Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

A Modular Approach to Highly Functionalized 3-Sulfonylfurans *via* Conjugate Addition of 3-Cyclopropylideneprop-2-en-1-ones with Sodium Sulfinates and Sequential 5-*Endo*-trig Iodocyclization

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Supporting Information

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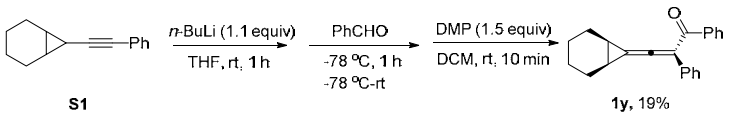
1. General Methods.

NMR spectra were recorded on a Bruker AV-400 MHz spectrometer. The ^{1}H NMR (400 MHz) chemical shifts were reported in parts per million (δ) relative to internal standard TMS (0 ppm). The coupling constants, *J* values are reported in Hertz (Hz). The ^{13}C NMR (100 MHz) chemical shifts were referenced to the internal solvent signals (central peak is 77.0 ppm in $CDCl_3$). High-resolution mass spectra (HRMS) were recorded on a Waters TOFMS GCT Premier using ESI ionization. Melting points were measured with WRR digital point apparatus and not corrected. All commercial reagents and solvents were used without additional purification. Petroleum ether refers to the fraction with boiling point in the range 60−90 °C. All reactions were monitored by TLC with GF 254 silica gel coated plates. Flash column chromatography was carried out using 200−300 mesh silica gel. The 3-cyclopropylideneprop-2-en-1-ones[1] **1** and sodium sulfinates[2] **2** were prepared according to the literature procedure.

2. Procedure and additional experiment data for material 1y and MCPs 3[3]

Method for the synthesis of cyclohexyl fused substrate **1y**



S1 **1y**, 19%

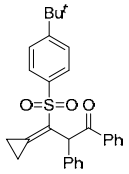
To a solution of 7-(phenylethynyl)bicyclo[4.1.0]heptane **S1** synthesized according to the reported procedure[4] (2.87 g, 14.6 mmol) in 15 mL of anhydrous THF was added *n*-BuLi (6.42 mL, 2.5 M in hexane, 1.1 equiv) at room temperature; the resulting mixture was stirred for 20 min, and cooled to -78 °C. Then PhCHO (1.55 g, 14.6 mmol, 1.0 equiv) was added with a syringe to this mixture at -78 °C. After being stirred for 15 min, the mixture was allowed to warm up to room temperature, quenched with water, extracted with ethyl acetate, dried over $MgSO_4$, filtered, and evaporated. The residue was chromatographed through a silica gel column (petroleum ether/ethyl acetate 4:1 v/v) to afford the mixture of cyclopropyl allenol as yellow oil. To a solution of the mixture of cyclopropyl allenol (7.00 mmol, 2.10 g) in 10 mL of DCM were added 1.2 equiv of DMP. After being stirred for 10 min, silica gel 10 g was added and the solvent was evaporated. The solid residue was purified by column chromatography (petroleum ether/ethyl acetate 50:1 v/v) on a silica gel column to give the starting material **1y** (815 mg, 19%) as yellow solid: M.p. 84-86 °C (petroleum ether/ethyl acetate); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.91-7.86 (m, 2H), 7.58-7.53 (m, 2H), 7.48 (t, *J* = 7.6 Hz, 1H),

7.41-7.34 (m, 4H), 7.27 (t, *J* = 6.4 Hz, 1H), 2.31-2.25 (m, 2H), 2.00-1.92 (m, 4H), 1.51-1.30 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 196.0, 194.7, 139.4, 135.0, 131.8, 129.2, 128.3, 128.2,127.8, 127.0, 110.0, 89.0, 25.7, 23.4, 20.9; HRMS (ES^+-TOF): calcd for $C_{22}H_{21}O$ ($[M+H]^+$): 301.1592, Found 301.1594.

MCPs **3a**-**l**, **3n**-**o**, **3q**-**u**, **3w**-**x** were synthesized according to the known procedure as following:

3-Cyclopropylideneprop-2-en-1-ones **1** (0.2 mmol, 1.0 equiv), sodium sulfinates **2** (0.4 mmol, 2.0 equiv), and AcOH (0.4 mmol, 2.0 equiv) were dissolved in 2 mL of MeOH in sequence. The mixture was then stirred at rt under ambient atmosphere for 10 min-20 min. After completion of the reaction, the solvent was removed *in vacuo*, and the residue was purified with flash silica gel chromatography to afford **3**.

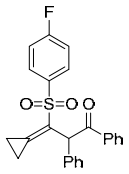
Additional experiment data for **3c**, **3e**, **3i**, **3k**, **3r**, **3s**, **3t**, **3u**:



(3c)

3-((4-(tert-butyl)phenyl)sulfonyl)-3-cyclopropylidene-1,2-diphenylpropan-1-one (3c)

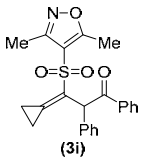
A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2mmol, 1.0 equiv), sodium 4-(*tert*-butyl)benzenesulfinate **2c** (89 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 10 min to afford **3c** (86 mg, 95%) as a yellow solid; M.p. 129-130 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.15 (Petroleum ether/EtOAc = 10/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.98 (d, *J* = 7.2 Hz, 2H), 7.62 (d, *J* = 8.4 Hz, 2H), 7.51 (t, *J* = 7.2 Hz, 1H), 7.40 (t, *J* = 7.6 Hz, 2H), 7.33 (d, *J* = 8.4 Hz, 2H), 7.19-7.14 (m, 3H), 7.08-7.02 (m, 2H), 6.13 (s, 1H), 1.44-1.33 (m, 2H), 1.27 (s, 9H), 1.03 (dd, J_1 = 19.8 Hz, J_2 = 9.8 Hz, 1H), 0.91 (dd, J_1 = 19.8 Hz, J_2 = 10.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 194.9, 156.9, 141.5, 137.2, 135.8, 135.5, 133.2, 130.7, 129.3, 128.8, 128.6, 128.4, 128.0, 127.4, 125.7, 53.6, 35.0, 31.0, 5.1, 4.6; HRMS (ES^+-TOF) calcd for $C_{28}H_{29}O_3S$ ($[M+H]^+$): 445.1837, found 445.1834.



(3e)

3-cyclopropylidene-3-((4-fluorophenyl)sulfonyl)-1,2-diphenylpropan-1-one (3e)

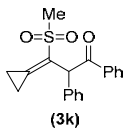
A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2mmol, 1.0 equiv), sodium 4-fluorobenzenesulfinate **2e** (73 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 15 min to afford **3e** (79 mg, 96%) as white solid; M.p. 106-107 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.33 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.99 (d, *J* = 7.6 Hz, 2H), 7.75-7.69 (m, 2H), 7.52 (t, *J* = 7.4 Hz, 1H), 7.41 (t, *J* = 7.4 Hz, 2H), 7.23-7.17 (m, 3H), 7.12-7.16 (m, 2H), 7.01 (t, *J* = 8.4 Hz, 2H), 6.15 (s, 1H), 1.44-1.24 (m, 2H), 1.03 (dd, J_1 = 19.4 Hz, J_2 = 10.2 Hz, 1H), 0.87 (dd, J_1 = 19.6 Hz, J_2 = 10.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 195.0, 165.3 (d, *J* = 254.4 Hz), 142.3, 136.5 (d, *J* = 3.3 Hz), 135.7, 135.2, 133.3, 130.88, 130.86 (d, *J* = 9.4 Hz), 129.4, 128.73, 128.67, 128.5, 127.6, 115.9 (d, *J* = 21.7 Hz), 53.8, 5.0, 4.8; HRMS (ES^+-TOF) calcd for $C_{24}H_{20}FO_3S$ ($[M+H]^+$): 407.1117, found 407.1111.



(3i)

3-cyclopropylidene-3-((3,5-dimethylisoxazol-4-yl)sulfonyl)-1,2-diphenylpropan-1-one (3i)

A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (49 mg, 0.2mmol, 1.0 equiv), sodium 3,5-dimethylisoxazole-4-sulfinate **2i** (74 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 30 min to afford **3i** (66 mg, 82%) as white solid; M.p. 138-139 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.29 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.86 (d, *J* = 7.2 Hz, 2H), 7.46 (t, *J* = 7.2 Hz, 1H), 7.34 (t, *J* = 7.6 Hz, 2H), 7.24-7.15 (m, 3H), 7.09-7.04 (m, 2H), 5.93 (s, 1H), 2.35 (s, 3H), 2.14 (s, 3H), 1.45-1.33 (m, 2H), 1.06 (dd, J_1 = 19.6 Hz, J_2 = 10.8 Hz, 1H), 0.83 (dd, J_1 = 19.6 Hz, J_2 = 10.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 194.5, 174.3, 157.9, 142.4, 135.5, 135.3, 133.5, 129.7, 128.83, 128.78, 128.7, 128.6, 127.9, 115.6, 53.1, 12.4, 10.5, 5.3, 4.4; HRMS (ES^+-TOF) calcd for $C_{23}H_{22}NO_4S$ ($[M+H]^+$): 408.1270, found 408.1268.

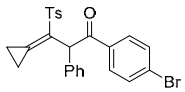


(3k)

3-cyclopropylidene-3-(methylsulfonyl)-1,2-diphenylpropan-1-one (3k)

A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2 mmol, 1.0 equiv),

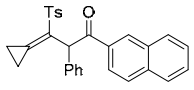
sodium methanesulfinate **2k** (42 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 10 min to afford **3k** (64 mg, 97%) as white solid; M.p. 55-56 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.20 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (d, *J* = 7.6 Hz, 2H), 7.51 (t, *J* = 7.4 Hz, 1H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.36-7.28 (m, 3H), 7.25 (d, *J* = 7.6 Hz, 2H), 6.16 (s, 1H), 2.87 (s, 3H), 1.50-1.43 (m, 2H), 0.99 (dd, J_1 = 19.8 Hz, J_2 = 10.2 Hz, 1H), 0.80 (dd, J_1 = 20.0 Hz, J_2 = 10.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 196.0, 141.9, 135.6, 135.2, 133.4, 131.0, 129.6, 129.0, 128.8, 128.7, 127.9, 54.6, 43.0, 4.6; HRMS (ES^+-TOF) calcd for $C_{19}H_{19}O_3S$ ($[M+H]^+$): 327.1055, found 327.1053.



(3r)

1-(4-bromophenyl)-3-cyclopropylidene-2-phenyl-3-tosylpropan-1-one (3r)

A mixture of 1-(4-bromophenyl)-3-cyclopropylidene-2-phenylprop-2-en-1-one **1r** (66 mg, 0.2mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (73 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 10 min to afford **3r** (88 mg, 90%) as white solid; M.p. 113-114 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.27 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.84 (d, *J* = 8.8 Hz, 2H), 7.60 (d, *J* = 8.0 Hz, 2H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.23-7.14 (m, 5H), 7.09-7.03 (m, 2H), 6.06 (s, 1H), 2.36 (s, 3H), 1.36-1.28 (m, 2H), 1.00 (dd, J_1 = 19.8 Hz, J_2 = 9.8 Hz, 1H), 0.83 (dd, J_1 = 19.6 Hz, J_2 = 9.6 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 194.2, 144.1, 141.6, 137.3, 135.1, 134.6, 131.9, 130.9, 130.3, 129.4, 129.3, 128.5, 128.4, 128.1, 127.5, 53.7, 21.5, 5.0, 4.6; HRMS (ES^+-TOF) calcd for $C_{25}H_{22}BrO_3S$ ($[M+H]^+$): 481.0473, found 481.0499.

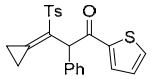


(3s)

3-cyclopropylidene-1-(naphthalen-2-yl)-2-phenyl-3-tosylpropan-1-one (3s)

A mixture of 3-cyclopropylidene-1-(naphthalen-2-yl)-2-phenylprop-2-en-1-one **1s** (60 mg, 0.2mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (73 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 10 min to afford **3s** (83 mg, 91%) as white solid; M.p. 111-112 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.29 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.54 (s, 1H), 8.00 (d, *J* = 8.4 Hz, 1H), 7.94 (d, *J* = 8.0 Hz, 1H), 7.84 (d, *J* = 8.8 Hz, 2H), 7.65-7.50 (m, 4H), 7.24-7.11 (m, 7H), 6.30 (s, 1H),

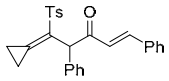
2.33 (s, 3H), 1.41-1.29 (m, 2H), 1.04 (dd, J_1 = 19.2 Hz, J_2 = 10.0 Hz, 1H), 0.89 (dd, J_1 = 19.2 Hz, J_2 = 10.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 195.1, 144.0, 141.5, 137.4, 135.6, 135.5, 133.2, 132.4, 131.1, 130.7, 129.8, 129.40, 129.39, 128.6, 128.5, 128.4, 128.2, 127.6, 127.4, 126.7, 124.3, 53.7, 21.5, 5.0, 4.7; HRMS (ES^+-TOF) calcd for $C_{29}H_{25}O_3S$ ($[M+H]^+$): 453.1524, found 453.1539.



(3t)

3-cyclopropylidene-2-phenyl-1-(thiophen-2-yl)-3-tosylpropan-1-one (3t)

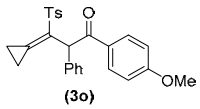
A mixture of 3-cyclopropylidene-2-phenyl-1-(thiophen-2-yl)prop-2-en-1-one **1t** (51 mg, 0.2mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (73 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 20 min to afford **3t** (74 mg, 90%) as white solid; M.p. 131-132 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.19 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.72 (d, *J* = 3.6 Hz, 1H), 7.53 (d, *J* = 8.0 Hz, 3H), 7.15-7.69 (m, 8H), 6.91 (s, 1H), 2.29 (s, 3H), 1.32-1.24 (m, 2H), 1.05 (dd, J_1 = 20.2 Hz, J_2 = 9.8 Hz, 1H), 0.84 (dd, J_1 = 19.8 Hz, J_2 = 9.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 187.8, 144.0, 143.0, 141.5, 137.2, 135.4, 134.2, 133.1, 130.7, 129.3, 129.2, 128.35, 128.27, 128.1, 127.4, 54.5, 21.5, 5.0, 4.7; HRMS (ES^+-TOF) calcd for $C_{23}H_{21}O_3S_2$ ($[M+H]^+$): 409.0932, found 409.0941.



(3u)

(E)-5-cyclopropylidene-1,4-diphenyl-5-tosylpent-1-en-3-one (3u)

A mixture of (*E*)-1-cyclopropylidene-2,5-diphenylpenta-1,4-dien-3-one **1u** (55 mg, 0.2mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeOH at rt under ambient atmosphere for 10 min to afford **3u** (76 mg, 88%) as white solid; M.p. 192-193 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.24 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.69-7.61 (m, 3H), 7.50-7.46 (m, 2H), 7.39-7.33 (m, 3H), 7.25-7.19 (m, 5H), 7.11-7.06 (m, 2H), 6.73 (d, *J* = 16.0 Hz, 1H), 5.51 (s, 1H), 2.37 (s, 3H), 1.41-1.30 (m, 2H), 1.16 (dd, J_1 = 19.2 Hz, J_2 = 10.4 Hz, 1H), 0.91 (dd, J_1 = 19.8 Hz, J_2 = 9.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 194.2, 144.1, 143.7, 141.3, 137.5, 135.3, 134.2, 130.74, 130.67, 129.5, 128.9, 128.5, 128.4, 128.2, 127.5, 124.6, 56.9, 21.5, 5.1, 4.7; HRMS (ES^+-TOF) calcd for $C_{27}H_{25}O_3S$ ($[M+H]^+$): 429.1524, found 429.1522.



(3o)

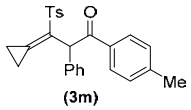
3-cyclopropylidene-1-(4-methoxyphenyl)-2-phenyl-3-tosylpropan-1-one (3o)

A mixture of 3-cyclopropylidene-1-(4-methoxyphenyl)-2-phenylprop-2-en-1-one **1o** (54 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of CH_2Cl_2 at rt under ambient atmosphere for 5 h to afford **3o** (69 mg, 82%) as white solid; M.p. 118-119 ^oC (Petroleum ether/EtOAc); R*f* = 0.13 (Petroleum ether/EtOAc = 5/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.96 (d, *J* = 9.2 Hz, 2H), 7.59 (d, *J* = 8.0 Hz, 2H), 7.20-7.05 (m, 7H), 6.88 (d, *J* = 8.8 Hz, 2H), 6.09 (s, 1H), 3.83 (s, 3H), 2.35 (s, 3H), 1.37-1.30 (m, 2H), 1.02 (dd, J_1 = 19.6 Hz, J_2 = 10.0 Hz, 1H), 0.86 (dd, J_1 = 19.8 Hz, J_2 = 9.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 195.4, 158.9, 143.9, 141.2, 137.5, 135.9, 133.1, 131.4, 130.5, 129.3, 128.8, 128.6, 128.2, 127.4, 113.8, 55.2, 53.0, 21.5, 4.9, 4.6; HRMS (ES^+-TOF) calcd for $C_{26}H_{25}O_4S$ ($[M+H]^+$): 433.1474, found 433.1481.

MCPs **3m, 3p, 3v, 3y** were synthesized according to the following procedure:

3-Cyclopropylideneprop-2-en-1-ones **1** (0.2 mmol, 1.0 equiv), sodium sulfinates **2** (0.4 mmol, 2.0 equiv), and AcOH (0.4 mmol, 2.0 equiv) were dissolved in 2 mL of DMSO in sequence. The mixture was then stirred at rt under ambient atmosphere for 2-4 min. After completion of the reaction, the mixture was quenched by 10 mL of H_2O and extracted with EtOAc (3 × 10 mL). The combined organic phase was washed with H_2O (3 × 10 mL), dried over anhydrous Na_2SO_4, concentrated *in vacuo* and purified with flash silica gel chromatography to afford **3**.

Additional experiment data for **3m**, **3p**, **3v, 3y**:

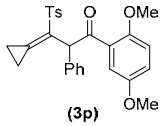


(3m)

3-cyclopropylidene-2-phenyl-1-(p-tolyl)-3-tosylpropan-1-one (3m)

A mixture of 3-cyclopropylidene-2-phenyl-1-(*p*-tolyl)prop-2-en-1-one **1b** (52 mg, 0.2mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of DMSO at rt under ambient atmosphere for 2 min to afford **3m** (80 mg, 96%) as white solid; M.p. 122-123 ^oC (Petroleum ether/EtOAc); R*f* = 0.24 (Petroleum ether/EtOAc = 5/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.88 (d, *J* = 8.4 Hz, 2H), 7.59 (d, *J* = 8.0 Hz, 2H),

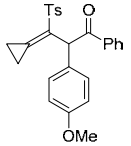
7.23-7.12 (m, 7H), 7.10-7.05 (m, 2H), 6.12 (s, 1H), 2.37 (s, 3H), 2.35 (s, 3H), 1.37-1.29 (m, 2H), 1.01 (dd, J_1 = 19.6 Hz, J_2 = 9.6 Hz, 1H), 0.85 (dd, J_1 = 19.8 Hz, J_2 = 10.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 194.6, 144.0, 143.9, 141.4, 137.4, 135.6, 133.3, 131.0, 129.33, 129.30, 129.29, 128.9, 128.3, 128.1, 127.3, 53.5, 21.6, 21.5, 4.9, 4.6; HRMS (ES^+-TOF) calcd for $C_{26}H_{25}O_3S$ ($[M+H]^+$): 417.1524, found 417.1527.



(3p)

3-cyclopropylidene-1-(2,5-dimethoxyphenyl)-2-phenyl-3-tosylpropan-1-one (3p)

A mixture of 3-cyclopropylidene-1-(2,5-dimethoxyphenyl)-2-phenylprop-2-en-1-one **1p** (61 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of DMSO at rt under ambient atmosphere for 4 min to afford **3p** (78 mg, 85%) as yellow oli; R*f* = 0.13 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.50 (d, *J* = 8.4 Hz, 2H), 7.29 (d, *J* = 2.8 Hz, 1H), 7.22-7.17 (m, 3H), 7.13-7.07 (m, 4H), 7.02-6.98 (m, 1H), 6.84 (d, *J* = 8.8 Hz, 1H), 6.35 (s, 1H), 3.83 (s, 3H), 3.75 (s, 3H), 2.34 (s, 3H), 1.40-1.20 (m, 2H), 1.09 (dd, J_1 =18.4 Hz, J_2 = 10.4 Hz, 1H), 0.88 (dd, J_1 = 18.6 Hz, J_2 = 10.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 195.7, 153.2, 153.1, 143.6, 140.1, 137.9, 136.1, 131.9, 129.7, 129.1, 128.0, 127.9, 127.0, 126.5, 120.8, 114.7, 113.2, 57.5, 55.9, 55.7, 21.4, 4.9, 4.8; HRMS (ES^+-TOF) calcd for $C_{27}H_{27}O_5S$ ($[M+H]^+$): 463.1579, found 463.1577.

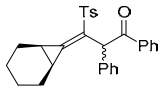


(3v)

3-cyclopropylidene-2-(4-methoxyphenyl)-1-phenyl-3-tosylpropan-1-one (3v)

A mixture of 3-cyclopropylidene-2-(4-methoxyphenyl)-1-phenylprop-2-en-1-one **1v** (55 mg, 0.2mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of DMSO at rt under ambient atmosphere for 4 min to afford **3v** (80 mg, 93%) as white solid; M.p. 99-100 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.18 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.96 (d, *J* = 7.6 Hz, 2H), 7.60 (d, *J* = 8.4 Hz, 2H), 7.51 (t, *J* = 7.4 Hz, 1H), 7.40 (t, *J* = 7.8 Hz, 2H), 7.16 (d, *J* = 7.6 Hz, 2H), 7.01 (d, *J* = 8.4 Hz, 2H), 6.74 (d, *J* = 8.4 Hz, 2H), 6.08 (s, 1H), 3.75 (s, 3H), 2.37 (s, 3H), 1.38-1.28 (m, 2H), 1.02 (dd, J_1 = 19.8

Hz, J_2 = 9.8 Hz, 1H), 0.88 (dd, J_1 = 19.6 Hz, J_2 = 10.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 195.4, 159.0, 144.0, 141.2, 137.6, 136.0, 133.2, 131.4, 130.6, 129.4, 128.8, 128.7, 128.2, 127.4, 113.9, 55.3, 53.1, 21.6, 5.0, 4.7; HRMS (ES$^+$-TOF) calcd for $C_{26}H_{25}O_4S$ ([M+H]$^+$): 433.1474, found 433.1467.



3y, (isomers 2:3)

(Z)-3-(cis-bicyclo[4.1.0]heptan-7-ylidene)-1,2-diphenyl-3-tosylpropan-1-one (3y)

A mixture of 3-(cis-bicyclo[4.1.0]heptan-7-ylidene)-1,2-diphenylprop-2-en-1-one **1y** (61 mg, 0.2mmol, 1.0 equiv), sodium 4-methylbenzenesulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of DMSO at rt under ambient atmosphere for 8 min to afford **3y** (88 mg, 94%, isomers 2:3) as a foam; R*f* = 0.48 (Petroleum ether/EtOAc = 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.99-7.90 (m, 2H), 7.66-7.47 (m, 3H), 7.44-7.35 (m, 2H), 7.23-6.97 (m, 7H), 6.14-6.04 (m, 1H), 2.37-2.31 (m, 3H), 2.06-1.73 (m, 2H), 1.62-1.42 (m, 2H), 1.40-0.80 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 195.5, 195.2, 152.3, 152.1, 143.83, 143.80, 137.5, 137.4, 136.4, 136.0, 135.6, 135.4, 133.2, 133.1, 131.1, 131.0, 129.5, 129.4, 129.3, 129.0, 128.9, 128.7, 128.6, 128.3, 128.2, 128.0, 127.4, 127.1, 54.1, 53.8, 22.3, 22.0, 21.8, 21.51, 21.47, 21.4, 21.10, 21.03, 21.02, 20.96, 16.0, 15.9, 15.4, 15.0; HRMS (ES$^+$-TOF) calcd for $C_{29}H_{29}O_3S$ ([M+H]$^+$): 457.1837, found 457.1834.

3. Procedure and experiment data for synthesis of 3-sulfonylfurans 4

One-pot Procedure for the synthesis of 3-sulfonylfurans **4** from materials **1** (*Condition A*):

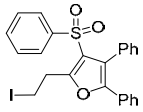
3-Cyclopropylideneprop-2-en-1-ones **1** (0.2 mmol, 1.0 equiv), sodium sulfinates **2** (0.4 mmol, 2.0 equiv) and AcOH (0.4 mmol, 2.0 equiv) were dissolved in 2 mL of MeCN in sequence. The mixture was then stirred at rt for 1.5-20 h under ambient atmosphere till complete consumption of **1**, followed by adding I_2 (254 mg, 1 mmol, 5.0 equiv) and stirred at 100 ^{o}C for 10-72 h. After completion of the reaction, the mixture was quenched by 10 mL of saturated $Na_2S_2O_3$ and extracted with EtOAc (3 × 10 mL). The combined organic phase was concentrated *in vacuo*, and the residue was purified with flash silica gel chromatography to afforded **4**.

Single-step Procedure for the synthesis of 3-sulfonylfurans **4** from MCPs **3** (*Condition B*):

MCPs **3** (0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN in a sealed tube, followed by addition of I_2 (0.6 mmol, 3.0 equiv). The mixture was then stirred at 100 ^{o}C for 7.5-43 h under ambient atmosphere. After completion of the reaction, the mixture was quenched by 10 mL of saturated

$Na_2S_2O_3$ and extracted with EtOAc (3 × 10 mL). The combined organic phase was concentrated *in vacuo*, and the residue was purified with flash silica gel chromatography to afforded **4**.

Experiment data for 3-sulfonylfurans **4**:



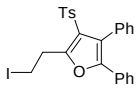
(4a)

2-(2-iodoethyl)-4,5-diphenyl-3-(phenylsulfonyl)furan (4a)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2 mmol, 1.0 equiv), sodium benzenesulfinate **2a** (66 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 2.5 h, then I_2 (255 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 22 h to afford **4a** (72 mg, 69%).

Condition B: 3-Cyclopropylidene-1,2-diphenyl-3-(phenylsulfonyl)propan-1-one **3a** (77 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 22 h to afford **4a** (79 mg, 75%).

White solid; M.p. 150-151 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.41 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.44 (t, *J* = 7.2 Hz, 1H), 7.40-7.33 (m, 3H), 7.30-7.21 (m, 6H), 7.20-7.15 (m, 3H), 7.02 (d, *J* = 7.2 Hz, 2H), 3.90 (t, *J* = 7.4 Hz, 2H),3.62 (t, *J* = 7.2 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.6, 149.0, 141.0, 132.9, 130.9, 130.0, 129.1, 128.5, 128.4, 128.3, 128.2, 128.1, 127.5, 125.5, 124.9, 120.2, 31.8, 0.1; HRMS (ES^+-TOF) calcd for $C_{24}H_{20}IO_3S$ ($[M+H]^+$): 515.0178, found 515.0178.



(4b)

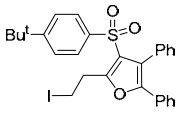
2-(2-iodoethyl)-4,5-diphenyl-3-tosylfuran (4b)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2 mmol, 1.0 equiv), 4-methylbenzenesulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 2.5 h, then I_2 (255 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 23.5 h to afford **4b** (72 mg, 67%).

Condition B: 3-Cyclopropylidene-1,2-diphenyl-3-tosylpropan-1-one **3b** (80 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 23.5 h to afford **4b** (79 mg, 75%).

White solid; M.p. 144-145 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.47 (Petroleum ether/EtOAc 5/1); ^{1}H

NMR (400 MHz, $CDCl_3$): δ 7.39-7.34 (m, 1H), 7.30-7.22 (m, 6H), 7.20-7.15 (m, 3H), 7.07-7.02 (m, 4H), 3.88 (t, *J* = 7.4 Hz, 2H), 3.61 (t, *J* = 7.4 Hz, 2H), 2.34 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.4, 149.0, 143.8, 138.3, 130.9, 130.2, 129.2, 129.1, 128.35, 128.27, 128.2, 128.1, 127.5, 125.5, 125.2, 120.3, 31.8, 21.5, 0.1; HRMS (ES^+-TOF) calcd for $C_{25}H_{22}IO_3S$ ($[M+H]^+$): 529.0334, found 529.0335.



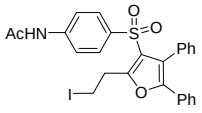
(4c)

3-((4-(tert-butyl)phenyl)sulfonyl)-2-(2-iodoethyl)-4,5-diphenylfuran (4c)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2 mmol, 1.0 equiv), 4-(*tert*-butyl)benzenesulfinate **2c** (89 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 12 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^oC for 16 h to afford **4c** (75 mg, 66%).

Condition B: 3-((4-(*Tert*-butyl)phenyl)sulfonyl)-3-cyclopropylidene-1,2-diphenylpropan-1-one **3c** (89 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^oC for 7.5 h to afford **4c** (73 mg, 64%).

White solid; M.p. 126-127 ^oC (Petroleum ether/EtOAc); R*f* = 0.53 (Petroleum ether/EtOAc 5/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.37-7.21 (m, 9H), 7.19-7.15 (m, 3H), 7.00 (d, *J* = 7.6 Hz, 2H), 3.89 (t, *J* = 7.2 Hz, 2H), 3.62 (t, *J* = 7.4 Hz, 2H), 1.27 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.7, 156.3, 149.0, 138.0, 130.9, 130.2, 129.2, 128.34, 128.25, 128.1, 127.3, 125.52, 125.45, 125.3, 120.3, 35.0, 31.8, 31.0, 0.1; HRMS (ES^+-TOF) calcd for $C_{28}H_{28}IO_3S$ ($[M+H]^+$): 571.0804, found 571.0807.



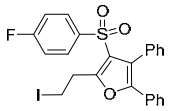
(4d)

N-(4-((2-(2-iodoethyl)-4,5-diphenylfuran-3-yl)sulfonyl)phenyl)acetamide (4d)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (51 mg, 0.2 mmol, 1.0 equiv), sodium 4-acetamidobenzenesulfinate **2d** (89 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 20 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^oC for 48 h to afford **4d** (60 mg, 51%).

Condition B: N-(4-(1-cyclopropylidene-3-*oxo*-2,3-diphenylpropylsulfonyl)phenyl)acetamide **3d** (89 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 7.5 h to afford **4d** (67 mg, 59%).

White solid; M.p. 168-169 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.39 (Petroleum ether/EtOAc 1/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (s, 1H), 7.43-7.32 (m, 3H), 7.30-7.21 (m, 6H), 7.20-7.15 (m, 3H), 7.05 (d, *J* = 7.2 Hz, 2H), 3.87 (t, *J* = 7.4 Hz, 2H), 3.59 (t, *J* = 7.4 Hz, 2H), 2.15 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 168.9, 156.4, 149.1, 142.4, 135.4, 130.9, 130.0, 129.0, 128.7, 128.4, 128.2, 125.5, 125.0, 120.1, 118.6, 31.8, 24.7, 0.0; HRMS (ES^+-TOF) calcd for $C_{26}H_{23}INO_4S$ ($[M+H]^+$): 572.0392, found 572.0393.



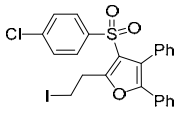
(4e)

3-((4-fluorophenyl)sulfonyl)-2-(2-iodoethyl)-4,5-diphenylfuran (4e)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (51 mg, 0.2 mmol, 1.0 equiv), sodium 4-fluorobenzenesulfinate **2e** (73 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 4 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 24 h to afford **4e** (83 mg, 75%).

Condition B: 3-Cyclopropylidene-3-((4-fluorophenyl)sulfonyl)-1,2-diphenylpropan-1-one **3e** (81 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (153 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 20 h to afford **4e** (72 mg, 68%).

White solid; M.p. 134-135 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.47 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.41-7.15 (m, 10H), 7.05 (d, *J* = 7.2 Hz, 2H), 6.90 (t, *J* = 8.0 Hz, 2H), 3.90 (t, *J* = 6.8 Hz, 2H), 3.62 (t, *J* = 7.0 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 165.2 (d, *J* = 253.9 Hz), 156.6, 149.2, 137.1 (d, *J* = 3.0 Hz), 130.9, 130.4 (d, *J* = 9.4 Hz), 130.1, 129.0, 128.4, 128.3, 128.2, 125.6, 124.9, 120.0, 115.7 (d, *J* = 22.5 Hz), 31.7, 0.0; HRMS (ES^+-TOF) calcd for $C_{24}H_{19}FIO_3S$ ($[M+H]^+$): 533.0084, found 533.0086.



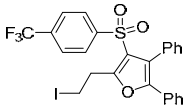
(4f)

3-((4-chlorophenyl)sulfonyl)-2-(2-iodoethyl)-4,5-diphenylfuran (4f)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (51 mg, 0.2 mmol, 1.0 equiv), sodium 4-chlorobenzenesulfinate **2f** (80 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 2 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 47 h to afford **4f** (74 mg, 66%).

Condition B: 3-((4-Chlorophenyl)sulfonyl)-3-cyclopropylidene-1,2-diphenylpropan-1-one **3f** (85 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 20 h to afford **4f** (80 mg, 73%).

White solid; M.p.139-140 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.53 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.39 (t, *J* = 7.4 Hz, 1H), 7.33-7.16 (m, 11H), 7.05 (d, *J* = 7.2 Hz, 2H), 3.89 (t, *J* = 7.2 Hz, 2H), 3.62 (t, *J* = 7.4 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.7, 149.2, 139.5, 139.4, 130.9, 130.0, 129.0, 128.9, 128.7, 128.44, 128.41, 128.38, 128.3, 125.6, 124.7, 119.9, 31.7, 0.1; HRMS (ES^+-TOF) calcd for $C_{24}H_{19}ClIO_3S$ ($[M+H]^+$): 548.9788, found 548.9792.



(4g)

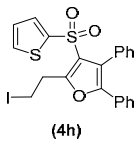
2-(2-iodoethyl)-4,5-diphenyl-3-((4-(trifluoromethyl)phenyl)sulfonyl)furan (4g)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2 mmol, 1.0 equiv), sodium 4-(trifluoromethyl)benzenesulfinate **2g** (93 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 8 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 20 h to afford **4g** (80 mg, 68%).

Condition B: 3-Cyclopropylidene-1,2-diphenyl-3-((4-(trifluoromethyl)phenyl)sulfonyl)propan-1-one **3g** (91 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (153 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 20 h to afford **4g** (86 mg, 74%).

White solid; M.p. 137-138 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.60 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.51-7.48 (m, 4H), 7.37 (t, *J* = 7.2 Hz, 1H), 7.29-7.17 (m, 7H), 7.01 (d, *J* = 7.2 Hz, 2H), 3.92 (t, *J* = 7.2 Hz, 2H), 3.64 (t, *J* = 7.2 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 157.1, 149.4, 144.3, 134.4 (q, *J* = 32.6 Hz), 130.9, 129.8, 128.8, 128.5, 128.44, 128.37, 128.1, 125.6, 125.5, 124.3,

123.1 (d, *J* = 271.3 Hz), 119.9, 31.7, -0.1; HRMS (ES^+-TOF) calcd for $C_{25}H_{19}F_3IO_3S$ ($[M+H]^+$): 583.0052, found 583.0050.



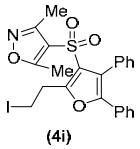
(4h)

2-(2-iodoethyl)-4,5-diphenyl-3-(thiophen-2-ylsulfonyl)furan (4h)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (49 mg, 0.2 mmol, 1.0 equiv), sodium thiophene-2-sulfinate **2h** (68 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 1.5 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^oC for 48 h to afford **4h** (36 mg, 35%).

Condition B: 3-Cyclopropylidene-1,2-diphenyl-3-(thiophen-2-ylsulfonyl)propan-1-one **3h** (79 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^oC for 24 h to afford **4h** (64 mg, 62%).

Yellow solid; M.p. 137-138 ^oC (Petroleum ether/EtOAc); R*f* = 0.55 (Petroleum ether/EtOAc 5/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.50 (dd, *J* = 5.2 Hz, 1.2 Hz, 1H), 7.42-7.30 (m, 3H), 7.29-7.24 (m, 2H), 7.22-7.14 (m, 5H), 6.93 (dd, *J* = 3.6 Hz, 1.2 Hz, 1H), 6.84-6.80 (m, 1H), 3.85 (t, *J* = 7.4 Hz, 2H), 3.59 (t, *J* = 7.4 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.5, 149.1, 142.7, 133.7, 133.5, 130.9, 130.1, 129.1, 128.4, 128.3, 128.2, 127.1, 125.6, 125.5, 120.2, 31.9, -0.1; HRMS (ES^+-TOF) calcd for $C_{22}H_{18}IO_3S_2$ ($[M+H]^+$): 520.9742, found 520.9743.



(4i)

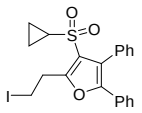
4-((2-(2-iodoethyl)-4,5-diphenylfuran-3-yl)sulfonyl)-3,5-dimethylisoxazole (4i)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (49 mg, 0.2 mmol, 1.0 equiv), sodium 3,5-dimethylisoxazole-4-sulfinate **2i** (74 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 2 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^oC for 72 h to afford **4i** (41 mg, 39%).

Condition B: 3-Cyclopropylidene-3-((3,5-dimethylisoxazol-4-yl)sulfonyl)-1,2-diphenylpropan-1-one

3i (82 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 22 h to afford **4i** (48 mg, 45%).

White solid; M.p. 184-185 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.24 (Petroleum ether/EtOAc 10/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.43-7.34 (m, 3H), 7.24-7.18 (m, 5H), 7.11-7.06 (m, 2H), 3.87 (t, *J* = 7.2 Hz, 2H), 3.60 (t, *J* = 7.2 Hz, 2H), 2.15 (s, 3H), 1.90 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 174.6, 157.1, 156.9, 149.6, 130.6, 129.9, 129.0, 128.84, 128.75, 128.52, 128.46, 125.4, 124.2, 119.6, 116.8, 32.0, 11.8, 10.4, -1.1; HRMS (ES^+-TOF) calcd for $C_{23}H_{21}INO_4S$ ($[M+H]^+$): 534.0236, found 534.0226.



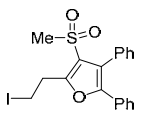
(4j)

3-(cyclopropylsulfonyl)-2-(2-iodoethyl)-4,5-diphenylfuran (4j)

Condition A: A mixture of 3-cyclopropylidiene-1,2-diphenylprop-2-en-1-one **1a** (50 mg, 0.2 mmol, 1.0 equiv), sodium cyclopropanesulfinate **2j** (52 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 1.5 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 72 h to afford **4j** (30 mg, 31%).

Condition B: 3-Cyclopropylidene-3-(cyclopropylsulfonyl)-1,2-diphenylpropan-1-one **3j** (71 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 43 h to afford **4j** (41 mg, 42%).

Yellow solid; M.p. 151-152 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.55 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47-7.42 (m, 5H), 7.33-7.28 (m, 2H), 7.25-7.21 (m, 3H), 3.72 (t, *J* = 7.2 Hz, 2H), 3.52 (t, *J* = 7.4 Hz, 2H), 2.12-2.04 (m, 1H), 1.00-0.94 (m, 2H), 0.81-0.74 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.5, 149.1, 131.0, 130.9, 129.2, 128.7, 128.6, 128.4, 128.2, 125.7, 124.8, 120.1, 33.1, 31.6, 5.5, 0.2; HRMS (ES^+-TOF) calcd for $C_{21}H_{20}IO_3S$ ($[M+H]^+$): 479.0178, found 479.0179.



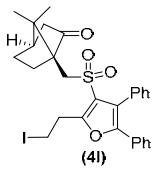
(4k)

2-(2-iodoethyl)-3-(methylsulfonyl)-4,5-diphenylfuran (4k)

Condition B: 3-Cyclopropylidene-3-(methylsulfonyl)-1,2-diphenylpropan-1-one **3k** (65 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The

mixture was stirred at 100 ^{o}C for 17 h to afford **4k** (40 mg, 44%).

White solid; M.p. 162-163 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.31 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47-7.44 (m, 5H), 7.33-7.22 (m, 5H), 3.77 (t, *J* = 7.2 Hz, 2H), 3.54 (t, *J* = 7.2 Hz, 2H), 2.74 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.8, 149.3, 130.9, 130.3, 129.0, 128.9, 128.8, 128.5, 128.4, 125.8, 124.5, 119.8, 44.7, 31.3, 0.4; HRMS (ES^+-TOF) calcd for $C_{19}H_{18}IO_3S$ ($[M+H]^+$): 453.0021, found 453.0024.

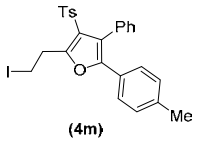


(1S,4R)-1-(((2-(2-iodoethyl)-4,5-diphenylfuran-3-yl)sulfonyl)methyl)-7,7-dimethylbicyclo[2.2.1]heptan-2-one (4l)

Condition B:

(*1S*,*4R*)-1-((1-cyclopropylidene-3-oxo-2,3-diphenylpropylsulfonyl)methyl)-7,7-dimethylbicyclo[2.2.1]heptan-2-one **3l** (93 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 28 h to afford **4l** (52 mg, 44%).

White solid; M.p. 133-134 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.14 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.50-7.42 (m, 5H), 7.34-7.29 (m, 2H), 7.25-7.20 (m, 3H), 3.83-3.70 (m, 2H), 3.57-3.51 (m, 2H), 3.35 (d, *J* = 14.4 Hz, 1H), 2.60 (d, *J* = 14.8 Hz, 1H), 2.45-2.36 (m, 1H), 2.27 (d, J_1 = 18.4 Hz, J_2 = 3.8 Hz, 1H), 2.01-1.81 (m, 3H), 1.61-1.53 (m, 1H), 1.39-1.31 (m, 1H), 0.85 (s, 3H), 0.57 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 214.3, 156.8, 149.2, 131.2, 130.6, 129,2, 128.8, 128.7, 128.4, 128.2, 125.8, 125.3, 119.9, 58.9, 52.8, 47.6, 42.4, 42.3, 31.6, 26.9, 24.5, 19.8, 19.4, 0.2; HRMS (ES^+-TOF) calcd for $C_{28}H_{30}IO_4S$ ($[M+H]^+$): 589.0909, found 589.0909.



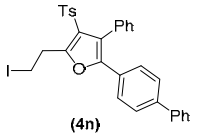
2-(2-iodoethyl)-4-phenyl-5-(p-tolyl)-3-tosylfuran (4m)

Condition A: A mixture of 3-cyclopropylidene-2-phenyl-1-(*p*-tolyl)prop-2-en-1-one **1b** (52 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 5 h, then I_2 (255 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 12 h to afford **4m**

(63 mg, 58%).

Condition B: 3-Cyclopropylidene-2-phenyl-1-(*p*-tolyl)-3-tosylpropan-1-one **3m** (83 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 10 h to afford **4m** (82 mg, 76%).

White solid; M.p. 165-166 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.48 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.36 (t, *J* = 7.4 Hz, 1H), 7.30-7.22 (m, 4H), 7.12 (d, *J* = 8.0 Hz, 2H), 7.07-7.02 (m, 4H),6.98 (d, *J* = 8.0 Hz, 2H), 3.87 (t, *J* = 7.4 Hz, 2H), 3.60 (t, *J* = 7.4 Hz, 2H), 2.34 (s, 3H), 2.25 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.1, 149.2, 143.8, 138.2, 138.1, 131.0, 130.3, 129.09, 129.06, 128.2, 128.1, 127.5, 126.4, 125.5, 125.1, 119.5, 31.8, 21.5, 21.2, 0.2; HRMS (ES^+-TOF) calcd for $C_{26}H_{24}IO_3S$ ($[M+H]^+$): 543.0491, found 543.0487.



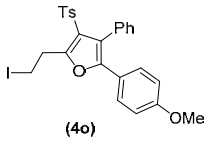
(4n)

2-([1,1'-biphenyl]-4-yl)-5-(2-iodoethyl)-3-phenyl-4-tosylfuran (4n)

Condition A: A mixture of 1-([1,1'-biphenyl]-4-yl)-3-cyclopropylidene-2-phenylprop-2-en-1-one **1c** (64 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 9 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 10 h to afford **4n** (40 mg, 33%).

Condition B: 1-([1,1'-Biphenyl]-4-yl)-3-cyclopropylidene-2-phenyl-3-tosylpropan-1-one **3n** (96 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 10 h to afford **4n** (101mg, 86%).

White solid; M.p. 151-152 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.48 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.51 (d, *J* = 7.6 Hz, 2H), 7.44-7.36 (m, 5H), 7.34-7.24 (m, 7H), 7.10-7.03 (m, 4H), 3.90 (t, *J* = 7.4 Hz, 2H), 3.62 (t, *J* = 7.4 Hz, 2H), 2.35 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.5, 148.9, 143.9, 140.7, 140.1, 138.3, 131.0, 130.3, 129.1, 128.8, 128.34, 128.26, 128.1, 127.6, 127.0, 126.8, 125.9, 125.4, 120.4, 31.9, 21.5, 0.1; HRMS (ES^+-TOF) calcd for $C_{31}H_{25}IO_3S$ ($[M]^+$): 604.0569, found 604.0577.



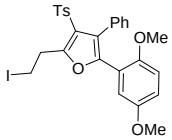
(4o)

2-(2-iodoethyl)-5-(4-methoxyphenyl)-4-phenyl-3-tosylfuran (4o)

Condition A: A mixture of 3-cyclopropylidene-1-(4-methoxyphenyl)-2-phenylprop-2-en-1-one **1d** (55 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 6 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 14 h to afford **4o** (75 mg, 67%).

Condition B: 3-Cyclopropylidene-1-(4-methoxyphenyl)-2-phenyl-3-tosylpropan-1-one **3o** (86 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 10 h to afford **4o** (88 mg, 80%).

White solid; M.p. 119-120 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.33 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.36 (t, *J* = 7.4 Hz, 1H), 7.30-7.22 (m, 4H), 7.17 (d, *J* = 8.4 Hz, 2H), 7.07-7.02 (m, 4H), 6.71(d, *J* = 8.4 Hz, 2H), 3.86 (t, *J* = 7.4 Hz, 2H), 3.73 (s, 3H), 3.59 (t, *J* = 7.4 Hz, 2H), 2.34 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.4, 155.8, 149.2, 143.7, 138.4, 131.1, 130.5, 129.1, 128.2, 128.0, 127.5, 127.1, 125,0, 121.9, 118.6, 113.8, 55.2, 31.8, 21.5, 0.2; HRMS (ES^+-TOF) calcd for $C_{26}H_{24}IO_4S$ ($[M+H]^+$): 559.0440, found 559.0436.



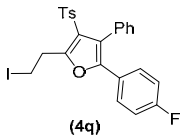
(4p)

2-(2,5-dimethoxyphenyl)-5-(2-iodoethyl)-3-phenyl-4-tosylfuran (4p)

Condition A: A mixture of 3-cyclopropylidene-1-(2,5-dimethoxyphenyl)-2-phenylprop-2-en-1-one **1e** (61 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 5 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 13 h to afford **4p** (67 mg, 57%).

Condition B: 3-Cyclopropylidene-1-(2,5-dimethoxyphenyl)-2-phenyl-3-tosylpropan-1-one **3p** (92 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 11 h to afford **4p** (81 mg, 69%).

Yellow solid; M.p. 117-118 °C (Petroleum ether/EtOAc); R*f* = 0.20 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.30-7.26 (m, 2H), 7.25-7.15 (m, 3H), 7.06-7.00 (m, 4H), 6.81-6.67 (m, 3H), 3.87 (t, *J* = 7.4 Hz, 2H), 3.62-3.56 (m, 5H), 3.37 (s, 3H), 2.32 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 157.0, 153.0, 150.9, 147.6, 143.6, 138.5, 131.0, 130.7, 129.0, 127.51, 127.48, 124.4, 122.2, 118.7, 115.9, 115.6, 112.8, 55.6, 32.0, 21.5, 0.2; HRMS (ES^+-TOF) calcd for $C_{27}H_{26}IO_5S$ ($[M+H]^+$): 589.0546, found 589.0554.



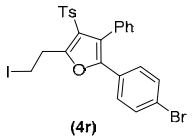
(4q)

2-(4-fluorophenyl)-5-(2-iodoethyl)-3-phenyl-4-tosylfuran (4q)

Condition A: A mixture of 3-cyclopropylidene-1-(4-fluorophenyl)-2-phenylprop-2-en-1-one **1f** (53 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 5 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 °C for 20 h to afford **4q** (56 mg, 51%).

Condition B: 3-Cyclopropylidene-1-(4-fluorophenyl)-2-phenyl-3-tosylpropan-1-one **3q** (84 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 °C for 16 h to afford **4q** (79 mg, 75%).

White solid; M.p.150-151 °C (Petroleum ether/EtOAc); R*f* = 0.35 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.38 (t, *J* = 7.4 Hz, 1H), 7.32-7.18 (m, 6H), 7.07-7.01 (m, 4H), 6.87 (t, *J* = 8.6 Hz, 2H), 3.88 (t, *J* = 7.2 Hz, 2H), 3.60 (t, *J* = 7.6 Hz, 2H), 2.34 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.3 (d, *J* = 248.2 Hz), 156.4, 148.2, 143.9, 138.2, 130.9, 130.0, 129.1, 128.4, 128.3, 127.51, 127.47 (d, *J* = 7.6 Hz), 125.4 (d, *J* = 3.8 Hz), 125.3, 119.9, 115,5 (d, *J* = 22.1 Hz), 31.8, 21.5, 0.1; HRMS (ES^+-TOF) calcd for $C_{25}H_{21}FIO_3S$ ($[M+H]^+$): 547.0240, found 547.0249.



(4r)

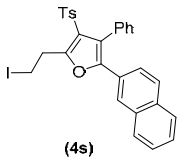
2-(4-bromophenyl)-5-(2-iodoethyl)-3-phenyl-4-tosylfuran (4r)

Condition A: A mixture of 1-(4-bromophenyl)-3-cyclopropylidene-2-phenylprop-2-en-1-one **1g** (65 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (73 mg, 0.4 mmol, 2.0 equiv), and

AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 4 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 21 h to afford **4r** (74 mg, 61%).

Condition B: 1-(4-Bromophenyl)-3-cyclopropylidene-2-phenyl-3-tosylpropan-1-one **3r** (96 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 23 h to afford **4r** (89 mg, 74%).

White solid; M.p. 167-168 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.42 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.38 (t, *J* = 7.4 Hz, 1H), 7.32-7.21 (m, 6H), 7.11-7.00 (m, 6H), 3.88 (t, *J* = 7.2 Hz, 2H), 3.60 (t, *J* = 7.0 Hz, 2H), 2.34 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.6, 148.0, 143.9, 138.1, 131.6, 130.8, 129.9, 129.1, 128.4, 128.0, 127.5, 126.9, 125.4, 122.2, 120.9, 31.8, 21.5, 0.0; HRMS (ES^+-TOF) calcd for $C_{25}H_{21}BrIO_3S$ ($[M+H]^+$): 606.9439, found 606.9445.



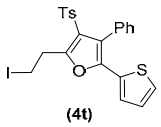
(4s)

2-(2-iodoethyl)-5-(naphthalen-2-yl)-4-phenyl-3-tosylfuran (4s)

Condition A: A mixture of 3-cyclopropylidene-1-(naphthalen-2-yl)-2-phenylprop-2-en-1-one **1h** (59 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (73 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 12 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 24 h to afford **4s** (68 mg, 59%).

Condition B: 3-Cyclopropylidene-1-(naphthalen-2-yl)-2-phenyl-3-tosylpropan-1-one **3s** (90 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 12 h to afford **4s** (93 mg, 81%).

White solid; M.p. 204-205 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.44 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.77-7.58 (m, 4H), 7.44-7.37 (m, 3H), 7.33-7.27 (m, 4H), 7.26-7.24 (m, 1H), 7.12-7.03 (m, 4H), 3.93 (t, *J* = 7.6 Hz, 2H), 3.65 (t, *J* = 7.4 Hz, 2H), 2.34 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.7, 149.2, 143.9, 138.3, 132,9, 132.7, 131.1, 130.3, 129.2, 128.34, 128.29, 128.0, 127.58, 127.56, 126.6, 126.5, 126.4, 125.4, 125.0, 123.1, 120.7, 32.0, 21.5, 0.1; HRMS (ES^+-TOF) calcd for $C_{29}H_{24}IO_3S$ ($[M+H]^+$): 579.0491, found 579.0487.



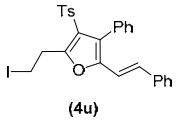
(4t)

2-(2-iodoethyl)-4-phenyl-5-(thiophen-2-yl)-3-tosylfuran (4t)

Condition A: A mixture of 3-cyclopropylidene-2-phenyl-1-(thiophen-2-yl)prop-2-en-1-one **1i** (51 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 3 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 20 h to afford **4t** (76 mg, 65%).

Condition B: 3-Cyclopropylidene-2-phenyl-1-(thiophen-2-yl)-3-tosylpropan-1-one **3t** (82 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 12 h to afford **4t** (74 mg, 69%).

Yellow solid; M.p. 101-102 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.46 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.40 (t, *J* = 7.4 Hz, 1H), 7.34-7.25 (m, 4H), 7.13-7.04 (m, 5H), 6.92-6.84 (m, 2H), 3.85 (t, *J* = 7.4 Hz, 2H), 3.58 (t, *J* = 7.6 Hz, 2H), 2.35 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.0, 145.8, 144.0, 138.2, 131.1, 131.0, 129.4, 129.2, 128.5, 128.3, 127.6, 127.1, 125.7, 125.2, 124.7, 119.1, 31.7, 21.5, -0.1; HRMS (ES^+-TOF) calcd for $C_{23}H_{20}IO_3S_2$ ($[M+H]^+$): 534.9899, found 534.9900.



(4u)

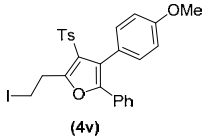
(E)-2-(2-iodoethyl)-4-phenyl-5-styryl-3-tosylfuran (4u)

Condition A: A mixture of (*E*)-1-cyclopropylidene-2,5-diphenylpenta-1,4-dien-3-one **1j** (54 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 4 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 11 h to afford **4u** (30 mg, 27%).

Condition B: (*E*)-5-cyclopropylidene-1,4-diphenyl-5-tosylpent-1-en-3-one **3u** (86 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 26 h to afford **4u** (29 mg, 26%).

White solid; M.p. 175-176 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.48 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.41-7.25 (m, 9H), 7.24-7.18 (m, 1H), 7.16-7.01 (m, 5H), 6.48 (d, *J* = 16.4 Hz, 1H), 3.85 (t, *J* = 7.4 Hz, 2H), 3.59 (t, *J* = 7.4 Hz, 2H), 2.33 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ

156.9, 149.5, 143.9, 138.2, 136,2, 131.1, 129.5, 129.4, 129.1, 128.7, 128.2, 128.1, 127.9, 127.4, 126.5, 124.8, 122.2, 113.5, 32.0, 21.5, -0.1; HRMS (ES^+-TOF) calcd for $C_{27}H_{24}IO_3S$ ($[M+H]^+$): 555.0491, found 555.0491.



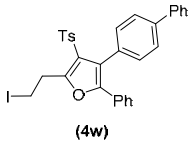
(4v)

2-(2-iodoethyl)-4-(4-methoxyphenyl)-5-phenyl-3-tosylfuran (4v)

Condition A: A mixture of 3-cyclopropylidene-2-(4-methoxyphenyl)-1-phenylprop-2-en-1-one **1k** (55 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (71 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 12 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^oC for 24 h to afford **4v** (67 mg, 60%).

Condition B: 3-Cyclopropylidene-2-(4-methoxyphenyl)-1-phenyl-3-tosylpropan-1-one **3v** (86 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^oC for 10 h to afford **4v** (83 mg, 75%).

White solid; M.p. 136-137 ^oC (Petroleum ether/EtOAc); R*f* = 0.35 (Petroleum ether/EtOAc 5/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.31-7.24 (m, 4H), 7.21-7.16 (m, 3H), 7.07 (d, *J* = 8.0 Hz, 2H), 6.97 (d, *J* = 8.0 Hz, 2H), 6.82 (d, *J* = 8.4 Hz, 2H), 3.90-3.84 (m, 5H), 3.60 (t, *J* = 7.2 Hz, 2H), 2.35 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.5, 156.3, 149.0, 143.8, 138.3, 132.1, 129.2, 129.1, 128.3, 128.0, 127.5, 125.4, 125.3, 122.1, 120.0, 113.7, 55.2, 31.8, 21.5, 0.2; HRMS (ES^+-TOF) calcd for $C_{26}H_{24}IO_4S$ ($[M+H]^+$): 559.0440, found 559.0442.



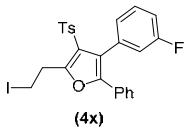
(4w)

3-([1,1'-biphenyl]-4-yl)-5-(2-iodoethyl)-2-phenyl-4-tosylfuran (4w)

Condition A: A mixture of 2-([1,1'-biphenyl]-4-yl)-3-cyclopropylidene-1-phenylprop-2-en-1-one **1l** (64 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (72 mg, 0.4 mmol, 2.0 equiv), and AcOH (25 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 2.5 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^oC for 18 h to afford **4w** (31 mg, 26%).

Condition B: 2-([1,1'-Biphenyl]-4-yl)-3-cyclopropylidene-1-phenyl-3-tosylpropan-1-one **3w** (98 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 30 h to afford **4w** (78 mg, 65%).

White solid; M.p. 177-178 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.42 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.66 (d, *J* = 6.8 Hz, 2H), 7.55-7.46 (m, 4H), 7.40 (t, *J* = 6.8 Hz, 1H), 7.33-7.26 (m, 4H), 7.22-7.16 (m, 3H), 7.12 (d, *J* = 7.6 Hz, 2H), 7.03 (d, *J* = 7.6 Hz, 2H), 3.90 (t, *J* = 7.0 Hz, 2H), 3.62 (t, *J* = 7.0 Hz, 2H), 2.33 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.5, 149.1, 143.9, 140.8, 140.4, 138.2, 131.4, 129.22, 129.17, 129.1, 128.9, 128.4, 128.2, 127.6, 127.0, 126.8, 125.6, 125.4, 119.9, 31.9, 21.5, 0.1; HRMS (ES^+-TOF) calcd for $C_{31}H_{26}IO_3S$ ($[M+H]^+$): 605.0647, found 605.0644.



(4x)

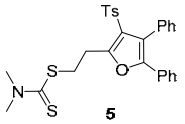
3-(3-fluorophenyl)-5-(2-iodoethyl)-2-phenyl-4-tosylfuran (4x)

Condition A: A mixture of 3-cyclopropylidene-2-(3-fluorophenyl)-1-phenylprop-2-en-1-one **1m** (53 mg, 0.2 mmol, 1.0 equiv), sodium 4-methylbenzensulfinate **2b** (73 mg, 0.4 mmol, 2.0 equiv) was stirred in 2 mL of MeCN at rt under ambient atmosphere for 2.5 h, then I_2 (254 mg, 1 mmol, 5.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 22 h to afford **4x** (59 mg, 54%).

Condition B: 3-Cyclopropylidene-2-(3-fluorophenyl)-1-phenyl-3-tosylpropan-1-one **3x** (84 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of MeCN, then I_2 (154 mg, 0.6 mmol, 3.0 equiv) was added. The mixture was stirred at 100 ^{o}C for 12 h to afford **4x** (85 mg, 78%).

White solid; M.p. 130-131 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.47 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.33-7.18 (m, 8H), 7.12-7.03 (m, 3H), 6.92 (d, *J* = 7.6 Hz, 1H), 6.63 (d, *J* = 9.6 Hz, 1H), 3.89 (t, *J* = 7.2 Hz, 2H), 3.61 (t, *J* = 7.2 Hz, 2H), 2.36 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.5 (d, *J* = 246.0 Hz), 156.6, 149.2, 144.2, 138.2, 132.4 (d, *J* = 8.5 Hz), 129.9 (d, *J* = 9.4 Hz), 129.2, 128.8, 128.5, 128.4, 127.5, 127.0 (d, *J* = 2.5 Hz), 125.6, 125.2, 118.9 (d, *J* = 1.4 Hz), 117.9 (d, *J* = 21.6 Hz), 115.2 (d, *J* = 21.1 Hz), 31.8, 21.5, -0.1; HRMS (ES^+-TOF) calcd for $C_{25}H_{21}FIO_3S$ ($[M+H]^+$): 547.0240, found 547.0244.

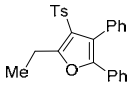
3. Transformation of 3-sulfonylfuran 4b to other functionalized furans 5-10



5

2-(4,5-diphenyl-3-tosylfuran-2-yl)ethyl dimethylcarbamodithioate (5)

2-(2-iodoethyl)-4,5-diphenyl-3-tosylfuran **4b** (106 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of DMF, and dimethyldithiocarbamic acid sodium salt dihydrate (72 mg, 0.4 mmol, 2.0 equiv) was added, the mixture was then stirred at 150 ^{o}C for 0.5 h under ambient atmosphere. After completion of the reaction, the mixture was quenched by 10 mL of H_2O and extracted with EtOAc (3 × 10 mL). The combined organic phase was washed with H_2O (3 × 10 mL), dried over anhydrous Na_2SO_4, concentrated *in vacuo* and purified with flash silica gel chromatography to afford **5** (94 mg, 90%) as a white solid; M.p. 126-127 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.14 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.37 (t, *J* = 7.6 Hz, 1H), 7.32-7.22 (m, 6H), 7.19-7.15 (m, 3H), 7.08-7.03 (m, 4H), 3.83 (t, *J* = 7.4 Hz, 2H), 3.70 (t, *J* = 7.4 Hz, 2H), 3.59 (s, 3H), 3.42 (s, 3H), 2.34 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 196.3, 156.5, 148.7, 143.6, 138.6, 130.9, 130.5, 129.3, 129.0, 128.23, 128.17, 128.1, 127.8, 127.4, 125.4, 124.8, 120.1, 45.3, 41.4, 35.2, 27.2, 21.4; HRMS (ES^{+}-TOF) calcd for $C_{27}H_{24}IO_3S$ ($[M+H]^{+}$): 522.1231, found 522.1236.

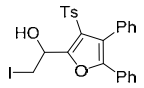


6

2-ethyl-4,5-diphenyl-3-tosylfuran (6)

To a solution of 2-(2-iodoethyl)-4,5-diphenyl-3-tosylfuran **4b** (106 mg, 0.2 mmol, 1.0 equiv) in 2 ml of AcOH was added zinc power (131 mg, 2 mmol, 10.0 equiv) in portions at 65 ^{o}C. The mixture was stirred at 65 ^{o}C for 1 h. After completion of the reaction, zinc power was filtered off, the filtrate was diluted with EtOAc and neutralized by the addition of aq 70% $NaHCO_3$ (10 mL), was extracted with EtOAc (3 × 10 mL). The combined organic phase was dried over anhydrous Na_2SO_4, concentrated *in vacuo* and purified with flash silica gel chromatography to afford **6** (69 mg, 86%) as a white solid; M.p. 131-132 ^{o}C (Petroleum ether/EtOAc); R*f* = 0.31 (Petroleum ether/EtOAc 5/1); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.36 (t, *J* = 7.4 Hz, 1H), 7.31-7.20 (m, 6H), 7.19-7.14 (m, 3H), 7.08-7.03 (m, 4H), 3.30 (q, *J* = 7.6 Hz, 2H), 2.34 (s, 3H), 1.46 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 160.5, 148.1, 143.5, 139.0, 131.0, 130.7, 129.5, 129.1, 128.3, 128.2, 128.0, 127.7, 127.3, 125.3, 123.2, 120.2, 21.5,

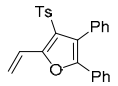
21.2, 12.9; HRMS (ES^+-TOF) calcd for $C_{25}H_{22}NaO_3S$ ($[M+Na]^+$): 403.1368, found 403.1362.



7

1-(4,5-diphenyl-3-tosylfuran-2-yl)-2-iodoethan-1-ol (7)

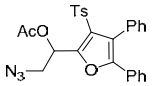
A solution of cerium (IV) ammonium nitrate (CAN) (274 mg, 0.5 mmol, 2.5 equiv) in water (2 ml) was added dropwise to a stirring solution of the **4b** (106 mg, 0.2 mmol, 1.0 equiv) in acetonitrile (6 ml), the mixture was stirred at room temperature for 20 min, then added 10 mL of H_2O and extracted with EtOAc (3 × 10 mL). The combined organic phase was dried over anhydrous Na_2SO_4. After filtration, the filtrate was concentrated *in vacuo*. The residue was purified with flash silica gel chromatography to afford **7** (46 mg, 42%) as a white solid; M.p. 176-177 ^oC (Petroleum ether/EtOAc); R*f* = 0.31 (Petroleum ether/EtOAc 5/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.37 (t, *J* = 7.4 Hz, 1H), 7.30-7.23 (m, 6H), 7.21-7.15 (m, 3H), 7.08-6.99 (m, 4H), 5.58 (t, *J* = 6.8 Hz, 1H), 4.02 (br, 1H), 3.88-3.75 (m, 2H), 2.35 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 155.6, 149.4, 144.3, 137.4, 130.9, 129.6, 129.2, 128.8, 128.43, 128.41, 128.35, 128.3, 127.6, 125.8, 120.6, 67.8, 21.6, 7.3; HRMS (ES^+-TOF) calcd for $C_{25}H_{21}INaO_4S$ ($[M+Na]^+$): 567.0103, found 567.0106.



8

(E)-2-(2-iodoethyl)-4-phenyl-5-styryl-3-tosylfuran (8)

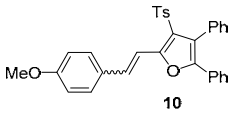
2-(2-iodoethyl)-4,5-diphenyl-3-tosylfuran **4b** (106 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of THF, and Et_3N (204 mg, 2 mmol, 10.0 equiv) was added, the mixture was then stirred at 80 ^oC for 0.5 h under ambient atmosphere. After completion of the reaction, the solvent was removed *in vacuo*, and the residue was purified with flash silica gel chromatography to afford **8** (73 mg, 91%) as a white solid; M.p. 184-185 ^oC (Petroleum ether/EtOAc); R*f* = 0.25 (Petroleum ether/EtOAc 20/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.59 (dd, J_1 = 17.4 Hz, J_2 = 11.4 Hz, 1H), 7.38 (*J* = 7.4 Hz, 1H), 7.33-7.23 (m, 6H), 7.20-7.15 (m, 3H), 7.09-7.03 (m, 4H), 6.21-6.14 (m, 1H), 5.66-5.60 (m, 1H), 2.35 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 152.7, 149.0, 143.7, 138.7, 130.9, 130.2, 129.2, 129.1, 128.34, 128.27, 128.2, 127.4, 125.7, 124.7, 123.4, 121.3, 119.1, 21.5; HRMS (ES^+-TOF) calcd for $C_{27}H_{24}IO_3S$ ($[M+H]^+$): 401.1211, found 401.1216.



9

2-azido-1-(4,5-diphenyl-3-tosylfuran-2-yl)ethyl acetate (9)

2-(2-iodoethyl)-4,5-diphenyl-3-tosylfuran **4b** (106 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of THF, and Et_3N (204 mg, 2 mmol, 10.0 equiv) was added, the mixture was then stirred at 80 ^oC for 0.5 h under ambient atmosphere. After completion of the reaction, THF and Et_3N were removed *in vacuo*, the mixture was directly used in the next step. To a suspension of NaN_3 (39 mg, 0.6 mmol, 3.0 equiv) and KI (34 mg, 0.2 mmol, 1.0 equiv) in AcOH (2 mL) at room temperature under N_2 atmosphere was added $NaIO_4$ (43 mg, 0.2 mmol, 1.0 equiv) and the reaction mixture was stirred for 5 min when a dark brown color was observed. This was followed by the addition of the crude product prepared and the entire reaction mixture was stirred at rt for 24 h. After completion of the reaction, the mixture was quenched by adding 10 mL of H_2O and extracted with EtOAc (3 × 10 mL). The combine organic layers were washed with sat. aq $NaHCO_3$ (5 mL), aq 5% $Na_2S_2O_3$ (5 mL), dried over Na_2SO_4, concentrated under reduced pressure. The residue was purified with flash silica gel chromatography to afford **9** (54mg, 54%) as a white solid; M.p. 125-126 ^oC (Petroleum ether/EtOAc); R*f* = 0.13 (Petroleum ether/EtOAc 10/1); ^1H NMR (400 MHz, $CDCl_3$): δ 7.42-7.34 (m, 3H), 7.30 (t, *J* = 7.6 Hz, 2H), 7.25-7.18 (m, 5H), 7.09 (d, *J* = 8.0 Hz, 2H), 7.04 (d, *J* = 7.2 Hz, 2H), 6.86 (dd, J_1 = 7.2 Hz, J_2 = 4.4 Hz, 1H), 3.95-3.81 (m, 2H), 2.35 (m, 3H), 2.26 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 169.8, 151.0, 150.3, 144.2, 137.7, 130.9, 129.6, 129.2, 128.8, 128.5, 128.4, 128.3, 127.8, 125.7, 120.3, 67.7, 53.0, 21.6, 20.8; HRMS (ES^+-TOF) calcd for $C_{27}H_{23}N_3NaO_5S$ ($[M+Na]^+$): 502.1437, found 524.1264.



10

2-(4-methoxystyryl)-4,5-diphenyl-3-tosylfuran (10)

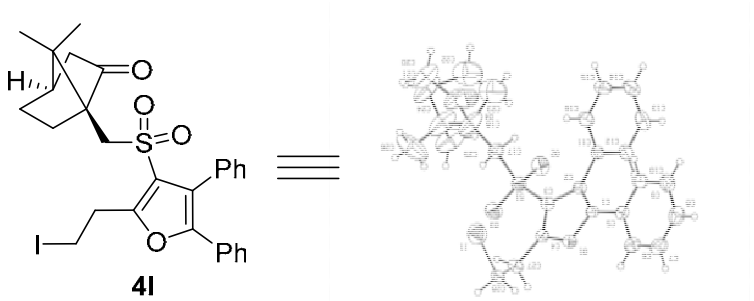
2-(2-iodoethyl)-4,5-diphenyl-3-tosylfuran **4b** (106 mg, 0.2 mmol, 1.0 equiv) was dissolved in 2 mL of CH_3CN, and Et_3N (204 mg, 2 mmol, 10.0 equiv) was added, the mixture was then stirred at 80 ^oC for 0.5 h under N_2 atmosphere. After completion of the reaction, 4-iodoanisole (57 mg, 0.24 mmol, 1.2 equiv) and $Pd(OAc)_2$ (5 mg, 0.02 mmol, 0.1 equiv) were added and the entire reaction mixture was stirred at the same temperature for 24 h, the solvent was removed *in vacuo*, and the residue was purified with flash silica gel chromatography to afford **10** (61 mg, 60%) as a yellow solid (*E*/*Z* =6:1); M.p. 190-191 ^oC (Petroleum ether/EtOAc); R*f* = 0.34 (Petroleum ether/EtOAc 5/1); ^1H NMR (400

MHz, $CDCl_3$): δ 7.84-7.28 (m, 5H), 7.33-7.27 (m, 6H), 7.22-7.18 (m, 2H), 7.10-6.86 (m, 7H), 3.88-3.84 (m, 3H), 2.36-2.33 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 160.3, 153.7, 148.5, 143.6, 138.9, 133.2, 131.0, 130.4, 129.3, 129.1, 129.0, 128.8, 128.35, 128.27, 128.2, 128.1, 127.4, 125.7, 123.5, 121.6, 114.3, 112.1, 55.4, 21.5; HRMS (ES^+-TOF) calcd for $C_{32}H_{27}O_4S$ ($[M+H]^+$): 507.1630, found 507.1631.

4. X-ray diffraction analysis of 3l

Crystallographic structure analysis of **3l**: A suitable single crystal was mounted on a *Xcalibur, Atlas, Gemini ultra* at 296(2) using Mo Kα radiation (λ=0.71073 Å). The intensity data were collected with *CrysAlisPro* program and reduced by *CrysAlisPro* program. The structure was solved by direct methods, expended by difference Fourier syntheses and refined by Full-matrix squares on F^2 using *SHELXL* program packages. All non-hydrogen atoms were refined anisotropically. Hydrogen atoms were placed in ideal positions and refined as riding atoms. Details of the X-ray experiments and crystal data are summarized in ***Table S1***.

Figure S1. ORTEP drawing of **3l** with ellipsoid contour at 30% probability level (CCDC 1543241)



4l

Table S1. Crystal data and structure refinement for **3l**.

Empirical formula	$C_{28}H_{29}IO_4S$	
Formula weight	588.47	
Temperature	293(2) K	
Wavelength	0.71073 Å	
Crystal system, Space group	Monoclinic, P 21/n	
Unit cell dimensions	a= 12.0087(6) Å	α= 90.00°
	b= 17.7464(7) Å	β= 103.892(5)°
	c= 12.6045(7) Å	γ= 90.00°
Volume	2607.6(2) $Å^3$	
Z	4	
Density(calculated)	1.499 Mg/m^3	
Absorption coefficient	1.339 mm^{-1}	
F(000)	1192	
Crystal size	0.49*0.40*0.36 mm^3	
Theta range for data collection	2.92 to 25.35°.	
Index ranges	-13<=h<=14, -21<=k<=21, -14<=l<=15	
Reflections collected	18518	
Independent reflections	4753 [R(int)= 0.0319]	
Completeness to theta=26.32°	99.75 %	
Absorption correction	Multi-scan from equivalents	
Max. and min. transmission	1.000 and 0.843	
Refinement method	Full-matrix squares on F^2	
Data/restraints/parameters	4753 / 49 / 328	
Goodness-of-fit on F^2	1.049	
Final R indices [I>2sigma(I)]	R_1= 0.0665, wR_2= 0.1759	
R indices(all data)	R_1= 0.0879, wR_2= 0.1906	
Extinction coefficient	?	
Largest diff.peak and hole	0.776 and -0.469 $eÅ^3$	

References

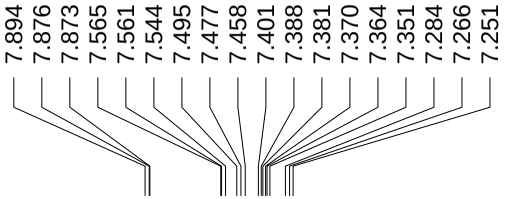
1. Miao, M.; Cao, J.; Zhang, J.; Huang, X.; Wu, L. *Org. Lett.* **2012**, *14*, 2718;

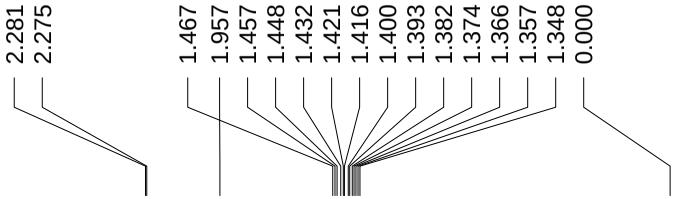
2. Crowell, T. A.; Halliday, B. D.; McDonald, J. H., III; Indelicato, J. M.; Pasini, C. E.; Wu, E. C. Y. *J. Med. Chem.* **1989**, *32*, 2436;

3. Miao, M.; Luo, Y.; Xu, H.; Chen, Z.; Xu, J.; Ren, H. *Org. Lett.* **2016**, *18*, 4292;

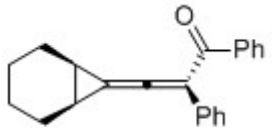
4. Ye, S.; Yu, Z.-X. *Org. Lett.* **2009** *12*, 804.

6. Copies of ^{1}H NMR and ^{13}C NMR

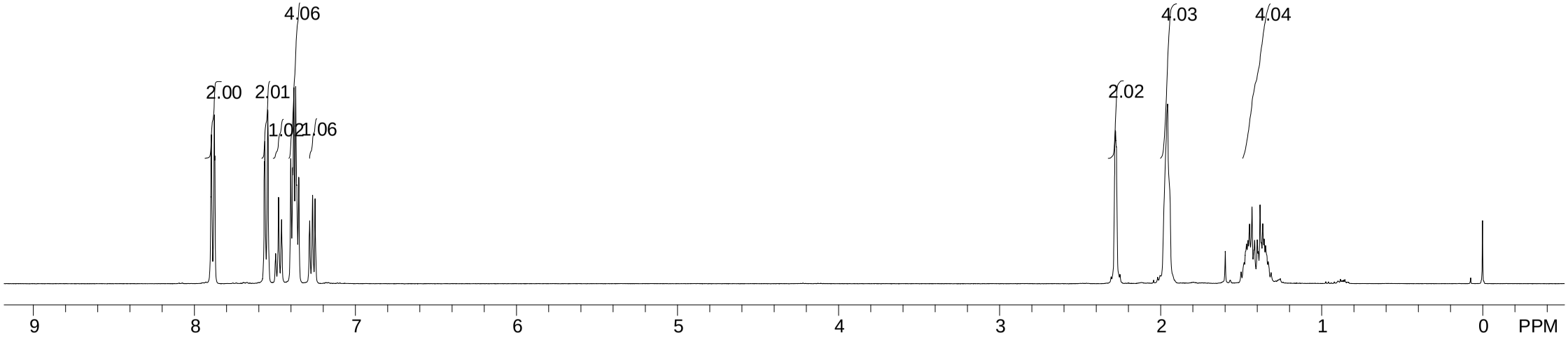


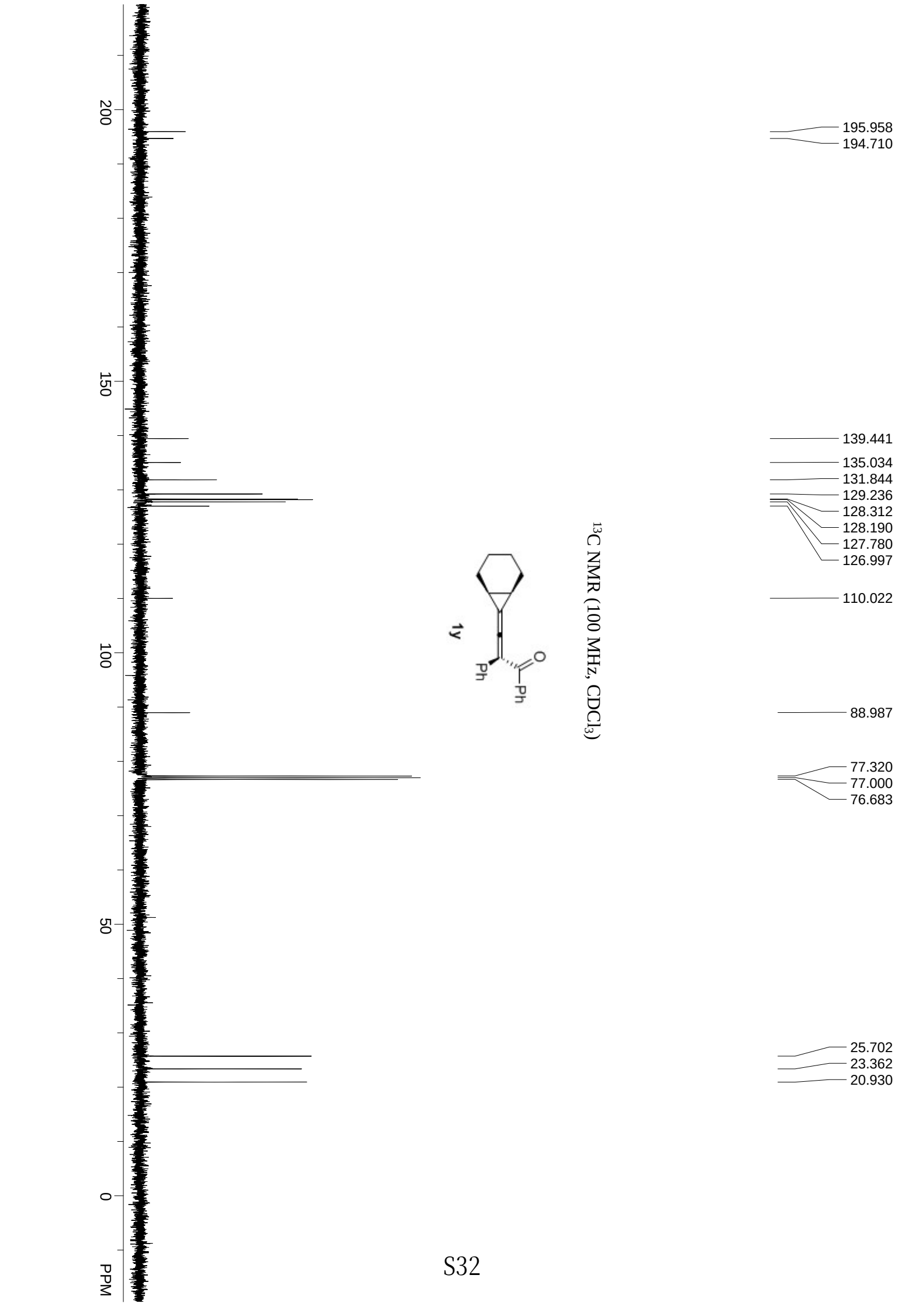


^{1}H NMR (400 MHz, $CDCl_3$)



1y

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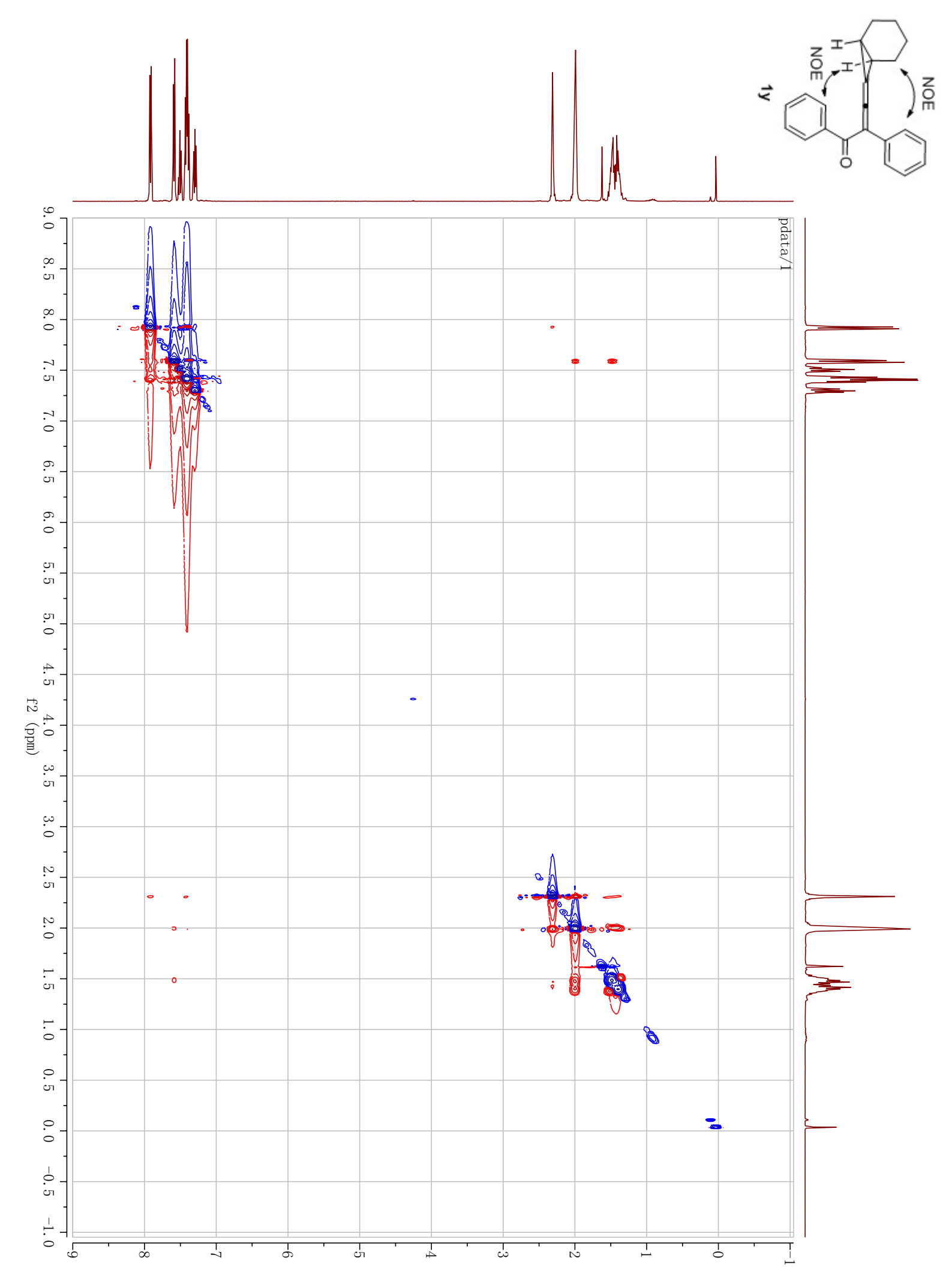
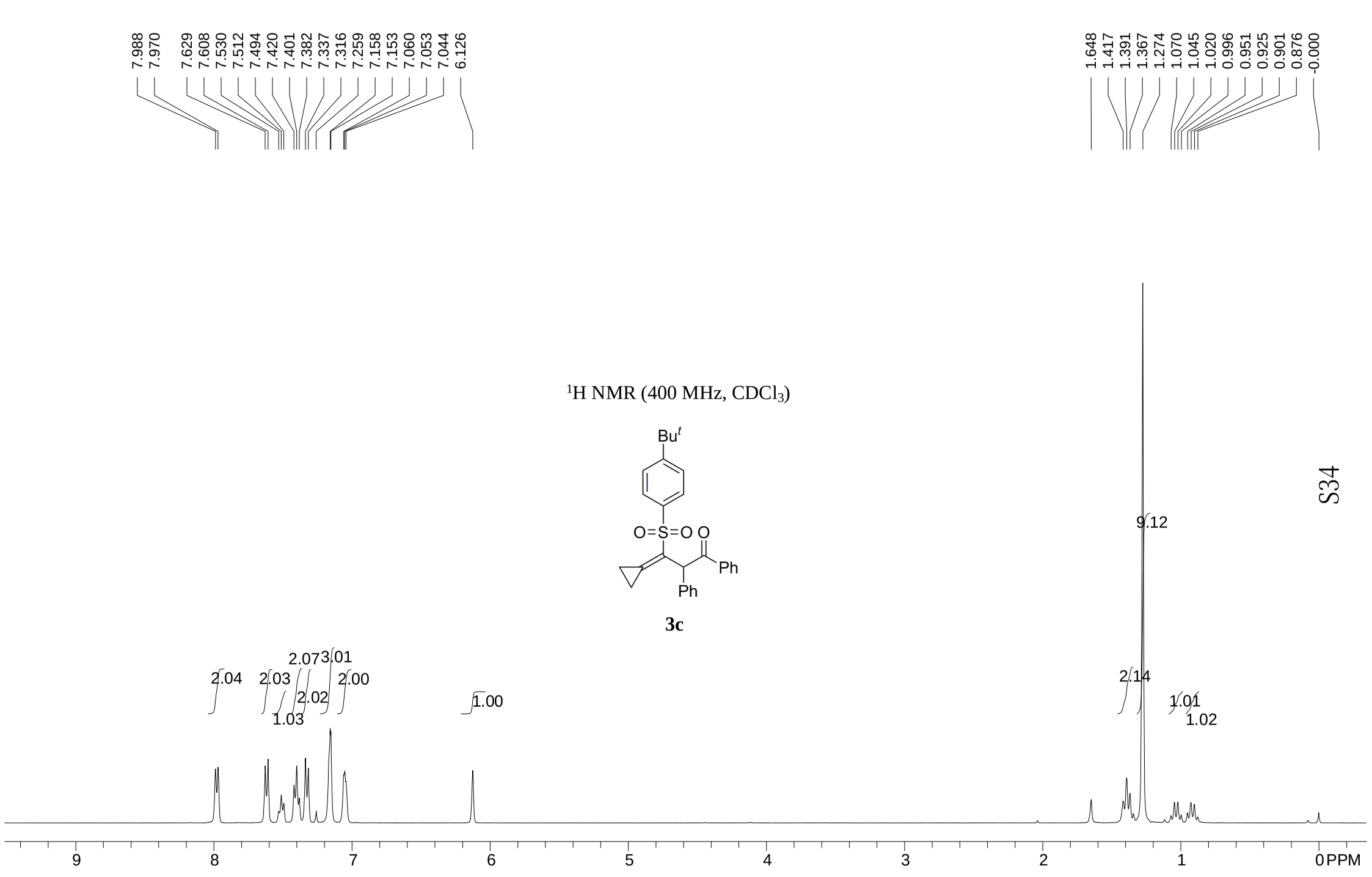
139.441
135.034
131.844
129.236
128.312
128.190
127.780
126.997
110.022
88.987
77.320
77.000
76.683
25.702
23.362
20.930
200
150
100
50
0
PPM
1y
Ph
O
Ph
^{13}C NMR (100 MHz, $CDCl_3$)


NOE
NOE
H
H
O
1y
pdata/1
f2 (ppm)
f1 (ppm)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7.530
7.512
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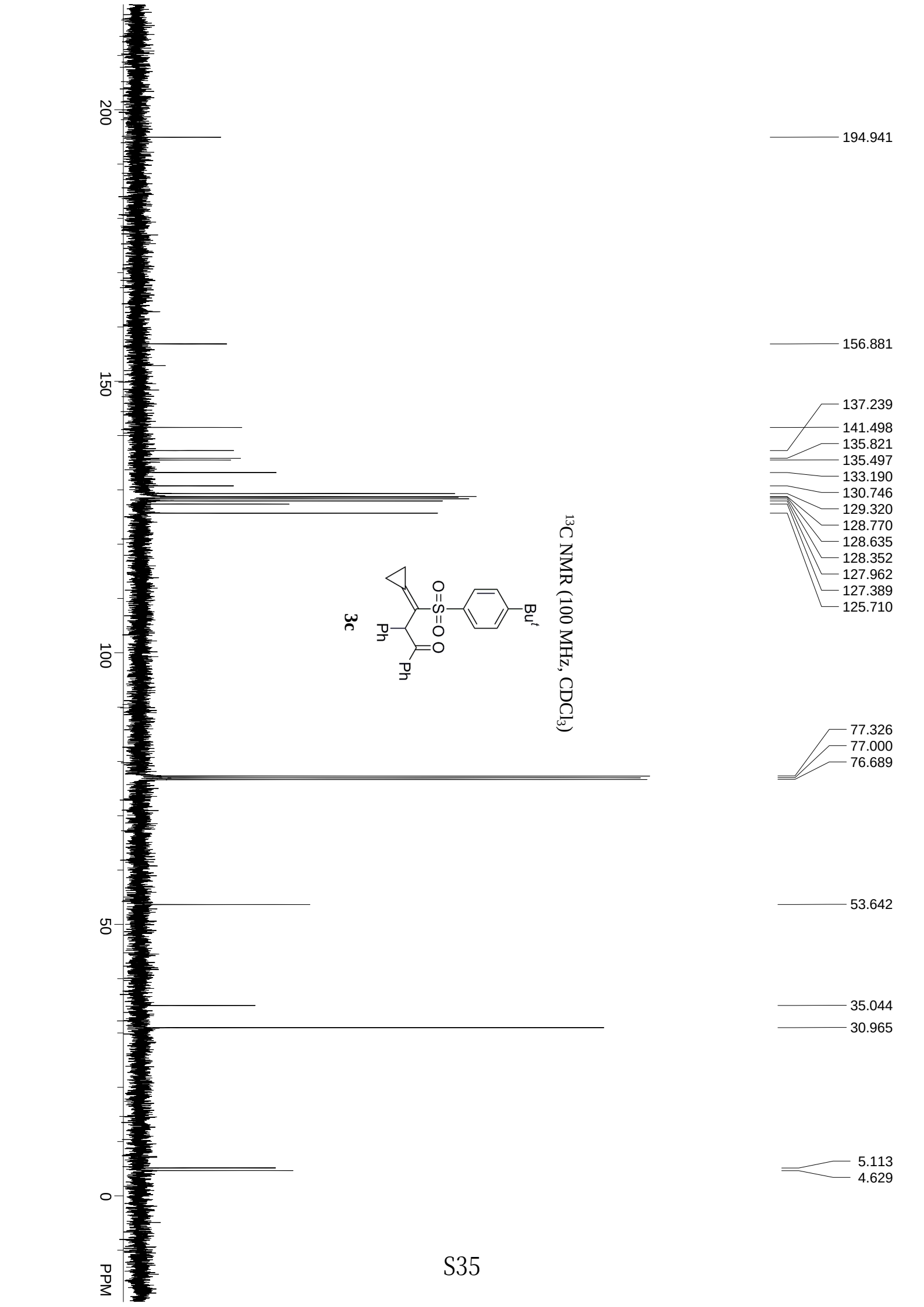
7.420
7.401
7.382
7.337
7.316
7.259
7.158
7.153
7.060
7.053
7.044
6.126
1.648
1.417
1.391
1.367
1.274
1.070
1.045
1.020
0.996
0.951
0.925
0.901
0.876
-0.000
^{1}H NMR (400 MHz, CDCl$_3$)
Bu^t
O=S=O
O
Ph
Ph
3c
2.04
2.03
1.03
2.07
2.02
3.01
2.00
1.00
9.12
2.14
1.01
1.02
9
8
7
6
5
4
3
2
1
0
PPM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137.239
141.498
135.821
135.497
133.190
130.746
129.320
128.770
128.635
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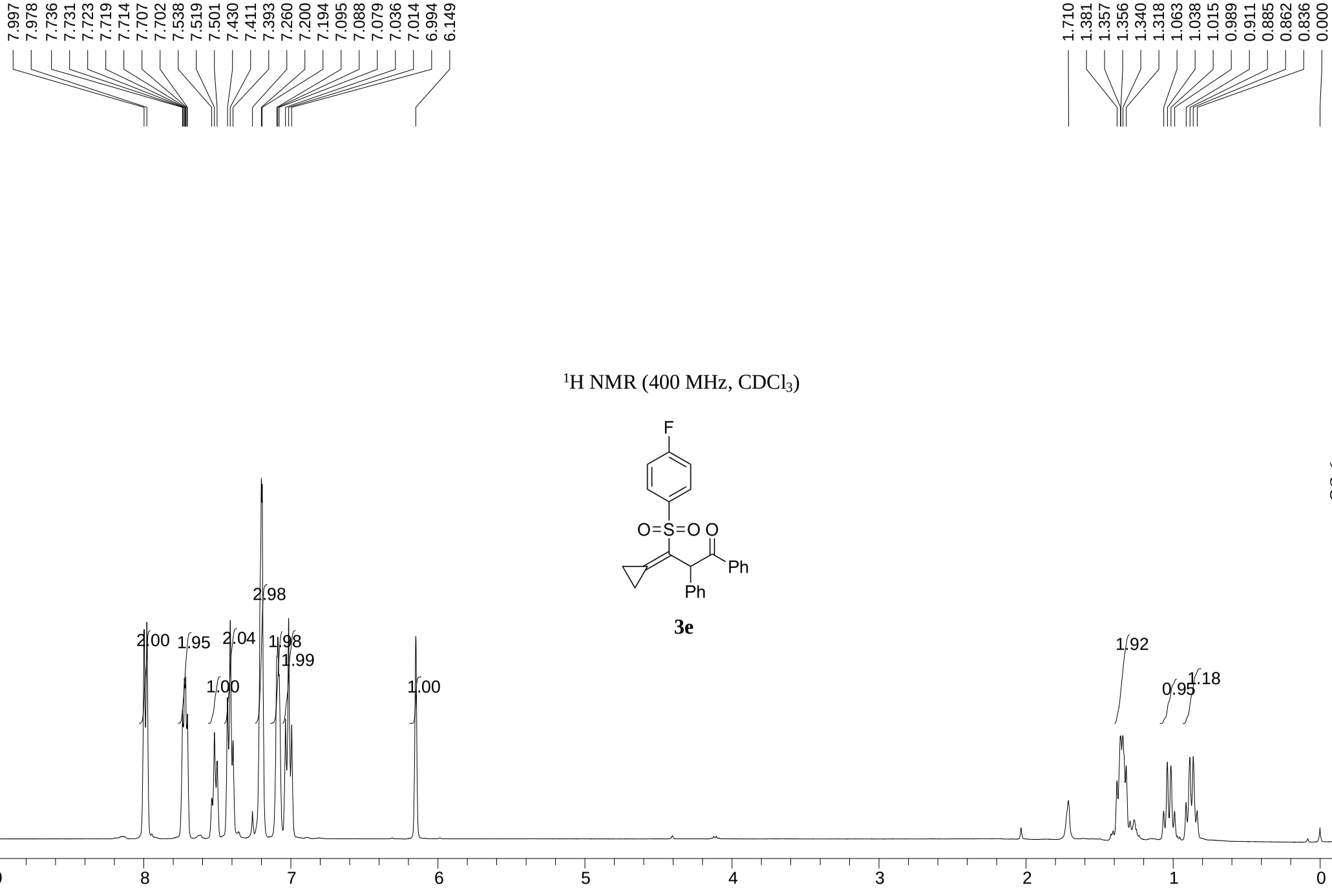
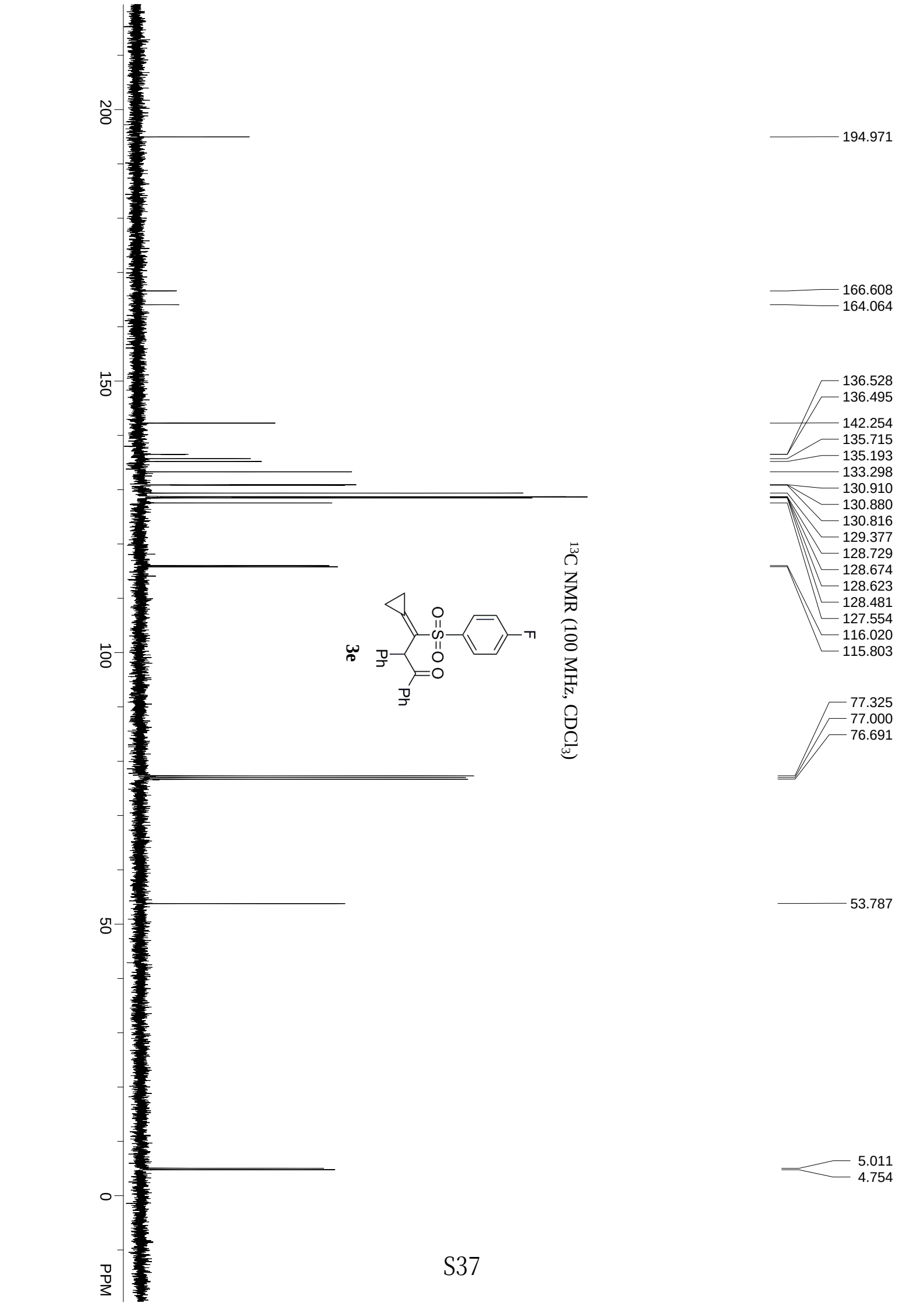
127.962
127.389
125.710
77.326
77.000
76.689
53.642
35.044
30.965
5.113
4.629
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
3c
Ph
Ph
O=S=O
Bu^t



^{1}H NMR (400 MHz, $CDCl_3$)

3e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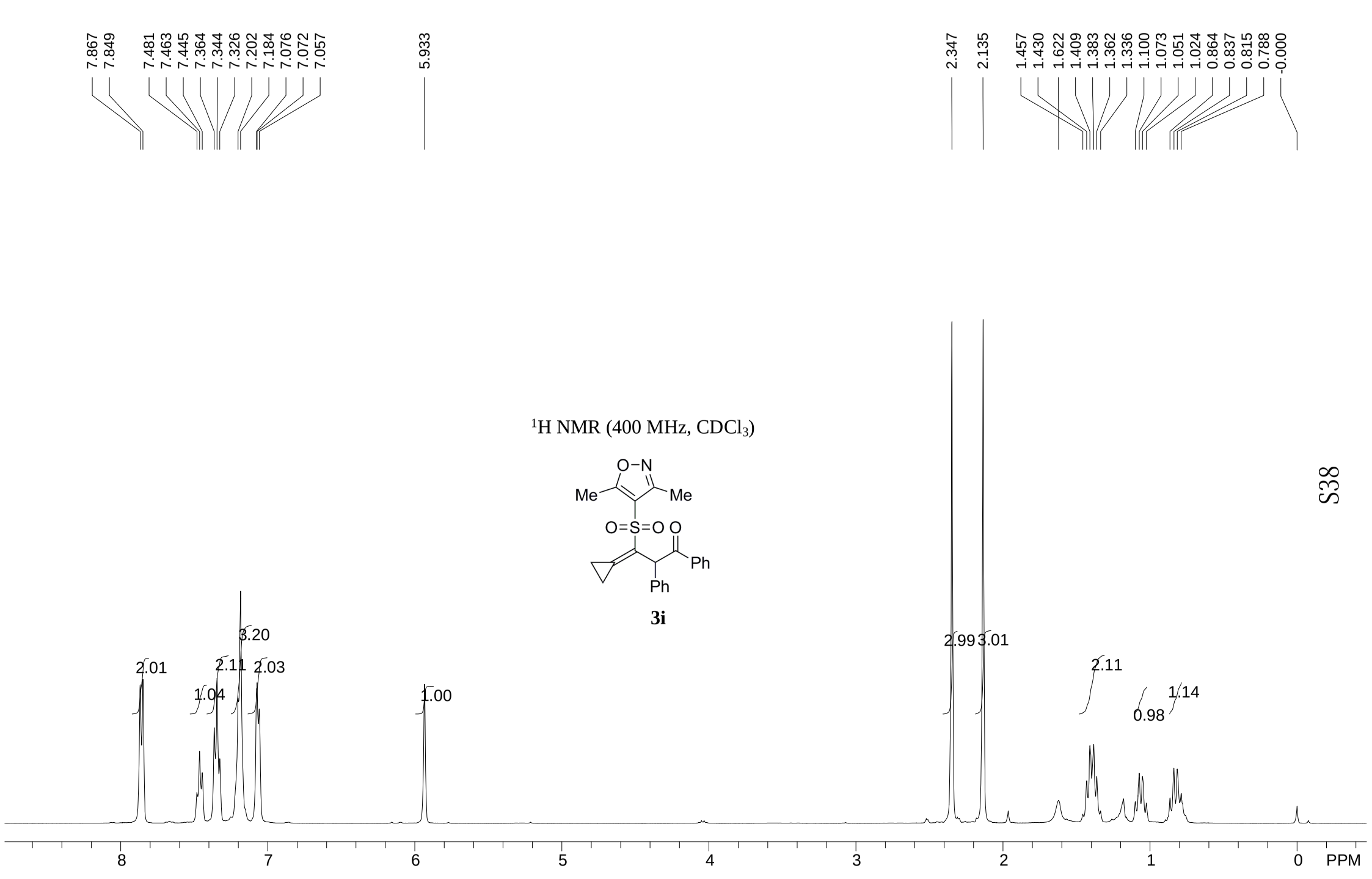
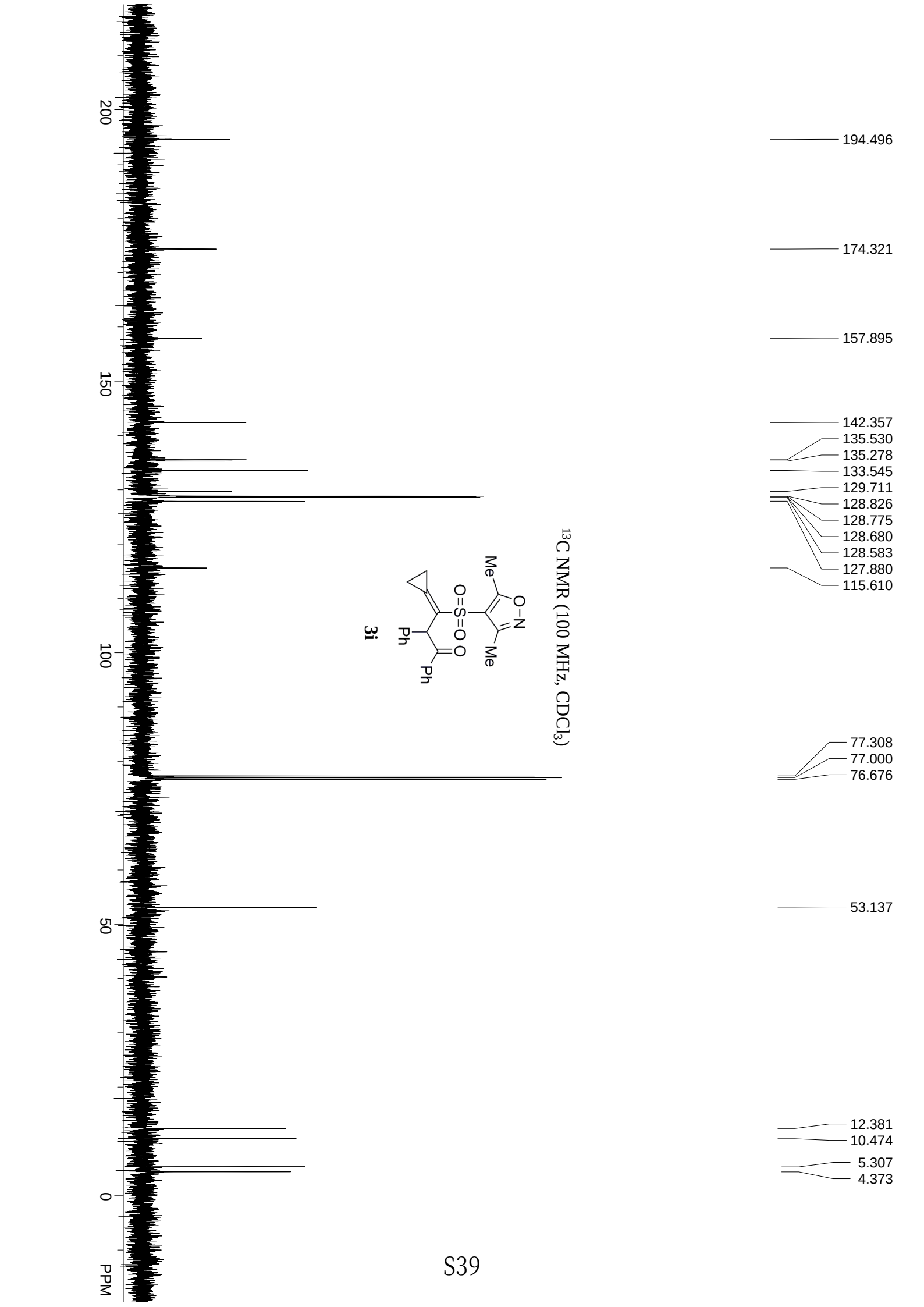
136.495
142.254
135.715
135.193
133.298
130.910
130.880
130.816
129.377
128.729
128.674
128.623
128.481
127.554
116.020
115.803
77.325
77.000
76.691
53.787
5.011
4.754
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
3e
O=S=O
O
Ph
Ph
F



^{1}H NMR (400 MHz, $CDCl_3$)

3i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129.711
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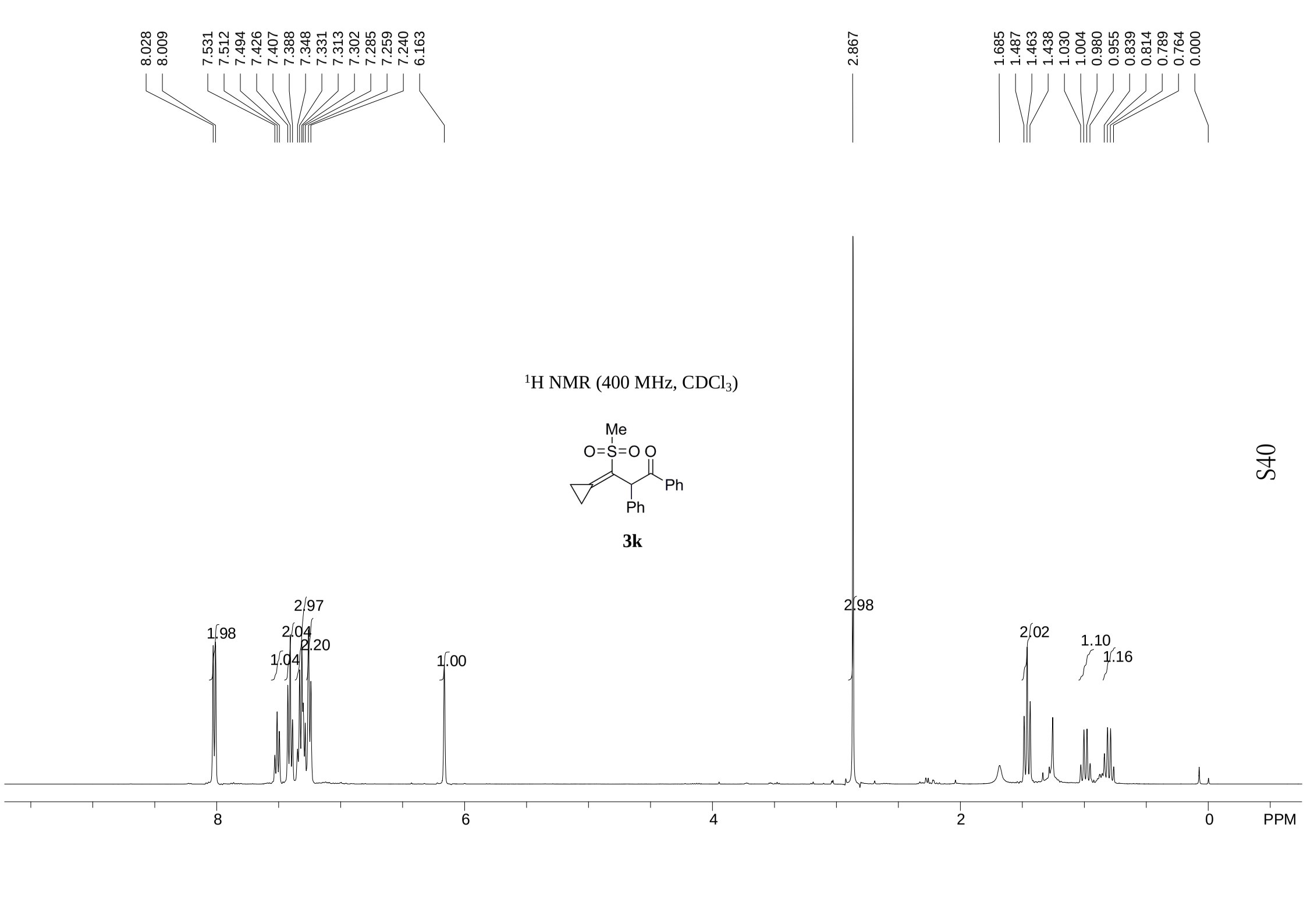
127.880
115.610
77.308
77.000
76.676
53.137
12.381
10.474
5.307
4.373
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
3i
Me
O–N
Me
O=S=O
O
Ph
Ph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7.259
7.240
6.163
2.867
1.685
1.487
1.463
1.438
1.030
1.004
0.980
0.955
0.839
0.814
0.789
0.764
0.000
1H NMR (400 MHz, CDCl3)
Me
O=S=O
O
Ph
Ph
3k
1.98
2.97
2.04
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1.00
2.98
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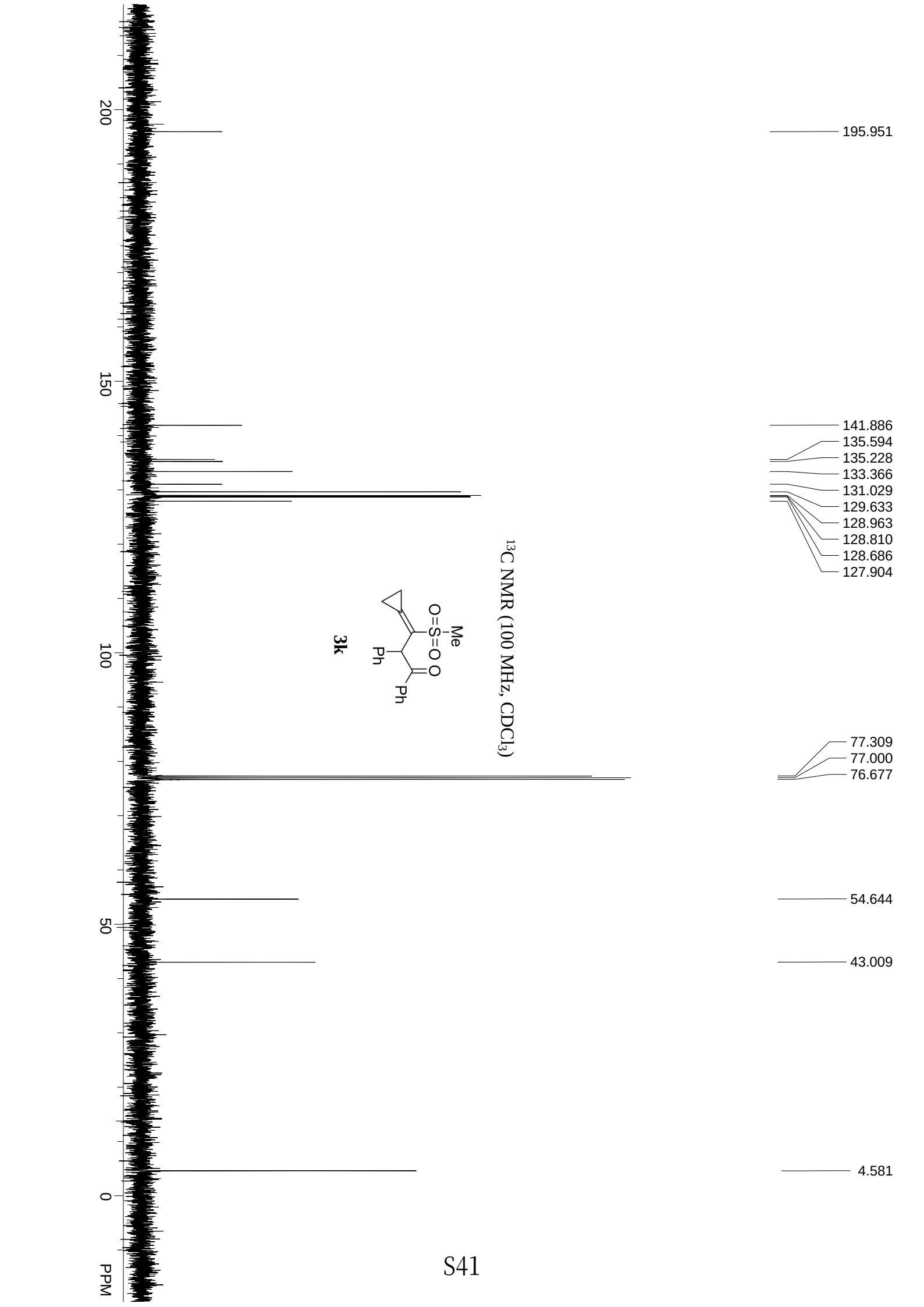
1.10
1.16
8
6
4
2
0
PPM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77.000
76.677
54.644
43.009
4.581
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150
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50
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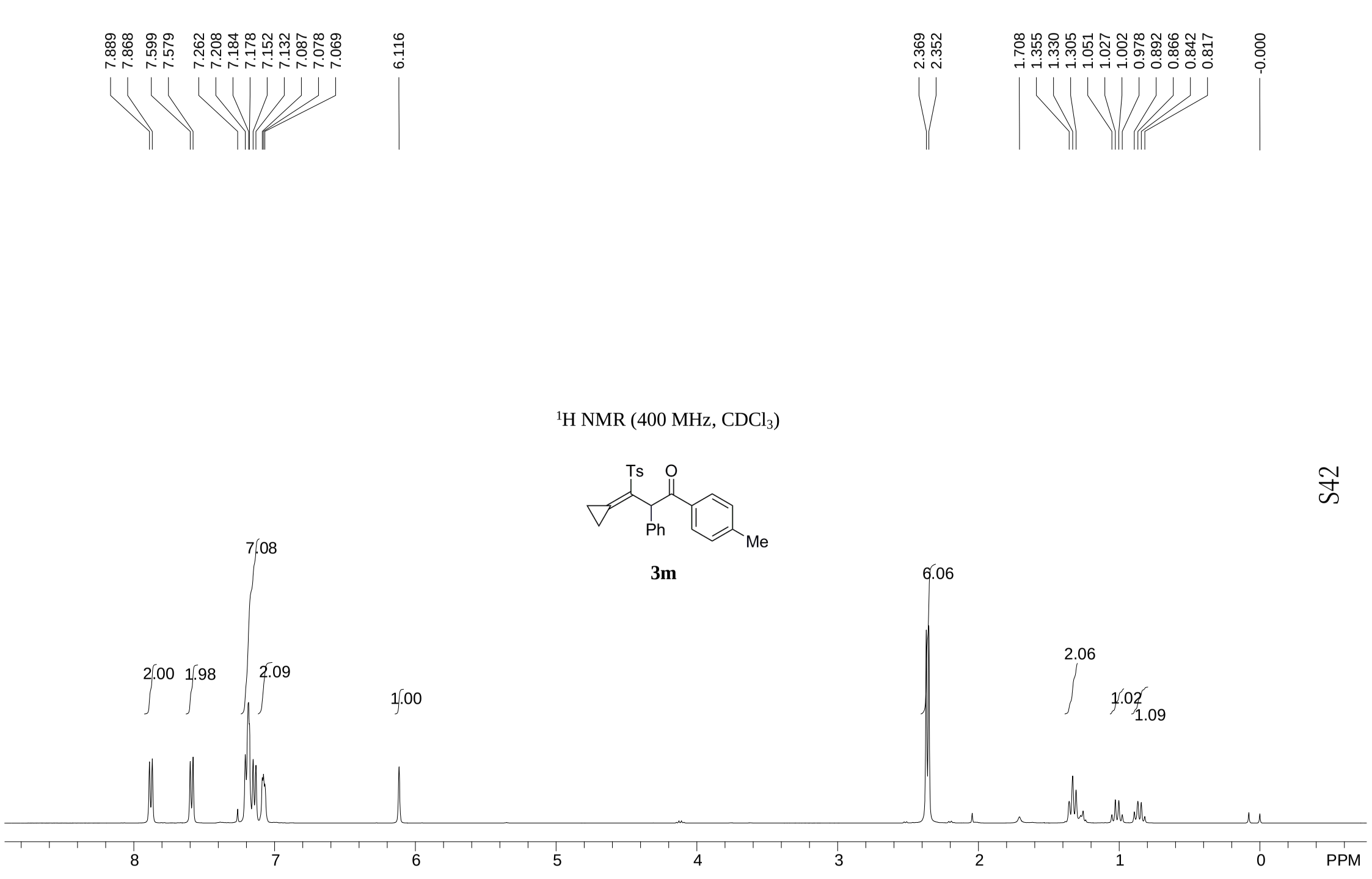
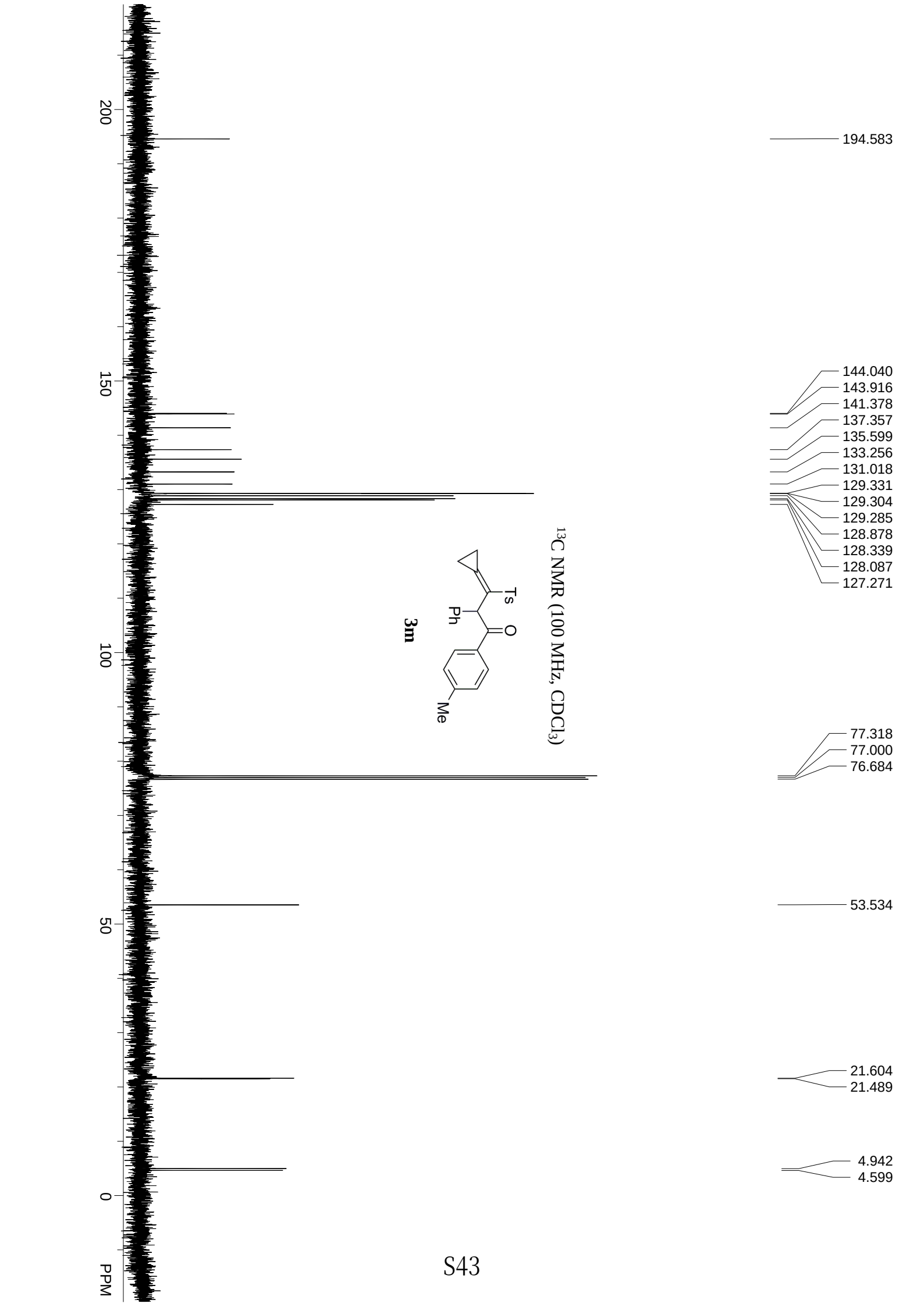
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
3k
Me
O=S=O
O
Ph
Ph



^{1}H NMR (400 MHz, $CDCl_3$)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128.087
127.271
77.318
77.000
76.684
53.534
21.604
21.489
4.942
4.599
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150
100
50
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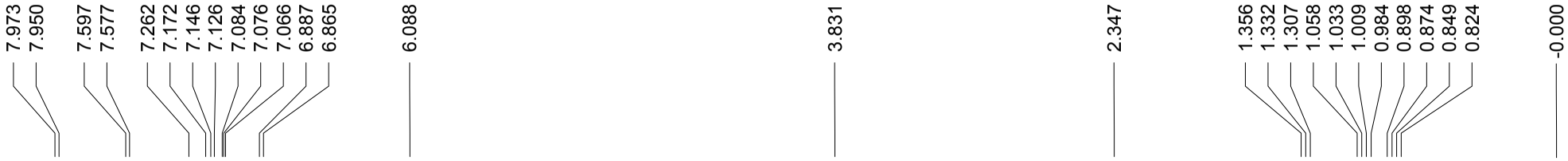
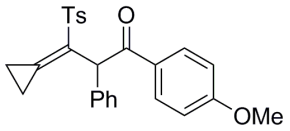
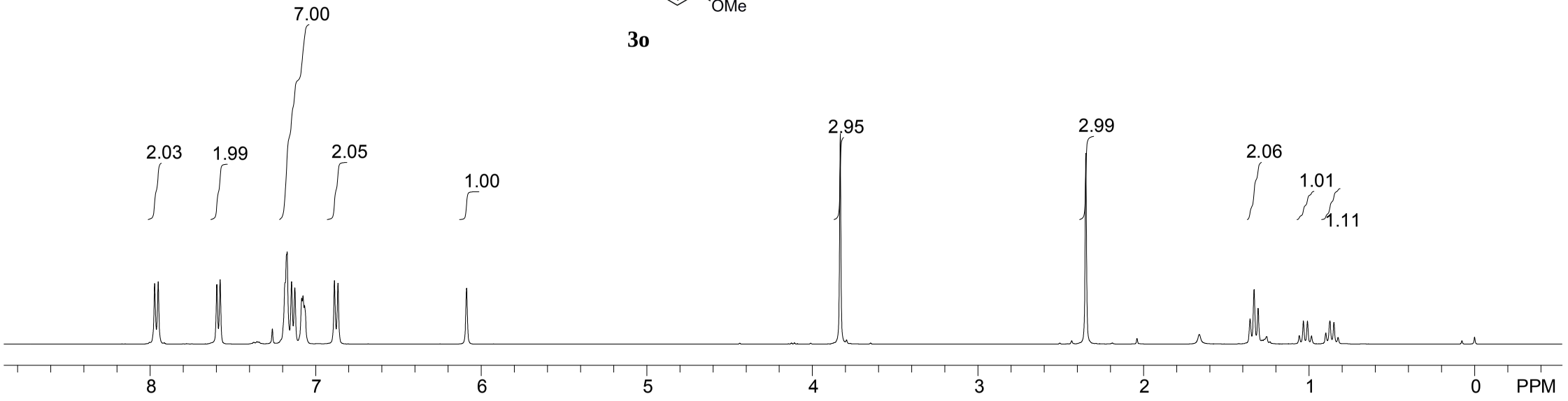
PPM
^{13}C NMR (100 MHz, $CDCl_3$)
3m
Ts
O
Ph
Me

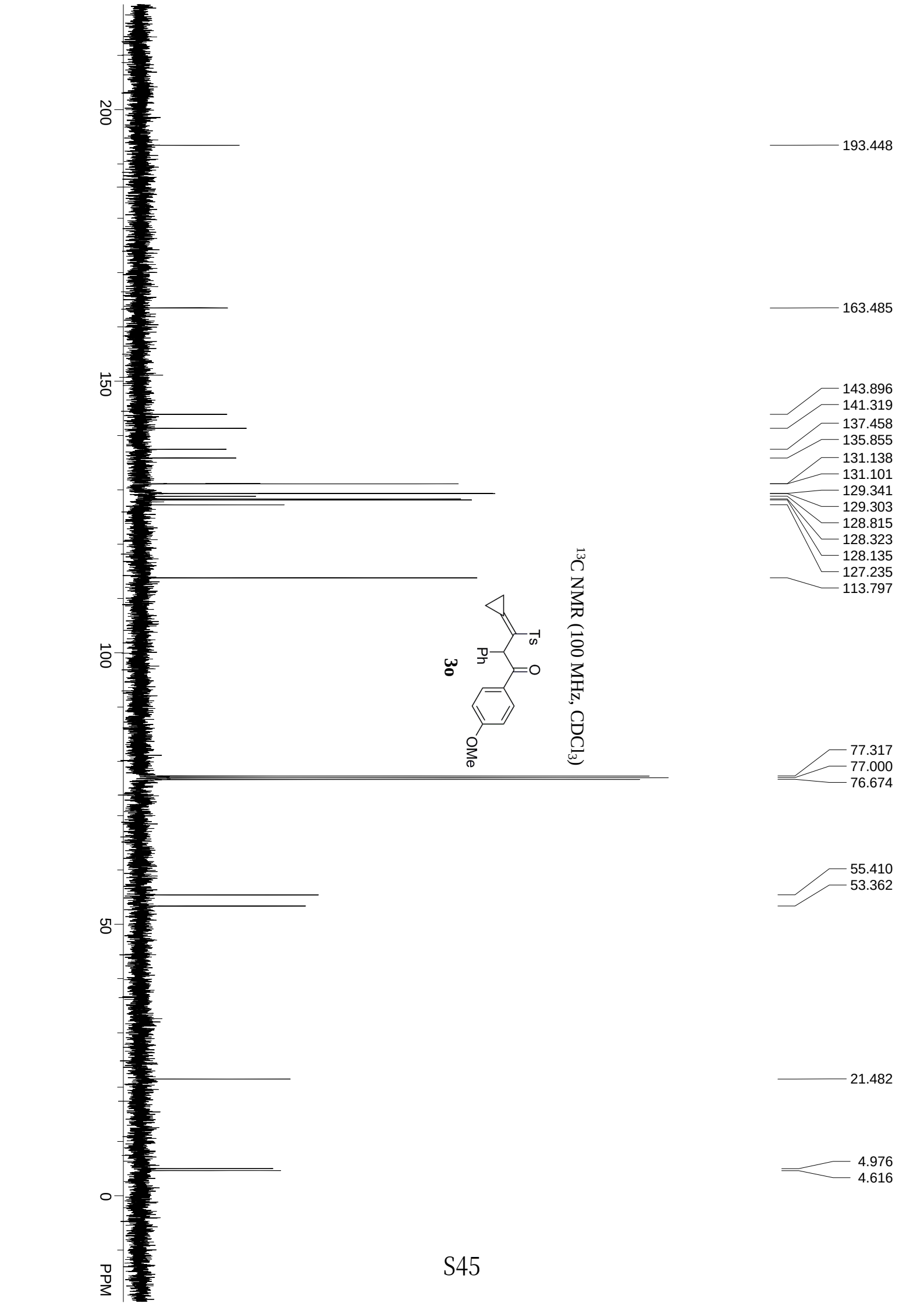


^{1}H NMR (400 MHz, $CDCl_3$)



3o

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128.135
127.235
113.797
77.317
77.000
76.674
55.410
53.362
21.482
4.976
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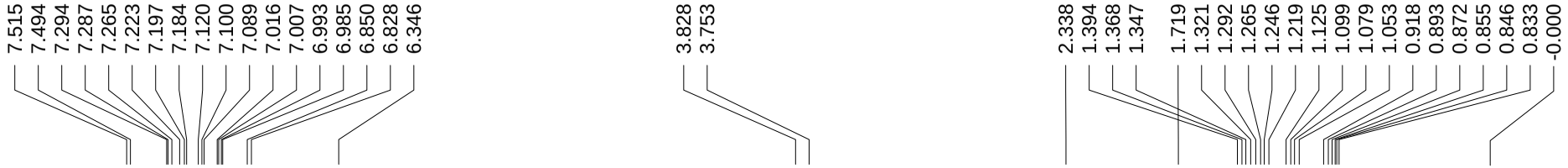
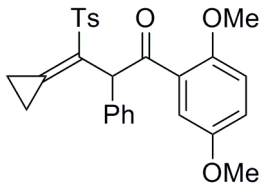
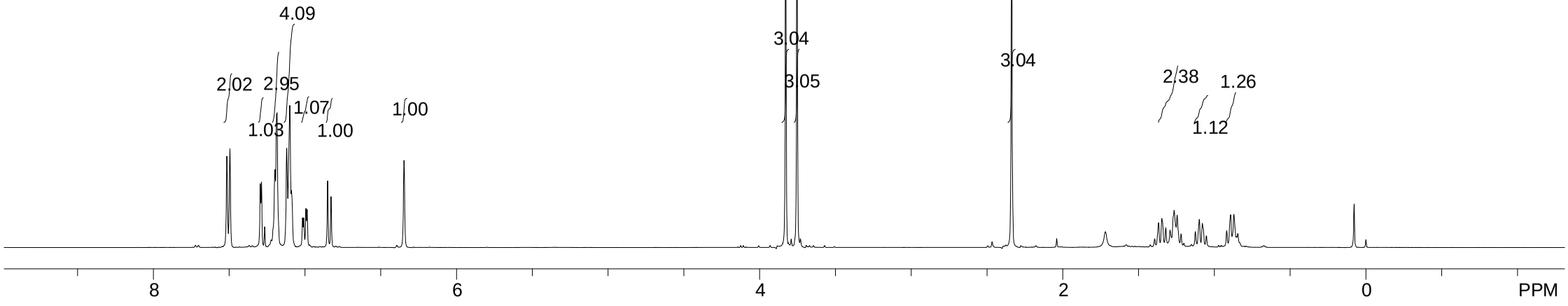
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
Ts
O
Ph
OMe
3o

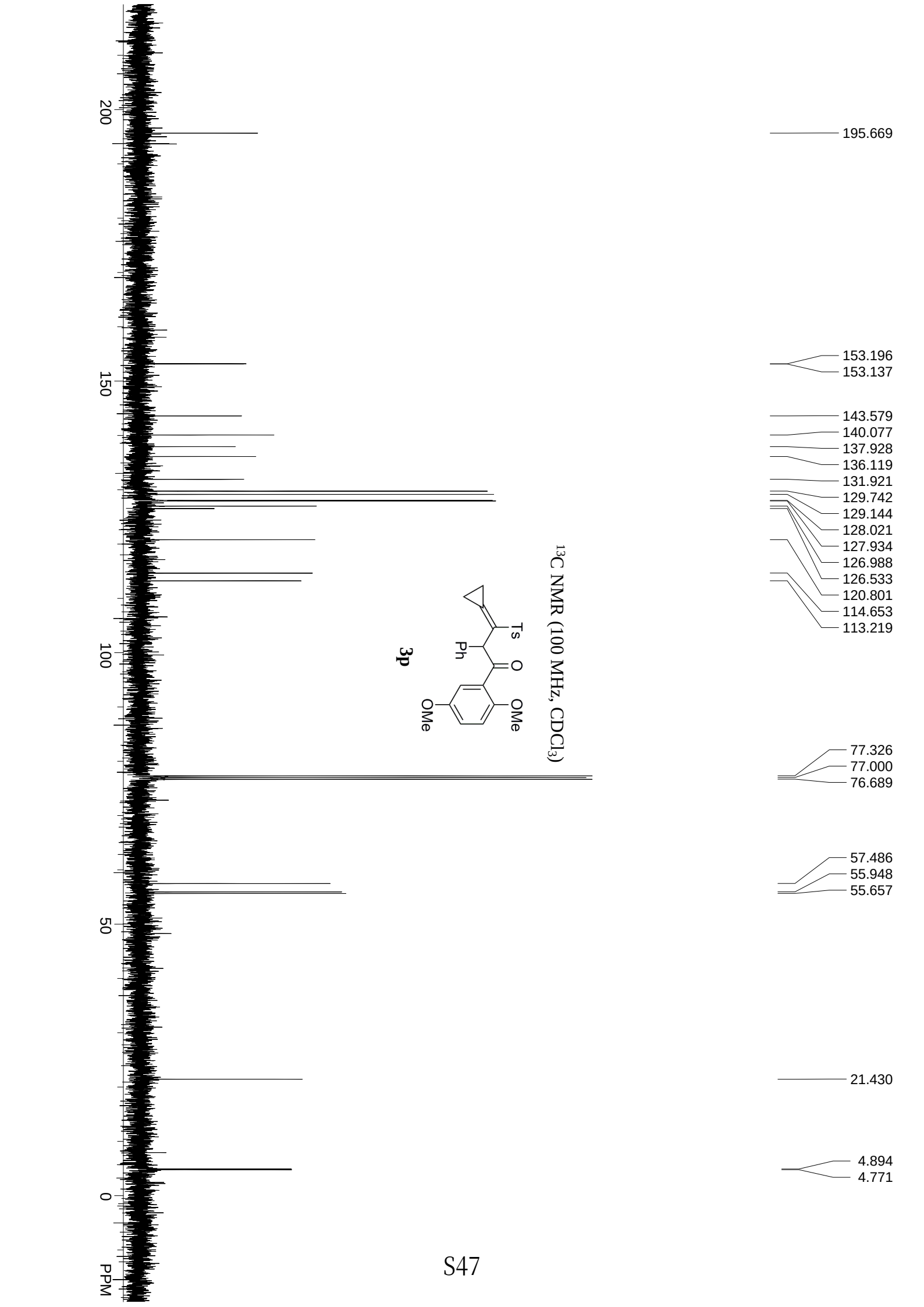


^{1}H NMR (400 MHz, $CDCl_3$)



3p




^{13}C NMR (100 MHz, $CDCl_3$)
3p
Ts
Ph
O
OMe
OMe
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137.928
136.119
131.921
129.742
129.144
128.021
127.934
126.988
126.533
120.801
114.653
113.219
77.326
77.000
76.689
57.486
55.948
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4.894
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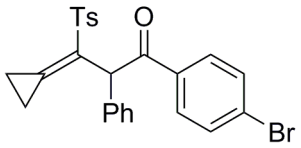
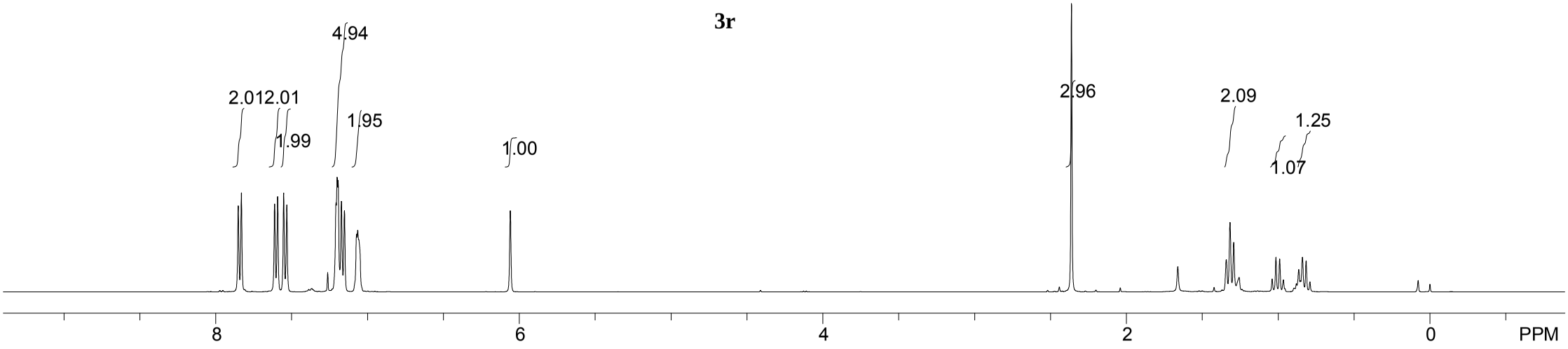
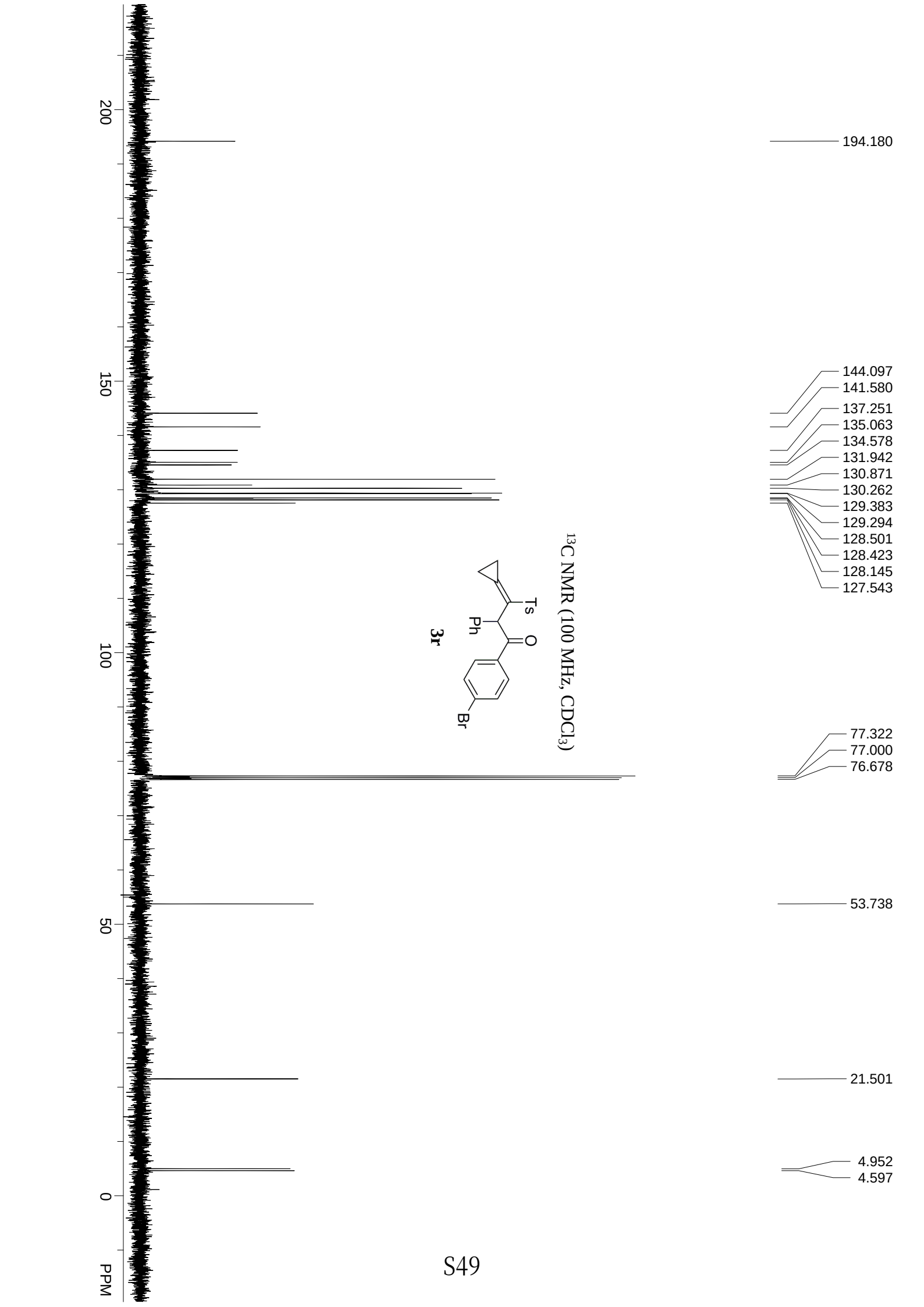
200
150
100
50
0
PPM

^{1}H NMR (400 MHz, $CDCl_3$)



3r

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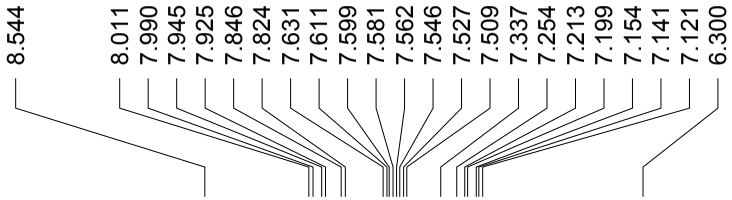
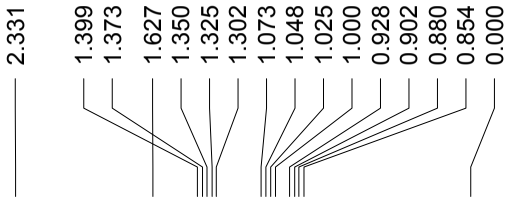
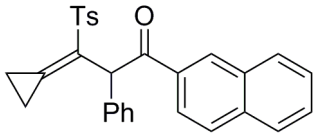
76.678
53.738
21.501
4.952
4.597
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
Ts
O
Ph
Br
3r

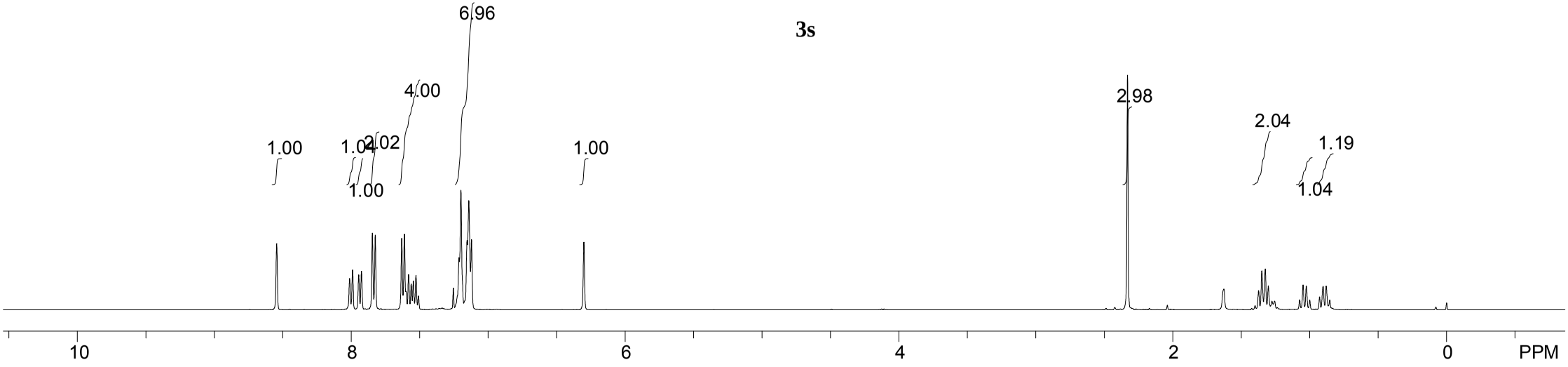


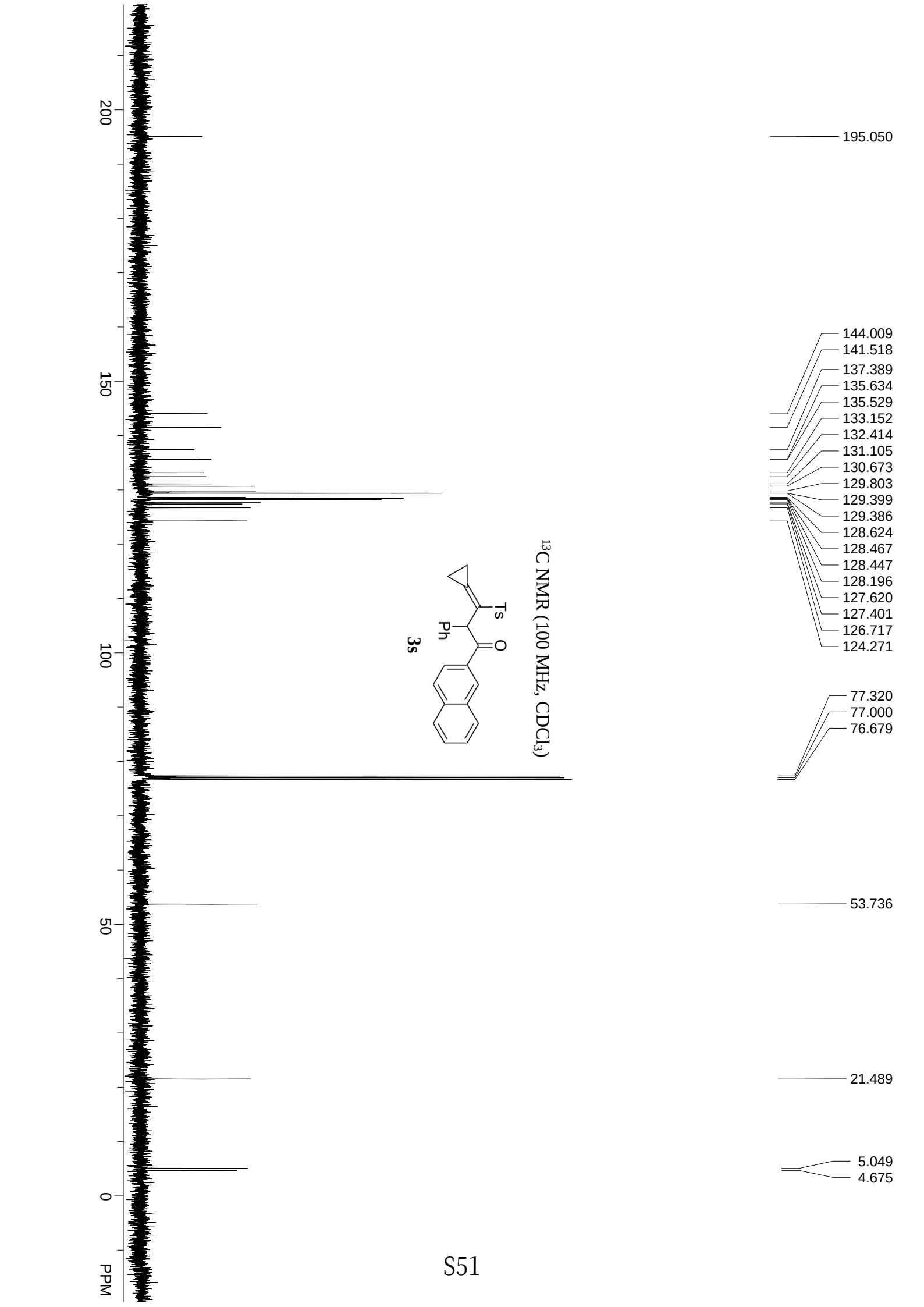


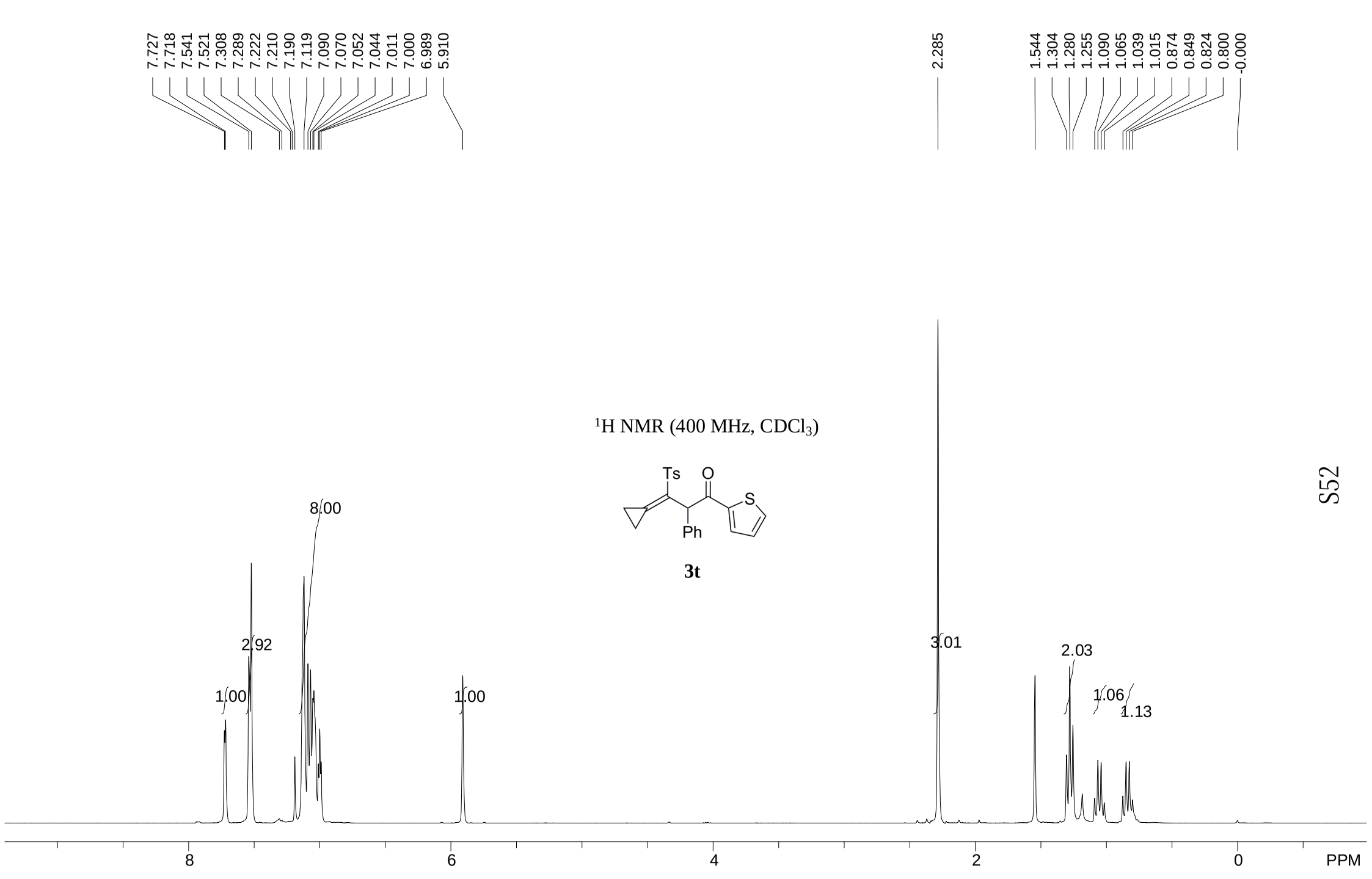
^{1}H NMR (400 MHz, $CDCl_3$)

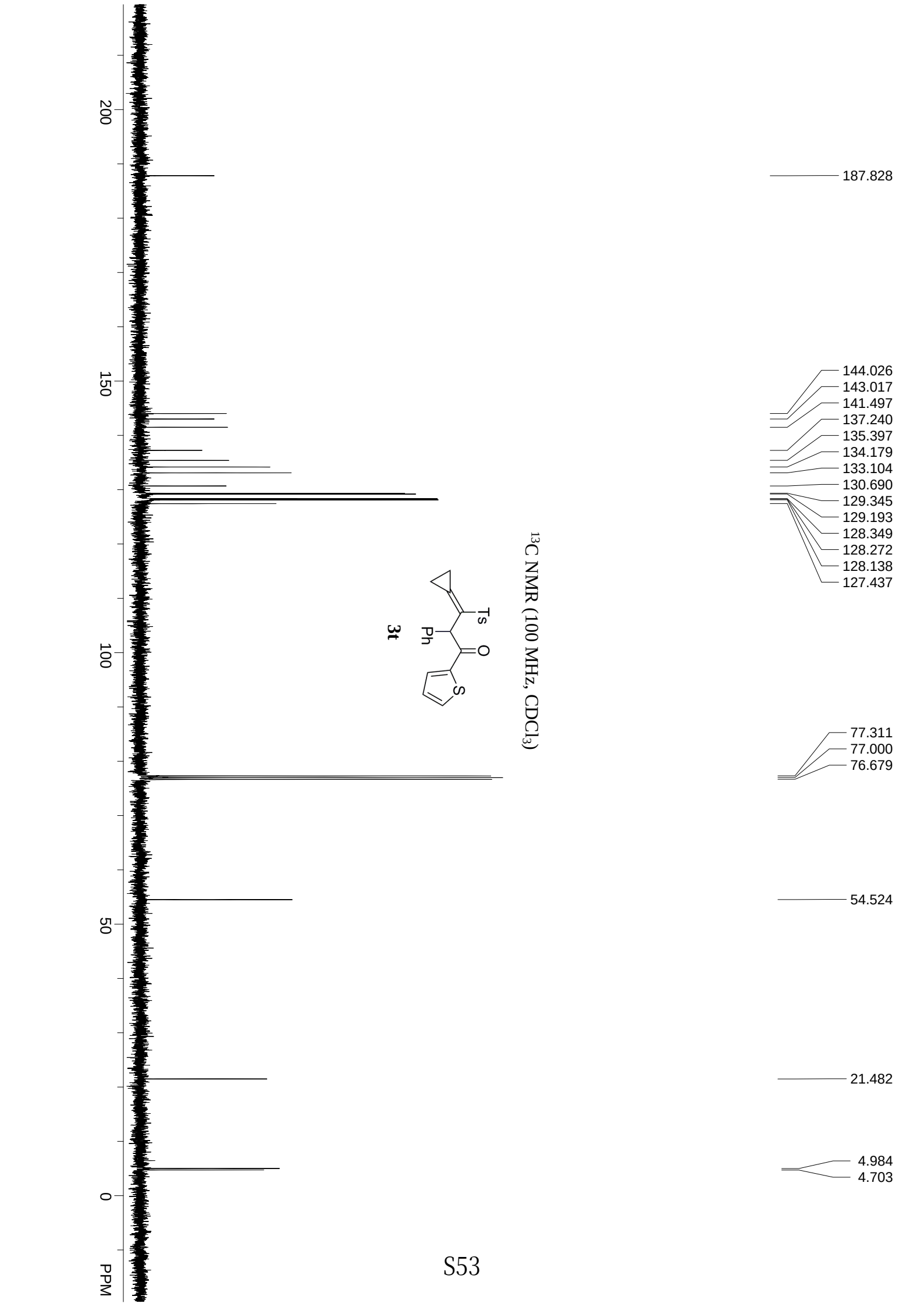


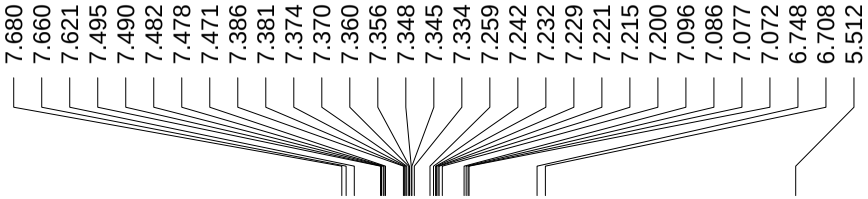
3s

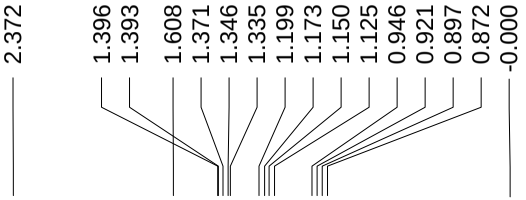



200
150
100
50
0
PPM
195.050
144.009
141.518
137.389
135.634
135.529
133.152
132.414
131.105
130.673
129.803
129.399
129.386
128.624
128.467
128.447
128.196
127.620
127.401
126.717
124.271
77.320
77.000
76.679
53.736
21.489
5.049
4.675
Ts
O
Ph
3s
^{13}C NMR (100 MHz, CDCl$_3$)

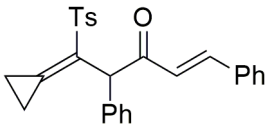

7.727
7.718
7.541
7.521
7.308
7.289
7.222
7.210
7.190
7.119
7.090
7.070
7.052
7.044
7.011
7.000
6.989
5.910
2.285
1.544
1.304
1.280
1.255
1.090
1.065
1.039
1.015
0.874
0.849
0.824
0.800
-0.000
^{1}H NMR (400 MHz, CDCl$_3$)
Ts
O
S
Ph
3t
8.00
2.92
1.00
1.00
3.01
2.03
1.06
1.13
8
6
4
2
0
PPM


200
150
100
50
0
PPM
187.828
144.026
143.017
141.497
137.240
135.397
134.179
133.104
130.690
129.345
129.193
128.349
128.272
128.138
127.437
77.311
77.000
76.679
54.524
21.482
4.984
4.703
Ts
O
Ph
S
3t
^{13}C NMR (100 MHz, $CDCl_3$)

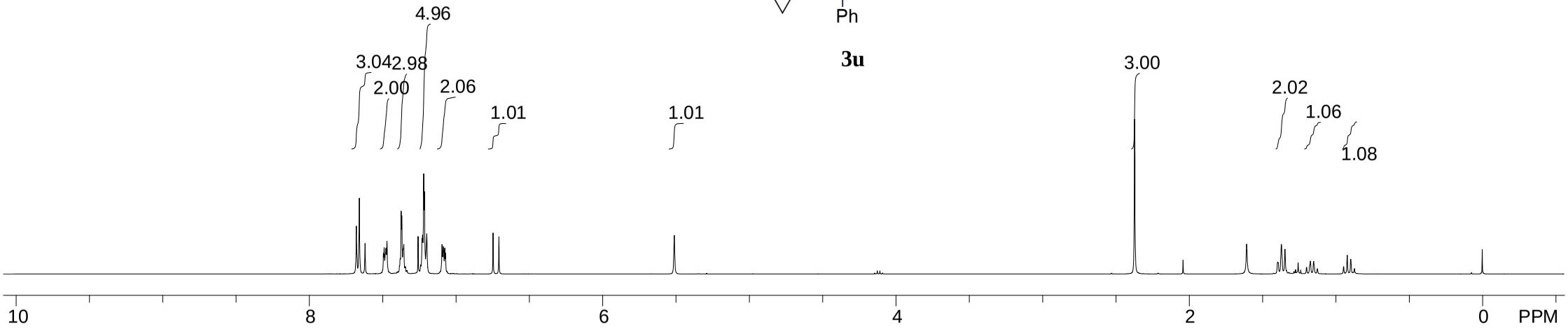


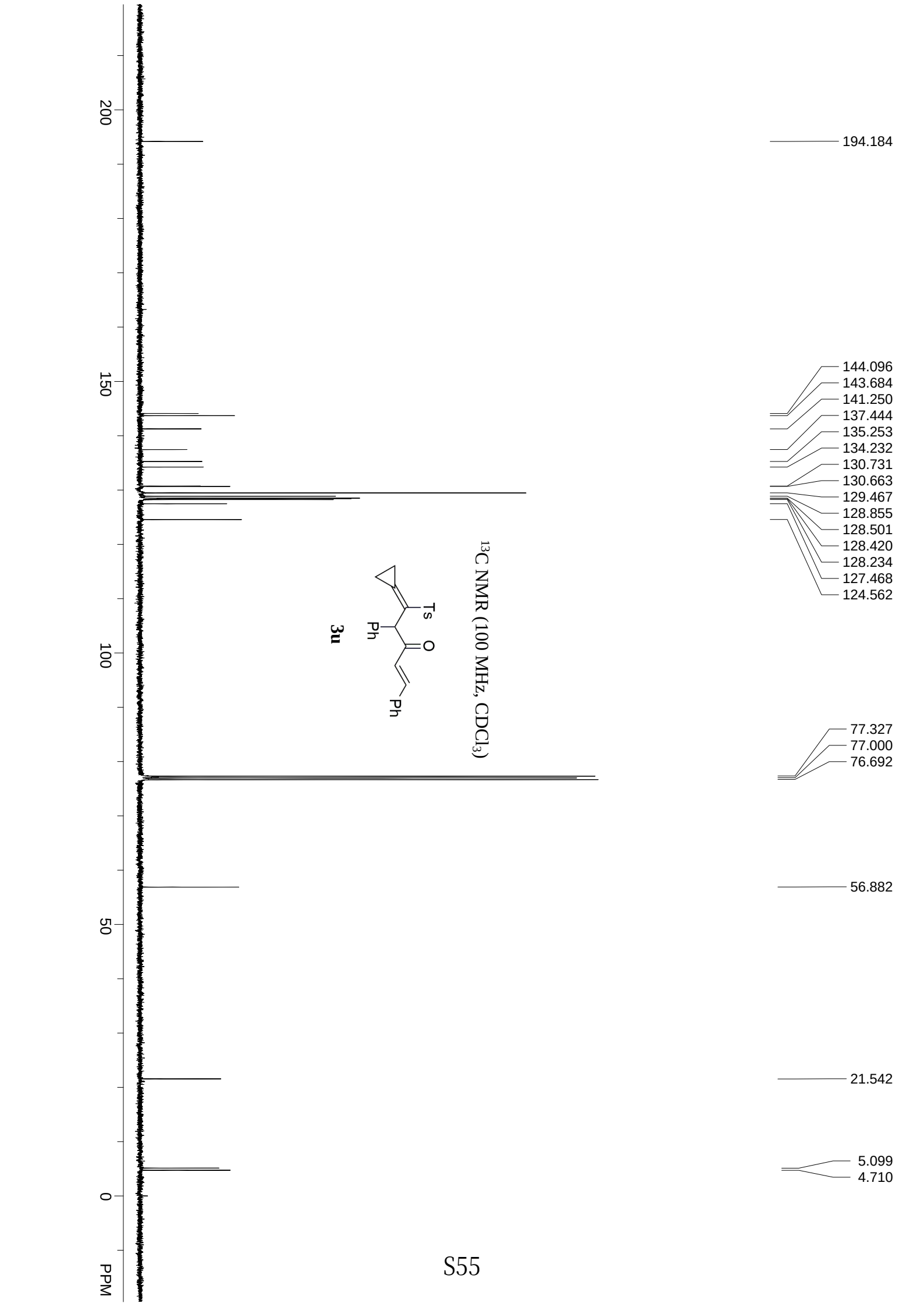


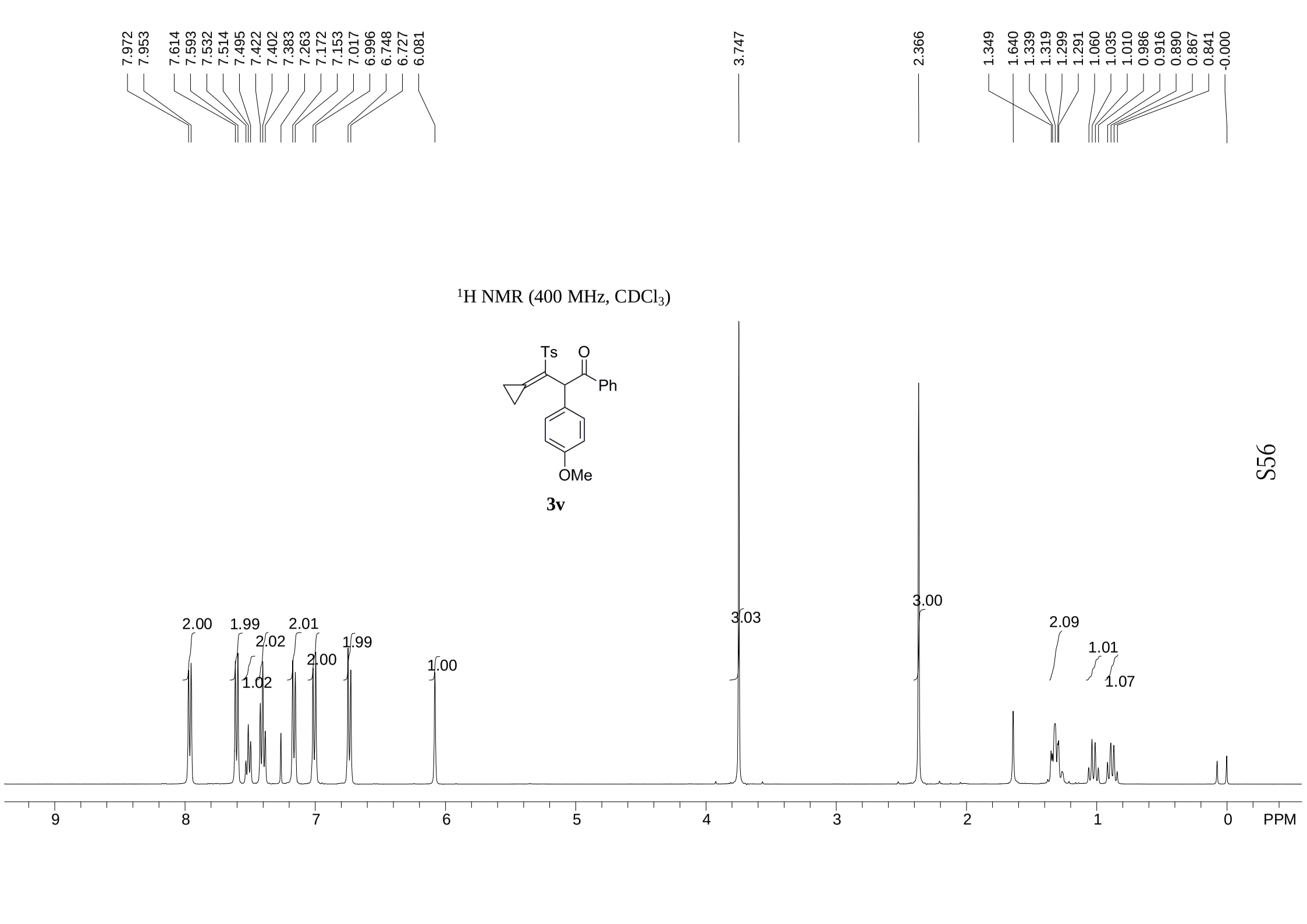
^{1}H NMR (400 MHz, $CDCl_3$)

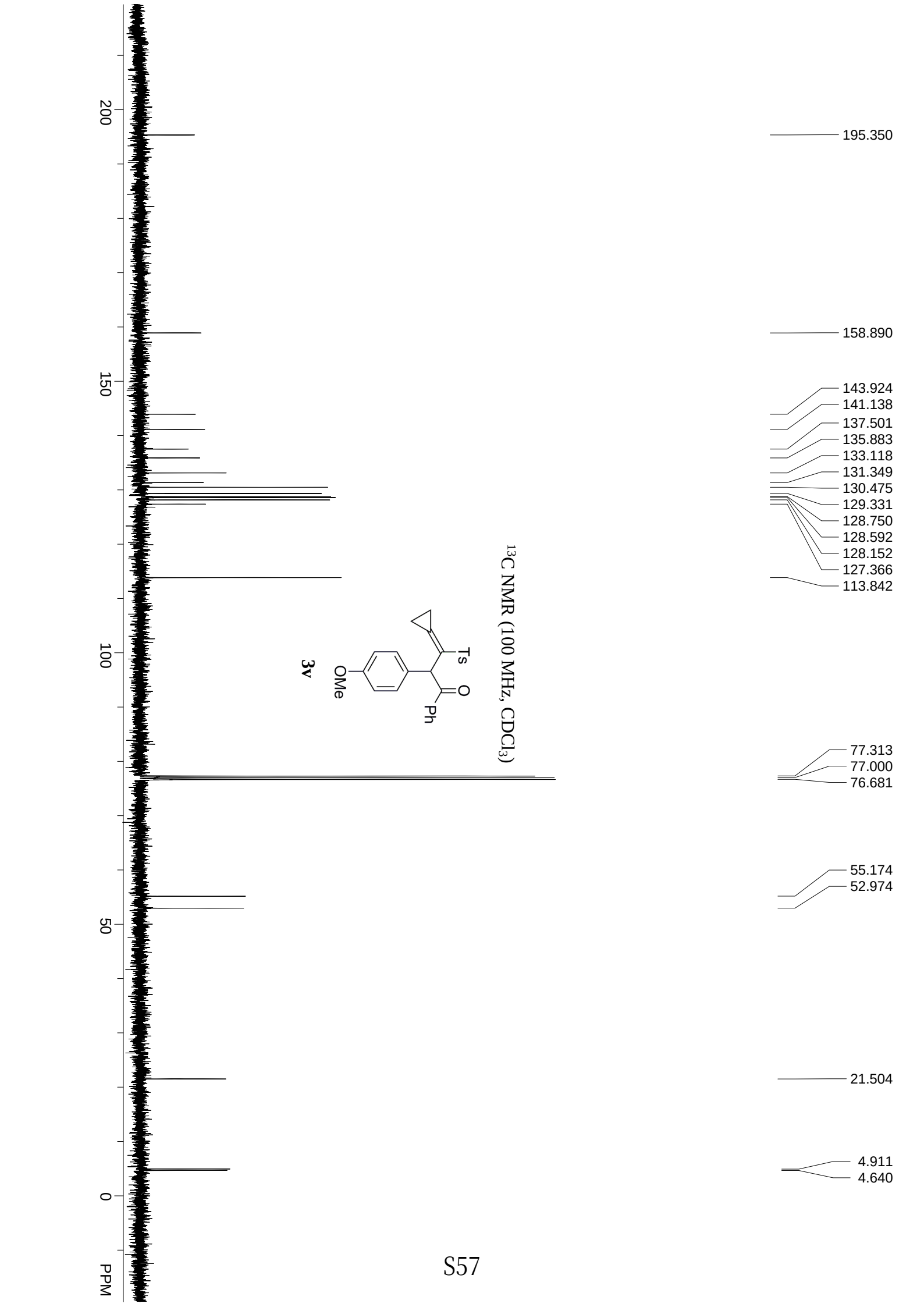


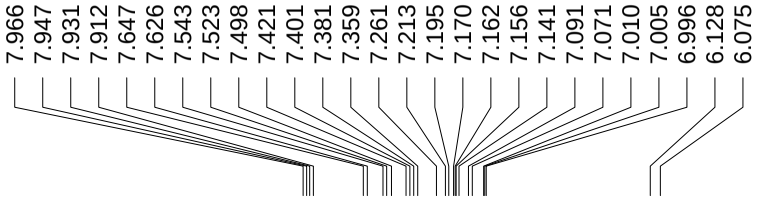
3u

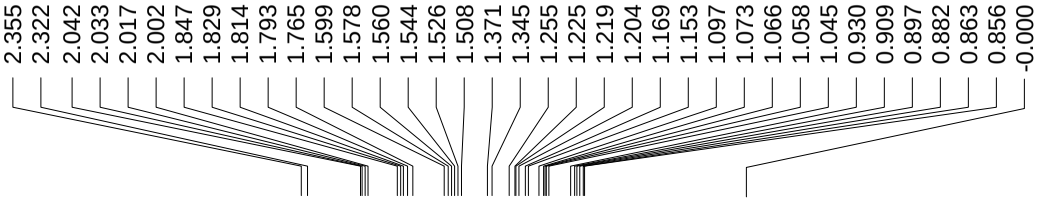



194.184
144.096
143.684
141.250
137.444
135.253
134.232
130.731
130.663
129.467
128.855
128.501
128.420
128.234
127.468
124.562
77.327
77.000
76.692
56.882
21.542
5.099
4.710
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
3u
Ts
O
Ph
Ph

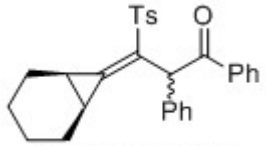

7.972
7.953
7.614
7.593
7.532
7.514
7.495
7.422
7.402
7.383
7.263
7.172
7.153
7.017
6.996
6.748
6.727
6.081
3.747
2.366
1.349
1.640
1.339
1.319
1.299
1.291
1.060
1.035
1.010
0.986
0.916
0.890
0.867
0.841
-0.000
^{1}H NMR (400 MHz, $CDCl_3$)
Ts
O
Ph
OMe
3v
2.00
1.99
2.02
1.02
2.01
2.00
1.99
1.00
3.03
3.00
2.09
1.01
1.07
9
8
7
6
5
4
3
2
1
0
PPM


^{13}C NMR (100 MHz, CDCl$_3$)
3v
OMe
Ts
O
Ph
195.350
158.890
143.924
141.138
137.501
135.883
133.118
131.349
130.475
129.331
128.750
128.592
128.152
127.366
113.842
77.313
77.000
76.681
55.174
52.974
21.504
4.911
4.640
200
150
100
50
0
PPM

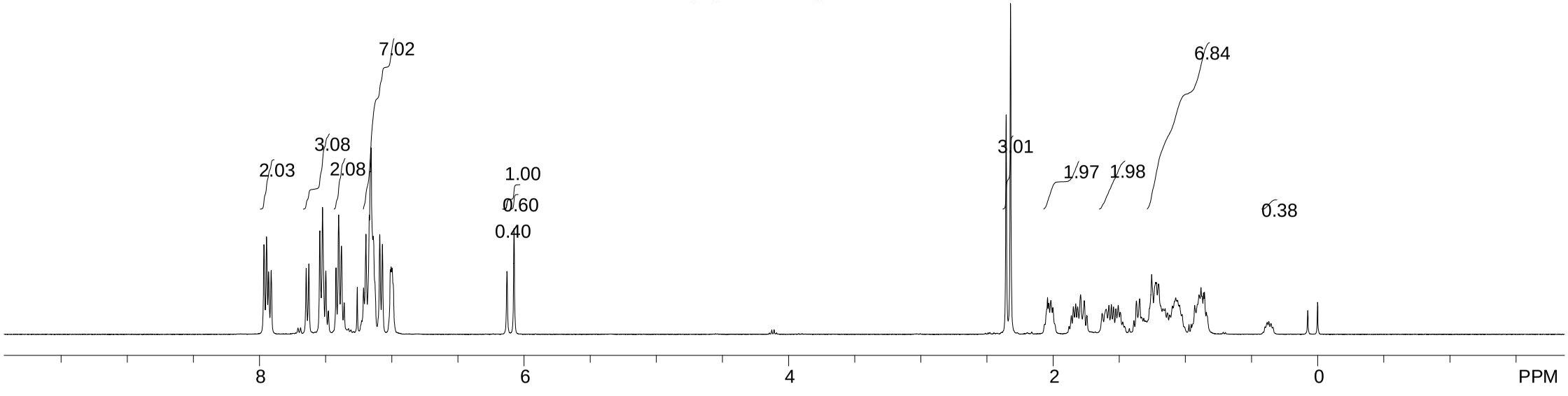




^{1}H NMR (400 MHz, $CDCl_3$)

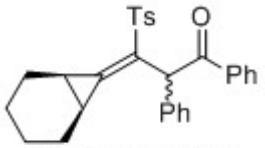


3y, (isomers 2:3)

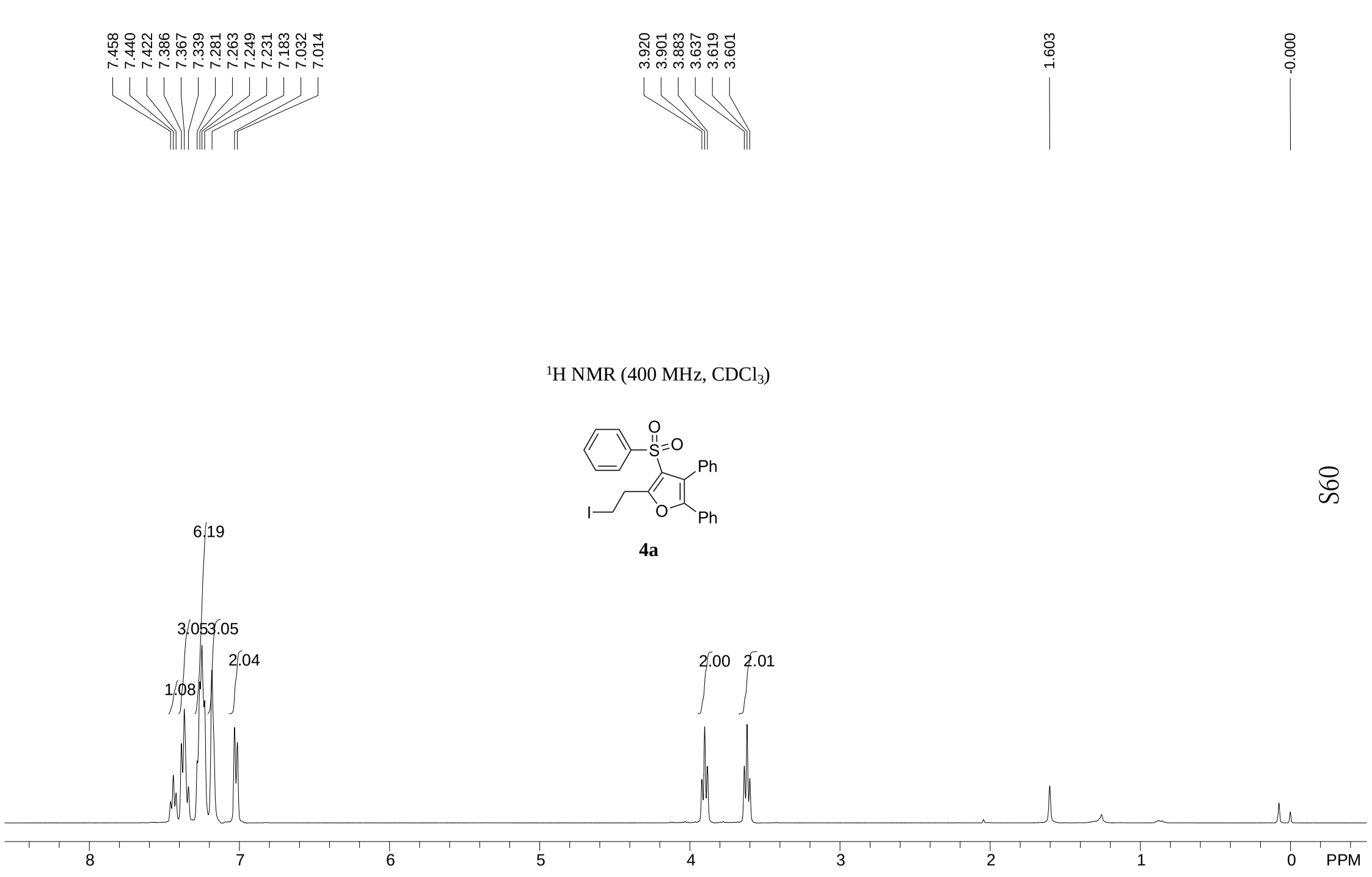


195.450
195.188
152.269
152.137
143.830
143.799
137.477
137.406
136.380
136.035
135.647
135.403
133.219
133.073
131.064
130.973
129.509
129.363
129.253
129.011
128.926
128.663
128.569
128.265
128.218
127.991
127.400
127.139
77.323
77.000
76.687
54.136
53.772
22.311
22.041
21.756
21.511
21.473
21.145
21.105
21.034
21.023
20.961
16.025
15.855
15.376
15.027

^{13}C NMR (100 MHz, $CDCl_3$)

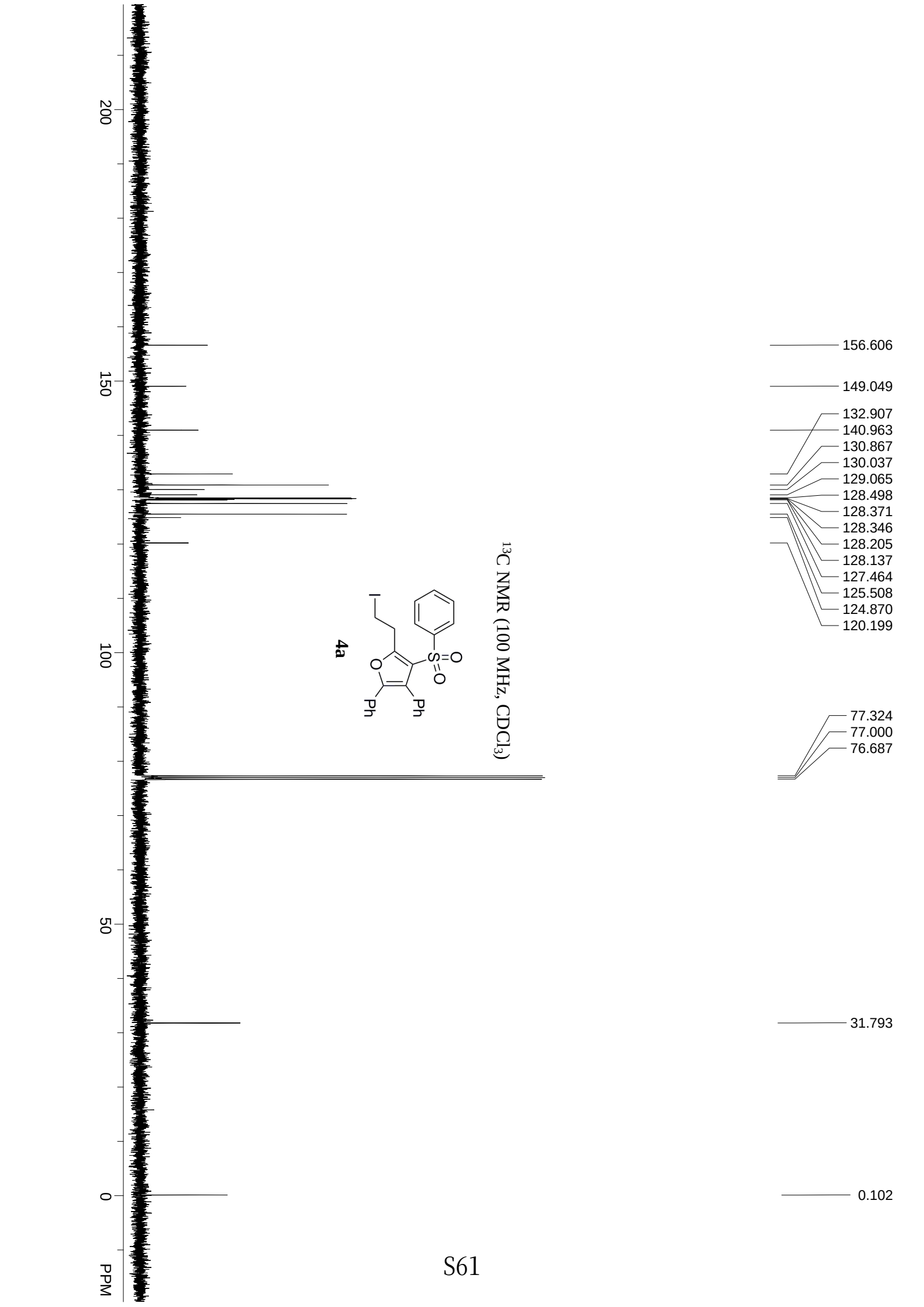


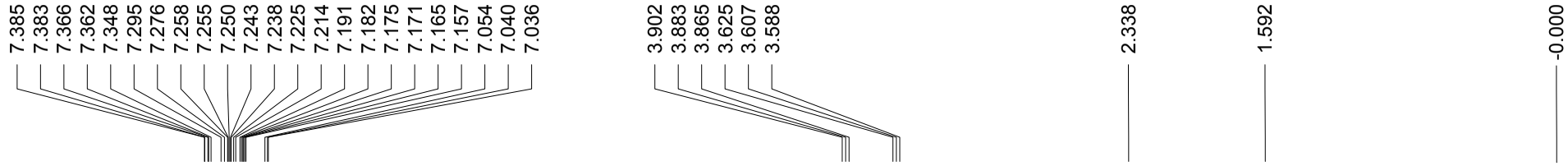
3y, (isomers 2:3)



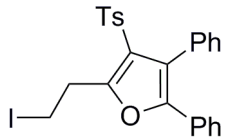
^{1}H NMR (400 MHz, $CDCl_3$)

4a

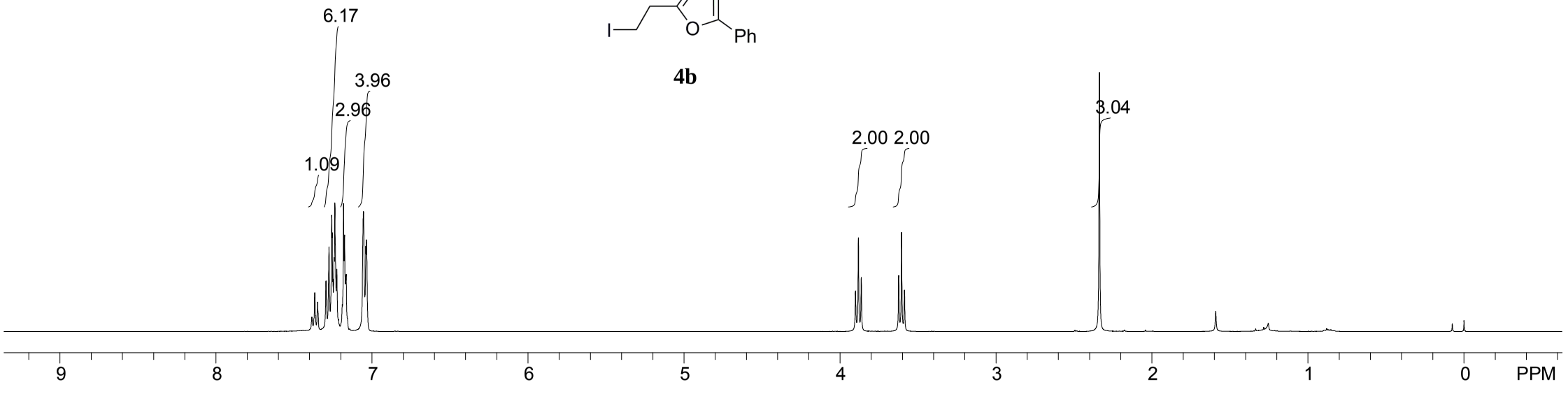

^{13}C NMR (100 MHz, CDCl$_3$)
4a
I
O
S
O
O
Ph
Ph
200
150
100
50
0
PPM
156.606
149.049
132.907
140.963
130.867
130.037
129.065
128.498
128.371
128.346
128.205
128.137
127.464
125.508
124.870
120.199
77.324
77.000
76.687
31.793
0.102

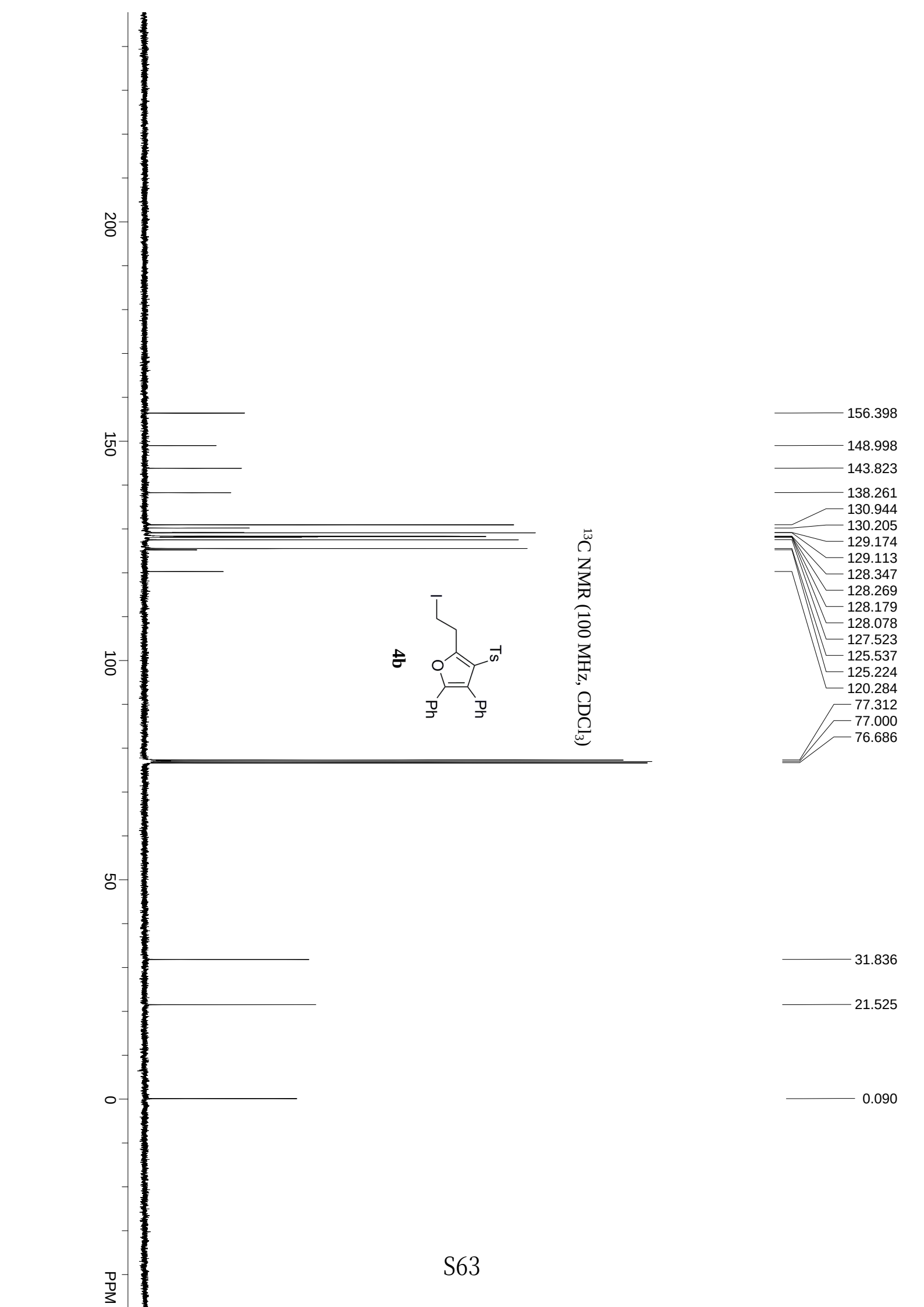


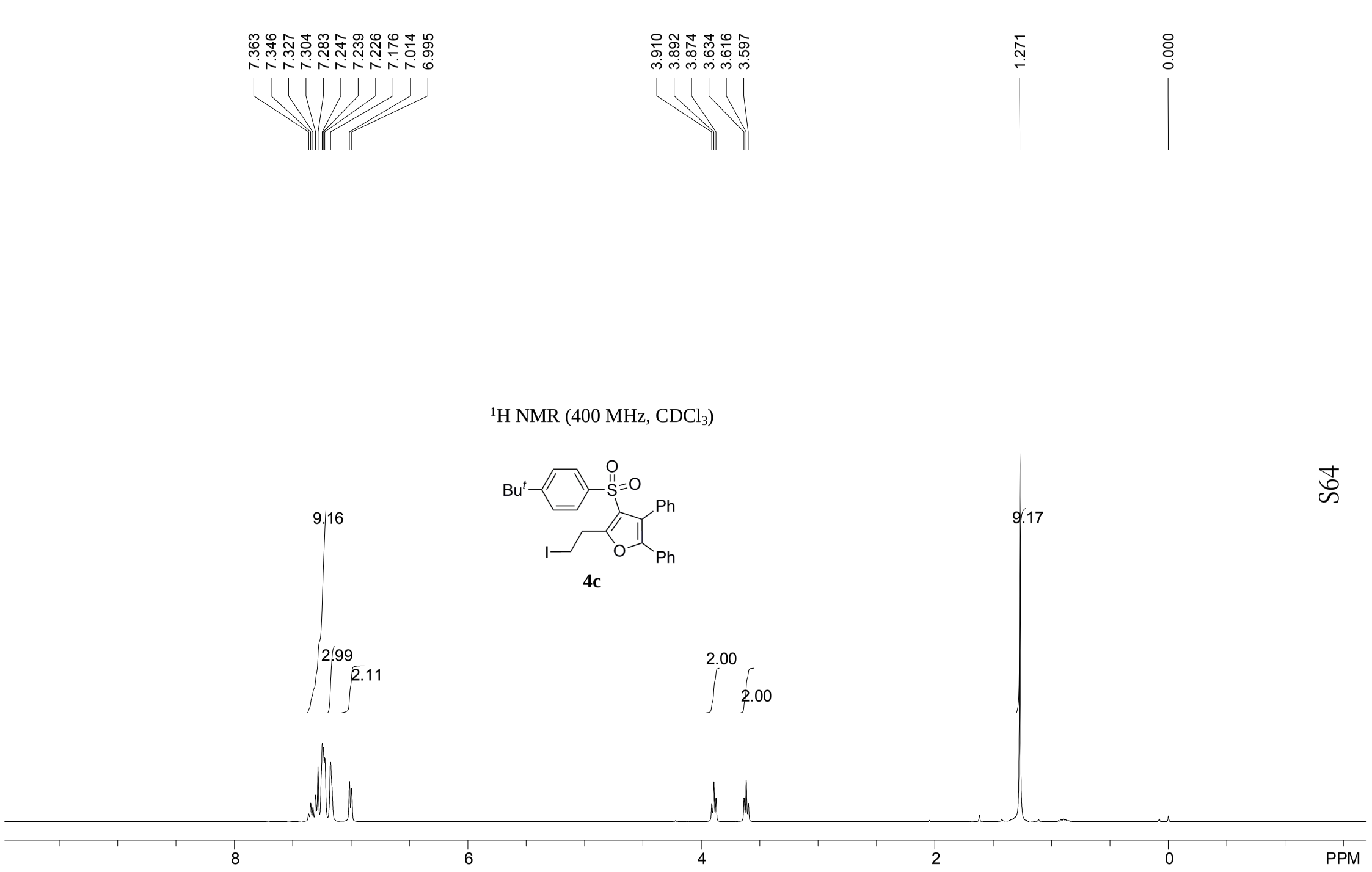
^{1}H NMR (400 MHz, $CDCl_3$)



4b

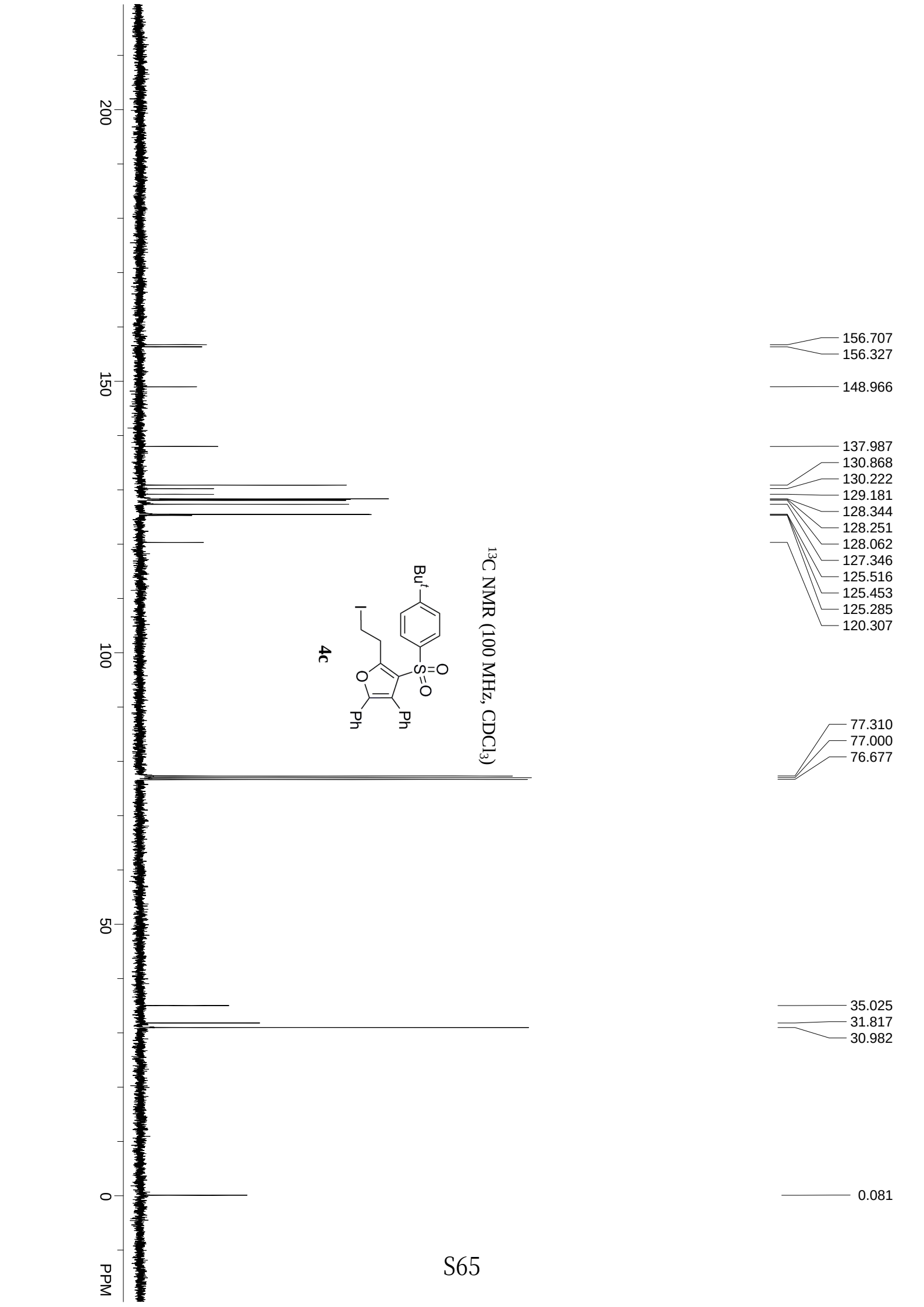


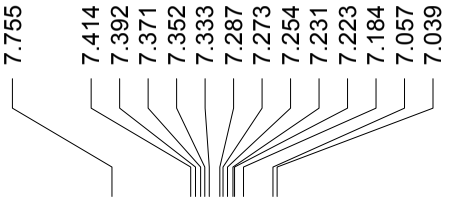

^{13}C NMR (100 MHz, CDCl$_3$)
4b
I
O
Ts
Ph
Ph
156.398
148.998
143.823
138.261
130.944
130.205
129.174
129.113
128.347
128.269
128.179
128.078
127.523
125.537
125.224
120.284
77.312
77.000
76.686
31.836
21.525
0.090
200
150
100
50
0
PPM

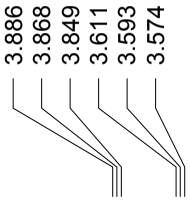


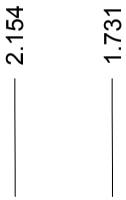
^{1}H NMR (400 MHz, $CDCl_3$)

4c

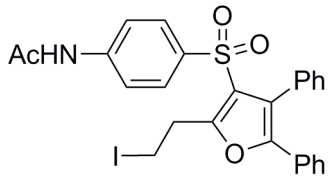

156.707
156.327
148.966
137.987
130.868
130.222
129.181
128.344
128.251
128.062
127.346
125.516
125.453
125.285
120.307
77.310
77.000
76.677
35.025
31.817
30.982
0.081
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4c
Bu^t
I
O
S
O
O
Ph
Ph



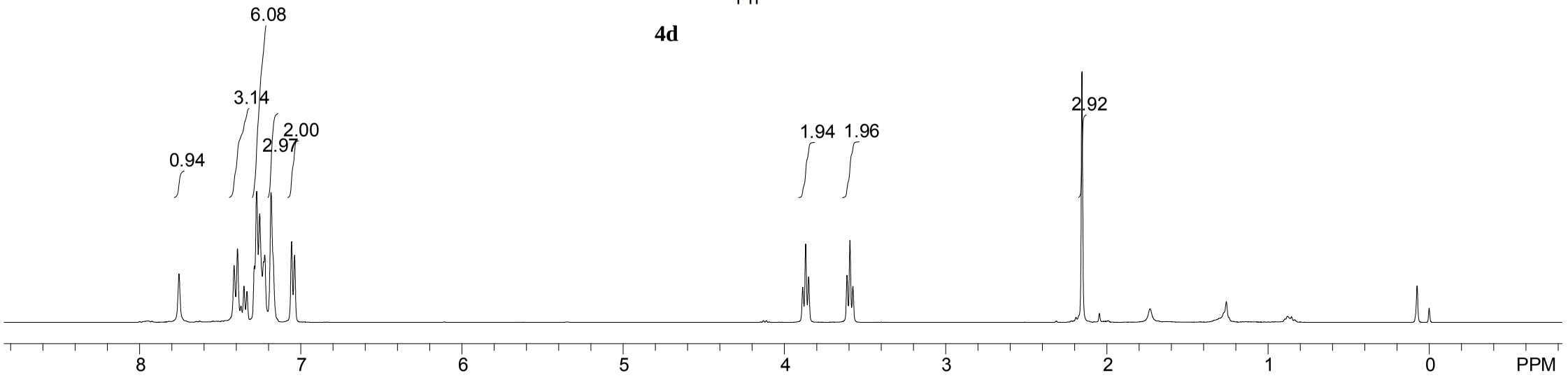


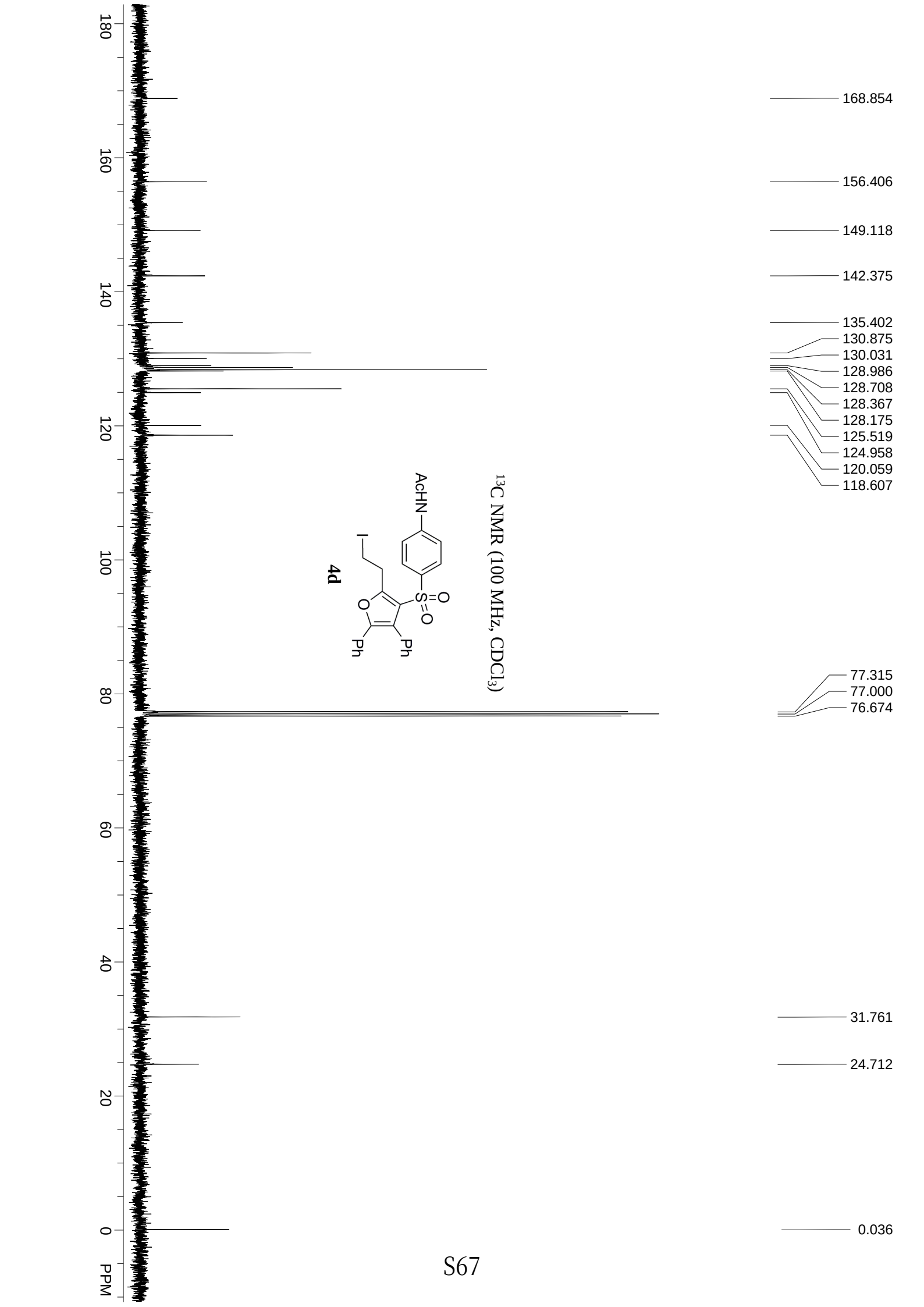


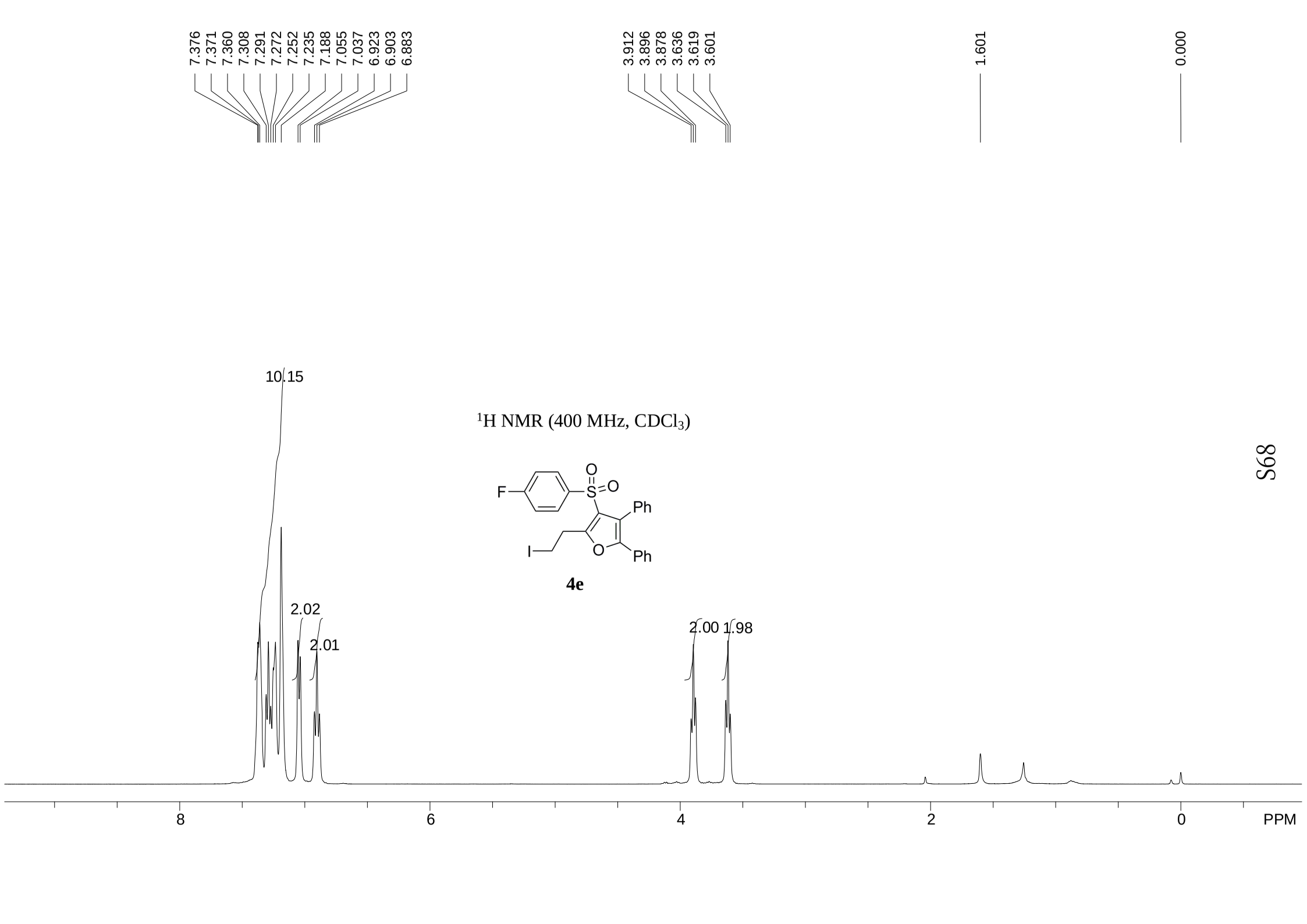
^{1}H NMR (400 MHz, $CDCl_3$)



4d

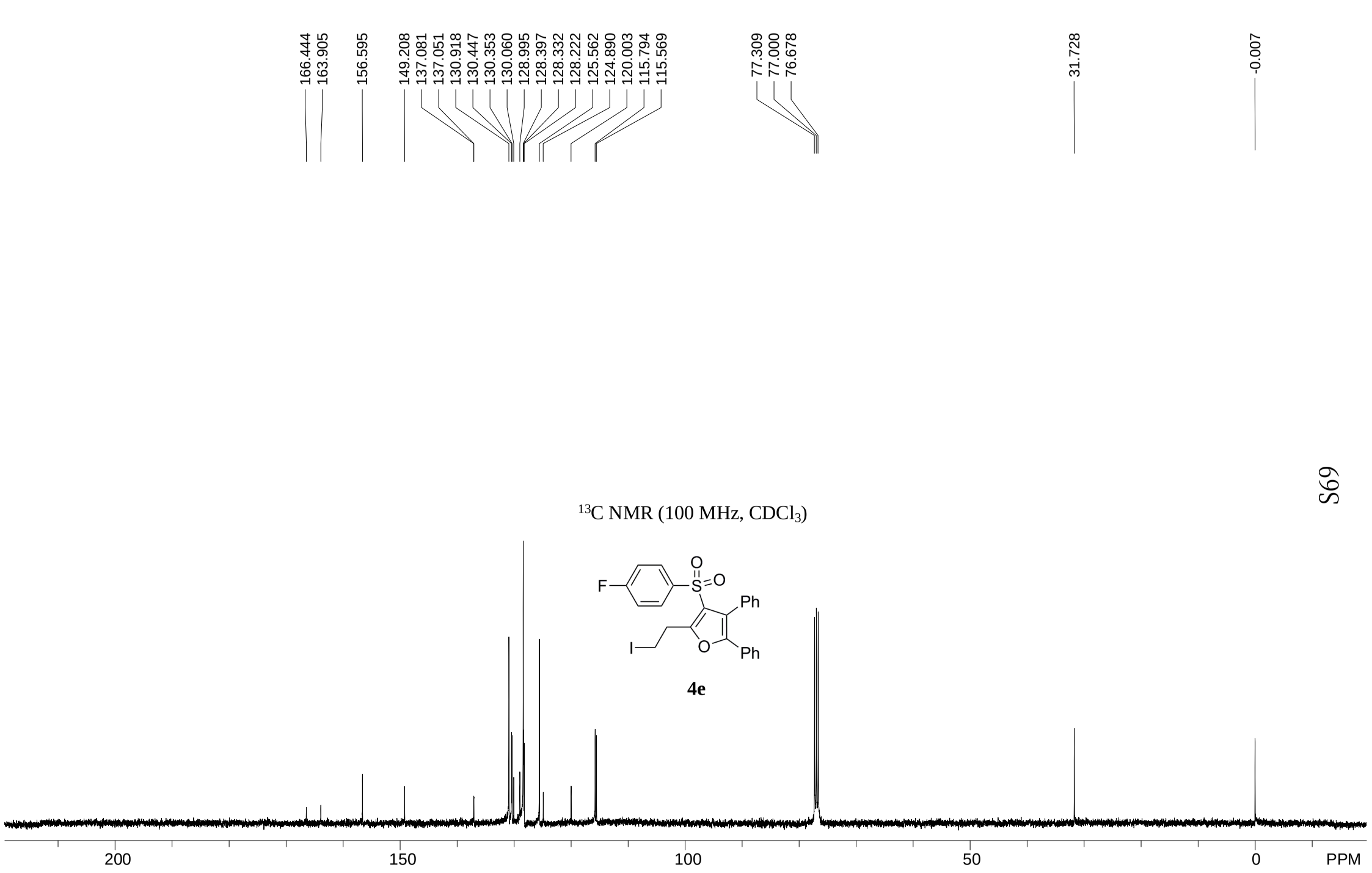



180
160
140
120
100
80
60
40
20
0
PPM
168.854
156.406
149.118
142.375
135.402
130.875
130.031
128.986
128.708
128.367
128.175
125.519
124.958
120.059
118.607
77.315
77.000
76.674
31.761
24.712
0.036
AcHN
I
O
S
O
O
Ph
Ph
4d
13C NMR (100 MHz, CDCl3)



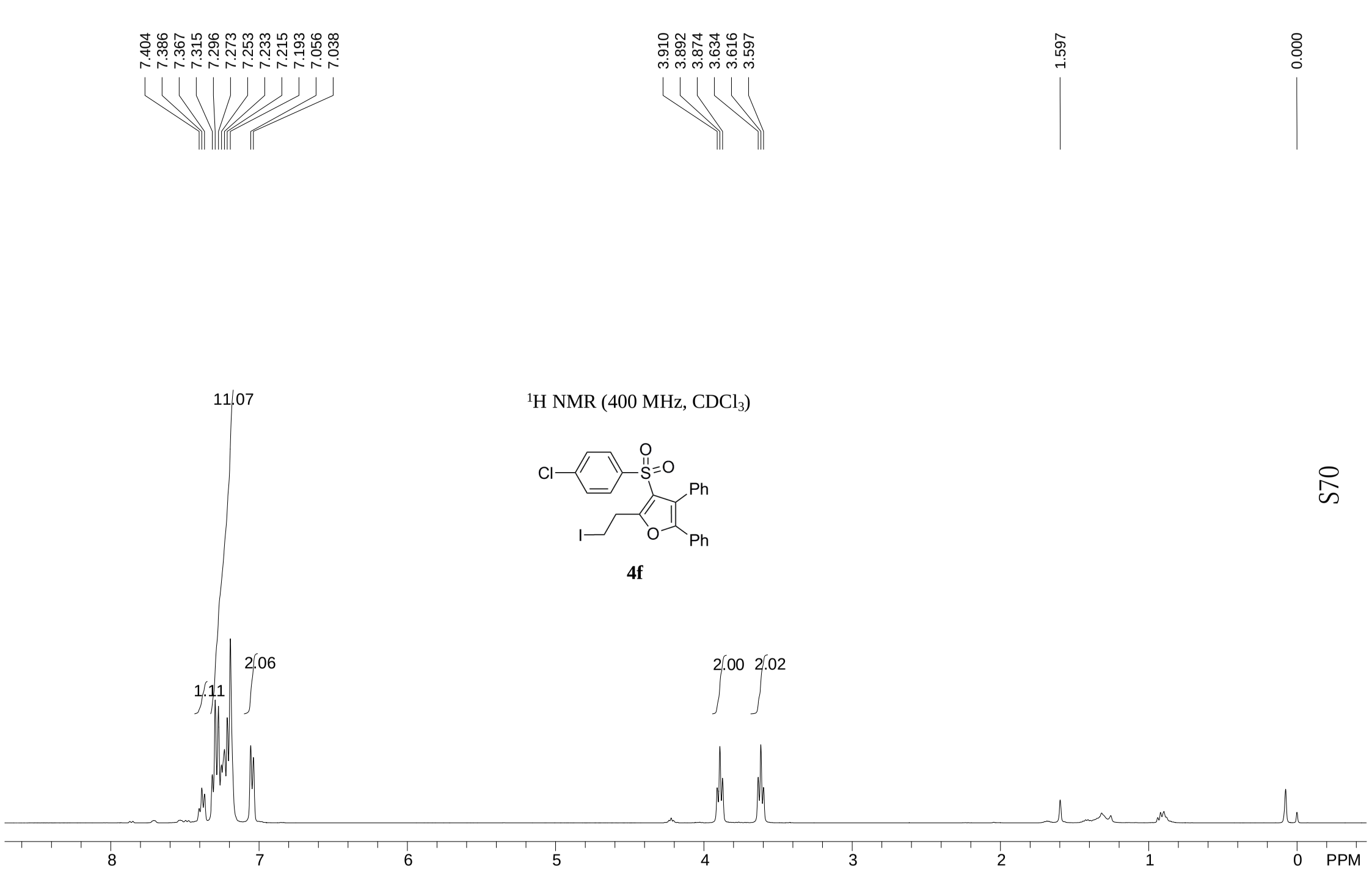
^{1}H NMR (400 MHz, $CDCl_3$)

4e



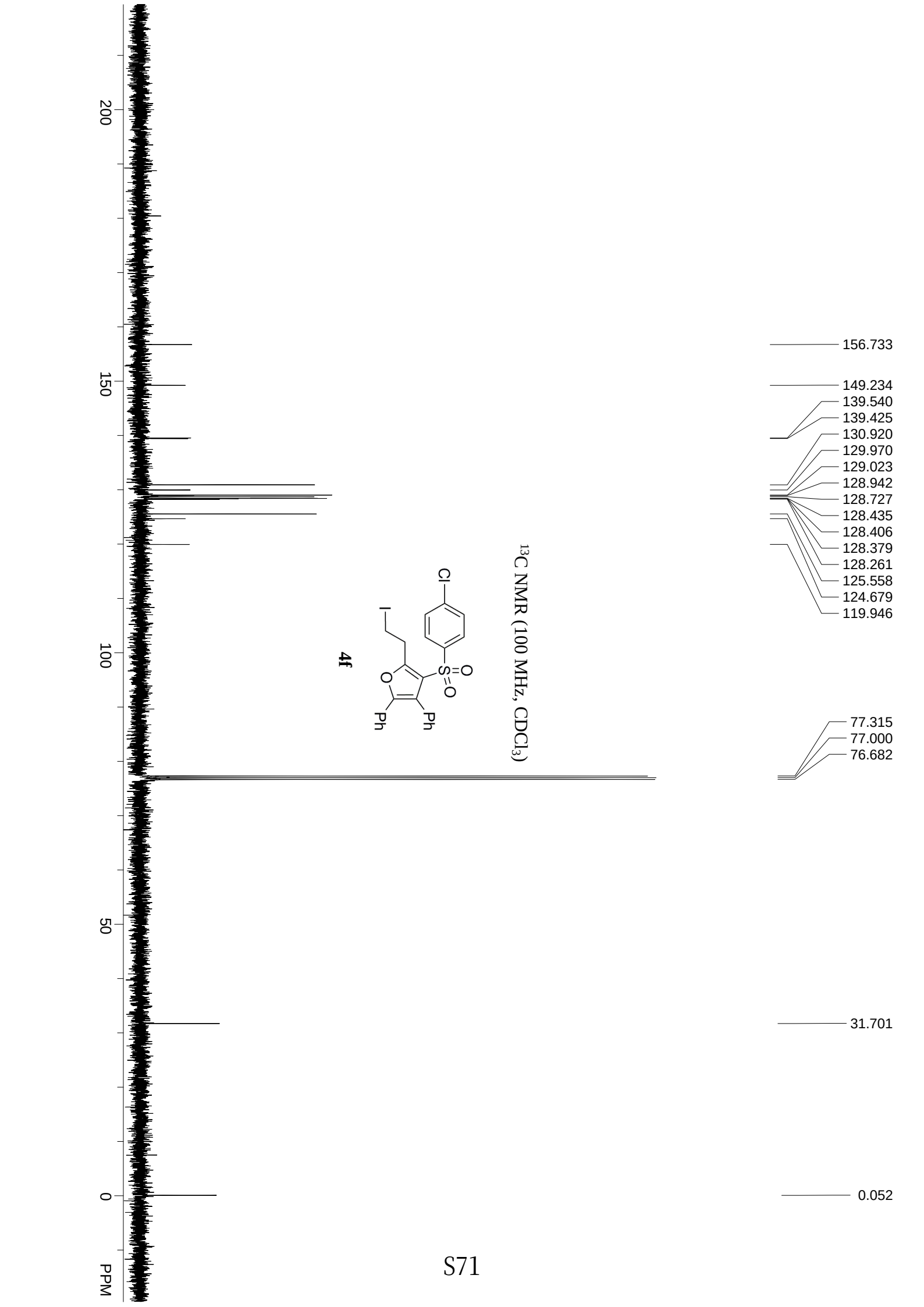
^{13}C NMR (100 MHz, $CDCl_3$)

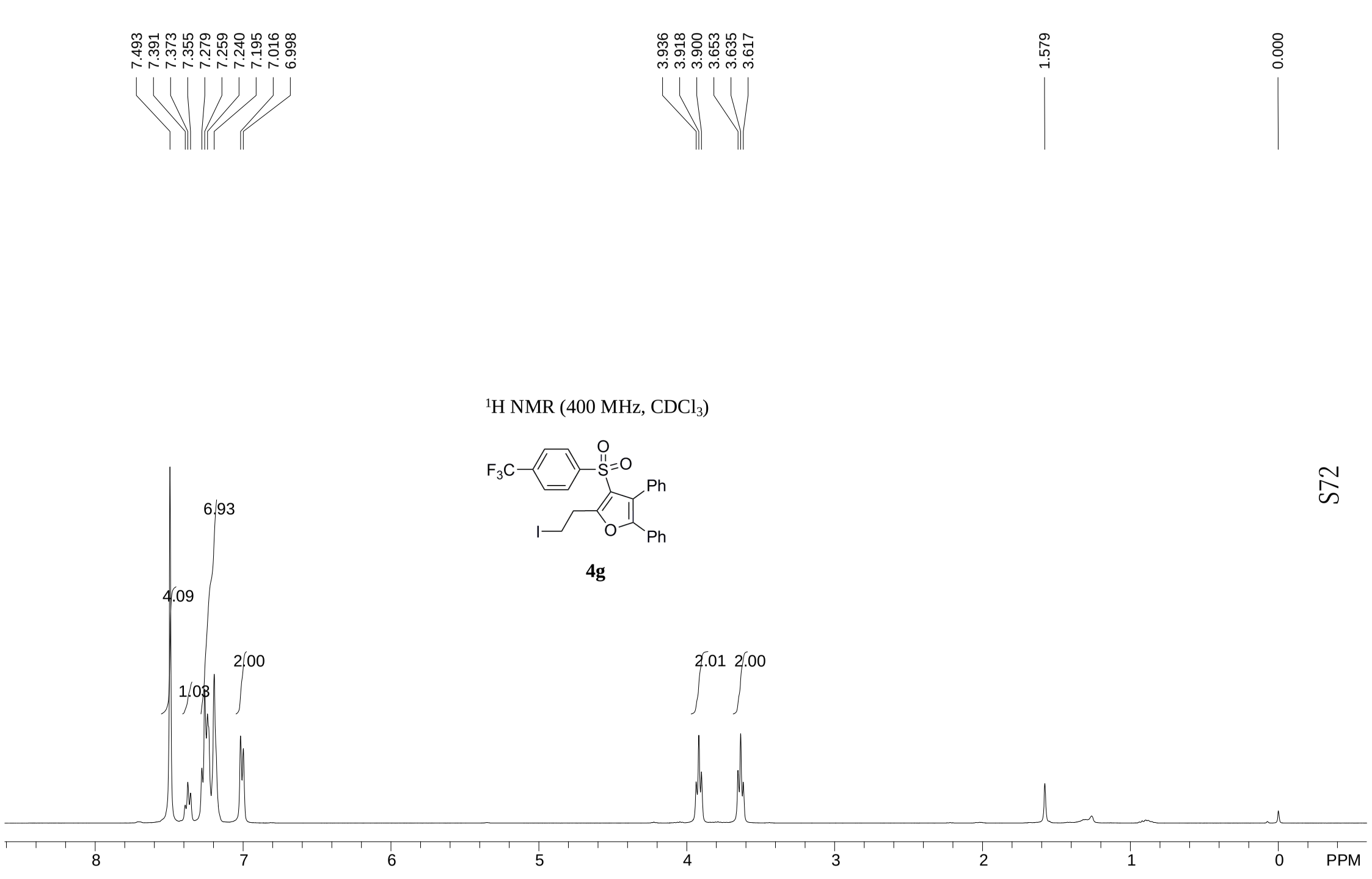
4e

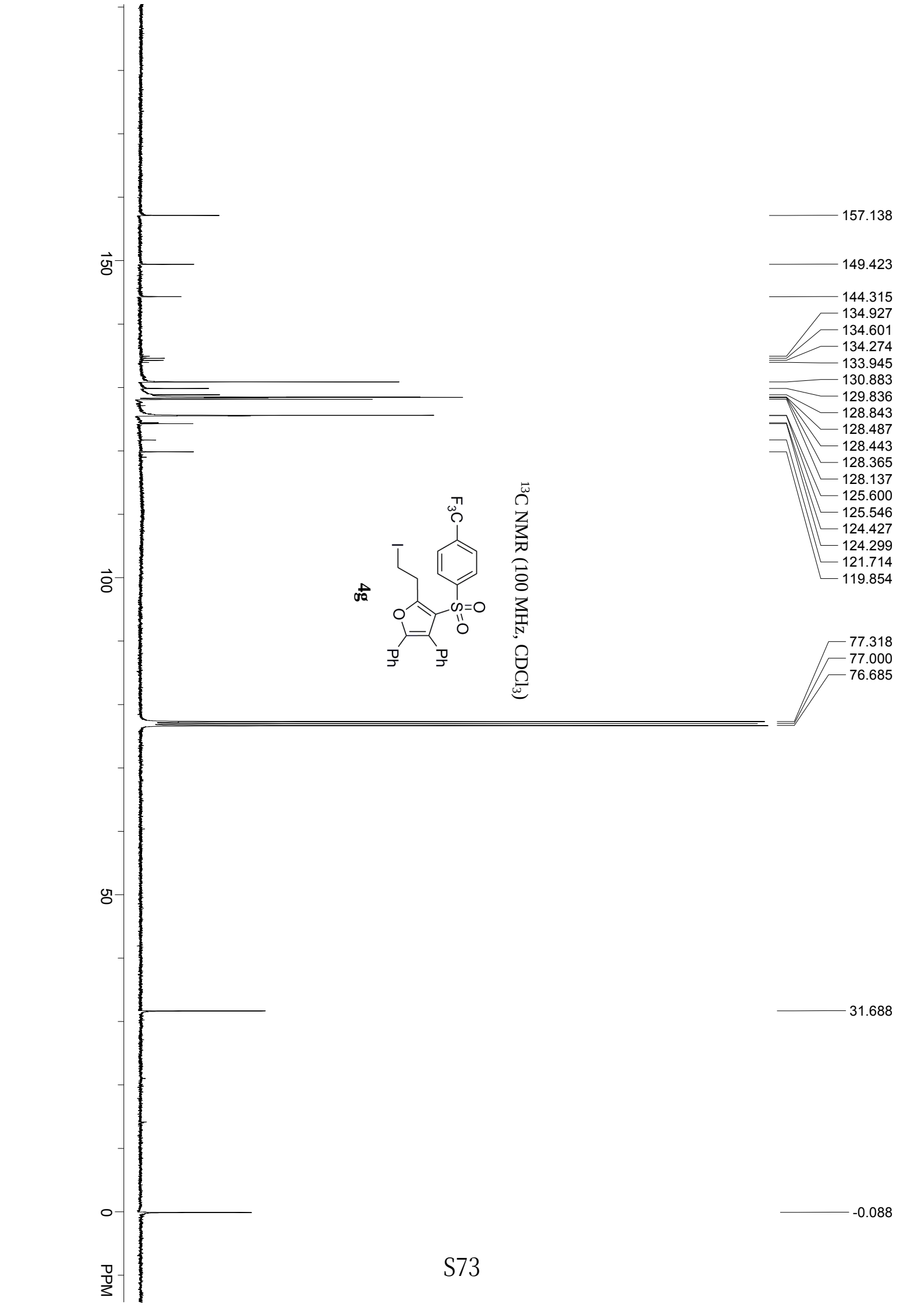


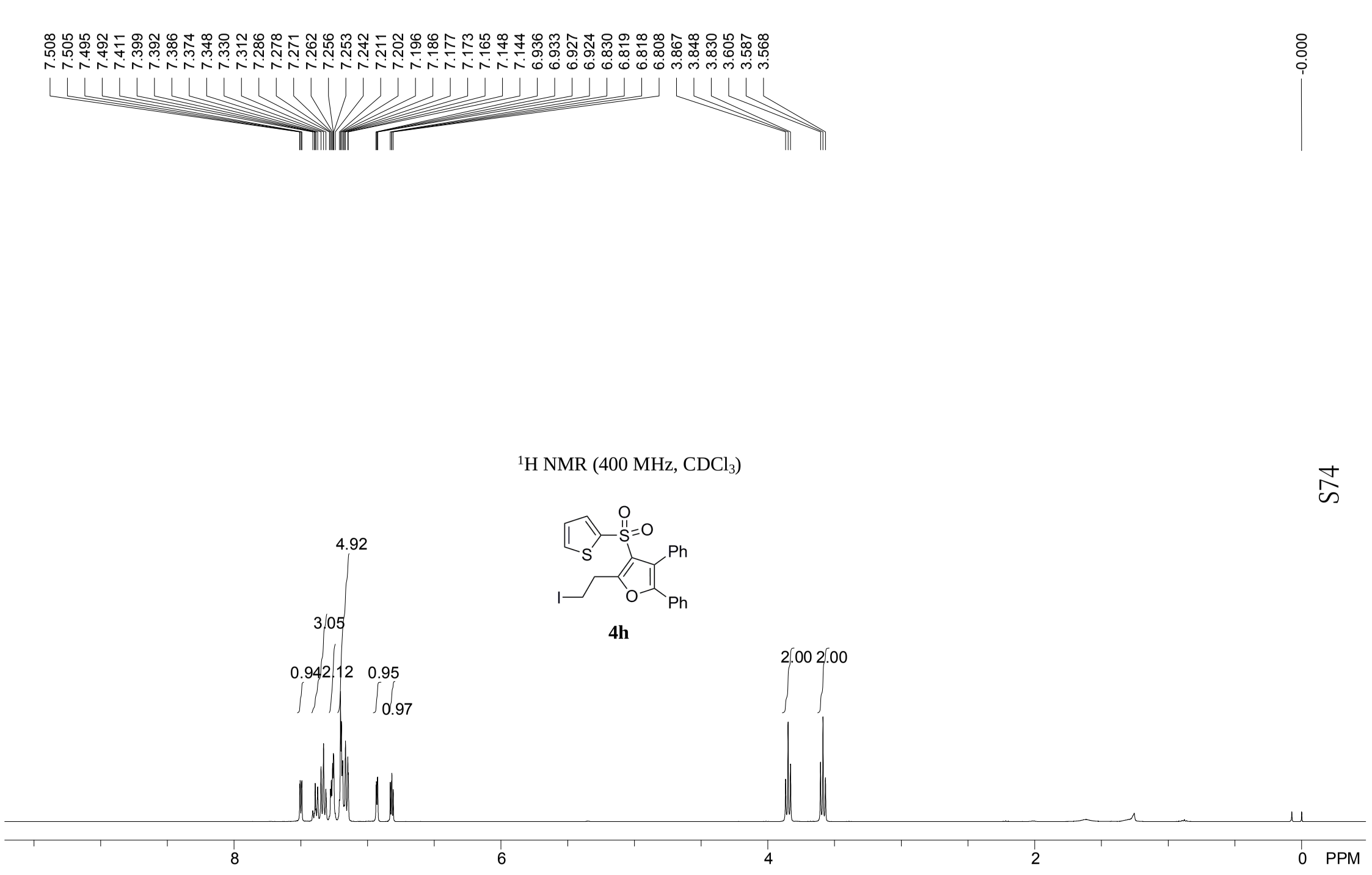
^{1}H NMR (400 MHz, $CDCl_3$)

4f


156.733
149.234
139.540
139.425
130.920
129.970
129.023
128.942
128.727
128.435
128.406
128.379
128.261
125.558
124.679
119.946
77.315
77.000
76.682
31.701
0.052
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4f
Cl
I
O
S
O
O
Ph
Ph

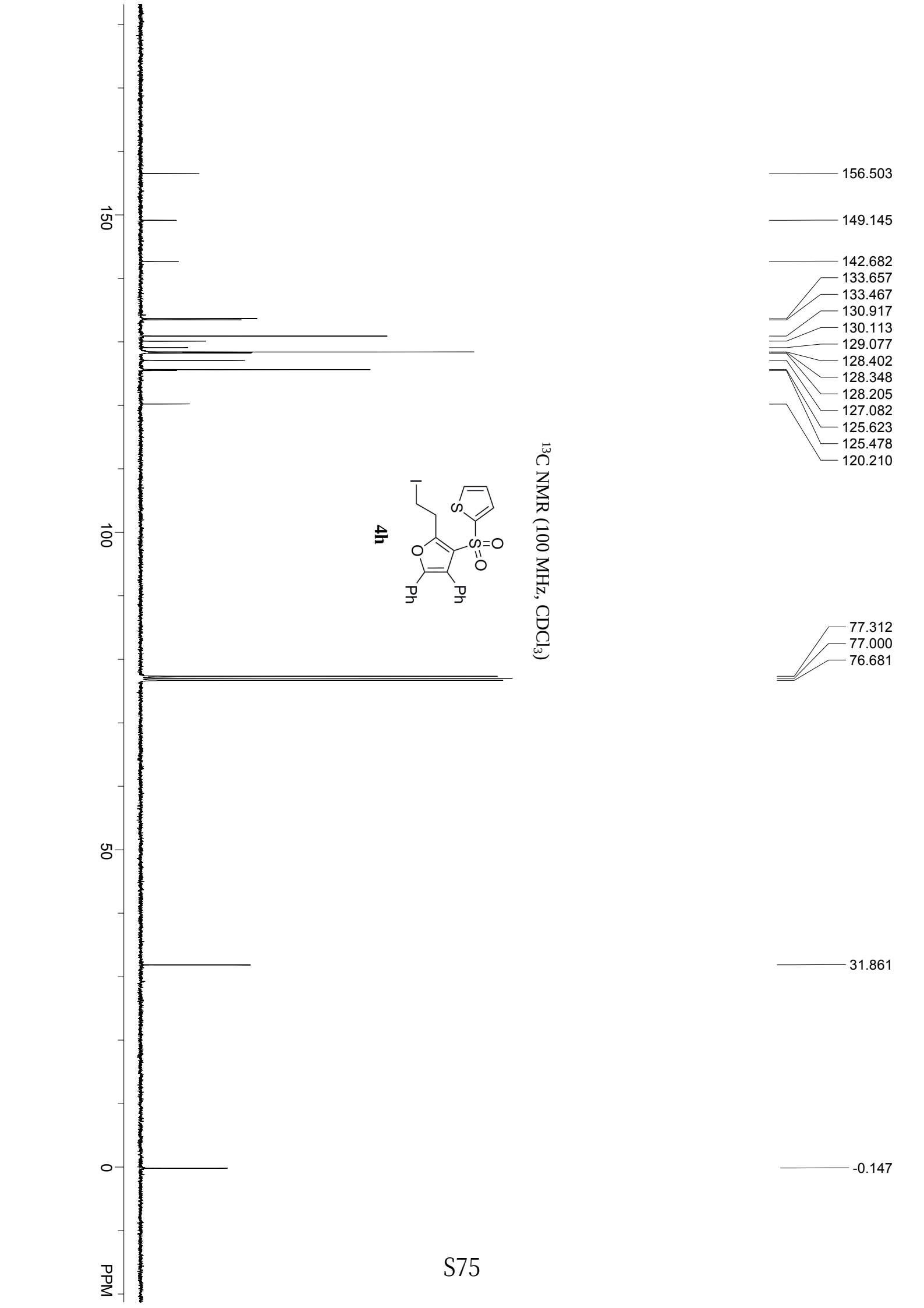

7.493
7.391
7.373
7.355
7.279
7.259
7.240
7.195
7.016
6.998
3.936
3.918
3.900
3.653
3.635
3.617
1.579
0.000
^{1}H NMR (400 MHz, $CDCl_3$)
F_3C
S
O
O
Ph
Ph
I
O
4g
6.93
4.09
2.00
1.03
2.01
2.00
8
7
6
5
4
3
2
1
0
PPM

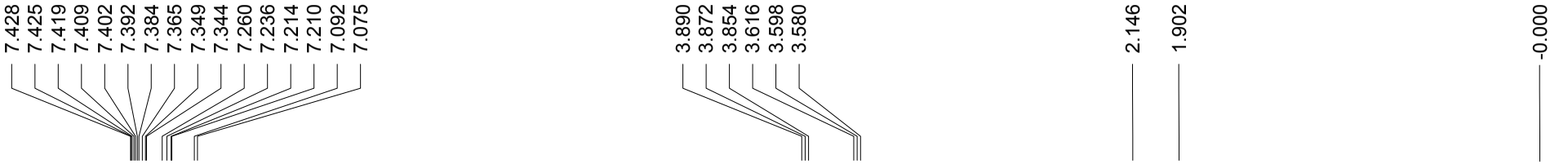

157.138
149.423
144.315
134.927
134.601
134.274
133.945
130.883
129.836
128.843
128.487
128.443
128.365
128.137
125.600
125.546
124.427
124.299
121.714
119.854
77.318
77.000
76.685
31.688
-0.088
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4g
F$_3$C
I
O
S
O
O
Ph
Ph



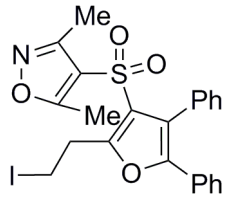
^{1}H NMR (400 MHz, $CDCl_3$)

4h

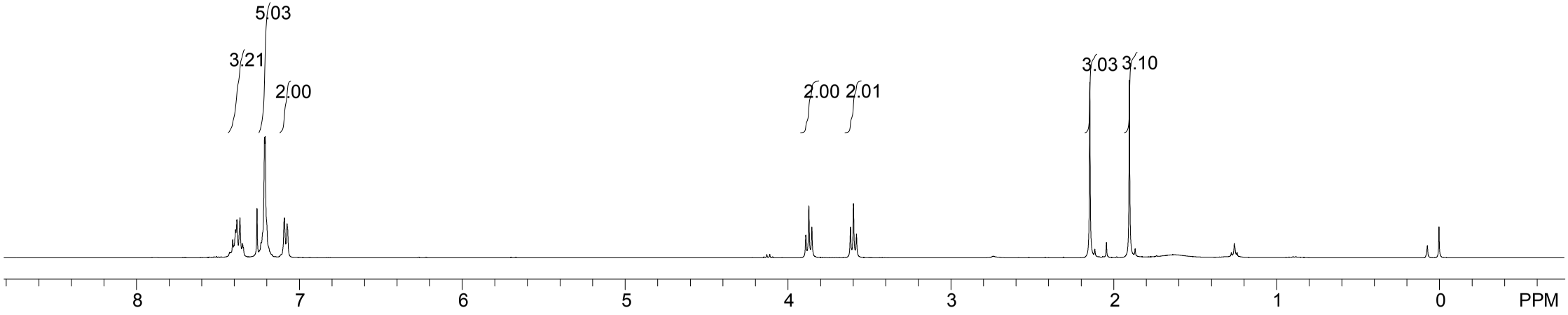

156.503
149.145
142.682
133.657
133.467
130.917
130.113
129.077
128.402
128.348
128.205
127.082
125.623
125.478
120.210
77.312
77.000
76.681
31.861
-0.147
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4h
I
S
O
S=O
O
Ph
Ph

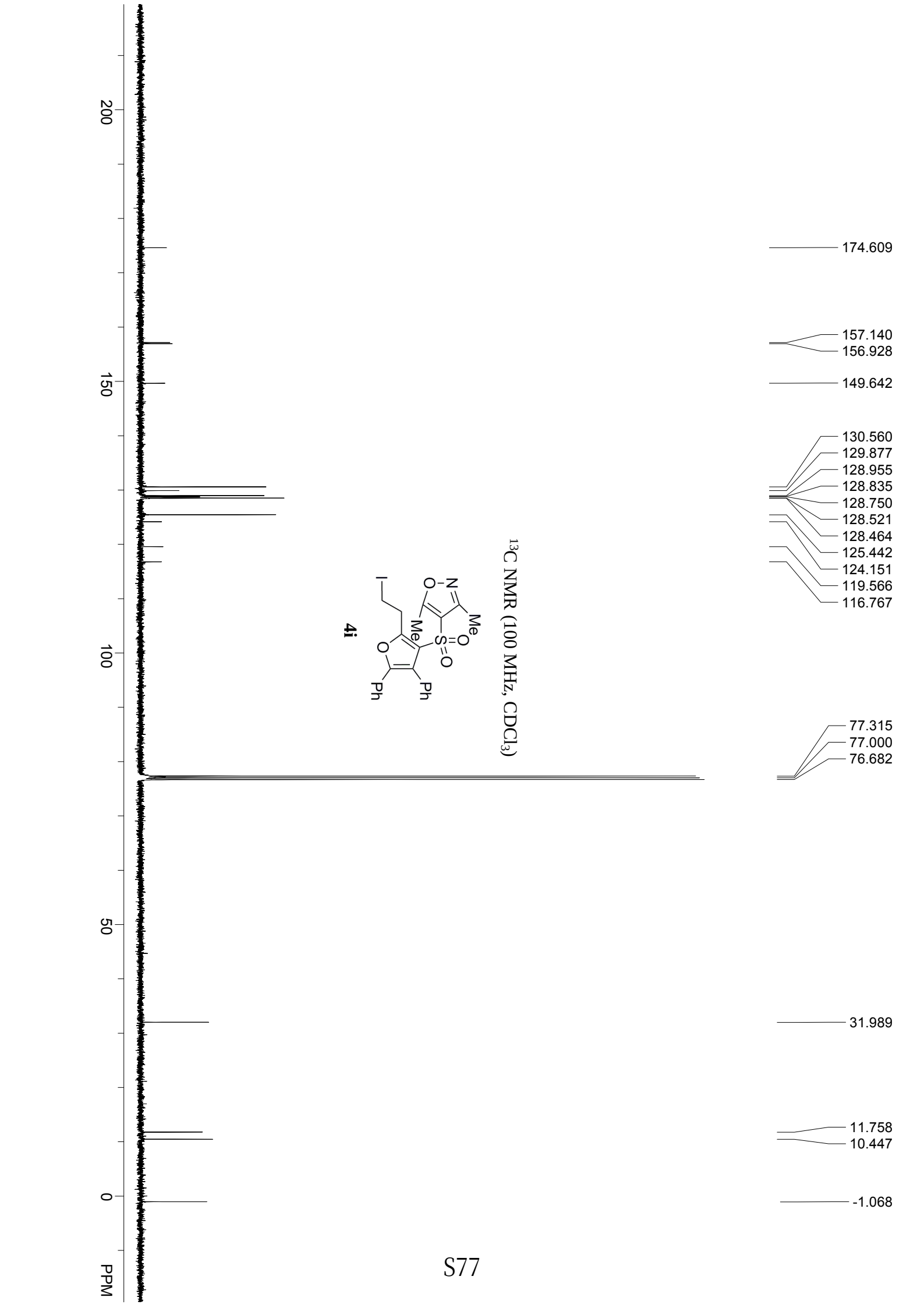


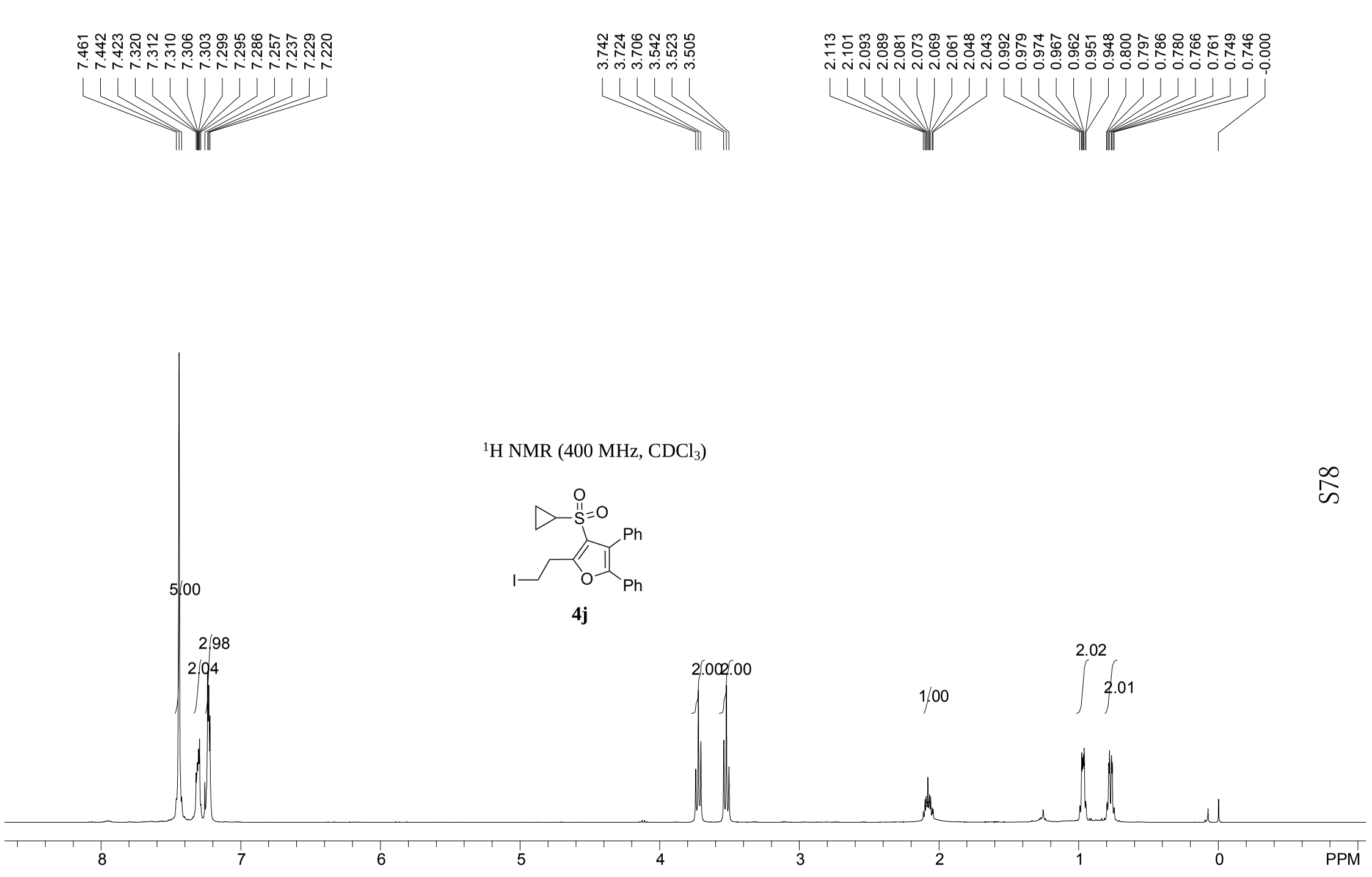
^{1}H NMR (400 MHz, $CDCl_3$)

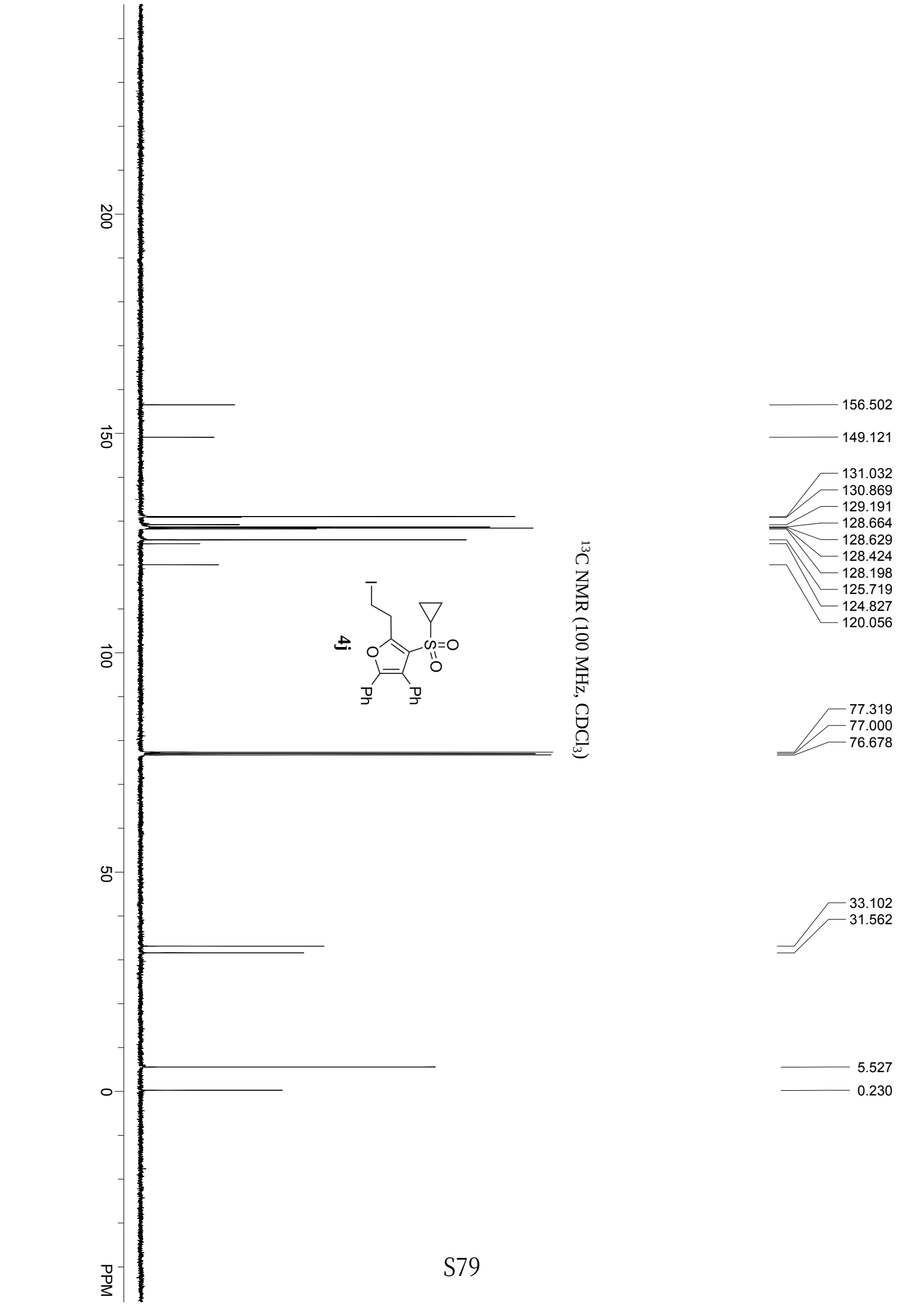


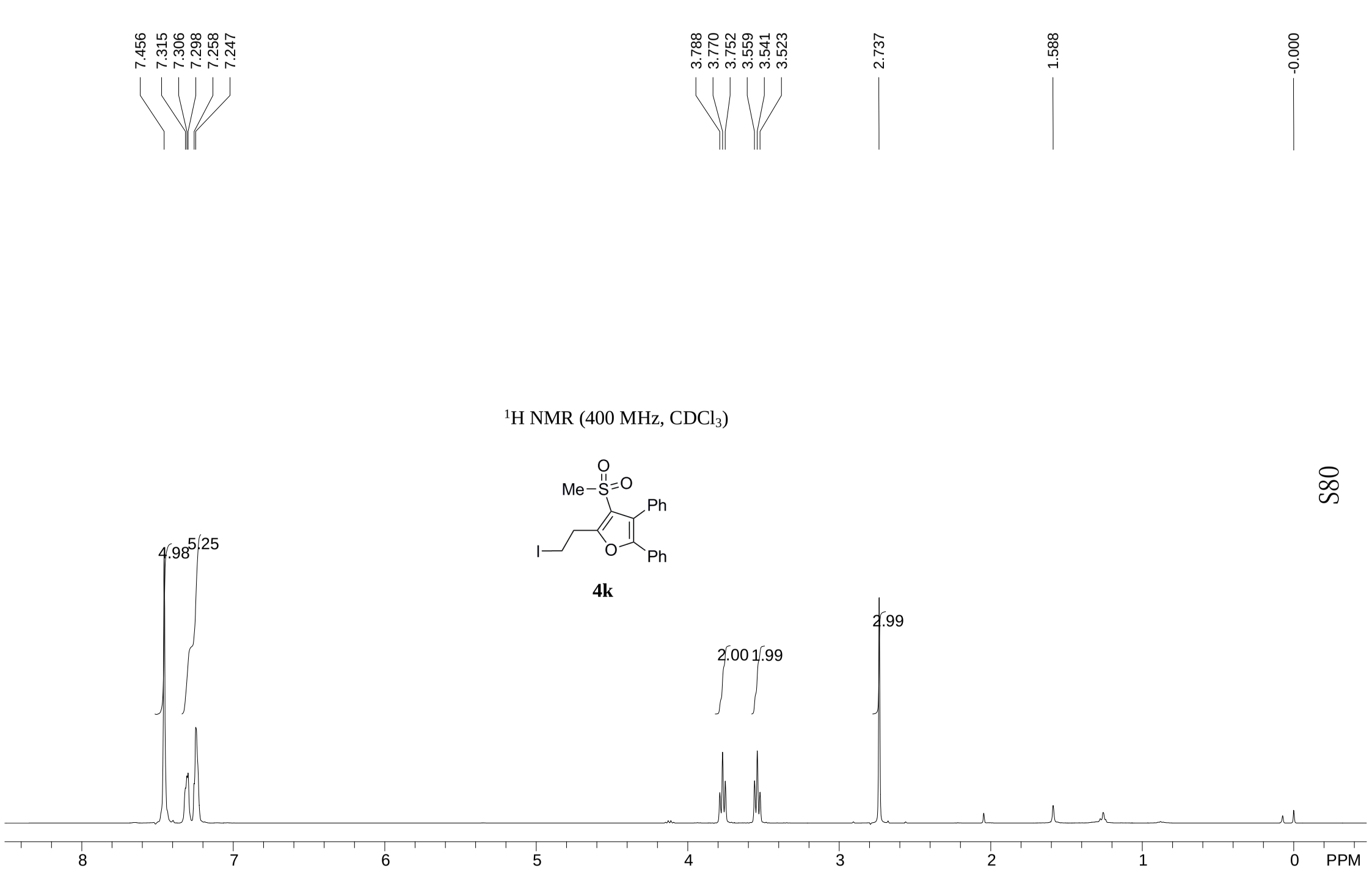
4i

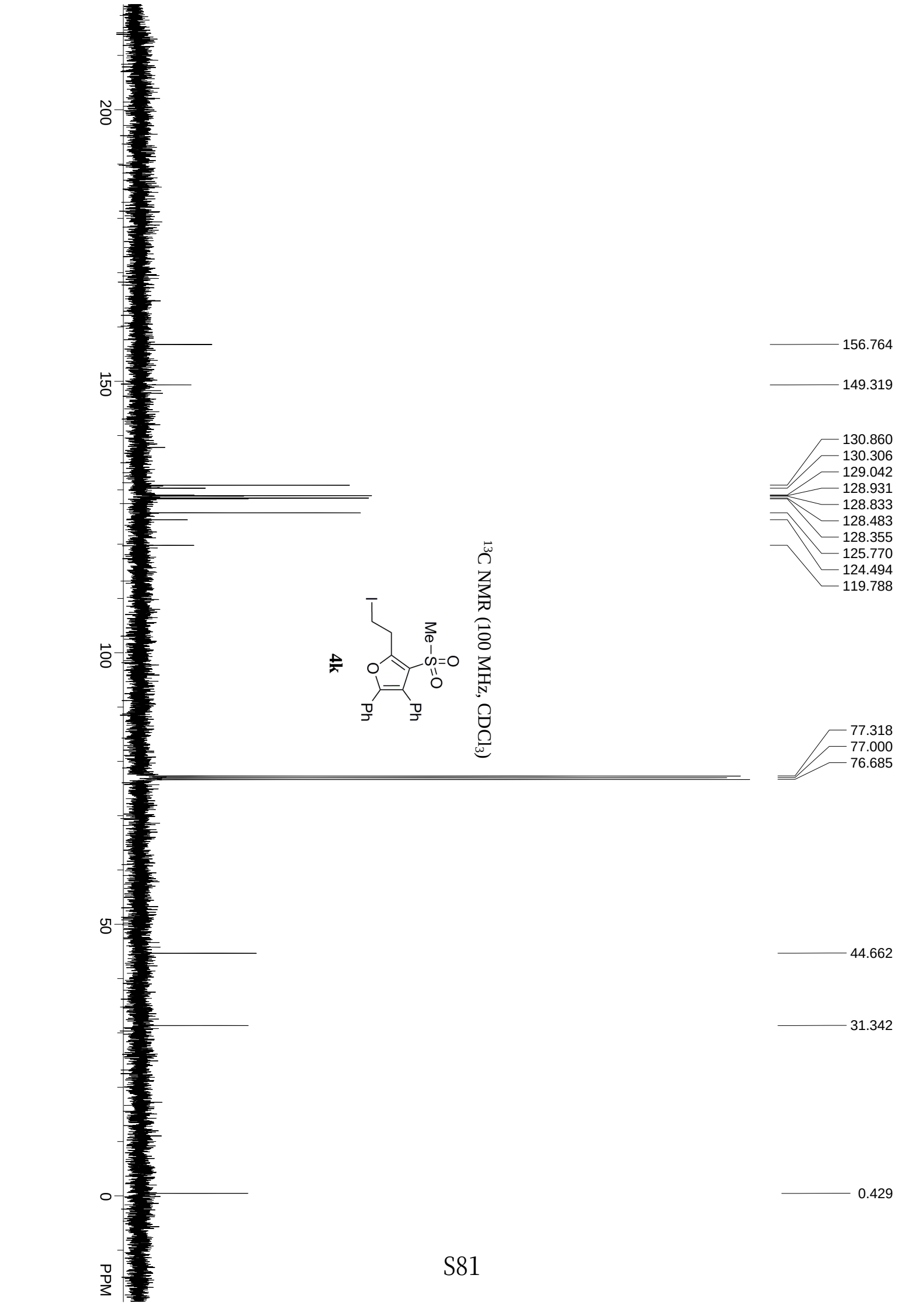


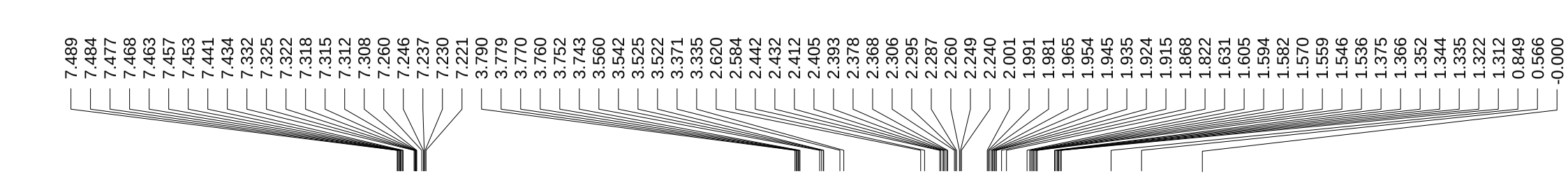

174.609
157.140
156.928
149.642
130.560
129.877
128.955
128.835
128.750
128.521
128.464
125.442
124.151
119.566
116.767
77.315
77.000
76.682
31.989
11.758
10.447
-1.068
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4i


7.461
7.442
7.423
7.320
7.312
7.310
7.306
7.303
7.299
7.295
7.286
7.257
7.237
7.229
7.220
3.742
3.724
3.706
3.542
3.523
3.505
2.113
2.101
2.093
2.089
2.081
2.073
2.069
2.061
2.048
2.043
0.992
0.979
0.974
0.967
0.962
0.951
0.948
0.800
0.797
0.786
0.780
0.766
0.761
0.749
0.746
-0.000
^{1}H NMR (400 MHz, CDCl$_3$)
O
S
O
Ph
I
O
Ph
4j
5.00
2.98
2.04
2.00
2.00
1.00
2.02
2.01
8
7
6
5
4
3
2
1
0
PPM

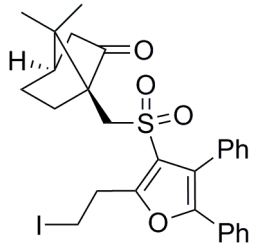

156.502
149.121
131.032
130.869
129.191
128.664
128.629
128.424
128.198
125.719
124.827
120.056
77.319
77.000
76.678
33.102
31.562
5.527
0.230
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4j
I
O
S
O
O
Ph
Ph


7.456
7.315
7.306
7.298
7.258
7.247
3.788
3.770
3.752
3.559
3.541
3.523
2.737
1.588
-0.000
^{1}H NMR (400 MHz, $CDCl_3$)
O
Me−S=O
Ph
I
O
Ph
4k
4.98
5.25
2.00
1.99
2.99
8
7
6
5
4
3
2
1
0
PPM

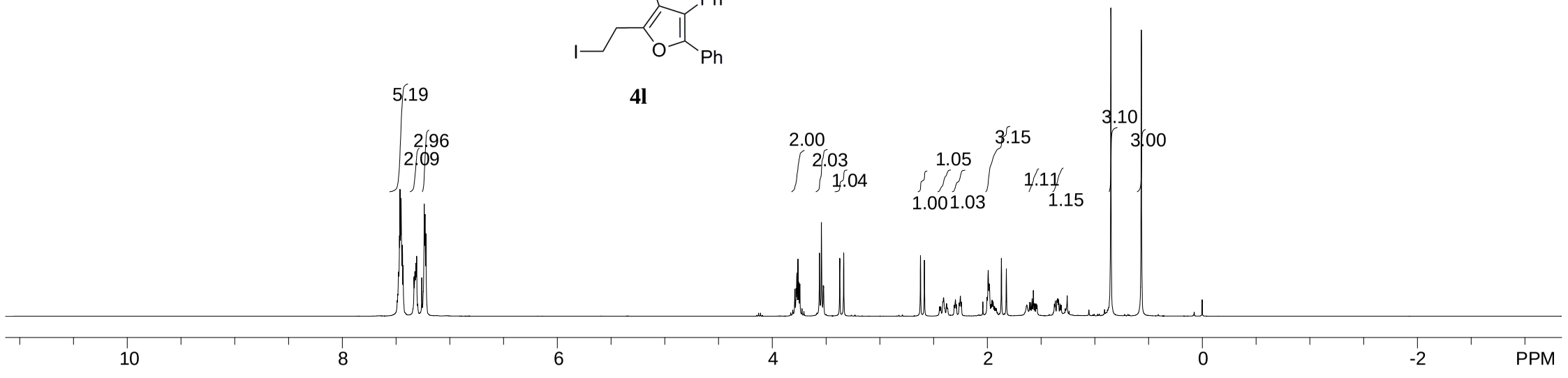

156.764
149.319
130.860
130.306
129.042
128.931
128.833
128.483
128.355
125.770
124.494
119.788
77.318
77.000
76.685
44.662
31.342
0.429
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4k
I
Me
S
O
O
O
Ph
Ph

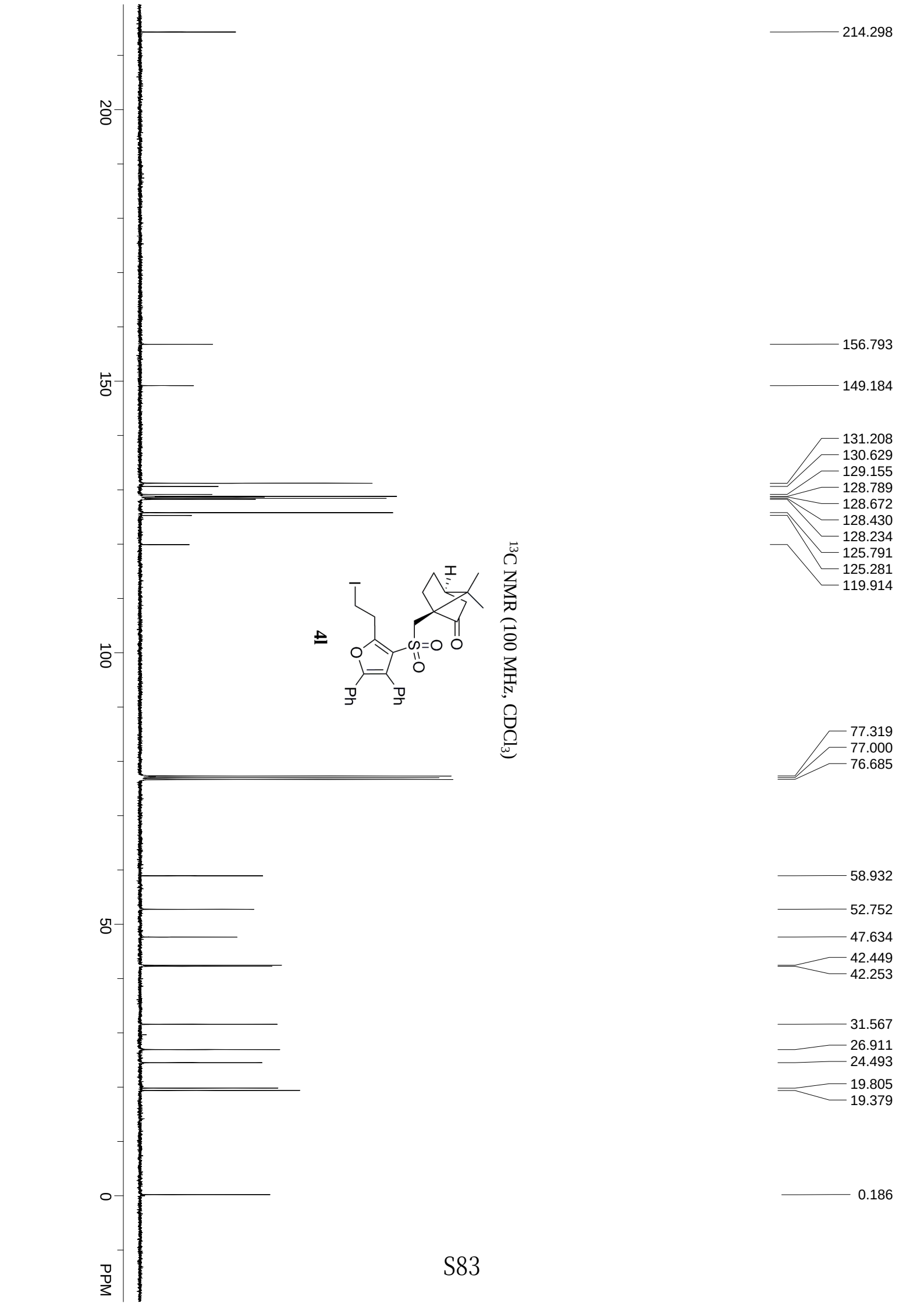


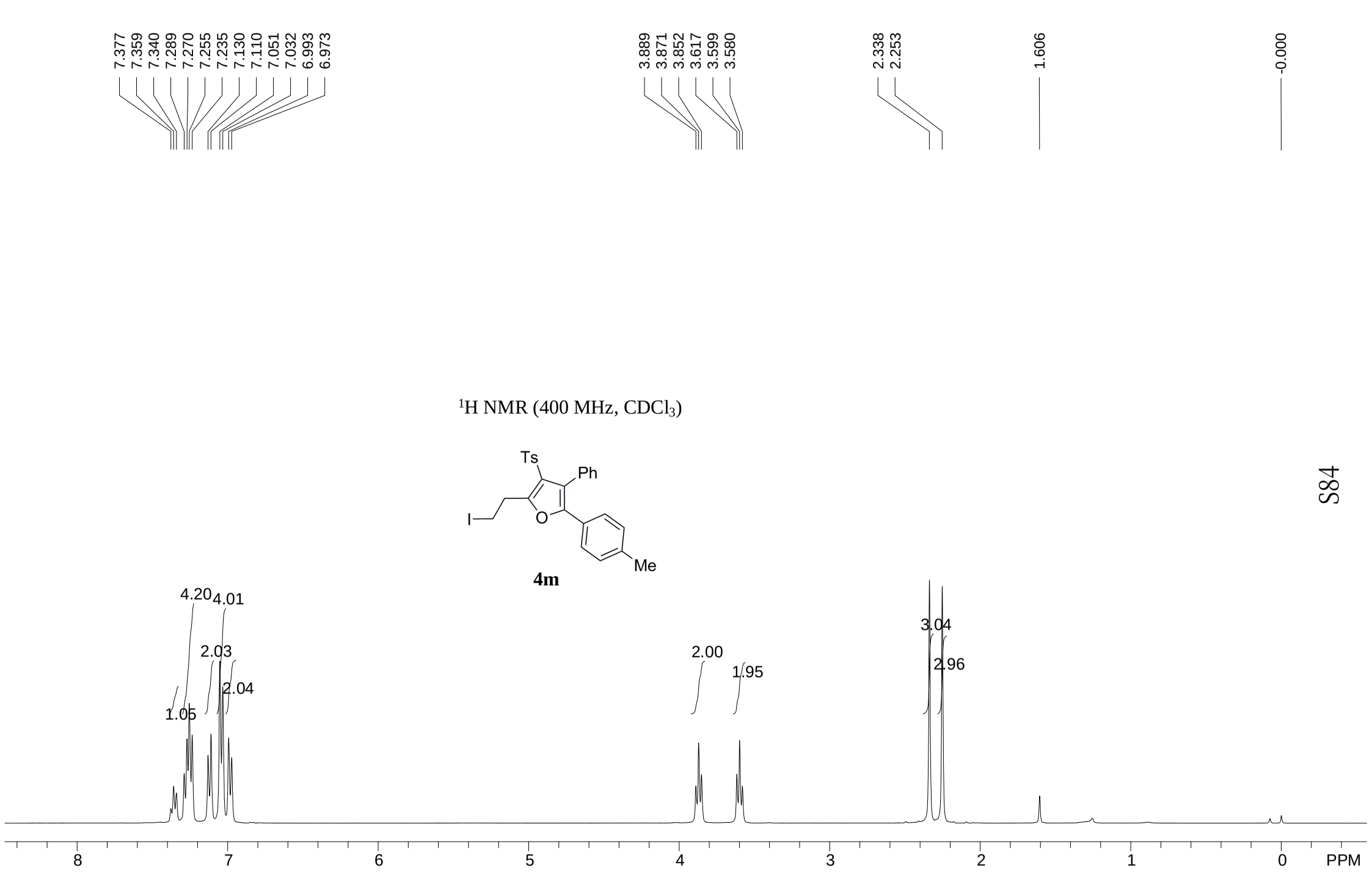
^{1}H NMR (400 MHz, $CDCl_3$)



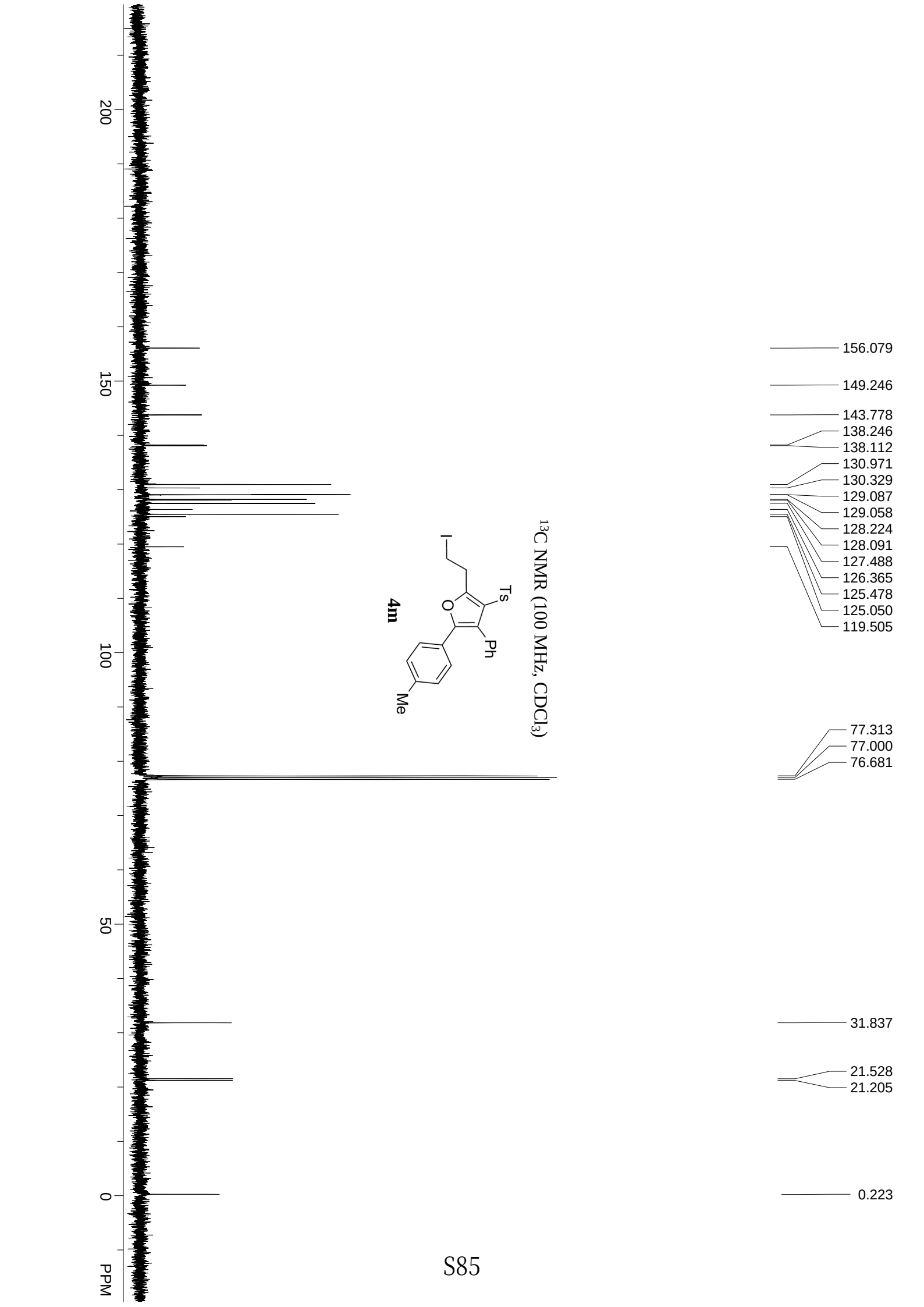
4l

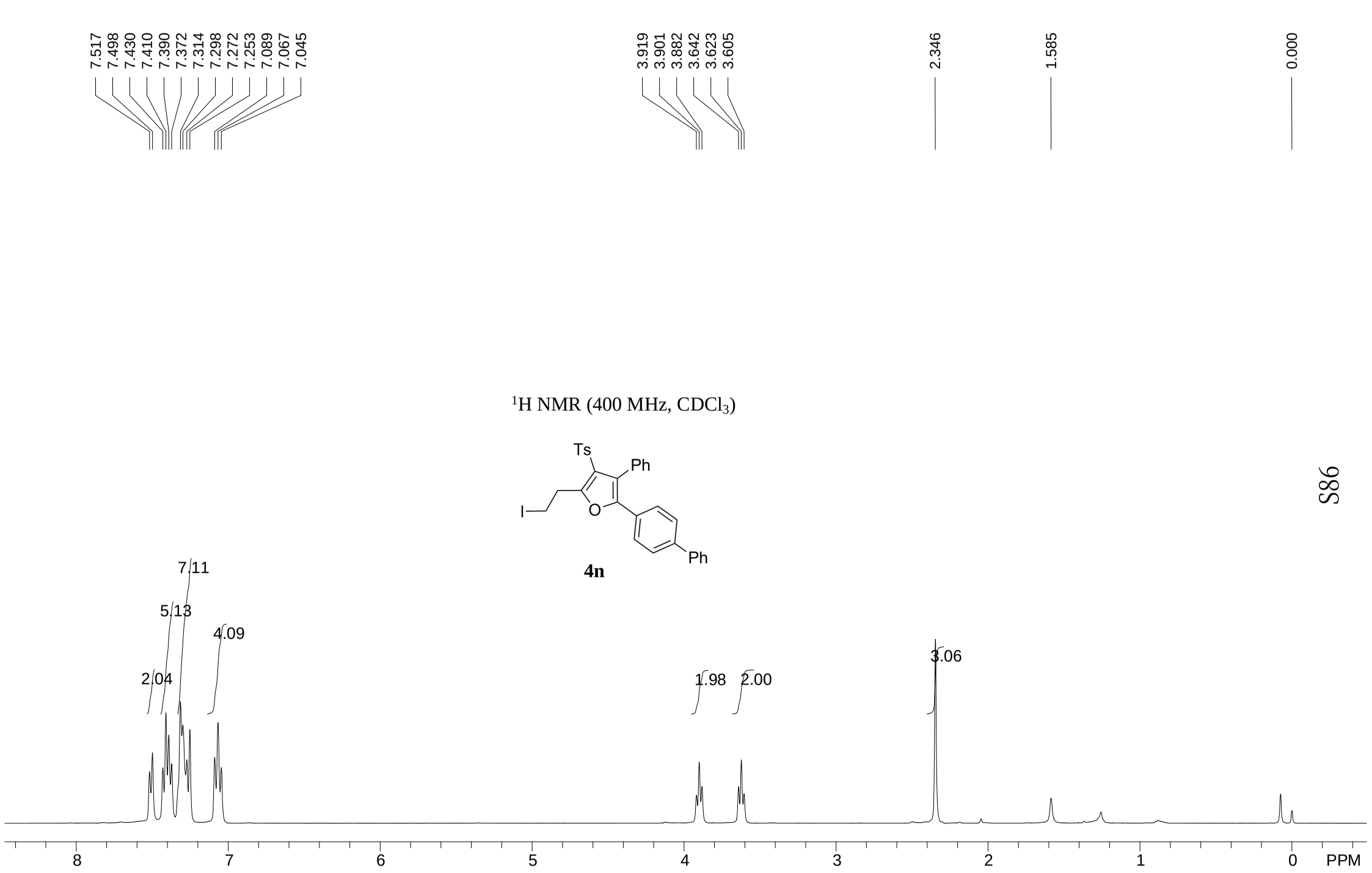



214.298
156.793
149.184
131.208
130.629
129.155
128.789
128.672
128.430
128.234
125.791
125.281
119.914
77.319
77.000
76.685
58.932
52.752
47.634
42.449
42.253
31.567
26.911
24.493
19.805
19.379
0.186
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4l
I
O
S
O
O
O
H
Ph
Ph

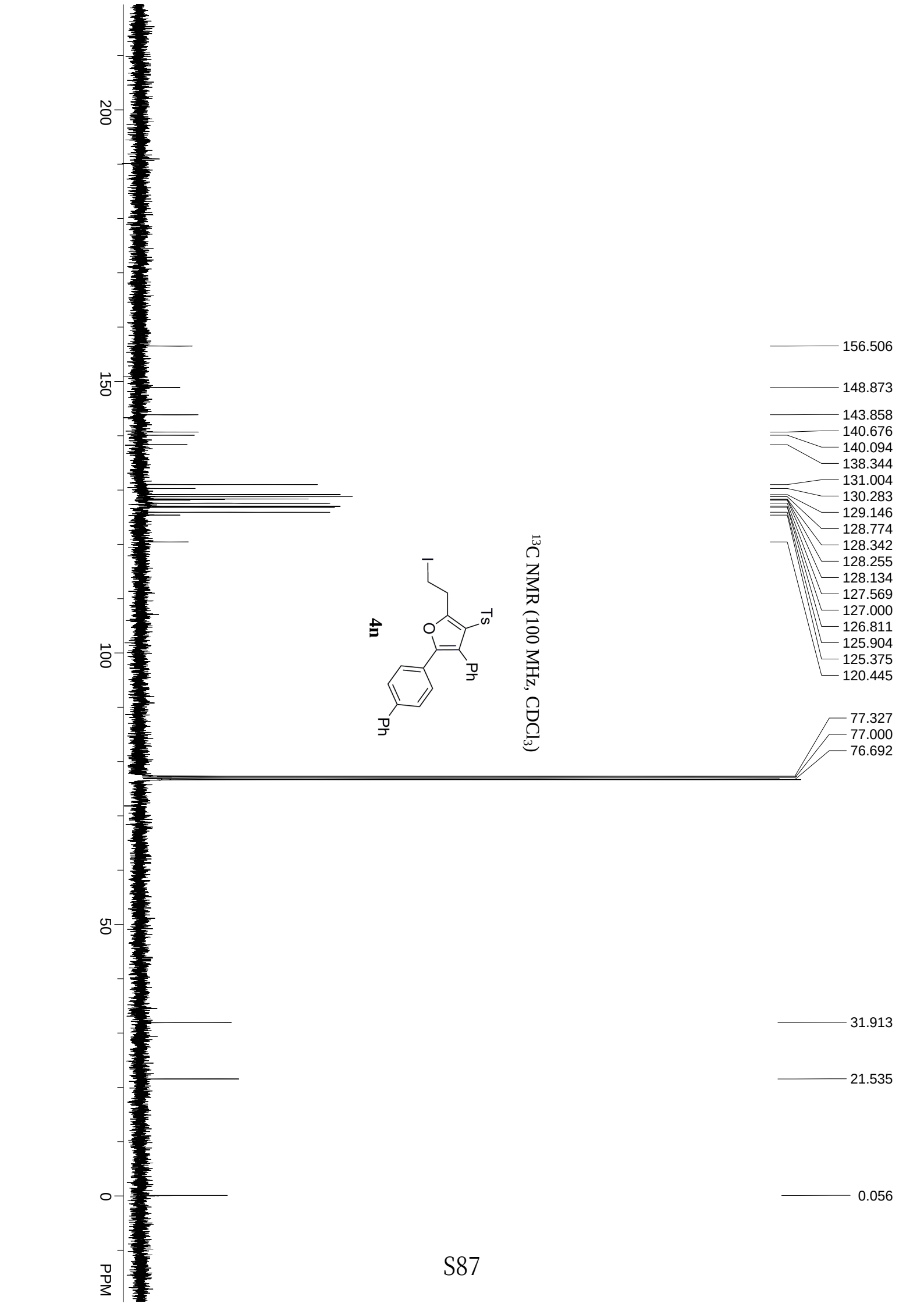


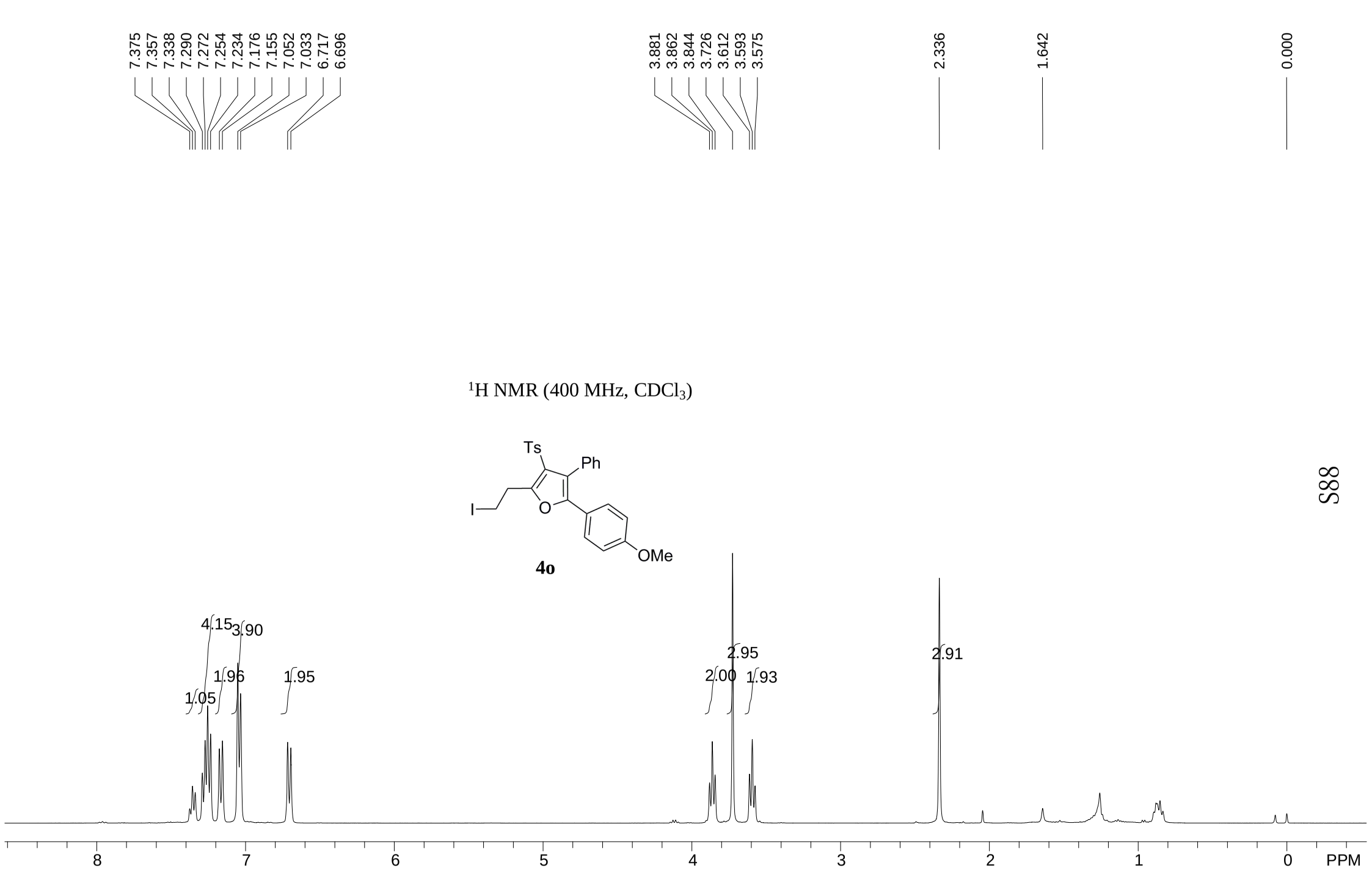
^{1}H NMR (400 MHz, $CDCl_3$)


^{13}C NMR (100 MHz, CDCl$_3$)
4m
I
Ts
O
Ph
Me
156.079
149.246
143.778
138.246
138.112
130.971
130.329
129.087
129.058
128.224
128.091
127.488
126.365
125.478
125.050
119.505
77.313
77.000
76.681
31.837
21.528
21.205
0.223
200
150
100
50
0
PPM



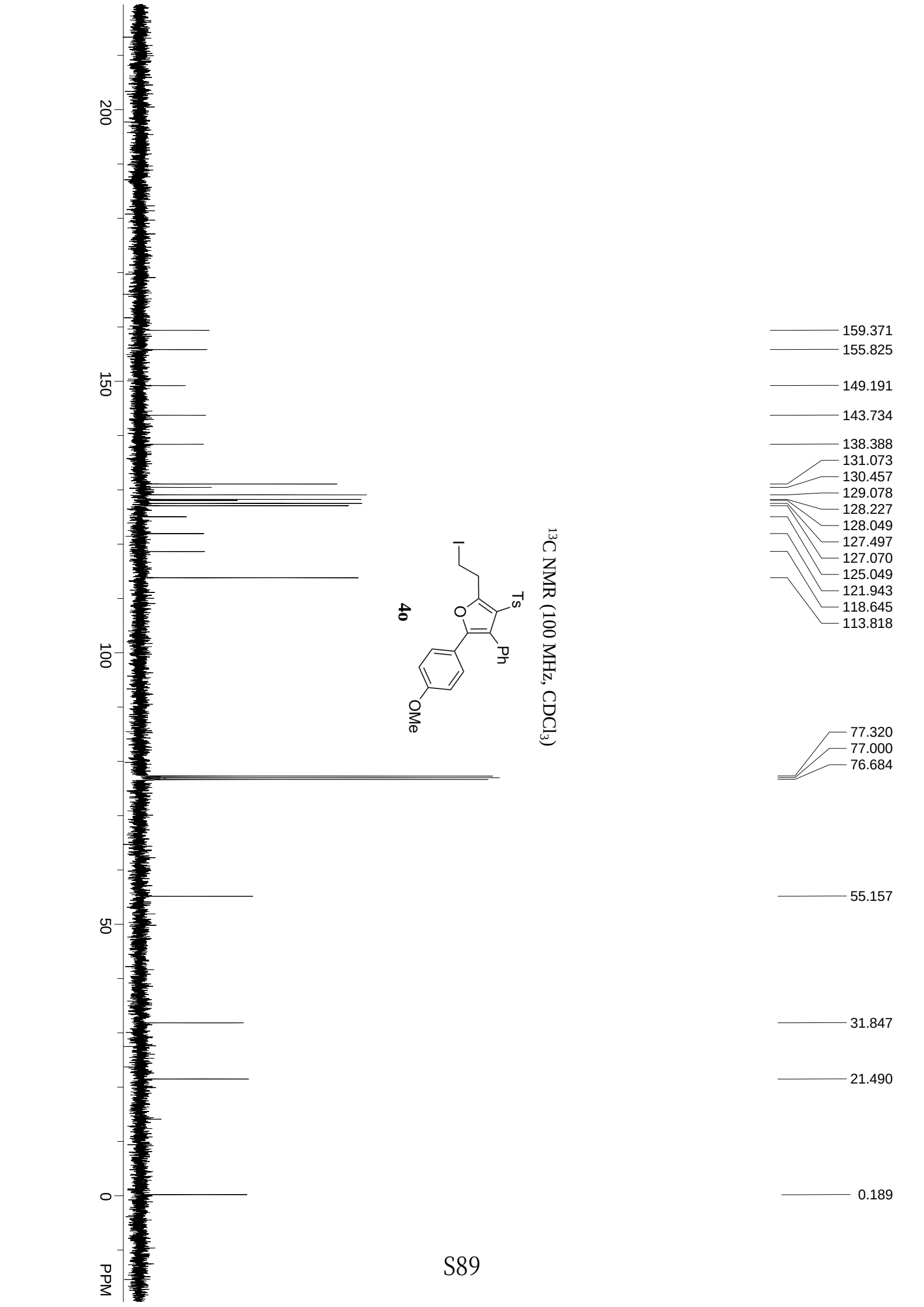
^{1}H NMR (400 MHz, $CDCl_3$)

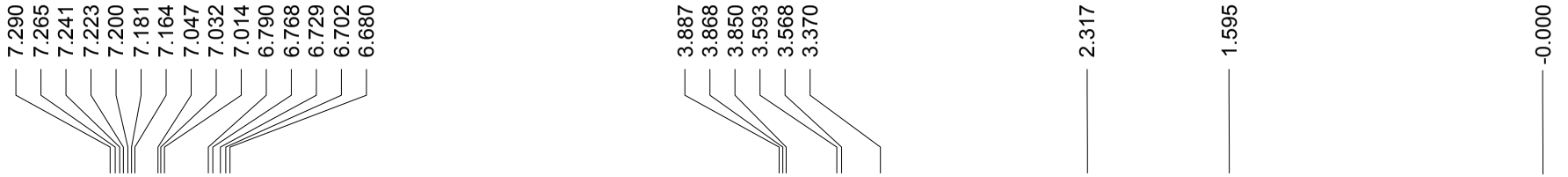

156.506
148.873
143.858
140.676
140.094
138.344
131.004
130.283
129.146
128.774
128.342
128.255
128.134
127.569
127.000
126.811
125.904
125.375
120.445
77.327
77.000
76.692
31.913
21.535
0.056
200
150
100
50
0
PPM
4n
Ts
Ph
Ph
I
O
^{13}C NMR (100 MHz, $CDCl_3$)



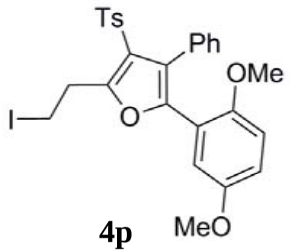
^{1}H NMR (400 MHz, $CDCl_3$)

4o

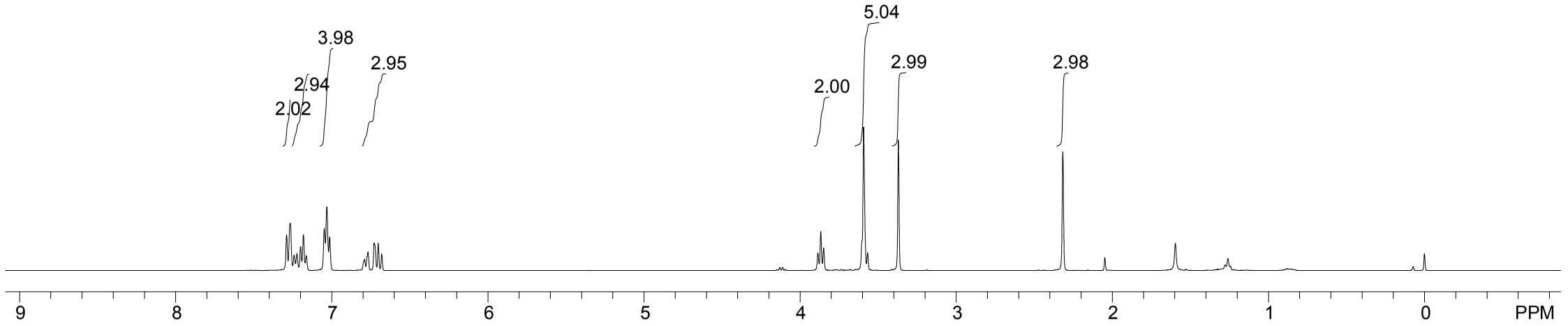

^{13}C NMR (100 MHz, $CDCl_3$)
4o
I
O
Ts
Ph
OMe
159.371
155.825
149.191
143.734
138.388
131.073
130.457
129.078
128.227
128.049
127.497
127.070
125.049
121.943
118.645
113.818
77.320
77.000
76.684
55.157
31.847
21.490
0.189
200
150
100
50
0
PPM

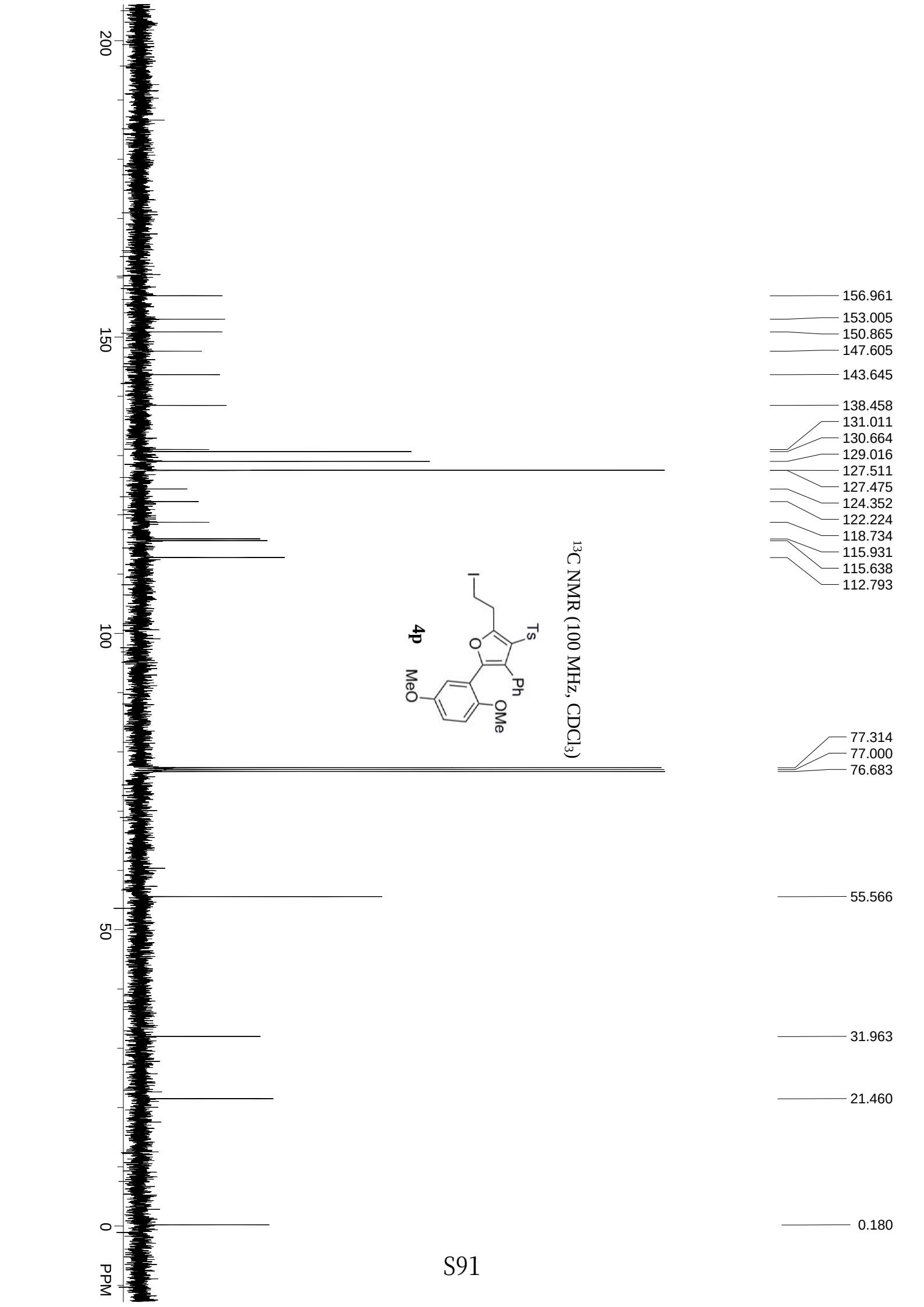


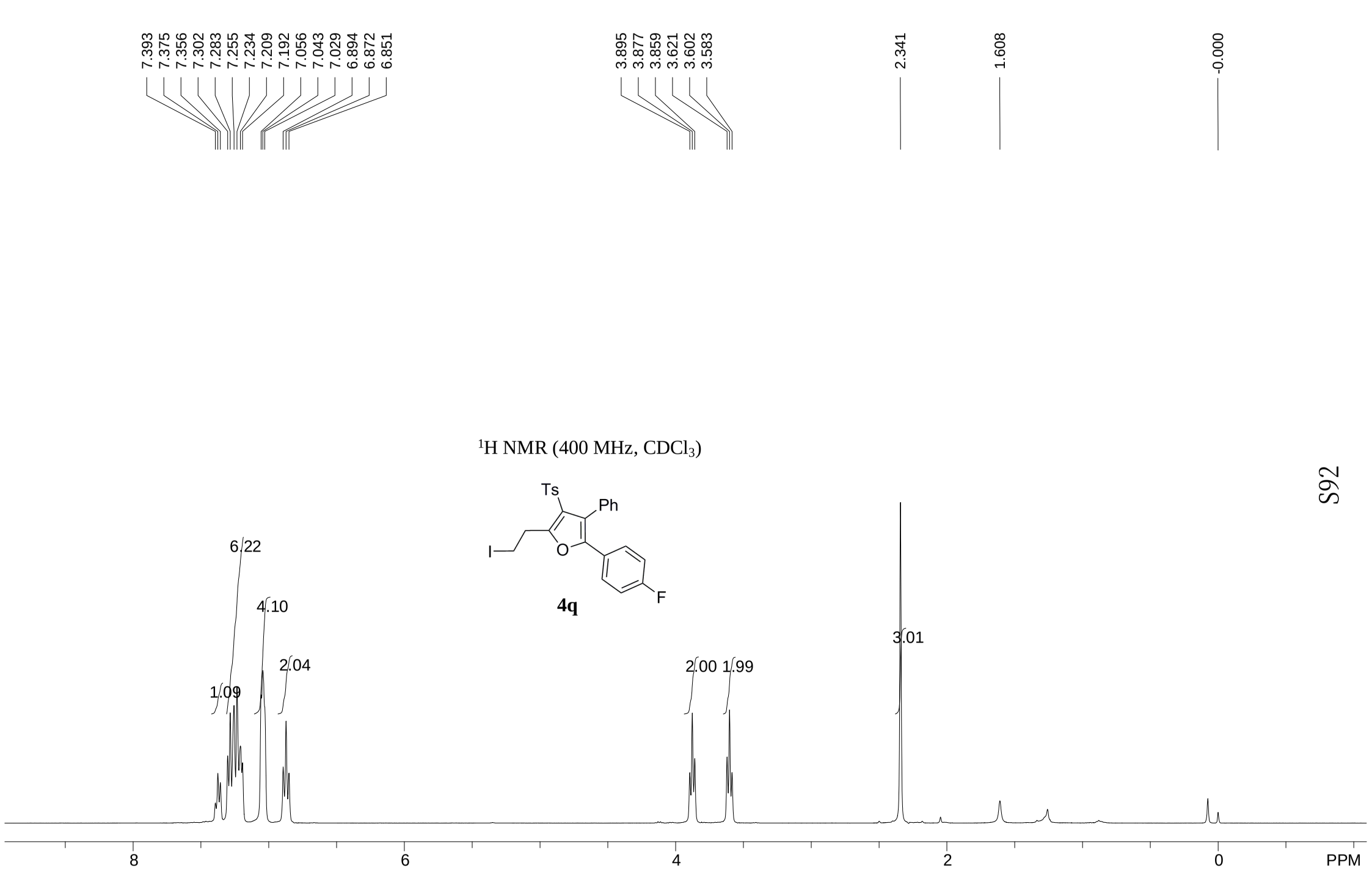
^{1}H NMR (400 MHz, $CDCl_3$)



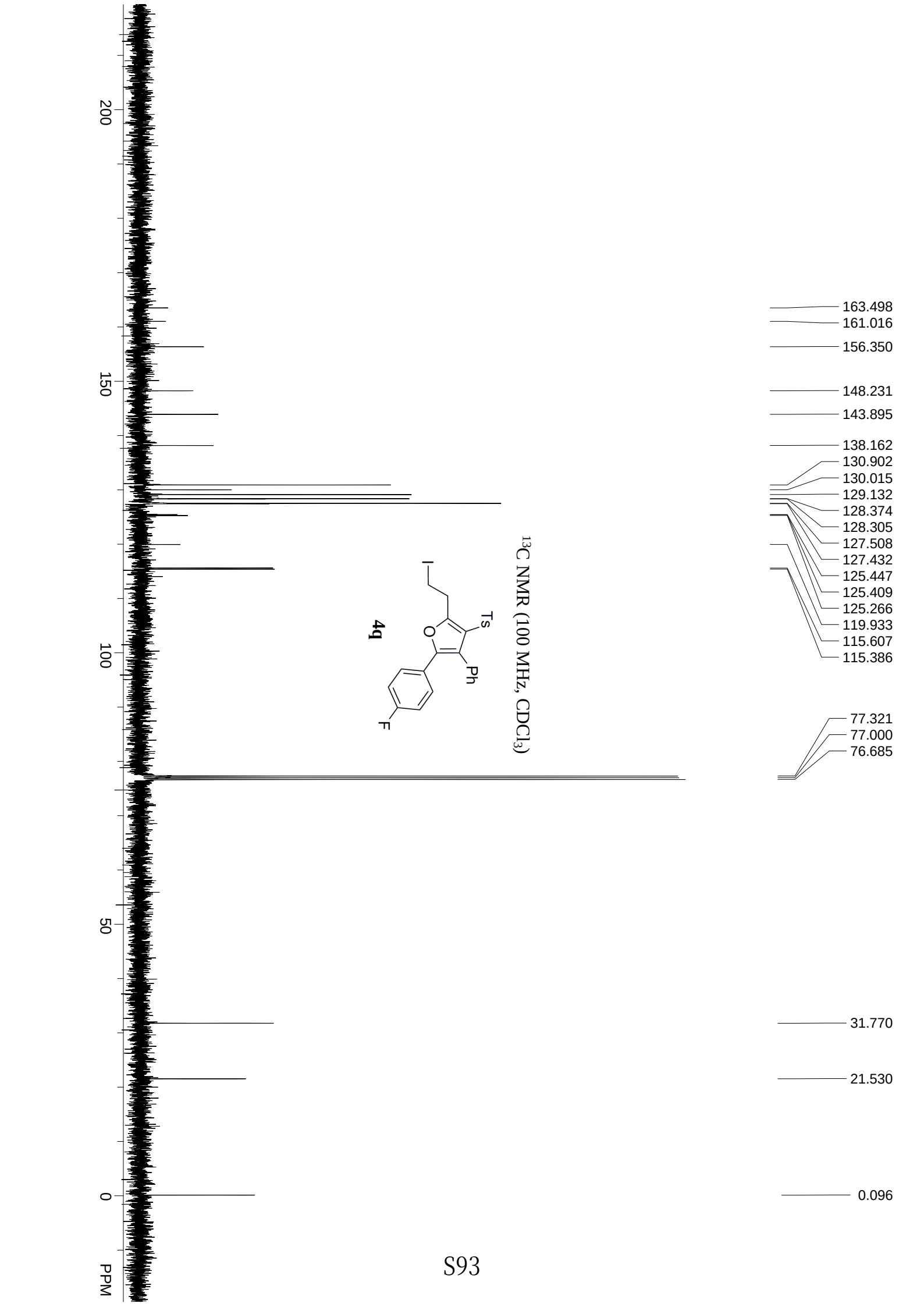
4p

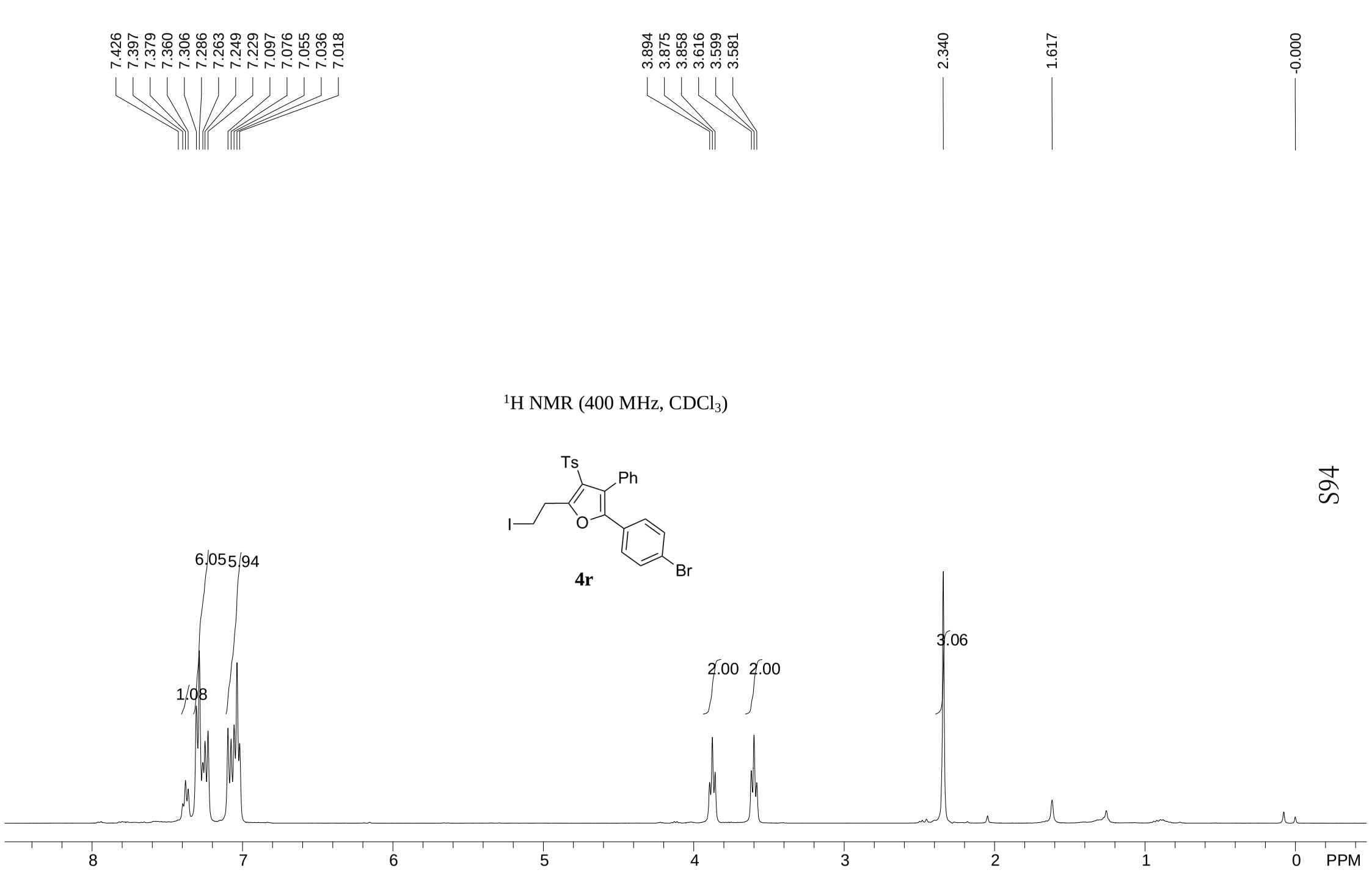



156.961
153.005
150.865
147.605
143.645
138.458
131.011
130.664
129.016
127.511
127.475
124.352
122.224
118.734
115.931
115.638
112.793
77.314
77.000
76.683
55.566
31.963
21.460
0.180
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, $CDCl_3$)
4p
I
Ts
O
Ph
MeO
OMe

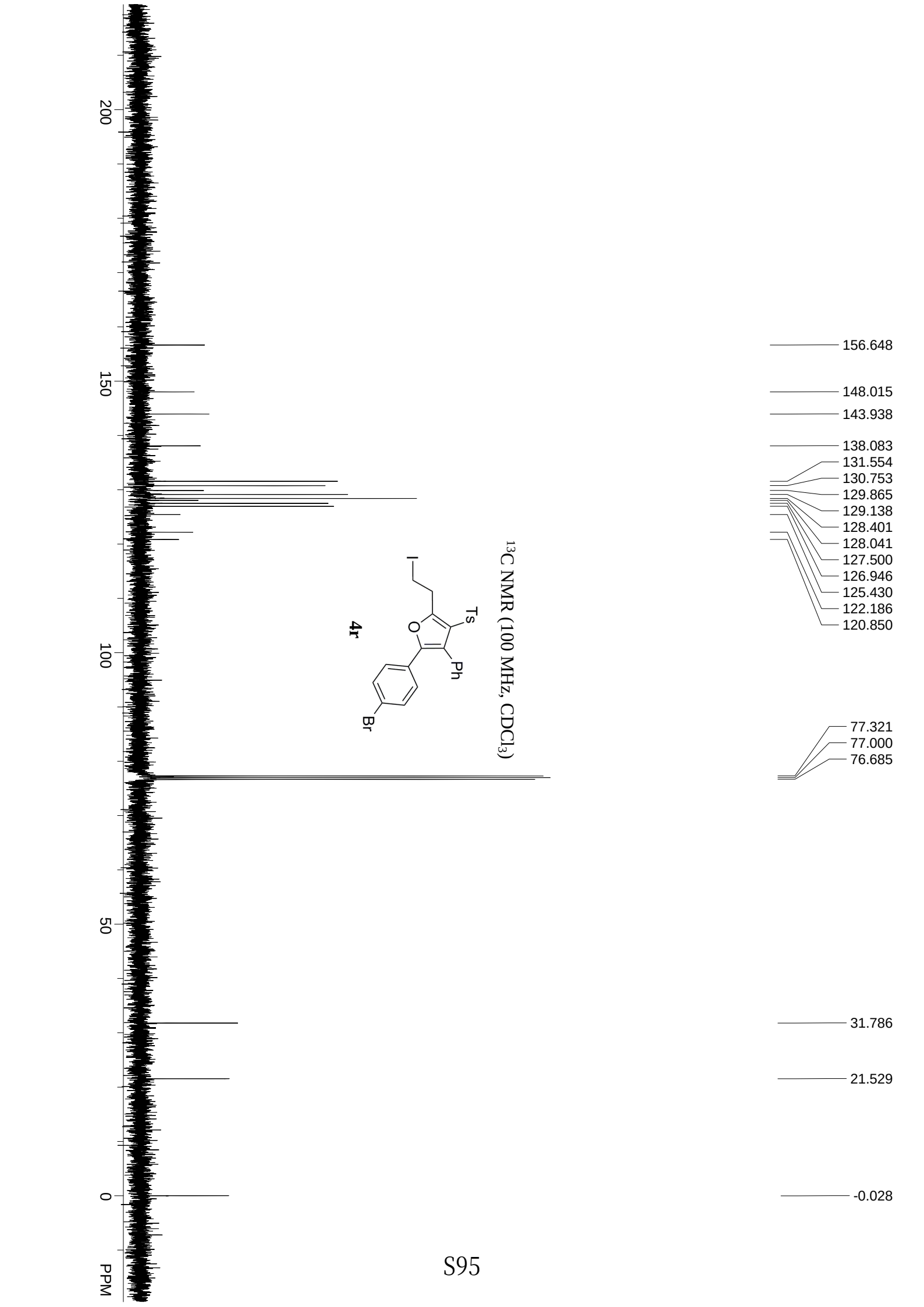


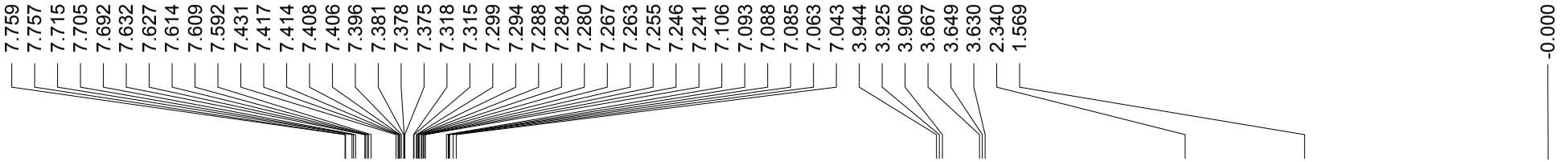
^{1}H NMR (400 MHz, $CDCl_3$)


^{13}C NMR (100 MHz, CDCl$_3$)
4q
I
Ts
O
Ph
F
163.498
161.016
156.350
148.231
143.895
138.162
130.902
130.015
129.132
128.374
128.305
127.508
127.432
125.447
125.409
125.266
119.933
115.607
115.386
77.321
77.000
76.685
31.770
21.530
0.096
200
150
100
50
0
PPM

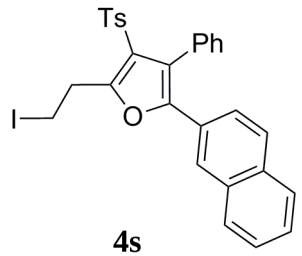


^{1}H NMR (400 MHz, $CDCl_3$)

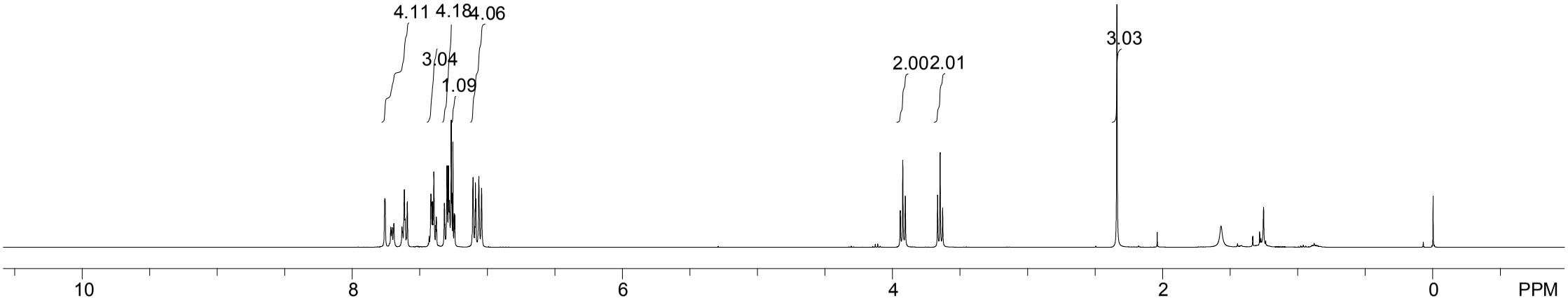

^{13}C NMR (100 MHz, $CDCl_3$)
4r
I
Ts
O
Ph
Br
156.648
148.015
143.938
138.083
131.554
130.753
129.865
129.138
128.401
128.041
127.500
126.946
125.430
122.186
120.850
77.321
77.000
76.685
31.786
21.529
-0.028
200
150
100
50
0
PPM

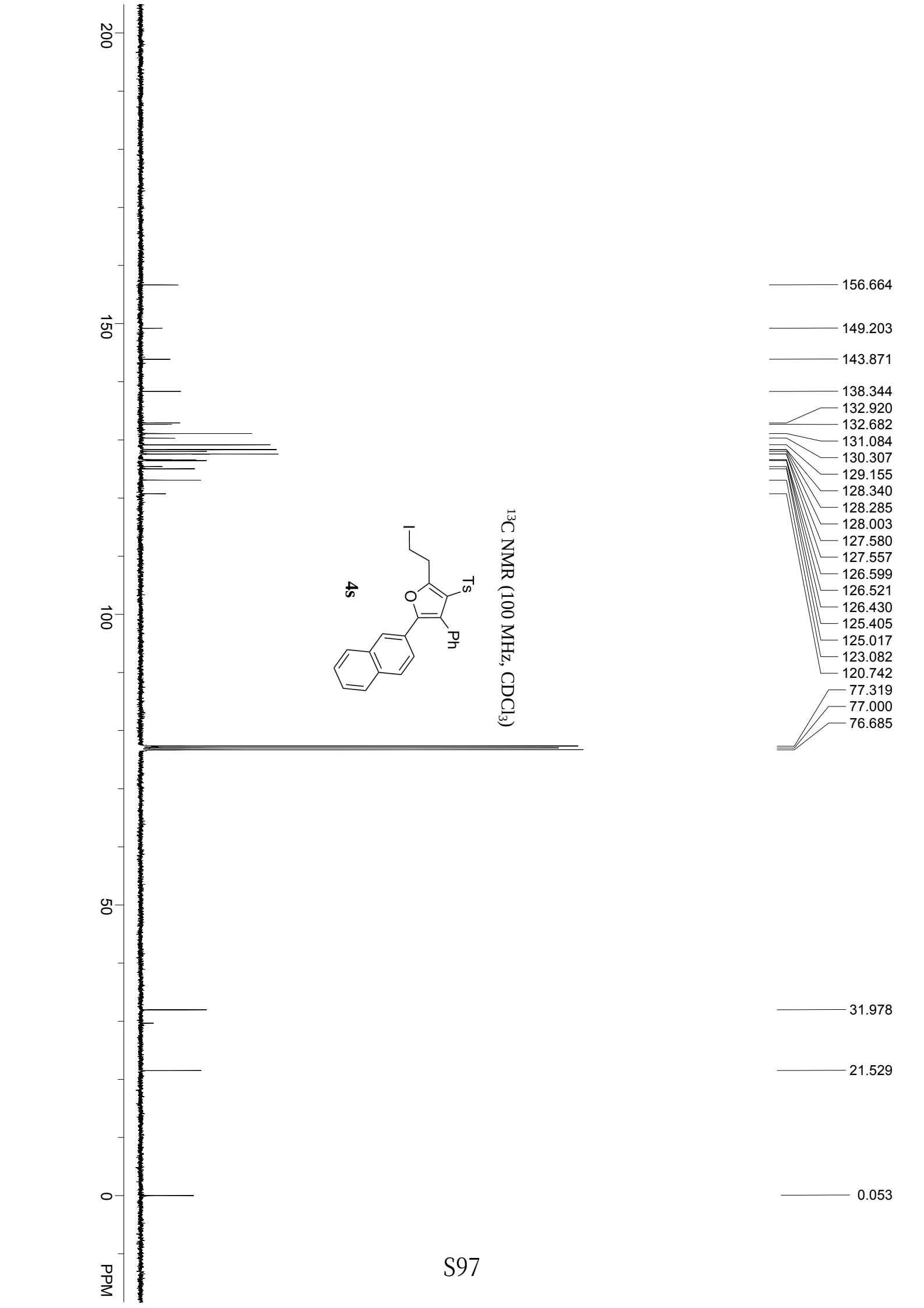


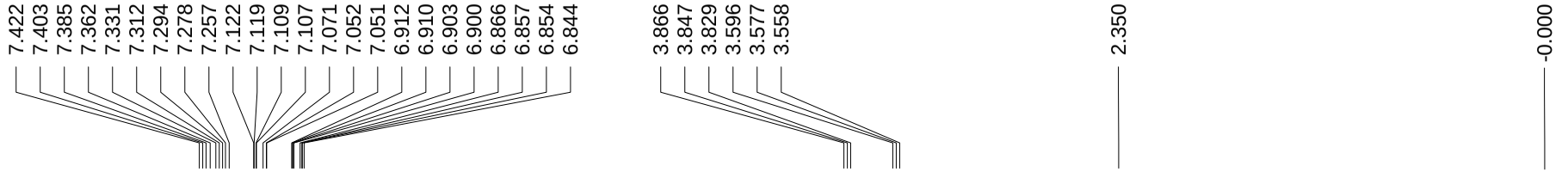
^{1}H NMR (400 MHz, $CDCl_3$)



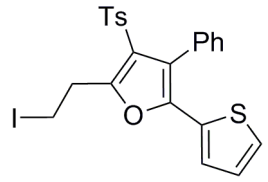
4s



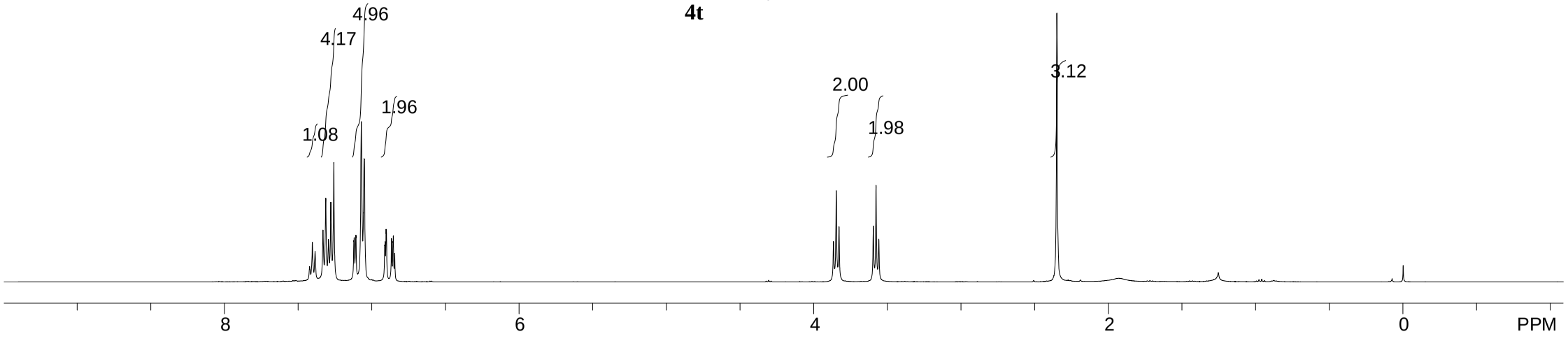

156.664
149.203
143.871
138.344
132.920
132.682
131.084
130.307
129.155
128.340
128.285
128.003
127.580
127.557
126.599
126.521
126.430
125.405
125.017
123.082
120.742
77.319
77.000
76.685
31.978
21.529
0.053
200
150
100
50
0
PPM
4s
I
O
Ts
Ph
^{13}C NMR (100 MHz, $CDCl_3$)

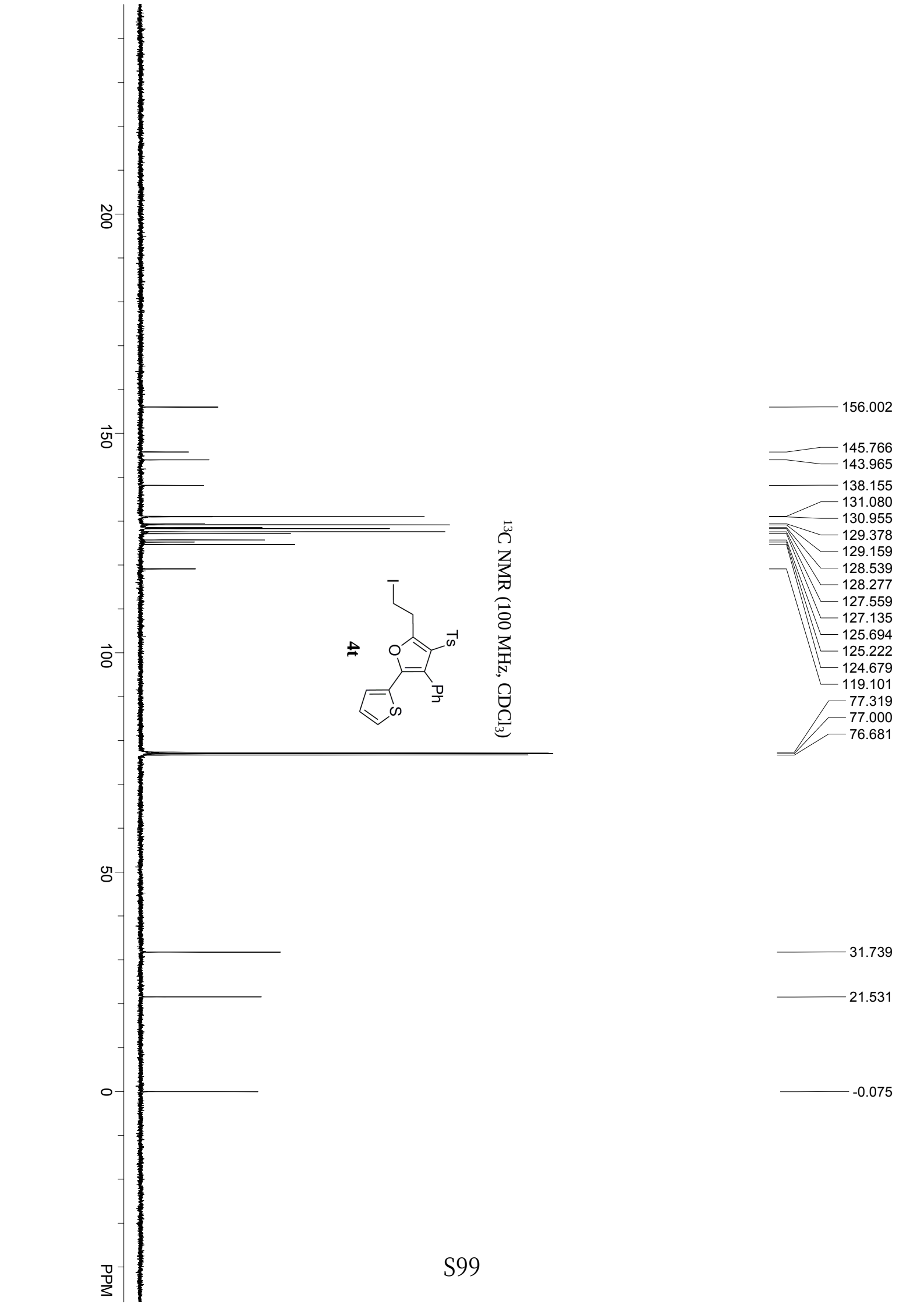


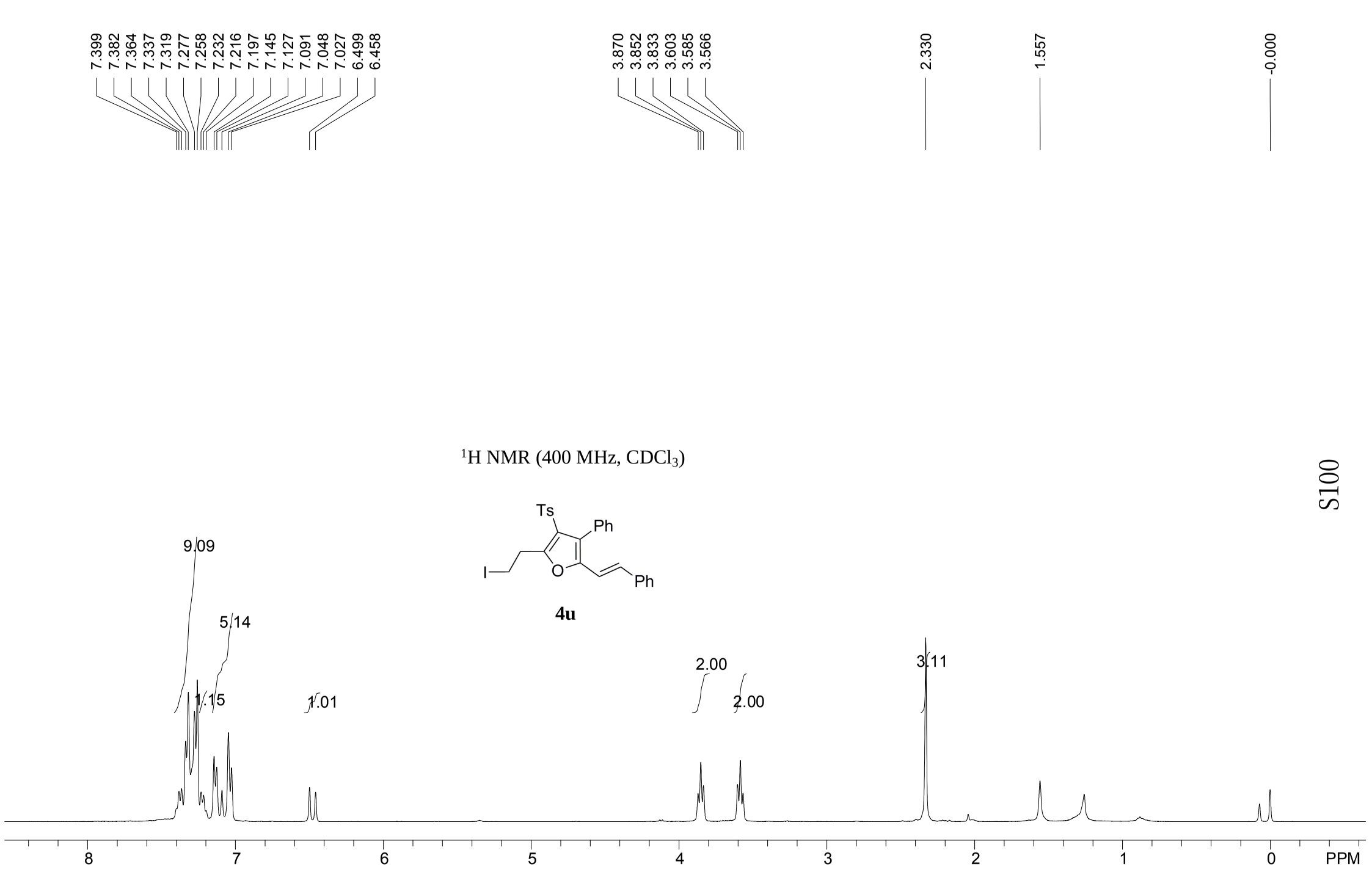
^{1}H NMR (400 MHz, $CDCl_3$)



4t

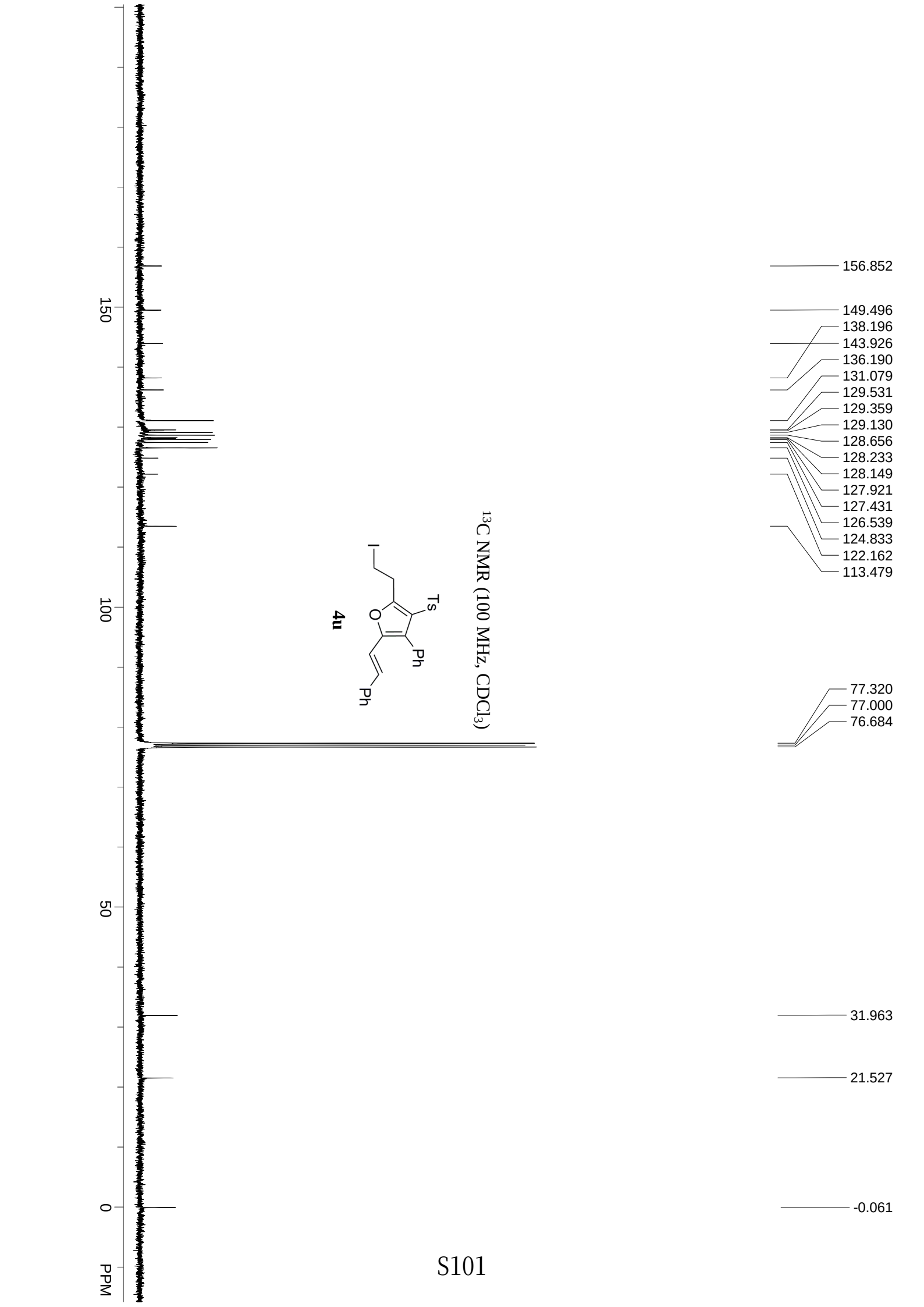


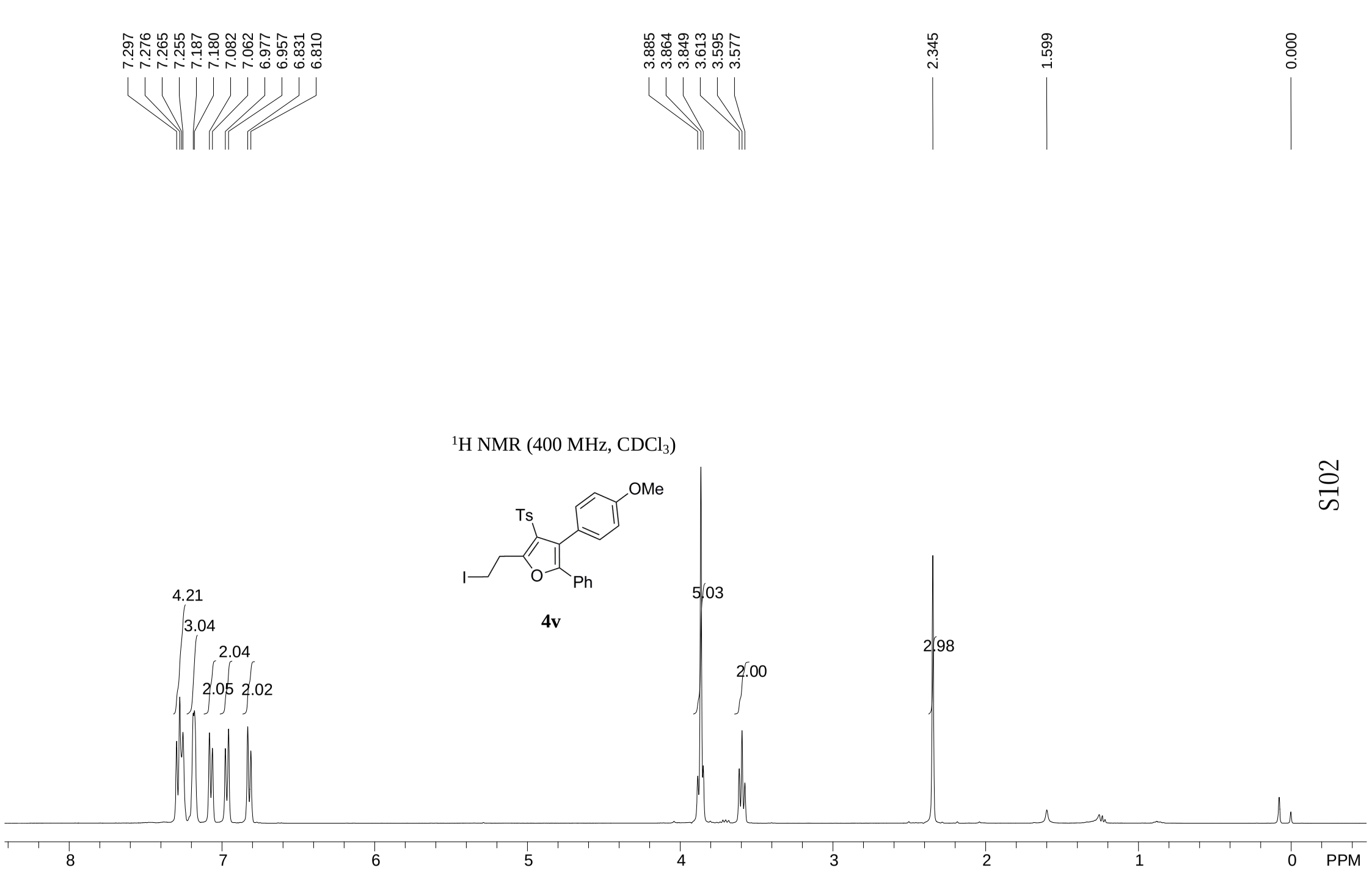

^{13}C NMR (100 MHz, CDCl$_3$)
4t
I
O
Ts
Ph
S
156.002
145.766
143.965
138.155
131.080
130.955
129.378
129.159
128.539
128.277
127.559
127.135
125.694
125.222
124.679
119.101
77.319
77.000
76.681
31.739
21.531
-0.075
200
150
100
50
0
PPM



^{1}H NMR (400 MHz, $CDCl_3$)

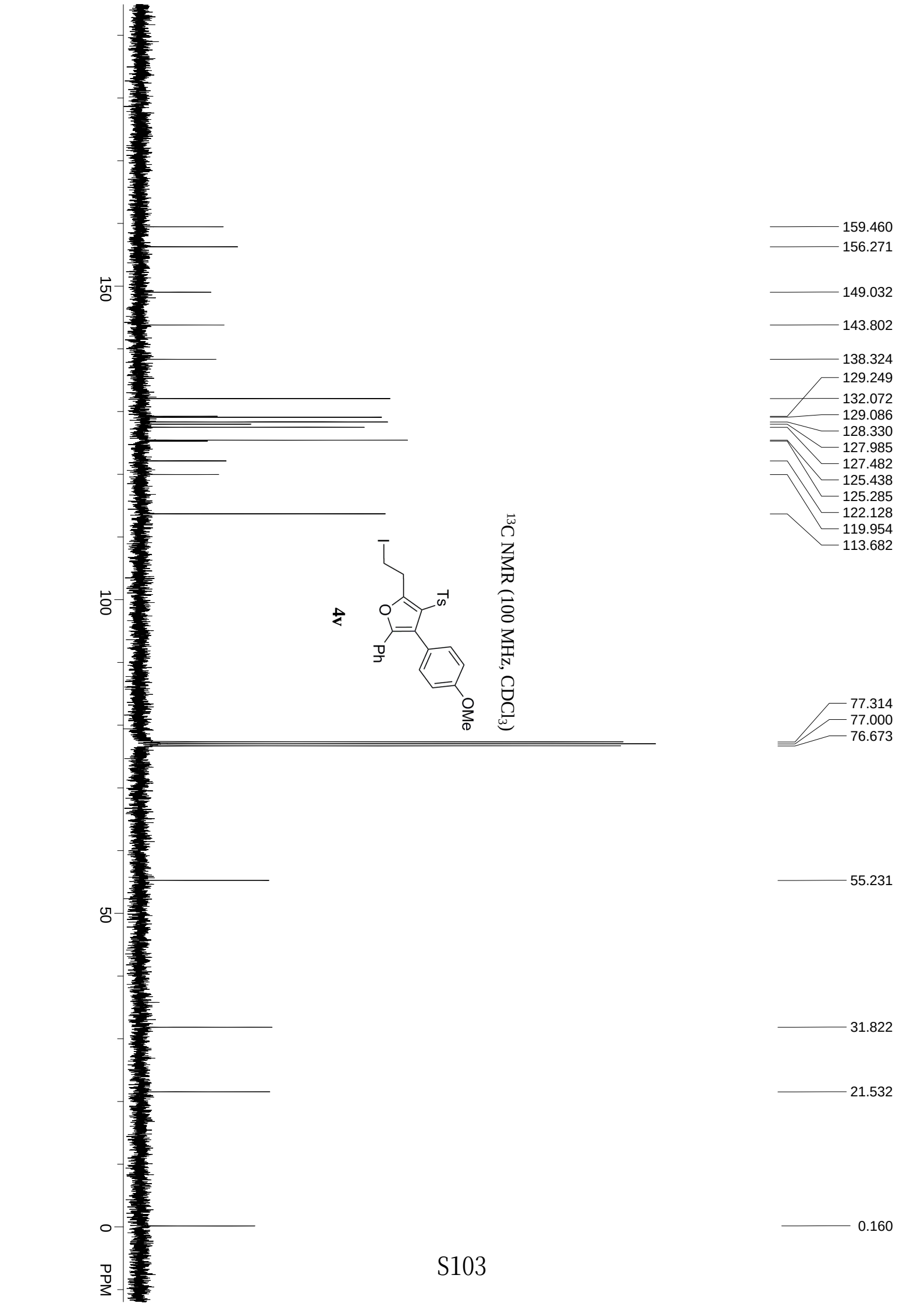
4u

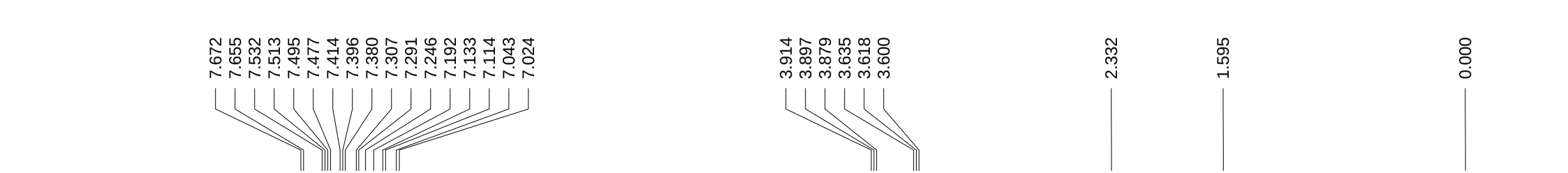

156.852
149.496
138.196
143.926
136.190
131.079
129.531
129.359
129.130
128.656
128.233
128.149
127.921
127.431
126.539
124.833
122.162
113.479
77.320
77.000
76.684
31.963
21.527
-0.061
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4u
I
O
Ts
Ph
Ph



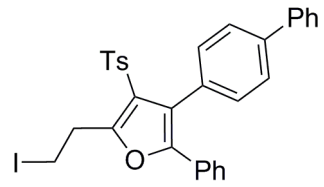
^{1}H NMR (400 MHz, $CDCl_3$)

4v

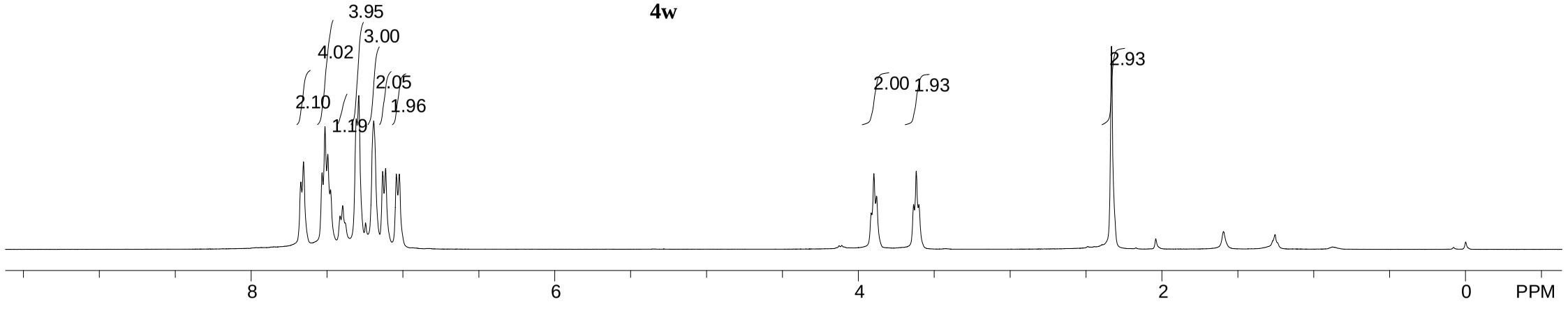

159.460
156.271
149.032
143.802
138.324
129.249
132.072
129.086
128.330
127.985
127.482
125.438
125.285
122.128
119.954
113.682
77.314
77.000
76.673
55.231
31.822
21.532
0.160
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4v
I
Ts
O
Ph
OMe

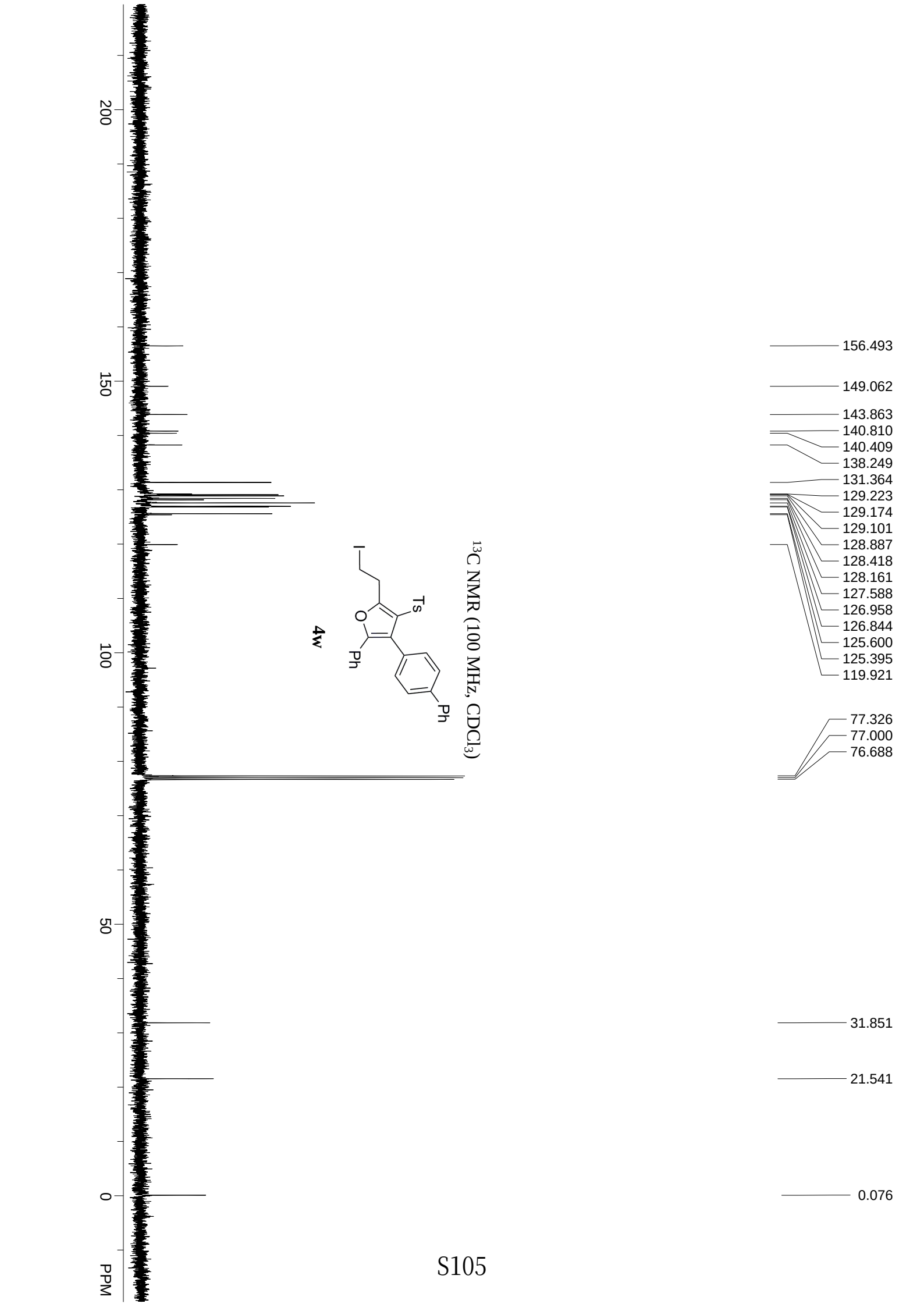


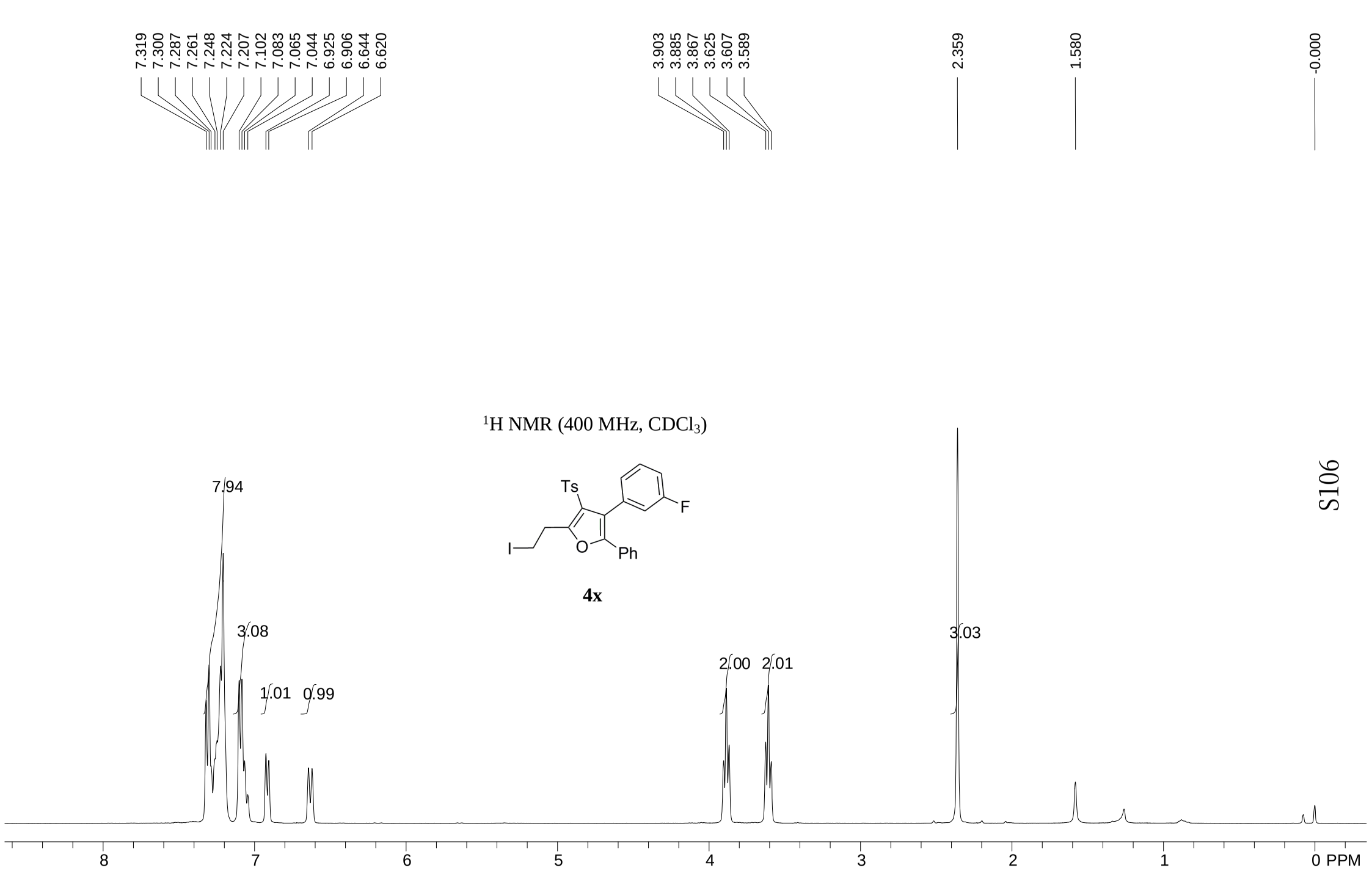
^{1}H NMR (400 MHz, $CDCl_3$)

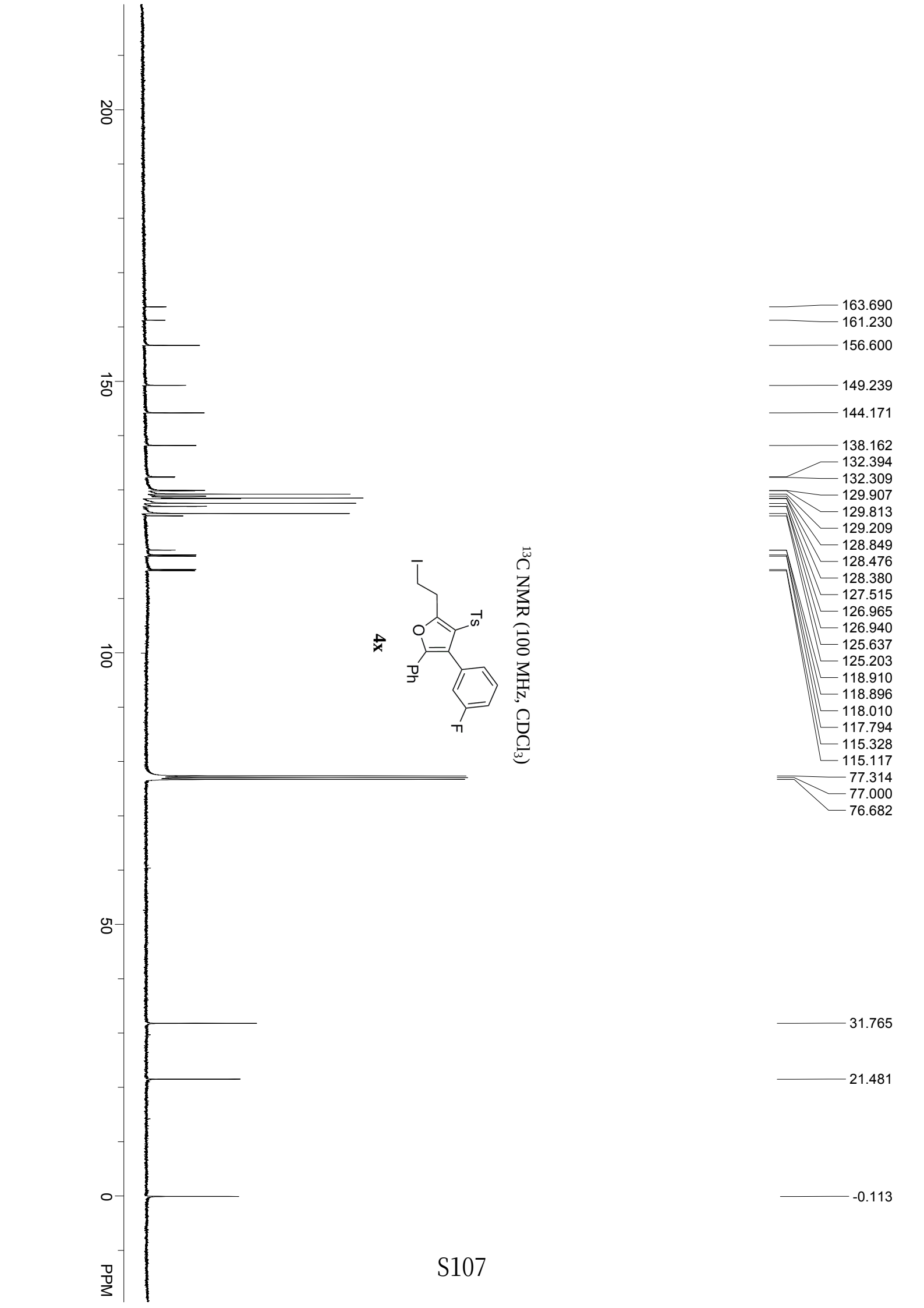


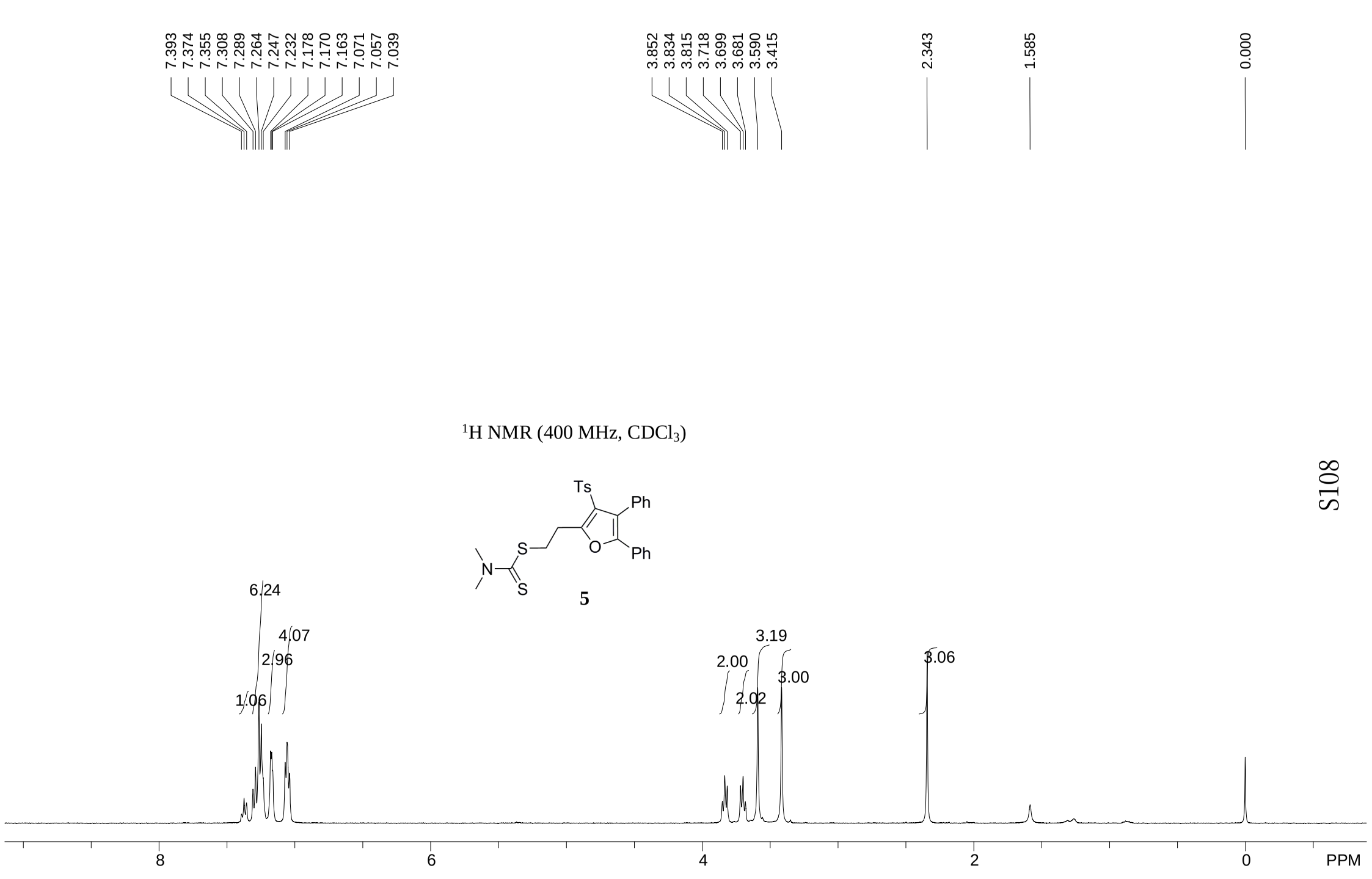
4w




156.493
149.062
143.863
140.810
140.409
138.249
131.364
129.223
129.174
129.101
128.887
128.418
128.161
127.588
126.958
126.844
125.600
125.395
119.921
77.326
77.000
76.688
31.851
21.541
0.076
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
4w
I
O
Ts
Ph
Ph

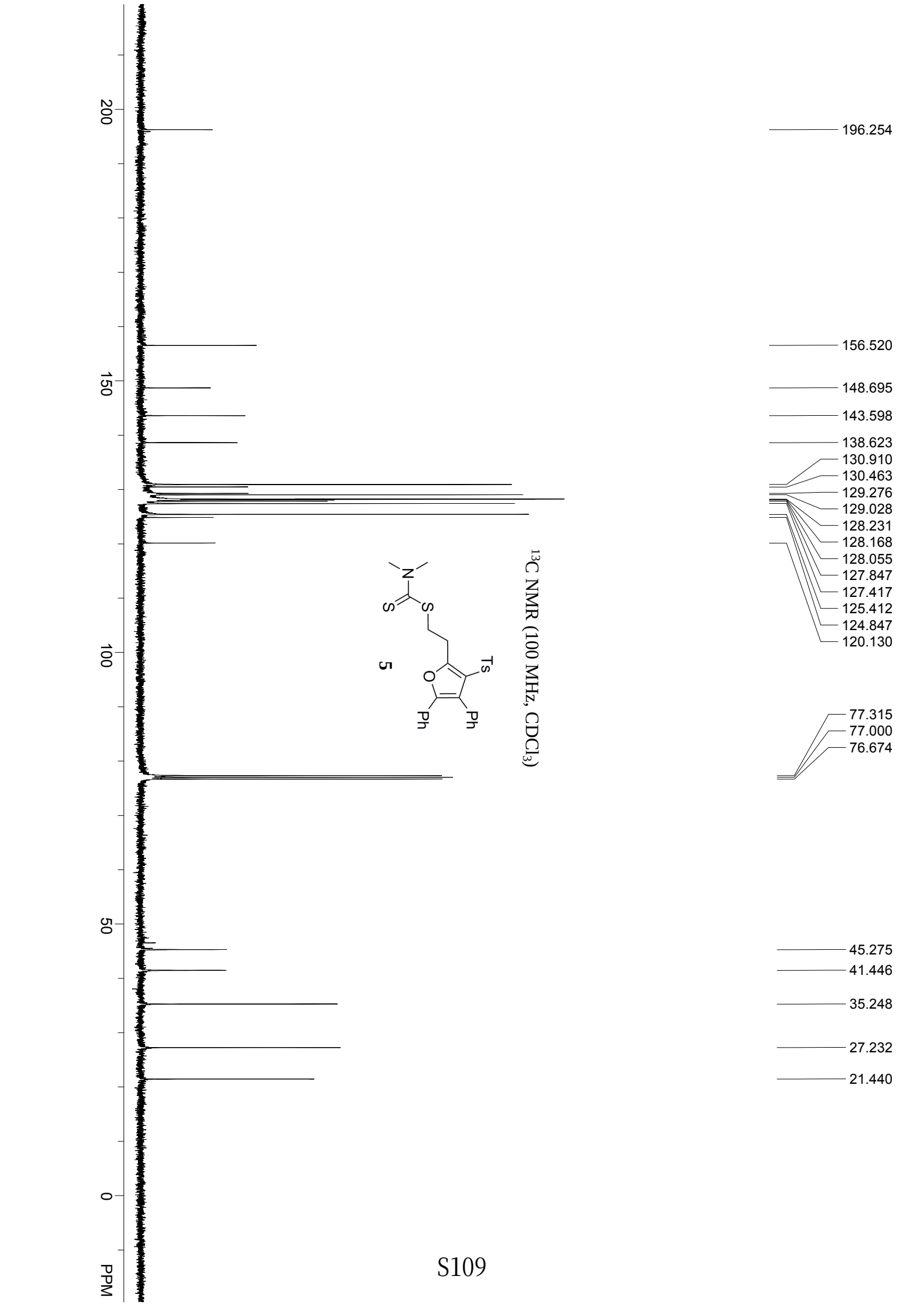

7.319
7.300
7.287
7.261
7.248
7.224
7.207
7.102
7.083
7.065
7.044
6.925
6.906
6.644
6.620
3.903
3.885
3.867
3.625
3.607
3.589
2.359
1.580
-0.000
^{1}H NMR (400 MHz, $CDCl_3$)
Ts
F
I
O
Ph
4x
7.94
3.08
1.01
0.99
2.00
2.01
3.03
8
7
6
5
4
3
2
1
0 PPM

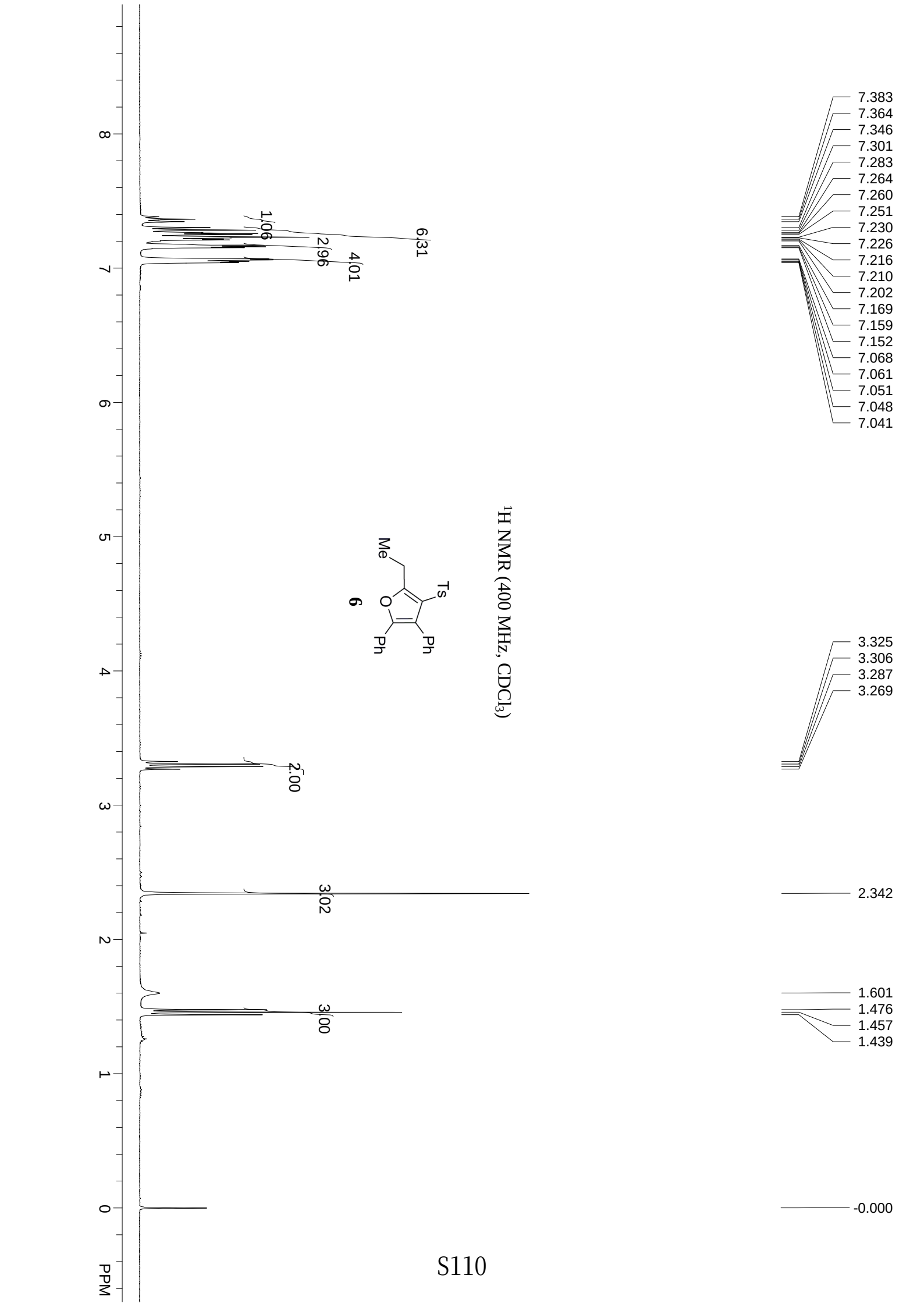

^{13}C NMR (100 MHz, $CDCl_3$)
4x
I
Ts
O
Ph
F
163.690
161.230
156.600
149.239
144.171
138.162
132.394
132.309
129.907
129.813
129.209
128.849
128.476
128.380
127.515
126.965
126.940
125.637
125.203
118.910
118.896
118.010
117.794
115.328
115.117
77.314
77.000
76.682
31.765
21.481
-0.113
200
150
100
50
0
PPM

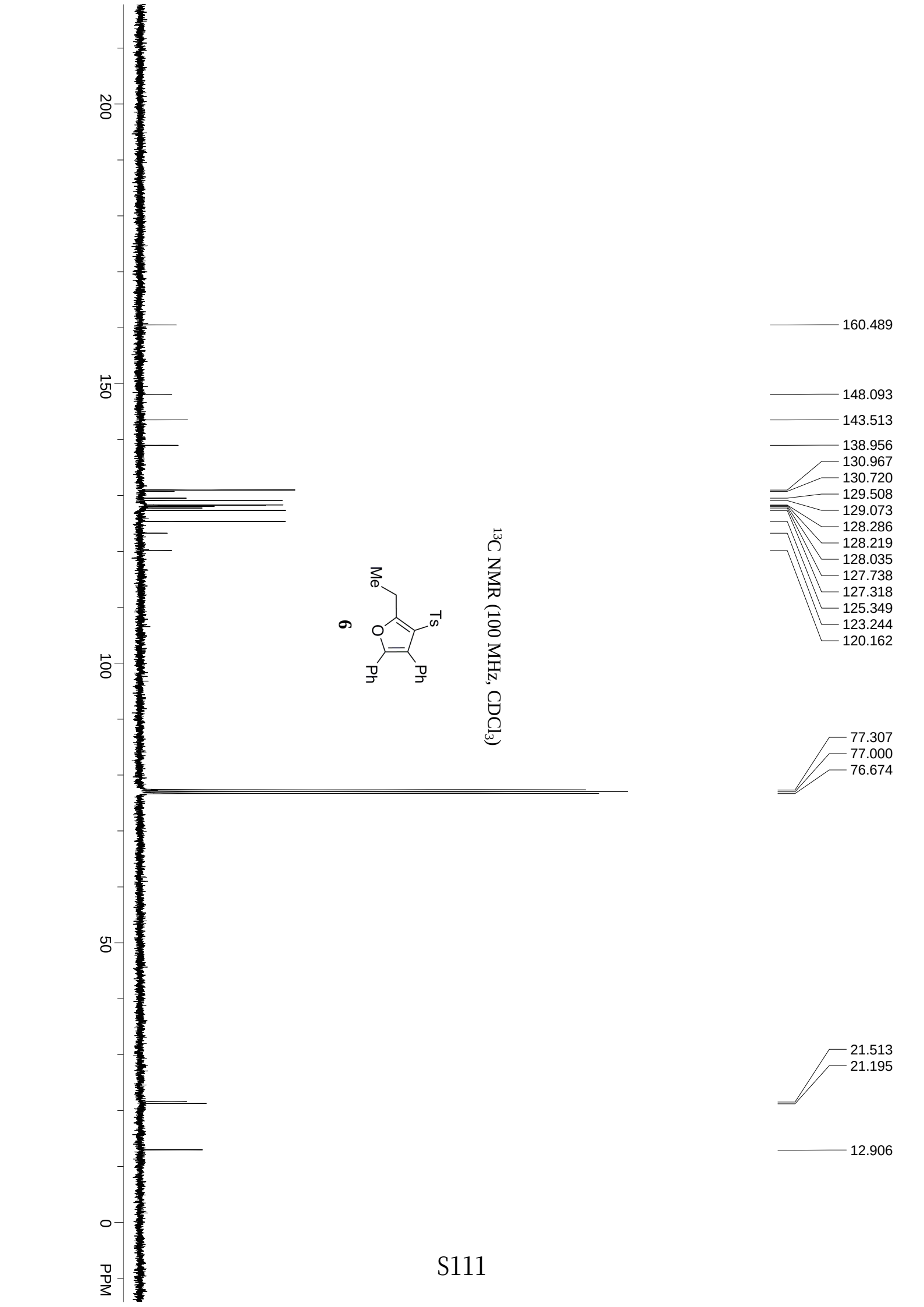


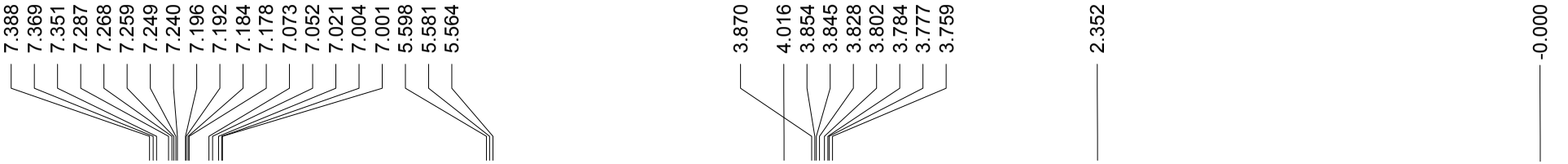
^{1}H NMR (400 MHz, $CDCl_3$)

5

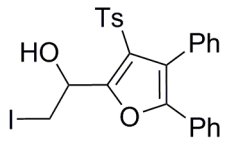

200
150
100
50
0
PPM
196.254
156.520
148.695
143.598
138.623
130.910
130.463
129.276
129.028
128.231
128.168
128.055
127.847
127.417
125.412
124.847
120.130
77.315
77.000
76.674
45.275
41.446
35.248
27.232
21.440
N
S
S
O
Ts
Ph
Ph
5
^{13}C NMR (100 MHz, CDCl$_3$)


^{1}H NMR (400 MHz, CDCl$_3$)
Me
Ts
O
Ph
Ph
6
7.383
7.364
7.346
7.301
7.283
7.264
7.260
7.251
7.230
7.226
7.216
7.210
7.202
7.169
7.159
7.152
7.068
7.061
7.051
7.048
7.041
3.325
3.306
3.287
3.269
2.342
1.601
1.476
1.457
1.439
-0.000
1.06
6.31
2.96
4.01
2.00
3.02
3.00
PPM

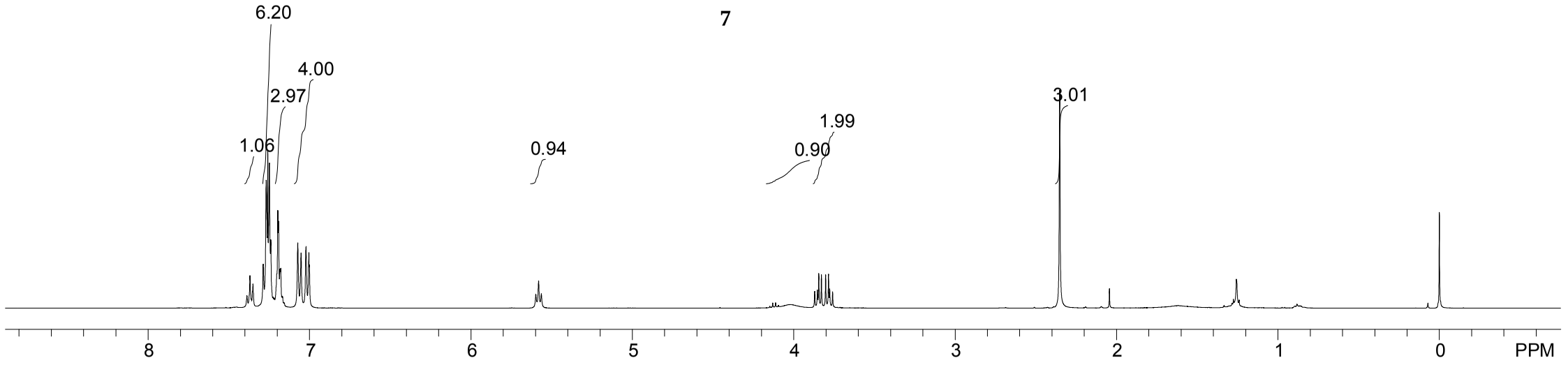

160.489
148.093
143.513
138.956
130.967
130.720
129.508
129.073
128.286
128.219
128.035
127.738
127.318
125.349
123.244
120.162
77.307
77.000
76.674
21.513
21.195
12.906
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
6
Me
Ts
O
Ph
Ph

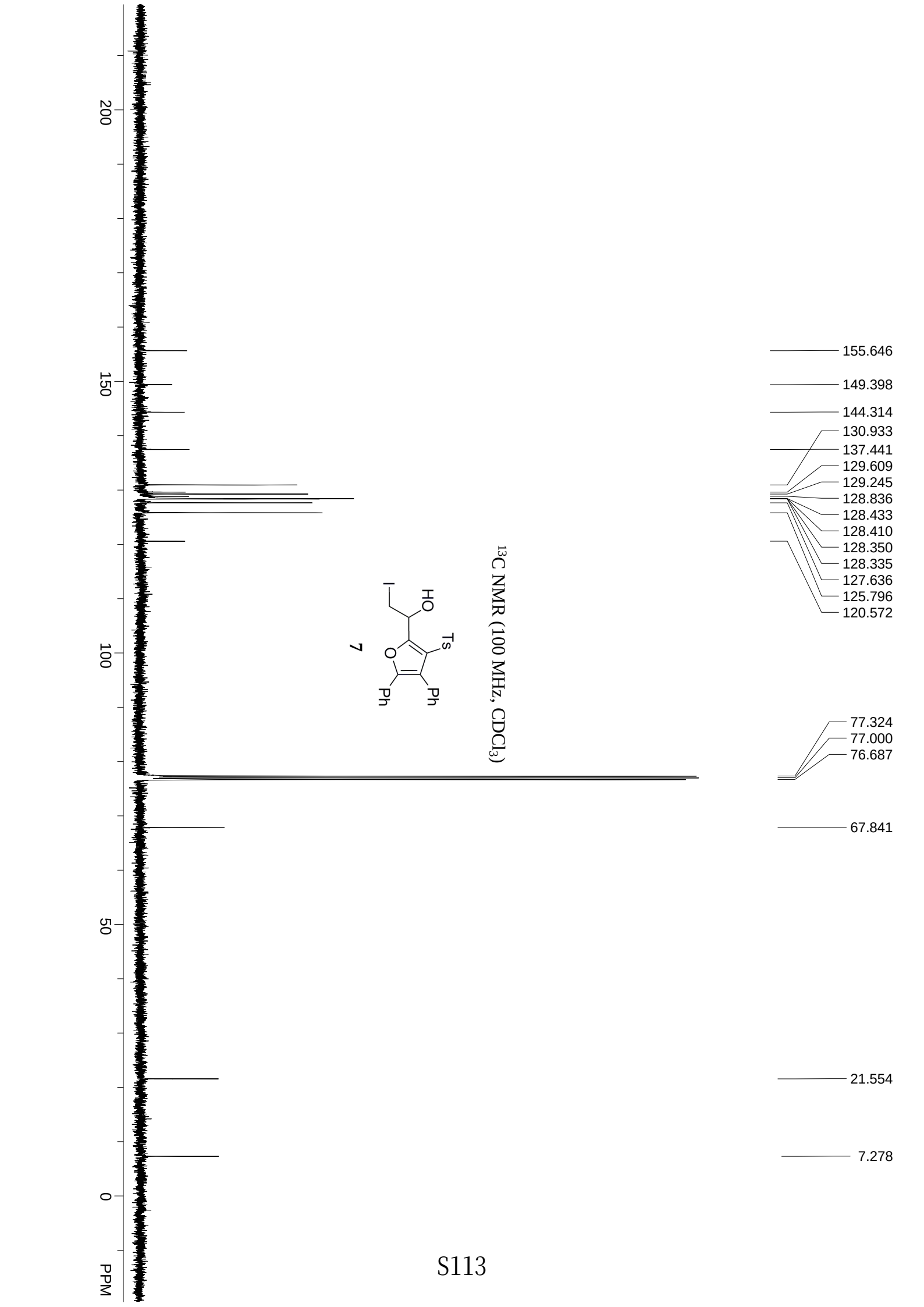


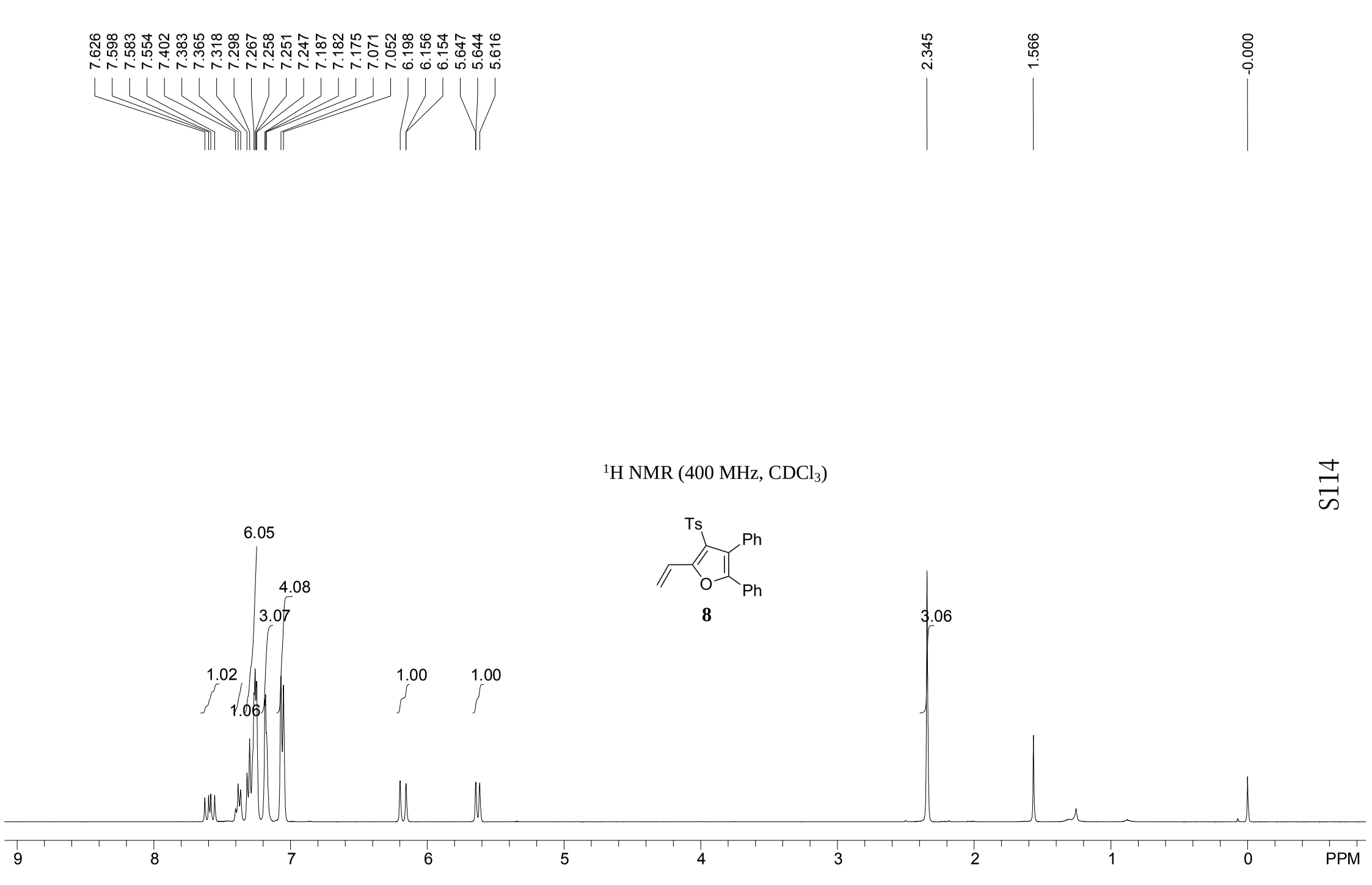
^{1}H NMR (400 MHz, $CDCl_3$)



7

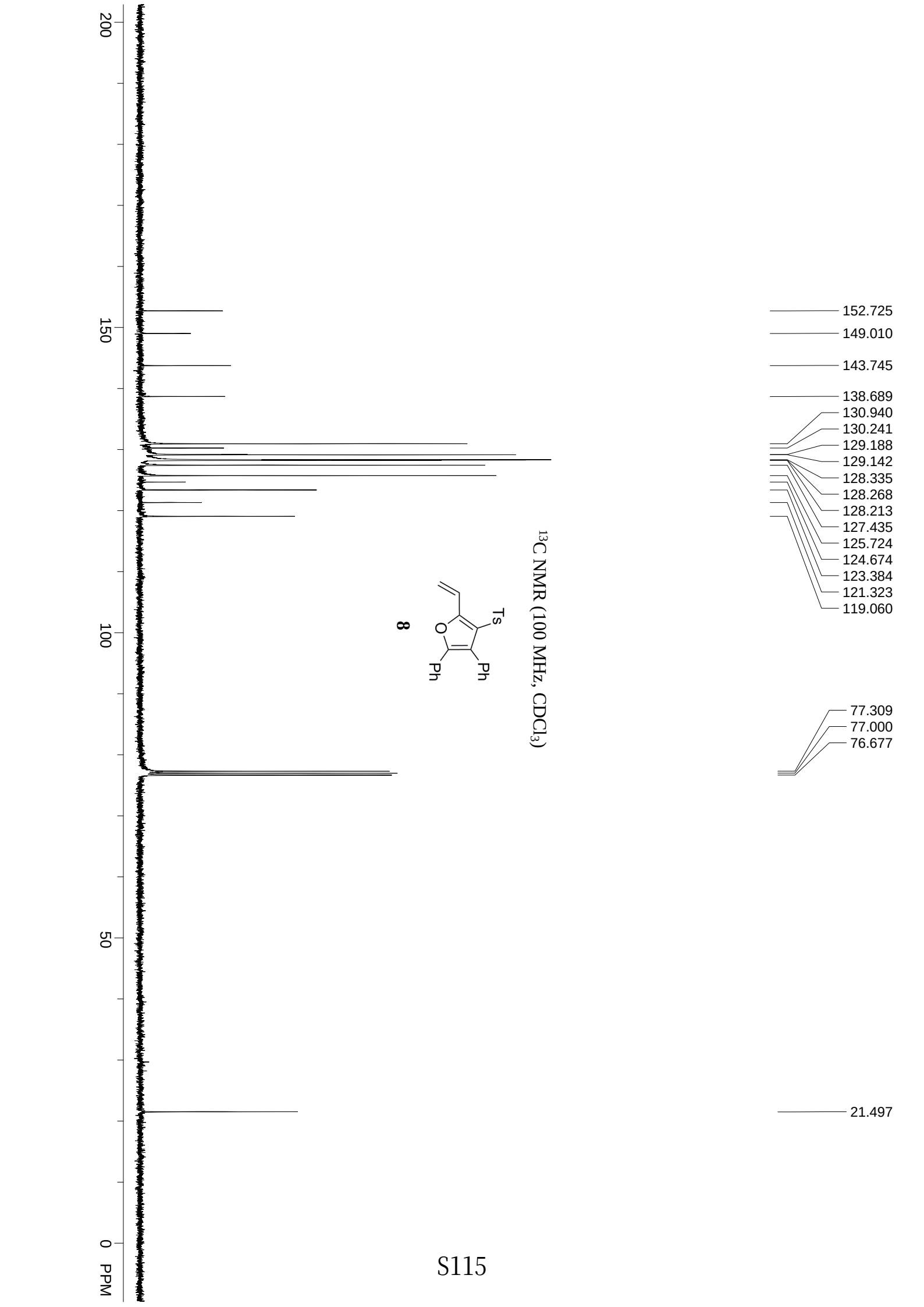


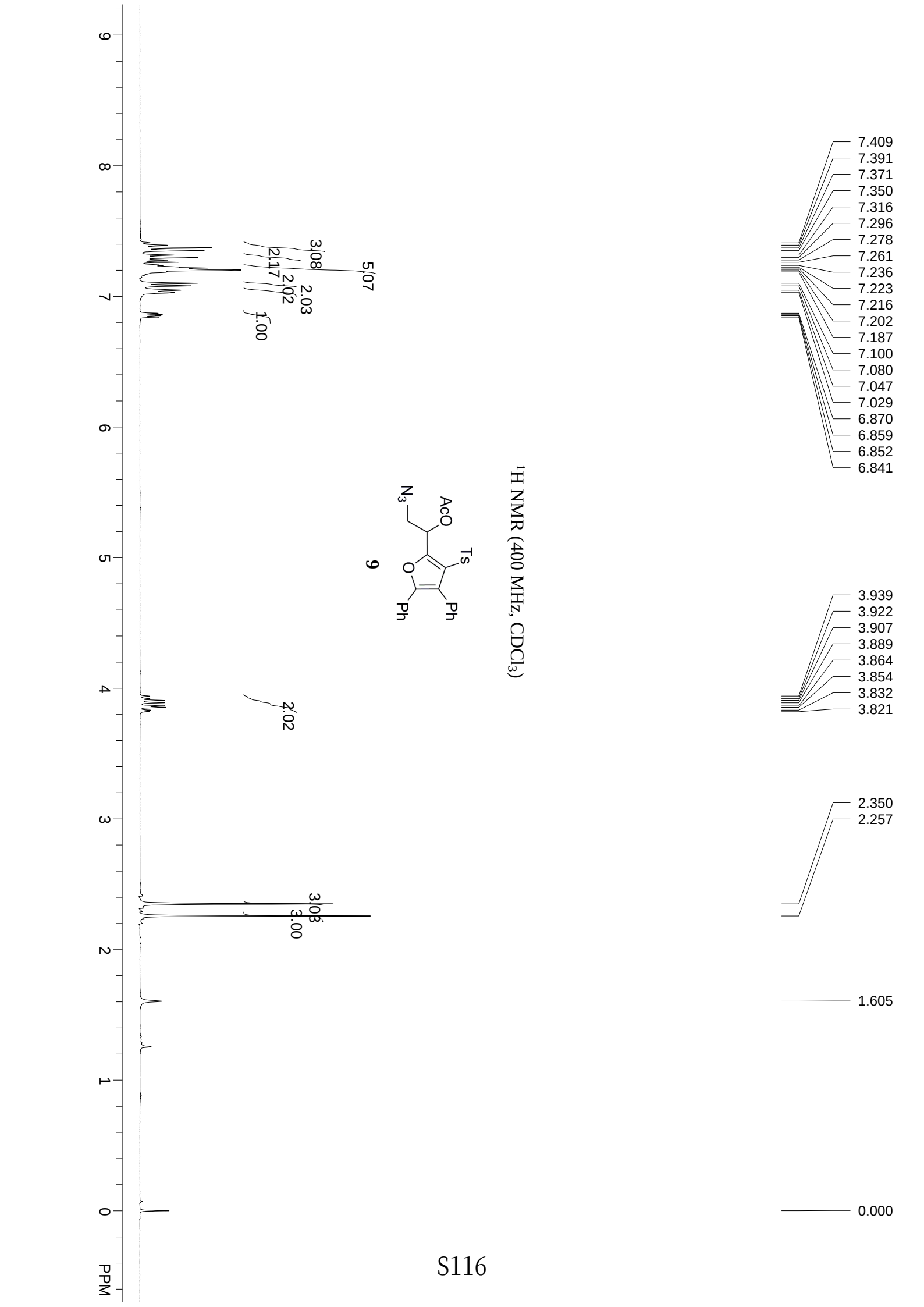

^{13}C NMR (100 MHz, $CDCl_3$)
7
I
HO
Ts
O
Ph
Ph
155.646
149.398
144.314
130.933
137.441
129.609
129.245
128.836
128.433
128.410
128.350
128.335
127.636
125.796
120.572
77.324
77.000
76.687
67.841
21.554
7.278
200
150
100
50
0
PPM

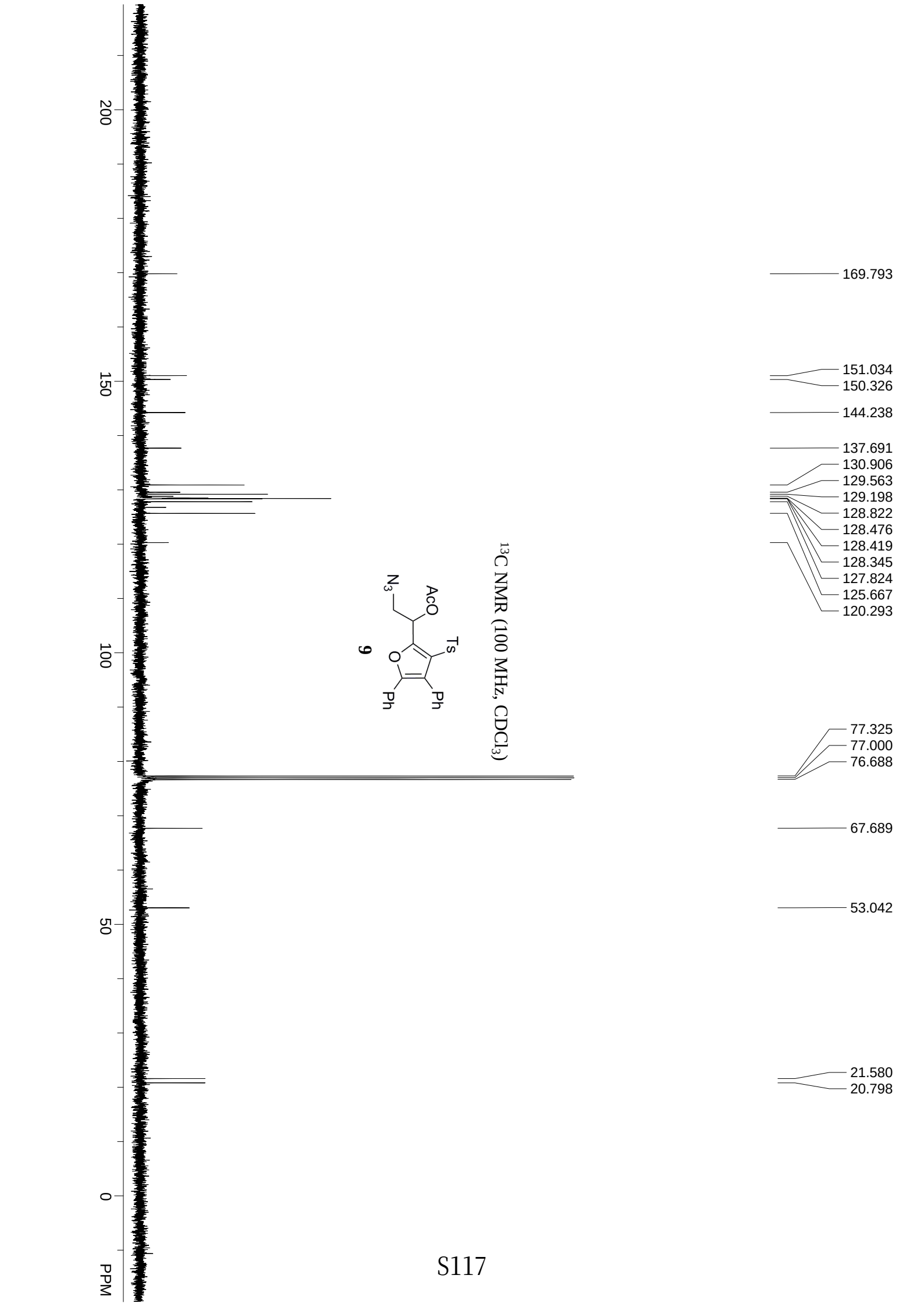


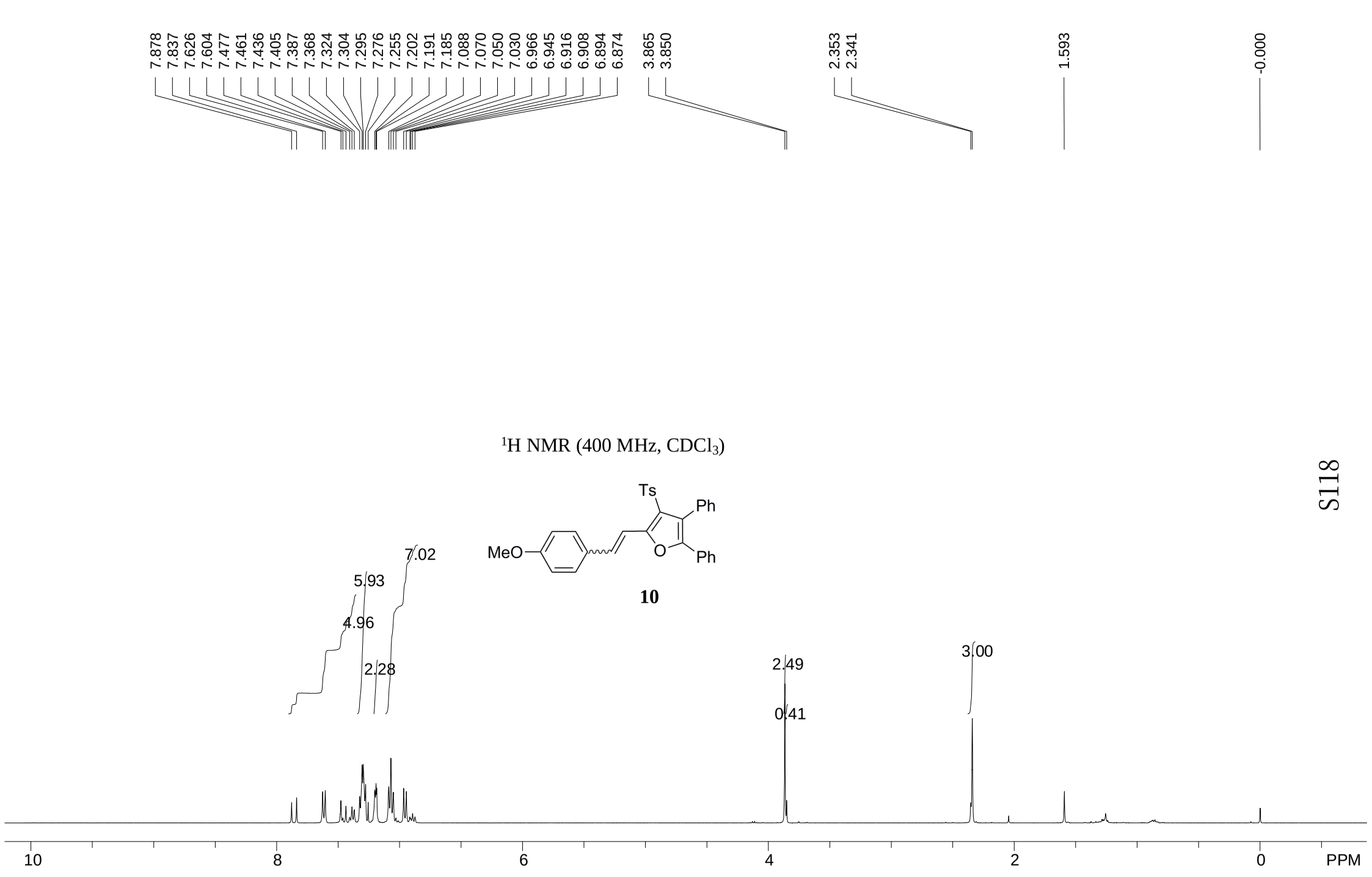
^{1}H NMR (400 MHz, $CDCl_3$)

8

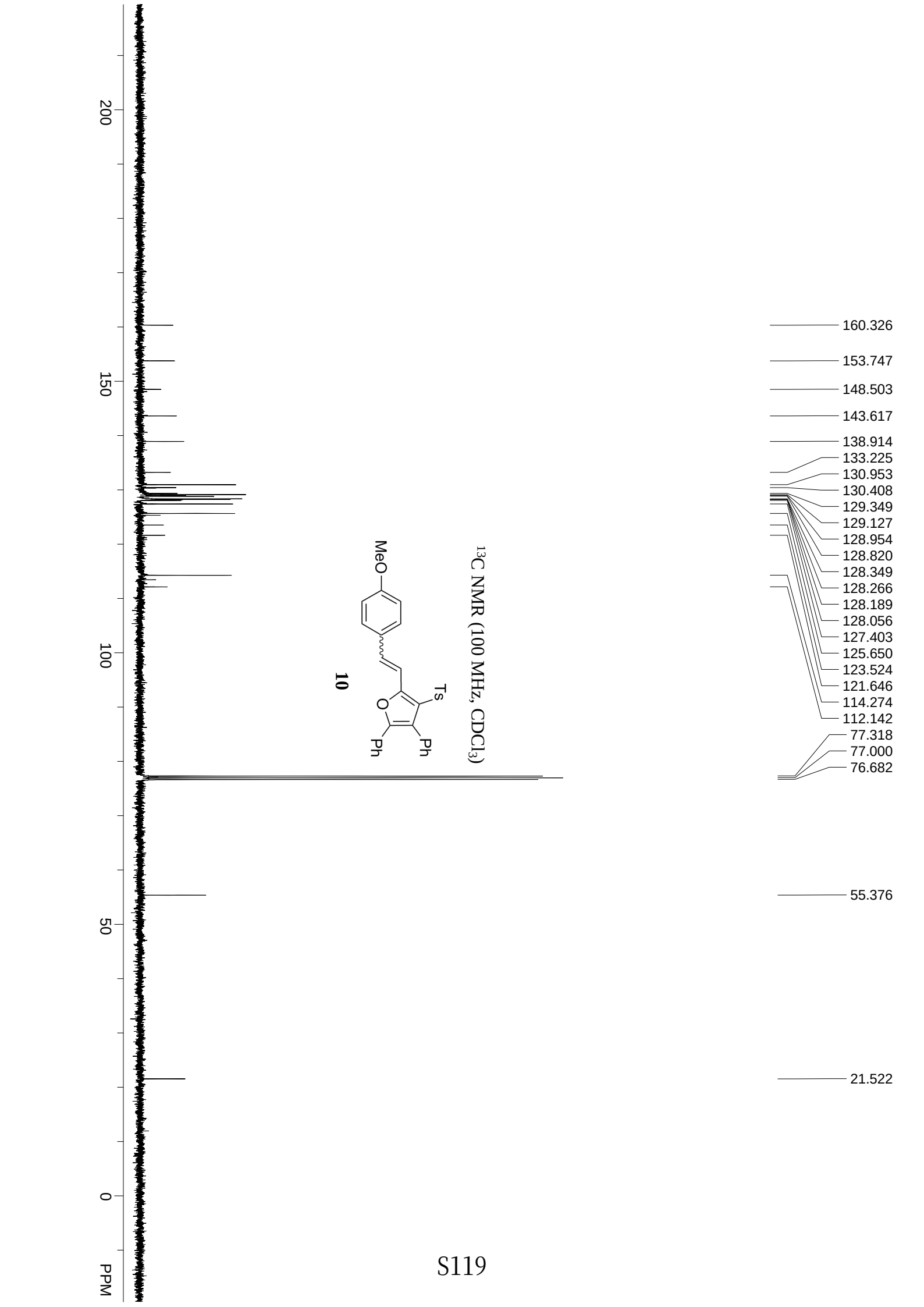

200
150
100
50
0
PPM
152.725
149.010
143.745
138.689
130.940
130.241
129.188
129.142
128.335
128.268
128.213
127.435
125.724
124.674
123.384
121.323
119.060
77.309
77.000
76.677
21.497
^{13}C NMR (100 MHz, $CDCl_3$)
8
Ts
O
Ph
Ph


^{1}H NMR (400 MHz, $CDCl_3$)
9
AcO
N_3
Ts
Ph
Ph
O
7.409
7.391
7.371
7.350
7.316
7.296
7.278
7.261
7.236
7.223
7.216
7.202
7.187
7.100
7.080
7.047
7.029
6.870
6.859
6.852
6.841
3.939
3.922
3.907
3.889
3.864
3.854
3.832
3.821
2.350
2.257
1.605
0.000
5.07
3.08
2.03
2.02
2.17
1.00
2.02
3.05
3.00
PPM


169.793
151.034
150.326
144.238
137.691
130.906
129.563
129.198
128.822
128.476
128.419
128.345
127.824
125.667
120.293
77.325
77.000
76.688
67.689
53.042
21.580
20.798
200
150
100
50
0
PPM
^{13}C NMR (100 MHz, CDCl$_3$)
9
N$_3$
AcO
Ts
O
Ph
Ph



^{1}H NMR (400 MHz, $CDCl_3$)


^{13}C NMR (100 MHz, $CDCl_3$)
MeO
Ts
Ph
Ph
O
10
160.326
153.747
148.503
143.617
138.914
133.225
130.953
130.408
129.349
129.127
128.954
128.820
128.349
128.266
128.189
128.056
127.403
125.650
123.524
121.646
114.274
112.142
77.318
77.000
76.682
55.376
21.522
200
150
100
50
0
PPM