Supporting Information

Dichlorination of Olefins with Trichloroisocyanuric Acid (TCCA) and Tetrabutylammonium Chloride (TBACl)

Ramazan Koçak*[1,2]

Address: [1]Department of Chemistry, Faculty of Arts and Sciences, Amasya University, Amasya, Turkey, [2]Department of Chemistry, Faculty of Science, Ataturk University, Erzurum, Turkey.

Email: ramazan.kocak@amasya.edu.tr, ramazan.kocak@atauni.edu.tr

Table of contents

Experimental

General

Compounds **1d** and **1o** were synthesized following the procedures reported in the literature.[1-2] All chemicals and solvents, purchased from Sigma-Aldrich, were used without further purification. Reactions that require heating were carried out under oil bath conditions. Reactions were monitored by thin layer chromatography using Merck TLC Silica gel 60 F254 and the plates were inspected by 254 nm or 365 nm UV-ligth and/or by acquiring ^{1}H-NMR spectra. Column chromatography was performed over Merck Silica gel 60F (70-230 mesh ASTM). The one and two dimensional ^{1}H- and ^{13}C NMR spectra were recorded on a Varian-400 or a Bruker-400 spectrometer in $CDCl_3$ using tetramethylsilane as the internal reference. All spectra were recorded at 25 ^{o}C and coupling constants (*J* values) are given in Hz. Chemical shifts are given in parts per million (ppm). Abbreviations used to define the multiplicities are as follows: s = singlet; d = doublet; dd = doublet of doublets; m = multiplet. Mass spectra of the compounds (**2e**, **3u**, **3w** and **2ac**) that are unknown and/or whose data cannot be accessed were recorded on the Agilent Technologies 6530 Accurate-Mass Q-TOF-LC/MS.

General procedure

For Chlorination of Olefins with TCCA/TBACl

Olefine (**1**) (0,5 mmol) and TBACl (153 mg, 0.55 mmol) were dissolved in 2 mL CH_2Cl_2 in a 10 mL reaction tube. Then, TCCA (81 mg, 0.35 mmol) was added to the reaction mixture (Caution: When the TCCA is added before TBACl, the yield of some products decreases). The reaction mixture was stirred at room temperature for 10 minutes. 2 mL *n*- hexane was added and stirred at room temperature. After about 5 minutes, a dense viscous part formed at the bottom of the tube, and the CH_2Cl_2/*n*- hexane phase containing chlorinated compounds was transferred to a short silica gel column with a pipette. Dichlorinated compounds were purified by eluting with *n*- hexane/CH_2Cl_2 (1:1).

For Regioselective Chlorobromination and Dibromination Reactions of Bicyclic Alkene Benzonorbornadiene with TCCA/TBABr Redox Reactions

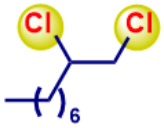
TCCA (0.5-1.1 equiv) and TBABr (0.5-3.0 equiv) were dissolved in 2 mL CH_2Cl_2 in a 10 mL reaction tube and stirred for 5 min at room temperature. Then, olefine (**1**) (0,5 mmol) was added to the reaction mixture. The reaction mixture was stirred at room temperature for an additional 10 minutes. 2 mL *n*-hexane was added and stirred at room temperature. After about 5 minutes, a dense viscous part formed at the bottom of the tube, and the CH_2Cl_2/*n*- hexane phase containing chlorinated compounds was transferred to a short silica gel column with a pipette. Regioselective chlorobromination and dibromination redox products were purified by eluting with *n*- hexane/CH_2Cl_2 (1:1).

For Control experiments: Regioselective Chlorobromination and Dibromination Reactions of Bicyclic Alkene Benzonorbornadiene with DBI/TBAX (Cl, Br).

Benzonorbornadiene (**1o**) (0,5 mmol) and TBACl (153 mg, 0.55 mmol) or TBABr (177 mg, 0.55 mmol) were dissolved in 2 mL CH_2Cl_2 in a 10 mL reaction tube. Then, DBI (158 mg, 0.55 mmol) was added to the reaction mixture. The reaction mixture was stirred at room temperature for 10 minutes. 2 mL *n*-hexane was added and stirred at room temperature. After about 5 minutes, a dense viscous part

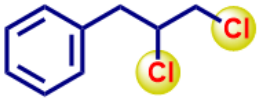
formed at the bottom of the tube, and the CH_2Cl_2/*n*- hexane phase containing chlorinated compounds was transferred to a short silica gel column with a pipette. Dichlorinated compounds were purified by eluting with *n*- hexane/CH_2Cl_2 (1:1).

1,2-Dichlorononane (2a)[3]



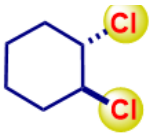
Colorless oil (94 mg, 95%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.08 – 3.99 (m, 1H), 3.76 (dd, *J* = 11.3, 5.2 Hz, 1H), 3.65 (dd, *J* = 11.3, 7.4 Hz, 1H), 2.05 – 1.92 (m, 1H), 1.79 – 1.64 (m, 1H), 1.48 – 1.21 (m, 10H), 0.89 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 61.4, 48.4, 35.2, 31.9, 29.2, 29.1, 26.0, 22.8, 14.2.

(2,3-Dichloropropyl)benzen (2b)[4]



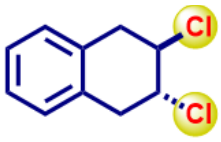
Colorless oil (85 mg, 90%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 – 7.16 (m, 5H), 4.23 – 4.13 (m, 1H), 3.66 (dd, *J* = 11.5, 4.8 Hz, 1H), 3.58 (dd, *J* = 11.5, 6.9 Hz, 1H), 3.24 (dd, *J* = 14.2, 5.7 Hz, 1H), 2.99 (dd, *J* = 14.2, 7.3 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 136.4, 129.7, 128.7, 127.3, 61.1, 47.6, 41.1.

***trans*-1,2-Dichlorocyclohexane (2c)[5]**



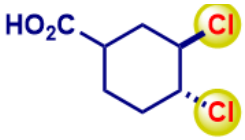
Colorless oil (71 mg, 93%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.10 – 3.87 (m, 2H), 2.38 – 2.27 (m, 2H), 1.86 – 1.65 (m, 4H), 1.51 – 1.34 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 63.3, 33.6, 23.2.

***trans*-2,3-Dichloro-1,2,3,4-tetrahydronaphthalene (2d)[6]**



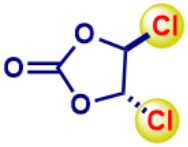
White crystal (88 mg, 87%). Mp: 84-85˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 – 7.18 (AA' part of AA'BB' system, 2H), 7.16 – 7.09 07 (BB' part of AA'BB' system, 2H), 4.53 – 4.44 (m, 2H), 3.69 (dd, *J* = 18.4, 3.2 Hz, 2H), 3.20 – 3.10 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 131.3, 129.0, 126.9, 58.0, 34.8.

***trans*-3,4-Dichlorocyclohexane-1-carboxylic acid (2e)**



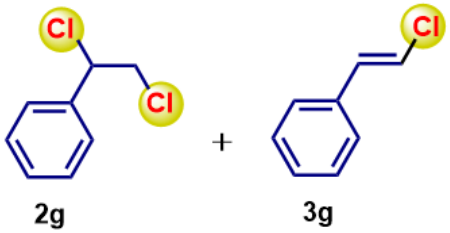
White solid (95 mg, 96%). Mp: 128-129˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.78 – 4.74 (t, *J* = 5.2 Hz, 1H), 4.33 (t, *J* = 4.7 Hz, 1H), 2.69-2.63 (m, 1H), 2.52 (d, *J* = 12.3 Hz, 1H), 2.34 – 2.21 (m, 2H), 2.07 (dd, *J* = 16.1, 5.4 Hz, 1H), 1.99 – 1.79 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.7, 79.0, 53.5, 38.2, 31.9, 27.9, 22.4. HRMS (ESI) m/z: $[M - HCl + H]^+$ calcd for $C_7H_{10}ClO_2$: 161.0364, found: 161.0365.

***trans*-4,5-Dichloro-1,3-dioxolan-2-one (2f)[7]**



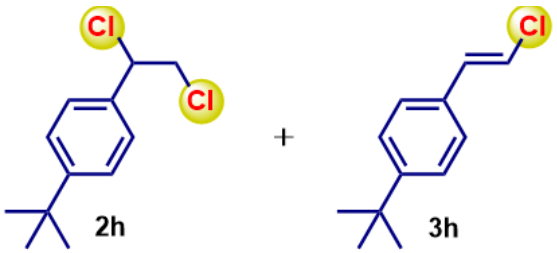
Colorless viscous (74 mg, 94%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.33 (s, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.9, 90.5.

(1,2-Dichloroethyl)benzene (2g)[8] and (*E*)-(2-chlorovinyl)benzene (3g)[9]



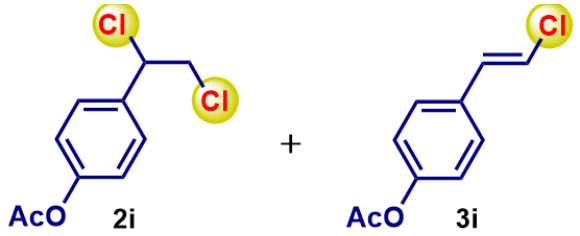
Mixture of **2g** (79%) and **3g** (9%, was not isolated). **2g:** colorless oil (69 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.33 (m, 5H), 5.01 (dd, *J* = 7.9, 6.6 Hz, 1H), 4.01 (dd, *J* = 11.3, 6.6 Hz, 1H), 3.94 (dd, *J* = 11.3, 7.9 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 138.1, 129.3, 129.0, 127.5, 61.9, 48.5.

1-(*tert*-Butyl)-4-(1,2-dichloroethyl)benzene (2h)[8] and (*E*)-1-(tert-butyl)-4-(2-chlorovinyl) benzene (3h)[10]



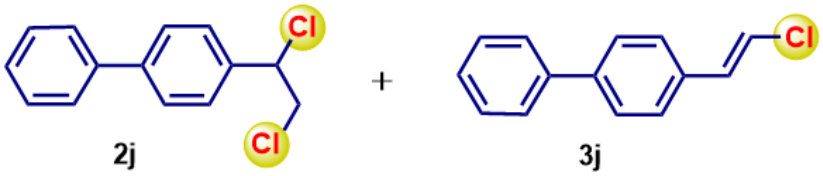
Mixture of **2h** (72%) and **3h** (9%, was not isolated). **2h:** colorless oil (83 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.4 Hz, 2H), 5.00 (t, *J* = 7.2 Hz, 1H), 4.02 – 3.90 (m, 2H), 1.33 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 152.4, 135.1, 127.2, 125.9, 62.0, 48.6, 34.8, 31.4.

4-(1,2-Dichloroethyl)phenyl acetate (2i)[11] and (*E*)-4-(2-chlorovinyl)phenyl acetate (3i)[12]



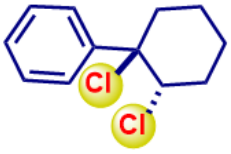
Mixture of **2i** (72%) and **3i** (14%, was not isolated). **2i:** colorless oil (84 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (d, *J* = 8.7 Hz, 2H), 7.12 (d, *J* = 8.7 Hz, 2H), 5.00 (dd, *J* = 7.8, 6.6 Hz, 1H), 3.98 (dd, *J* = 11.4, 6.6 Hz, 1H), 3.89 (dd, *J* = 11.4, 7.8 Hz, 1H), 2.31 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.2, 151.1, 135.5, 128.6, 122.0, 61.2, 48.4, 21.1.

4-(1,2-Dichloroethyl)-1,1'-biphenyl (2j)[11] and (*E*)-4-(2-chlorovinyl)-1,1'-biphenyl (3j)[13]



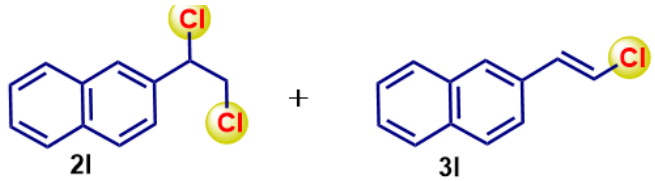
Mixture of **2j** (83%) and **3j** (8%, was not isolated). **2j:** white crystal (105 mg). Mp: 101-103˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 – 7.55 (m, 4H), 7.54 – 7.42 (m, 4H), 7.42 – 7.34 (m, 1H), 5.06 (dd, *J* = 7.9, 6.6 Hz, 1H), 4.11 – 3.92 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.3, 140.4, 137.0, 129.0, 128.0, 127.8, 127.7, 127.3, 61.7, 48.4.

***trans*-1,2-Dichlorocyclohexyl)benzene (2k)[14]**



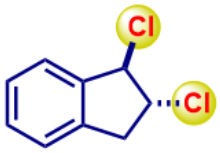
Colorless oil (109 mg, 95%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 – 7.50 (m, 2H), 7.43 – 7.36 (m, 2H), 7.35 – 7.29 (m, 1H), 4.81-4.77 (m, 1H), 2.74 – 2.59 (m, 2H), 2.34 – 2.25 (m, 1H), 2.09 – 1.92 (m, 2H), 1.90 – 1.75 (m, 2H), 1.70 – 1.60 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.1, 128.4, 128.2, 126.1, 73.8, 65.1, 31.1, 30.1, 21.4, 18.6.

2-(1,2-Dichloroethyl)naphthalene (2l)[11] and (*E*)-2-(2-chlorovinyl)naphthalene (3l)[15]



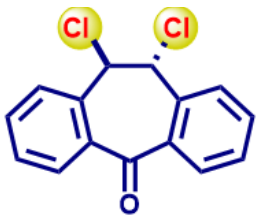
Mixture of **2l** (80%) and **3l** (8%, was not isolated). **2l:** white crystal (90 mg). Mp: 66-67 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 – 7.84 (m, 4H), 7.58 – 7.49 (m, 3H), 5.19 (dd, *J* = 8.0, 6.6 Hz, 1H), 4.15 – 4.00 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 135.2, 133.6, 133.0, 129.1, 128.3, 127.9, 127.4, 127.0, 126.8, 124.3, 62.2, 48.3.

***trans*-1,2-Dichloro-2,3-dihydro-1H-indene (2m)[8]**



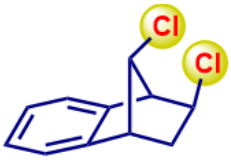
Colorless oil (81 mg, 87%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 – 7.44 (m, 1H), 7.40 – 7.27 (m, 3H), 5.36 (d, *J* = 3.0 Hz, 1H), 4.67 (dt, *J* = 6.1, 3.2 Hz, 1H), 3.71 (dd, *J* = 16.8, 6.1 Hz, 1H), 3.19 (dd, *J* = 16.7, 3.4 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.0, 129.8, 128.1, 125.6, 125.2, 67.8, 64.6, 40.9.

***trans*-10,11-Dichloro-10,11-dihydro-5H-dibenzo[a,d][7]annulen-5-one (2n)[16]**



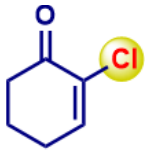
Brown crystal (94 mg, 91%). Mp: 188-191 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (dd, *J* = 7.7, 1.5 Hz, 2H), 7.57 (dt, *J* = 7.4, 1.5 Hz, 2H), 7.50 (dt, *J* = 7.6, 1.4 Hz, 2H), 7.43 (dd, *J* = 7.5, 1.2 Hz, 2H), 5.58 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 192.8, 137.9, 135.3, 132.9, 131.4, 131.2, 129.8, 62.4.

***(1R (S),2S(R),4R(S),9R(S))*-2,9-dichloro-1,2,3,4-tetrahydro-1,4-methanonaphthalene (2o)[16]**



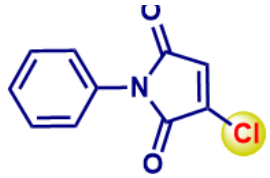
White crystal (101 mg, 95%). Mp: 48-49 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 – 7.14 (m, 4H), 4.13 – 4.09 (m, 1H), 3.86 (ddd, *J* = 7.9, 4.3, 1.1 Hz, 1H), 3.66 – 3.63 (m, 1H), 3.53 – 3.49 (m, 1H), 2.70 (dt, A part of AB system, *J* = 13.2, 4.0 Hz, 1H), 2.19 (dd, B part of AB system, *J* = 13.2, 7.9 Hz, 1H).^{13}C NMR (101 MHz, $CDCl_3$) δ 143.9, 142.3, 128.0, 127.4, 122.0, 122.0, 66.4, 56.9, 56.9, 50.6, 36.4.

2-Chlorocyclohex-2-en-1-one (3p)[14]



White crystal (61 mg, 94%). Mp: 60-71 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.14 (t, *J* = 4.5 Hz, 1H), 2.62 – 2.57 (m, 2H), 2.50 – 2.45 (m, 2H), 2.10 – 2.01 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 191.7, 146.8, 132.3, 38.6, 27.2, 22.7.

3-Chloro-1-phenyl-1H-pyrrole-2,5-dione (3q)[17]



White crystal (84 mg, 81%). Mp: 164-165 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 – 7.44 (m, 2H), 7.42 – 7.37 (m, 1H), 7.36 – 7.31 (m, 2H), 6.82 – 6.75 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.8, 164.0, 141.4, 131.0, 129.4, 128.5, 126.9, 126.2.

***trans*-2,3-Dichloro-2,3-dihydrobenzofuran (2r)[18]**

Colorless viscous (81 mg, 86%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 7.6 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 1H), 7.13 (t, *J* = 7.5 Hz, 1H), 7.05 (d, *J* = 8.1 Hz, 1H), 6.51 (s, 1H), 5.48 (s, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 157.6, 131.8, 126.1, 125.1, 123.9, 112.2, 98.3, 64.2.

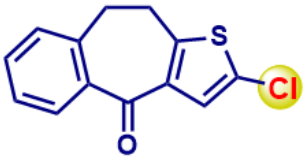
3-Chloro-1-tosyl-1H-indole (3s)[19]

White crystal (152 mg, 89%). Mp: 122-123 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.3 Hz, 1H), 7.77 (d, *J* = 8.4 Hz, 2H), 7.59 – 7.52 (m, 2H), 7.38 (dt, *J* = 7.8, 1.2 Hz, 1H), 7.31 (dt, *J* = 7.8, 0.9 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 2H), 2.34 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.5, 134.9, 134.2, 130.1, 128.5, 127.0, 125.9, 123.9, 122.5, 119.2, 114.0, 113.9, 21.8.

3-Chlorobenzo[b]thiophene (3t)[20]

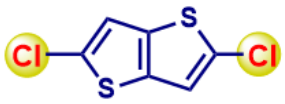
Colorless oil (96 mg, 81%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 – 7.80 (m, 2H), 7.52 – 7.38 (m, 2H), 7.32 (s, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 138.52, 136.23, 125.46, 124.98, 123.03, 121.97, 121.28, 120.88, 77.48, 77.16, 76.84.

2-Chloro-9,10-dihydro-4H-benzo[4,5]cyclohepta[1,2-b]thiophen-4-one (3u)



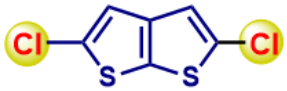
Brown viscous (116 mg, 93%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.48 – 7.40 (m, 2H), 7.35 (dt, *J* = 7.7, 1.2 Hz, 1H), 7.22 (d, *J* = 7.4 Hz, 1H), 3.23 – 3.17 (m, 2H), 3.16 – 3.09 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 186.7, 151.5, 139.5, 138.5, 138.4, 132.6, 130.8, 129.4, 128.9, 127.4, 126.2, 35.3, 29.2. HRMS (ESI) m/z: $[M + H]^+$ calcd for $C_{13}H_{10}ClOS$: 249.0141, found: 249,0132.

2,5-Dichlorothieno[3,2-b]thiophene (3v)[21]



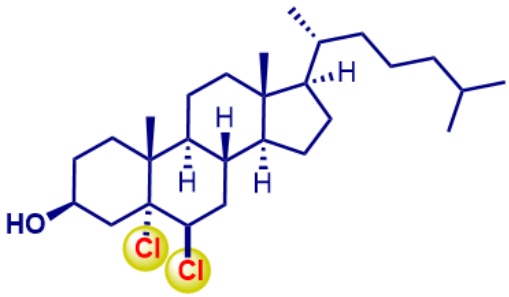
White crystal (95 mg, 91%). Mp: 99-100 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.03 (s, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 134.6, 131.0, 118.7.

2,5-Dichlorothieno[2,3-b]thiophene (3w)



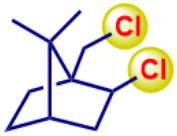
White crystal (92 mg, 88%). Mp: 54-55 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.01 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.2, 131.4, 131.1, 119.5. HRMS (APCI): m/z $[M]^+$ calcd for $C_6H_2Cl_2S_2$: 207.8969, found: 207.8968.

Dichloro-cholesterol (2x)[22]



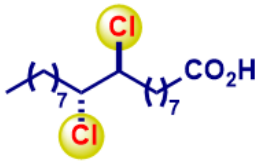
White crystal (146 mg, 64%). Mp: 140-142 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.89 (d, *J* = 4.1 Hz, 1H), 4.77 (dd, *J* = 11.8, 4.8 Hz, 1H), 4.64 – 4.49 (m, 1H), 2.20 – 0.82 (m, 59H), 0.63 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 86.7, 67.3, 67.1, 61.4, 56.1, 55.7, 47.5, 43.5, 42.9, 39.6, 39.5, 37.9, 36.2, 35.9, 35.6, 32.4, 28.3, 28.2, 26.6, 24.1, 23.9, 22.9, 22.7, 20.7, 18.8, 18.3, 12.2.

***(1S,2S,4S)*-2-Chloro-1-(chloromethyl)-7,7-dimethylbicyclo[2.2.1]heptane (2y)[23,24]**



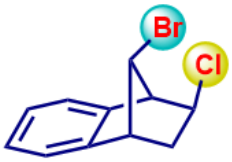
Colorless oil (27 mg, 69%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.18 (dd, *J* = 8.5, 4.5 Hz, 1H), 3.95 (d, *J* = 10.8 Hz, 1H), 3.52 (d, *J* = 10.8 Hz, 1H), 2.28 – 2.20 (m, 1H), 2.08 (dd, *J* = 14.0, 8.5 Hz, 1H), 1.93 – 1.70 (m, 3H), 1.55 – 1.45 (m, 1H), 1.20 – 1.14 (m, 4H), 0.93 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) 64.3, 54.3, 48.9, 47.6, 46.1, 41.8, 33.0, 26.6, 21.1, 20.4.

trans-9,10-Dichlorooctadecanoic acid (2z)[25]



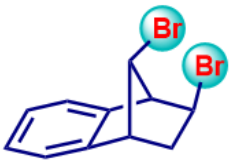
White viscous (134 mg, 95%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.03 (dd, *J* = 8.8, 3.2 Hz, 2H), 2.35 (t, *J* = 7.5 Hz, 2H), 2.01 – 1.19 (m, 26H), 0.88 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 180.2, 65.8, 65.7, 34.54, 34.50, 34.1, 32.0, 29.5, 29.4, 29.2 (2C), 29.0, 28.9, 26.9, 26.8, 24.7, 22.8, 14.3.

(1R(S),2S(R),4R(S),9R(S))-9-bromo-2-chloro-1,2,3,4-tetrahydro-1,4-methanonaphthalene (2ab)



Yellowish viscous (116 mg, 90%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 – 7.12 (m, 4H), 4.16 – 4.13 (m, 1H), 3.87 (ddd, *J* = 8.1, 4.4, 1.3 Hz, 1H), 3.69 (bs, 1H), 3.56 – 3.52 (m, 1H), 2.76 (dt, A part of AB system, *J* = 13.1, 4.0 Hz, 1H), 2.21 (dd, B part of AB system, *J* = 13.1, 8.1 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.2, 142.7, 128.0, 127.4, 121.9, 121.7, 57.1, 56.9, 55.5, 51.0, 36.7. HRMS (ESI) m/z: $[M - HCl + H]^+$ calcd for $C_{11}H_{10}Br$: 220.9960, found: 220.9957.

(1R,2S,4R,9R)-2,9-dibromo-1,2,3,4-tetrahydro-1,4-methanonaphthalene (2ac)[16,26]



White crystal (137 mg, 91%). Mp: 77-78 ˚C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 – 7.11 (m, 4H), 4.16 – 4.15 (m, 1H), 3.80 (ddd, *J* = 8.0, 4.6, 1.3 Hz, 1H), 3.76 (bs, 1H), 3.54 – 3.49 (m, 1H), 2.87 (dt, A part of AB system, *J* = 13.4, 4.2 Hz, 1H), 2.21 (dd, B part of AB system, *J* = 13.4, 8.0 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.7, 143.1, 128.0, 127.5, 122.0, 121.5, 56.6, 55.7, 51.2, 45.3, 36.8.

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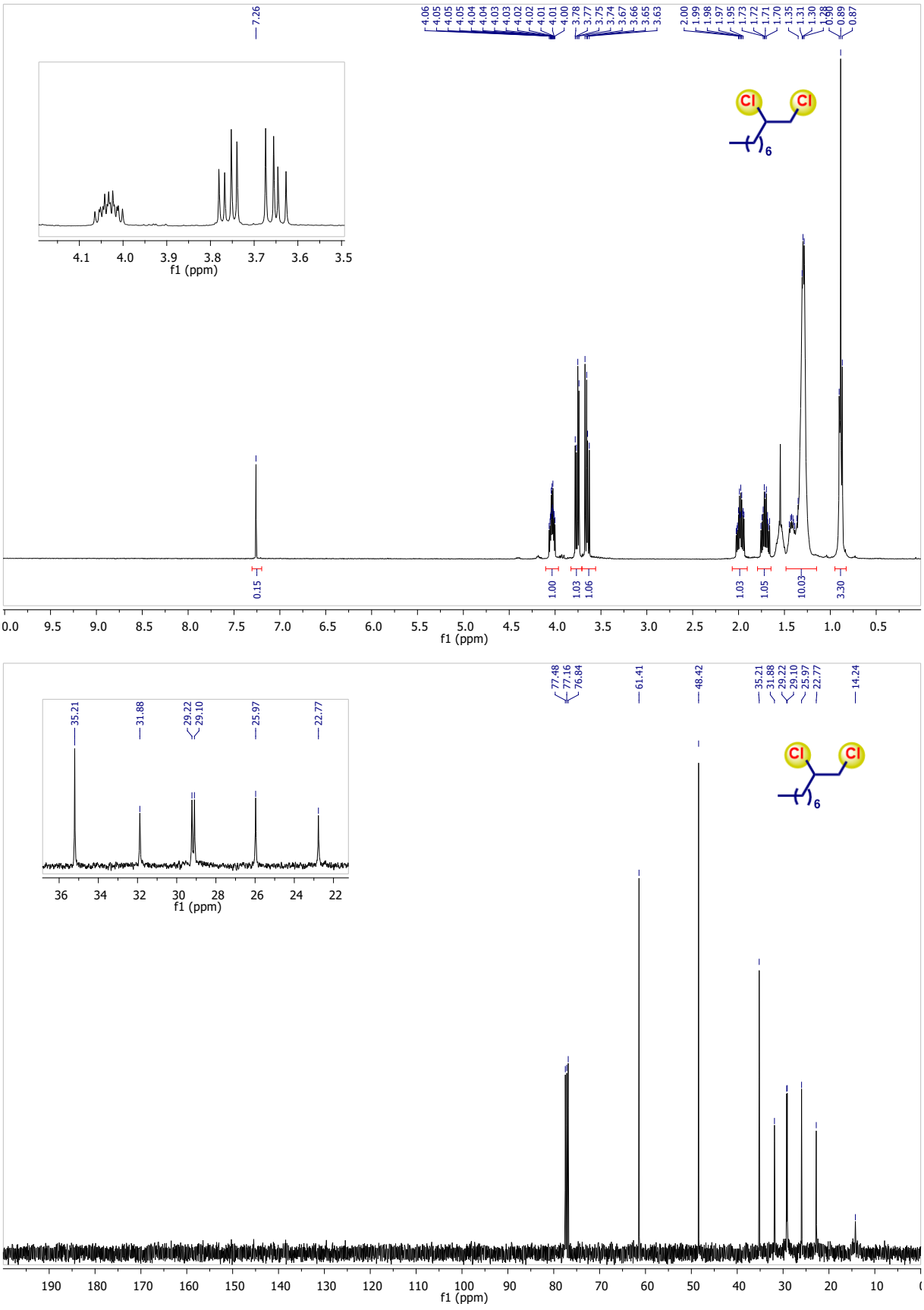
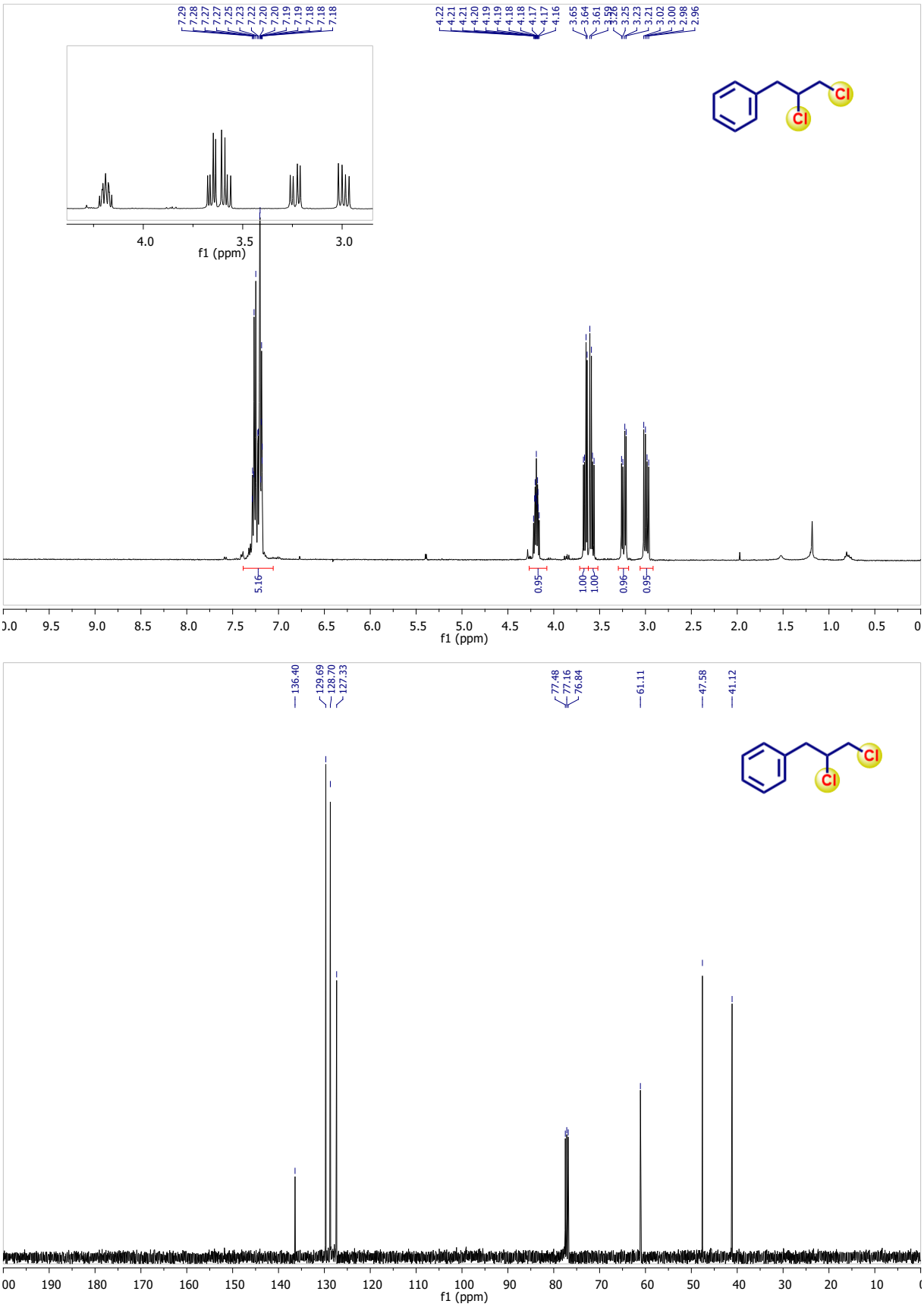
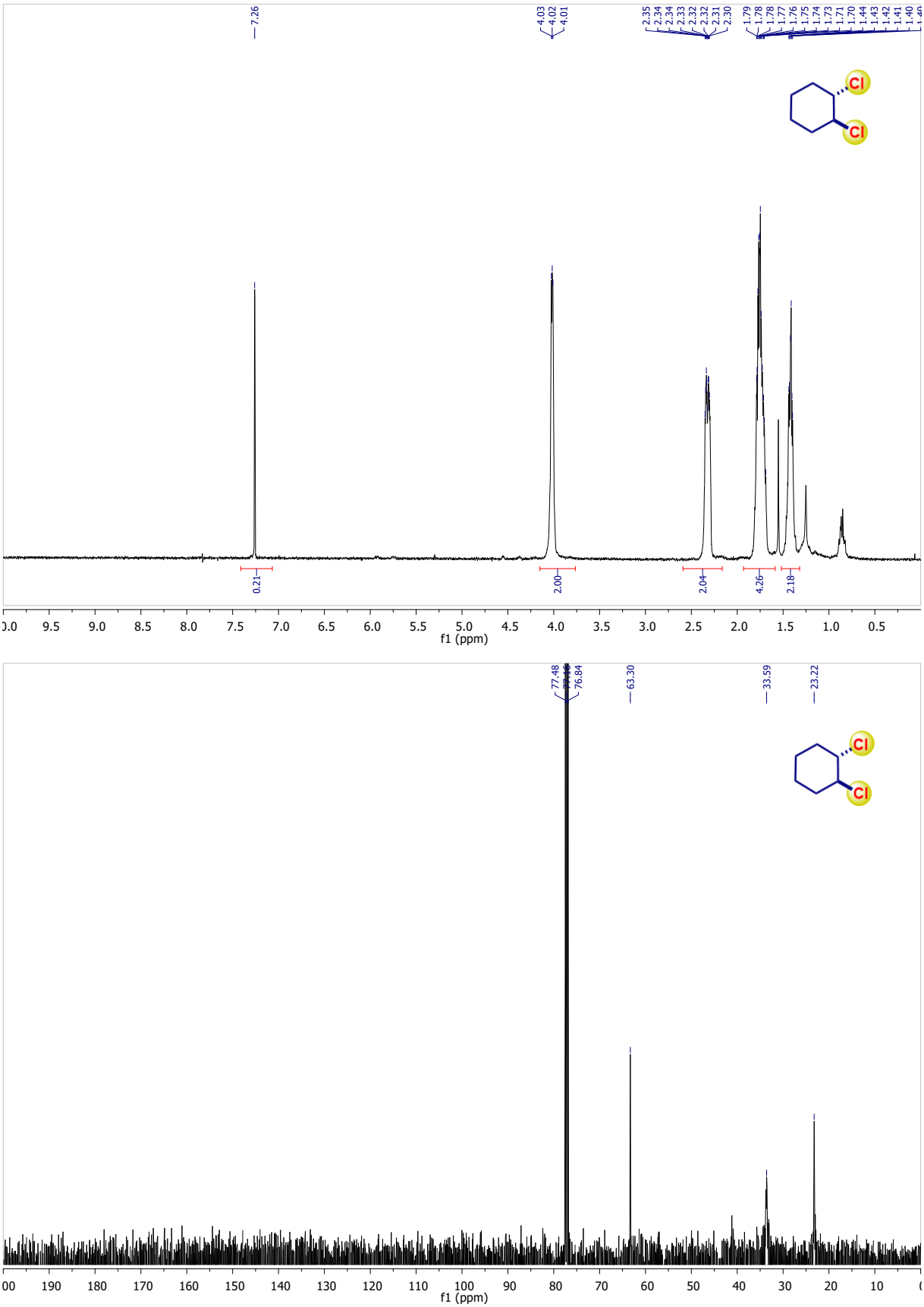
^{1}H NMR, ^{13}C NMR, and HRMS Spectra



400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2a** ($CDCl_3$)



400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2b** ($CDCl_3$)



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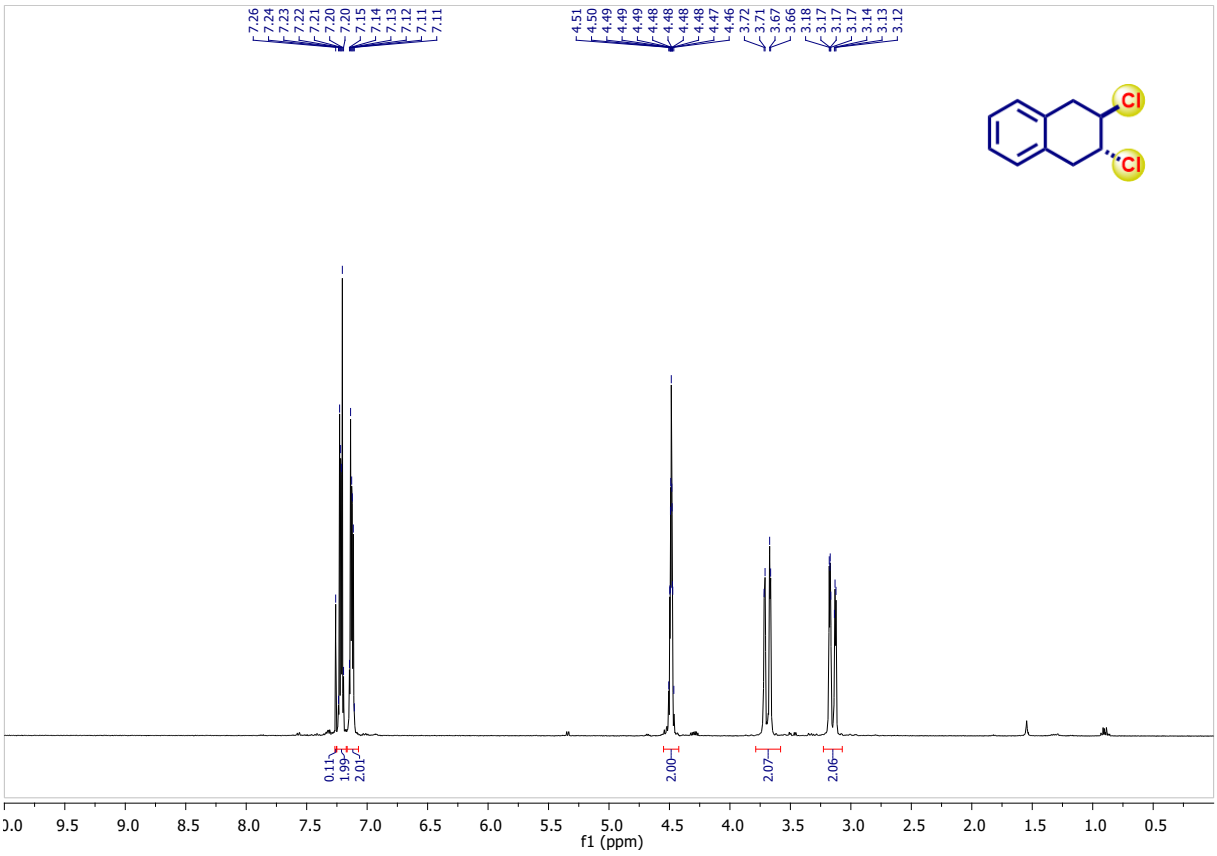

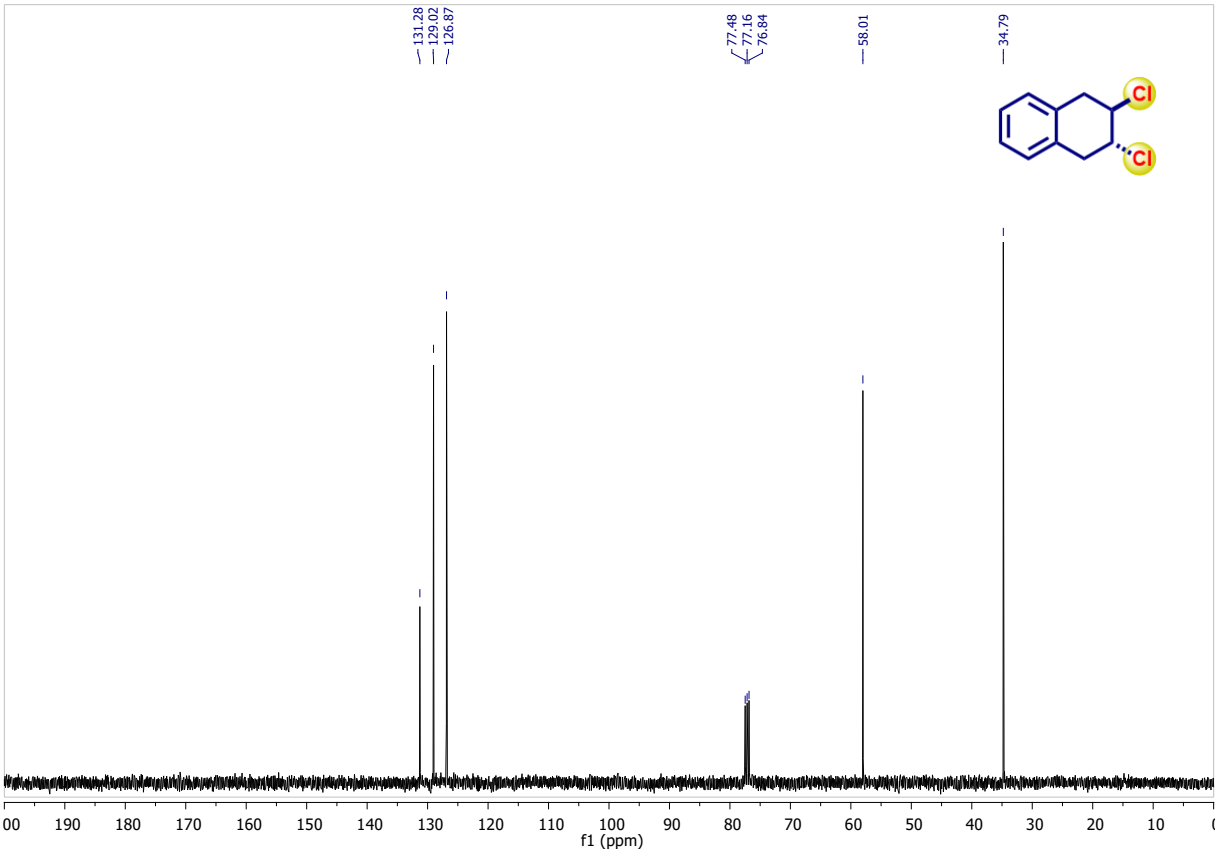

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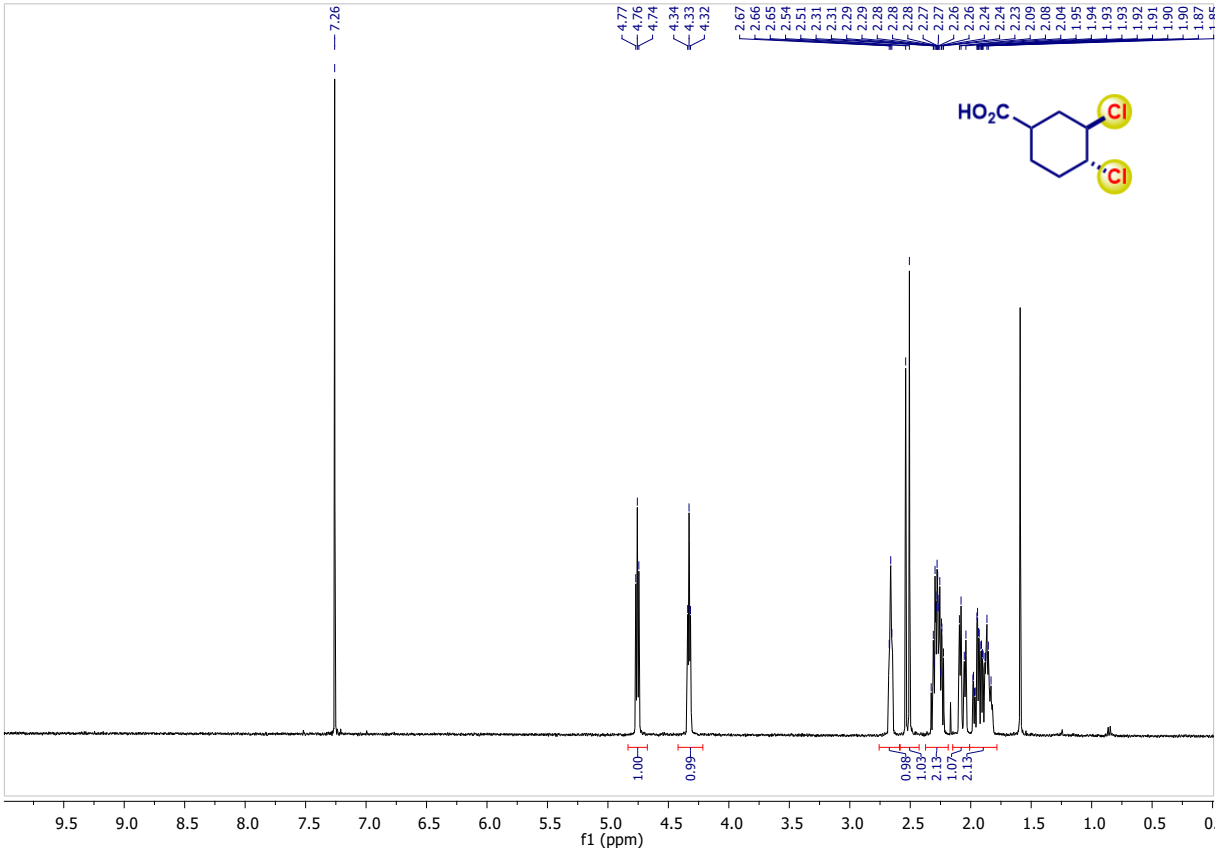

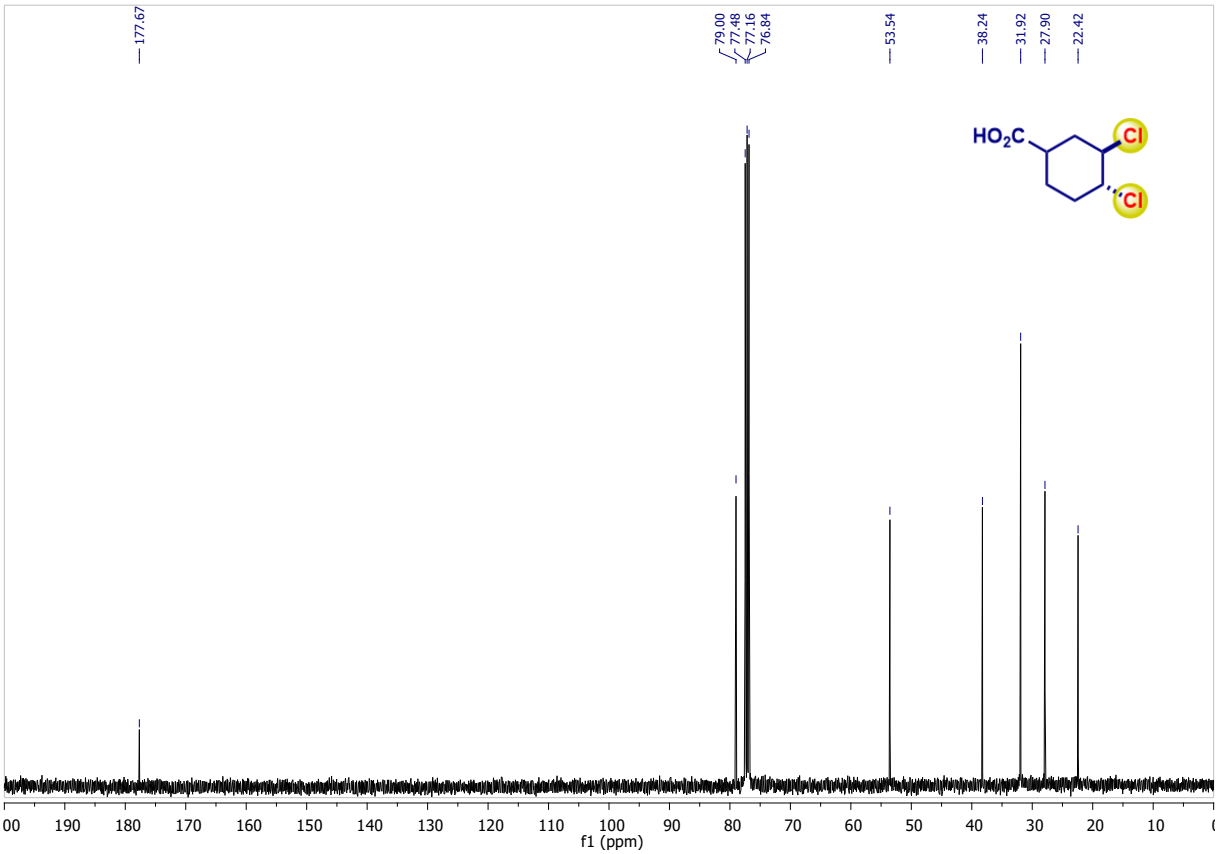

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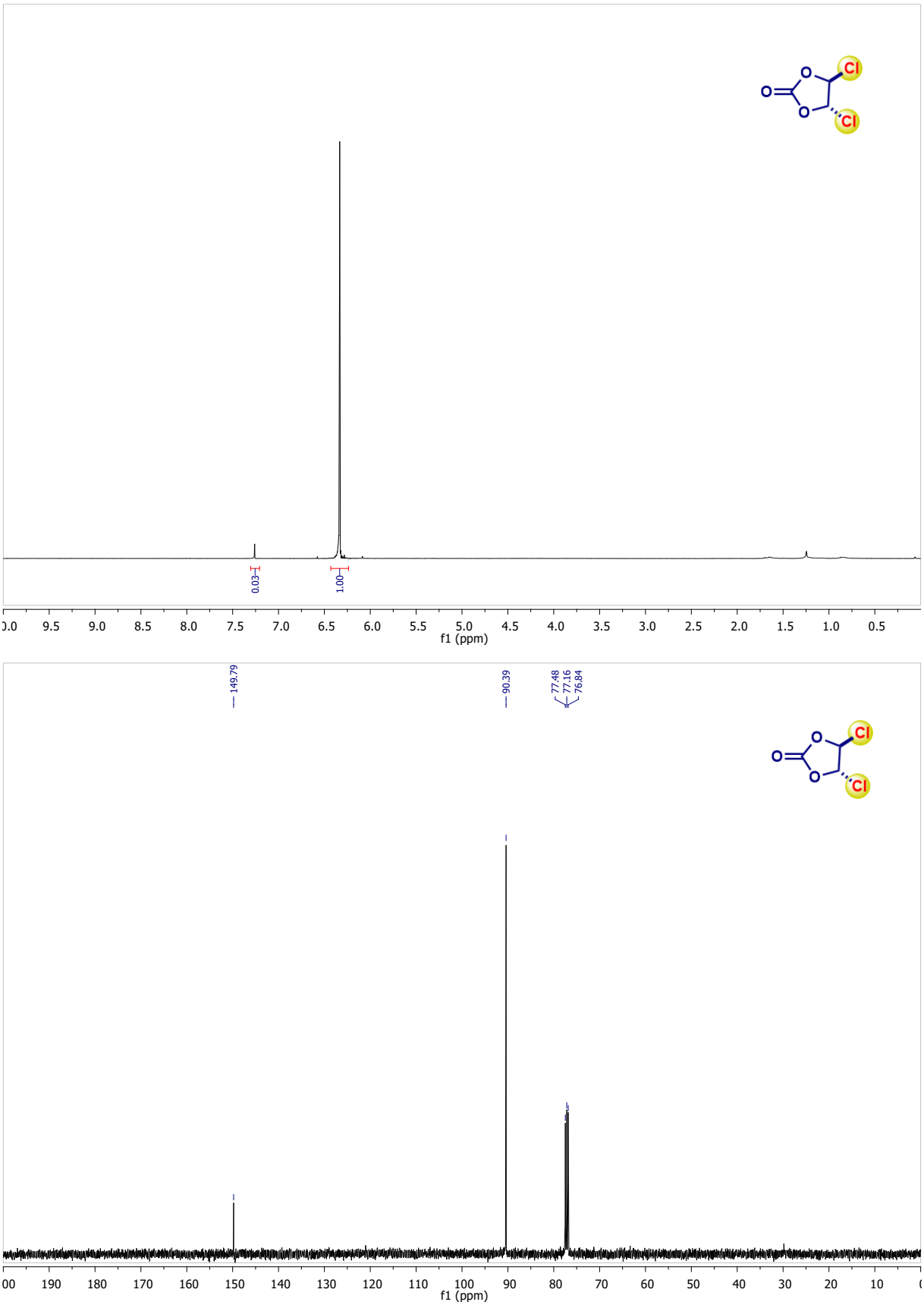

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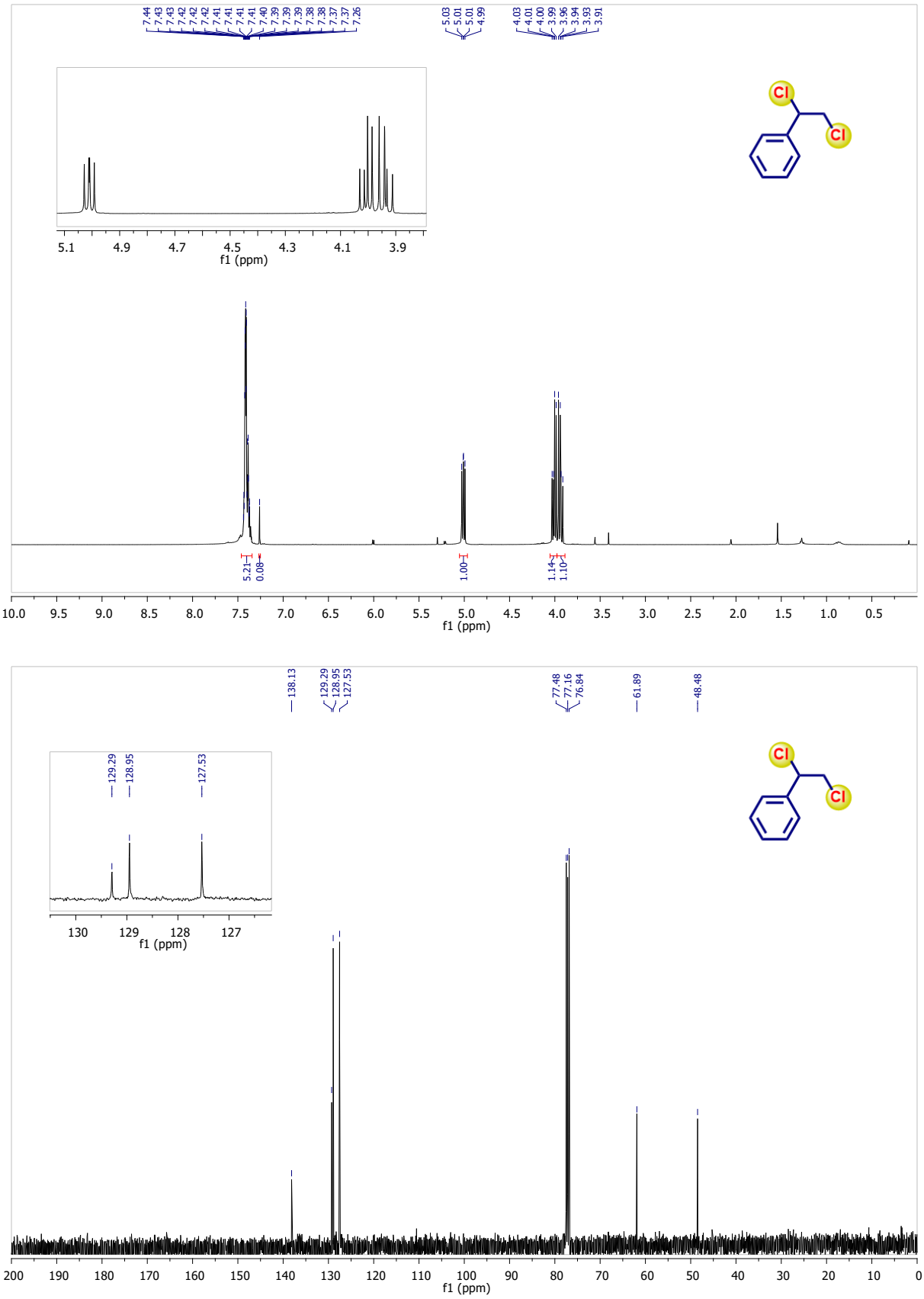

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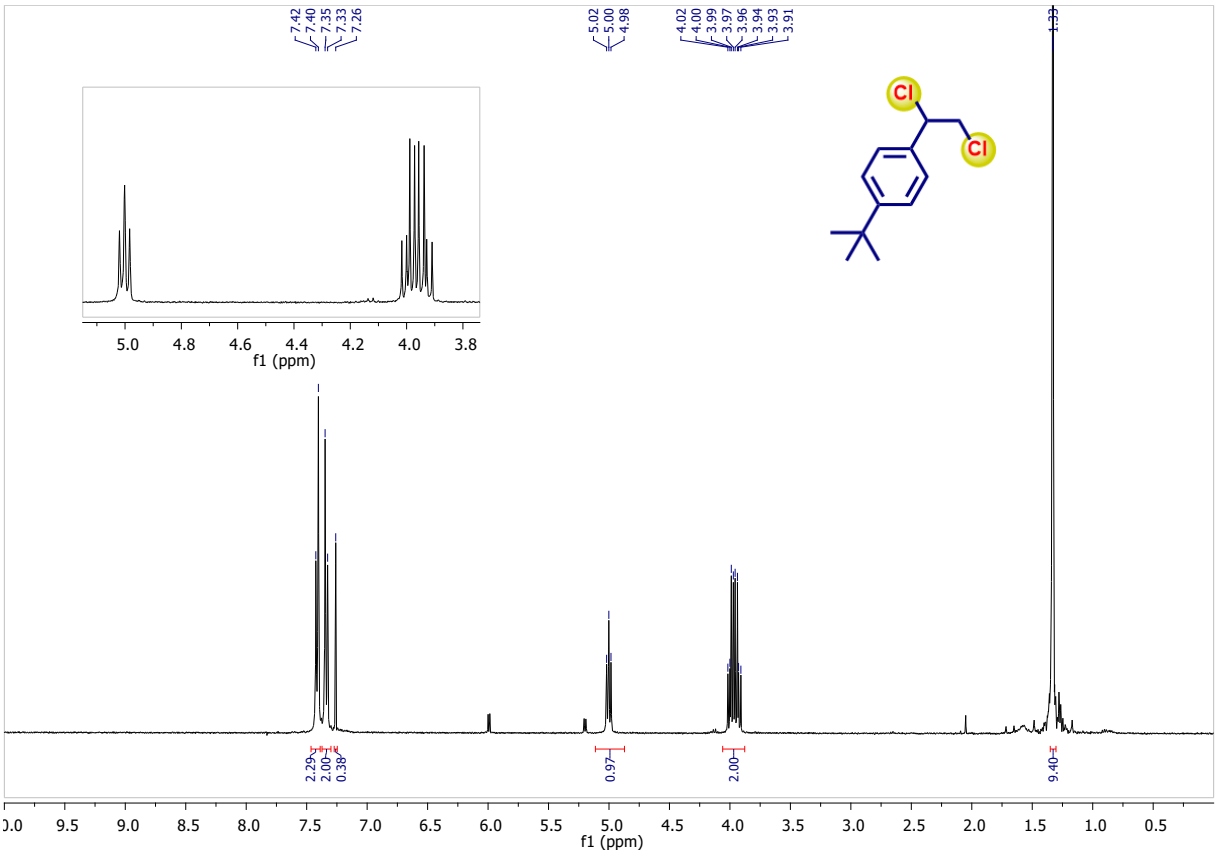

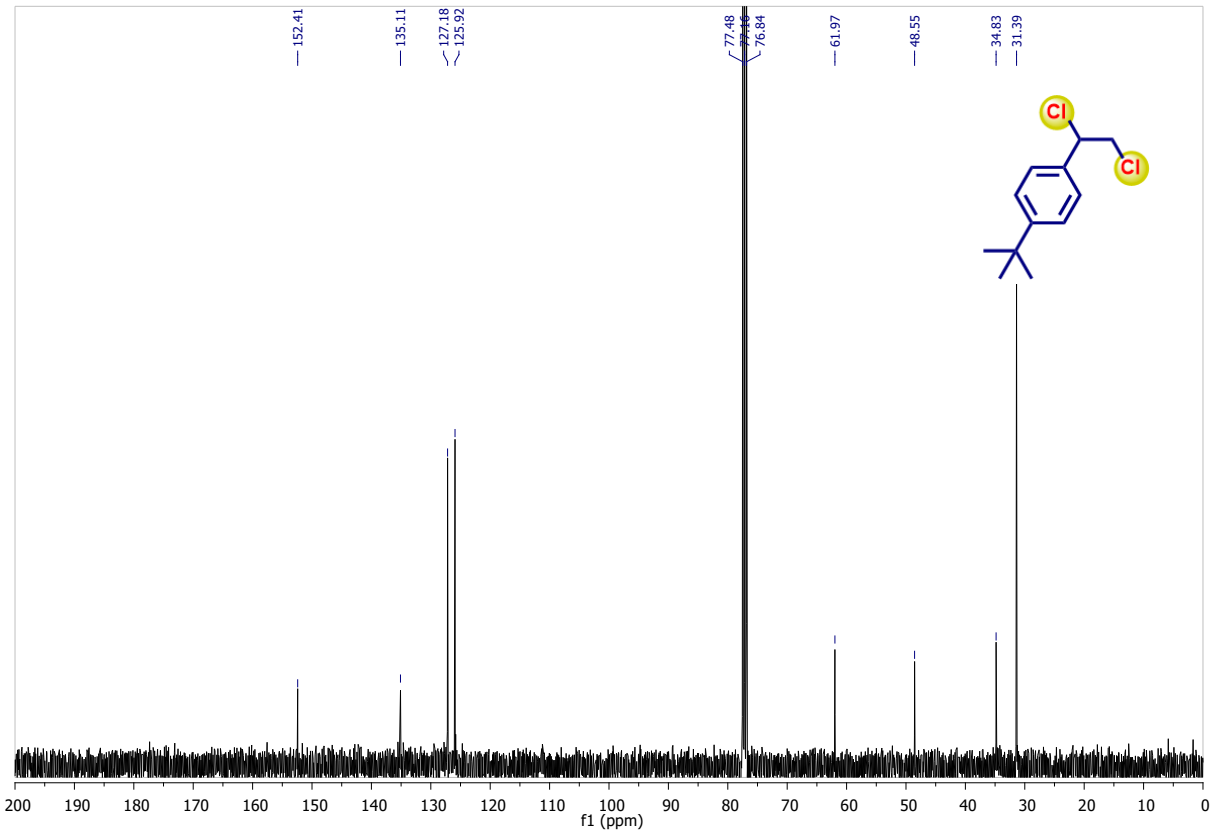

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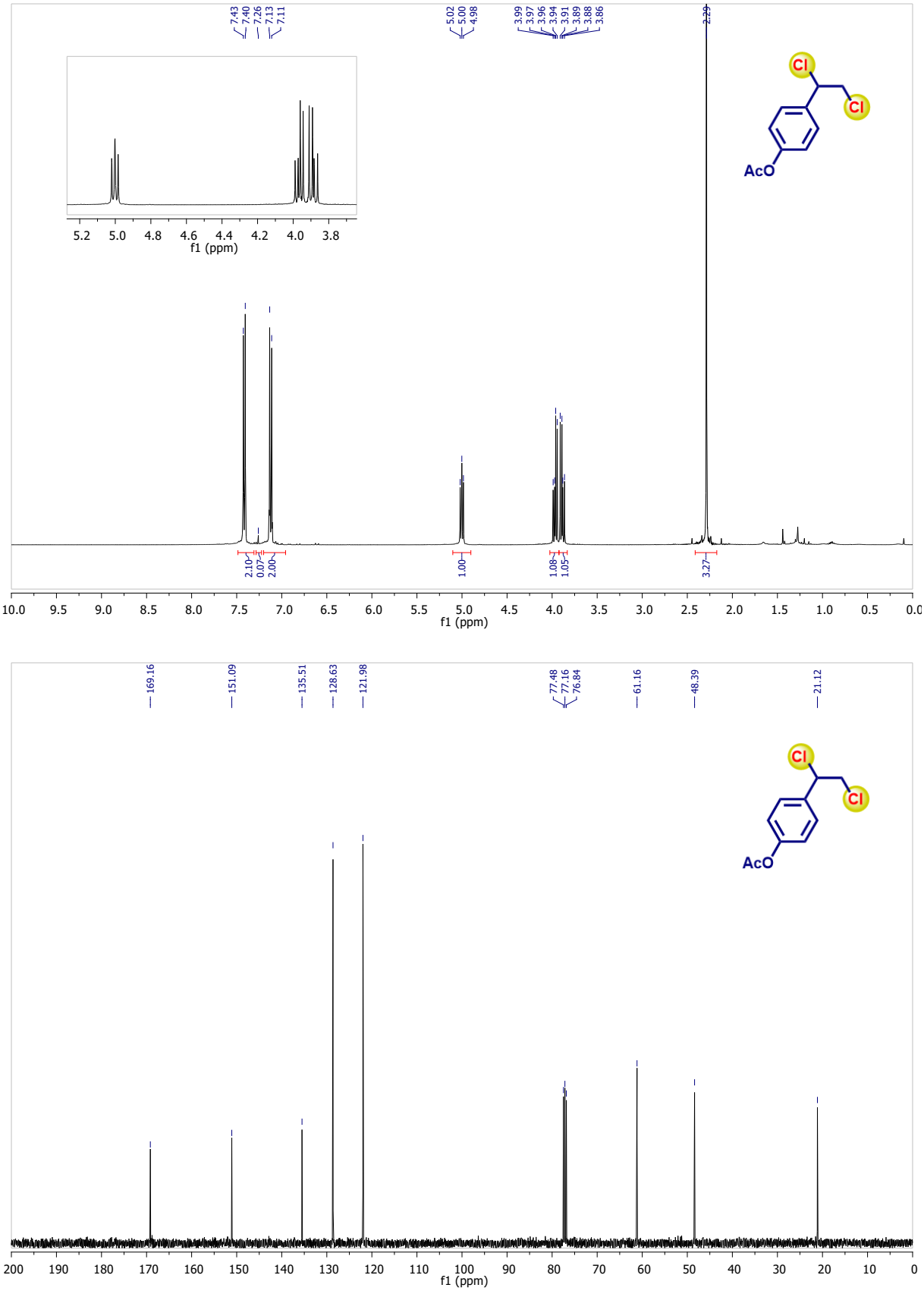

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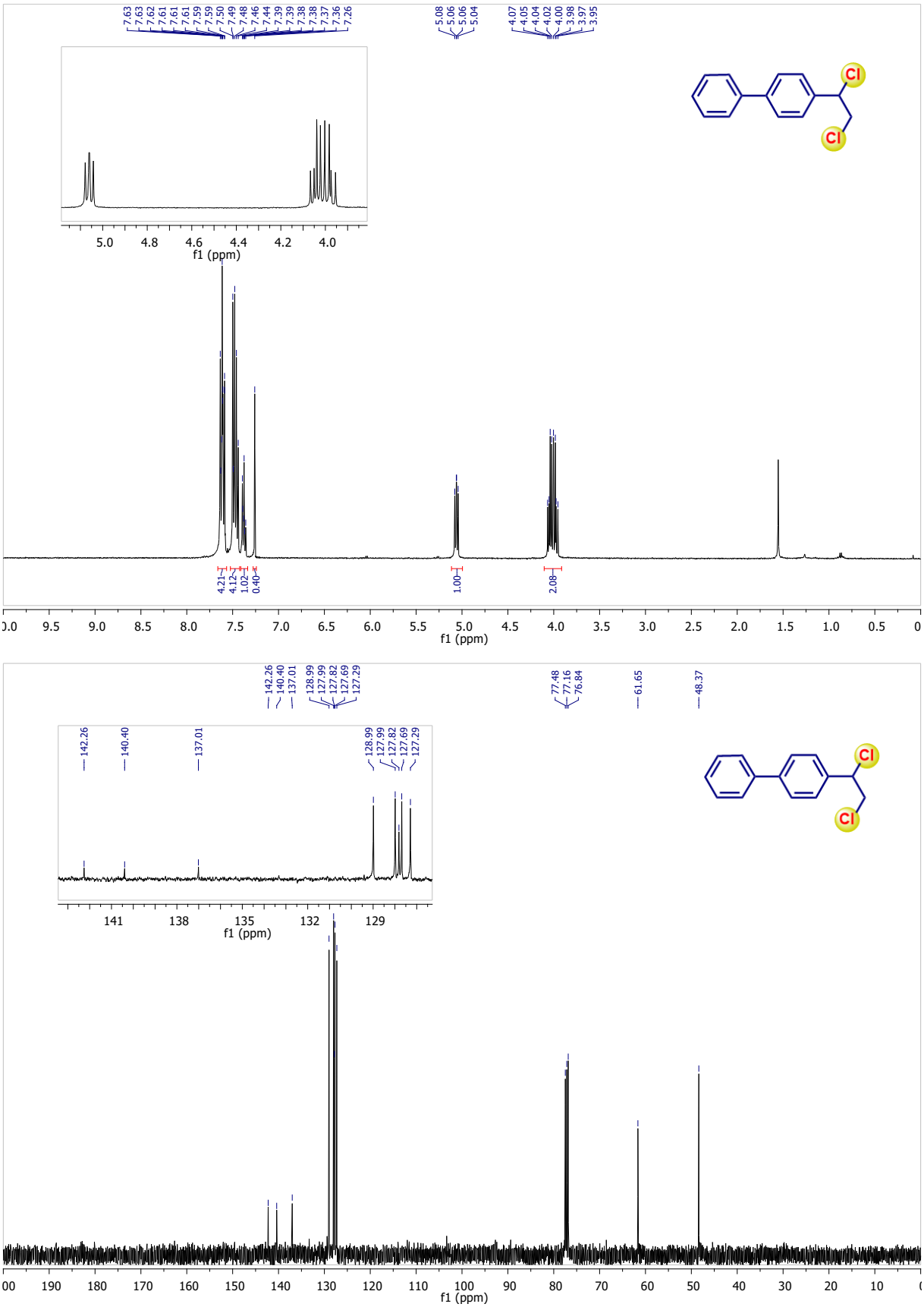

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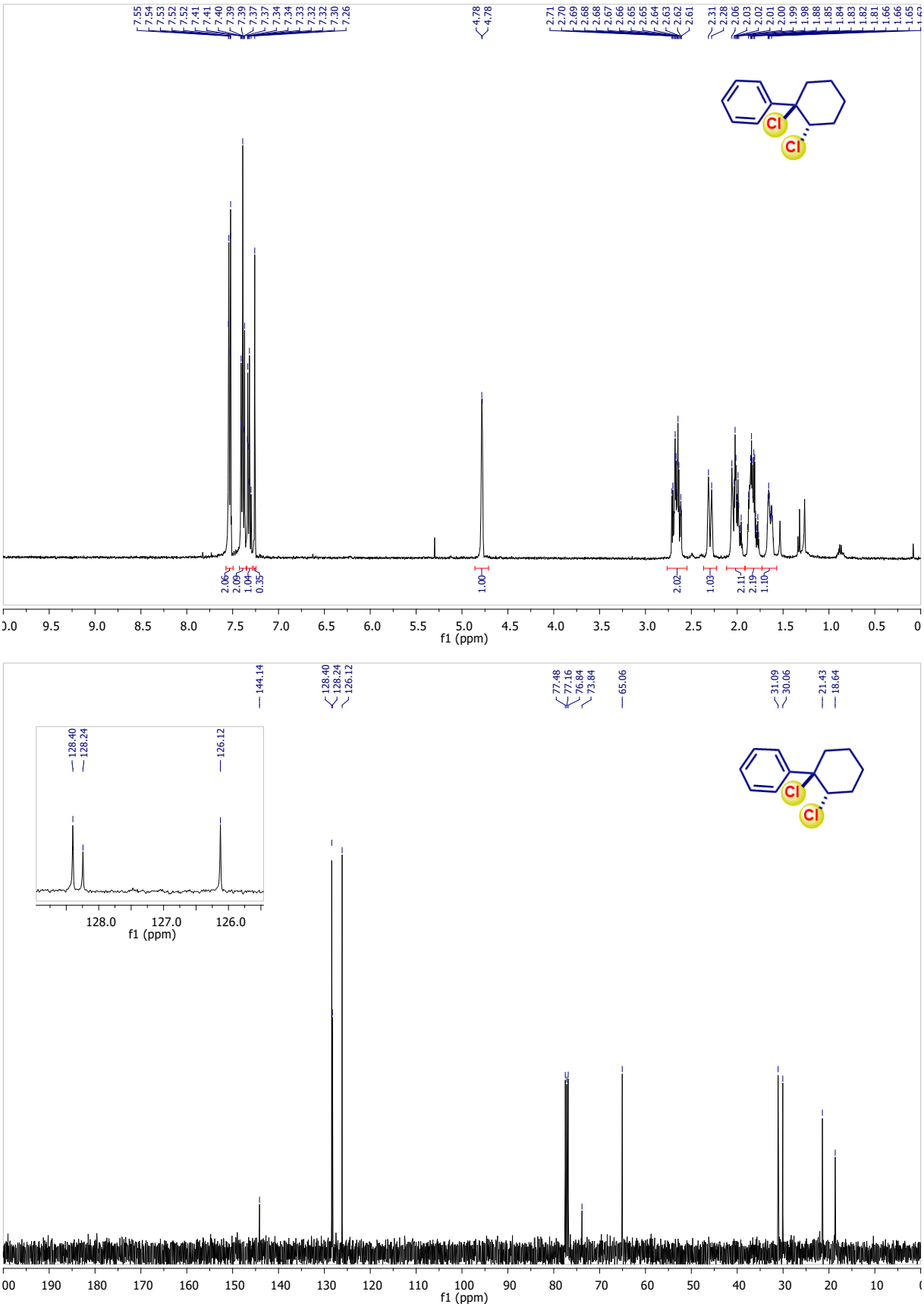

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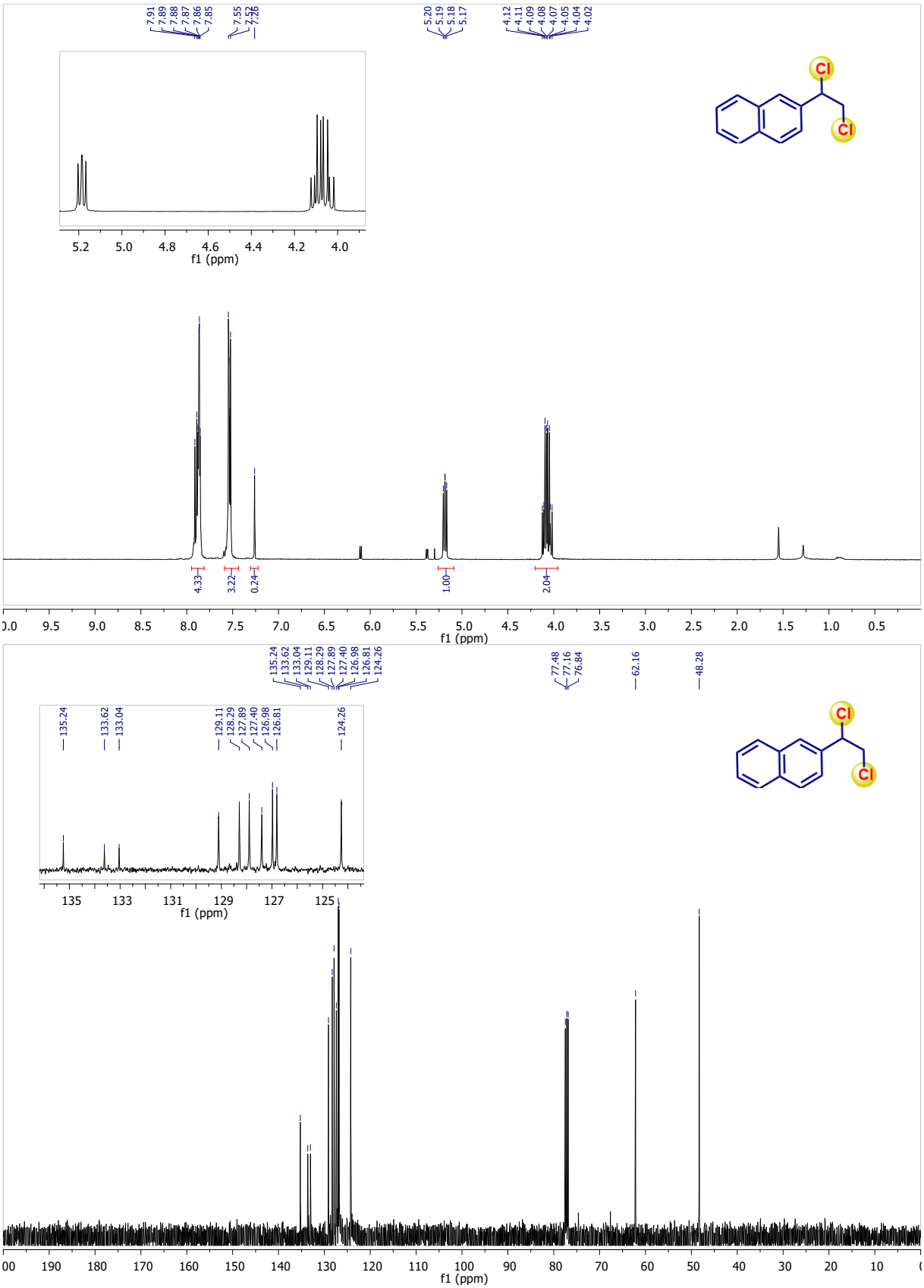

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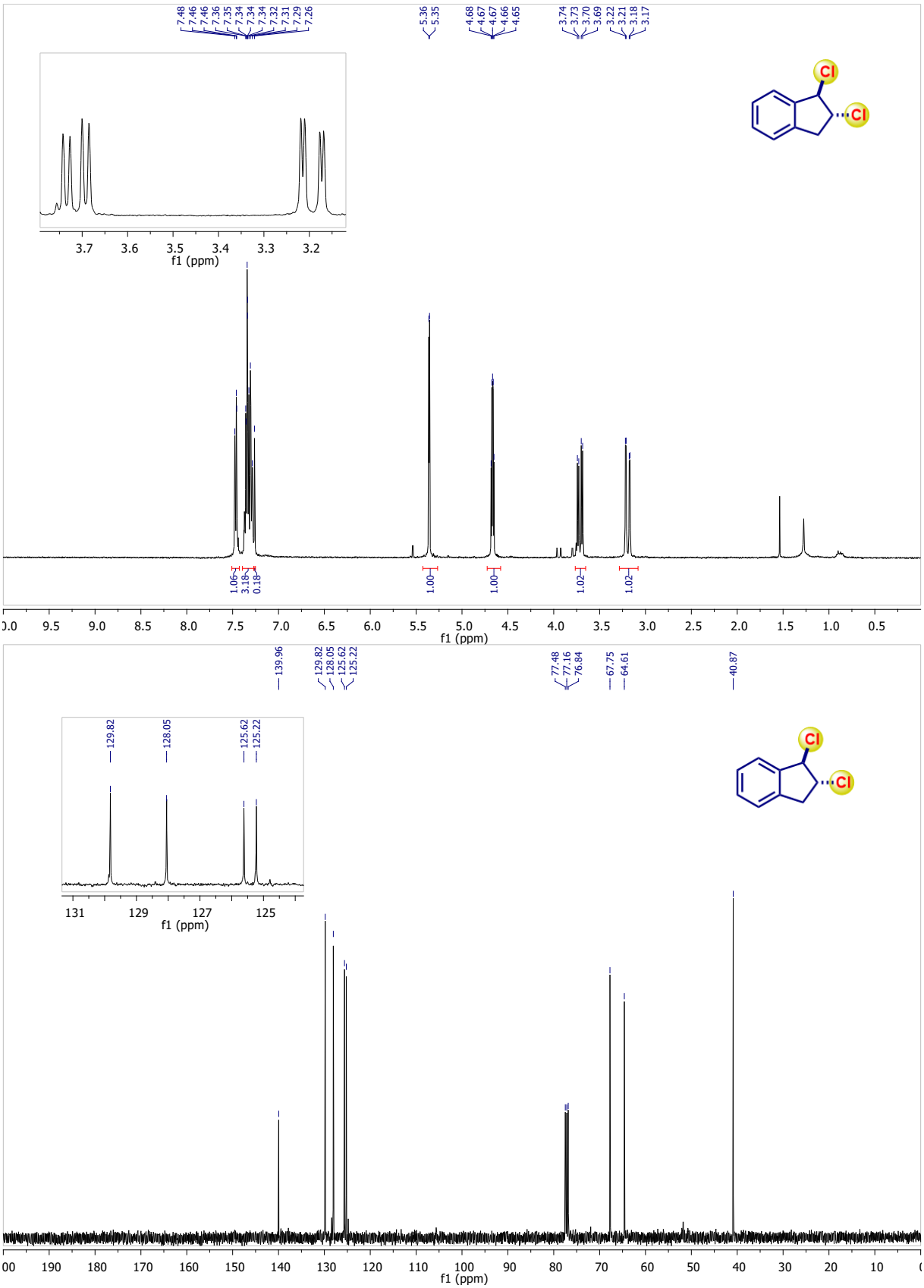

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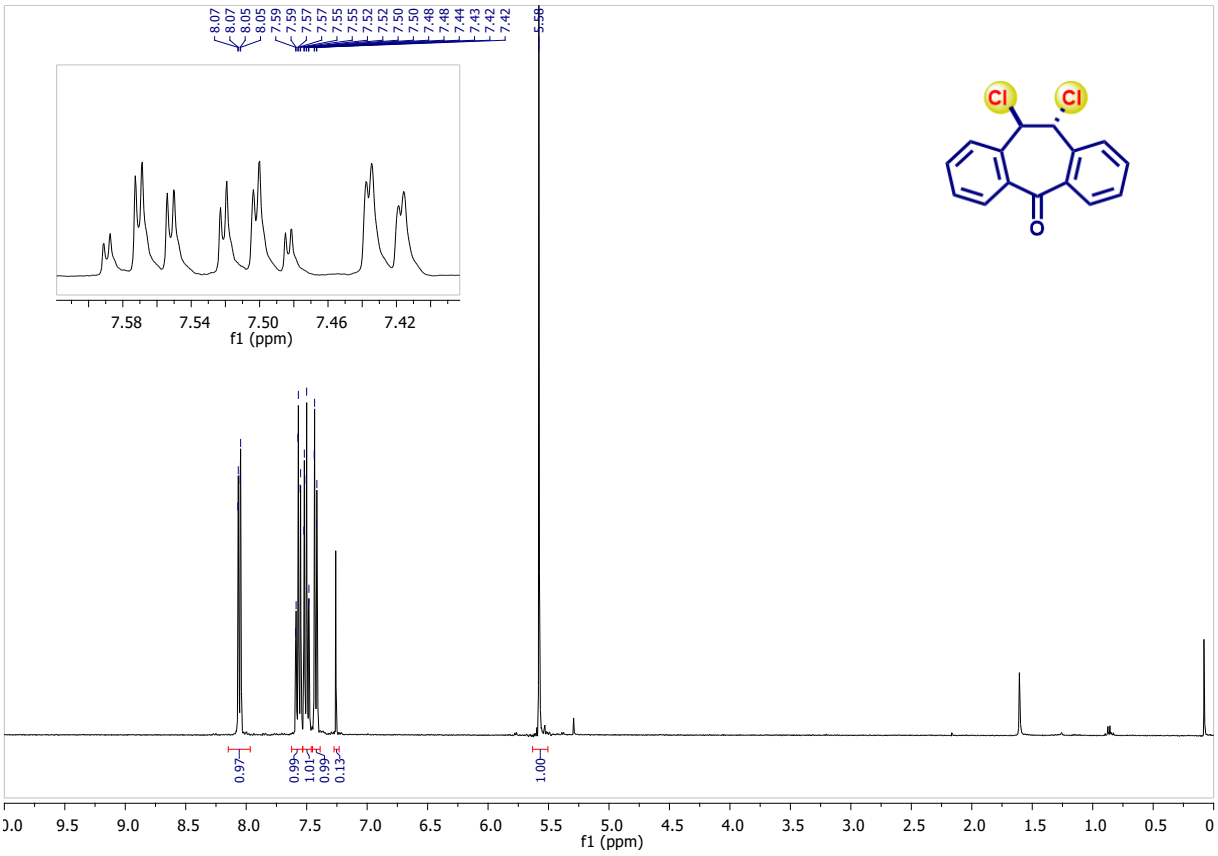

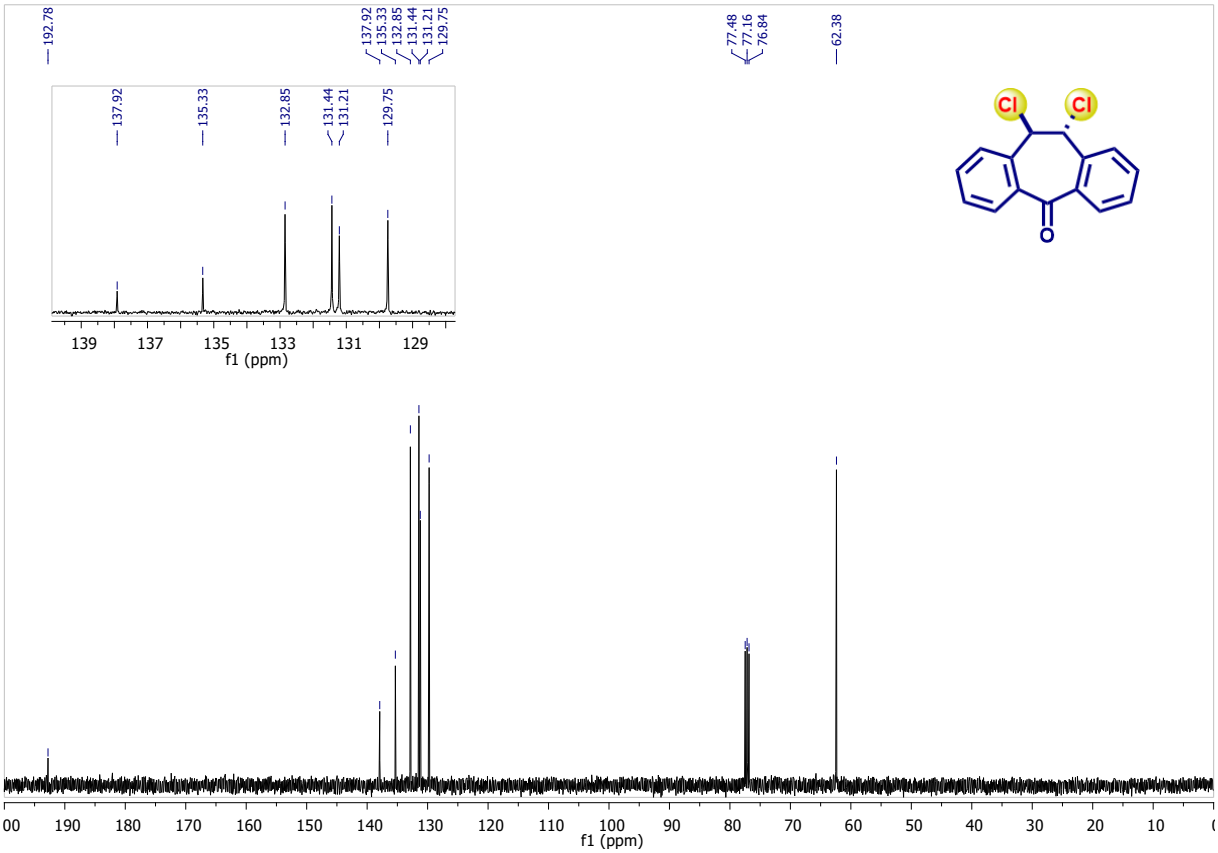

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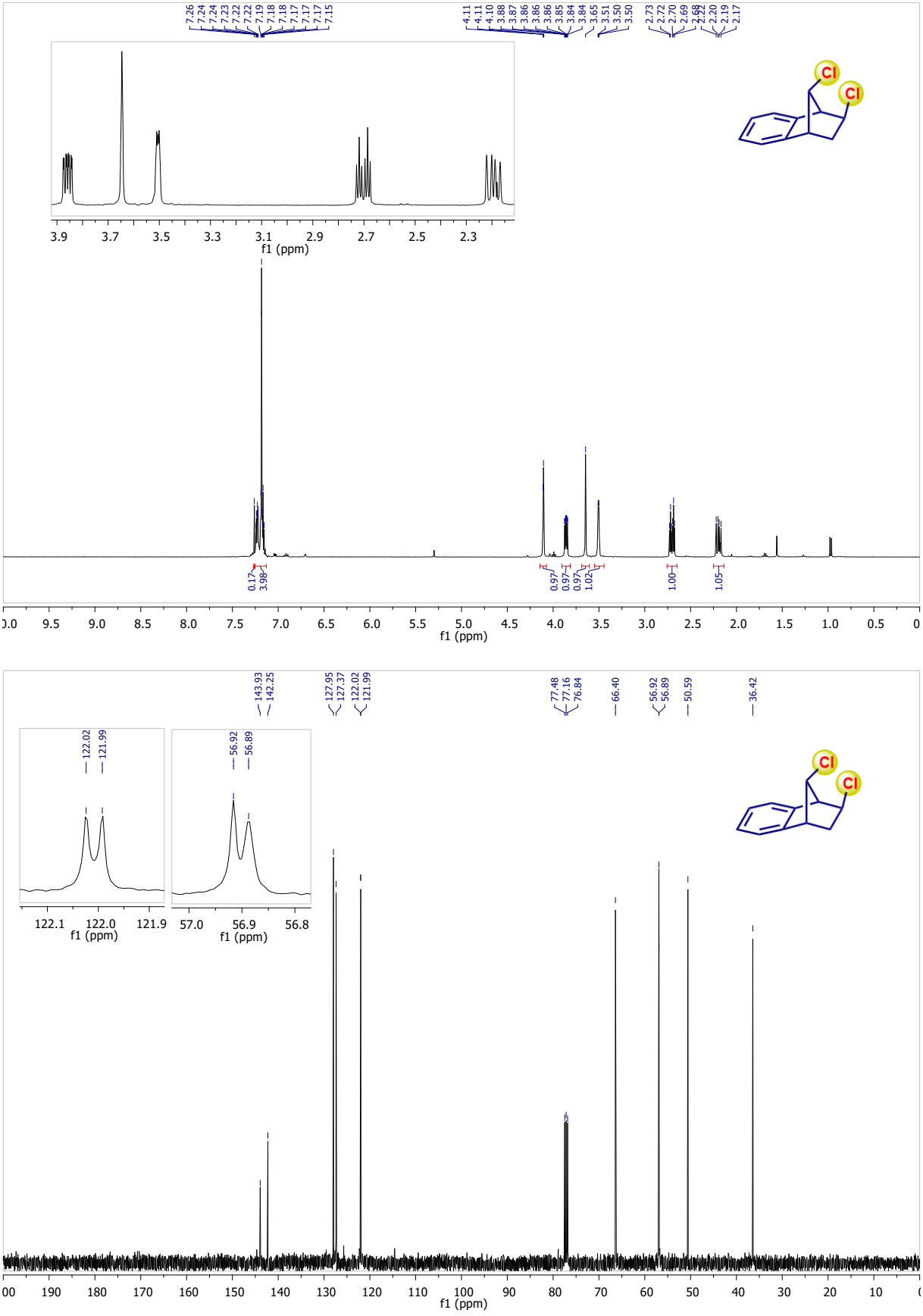

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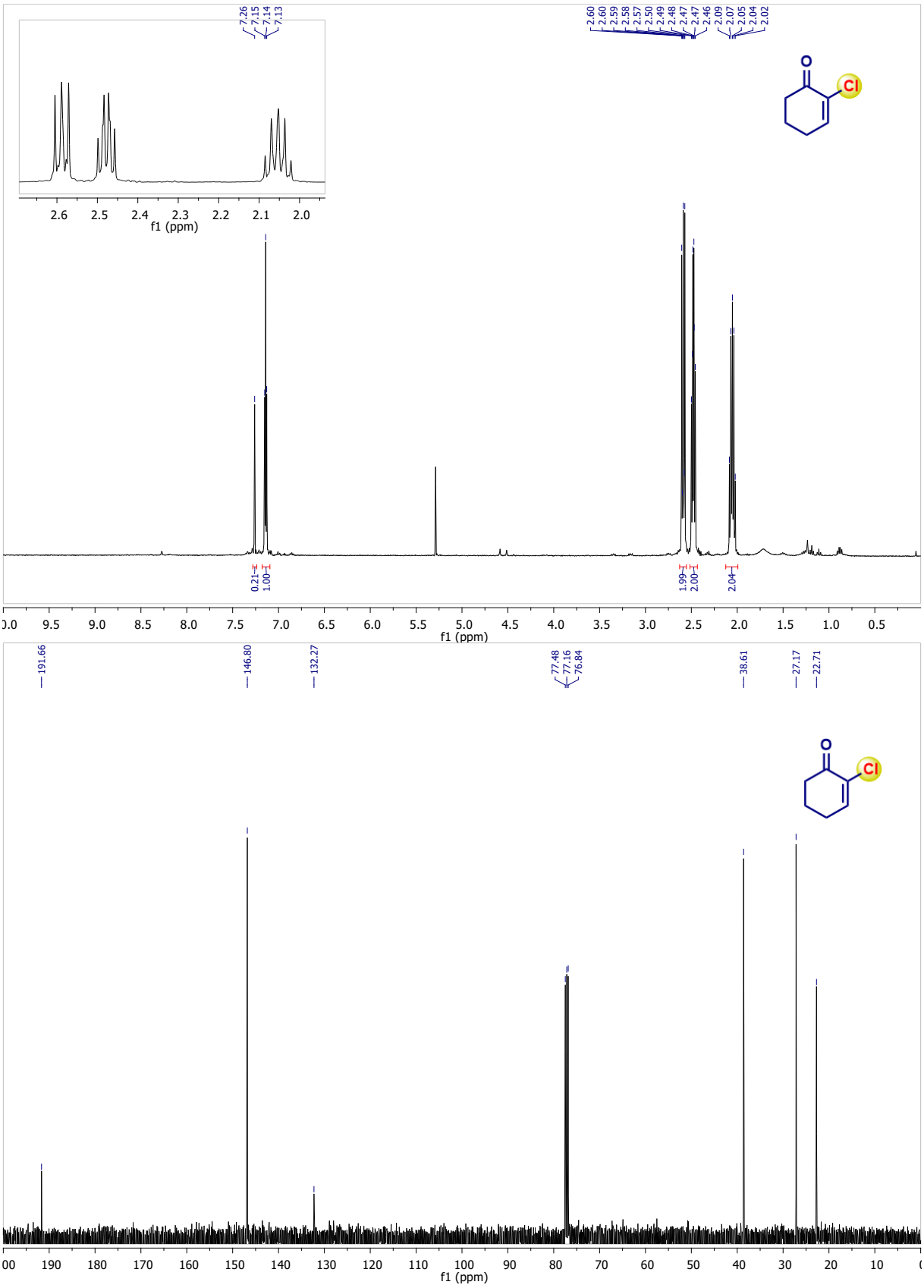

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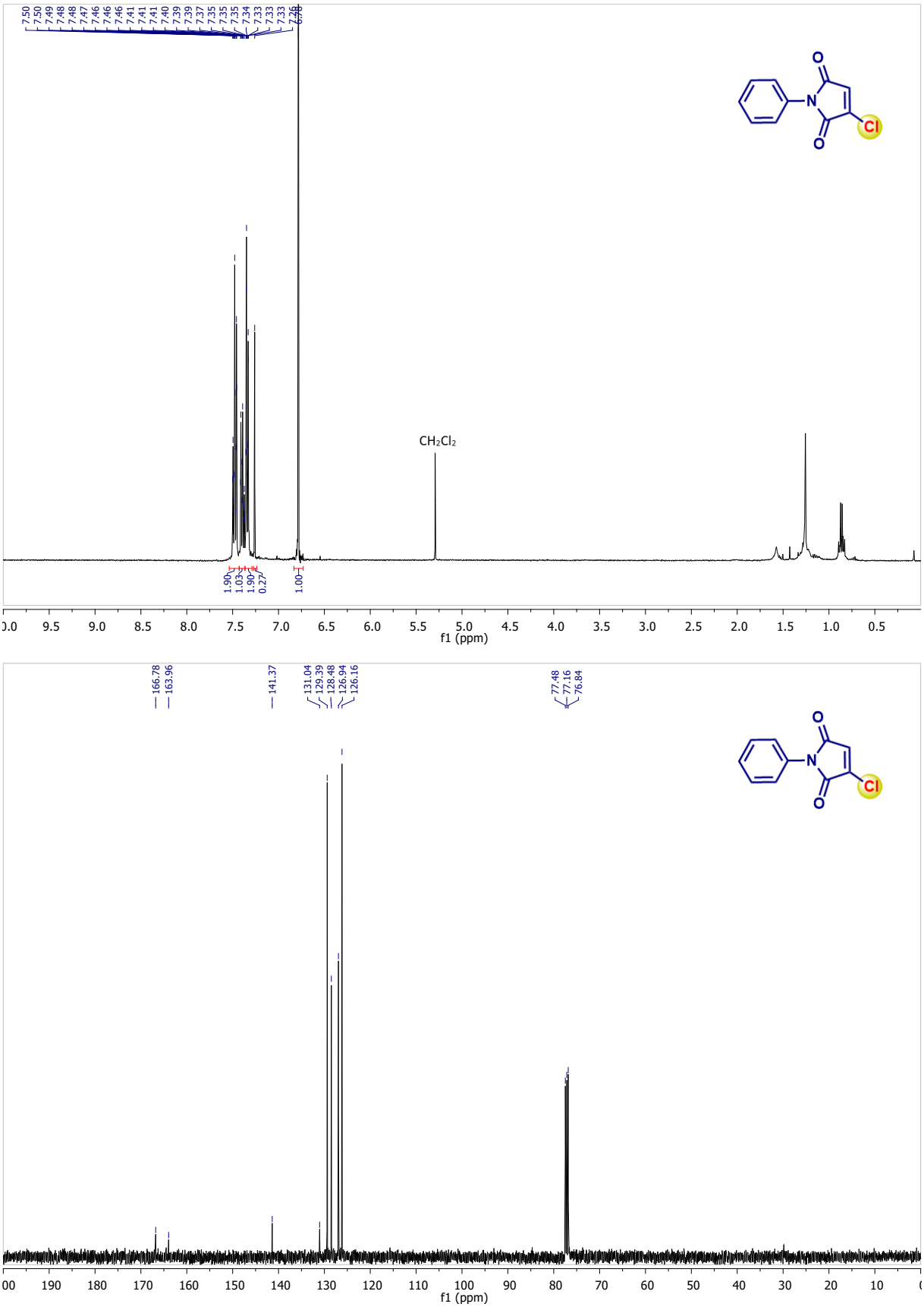

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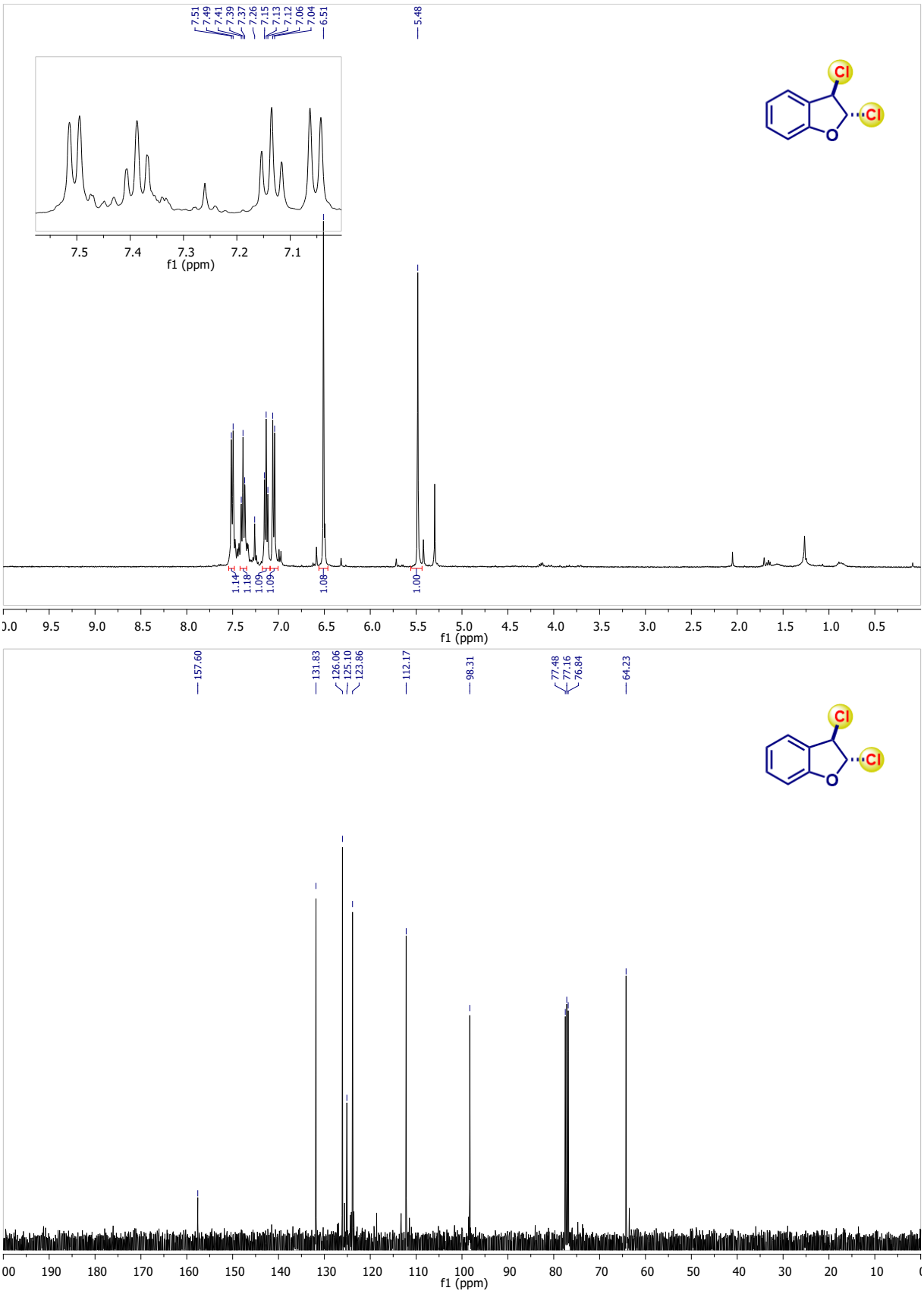

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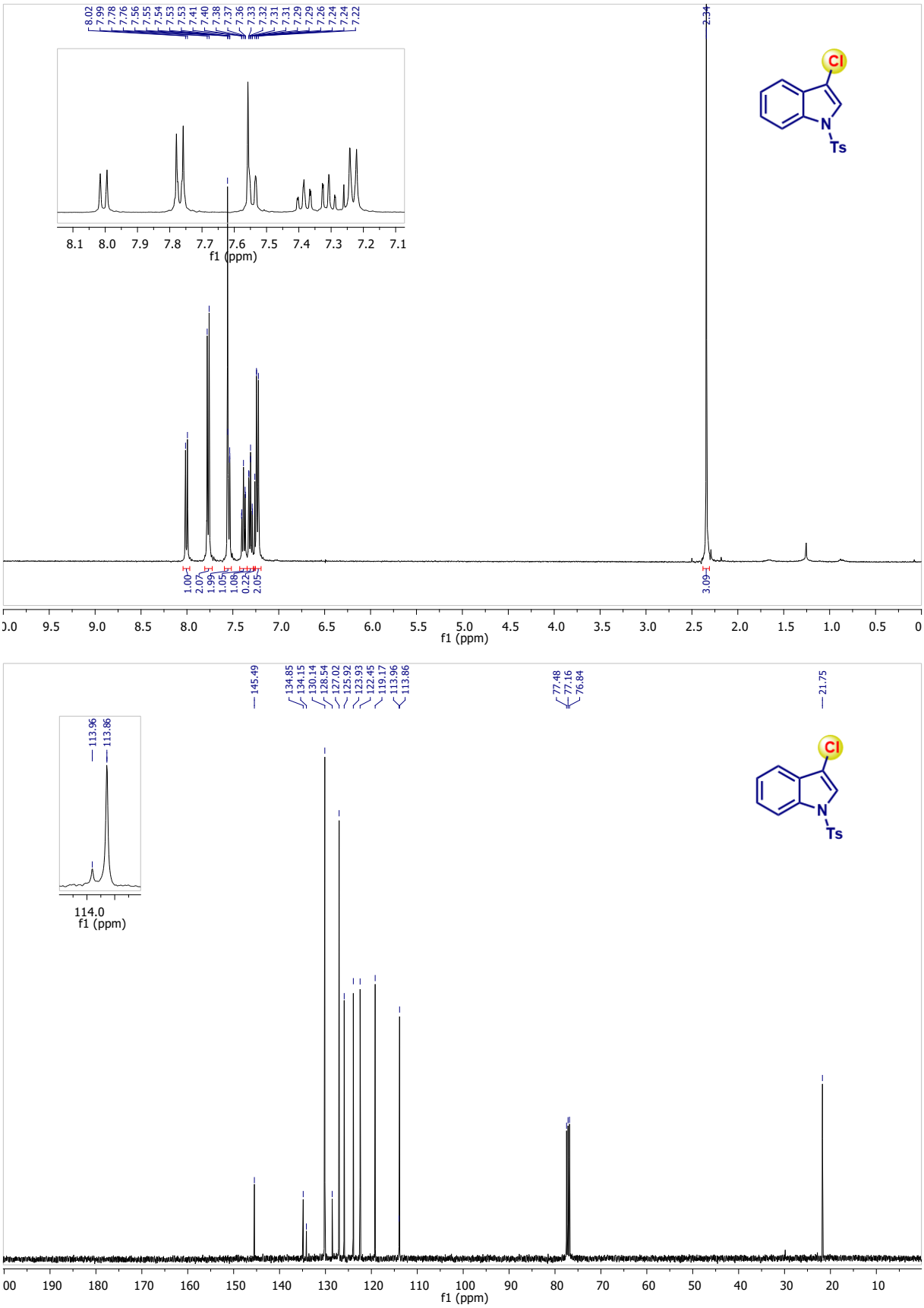

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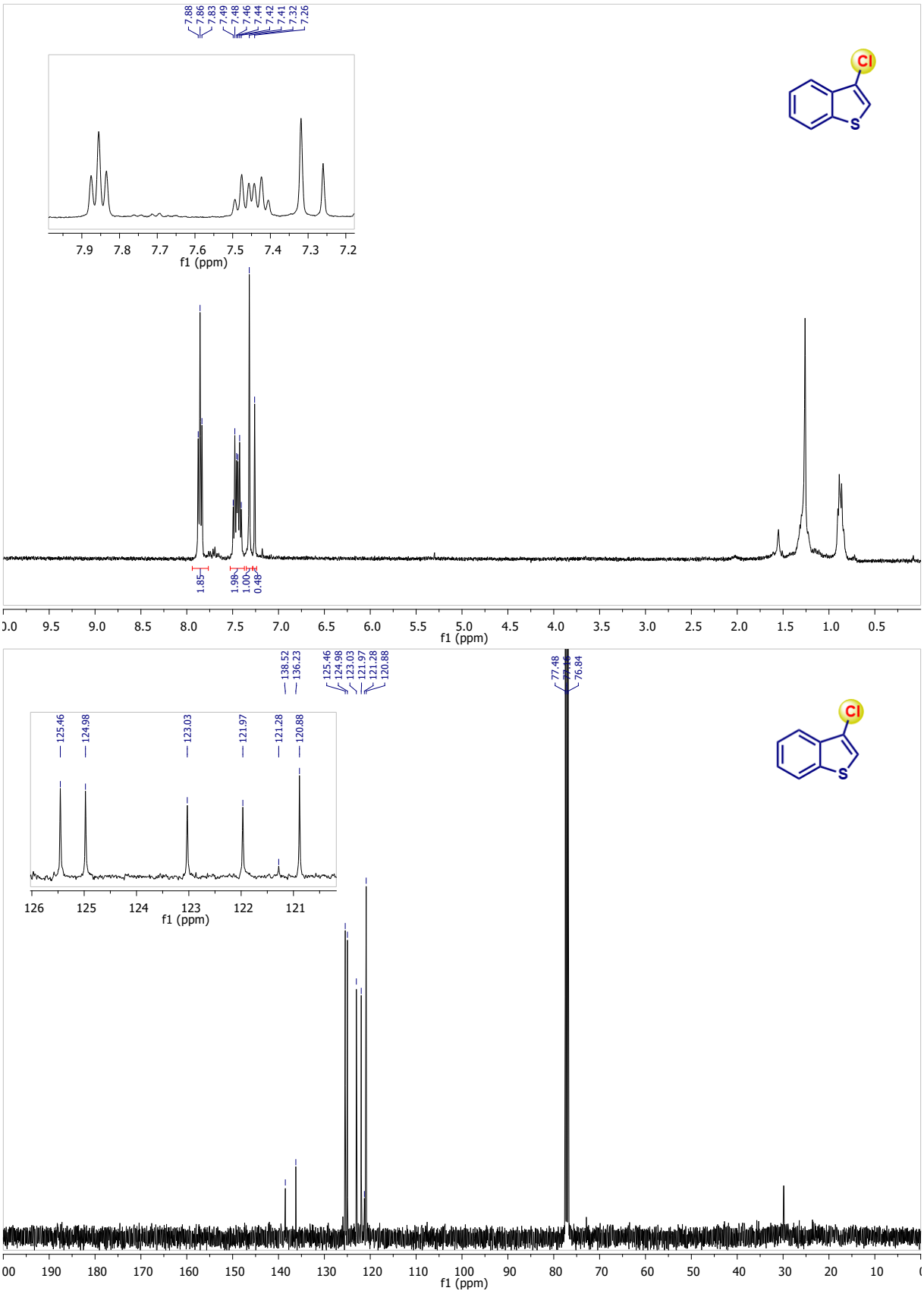
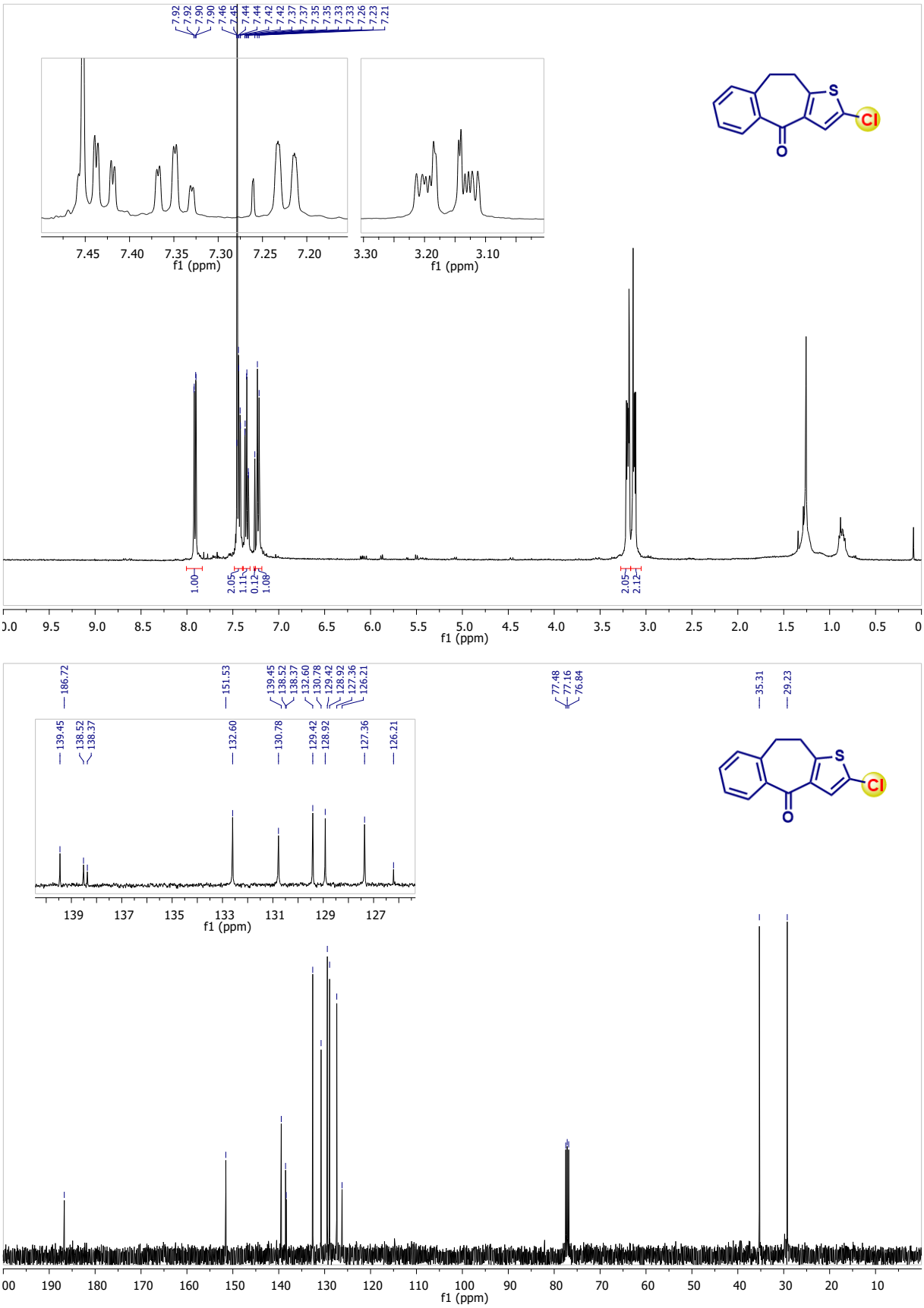
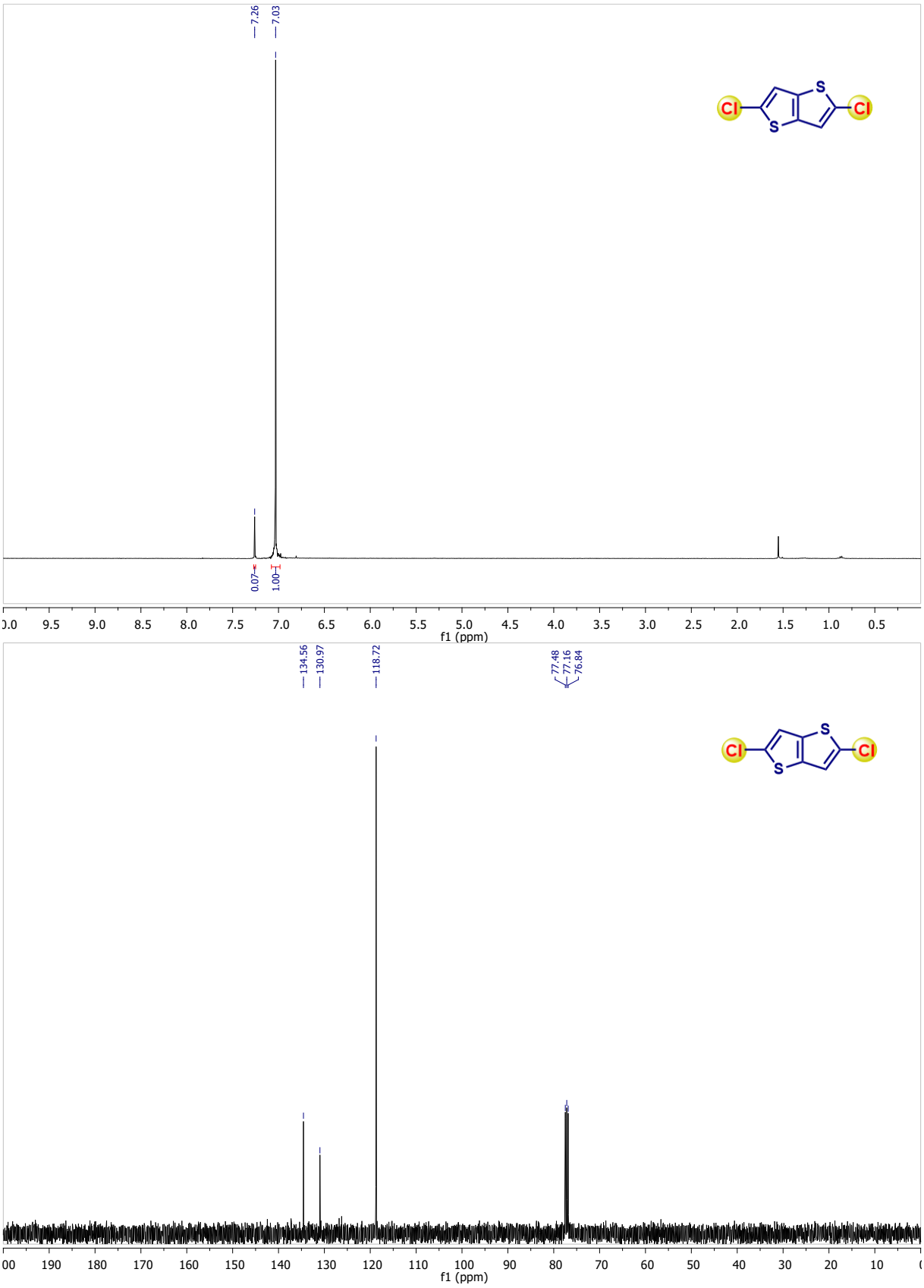


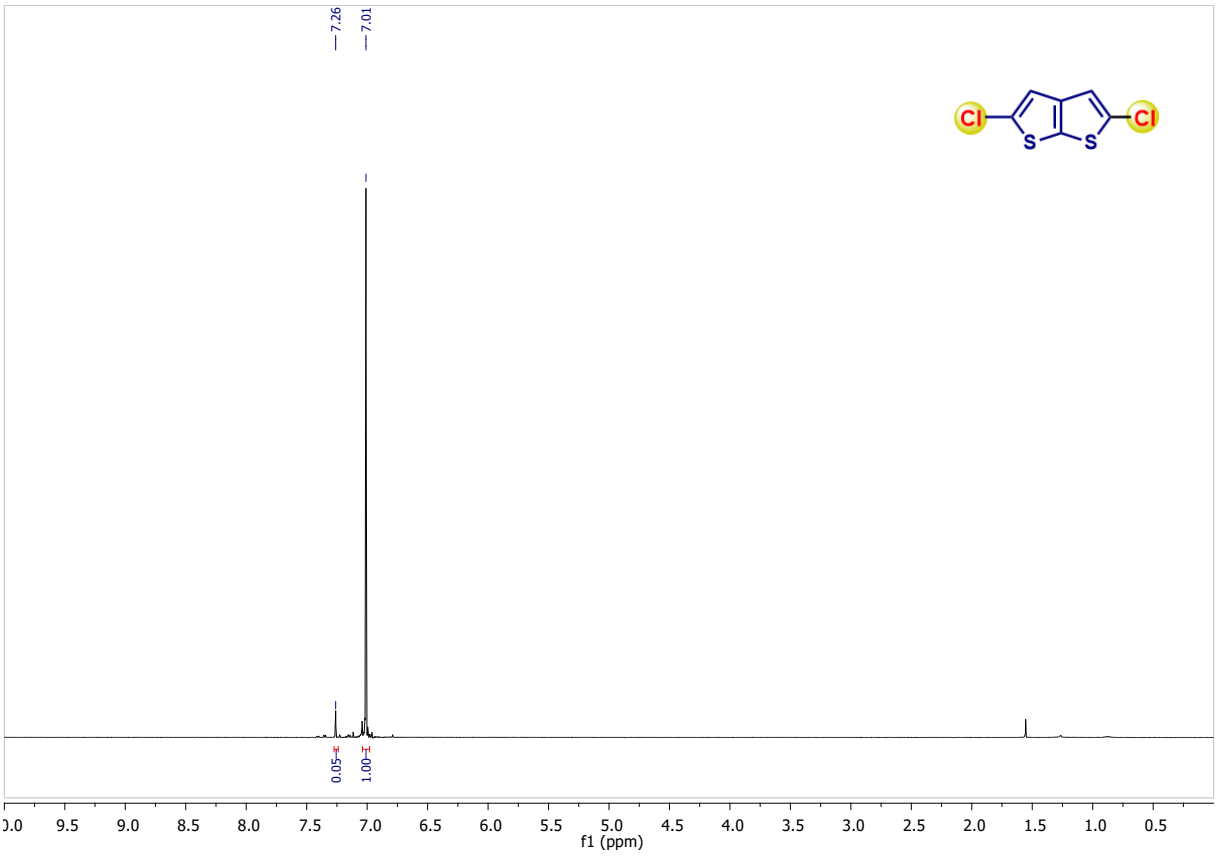
400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2t** ($CDCl_3$)

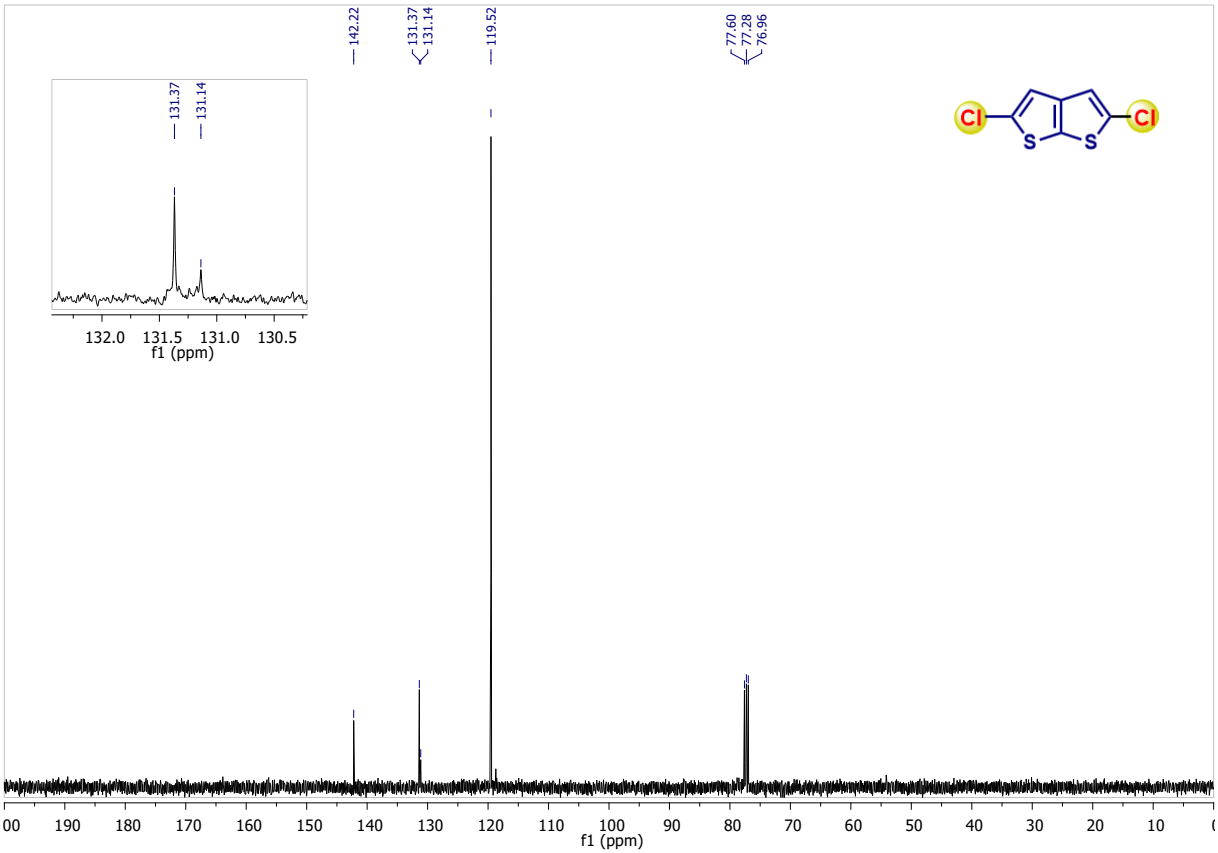


400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2u** ($CDCl_3$)

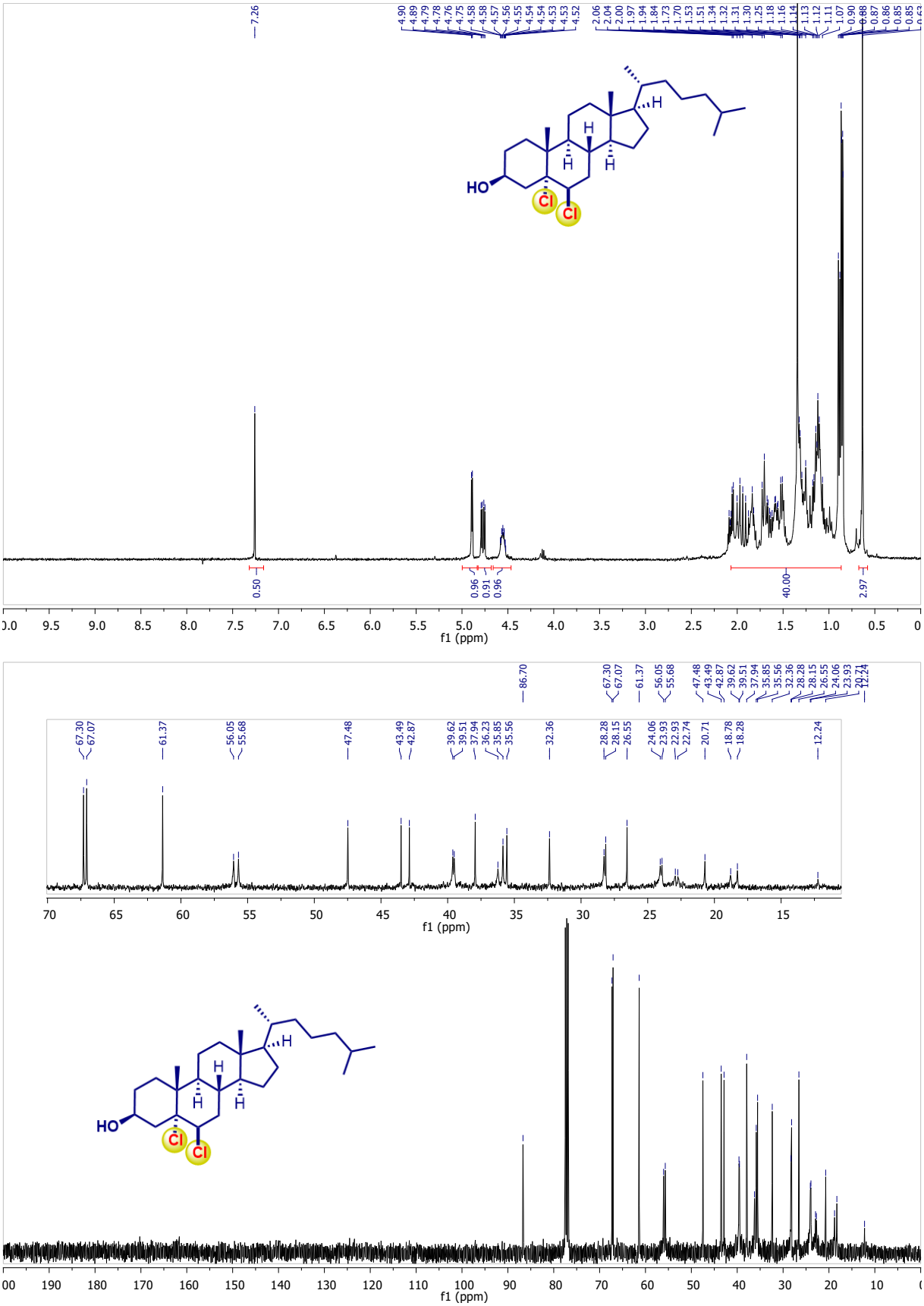


400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2v** ($CDCl_3$)

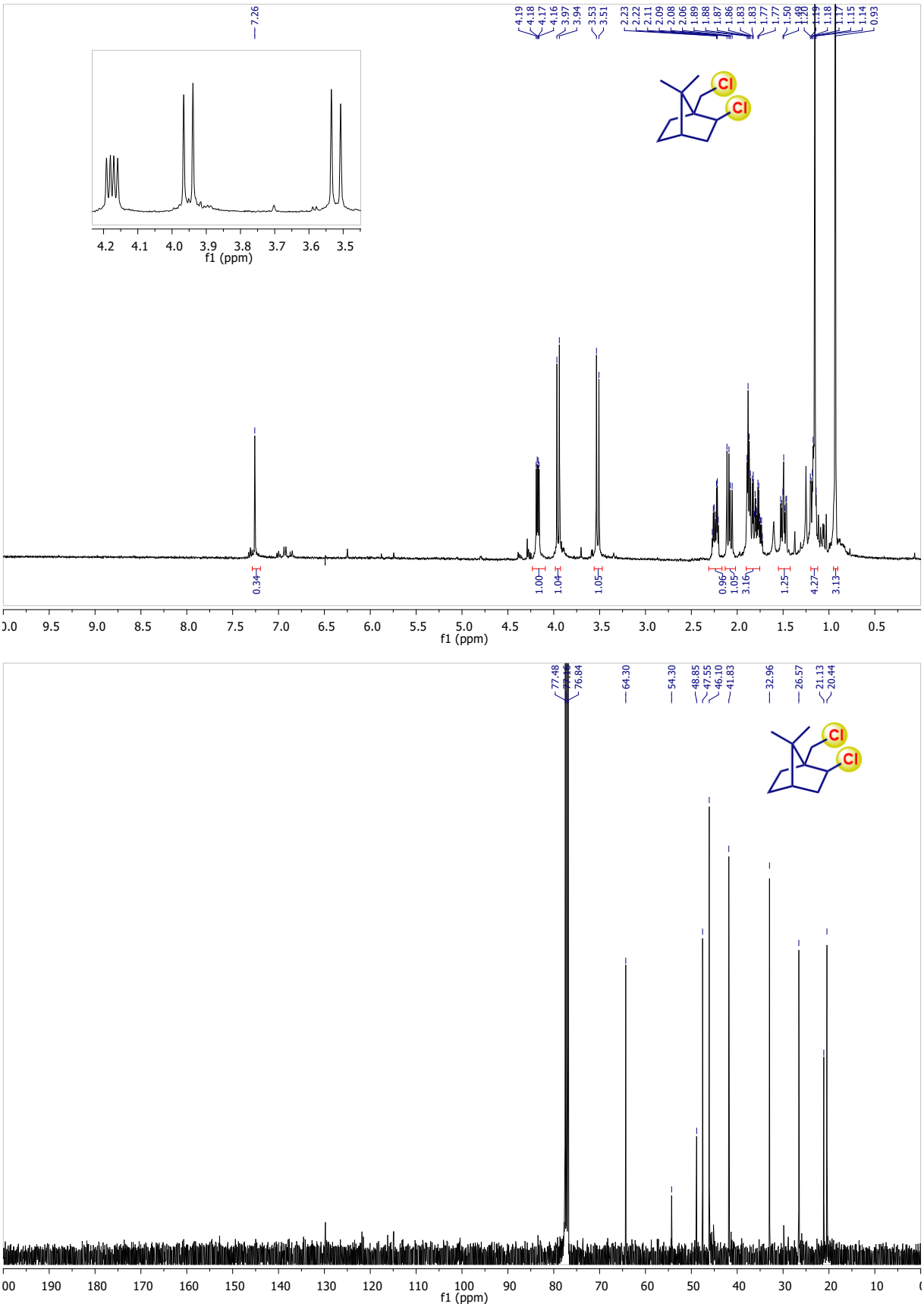




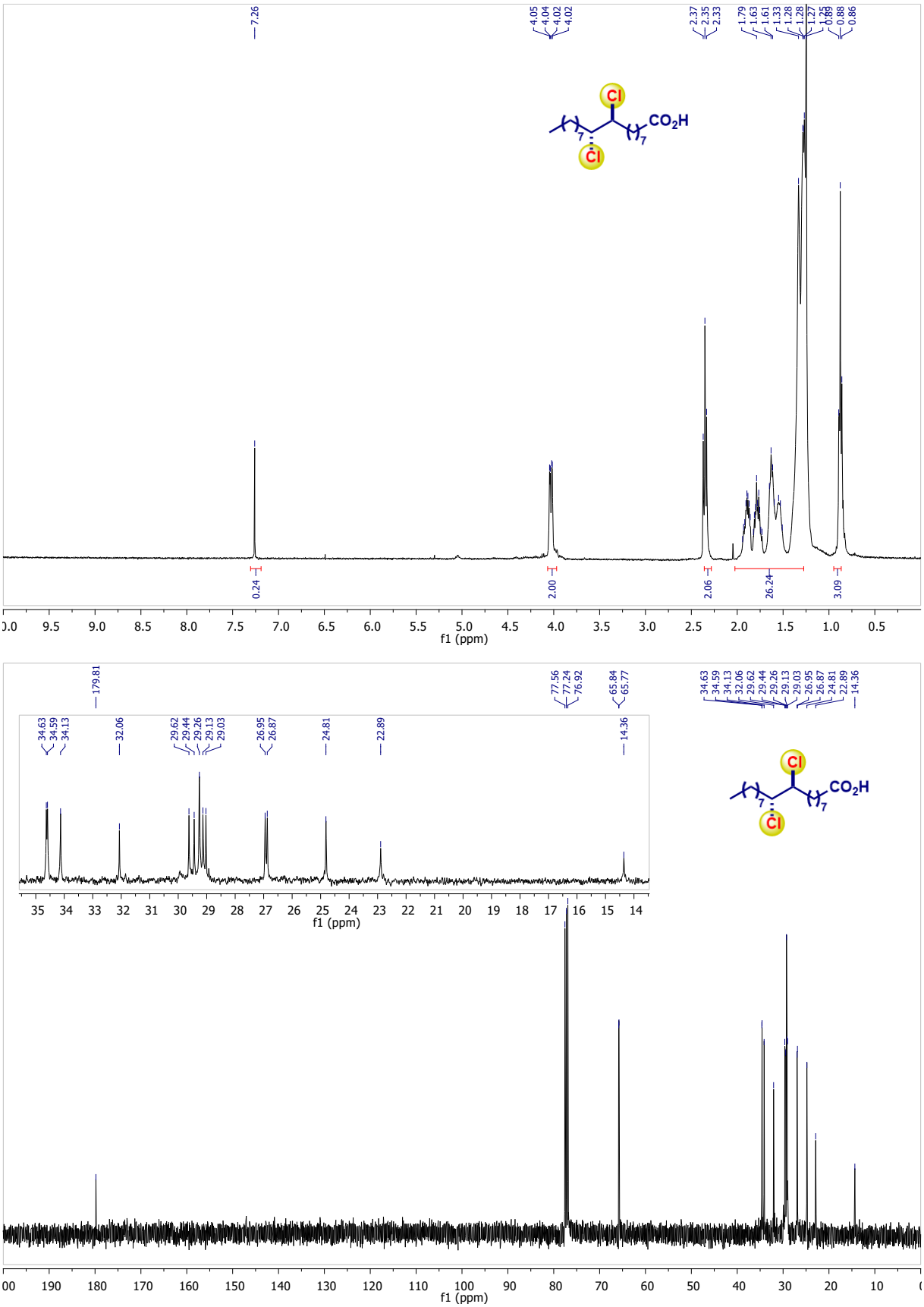
400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2w** ($CDCl_3$)



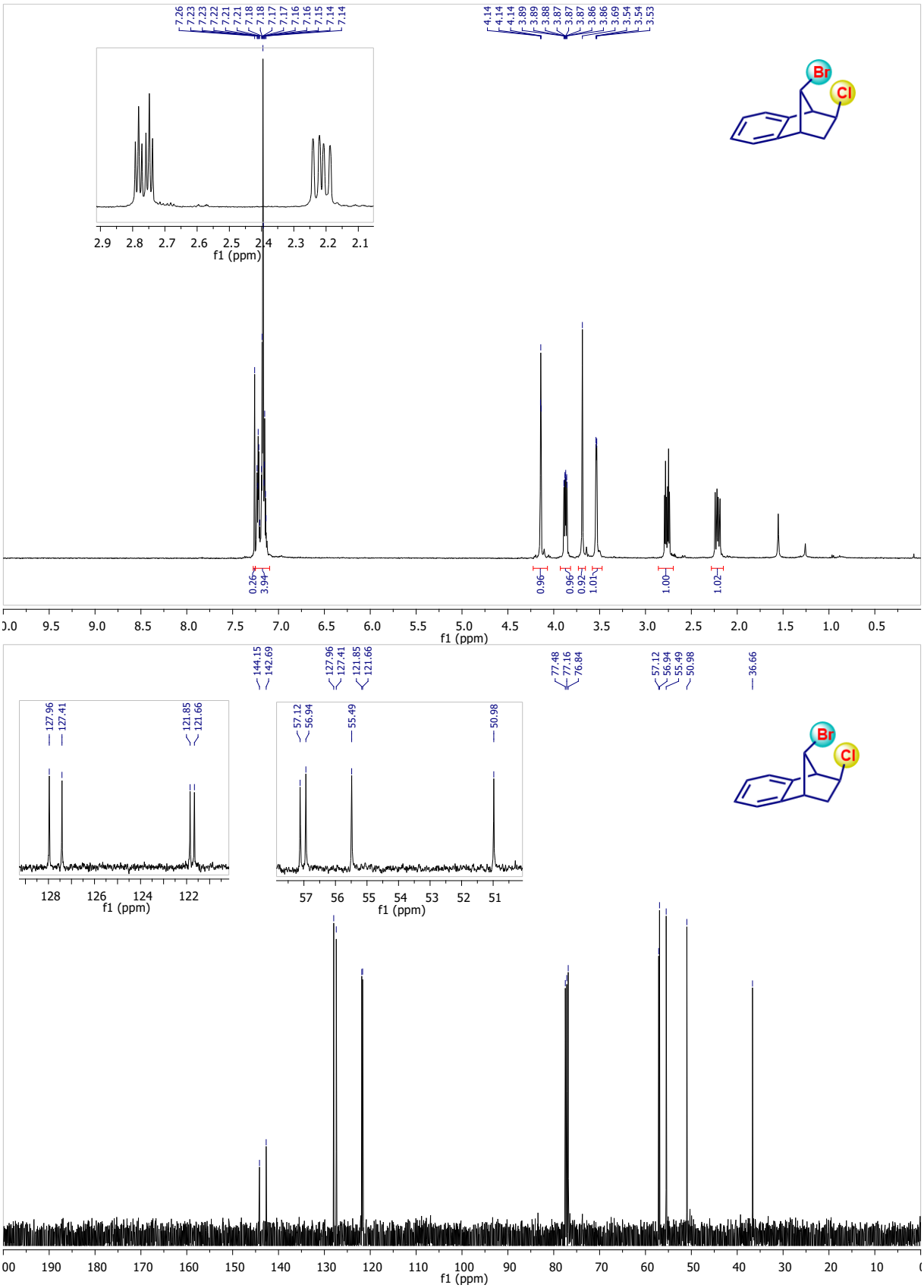
400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2x** ($CDCl_3$)



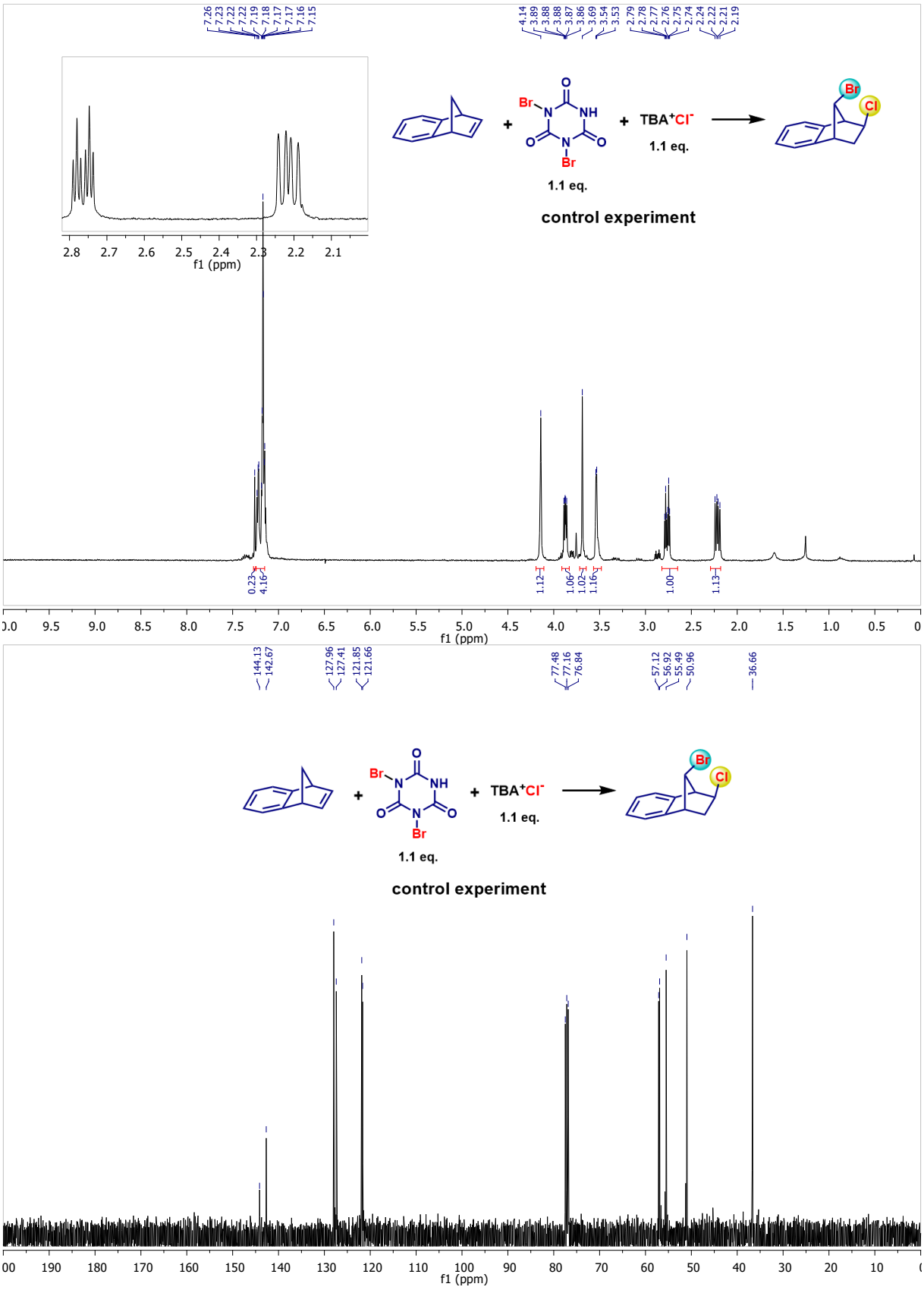
400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2y** ($CDCl_3$)



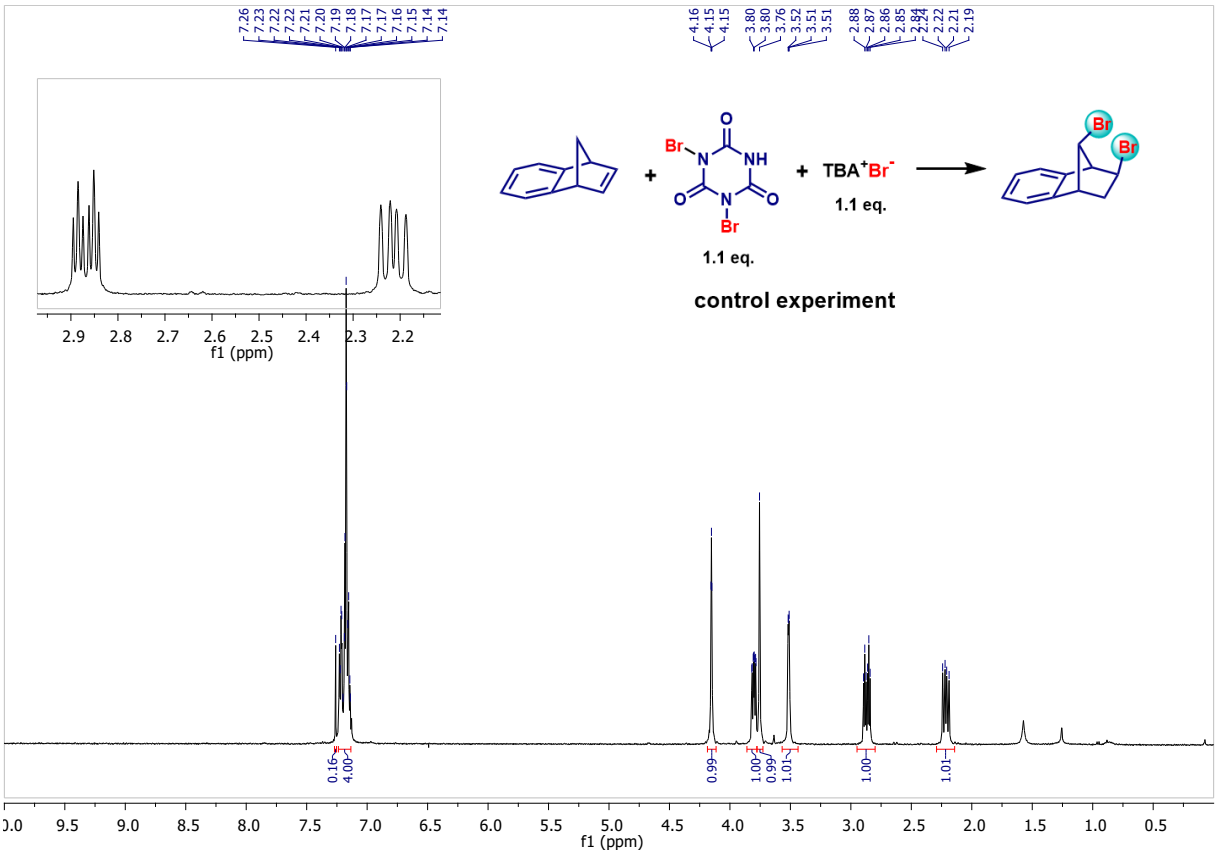
400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2z** ($CDCl_3$)

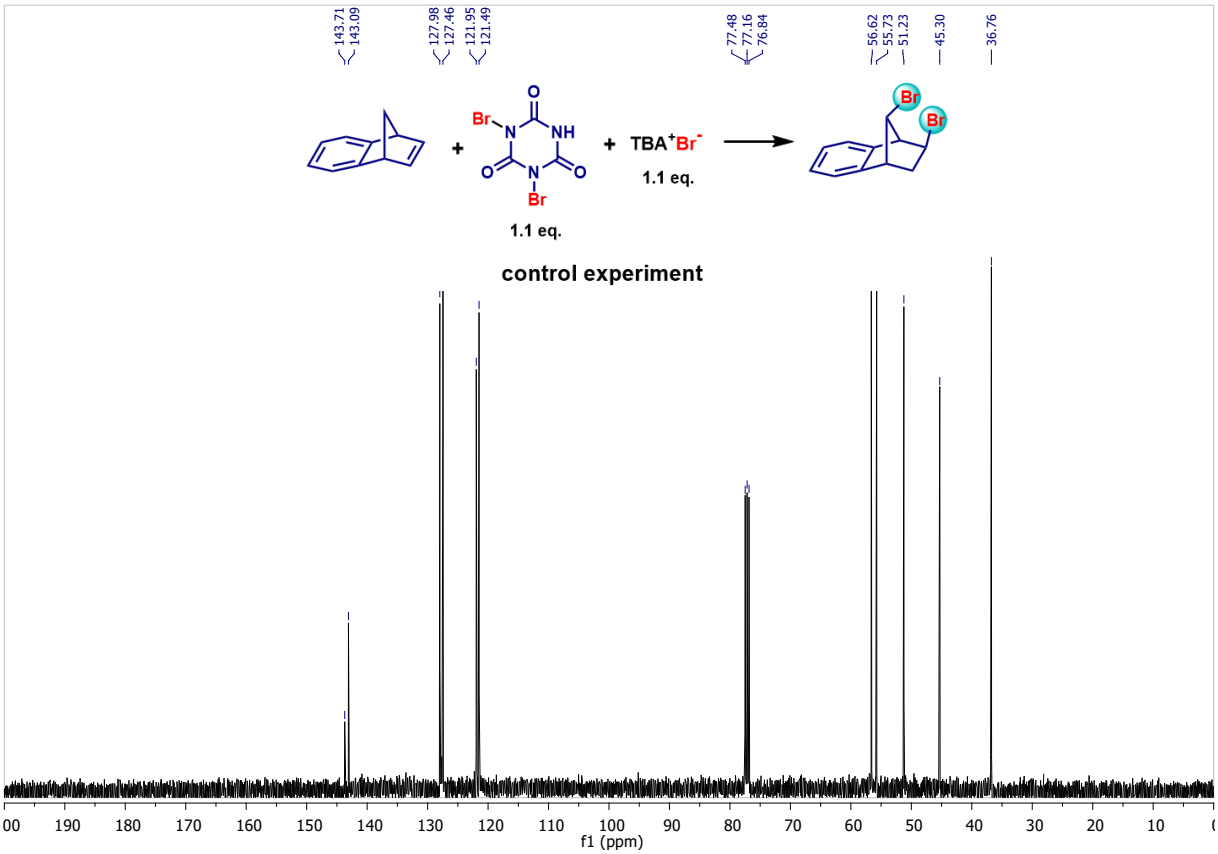


400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2ab** ($CDCl_3$)



400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2ab** (from control experimental) ($CDCl_3$)





400 MHz ^{1}H-NMR (top) and 101 MHz ^{13}C-NMR (bottom) spectra of **2ac** (from control experimental) ($CDCl_3$)