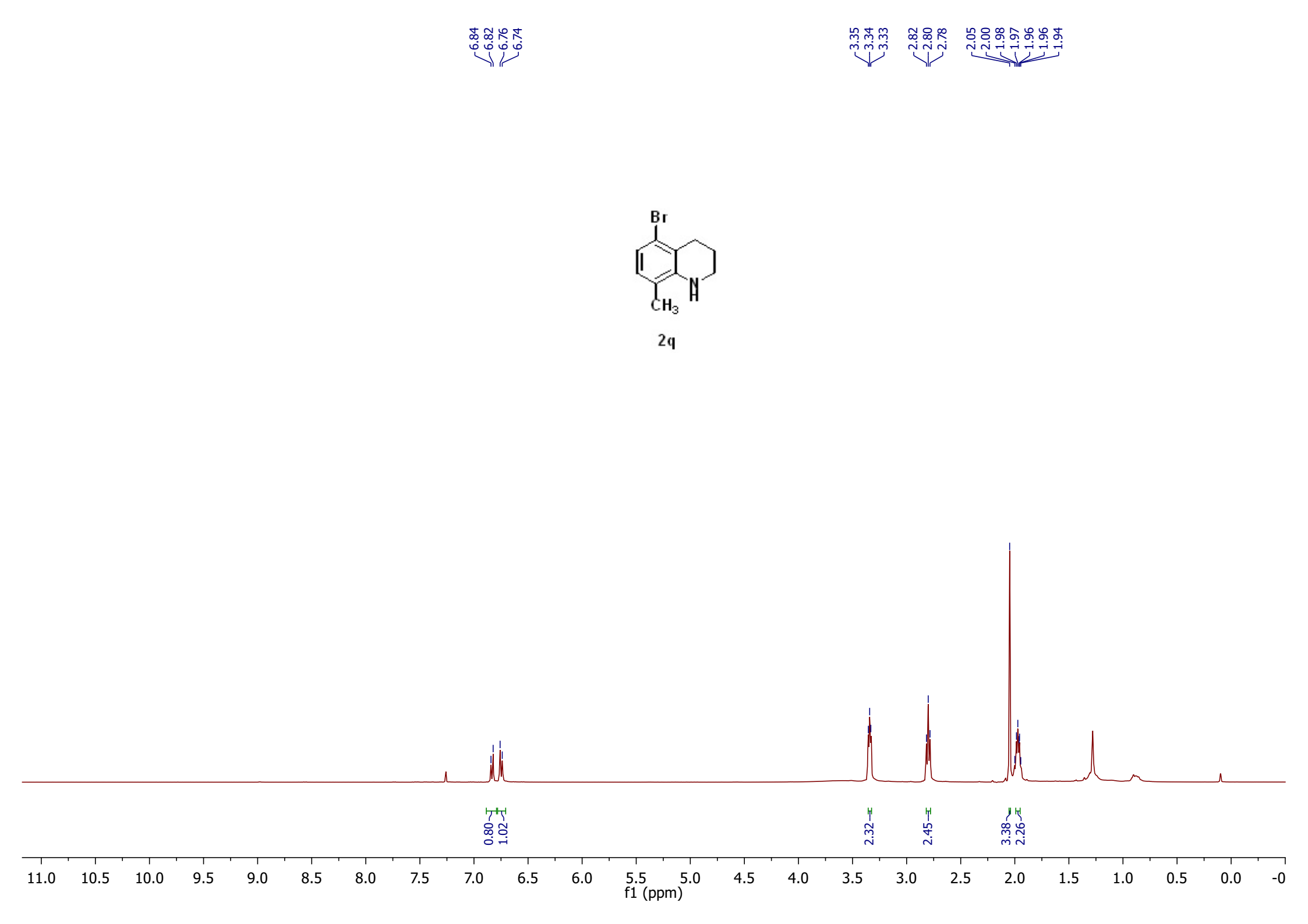
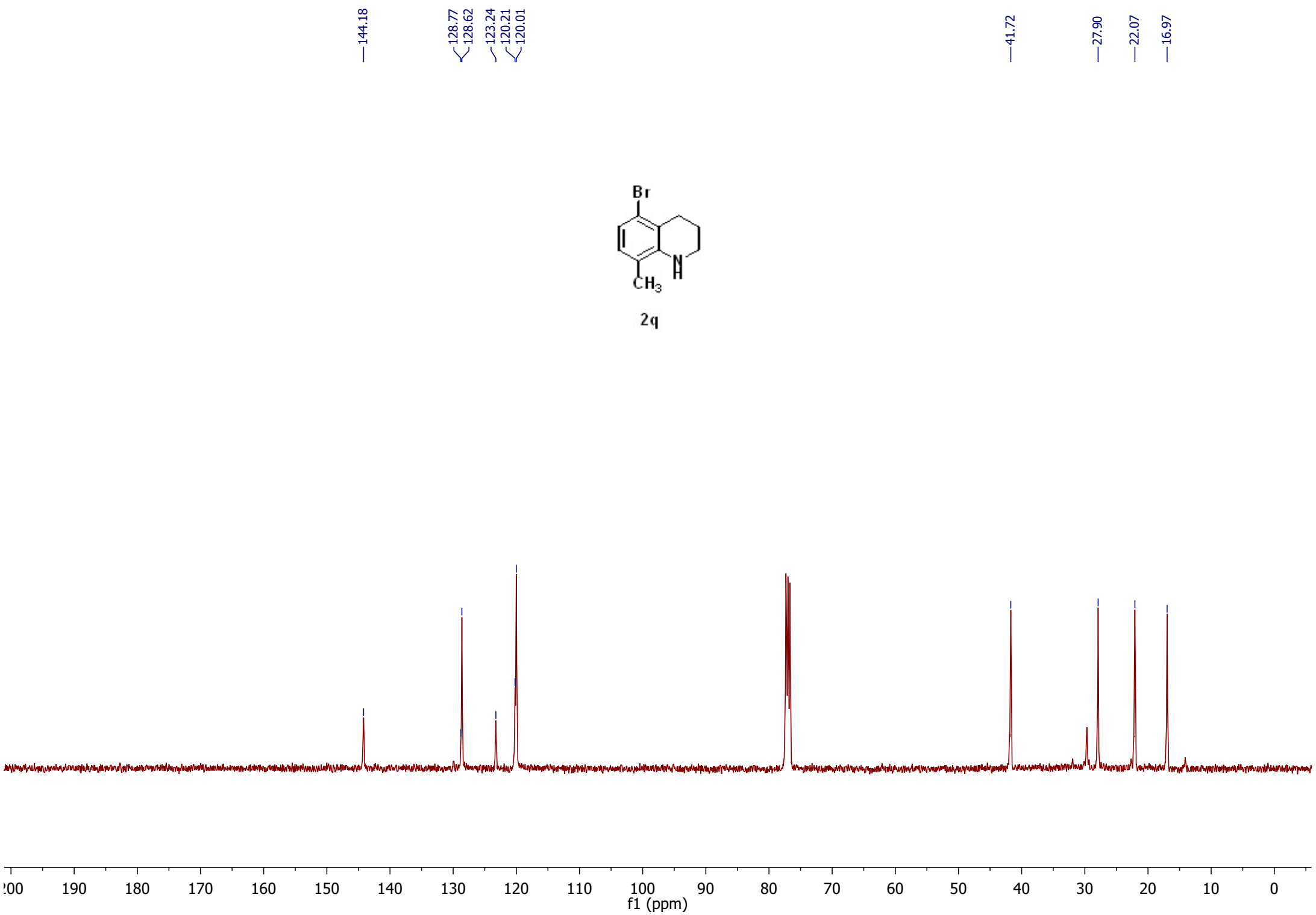
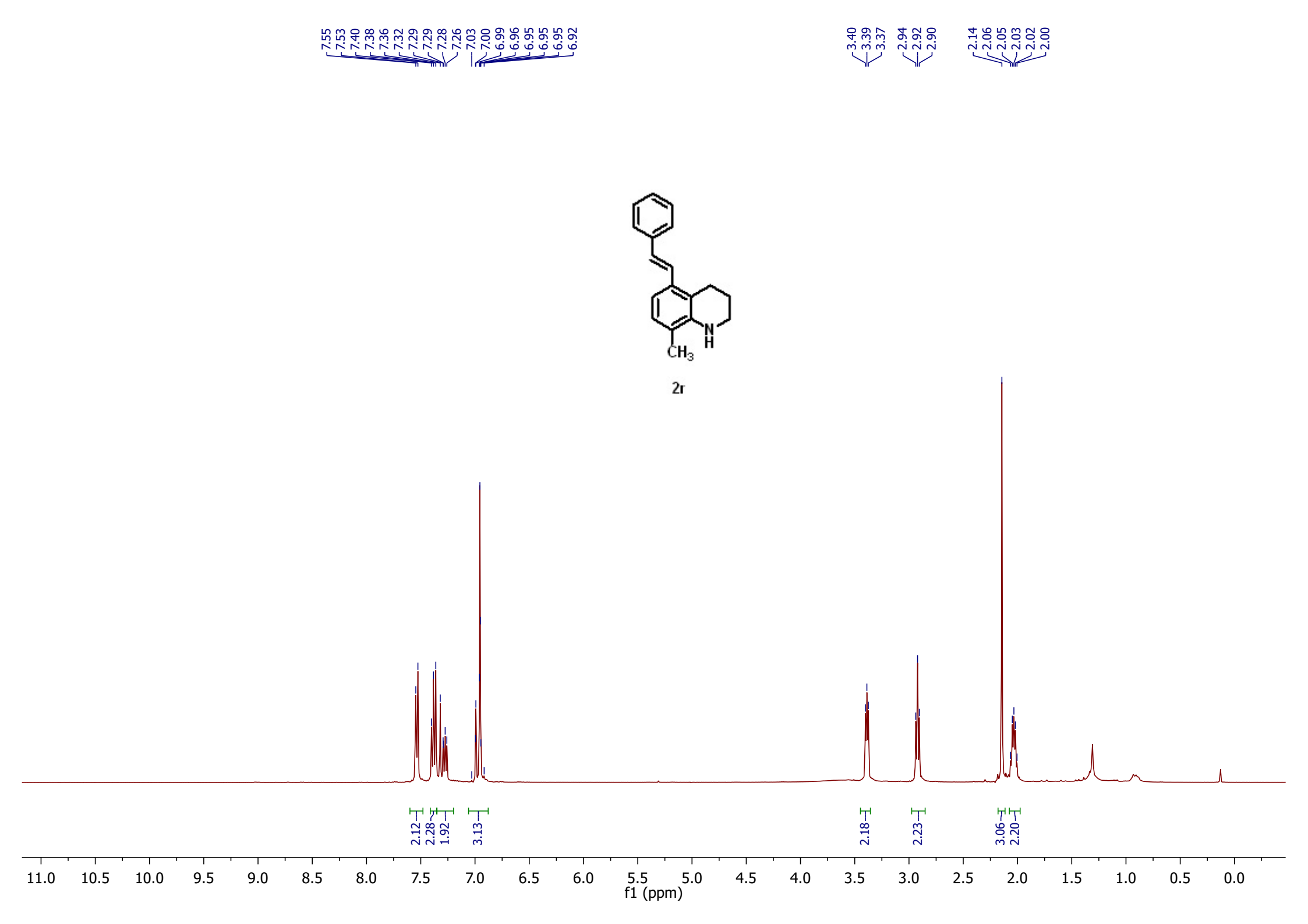
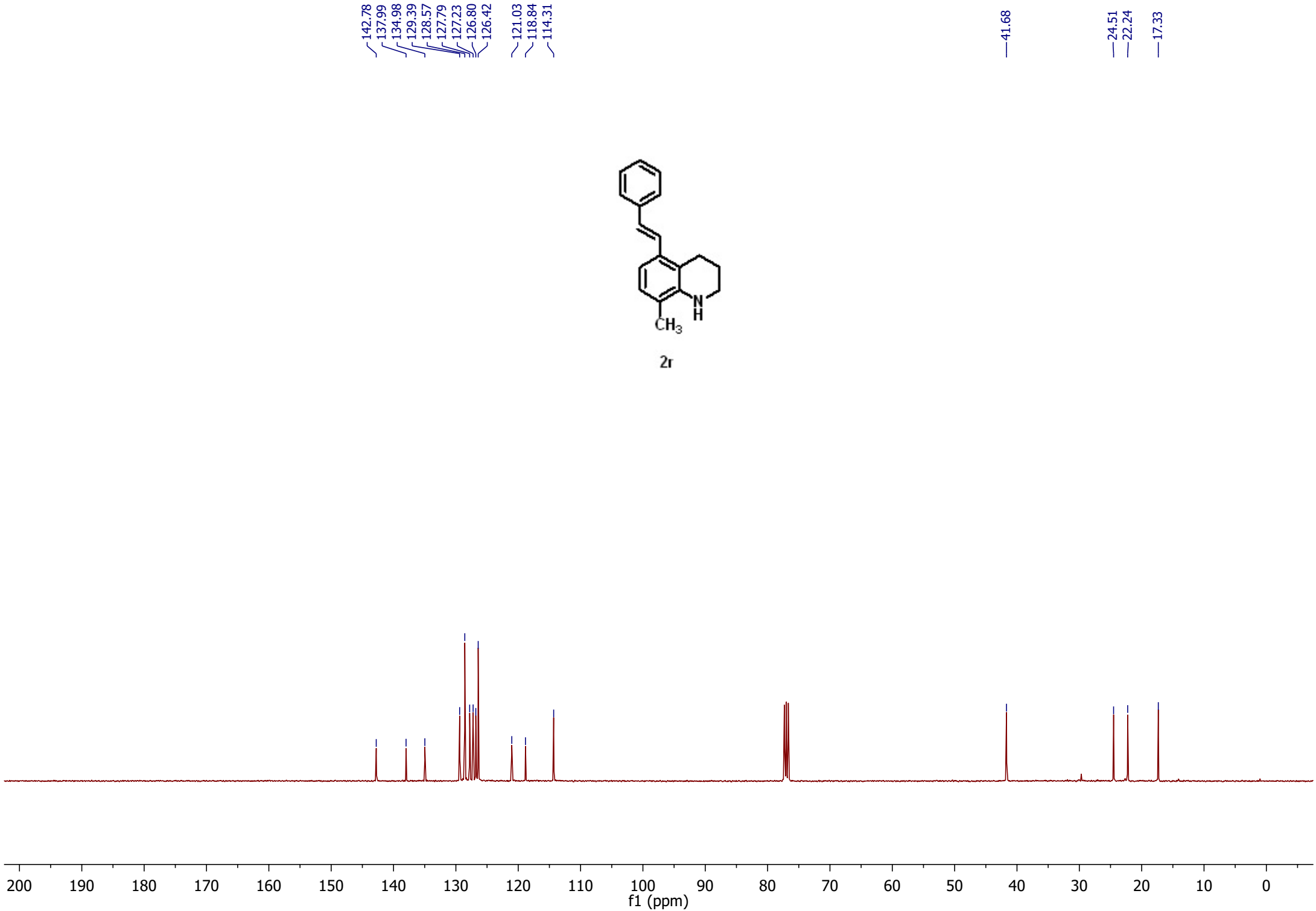
142.38
140.17
134.58
130.25
127.51
120.12
118.52
118.24
113.30
55.23
42.09
26.20
22.13
17.27
OMe
N
H
CH3
2p
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


6.84
6.82
6.76
6.74
3.35
3.34
3.33
2.82
2.80
2.78
2.05
2.00
1.98
1.97
1.96
1.96
1.94
Br
CH3
N
H
2q
0.80
1.02
2.32
2.45
3.38
2.26
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
f1 (ppm)


144.18
128.77
128.62
123.24
120.21
120.01
41.72
27.90
22.07
16.97
Br
CH3
2q
f1 (ppm)


7.55
7.53
7.40
7.38
7.36
7.32
7.29
7.29
7.28
7.26
7.03
7.00
6.99
6.96
6.95
6.95
6.95
6.92
3.40
3.39
3.37
2.94
2.92
2.90
2.14
2.06
2.05
2.03
2.02
2.00
N
H
CH3
2r
2.12
2.28
1.92
3.13
2.18
2.23
3.06
2.20
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
f1 (ppm)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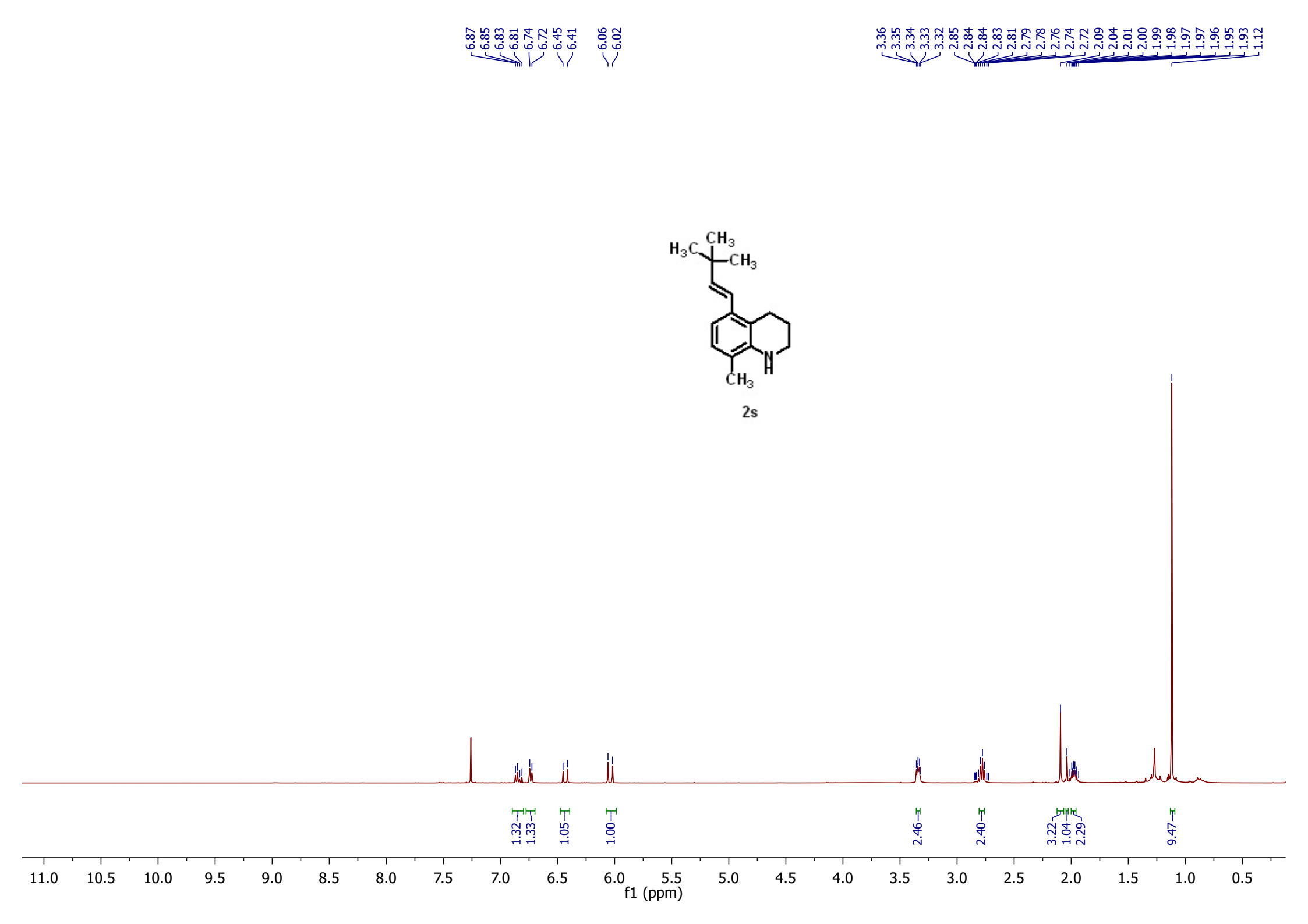
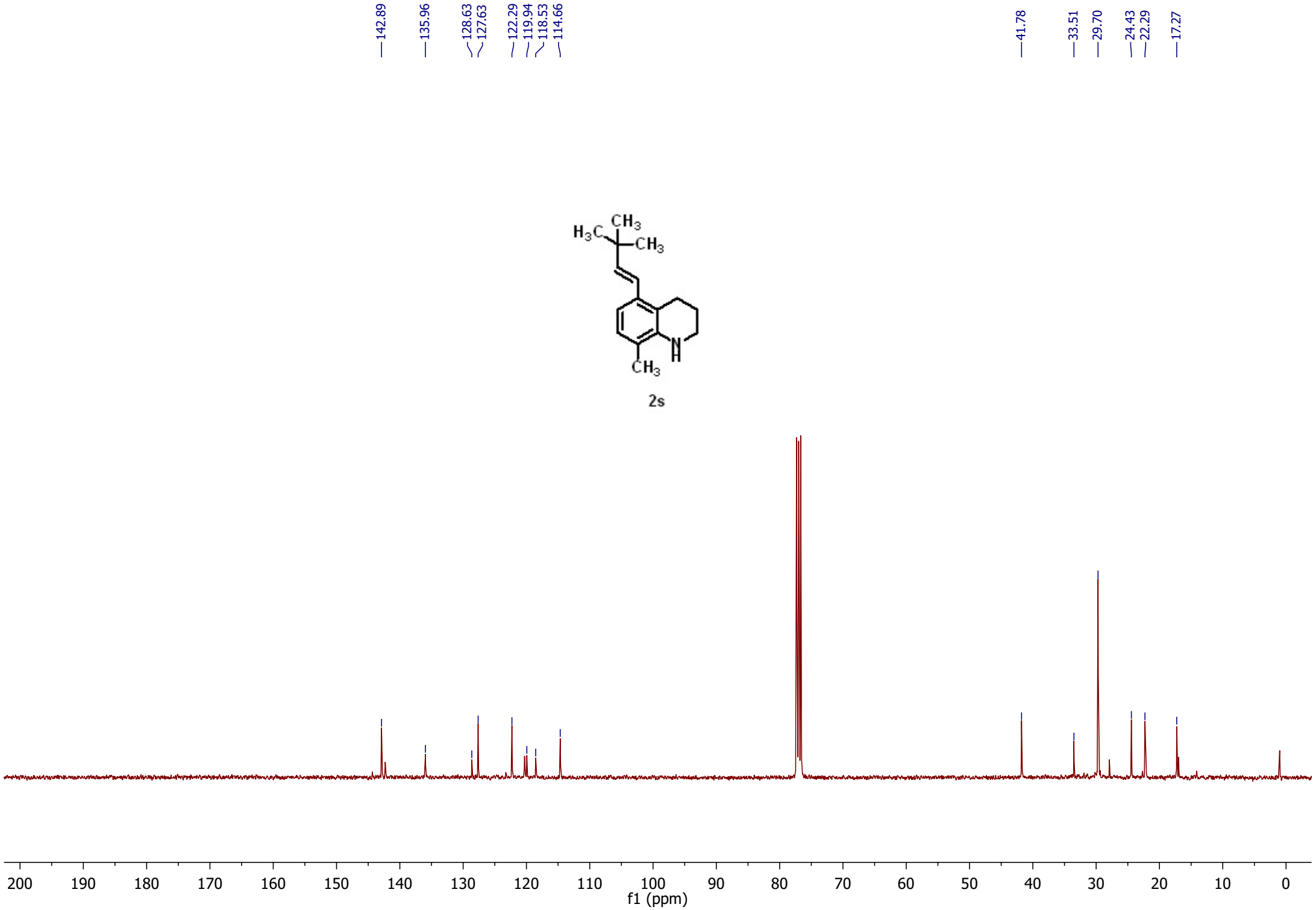
134.98
129.39
128.57
127.79
127.23
126.80
126.42
121.03
118.84
114.31
41.68
24.51
22.24
17.33
N
H
CH3
2r
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


6.87
6.85
6.83
6.81
6.74
6.72
6.45
6.41
6.06
6.02
3.36
3.35
3.34
3.33
3.32
2.85
2.84
2.84
2.83
2.81
2.79
2.78
2.76
2.74
2.72
2.09
2.04
2.01
2.00
1.99
1.98
1.97
1.97
1.96
1.95
1.93
1.12
CH3
H3C
CH3
CH3
N
H
2s
1.32
1.33
1.05
1.00
2.46
2.40
3.22
1.04
2.29
9.47
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
f1 (ppm)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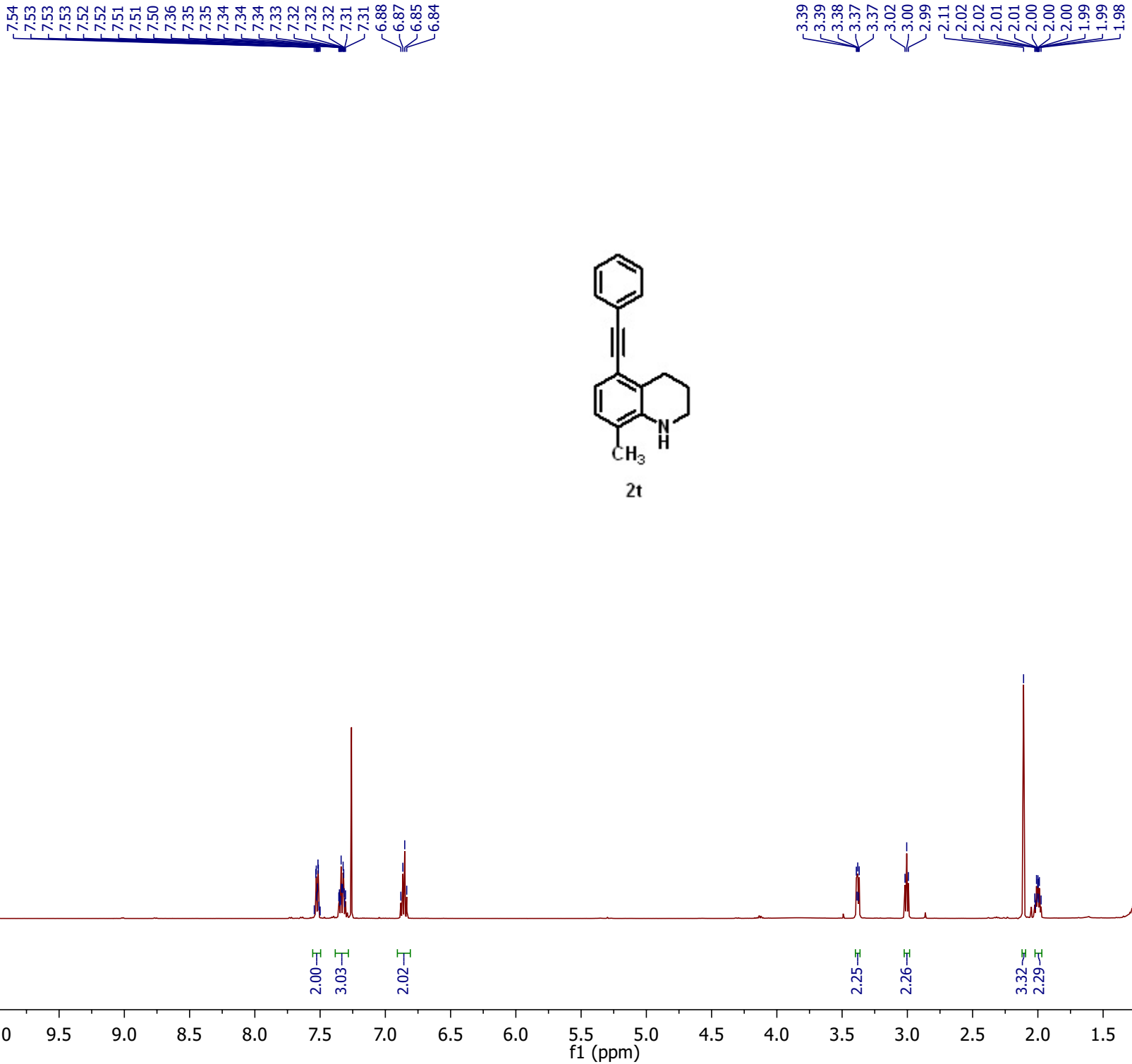
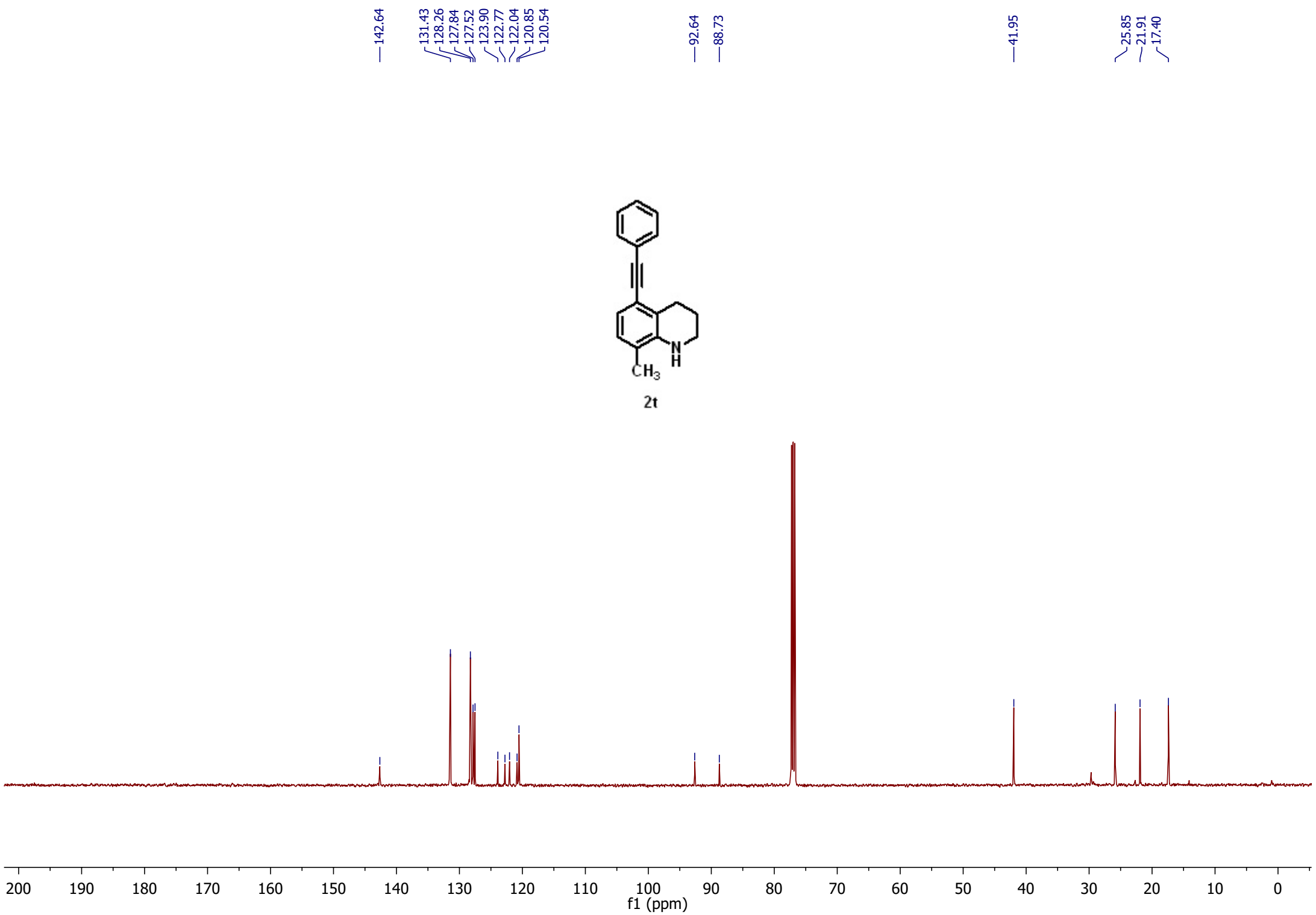
135.96
128.63
127.63
122.29
119.94
118.53
114.66
41.78
33.51
29.70
24.43
22.29
17.27
H3C
CH3
CH3
N
H
CH3
2s
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.54 7.53 7.53 7.53 7.52 7.52 7.51 7.51 7.50 7.36 7.35 7.35 7.34 7.34 7.34 7.33 7.32 7.32 7.31 7.31 6.88 6.87 6.85 6.84
3.39 3.39 3.38 3.37 3.37 3.02 3.00 2.99 2.11 2.02 2.02 2.01 2.01 2.00 2.00 2.00 1.99 1.99 1.98
N
H
CH3
2t
2.00 3.03 2.02 2.25 2.26 3.32 2.29
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.
f1 (ppm)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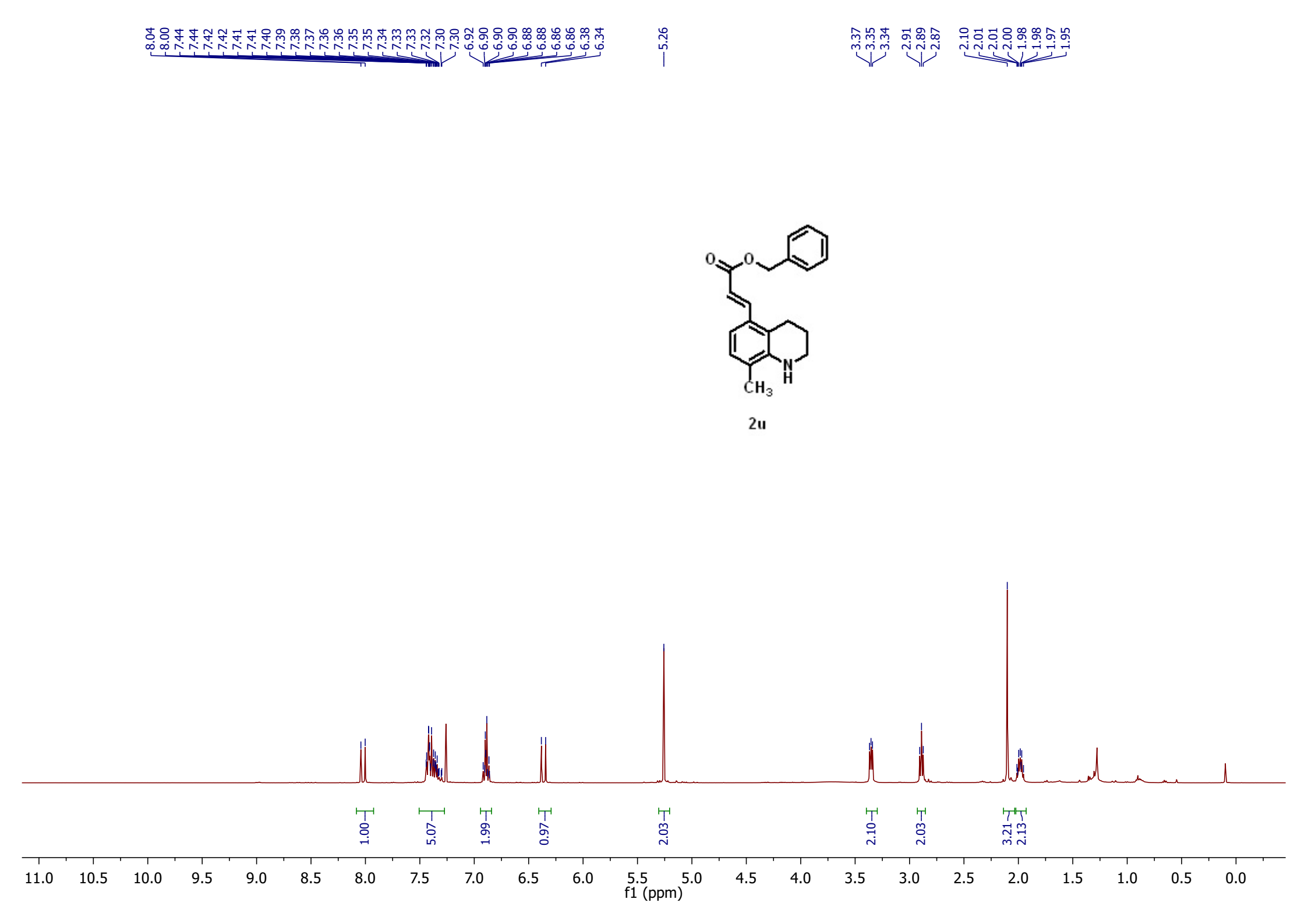
131.43
128.26
127.84
127.52
123.90
122.77
122.04
120.85
120.54
92.64
88.73
41.95
25.85
21.91
17.40
N
H
CH3
2t
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.44
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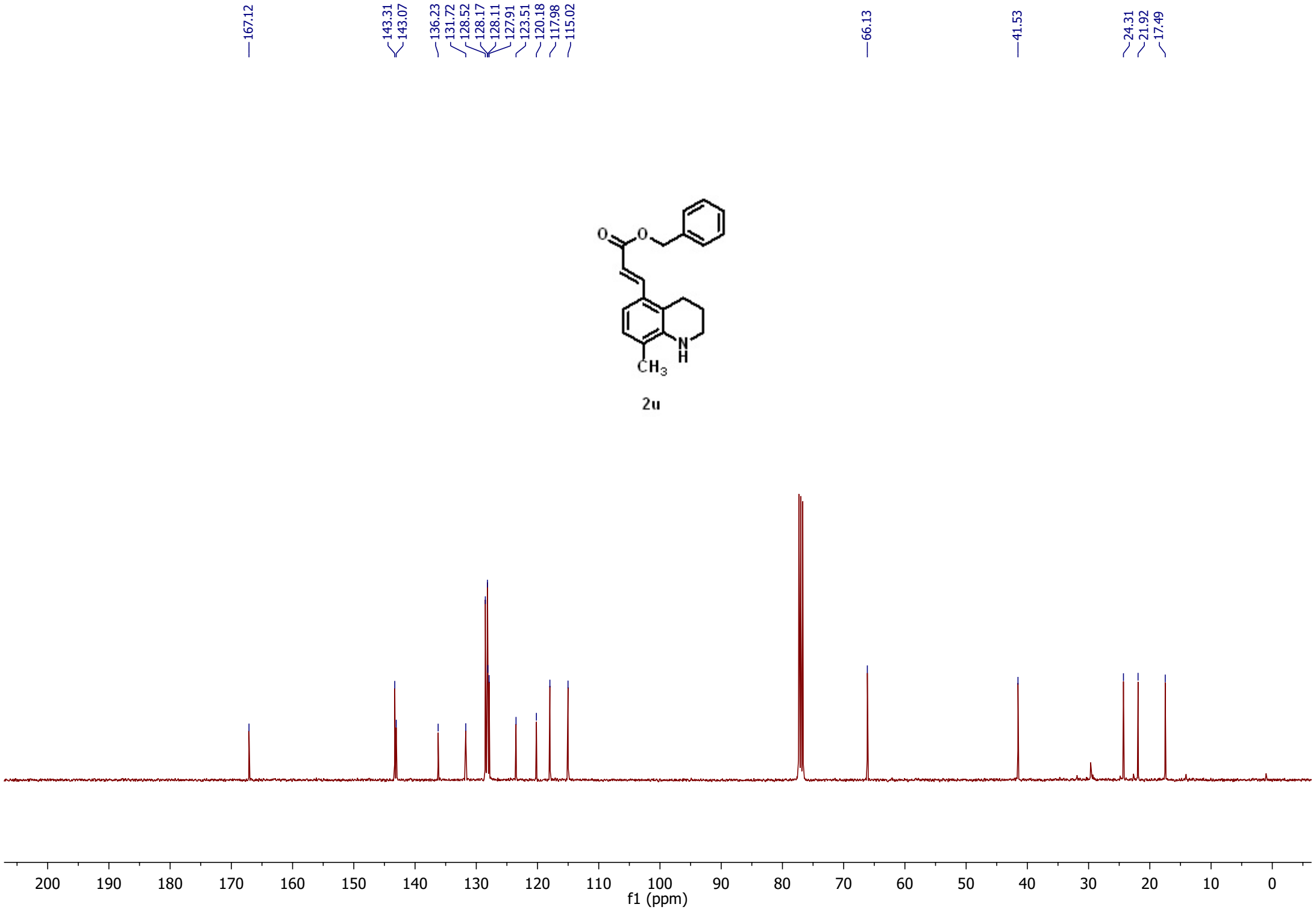
7.42
7.41
7.41
7.40
7.39
7.38
7.37
7.36
7.36
7.35
7.35
7.34
7.33
7.33
7.32
7.30
7.30
6.92
6.90
6.90
6.90
6.88
6.88
6.86
6.86
6.38
6.34
5.26
3.37
3.35
3.34
2.91
2.89
2.87
2.10
2.01
2.01
2.00
1.98
1.98
1.97
1.95
O
O
N
H
CH3
2u
1.00
5.07
1.99
0.97
2.03
2.10
2.03
3.21
2.13
11.0
10.5
10.0
9.5
9.0
8.5
8.0
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
f1 (ppm)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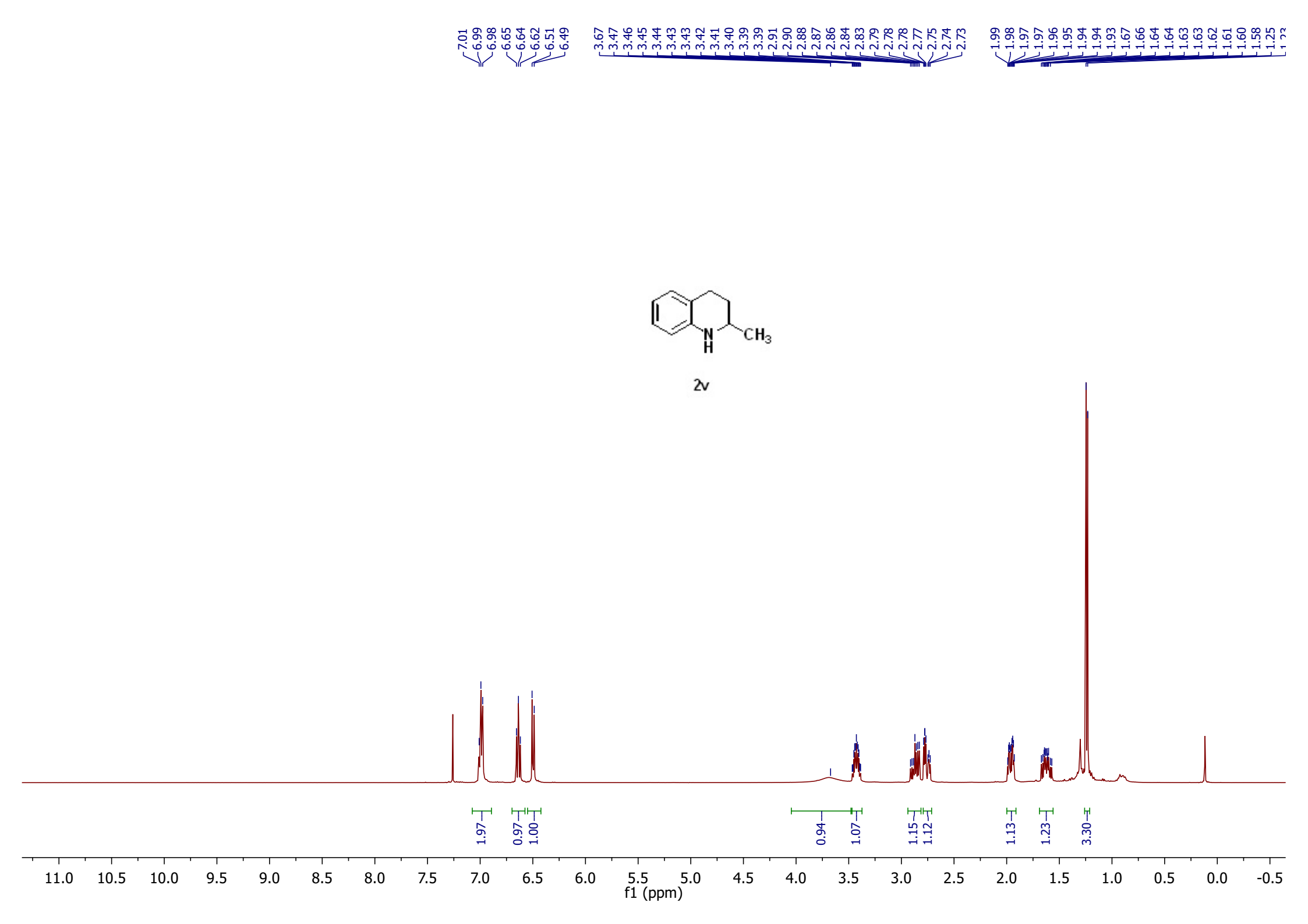
143.31
143.07
136.23
131.72
128.52
128.17
128.11
127.91
123.51
120.18
117.98
115.02
66.13
41.53
24.31
21.92
17.49
O
O
N
H
CH3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

2u


7.01
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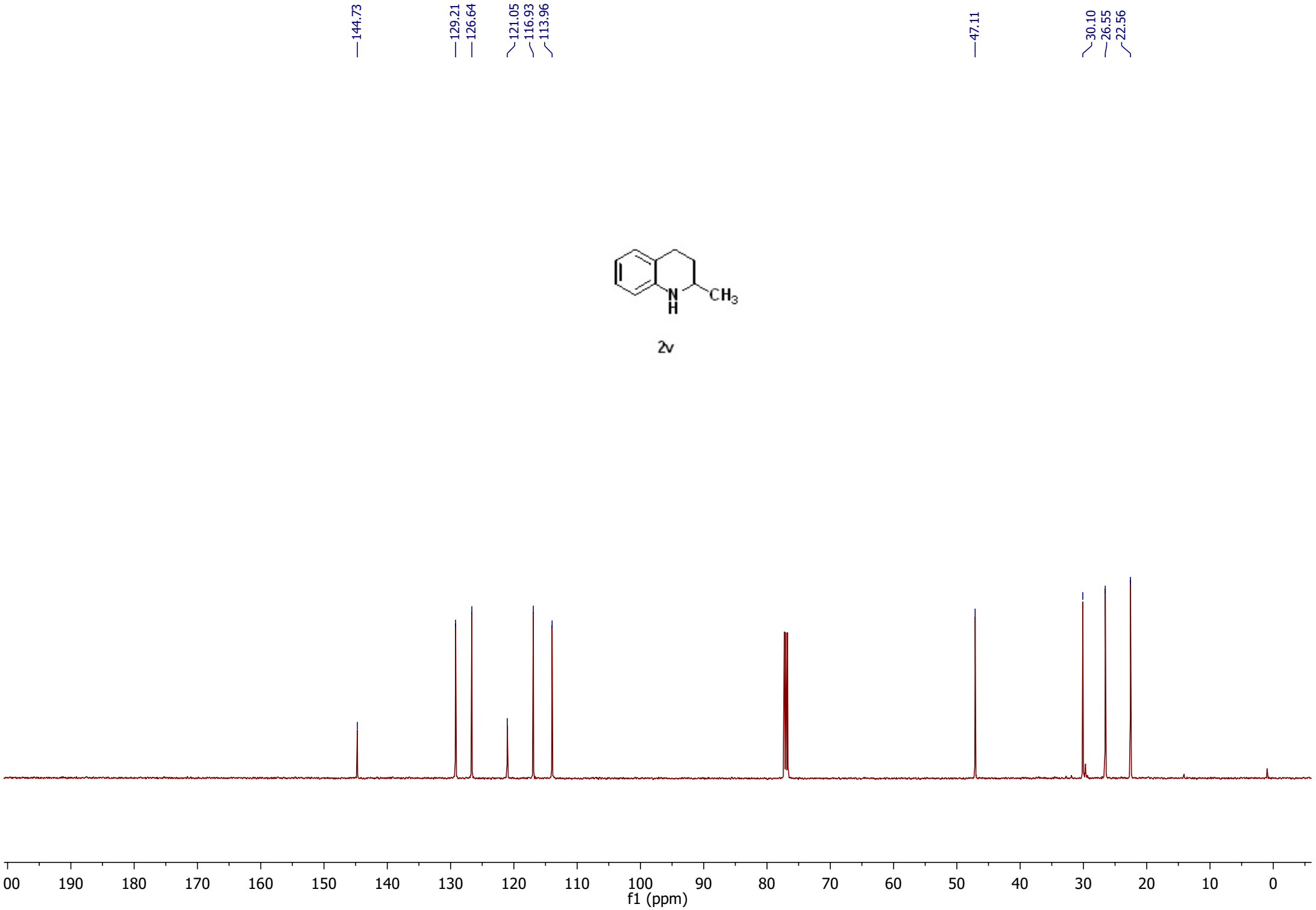
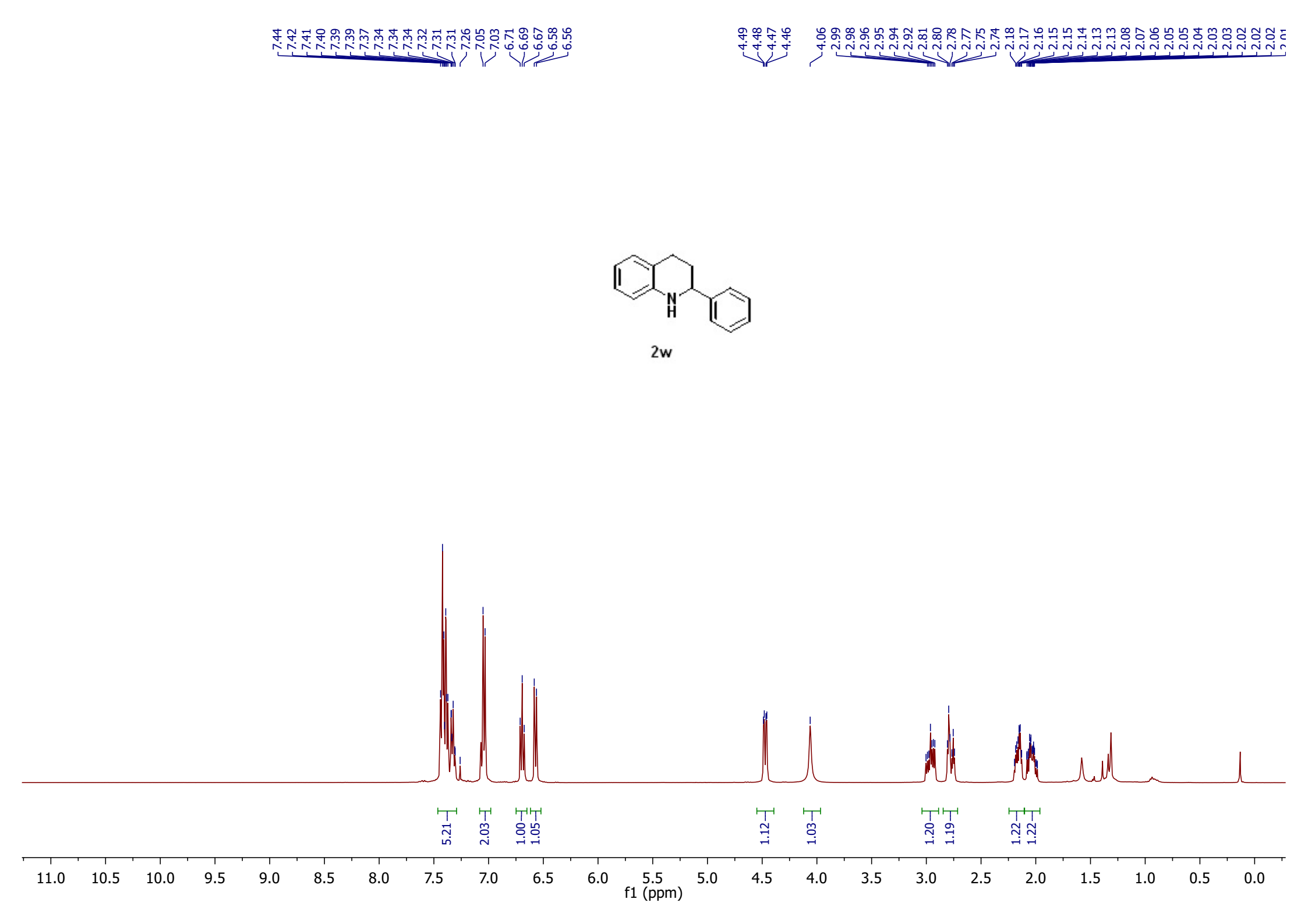
6.98
6.65
6.64
6.62
6.51
6.49
3.67
3.47
3.46
3.45
3.44
3.43
3.43
3.42
3.41
3.40
3.39
3.39
2.91
2.90
2.88
2.87
2.86
2.84
2.83
2.79
2.78
2.78
2.77
2.75
2.74
2.73
1.99
1.98
1.97
1.97
1.96
1.95
1.94
1.94
1.93
1.67
1.66
1.64
1.64
1.63
1.63
1.62
1.61
1.60
1.58
1.25
N
H
CH3
2v
1.97
0.97
1.00
0.94
1.07
1.15
1.12
1.13
1.23
3.30
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)


144.73
129.21
126.64
121.05
116.93
113.96
47.11
30.10
26.55
22.56
N
H
CH3
2v
00
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.44
7.42
7.41
7.40
7.39
7.39
7.37
7.34
7.34
7.34
7.32
7.31
7.31
7.26
7.05
7.03
6.71
6.69
6.67
6.58
6.56
4.49
4.48
4.47
4.46
4.06
2.99
2.98
2.96
2.95
2.94
2.92
2.81
2.80
2.78
2.77
2.75
2.74
2.18
2.17
2.16
2.15
2.15
2.14
2.13
2.13
2.08
2.07
2.06
2.05
2.05
2.04
2.03
2.03
2.02
2.02
2.02
N
H
2w
5.21
2.03
1.00
1.05
1.12
1.03
1.20
1.19
1.22
1.22
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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1.0
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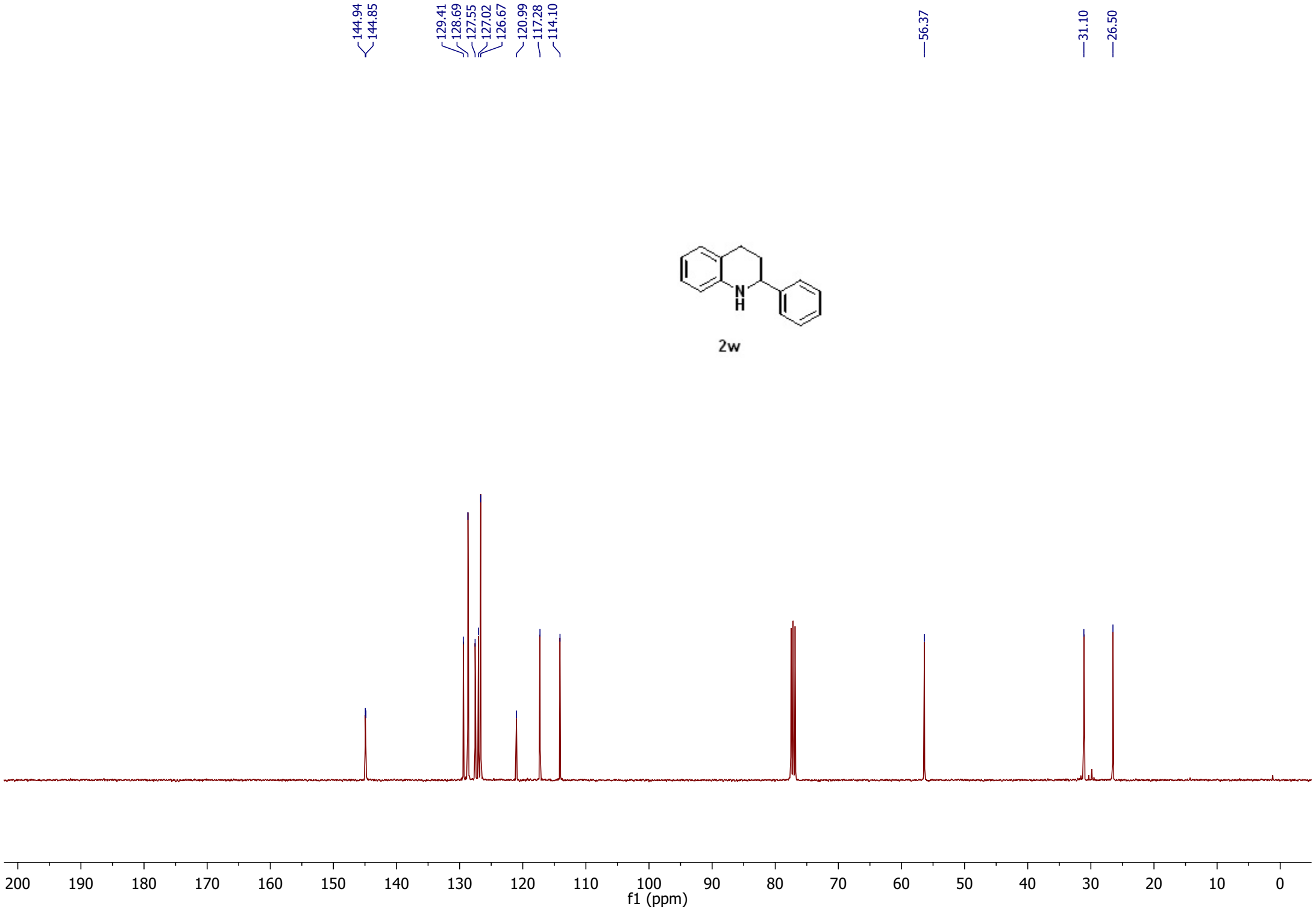
f1 (ppm)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144.85
129.41
128.69
127.55
127.02
126.67
120.99
117.28
114.10
56.37
31.10
26.50
N
H
2w
200
190
180
170
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130
120
110
100
90
80
70
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50
40
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10
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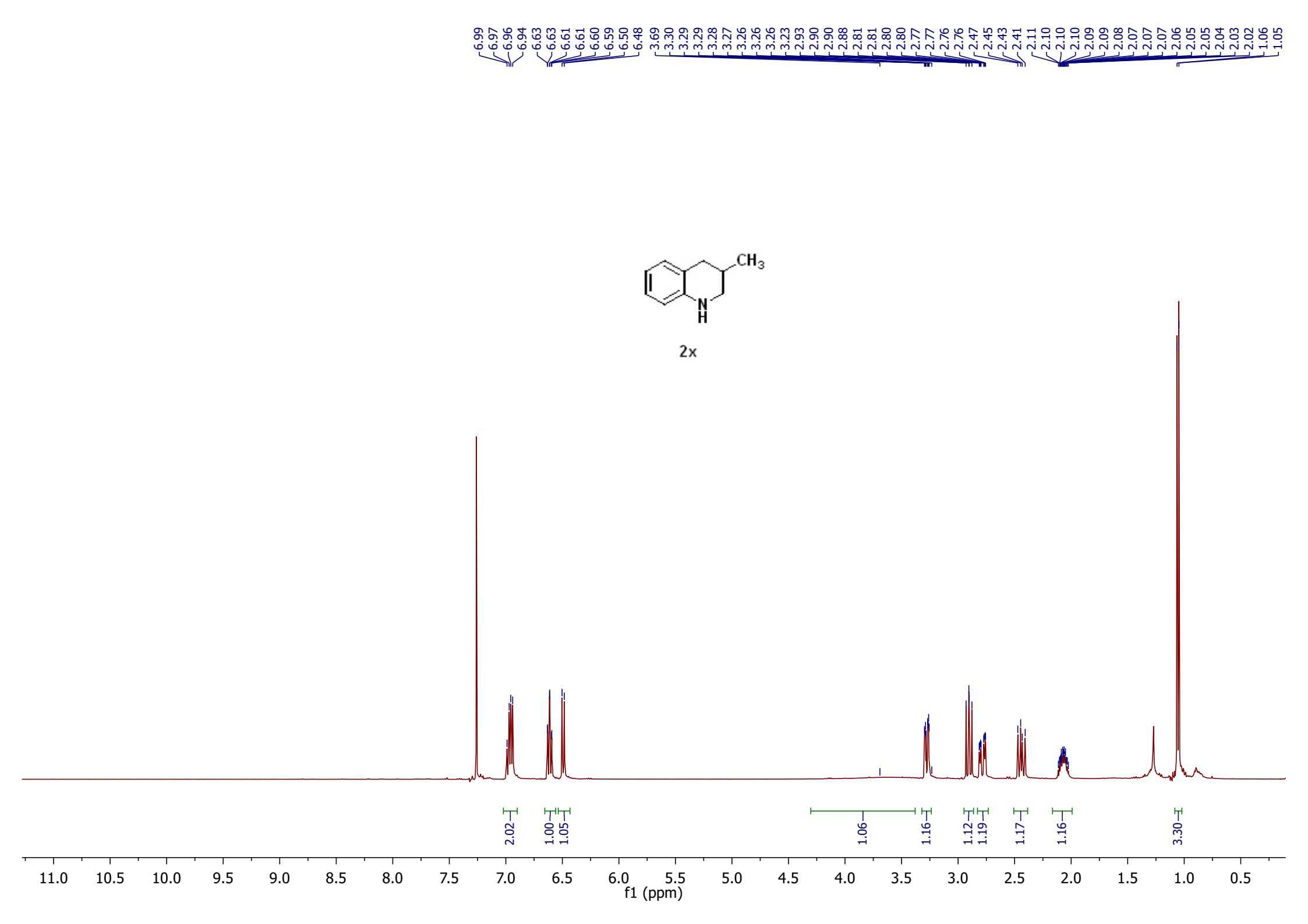
f1 (ppm)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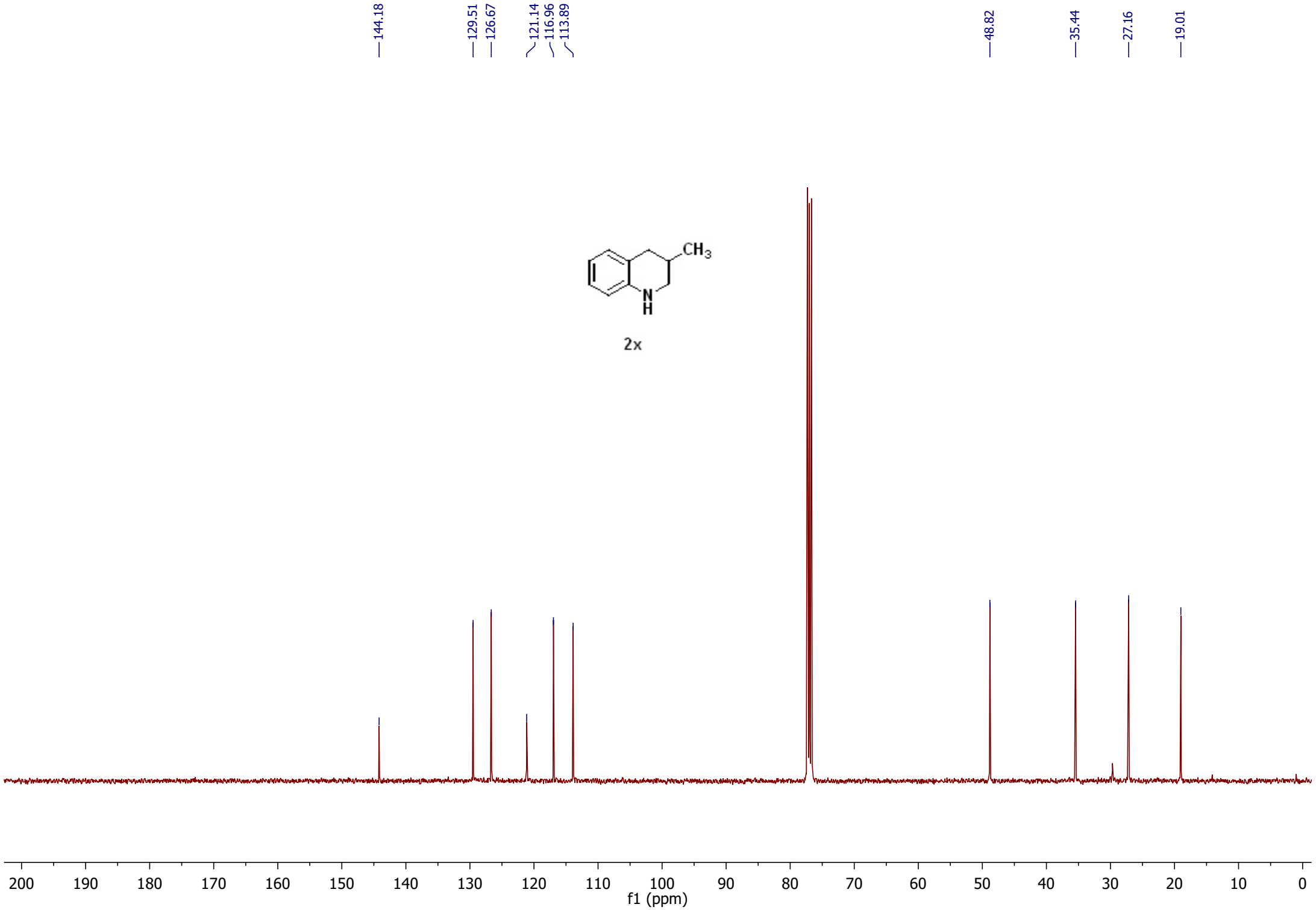
CH3
N
H
2x
2.02 1.00 1.05 1.06 1.16 1.12 1.19 1.17 1.16 3.30
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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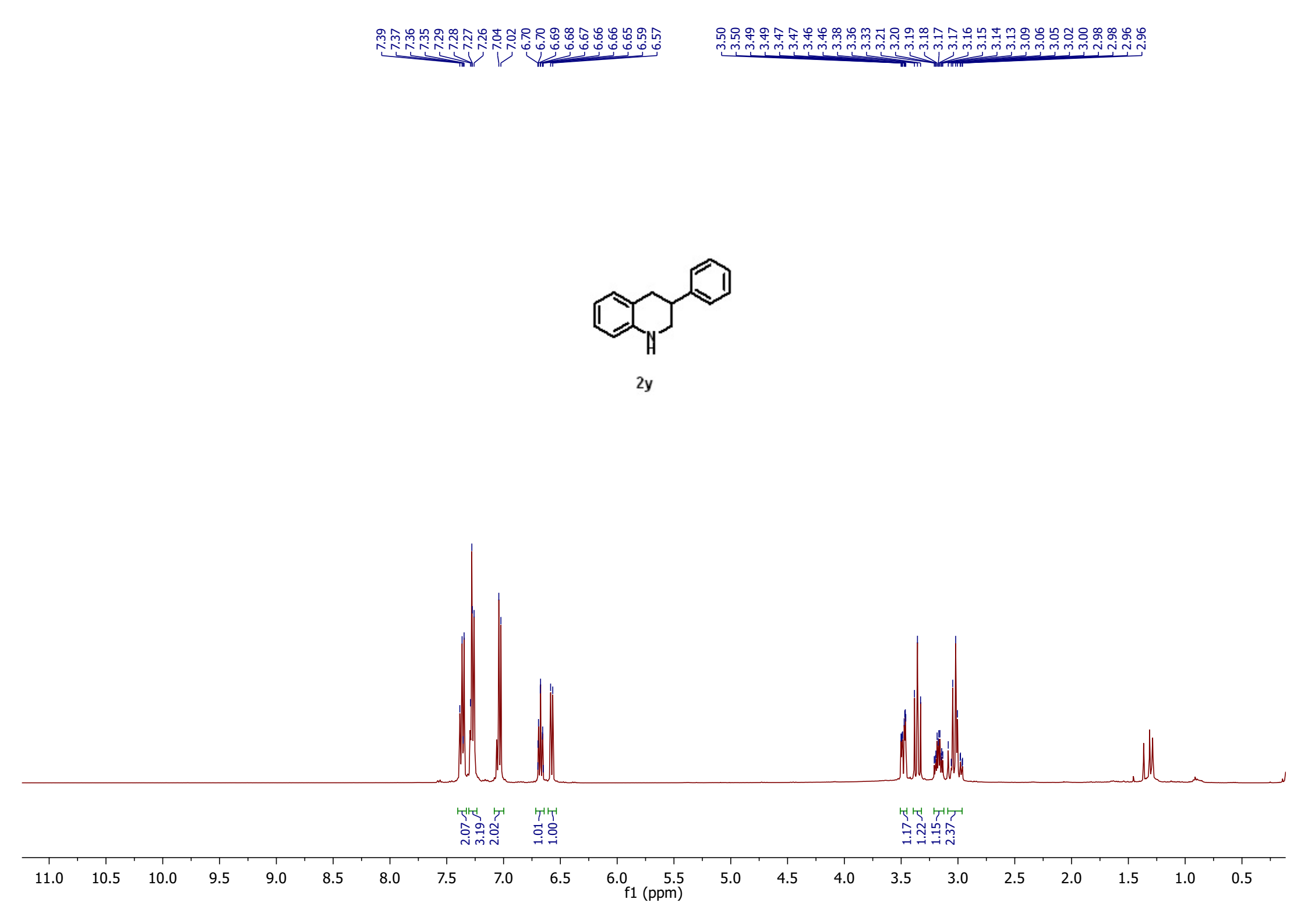
113.89
48.82
35.44
27.16
19.01
CH3
N
H
2x
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.26
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7.02
6.70
6.70
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6.68
6.67
6.66
6.66
6.65
6.59
6.57
3.50
3.50
3.49
3.49
3.47
3.47
3.46
3.46
3.38
3.36
3.33
3.21
3.20
3.19
3.18
3.17
3.17
3.16
3.15
3.14
3.13
3.09
3.06
3.05
3.02
3.00
2.98
2.98
2.96
2.96
2y
2.07
3.19
2.02
1.01
1.00
1.17
1.22
1.15
2.37
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
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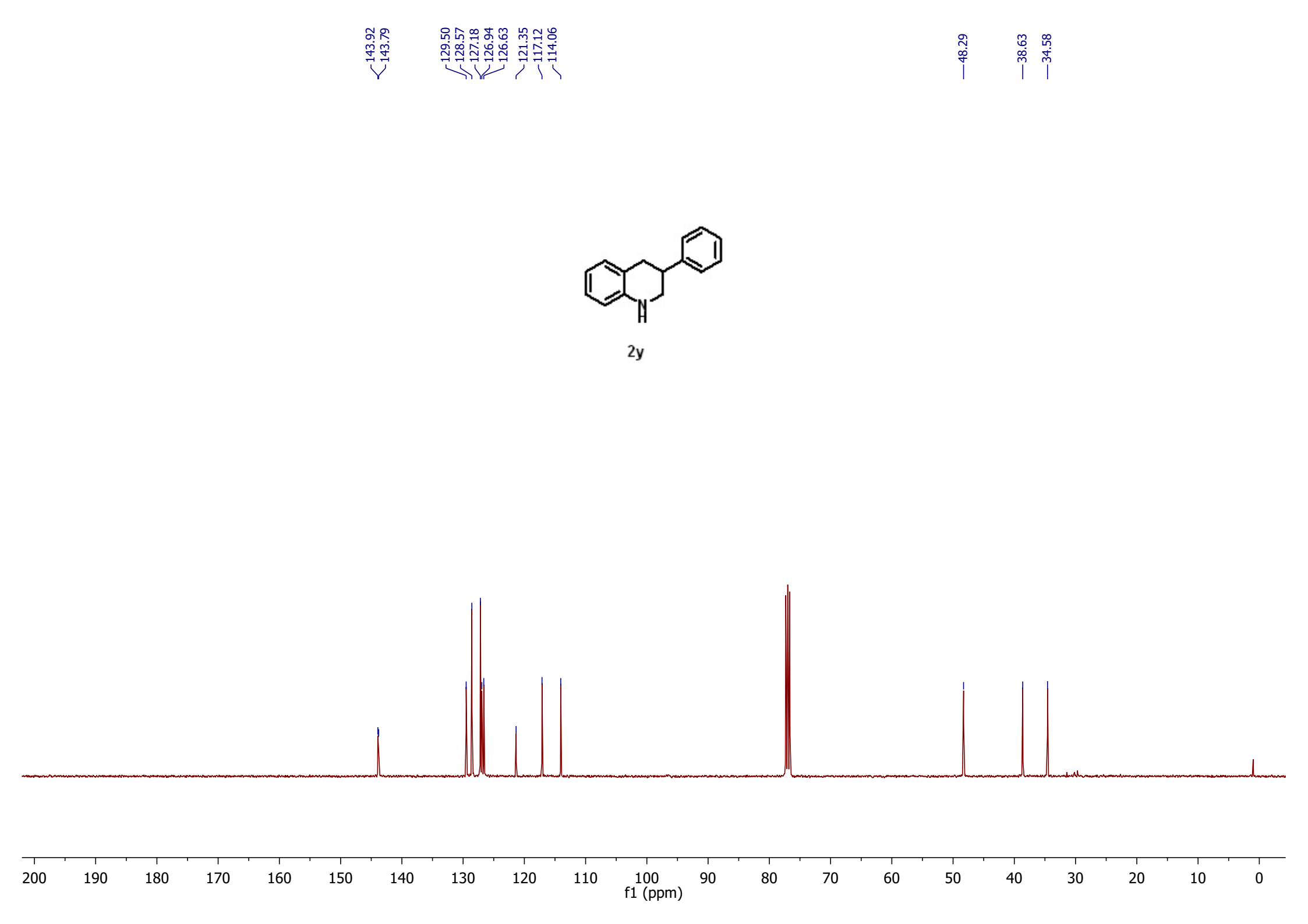
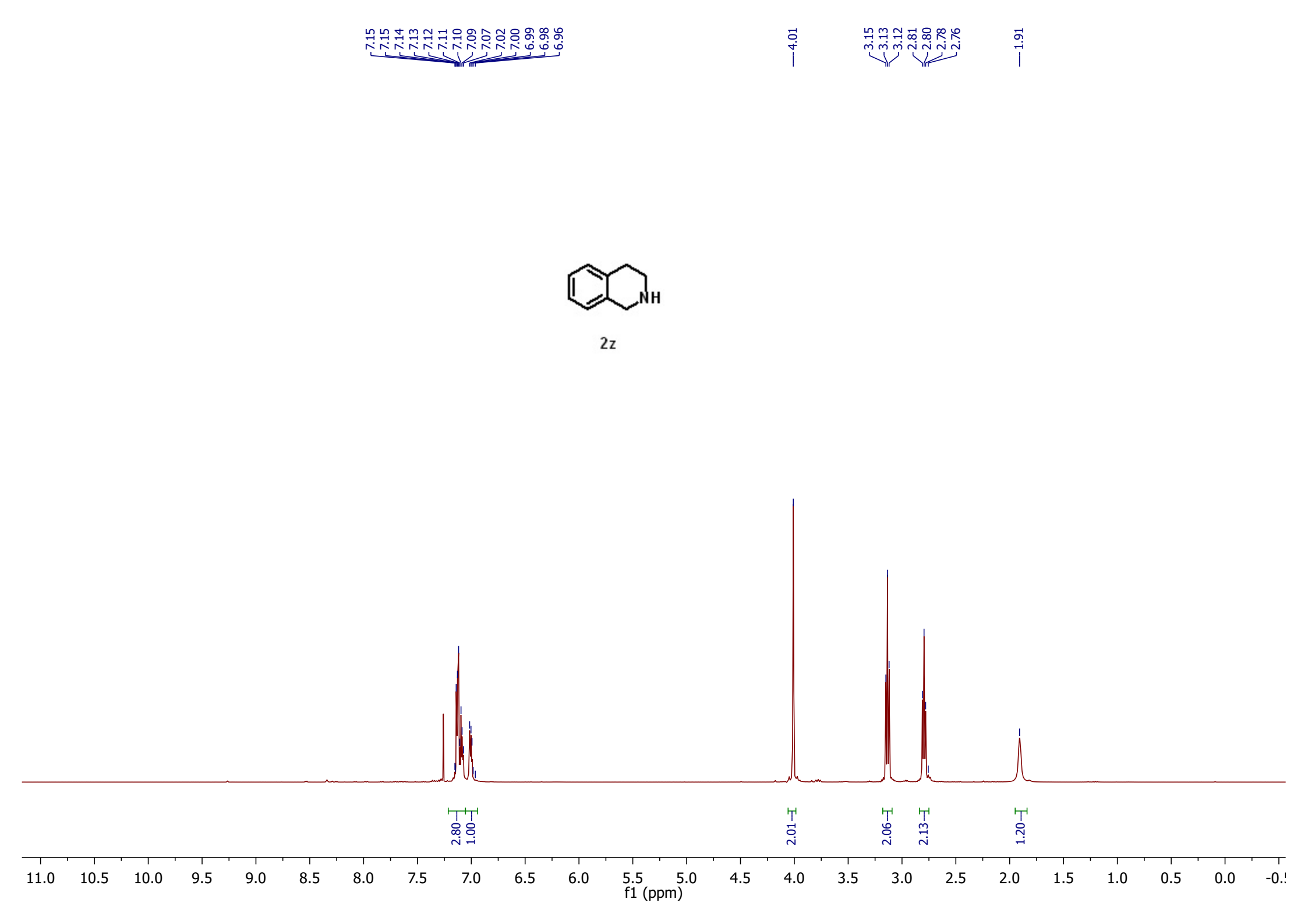
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


143.92
143.79
129.50
128.57
127.18
126.94
126.63
121.35
117.12
114.06
48.29
38.63
34.58
2y
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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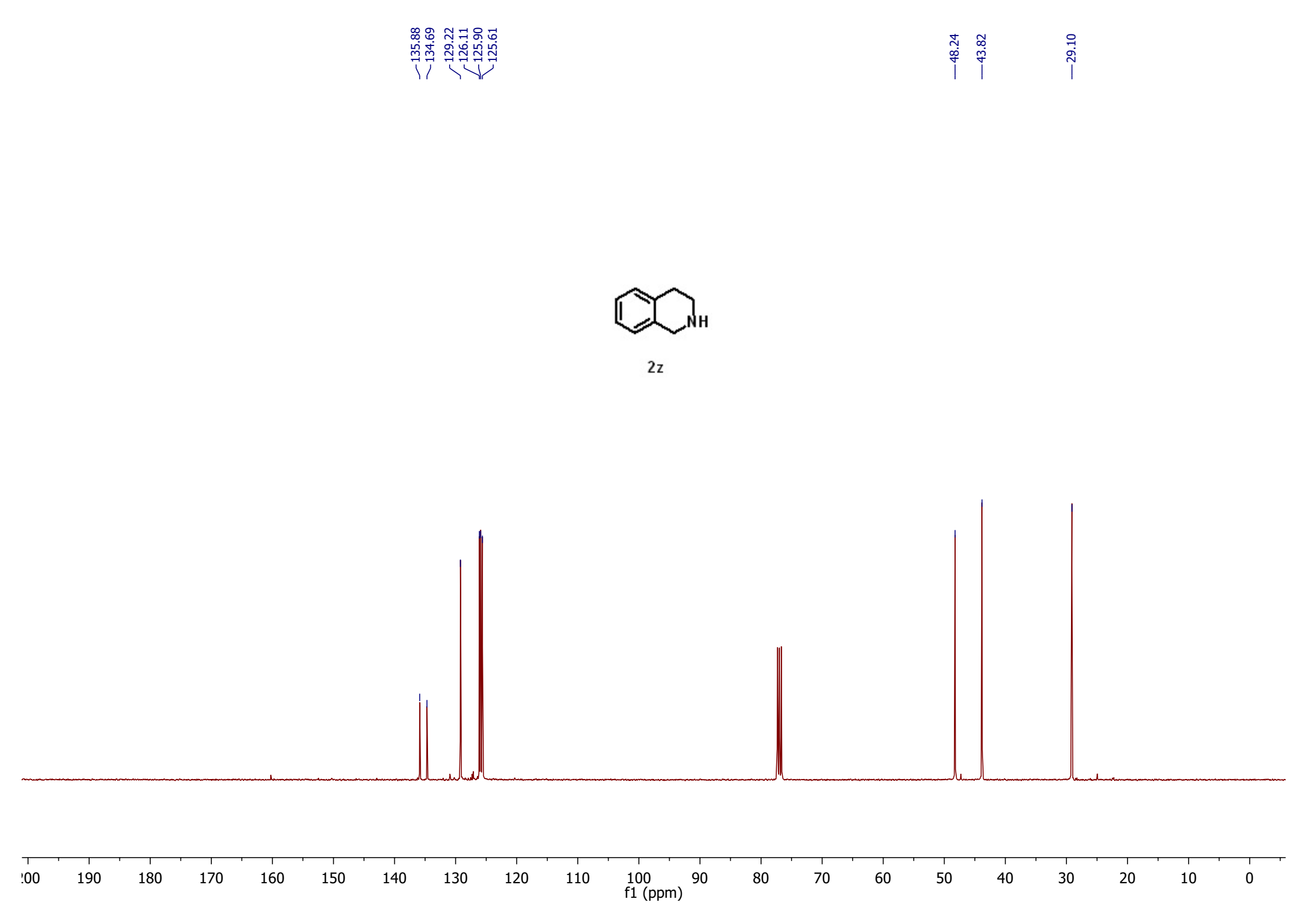
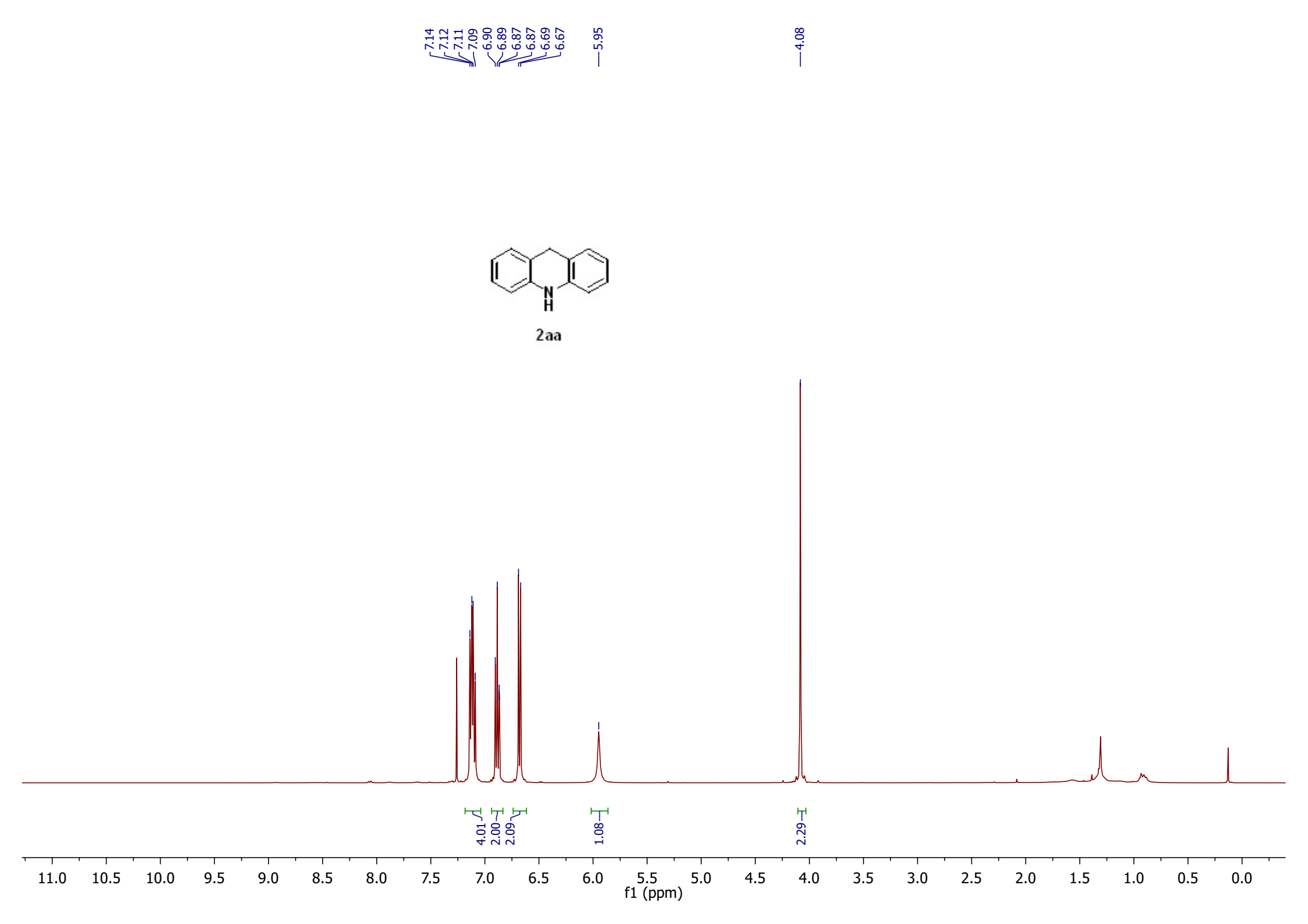
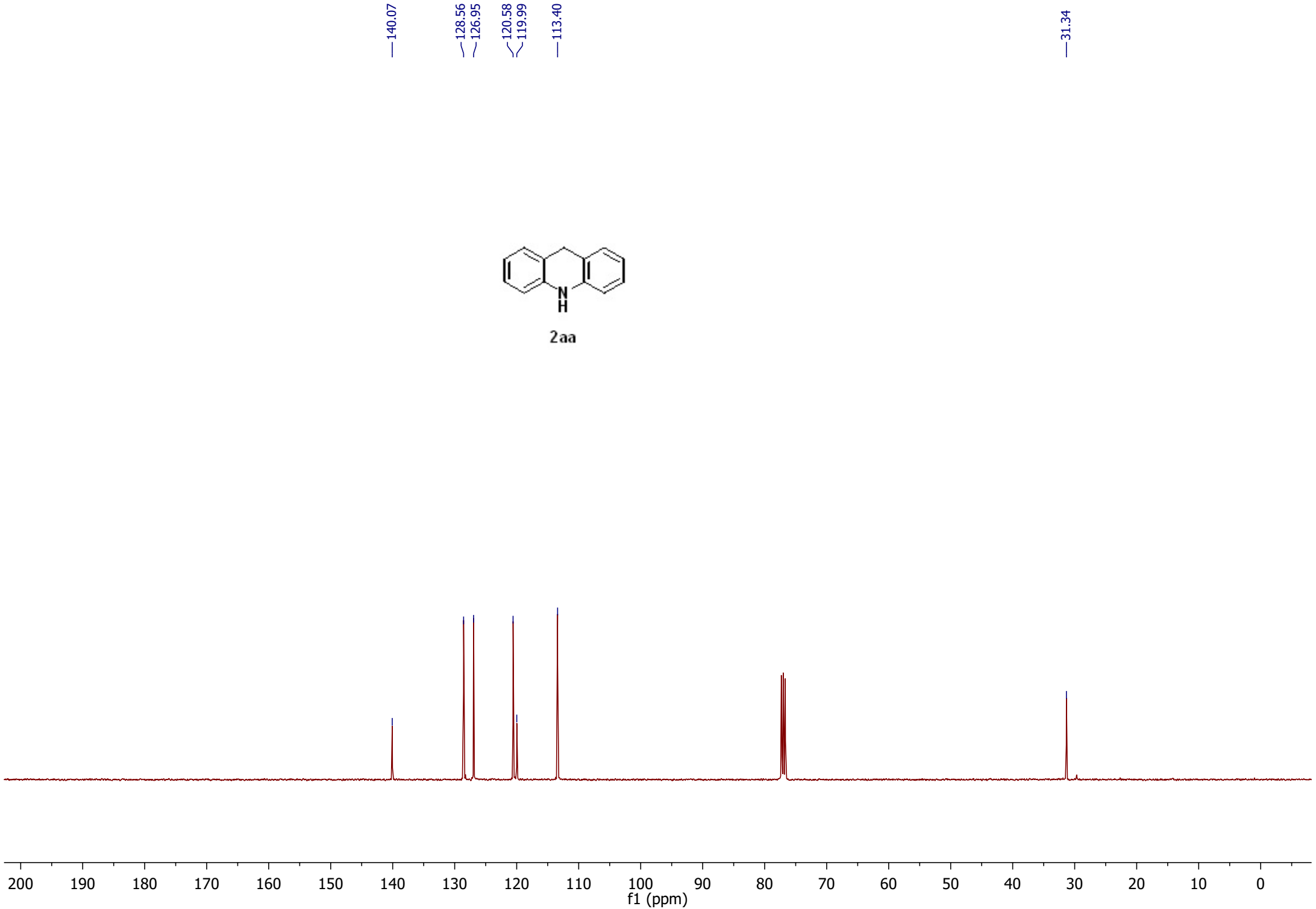
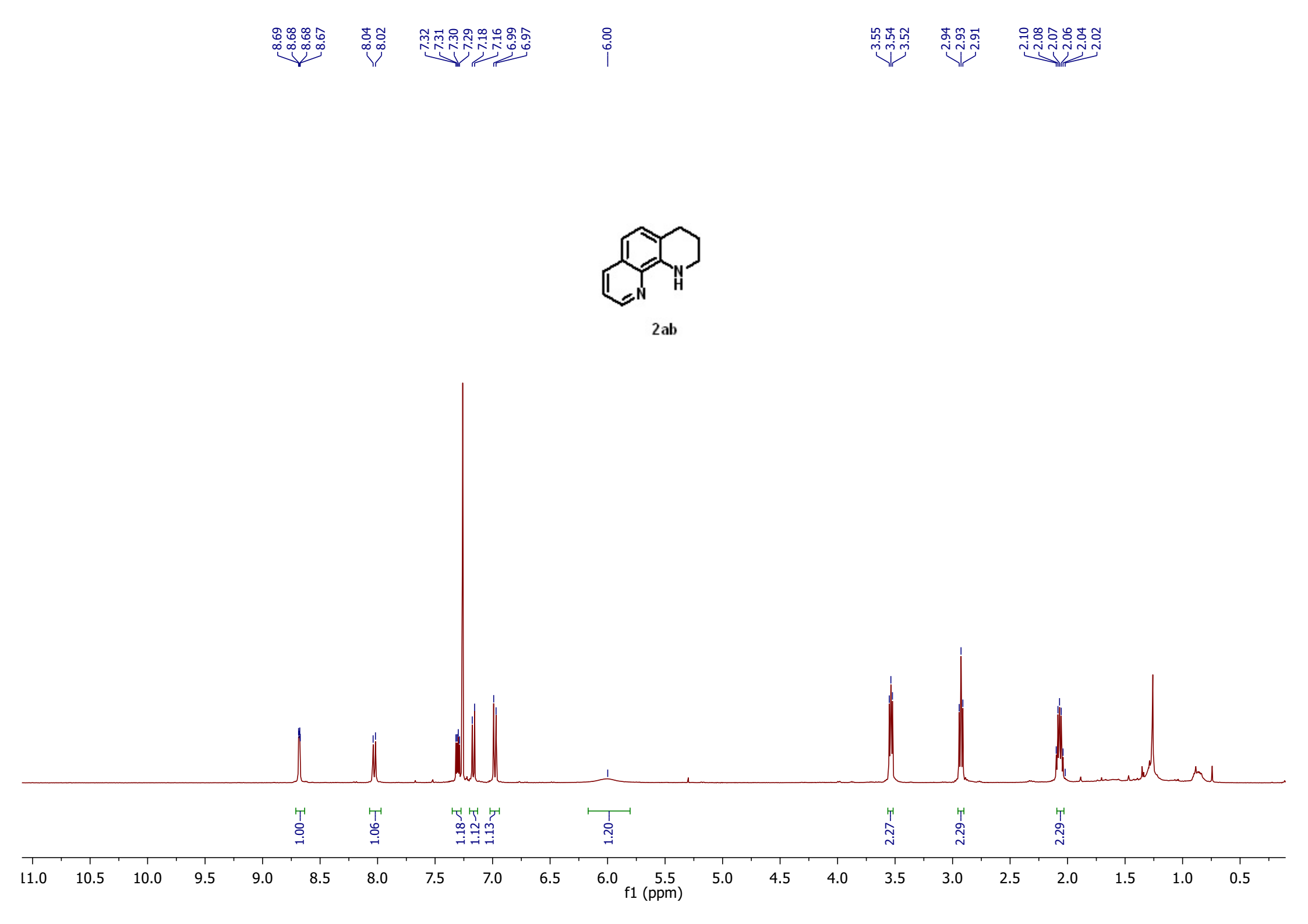
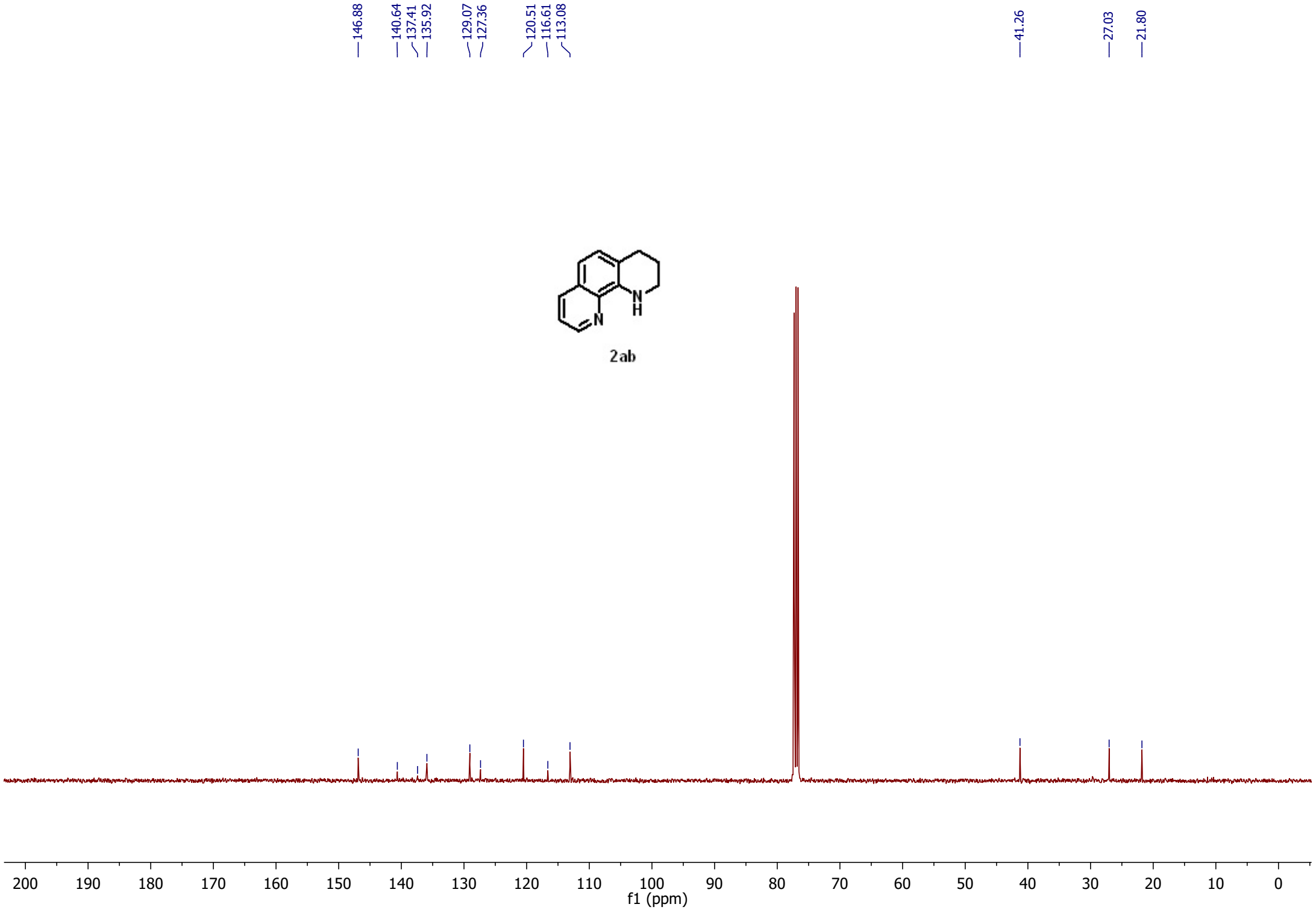
7.15
7.14
7.13
7.12
7.11
7.10
7.09
7.07
7.02
7.00
6.99
6.98
6.96
4.01
3.15
3.13
3.12
2.81
2.80
2.78
2.76
1.91
NH
2z
2.80
1.00
2.01
2.06
2.13
1.20
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


135.88
134.69
129.22
126.11
125.90
125.61
48.24
43.82
29.10
NH
2z
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.14
7.12
7.11
7.09
6.90
6.89
6.87
6.87
6.69
6.67
5.95
4.08
N
H
2aa
4.01
2.00
2.09
1.08
2.29
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
f1 (ppm)


140.07
128.56
126.95
120.58
119.99
113.40
31.34
N
H
2aa
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.69
8.68
8.68
8.67
8.04
8.02
7.32
7.31
7.30
7.29
7.18
7.16
6.99
6.97
6.00
3.55
3.54
3.52
2.94
2.93
2.91
2.10
2.08
2.07
2.06
2.04
2.02
N
H
N
2ab
1.00
1.06
1.18
1.12
1.13
1.20
2.27
2.29
2.29
f1 (ppm)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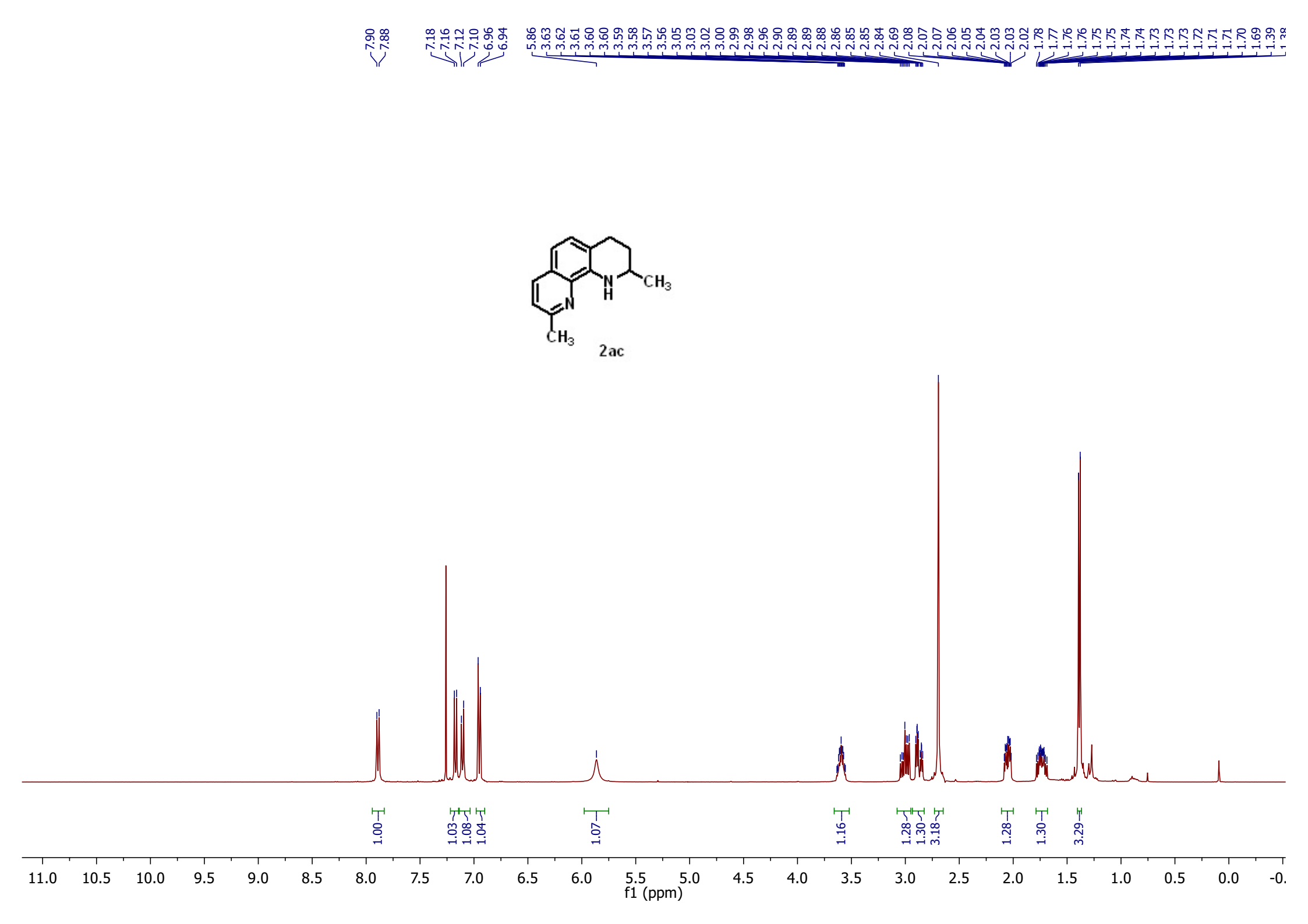
140.64
137.41
135.92
129.07
127.36
120.51
116.61
113.08
41.26
27.03
21.80
N
H
N
2ab
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.88
7.18
7.16
7.12
7.10
6.96
6.94
5.86
3.63
3.62
3.61
3.60
3.60
3.59
3.58
3.57
3.56
3.05
3.03
3.02
3.00
2.99
2.98
2.96
2.90
2.89
2.89
2.88
2.86
2.85
2.85
2.84
2.69
2.08
2.07
2.07
2.06
2.05
2.04
2.03
2.03
2.02
1.78
1.77
1.76
1.76
1.75
1.75
1.74
1.74
1.73
1.73
1.73
1.72
1.71
1.71
1.70
1.69
1.39
N
H
CH3
N
CH3
2ac
1.00
1.03
1.08
1.04
1.07
1.16
1.28
1.30
3.18
1.28
1.30
3.29
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
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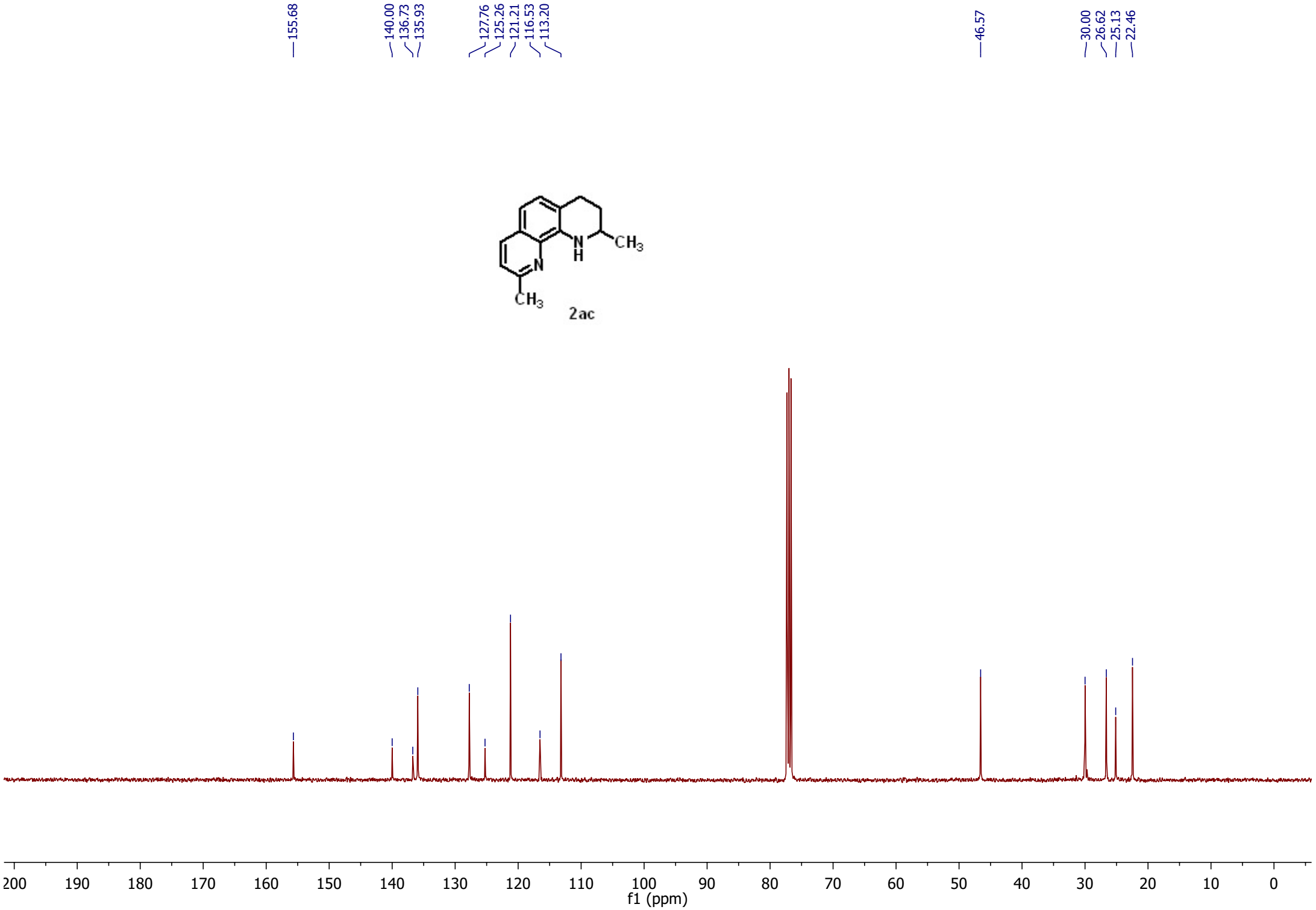
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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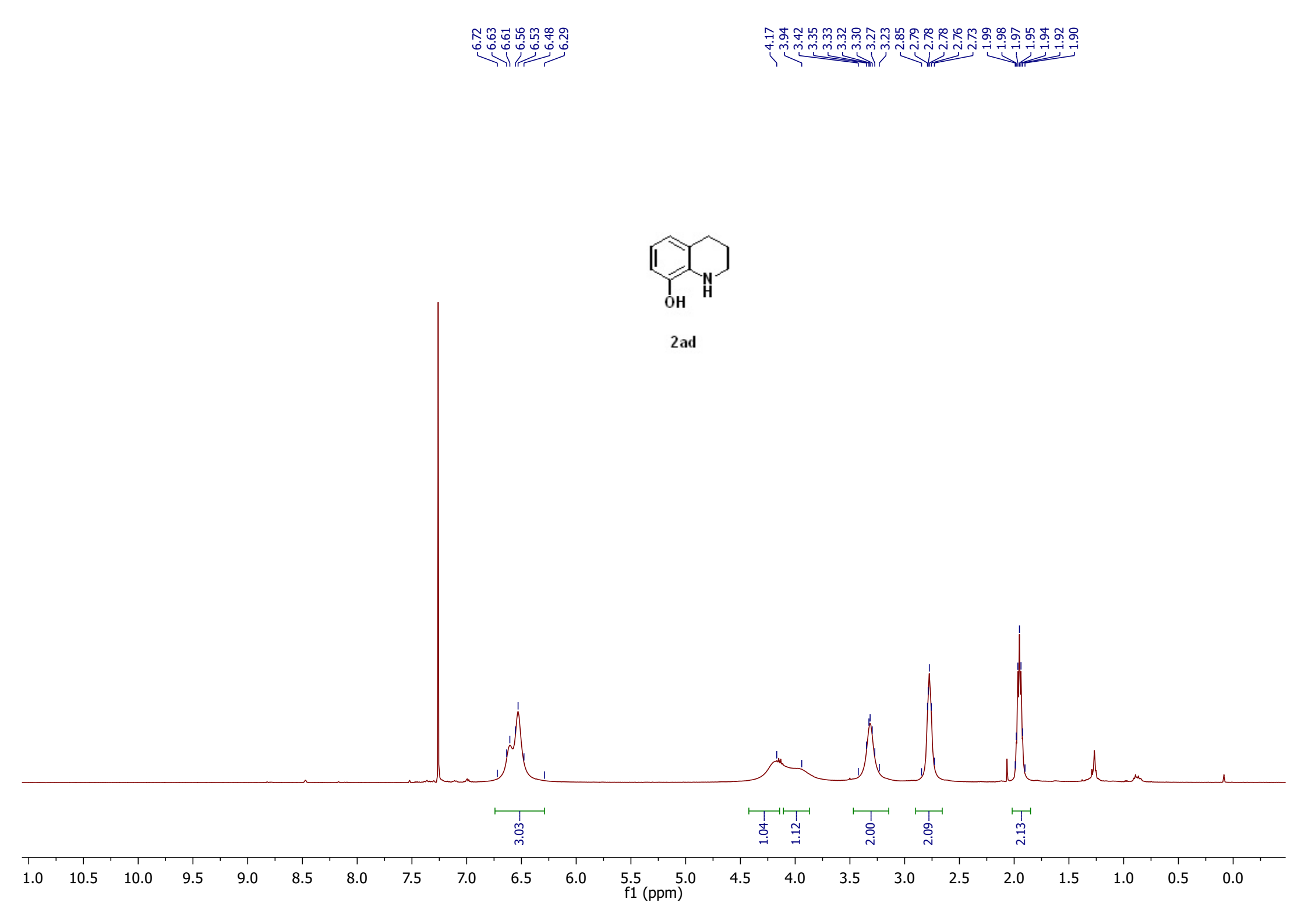
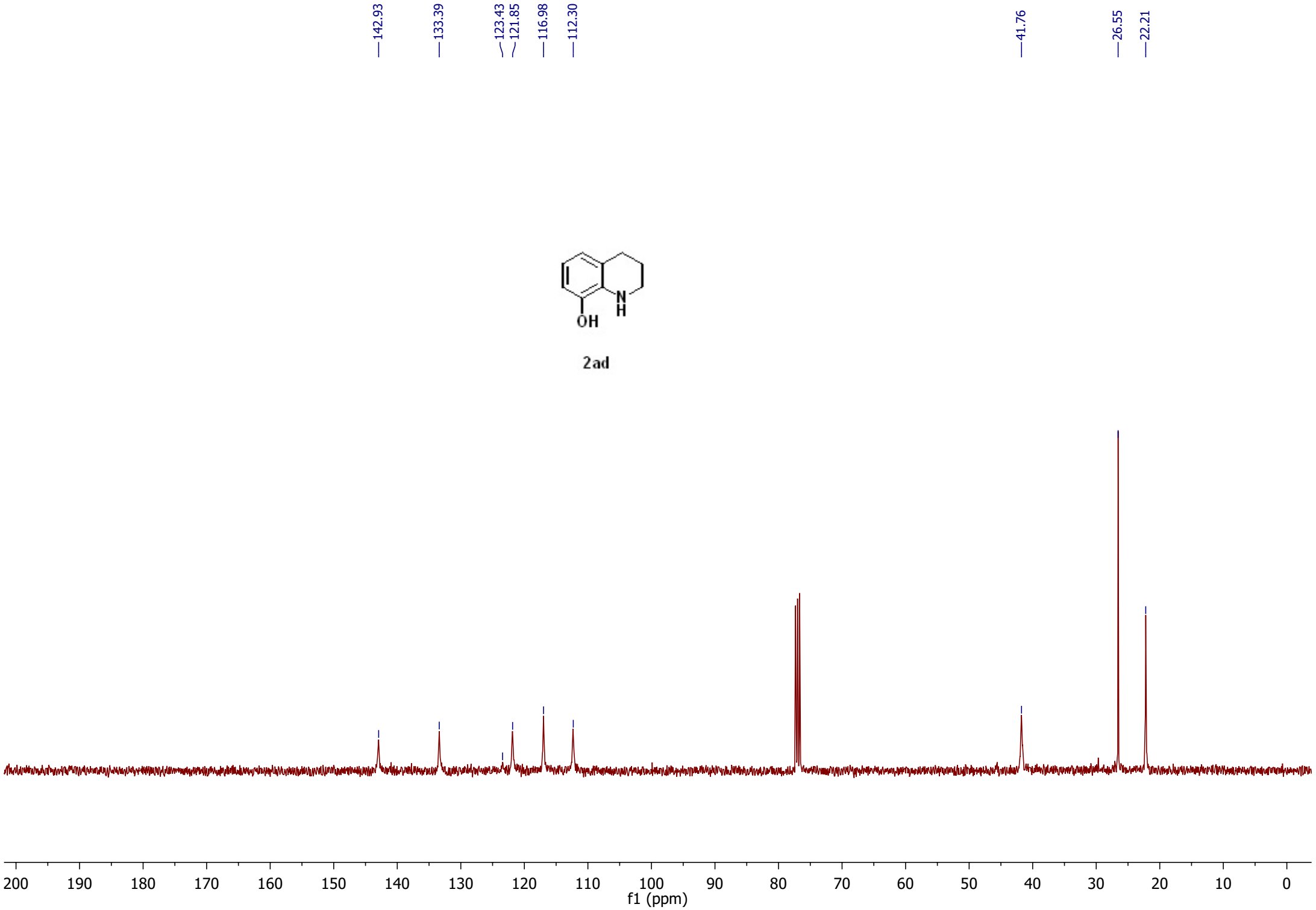
136.73
135.93
127.76
125.26
121.21
116.53
113.20
46.57
30.00
26.62
25.13
22.46
N
H
CH3
N
CH3
2ac
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


6.72
6.63
6.61
6.56
6.53
6.48
6.29
4.17
3.94
3.42
3.35
3.33
3.32
3.30
3.27
3.23
2.85
2.79
2.78
2.78
2.76
2.73
1.99
1.98
1.97
1.95
1.94
1.92
1.90
OH
N
H
2ad
3.03
1.04
1.12
2.00
2.09
2.13
1.0
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
f1 (ppm)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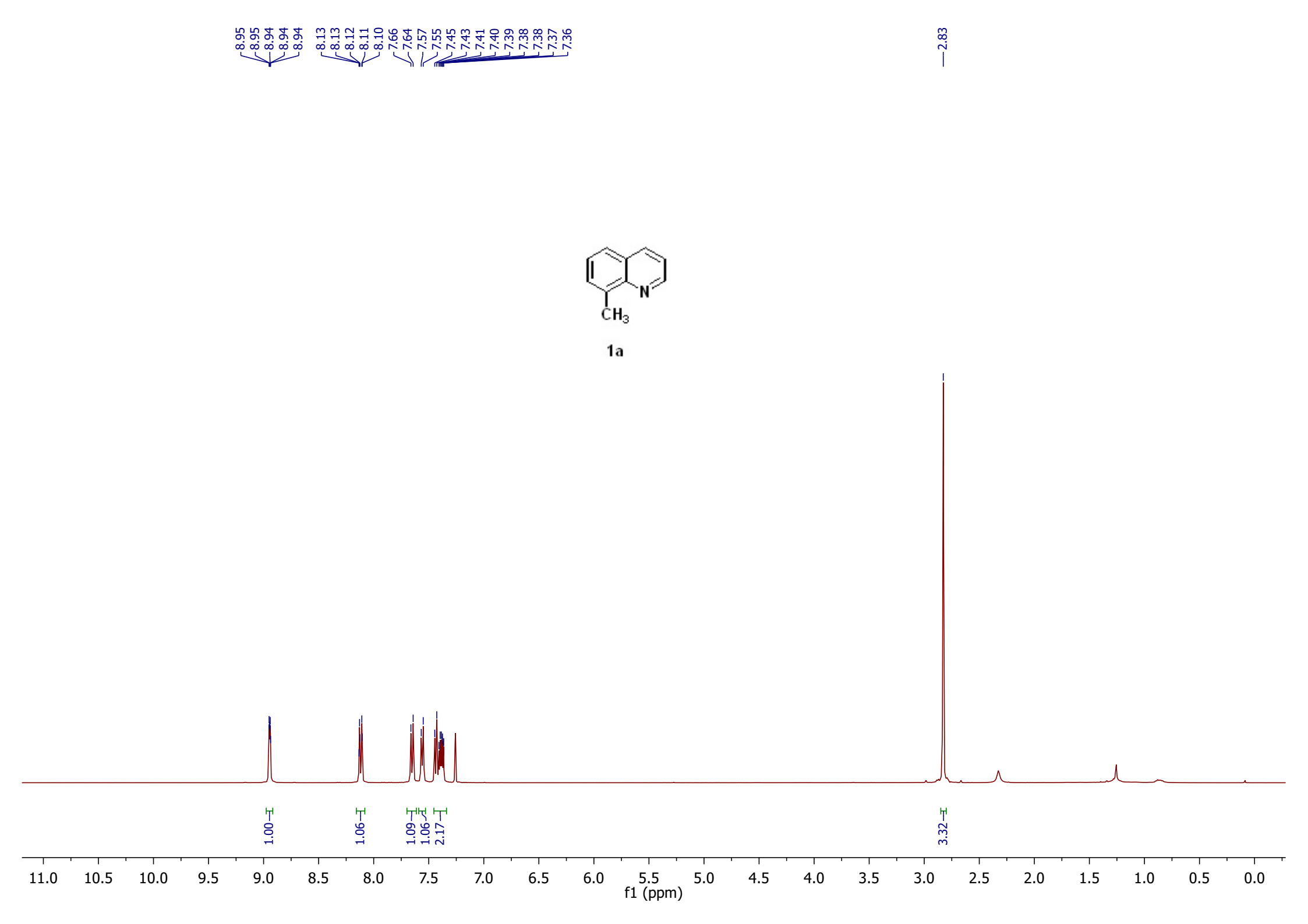
133.39
123.43
121.85
116.98
112.30
41.76
26.55
22.21
OH
N
H
2ad
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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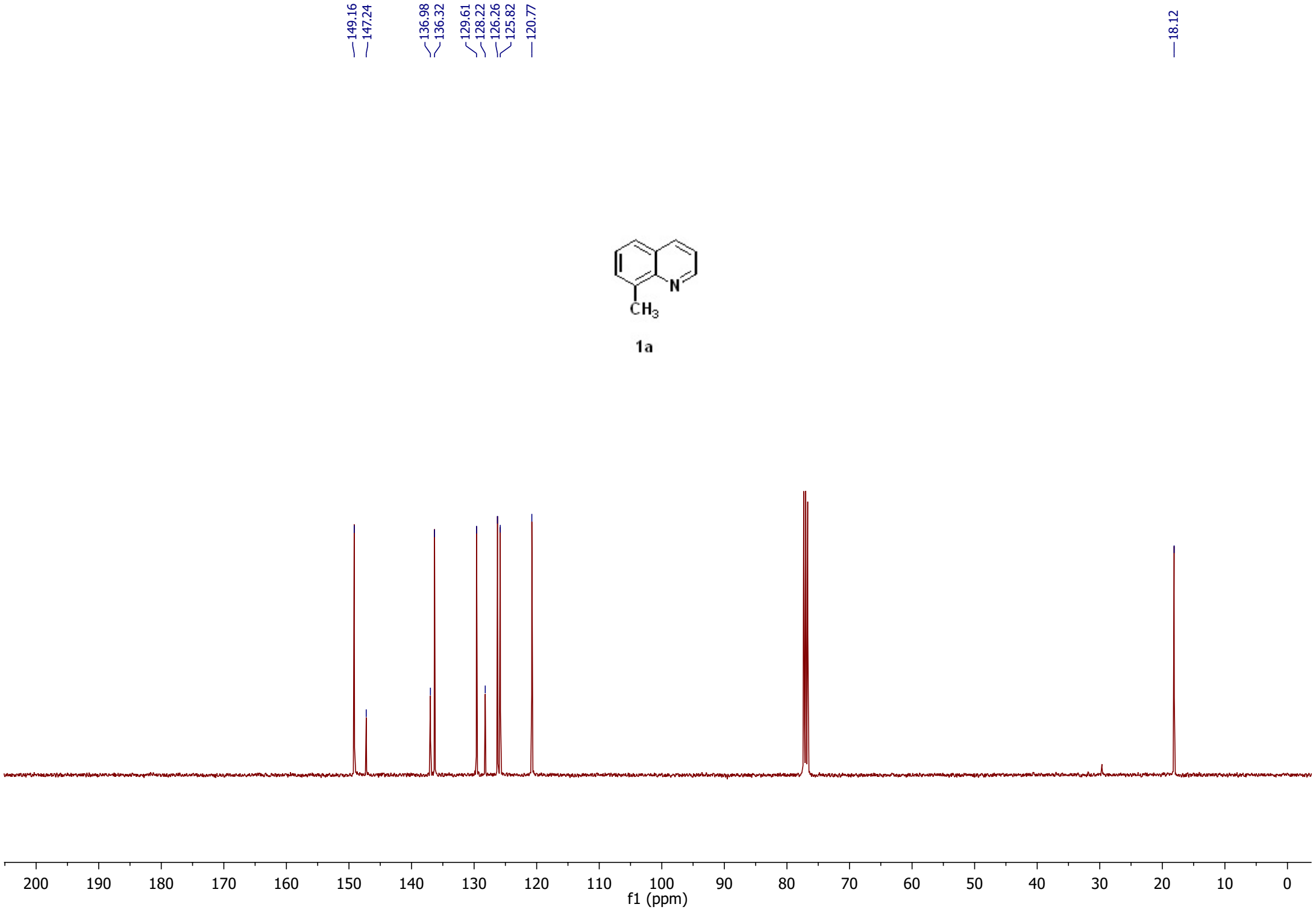
8.95
8.94
8.94
8.94
8.13
8.13
8.12
8.11
8.10
7.66
7.64
7.57
7.55
7.45
7.43
7.41
7.40
7.39
7.38
7.38
7.37
7.36
2.83
N
CH3
1a
1.00
1.06
1.09
1.06
2.17
3.32
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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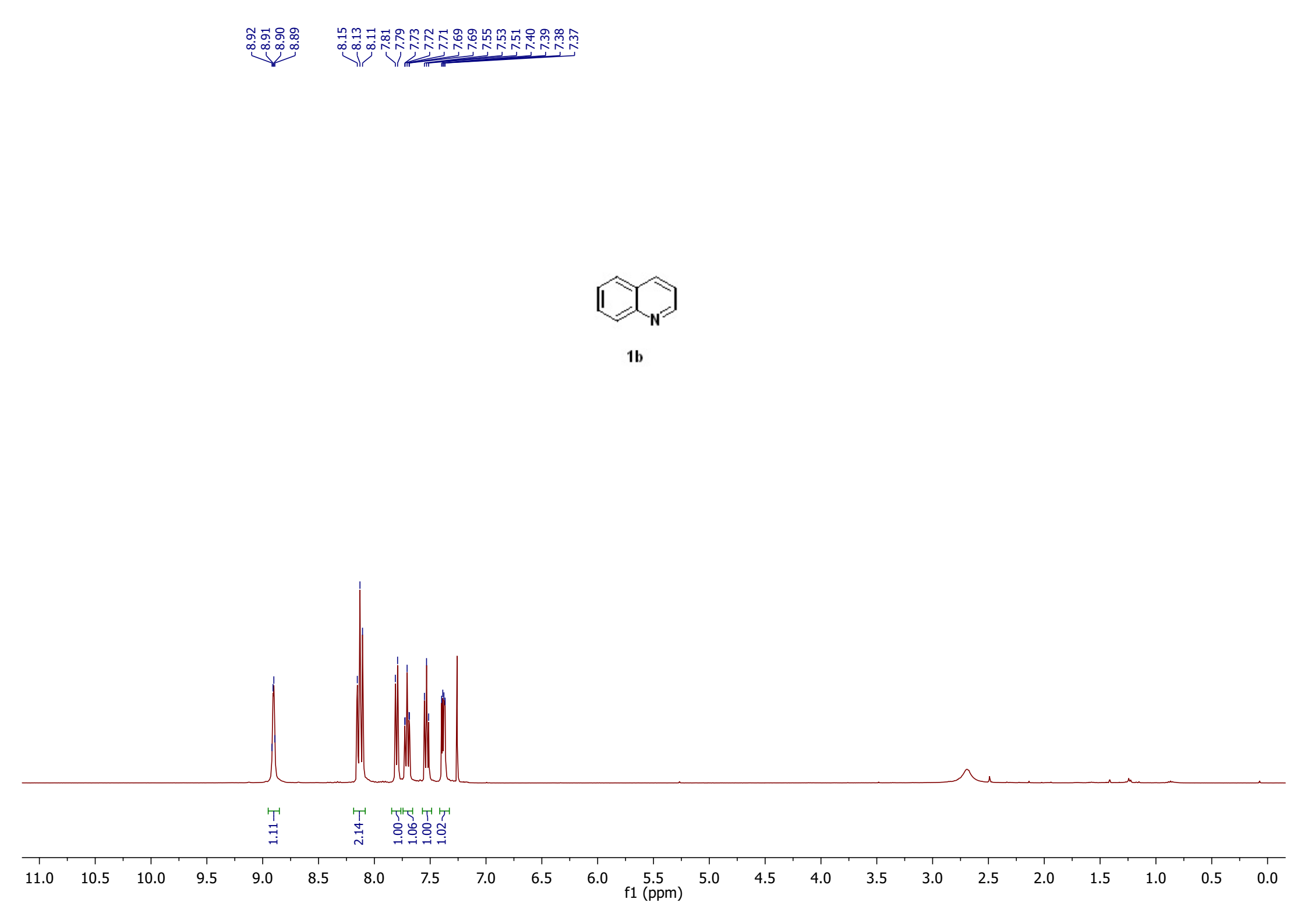
147.24
136.98
136.32
129.61
128.22
126.26
125.82
120.77
18.12
N
CH3
1a
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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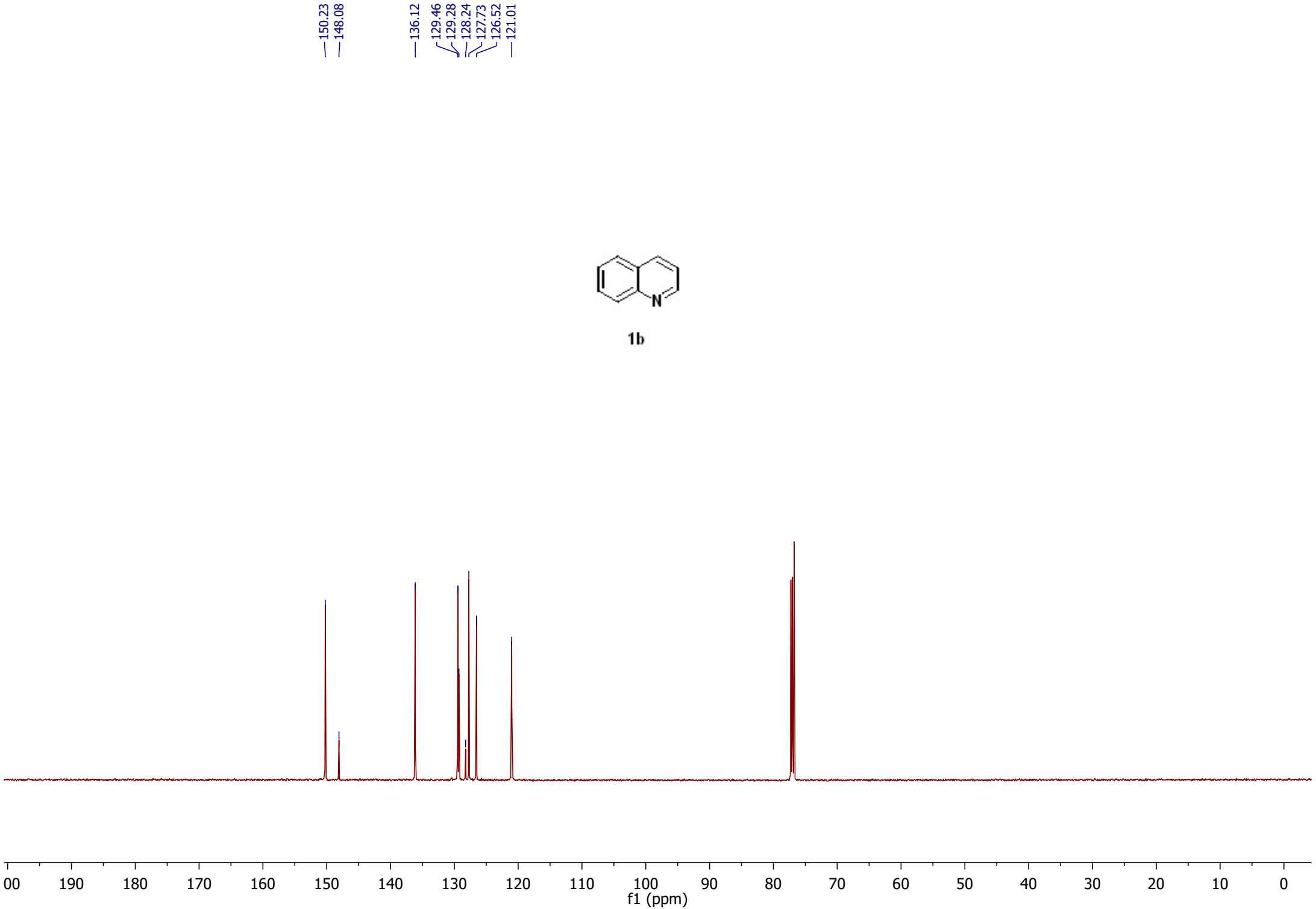
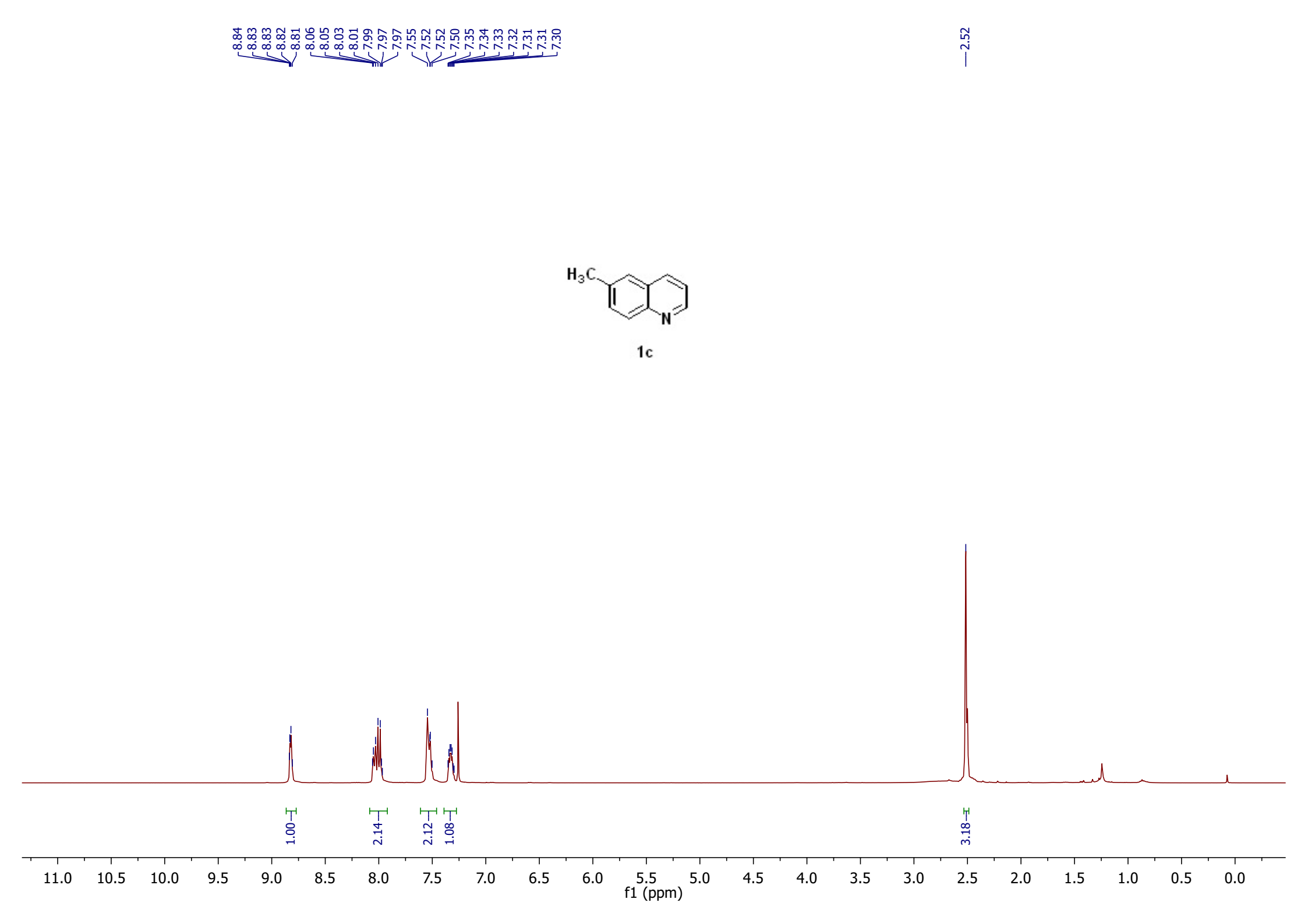
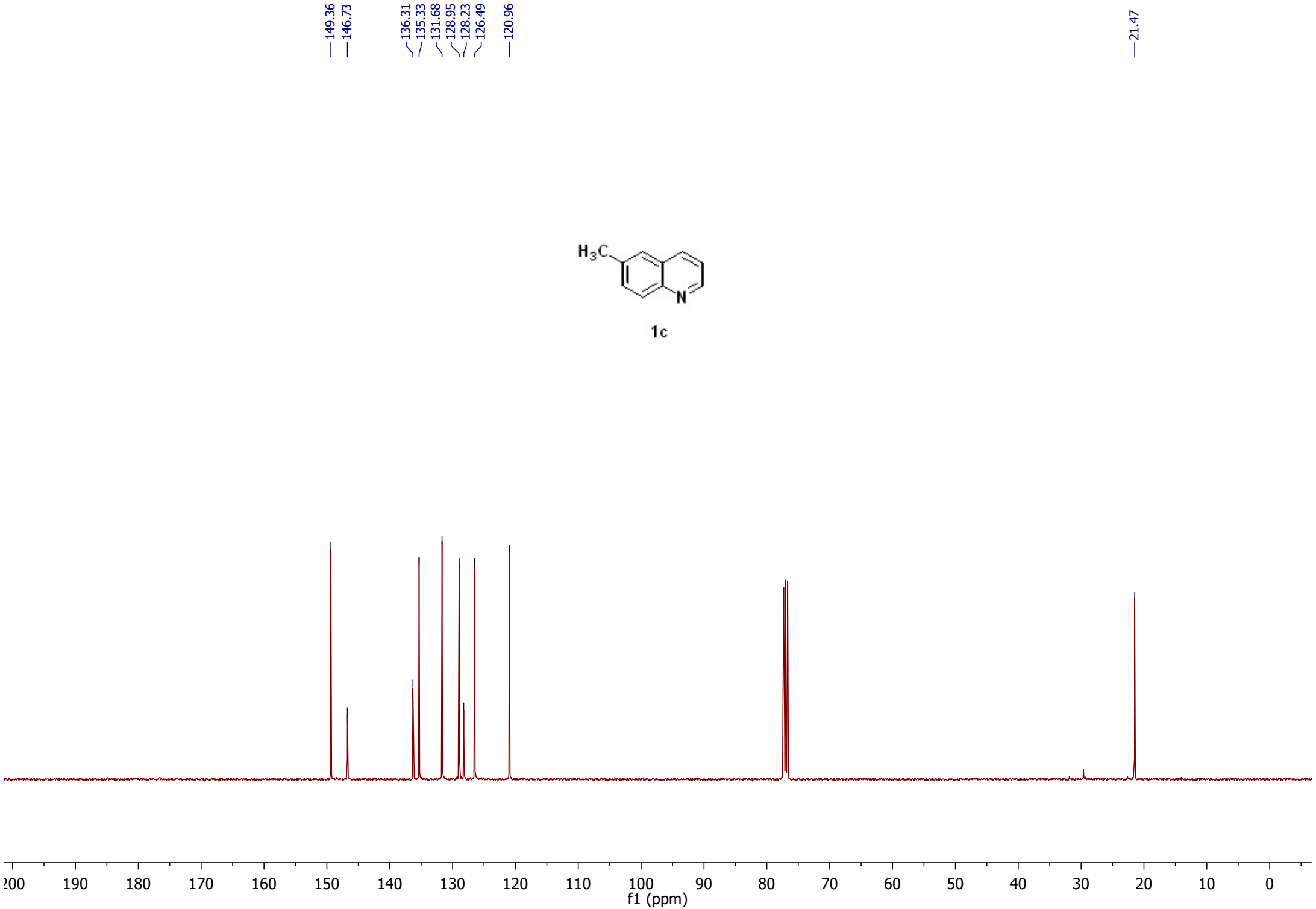
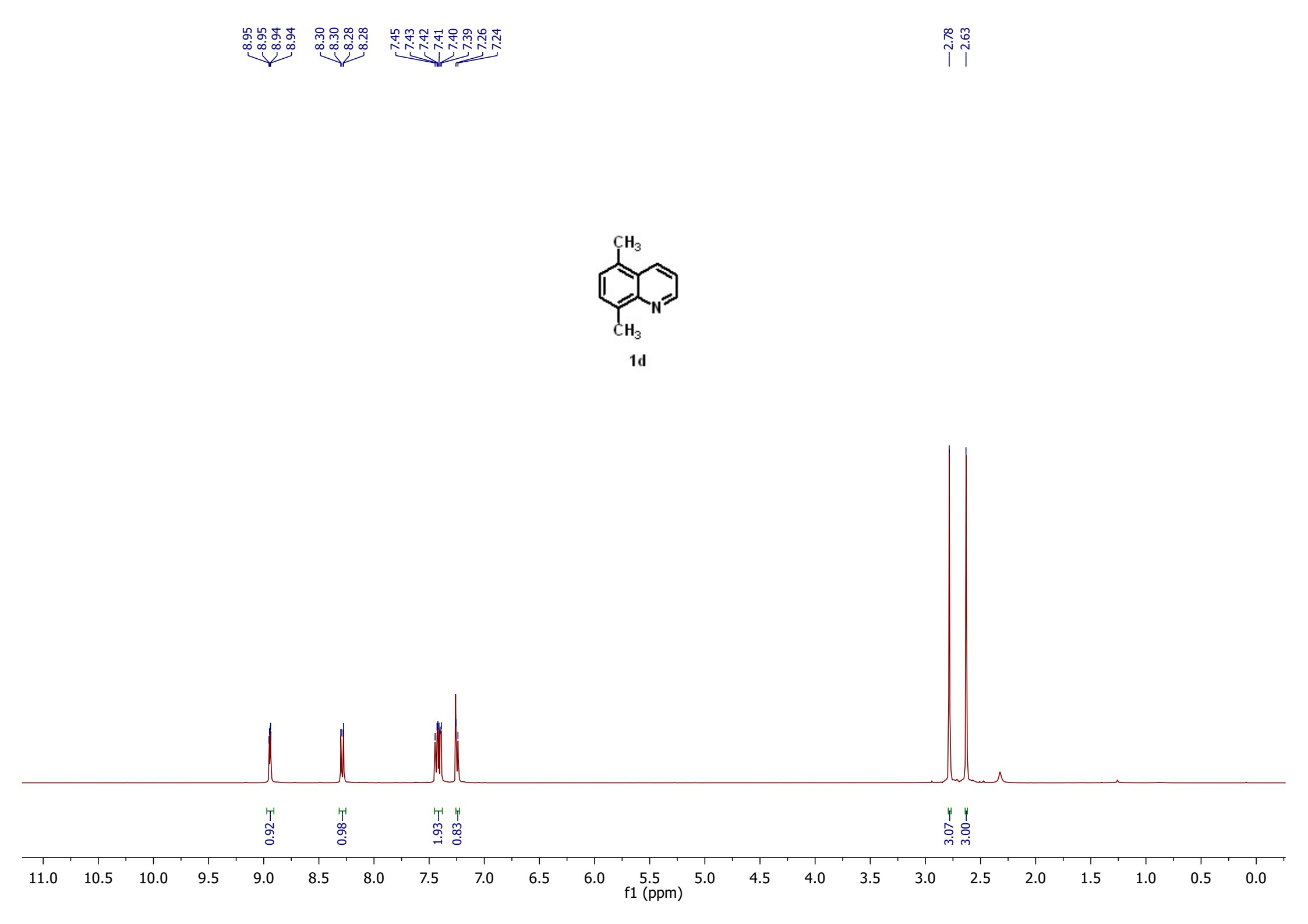
8.13
8.11
7.81
7.79
7.73
7.72
7.71
7.69
7.69
7.55
7.53
7.51
7.40
7.39
7.38
7.37
1.11
2.14
1.00
1.06
1.00
1.02
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

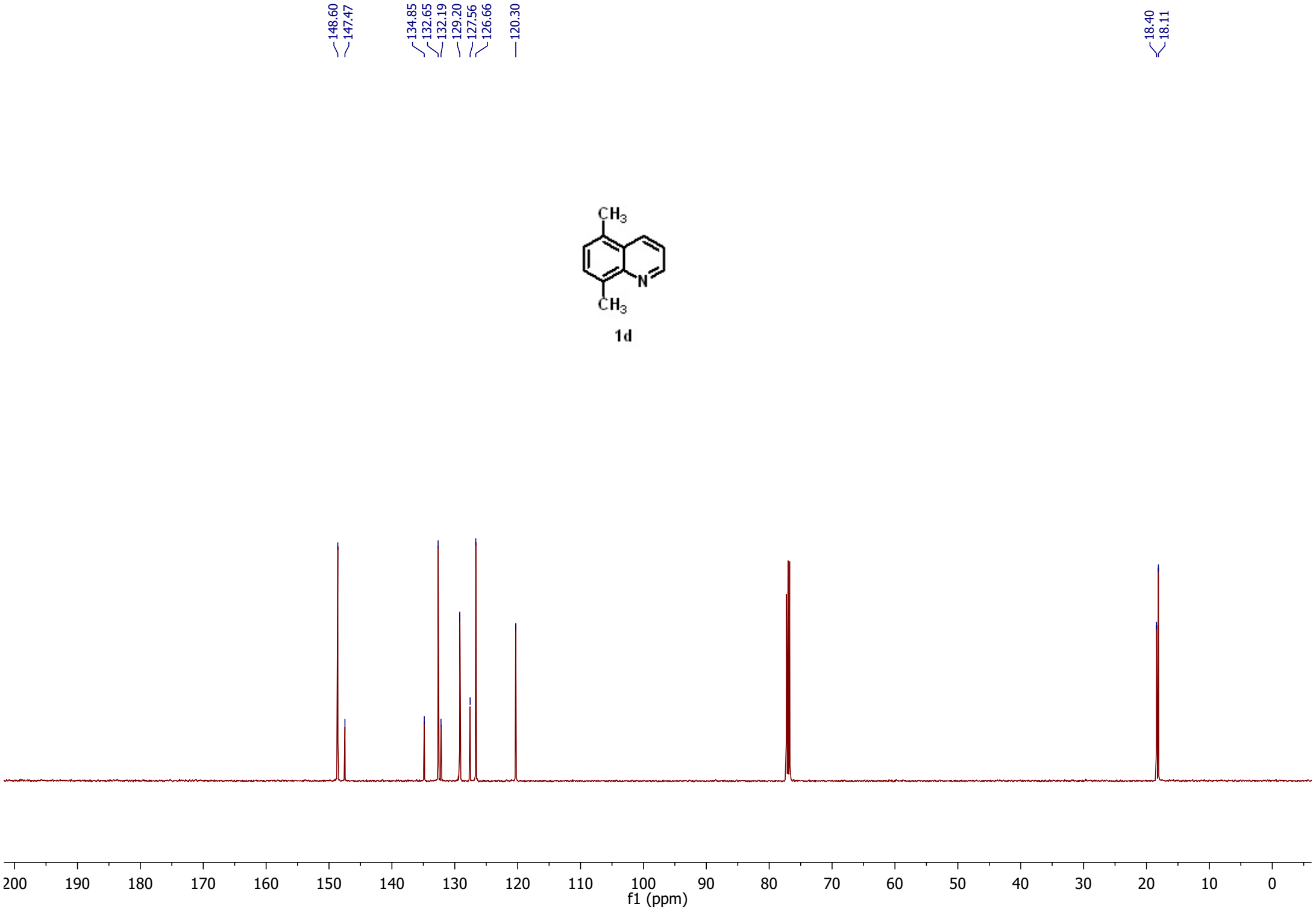
1b

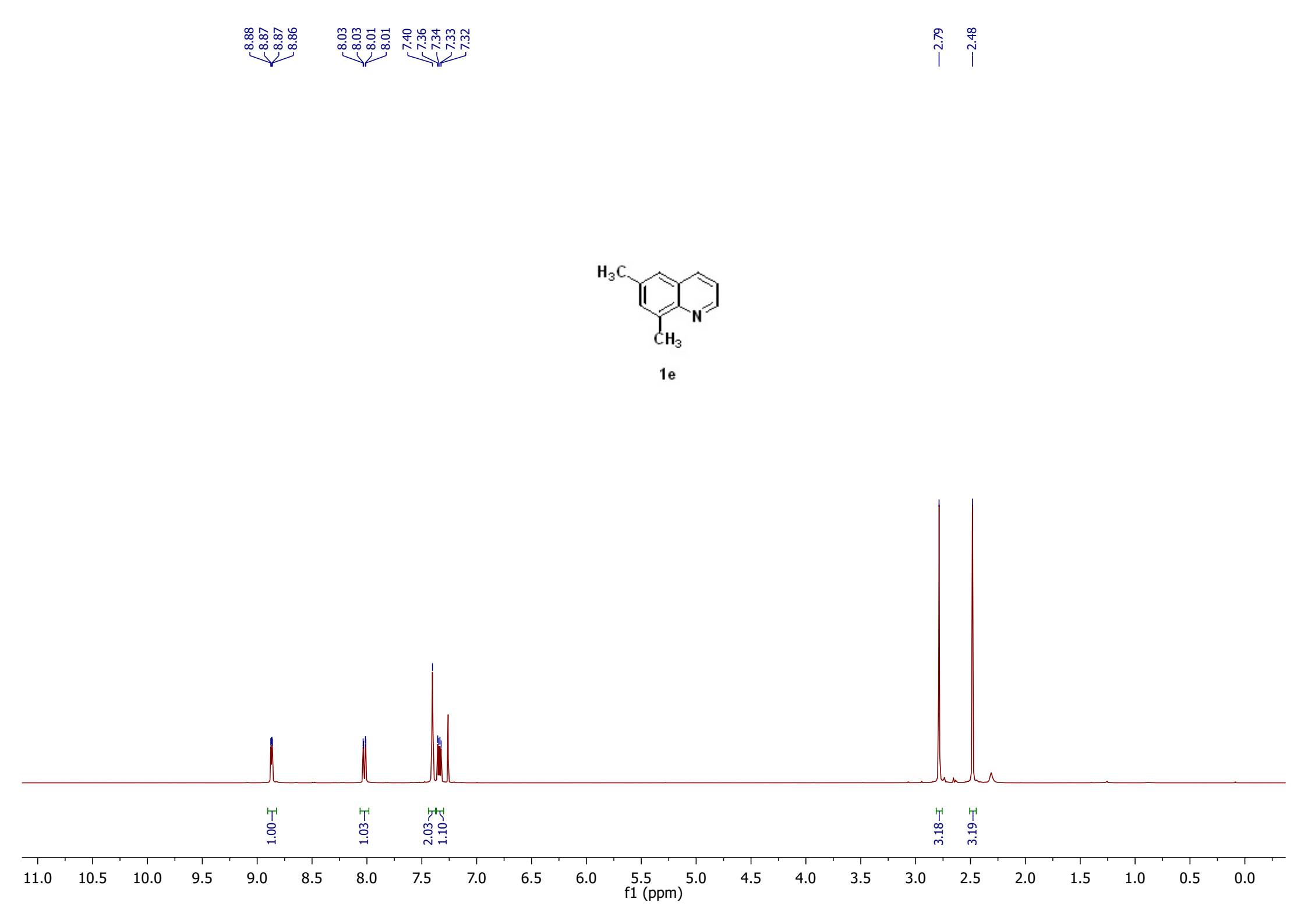

150.23
148.08
136.12
129.46
129.28
128.24
127.73
126.52
121.01
N
1b
00
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.84
8.83
8.83
8.82
8.81
8.06
8.05
8.03
8.01
7.99
7.97
7.97
7.55
7.52
7.52
7.50
7.35
7.34
7.33
7.32
7.31
7.31
7.30
2.52
H3C
N
1c
1.00
2.14
2.12
1.08
3.18
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
f1 (ppm)


149.36
146.73
136.31
135.33
131.68
128.95
128.23
126.49
120.96
21.47
H3C
N
1c
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.95
8.95
8.94
8.94
8.30
8.30
8.28
8.28
7.45
7.43
7.42
7.41
7.40
7.39
7.26
7.24
2.78
2.63
CH3
N
CH3
1d
0.92
0.98
1.93
0.83
3.07
3.00
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
f1 (ppm)


148.60
147.47
134.85
132.65
132.19
129.20
127.56
126.66
120.30
18.40
18.11
CH3
N
CH3
1d
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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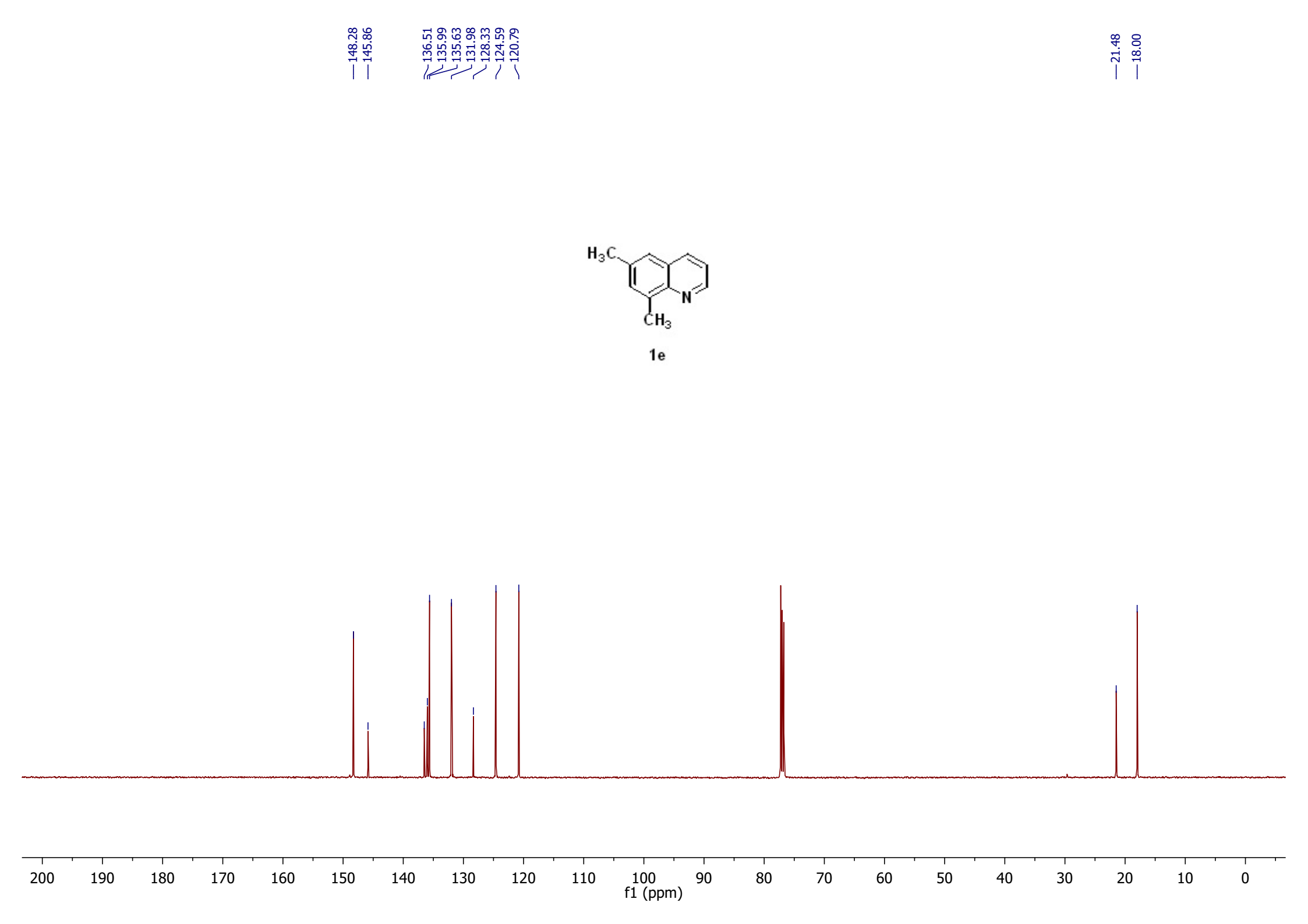
8.87
8.87
8.86
8.03
8.03
8.01
8.01
7.40
7.36
7.34
7.33
7.32
2.79
2.48
H3C
N
CH3
1e
1.00
1.03
2.03
1.10
3.18
3.19
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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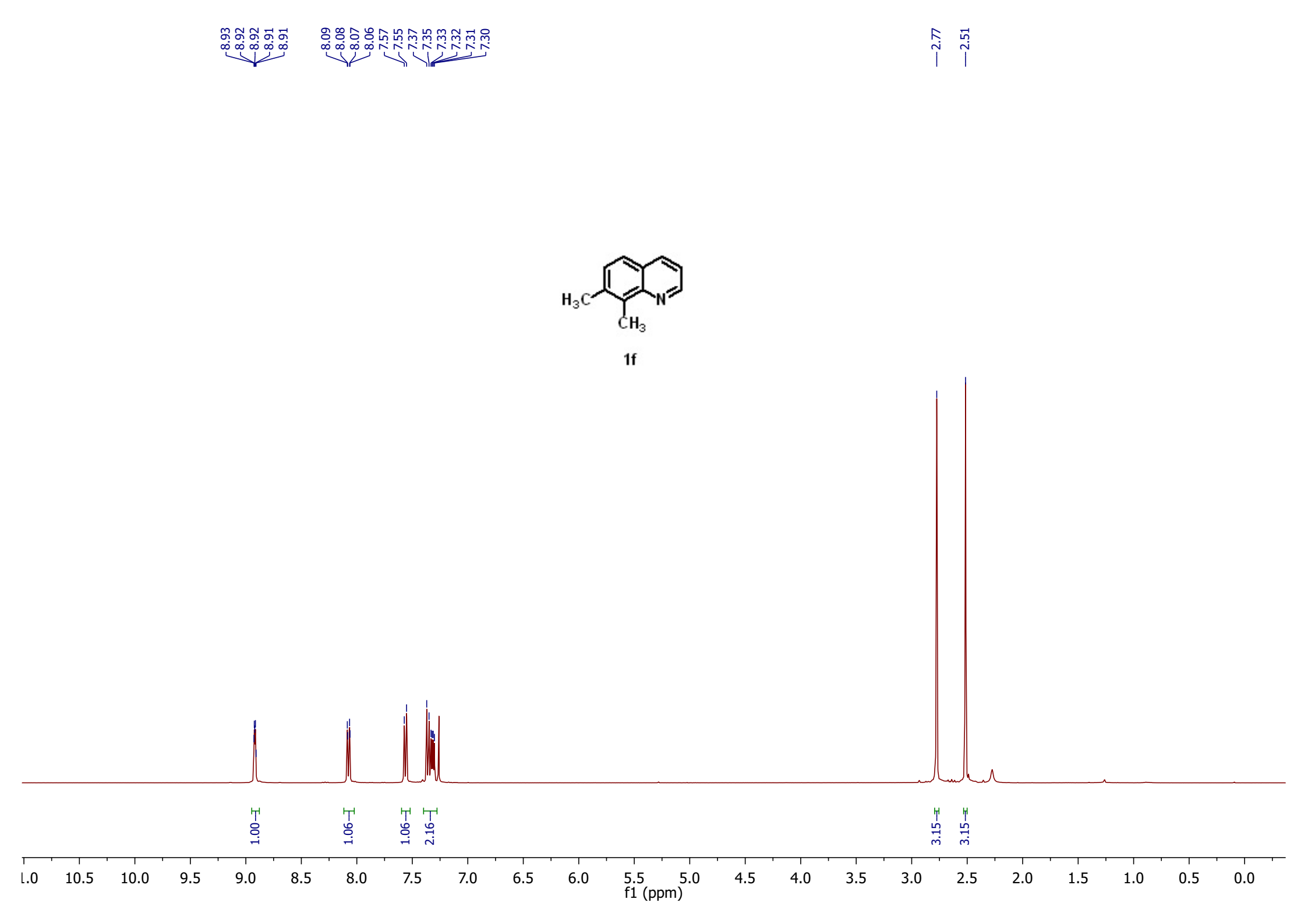
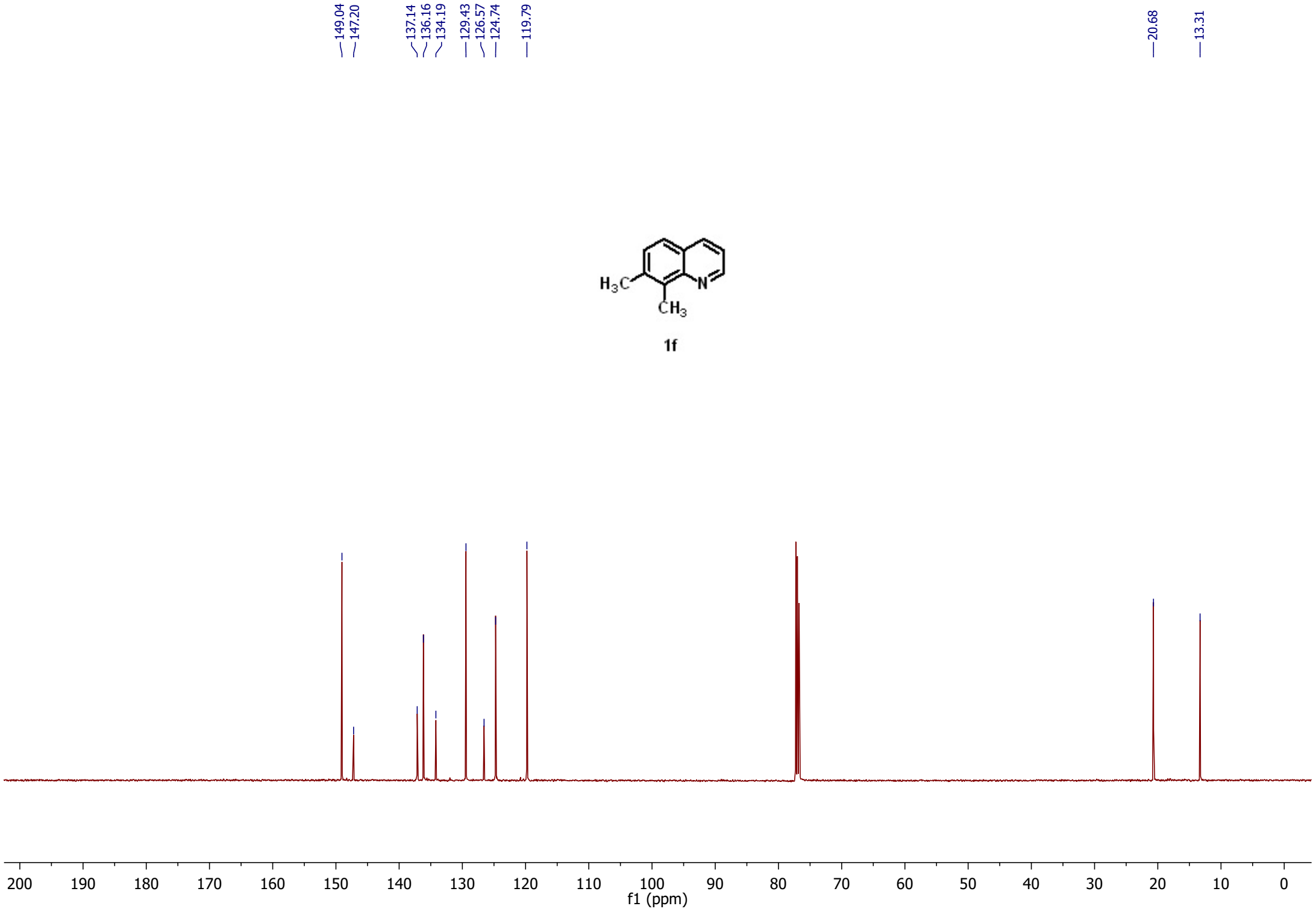
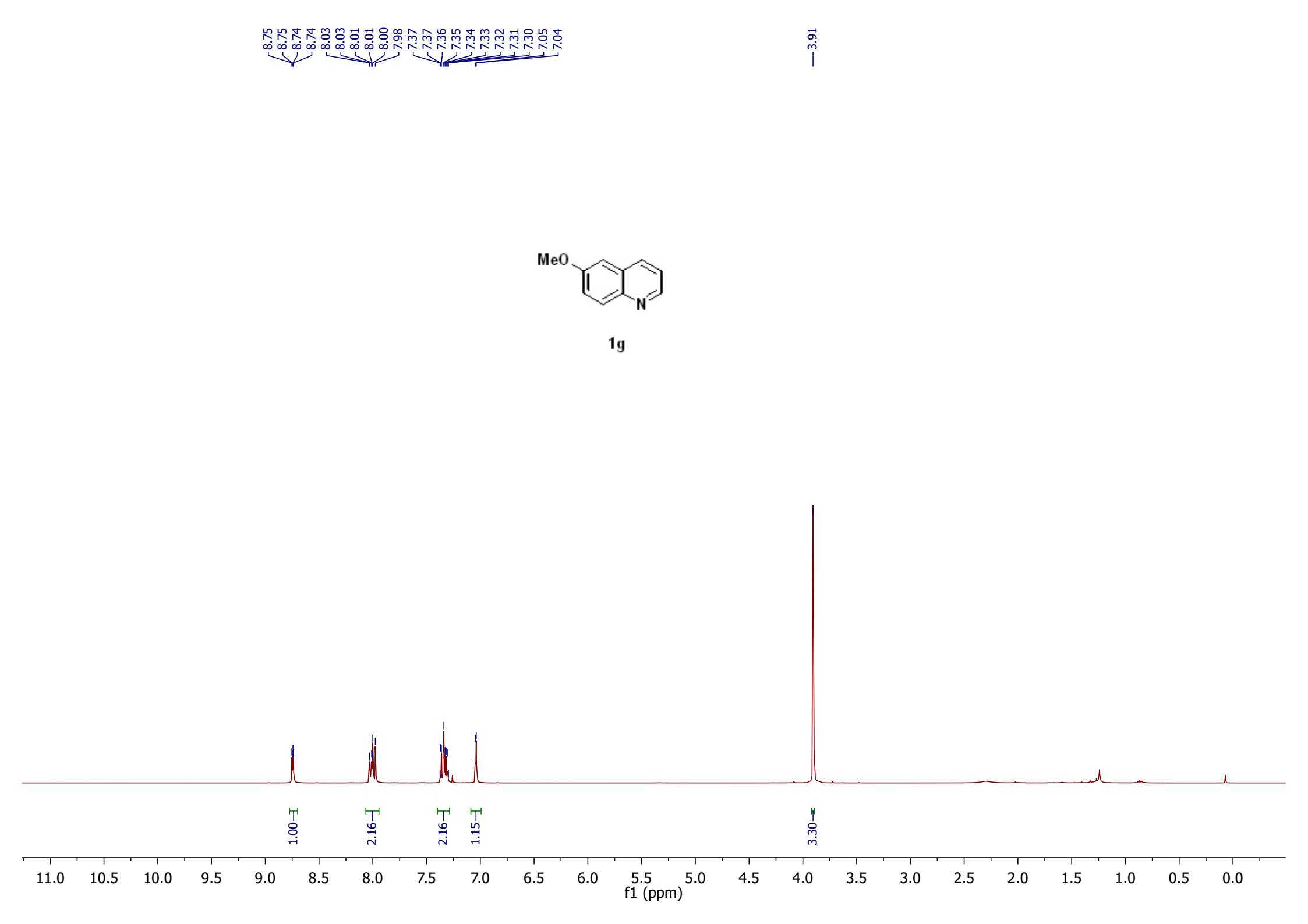
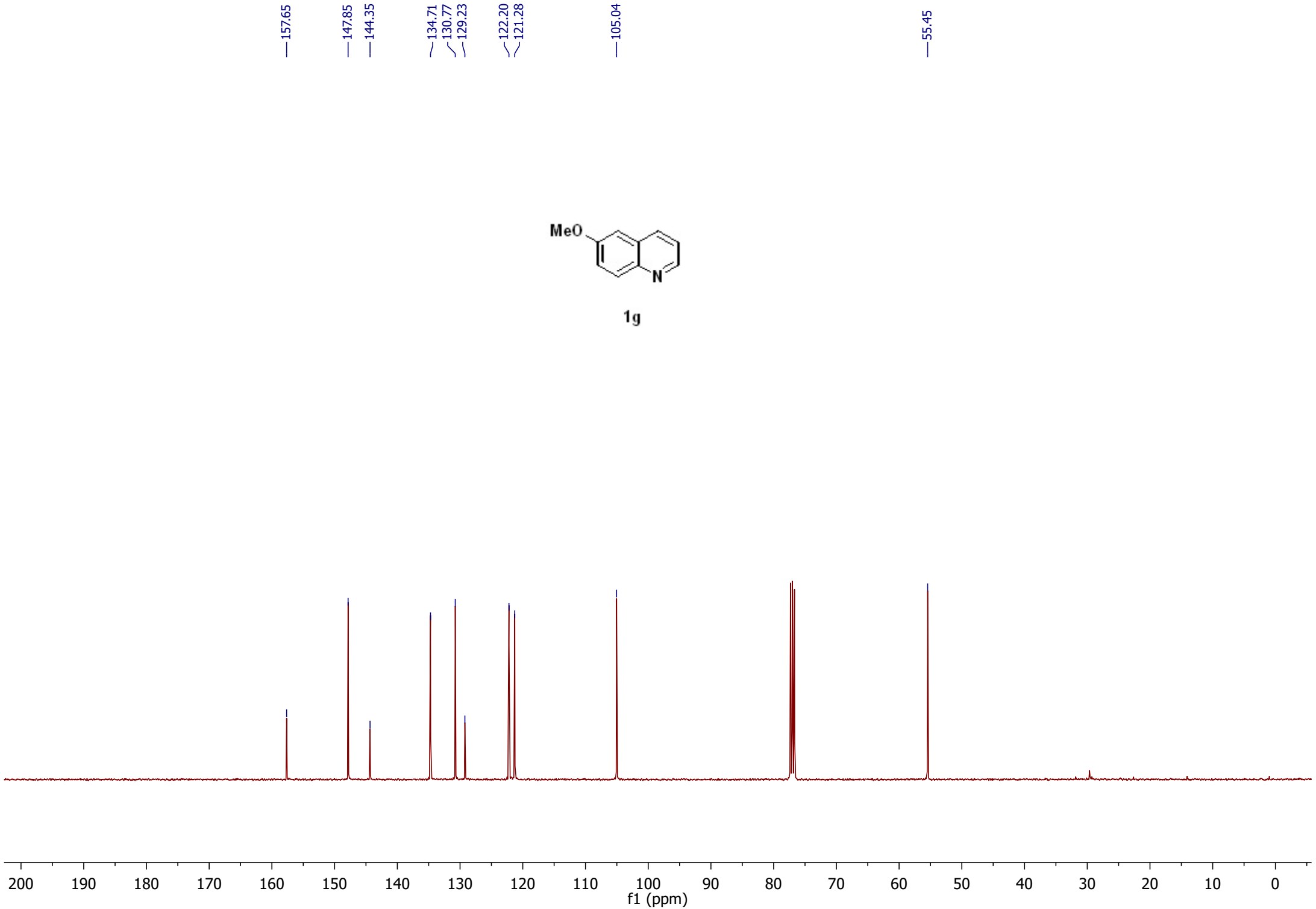
145.86
136.51
135.99
135.63
131.98
128.33
124.59
120.79
21.48
18.00
H3C
N
CH3
1e
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.93
8.92
8.92
8.91
8.91
8.09
8.08
8.07
8.06
7.57
7.55
7.37
7.35
7.33
7.32
7.31
7.30
2.77
2.51
H3C
N
CH3
1f
1.00
1.06
1.06
2.16
3.15
3.15
f1 (ppm)


149.04
147.20
137.14
136.16
134.19
129.43
126.57
124.74
119.79
20.68
13.31
H3C
N
CH3
1f
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.75
8.75
8.74
8.74
8.03
8.03
8.01
8.01
8.00
7.98
7.37
7.37
7.36
7.35
7.34
7.33
7.32
7.31
7.30
7.05
7.04
3.91
MeO
N
1g
1.00
2.16
2.16
1.15
3.30
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
f1 (ppm)


157.65
147.85
144.35
134.71
130.77
129.23
122.20
121.28
105.04
55.45
MeO
N
1g
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.93
8.93
8.92
8.54
8.52
8.09
8.07
7.83
7.81
7.58
7.58
7.56
7.54
7.54
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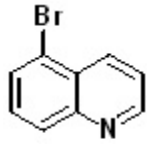
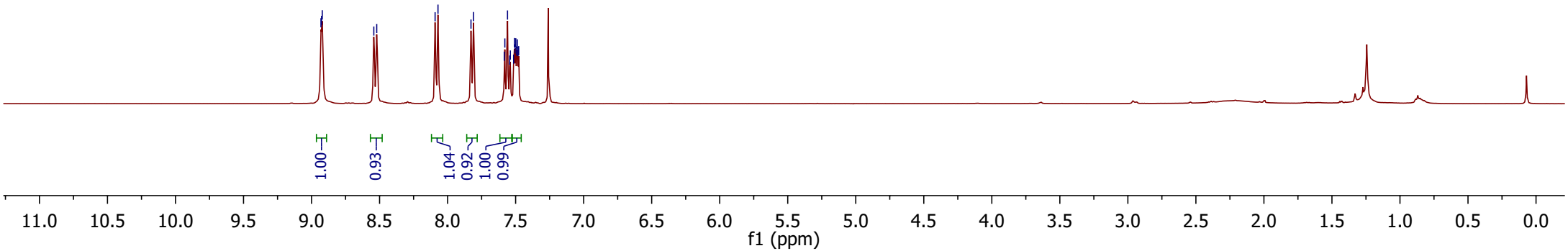
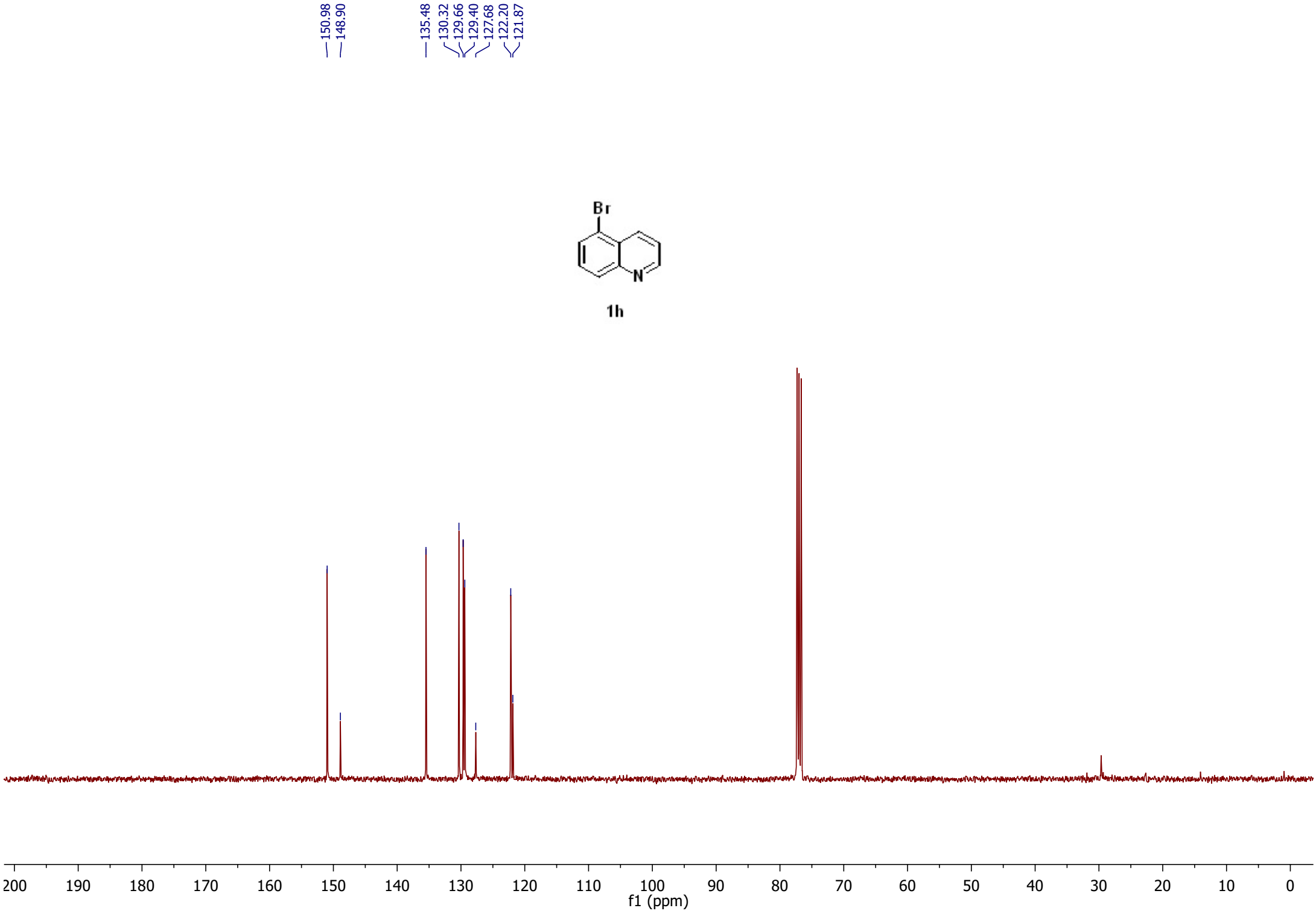
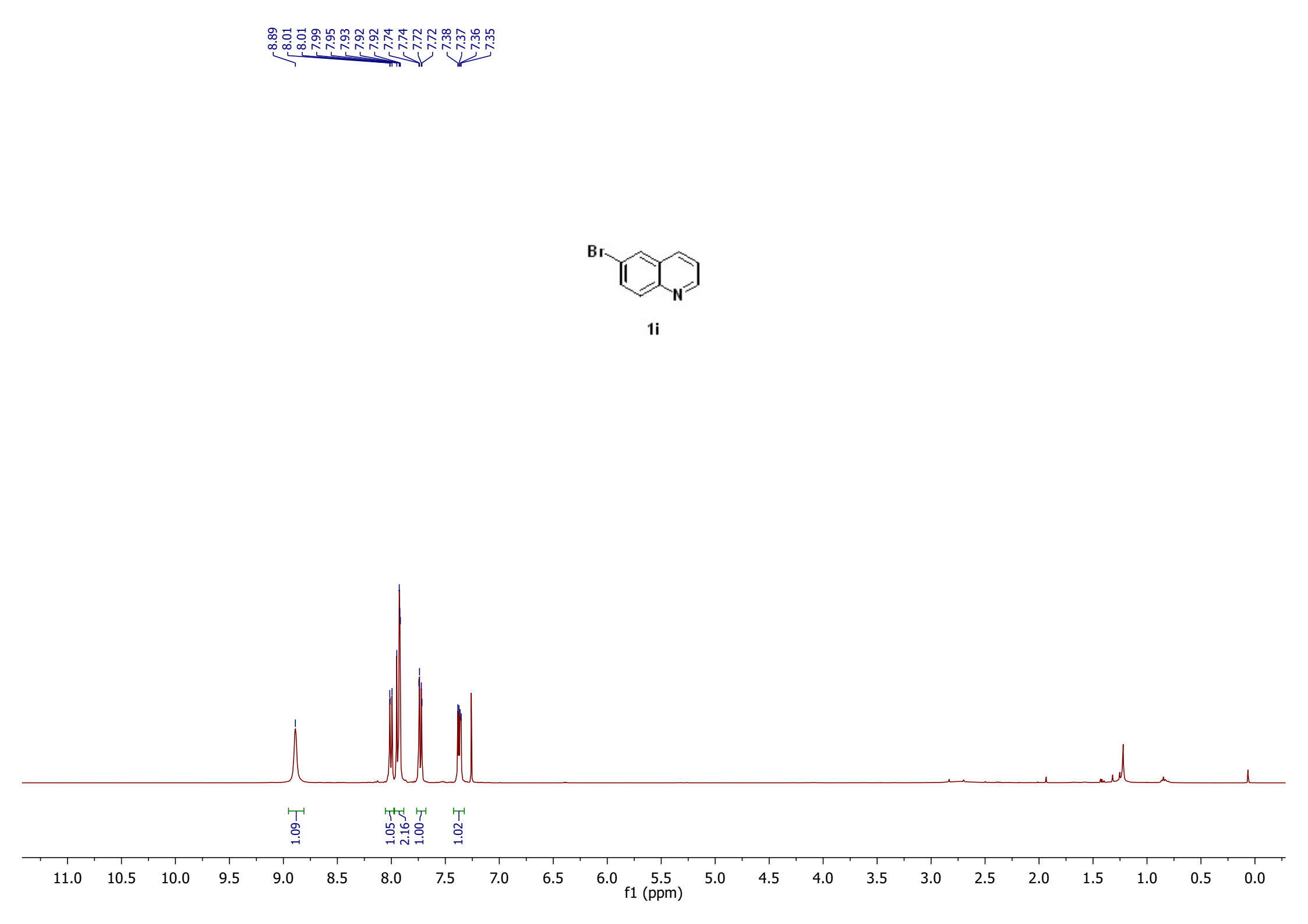
7.50
7.50
7.49
7.49
7.48
7.48

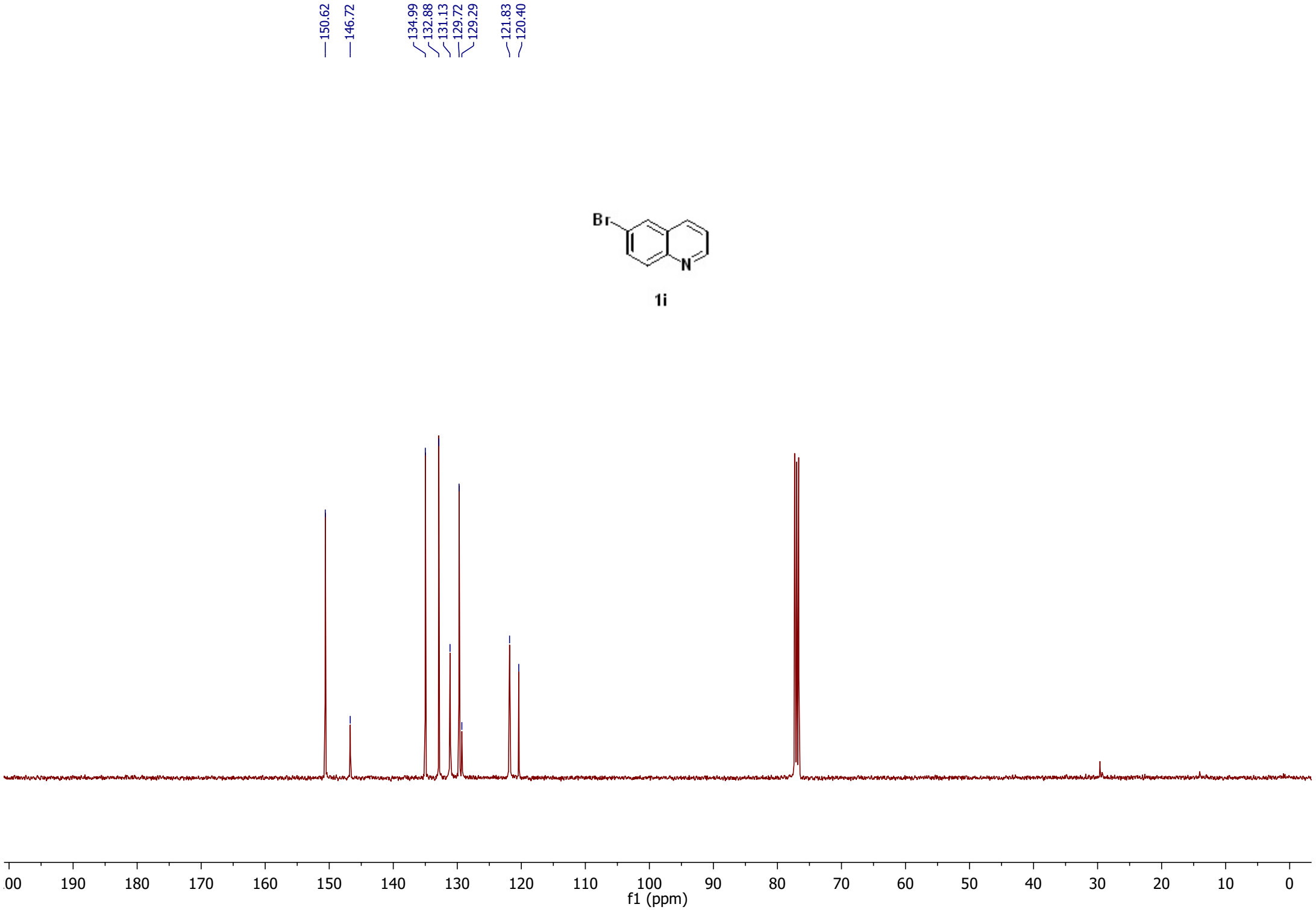

Br
N

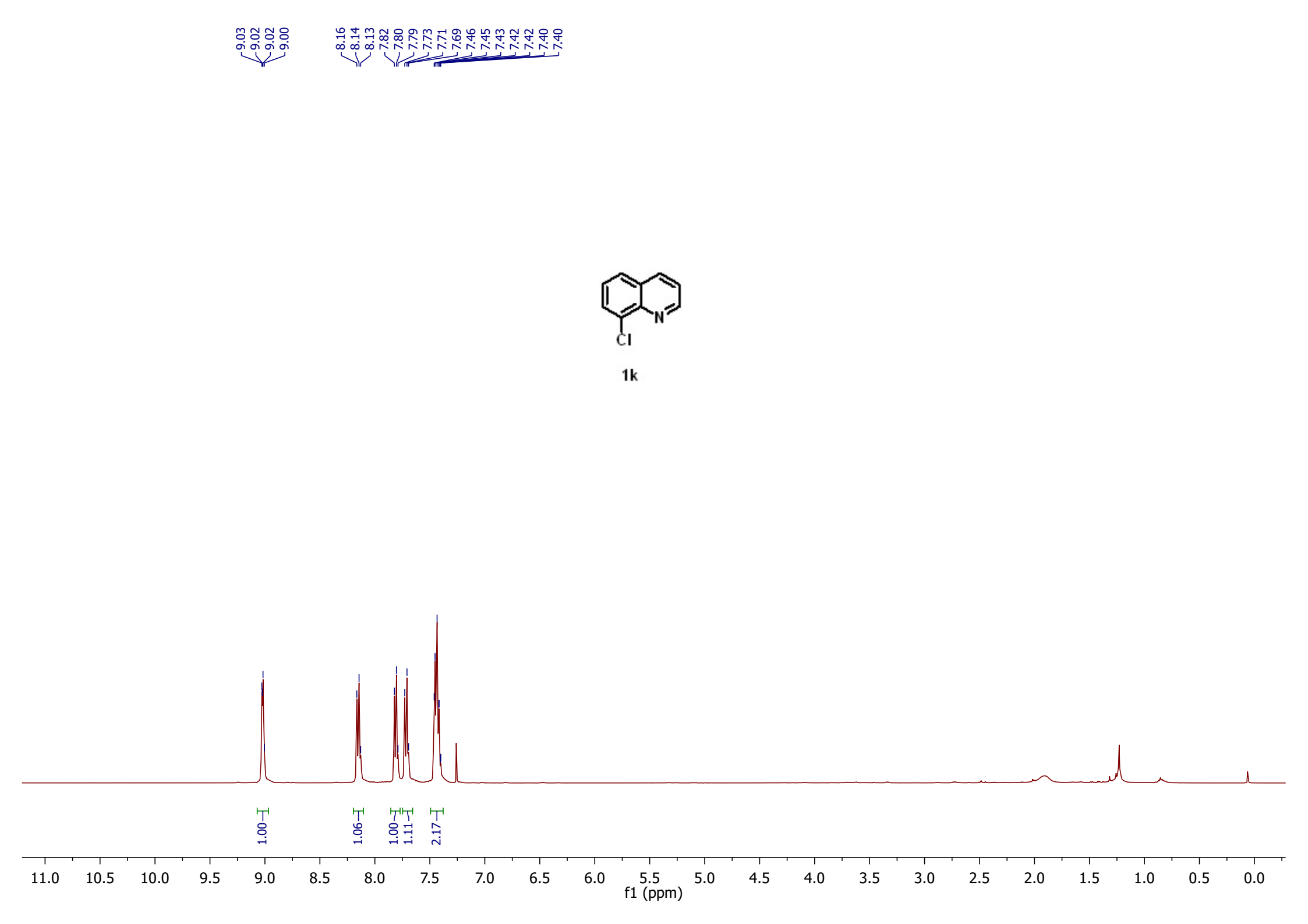
1h

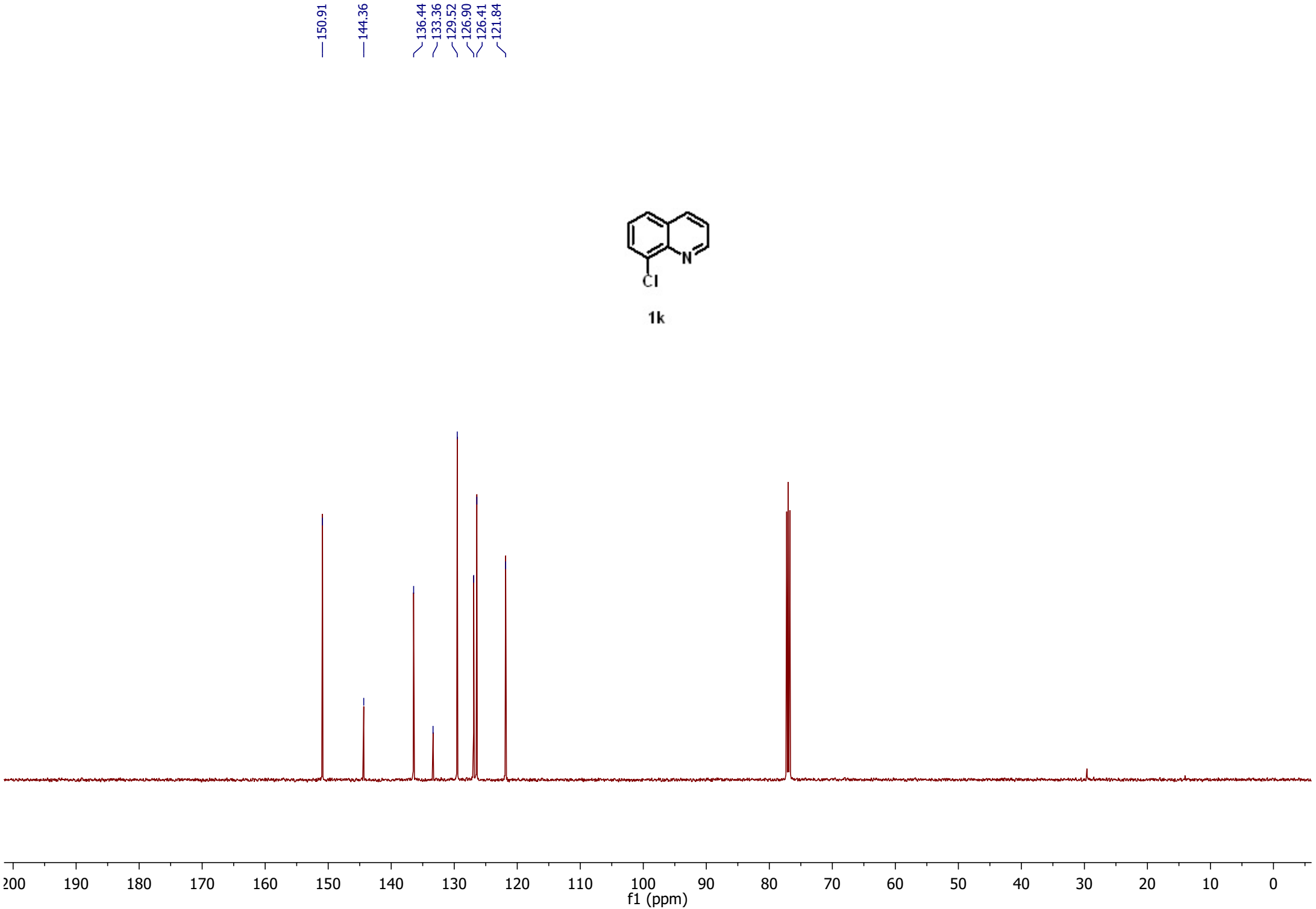

1.00
0.93
1.04
0.92
1.00
0.99
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

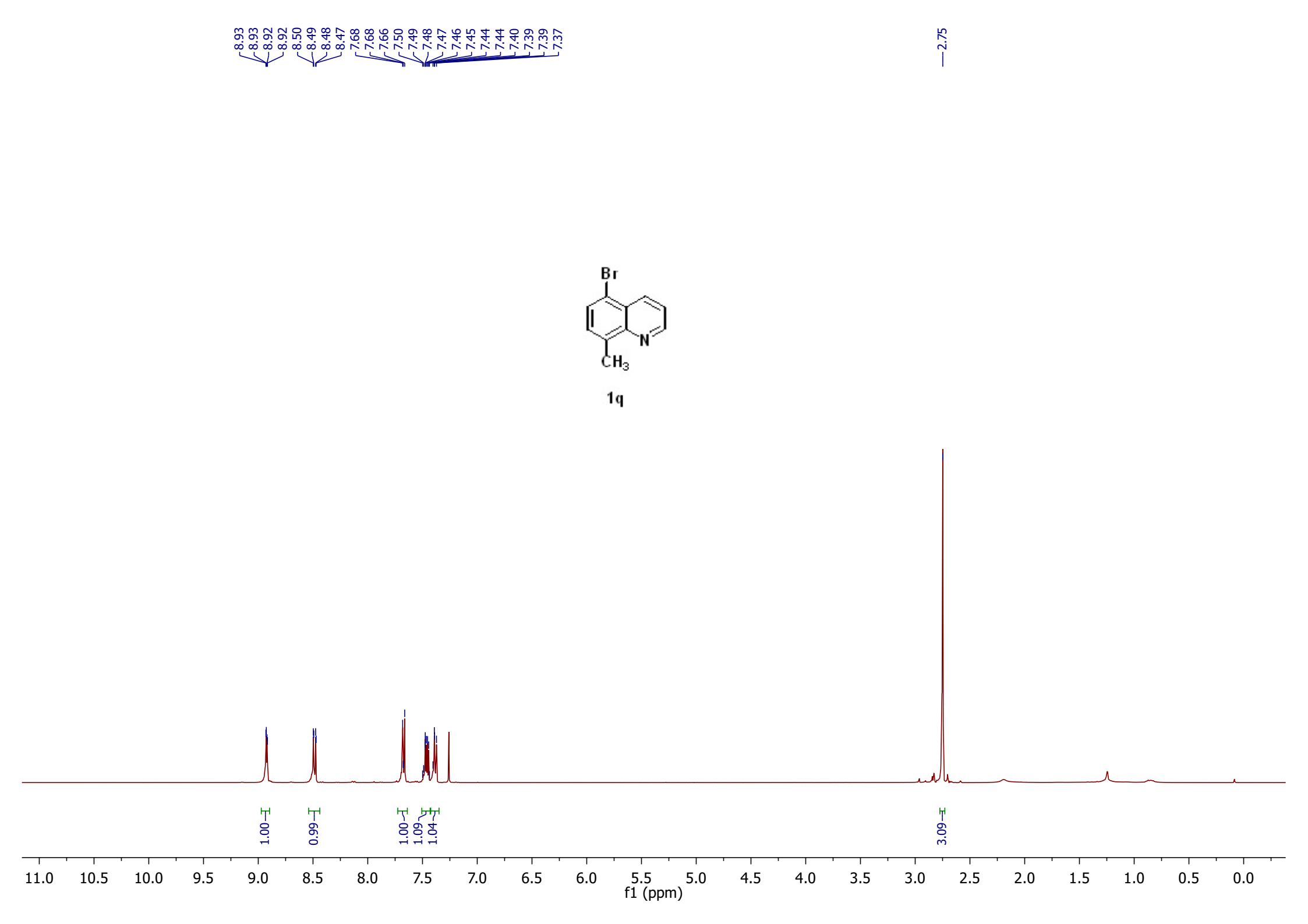

150.98
148.90
135.48
130.32
129.66
129.40
127.68
122.20
121.87
Br
N
1h
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.89
8.01
8.01
7.99
7.95
7.93
7.92
7.92
7.74
7.74
7.72
7.72
7.38
7.37
7.36
7.35
Br
N
1i
1.09
1.05
2.16
1.00
1.02
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
f1 (ppm)


150.62
146.72
134.99
132.88
131.13
129.72
129.29
121.83
120.40
Br
N
1i
f1 (ppm)


9.03
9.02
9.02
9.00
8.16
8.14
8.13
7.82
7.80
7.79
7.73
7.71
7.69
7.46
7.45
7.43
7.42
7.42
7.40
7.40
N
Cl
1k
1.00
1.06
1.00
1.11
2.17
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
f1 (ppm)


150.91
144.36
136.44
133.36
129.52
126.90
126.41
121.84
N
Cl
1k
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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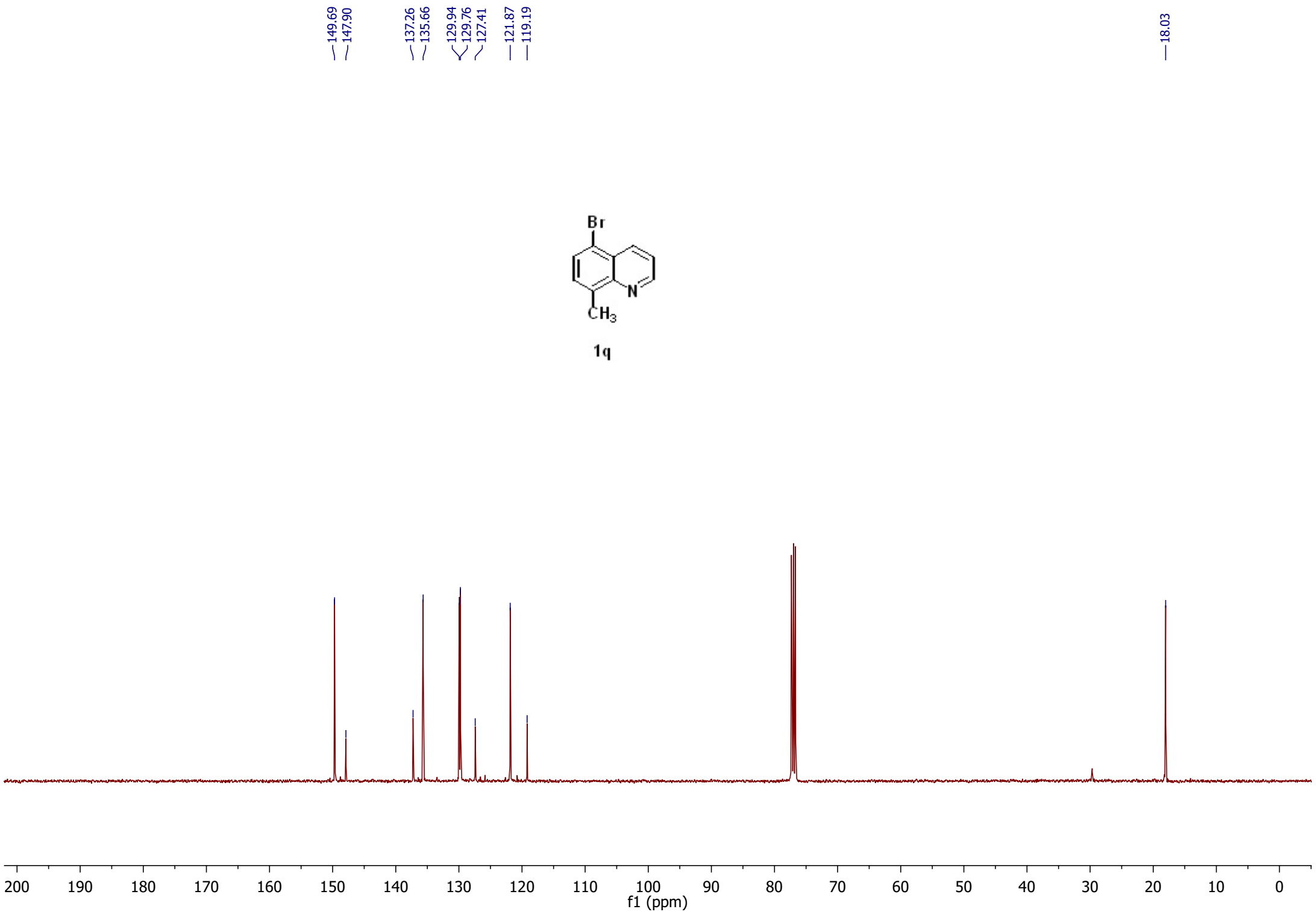
8.93
8.92
8.92
8.50
8.49
8.48
8.47
7.68
7.68
7.66
7.50
7.49
7.48
7.47
7.46
7.45
7.44
7.44
7.40
7.39
7.39
7.37
2.75
Br
N
CH3
1q
1.00
0.99
1.00
1.09
1.04
3.09
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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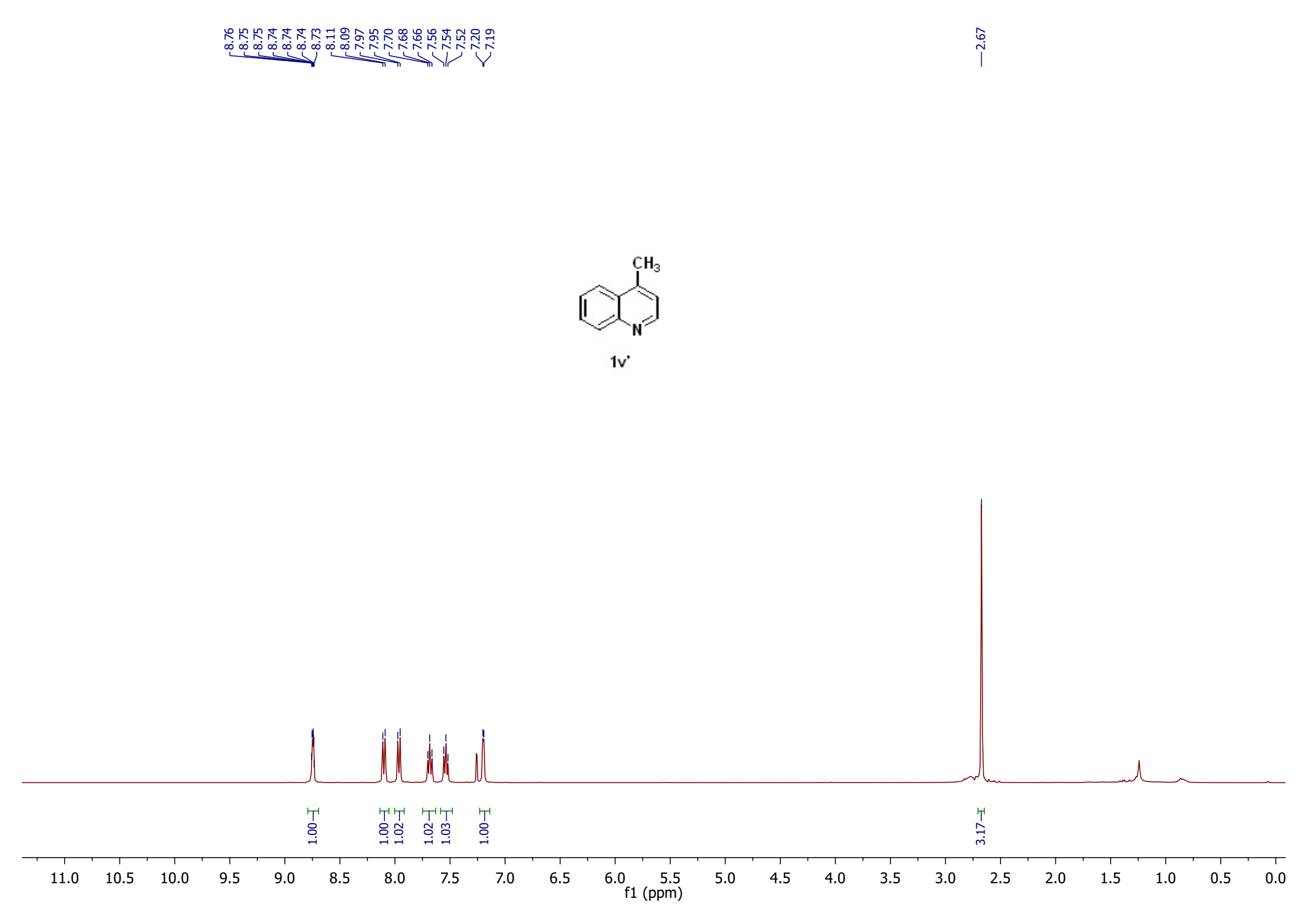
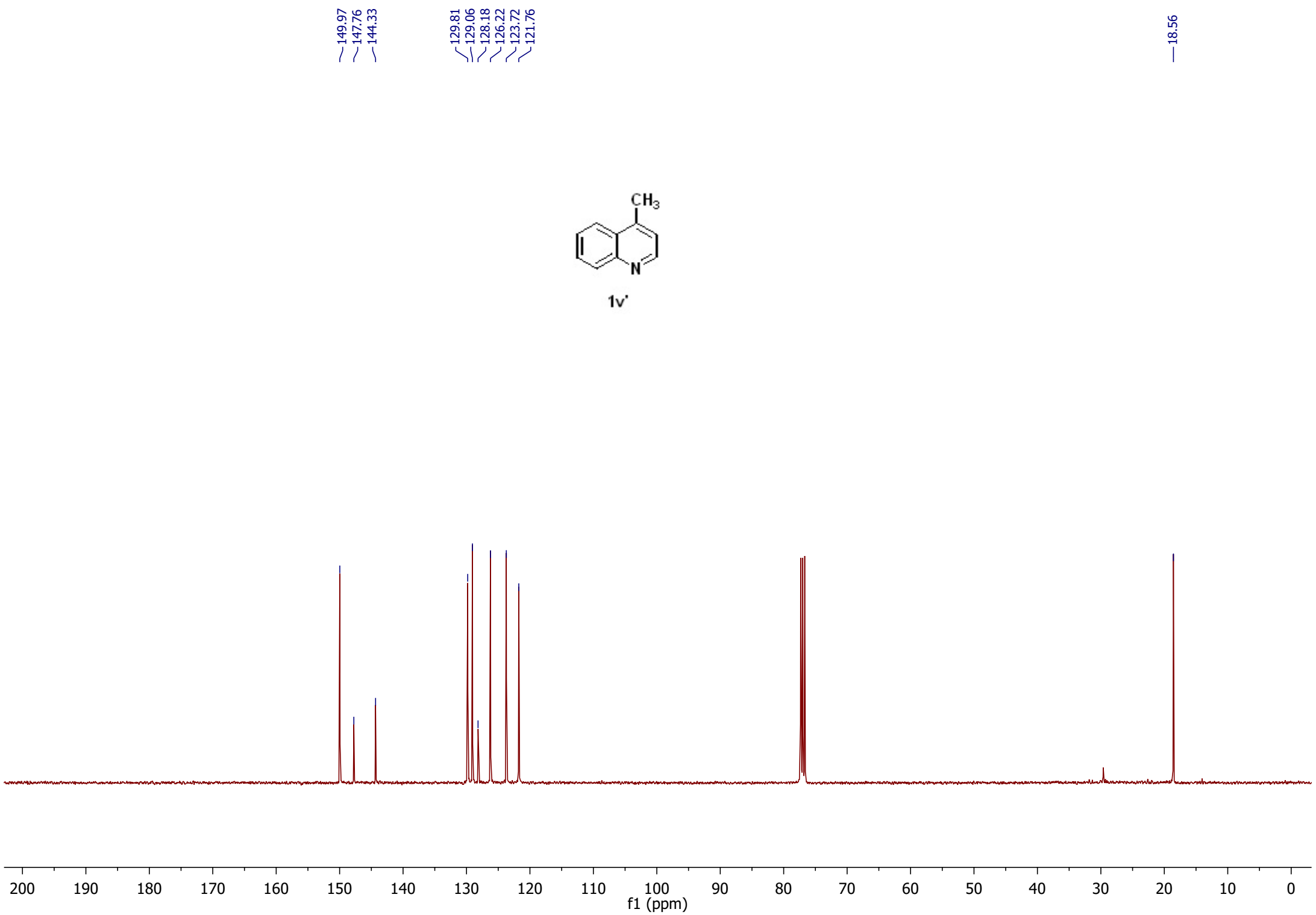
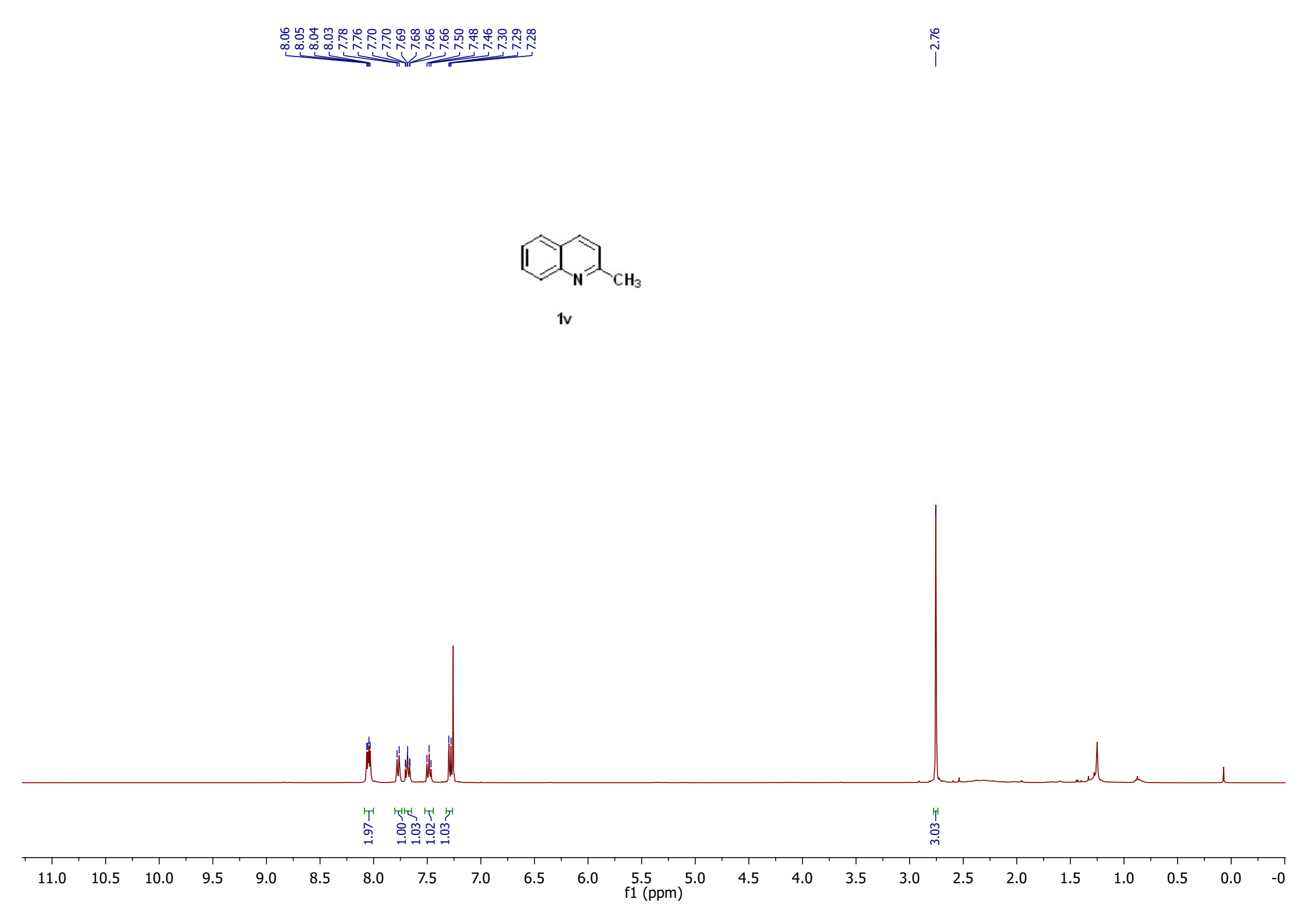
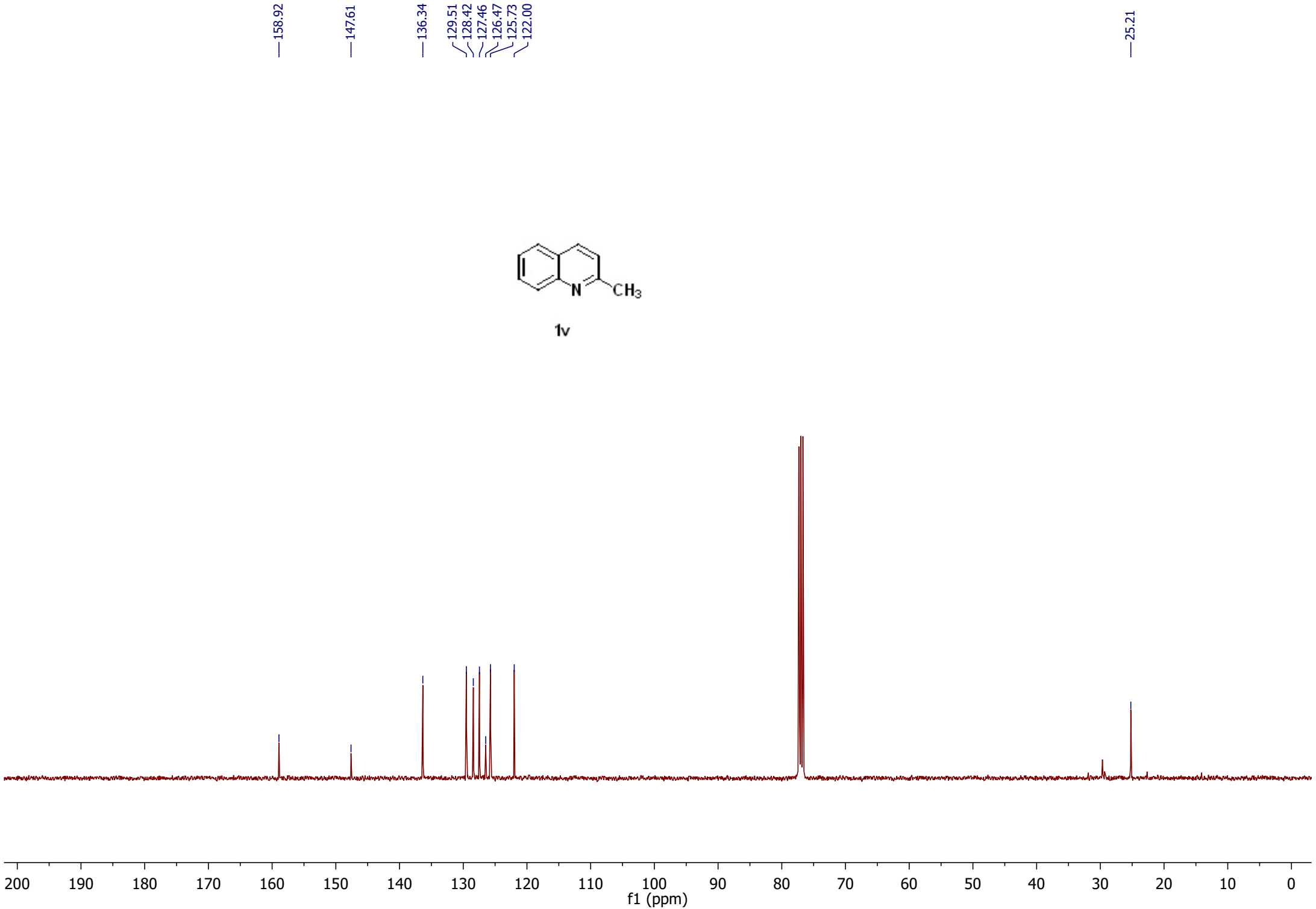
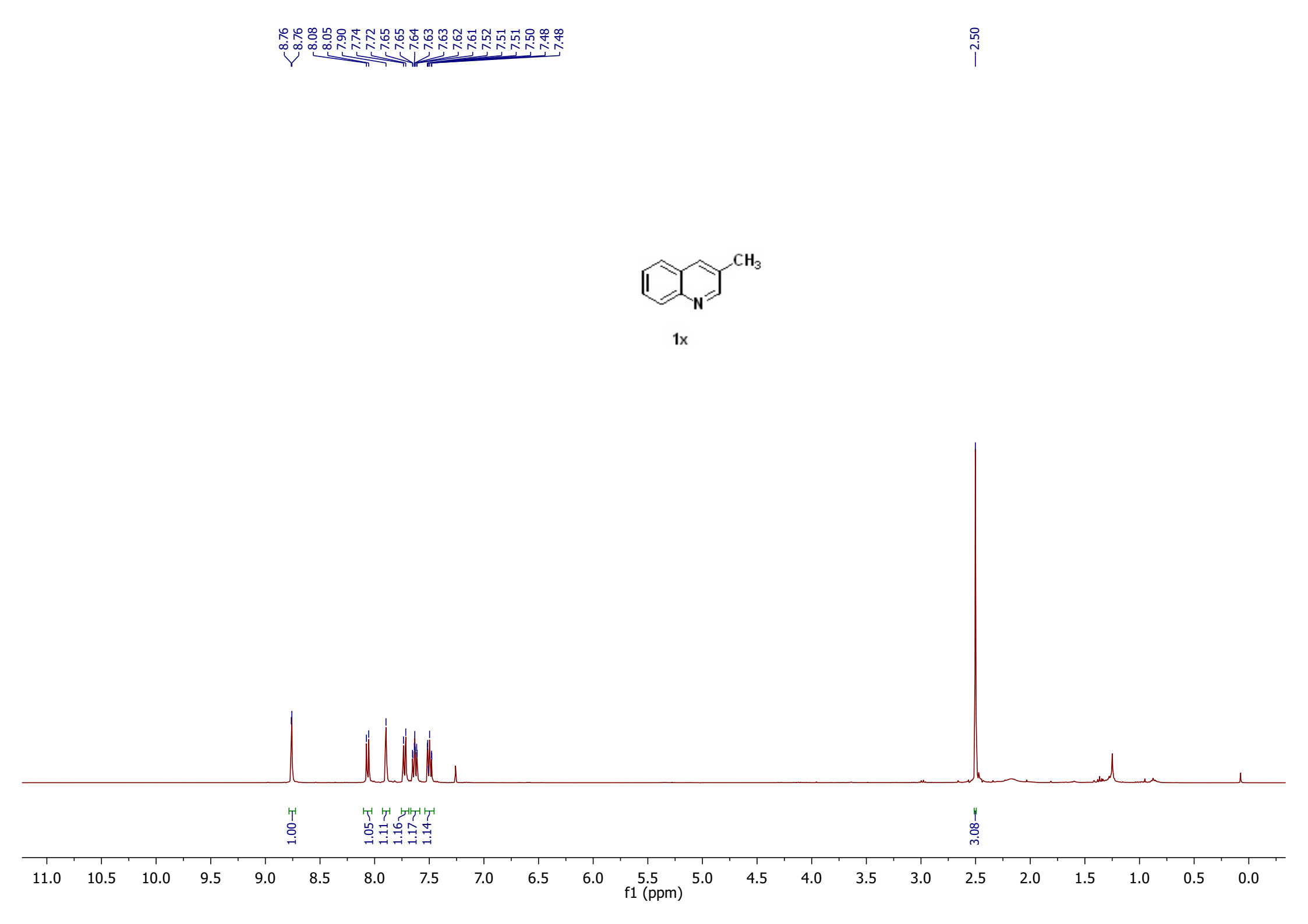
147.90
137.26
135.66
129.94
129.76
127.41
121.87
119.19
18.03
Br
N
CH3
1q
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

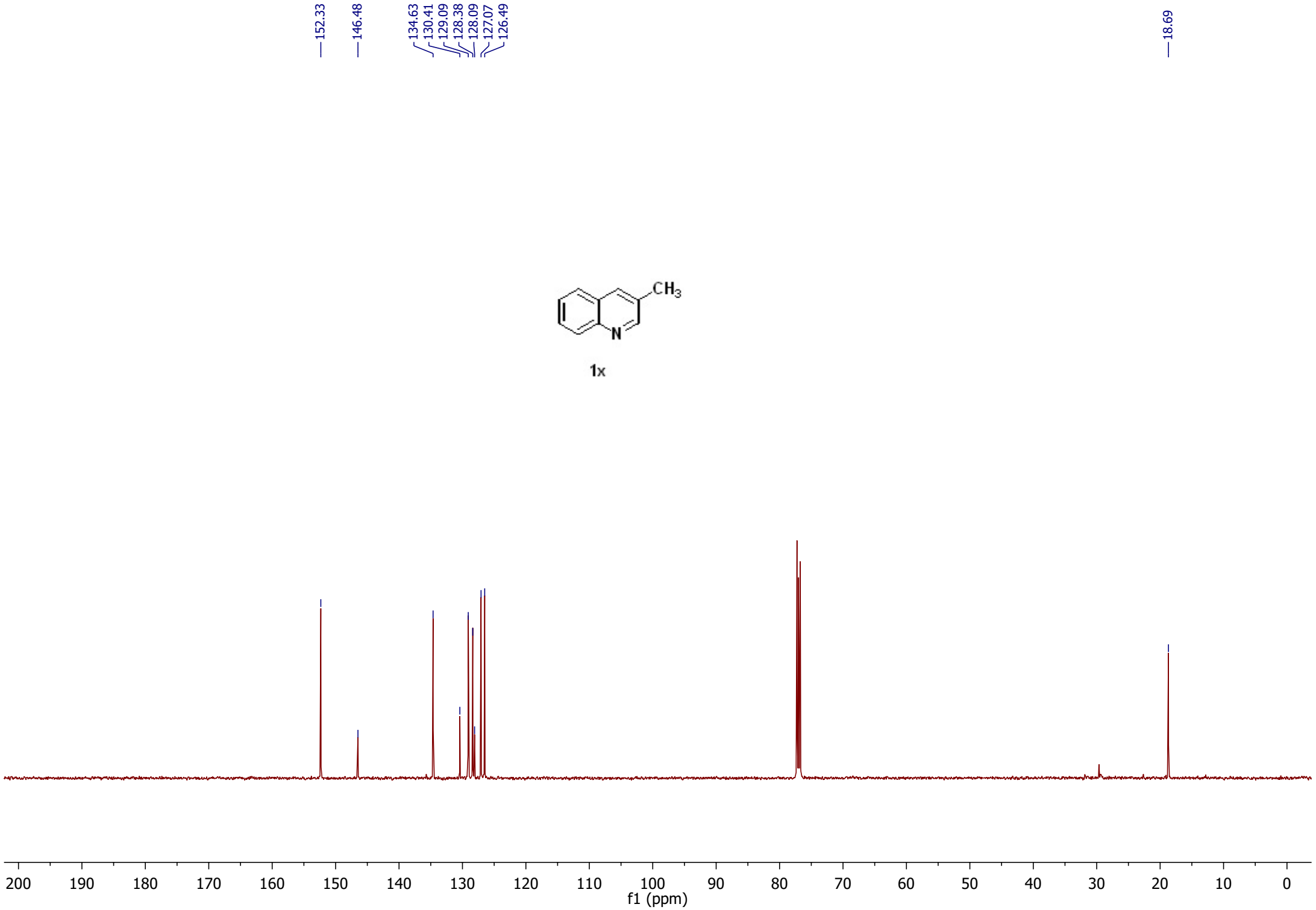

8.76
8.75
8.75
8.74
8.74
8.74
8.73
8.11
8.09
7.97
7.95
7.70
7.68
7.66
7.56
7.54
7.52
7.20
7.19
2.67
CH3
N
1v'
1.00
1.00
1.02
1.02
1.03
1.00
3.17
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

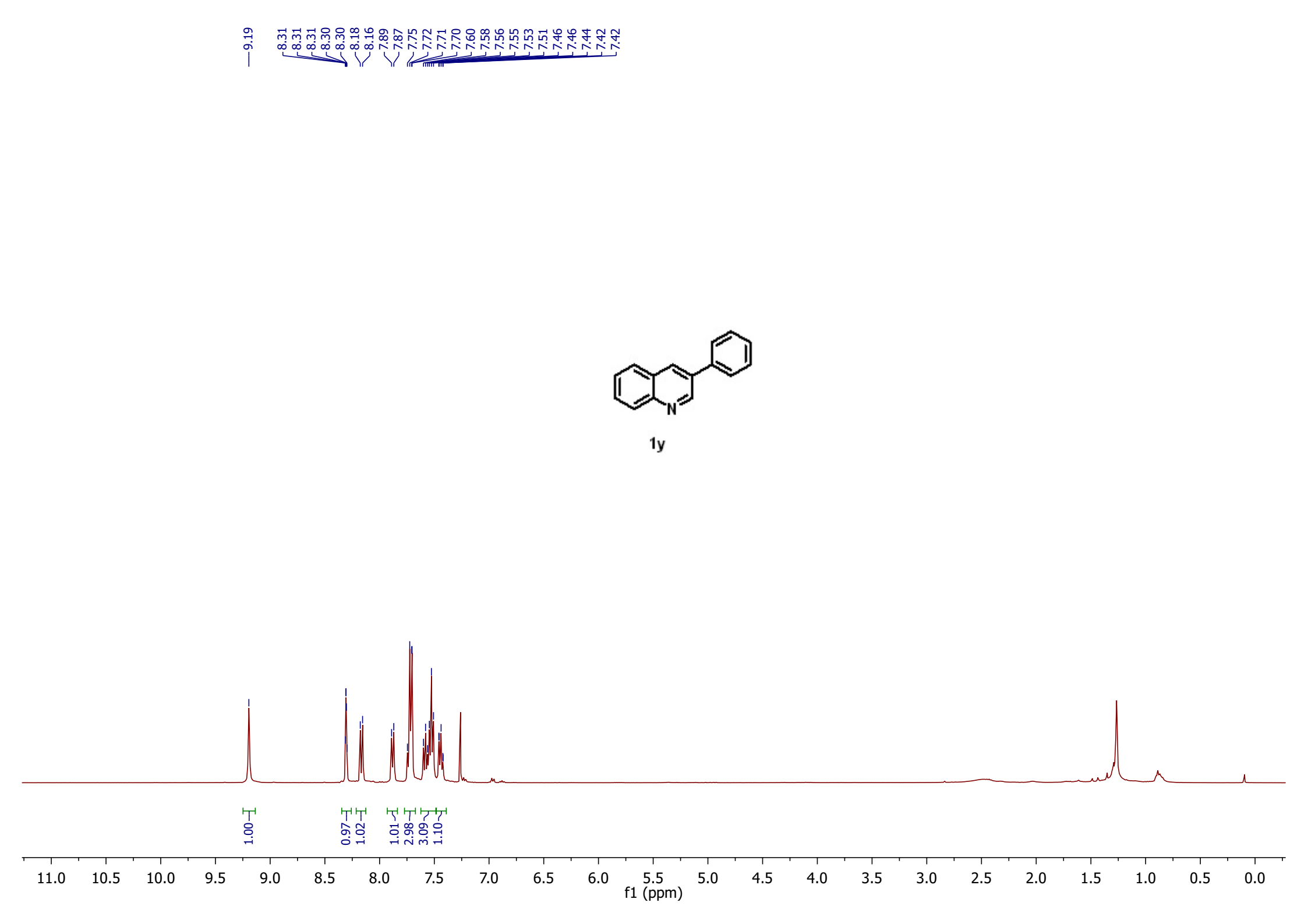

149.97
147.76
144.33
129.81
129.06
128.18
126.22
123.72
121.76
18.56
CH3
N
1v'
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

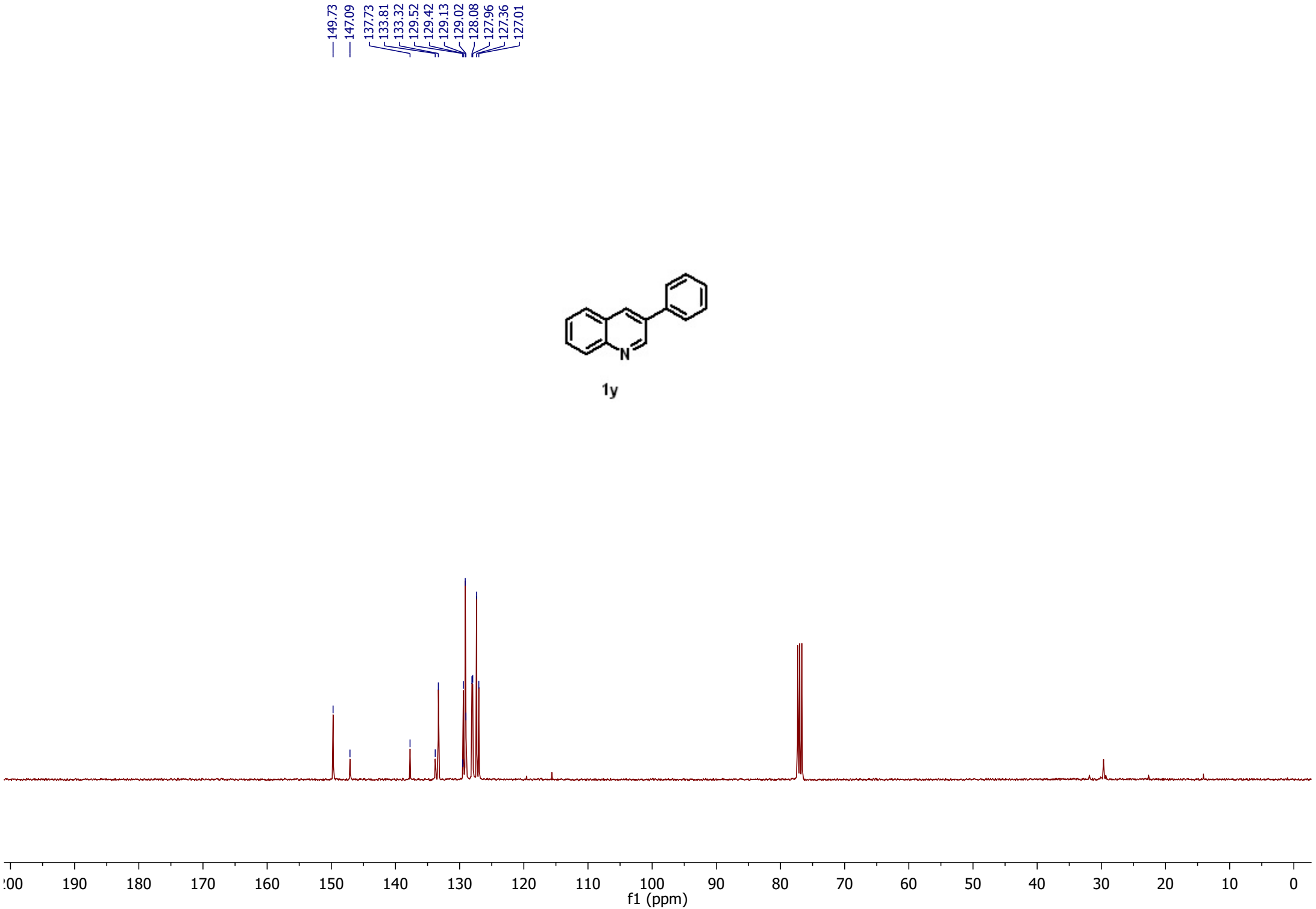

8.06
8.05
8.04
8.03
7.78
7.76
7.70
7.70
7.69
7.68
7.66
7.66
7.50
7.48
7.46
7.30
7.29
7.28
2.76
N
CH3
1v
1.97
1.00
1.03
1.02
1.03
3.03
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
f1 (ppm)


158.92
147.61
136.34
129.51
128.42
127.46
126.47
125.73
122.00
25.21
N
CH3
1v
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

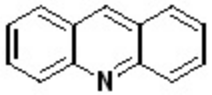

8.76
8.76
8.08
8.05
7.90
7.74
7.72
7.65
7.65
7.64
7.63
7.63
7.62
7.61
7.52
7.51
7.51
7.50
7.48
7.48
2.50
CH3
N
1x
1.00
1.05
1.11
1.16
1.17
1.14
3.08
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


152.33
146.48
134.63
130.41
129.09
128.38
128.09
127.07
126.49
18.69
CH3
N
1x
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

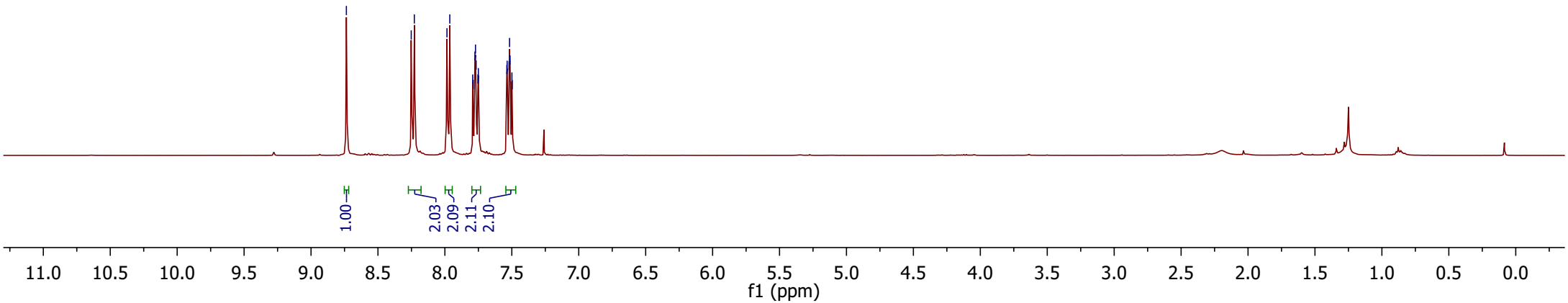

9.19
8.31
8.31
8.31
8.30
8.30
8.18
8.16
7.89
7.87
7.75
7.72
7.71
7.70
7.60
7.58
7.56
7.55
7.53
7.51
7.46
7.46
7.44
7.42
7.42
N
1y
1.00
0.97
1.02
1.01
2.98
3.09
1.10
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

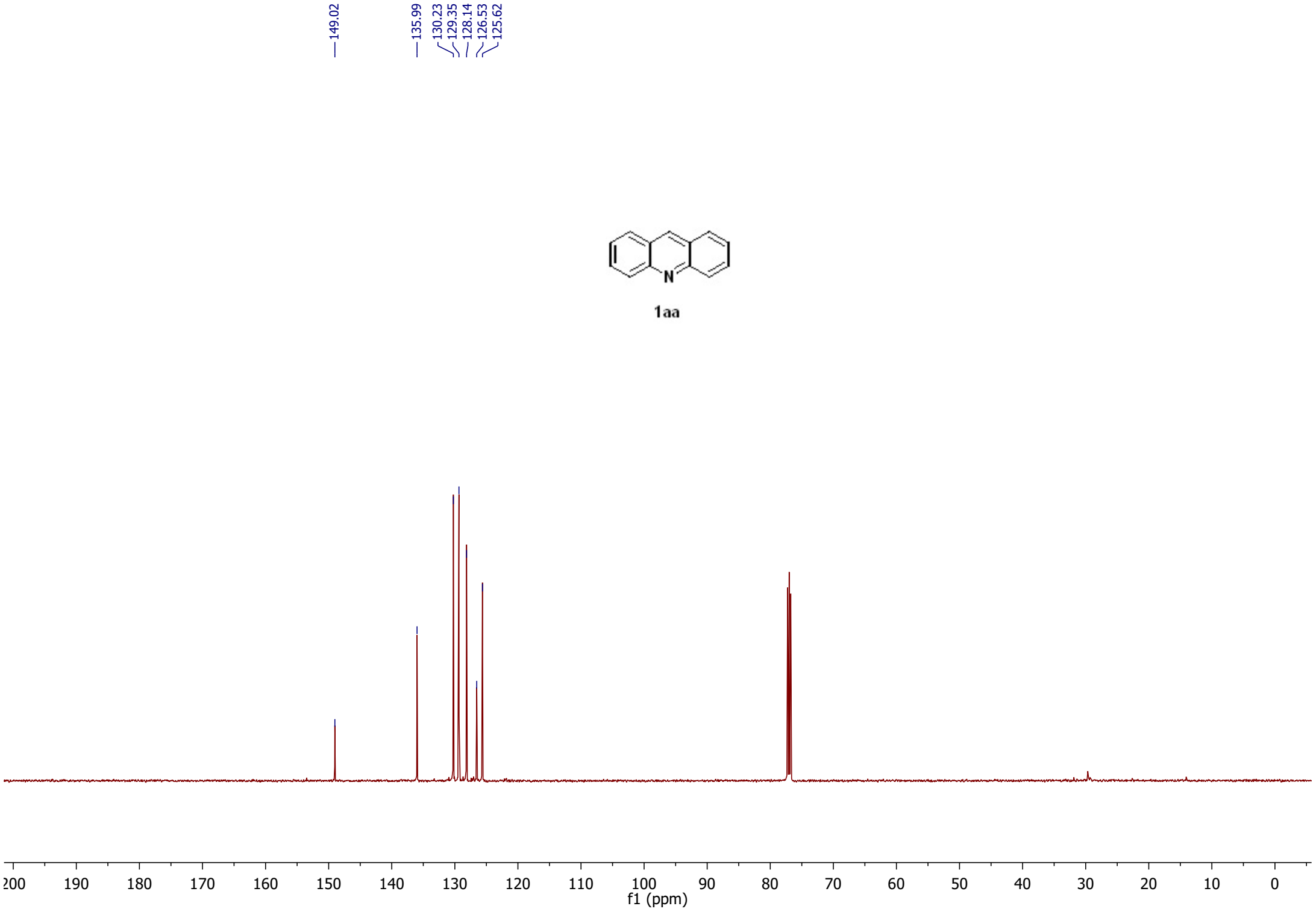

149.73
147.09
137.73
133.81
133.32
129.52
129.42
129.13
129.02
128.08
127.96
127.36
127.01
N
1y
f1 (ppm)


8.74
8.25
8.23
7.98
7.96
7.79
7.79
7.78
7.77
7.77
7.75
7.75
7.54
7.53
7.52
7.52
7.51
7.50
7.50


N

1aa


1.00
2.03
2.09
2.11
2.10
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
f1 (ppm)


149.02
135.99
130.23
129.35
128.14
126.53
125.62
N
1aa
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)