

Supporting Information

Enantioselective Synthesis of α -Amino Phosphonates via Pd-Catalyzed Asymmetric Hydrogenation

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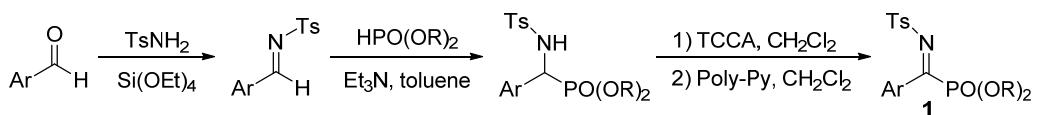
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1. General

All reactions were carried out under an atmosphere of nitrogen using the standard Schlenk techniques, unless otherwise noted. Commercially available reagents were used without further purification. Solvents were treated prior to use according to the standard methods. ^1H NMR, ^{13}C NMR, ^{31}P NMR and ^{19}F NMR spectra were recorded at room temperature in CDCl_3 on 400 MHz instrument with tetramethylsilane (TMS) as internal standard. Optical rotations were measured with JASCO P-1010 polarimeter. Flash column chromatography was performed on silica gel (200-300 mesh). All reactions were monitored by TLC analysis.

2. General Procedure for Synthesis of Iminophosphonates **1** and **3**

Linear α -iminophosphonates **1** were synthesized according to Palacios's procedure.² Among them, **1a-f**, **1h** and **1i** are the known compounds.



Following a known literature report,¹ the aldehyde (5.2 mmol), *p*-toluenesulfonamides (5.0 mmol) and ethyl silicate (5.4 mmol) were combined in a flask. The mixture was heated at 160 °C under nitrogen for 5 h. On cooling, the reaction mixture was dissolved in warm ethyl acetate (30 mL) and treated with petroleum ether (50 mL), and stirred at room temperature for 1 h. During this time crystals formed, which were collected by filtration, washed with petroleum ether and dried to afford *N*-sulfonyl aldimine.

To a suspension of the corresponding *N*-sulfonyl aldimine (25 mmol) and the corresponding dialkylphosphite (30 mmol) in toluene (50 mL) was added triethylamine (2.5 mmol). The solution was stirred and refluxed in toluene for 24 h until disappearance of *N*-sulfonyl aldimine. The solution was allowed to cool to room temperature, and upon cooling to -20 °C, crystals were obtained. The resulting solid was collected by filtration, washed with cold toluene (30 mL) and hexanes (30 mL) and dried under low pressure to afford pure *N*-tosyl α -aminophosphonates.²

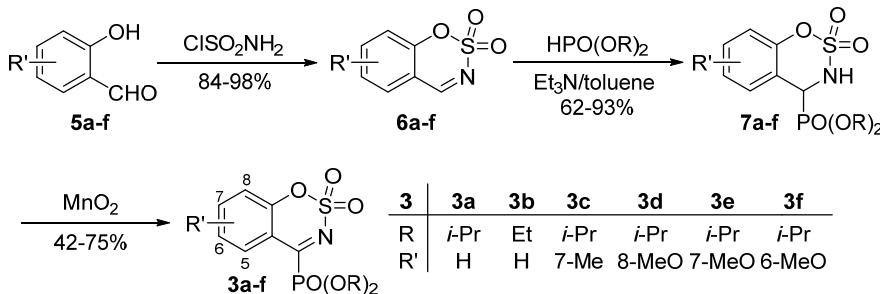
To a solution of *N*-tosyl α -aminophosphonate (5.0 mmol) in dichloromethane (15 mL) was added trichloroisocyanuric acid (15 mmol). The resulting suspension was stirred until disappearance of the *N*-tosyl α -aminophosphonate, which was monitored by ^{31}P NMR. Then the solid residue was eliminated by filtration to afford a clear solution of intermediate *N*-chloro α -aminophosphonate and poly(4-vinylpyridine) (5.0 mmol), previously dried at 100 °C overnight, was added. The resulting suspension was stirred under reflux overnight and the reaction was then filtered and concentrated under reduced pressure. The resulting yellow oily crude was purified by crystallization from diethyl ether.²

(E)-Diisopropyl(4-bromophenyl)(tosylimino)methylphosphonate (1g): The reaction was run by using diisopropyl((4-bromophenyl)(4-methylphenylsulfonamido)methyl)phosphonate (2.02 g,

4.0 mmol), affording 1.16 g (58% yield) of **1g** as a white solid, m.p. = 99-100 °C. ^1H NMR (400 MHz, CDCl_3) δ 7.78 (d, J = 8.3 Hz, 2H), 7.68-7.56 (m, 4H), 7.30 (d, J = 8.3 Hz, 2H), 4.76-4.56 (m, 2H), 2.44 (s, 3H), 1.27 (d, J = 6.1 Hz, 6H), 1.10 (d, J = 6.2 Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.7 (d, J_{PC} = 199.6 Hz), 144.7, 137.0, 133.1 (d, J_{PC} = 25.4 Hz), 131.5, 130.1 (d, J_{PC} = 4.1 Hz), 129.7, 127.9, 126.6, 74.2 (d, J_{PC} = 7.2 Hz), 24.2 (d, J_{PC} = 3.6 Hz), 23.5 (d, J_{PC} = 5.7 Hz),

21.8; ^{31}P NMR (162 MHz, CDCl_3) δ 1.7. HRMS Calculated for $\text{C}_{20}\text{H}_{26}\text{BrNO}_5\text{PS} [\text{M}+\text{H}]^+$ 502.0447, found 502.0450.

Cyclic six-membered ring α -iminophosphonates **3a-f** were synthesized from salicylaldehyde by the combination of slightly modified literature procedures.^{2,3,4}



Following a known literature report,³ to a solution of salicylaldehyde (15 mmol) in dimethylacetamide (100 mL) at 0 °C was carefully added freshly prepared chlorosulfonamide (40 mmol) in small portions and the resulting solution was stirred for 12 h. The reaction was quenched carefully with ice-cold water (100 mL) and the mixture was transferred to a separating funnel containing dichloromethane (200 mL). The aqueous layer was separated and extracted with dichloromethane (3×50 mL), and the combined organic layers were washed with saturated sodium bicarbonate solution (100 mL), dried over sodium sulfate, filtered through a short pad of silica using dichloromethane as eluent and concentrated in vacuo. The residue was heated to 180 °C under vacuum to remove volatile impurities to get benzoxathiazine-2,2-dioxide (**6a-f**).

To a suspension of the corresponding benzoxathiazine-2,2-dioxide (25 mmol) and the corresponding dialkylphosphite (30 mmol) in toluene (50 mL) was added triethylamine (2.5 mmol). The solution was stirred and refluxed in toluene for 24 h until disappearance of benzoxathiazine-2,2-dioxide. The solution was allowed to cool to room temperature and purification was performed by a silica gel column eluted with dichloromethane to give pure product.²

To a solution of the above product (1.0 mmol) in dichloromethane was added freshly prepared manganese dioxide (10 mmol) (the manganese dioxide must be freshly prepared, or the reaction yield will be low). The solution was stirred and refluxed at 50 °C for 4-8 h. The solution was allowed to cool to room temperature and purification was performed by a silica gel column eluted with dichloromethane to give pure product **3a-f**.⁴

1,2,3-Benzoxathiazine-2,2-dioxide-4-diisopropylphosphonate (3a): The reaction was conducted by using 3,4-dihydro-1,2,3-benzoxathiazine-2,2-dioxide-4-diisopropylphosphonate (3.07 g, 8.8

mmol), affording 1.82 g (60% yield) of **3a** as a white solid, m.p. = 69-70 °C, R_f = 0.60 (dichloromethane/methanol 80/1). ^1H NMR (400 MHz, CDCl_3) δ 8.54-8.49 (m, 1H), 7.80-7.69 (m, 1H), 7.48-7.38 (m, 1H), 7.30 (d, J = 8.4 Hz, 1H), 5.00-4.85 (m, 2H), 1.43 (d, J = 6.2 Hz, 6H), 1.40 (d, J = 6.2 Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 173.6 (d, J_{PC} = 199.8 Hz), 154.4 (d, J_{PC} = 8.8 Hz), 137.8, 131.5, 126.4, 119.2 (d, J_{PC} = 3.2 Hz), 115.9 (d, J_{PC} = 24.2 Hz), 75.2 (d, J_{PC} = 7.1 Hz), 24.2 (d, J_{PC} = 3.9 Hz), 23.9 (d, J_{PC} = 5.4 Hz); ^{31}P NMR (162 MHz, CDCl_3) δ -0.8. HRMS Calculated for $\text{C}_{13}\text{H}_{19}\text{NO}_6\text{PS} [\text{M}+\text{H}]^+$ 348.0665, found 348.0667.

1,2,3-Benzoxathiazine-2,2-dioxide-4-diethylphosphonate (3b): The reaction was conducted by using 3,4-dihydro-1,2,3-benzoxathiazine-2,2-dioxide-4-diethylphosphonate (0.964 g, 3.0

mmol), affording 0.488 g (51% yield) of **3b** as colorless oil, $R_f = 0.40$ (dichloromethane/methanol 80/1). ^1H NMR (400 MHz, CDCl_3) δ 8.52-8.47 (m, 1H), 7.79-7.72 (m, 1H), 7.47-7.40 (m, 1H), 7.31 (d, $J = 8.4$ Hz, 1H), 4.46-4.26 (m, 4H), 1.42 (t, $J = 7.1$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 173.0 (d, $J_{\text{PC}} = 199.4$ Hz), 154.4 (d, $J_{\text{PC}} = 8.9$ Hz), 138.0, 131.4, 126.5, 119.2 (d, $J_{\text{PC}} = 3.2$ Hz), 115.9 (d, $J_{\text{PC}} = 24.3$ Hz), 65.7 (d, $J_{\text{PC}} = 7.1$ Hz), 16.5 (d, $J_{\text{PC}} = 6.0$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ 0.9. HRMS Calculated for $\text{C}_{11}\text{H}_{15}\text{NO}_6\text{PS} [\text{M}+\text{H}]^+$ 320.0352, found 320.0355.

1,2,3-Benzoxathiazine-2,2-dioxide-7-methyl-4-diisopropylphosphonate (3c): The reaction was conducted by using the 4-dihydro-1,2,3-benzoxathiazine-2,2-dioxide-7-methyl-4-diisopropylphos-

phonate (0.363 g, 1.0 mmol), affording 0.272 g (75% yield) of **3c** as a white solid, m.p. = 125-126 °C, $R_f = 0.70$ (dichloromethane/methanol 80/1). ^1H NMR (400 MHz, CDCl_3) δ 8.39 (d, $J = 8.2$ Hz, 1H), 7.25-7.19 (m, 1H), 7.11 (s, 1H), 4.98-4.84 (m, 2H), 2.50 (s, 3H), 1.42 (d, $J = 6.2$ Hz, 6H), 1.40 (d, $J = 6.2$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 173.3 (d, $J_{\text{PC}} = 199.7$ Hz), 154.6 (d, $J_{\text{PC}} = 9.0$ Hz), 150.6, 131.2, 127.4, 119.3 (d, $J_{\text{PC}} = 3.2$ Hz), 113.7 (d, $J_{\text{PC}} = 24.5$ Hz), 75.0 (d, $J_{\text{PC}} = 7.1$ Hz), 24.2 (d, $J_{\text{PC}} = 3.9$ Hz), 23.9 (d, $J_{\text{PC}} = 5.4$ Hz), 22.5; ^{31}P NMR (162 MHz, CDCl_3) δ -0.5. HRMS Calculated for $\text{C}_{14}\text{H}_{21}\text{NO}_6\text{PS} [\text{M}+\text{H}]^+$ 362.0822, found 362.0823.

1,2,3-Benzoxathiazine-2,2-dioxide-8-methoxy-4-diisopropylphosphonate (3d): The reaction was conducted by using 3,4-dihydro-1,2,3-benzoxathiazine-2,2-dioxide-8-methoxy-4-diisoprop-

ylphosphonate (0.493 g, 1.3 mmol), affording 0.326 g (66% yield) of **3d** as a white solid, m.p. = 103-104 °C, $R_f = 0.40$ (dichloromethane/methanol 80/1). ^1H NMR (400 MHz, CDCl_3) δ 8.10-8.02 (m, 1H), 7.38-7.27 (m, 2H), 4.98-4.84 (m, 2H), 3.96 (s, 3H), 1.42 (d, $J = 6.2$ Hz, 6H), 1.40 (d, $J = 6.2$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 174.0 (d, $J_{\text{PC}} = 200.5$ Hz), 148.8 (d, $J_{\text{PC}} = 4.3$ Hz), 143.9 (d, $J_{\text{PC}} = 9.3$ Hz), 126.0, 122.1, 120.0, 116.6 (d, $J_{\text{PC}} = 24.7$ Hz), 75.1 (d, $J_{\text{PC}} = 7.1$ Hz), 56.8, 24.2 (d, $J_{\text{PC}} = 3.9$ Hz), 23.9 (d, $J_{\text{PC}} = 5.4$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ -0.7. HRMS Calculated for $\text{C}_{14}\text{H}_{21}\text{NO}_7\text{PS} [\text{M}+\text{H}]^+$ 378.0771, found 378.0774.

1,2,3-Benzoxathiazine-2,2-dioxide-7-methoxy-4-diisopropylphosphonate (3e): The reaction was conducted by using 3,4-dihydro-1,2,3-benzoxathiazine-2,2-dioxide-7-methoxy-4-diisoprop-

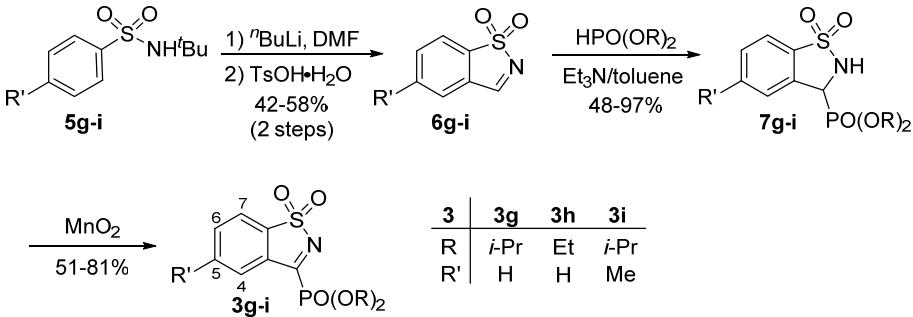
ylphosphonate (0.152 g, 0.4 mmol), affording 0.064 g (42% yield) of **3e** as a white solid, m.p. = 112-113 °C, $R_f = 0.90$ (dichloromethane). ^1H NMR (400 MHz, CDCl_3) δ 8.46 (d, $J = 9.1$ Hz, 1H), 6.92-6.85 (m, 1H), 6.75-6.71 (m, 1H), 4.97-4.81 (m, 2H), 3.93 (s, 3H), 1.41 (d, $J = 6.2$ Hz, 6H), 1.38 (d, $J = 6.2$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 172.4 (d, $J_{\text{PC}} = 199.3$ Hz), 167.3, 157.2 (d, $J_{\text{PC}} = 9.6$ Hz), 133.4, 113.6, 109.8 (d, $J_{\text{PC}} = 24.9$ Hz), 103.5 (d, $J_{\text{PC}} = 3.3$ Hz), 74.9 (d, $J_{\text{PC}} = 7.1$ Hz), 56.6, 24.2 (d, $J_{\text{PC}} = 3.9$ Hz), 23.9 (d, $J_{\text{PC}} = 5.3$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ -0.2. HRMS Calculated for $\text{C}_{14}\text{H}_{21}\text{NO}_7\text{PS} [\text{M}+\text{H}]^+$ 378.0771, found 378.0774.

1,2,3-Benzoxathiazine-2,2-dioxide-6-methoxy-4-diisopropylphosphonate (3f): The reaction was conducted by using 3,4-dihydro-1,2,3-benzoxathiazine-2,2-dioxide-6-methoxy-4-diisoprop-

ylphosphonate (0.683 g, 1.8 mmol), affording 0.377 g (55% yield) of **3f** as yellow oil, $R_f = 0.40$ (dichloromethane/methanol 80/1). ^1H NMR (400 MHz, CDCl_3) δ 8.04-7.99 (m, 1H), 7.32-7.20 (m, 2H), 4.99-4.85 (m, 2H), 3.87 (s, 3H), 1.44 (d, $J = 6.2$ Hz, 6H), 1.41 (d, $J = 6.2$ Hz, 6H); ^{13}C NMR

(100 MHz, CDCl₃) δ 173.3 (d, *J*_{PC} = 200.0 Hz), 157.1, 148.3 (d, *J*_{PC} = 8.6 Hz), 125.3, 120.1 (d, *J*_{PC} = 3.2 Hz), 116.2 (d, *J*_{PC} = 24.0 Hz), 113.4, 75.2 (d, *J*_{PC} = 7.1 Hz), 56.2, 24.2 (d, *J*_{PC} = 3.9 Hz), 23.9 (d, *J*_{PC} = 5.4 Hz); ³¹P NMR (162 MHz, CDCl₃) δ -0.5. HRMS Calculated for C₁₄H₂₁NO₇PS [M+H]⁺ 378.0771, found 378.0770.

Cyclic five-membered ring *α*-iminophosphonates **3g-i** were synthesized from *N*-*tert*-butylbenzenesulfonamide by the combination of slightly modified literature procedure.^{2,4,5,6}



To a solution of *N*-*tert*-butylbenzenesulfonamide (20 mmol) in tetrahydrofuran (50 mL) held at -78 °C under nitrogen atmosphere was added dropwise a 1.6 M solution of *n*-butyllithium in tetrahydrofuran (44 mmol). After stirred at -20 °C for 0.5 h, the yellow mixture was placed at -78 °C and dimethyl formamide (30 mmol) was added. The solution was allowed to stir for 4 h then warm slowly to room temperature. Saturated aqueous ammonium chloride (50 mL) was added, the mixture was transferred to a separatory funnel with ethyl acetate, and the organic phase was separated. The aqueous phase was extracted with ethyl acetate (3×30 mL) and the organic extracts were combined, washed with brine (50 mL), dried over sodium sulfate. The resulting mixture was concentrated in vacuo and further purification was performed by a short silica gel column.⁵ Subsequently, to a solution of the above crude product in toluene, *p*-toluenesulfonic acid (20 mg) was added. The mixture was stirred at 110 °C for 5 h. The yellow oil was purified by a silica gel column eluted with petroleum ether/ethyl acetate = 2/1 to give pure product benzo[d]isothiazole 1,1-dioxide (**6g-i**).⁶

To a suspension of the corresponding benzo[d]isothiazole 1,1-dioxide (5.6 mmol) and the corresponding dialkylphosphite (6.7 mmol) in toluene (15 mL) was added triethylamine (0.56 mmol). The solution was stirred and refluxed in toluene for 24 h until disappearance of benzo[d]isothiazole 1,1-dioxide. The solution was allowed to cool to room temperature and purification was performed by a silica gel column eluted with petroleum ether/ethyl acetate = 1/1 to give pure product.²

To a solution of the above product (5.0 mmol) in dichloromethane was added freshly prepared manganese dioxide (50 mmol) (the manganese dioxide must be freshly prepared, otherwise the reaction yield will be low). The solution was stirred and refluxed at 50 °C for 4-8 h. The solution was allowed to cool to room temperature and purification was performed by a silica gel column eluted with dichloromethane to give iminophosphonates **3g-i**.⁴

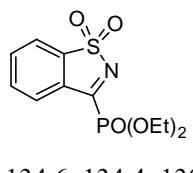
5-Methyl-benzo[d]isothiazole 1,1-dioxide (6i): The reaction was conducted by using *N*-*tert*-butyl-4-methylbenzenesulfonamide (3.26 g, 14 mmol), affording 1.09 g (42% yield) of **6i** as white solid, m.p. = 127-128 °C, R_f = 0.10 (petroleum ether/ethyl acetate 5/1). ¹H NMR (400 MHz, CDCl₃) δ 8.73 (s, 1H), 7.80 (d, *J* = 7.6 Hz, 1H), 7.56 (d, *J* = 7.3 Hz, 1H), 7.47 (s, 1H), 2.52 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 163.4, 145.8, 136.3, 135.1, 131.2, 126.8, 122.8, 21.8. HRMS Calculated for C₈H₈NO₂S [M+H]⁺ 182.0270,

found 182.0269.

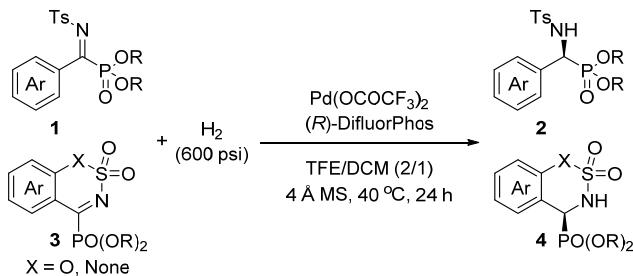
Diisopropyl(1,1-dioxidobenzo[d]isothiazol-3-yl)phosphonate (3g): The reaction was conducted by using diisopropyl(1,1-dioxido-2,3-dihydrobenzo[d]isothiazol-3-yl)phosphonate (1.67 g, 5.0 mmol), affording 1.35 g (81% yield) of **3g** as colorless oil, $R_f = 0.80$ (petroleum ether/ethyl acetate 1/2). ^1H NMR (400 MHz, CDCl_3) δ 8.24-8.18 (m, 1H), 7.97-7.90 (m, 1H), 7.81-7.72 (m, 2H), 5.03-4.89 (m, 2H), 1.47-1.38 (m, 12H); ^{13}C NMR (100 MHz, CDCl_3) δ 168.3 (d, $J_{\text{PC}} = 204.1$ Hz), 138.6 (d, $J_{\text{PC}} = 3.3$ Hz), 134.6, 134.2, 130.1 (d, $J_{\text{PC}} = 25.5$ Hz), 127.7, 123.0, 75.0 (d, $J_{\text{PC}} = 6.9$ Hz), 24.1 (d, $J_{\text{PC}} = 4.0$ Hz), 23.9 (d, $J_{\text{PC}} = 5.1$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ -1.2. HRMS Calculated for $\text{C}_{13}\text{H}_{19}\text{NO}_5\text{PS} [\text{M}+\text{H}]^+$ 332.0716, found 332.0717.

Diethyl(1,1-dioxidobenzo[d]isothiazol-3-yl)phosphonate (3h): The reaction was conducted by using diethyl(1,1-dioxido-2,3-dihydrobenzo[d]isothiazol-3-yl)phosphonate (0.183 g, 0.6 mmol), affording 0.090 g (51% yield) of **3h** as white solid, m.p. = 76-77 °C, $R_f = 0.60$ (dichloromethane/ethyl acetate 1/1). ^1H NMR (400 MHz, CDCl_3) δ 8.22-8.10 (m, 1H), 7.96-7.86 (m, 1H), 7.81-7.69 (m, 2H), 4.45-4.29 (m, 4H), 1.41 (t, $J = 7.0$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 167.6 (d, $J_{\text{PC}} = 203.1$ Hz), 138.6, 134.6, 134.4, 130.0 (d, $J_{\text{PC}} = 25.7$ Hz), 127.7, 123.1, 65.5 (d, $J_{\text{PC}} = 6.3$ Hz), 16.4 (d, $J_{\text{PC}} = 5.4$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ 0.6. HRMS Calculated for $\text{C}_{11}\text{H}_{15}\text{NO}_5\text{PS} [\text{M}+\text{H}]^+$ 304.0403, found 304.0407.

Diisopropyl(5-methyl-1,1-dioxidobenzo[d]isothiazol-3-yl)phosphonate (3i): The reaction was conducted by using diisopropyl(5-methyl-1,1-dioxido-2,3-dihydrobenzo[d]-isothiazol-3-yl)phosphonate (0.278 g, 0.8 mmol), affording 0.157 g (57% yield) of **3i** as white solid, m.p. = 73-74 °C, $R_f = 0.50$ (petroleum ether/ethyl acetate 2/1). ^1H NMR (400 MHz, CDCl_3) δ 7.96 (s, 1H), 7.79-7.73 (m, 1H), 7.53 (d, $J = 7.7$ Hz, 1H), 4.98-4.84 (m, 2H), 2.49 (s, 3H), 1.44-1.34 (m, 12H); ^{13}C NMR (100 MHz, CDCl_3) δ 168.3 (d, $J_{\text{PC}} = 203.2$ Hz), 146.0, 136.0 (d, $J_{\text{PC}} = 3.2$ Hz), 134.7, 130.7 (d, $J_{\text{PC}} = 25.6$ Hz), 128.1 (d, $J_{\text{PC}} = 1.4$ Hz), 122.7, 75.0 (d, $J_{\text{PC}} = 6.9$ Hz), 24.1 (d, $J_{\text{PC}} = 4.0$ Hz), 23.9 (d, $J_{\text{PC}} = 5.1$ Hz), 21.9; ^{31}P NMR (162 MHz, CDCl_3) δ -1.2. HRMS Calculated for $\text{C}_{14}\text{H}_{21}\text{NO}_5\text{PS} [\text{M}+\text{H}]^+$ 346.0873, found 346.0876.



3. General Procedure for Asymmetric Hydrogenation



Pd(OCOCF₃)₂ (0.7 mg, 0.002 mmol) and (*R*)-Difluorophos (1.6 mg, 0.0024 mmol) were placed in a dried Schlenk tube under nitrogen atmosphere, and degassed anhydrous acetone was added. The mixture was stirred at room temperature for 1 h, then, the solvent was removed under vacuum to give the catalyst. In a glovebox, to the mixture of iminophosphonates (0.10 mmol) and 4 Å MS (50 mg) was added the above catalyst with 1.5 mL mixed solvent (2,2,2-trifluoroethanol/dichloromethane = 2/1). The hydrogenation was performed at 40 °C under hydrogen (600 psi) in a stainless steel autoclave for 24 h. After carefully releasing the hydrogen, the autoclave was opened and the reaction mixture was evaporated in *vacuo*. Flash chromatography on silica gel using dichloromethane as the eluent gave the amino phosphonate products.

(S)-Diethyl(4-methylphenylsulfonamido)(phenyl)methylphosphonate (2a): 37 mg, 93% yield, 96% ee, $[\alpha]^{20}_D = -16.22$ (*c* 0.74, CHCl₃), known compound,² white solid, m.p. = 130-131 °C, R_f =

$[\alpha]^{20}_D = -16.22$ (*c* 0.74, CHCl₃), known compound,² white solid, m.p. = 130-131 °C, R_f = 0.50 (petroleum ether/ethyl acetate 1/1). ¹H NMR (400 MHz, CDCl₃) δ 7.59-7.51 (m, 1H), 7.45 (d, *J* = 8.3 Hz, 2H), 7.26-7.19 (m, 2H), 7.14-7.00 (m, 3H), 6.91 (d, *J* = 8.0 Hz, 2H), 4.82 (dd, *J* = 9.9 Hz, *J*_{PH} = 24.4 Hz, 1H), 4.34-4.23 (m, 2H), 3.92-3.80 (m, 1H), 3.65-3.52 (m, 1H), 2.24 (s, 3H), 1.37 (t, *J* = 7.1 Hz, 3H), 1.03 (t, *J* = 7.1 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 142.7, 138.2 (d, *J*_{PC} = 1.8 Hz), 133.8, 129.0, 128.5 (d, *J*_{PC} = 5.9 Hz), 128.2 (d, *J*_{PC} = 2.2 Hz), 127.8 (d, *J*_{PC} = 2.9 Hz), 127.2, 64.3 (d, *J*_{PC} = 7.0 Hz), 63.7 (d, *J*_{PC} = 7.0 Hz), 55.6 (d, *J*_{PC} = 157.2 Hz), 21.4, 16.6 (d, *J*_{PC} = 6.0 Hz), 16.2 (d, *J*_{PC} = 5.6 Hz); ³¹P NMR (162 MHz, CDCl₃) δ 19.6. HPLC: Chiralcel IA-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 65/35, flow = 0.7 mL/min, retention time 13.2 min and 22.6 min (maj).

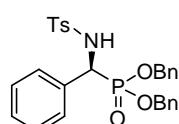
(S)-Dimethyl(4-methylphenylsulfonamido)(phenyl)methylphosphonate (2b): 36 mg, 97% yield, 94% ee, $[\alpha]^{20}_D = -26.00$ (*c* 0.60, CHCl₃), known compound,² white solid, m.p. = 169-170 °C,

$[\alpha]^{20}_D = -26.00$ (*c* 0.60, CHCl₃), known compound,² white solid, m.p. = 169-170 °C, R_f = 0.10 (petroleum ether/ethyl acetate 1/1). ¹H NMR (400 MHz, CDCl₃) δ 7.47 (d, *J* = 8.1 Hz, 2H), 7.29-7.18 (m, 3H), 7.17-7.03 (m, 3H), 6.95 (d, *J* = 8.0 Hz, 2H), 4.85 (dd, *J* = 9.0 Hz, *J*_{PH} = 24.4 Hz, 1H), 3.88 (d, *J*_{PH} = 10.7 Hz, 3H), 3.40 (d, *J*_{PH} = 10.6 Hz, 3H), 2.25 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 143.0, 138.1 (d, *J*_{PC} = 1.6 Hz), 133.6, 129.1, 128.4 (d, *J*_{PC} = 2.2 Hz), 128.4 (d, *J*_{PC} = 6.0 Hz), 128.1 (d, *J*_{PC} = 2.9 Hz), 127.2, 55.1 (d, *J*_{PC} = 157.2 Hz), 54.8 (d, *J*_{PC} = 7.2 Hz), 54.1 (d, *J*_{PC} = 7.0 Hz), 21.5; ³¹P NMR (162 MHz, CDCl₃) δ 21.9. HPLC: Chiralcel IA-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 65/35, flow = 0.7 mL/min, retention time 14.4 min and 19.7 min (maj).

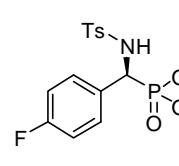
(S)-Diisopropyl(4-methylphenylsulfonamido)(phenyl)methylphosphonate (2c): 42 mg, 98% yield, 96% ee, $[\alpha]^{20}_D = -9.75$ (*c* 0.80, CHCl₃), known compound,² white solid, m.p. = 190-191 °C, R_f = 0.60 (petroleum ether/ethyl acetate 1/1). ¹H NMR (400 MHz, CDCl₃) δ 7.43 (d, *J* = 8.2 Hz, 2H), 7.19 (d, *J* = 7.4 Hz, 2H), 7.12-6.95 (m, 4H), 6.91 (d, *J* = 8.1 Hz, 2H), 4.93-4.80 (m, 1H), 4.74 (dd, *J* = 9.7 Hz, *J*_{PH} = 24.6 Hz, 1H), 4.42-4.28 (m, 1H), 2.24 (s, 3H), 1.44-1.34 (m, 6H), 1.21 (d, *J*

= 6.2 Hz, 3H), 0.76 (d, J = 6.2 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 142.6, 138.3 (d, $J_{\text{PC}} = 1.8$ Hz), 134.1, 129.0, 128.7 (d, $J_{\text{PC}} = 5.9$ Hz), 128.1 (d, $J_{\text{PC}} = 2.2$ Hz), 127.7 (d, $J_{\text{PC}} = 2.9$ Hz), 127.2, 73.0 (d, $J_{\text{PC}} = 7.3$ Hz), 72.7 (d, $J_{\text{PC}} = 7.3$ Hz), 56.1 (d, $J_{\text{PC}} = 158.8$ Hz), 24.5 (d, $J_{\text{PC}} = 3.3$ Hz), 24.3 (d, $J_{\text{PC}} = 2.9$ Hz), 24.0 (d, $J_{\text{PC}} = 5.9$ Hz), 23.0 (d, $J_{\text{PC}} = 6.2$ Hz), 21.5; ^{31}P NMR (162 MHz, CDCl_3) δ 18.0. HPLC: Chiralcel IA-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 65/35, flow = 0.7 mL/min, retention time 12.1 min and 21.5 min (maj).

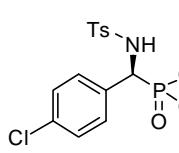
(S)-Dibenzyl(4-methylphenylsulfonamido)(phenyl)methylphosphonate (2d): 49 mg, 93% yield, 95% ee, $[\alpha]^{20}_{\text{D}} = +20.12$ (c 0.84, CHCl_3), known compound,² white solid, m.p. = 136-137


 ^1H NMR (400 MHz, CDCl_3) δ 7.73-7.61 (m, 1H), 7.49 (d, J = 8.3 Hz, 2H), 7.40-7.19 (m, 10H), 7.18-7.11 (m, 1H), 7.10-6.98 (m, 4H), 6.85 (d, J = 8.1 Hz, 2H), 5.27-5.08 (m, 2H), 4.99 (dd, J = 9.9 Hz, $J_{\text{PH}} = 24.6$ Hz, 1H), 4.82-4.74 (m, 1H), 4.52-4.43 (m, 1H), 2.21 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 142.8, 138.2 (d, $J_{\text{PC}} = 1.7$ Hz), 136.2 (d, $J_{\text{PC}} = 6.1$ Hz), 135.8 (d, $J_{\text{PC}} = 5.9$ Hz), 133.7, 129.1, 128.7, 128.6 (d, $J_{\text{PC}} = 6.0$ Hz), 128.6, 128.6, 128.5, 128.4 (d, $J_{\text{PC}} = 2.3$ Hz), 128.3, 128.0 (d, $J_{\text{PC}} = 2.9$ Hz), 127.9, 127.2, 69.5 (d, $J_{\text{PC}} = 7.2$ Hz), 68.8 (d, $J_{\text{PC}} = 7.1$ Hz), 55.7 (d, $J_{\text{PC}} = 157.4$ Hz), 21.5; ^{31}P NMR (162 MHz, CDCl_3) δ 20.5. HPLC: Chiralcel IA-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 65/35, flow = 0.7 mL/min, retention time 25.8 min and 30.1 min (maj).

(S)-Diisopropyl((4-fluorophenyl)(4-methylphenylsulfonamido)methyl)phosphonate (2e): 40 mg, 91% yield, 97% ee, $[\alpha]^{20}_{\text{D}} = -7.04$ (c 0.81, CHCl_3), known compound,² white solid, m.p. =

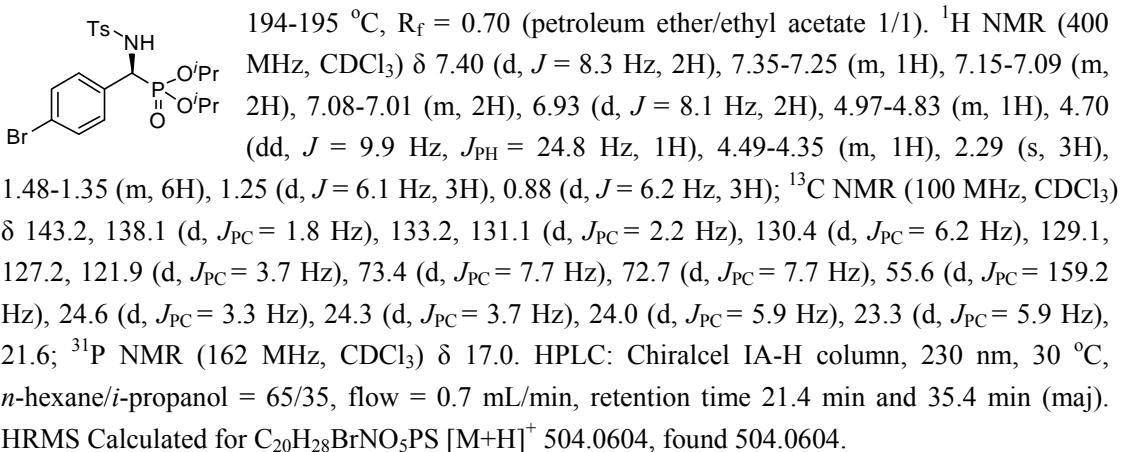

 ^1H NMR (400 MHz, CDCl_3) δ 7.66-7.52 (m, 1H), 7.42 (d, J = 8.3 Hz, 2H), 7.23-7.13 (m, 2H), 6.90 (d, J = 8.1 Hz, 2H), 6.73-6.63 (m, 2H), 4.99-4.85 (m, 1H), 4.75 (dd, J = 10.1 Hz, $J_{\text{PH}} = 24.9$ Hz, 1H), 4.46-4.32 (m, 1H), 2.24 (s, 3H), 1.43 (d, J = 6.2 Hz, 3H), 1.40 (d, J = 6.1 Hz, 3H), 1.23 (d, J = 6.2 Hz, 3H), 0.83 (d, J = 6.1 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 162.4 (dd, $J_{\text{FC}} = 246.7$ Hz, $J_{\text{PC}} = 3.2$ Hz), 142.8, 138.4 (d, $J_{\text{PC}} = 2.1$ Hz), 130.4 (dd, $J_{\text{FC}} = 8.2$ Hz, $J_{\text{PC}} = 6.0$ Hz), 130.1 (d, $J_{\text{PC}} = 3.2$ Hz), 129.0, 127.2, 114.9 (dd, $J_{\text{FC}} = 21.5$ Hz, $J_{\text{PC}} = 2.2$ Hz), 73.3 (d, $J_{\text{PC}} = 7.3$ Hz), 72.6 (d, $J_{\text{PC}} = 7.5$ Hz), 55.4 (d, $J_{\text{PC}} = 160.7$ Hz), 24.6 (d, $J_{\text{PC}} = 3.2$ Hz), 24.3 (d, $J_{\text{PC}} = 3.4$ Hz), 24.0 (d, $J_{\text{PC}} = 5.7$ Hz), 23.2 (d, $J_{\text{PC}} = 5.7$ Hz), 21.5; ^{31}P NMR (162 MHz, CDCl_3) δ 17.5 (d, $J_{\text{FP}} = 4.9$ Hz); ^{19}F NMR (376 MHz, CDCl_3) δ -114.6 (d, $J_{\text{PF}} = 4.8$ Hz). HPLC: Chiralcel IA-H column, 230 nm, 30 °C, *n*-hexane/*i*-propanol = 65/35, flow = 0.7 mL/min, retention time 16.3 min and 25.4 min (maj).

(S)-Diisopropyl((4-chlorophenyl)(4-methylphenylsulfonamido)methyl)phosphonate (2f): 43 mg, 93% yield, 94% ee, $[\alpha]^{20}_{\text{D}} = -4.42$ (c 0.86, CHCl_3), known compound,² white solid, m.p. =

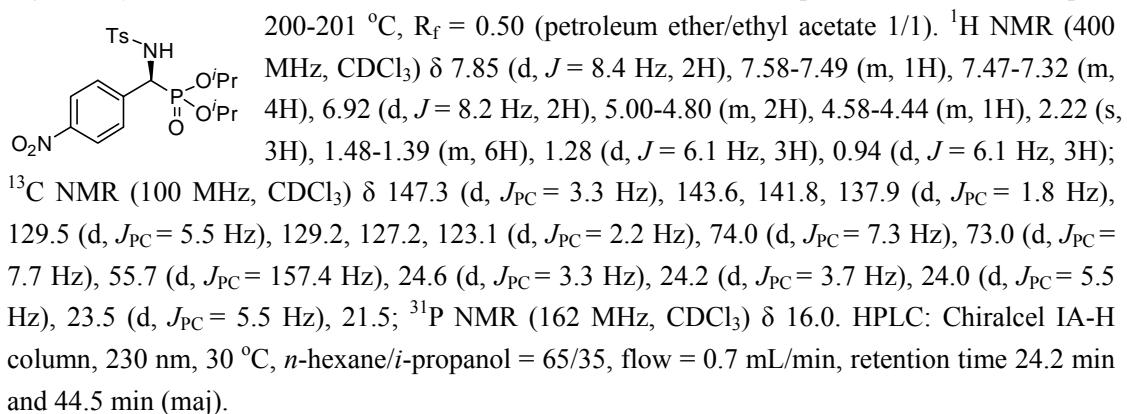

 ^1H NMR (400 MHz, CDCl_3) δ 7.89-7.74 (m, 1H), 7.40 (d, J = 8.3 Hz, 2H), 7.18-7.08 (m, 2H), 6.99-6.84 (m, 4H), 5.02-4.88 (m, 1H), 4.74 (dd, J = 10.2 Hz, $J_{\text{PH}} = 25.1$ Hz, 1H), 4.49-4.35 (m, 1H), 2.26 (s, 3H), 1.46 (d, J = 6.1 Hz, 3H), 1.42 (d, J = 6.2 Hz, 3H), 1.25 (d, J = 6.1 Hz, 3H), 0.87 (d, J = 6.2 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 142.9, 138.3 (d, $J_{\text{PC}} = 1.8$ Hz), 133.6 (d, $J_{\text{PC}} = 3.3$ Hz), 132.7, 130.1 (d, $J_{\text{PC}} = 5.9$ Hz), 128.9, 128.0 (d, $J_{\text{PC}} = 2.2$ Hz), 127.2, 73.4 (d, $J_{\text{PC}} = 7.3$ Hz), 72.6 (d, $J_{\text{PC}} = 7.3$ Hz), 55.5 (d, $J_{\text{PC}} = 160.7$ Hz), 24.6 (d, $J_{\text{PC}} = 2.9$ Hz), 24.2 (d, $J_{\text{PC}} = 3.7$ Hz), 24.0 (d, $J_{\text{PC}} = 5.9$ Hz), 23.2 (d, $J_{\text{PC}} = 5.9$ Hz), 21.5;

³¹P NMR (162 MHz, CDCl₃) δ 17.2. HPLC: Chiralcel IA-H column, 230 nm, 30 °C, *n*-hexane/*i*-propanol = 65/35, flow = 0.7 mL/min, retention time 20.2 min and 31.5 min (maj).

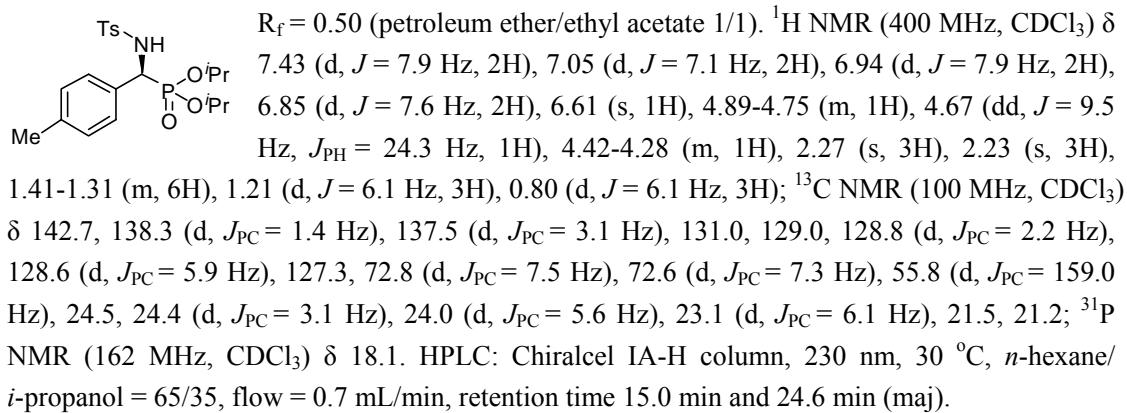
(S)-Diisopropyl((4-bromophenyl)(4-methylphenylsulfonamido)methyl)phosphonate (2g): 45 mg, 90% yield, 92% ee, [α]²⁰_D = -1.10 (*c* 0.82, CHCl₃), unknown compound, white solid, m.p. =



(S)-Diisopropyl((4-methylphenylsulfonamido)(4-nitrophenyl)methyl)phosphonate (2h): 43 mg, 92% yield, 85% ee, [α]²⁰_D = -7.91 (*c* 0.86, CHCl₃), known compound,² white solid, m.p. =



(S)-Diisopropyl((4-methylphenylsulfonamido)(*p*-tolyl)methyl)phosphonate (2i): 42 mg, 96% yield, 97% ee, [α]²⁰_D = -11.12 (*c* 0.80, CHCl₃), known compound,² white solid, m.p. = 157-158 °C,



(S)-3,4-Dihydro-1,2,3-benzoxathiazine-2,2-dioxide-4-diisopropylphosphonate (4a): 32 mg, 90% yield, 96% ee, [α]²⁰_D = -72.11 (*c* 0.43, CHCl₃), unknown compound, white solid, m.p. = 158-159 °C, R_f = 0.40 (petroleum ether/ethyl acetate 2/1). ¹H NMR (400 MHz, CDCl₃) δ 7.86-7.77 (m, 1H), 7.38-7.29 (m, 1H), 7.24-7.15 (m, 1H), 7.02 (d, *J* = 8.2 Hz, 1H), 5.95-5.70 (m,

1H), 5.05 (dd, $J = 7.7$ Hz, $J_{\text{PH}} = 20.4$ Hz, 1H), 4.88-4.75 (m, 1H), 4.72-4.58 (m, 1H), 1.40-1.33 (m, 6H), 1.31 (d, $J = 6.2$ Hz, 3H), 1.10 (d, $J = 6.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 151.8 (d, $J_{\text{PC}} = 9.0$ Hz), 130.0 (d, $J_{\text{PC}} = 2.1$ Hz), 128.0 (d, $J_{\text{PC}} = 3.3$ Hz), 125.5 (d, $J_{\text{PC}} = 2.2$ Hz), 119.3 (d, $J_{\text{PC}} = 0.6$ Hz), 116.6 (d, $J_{\text{PC}} = 3.8$ Hz), 73.9 (d, $J_{\text{PC}} = 7.1$ Hz), 73.5 (d, $J_{\text{PC}} = 7.0$ Hz), 54.4 (d, $J_{\text{PC}} = 154.2$ Hz), 24.3 (d, $J_{\text{PC}} = 3.4$ Hz), 24.2 (d, $J_{\text{PC}} = 4.0$ Hz), 23.9 (d, $J_{\text{PC}} = 4.9$ Hz), 23.6 (d, $J_{\text{PC}} = 5.4$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ 14.4. HPLC: Chiralcel AD-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.8 mL/min, retention time 7.1 min (maj) and 7.9 min. HRMS Calculated for $\text{C}_{13}\text{H}_{21}\text{NO}_6\text{PS} [\text{M}+\text{H}]^+$ 350.0822, found 350.0824.

(S)-3,4-Dihydro-1,2,3-benzoxathiazine-2,2-dioxide-4-diethylphosphonate (4b): 27 mg, 85% yield, 93% ee, $[\alpha]^{20}_{\text{D}} = -58.24$ (c 0.36, CHCl_3), unknown compound, white solid, m.p. = 153-154 °C, $R_f = 0.20$ (dichloromethane). ^1H NMR (400 MHz, CDCl_3) δ 7.80-7.73 (m, 1H), 7.38-7.30 (m, 1H), 7.24-7.16 (m, 1H), 7.02 (d, $J = 8.3$ Hz, 1H), 6.00 (s, 1H), 5.11 (d, $J_{\text{PH}} = 20.7$ Hz, 1H), 4.30-4.19 (m, 2H), 4.18-4.00 (m, 2H), 1.37 (t, $J = 7.1$ Hz, 3H), 1.23 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 151.8 (d, $J_{\text{PC}} = 8.9$ Hz), 130.0 (d, $J_{\text{PC}} = 2.0$ Hz), 127.7 (d, $J_{\text{PC}} = 3.4$ Hz), 125.5 (d, $J_{\text{PC}} = 2.2$ Hz), 119.3, 116.3 (d, $J_{\text{PC}} = 3.2$ Hz), 64.7 (d, $J_{\text{PC}} = 6.9$ Hz), 64.2 (d, $J_{\text{PC}} = 6.8$ Hz), 53.9 (d, $J_{\text{PC}} = 155.5$ Hz), 16.4 (d, $J_{\text{PC}} = 4.1$ Hz), 16.4 (d, $J_{\text{PC}} = 4.0$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ 16.6. HPLC: Chiralcel AS-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 10.3 min and 19.6 min (maj). HRMS Calculated for $\text{C}_{11}\text{H}_{17}\text{NO}_6\text{PS} [\text{M}+\text{H}]^+$ 322.0509, found 322.0514.

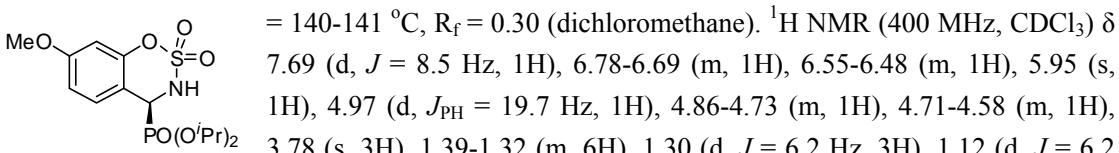
(S)-3,4-Dihydro-1,2,3-benzoxathiazine-2,2-dioxide-7-methyl-4-diisopropylphosphonate (4c): 31 mg, 86% yield, 99% ee, $[\alpha]^{20}_{\text{D}} = -75.16$ (c 0.62, CHCl_3), unknown compound, white solid, m.p. = 132-133 °C, $R_f = 0.30$ (dichloromethane). ^1H NMR (400 MHz, CDCl_3) δ 7.68 (d, $J = 8.1$ Hz, 1H), 7.00 (d, $J = 8.1$ Hz, 1H), 6.82 (s, 1H), 5.79 (s, 1H), 5.00 (d, $J_{\text{PH}} = 20.1$ Hz, 1H), 4.87-4.74 (m, 1H), 4.71-4.57 (m, 1H), 2.33 (s, 3H), 1.41-1.33 (m, 6H), 1.30 (d, $J = 6.2$ Hz, 3H), 1.11 (d, $J = 6.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 151.6 (d, $J_{\text{PC}} = 9.0$ Hz), 140.6 (d, $J_{\text{PC}} = 2.1$ Hz), 127.7 (d, $J_{\text{PC}} = 3.2$ Hz), 126.4 (d, $J_{\text{PC}} = 2.3$ Hz), 119.5 (d, $J_{\text{PC}} = 0.6$ Hz), 113.4 (d, $J_{\text{PC}} = 3.8$ Hz), 73.7 (d, $J_{\text{PC}} = 7.0$ Hz), 73.4 (d, $J_{\text{PC}} = 6.9$ Hz), 54.2 (d, $J_{\text{PC}} = 154.5$ Hz), 24.3 (d, $J_{\text{PC}} = 3.3$ Hz), 24.2 (d, $J_{\text{PC}} = 4.0$ Hz), 23.9 (d, $J_{\text{PC}} = 4.9$ Hz), 23.6 (d, $J_{\text{PC}} = 5.4$ Hz), 21.1; ^{31}P NMR (162 MHz, CDCl_3) δ 14.6. HPLC: Chiralcel AS-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.8 mL/min, retention time 6.9 min and 9.5 min (maj). HRMS Calculated for $\text{C}_{14}\text{H}_{23}\text{NO}_6\text{PS} [\text{M}+\text{H}]^+$ 364.0978, found 364.0986.

(S)-3,4-Dihydro-1,2,3-benzoxathiazine-2,2-dioxide-8-methoxy-4-diisopropylphosphonate (4d): 33 mg, 87% yield, 97% ee, $[\alpha]^{20}_{\text{D}} = -65.30$ (c 0.63, CHCl_3), unknown compound, white solid, m.p. = 168-169 °C, $R_f = 0.20$ (dichloromethane). ^1H NMR (400 MHz, CDCl_3) δ 7.34 (d, $J = 8.1$ Hz, 1H), 7.11 (t, $J = 8.2$ Hz, 1H), 6.93 (d, $J = 8.2$ Hz, 1H), 6.54-6.26 (m, 1H), 5.03 (dd, $J = 7.5$ Hz, $J_{\text{PH}} = 20.5$ Hz, 1H), 4.88-4.74 (m, 1H), 4.74-4.58 (m, 1H), 3.86 (s, 3H), 1.44-1.32 (m, 6H), 1.30 (d, $J = 6.2$ Hz, 3H), 1.14 (d, $J = 6.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 149.0, 141.4 (d, $J_{\text{PC}} = 9.2$ Hz), 125.0 (d, $J_{\text{PC}} = 2.1$ Hz), 118.8 (d, $J_{\text{PC}} = 3.2$ Hz), 117.7 (d, $J_{\text{PC}} = 3.3$ Hz), 112.3 (d, $J_{\text{PC}} = 1.7$ Hz), 73.8 (d, $J_{\text{PC}} = 7.0$ Hz), 73.4 (d, $J_{\text{PC}} = 7.0$ Hz), 56.3, 54.5 (d, $J_{\text{PC}} = 156.0$ Hz), 24.2 (d, $J_{\text{PC}} = 3.3$ Hz), 24.1 (d, $J_{\text{PC}} = 4.0$ Hz),

23.8 (d, $J_{PC} = 4.9$ Hz), 23.5 (d, $J_{PC} = 5.4$ Hz); ^{31}P NMR (162 MHz, CDCl₃) δ 14.4. HPLC: Chiralcel AS-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.8 mL/min, retention time 10.0 min and 12.5 min (maj). HRMS Calculated for C₁₄H₂₃NO₇PS [M+H]⁺ 380.0927, found 380.0930.

(S)-3,4-Dihydro-1,2,3-benzoxathiazine-2,2-dioxide-7-methoxy-4-diisopropylphosphonate (4e):

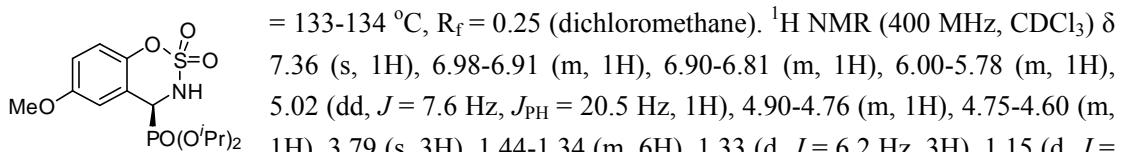
34 mg, 90% yield, 98% ee, $[\alpha]^{20}_D = -75.48$ (*c* 0.62, CHCl₃), unknown compound, white solid, m.p.



= 140-141 °C, R_f = 0.30 (dichloromethane). 1H NMR (400 MHz, CDCl₃) δ 7.69 (d, $J = 8.5$ Hz, 1H), 6.78-6.69 (m, 1H), 6.55-6.48 (m, 1H), 5.95 (s, 1H), 4.97 (d, $J_{PH} = 19.7$ Hz, 1H), 4.86-4.73 (m, 1H), 4.71-4.58 (m, 1H), 3.78 (s, 3H), 1.39-1.32 (m, 6H), 1.30 (d, $J = 6.2$ Hz, 3H), 1.12 (d, $J = 6.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl₃) δ 160.7 (d, $J_{PC} = 1.7$ Hz), 152.6 (d, $J_{PC} = 9.2$ Hz), 128.6 (d, $J_{PC} = 3.0$ Hz), 112.0 (d, $J_{PC} = 2.0$ Hz), 108.1 (d, $J_{PC} = 3.5$ Hz), 104.2, 73.8 (d, $J_{PC} = 7.0$ Hz), 73.3 (d, $J_{PC} = 6.9$ Hz), 55.7, 53.9 (d, $J_{PC} = 155.4$ Hz), 24.3 (d, $J_{PC} = 3.3$ Hz), 24.1 (d, $J_{PC} = 4.0$ Hz), 23.9 (d, $J_{PC} = 4.9$ Hz), 23.6 (d, $J_{PC} = 5.3$ Hz); ^{31}P NMR (162 MHz, CDCl₃) δ 14.7. HPLC: Chiralcel AS-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.8 mL/min, retention time 8.1 min and 12.6 min (maj). HRMS Calculated for C₁₄H₂₃NO₇PS [M+H]⁺ 380.0927, found 380.0929.

(S)-3,4-Dihydro-1,2,3-benzoxathiazine-2,2-dioxide-6-methoxy-4-diisopropylphosphonate (4f):

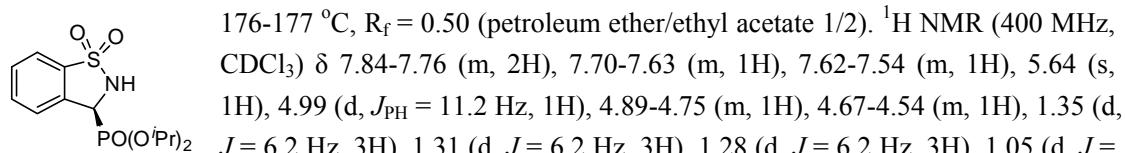
35 mg, 92% yield, 94% ee, $[\alpha]^{20}_D = -80.51$ (*c* 0.74, CHCl₃), unknown compound, white solid, m.p.



= 133-134 °C, R_f = 0.25 (dichloromethane). 1H NMR (400 MHz, CDCl₃) δ 7.36 (s, 1H), 6.98-6.91 (m, 1H), 6.90-6.81 (m, 1H), 6.00-5.78 (m, 1H), 5.02 (dd, $J = 7.6$ Hz, $J_{PH} = 20.5$ Hz, 1H), 4.90-4.76 (m, 1H), 4.75-4.60 (m, 1H), 3.79 (s, 3H), 1.44-1.34 (m, 6H), 1.33 (d, $J = 6.2$ Hz, 3H), 1.15 (d, $J = 6.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl₃) δ 156.7 (d, $J_{PC} = 2.3$ Hz), 145.5 (d, $J_{PC} = 8.9$ Hz), 120.1, 117.1 (d, $J_{PC} = 3.9$ Hz), 116.3 (d, $J_{PC} = 1.9$ Hz), 111.8 (d, $J_{PC} = 3.1$ Hz), 73.9 (d, $J_{PC} = 7.0$ Hz), 73.5 (d, $J_{PC} = 6.9$ Hz), 55.9, 54.5 (d, $J_{PC} = 154.3$ Hz), 24.3 (d, $J_{PC} = 3.3$ Hz), 24.2 (d, $J_{PC} = 4.0$ Hz), 24.0 (d, $J_{PC} = 4.9$ Hz), 23.6 (d, $J_{PC} = 5.3$ Hz); ^{31}P NMR (162 MHz, CDCl₃) δ 14.5. HPLC: Chiralcel AS-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.8 mL/min, retention time 9.1 min and 13.6 min (maj). HRMS Calculated for C₁₄H₂₃NO₇PS [M+H]⁺ 380.0927, found 380.0931.

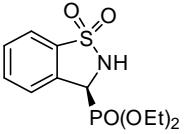
(S)-Diisopropyl(1,1-dioxido-2,3-dihydrobenzo[*d*]isothiazol-3-yl)phosphonate (4g): 33 mg,

91% yield, 96% ee, $[\alpha]^{20}_D = -40.87$ (*c* 0.46, CHCl₃), unknown compound, white solid, m.p. =

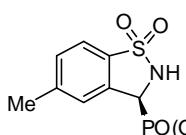


176-177 °C, R_f = 0.50 (petroleum ether/ethyl acetate 1/2). 1H NMR (400 MHz, CDCl₃) δ 7.84-7.76 (m, 2H), 7.70-7.63 (m, 1H), 7.62-7.54 (m, 1H), 5.64 (s, 1H), 4.99 (d, $J_{PH} = 11.2$ Hz, 1H), 4.89-4.75 (m, 1H), 4.67-4.54 (m, 1H), 1.35 (d, $J = 6.2$ Hz, 3H), 1.31 (d, $J = 6.2$ Hz, 3H), 1.28 (d, $J = 6.2$ Hz, 3H), 1.05 (d, $J = 6.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl₃) δ 135.3 (d, $J_{PC} = 5.9$ Hz), 133.3 (d, $J_{PC} = 2.6$ Hz), 132.7 (d, $J_{PC} = 5.7$ Hz), 130.0 (d, $J_{PC} = 2.5$ Hz), 126.0 (d, $J_{PC} = 2.9$ Hz), 121.7 (d, $J_{PC} = 2.0$ Hz), 73.6 (d, $J_{PC} = 7.2$ Hz), 73.5 (d, $J_{PC} = 7.3$ Hz), 54.7 (d, $J_{PC} = 161.7$ Hz), 24.3 (d, $J_{PC} = 1.9$ Hz), 24.3 (d, $J_{PC} = 1.9$ Hz), 23.9 (d, $J_{PC} = 5.4$ Hz), 23.6 (d, $J_{PC} = 5.2$ Hz); ^{31}P NMR (162 MHz, CDCl₃) δ 14.8. HPLC: Chiralcel OD-H column, 230 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.8 mL/min, retention time 9.3 min and 10.8 min (maj). HRMS Calculated for C₁₃H₂₁NO₅PS [M+H]⁺ 334.0873, found 334.0875.

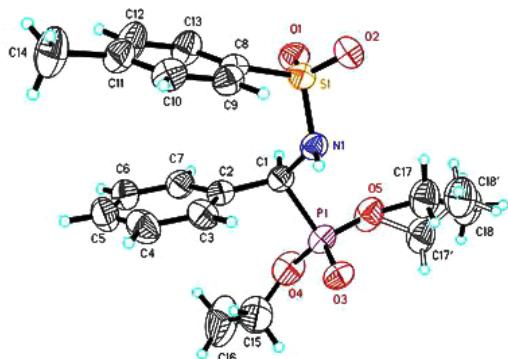
(S)-Diethyl(1,1-dioxido-2,3-dihydrobenzo[d]isothiazol-3-yl)phosphonate (4h): 28 mg, 92% yield, 91% ee, $[\alpha]^{20}_D = -38.93$ (c 0.56, CHCl_3), unknown compound, white solid, m.p. = 154-155

 ^1H NMR (400 MHz, CDCl_3) δ 7.80 (d, $J = 7.7$ Hz, 1H), 7.74 (d, $J = 7.8$ Hz, 1H), 7.69-7.62 (m, 1H), 7.62-7.52 (m, 1H), 6.78 (s, 1H), 5.12 (d, $J_{\text{PH}} = 10.9$ Hz, 1H), 4.34-4.18 (m, 2H), 4.18-4.00 (m, 2H), 1.34-1.20 (m, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 135.2 (d, $J_{\text{PC}} = 5.5$ Hz), 133.2 (d, $J_{\text{PC}} = 2.5$ Hz), 132.5 (d, $J_{\text{PC}} = 5.2$ Hz), 130.0 (d, $J_{\text{PC}} = 2.5$ Hz), 126.1 (d, $J_{\text{PC}} = 2.7$ Hz), 121.6 (d, $J_{\text{PC}} = 2.0$ Hz), 64.9 (d, $J_{\text{PC}} = 7.0$ Hz), 64.1 (d, $J_{\text{PC}} = 7.2$ Hz), 54.3 (d, $J_{\text{PC}} = 163.7$ Hz), 16.5 (d, $J_{\text{PC}} = 5.5$ Hz), 16.4 (d, $J_{\text{PC}} = 5.6$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ 17.0. HPLC: Chiralcel AS-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 60/40, flow = 0.6 mL/min, retention time 13.3 min and 28.8 min (maj). HRMS Calculated for $\text{C}_{11}\text{H}_{17}\text{NO}_5\text{PS} [\text{M}+\text{H}]^+$ 306.0560, found 306.0561.

(S)-Diisopropyl(5-methyl-1,1-dioxido-2,3-dihydrobenzo[d]isothiazol-3-yl)phosphonate (4i): 34 mg, 99% yield, 94% ee, $[\alpha]^{20}_D = -57.33$ (c 0.59, CHCl_3), unknown compound, white solid, m.p. = 150-151 °C, $R_f = 0.10$ (petroleum ether/ethyl acetate 2/1). ^1H NMR (400

 MHz, CDCl_3) δ 7.67 (d, $J = 8.0$ Hz, 1H), 7.56 (s, 1H), 7.36 (d, $J = 8.0$ Hz, 1H), 5.75 (s, 1H), 4.95 (d, $J_{\text{PH}} = 11.1$ Hz, 1H), 4.89-4.74 (m, 1H), 4.67-4.55 (m, 1H), 2.47 (s, 3H), 1.35 (d, $J = 6.2$ Hz, 3H), 1.32-1.24 (m, 6H), 1.05 (d, $J = 6.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 144.3 (d, $J_{\text{PC}} = 2.6$ Hz), 133.0 (d, $J_{\text{PC}} = 5.7$ Hz), 132.6 (d, $J_{\text{PC}} = 6.0$ Hz), 131.0 (d, $J_{\text{PC}} = 2.4$ Hz), 126.2 (d, $J_{\text{PC}} = 2.9$ Hz), 121.4 (d, $J_{\text{PC}} = 2.0$ Hz), 73.5 (d, $J_{\text{PC}} = 3.0$ Hz), 73.4 (d, $J_{\text{PC}} = 3.3$ Hz), 54.6 (d, $J_{\text{PC}} = 161.2$ Hz), δ 24.3 (d, $J = 3.4$ Hz), 24.3 (d, $J = 3.4$ Hz), 24.0 (d, $J_{\text{PC}} = 5.3$ Hz), 23.6 (d, $J_{\text{PC}} = 5.1$ Hz), 22.0; ^{31}P NMR (162 MHz, CDCl_3) δ 15.0. HPLC: Chiralcel OD-H column, 220 nm, 30 °C, *n*-hexane/*i*-propanol = 90/10, flow = 0.7 mL/min, retention time 21.7 min and 25.5 min (maj). HRMS Calculated for $\text{C}_{14}\text{H}_{23}\text{NO}_5\text{PS} [\text{M}+\text{H}]^+$ 348.1029, found 348.1033.

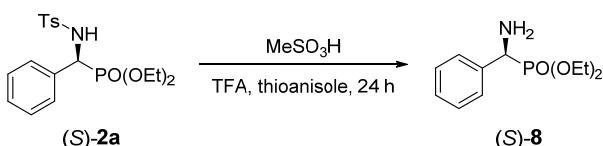
4. Determination of the Absolute Configuration of 2a



X-ray Single Crystal Structure of (S)-2a

After a simple recrystallization from *n*-hexane and dichloromethane, **2a** could be obtained with up to >99% ee. Based on single crystal X-ray diffraction analysis, the absolute configuration of **2a** was determined to be (S)-diethyl(4-methyl- phenylsulfonamido)(phenyl)methylphosphonate. The CCDC number is 1418867. These details can be obtained free of charge via www.ccdc.com.ac.uk/data_request/cif from the Cambridge Crystallographic Data Centre.

5. Procedure for desulfonylation reaction of **2a**⁷



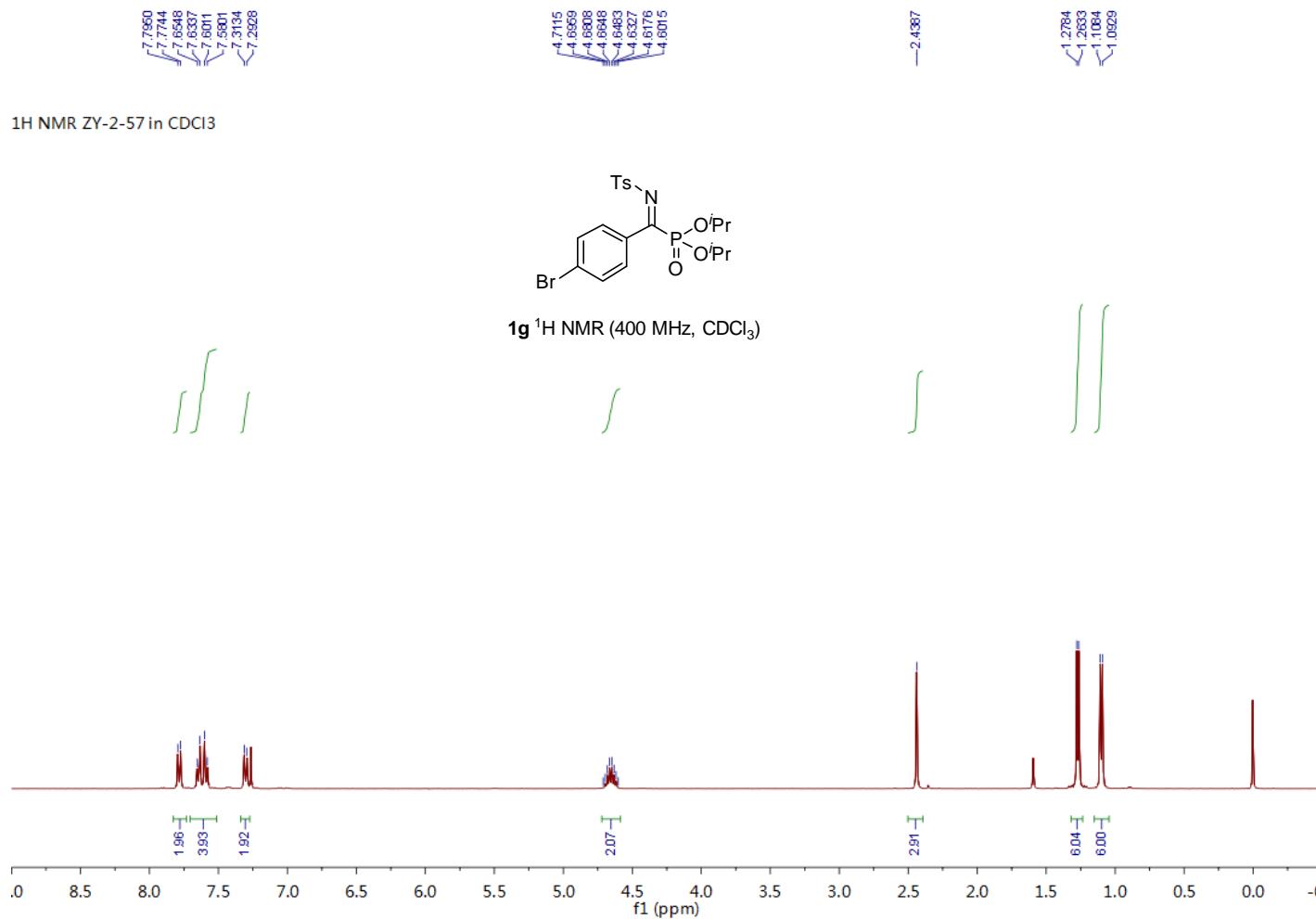
(*S*)-Diethyl(4-methylphenylsulfonamido)(phenyl)methylphosphonate ((*S*)-**2a**, 40 mg, 0.1 mmol, 99% ee) placed in round-bottom flask was treated with a 0.15 M solution of methanesulfonic acid in trifluoroacetic acid/thioanisole (9/1, 1.3 mL) at room temperature, and the solution was stirred for 24 h. After removal volatiles under reduced pressure, added saturated sodium bicarbonate and extracted with dichloromethane (3×10 mL). The organic layer was dried over sodium sulfate and concentrated under reduced pressure to give the crude product, which was purified by silica gel column chromatography to give **8**.

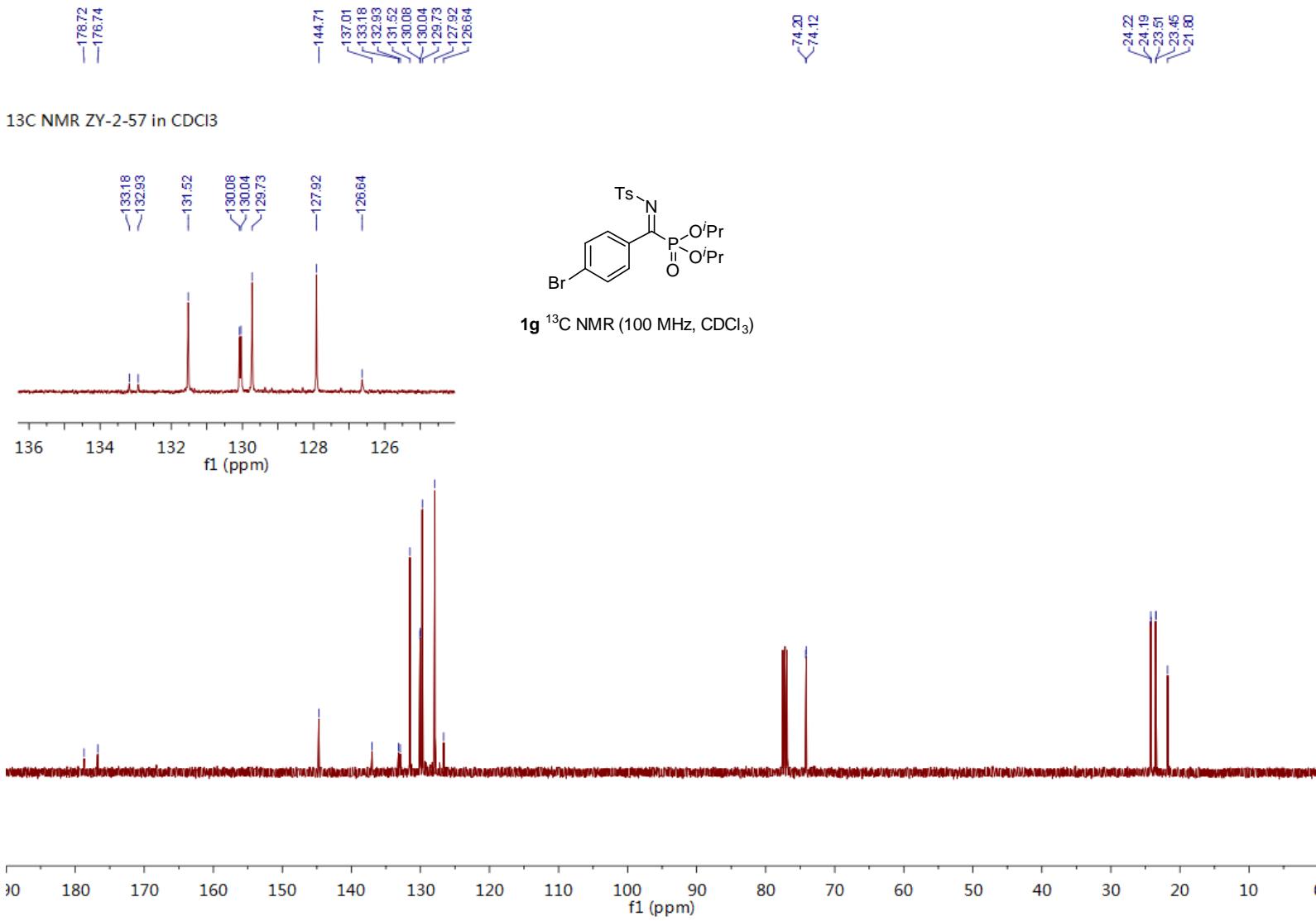
(S)-diethyl(amino(phenyl)methyl)phosphonate (8): 17 mg, 71% yield, 98% ee, $[\alpha]^{20}_D = -15.00$ (c 0.26, CHCl_3), [lit.⁸: $[\alpha]^{20}_D = +17.2$ (c 1.0, CHCl_3) for the (*R*)-enantiomer], known compound,⁸ yellow oil, $R_f = 0.40$ (dichloromethane/methanol 15/1). ^1H NMR (400 MHz, CDCl_3) δ 7.45 (d, $J = 7.5$ Hz, 2H), 7.35 (t, $J = 7.5$ Hz, 2H), 7.32-7.26 (m, 1H), 4.26 (d, $J = 17.1$ Hz, 1H), 4.10-4.01 (m, 2H), 4.01-3.93 (m, 1H), 3.92-3.80 (m, 1H), 1.87 (s, 2H), 1.27 (t, $J = 7.1$ Hz, 3H), 1.18 (t, $J = 7.0$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 137.8 (d, $J_{\text{PC}} = 3.6$ Hz), 128.5 (d, $J_{\text{PC}} = 2.5$ Hz), 127.9 (d, $J_{\text{PC}} = 3.2$ Hz), 127.8 (d, $J_{\text{PC}} = 6.1$ Hz), 62.9 (d, $J_{\text{PC}} = 7.1$ Hz), 62.7 (d, $J_{\text{PC}} = 7.3$ Hz), 54.2 (d, $J_{\text{PC}} = 149.5$ Hz), 16.5 (d, $J_{\text{PC}} = 5.7$ Hz), 16.4 (d, $J_{\text{PC}} = 5.7$ Hz); ^{31}P NMR (162 MHz, CDCl_3) δ 24.9. HPLC: Chiralcel AD-H column, 230 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.7 mL/min, retention time 8.4 min and 9.6 min (maj).

6. References

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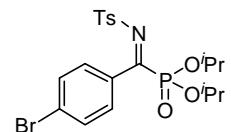
7. Copy of NMR and HPLC for the Compounds



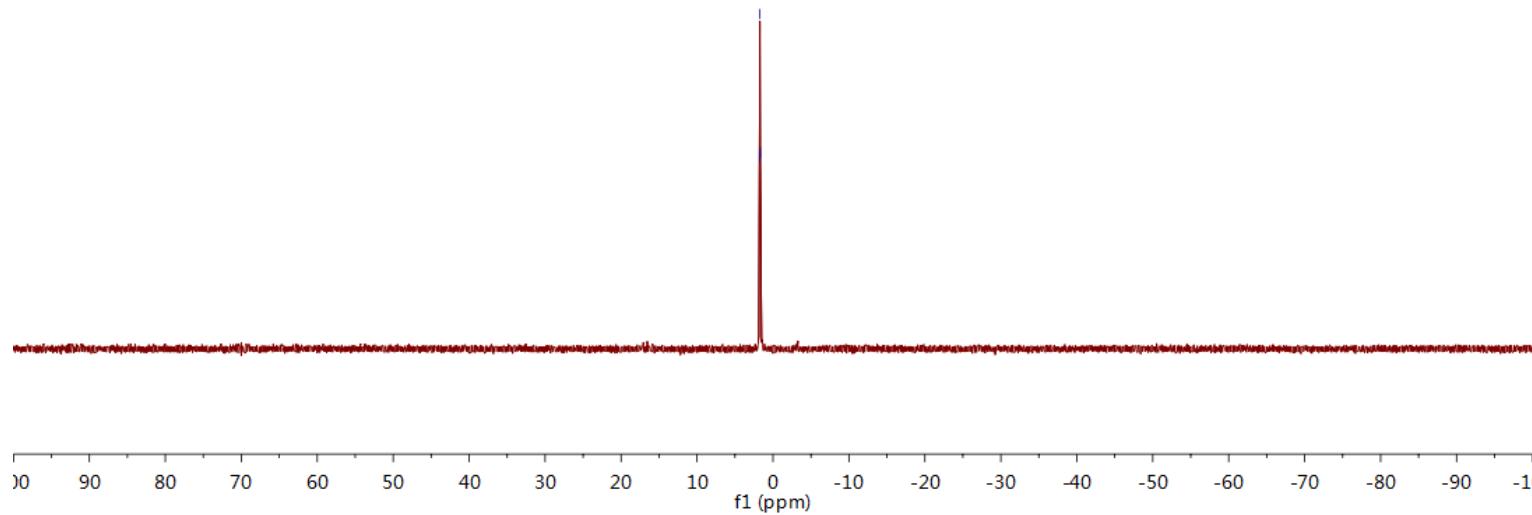


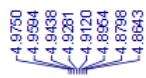
¹⁷⁶
¹⁷²
¹⁶⁸

³¹P NMR ZY-2-57 in CDCl₃

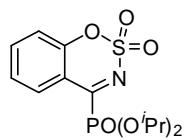


1g ³¹P NMR (162 MHz, CDCl₃)

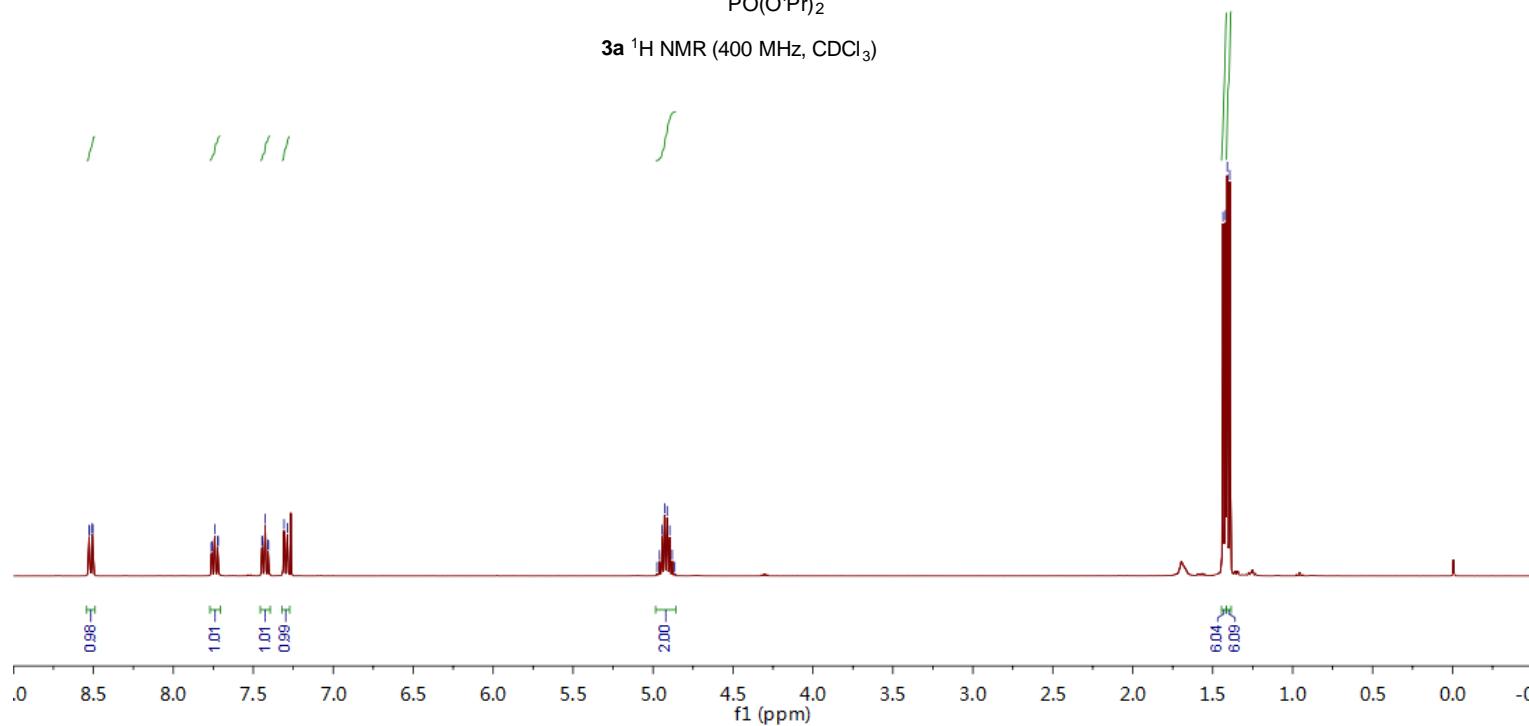




¹H NMR ZY-3-27A in CDCl₃

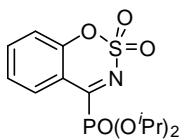


3a ¹H NMR (400 MHz, CDCl₃)

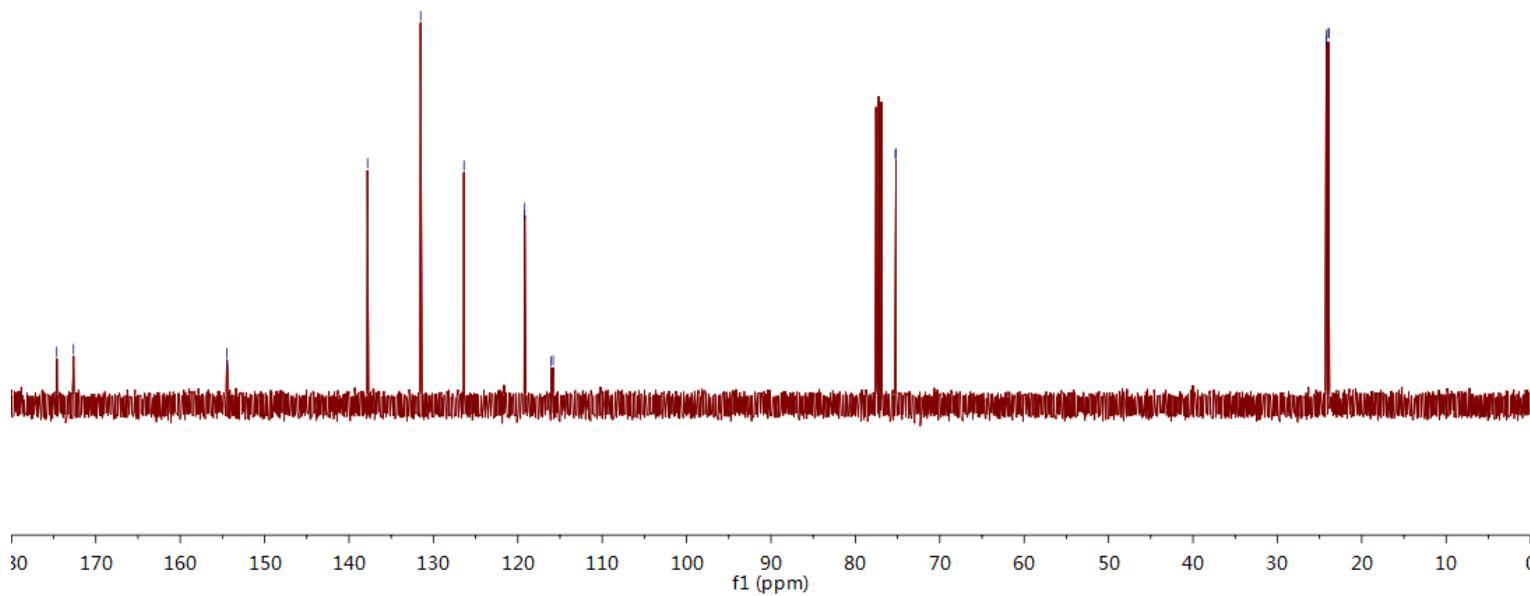


—174.63
—172.65
—154.48
—154.40
—137.80
—131.51
—126.38
—119.21
—119.18
—116.08
—115.82
—75.28
—75.19
—24.20
—24.17
—23.95
—23.89

¹³C NMR ZY-3-27A in CDCl₃



3a ¹³C NMR (100 MHz, CDCl₃)

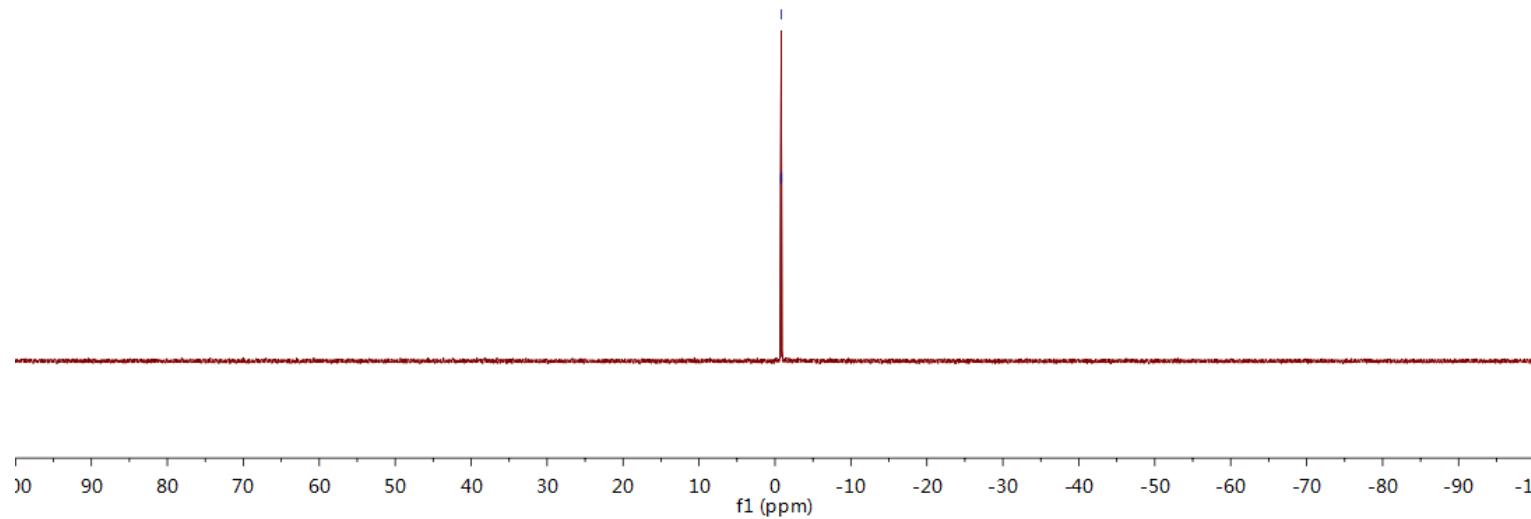




^{31}P NMR ZY-3-27A in CDCl_3



3a ^{31}P NMR (162 MHz, CDCl_3)



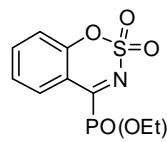
8.5078
8.5041
8.4676
8.4841

7.7768
7.7729
7.7556
7.7373
7.7334
7.4557
7.4532
7.4348
7.4169
7.4145
7.3186
7.2978

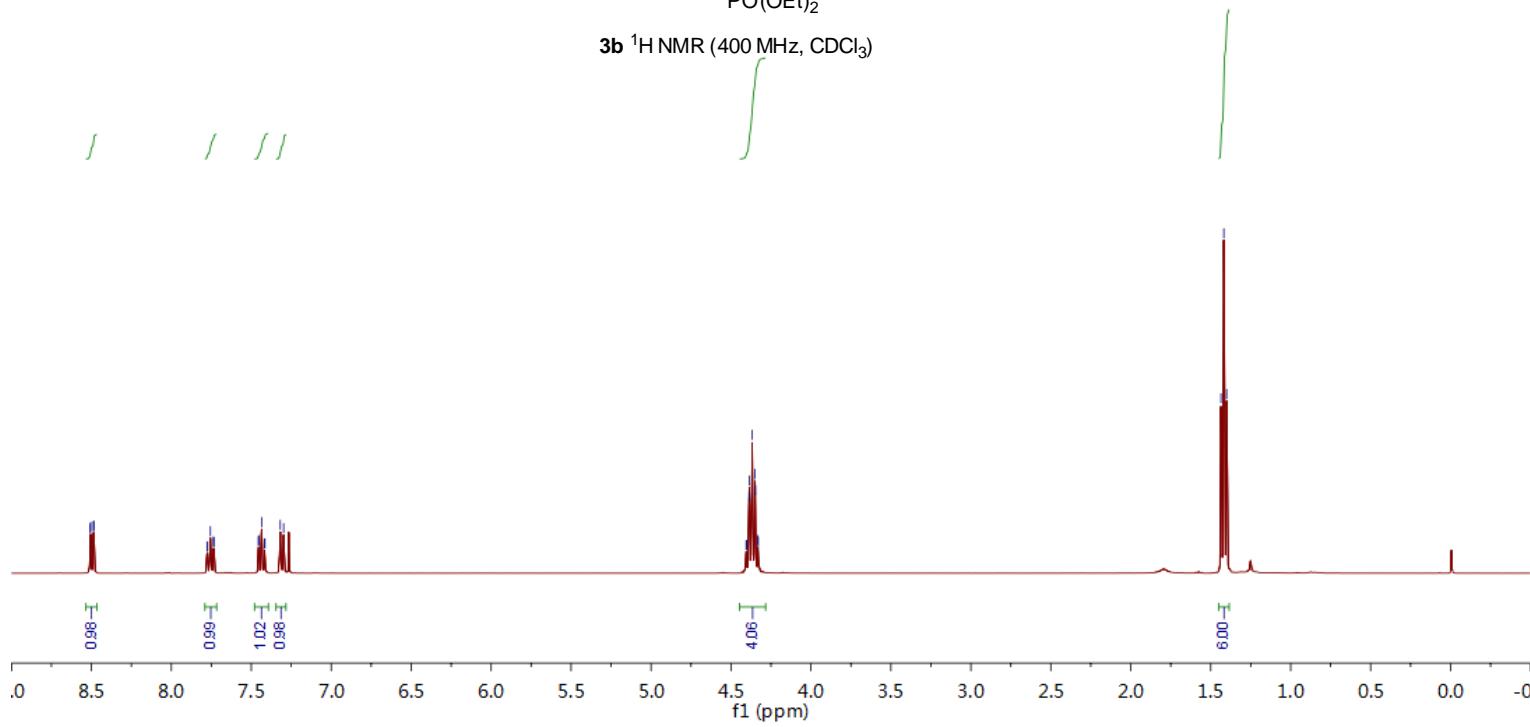
4.4054
4.4025
4.3675
4.3849
4.3672
4.3494
4.3474
4.3316
4.3298

1.4368
1.4181
1.4005

¹H NMR ZY-3-30A in CDCl₃

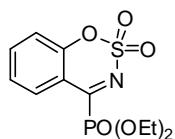


3b ¹H NMR (400 MHz, CDCl₃)

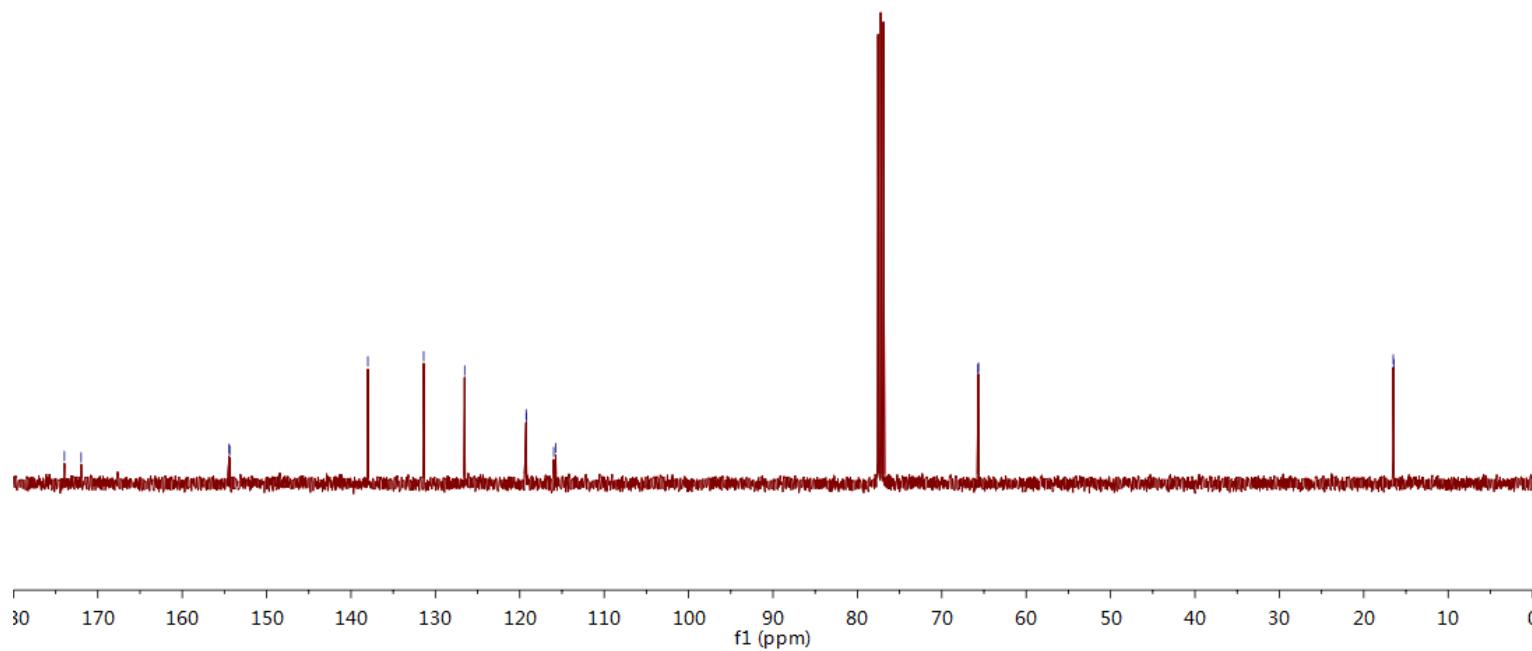


—173.95
—171.97
—154.45
—154.36
—138.00
—131.39
—126.53
—119.25
—119.22
—115.98
—115.74

¹³C NMR ZY-3-30A in CDCl₃

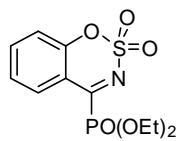


3b ¹³C NMR (100 MHz, CDCl₃)

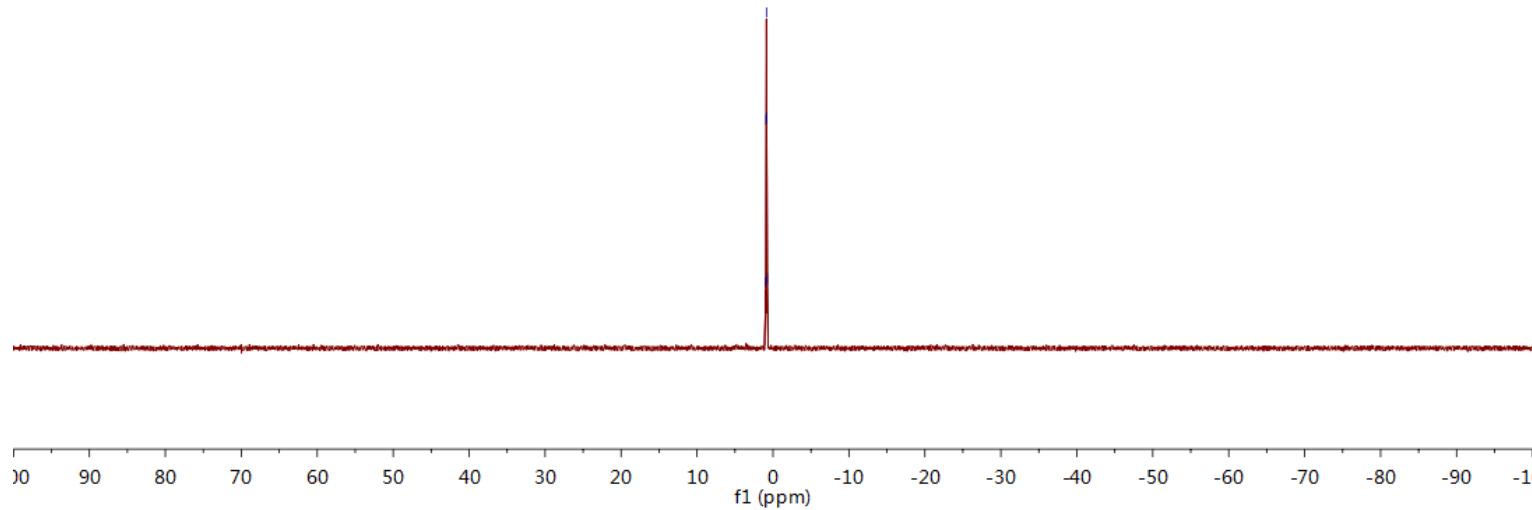


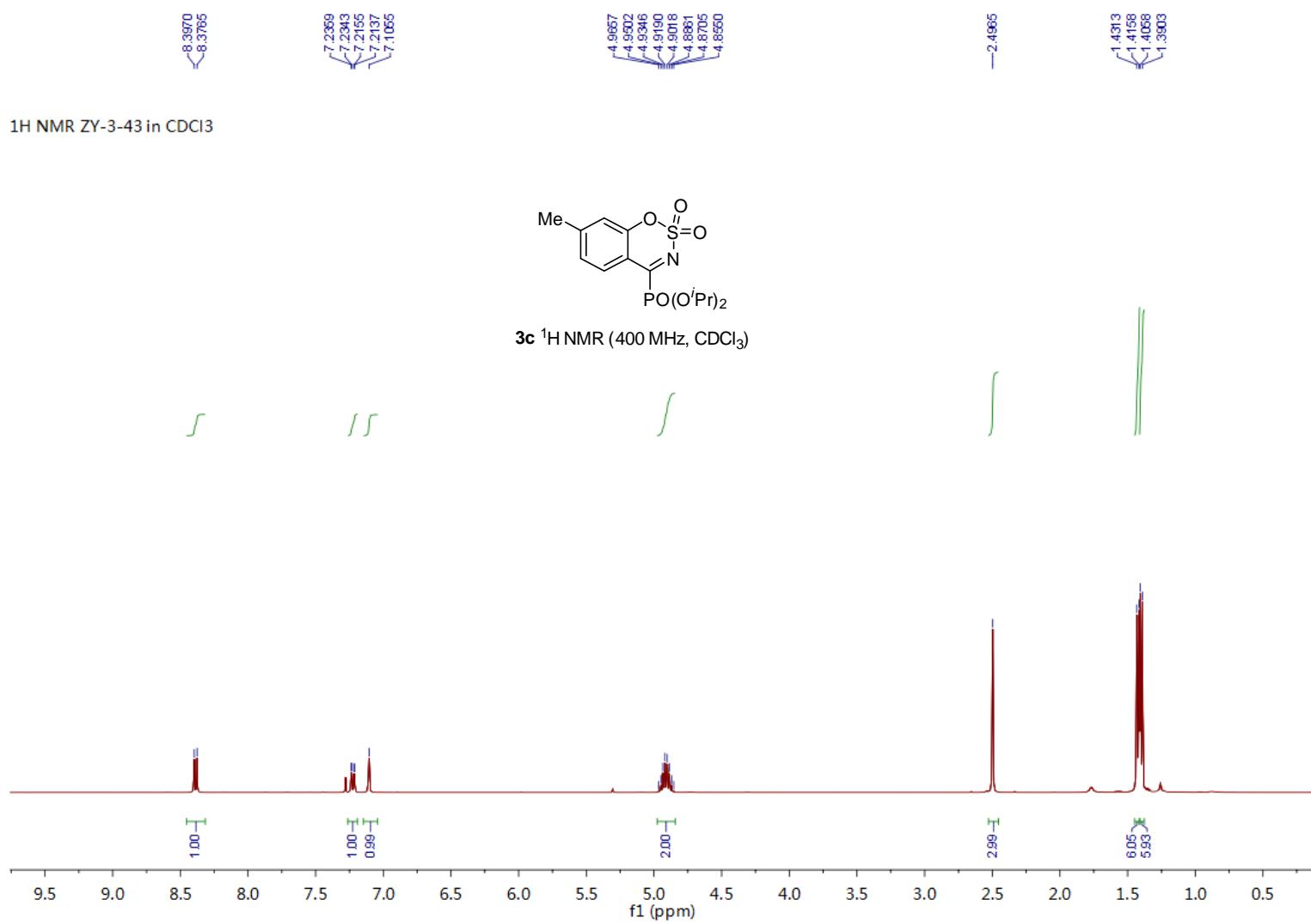


³¹P NMR ZY-3-30A in CDCl₃



3b ³¹P NMR (162 MHz, CDCl₃)





—174.27
—172.28

—154.59
—154.50
—150.64

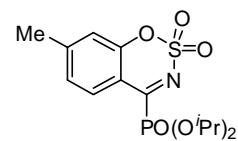
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—127.38

—119.34
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—113.80
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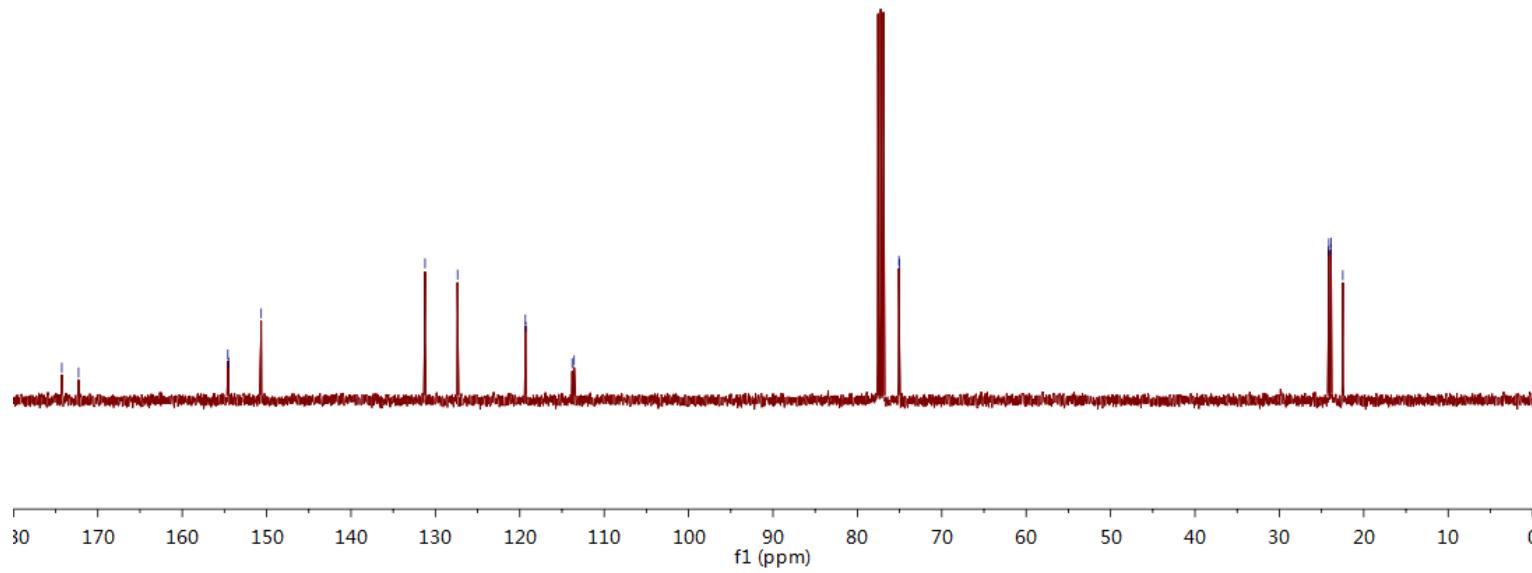
<75.08
<75.01

24.18
24.14
23.92
23.86
22.48

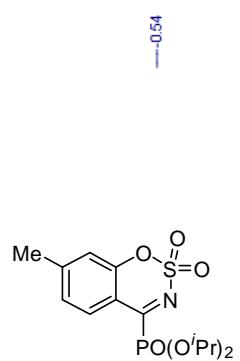
^{13}C NMR ZY-3-43 in CDCl_3



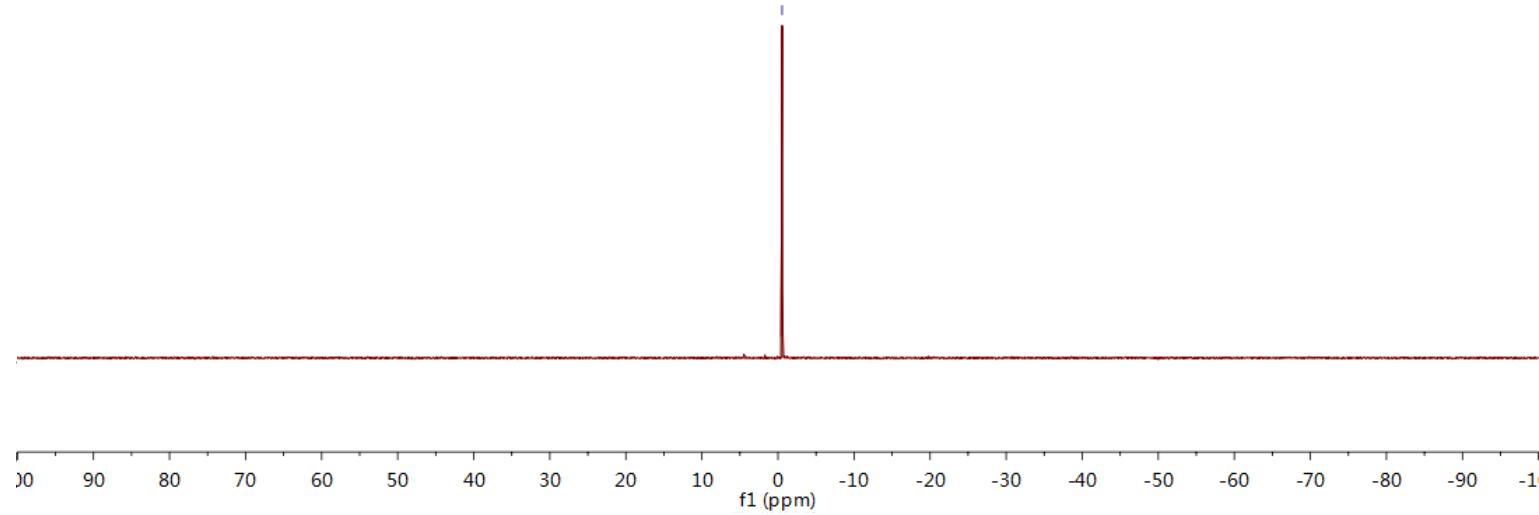
3c ^{13}C NMR (100 MHz, CDCl_3)



^{31}P NMR ZY-3-43 in CDCl_3



3c ^{31}P NMR (162 MHz, CDCl_3)



8.0761
8.0717
8.0571
8.0526

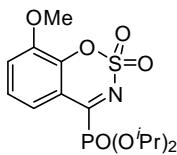
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7.3890
7.3198
7.3123
7.3079
7.2915
7.2871

4.9645
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4.9334
4.9177
4.9004
4.8848
4.8693
4.8538

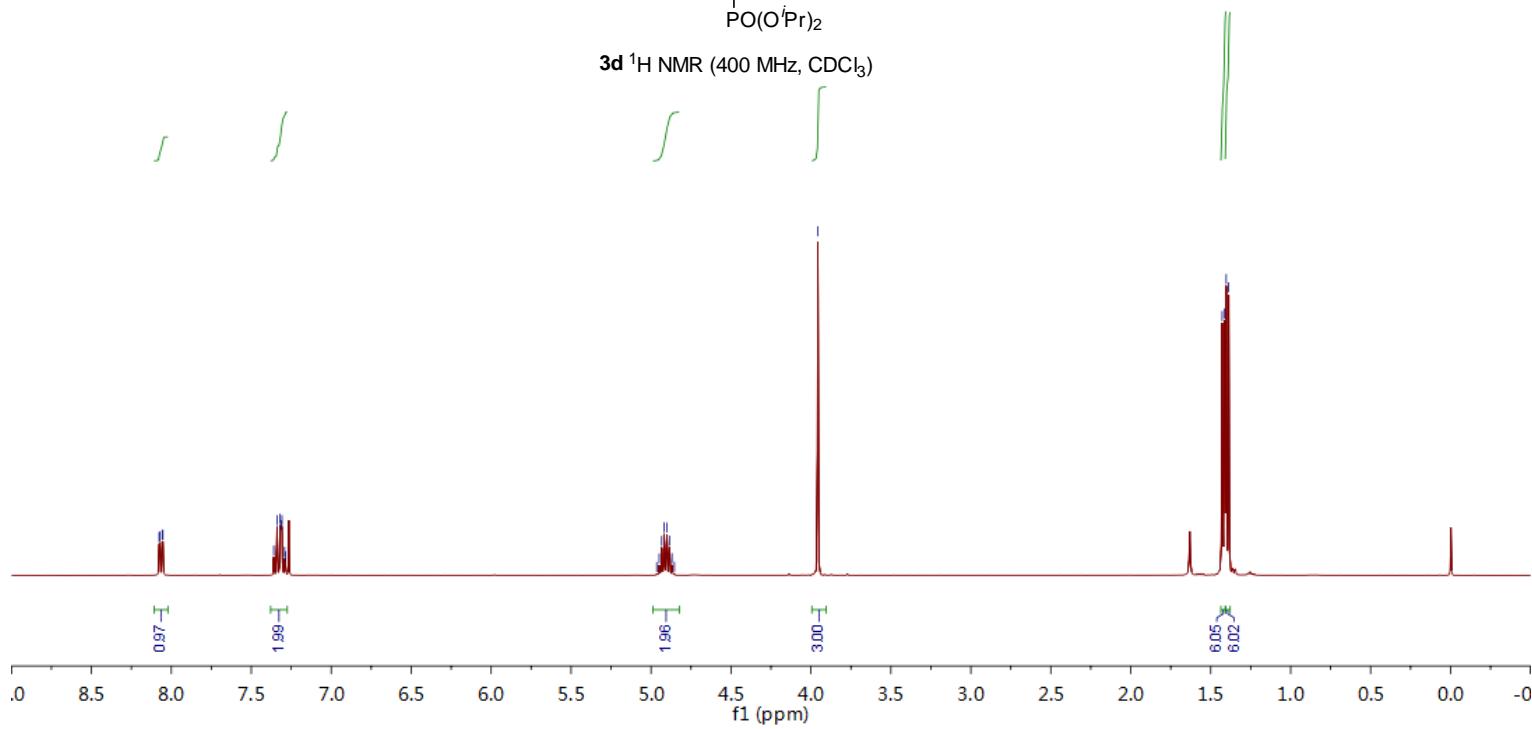
-3.9570

1.4286
1.4131
1.4031
1.3676

¹H NMR ZY-3-36A in CDCl₃



3d ¹H NMR (400 MHz, CDCl₃)



—174.95
—172.96

<148.82
<148.77
<143.91
<143.82

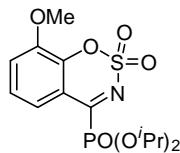
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~122.10
~120.02
~116.71
~116.46

<75.14
<75.07

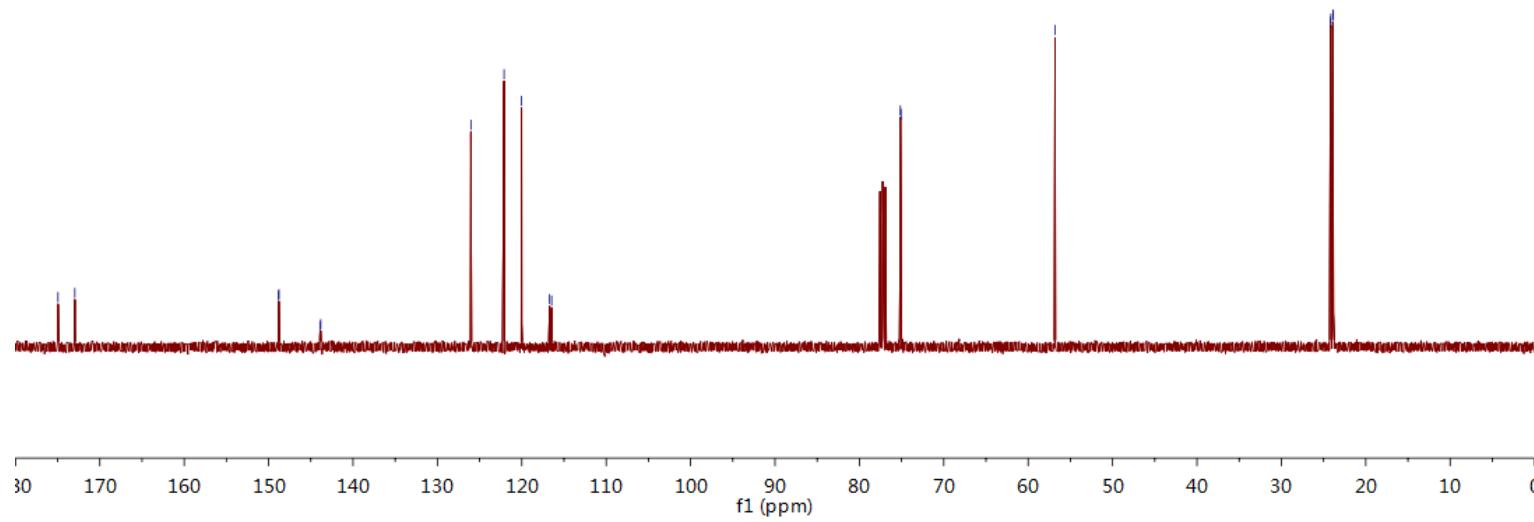
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¹³C NMR ZY-3-36A in CDCl₃

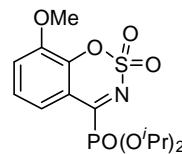


3d ¹³C NMR (100 MHz, CDCl₃)

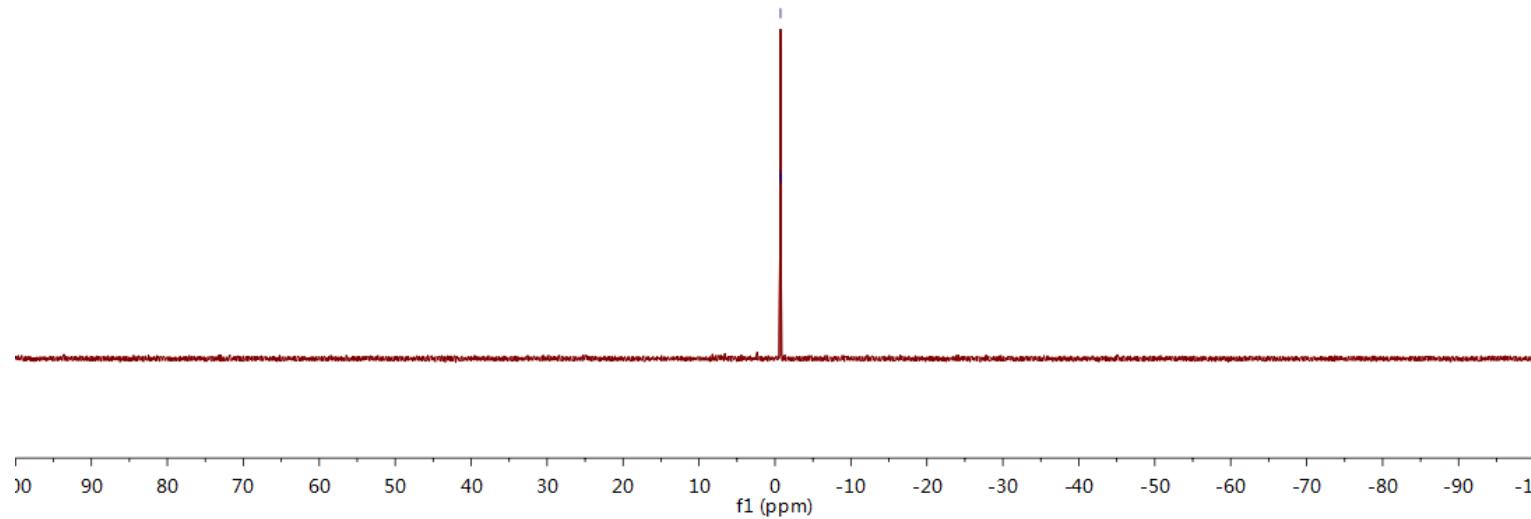


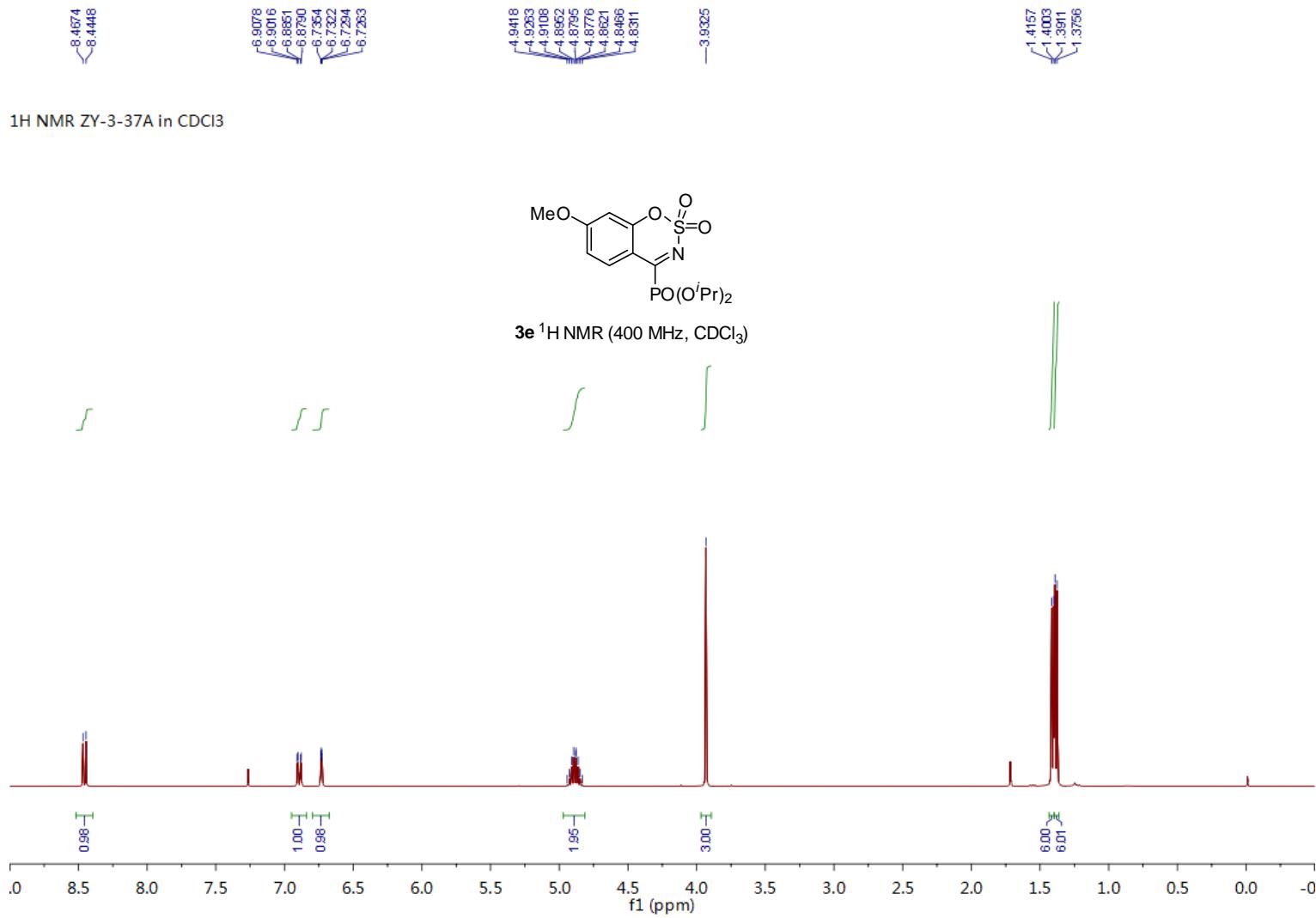
 -0.73
-0.68

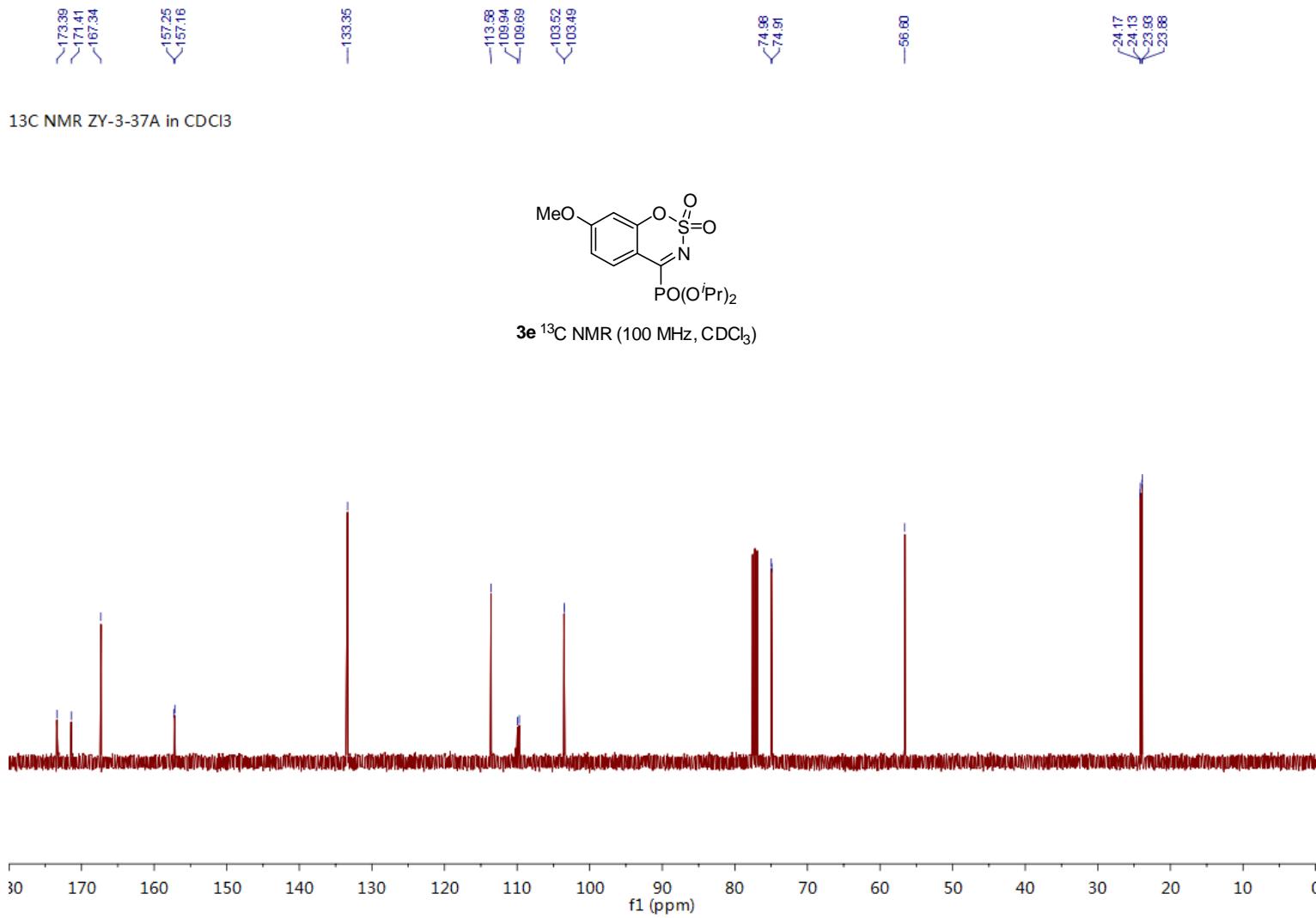
³¹P NMR ZY-3-36A in CDCl₃



3d ³¹P NMR (162 MHz, CDCl₃)

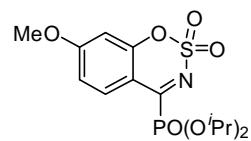




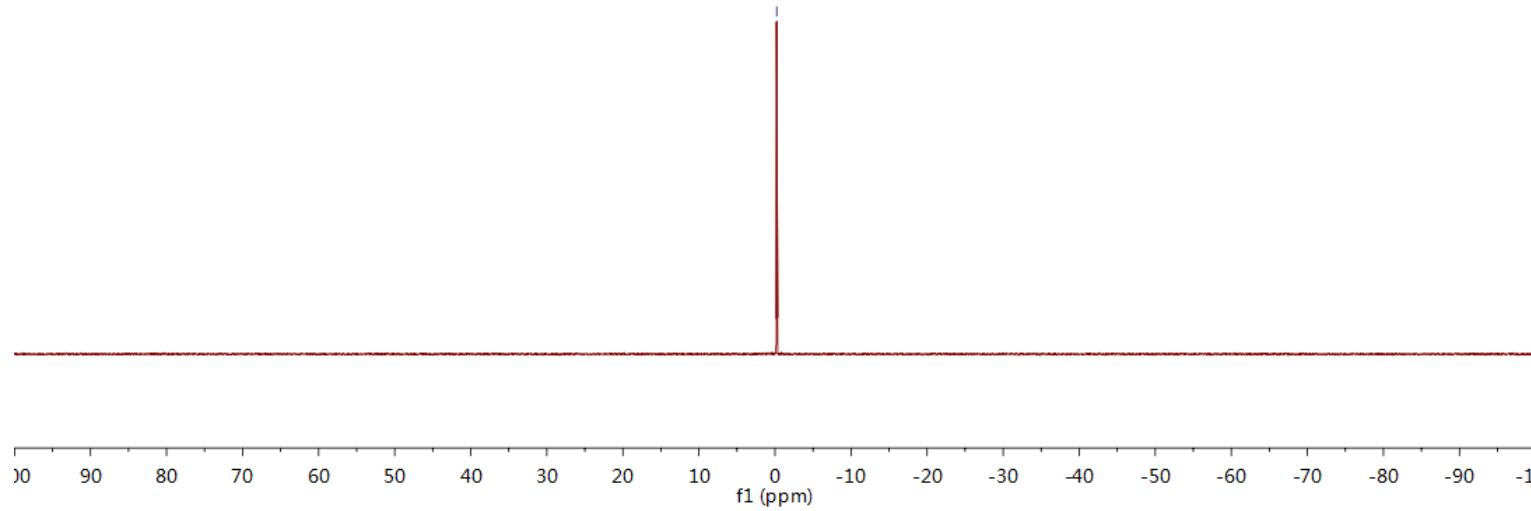


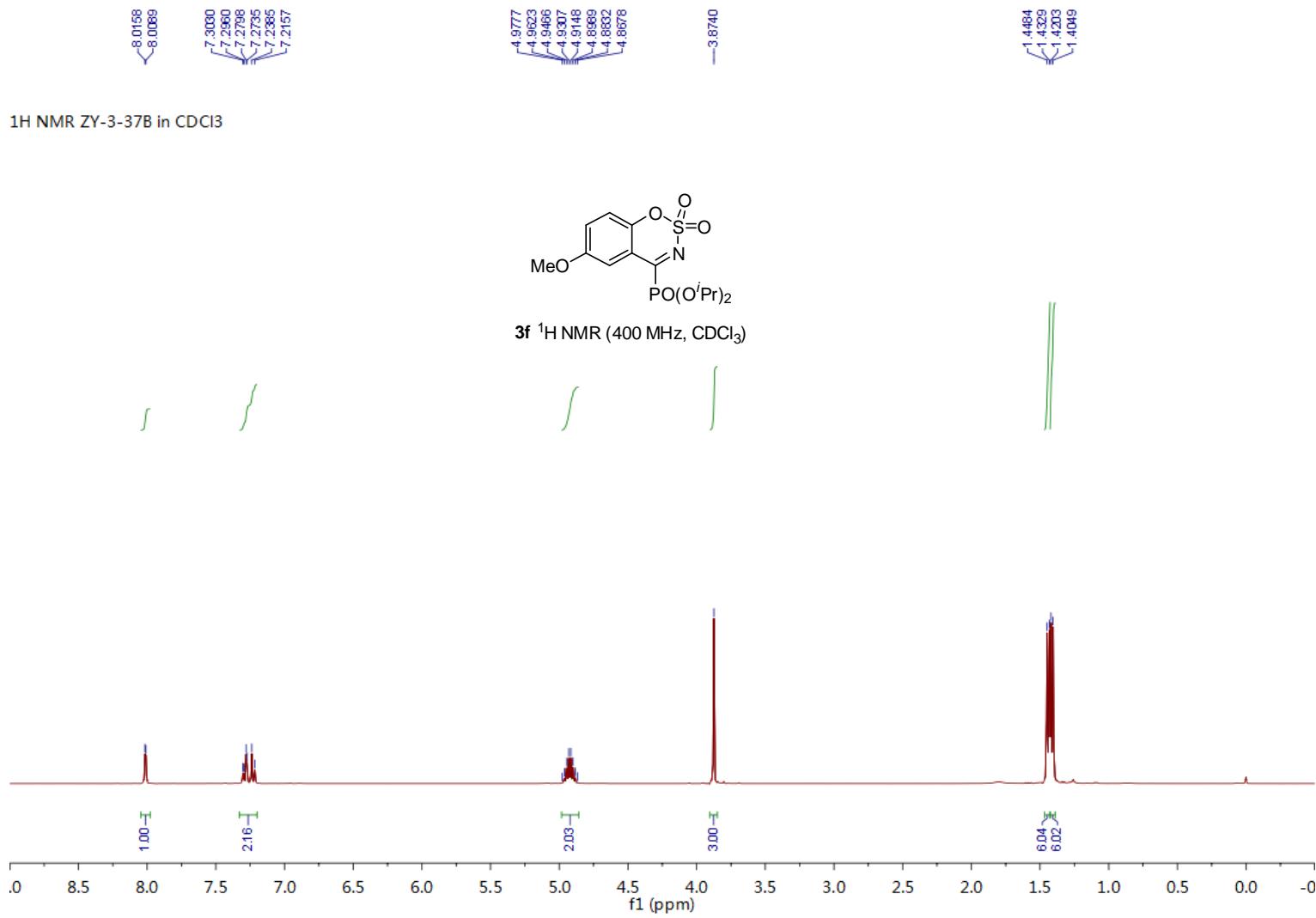
0.023

^{31}P NMR ZY-3-37A in CDCl_3



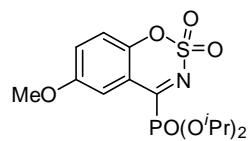
3e ^{31}P NMR (162 MHz, CDCl_3)



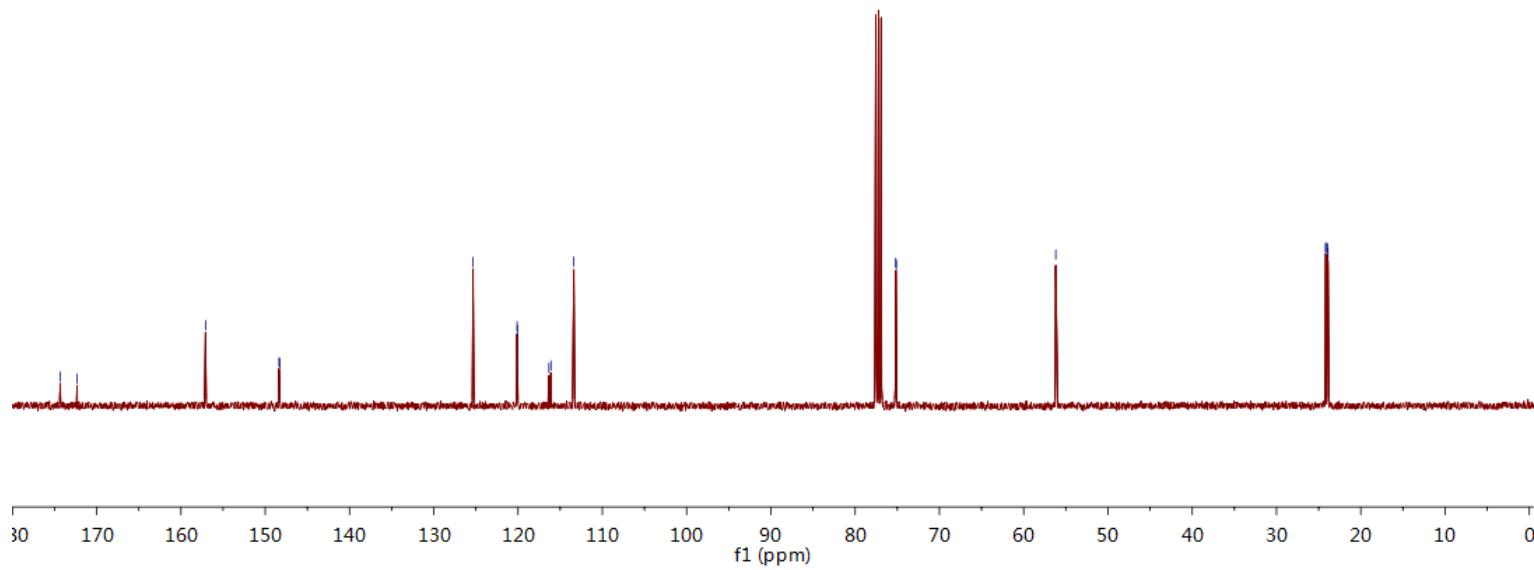


—174.31
—172.32
—157.08
—148.36
<148.28
—125.34
—120.11
—120.08
—116.34
—116.10
—113.38
—75.18
<75.11
—56.19
—24.18
—24.14
—23.94
—23.89

13C NMR ZY-3-37B in CDCl₃

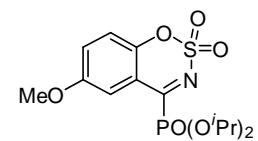


3f ¹³C NMR (100 MHz, CDCl₃)

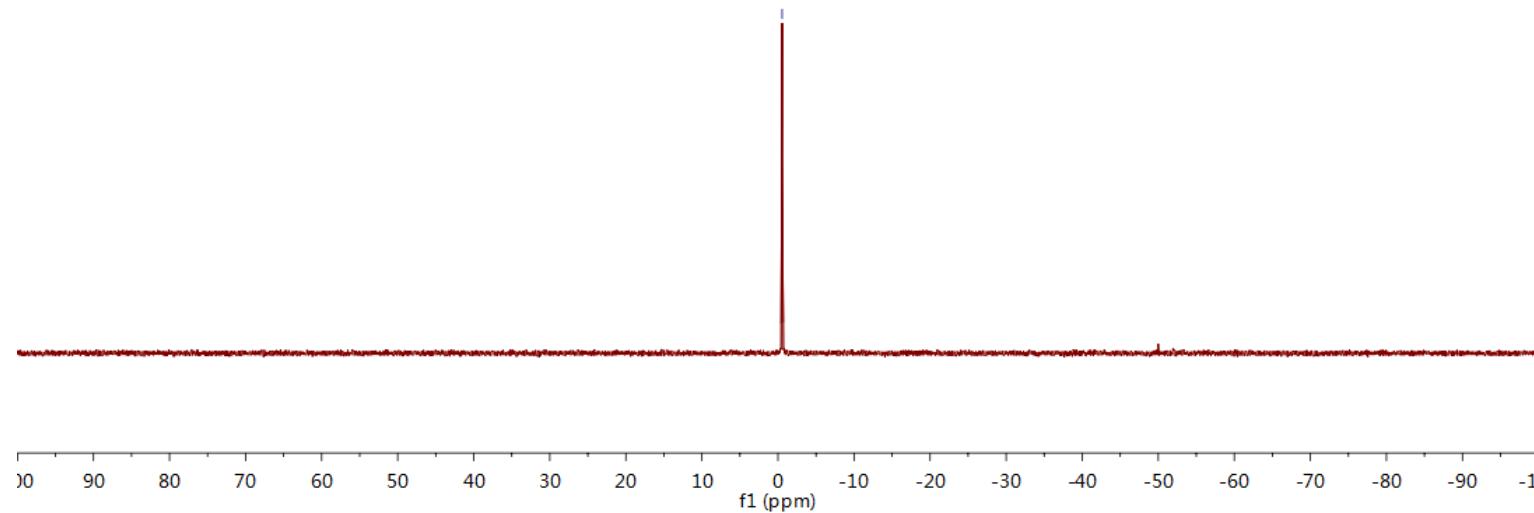


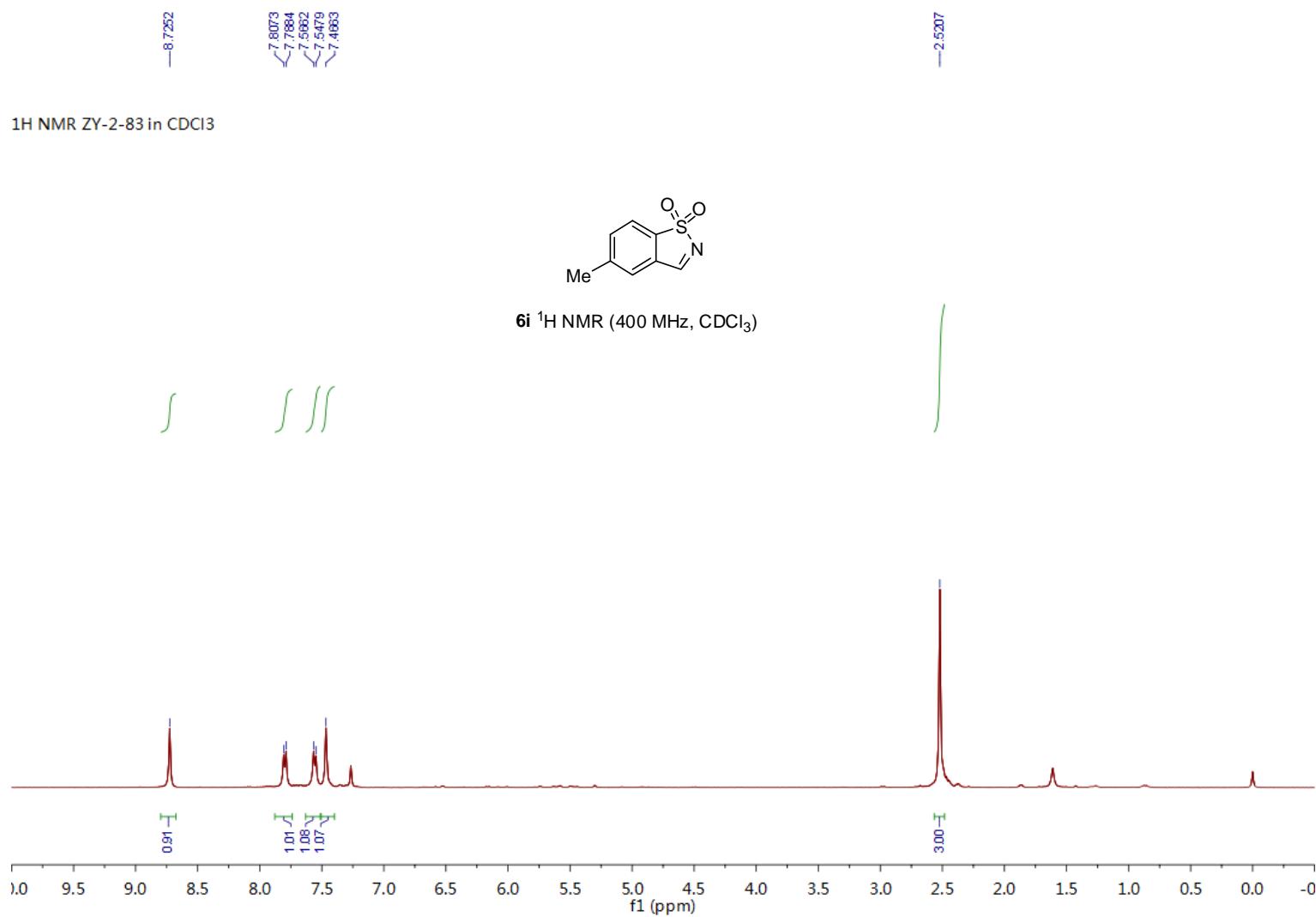
-0.54

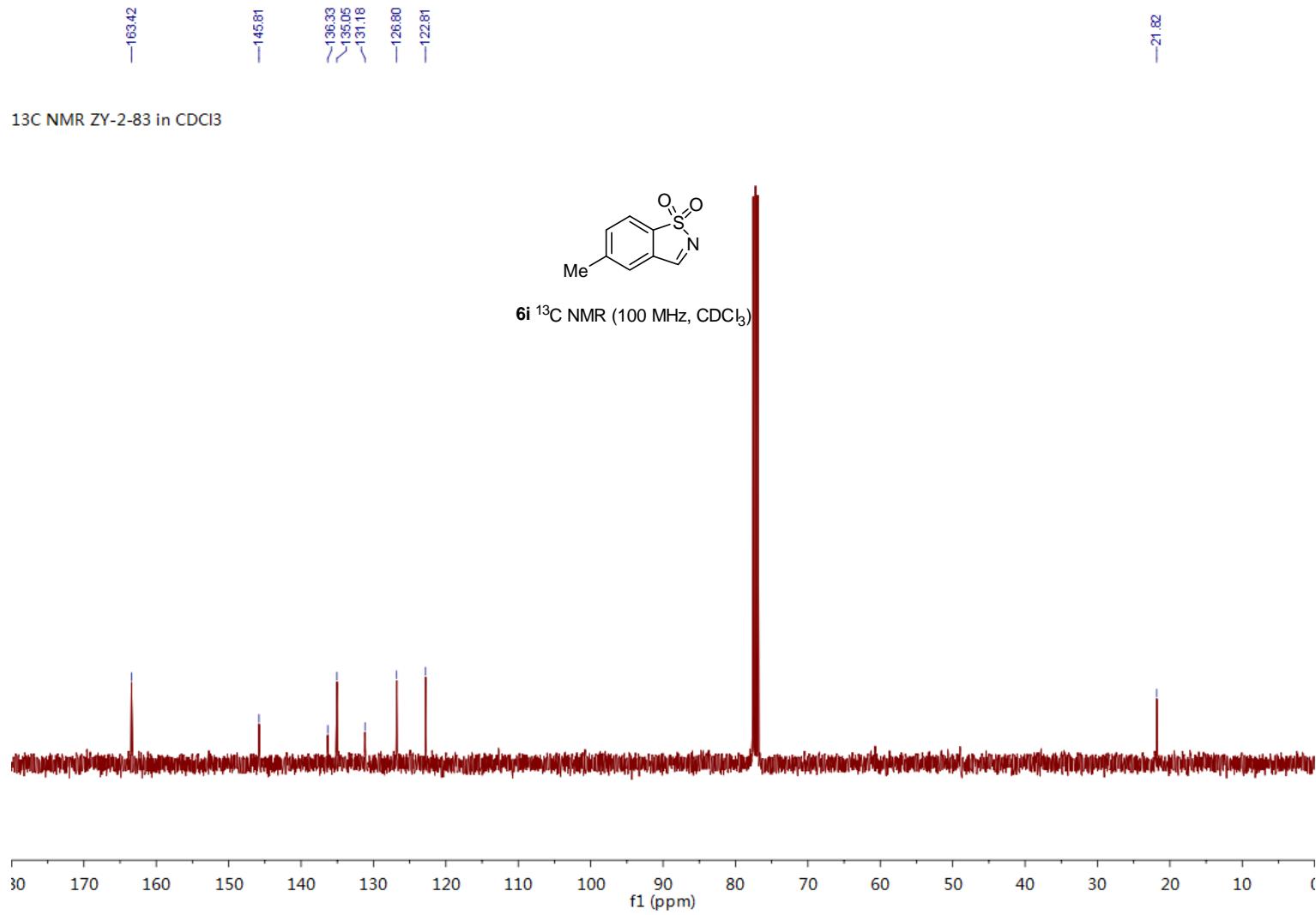
^{31}P NMR ZY-3-37B in CDCl_3



3f ^{31}P NMR (162 MHz, CDCl_3)





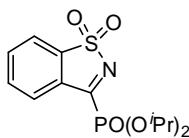


8.2235
8.2118
8.2096
8.2020
7.9446
7.9377
7.9340
7.9277
7.9231
7.9169
7.8866
7.7747
7.7717
7.7626
7.7535
7.7507
7.7363

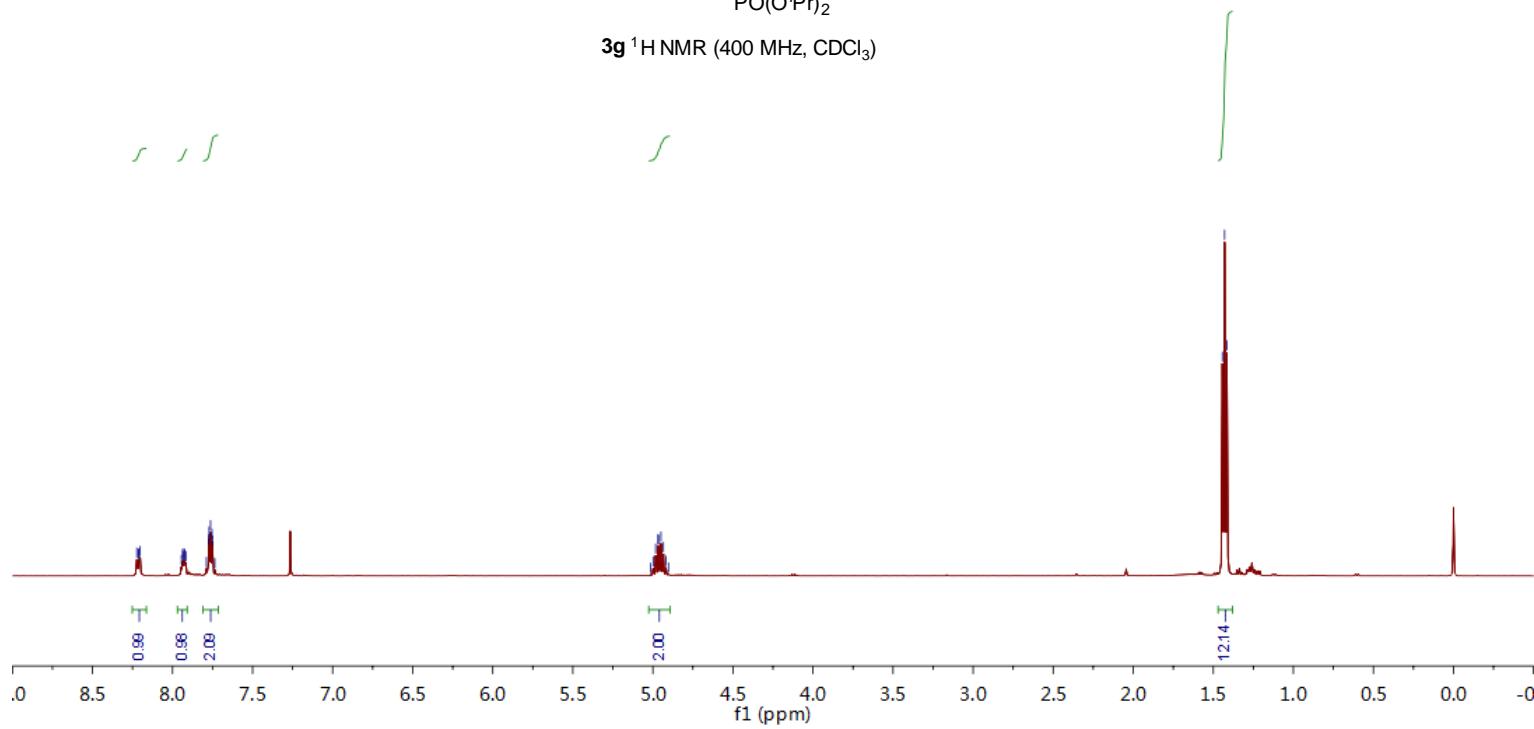
5.0138
4.9864
4.9829
4.9673
4.9654
4.9495
4.9339
4.9184
4.9028

1.4434
1.4294
1.4152

¹H NMR ZY-2-66 in CDCl₃



3g ¹H NMR (400 MHz, CDCl₃)



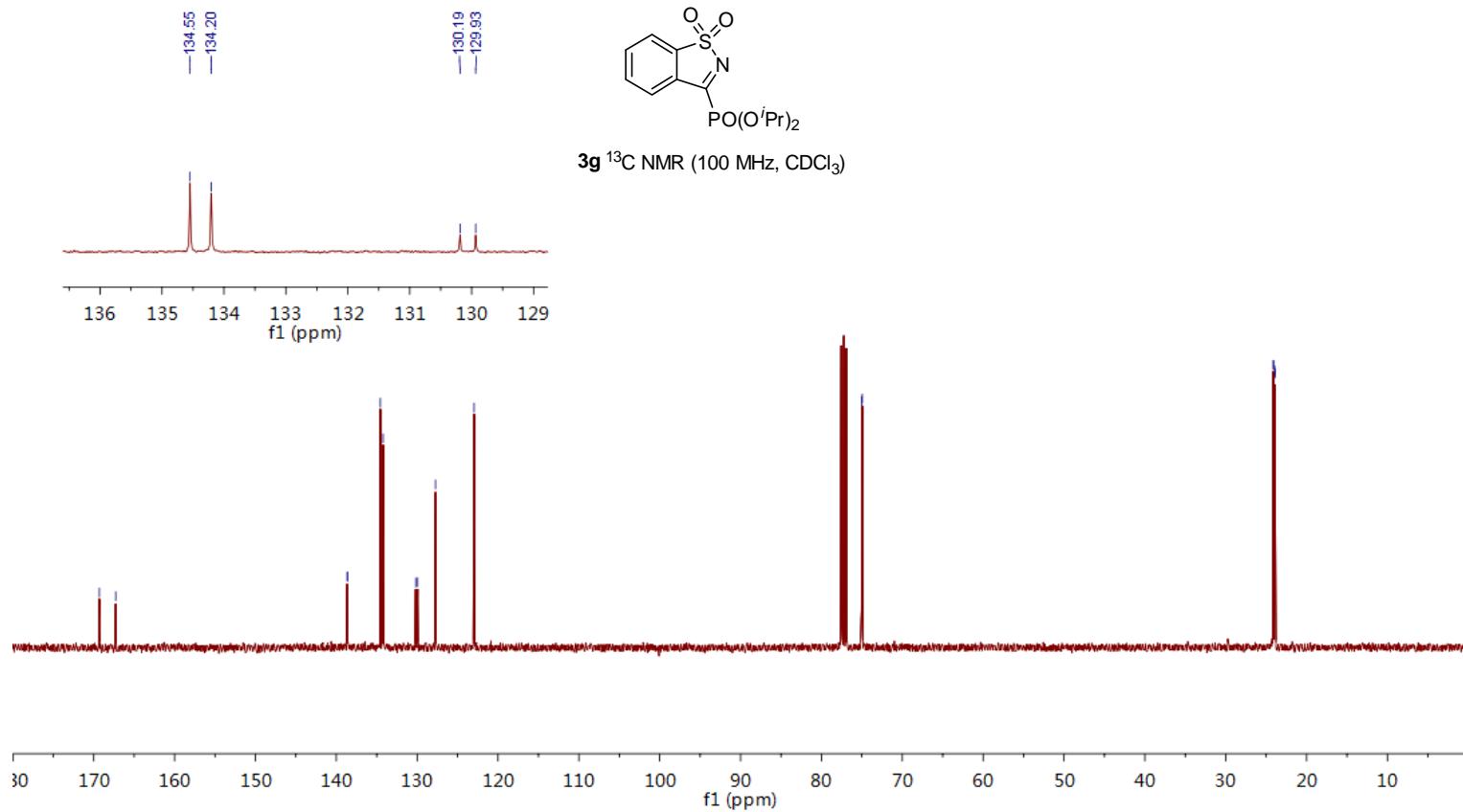
—169.31
—167.28

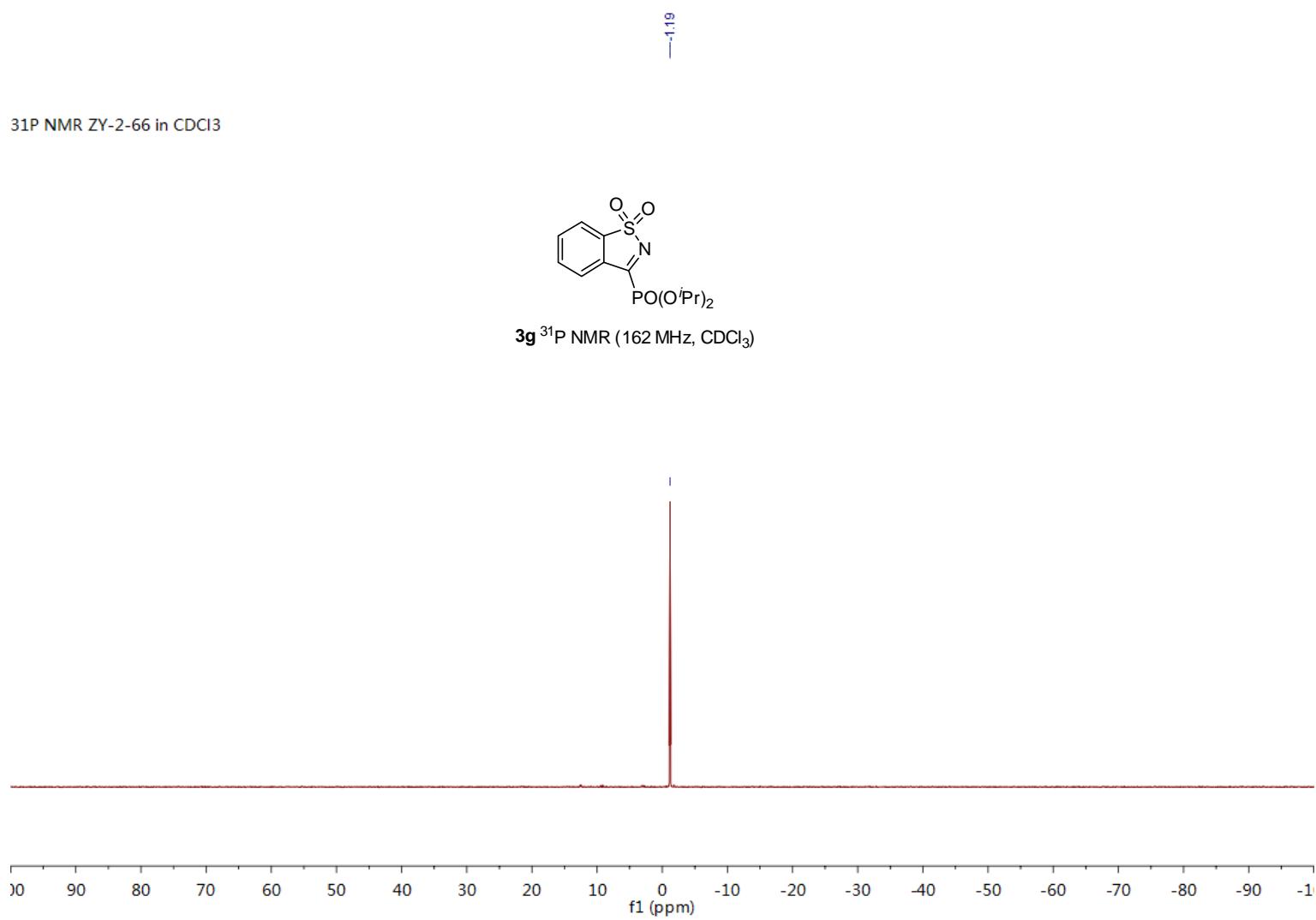
—138.65
—138.62
—134.55
—134.20
—130.19
—129.93
—127.73
—122.95

—75.02
—74.95

—24.12
—24.08
—23.94
—23.89

^{13}C NMR ZY-2-66 in CDCl_3



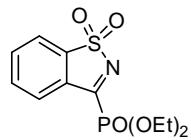


8.1772
8.1608
7.9236
7.9066
7.7887
7.7677
7.7579
7.7472
7.7272

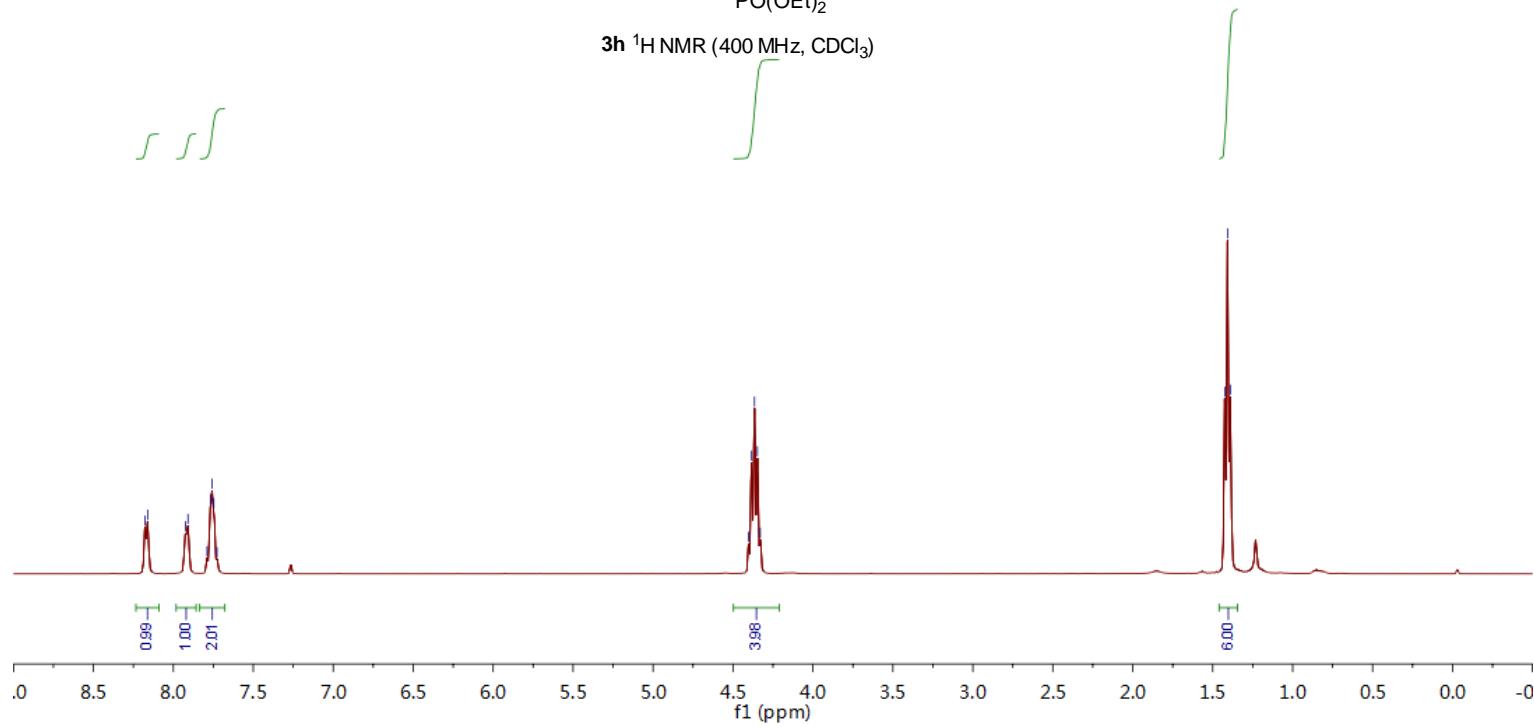
4.4019
4.3838
4.3665
4.3474
4.3297

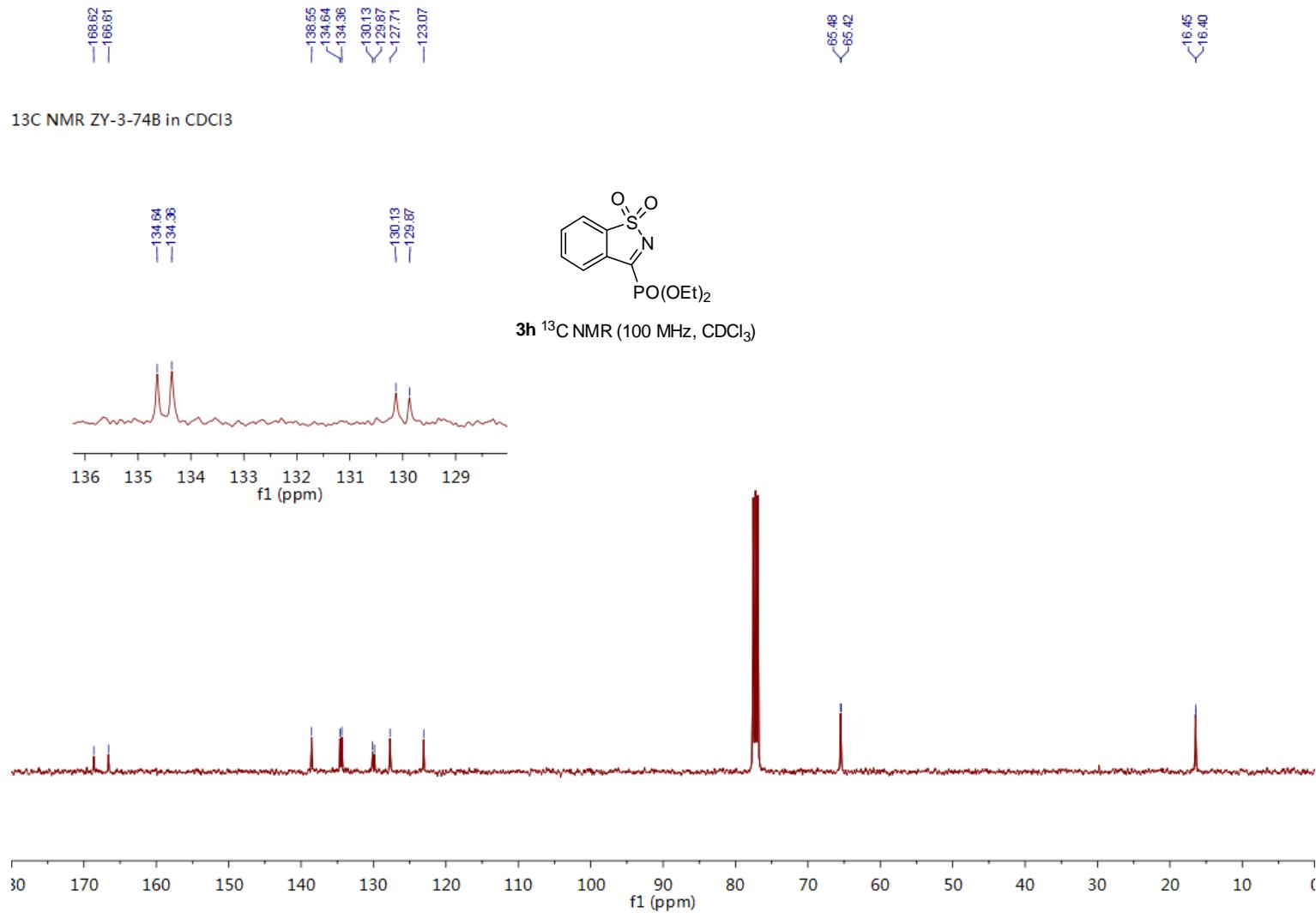
1.4249
1.4073
1.3900

^1H NMR ZY-3-74B in CDCl_3



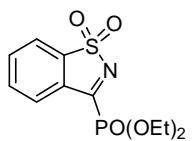
3h ^1H NMR (400 MHz, CDCl_3)



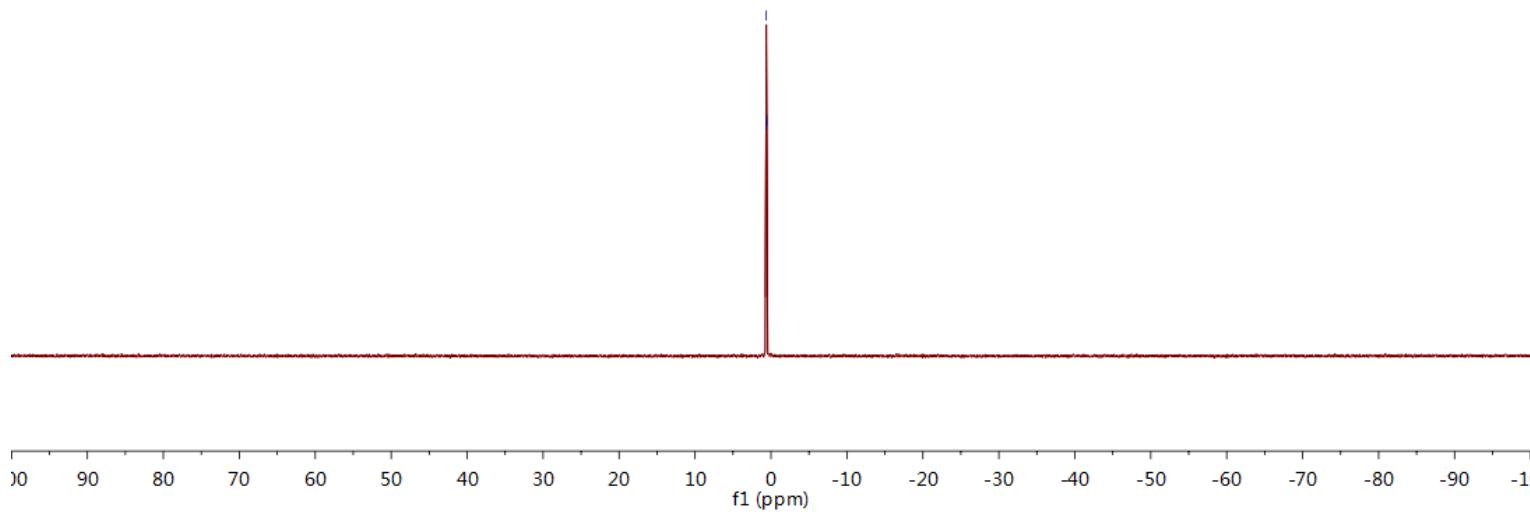


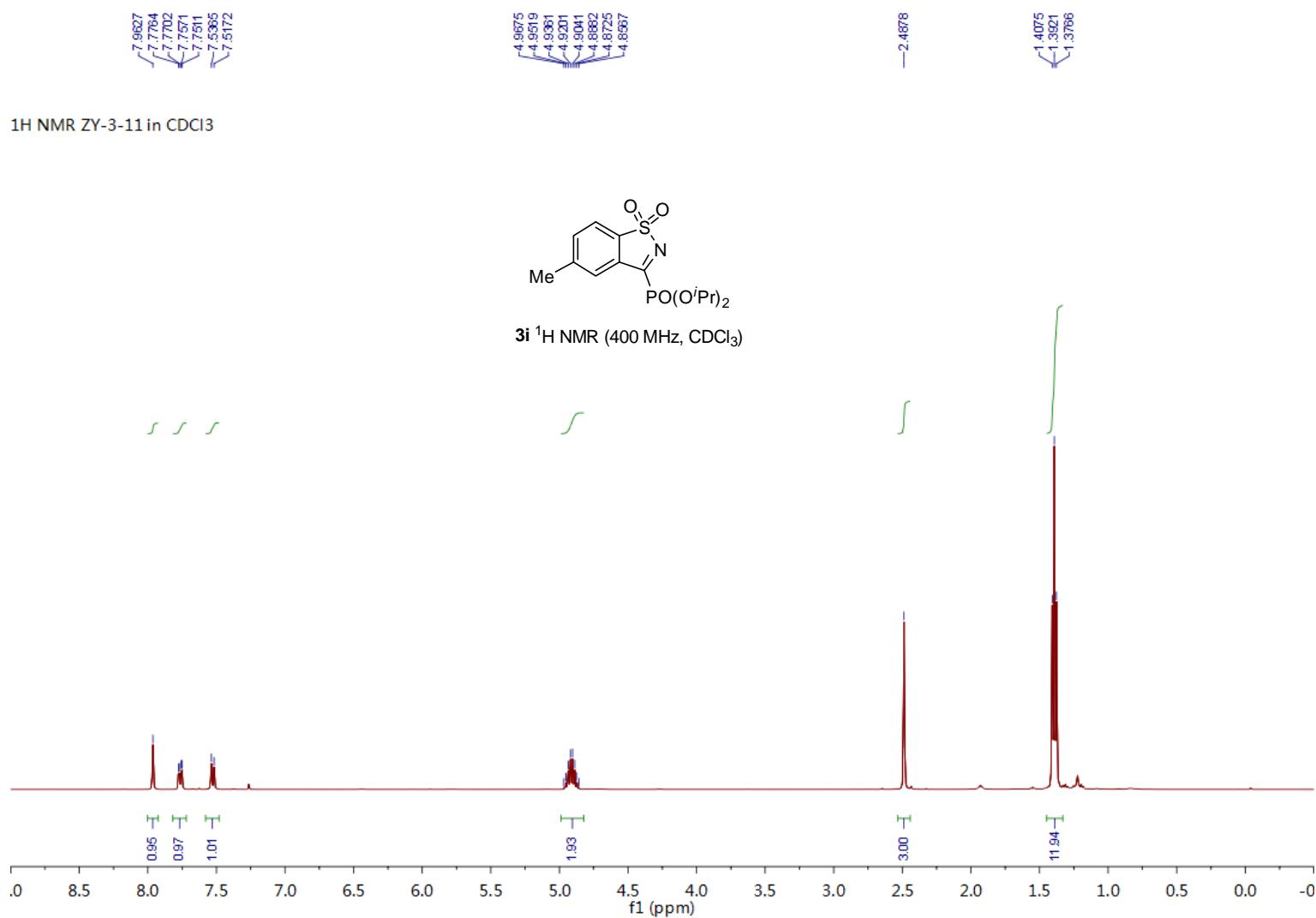
0.66
0.61
0.56

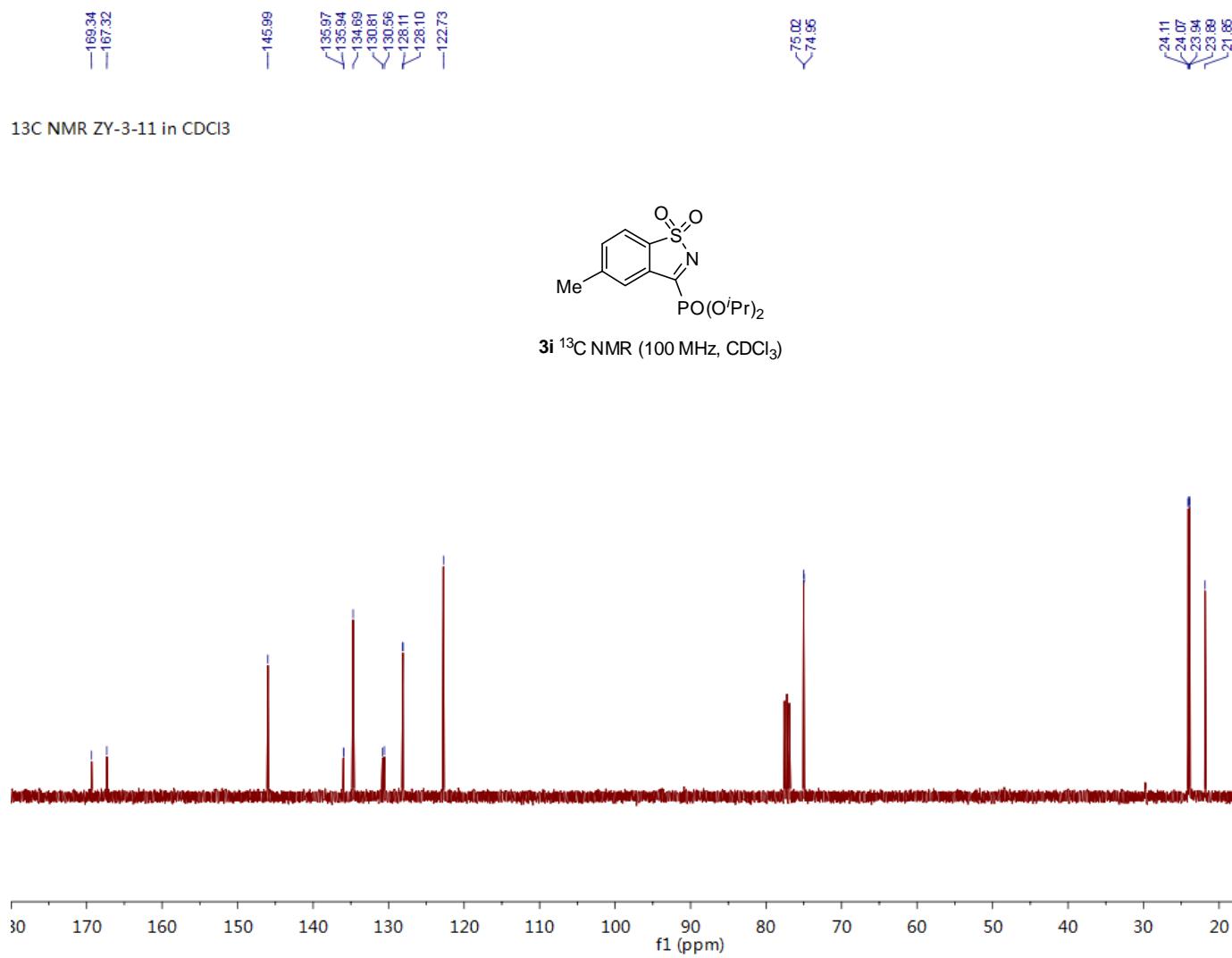
³¹P NMR ZY-3-74B in CDCl₃



3h ³¹P NMR (162 MHz, CDCl₃)

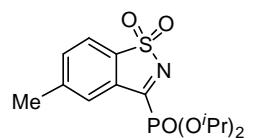




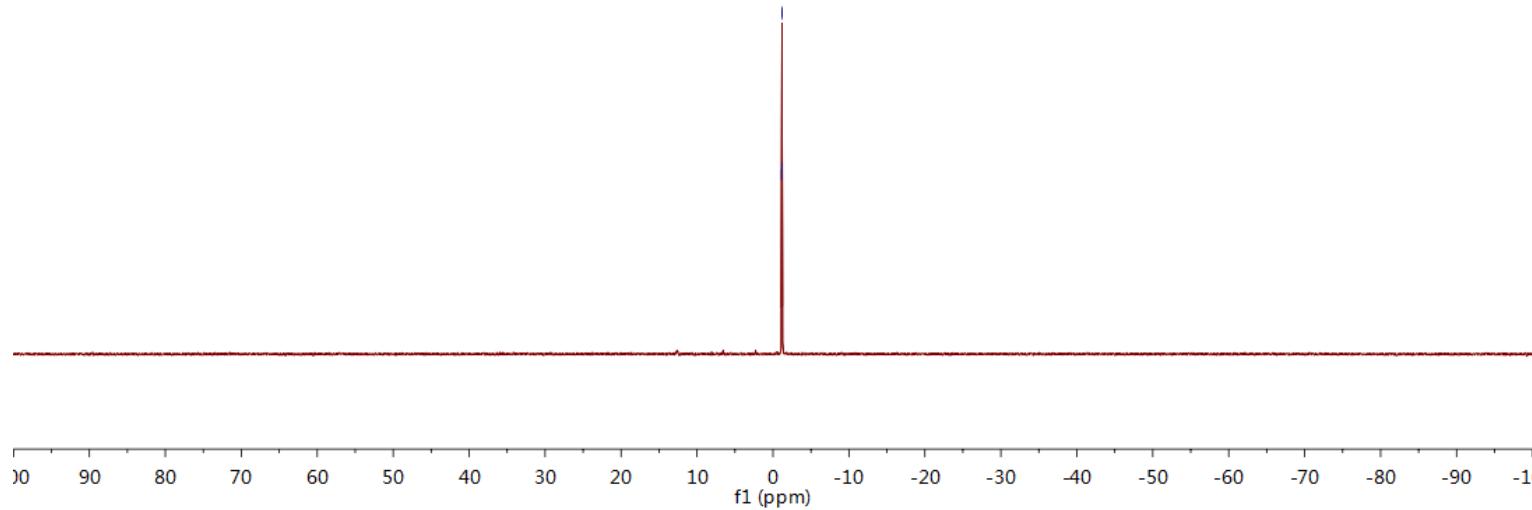


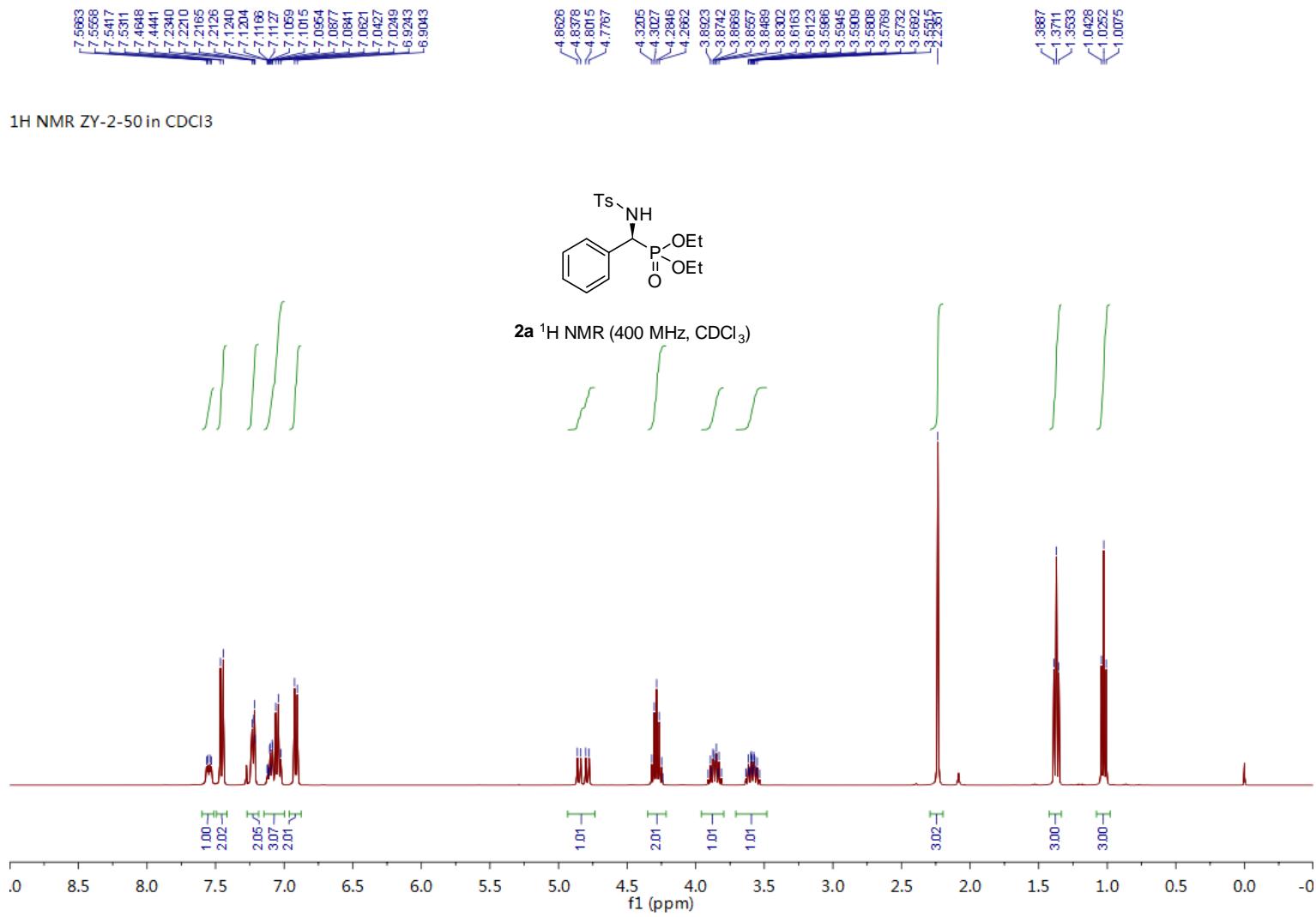


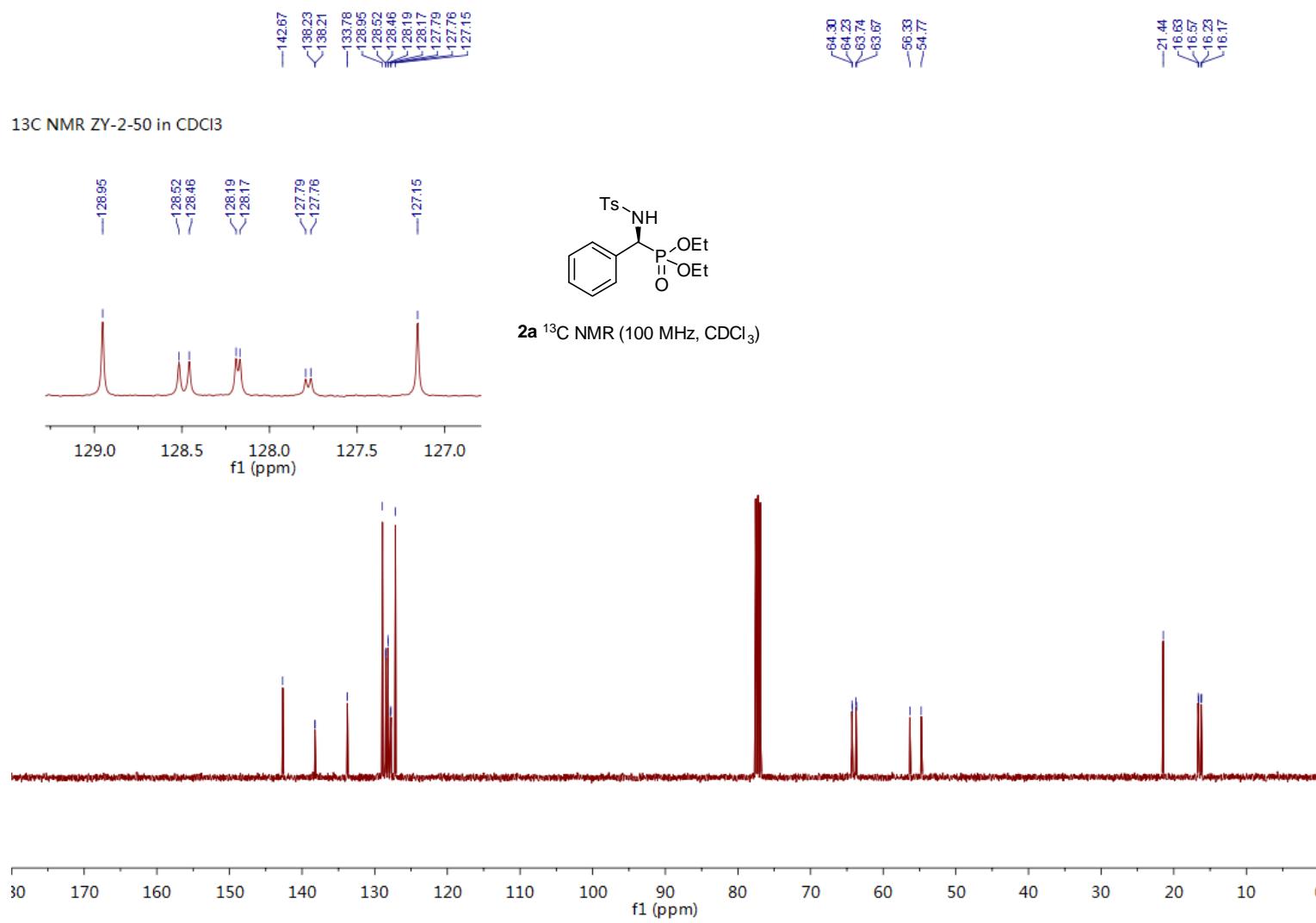
^{31}P NMR ZY-3-11 in CDCl_3



3i ^{31}P NMR (162 MHz, CDCl_3)

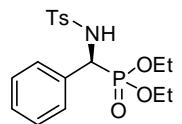




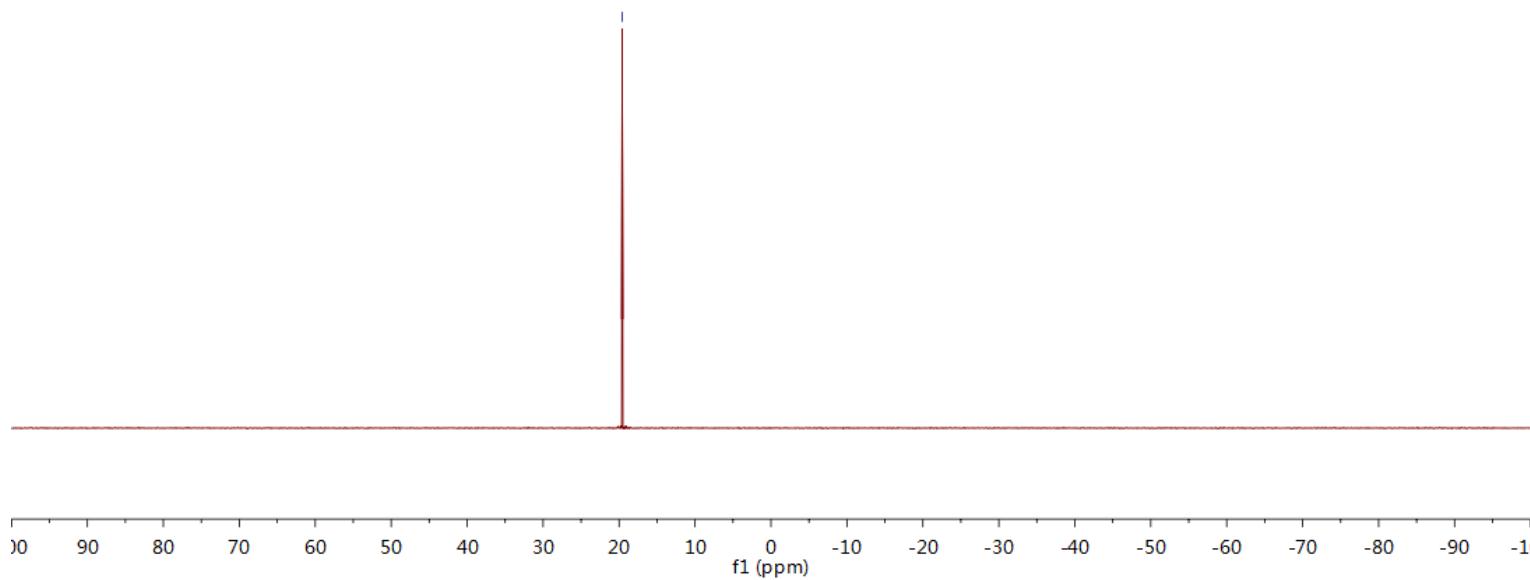


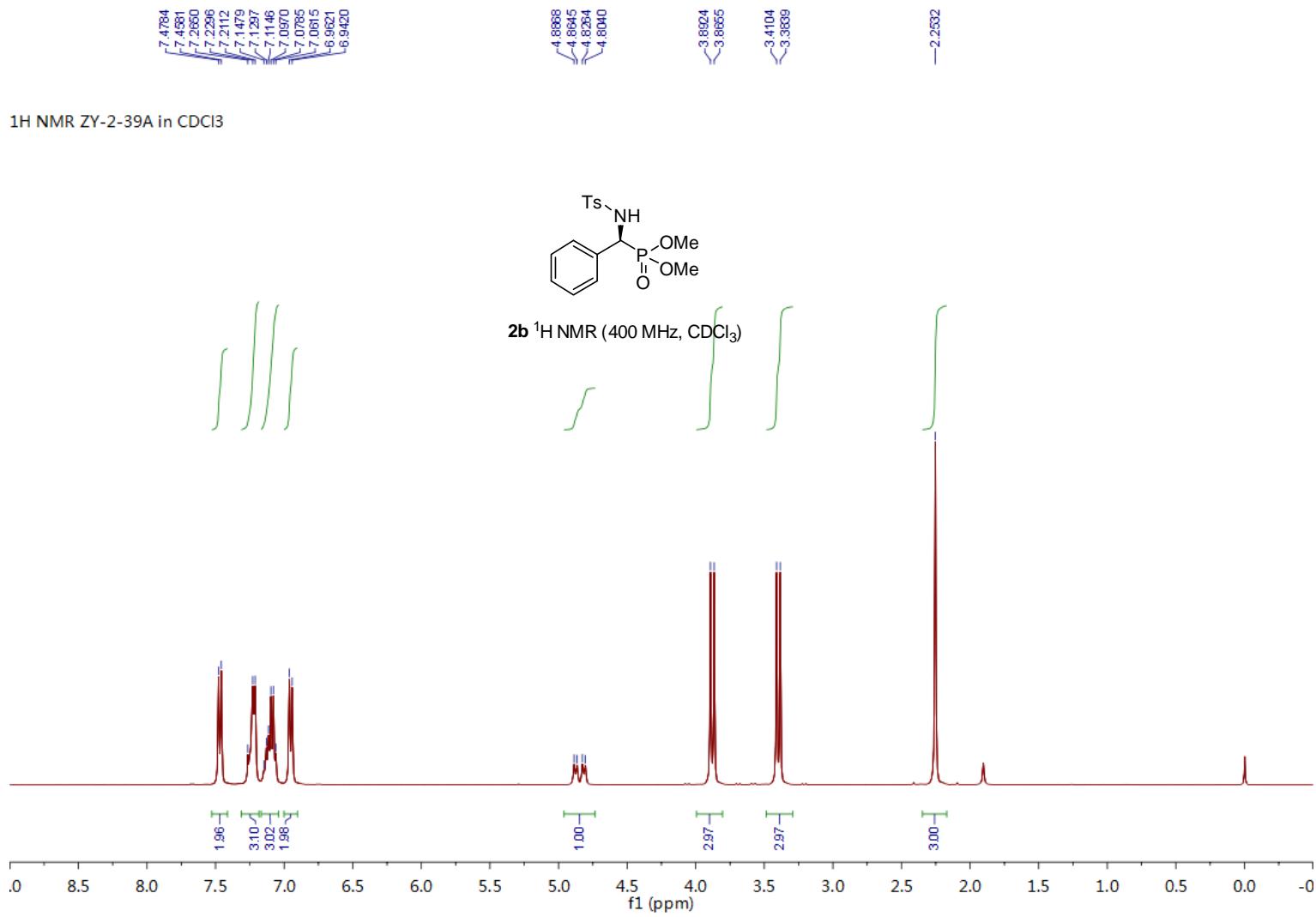
-19.59

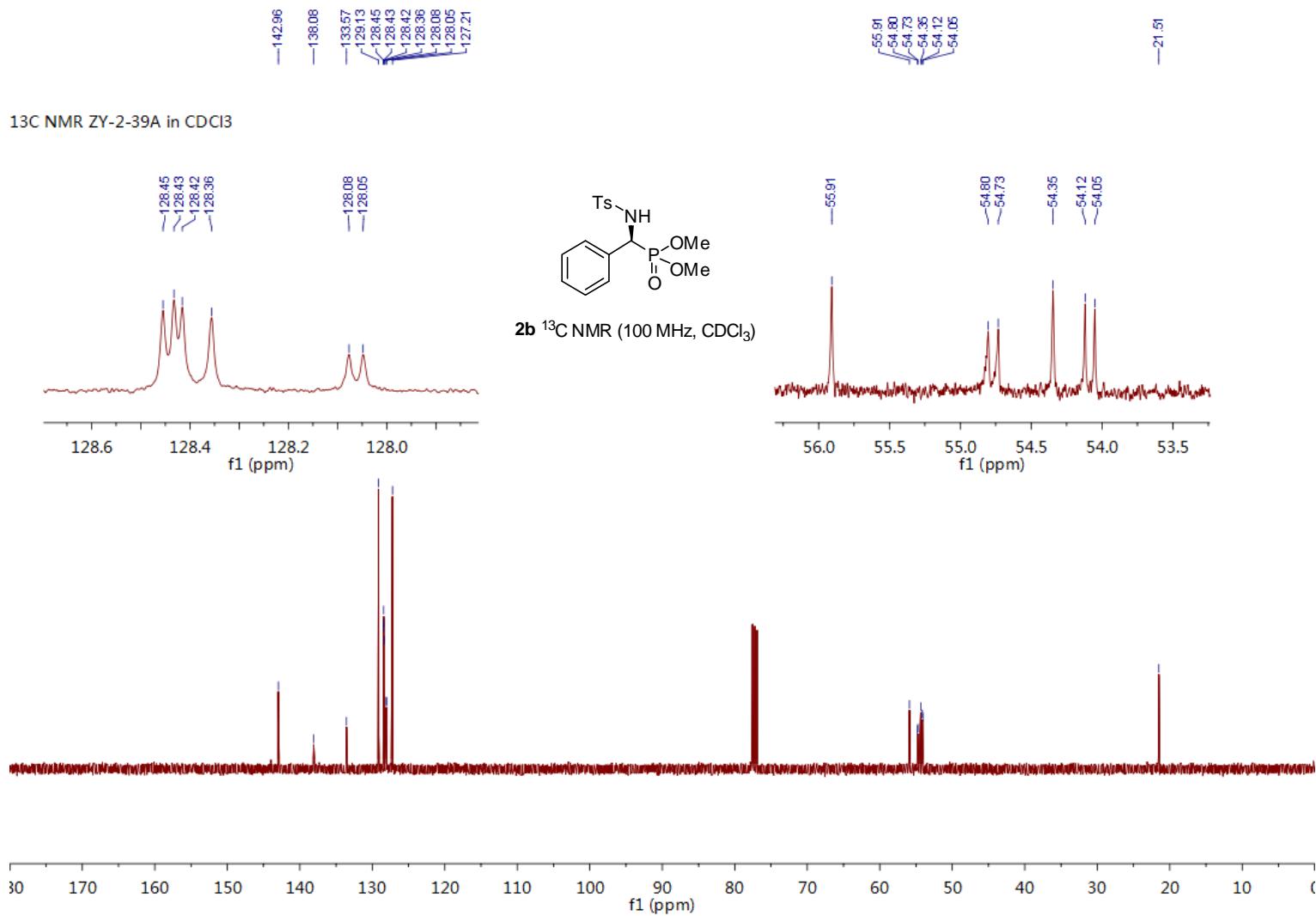
^{31}P NMR ZY-2-50 in CDCl_3



2a ^{31}P NMR (162 MHz, CDCl_3)

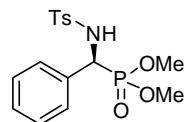




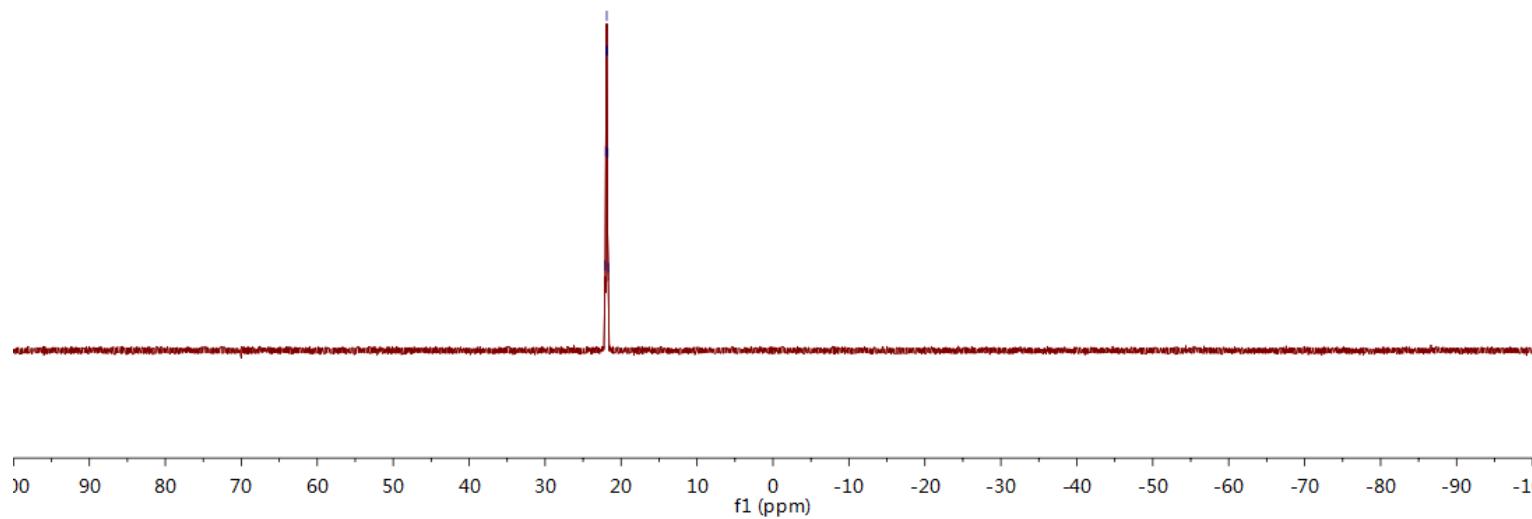


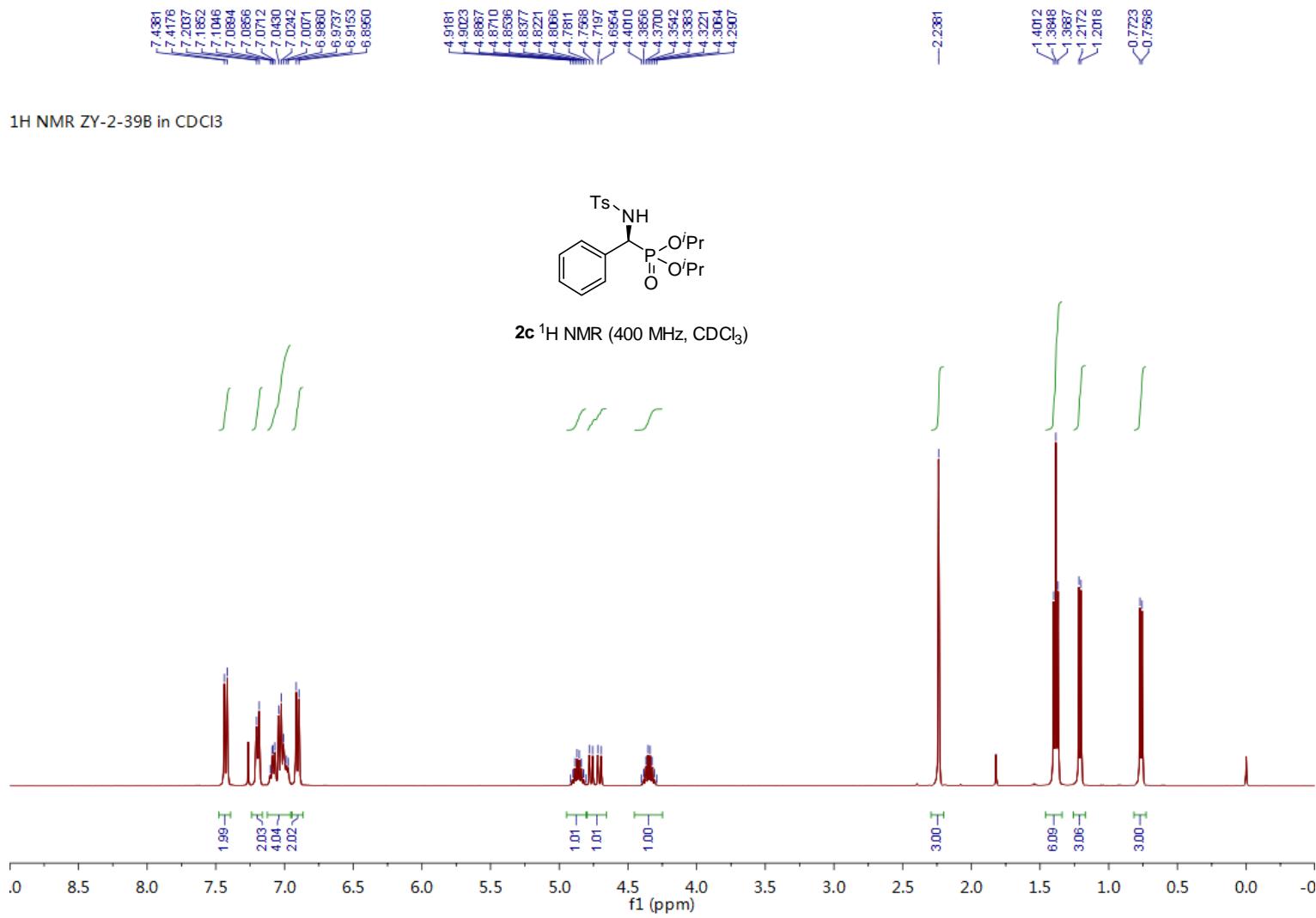


31P NMR ZY-2-39A in CDCl₃



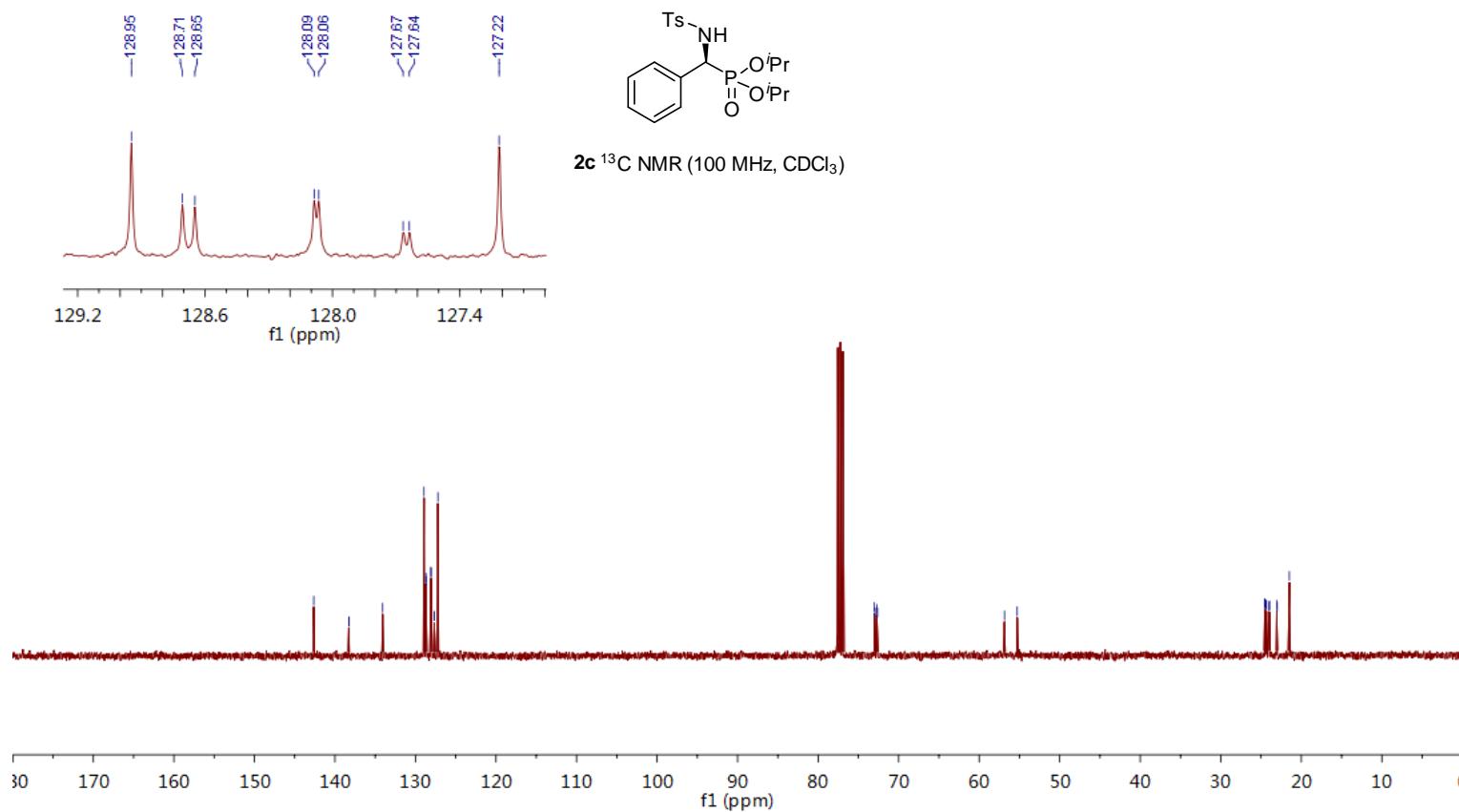
2b ³¹P NMR (162 MHz, CDCl₃)





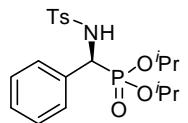


^{13}C NMR ZY-2-39B in CDCl_3

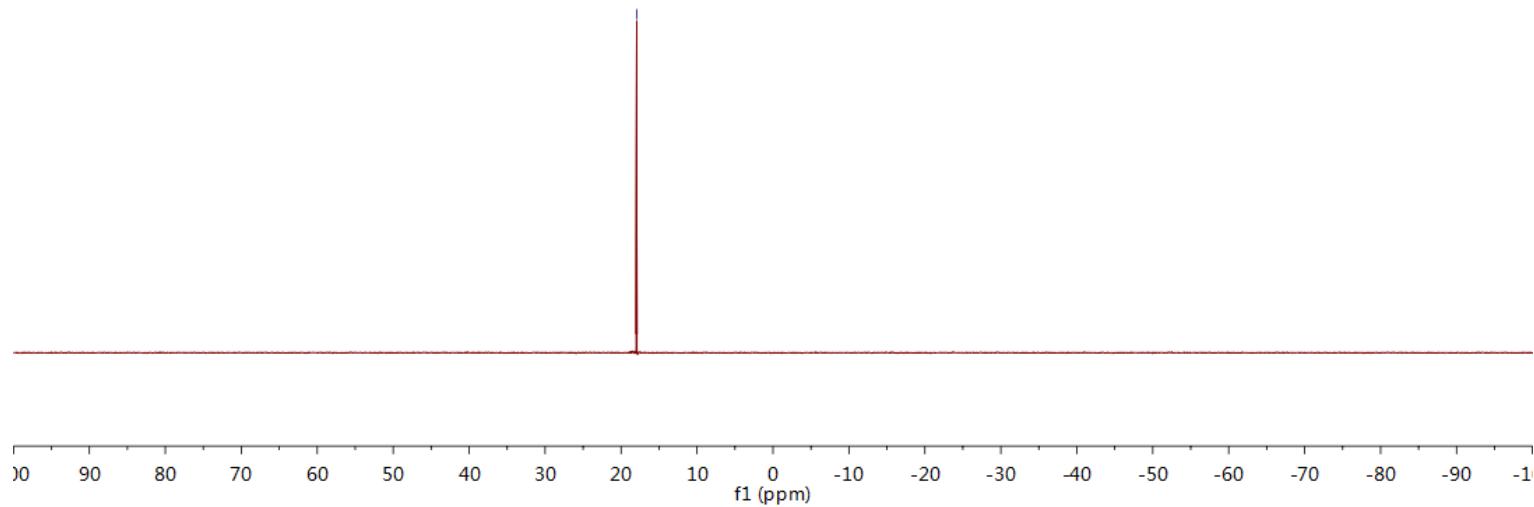


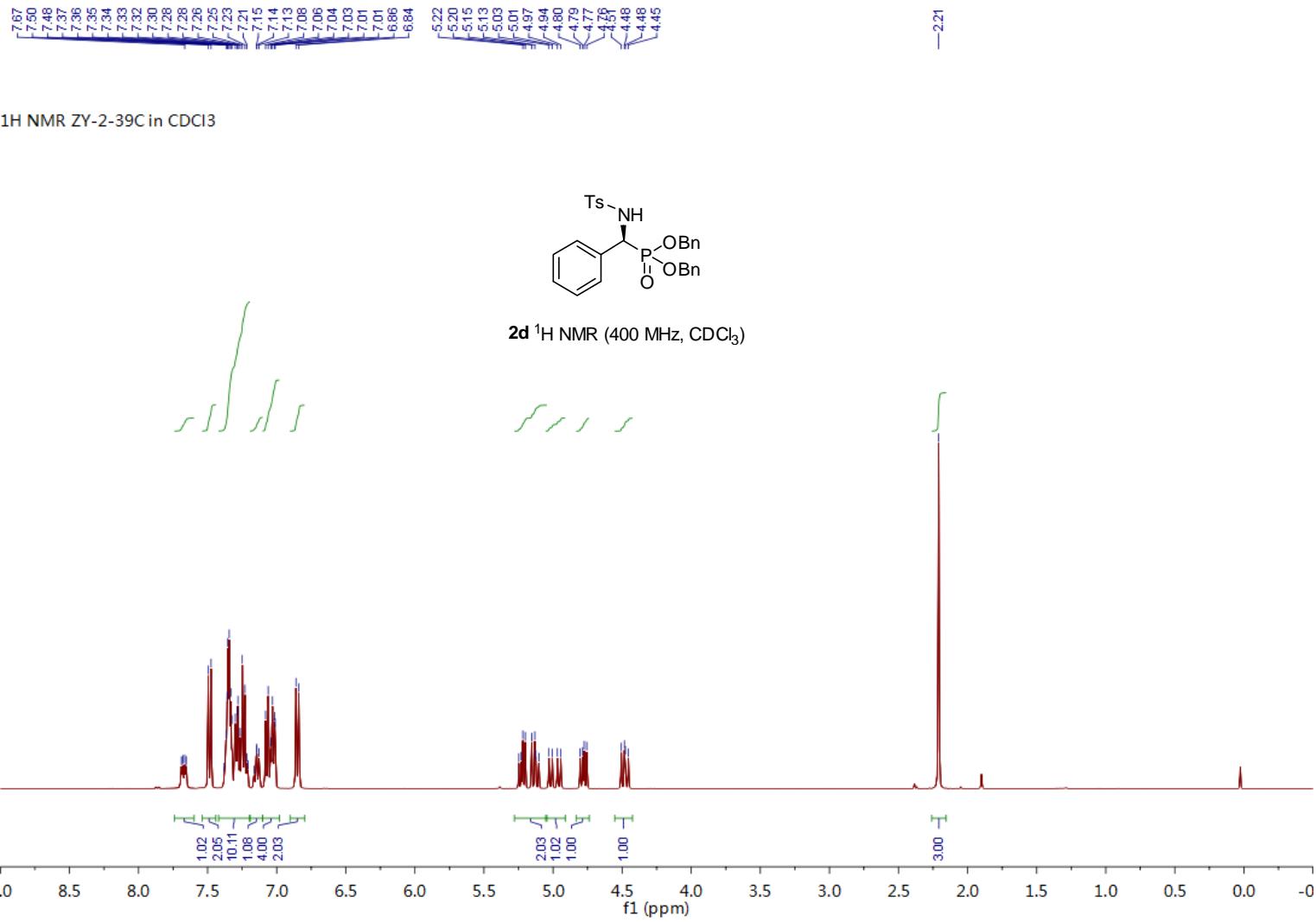
—17.95

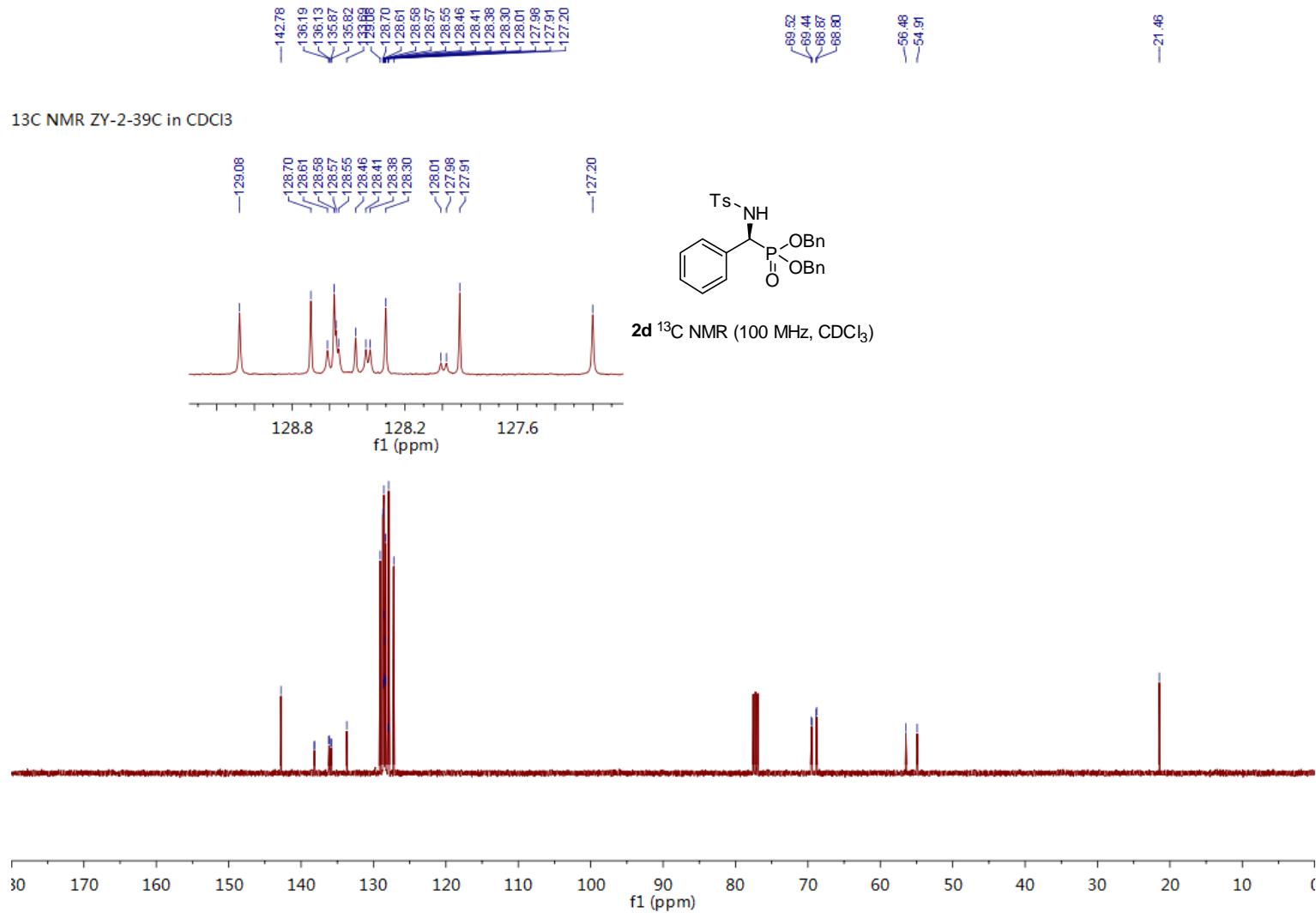
^{31}P NMR ZY-2-39B in CDCl_3



2c ^{31}P NMR (162 MHz, CDCl_3)

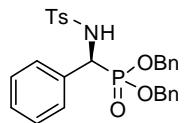




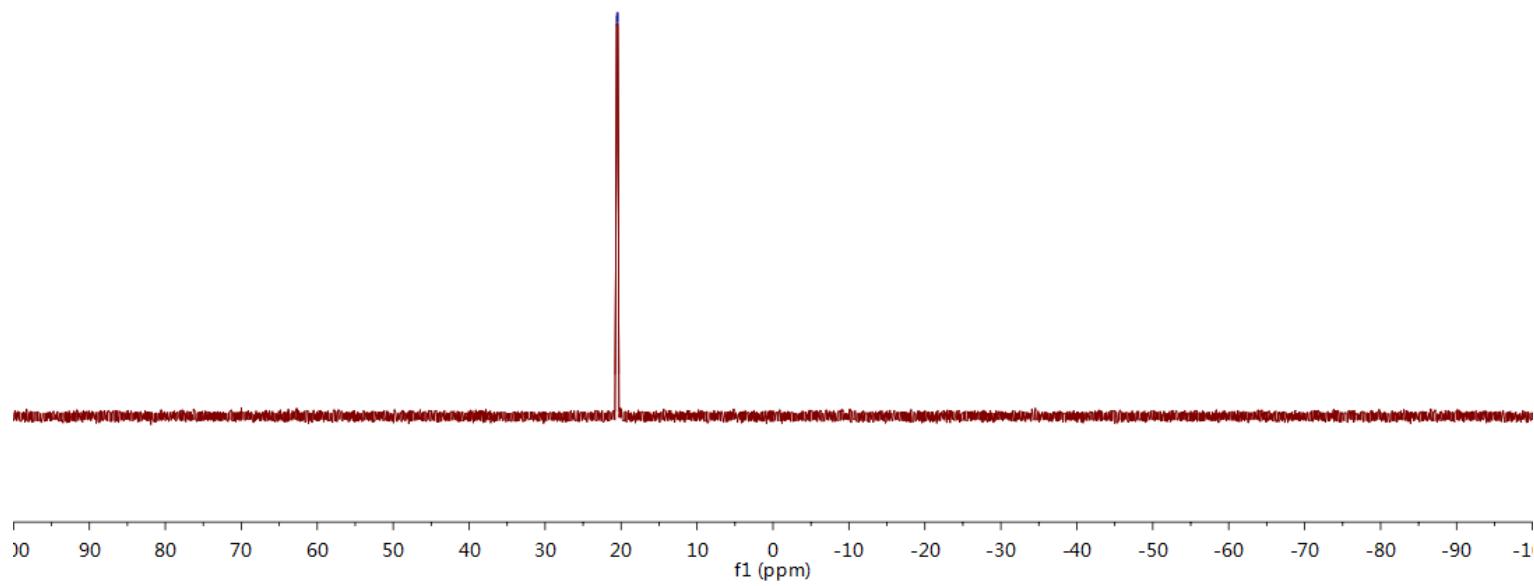


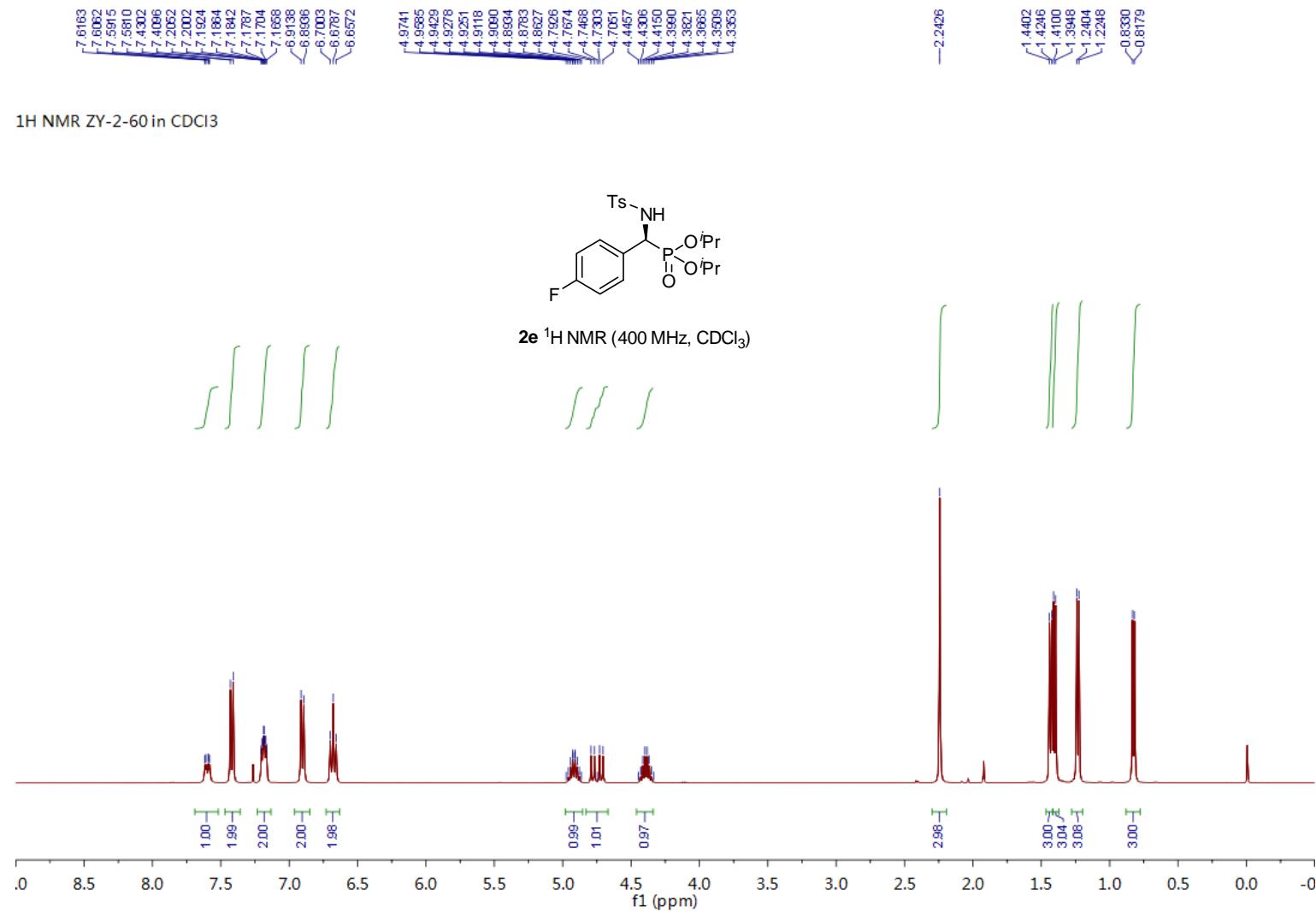


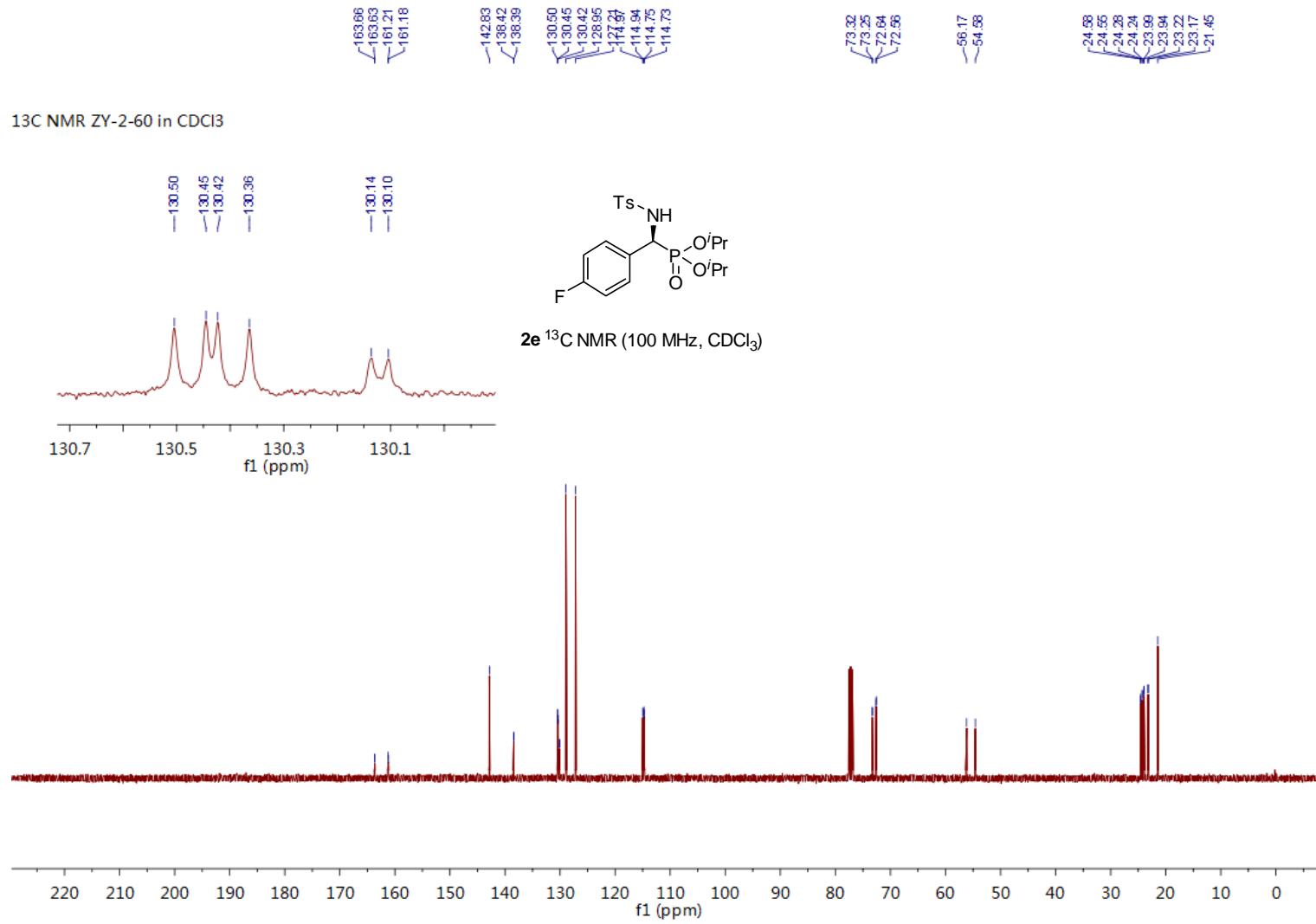
^{31}P NMR ZY-2-39C in CDCl_3



2d ^{31}P NMR (162 MHz, CDCl_3)

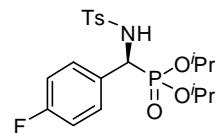




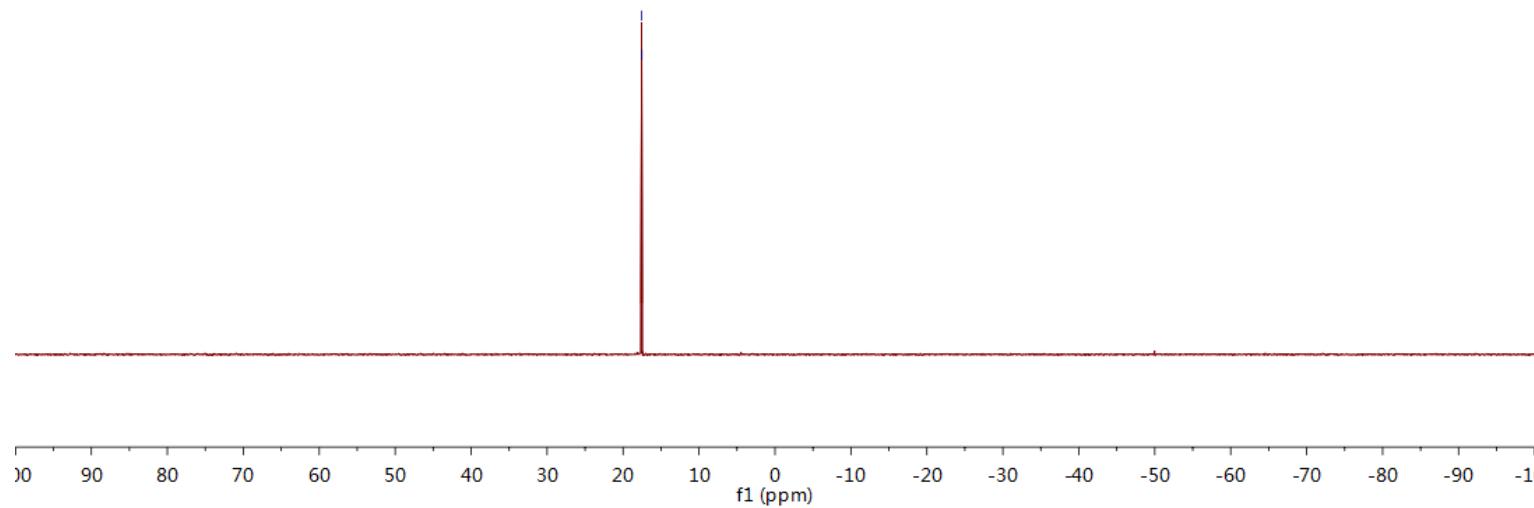


¹⁷⁵⁶
¹⁷⁵²

³¹P NMR ZY-2-60 in CDCl₃

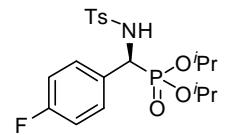


2e ³¹P NMR (162 MHz, CDCl₃)

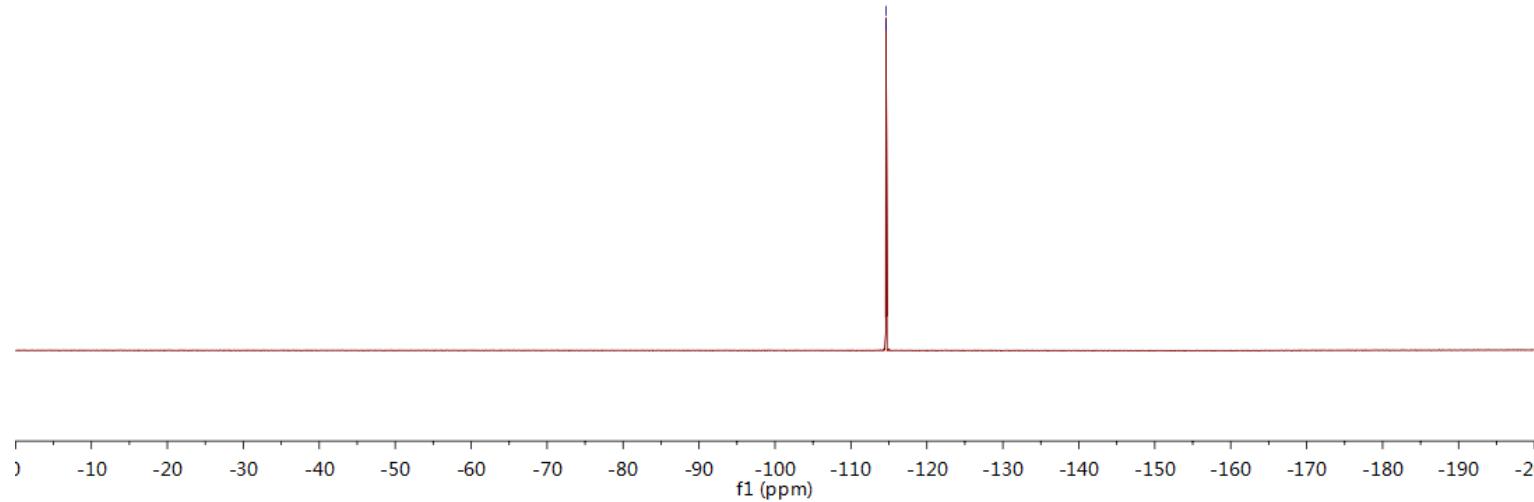


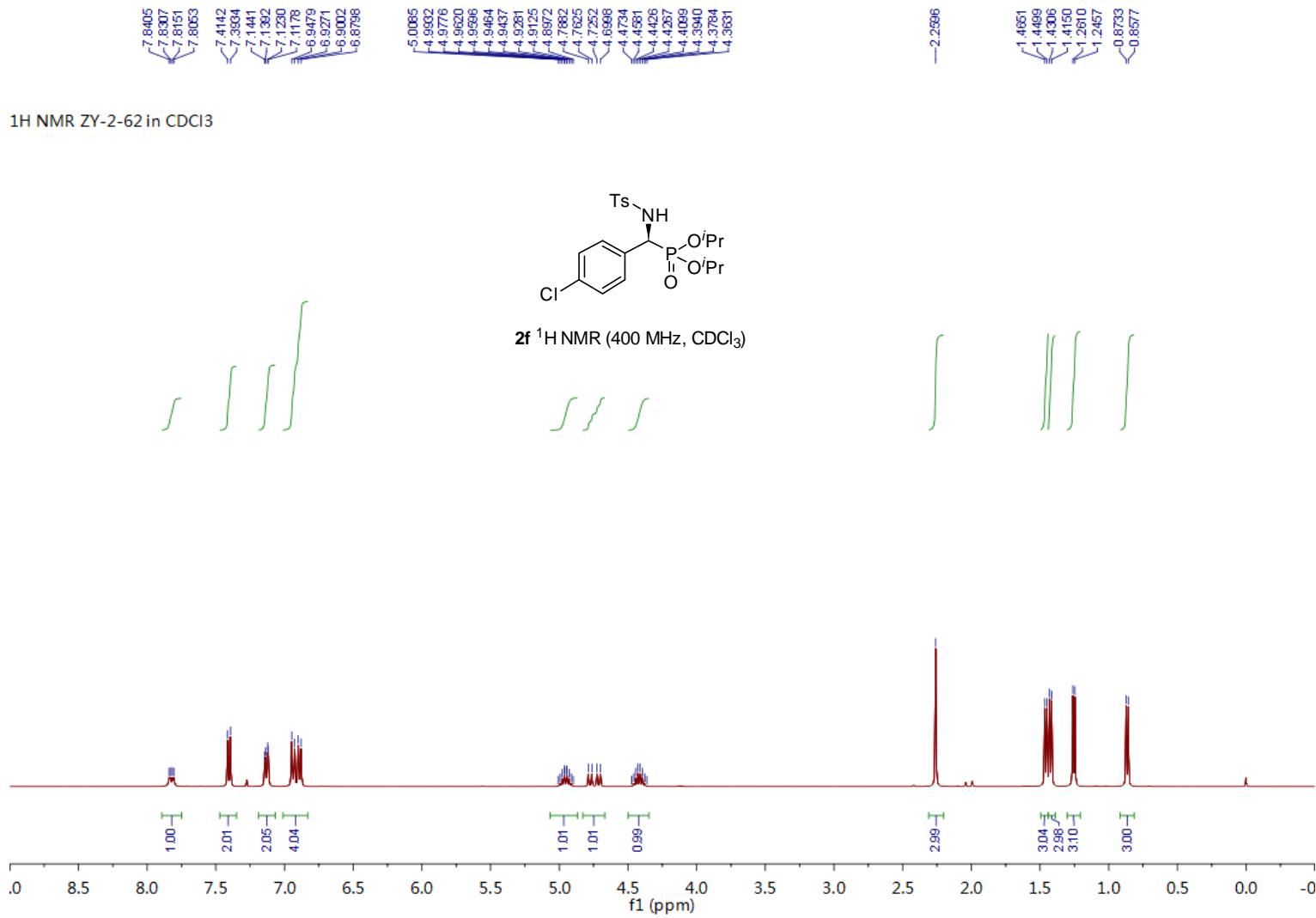
-114.61

¹⁹F NMR ZY-2-60 in CDCl₃



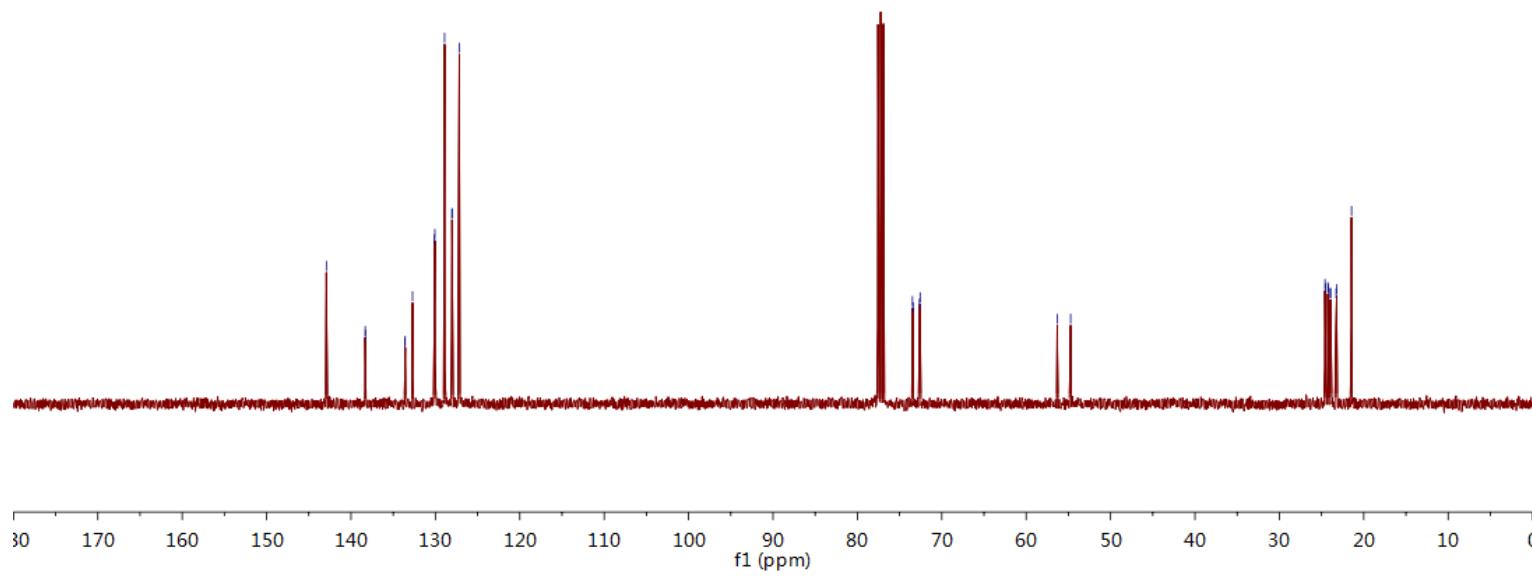
2e ¹⁹F NMR (376 MHz, CDCl₃)





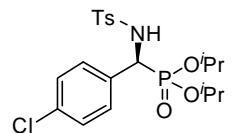


^{13}C NMR ZY-2-62 in CDCl_3

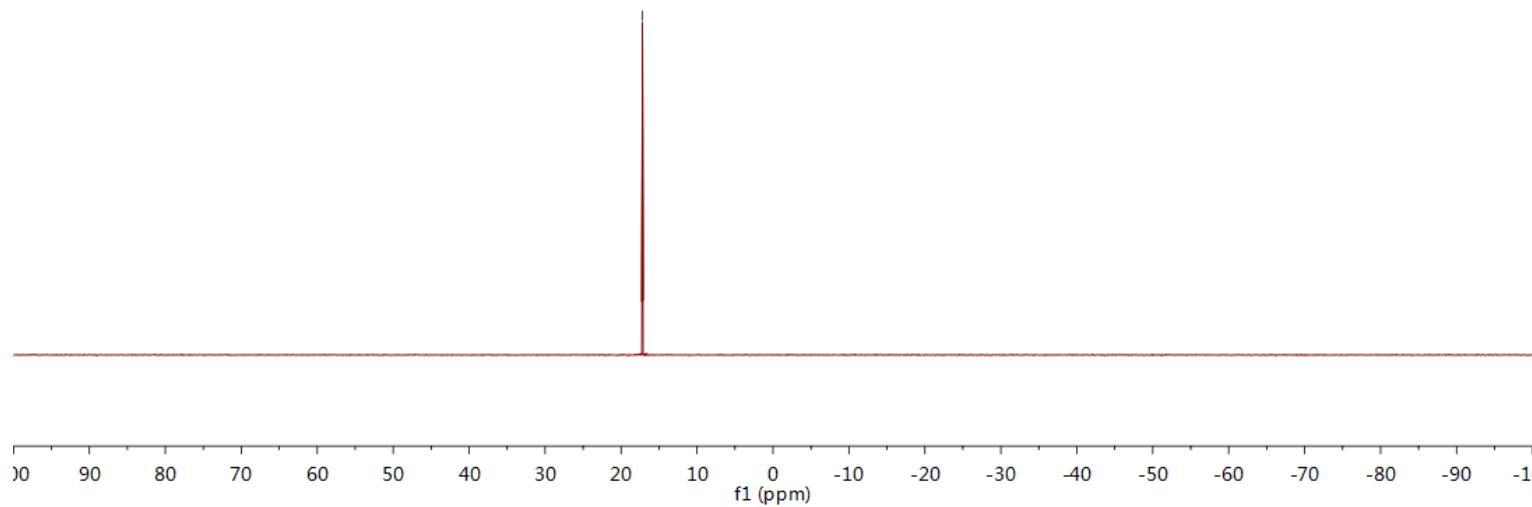


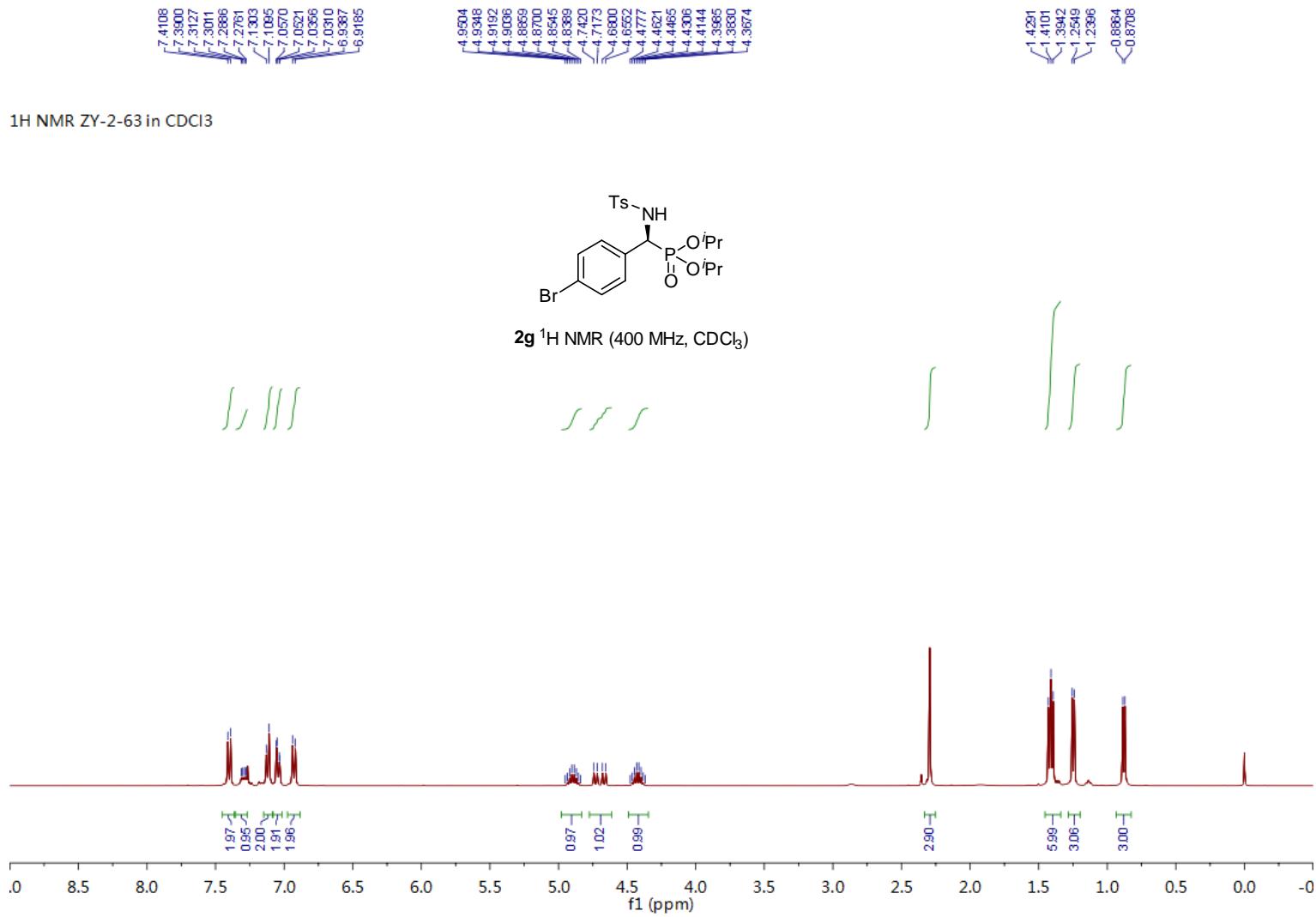
—17.18

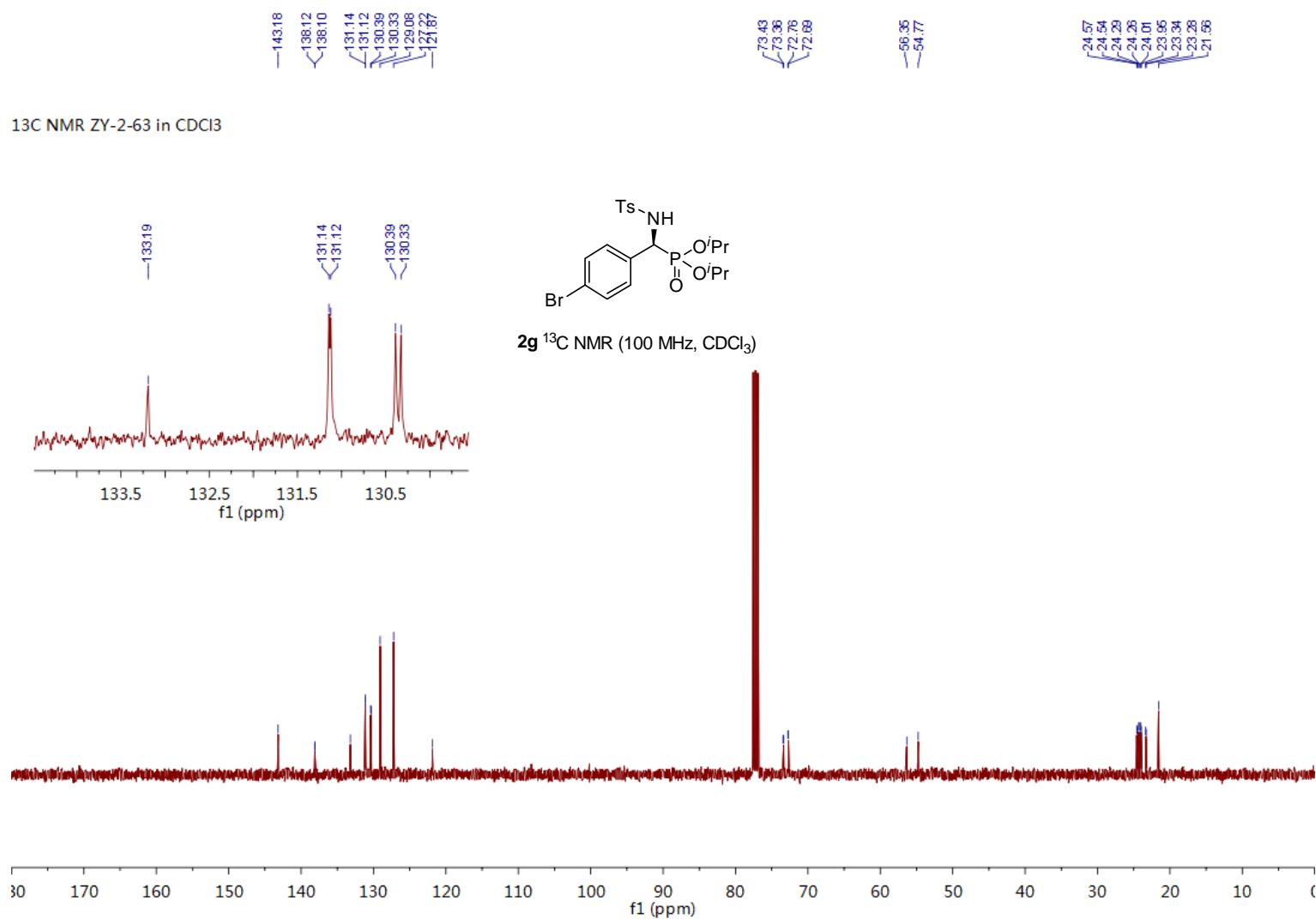
³¹P NMR ZY-2-62 in CDCl₃



2f ³¹P NMR (162 MHz, CDCl₃)

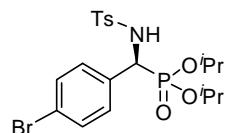




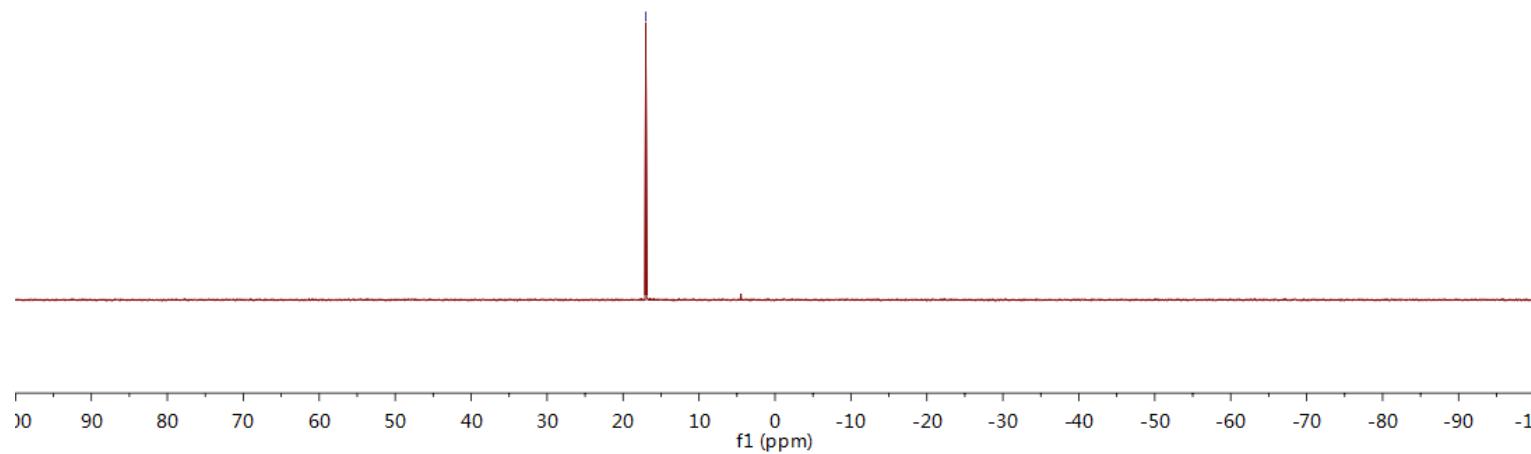


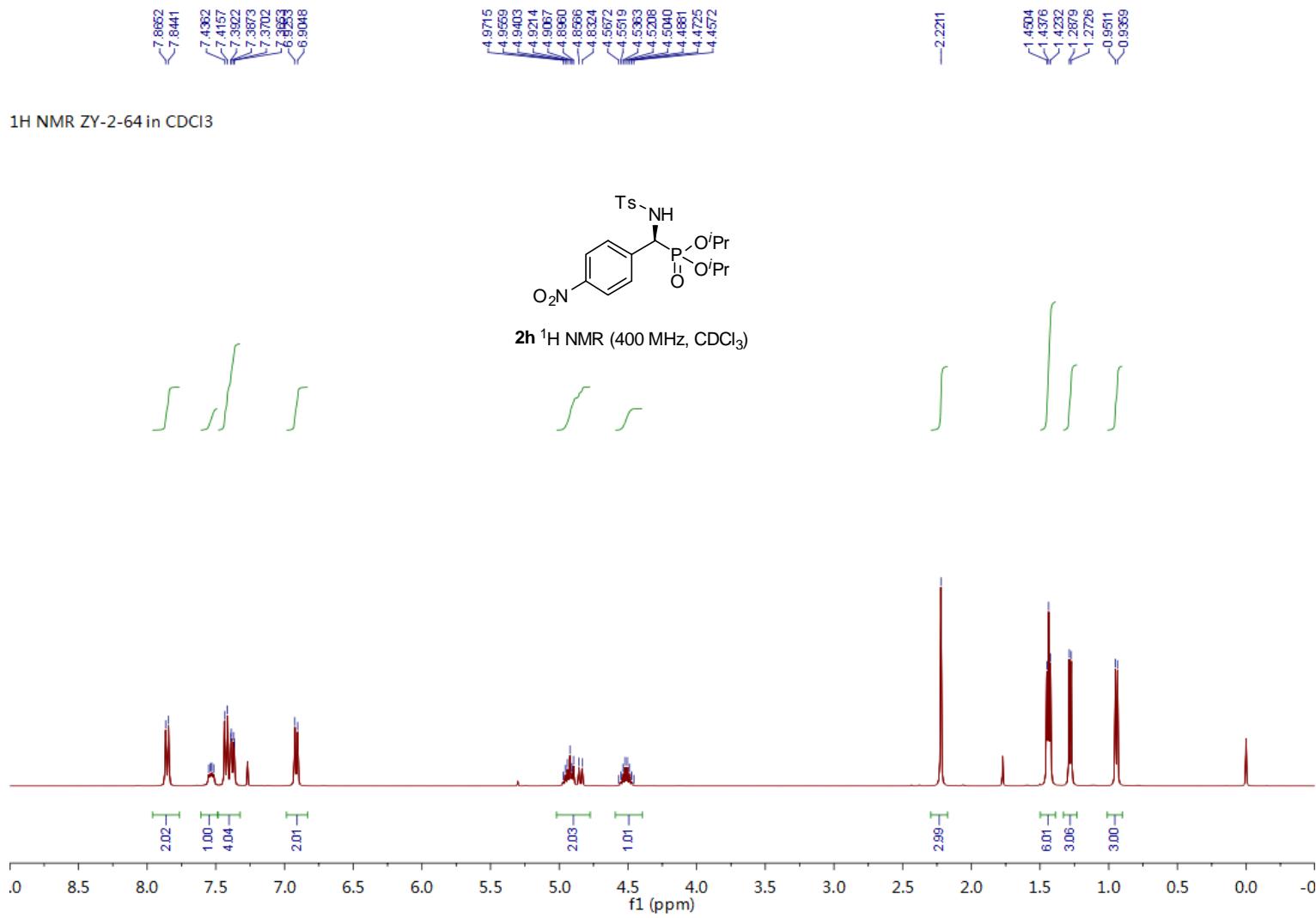
17.01

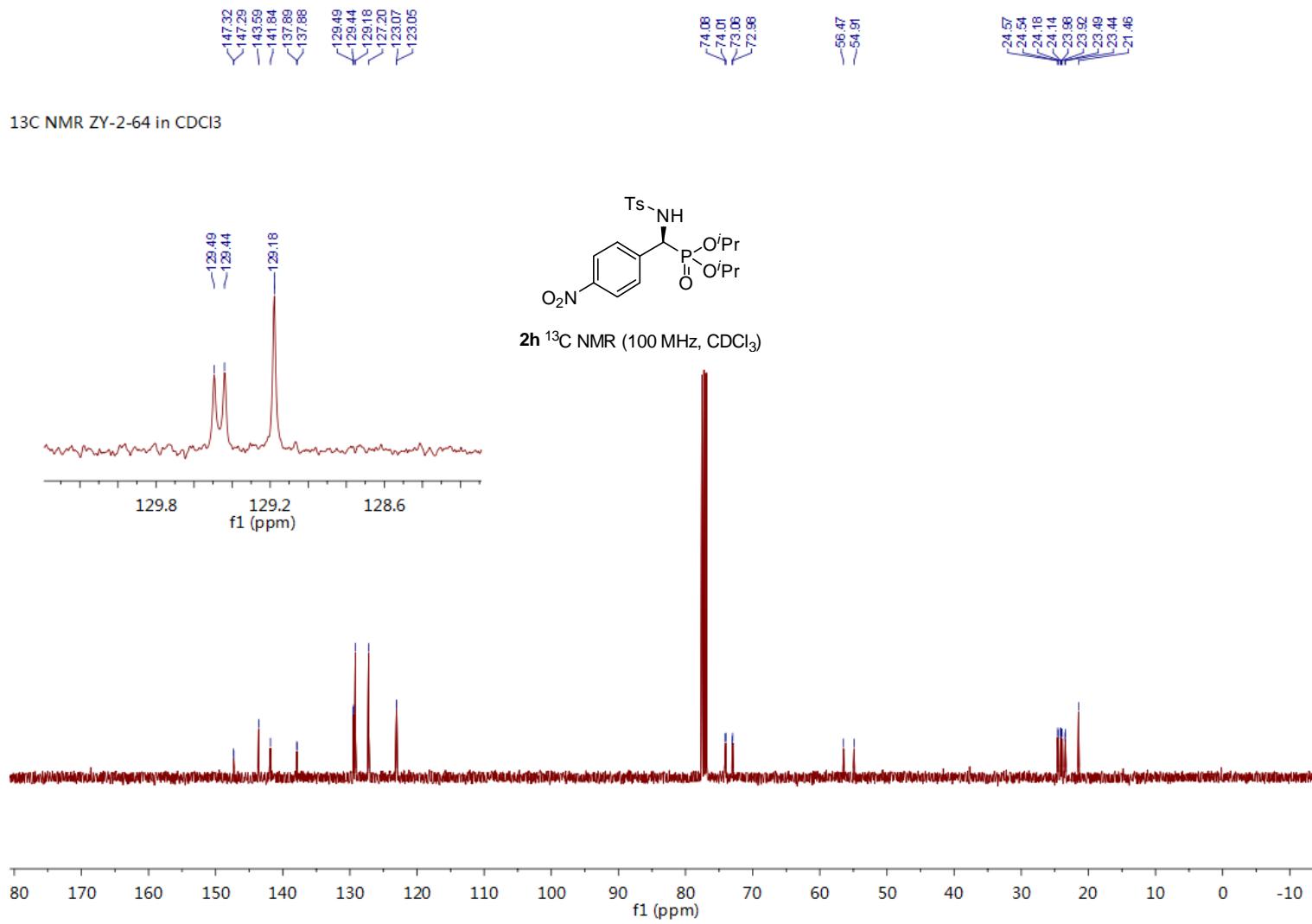
³¹P NMR ZY-2-63 in CDCl₃



2g ³¹P NMR (162 MHz, CDCl₃)

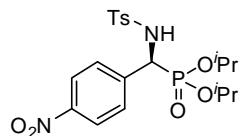




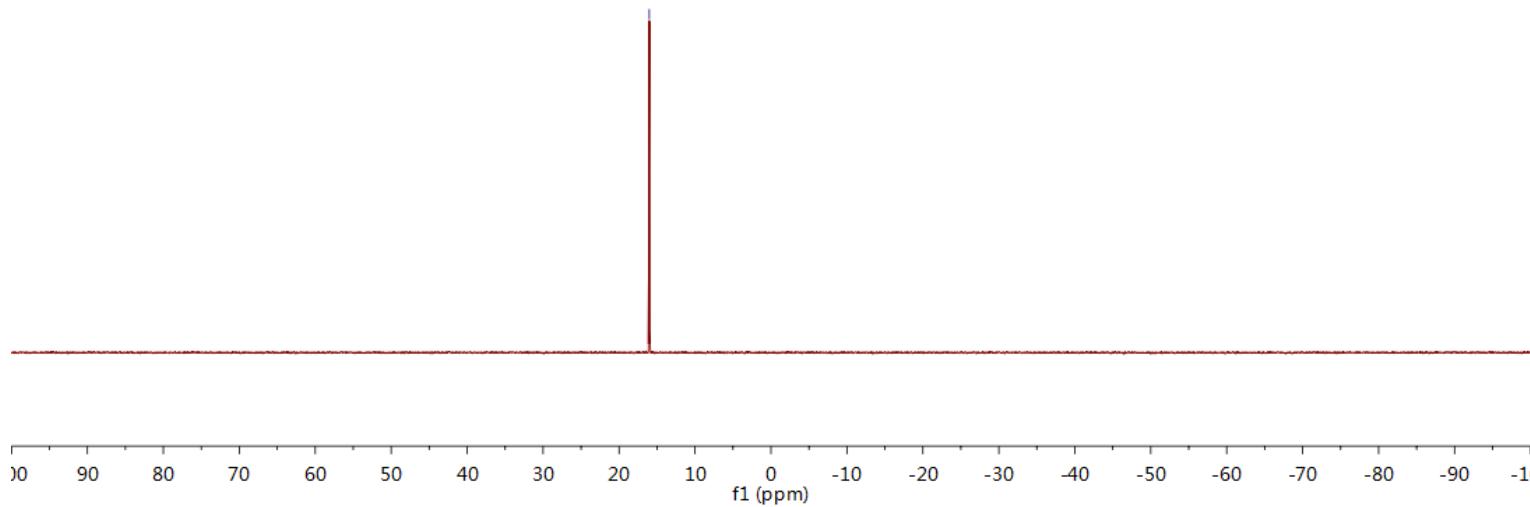


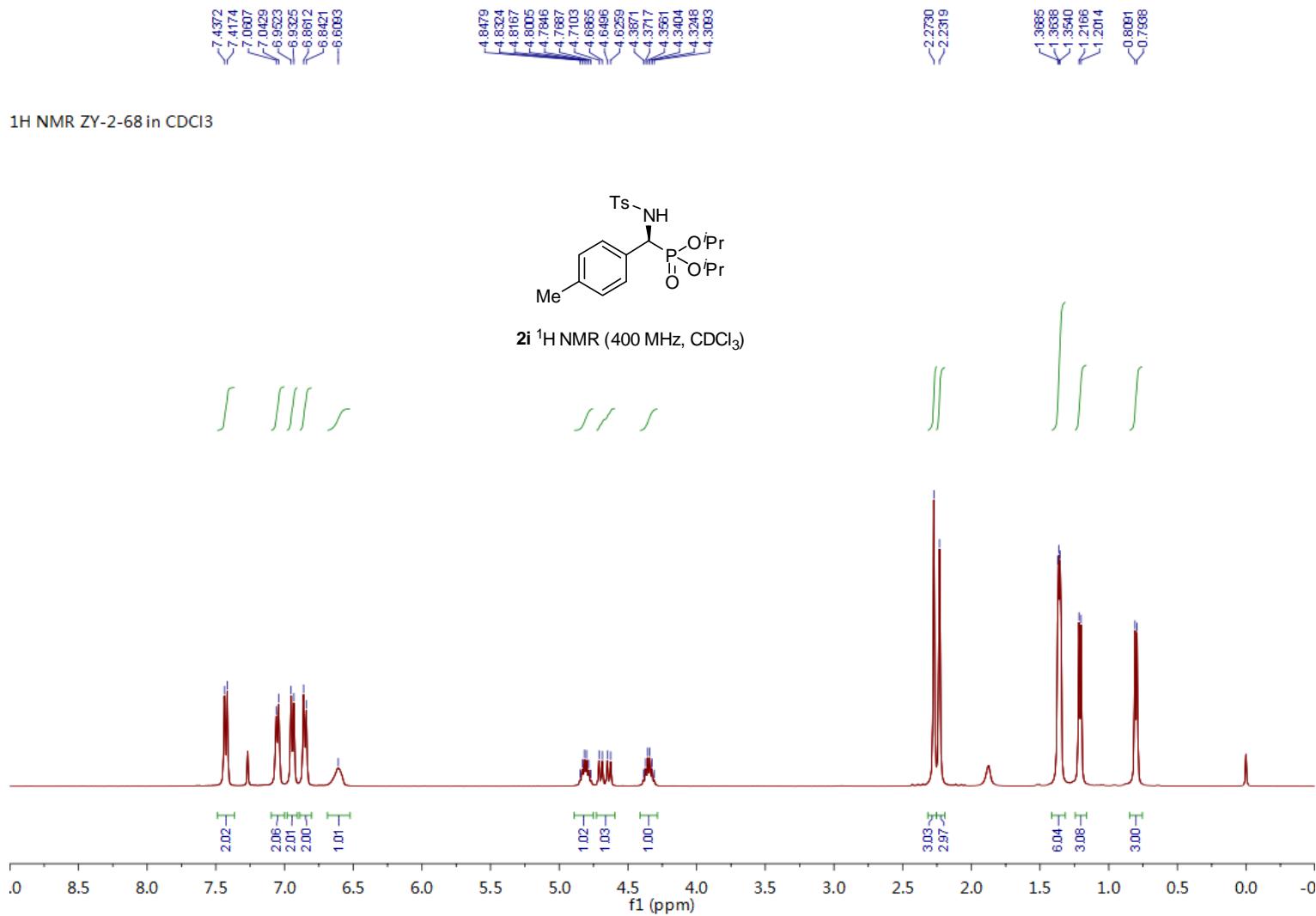
-16.02

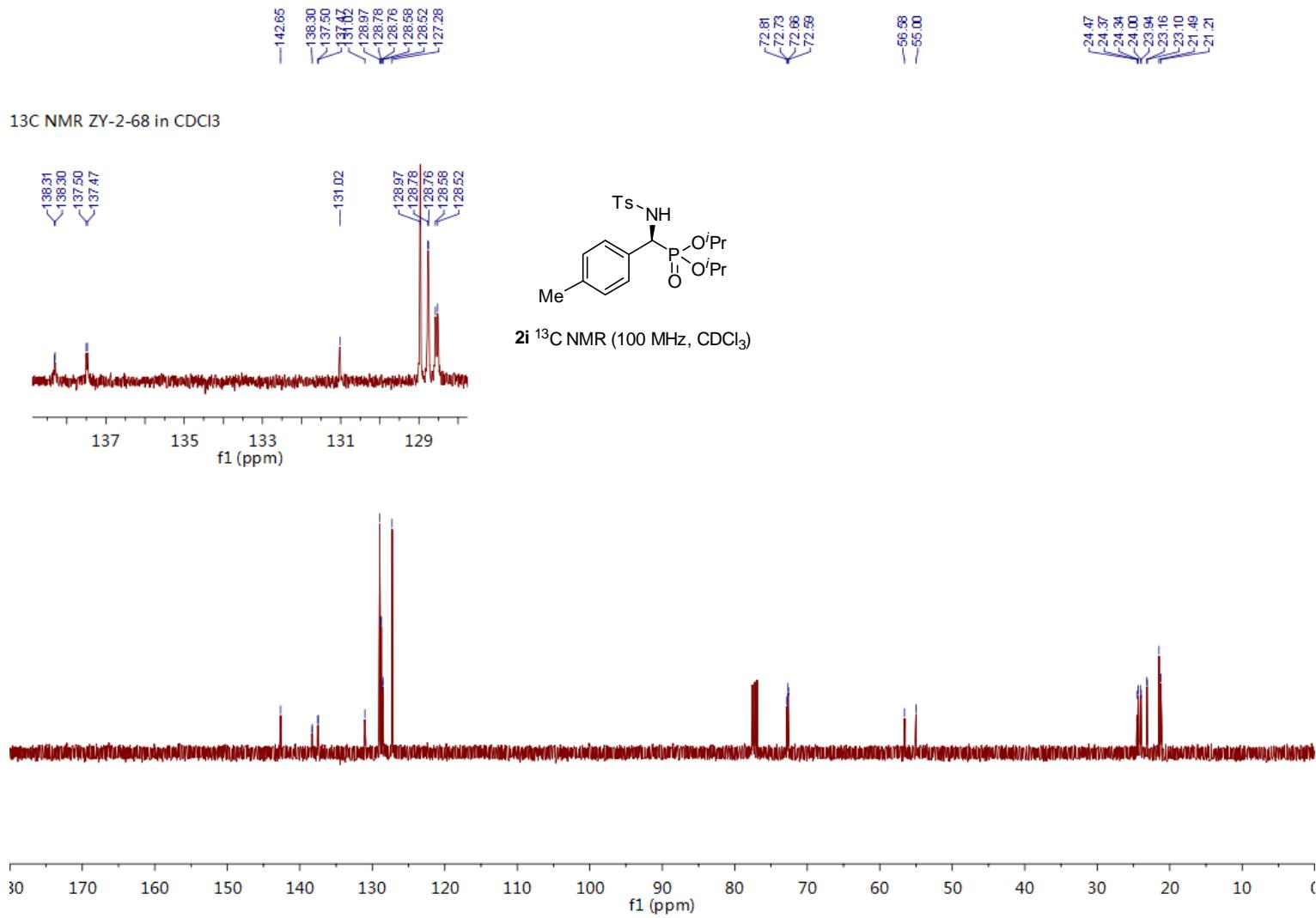
³¹P NMR ZY-2-64 in CDCl₃



2h ³¹P NMR (162 MHz, CDCl₃)

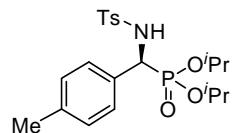




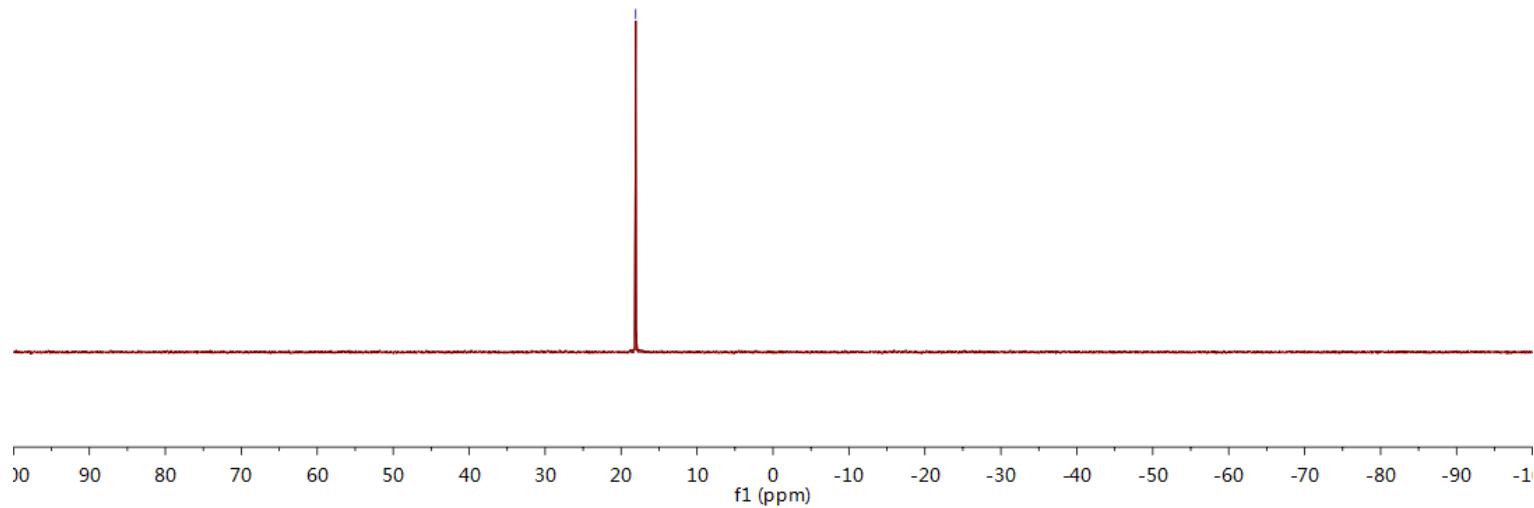


—
1807

³¹P NMR ZY-2-68 in CDCl₃

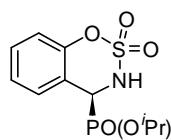


2i ³¹P NMR (162 MHz, CDCl₃)

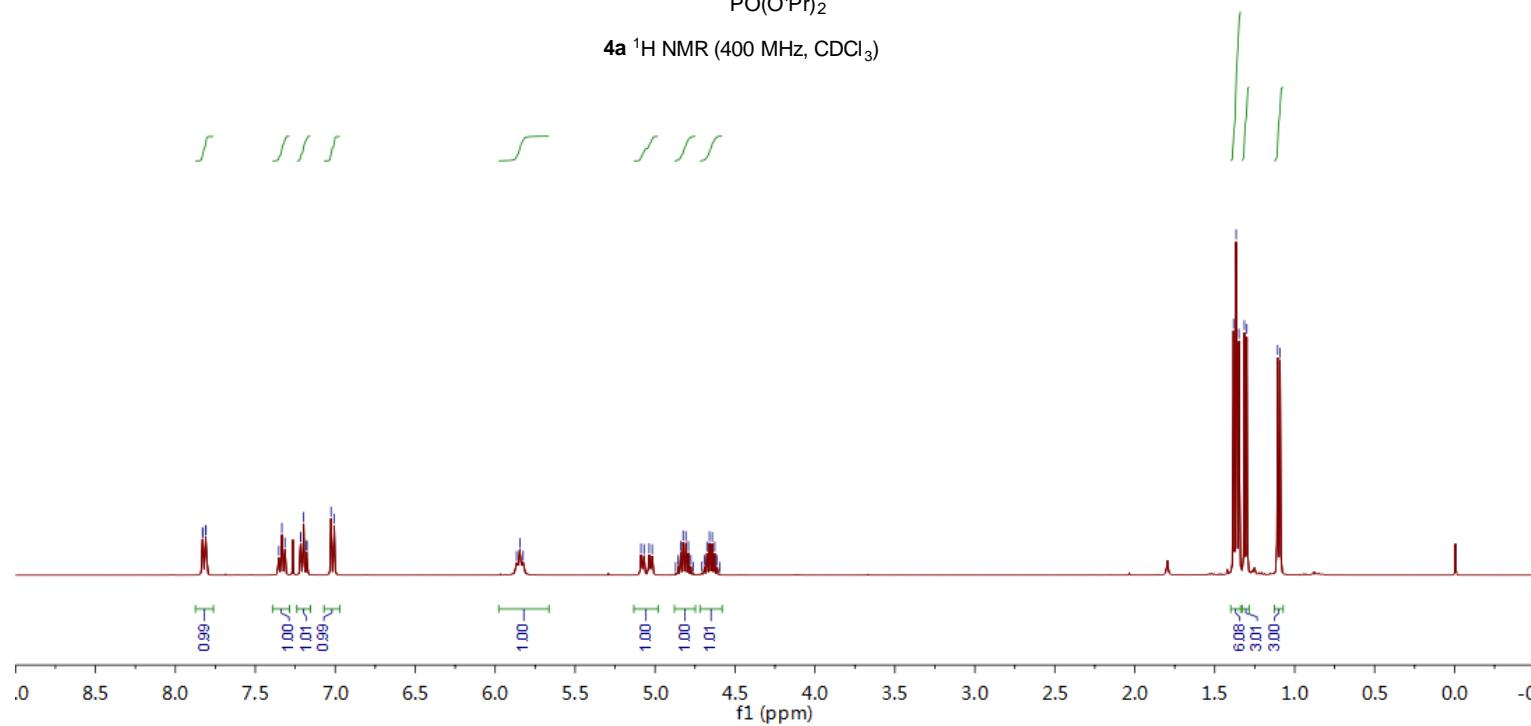


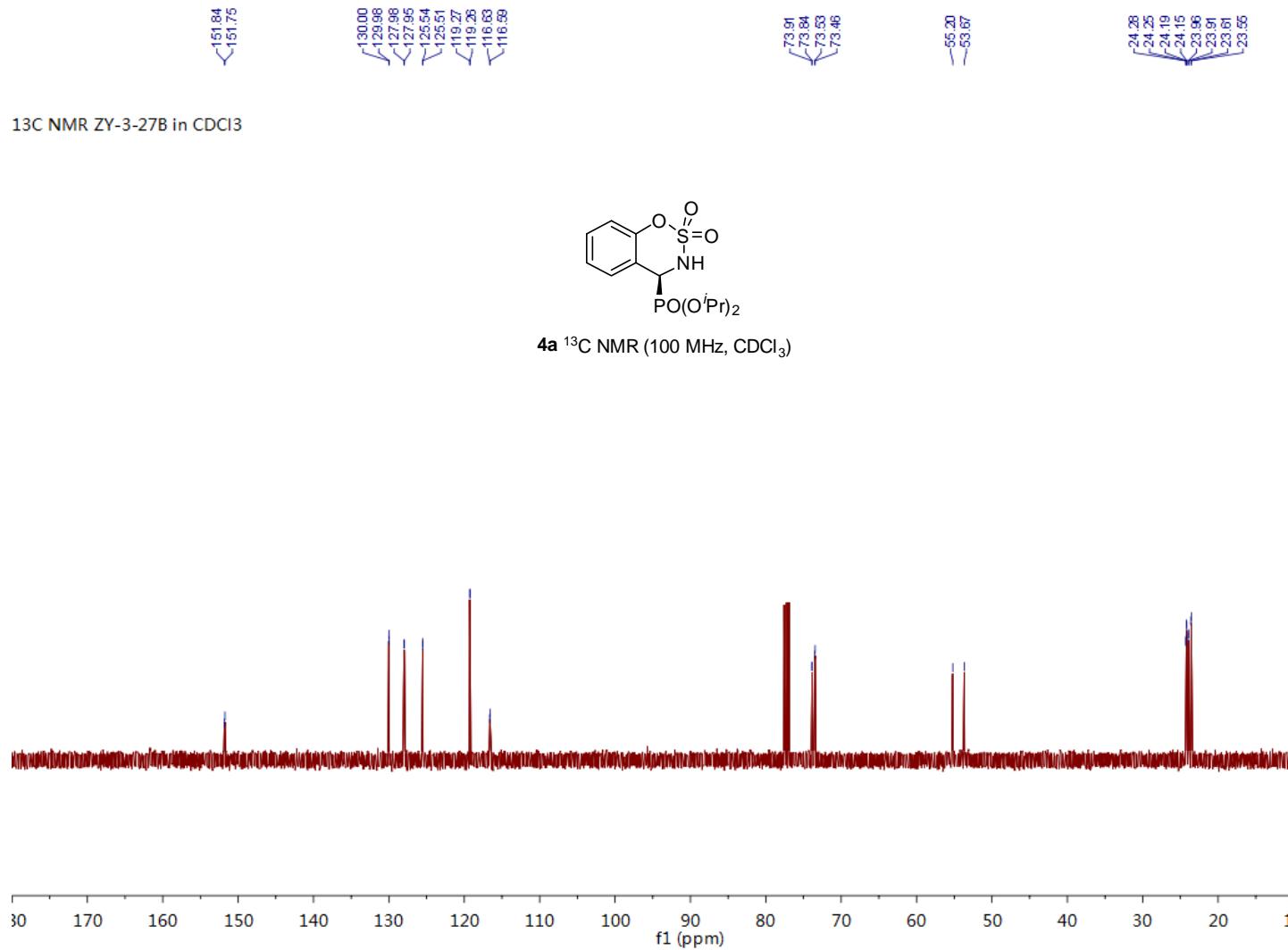


^1H NMR ZY-3-27B in CDCl_3



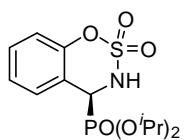
4a ^1H NMR (400 MHz, CDCl_3)



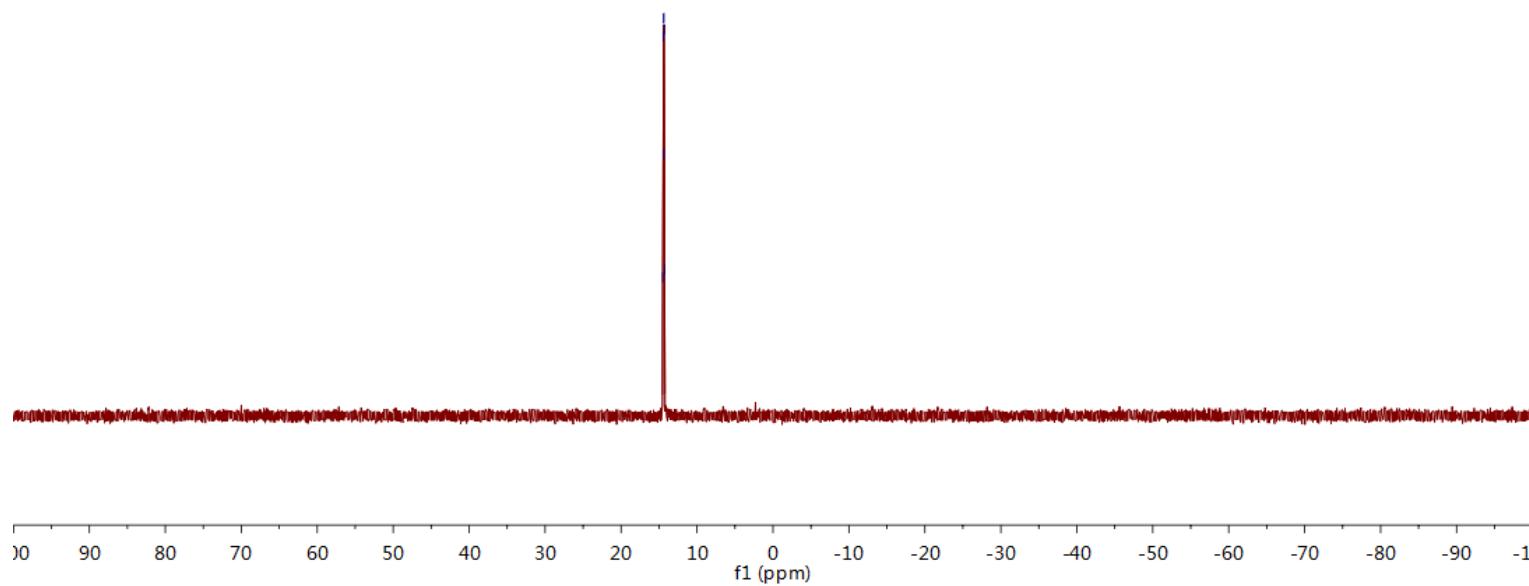


14.51
14.47
14.42
14.38
14.34
14.29
14.25

³¹P NMR ZY-3-27B in CDCl₃

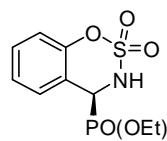


4a ³¹P NMR (162 MHz, CDCl₃)

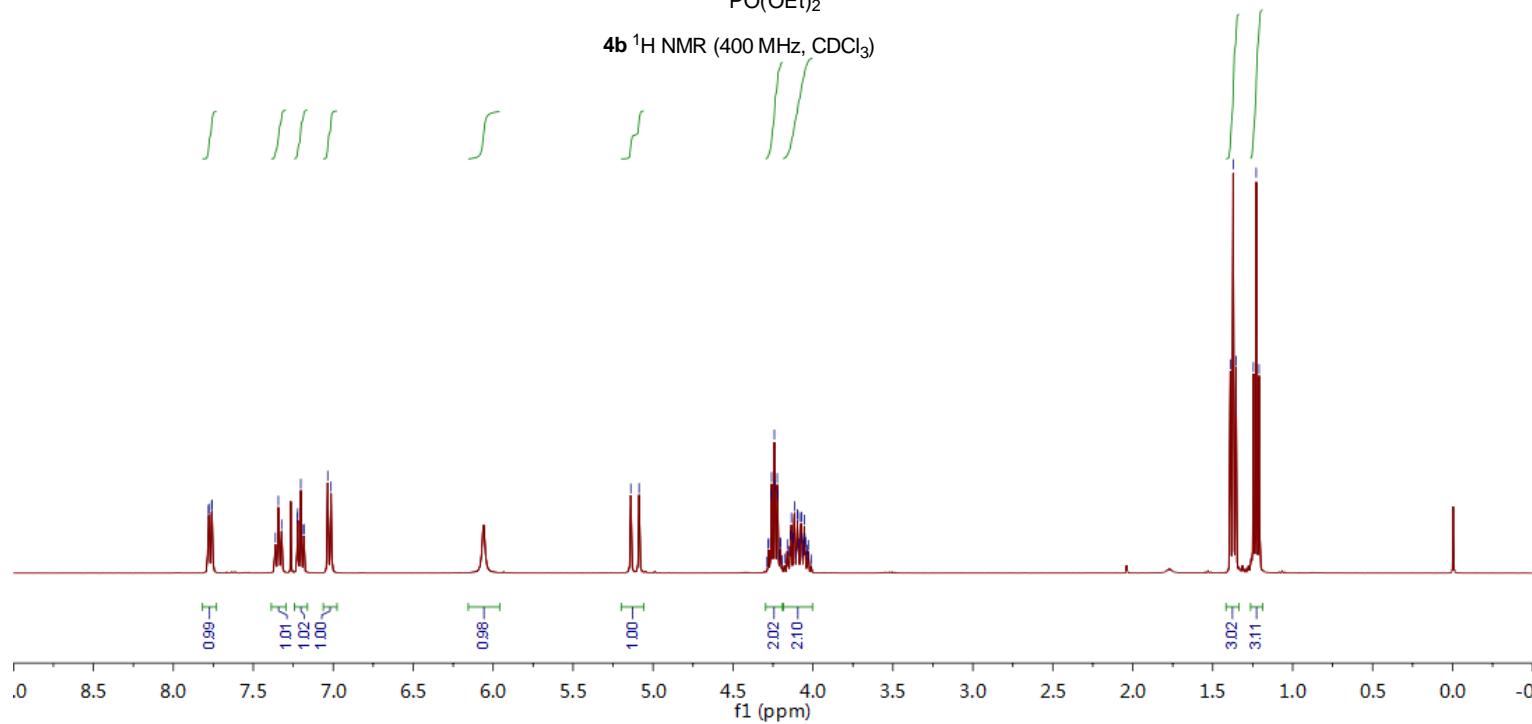


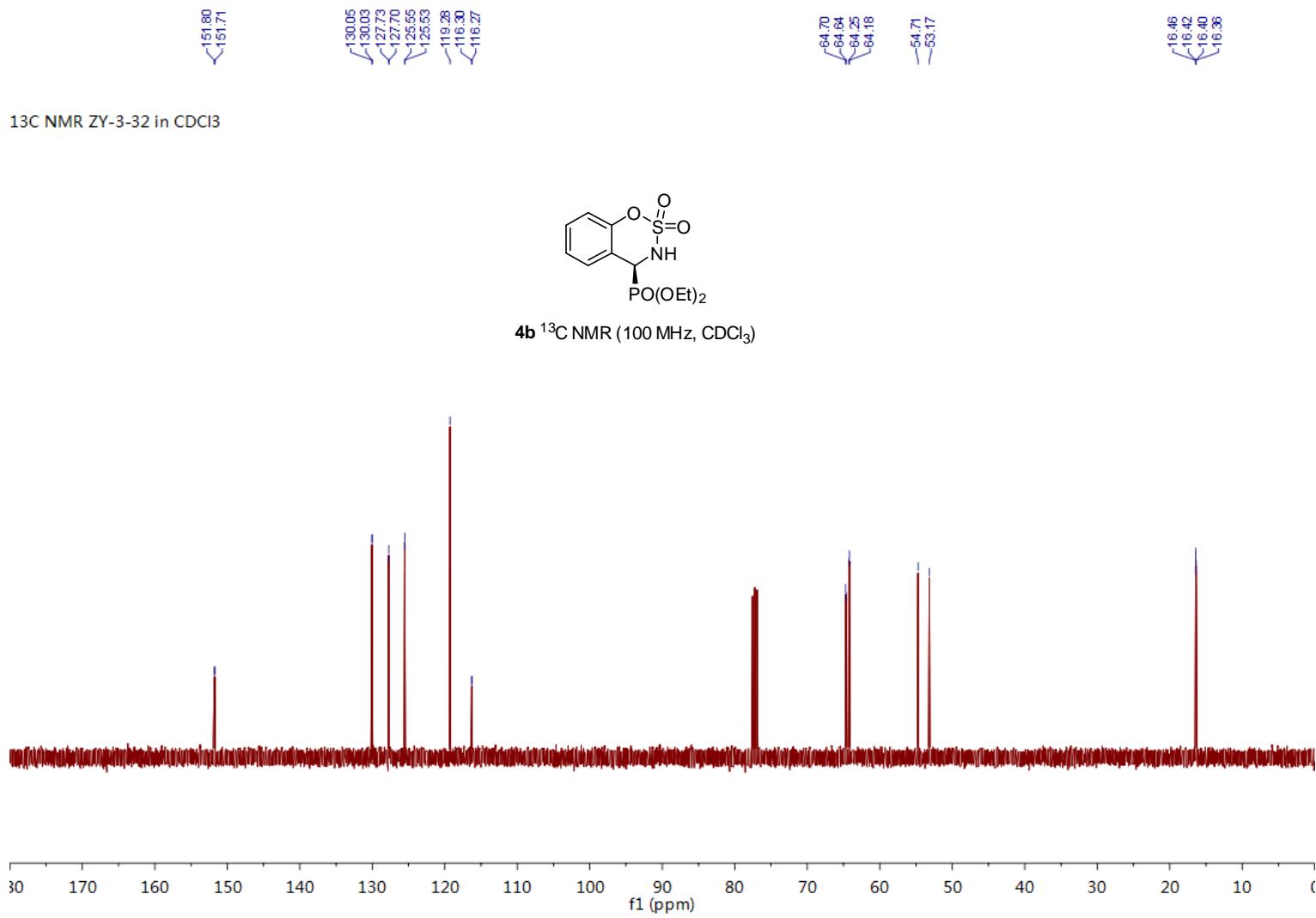


¹H NMR ZY-3-32 in CDCl₃



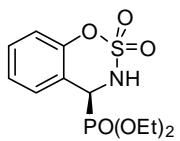
4b ¹H NMR (400 MHz, CDCl₃)



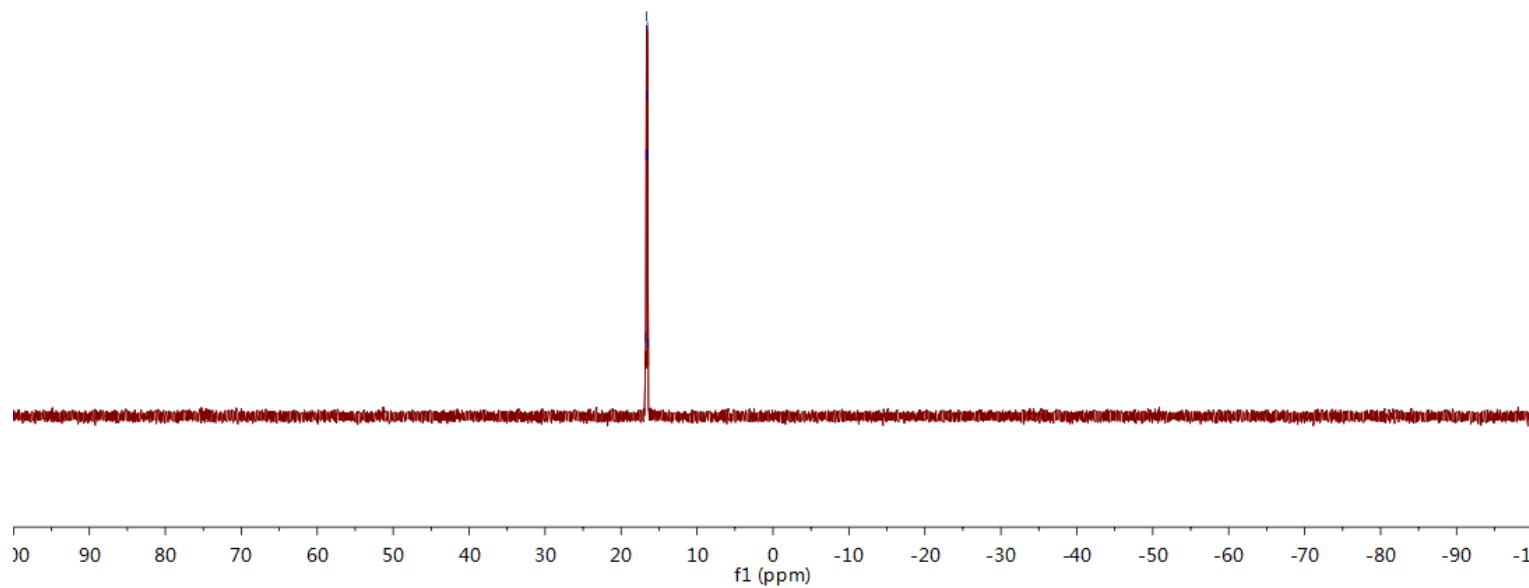


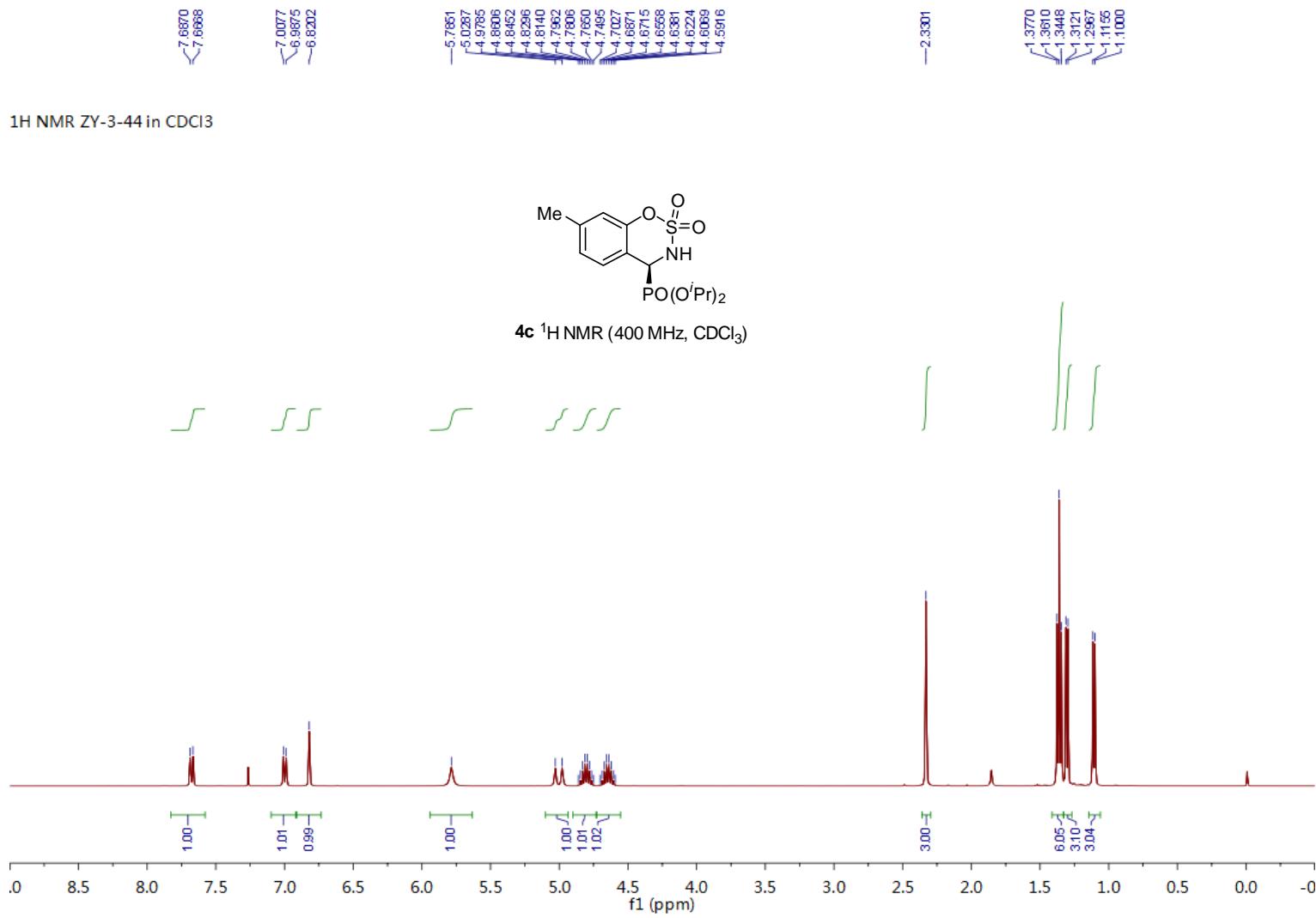
16.76
16.70
16.65
16.59
16.53
16.48
16.42

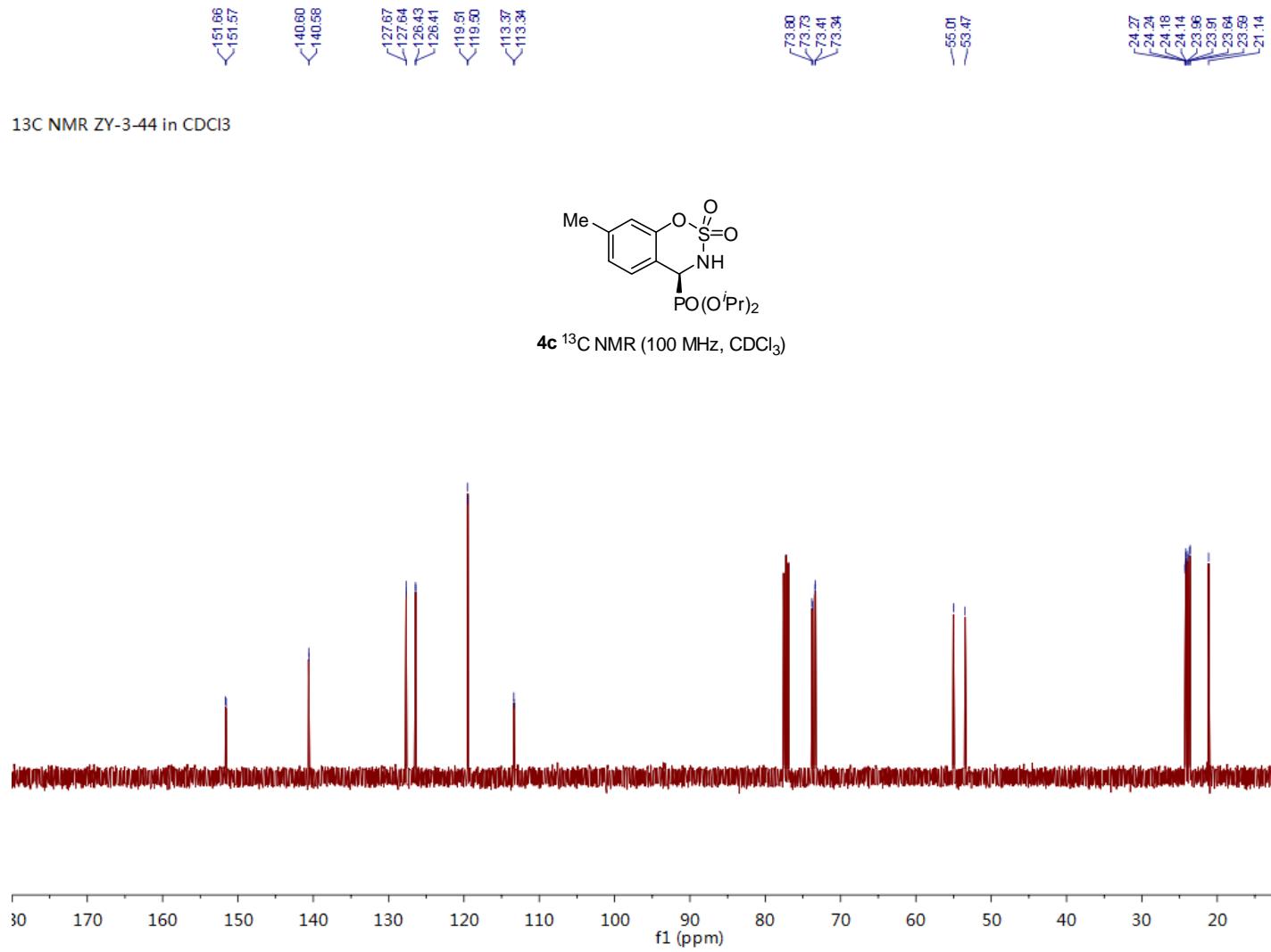
³¹P NMR ZY-3-32 in CDCl₃



4b ³¹P NMR (162 MHz, CDCl₃)

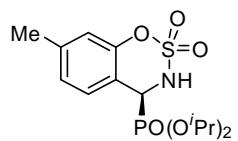




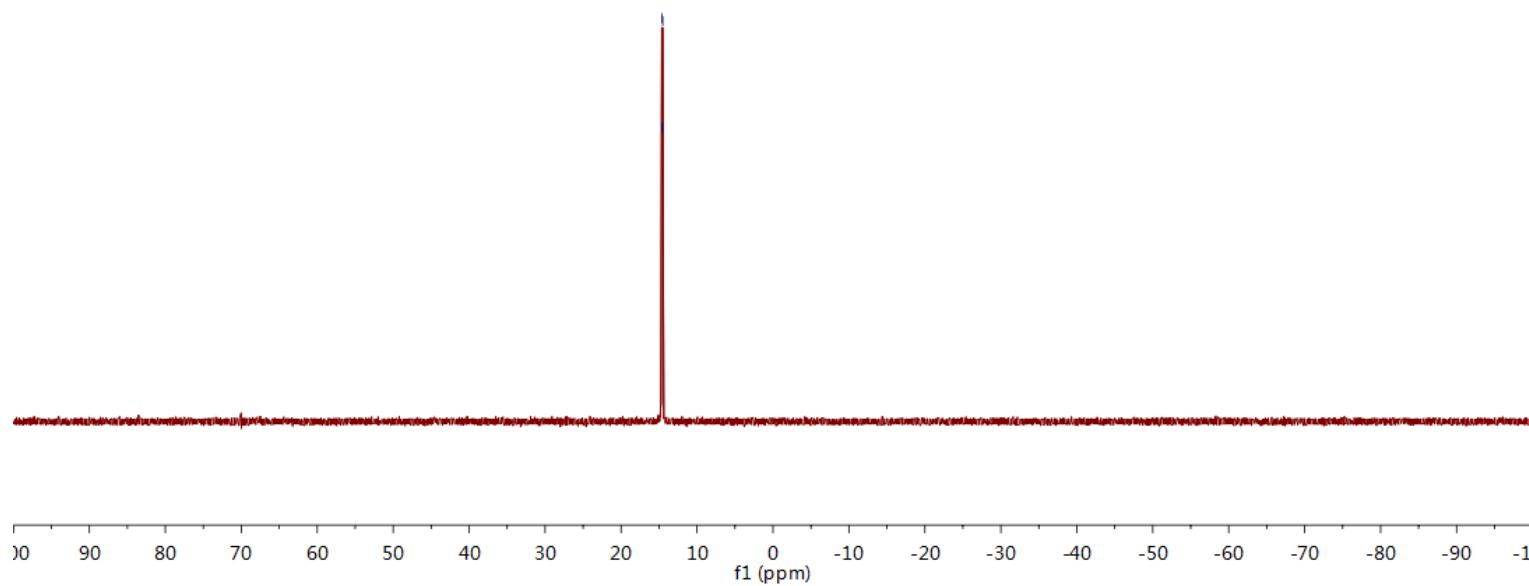


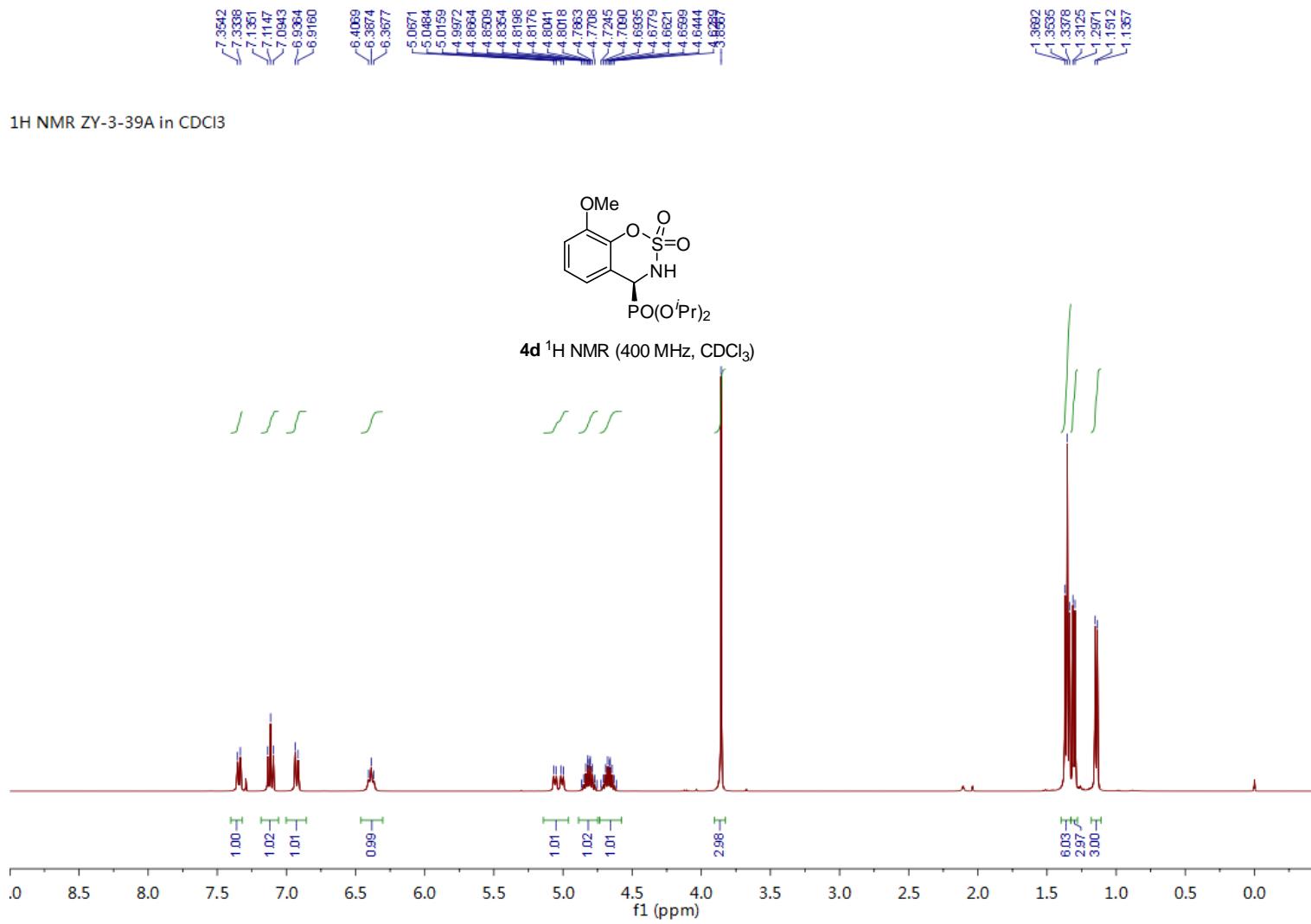
14.64
14.59
14.57
14.52

³¹P NMR ZY-3-44 in CDCl₃



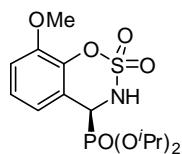
4c ³¹P NMR (162 MHz, CDCl₃)



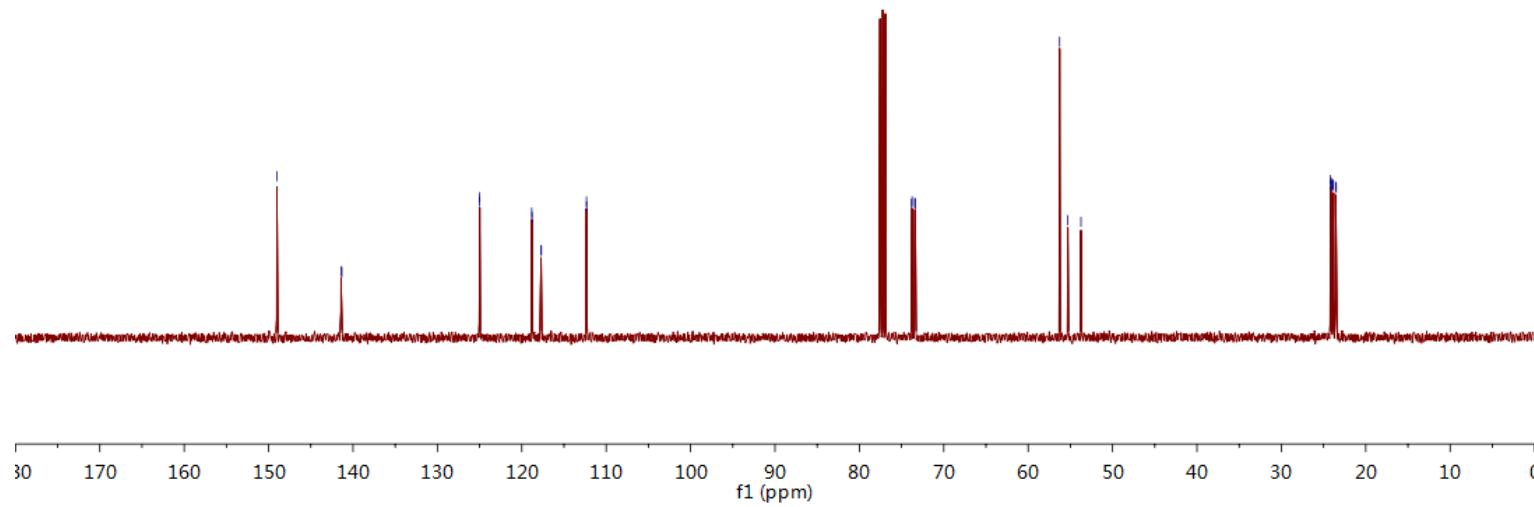




¹³C NMR ZY-3-39A in CDCl₃

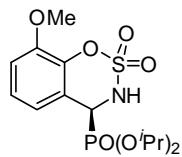


4d ¹³C NMR (100 MHz, CDCl₃)

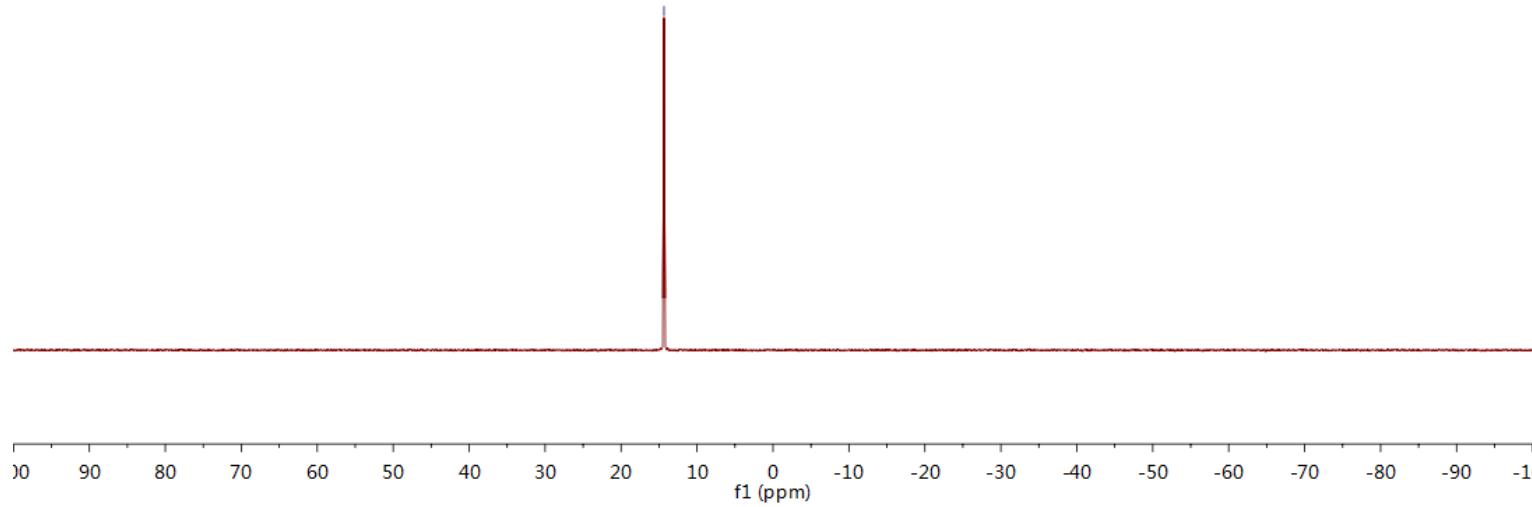


—14.35

³¹P NMR ZY-3-39A in CDCl₃

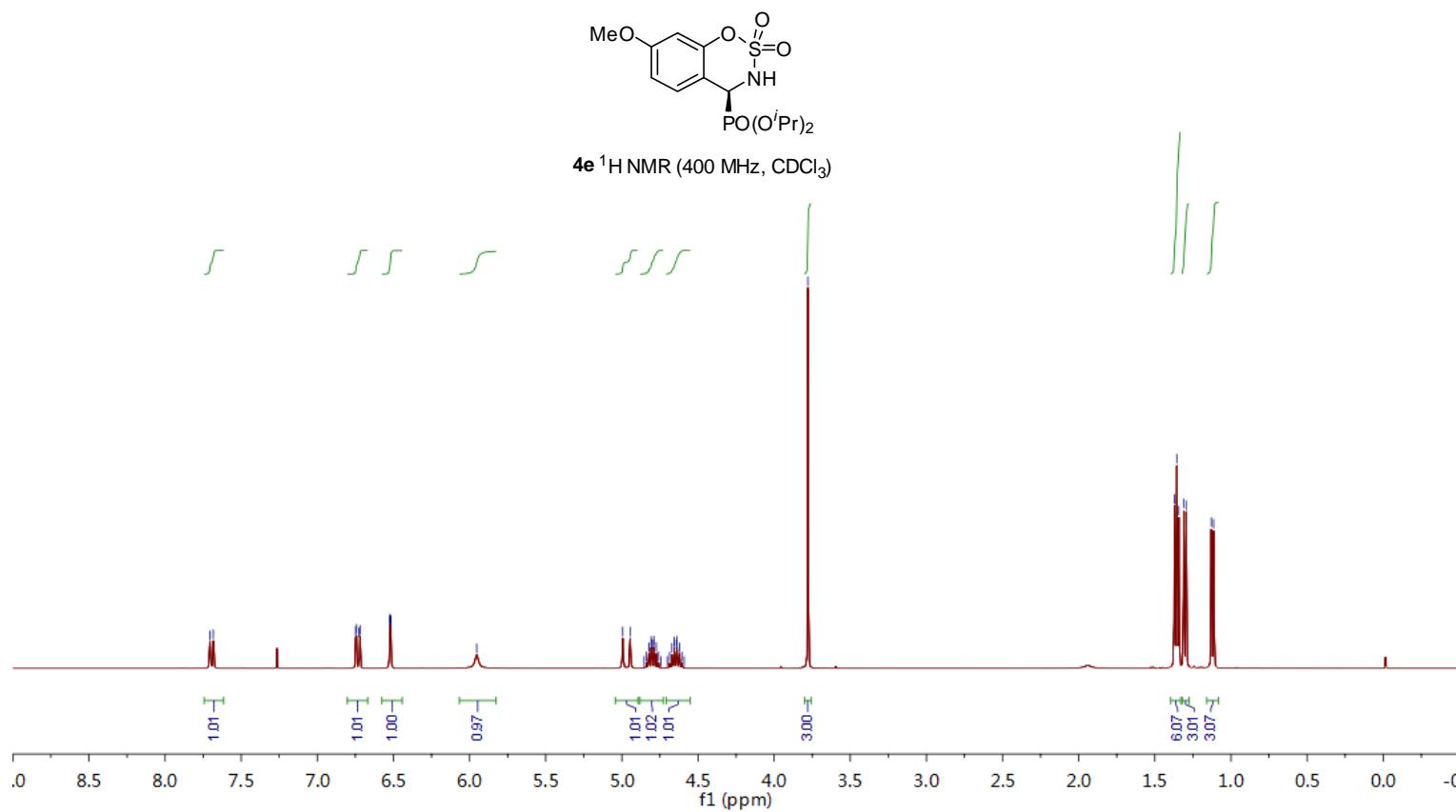


4d ³¹P NMR (162 MHz, CDCl₃)



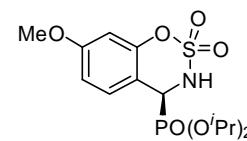


¹H NMR ZY-3-39B in CDCl₃

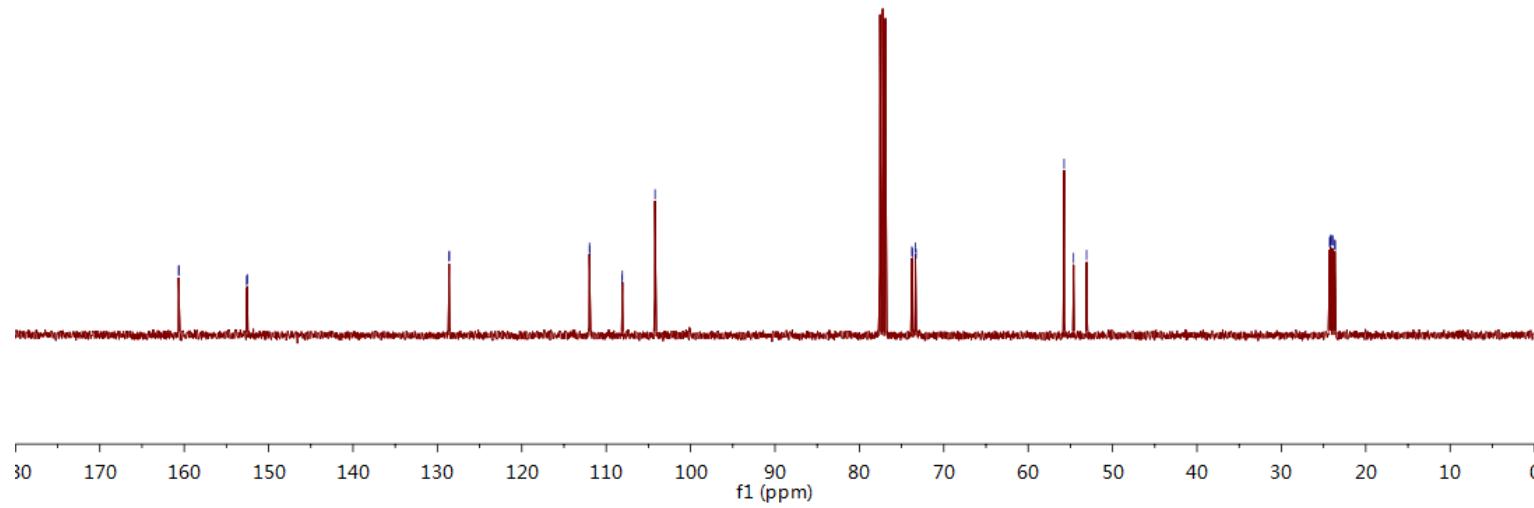




^{13}C NMR ZY-3-39B in CDCl_3

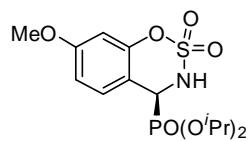


4e ^{13}C NMR (100 MHz, CDCl_3)

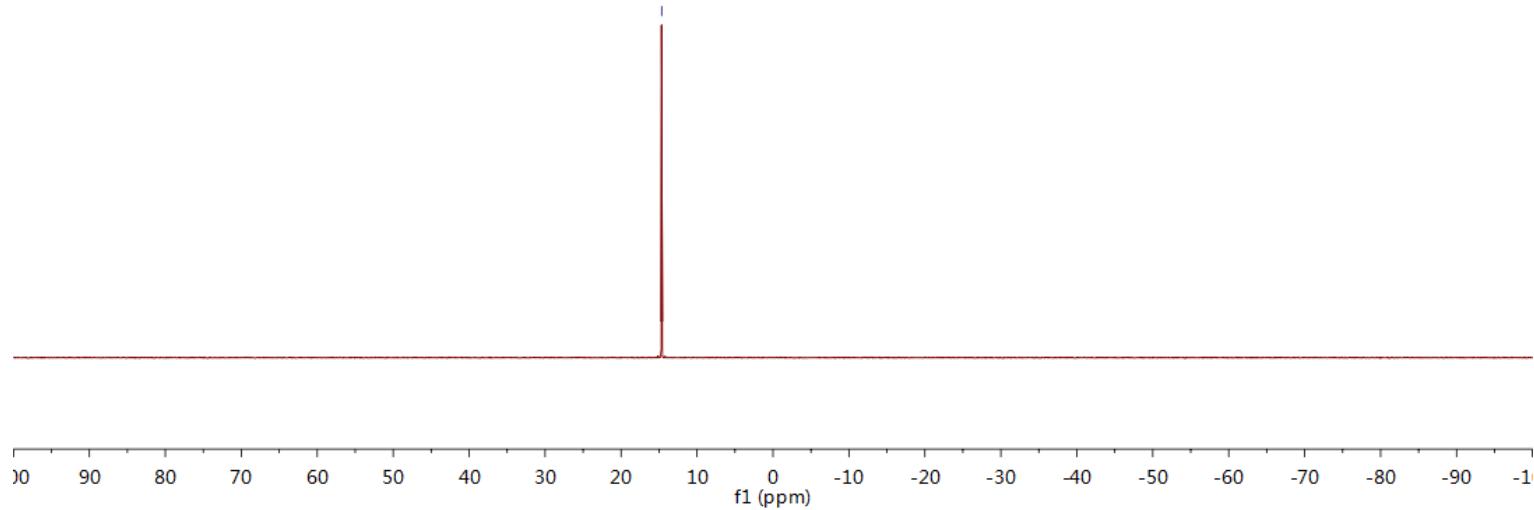


— 14.66

^{31}P NMR ZY-3-39B in CDCl_3

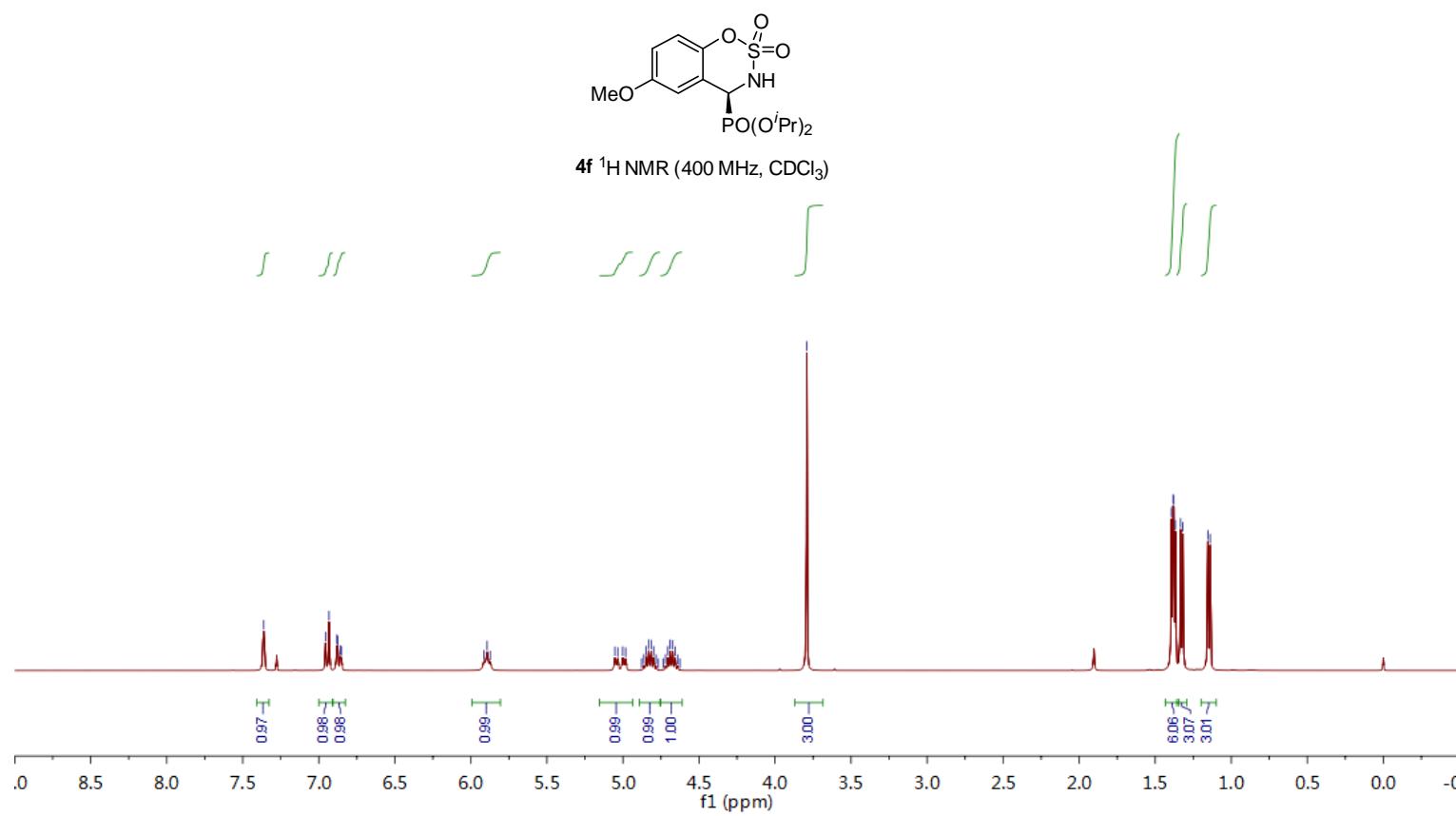


4e ^{31}P NMR (162 MHz, CDCl_3)



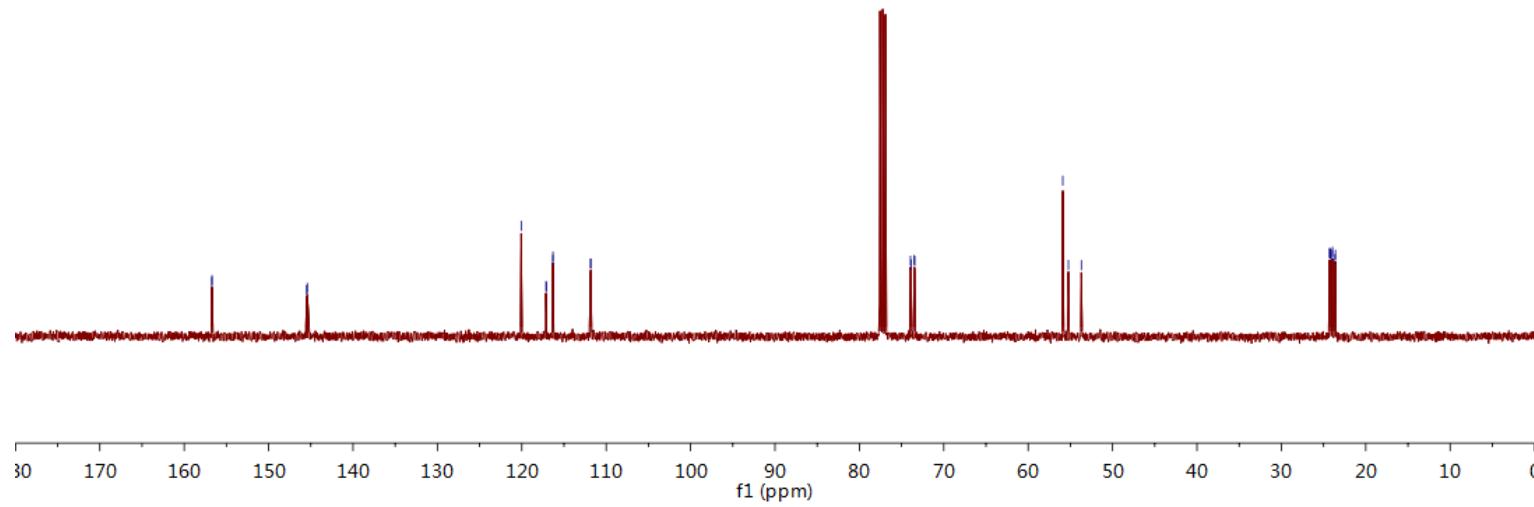
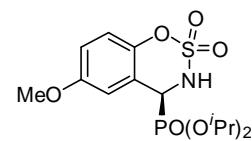


¹H NMR ZY-3-40C in CDCl₃



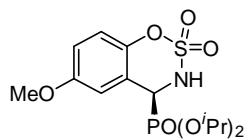


^{13}C NMR ZY-3-40C in CDCl_3

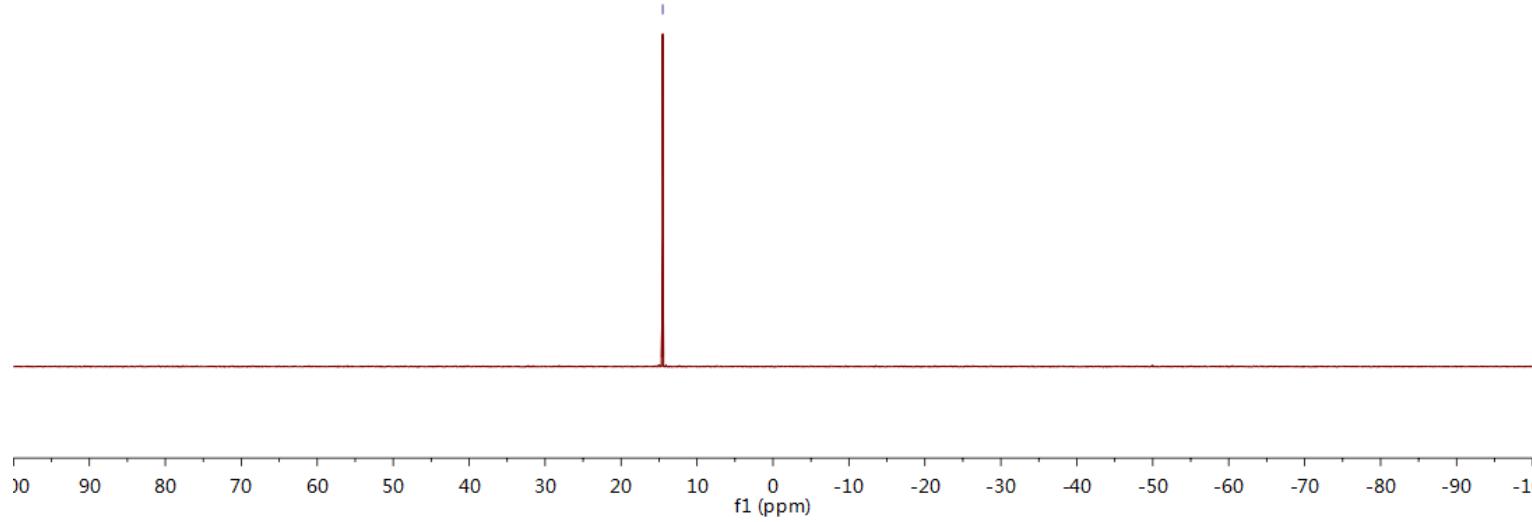


—
1452

³¹P NMR ZY-3-40C in CDCl₃



4f ³¹P NMR (162 MHz, CDCl₃)

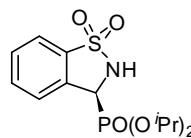


7.8212
7.8022
7.7831
7.6806
7.6832
7.6428
7.6046
7.5883
7.5677

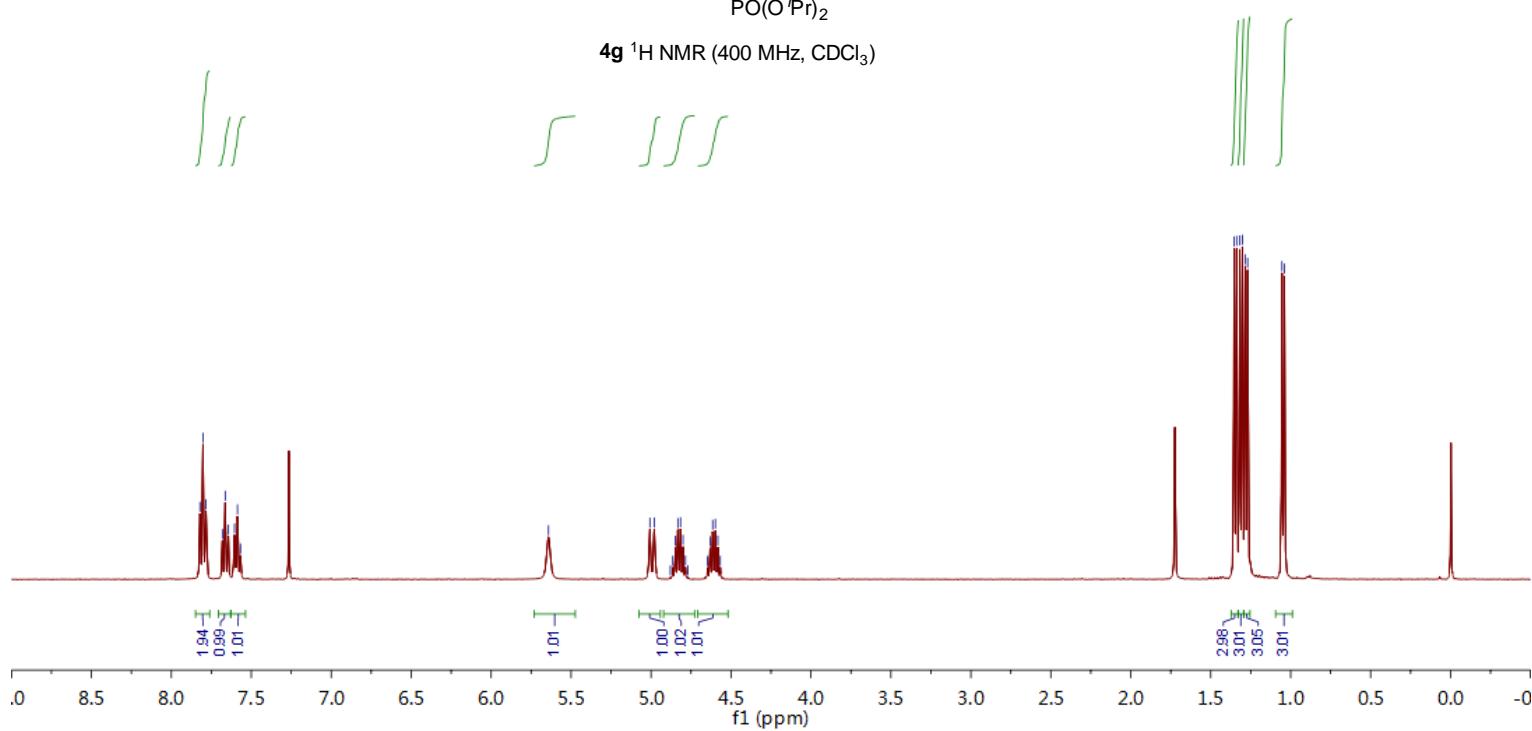
5.6412
5.0075
4.9795
4.8793
4.8639
4.8483
4.8325
4.8159
4.8002
4.7846
4.7692
4.6464
4.6307
4.6150
4.5980
4.5823
4.5668

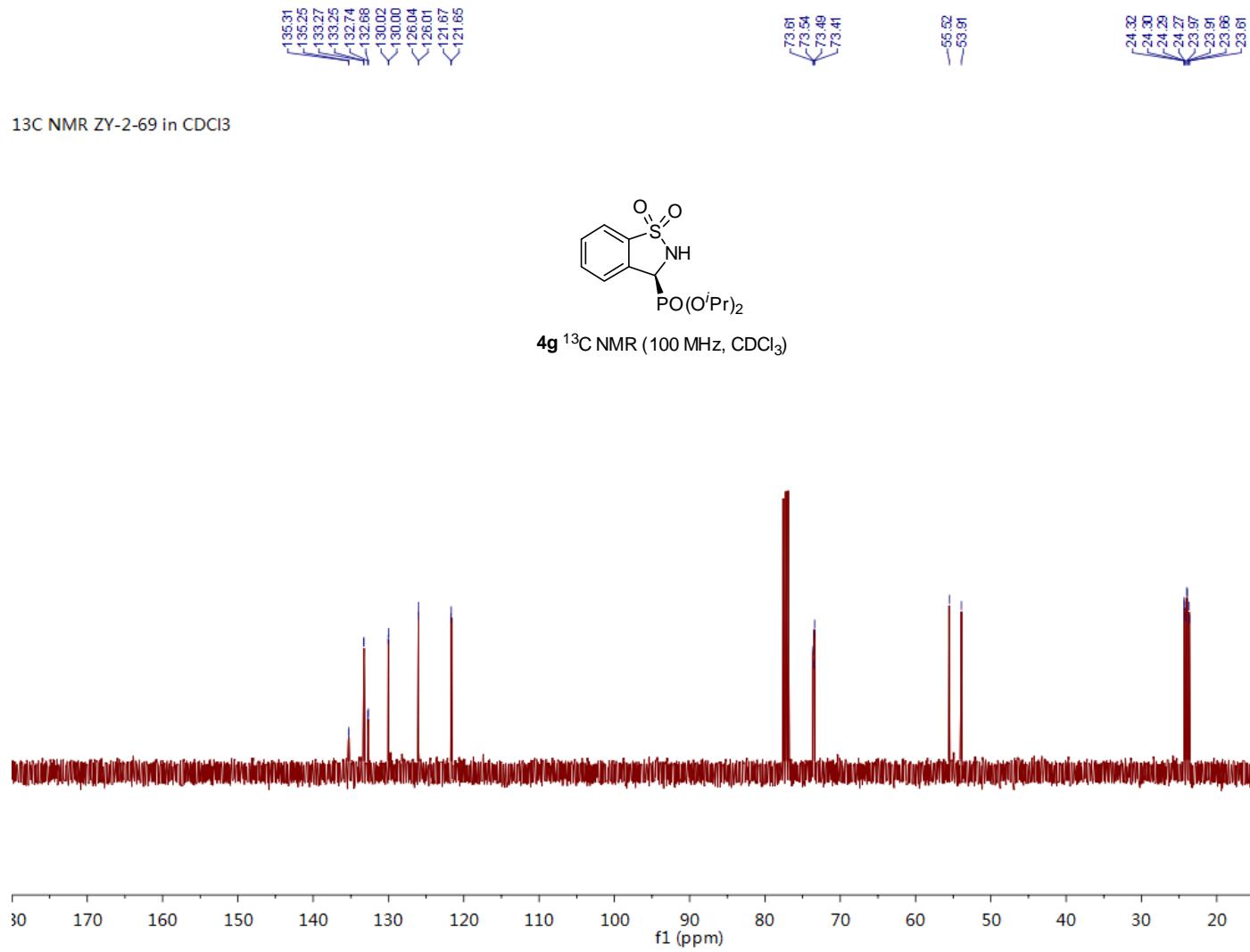
1.3536
1.3381
1.3176
1.3022
1.2849
1.2694
1.0544
1.0386

¹H NMR ZY-2-69 in CDCl₃



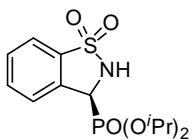
4g ¹H NMR (400 MHz, CDCl₃)



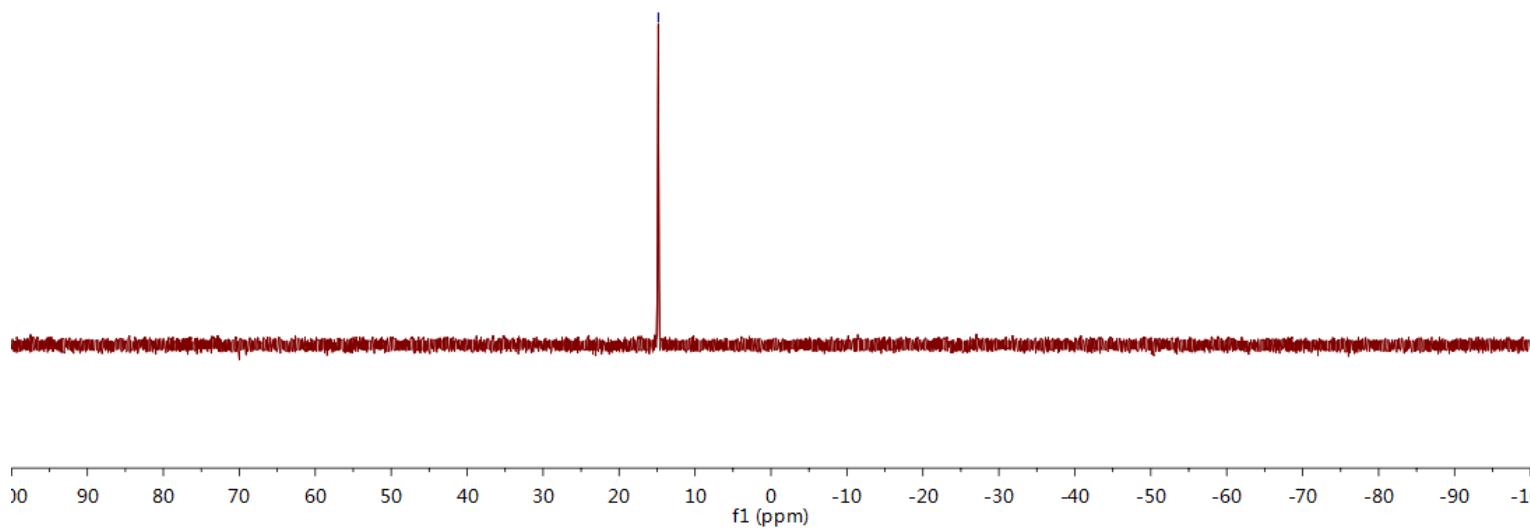


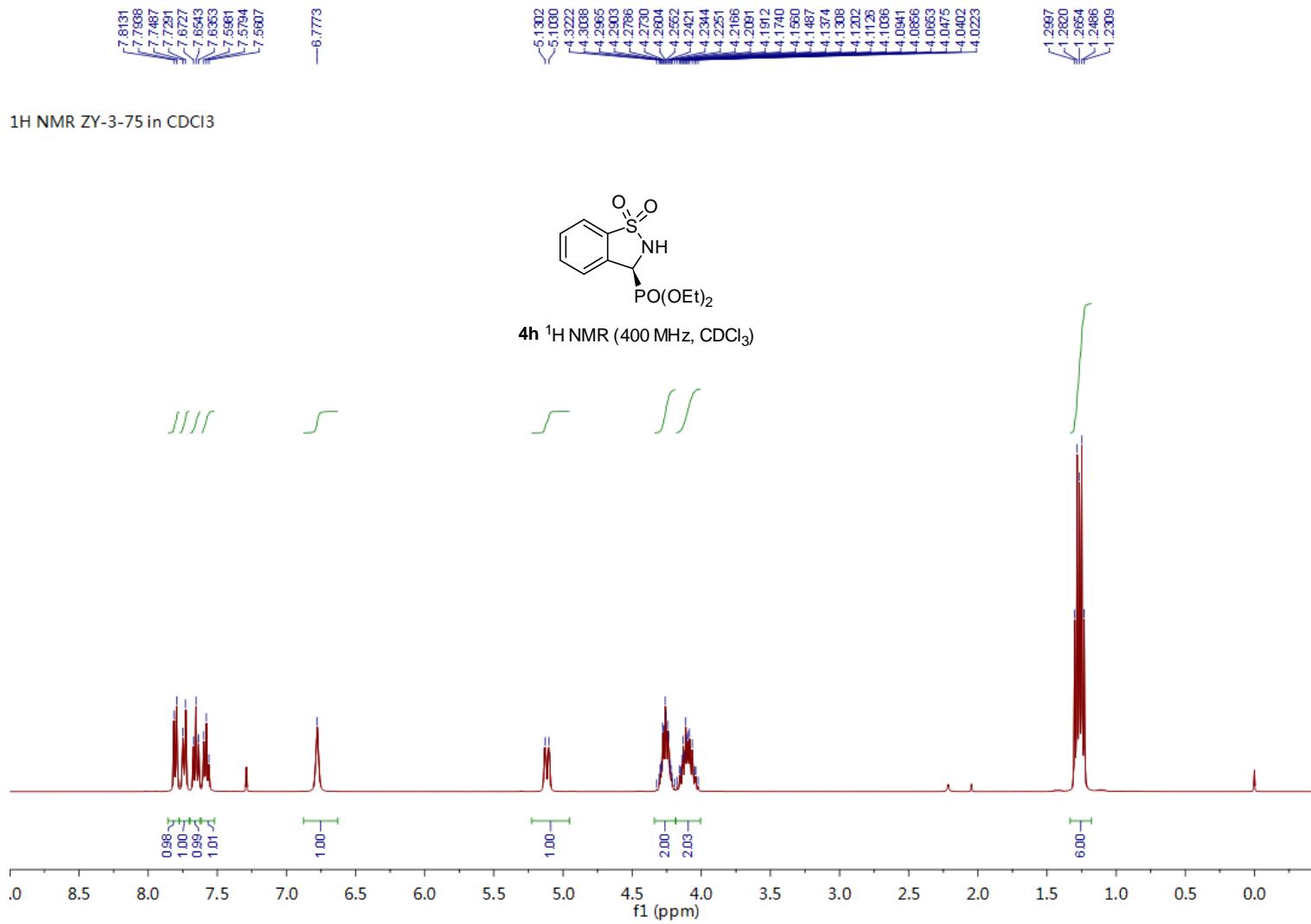
\sim 14.83
14.85

^{31}P NMR ZY-2-69 in CDCl_3



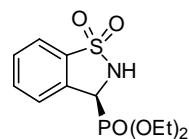
4g ^{31}P NMR (162 MHz, CDCl_3)



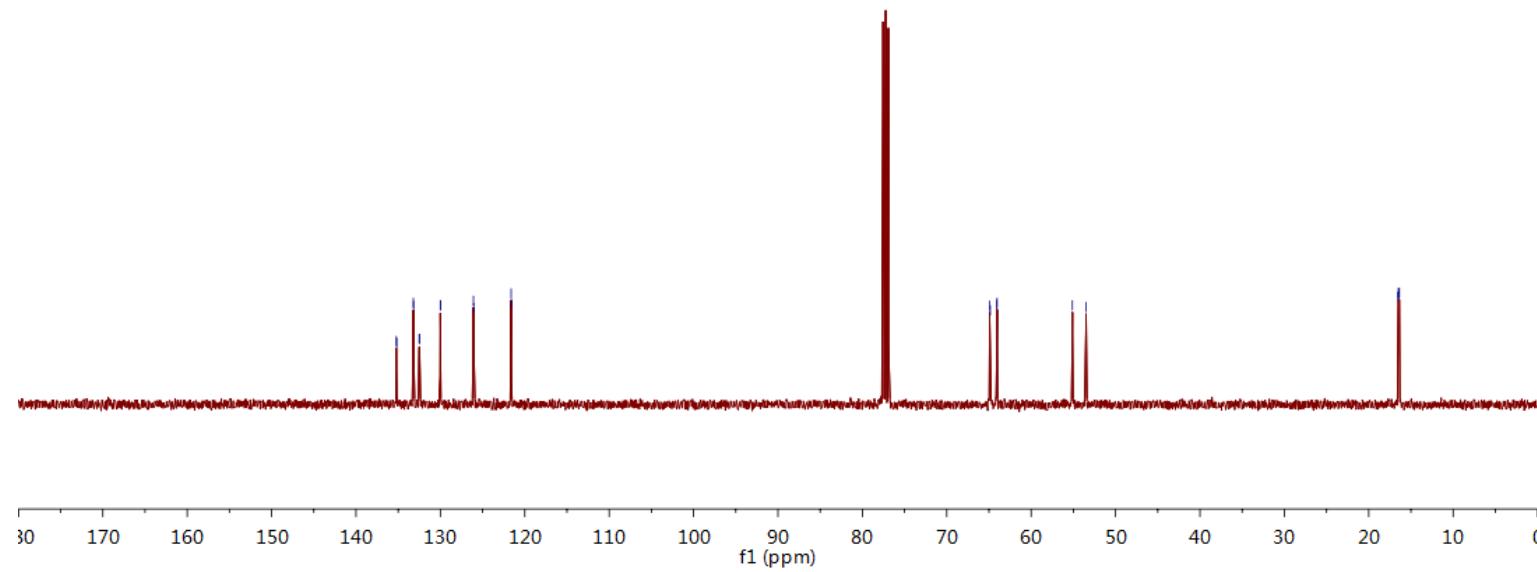




¹³C NMR ZY-3-75 in CDCl₃

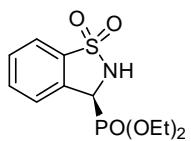


4h ¹³C NMR (100 MHz, CDCl₃)

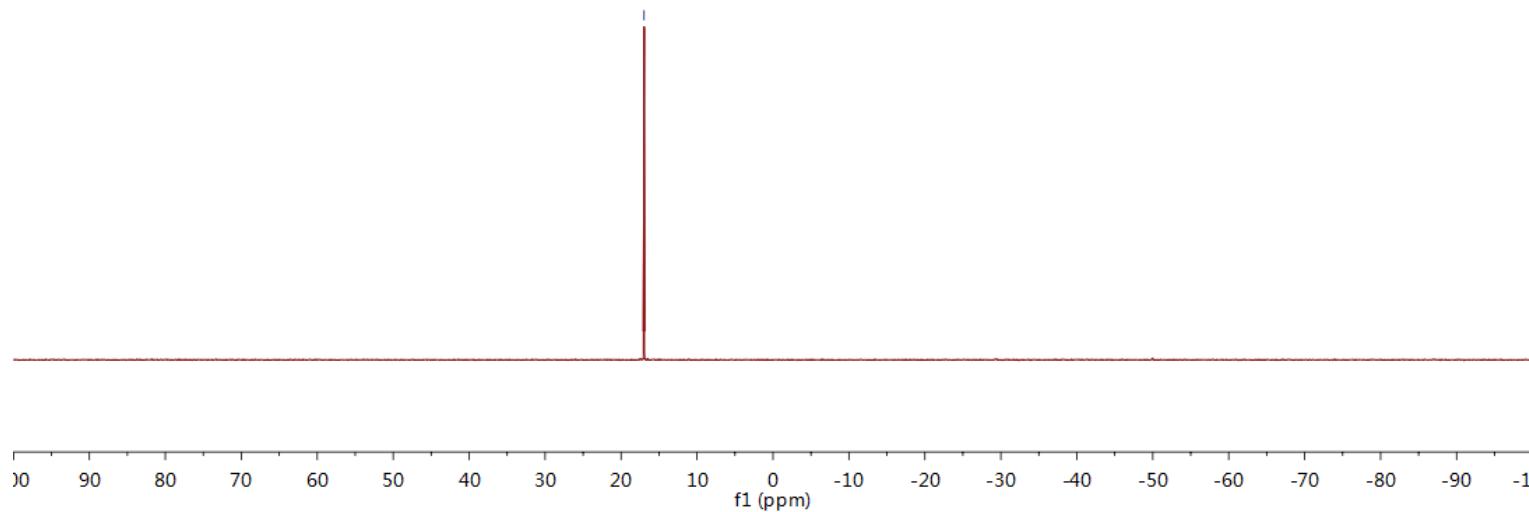


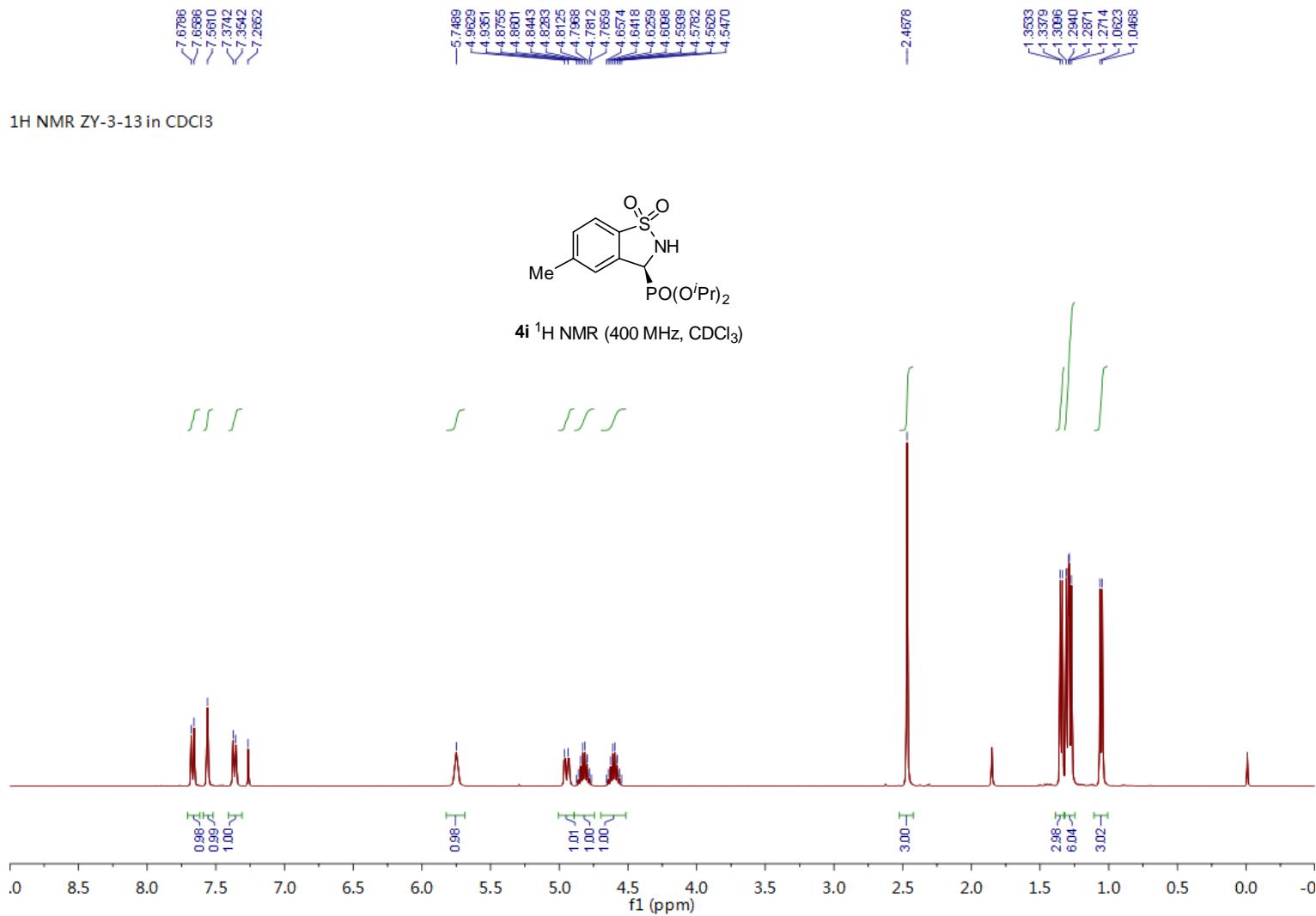
—16.97

^{31}P NMR ZY-3-75 in CDCl_3



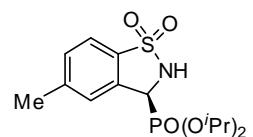
4h ^{31}P NMR (162 MHz, CDCl_3)



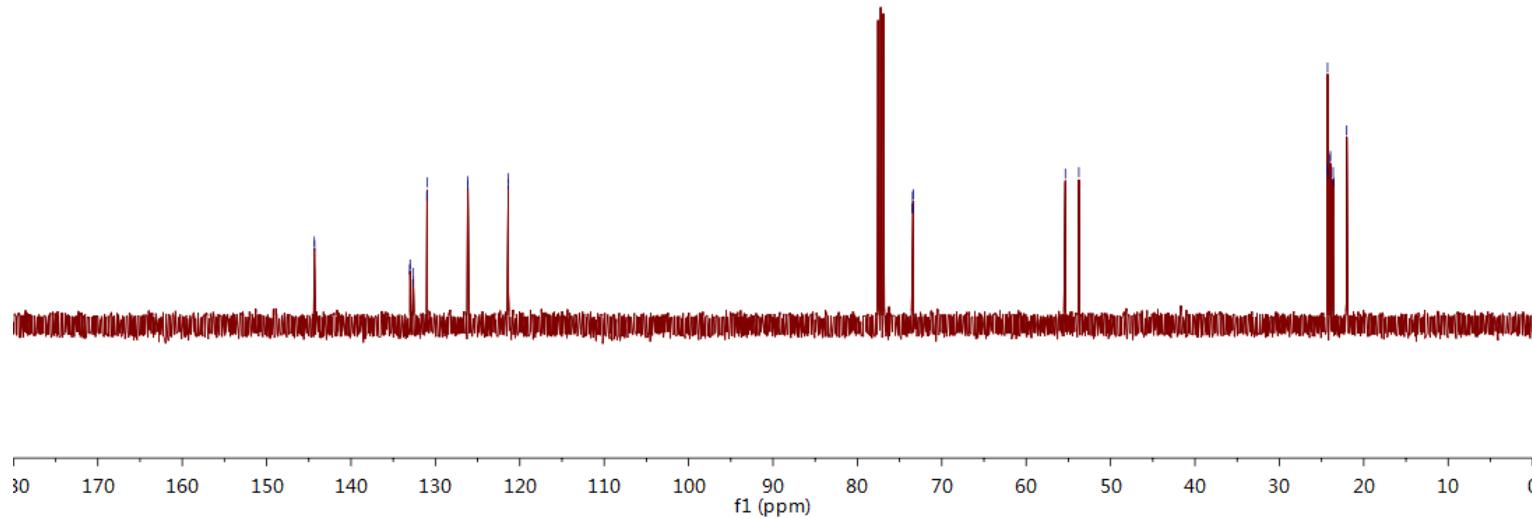




¹³C NMR ZY-3-13 in CDCl₃

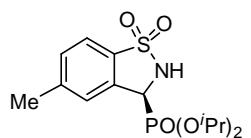


4i ¹³C NMR (100 MHz, CDCl₃)

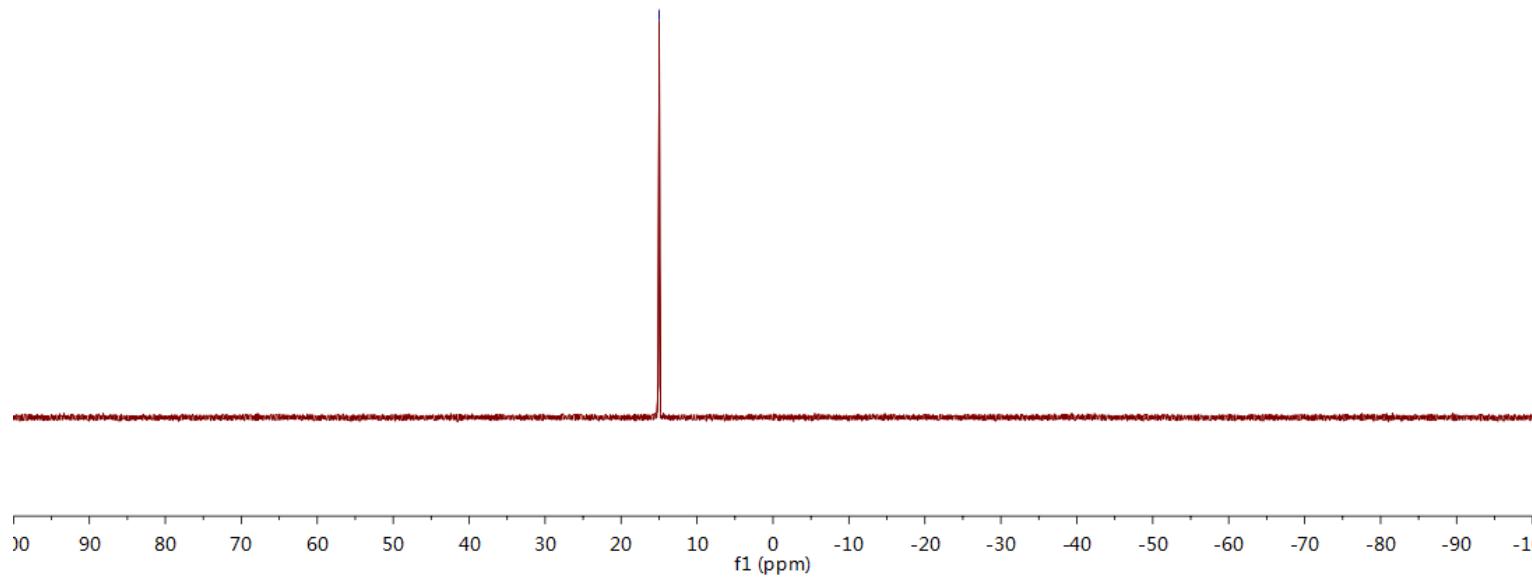


15.01
14.98

³¹P NMR ZY-3-13 in CDCl₃



4i ³¹P NMR (162 MHz, CDCl₃)

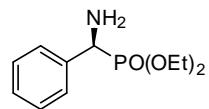


7.4920
7.4433
7.3672
7.3486
7.3300
7.3043
7.2880
7.2673

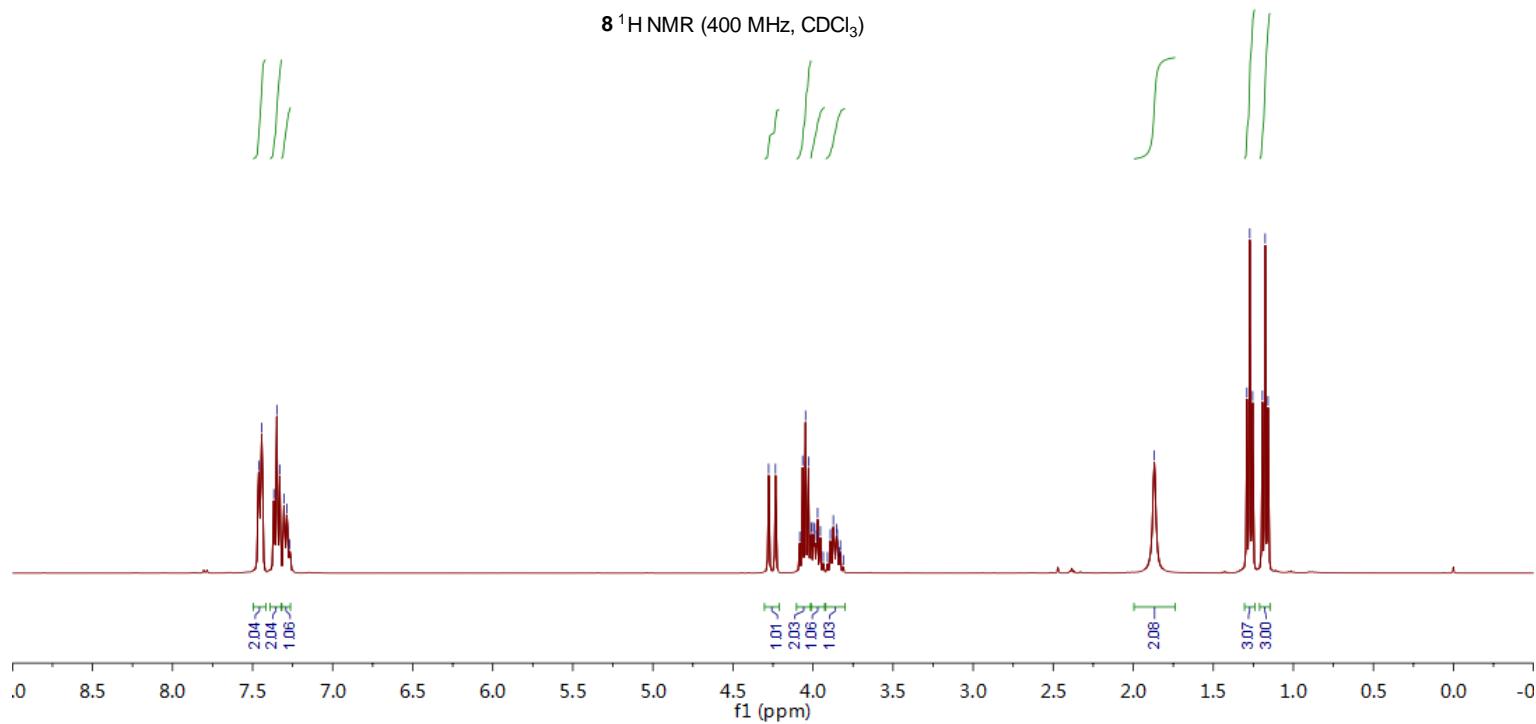
4.2770
4.2343
4.0827
4.0647
4.0467
4.0283
4.0109
3.9965
3.9892
3.9795
3.9712
3.9635
3.9567
3.9095
3.8914
3.8731
3.8636
3.8483
3.8352
3.8288
3.8105

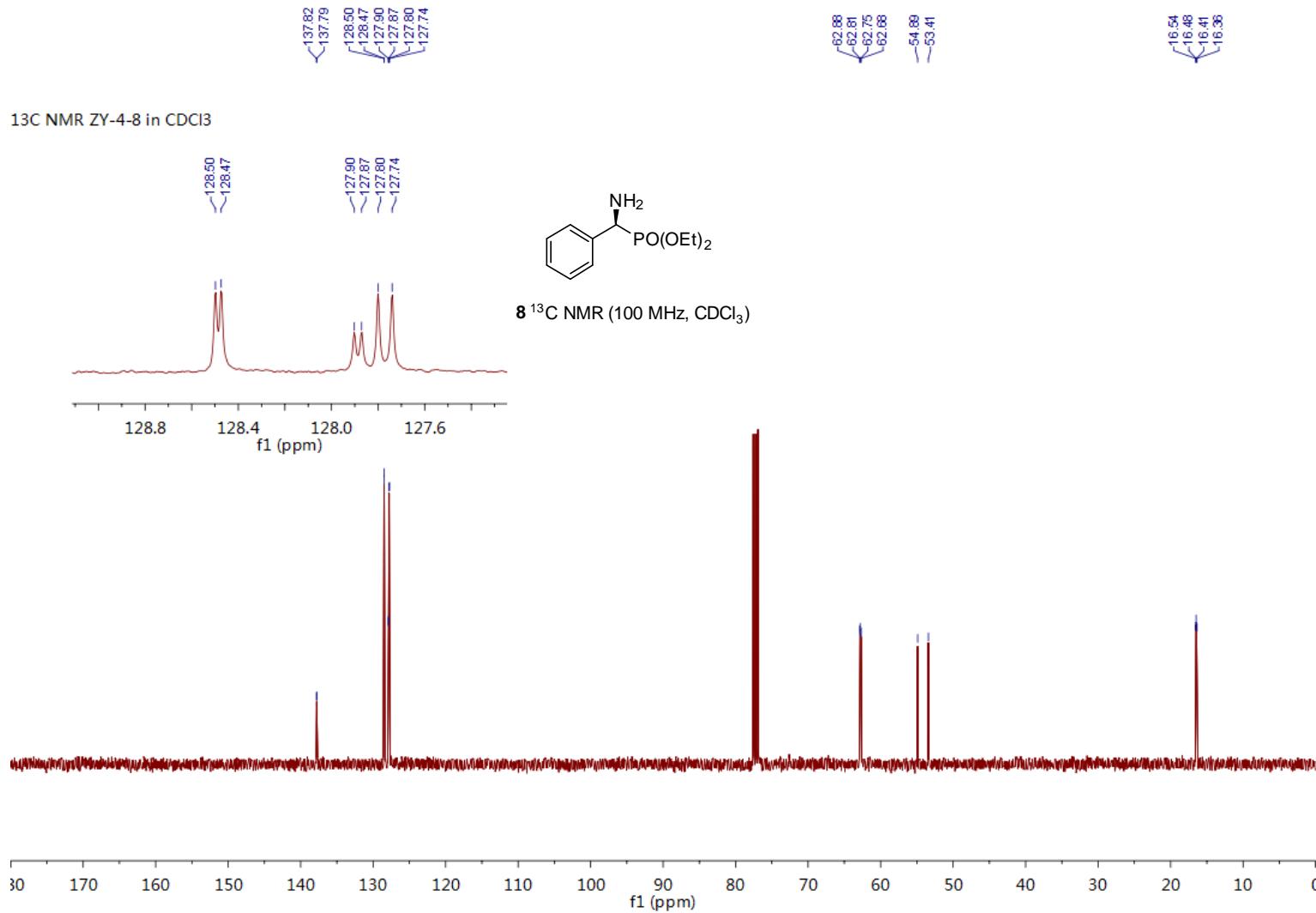
-1.8883
1.2898
1.2721
1.2544
1.1933
1.1759
1.1681

^1H NMR ZY-4-8 in CDCl_3



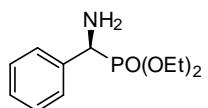
8 ^1H NMR (400 MHz, CDCl_3)



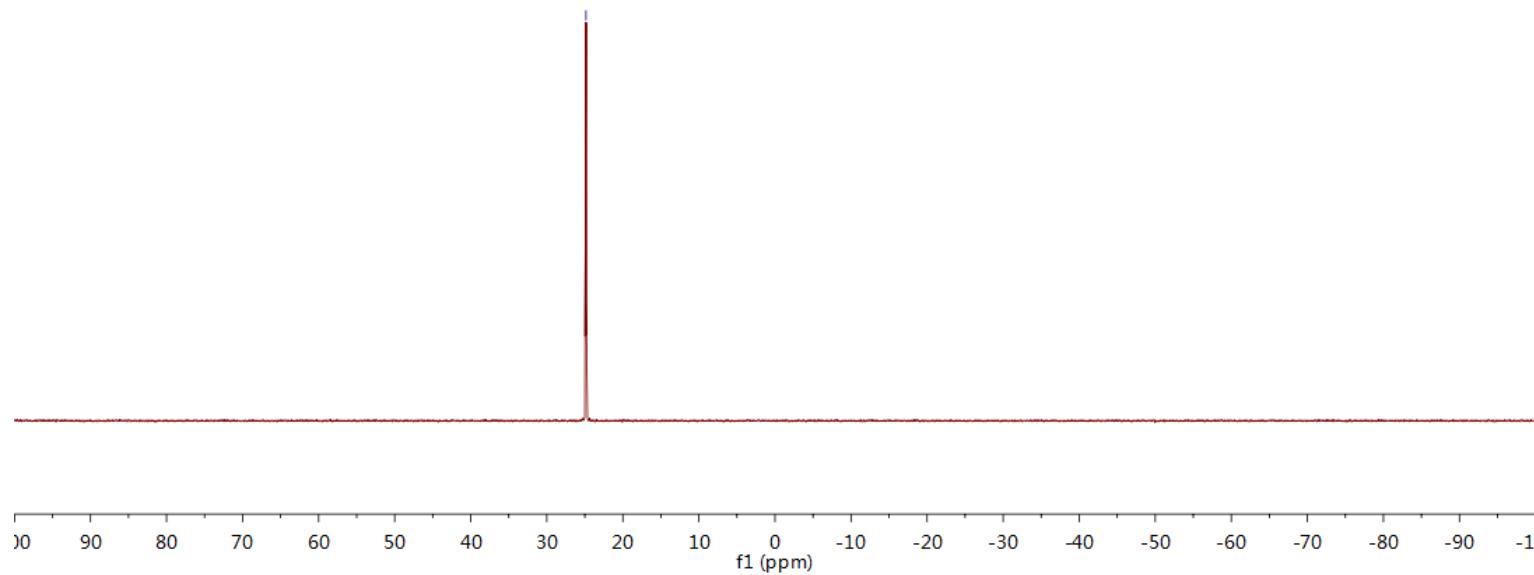


—24.85

^{31}P NMR ZY-4-8 in CDCl_3

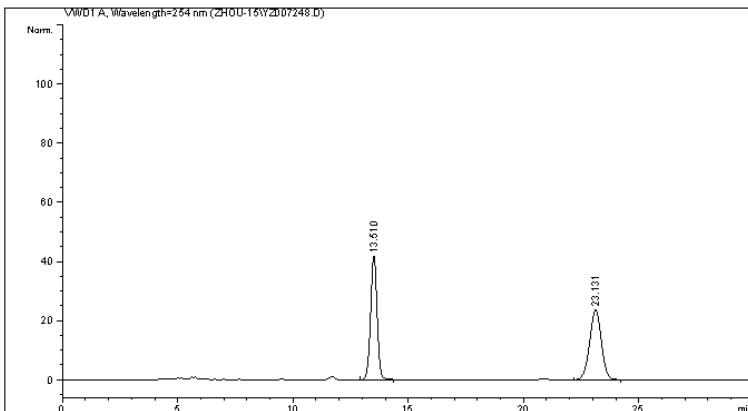


8 ^{31}P NMR (162 MHz, CDCl_3)



Data File C:\CHEM32\1\DATA\ZHOUE-15\Y2007248.D
Sample Name: ZY-1-90(+-)

```
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Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 3/12/2015 10:52:10 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 3/12/2015 10:32:12 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:34:48 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

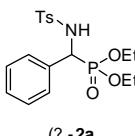
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s [mAU]	Area %
1	13.510	BB	0.2992	823.91858	41.91668	49.2009
2	23.131	BB	0.5503	850.68213	23.83616	50.7991

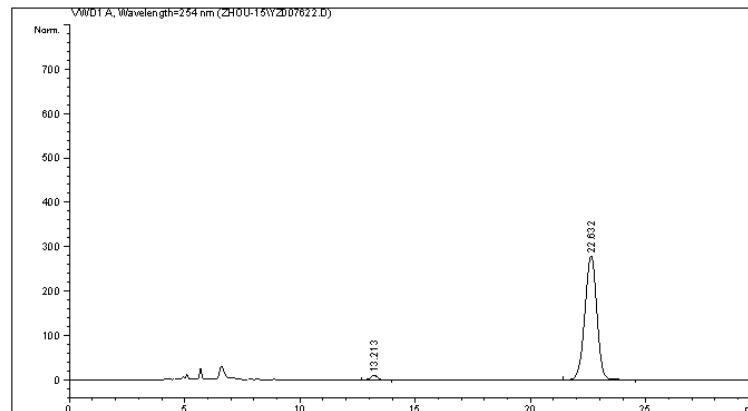
Totals : 1674.60071 65.75284

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOUE-15\Y2007622.D
Sample Name: ZY-2-50

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 4/22/2015 12:17:54 PM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 4/22/2015 11:48:43 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:31:52 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

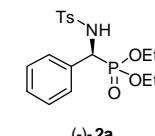
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s [mAU]	Area %
1	13.213	VB	0.3000	207.87032	10.53847	2.0210
2	22.632	VB	0.5606	1.00777e4	279.40738	97.9790

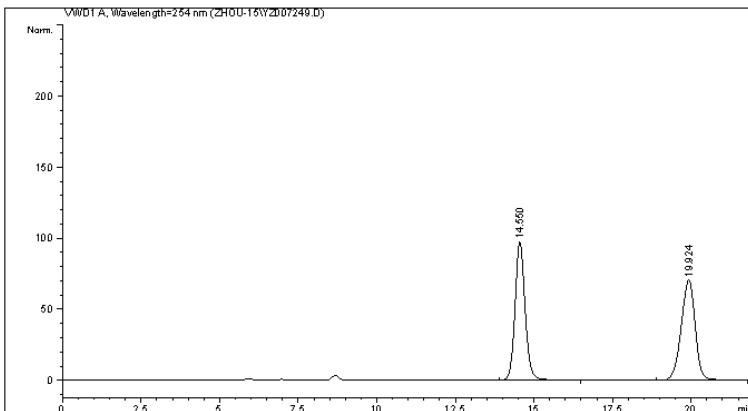
Totals : 1.02856e4 289.94585

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007249.D
Sample Name: ZY-2-17(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1
Injection Date : 3/12/2015 11:44:59 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 3/12/2015 10:32:12 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:37:17 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

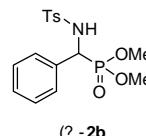
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	14.550	BB	0.3446	2194.52100	97.32050	49.9624
2	19.924	VB	0.4801	2197.82739	70.51804	50.0376

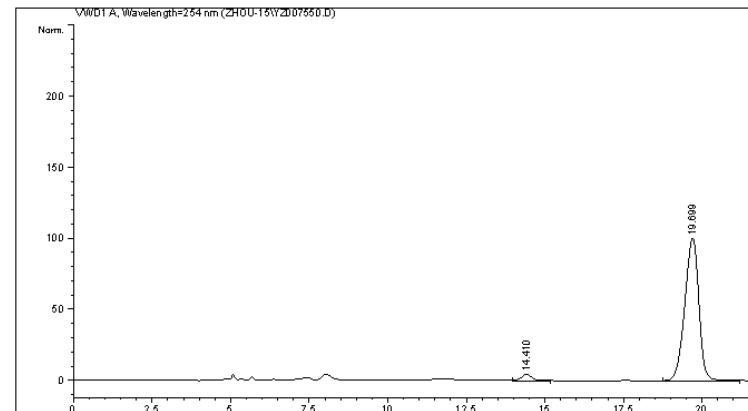
Totals : 4392.34839 167.83853

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007550.D
Sample Name: ZY-2-39A

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1
Injection Date : 4/14/2015 12:30:12 PM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 4/14/2015 12:08:40 PM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:37:17 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

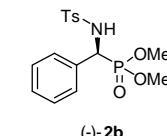
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	14.410	BB	0.3425	102.40273	4.47820	3.1805
2	19.699	BB	0.4856	3117.30078	100.10435	96.8195

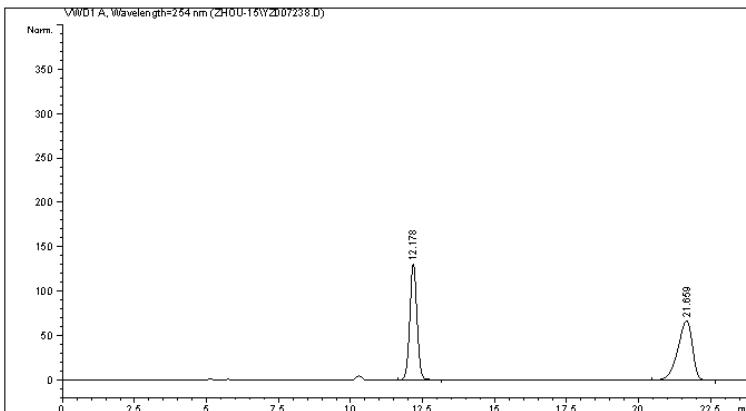
Totals : 3219.70351 104.58256

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007238.D
Sample Name: ZY-2-16(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1
Injection Date : 3/12/2015 12:35:00 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 3/12/2015 12:14:02 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:43:29 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

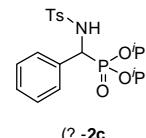
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	12.178	BB	0.2673	2281.16602	130.96259	49.0600
2	21.659	BB	0.5468	2368.58472	66.92880	50.9400

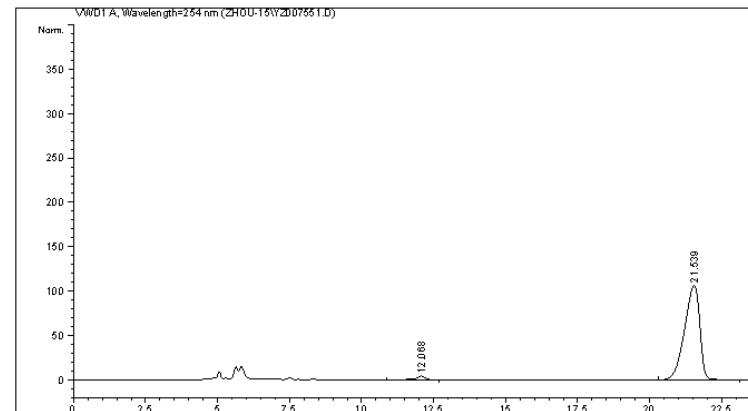
Totals : 4649.75073 197.89139

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007551.D
Sample Name: ZY-2-39B

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1
Injection Date : 4/14/2015 12:54:50 PM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 4/14/2015 12:08:40 PM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:43:29 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

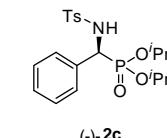
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	12.068	WB	0.3158	89.39634	4.14231	2.2343
2	21.539	BB	0.5747	3911.69043	106.34316	97.7657

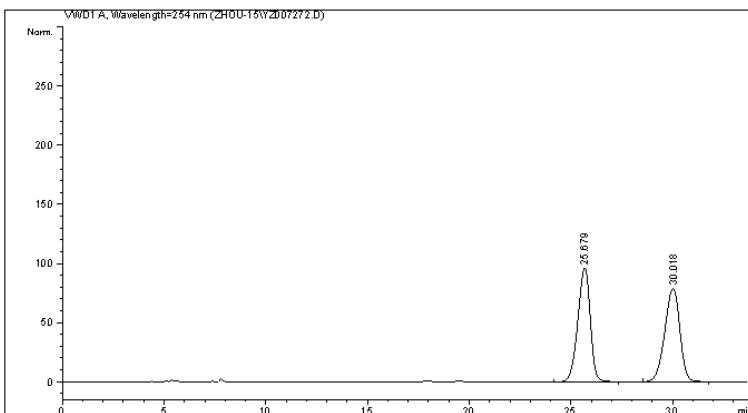
Totals : 4001.08677 110.48547

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007272.D
Sample Name: ZY-2-18(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 3/14/2015 7:04:13 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 3/14/2015 6:42:44 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:00:13 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

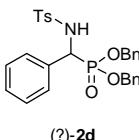
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	25.679	VB	0.6605	4115.16211	96.51466	50.2108	
2	30.018	BB	0.8113	4080.61499	79.13465	49.7892	

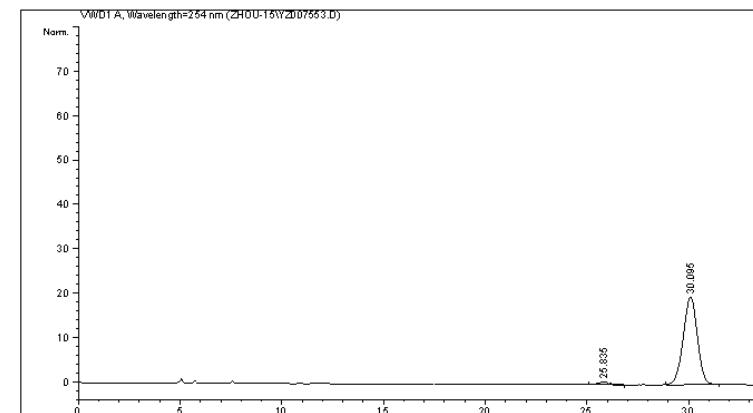
Totals : 8195.77710 175.64931

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007553.D
Sample Name: ZY-2-39C

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 4/15/2015 4:39:25 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 4/15/2015 4:31:56 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:58:18 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 254 nm
```



```
=====
Area Percent Report
=====

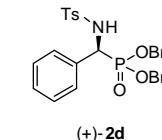
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	25.835	BB	0.5410	25.08924	6.37130e-1	2.5579	
2	30.095	BB	0.7459	955.75842	19.72377	97.4421	

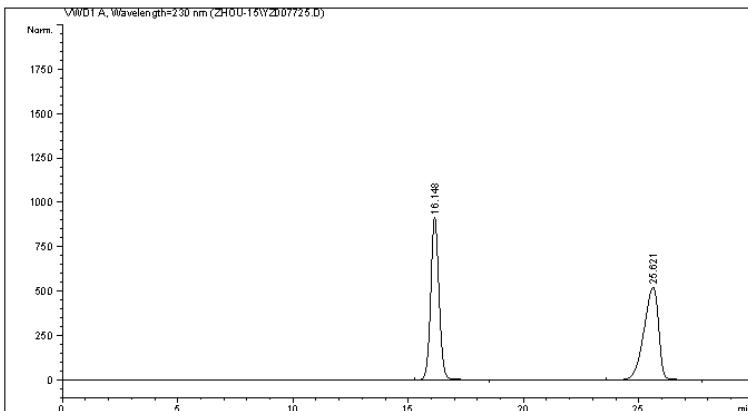
Totals : 980.84767 20.36090

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007725.D
Sample Name: ZY-2-60(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/10/2015 12:41:29 PM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 5/10/2015 11:56:37 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:03:40 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```



```
=====
Area Percent Report
=====

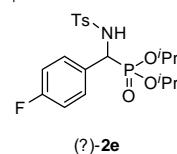
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime	Type	Width	Area	Height	Area %
	[min]		[min]	[mAU]	*s	[mAU]
1	16.148	VB	0.3853	2.29027e4	914.55389	49.9067
2	25.621	VB	0.6890	2.29883e4	521.54175	50.0933

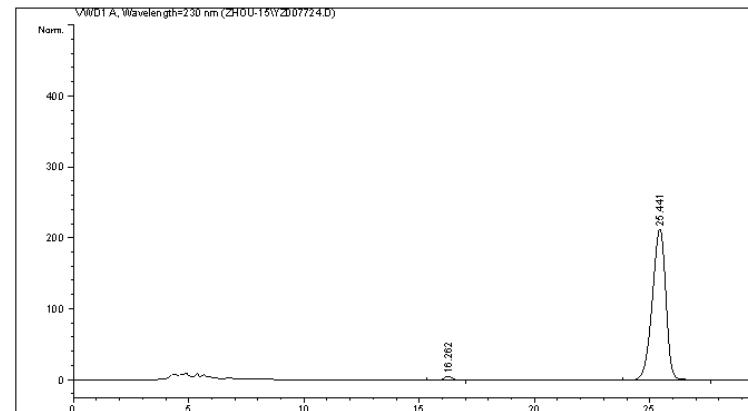
Totals : 4.58910e4 1436.09564

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007724.D
Sample Name: ZY-2-60

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/10/2015 12:00:55 PM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 5/10/2015 11:56:37 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:02:16 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```



```
=====
Area Percent Report
=====

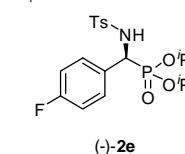
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime	Type	Width	Area	Height	Area %
	[min]		[min]	[mAU]	*s	[mAU]
1	16.262	VB	0.3886	138.48155	5.46983	1.5634
2	25.441	VB	0.6405	8719.41895	213.08725	98.4366

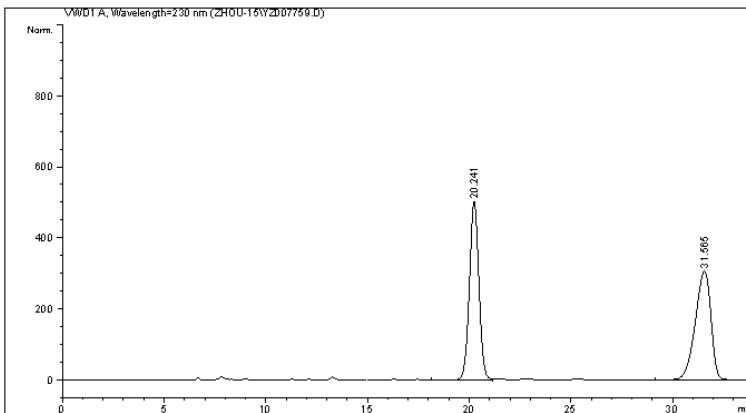
Totals : 8857.90050 218.55708

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007759.D
Sample Name: ZY-2-47(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/14/2015 7:25:26 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 5/14/2015 7:14:08 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:07:26 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```



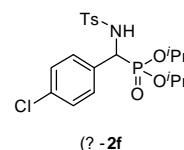
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.0000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

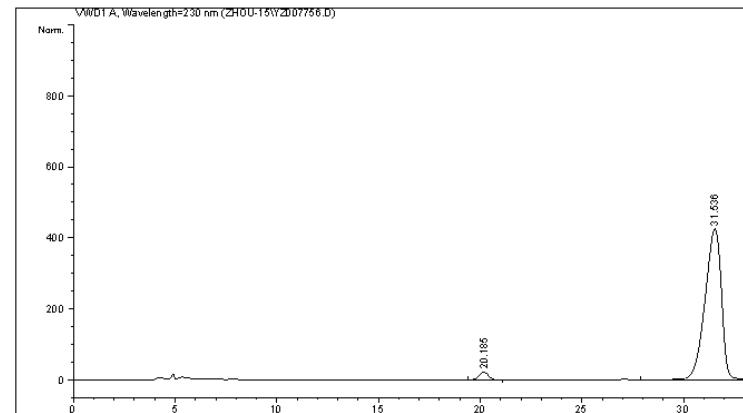
Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	20.241	VV	0.5027	1.64177e4	503.57755	49.8013	
2	31.566	BB	0.8494	1.65487e4	307.39764	50.1987	

Totals : 3.29663e4 810.97519



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007756.D
Sample Name: ZY-2-62

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/14/2015 5:20:40 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 5/14/2015 4:18:24 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:06:06 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```



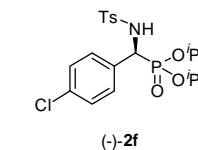
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

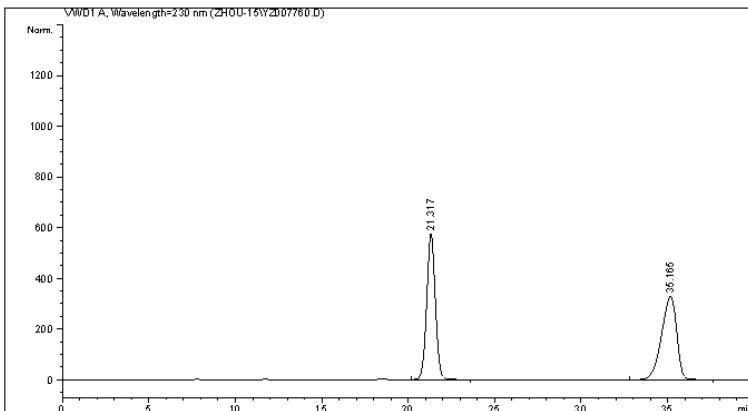
Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	20.185	BB	0.4981	694.24274	21.55166	2.8272	
2	31.536	VB	0.8865	2.38618e4	425.94775	97.1728	

Totals : 2.45560e4 447.49941



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007760.D
Sample Name: ZY-2-45(+-)

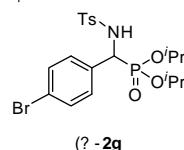
```
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/14/2015 8:14:26 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF.LC.M
Last changed : 5/14/2015 8:06:24 AM by ZHOU
                (modified after loading)
Analysis Method : C:\CHER32\1\METHODS\DEF.LC.M
Last changed : 8/11/2015 09:39:39 PM by
                (modified after loading)
Sample Info : IA-H2/ProR = 65/35, 0.7 mL/min, 30 °C, 230 nm
```



=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs

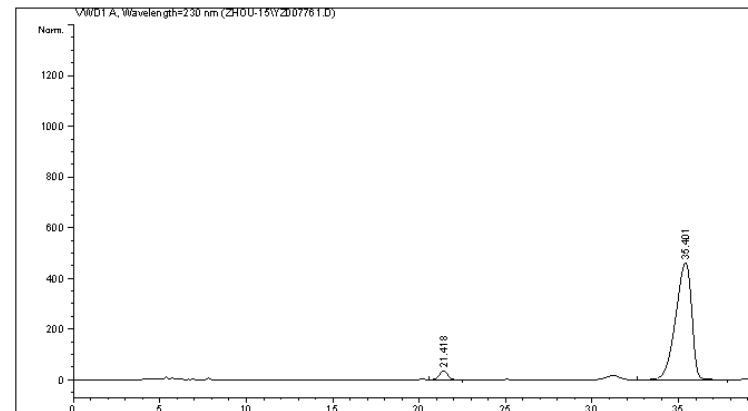
Signal 1: WWD1 A, Wavelength=230 nm						
Peak #	RetTime [min]	Type	Width [min]	Area ^s [mAU]	Heidht [mAU]	Area %
1	21.317	VB	0.5331	2.00268e4	576.90540	49.8811
2	35.165	BB	0.9642	0.21222e4	328.88745	50.1189
Totals :				4.01490e4	905.79285	



=====
*** End of Report ***

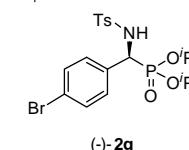
Data File C:\CHEM32\1\DATA\ZHOU-15\Y2007761.D
Sample Name: ZY-2-63

Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/14/2015 9:03:28 AM
Acq. Method : C:\HPCHEM\1\METHOD\SVDEF.LC.M
Last changed : 5/14/2015 8:06:24 AM by ZHOU
Analysis Method : C:\CHEM32\1\METHOD\SVDEF.LC.M
Last changed : 8/11/2015 9:09:39 PM by
 (modified after loading)
Sample Info : IA-H, H₂-PrOH = 65/35, 0.7 mL/min, 30 °C, 230 nm



```
=====
                         Area Percent Report
=====
Sorted By      :      Signal
Multiplier:    :      1.0000
Dilution:     :      1.0000
Sample Amount: :      1.00000 [ng/uL] (not used in calc)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm						
Peak #	RetTime [min]	Type	Width [min]	Area μAU	Height [mAU]	Area %
1	21.418	VB	0.5359	1247.77844	36.21691	4.0145
2	35.401	VB	1.0152	9.29837e4	462.17953	95.9855

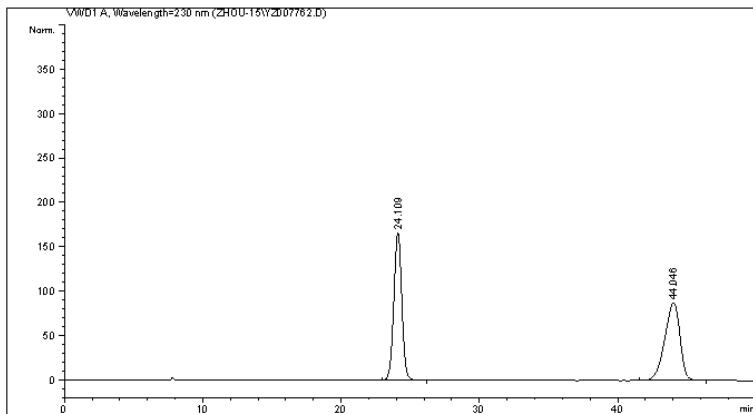


Totals : 3.10815e4 498.39643

*** End of Report ***

Data File C:\CHEM32\1\DATA\ZHOUE-15\Y2007762.D
Sample Name: ZY-2-55(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/14/2015 9:54:28 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 5/14/2015 8:06:24 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:13:13 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```



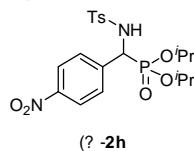
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

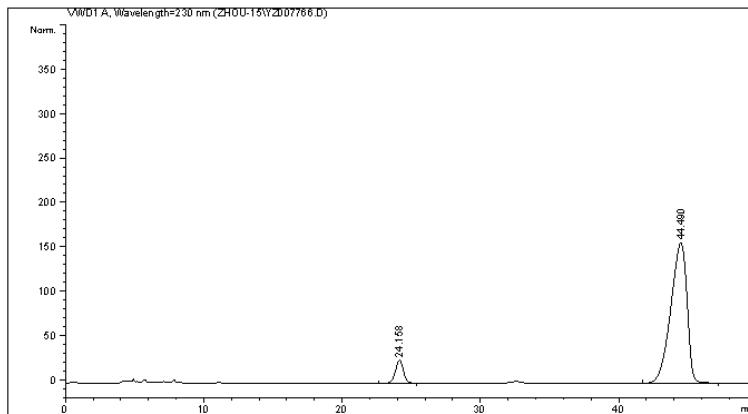
Peak #	RetTime [min]	Type	Width [min]	Area mAU	*s	Height [mAU]	Area %
1	24.109	BB	0.6208	6714.40918		166.89873	50.0393
2	44.046	BB	1.1822	6703.86719		87.77921	49.9607

Totals : 1.34183e4 254.67793



Data File C:\CHEM32\1\DATA\ZHOUE-15\Y2007766.D
Sample Name: ZY-2-64

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 5/14/2015 1:07:43 PM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 5/14/2015 1:00:52 PM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:13:13 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```



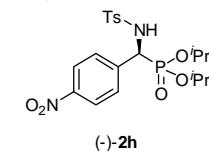
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

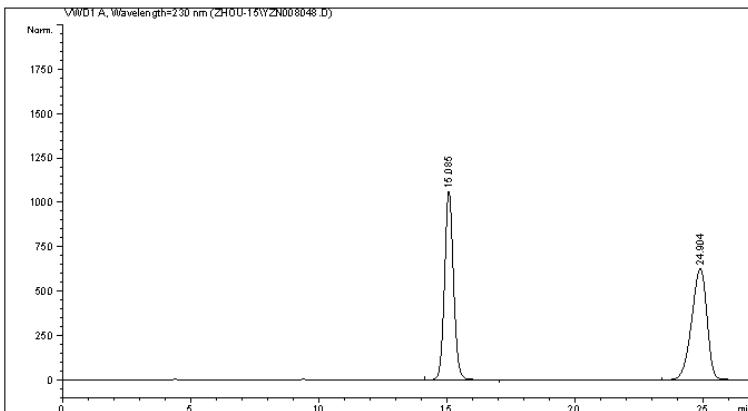
Peak #	RetTime [min]	Type	Width [min]	Area mAU	*s	Height [mAU]	Area %
1	24.158	BB	0.6134	1032.35193		25.74897	7.3902
2	44.490	BB	1.2932	1.29368e4		157.97046	92.6098

Totals : 1.39692e4 183.71943



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN008048.D
Sample Name: ZY-2-68(+-)

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 5/17/2015 9:26:26 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 5/17/2015 9:07:17 PM by
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:19:32 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```

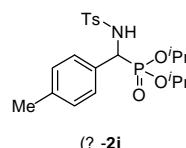


```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

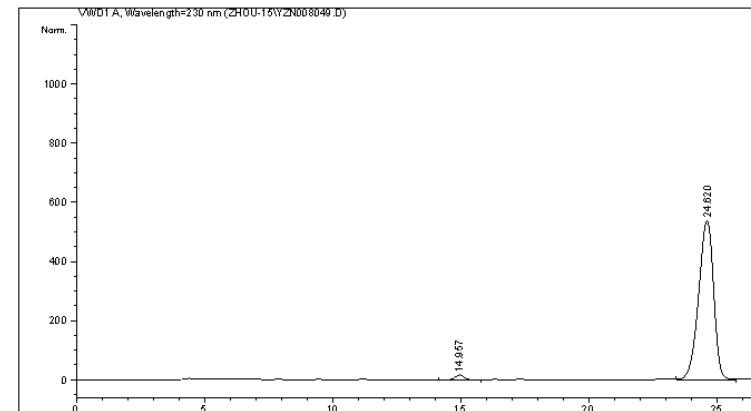
Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 15.085	BV	0.3696	2.57287e4	1063.61328	49.7532		
2 24.904	BB	0.6493	2.59840e4	627.22388	50.2468		
Totals :			5.17127e4		1690.83716		



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN008049.D
Sample Name: ZY-2-68

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 5/17/2015 10:05:37 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 5/17/2015 10:03:46 PM by
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 9:18:28 PM by
(modified after loading)
Sample Info : IA-H, H/i-PrOH = 65/35, 0.7 mL/min, 30 oC, 230 nm
```

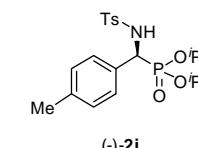


```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

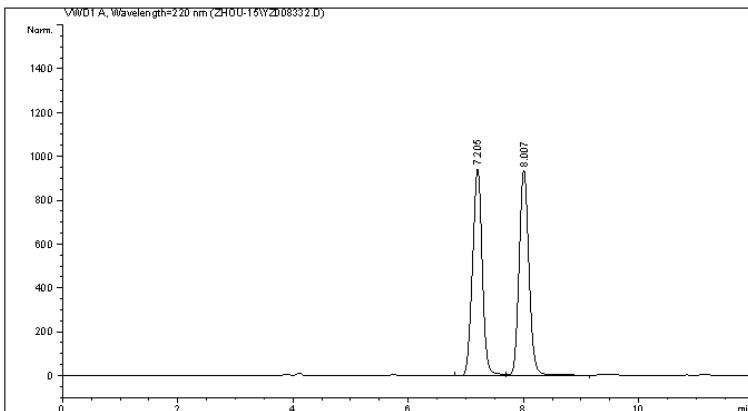
Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 14.957	VV	0.3665	394.78836	16.49968	1.7694		
2 24.620	VV	0.6371	2.19168e4	539.39819	96.2306		
Totals :			2.23116e4		555.89787		



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008332.D
Sample Name: ZY-3-27(-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/11/2015 11:42:48 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/11/2015 11:28:54 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 7:23:20 PM by
(modified after loading)
Sample Info : AD-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```



```
=====
Area Percent Report
=====

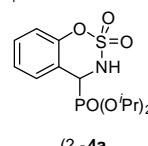
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	7.205	VV	0.1772	1.1050e4	944.92365	49.7383
2	8.007	VB	0.1843	1.11663e4	936.29181	50.2617

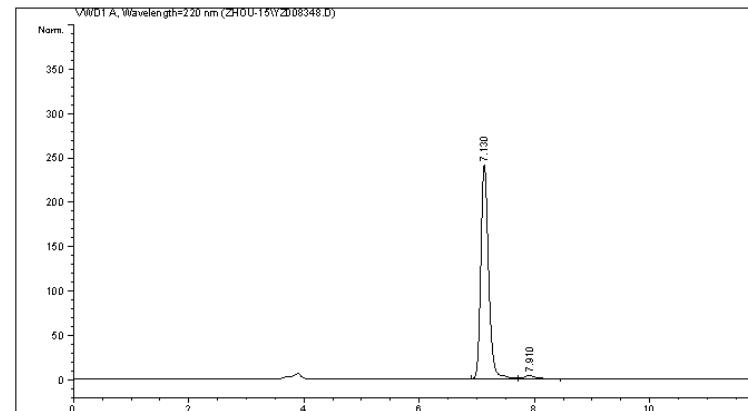
Totals : 2.22164e4 1881.21545

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008348.D
Sample Name: ZY-3-27

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/14/2015 4:39:41 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/14/2015 4:27:24 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 7:45:50 PM by
(modified after loading)
Sample Info : AD-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```



```
=====
Area Percent Report
=====

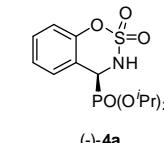
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	7.130	VV	0.1426	2258.65356	241.46654	98.0404
2	7.910	VB	0.1790	45.14535	3.73060	1.9596

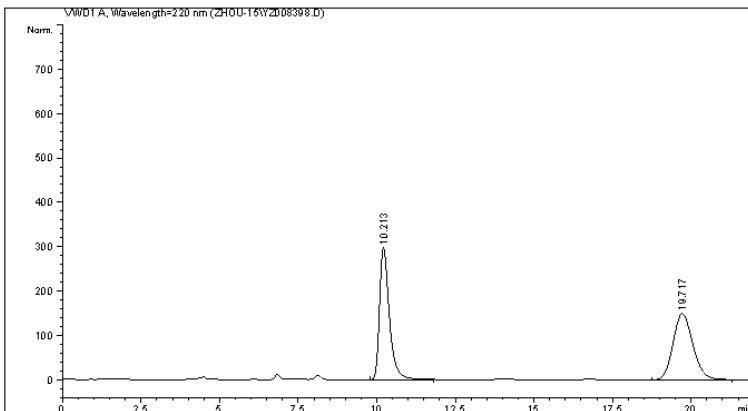
Totals : 2303.79892 245.19714

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008398.D
Sample Name: ZY-3-32(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/19/2015 5:25:01 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/19/2015 4:52:35 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 7:52:06 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 220 nm
```



```
=====
Area Percent Report
=====

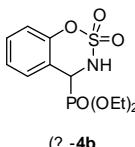
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	10.213	BB	0.3271	6448.65576	297.58121	49.7395
2	19.717	BB	0.6824	6516.20850	149.32648	50.2605

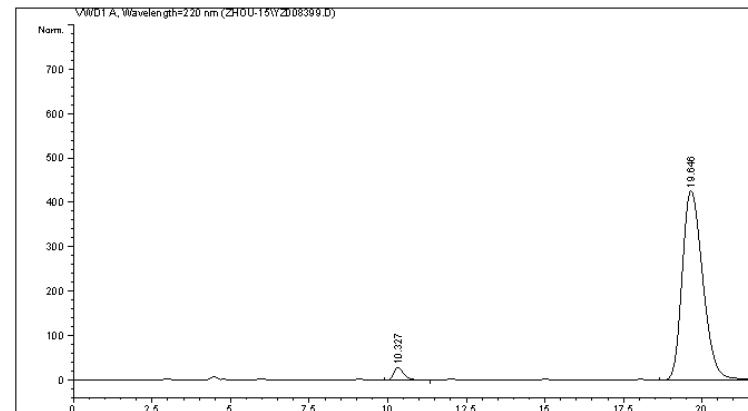
Totals : 1.29649e4 446.90768

=====
*** End of Report ***
=====



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008399.D
Sample Name: ZY-3-32

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/19/2015 5:51:11 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/19/2015 4:52:35 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 7:49:50 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 220 nm
```



```
=====
Area Percent Report
=====

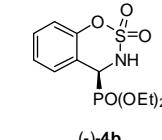
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	10.327	VB	0.3513	671.14966	28.71792	3.3383
2	19.646	VB	0.7058	1.94331e4	426.88303	96.6617

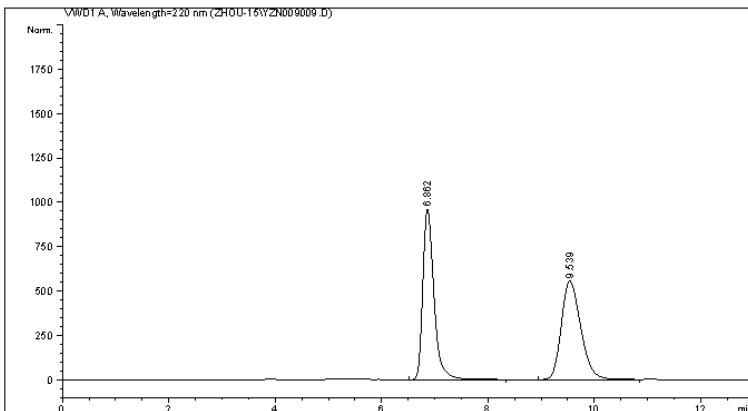
Totals : 2.01043e4 455.60095

=====
*** End of Report ***
=====



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN009009.D
Sample Name: ZY-3-44(+-)

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 8/14/2015 4:30:02 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/14/2015 4:19:43 PM by
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/14/2015 9:10:49 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```

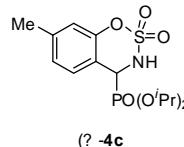


```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

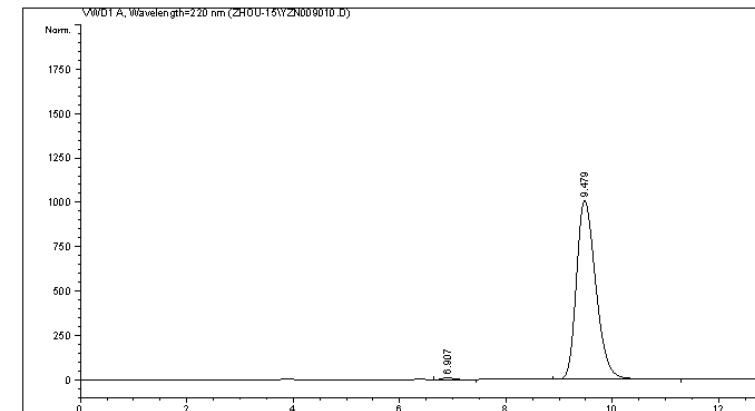
Signal 1: VWD1 A, Wavelength=220 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 6.862	BB	0.2242	1.39994e4	958.87585	49.7778		
2 9.539	BB	0.3941	1.41244e4	555.66052	50.2222		
Totals :			2.81238e4		1514.53638		



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN009010.D
Sample Name: ZY-3-44

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 8/14/2015 4:52:48 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/14/2015 4:49:32 PM by
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/14/2015 9:10:49 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```

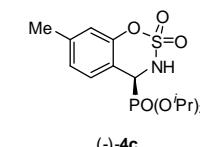


```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

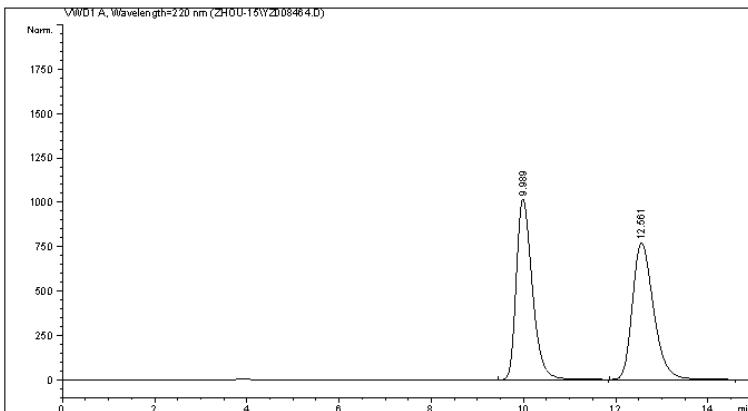
Signal 1: VWD1 A, Wavelength=220 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 6.907	BV	0.2122	160.40375	11.71393	0.6271		
2 9.479	BB	0.3904	2.54200e4	1007.65417	99.3729		
Totals :			2.55804e4		1019.36810		



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008464.D
Sample Name: ZY-3-39A(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/26/2015 6:06:20 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/26/2015 5:52:41 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 7:36:12 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```



```
=====
Area Percent Report
```

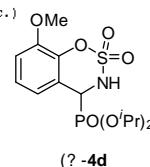
```
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s [mAU]	Area %
1	9.989	BB	0.3726	2.4601e4	1016.60431	50.0230
2	12.561	BB	0.4924	2.45789e4	771.69440	49.9770

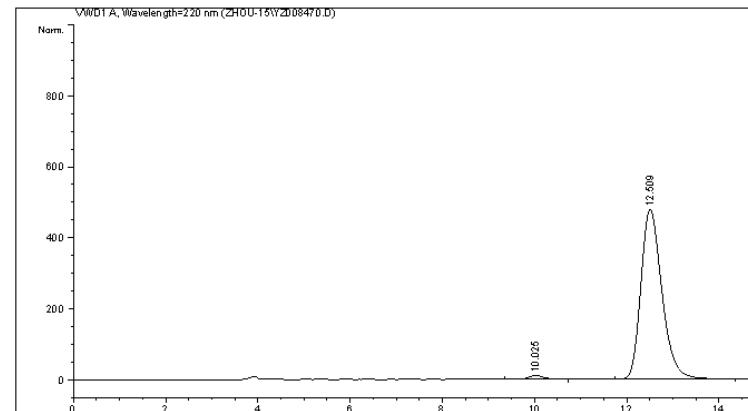
Totals : 4.9180e4 1788.29871

*** End of Report ***



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008470.D
Sample Name: ZY-3-39A

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/27/2015 10:44:12 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/27/2015 10:20:48 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 7:55:04 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```



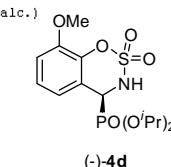
```
=====
Area Percent Report
```

```
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s [mAU]	Area %
1	10.025	BB	0.3672	252.51248	10.47107	1.6348
2	12.509	BB	0.4882	1.51931e4	478.76001	98.3652

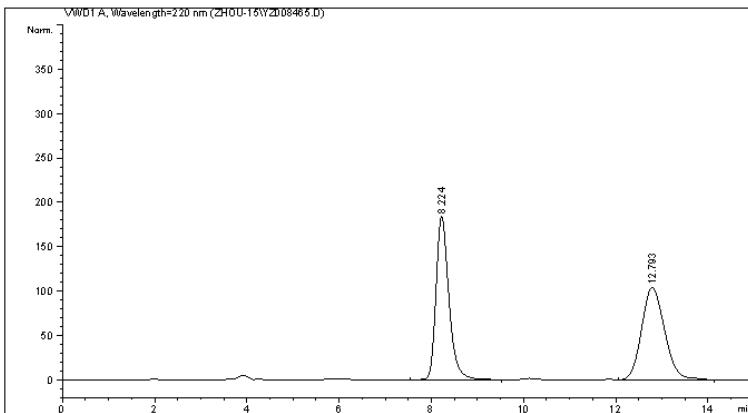
Totals : 1.54456e4 489.23108



*** End of Report ***

Data File C:\CHEM32\1\DATA\ZHOUE-15\Y2008465.D
Sample Name: ZY-3-39B(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/26/2015 6:33:22 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/26/2015 5:52:41 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 7:56:35 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```

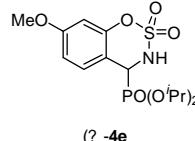


```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	8.224	VB	0.2986	3614.50391	184.36823	49.9670	
2	12.793	VB	0.5459	3619.27368	104.34889	50.0330	

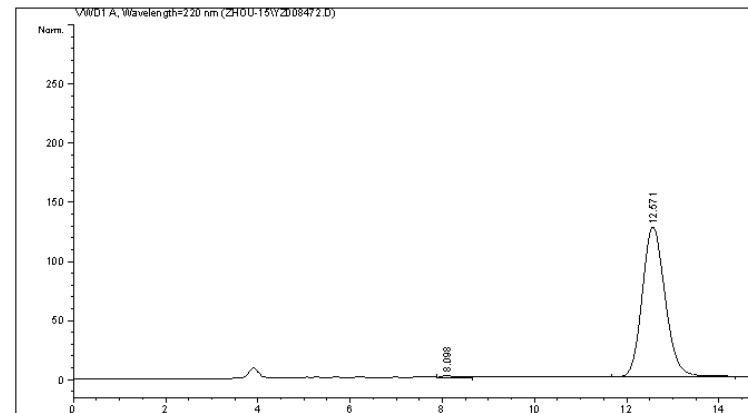


Totals : 7233.77759 288.71712

```
=====
*** End of Report ***
=====
```

Data File C:\CHEM32\1\DATA\ZHOUE-15\Y2008472.D
Sample Name: ZY-3-39B

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/28/2015 1:24:53 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/28/2015 1:06:42 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:02:22 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```



```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

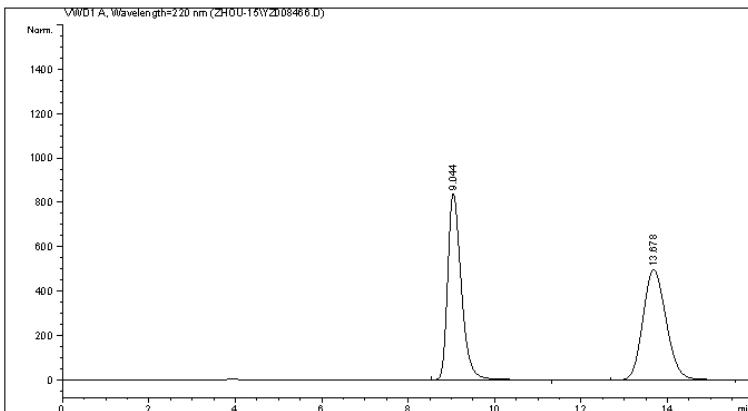
Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	8.098	VB	0.2903	43.01221	2.05907	0.9742	
2	12.571	VB	0.5366	4372.24658	126.69587	99.0258	

Totals : 4415.25879 128.75494

```
=====
*** End of Report ***
=====
```

Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008466.D
Sample Name: ZY-3-40C--)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/26/2015 6:56:06 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/26/2015 5:52:41 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:05:02 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```



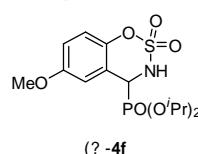
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

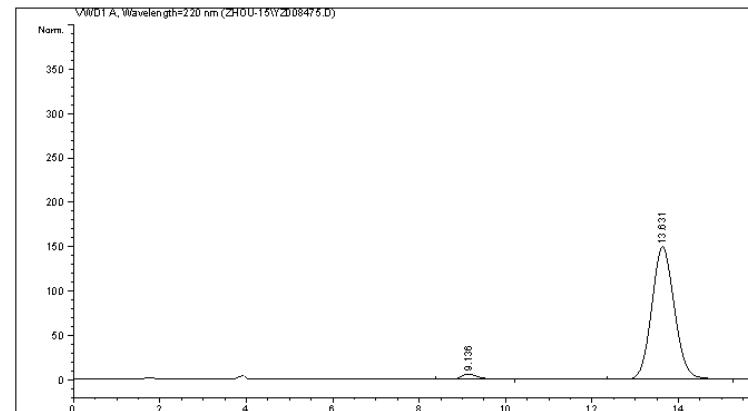
Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	9.044	VV	0.3375	1.8429e4	840.06244	49.7944
2	13.678	VV	0.5854	1.8581e4	499.57952	50.2056

Totals : 3.70107e4 1339.64206



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008475.D
Sample Name: ZY-3-40C

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/28/2015 6:04:21 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/28/2015 5:07:03 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:06:58 PM by
(modified after loading)
Sample Info : AS-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 220 nm
```



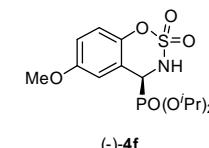
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

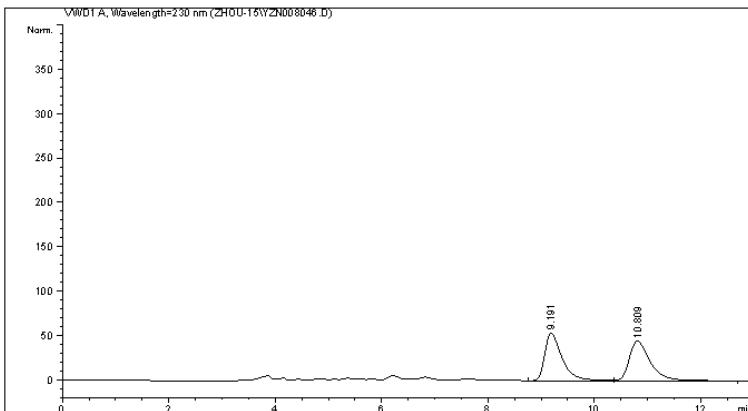
Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	9.136	VV	0.4306	178.02995	6.15528	3.1597
2	13.631	VV	0.5712	5456.28027	149.56255	96.8403

Totals : 5634.31023 155.71782



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN008046.D
Sample Name: ZY-2-69(+-)

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 5/17/2015 8:06:20 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 5/17/2015 7:43:07 PM by
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:49:10 PM by
(modified after loading)
Sample Info : OD-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 230 nm
```



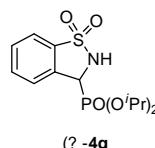
```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

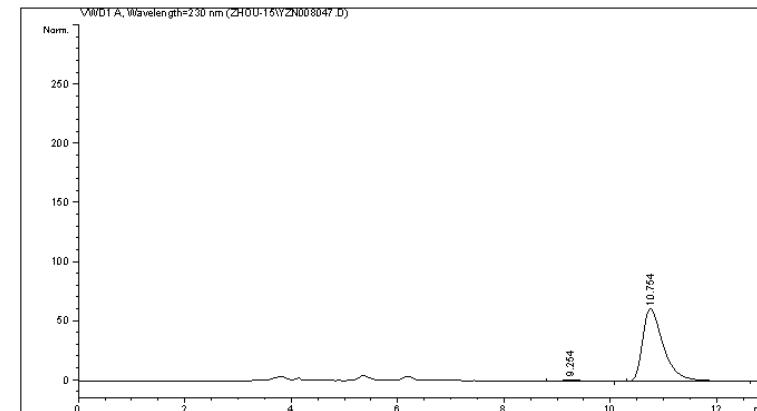
Peak RetTime	Type	Width	Area	Height	Area
# [min]		[min]	[mAU]	*s	[mAU]
1 9.191	VV	0.3468	1262.99231	54.35741	50.0637
2 10.809	VB	0.4200	1259.77686	44.96738	49.9363

Totals : 2522.76917 99.32479



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN008047.D
Sample Name: ZY-2-69

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 5/17/2015 8:44:52 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 5/17/2015 8:33:07 PM by
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:27:19 PM by
(modified after loading)
Sample Info : OD-H, H/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 230 nm
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

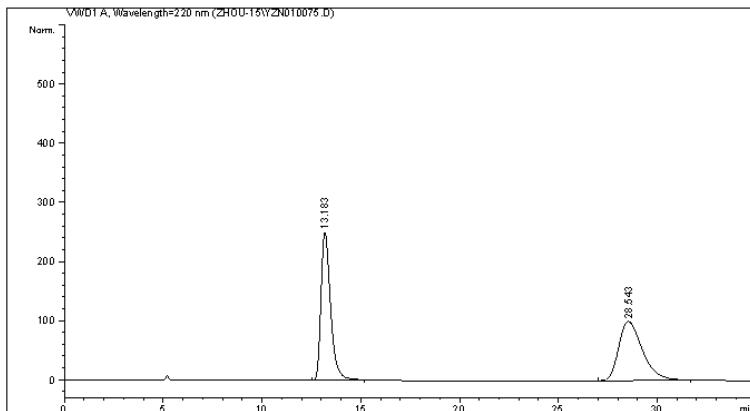
Peak RetTime	Type	Width	Area	Height	Area
# [min]		[min]	[mAU]	*s	[mAU]
1 9.254	BB	0.3770	32.98437	1.30225	1.9158
2 10.754	BB	0.4144	1688.74048	61.34391	96.0842

Totals : 1721.72485 62.64616



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN010075.D
Sample Name: ZY-3-75(+-)

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 11/18/2015 2:00:24 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 11/18/2015 1:36:43 PM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 11/18/2015 4:37:11 PM
(modified after loading)
Sample Info : AS, H/i-PrOH = 60/40, 0.6 mL/min, 30 oC, 220 nm
```

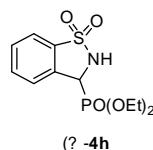


```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

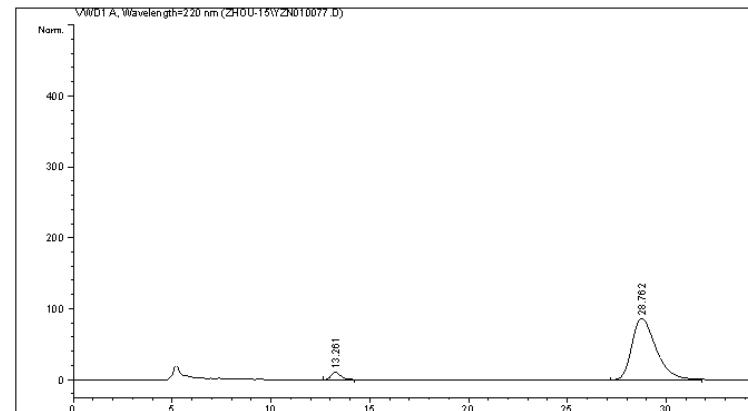
Signal 1: VWD1 A, Wavelength=220 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 13.183	BB	0.5137	8430.03613	250.33791	50.2204		
2 28.543	BB	1.2642	6356.02734	100.04061	49.7796		
Totals :			1.67861e4		350.37852		



Data File C:\CHEM32\1\DATA\ZHOU-15\YZN010077.D
Sample Name: ZY-3-75

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 11/18/2015 3:21:35 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 11/18/2015 3:19:35 PM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 11/18/2015 4:38:49 PM
(modified after loading)
Sample Info : AS, H/i-PrOH = 60/40, 0.6 mL/min, 30 oC, 220 nm
```

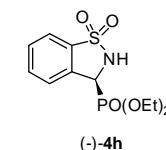


```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

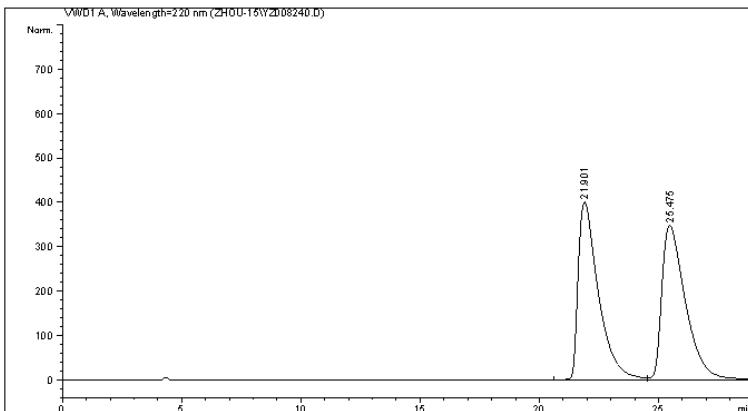
Signal 1: VWD1 A, Wavelength=220 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 13.261	BB	0.5052	346.55905	10.64141	4.5287		
2 28.762	BB	1.2801	7305.94385	86.44625	95.4713		
Totals :			7652.50290		97.08766		



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008240.D
Sample Name: ZY-3-13(+-)

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 7/2/2015 11:52:04 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 7/2/2015 11:30:53 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:20:18 PM by
(modified after loading)
Sample Info : OD-H, H/i-PrOH = 90/10, 0.7 mL/min, 30 oC, 220 nm
```



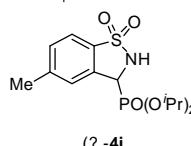
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

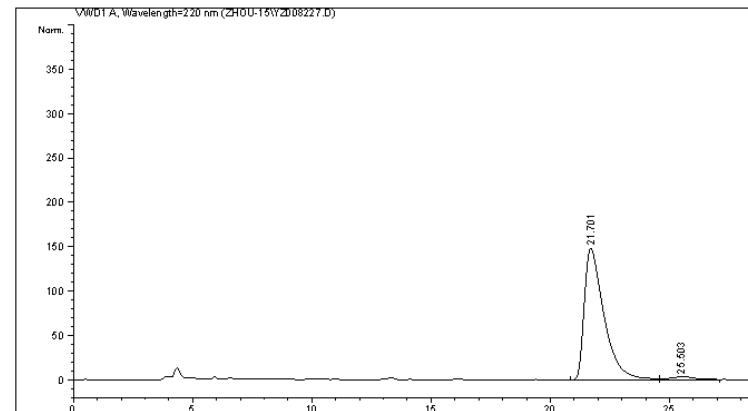
Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	21.901	VV	0.8762	2.37096e4	400.96143	49.5294
2	25.475	VV	1.0592	2.41602e4	348.51309	50.4706

Totals : 4.78698e4 749.47452



Data File C:\CHEM32\1\DATA\ZHOU-15\Y2008227.D
Sample Name: ZY-3-13

```
=====
Acq. Operator : ZHOU
Acq. Instrument : Instrument 1 Location : Vial 1
Injection Date : 6/30/2015 10:11:12 AM
Acq. Method : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 6/30/2015 9:53:32 AM by ZHOU
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed : 8/11/2015 8:18:57 PM by
(modified after loading)
Sample Info : OD-H, H/i-PrOH = 90/10, 0.7 mL/min, 30 oC, 220 nm
```



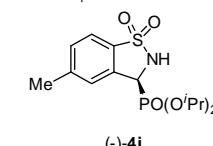
```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Sample Amount: : 1.00000 [ng/uL] (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=220 nm

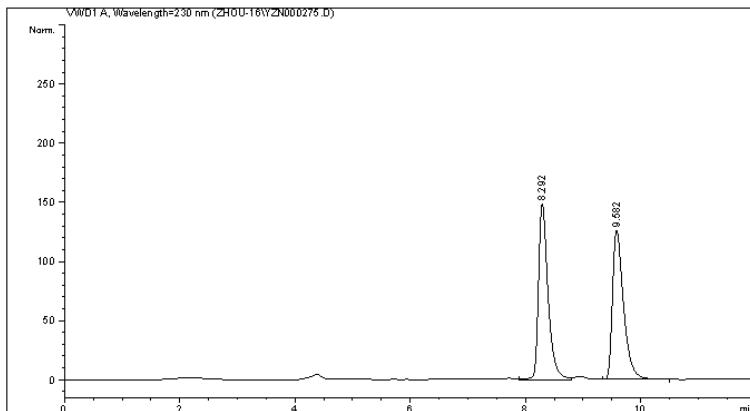
Peak #	RetTime	Type	Width [min]	Area [mAU]	Height *s [mAU]	Area %
1	21.701	VV	0.8876	8529.05176	148.06000	96.9415
2	25.503	VV	1.0050	269.09161	3.48747	3.0585

Totals : 8798.14337 151.54747



Data File C:\CHEM32\1\DATA\ZHOU-16\YZN000275.D
Sample Name: ZY-4-8(+)

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 1/23/2016 2:43:18 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 1/23/2016 2:38:22 PM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 1/24/2016 6:09:24 PM
(modified after loading)
Sample Info : AD, H/i-PrOH = 80/20, 0.7 mL/min, 30 oC, 230 nm
```

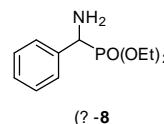


```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

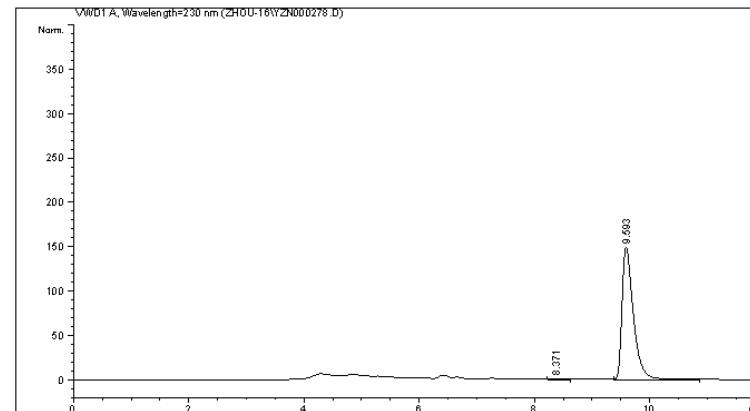
Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 8.292	VV	0.1737	1709.26624	148.34950	50.3000		
2 9.582	VB	0.2032	1688.87468	125.82125	49.7000		
Totals :			3398.14111		274.17075		



Data File C:\CHEM32\1\DATA\ZHOU-16\YZN000278.D
Sample Name: ZY-4-8

```
=====
Acq. Operator : Location : Vial 1
Acq. Instrument : Instrument 1
Injection Date : 1/23/2016 4:18:57 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 1/23/2016 4:10:18 PM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 1/24/2016 6:12:21 PM
(modified after loading)
Sample Info : AD, H/i-PrOH = 80/20, 0.7 mL/min, 30 oC, 230 nm
```



```
=====
Area Percent Report
=====

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime	Type	Width	Area	Height	Area		
# [min]		[min]	[mAU]	*s	[mAU]	1	%
1 8.371	VV	0.2593	18.82436	9.91617e-1	0.9113		
2 9.593	BB	0.2067	2046.95433	149.17377	99.0887		
Totals :			2065.75868		150.16538		

