Electronic Supplementary Information (ESI)

for

Synthesis of indoline-2,3-fused tetrahydroquinolines bearing two free N–H using a protecting-group-free approach

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1. General Information

***Reagents and Solvents*:** Unless otherwise stated, all commercially available reagents and solvents were employed for reactions as received without further purification. Dry solvents refer to solvents freshly distilled over appropriate drying agents prior to use. All dry reactions were carried out in oven-dried glassware and under nitrogen (N_2) atmosphere sealed with rubber septa (Aldrich). Commercially available solvents were used for column chromatography without any further purification.

***Purification of Synthesized Compounds*:** All reactions and fractions from column chromatography were monitored by thin-layer chromatography (TLC). Commercial aluminum sheets pre-coated (0.2mm layer thickness) with silica gel 60 F_{254} were used for this purpose. Visualization of TLC plates was performed by UV fluorescence at 254 nm and/or by staining with I_2 vapor or by immersion in an ethanolic vanillin solution or by immersion in a $KMnO_4$ solution followed by heating. Product purification by column chromatography was executed using silica gel (100–200 mesh) procured from Merck.

***Spectroscopy and Spectrometry*:** NMR spectra were recorded on JEOL 400 MHz, Bruker 500 MHz spectrometers. Chemical shifts (δ) are quoted in parts per million (ppm) and are referenced to residual $CHCl_3$ (7.27 ppm) or DMSO (2.50 ppm) for ^1H NMR spectra and for ^{13}C spectra, δ values were referenced to $CDCl_3$ (77.00 ppm) or DMSO-d_6 (39.52 ppm) as solvents. Coupling constants (*J*) are quoted in Hertz (Hz), rounded to the nearest 0.1 Hz. The ^1H NMR spectra are reported as follows: ppm (multiplicity, coupling constants, and number of protons). Multiplicities in ^1H NMR are abbreviated as follows: singlet (s), doublet (d), triplet (t), quartet (q), doublet of doublets (dd), doublet of doublet of doublets (ddd), doublet of triplets (dt), triplet of doublets (td), multiplet (m) and broad (br). All spectra were recorded at 25 °C. Spectra were analyzed using Mestrelab MestReNova 14.1 software. Low-resolution mass spectra (LRMS) were recorded on an Agilent 6125 SQ LCMS system. HRMS data were recorded by electron spray ionization with a Q-TOF mass analyzer.

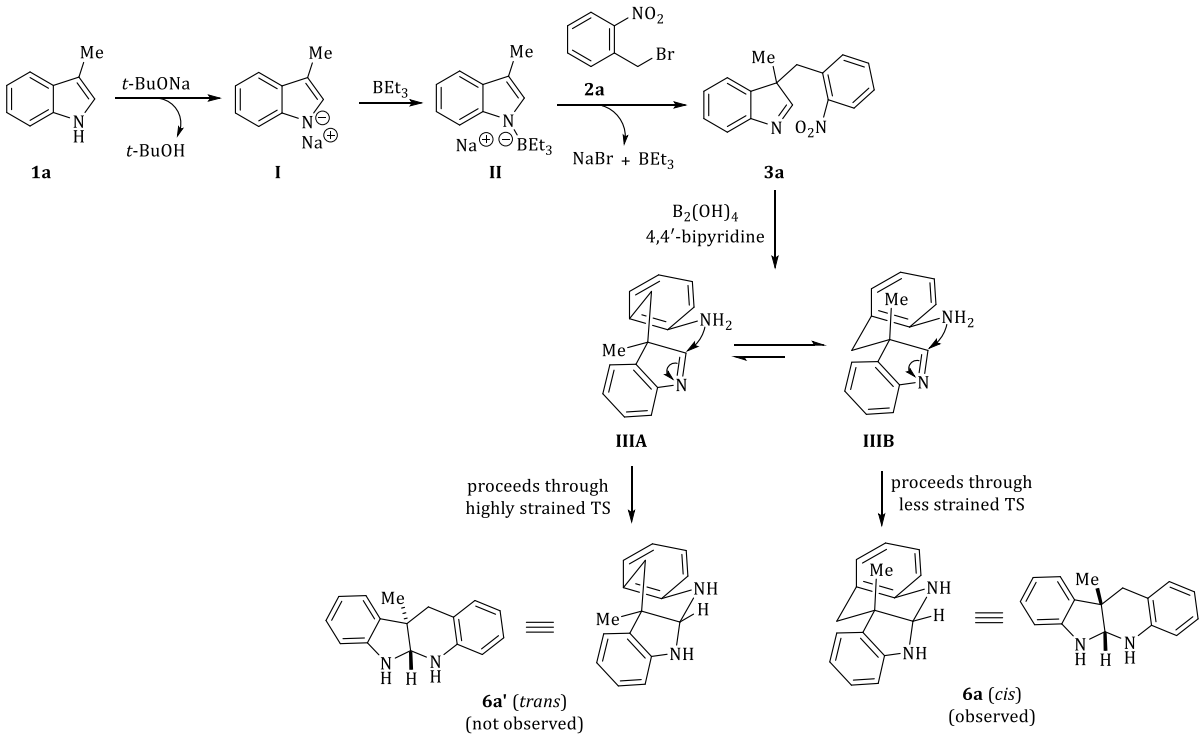
***Melting Points and CHN content*:** Melting points were determined with a Buchi-535 apparatus and are reported uncorrected. The organic content (wt % C, H, N) in the synthesized compounds was determined by combustion analysis using a PerkinElmer 20 CHN analyzer.

Stereochemical Notation and Naming of Compounds: Relative stereochemistry is indicated by solid bold (▬) and hatched bold (⋯) bonds according to the Maehr

convention. Compound names were given following IUPAC nomenclature and are generated using ChemDraw 19.0 software.

2. Proposed reaction mechanism

A plausible reaction mechanism for the two-step sequence is outlined in Scheme S1, using the synthesis of **6a** starting from **1a** and **2a** as a representative case. Deprotonation of **1a** by the *t*-BuONa generates anion **I**, which subsequently forms the *N*-indolyltriethylborate intermediate **II**. This intermediate then undergoes an indole C3-selective S_N2-type alkylation with **2a**, affording indolenine **3a**.[1] In the following step, chemoselective reduction of the nitro group by $B_2(OH)_4$ (4 equiv) in the presence of 4,4′-bipyridine (5 mol%) furnishes an aniline intermediate that undergoes intramolecular imine addition.[2] This cyclization reaction proceeds through the more favorable conformation **IIIB** rather than **IIIA**, thereby delivering exclusively the *cis*-fused product **6a**, with no detectable formation of the *trans*-fused isomer **6a′**.[3]



Scheme S1: Proposed reaction mechanism for the observed diastereoselectivity.

3. Experimental details and Characterization Data

3.1. Structures of the indoles and alkylating agents employed in this study

For the validation of our present two-step synthetic route, we have employed indoles **1a–m**, **4** and **7a–l** the structures of which are shown in Figure SI-1. Indoles **1a–c**, **1g**, **1m**, **7a–c**, and **7e–l** were procured from commercial sources. Remaining indoles **1d–f**, **1h–l** and **4** were synthesized according to established literature procedures.[4–9]

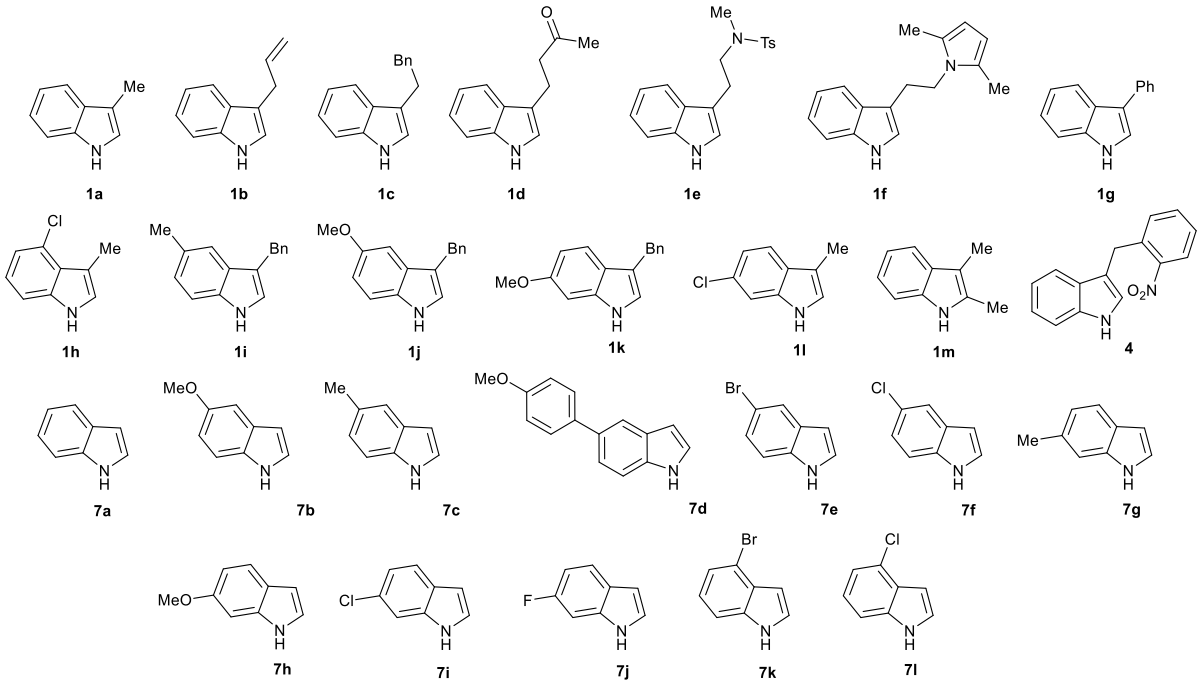


Figure S1. Structures of the indole substrates employed in this study.

We employed benzylic, allylic, and propargylic bromides **5a–i** as the alkylating agents (Figure SI-2). The benzylic bromides **2a–h** and **5f–i** were freshly prepared from the corresponding benzyl alcohols by known methods,[10–15] while the allylic bromides **5a–d** and propargylic bromide **5e** were obtained from commercial sources.

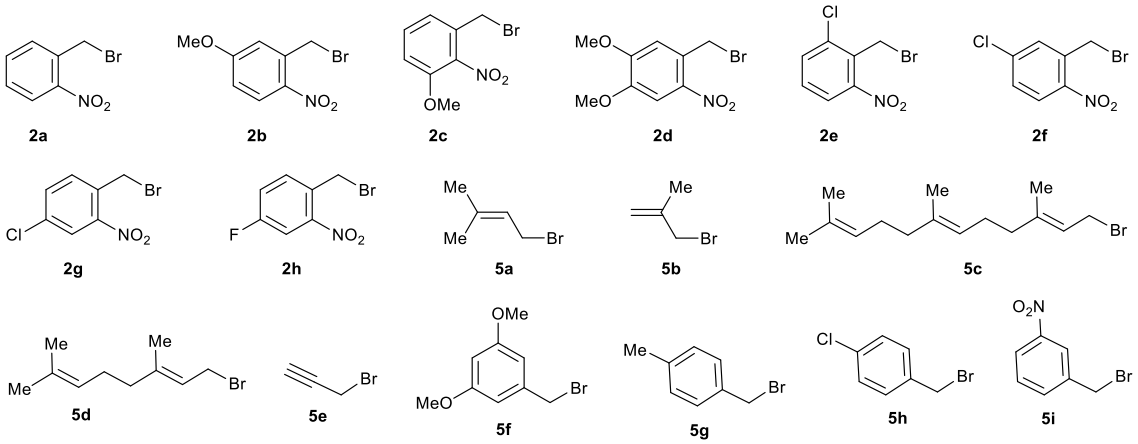


Figure S2. Structures of the benzylic, allylic, and propargyl bromides employed in this study.

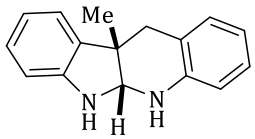
3.2. Synthesis of tetrahydro-5*H*-indolo[2,3-*b*]quinolines 6a–ac (Tables 2 and 3, Main Manuscript)

General procedure 1 (GP-1): To a solution of the corresponding 3-substituted indole **1** (0.4 mmol, 1.0 equiv) in anhydrous THF (3 mL) was added NaO*t*Bu (42 mg, 0.44 mmol, 1.1 equiv) under a nitrogen atmosphere at rt. The reaction mixture was stirred for 30 min, after which a solution of Et_3B (1.0 M in THF; 440 µL, 0.44 mmol, 1.1 equiv) was added dropwise. Stirring was continued for an additional 30 min. Subsequently, a

solution of the alkylating agent **2** or **5** (0.44 mmol, 1.1 equiv) in anhydrous THF (1 mL) was added, and the reaction mixture was stirred at rt for 12 h. The reaction was then quenched with saturated aqueous NH_4Cl (5 mL) and extracted with EtOAc (2 × 5 mL). The combined organic extracts were washed with brine (10 mL), dried over Na_2SO_4, filtered, and concentrated under reduced pressure. The crude residue was purified by column chromatography on silica gel (gradient elution from 10% to 80% EtOAc in hexanes) to afford the corresponding indolenine **3**, which was used directly in the next step without further characterization.

The obtained indolenine **3** was dissolved in DMF (2 mL), followed by the addition of $B_2(OH)_4$ (1.6 mmol, 4.0 equiv) and 4,4′-bipyridine (0.02 mmol, 5 mol %). The reaction mixture was stirred at rt for 20 min. Upon completion, as monitored by TLC, the mixture was diluted with water (10 mL) and extracted with EtOAc (2 × 10 mL). The combined organic layers were washed with brine (10 mL), dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. Purification by coulmn chromatography on silica gel (gradient elution from 10% to 50% EtOAc in hexanes) furnished the corresponding tetrahydro-5*H*-indolo[2,3-*b*]quinoline 6 derivative in pure form.

(±)-(5a*R*,10b*S*)-10b-Methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinolone (6a)

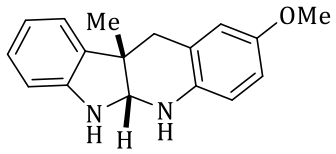


6a

Following the **GP-1**, compound **6a** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and 2-nitrobenzyl bromide **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Off-white semi-solid. Yield: 77% (73 mg) over two steps. Synthesis of **6a** was also repeated on a larger scale starting from **1a** (1.312 g, 10.0 mmol, 1.0 equiv), **2a** (2.4 g, 11.0 mmol, 1.1 equiv), providing this product in 80% (1.89 g) yield over two steps. In this large-scale experiment, the cyclization step was carried out with particular caution, using slow addition of the reagent solutions in DMF due to the highly exothermic nature of the reaction. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.10 (dd, *J* = 7.4, 1.3 Hz, 1H), 7.06–6.98 (m, 3H), 6.78 (td, *J* = 7.4, 1.0 Hz, 1H), 6.68 (td, *J* = 7.4, 1.1 Hz, 1H), 6.64–6.58 (m, 2H), 4.89 (s, 1H), 4.25 (br m, 2H, overlapping broad singlets

corresponding to two N–H protons), 2.88 (d, *J* = 14.9 Hz, 1H), 2.59 (d, *J* = 14.9 Hz, 1H), 1.30 (s, 3H). **^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$):** δ 147.4, 141.7, 136.8, 128.7, 127.5, 127.0, 122.2, 122.0, 119.3, 118.2, 113.6, 109.8, 77.7, 42.3, 37.4, 23.5. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{16}H_{17}N_2$ [M + H]$^+$: 237.1; found: 237.1 (100%). **Anal. Calcd** for $C_{16}H_{16}N_2$: C, 81.32; H, 6.82; N, 11.85. Found: C, 81.51; H, 6.87; N, 11.81.

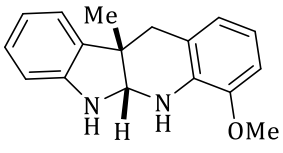
(±)-(5a*R*,10b*S*)-2-Methoxy-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6b)



6b

Following the **GP-1**, compound **6b** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2b** (109 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Off-white gum. Yield: 81% (86 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.10–7.08 (m, 1H), 7.03 (td, *J* = 7.6, 1.3 Hz, 1H), 6.77 (td, *J* = 7.4, 1.0 Hz, 1H), 6.65–6.58 (m, 3H), 6.53 (d, *J* = 8.4 Hz, 1H), 4.85 (s, 1H), 3.95 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 3.73 (s, 3H), 2.86 (d, *J* = 14.9 Hz, 1H), 2.60 (d, *J* = 14.9 Hz, 1H), 1.32 (s, 3H). **^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$):** δ 152.4, 147.7, 136.5, 135.7, 127.5, 124.3, 122.0, 119.1, 114.5, 114.4, 112.3, 109.5, 78.2, 55.6, 43.2, 37.9, 24.3. **HRMS (ESI)** *m*/*z* calcd for $C_{17}H_{19}N_2O$ [M + H]$^+$: 267.1492; found: 267.1484.

(±)-(5a*S*,10b*S*)-4-Methoxy-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6c)

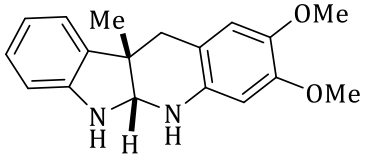


6c

Following the **GP-1**, compound **6c** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2c** (109 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Colorless gum. Yield: 76% (81 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.09–7.08 (m,

1H), 7.02 (td, *J* = 7.6, 1.3 Hz, 1H), 6.76 (tt, *J* = 7.4, 0.7 Hz, 1H), 6.68–6.59 (m, 4H), 4.89 (s, 1H), 3.84 (s, 3H), 2.84 (d, *J* = 15.1 Hz, 1H), 2.54 (d, *J* = 15.1 Hz, 1H), 1.24 (s, 3H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$):** δ 147.3, 145.6, 137.0, 130.9, 127.5, 121.9, 121.8, 121.1, 119.1, 116.8, 109.8, 107.9, 77.1, 55.5, 41.2, 36.9, 22.7. **HRMS (ESI)** *m*/*z* calcd for $C_{17}H_{19}N_2O$ $[M + H]^+$: 267.1492; found: 267.1488.

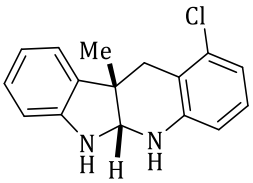
(±)-(5a*R*,10b*S*)-2,3-Dimethoxy-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6d)



6d

Following the **GP-1**, compound **6d** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2d** (122 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–30% EtOAc/hexanes). Colorless gum. Yield: 82% (97 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.09 (dd, *J* = 7.4, 1.3 Hz, 1H), 7.03 (td, *J* = 7.6, 1.3 Hz, 1H), 6.78 (td, *J* = 7.4, 1.0 Hz, 1H), 6.63 (dt, *J* = 7.7, 0.8 Hz, 1H), 6.54 (s, 1H), 6.22 (s, 1H), 4.85 (s, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 2.79 (d, *J* = 14.8 Hz, 1H), 2.50 (d, *J* = 14.9 Hz, 1H), 1.29 (s, 3H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.1, 147.4, 141.6, 137.0, 135.2, 127.5, 121.9, 119.2, 113.5, 113.1, 109.8, 99.1, 77.9, 56.5, 55.9, 42.4, 37.0, 23.6. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{18}H_{21}N_2O_2$ $[M + H]^+$: 297.2; found: 297.2 (100%). **Anal. Calcd** for $C_{18}H_{20}N_2O_2$: C, 72.95; H, 6.80; N, 9.45. Found: C, 72.78; H, 6.85; N, 9.55.

(±)-(5a*S*,10b*S*)-1-Chloro-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6e)

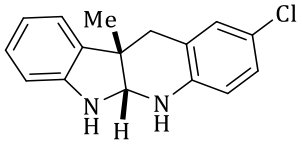


6e

Following the **GP-1**, compound **6e** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2e** (111

mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Off-white semi-solid. Yield: 75% (81 mg) over two steps. **^{1}H NMR (400 MHz, DMSO-*d*$_6$):** δ 7.03 (d, *J* = 7.3 Hz, 1H), 6.93–6.87 (m, 2H), 6.63–6.50 (m, 5H; four aromatic protons and one N–H), 5.93 (d, *J* = 2.4 Hz, 1H; for the other N–H proton), 4.68 (t, *J* = 3.0 Hz, 1H), 2.76–2.63 (m, 2H), 1.19 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, DMSO-*d*$_6$):** δ 148.4, 145.0, 135.7, 132.4, 127.3, 127.3, 121.5, 118.3, 117.6, 116.4, 112.0, 108.9, 76.1, 41.3, 33.4, 23.8. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{16}H_{16}ClN_2$ [M + H]$^+$: 271.1; found: 271.1 (100%). **Anal. Calcd** for $C_{16}H_{15}ClN_2$: C, 70.98; H, 5.58; N, 10.35. Found: C, 71.12; H, 5.65; N, 10.43.

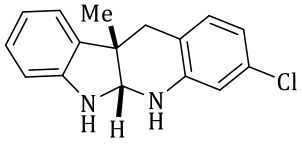
(±)-(5a*R*,10b*S*)-2-Chloro-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6f)



6f

Following the **GP-1**, compound **6f** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2f** (111 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Off-white semi-solid. Yield: 80% (87 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.08–7.00 (m, 2H), 6.97–6.93 (m, 2H), 6.77 (td, *J* = 7.4, 1.0 Hz, 1H), 6.60 (dt, *J* = 7.8, 0.8 Hz, 1H), 6.47 (d, *J* = 8.2 Hz, 1H), 4.83 (s, 1H), 2.82 (d, *J* = 15.1 Hz, 1H), 2.52 (d, *J* = 15.1 Hz, 1H), 1.26 (s, 3H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 147.2, 140.4, 136.2, 128.3, 127.7, 126.8, 123.9, 122.5, 122.0, 119.5, 114.6, 109.9, 77.5, 42.1, 37.1, 23.5. **HRMS (ESI)** *m*/*z* calcd for $C_{16}H_{16}ClN_2$ [M + H]$^+$: 271.0997; found: 271.1013.

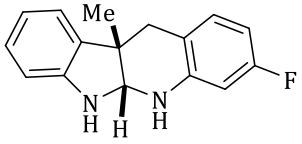
(±)-(5a*R*,10b*S*)-3-Chloro-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6g)



6g

Following the **GP-1**, compound **4g** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2g** (111 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Off-white semi-solid. Yield: 80% (88 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.07–7.00 (m, 2H), 6.86 (dd, *J* = 7.9, 0.9 Hz, 1H), 6.77 (tt, *J* = 7.5, 0.8 Hz, 1H), 6.63–6.60 (m, 2H), 6.54 (d, *J* = 2.1 Hz, 1H), 4.81 (s, 1H), 4.32 (br s, 1H), 3.47 (br s, 1H), 2.80 (d, *J* = 15.0 Hz, 1H), 2.53 (d, *J* = 15.0 Hz, 1H), 1.25 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 147.2, 142.8, 136.3, 132.1, 129.6, 127.7, 121.9, 120.6, 119.5, 118.0, 113.3, 110.0, 77.3, 42.2, 36.7, 23.4. **HRMS (ESI)** *m*/*z* calcd for $C_{16}H_{16}ClN_2$ [M + H]$^+$: 271.0997; found: 271.0993.

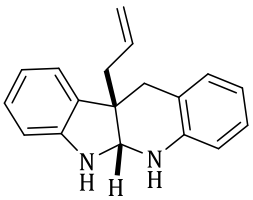
(±)-(5a*R*,10b*S*)-3-Fluoro-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6h)



6h

Following the **GP-1**, compound **6h** was prepared starting from **1a** (53 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2h** (84 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Off-white semi-solid. Yield: 78% (79 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.11–7.04 (m, 2H), 6.92–6.89 (m, 1H), 6.80 (tt, *J* = 7.4, 0.9 Hz, 1H), 6.65 (dt, *J* = 7.7, 0.8 Hz, 1H), 6.38 (td, *J* = 8.5, 2.5 Hz, 1H), 6.30 (dd, *J* = 10.4, 2.5 Hz, 1H), 4.85 (s, 1H), 4.51 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.82 (d, *J* = 14.9 Hz, 1H), 2.55 (d, *J* = 15.0 Hz, 1H), 1.28 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 162.2 (d, *J* = 241.1 Hz), 147.1, 142.8 (d, *J* = 10.7 Hz), 136.4, 129.5 (d, *J* = 9.7 Hz), 127.6, 121.9, 119.4, 117.5 (d, *J* = 2.6 Hz), 109.9, 104.43 (d, *J* = 21.3 Hz), 100.4 (d, *J* = 24.7 Hz), 77.2, 42.0, 36.5, 23. **^{19}F NMR (376 MHz, $CDCl_3$)** δ -116.3. **HRMS (ESI)** *m*/*z* calcd for $C_{16}H_{16}FN_2$ [M + H]$^+$: 255.1293; found: 255.1290.

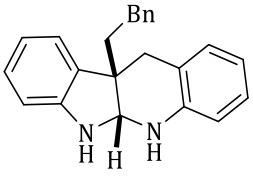
(±)-(5a*R*,10b*S*)-10b-Allyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6i)



6i

Following the **GP-1**, compound **6i** was prepared starting from **1b** (63 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Colorless gum. Yield: 78% (82 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.08 (dd, *J* = 7.4, 1.3 Hz, 1H), 7.03–6.97 (m, 2H), 6.95 (dd, *J* = 7.4, 1.4 Hz, 1H), 6.75 (td, *J* = 7.4, 1.0 Hz, 1H), 6.68 (td, *J* = 7.4, 1.2 Hz, 1H), 6.61–6.55 (m, 2H), 5.74 (dddd, *J* = 16.6, 10.3, 8.5, 6.1 Hz, 1H), 5.11–5.06 (m, 2H), 5.03 (s, 1H), 3.56 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.91 (d, *J* = 14.9 Hz, 1H), 2.77 (d, *J* = 14.9 Hz, 1H), 2.54 (ddt, *J* = 14.1, 6.1, 1.5 Hz, 1H), 2.39 (ddt, *J* = 14.1, 8.6, 1.0 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.3, 142.4, 134.2, 134.1, 128.4, 127.6, 126.9, 123.3, 122.8, 119.2, 118.8, 118.2, 114.1, 109.7, 74.8, 48.1, 42.4, 36.5. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{18}H_{19}N_2$ $[M + H]^+$: 263.2; found: 263.2 (100%). **Anal. Calcd** for $C_{18}H_{18}N_2$: C, 82.41; H, 6.92; N, 10.68. Found: C, 82.25; H, 6.85; N, 10.72.

(±)-(5a*R*,10b*S*)-10b-Phenethyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6j)

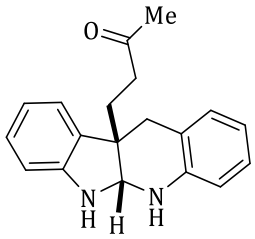


6j

Following the **GP-1**, compound **6j** was prepared starting from **1c** (89 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–15% EtOAc/hexanes). Colorless gum. Yield: 81% (106 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.28–7.23 (m, 2H), 7.19–7.14 (m, 1H), 7.13–7.09 (m, 3H), 7.03–6.98 (m, 2H), 6.94 (dd, *J* = 7.4, 1.4 Hz, 1H), 6.77 (td, *J* = 7.4, 1.0 Hz, 1H), 6.68 (td, *J* = 7.4, 1.1 Hz, 1H), 6.61–6.57 (m, 2H), 5.11 (s, 1H), 3.52 (br m, 2H, overlapping broad singlets corresponding to two N–H protons),

2.96 (d, *J* = 14.7 Hz, 1H), 2.77 (d, *J* = 14.7 Hz, 1H), 2.70–2.51 (m, 2H), 2.07–1.97 (m, 2H). **$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$):** δ 148.5, 142.3, 142.2, 134.0, 128.3, 128.3, 128.2, 127.6, 126.9, 125.8, 123.7, 122.6, 119.3, 118.9, 114.2, 109.6, 75.1, 48.9, 40.2, 37.2, 30.7. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{23}H_{23}N_2$ $[M + H]^+$: 327.2; found: 327.2 (100%). **Anal. Calcd** for $C_{23}H_{22}N_2$: C, 84.63; H, 6.79; N, 8.58. Found: C, 84.76; H, 6.82; N, 8.52.

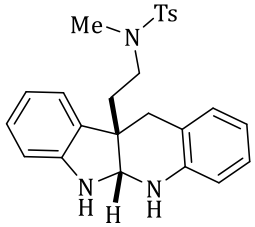
(±)-4-((5a*R*,10b*S*)-5,5a,6,11-Tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)butan-2-one (6k)



6k

Following the **GP-1**, compound **6k** was prepared starting from **1d** (75 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–15% EtOAc/hexanes). Colorless gum. Yield: 74% (87 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.05–6.89 (m, 4H), 6.73–6.64 (m, 2H), 6.58–6.52 (m, 2H), 4.93 (s, 1H), 4.14 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.95–2.89 (m, 1H), 2.74 (d, *J* = 14.6 Hz, 1H), 2.49 (ddd, *J* = 16.9, 10.1, 6.0 Hz, 1H), 2.35 (ddd, *J* = 17.2, 10.0, 5.4 Hz, 1H), 2.07–2.00 (m, 5H). **$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$):** δ 208.5, 148.7, 142.4, 133.1, 128.3, 127.7, 126.9, 123.6, 122.5, 119.1, 118.9, 114.1, 109.2, 75.2, 48.4, 38.6, 37.1, 32.0, 30.0. **HRMS (ESI)** *m*/*z* calcd for $C_{19}H_{21}N_2O$ $[M + H]^+$: 293.1649; found: 293.1659.

(±)-(*N*,4-Dimethyl-*N*-(2-((5aR,10bR)-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)ethyl)benzenesulfonamide (6l)

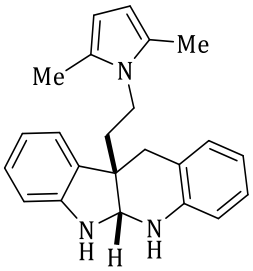


6l

Following the **GP-1**, compound **6l** was prepared starting from **1e** (131 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and

4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–15% EtOAc/hexanes). Colorless gum. Yield: 75% (130 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.56–7.53 (m, 2H), 7.26–7.24 (m, 2H), 7.03–6.97 (m, 3H), 6.93 (dd, *J* = 7.4, 1.4 Hz, 1H), 6.73 (td, *J* = 7.4, 1.0 Hz, 1H), 6.67 (td, *J* = 7.4, 1.1 Hz, 1H), 6.56–6.52 (m, 2H), 5.04 (s, 1H), 3.18 (ddd, *J* = 13.5, 9.8, 6.5 Hz, 1H), 2.94–2.85 (m, 2H), 2.69–2.62 (m, 4H), 2.41 (s, 3H), 2.02–1.90 (m, 2H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.3, 143.2, 142.2, 134.2, 133.2, 129.6, 128.3, 127.7, 127.2, 127.0, 122.6, 122.2, 119.0, 118.5, 114.0, 109.6, 74.6, 46.5, 46.3, 36.9, 35.3, 34.8, 21.4. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{25}H_{28}N_3O_2S$ [M + H]$^+$: 434.2; found: 434.2 (100%). **Anal. Calcd** for $C_{25}H_{27}N_3O_2S$: C, 69.26; H, 6.28; N, 9.69. Found: C, 69.43; H, 6.32; N, 9.64.

(±)-(5a*R*,10b*R*)-10b-(2-(2,5-dimethyl-1*H*-pyrrol-1-yl)ethyl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6m)

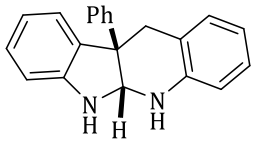


6m

Following the **GP-1**, compound **6m** was prepared starting from **1f** (96 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Light-brown semi-solid. Yield: 77% (106 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.12 (dd, *J* = 7.4, 1.3 Hz, 1H), 7.06–7.00 (m, 2H), 6.95 (dd, *J* = 7.4, 1.4 Hz, 1H), 6.79 (td, *J* = 7.4, 1.0 Hz, 1H), 6.69 (td, *J* = 7.4, 1.2 Hz, 1H), 6.61–6.58 (m, 2H), 5.74 (s, 2H), 5.06 (s, 1H), 4.29 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 3.84 (ddd, *J* = 14.3, 10.9, 6.6 Hz, 1H), 3.66 (ddd, *J* = 14.3, 10.7, 6.3 Hz, 1H), 2.97 (d, *J* = 14.8 Hz, 1H), 2.76 (d, *J* = 14.8 Hz, 1H), 2.11 (s, 6H), 2.06–1.95 (m, 2H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.3, 142.1, 133.0, 128.4, 128.0, 127.1, 127.0, 122.9, 122.3, 119.3, 119.0, 114.0, 109.6, 105.1, 75.2, 47.2, 39.2, 38.9, 36.8, 12.2. **LRMS (ESI$^+$)** *m*/*z* calcd for

$C_{23}H_{26}N_3$ [M + H]$^+$: 344.2; found: 344.2 (100%). **Anal. Calcd** for $C_{23}H_{25}N_3$: C, 80.43; H, 7.34; N, 12.23. Found: C, 80.31; H, 7.37; N, 12.12.

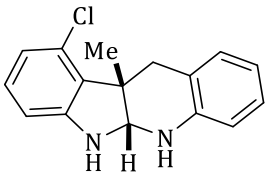
(±)-(5a*R*,10b*R*)-10b-phenyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6n)



6n

Following the **GP-1**, compound **6n** was prepared starting from **1g** (86 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–15% EtOAc/hexanes). White semi-solid. Yield: 52% (62 mg) over two steps. **^{1}H NMR (400 MHz, DMSO-d_6):** δ 7.36–7.33 (m, 2H), 7.29–7.25 (m, 2H), 7.20–7.16 (m, 1H), 6.96 (dd, *J* = 7.3, 1.5 Hz, 1H), 6.94–6.85 (m, 2H), 6.77 (dd, *J* = 7.3, 1.3 Hz, 1H), 6.58–6.47 (m, 4H), 6.24 (d, *J* = 3.6 Hz, 1H), 6.00 (d, *J* = 2.3 Hz, 1H), 5.19 (dd, *J* = 3.6, 2.3 Hz, 1H), 3.21 (d, *J* = 15.2 Hz, 1H), 3.03 (d, *J* = 15.2 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6):** δ 148.9, 145.1, 143.5, 135.4, 128.2, 127.8, 127.4, 127.2, 126.5, 126.3, 123.3, 121.9, 117.6, 116.6, 113.2, 109.1, 77.9, 50.0, 35.3. **HRMS (ESI)** *m*/*z* calcd for $C_{21}H_{19}N_2$ [M + H]$^+$: 299.1543; found: 299.1561.

(±)-(5a*R*,10b*S*)-10-Chloro-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6o)

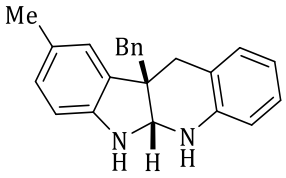


6o

Following the **GP-1**, compound **6o** was prepared starting from **1h** (66 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). White semi-solid. Yield: 73% (79 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.07–7.03 (m, 2H), 6.92 (t, *J* = 7.9 Hz, 1H), 6.73 (td, *J* = 7.4, 1.2 Hz, 1H), 6.66 (dd, *J* = 8.0, 0.9 Hz, 1H), 6.61–6.59 (m, 1H), 6.43 (dd, *J* = 7.8, 0.9 Hz, 1H), 4.83 (s, 1H), 4.13 (br m, 2H, overlapping

broad singlets corresponding to two N–H protons), 3.17 (d, *J* = 14.8 Hz, 1H), 2.83 (d, *J* = 14.8 Hz, 1H), 1.50 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 149.6, 142.0, 131.3, 130.3, 128.8, 128.5, 127.0, 123.2, 120.3, 118.8, 113.9, 107.7, 77.7, 46.0, 34.8, 23.4. **Anal. Calcd** for $C_{16}H_{15}ClN_2$: C, 70.98; H, 5.58; N, 10.35. Found: C, 70.81; H, 5.52; N, 10.43.

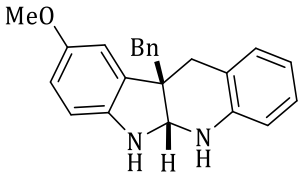
(±)-(5a*R*,10b*S*)-10b-Benzyl-9-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6p)



6p

Following the **GP-1**, compound **6p** was prepared starting from **1i** (89 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Colorless gum. Yield: 78% (102 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.19–7.14 (m, 3H), 6.97–6.93 (m, 4H), 6.78–6.75 (m, 2H), 6.64 (t, *J* = 7.4 Hz, 1H), 6.49 (d, *J* = 7.7 Hz, 1H), 6.38 (d, *J* = 7.7 Hz, 1H), 4.78 (s, 1H), 3.62 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 3.09 (d, *J* = 13.6 Hz, 1H), 2.90–2.75 (m, 3H), 2.23 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 146.0, 142.6, 137.5, 134.3, 130.6, 128.6, 128.4, 128.0, 127.8, 126.9, 126.3, 123.8, 122.5, 118.2, 113.7, 110.1, 74.3, 48.6, 43.2, 36.4, 21.0. **Anal. Calcd** for $C_{23}H_{22}N_2$: C, 84.63; H, 6.79; N, 8.58. Found: C, 84.75; H, 6.85; N, 8.52.

(±)-(5a*R*,10b*S*)-10b-Benzyl-9-methoxy-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6q)

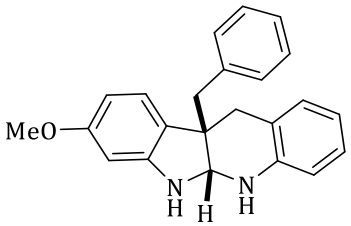


6q

Following the **GP-1**, compound **6q** was prepared starting from **1j** (95 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Colorless

gum. Yield: 80% (110 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.25–7.21 (m, 3H), 7.05–6.99 (m, 4H), 6.69 (td, *J* = 7.4, 1.2 Hz, 1H), 6.61–6.55 (m, 3H), 6.47 (d, *J* = 8.4 Hz, 1H), 4.86 (s, 1H), 3.74 (s, 3H), 3.14 (d, *J* = 13.6 Hz, 1H), 2.91–2.82 (m, 3H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 153.7, 142.6, 142.2, 137.3, 135.8, 130.6, 128.6, 127.8, 126.9, 126.4, 122.3, 118.3, 113.7, 112.5, 111.1, 110.0, 74.7, 55.8, 49.1, 43.3, 36.2. **Anal. Calcd** for $C_{23}H_{22}N_2O$: C, 80.67; H, 6.48; N, 8.18. Found: C, 80.79; H, 6.52; N, 8.12.

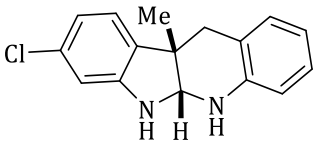
(±)-(5a*R*,10b*S*)-10b-Benzyl-8-methoxy-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6r)



6r

Following the **GP-1**, compound **6r** was prepared starting from **1k** (95 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Colorless gum. Yield: 79% (112 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.24–7.20 (m, 3H), 7.03–6.95 (m, 4H), 6.81 (d, *J* = 8.2 Hz, 1H), 6.68 (td, *J* = 7.4, 1.1 Hz, 1H), 6.57 (dd, *J* = 7.8, 1.1 Hz, 1H), 6.26 (dd, *J* = 8.2, 2.3 Hz, 1H), 6.08 (d, *J* = 2.3 Hz, 1H), 4.91 (s, 1H), 4.09 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 3.71 (s, 3H), 3.12 (d, *J* = 13.5 Hz, 1H), 2.94–2.83 (m, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 159.8, 149.9, 142.7, 137.5, 130.7, 128.5, 127.8, 126.9, 126.3, 126.0, 123.7, 123.3, 118.6, 113.9, 103.9, 96.4, 74.9, 55.1, 48.9, 44.1, 36.6. **HRMS (ESI)** *m*/*z* calcd for $C_{23}H_{23}N_2O$ $[M + H]^+$: 343.1805; found: 343.1804.

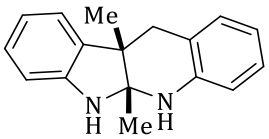
(±)-(5a*R*,10b*S*)-8-Chloro-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6s)



6s

Following the **GP-1**, compound **6s** was prepared starting from **1l** (66 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Off-white semi-solid. Yield: 66% (72 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.07–7.03 (m, 1H), 6.99–6.95 (m, 2H), 6.73–6.68 (m, 2H), 6.60–6.55 (m, 2H), 4.87 (s, 1H), 3.92 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.84 (d, *J* = 14.7 Hz, 1H), 2.59 (d, *J* = 14.9 Hz, 1H), 1.29 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.7, 141.6, 135.0, 132.9, 128.6, 127.1, 122.8, 122.3, 118.8, 118.5, 113.8, 109.6, 77.9, 42.5, 37.3, 23.9. **Anal. Calcd** for $C_{16}H_{15}ClN_2$: C, 70.98; H, 5.58; N, 10.35. Found: C, 71.16; H, 5.67; N, 10.27.

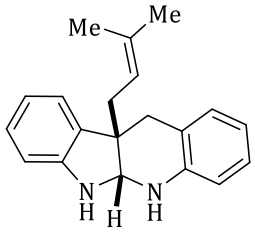
(±)-(5a*R*,10b*S*)-5a,10b-Dimethyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6t)



6t

Following the **GP-1**, compound **6t** was prepared starting from **1m** (58 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **2a** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Off-white semi-solid. Yield: 40% (39 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.05 (dd, *J* = 7.3, 1.3 Hz, 1H), 7.01–6.95 (m, 3H), 6.75 (td, *J* = 7.4, 1.0 Hz, 1H), 6.65–6.58 (m, 2H), 6.49 (dd, *J* = 7.8, 1.1 Hz, 1H), 4.00 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.98 (d, *J* = 15.1 Hz, 1H), 2.61 (d, *J* = 15.1 Hz, 1H), 1.51 (s, 3H), 1.26 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 147.1, 142.7, 136.7, 128.3, 127.3, 126.8, 122.1, 121.8, 119.1, 117.6, 112.7, 109.7, 80.7, 44.8, 38.9, 25.4, 20.4. **HRMS (ESI)** *m/z* calcd for $C_{17}H_{19}N_2$ $[M + H]^+$: 251.1543; found: 251.1539.

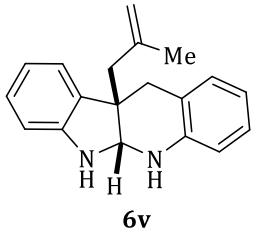
(±)-(5a*R*,10b*S*)-10b-(3-Methylbut-2-en-1-yl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6u)



6u

Following the **GP-1**, compound **6u** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5a** (66 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Colorless gum. Yield: 81% (94 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.06 (dd, *J* = 7.5, 1.3 Hz, 1H), 7.02–6.97 (m, 2H), 6.95 (dd, *J* = 7.4, 1.4 Hz, 1H), 6.74 (td, *J* = 7.4, 1.0 Hz, 1H), 6.67 (td, *J* = 7.4, 1.2 Hz, 1H), 6.59–6.56 (m, 2H), 5.20–5.15 (m, 1H), 4.98 (s, 1H), 3.61 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.90 (d, *J* = 14.9 Hz, 1H), 2.77 (d, *J* = 14.9 Hz, 1H), 2.44–2.33 (m, 2H), 1.69 (s, 3H), 1.54 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.3, 142.5, 134.8, 134.5, 128.5, 127.4, 126.8, 123.3, 122.7, 119.6, 119.2, 118.6, 113.9, 109.6, 75.0, 48.5, 36.2, 36.0, 26.0, 18.0. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{20}H_{23}N_2$ $[M + H]^+$: 291.2; found: 291.2 (100%). **Anal. Calcd** for $C_{20}H_{22}N_2$: C, 82.72; H, 7.64; N, 9.65. Found: C, 82.89; H, 7.74; N, 9.61.

(±)-(5a*R*,10b*S*)-10b-(2-Methylallyl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6v)

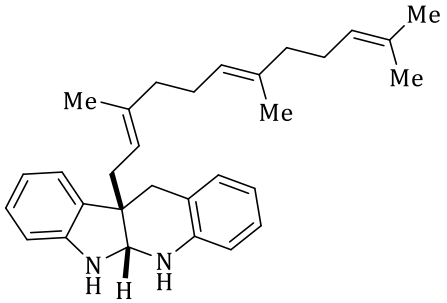


6v

Following the **GP-1**, compound **6v** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5b** (60 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Colorless gum. Yield: 77% (85 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.09–7.06 (m, 1H), 7.01–6.91 (m, 3H), 6.71 (td, *J* = 7.4, 1.0 Hz, 1H), 6.65 (td, *J* = 7.4, 1.2 Hz, 1H), 6.58 (dd, *J* = 7.8, 1.1 Hz, 1H), 6.53 (dt, *J* = 7.8, 0.8 Hz, 1H), 5.11 (s, 1H), 4.82 (dq, *J* = 2.9, 1.5 Hz, 1H), 4.67 (dq, *J* = 2.1, 0.9 Hz, 1H), 3.33 (br m, 2H, overlapping broad singlets

corresponding to two N–H protons), 2.87 (d, *J* = 14.8 Hz, 1H), 2.72 (d, *J* = 14.8 Hz, 1H), 2.55 (dd, *J* = 13.9, 1.2 Hz, 1H), 2.36 (dd, *J* = 13.9, 0.7 Hz, 1H), 1.49 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.3, 142.7, 142.5, 134.6, 128.5, 127.5, 126.9, 123.4, 122.9, 119.1, 118.7, 115.1, 114.1, 109.7, 74.1, 48.0, 45.5, 37.8, 24.5. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{19}H_{21}N_2$ [M + H]$^+$: 277.2; found: 277.2 (100%). **Anal. Calcd** for $C_{19}H_{20}N_2$: C, 82.57; H, 7.29; N, 10.14. Found: C, 82.69; H, 7.21; N, 10.18.

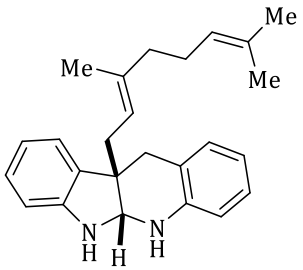
(±)-(5a*R*,10b*S*)-10b-((2*E*,6*E*)-3,7,11-Trimethyldodeca-2,6,10-trien-1-yl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6w)



6w

Following the **GP-1**, compound **6w** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5c** (126 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step.The crude product was purified by silica gel column chromatography (10–15% EtOAc/hexanes). Colorless gum. Yield: 68% (116 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.06–7.04 (m, 1H), 7.00–6.93 (m, 3H), 6.72 (td, *J* = 7.4, 1.0 Hz, 1H), 6.66 (td, *J* = 7.3, 1.1 Hz, 1H), 6.58–6.54 (m, 2H), 5.13–5.06 (m, 3H), 4.97 (s, 1H), 2.90 (d, *J* = 14.8 Hz, 1H), 2.78 (d, *J* = 14.9 Hz, 1H), 2.41–2.38 (m, 2H), 2.07–2.03 (m, 4H), 2.01–1.97 (m, 4H), 1.70 (s, 6H), 1.59 (s, 3H), 1.54 (s, 3H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.4, 142.6, 138.1, 135.0, 134.7, 131.3, 128.4, 127.4, 126.8, 124.3, 124.0, 123.5, 122.8, 119.5, 119.1, 118.6, 113.9, 109.6, 75.2, 48.8, 39.9, 39.7, 36.2, 36.1, 26.7, 26.5, 25.7, 17.7, 16.3, 16.0. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{30}H_{39}N_2$ [M + H]$^+$: 427.3; found: 427.3 (100%). **Anal. Calcd** for $C_{30}H_{38}N_2$: C, 84.46; H, 8.98; N, 6.57. Found: C, 84.62; H, 8.92; N, 6.53.

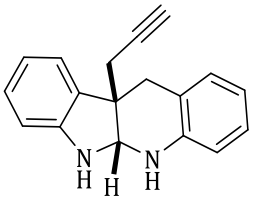
(±)-(5a*R*,10b*S*)-10b-((*E*)-3,7-Dimethylocta-2,6-dien-1-yl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6x)



6x

Following the **GP-1**, compound **6x** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5d** (96 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–15% EtOAc/hexanes). Colorless gum. Yield: 70% (100 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.04 (dd, *J* = 7.4, 1.3 Hz, 1H), 7.00–6.91 (m, 3H), 6.70 (td, *J* = 7.4, 1.1 Hz, 1H), 6.64 (td, *J* = 7.4, 1.2 Hz, 1H), 6.56–6.53 (m, 2H), 5.20–5.16 (m, 1H), 5.07–5.02 (m, 1H), 4.95 (s, 1H), 3.63 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.88 (d, *J* = 14.8 Hz, 1H), 2.77 (d, *J* = 14.9 Hz, 1H), 2.43–2.37 (m, 2H), 2.02–1.98 (m, 4H), 1.67 (s, 3H), 1.58 (s, 3H), 1.52 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.5, 142.6, 138.0, 134.7, 131.4, 128.4, 127.4, 126.8, 124.3, 123.5, 122.8, 119.6, 119.1, 118.6, 113.9, 109.6, 75.2, 48.9, 39.9, 36.3, 36.1, 26.5, 25.7, 17.7, 16.3. **LRMS (ESI$^+$)** *m/z* calcd for $C_{25}H_{31}N_2$ $[M + H]^+$: 359.2; found: 359.2 (100%). **Anal. Calcd** for $C_{25}H_{30}N_2$: C, 83.75; H, 8.43; N, 7.81. Found: C, 83.57; H, 8.49; N, 7.90.

(±)-(5a*R*,10b*S*)-10b-(Prop-2-yn-1-yl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6y)

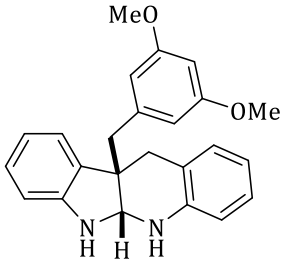


6y

Following the **GP-1**, compound **6y** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5e** (53 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Colorless gum. Yield: 75% (78 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.25 (dd, *J* = 7.7, 1.0 Hz, 1H), 7.06–6.97 (m, 3H), 6.77 (td, *J* = 7.4, 1.0 Hz, 1H), 6.69 (td, *J* = 7.4, 1.2 Hz, 1H),

6.61–6.57 (m, 2H), 5.12 (s, 1H), 3.81 (br m, 2H, overlapping broad singlets corresponding to two N–H protons), 2.95 (s, 2H), 2.61–2.47 (m, 2H), 2.05 (t, *J* = 2.6 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.0, 142.1, 133.5, 128.6, 128.0, 127.1, 122.7, 122.2, 119.3, 118.7, 114.0, 109.8, 80.8, 75.1, 71.2, 46.9, 35.1, 27.4. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{18}H_{17}N_2$ [M + H]$^+$: 261.1; found: 261.1 (100%). **Anal. Calcd** for $C_{18}H_{16}N_2$: C, 83.04; H, 6.19; N, 10.76. Found: C, 83.16; H, 6.26; N, 10.71.

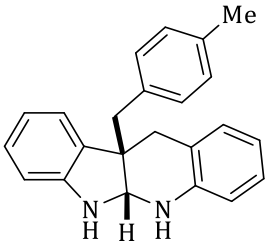
(±)-(5a*R*,10b*S*)-10b-(3,5-Dimethoxybenzyl)-5a,6,10b,11-tetrahydro-5*H*-indolo [2,3-*b*]quinoline (6z)



6z

Following the **GP-1**, compound **6z** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5f** (102 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–30% EtOAc/hexanes). Colorless gum. Yield: 82% (122 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.03 (dd, *J* = 7.4, 1.3 Hz, 1H), 6.99–6.92 (m, 3H), 6.72 (td, *J* = 7.4, 1.0 Hz, 1H), 6.65 (td, *J* = 7.4, 1.1 Hz, 1H), 6.54 (dd, *J* = 7.8, 1.1 Hz, 1H), 6.46 (dt, *J* = 7.8, 0.7 Hz, 1H), 6.28 (t, *J* = 2.3 Hz, 1H), 6.10 (d, *J* = 2.3 Hz, 2H), 4.90 (s, 1H), 3.62 (s, 6H), 3.09 (d, *J* = 13.5 Hz, 1H), 2.95 (d, *J* = 14.8 Hz, 1H), 2.84 (d, *J* = 14.8 Hz, 1H), 2.77 (d, *J* = 13.5 Hz, 1H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 160.1, 148.9, 142.8, 139.7, 133.9, 128.5, 127.6, 126.9, 123.2, 123.2, 119.0, 118.6, 114.0, 109.9, 108.5, 98.6, 74.3, 55.1, 49.6, 44.3, 36.8. **HRMS (ESI)** *m*/*z* calcd for $C_{24}H_{24}N_2O_2$ [M + H]$^+$: 373.1911; found: 373.1876.

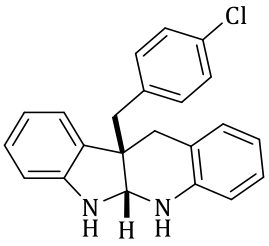
(±)-(5a*R*,10b*S*)-10b-(4-Methylbenzyl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6aa)



6aa

Following the **GP-1**, compound **6aa** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5g** (82 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–20% EtOAc/hexanes). Colorless gum. Yield: 81% (106 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.02–6.94 (m, 6H), 6.90–6.88 (m, 2H), 6.72 (td, *J* = 7.4, 1.1 Hz, 1H), 6.66 (td, *J* = 7.4, 1.1 Hz, 1H), 6.58–6.56 (m, 1H), 6.50 (dt, *J* = 7.4, 0.9 Hz, 1H), 4.93 (s, 1H), 3.11 (d, *J* = 13.6 Hz, 1H), 2.94 (d, *J* = 14.8 Hz, 1H), 2.86–2.80 (m, 2H), 2.29 (s, 3H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.6, 142.7, 135.8, 134.2, 133.9, 130.5, 128.6, 128.6, 127.5, 126.9, 123.3, 123.1, 119.0, 118.5, 113.9, 109.9, 74.3, 49.3, 43.3, 36.5, 21.0. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{23}H_{23}N_2$ $[M + H]^+$: 327.2; found: 327.2 (100%). **Anal. Calcd** for $C_{23}H_{22}N_2$: C, 84.63; H, 6.79; N, 8.58. Found: C, 84.78; H, 6.84; N, 8.52.

(±)-(5a*R*,10b*S*)-10b-(4-Chlorobenzyl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (6ab)

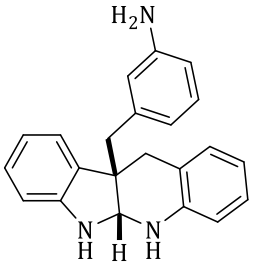


6ab

Following the **GP-1**, compound **6ab** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5h** (91 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (10–25% EtOAc/hexanes). Colorless gum. Yield: 79% (110 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.16–7.13 (m, 2H), 7.00–6.87 (m, 6H), 6.71 (td, *J* = 7.4, 1.0 Hz, 1H), 6.65 (td, *J* = 7.4, 1.1 Hz, 1H), 6.55

(dd, *J* = 7.8, 1.1 Hz, 1H), 6.48 (dt, *J* = 7.7, 0.8 Hz, 1H), 4.87 (s, 1H), 3.10 (d, *J* = 13.6 Hz, 1H), 2.93 (d, *J* = 14.8 Hz, 1H), 2.85–2.80 (m, 2H). The signals corresponding to the two N–H protons did not appear due to extensive broadening. **$^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$):** δ 148.6, 142.6, 135.8, 133.3, 132.3, 131.9, 128.5, 128.0, 127.8, 127.0, 123.2, 122.9, 119.1, 118.7, 114.0, 109.9, 74.4, 49.4, 43.2, 36.5. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{22}H_{20}ClN_2$ $[M + H]^+$: 347.1; found: 347.1 (100%). **Anal. Calcd** for $C_{22}H_{19}ClN_2$: C, 76.18; H, 5.52; N, 8.08. Found: C, 76.01; H, 5.60; N, 8.01.

(±)-3-(((5a*R*,10b*S*)-5,5a,6,11-Tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6ac)



6ac

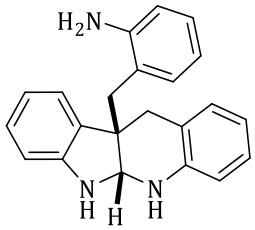
Following the **GP-1**, compound **6ac** was prepared starting from **4** (101 mg, 0.4 mmol) *t*-BuONa (43 mg, 0.44 mmol, 1.1 equiv), Et_3B (440 μL, 0.44 mmol, 1.1 equiv) and **5i** (95 mg, 0.44 mmol, 1.1 equiv) in the first step; $B_2(OH)_4$ (144 mg, 1.6 mmol, 4.0 equiv) and 4,4'-bipyridine (3.2 mg, 0.02 mmol, 5.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Colorless gum. Yield: 75% (98 mg) over two steps. **^1H NMR (400 MHz, $CDCl_3$):** δ 7.01–6.93 (m, 5H), 6.72 (td, *J* = 7.4, 1.0 Hz, 1H), 6.64 (td, *J* = 7.4, 1.2 Hz, 1H), 6.52–6.46 (m, 3H), 6.40 (dt, *J* = 7.6, 1.3 Hz, 1H), 6.25 (t, *J* = 2.0 Hz, 1H), 4.85 (s, 1H), 3.44 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 3.04 (d, *J* = 13.6 Hz, 1H), 2.90 (d, *J* = 14.9 Hz, 1H), 2.80 (d, *J* = 14.9 Hz, 1H), 2.70 (d, *J* = 13.6 Hz, 1H). **$^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$):** δ 148.6, 145.8, 142.6, 138.7, 134.2, 128.7, 128.6, 127.5, 126.9, 123.2, 122.9, 121.1, 119.0, 118.4, 117.5, 113.8, 113.2, 109.9, 74.1, 48.8, 43.4, 36.7. **HRMS (ESI)** *m*/*z* calcd for $C_{22}H_{22}N_3$ $[M + H]^+$: 328.1809; found: 328.1807.

3.3. Synthesis of tetrahydro-5*H*-indolo[2,3-*b*]quinolines 6ad–6ao (Scheme 2, main manuscript)

General procedure 2 (GP-2) for the synthesis of tetrahydro-5*H*-indolo[2,3-*b*] quinolines 6ad–6ao: To a solution of the corresponding 3-unsubstituted indole **7** (0.4 mmol, 1.0 equiv) in anhydrous THF (4 mL) was added NaO*t*Bu (84 mg, 0.88 mmol, 2.2 equiv) under a nitrogen atmosphere at rt. The mixture was stirred for 30 min, followed

by the dropwise addition of Et_3B (1.0 M in THF; 0.88 mL, 0.88 mmol, 2.2 equiv). Stirring was continued for an additional 30 min, after which a solution of 2-nitrobenzyl bromide **2** (0.88 mmol, 2.2 equiv) in anhydrous THF (1 mL) was added. The reaction mixture was stirred at room temperature for 12 h. The reaction was quenched by the addition of saturated aqueous NH_4Cl (5.0 mL) and diluted with EtOAc (5 mL). The aqueous layer was separated and extracted with EtOAc (5 mL). The combined organic extracts were washed with brine (10 mL), dried over Na_2SO_4, filtered, and concentrated under reduced pressure. The crude product was purified by coulmn chromatography on silica gel using a gradient of 20–90% EtOAc in hexanes to afford the corresponding indolenine intermediate in pure form, which was used immediately in the next step without further characterization. The freshly prepared indolenine intermediate **3** was dissolved in DMF (4 mL), and $B_2(OH)_4$ (3.2 mmol, 8.0 equiv) and 4,4′-bipyridine (0.04 mmol, 10 mol%) were added. The reaction mixture was stirred at rt for 20 min. Upon completion (monitored by TLC; ~ 20 min), the mixture was diluted with water (10 mL) and extracted with EtOAc (2 × 10 mL). The combined organic layers were washed with brine (10 mL), dried over Na_2SO_4, filtered, and concentrated under reduced pressure. The crude residue was purified by column chromatography on silica gel using a gradient of 20–60% EtOAc in hexanes to afford the amino-substituted tetrahydro-5*H*-indolo[2,3-*b*]quinoline derivative **6** in pure form.

(±)-2-(((5a*R*,10b*S*)-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6ad)

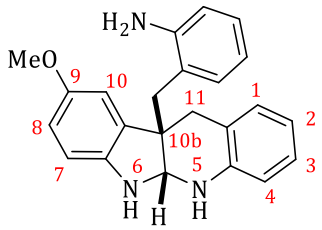


6ad

Following the **GP-2**, compound **6ad** was prepared starting from **7a** (47 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 70% (92 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.06–6.92 (m, 6H), 6.72–6.65 (m, 3H), 6.59 (dd, *J* = 7.9, 1.3 Hz, 1H), 6.55–6.51 (m, 2H), 4.91 (s, 1H), 3.54–2.82 (m, 8H; overlapping of signals for NH_2, two N–H and four benzylic

protons). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.3, 145.7, 142.7, 133.5, 132.5, 128.7, 127.8, 127.6, 127.0, 123.1, 122.5, 122.3, 119.2, 118.5, 118.4, 116.2, 113.6, 110.0, 74.7, 49.1, 38.3, 36.0. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{22}H_{22}N_3$ [M + H]$^+$: 328.2; found: 328.2 (100%). **Anal. Calcd** for $C_{22}H_{21}N_3$: C, 80.70; H, 6.46; N, 12.83. Found: C, 80.90; H, 6.49; N, 12.88.

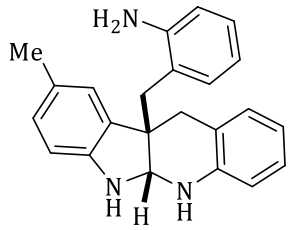
(±)-2-(((5a*R*,10b*S*)-8-Methoxy-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6ae)



6ae

Following the **GP-2**, compound **6ae** was prepared starting from **7b** (59 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–50% EtOAc/hexanes). Light brown gum. Yield: 75% (107 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.06–6.97 (m, 4H), 6.72–6.64 (m, 2H), 6.61–6.49 (m, 5H), 4.89 (s, 1H), 3.68 (s, 3H), 3.35–2.79 (m, 8H; overlapping of signals for NH_2, two N–H and four benzylic protons). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 153.8, 145.7, 142.7, 141.9, 135.4, 132.5, 128.8, 127.6, 127.1, 122.2, 122.1, 118.5, 118.3, 116.1, 113.5, 113.0, 111.2, 109.7, 75.1, 55.8, 49.4, 38.2, 35.8. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{23}H_{24}N_3O$ [M + H]$^+$: 358.2; found: 358.2 (100%). **Anal. Calcd** for $C_{23}H_{23}N_3O$: C, 77.28; H, 6.49; N, 11.76. Found: C, 77.11; H, 6.45; N, 11.84.

(±)-2-(((5a*R*,10b*S*)-9-Methyl-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6af)

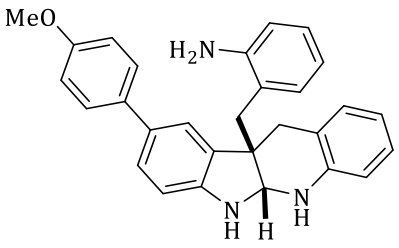


6af

Following the **GP-2**, compound **6af** was prepared starting from **7c** (53 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and

4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 72% (98 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.05–6.96 (m, 4H), 6.82–6.75 (m, 2H), 6.71–6.64 (m, 2H), 6.59 (dd, *J* = 7.9, 1.2 Hz, 1H), 6.53 (dd, *J* = 8.2, 1.1 Hz, 1H), 6.48 (d, *J* = 7.7 Hz, 1H), 4.91 (s, 1H), 3.59 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 3.02–2.96 (m, 2H), 2.94–2.89 (m, 1H), 2.80 (d, *J* = 14.3 Hz, 1H), 2.21 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 145.9, 145.7, 142.8, 134.1, 132.5, 128.8, 128.7, 128.2, 127.6, 127.0, 123.7, 122.4, 122.3, 118.5, 118.3, 116.1, 113.5, 110.2, 74.7, 49.0, 38.4, 36.0, 21.0. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{23}H_{24}N_3$ [M + H]$^+$: 342.2; found: 342.2 (100%). **Anal. Calcd** for $C_{23}H_{23}N_3$: C, 80.90; H, 6.79; N, 12.31. Found: C, 80.98; H, 6.74; N, 12.38.

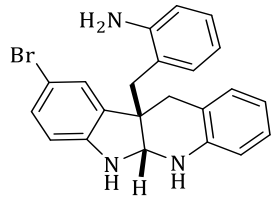
(±)-2-(((5a*R*,10b*S*)-9-(4-Methoxyphenyl)-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6ag)



6ag

Following the **GP-2**, compound **6ag** was prepared starting from **7d** (89 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 75% (130 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.37–7.33 (m, 2H), 7.19 (dd, *J* = 8.0, 1.9 Hz, 1H), 7.11–7.06 (m, 2H), 7.01 (d, *J* = 1.9 Hz, 1H), 6.99–6.92 (m, 4H), 6.75 (td, *J* = 7.4, 1.2 Hz, 1H), 6.67–6.61 (m, 2H), 6.58 (d, *J* = 8.0 Hz, 1H), 6.54 (dd, *J* = 7.8, 1.1 Hz, 1H), 4.97 (s, 1H), 3.85 (s, 3H), 3.40–2.87 (m, 8H, overlapping of signals for NH_2, two N–H and four benzylic protons). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 158.3, 147.3, 145.7, 142.8, 134.2, 133.7, 132.6, 132.0, 128.8, 127.7, 127.4, 127.0, 126.5, 122.6, 122.3, 121.7, 118.6, 118.5, 116.2, 114.0, 113.7, 109.9, 75.4, 55.3, 49.5, 38.7, 35.8. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{29}H_{28}N_3O$ [M + H]$^+$: 434.2; found: 434.2 (100%). **Anal. Calcd** for $C_{29}H_{27}N_3O$: C, 80.34; H, 6.28; N, 9.69. Found: C, 80.17; H, 6.21; N, 9.75.

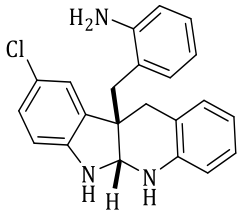
(±)-2-(((5a*R*,10b*S*)-9-Bromo-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6ah)



6ah

Following the **GP-2**, compound **6ah** was prepared starting from **7e** (75 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 67% (109 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.09–6.95 (m, 6H), 6.74–6.68 (m, 2H), 6.63 (dd, *J* = 7.9, 1.2 Hz, 1H), 6.51 (dd, *J* = 7.8, 1.2 Hz, 1H), 6.38 (d, *J* = 8.2 Hz, 1H), 4.92 (s, 1H), 4.09–3.34 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 2.97–2.88 (m, 3H), 2.79 (d, *J* = 14.5 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 147.3, 145.5, 142.4, 136.0, 132.5, 130.5, 128.8, 127.8, 127.2, 126.1, 122.2, 121.6, 118.7, 118.6, 116.2, 113.7, 111.1, 110.7, 74.8, 49.5, 38.1, 35.9. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{22}H_{21}BrN_3$ $[M + H]^+$: 406.1; found: 406.1 (100%). **Anal. Calcd** for $C_{22}H_{20}BrN_3$: C, 65.03; H, 4.96; N, 10.34. Found: C, 65.17; H, 5.04; N, 10.44.

(±)-2-(((5a*R*,10b*S*)-9-Chloro-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6ai)

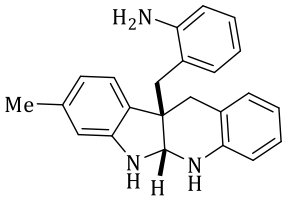


6ai

Following the **GP-2**, compound **6ai** was prepared starting from **7f** (61 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 66% (96 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.04 (td, *J*

= 7.6, 1.6 Hz, 1H), 7.01–6.91 (m, 4H), 6.88 (d, *J* = 2.1 Hz, 1H), 6.72–6.66 (m, 2H), 6.61 (dd, *J* = 7.9, 1.2 Hz, 1H), 6.48 (dd, *J* = 7.8, 1.2 Hz, 1H), 6.39 (d, *J* = 8.2 Hz, 1H), 4.88 (s, 1H), 3.60 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 2.95–2.85 (m, 3H), 2.77 (d, *J* = 14.5 Hz, 1H). **$^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$):** δ 146.8, 145.5, 142.4, 135.5, 132.5, 128.8, 127.8, 127.6, 127.2, 123.7, 123.3, 122.1, 121.7, 118.6, 118.6, 116.1, 113.7, 110.6, 74.8, 49.4, 38.0, 35.9. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{22}H_{21}ClN_3$ $[M + H]^+$: 362.1; found: 362.1 (100%). **Anal. Calcd** for $C_{22}H_{20}ClN_3$: C, 73.02; H, 5.57; N, 11.61. Found: C, 73.12; H, 5.66; N, 11.65.

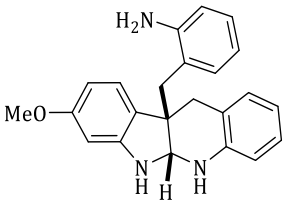
(±)-2-(((5a*R*,10b*S*)-8-Methyl-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6aj)



6aj

Following the **GP-2**, compound **6aj** was prepared starting from **7g** (53 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 72% (96 mg) over two steps. **^1H NMR (400 MHz, $CDCl_3$):** δ 7.07–6.98 (m, 4H), 6.85 (d, *J* = 7.5 Hz, 1H), 6.74–6.67 (m, 2H), 6.60 (dd, *J* = 7.9, 1.3 Hz, 1H), 6.55–6.50 (m, 2H), 6.37–6.36 (m, 1H), 4.85 (s, 1H), 3.58 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 3.01–2.95 (m, 2H), 2.89 (d, *J* = 15.0 Hz, 1H), 2.80 (d, *J* = 14.3 Hz, 1H), 2.24 (s, 3H). **$^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$):** δ 148.3, 145.6, 142.6, 137.6, 132.6, 130.8, 128.8, 127.5, 127.0, 122.6, 122.5, 122.4, 120.0, 118.4, 118.3, 116.1, 113.5, 110.9, 74.7, 48.4, 38.1, 36.1, 21.5. **HRMS (ESI)** *m*/*z* calcd for $C_{23}H_{24}N_3$ $[M + H]^+$: 342.1965; found: 342.1959.

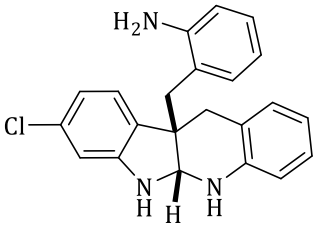
(±)-2-(((5a*R*,10b*S*)-8-Methoxy-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)anilineindole (6ak)



6ak

Following the **GP-2**, compound **6ak** was prepared starting from **7h** (59 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–50% EtOAc/hexanes). Light brown gum. Yield: 75% (107 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.07–6.96 (m, 4H), 6.78–6.71 (m, 2H), 6.70–6.65 (m, 1H), 6.60 (dd, *J* = 7.9, 1.2 Hz, 1H), 6.52 (dd, *J* = 7.7, 1.1 Hz, 1H), 6.22 (dd, *J* = 8.1, 2.3 Hz, 1H), 6.11 (d, *J* = 2.3 Hz, 1H), 4.89 (s, 1H), 3.70 (m, 7H, overlapping of the very broad singlets for NH_2 and two N–H protons with the sharp singlet of -OCH_3 protons), 2.99–2.88 (m, 3H), 2.83 (d, *J* = 14.2 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 160.0, 149.6, 145.6, 142.8, 132.5, 128.7, 127.5, 127.0, 125.6, 123.5, 122.9, 122.5, 118.5 (overlap of two aromatic carbon signals), 116.2, 113.7, 104.1, 96.5, 75.3, 55.1, 48.7, 38.7, 36.2. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{23}H_{24}N_3O$ $[M + H]^+$: 358.2; found: 358.2 (100%). **Anal. Calcd** for $C_{23}H_{23}N_3O$: C, 77.28; H, 6.49; N, 11.76. Found: C, 77.38; H, 6.57; N, 11.79.

(±)-2-(((5a*R*,10b*S*)-8-Chloro-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6al)

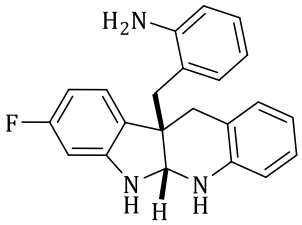


6al

Following the **GP-2**, compound **6al** was prepared starting from **7i** (61 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 65% (94 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.07–6.94 (m, 4H), 6.76–6.66 (m, 3H), 6.63–6.60 (m, 2H), 6.53 (dd, *J* = 7.8, 1.1 Hz, 1H), 6.49 (d, *J* = 1.8 Hz, 1H), 4.97 (s, 1H), 4.19–3.30 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 3.00–2.90 (m, 3H), 2.84 (d, *J* = 14.3 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 149.6, 145.5, 142.6, 133.3, 132.5, 131.7, 128.7, 127.8, 127.1, 124.0, 122.7, 121.8, 118.8 (overlap of two aromatic carbon signals), 118.6, 116.2, 113.9, 109.7, 75.3, 49.4, 38.5, 36.0. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{22}H_{21}ClN_3$

[M + H]$^+$: 362.1; found: 362.1 (100%). **Anal. Calcd** for $C_{22}H_{20}ClN_3$: C, 73.02; H, 5.57; N, 11.61. Found: C, 73.19; H, 5.67; N, 11.65.

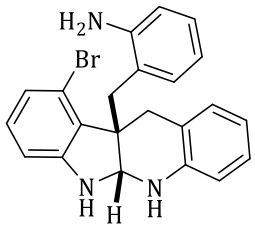
(±)-2-(((5a*R*,10b*S*)-8-Fluoro-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6am)



6am

Following the **GP-2**, compound **6am** was prepared starting from **7j** (54 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 67% (93 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.10–7.05 (m, 1H), 7.04–6.97 (m, 3H), 6.80–6.68 (m, 3H), 6.62 (dd, *J* = 7.9, 1.2 Hz, 1H), 6.51 (dd, *J* = 7.9, 1.1 Hz, 1H), 6.36 (ddd, *J* = 9.5, 8.1, 2.3 Hz, 1H), 6.19 (dd, *J* = 9.7, 2.4 Hz, 1H), 4.90 (s, 1H), 4.15–3.31 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 2.99–2.88 (m, 3H), 2.83 (d, *J* = 14.3 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 163.09 (d, *J* = 242.2 Hz), 149.70 (d, *J* = 11.7 Hz), 145.5, 142.6, 132.5, 128.7, 128.61 (d, *J* = 2.3 Hz), 127.7, 127.1, 123.70 (d, *J* = 10.5 Hz), 122.7, 122.0, 118.7, 118.5, 116.2, 113.8, 105.05 (d, *J* = 22.7 Hz), 97.32 (d, *J* = 26.0 Hz), 75.3, 48.8, 38.4, 36.1. **^{19}F NMR (376 MHz, $CDCl_3$)** δ -114.5. **HRMS (ESI)** *m*/*z* calcd for $C_{22}H_{21}FN_3$ [M + H]$^+$: 346.1715; found: 346.1718.

(±)-2-(((5a*R*,10b*S*)-10-Bromo-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6an)

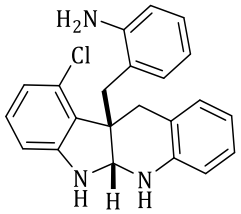


6an

Following the **GP-2**, compound **6an** was prepared starting from **7k** (75 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and

4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 65% (106 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.10 (dd, *J* = 7.5, 1.4 Hz, 1H), 7.04–6.96 (m, 3H), 6.86–6.78 (m, 2H), 6.72–6.68 (m, 1H), 6.66–6.62 (m, 2H), 6.54–6.51 (m, 1H), 6.39 (dd, *J* = 7.4, 1.3 Hz, 1H), 5.05 (s, 1H), 3.59–2.87 (m, 8H, overlapping of signals for NH_2, two N–H and four benzylic protons). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 151.0, 145.5, 142.8, 132.1, 130.5, 129.4, 128.3, 127.5, 127.0, 123.8, 123.5, 121.9, 118.9, 118.9, 118.6, 115.9, 113.8, 108.7, 73.5, 53.7, 35.6, 33.8. **^{1}H NMR (400 MHz, $CDCl_3$) after D_2O shake experiment:** δ 7.10 (dd, *J* = 7.4, 1.4 Hz, 1H), 7.03–6.96 (m, 3H), 6.86–6.78 (m, 2H), 6.70 (td, *J* = 7.4, 1.2 Hz, 1H), 6.66–6.62 (m, 2H), 6.52 (dd, *J* = 7.8, 1.1 Hz, 1H), 6.38 (dd, *J* = 7.4, 1.2 Hz, 1H), 5.04 (s, 1H), 3.56 (d, *J* = 14.8 Hz, 1H), 3.46 (d, *J* = 14.8 Hz, 1H), 2.99 (d, *J* = 14.8 Hz, 1H), 2.88 (d, *J* = 14.8 Hz, 1H). **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{22}H_{20}BrN_3$ [M + H]$^+$: 406.1; found: 406.1 (100%). **Anal. Calcd** for $C_{22}H_{20}BrN_3$: C, 65.03; H, 4.96; N, 10.34. Found: C, 65.15; H, 5.04; N, 10.24.

(±)-2-(((5a*R*,10b*S*)-10-Chloro-5,5a,6,11-tetrahydro-10b*H*-indolo[2,3-*b*]quinolin-10b-yl)methyl)aniline (6ao)

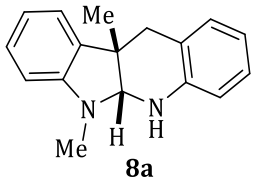


6ao

Following the **GP-2**, compound **6ao** was prepared starting from **7l** (71 mg, 0.4 mmol) *t*-BuONa (86 mg, 0.88 mmol, 2.2 equiv), Et_3B (0.88 mL, 0.88 mmol, 2.2 equiv) and **2a** (190 mg, 0.88 mmol, 2.2 equiv) in the first step; $B_2(OH)_4$ (288 mg, 3.2 mmol, 4.0 equiv) and 4,4'-bipyridine (6.4 mg, 0.04 mmol, 10.0 mol%) in the second step. The crude product was purified by silica gel column chromatography (20–40% EtOAc/hexanes). Light brown gum. Yield: 64% (93 mg) over two steps. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.08 (dd, *J* = 7.3, 1.4 Hz, 1H), 7.03–6.97 (m, 3H), 6.88 (t, *J* = 7.9 Hz, 1H), 6.70 (td, *J* = 7.4, 1.1 Hz, 1H), 6.69–6.62 (m, 3H), 6.53 (dd, *J* = 7.8, 1.1 Hz, 1H), 6.34 (dd, *J* = 7.8, 0.9 Hz, 1H), 5.05 (s, 1H), 3.86 (br m, 4H, overlapping broad singlets corresponding to NH_2 protons and two N–H protons), 3.48 (d, *J* = 14.7 Hz, 1H), 3.42 (d, *J* = 14.7 Hz, 1H), 3.02 (d, *J* = 14.7 Hz, 1H), 2.90 (d, *J* = 14.8 Hz, 1H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 150.7, 145.5, 142.8, 132.1, 130.3, 129.2, 129.2, 128.4, 127.6, 127.0, 123.6, 122.0, 120.6, 118.9, 118.7, 115.9, 113.8, 108.1, 73.4, 53.0, 35.8, 34.1. **HRMS (ESI)** *m*/*z* calcd for $C_{22}H_{21}ClN_3$ [M + H]$^+$: 362.1419; found: 362.1426.

3.4. Synthesis of Products 8a–c, 9a,b, 10, 11, 12 (Scheme 2, main manuscript)

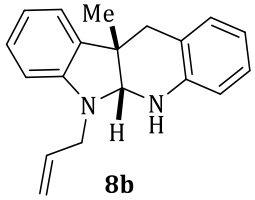
(±)-(5a*R*,10b*S*)-6,10b-Dimethyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (8a)



8a

To an ice-cooled solution of **6a** (150 mg, 0.63 mmol, 1.0 equiv) in anhydrous DMF (2 mL), was added NaH (20 mg, 0.83 mmol, 1.3 equiv) under nitrogen atmosphere and the resulting mixture was stirred for 10 minutes at room temperature. Next, to this solution was added MeI (52 µL, 0.6 mmol, 1.3 equiv) dropwise. The reaction mixture was stirred for an additional 2 h before being quenched by dropwise addition of ice water (10 mL) and diluted with EtOAc (10 mL). The aqueous phase was separated and extracted with EtOAc (10 mL). The combined organic phases were washed with brine (20 mL), dried over Na_2SO_4, filtered, and concentrated under reduced pressure. Purification of the crude product on silica gel using a gradient of 2–20% EtOAc/hexanes afforded product **8a** in pure form. Colorless gum. Yield: 76% (120 mg). **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.19–7.14 (m, 2H), 7.11–7.07 (m, 1H), 7.02 (d, *J* = 7.3 Hz, 1H), 6.84–6.80 (m, 1H), 6.74–6.70 (m, 1H), 6.66 (d, *J* = 7.9 Hz, 1H), 6.57 (d, *J* = 7.8 Hz, 1H), 4.64 (s, 1H), 4.15 (s, 1H), 2.86–2.79 (m, 4H), 2.53 (d, *J* = 15.2 Hz, 1H), 1.26 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 149.1, 141.0, 137.0, 129.1, 127.7, 127.0, 121.3, 121.2, 118.6, 117.8, 113.4, 107.9, 83.7, 38.8, 37.4, 32.1, 21.3. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{17}H_{19}N_2$ [M + H]$^+$: 251.2; found: 251.2 (100%). **Anal. Calcd** for $C_{17}H_{18}N_2$: C, 81.56; H, 7.25; N, 11.19. Found: C, 81.74; H, 7.29; N, 11.11.

(±)-(5a*R*,10b*S*)-6-Allyl-10b-methyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (8b)

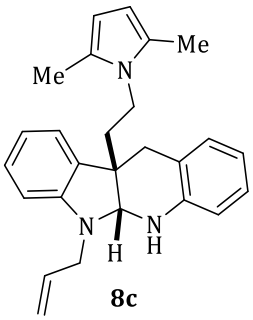


8b

Following the similar procedure described for the preparation of compound **8a**, compound **8b** was synthesized from **6a** (150 mg, 0.63 mmol) and using NaH (20 mg, 0.83 mmol) and allyl bromide (72 µL, 0.83 mmol). Purification of the crude product by silica gel column chromatography (2–20% EtOAc/hexanes) afforded **8b** (141 mg, 81%) as a colorless gum. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.12–7.04 (m, 3H), 7.00 (d, *J* = 7.3 Hz,

1H), 6.75 (td, *J* = 7.4, 1.0 Hz, 1H), 6.70 (td, *J* = 7.4, 1.2 Hz, 1H), 6.62 (dd, *J* = 7.9, 1.1 Hz, 1H), 6.52 (d, *J* = 7.7 Hz, 1H), 5.95 (dddd, *J* = 17.1, 10.2, 6.8, 5.0 Hz, 1H), 5.33 (dq, *J* = 17.2, 1.7 Hz, 1H), 5.23 (dq, *J* = 10.2, 1.5 Hz, 1H), 4.49 (s, 2H), 3.94 (ddt, *J* = 16.0, 5.0, 1.7 Hz, 1H), 3.82 (ddt, *J* = 16.0, 6.8, 1.4 Hz, 1H), 2.84 (d, *J* = 15.0 Hz, 1H), 2.54 (d, *J* = 15.0 Hz, 1H), 1.27 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.1, 141.4, 136.6, 134.1, 128.8, 127.6, 126.9, 122.1, 121.5, 118.1, 118.0, 117.4, 113.6, 107.7, 81.1, 47.7, 40.2, 37.7, 22.5. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{19}H_{21}N_2$ [M + H]$^+$: 277.2; found: 277.2 (100%). **Anal. Calcd** for $C_{19}H_{20}N_2$: C, 82.57; H, 7.29; N, 10.14. Found: C, 82.39; H, 7.37; N, 10.19.

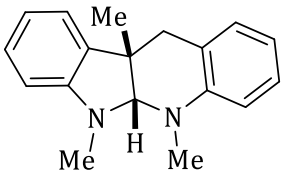
(±)-(5a*R*,10b*R*)-6-Allyl-10b-(2-(2,5-dimethyl-1*H*-pyrrol-1-yl)ethyl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (8c)



8c

Following the similar procedure described for the preparation of compound **8a**, compound **8c** was synthesized from **6m** (40 mg, 0.12 mmol) and using NaH (3.6 mg, 0.15 mmol) and allyl bromide (25 μL, 0.15 mmol. Purification of the crude product by silica gel column chromatography (2–15% EtOAc/hexanes) afforded **8c** (36 mg, 78%) as a colorless gum. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.15–7.01 (m, 3H), 6.95 (dd, *J* = 7.4, 1.4 Hz, 1H), 6.77–6.67 (m, 2H), 6.61 (d, *J* = 7.8 Hz, 1H), 6.47 (d, *J* = 7.8 Hz, 1H), 5.94 (dddd, *J* = 16.8, 10.0, 6.4, 4.9 Hz, 1H), 5.73 (s, 2H), 5.35 (dd, *J* = 17.2, 1.7 Hz, 1H), 5.26 (dd, *J* = 10.2, 1.6 Hz, 1H), 4.72 (d, *J* = 3.2 Hz, 1H), 4.50 (d, *J* = 3.5 Hz, 1H), 3.95 (ddt, *J* = 16.1, 5.1, 1.8 Hz, 1H), 3.87–3.75 (m, 2H), 3.67 (ddd, *J* = 14.2, 9.4, 7.6 Hz, 1H), 2.93 (d, *J* = 14.8 Hz, 1H), 2.70 (d, *J* = 14.9 Hz, 1H), 2.10 (s, 6H), 2.00–1.96 (m, 2H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 148.8, 141.9, 133.9, 133.1, 128.4, 128.0, 127.1, 127.0, 122.8, 121.9, 118.9, 118.1, 117.6, 114.1, 107.2, 105.1, 78.7, 47.5, 45.1, 39.3, 37.9, 37.3, 12.3. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{26}H_{30}N_3$ [M + H]$^+$: 384.2; found: 384.2 (100%). **Anal. Calcd** for $C_{26}H_{29}N_3$: C, 81.42; H, 7.62; N, 10.96. Found: C, 81.62; H, 7.54; N, 10.99.

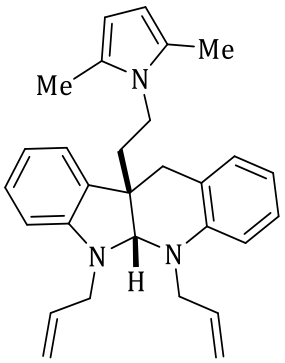
(±)-(5a*R*,10b*S*)-5,6,10b-Trimethyl-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (9a)



9a

Following the similar procedure described for the preparation of compound **8a**, compound **9a** was synthesized from **6a** (77 mg, 0.32 mmol, 1.0 equiv) and using NaH (20 mg, 0.8 mmol, 2.5 equiv) and allyl bromide (70 μL, 0.8 mmol, 2.5 equiv). Purification of the crude product by silica gel column chromatography (2–15% EtOAc/hexanes) afforded **9a** (73 mg, 87%) as a colorless gum. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.20–7.17 (m, 1H), 7.14–7.08 (m, 2H), 7.00 (d, *J* = 7.1 Hz, 1H), 6.78–6.70 (m, 3H), 6.49 (d, *J* = 7.6 Hz, 1H), 4.15 (s, 1H), 3.25 (s, 3H), 2.91–2.87 (m, 4H), 2.57 (d, *J* = 15.0 Hz, 1H), 1.29 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 149.5, 143.5, 137.1, 128.3, 127.6, 127.0, 123.8, 121.2, 118.3, 117.5, 111.2, 107.7, 92.4, 41.1, 40.2, 38.1, 34.7, 22.9. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{18}H_{21}N_2$ [M + H]$^+$: 265.2; found: 265.2 (100%). **Anal. Calcd** for $C_{18}H_{20}N_2$: C, 81.78; H, 7.63; N, 10.60. Found: C, 81.92; H, 7.73; N, 10.65.

(±)-(5a*R*,10b*R*)-5,6-Diallyl-10b-(2-(2,5-dimethyl-1*H*-pyrrol-1-yl)ethyl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (9b)

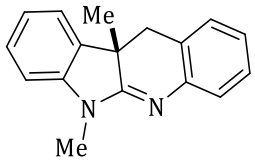


9b

Following the similar procedure described for the preparation of compound **8a**, compound **9b** was synthesized from **6m** (80 mg, 0.23 mmol, 1.0 equiv) and using NaH (14 mg, 0.6 mmol, 2.5 equiv) and allyl bromide (52 μL, 0.6 mmol, 2.5 equiv). Purification of the crude product by silica gel column chromatography (2–15% EtOAc/hexanes) afforded **9b** (83 mg, 84%) as a colorless gum. **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.12–7.05 (m, 2H), 7.01 (td, *J* = 7.6, 1.3 Hz, 1H), 6.92 (dd, *J* = 7.2, 1.6 Hz, 1H), 6.76–6.67 (m, 3H), 6.31 (dd, *J* = 7.8, 1.0 Hz, 1H), 6.00–5.79 (m, 2H), 5.75 (s, 2H), 5.35 (dq, *J* = 17.3, 1.6 Hz, 1H), 5.27 (dq, *J* = 10.3, 1.6 Hz, 1H), 5.24–5.16 (m, 2H), 4.84 (s, 1H), 4.31–4.21 (m, 1H), 4.06–3.98 (m, 2H), 3.81–3.69 (m, 2H), 3.62–3.49 (m, 1H), 2.89 (d, *J* = 14.0 Hz, 1H), 2.74 (d, *J* = 14.1 Hz, 1H), 2.14 (s, 6H), 2.06–1.98 (m, 2H). **^{13}C{^{1}H} NMR (100**

MHz, $CDCl_3$): δ 150.2, 144.3, 135.3, 133.6, 132.5, 128.0, 127.8, 127.3, 127.0, 126.8, 121.9, 119.4, 117.8, 117.6, 117.0, 114.3, 106.8, 105.2, 85.1, 53.0, 50.2, 49.7, 39.9, 39.4, 38.5, 12.4. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{29}H_{34}N_3$ $[M + H]^+$: 424.3; found: 424.3 (100%). **Anal. Calcd** for $C_{29}H_{33}N_3$: C, 82.23; H, 7.85; N, 9.92. Found: C, 82.41; H, 7.89; N, 9.87.

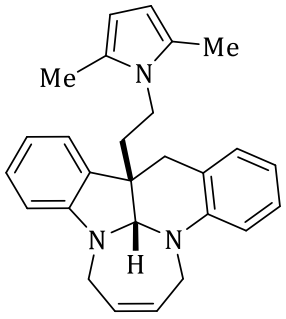
(±)-(*S*)-6,10b-Dimethyl-10b,11-dihydro-6*H*-indolo[2,3-*b*]quinoline (10)



10

To a solution of **8a** (100 mg, 0.4 mmol, 1.0 equiv) in anhydrous CH_2Cl_2 (10 mL), was added DDQ (227 mg, 1.0 mmol, 2.5 equiv) and the resulting mixture was stirred for 30 minutes at room temperature. The reaction mixture was quenched by dropwise addition of saturated aq. $NaHCO_3$ (15 mL). The aqueous phase was separated and extracted with CH_2Cl_2 (10 mL). The combined organic phases were washed with brine (20 mL), dried over Na_2SO_4, filtered, and concentrated under reduced pressure. Purification of the crude product on silica gel using a gradient of 5–30% EtOAc/hexanes afforded product **10** in pure form. Off-white gum. Yield: 71% (70 mg). **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.26 (td, *J* = 7.7, 1.2 Hz, 1H), 7.23–7.20 (m, 3H), 7.15 (d, *J* = 7.2 Hz, 1H), 7.01–6.96 (m, 2H), 6.82 (d, *J* = 7.8 Hz, 1H), 3.36 (s, 3H), 3.06–2.97 (m, 2H), 1.18 (s, 3H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 171.2, 145.8, 145.7, 135.5, 128.8, 128.2, 128.0, 124.3, 123.5, 123.2, 122.2, 121.4, 107.8, 41.3, 35.5, 27.8, 22.7. **LRMS (ESI$^+$)** *m*/*z* calcd for $C_{17}H_{17}N_2$ $[M + H]^+$: 249.1; found: 249.1 (100%). **Anal. Calcd** for $C_{17}H_{16}N_2$: C, 82.22; H, 6.49; N, 11.28. Found: C, 82.31; H, 6.41; N, 11.36.

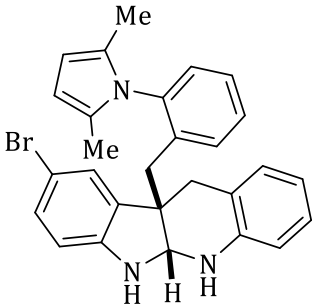
(±)-(4a1*R*,9a*R*)-9a-(2-(2,5-Dimethyl-1*H*-pyrrol-1-yl)ethyl)-1,4,4a1,9a-tetrahydro-9*H*-4a,13b-diazabenzo[*b*]cyclohepta[*lm*]fluorene (11)



11

To a solution of **9b** (65 mg, 0.15 mmol) in CH_2Cl_2 (1 mL), was added Grub's first-generation catalyst "Bis(tricyclohexylphosphine)benzylidine ruthenium (IV) dichloride" (12 mg, 10 mol%) under nitrogen atmosphere and the resulting mixture was stirred for 1 h minutes at room temperature. The reaction mixture was filtered through a pad of celite (washed with additional 10 ml of CH_2Cl_2) and then the filtrate was concentrated under reduced pressure. Purification of the crude product on silica gel using a gradient of 2–15% EtOAc/hexanes afforded product **11** in pure form. Colorless gum. Yield: 89% (53 mg). **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.06 (td, *J* = 7.8, 1.5 Hz, 1H), 7.03–6.97 (m, 2H), 6.89 (d, *J* = 7.4 Hz, 1H), 6.69–6.63 (m, 3H), 6.26 (d, *J* = 7.8 Hz, 1H), 6.15–6.09 (m, 1H), 6.00–6.04 (m, 1H), 5.76 (s, 2H), 4.91 (s, 1H), 4.19 (dd, *J* = 17.4, 5.4 Hz, 1H), 4.12–4.06 (m, 1H), 3.97 (dd, *J* = 16.9, 6.0 Hz, 1H), 3.86–3.78 (m, 2H), 3.63–3.55 (m, 1H), 2.91–2.80 (m, 2H), 2.22–2.05 (m, 8H). **^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$):** δ 150.0, 144.9, 131.6, 130.8, 128.3, 128.1, 127.7, 127.4, 127.1, 127.1, 122.2, 119.3, 117.7, 113.7, 105.6, 105.1, 88.0, 52.1, 49.1, 45.0, 41.3, 39.3, 38.5, 12.4. **Anal. Calcd** for $C_{27}H_{29}N_3$: C, 81.99; H, 7.39; N, 10.62. Found: C, 82.15; H, 7.31; N, 10.64.

(±)-(5a*R*,10b*S*)-9-Bromo-10b-(2-(2,5-dimethyl-1*H*-pyrrol-1-yl)benzyl)-5a,6,10b,11-tetrahydro-5*H*-indolo[2,3-*b*]quinoline (12)



12

To a solution of **6ah** (81 mg, 0.2 mmol) and hexane-2,5-dione (23 mg, 0.2 mmol) in CH_2Cl_2 (1 mL), was added ascorbic acid (2 mg, 5 mol%) at room temperature. The reaction mixture was stirred at room temperature for 2 h. After consumption of starting material, the mixture was concentrated under reduced pressure. Purification of the crude product on silica gel using a gradient of 5–20% EtOAc/hexanes afforded product **8** in pure form. Light brown gum. Yield: 71% (68 mg). **^{1}H NMR (400 MHz, $CDCl_3$):** δ 7.31–7.27 (m, 2H, overlapped with the residual $CHCl_3$ peak), 7.13–7.08 (m, 2H), 7.06 (dd, *J* = 8.2, 2.0 Hz, 1H), 7.01 (td, *J* = 7.6, 1.5 Hz, 1H), 6.92–6.89 (m, 1H), 6.75 (d, *J* = 2.0 Hz, 1H), 6.67 (td, *J* = 7.4, 1.2 Hz, 1H), 6.56 (dd, *J* = 7.9, 1.1 Hz, 1H), 6.36 (d, *J* = 8.2 Hz, 1H), 5.95–5.93 (m, 2H), 4.79 (s, 1H), 4.17 (br m, 2H, overlapping broad singlets

corresponding to two N–H protons), 3.03 (d, *J* = 14.6 Hz, 1H), 2.75 (d, *J* = 14.9 Hz, 1H), 2.62–2.56 (m, 2H), 1.95 (s, 3H), 1.73 (s, 3H). **$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$):** δ 147.1, 141.9, 138.5, 136.3, 135.7, 132.2, 130.5, 129.5, 128.8, 128.7, 127.9, 127.6, 127.4, 127.1, 126.0, 122.0, 118.6, 113.9, 111.2, 110.8, 106.5, 106.2, 74.2, 48.5, 37.5, 36.9, 12.9, 12.7. **HRMS (ESI)** *m*/*z* calcd for $C_{28}H_{27}BrN_3$ $[M + H]^+$: 484.1383; found: 484.1354.

4. X-Ray Crystallography Data

- Methods to cultivate the crystals of product **6n**:
  The pure product **6n** (15 mg) was dissolved in hexanes/EtOAc = 4:1 mixture (5 mL) in a 10 mL flat bottom glass vial and the resultant solution was kept for 7 days at room temperature.
- X-ray crystallography:
  X-ray reflections were collected on a Bruker APEX-II, CCD diffractometer using Mo Kα (λ = 0.71073 Å) radiation. Data reductions were performed using Bruker SAINT Software. Intensities for absorption were corrected using SADABS-2014/2. Structures were solved in Olex2-1.5- alpha software using ShelXT settings and refined using ShelXL-2014 settings with anisotropic displacement parameters for non-H atoms. A check of the final CIF file using PLATON did not shows any missed symmetry.[16] The crystallographic parameters for the crystal structure of **6n** are summarized in Table S1. Crystal structure (ORTEP drawing with 50% probability) of **6n** is shown in Figure S3.

Table S1: Crystallographic data of **6n**

Crystal Data	rc1205_a (6n)
Formula unit	C_{21} H_{18} N_2
Formula wt.	298.37
Crystal system	orthorhombic
T [K]	296
a [Å]	6.466(11)
b [Å]	12.77(2)
c [Å]	19.58(3)
α [°]	90

β [°]	90
γ [°]	90
Volume [Å^3]	1616(5)
Space group	P 21 21 21
Z	4
D_{calc} [g cm^{-3}]	1.226
μ/mm^{-1}	0.072
Reflns. Collected	3080
Observed reflns.	3069
R_1 [I>2σ(I)], wR_2	0.0831(1162), 0.2361(3069)
GOOF	0.935
Instrument	Bruker APEX-II CCD
X-ray	MoK\a
CCDC Reference No.	**2483689**

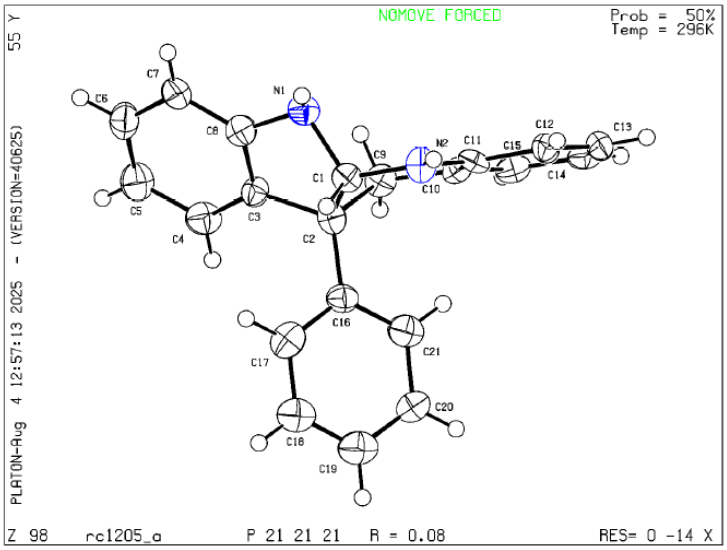


Figure S3. Crystal structure (ORTEP drawing with 50% probability) of **6n**.

5. References

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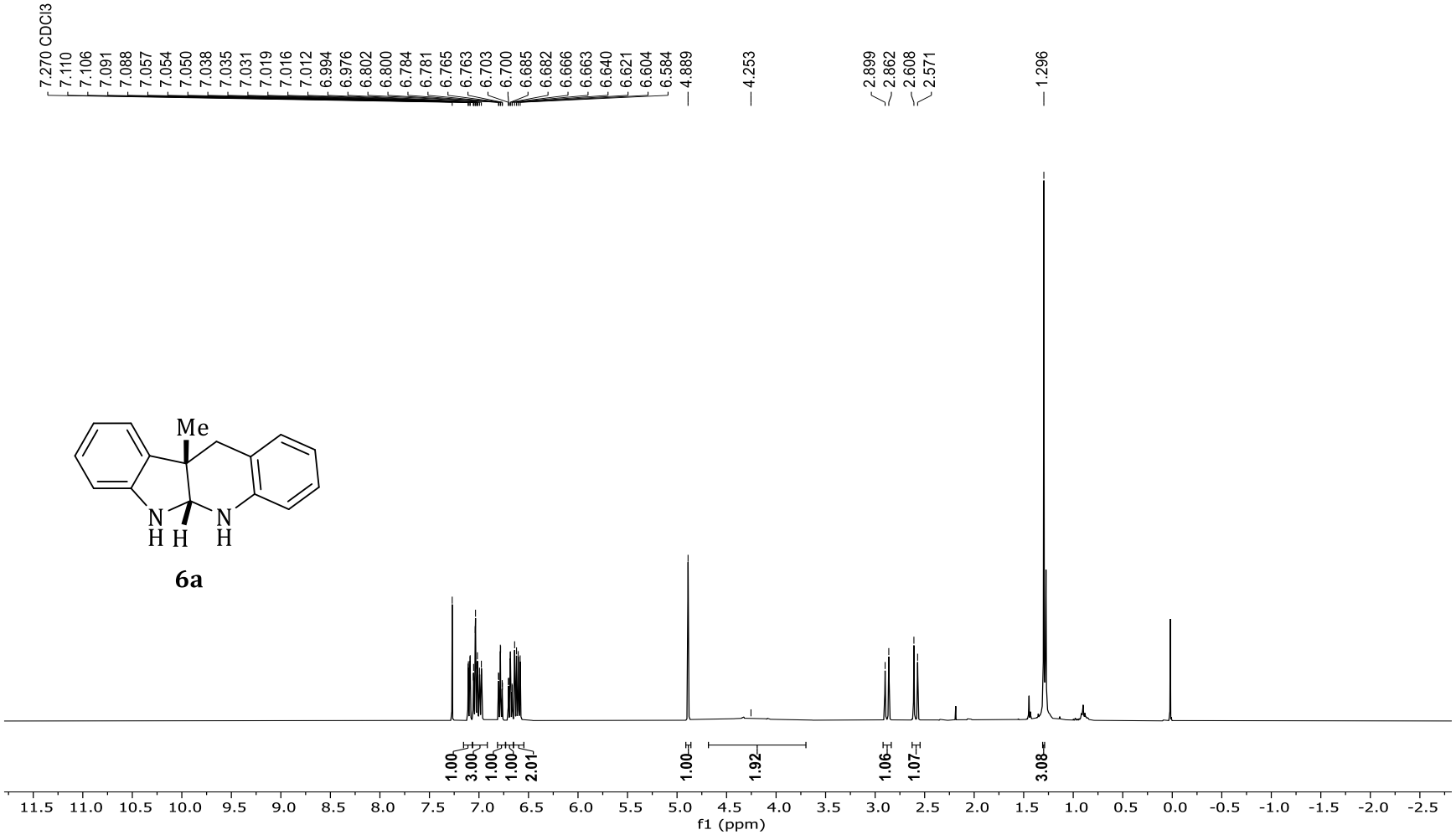
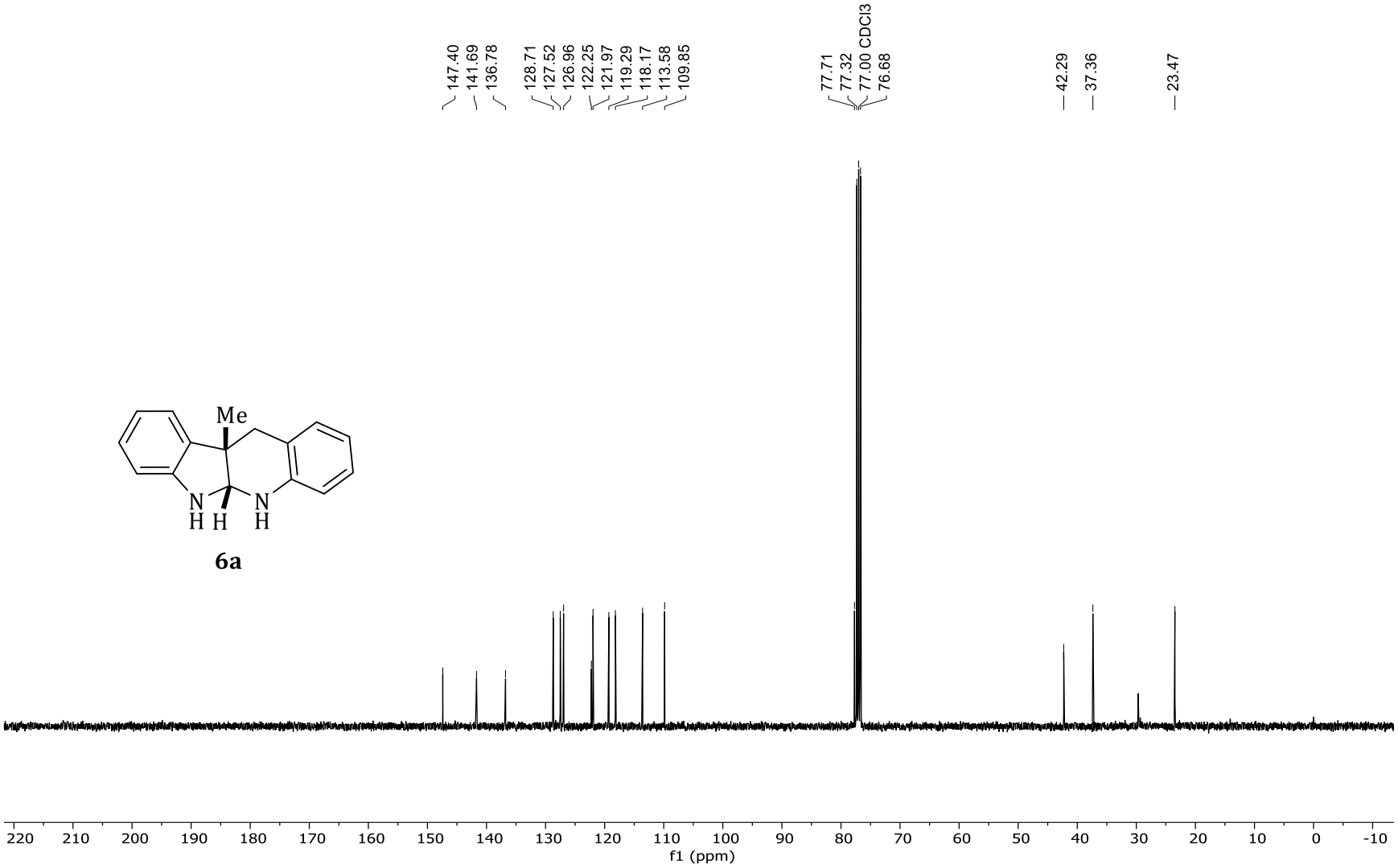
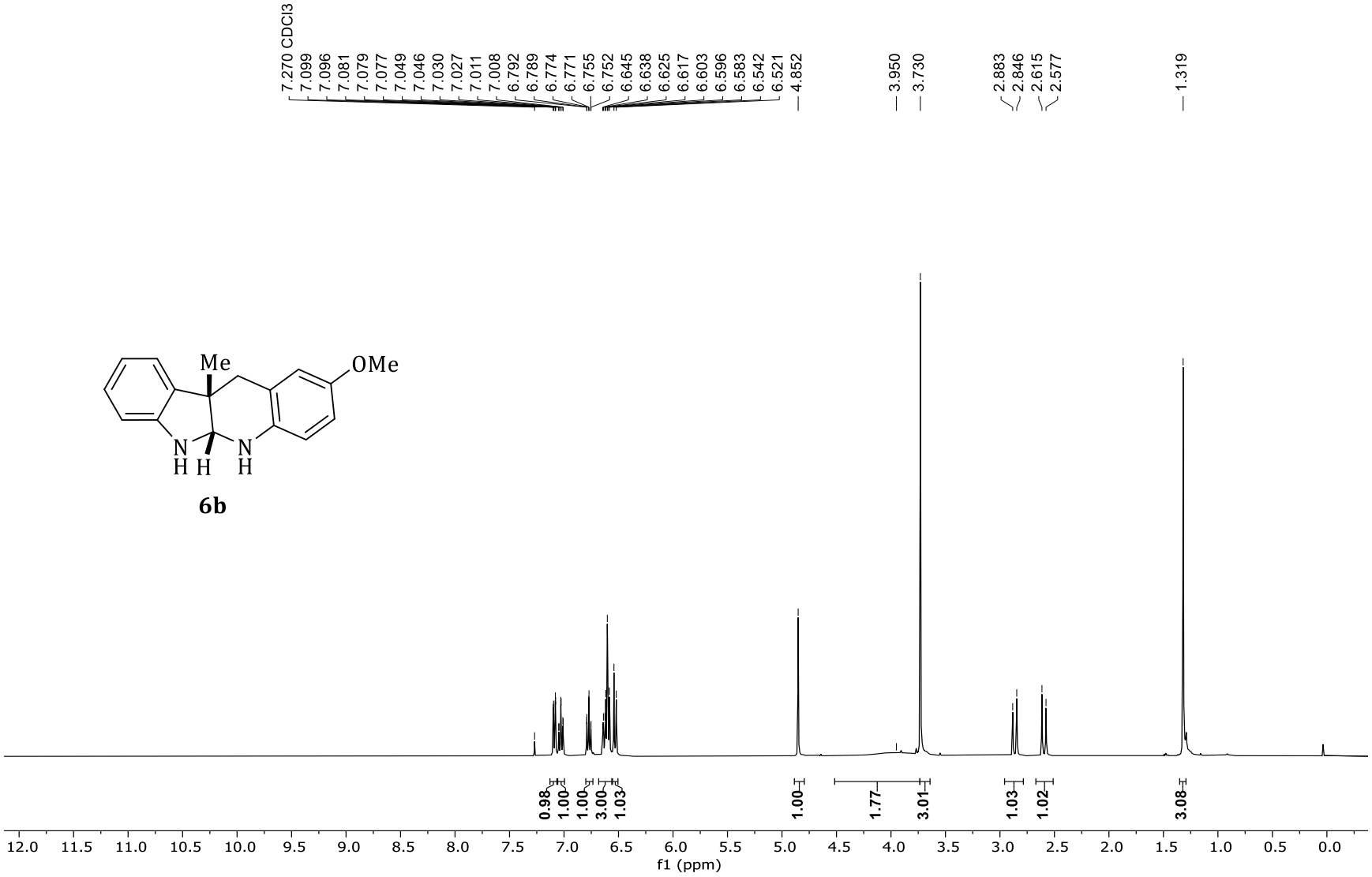
6. NMR Spectra of Compounds



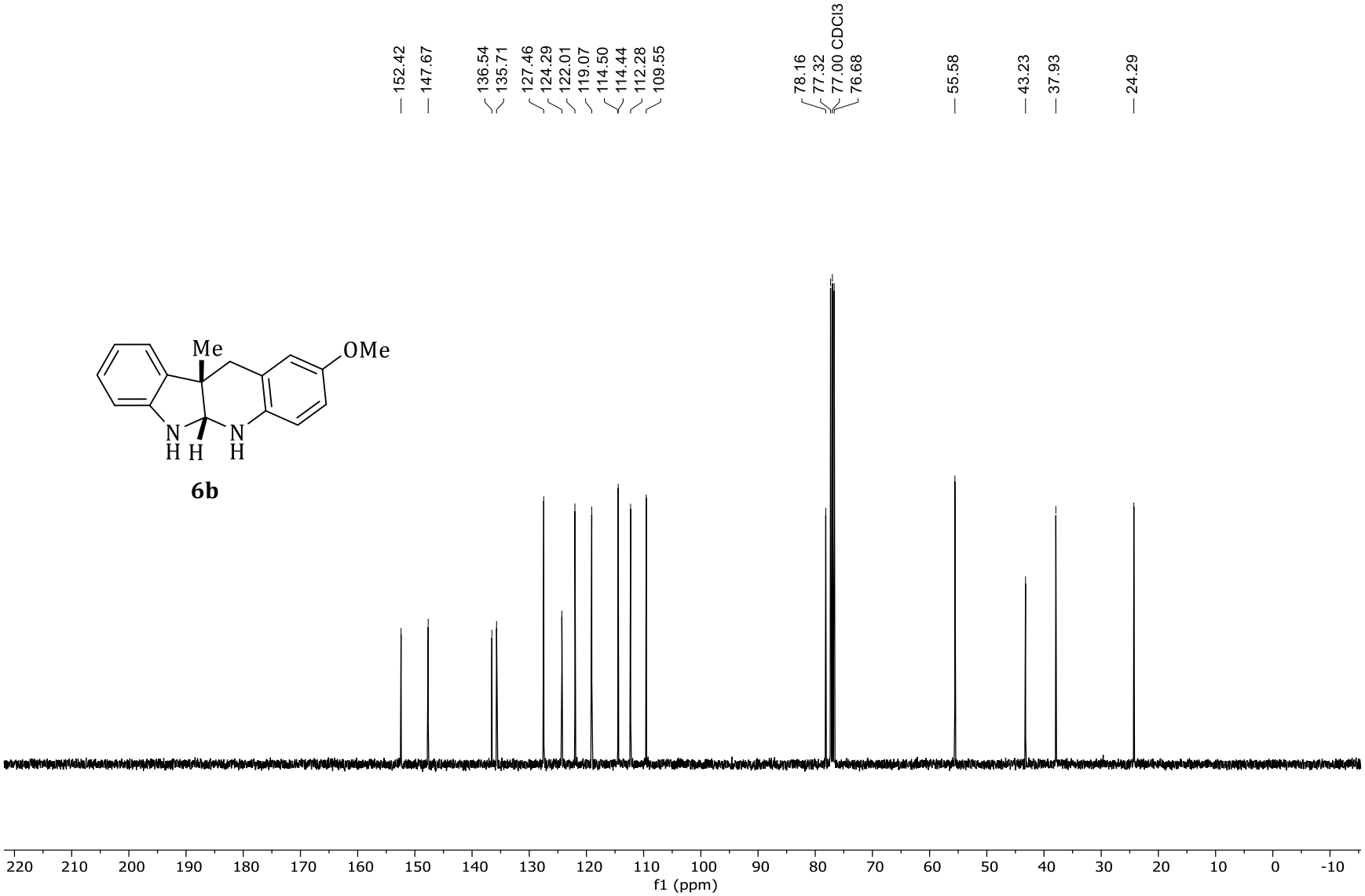
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6a**.



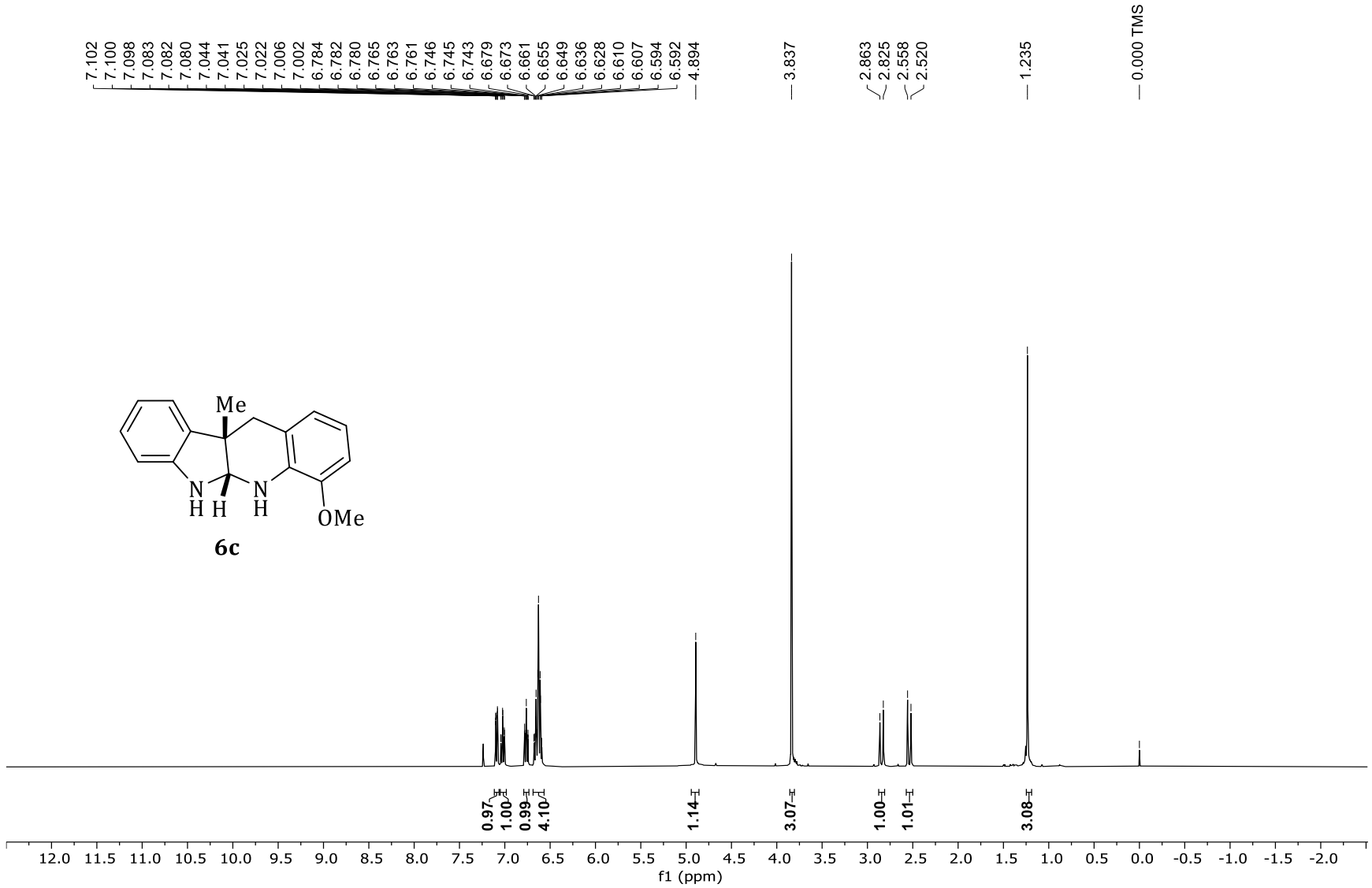
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6a**.



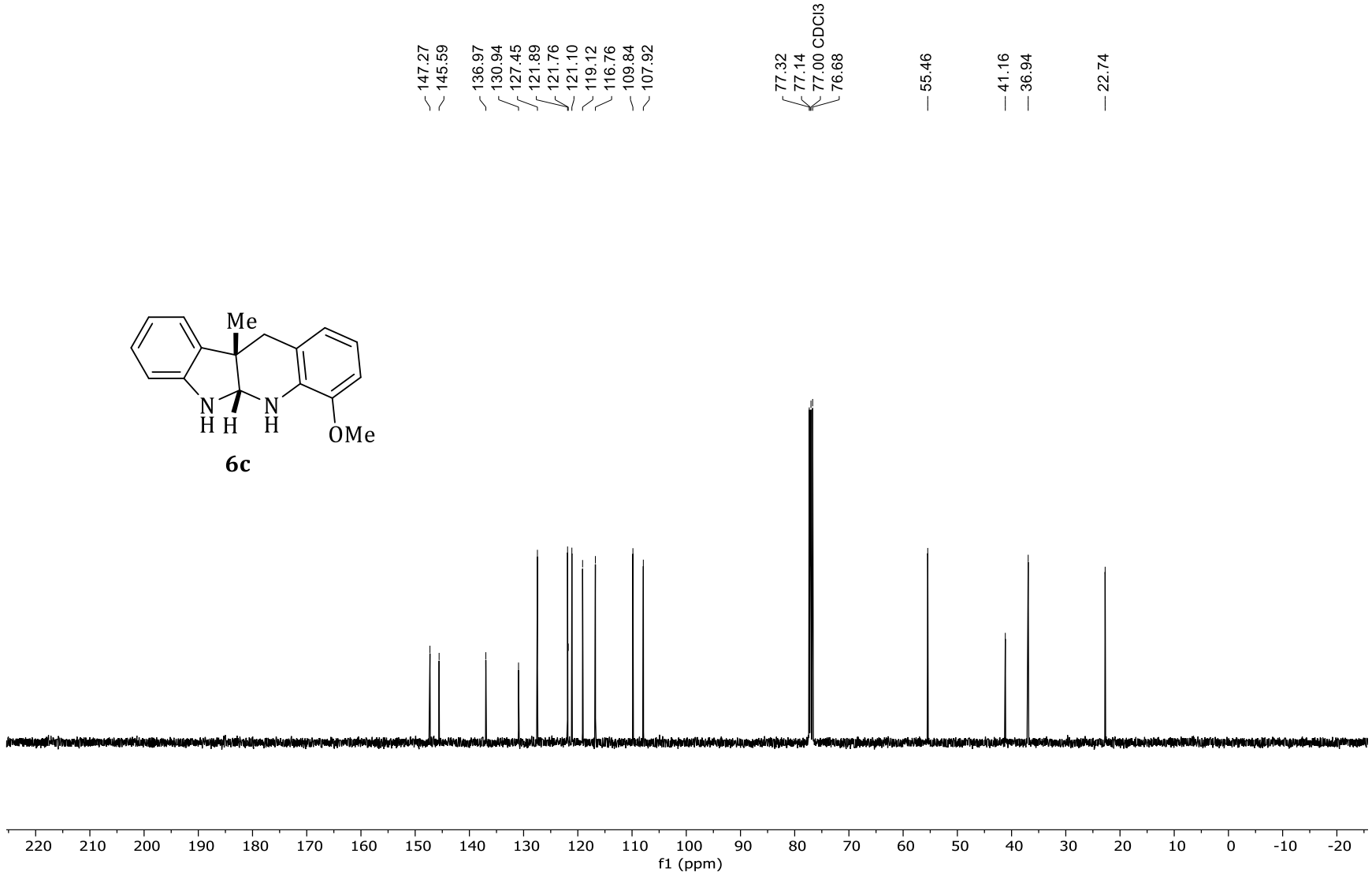
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6b**.



$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6b**.



^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6c**.



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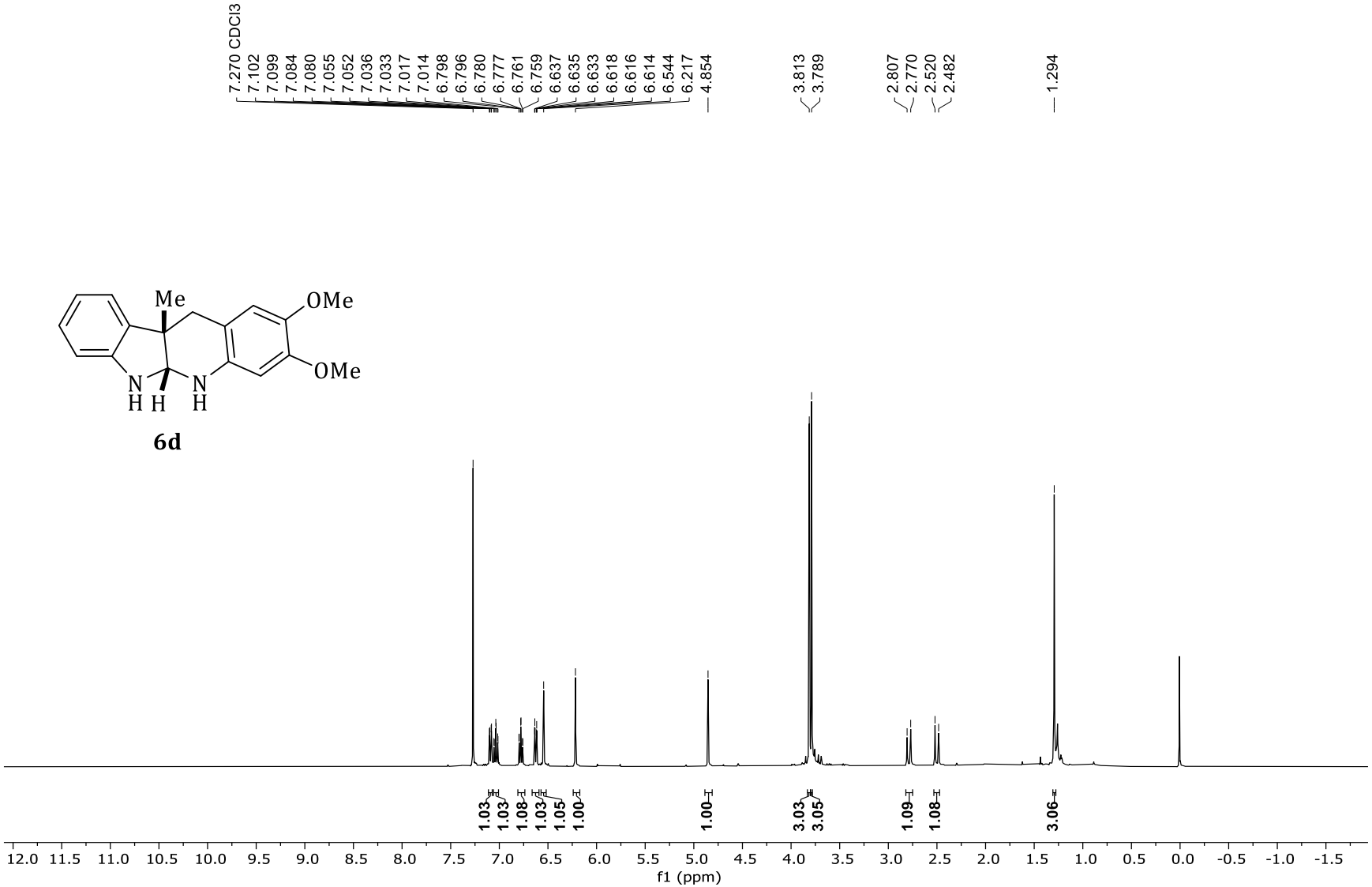
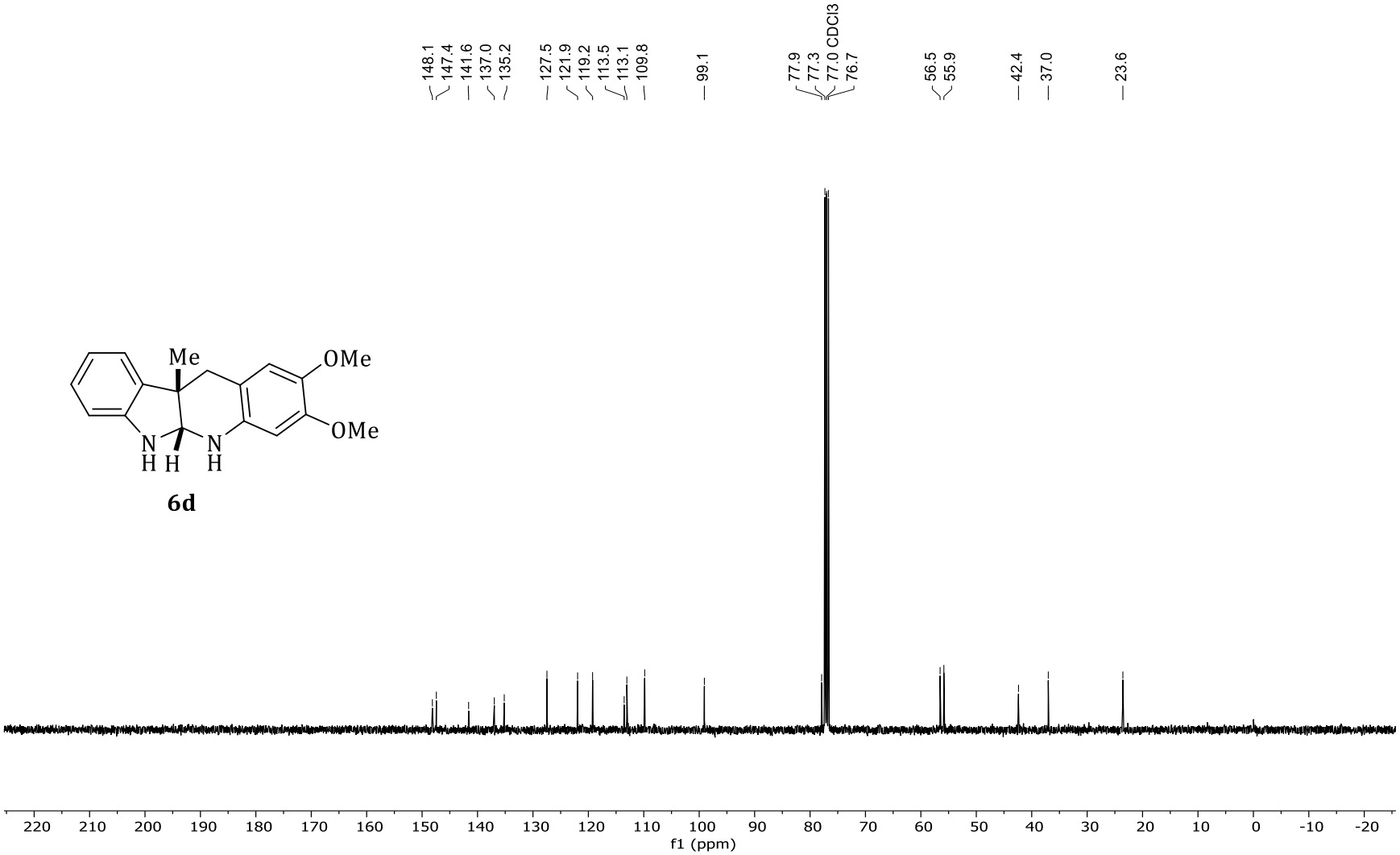
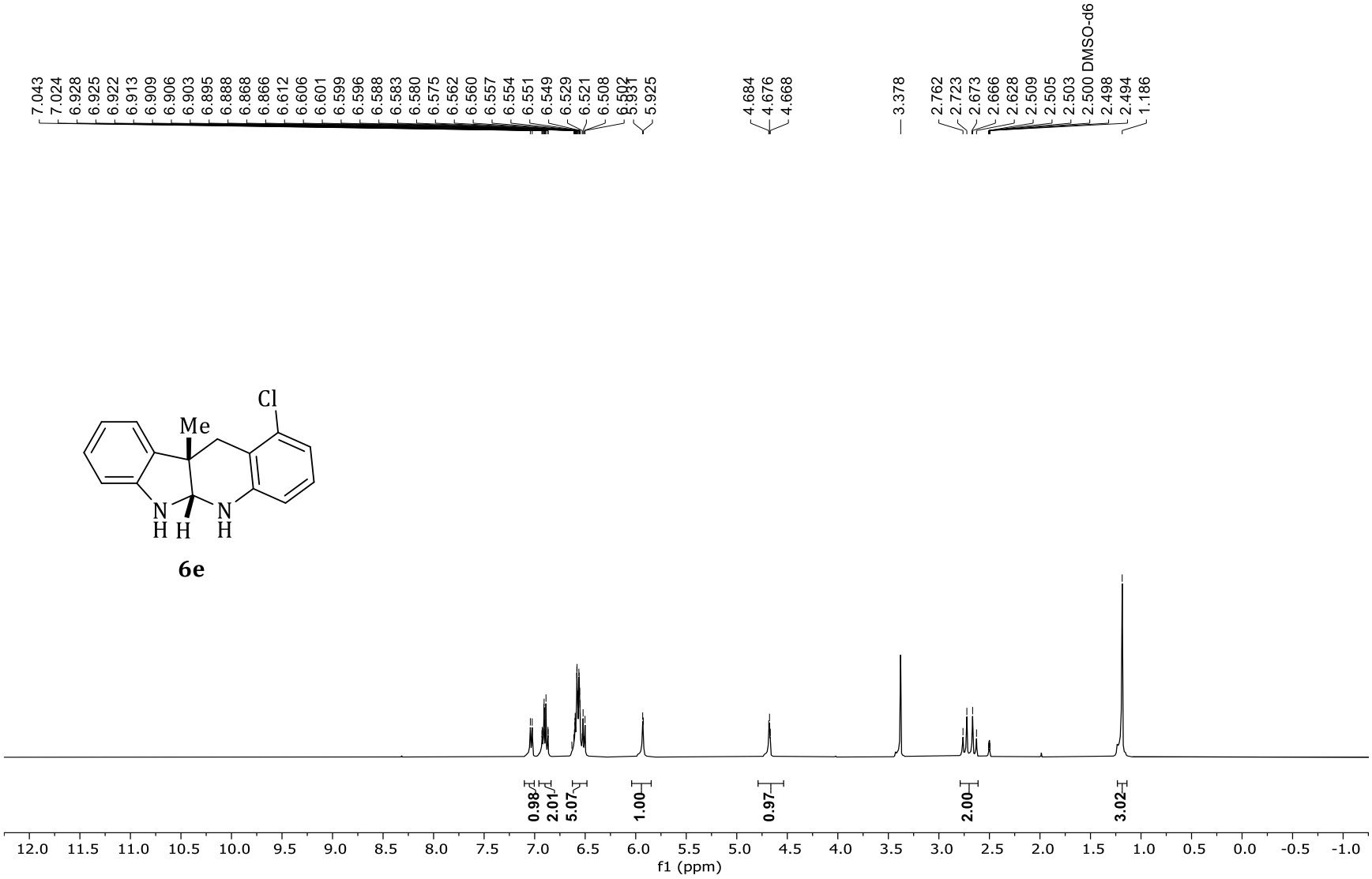


^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6d**.

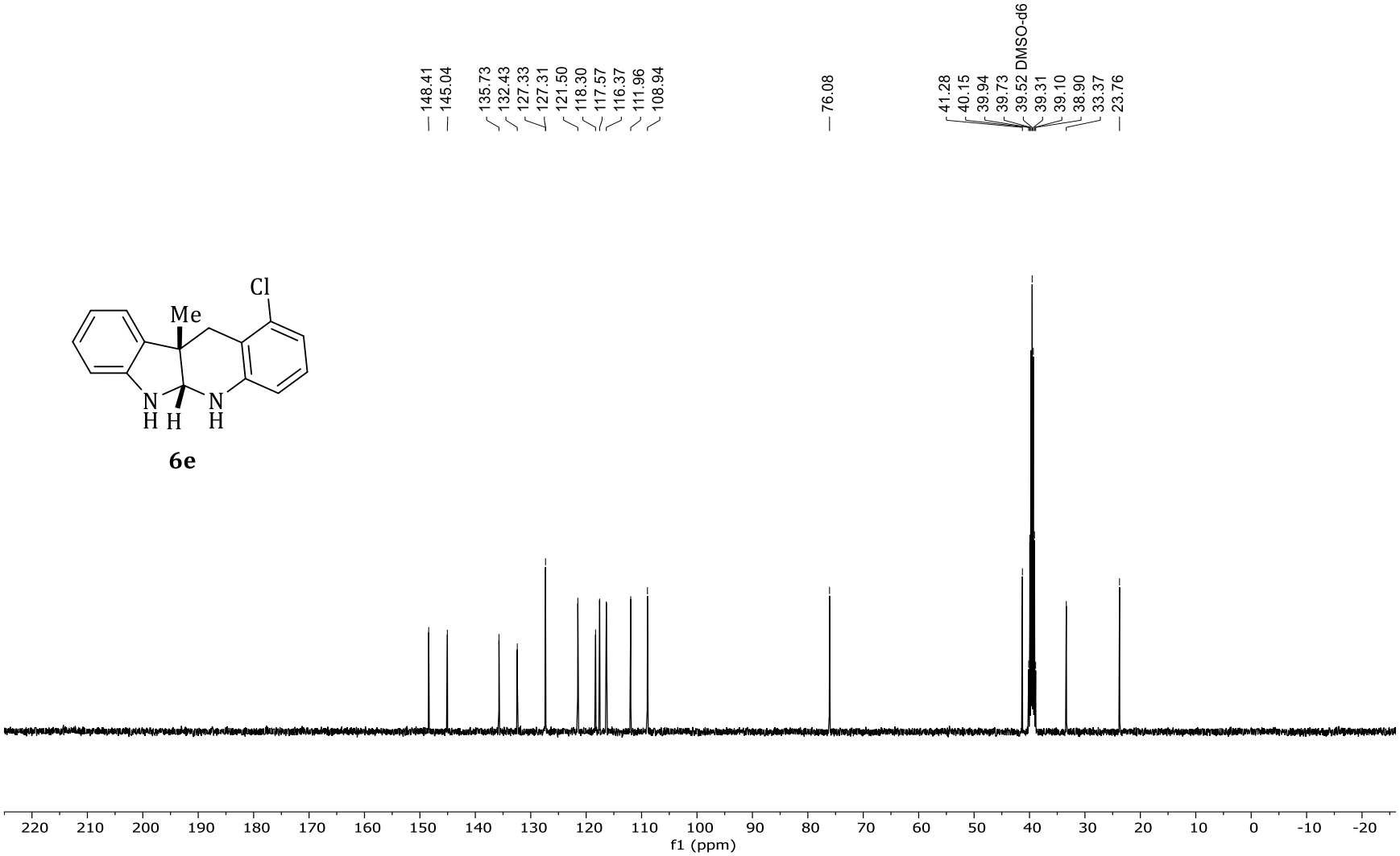


6d

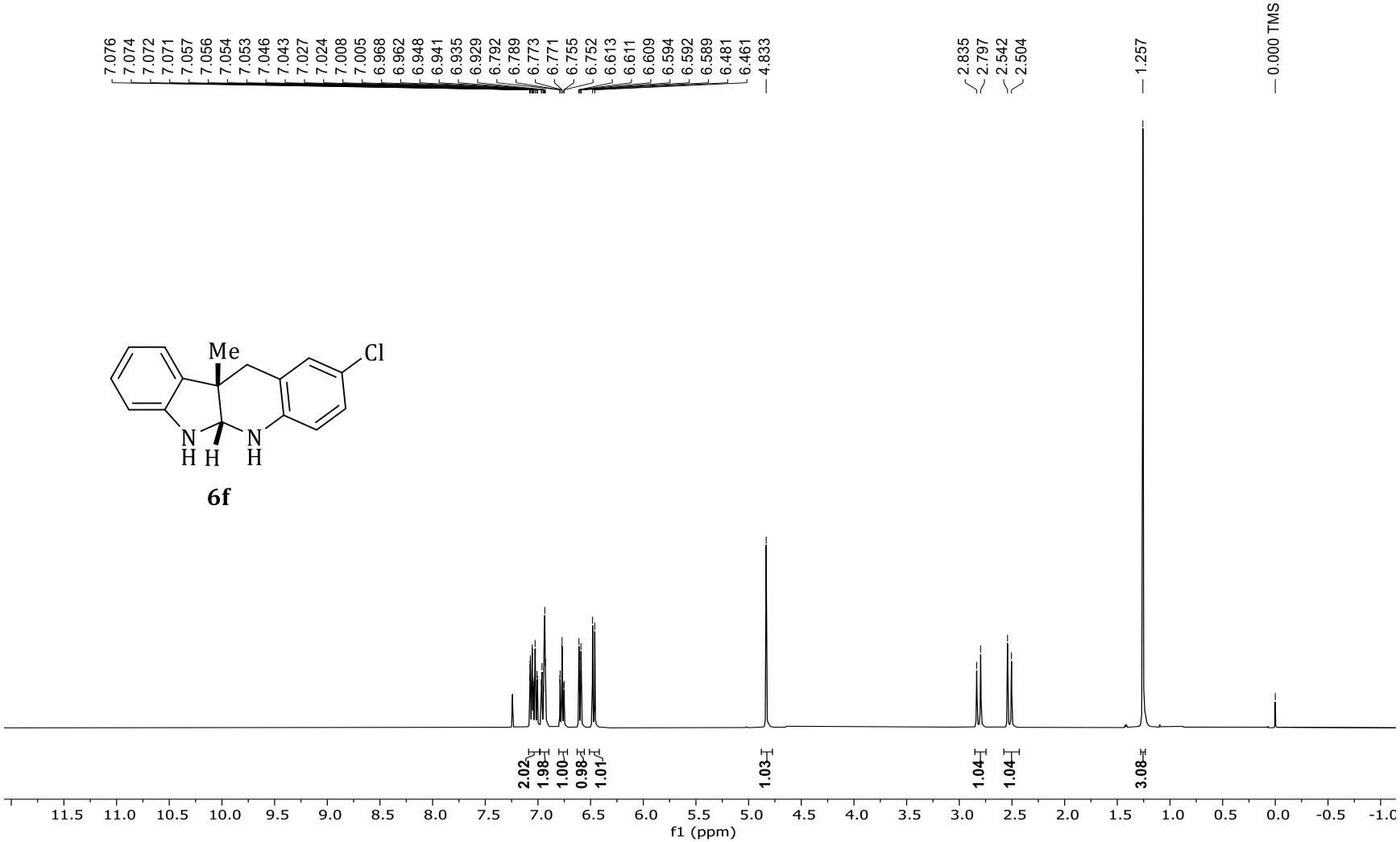
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6d**.



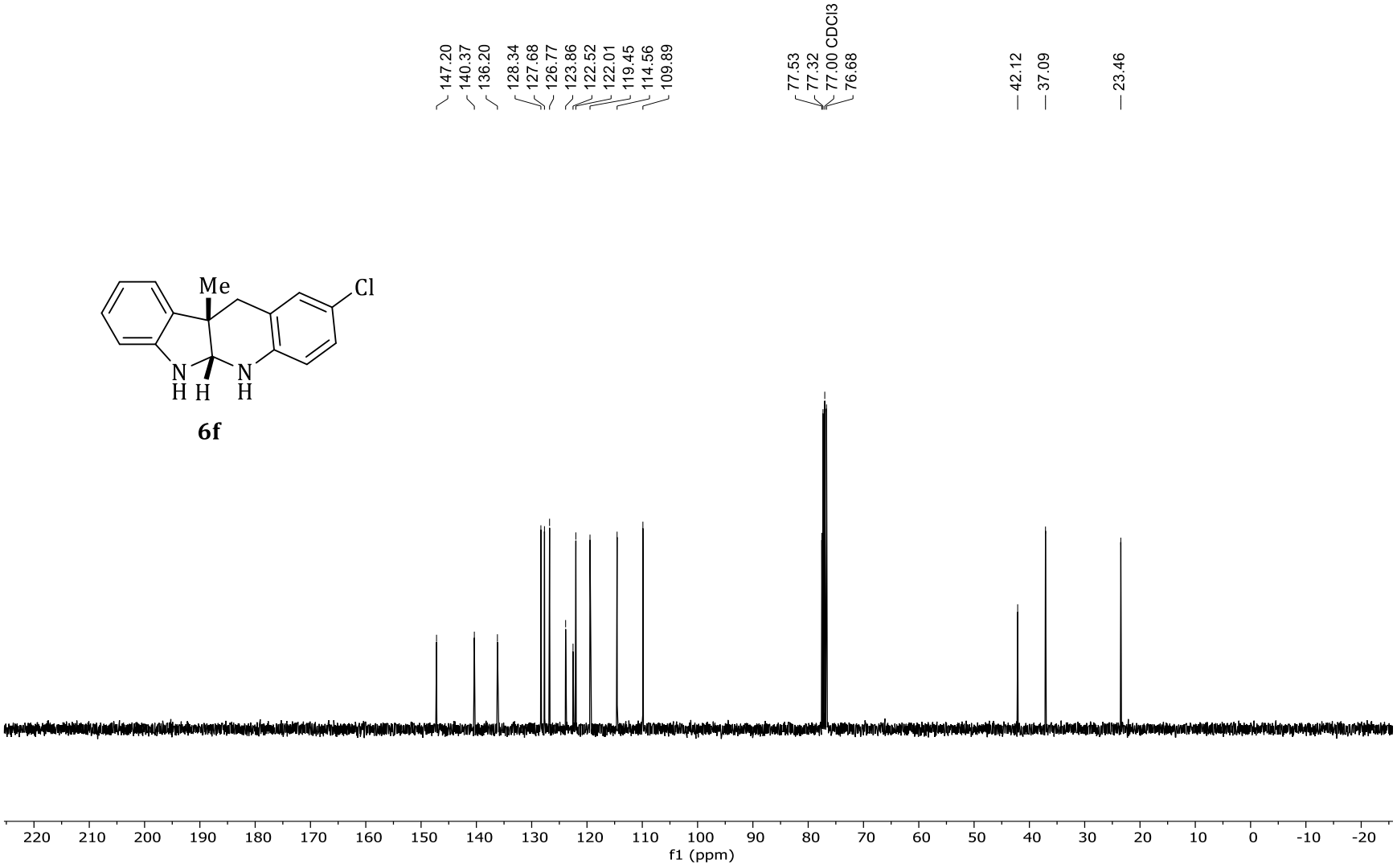
^{1}H NMR spectrum (400 MHz, DMSO-d_6) of **6e**.



$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, DMSO-d_6) of **6e**.



^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6f**.



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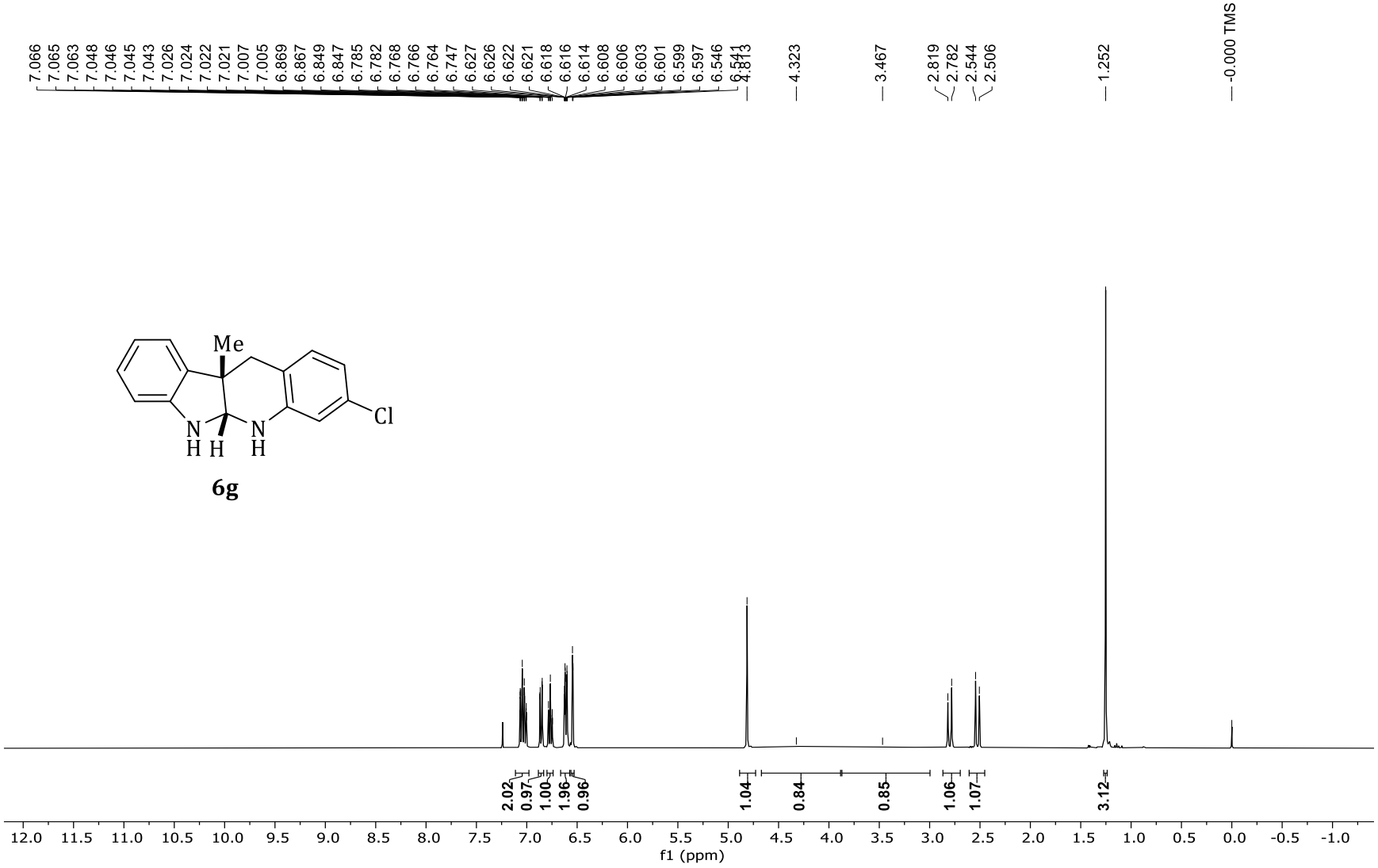
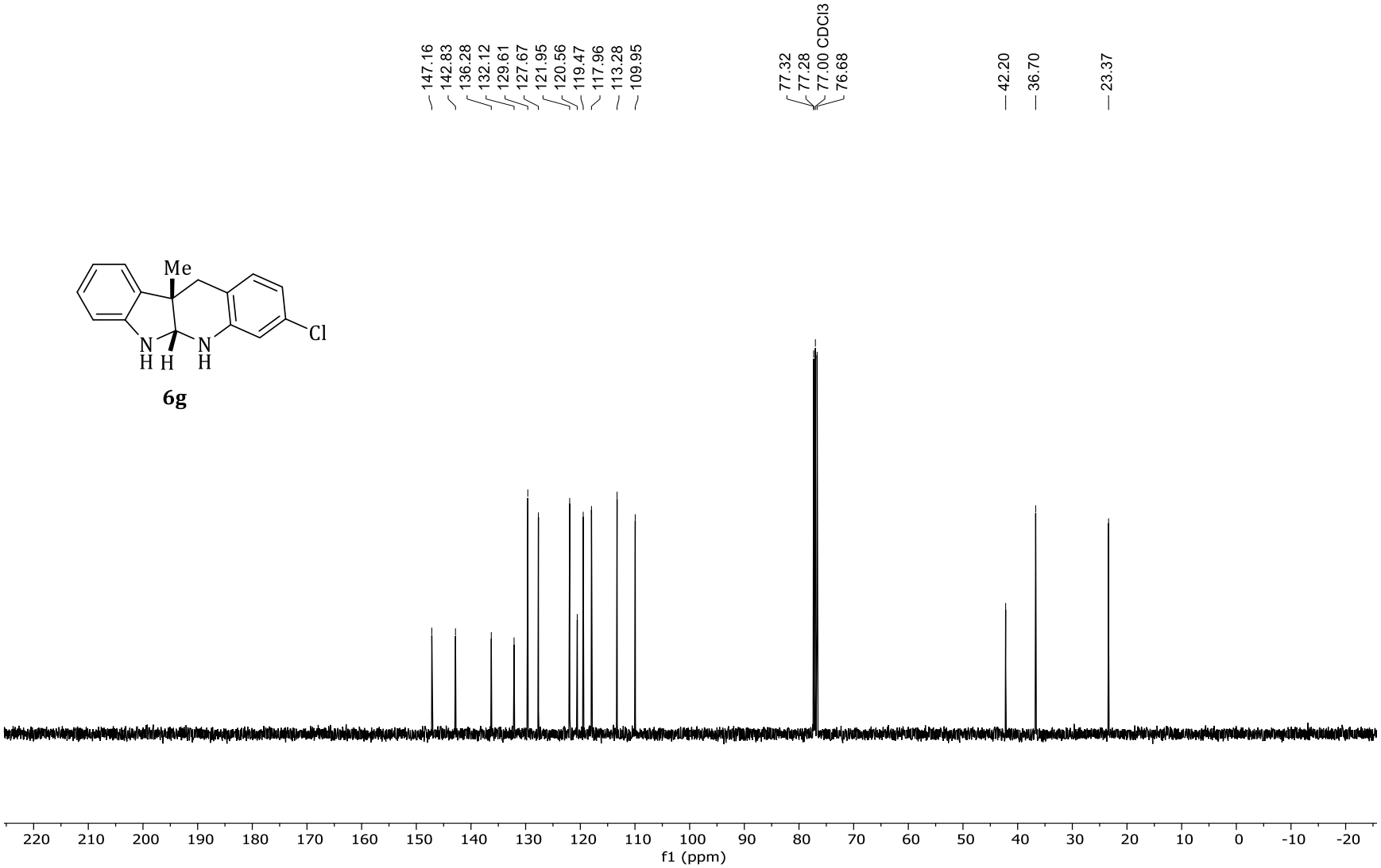
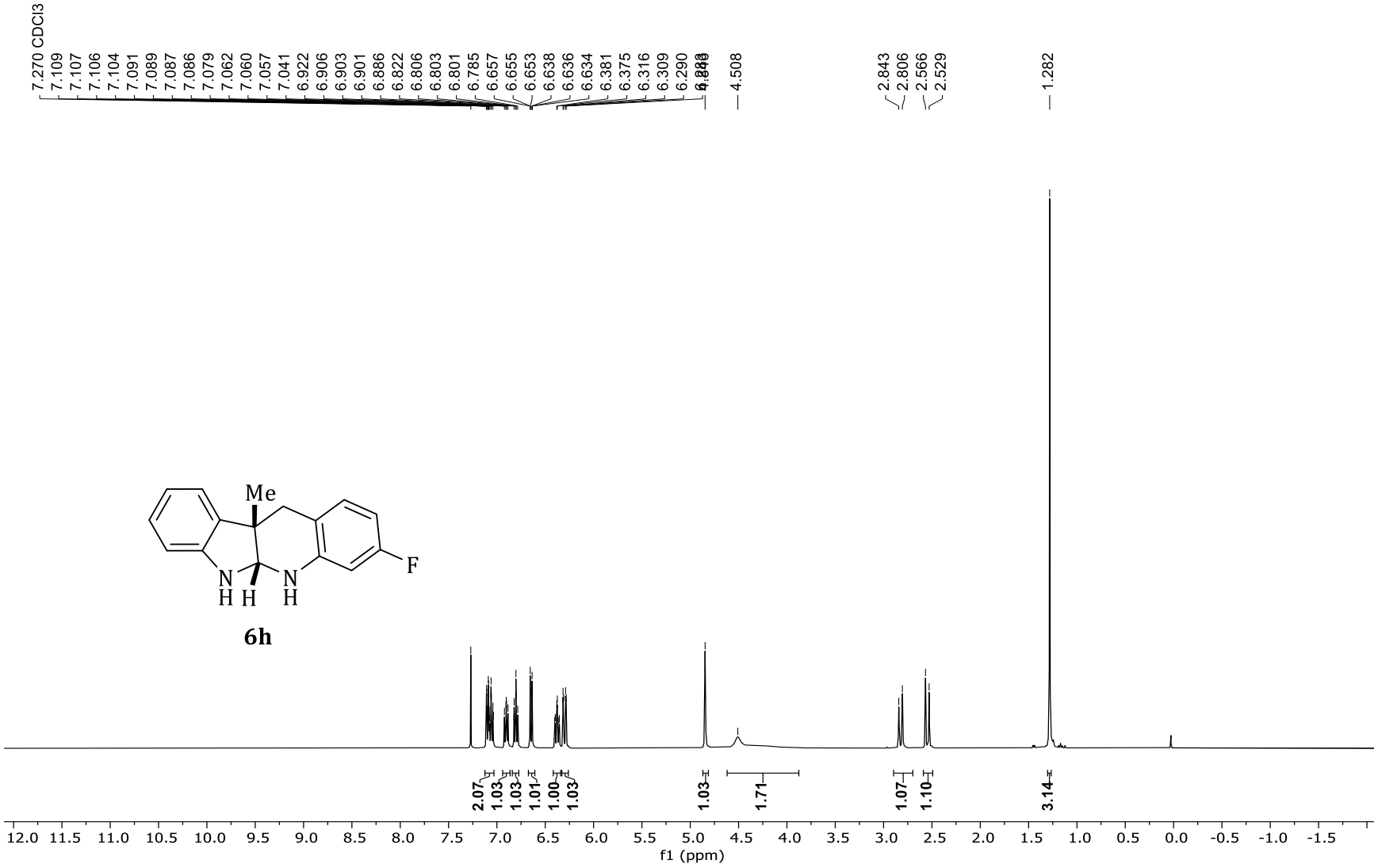


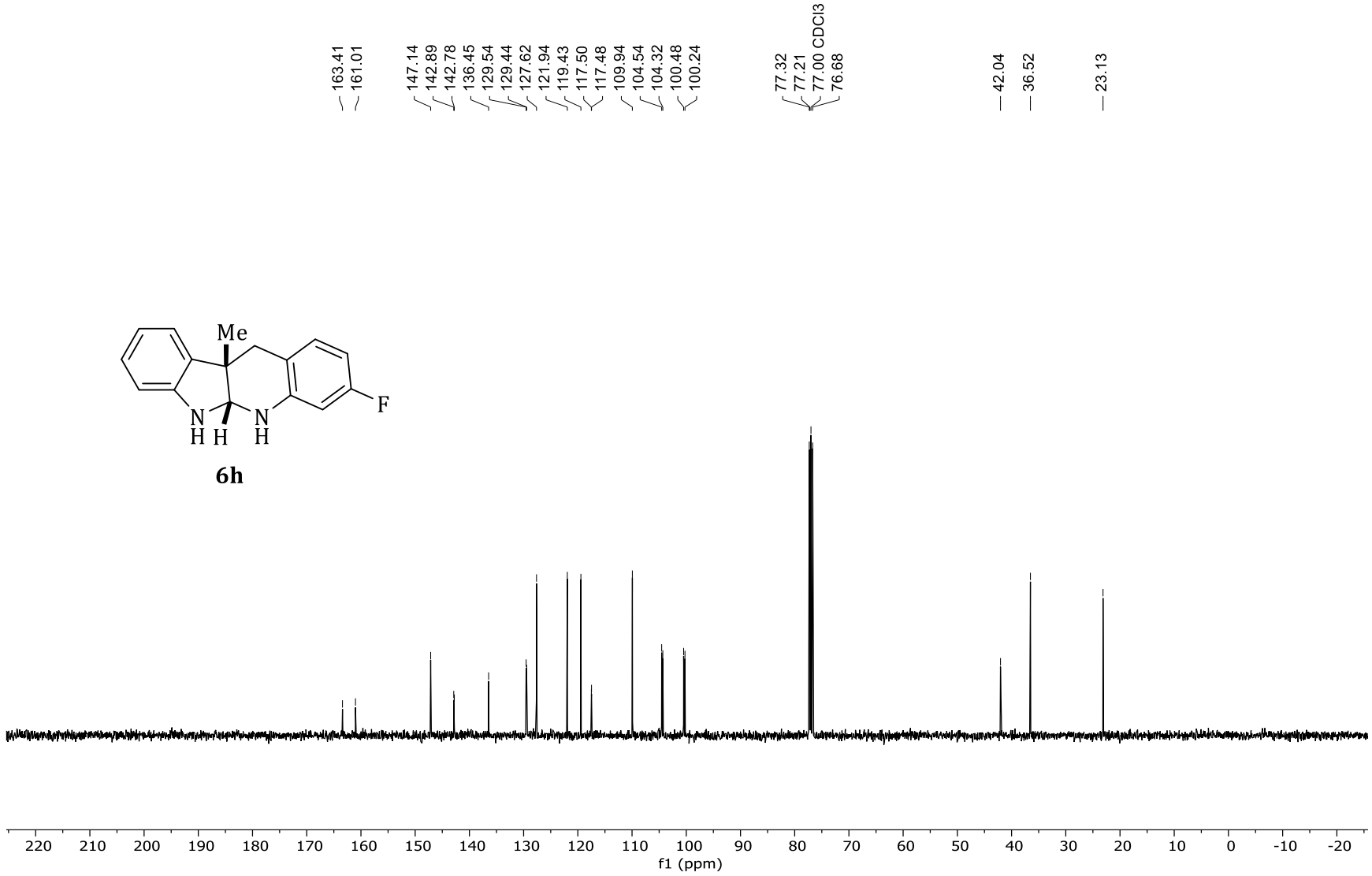
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6g**.



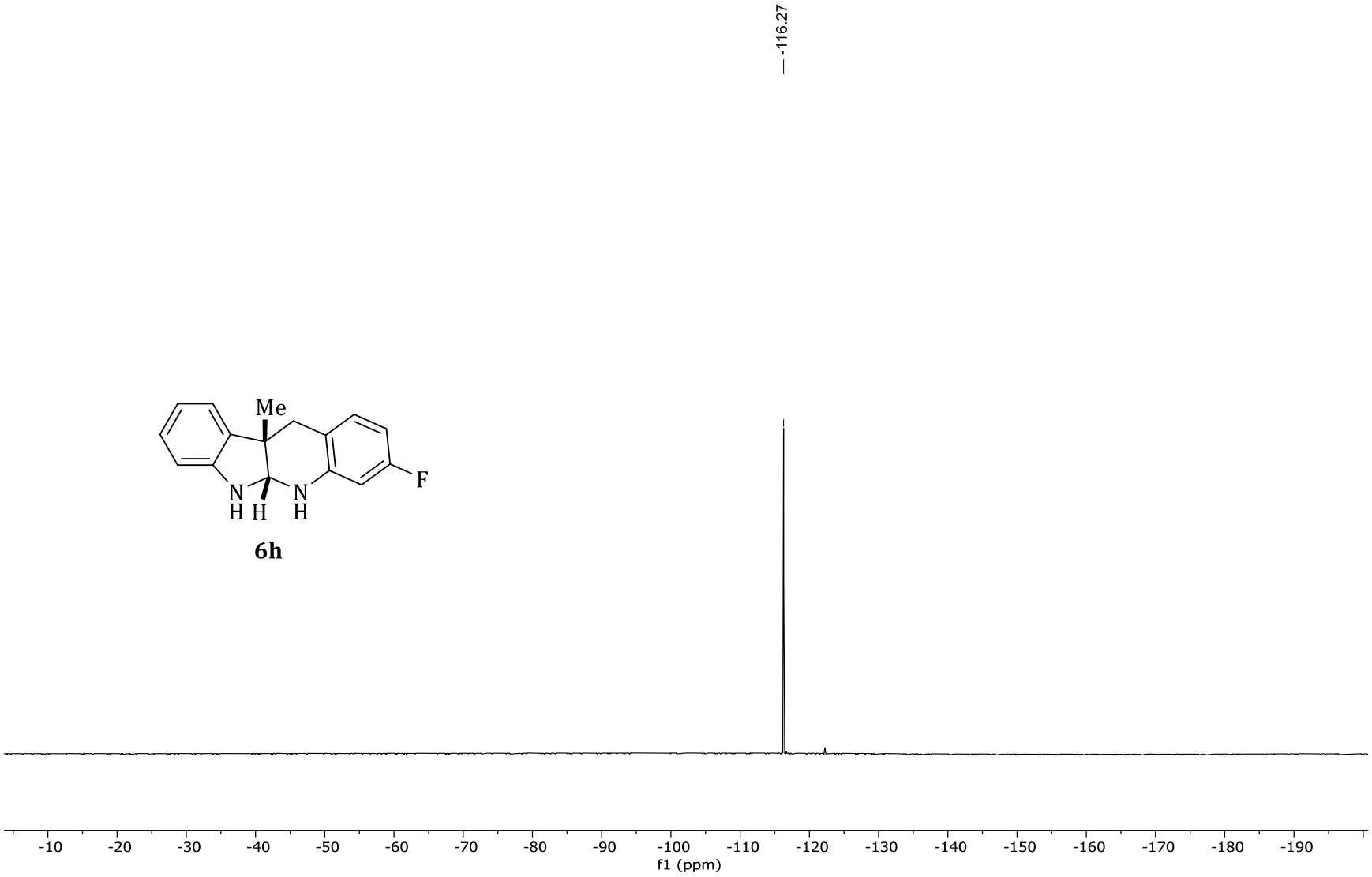
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6g**.



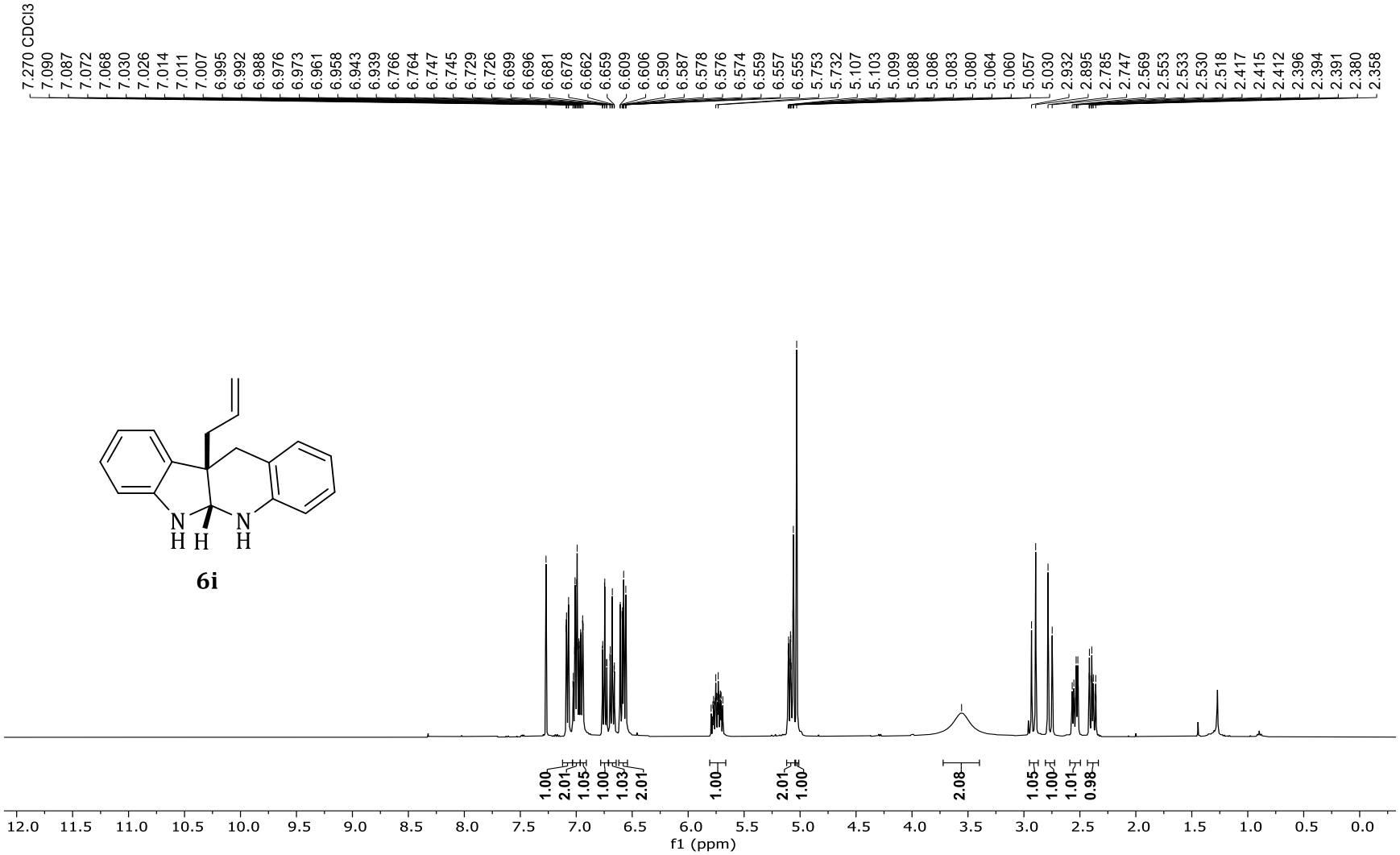
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6h**.



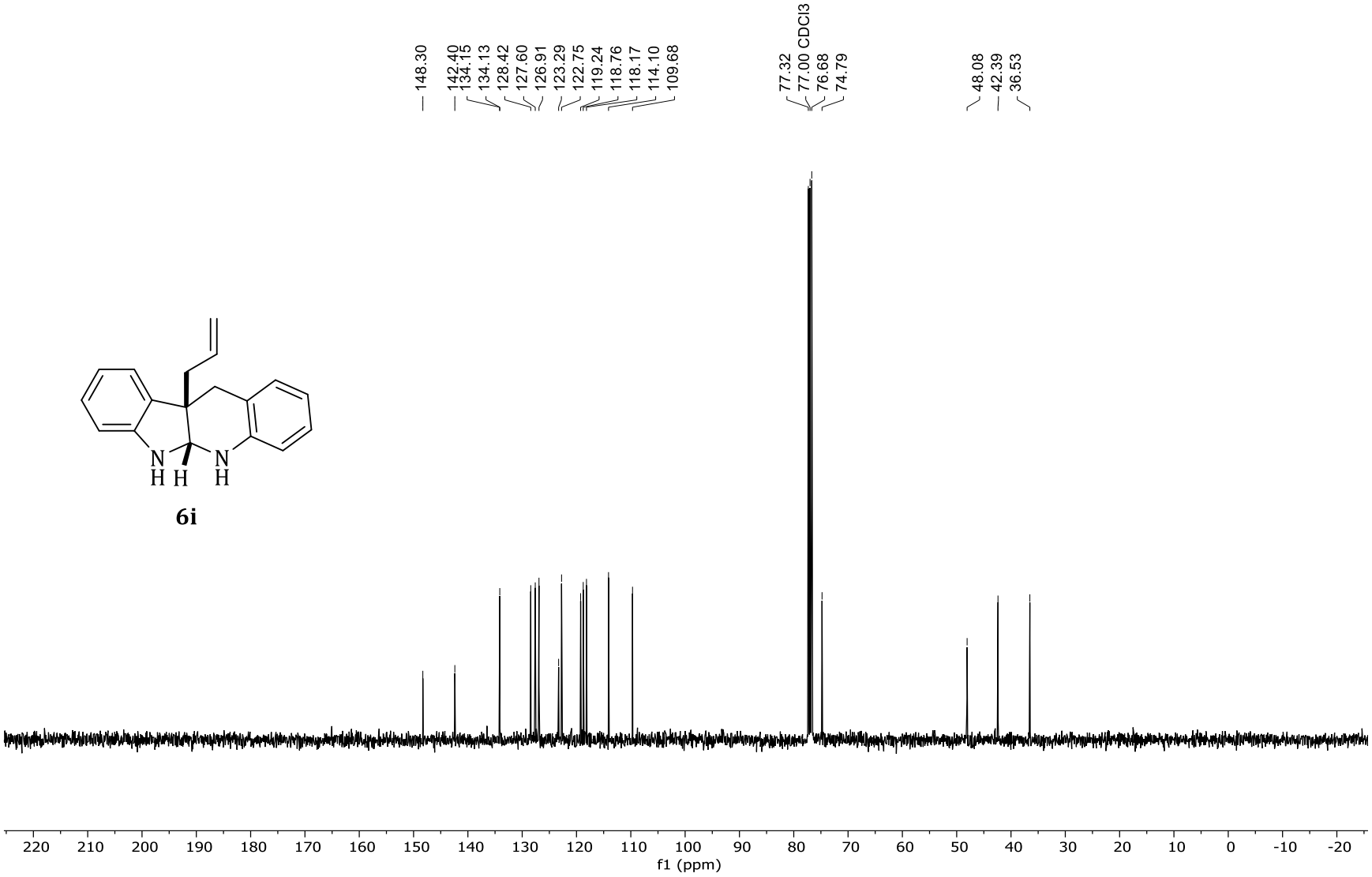
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6h**.



^{19}F NMR spectrum (376 MHz, $CDCl_3$) of **6h**.

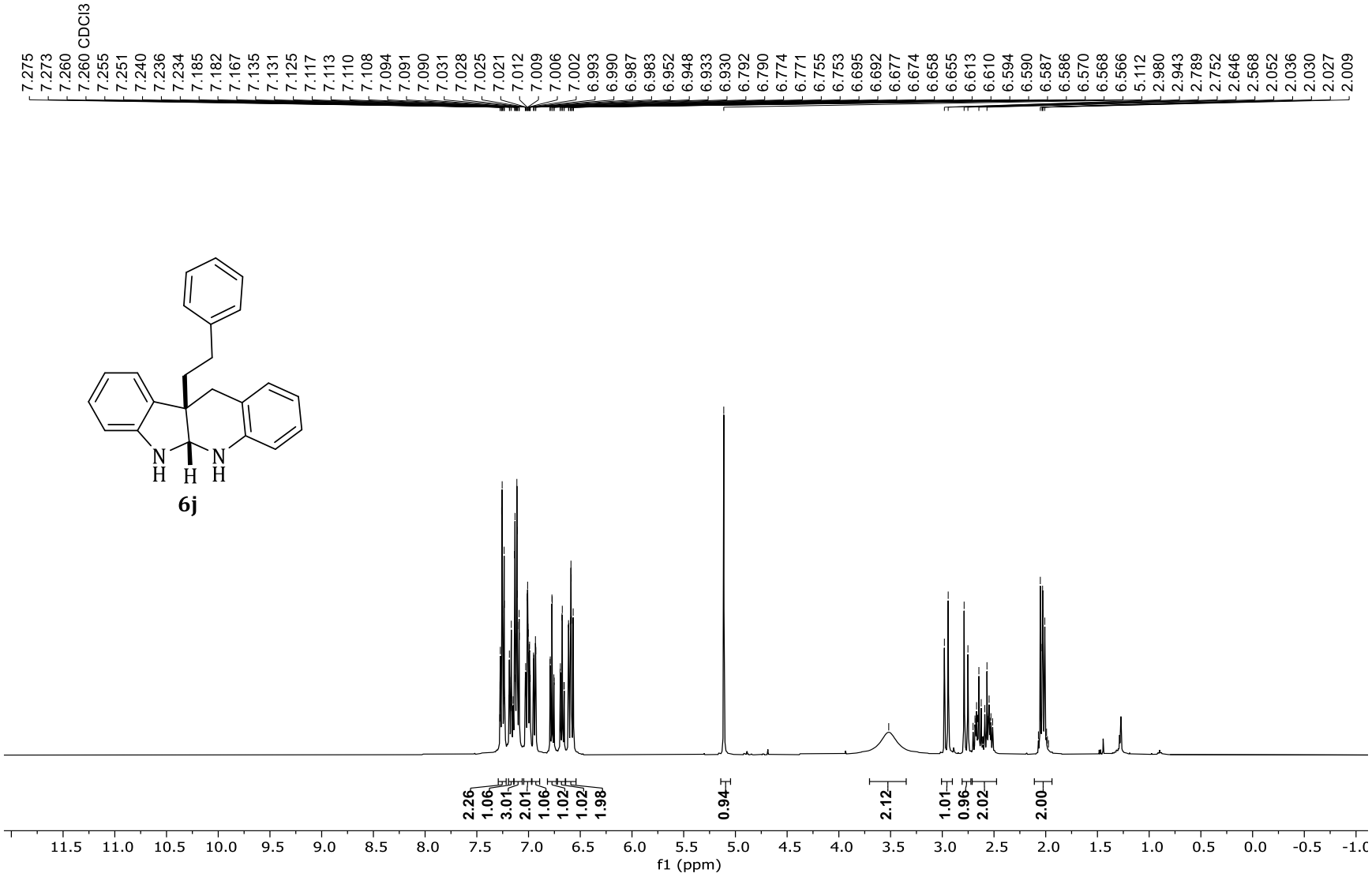


^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6i**.

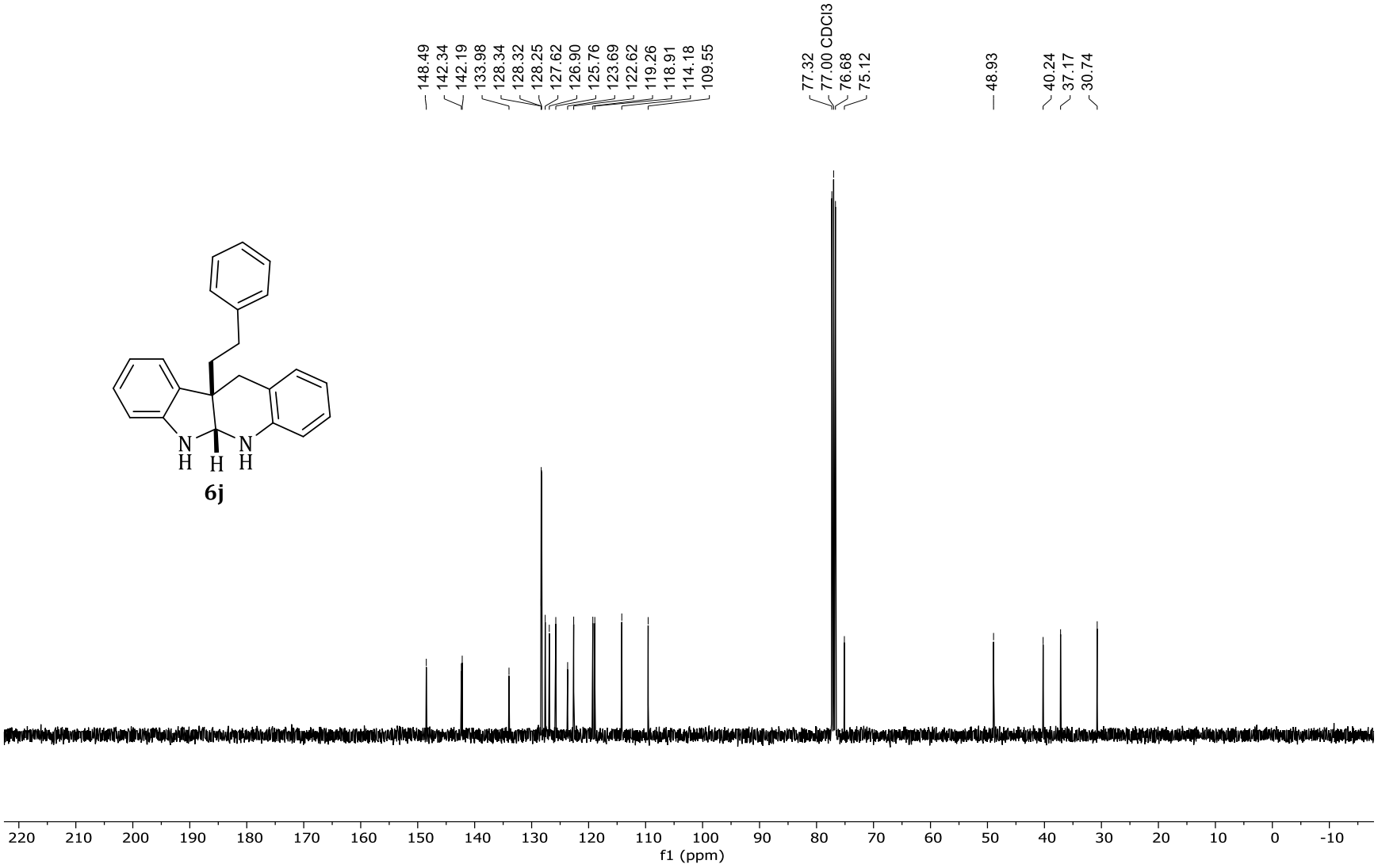


6i

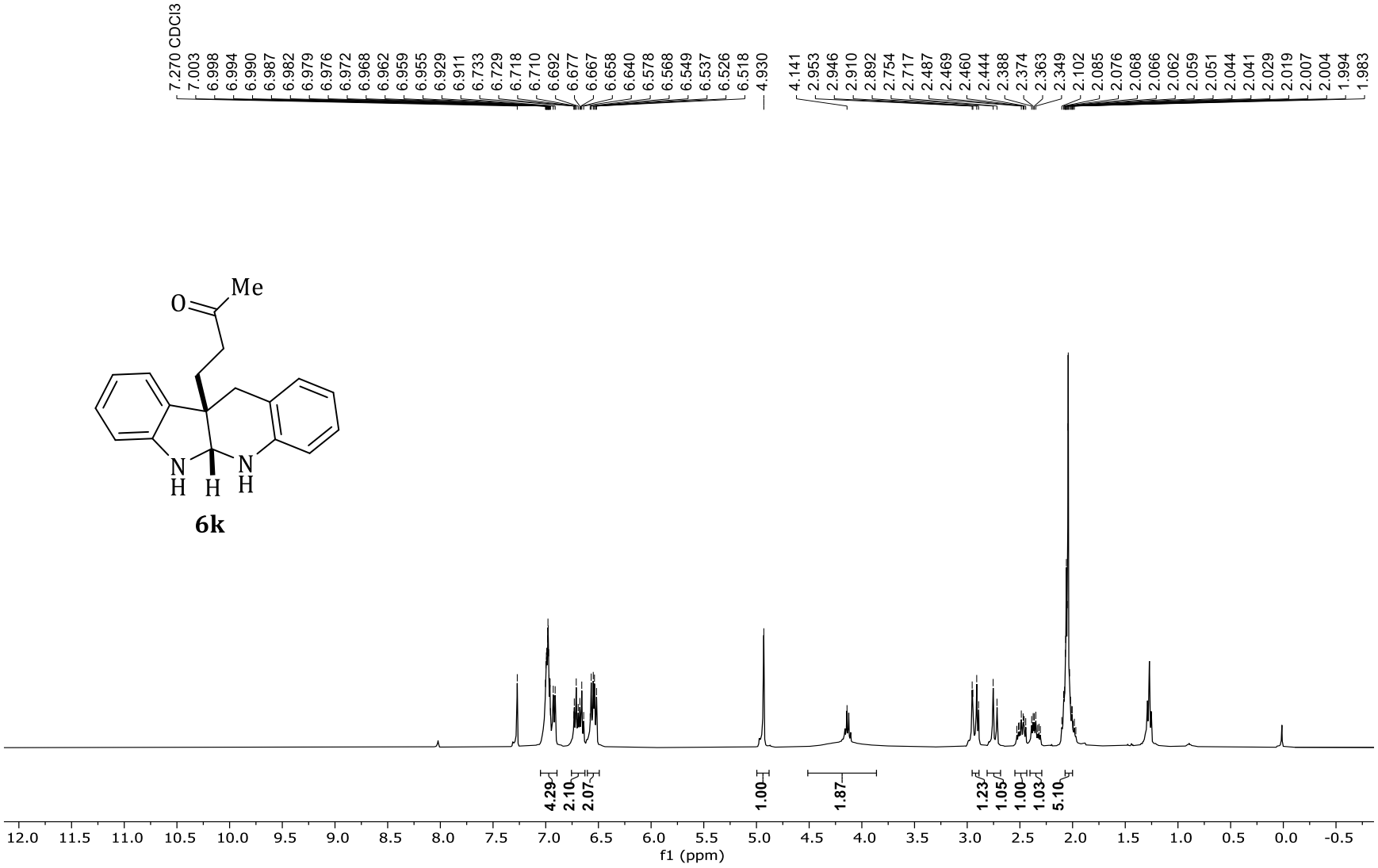
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6i**.



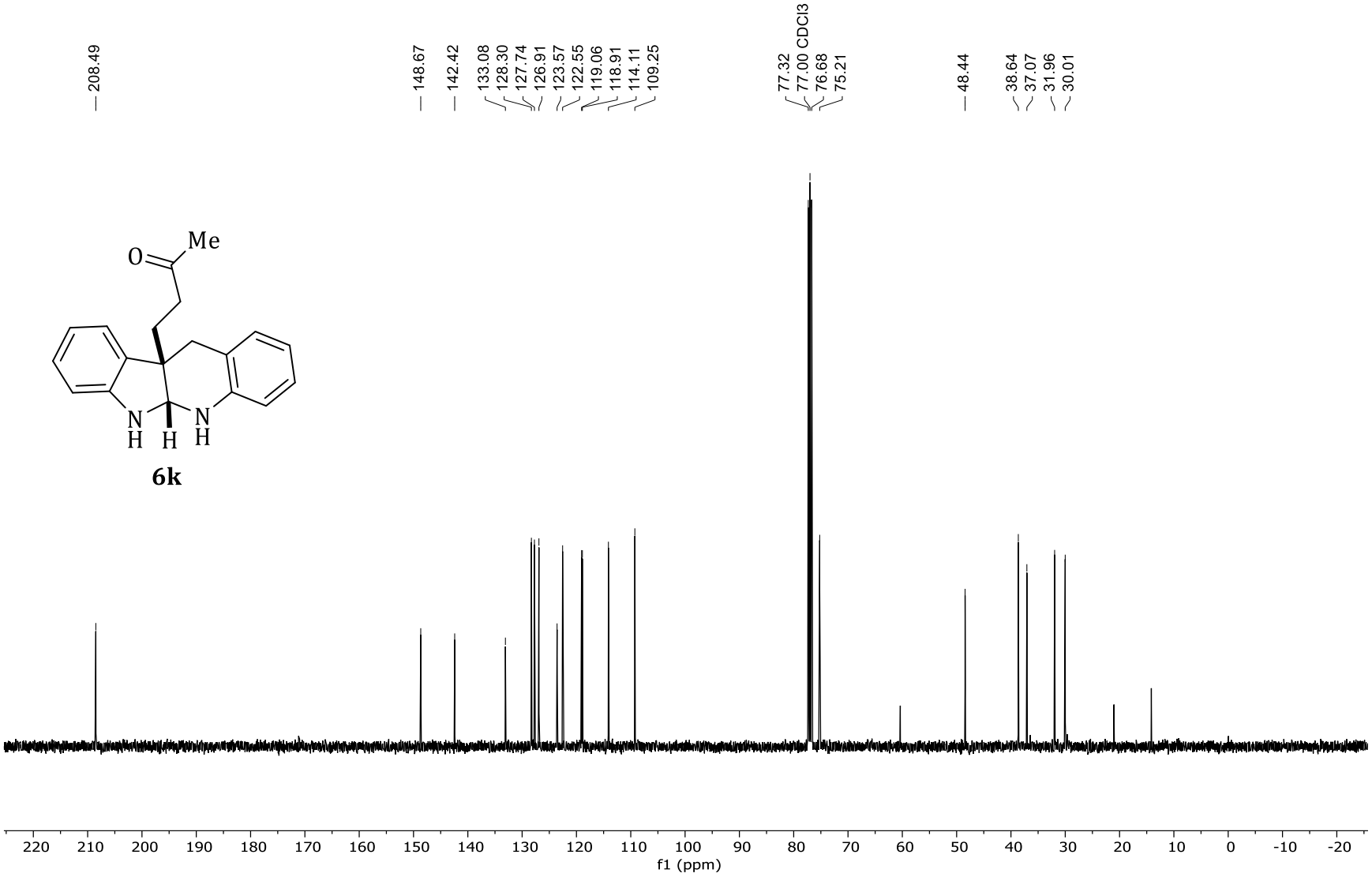
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6j**.



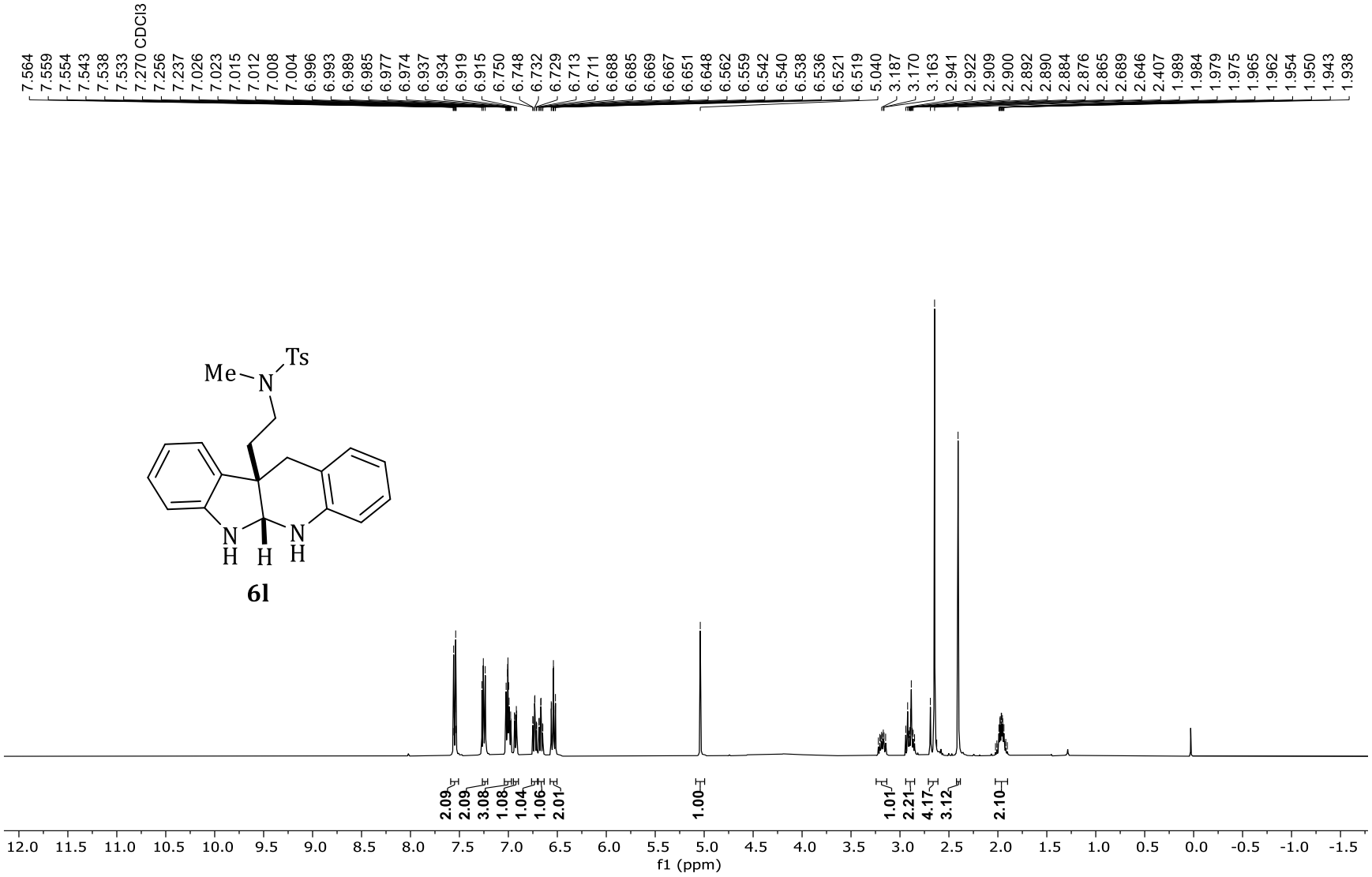
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6j**.



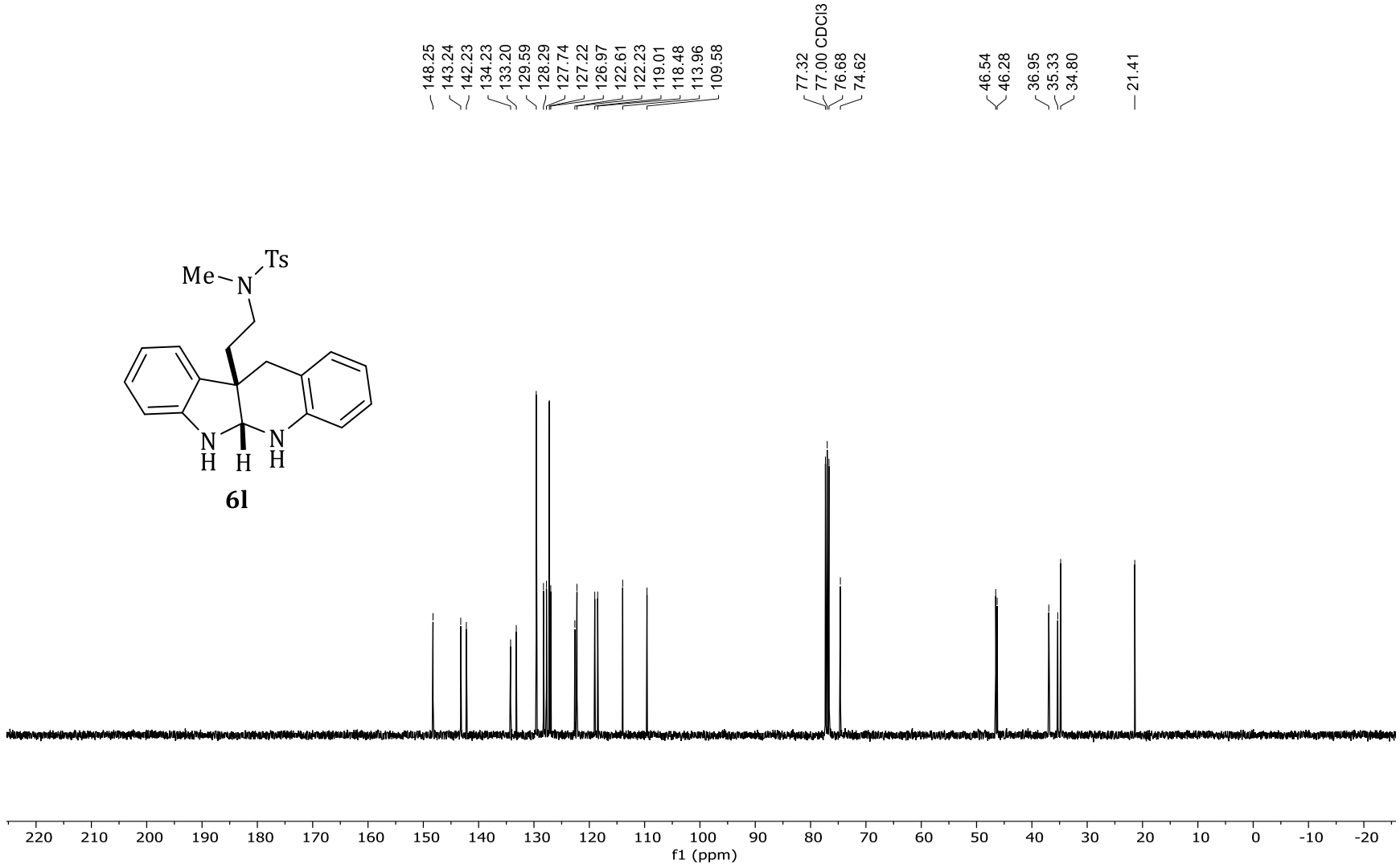
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6k**.



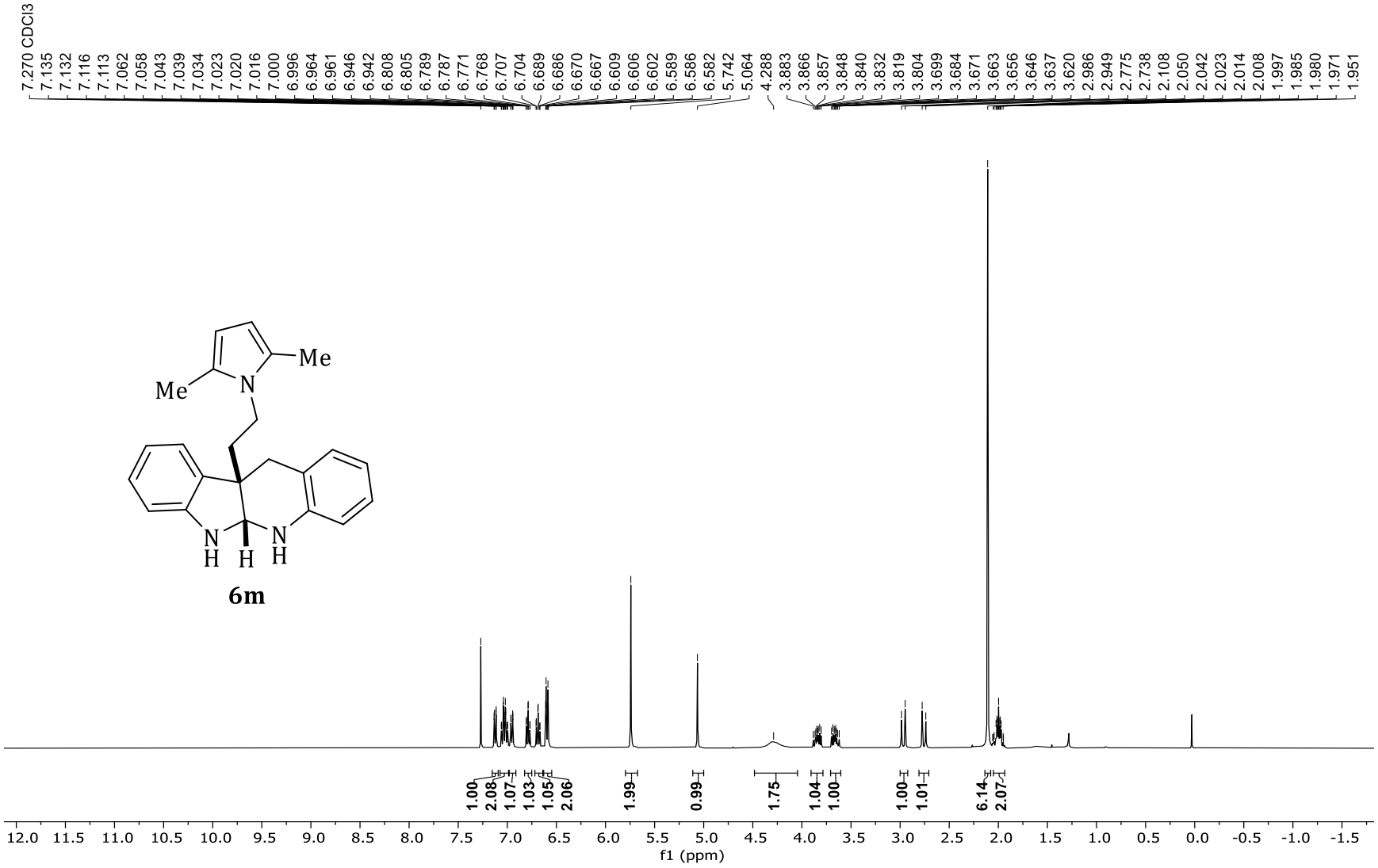
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6k**.



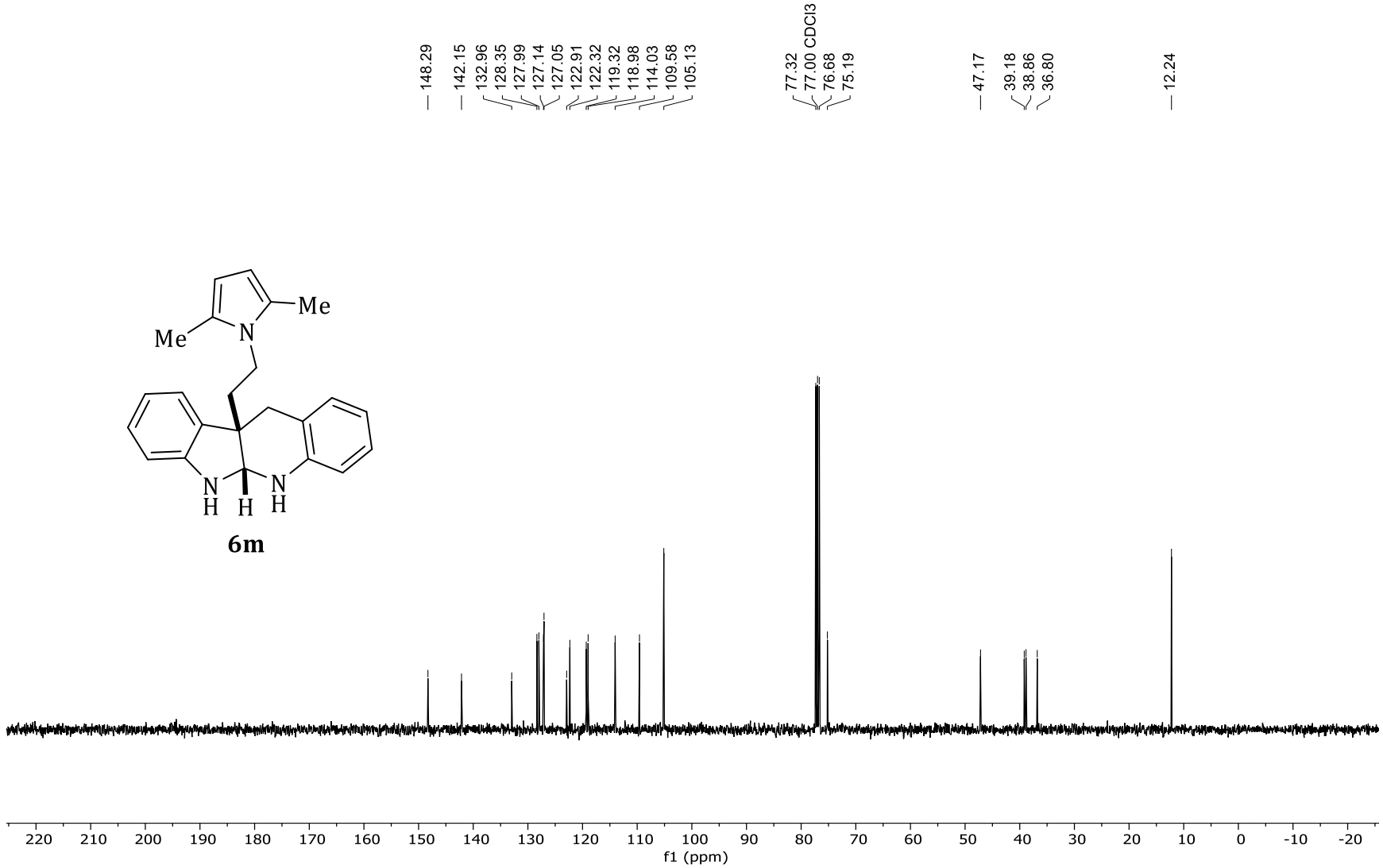
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6l**.



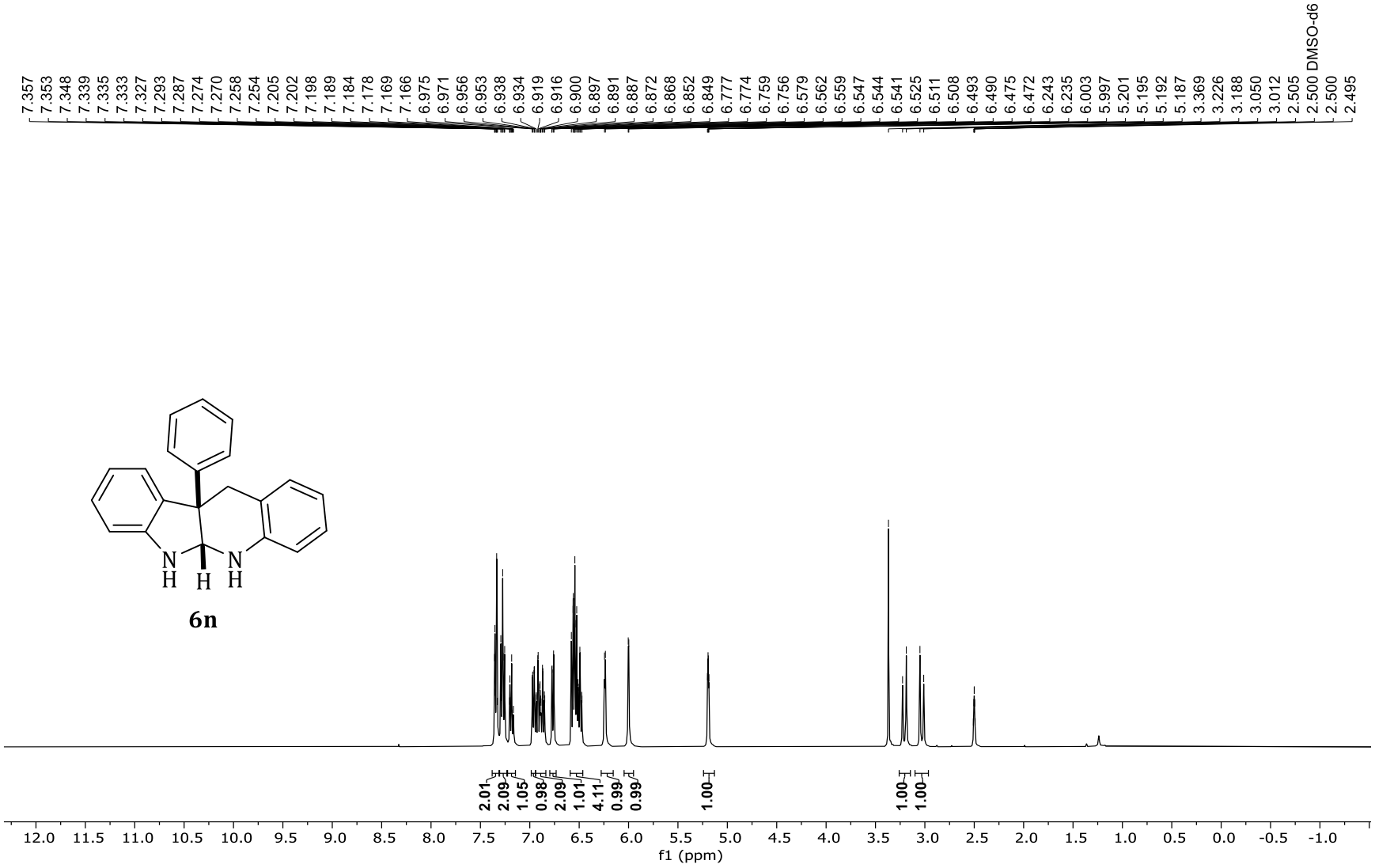
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6l**.



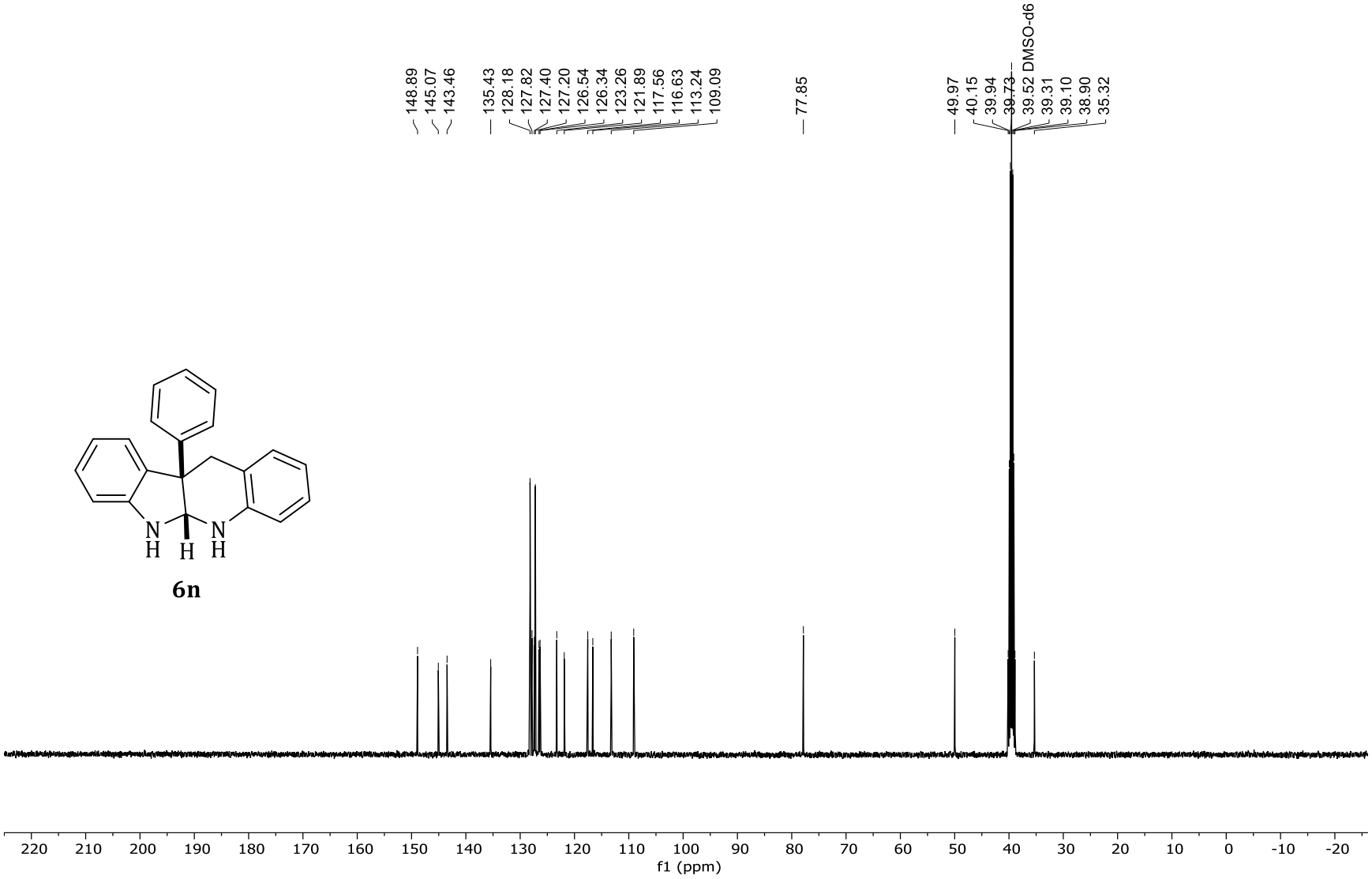
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6m**.



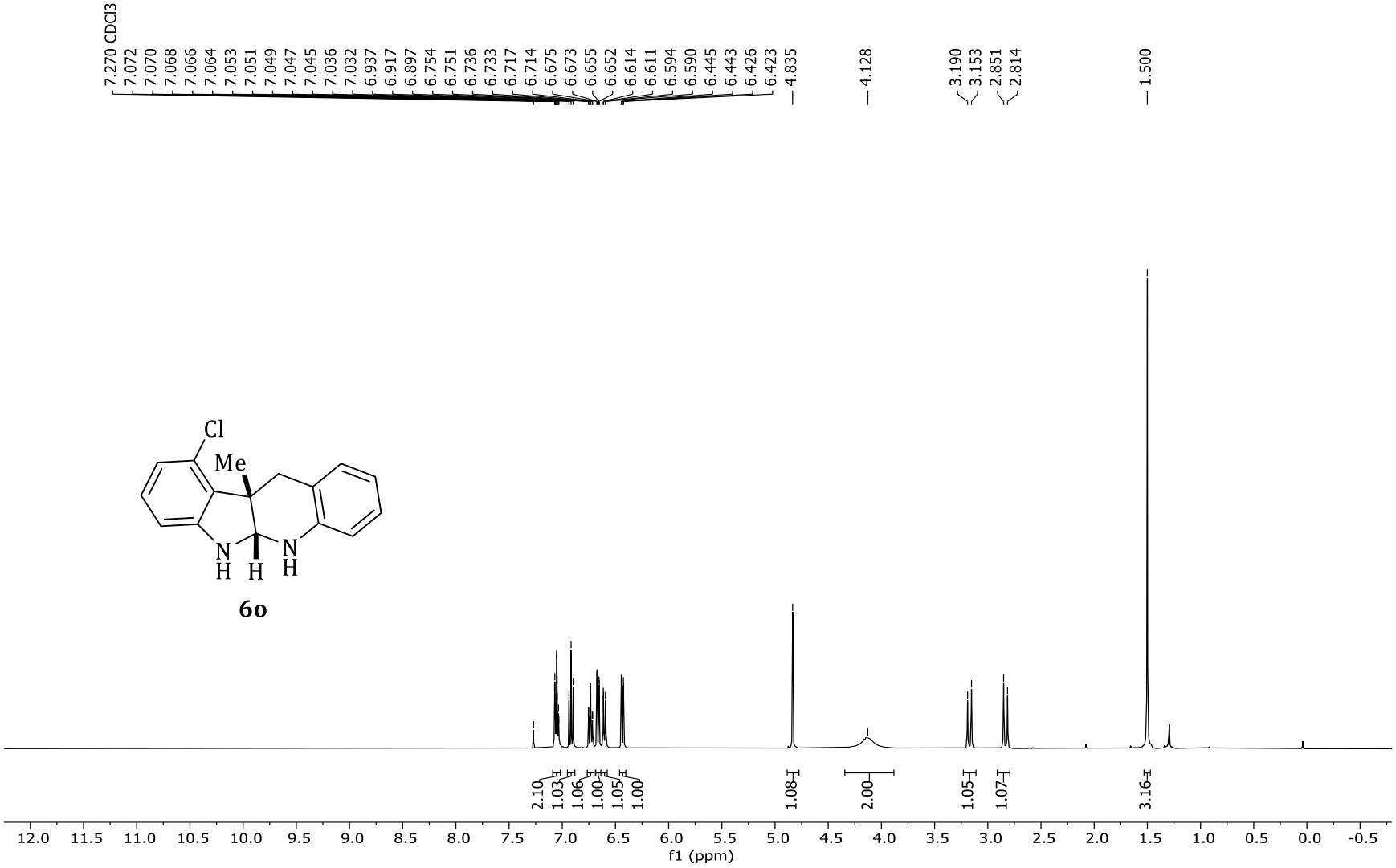
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6m**.



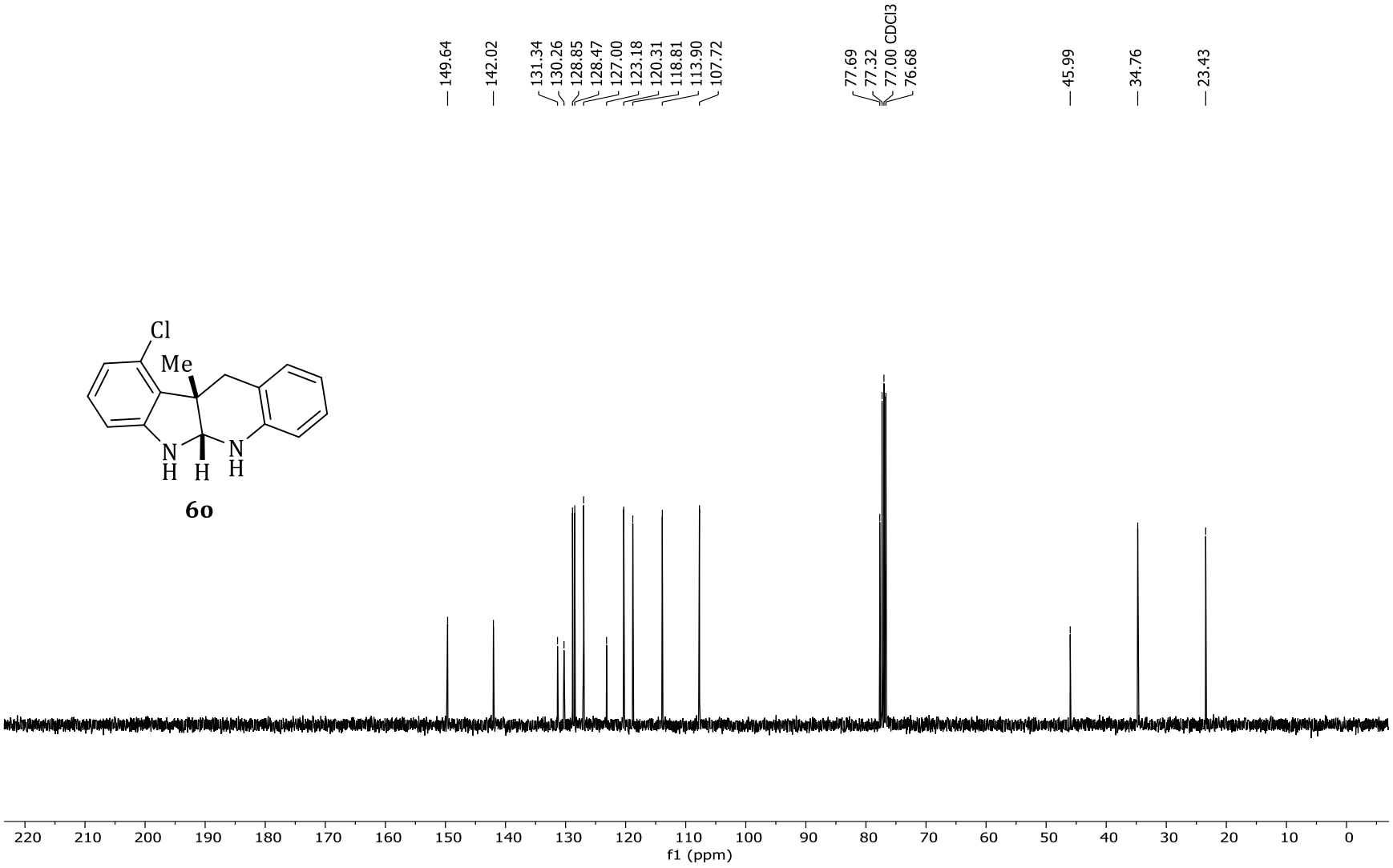
^{1}H NMR spectrum (400 MHz, DMSO-d_6) of **6n**.



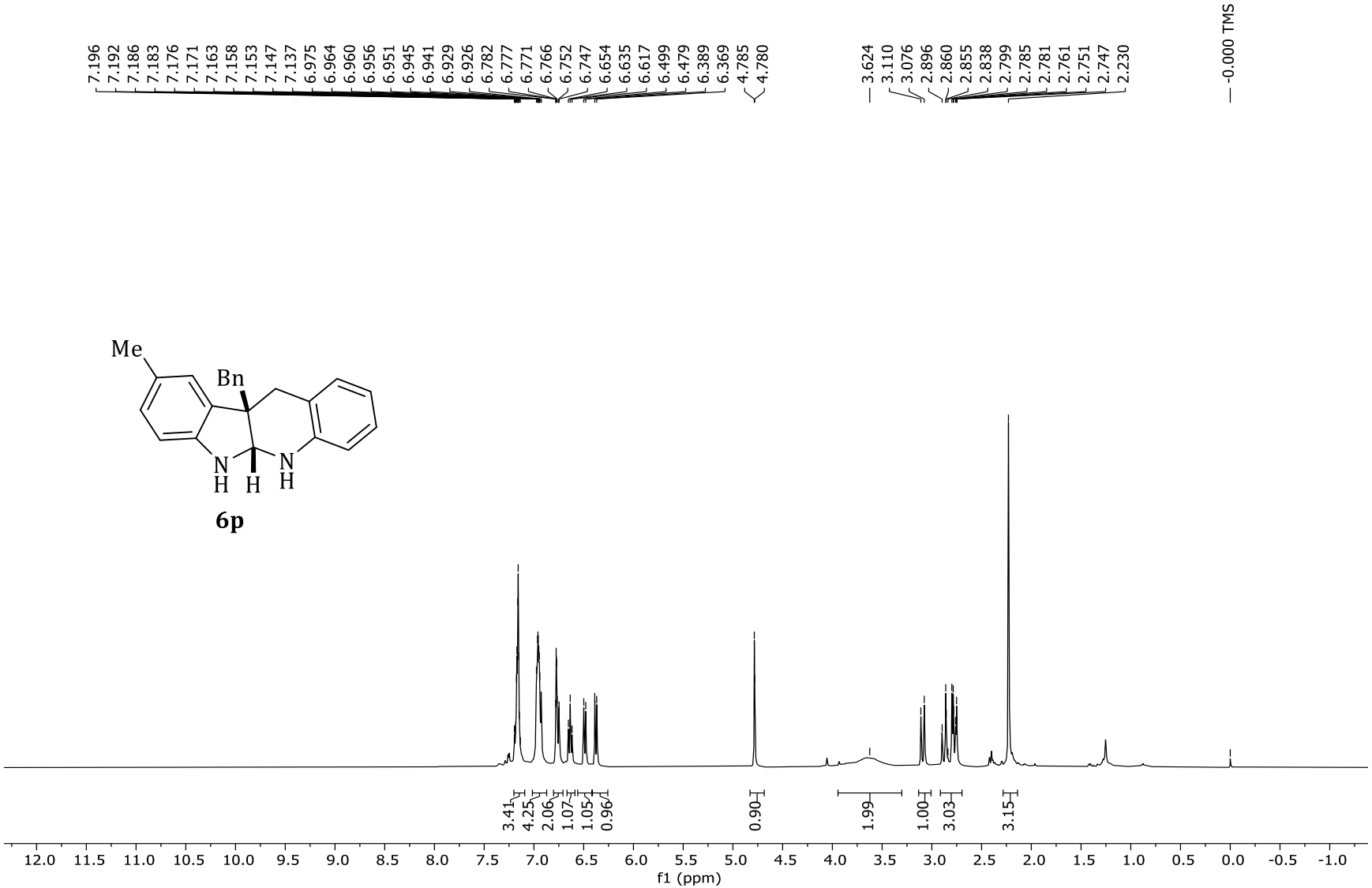
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, DMSO-d_6) of **6n**.



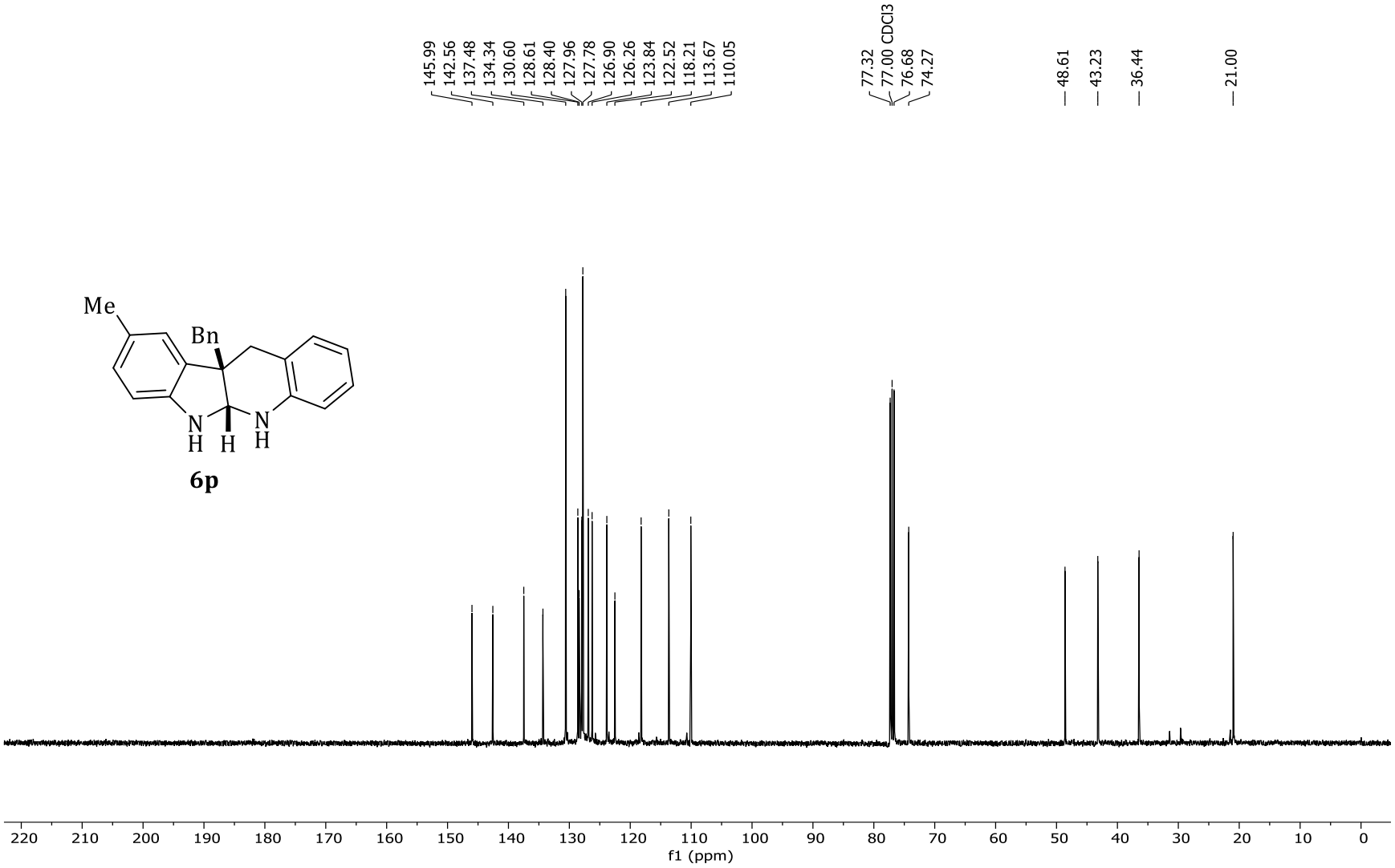
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6o**.



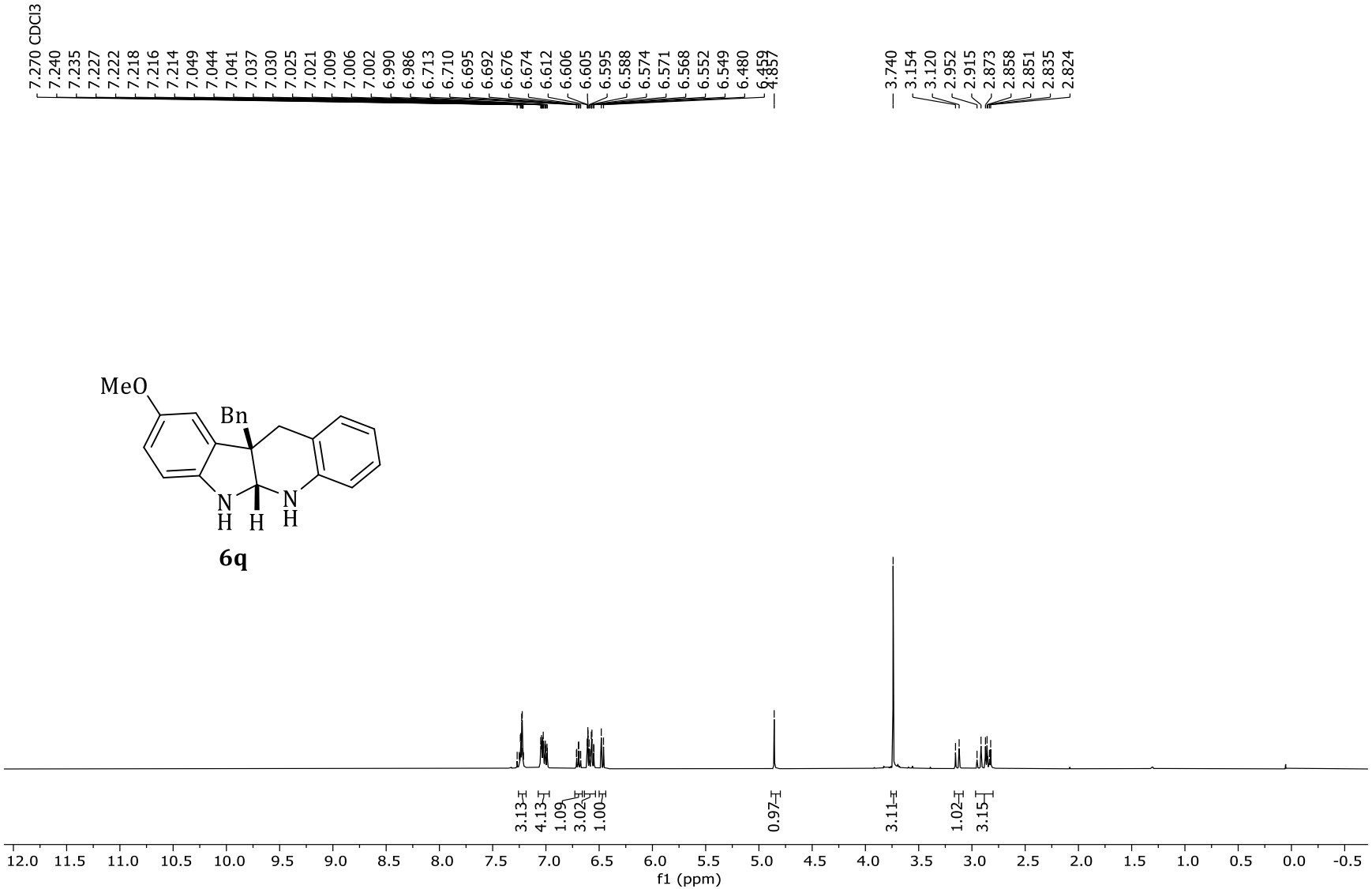
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6o**.



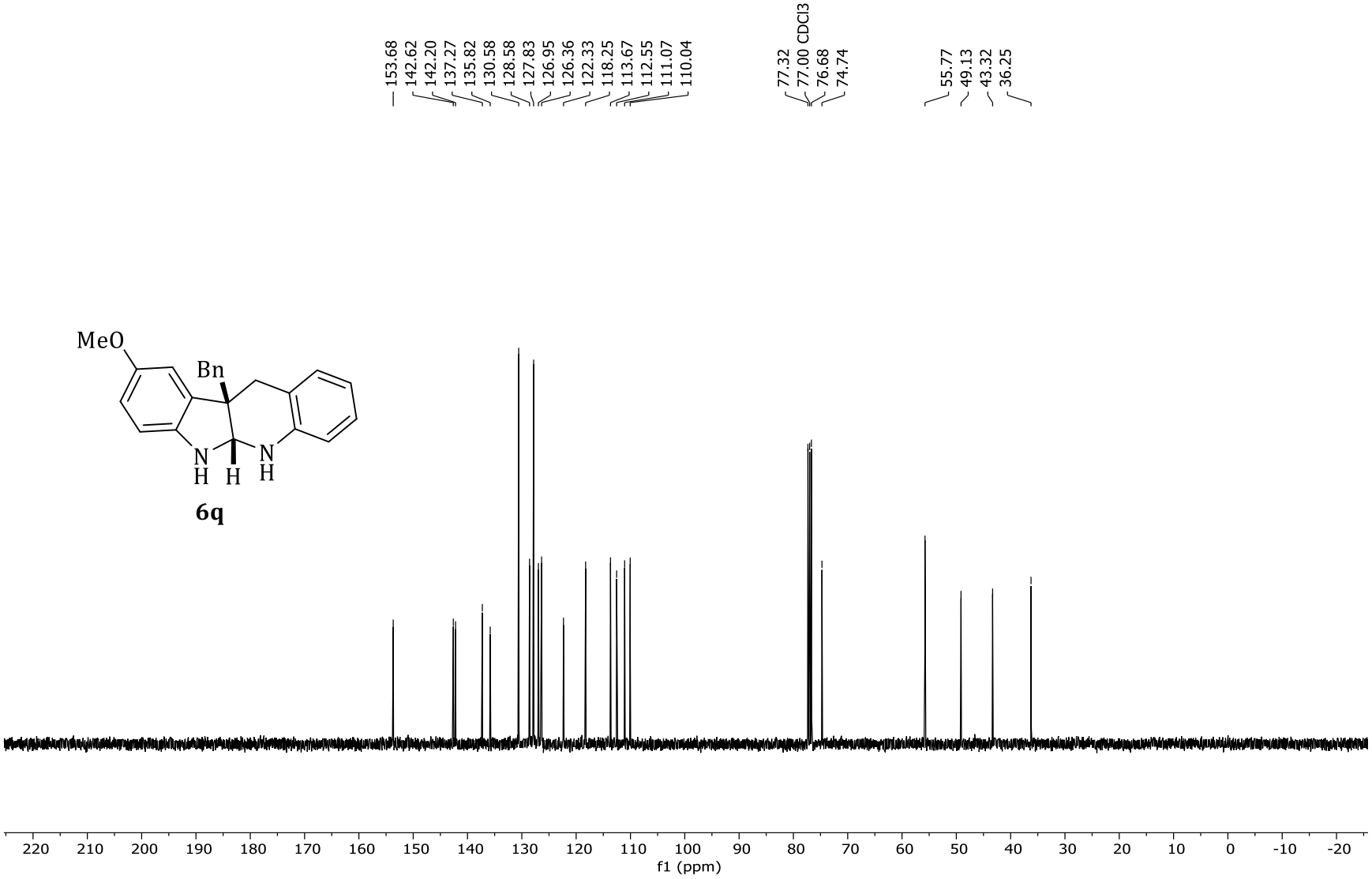
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6p**.



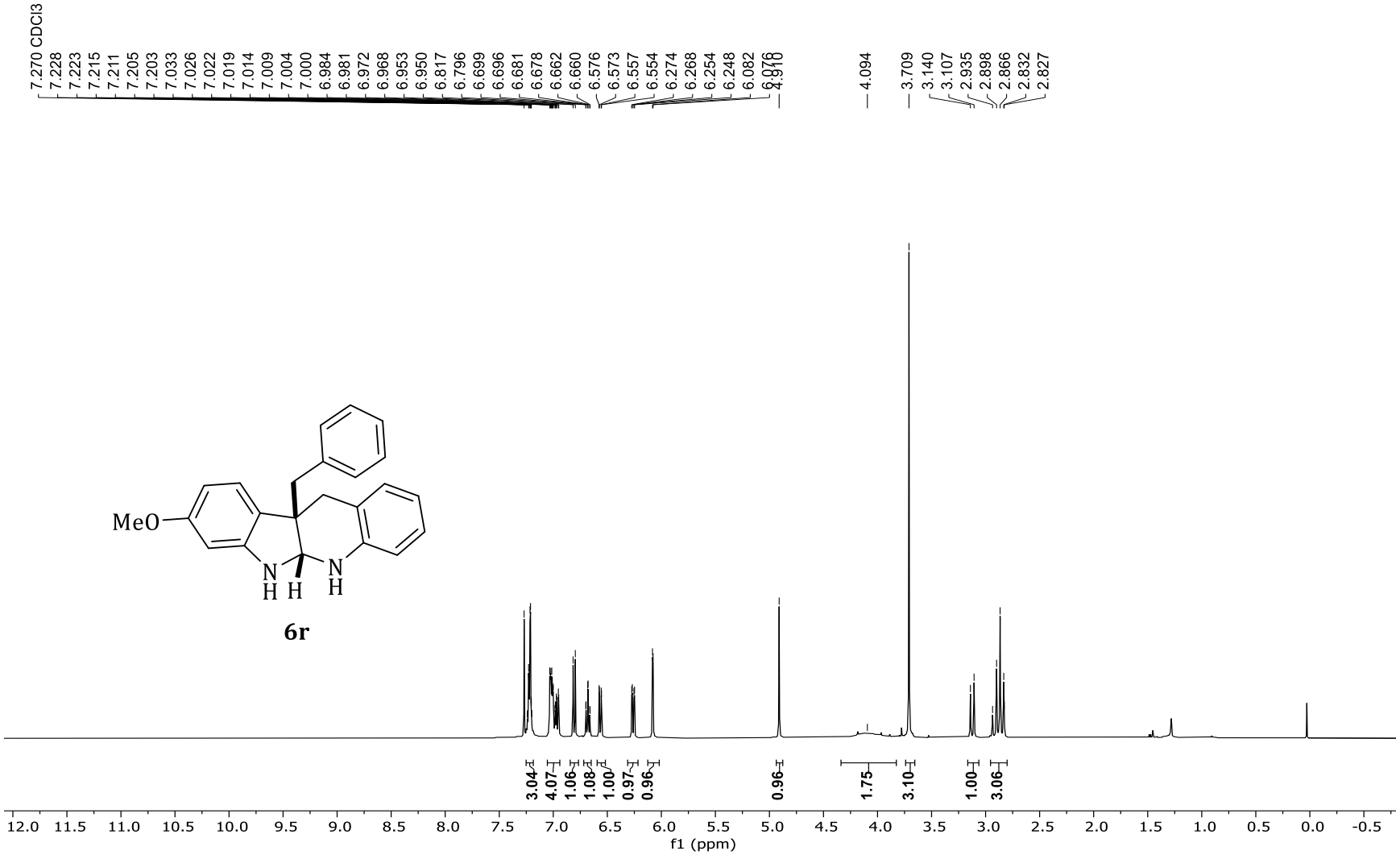
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6p**.



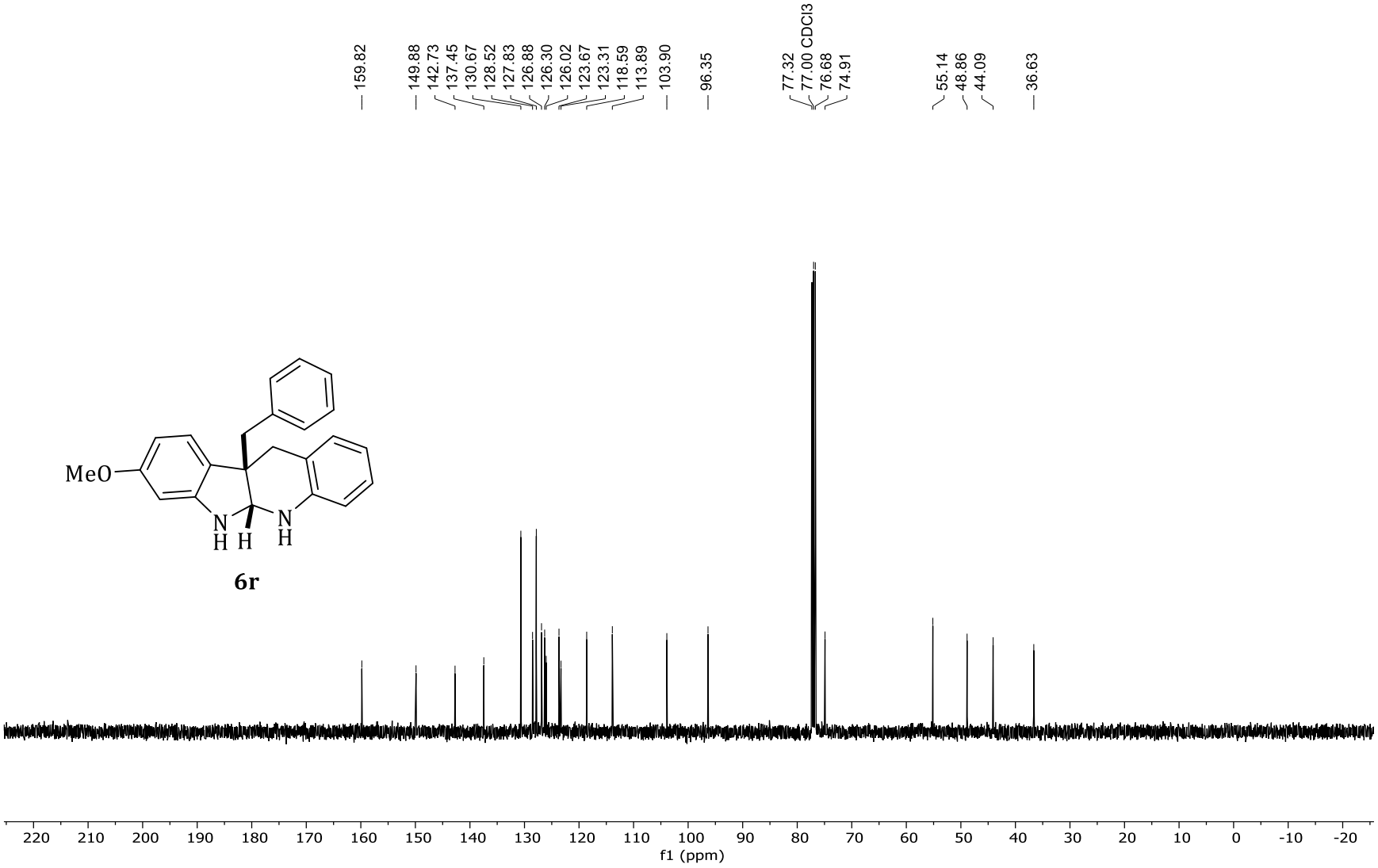
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6q**.



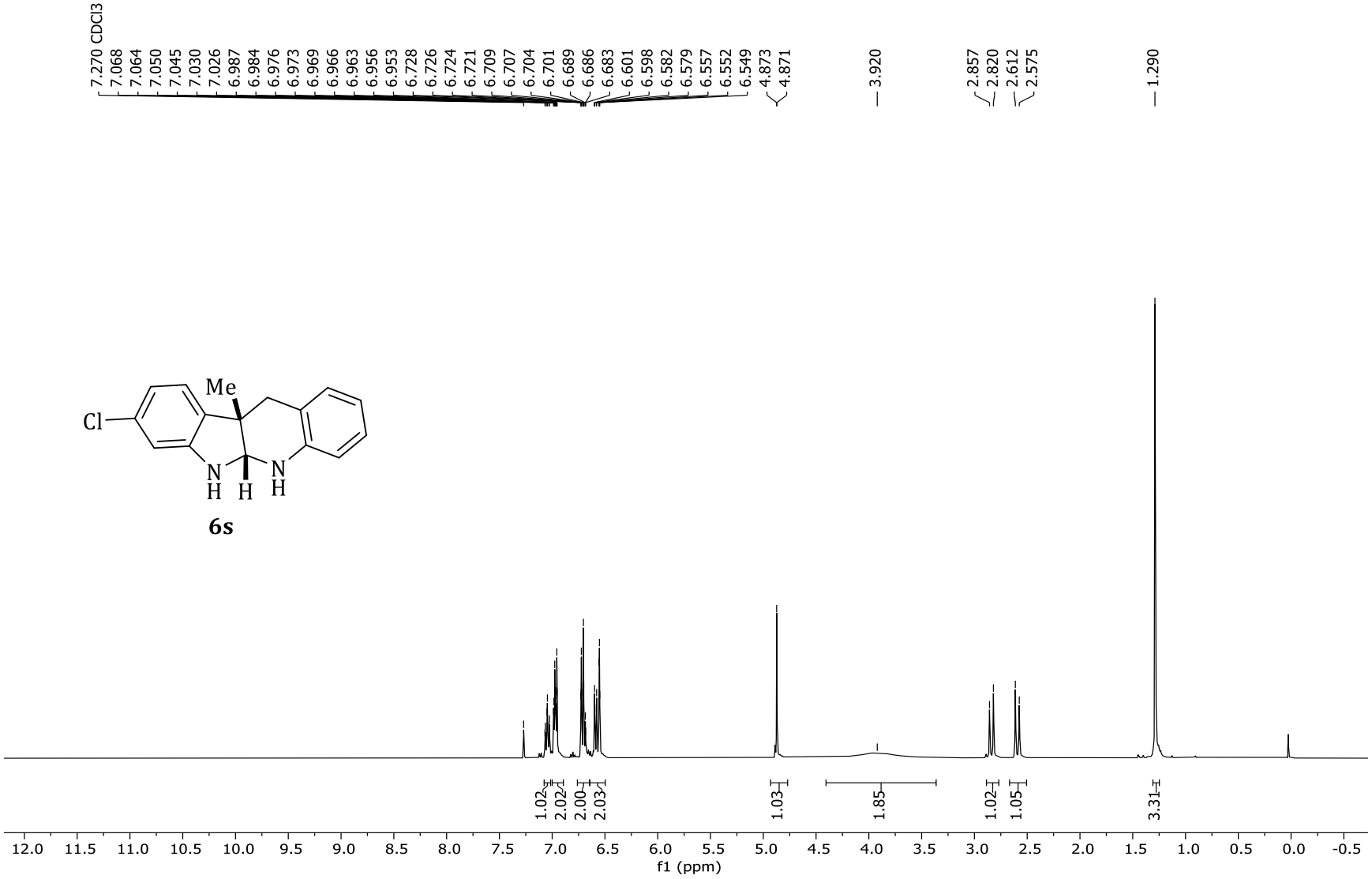
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6q**.



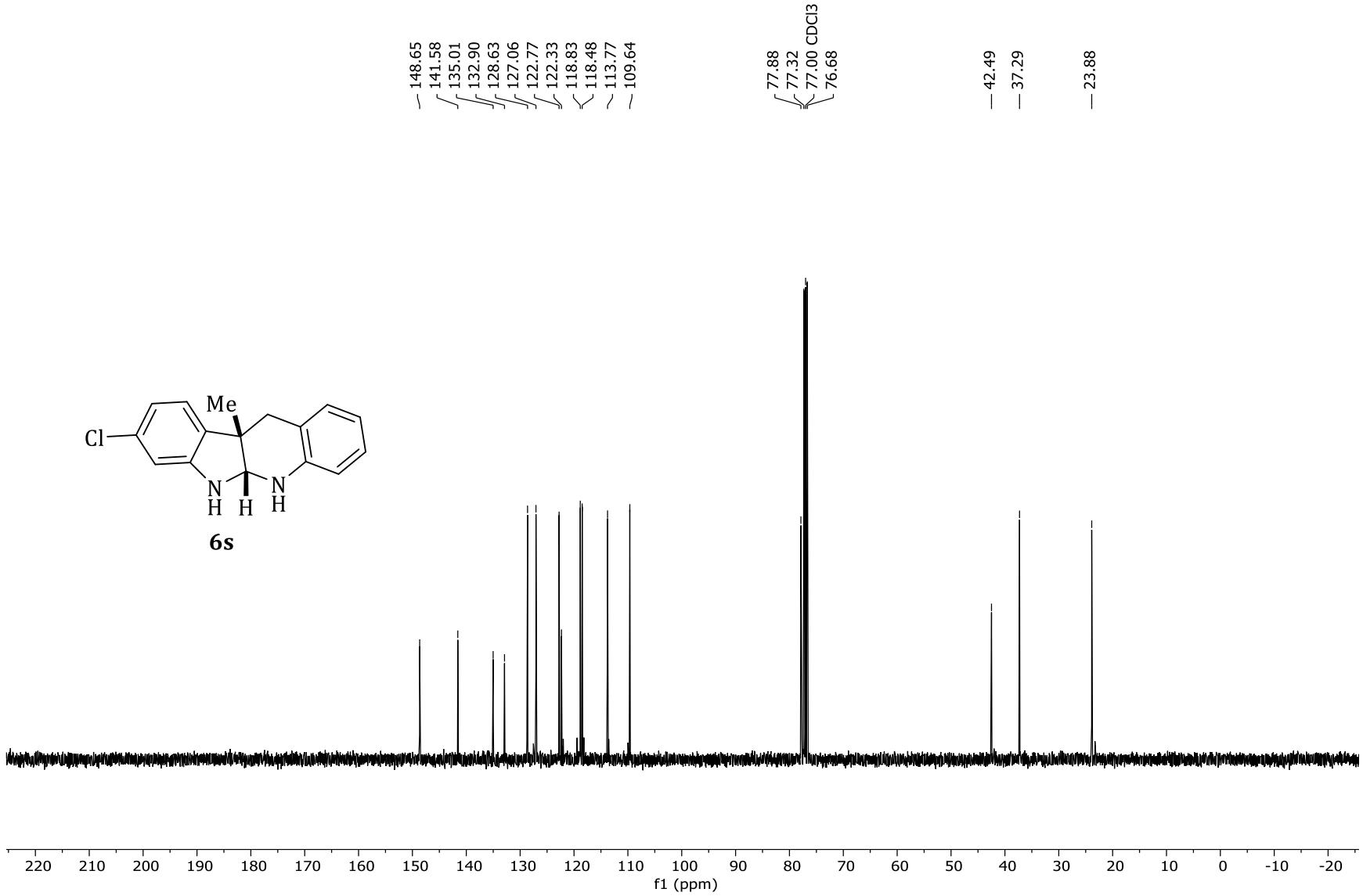
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6r**.



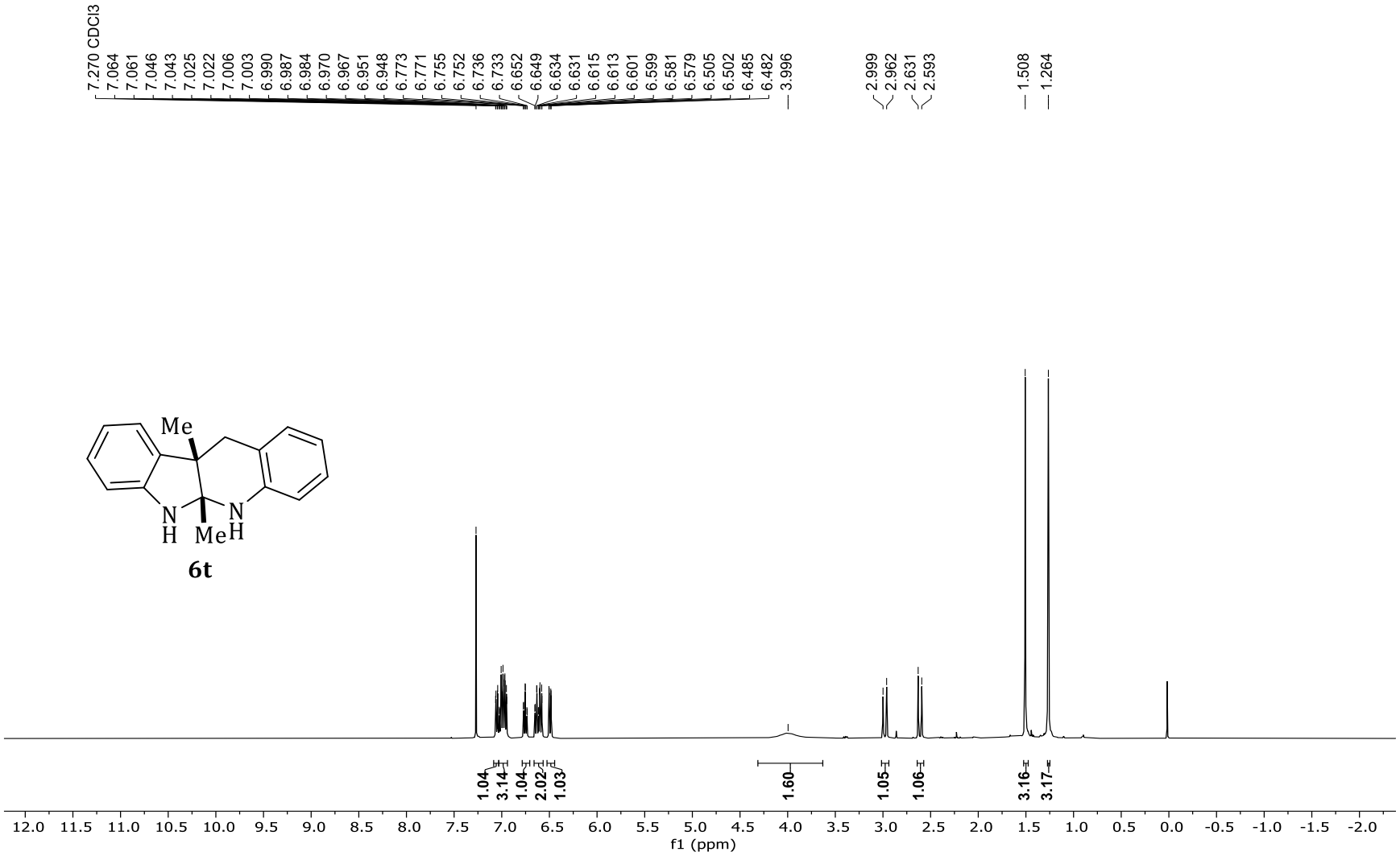
$^{13}C\{^{1}H\}$ spectrum (100 MHz, $CDCl_3$) of **6r**.



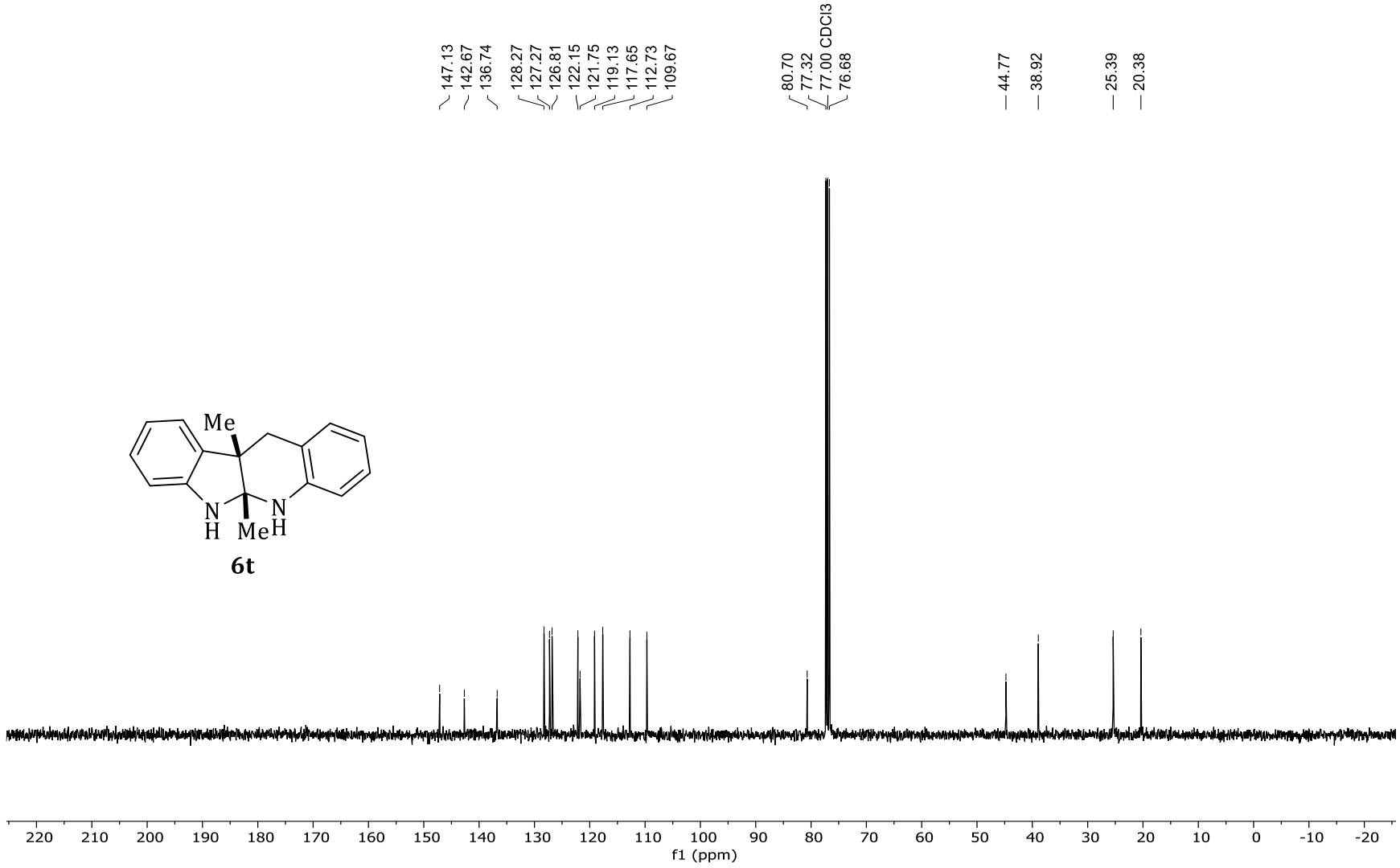
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6s**.



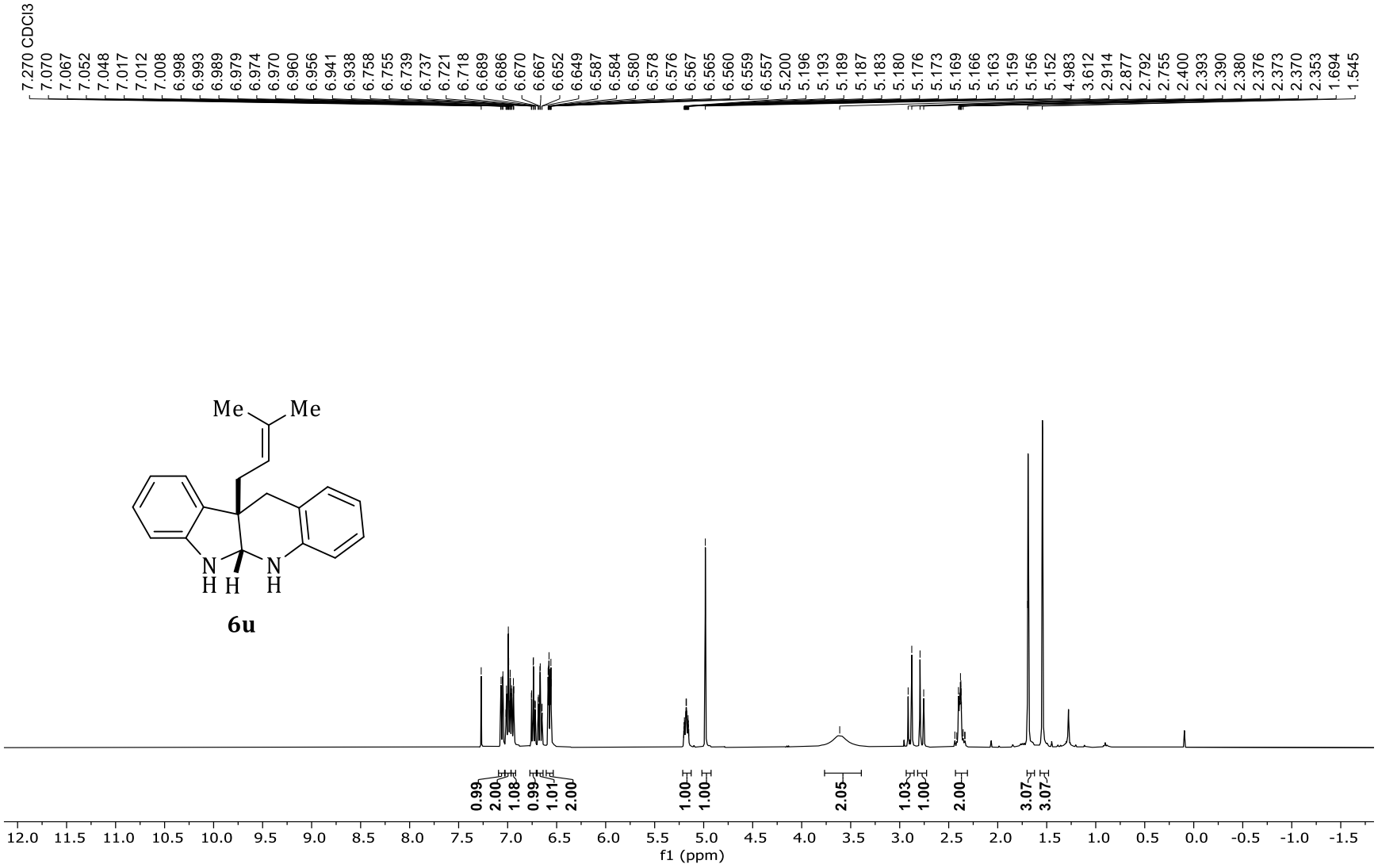
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6s**.



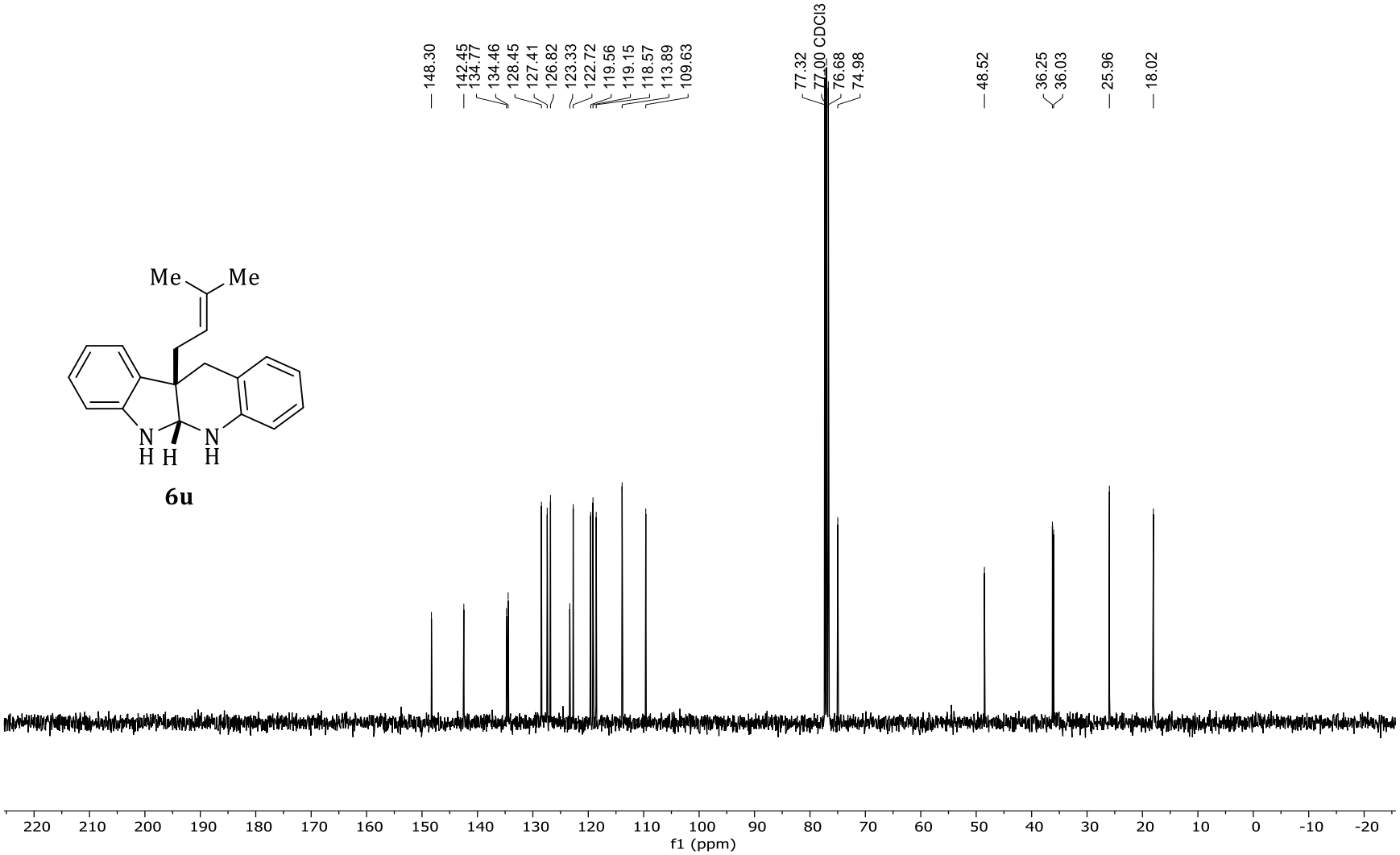
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6t**.



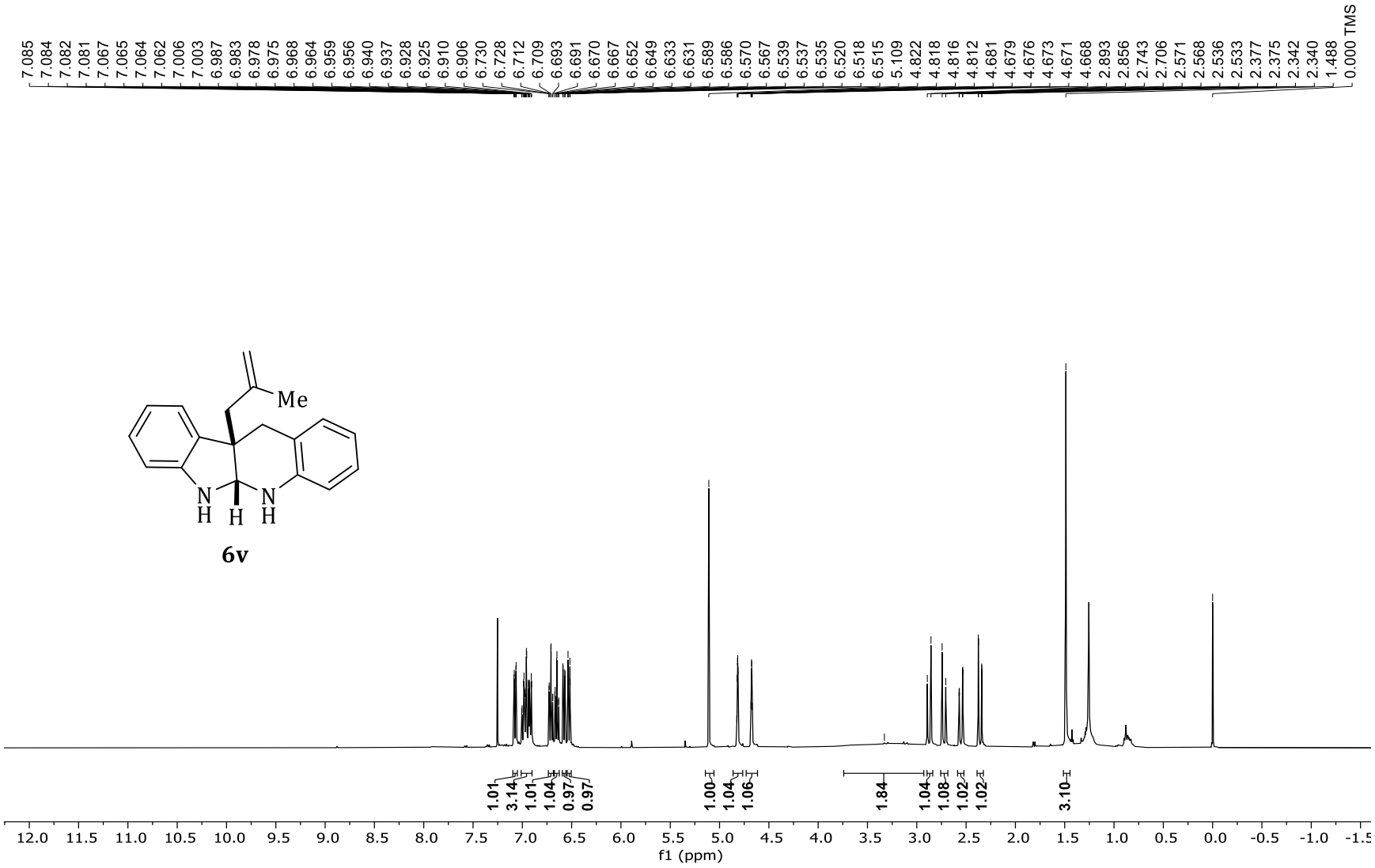
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6t**.



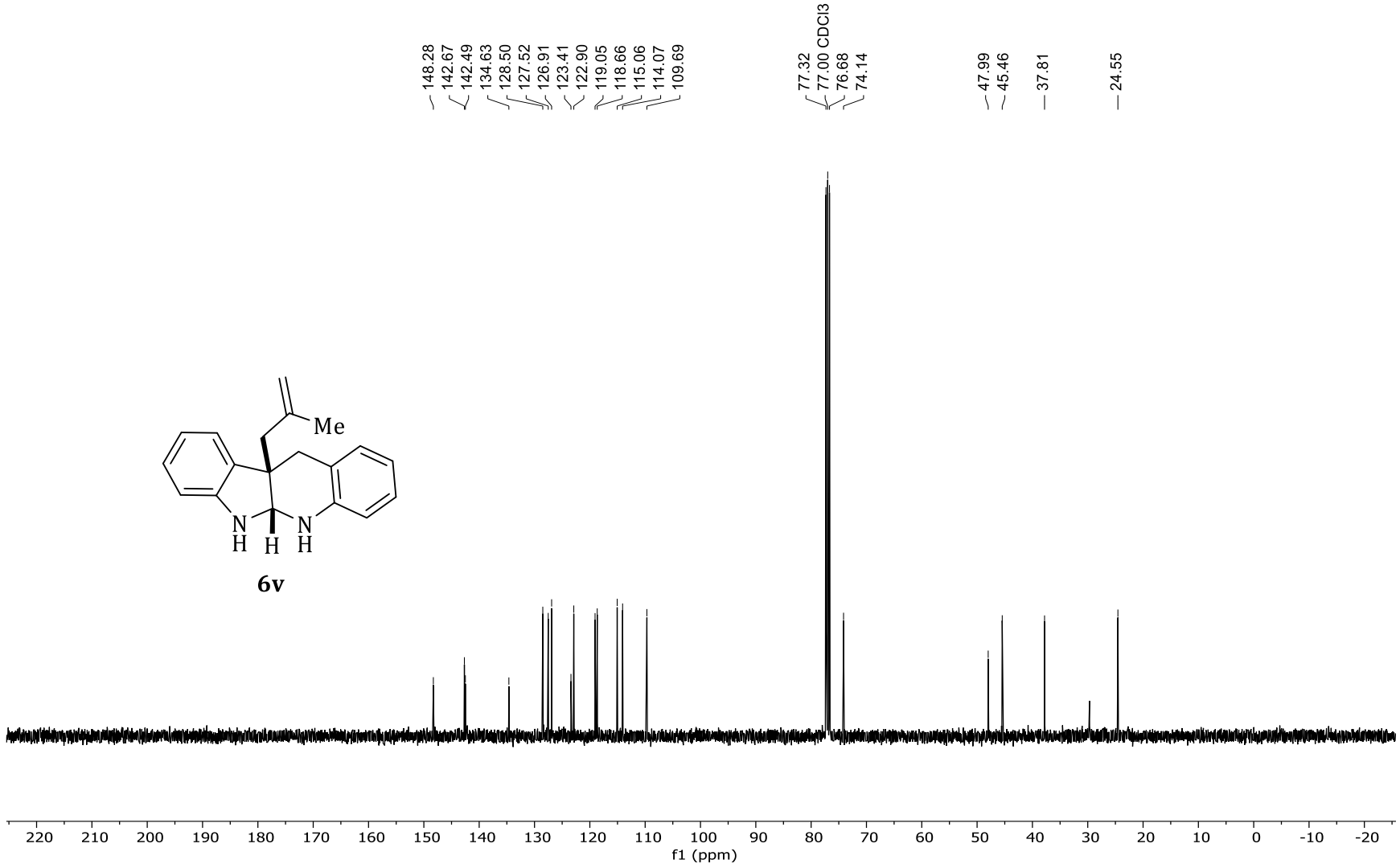
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6u**.



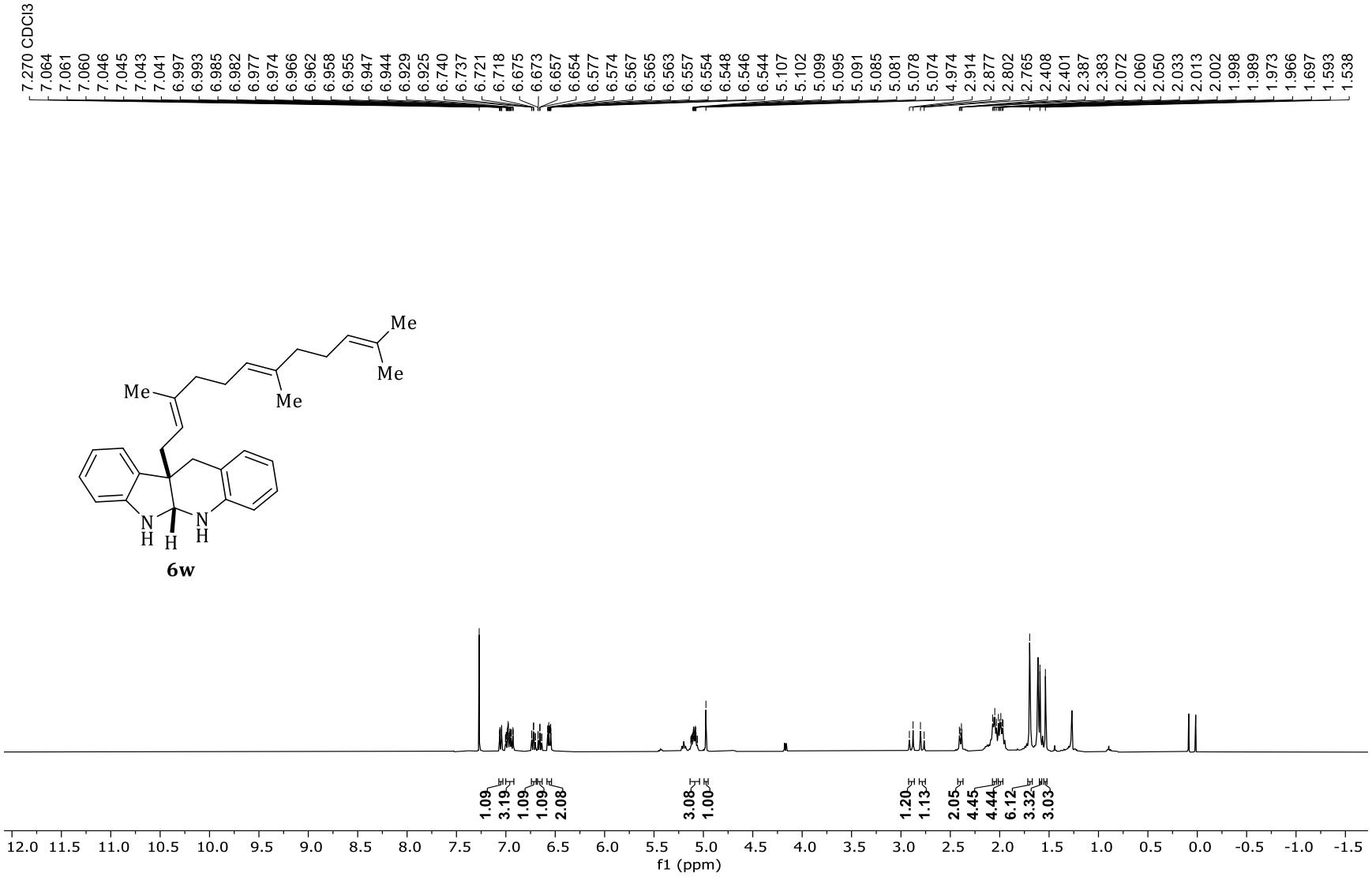
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6u**.



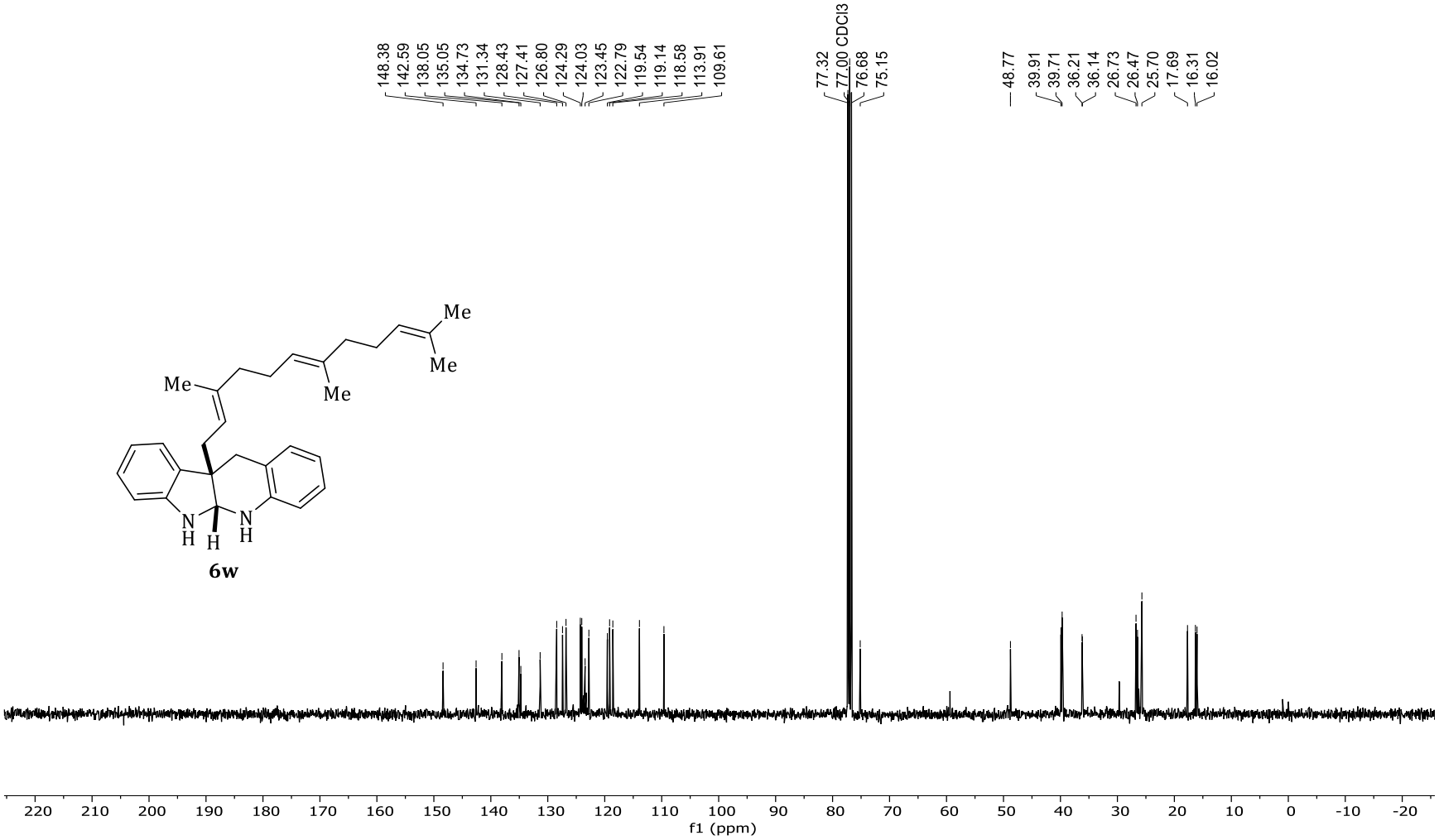
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6v**.



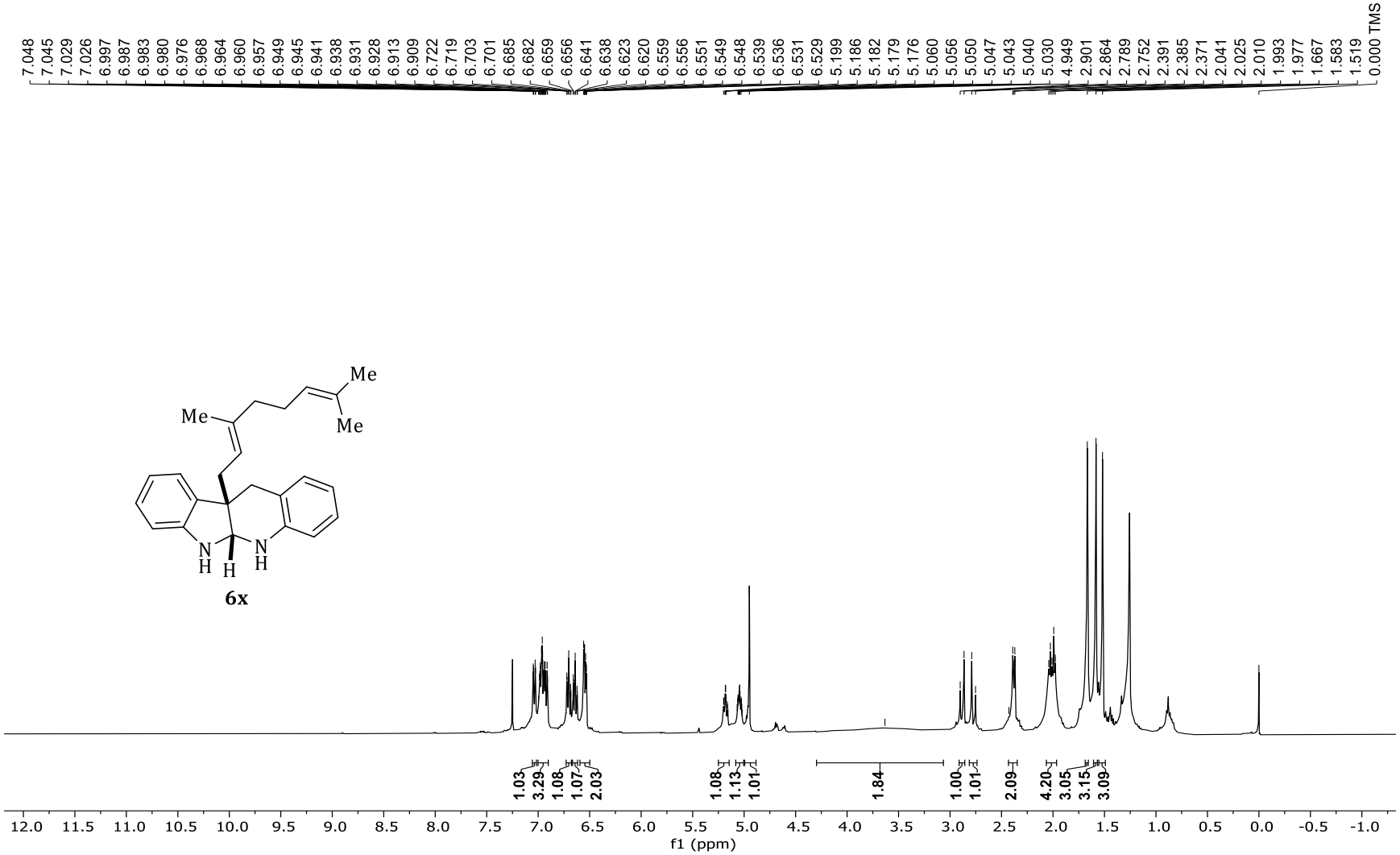
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6v**.



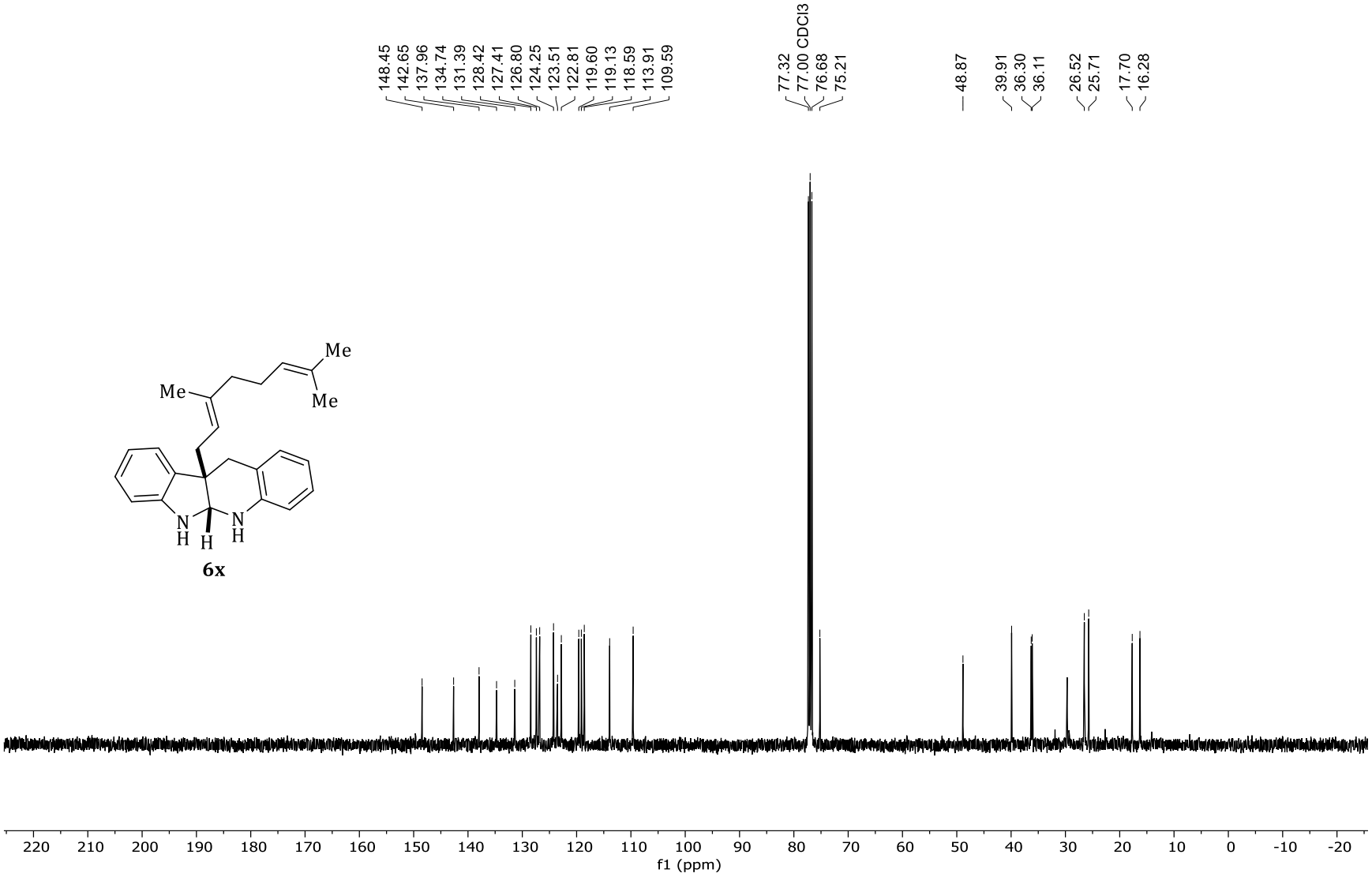
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6w**.



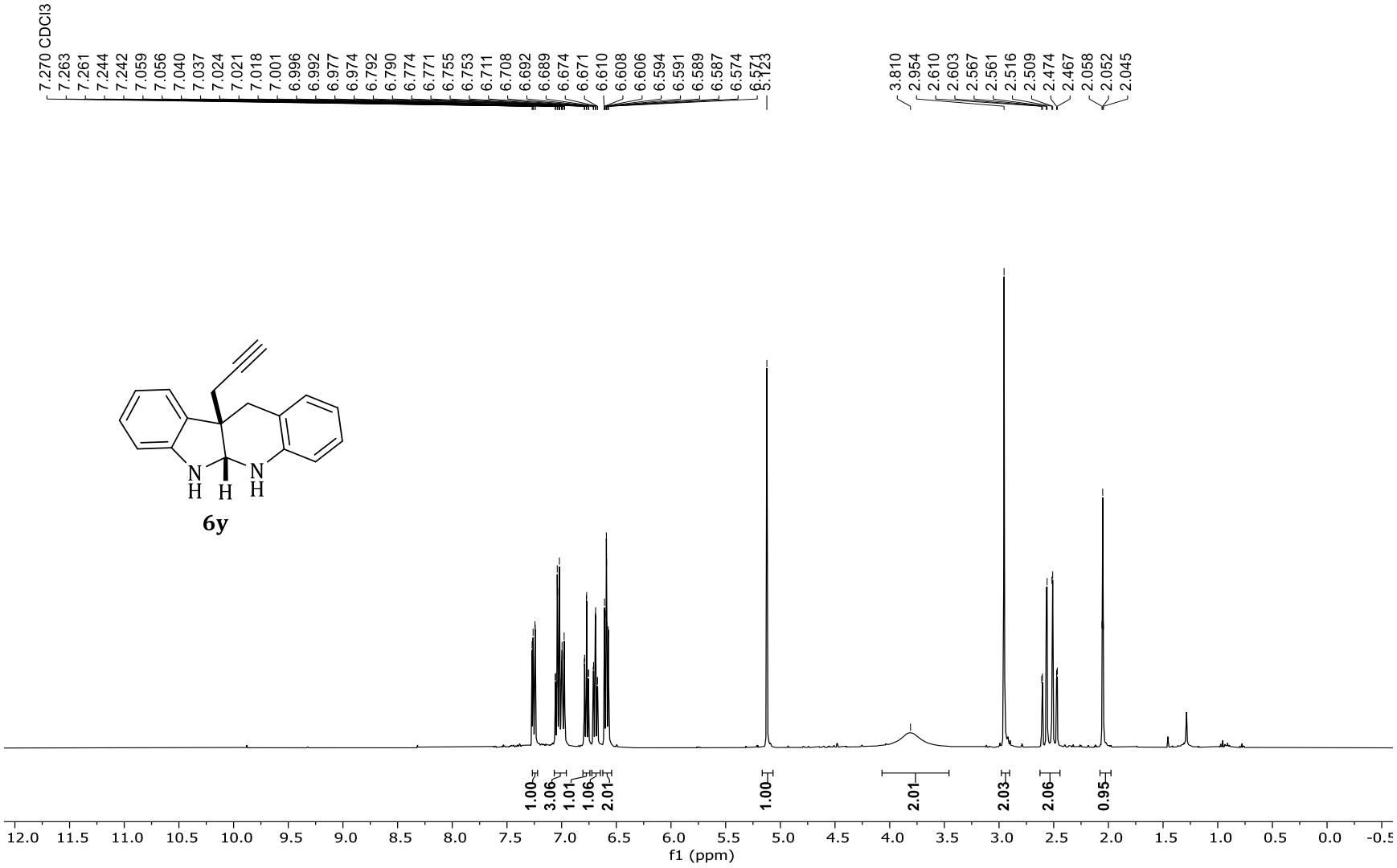
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6w**.



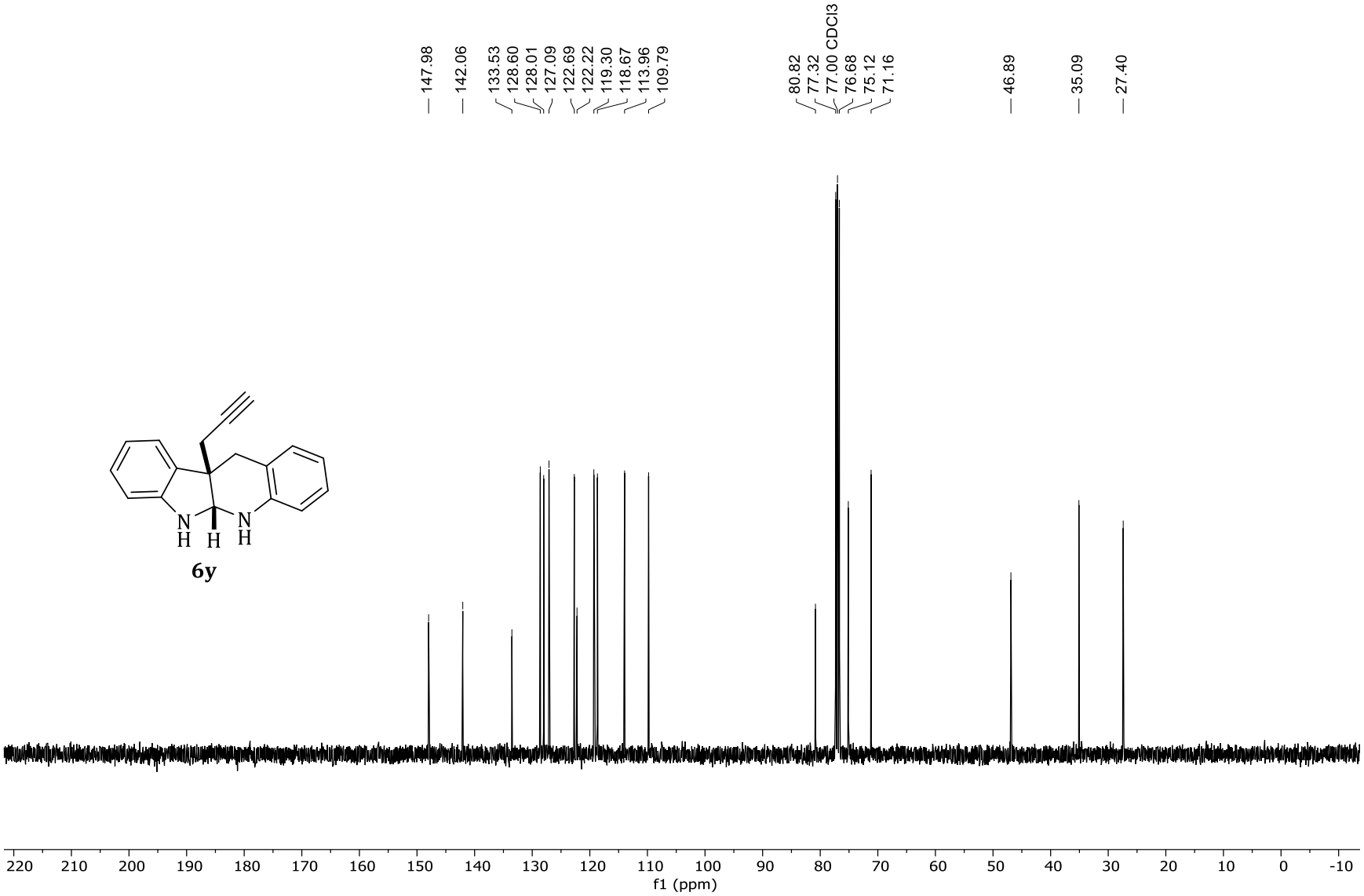
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6x**.



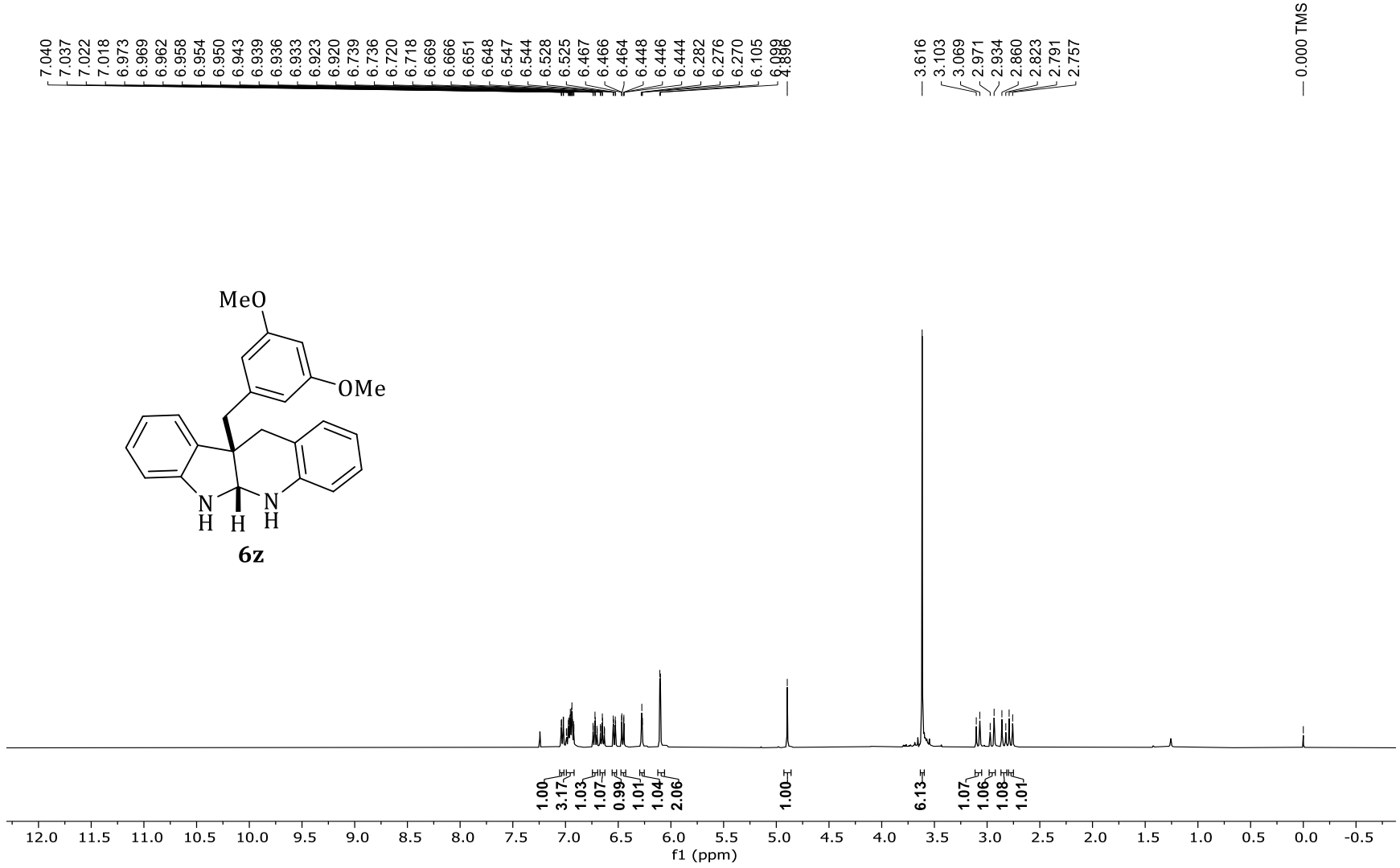
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6x**.



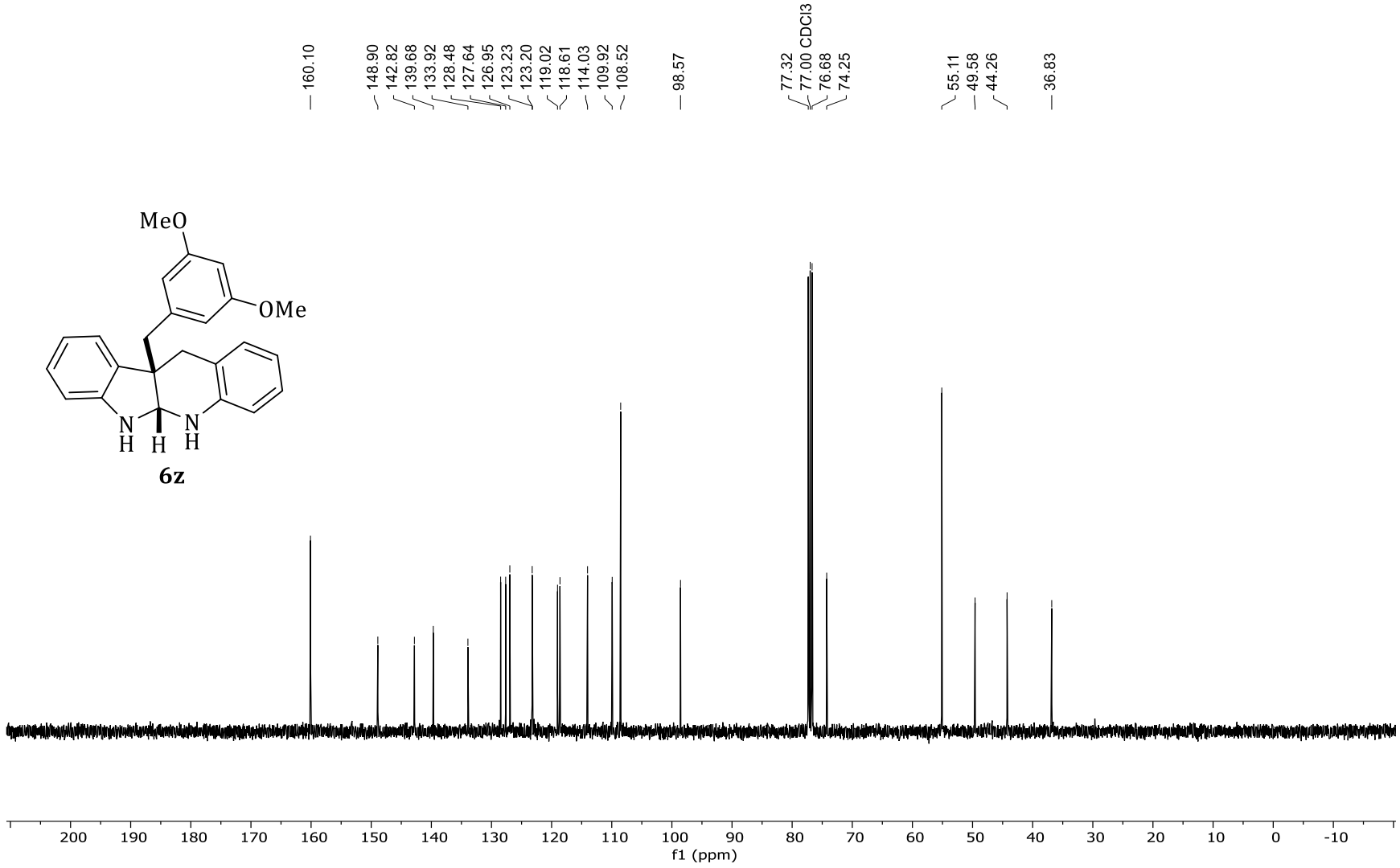
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6y**.



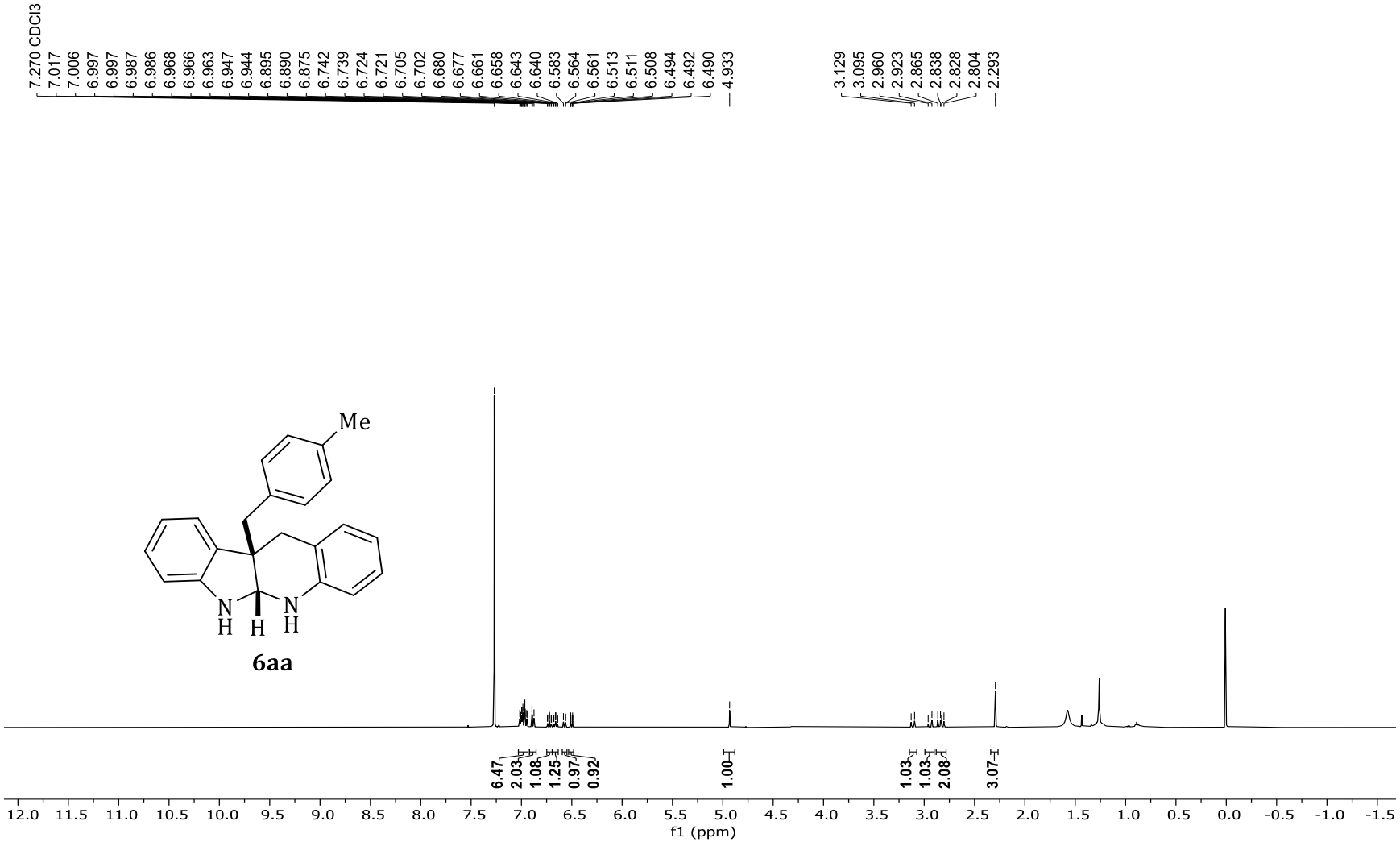
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6y**.



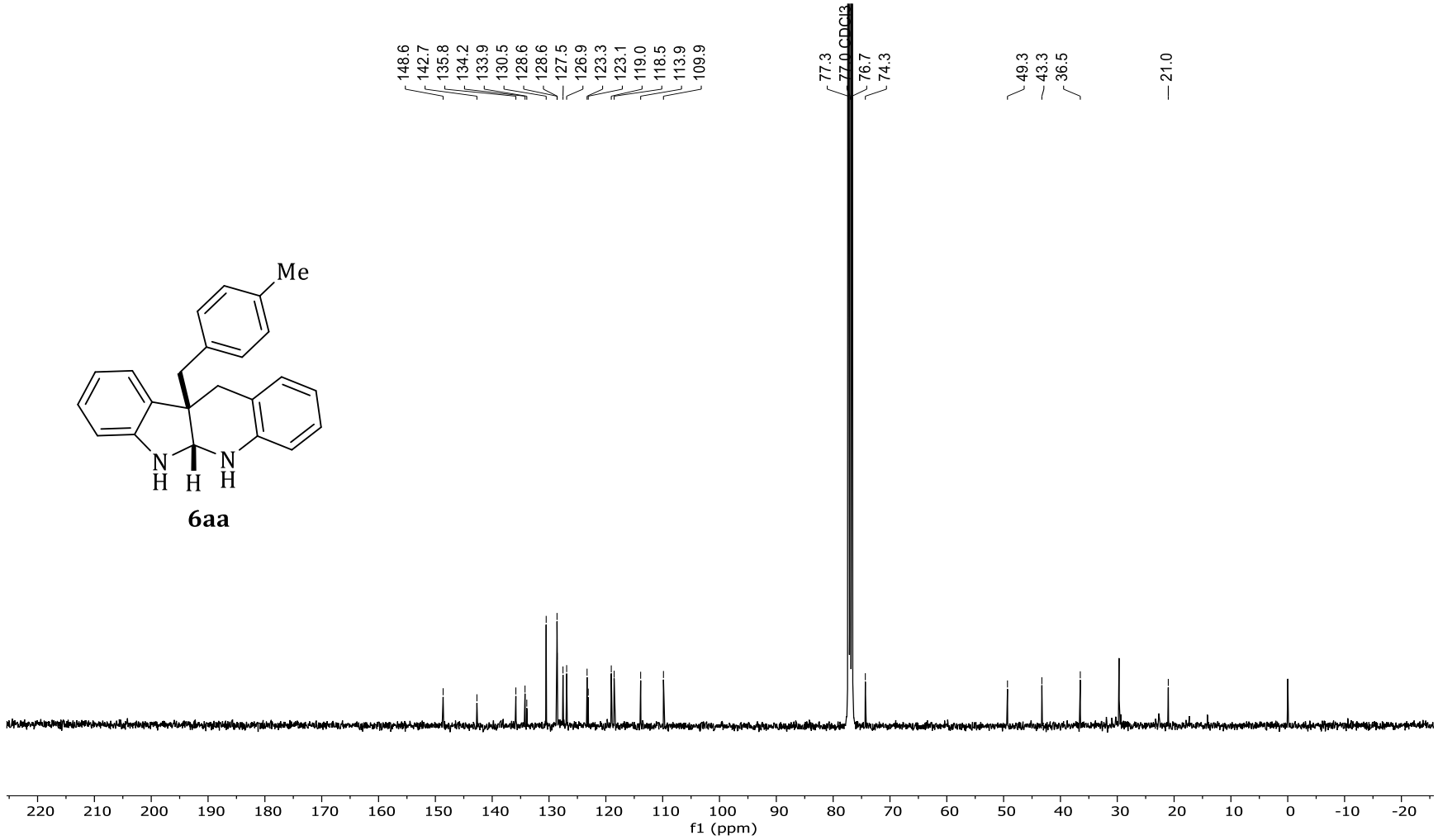
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6z**.



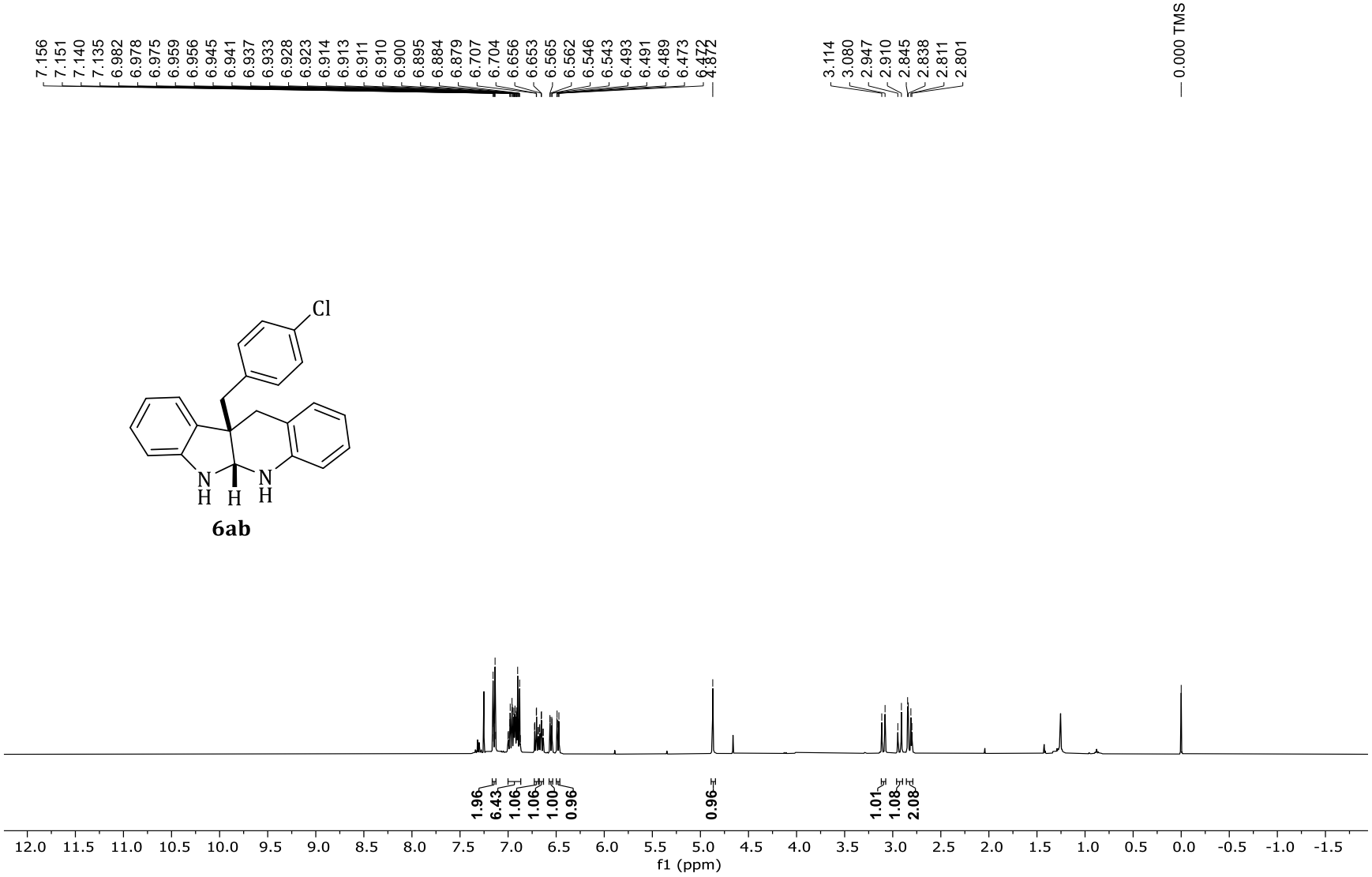
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6z**.



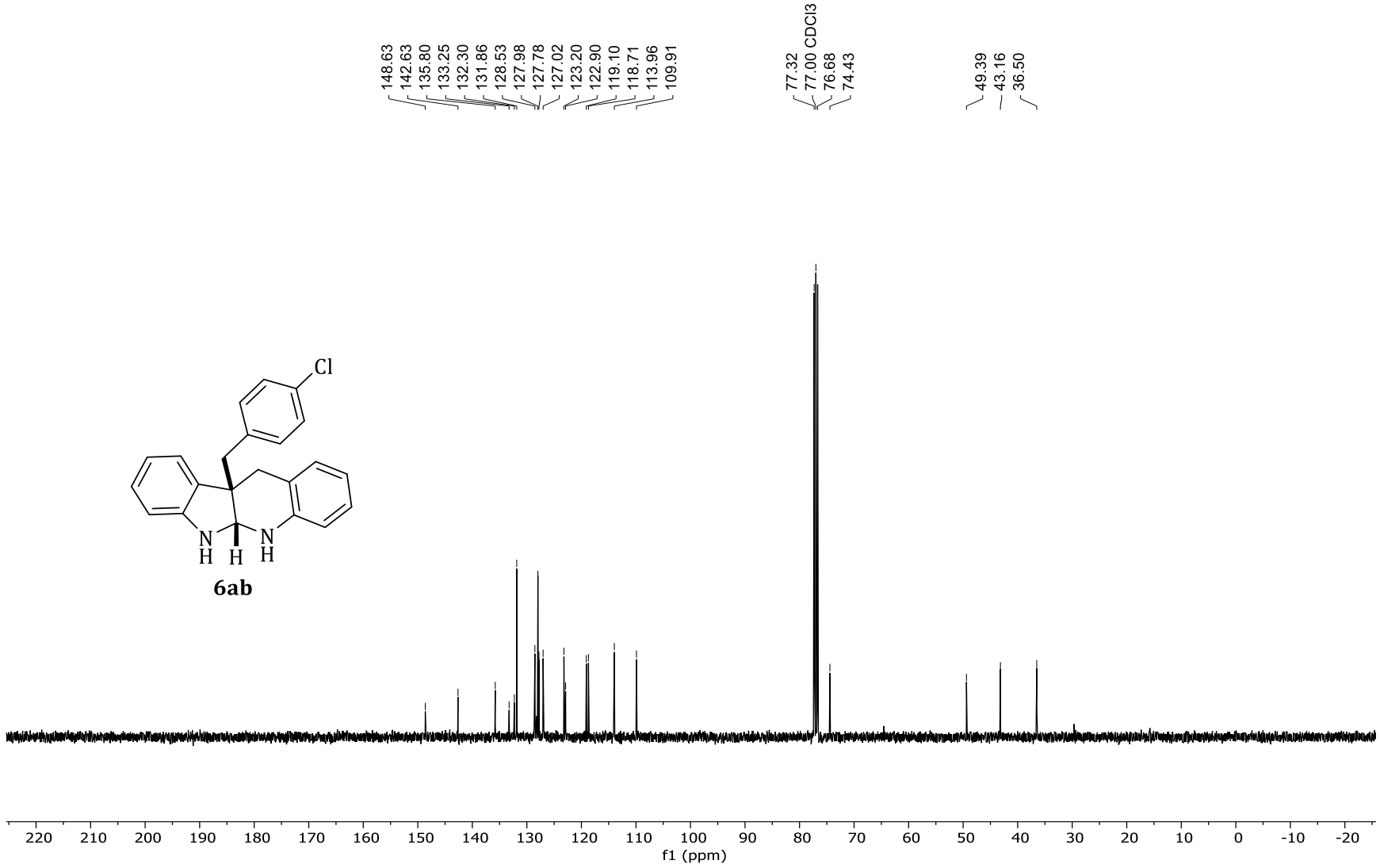
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6aa**.



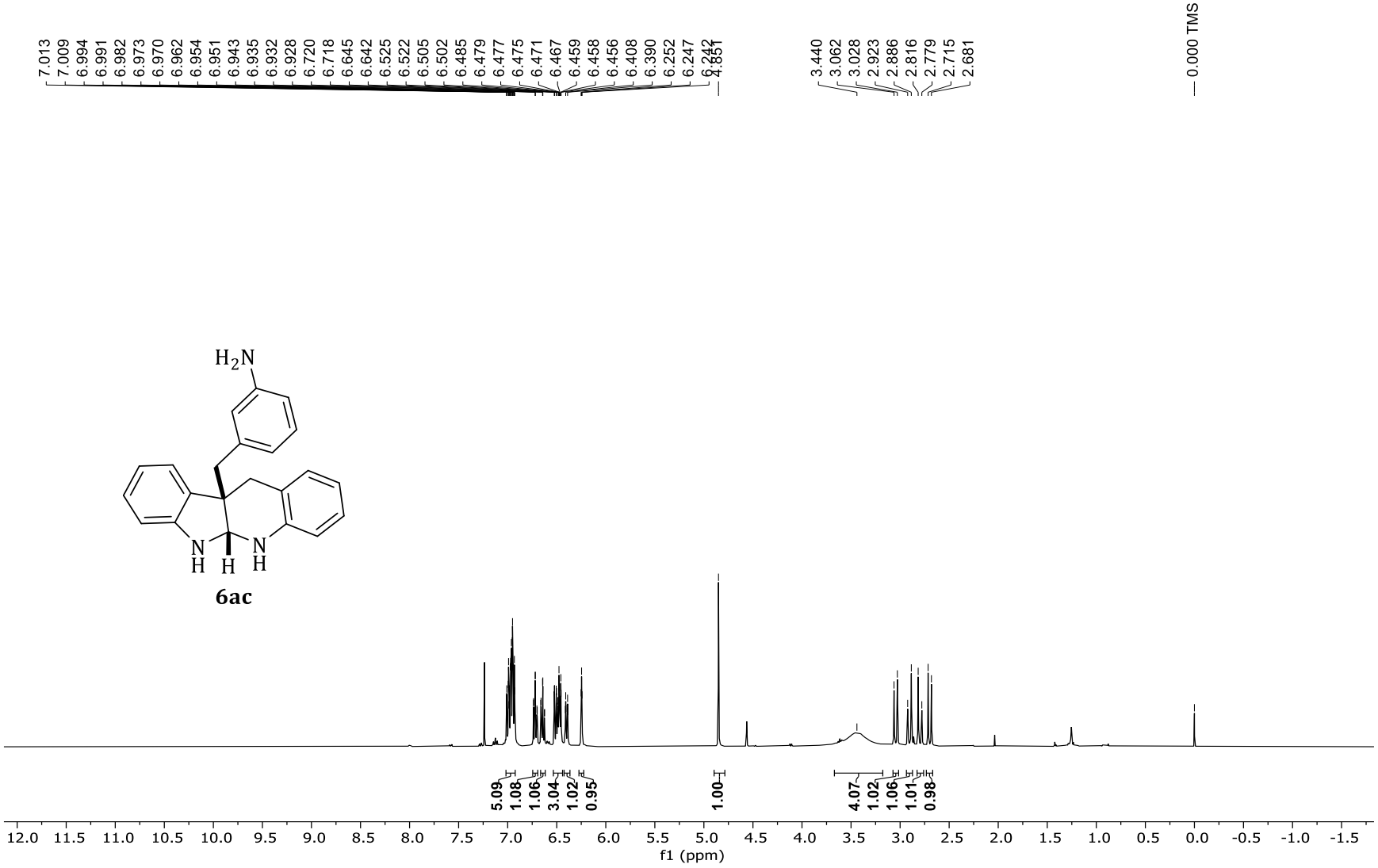
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6aa**.



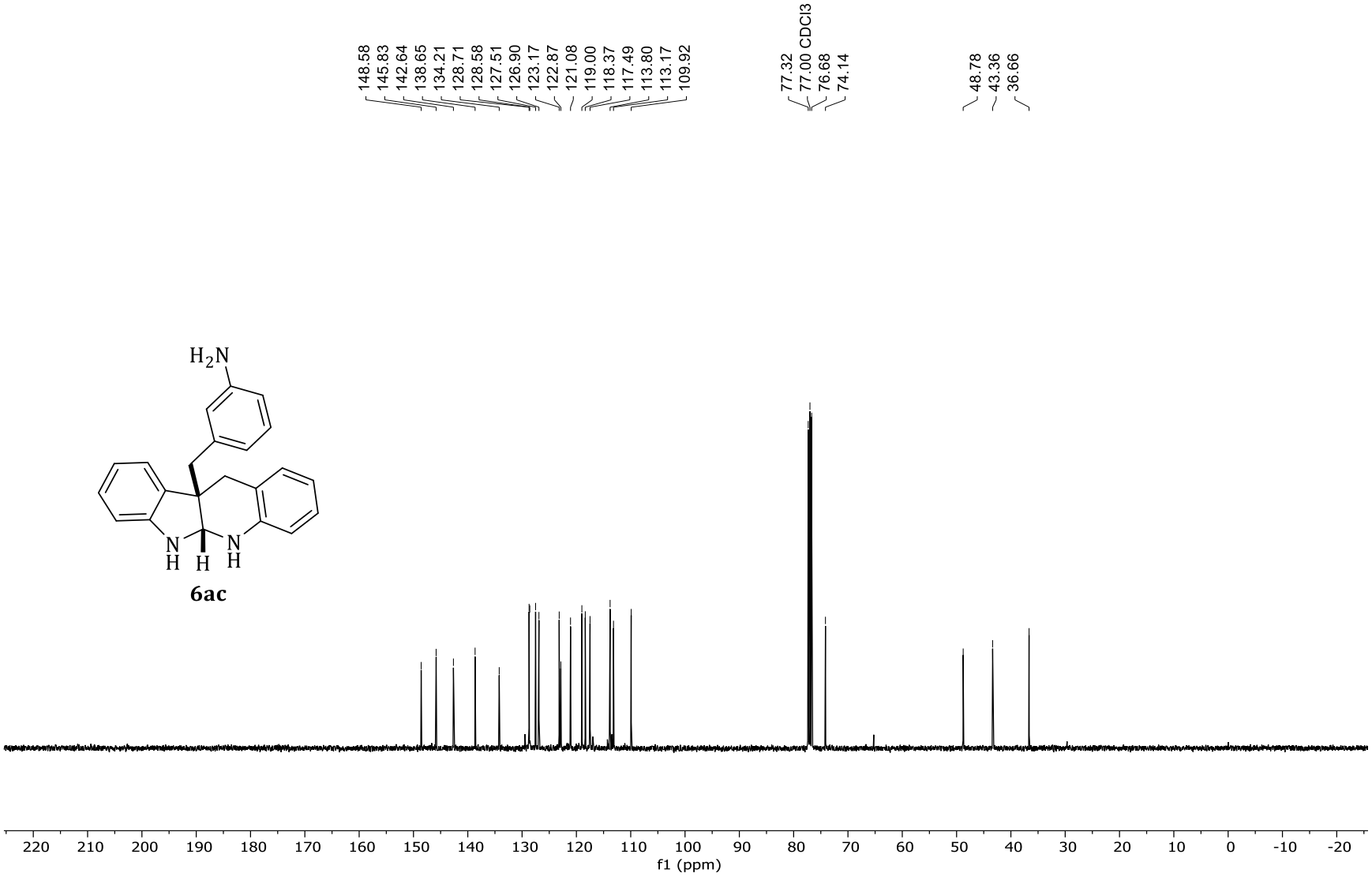
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ab**.



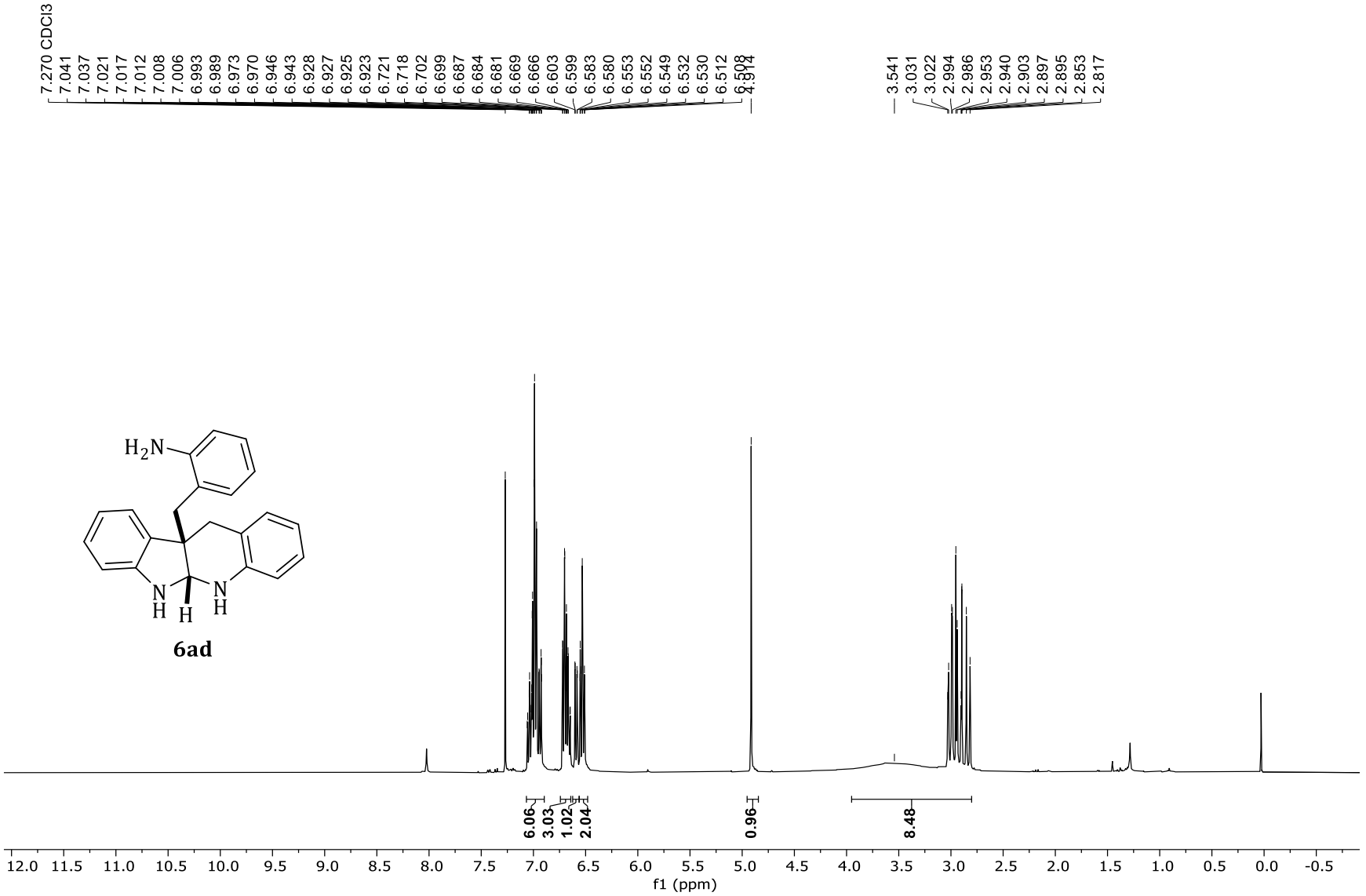
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ab**.



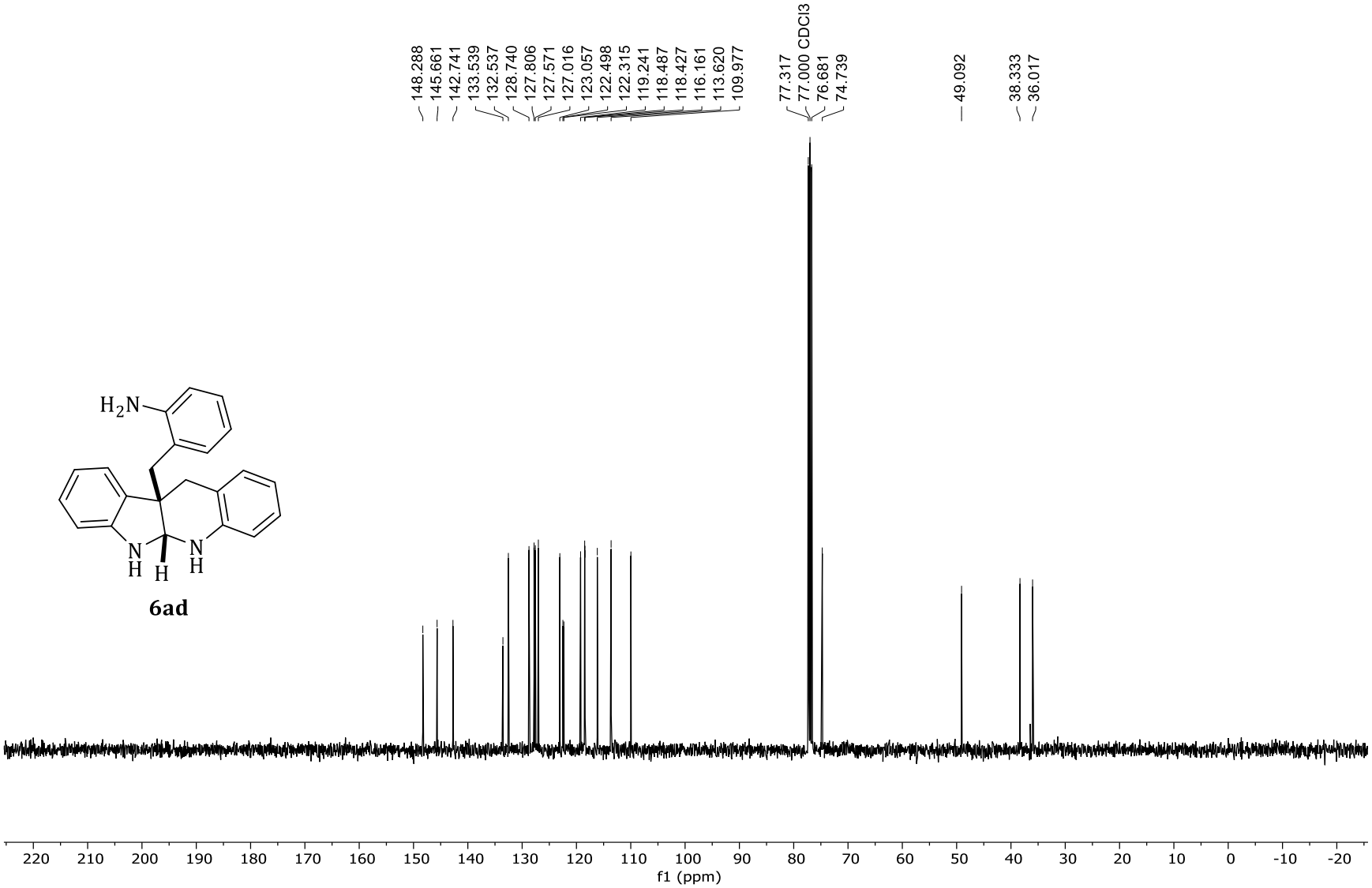
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ac**.



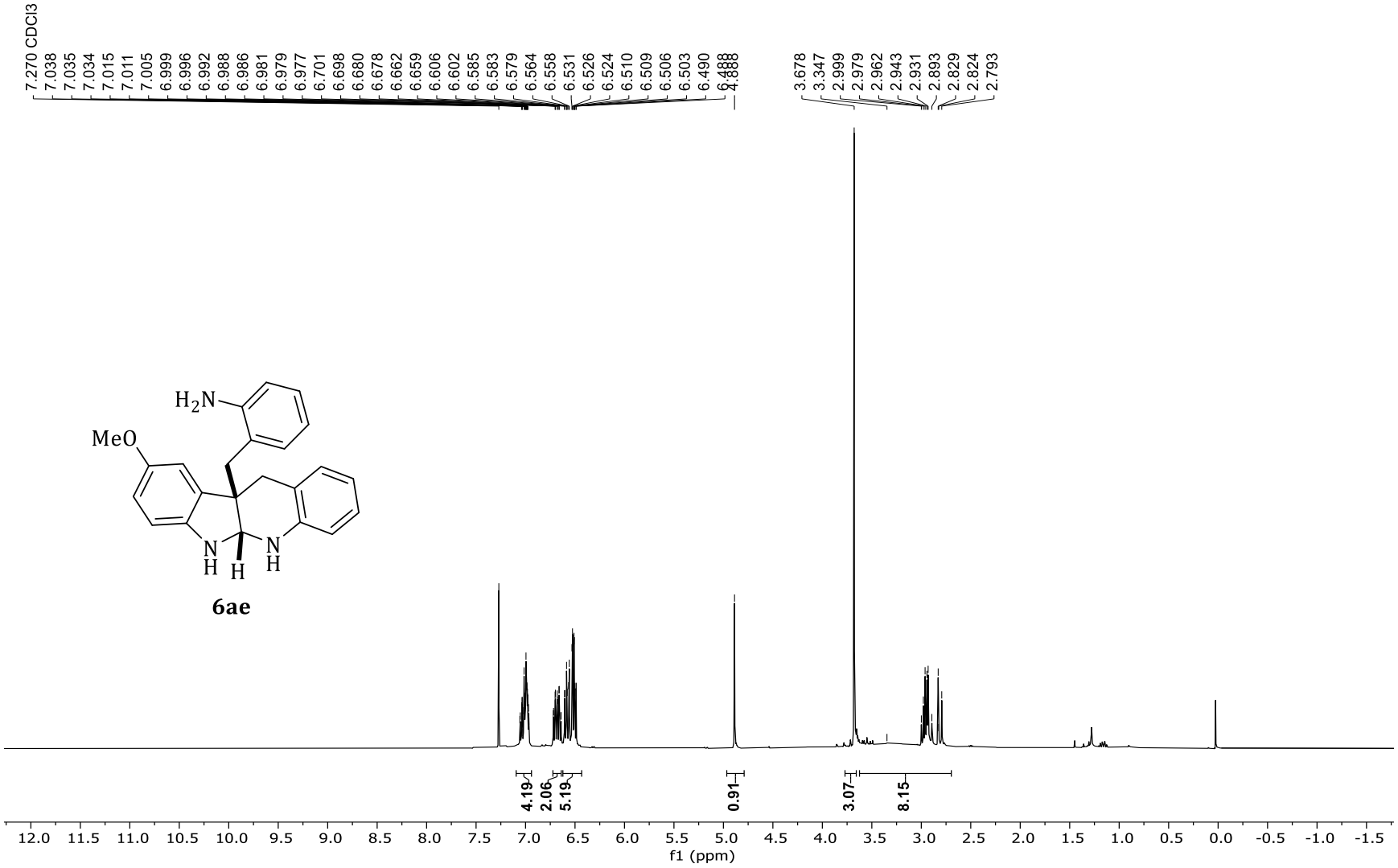
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ac**.



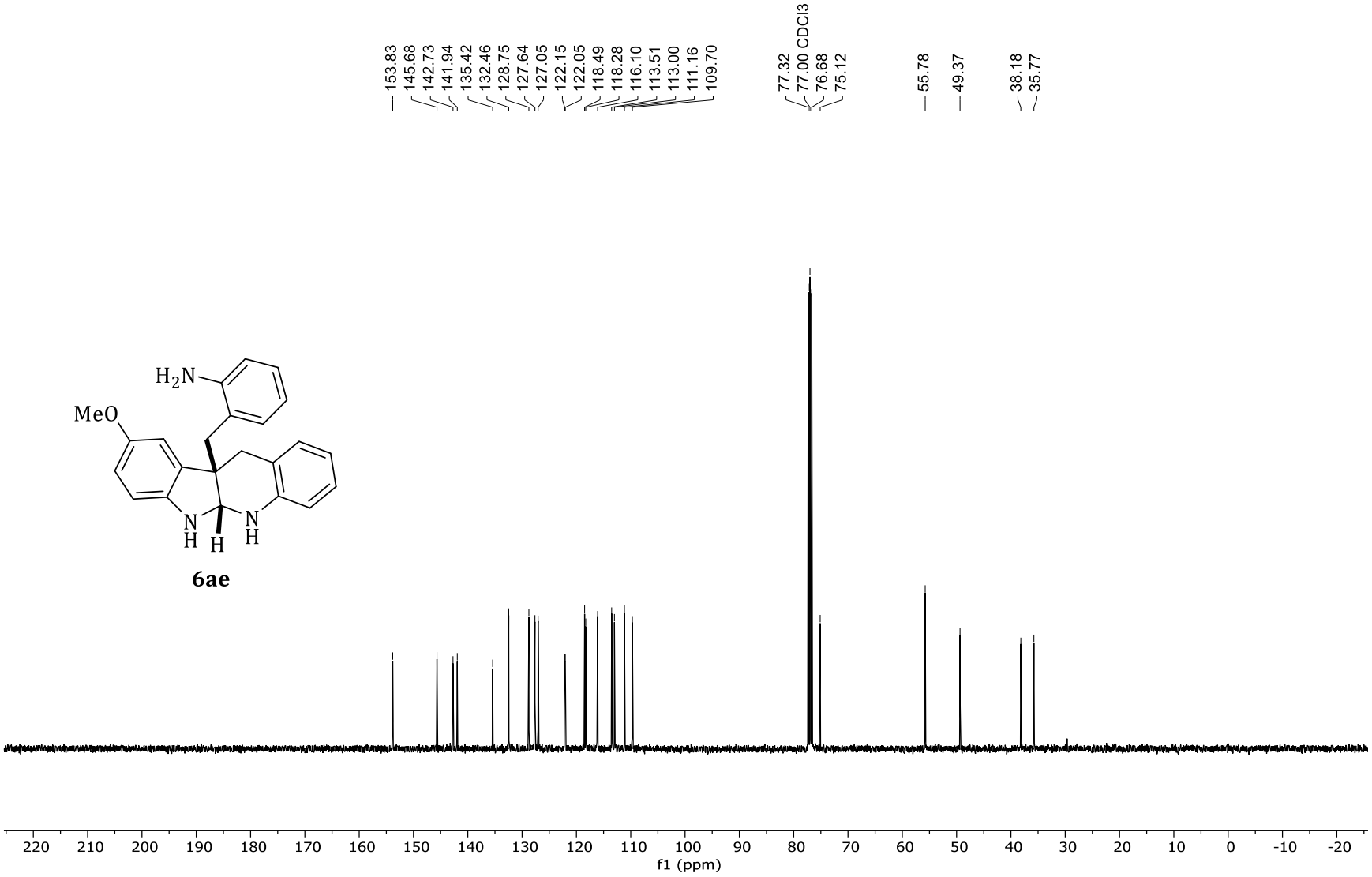
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ad**.



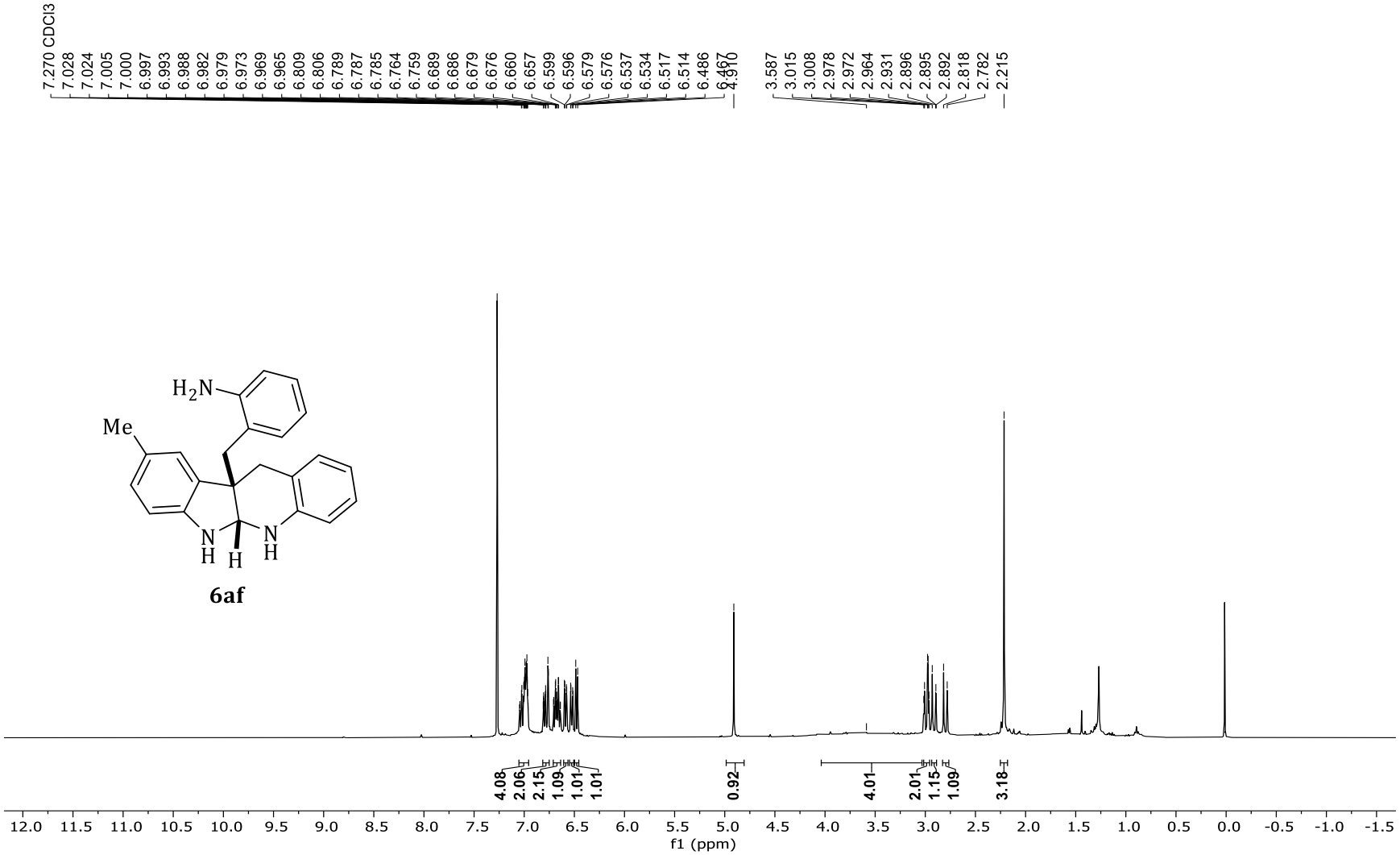
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ad**.



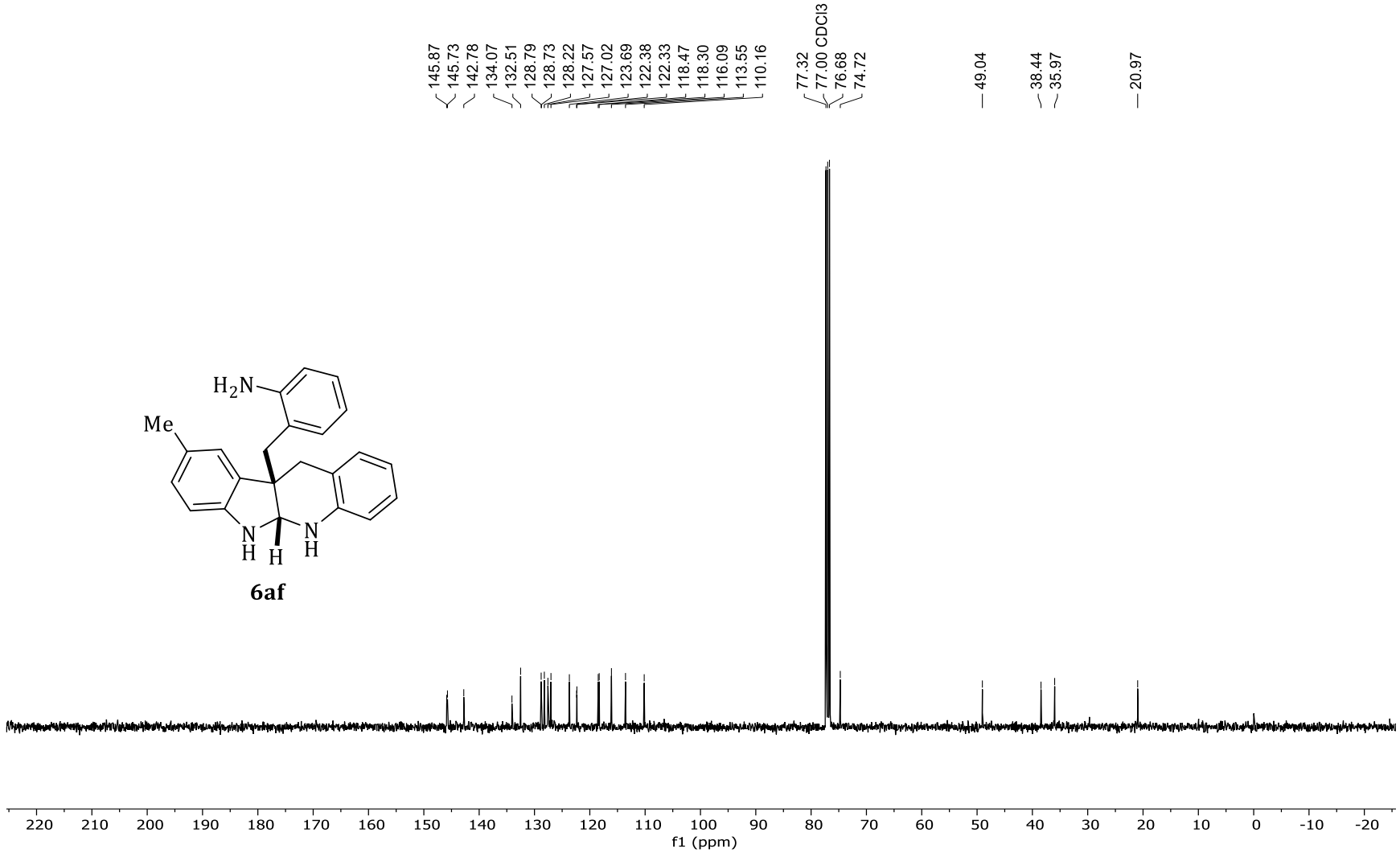
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ae**.



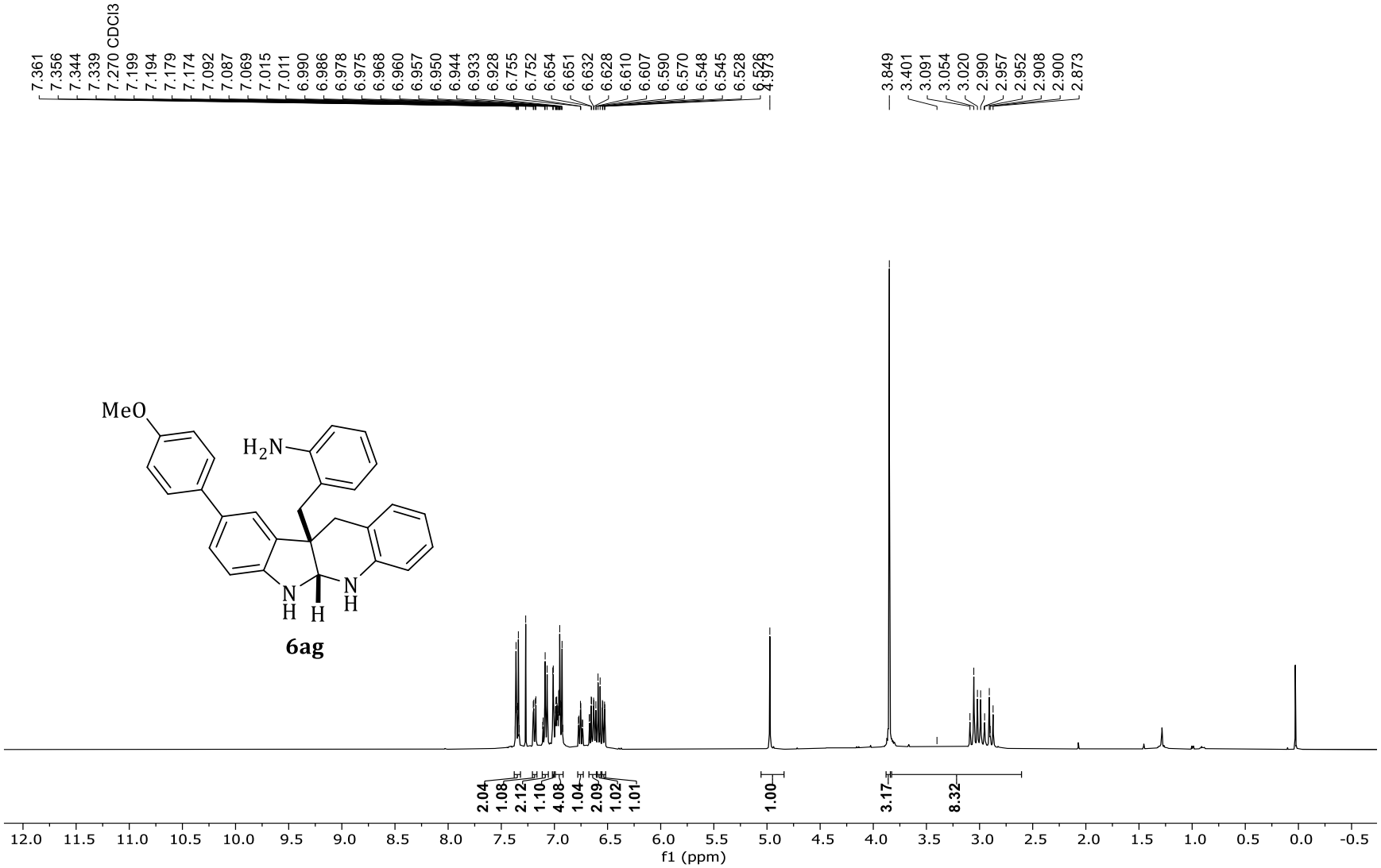
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ae**.



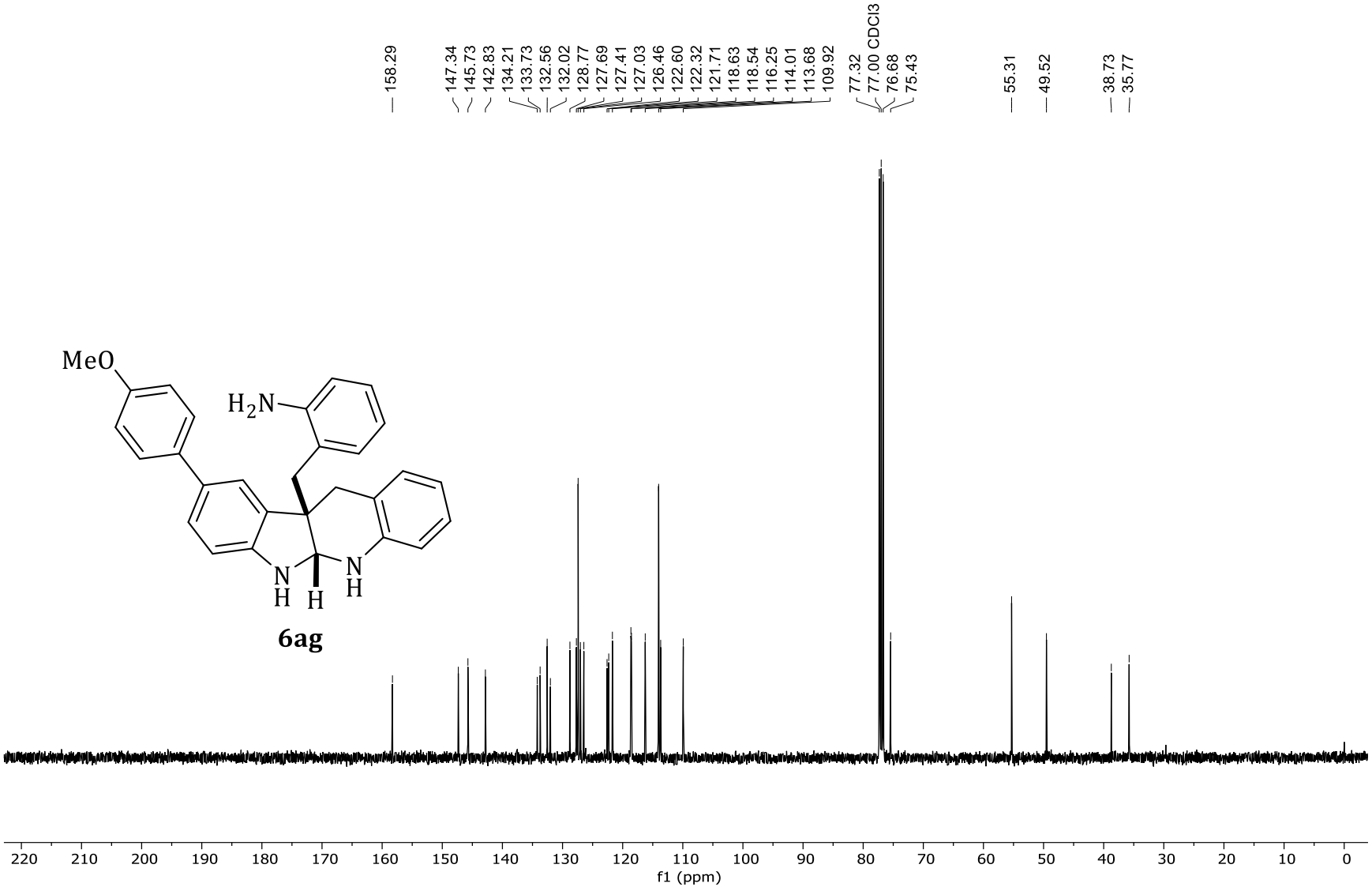
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6af**.



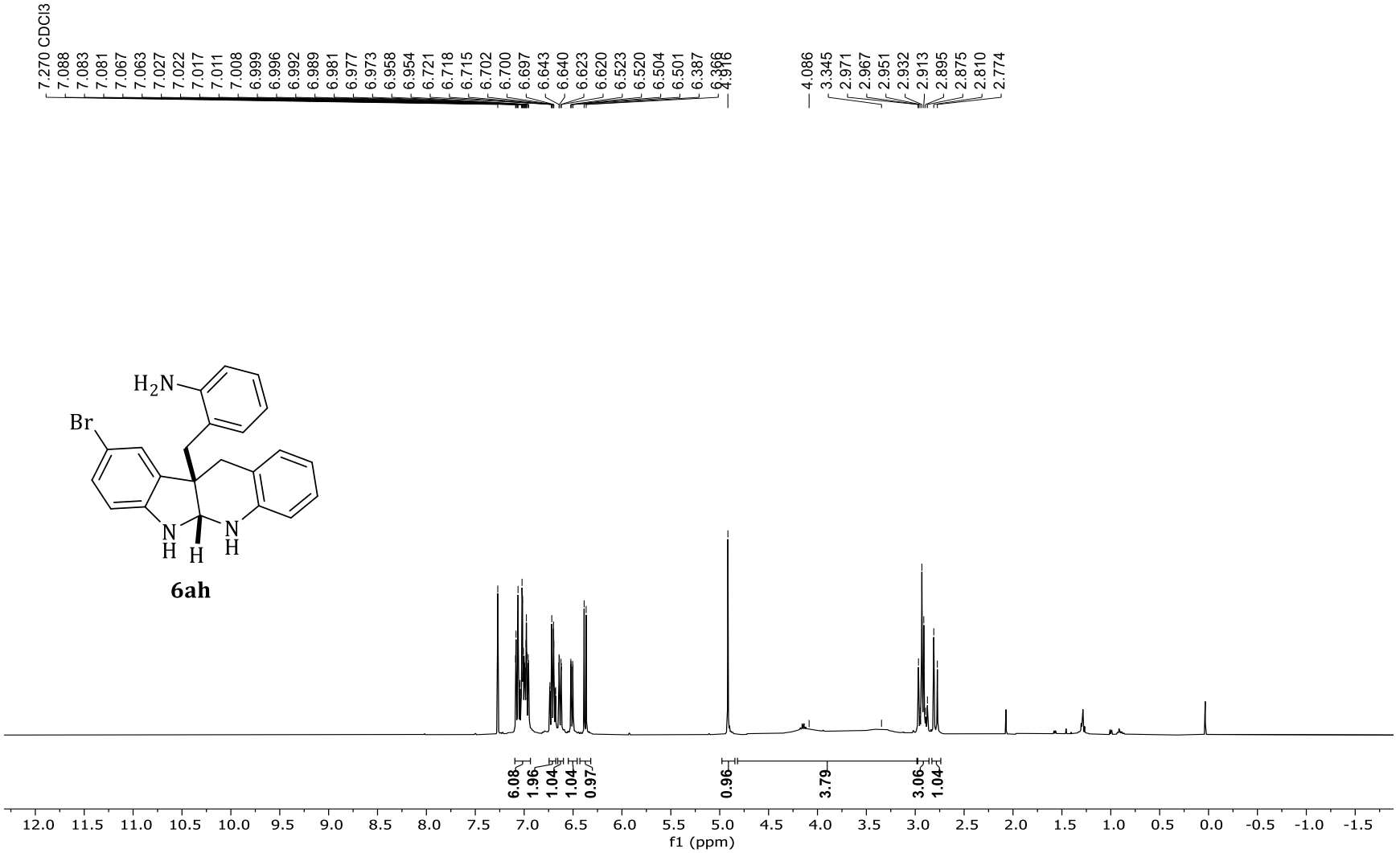
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6af**.



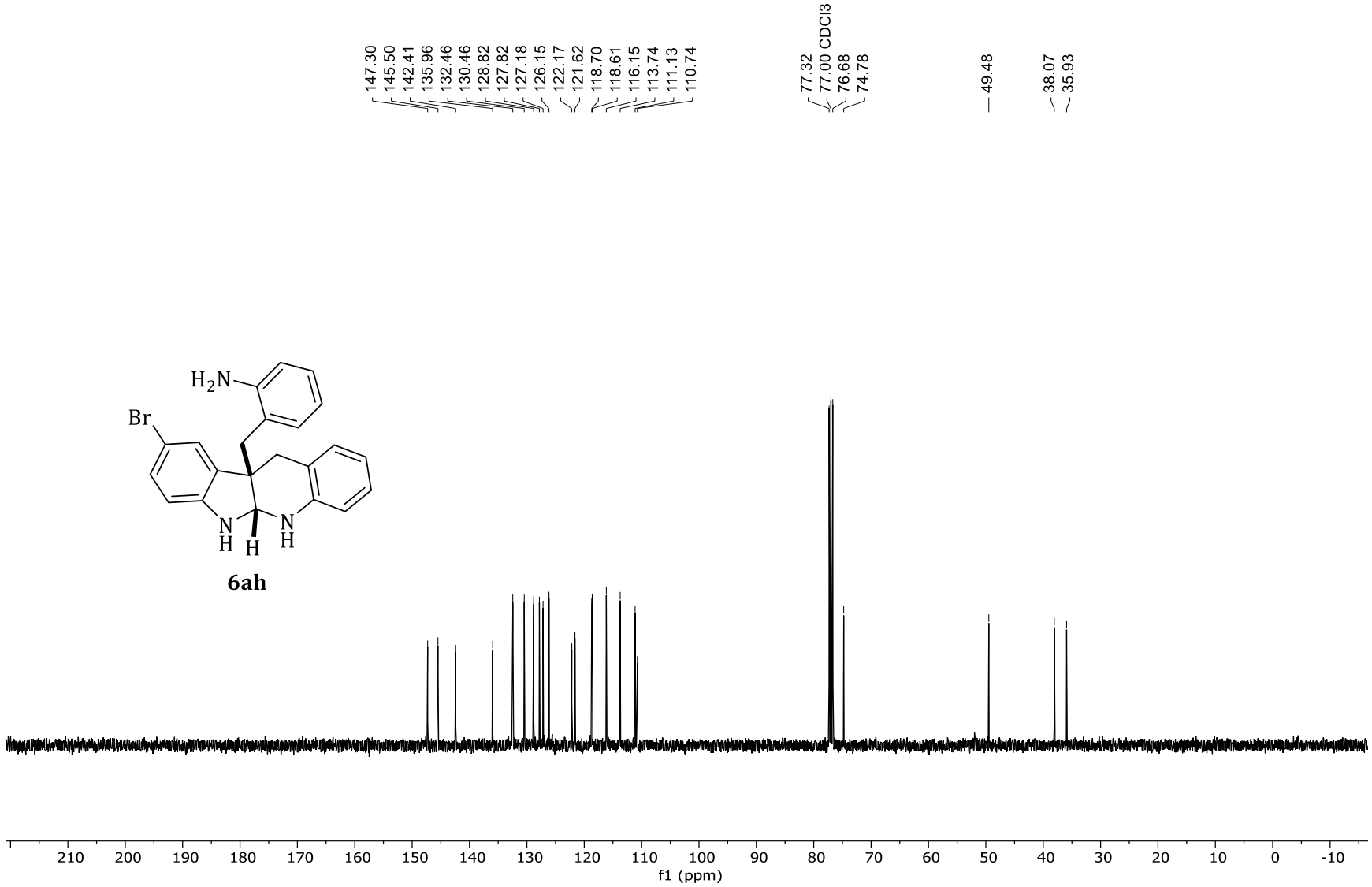
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ag**.



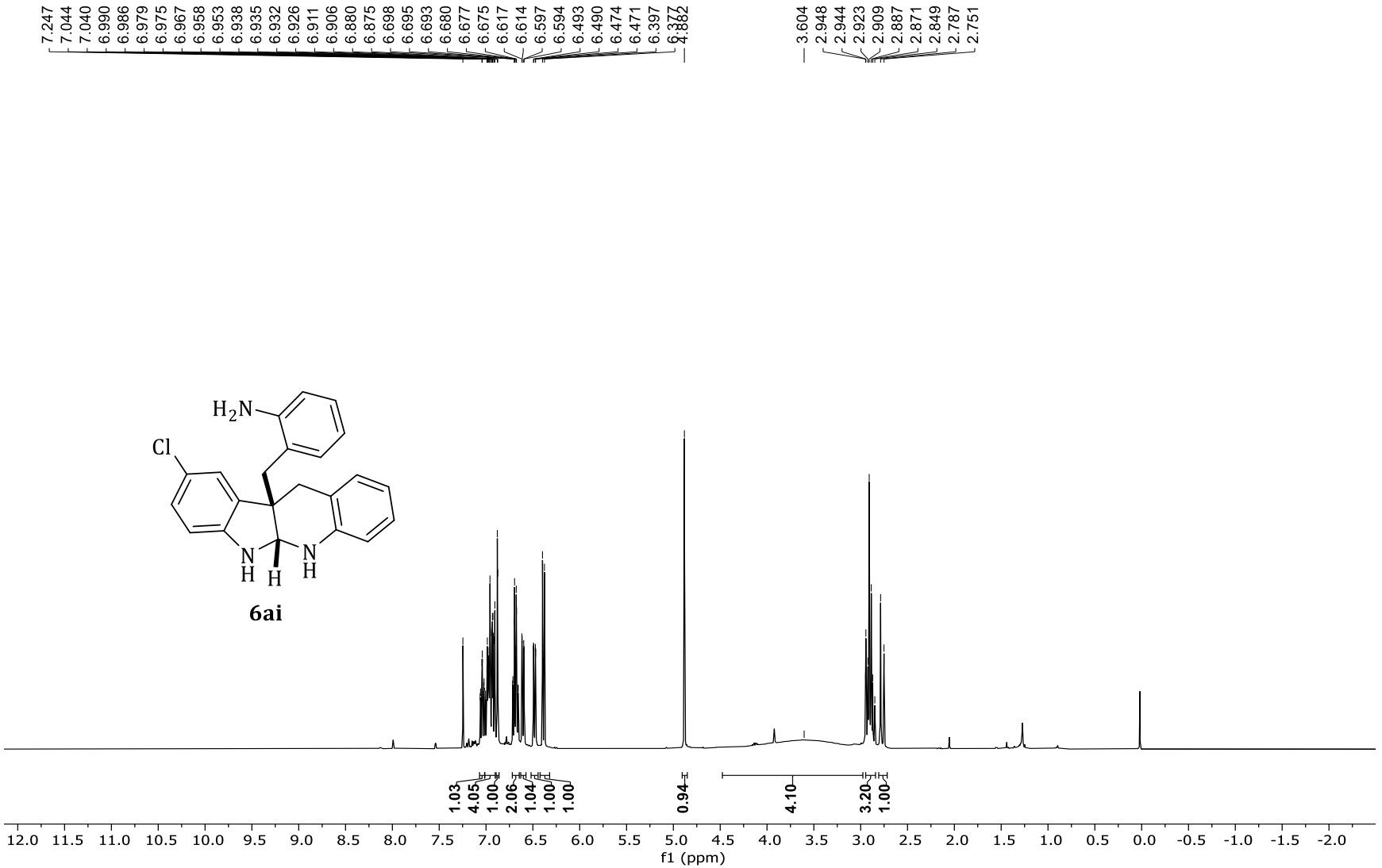
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ag**.



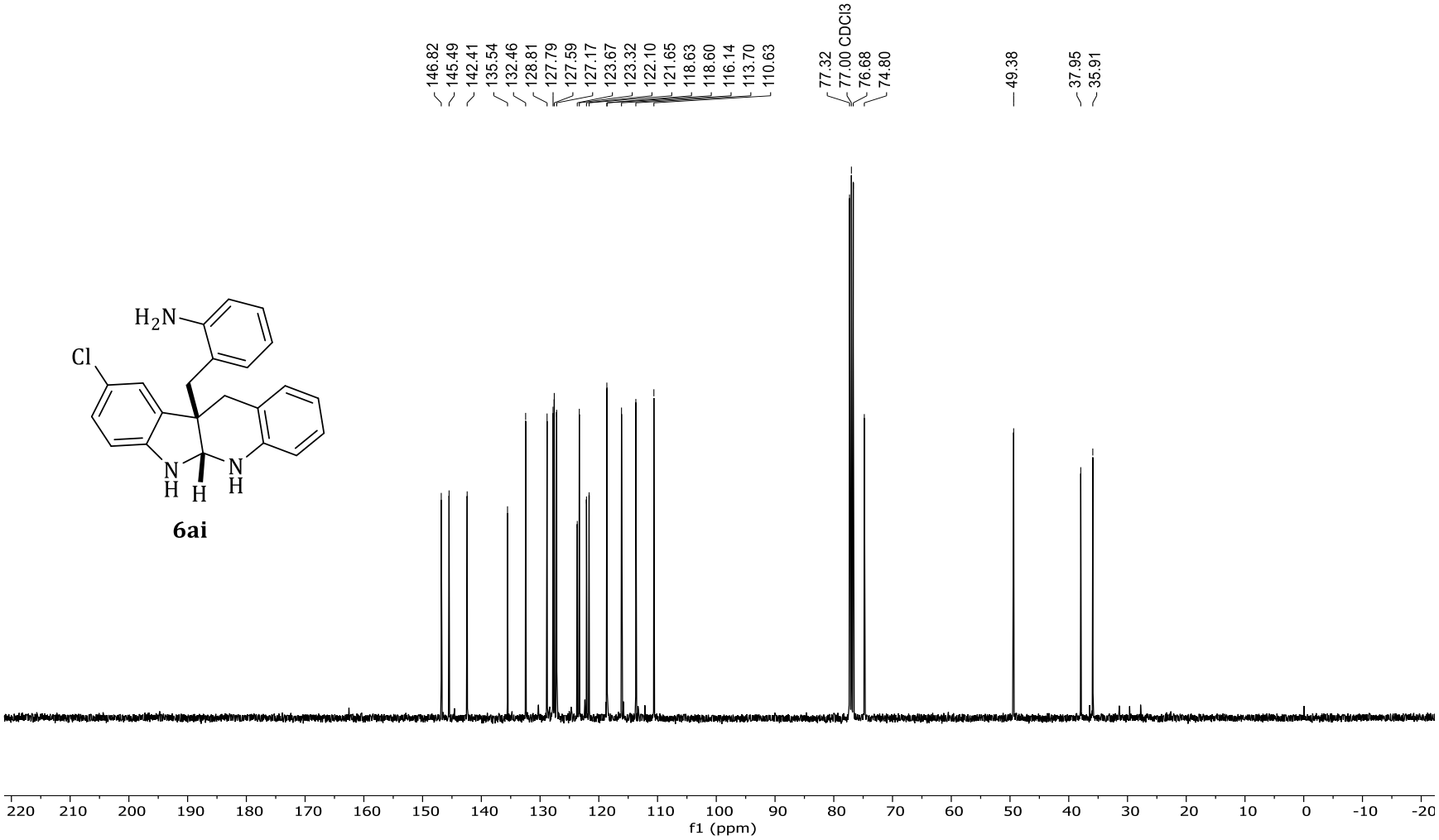
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ah**.



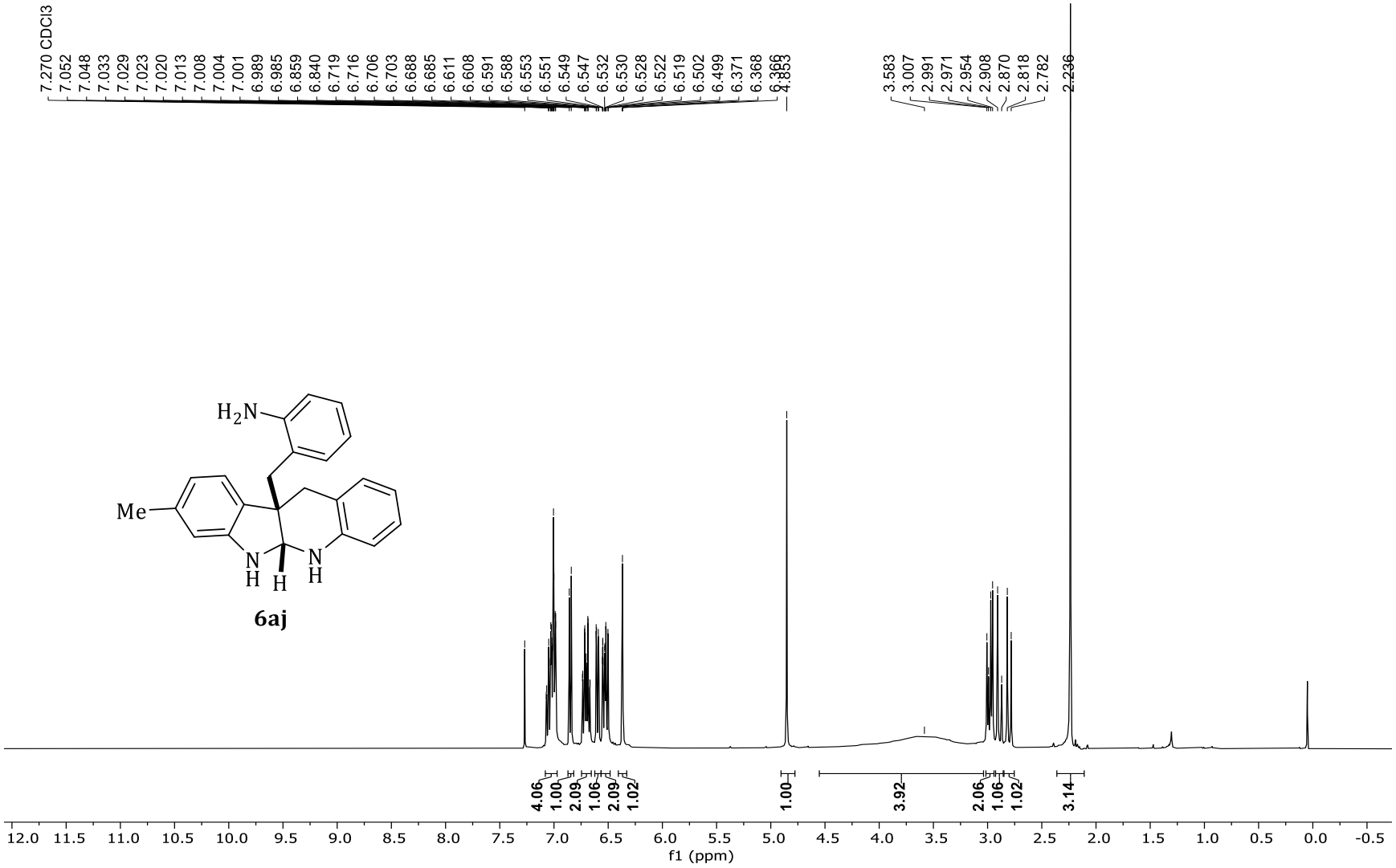
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ah**.



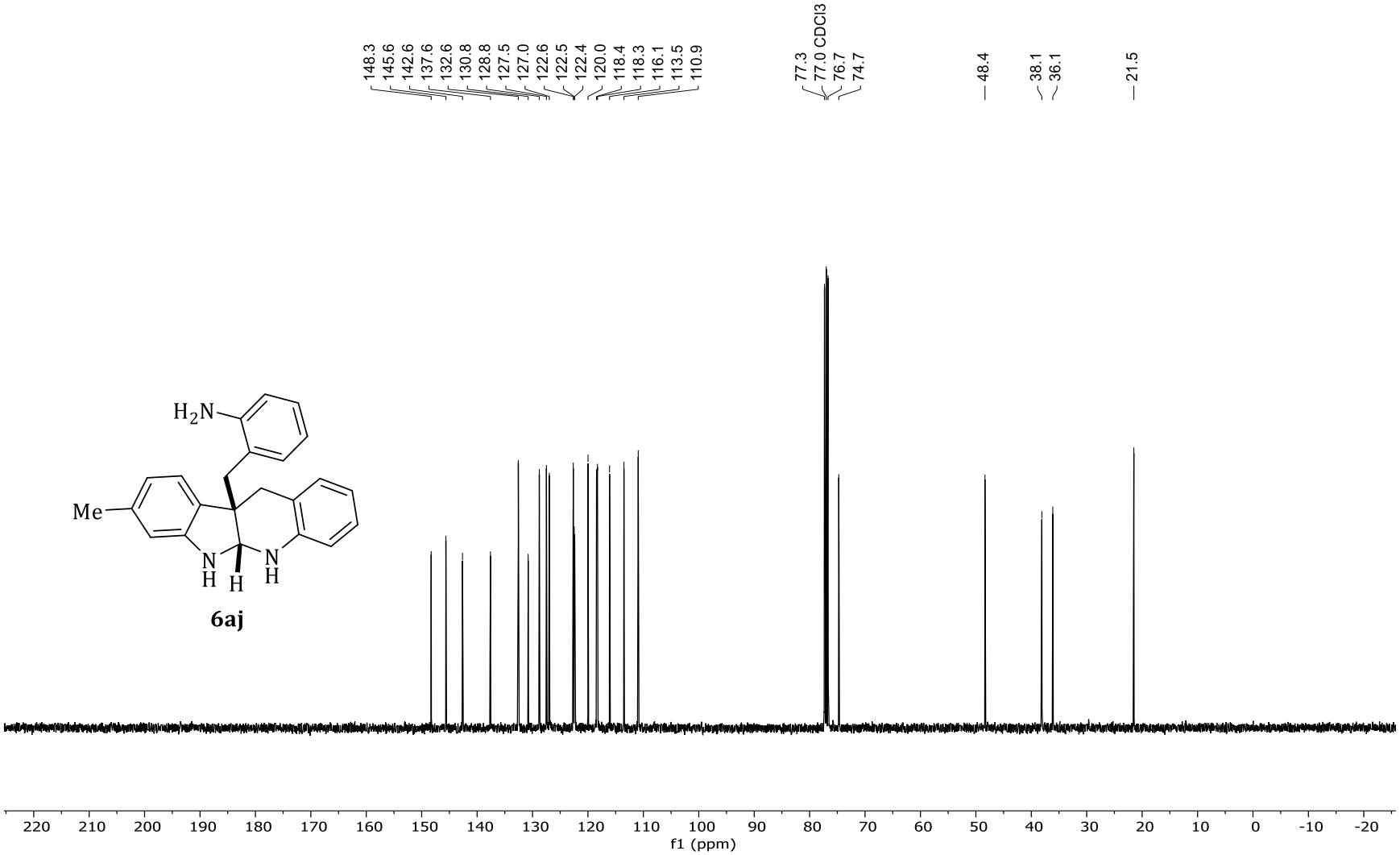
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ai**.



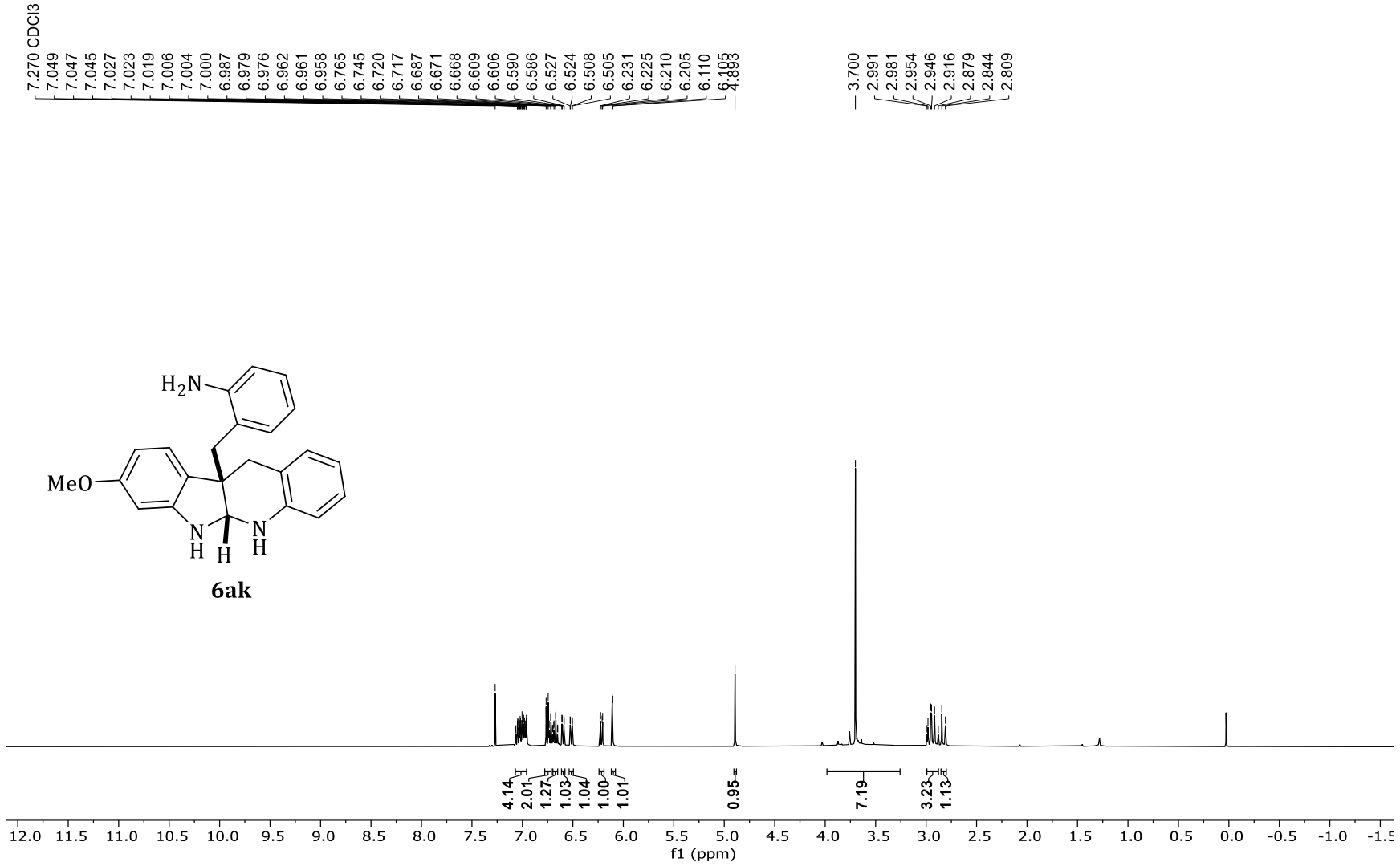
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ai**.



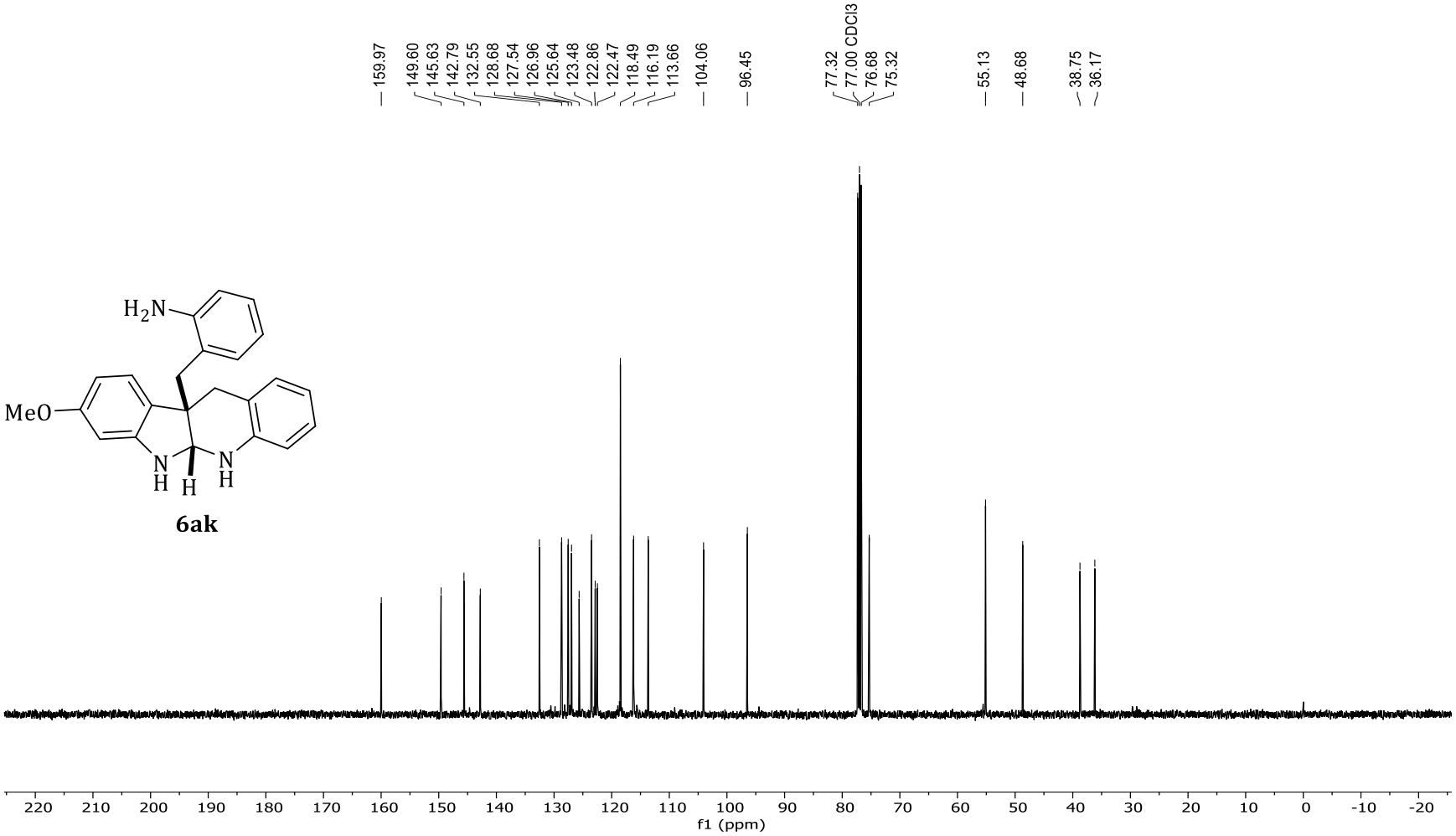
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6aj**.



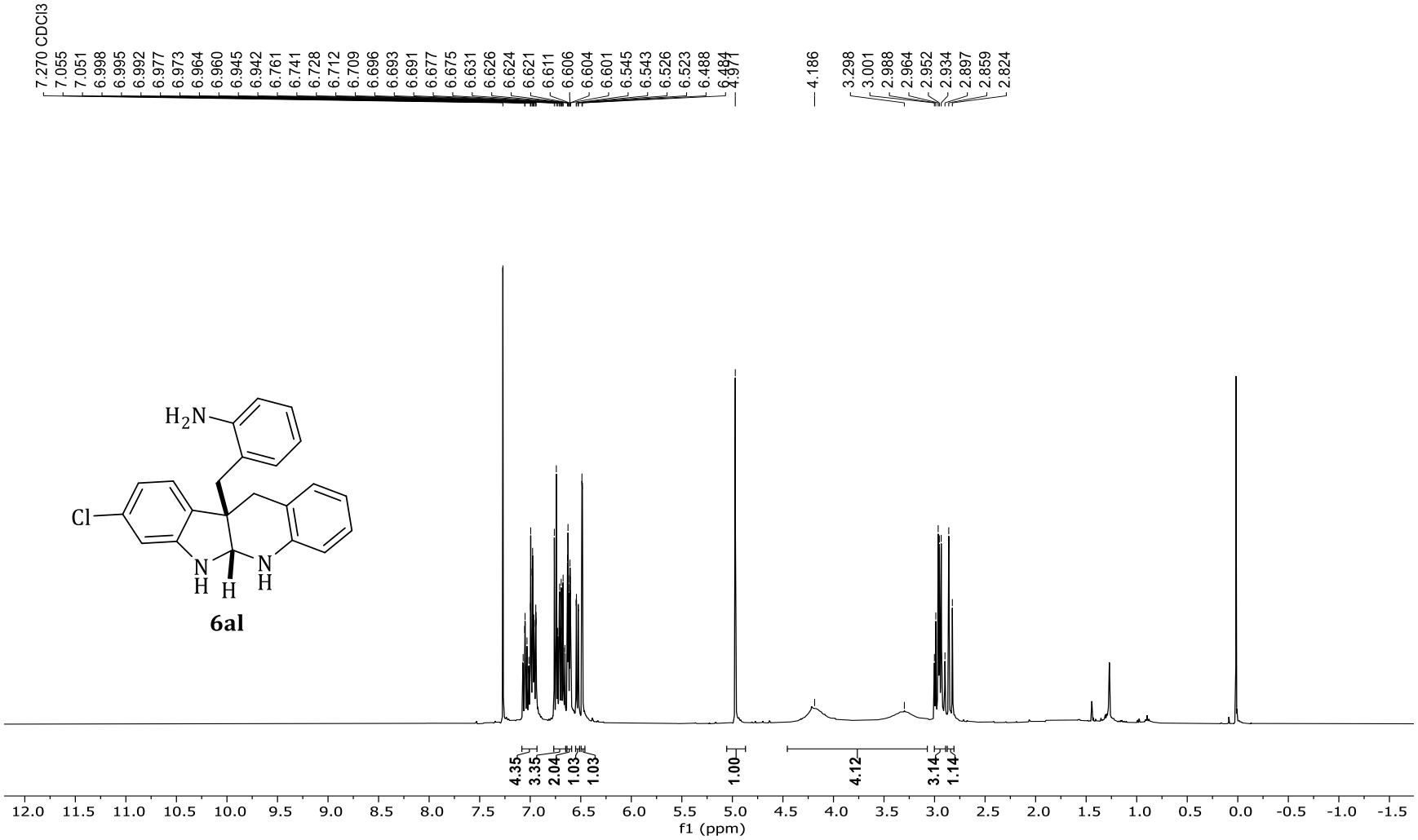
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6aj**.



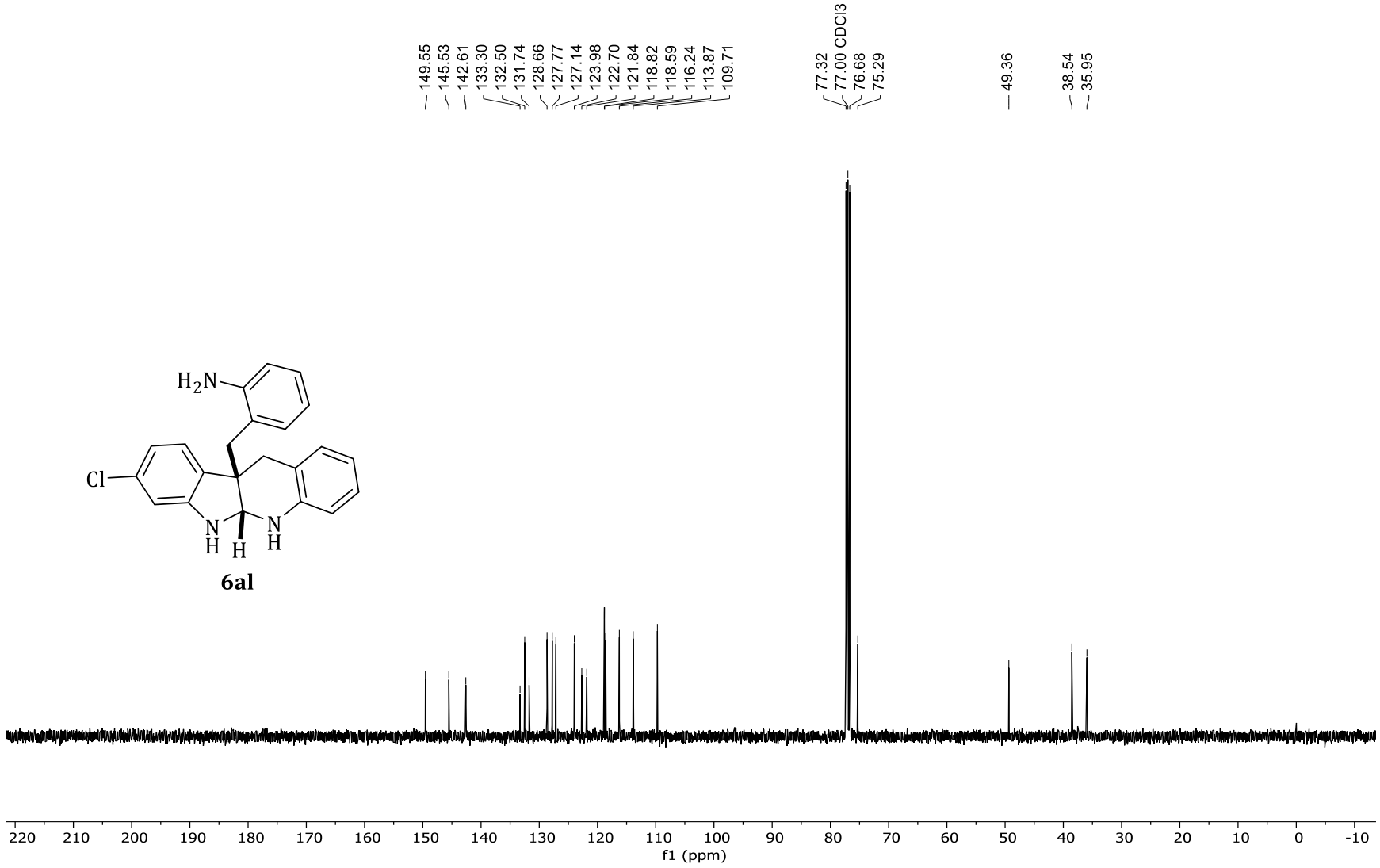
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ak**.



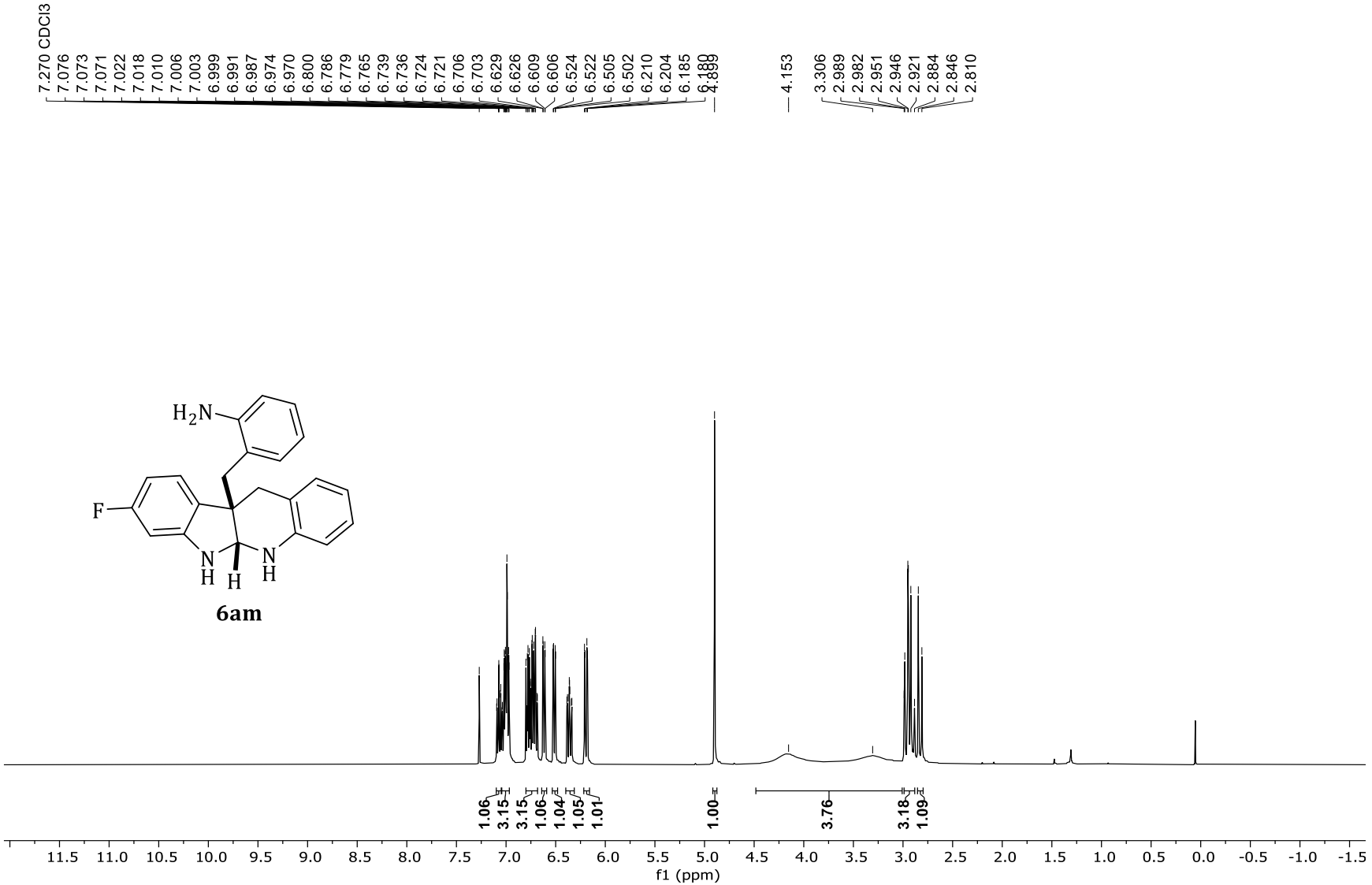
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ak**.



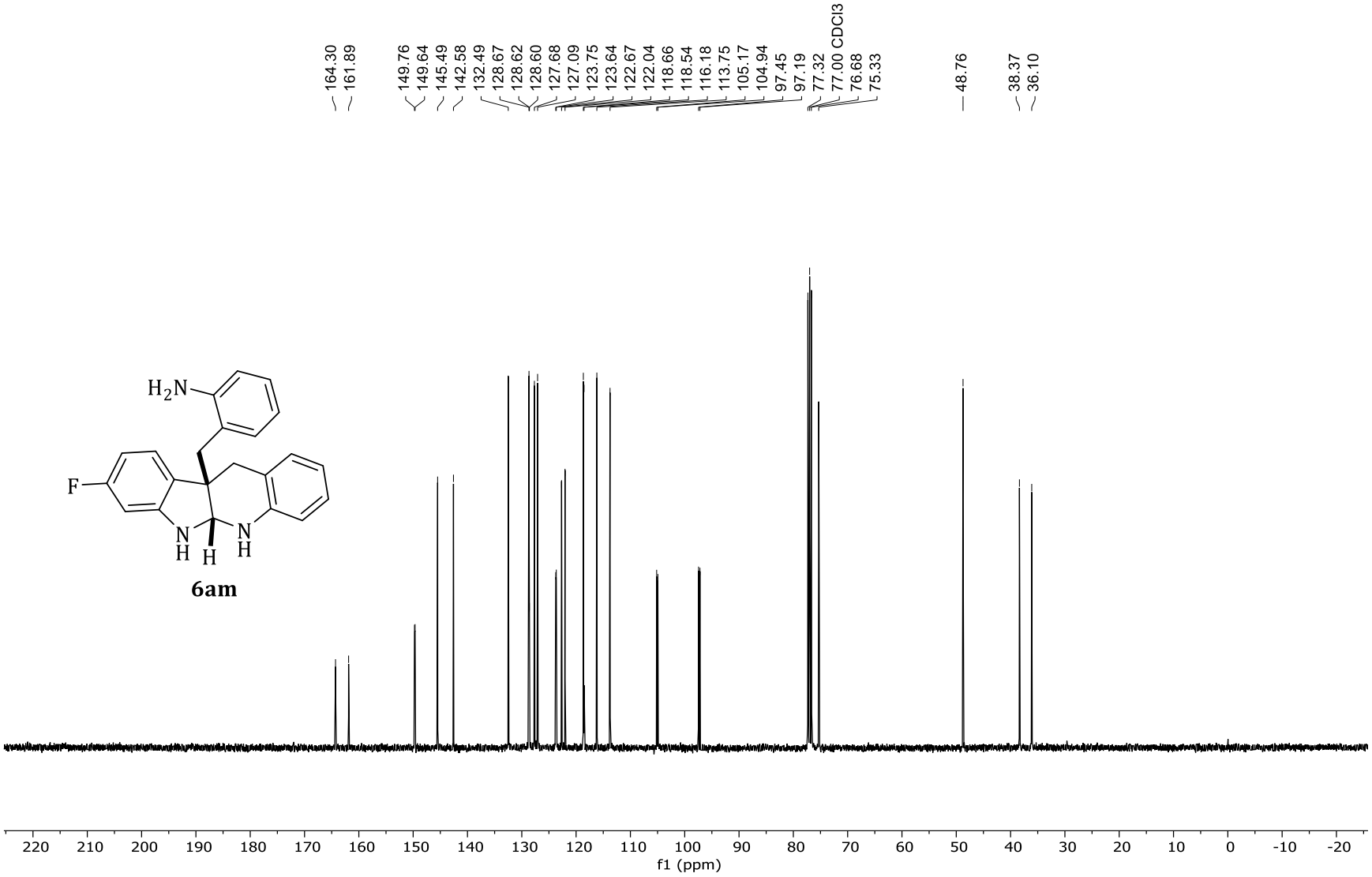
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6al**.



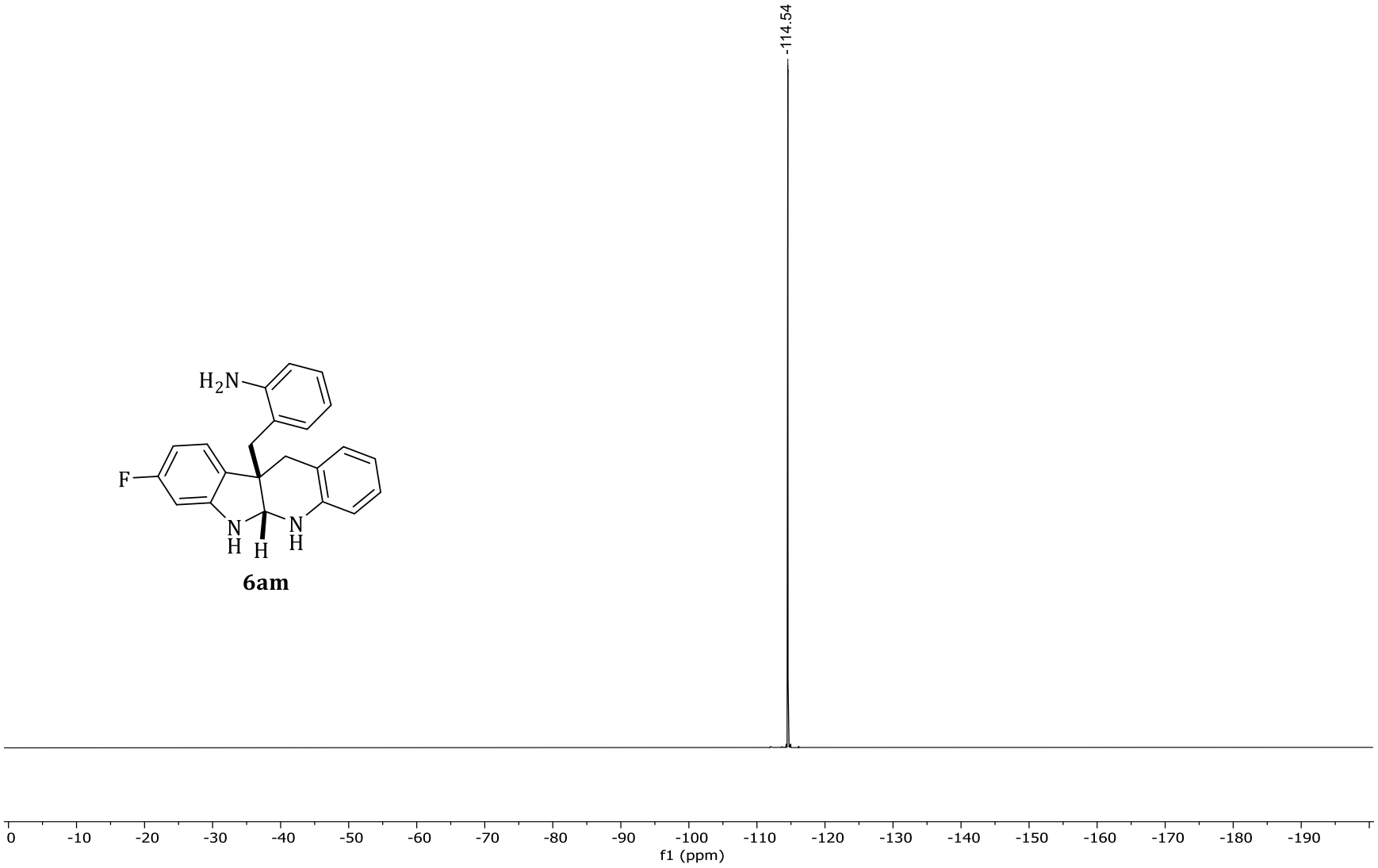
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6al**.



^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6am**.

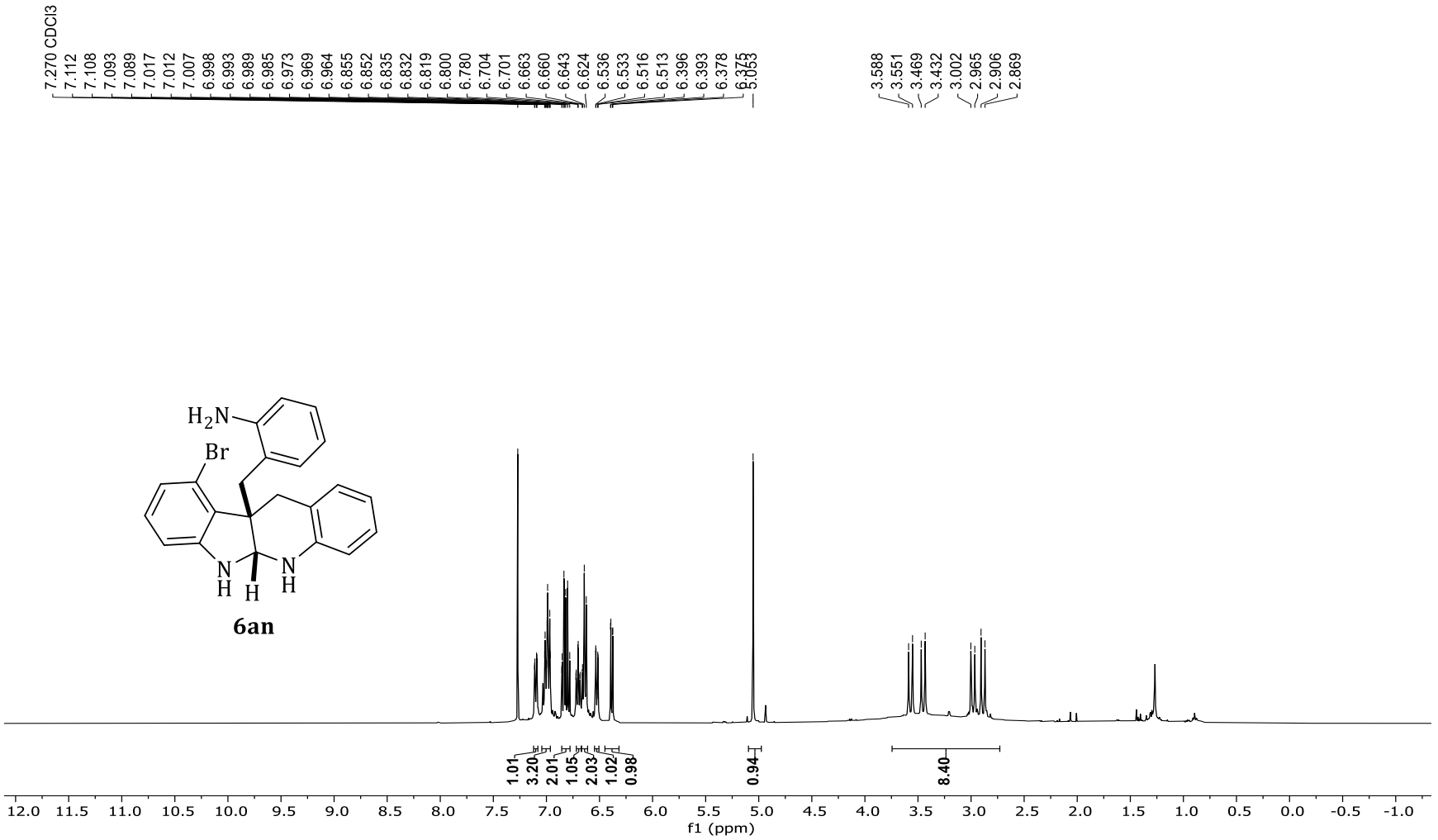


$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6am**.

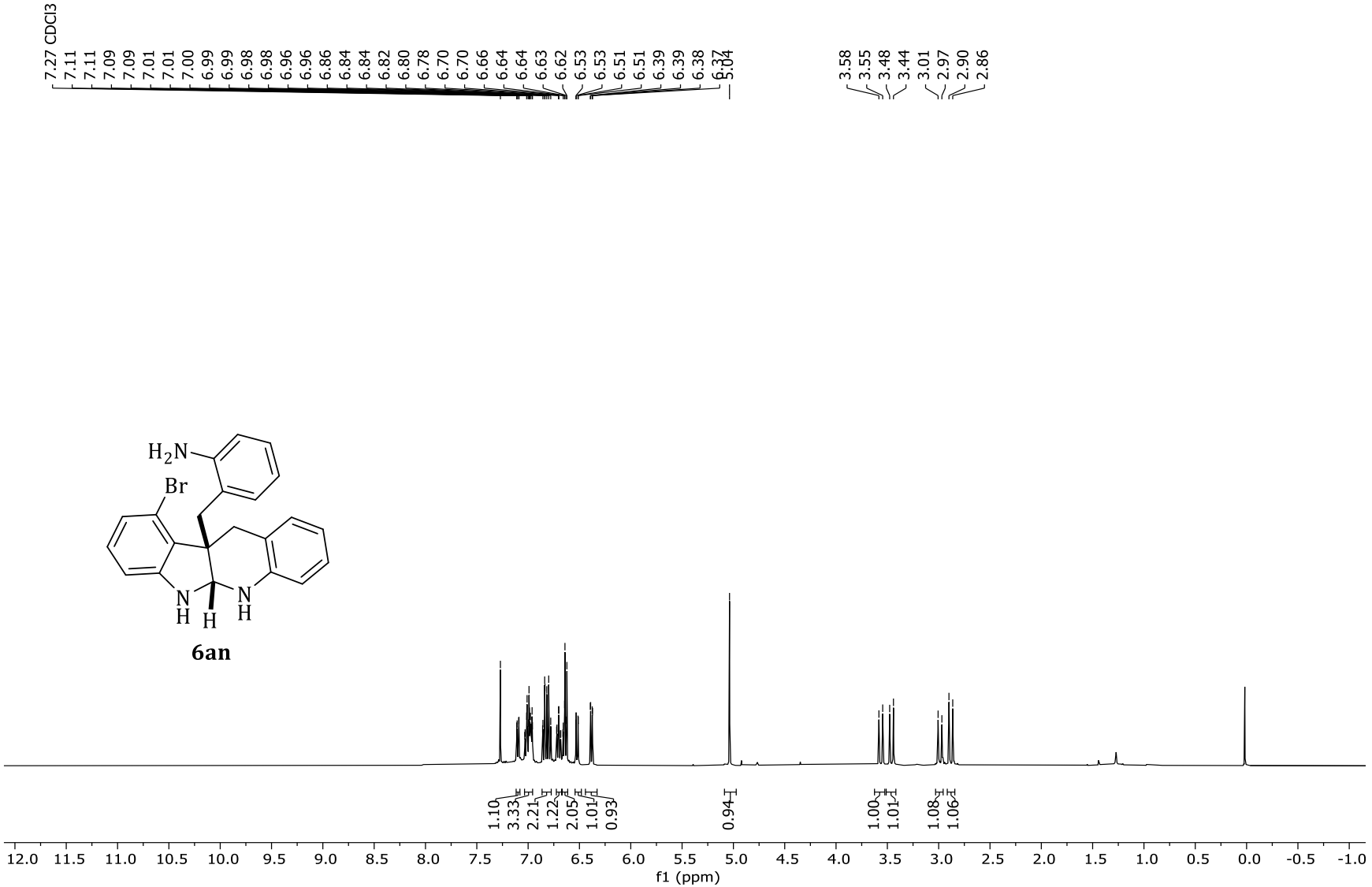


6am

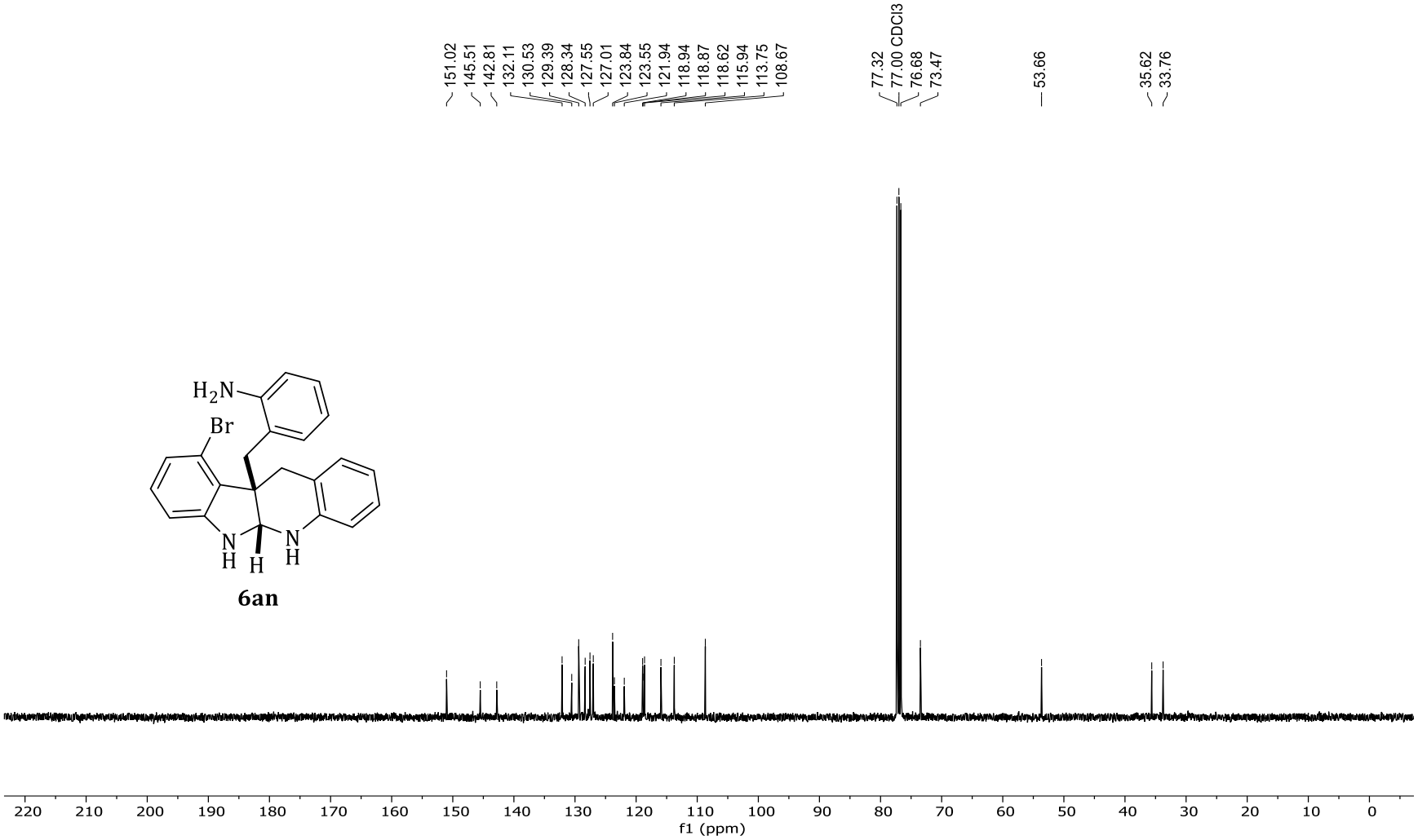
^{19}F NMR spectrum (376 MHz, $CDCl_3$) of **6am**.



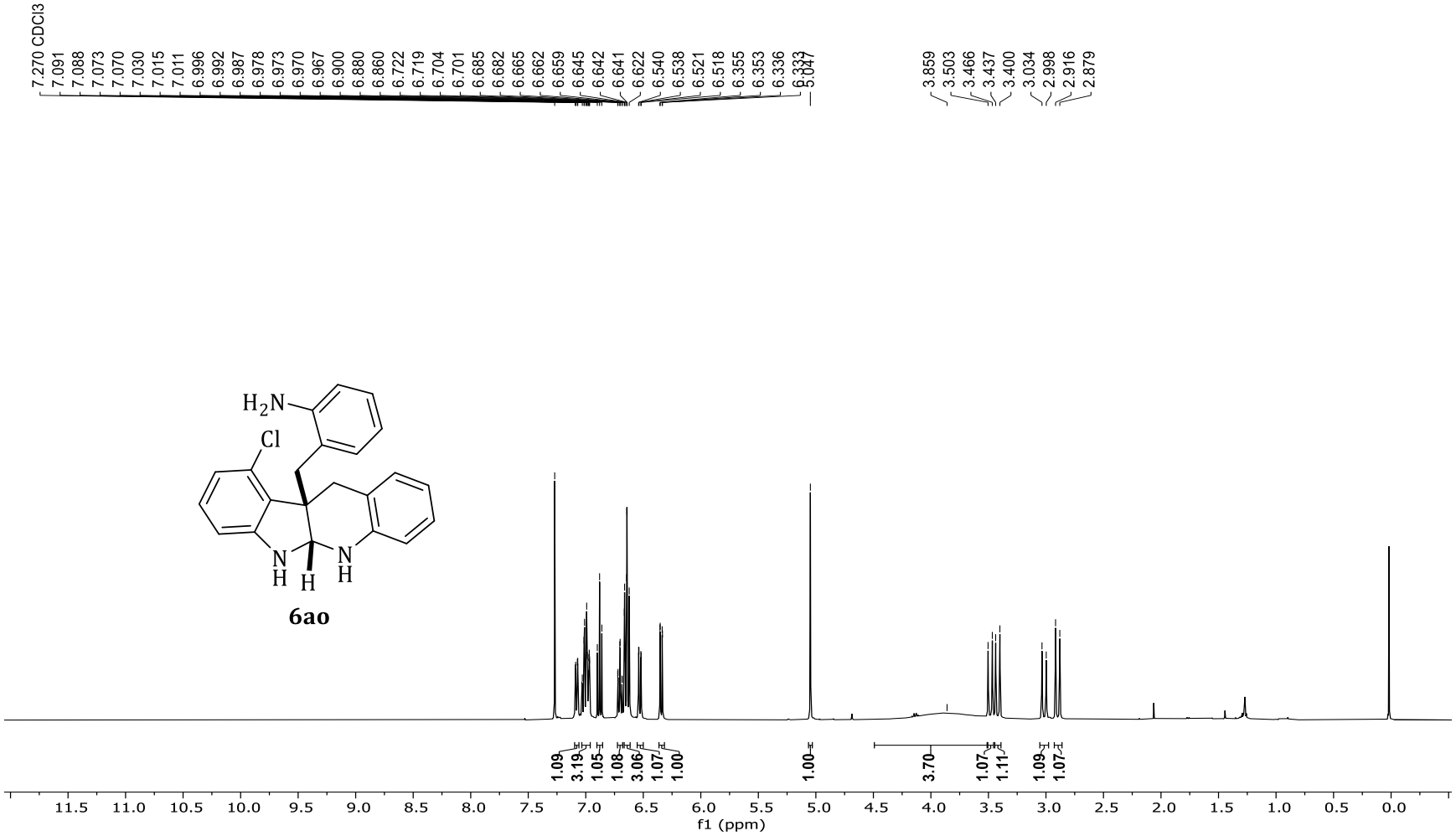
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6an**.



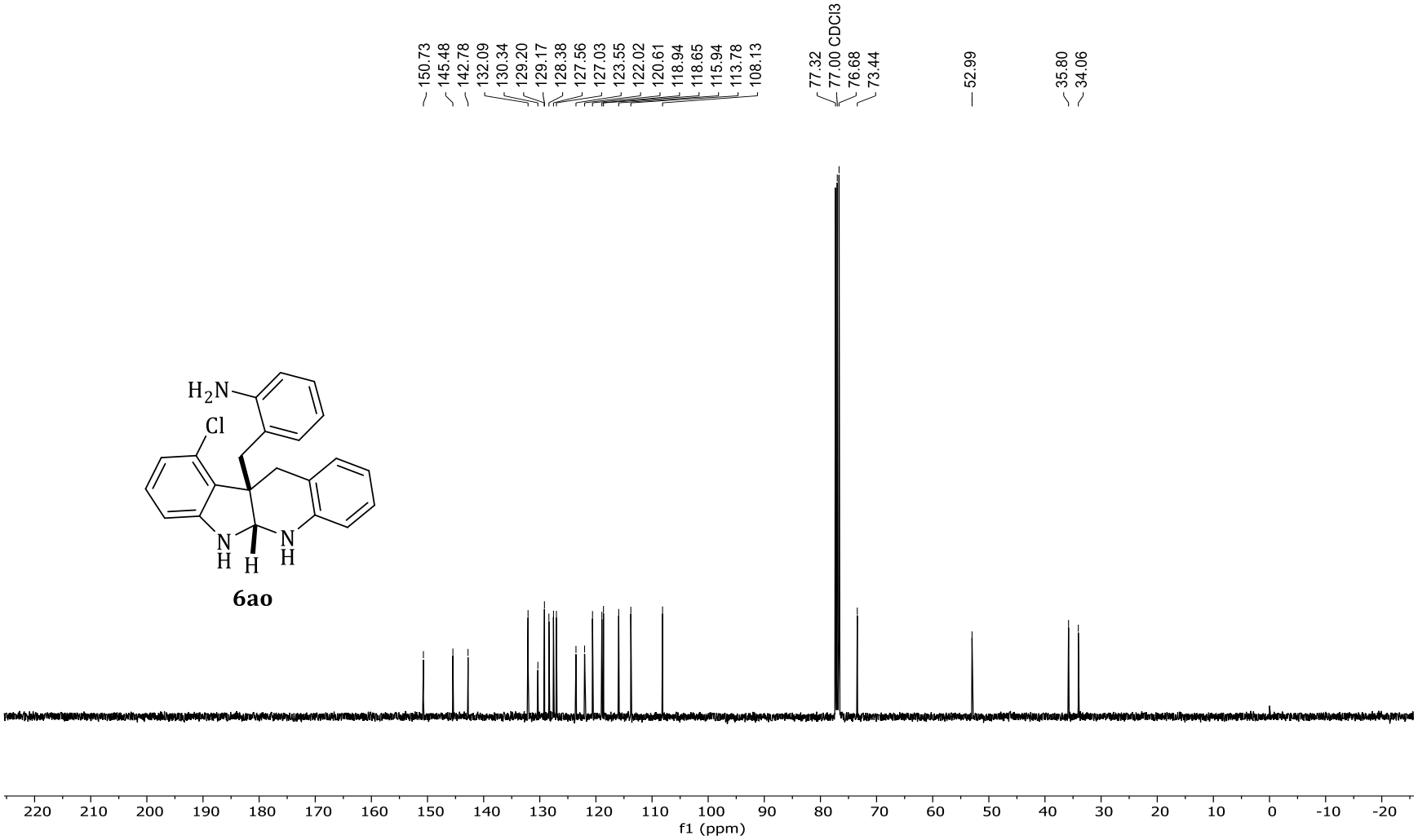
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6an** (recorded after D_2O shake experiment).



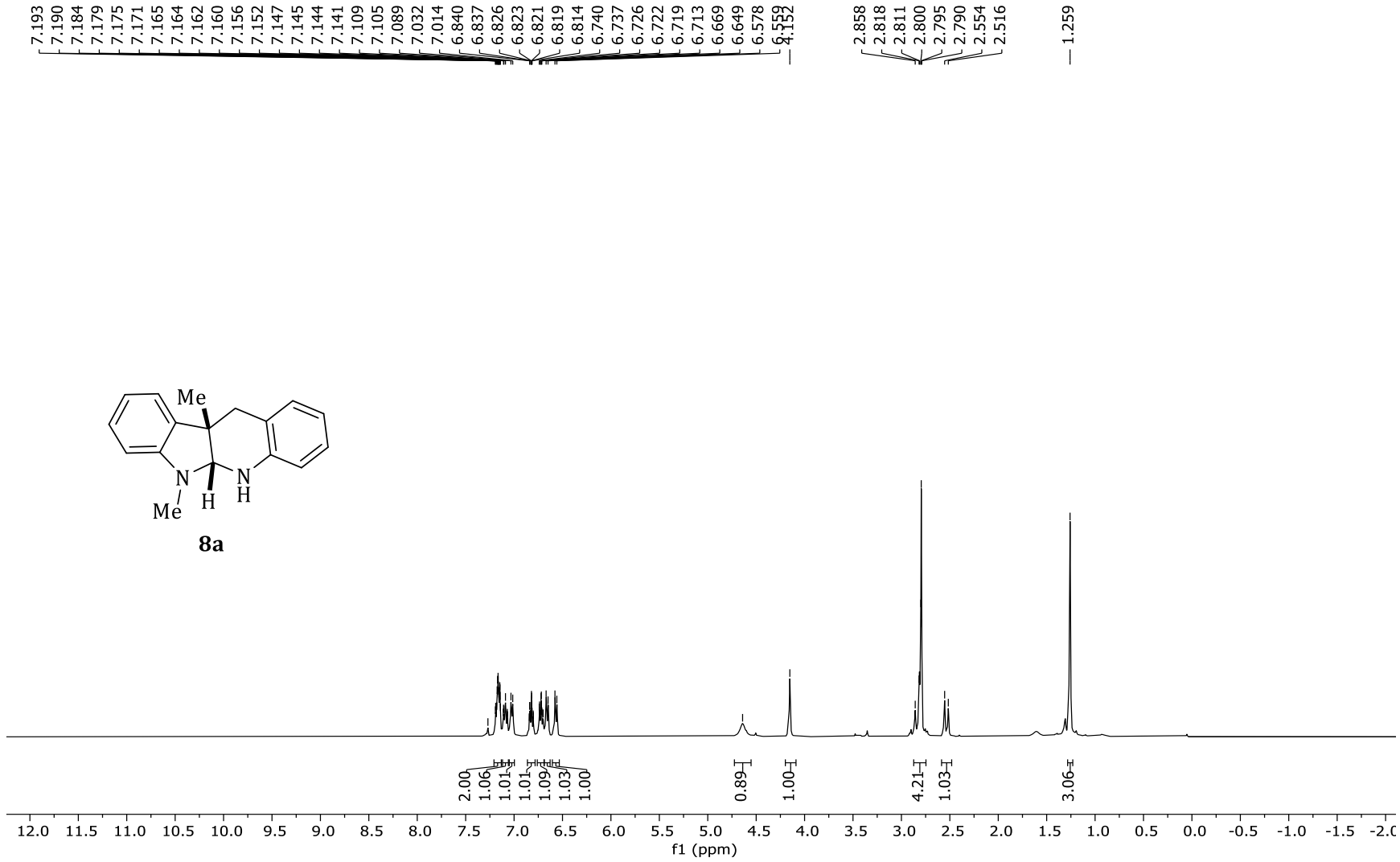
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6an**.



^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **6ao**.

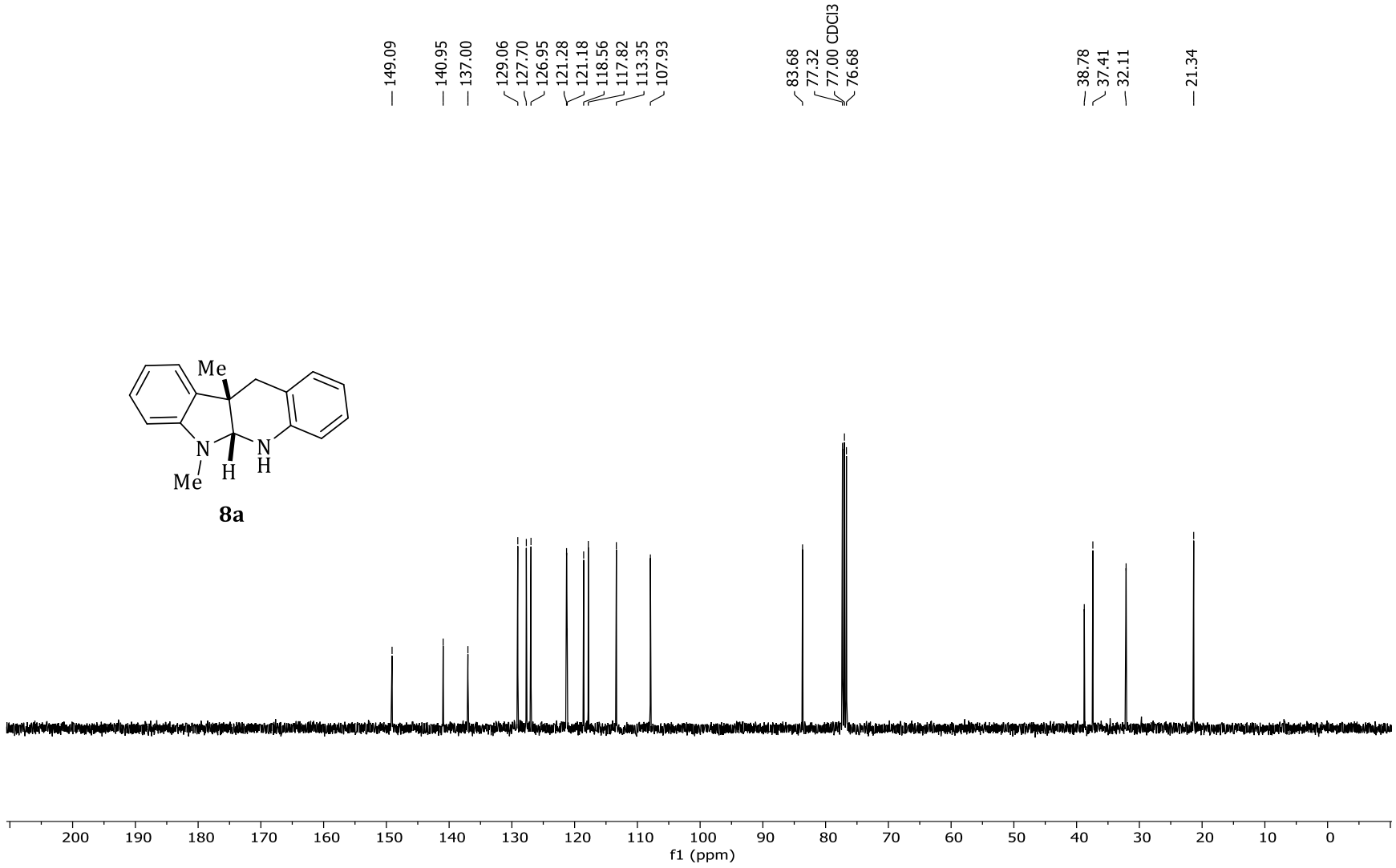


$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **6ao**.



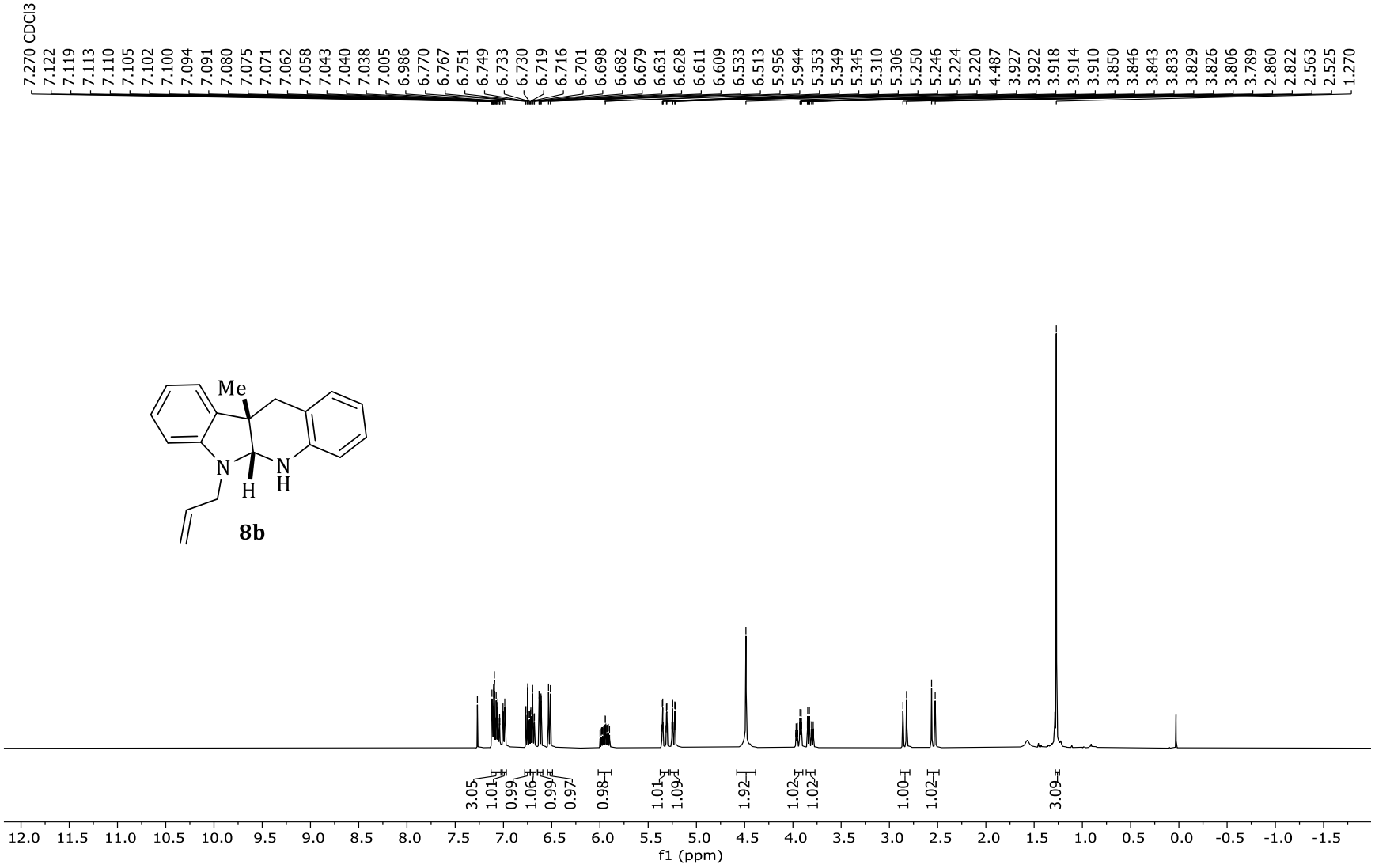
8a

^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **8a**.

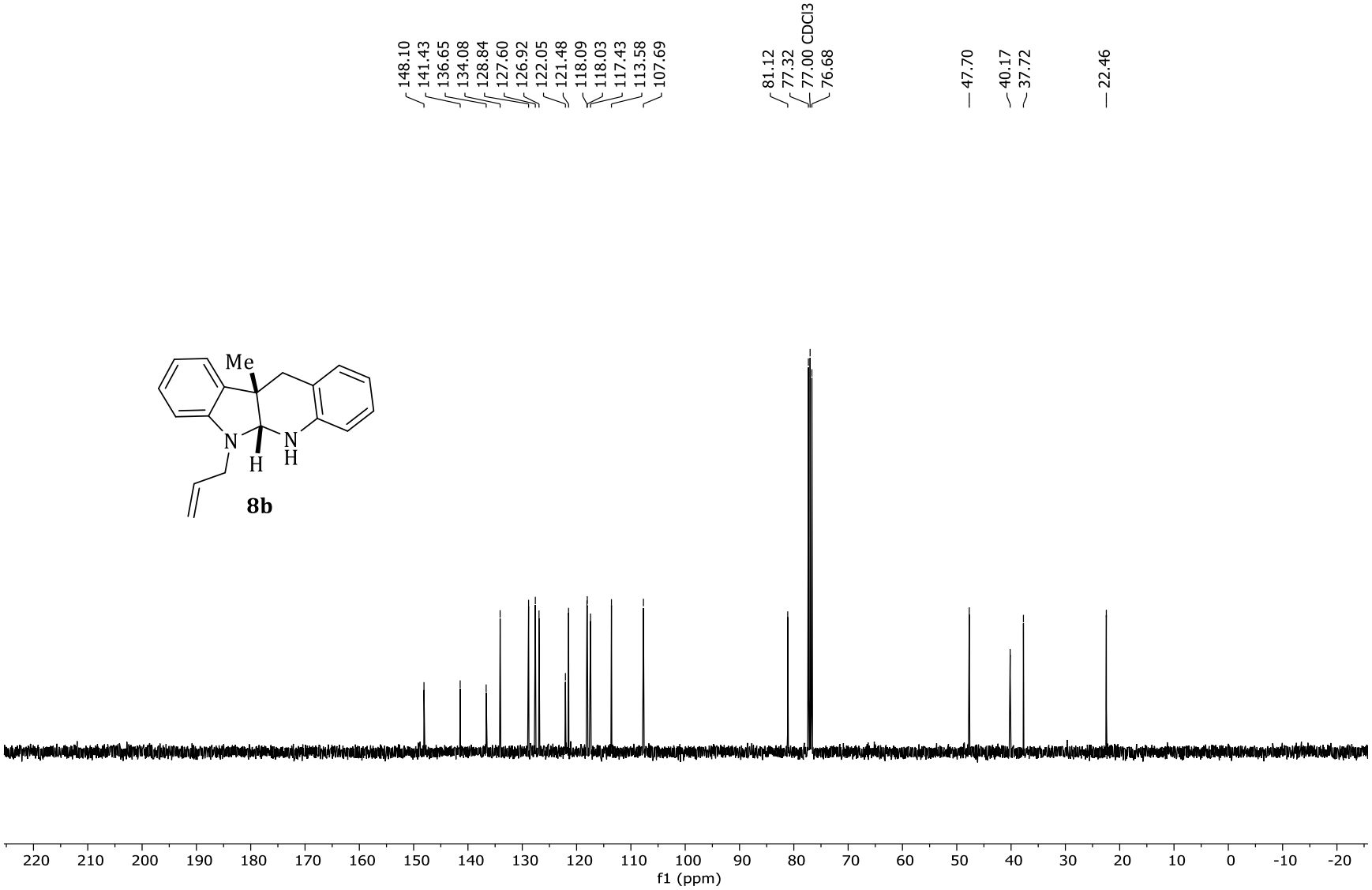


8a

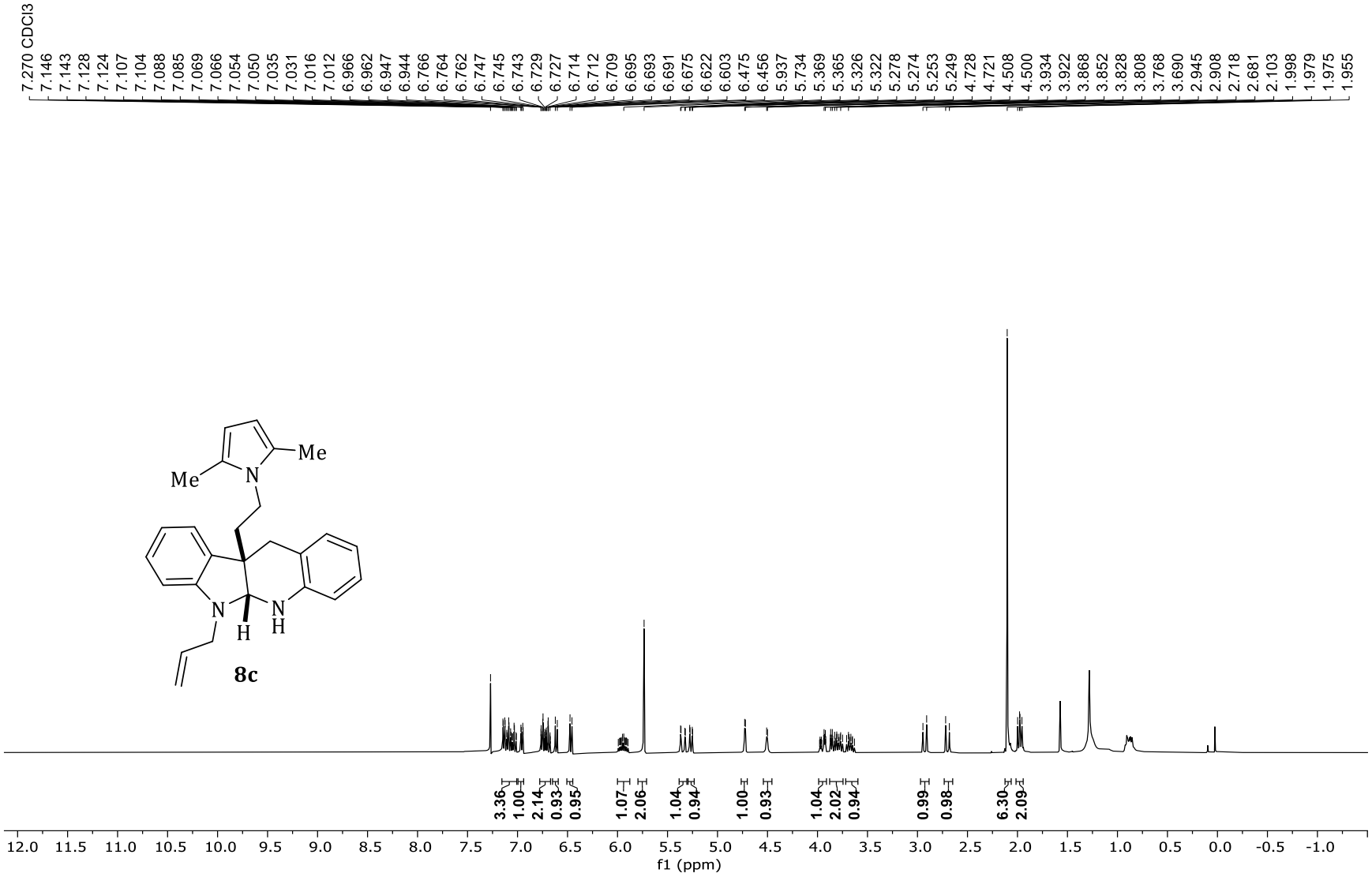
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **8a**.



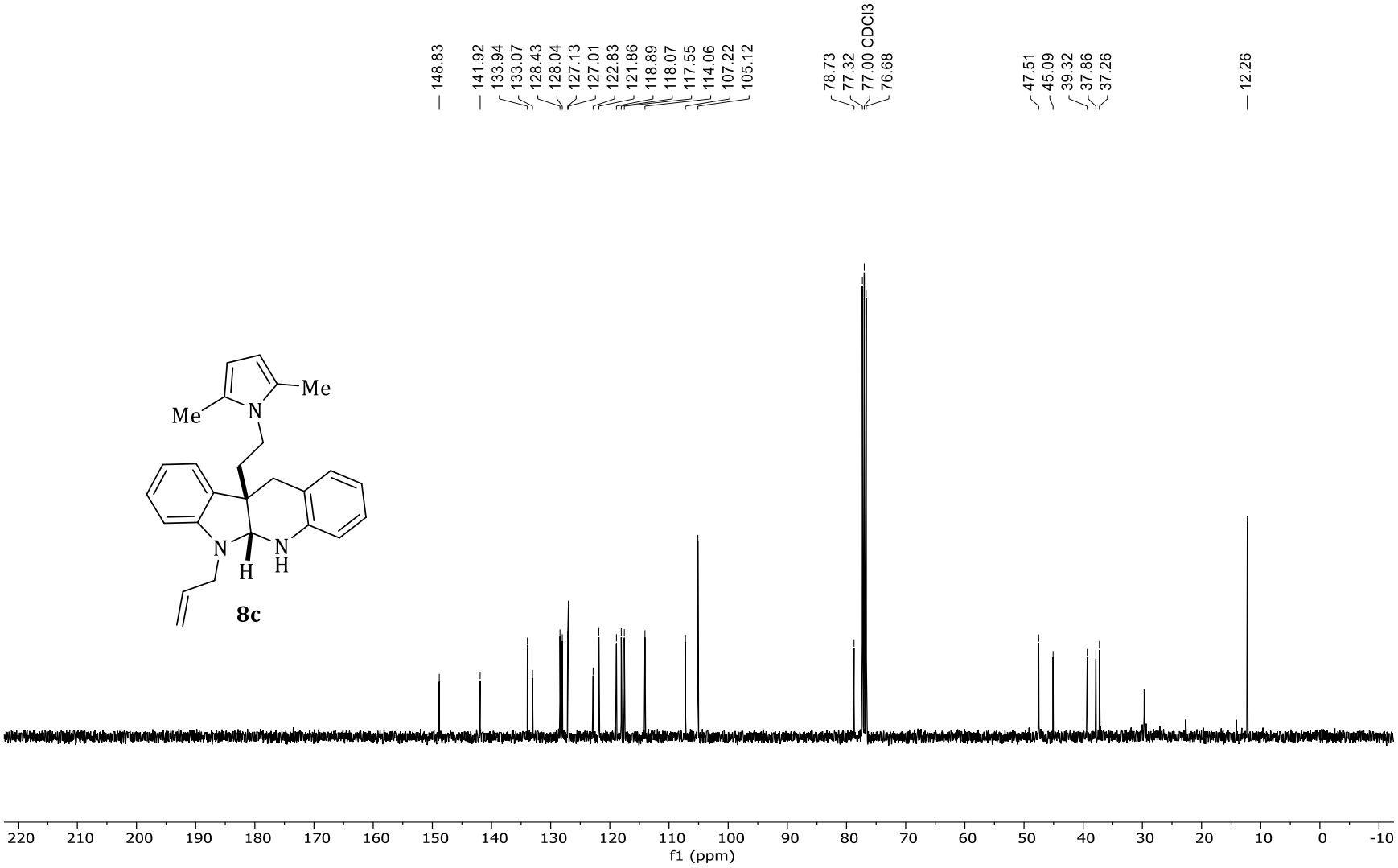
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **8b**.



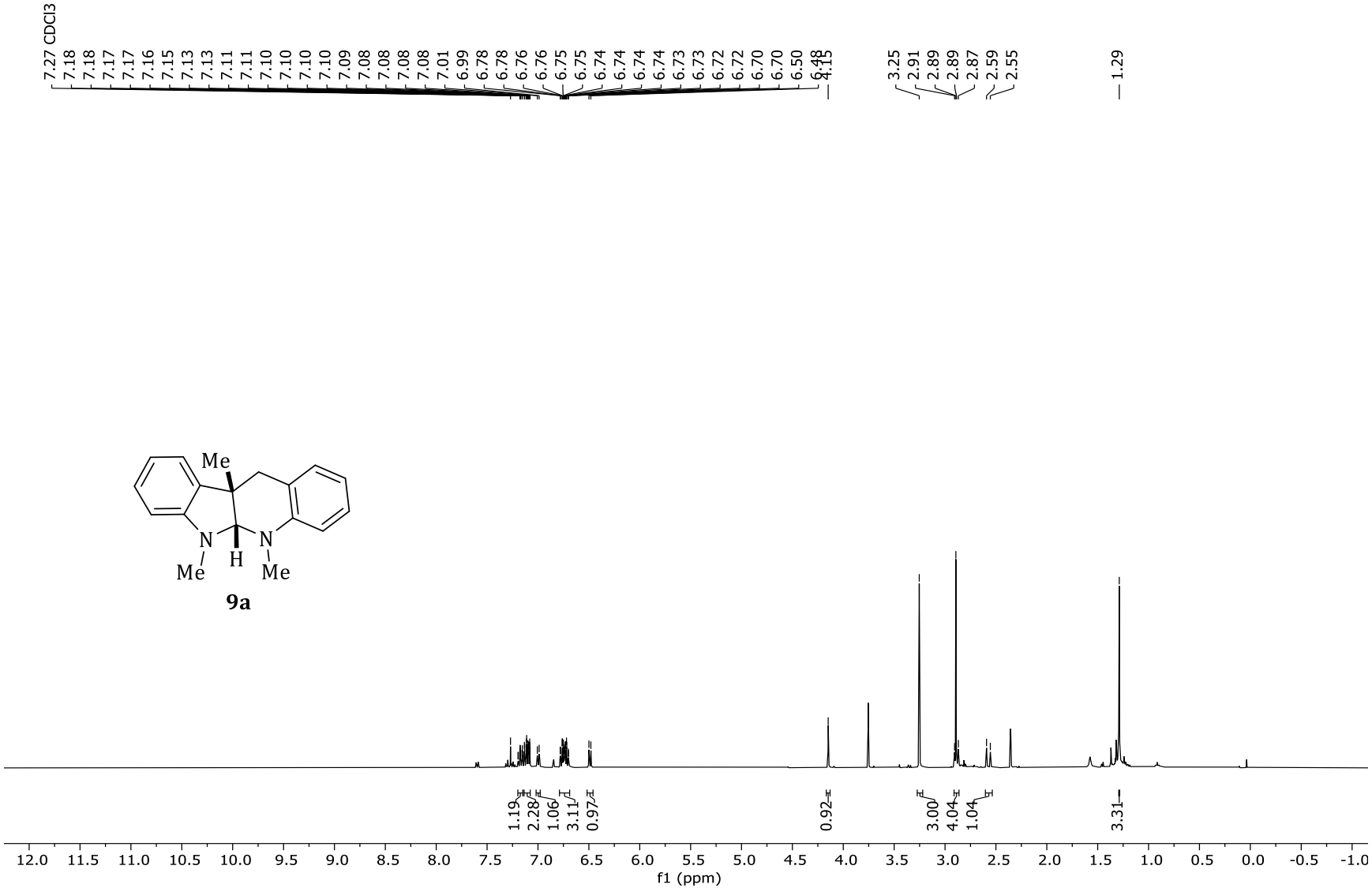
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **8b**.



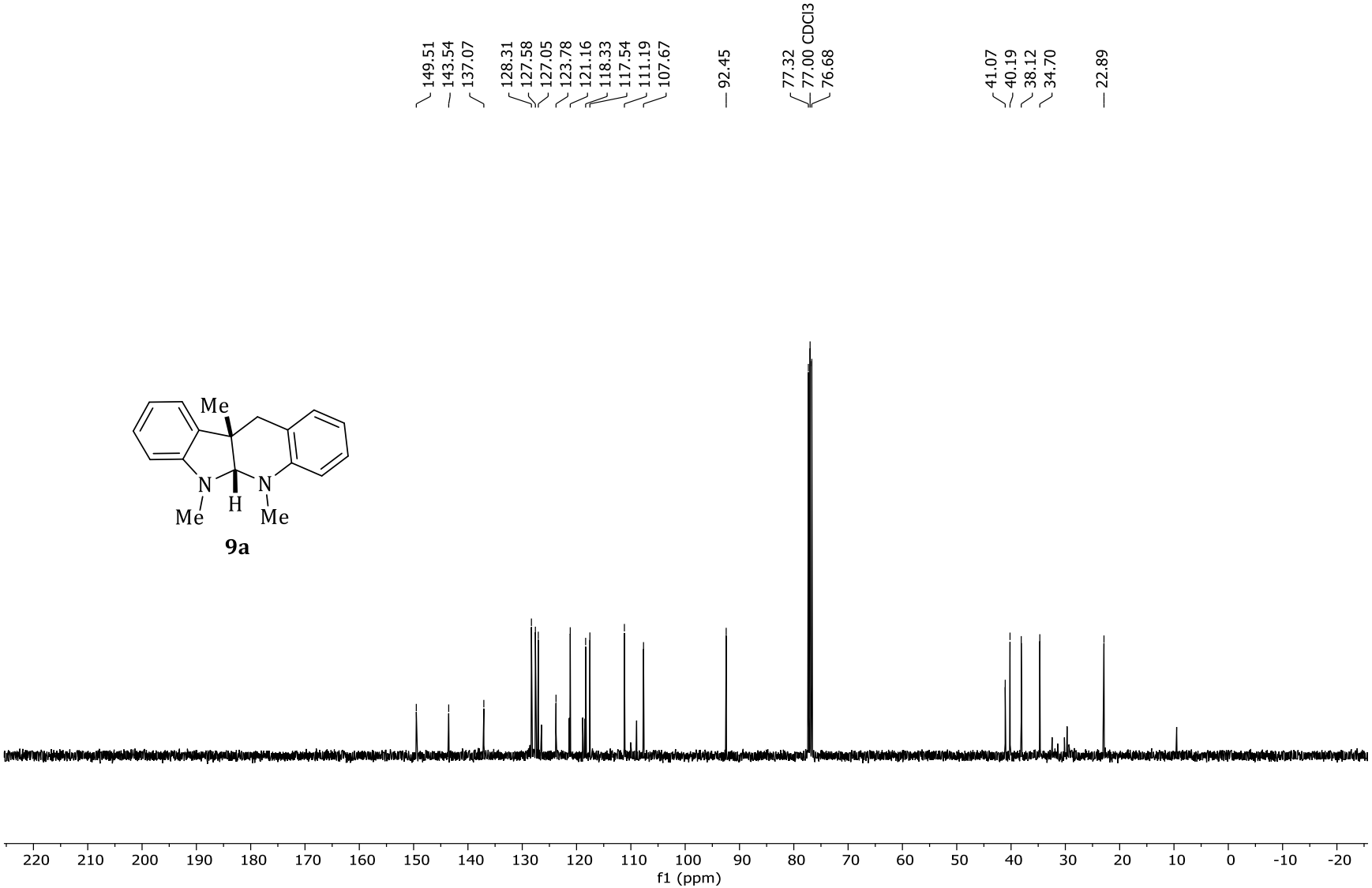
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **8c**.



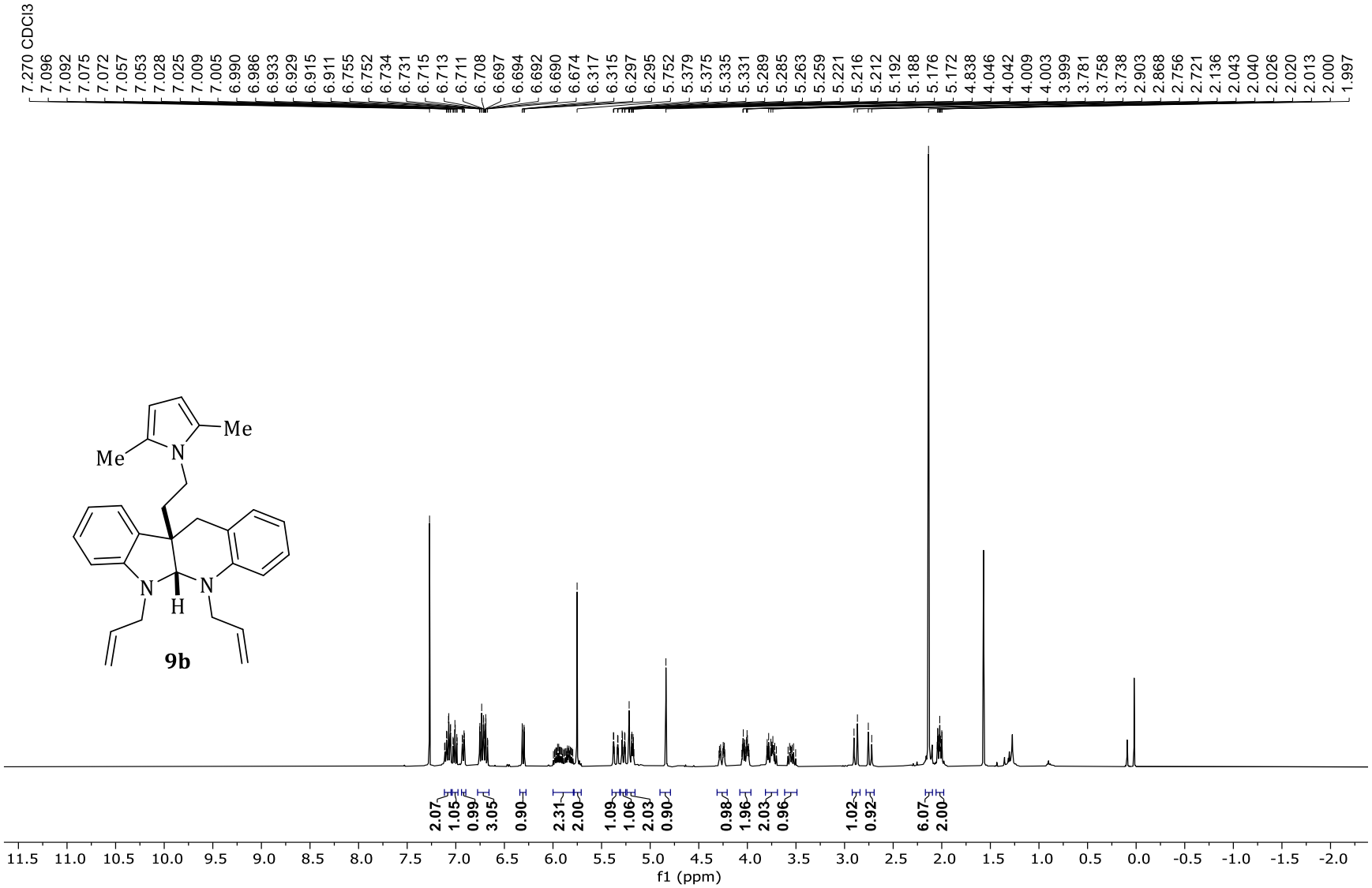
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **8c**.



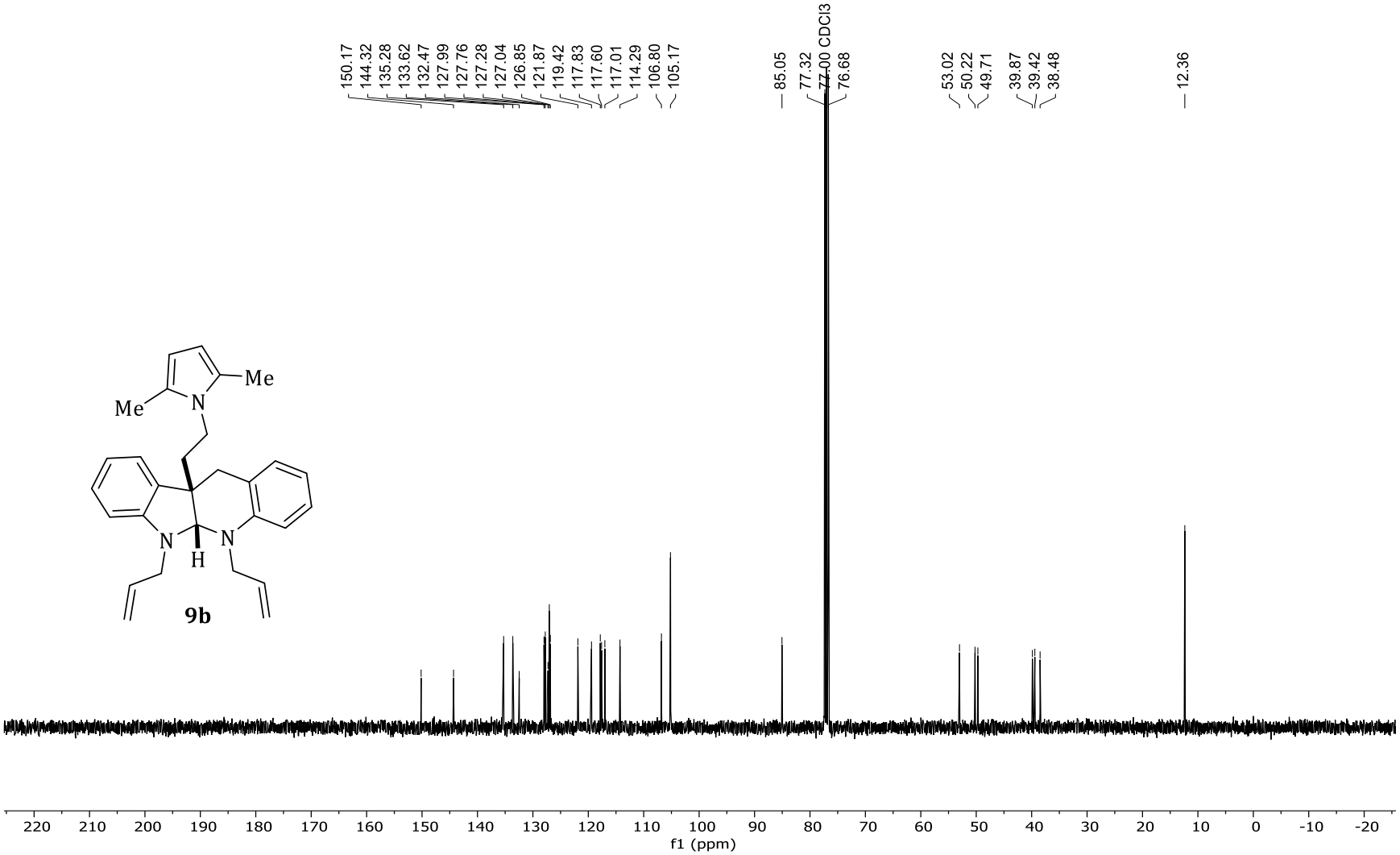
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **9a**.



$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **9a**.



^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **9b**.



$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **9b**.

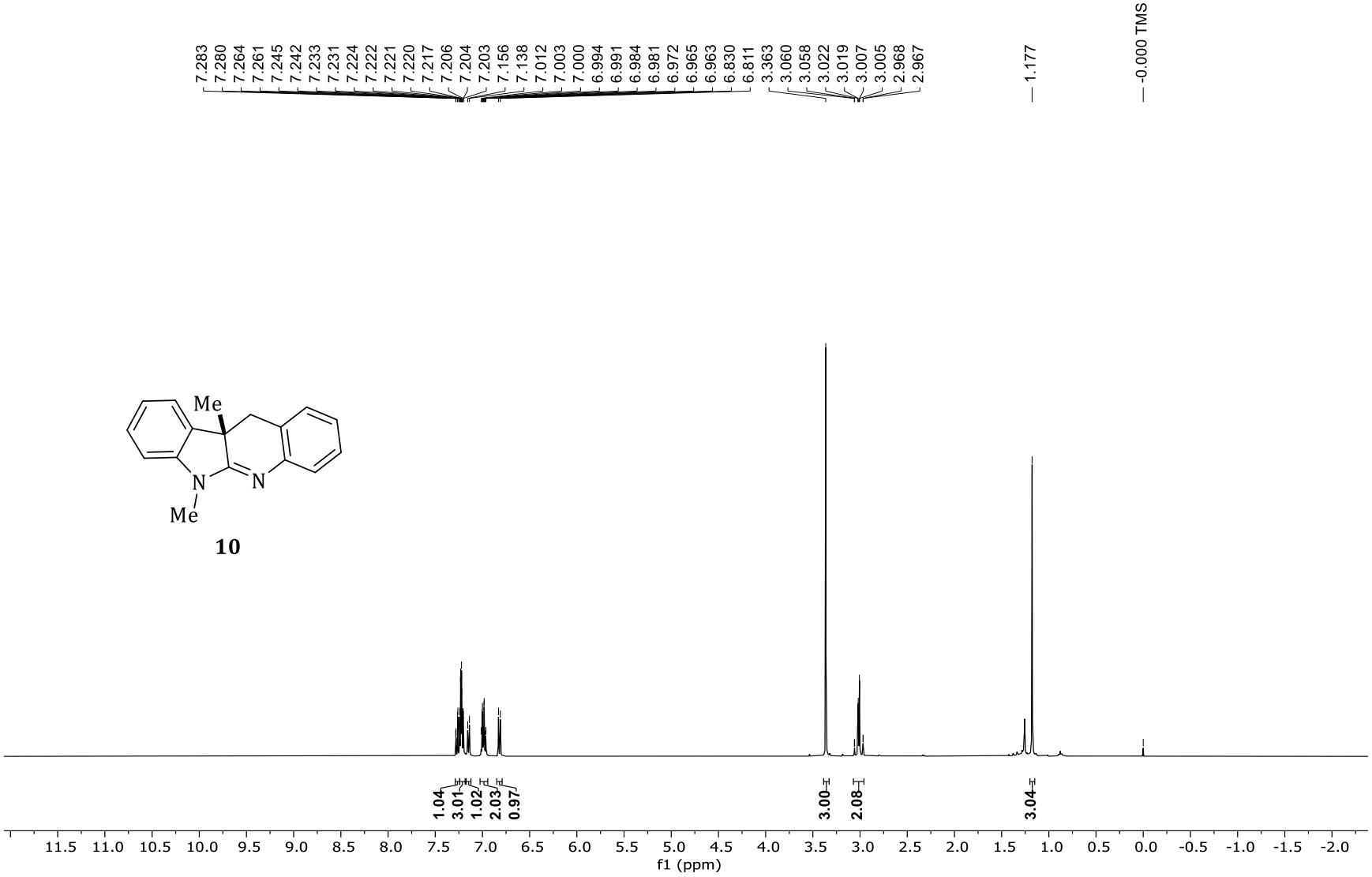
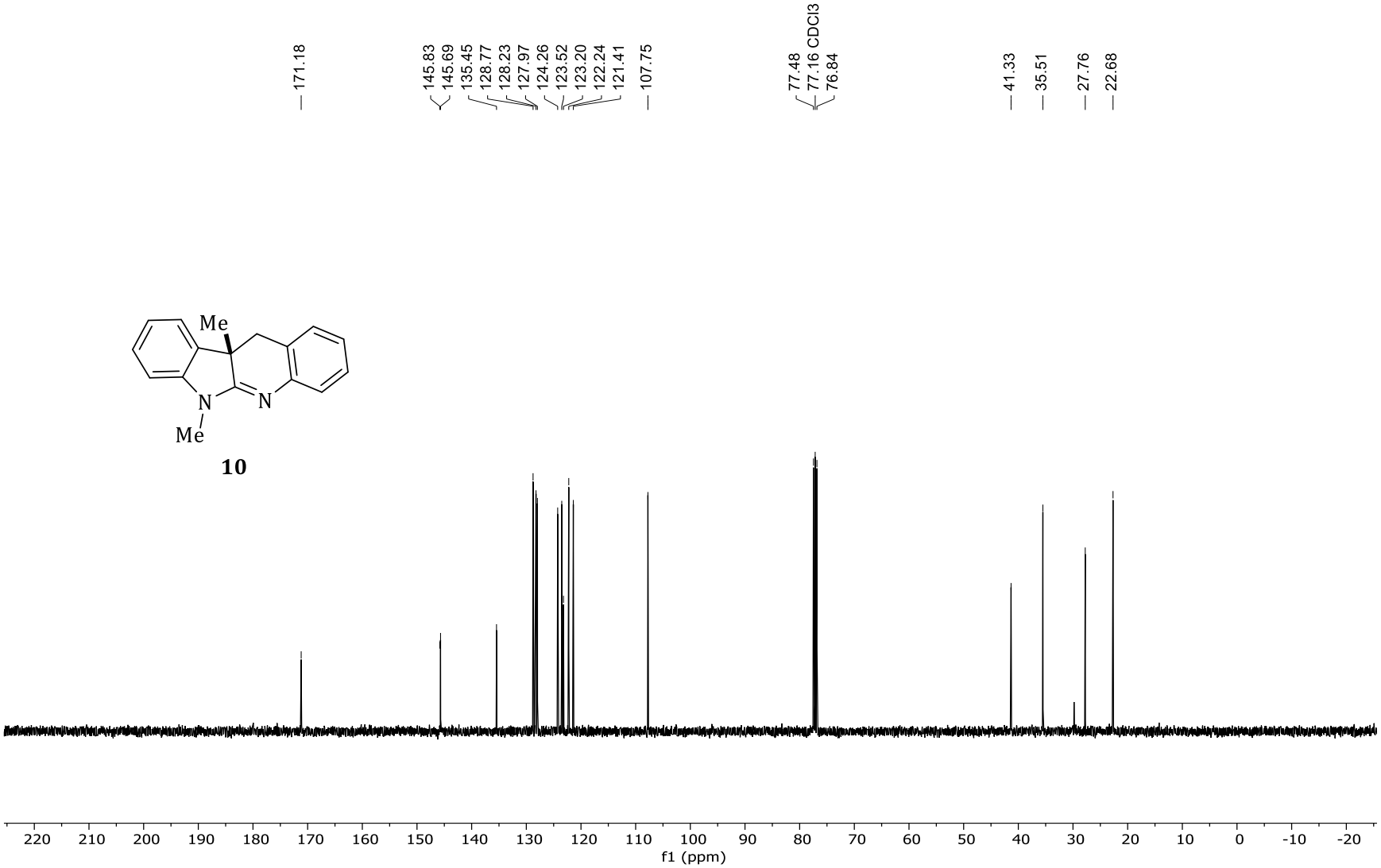
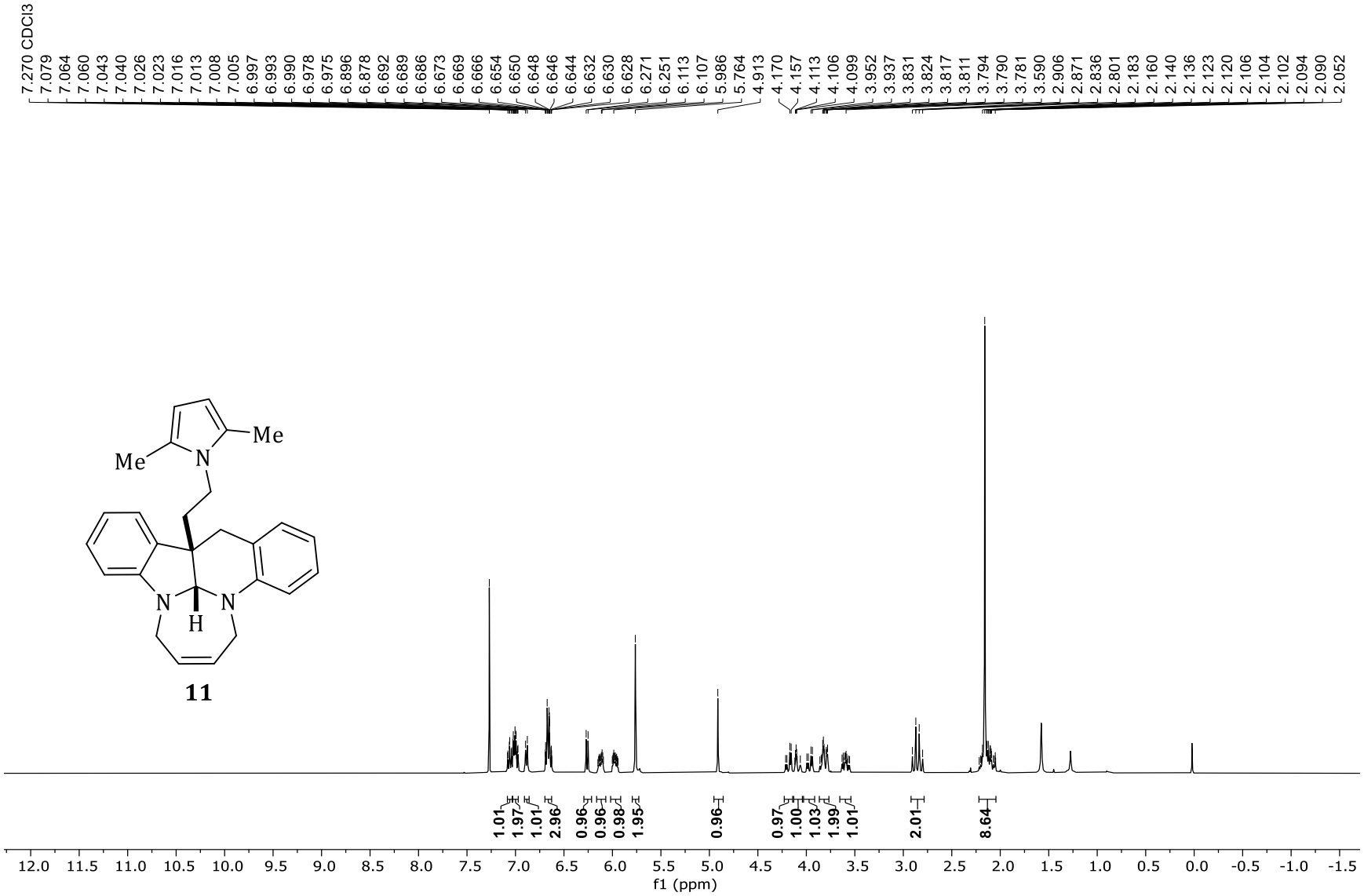


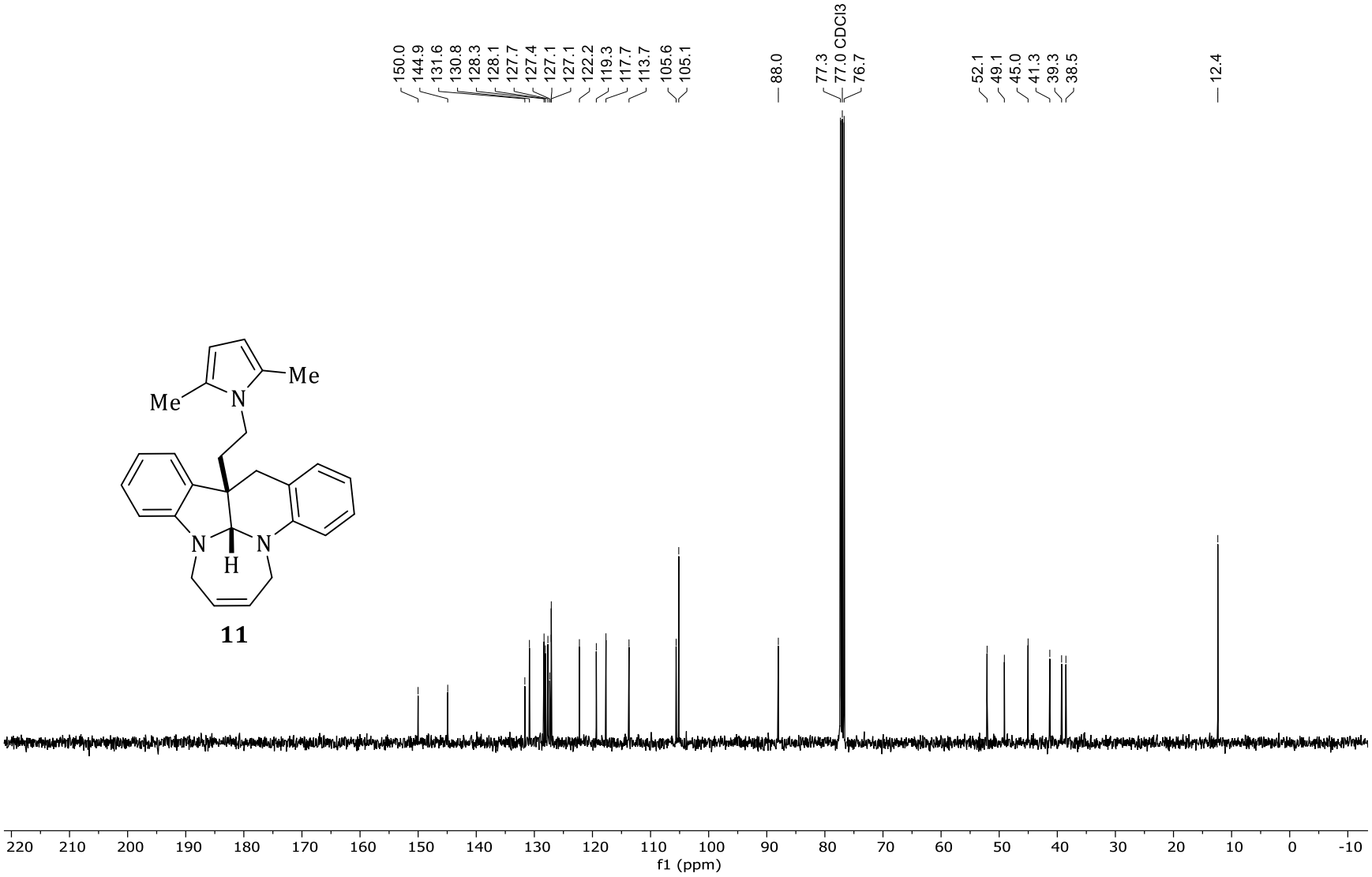
Figure 6.20. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **10**.



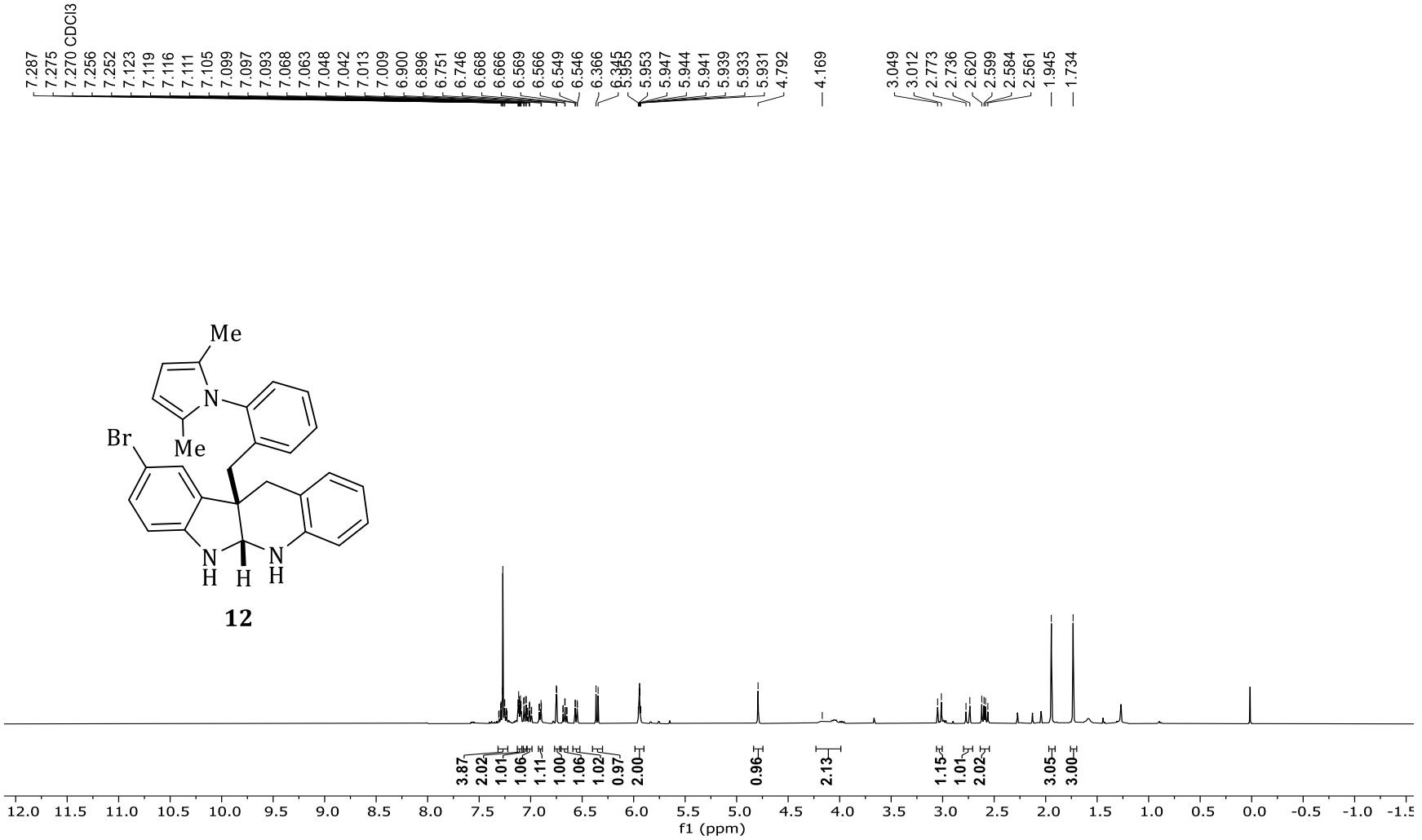
$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **10**.



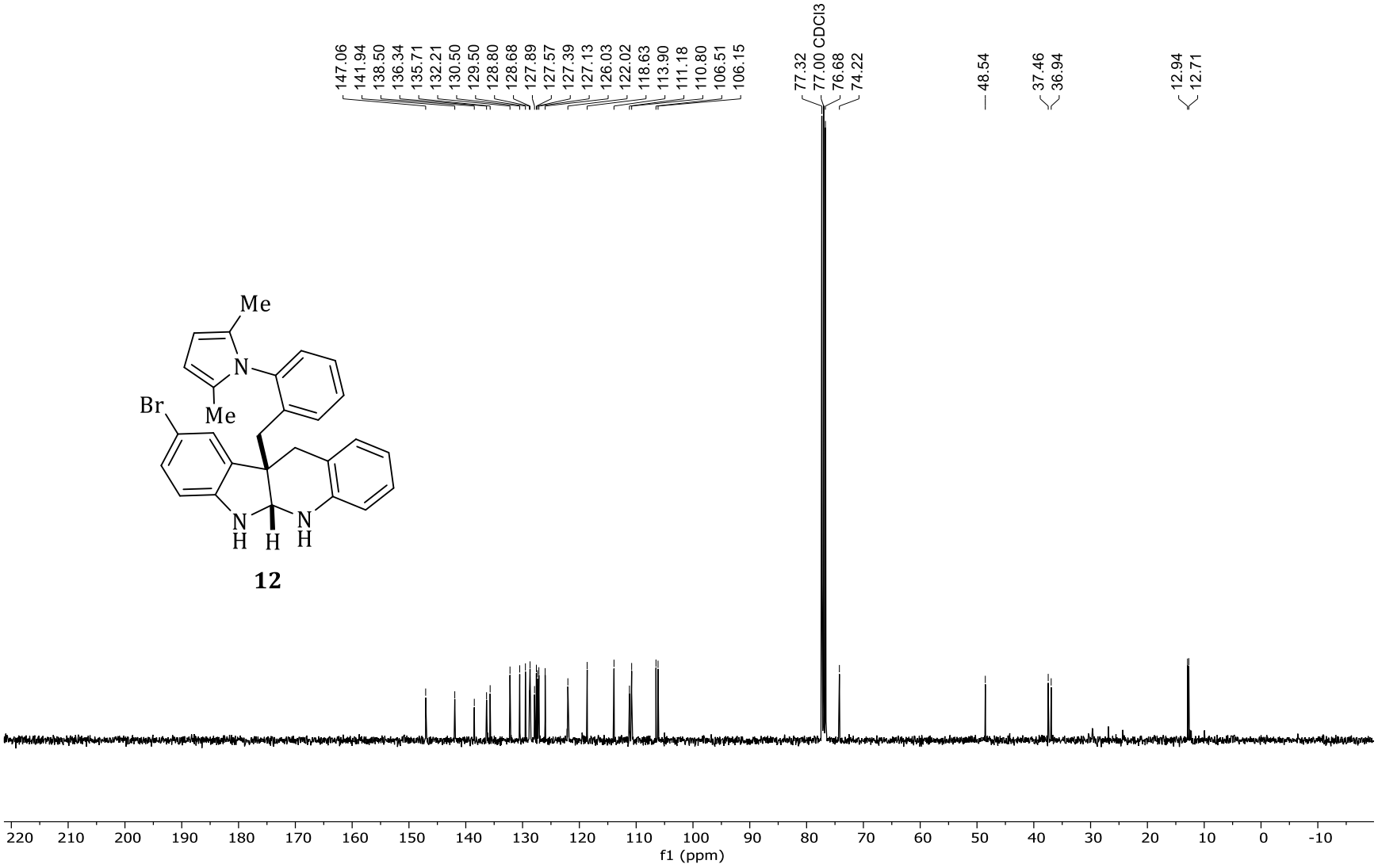
^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **11**.



$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **11**.



^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **12**.



$^{13}C\{^{1}H\}$ NMR spectrum (100 MHz, $CDCl_3$) of **12**.