Supporting Information for:

Silver-Promoted Synthesis of Vinyl Sulfones from Vinyl Bromides and Sulfonyl Hydrazides in Water

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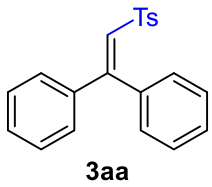
1. General Information

All commercially available chemical resources were used as received. Chromatographic purification of products was accomplished using forced flow chromatography on silica gel 60 (300~400 μm). Thin layer chromatography was performed on silica gel (200~300 μm). Nuclear Magnetic Resonance (NMR) spectras were acquired on a Varian Mercury 400 operating at 400, 100 and 376 MHz for ^{1}H, ^{13}C, ^{19}F respectively. Chemical shifts were reported in δ ppm referenced to an internal $SiMe_4$ standard for **^{1}H NMR**, chloroform-d (δ 77.16) for **^{13}C NMR**. Multiplicities were reported using the following abbreviations: s = singlet, d = doublet, t = triplet, q = quartet, m = multiple, br = broad resonance. 2,2-Diarylvinyl bromides **1a-1q** and **1a'** were prepared according to the reported procedures, [1, 2] and **1r-1u** were obtained from commercial resources. Sulfonyl hydrazides **2d-2f**, **2i-2m** and **2p** were prepared according to the reported procedures, [3-6] and **2a-2c, 2g, 2n** and **2o** were obtained from commercial resources.

2. Synthesis of Vinyl Sulfones 3

General Procedure: To a 25 mL Schlenk tube charged with a stir bar, vinyl bromides **1** (0.2 mmol), sulfonyl hydrazides **2** (0.3 mmol), AgF (50.8 mg, 0.4 mmol), and DPPH (13.6 mg, 0.03 mmol) were added. After filled with argon, water (5 mL) was added via a syringe. After stirred at 80 °C for 10 h, the reaction mixture was cooled down to room temperature, washed with brine (15 mL) and extracted with EtOAc (3×10 mL). The combined organic phases were dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. The residue was purified by silica gel chromatography (PE/EA = 5:1~2:1) to afford pure products **3**.

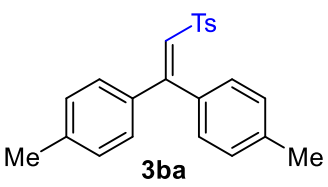
(2-tosylethene-1,1-diyl)dibenzene (3aa)



3aa

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.47 (d, *J* = 8.0 Hz, 2H), 7.41-7.24 (m, 6H), 7.23-7.07 (m, 6H), 6.99 (s, 1H), 2.36 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ 154.81, 143.86, 139.32, 138.69, 135.67, 130.34, 129.87, 129.44, 129.06, 128.94, 128.67, 128.31, 127.91, 127.79, 21.68; **EI-MS** (m/z, %): 334 (M^+, 2.09), 84 (100), 86 (62.74), 57 (34.83); **HRMS** (EI): m/z calcd for: $C_{21}H_{18}O_2S$, 334.1028 $[M]^+$; found: 334.1034.

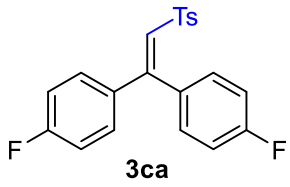
4,4'-(2-tosylethene-1,1-diyl)bis(methylbenzene) (3ba)



3ba

White solid; **^{1} H NMR** (400 MHz, $CDCl_3$): δ 7.50 (d, *J* = 8.3 Hz, 2H), 7.15 (d, *J* = 8.0 Hz, 2H), 7.12-7.07 (m, 6H), 6.99 (d, *J* = 8.0 Hz, 2H), 6.90 (s, 1H), 2.39 (s, 3H), 2.38 (s, 3H), 2.33 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ 154.99, 143.72, 140.71, 139.03, 138.94, 136.80, 132.99, 129.91, 129.35, 129.35, 128.55, 128.37, 127.80, 127.66, 21.69, 21.56, 21.39. **EI-MS** (m/z, %): 362 (M^+, 34.15), 91 (100), 119 (58.6), 148 (38.35); **HRMS** (EI): m/z calcd for: $C_{23}H_{22}O_2S$, 362.1341 $[M]^+$; found: 362.1342.

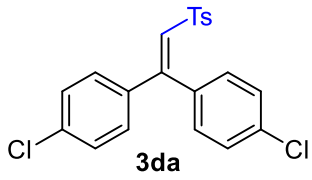
4,4'-(2-tosylethene-1,1-diyl)bis(fluorobenzene) (3ca)



3ca

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.50 (d, *J* = 8.3 Hz, 2H), 7.23-7.14 (m, 4H), 7.14-7.07 (m, 2H), 7.05-6.97 (m, 4H), 6.93 (s, 1H), 2.39 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 164.14 (d, *J* = 248.1 Hz), 163.30 (d, *J* = 248.1 Hz), 152.53, 144.21, 138.52, 135.34 (d, *J* = 3.3 Hz), 131.92 (d, *J* = 8.4 Hz), 131.45 (d, *J* = 3.4 Hz), 130.33 (d, *J* = 8.6 Hz), 129.57, 129.22, 127.74, 115.90 (d, *J* = 21.8 Hz), 115.189 (d, *J* = 21.6 Hz), 21.69. **^{19}F NMR** (376 MHz, $CDCl_3$) δ -109.76, -111.61; **EI-MS** (m/z, %): 370 (M^+, 0.6), 91 (100), 119 (54.67), 84 (45.21); **HRMS** (EI): m/z calcd for: $C_{21}H_{16}O_2F_2S$, 370.0839 $[M]^+$; found: 370.0834.

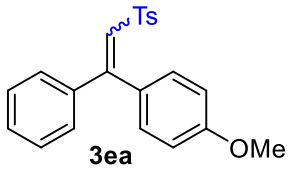
4,4'-(2-tosylethene-1,1-diyl)bis(chlorobenzene) (**3da**)



3da

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.51 (d, *J* = 8.3 Hz, 2H), 7.32-7.25 (m, 4H), 7.21 (d, *J* = 8.1 Hz, 2H), 7.11 (d, *J* = 8.5 Hz, 2H), 7.05 (d, *J* = 8.5 Hz, 2H), 6.95 (s, 1H), 2.41 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 152.01, 144.41, 139.18, 137.37, 136.88, 135.54, 133.73, 131.27, 129.84, 129.66, 129.55, 129.10, 128.41, 127.85, 21.76. **EI-MS** (m/z, %): 402 (M^+, 74.12), 212 (100), 91 (97.2), 176 (86.32); **HRMS** (EI): m/z calcd for: $C_{21}H_{16}O_2SCl_2$, 402.0248 $[M]^+$; found: 402.0243.

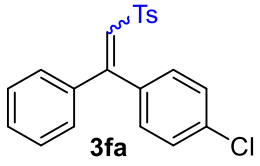
1-methoxy-4-(1-phenyl-2-tosylvinyl)benzene (1:1) (**3ea**)



3ea

(Isomer ratio = 1:1); White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.45 (d, *J* = 8.3 Hz, 1H), 7.37 (d, *J* = 8.3 Hz, 1H), 7.28 (d, *J* = 7.3 Hz, 1H), 7.24-7,18 (m, 2H), 7.14-7.09 (m, 1.5H), 7.09-7.03 (m, 2.5H), 7.01-6.97 (m, 2H), 6.86 (s, 0.5H), 6.81 (s, 0.5H), 6.76-6.70 (m, 2H), 3.77 (s, 1.5H), 3.71 (s, 1.5H), 2.30 (s, 1.5H), 2.29 (s, 1.5H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 161.48, 160.39, 154.81, 154.42, 143.77, 143.62, 139.90, 138.98, 138.82, 135.84, 135.81, 131.68, 131.45, 130.24, 129.83, 129.38, 129.34, 128.79, 128.58, 128.54, 128.36, 127.98, 127.82, 127.69, 127.68, 126.78, 114.03, 113.28, 55.47, 55.38, 21.65, 21.63. **EI-MS** (m/z, %): 364 (M^+, 4.79), 191 (100), 84 (80.93), 86 (50.26); **HRMS** (EI): m/z calcd for: $C_{22}H_{20}O_3S$, 364.1133 $[M]^+$; found: 364.1143.

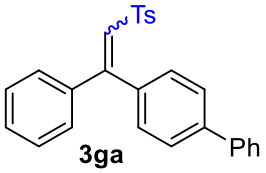
1-chloro-4-(1-phenyl-2-tosylvinyl)benzene (**3fa**)



3fa

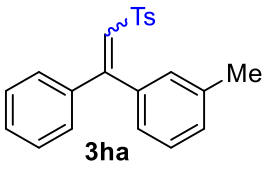
(Isomer ratio = 1:1); White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.51 (d, *J* = 8.0 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.41-7.22 (m, 5H), 7.21-7.02 (m, 6H), 6.97 (s, 1H), 2.39 (s, 1.5H), 2.36 (s, 1.5H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 153.41, 153.29, 144.20, 144.00, 138.80, 138.45, 138.39, 137.73, 136.52, 135.20, 135.17, 134.10, 131.26, 130.53, 129.79, 129.77, 129.54, 129.46, 129.37, 129.35, 129.13, 128.89, 128.76, 128.24, 128.17, 128.01, 127.77, 127.72, 21.68, 21.65. **EI-MS** (m/z, %): 368 (M^+, 41.53), 178 (100), 212 (57.73), 176 (55.52); **HRMS** (EI): m/z calcd for: $C_{21}H_{17}O_2SCl$, 368.0638 $[M]^+$; found: 368.0646.

4-(1-phenyl-2-tosylvinyl)-1,1'-biphenyl (**3ga**)



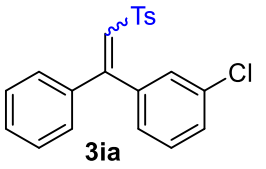
(Isomer ratio = 5:2)**;** White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.56-7.157(m, 14H), 7.13-7.03 (m, 4H), 6.95 (m, 1H), 2.31 (m, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ 154.37, 143.88, 143.22, 140.00, 139.38, 138.11, 135.64, 130.52, 130.40, 129.92, 129.47, 129.41, 129.03, 128.80, 128.74, 128.45, 128.07, 127.99, 127.91, 127.85, 127.33, 127.23, 127.19, 126.56, 21.70. **EI-MS** (m/z, %): 410 (M^+, 3.03), 191 (100), 84 (52.13), 57 (37.56); **HRMS** (EI): m/z calcd for: $C_{27}H_{22}O_2S$, 410.1341 $[M]^+$; found: 410.1337.

1-methyl-3-(1-phenyl-2-tosylvinyl)benzene (**3ha**)



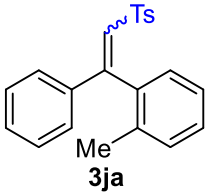
(Isomer ratio = 1:1); White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.46 (dd, *J* = 8.1, 6.3 Hz, 2H), 7.39-7.33 (m, 1H), 7.32-7.27 (m, 2H), 7.23-7.07 (m, 6H), 7.03 (s, 0.5H), 6.99-6.92 (m, 2H), 6.73 (s, 0.5H), 2.38 (m, 3H), 2.29 (s, 1.5H), 2.25 (s, 1.5H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 155.07, 143.80, 143.71, 139.36, 139.28, 138.77, 138.43, 137.51, 135.77, 135.53, 131.14, 130.30, 130.12, 129.86, 129.86, 129.62, 129.41, 129.31, 129.09, 128.90, 128.79, 128.66, 128.55, 128.28, 128.28, 127.86, 127.86, 127.79, 127.12, 125.64, 21.68, 21.65, 21.45, 21.40. **EI-MS** (m/z, %): 348 (M^+, 66.65), 192 (100), 178 (80.87), 193 (55.08); **HRMS** (EI): m/z calcd for: $C_{22}H_{20}O_2S$, 348.1184 $[M]^+$; found: 348.1196.

1-chloro-3-(1-phenyl-2-tosylvinyl)benzene (**3ia**)



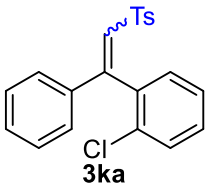
(Isomer ratio = 1:1); White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.47 (d, *J* = 8.0 Hz, 2H), 7.43-7.35 (m, 1H), 7.36-7.27 (m, 3.5H), 7.27-7.03 (m, 6.5H), 6.97 (s, 0.5H), 6.83 (s, 0.5H), 2.40 (s, 1.5H), 2.38 (s, 1.5H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 153.23, 152.97, 144.29, 144.11, 141.22, 138.39, 138.33, 137.26, 135.03, 134.77, 134.04, 130.61, 130.23, 130.23, 129.99, 129.92, 129.80, 129.56, 129.52, 129.32, 129.24, 128.96, 128.84, 128.34, 128.22, 128.14, 128.08, 127.83, 127.78, 126.51, 21.69, 21.69. **EI-MS** (m/z, %): 368 (M^+, 41.53), 178 (100), 212 (57.73), 176 (55.52); **HRMS** (EI): m/z calcd for: $C_{21}H_{17}O_2SCl$, 368.0638 $[M]^+$; found: 368.0646.

1-methyl-2-(1-phenyl-2-tosylvinyl)benzene (**3ja**)



(Isomer ratio = 1:1); White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.58 (d, *J* = 8.2 Hz, 0.33H), 7.41-7.16 (m, 9.16H), 7.16-7.10 (m, 2.66H), 7.08-7.03 (m, 1.66H), 6.59 (s, 0.16H), 2.38 (s, 3H), 2.04 (s, 0.5H), 1.69 (s, 2.5H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 154.48, 143.92, 138.33, 137.74, 136.34, 134.55, 131.37, 131.02, 130.39, 130.09, 130.08, 129.94, 129.51, 129.47, 129.33, 129.15, 128.93, 128.86, 127.99, 127.78, 127.67, 127.37, 125.92, 125.29, 21.68, 20.35, 19.59, 17.79. **EI-MS** (m/z, %): 348 (M^+, 8.61), 193 (100), 192 (93.17), 115 (55.66); **HRMS** (EI): m/z calcd for: $C_{21}H_{18}O_3S$, 348.1184 $[M]^+$; found: 348.1188.

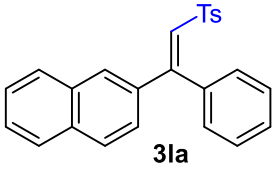
1-chloro-2-(1-phenyl-2-tosylvinyl)benzene (**3ka**)



3ka

(Isomer ratio = 5:1); White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.57 (d, *J* = 8.3 Hz, 0.33H), 7.51 (d, *J* = 8.3 Hz, 1.66H), 7.39-7.14 (m, 11H), 7.07 (s, 0.83H), 6.71 (s, 0.16H), 2.39 (s, 2.5H), 2.37 (s, 0.5H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 151.24, 144.26, 137.87, 137.15, 134.24, 133.23, 133.09, 131.94, 130.94, 130.44, 130.22, 129.83, 129.75, 129.58, 129.56, 129.49, 129.37, 128.86, 127.98, 127.83, 127.80, 127.40, 126.90, 126.38, 21.73, 21.70. **EI-MS** (m/z, %): 368 (M^+, 0.16), 333 (100), 334 (46.13), 178 (37.18); **HRMS** (EI): m/z calcd for: $C_{21}H_{17}O_2SCl$, 368.0638 $[M]^+$; found: 368.0641.

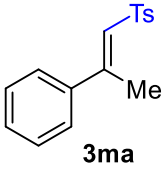
(*E*)-2-(1-phenyl-2-tosylvinyl)naphthalene (**3la**)



3la

Withe solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.85 (d, *J* = 8.2 Hz, 1H), 7.72 (d, *J* = 8.2 Hz, 1H), 7.55-7.50 (m, 1H), 7.46 (d, *J* = 6.9 Hz, 1H), 7.36 (s, 1H), 7.34-7.24 (m, 6H), 7.11 (d, *J* = 8.1 Hz, 2H), 7.03 (dd, *J* = 12.1, 7.8 Hz, 2H), 6.70 (d, *J* = 8.1 Hz, 2H), 2.11 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 153.14, 143.35, 138.23, 133.41, 132.12, 131.61, 130.75, 130.71, 130.46, 129.51, 129.46, 128.93, 128.81, 128.15, 127.68, 127.38, 126.08, 125.70, 125.68, 124.99, 21.39. **EI-MS** (m/z, %): 384 (M^+, 1.02), 229 (100), 228 (93.13), 230 (26.32); **HRMS** (EI): m/z calcd for: $C_{25}H_{20}O_2S$, 384.1184 $[M]^+$; found: 384.1190. The geometry was tentatively assigned according to the proposed mechanism.

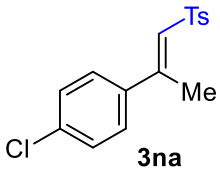
(*E*)-1-methyl-4-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**3ma**)



3ma

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.85 (d, *J* = 8.3 Hz, 2H), 7.42-7.32 (m, 7H), 6.60 (d, *J* = 1.2 Hz, 1H), 2.52 (d, *J* = 1.2 Hz, 3H), 2.44 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ 144.28, 140.41, 134.77, 129.99, 129.94, 128.85, 128.02, 127.97, 127.45, 126.45, 21.75, 17.31. **EI-MS** (m/z, %): 272 (M^+, 79.22), 115 (100), 206 (87.43), 105 (74.64); **HRMS** (EI): m/z calcd for: $C_{16}H_{16}O_2S$, 272.0871 $[M]^+$; found: 272.0870. The data is consistent with the reported literature.[7]

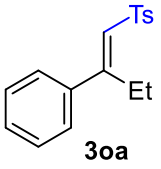
(*E*)-1-chloro-4-(1-tosylprop-1-en-2-yl)benzene (**3na**)



3na

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.85 (d, *J* = 8.3 Hz, 2H), 7.38-7.30 (m, 6H), 6.59 (d, *J* = 1.2 Hz, 1H), 2.50 (d, *J* = 1.2 Hz, 3H), 2.44 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 151.56, 144.42, 139.05, 138.60, 135.95, 130.00, 128.99, 128.24, 127.72, 127.39, 21.72, 17.13. **EI-MS** (m/z, %): 306 (M^+, 75.04), 115 (100), 139 (85.18), 240 (66.46); **HRMS** (EI): m/z calcd for: $C_{16}H_{15}O_2ClS$, 306.0481 $[M]^+$; found: 306.0487. The geometry was determined by NOE analysis.

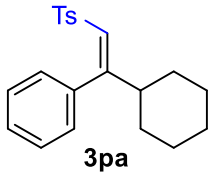
(*E*)-1-methyl-4-((2-phenylbut-1-en-1-yl)sulfonyl)benzene (**3oa**)



3oa

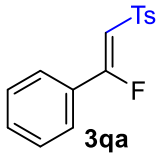
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.86 (d, *J* = 8.2 Hz, 2H), 7.35 (d, *J* = 7.4 Hz, 7H), 6.47 (s, 1H), 3.06 (q, *J* = 7.4 Hz, 2H), 2.44 (s, 3H), 0.97 (t, *J* = 7.4 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 159.32, 144.25, 139.54, 139.02, 129.99, 129.76, 128.86, 127.56, 127.40, 126.91, 23.78, 21.77, 13.24. **EI-MS** (m/z, %): 286 (M^+, 60.79), 220 (100), 91 (79.69), 251 (62.09); **HRMS** (EI): m/z calcd for: $C_{17}H_{18}O_2S$, 286.1028 $[M]^+$; found: 286.1032. The geometry was determined by NOE analysis.

(*Z*)-1-((2-cyclohexyl-2-phenylvinyl)sulfonyl)-4-methylbenzene (**3pa**)



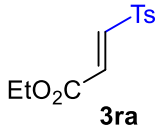
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.27 (ddd, *J* = 22.9, 14.3, 7.5 Hz, 5H), 7.09 (d, *J* = 8.0 Hz, 2H), 6.91 (d, *J* = 7.0 Hz, 2H), 6.46 (s, 1H), 2.36 (s, 3H), 2.14 (t, *J* = 11.0 Hz, 1H), 1.73 (d, *J* = 10.2 Hz, 4H), 1.63 (d, *J* = 12.9 Hz, 1H), 1.14 (ddd, *J* = 23.7, 18.4, 7.0 Hz, 5H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 162.92, 143.51, 138.87, 136.53, 129.26, 128.41, 128.01, 127.96, 127.63, 127.59, 47.85, 31.31, 26.29, 25.88, 21.65. **EI-MS** (m/z, %): 340 (M^+, 59.22), 84 (100), 86 (78.18), 141 (23.8); **HRMS** (EI): m/z calcd for: $C_{21}H_{24}O_2S$, 340.1497 $[M]^+$; found: 340.1505. The geometry was determined by NOE analysis.

(*E*)-1-((2-fluoro-2-phenylvinyl)sulfonyl)-4-methylbenzene (**3qa**)



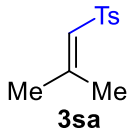
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.94 (d, *J* = 8.0 Hz, 2H), 7.59-7.32 (m, 7H), 6.56 (d, *J* = 32.3 Hz, 1H), 2.45 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 162.76, 144.73, 132.51, 129.94, 129.13 (d, *J* = 1.5 Hz), 127.81 (d, *J* = 1.3 Hz), 126.02 (d, *J* = 7.8 Hz), 109.93 (d, *J* = 12.5 Hz), 21.79. **^{19}F NMR** (376 MHz, $CDCl_3$) δ = -93.48 (d, 32.3 Hz); **EI-MS** (m/z, %): 276 (M^+, 1.33), 84 (100), 86 (65.01), 47 (15.51); **HRMS** (EI): m/z calcd for: $C_{15}H_{13}O_2FS$, 276.0620 $[M]^+$; found: 276.0630. The geometry was determined by NOE analysis.

ethyl (*E*)-3-tosylacrylate (**3ra**)



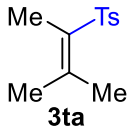
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.80 (d, *J* = 8.1 Hz, 2H), 7.44-7.24 (m, 3H), 6.80 (d, *J* = 15.2 Hz, 1H), 4.25 (q, *J* = 7.1 Hz, 2H), 2.47 (s, 3H), 1.30 (t, *J* = 7.1 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 163.66, 145.79, 143.54, 135.50, 130.61, 130.40, 128.52, 62.14, 21.88, 14.17. **EI-MS** (m/z, %): 254 (M^+, 24), 139 (100), 91 (28.18), 145 (14.74); **HRMS** (EI): m/z calcd for: $C_{12}H_{14}O_4S$, 254.0613 $[M]^+$; found: 254.0618. The data is consistent with the reported literature. [8]

1-methyl-4-((2-methylprop-1-en-1-yl)sulfonyl)benzene (**3sa**)



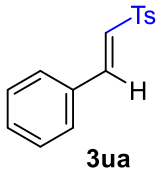
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.78 (d, *J* = 8.2 Hz, 2H), 7.33 (d, *J* = 8.2 Hz, 2H), 6.18 (s, 1H), 2.43 (s, 3H), 2.14 (s, 3H), 1.88 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ 153.75, 143.95, 139.57, 129.81, 127.19, 126.62, 27.13, 21.64, 19.23. **EI-MS** (m/z, %): 210 (M^+, 63.75), 144 (100), 143 (89.75), 139 (69.06); **HRMS** (EI): m/z calcd for: $C_{11}H_{14}O_2S$, 210.0715 $[M]^+$; found: 210.0716.

1-methyl-4-((3-methylbut-2-en-2-yl)sulfonyl)benzene (**3ta**)



White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.74 (d, *J* = 8.2 Hz, 2H), 7.31 (d, *J* = 8.2 Hz, 2H), 2.43 (s, 3H), 2.21 (d, *J* = 1.2 Hz, 3H), 2.00 (s, 3H), 1.86 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 146.84, 143.71, 139.19, 131.36, 129.72, 127.15, 103.58, 24.57, 22.22, 21.70, 16.03. **EI-MS** (m/z, %): 224 (M^+, 47.43), 158 (100), 159 (62.86), 139 (57.09); **HRMS** (EI): m/z calcd for: $C_{12}H_{16}O_2S$, 224.0871 $[M]^+$; found: 224.0873.

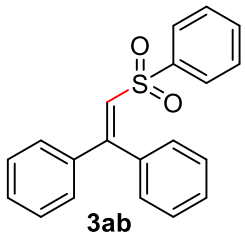
(*E*)-1-methyl-4-(styrylsulfonyl)benzene (3ua)



3ua

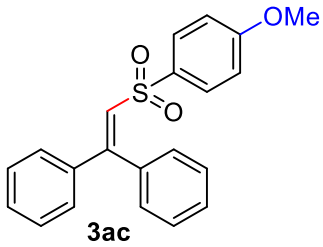
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.83 (d, *J* = 8.3 Hz, 2H), 7.66 (d, *J* = 15.4 Hz, 1H), 7.51-7.45 (m, 2H), 7.36 (dd, *J* = 18.2, 7.6 Hz, 5H), 6.85 (d, *J* = 15.4 Hz, 1H), 2.43 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 144.50, 142.04, 137.84, 132.55, 131.21, 130.07, 129.16, 128.62, 127.81, 127.73, 21.73. **EI-MS** (m/z, %): 258 (M^+, 53.86), 91 (100), 139 (78.84), 77 (39.22); **HRMS** (EI): m/z calcd for: $C_{15}H_{14}O_2S$, 258.0715 $[M]^+$; found: 258.0724.

(2-(phenylsulfonyl)ethene-1,1-diyl)dibenzene (3ab)


3ab

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.50 (d, *J* = 7.3 Hz, 2H), 7.40 (t, *J* = 7.4 Hz, 1H), 7.32-7.16 (m, 8H), 7.13 (d, *J* = 7.3 Hz, 2H), 7.00 (d, *J* = 7.1 Hz, 2H), 6.95 (s, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 155.31, 141.53, 139.16, 135.54, 132.94, 130.44, 129.84, 128.97, 128.83, 128.77, 128.69, 128.30, 127.95, 127.71. **EI-MS** (m/z, %): 320 (M^+, 14.3), 191 (100), 178 (31.18), 57 (28.6); **HRMS** (EI): m/z calcd for: $C_{20}H_{16}O_2S$, 320.0871 $[M]^+$; found: 320.0878.

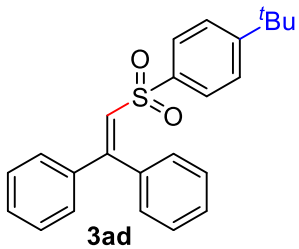
(2-((4-methoxyphenyl)sulfonyl)ethene-1,1-diyl)dibenzene (3ac)



3ac

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.42 (d, *J* = 8.9 Hz, 2H), 7.32-7.26 (m, 1H), 7.26-7.19 (m, 4H), 7.15-7.10 (m, 2H), 7.05-7.00 (m, 2H), 6.93 (s, 1H), 6.73 (d, *J* = 8.9 Hz, 2H), 3.75 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 163.22, 154.40, 139.32, 135.70, 133.20, 130.29, 129.95, 129.89, 129.45, 128.92, 128.67, 128.27, 127.95, 114.01, 55.73. **EI-MS** (m/z, %): 350 (M^+, 34.15), 178 (100), 286 (58.18), 179 (35.4); **HRMS** (EI): m/z calcd for: $C_{21}H_{18}O_3S$, 350.0977 $[M]^+$; found: 350.0985.

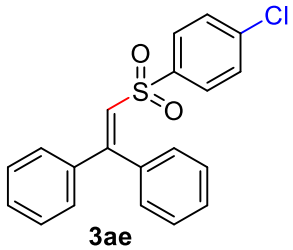
(2-((4-(*tert*-butyl)phenyl)sulfonyl)ethene-1,1-diyl)dibenzene (3ad)



3ad

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.50 (d, *J* = 8.6 Hz, 2H), 7.40-7.24 (m, 8H), 7.23-7.19 (m, 2H), 7.11-7.05 (m, 2H), 7.02 (s, 1H), 1.30 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 156.72, 154.62, 139.28, 138.35, 135.69, 130.32, 129.86, 129.22, 128.85, 128.66, 128.30, 127.91, 127.62, 125.76, 35.20, 31.14. **EI-MS** (m/z, %): 376 (M^+, 32.15), 178 (100), 167 (50), 179 (41.89); **HRMS** (EI): m/z calcd for: $C_{24}H_{24}O_2S$, 376.1497 $[M]^+$; found: 376.1500.

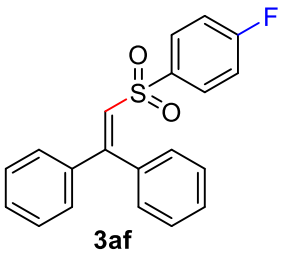
(2-((4-chlorophenyl)sulfonyl)ethene-1,1-diyl)dibenzene (3ae)



3ae

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.46 (d, *J* = 8.6 Hz, 2H), 7.37 (dt, *J* = 4.9, 4.0 Hz, 2H), 7.34-7.26 (m, 6H), 7.23-7.18 (m, 2H), 7.08-7.04 (m, 2H), 7.02 (s, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 155.70, 139.89, 139.46, 138.82, 135.36, 130.58, 129.79, 129.16, 129.08, 128.93, 128.69, 128.55, 128.25, 127.96. **EI-MS** (m/z, %): 354 (M^+, 25.72), 178 (100), 179 (42.76), 115 (40.19); **HRMS** (EI): m/z calcd for: $C_{20}H_{15}O_2SCl$, 354.0481 $[M]^+$; found: 354.0476.

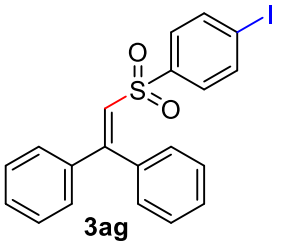
(2-((4-fluorophenyl)sulfonyl)ethene-1,1-diyl)dibenzene (**3af**)



3af

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.57-7.51 (m, 2H), 7.41-7.35 (m, 2H), 7.34-7.27 (m, 4H), 7.23-7.18 (m, 2H), 7.09-7.05 (m, 2H), 7.04 (s, 1H), 6.99 (t, *J* = 8.6 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 165.29 (d, *J* = 257.9 Hz), 155.49, 138.95, 135.46, 130.58, 130.57 (d, *J* = 9.5 Hz), 129.86, 129.10, 128.89, 128.74, 128.29, 128.03, 115.94 (d, *J* = 22.5 Hz). **EI-MS** (m/z, %): 338 (M^+, 40.83), 178 (100), 179 (45.29), 167 (34.39); **HRMS** (EI): m/z calcd for: $C_{20}H_{15}O_2FS$, 338.0777 $[M]^+$; found: 338.0772.

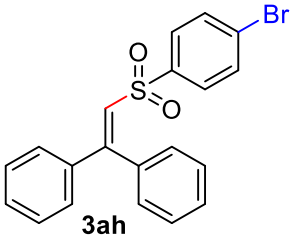
(2-((4-iodophenyl)sulfonyl)ethene-1,1-diyl)dibenzene (**3ag**)



3ag

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.67 (d, *J* = 8.4 Hz, 2H), 7.42-7.17 (m, 10H), 7.05 (d, *J* = 7.2 Hz, 2H), 7.01 (s, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 155.78, 141.14, 138.90, 137.95, 135.42, 130.63, 129.85, 129.14, 129.12, 128.75, 128.53, 128.31, 128.02, 100.72. **EI-MS** (m/z, %): 446 (M^+, 24.29), 57 (100), 71 (82.35), 178 (76.66); **HRMS** (EI)**:** m/z calcd for: $C_{20}H_{15}O_2IS$, 445.9838 $[M]^+$; found: 445.9840.

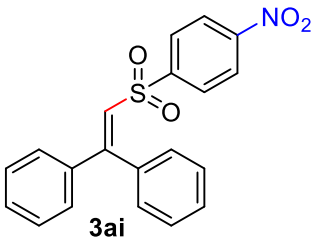
(2-((4-bromophenyl)sulfonyl)ethene-1,1-diyl)dibenzene (**3ah**)



3ah

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.45 (d, *J* = 8.5 Hz, 2H), 7.41-7.35 (m, 4H), 7.30 (td, *J* = 7.6, 2.2 Hz, 4H), 7.20 (d, *J* = 7.4 Hz, 2H), 7.06 (d, *J* = 7.4 Hz, 2H), 7.02 (s, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 155.77, 140.45, 138.85, 135.39, 131.94, 130.61, 129.82, 129.27, 129.12, 128.86, 128.73, 128.53, 128.10, 128.00. **EI-MS** (m/z, %): 398 (M^+, 17.76), 178 (100), 179 (42.98), 167 (31.61); **HRMS** (EI): m/z calcd for: $C_{20}H_{15}O_2SBr$, 397.9976 $[M]^+$; found: 397.9977.

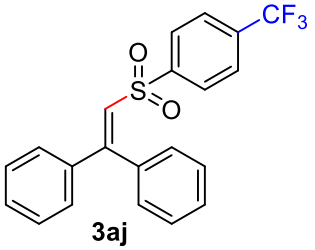
(2-((4-nitrophenyl)sulfonyl)ethene-1,1-diyl)dibenzene (**3ai**)



3ai

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 8.13 (d, *J* = 8.7 Hz, 2H), 7.68 (d, *J* = 8.7 Hz, 2H), 7.41 (dd, *J* = 12.7, 7.2 Hz, 2H), 7.36-7.25 (m, 4H), 7.22 (d, *J* = 7.7 Hz, 2H), 7.07 (s, 1H), 7.03 (d, *J* = 7.5 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 157.21, 150.07, 147.04, 138.47, 135.18, 131.03, 129.90, 129.46, 129.08, 128.85, 128.38, 128.13, 127.77, 123.76. **EI-MS** (m/z, %): 365 (M^+, 32.24), 178 (100), 179 (45.28), 167 (19.85); **HRMS** (EI): m/z calcd for: $C_{20}H_{15}NO_4S$, 365.0722 $[M]^+$; found: 365.0729.

(2-((4-(trifluoromethyl)phenyl)sulfonyl)ethene-1,1-diyl)dibenzene (**3aj**)

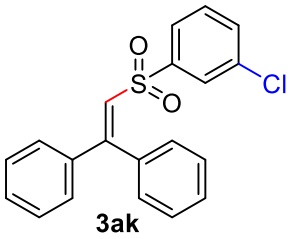


3aj

White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.65 (d, *J* = 8.2 Hz, 2H), 7.56 (d, *J* = 8.2 Hz, 2H), 7.44-7.18 (m, 8H), 7.06 (s, 1H), 7.02 (d, *J* = 7.3 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 156.47, 144.83, 138.68, 135.31, 134.59, 134.27, 130.85, 129.87, 129.26, 128.82, 128.37, 128.33, 128.25, 128.09, 125.77 (q, *J* = 3.7 Hz). **^{19}F NMR** (376 MHz,

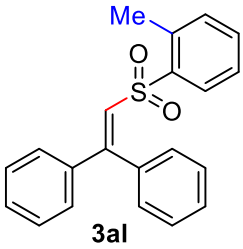
$CDCl_3$) δ -63.25; **EI-MS** (m/z, %): 388 (M^+, 5.4), 84 (100), 86 (69.93), 191 (28.22); **HRMS** (EI): m/z calcd for: $C_{21}H_{15}F_3O_2S$, 388.0745 $[M]^+$; found: 388.0752.

(2-((3-chlorophenyl)sulfonyl)ethene-1,1-diyl)dibenzene (**3ak**)



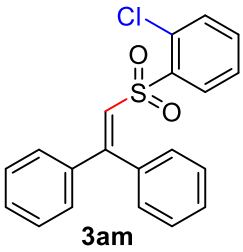
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.49-7.37 (m, 5H), 7.31 (dd, *J* = 14.8, 7.8 Hz, 5H), 7.24-7.20 (m, 2H), 7.06 (s, 1H), 7.04 (s, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 156.19, 143.17, 138.83, 135.20, 134.91, 133.07, 130.73, 130.05, 129.84, 129.35, 128.80, 128.53, 128.35, 128.17, 128.06, 125.87. **EI-MS** (m/z, %): 354 (M^+, 32.79), 178 (100), 179 (48.67), 167 (31.3); **HRMS** (EI): m/z calcd for: $C_{20}H_{15}O_2SCl$, 354.0481 $[M]^+$; found: 354.0885.

(2-(o-tolylsulfonyl)ethene-1,1-diyl)dibenzene (**3al**)



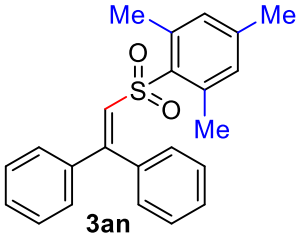
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.45-7.36 (m, 2H), 7.31 (dd, *J* = 14.3, 7.4 Hz, 3H), 7.27-7.21 (m, 4H), 7.17 (t, *J* = 7.4 Hz, 3H), 7.06 (s, 1H), 7.03-6.96 (m, 3H), 2.65 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 153.96, 138.23, 136.23, 134.37, 131.89, 130.97, 129.47, 128.67, 128.50, 127.96, 127.87, 127.80, 127.31, 126.87, 125.01, 19.70. **EI-MS** (m/z, %): 334 (M^+, 11.13), 178 (100), 57 (67.38), 191 (53.13); **HRMS** (EI): m/z calcd for: $C_{21}H_{18}O_2S$, 334.1028 $[M]^+$; found: 334.1037.

(2-((2-chlorophenyl)sulfonyl)ethene-1,1-diyl)dibenzene (**3am**)



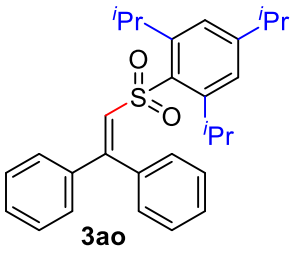
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.44 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.41-7.31 (m, 5H), 7.29-7.20 (m, 3H), 7.18 (s, 1H), 7.13 (t, *J* = 7.6 Hz, 2H), 7.05 (td, *J* = 8.1, 1.4 Hz, 1H), 6.99 (d, *J* = 7.1 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 155.41, 139.13, 135.33, 133.75, 132.21, 131.18, 130.97, 130.55, 129.60, 128.96, 128.77, 128.46, 128.24, 127.79, 126.74. **EI-MS** (m/z, %): 354 (M^+, 29.38), 178 (100), 167 (43.14), 179 (42.59); **HRMS** (EI): m/z calcd for: $C_{20}H_{15}O_2SCl$, 354.0481 $[M]^+$; found: 354.0488.

(2-(mesitylsulfonyl)ethene-1,1-diyl)dibenzene (**3an**)



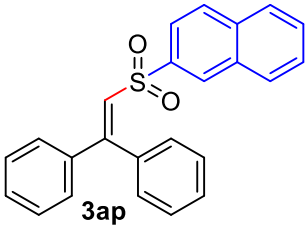
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.40-7.24 (m, 4H), 7.24-7.16 (m, 4H), 7.06 (s, 1H), 6.98 (d, *J* = 7.2 Hz, 2H), 6.75 (m, 2H), 2.44 (s, 6H), 2.24 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 153.19, 142.60, 139.45, 139.25, 135.58, 135.51, 131.77, 131.28, 130.20, 129.21, 128.74, 128.61, 128.09, 127.89, 22.60, 21.03. **EI-MS** (m/z, %): 362 (M^+, 4.33), 178 (100), 297 (89.71), 165 (61.43); **HRMS** (EI): m/z calcd for: $C_{23}H_{22}O_2S$, 362.1341 $[M]^+$; found: 364.1343.

(2-((2,4,6-triisopropylphenyl)sulfonyl)ethene-1,1-diyl)dibenzene (3ao)



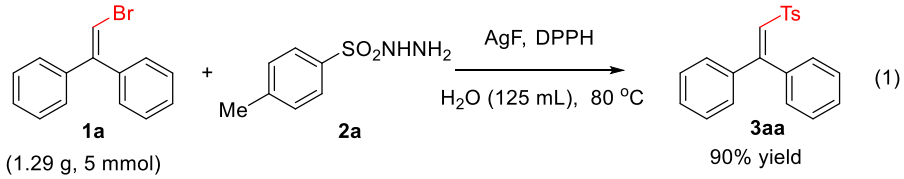
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.31-7.15 (m, 4H), 7.14-7.07 (m, 4H), 7.04 (s, 1H), 6.96 (d, *J* = 7.3 Hz, 2H), 6.91 (s, 2H), 3.93 (dt, *J* = 13.4, 6.7 Hz, 2H), 2.77 (dt, *J* = 13.8, 6.9 Hz, 1H), 1.15 (d, *J* = 6.9 Hz, 6H), 1.10 (d, *J* = 6.7 Hz, 12H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 153.21, 150.37, 139.61, 132.86, 130.04, 129.60, 128.72, 128.58, 128.09, 127.85, 123.26, 123.26, 34.41, 29.88, 24.93, 23.78. **EI-MS** (m/z, %): 446 (M^+, 1.55), 180 (100), 191 (72.5), 57 (29.85); **HRMS** (EI): m/z calcd for: $C_{29}H_{34}O_2S$, 446.2280 $[M]^+$; found: 446.2284.

2-((2,2-diphenylvinyl)sulfonyl)naphthalene (3ap)



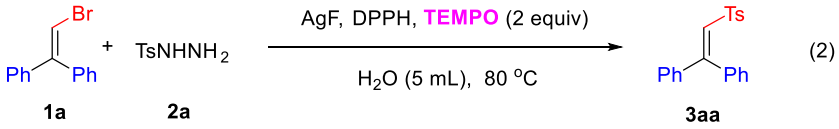
White solid; **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.97 (s, 1H), 7.90-7.80 (m, 2H), 7.76 (d, *J* = 7.9 Hz, 1H), 7.60 (ddd, *J* = 31.2, 15.8, 7.8 Hz, 3H), 7.39-7.32 (m, 1H), 7.28 (t, *J* = 7.3 Hz, 3H), 7.18 (dd, *J* = 13.4, 7.1 Hz, 4H), 7.10 (s, 1H), 7.03 (d, *J* = 7.3 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$): δ 155.46, 139.08, 138.04, 135.34, 134.91, 131.97, 130.46, 129.81, 129.74, 129.45, 129.10, 129.07, 129.03, 128.84, 128.68, 128.29, 127.87, 127.82, 127.39, 122.61. **EI-MS** (m/z, %): 370 (M^+, 1.98), 84 (100), 86 (79.14), 47 (26.24); **HRMS** (EI): m/z calcd for: $C_{24}H_{18}O_2S$, 370.1028 $[M]^+$; found: 370.1034.

3. Gram-Scale Synthesis

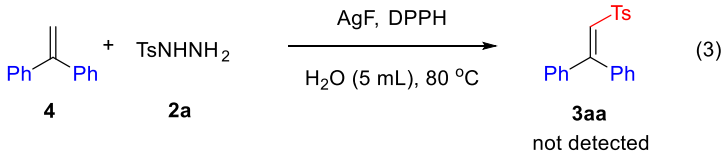


To a 250 mL Schlenk tube charged with a stir bar, 2,2-diphenylethenyl bromide (**1a**) (5 mmol), 4-methylbenzenesulfonohydrazide (**2a**) (7.5 mmol), AgF (1.27 g, 10 mmol), and DPPH (340 mg, 0.75 mmol) were added. After stirred at 80 °C for 10 h, the reaction mixture was cooled down to room temperature, washed with brine (15 mL) and extracted with EtOAc (3×10 mL). The combined organic phases were dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. The residue was purified by silica gel chromatography (PE/EA = 5:1) to afford pure products **3aa** in 90% yield.

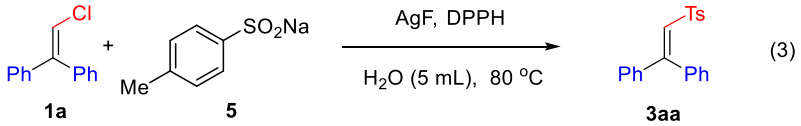
4. Control Experiments



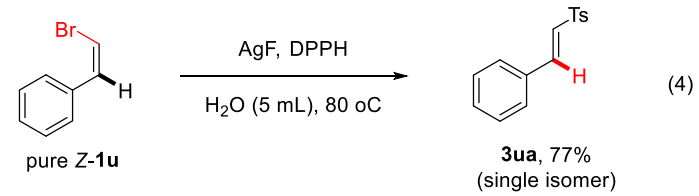
To a 25 mL Schlenk tube charged with a stir bar, 2,2-diphenylethenyl bromide (**1a**) (0.2 mmol), 4-methylbenzenesulfonohydrazide (**2a**) (0.3 mmol), AgF (50.8 mg, 0.4 mmol), DPPH (13.6 mg, 0.03 mmol) and TEMPO (62.4 mg, 2 equiv) were added. After filled with argon, water (5 mL) was added via a syringe. The mixture was stirred at 80 °C for 10 h. Upon completion, the yield of the product was detected by **^{1}H NMR** with CH_2Br_2 as the internal standard.

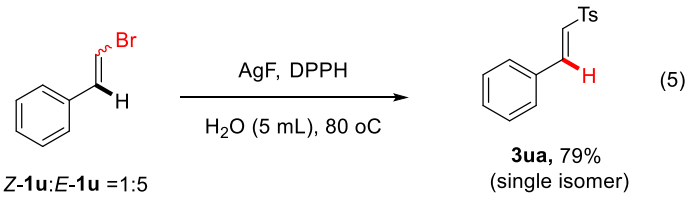


To a 25 mL Schlenk tube charged with a stir bar, 1,1-diphenylethene (**1a**) (0.2 mmol), 4-methylbenzenesulfonohydrazide (**2a**) (0.3 mmol), AgF (50.8 mg, 0.4 mmol), DPPH (13.6 mg, 0.03 mmol) were added. After filled with argon, water (5 mL) was added via a syringe. The mixture was stirred at 80 °C for 10 h. Upon completion, the yield of the product was detected by **^{1}H NMR** with CH_2Br_2 as the internal standard.



To a 25 mL Schlenk tube charged with a stir bar, 2,2-diphenylethenyl bromide (**1a**) (0.2 mmol), sodium *p*-tolylsulfinate (**5**) (0.3 mmol), AgF (50.8 mg, 0.4 mmol), DPPH (13.6 mg, 0.03 mmol) were added. After filled with argon, water (5 mL) was added via a syringe. The mixture was stirred at 80 °C for 10 h. Upon completion, the yield of the product was detected by **^{1}H NMR** with CH_2Br_2 as the internal standard.





To a 25 mL Schlenk tube charged with a stir bar, *Z*-*β*-bromostyrene (*Z*-**1u**) or β-bromostyrene (*Z*-**1u**:*E*-**1u** = 1:5) (0.2 mmol), 4-methylbenzenesulfonohydrazide (**2a**) (0.3 mmol), AgF (50.8 mg, 0.4 mmol), DPPH (13.6 mg, 0.03 mmol) were added. After filled with argon, water (5 mL) was added via a syringe. The mixture was stirred at 80 °C for 10 h. Upon completion, the reaction mixture was washed with brine (15 mL) and extracted with EtOAc (3×10 mL). The combined organic phases were dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. The residue was purified by silica gel chromatography (PE/EA = 5:1) to afford pure products (**3ua**).

5. References

[1] G. Zhang, R. X. Bai, C. H. Li, C. G. Feng, G. Q. Lin, *Tetrahedron* 2019, **75**, 1658.

[2] J. J. Molloy, J. B. Metternich, C. G. Daniliuc, A. J. B. Watson, R. Gilmour, *Angew. Chem. Int. Ed.* 2018, **57**, 3168.

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[5] B. Wang, Z. C. Yan, Y. Y. Liu, J. W. Wang, Z. G. Zha, Z. Y. Wang, *Green Chem.* 2019, **21**, 205.

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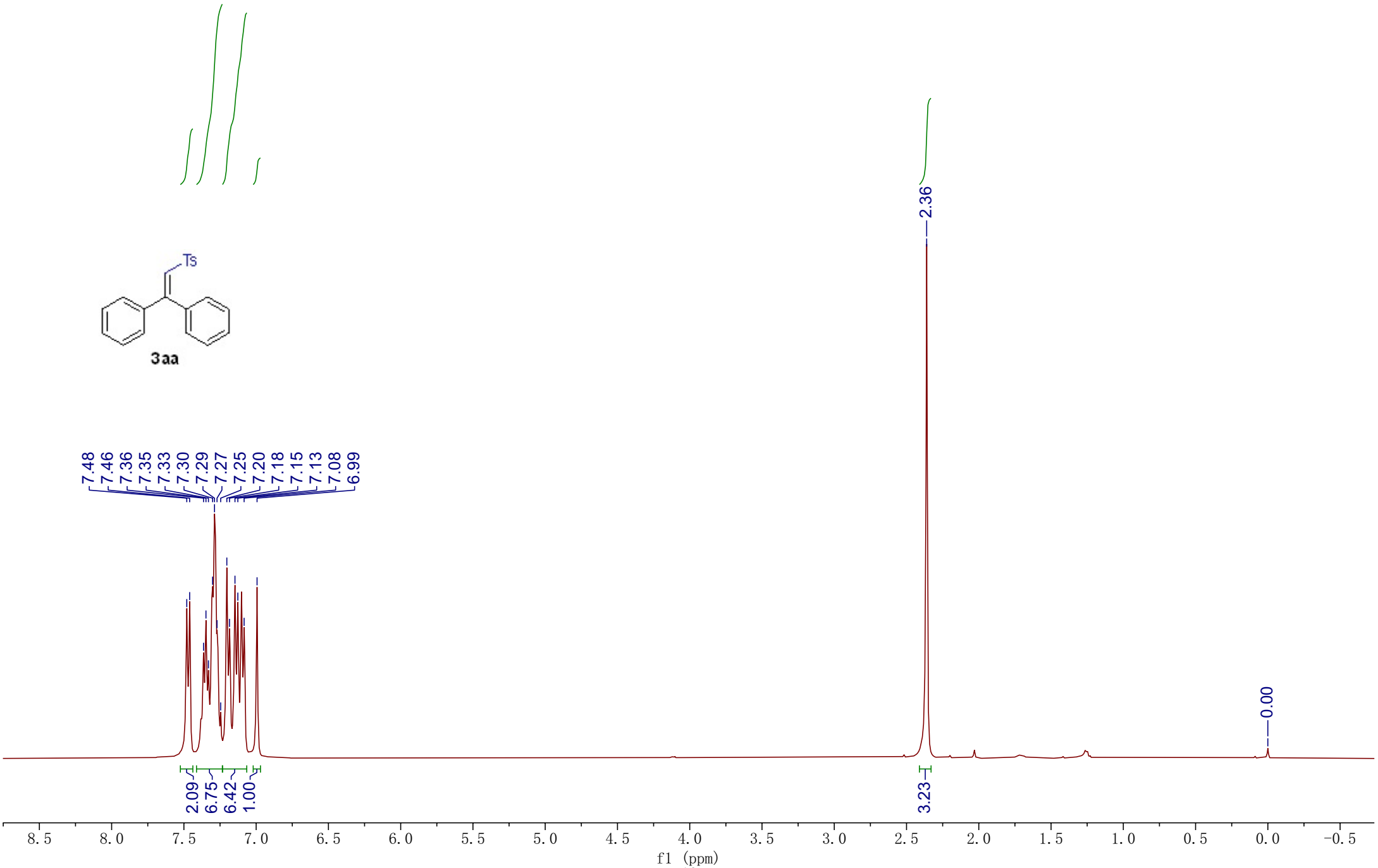
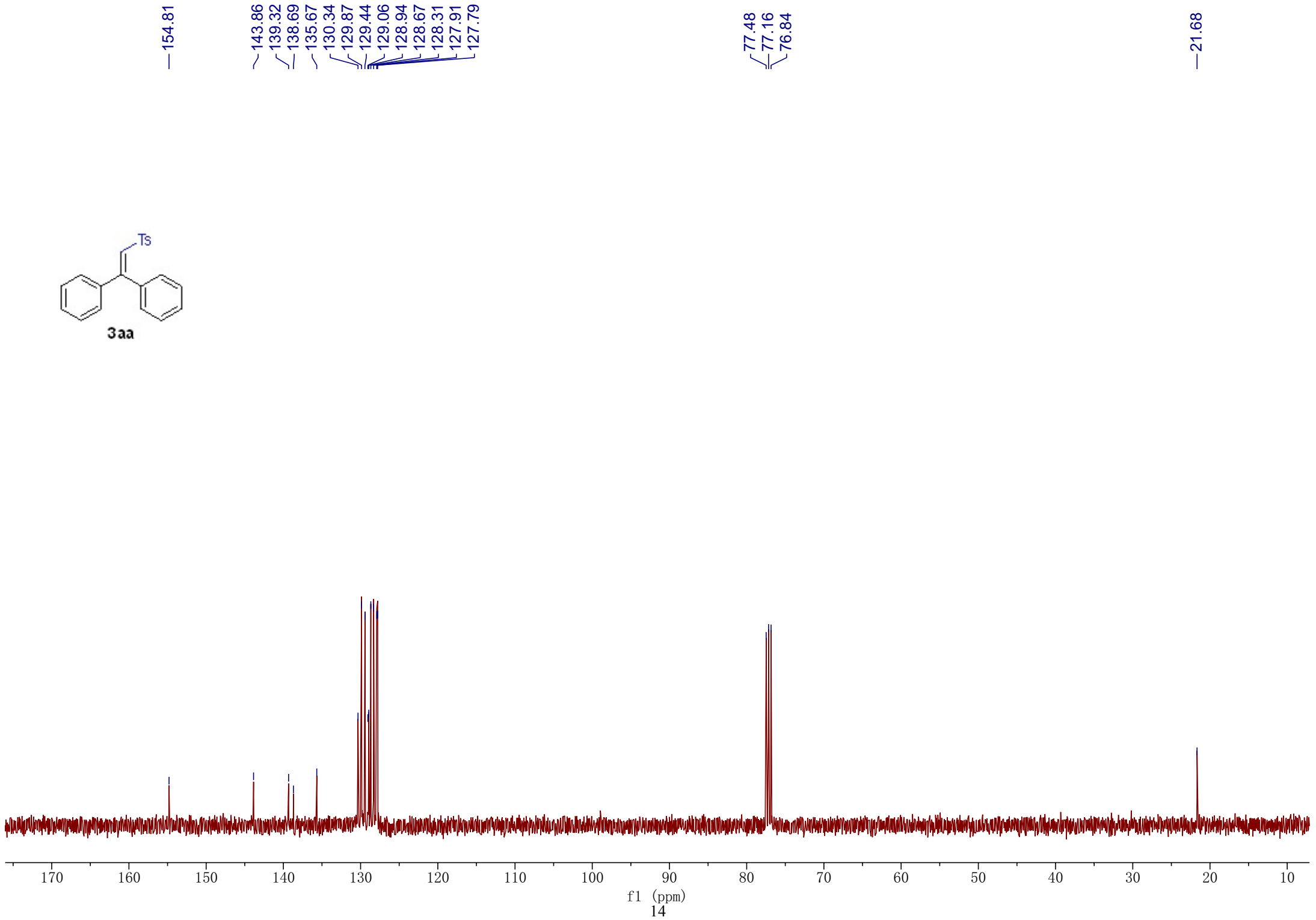
6. Copies of **^{1}HNMR, ^{13}CNNMR** and **^{19}F NMR**

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128.67
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127.91
127.79
77.48
77.16
76.84
21.68
Ts
3aa
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150
140
130
120
110
100
90
80
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60
50
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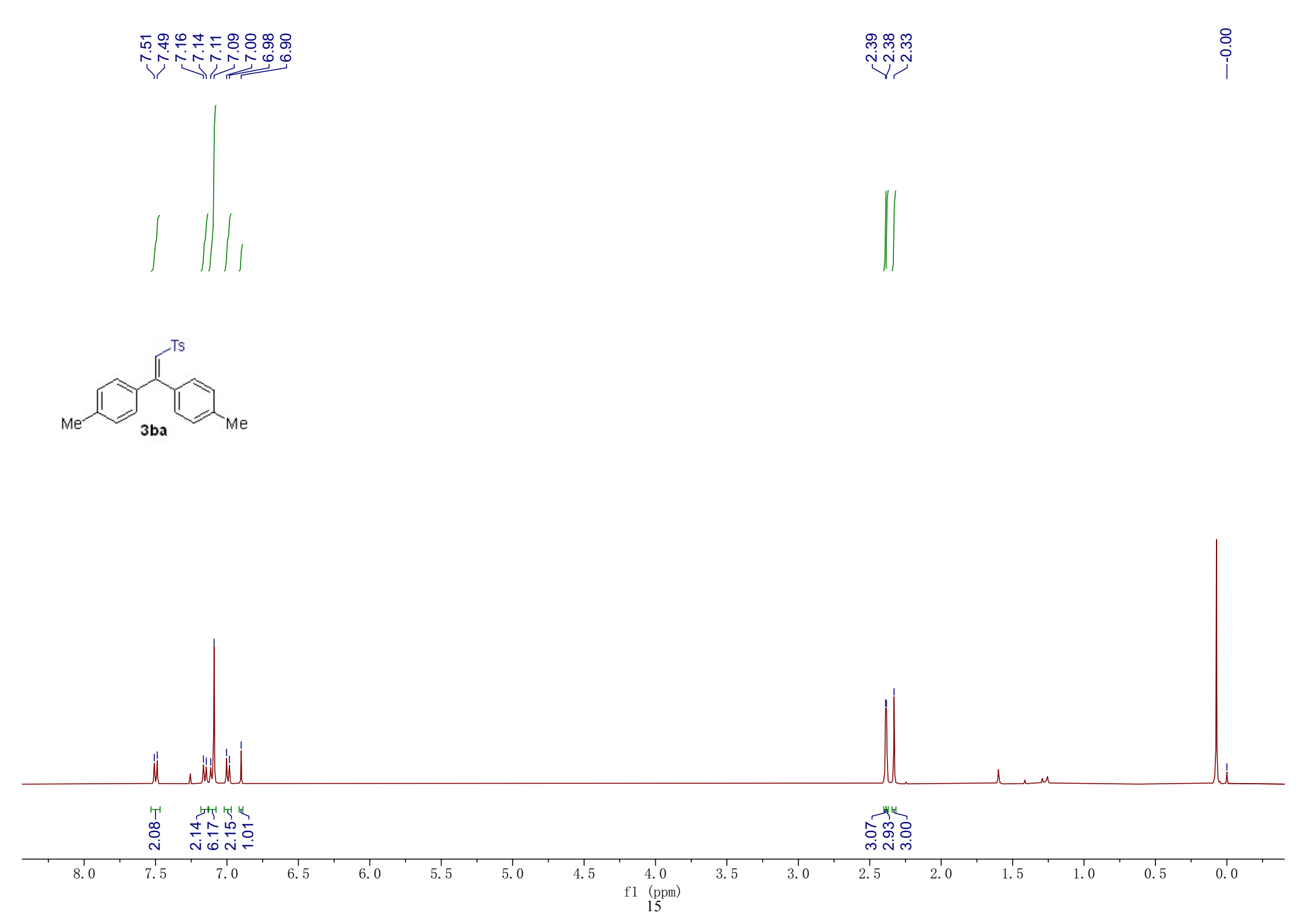
30
20
10
f1 (ppm)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0.00
Ts
Me
Me
3ba
2.08
2.14
6.17
2.15
1.01
3.07
2.93
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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3.5
3.0
2.5
2.0
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1.0
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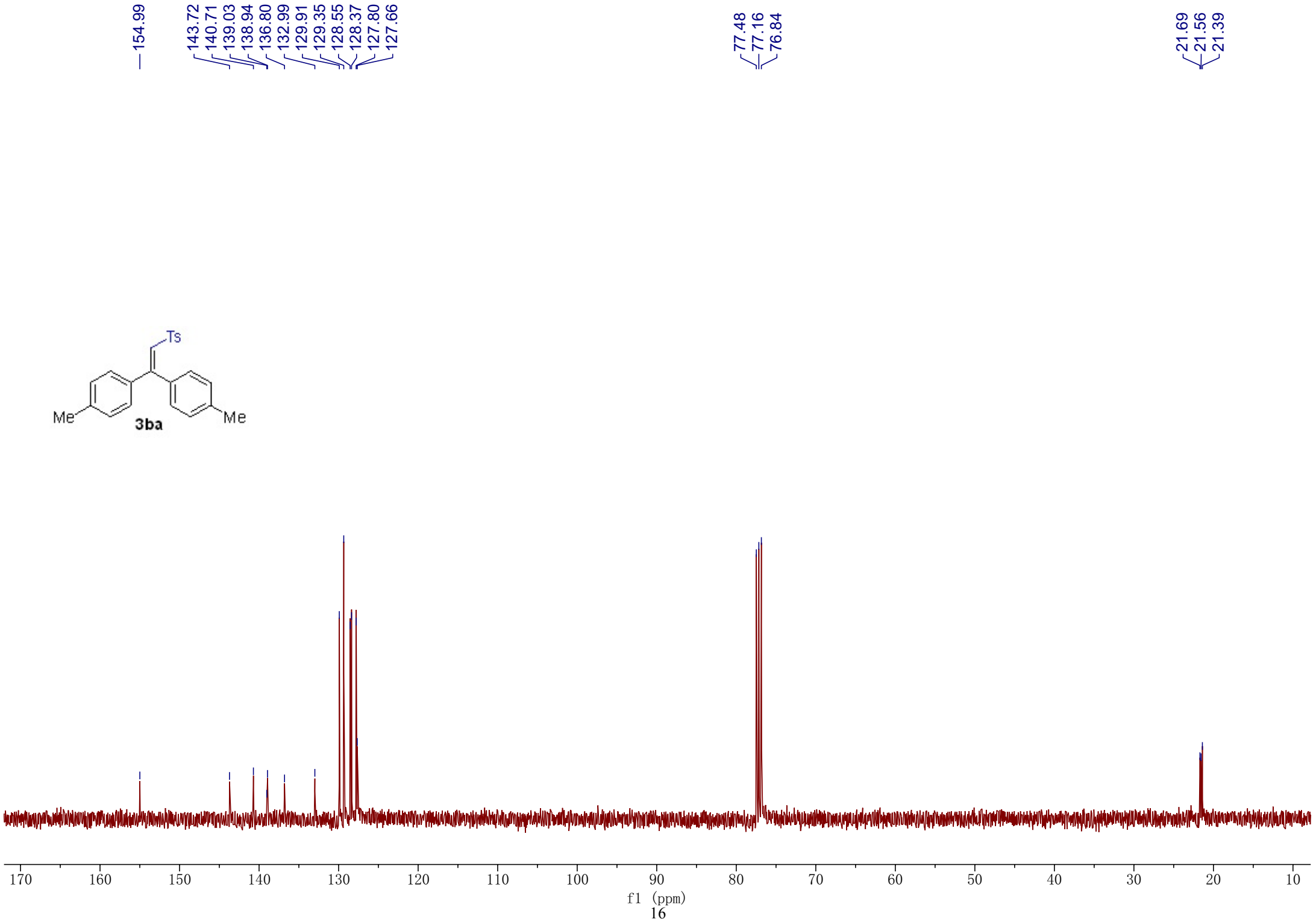
0.0
f1 (ppm)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77.48
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76.84
21.69
21.56
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Ts
Me
Me
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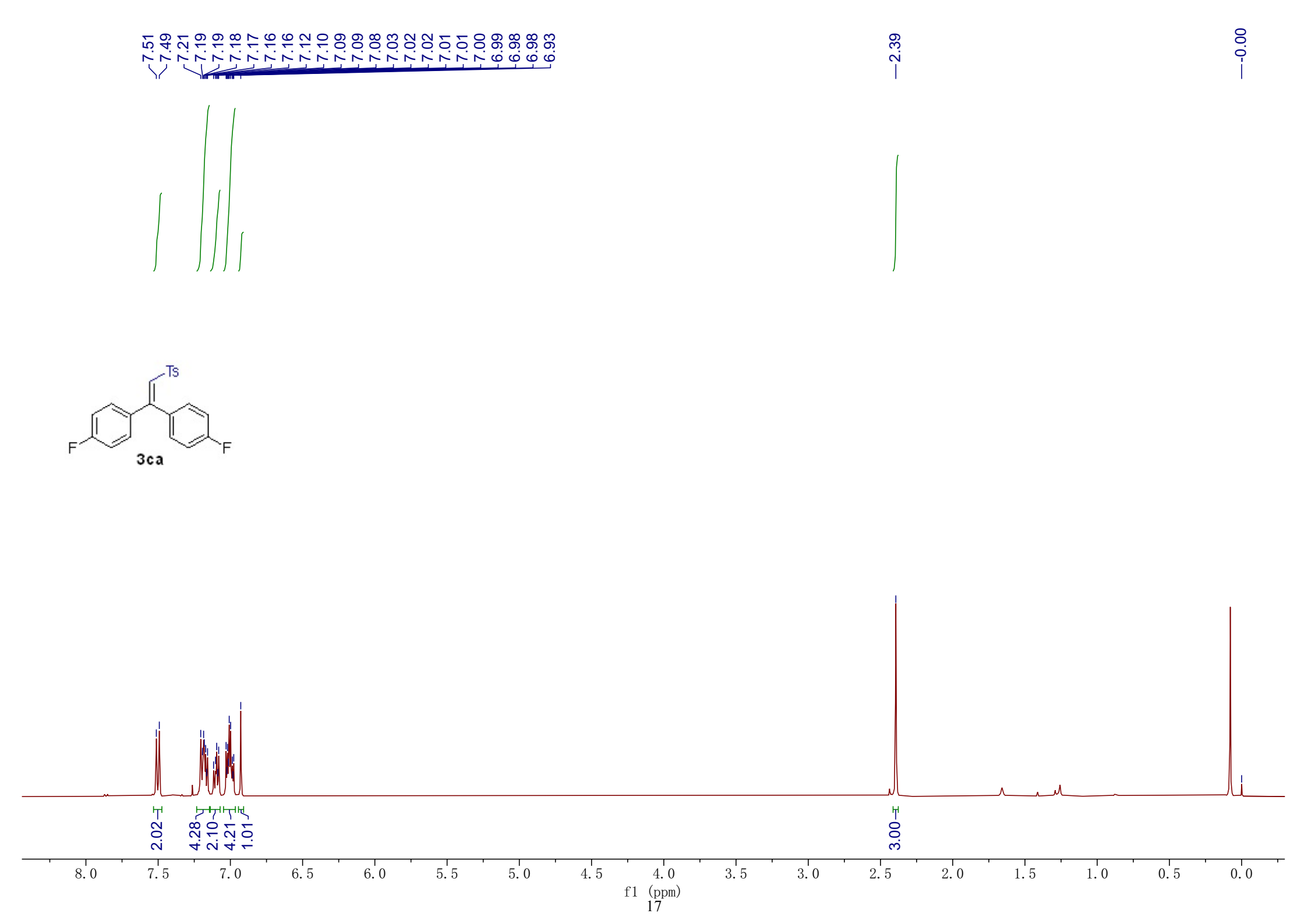
10
f1 (ppm)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7.12
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7.09
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7.08
7.03
7.02
7.02
7.01
7.01
7.00
6.99
6.98
6.98
6.93
2.39
0.00
Ts
F
F
3ca
2.02
4.28
2.10
4.21
1.01
3.00
8.0
7.5
7.0
6.5
6.0
5.5
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2.5
2.0
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1.0
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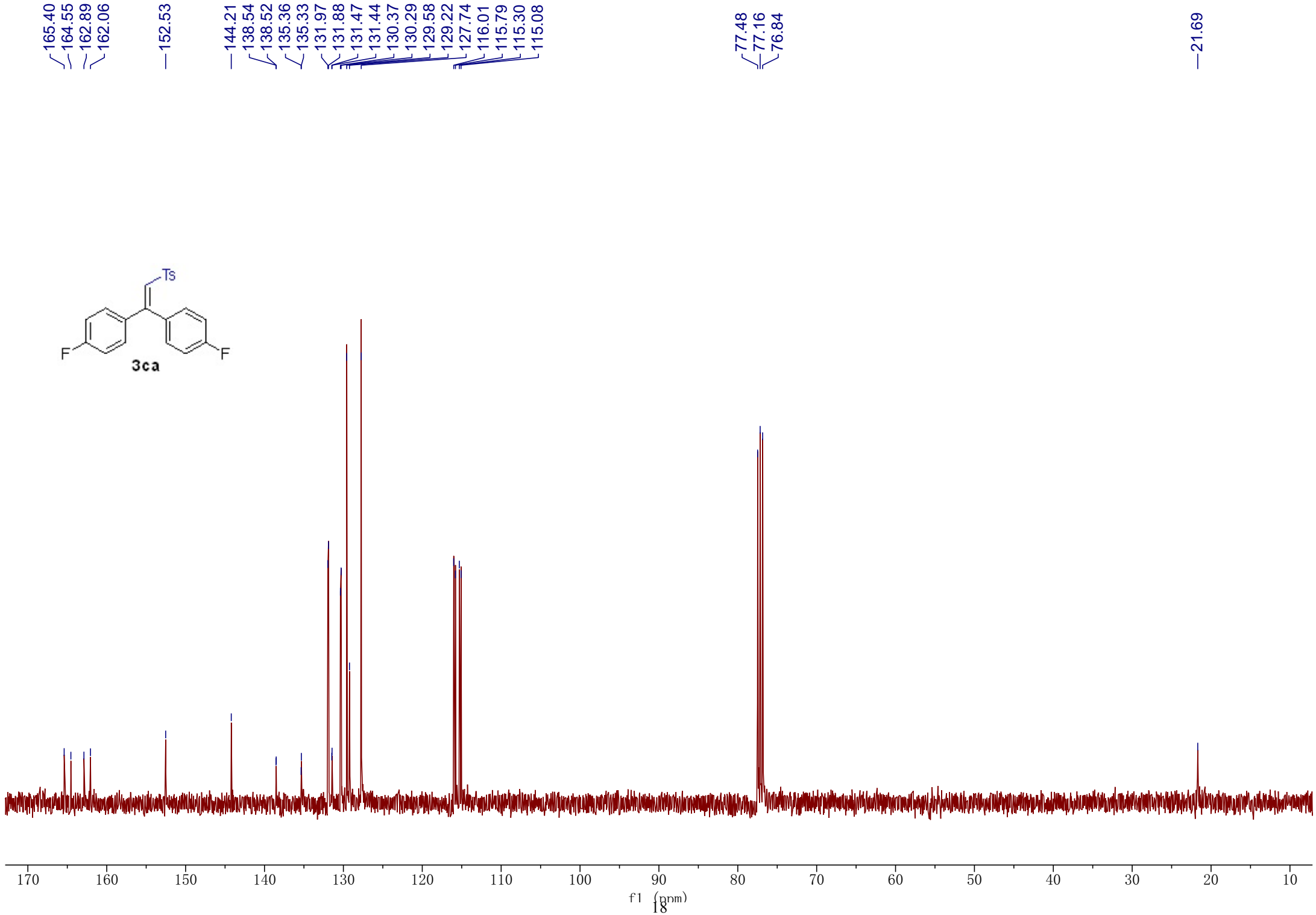
0.0
f1 (ppm)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131.47
131.44
130.37
130.29
129.58
129.22
127.74
116.01
115.79
115.30
115.08
77.48
77.16
76.84
21.69
Ts
F
F
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120
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100
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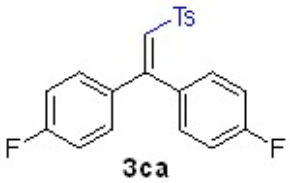
50
40
30
20
10
f1 (ppm)


Ts
F
F

3ca

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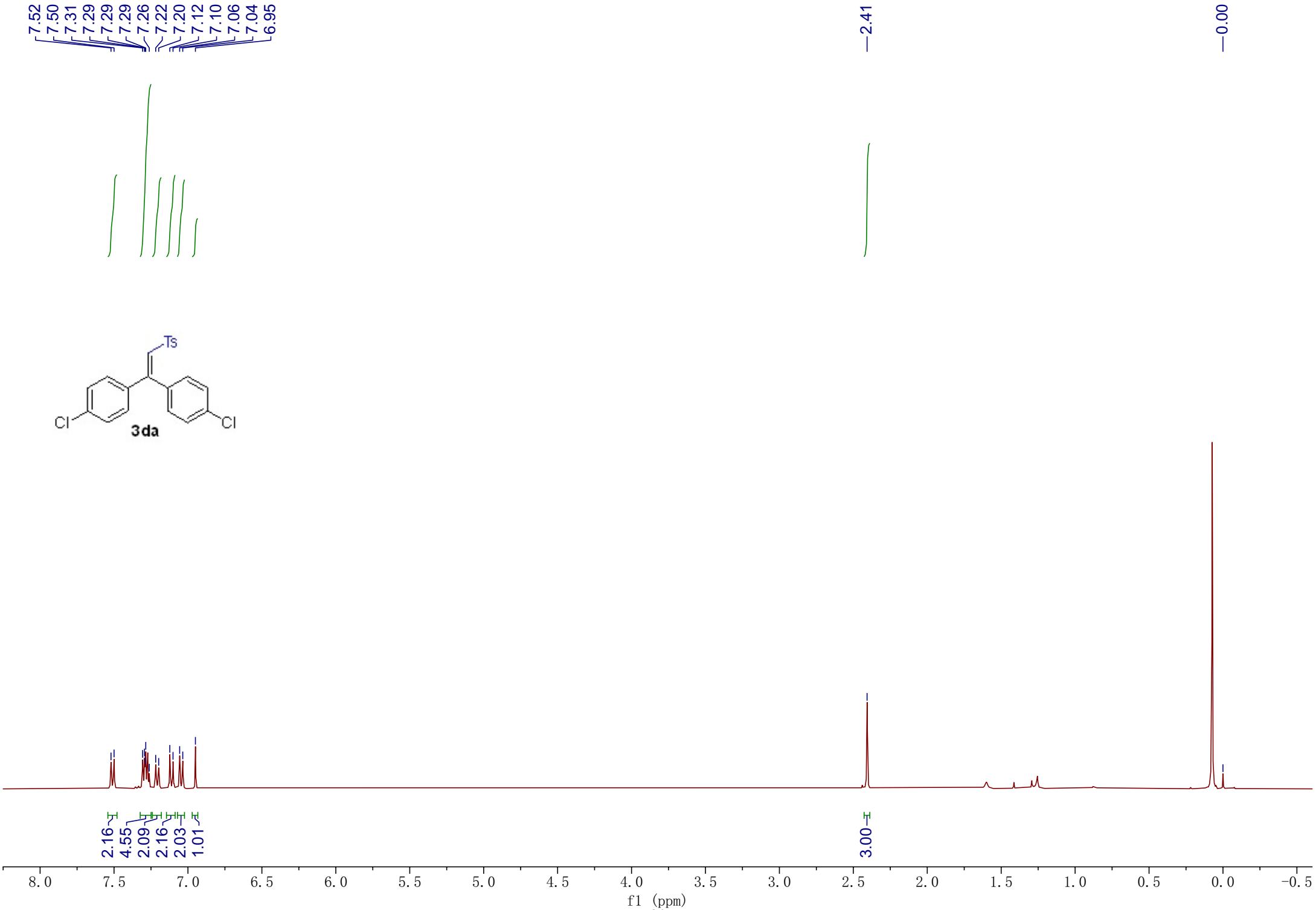
f1 (ppm)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Cl
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2.09
2.16
2.03
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3.00
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7.0
6.5
6.0
5.5
5.0
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0.5
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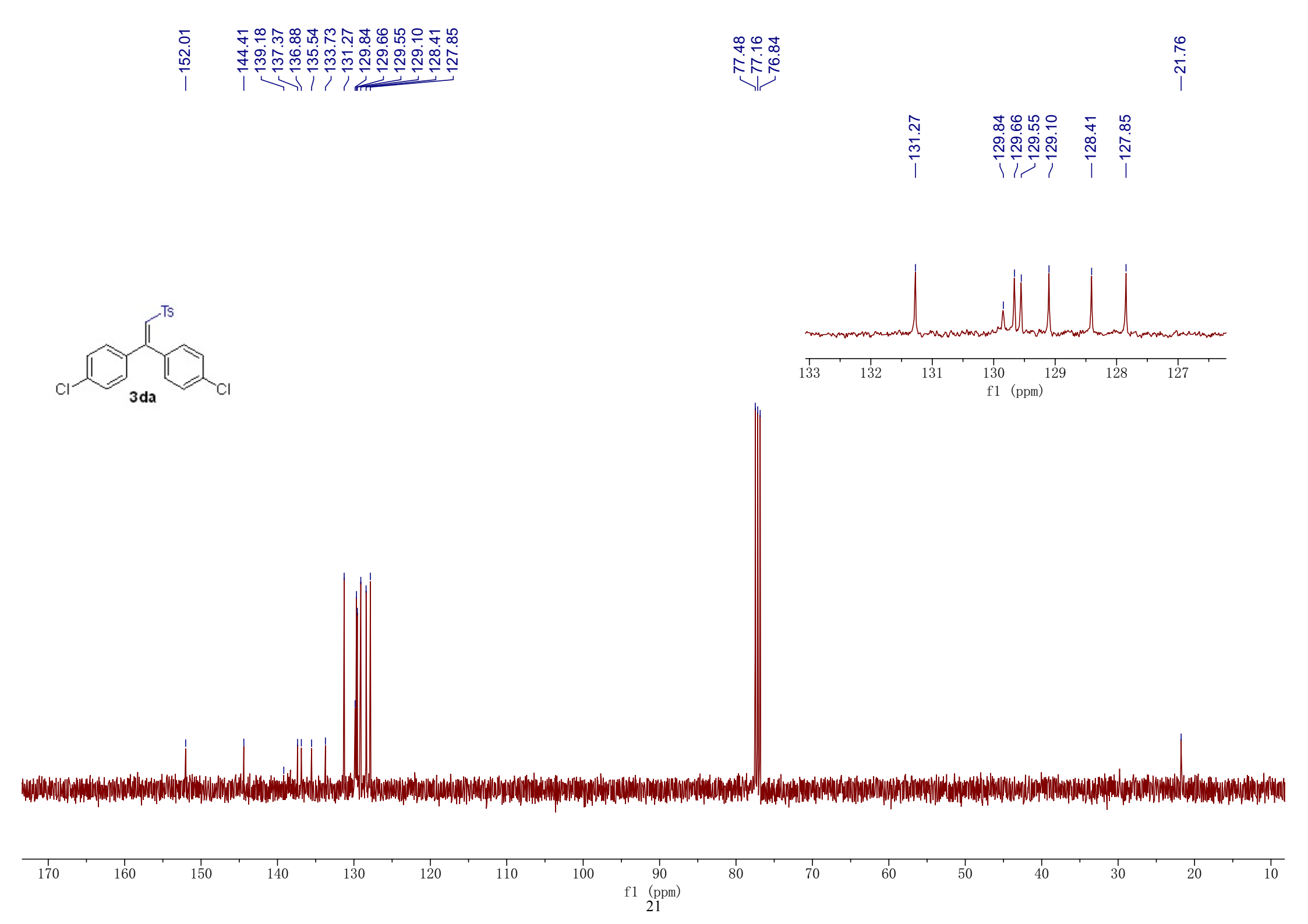
f1 (ppm)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Ts
Cl
Cl
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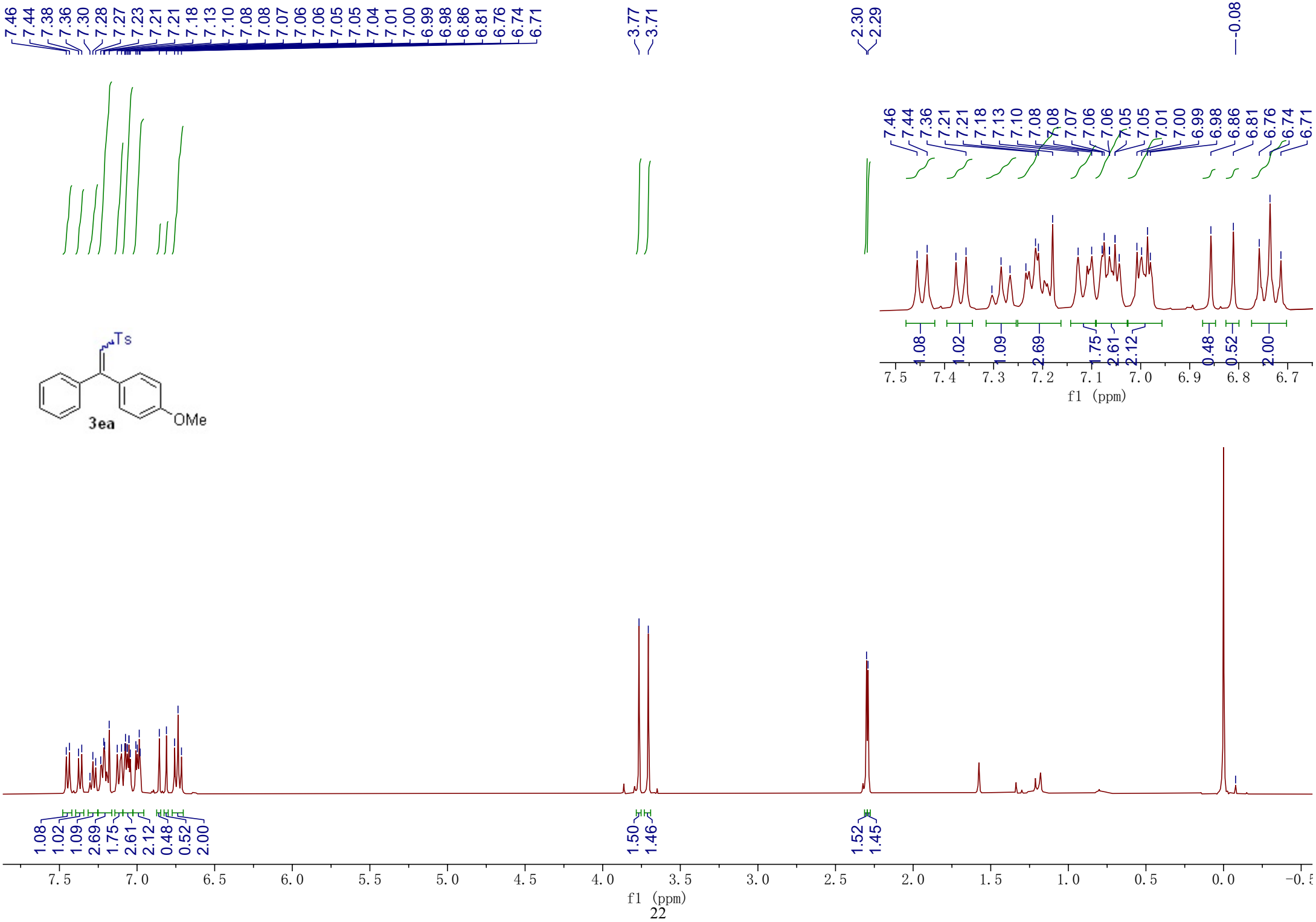
f1 (ppm)
f1 (ppm)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3.77 3.71
2.30 2.29
-0.08
Ts
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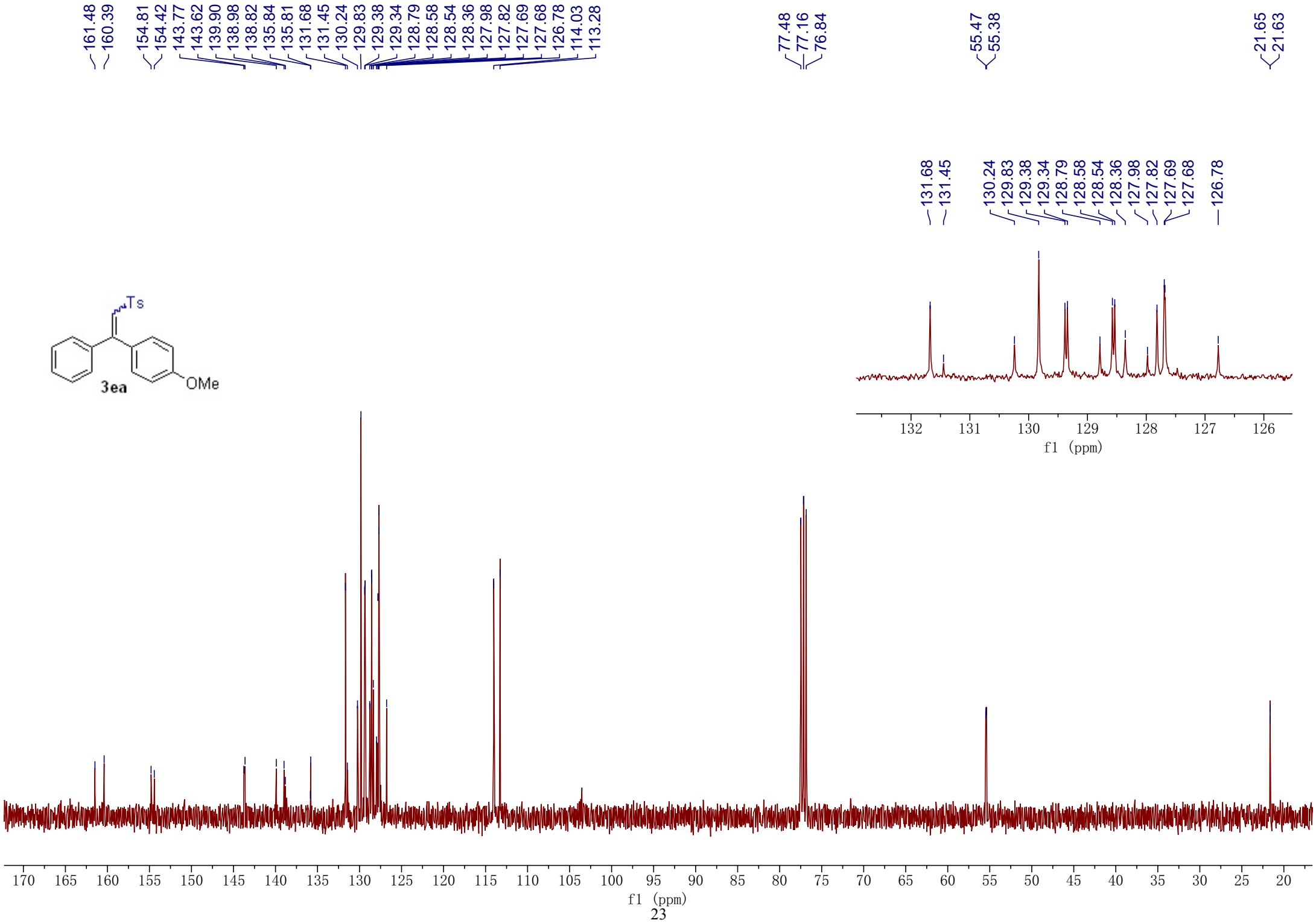
1.50 1.46
1.52 1.45
f1 (ppm)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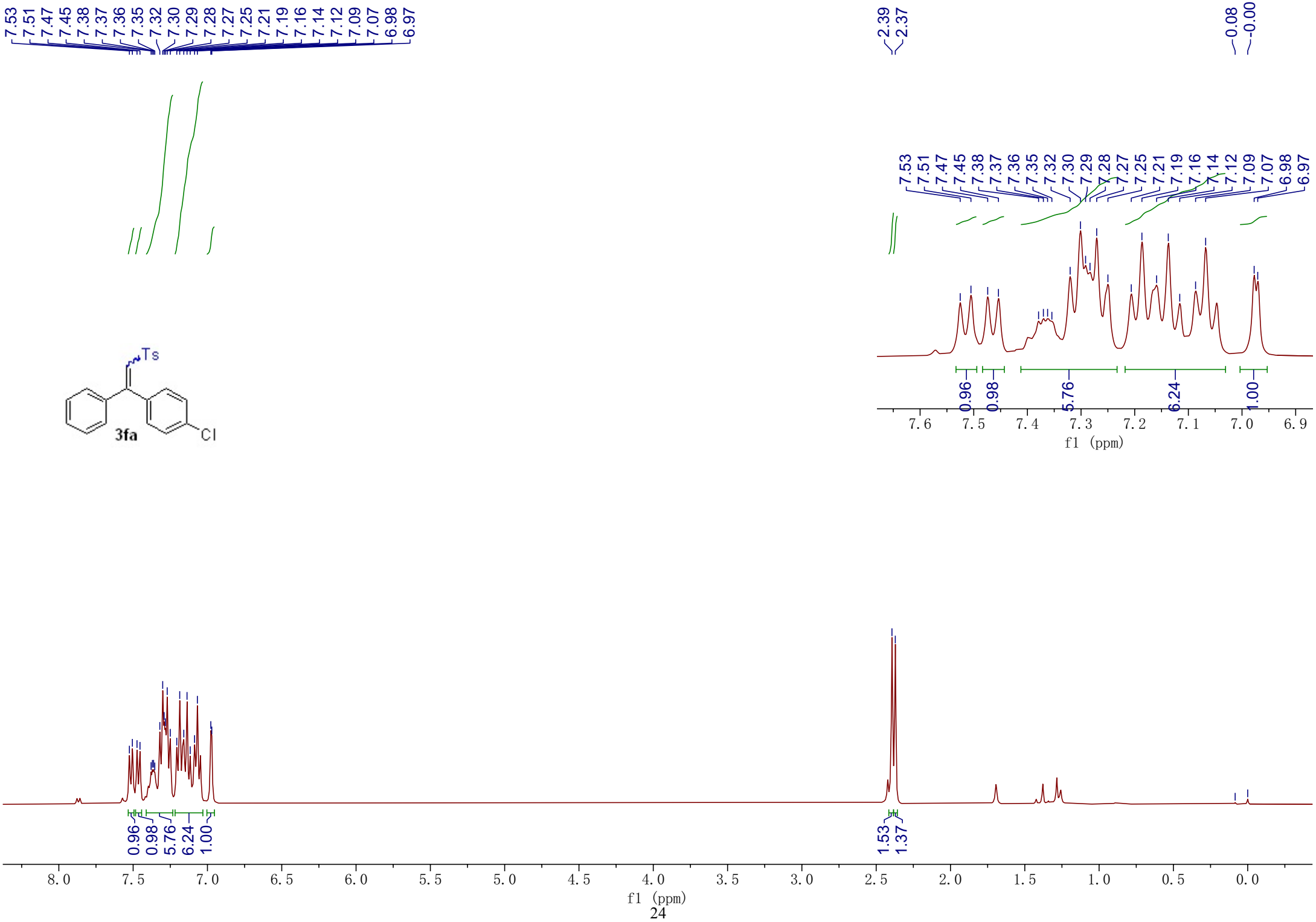
f1 (ppm)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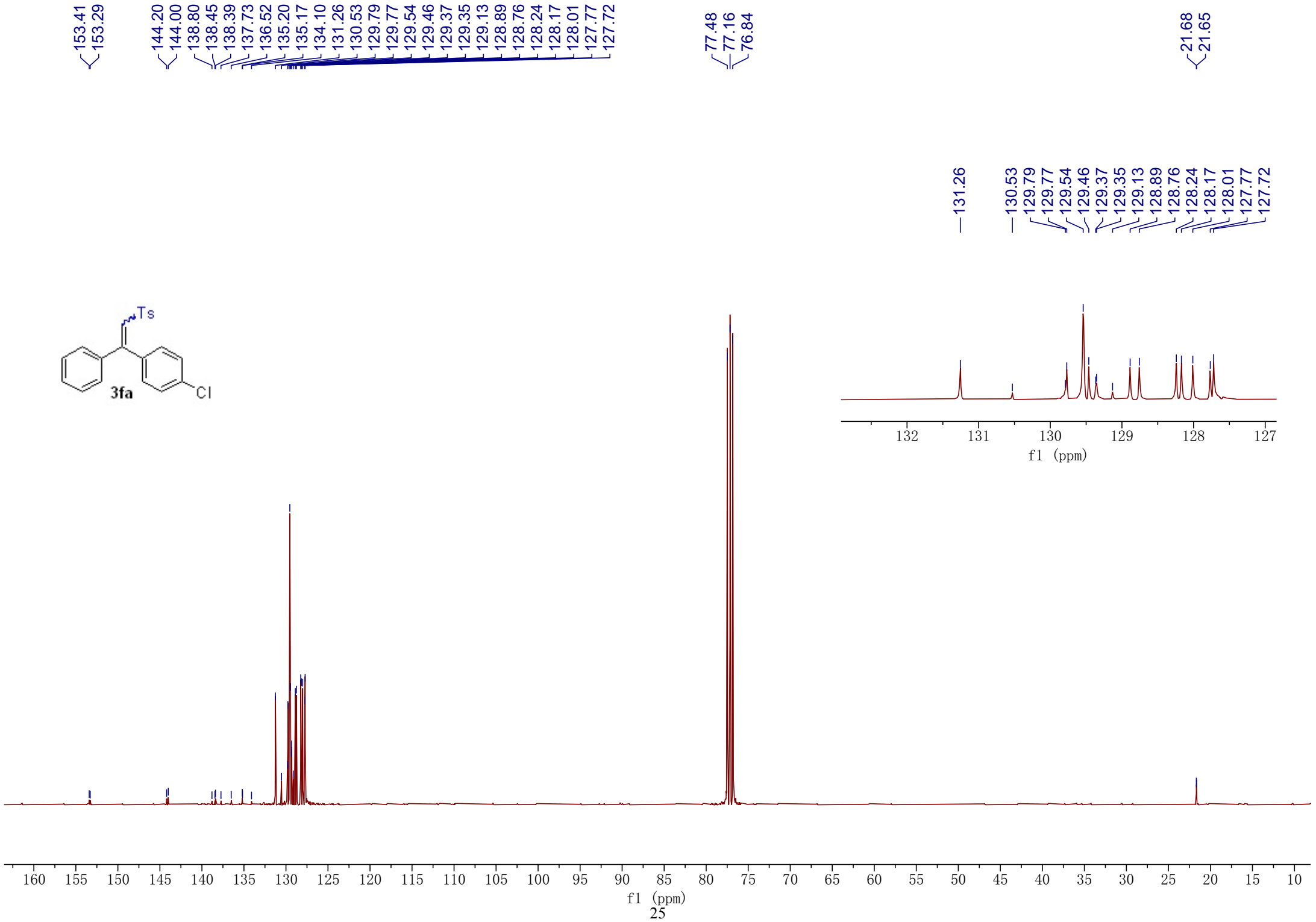
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45
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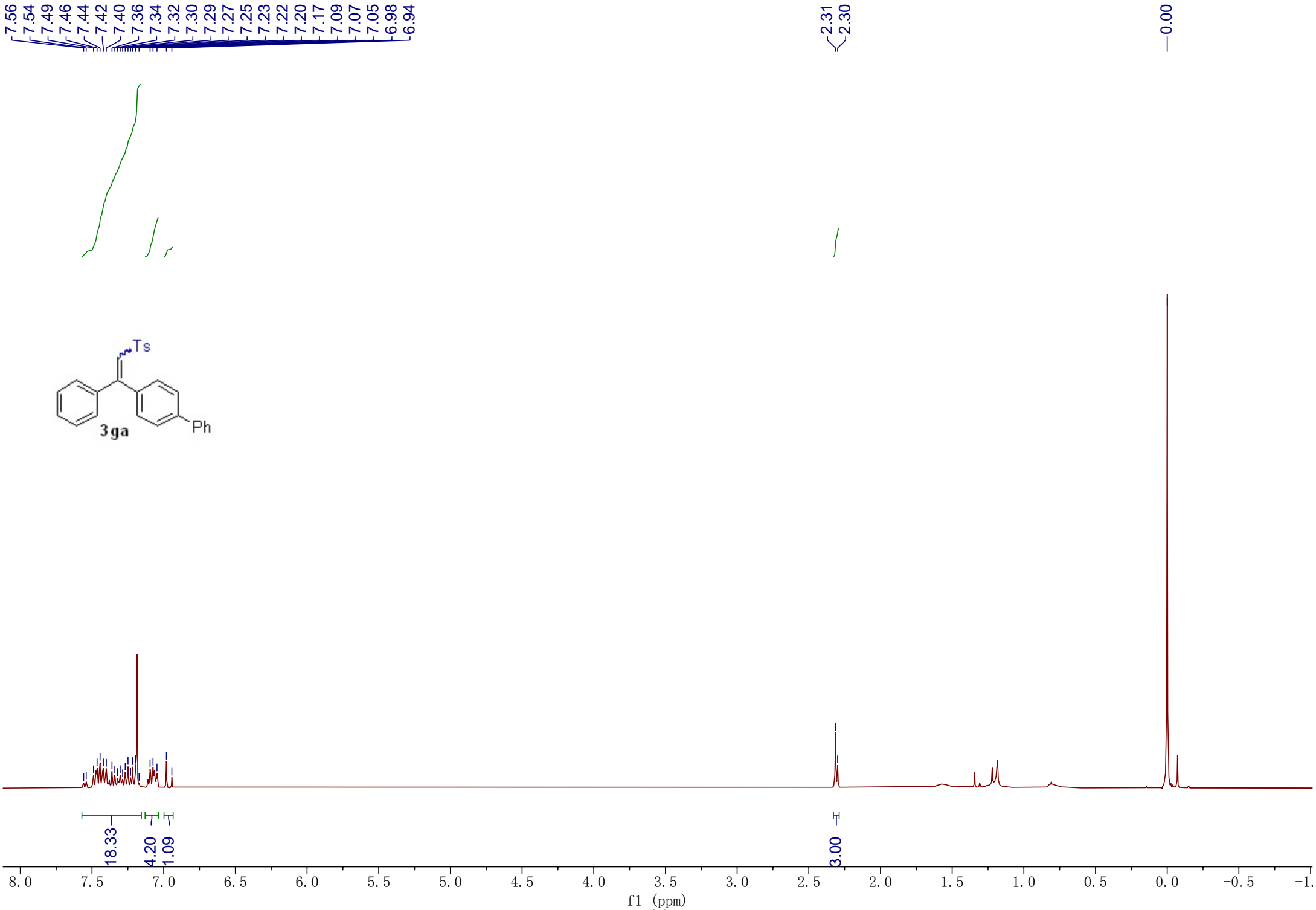
35
30
25
20
15
10
f1 (ppm)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7.54
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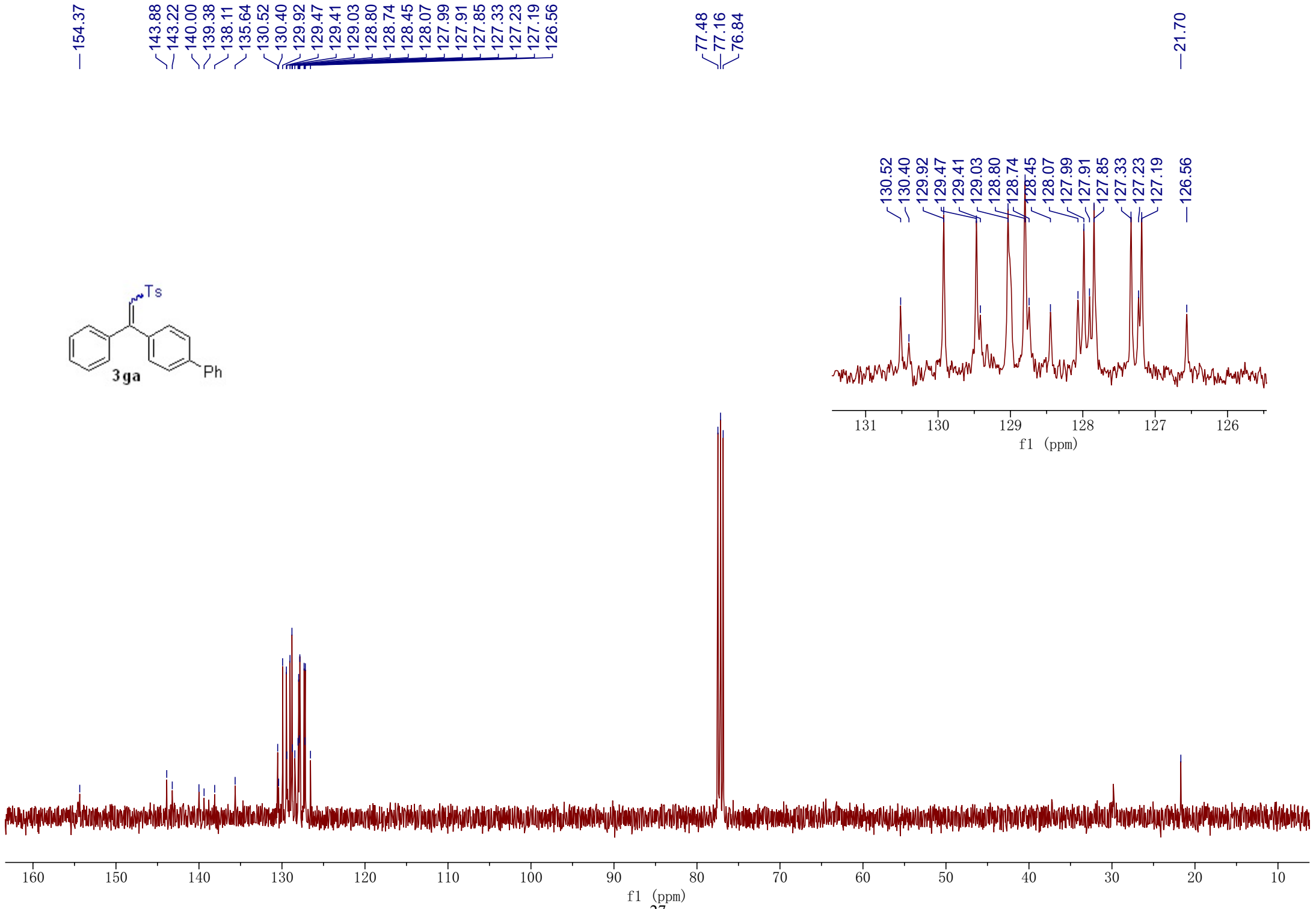
7.42
7.40
7.36
7.34
7.32
7.30
7.29
7.27
7.25
7.23
7.22
7.20
7.17
7.09
7.07
7.05
6.98
6.94
2.31
2.30
0.00
Ts
Ph
3ga
18.33
4.20
1.09
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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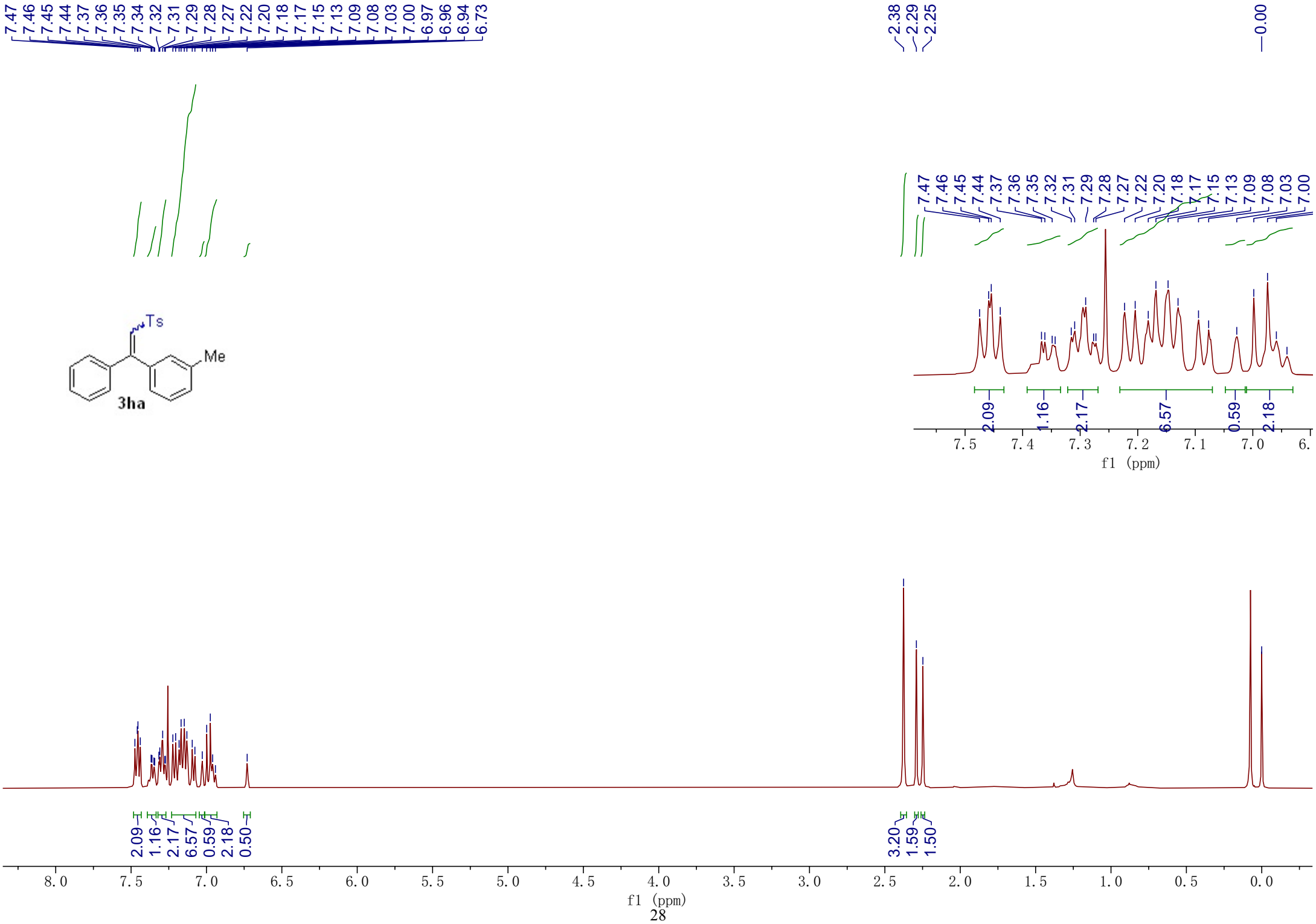
138.11
135.64
130.52
130.40
129.92
129.47
129.41
129.03
128.80
128.74
128.45
128.07
127.99
127.91
127.85
127.33
127.23
127.19
126.56
77.48
77.16
76.84
21.70
Ts
Ph
3ga
f1 (ppm)
f1 (ppm)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2.38 2.29 2.25
0.00
Ts
Me
3ha
2.09 1.16 2.17 6.57 0.59 2.18
7.5 7.4 7.3 7.2 7.1 7.0 6.
f1 (ppm)
2.09 1.16 2.17 6.57 0.59 2.18 0.50
3.20 1.59 1.50
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


155.07
143.80
143.71
139.36
139.28
138.77
138.43
137.51
135.77
135.53
131.14
130.30
130.12
129.86
129.62
129.41
129.31
129.09
128.90
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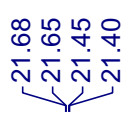
128.66
128.55
128.28
127.86
127.79
127.12
125.64


77.48
77.16
76.84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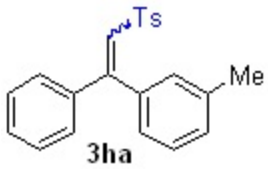
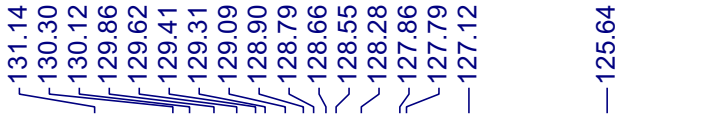
21.65
21.45
21.40


Ts
Me
3ha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129.62
129.41
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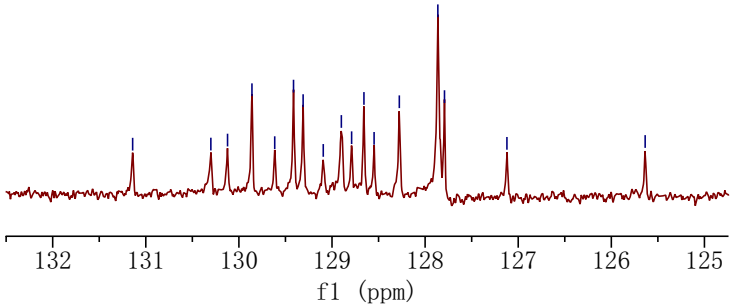
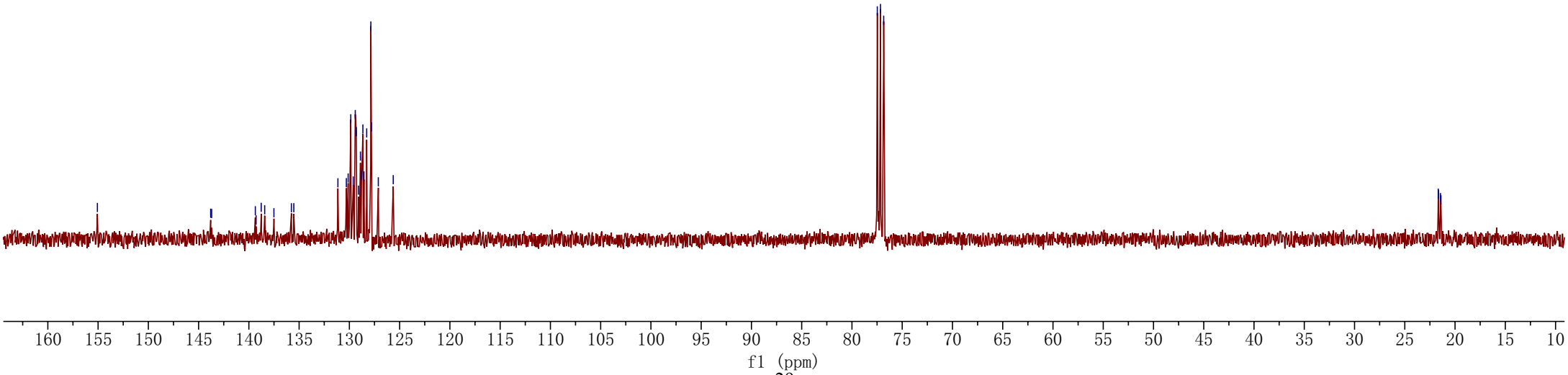
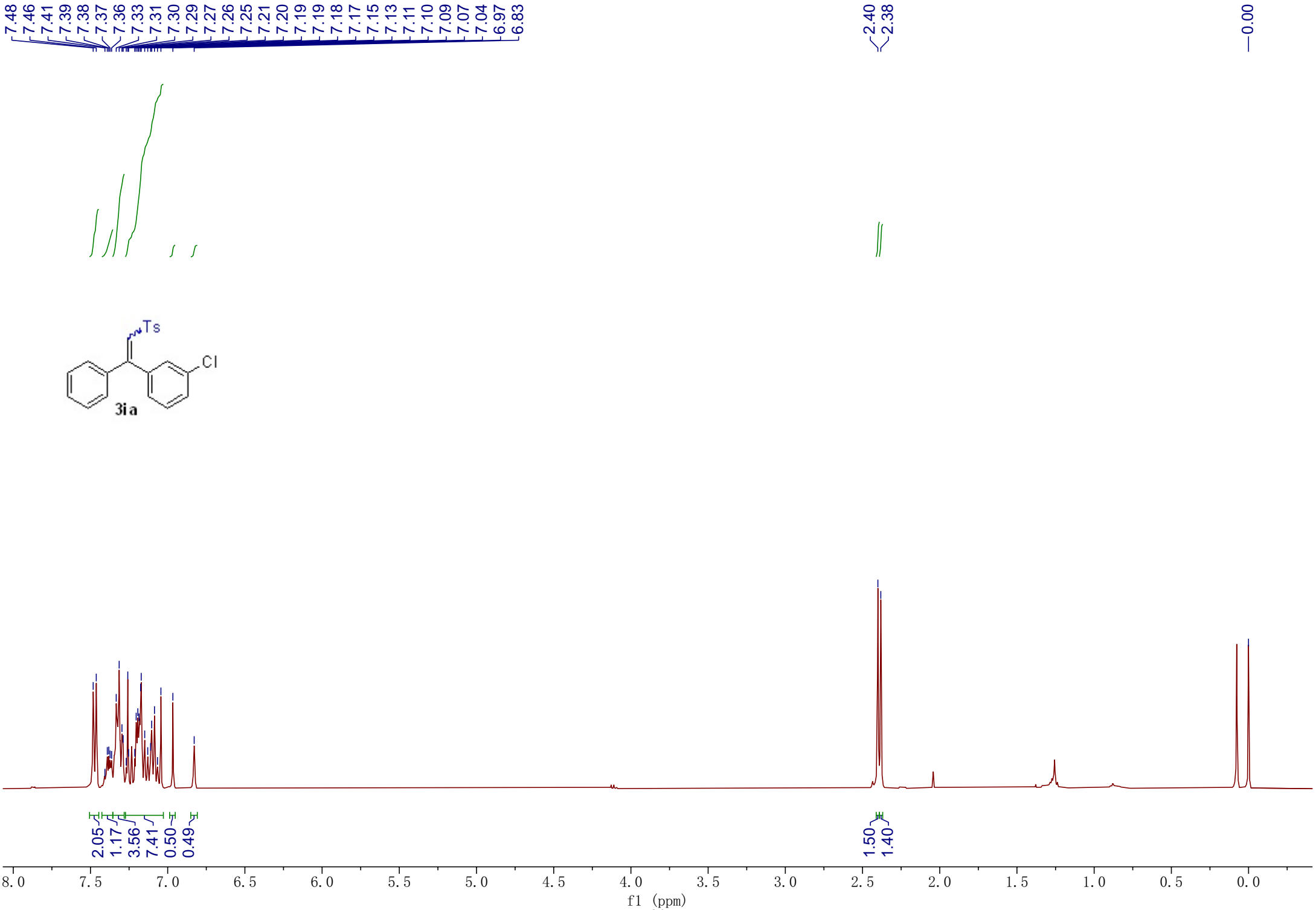
129.09
128.90
128.79
128.66
128.55
128.28
127.86
127.79
127.12
125.64


132
131
130
129
128
127
126
125
f1 (ppm)


160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
f1 (ppm)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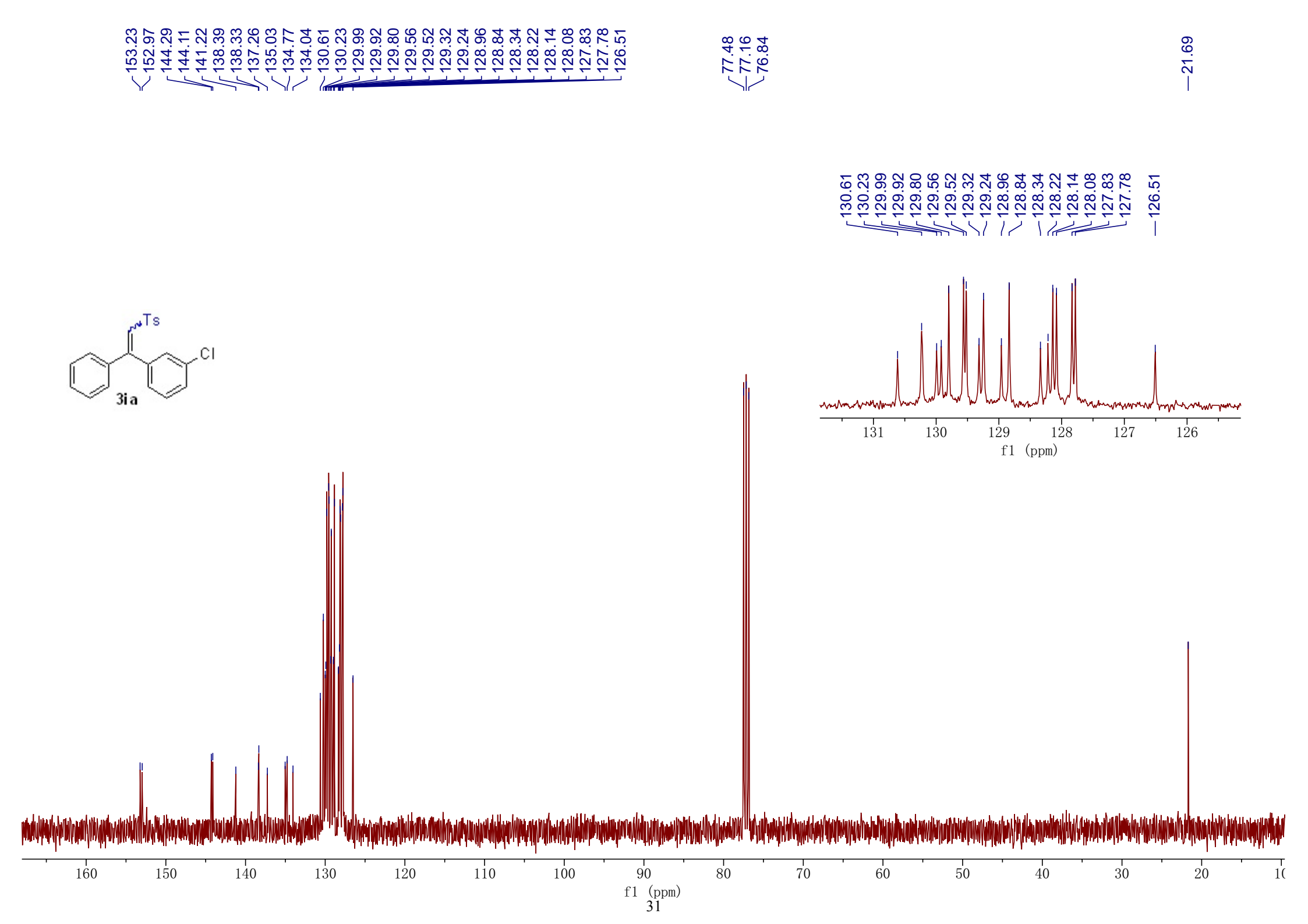
7.46
7.41
7.39
7.38
7.37
7.36
7.33
7.31
7.30
7.29
7.27
7.26
7.25
7.21
7.20
7.19
7.19
7.18
7.17
7.15
7.13
7.11
7.10
7.09
7.07
7.04
6.97
6.83
2.40
2.38
0.00
Ts
Cl
3ia
2.05
1.17
3.56
7.41
0.50
0.49
1.50
1.40
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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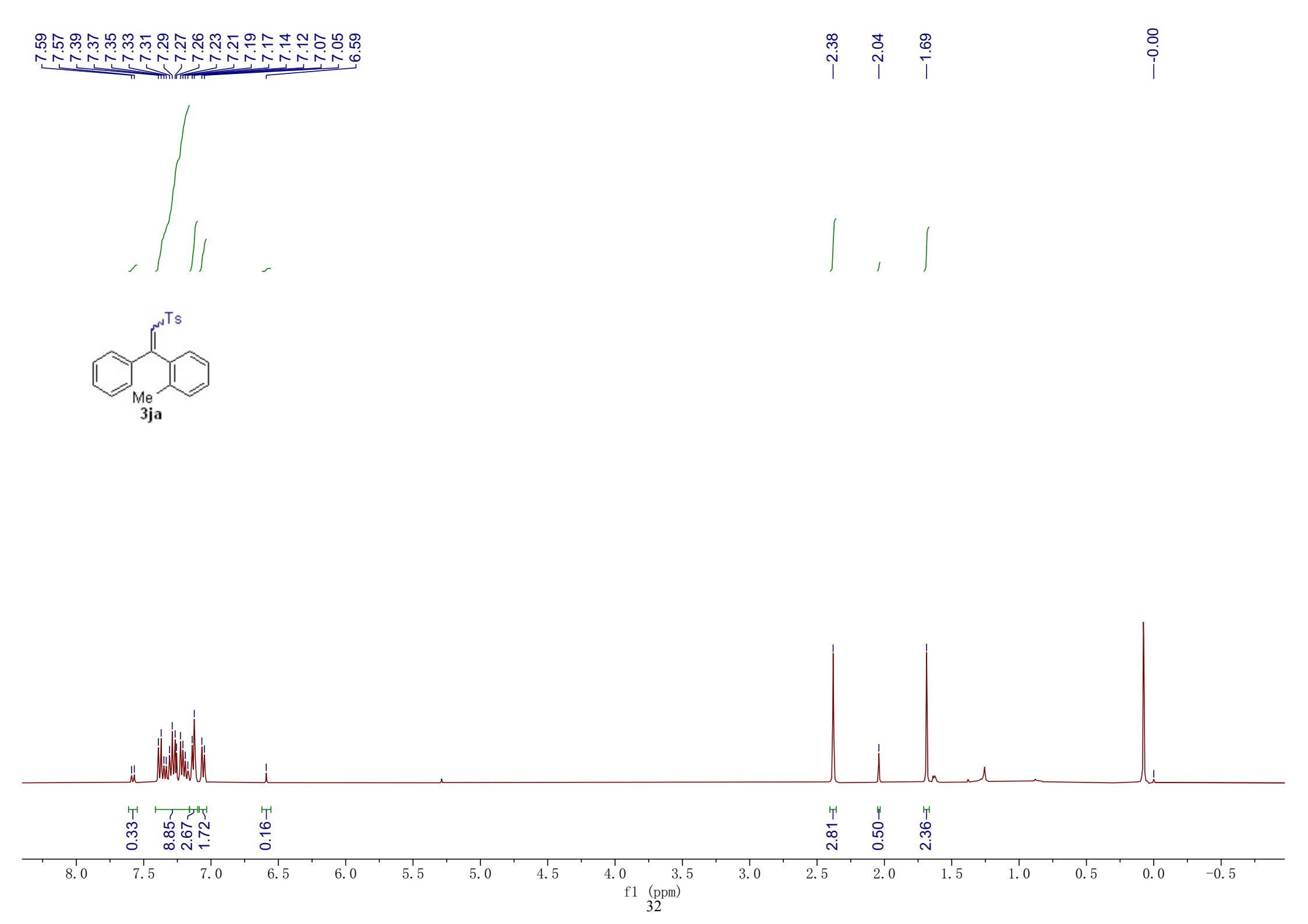
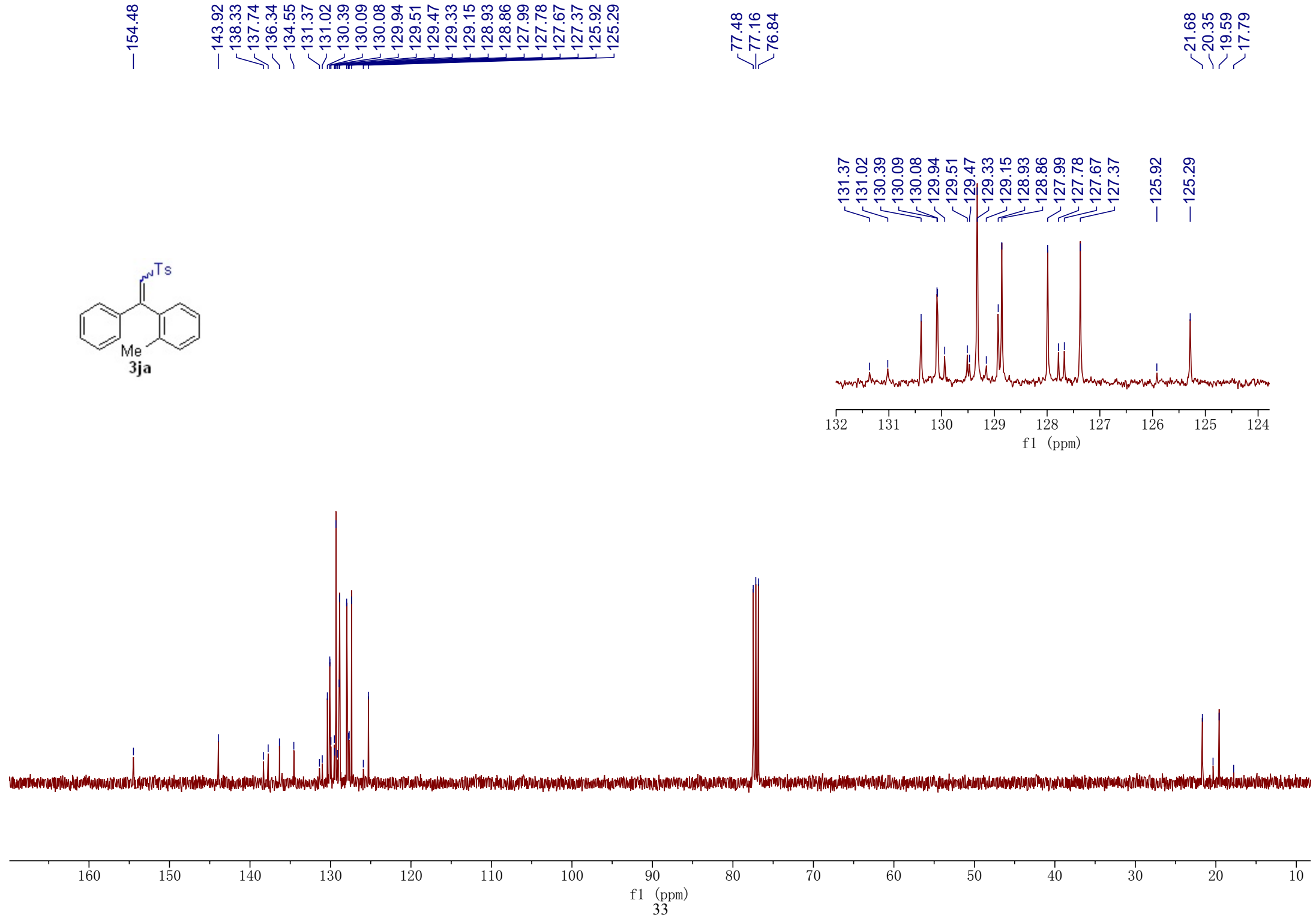
152.97
144.29
144.11
141.22
138.39
138.33
137.26
135.03
134.77
134.04
130.61
130.23
129.99
129.92
129.80
129.56
129.52
129.32
129.24
128.96
128.84
128.34
128.22
128.14
128.08
127.83
127.78
126.51
77.48
77.16
76.84
21.69
Ts
Cl
3ia
f1 (ppm)
f1 (ppm)


7.59
7.57
7.39
7.37
7.35
7.33
7.31
7.29
7.27
7.26
7.23
7.21
7.19
7.17
7.14
7.12
7.07
7.05
6.59
2.38
2.04
1.69
-0.00
Ts
Me
3ja
0.33
8.85
2.67
1.72
0.16
2.81
0.50
2.36
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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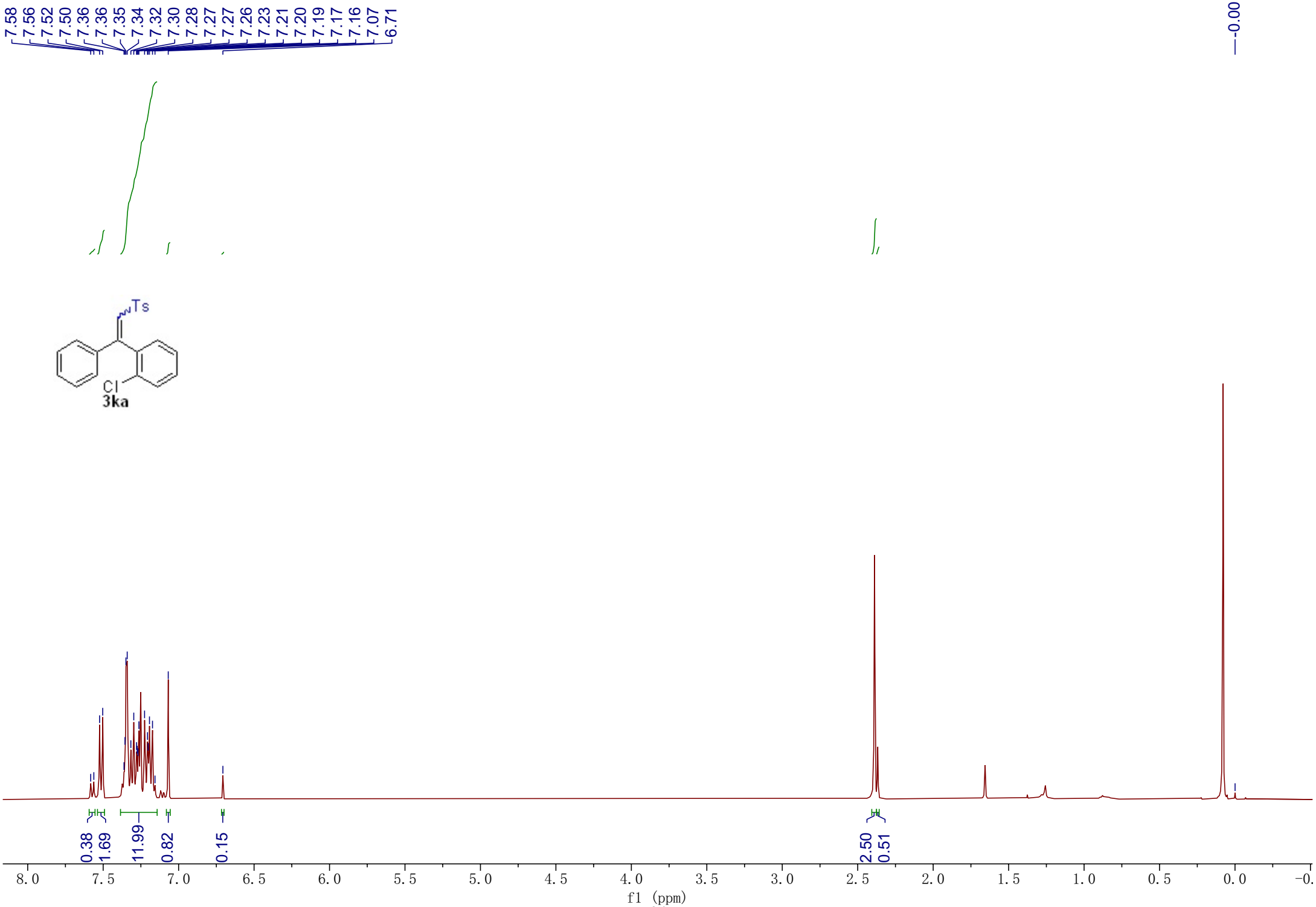
143.92
138.33
137.74
136.34
134.55
131.37
131.02
130.39
130.09
130.08
129.94
129.51
129.47
129.33
129.15
128.93
128.86
127.99
127.78
127.67
127.37
125.92
125.29
77.48
77.16
76.84
21.68
20.35
19.59
17.79
Ts
Me
3ja
f1 (ppm)
f1 (ppm)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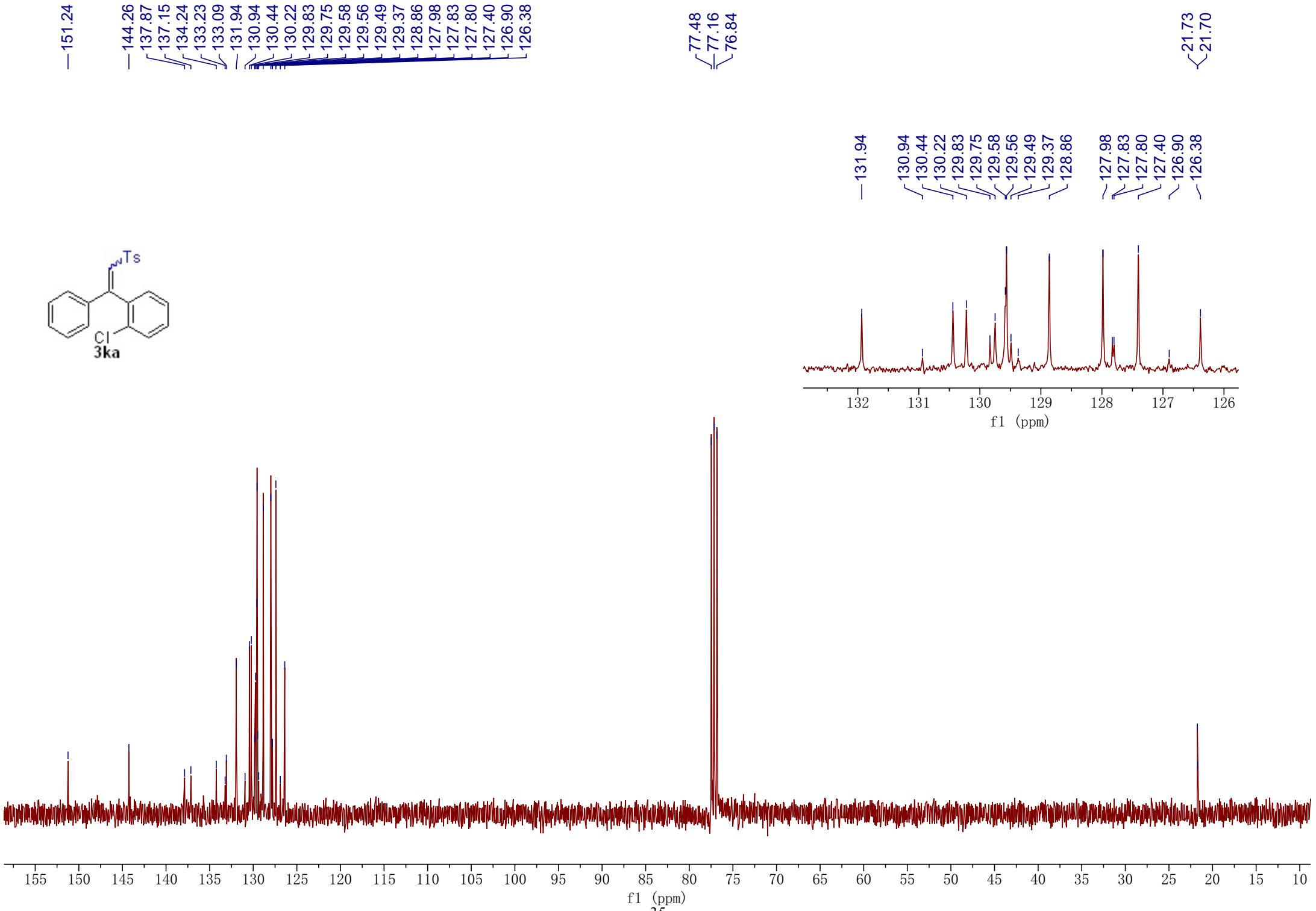
7.56
7.52
7.50
7.36
7.36
7.35
7.34
7.32
7.30
7.28
7.27
7.27
7.26
7.23
7.21
7.20
7.19
7.17
7.16
7.07
6.71
-0.00
Ts
Cl
3ka
0.38
1.69
11.99
0.82
0.15
2.50
0.51
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.
f1 (ppm)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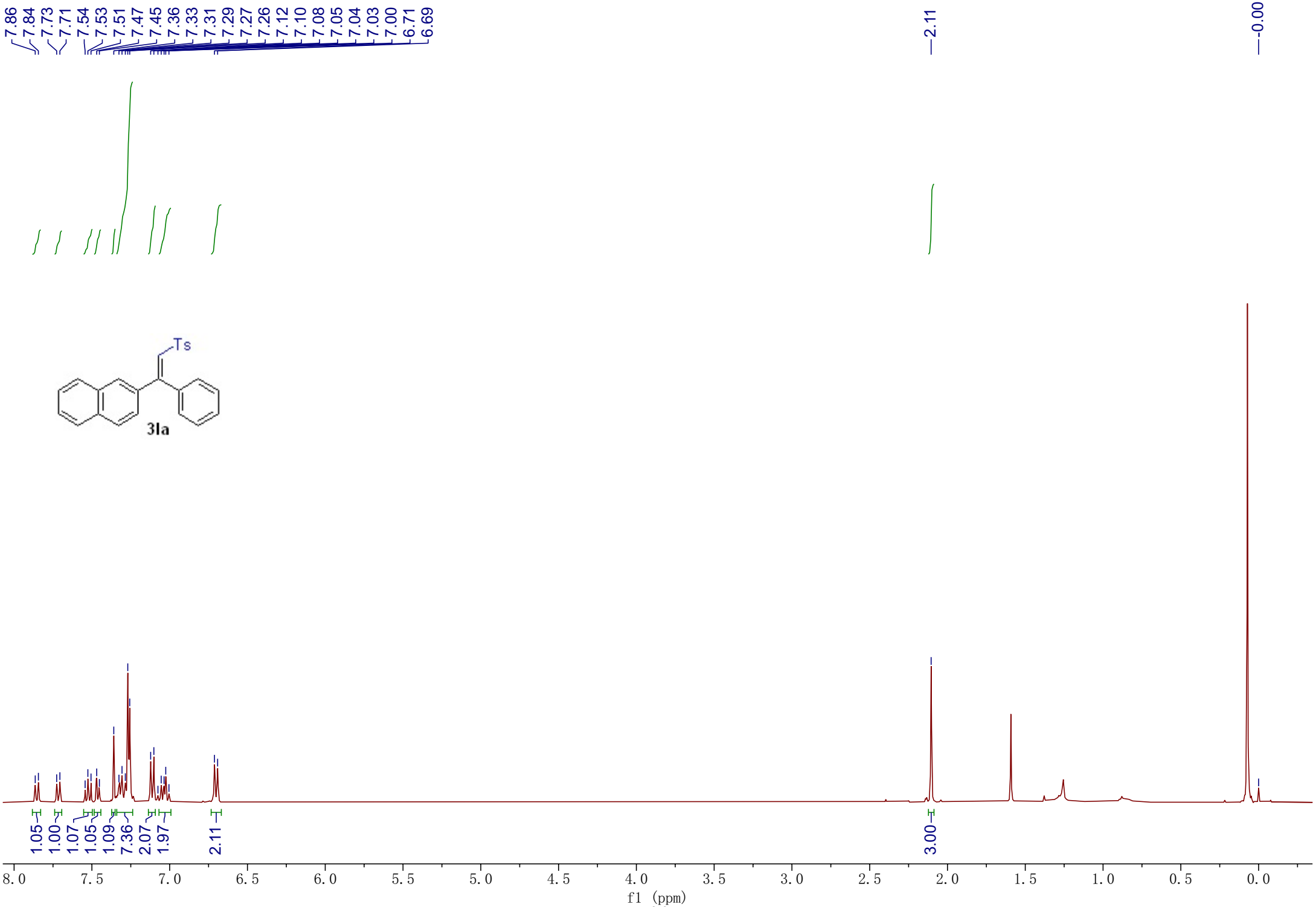
144.26
137.87
137.15
134.24
133.23
133.09
131.94
130.94
130.44
130.22
129.83
129.75
129.58
129.56
129.49
129.37
128.86
127.98
127.83
127.80
127.40
126.90
126.38
77.48
77.16
76.84
21.73
21.70
Ts
Cl
3ka
f1 (ppm)
f1 (ppm)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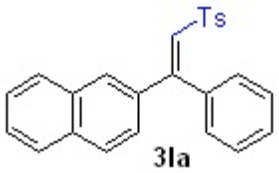
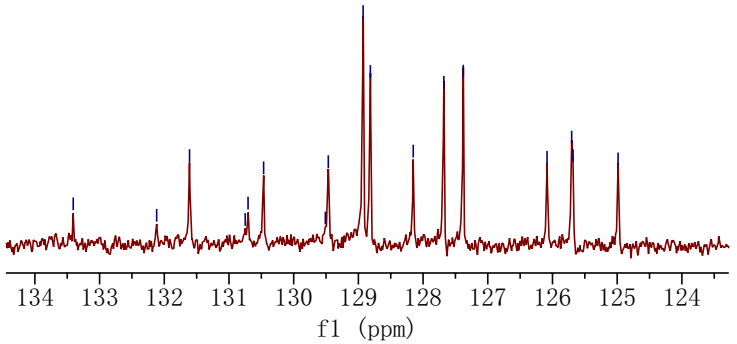
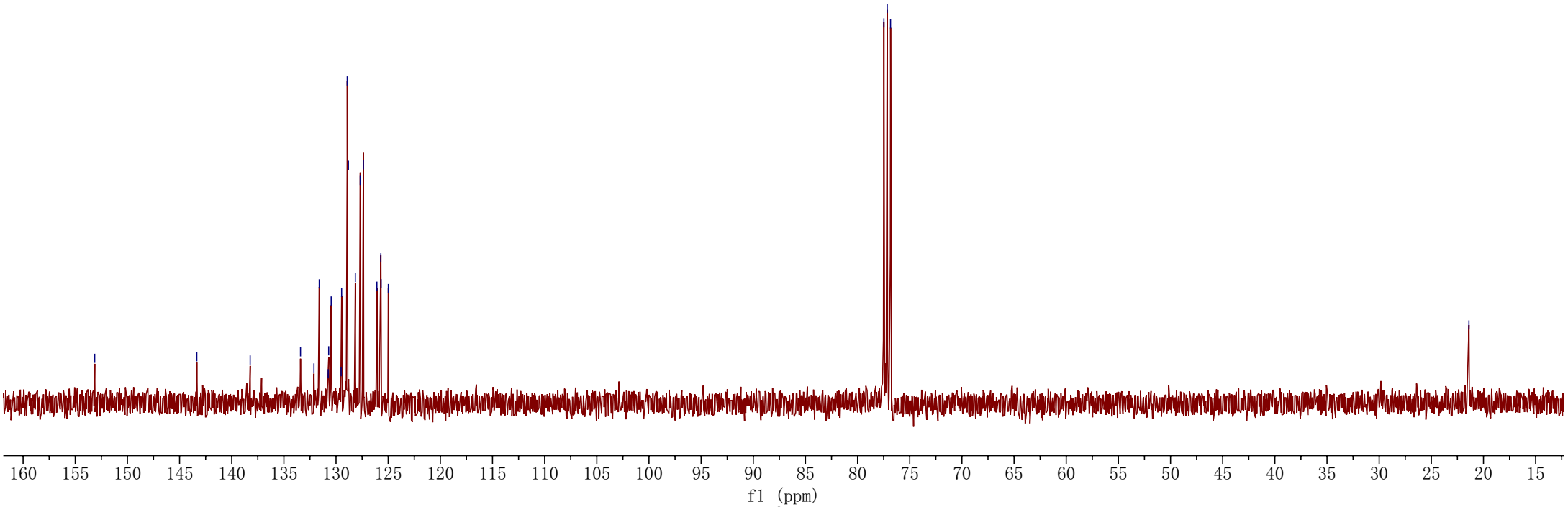
7.84
7.73
7.71
7.54
7.53
7.51
7.47
7.45
7.36
7.33
7.31
7.29
7.27
7.26
7.12
7.10
7.08
7.05
7.04
7.03
7.00
6.71
6.69
2.11
0.00
Ts
3la
1.05
1.00
1.07
1.05
1.09
7.36
2.07
1.97
2.11
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

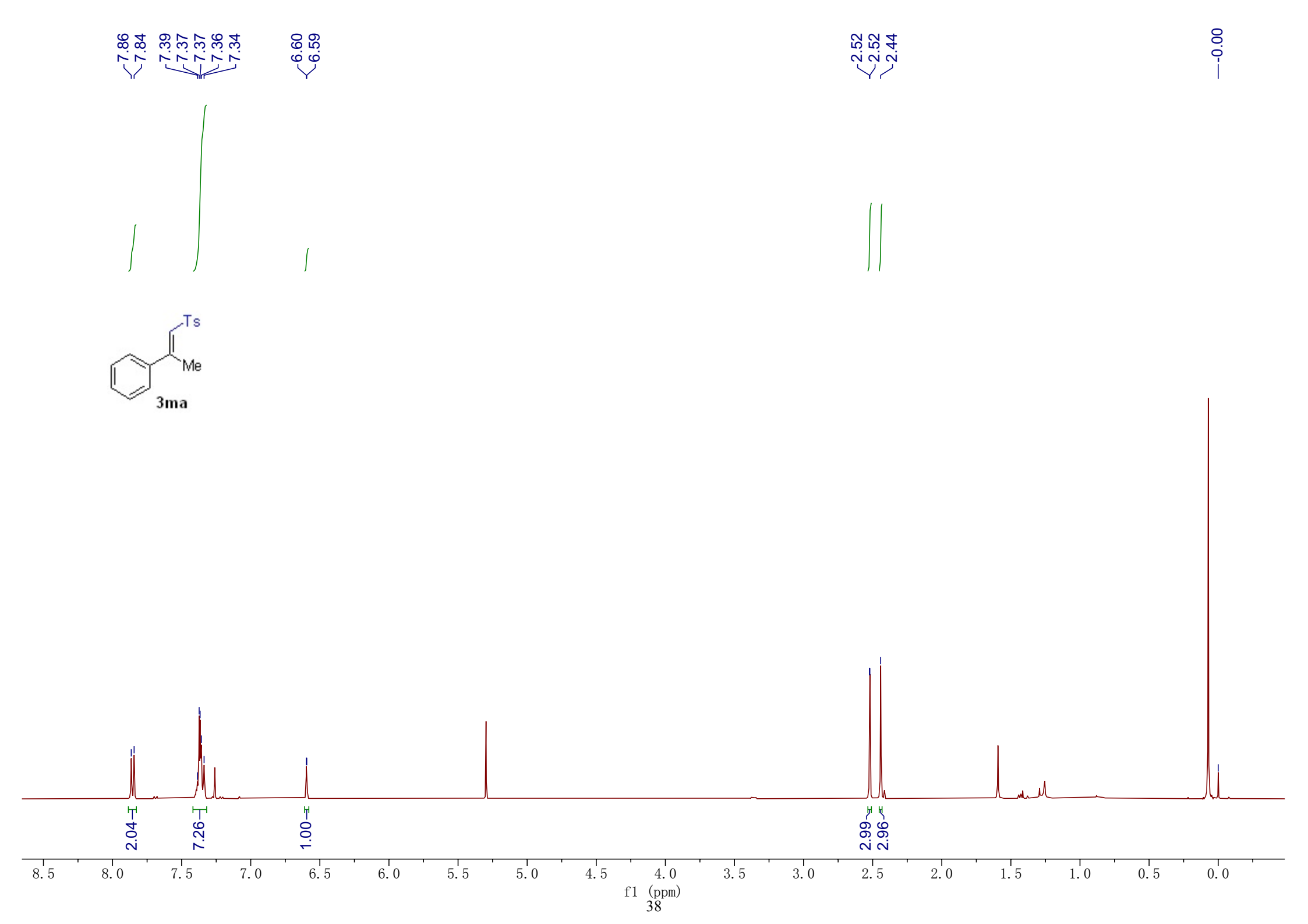
153.14
143.35
138.23
133.41
132.12
131.61
130.75
130.71
130.46
129.51
129.46
128.93
128.81
128.15
127.68
127.38
126.08
125.70
125.68
124.99
77.48
77.16
76.84
21.39

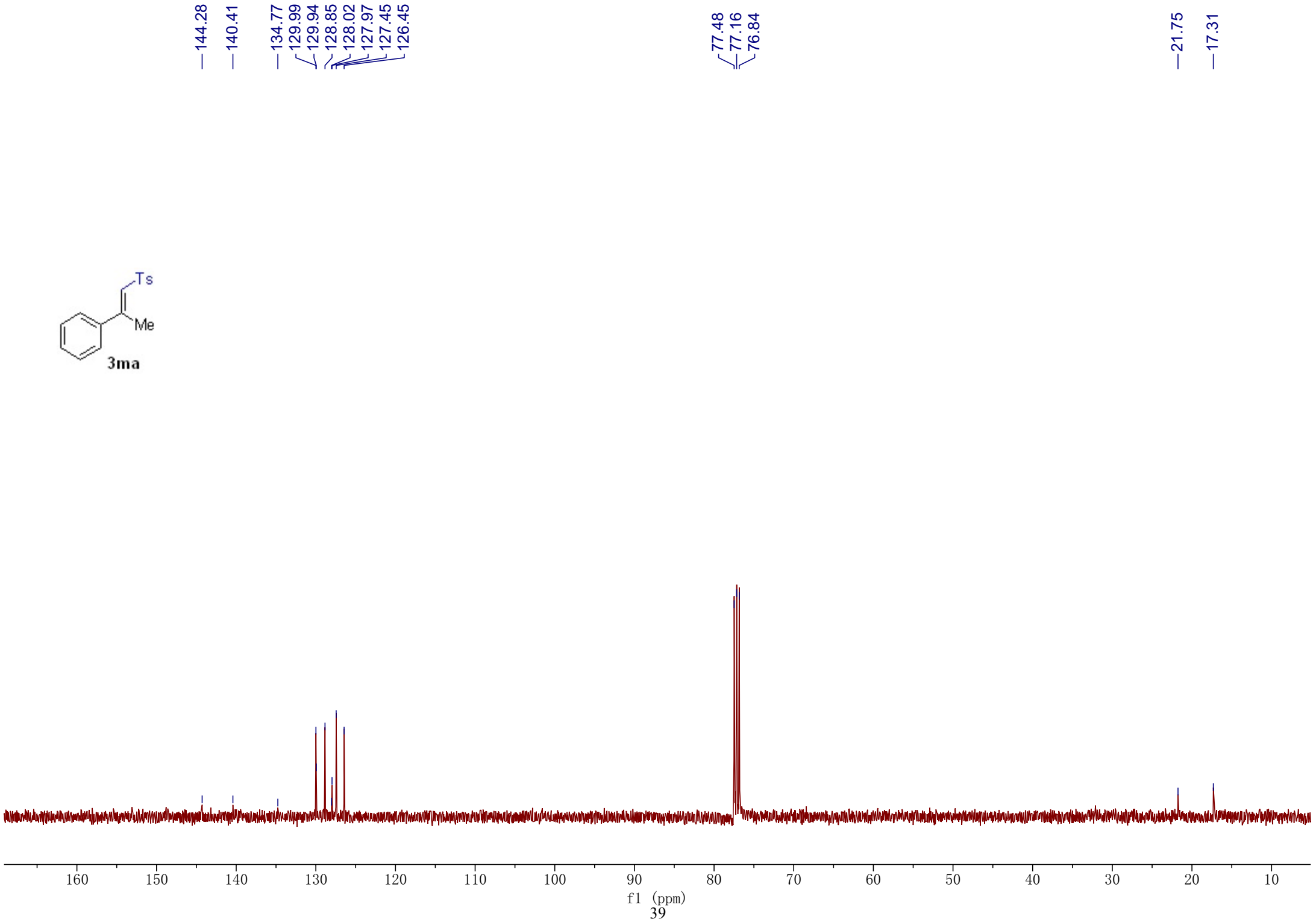


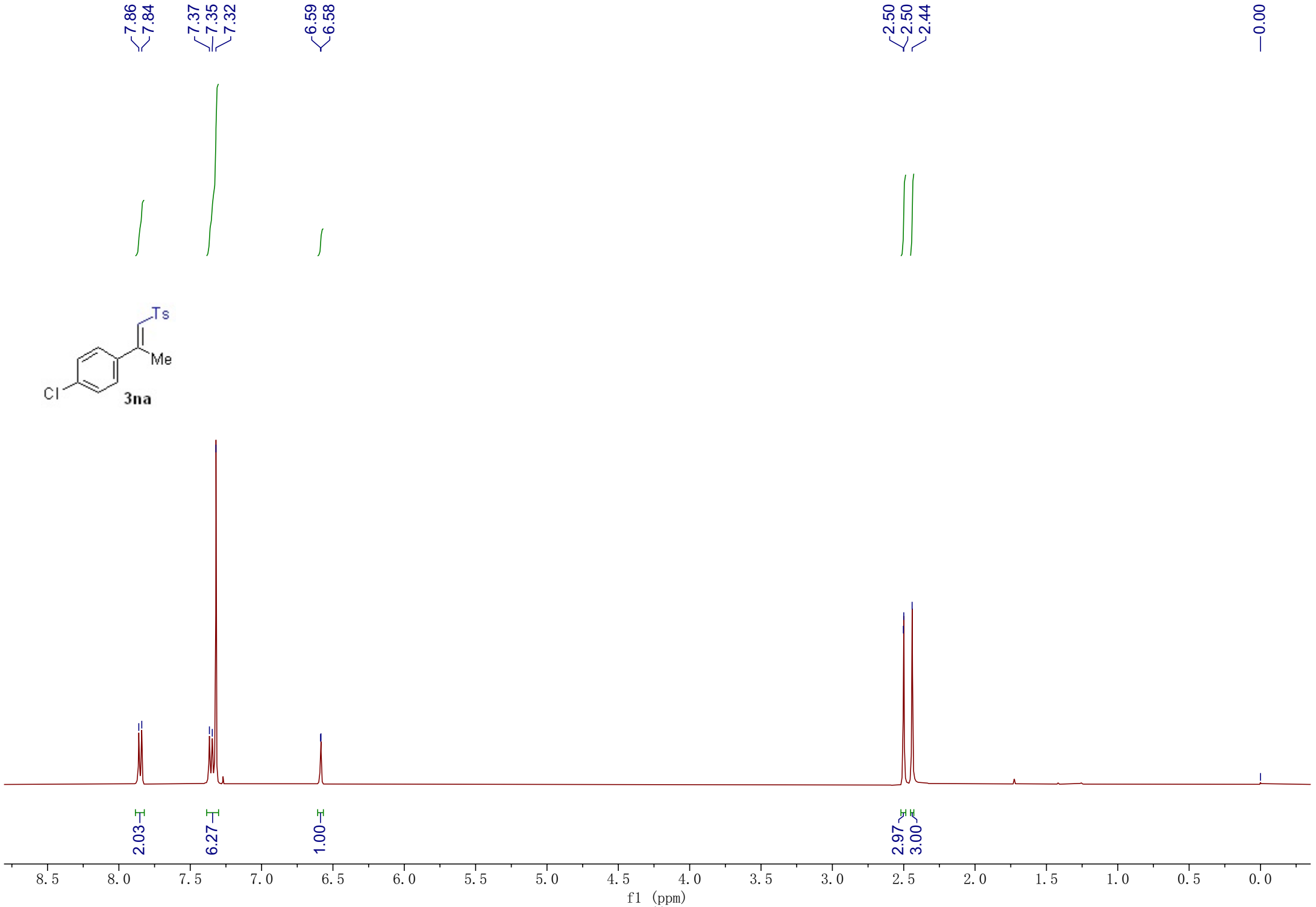
3la

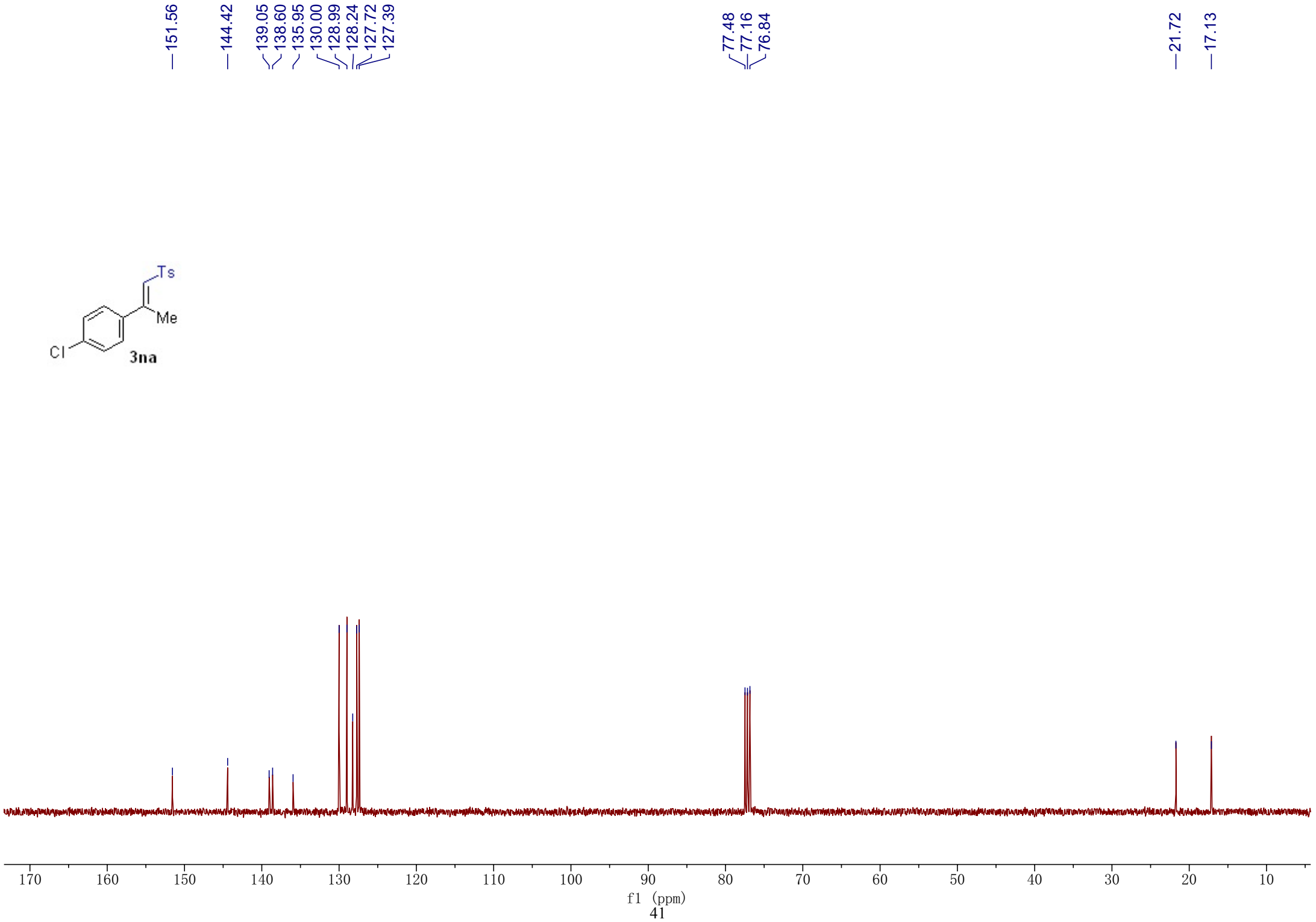


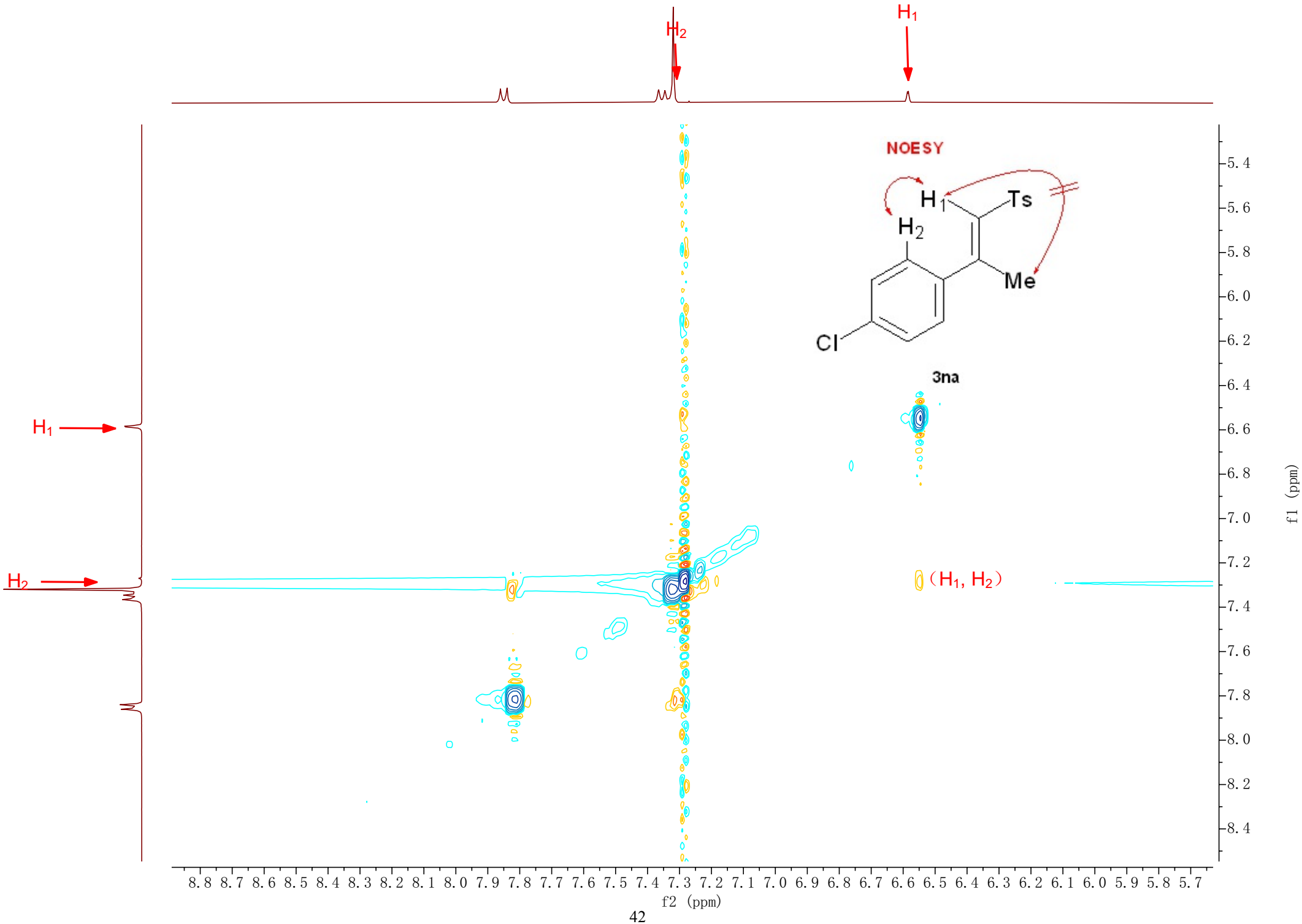


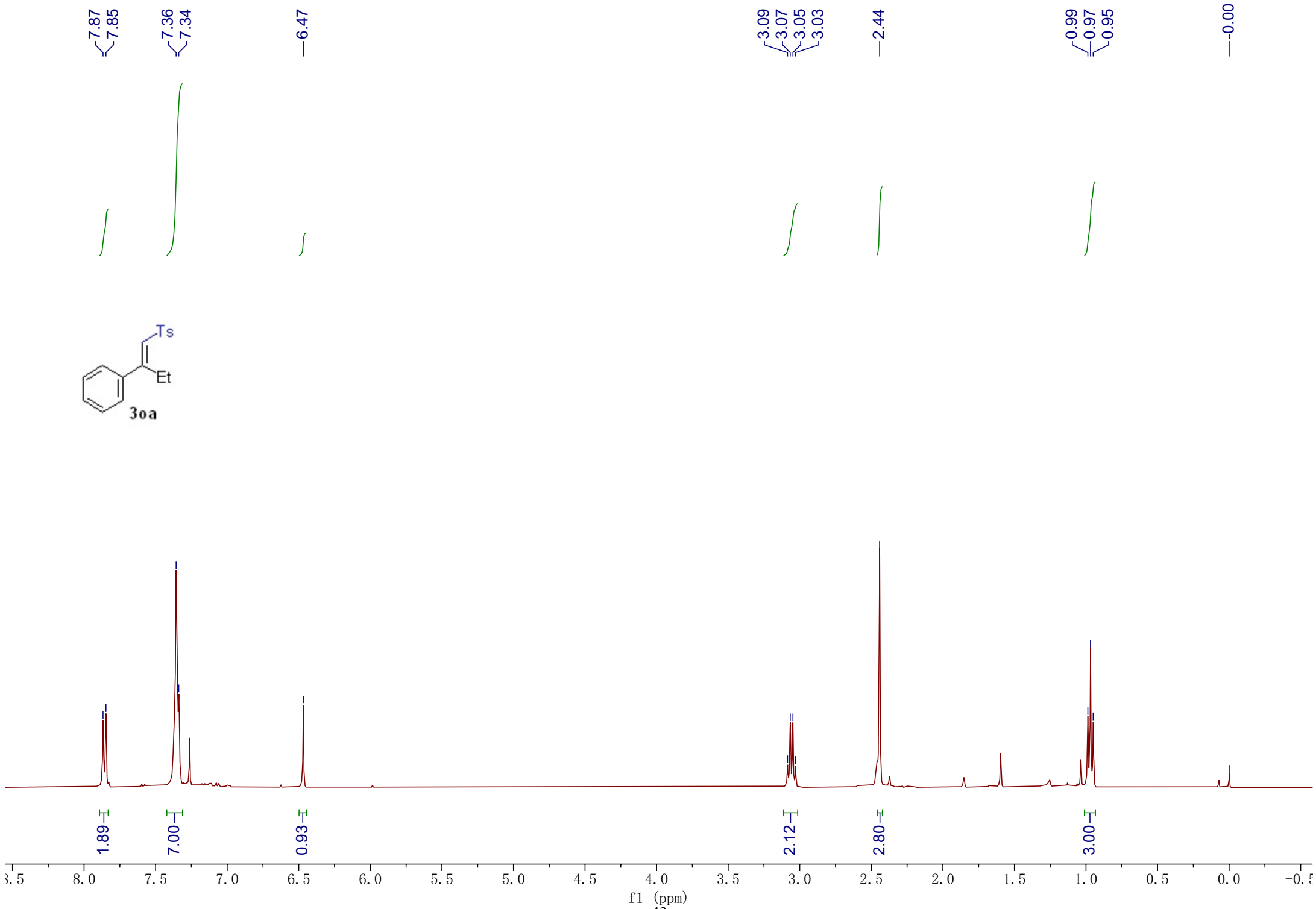

7.86
7.84
7.39
7.37
7.37
7.36
7.34
6.60
6.59
2.52
2.52
2.44
-0.00
Ts
Me
3ma
2.04
7.26
1.00
2.99
2.96
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

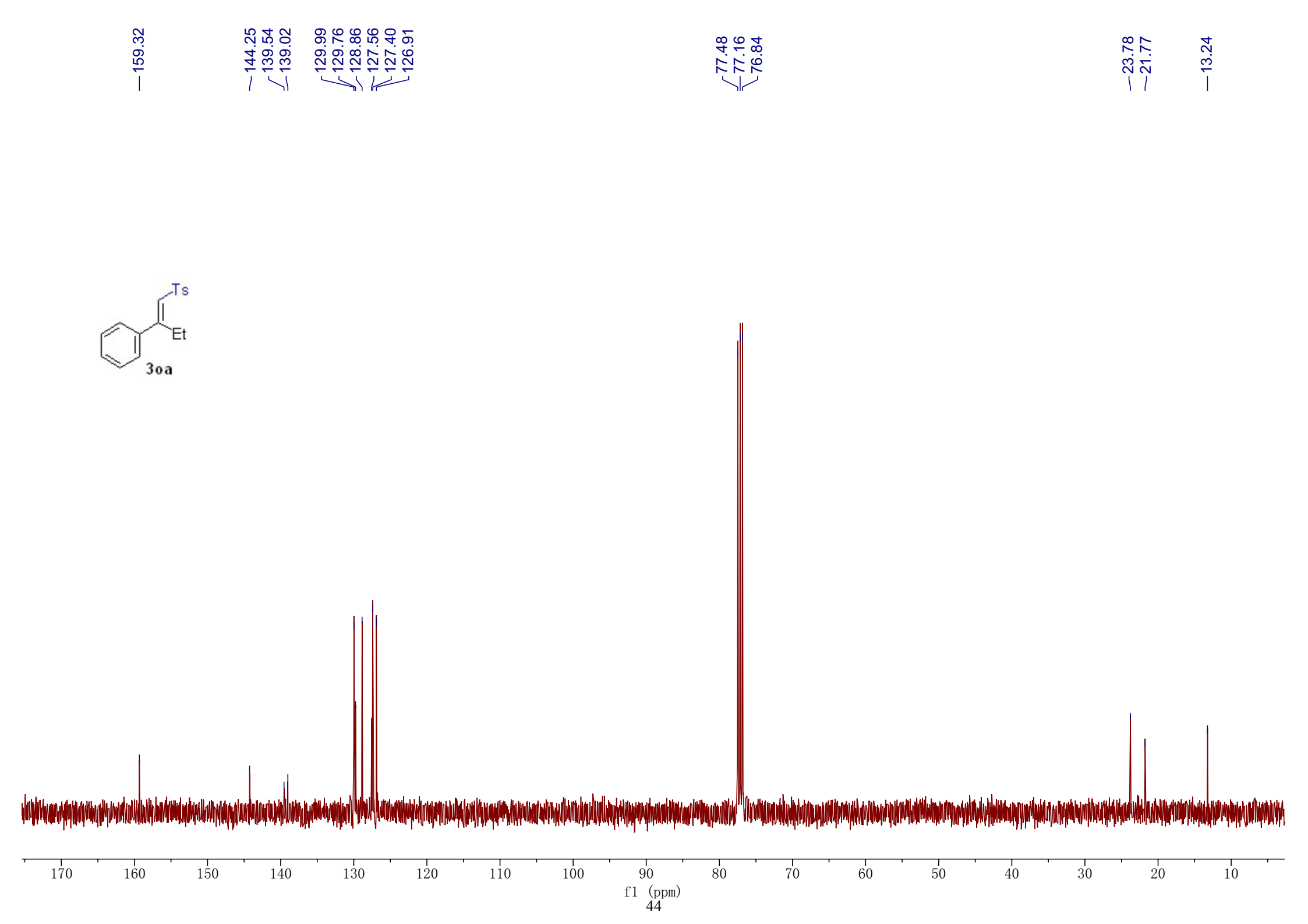

144.28
140.41
134.77
129.99
129.94
128.85
128.02
127.97
127.45
126.45
77.48
77.16
76.84
21.75
17.31
Ts
Me
3ma
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

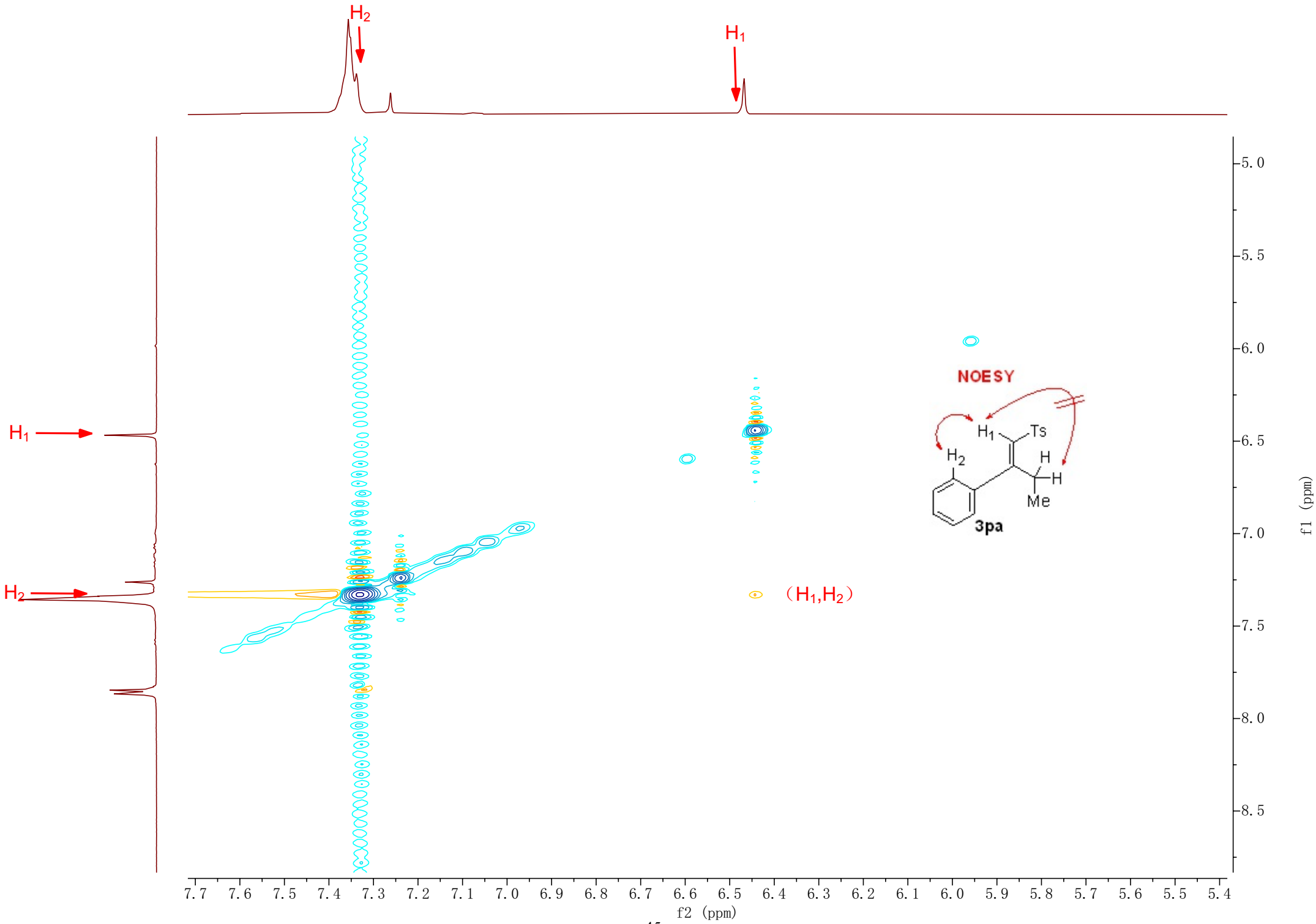

7.86
7.84
7.37
7.35
7.32
6.59
6.58
2.50
2.50
2.44
0.00
Ts
Me
Cl
3na
2.03
6.27
1.00
2.97
3.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

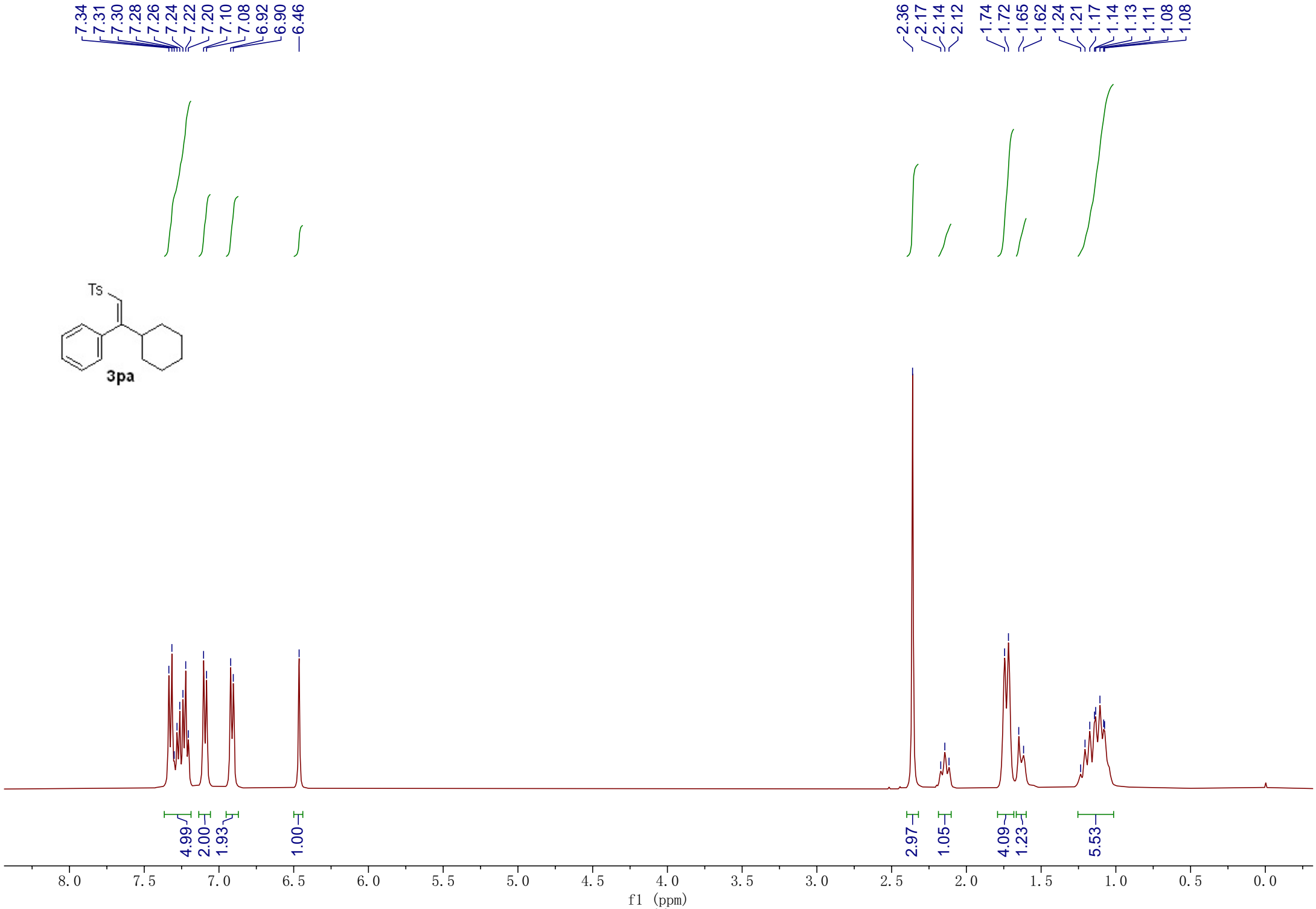

151.56
144.42
139.05
138.60
135.95
130.00
128.99
128.24
127.72
127.39
77.48
77.16
76.84
21.72
17.13
Ts
Me
Cl
3na
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

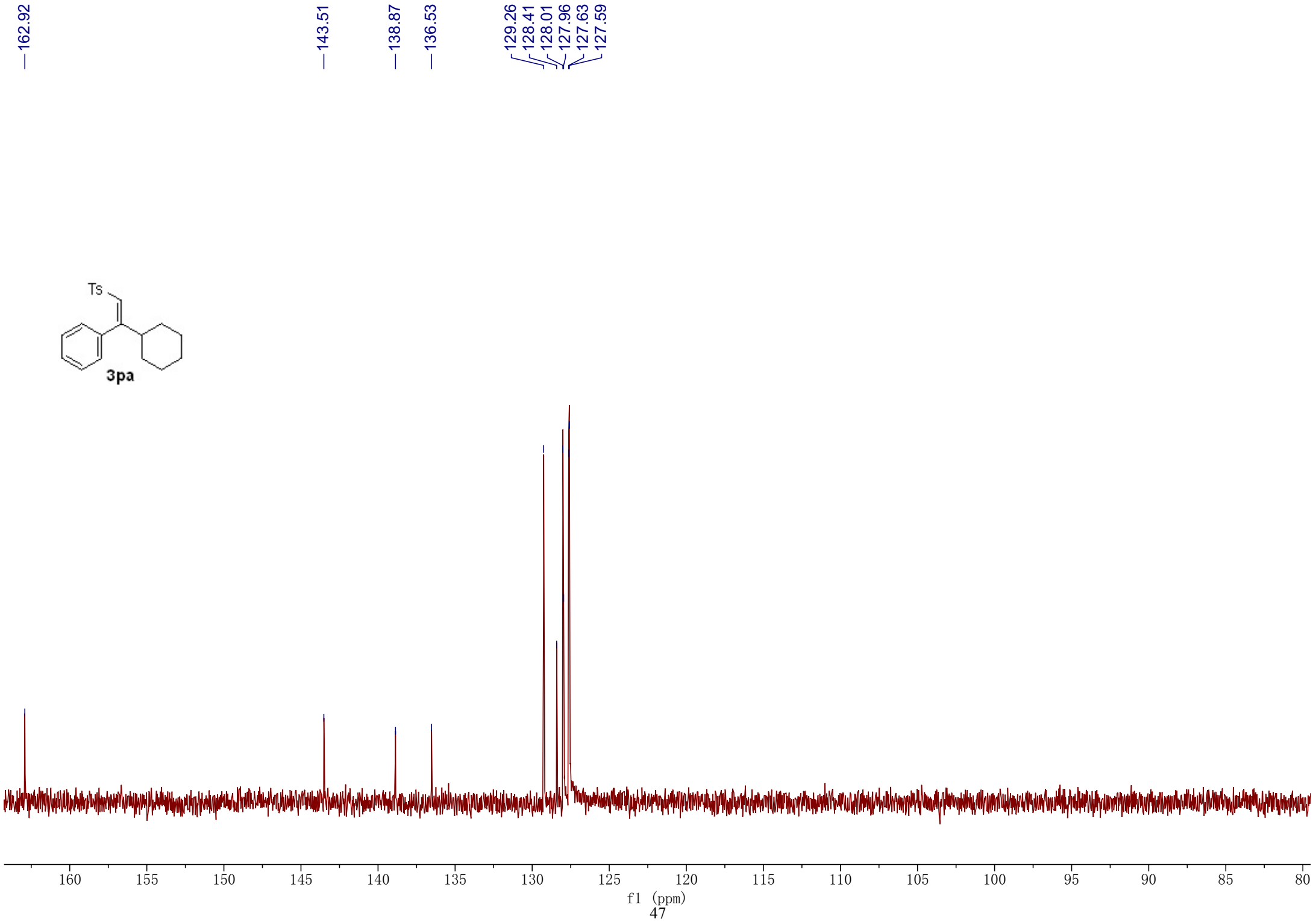

H2
H1
NOESY
H1
Ts
H2
Me
Cl
3na
H1
H2
(H1, H2)
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0
8.2
8.4
f1 (ppm)
8.8 8.7 8.6 8.5 8.4 8.3 8.2 8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4 6.3 6.2 6.1 6.0 5.9 5.8 5.7
f2 (ppm)

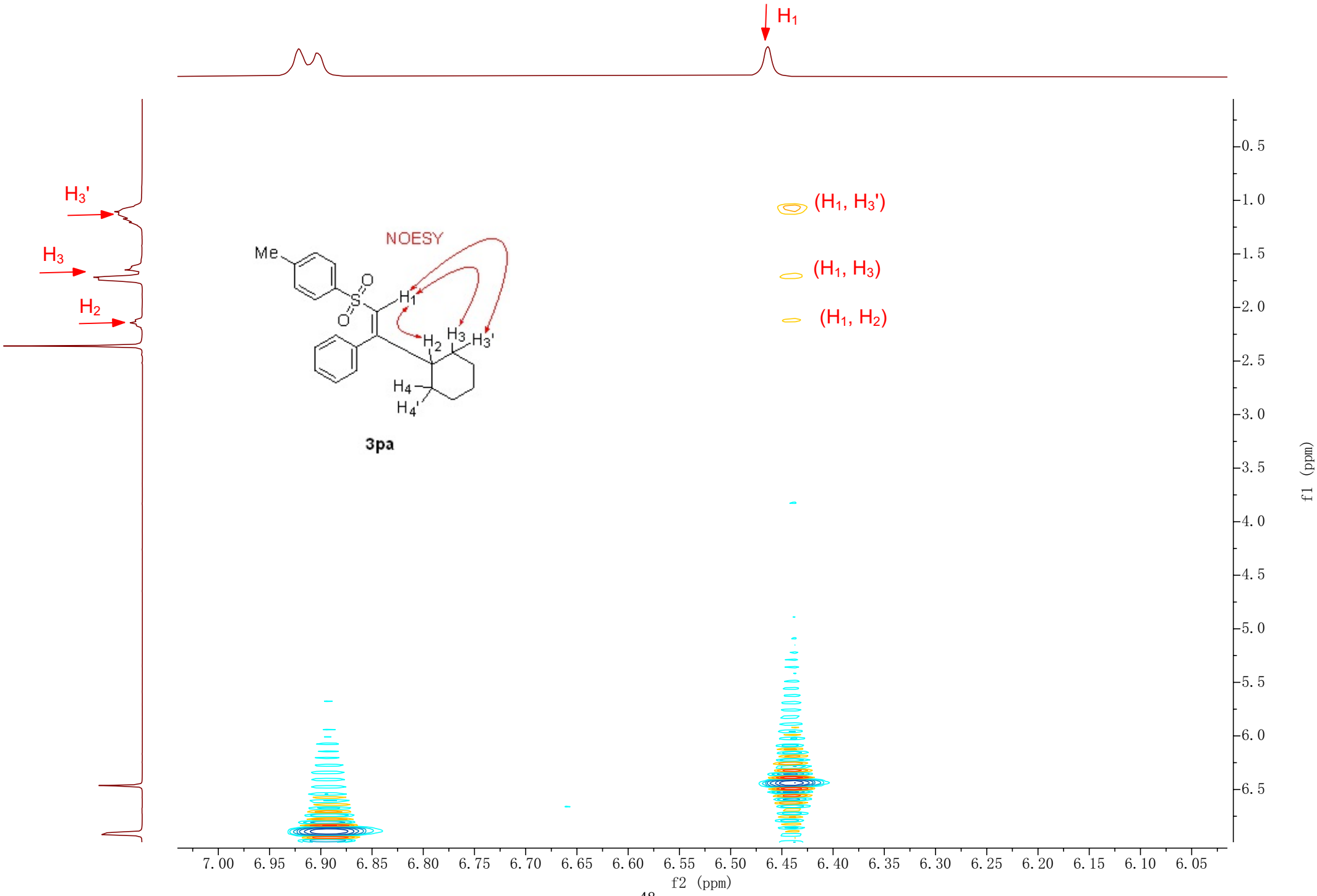

7.87
7.85
7.36
7.34
6.47
3.09
3.07
3.05
3.03
2.44
0.99
0.97
0.95
-0.00
Ts
Et
3oa
1.89
7.00
0.93
2.12
2.80
3.00
f1 (ppm)

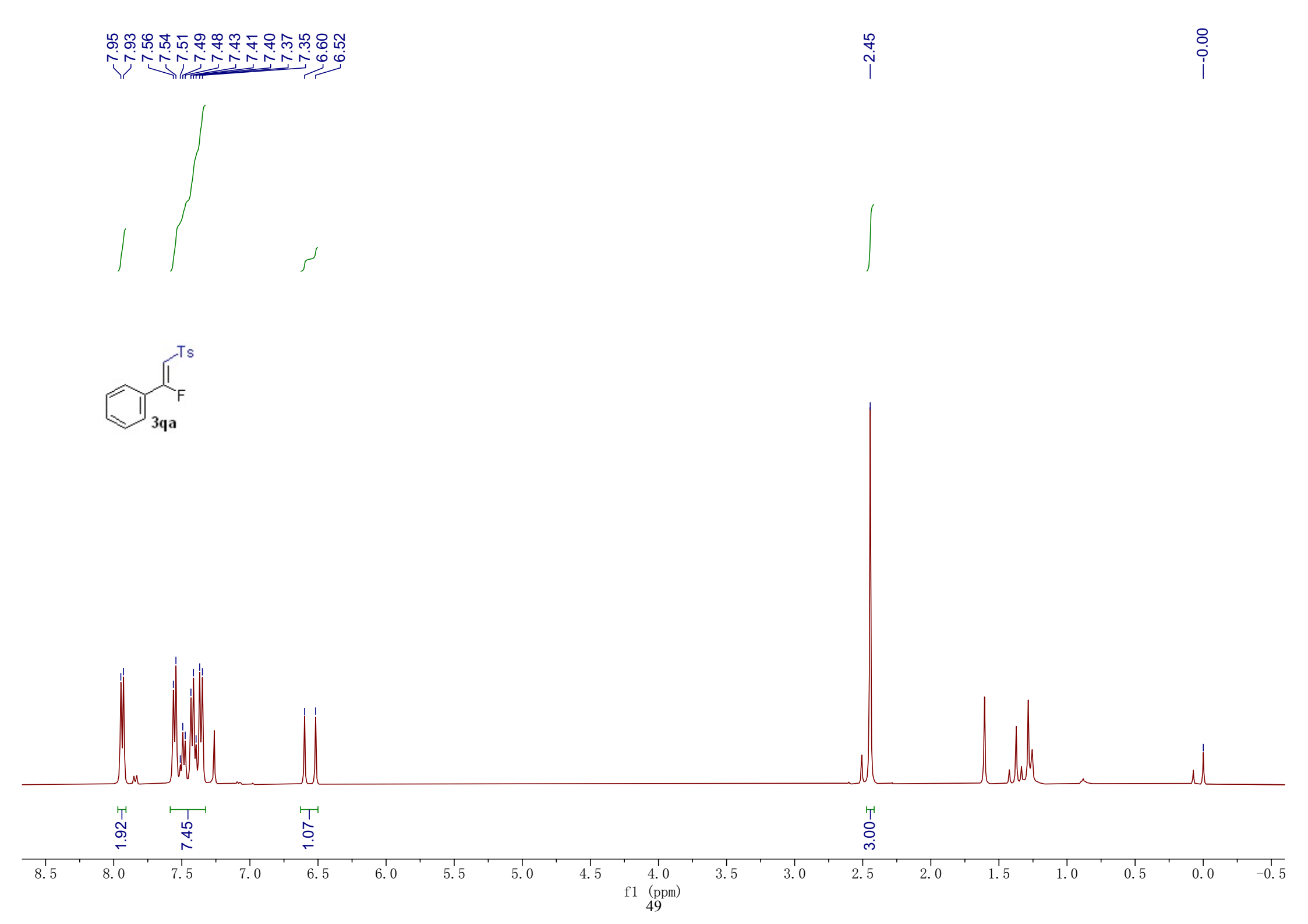

159.32
144.25
139.54
139.02
129.99
129.76
128.86
127.56
127.40
126.91
77.48
77.16
76.84
23.78
21.77
13.24
Ts
Et
3oa
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

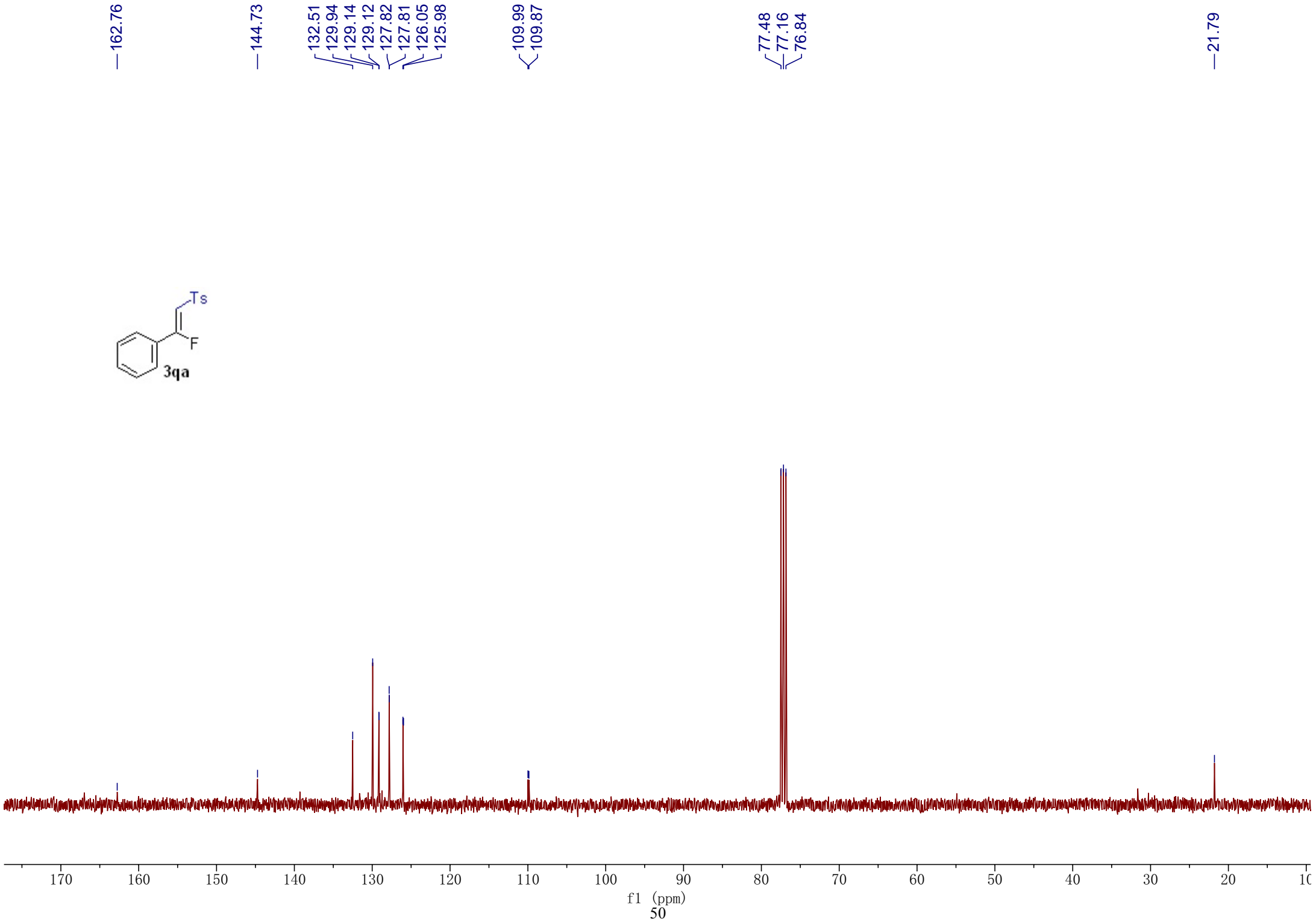

H2
H1
H1
H2
(H1,H2)
NOESY
H1
Ts
H2
H
H
Me
3pa
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
f1 (ppm)
7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4 6.3 6.2 6.1 6.0 5.9 5.8 5.7 5.6 5.5 5.4
f2 (ppm)

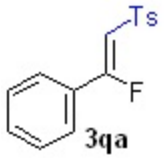

7.34
7.31
7.30
7.28
7.26
7.24
7.22
7.20
7.10
7.08
6.92
6.90
6.46
2.36
2.17
2.14
2.12
1.74
1.72
1.65
1.62
1.24
1.21
1.17
1.14
1.13
1.11
1.08
1.08
Ts
3pa
4.99
2.00
1.93
1.00
2.97
1.05
4.09
1.23
5.53
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


162.92
143.51
138.87
136.53
129.26
128.41
128.01
127.96
127.63
127.59
Ts
3pa
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
f1 (ppm)


H1
H3'
H3
H2
NOESY
Me
O
O
S
H1
H2
H3
H3'
H4
H4'
3pa
(H1, H3')
(H1, H3)
(H1, H2)
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
f1 (ppm)
7.00
6.95
6.90
6.85
6.80
6.75
6.70
6.65
6.60
6.55
6.50
6.45
6.40
6.35
6.30
6.25
6.20
6.15
6.10
6.05
f2 (ppm)

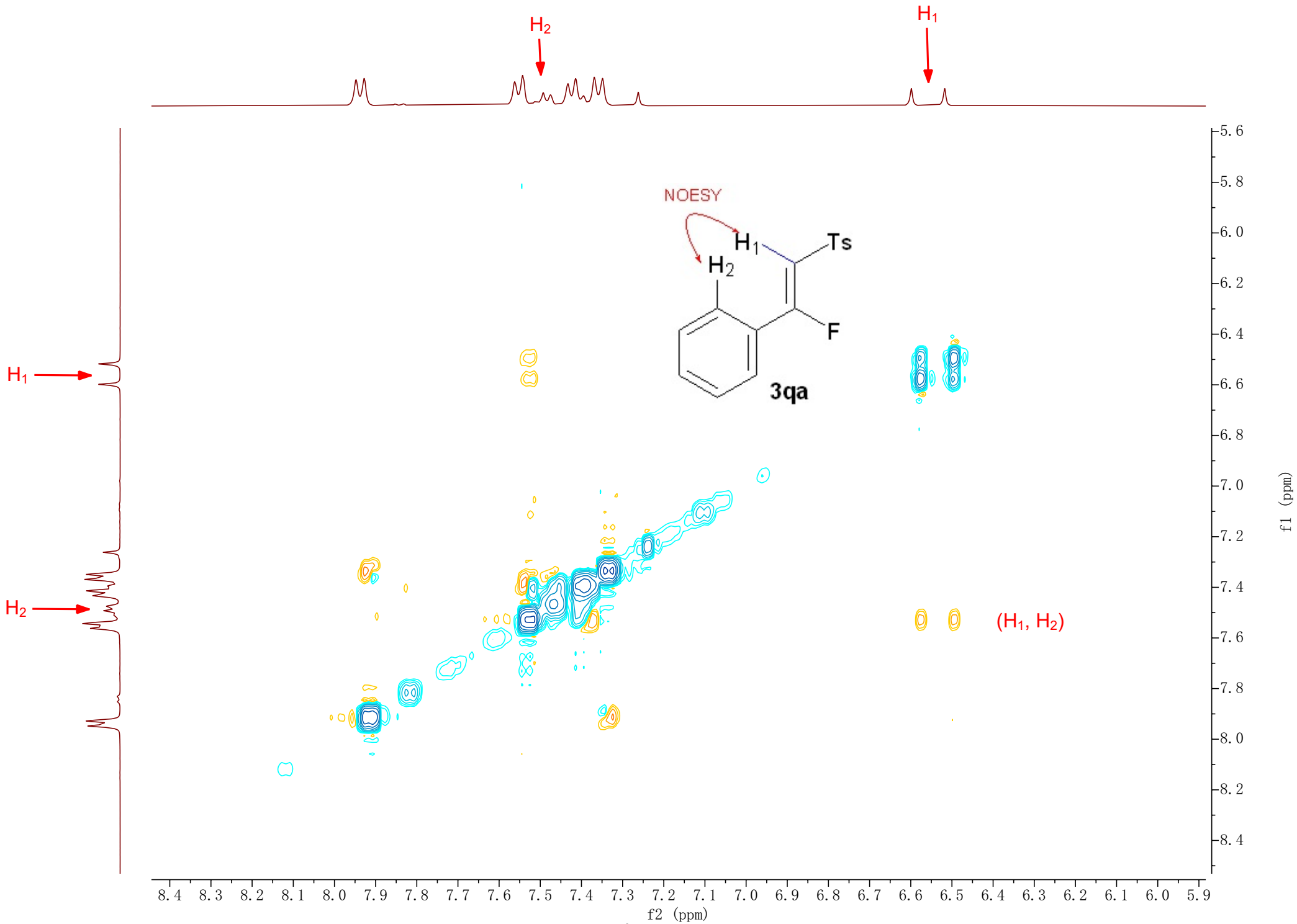

7.95
7.93
7.56
7.54
7.51
7.49
7.48
7.43
7.41
7.40
7.37
7.35
6.60
6.52
2.45
0.00
Ts
F
3qa
1.92
7.45
1.07
3.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

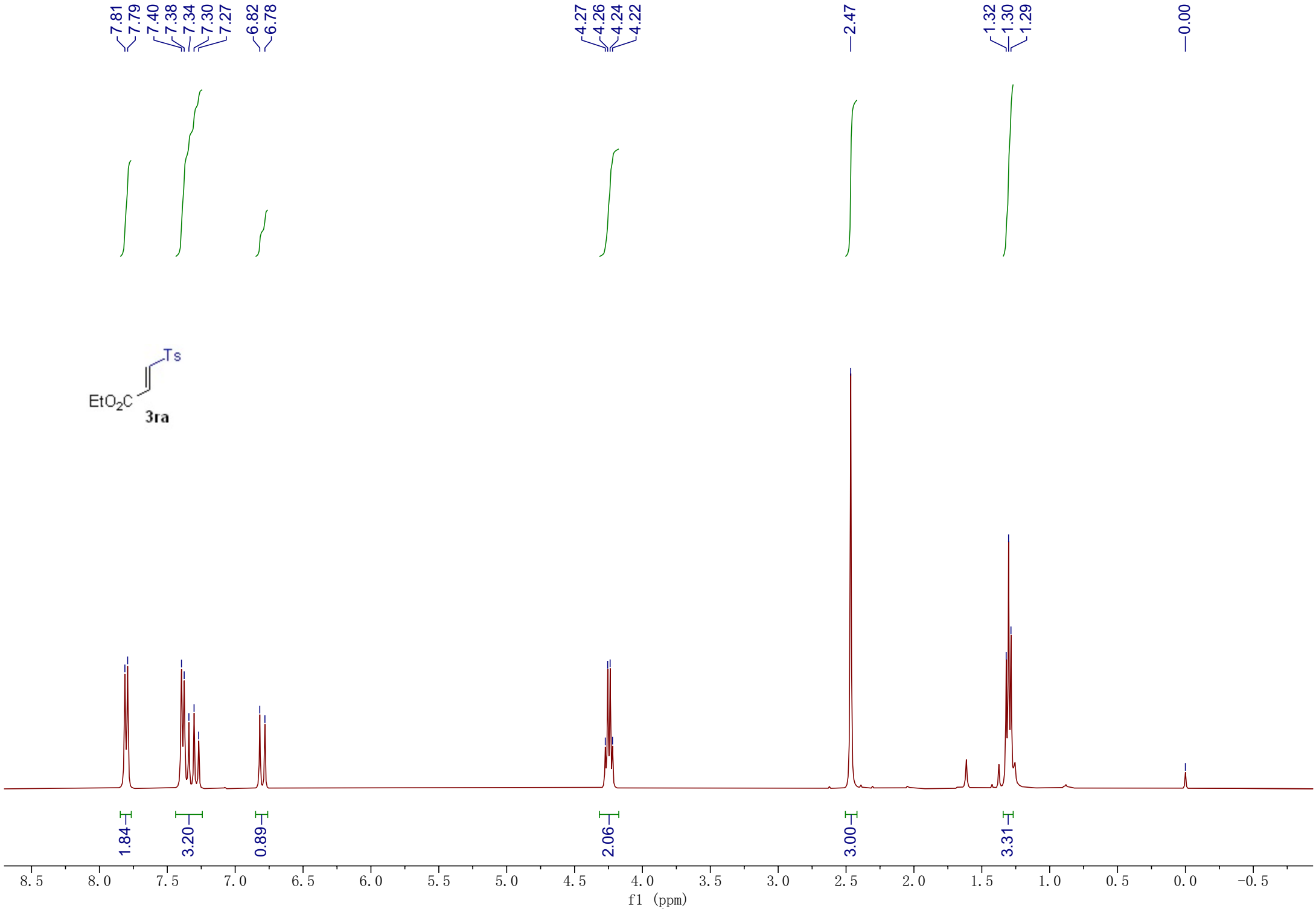

162.76
144.73
132.51
129.94
129.14
129.12
127.82
127.81
126.05
125.98
109.99
109.87
77.48
77.16
76.84
21.79
Ts
F
3qa
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)

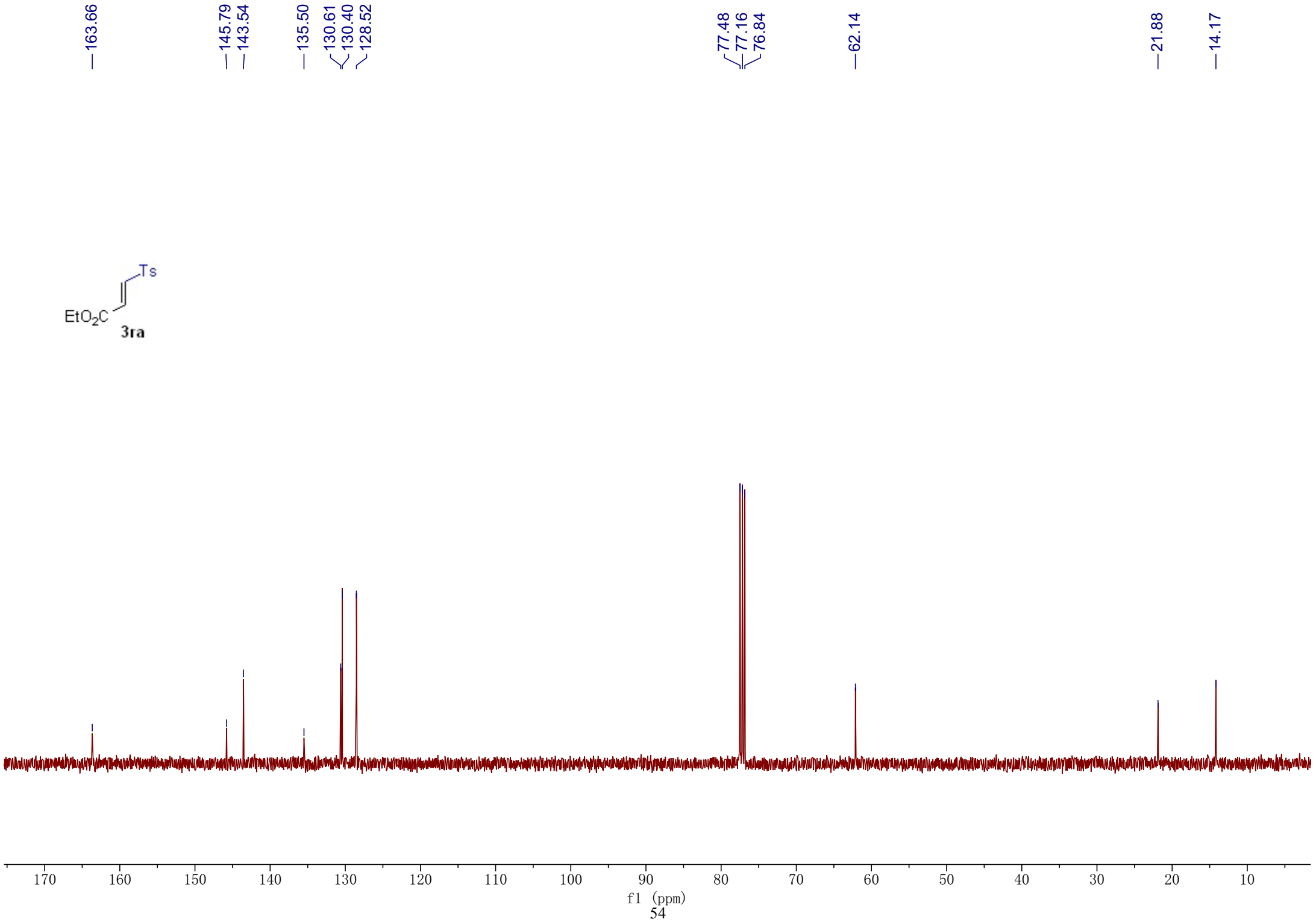

Ts
F

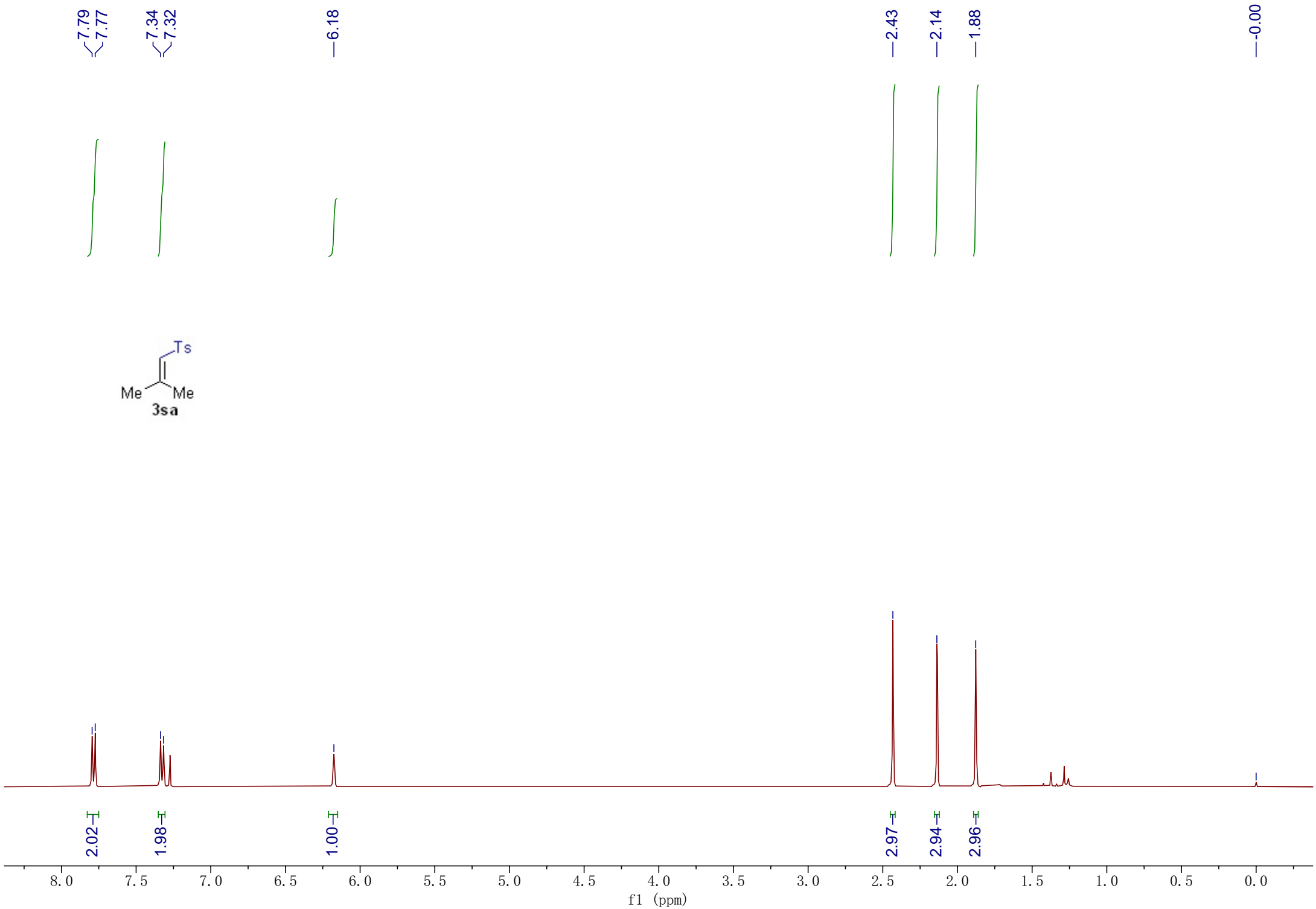
3qa

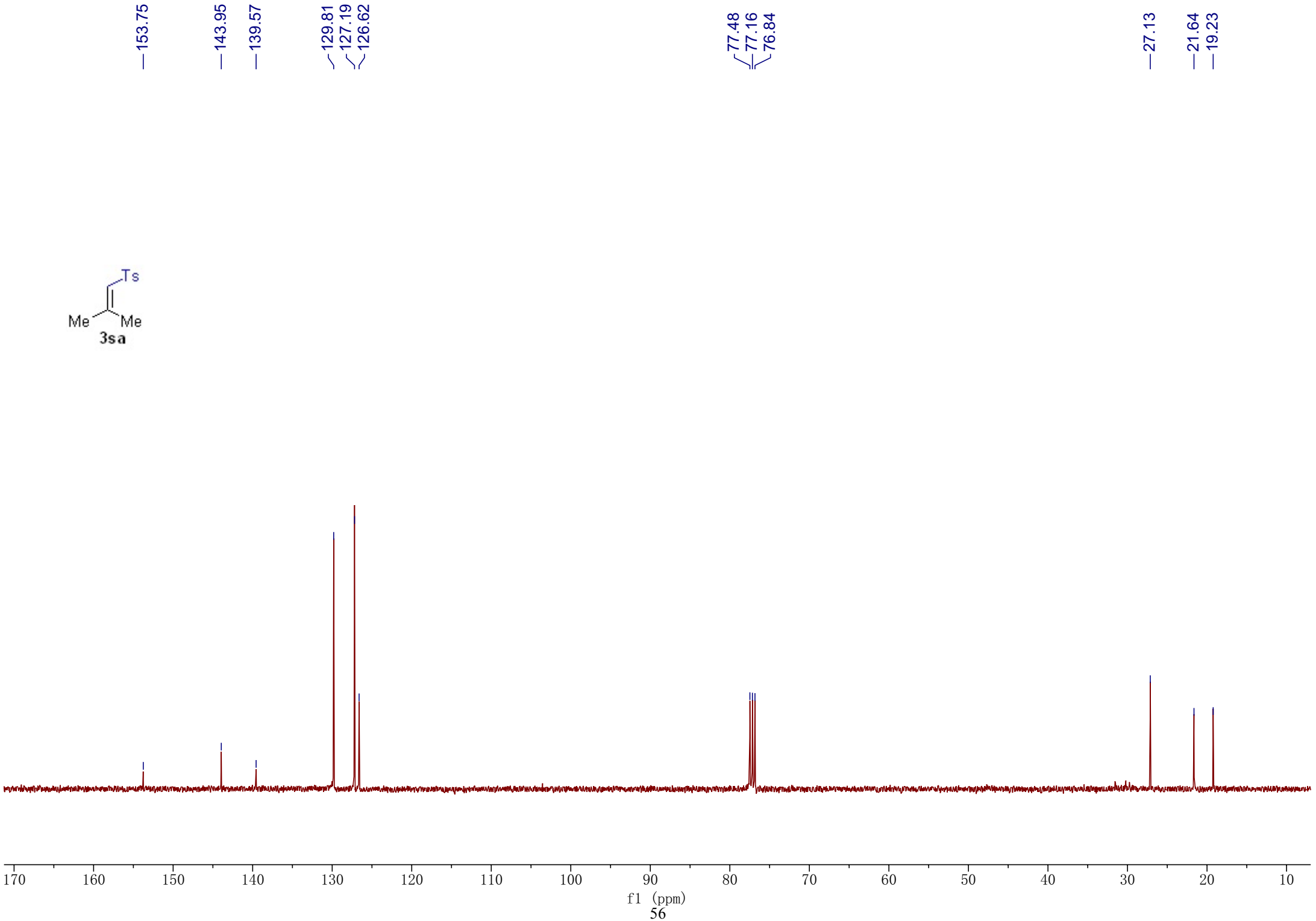
-93.431
-93.517
-85
-86
-87
-88
-89
-90
-91
-92
-93
-94
-95
-96
-97
-98
-99
-100
-101
-102
-103
-104
f1 (ppm)

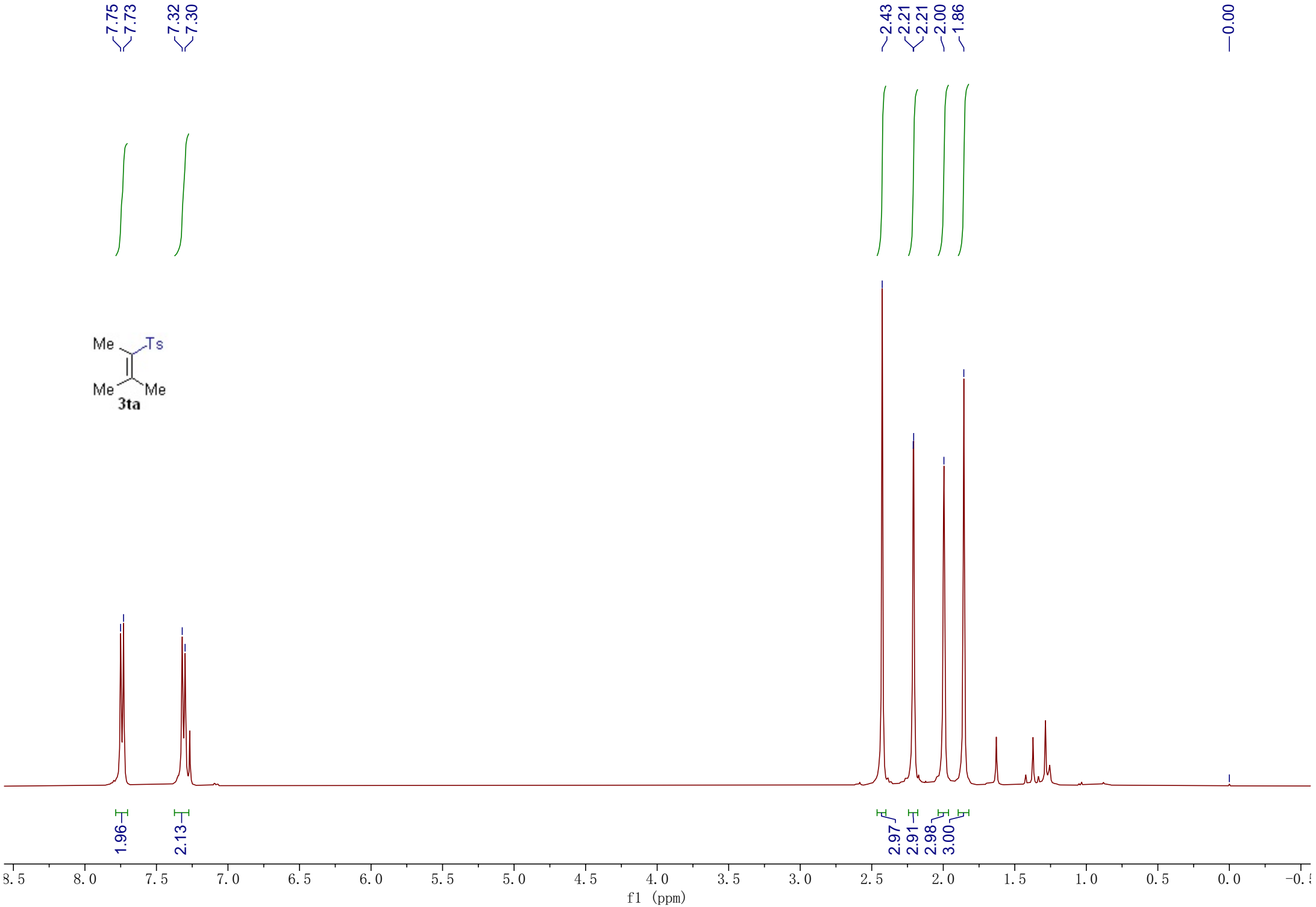

H2
H1
H1
H2
NOESY
H1
Ts
H2
F
3qa
(H1, H2)
f1 (ppm)
f2 (ppm)
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0
8.2
8.4
8.4 8.3 8.2 8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4 6.3 6.2 6.1 6.0 5.9

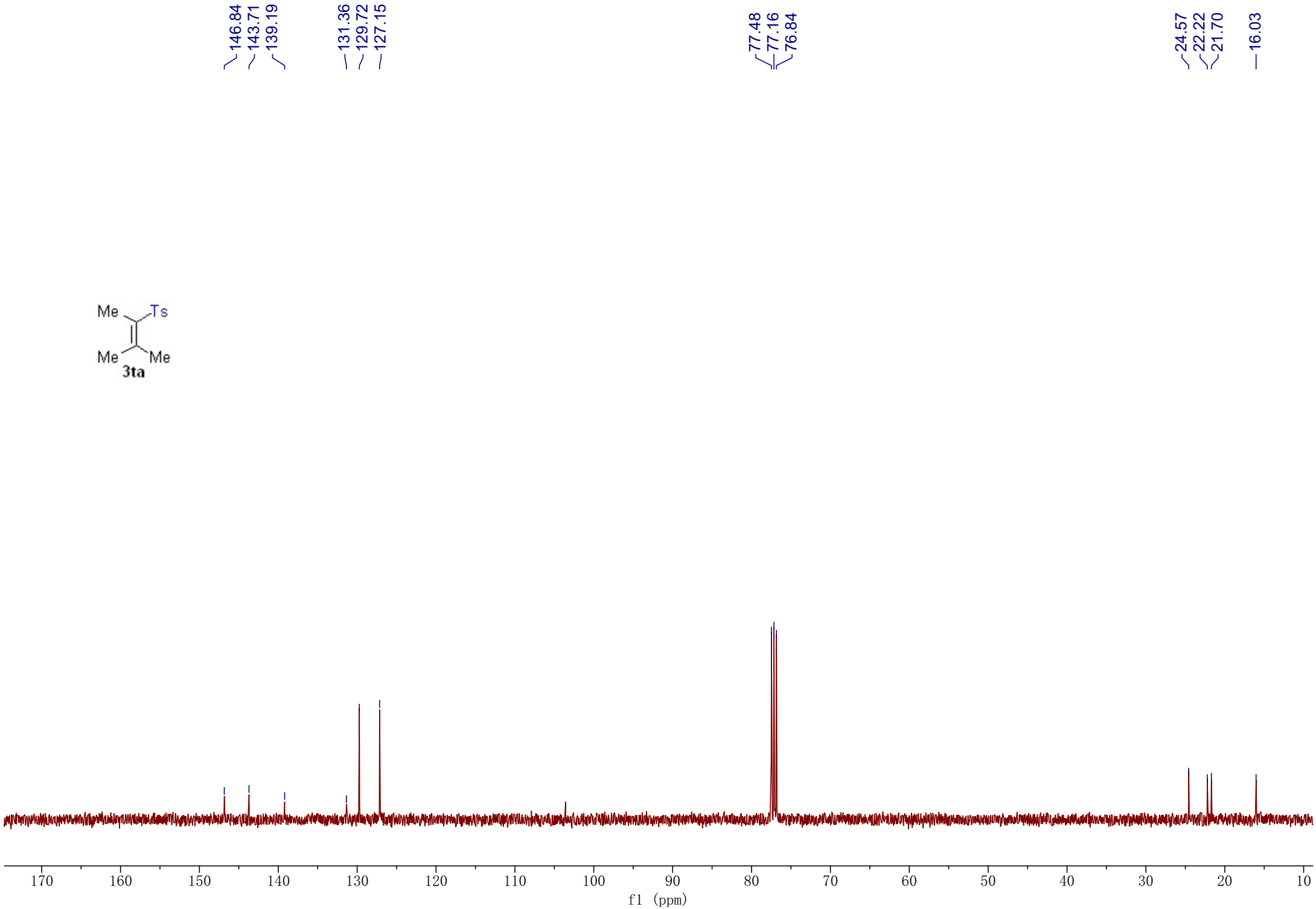

7.81
7.79
7.40
7.38
7.34
7.30
7.27
6.82
6.78
4.27
4.26
4.24
4.22
2.47
1.32
1.30
1.29
0.00
Ts
EtO2C
3ra
1.84
3.20
0.89
2.06
3.00
3.31
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

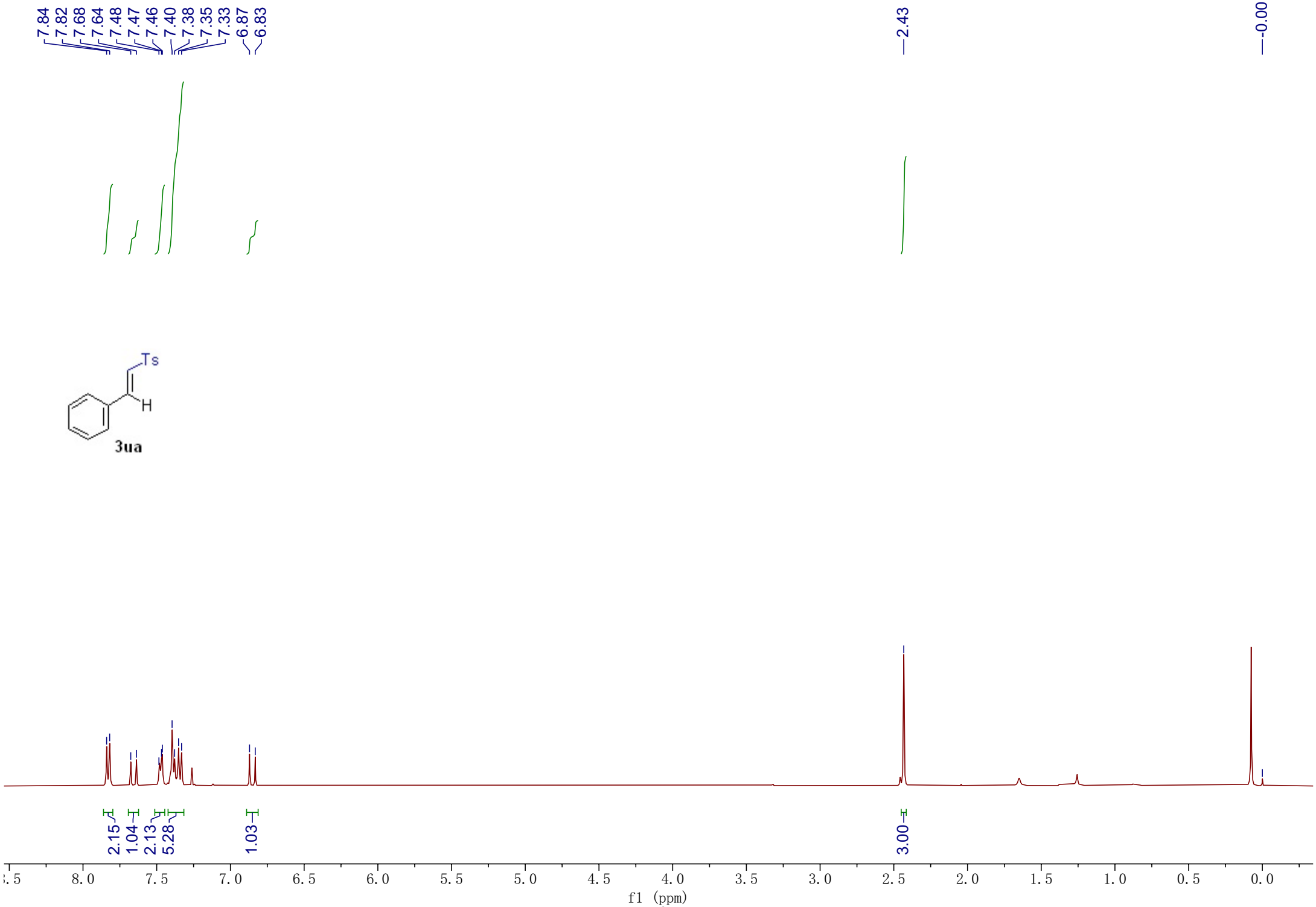

163.66
145.79
143.54
135.50
130.61
130.40
128.52
77.48
77.16
76.84
62.14
21.88
14.17
Ts
EtO2C
3ra
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

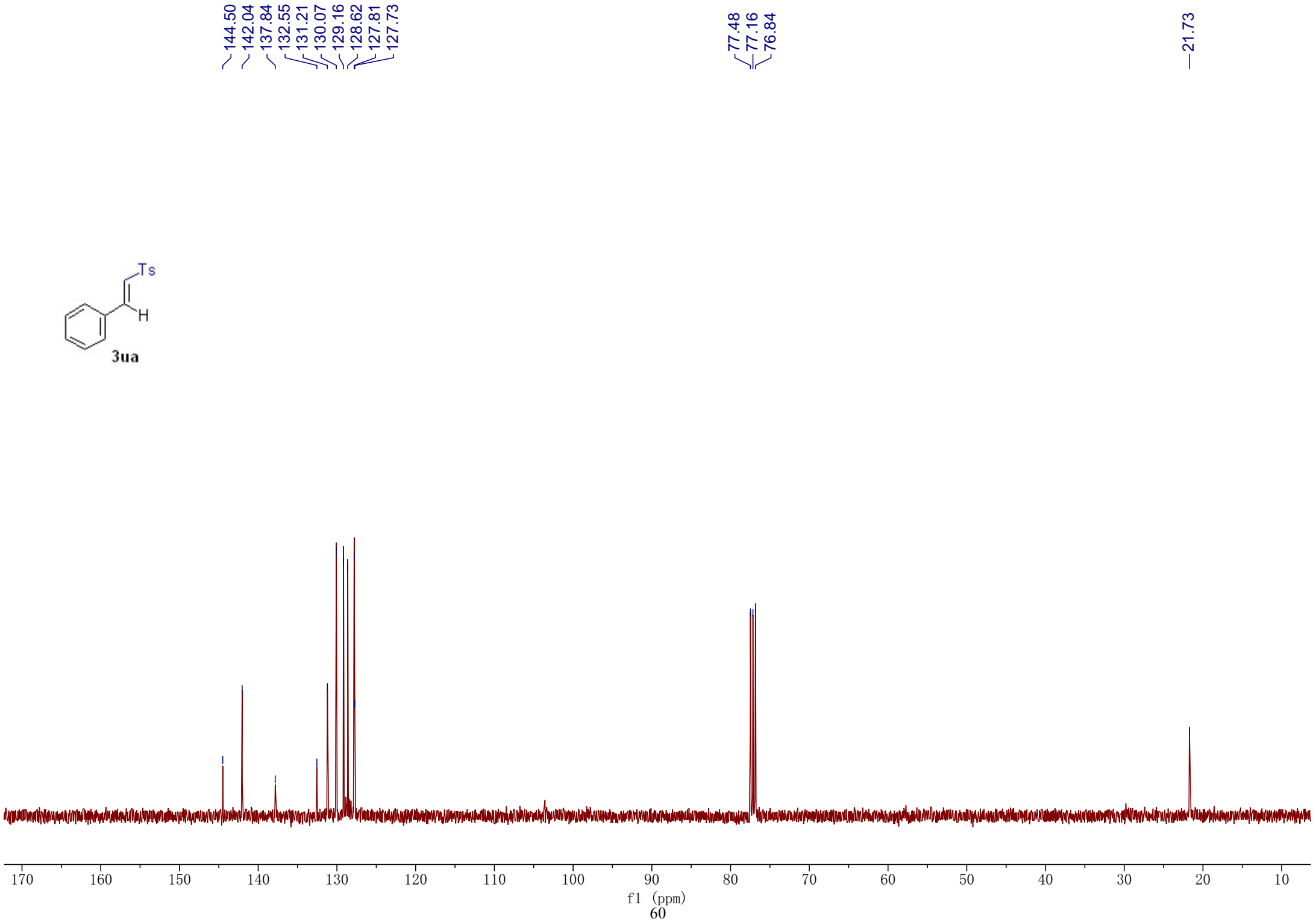

7.79
7.77
7.34
7.32
6.18
2.43
2.14
1.88
-0.00
Ts
Me
Me
3sa
2.02
1.98
1.00
2.97
2.94
2.96
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

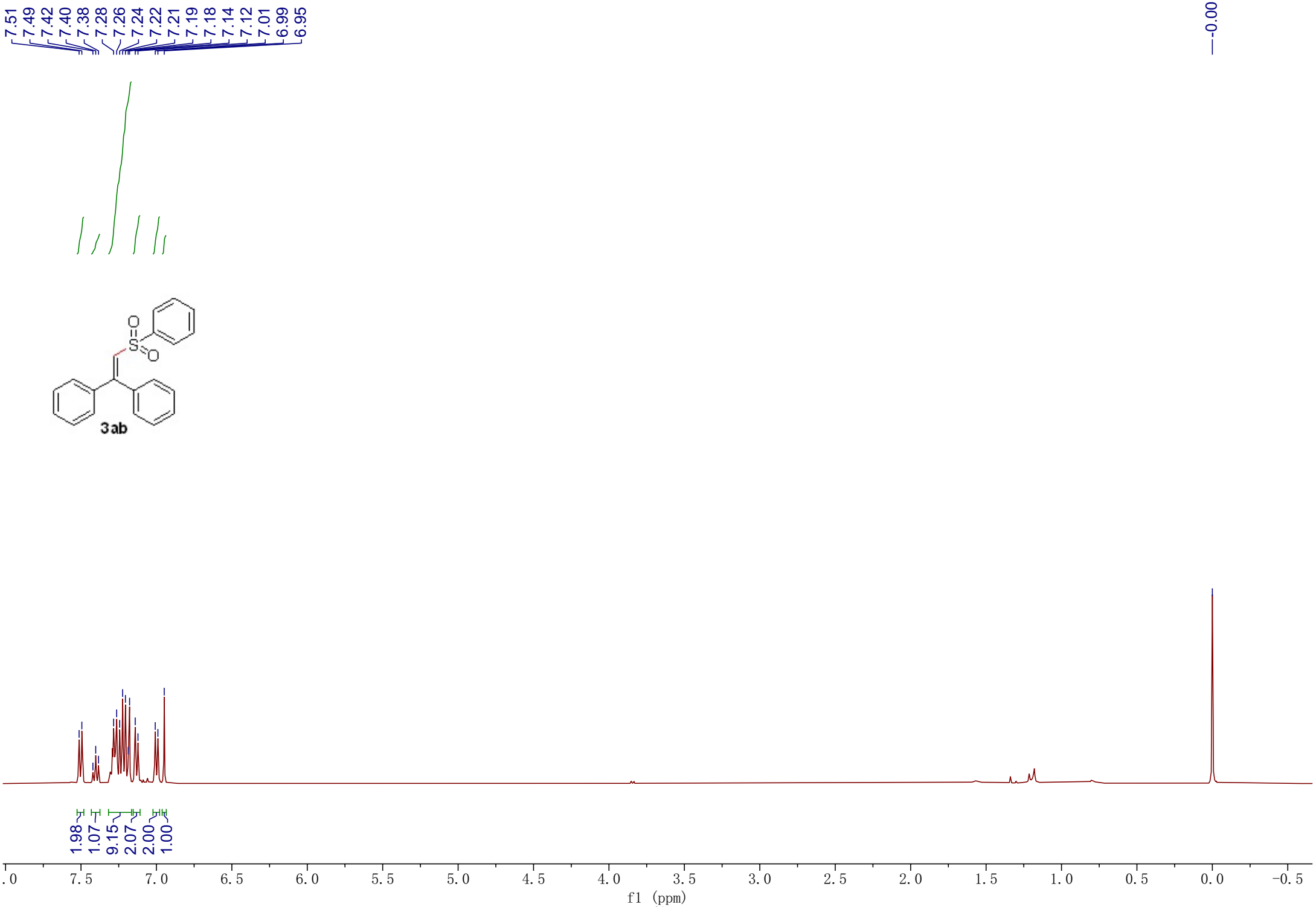

153.75
143.95
139.57
129.81
127.19
126.62
77.48
77.16
76.84
27.13
21.64
19.23
Ts
Me
Me
3sa
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

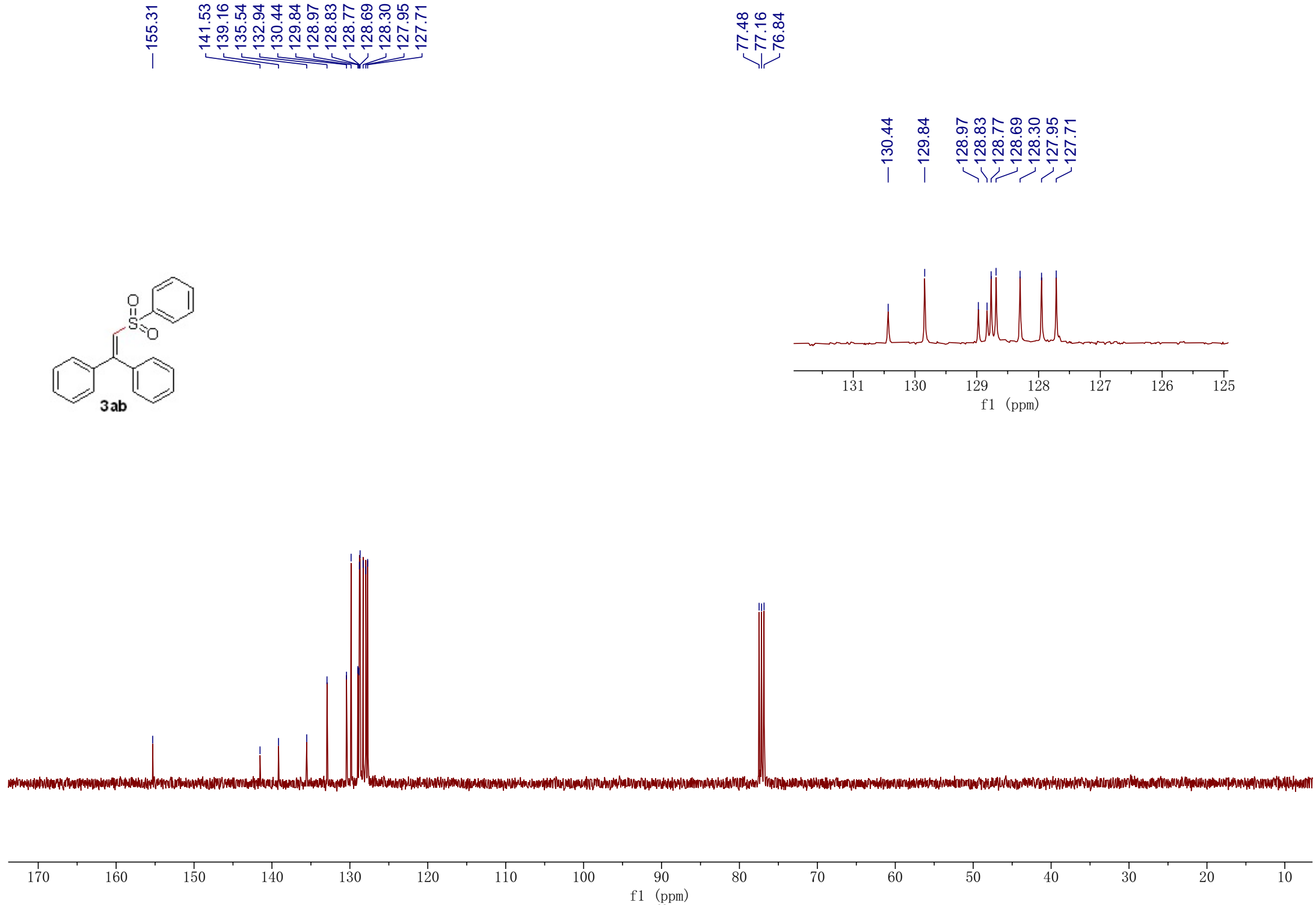

7.75
7.73
7.32
7.30
2.43
2.21
2.21
2.00
1.86
0.00
Me
Ts
Me
Me
3ta
1.96
2.13
2.97
2.91
2.98
3.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

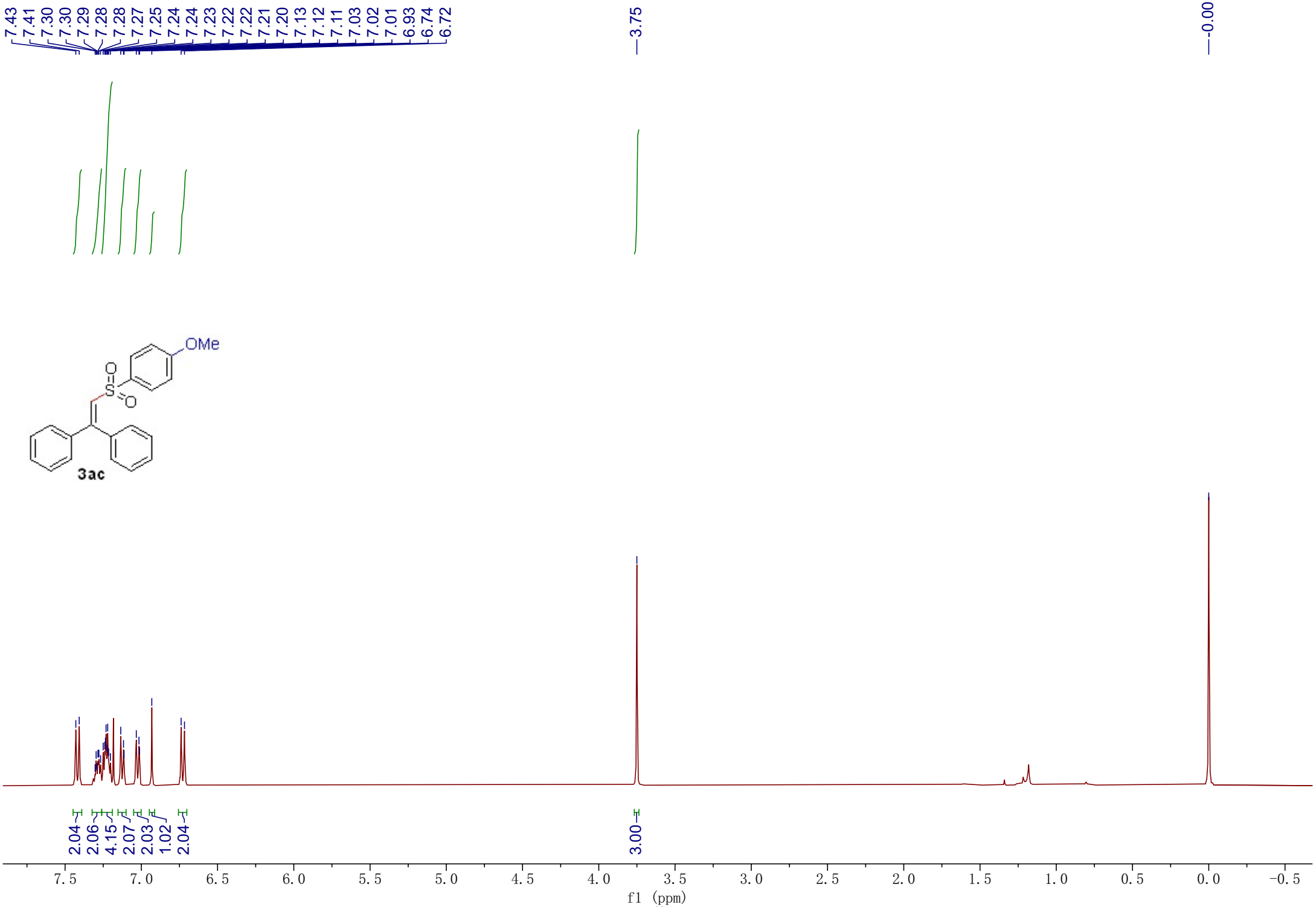

146.84
143.71
139.19
131.36
129.72
127.15
77.48
77.16
76.84
24.57
22.22
21.70
16.03
Me
Ts
Me
Me
3ta
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

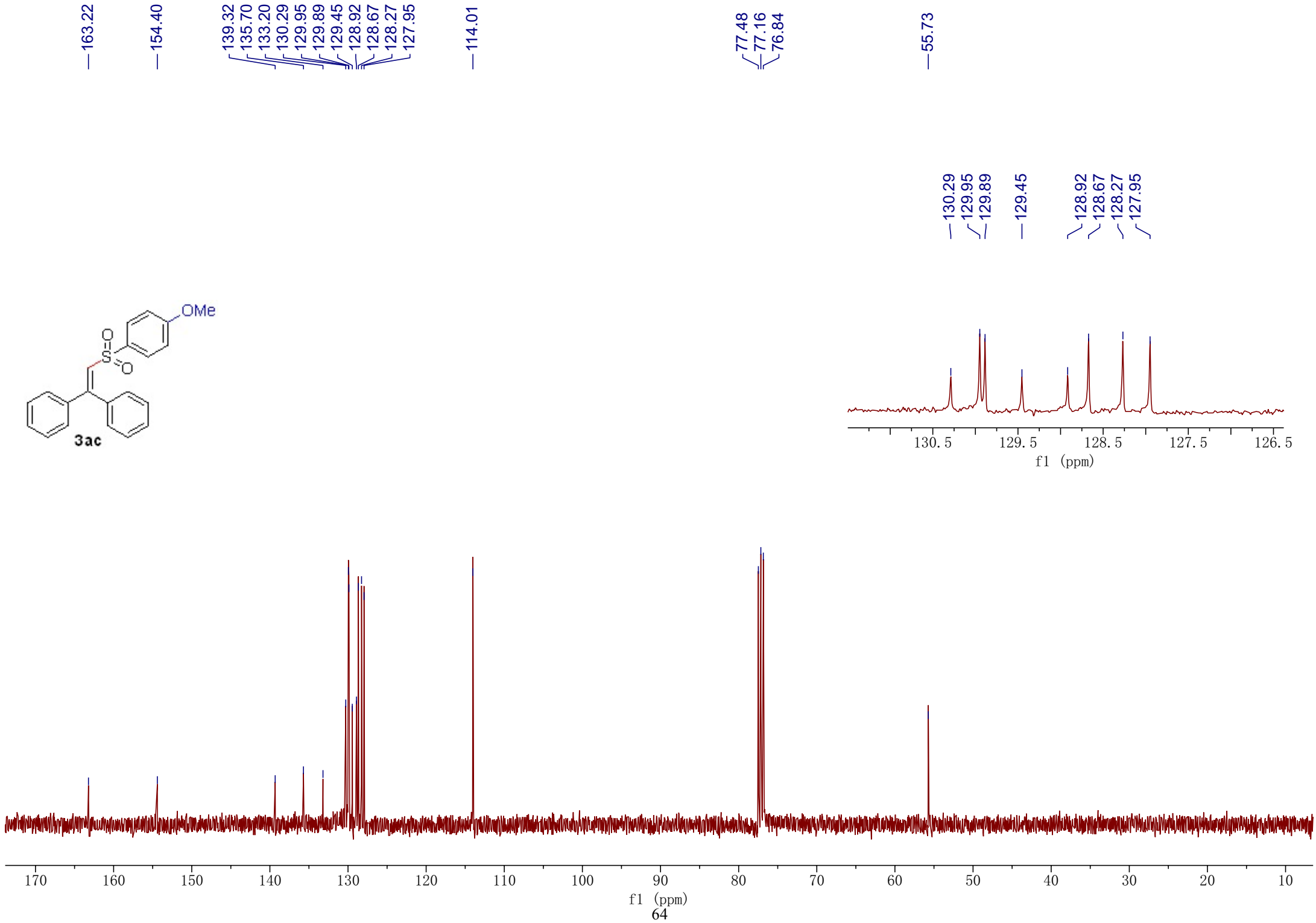

7.84
7.82
7.68
7.64
7.48
7.47
7.46
7.40
7.38
7.35
7.33
6.87
6.83
2.43
0.00
Ts
H
3ua
2.15
1.04
2.13
5.28
1.03
3.00
f1 (ppm)

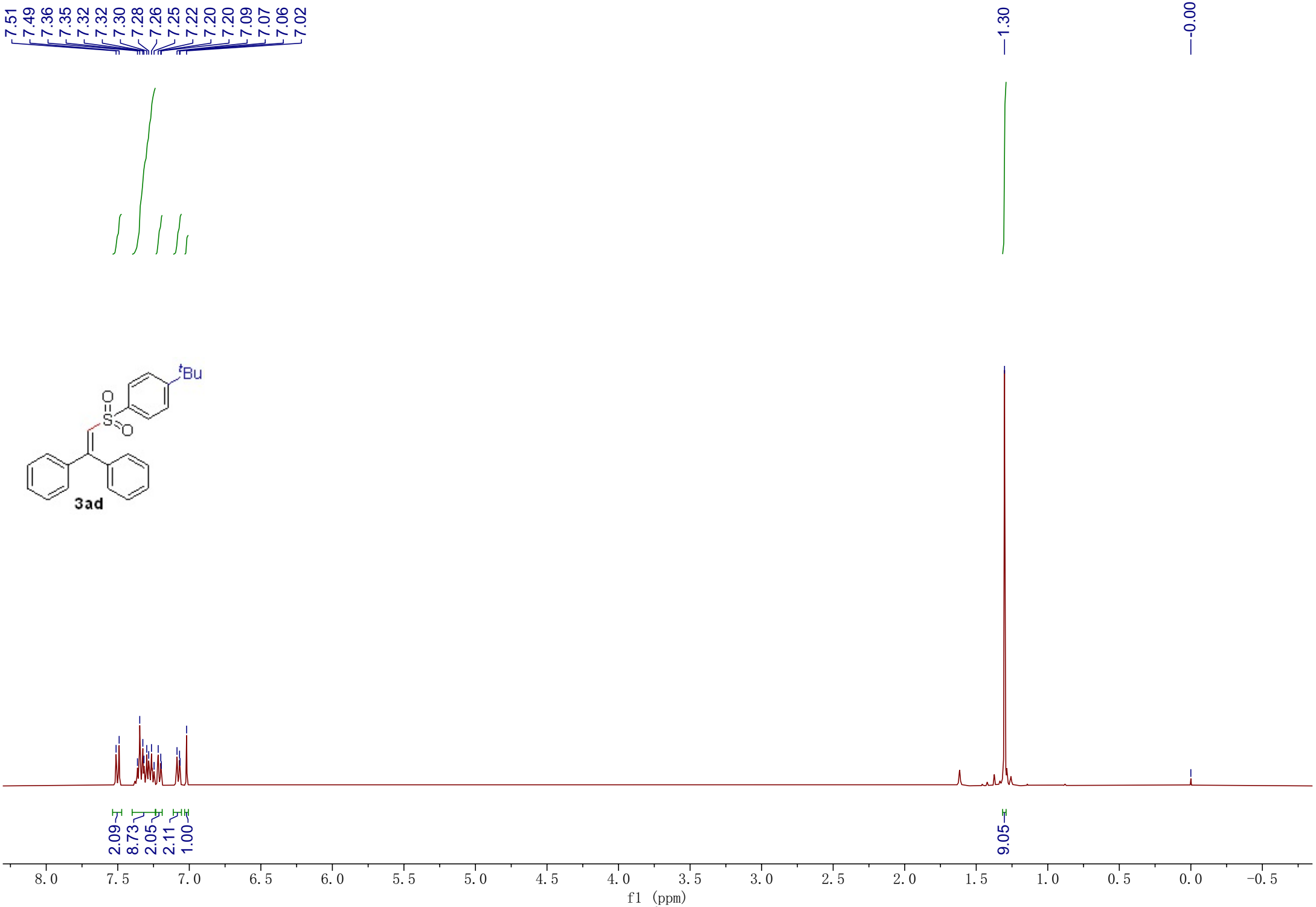

144.50
142.04
137.84
132.55
131.21
130.07
129.16
128.62
127.81
127.73
77.48
77.16
76.84
21.73
Ts
H
3ua
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

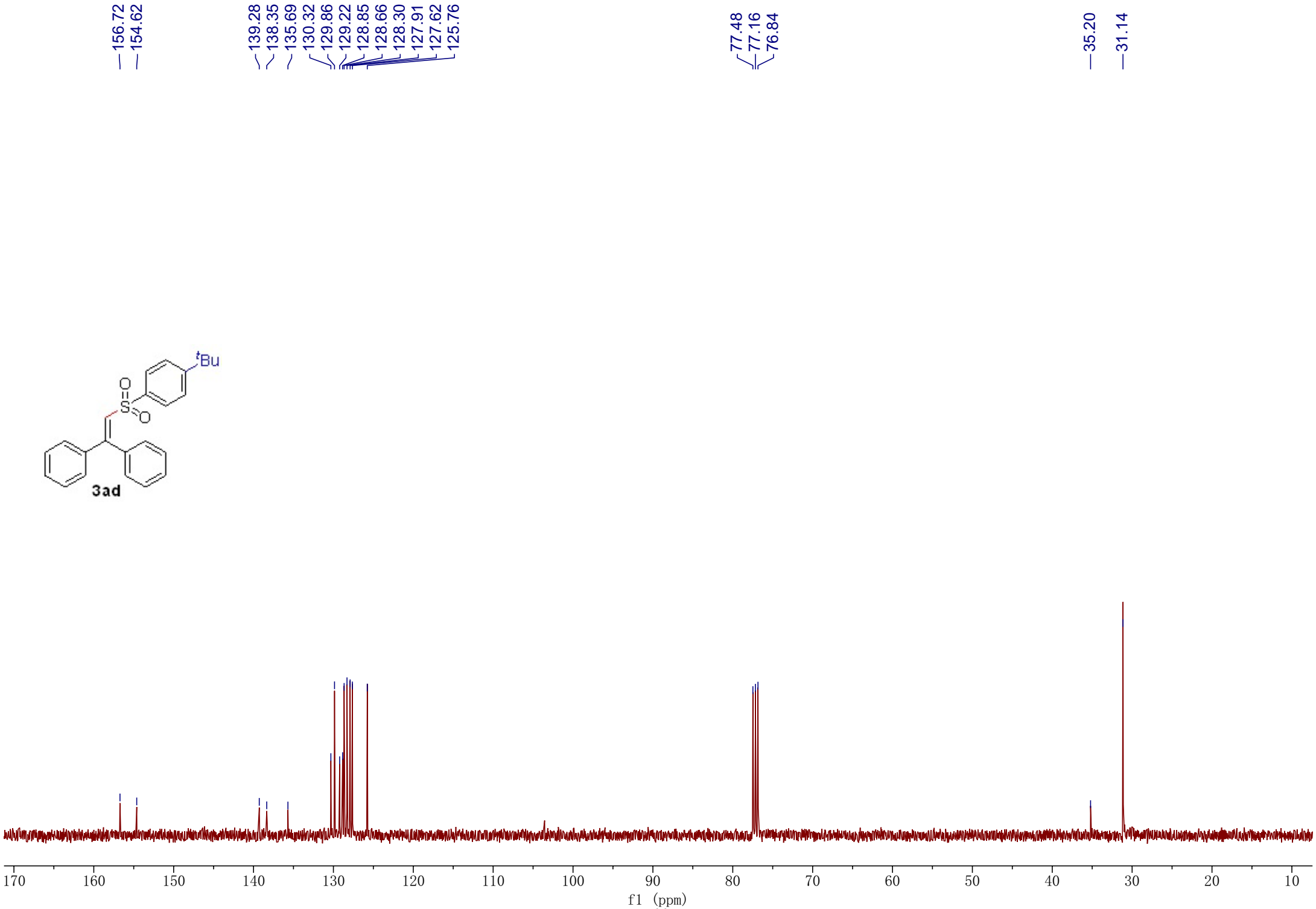

7.51
7.49
7.42
7.40
7.38
7.28
7.26
7.24
7.22
7.21
7.19
7.18
7.14
7.12
7.01
6.99
6.95
-0.00
3ab
1.98
1.07
9.15
2.07
2.00
1.00
f1 (ppm)

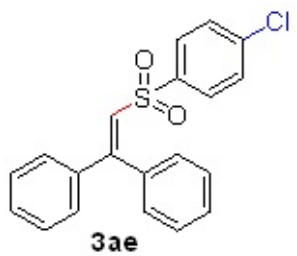

155.31
141.53
139.16
135.54
132.94
130.44
129.84
128.97
128.83
128.77
128.69
128.30
127.95
127.71
77.48
77.16
76.84
3ab
130.44
129.84
128.97
128.83
128.77
128.69
128.30
127.95
127.71
131
130
129
128
127
126
125
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


7.43
7.41
7.30
7.30
7.29
7.28
7.28
7.27
7.25
7.24
7.24
7.23
7.22
7.22
7.21
7.20
7.13
7.12
7.11
7.03
7.02
7.01
6.93
6.74
6.72
3.75
-0.00
OMe
O
S
O
3ac
2.04
2.06
4.15
2.07
2.03
1.02
2.04
3.00
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

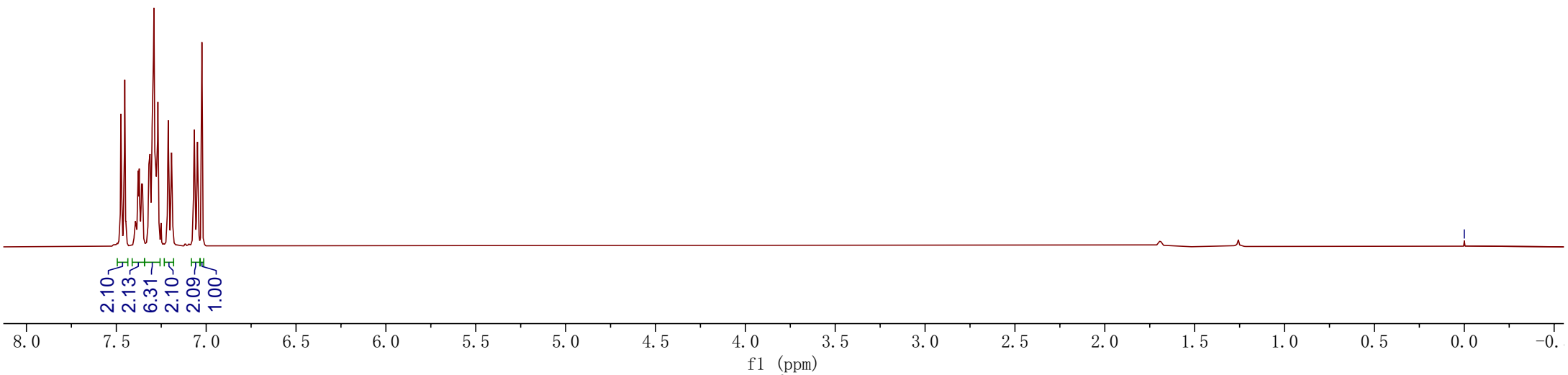

163.22
154.40
139.32
135.70
133.20
130.29
129.95
129.89
129.45
128.92
128.67
128.27
127.95
114.01
77.48
77.16
76.84
55.73
OMe
O
S
O
3ac
130.29
129.95
129.89
129.45
128.92
128.67
128.27
127.95
130.5
129.5
128.5
127.5
126.5
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

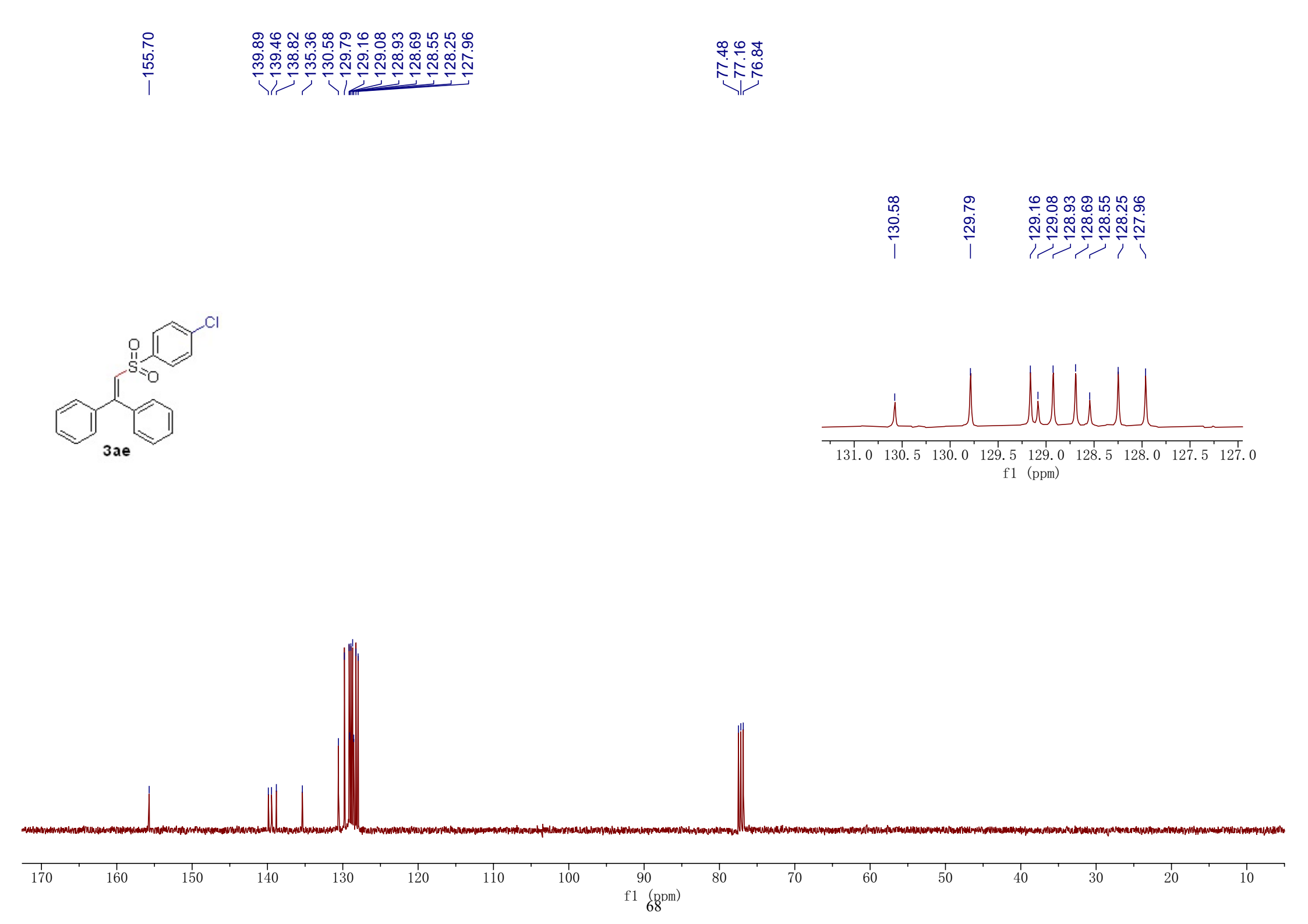

7.51
7.49
7.36
7.35
7.32
7.32
7.30
7.28
7.26
7.25
7.22
7.20
7.20
7.09
7.07
7.06
7.02
1.30
-0.00
tBu
S
O
O
3ad
2.09
8.73
2.05
2.11
1.00
9.05
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

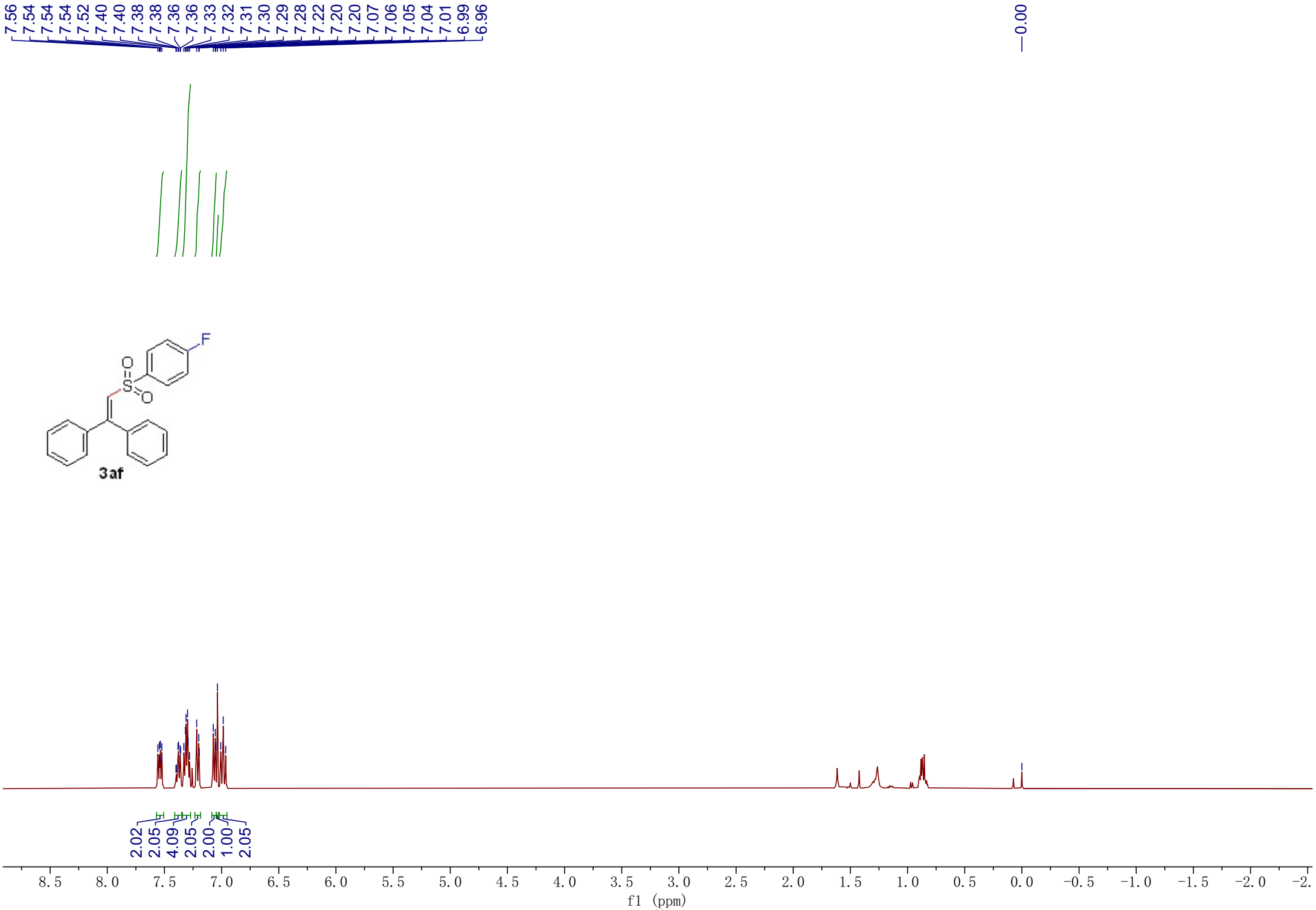

156.72
154.62
139.28
138.35
135.69
130.32
129.86
129.22
128.85
128.66
128.30
127.91
127.62
125.76
77.48
77.16
76.84
35.20
31.14
tBu
O
S
O
3ad
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

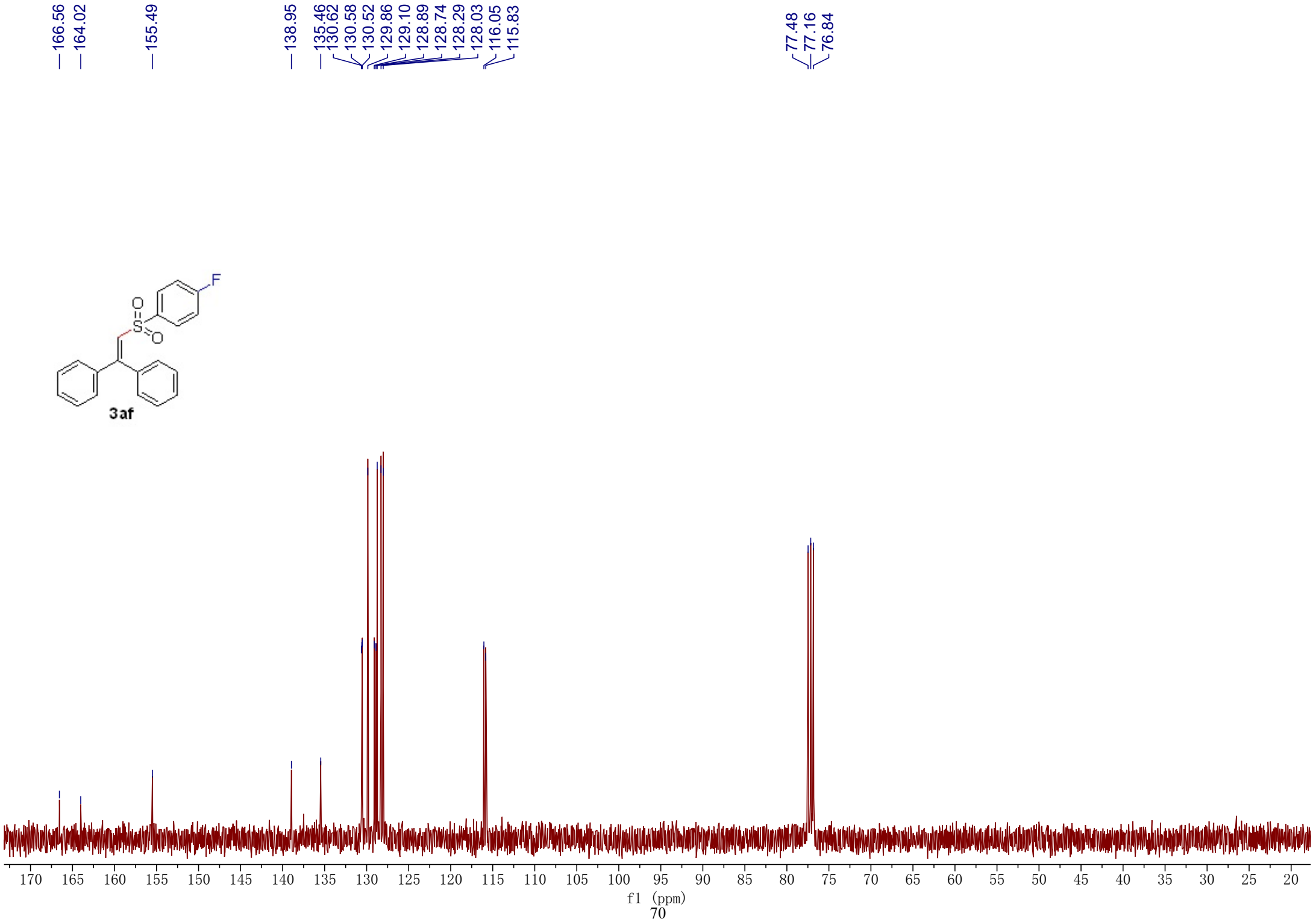

Cl
O
S
O

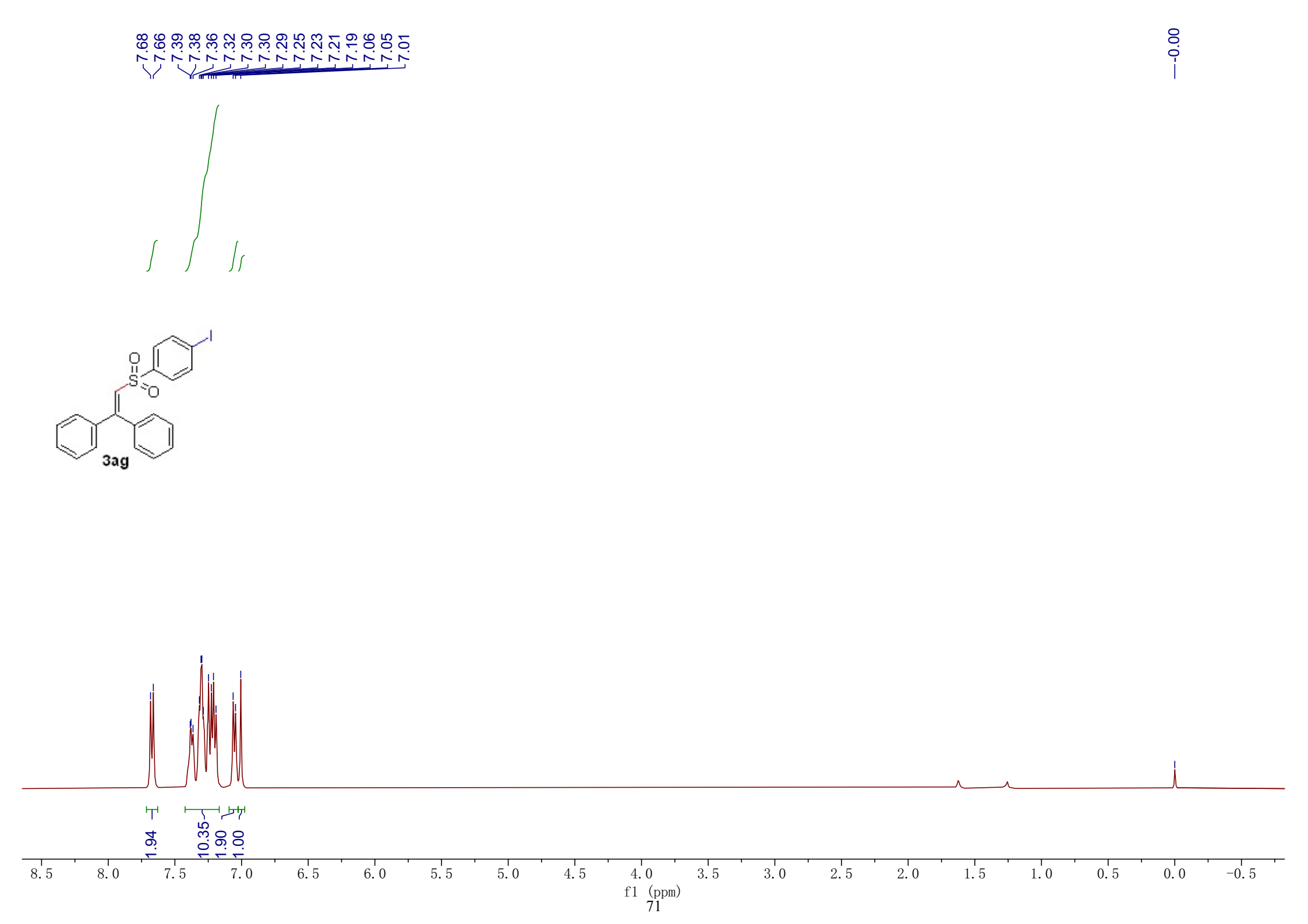
3ae

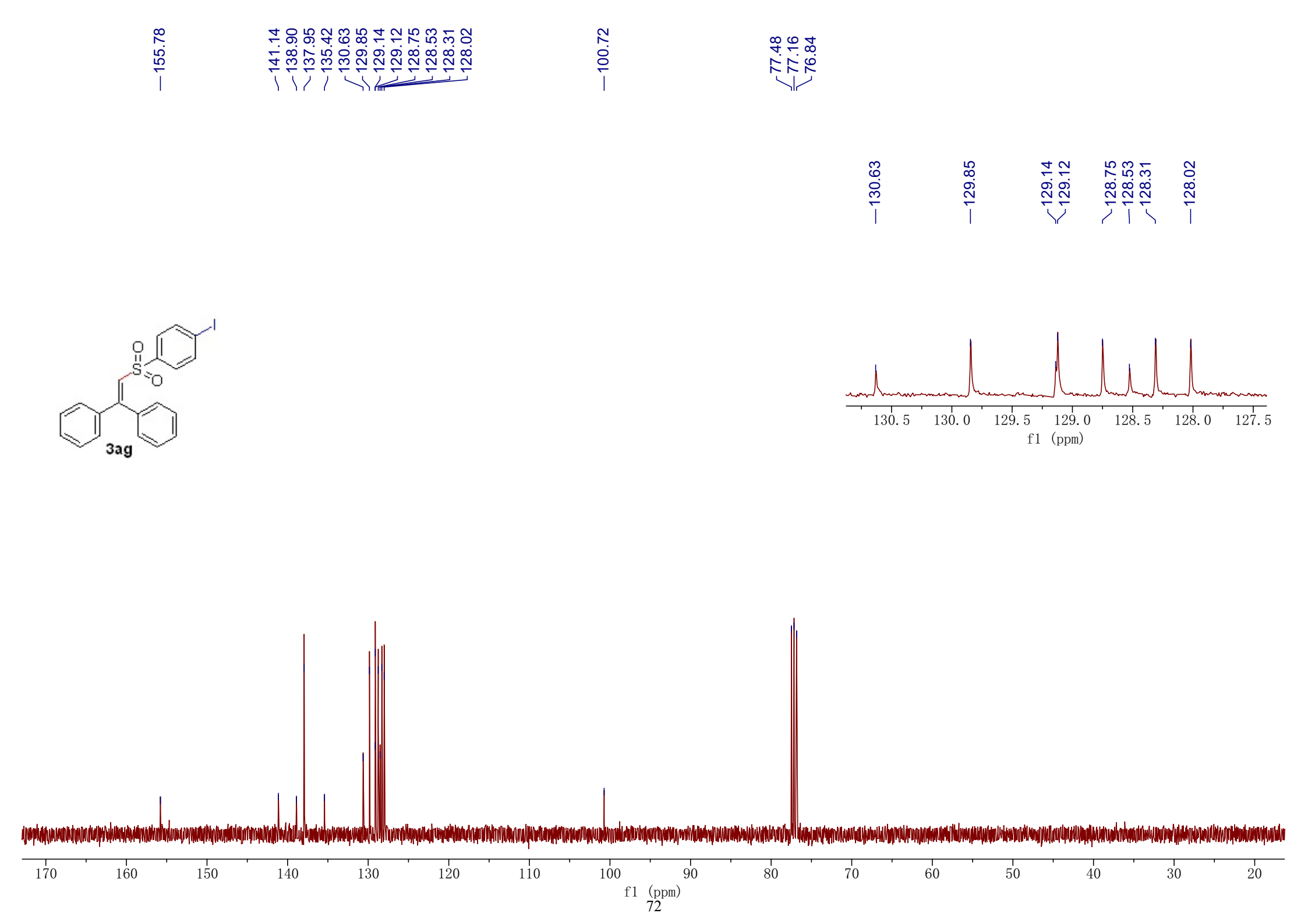

-0.00
2.10
2.13
6.31
2.10
2.09
1.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


155.70
139.89
139.46
138.82
135.36
130.58
129.79
129.16
129.08
128.93
128.69
128.55
128.25
127.96
77.48
77.16
76.84
Cl
O
S
O
3ae
130.58
129.79
129.16
129.08
128.93
128.69
128.55
128.25
127.96
131.0 130.5 130.0 129.5 129.0 128.5 128.0 127.5 127.0
f1 (ppm)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)


7.56
7.54
7.54
7.54
7.52
7.40
7.40
7.38
7.38
7.36
7.36
7.33
7.32
7.31
7.30
7.29
7.28
7.22
7.20
7.20
7.07
7.06
7.05
7.04
7.01
6.99
6.96
0.00
F
O
S
O
3af
2.02
2.05
4.09
2.05
2.00
1.00
2.05
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.
f1 (ppm)


166.56
164.02
155.49
138.95
135.46
130.62
130.58
130.52
129.86
129.10
128.89
128.74
128.29
128.03
116.05
115.83
77.48
77.16
76.84
F
O
S
O
3af
170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20
f1 (ppm)


7.68
7.66
7.39
7.38
7.36
7.32
7.30
7.30
7.29
7.25
7.23
7.21
7.19
7.06
7.05
7.01
-0.00
3ag
1.94
10.35
1.90
1.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


155.78
141.14
138.90
137.95
135.42
130.63
129.85
129.14
129.12
128.75
128.53
128.31
128.02
100.72
77.48
77.16
76.84
130.63
129.85
129.14
129.12
128.75
128.53
128.31
128.02
130.5
130.0
129.5
129.0
128.5
128.0
127.5
f1 (ppm)
3ag
170
160
150
140
130
120
110
100
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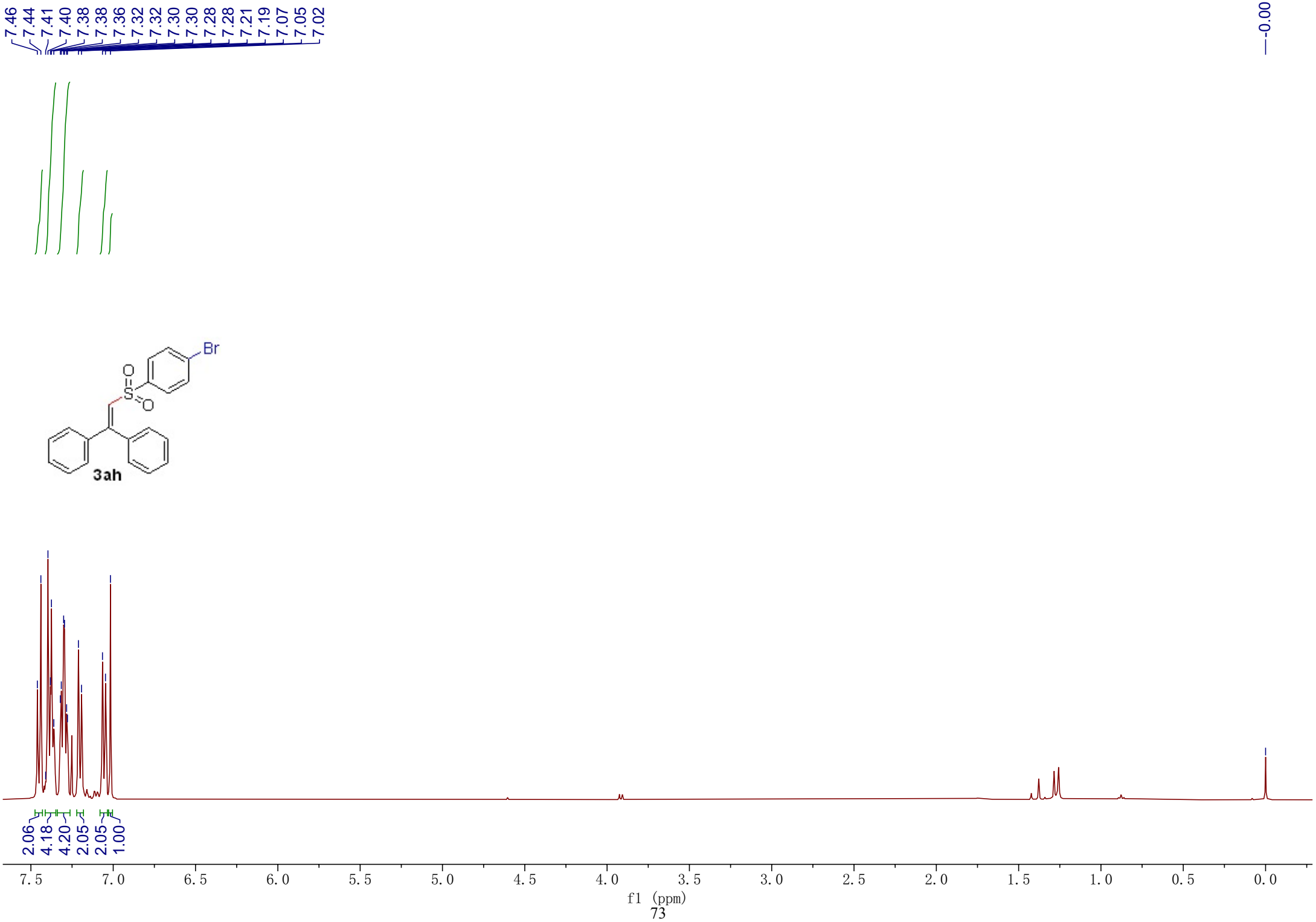
20
f1 (ppm)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7.44
7.41
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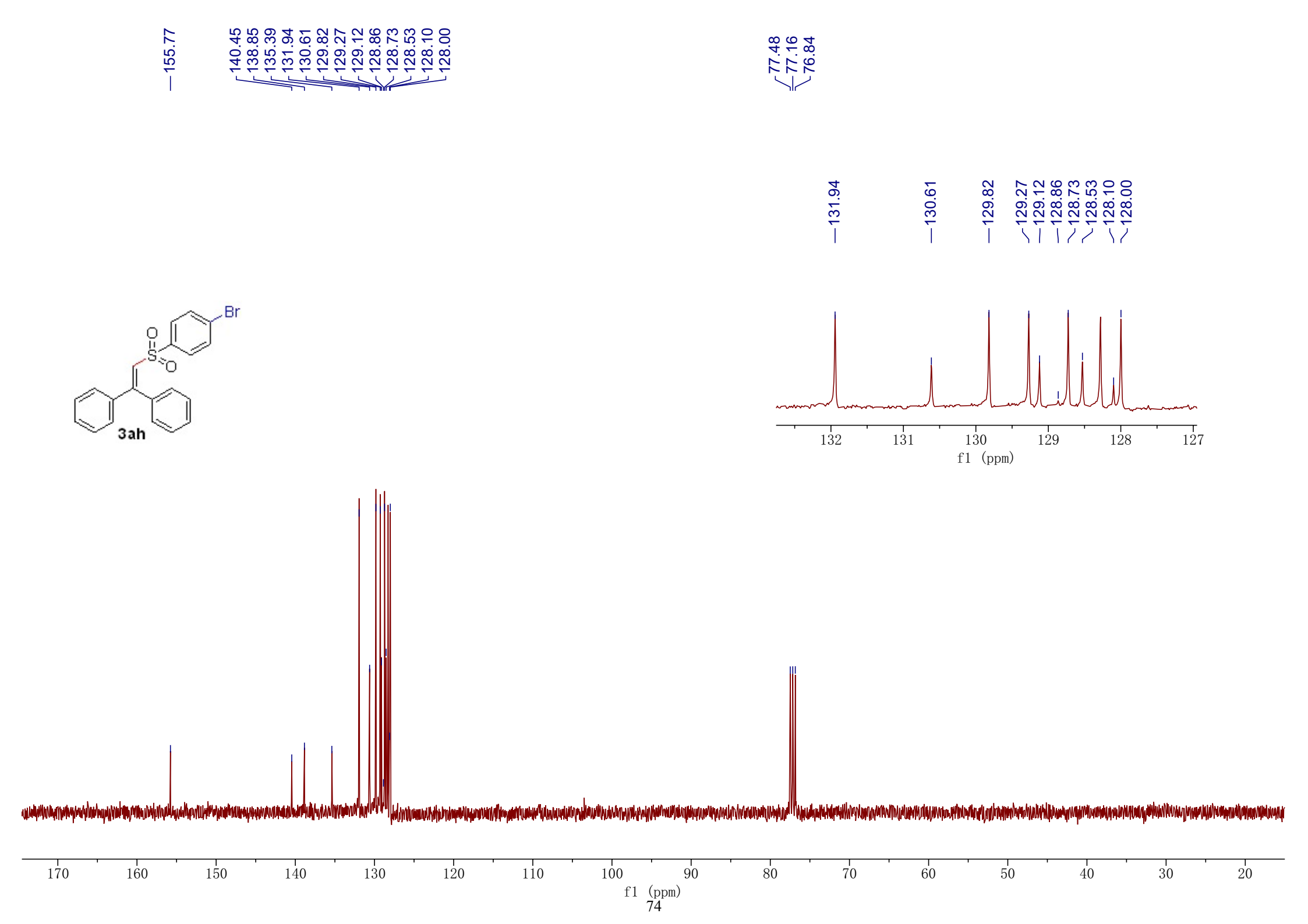
7.38
7.36
7.32
7.32
7.30
7.30
7.28
7.28
7.21
7.19
7.07
7.05
7.02
-0.00
Br
O
S
O
3ah
2.06
4.18
4.20
2.05
2.05
1.00
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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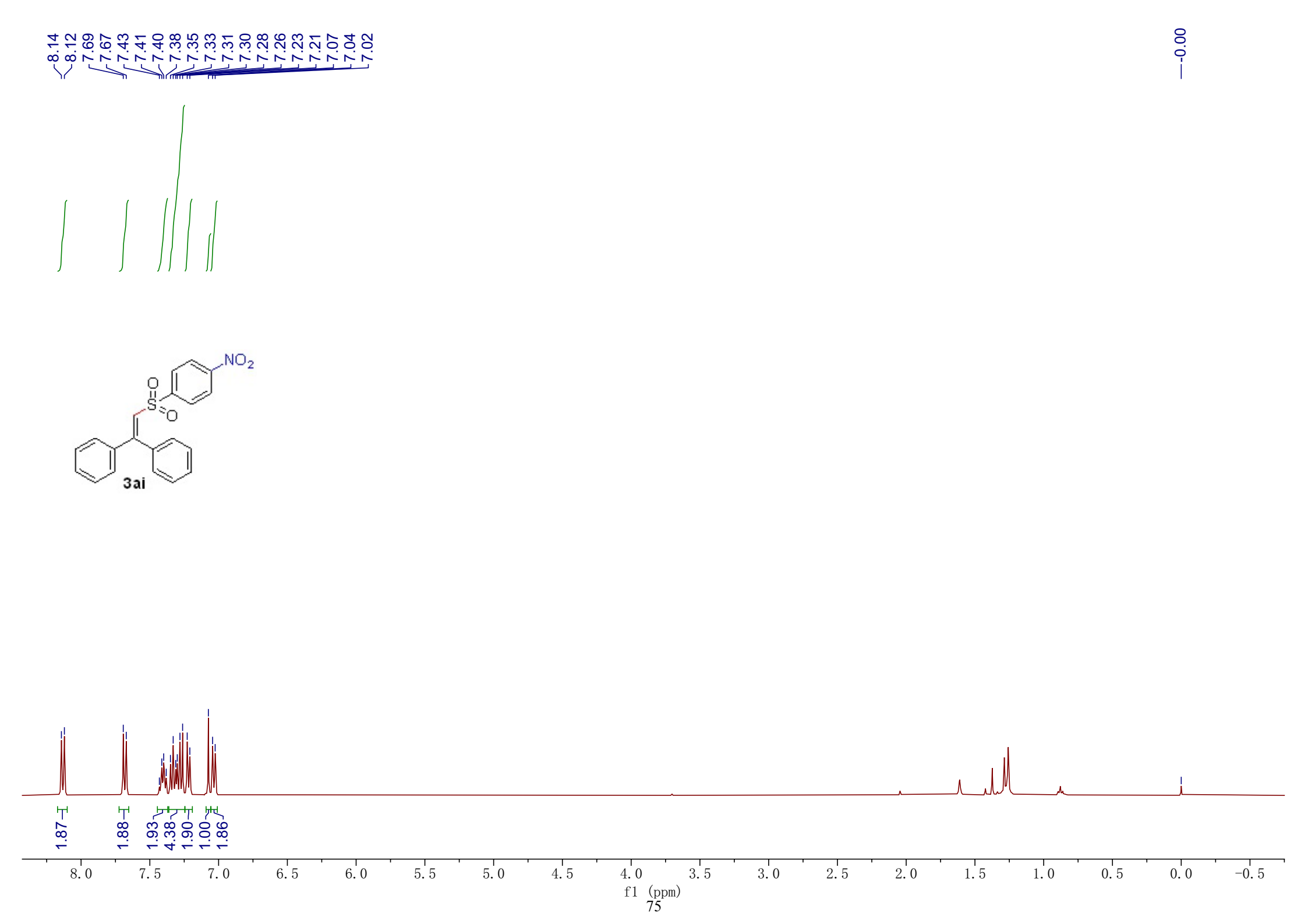
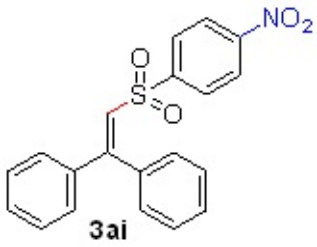
130.61
129.82
129.27
129.12
128.86
128.73
128.53
128.10
128.00
77.48
77.16
76.84
Br
S=O
O
3ah
131.94
130.61
129.82
129.27
129.12
128.86
128.73
128.53
128.10
128.00
132
131
130
129
128
127
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)


8.14
8.12
7.69
7.67
7.43
7.41
7.40
7.38
7.35
7.33
7.31
7.30
7.28
7.26
7.23
7.21
7.07
7.04
7.02
-0.00
NO2
S
O
O
3ai
1.87
1.88
1.93
4.38
1.90
1.00
1.86
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

157.21
150.07
147.04
138.47
135.18
131.03
129.90
129.46
129.08
128.85
128.38
128.13
127.77
123.76
77.48
77.16
76.84



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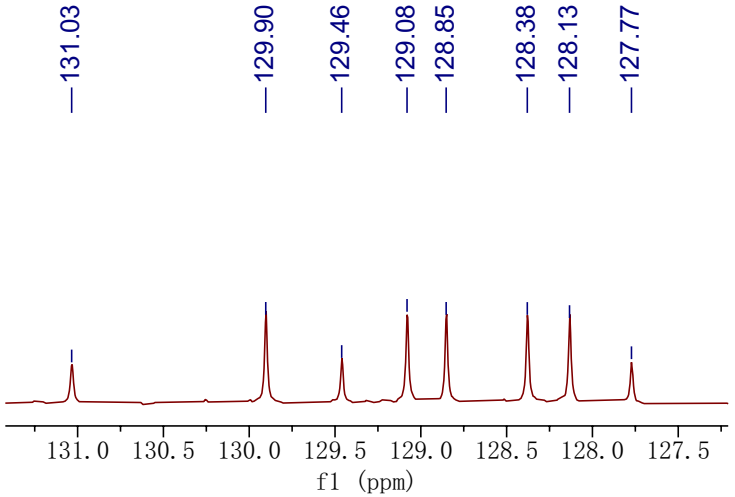
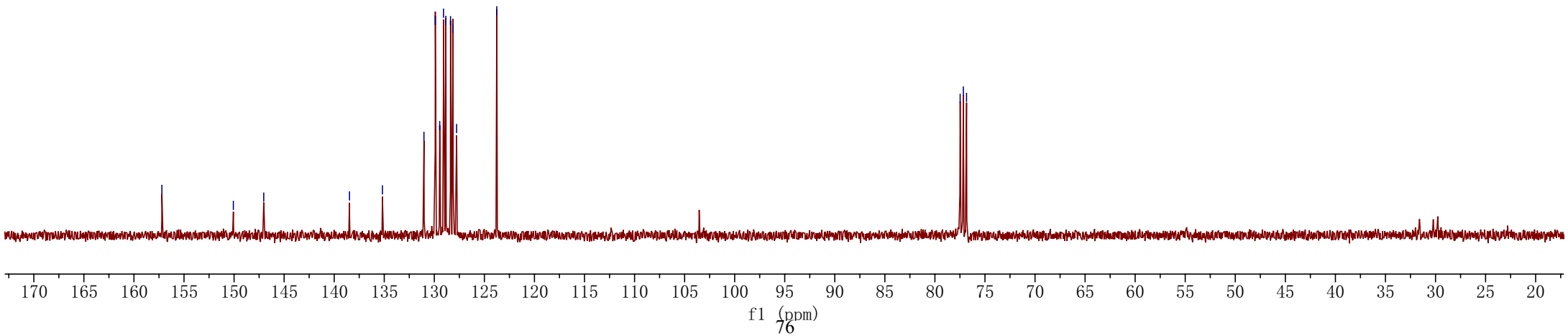
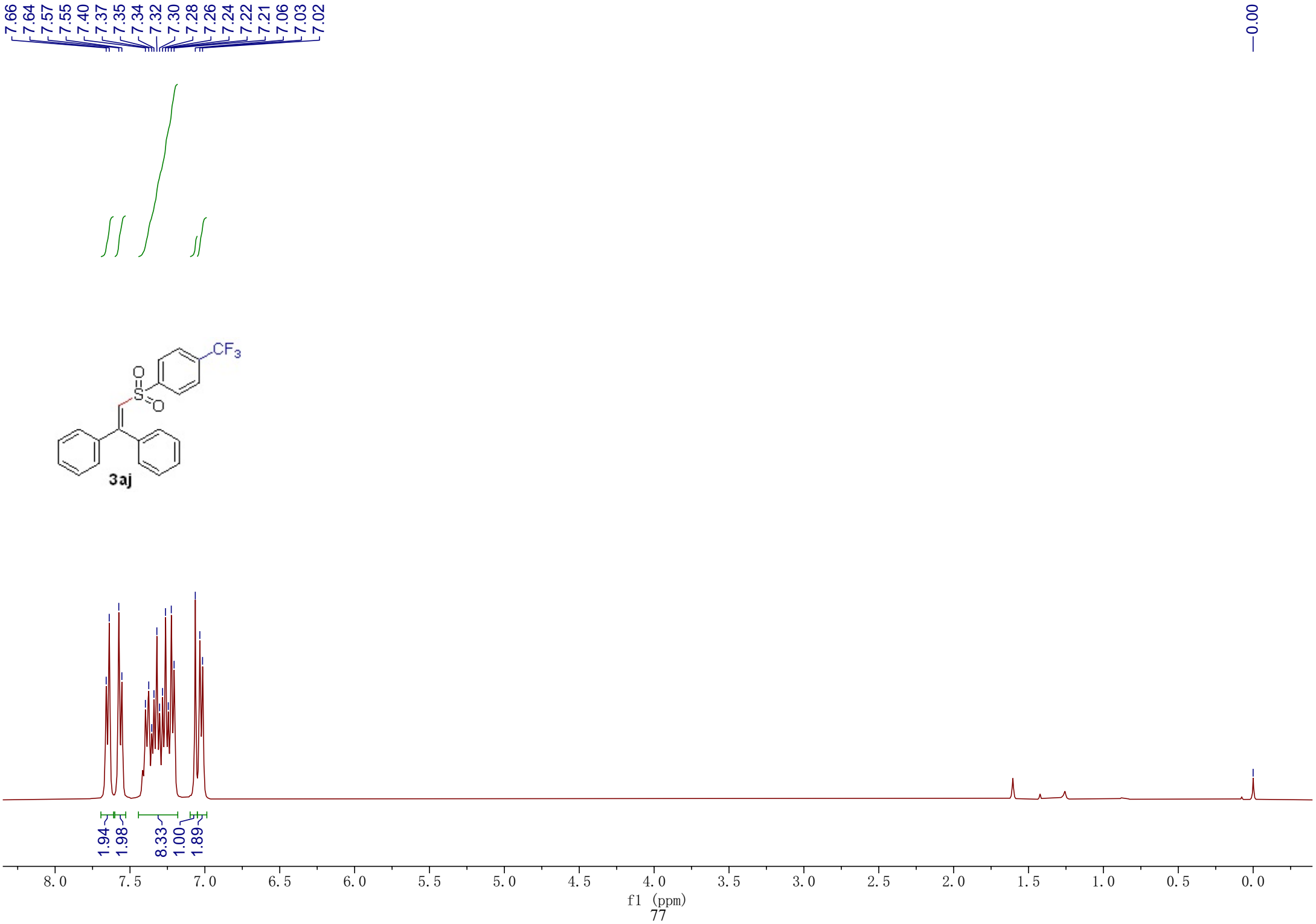
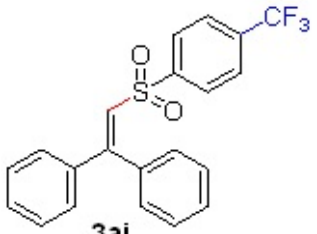


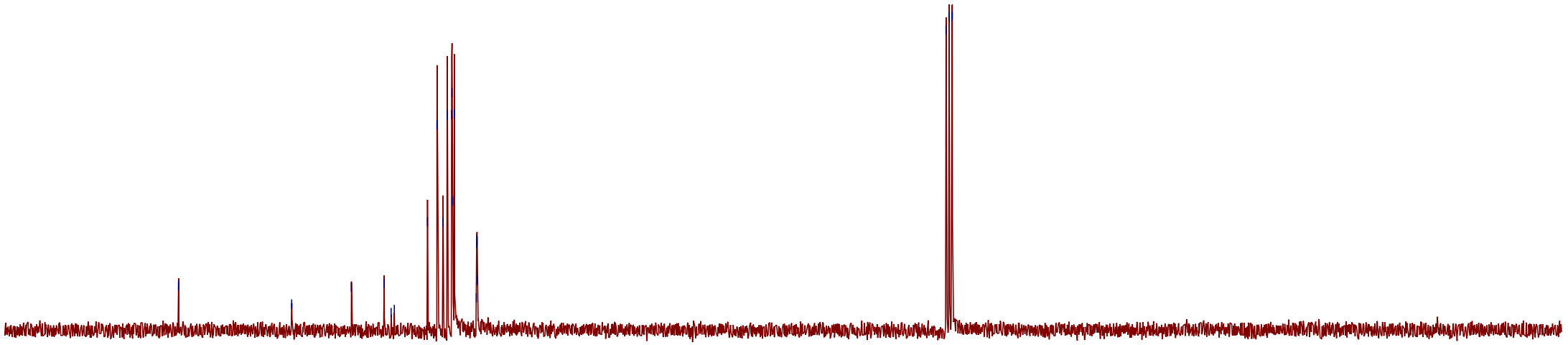


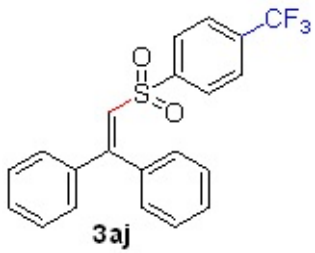

7.66
7.64
7.57
7.55
7.40
7.37
7.35
7.34
7.32
7.30
7.28
7.26
7.24
7.22
7.21
7.06
7.03
7.02
0.00
CF3
S=O
O
3aj
1.94
1.98
8.33
1.00
1.89
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

156.47
144.83
138.68
135.31
134.59
134.27
130.85
129.87
129.26
128.82
128.37
128.33
128.25
128.09
125.82
125.79
125.75
125.71
77.48
77.16
76.84

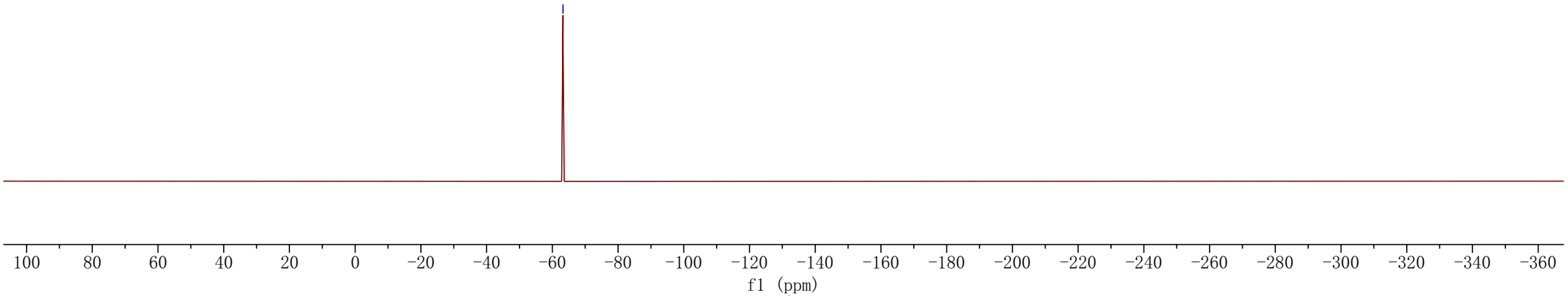


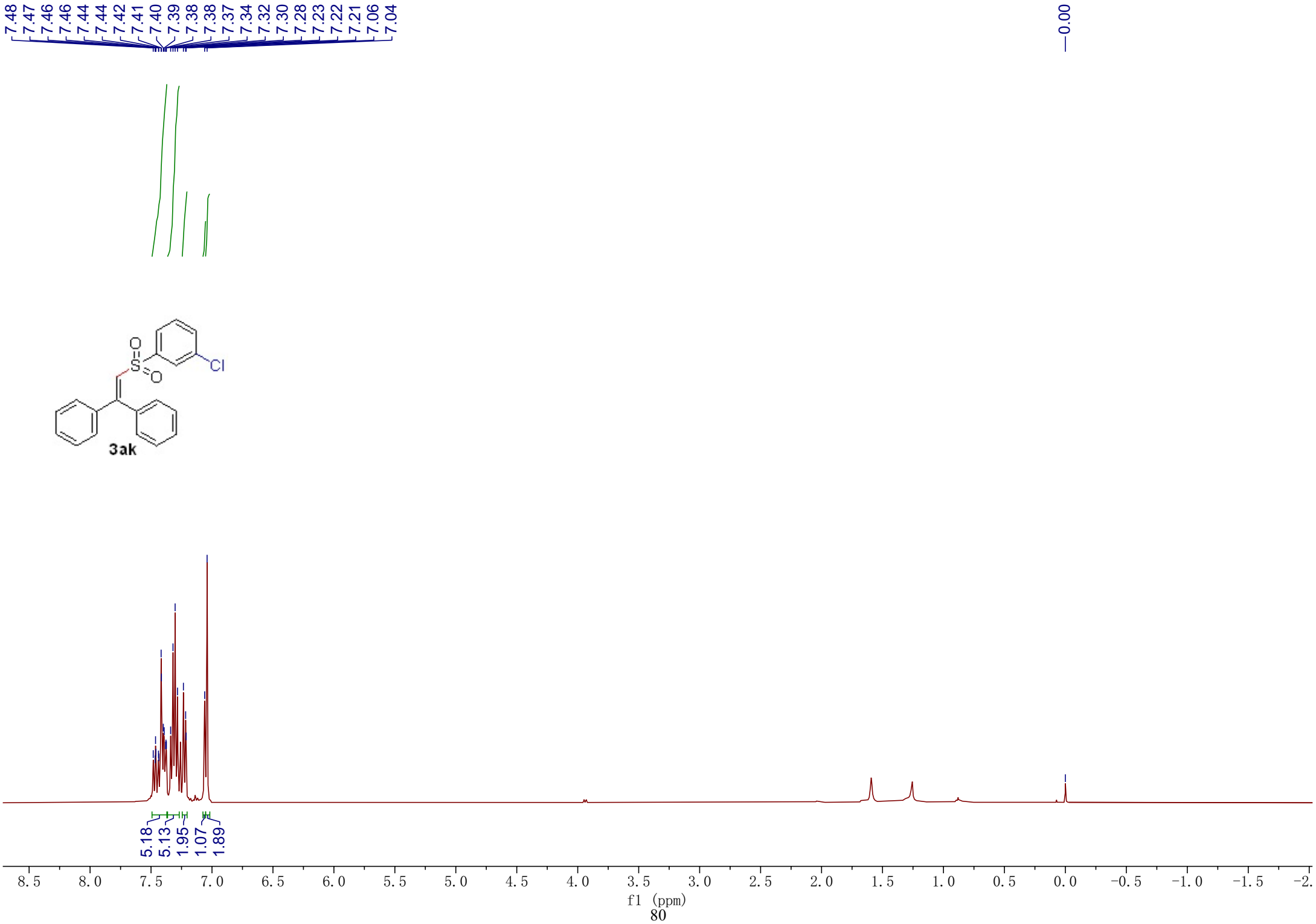
3aj

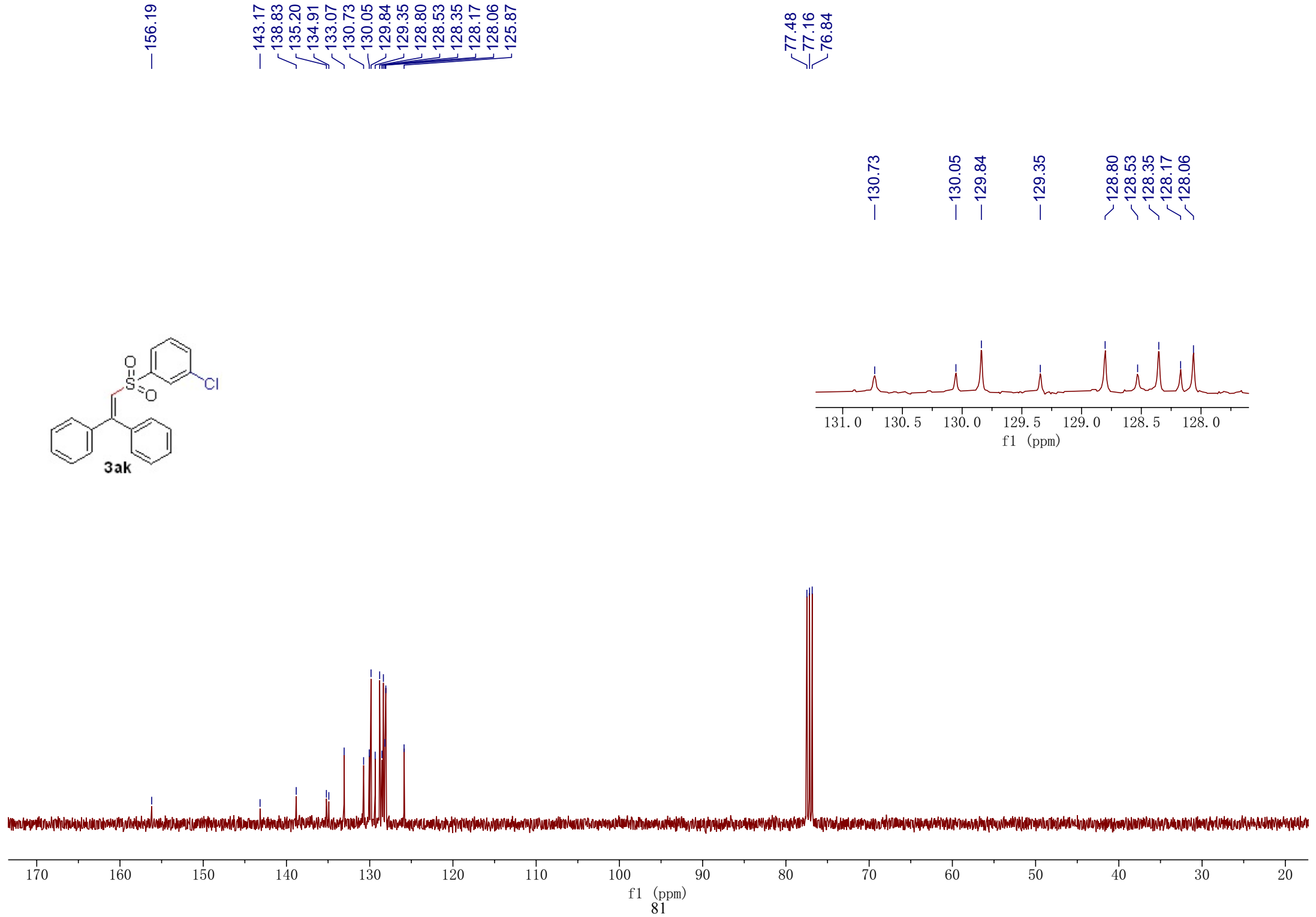



CF3
O
S
O

3aj


-63.25
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
-260
-280
-300
-320
-340
-360
f1 (ppm)


7.48
7.47
7.46
7.46
7.44
7.44
7.42
7.41
7.40
7.39
7.38
7.38
7.37
7.34
7.32
7.30
7.28
7.23
7.22
7.21
7.06
7.04
0.00
O
S
O
Cl
3ak
5.18
5.13
1.95
1.07
1.89
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.
f1 (ppm)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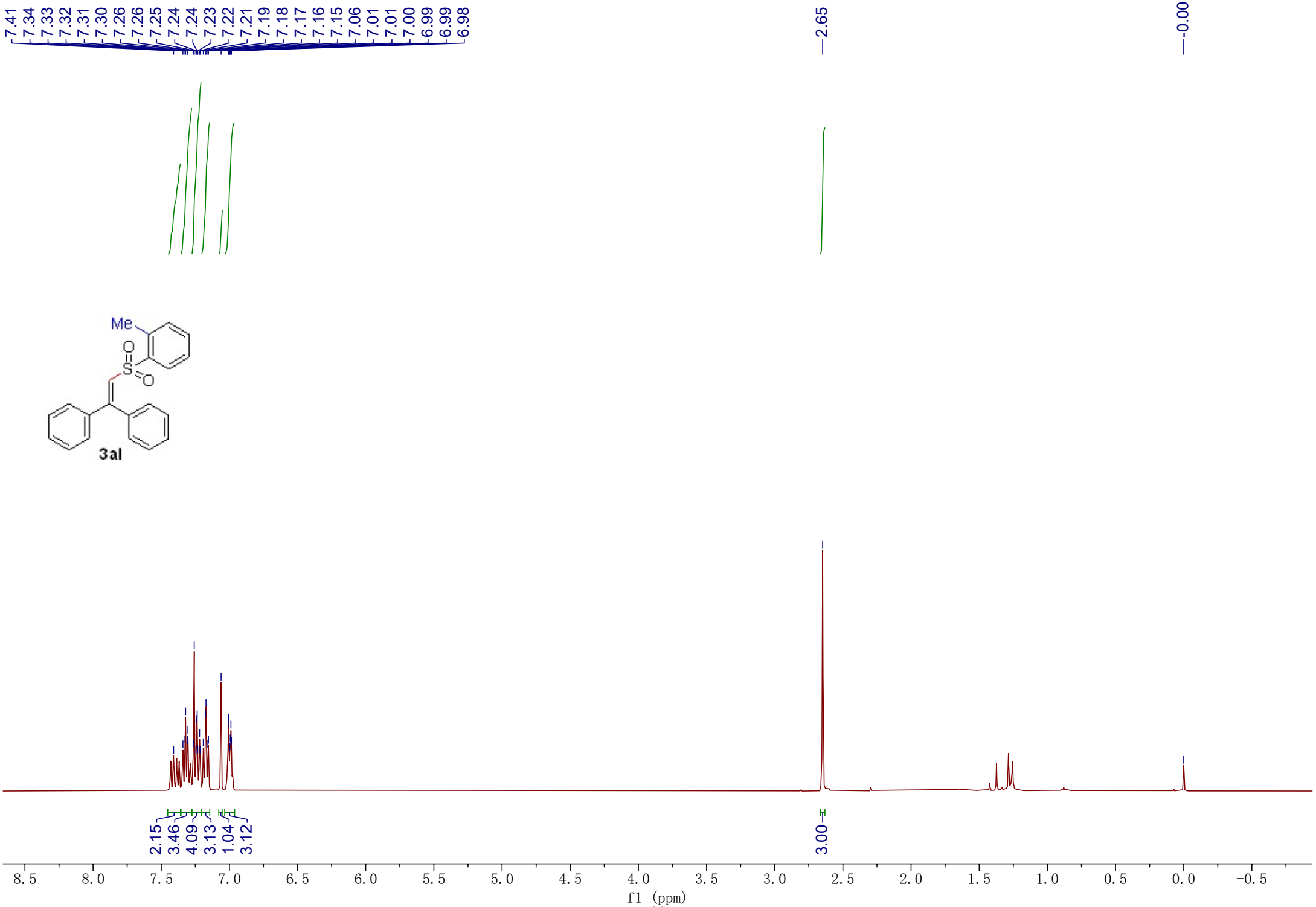
143.17
138.83
135.20
134.91
133.07
130.73
130.05
129.84
129.35
128.80
128.53
128.35
128.17
128.06
125.87
77.48
77.16
76.84
130.73
130.05
129.84
129.35
128.80
128.53
128.35
128.17
128.06
Cl
3ak
131.0
130.5
130.0
129.5
129.0
128.5
128.0
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)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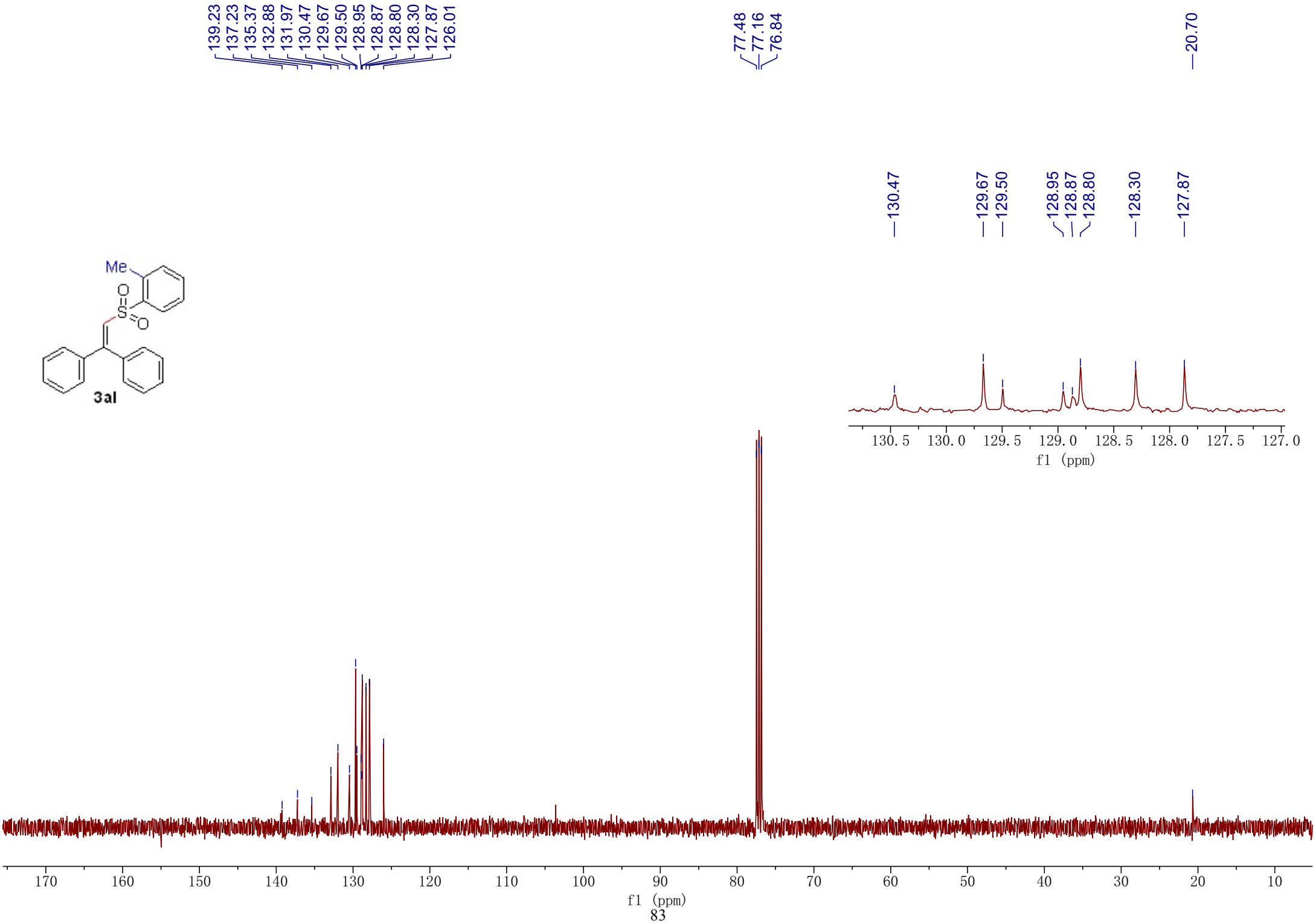
7.34
7.33
7.32
7.31
7.30
7.26
7.26
7.25
7.24
7.24
7.23
7.22
7.21
7.19
7.18
7.17
7.16
7.15
7.06
7.01
7.01
7.00
6.99
6.99
6.98
2.65
0.00
Me
O
S
O
3al
2.15
3.46
4.09
3.13
1.04
3.12
3.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


139.23
137.23
135.37
132.88
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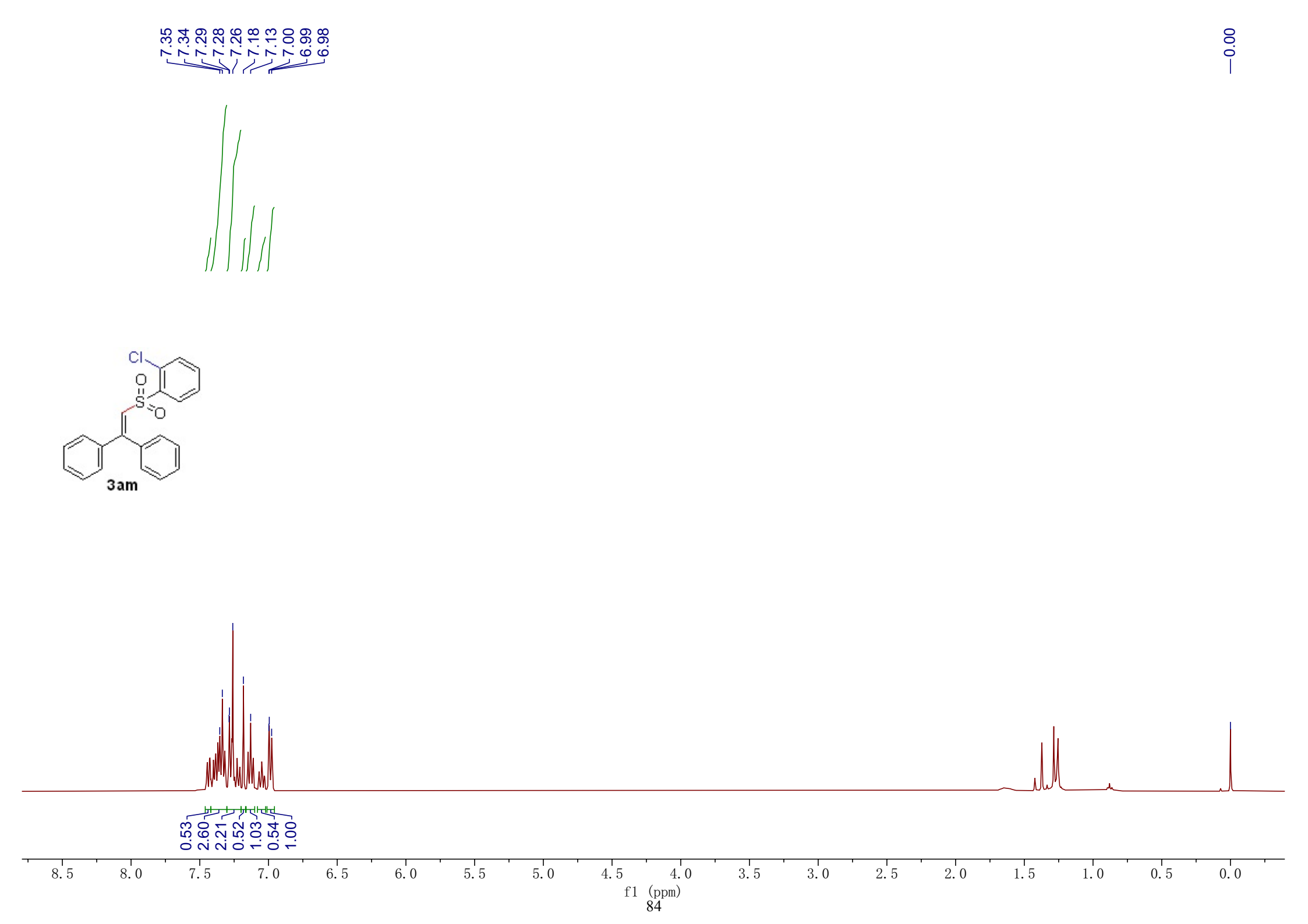
130.47
129.67
129.50
128.95
128.87
128.80
128.30
127.87
126.01
77.48
77.16
76.84
20.70
130.47
129.67
129.50
128.95
128.87
128.80
128.30
127.87
Me
O
S
O
3al
130.5
130.0
129.5
129.0
128.5
128.0
127.5
127.0
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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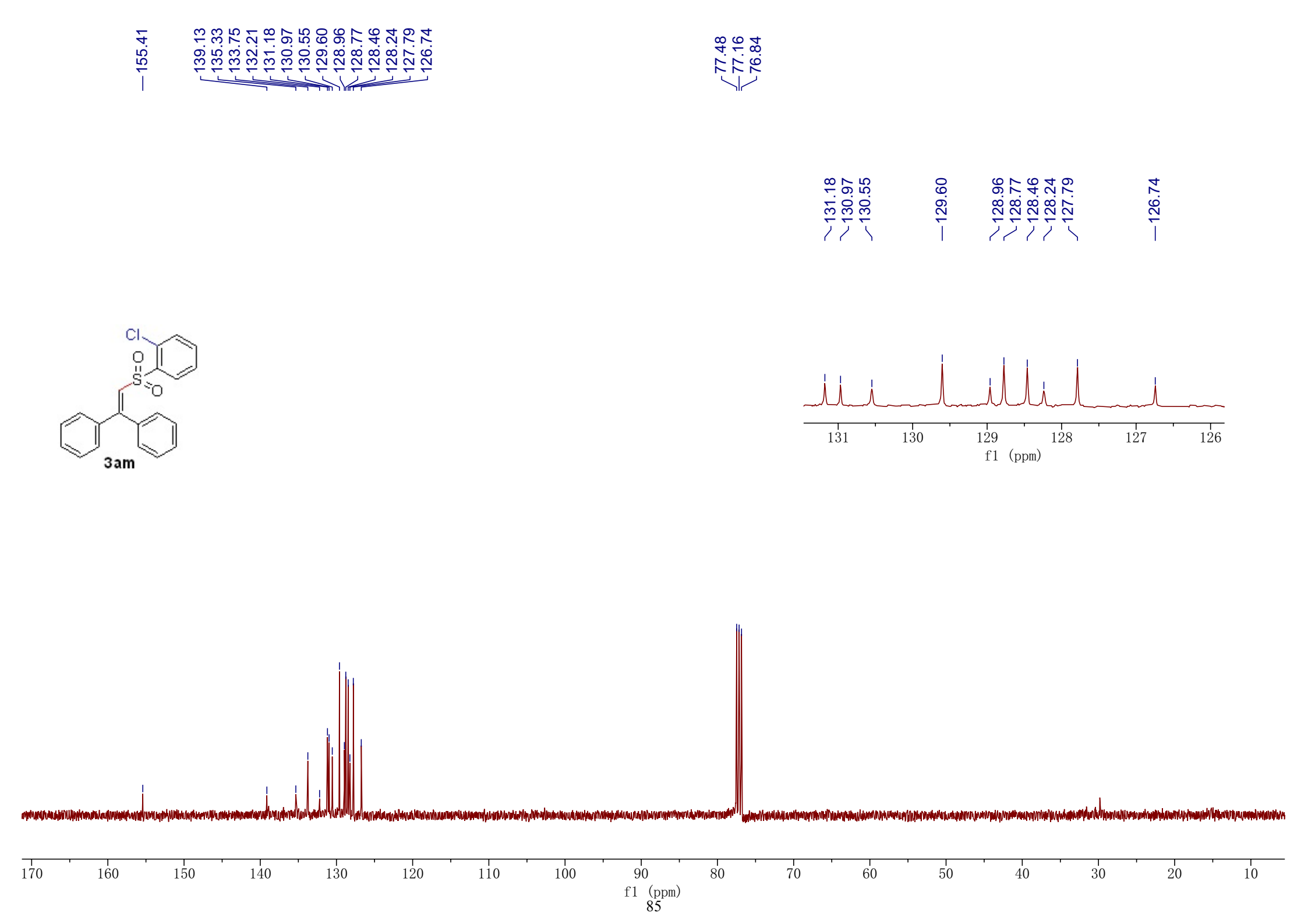
7.34
7.29
7.28
7.26
7.18
7.13
7.00
6.99
6.98
0.00
Cl
O
S
O
3am
0.53
2.60
2.21
0.52
1.03
0.54
1.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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129.60
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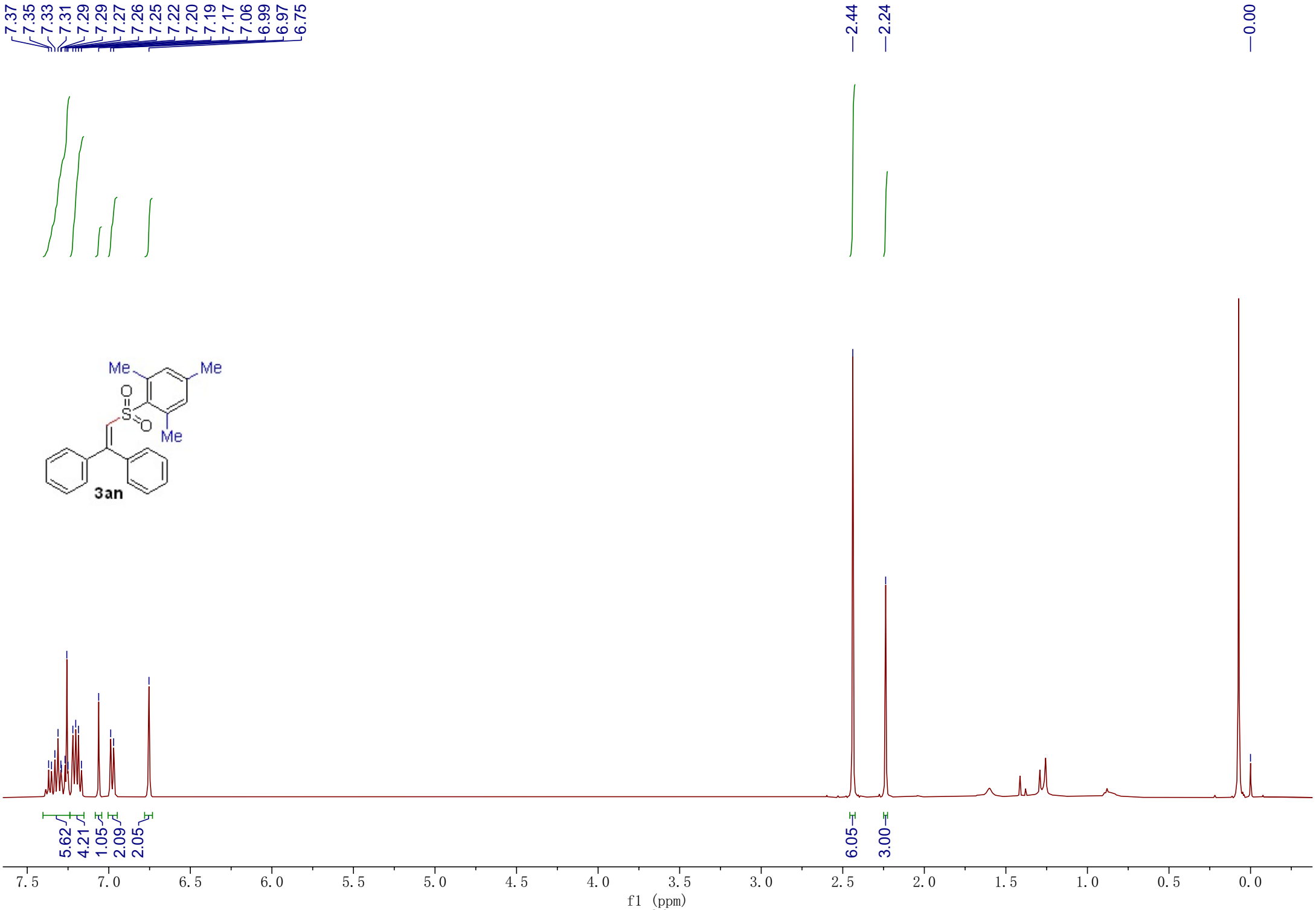
128.46
128.24
127.79
126.74
77.48
77.16
76.84
Cl
O
S
O
3am
131.18
130.97
130.55
129.60
128.96
128.77
128.46
128.24
127.79
126.74
131
130
129
128
127
126
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.31
7.29
7.29
7.27
7.26
7.25
7.22
7.20
7.19
7.17
7.06
6.99
6.97
6.75
2.44
2.24
0.00
Me
Me
Me
S
O
O
3an
5.62
4.21
1.05
2.09
2.05
6.05
3.00
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

153.19
142.60
139.45
139.25
135.58
135.51
131.77
131.28
130.20
129.21
128.74
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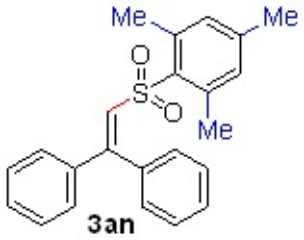
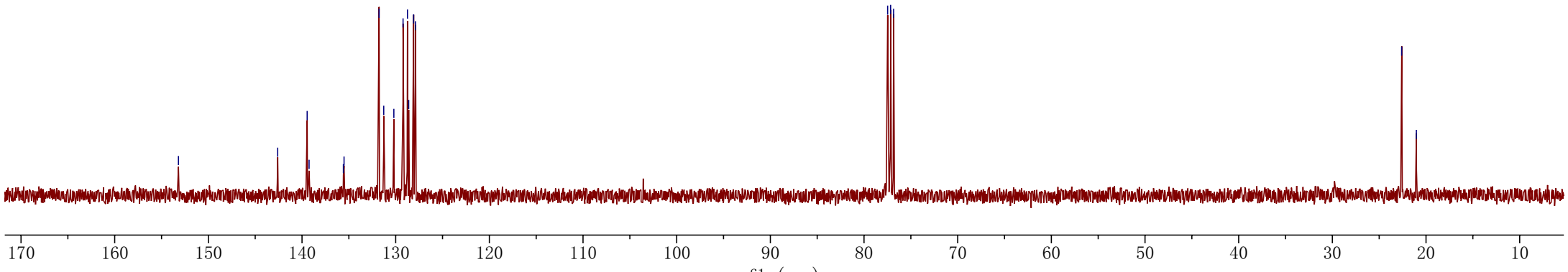
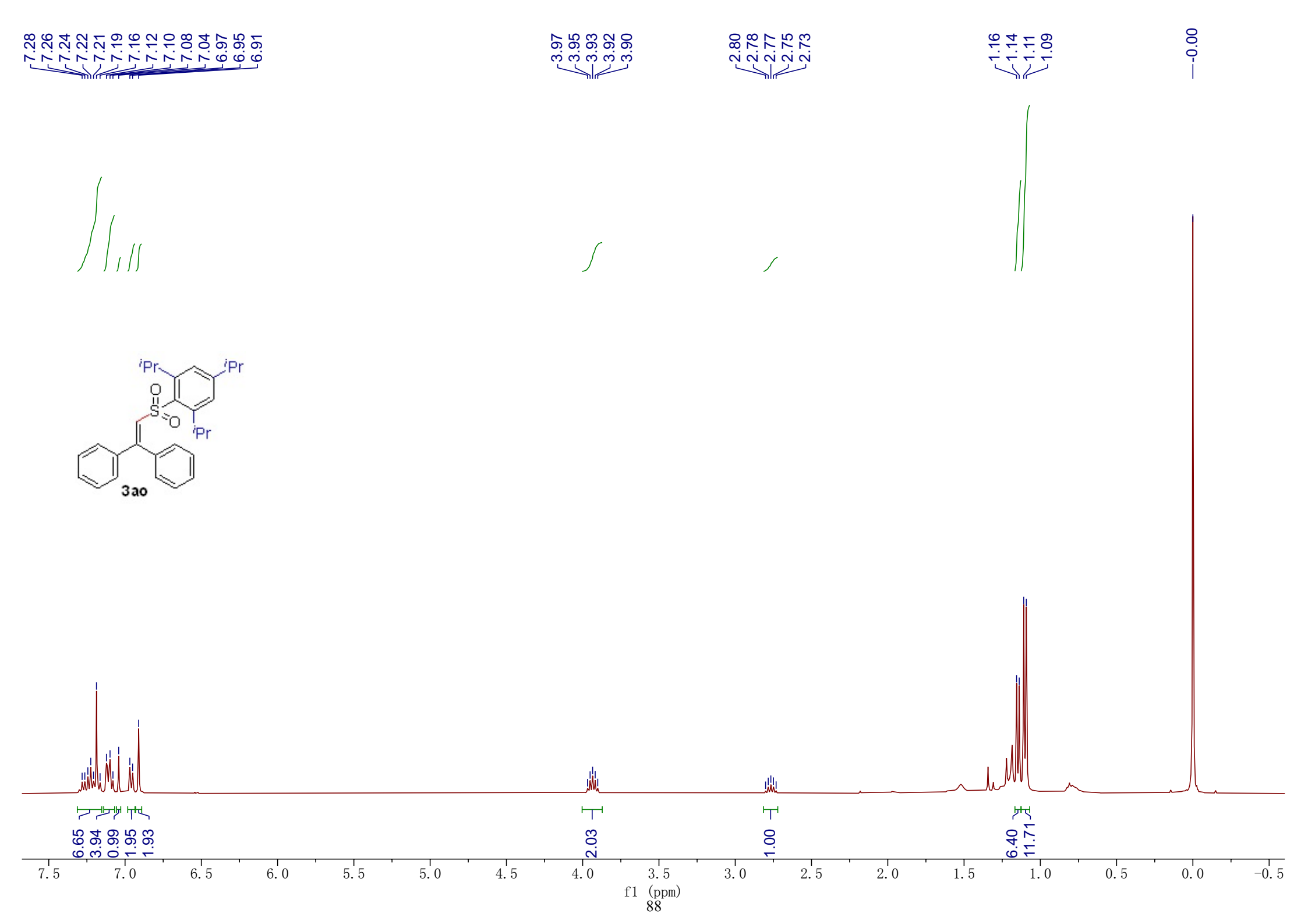
127.89
77.48
77.16
76.84
22.60
21.03



3an




7.28
7.26
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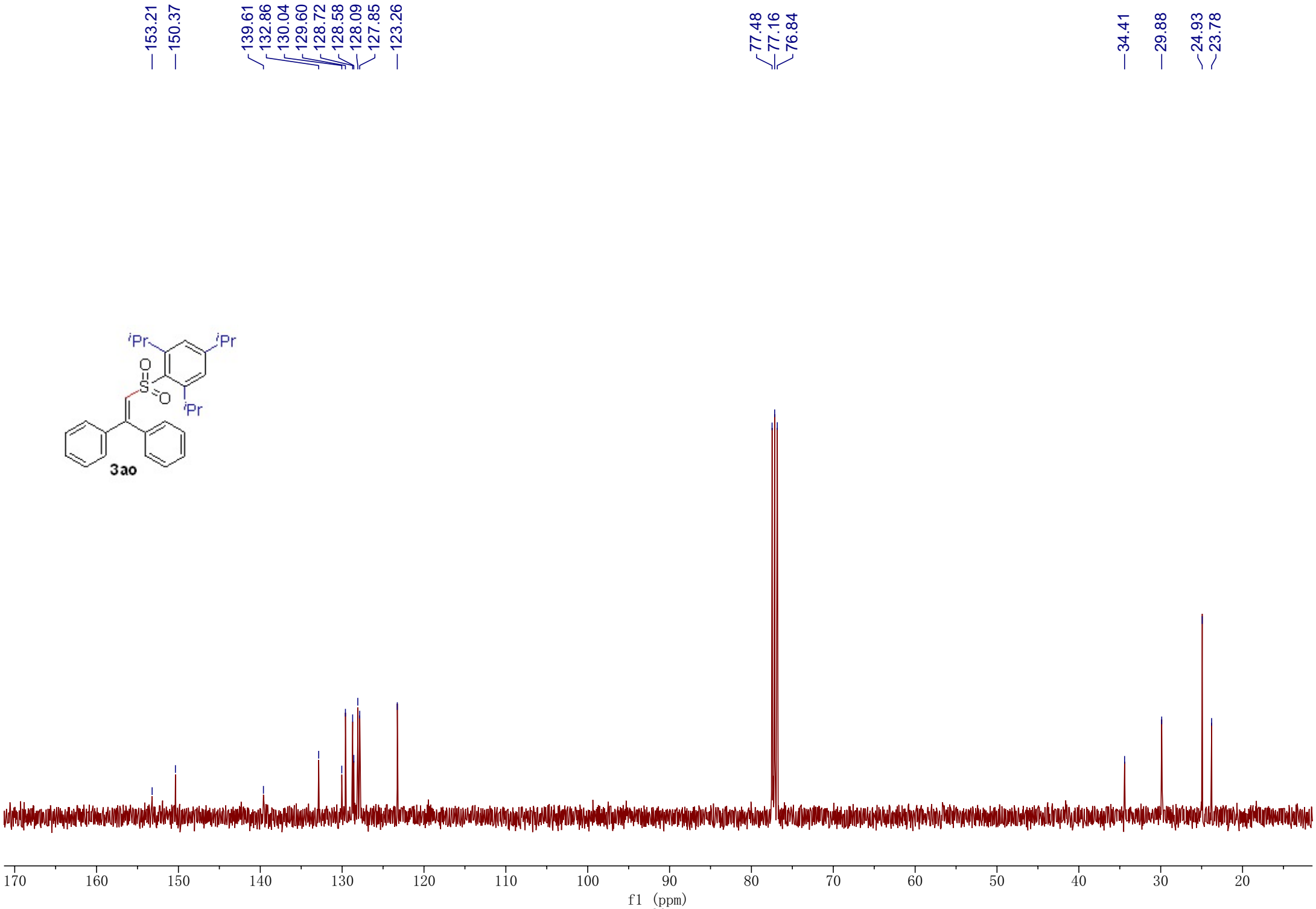
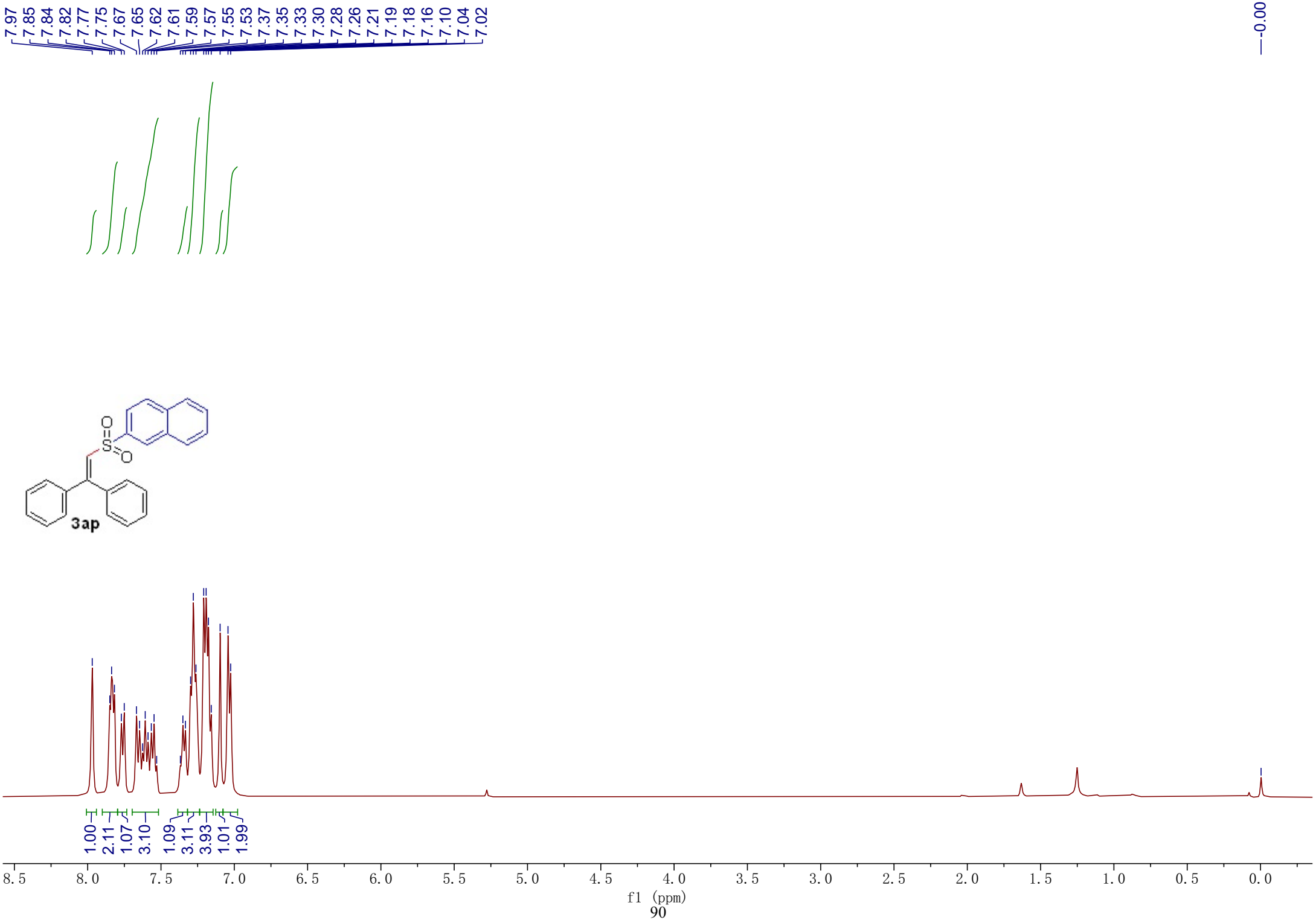
7.22
7.21
7.19
7.16
7.12
7.10
7.08
7.04
6.97
6.95
6.91
3.97
3.95
3.93
3.92
3.90
2.80
2.78
2.77
2.75
2.73
1.16
1.14
1.11
1.09
-0.00
iPr
iPr
iPr
O
S
O
3ao
6.65
3.94
0.99
1.95
1.93
2.03
1.00
6.40
11.71
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


153.21
150.37
139.61
132.86
130.04
129.60
128.72
128.58
128.09
127.85
123.26
77.48
77.16
76.84
34.41
29.88
24.93
23.78
iPr
iPr
iPr
O
S
O
3ao
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)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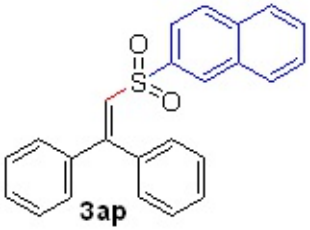
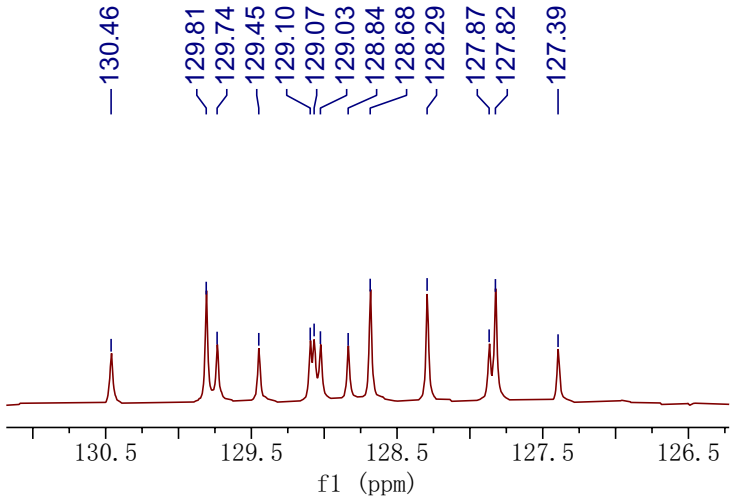
7.61
7.59
7.57
7.55
7.53
7.37
7.35
7.33
7.30
7.28
7.26
7.21
7.19
7.18
7.16
7.10
7.04
7.02
0.00
3ap
1.00
2.11
1.07
3.10
1.09
3.11
3.93
1.01
1.99
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


O
S
O
3ap


130.46
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129.74
129.45
129.10
129.07
129.03
128.84
128.68
128.29
127.87
127.82
127.39
130.5
129.5
128.5
127.5
126.5
f1 (ppm)

155.46
139.08
138.04
135.34
134.91
131.97
130.46
129.81
129.74
129.45
129.10
129.07
129.03
128.84
128.68
128.29
127.87
127.82
127.39
122.61
77.48
77.16
76.84
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)