Supplementary Information-Experimental Details

Aryl(TMP)iodonium Tosylate Reagents as a Strategic Entry Point to Diverse Aryl Intermediates: Selective Access to Arynes

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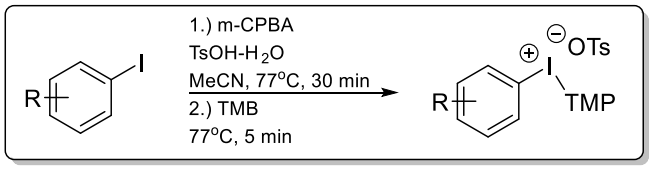
General Considerations

Materials: Commercially available reagents and solvents were used without further purification unless otherwise stated. The percentage of active oxidant for *m*-CPBA was determined by iodometric titration[13]. Iodonium salts **1a, 1b, 1c 1d, 1e, 1g, 1i, 1j, 1k, 1l, 1n, 1q, 1r, 1v, 1w,** and **1x** were synthesized by known method and the spectral data is consistent with previous reports[1,2,4]. The preparation of all other materials is described in detail below.

Methods: Reactions performed above ambient room temperature were done so in an oil bath or aluminum block heated externally. Reactions performed below ambient room temperature were done so in an ice bath. Crude reaction mixtures were analyzed by ^{1}H NMR spectroscopy or thin-layer chromatography (TLC) on Selecto Scientific Flexible TLC plates (silica gel 60 Å F-254) and visualized by UV irradiation or iodine stain. Crude material was purified by flash column chromatography on SilicaFlash P60 silica gel, unless otherwise stated. NMR yields for optimization and one-pot competition experiments were obtained by integration of peaks known for the analyte molecules. For optimization experiments, these integrations are compared to integration of peaks belonging to an internal standard. ^{1}H, $^{13}C\{^{1}H\}$, and $^{19}F\{^{1}H\}$ spectra were recorded in $CDCl_3$, DMSO-d_6, or CD_3OD with tetramethylsilane as an internal standard on a Bruker Avance II 400 MHz or Bruker Avance III 600 MHz spectrometer; the following notation is used: br – broad, s – singlet, d – doublet, t – triplet, q – quartet, m – multiplet, dd – doublet of doublets, dt – doublet of triplets, and ddd – doublet of doublet of doublets. FTIR spectra were recorded on Thermo Scientific Nicolet iS5 Infra-red spectrometer. High resolution mass spectrometry (HRMS) data were recorded on Thermo Scientific Q-exactive mass spectrometer by electrospray ionization with an Orbitrap mass-analyzer (ESI-Orbitrap). Melting points were recorded on Mel-Temp (Thermo scientific) and are reported as uncorrected.

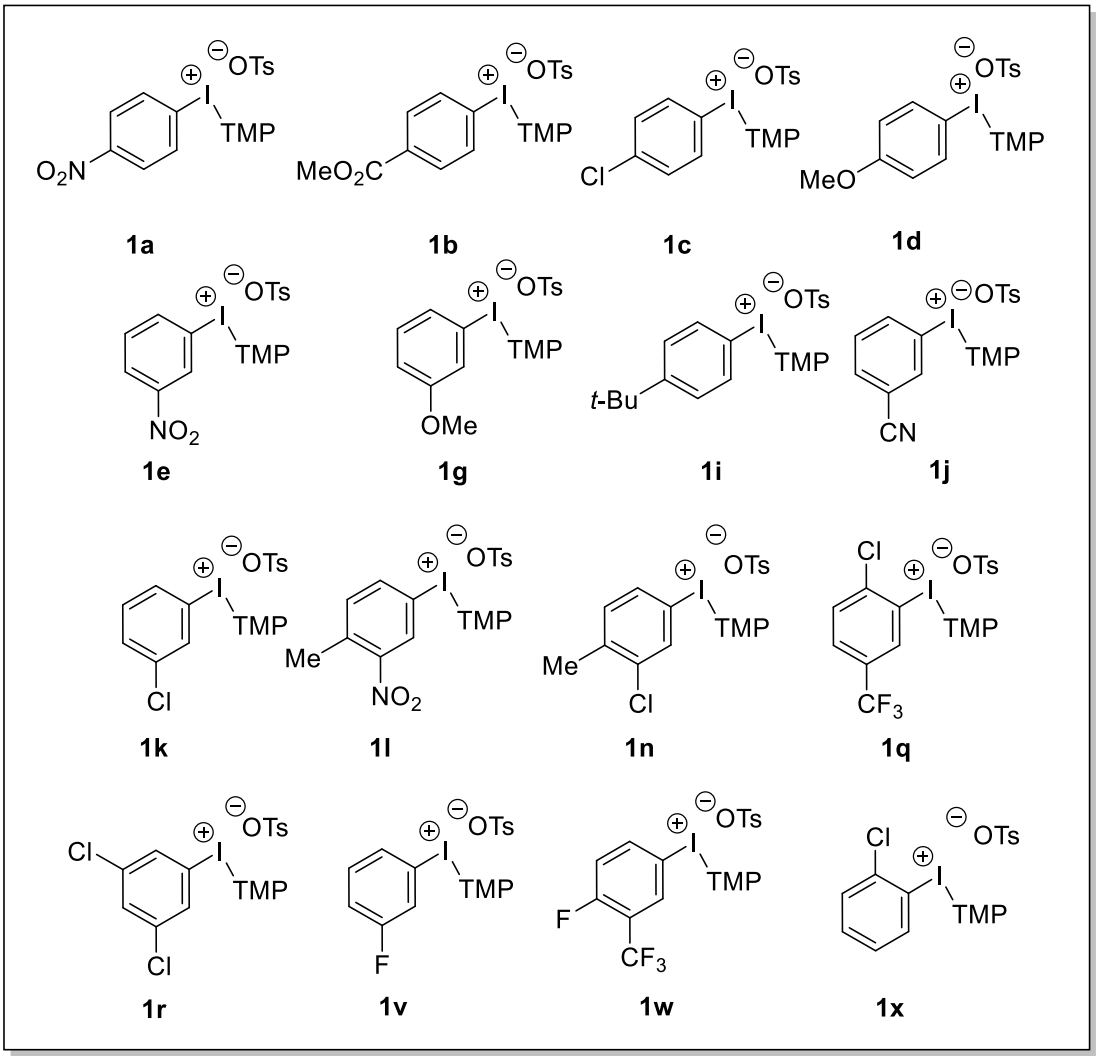
Synthesis and Characterization of Aryl(trimethoxyphenyl)iodonium Tosylates

General Procedure A

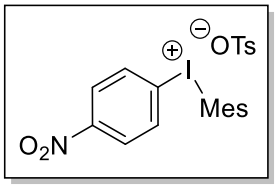


Aryl(trimethoxyphenyl)iodonium tosylates were prepared by known literature procedure.[1] Aryl iodide (1 equiv.) and acetonitrile (1mL/mmol) were added to an appropriately sized round bottom flask, equipped with a magnetic stir bar. *p*-Toluenesulfonic acid monohydrate (1 equiv.) was added in one portion, followed by one portion of *m*-CPBA (1 equiv.). The reaction was loosely capped and stirred vigorously at 77 °C for 30 minutes. After 30 minutes, the flask was raised from the oil bath, and 1,3,5-trimethoxybenzene (1 equiv.) was added in one portion. The flask was returned to the oil bath and stirring was continued at 77 °C for 5 min. The reaction was removed from heat and was triturated with diethyl ether until precipitation ceased. The precipitate was isolated by vacuum filtration and washed by slurry filtration with diethyl ether (3 × 10 mL). After drying under air for 15 minutes the diaryliodonium salt was obtained in pure form. See below for specific scale of reactions and characterization of data for individual compounds.

Compounds Prepared by Known Literature Procedure



Compound 1a-Mes

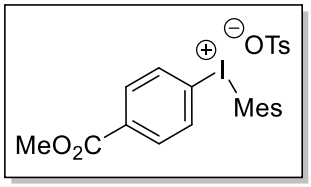


Prepared according to the general procedure A on a 2 mmol scale with the following modifications: Using mesitylene (1 equiv.) instead of TMB, the second stage of the reaction was allowed to proceed for 3 hours. An isolated yield of 65% (0.70 g, 1.3 mmol) as a tan powder was obtained. Spectral information is consistent with previous reports.[14]

^{1}H NMR (600 MHz, [D6] DMSO) δ = 8.25 (d, *J*=9.1 Hz, 2H), 8.19 (d, *J*= 8.8 Hz, 2H), 7.49 (d, *J*= 7.4, 2H), 7.24 (s, 2H), 7.14 (d, *J*=7.5 Hz, 2H), 2.60 (s, 6H), 2.31 (s, 3H) & 2.30 (s, 3H) (signals overlap)

^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 149.1, 144.6, 143.6, 141.7, 138.2, 135.5, 129.9, 128.1, 126.1, 125.4, 122.8, 120.7, 26.2, 20.7, 20.4

Compound 1b-Mes



Prepared according to the general procedure A on a 5 mmol scale with the following modifications: Using mesitylene (1 equiv.) instead of TMB, the second stage of the reaction was allowed to proceed for 3 hours. An isolated yield of 77% (2.12 g, 3.84 mmol) as a white powder was obtained.

^{1}H NMR (600 MHz, [D6] DMSO) δ = 8.09 (d, *J*= 8.5 Hz, 2H), 7.98 (d, *J*= 8.5 Hz, 2H), 7.46 (d, *J*=7.9 Hz, 2H), 7.23 (s, 2H), 7.10 (d, *J*= 7.9 Hz, 2H), 3.86 (s, 3H), 2.59 (s, 6H), 2.30 (s, 3H), 2.28 (s, 3H).

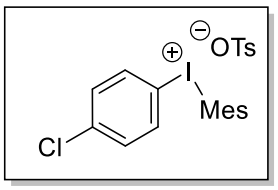
^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 165.0, 145.5, 143.2, 141.6, 137.5, 134.6, 132.2, 131.8, 129.8, 127.9, 125.4, 122.6, 119.4, 52.6, 26.2, 20.7, 20.4.

FTIR: 2953, 1719, 1583, 1425, 1152, 1104, 1030, 814, 677 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M - OTs]^+$ Calcd for $C_{17}H_{18}IO_2^+$ 381.0346; Found: 381.0337.

Melting point: 189-192 °C.

Compound 1c-Mes



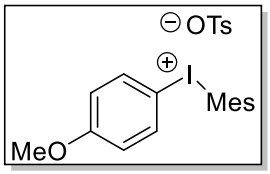
Prepared according to the general procedure A on a 5 mmol scale with the following modifications: Using mesitylene (1 equiv.) instead of TMB, the second stage of the reaction was allowed to proceed for 3

hours. An isolated yield of 81% (2.13 g, 4.1 mmol) as a white powder was obtained. Spectral information is consistent with previous reports.[14]

^{1}H NMR (600 MHz, [D6] DMSO) δ = 7.96 (d, *J*=8.6 Hz, 2H), 7.57 (d, *J*=8.6 Hz, 2H), 7.46 (d, *J*=8.0 Hz, 2H), 7.22 (s, 2H), 7.10 (d, *J*=8.0 Hz, 2H), 2.58 (s, 3H), 2.30 (s, 3H), 2.29 (s, 3H)

^{13}C{^{1}H} NMR (101 MHz, [D6] CD_3OD) δ = 146.0, 143.6(1), 143.6(59), 141.8, 139.9, 138.7, 136.9, 133.4, 133.0, 131.5, 129.9, 127.1, 122.7, 111.7, 27.2, 21.4, 21.2

Compound 1d-Mes

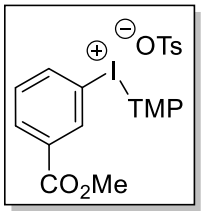


Prepared according to the general procedure A on a 1 mmol scale with the following modifications: Using mesitylene (1 equiv.) instead of TMB, the second stage of the reaction was allowed to proceed for 3 hours. An isolated yield of 76% (0.40 g, 0.76 mmol) as a white powder was obtained. Spectra is consistent with previous reports.[14]

^{1}H NMR (600 MHz, [D6] DMSO) δ = 7.92 (d, *J*=8.9 Hz, 2H), 7.46 (d, *J*= 8.0 Hz, 2H), 7.18 (s, 2H), 7.10 (d, *J*= 7.9 Hz, 2H), 7.03 (d, *J*=8.9 Hz, 2H), 3.78 (s, 3H), 2.60 (s, 6H), 2.28 (s, 6H).

^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 161.6, 145.5, 142.7, 141.2, 137.5, 136.4, 129.5, 127.9, 125.4, 123.0, 117.4, 103.3, 55.6, 26.1, 20.7, 20.4.

Compound 1f



Prepared according to the general procedure A on a 3 mmol scale and obtained an isolated yield of 87% (1.56 g, 2.6 mmol) as a white powder.

^{1}H NMR (600 MHz, [D6] DMSO) δ = 8.43 (m, 1H), 8.13 (d, *J* = 7.9 Hz, 2H), 7.62 (t, *J* = 7.9 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 2H), 7.10 (d, *J* = 7.8 Hz, 2H), 6.48 (s, 2H), 3.95 (s, 6H), 3.88 (s, overlaps with singlet at 3.87, 3H), 3.87 (s, overlaps with singlet at 3.88, 3H), 2.28 (s, 3H).

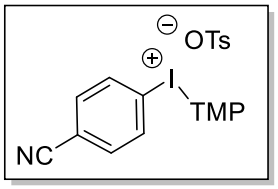
^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 166.3, 164.4, 159.4, 145.8, 138.4, 137.5, 134.4, 132.1, 132.0, 131.8, 128.0, 125.5, 116.1, 92.2, 87.0, 57.4, 56.2, 52.8, 20.8.

FTIR: 2943, 1725, 1578, 1344, 1158, 1100, 1031, 814, 677 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M - OTs]^+$ Calcd for $C_{17}H_{18}O_5I^+$ 429.0193; Found: 429.0179.

Melting point: 195-199 °C.

Compound 1h

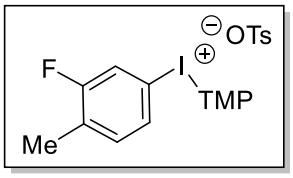


Prepared according to the general procedure A on a 3 mmol scale and obtained an isolated yield of 81% (1.38 g, 2.4 mmol) as a white powder. Spectral information is consistent with previous reports[3].

^{1}H NMR (400 MHz, [D6] DMSO) δ = 8.06 (d, *J* = 8.4 Hz, 2H), 7.91 (d, *J* = 8.4 Hz, 2H), 7.47 (d, *J* = 8.0 Hz, 2H), 7.11 (d, *J* = 7.9 Hz, 2H), 6.49 (s, 2H), 3.94 (s, 6H), 3.88 (s, 3H), 2.29 (s, 3H).

^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 166.5, 159.4, 145.7, 137.6, 134.8(3), 134.8(0), 128.0, 125.5, 121.0, 117.5, 114.1, 92.2, 87.0, 57.4, 56.2, 20.8.

Compound 1m



Prepared according to the general procedure A on a 3 mmol scale and obtained an isolated yield of 90% (1.55 g, 2.7 mmol) as a white powder.

^{1}H NMR (400 MHz, [D6] DMSO) δ = 7.89 (dd, *J* = 6.8, 1.6 Hz, 1H), 7.80-7.76 (m, 1H), 7.46 (d, *J* = 7.99 Hz, 2H), 7.25 (t, *J* = 9.2 Hz, 1H), 7.10 (d, *J* = 7.9 Hz, 2H), 6.46 (s, 2H), 3.95 (s, 6H), 3.86 (s, 3H), 2.28 (s, 3H), 2.25 (s, 3H).

^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 166.2, 160.3 (d, $J_{C\text{-}F}$ = 250.9 Hz), 159.3, 145.7, 137.6, 134.2 (d $J_{C\text{-}F}$ = 4.7 Hz), 130.2 (d, $J_{C\text{-}F}$ = 3.3 Hz), 128.9 (d, $J_{C\text{-}F}$ = 16.7 Hz), 128.0, 125.5, 120.9 (d, $J_{C\text{-}F}$ = 25.4 Hz), 112.1 (d, $J_{C\text{-}F}$ = 7.2 Hz), 92.0, 87.3, 57.3, 56.2, 20.7, 14.1 (d, $J_{C\text{-}F}$ = 2.9 Hz).

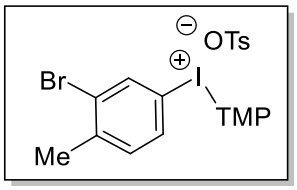
^{19}F{^{1}H} NMR (376 MHz, [D6] DMSO) δ = -111.5.

FTIR: 3090, 2941, 1580, 1175, 1117, 1031, 1008 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M - OTs]^+$ Calcd for $C_{16}H_{17}FO_3I^+$ 403.0201; Found: 403.0191.

Melting point: 207-209 °C.

Compound 1o



Prepared according to the general procedure A on a 3 mmol scale and obtained an isolated yield of 83% (1.58 g, 2.5 mmol) as a white powder.

^{1}H NMR (400 MHz, [D6] DMSO) δ = 8.12 (d, *J* = 1.5 Hz, 1H), 7.77 (dd, *J* = 8.1, 1.5 Hz, 1H), 7.48-7.43 (m, 3H), 7.10 (d, *J* = 7.9 Hz, 2H), 6.47 (s, 2H), 3.95 (s, 6H), 3.87 (s, 3H), 2.36 (s, 3H), 2.28 (s, 3H).

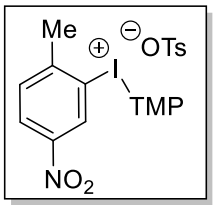
^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 166.2, 159.3, 145.7, 141.6, 137.6, 136.6, 133.7, 133.3, 128.0, 125.4(8), 125.4(6), 113.1, 92.1, 87.2, 57.3, 56.2, 22.3, 20.8.

FTIR: 3091, 2936, 1578, 1160, 1116, 1031, 1008 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M - OTs]^+$ Calcd for $C_{16}H_{17}BrO_3I^+$ 462.9400; Found: 462.9392.

Melting point: 223-226 °C.

Compound 1p



Prepared according to the general procedure A on a 2.0 mmol scale and obtained an isolated yield of 68% (0.830g, 1.4 mmol) as a white powder.

^{1}H NMR (400 MHz, [D6] DMSO) δ = 8.81 (d, *J* = 1.3 Hz, 1H), 8.33 (dd, *J* = 8.4, 1.3 Hz, 1H), 7.78 (d, *J* = 8.5 Hz, 1H), 7.46 (d, *J* = 7.7 Hz, 1H), 7.10 (d, *J* = 7.8 Hz, 1H), 6.46 (s, 2H), 3.97 (s, 6H), 3.85 (s, 3H), 2.71 (s, 3H), 2.28 (s, 3H).

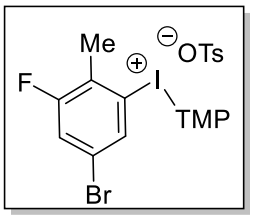
^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 166.1, 159.2, 148.1, 145.9, 145.5, 137.5, 131.6, 131.3, 127.9, 126.5, 125.3, 120.8, 92.1, 87.2, 57.2, 56.1, 24.8, 20.7.

FTIR: 3100, 2923, 2856, 1601, 1511, 1342, 1012, 727, 680 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M - OTs]^+$ Calcd for $C_{16}H_{17}NO_5I^+$ 430.0146; Found: 430.0133.

Melting point: 217-218 °C.

Compound 1s



Prepared according to the general procedure A on 2.0 mmol and obtained an isolated yield of 85% (1.11g, 1.7 mmol) as a white powder.

^{1}H NMR (400 MHz, [D6] DMSO) δ = 8.39 (d, *J* = 6.7 Hz, 1H), 7.61 (d, *J* = 9.5 Hz, 1H), 7.46 (d, *J* = 7.5 Hz, 2H), 7.10 (d, *J*=7.7 Hz, 2H), 6.45 (s, 2H), 3.96 (s, 6H), 3.86 (s, 3H), 2.55 (s, 3H), 2.29 (s, 3H).

^{13}C{^{1}H} NMR (101 MHz, [D6] DMSO) δ = 166.0, 160.0 (d, J_{C-F} = 248.4 Hz), 159.15, 145.6, 143.3 (d, J_{C-F} = 8.6 Hz), 140.9, 137.4, 127.9, 125.4, 118.8 (d, J_{C-F} = 23.4 Hz), 116.0, 106.7 (d, J_{C-F} = 22.1 Hz), 92.0, 86.9, 57.1, 56.1, 24.2, 20.7.

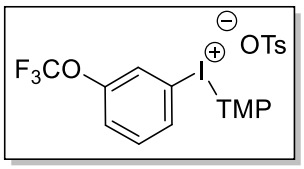
$^{19}F\{^{1}H\}$ NMR (376 MHz, [D6] DMSO) δ = -102.9.

FTIR: 3021, 2980, 2844, 1584, 1177,1117, 1030, 1007, 875, 678 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M - OTs]^+$ Calcd for $C_{16}H_{16}BrFO_3I^+$ 480.9306; Found: 480.9298.

Melting Point: 195-197 °C.

Compound 1u



Prepared according to the general procedure A on 1 mmol scale and obtained an isolated yield of 79% (0.496 g, 0.79 mmol) as a white powder.

^{1}H NMR (400 MHz, [D6] DMSO) δ = 8.00 (s, 1H), 7.89 (d, *J* = 7.4 Hz, 1H), 7.63-7.61 (m, 2H), 7.47 (d, *J* = 7.9 Hz, 2H), 7.11 (d, *J*=7.8 Hz, 2H), 6.48 (s, 2H), 3.94 (s, 6H), 3.88 (s, 3H), 2.28 (s, 3H).

$^{13}C\{^{1}H\}$ NMR (101 MHz, [D6] DMSO) δ = 166.3, 159.3, 148.4 (m), 145.6, 137.5, 133.2, 133.1, 127.9, 126.7, 125.4, 124.3, 119.7 (q, J_{C-F} = 257.9), 115.9, 92.0, 87.1, 57.2, 56.1, 20.7.

$^{19}F\{^{1}H\}$ NMR (376 MHz, [D6] DMSO) δ = -57.1.

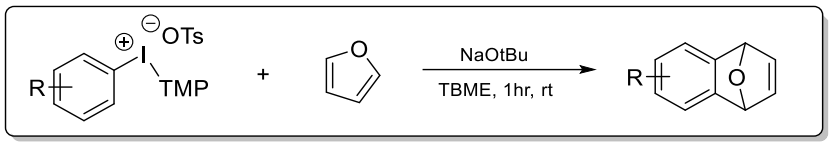
FTIR: 3056, 2963, 2925, 2902, 2846, 1572, 1161, 1114, 1029, 744, 704 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M - OTs]^+$ Calcd for $C_{16}H_{15}O_4F_3I^+$ 454.9962; Found: 454.9951.

Melting Point: 173.7-175 °C.

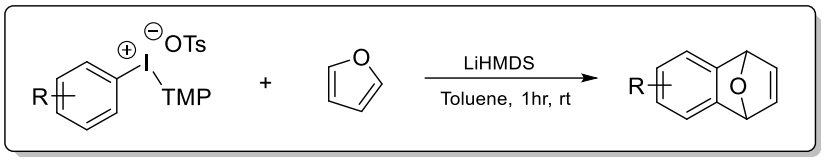
Synthesis and Characterization of Aryne Adducts

General Procedure B



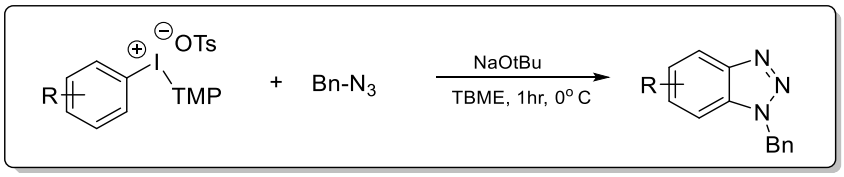
The iodonium salt (0.5 mmol, 1 equiv.) is weighed out in air and placed in a 12 mL vial containing a magnetic stir bar. TBME (2.5 mL) and furan (0.109 mL, 1.5 mmol, 3 equiv., or as indicated) are added sequentially via syringe and micropipette respectively. NaO*t*-Bu (0.0721 g, 0.75 mmol, 1.5 equiv.) is added in one portion, a cap is screwed on tightly and the reaction is stirred for 1 hour at room temperature. The reaction is quenched with an aqueous solution of ammonium chloride. The biphasic mixture is separated and aqueous layer is extracted with ethyl acetate (3 × 5 mL). The combined organic phases are dried with $MgSO_4$, the drying agent removed by suction filtration, and the solvent removed on the rotary evaporator. The crude residue is purified by flash column chromatography on silica gel with ether/hexanes or ethyl acetate/hexanes as the eluent.

General Procedure C



The iodonium salt (0.5 mmol, 1 equiv.) is weighed out in air and placed in a 12 mL vial containing a magnetic stir bar. Toluene (2.0 mL) and furan (0.200 mL, 2.7 mmol, 5.5 equiv.) are added sequentially via syringe and micropipette, respectively. LiHMDS (1 M in toluene, 0.5 mL, 1 equiv.) is added via a glass syringe, the vial is tightly capped and the reaction is stirred for 1 hour at room temperature. The reaction is quenched with an aqueous solution of ammonium chloride. The biphasic mixture is extracted with ethyl acetate (3 × 5 mL). The combined organic phases are dried with $MgSO_4$, the drying agent removed by suction filtration, and the solvent removed on the rotary evaporator. The crude residue is purified by flash column chromatography on silica gel with ether/hexanes or ethyl acetate/hexanes as the eluent.

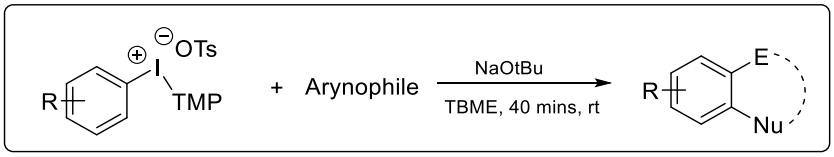
General Procedure D



The iodonium salt (0.5 mmol, 1 equiv.) is weighed out in air and placed in a 12 mL vial containing a magnetic stir bar. TBME (2.5 mL) and benzyl azide (0.070 mL, 0.55 mmol, 1.1 equiv.) are added

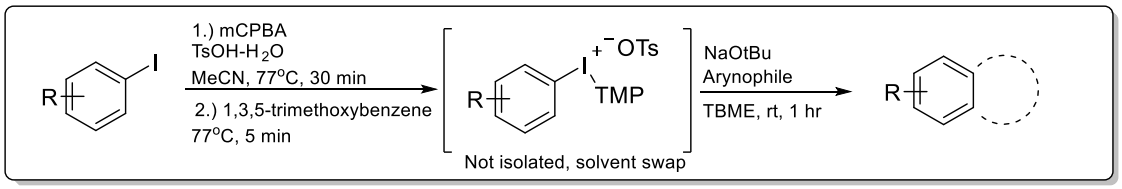
sequentially via syringe and micropipette respectively. NaO*t*-Bu (0.072 g, 0.75 mmol, 1.5 equiv.) is added and the vial is tightly capped. The reaction is stirred for 1 hour at 0°C. The reaction is quenched with an aqueous solution of ammonium chloride. The biphasic mixture is placed in a separatory funnel and extracted with ethyl actetae (3 × 5 mL). The combined organic phases are dried with $MgSO_4$, the drying agent removed by suction filtration, and the solvent removed on the rotary evaporator. The crude residue is purified by flash column chromatography on silica gel with ethyl acetate/hexanes as eluent.

General Procedure E



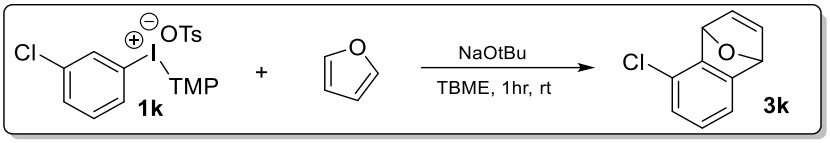
The iodonium salt (0.5 mmol, 1 equiv.) was weighed out and placed in a 12 mL vial containing a magnetic stir bar. MTBE (2.5 mL) and arynophile (1.1 – 3 equiv.) were added sequentially forming slurry. NaO*t*-Bu (0.0721g, 0.75 mmol, 1.5 equiv. or as indicated) was weighed out in air and added to the vial with stirring in one portion. The vial was sealed with a cap, and the reaction mixture was vigorously stirred at the indicated temperature for the indicated time. The reaction was quenched with ammonium chloride solution (7 mL) and extracted with EtOAc (3 × 3 mL). The combined organic phases were dried with $MgSO_4$, drying agent was removed by vacuum filtration, and solvent was removed on rotary evaporator. The crude residue was purified by column chromatography on silica gel.

General Procedure F: Telescoped Reaction



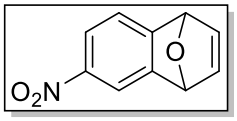
Aryl iodide (0.5 mmol, 1 equiv.) was weighed out and added to a 12 mL vial containing a stir bar. Acetonitrile (0.5 mL) was added to the vial followed by *p*-toluenesulfonic acid monohydrate (0.095 g, 0.5 mmol, 1 equiv.) and m-CPBA (0.122 g, 0.5 mmol, 1 equiv.). The vial was placed in an aluminum block set to 77 °C, and the mixture was stirred at this temperature for 30 mins. 1,3,5-Trimethoxybenzene (0.084 g, 0.5 mmol, 1 equiv.) was added in one portion and the reaction was stirred for 5 mins. The vial was removed from heat and allowed to cool. TBME was added at stirring, and iodonium salt was allowed to precipitate out of the solution until free-flowing powder was observed. The vial was removed from a stir plate and, after the solid settled, the liquid phase was removed with a pipette. Washing with TBME was repeated two more times. TBME (2 mL) was added to the resulting slurry followed by arynophile (3 equiv.). NaO*t*-Bu (1.5 equiv. with furan or 5 equiv. with DMI) was added at stirring, and the mixture was allowed to react for 1 hour at room temperature. The reaction was quenched with brine (7 mL) and extracted with EtOAc (3 × 3 mL). The combined organic phases were dried with $MgSO_4$, drying agent was removed by vacuum filtration, and solvent was removed on rotary evaporator. The crude residue was purified by column chromatography on silica gel.

General Procedure G: 1 mmol scale reaction



The iodonium salt **1k** (0.576 g, 1 mmol, 1 equiv.) is weighed out in air and placed in a 12 mL vial containing a magnetic stir bar. TBME (5 mL) and furan (0.219 mL, 3 mmol, 3 equiv.) are added sequentially via syringe and micropipette respectively. NaO*t*-Bu (0.144 g, 1.5 mmol, 1.5 equiv.) is added in one portion, a cap is screwed on tightly and the reaction is stirred for 1 hour at room temperature. The reaction is quenched with an aqueous solution of ammonium chloride (~6 mL). The biphasic mixture is separated and aqueous layer is extracted with ethyl acetate (3 × 5 mL). The combined organic phases are dried with $MgSO_4$, the drying agent removed by suction filtration, and the solvent removed on the rotary evaporator. The crude residue is dry-loaded onto silica and purified by flash column chromatography on silica gel with 5% EtOAc in hexanes. See compound **3k** for further details.

Compound 3a



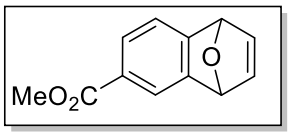
Prepared from **1a** according to the general procedure C on 0.5 mmol scale and obtained an isolated yield of 57% (0.0539 g, 0.29 mmol) as a golden crystalline solid after purification by column chromatography on silica gel using 10% EtOAc in hexanes. Spectral data is consistent with previous reports.[7]

R_f = 0.35 in 5% DCM, 15% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.04 (d, *J* = 1.8 Hz, 1H), 7.98 (dd, *J* = 7.8, 1.9 Hz, 1H), 7.36 (d, *J*= 7.8 Hz, 1H), 7.10 (dd, *J* = 5.5, 1.8 Hz, 1H), 7.05 (dd, *J* = 5.5, 1.8 Hz, 1H), 5.82-5.80 (m, 2H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 156.4, 151.3, 145.4, 143.4, 142.3, 122.3, 120.1, 115.2, 82.0(2), 82.0(1).

Compound 3b



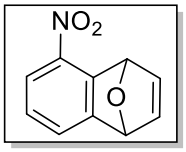
Prepared from **1b** according to the general procedure C on 0.5 mmol scale with the following modification: reaction was conducted at 0 °C; and obtained an isolated yield of 69% (0.0700 g, 0.35 mmol) as a white solid after purification by column chromatography on silica gel using 10% EtOAc in hexanes. Spectral data is consistent with previous reports.[7]

R_f = 0.26 in 10% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.87 (s, 1H), 7.76 (d, *J* = 7.4 Hz, 1H), 7.29 (d, *J* = 7.4 Hz, 1H), 7.05 (d, *J*=5.8 Hz, 1H), 7.01 (d, *J*= 5.52 Hz, 1H), 5.75-5.74 (m, 2H), 3.89 (s, 3H).

$^{13}C\{^{1}H\}$ NMR (101 MHz, $CDCl_3$) δ = 166.9, 154.4, 149.5, 143.3, 142.4, 128.1, 127.3, 120.7, 119.9, 82.1(5), 82.1(2), 52.1.

Compound 3e



Prepared from **1e** according to the general procedure B on a 0.5 mmol scale and obtained an isolated yield of 82% (0.0834 g, 0.41 mmol) as a yellow crystalline solid after purification by column chromatography on silica gel using 10% EtOAc in hexanes.

R_f = 0.38 in 20% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.72 (dd, *J* = 8.4, 0.7 Hz 1H), 7.49 (d, *J* = 7.0 Hz, 1H), 7.17-7.12 (m, 3H), 6.49 (m, 1H), 5.83 (m, 1H).

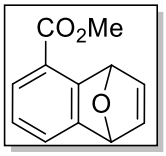
$^{13}C\{^{1}H\}$ NMR (101 MHz, $CDCl_3$) δ = 152.6, 146.7, 144.3, 142.4, 142.0, 126.8, 124.9, 119.4, 82.7, 81.9.

FTIR: 3100, 2922, 2856, 1511, 1342, 1276, 727 cm^{-1}

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{10}H_8NO_3^+$ 190.0504; Found: 190.0499

Melting point: 120.9-122.6 °C

Compound 3f



Prepared from **1f** according to the general procedure C on 0.5 mmol scale and isolated in 70% yield (0.0704 g, 0.35 mmol) as a colorless oil after purification by column chromatography on silica gel using 2% DCM, 4% EtOAc in hexanes. Structural isomer (**3b**) resulted from deprotonation of the more sterically accessible position and was isolated in 8% yield (0.0080 g, 0.04 mmol). Characterization for the major isomer is shown below.

R_f = 0.18 in 20% Et_2O/hexanes.

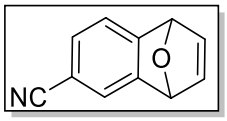
^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.55 (d, *J* = 8.1 Hz, 1H), 7.37 (d, *J* = 7.0 Hz, 1H), 7.10-7.02 (m, 3H), 6.37 (s, 1H), 5.74 (s, 1H), 3.93 (s, 3H)

$^{13}C\{^{1}H\}$ NMR (101 MHz, $CDCl_3$) δ = 166.4, 152.4, 150.2, 143.7, 142.6, 125.4, 125.2, 123.7(3), 123.6(9), 82.7, 81.8, 52.0

FTIR: 3008, 2950, 2843, 1713, 1274, 1118 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{12}H_{11}O_3^+$ 203.0708; Found: 203.0698.

Compound 3h



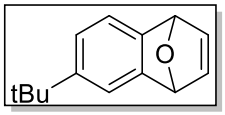
Prepared from **1h** according to the general procedure C on 0.5 mmol scale and obtained an isolated yield of 78% (0.0663 g, 0.39 mmol) as a yellow crystalline solid after purification by column chromatography on silica gel using 5% DCM, 15% EtOAc in hexanes. Spectral data is consistent with previous reports.[6]

R_f = 0.28 in 5% DCM, 15% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.46 (s, 1H), 7.37-7.32 (m, 2H), 7.07-7.02 (m, 2H), 5.77-5.76 (m, 2H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 154.6, 150.5, 143.1, 142.5, 130.9, 122.8, 120.7, 119.1, 108.8, 82.1, 81.9.

Compound 3i



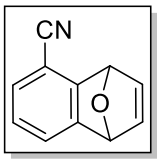
Prepared from **1i** with furan (0.2 mL, 2.75 mmol, 5.5 equiv.), according to the general procedure B on 0.5 mmol scale and obtained an isolated yield of 48% (0.0480g, 0.24 mmol) as a yellow oil after purification by column chromatography on silica gel using 10% Et_2O in hexanes. Spectral data is consistent with previous reports[11].

R_f = 0.32 in 10% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.33 (s, 1H), 7.16 (d, *J* = 7.5 Hz, 1H), 7.01 (s, 2H), 6.96 (d, J = 7.4 Hz, 1H), 5.68 (s, 2H), 1.28 (s, 9H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 148.9, 148.3, 145.9, 143.0, 142.8, 121.2, 119.6, 118.1, 82.5, 82.2, 77.0, 34.7, 31.5.

Compound 3j



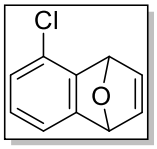
Prepared from **1j** according to the general procedure B on 0.5 mmol scale and obtained an isolated yield of 81% (0.0688 g, 0.41 mmol) as a white solid after purification by column chromatography on silica gel using 10% EtOAc in hexanes Spectral data is consistent with previous reports.[6]

R_f = 0.26 in 5% DCM, 15% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.42 (d, *J*= 7.1 Hz, 1H), 7.19 (dd, *J* = 7.9, 1.0 Hz, 1H), 7.10-7.06 (m, 3H), 5.95 (s,1H), 5.79 (s, 1H).

$^{13}C\{^{1}H\}$ NMR (101 MHz, $CDCl_3$) δ = 154.6, 150.8, 143.7, 142.3, 127.1, 126.1, 123.8, 116.8, 105.1, 82.5, 81.5.

Compound 3k



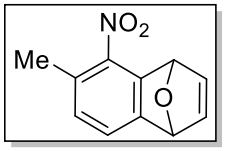
Prepared from **1k** according to the general procedure B on 0.5 scale and obtained an isolated yield of 78% (0.0701 g, 0.39 mmol) as a white solid after purification by column chromatography on silica gel using 5% EtOAc in hexanes. Prepared from **1k** according to general procedure G and obtained an isolated yield of 89% (0.159 g, 0.89 mmol). Prepared according to the general procedure F (telescoped reaction) with furan **2a** (3 equiv.) and obtained in 67% yield (0.0607 g, 0.34mmol) as a white solid after purification by column chromatography on silica gel using 5% EtOAc in hexanes. Spectral data is consistent with previous reports.[6]

R_f = 0.46 in 10% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.14-7.09 (m, 1H), 7.08-7.04 (m, 2H), 6.94-6.89 (m, 2H), 5.88 (s, 1H), 5.74 (s, 1H).

$^{13}C\{^{1}H\}$ NMR (101 MHz, $CDCl_3$) δ = 151.5 147.2, 143.3, 142.4, 126.9, 126.5, 125.7, 118.5, 82.9, 81.2.

Compound 3l



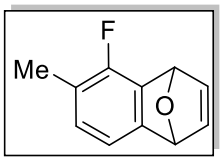
Prepared from **1l** according to the general procedure B on 0.5 mmol scale and obtained a yield of 70% (0.0747 g, 0.37 mmol) contaminated with 3% of 2,4,6-trimethoxyphenyl iodide, as a dark yellow solid after purification by column chromatography on silica gel using 10% toluene, 5% Et_2O in hexanes. Spectral data is consistent with previous reports.[6]

R_f = 0.34 in 10% Et_2O, 10% Toluene/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.29 (d, *J* = 7.1 Hz, 1H), 7.17 (dd, *J* = 5.5, 1.6 Hz, 1H), 7.11 (dd, *J* = 5.5, 1.6 Hz, 1H), 6.95 (d, *J* = 7.2 Hz, 1H), 6.11 (s, 1H), 5.78 (s, 1H), 2.51 (s, 3H).

$^{13}C\{^{1}H\}$ NMR (101 MHz, $CDCl_3$) δ = 150.0, 147.3, 144.2, 143.7, 142.1, 129.4, 129.1, 123.4, 82.8, 82.1, 19.7.

Compound 3m



Prepared from **1m** according to the general procedure B on 0.5 mmol scale and obtained an isolated yield of 77% (0.0680 g, 0.385 mmol) as a white solid after purification by column chromatography on silica gel using 5% EtOAc in hexanes.

R_f = 0.24 in 20% ether/hexanes.

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.04-7.01 (m, 2H), 6.91 (d, *J* = 7.0 Hz, 1H), 6.77 (dd, appears as triplet, *J* = 6.8 Hz, 1H), 5.93 (s, 1H), 5.69 (m, 1H), 2.20 (d, *J* = 1.6 Hz, 3H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 154.8 (d, $J_{C\text{-}F}$ = 245.8 Hz), 150.0 (d, $J_{C\text{-}F}$ = 4.4 Hz), 143.3, 142.4, 133.4 (d, $J_{C\text{-}F}$ = 21.4 Hz), 128.2 (d, $J_{C\text{-}F}$ = 3.5 Hz), 123.3 (d, $J_{C\text{-}F}$ = 17.8 Hz), 115.9 (d, $J_{C\text{-}F}$ = 3.1 Hz), 82.4, 79.5, 14.4 (d, $J_{C\text{-}F}$ = 3.4 Hz).

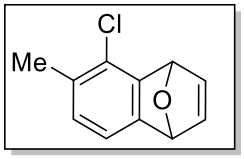
^{19}F NMR (376 MHz, $CDCl_3$) δ = -125.4.

FTIR: 3032, 2952, 2860, 1472, 1235, 823 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_{10}OF^+$ 177.0710; Found: 177.0706.

Melting point: 28.3-30.9 °C

Compound 3n



Prepared from **1n** according to the general procedure B on 0.5 mmol scale and obtained an isolated yield of 75% (0.0722g, 0.375mmol) as a white solid after purification by column chromatography on silica gel using 2% EtOAc in hexanes.

R_f = 0.66 in 16% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.07-7.03 (m, 2H), 7.00 (d, *J* = 7.1 Hz, 1H), 6.82 (dd, *J* = 7.1, 0.5 Hz, 1H), 5.86 (s, 1H), 5.71 (s, 1H), 2.29 (s, 3H).

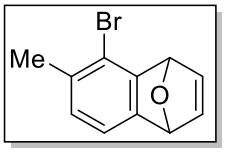
^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 148.8, 147.8, 143.7, 142.2, 133.1, 127.3, 127.2, 118.2, 83.0, 81.6, 19.4.

FTIR: 3032, 2943, 2850, 1488, 1279, 835 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_{10}OCl^+$ 193.0415; Found: 193.0413.

Melting point: 66.3-68.5 °C

Compound 3o



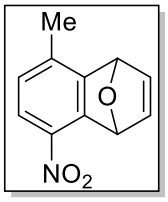
Prepared from **1o** according to the general procedure B on 0.5 mmol scale and obtained an isolated yield of 87% (0.103 g, 0.44 mmol) as an off-white solid after purification by column chromatography on silica gel using 5% Et_2O in hexanes. Spectral data is consistent with previous reports.[6]

R_f = 0.51 in 20% Et_2O/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.09-7.02 (m, 3H), 6.82 (dd, *J* = 7.0, 0.5 Hz, 1H), 5.79 (s, 1H), 5.75 (s, 1H), 2.31 (s, 3H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 150.6, 148.8, 143.8, 142.2, 134.6, 127.2, 118.7, 117.5, 83.3, 83.2, 22.1.

Compound 3p



Prepared from **1p** according to the general procedure C on 0.5 mmol and obtained an isolated yield of 72% (0.36 mmol, 0.0731 g) as an orange crystalline solid after purification by column chromatography on silica gel using 4% EtOAc in hexanes.

R_f = 0.20 in 10% ether/hexanes.

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.63 (d, *J* = 8.5 Hz, 1H), 7.16-7.12 (m, 1H), 6.93 (d, *J* = 8.5 Hz, 1H), 6.49 (s, 1H), 5.87 (s, 1H), 2.40 (s, 3H).

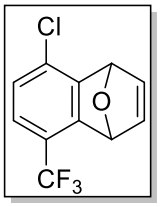
^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 150.7, 146.4, 143.8, 142.3, 140.8, 136.0, 128.4, 119.5, 83.0, 80.6, 18.3.

FTIR: 3100, 2922, 2856, 1511, 1342, 794 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_{10}NO_3^+$ 204.0665; Found: 204.0654.

Melting point: 148-150 °C

Compound 3q



Prepared from **1q** according to the general procedure C on 0.5 mmol scale and obtained in an isolated yield of 54% (0.0665 g, 0.27 mmol) as a yellow oil after purification by column chromatography on silica gel using 3% EtOAc in hexanes.

R_f = 0.65 in 6% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.14-7.03 (m, 4H), 6.03 (s,1H), 5.93 (s,1H).

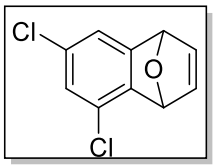
^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 150.5 (q, J_{C-F} = 2.69 Hz), 148.8, 143.1, 142.9, 129.8, 126.6, 123.7 (q, J_{C-F} = 272.5 Hz), 123.2 (q, J_{C-F} = 3.9 Hz), 122.3 (q, J_{C-F} = 34.0 Hz), 82.3 (d, J_{C-F} = 1.6 Hz), 81.1.

^{19}F NMR (376 MHz, $CDCl_3$) δ = -60.7.

FTIR: 1603, 1314, 1280, 1162, 1093, 875 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_7OClF_3^+$ 247.0132; Found: 247.0128.

Compound 3r



Prepared from **1r** according to the general procedure B on 0.5 mmol scale and obtained an isolated yield of 87% (0.0926 g, 0.44 mmol) as a white solid after purification by column chromatography on silica gel using 3% EtOAc in hexanes.

R_f = 0.47 in 10% ether/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.11 (s, 1H), 7.07 (d, *J* = 5.5 Hz 1H), 7.02 (d, *J* = 5.5 Hz, 1H), 6.95 (s, 1H), 5.84 (s, 1H), 5.72 (s, 1H).

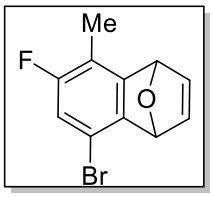
^{13}C{^{1}H} NMR (101 MHz $CDCl_3$) δ = 153.1, 146.0, 142.9, 142.6, 131.8, 126.6, 125.2, 119.8, 82.8, 81.1.

FTIR: 3069, 3030, 2958, 1580, 1276, 817 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{10}H_7Cl_2O^+$ 212.9868; Found: 212.9869.

Melting point: 36-39 °C.

Compound 3s



Prepared from **1s** according to the general procedure B on 0.5 mmol and obtained an isolated yield of 76% (0.0969 g, 0.38 mmol) as a white solid after purification by column chromatography on silica gel using 4% EtOAc in hexanes.

R_f = 0.39 in 10% ether/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.08 (s, 2H), 6.53 (d, *J* = 9.7 Hz, 1H), 5.84 (s, 1H), 5.78 (s, 1H), 2.25 (s, 3H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 156.3 (d, $J_{C\text{-}F}$ = 246.5 Hz), 152.1 (d, $J_{C\text{-}F}$ = 1.3 Hz), 144.7 (d, $J_{C\text{-}F}$ = 2.2 Hz), 143.6, 142.2, 130.0 (d, $J_{C\text{-}F}$ = 7.4 Hz), 113.5 (d, $J_{C\text{-}F}$ = 23.4 Hz), 100.1 (d, $J_{C\text{-}F}$ = 25.0 Hz), 83.0 (d, $J_{C\text{-}F}$ = 2.9 Hz), 81.7, 17.6 (d, $J_{C\text{-}F}$ = 1.0 Hz).

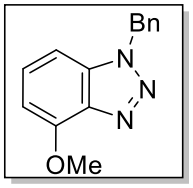
^{19}F NMR (376 MHz, $CDCl_3$) δ = -115.5.

FTIR: 3019, 2925, 2849, 1455, 1275, 1126, 879 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_9OBrF^+$ 254.9815; Found: 254.9811.

Melting point: 59.6-61.5 °C.

Compound 3t



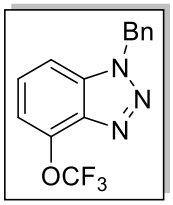
Prepared from **1g** according to the general procedure D on 0.5 mmol and obtained an isolated yield of 97% (0.116 g, 0.49 mmol) as an off-white solid after purification by column chromatography on silica gel using 3%→15% EtOAc in hexanes. Spectral data is consistent with previous reports.[9]

R_f = 0.30 in 23% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.32-7.25 (m, overlaps with solvent peak, 6H), 6.89 (d, *J* = 8.3 Hz, 1H), 6.66 (d, *J* = 7.7 Hz, 1H), 5.81 (s, 2H), 4.10 (s, 3H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 151.7, 138.3, 134.7(9), 134.7(5), 128.9, 128.6, 128.4, 127.5, 103.3, 101.8, 56.2, 52.2.

Compound 3u



Prepared from **1u** according to the general procedure D on 0.5 mmol and obtained an isolated yield of 66% (0.0967 g, 0.33 mmol) as an orange solid after purification by column chromatography on silica gel using 3%→15% EtOAc in hexanes.

R_f = 0.31 in 16% EtOAc/Hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.40-7.32 (m, 4H), 7.29-7.26 (m, overlaps with solvent signal, 3H), 7.19 (dd, *J* = 7.7, 1.1 Hz, 1H), 5.86 (s, 2H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 140.1 (q, J_{C-F} = 1.94 Hz), 139.4, 135.1, 134.2, 129.1, 128.7, 127.8, 127.7, 120.7 (q, J_{C-F} = 259.81 Hz), 114.3 (d, J_{C-F} = 0.94 Hz), 108.5, 52.6.

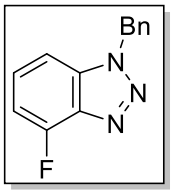
^{19}F{^{1}H} NMR (376 MHz, $CDCl_3$) δ = -57.7.

FTIR: 3090, 2918, 2850, 1626, 1508, 1216, 1143, 721, 693 cm^{-1}.

HRMS: (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{14}H_{11}F_3N_3O^+$ 294.0849; Found: 294.0839.

Melting point: 73.7-75.1 °C.

Compound 3v



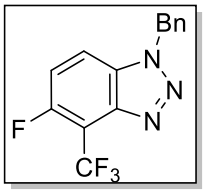
Prepared from **1v** according to the general procedure D on 0.5 mmol and obtained an isolated yield of 56% (0.0636 g, 0.28 mmol) as an off-white solid after purification by column chromatography on silica gel using 15% EtOAc. Spectral data is consistent with previous reports[8].

R_f = 0.29 in 16% EtOAc/Hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.36-7.26 (m, overlaps with solvent peak, 6H), 7.13 (d, *J* = 8.4 Hz, 1H), 6.99 (dd, *J*= 10.0, 7.8 Hz, 1H), 5.85 (s, 2H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 153.4 (d, J_{C-F} = 259.4 Hz), 136.5 (d, J_{C-F} = 18.9 Hz), 135.6 (d, J_{C-F} = 6.5 Hz), 134.3, 129.`, 128.6, 128.2 (d, J_{C-F} = 6.8 Hz), 127.6, 108.5 (d, J_{C-F}= 16.9 Hz), 105.8 (d, J_{C-F}= 5.0 Hz), 52.5.

Compound 3w



Prepared from **1w** according to the general procedure D on 0.5 mmol and obtained an isolated yield of 60% (0.0884 g, 0.30 mmol) as an orange crystalline solid after purification by column chromatography on silica gel using 20% EtOAc in hexanes.

R_f = 0.32 in 29% EtOAc/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.50-7.47 (m, 1H), 7.38-7.34 (m, 3H), 7.29-7.24 (m, overlaps with solvent peak, 3H), 5.89 (s, 2H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 158.4 (m), 155.8 (q, *J* = 2.9 Hz), 142.8 (m), 133.8, 130.1, 129.3, 129.0, 127.6, 124.12 (dq, *J* = 274.9, 1.5 Hz), 118.0 (d, J_{C-F} = 27.9 Hz), 114.9 (d, J_{C-F} = 11.0 Hz), 52.9.

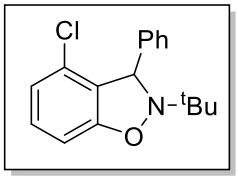
^{19}F NMR (376 MHz, $CDCl_3$) δ = -56.4 (d, *J* = 19.1 Hz), -117.1 (q, *J* = 19.1 Hz).

FTIR: 3093, 2923, 1602, 1428, 1319, 1263, 780, 710 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{14}H_{10}F_4N_3^+$ 296.0805; Found: 296.0796.

Melting point: 149.0-152.0 °C.

Compound 5a



Prepared from **1k** and N-tert-Butyl-α-phenylnitrone (0.2658g, 1.5mmol, 3 equiv.) according to general procedure E on a 0.5 mmol scale for 1 hour and obtained an isolated yield of 94% (0.135 g, 0.47mmol, mixture of regioisomers, 0.09:1 ratio) as a white solid after purification by column chromatography on silica gel using 5% Et_2O→5% DCM→ 5%EtOAc in hexanes.

Characterization of the major isomer is shown below.

R_f = 0.84 in 16% EtOAc/Hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.33-7.23 (m, 5H, overlaps with peaks of minor isomer), 7.11 (dd, appears as triplet, *J* = 8.0 Hz, 1H), 6.80 (d, *J* = 7.6 Hz, 1H), 6.74 (d, *J* = 8.0 Hz, 1H), 5.60 (s, 1H), 1.18 (s, 9H).

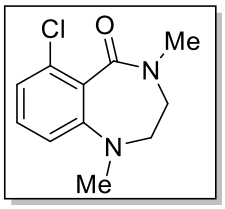
^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 158.5, 141.7, 130.2, 129.5, 128.5, 128.0, 127.6, 127.5, 121.3, 105.3, 66.6, 61.6, 25.3.

FTIR: 3027, 2972, 2934, 1590, 1447, 1366, 1258, 1199, 926, 735, 721 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{17}H_{19}ClNO^+$ 288.1150; Found: 288.1141.

Melting point: 54.8-57.4 °C.

Compound 5b



Prepared from **1k** and DMI (0.181ml, 1.5mmol, 3equiv.) according to general procedure E on a 0.5 mmol scale and obtained an isolated yield of 68% (0.0764g, 0.34 mmol) as a white solid after purification by column chromatography on silica gel using 30% acetone in hexanes.

R_f = 0.3 in 30% Acetone/Hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.23 (dd, appears as triplet, *J* = 8.0 Hz, 1H), 7.05 (dd, *J* = 8.0, 0.8 Hz, 1H), 6.81 (dd, *J* = 8.1, 0.5 Hz, 1H), follows (would require integrating a "bump" for 2H's and singlet separately): 3.42-3.33 (br, 2H), 3.21 (s, 3H), 2.79 (s, 3H)

Note: two H's of ethylene group are not reported as they appear as broad signals between ~ 4-2 ppm, consistent with previous reports on related compounds[12].

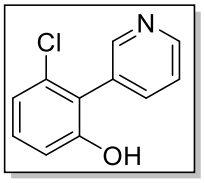
^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 167.1, 148.1, 132.7, 131.0, 128.8, 124.0, 116.3, 57.1, 47.8, 40.2, 33.4.

FTIR: 3073, 2940, 2814, 1642, 1585, 1395, 1257, 1171, 806, 666 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_{14}ClN_2O^+$ 225.0789; Found: 225.0782.

Melting point: 187.5-190.5 °C.

Compound 5c



Prepared from **1k** and pyridine N-Oxide (0.2615g, 2.75mmol, 5.5 equiv.) according to general procedure E on a 0.5 mmol scale and obtained an isolated yield of 38% (0.0390g, 0.19 mmol) as an orange/brown solid after purification by column chromatography on silica gel using 35% acetone in hexanes

R_f = 0.18 in 30% Acetone/Hexanes

^{1}H NMR (600 MHz, $CDCl_3$) δ = 10.03 (br, 1H), 8.54 (dd, *J* = 4.8, 1.5 Hz, 1H), 8.46 (d, *J* = 1.6 Hz, 1H), 7.70 (ddd, appears as a doublet of triplets, *J* = 7.9, 3.8 Hz, 1H), 7.47-7.45 (m, 1H), 7.23 (t, *J* = 8.1 Hz, 1H), 7.02 (dd, *J* = 8.0, 0.8 Hz, 1H), 6.95 (dd, *J* = 8.2, 0.7 Hz, 1H).

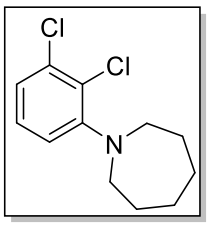
^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 156.3, 150.6, 148.2, 137.9, 133.0, 131.4, 130.0, 124.1, 123.1, 119.9, 114.5.

FTIR: 3399, 3031, 2848, 1584, 1410, 1389, 1286, 1169, 1003, 897, 786, 704 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_9ClNO^+$ 206.0367; Found: 206.0362.

Melting Point: Decomposes at 190 °C.

Compound 5d



Prepared from **1k** and 1-chloroazepane (0.2004g, 1.5 mmols, 3 equiv.) according to general procedure E for 3 hours at 0 ˚C on a 0.5 mmol scale and obtained an isolated yield of 63% (0.0769 g, 0.32 mmol) as a colorless liquid after purification by column chromatography on silica gel using petroleum ether.

R_f = 0.97 in 16% EtOAc/Hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.10-7.05 (m, 2H), 7.03-6.97 (m, 1H), 3.20 (ddd, appears as a triplet, *J* = 5.7 Hz, 4H), 1.82 (Br, 4H), 1.74-1.68 (m, 4H).

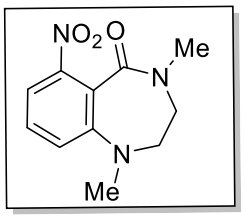
^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 153.8, 133.9, 127.1, 127.0, 123.2, 119.9, 55.0, 29.1, 27.2.

FTIR: 3062, 2924, 2852, 1737, 1576, 1444, 1237, 1047, 905, 773 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{12}H_{16}Cl_2N^+$ 244.0654; Found: 244.0652.

Synthesis of Diazepinone Via Telescoped Reaction

Compound 5e



Prepared from 3-nitrophenyl iodide and DMI according to the general procedure F with the following modifications: the crude reaction mixture was purified by flash chromatography using 25% acetone in hexanes to give a mixture of 3a and DMI. The mixture was further purified by crystallization using acetone/diethyl ether. The crystals were washed with diethyl ether affording **3a** in 55% yield (0.0646 g, 0.27 mmol) as an orange crystalline solid.

R_f = 0.20 in 30% acetone/hexanes

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.44-7.38 (m, 2H), 7.07 (dd, *J* = 7.1, 2.2 Hz, 1H), 3.60 (t, *J* = 5.7, 2H), 3.33 (t, *J*=5.7, 2H), 3.21 (s, 3H), 2.86 (s, 3H).

^{13}C{^{1}H} NMR (101 MHz, $CDCl_3$) δ = 166.3, 150.1, 147.1, 130.9, 124.7, 121.9, 116.7, 56.8, 47.9, 40.2, 33.6.

FTIR: 3089, 2906, 2827, 1663, 1522, 1487, 1430, 1353, 849 cm^{-1}.

HRMS (ESI-Orbitrap) m/z: $[M + H]^+$ Calcd for $C_{11}H_{14}N_3O_3^+$ 236.1030; Found: 236.1021.

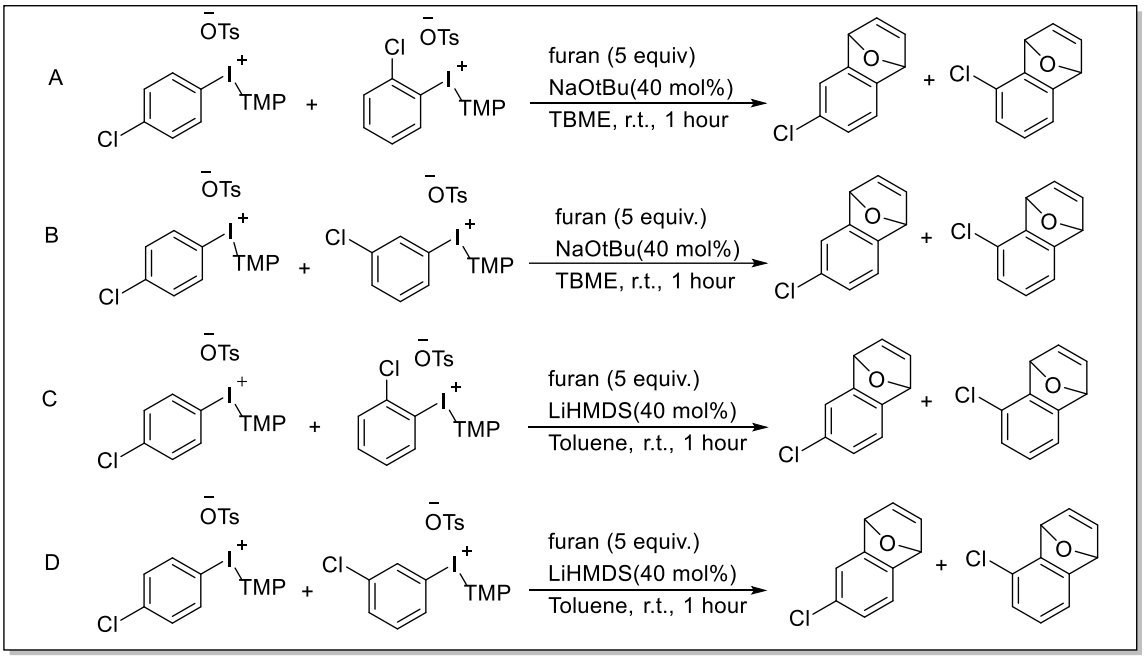
Melting Point: 155.0-156.4 °C.

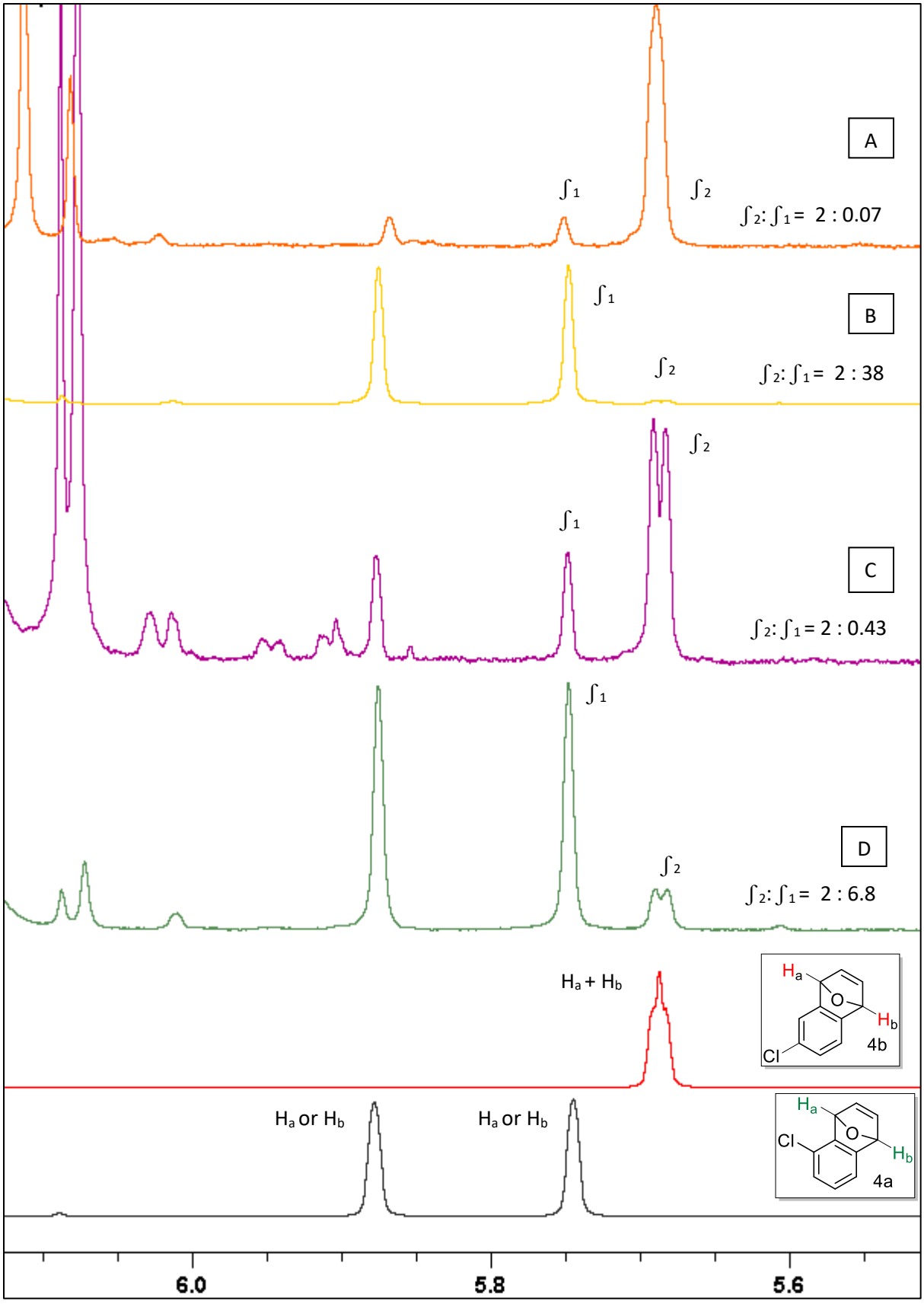
Mechanistic Studies

Reactions A and B were conducted according to general procedure C on a 0.1 mmol scale with the following modifications: The reactions are extracted with ethyl acetate (3x) and filtered through magnesium sulfate and a small cotton plug. The reactions are concentrated under reduced pressure and a ^{1}H-NMR is acquired with a relaxation delay of 30 seconds. Integrations are acquired for known peaks based upon samples of the reaction products.

Reactions C and D were conducted according to general procedure B on a 0.1 mmol scale with the following modifications: The reactions are extracted with ethyl acetate (3x) and filtered through magnesium sulfate and a small cotton plug. The reactions are concentrated under reduced pressure and a ^{1}H-NMR is acquired with a relaxation delay of 30 seconds. Integrations are acquired for known peaks based upon samples of the reaction products.

Integrations were aquired for the resonace at 5.68 ppm corresponding to H_a and H_b for compound 4b and were calibrated to 2H. Integrations were then aquired for the resonace at 5.74ppm corresponding to either H_a or H_b for compound 4a. These integrations correspond to the ratio of the respective products where integral 2 corresponds to two hydrogen atoms and integral 1 corresponds to one hydrogen atom.




A
∫1
∫2
∫2: ∫1 = 2 : 0.07
B
∫1
∫2
∫2: ∫1 = 2 : 38
C
∫2
∫1
∫2: ∫1 = 2 : 0.43
D
∫1
∫2
∫2: ∫1 = 2 : 6.8
Ha + Hb
Ha
O
Hb
Cl
4b
Ha or Hb
Ha or Hb
Ha
Cl
O
Hb
4a
6.0
5.8
5.6

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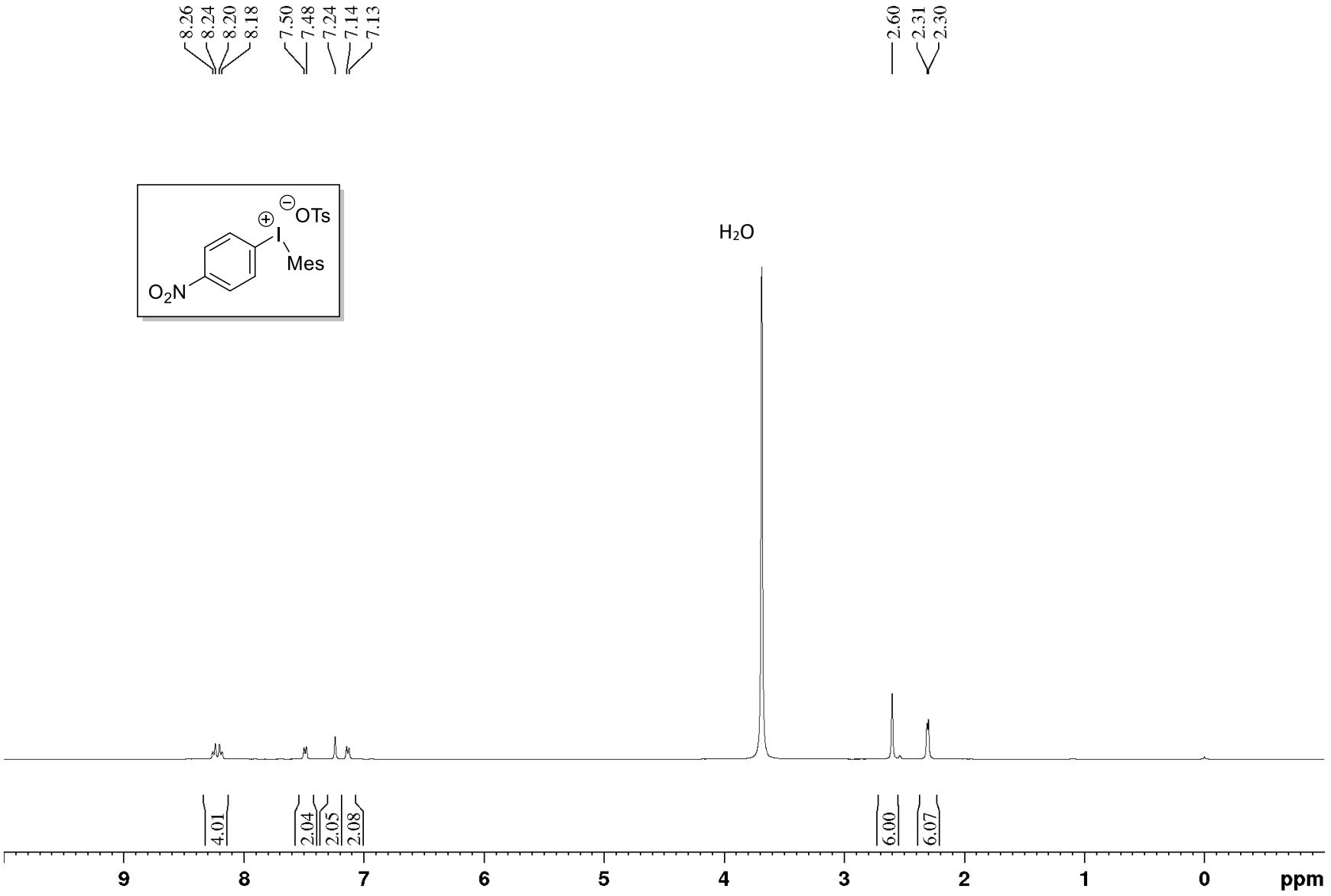
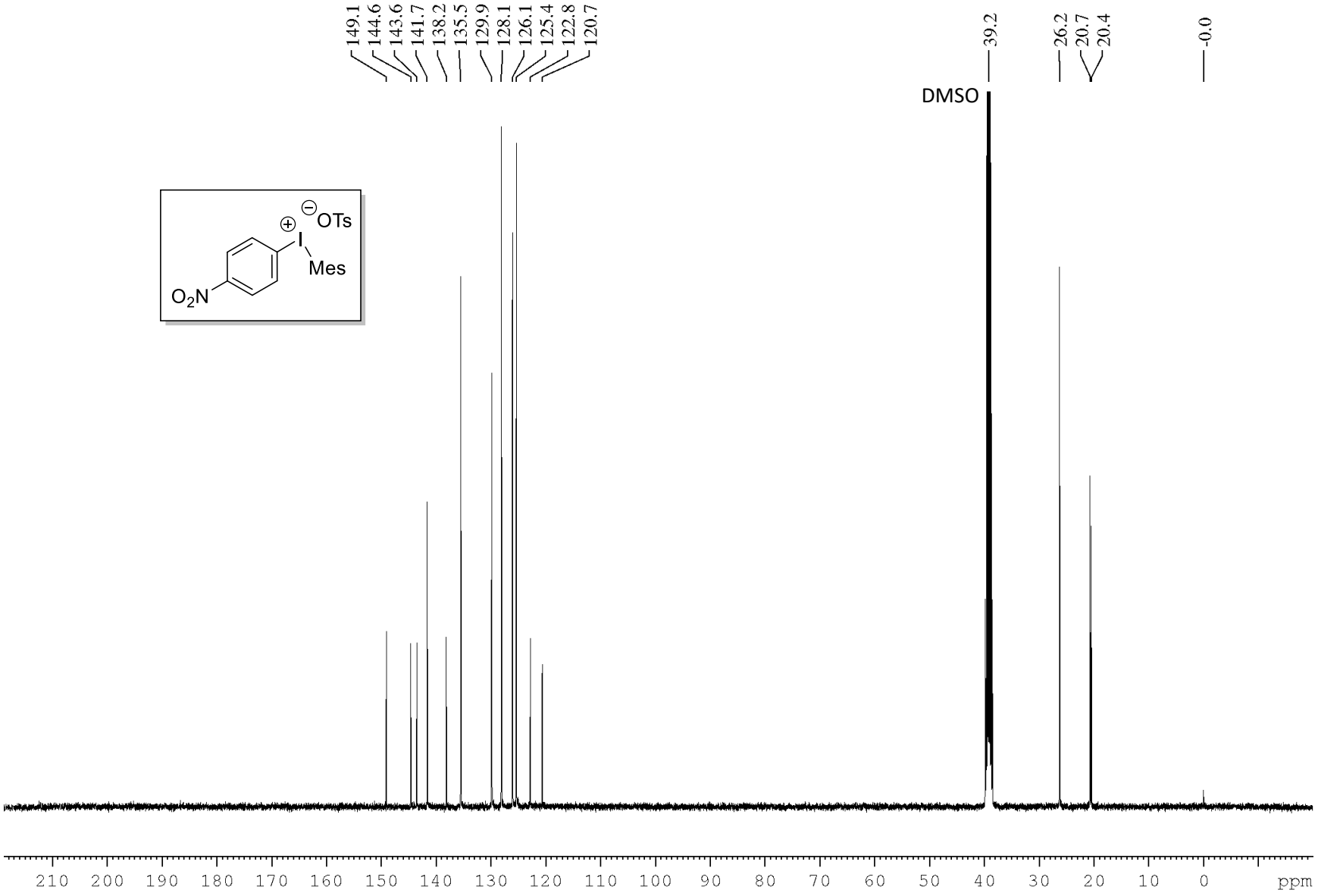
^{1}H, ^{13}C{^{1}H}, and ^{19}F{^{1}H} NMR Spectra

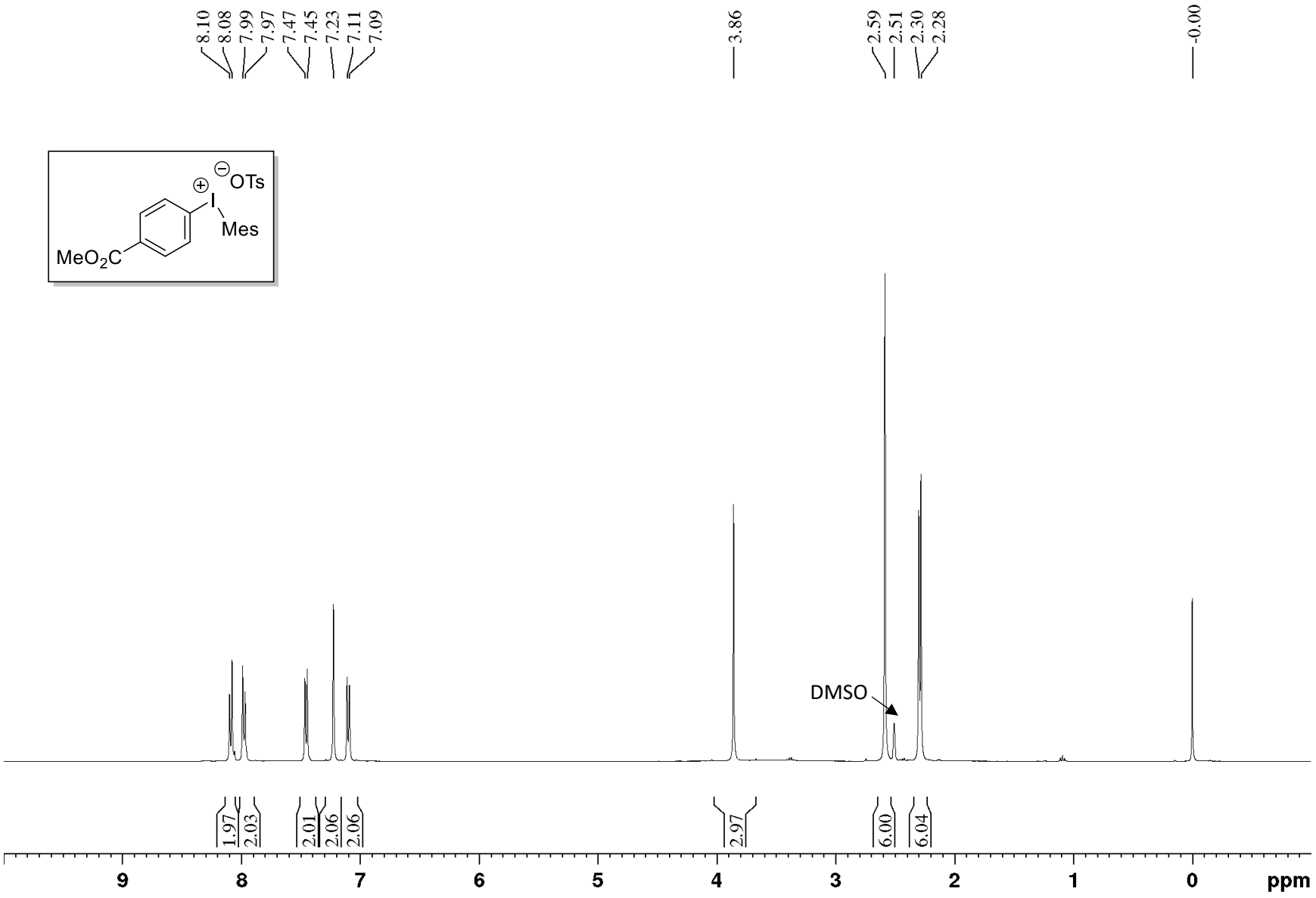
^{1}H NMR of 1a-Mes in DMSO-d_6 at 400 MHz



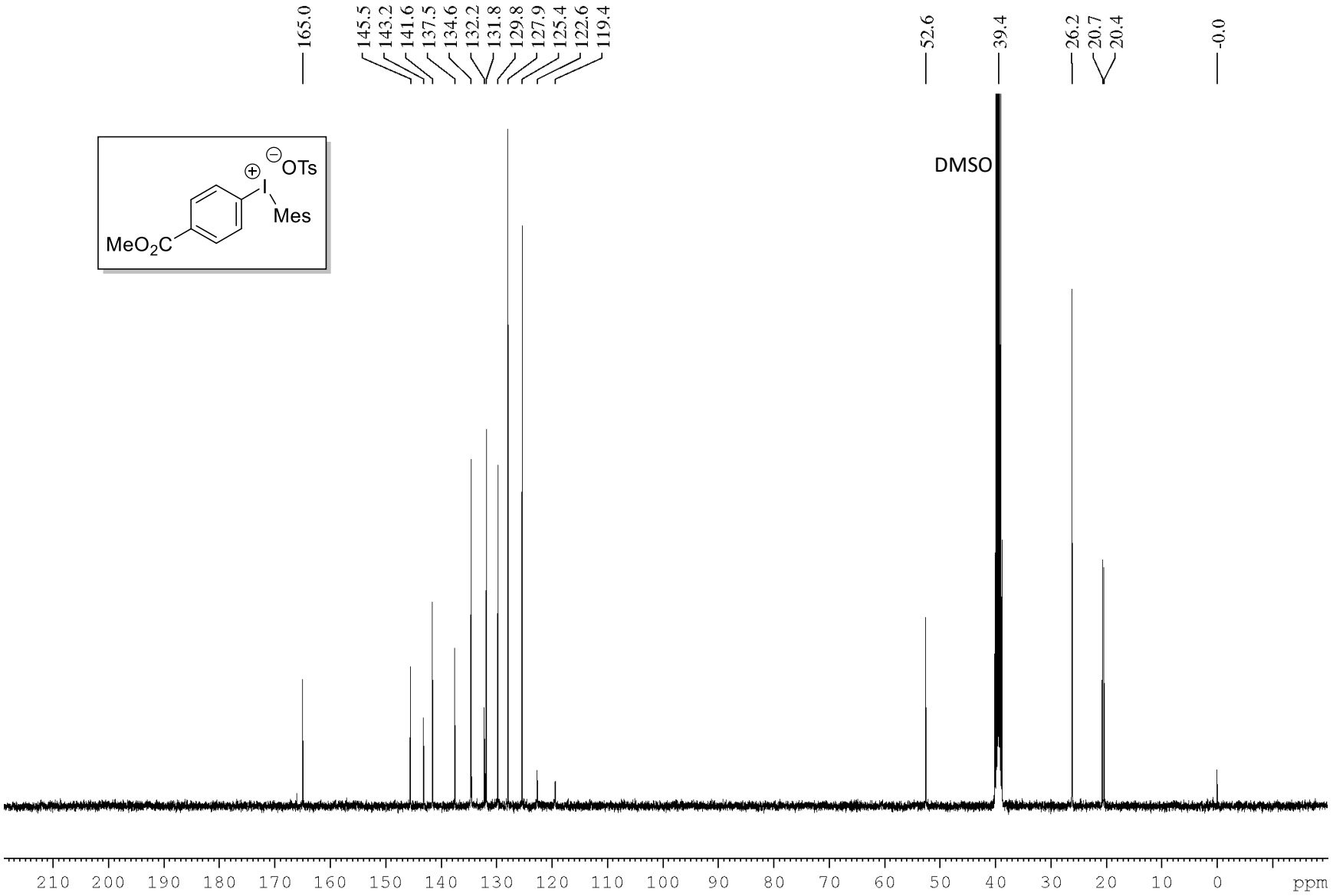
$^{13}C\{^{1}H\}$ NMR of 1a-Mes in DMSO-d_6 at 101 MHz



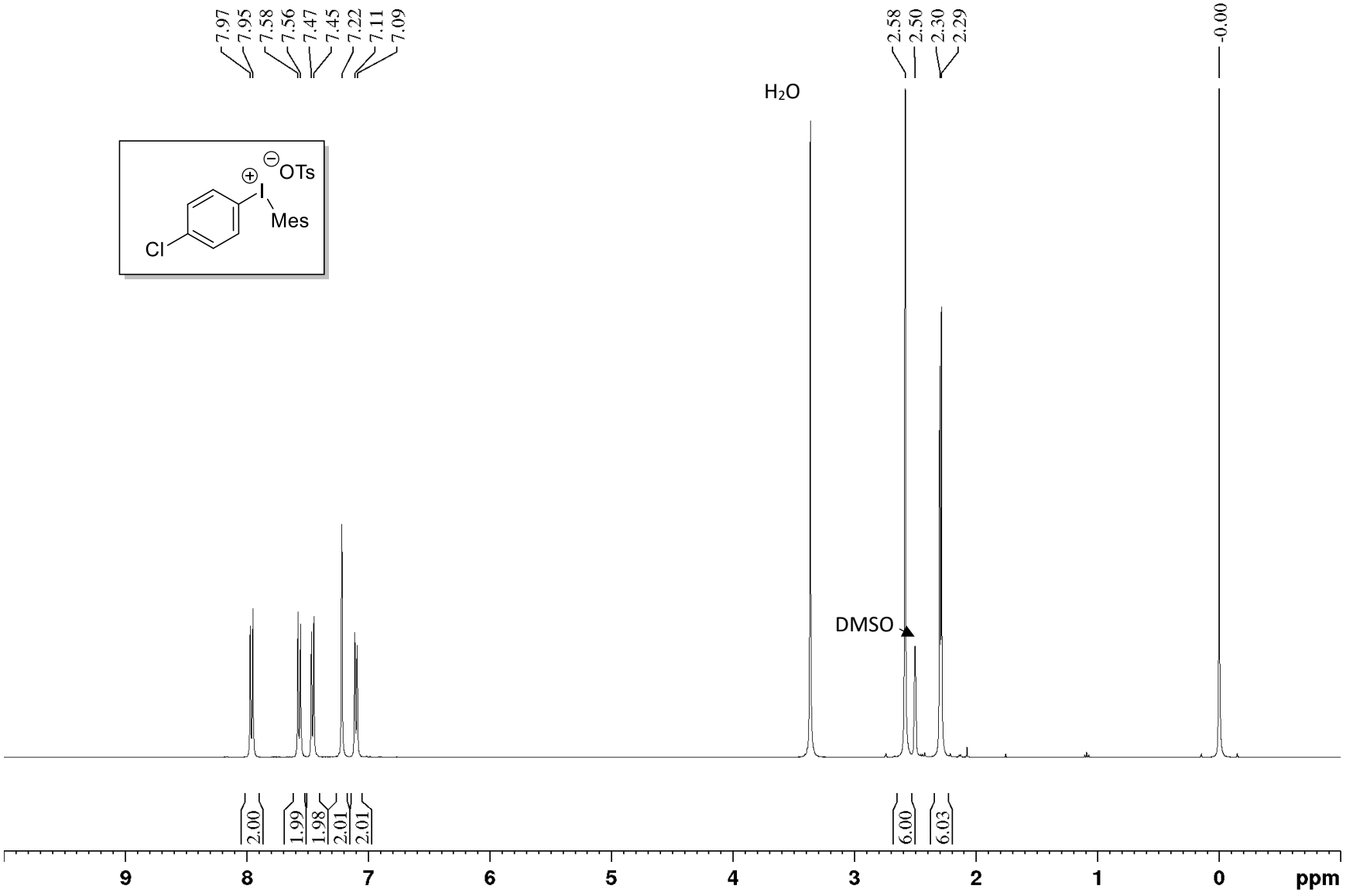
^{1}H NMR of 1b-Mes in DMSO-d_6 at 400 MHz



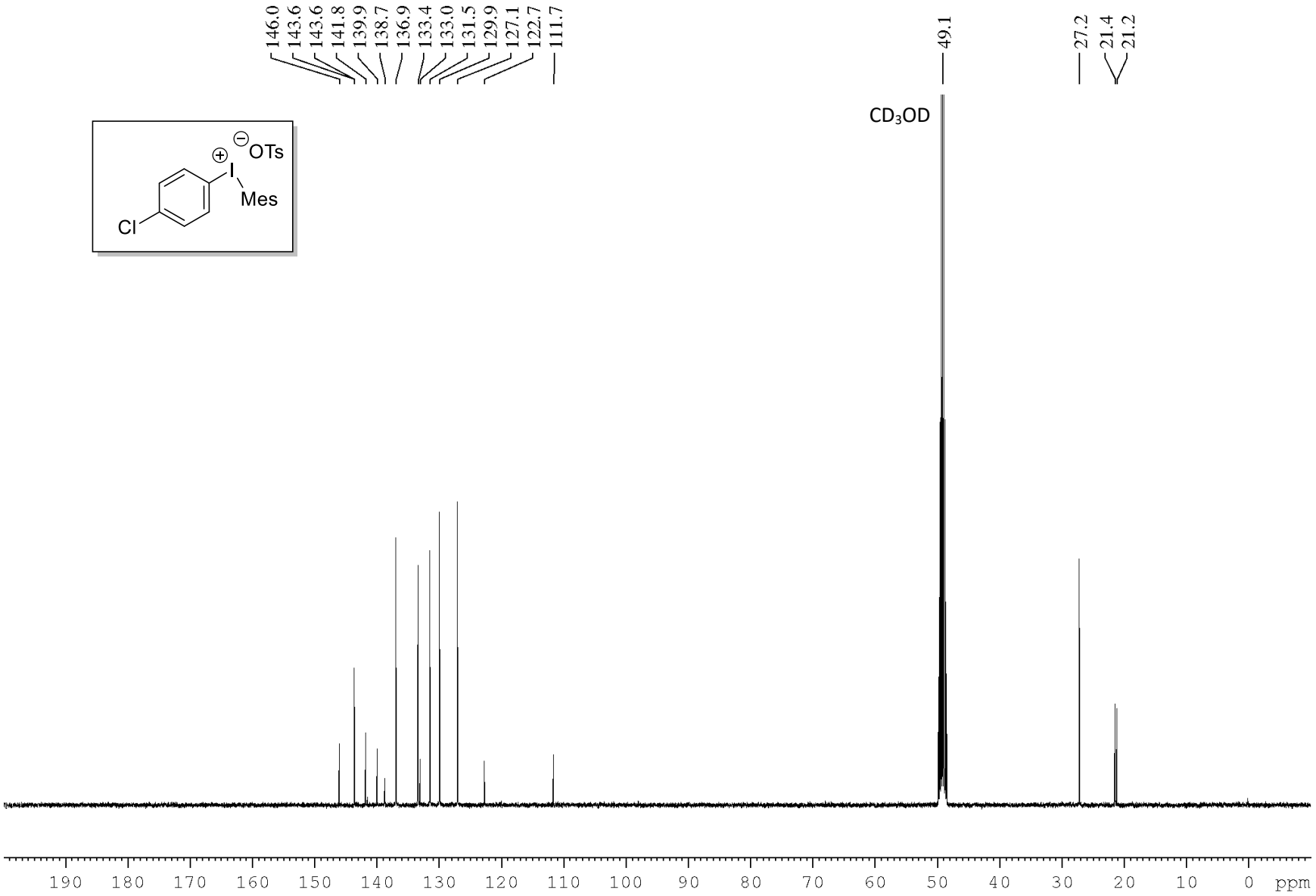
$^{13}C\{^{1}H\}$ NMR of 1b-Mes in DMSO-d_6 at 101 MHz



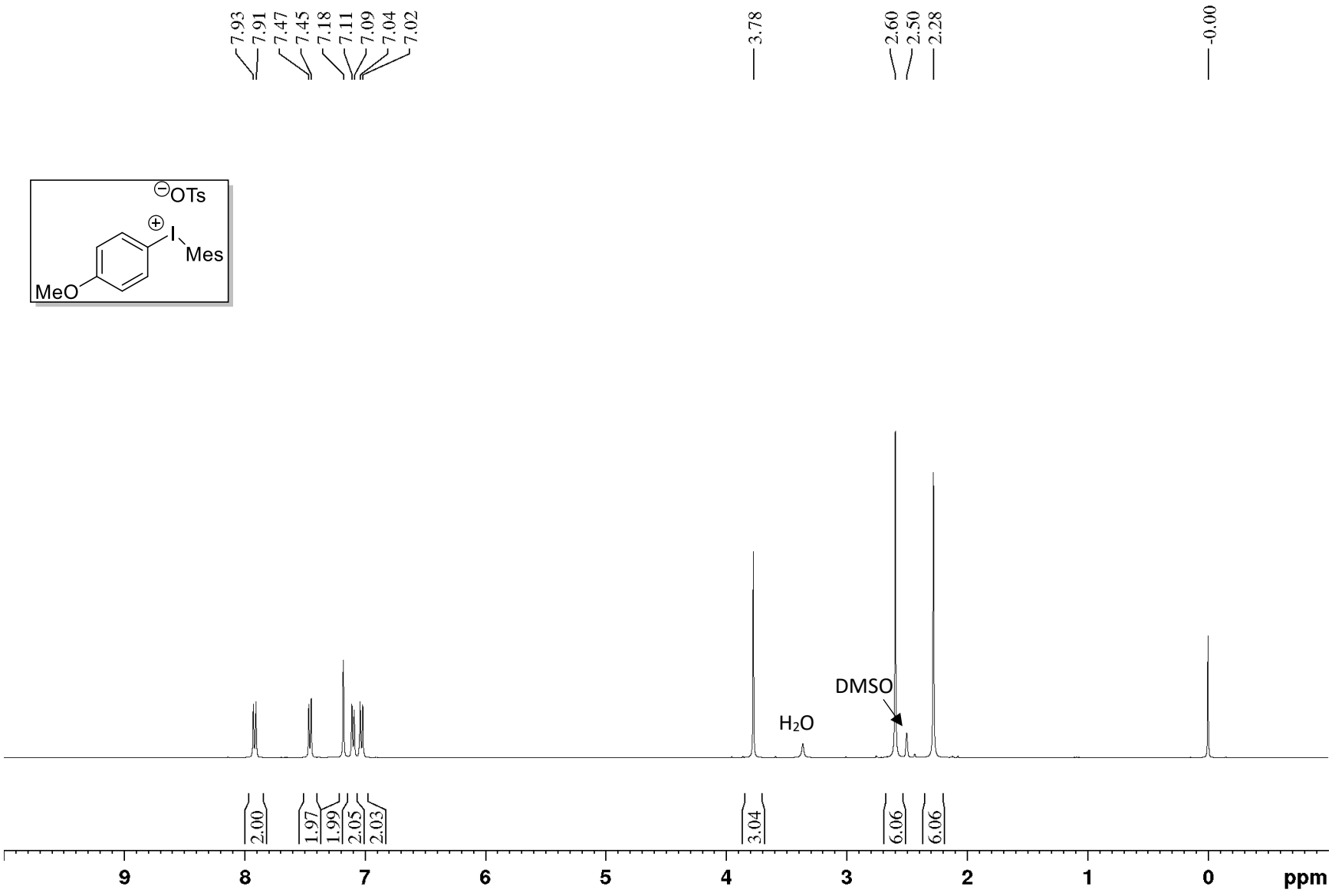
^{1}H NMR of 1c-Mes in DMSO-d_6 at 400 MHz



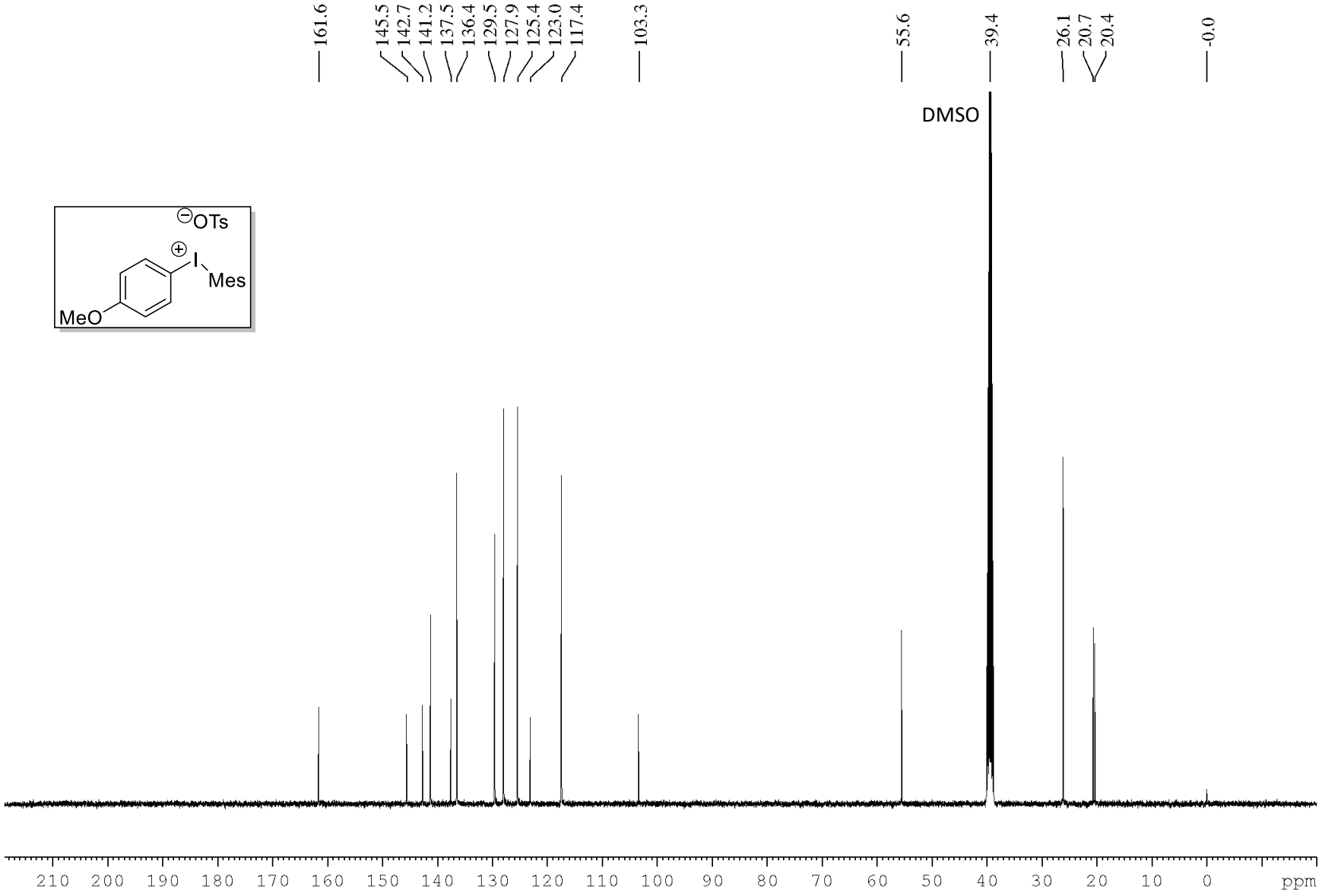
$^{13}C\{^{1}H\}$ NMR of 1d-Mes in CD_3OD at 101 MHz



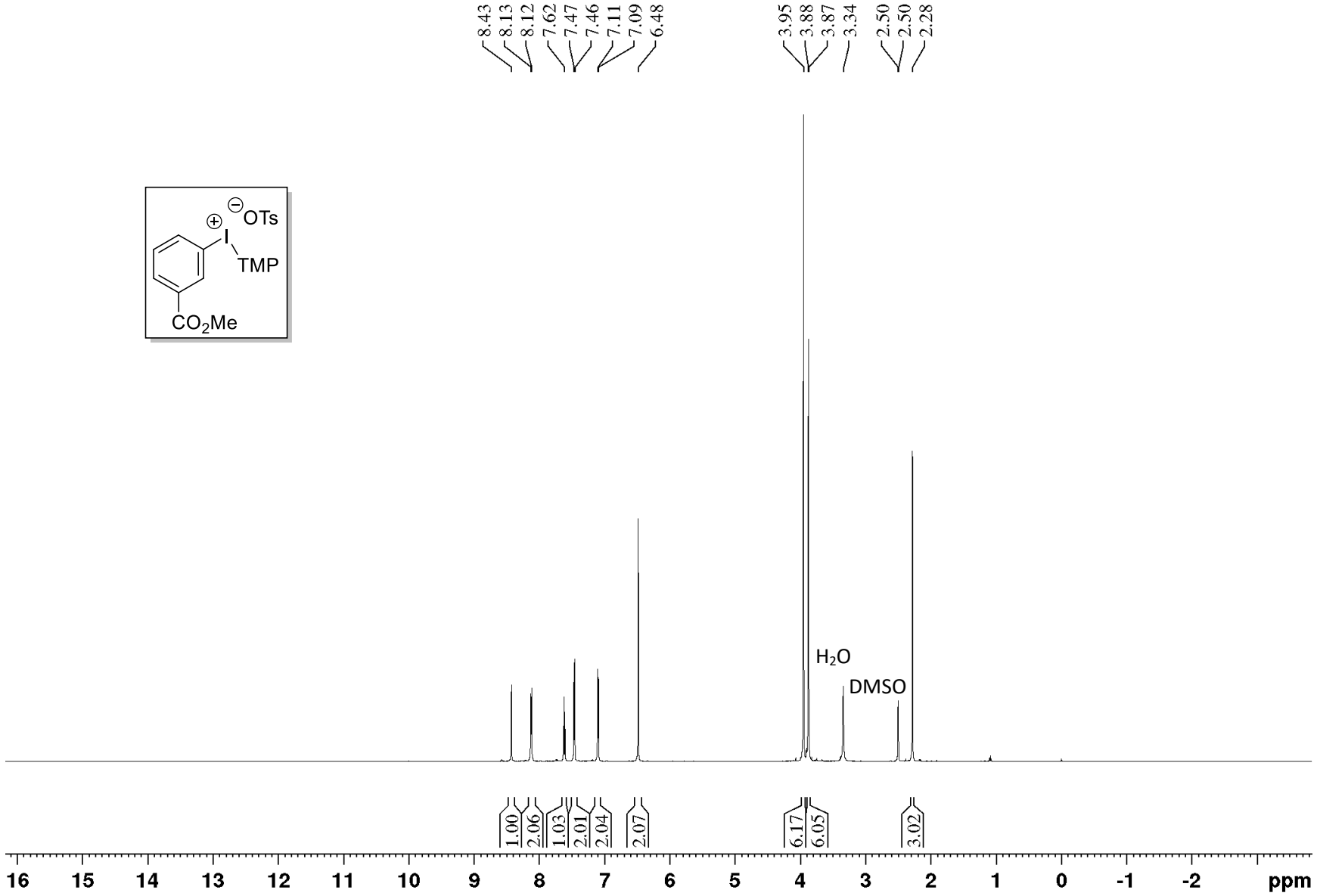
^{1}H NMR of 1d-Mes in DMSO-d_6 at 400 MHz



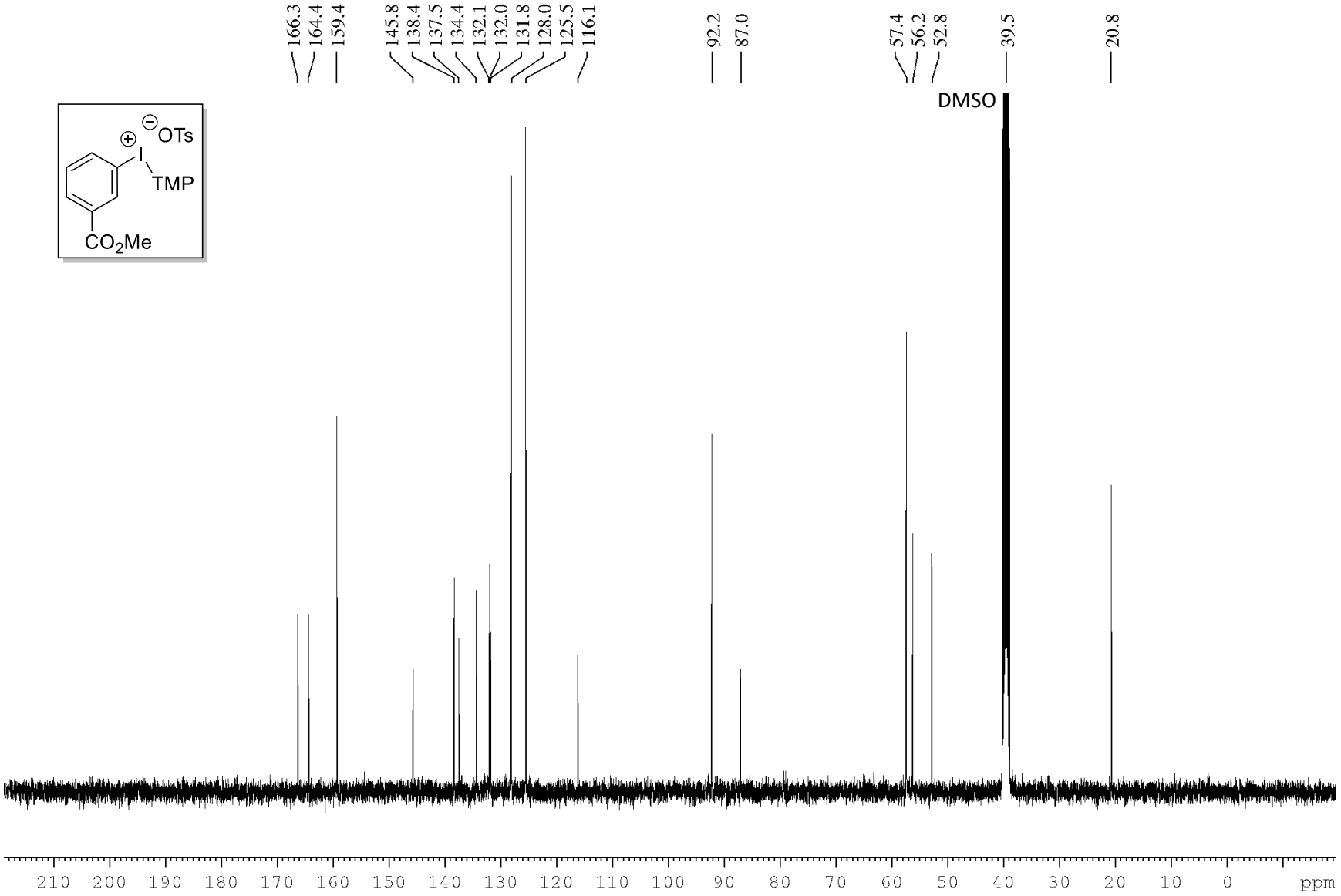
$^{13}C\{^{1}H\}$ NMR of 1d-Mes in DMSO-d_6 at 101 MHz



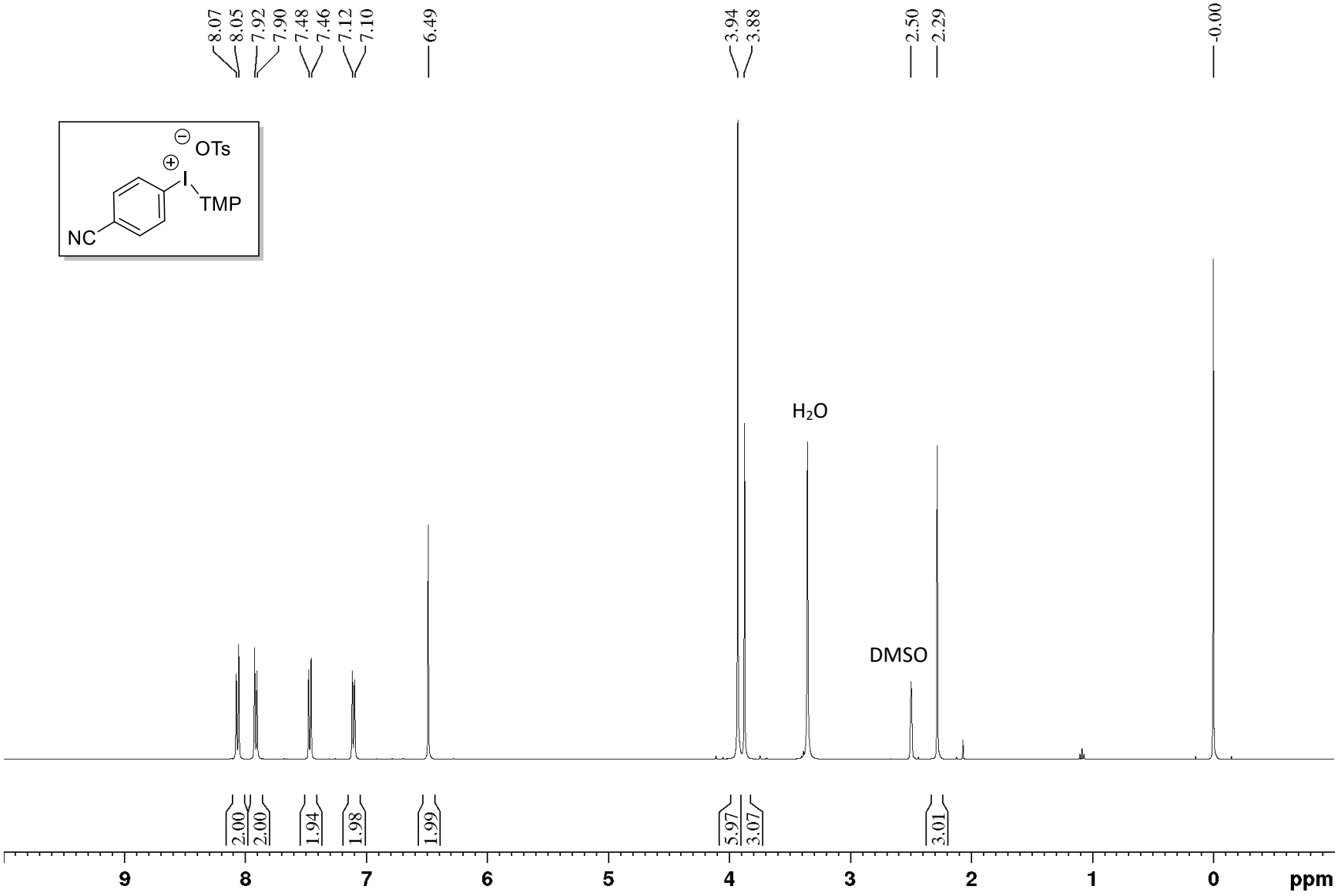
^{1}H NMR of 1f in DMSO-d_6 at 400 MHz



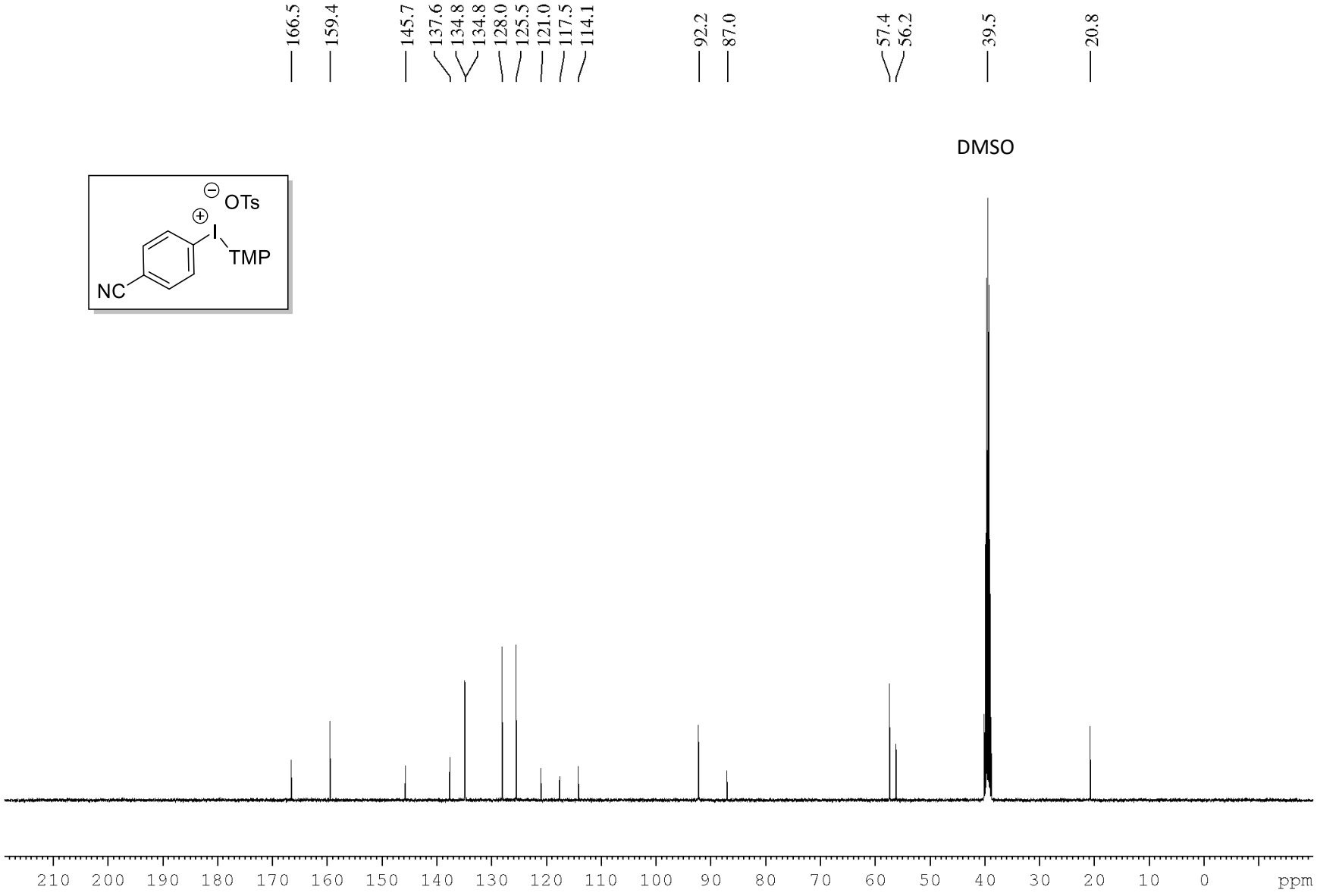
$^{13}C\{^{1}H\}$ NMR of 1f in DMSO-d_6 at 101 MHz



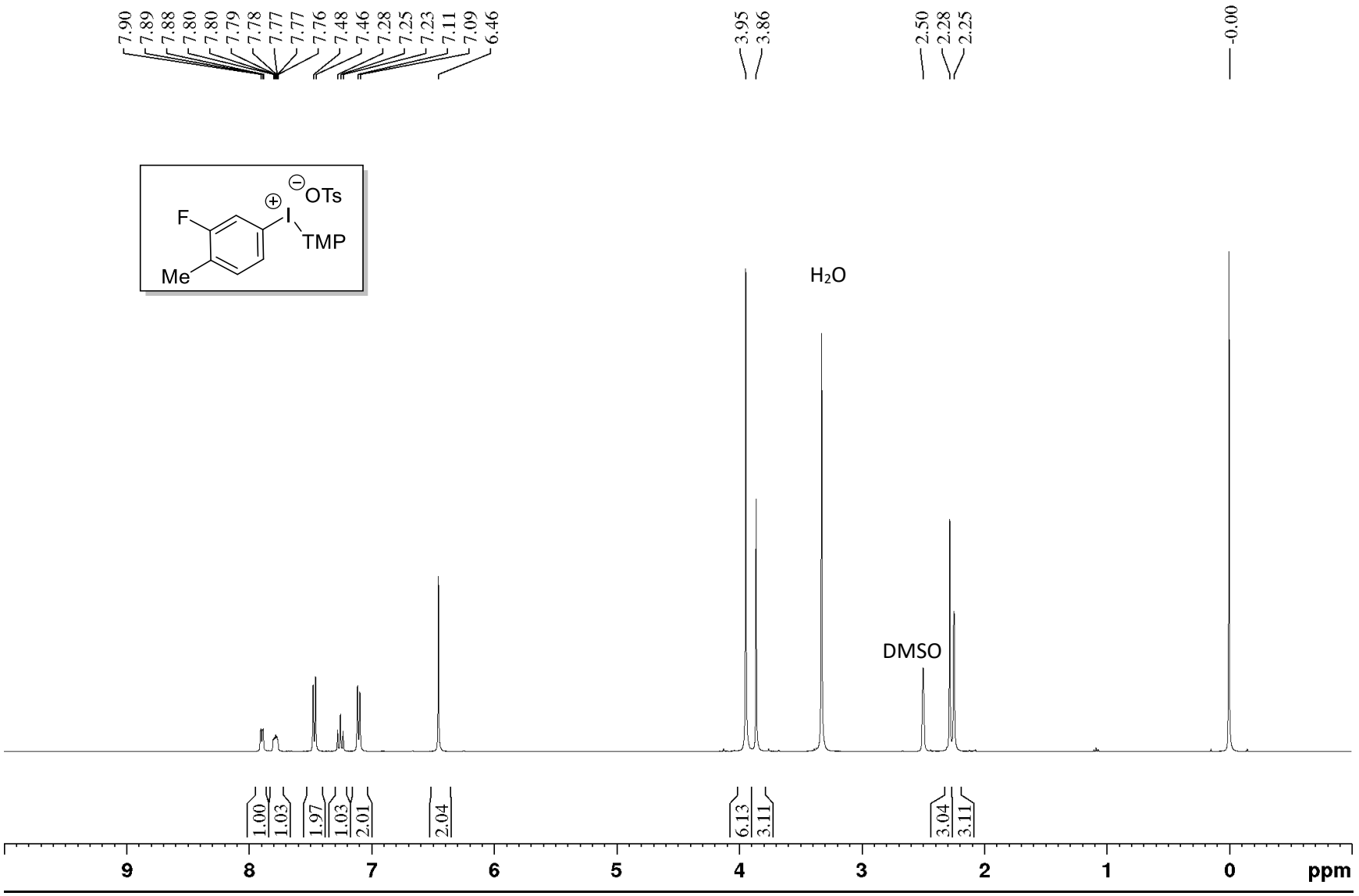
^{1}H NMR of 1h in DMSO-d_6 with 1% v/v TMS at 400 MHz



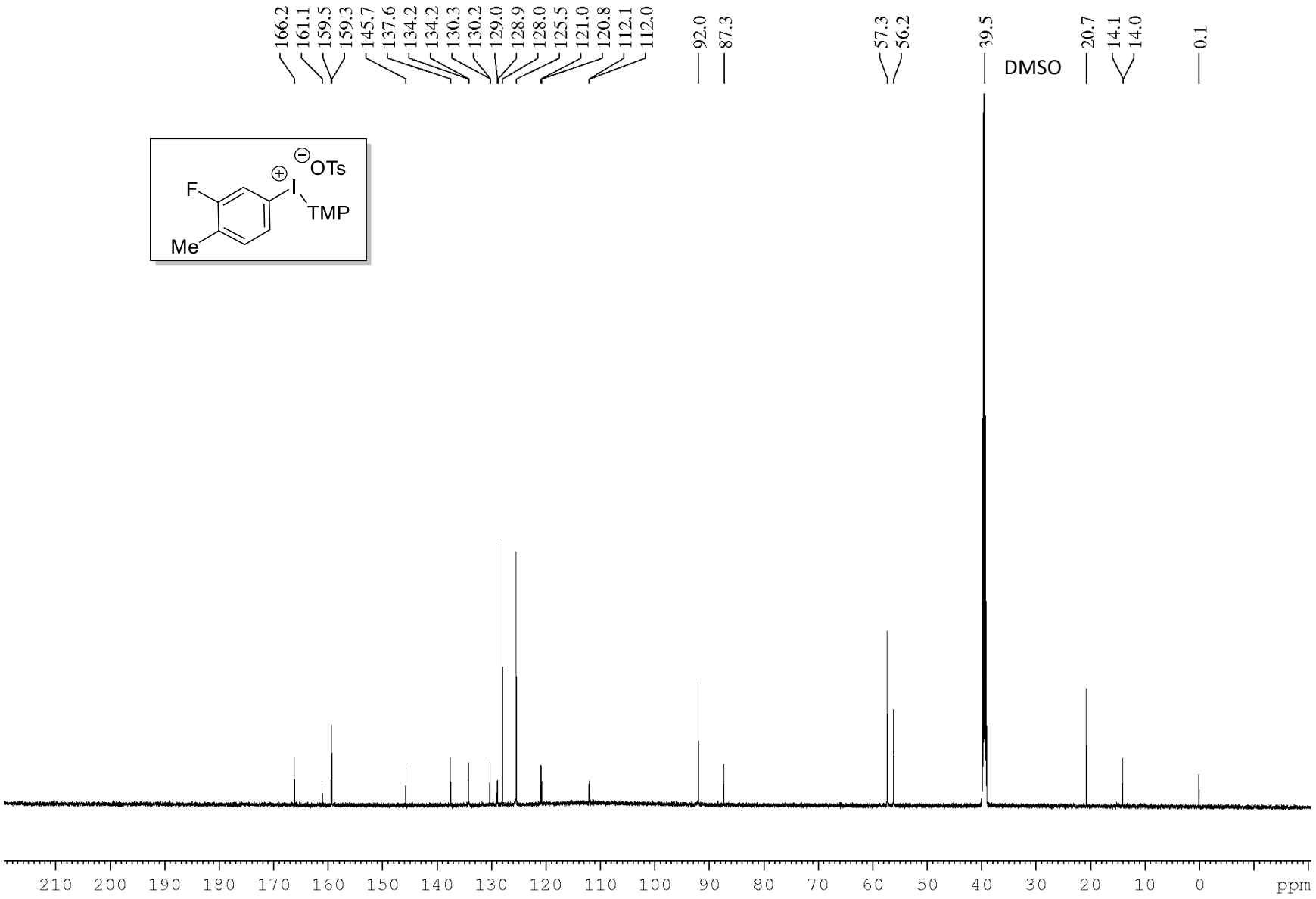
$^{13}C\{^{1}H\}$ NMR of 1h in DMSO-d_6 with 1% v/v TMS at 101 MHz



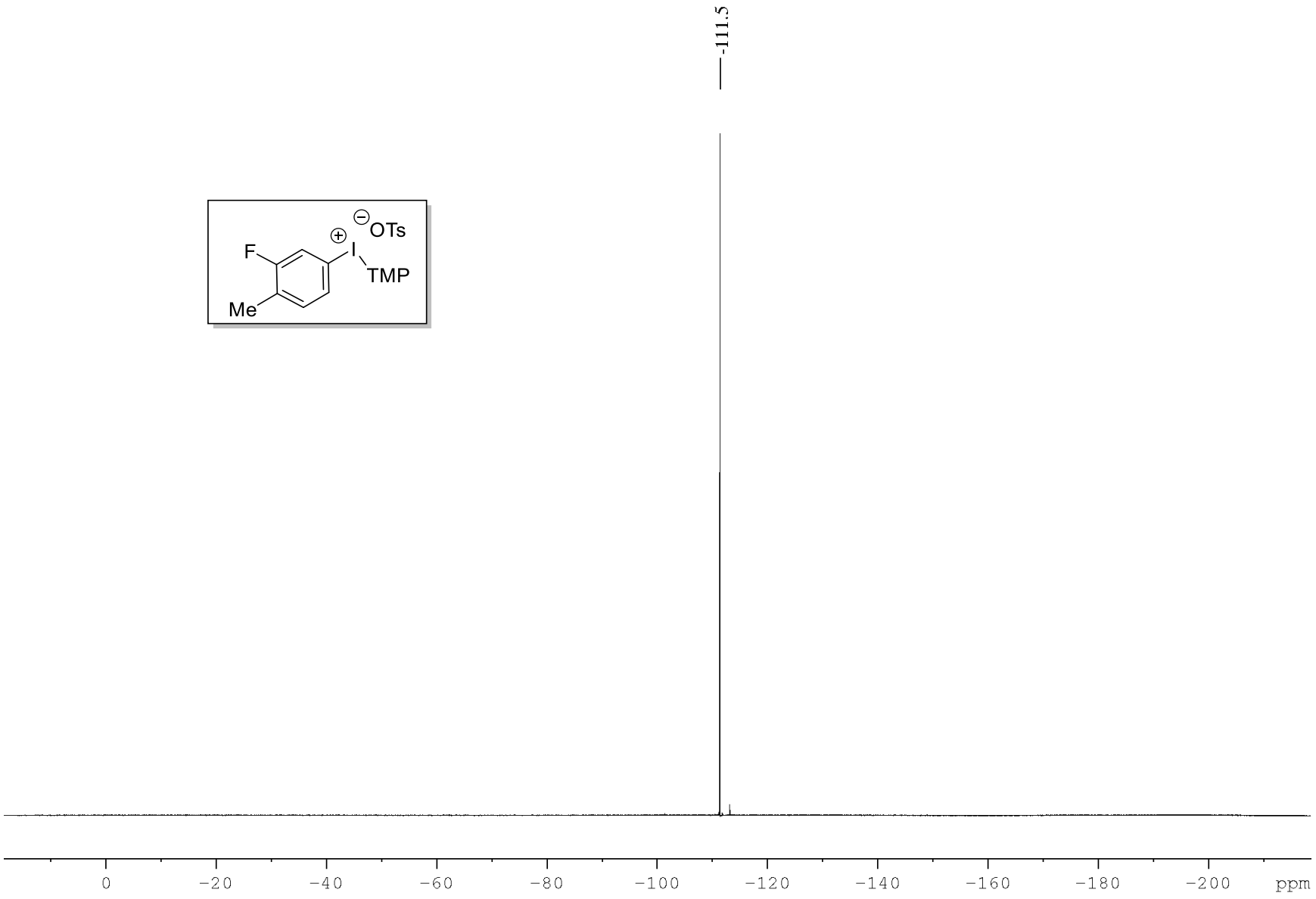
^{1}H NMR of 1m in DMSO-d_6 with 1% v/v TMS at 400 MHz



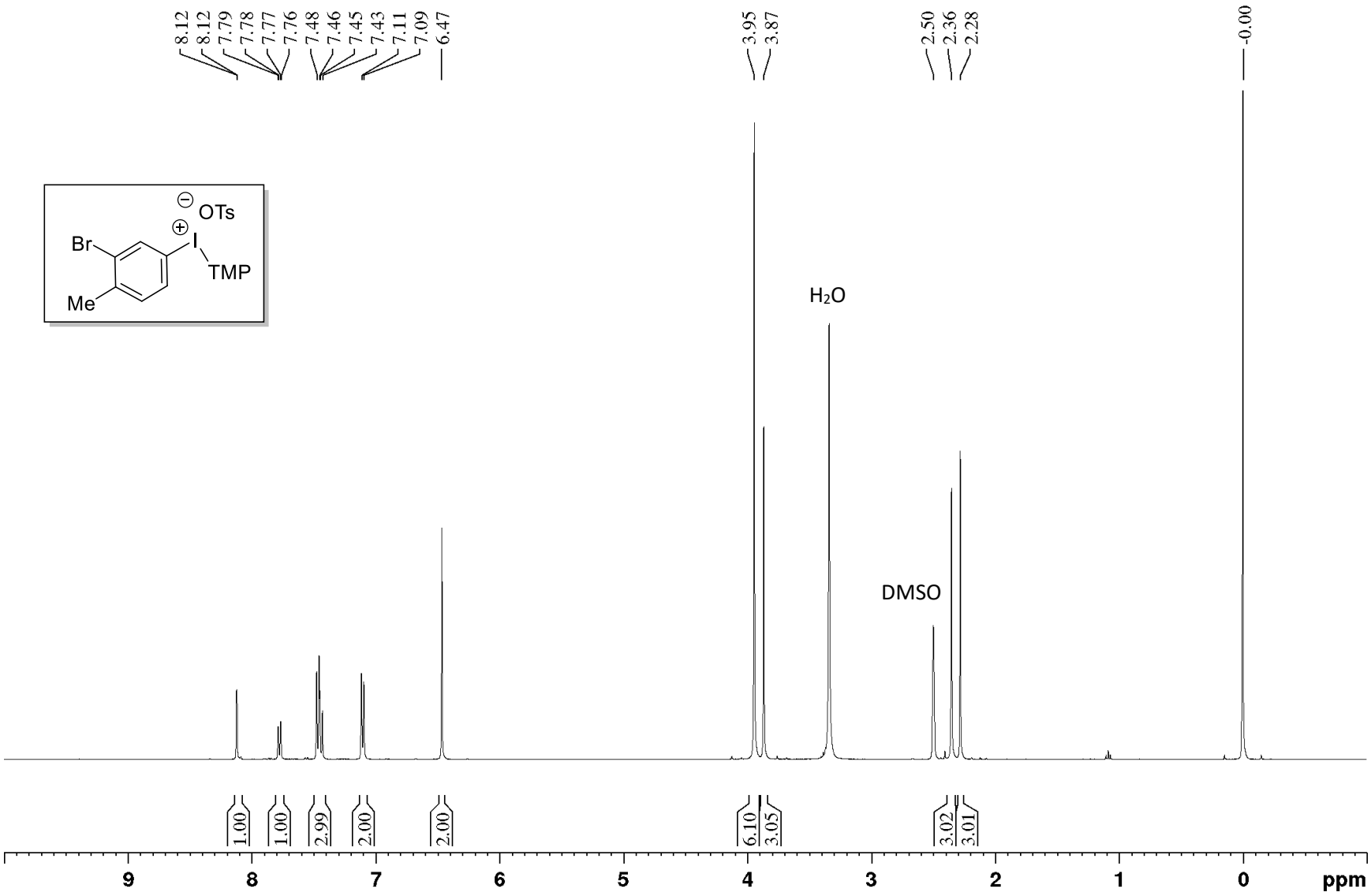
$^{13}C\{^{1}H\}$ NMR of 1m in DMSO-d_6 with 1% v/v TMS at 101 MHz



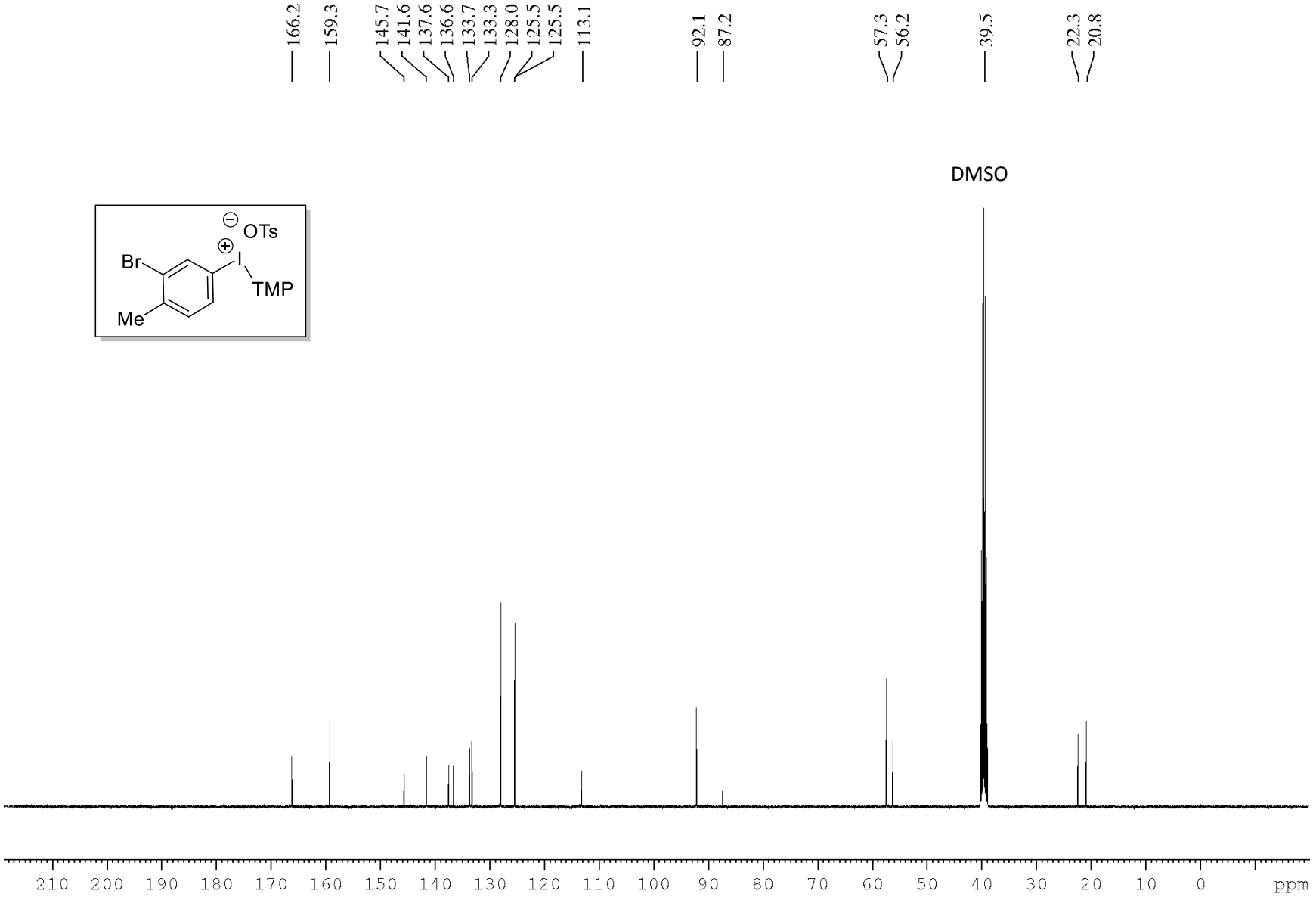
$^{19}F\{^{1}H\}$ NMR of 1m in DMSO-d_6 with 1% v/v TMS at 376 MHz



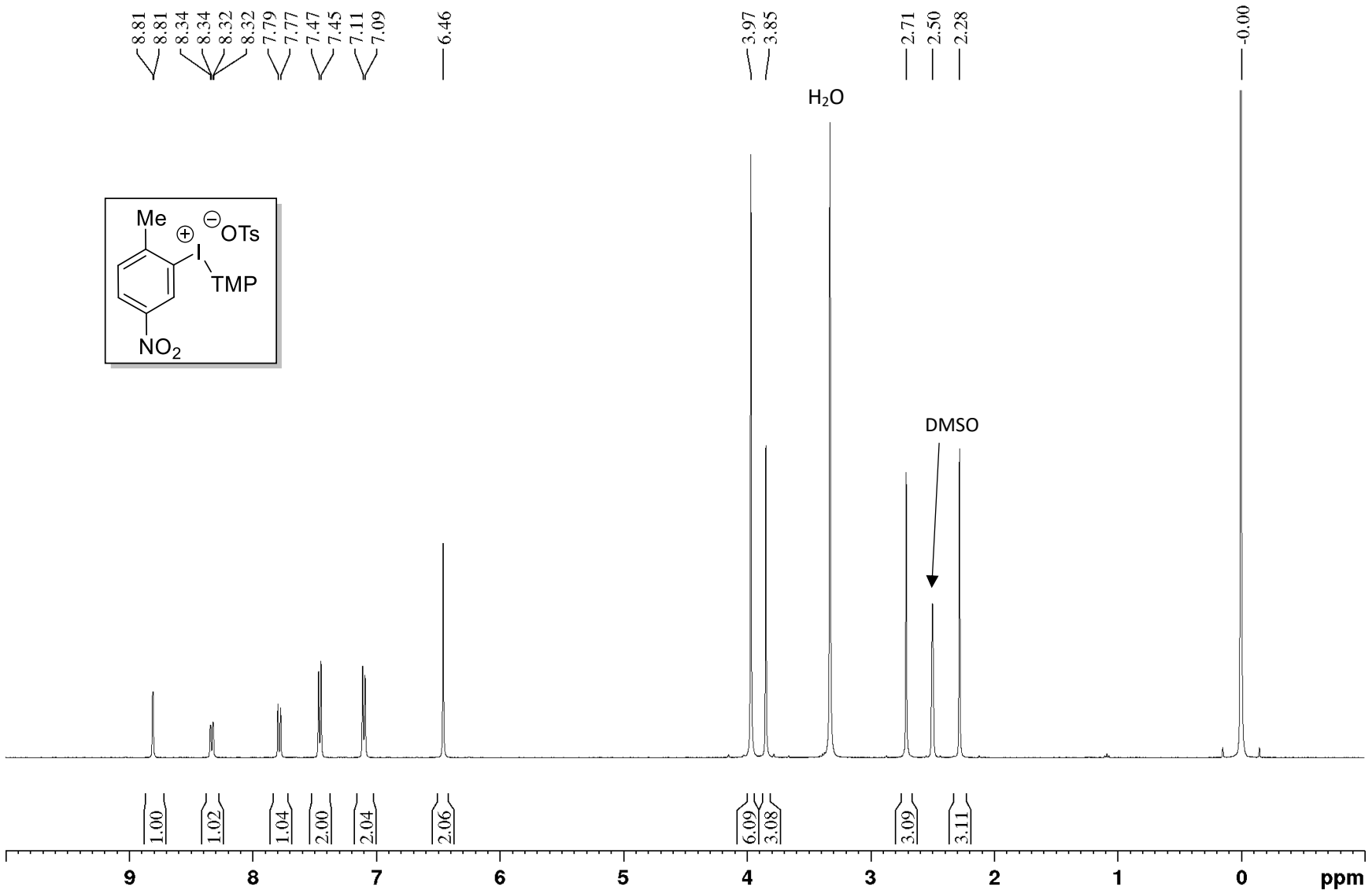
^{1}H NMR of 1o in DMSO-d_6 with 1% v/v TMS at 400 MHz



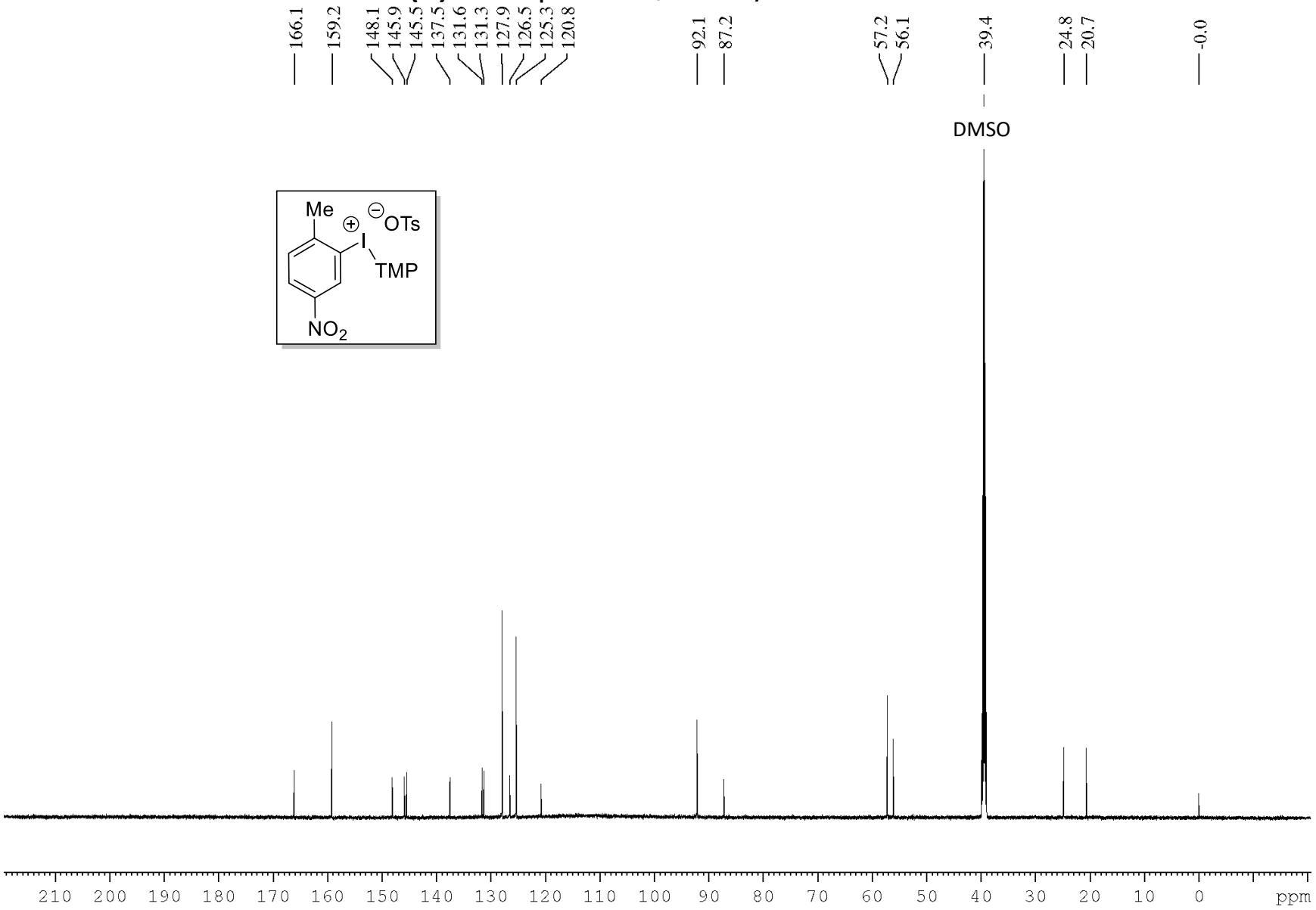
$^{13}C\{^{1}H\}$ NMR of 1o in DMSO with 1% v/v TMS at 101 MHz



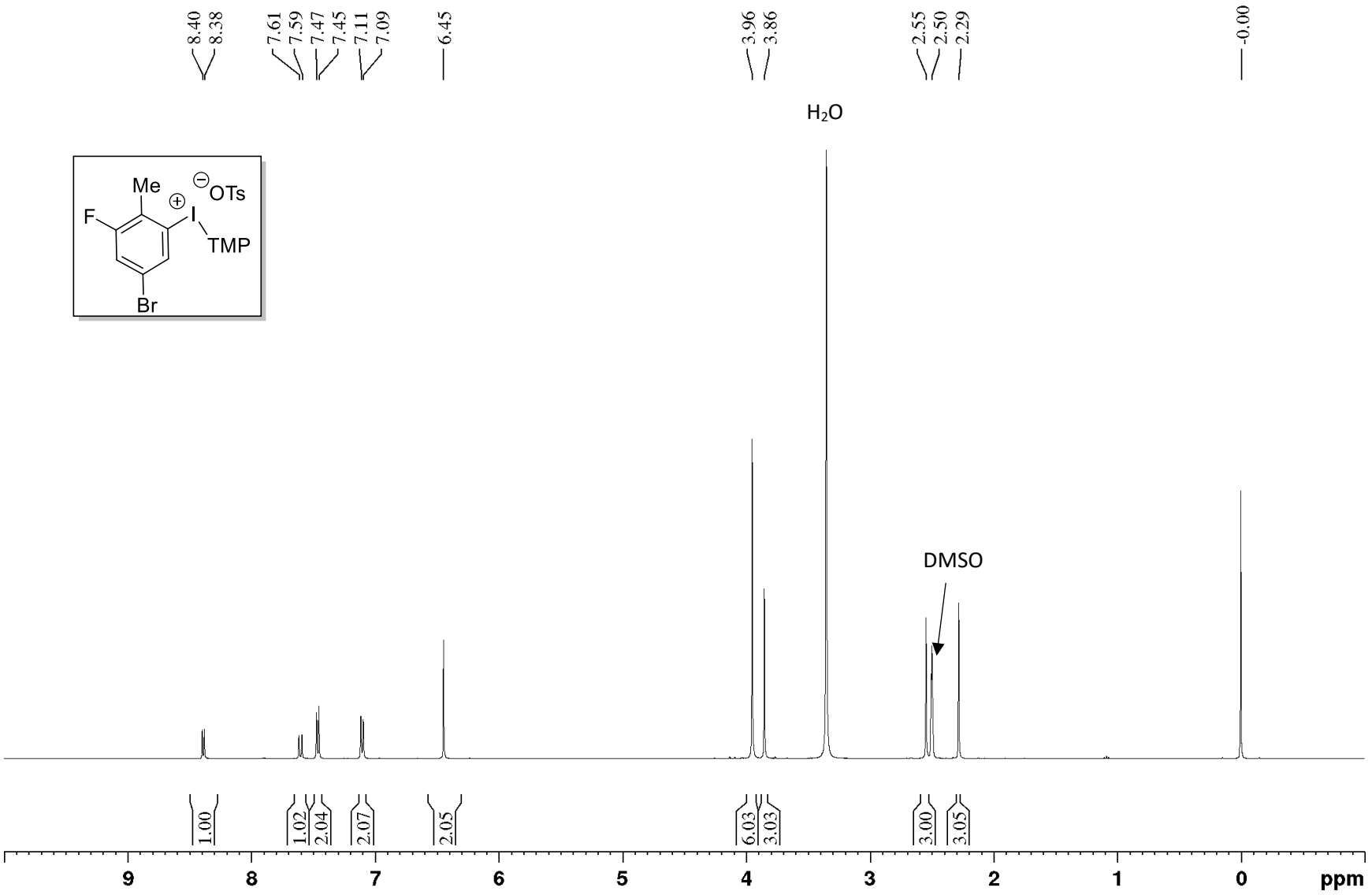
^{1}H NMR of 1p in DMSO-d_6 with 1% v/v TMS at 400 MHz



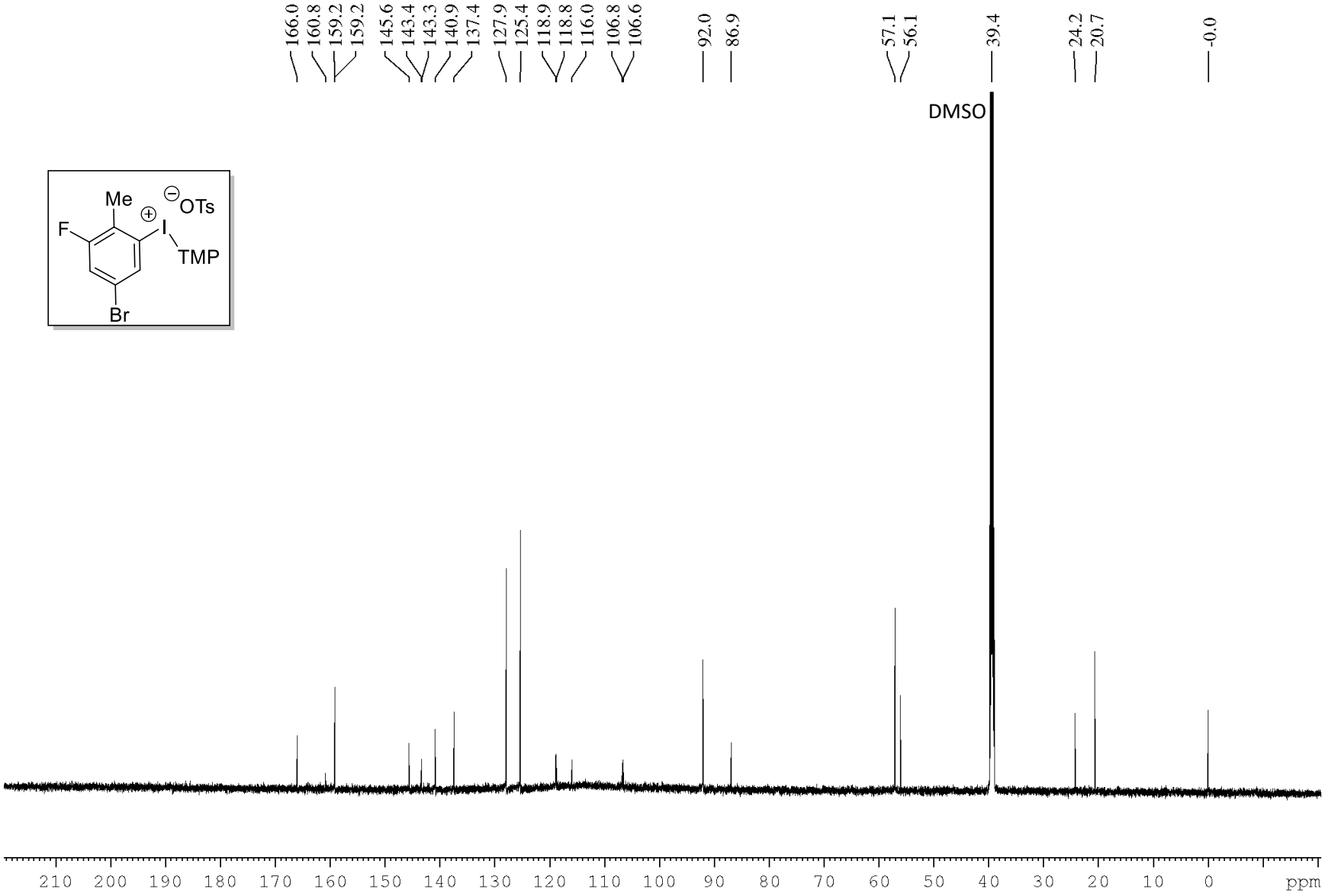
$^{13}C\{^{1}H\}$ NMR of 1p in DMSO-d_6 with 1% v/v TMS at 101 MHz



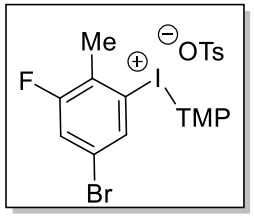
^{1}H NMR of 1s in DMSO-d_6 with 1% v/v TMS at 400 MHz



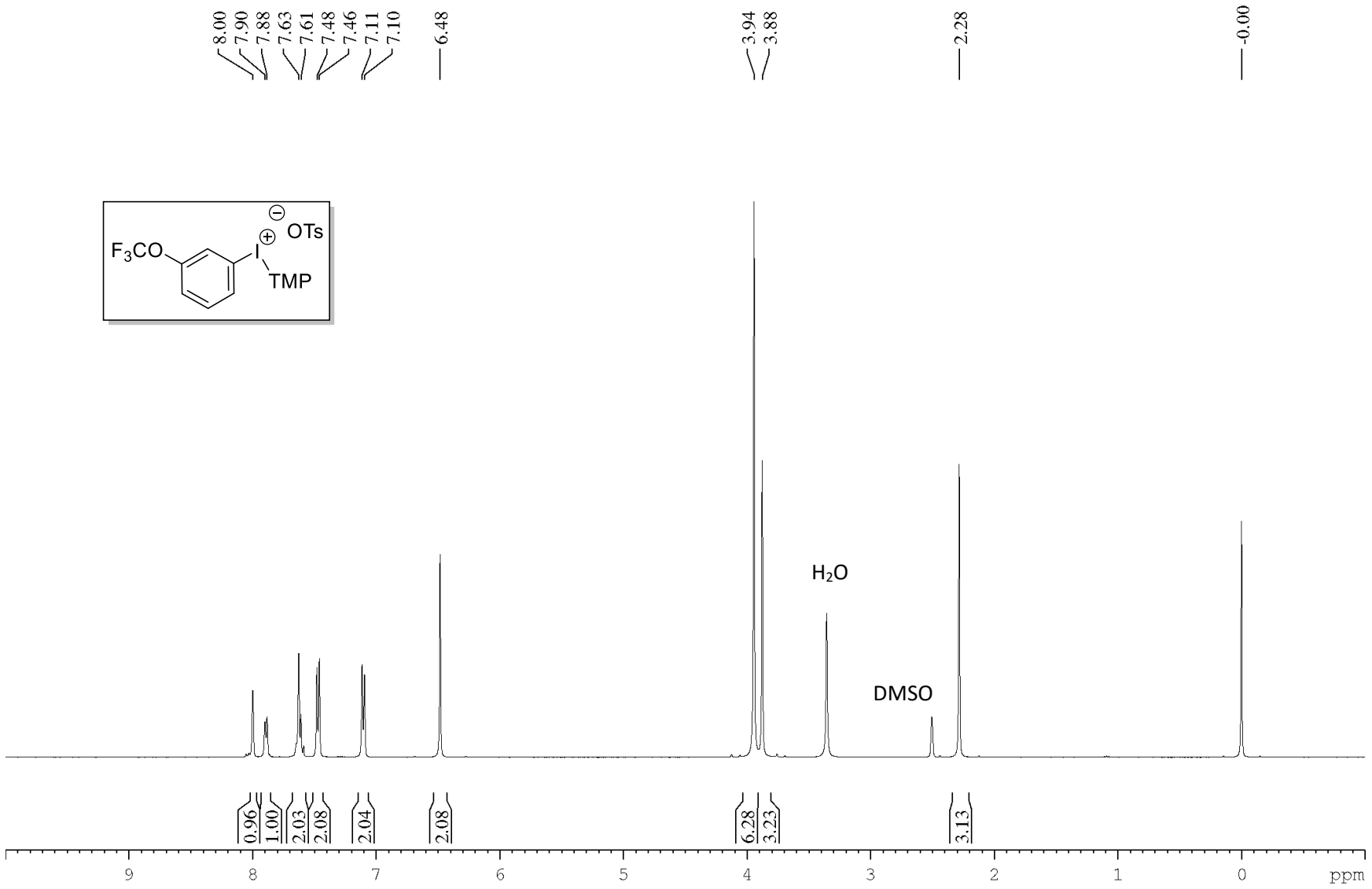
$^{13}C\{^{1}H\}$ NMR of 1s in DMSO-d_6 with 1% v/v TMS at 101 MHz



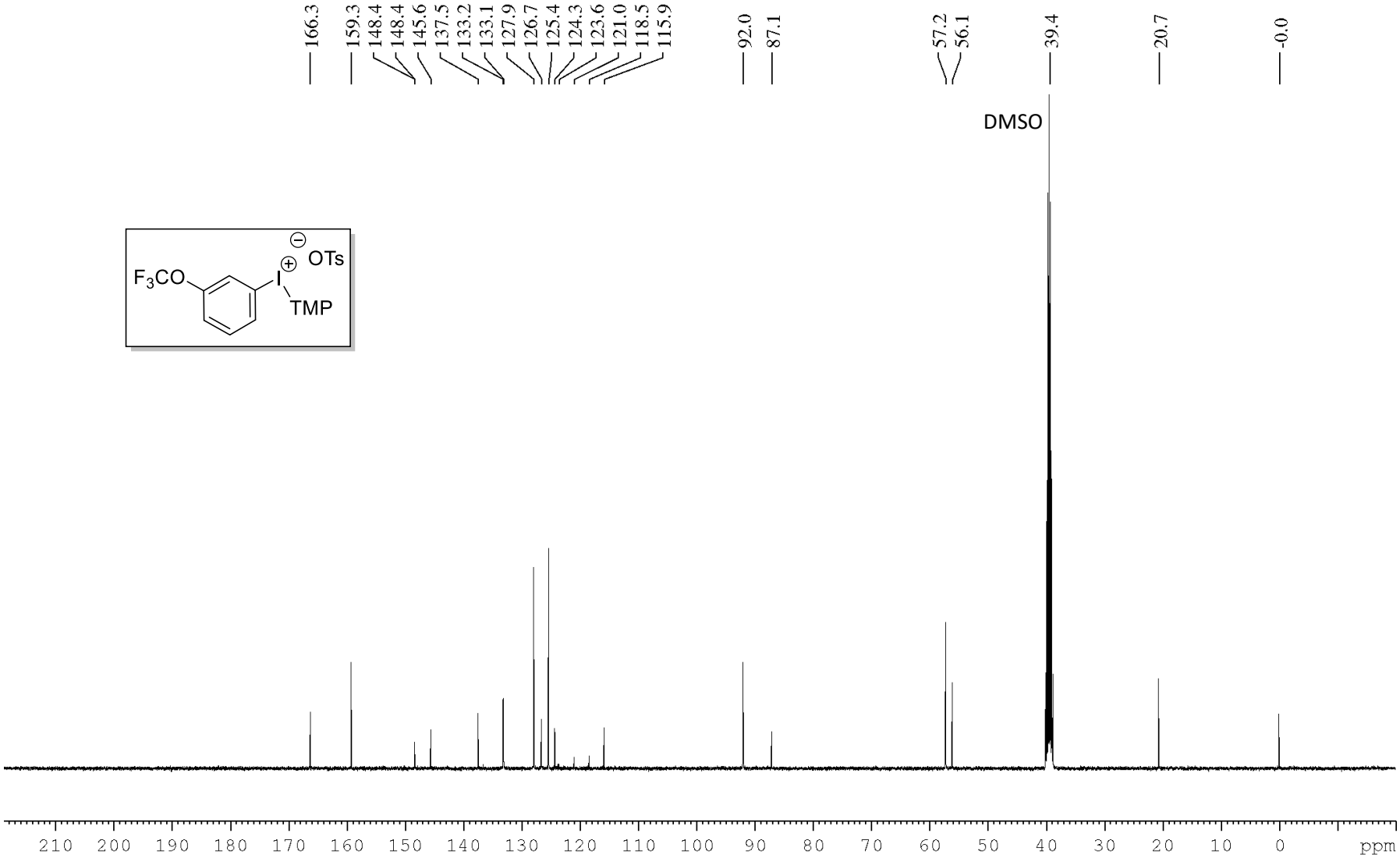
$^{19}F\{^{1}H\}$ NMR of 1s in DMSO-d_6 with 1% v/v TMS at 376 MHz



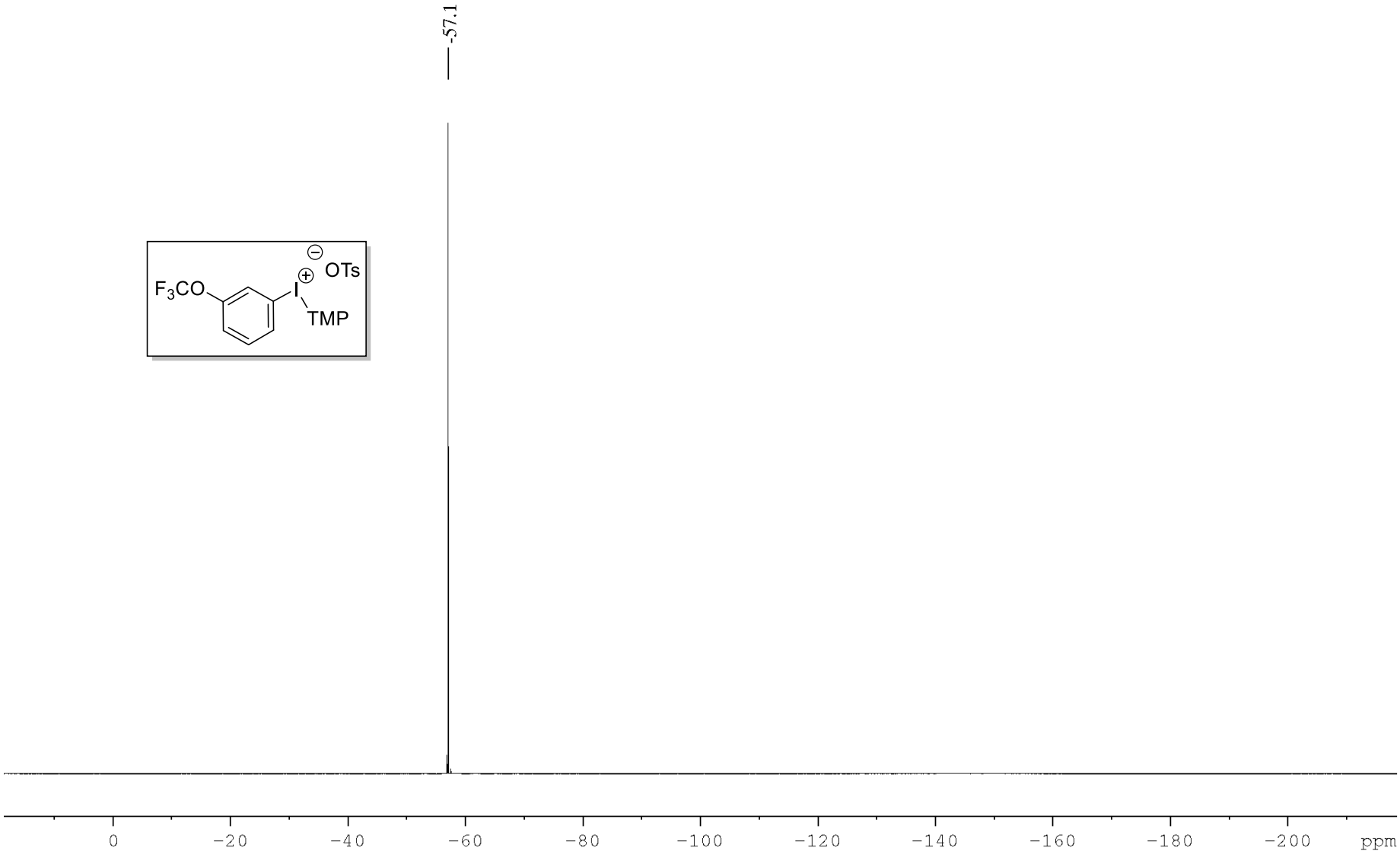
^{1}H NMR of 1u in DMSO-d_6 with 1% v/v TMS at 400 MHz



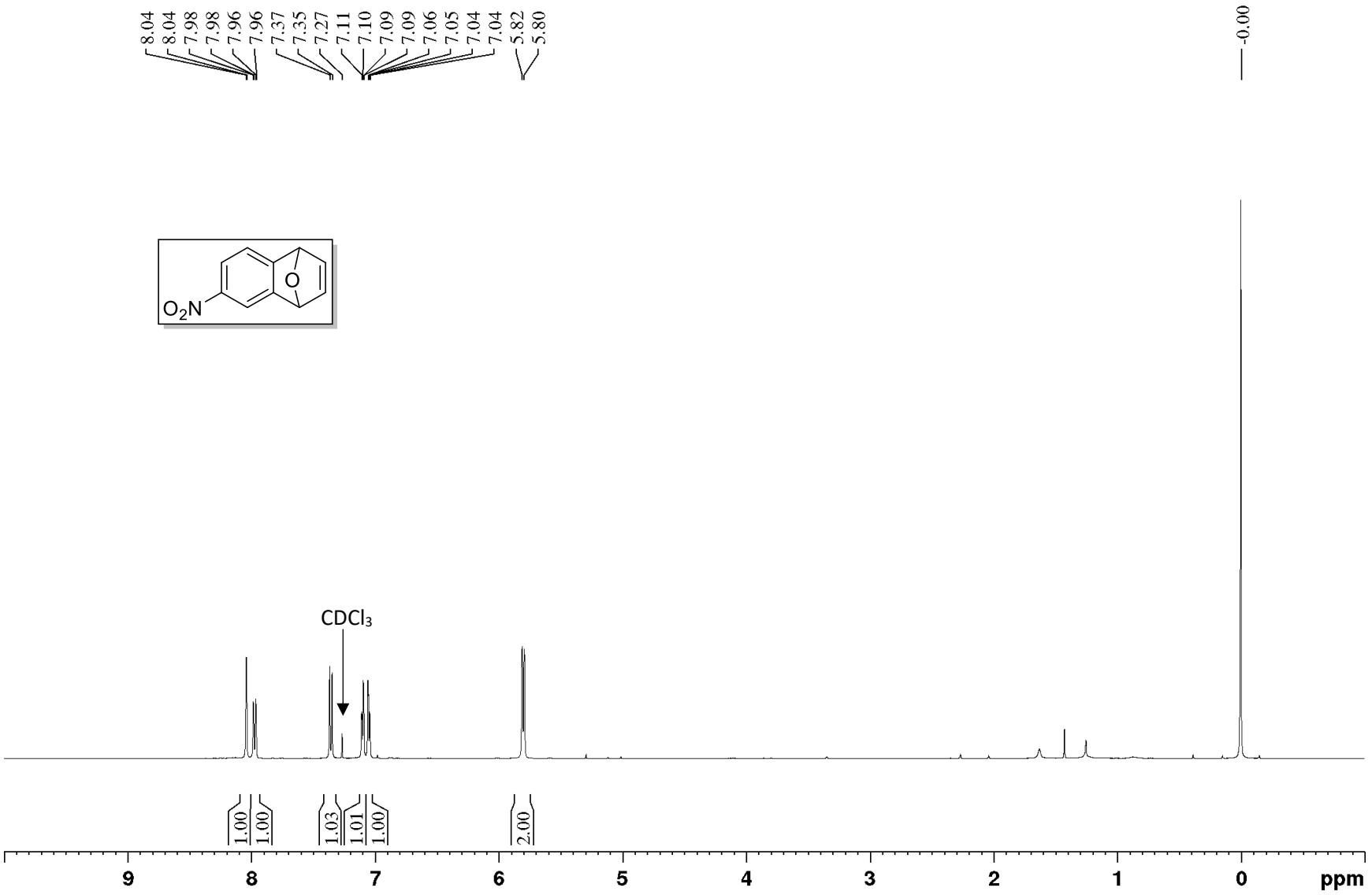
$^{13}C\{^{1}H\}$ NMR of 1u in DMSO-d_6 with 1% v/v TMS at 101 MHz



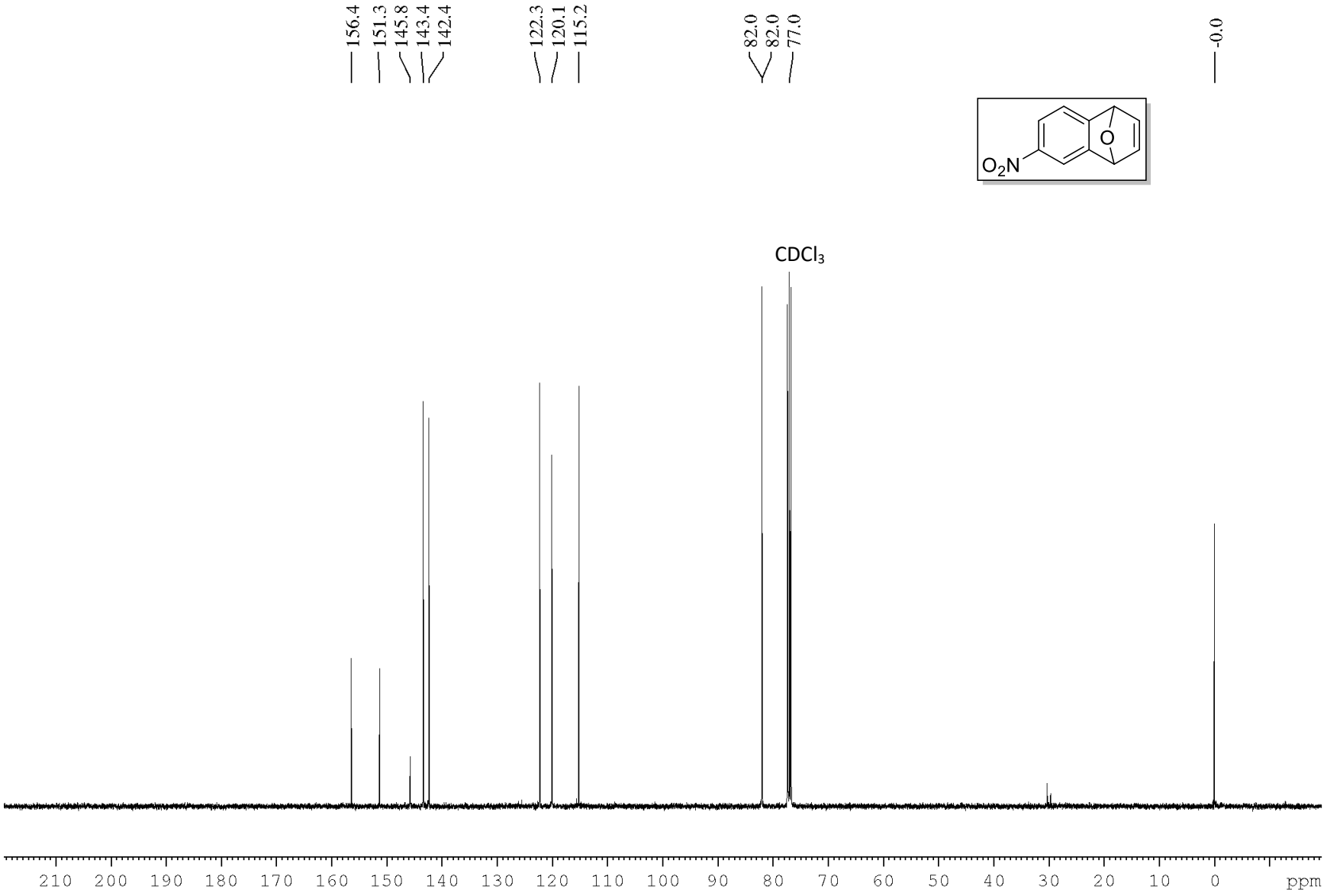
$^{19}F\{^{1}H\}$ NMR of 1u in DMSO-d_6 with 1% v/v TMS at 376 MHz



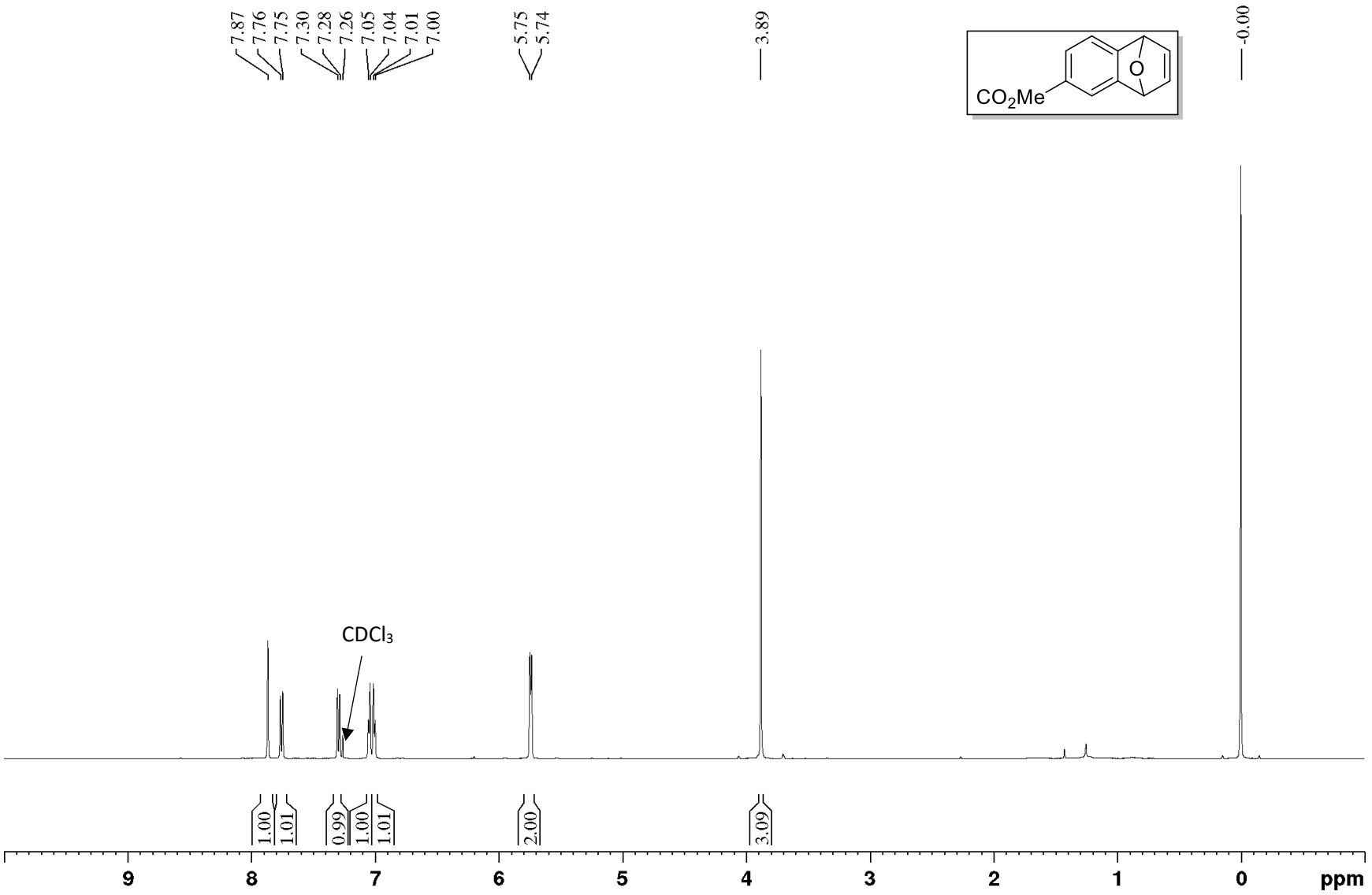
^{1}H NMR of 3a in $CDCl_3$ with 1% v/v TMS at 400 MHz



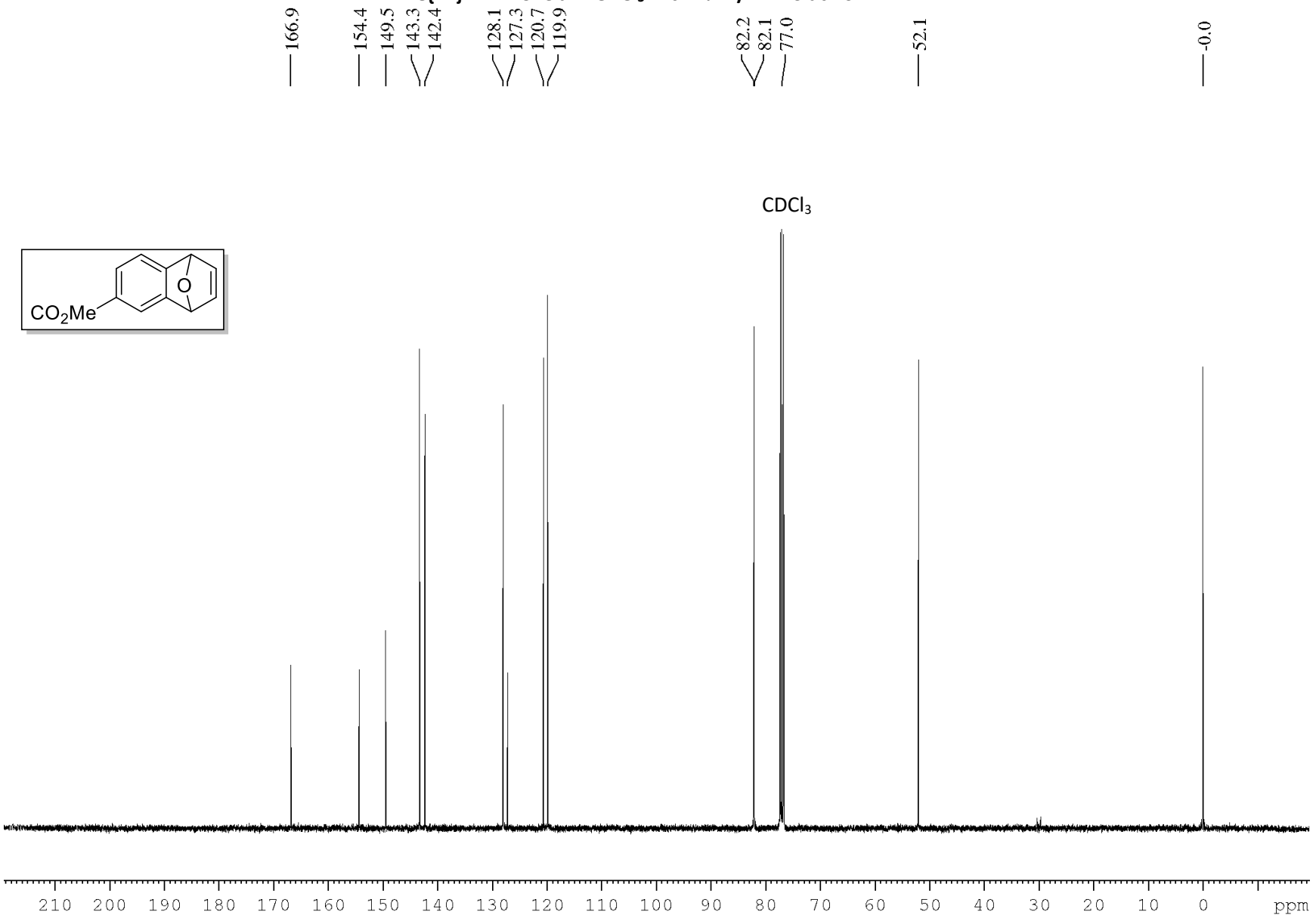
$^{13}C\{^{1}H\}$ NMR of 3a in $CDCl_3$ with 1% v/v TMS at 101 MHz



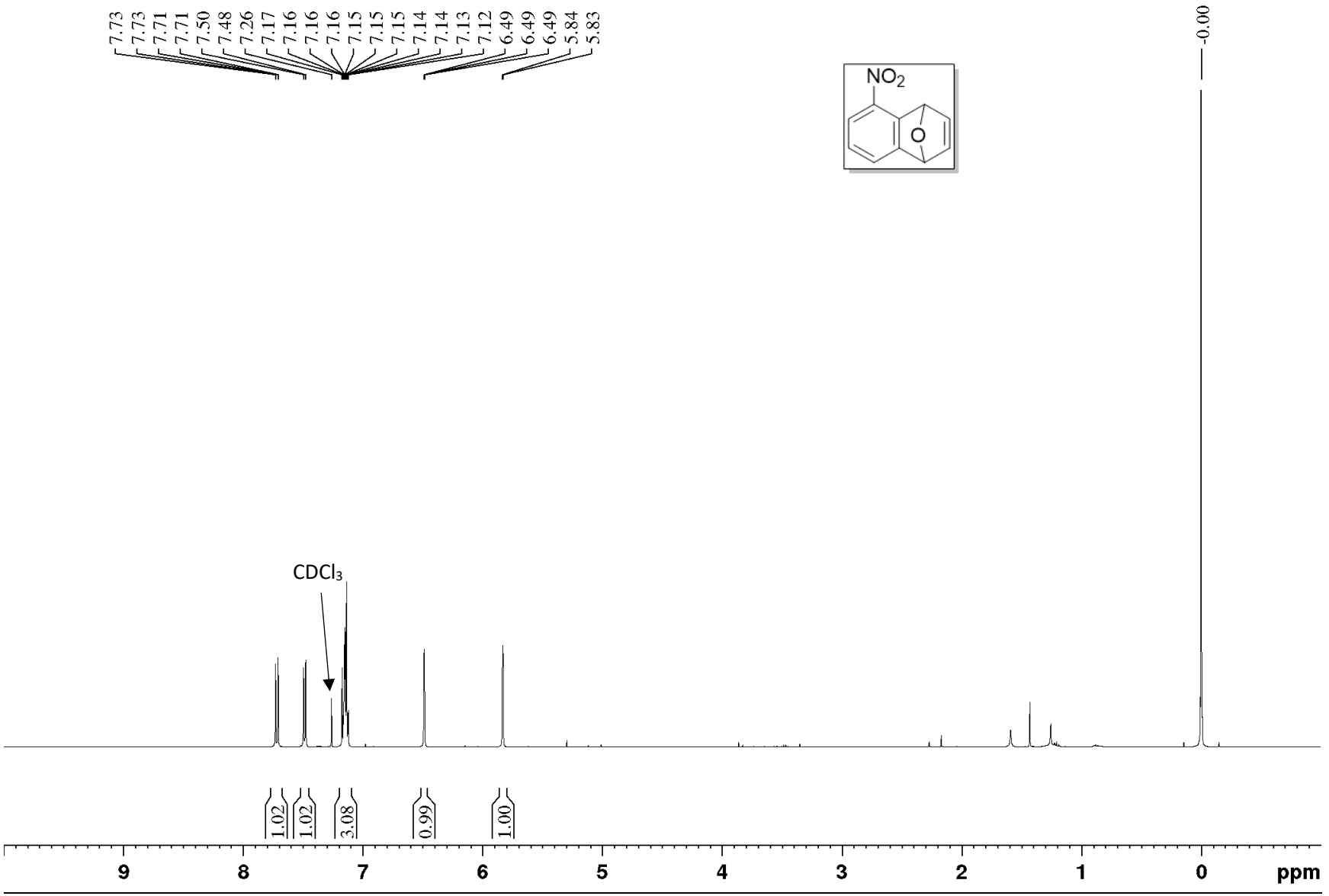
^{1}H NMR of 3b in $CDCl_3$ with 1% v/v TMS at 400 MHz



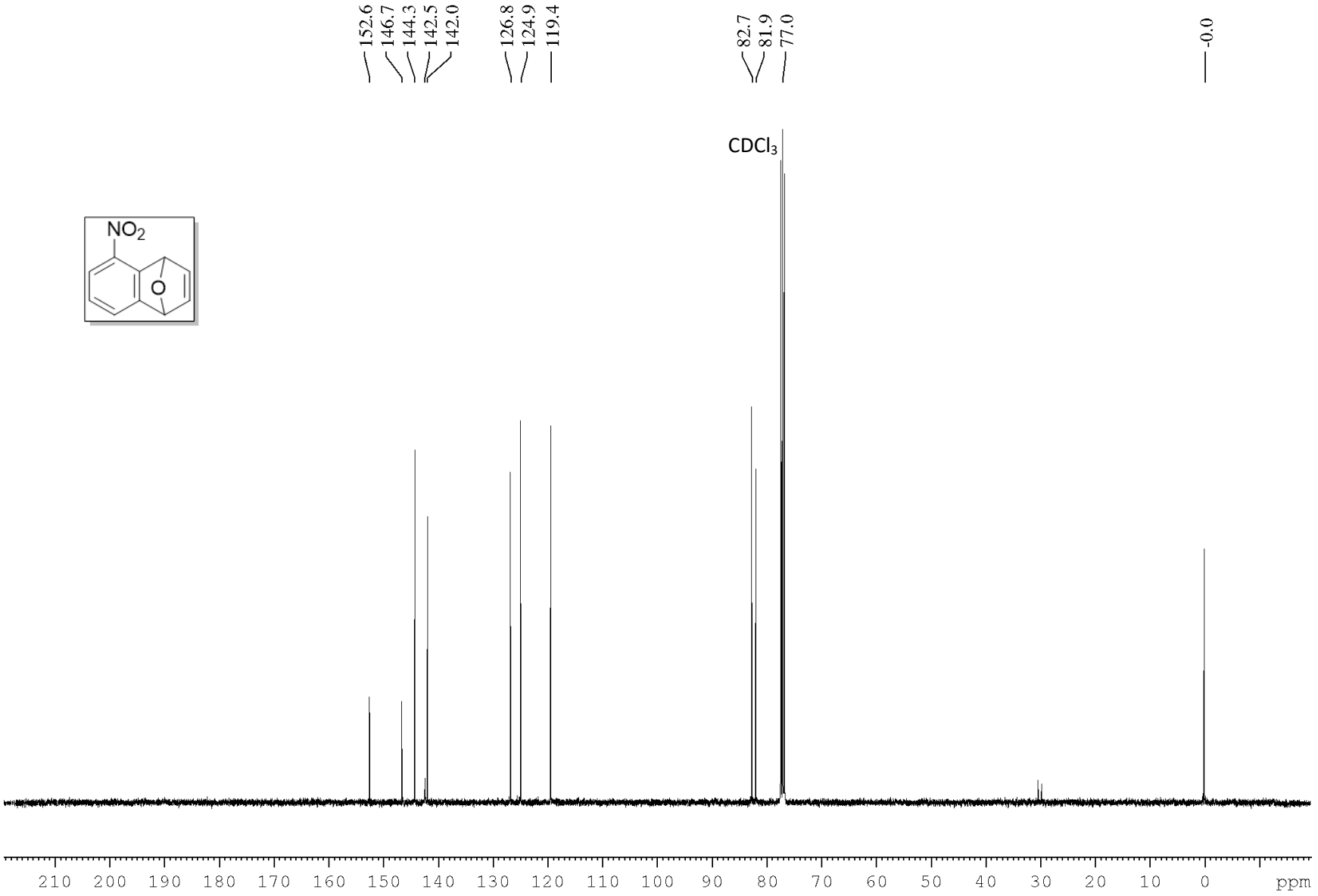
$^{13}C\{^{1}H\}$ NMR of 3b in $CDCl_3$ with 1% v/v TMS at 101 MHz



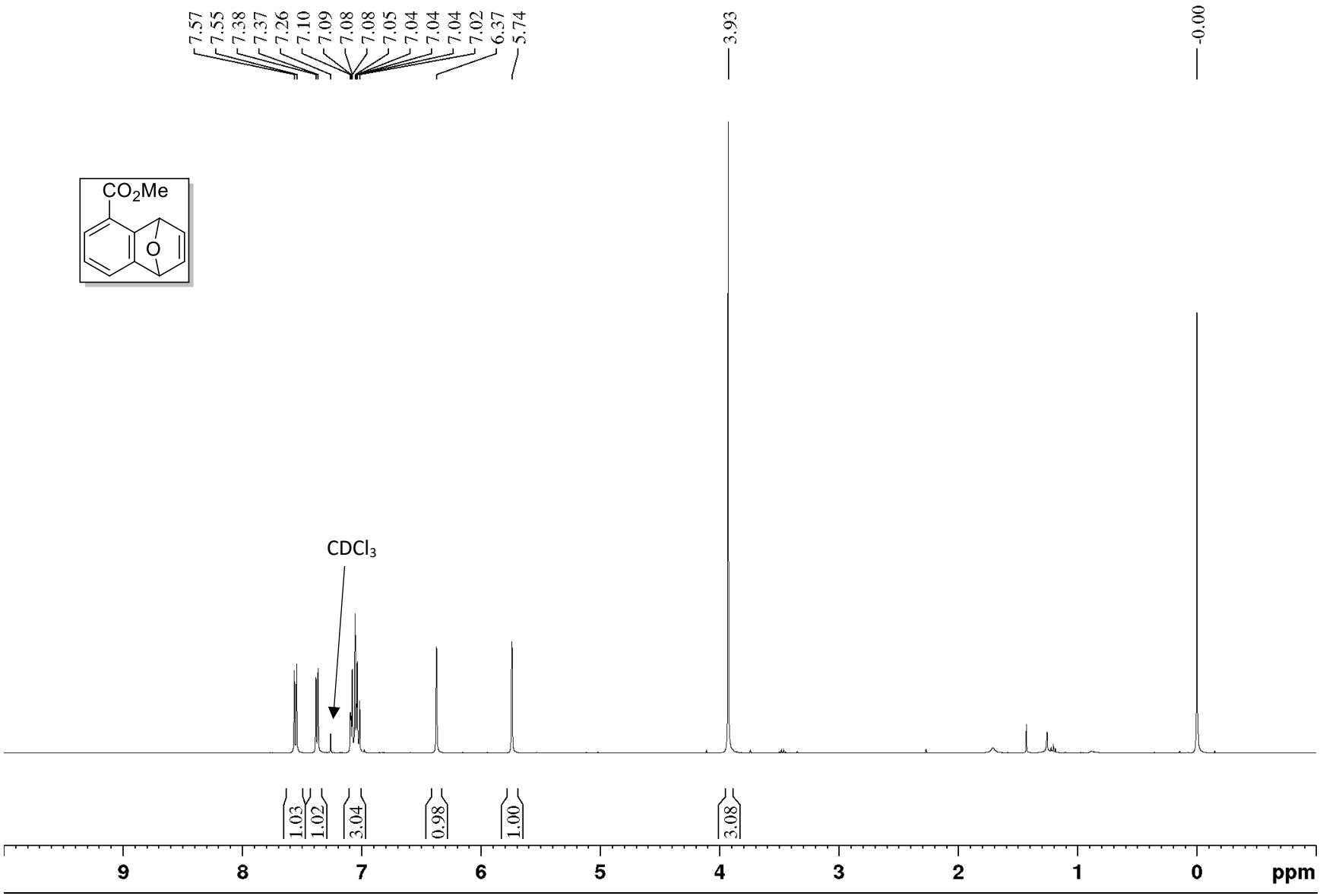
^{1}H NMR of 3e in $CDCl_3$ with 1% v/v TMS at 400 MHz



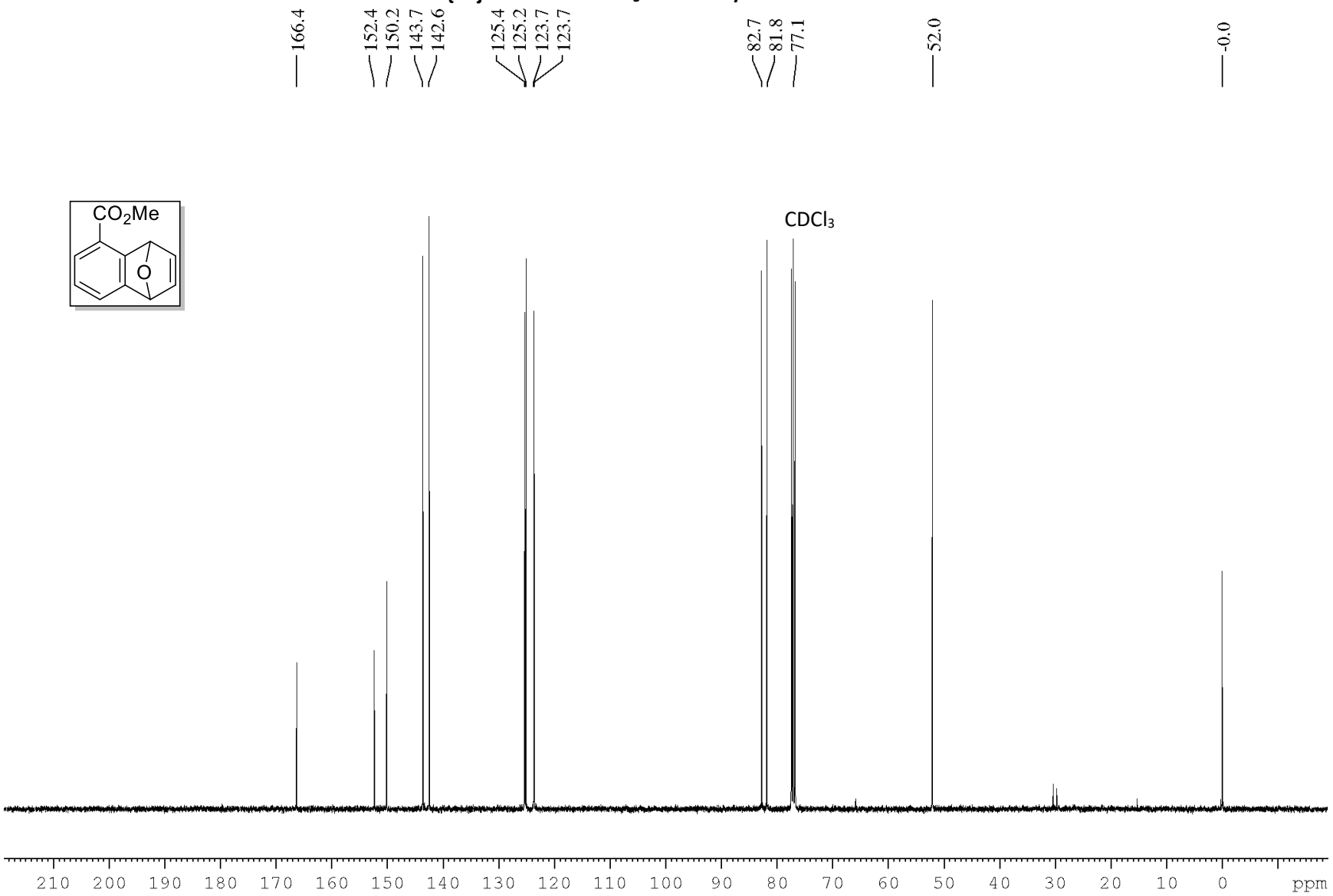
$^{13}C\{^{1}H\}$ NMR of 3e in $CDCl_3$ with 1% v/v TMS at 101 MHz



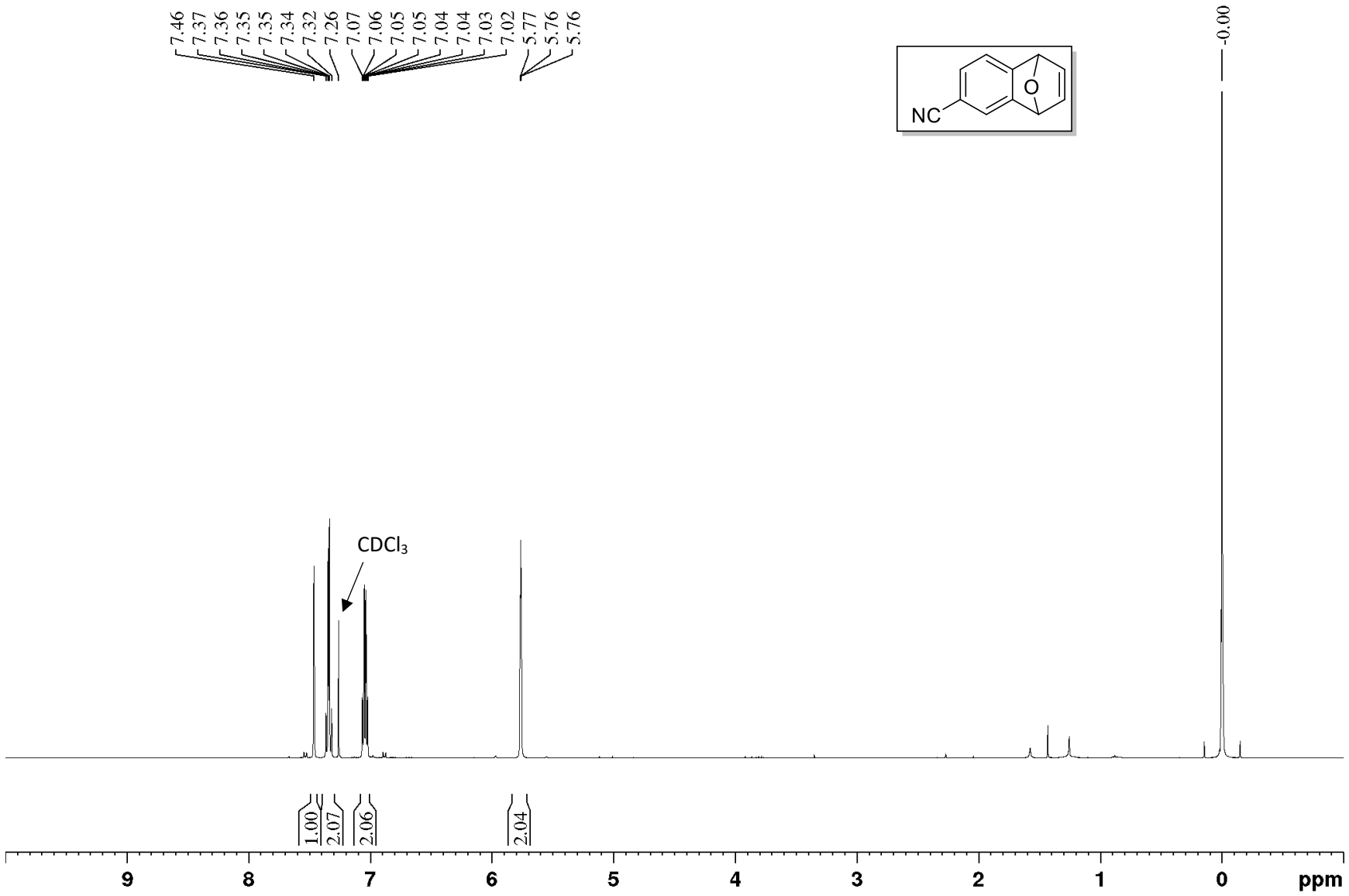
^{1}H NMR of 3f in $CDCl_3$ with 1% v/v TMS at 400 MHz



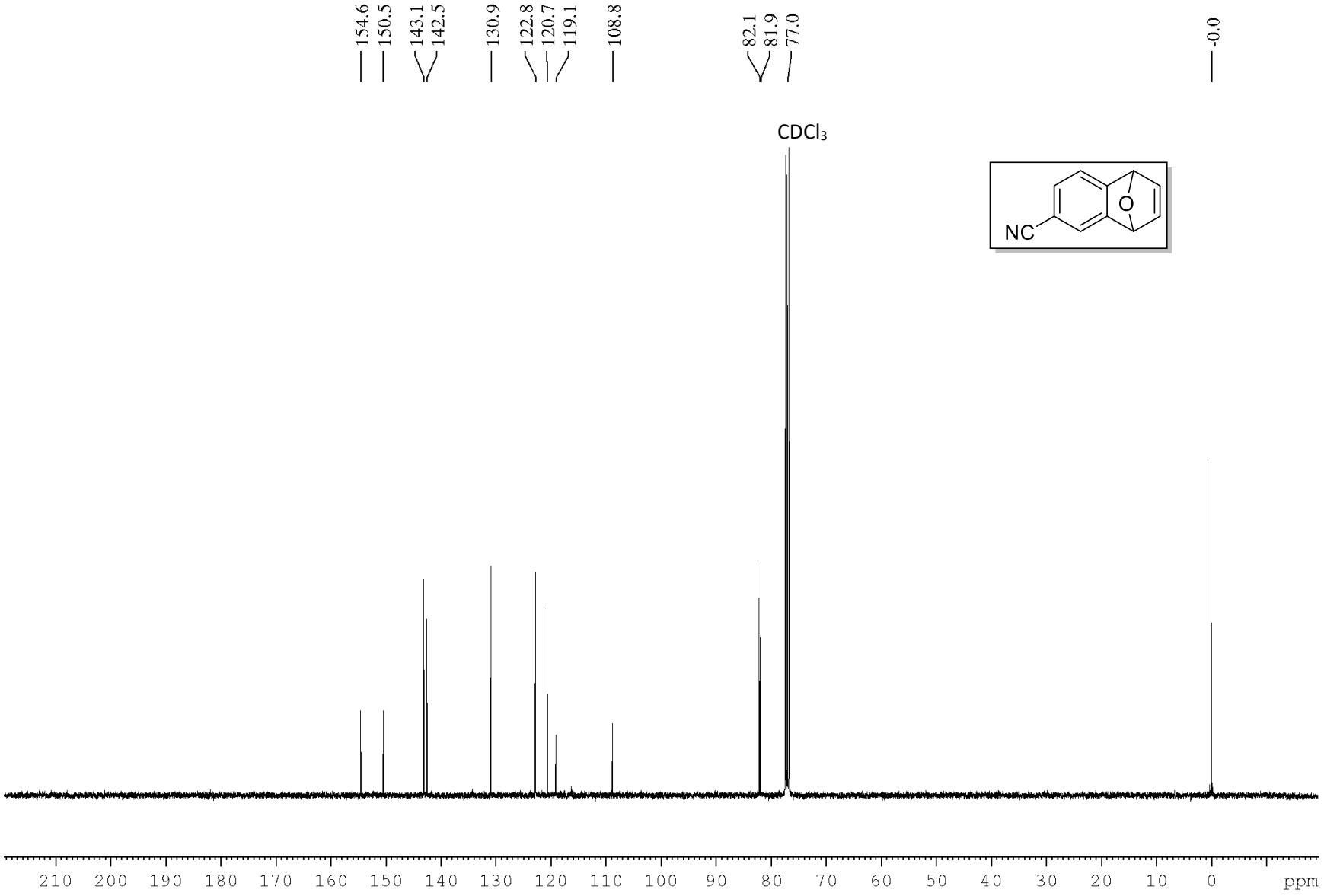
$^{13}C\{^{1}H\}$ NMR of 3f $CDCl_3$ with 1% v/v TMS at 101 MHz



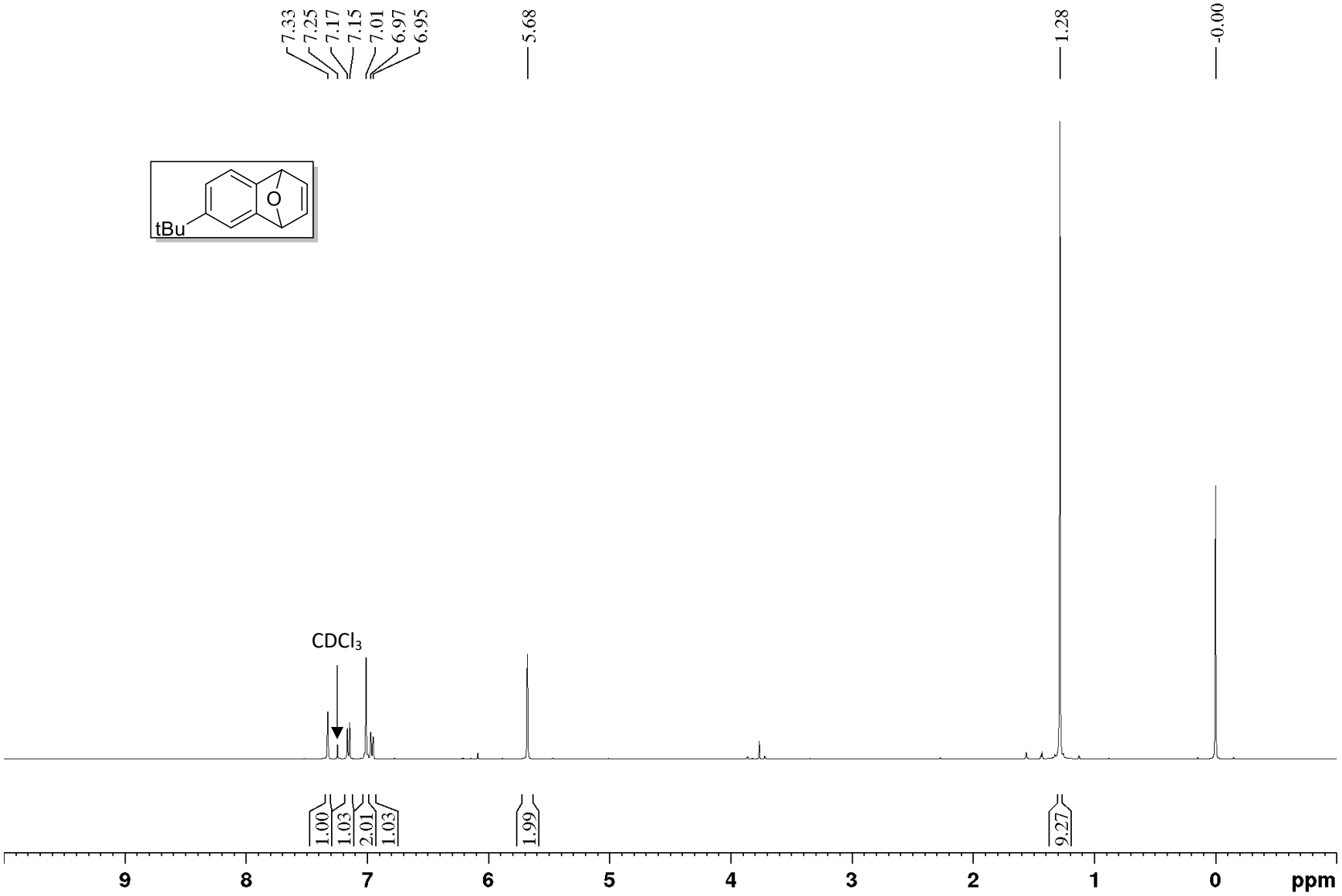
^{1}H NMR of 3h in $CDCl_3$ with 1% v/v TMS at 400 MHz



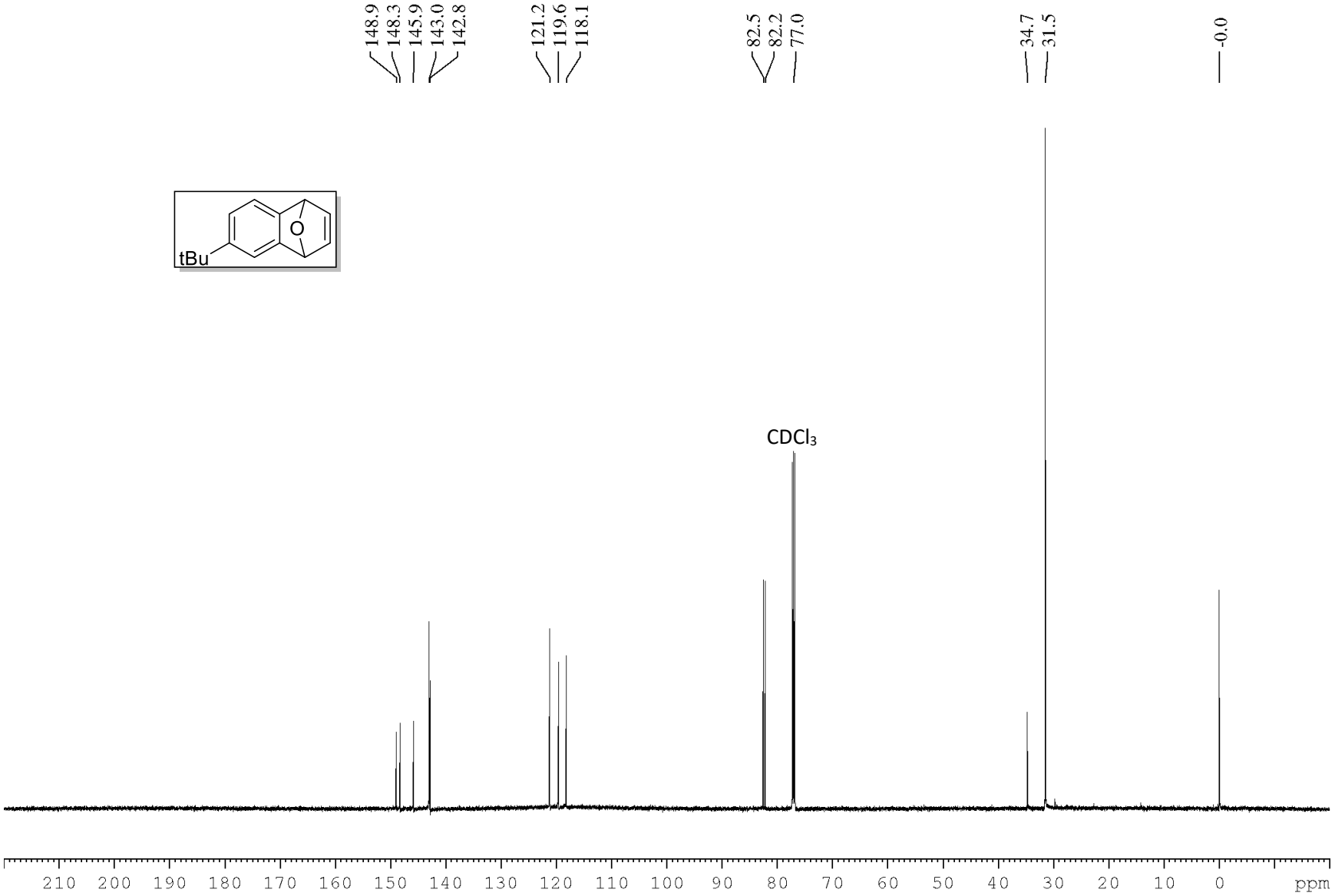
$^{13}C\{^{1}H\}$ NMR of 3h in $CDCl_3$ with 1% v/v TMS at 101 MHz



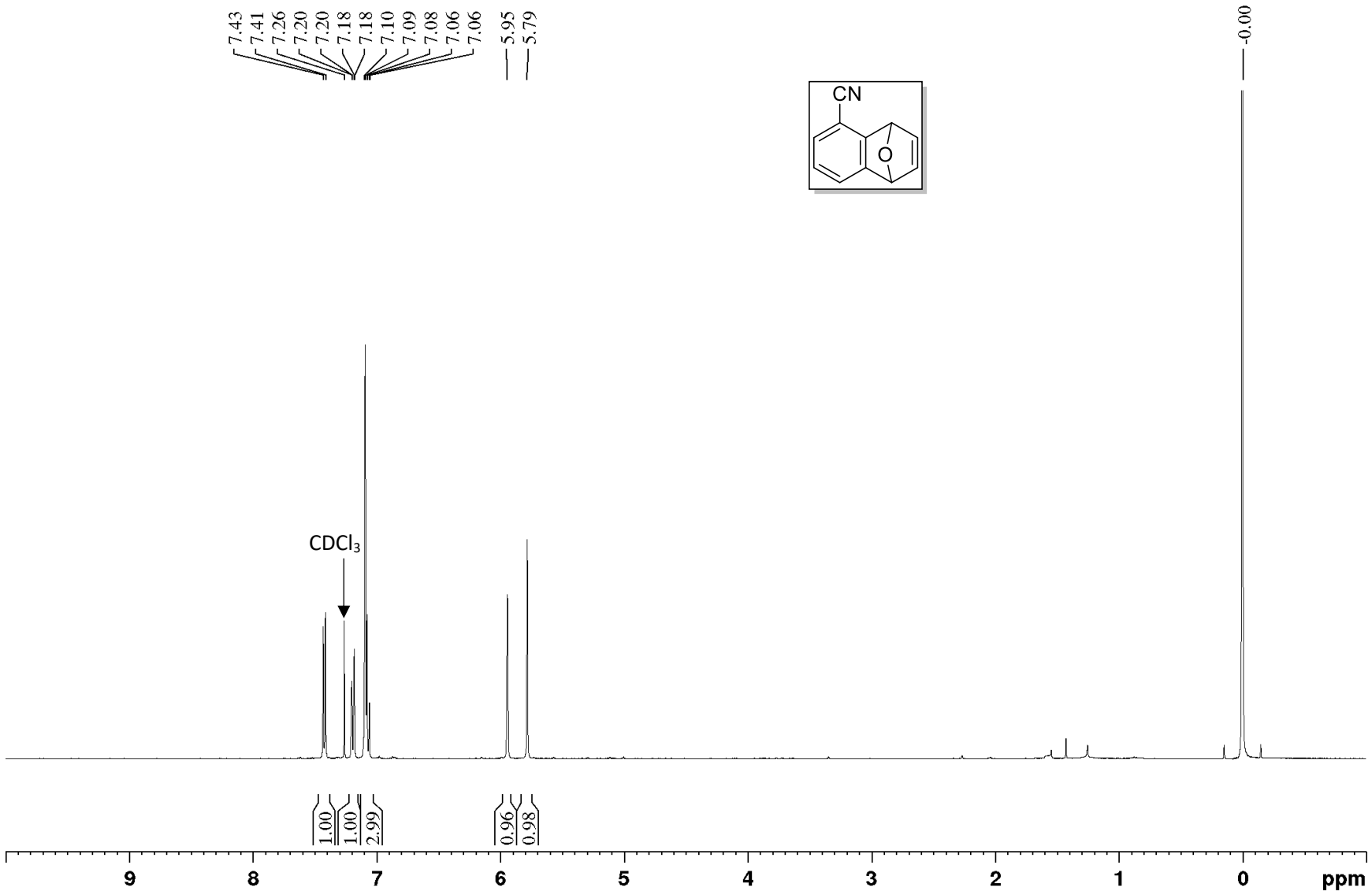
^{1}H NMR of 3i in $CDCl_3$ with 1% v/v TMS at 400 MHz



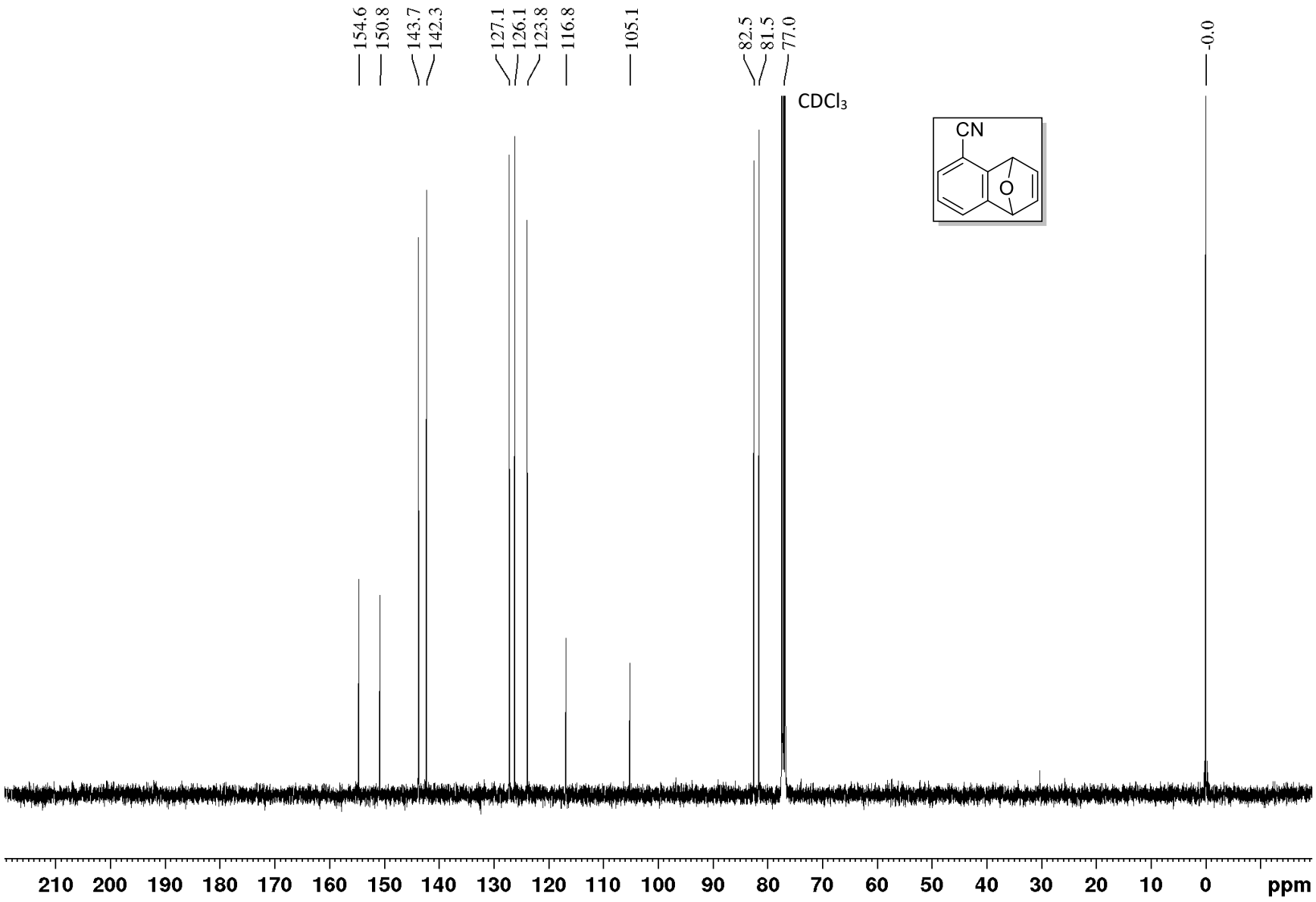
$^{13}C\{^{1}H\}$ NMR of 3i in $CDCl_3$ with 1% v/v TMS at 101 MHz



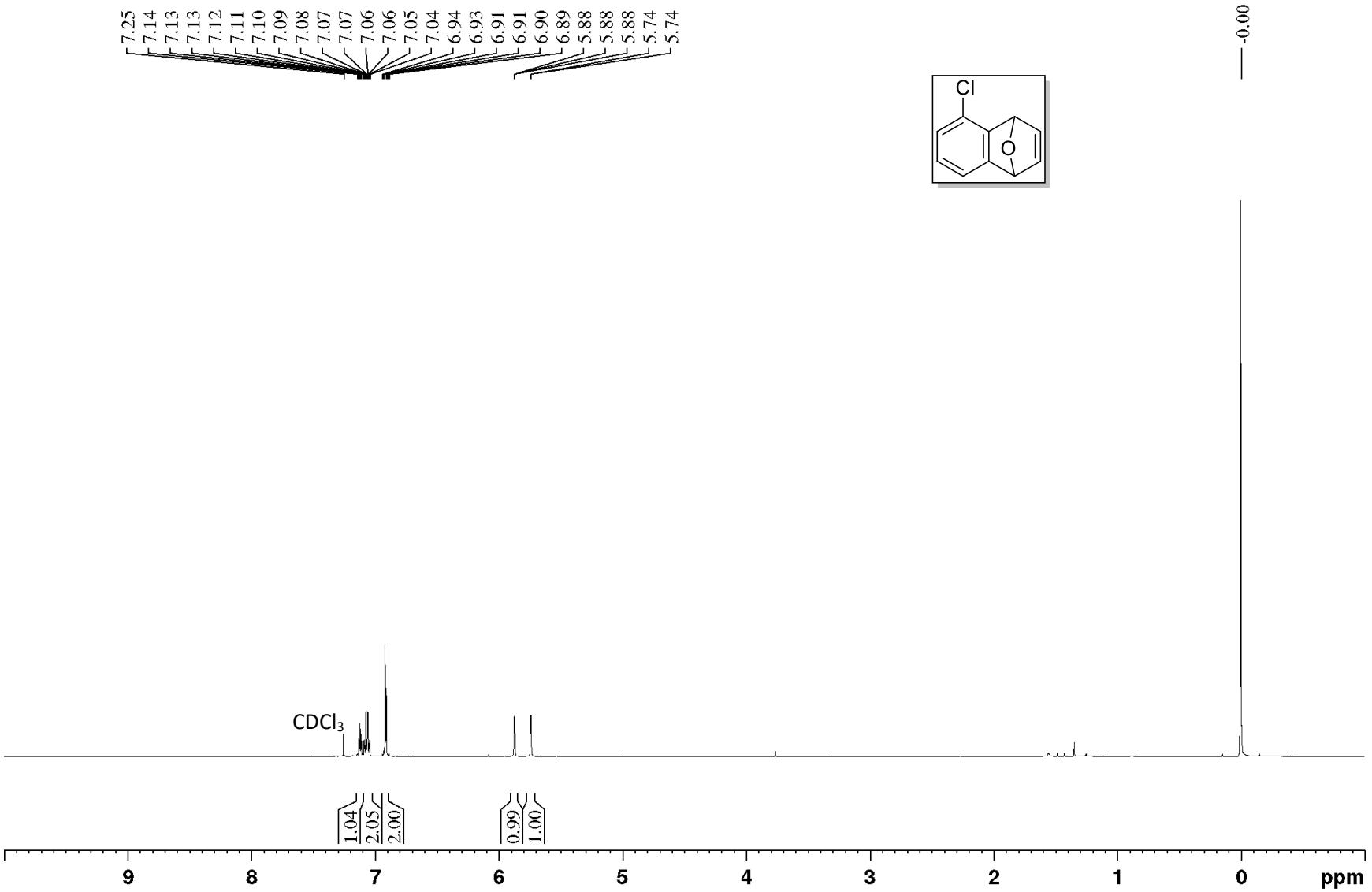
^{1}H NMR of 3j in $CDCl_3$ with 1% v/v TMS at 400 MHz



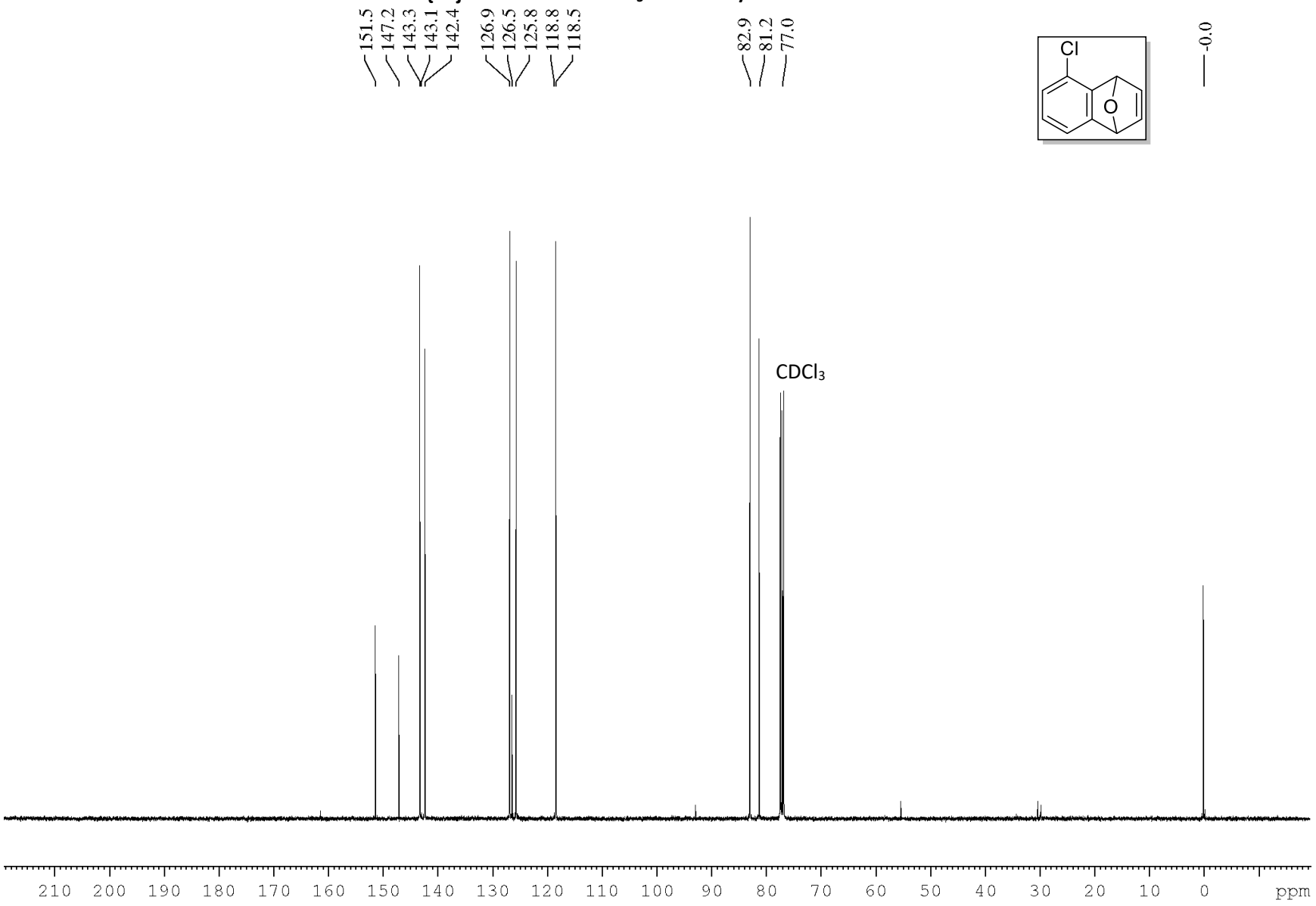
$^{13}C\{^{1}H\}$ NMR of 3j in $CDCl_3$ with 1% v/v TMS at 101 MHz



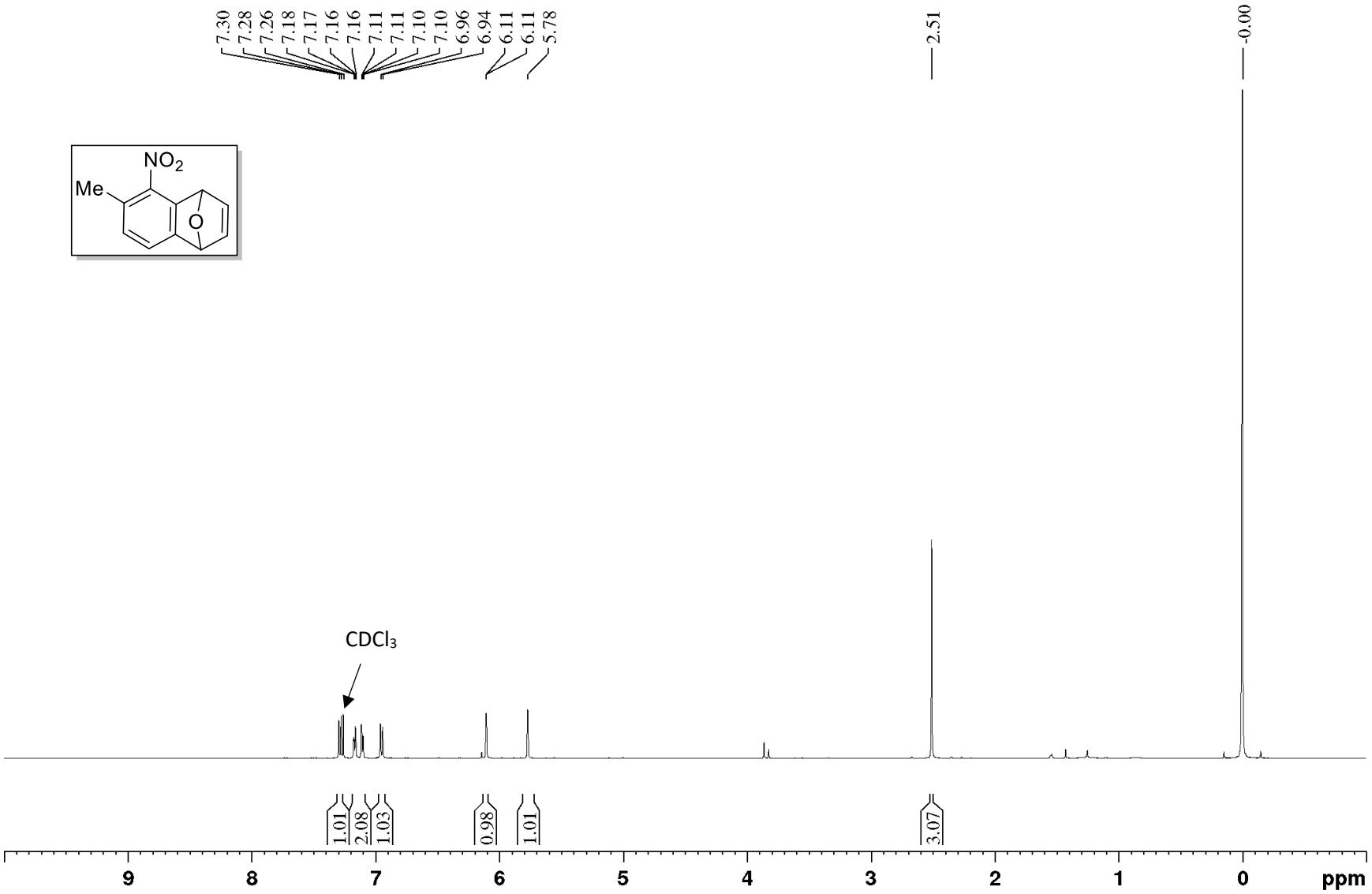
^{1}H NMR of 3k in $CDCl_3$ with 1% v/v TMS at 400 MHz



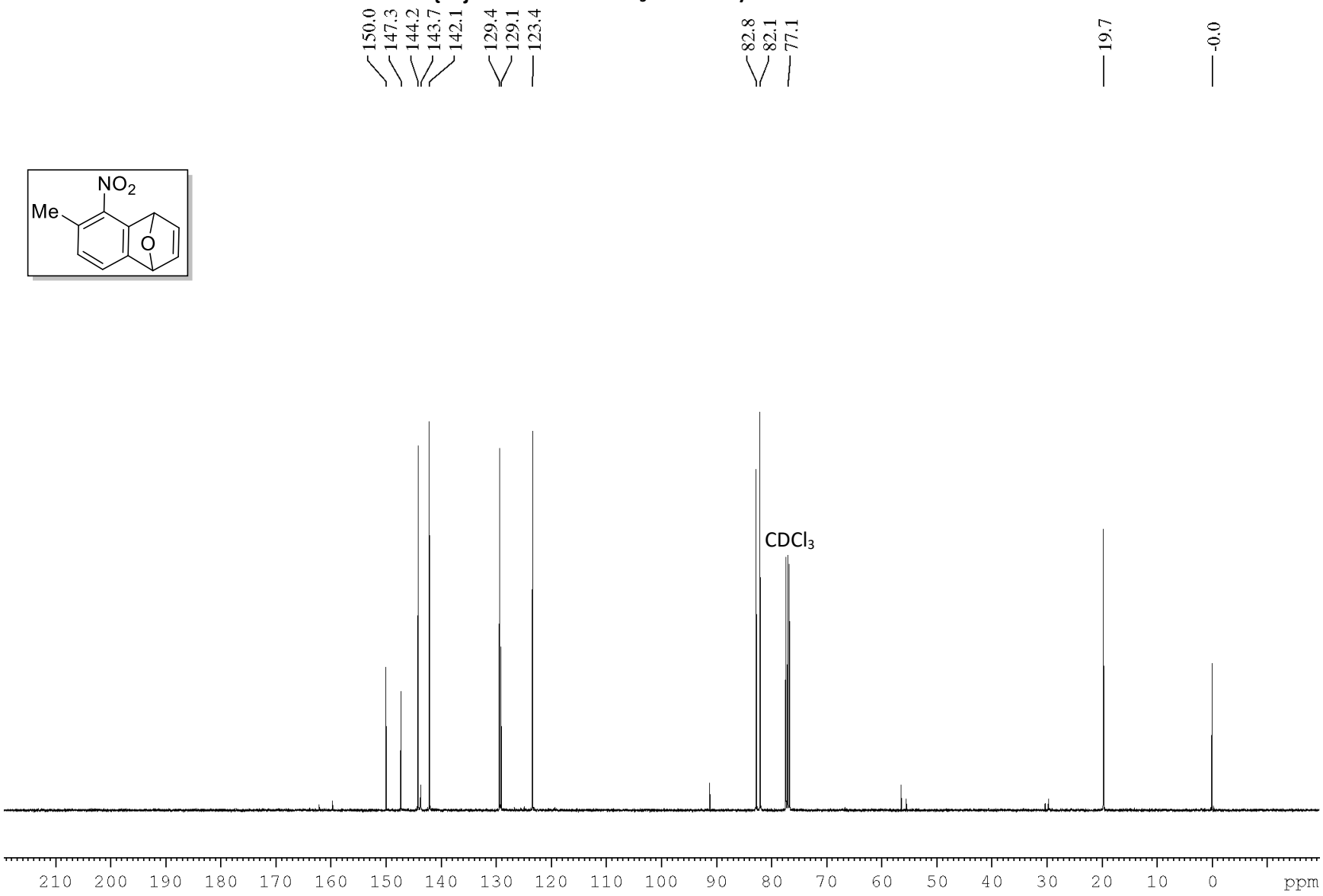
$^{13}C\{^{1}H\}$ NMR of 3k in $CDCl_3$ with 1% v/v TMS at 101 MHz



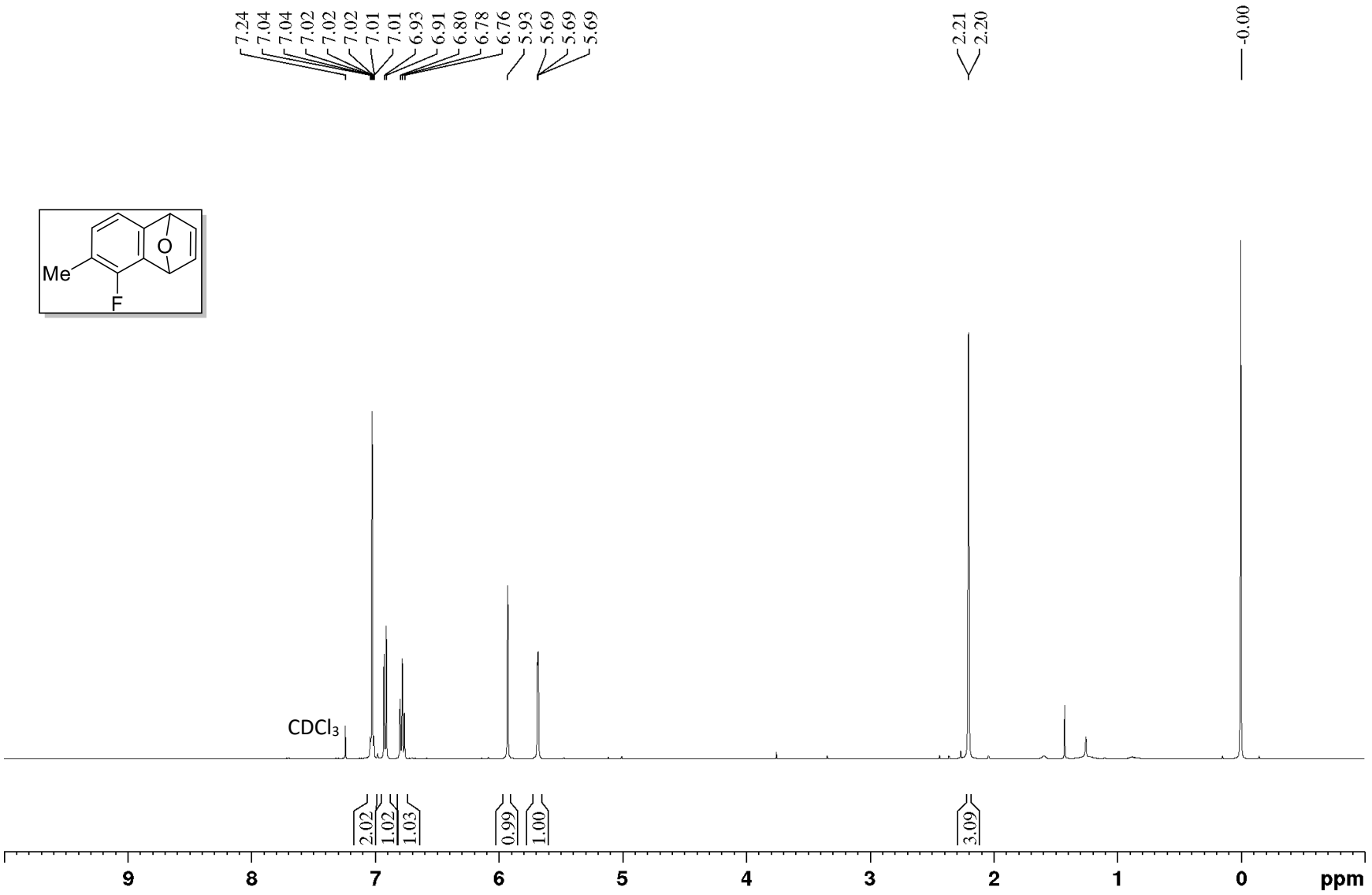
^{1}H NMR of 3l in $CDCl_3$ with 1% v/v TMS at 400 MHz



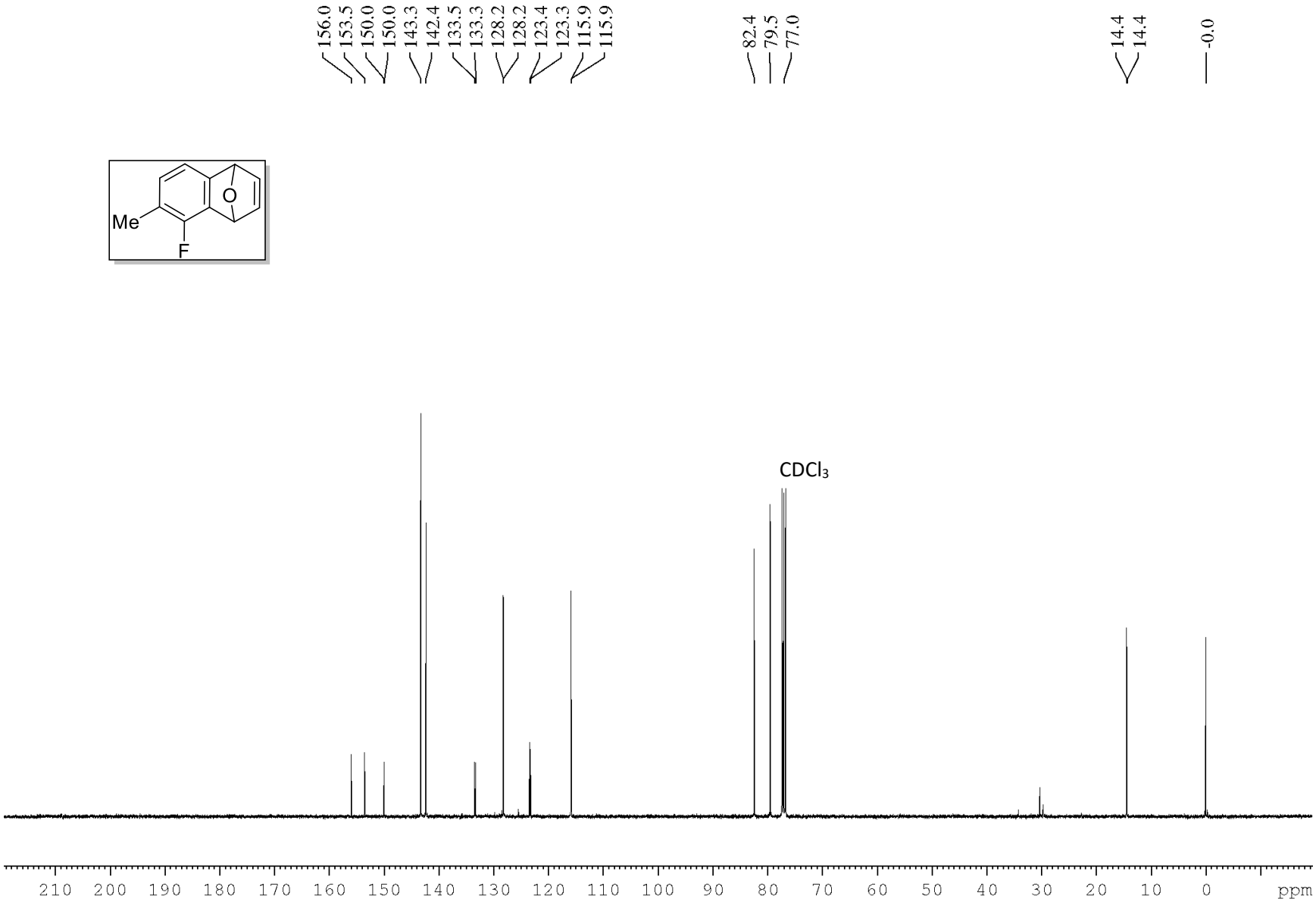
$^{13}C\{^{1}H\}$ NMR of 3l in $CDCl_3$ with 1% v/v TMS at 101 MHz



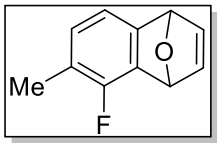
^{1}H NMR of 3m in $CDCl_3$ with 1% v/v TMS at 400 MHz



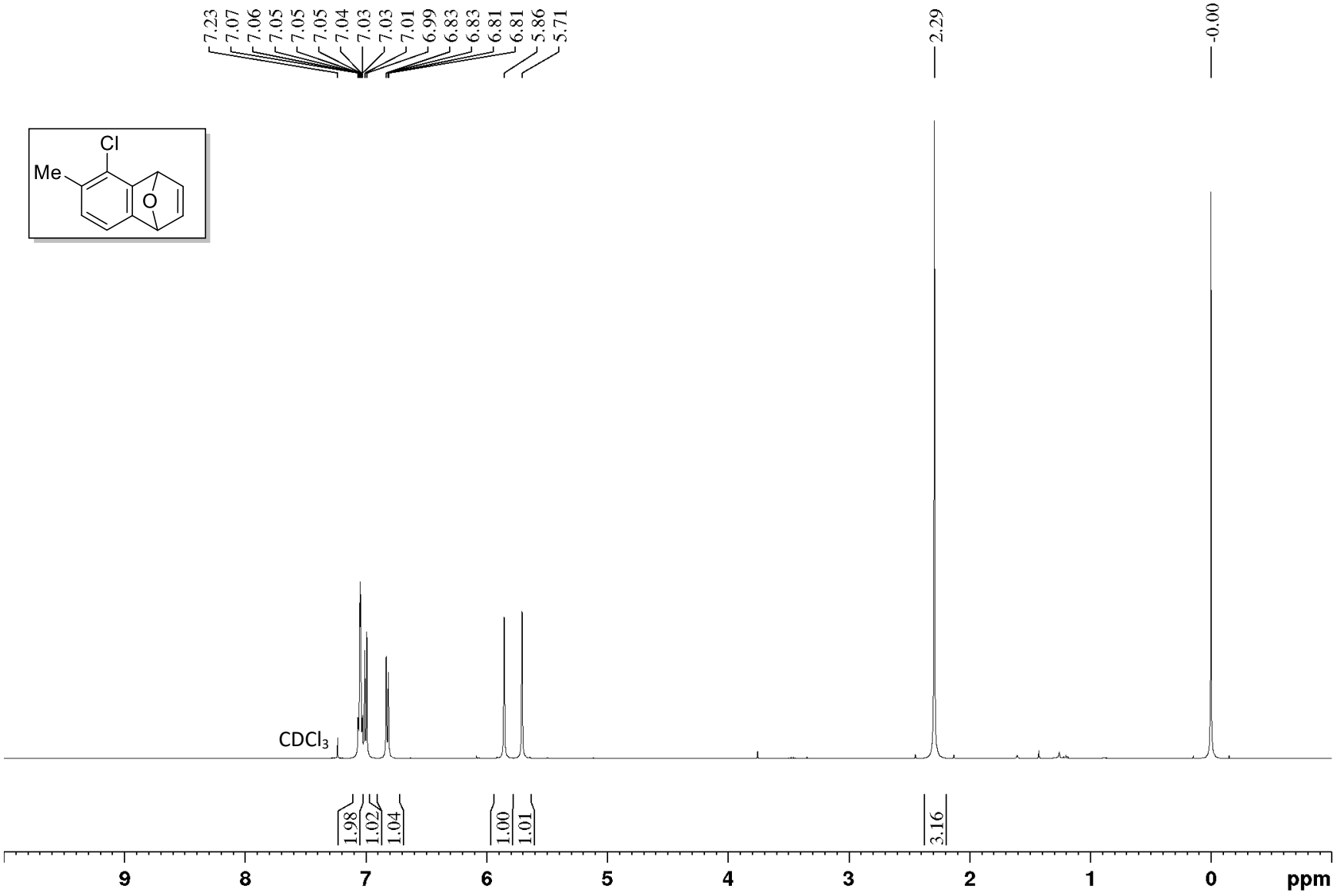
$^{13}C\{^{1}H\}$ NMR of 3m in $CDCl_3$ with 1% v/v TMS at 101 MHz



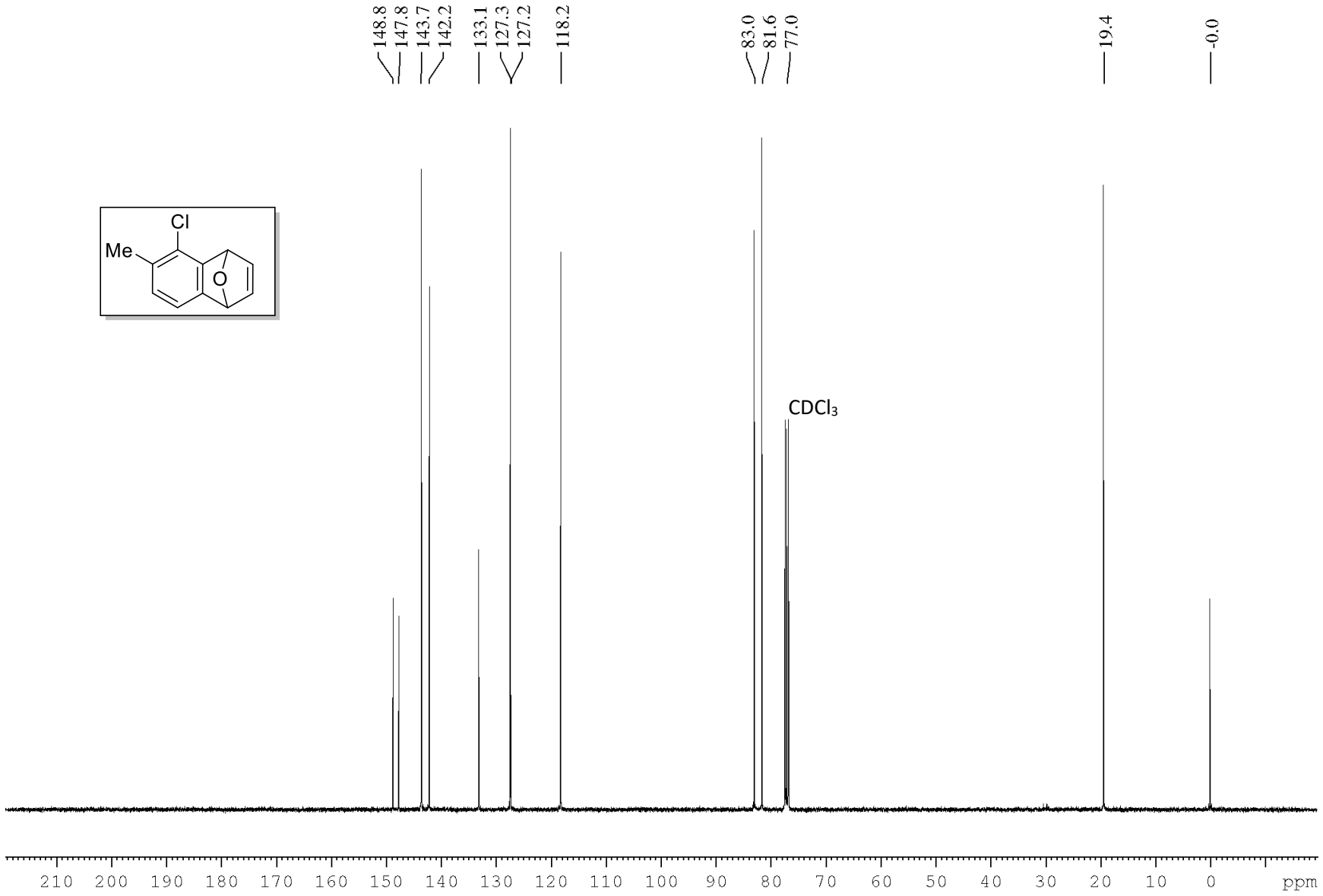
$^{19}F\{^{1}H\}$ NMR of 3m in $CDCl_3$ with 1% v/v TMS at 376 MHz



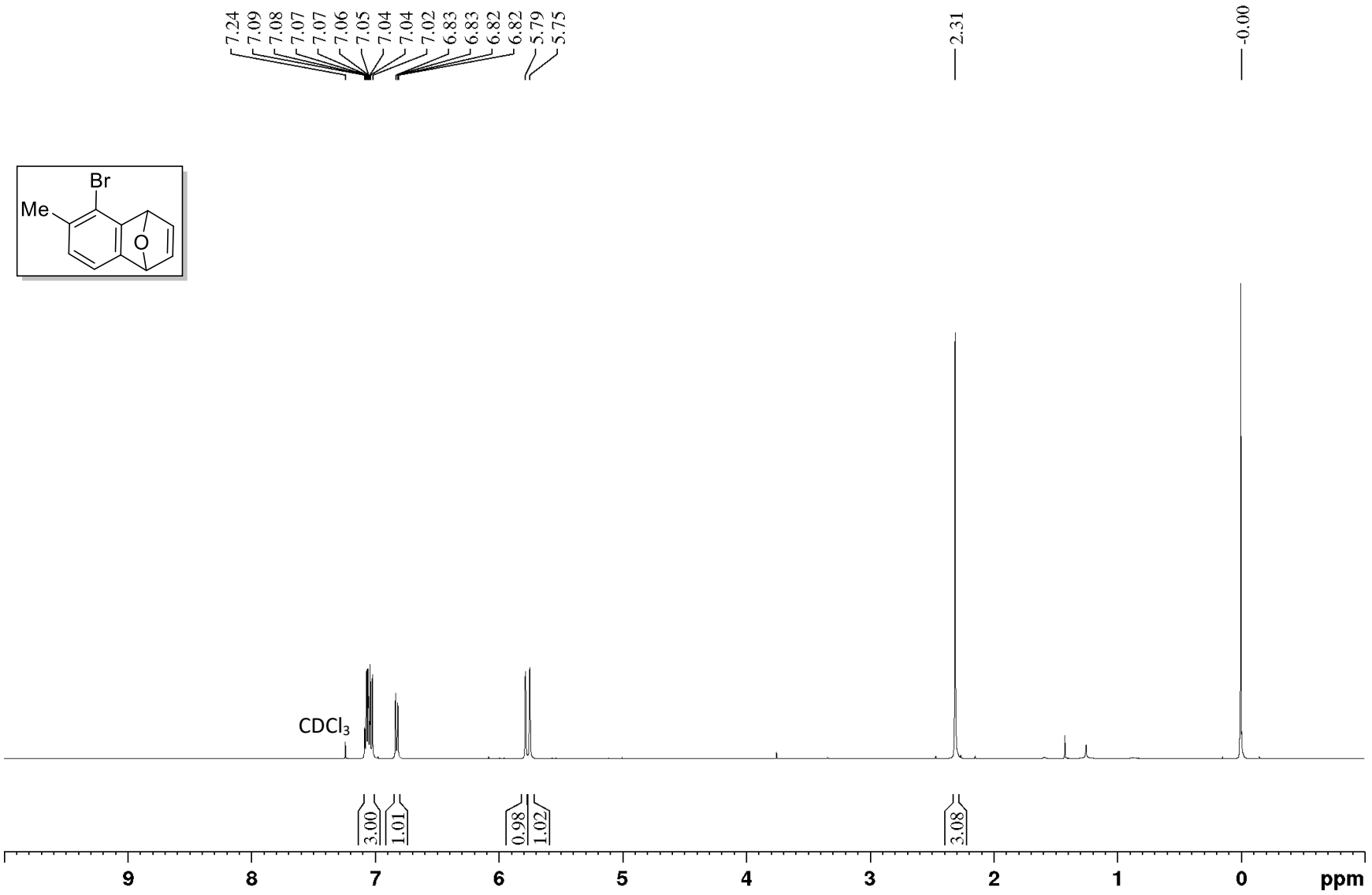
^{1}H NMR of 3n in $CDCl_3$ with 1% v/v TMS at 400 MHz



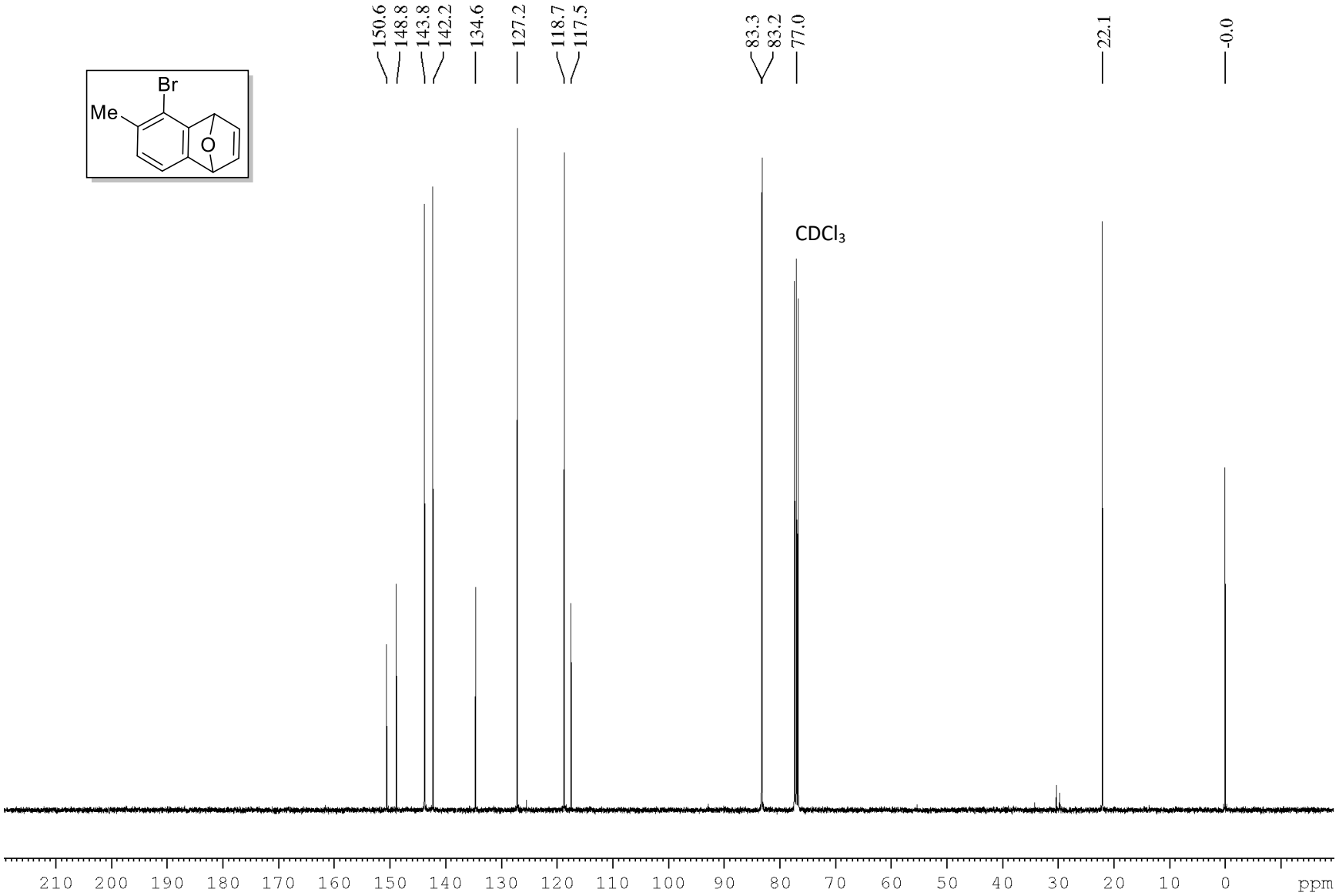
$^{13}C\{^{1}H\}$ NMR of 3n in $CDCl_3$ with 1% v/v TMS at 101 MHz



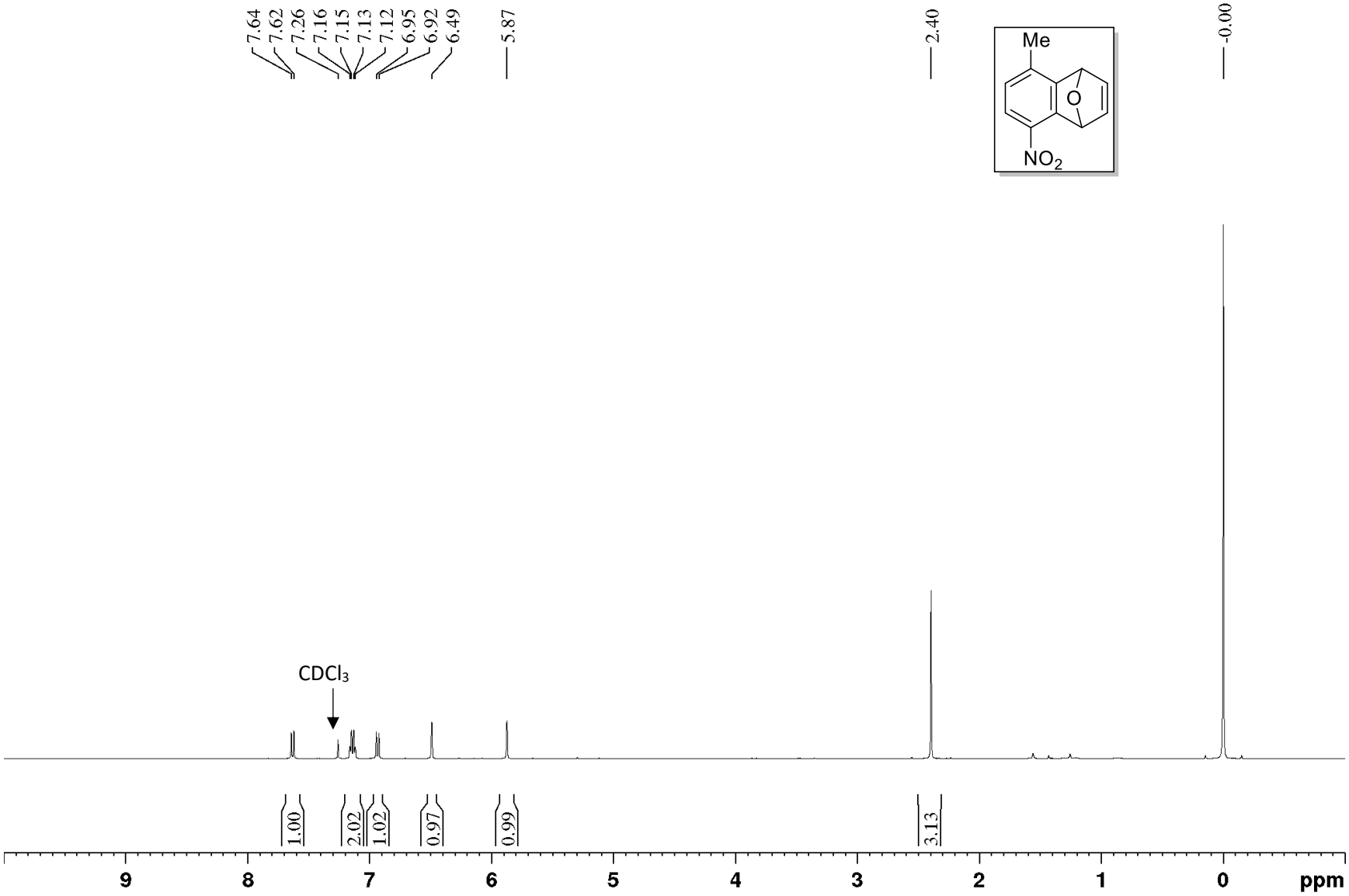
^{1}H NMR of 3o in $CDCl_3$ with 1% v/v TMS at 400 MHz



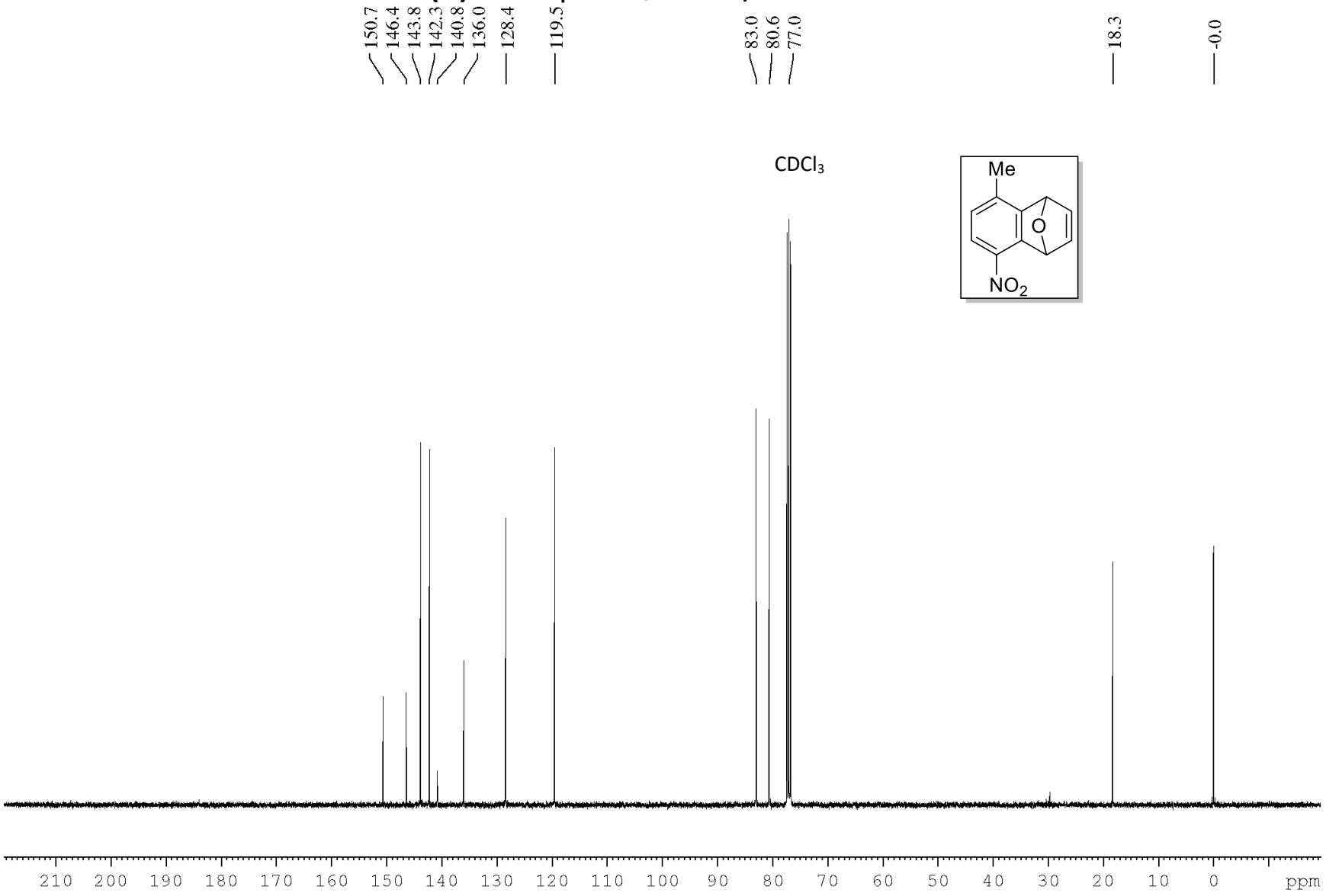
$^{13}C\{^{1}H\}$ NMR of 3o in $CDCl_3$ with 1% v/v TMS at 101 MHz



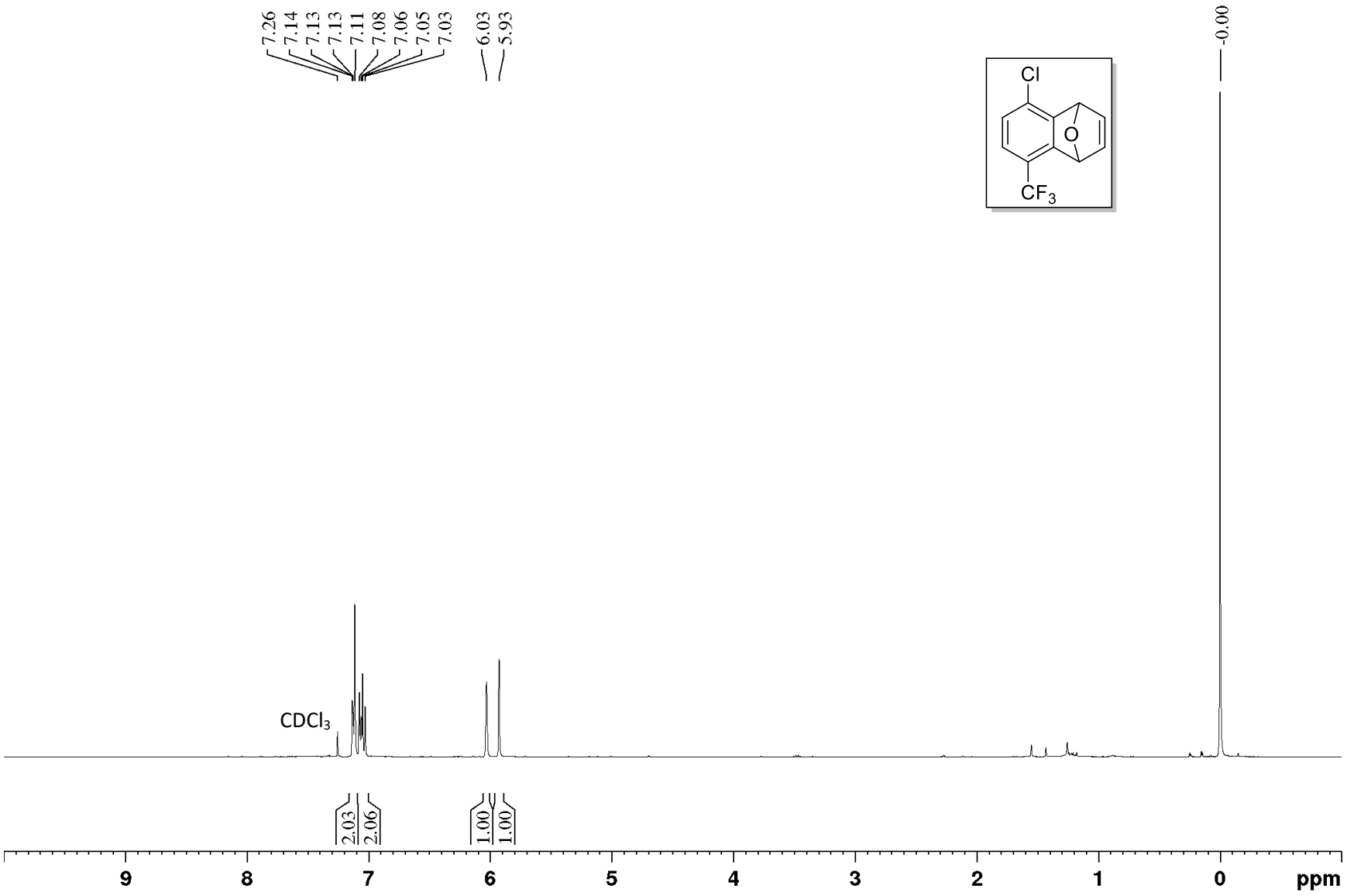
^{1}H NMR of 3p in $CDCl_3$ with 1% v/v TMS at 400 MHz



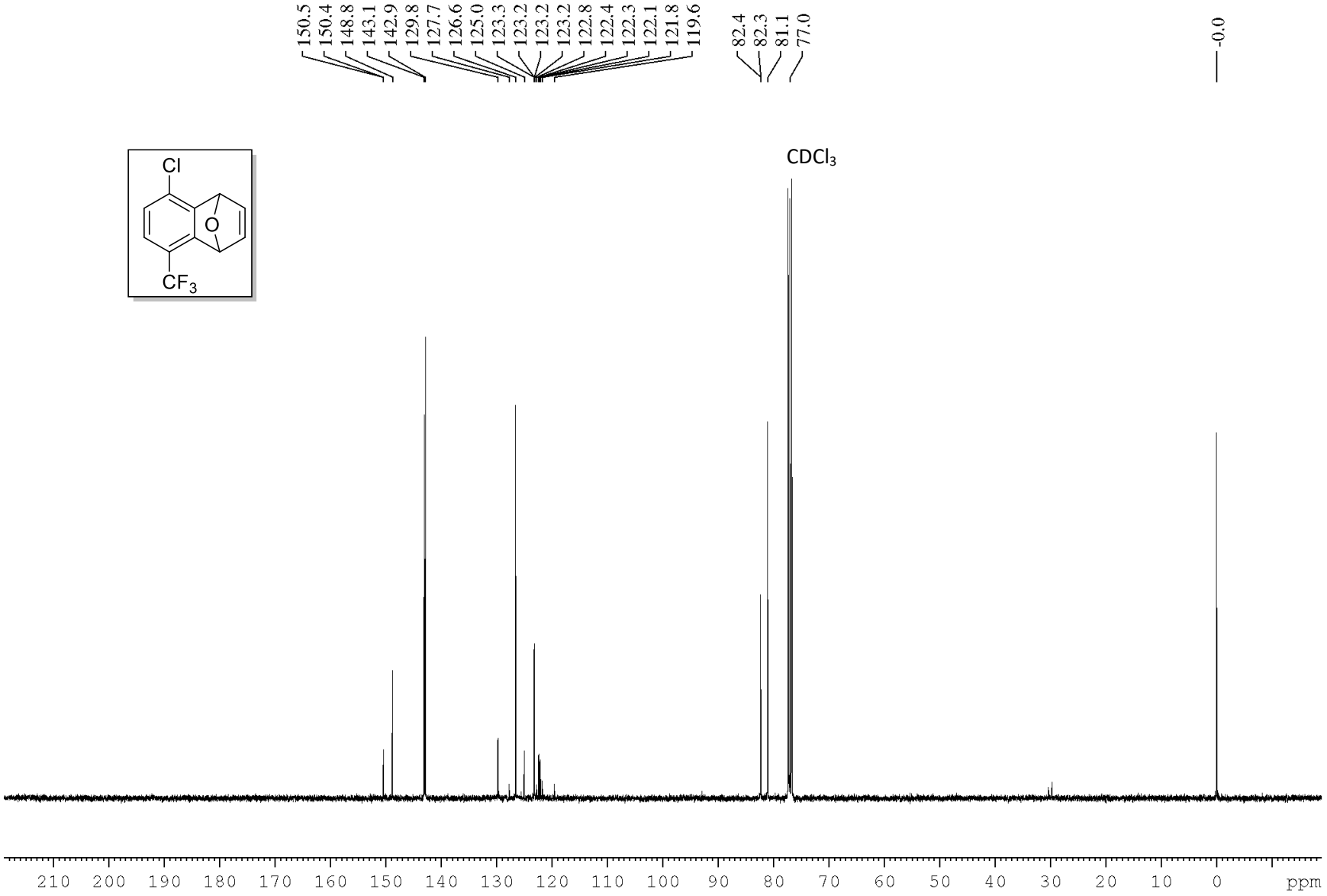
$^{13}C\{^{1}H\}$ NMR of 3p in $CDCl_3$ with 1% v/v TMS at 101 MHz



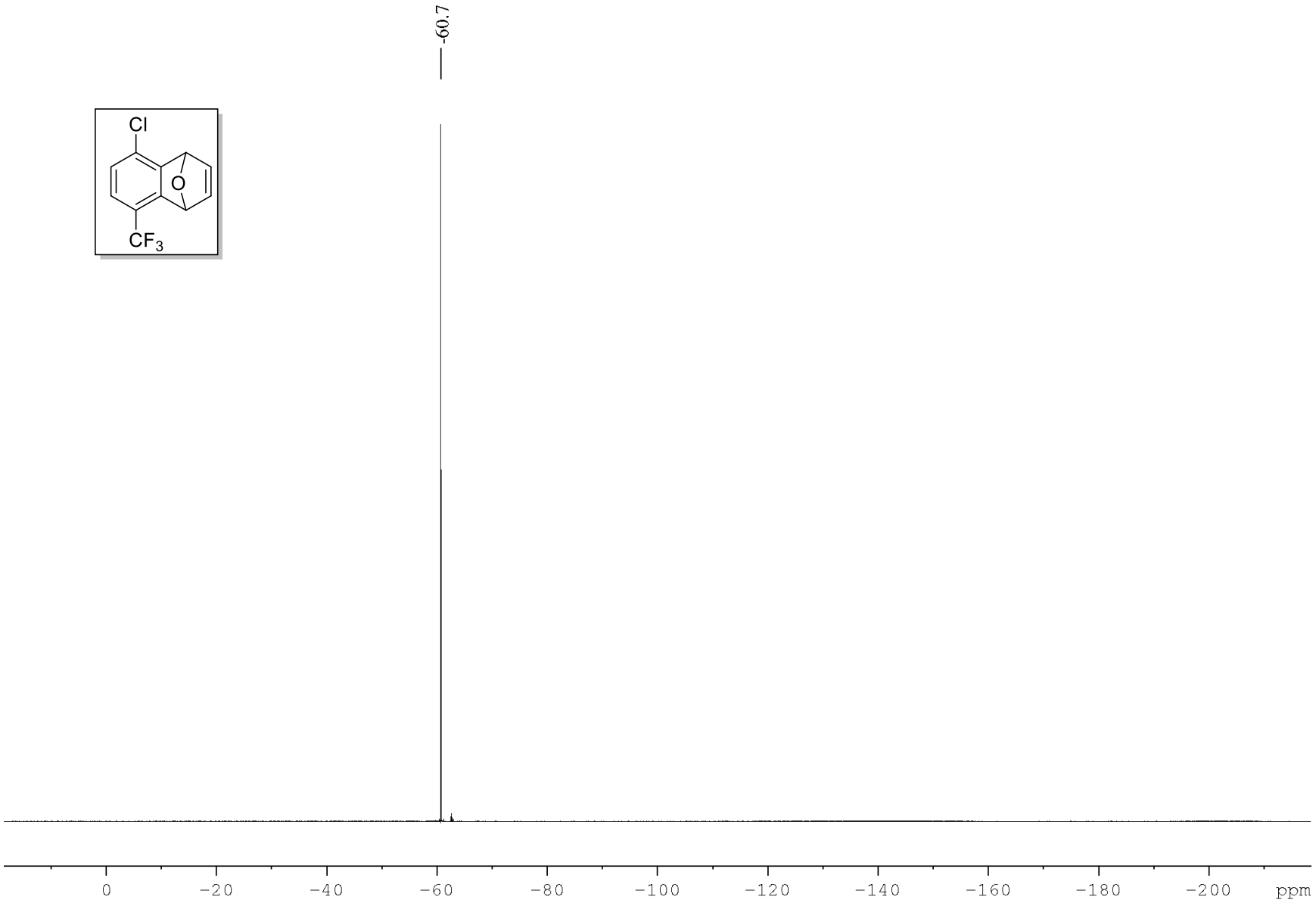
^{1}H NMR of 3q in $CDCl_3$ with 1% v/v TMS at 400 MHz



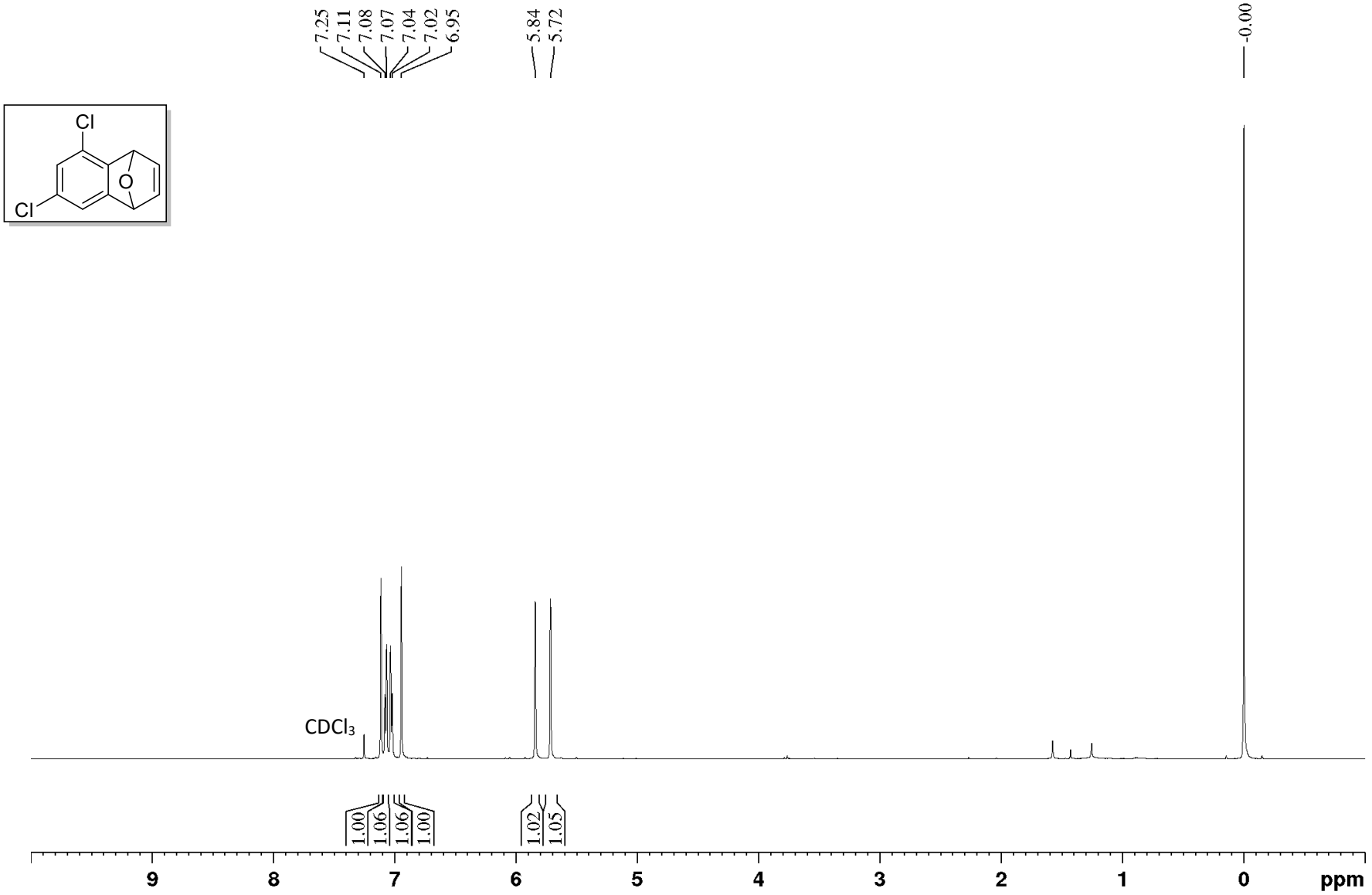
$^{13}C\{^{1}H\}$ NMR of 3q in $CDCl_3$ with 1% v/v TMS at 101 MHz



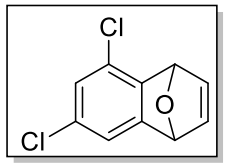
$^{19}F\{^{1}H\}$ NMR of 3q in DMSO-d_6 with 1% v/v TMS at 376 MHz



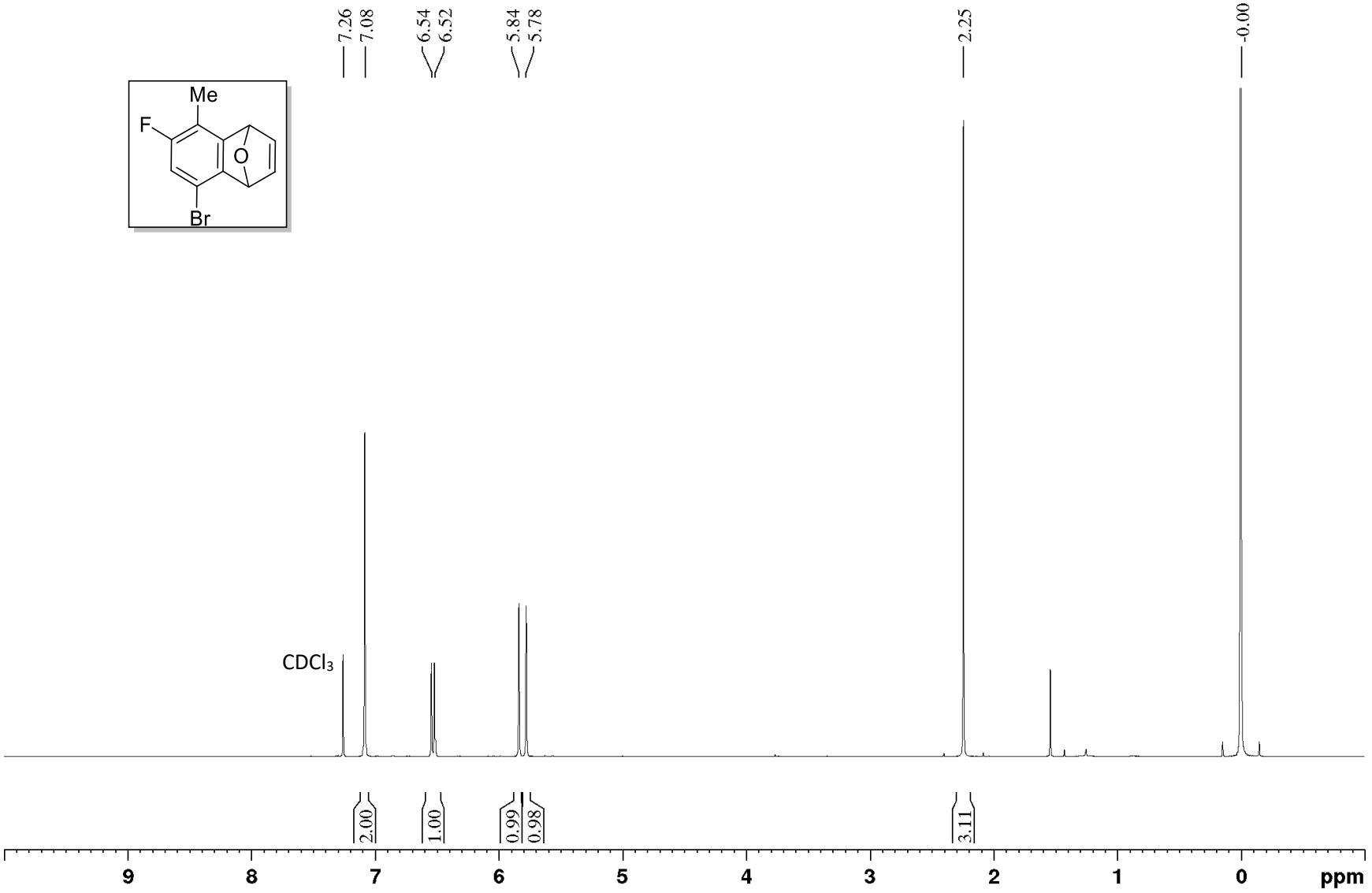
^{1}H NMR of 3r in $CDCl_3$ with 1% v/v TMS at 400 MHz



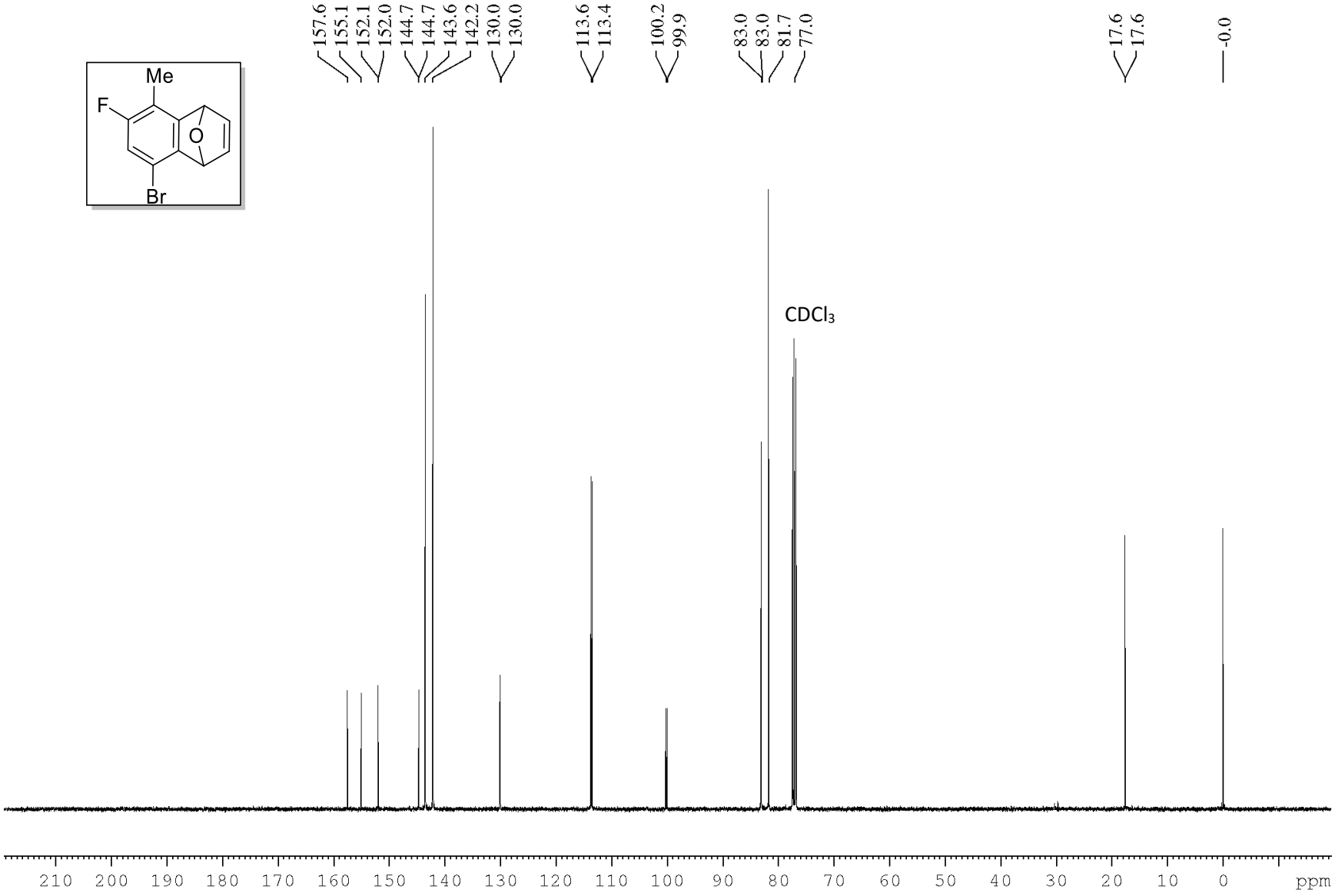
$^{13}C\{^{1}H\}$ NMR of 3r in $CDCl_3$ with 1% v/v TMS at 101 MHz



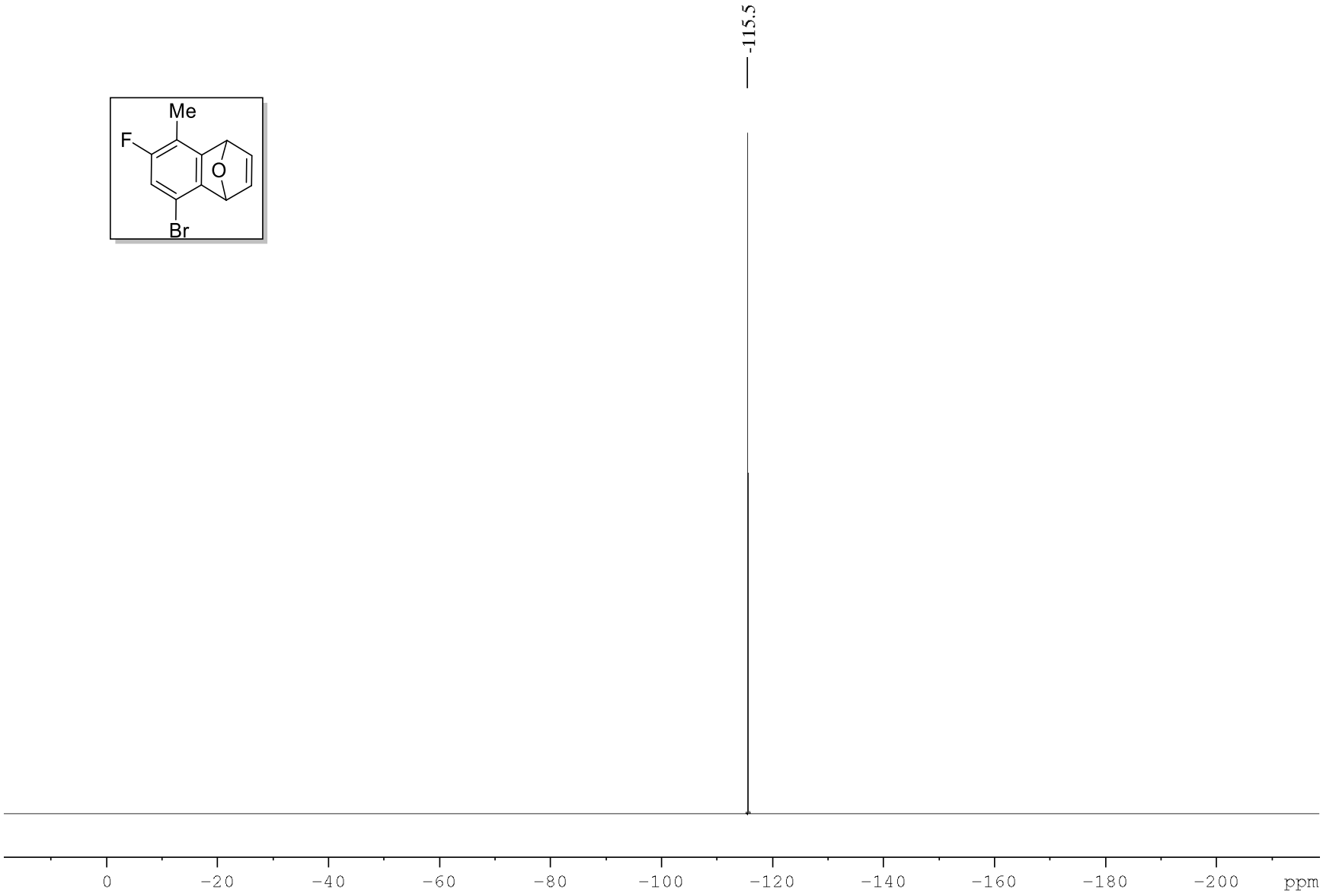
^{1}H NMR of 3s in $CDCl_3$ with 1% v/v TMS at 400 MHz



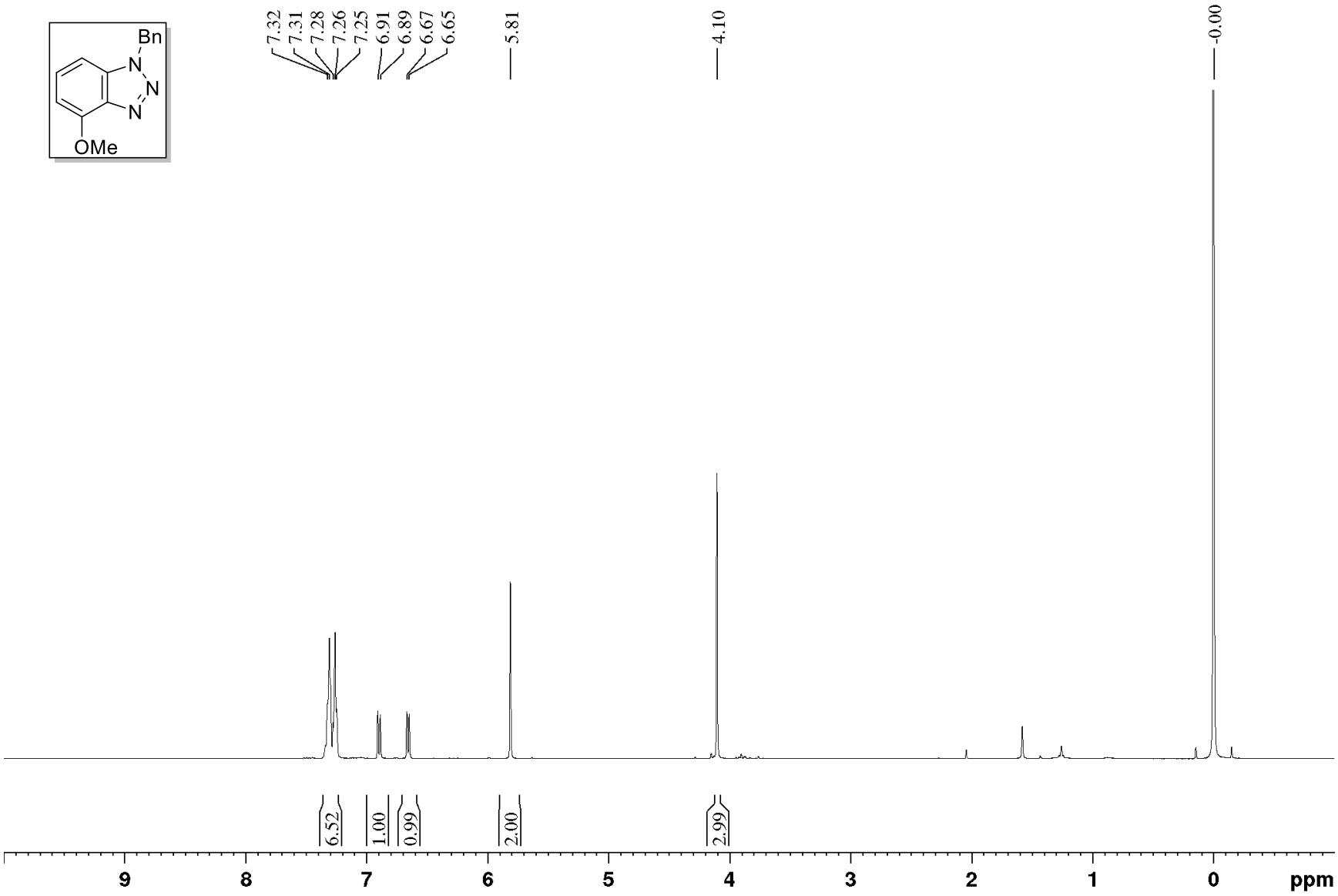
$^{13}C\{^{1}H\}$ NMR of 3s in $CDCl_3$ with 1% v/v TMS at 101 MHz



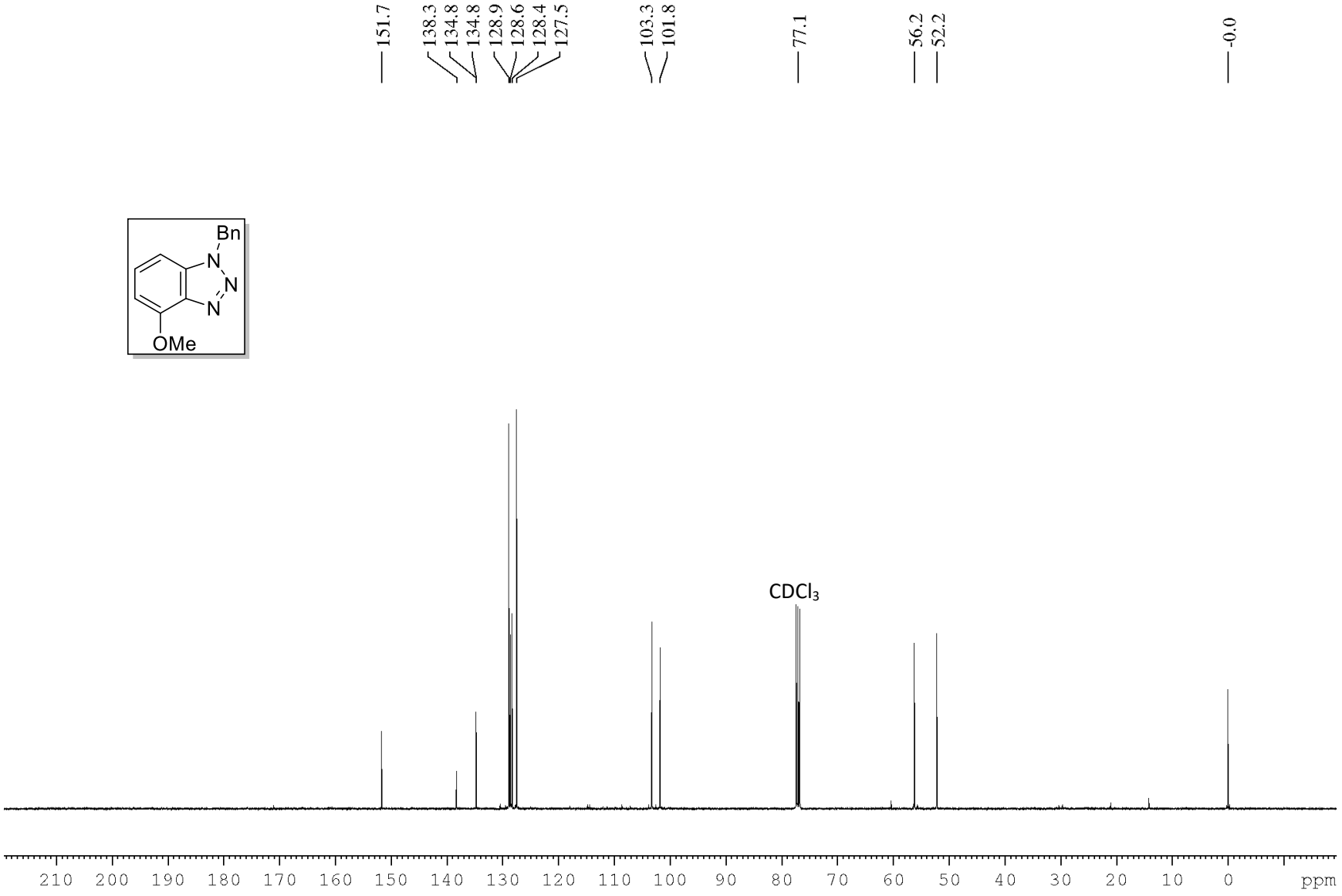
$^{19}F\{^{1}H\}$ NMR of 3s in DMSO-d_6 with 1% v/v TMS at 376 MHz



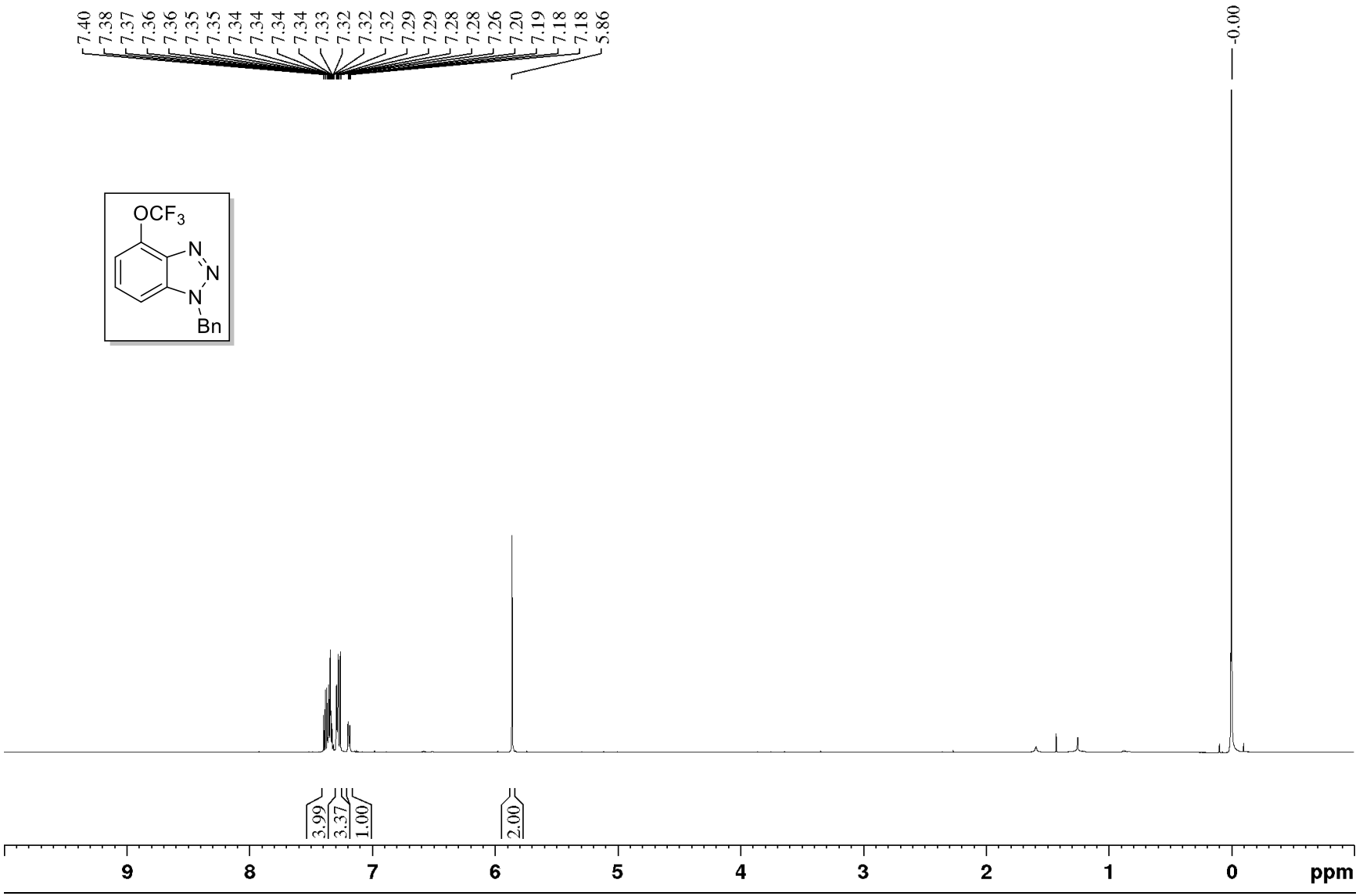
^{1}H-NMR of 3t in $CDCl_3$ with 1% v/v TMS at 400 MHz



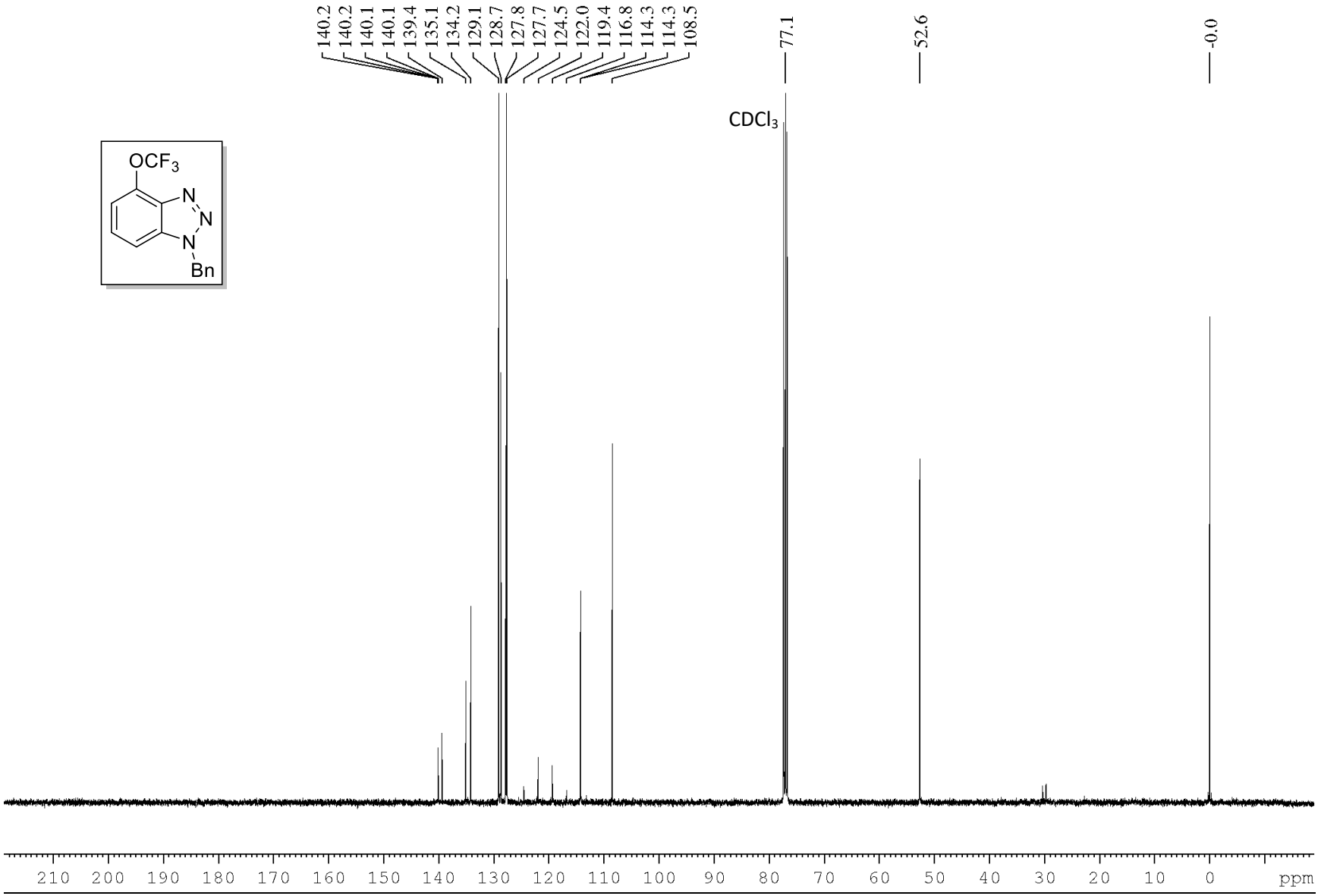
$^{13}C\{^{1}H\}$ NMR of 3t in $CDCl_3$ with 1% v/v TMS at 101 MHz



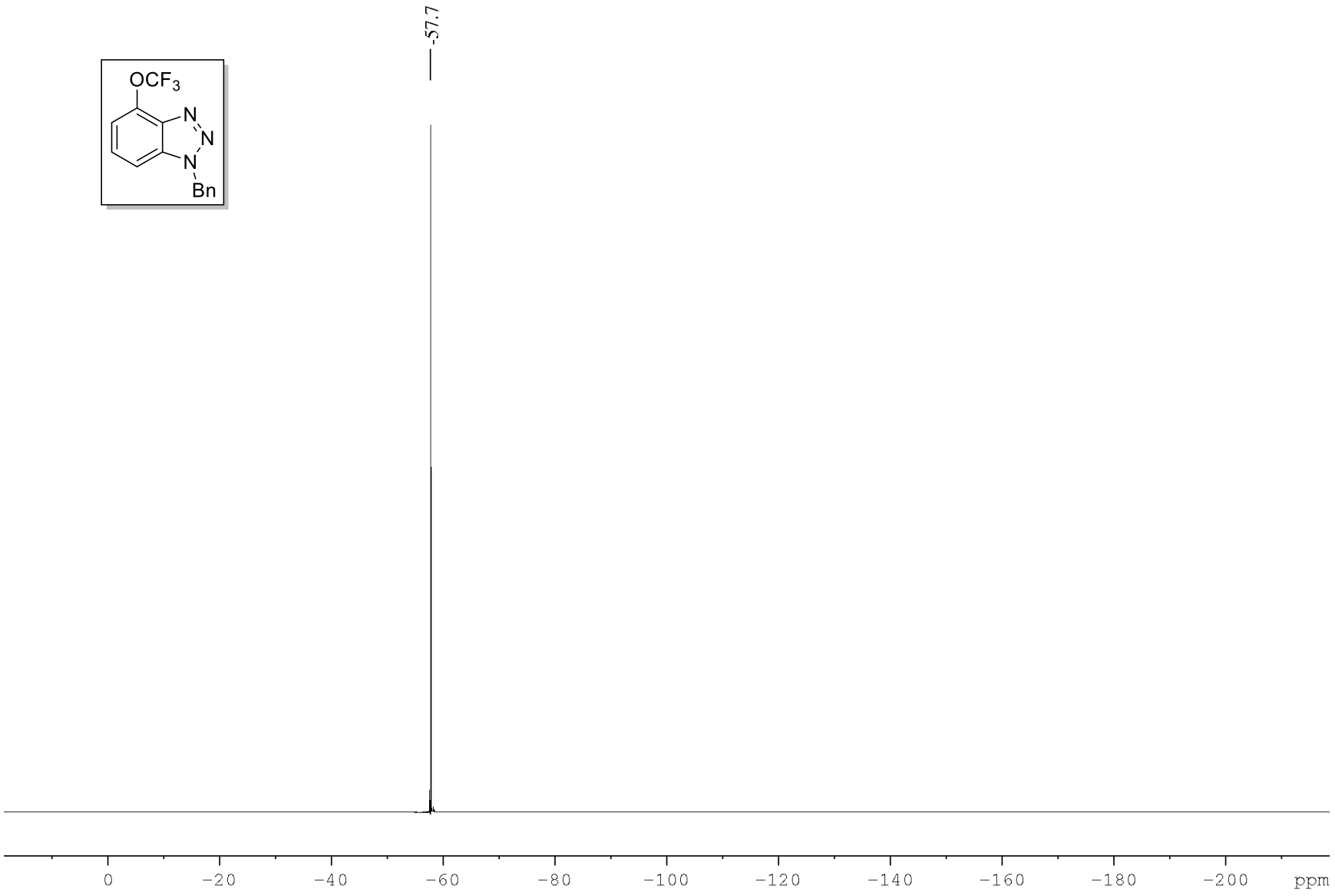
^{1}H NMR of 3u in $CDCl_3$ with 1% v/v TMS at 400 MHz



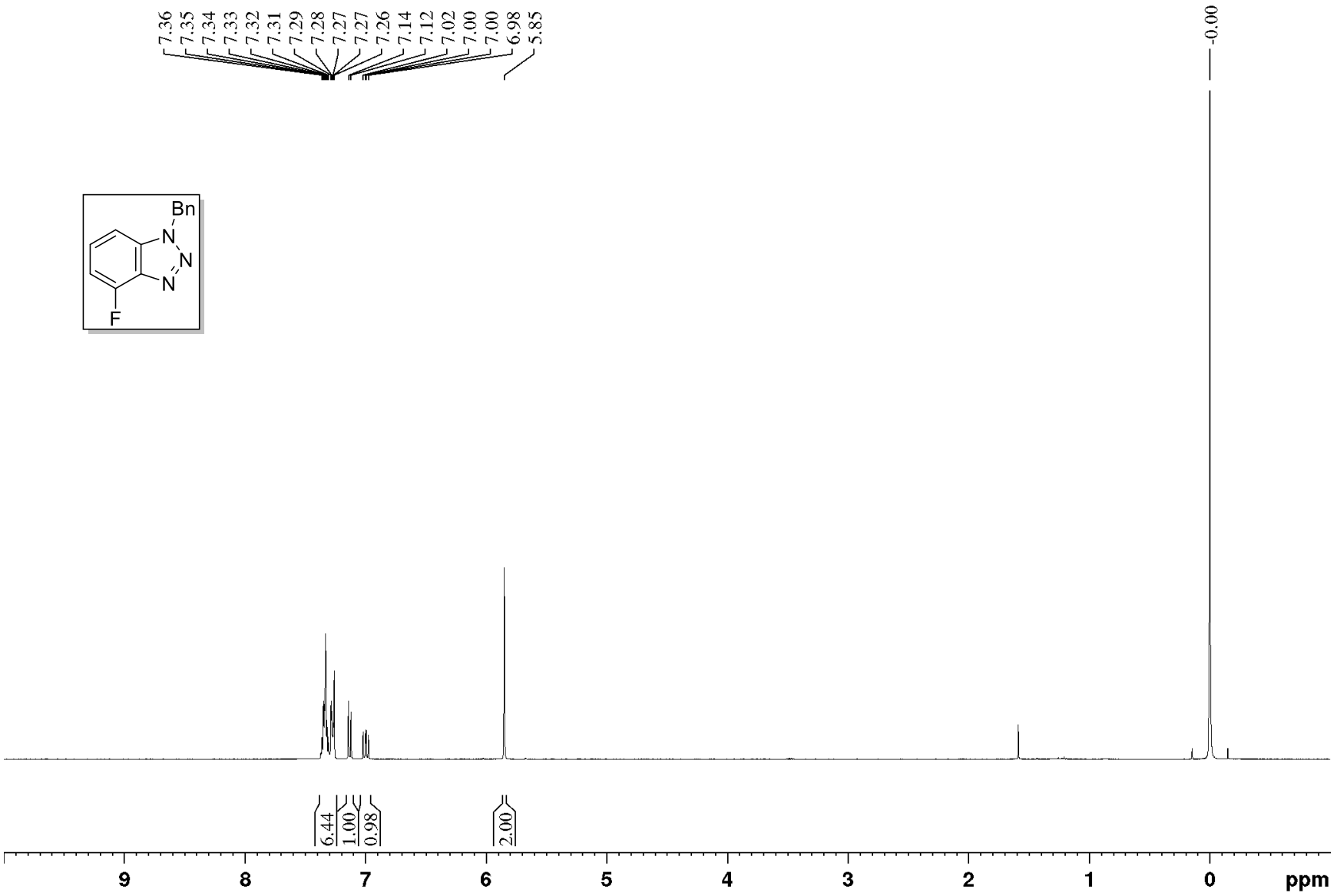
$^{13}C\{^{1}H\}$ NMR of 3u in $CDCl_3$ with 1% v/v TMS at 101 MHz



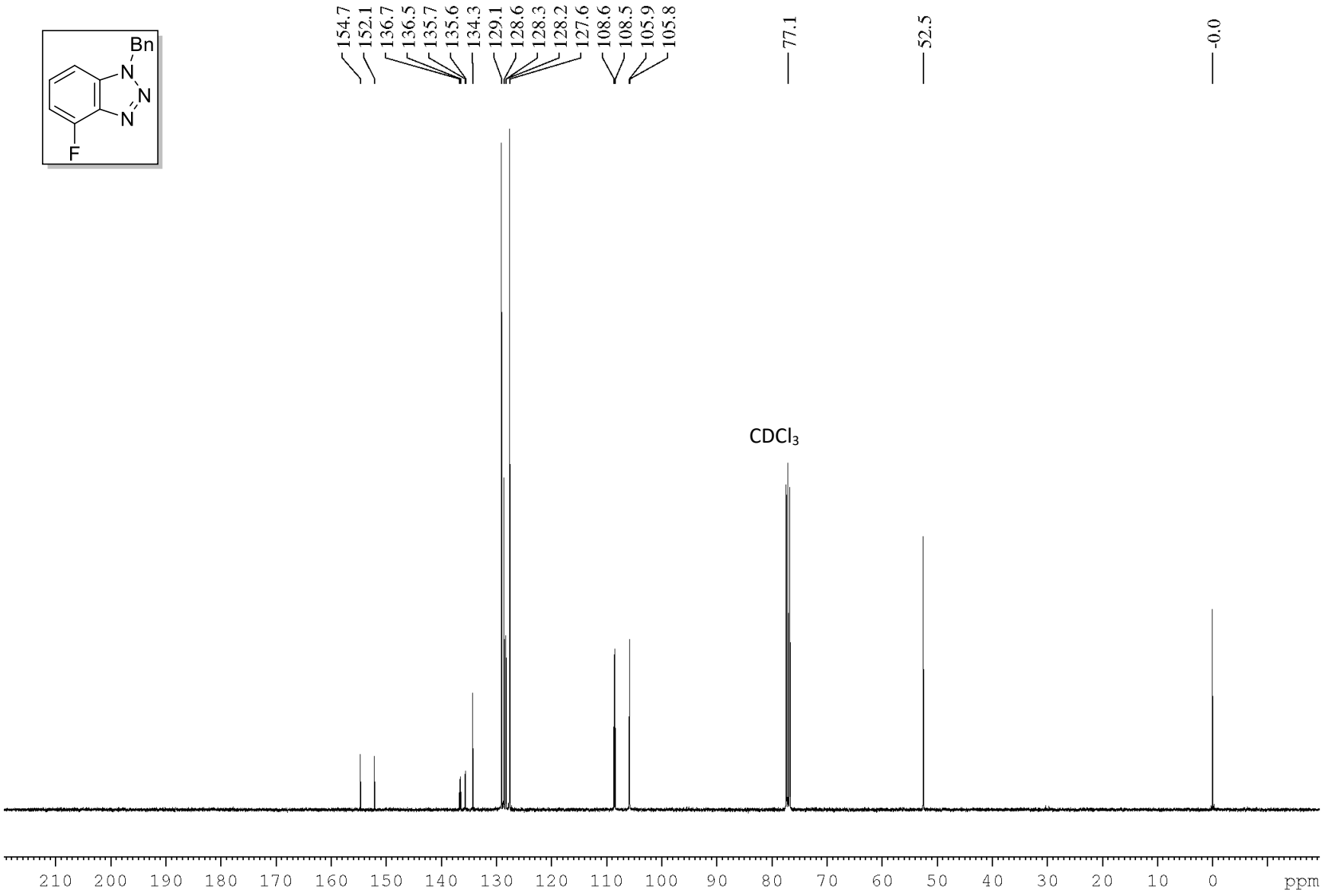
$^{19}F\{^{1}H\}$ NMR of 3u in $CDCl_3$ with 1% v/v TMS at 376 MHz



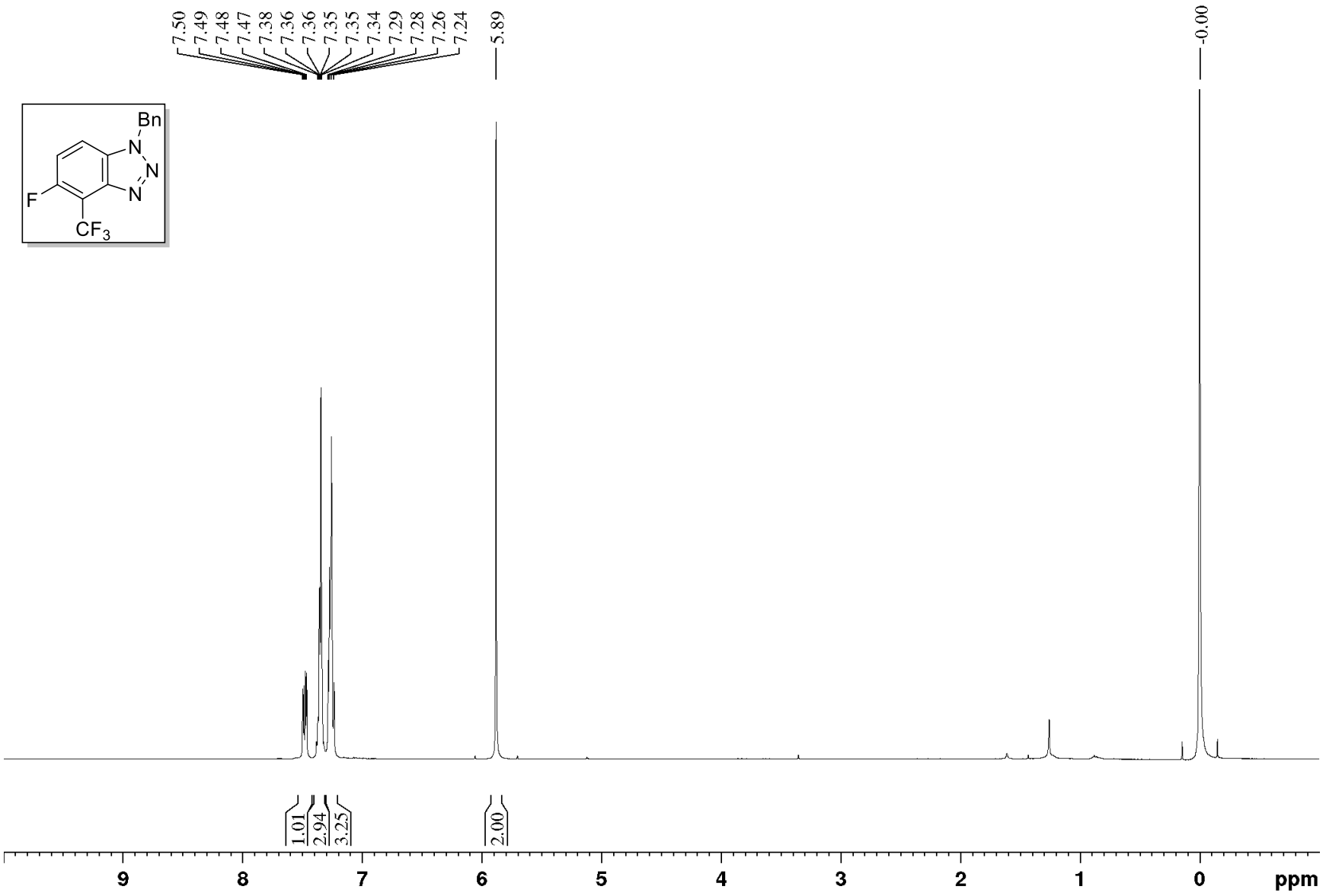
^{1}H NMR of 3v in $CDCl_3$ with 1% v/v TMS at 400 MHz



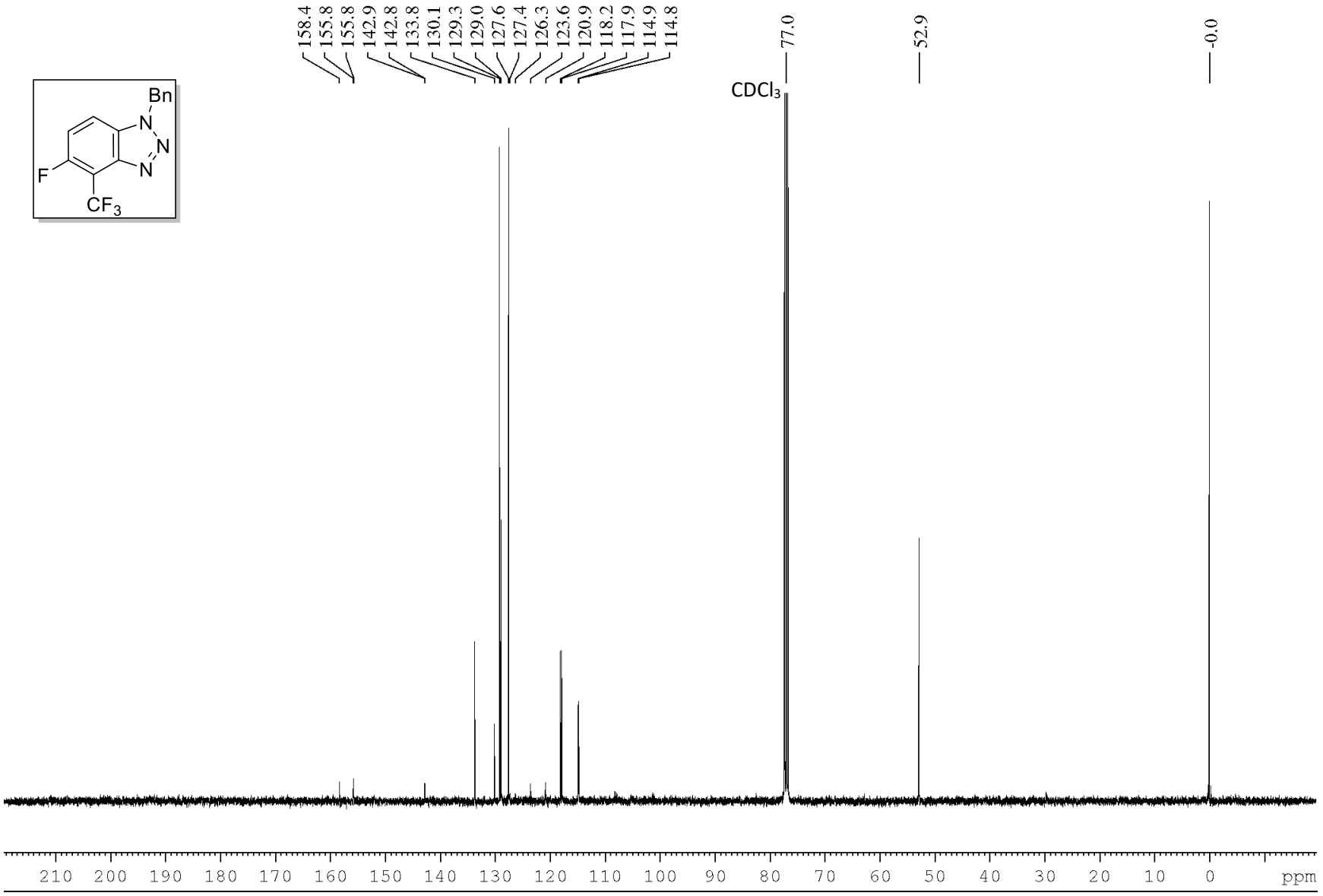
$^{13}C\{^{1}H\}$ NMR of 3v in $CDCl_3$ with 1% v/v TMS at 101 MHz



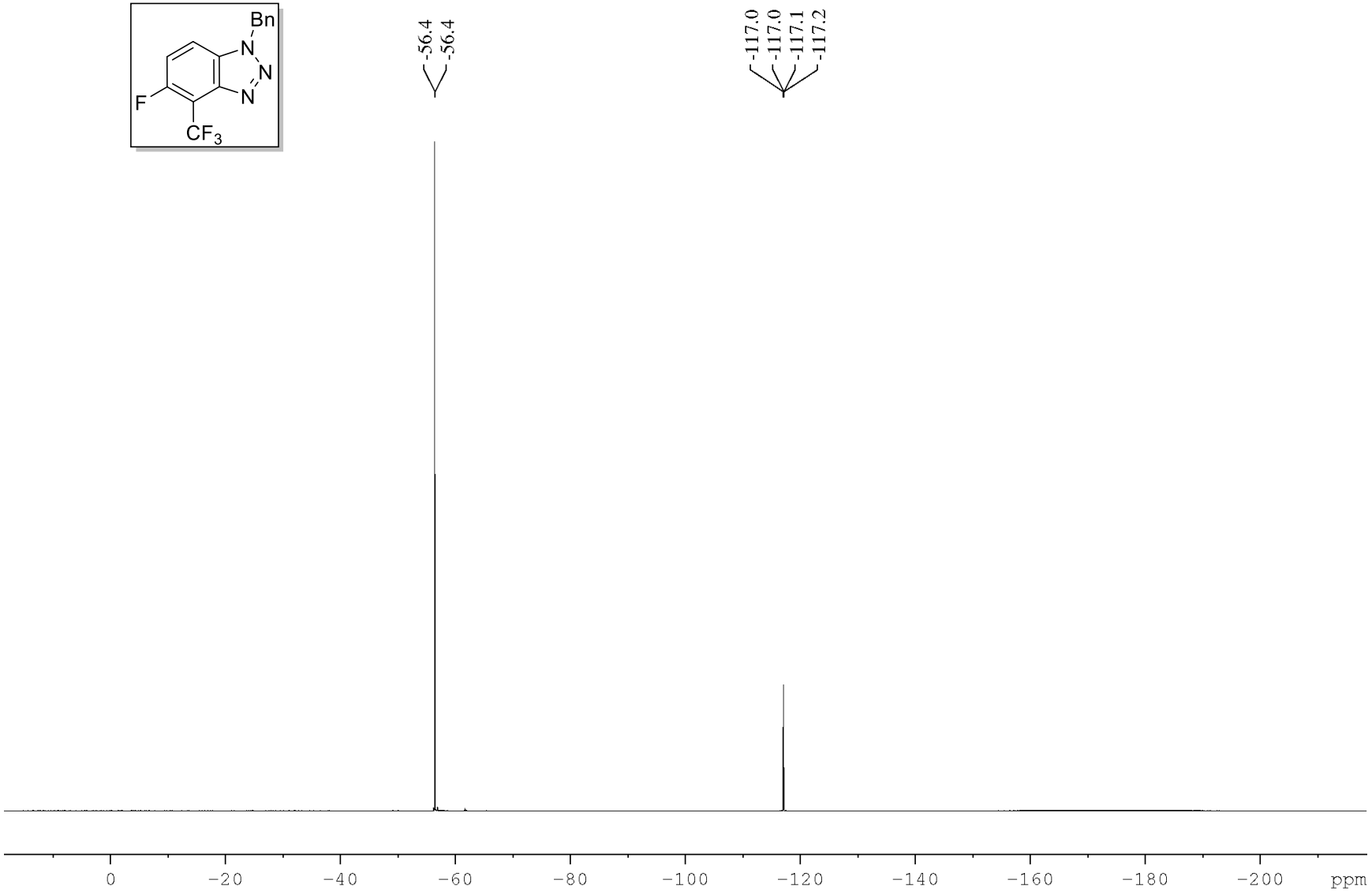
^{1}H NMR of 3w in $CDCl_3$ with 1% v/v TMS at 400 MHz



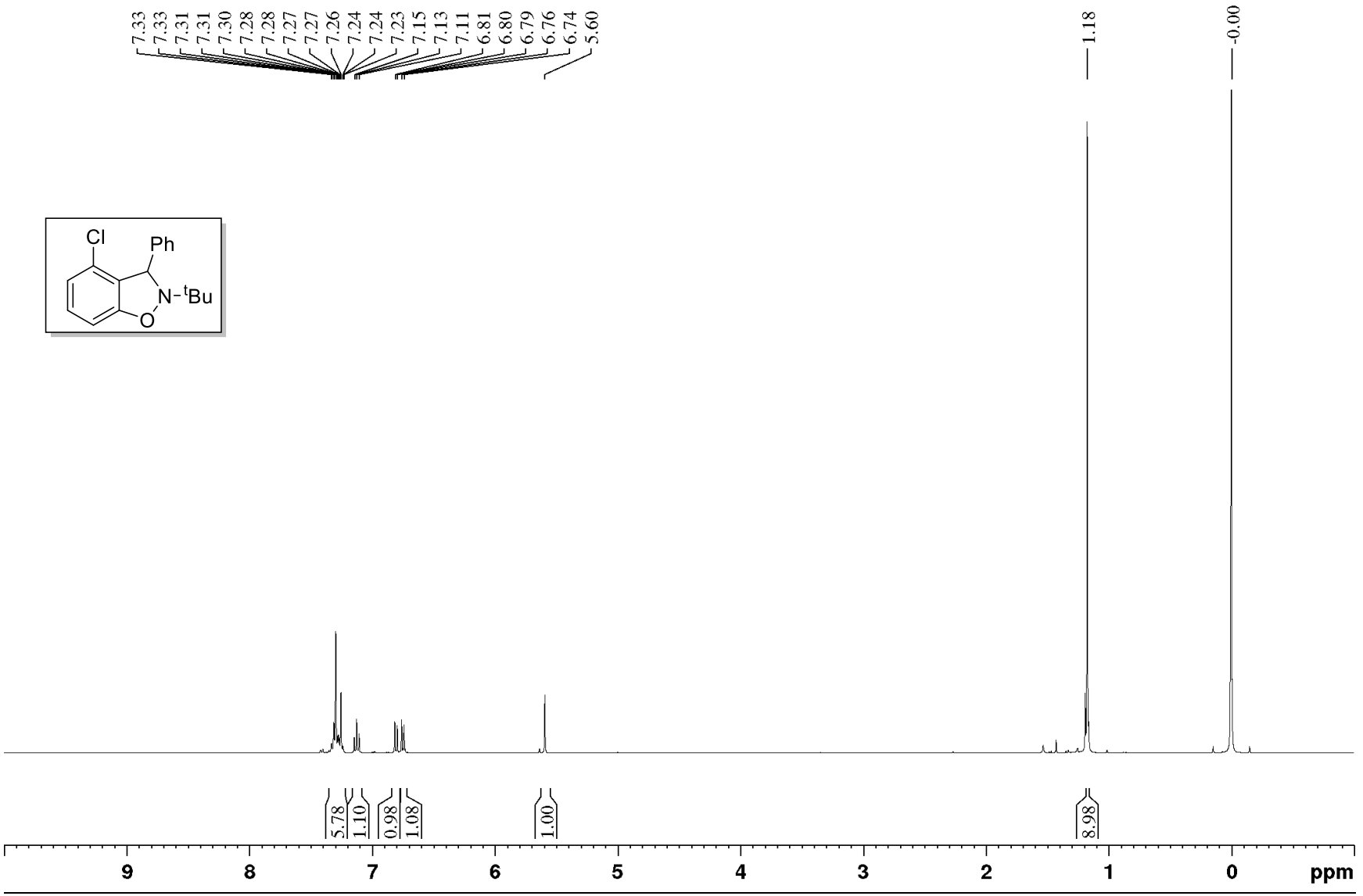
$^{13}C\{^{1}H\}$ NMR of 3w in $CDCl_3$ with 1% v/v TMS at 101 MHz



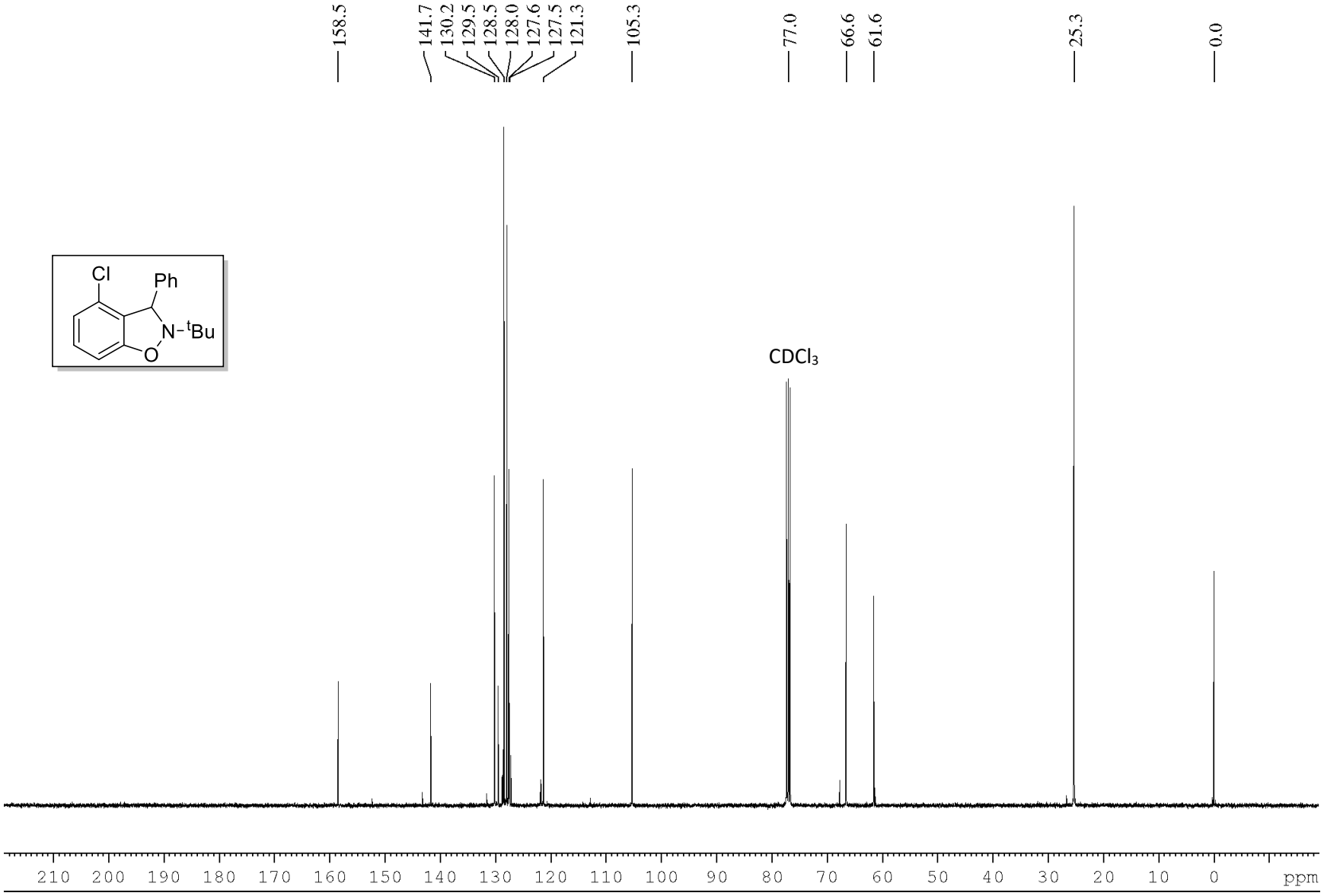
$^{19}F\{^{1}H\}$ NMR of 3w in $CDCl_3$ with 1% v/v TMS at 376 MHz



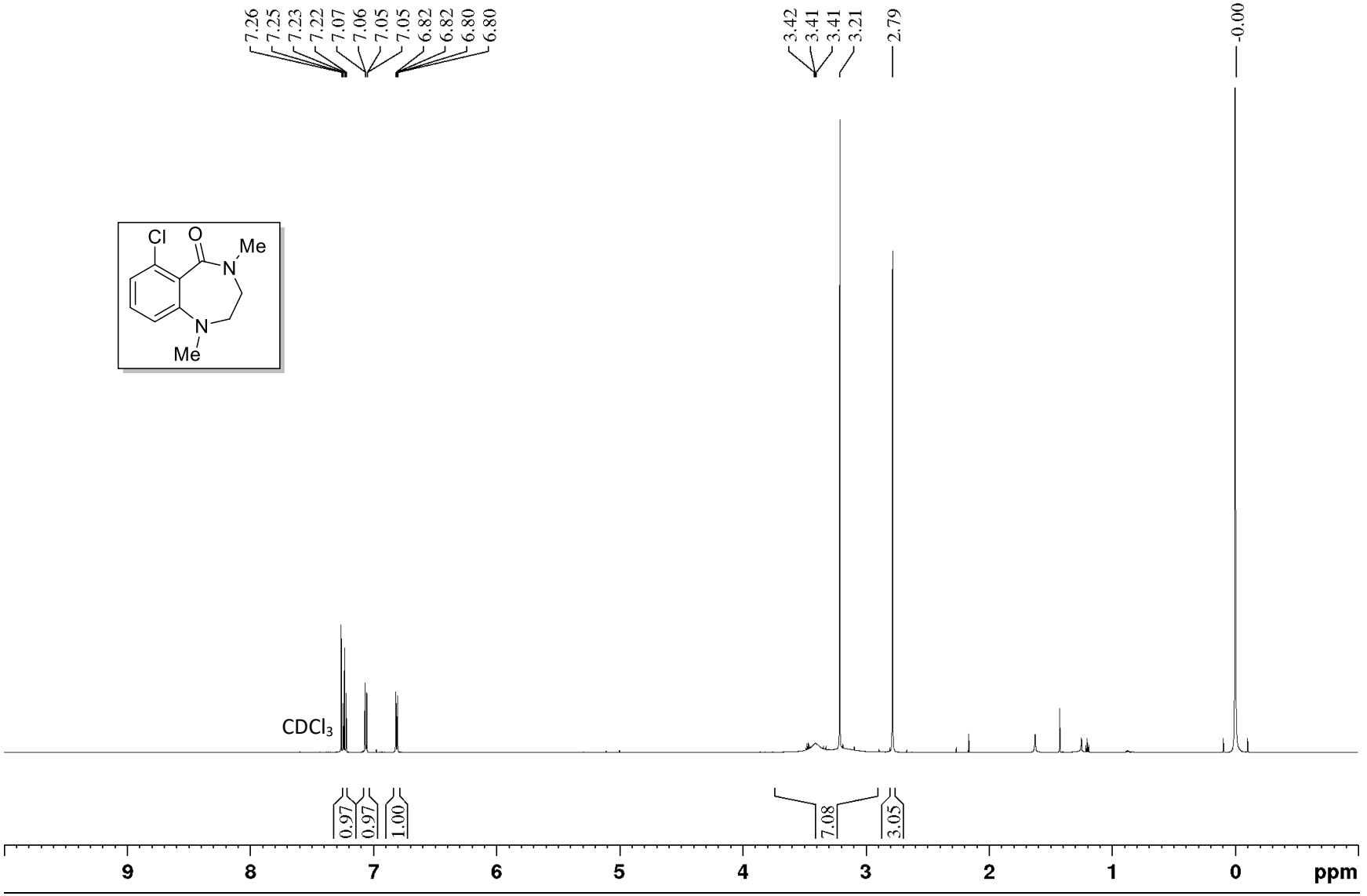
^{1}H NMR of 5a in $CDCl_3$ with 1% v/v TMS at 400 MHz



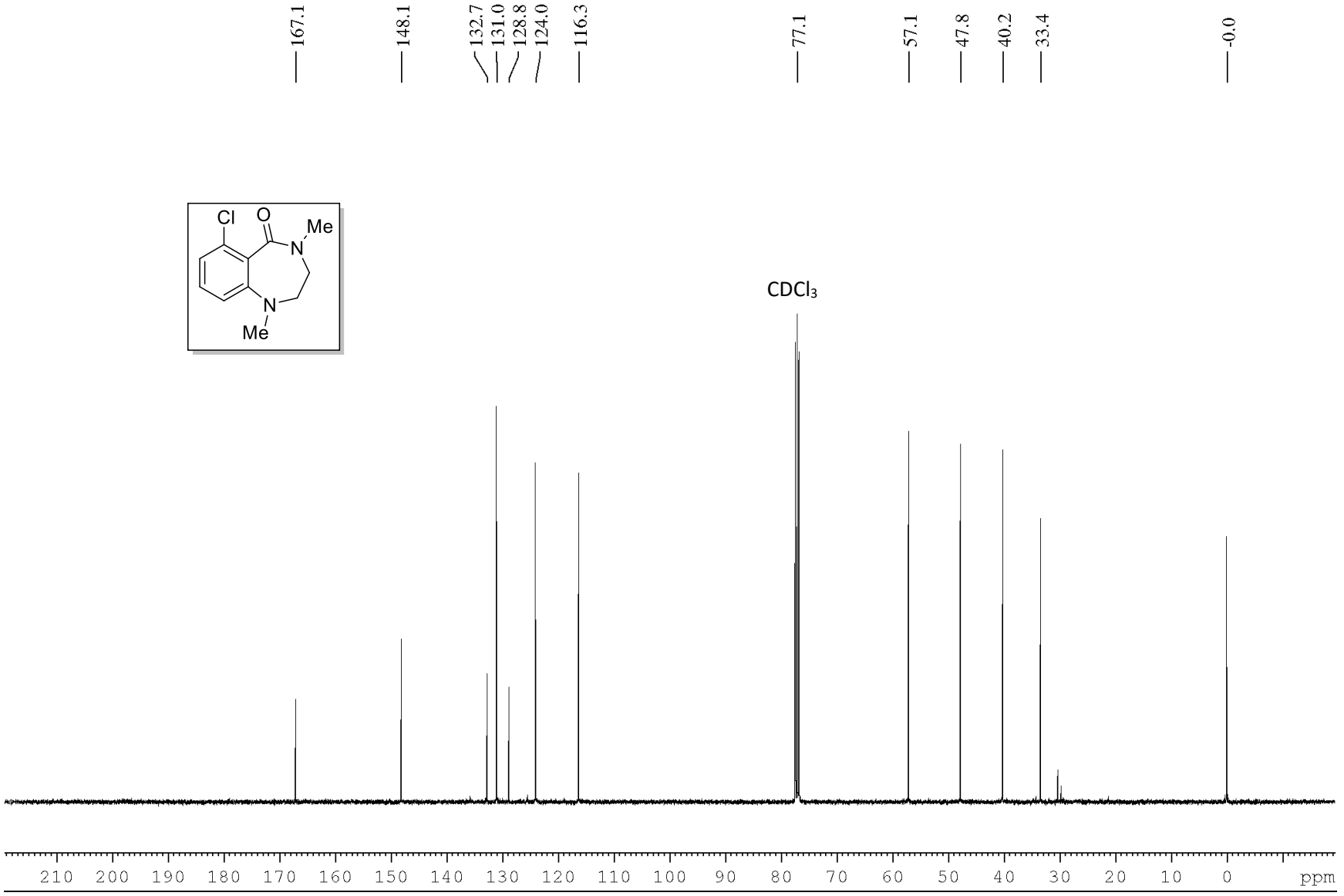
$^{13}C\{^{1}H\}$ NMR of 5a in $CDCl_3$ with 1% v/v TMS at 101 MHz



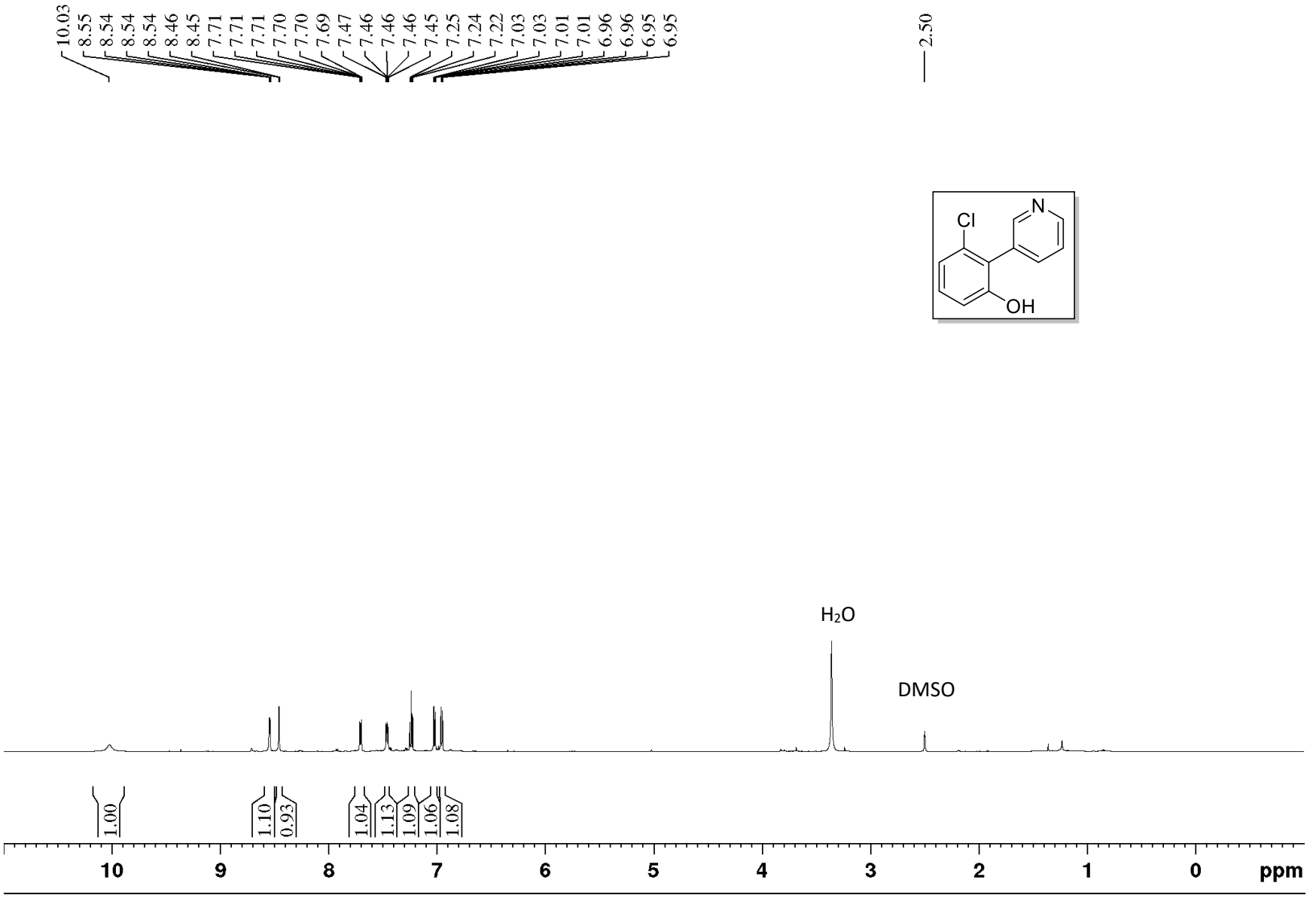
^{1}H NMR of 5b in $CDCl_3$ with 1% v/v TMS at 400 MHz



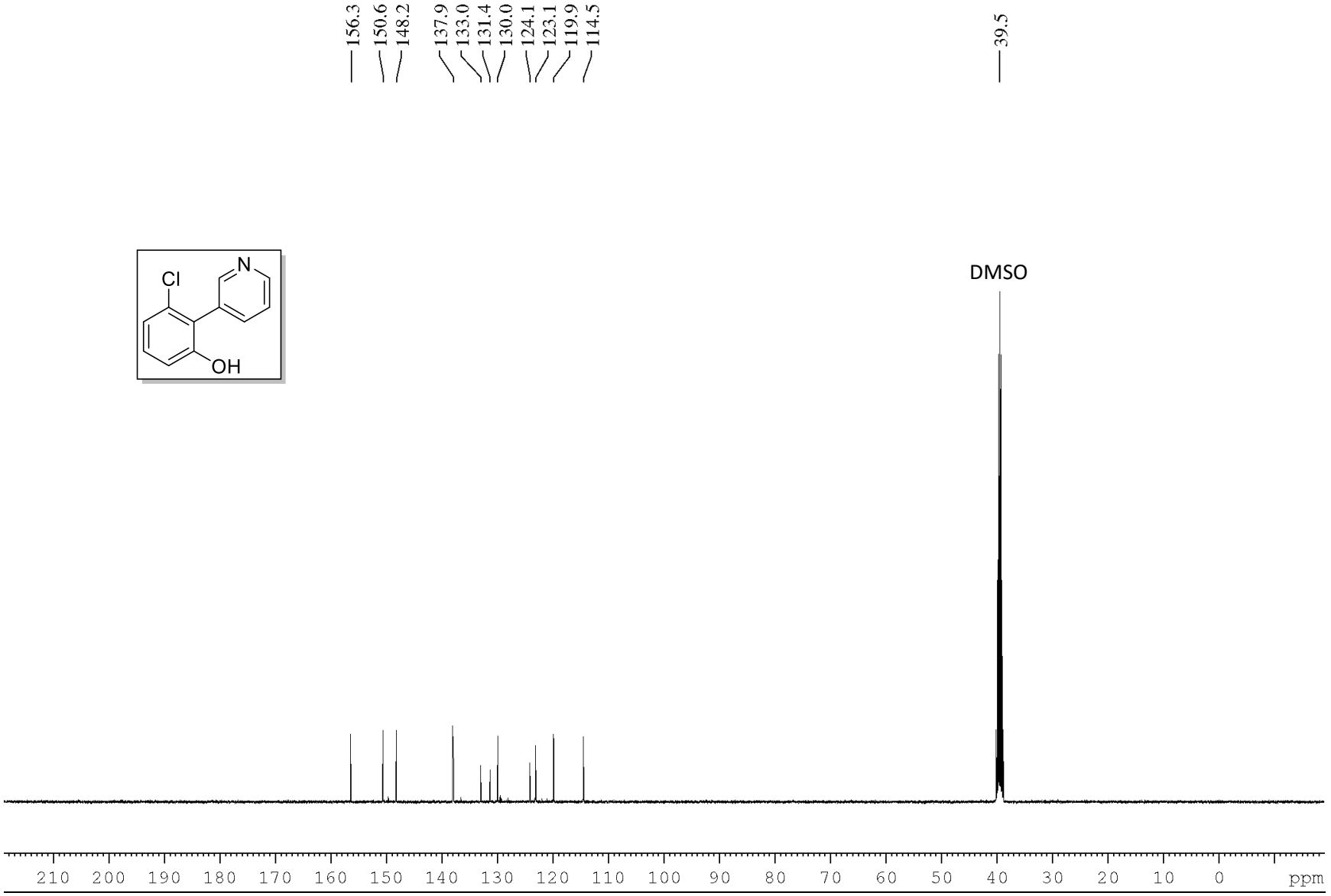
$^{13}C\{^{1}H\}$ NMR of 5b in $CDCl_3$ with 1% v/v TMS at 101 MHz



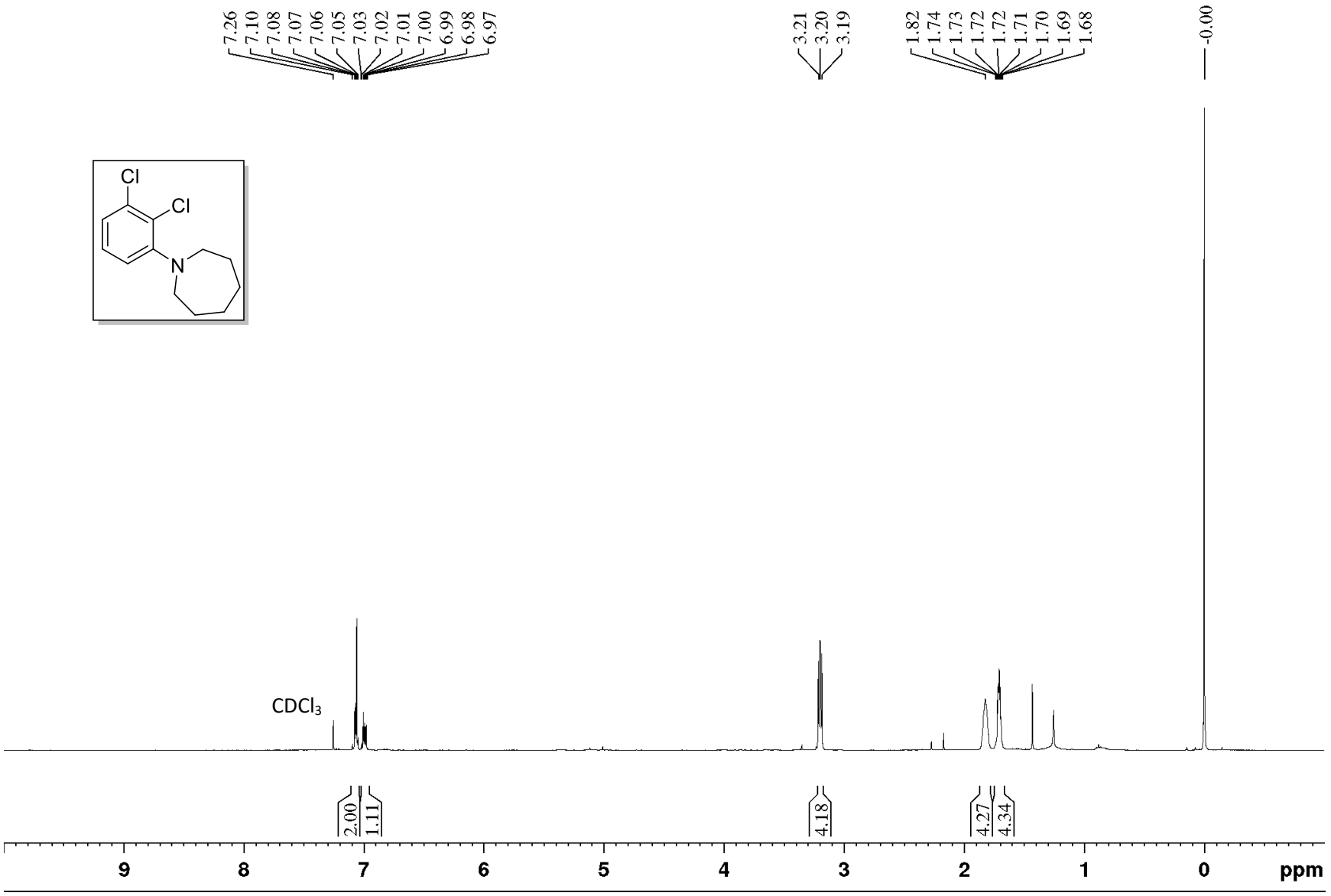
^{1}H NMR of 5c in DMSO-d^{6} 600 MHz



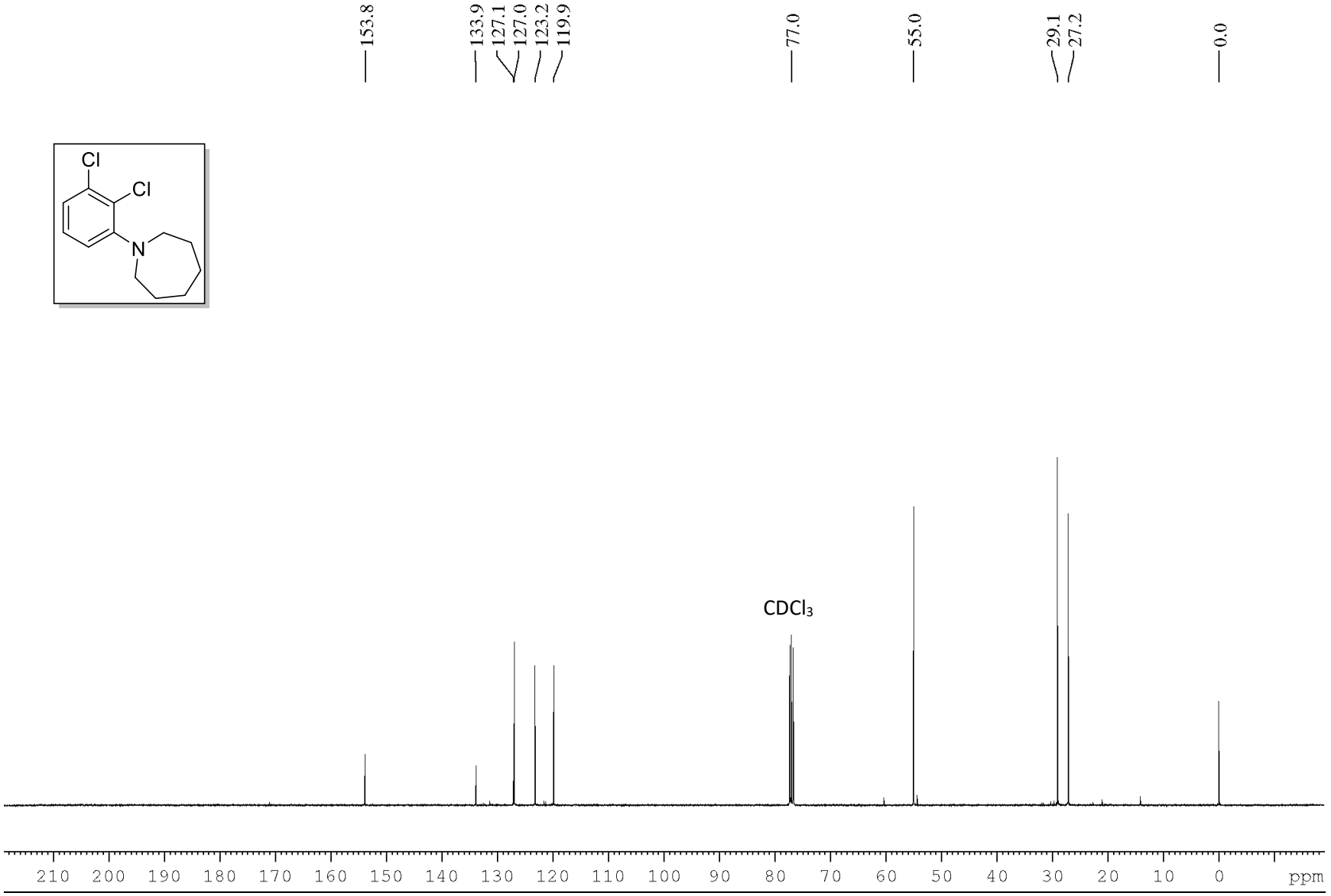
$^{13}C\{^{1}H\}$ NMR of 5c in DMSO-d^{6} at 101 MHz



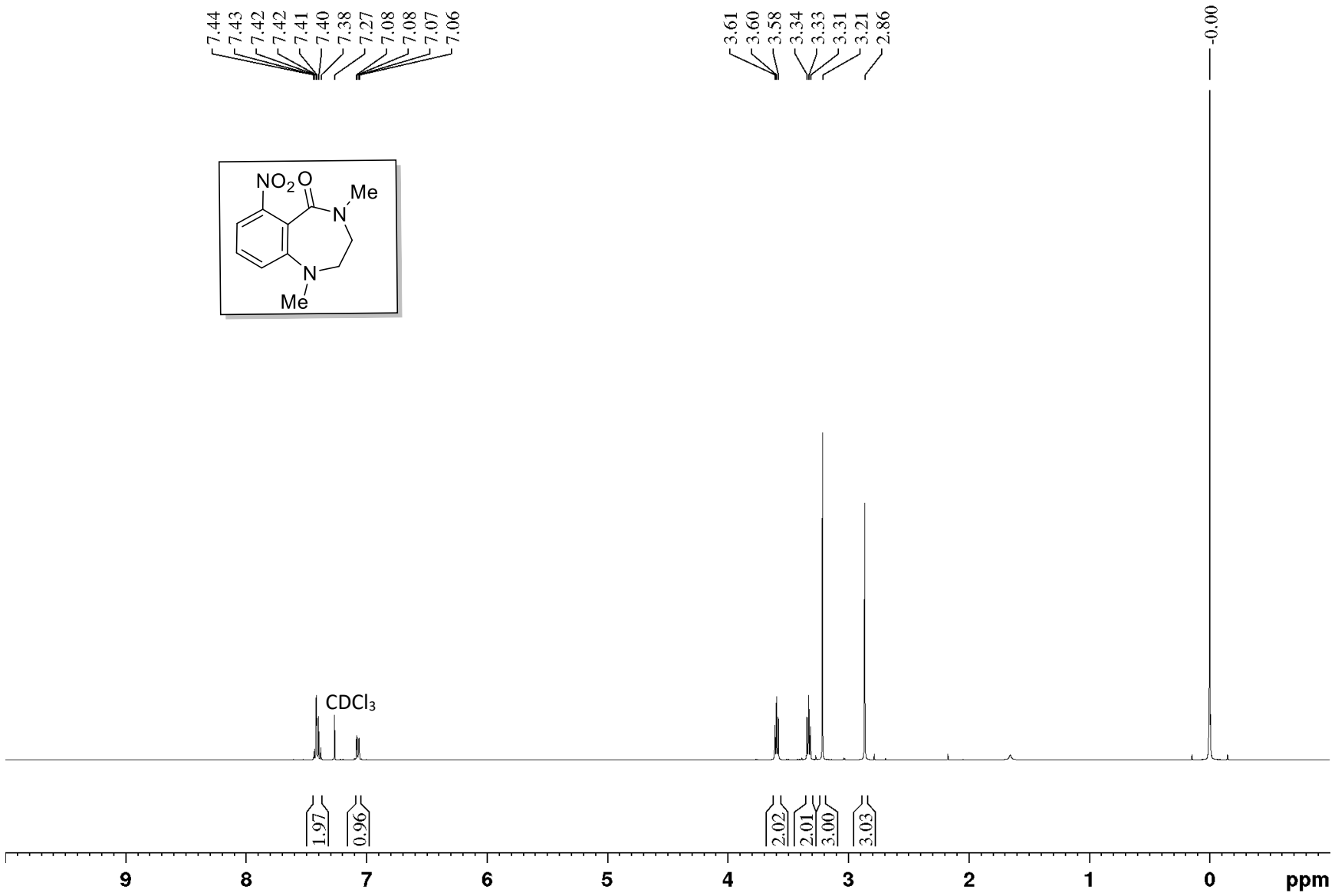
^{1}H NMR of 5d in $CDCl_3$ with 1% v/v TMS at 400 MHz



$^{13}C\{^{1}H\}$ NMR of 5d in $CDCl_3$ with 1% v/v TMS at 101 MHz



^{1}H NMR of 5e in $CDCl_3$ at 400 MHz



$^{13}C\{^{1}H\}$ NMR of 5e in $CDCl_3$ at 101 MHz