Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Chiral Lithium Amide Mediated Desymmetrization of 3-Substituted Cyclobutanone

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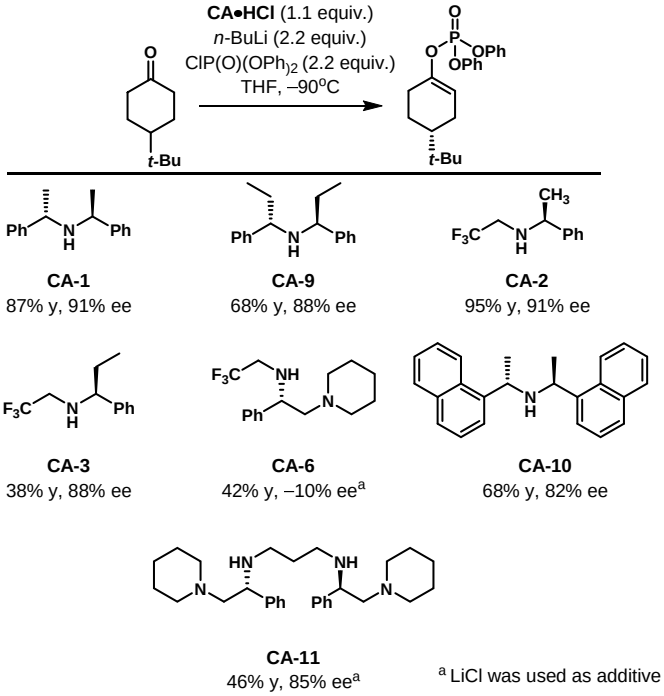
Supporting Information

General Information.

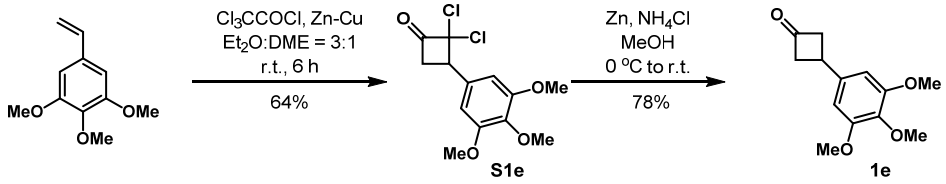
All reactions were carried out under an inert atmosphere of dry argon in oven or flame-dried glassware, unless the reaction procedure states otherwise. Tetrahydrofuran (THF), toluene and ether (diethyl ether) were distilled from sodium-benzophenone in a continuous still under an atmosphere of argon. Dichloromethane and triethylamine were distilled from calcium hydride in a continuous still under an atmosphere of argon. Reaction temperatures were controlled by Heidolph MR Hei-Standard. Analytical thin-layer chromatography (TLC) was performed using pre-coated TLC plates and visualized using combinations of UV, anisaldehyde, ceric ammonium molybdate (CAM), potassium permanganate, and iodine staining. Flash column chromatography was preformed using 300-400 mesh silica gel (Huanghai, Shandong) as the stationary phase. Proton nuclear magnetic resonance spectra were recorded at Agilent–400 MHz spectrometer and Bruker–400 MHz spectrometer, in relative to the solvent residual signal (7.26 ppm) in $CDCl_3$. Carbon nuclear magnetic resonance spectra were recorded at Agilent–100 MHz spectrometer and Bruker–100 MHz spectrometer, in relative to the signal of $CDCl_3$ (77.0 ppm). Optical Rotations were measured on a Rudolph Autopol III S2 polarimeter. The enantiomeric excess (ee) of the products was determined by chiral stationary phase HPLC (SHIMADZU LC 20AB and Daicel Chiralpak columns). The temperature –90 °C was maintained using liquid nitrogen/methanol cooling bath. EA = ethyl acetate; PE = petroleum ether; DCM = dichloromethane

1. Lithium Chiral amide mediated deprotonation of 4-*tert*-butylcyclohexanone



2. Experiment procedure and characterization data

a) Synthesis of Cyclobutanone 1:



General procedure A:

3-(3,4,5-Trimethoxyphenyl)cyclobutan-1-one (1e)

a) A flame-dried 250 mL round-bottom flask was charged with 3,4,5-trimethoxy styrene (7.80 g, 40.2 mmol), Zn-Cu coupling (8.04 g, 0.123 mol), 150 mL of Et_2O and 50 mL of DME. Then Cl_3CCOCl (9.20 mL, 14.9 g, 82.0 mmol) was added dropwise at room temperature. After stirring overnight, the reaction mixture was filtered through a pad of celite, and rinsed with 100 mL of Et_2O. The filtrate was treated with a cold aqueous solution of HCl (1 M, 100 mL) and extracted with EA twice. The combined organic phase was washed sequentially with a saturated solution of $NaHCO_3$, brine, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 95:5) to afford the product **S1e** (7.80 g, 25.6 mmol, 64% yield) as a yellow solid, which was directly submitted to next step without further characterization. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 6.49 (s, 2H), 4.17 (t, J = 10.3 Hz, 1H), 3.90 (s, 6H), 3.88 (s, 3H), 3.72-3.61 (m, 1H), 3.60-3.49 (m, 1H).

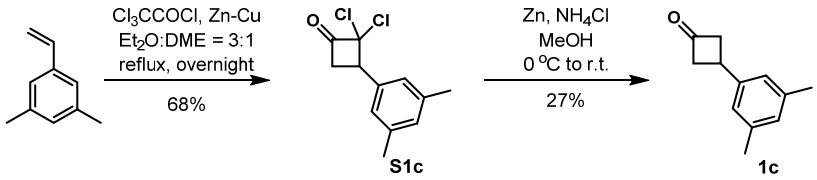
b) To a solution of **S1e** (7.80 g, 25.6 mmol) in MeOH (180 mL) was added NH_4Cl (13.8 g, 0.257 mol), zinc dust (10.1 g, 0.154 mol) sequentially at 0°C. After stirring for 6 h at room temperature, the reaction mixture was filtered through a pad of celite, and rinsed with EA. The filtrate was concentrated under vacuum. Then water was added, the aqueous phase was extracted with EA three times. The combined organic phase was washed with brine, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 4:1) to afford the product **1e** (4.73 g, 20.0 mmol, 78% yield) as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 6.49 (s, 2H), 3.87 (s, 6H), 3.83 (s, 3H), 3.71-3.57 (m, 1H), 3.55-3.42 (m, 2H), 3.31-3.16 (m, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 206.59, 153.38, 139.29, 136.73, 103.47, 60.86, 56.15, 54.69, 28.81.

IR (neat, cm^{-1}): 3013, 2990, 2978, 2970, 2946, 2920, 2835, 1788, 1771, 1586, 1511, 1469, 1457, 1422, 1370, 1345, 1317, 1237, 1188, 1153, 1126, 1103, 1107.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{13}H_{16}O_4$, 236.1043; found, 236.1041.



3-(3,5-Dimethylphenyl)cyclobutan-1-one (1c)

a) The substrate **S1c** was prepared according to **General Procedure A**; using 3,5-dimethylstyrene (1.29 g, 9.77 mmol), Zn-Cu (1.28 g, 19.6 mmol), CCl_3COCl (2.66 g, 14.7 mmol), Et_2O (30 mL) and DME (10 mL); flash chromatography on silica gel (PE:EA = 98:2) provided **S1c** (1.60 g, 8.37 mmol, 67% yield) as a yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.01 (s, 1H), 6.91 (s, 2H), 4.17 (t, *J* = 10.3 Hz, 1H), 3.70 (dd, *J* = 17.6, 10.4 Hz, 1H), 3.51 (dd, *J* = 17.6, 10.2 Hz, 1H), 2.36 (s, 6H).

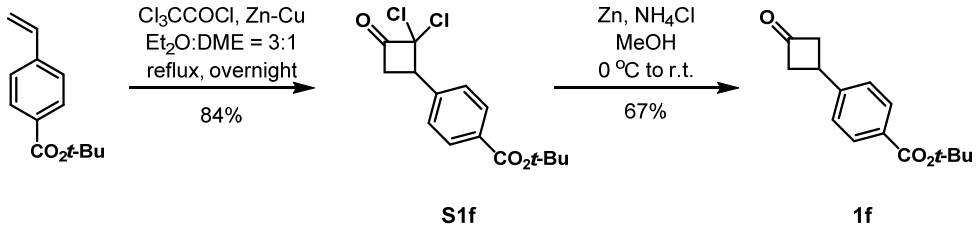
b) The substrate **1c** was prepared according to **General Procedure A**; using **S1c** (1.60 g, 6.58 mmol), NH_4Cl (3.52 g, 65.8 mmol), Zn (2.58 g, 39.5 mmol) and MeOH (15 mL); flash chromatography on silica gel (PE:EA = 95:5) provided **1c** (0.304 g, 1.74 mmol, 27% yield) as a colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 6.93 (s, 2H), 6.91 (s, 1H), 3.71-3.53 (m, 1H), 3.53-3.38 (m, 2H), 3.29-3.19 (m, 2H), 2.33 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 207.21, 143.54, 138.28, 128.24, 124.28, 54.63, 28.22, 21.29.

IR (neat, cm^{-1}): 3020, 2949, 2919, 1784, 1604, 1473, 1458, 1380, 1341, 1261, 1199, 1172, 1154, 1109.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{12}H_{14}O$, 174.1039; found, 174.1040.



***tert*-Butyl 4-(3-oxocyclobutyl)benzoate (1f)**

a) The substrate **S1f** was prepared according to **General Procedure A**; using 4-*t*-butyloxycarbonylstyrene (2.04 g, 10.0 mmol), Zn-Cu (1.95 g, 30.0 mmol), CCl_3COCl (5.45 g, 30.0 mmol), Et_2O (30 mL) and DME (10 mL); flash chromatography on silica gel (PE:EA = 98:2) provided **S1f** (2.64 g, 8.37 mmol, 84% yield) as a yellow solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.03 (dd, *J* = 10.5, 8.9 Hz, 2H), 7.36 (d, *J* = 8.1 Hz, 2H), 4.29 (t, *J* = 10.3 Hz, 1H), 3.74 (dd, *J* = 17.6, 10.4 Hz, 1H), 3.58 (dd, *J* = 17.6, 10.2 Hz, 1H), 1.60 (s, 9H).

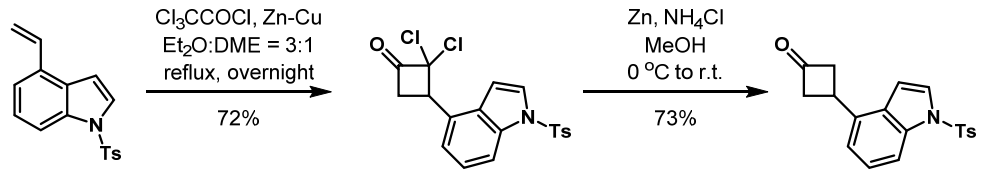
b) The substrate **1f** was prepared according to **General Procedure A**; using **S1f** (2.64 g, 8.37 mmol), NH_4Cl (10.1 g, 87.0 mmol), Zn (3.28 g, 50.4 mmol) and MeOH (20 mL); flash chromatography on silica gel (PE:EA = 95:5) provided **1f** (1.39 g, 5.65 mmol, 67% yield) as a colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.97 (d, *J* = 8.3 Hz, 2H), 7.34 (d, *J* = 8.2 Hz, 2H), 3.80-3.67 (m, 1H), 3.62-3.45 (m, 2H), 3.33-3.18 (m, 2H), 1.59 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 205.83, 165.41, 148.18, 130.52, 129.85, 126.34, 81.01, 54.66, 28.48, 28.16.

IR (neat, cm^{-1}): 3003, 2981, 2970, 2932, 2908, 2869, 1783, 1703, 1607, 1479, 1458, 1422, 1391. 1367, 1312, 1295, 1252, 1203, 1159, 1115, 1099, 1018, 1003.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{15}H_{19}O_3$, 247.1329; found, 247.1328.



3-(1-Tosyl-1*H*-indol-4-yl)cyclobutan-1-one (1i)

a) The substrate **S1i** was prepared according to **General Procedure A**; using 1-tosyl-4-vinyl-1*H*-indole (1.77 g, 5.92 mmol), Zn-Cu (1.15 g, 17.7 mmol), CCl_3COCl (3.22 g, 17.7 mmol), Et_2O (20 mL) and DME (7 mL); flash chromatography on silica gel (PE:EA = 10:1) provided **S1i** (1.76 g, 4.31 mmol, 72% yield) as a yellow solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.01 (t, *J* = 8.0 Hz, 1H), 7.79 (d, *J* = 8.4 Hz, 2H), 7.66 (dd, *J* = 7.1, 2.7 Hz, 1H), 7.35 (dt, *J* = 16.4, 8.1 Hz, 1H), 7.28-7.23 (m, 2H), 7.09 (d, *J* = 7.6 Hz, 1H), 6.94 (dd, *J* = 3.8, 0.7 Hz, 1H), 4.58-4.47 (m, 1H), 3.89 (dd, *J* = 17.9, 10.3 Hz, 1H), 3.64-3.43 (m, 1H), 2.36 (s, 3H).

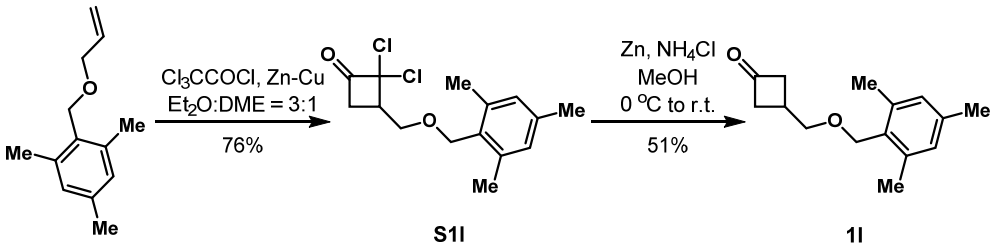
b) The substrate **1i** was prepared according to **General Procedure A**; using **S1i** (1.76 g, 4.31 mmol), NH_4Cl (2.30 g, 43.0 mmol), Zn (1.68 g, 25.8 mmol) and MeOH (15 mL); flash chromatography on silica gel (PE:EA = 3:1) provided **1i** (1.07 g, 3.15 mmol, 73% yield) as a colorless foam.

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.91 (d, *J* = 8.3 Hz, 1H), 7.78 (d, *J* = 8.4 Hz, 2H), 7.62 (t, *J* = 6.2 Hz, 1H), 7.31 (t, *J* = 7.9 Hz, 1H), 7.27-7.20 (m, 2H), 7.15 (d, *J* = 7.5 Hz, 1H), 6.64 (d, *J* = 3.7 Hz, 1H), 3.98-3.86 (m, 1H), 3.60-3.47 (m, 2H), 3.43-3.25 (m, 2H), 2.34 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 206.37, 145.06, 135.82, 135.20, 134.80, 129.92, 129.24, 126.87, 126.23, 124.69, 119.73, 112.11, 106.82, 53.68, 26.29, 21.56.

IR (neat, cm^{-1}): 3143, 3118, 3063, 3033, 2979, 2923, 1780, 1733, 1596, 1527, 1484, 1422, 1371, 1361, 1283, 1179, 1163, 1129, 1089, 1038, 1017.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{19}H_{17}NO_3S$, 339.0924; found, 339.0922.



3-(((2,4,6-Trimethylbenzyl)oxy)methyl)cyclobutan-1-one (1l)

a) The substrate **S1l** was prepared according to **General Procedure A**; using 3-(((2,4,6-trimethylbenzyl)oxy)methyl)cyclobutan-1-one (7.40 g, 39.0 mmol), Zn-Cu (7.60 g, 65.4 mmol), CCl_3COCl (14.2 g, 0.078 mmol), Et_2O (100 mL) and DME (30 mL); flash chromatography on silica gel (PE:EA = 15:1) provided **S1l** (8.96 g, 29.7 mmol, 76% yield) as a yellow solid. ^1H NMR (400 MHz, $CDCl_3$) δ (ppm): 6.86 (s, 2H), 4.57 (s, 2H), 3.87 (dd, *J* = 9.9, 6.4 Hz, 1H), 3.74-3.60 (m, 1H), 3.46-3.37 (m, 1H), 3.22-3.04 (m, 2H), 2.36 (s, 6H), 2.26 (s, 3H).

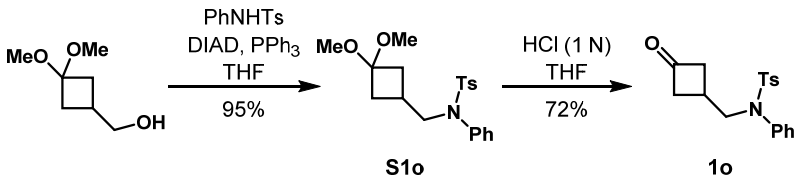
b) The substrate **1l** was prepared according to **General Procedure A**; using **S1l** (8.96 g, 29.7 mmol), NH_4Cl (16.0 g, 0.300 mol), Zn (11.8 g, 0.182 mol) and MeOH (100 mL); flash chromatography on silica gel (PE:EA = 10:1) provided **1l** (3.55 g, 15.3 mmol, 51% yield) as a white solid.

^1H NMR (400 MHz, $CDCl_3$) δ (ppm): 6.86 (s, 2H), 4.56 (d, *J* = 8.5 Hz, 2H), 3.86 (dt, *J* = 18.4, 9.2 Hz, 2H), 3.75-3.65 (m, 2H), 3.51-3.33 (m, 2H), 3.23-3.02 (m, 1H), 2.35 (s, 6H), 2.26 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 207.61, 137.72, 137.68, 130.92, 128.98, 72.91, 67.10, 50.06, 23.65, 20.94, 19.53.

IR (neat, cm^{-1}): 3055, 2970, 2915, 2872, 1778, 1611, 1582, 1434, 1379, 1358, 1317, 1266, 1214, 1146, 1108, 1083, 1031, 1016.

HRMS-ESI (*m*/*z*): $[M+NH_4]^+$ calcd. for $C_{15}H_{24}NO_2$, 250.1802; found, 250.1798.



4-Methyl-N-((3-oxocyclobutyl)methyl)-N-phenylbenzenesulfonamide (1o)

A flame-dried 250 mL round-bottom flask was charged with (3,3-dimethoxycyclobutyl)methanol (1.32 g, 8.90 mol), phenyl toluenesulfonamide (2.65 g, 10.7 mmol), PPh_3 (2.83 g, 10.7 mmol) and 50 mL of THF. DIAD (2.10 mL, 2.16 g, 10.7 mmol) was added dropwise at 0 °C. After stirring for 17 h, the reaction mixture was concentrated, diluted with PE and Et_2O (1:1, 50 mL) and stirred for 10 min. The resultant mixture was filtered through a pad of celite, and rinsed with PE and Et_2O. The filtrate was then concentrated under vacuum, and purified by column chromatography on silica gel (PE:EA = 5:1) to afford **S1o** (3.18 g, 8.47 mmol, 95% yield) as a colorless oil, which was directly submitted to next step without further characterization. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.50-7.42 (m, 2H), 7.31-7.26 (m, 3H), 7.24 (d, *J* = 8.0 Hz, 2H), 7.03-6.94 (m, 2H), 3.59 (d, *J* = 7.3 Hz, 2H), 3.09 (s, 3H), 3.07 (s, 3H), 2.41 (s, 3H), 2.18-2.00 (m, 3H), 1.84-1.74 (m, 2H).

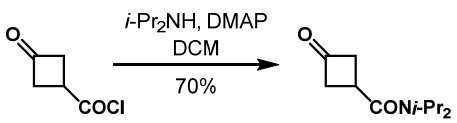
b) To a solution of **S1o** (3.18 g, 8.47 mmol) in 40 mL THF was added 2 M aqueous solution of HCl (85 mL, 85.0 mmol). After stirring for 6 h at room temperature, the solvent was removed under vacuum. A saturated aqueous solution of $NaHCO_3$ was added until pH=7, the aqueous phase was extracted with EA three times. The combined organic phase was washed with brine, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 5:1) to afford the product **1o** (2.01 g, 6.10 mmol, 72% yield) as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.47 (d, *J* = 8.3 Hz, 1H), 7.37-7.30 (m, 2H), 7.26 (d, *J* = 7.8 Hz, 3H), 7.07-6.99 (m, 2H), 3.73 (d, *J* = 7.7 Hz, 2H), 3.09-2.95 (m, 2H), 2.89-2.75 (m, 2H), 2.52-2.45 (m, 2H), 2.43 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 206.05, 143.63, 138.98, 135.00, 129.46, 129.20, 128.78, 128.27, 127.63, 55.07, 50.64, 22.89, 21.51.

IR (neat, cm^{-1}): 2967, 2901, 1786, 1593, 1488, 1475, 1451, 1394, 1377, 1339, 1309, 1230, 1161, 1100, 1089, 1049, 1026, 1011.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{18}H_{19}NO_3S$, 329.1080; found, 329.1078.



1p

***N,N*-Diisopropyl-3-oxocyclobutane-1-carboxamide (1p)**

A flame-dried 250 mL round-bottom flask was charged with 3-oxocyclobutane-1-carbonyl chloride (10.0 g, 75.5 mmol), DMAP (0.922 g, 7.55 mmol) and DCM (80 mL). *i*-Pr$_2$NH (60.0 mL, 38.8 g, 0.383 mol) was added dropwise under 0 °C. The resultant mixture was allowed to stir at room temperature for 20 h. Then the

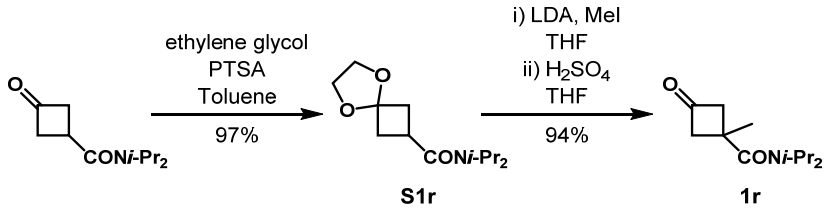
mixture was quenched with water (100 mL), the resultant was extracted with DCM. The combined organic phase was washed with brine, dried over Na_2SO_4, to afford **1p** (11.4 g, 57.8 mmol, 77% yield) as a faint yellow solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 4.02-3.88 (m, 1H), 3.57-3.39 (m, 3H), 3.31-3.18 (m, 1H), 3.15-3.03 (m, 2H), 1.36 (d, *J* = 6.8 Hz, 6H), 1.19 (d, *J* = 6.7 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 204.87, 170.72, 50.65, 48.35, 45.86, 27.28, 20.97, 20.45.

IR (neat, cm^{-1}): 2976. 2941, 2922, 2915, 2888, 1779, 1619, 1504, 1472, 1445, 1370, 1352, 1324, 1293, 1265, 1209, 1202, 1141, 1121, 1103, 1049, 1030.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{11}H_{20}NO_2$, 198.1489; found, 198.1487.



_N,N_-Diisopropyl-1-methyl-3-oxocyclobutane-1-carboxamide (1r)

a) To a round-bottom flask was charged with *N,N*-diisopropyl-3-oxocyclobutane-1-carboxamide (2.00 g, 10.1 mmol), ethylene glycol (0.9 mL, 0.943 g, 15.2 mmol), *p*-toluenesulfonic acid monohydrate (9.63 mg, 5.07 mmol) and toluene (50 ml). The flask was fitted with a Dean Stark trap and the reaction was heated to reflux for 10 h. The resultant mixture was cooled down to room temperature, diluted with water, and the aqueous phase was extracted with DCM. The combined organic phase was dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 4:1) to afford the product **S1r** (2.52 g, 9.87 mmol, 97% yield) as a yellow oil, which was directly submitted to next step without further characterization. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 3.97-3.80 (m, 5H), 2.93 (p, *J* = 8.8 Hz, 1H), 2.71-2.61 (m, 2H), 2.44-2.33 (m, 2H), 1.37 (d, *J* = 6.8 Hz, 6H), 1.28-1.19 (m, 1H), 1.15 (d, J = 6.7 Hz, 6H).

b) A flame-dried 500 mL round-bottom flask was charged with *i*-Pr_2NH (7.4 mL, 5.34 g, 52.8 mmol) and THF (140 mL), and *n*-BuLi (2.28 M, 21.9 mL, 49.9 mmol) was added dropwise under −78 °C. The reaction mixture was stirred for 1 h before **S1r** (6.00 g, 24.9 mmol) in THF (60 mL) was added dropwise. The reaction was stirred at the same temperature for 1 h before warmed to 0 °C. After additional 1 h, the mixture was then again cooled down to −78 °C. MeI (7.8 mL, 17.8 g, 0.125 mol) was then added dropwise. After stirring for 0.5 h at −78 °C and 1 h at 0 °C, the reaction was quenched with a saturated aqueous solution of NH_4Cl, and extracted

with DCM. The combined organic phase was concentrated, and directly submitted to next step without purification.

c) The resultant crude product above was dissolved in THF (100 mL) in a 100 mL round-bottom flask, an aqueous solution of H_2SO_4 (1.0 M, 100 mL, 0.100 mol) was added at 0 ºC. The resultant mixture was stirred for 0.5 h before warmed to room temperature. After 20 h, the reaction mixture was extracted with DCM, the combined organic phase was washed with a saturated aqueous solution of $NaHCO_3$ and brine sequentially, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 10:1) to afford the product **2r** (4.98 g, 23.4 mmol, 94% yield) as a faint yellow solid.

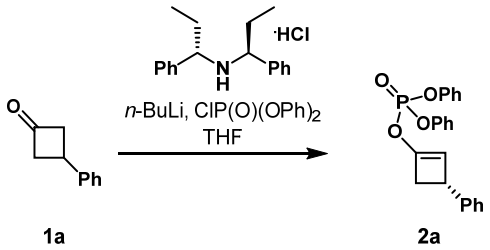
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 3.77-3.65 (m, 1H), 3.62-3.53 (m, 2H), 3.36-3.22 (m, 1H), 2.81-2.68 (m, 2H), 1.48 (s, 3H), 1.37 (d, *J* = 6.8 Hz, 6H), 1.17 (d, *J* = 6.6 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 206.27, 173.23, 57.10, 49.12, 46.33, 35.79, 24.58, 20.57, 20.40.

IR (neat, cm^{-1}): 3022, 2999, 2966, 2935, 2877, 1782, 1619, 1470, 1460, 1438, 1373, 1333, 1238, 1213, 1189, 1168, 1135, 1116, 1039.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{12}H_{22}NO_2$, 212.1645; found, 212.1643.

b) Synthesis of Cyclobutene 2:



1a 2a

General Procedure B：

(*R*)-Diphenyl (3-phenylcyclobut-1-en-1-yl) phosphate (2a)

A flame-dried 25 mL Schlenk tube was charged with hydrochloride salt of chiral amine CA-9·HCl (0.127 g, 0.440 mmol) and THF (1.2 mL). The resultant was cooled down to −78 ℃, and *n*-BuLi (2.28 M in hexane, 0.39 mL, 0.880 mmol) was added dropwise. The mixture was stirred for 5 min before warmed to room temperature. The mixture was then stirred for additional 15 min until the solution became clear. Then the reaction was cooled down to −90 ℃, and a solution of 3-phenylcyclobutan-1-one (58.5 mg, 0.400 mmol) in THF (0.5 mL + 0.3 mL + 0.2 mL) was added over 0.5 h. After stirring for additional 30 min, $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol) was added dropwise over 10 min. The reaction mixture was then stirred for

0.5 h at −90 ℃ before warmed to −78 ℃. After further 3.5 h, the reaction was quenched with THF-MeOH (3:1, 0.4 mL), and followed by 2 M aqueous solution of HCl. The resultant was extracted with ethyl acetate, and the combined organic phase was washed with a saturated aqueous solution of $NaHCO_3$ and brine sequentially, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 10:1) to afford the product **2a** (0.115 g, 0.308 mmol, 76% yield) as a colorless oil.

Ee: 94% (Chiralcel® OJ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=14.2min (major); t_2=16.2 min (minor).

$[\alpha]_D^{18}$ 7.58 (c 0.81, $CHCl_3$).

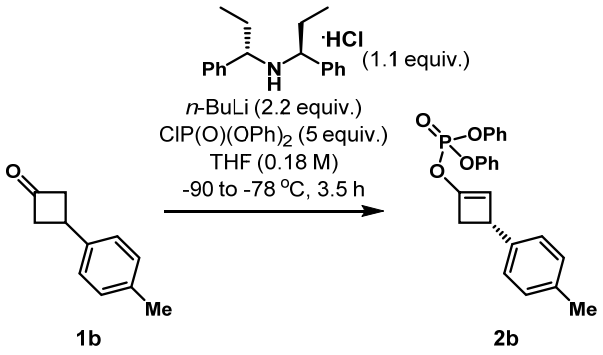
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.46–7.36 (m, 4H), 7.36–7.22 (m, 11H), 5.47 (s, 1H), 3.75–3.67 (m, 1H), 3.33 (dd, *J* = 13.3, 4.5 Hz, 1H), 2.64 (d, *J* = 13.3 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.25 (d, *J* = 7.3 Hz), 142.06 (d, *J* = 9.8 Hz), 142.06, 129.88, 128.36, 126.60, 126.54, 125.68, 120.02 (d, *J* = 4.8 Hz), 120.01 (d, *J* = 5.0 Hz), 113.81 (d, *J* = 7.8 Hz), 42.90 (d, *J* = 5.6 Hz), 37.76.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.16.

IR (neat, cm^{-1}): 3062, 3028, 2970, 2931, 1645, 1630, 1589, 1300, 1180, 1161.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{22}H_{19}O_4P$, 378.1015; found, 378.1009.



(*R*)-Diphenyl (3-(p-tolyl)cyclobut-1-en-1-yl) phosphate (2b)

According to **General Procedure B**, using **1b** (64.0 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 5:1) afforded **2b** (0.155 g, 0.332 mmol, 85% yield) as a colorless oil.

Ee: 93% (Chiralcel® OD-H; 5% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=10.5 min (major); t_2=11.8 min (minor).

$[\alpha]_D^{25}$ 11.44 (c 0.50, $CHCl_3$).

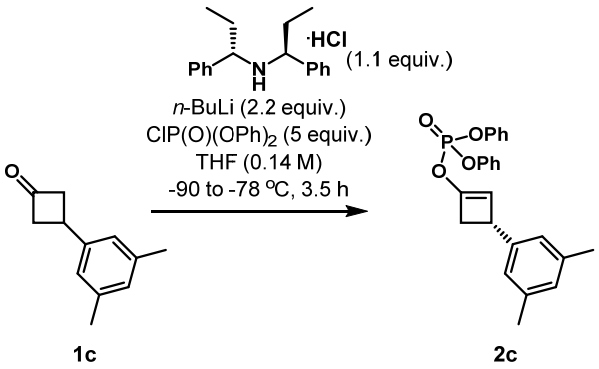
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.41-7.32 (m, 4H), 7.30-7.19 (m, 7H), 7.15-7.02 (m, 3H), 5.40 (s, 1H), 3.64 (d, *J* = 3.4 Hz, 1H), 3.27 (ddd, *J* = 13.2, 4.5, 1.5 Hz, 1H), 2.57 (d, *J* = 13.2 Hz, 1H), 2.32 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.29 (d, *J* = 7.3 Hz), 141.98 (d, *J* = 9.9 Hz), 139.04, 136.19, 129.89, 129.06, 126.46, 125.68, 120.05 (d, *J* = 4.9 Hz), 120.04 (d, *J* = 5.0 Hz), 113.97 (d, *J* = 7.8 Hz), 42.99 (d, *J* = 5.6 Hz), 37.47, 21.02.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.19.

IR (neat, cm^{-1}): 3070, 3044, 3014, 2973, 2941, 2990, 2837, 1786, 1716, 1645, 1631, 1590, 1488, 1310, 1219, 1812, 1611, 1025, 1009.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{23}H_{21}O_4P$, 392.1172; found, 392.1167.



(*R*)-3-(3,5-Dimethylphenyl)cyclobut-1-en-1-yl diphenyl phosphate (2c)

According to **General Procedure B**, using **1c** (47.4 mg, 0.272 mmol), CA-9·HCl (96.0 mg, 0.33 mmol), *n*-BuLi (2.25 M in hexane, 0.29 mL, 0.66 mmol) and $ClP(O)(OPh)_2$ (0.31 mL, 0.40 g, 1.50 mmol); flash chromatography on silica gel (PE:EA = 95:5) afforded **2c** (97.4 mg, 0.240 mmol, 88% yield) as a colorless oil. Ee: 93% (Chiralcel® OJ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=7.0 min (major); t_2=8.2 min (minor).

$[\alpha]_D^{24}$ 8.70 (c 1.0, $CHCl_3$).

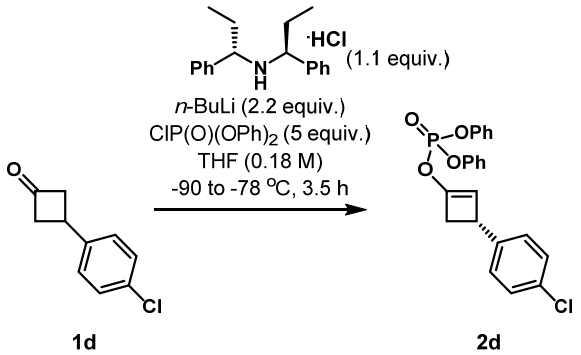
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.45-7.30 (m, 4H), 7.30-7.17 (m, 6H), 6.85 (s, 3H), 5.41 (s, 1H), 3.63-3.59 (m, 1H), 3.26 (ddd, *J* = 13.2, 4.5, 1.5 Hz, 1H), 2.59 (d, *J* = 13.2 Hz, 1H), 2.28 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.27 (d, *J* = 7.3 Hz), 142.00, 141.87 (d, *J* = 9.9 Hz), 137.91, 129.87, 128.27, 125.67, 124.34, 120.02 (d, *J* = 4.9 Hz), 120.01 (d, *J* = 4.9 Hz), 113.89 (d, *J* = 7.8 Hz) , 42.82 (d, *J* = 5.6 Hz), 37.64, 21.22.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.20.

IR (neat, cm^{-1}): 3072, 3043, 3013, 2973, 2943, 2910, 2835, 1786, 1716, 1646, 1631, 1590, 1489, 1313, 1302, 1219, 1184, 1161, 1051, 1026, 1010.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{24}H_{23}O_4P$, 407.1407; found, 407.1406.



(*R*)-3-(4-Chlorophenyl)cyclobut-1-en-1-yl diphenyl phosphate (2d)

According to **General Procedure B**, using **1d** (76.0 mg, 0.421 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 95:5) afforded **2d** (0.132 g, 0.320 mmol, 80% yield) as a colorless oil. Ee: 93% (Chiralcel® OJ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=18.0 min (major); t_2=26.4 min (minor).

$[\alpha]_D^{25}$ 12.74 (c 1.0, $CHCl_3$).

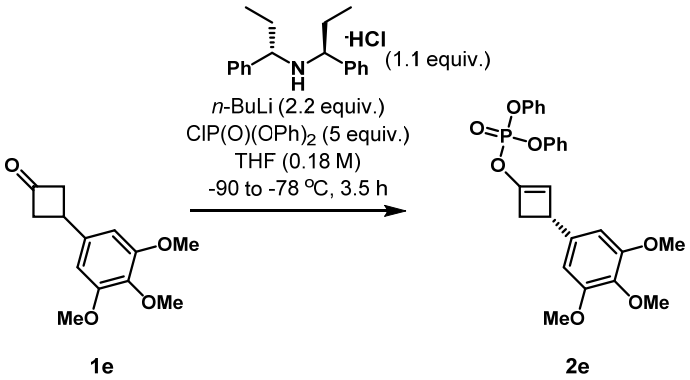
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.37 (t, *J* = 7.9 Hz, 4H), 7.32-7.19 (m, 8H), 7.17-7.11 (d, *J* = 8.4 Hz, 2H), 5.38 (s, 1H), 3.64 (d, *J* = 3.7 Hz, 1H), 3.28 (ddd, *J* = 13.3, 4.5, 1.4 Hz, 1H), 2.54 (d, *J* = 13.3 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.23 (d, *J* = 7.2 Hz), 142.35 (d, *J* = 9.7 Hz), 140.61, 132.27, 129.92, 128.49, 127.93, 125.75, 120.02 (d, *J* = 5.0 Hz), 120.01 (d, *J* = 5.1 Hz), 113.48 (d, *J* = 7.9 Hz), 42.95 (d, *J* = 5.7 Hz), 37.20.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.21.

IR (neat, cm^{-1}): 3070, 2974, 2941, 2899, 2839, 1786, 1716, 1646, 1631, 1590, 1489, 1409, 1312, 1300, 1181, 1161, 1090, 1026, 1010.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{22}H_{18}ClO_4P$, 413.0704; found, 413.0700.



1e **2e**

(*R*)-Diphenyl (3-(3,4,5-trimethoxyphenyl)cyclobut-1-en-1-yl) phosphate (2e)

According to **General Procedure B**, using **1e** (95.0 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.28 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 5:1) afforded **2e** (0.136 g, 0.290 mmol, 73% yield) as a colorless oil.

Ee: 88% (Chiralcel® OZ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=43.8 min (major); t_2=51.6 min (minor).

$[\alpha]_D^{22}$ 1.54 (c 1.0, $CHCl_3$).

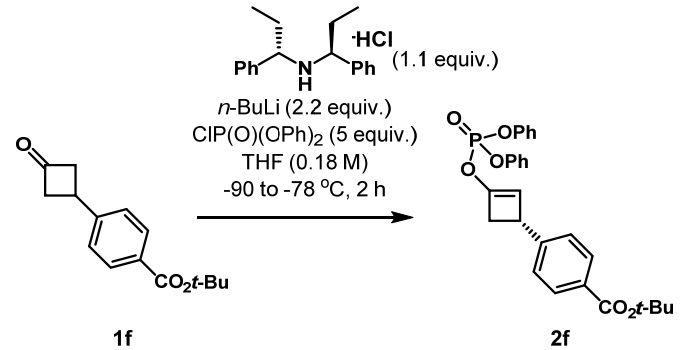
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.37 (t, *J* = 7.8 Hz, 4H), 7.29-7.20 (m, 6H), 6.47 (s, 2H), 5.42 (s, 1H), 3.82 (s, 3H), 3.81 (s, 6H), 3.63 (s, 1H), 3.32-3.23 (m, 1H), 2.61 (d, *J* = 13.2 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 153.26, 150.26 (d, *J* = 7.2 Hz), 142.35 (d, *J* = 9.8 Hz), 137.94, 136.70, 129.91, 125.74, 119.99 (d, *J* = 4.9 Hz), 119.98 (d, *J* = 5.0 Hz) 113.69 (d, *J* = 7.7 Hz), 103.37, 60.82, 56.04, 43.09 (d, *J* = 5.5 Hz), 38.13.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.16.

IR (neat, cm^{-1}): 3077, 2972, 2940, 2911, 2840, 1783, 1645, 1631, 1588, 1506, 1488, 1457, 1418, 1342, 1313, 1301, 1234, 1183, 1162, 1123, 1025, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{25}H_{26}O_7P$, 469.1411; found, 469.1403.



1f **2f**

***tert*-Butyl (*R*)-4-(3-((diphenoxyphosphoryl)oxy)cyclobut-2-en-1-yl)benzoate (2f)**

According to **General Procedure B**, using **1f** (98.5 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-

BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and ClP(O)(OPh)$_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 5:1) afforded **2f** (0.159 g, 0.332 mmol, 83% yield) as a colorless oil.

Ee: 90% (Chiralcel® OD-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=20.5 min (major); t_2=23.9 min (minor).

$[\alpha]_D^{22}$ 12.57 (c 0.81, $CHCl_3$).

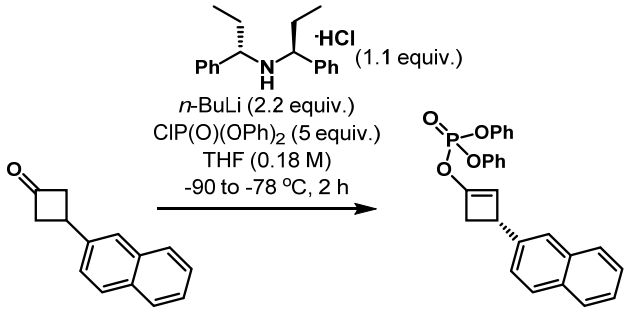
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.90 (d, *J* = 8.3 Hz, 2H), 7.37 (t, *J* = 7.8 Hz, 4H), 7.30-7.20 (m, 8H), 5.42 (s, 1H), 3.76-3.67 (m, 1H), 3.31 (ddd, *J* = 13.3, 4.5, 1.5 Hz, 1H), 2.57 (d, *J* = 13.3 Hz, 1H), 1.59 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 165.62, 150.22 (d, *J* = 7.1 Hz), 150.18, 146.96, 142.35 (d, *J* = 9.7 Hz), 130.47, 129.91, 129.57, 126.39, 125.75, 120.01 (d, *J* = 5.0 Hz), 120.00 (d, *J* = 4.9 Hz), 113.40 (d, *J* = 7.8 Hz), 80.83, , 42.82 (d, *J* = 5.8 Hz), 37.69, 28.17.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.21.

IR (neat, cm^{-1}): 3070, 3005, 2976, 2932, 1708, 1645, 1631, 1590, 1488, 1456, 1415, 1392, 1368, 1309, 1291, 1220, 1182, 1161, 1115, 1102, 1082, 1025, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{27}H_{27}O_6P$, 479.1618; found, 479.1613.



1g **2g**

(*R*)-3-(Naphthalen-2-yl)cyclobut-1-en-1-yl diphenyl phosphate (2g)

According to **General Procedure B**, using **1g** (78.5 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and ClP(O)(OPh)$_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 10:1) afforded **2g** (0.134 g, 0.313 mmol, 78% yield) as a colorless oil.

Ee: 92% (Chiralcel® OJ-H; 40% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=20.8 min (major); t_2=26.3 min (minor).

$[\alpha]_D^{26}$ 19.54 (c 1.0, $CHCl_3$).

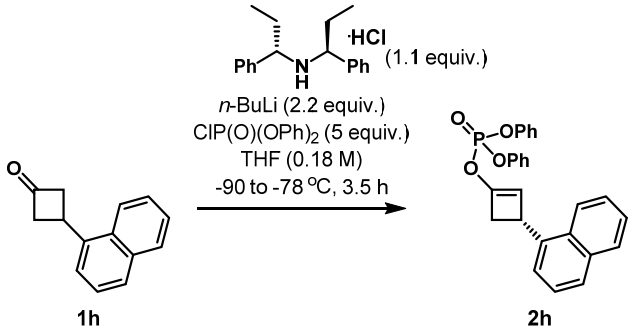
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.82-7.73 (m, 3H), 7.66 (s, 1H), 7.48-7.19 (m, 13H), 5.51 (s, 1H), 3.87-3.81 (m, 1H), 3.35 (ddd, *J* = 13.3, 4.5, 1.5 Hz, 1H), 2.67 (d, *J* = 13.3 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.28 (d, *J* = 7.2 Hz), 142.22 (d, *J* = 9.8 Hz), 139.59, 133.39, 132.46, 129.91, 128.11, 127.59, 127.51, 126.05, 125.72, 125.44, 124.99, 124.92, 120.05 (d, *J* = 5.0 Hz), 113.81 (d, *J* = 7.8 Hz), 42.82 (d, *J* = 5.7 Hz), 37.95.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.15.

IR (neat, cm^{-1}): 3094, 3054, 3015, 2978, 2928, 1652, 1625, 1587, 1485, 1456, 1308, 1292, 1220, 1184, 1163, 1124, 1071, 1024, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{26}H_{22}O_4P$, 429.1250; found, 429.1246.



(*R*)-3-(Naphthalen-1-yl)cyclobut-1-en-1-yl diphenyl phosphate (2h)

According to **General Procedure B**, using **1h** (81.0 mg, 0.413 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 10:1) afforded **2h** (0.153 g, 0.313 mmol, 86% yield) as a colorless oil. Ee: 93% (Chiralcel® OD-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=12.1 min (major); t_2=14.1 min (minor).

$[\alpha]_D^{24}$ -171.82 (c 1.0, $CHCl_3$).

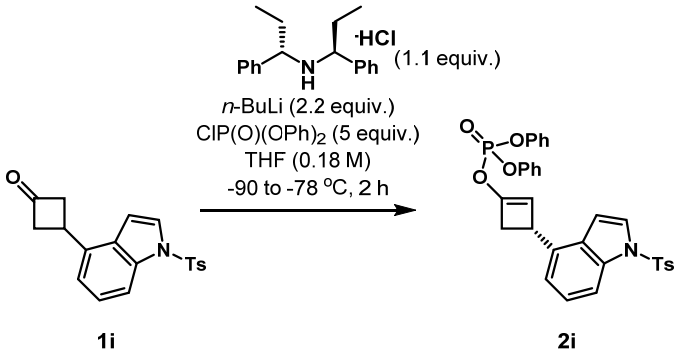
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.00-7.93 (m, 1H), 7.89-7.85 (m, 1H), 7.74 (d, *J* = 8.1 Hz, 1H), 7.55-7.46 (m, 2H), 7.44-7.17 (m, 12H), 5.67 (s, 1H), 4.34 (d, *J* = 3.6 Hz, 1H), 3.53 (ddd, *J* = 13.0, 4.6, 1.5 Hz, 1H), 2.62 (d, *J* = 13.0 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.27 (d, *J* = 7.4 Hz), 150.25 (d, *J* = 7.2 Hz), 141.92 (d, *J* = 9.8 Hz), 138.11, 133.52, 131.59, 129.89, 128.77, 127.17, 126.01, 125.70, 125.65, 125.37, 123.31, 123.10, 120.07 (d, *J* = 4.9 Hz), 120.05 (d, *J* = 5.0 Hz), 111.80 (d, *J* = 7.8 Hz), 42.08 (d, *J* = 5.8 Hz), 34.93.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.13.

IR (neat, cm^{-1}): 3062, 3064, 2974, 2942, 2900, 2834, 1786, 1716, 1647, 1634, 1590, 1488, 1457, 1396, 1301, 1219, 1184, 1161, 1072, 1025, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{26}H_{22}O_4P$, 429.1250; found, 429.1247.



1i **2i**

(*R*)-Diphenyl (3-(1-tosyl-1H-indol-4-yl)cyclobut-1-en-1-yl) phosphate (2i)

According to **General Procedure B**, using **1i** (0.136 g, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.28 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 95:5) afforded **2i** (91.0 mg, 0.159 mmol, 40% yield) as a colorless oil. Ee: 93% (Chiralcel® AD-H; 40% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=34.8 min (major); t_2=38.3 min (minor).

$[\alpha]_D^{23}$ -19.78 (c 1.0, $CHCl_3$).

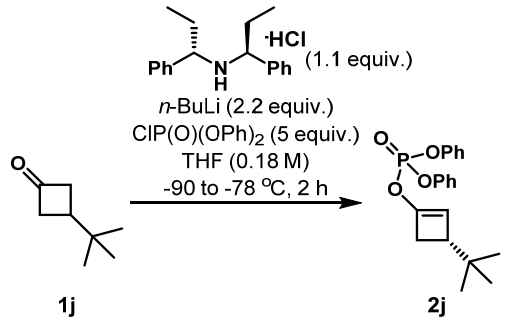
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.86 (d, *J* = 8.3 Hz, 1H), 7.78-7.73 (m, 2H), 7.55 (d, *J* = 3.7 Hz, 1H), 7.39-7.31 (m, 4H), 7.28-7.18 (m, 9H), 7.07 (d, *J* = 7.4 Hz, 1H), 6.72 (dd, *J* = 3.7, 0.6 Hz, 1H), 5.49 (s, 1H), 3.97-3.93 (m, 1H), 3.34 (ddd, *J* = 13.2, 4.5, 1.5 Hz, 1H), 2.66 (d, *J* = 13.2 Hz, 1H), 2.33 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.21 (d, *J* = 7.3 Hz), 144.91, 142.01 (d, *J* = 9.8 Hz), 135.25, 134.83, 134.68, 129.89, 129.86, 129.16, 126.82, 125.99, 125.72, 124.53, 120.53, 120.01 (d, *J* = 4.9 Hz), 120.00 (d, *J* = 4.9 Hz), 112.95 (d, *J* = 7.8 Hz), 111.95, 106.79, 41.89 (d, *J* = 5.7 Hz), 35.57, 21.53.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.15.

IR (neat, cm^{-1}): 3061, 2043, 2977, 2938, 1786, 1730, 1646, 1631, 1590, 1527, 1487, 1421, 1372, 1301, 1282, 1179, 1161, 1130, 1089, 1025, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{31}H_{27}NO_6PS$, 572.1291; found, 572.1290.



(*R*)-3-(*tert*-Butyl)cyclobut-1-en-1-yl diphenyl phosphate (2j)

According to **General Procedure B**, using **1j** (50.5 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 98:2) afforded **2j** (0.103 g, 0.288 mmol, 72% yield) as a colorless oil. Ee: 87% (Chiralcel® AD-H; 5% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=20.0 min (minor); t_2=23.5 min (major).

$[\alpha]_D^{21}$ 11.24 (c 1.0, $CHCl_3$).

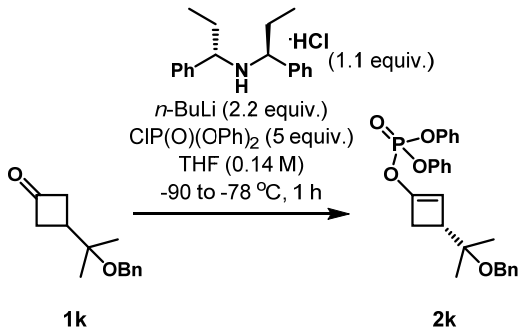
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.39-7.32 (m, 4H), 7.27-7.18 (m, 6H), 5.18 (s, 1H), 2.68 (ddd, *J* = 13.4, 4.4, 1.6 Hz, 1H), 2.45 (d, *J* = 13.4 Hz, 1H), 2.34 (s, 1H), 0.87 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.32 (d, *J* = 7.3 Hz), 141.50 (d, *J* = 10.2 Hz), 129.83, 125.57, 120.02 (d, *J* = 5.0 Hz), 112.82 (d, *J* = 7.7 Hz), 44.76, 34.31 (d, *J* = 5.6 Hz), 31.21, 26.43.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.12.

IR (neat, cm^{-1}): 3072, 2957, 2867, 1642, 1627, 1590, 1489, 1365, 1313, 1301, 1285, 1221, 1180, 1161, 1071, 1025, 1009.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{20}H_{23}O_4P$, 358.1328; found, 358.1328.



(*R*)-3-(2-(Benzyloxy)propan-2-yl)cyclobut-1-en-1-yl diphenyl phosphate (2k)

According to **General Procedure B**, using **1k** (89.6 mg, 0.410 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash

chromatography on silica gel (PE:EA = 10:1) afforded **2k** (0.133 g, 0.295 mmol, 74% yield) as a colorless oil. Ee: 90% (Chiralcel® OD-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=14.0 min (major); t_2=24.0 min (minor).

$[\alpha]_D^{24}$ 7.76 (c 1.0, $CHCl_3$).

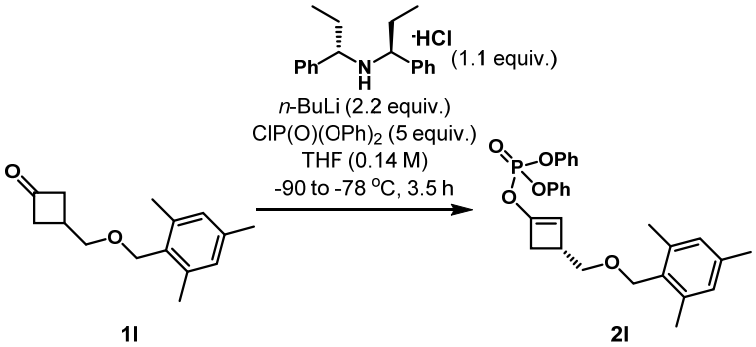
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.31-7.20 (m, 8H), 7.20-7.08 (m, 7H), 5.15 (s, 1H), 4.40 (s, 1H), 2.79-2.67 (m, 2H), 2.62-2.56 (m, 1H), 1.16 (d, *J* = 2.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.26 (d, *J* = 7.3 Hz), 142.06 (d, *J* = 9.9 Hz), 139.80, 129.85, 128.24, 127.09, 125.62, 120.03 (d, *J* = 5.0 Hz), 112.02 (d, *J* = 7.8 Hz), 75.47, 64.11, 42.93, 34.88 (d, *J* = 5.7 Hz), 22.75, 22.11.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.17.

IR (neat, cm^{-1}): 3062, 2973, 2901, 2833, 1786, 1711, 1631, 1590, 1489, 1313, 1220, 1185, 1160, 1054, 1026, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{26}H_{28}O_5P$, 451.1671; found, 451.1671.



(*R*)-Diphenyl (3-(((2,4,6-trimethylbenzyl)oxy)methyl)cyclobut-1-en-1-yl) phosphate (2l)

According to **General Procedure B**, using **1l** (93.0 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 10:1) afforded **2l** (0.153 g, 0.329 mmol, 83% yield) as a colorless oil. Ee: 81% (Chiralcel® OJ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=14.5 min (major); t_2=16.8 min (minor).

$[\alpha]_D^{24}$ 15.80 (c 1.0, $CHCl_3$).

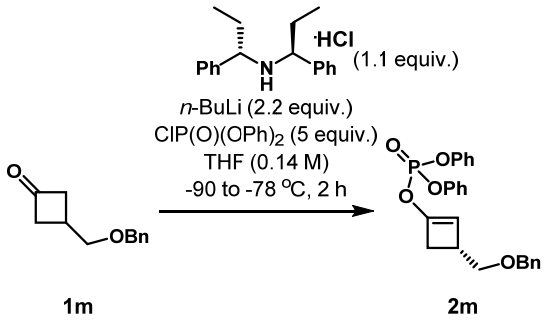
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.38-7.29 (m, 4H), 7.25-7.17 (m, 6H), 6.83 (s, 2H), 5.22 (s, 1H), 4.49 (s, 2H), 3.47 (ddd, *J* = 16.6, 9.3, 6.9 Hz, 2H), 2.90 (ddd, *J* = 13.5, 4.2, 1.4 Hz, 1H), 2.79-2.69 (m, 1H), 2.40 (d, *J* = 13.5 Hz, 1H), 2.33 (s, 6H), 2.24 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.22 (d, *J* = 7.3 Hz), 141.99 (d, *J* = 9.9 Hz), 137.69, 137.54, 131.11, 129.83, 128.92, 125.63, 125.62, 120.02 (d, *J* = 4.9 Hz), 112.38 (d, *J* = 7.9 Hz), 73.42, 67.13, 36.96 (d, *J* = 5.8 Hz), 33.57, 20.92, 19.50.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.25.

IR (neat, cm^{-1}): 3069, 2974, 2940, 2901, 2483, 1791, 1716, 1642, 1629, 1590, 1489, 1313, 1302, 1220, 1185, 1161, 1083, 1053, 1026, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{27}H_{29}O_5P$, 465.1825; found, 465.1825.



1m **2m**

(*R*)-3-((Benzyloxy)methyl)cyclobut-1-en-1-yl diphenyl phosphate (2m)

According to **General Procedure B**, using **1m** (76.1 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.44 M in hexane, 0.36 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 10:1) afforded **2m** (0.136 g, 0.322 mmol, 81% yield) as a colorless oil.

Ee: 83% (Chiralcel® OJ-H; 5% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=27.4 min (minor); t_2=29.2 min (major).

$[\alpha]_D^{24}$ 20.02 (c 1.0, $CHCl_3$).

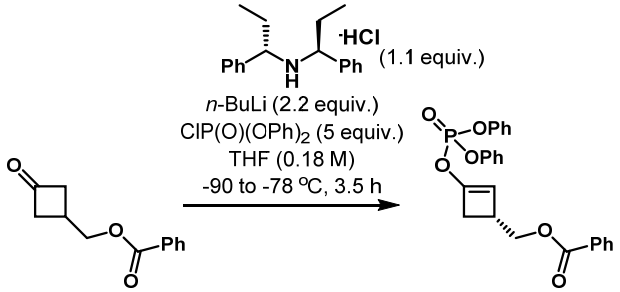
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.38-7.26 (m, 9H), 7.27-7.17 (m, 6H), 5.24 (s, 1H), 4.52 (s, 2H), 3.47 (ddd, *J* = 26.0, 9.4, 7.0 Hz, 2H), 2.95-2.87 (m, 1H), 2.82-2.73 (m, 1H), 2.43 (d, *J* = 13.5 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.24 (d, *J* = 7.3 Hz), 142.02 (d, *J* = 9.7 Hz), 138.29, 129.85, 128.38, 127.65, 127.62, 125.65, 120.04 (d, *J* = 5.0 Hz), 112.30 (d, *J* = 7.9 Hz), 73.40, 73.18, 36.86 (d, *J* = 5.8 Hz), 33.54.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.17.

IR (neat, cm^{-1}): 3062, 3029, 2978, 2936, 2865, 2848, 1783, 1723, 1702, 1641, 1626, 1589, 1488, 1455, 1311, 1301, 1219, 1184, 1160, 1093, 1025, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{24}H_{24}O_5P$, 423.1356; found, 423.1350.



1n **2n**

(*R*)-(3-((Diphenoxyphosphoryl)oxy)cyclobut-2-en-1-yl)methyl benzoate (2n)

According to **General Procedure B**, using **1n** (81.8 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.49 M in hexane, 0.35 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 6:1) afforded **2n** (0.110 g, 0.252 mmol, 63% yield) as a colorless oil.

Ee: 81% (Chiralcel® OJ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=39.2 min (major); t_2=43.9 min (minor).

$[\alpha]_D^{20}$ 16.69 (c 0.58, $CHCl_3$).

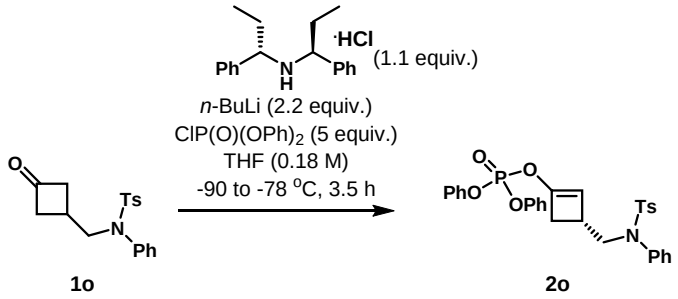
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.03 (d, *J* = 7.6 Hz, 1H), 7.55 (t, *J* = 7.4 Hz, 1H), 7.41 (t, *J* = 7.7 Hz, 1H), 7.35 (t, *J* = 7.8 Hz, 2H), 7.27-7.17 (m, 3H), 5.27 (s, 1H), 4.42-4.27 (m, 1H), 3.05-2.86 (m, 1H), 2.59 (d, *J* = 13.4 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 166.44, 150.19 (d, *J* = 7.2 Hz), 142.26 (d, *J* = 9.8 Hz), 132.96, 130.10, 129.88, 129.57, 128.34, 125.72, 120.01 (d, *J* = 4.9 Hz), 111.47 (d, *J* = 7.9 Hz), 67.18, 36.54 (d, *J* = 5.9 Hz), 32.61.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.25.

IR (neat, cm^{-1}): 3060, 2982, 2949, 2882, 2829, 1716, 1629, 1588, 1488, 1452, 1313, 1269, 1183, 1160, 1110, 1070, 1025, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{24}H_{22}O_6P$, 437.1149; found, 437.1141.



(*R*)-3-(((4-Methyl-N-phenylphenyl)sulfonamido)methyl)cyclobut-1-en-1-yl diphenyl phosphate (2o)

According to **General Procedure B**, using **1o** (0.264 g, 0.800 mmol), CA-9·HCl (0.255 g, 0.880 mmol), *n*-BuLi (2.49 M in hexane, 0.71 mL, 1.76 mmol) and $ClP(O)(OPh)_2$ (0.84 mL, 1.08 g, 4.00 mmol); flash chromatography on silica gel (PE:Acetone = 6:1) afforded **2o** (0.369g, 0.657 mmol, 82% yield) as a white solid.

Ee: 90% (Chiralcel® IA; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=87.9 min (major); t_2=94.9 min (minor).

$[\alpha]_D^{23}$ 17.12 (c 0.5, $CHCl_3$).

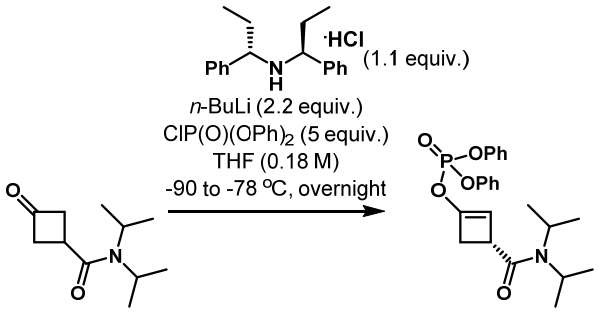
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.46 (d, *J* = 8.1 Hz, 2H), 7.35 (t, *J* = 7.2 Hz, 4H), 7.31-7.27 (m, 3H), 7.25 (d, *J* = 4.0 Hz, 2H), 7.21 (t, *J* = 8.7 Hz, 6H), 7.05-6.99 (m, 2H), 4.99 (s, 1H), 3.59 (d, *J* = 7.1 Hz, 2H), 2.79 (dd, *J* = 13.6, 3.7 Hz, 1H), 2.59 (d, *J* = 4.5 Hz, 1H), 2.42 (s, 3H), 2.38 (d, *J* = 13.7 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.15 (d, *J* = 7.3 Hz), 143.41, 141.85 (d, *J* = 9.9 Hz), 139.44, 135.23, 129.86, 129.39, 129.06, 128.97, 128.07, 127.66, 125.67, 119.99 (d, *J* = 4.9 Hz), 112.21 (d, *J* = 7.9 Hz), 54.58, 37.13 (d, *J* = 5.9 Hz), 33.12, 21.52.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.32.

IR (neat, cm^{-1}): 3060, 2839, 2796, 1794, 1639, 1626, 1588, 1489, 1349, 1337, 1302, 1278, 1222, 1187, 118178, 1163, 1027, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{30}H_{28}NO_6PS$, 562.1448; found, 562.1445.



1p 2p

(*R*)-3-(Diisopropylcarbamoyl)cyclobut-1-en-1-yl diphenyl phosphate (2p)

According to **General Procedure B**, using **1p** (79.0 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:Acetone = 7:1) afforded **2p** (86.8 mg, 0.202 mmol, 51% yield) as a colorless oil.

Ee: 70% (Chiralcel® IA; 3% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=53.7 min (minor); t_2=57.7 min (major).

$[\alpha]_D^{19}$ 14.40 (c 1.0, $CHCl_3$).

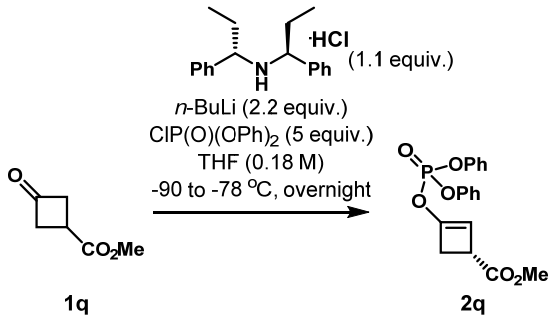
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.44-7.30 (m, 4H), 7.30-7.16 (m, 6H), 5.47 (s, 1H), 3.83-3.70 (m, 1H), 3.34-3.21 (m, 1H), 3.17 (d, *J* = 12.8 Hz, 1H), 2.64 (d, *J* = 12.8 Hz, 1H), 1.45 (s, 3H), 1.40 (t, *J* = 6.1 Hz, 6H), 1.22-1.14 (dd, *J* = 6.3, 2.7 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 170.19, 150.14 (d, *J* = 7.5 Hz), 150.10 (d, *J* = 7.5 Hz), 142.18 (d, *J* = 9.5 Hz), 129.82, 125.67, 125.66, 120.06 (d, *J* = 4.9 Hz), 120.05 (d, *J* = 4.9 Hz), 110.63 (d, *J* = 8.3 Hz), 48.11, 45.68, 37.29, 36.83 (d, *J* = 5.7 Hz), 20.81 (d, *J* = 5.5 Hz), 20.46 (d, *J* = 5.8 Hz).

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.31.

IR (neat, cm^{-1}): 3096, 3068, 2999, 2966, 2932, 2873, 1632, 1589, 1488, 1440, 1371, 1342, 1313, 1301, 1269, 1216, 1282, 1160, 1315, 1072, 1025, 1009.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{23}H_{28}NO_5P$, 429.1700; found, 429.1700.



1q 2q

Methyl (*R*)-3-((diphenoxyphosphoryl)oxy)cyclobut-2-ene-1-carboxylate (2q)

According to **General Procedure B**, using **1q** (51.3 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:Acetone = 5:1) afforded **2q** (0.118 g, 0.327 mmol, 82% yield) as a colorless oil.

Ee: 47% (Chiralcel® IC; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=33.0 min (major); t_2=37.2 min (minor).

$[\alpha]_D^{22}$ 22.84 (c 1.0, $CHCl_3$).

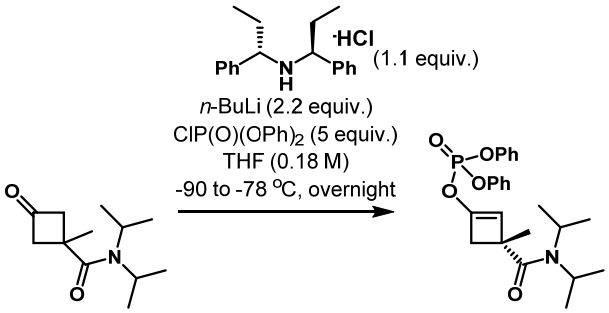
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.40 (7.40-7.33, 4H), 7.29-7.19 (m, 6H), 5.25 (s, 1H), 3.70 (s, 3H), 3.34-3.29 (m, 1H), 3.11-2.92 (m, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 173.17, 150.14 (d, J = 7.4 Hz), 150.12 (d, J = 7.4 Hz), 150.11, 150.08, 143.58 (d, J = 9.5 Hz), 129.91, 125.80, 120.05 (d, J = 4.9 Hz), 109.98 (d, J = 8.1 Hz), 51.99, 37.13 (d, J = 6.2 Hz), 36.33.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.46.

IR (neat, cm^{-1}): 3075, 2952, 2844, 1735, 1648, 1634, 1590, 1488, 1457, 1436, 1340, 1302, 1222, 1183, 1161, 1072, 1026, 1010.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{18}H_{18}O_6P$, 361.0836; found, 361.0831.



(*R*)-3-(Diisopropylcarbamoyl)-3-methylcyclobut-1-en-1-yl diphenyl phosphate (2r)

According to **General Procedure B**, using **1r** (84.7 mg, 0.400 mmol), CA-9·HCl (0.127 g, 0.440 mmol), *n*-BuLi (2.49 M in hexane, 0.35 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:Acetone = 7:1) afforded **2r** (0.160 g, 0.361 mmol, 90% yield) as a colorless oil.

Ee: 17% (Chiralcel® OZ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=14.9 min (major); t_2=32.2 min (minor).

$[\alpha]_D^{17}$ -4.42 (c 1.0, $CHCl_3$).

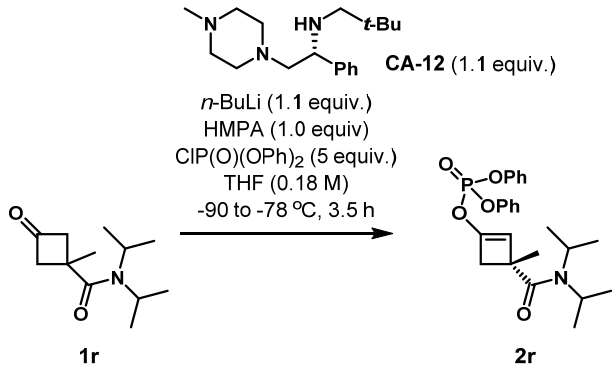
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.40-7.30 (m, 4H), 7.30-7.15 (m, 6H), 5.47 (s, 1H), 3.85-3.68 (m, 1H), 3.33-3.21 (m, 1H), 3.17 (d, *J* = 12.8 Hz, 1H), 2.64 (dd, *J* = 12.8, 1.1 Hz, 1H), 1.44 (d, *J* = 8.1 Hz, 3H), 1.40 (t, *J* = 6.2 Hz, 6H), 1.21-1.13 (m, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 172.64, 150.11 (d, *J* = 7.4 Hz), 150.06 (d, *J* = 7.3 Hz), 141.24 (d, *J* = 9.0 Hz), 129.79, 125.64, 125.63, 120.02 (d, *J* = 4.9 Hz), 119.99 (d, *J* = 4.8 Hz), 116.63 (d, *J* = 8.2 Hz), 48.50, 45.89, 44.44, 44.23 (d, *J* = 5.3 Hz), 22.82, 20.46, 20.43, 20.27, 20.23.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.24.

IR (neat, cm^{-1}): 3064, 2979, 2921, 1659, 1628, 1587, 1488, 1345, 1329, 1290, 1266, 1215, 1185, 1166, 1085, 1070, 1037, 1027, 1009.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{24}H_{30}NO_5P$, 443.1856; found, 443.1858.



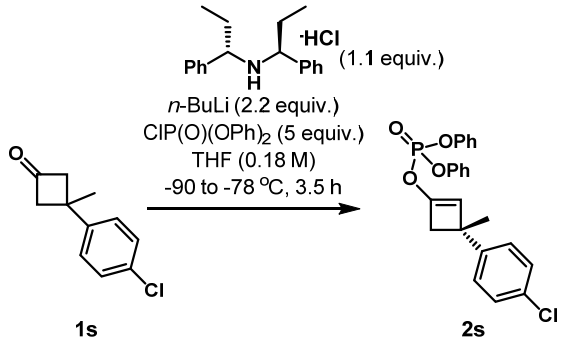
1r **2r**

(*R*)-3-(Diisopropylcarbamoyl)-3-methylcyclobut-1-en-1-yl diphenyl phosphate (2r)

According to **General Procedure B**, using **1r** (84.5 mg, 0.400 mmol), CA-12 (0.127 g, 0.440 mmol), HMPA (70.0 μL, 0.400 mmol) as co-solvent, *n*-BuLi (2.50 M in hexane, 0.18 mL, 0.440 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:Acetone = 7:1) afforded **2r** (0.118 g, 0.265 mmol, 66% yield) as a colorless oil.

Ee: 62% (Chiralcel® OZ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=14.9 min (major); t_2=32.2 min (minor).

$[\alpha]_D^{18}$ -12.54 (c 1.0, $CHCl_3$).



(*R*)-3-(4-Chlorophenyl)-3-methylcyclobut-1-en-1-yl diphenyl phosphate (2s)

According to **General Procedure B**, using **1s** (135.8 mg, 0.400 mmol), CA-9·HCl (77.9 mg, 0.440 mmol), *n*-BuLi (2.25 M in hexane, 0.39 mL, 0.880 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 10:1) afforded **2s** (0.133 g, 0.312 mmol, 78% yield) as a colorless oil. Ee: 10% (Chiralcel® OJ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=11.6 min (minor); t_2=21.5 min (major).

$[\alpha]_D^{22}$ 1.56 (c 0.5, $CHCl_3$).

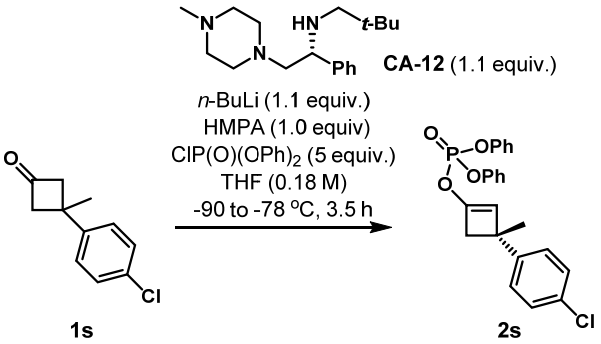
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.35 (t, *J* = 7.9 Hz, 4H), 7.30-7.18 (m, 10H), 5.55 (s, 1H), 2.95-2.76 (m, 2H), 1.53 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.23 (d, *J* = 7.4 Hz), 150.21 (d, *J* = 7.2 Hz), 144.66, 141.86 (d, *J* = 9.8 Hz), 131.85, 129.88, 128.23, 127.33, 125.72, 125.71, 120.03 (d, *J* = 4.9 Hz), 117.38 (d, *J* = 7.6 Hz), 48.60 (d, *J* = 5.6 Hz), 41.60, 26.87.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –18.12.

IR (neat, cm^{-1}): 3062, 2973, 2892, 2834, 1781, 1722, 1648, 1633, 1590, 1488, 1312, 1301, 1286, 1206, 1184, 1161, 1088, 1073, 1026, 1010.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{23}H_{20}ClO_4P$, 427.0860; found, 427.0858.

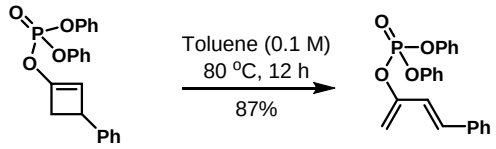


(*R*)-3-(4-Chlorophenyl)-3-methylcyclobut-1-en-1-yl diphenyl phosphate (2s)

According to **General Procedure B**, using **1s** (77.9 mg, 0.400 mmol), CA-12 (0.127 g, 0.440 mmol), HMPA (70.0 μL, 0.400 mmol) as co-solvent, *n*-BuLi (2.50 M in hexane, 0.18 mL, 0.440 mmol) and $ClP(O)(OPh)_2$ (0.42 mL, 0.540 g, 2.00 mmol); flash chromatography on silica gel (PE:EA = 10:1) afforded **2s** (0.123 g, 0.287 mmol, 72% yield) as a colorless oil.

Ee: 63% (Chiralcel® OJ-H; 10% *i*-PrOH in hexanes; flow rate = 1.0 mL/min; detection at 210 nm; t_1=11.6 min (minor); t_2=21.5 min (major).

$[\alpha]_D^{21}$ 15.18 (c 1.0, $CHCl_3$).



2a **3a**

(*E*)-Diphenyl (4-phenylbuta-1,3-dien-2-yl) phosphate (3a)

A solution of **2a** (37.8 mg, 0.100 mmol) in toluene (1.0 mL) was stirred at 80 °C for 12 h. After cooling, the mixture was concentrated, and purified by column chromatography on silica gel (PE:EA = 5:1) to afford the product **3a** (32.7 mg, 86.4 μmol, 87% yield) as a faint yellow oil.

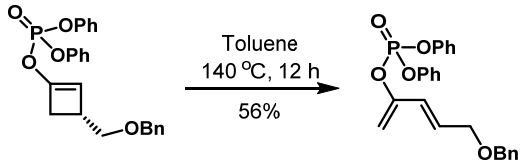
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.41-7.19 (m, 15H), 6.66 (d, *J* = 15.8 Hz, 1H), 6.54 (dd, *J* = 15.8, 2.6 Hz, 1H), 5.25 (t, *J* = 2.2 Hz, 1H), 4.95 (t, *J* = 2.5 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 151.34 (d, *J* = 8.1 Hz), 150.51 (d, *J* = 7.5 Hz), 135.74, 131.13, 129.85, 128.63, 128.37, 126.90, 125.62 (d, *J* = 1.1 Hz), 121.84 (d, *J* = 6.9 Hz), 120.20 (d, *J* = 4.9 Hz), 102.18 (d, *J* = 3.5 Hz).

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –17.93.

IR (neat, cm^{-1}): 3062, 3026, 2246, 1948, 1817, 1750, 1639, 1589, 1488, 1449, 1298, 1274, 1214, 1184, 1161, 1072, 1009.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{22}H_{20}O_4P$, 379.1094; found, 379.1091.



2m **3b**

(*E*)-5-(Benzyloxy)penta-1,3-dien-2-yl diphenyl phosphate (3b)

A solution of **2m** (42.2 mg, 0.100 mmol) in toluene (1.0 mL) was stirred at 140 °C for 20 h. After cooling, the mixture was concentrated, and purified by column chromatography on silica gel (PE:EA = 10:1) to afford the product **3b** (23.8 mg, 56.3 μmol, 56% yield) as a colorless oil.

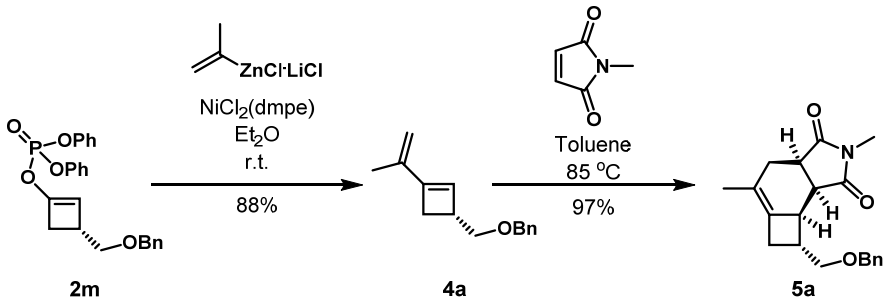
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.42-7.15 (m, 15H), 6.22-6.12 (m, 1H), 5.99 (dt, *J* = 15.5, 5.1 Hz, 1H), 5.17 (s, 1H), 4.84 (t, *J* = 2.2 Hz, 1H), 4.50 (s, 2H), 4.09-3.99 (m, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 150.71 (d, *J* = 8.1 Hz), 150.46 (d, *J* = 7.4 Hz), 137.99, 129.82, 129.35, 128.41, 127.70, 127.66, 125.56 (d, *J* = 1.1 Hz), 124.89 (d, *J* = 6.8 Hz), 120.15 (d, *J* = 4.9 Hz), 101.79, 72.38, 69.22.

^{31}P NMR (162 MHz, $CDCl_3$) δ (ppm): –17.88.

IR (neat, cm^{-1}): 3063, 3030, 2850, 2790, 1955, 1809, 1725, 1662, 1610, 1589, 1488, 1455, 1360, 1300, 1271, 1211, 1185, 1162, 1115, 1071, 1009.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{24}H_{24}O_5P$, 423.1356; found, 423.1354.



(3a*R*,7*R*,7a*R*,7b*S*)-7-((Benzyloxy)methyl)-2,5-dimethyl-3a,4,6,7,7a,7b-hexahydro-1H-cyclobuta[*e*]isoindole-1,3(2*H*)-dione (5a)

A flame-dried 10 mL screw tube was charged with $NiCl_2$(dmpe) (9.9 mg, 35.5 μmol), and a solution of **2m** (0.300 g, 0.710 mmol) in Et_2O (4 mL+3 mL) and prop-1-en-2-ylzinc (0.51 M in THF, 2.00 mL, 1.07 mmol) were added sequentially at 0 °C. After stirring for 3 h at room temperature, the reaction mixture was quenched with a saturated aqueous solution of NH_4Cl, diluted with H_2O, extracted with Et_2O. The combined organic phase was washed with brine, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 98:2) to afford **4a** (0.134 g, 0.624 mmol, 88% yield) as a colorless oil.

$[\alpha]_D^{23}$ 117.26 (c 0.71, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.35 (d, *J* = 4.4 Hz, 4H), 7.31-7.27 (m, 1H), 6.00 (s, 1H), 4.89 (d, *J* = 12.4 Hz, 2H), 4.54 (s, 2H), 3.65-3.36 (m, 2H), 2.97 (dd, *J* = 11.9, 6.3 Hz, 1H), 2.73 (dd, *J* = 13.0, 4.5 Hz, 1H), 2.23 (dd, *J* = 13.0, 1.6 Hz, 1H), 1.82 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 148.69, 138.95, 138.57, 129.35, 128.35, 127.66, 127.51, 112.19, 74.08, 73.12, 37.77, 31.98, 17.59.

IR (neat, cm^{-1}): 3086, 3064, 3031, 2943, 2917, 2851, 1583, 1496, 1453, 1435, 1375, 1361, 1141, 1094, 1028.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{15}H_{18}O$, 214.1352; found, 214.1357.

A solution of **4a** (0.134 g, 0.624 mmol) and *N*-methylmaleimide (0.138 g, 1.240 mmol) in toluene (7 ml) was stirred at 85 °C for 48 h. The mixture was then concentrated, and purified by column chromatography on silica gel (DCM to PE:EA = 3:1) to afford the product **5a** (0.195 g, 0.600 mmol, 97% yield) as a colorless oil.

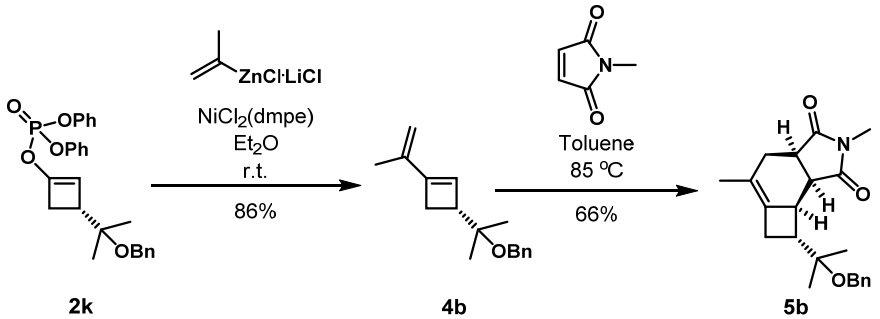
$[\alpha]_D^{23}$ 23.76 (c 0.50, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.39-7.27 (m, 5H), 4.56 (q, *J* = 12.0 Hz, 2H), 3.59 (ddd, *J* = 15.2, 9.7, 4.9 Hz, 2H), 3.18 (dd, *J* = 11.1, 8.6 Hz, 1H), 3.10-2.98 (m, 1H), 2.97 (s, 3H), 2.96-2.91 (m, 1H), 2.64-2.38 (m, 4H), 2.17-2.05 (m, 1H), 1.58 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 180.04, 178.04, 138.63, 131.29, 128.30, 127.57, 127.45, 122.17, 72.84, 72.54, 41.93, 40.66, 39.75, 37.93, 29.82, 27.03, 24.86, 17.76.

IR (neat, cm^{-1}): 2972, 2942, 2901, 2846, 1773, 1694, 1592, 1492, 1432, 1382, 1314, 1282, 1189, 1163, 1063, 1075, 1052, 1027.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{20}H_{24}O_3P$, 326.1751; found, 326.1751.



(3a*R*,7*R*,7a*R*,7b*S*)-7-(2-(Benzyloxy)propan-2-yl)-2,5-dimethyl-3a,4,6,7,7a,7b-hexahydro-1H-cyclobuta[*e*]isoindole-1,3(2*H*)-dione (5b)

A flame-dried 10 mL screw tube was charged with $NiCl_2$(dmpe) (2.8 mg, 10.0 μmol), and a solution of **2k** (0.103 g, 0.229 mmol) in Et_2O (1 mL+1 mL) and prop-1-en-2-ylzinc (0.51 M in THF, 0.67 mL, 0.334 mmol) were added sequentially at 0 °C. After stirring for 3 h at room temperature, the reaction mixture was quenched

with a saturated aqueous solution of NH_4Cl, diluted with H_2O, extracted with Et_2O. The combined organic phase was washed with brine, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA = 98:2) to afford **4b** (47.5 mg, 0.196 mmol, 86% yield) as a colorless oil.

$[\alpha]_D^{18}$ 37.28 (c 0.50, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.38-7.29 (m, 4H), 7.26-7.21 (m, 6H), 5.98 (s, 1H), 4.90 (d, *J* = 13.4 Hz, 2H), 4.55-4.47 (m, 2H), 2.99 (d, *J* = 4.2 Hz, 1H), 2.60 (dd, *J* = 12.9, 4.7 Hz, 1H), 2.44 (dd, *J* = 12.9, 2.0 Hz, 1H), 1.84 (s, 3H), 1.25 (d, *J* = 2.7 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 148.47, 140.08, 138.84, 129.32, 128.22, 127.19, 127.02, 111.98, 76.21, 64.20, 46.91, 30.19, 22.97, 22.32, 17.69.

IR (neat, cm^{-1}): 3081, 3055, 3034, 2972, 2919, 2887, 1582, 1453, 1382, 1363, 1266, 1235, 1145, 1085, 1061, 1028.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{17}H_{23}O_3$, 243.1743; found, 243.1740.

A solution of **4b** (47.5 mg, 0.196 mmol) and *N*-methylmaleimide (48.0 mg, 0.430 mmol) in toluene (2 ml) was stirred at 85 °C for 20 h. The mixture was then concentrated, and purified by column chromatography on silica gel (DCM to PE:EA = 5:1) to afford the product **5b** (46.5 mg, 0.132 mmol, 66% yield) as a colorless oil.

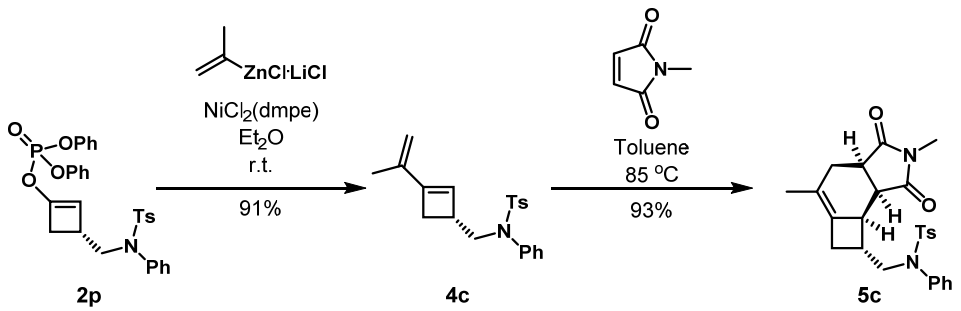
$[\alpha]_D^{18}$ -6.21 (c 1.04, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.38-7.30 (m, 4H), 7.28-7.22 (m, 1H), 4.50 (dd, *J* = 16.0, 12.0 Hz, 2H), 3.23-3.14 (m, 1H), 3.11 (t, *J* = 9.5 Hz, 1H), 3.07-3.02 (m, 1H), 2.97 (s, 3H), 2.79-2.70 (m, 1H), 2.59-2.37 (m, 3H), 2.17-2.07 (m, 1H), 1.57 (s, 3H), 1.35 (s, 3H), 1.21 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 180.21, 178.19, 140.30, 131.32, 128.16, 126.96, 126.91, 122.13, 74.66, 63.49, 47.28, 42.18, 41.33, 37.82, 27.70, 26.60, 24.94, 23.03, 22.53, 17.69.

IR (neat, cm^{-1}): 3088, 3062, 3030, 2968, 2929, 2908, 2868, 2852, 2728, 1772, 1696, 1497, 1434, 1383, 1364, 1319, 1283, 1243, 1212, 1163, 1132, 1089, 1059, 1027.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{22}H_{28}NO_3$, 354.2064; found, 354.2064.



_N_-(((3a_R_,7_R_,7a_R_,7b_S_)-2,5-Dimethyl-1,3-dioxo-2,3,3a,4,6,7,7a,7b-octahydro-1H-cyclobuta[_e_]isoindol-7-yl)methyl)-4-methyl-N-phenylbenzenesulfonamide (5c)

A flame-dried 10 mL screw tube was charged with $NiCl_2$(dmpe) (3.5 mg, 12.5 μmol), and a solution of **2p** (0.125 g, 0.250 mmol) in Et_2O (2 mL+1 mL) and prop-1-en-2-ylzinc (0.51 M in THF, 0.73 mL, 0.325 mmol) were added at 0 °C. After stirring for 3 h at room temperature, the reaction mixture was quenched with a saturated aqueous solution of NH_4Cl, diluted with H_2O, extracted with Et_2O. The combined organic phase was washed with brine, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA =5:1) to afford **4c** (72.0 mg, 0.204 mmol, 91% yield) as a white solid.

$[\alpha]_D^{23}$ 79.39 (c 0.82, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.50-7.46 (m, 2H), 7.32-7.28 (m, 3H), 7.24 (d, *J* = 8.5 Hz, 2H), 7.07-7.02 (m, 2H), 5.70 (s, 1H), 4.84 (s, 2H), 3.63 (dd, *J* = 7.3, 1.4 Hz, 2H), 2.80-2.68 (m, 1H), 2.57 (dd, *J* = 13.0, 4.5 Hz, 1H), 2.42 (s, 3H), 2.17 (dd, *J* = 13.1, 1.7 Hz, 1H), 1.74 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 148.30, 143.23, 139.60, 138.67, 135.48, 129.34, 129.07, 129.00, 128.93, 127.92, 127.70, 112.55, 54.76, 36.98, 32.25, 21.53, 17.52.

IR (neat, cm^{-1}): 3064, 3034, 2981, 2943, 2900, 2822, 1581, 1487, 1347, 1163, 1090, 1061, 1043.

HRMS-EI (*m*/*z*): $[M]^+$ calcd. for $C_{21}H_{23}NO_2S$, 353.1444; found, 353.1440.

A solution of **4c** (72.0 mg, 0.204 mmol) and *N*-methylmaleimide (44.0 mg, 0.396 mmol) in toluene (5 ml) was stirred at 85 °C for 25 h. The mixture was then concentrated, and purified by column chromatography on silica gel (DCM to PE:EA = 2:1) to afford the product **5c** (86.6 mg, 0.186 mmol, 93% yield) as a white solid.

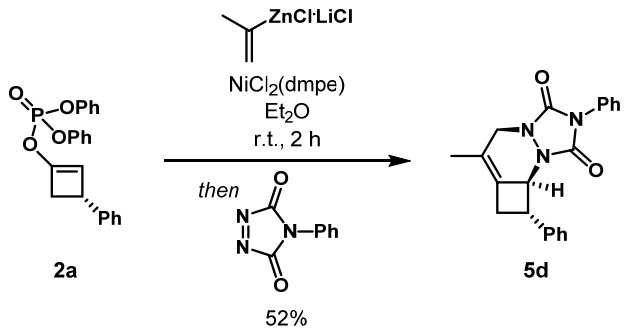
$[\alpha]_D^{25}$ -48.86 (c 1.0, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.40-7.35 (m, 2H), 7.26-7.16 (m, 6H), 7.03-6.98 (m, 2H), 3.63 (ddd, *J* = 18.3, 12.9, 7.3 Hz, 2H), 3.05-2.95 (m, 1H), 2.94-2.87 (m, 1H), 2.79-2.71 (m, 1H), 2.69 (s, 3H), 2.42-2.33 (m, 5H), 2.31-2.20 (m, 1H), 2.09-1.88 (m, 2H), 1.46 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 179.73, 177.76, 143.35, 138.94, 134.82, 130.13, 129.35, 128.76, 128.63, 127.75, 127.71, 122.12, 54.00, 41.70, 41.64, 40.36, 37.02, 31.37, 26.71, 24.62, 21.51, 17.82.

IR (neat, cm^{-1}): 3061, 3045, 2974, 2943, 2900, 2840, 1774, 1696, 1594, 1492, 1432, 1381, 1345, 1305, 1188, 1161, 1091, 1050, 1026.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{26}H_{29}N_2O_4$, 465.1843; found, 465.1842.



(8*S*,8a*S*)-6-Methyl-2,8-diphenyl-5,7,8,8a-tetrahydro-1H-cyclobuta[*c*][1,2,4]triazolo[1,2-a]pyridazine-1,3(2*H*)-dione (5d)

A flame-dried 10 mL screw tube was charged with $NiCl_2$(dmpe) (1.3 mg, 4.5 μmol), and a solution of **2a** (34.2 mg, 90.0 μmol) in Et_2O (0.3 mL+0.2 mL) and prop-1-en-2-ylzinc (0.52 M in THF, 0.26 mL, 0.135 mmol) were added sequentially at room temperature. After stirring for 2 h, 4-phenyl-1,2,4-triazolidine-3,5-dione (47.3 mg, 0.270 mmol) in DCM (0.5 mL+0.5 mL) was added. After stirring overnight, the mixture was quenched with a saturated aqueous solution of NH_4Cl, diluted with H_2O, and extracted with EA. The combined organic phase was washed with brine, dried over Na_2SO_4, concentrated, and purified by column chromatography on silica gel (PE:EA =3:1) to afford **5d** (16.2 mg, 46.9 μmol, 52% yield) as a white soild.

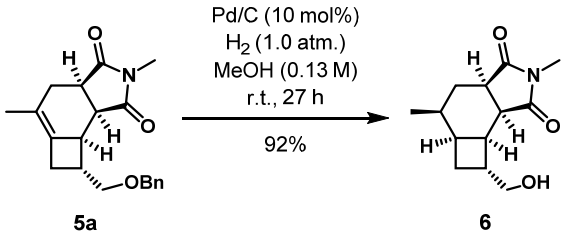
$[\alpha]_D^{13}$ -262.29 (c 0.59, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.56 (d, *J* = 7.6 Hz, 2H), 7.53-7.48 (m, 2H), 7.48-7.42 (m, 2H), 7.38-7.32 (m, 3H), 7.26-7.22 (m, 1H), 4.70-4.61 (m, 1H), 4.37 (d, *J* = 15.8 Hz, 1H), 3.95 (d, *J* = 15.8 Hz, 1H), 3.71 (dd, *J* = 15.9, 8.7 Hz, 1H), 3.32-3.21 (m, 1H), 3.06-2.95 (m, 1H), 1.82 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 152.99, 151.03, 140.58, 131.10, 129.09, 128.41, 128.05, 127.06, 126.87, 125.50, 124.07, 118.12, 62.51, 46.56, 44.72, 34.92, 14.66.

IR (neat, cm^{-1}): 3077, 3061, 3031, 2970, 2935, 2893, 2868, 2839, 1801, 1772, 1706, 1600, 1502, 1456, 1412, 1381, 1361, 1330, 1278, 1245, 1177, 1133, 1067, 1031.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{21}H_{20}N_3O_2$, 346.1550; found, 346.1547.



(3*aR*,5*S*,5*aS*,7*R*,7*aR*,7*bS*)-7-(Hydroxymethyl)-2,5-dimethyloctahydro-1H-cyclobuta[e]isoindole-1,3(2H)-dione (6)

A flame-dried 10 mL Schlenk tube was charged with Pd/C (10%, 27.0 mg, 25.4 μmol), then evacuated and backfilled with H_2 from a balloon for three times. A solution of **5a** (82.8 mg, 0.254 mmol) in MeOH (1 mL+1 mL) was added, and the mixture was stirred at room temperature for 27 h. The mixture was filtered through celite, washed with EA, concentrated, and purified by column chromatography on silica gel (PE:EA =2:1) to afford **6** (54.5 mg, 0.230 mmol, 92% yield) as a white soild.

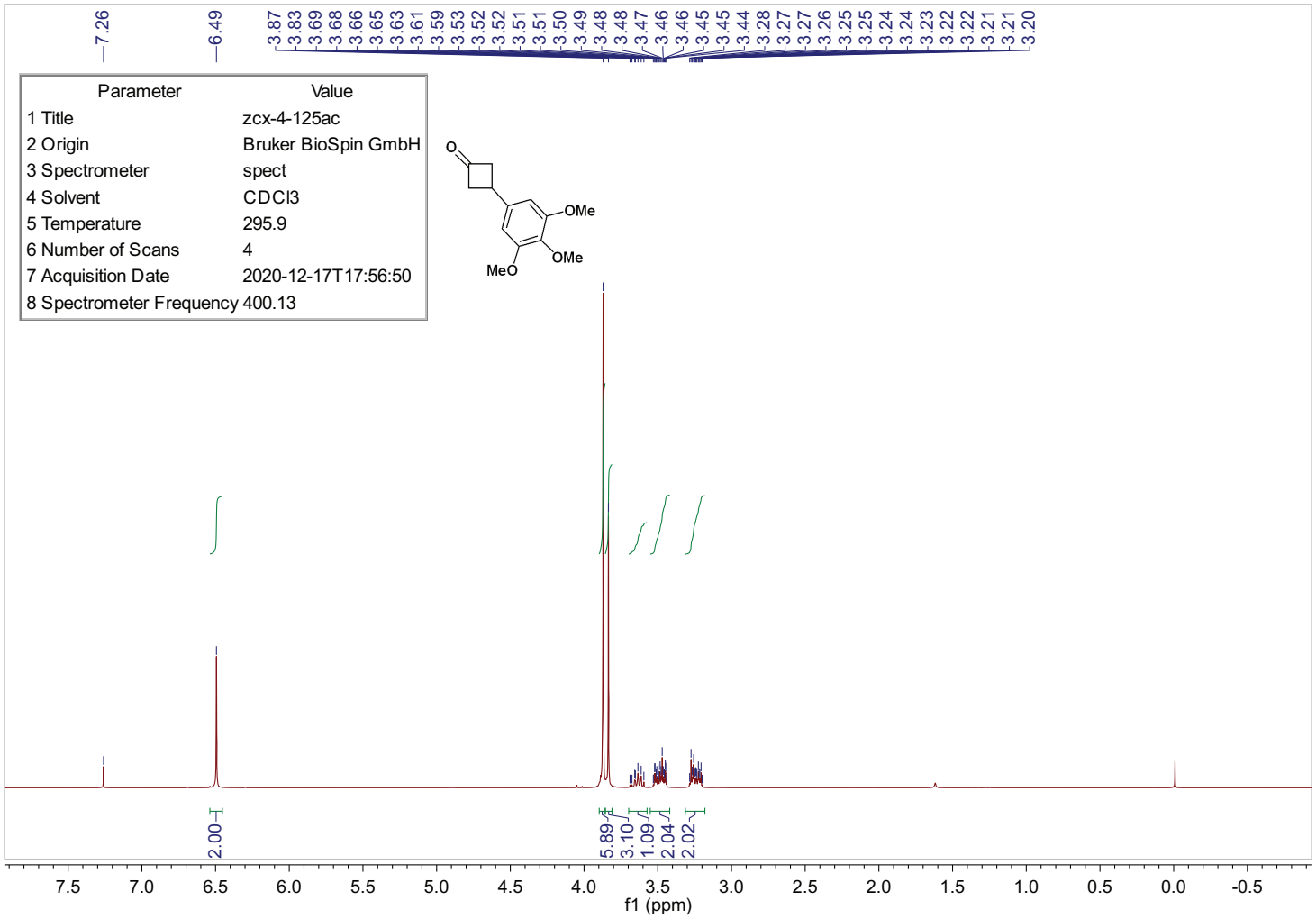
$[\alpha]_D^{24}$ 52.76 (c 0.50, $CHCl_3$).

^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 3.49 (qd, *J* = 11.2, 6.2 Hz, 2H), 3.05-2.96 (m, 1H), 2.99 (s, 3H), 2.94-2.87 (m, 1H), 2.54-2.43 (m, 1H), 2.08-1.99 (m, 1H), 1.90-1.78 (m, 2H), 1.77-1.55 (m, 5H), 0.90 (d, *J* = 6.7 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 181.21, 180.29, 67.59, 39.69, 39.66, 38.72, 37.24, 32.59, 29.49, 26.56, 24.67, 19.46, 17.06.

IR (neat, cm^{-1}): 3472, 2957, 2929, 2901, 2869, 1800, 1763, 1674, 1438, 1384, 1325, 1313, 1284, 1213, 1169, 1132, 1091, 1074, 1051, 1032.

HRMS-ESI (*m*/*z*): $[M+H]^+$ calcd. for $C_{13}H_{20}NO_3$, 238.1438; found, 238.1438.


7.26
6.49
3.87 3.83 3.69 3.68 3.66 3.65 3.63 3.61 3.59 3.53 3.52 3.52 3.51 3.51 3.50 3.49 3.48 3.48 3.47 3.46 3.46 3.45 3.45 3.44 3.28 3.27 3.27 3.26 3.25 3.25 3.24 3.24 3.23 3.22 3.22 3.21 3.21 3.20
Parameter Value
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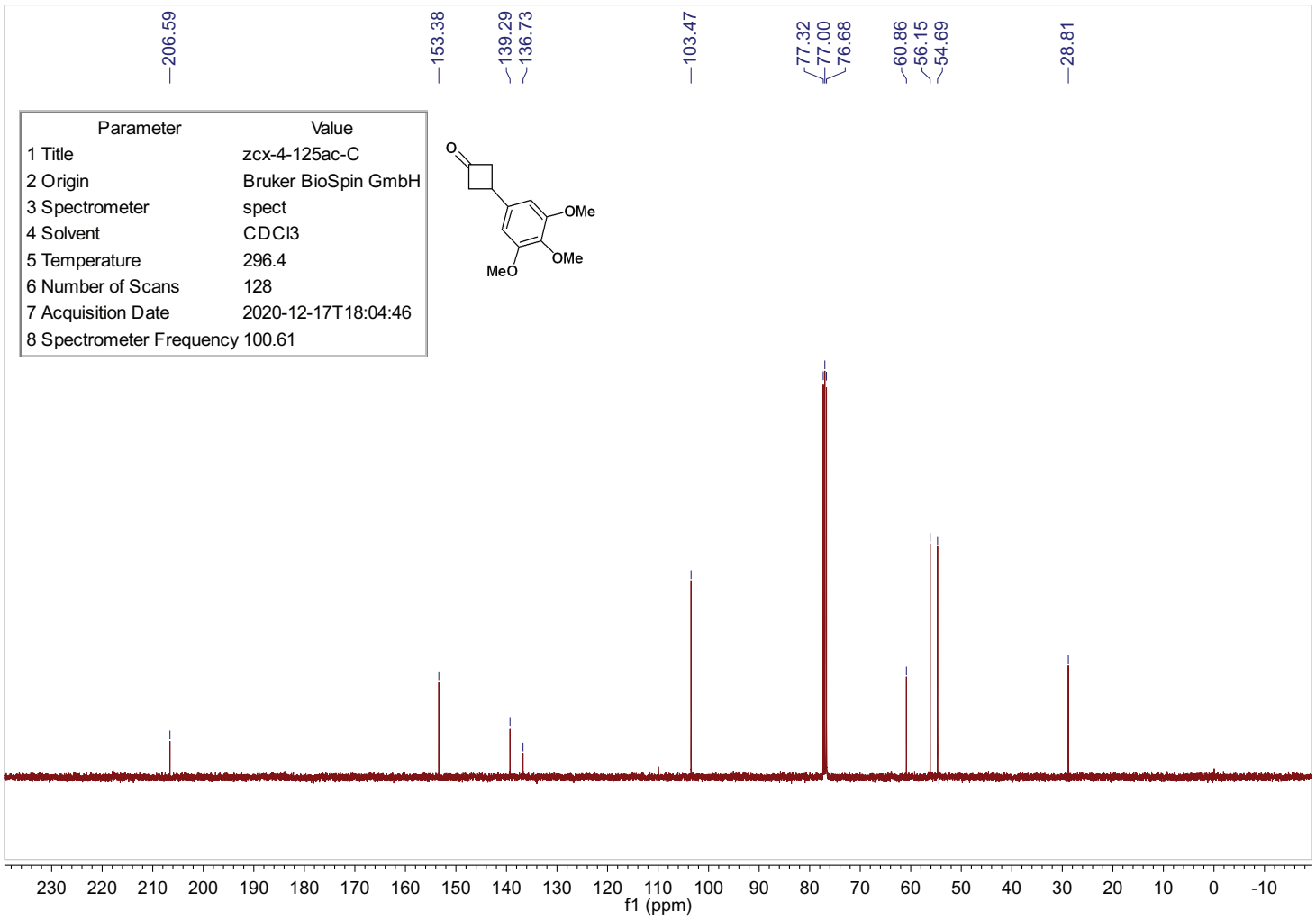
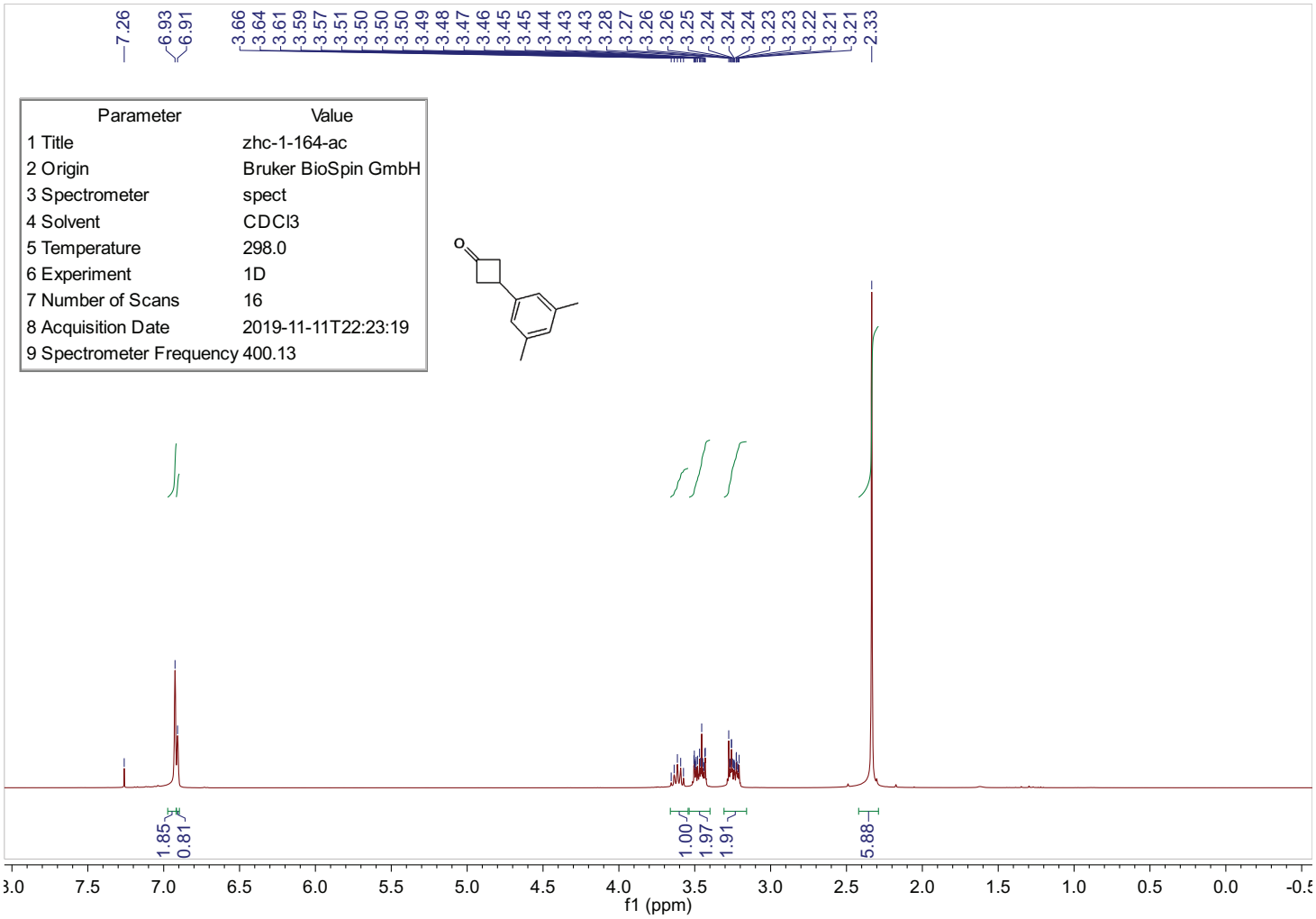
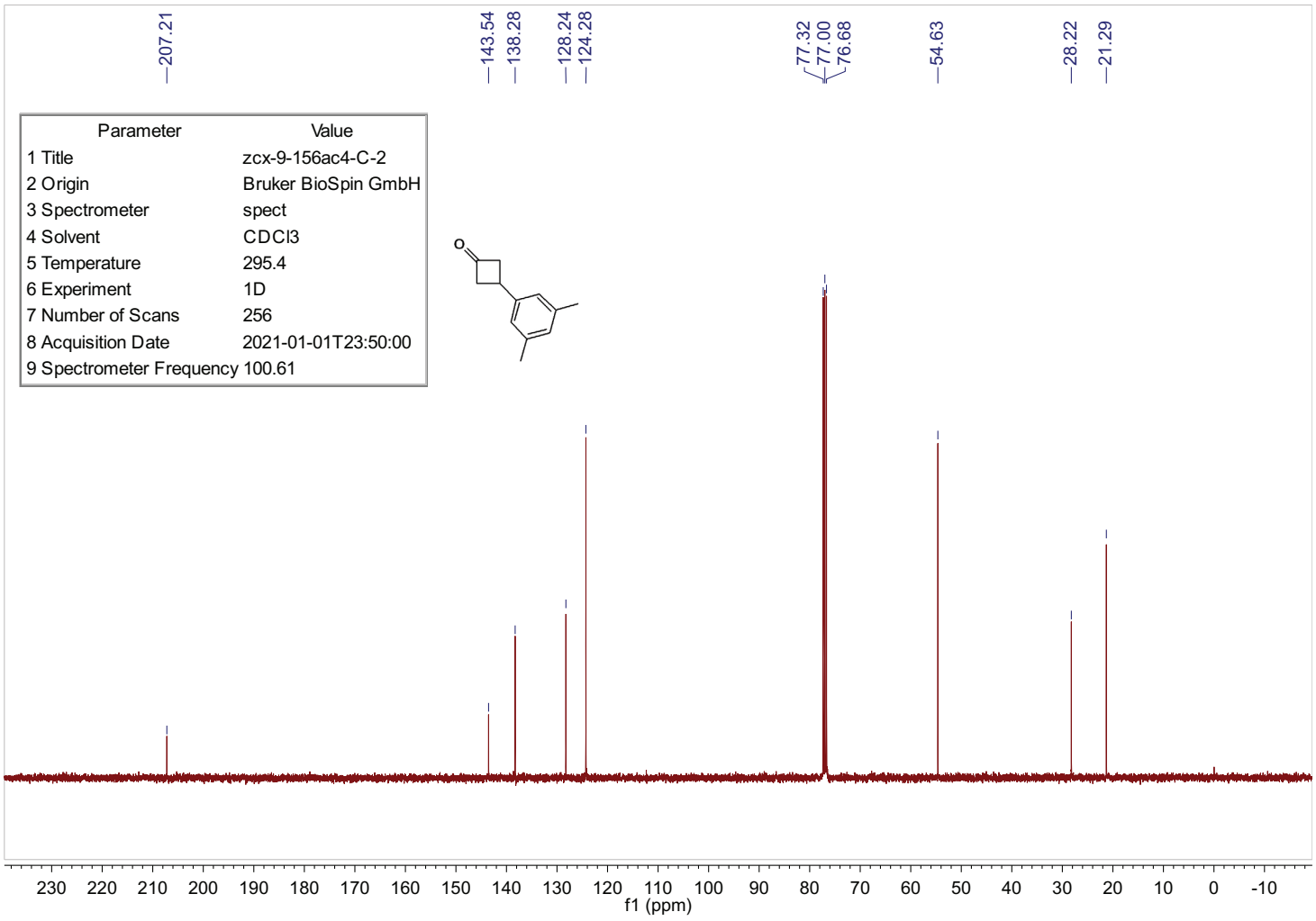
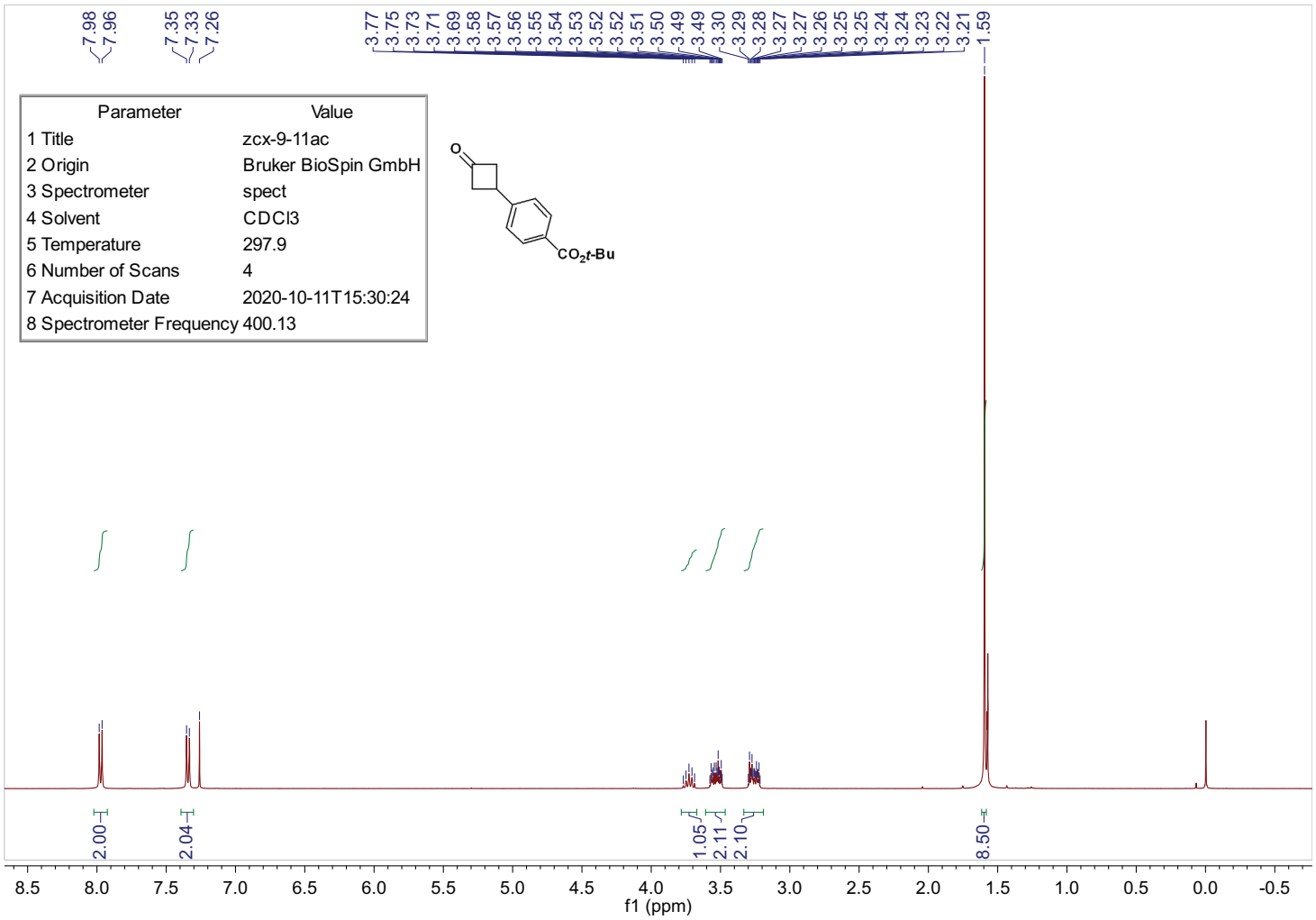
f1 (ppm)


206.59
153.38
139.29
136.73
103.47
77.32
77.00
76.68
60.86
56.15
54.69
28.81
Parameter Value
1 Title zcx-4-125ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.4
6 Number of Scans 128
7 Acquisition Date 2020-12-17T18:04:46
8 Spectrometer Frequency 100.61
O
OMe
OMe
MeO
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.26
6.93
6.91
3.66
3.64
3.61
3.59
3.57
3.51
3.50
3.50
3.50
3.49
3.48
3.47
3.46
3.45
3.45
3.44
3.43
3.43
3.28
3.27
3.26
3.26
3.25
3.24
3.24
3.24
3.23
3.23
3.22
3.21
3.21
2.33
Parameter Value
1 Title zhc-1-164-ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.0
6 Experiment 1D
7 Number of Scans 16
8 Acquisition Date 2019-11-11T22:23:19
9 Spectrometer Frequency 400.13
O
1.85
0.81
1.00
1.97
1.91
5.88
f1 (ppm)


207.21
143.54
138.28
128.24
124.28
77.32
77.00
76.68
54.63
28.22
21.29
Parameter Value
1 Title zcx-9-156ac4-C-2
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 295.4
6 Experiment 1D
7 Number of Scans 256
8 Acquisition Date 2021-01-01T23:50:00
9 Spectrometer Frequency 100.61
O
f1 (ppm)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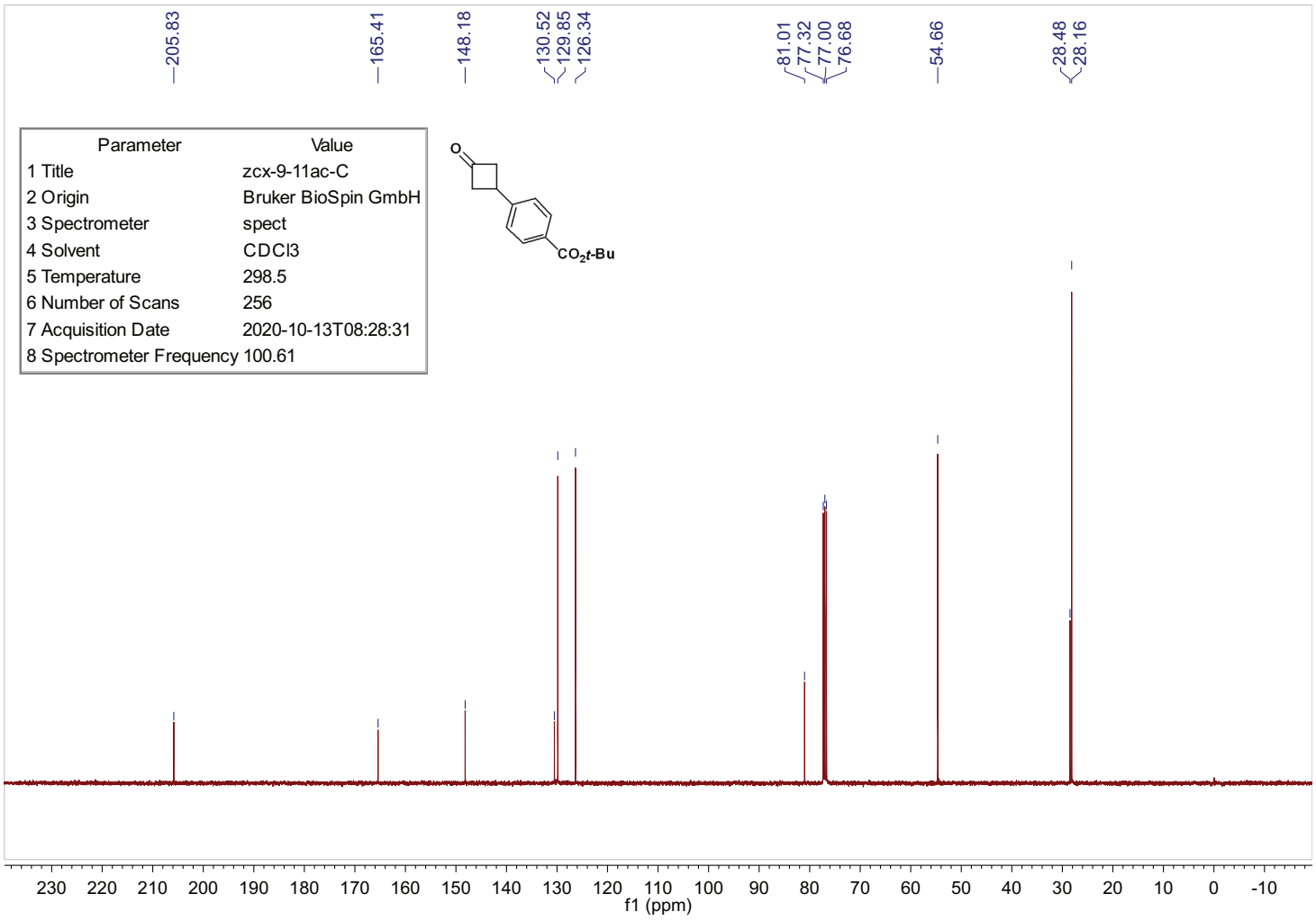
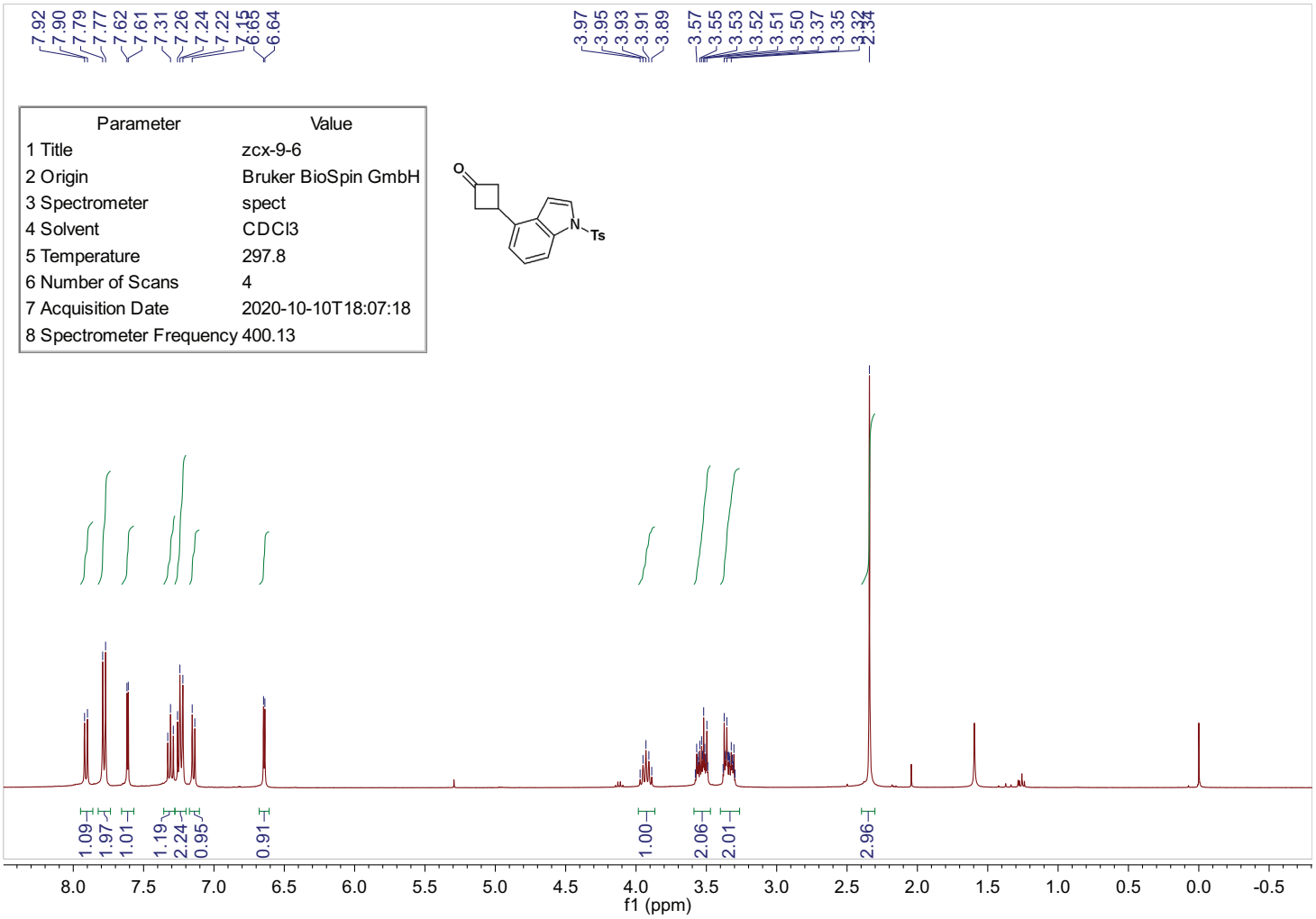
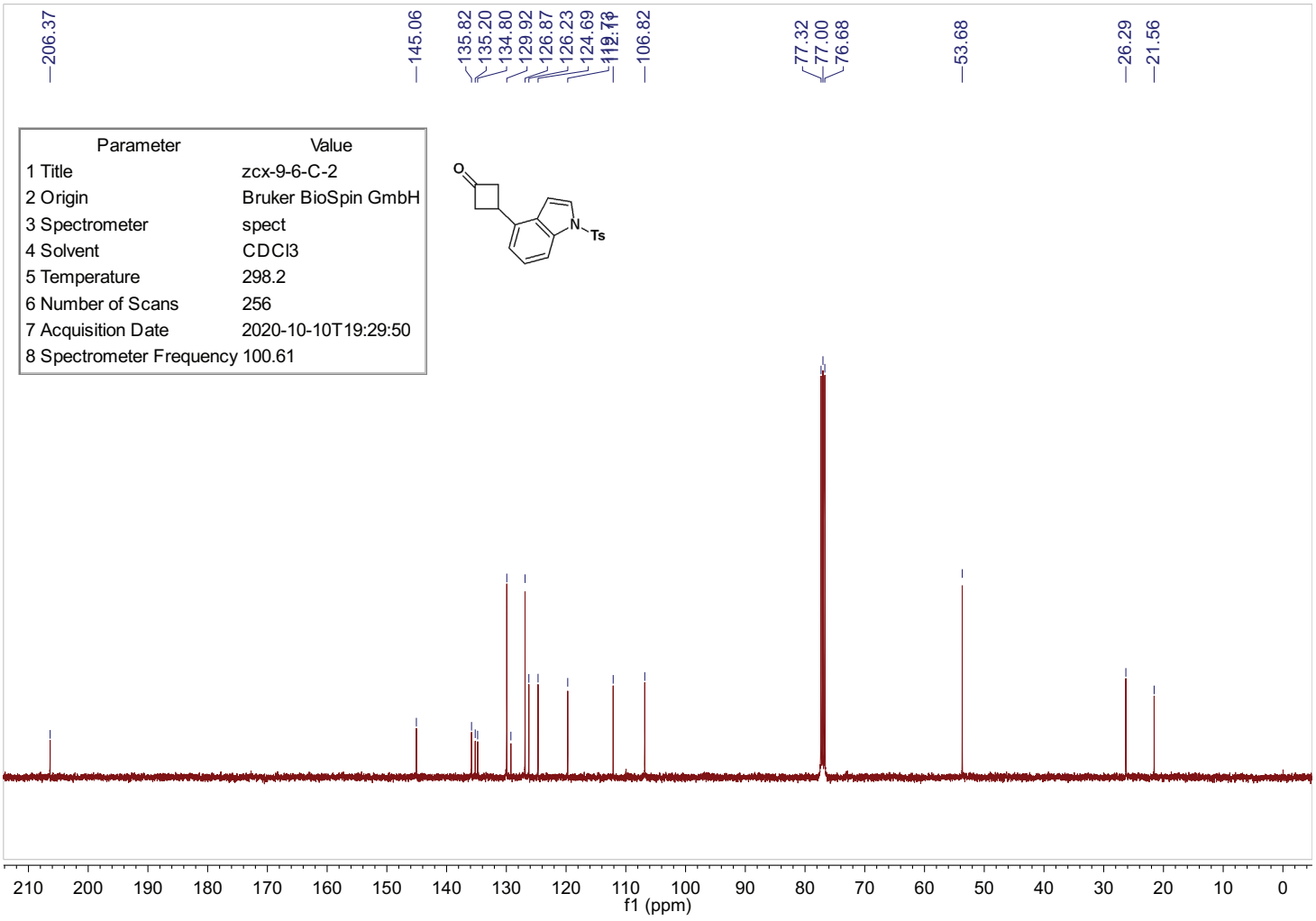
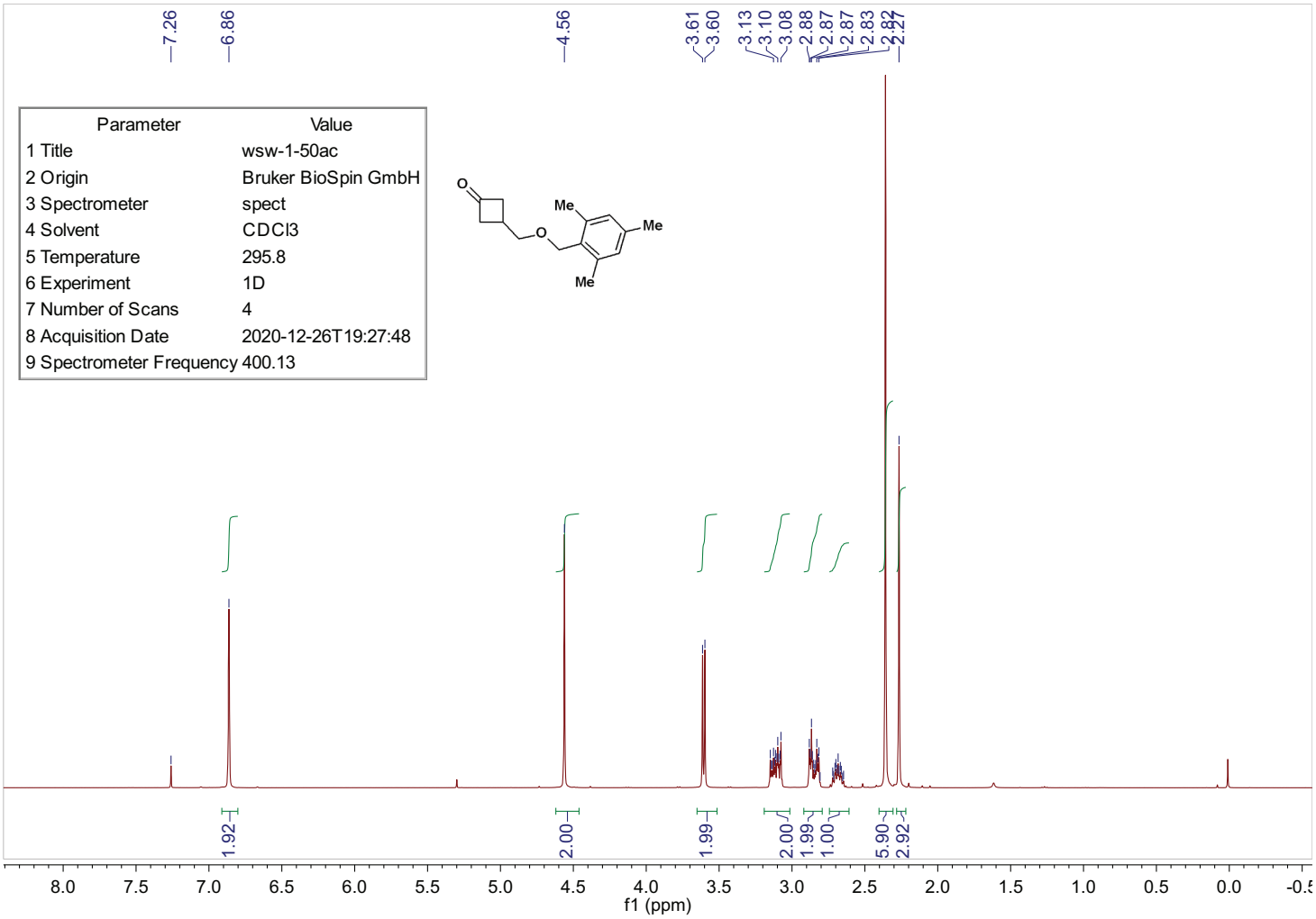
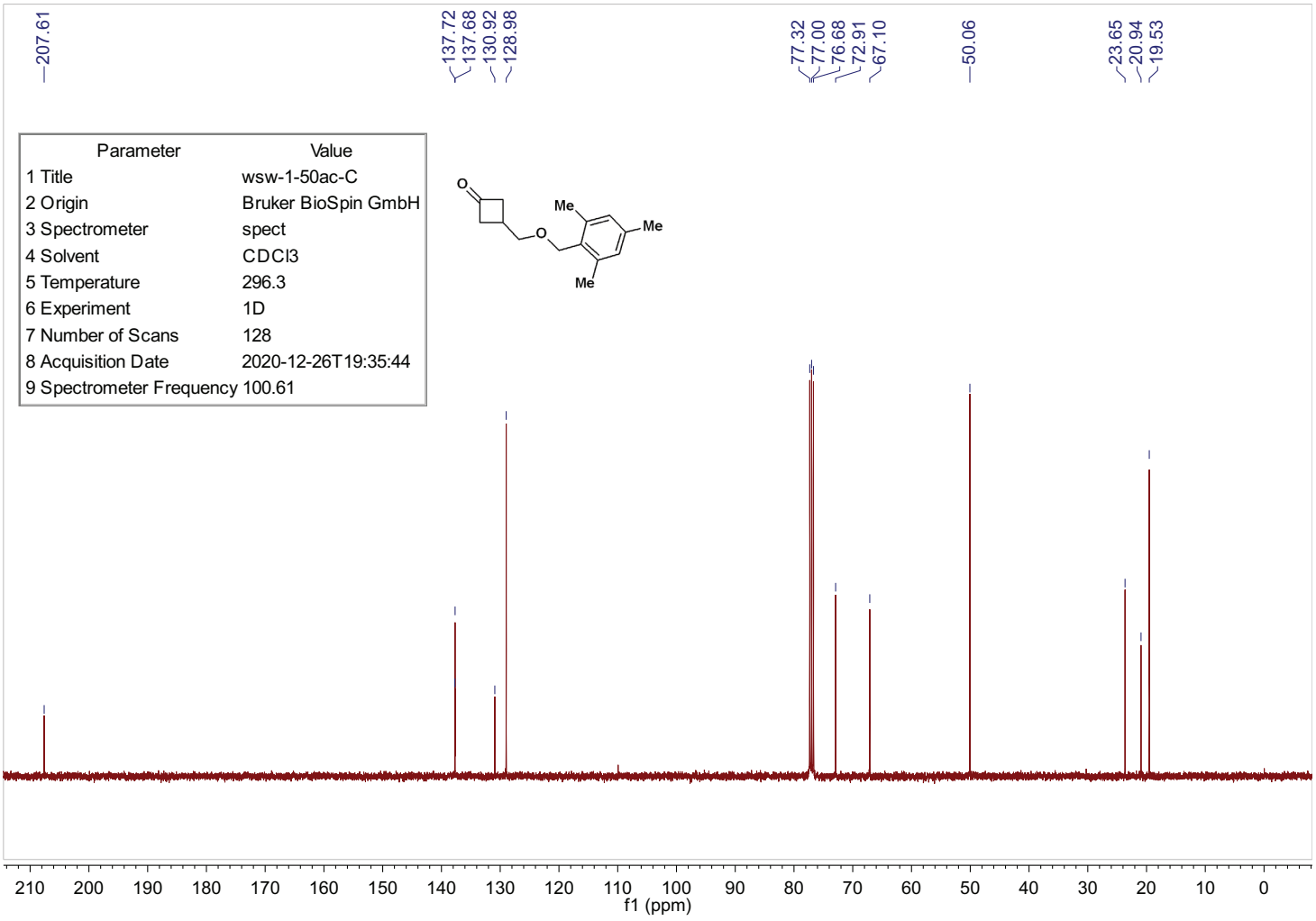
7.96
7.35
7.33
7.26
3.77
3.75
3.73
3.71
3.69
3.58
3.57
3.56
3.55
3.54
3.53
3.52
3.52
3.51
3.50
3.49
3.49
3.30
3.29
3.28
3.27
3.27
3.26
3.25
3.25
3.24
3.24
3.23
3.22
3.21
1.59
Parameter Value
1 Title zcx-9-11ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.9
6 Number of Scans 4
7 Acquisition Date 2020-10-11T15:30:24
8 Spectrometer Frequency 400.13
O
CO2t-Bu
2.00
2.04
1.05
2.11
2.10
8.50
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

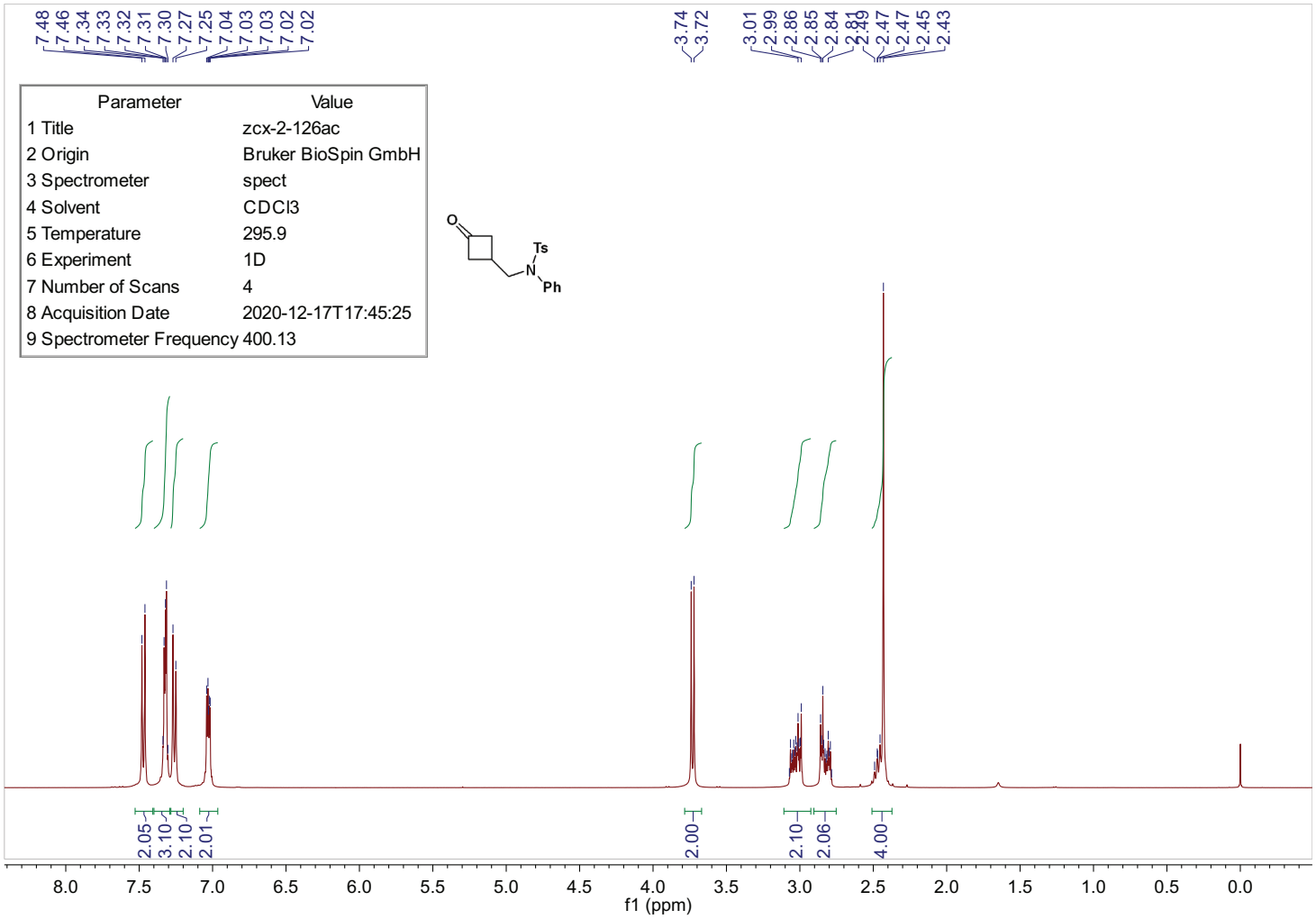

205.83
165.41
148.18
130.52
129.85
126.34
81.01
77.32
77.00
76.68
54.66
28.48
28.16
Parameter Value
1 Title zcx-9-11ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.5
6 Number of Scans 256
7 Acquisition Date 2020-10-13T08:28:31
8 Spectrometer Frequency 100.61
O
CO2t-Bu
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

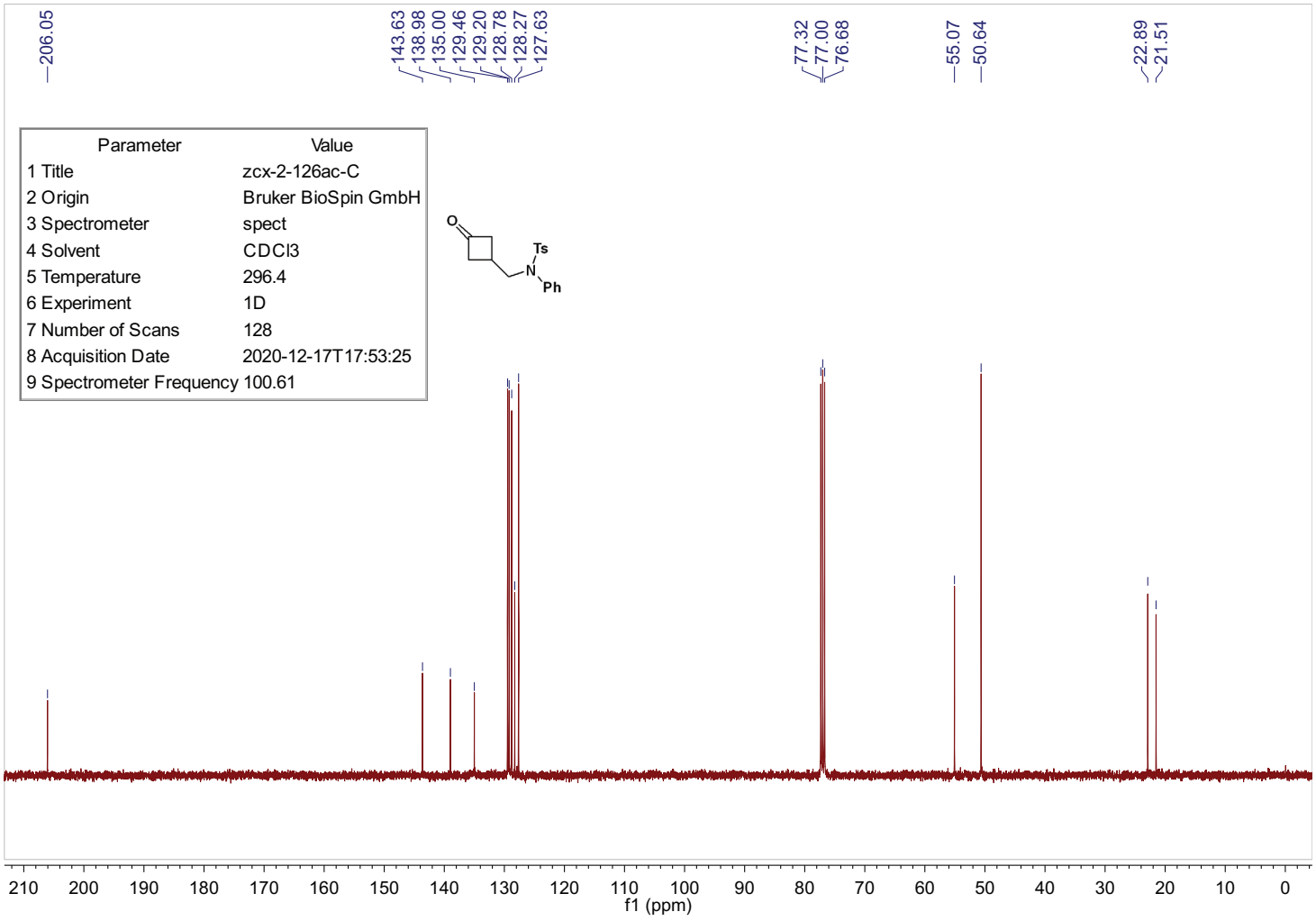

7.92
7.90
7.79
7.77
7.62
7.61
7.31
7.26
7.24
7.22
7.15
6.65
6.64
3.97
3.95
3.93
3.91
3.89
3.57
3.55
3.53
3.52
3.51
3.50
3.37
3.35
3.32
2.34
Parameter Value
1 Title zcx-9-6
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.8
6 Number of Scans 4
7 Acquisition Date 2020-10-10T18:07:18
8 Spectrometer Frequency 400.13
O
N
Ts
1.09
1.97
1.01
1.19
2.24
0.95
0.91
1.00
2.06
2.01
2.96
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


206.37
145.06
135.82
135.20
134.80
129.92
126.87
126.23
124.69
106.82
77.32
77.00
76.68
53.68
26.29
21.56
Parameter Value
1 Title zcx-9-6-C-2
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.2
6 Number of Scans 256
7 Acquisition Date 2020-10-10T19:29:50
8 Spectrometer Frequency 100.61
O
N
Ts
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.26
6.86
4.56
3.61
3.60
3.13
3.10
3.08
2.88
2.87
2.87
2.83
2.82
2.27
Parameter Value
1 Title wsw-1-50ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 295.8
6 Experiment 1D
7 Number of Scans 4
8 Acquisition Date 2020-12-26T19:27:48
9 Spectrometer Frequency 400.13
O
O
Me
Me
Me
1.92
2.00
1.99
2.00
1.99
1.00
5.90
2.92
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


207.61
137.72
137.68
130.92
128.98
77.32
77.00
76.68
72.91
67.10
50.06
23.65
20.94
19.53
Parameter Value
1 Title wsw-1-50ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.3
6 Experiment 1D
7 Number of Scans 128
8 Acquisition Date 2020-12-26T19:35:44
9 Spectrometer Frequency 100.61
O
O
Me
Me
Me
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.48
7.46
7.34
7.33
7.32
7.31
7.30
7.27
7.25
7.04
7.03
7.03
7.02
7.02
3.74
3.72
3.01
2.99
2.86
2.85
2.84
2.81
2.47
2.47
2.45
2.43
Parameter Value
1 Title zcx-2-126ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 295.9
6 Experiment 1D
7 Number of Scans 4
8 Acquisition Date 2020-12-17T17:45:25
9 Spectrometer Frequency 400.13
O
Ts
N
Ph
2.05
3.10
2.10
2.01
2.00
2.10
2.06
4.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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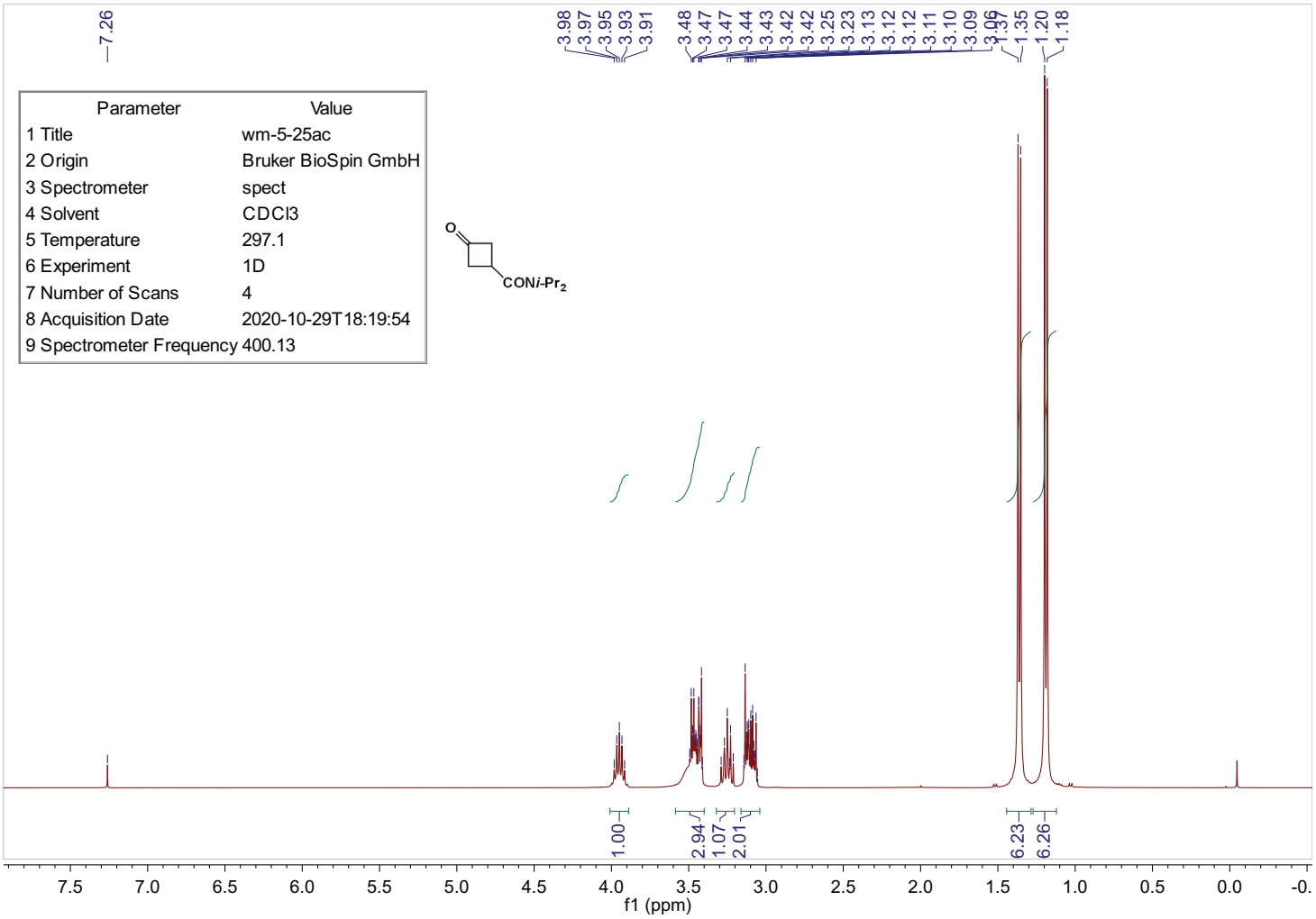
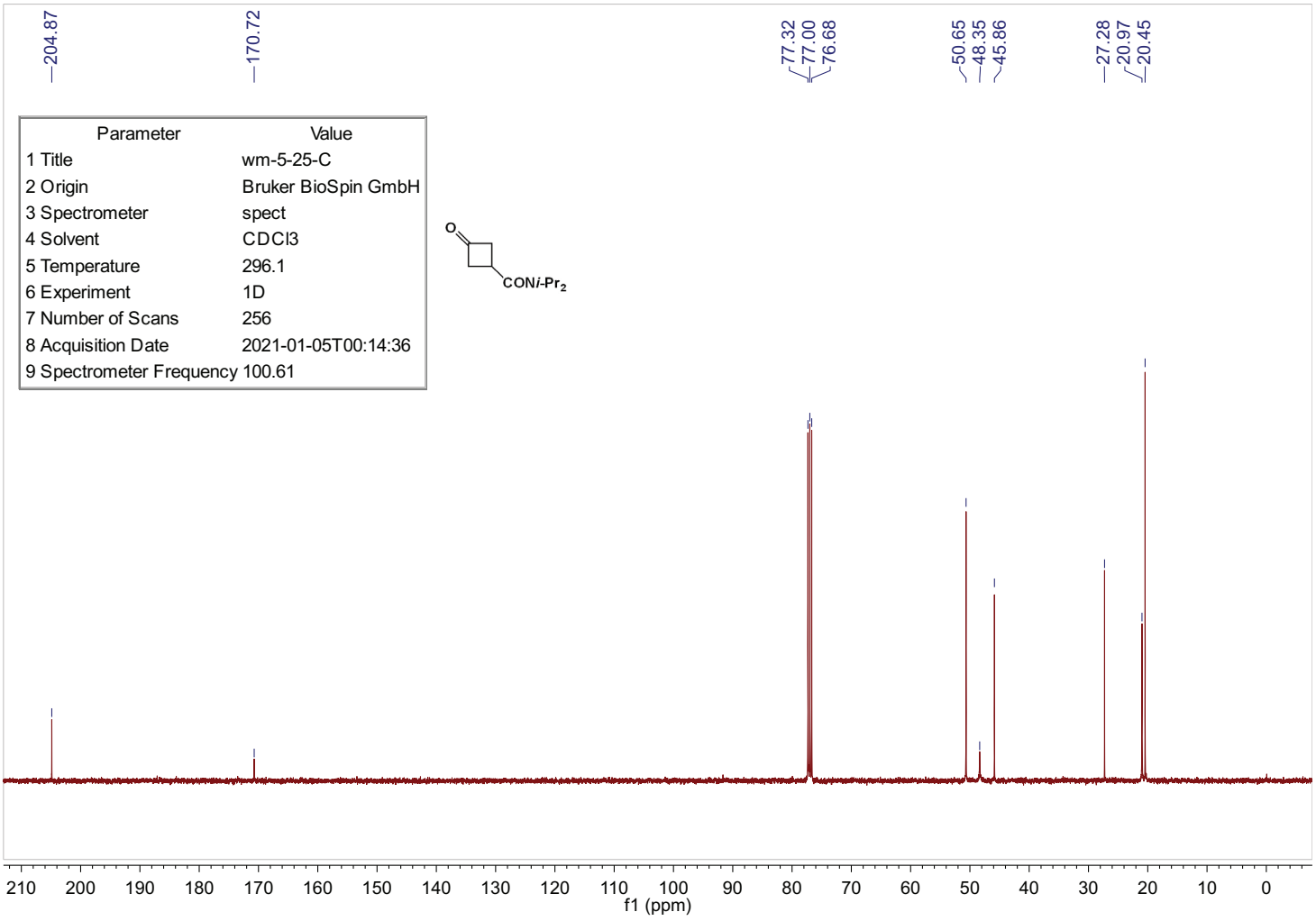
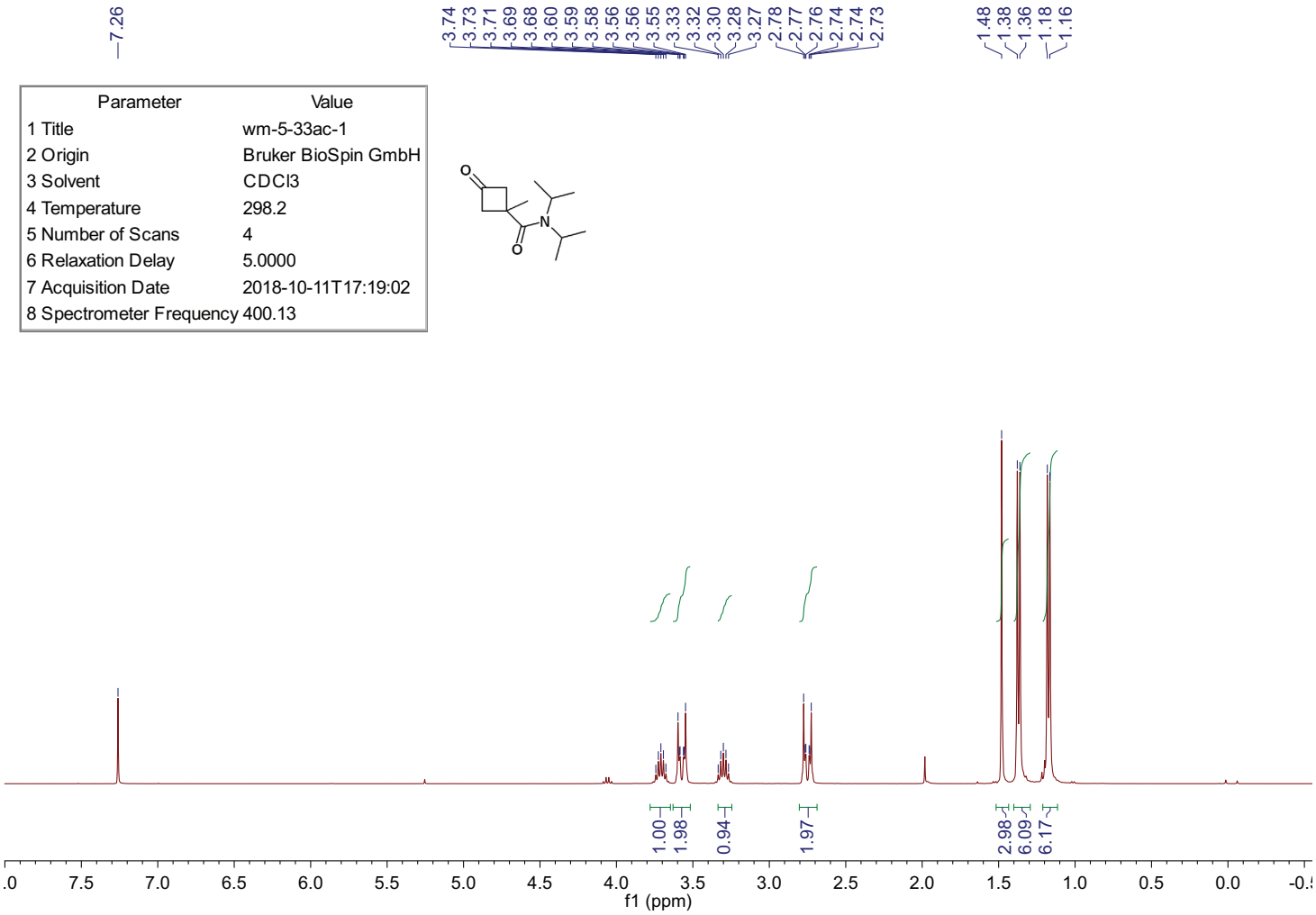
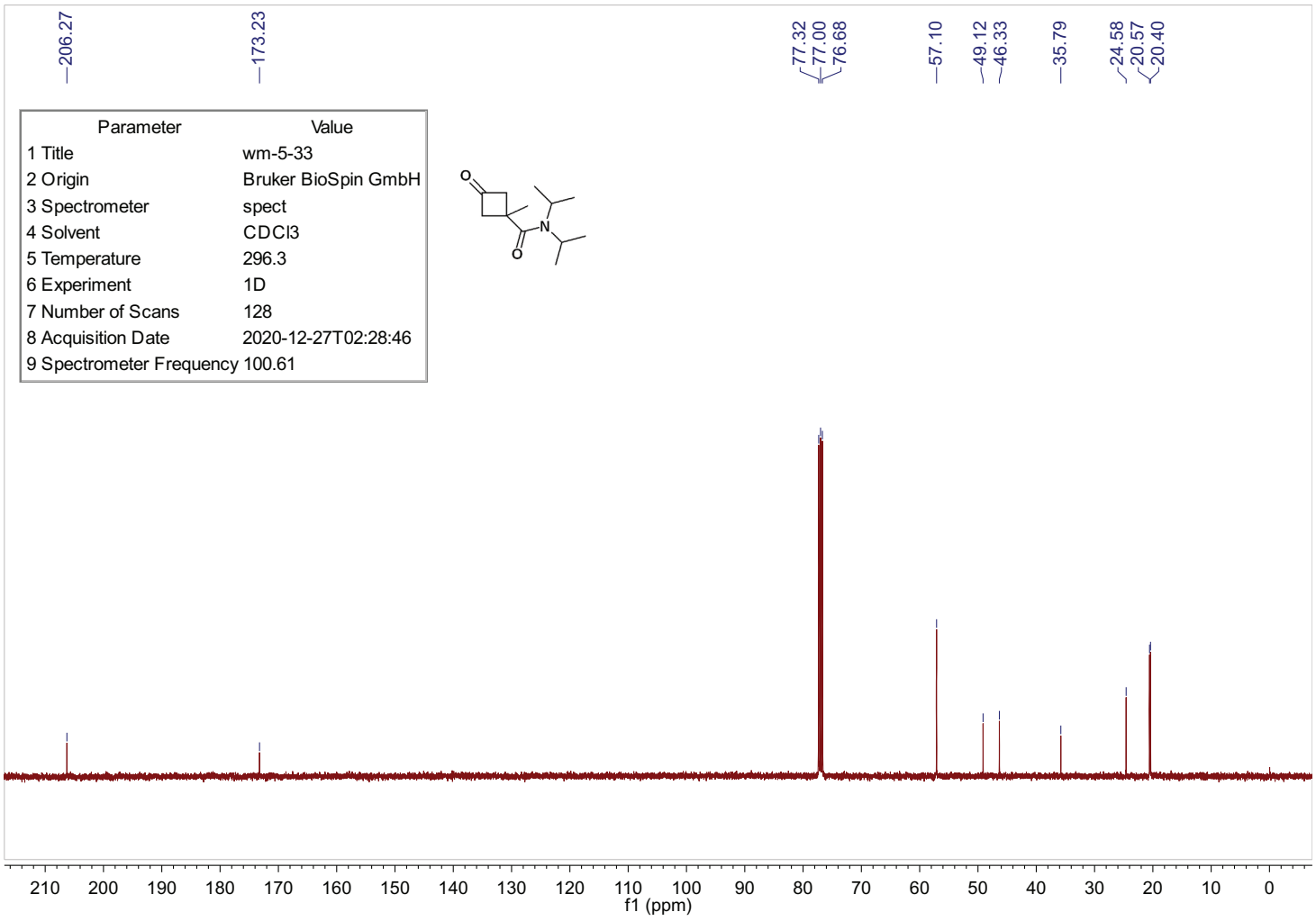
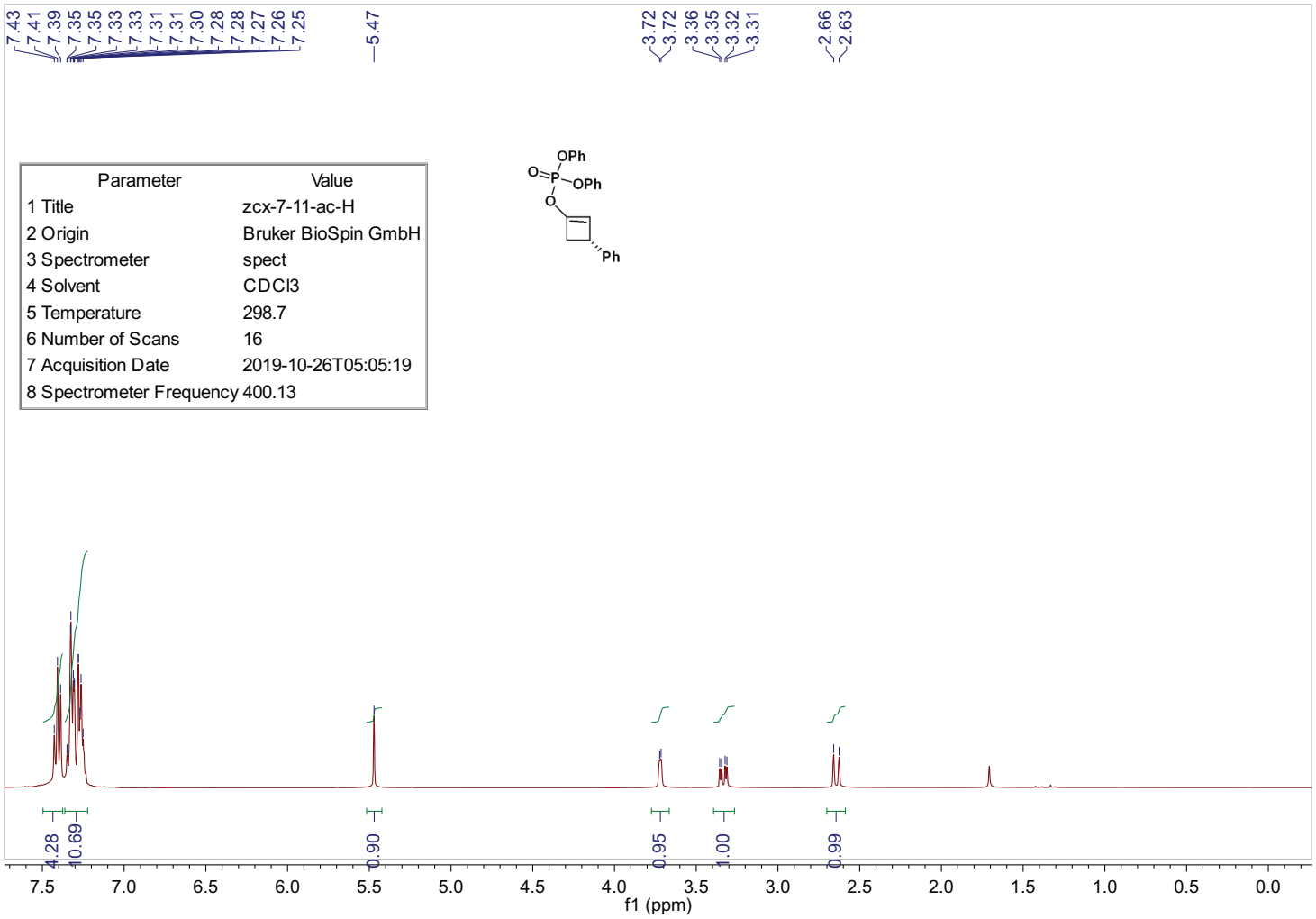
143.63
138.98
135.00
129.46
129.20
128.78
128.27
127.63
77.32
77.00
76.68
55.07
50.64
22.89
21.51
Parameter Value
1 Title zcx-2-126ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.4
6 Experiment 1D
7 Number of Scans 128
8 Acquisition Date 2020-12-17T17:53:25
9 Spectrometer Frequency 100.61
O
Ts
N
Ph
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.26
3.98
3.97
3.95
3.93
3.91
3.48
3.47
3.47
3.44
3.43
3.42
3.42
3.25
3.23
3.13
3.12
3.12
3.11
3.10
3.09
3.06
1.35
1.20
1.18
Parameter Value
1 Title wm-5-25ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.1
6 Experiment 1D
7 Number of Scans 4
8 Acquisition Date 2020-10-29T18:19:54
9 Spectrometer Frequency 400.13
O
CONi-Pr2
1.00
2.94
1.07
2.01
6.23
6.26
f1 (ppm)

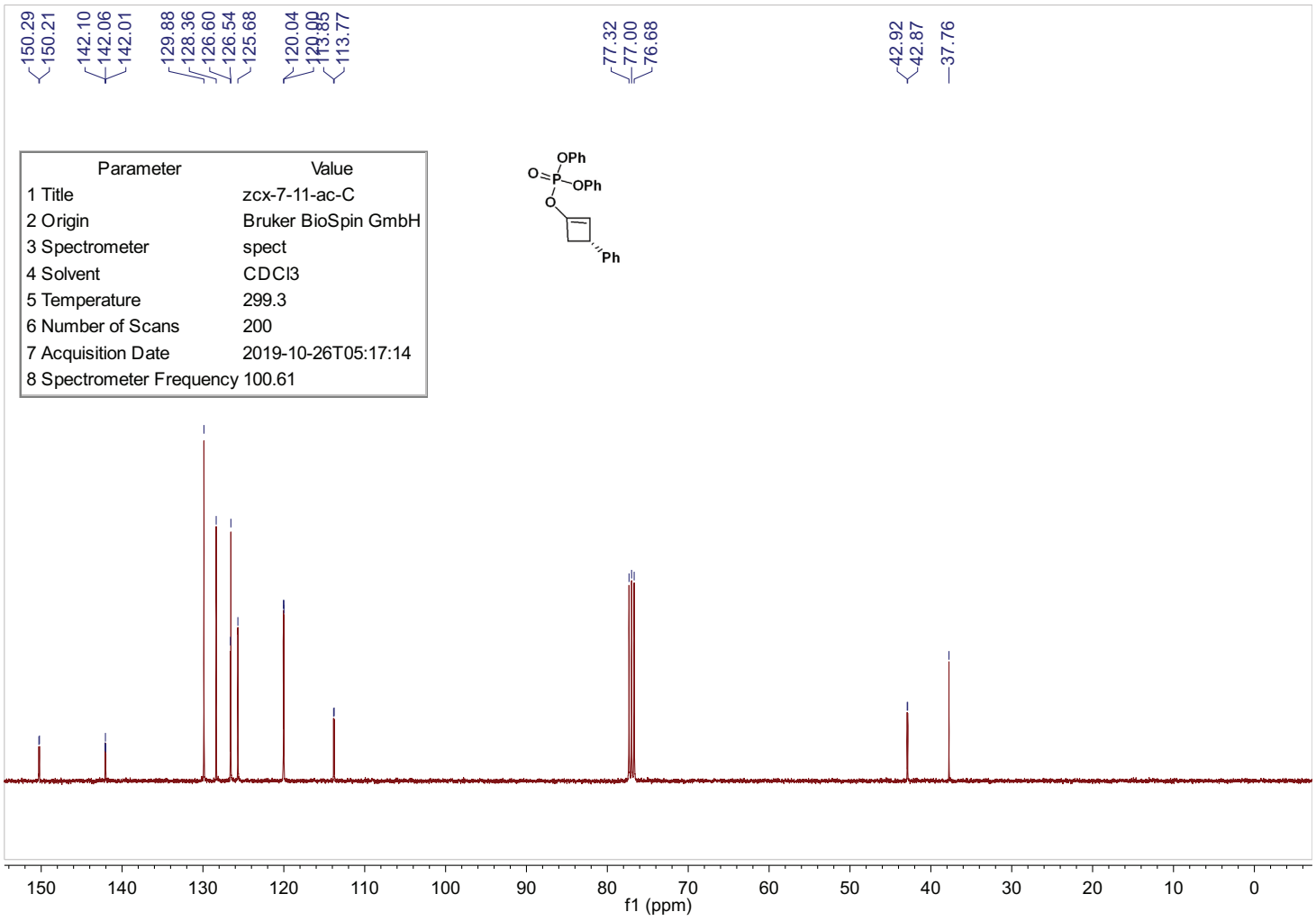

204.87
170.72
77.32
77.00
76.68
50.65
48.35
45.86
27.28
20.97
20.45
Parameter Value
1 Title wm-5-25-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.1
6 Experiment 1D
7 Number of Scans 256
8 Acquisition Date 2021-01-05T00:14:36
9 Spectrometer Frequency 100.61
O
CONi-Pr2
f1 (ppm)


7.26
3.74
3.73
3.71
3.69
3.68
3.60
3.59
3.58
3.56
3.56
3.55
3.33
3.32
3.30
3.28
3.27
2.78
2.77
2.76
2.74
2.74
2.73
1.48
1.38
1.36
1.18
1.16
Parameter Value
1 Title wm-5-33ac-1
2 Origin Bruker BioSpin GmbH
3 Solvent CDCl3
4 Temperature 298.2
5 Number of Scans 4
6 Relaxation Delay 5.0000
7 Acquisition Date 2018-10-11T17:19:02
8 Spectrometer Frequency 400.13
O
N
O
1.00
1.98
0.94
1.97
2.98
6.09
6.17
f1 (ppm)


206.27
173.23
77.32
77.00
76.68
57.10
49.12
46.33
35.79
24.58
20.57
20.40
Parameter Value
1 Title wm-5-33
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.3
6 Experiment 1D
7 Number of Scans 128
8 Acquisition Date 2020-12-27T02:28:46
9 Spectrometer Frequency 100.61
O
N
O
f1 (ppm)

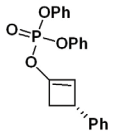


Parameter	Value
1 Title	zcx-7-11-ac-H
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.7
6 Number of Scans	16
7 Acquisition Date	2019-10-26T05:05:19
8 Spectrometer Frequency	400.13

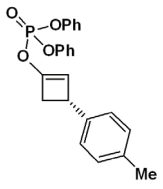


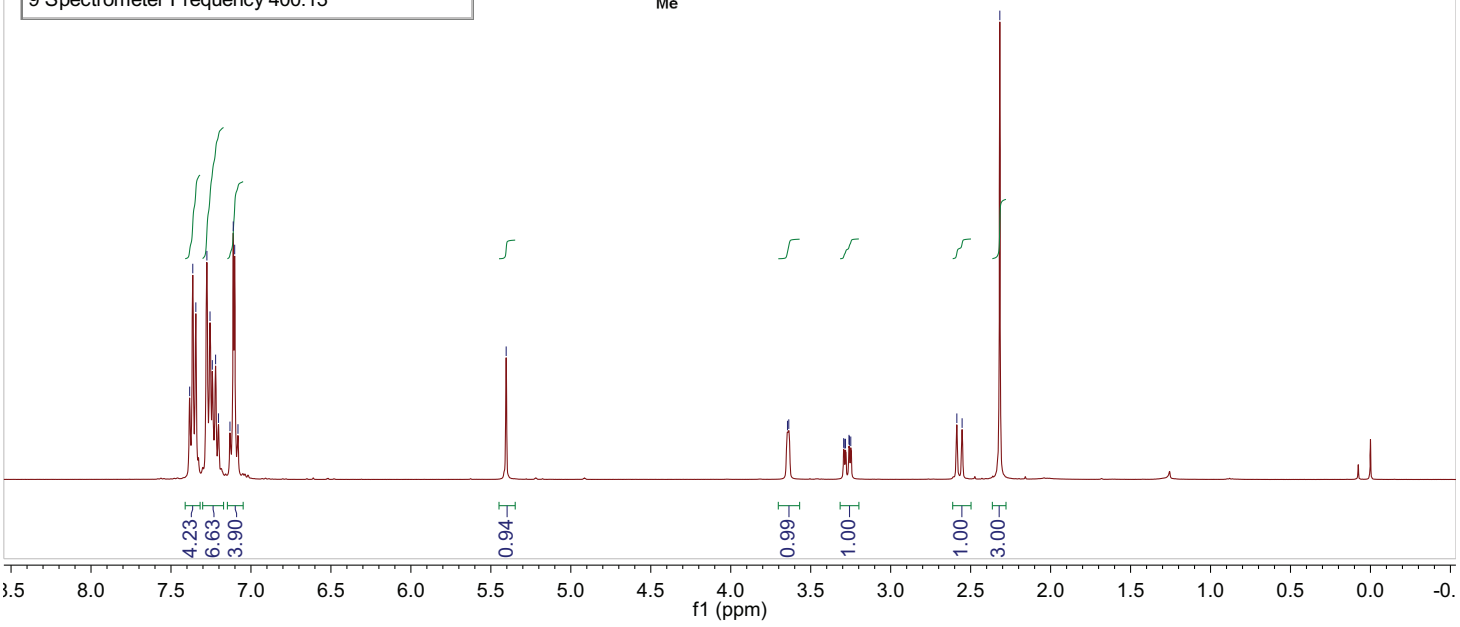
Parameter	Value
1 Title	zcx-7-11-ac-C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	299.3
6 Number of Scans	200
7 Acquisition Date	2019-10-26T05:17:14
8 Spectrometer Frequency	100.61

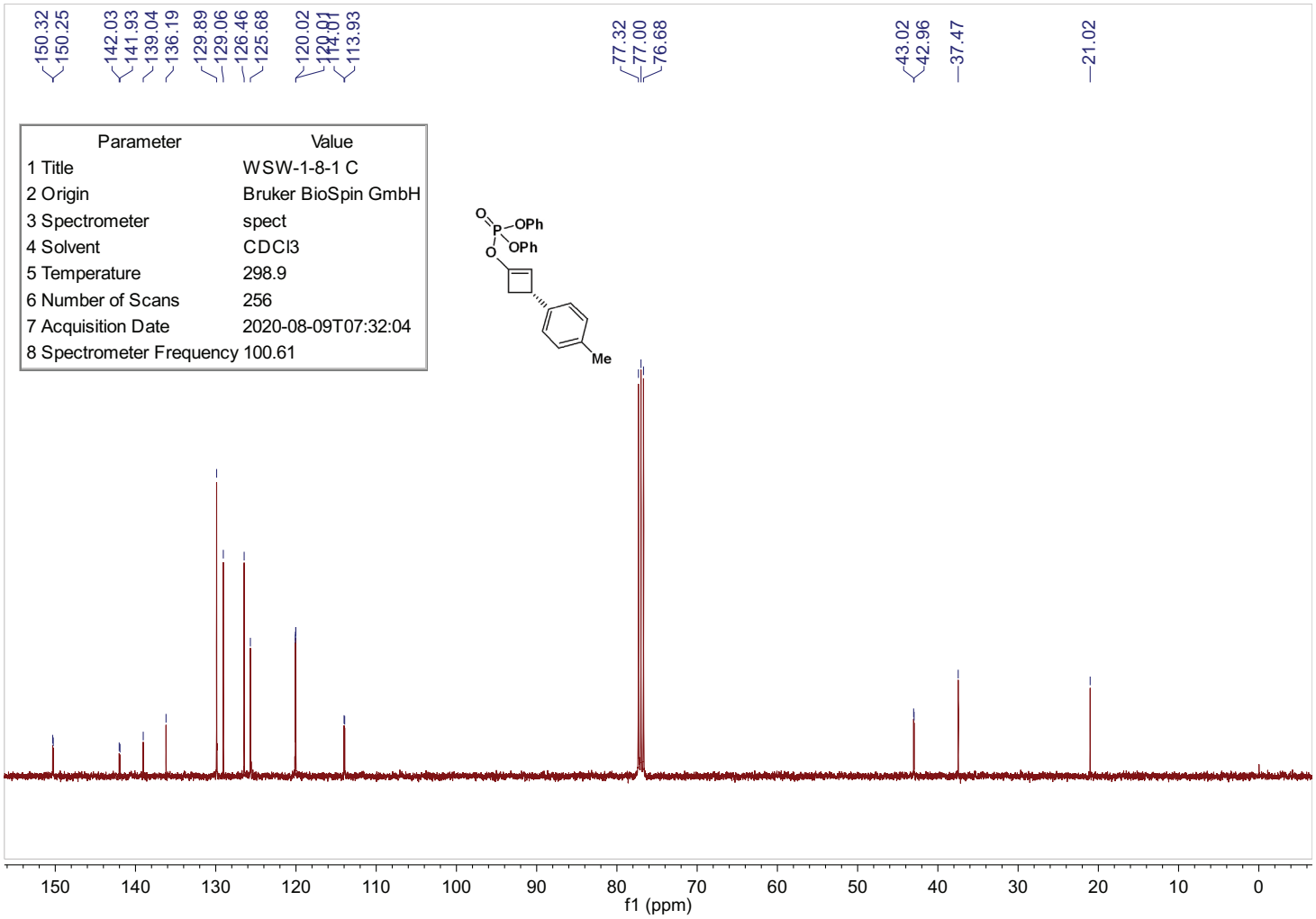
Parameter	Value
1 Title	zcx-7-11-ac-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	299.2
6 Number of Scans	16
7 Acquisition Date	2019-10-26T05:19:07
8 Spectrometer Frequency	161.98

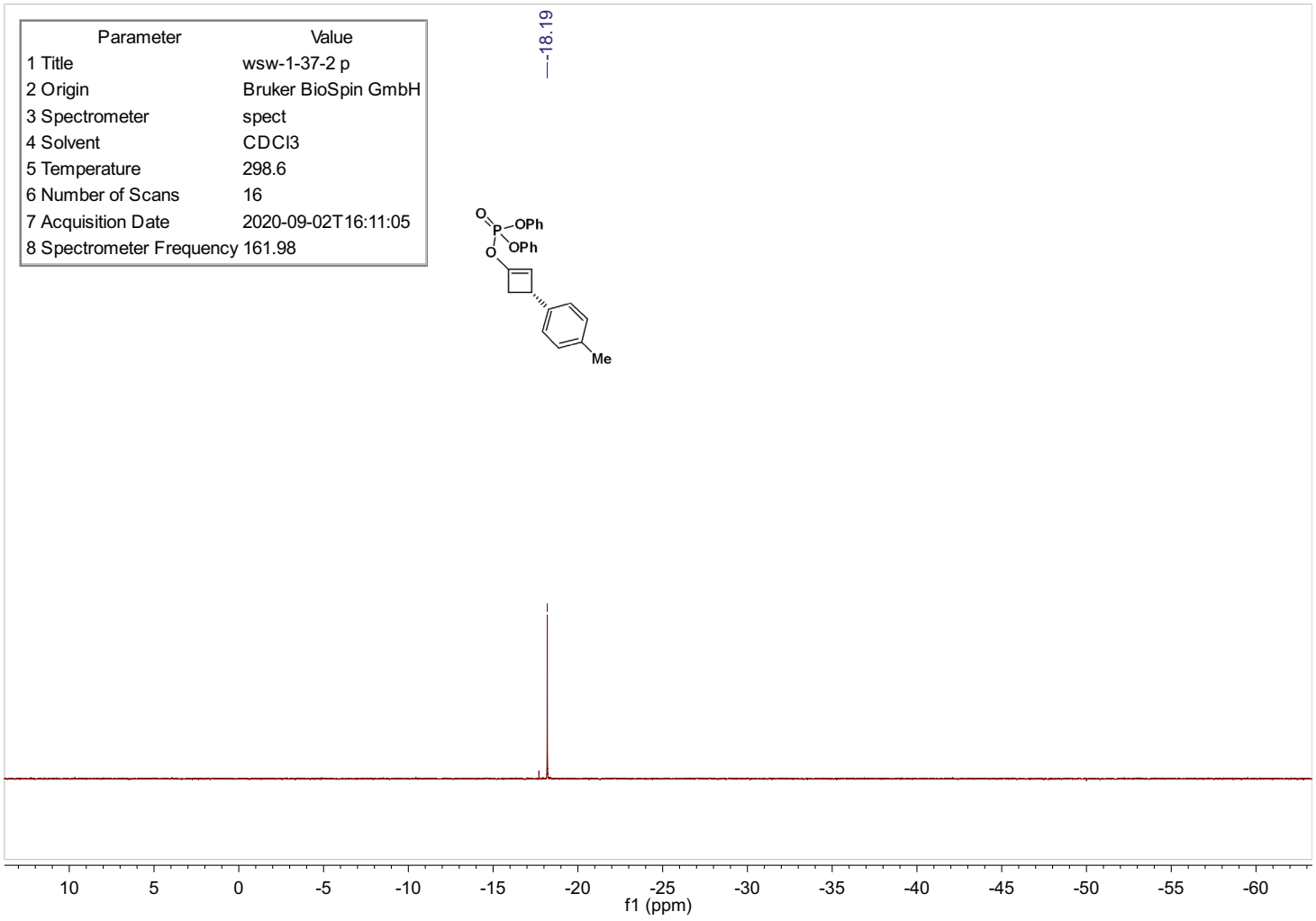


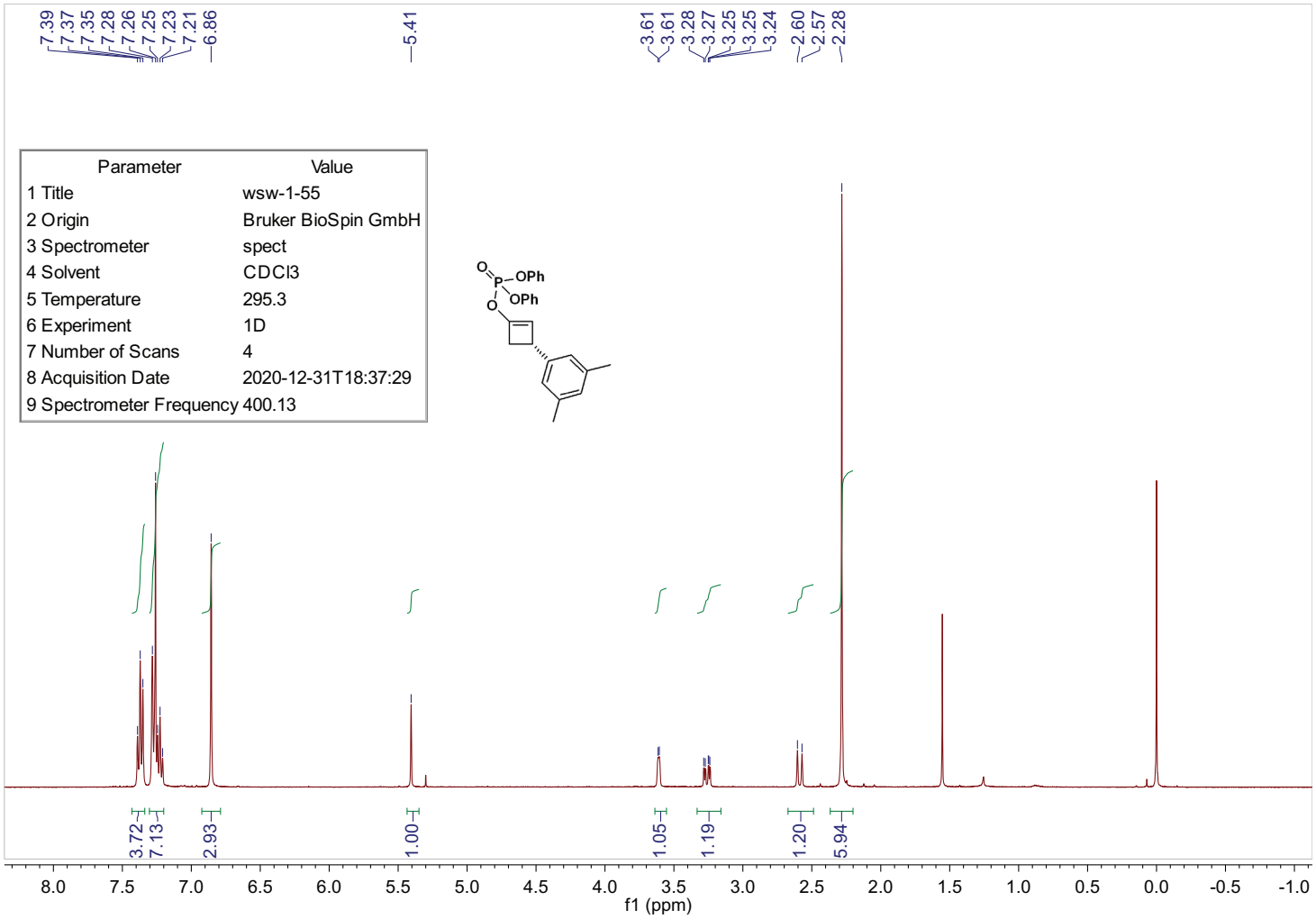
Parameter	Value
1 Title	wsw-1-8
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	294.2
6 Experiment	1D
7 Number of Scans	4
8 Acquisition Date	2020-12-31T07:51:01
9 Spectrometer Frequency	400.13

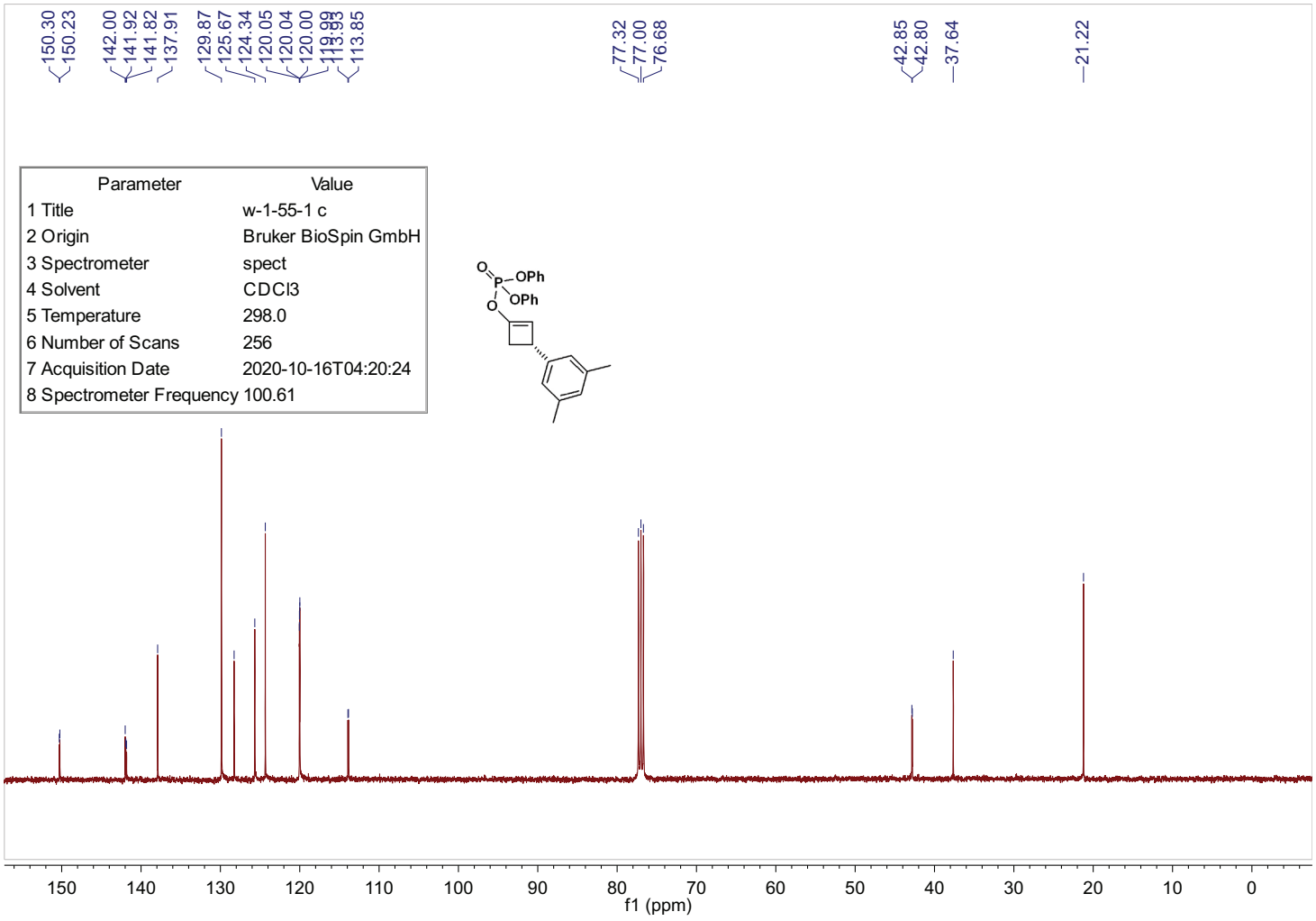




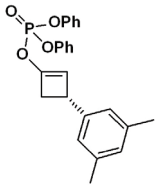

150.32
150.25
142.03
141.93
139.04
136.19
129.89
129.06
126.46
125.68
120.02
120.01
114.01
113.93
77.32
77.00
76.68
43.02
42.96
37.47
21.02
Parameter Value
1 Title WSW-1-8-1 C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.9
6 Number of Scans 256
7 Acquisition Date 2020-08-09T07:32:04
8 Spectrometer Frequency 100.61
OPh
OPh
Me
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


-18.19
Parameter Value
1 Title wsw-1-37-2 p
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.6
6 Number of Scans 16
7 Acquisition Date 2020-09-02T16:11:05
8 Spectrometer Frequency 161.98
OPh
OPh
Me
10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60
f1 (ppm)

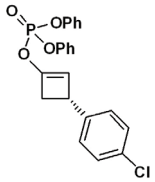

7.39
7.37
7.35
7.28
7.26
7.25
7.23
7.21
6.86
5.41
3.61
3.61
3.28
3.27
3.25
3.25
3.24
2.60
2.57
2.28
Parameter Value
1 Title wsw-1-55
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 295.3
6 Experiment 1D
7 Number of Scans 4
8 Acquisition Date 2020-12-31T18:37:29
9 Spectrometer Frequency 400.13
OPh
OPh
3.72
7.13
2.93
1.00
1.05
1.19
1.20
5.94
f1 (ppm)

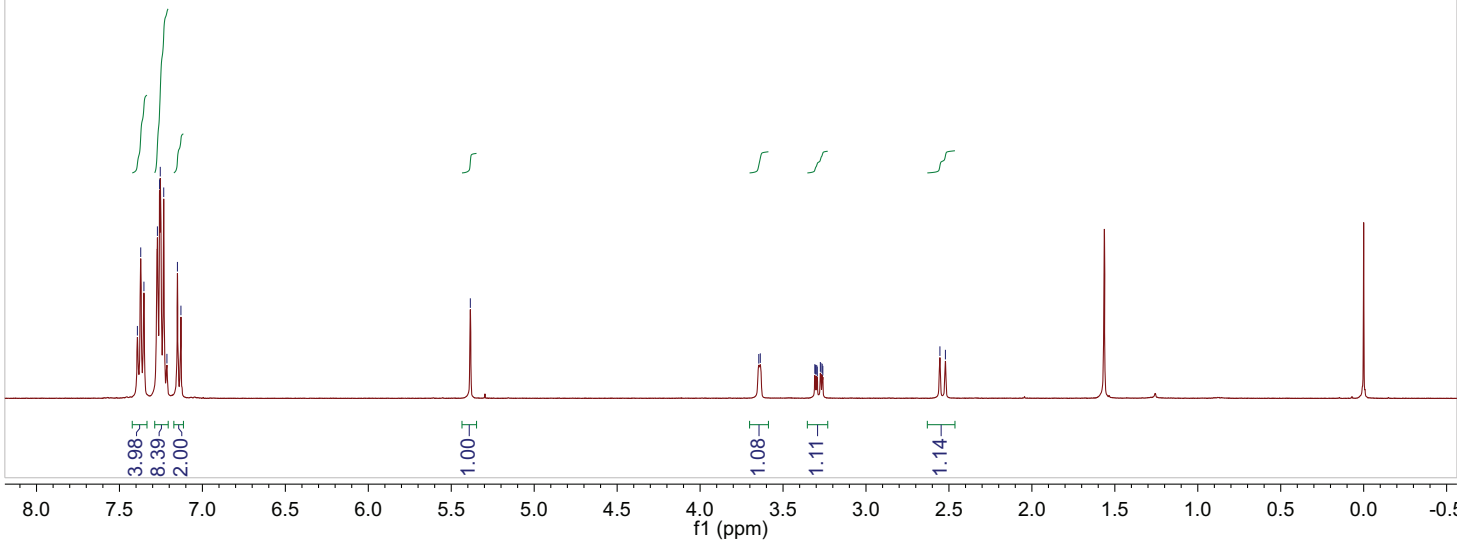

150.30
150.23
142.00
141.92
141.82
137.91
129.87
125.67
124.34
120.05
120.04
120.00
113.85
77.32
77.00
76.68
42.85
42.80
37.64
21.22
Parameter Value
1 Title w-1-55-1 c
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.0
6 Number of Scans 256
7 Acquisition Date 2020-10-16T04:20:24
8 Spectrometer Frequency 100.61
OPh
OPh
f1 (ppm)

Parameter	Value
1 Title	w-1-55-1 p
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.7
6 Number of Scans	16
7 Acquisition Date	2020-10-16T03:41:52
8 Spectrometer Frequency	161.98



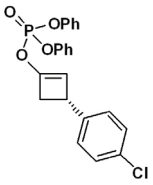
Parameter	Value
1 Title	w-1-38-1
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.1
6 Number of Scans	4
7 Acquisition Date	2020-09-03T23:23:13
8 Spectrometer Frequency	400.13





150.27
150.20
142.40
142.30
140.61
132.27
129.92
128.49
127.93
125.75
120.05
120.00
113.52
113.44
77.32
77.00
76.68
42.98
42.92
37.20

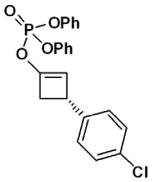
Parameter	Value
1 Title	WSW-1-10-1 C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.8
6 Number of Scans	128
7 Acquisition Date	2020-08-09T08:04:17
8 Spectrometer Frequency	100.61



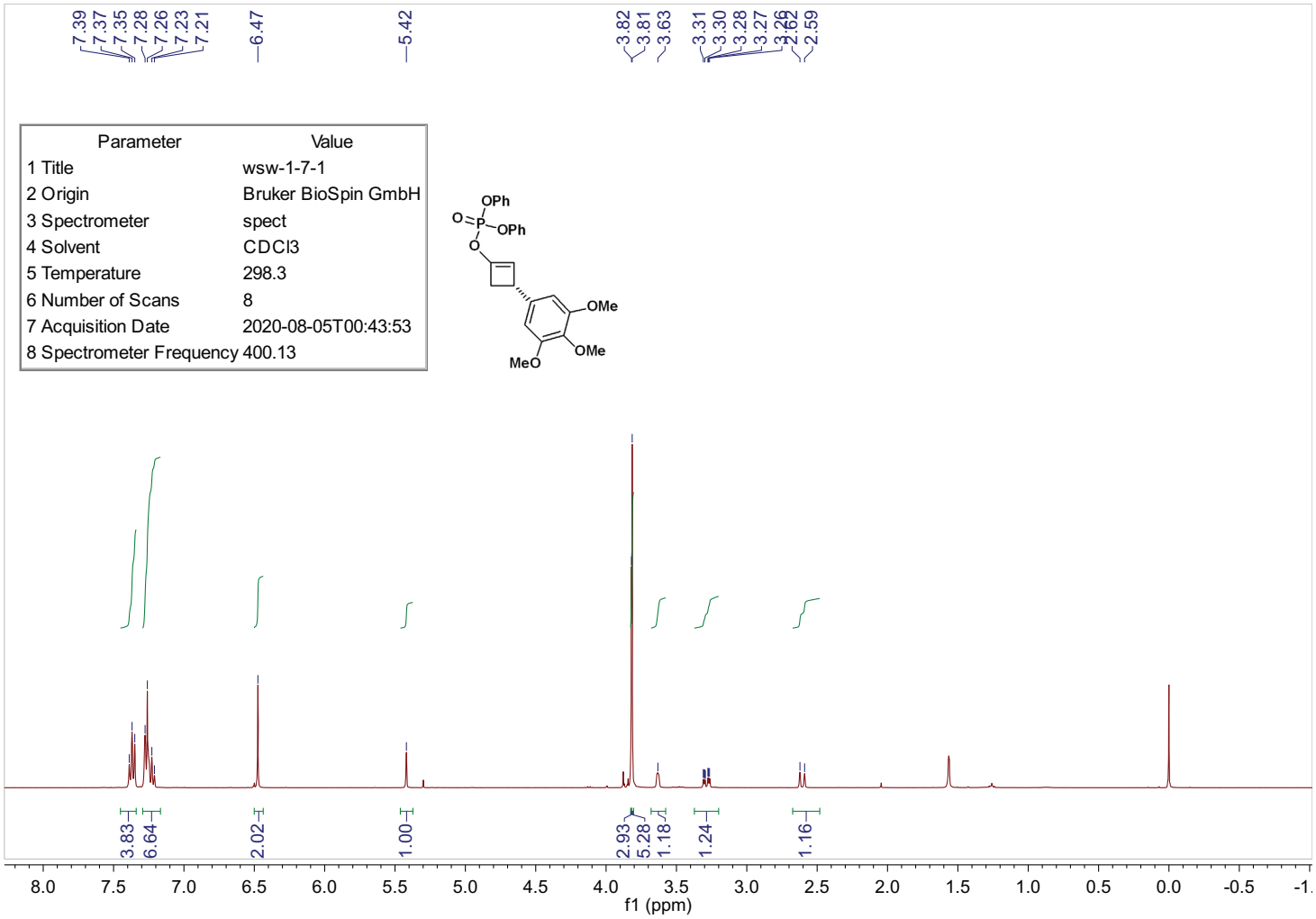
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

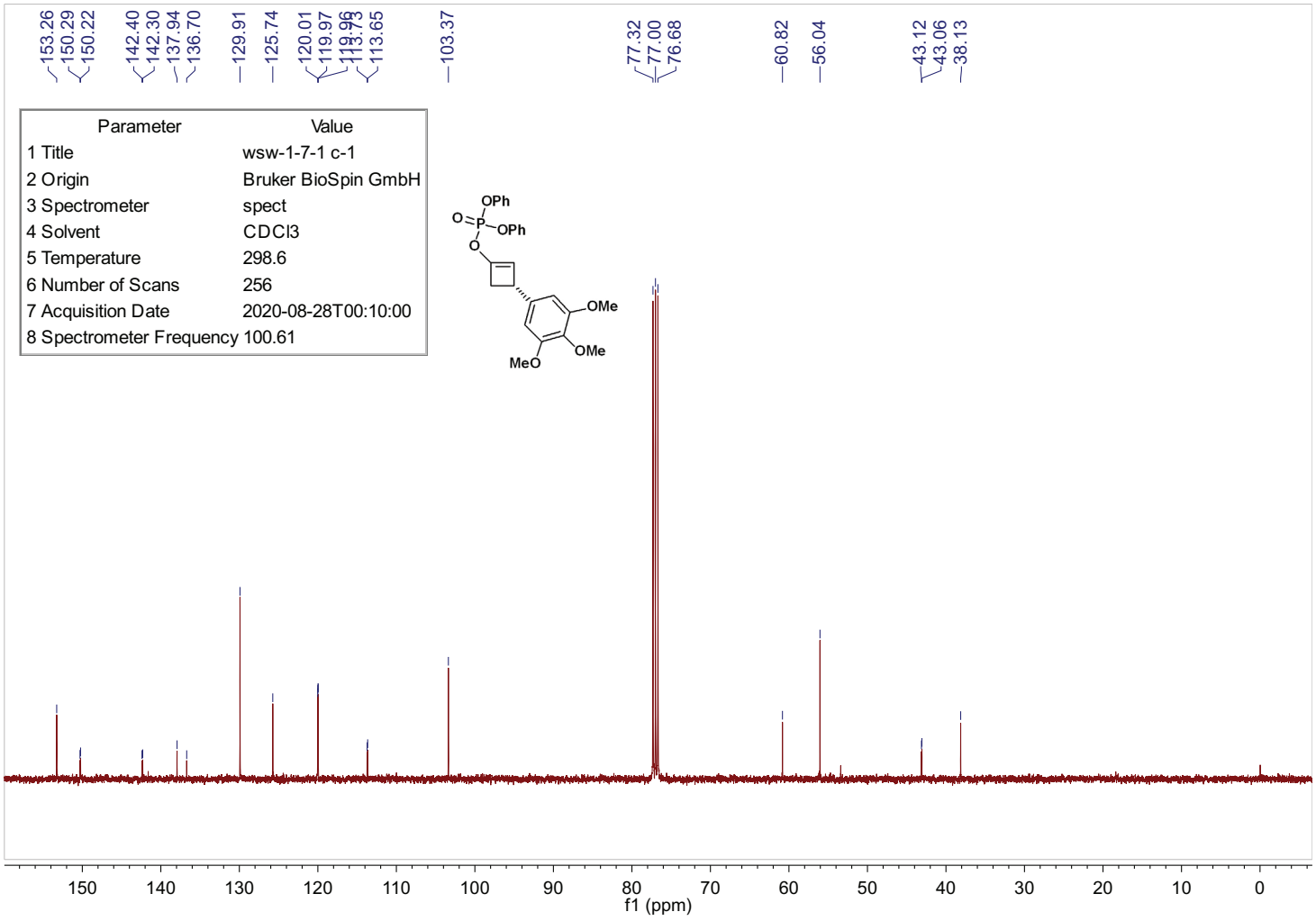
Parameter	Value
1 Title	WSW-1-10-1 P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.6
6 Number of Scans	16
7 Acquisition Date	2020-08-09T08:06:03
8 Spectrometer Frequency	161.98

-18.21

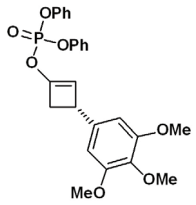


6 4 2 0 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20 -22 -24 -26 -28 -30 -32 -34 -36 -38 -40 -42 -44 -46 -48
f1 (ppm)

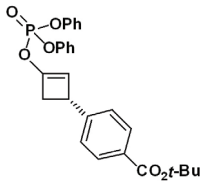

7.39
7.37
7.35
7.28
7.26
7.23
7.21
6.47
5.42
3.82
3.81
3.63
3.31
3.30
3.28
3.27
2.62
2.59
Parameter Value
1 Title wsw-1-7-1
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.3
6 Number of Scans 8
7 Acquisition Date 2020-08-05T00:43:53
8 Spectrometer Frequency 400.13
OPh
OPh
OMe
OMe
MeO
3.83
6.64
2.02
1.00
2.93
5.28
1.18
1.24
1.16
f1 (ppm)

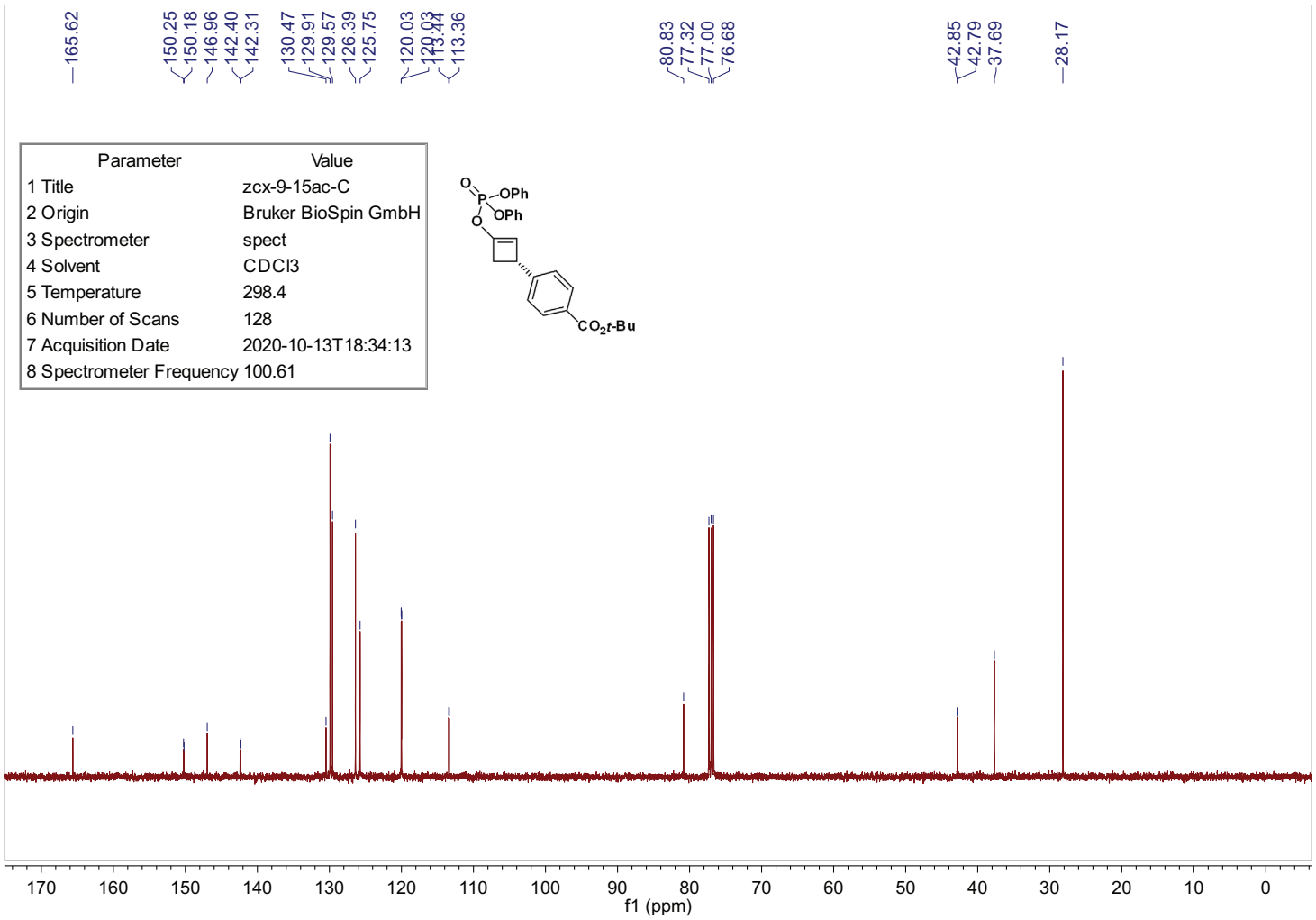

153.26
150.29
150.22
142.40
142.30
137.94
136.70
129.91
125.74
120.01
119.97
113.65
103.37
77.32
77.00
76.68
60.82
56.04
43.12
43.06
38.13
Parameter Value
1 Title wsw-1-7-1 c-1
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.6
6 Number of Scans 256
7 Acquisition Date 2020-08-28T00:10:00
8 Spectrometer Frequency 100.61
OPh
OPh
OMe
OMe
MeO
f1 (ppm)

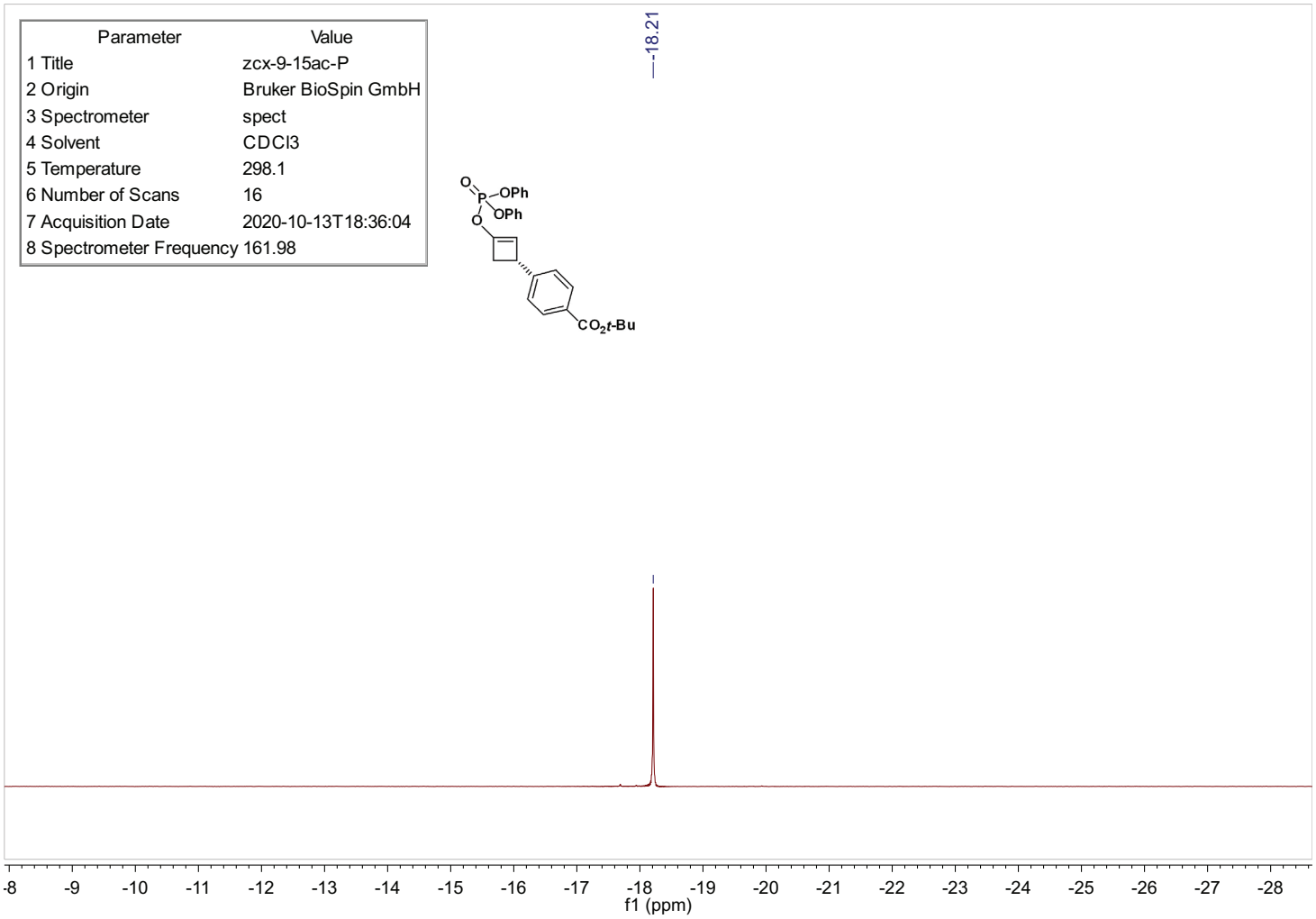
Parameter	Value
1 Title	WSW-1-7-1 P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.8
6 Number of Scans	16
7 Acquisition Date	2020-08-09T07:14:27
8 Spectrometer Frequency	161.98

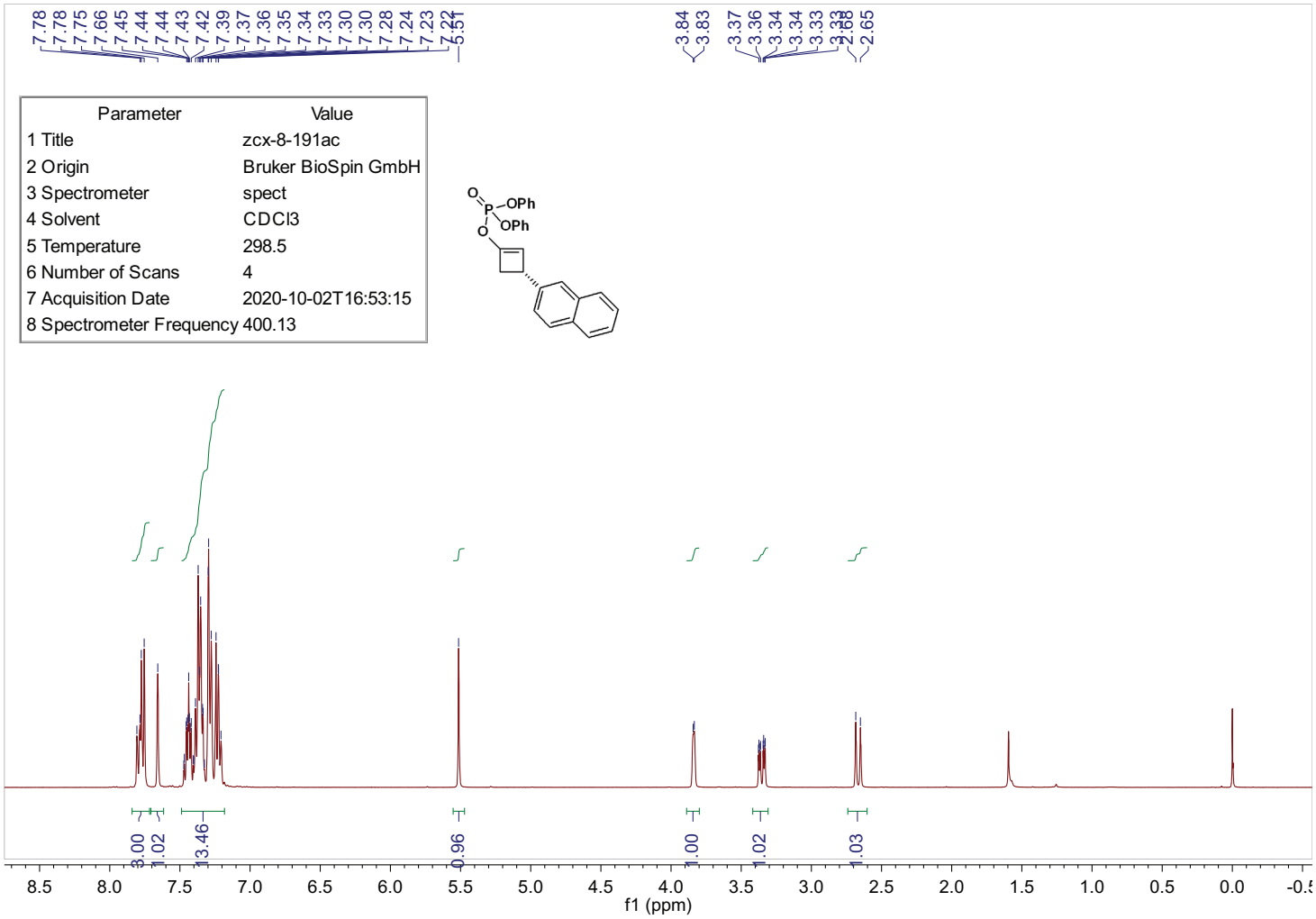


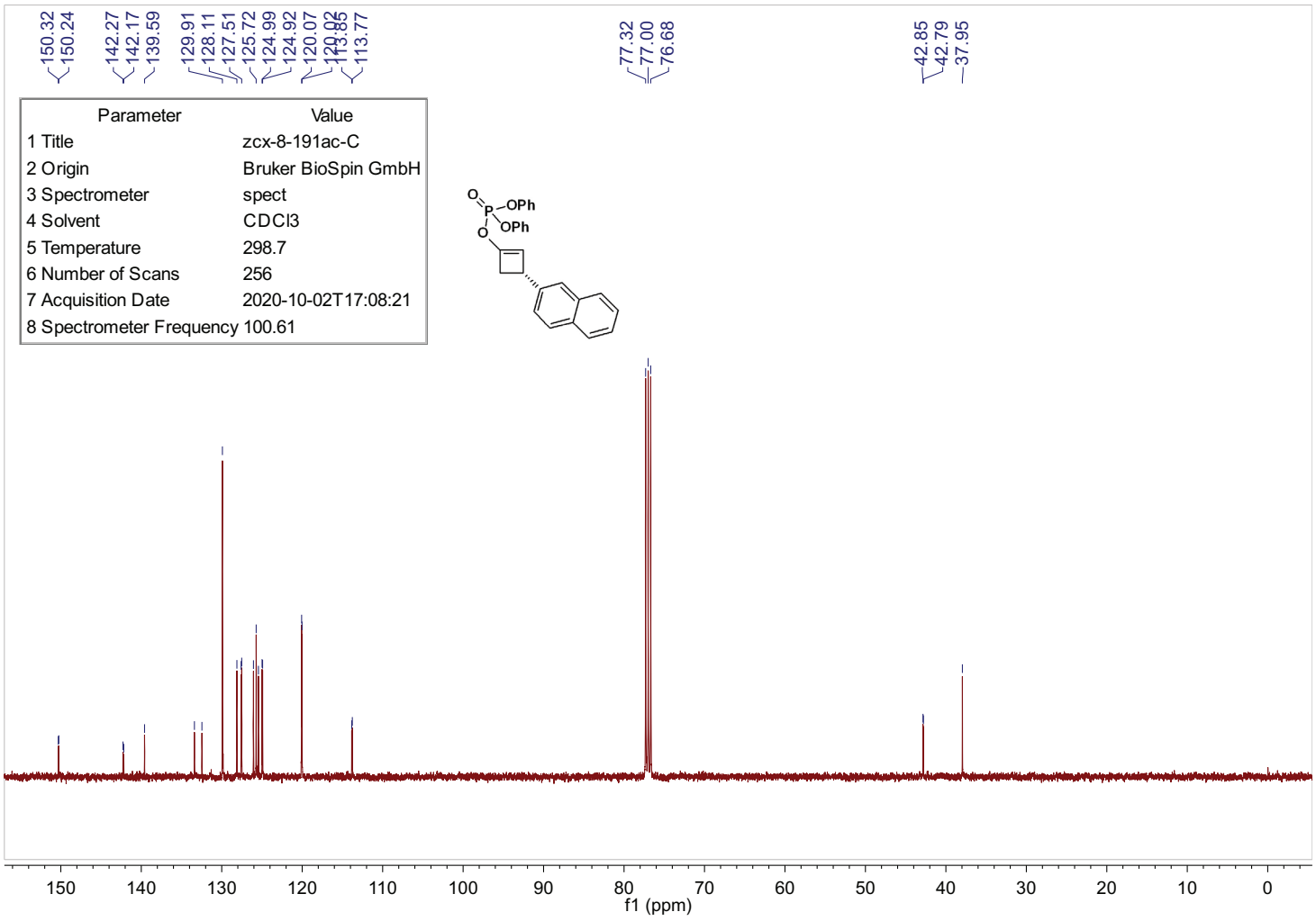
Parameter	Value
1 Title	zcx-9-15ac
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.8
6 Number of Scans	4
7 Acquisition Date	2020-10-13T18:28:14
8 Spectrometer Frequency	400.13



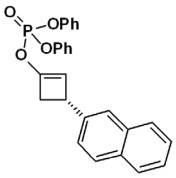

165.62
150.25
150.18
146.96
142.40
142.31
130.47
129.91
129.57
126.39
125.75
120.03
113.44
113.36
80.83
77.32
77.00
76.68
42.85
42.79
37.69
28.17
Parameter Value
1 Title zcx-9-15ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.4
6 Number of Scans 128
7 Acquisition Date 2020-10-13T18:34:13
8 Spectrometer Frequency 100.61
OPh
OPh
CO2t-Bu
f1 (ppm)


18.21
Parameter Value
1 Title zcx-9-15ac-P
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.1
6 Number of Scans 16
7 Acquisition Date 2020-10-13T18:36:04
8 Spectrometer Frequency 161.98
OPh
OPh
CO2t-Bu
f1 (ppm)

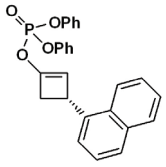

7.78
7.78
7.75
7.66
7.45
7.44
7.44
7.43
7.42
7.39
7.37
7.36
7.35
7.34
7.33
7.30
7.30
7.28
7.24
7.23
7.22
5.51
3.84
3.83
3.37
3.36
3.34
3.34
3.33
3.33
2.68
2.65
Parameter Value
1 Title zcx-8-191ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.5
6 Number of Scans 4
7 Acquisition Date 2020-10-02T16:53:15
8 Spectrometer Frequency 400.13
OPh
OPh
3.00
1.02
13.46
0.96
1.00
1.02
1.03
f1 (ppm)

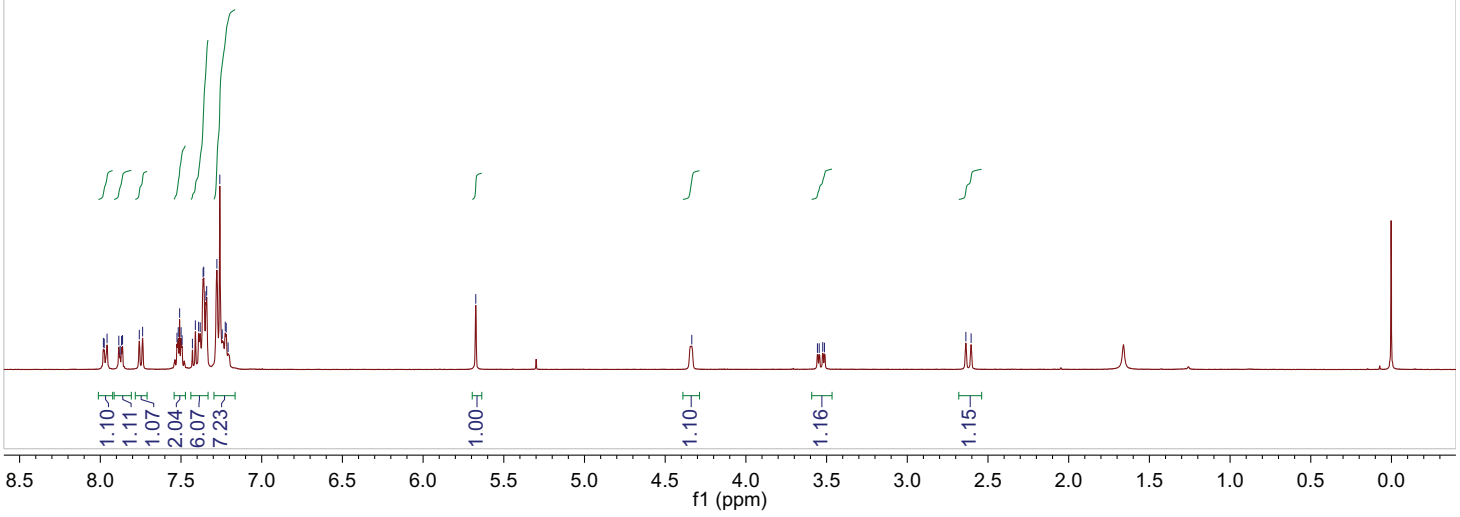

150.32
150.24
142.27
142.17
139.59
129.91
128.11
127.51
125.72
124.99
124.92
120.07
113.77
77.32
77.00
76.68
42.85
42.79
37.95
Parameter Value
1 Title zcx-8-191ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.7
6 Number of Scans 256
7 Acquisition Date 2020-10-02T17:08:21
8 Spectrometer Frequency 100.61
OPh
OPh
f1 (ppm)

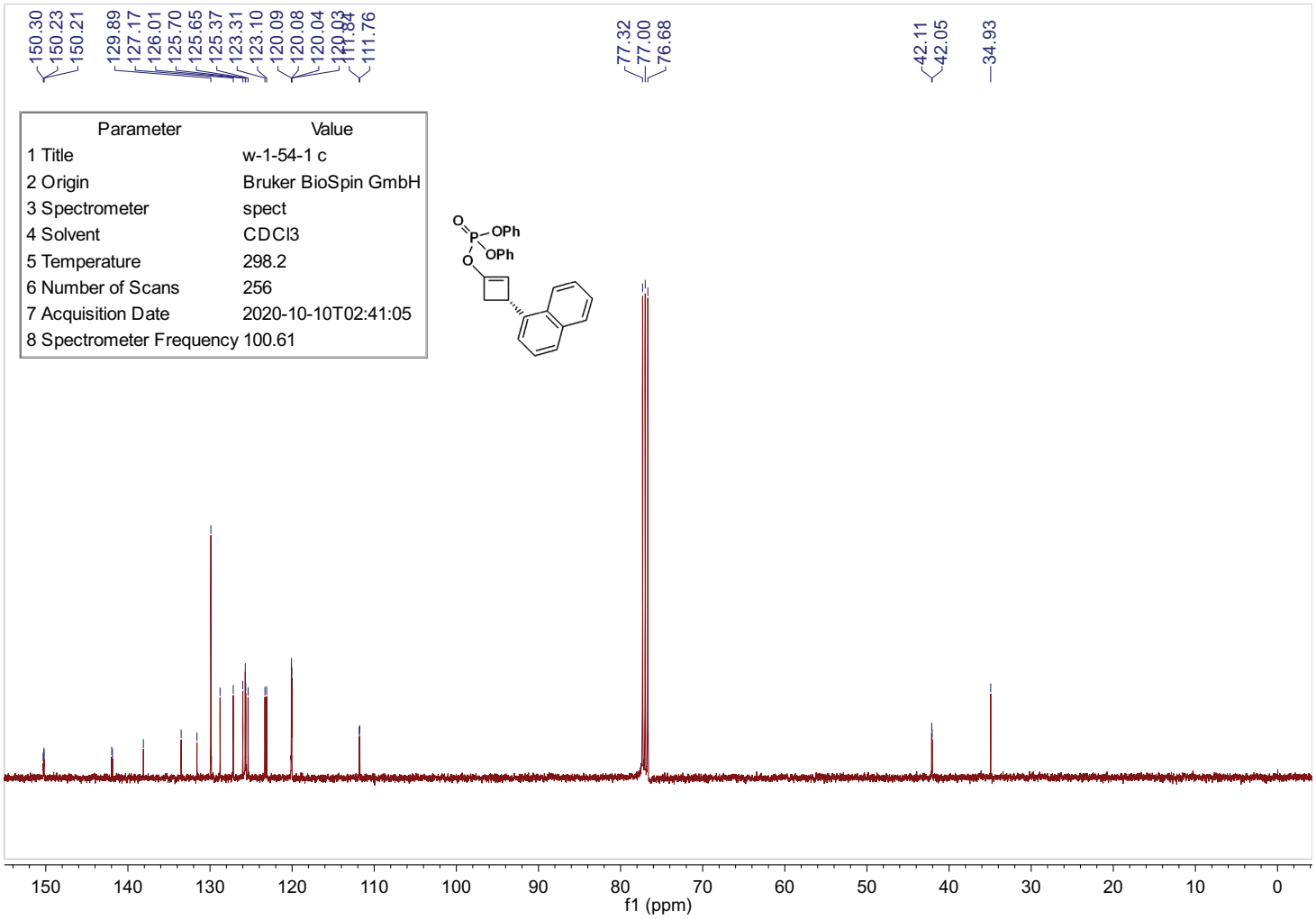
Parameter	Value
1 Title	zcx-8-191ac-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	299.5
6 Number of Scans	16
7 Acquisition Date	2020-10-01T16:47:18
8 Spectrometer Frequency	161.98

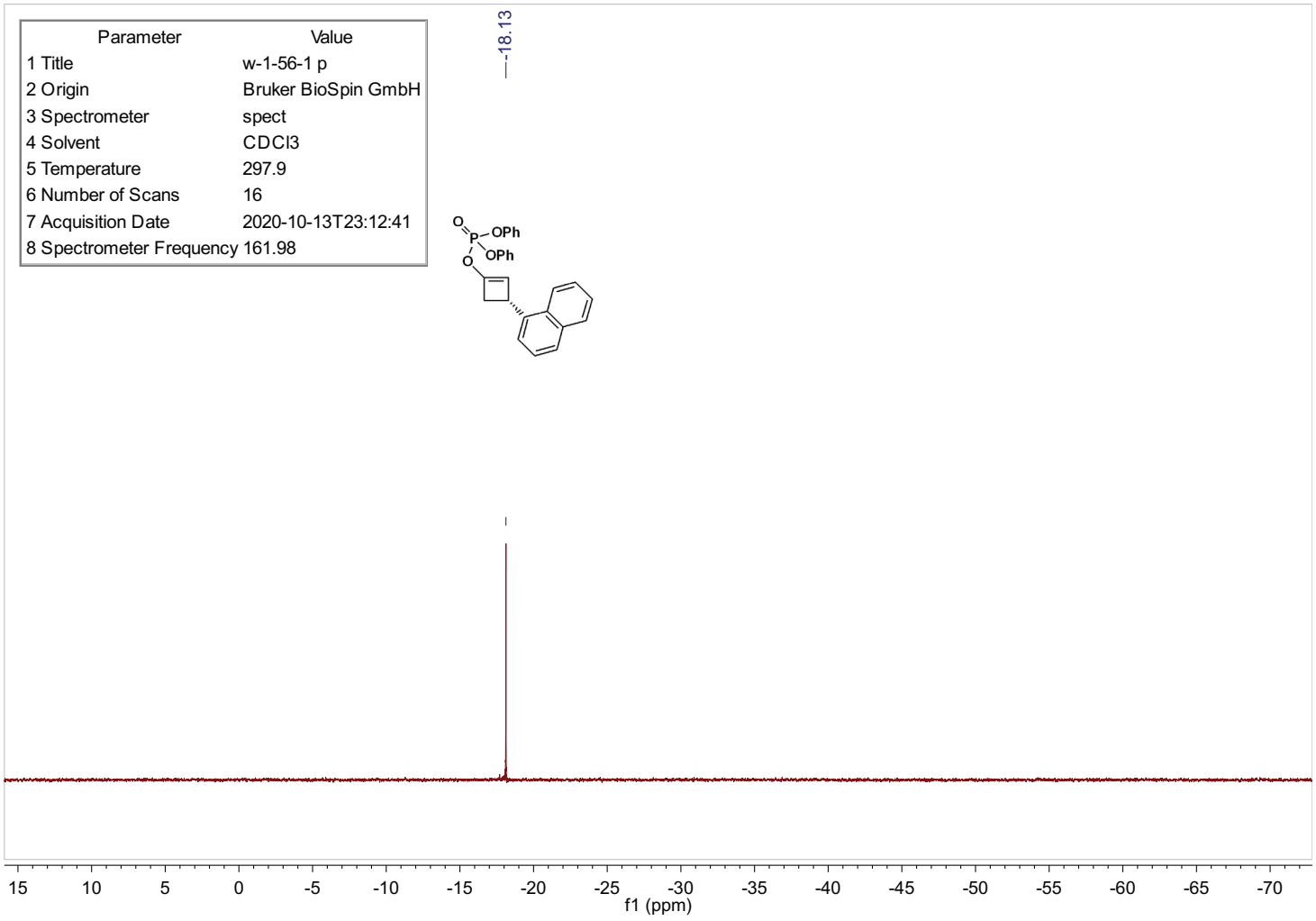


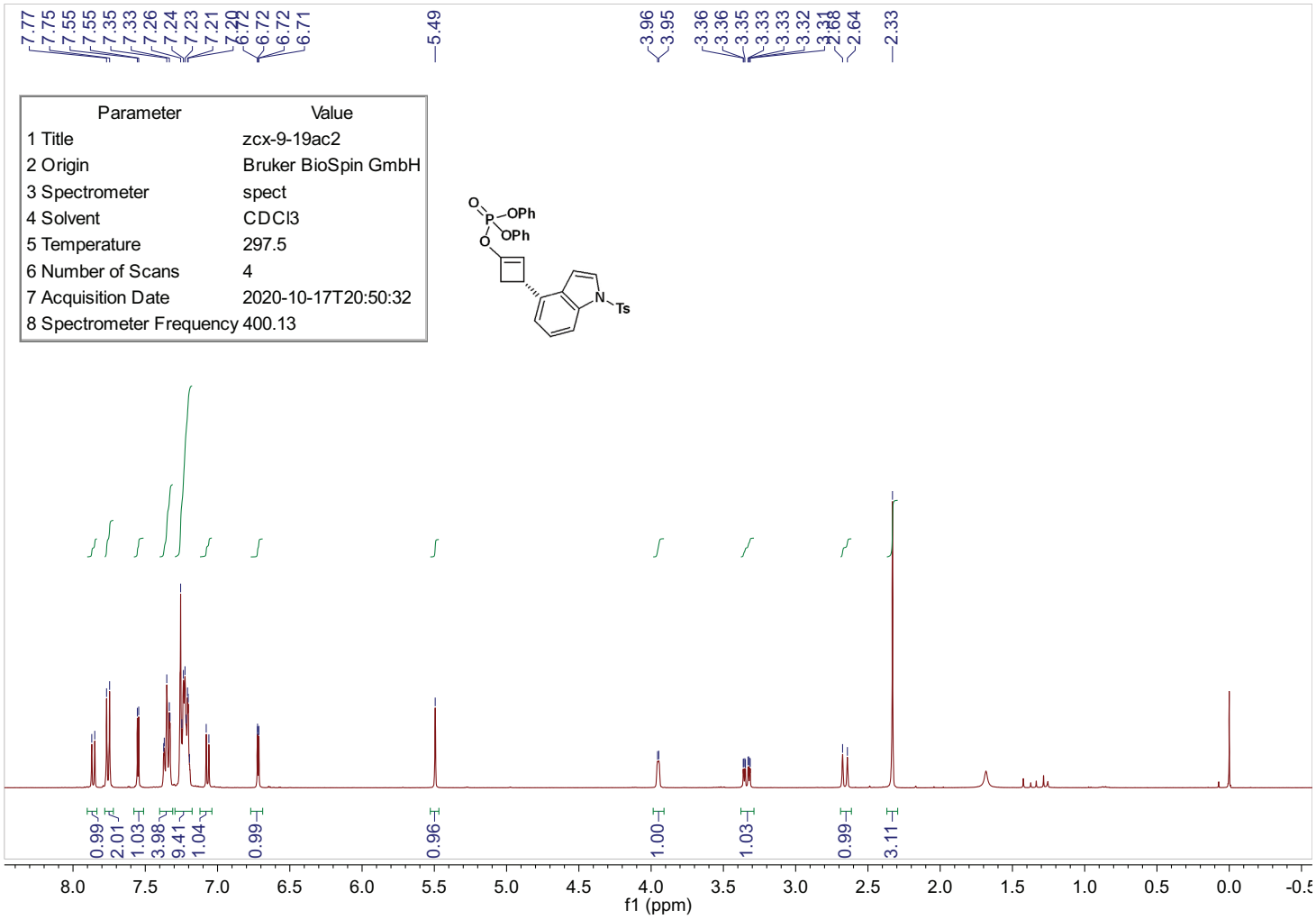
Parameter	Value
1 Title	wsw-1-56
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	295.0
6 Experiment	1D
7 Number of Scans	4
8 Acquisition Date	2021-01-03T02:45:57
9 Spectrometer Frequency	400.13

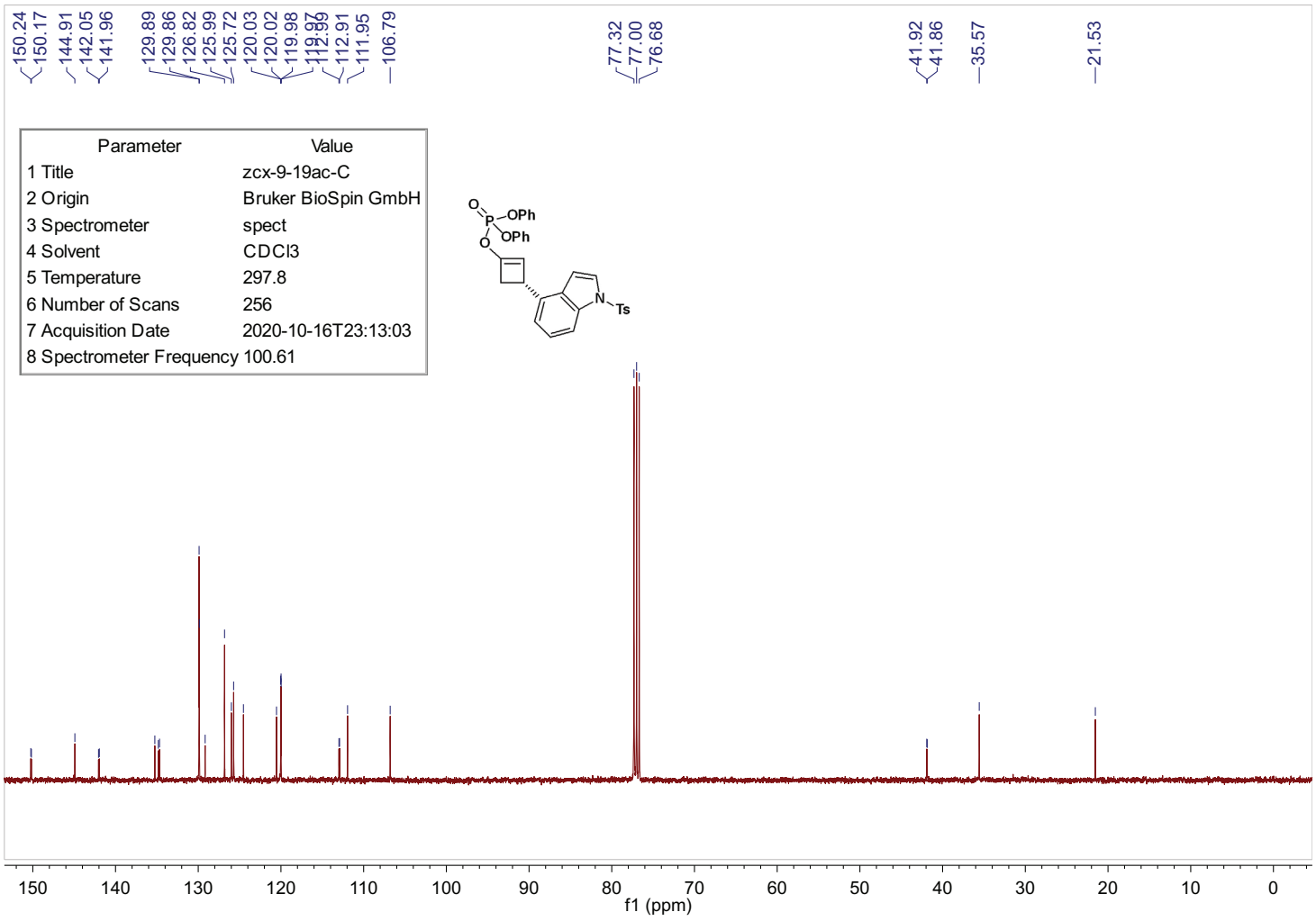




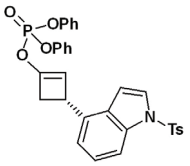

150.30
150.23
150.21
129.89
127.17
126.01
125.70
125.65
125.37
123.31
123.10
120.09
120.08
120.04
120.03
111.84
111.76
77.32
77.00
76.68
42.11
42.05
34.93
Parameter Value
1 Title w-1-54-1 c
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.2
6 Number of Scans 256
7 Acquisition Date 2020-10-10T02:41:05
8 Spectrometer Frequency 100.61
OPh
OPh
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

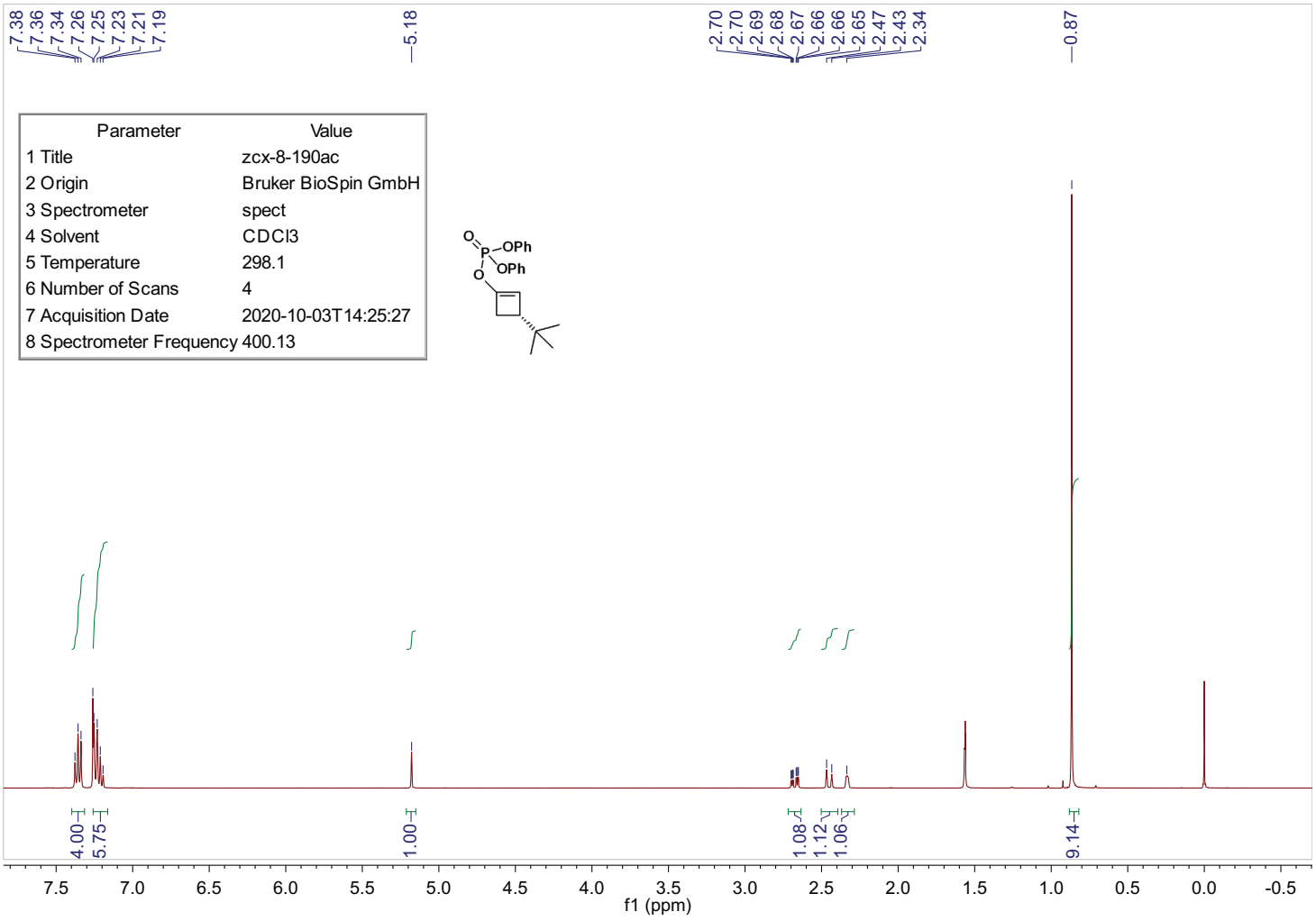

-18.13
Parameter Value
1 Title w-1-56-1 p
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.9
6 Number of Scans 16
7 Acquisition Date 2020-10-13T23:12:41
8 Spectrometer Frequency 161.98
OPh
OPh
15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70
f1 (ppm)


7.77
7.75
7.55
7.55
7.35
7.33
7.26
7.24
7.23
7.21
7.20
6.72
6.72
6.71
5.49
3.96
3.95
3.36
3.36
3.35
3.33
3.33
3.32
3.31
2.68
2.64
2.33
Parameter Value
1 Title zcx-9-19ac2
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.5
6 Number of Scans 4
7 Acquisition Date 2020-10-17T20:50:32
8 Spectrometer Frequency 400.13
OPh
OPh
Ts
0.99
2.01
1.03
3.98
9.41
1.04
0.99
0.96
1.00
1.03
0.99
3.11
f1 (ppm)


150.24
150.17
144.91
142.05
141.96
129.89
129.86
126.82
125.99
125.72
120.03
120.02
119.98
112.91
111.95
106.79
77.32
77.00
76.68
41.92
41.86
35.57
21.53
Parameter Value
1 Title zcx-9-19ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.8
6 Number of Scans 256
7 Acquisition Date 2020-10-16T23:13:03
8 Spectrometer Frequency 100.61
OPh
OPh
Ts
f1 (ppm)

Parameter	Value
1 Title	zcx-9-19ac-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.6
6 Number of Scans	16
7 Acquisition Date	2020-10-16T23:14:54
8 Spectrometer Frequency	161.98

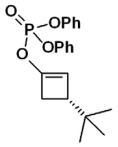


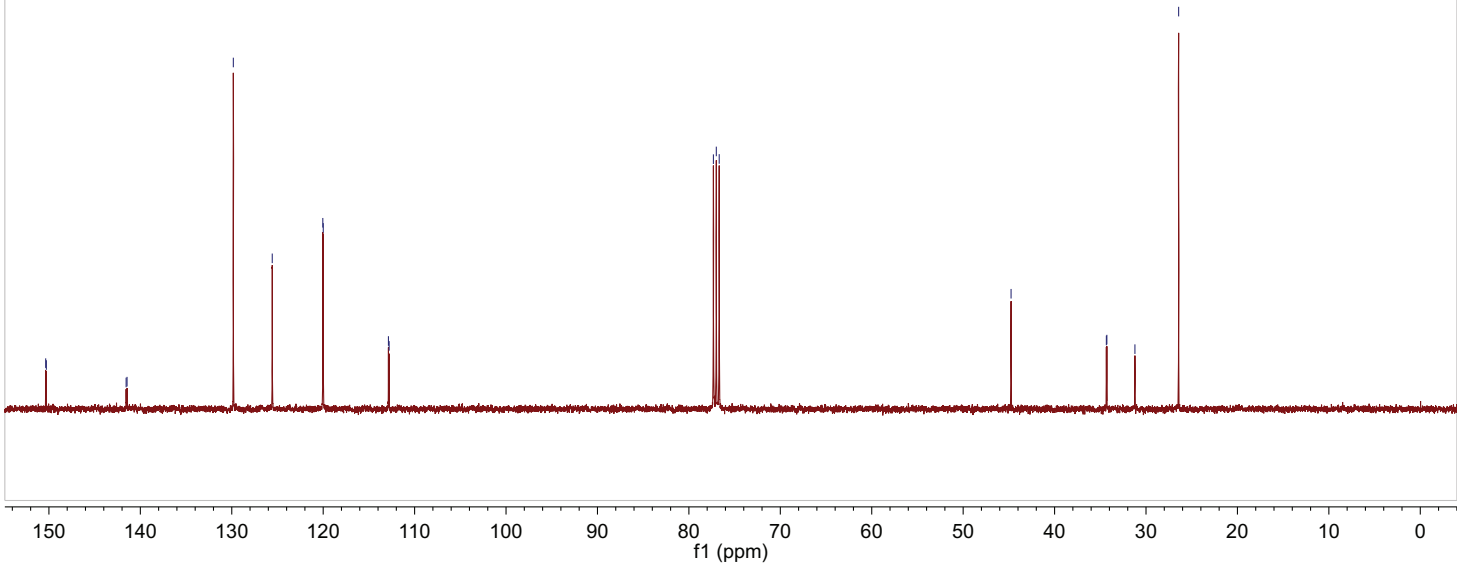


Parameter	Value
1 Title	zcx-8-190ac
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.1
6 Number of Scans	4
7 Acquisition Date	2020-10-03T14:25:27
8 Spectrometer Frequency	400.13

150.35
150.28
141.55
141.45
129.83
125.57
120.04
119.99
112.86
112.79
77.32
77.00
76.68
44.76
34.34
34.28
31.21
26.43

Parameter	Value
1 Title	zcx-8-190ac-C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.5
6 Number of Scans	128
7 Acquisition Date	2020-10-03T21:39:07
8 Spectrometer Frequency	100.61

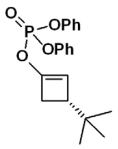


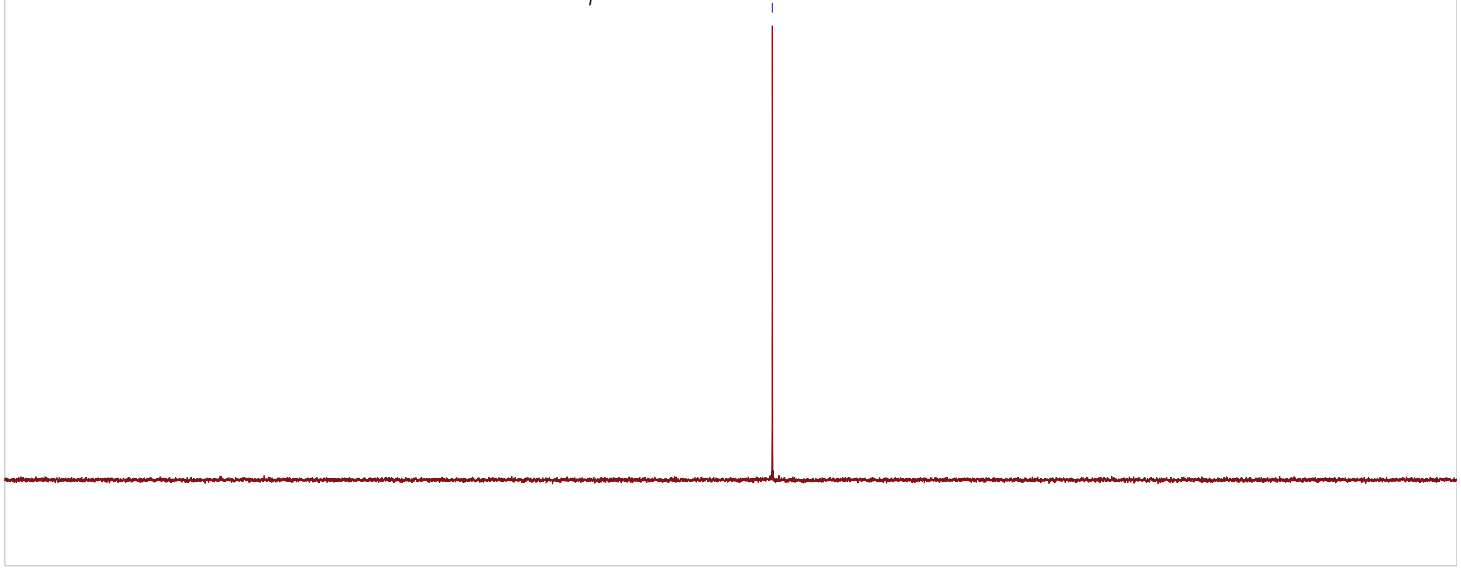


150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

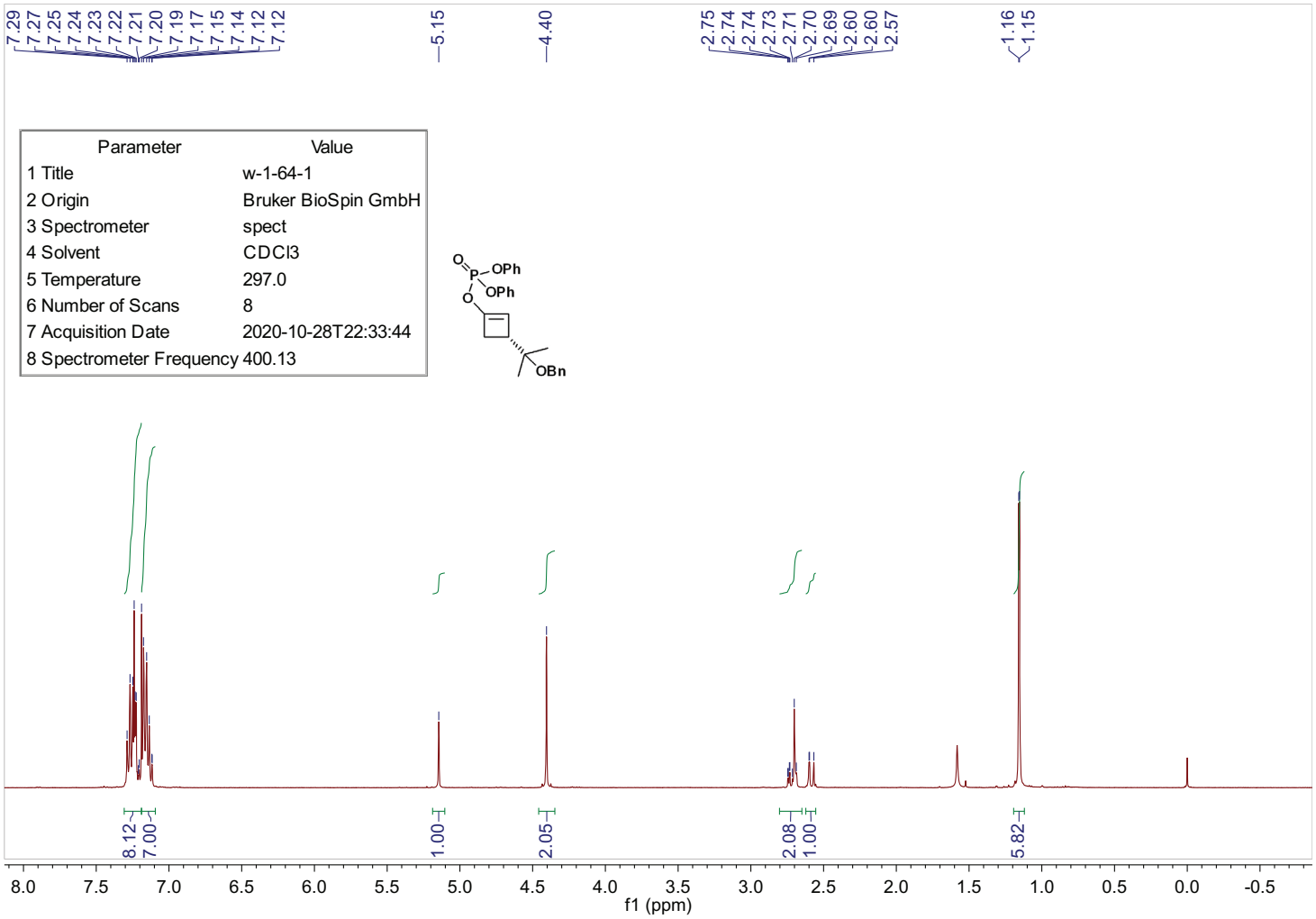
Parameter	Value
1 Title	zcx-8-190ac-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.3
6 Number of Scans	16
7 Acquisition Date	2020-10-03T18:25:13
8 Spectrometer Frequency	161.98

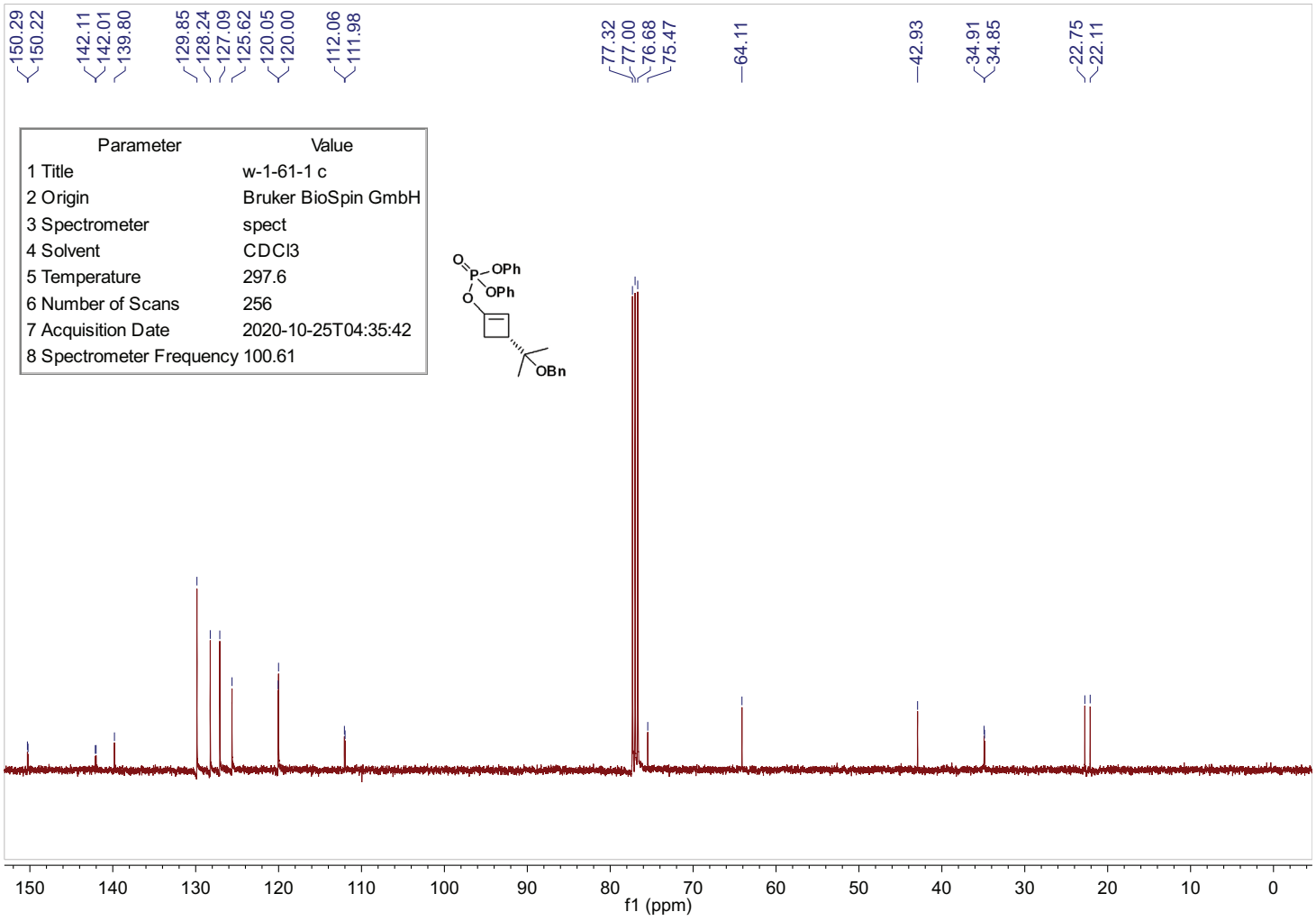
-18.12



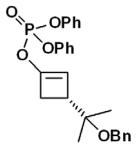


30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60
f1 (ppm)

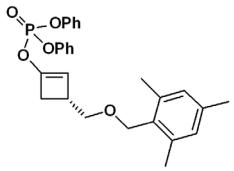

7.29
7.27
7.25
7.24
7.23
7.22
7.21
7.20
7.19
7.17
7.15
7.14
7.12
7.12
5.15
4.40
2.75
2.74
2.74
2.73
2.71
2.70
2.69
2.60
2.60
2.57
1.16
1.15
Parameter Value
1 Title w-1-64-1
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.0
6 Number of Scans 8
7 Acquisition Date 2020-10-28T22:33:44
8 Spectrometer Frequency 400.13
OPh
OPh
OBn
8.12
7.00
1.00
2.05
2.08
1.00
5.82
f1 (ppm)

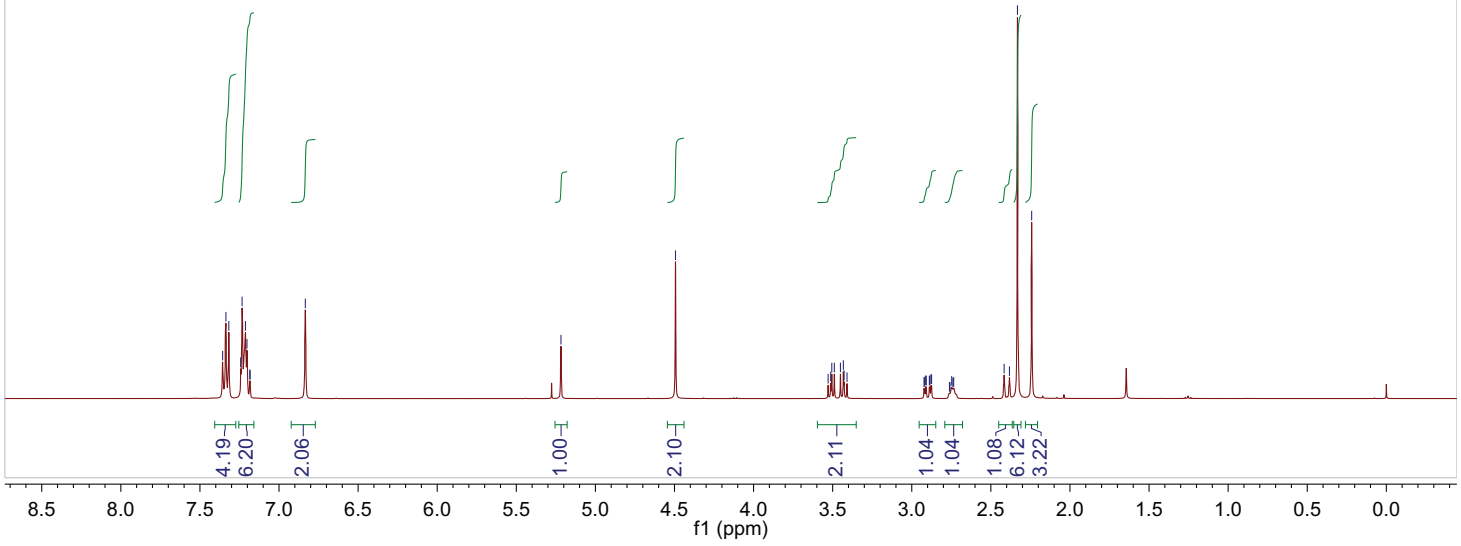

150.29
150.22
142.11
142.01
139.80
129.85
128.24
127.09
125.62
120.05
120.00
112.06
111.98
77.32
77.00
76.68
75.47
64.11
42.93
34.91
34.85
22.75
22.11
Parameter Value
1 Title w-1-61-1 c
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.6
6 Number of Scans 256
7 Acquisition Date 2020-10-25T04:35:42
8 Spectrometer Frequency 100.61
OPh
OPh
OBn
f1 (ppm)

Parameter	Value
1 Title	w-1-61-1 p
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.3
6 Number of Scans	16
7 Acquisition Date	2020-10-24T03:24:06
8 Spectrometer Frequency	161.98



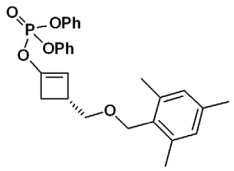
Parameter	Value
1 Title	W-1-53-1 H
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.6
6 Number of Scans	4
7 Acquisition Date	2020-10-08T08:49:10
8 Spectrometer Frequency	400.13

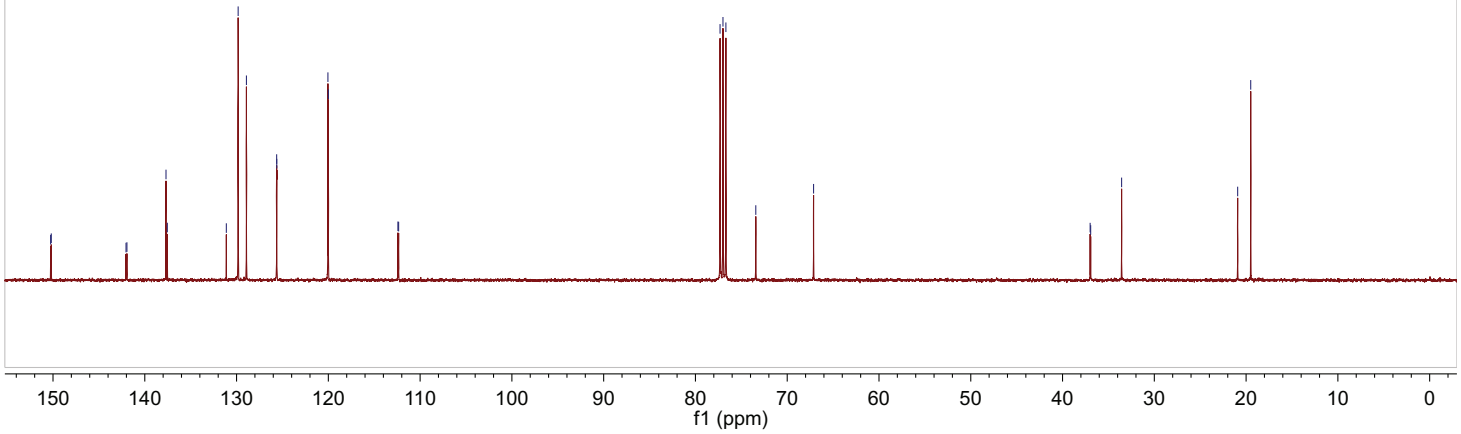




150.26
150.19
142.04
141.95
137.69
137.54
131.11
129.83
128.92
125.63
125.62
120.05
120.00
112.42
112.34
77.32
77.00
76.68
73.42
67.13
36.99
36.94
33.57
20.92
19.50

Parameter	Value
1 Title	W-1-53-1 C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.1
6 Number of Scans	384
7 Acquisition Date	2020-10-08T09:11:16
8 Spectrometer Frequency	100.61

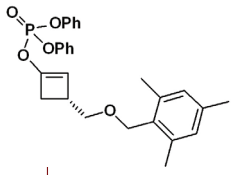


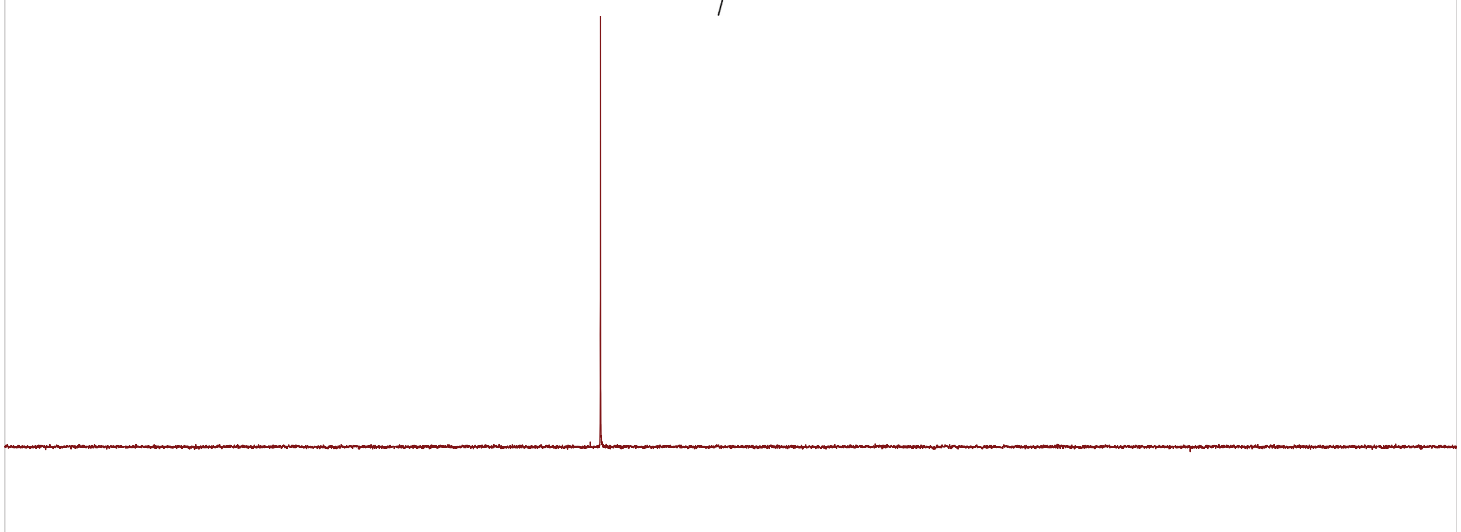


150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

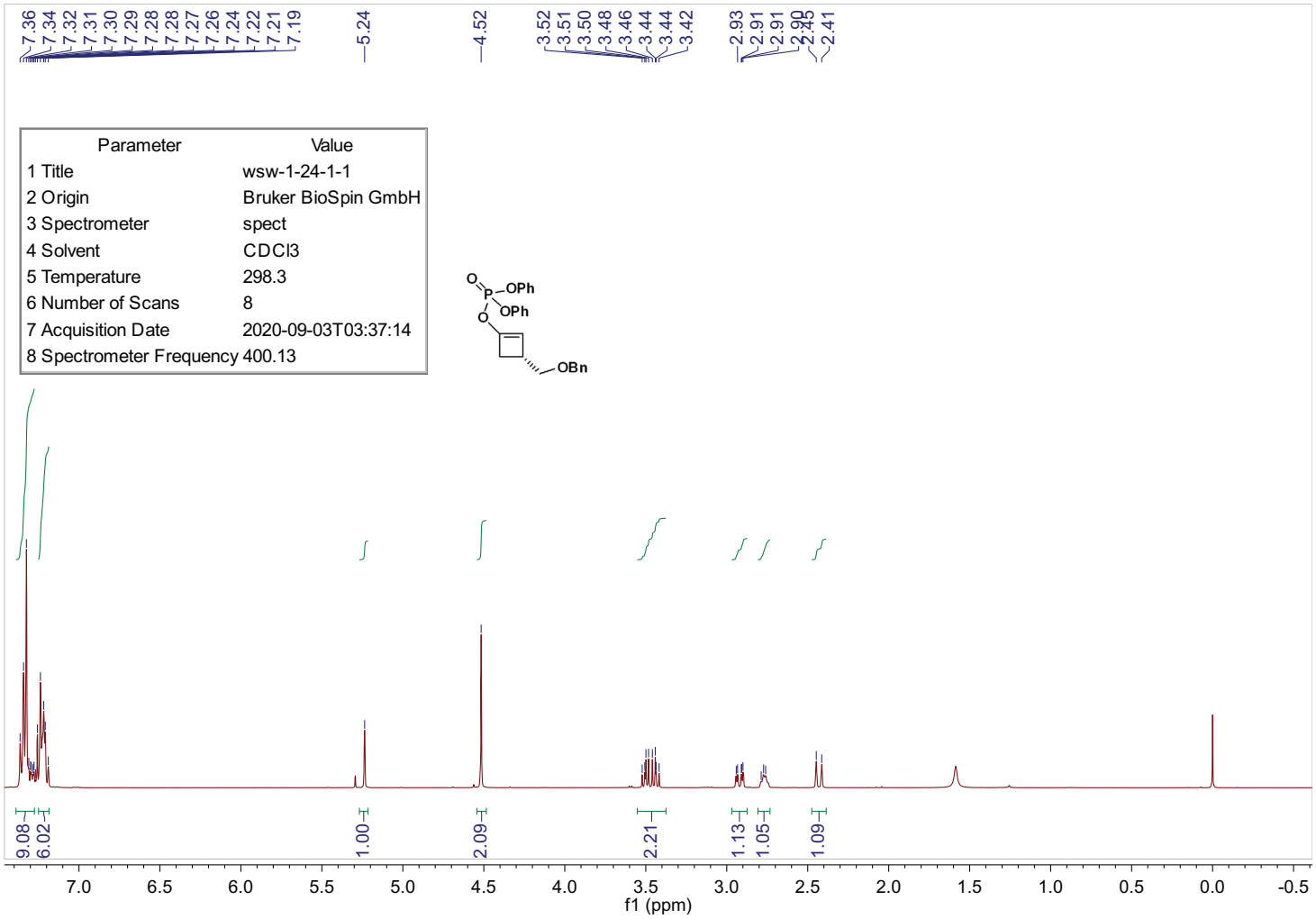
Parameter	Value
1 Title	w-1-53-1 p
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.7
6 Number of Scans	16
7 Acquisition Date	2020-10-08T04:11:56
8 Spectrometer Frequency	161.98

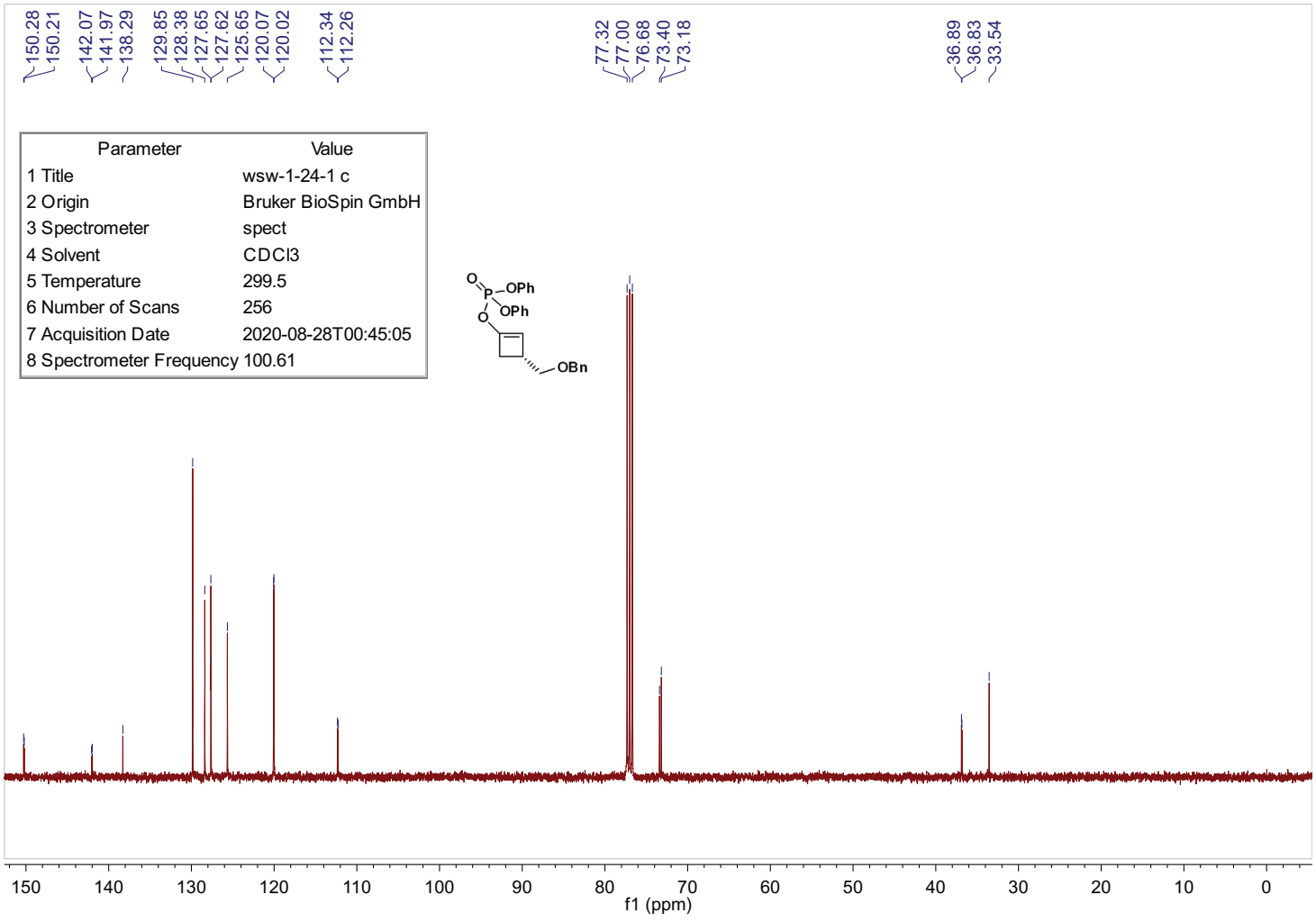
-18.25



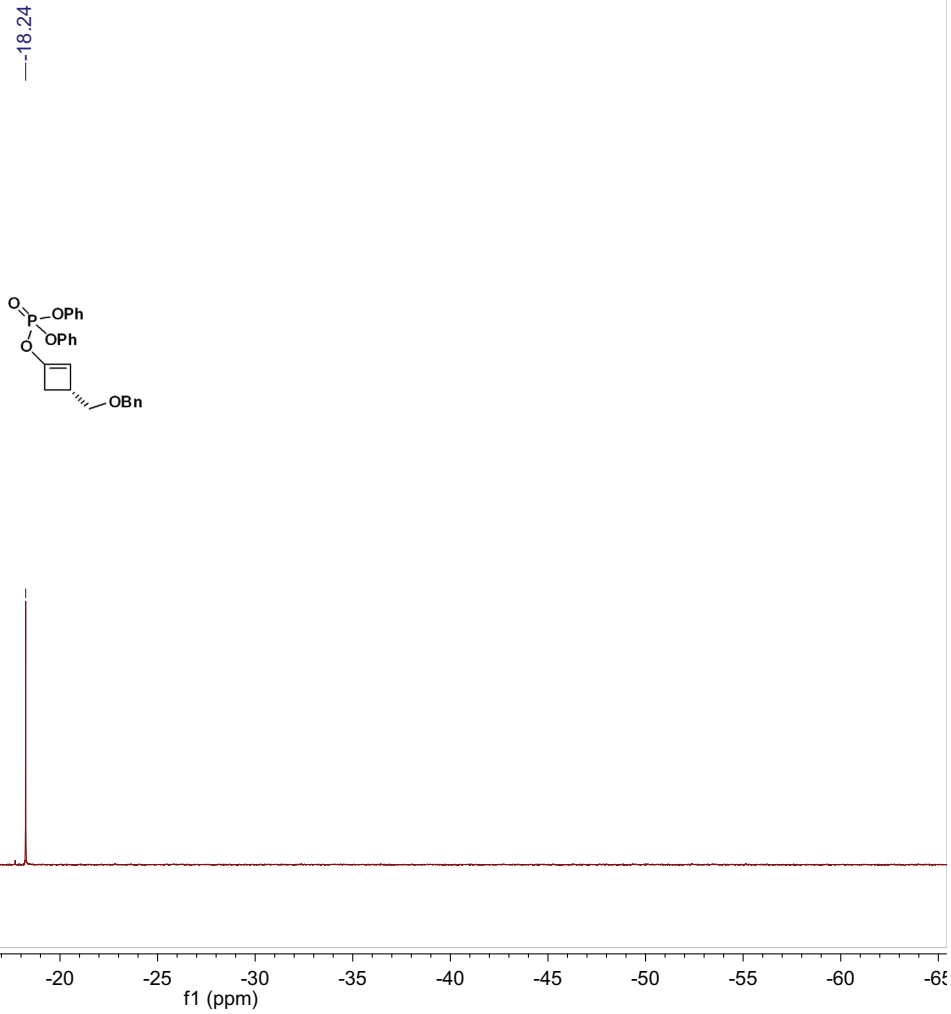


10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60
f1 (ppm)

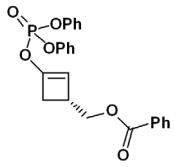

7.36
7.34
7.32
7.31
7.30
7.29
7.28
7.28
7.27
7.26
7.24
7.22
7.21
7.19
5.24
4.52
3.52
3.51
3.50
3.48
3.46
3.44
3.44
3.42
2.93
2.91
2.91
2.90
2.45
2.41
Parameter Value
1 Title wsw-1-24-1-1
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.3
6 Number of Scans 8
7 Acquisition Date 2020-09-03T03:37:14
8 Spectrometer Frequency 400.13
OPh
OPh
OBn
9.08
6.02
1.00
2.09
2.21
1.13
1.05
1.09
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

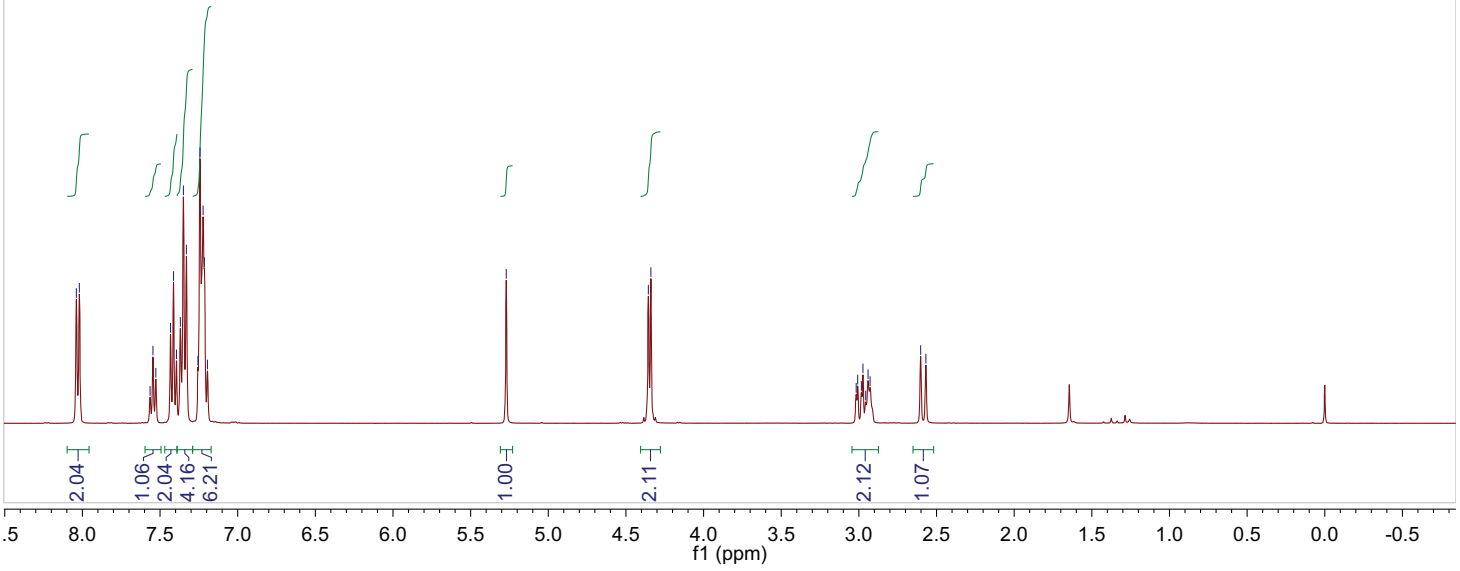

150.28
150.21
142.07
141.97
138.29
129.85
128.38
127.65
127.62
125.65
120.07
120.02
112.34
112.26
77.32
77.00
76.68
73.40
73.18
36.89
36.83
33.54
Parameter Value
1 Title wsw-1-24-1 c
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 299.5
6 Number of Scans 256
7 Acquisition Date 2020-08-28T00:45:05
8 Spectrometer Frequency 100.61
OPh
OPh
OBn
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

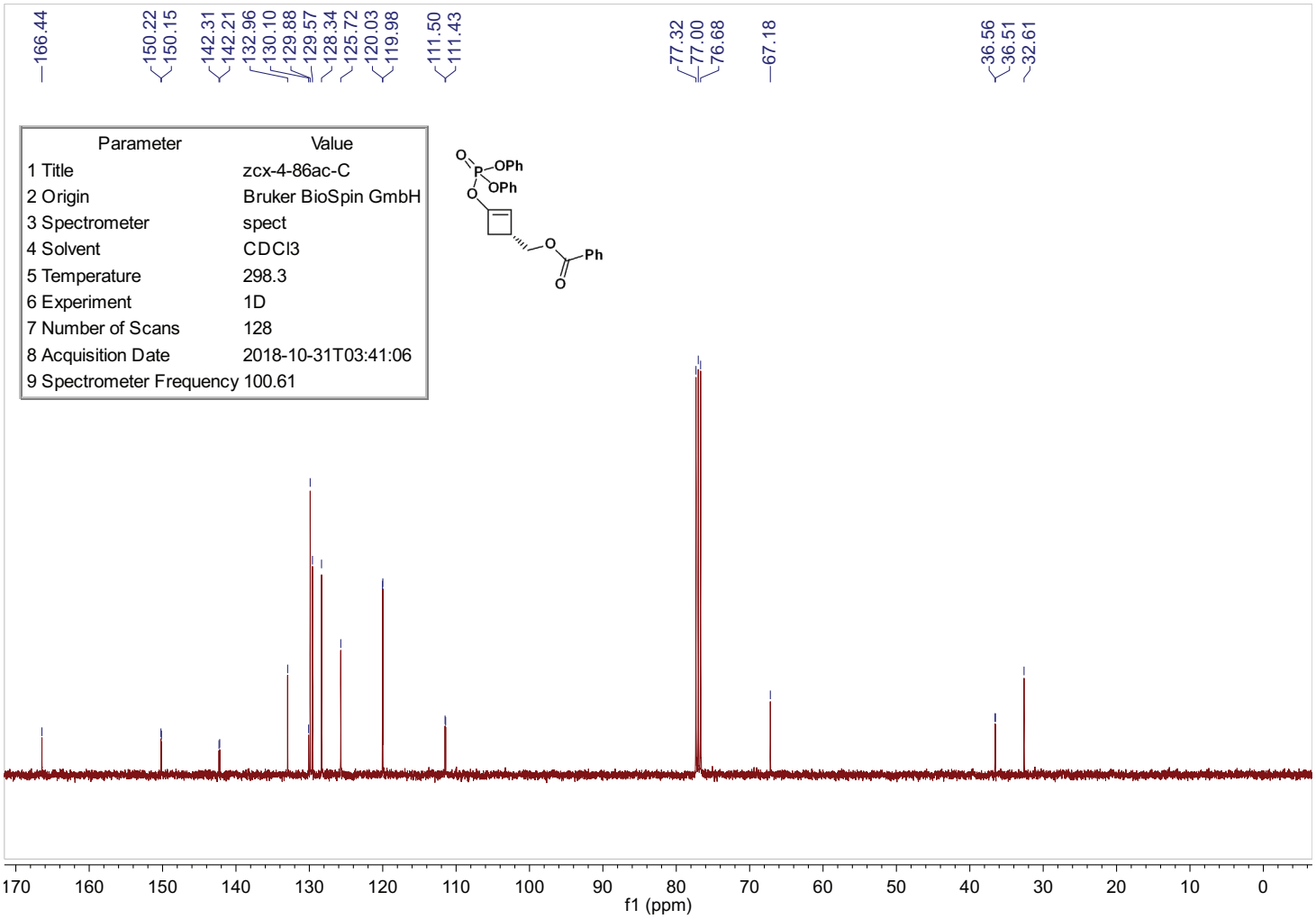
Parameter	Value
1 Title	wsw-1-24-1-1 p
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.6
6 Number of Scans	16
7 Acquisition Date	2020-09-03T03:38:50
8 Spectrometer Frequency	161.98



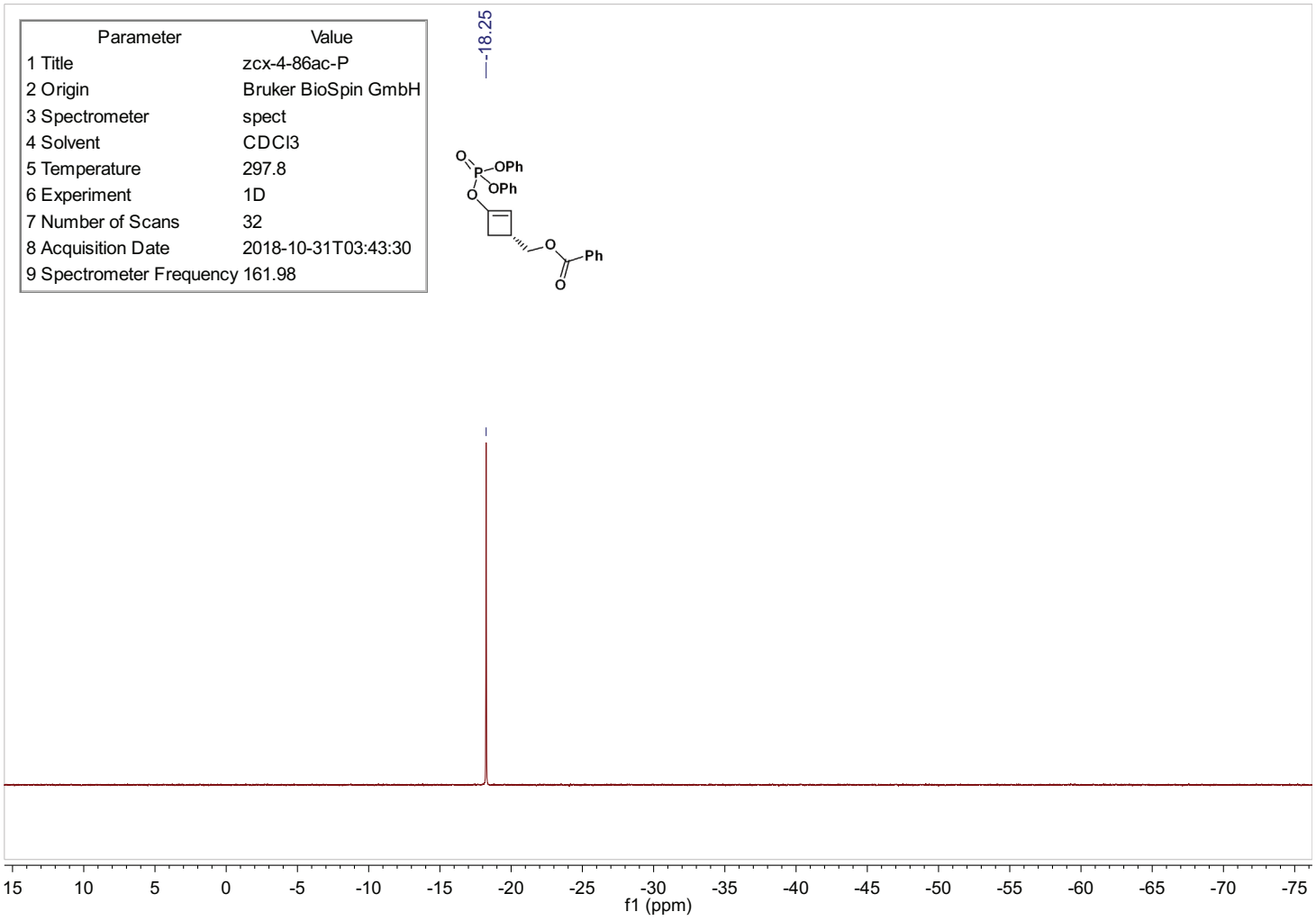
Parameter	Value
1 Title	zcx-4-86ac2
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.7
6 Experiment	1D
7 Number of Scans	4
8 Acquisition Date	2018-10-30T21:07:28
9 Spectrometer Frequency	400.13



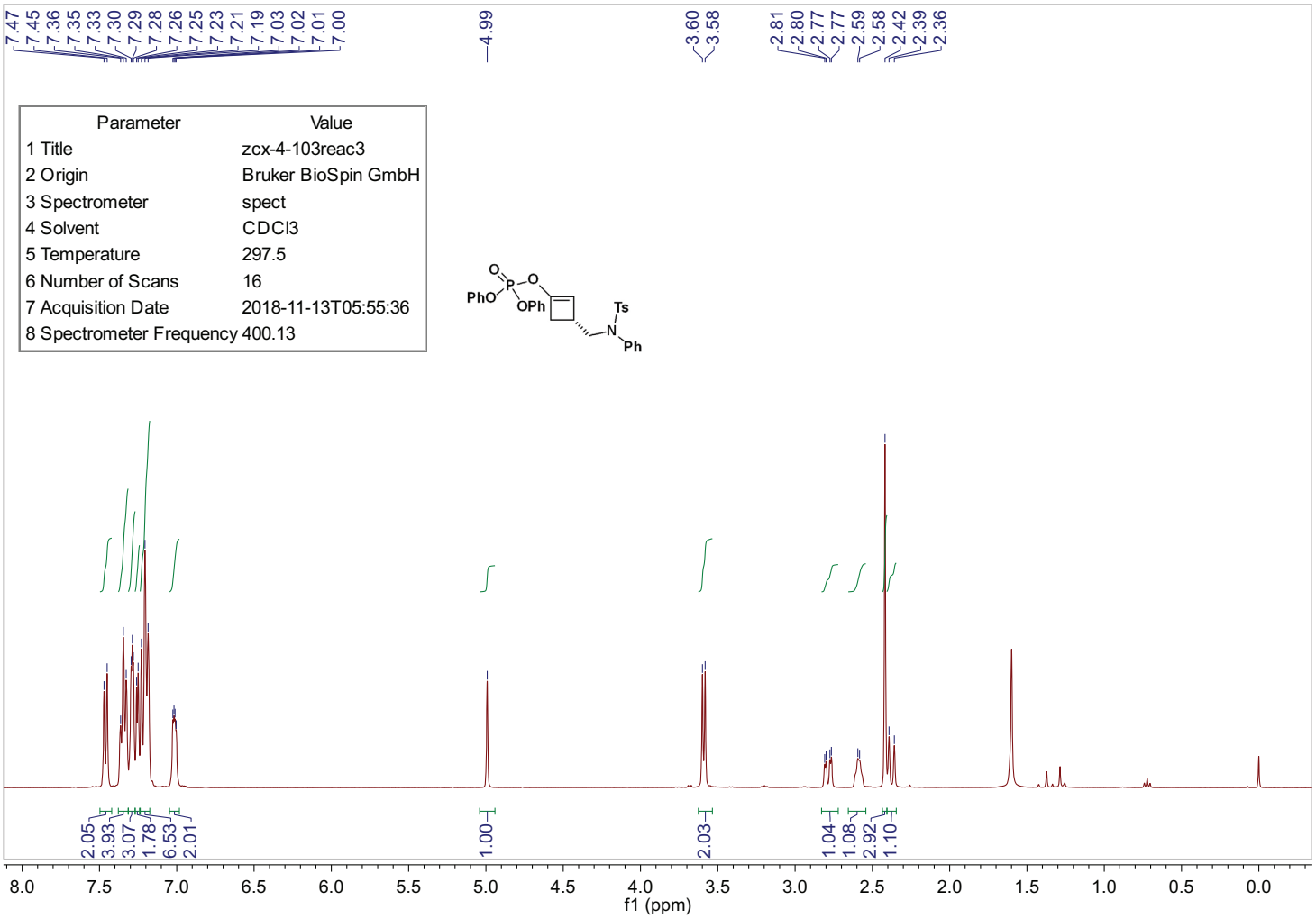




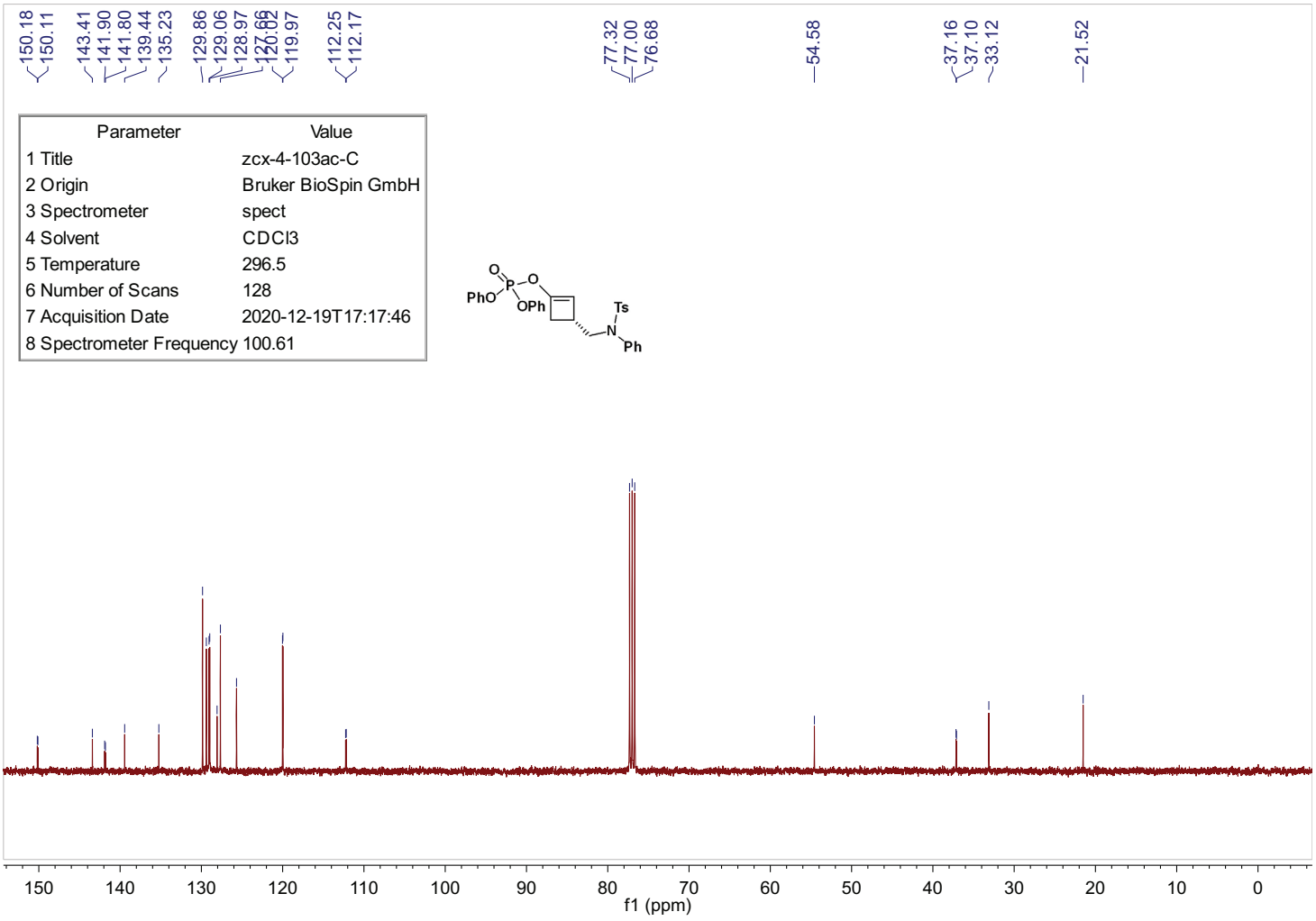
Parameter	Value
1 Title	zcx-4-86ac-C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.3
6 Experiment	1D
7 Number of Scans	128
8 Acquisition Date	2018-10-31T03:41:06
9 Spectrometer Frequency	100.61



Parameter	Value
1 Title	zcx-4-86ac-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.8
6 Experiment	1D
7 Number of Scans	32
8 Acquisition Date	2018-10-31T03:43:30
9 Spectrometer Frequency	161.98

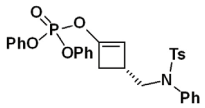


Parameter	Value
1 Title	zcx-4-103reac3
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.5
6 Number of Scans	16
7 Acquisition Date	2018-11-13T05:55:36
8 Spectrometer Frequency	400.13

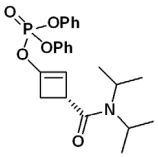


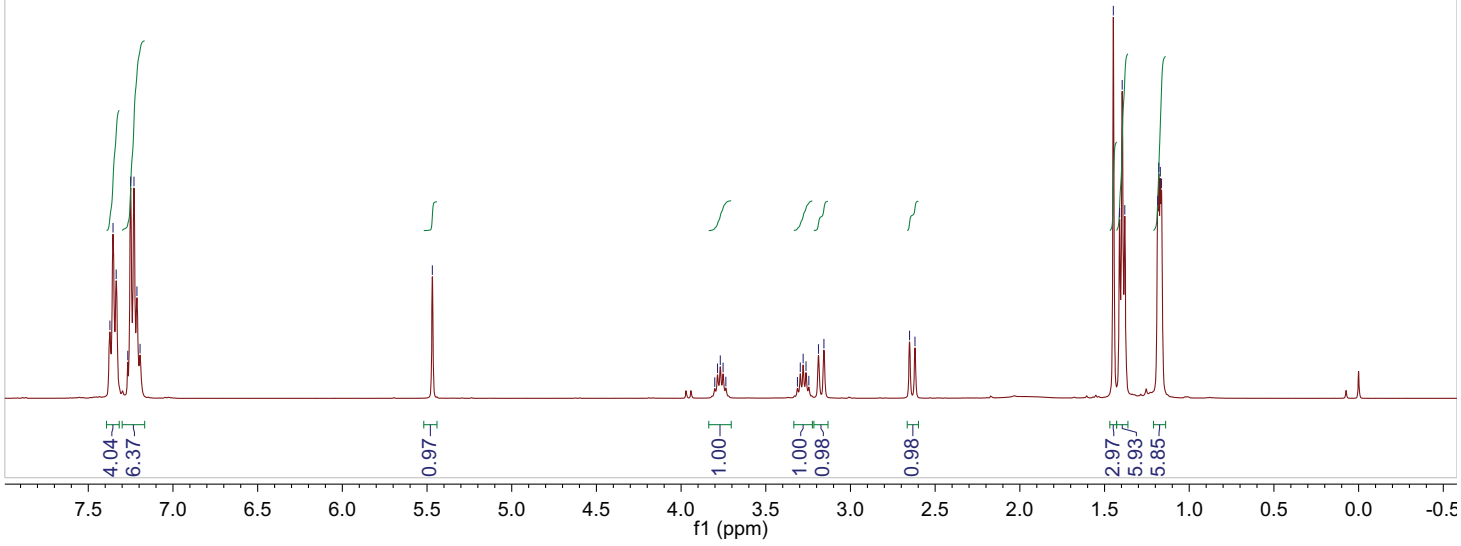
Parameter	Value
1 Title	zcx-4-103ac-C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.5
6 Number of Scans	128
7 Acquisition Date	2020-12-19T17:17:46
8 Spectrometer Frequency	100.61

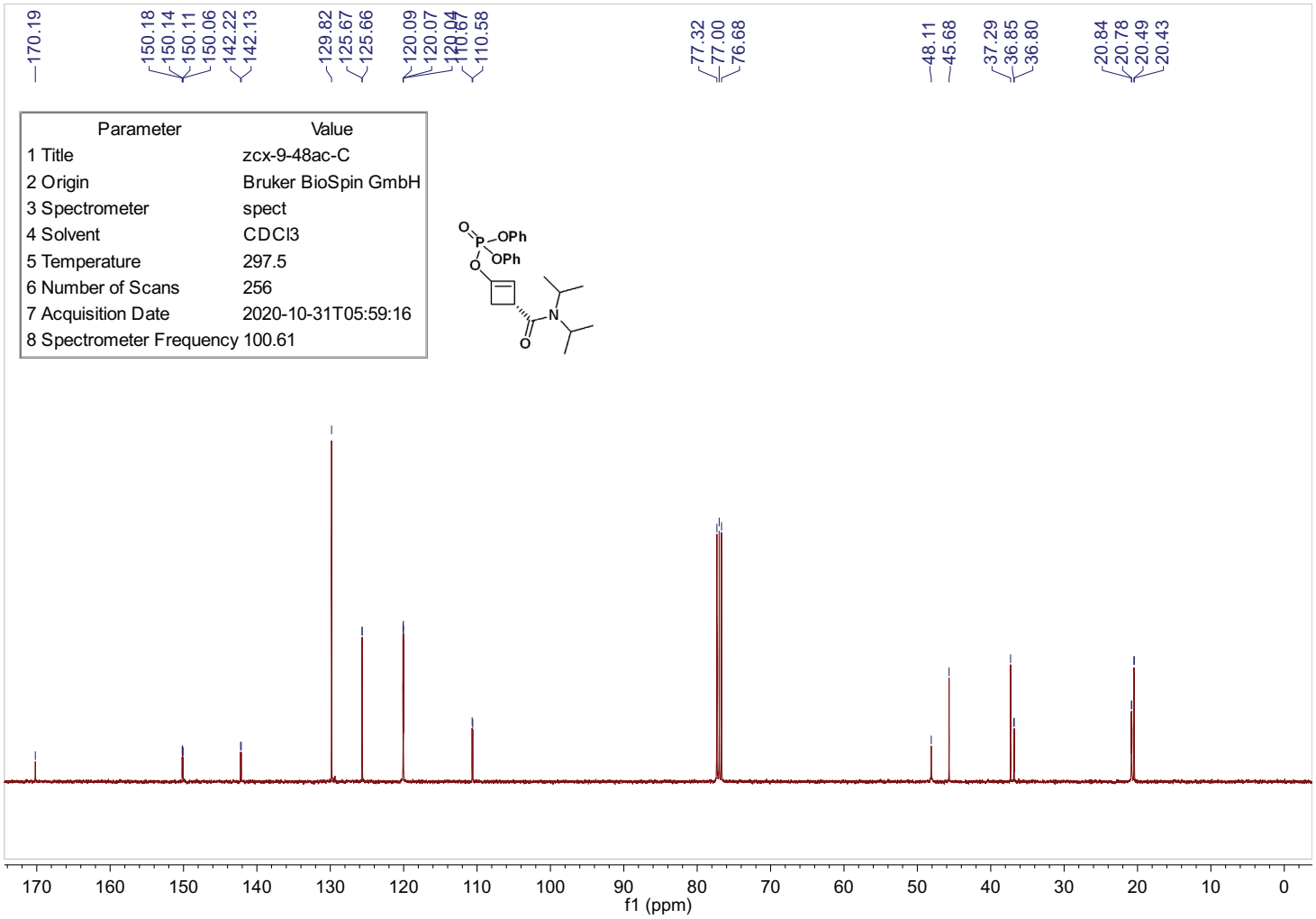
Parameter	Value
1 Title	zcx-4-103ac-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.2
6 Number of Scans	16
7 Acquisition Date	2020-12-19T17:19:37
8 Spectrometer Frequency	161.98

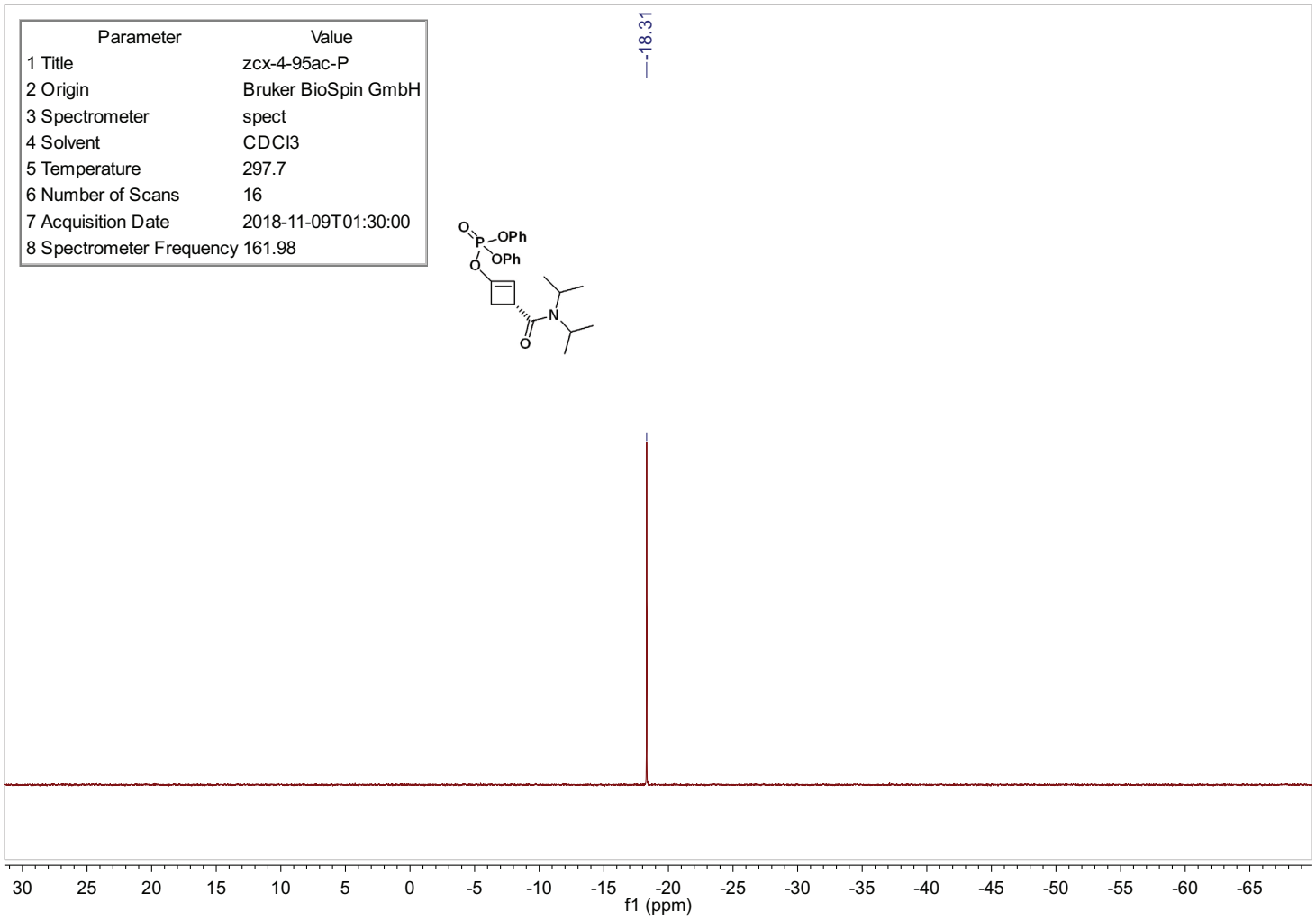


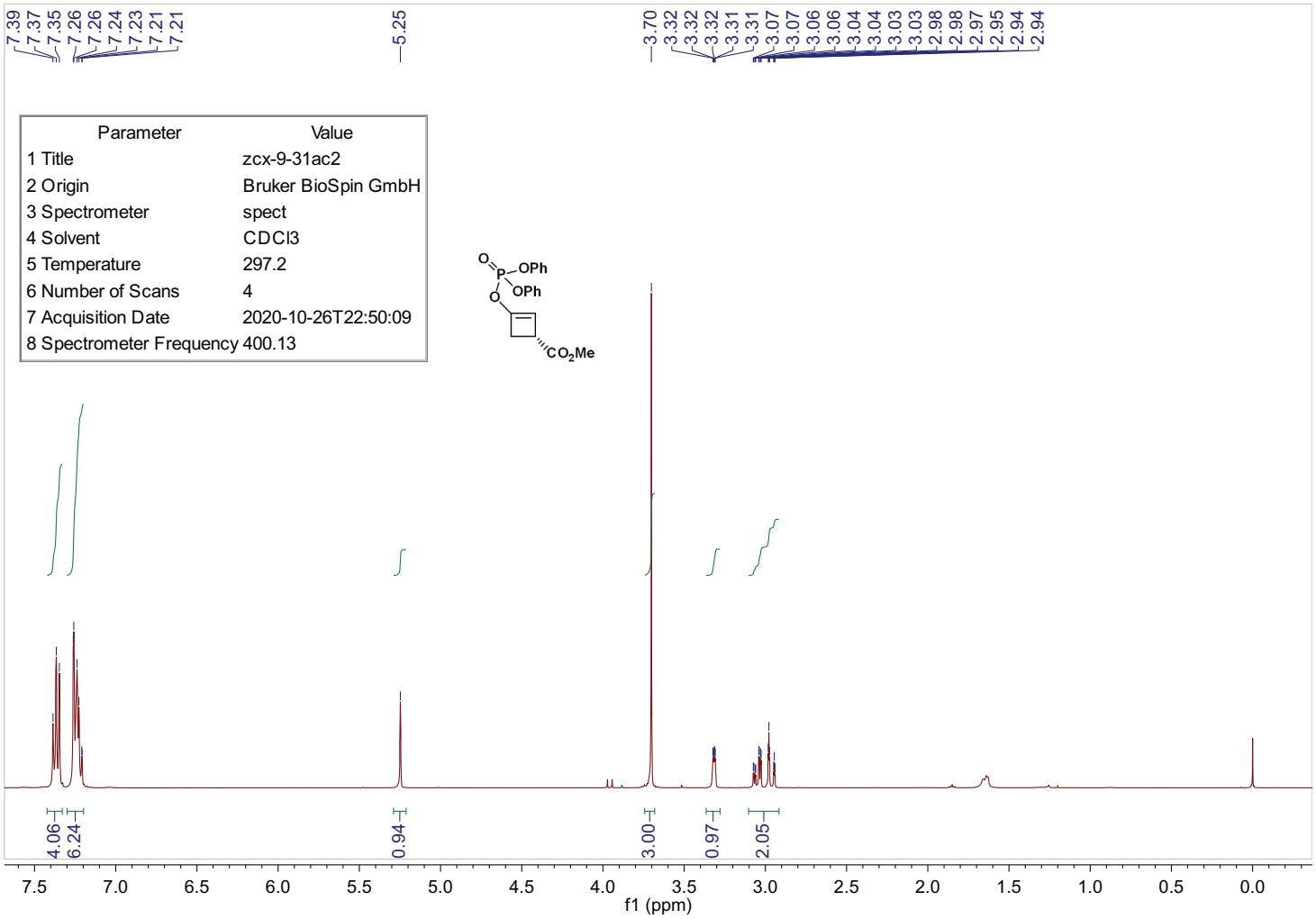
Parameter	Value
1 Title	zcx-4-97ac
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.7
6 Number of Scans	4
7 Acquisition Date	2018-11-09T05:22:02
8 Spectrometer Frequency	400.13

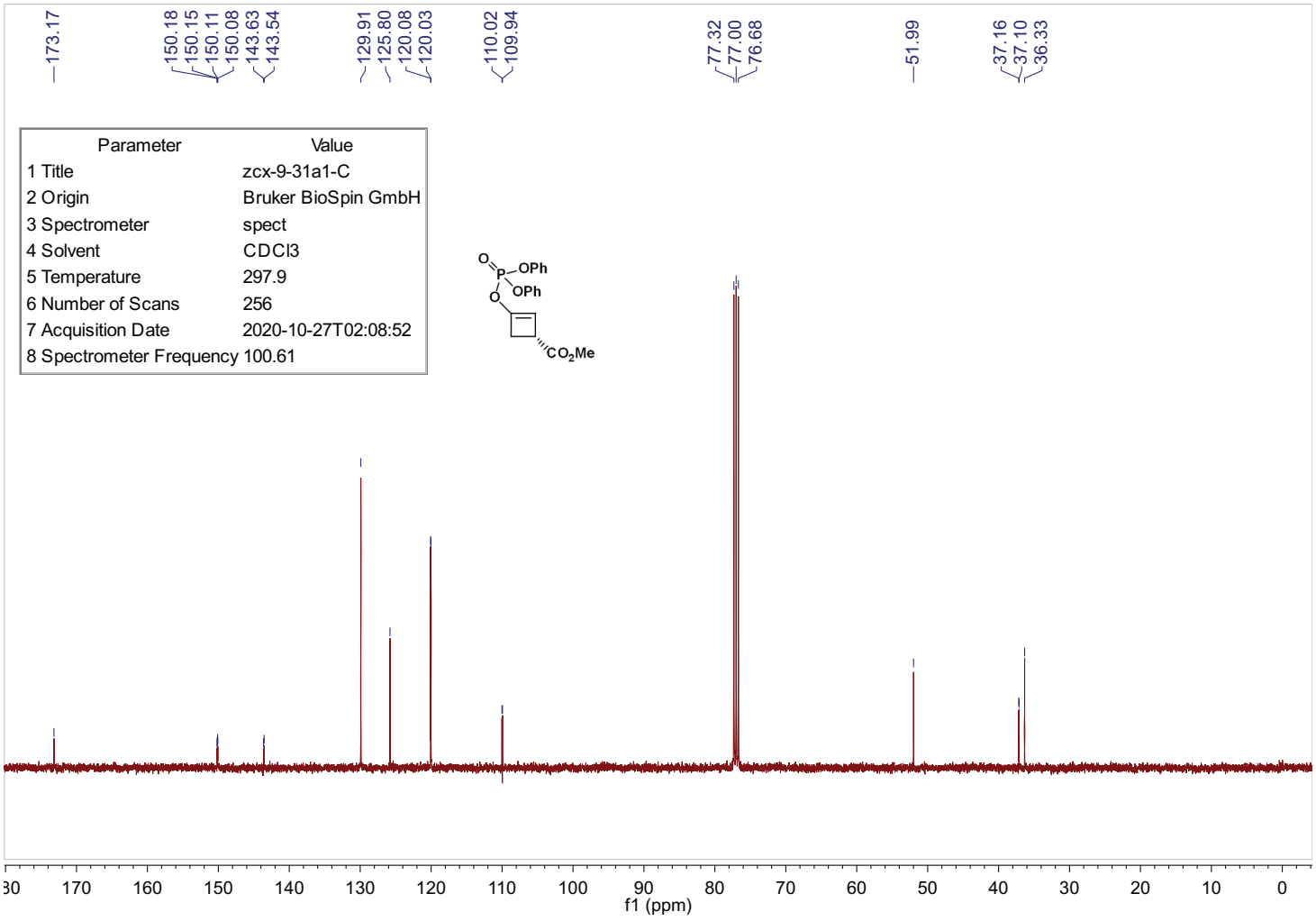




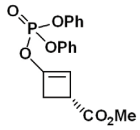

170.19
150.18
150.14
150.11
150.06
142.22
142.13
129.82
125.67
125.66
120.09
120.07
120.04
110.67
110.58
77.32
77.00
76.68
48.11
45.68
37.29
36.85
36.80
20.84
20.78
20.49
20.43
Parameter Value
1 Title zcx-9-48ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.5
6 Number of Scans 256
7 Acquisition Date 2020-10-31T05:59:16
8 Spectrometer Frequency 100.61
OPh
OPh
N
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


-18.31
Parameter Value
1 Title zcx-4-95ac-P
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.7
6 Number of Scans 16
7 Acquisition Date 2018-11-09T01:30:00
8 Spectrometer Frequency 161.98
OPh
OPh
N
30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65
f1 (ppm)

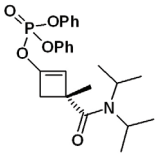

7.39
7.37
7.35
7.26
7.26
7.24
7.23
7.21
7.21
5.25
3.70
3.32
3.32
3.32
3.31
3.31
3.07
3.07
3.06
3.06
3.04
3.04
3.03
3.03
2.98
2.98
2.97
2.95
2.94
2.94
Parameter Value
1 Title zcx-9-31ac2
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.2
6 Number of Scans 4
7 Acquisition Date 2020-10-26T22:50:09
8 Spectrometer Frequency 400.13
OPh
OPh
CO2Me
4.06
6.24
0.94
3.00
0.97
2.05
f1 (ppm)

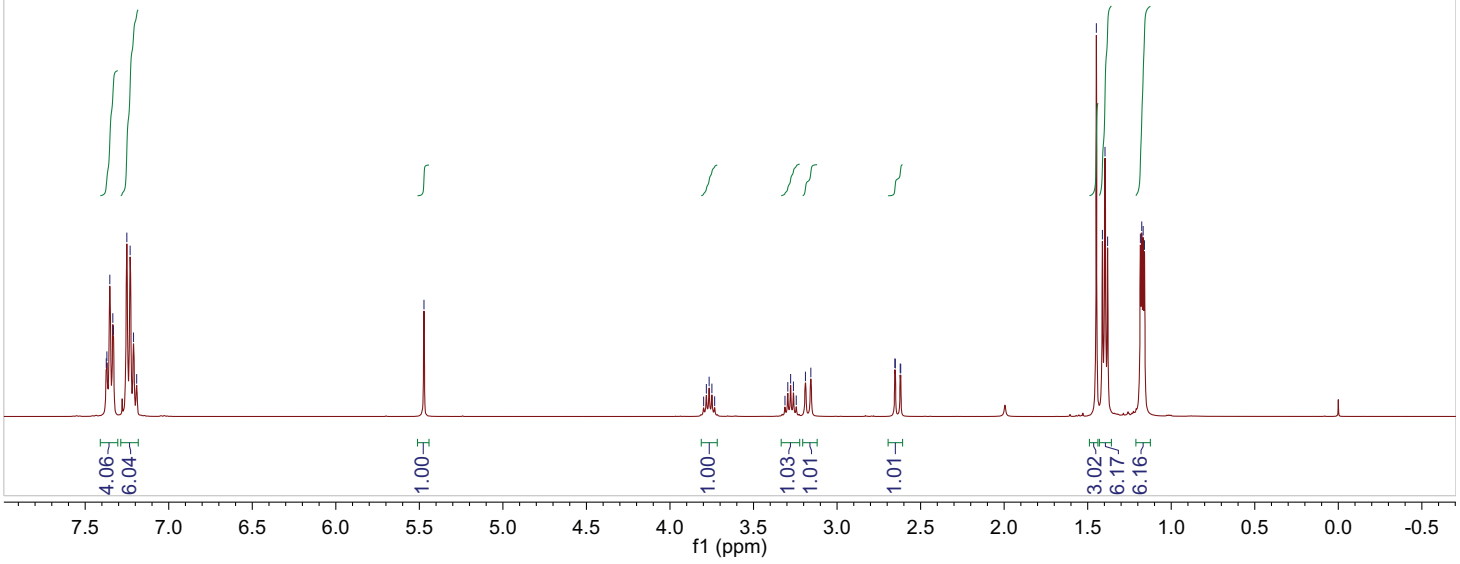

173.17
150.18
150.15
150.11
150.08
143.63
143.54
129.91
125.80
120.08
120.03
110.02
109.94
77.32
77.00
76.68
51.99
37.16
37.10
36.33
Parameter Value
1 Title zcx-9-31a1-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.9
6 Number of Scans 256
7 Acquisition Date 2020-10-27T02:08:52
8 Spectrometer Frequency 100.61
OPh
OPh
CO2Me
f1 (ppm)

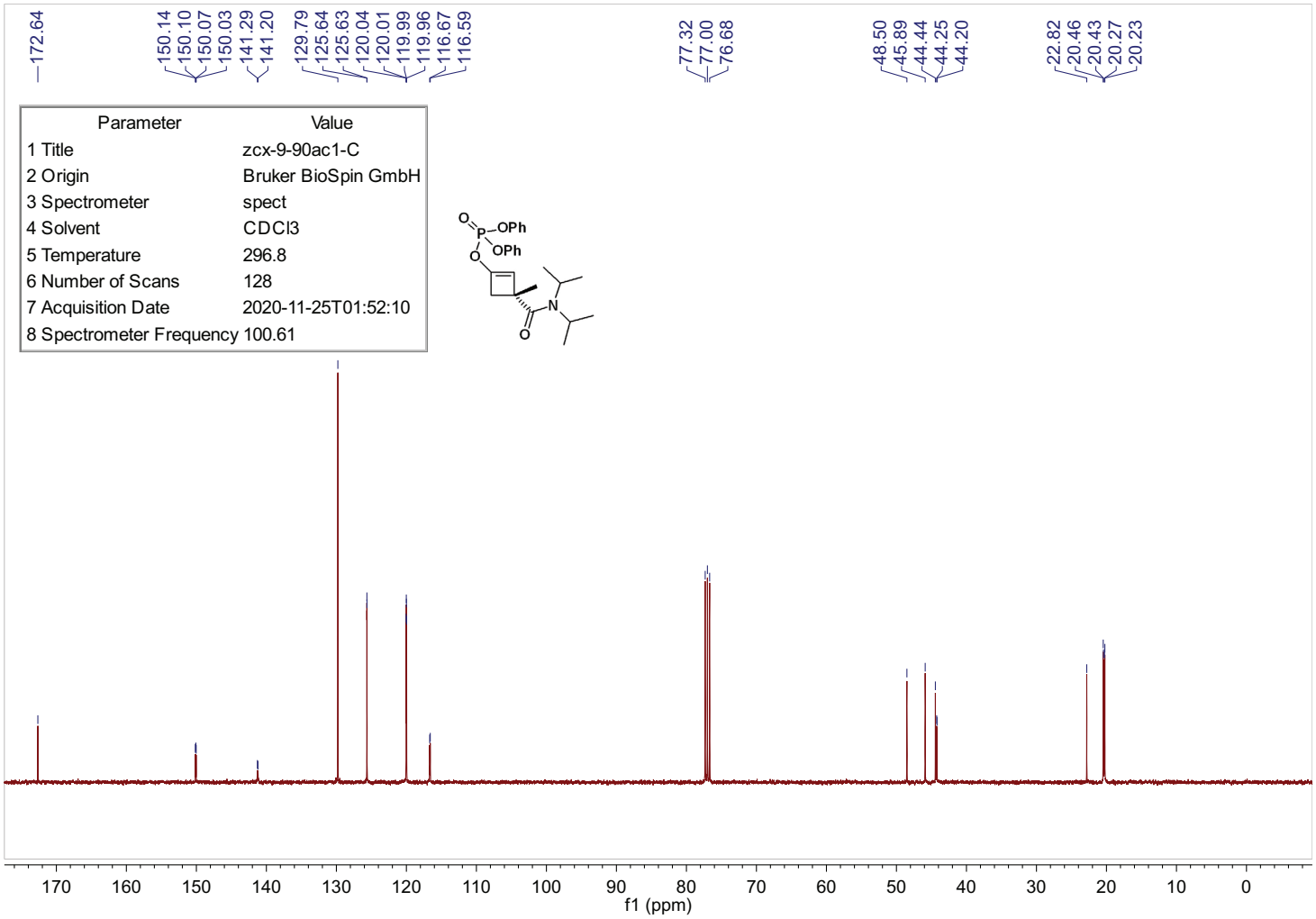
Parameter	Value
1 Title	zcx-9-31ac1-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.5
6 Number of Scans	16
7 Acquisition Date	2020-10-26T22:46:42
8 Spectrometer Frequency	161.98

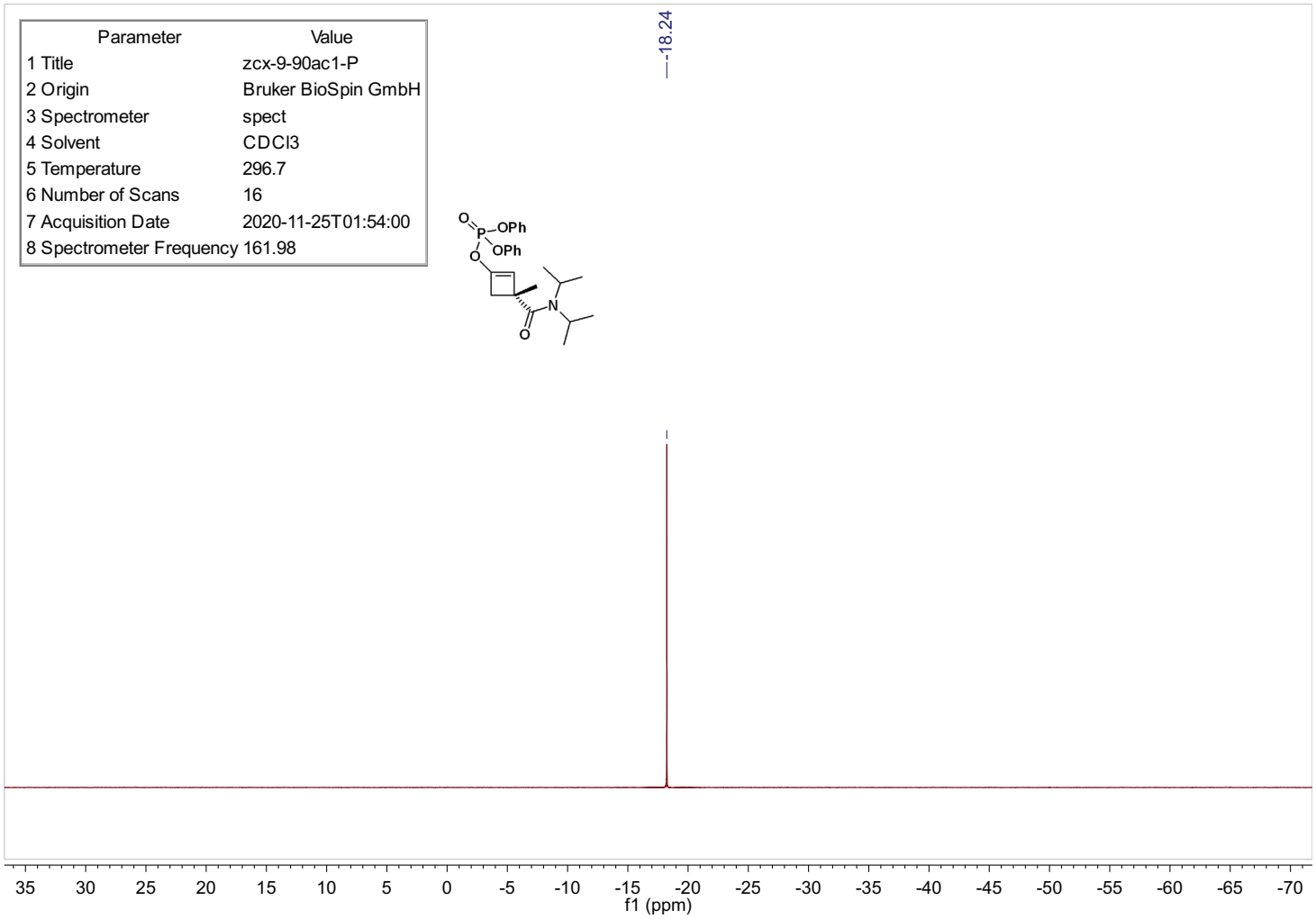


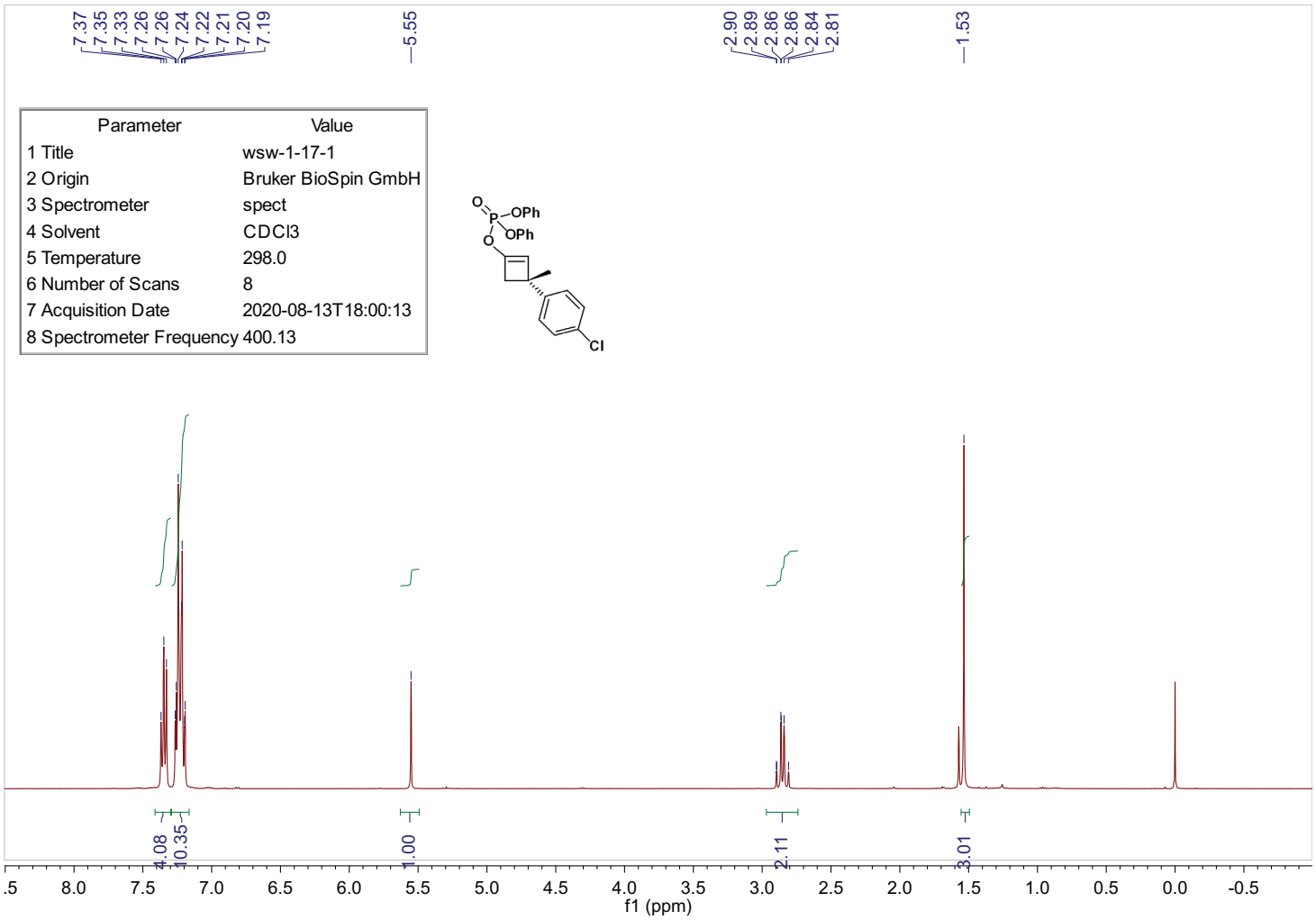
Parameter	Value
1 Title	zcx-9-90ac1
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.2
6 Number of Scans	4
7 Acquisition Date	2020-11-25T01:44:12
8 Spectrometer Frequency	400.13

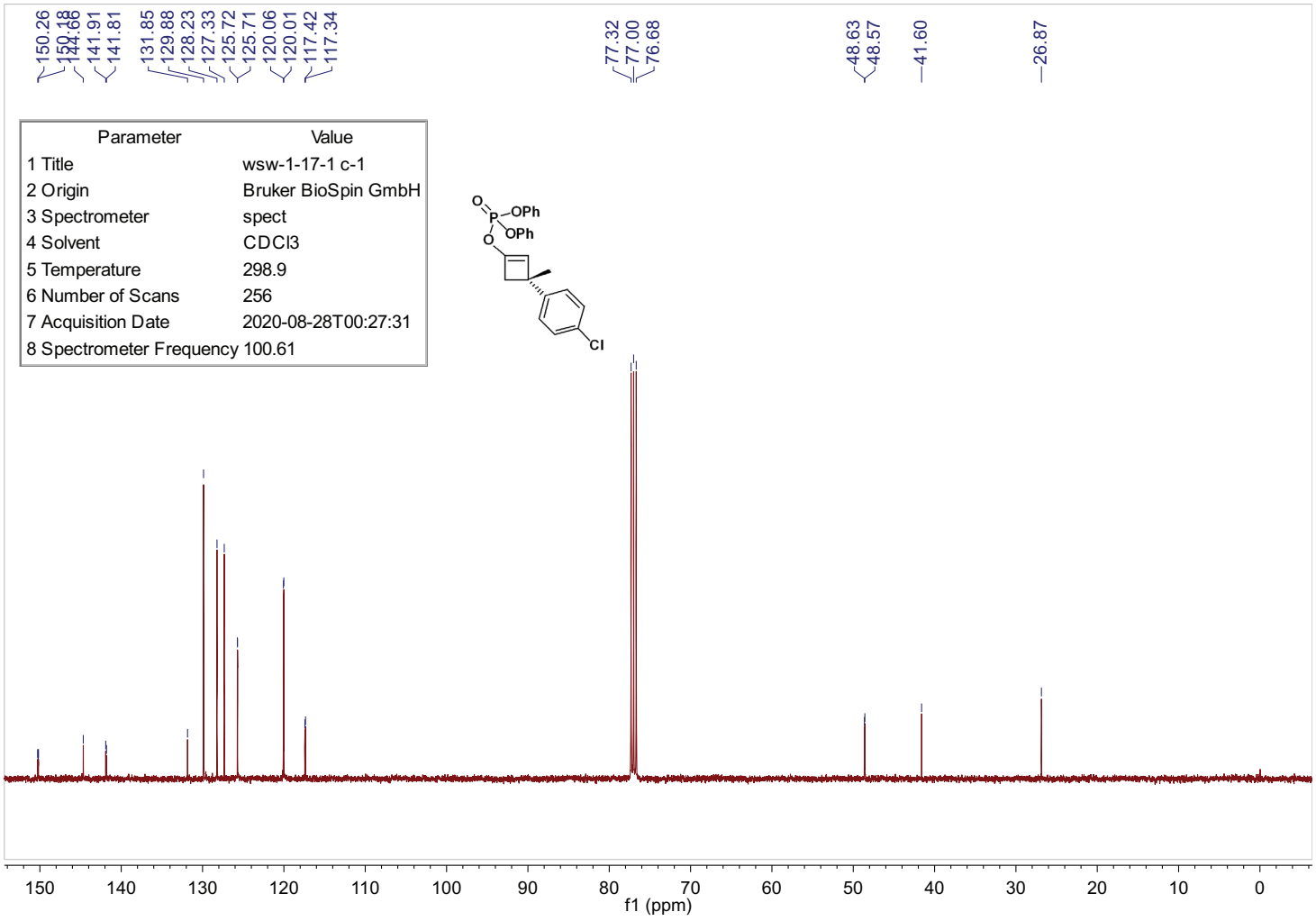




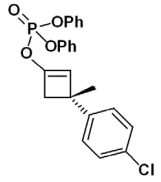

172.64
150.14
150.10
150.07
150.03
141.29
141.20
129.79
125.64
125.63
120.04
120.01
119.99
119.96
116.67
116.59
77.32
77.00
76.68
48.50
45.89
44.44
44.25
44.20
22.82
20.46
20.43
20.27
20.23
Parameter Value
1 Title zcx-9-90ac1-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.8
6 Number of Scans 128
7 Acquisition Date 2020-11-25T01:52:10
8 Spectrometer Frequency 100.61
OPh
OPh
N
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


18.24
Parameter Value
1 Title zcx-9-90ac1-P
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.7
6 Number of Scans 16
7 Acquisition Date 2020-11-25T01:54:00
8 Spectrometer Frequency 161.98
OPh
OPh
N
35 30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70
f1 (ppm)

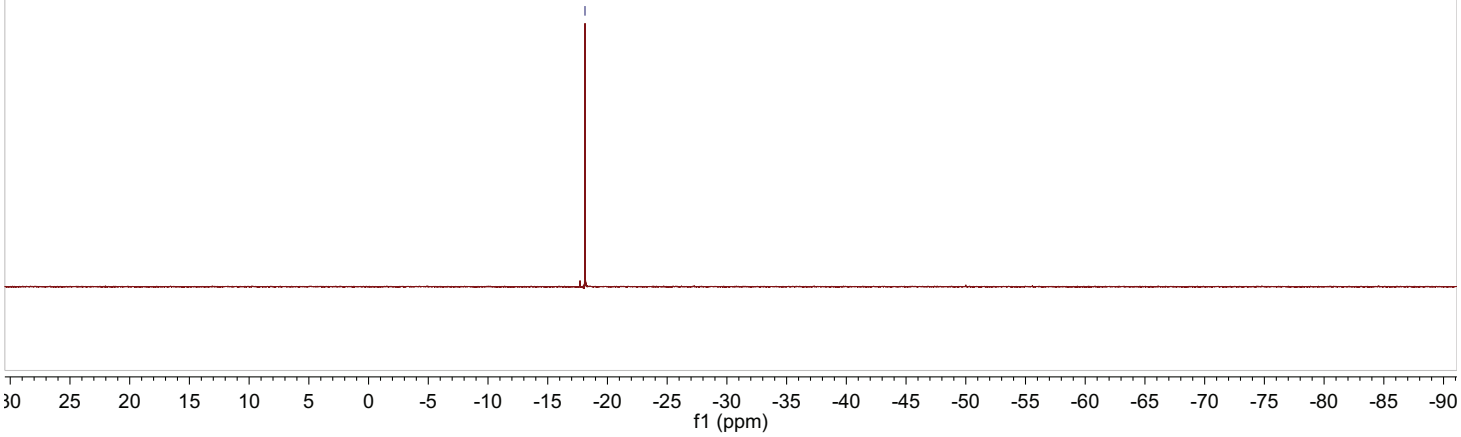

7.37
7.35
7.33
7.26
7.26
7.24
7.22
7.21
7.20
7.19
5.55
2.90
2.89
2.86
2.86
2.84
2.81
1.53
Parameter Value
1 Title wsw-1-17-1
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.0
6 Number of Scans 8
7 Acquisition Date 2020-08-13T18:00:13
8 Spectrometer Frequency 400.13
OPh
OPh
Cl
4.08
10.35
1.00
2.11
3.01
f1 (ppm)


150.26
150.18
144.66
141.91
141.81
131.85
129.88
128.23
127.33
125.72
125.71
120.06
120.01
117.42
117.34
77.32
77.00
76.68
48.63
48.57
41.60
26.87
Parameter Value
1 Title wsw-1-17-1 c-1
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.9
6 Number of Scans 256
7 Acquisition Date 2020-08-28T00:27:31
8 Spectrometer Frequency 100.61
OPh
OPh
Cl
f1 (ppm)

Parameter	Value
1 Title	wsw-1-17-1 p
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	298.3
6 Number of Scans	16
7 Acquisition Date	2020-08-13T18:10:01
8 Spectrometer Frequency	161.98



18.12



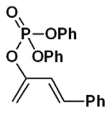
30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90

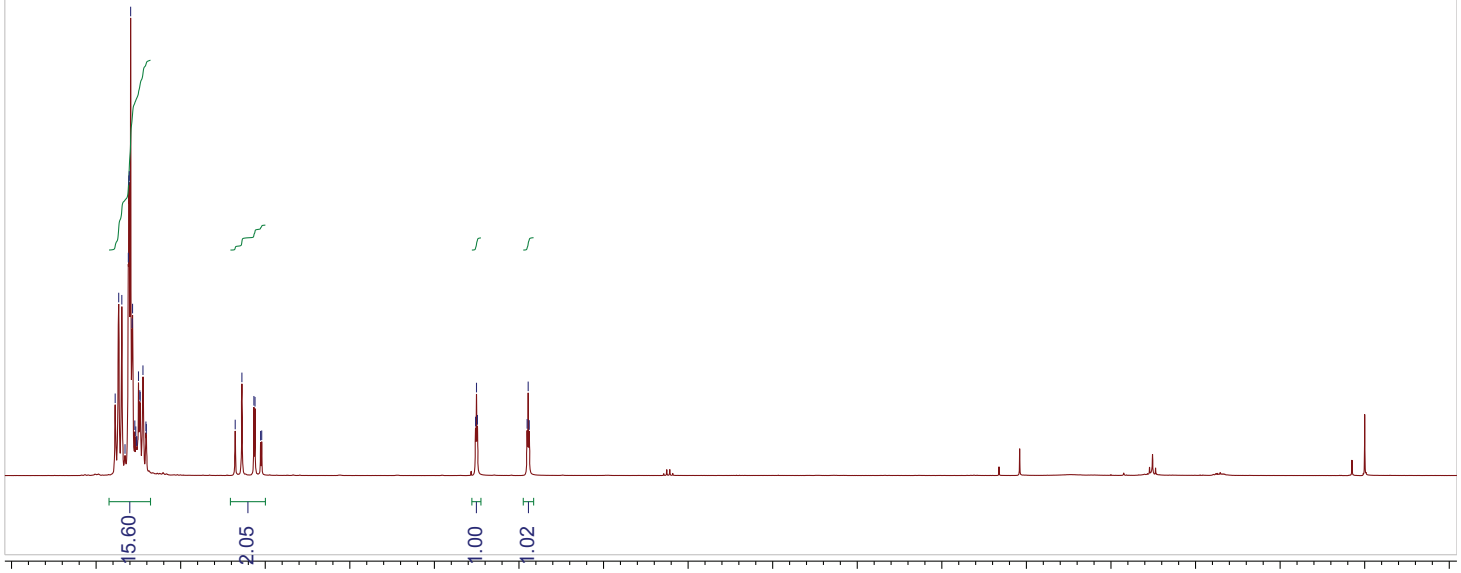
f1 (ppm)

7.37 7.35 7.31 7.31 7.30 7.30 7.29 7.28 6.68 6.64 6.57 6.56 6.53 6.52

5.26 5.25 5.25 4.95 4.95 4.94

Parameter	Value
1 Title	zcx-9-102ac
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.3
6 Number of Scans	4
7 Acquisition Date	2020-12-01T12:49:45
8 Spectrometer Frequency	400.13

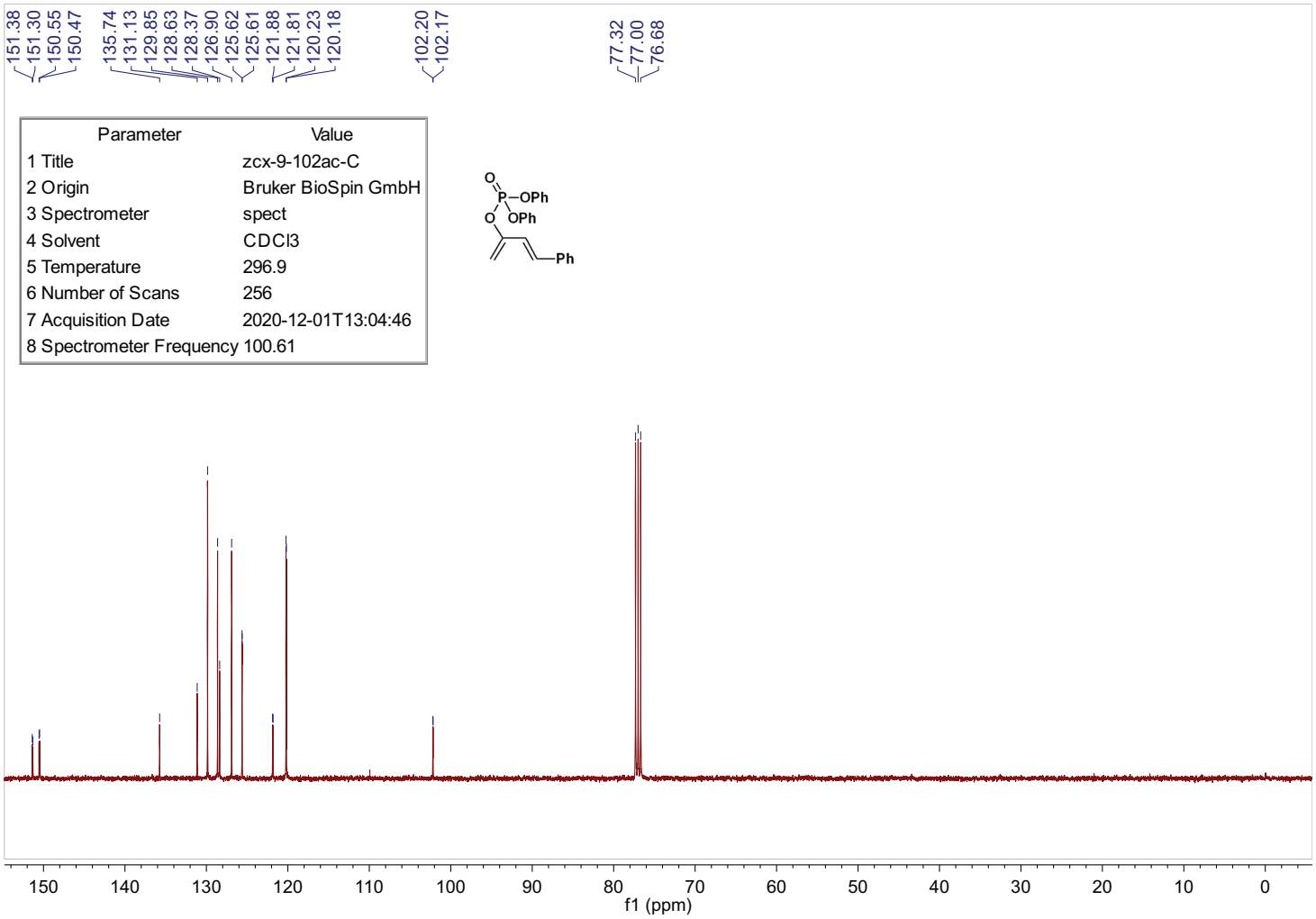


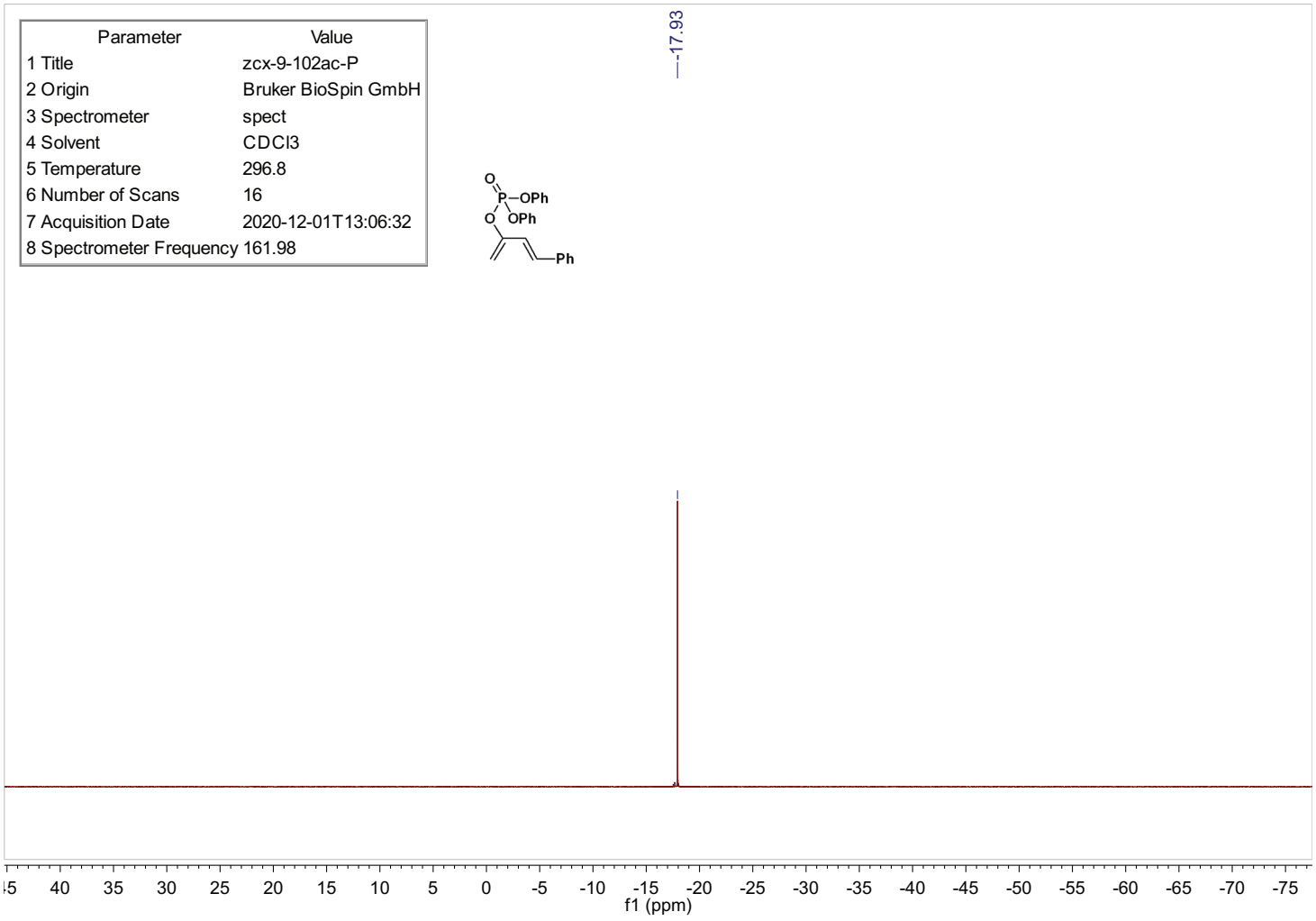


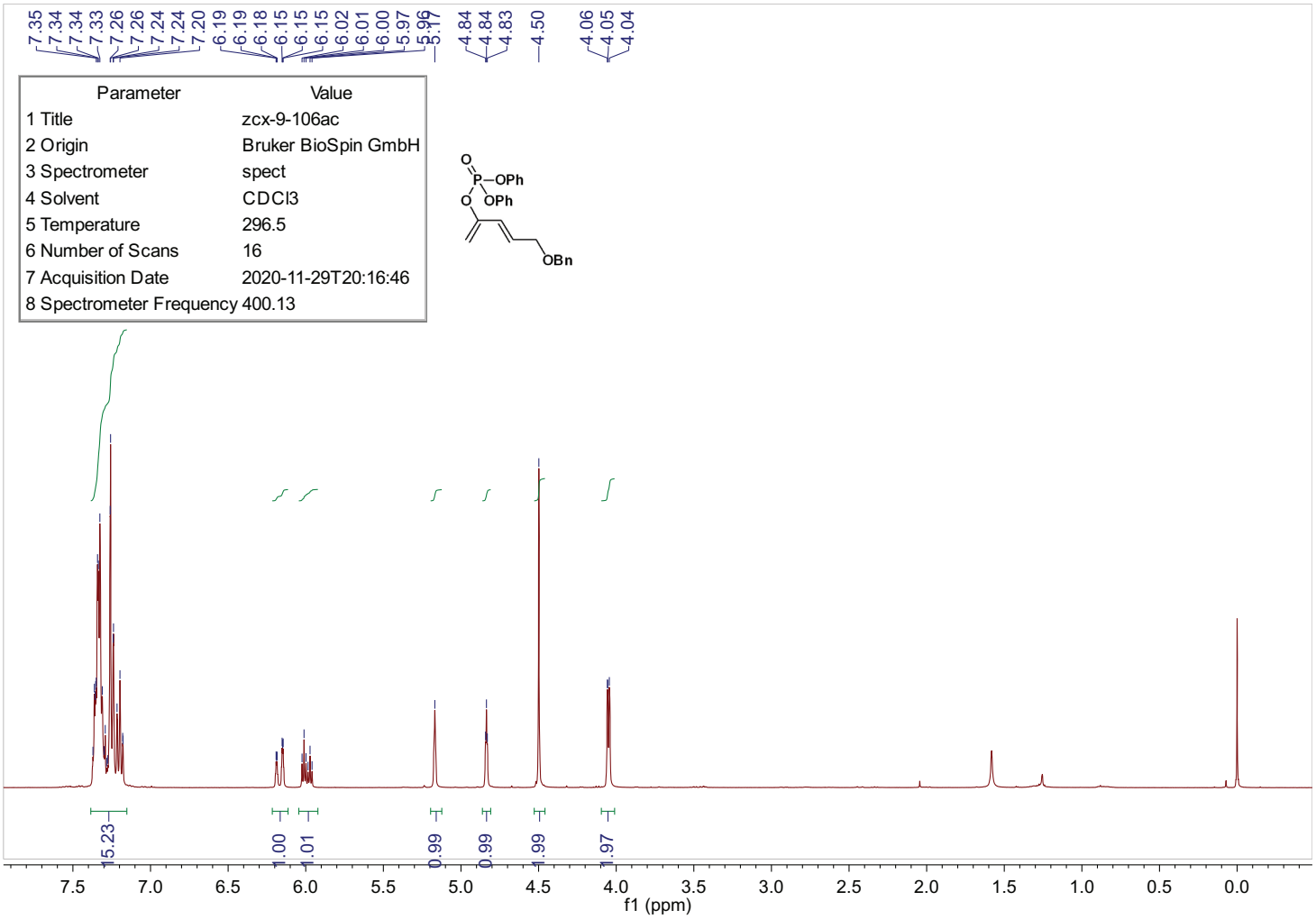
15.60 2.05 1.00 1.02

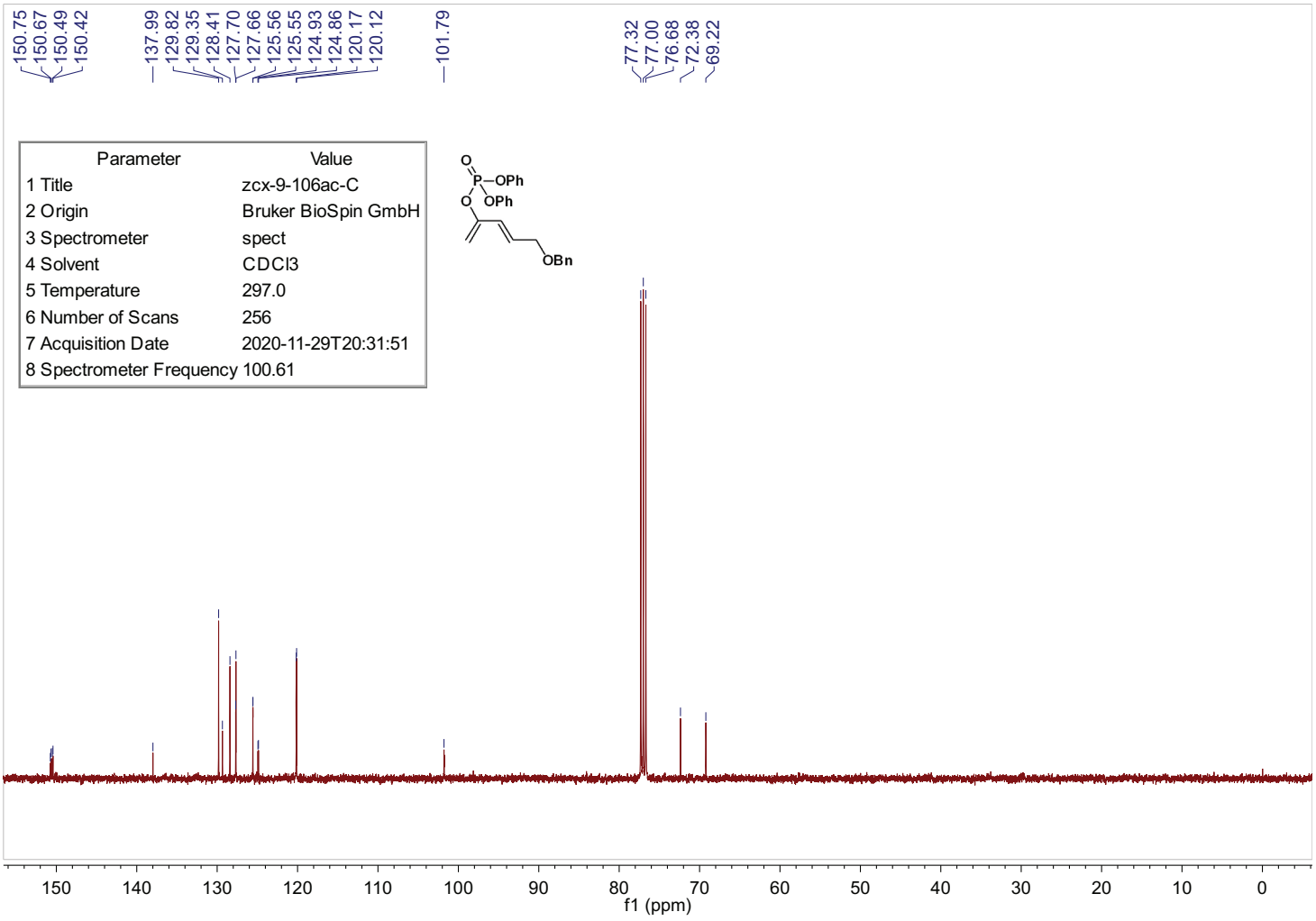
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0

f1 (ppm)

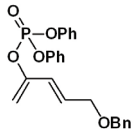

151.38
151.30
150.55
150.47
135.74
131.13
129.85
128.63
128.37
126.90
125.62
125.61
121.88
121.81
120.23
120.18
102.20
102.17
77.32
77.00
76.68
Parameter Value
1 Title zcx-9-102ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.9
6 Number of Scans 256
7 Acquisition Date 2020-12-01T13:04:46
8 Spectrometer Frequency 100.61
O
P—OPh
O OPh
Ph
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


-17.93
Parameter Value
1 Title zcx-9-102ac-P
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.8
6 Number of Scans 16
7 Acquisition Date 2020-12-01T13:06:32
8 Spectrometer Frequency 161.98
O
P—OPh
O OPh
Ph
40 35 30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75
f1 (ppm)

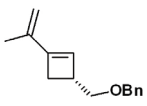

7.35 7.34 7.34 7.33 7.26 7.26 7.24 7.24 7.20 6.19 6.19 6.18 6.15 6.15 6.15 6.02 6.01 6.00 5.97 5.96 5.17 4.84 4.84 4.83 4.50 4.06 4.05 4.04
Parameter Value
1 Title zcx-9-106ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.5
6 Number of Scans 16
7 Acquisition Date 2020-11-29T20:16:46
8 Spectrometer Frequency 400.13
OPh
OPh
OBn
15.23 1.00 1.01 0.99 0.99 1.99 1.97
f1 (ppm)

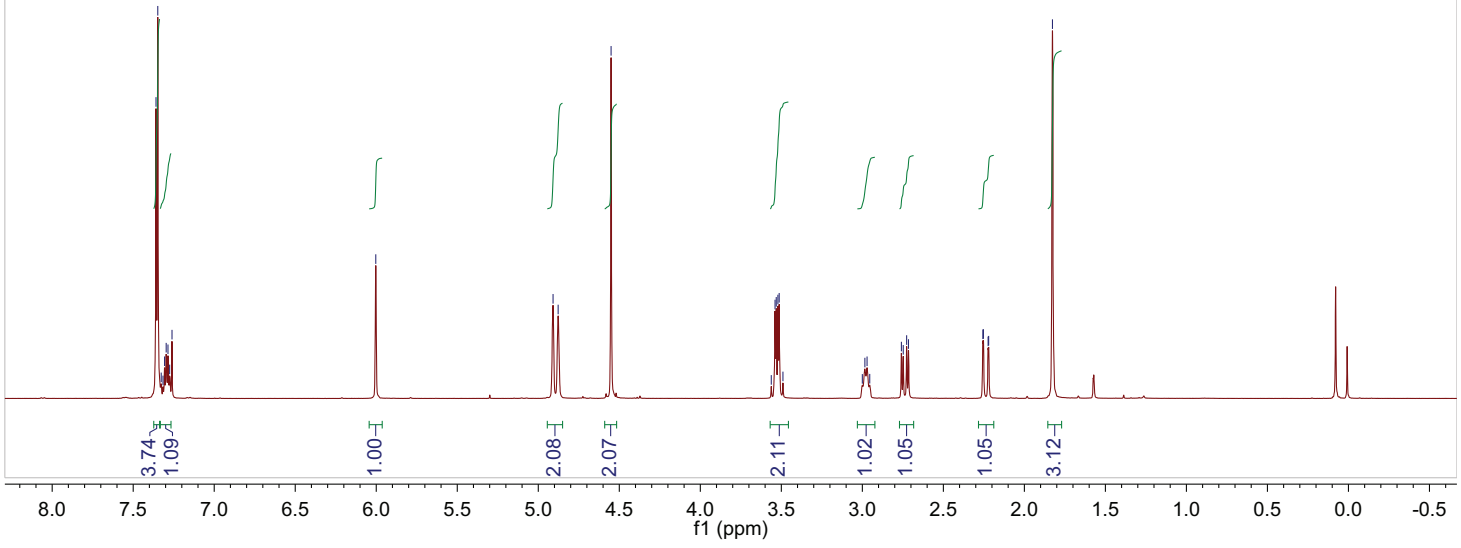

150.75 150.67 150.49 150.42 137.99 129.82 129.35 128.41 127.70 127.66 125.56 125.55 124.93 124.86 120.17 120.12 101.79 77.32 77.00 76.68 72.38 69.22
Parameter Value
1 Title zcx-9-106ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.0
6 Number of Scans 256
7 Acquisition Date 2020-11-29T20:31:51
8 Spectrometer Frequency 100.61
OPh
OPh
OBn
f1 (ppm)

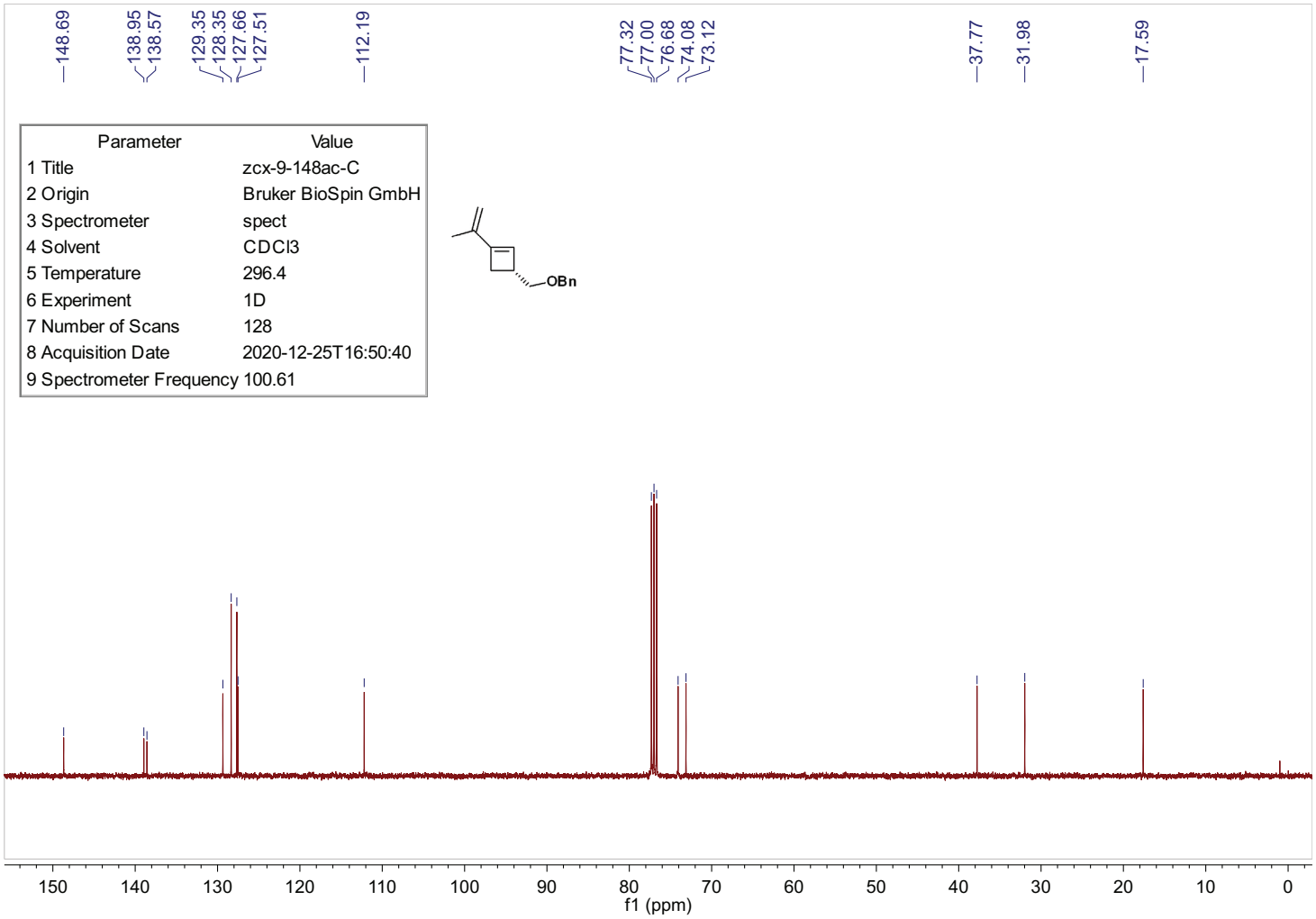
Parameter	Value
1 Title	zcx-9-106ac-P
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.5
6 Number of Scans	16
7 Acquisition Date	2020-11-30T03:16:37
8 Spectrometer Frequency	161.98



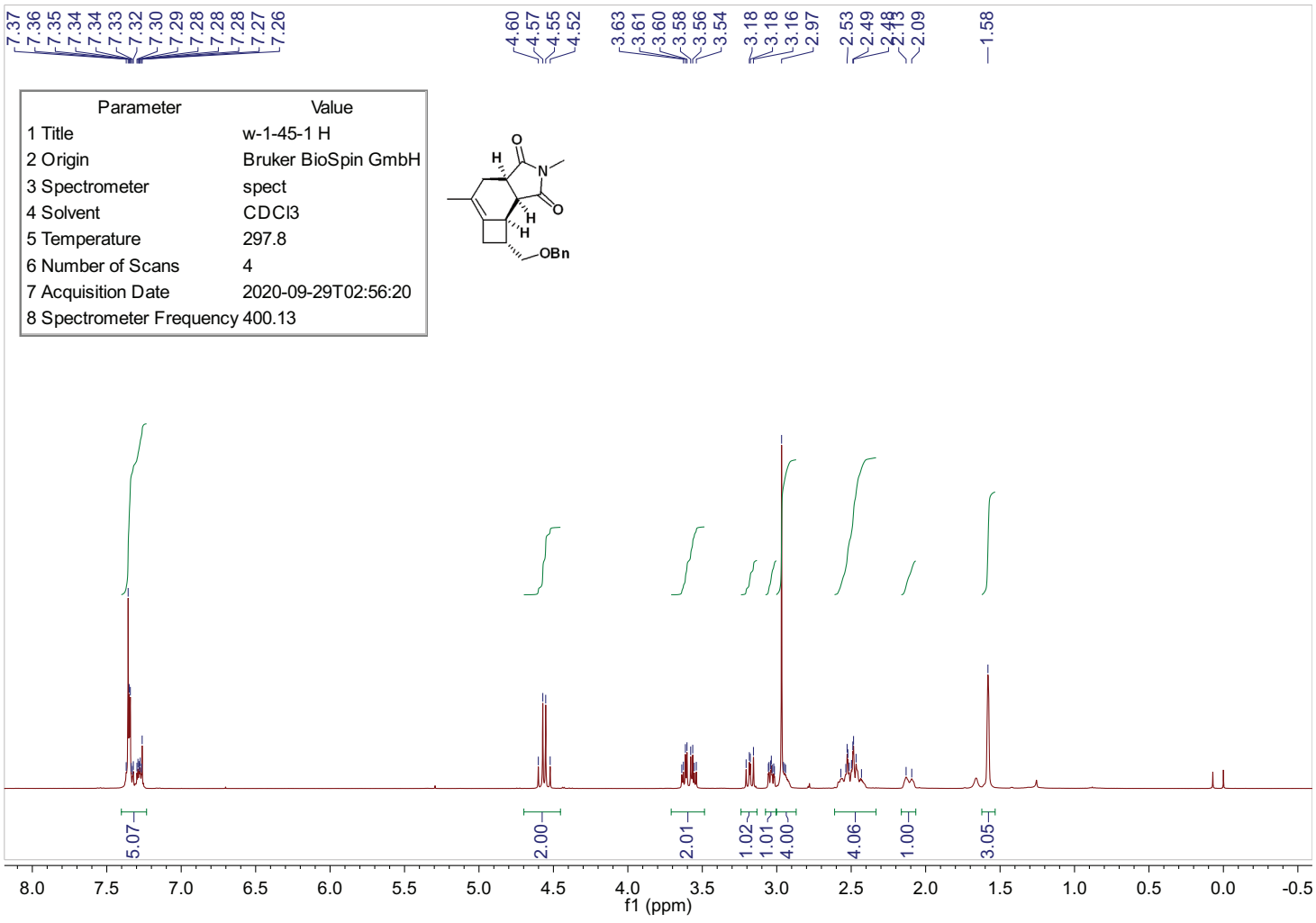
Parameter	Value
1 Title	zcx-9-148ac
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	295.8
6 Experiment	1D
7 Number of Scans	4
8 Acquisition Date	2020-12-25T16:42:45
9 Spectrometer Frequency	400.13



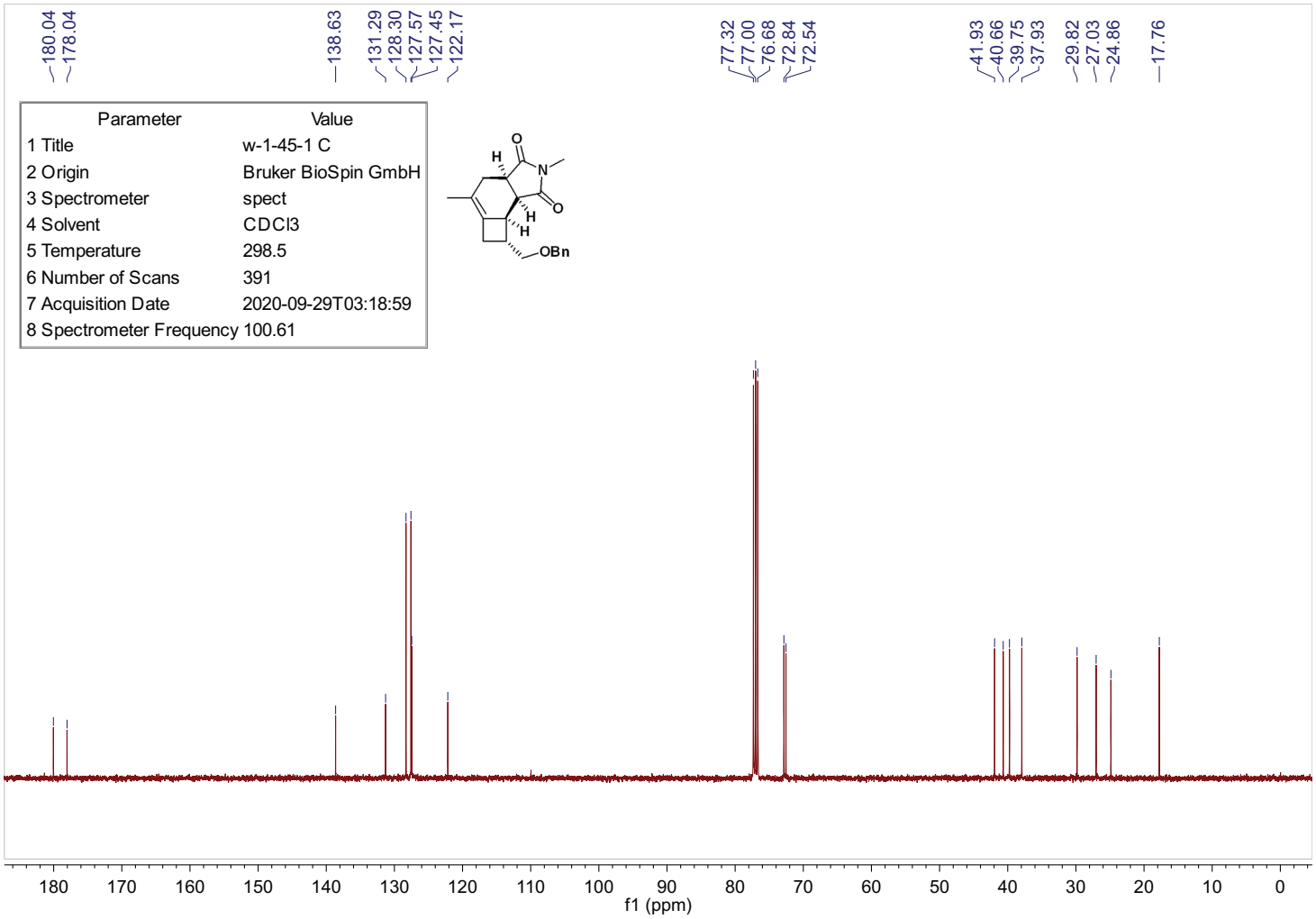


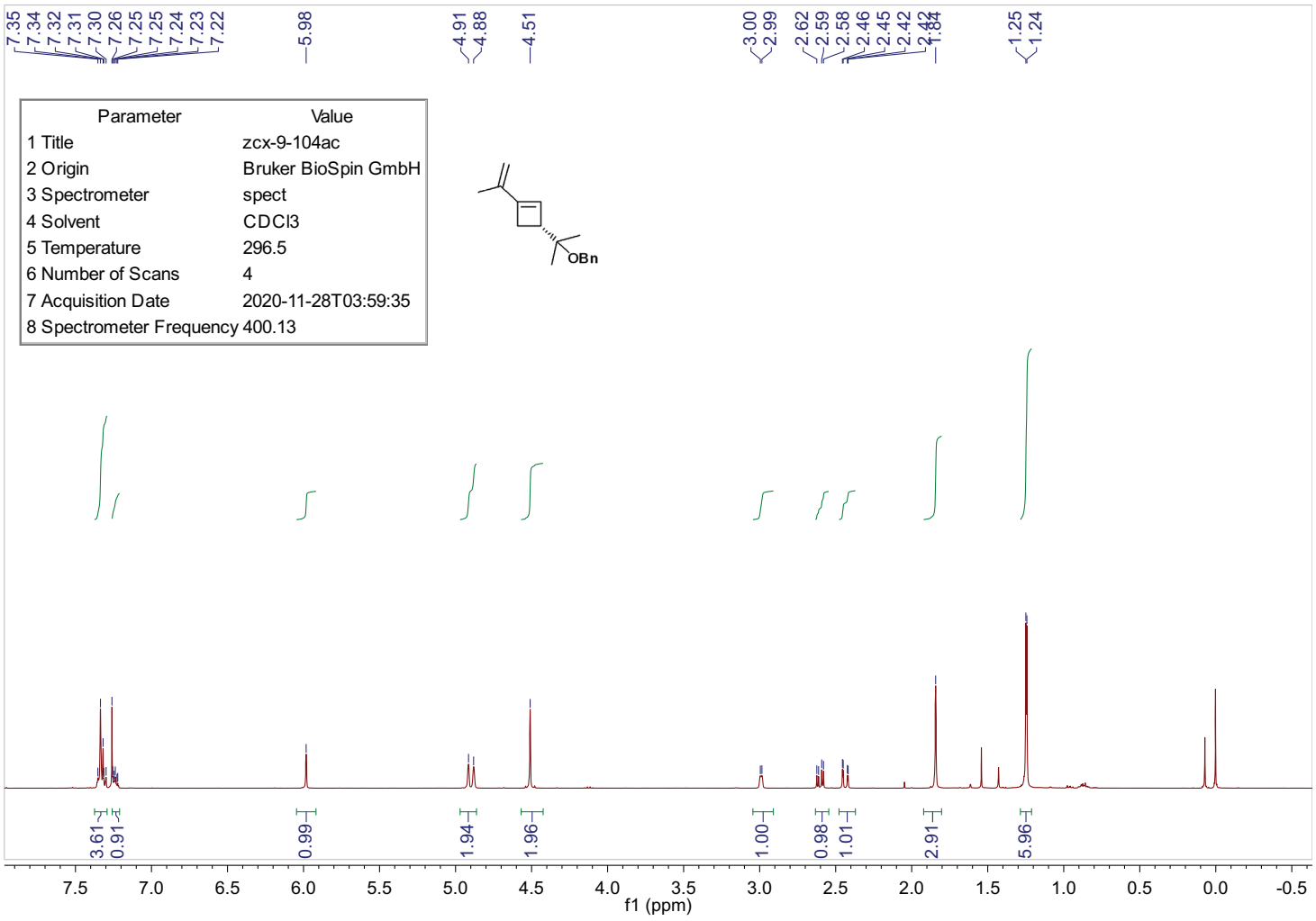


Parameter	Value
1 Title	zcx-9-148ac-C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.4
6 Experiment	1D
7 Number of Scans	128
8 Acquisition Date	2020-12-25T16:50:40
9 Spectrometer Frequency	100.61



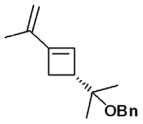
Parameter	Value
1 Title	w-1-45-1 H
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	297.8
6 Number of Scans	4
7 Acquisition Date	2020-09-29T02:56:20
8 Spectrometer Frequency	400.13


180.04
178.04
138.63
131.29
128.30
127.57
127.45
122.17
77.32
77.00
76.68
72.84
72.54
41.93
40.66
39.75
37.93
29.82
27.03
24.86
17.76
Parameter Value
1 Title w-1-45-1 C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 298.5
6 Number of Scans 391
7 Acquisition Date 2020-09-29T03:18:59
8 Spectrometer Frequency 100.61
H
O
N
O
H
H
OBn
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.35
7.34
7.32
7.31
7.30
7.26
7.25
7.25
7.24
7.23
7.22
5.98
4.91
4.88
4.51
3.00
2.99
2.62
2.59
2.58
2.46
2.45
2.42
1.84
1.25
1.24
Parameter Value
1 Title zcx-9-104ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.5
6 Number of Scans 4
7 Acquisition Date 2020-11-28T03:59:35
8 Spectrometer Frequency 400.13
OBn
3.61
0.91
0.99
1.94
1.96
1.00
0.98
1.01
2.91
5.96
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

148.47
140.08
138.84
129.32
128.22
127.19
127.02
111.98
77.32
77.00
76.68
76.21
64.20
46.91
30.19
22.97
22.32
17.69

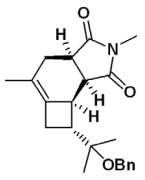
Parameter	Value
1 Title	zcx-9-150ac-C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.3
6 Experiment	1D
7 Number of Scans	256
8 Acquisition Date	2020-12-26T01:19:05
9 Spectrometer Frequency	100.61



160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

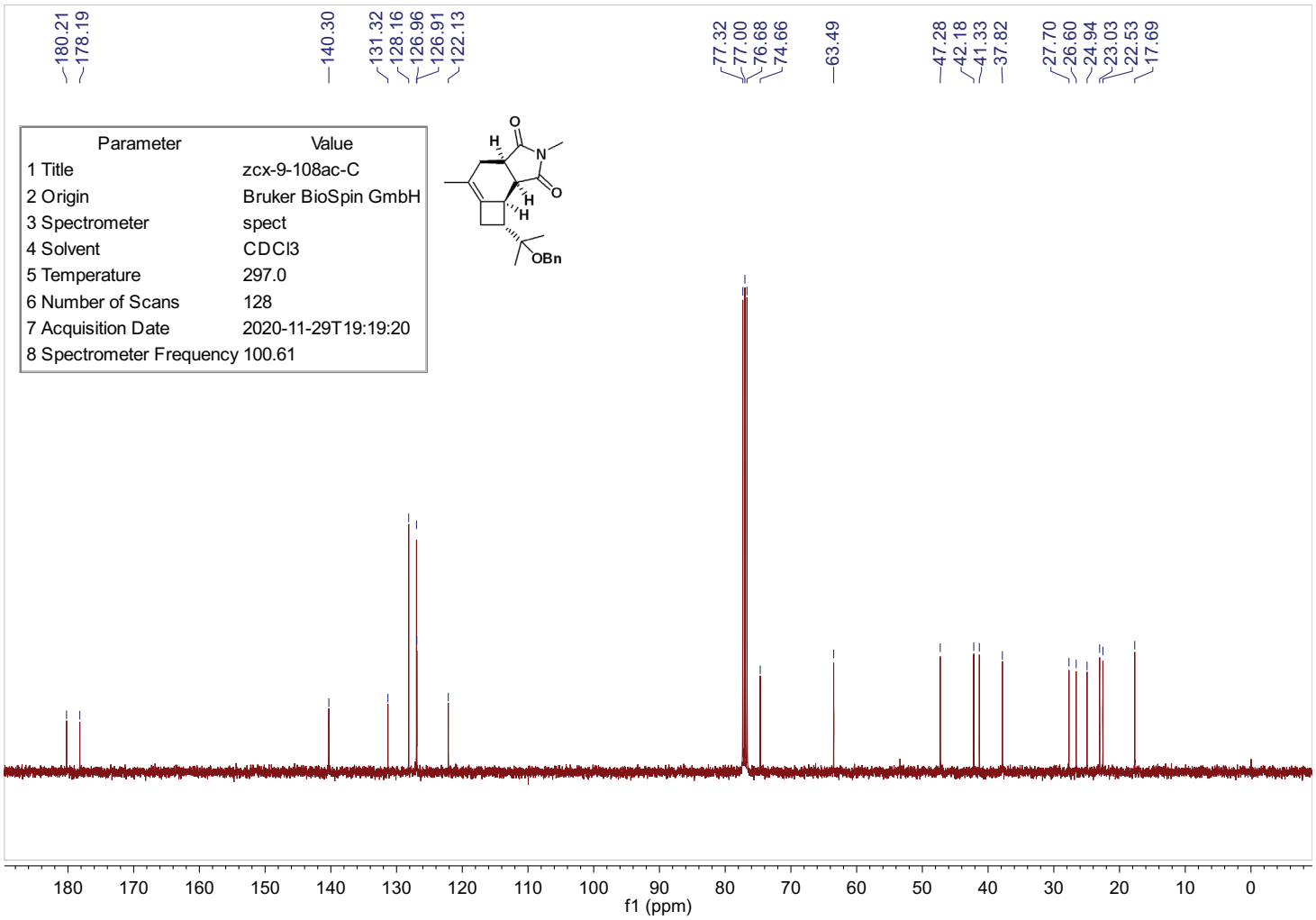
7.36
7.34
7.34
7.32
7.32
7.31
7.30
7.27
7.26
7.25
7.24
7.23
7.23
7.22
4.54
4.51
4.50
4.47
3.18
3.17
3.16
3.14
3.13
3.11
3.09
3.07
3.06
3.05
3.05
3.03
3.03
2.97
2.78
2.77
2.77
2.76
2.76
2.75
2.75
2.74
2.74
2.73
2.73
2.72
2.72
2.71
2.58
2.56
2.54
2.52
2.51
2.51
2.47
2.47
2.45
2.42
2.42
2.39
2.14
2.10
1.57
1.35
1.21

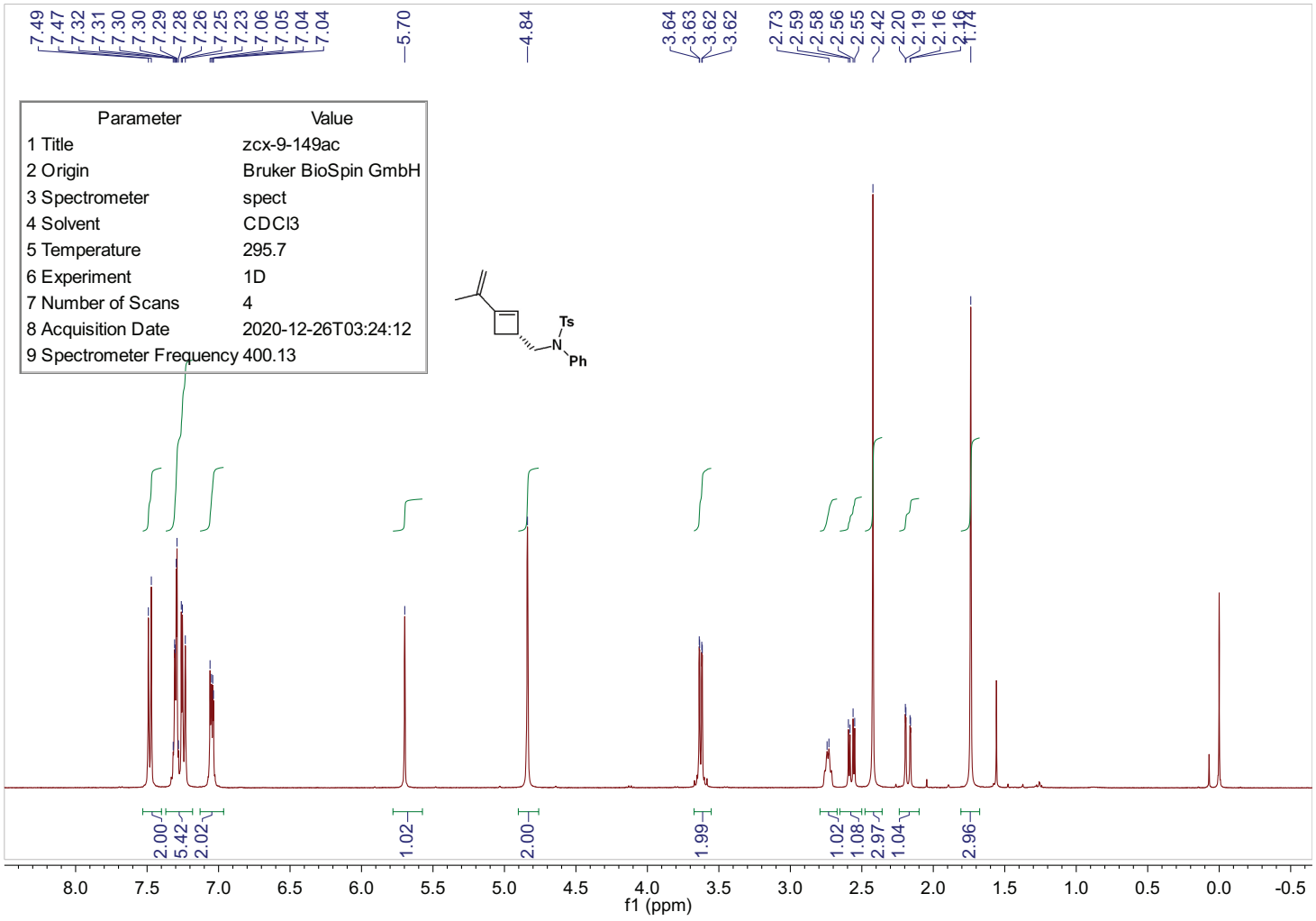
Parameter	Value
1 Title	zcx-9-108ac
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.5
6 Experiment	1D
7 Number of Scans	4
8 Acquisition Date	2020-11-30T17:49:53
9 Spectrometer Frequency	400.13

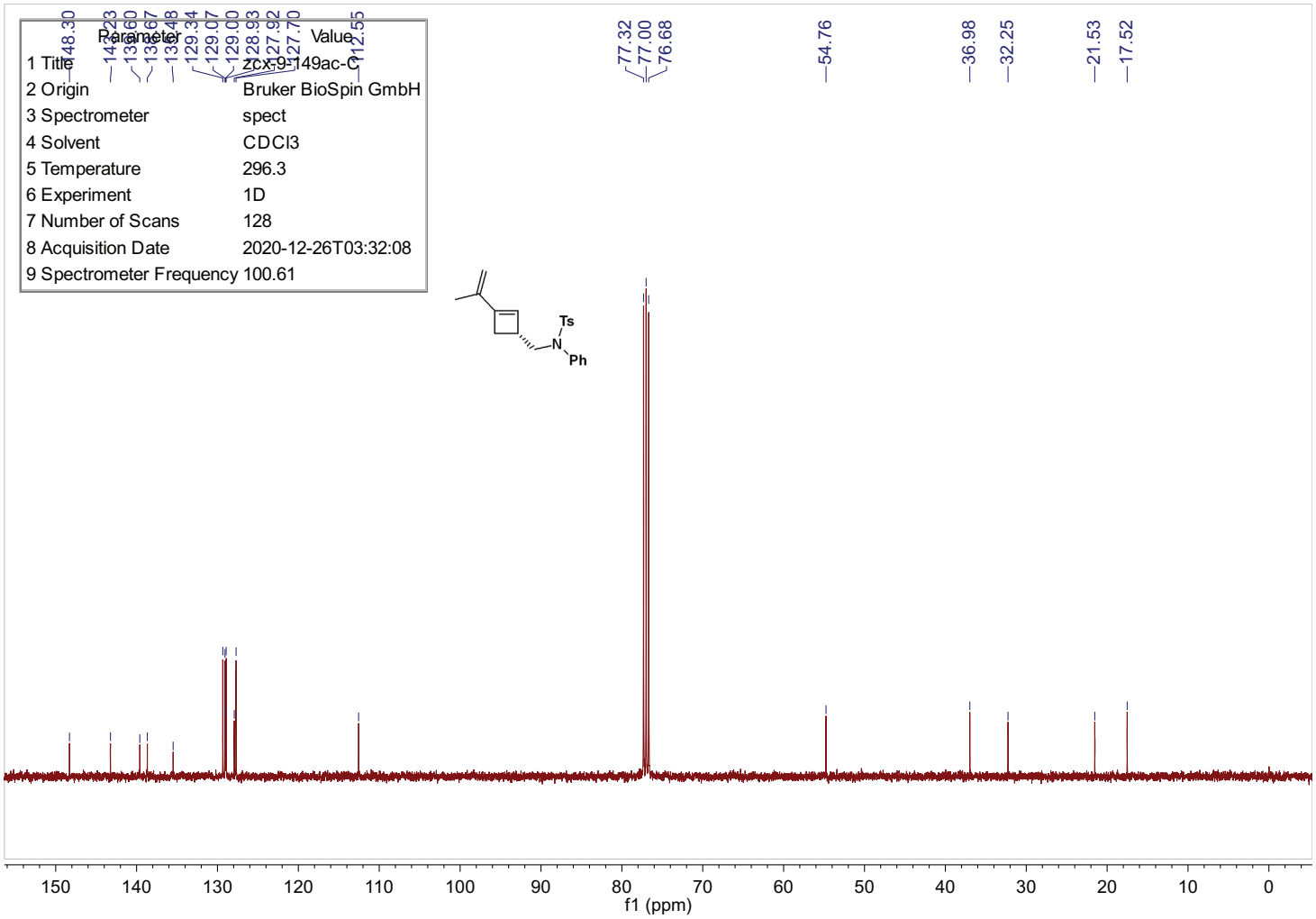


3.81
1.17
2.00
0.98
1.99
2.85
1.04
2.97
0.98
2.87
2.93
2.90

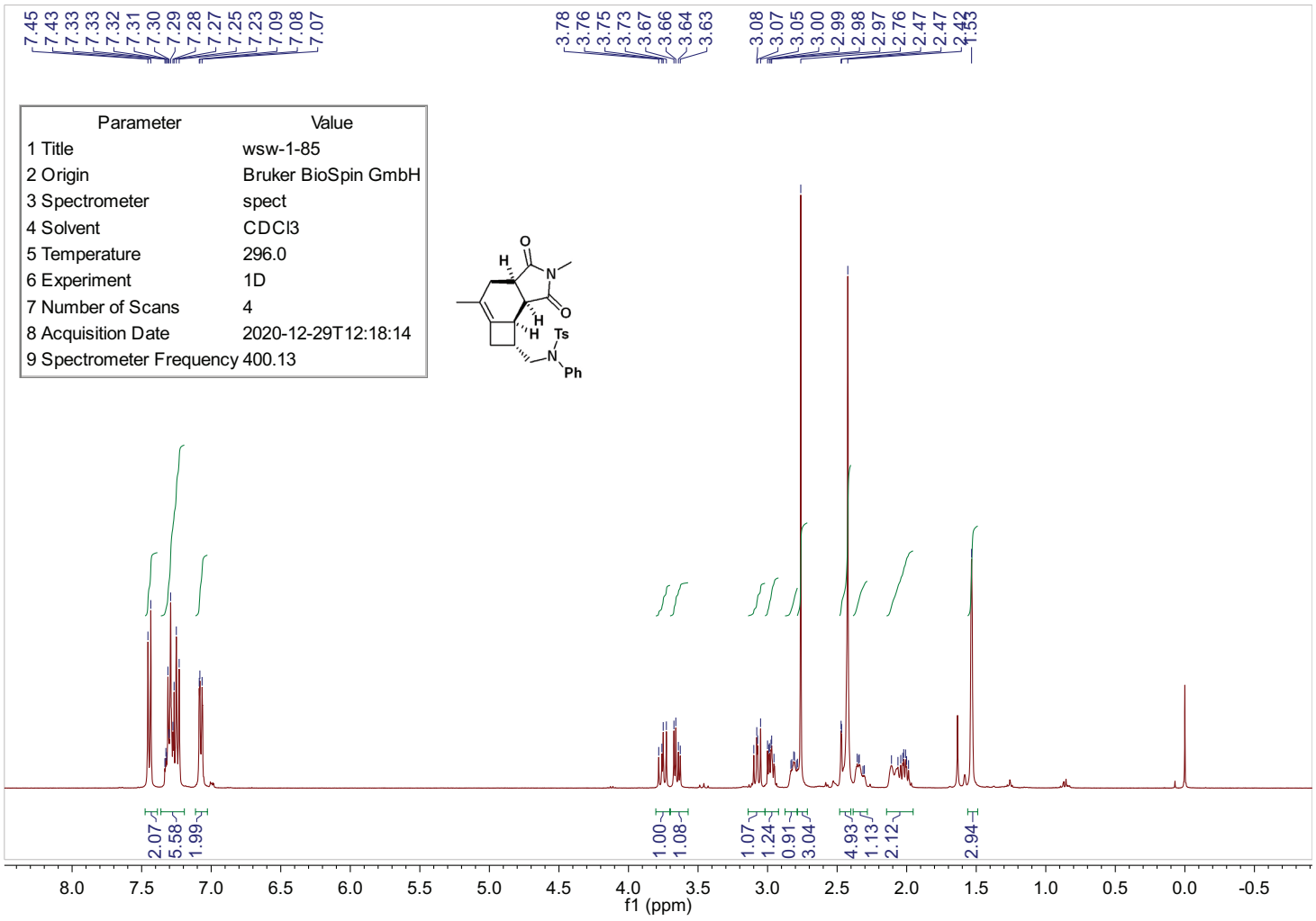
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


180.21
178.19
140.30
131.32
128.16
126.96
126.91
122.13
77.32
77.00
76.68
74.66
63.49
47.28
42.18
41.33
37.82
27.70
26.60
24.94
23.03
22.53
17.69
Parameter Value
1 Title zcx-9-108ac-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.0
6 Number of Scans 128
7 Acquisition Date 2020-11-29T19:19:20
8 Spectrometer Frequency 100.61
O
H
N
O
H
H
OBn
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

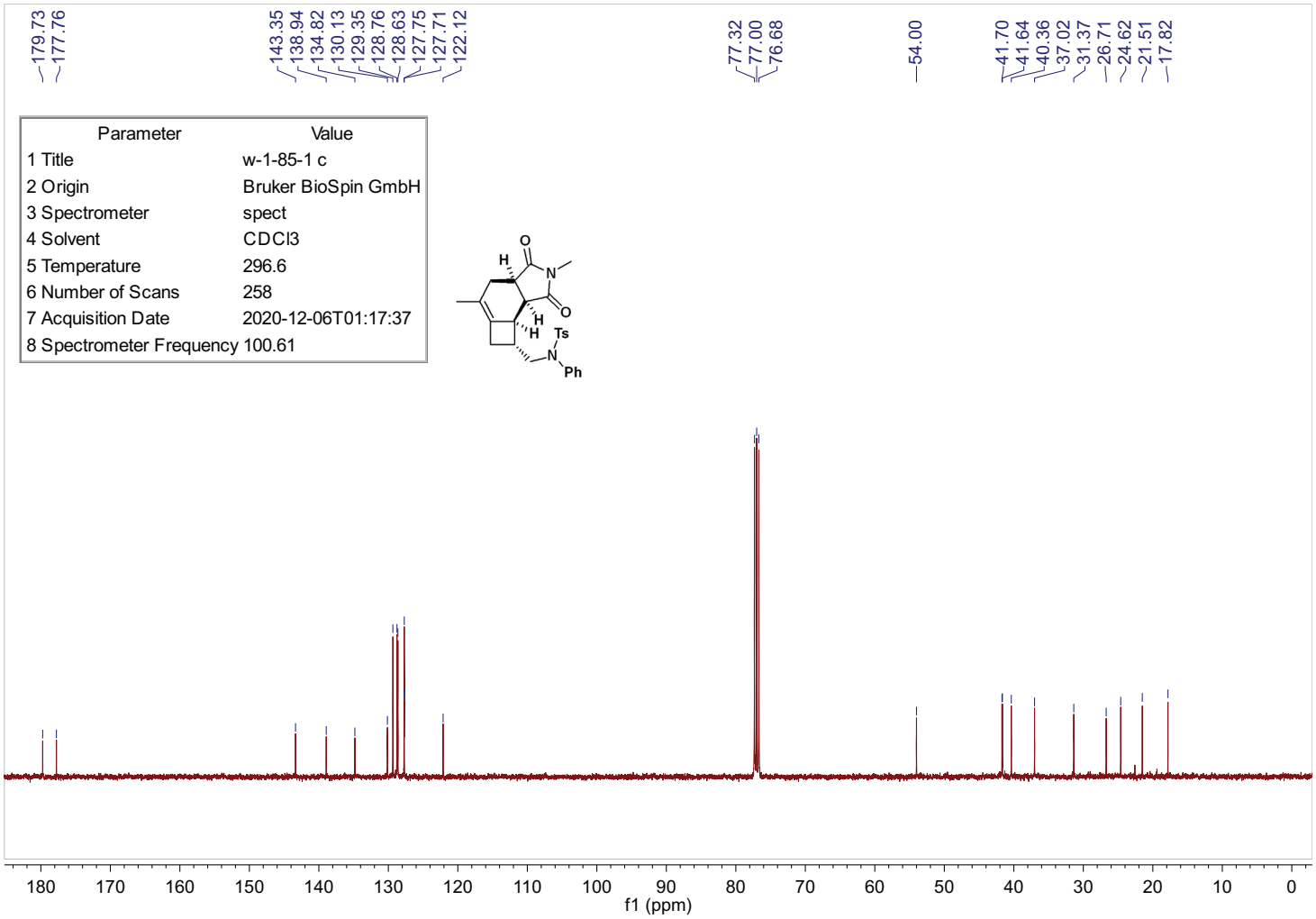

7.49
7.47
7.32
7.31
7.30
7.30
7.29
7.28
7.26
7.25
7.23
7.06
7.05
7.04
7.04
5.70
4.84
3.64
3.63
3.62
3.62
2.73
2.59
2.58
2.56
2.55
2.42
2.20
2.19
2.16
2.16
Parameter Value
1 Title zcx-9-149ac
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 295.7
6 Experiment 1D
7 Number of Scans 4
8 Acquisition Date 2020-12-26T03:24:12
9 Spectrometer Frequency 400.13
Ts
N
Ph
2.00
5.42
2.02
1.02
2.00
1.99
1.02
1.08
2.97
1.04
2.96
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)



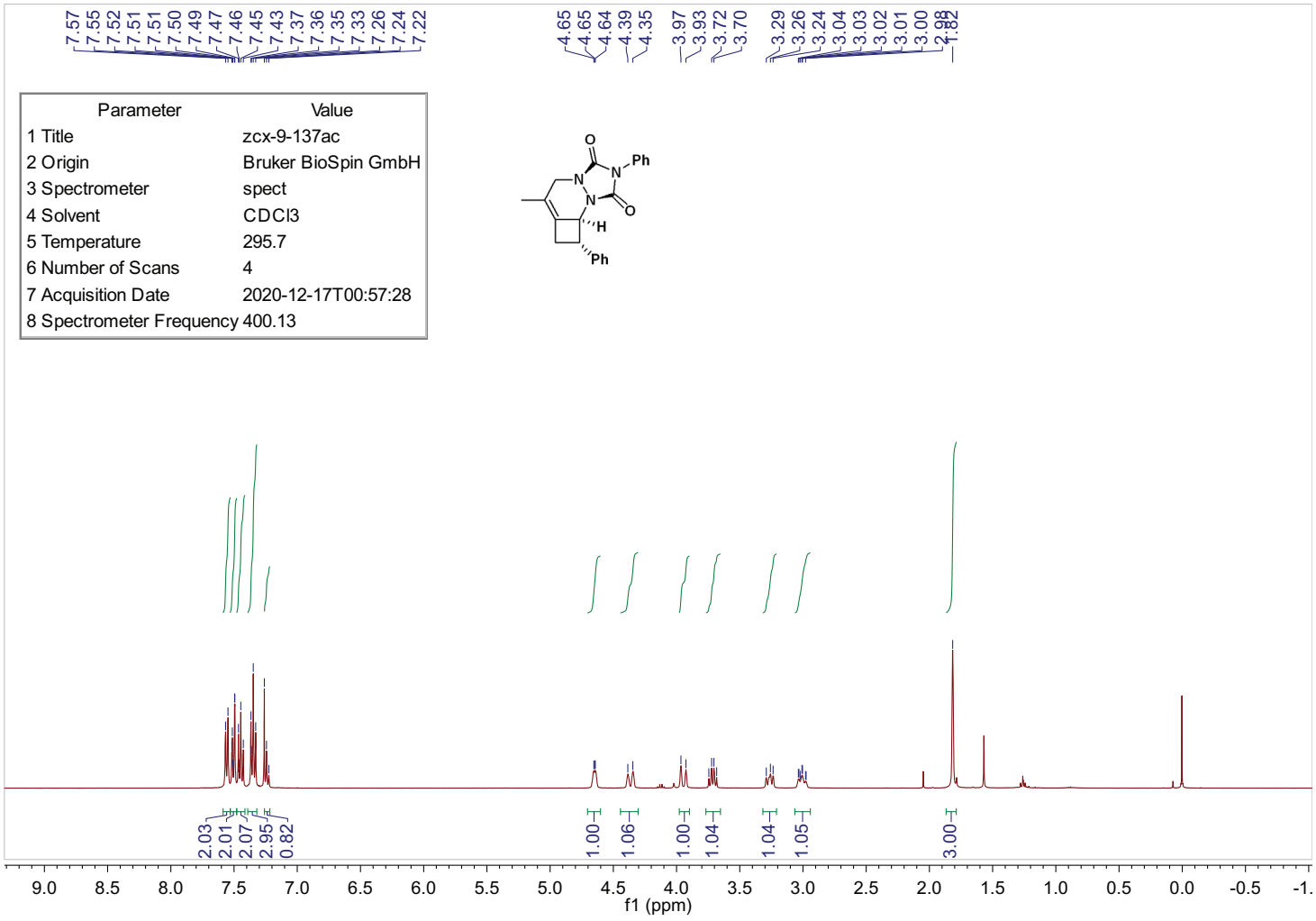
Parameter	Value
1 Title	zcx-9-149ac-C
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.3
6 Experiment	1D
7 Number of Scans	128
8 Acquisition Date	2020-12-26T03:32:08
9 Spectrometer Frequency	100.61



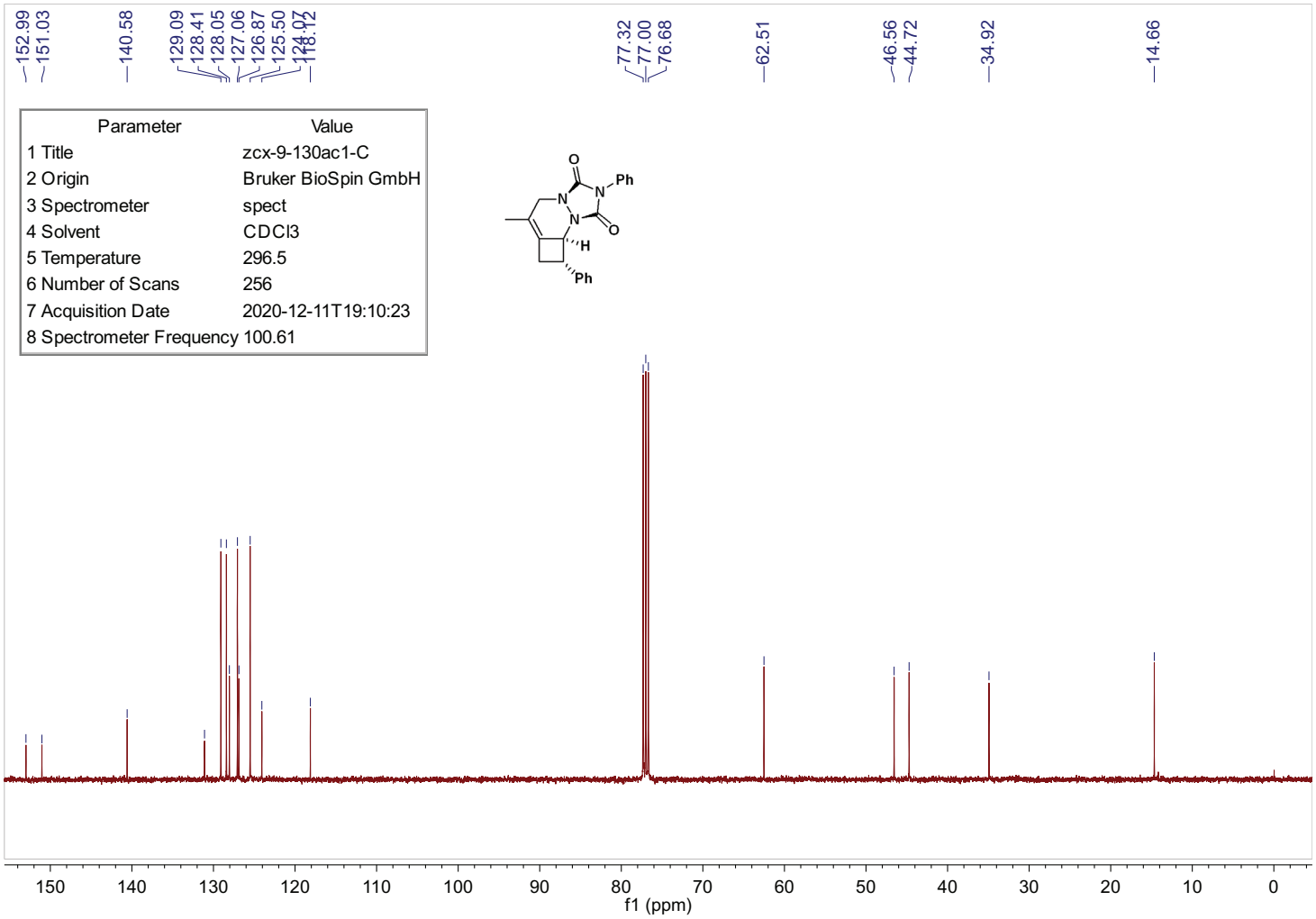
Parameter	Value
1 Title	wsw-1-85
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.0
6 Experiment	1D
7 Number of Scans	4
8 Acquisition Date	2020-12-29T12:18:14
9 Spectrometer Frequency	400.13

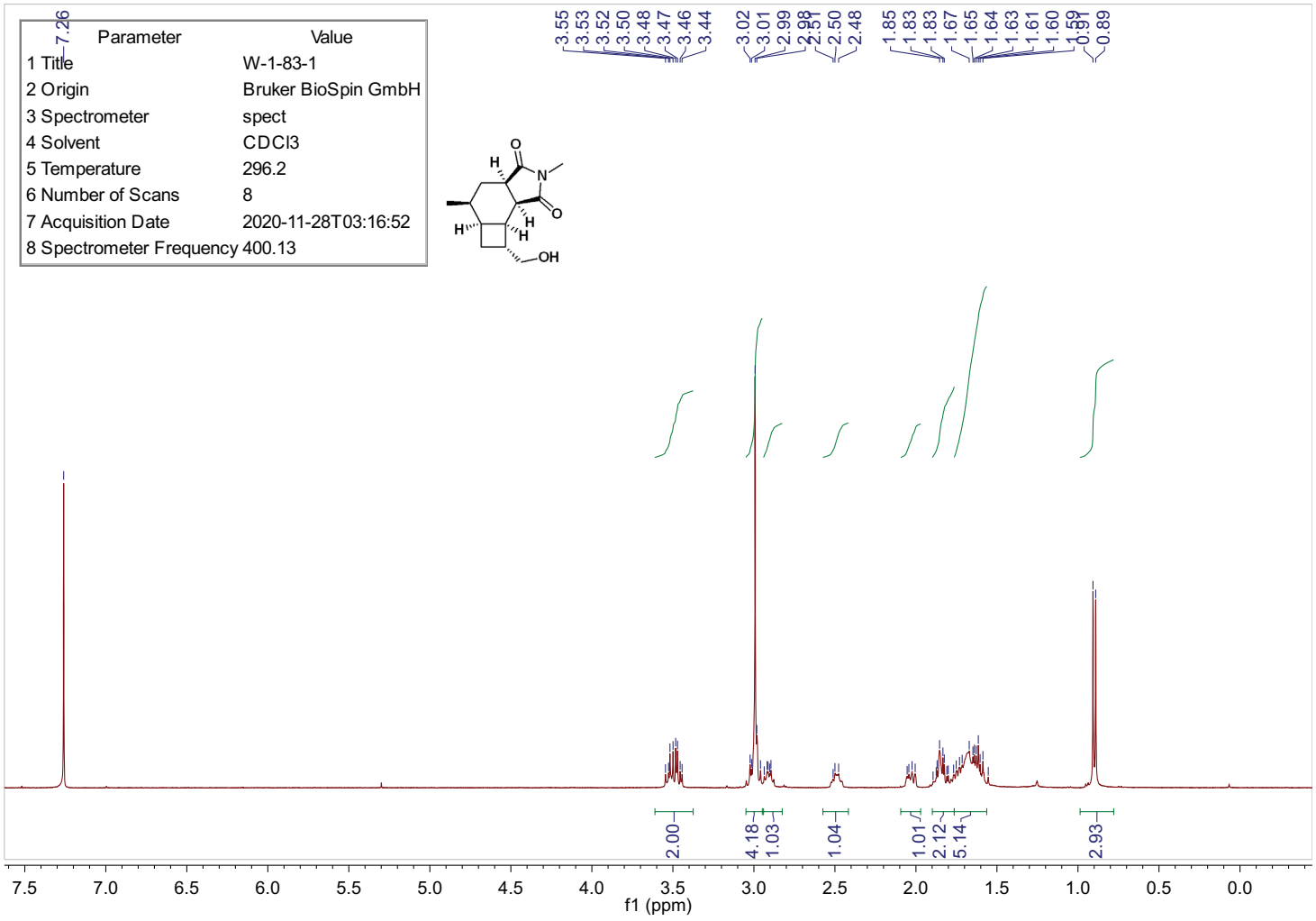


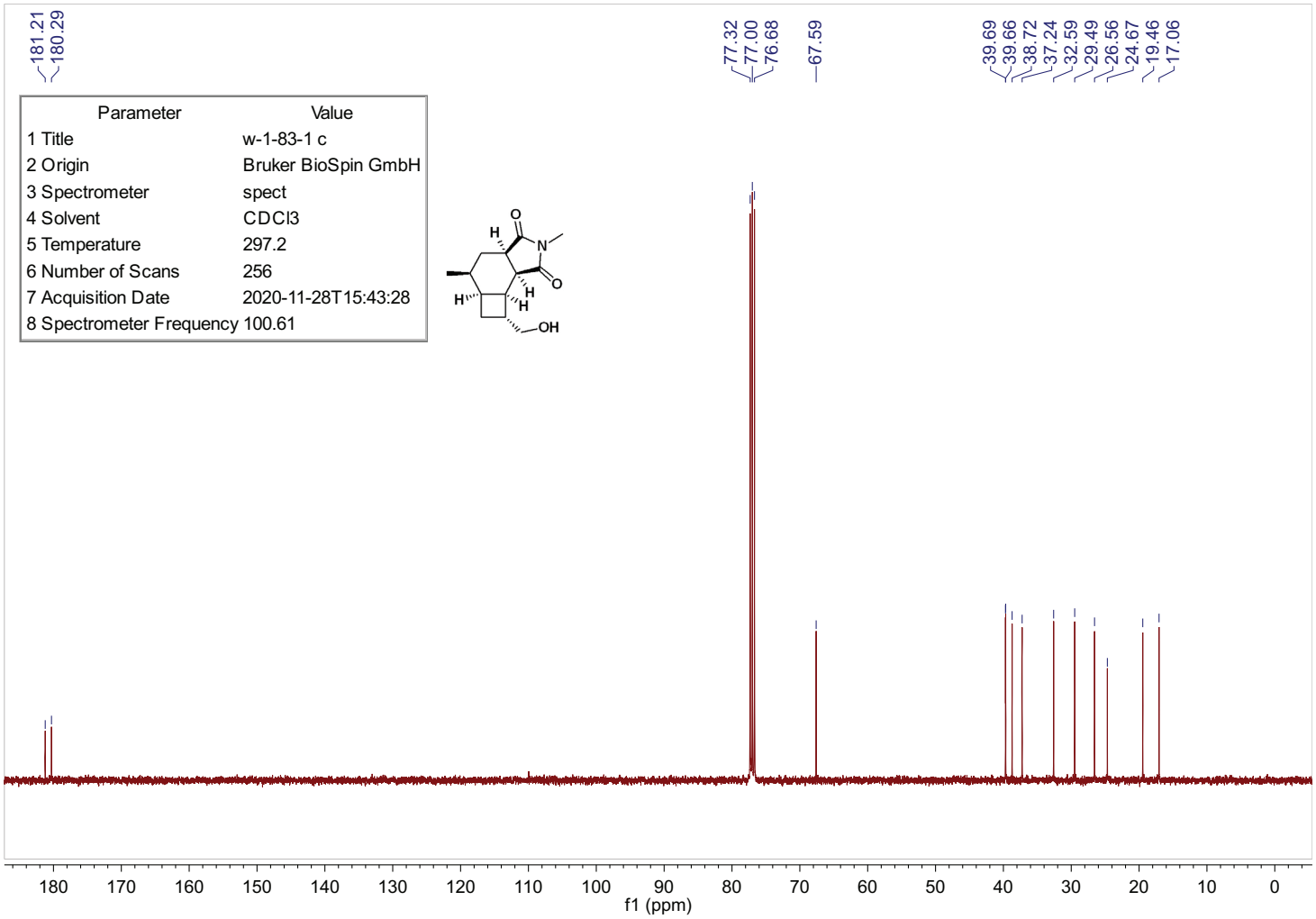
Parameter	Value
1 Title	w-1-85-1 c
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	296.6
6 Number of Scans	258
7 Acquisition Date	2020-12-06T01:17:37
8 Spectrometer Frequency	100.61



Parameter	Value
1 Title	zcx-9-137ac
2 Origin	Bruker BioSpin GmbH
3 Spectrometer	spect
4 Solvent	CDCl3
5 Temperature	295.7
6 Number of Scans	4
7 Acquisition Date	2020-12-17T00:57:28
8 Spectrometer Frequency	400.13

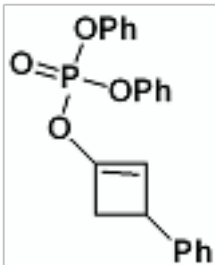

152.99
151.03
140.58
129.09
128.41
128.05
127.06
126.87
125.50
124.07
118.12
77.32
77.00
76.68
62.51
46.56
44.72
34.92
14.66
Parameter Value
1 Title zcx-9-130ac1-C
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.5
6 Number of Scans 256
7 Acquisition Date 2020-12-11T19:10:23
8 Spectrometer Frequency 100.61
O
Ph
N
N
N
O
H
Ph
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.26
3.55
3.53
3.52
3.50
3.48
3.47
3.46
3.44
3.02
3.01
2.99
2.51
2.50
2.48
1.85
1.83
1.83
1.67
1.65
1.64
1.63
1.61
1.60
0.91
0.89
Parameter Value
1 Title W-1-83-1
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 296.2
6 Number of Scans 8
7 Acquisition Date 2020-11-28T03:16:52
8 Spectrometer Frequency 400.13
O
H
N
O
H
H
OH
2.00
4.18
1.03
1.04
1.01
2.12
5.14
2.93
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


181.21
180.29
77.32
77.00
76.68
67.59
39.69
39.66
38.72
37.24
32.59
29.49
26.56
24.67
19.46
17.06
Parameter Value
1 Title w-1-83-1 c
2 Origin Bruker BioSpin GmbH
3 Spectrometer spect
4 Solvent CDCl3
5 Temperature 297.2
6 Number of Scans 256
7 Acquisition Date 2020-11-28T15:43:28
8 Spectrometer Frequency 100.61
O
H
N
O
H
H
OH
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

SHIMADZU LabSolutions

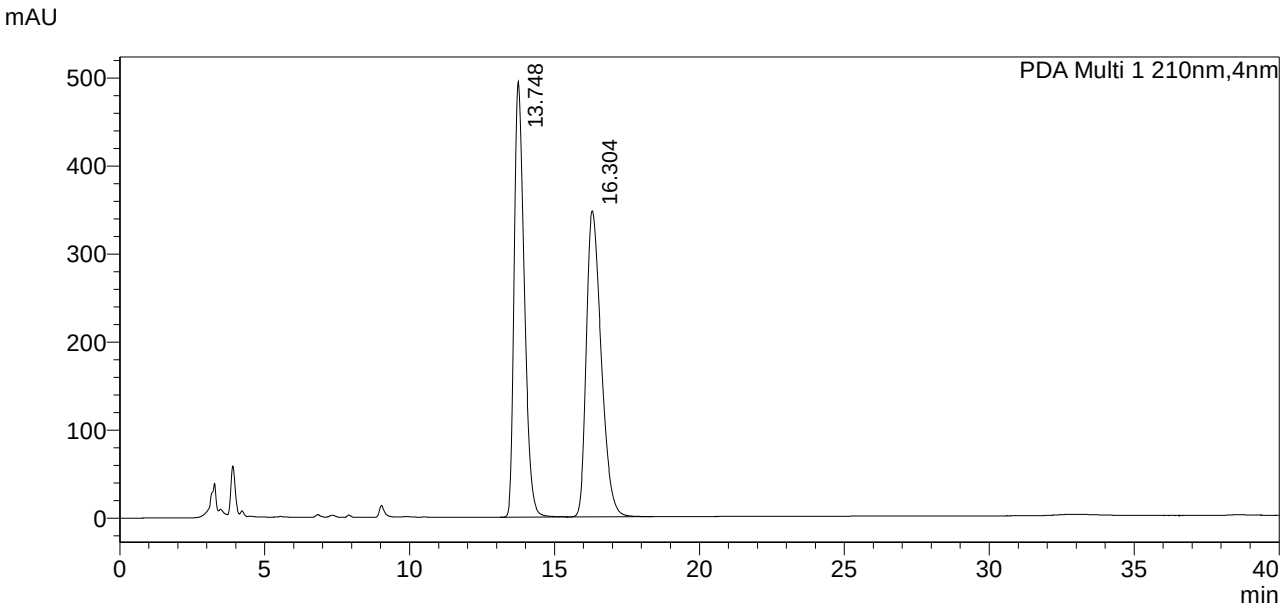
Analysis Report



<Sample Information>

Sample Name	: zcx-7-11ac		
Sample ID	:		
Data Filename	: zcx-7-11ac.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-7-11ac zcx-5-95 96ac.lcb		
Vial #	: 1-46	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/26/2019 11:13:36 AM	Acquired by	: System Administrator
Date Processed	: 10/26/2019 11:53:38 AM	Processed by	: System Administrator

<Chromatogram>



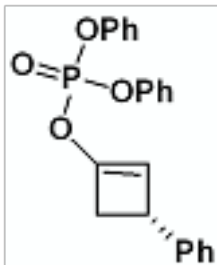
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.748	12107636	495033	49.358			
2	16.304	12422395	347484	50.642		V	
Total		24530031	842517				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: wsw-1-30-1		
Sample ID	:		
Data Filename	: wsw-1-30-1.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-8-81ac.lcb		
Vial #	: 1-31	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 8/28/2020 12:04:23 AM	Acquired by	: System Administrator
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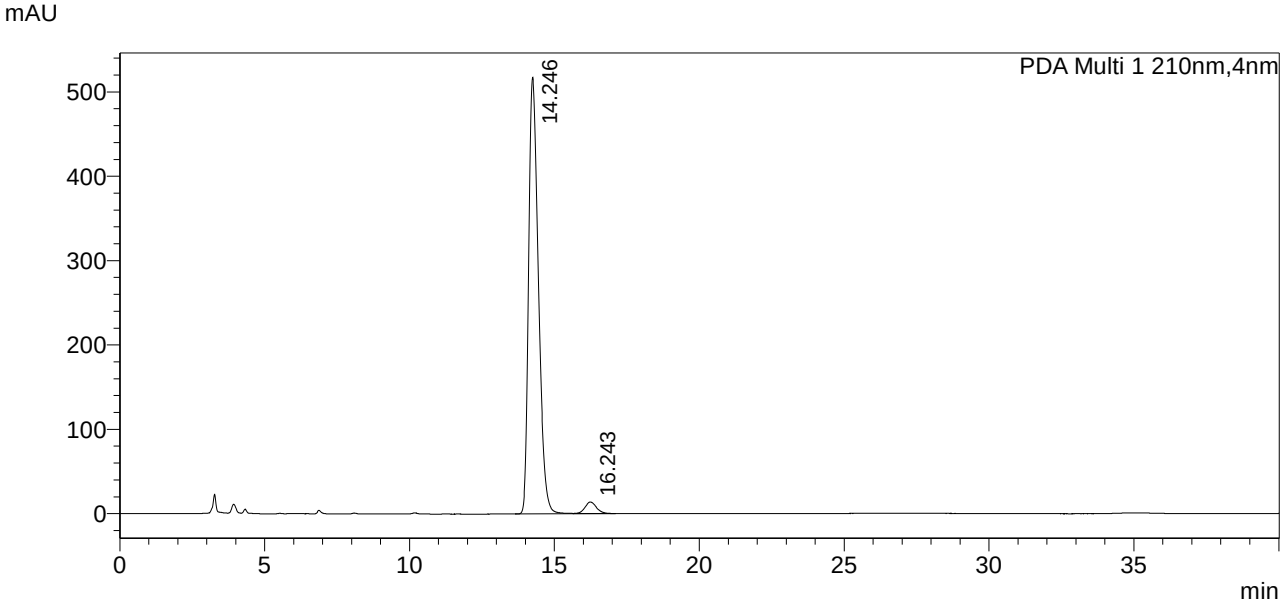


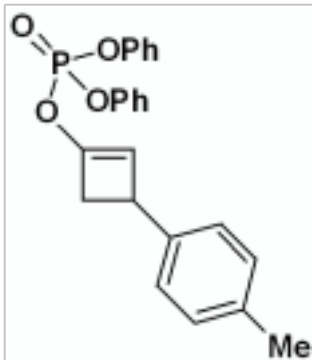
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.246	12194364	517584	97.061		S	
2	16.243	369253	13558	2.939		T	
Total		12563617	531141				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-8-1-1 ODH 5%		
Sample ID	:		
Data Filename	: w-1-8-1-1 ODH 5%.lcd		
Method Filename	: OD-H,1ml 5%IPA in Hex;40min.lcm		
Batch Filename	: ZJ-1-89.lcb		
Vial #	: 1-16	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 9/4/2020 11:31:31 PM	Acquired by	: System Administrator
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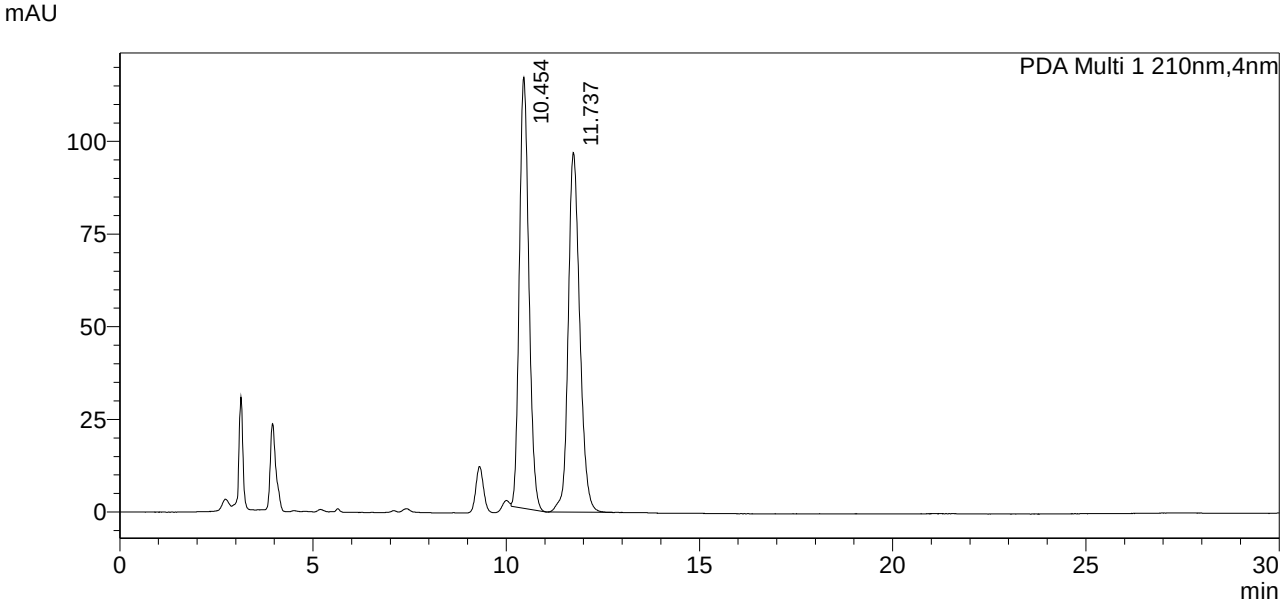


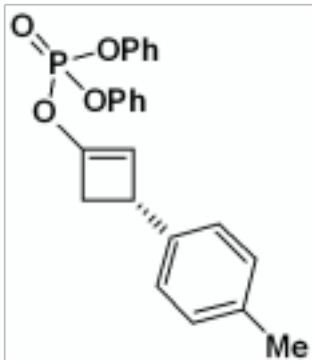
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10.454	1997289	116284	49.741			
2	11.737	2018088	97032	50.259			
Total		4015376	213316				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-37-2-1 ODH 5%		
Sample ID	:		
Data Filename	: w-1-37-2-1 ODH 5%.lcd		
Method Filename	: OD-H,1ml 5%IPA in Hex;40min.lcm		
Batch Filename	: ZJ-1-89.lcb		
Vial #	: 1-17	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 9/5/2020 12:12:04 AM	Acquired by	: System Administrator
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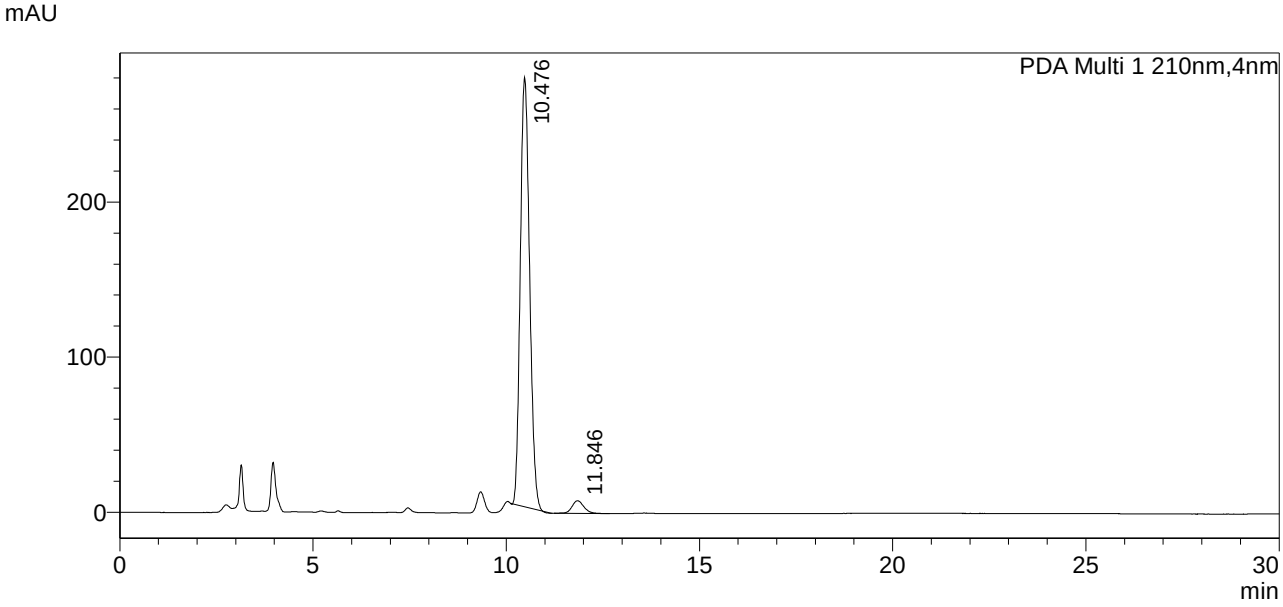


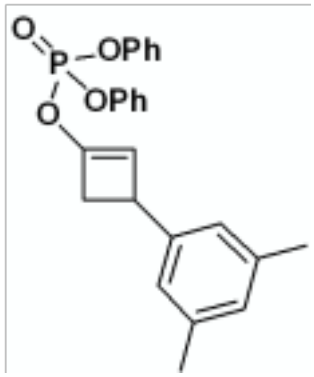
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10.476	4645956	276892	96.405			
2	11.846	173227	8152	3.595			
Total		4819183	285044				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-55-1 ojh 10%		
Sample ID	:		
Data Filename	: w-1-55-1 ojh 10%.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex; 40 min.lcm		
Batch Filename	: w-1-55-1		
Vial #	: 1-4	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/16/2020 1:45:39 AM	Acquired by	: System Administrator
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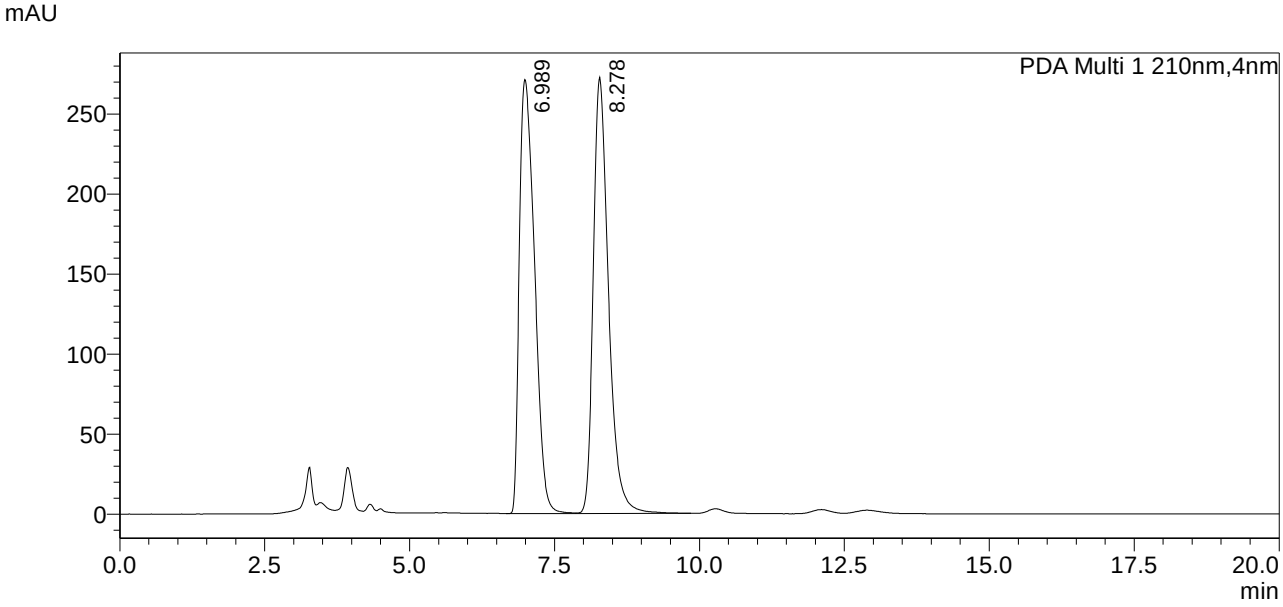


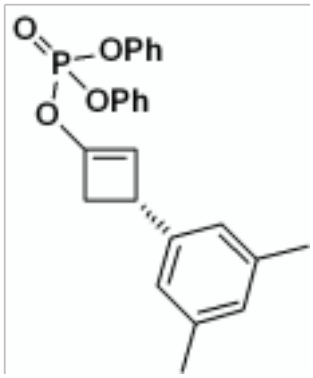
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	6.989	4957619	271180	49.880			
2	8.278	4981525	272479	50.120		V	
Total		9939144	543658				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-58-2 ojh 10%		
Sample ID	:		
Data Filename	: w-1-58-2 ojh 10%.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex; 20 min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-5	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/16/2020 6:17:41 PM	Acquired by	: System Administrator
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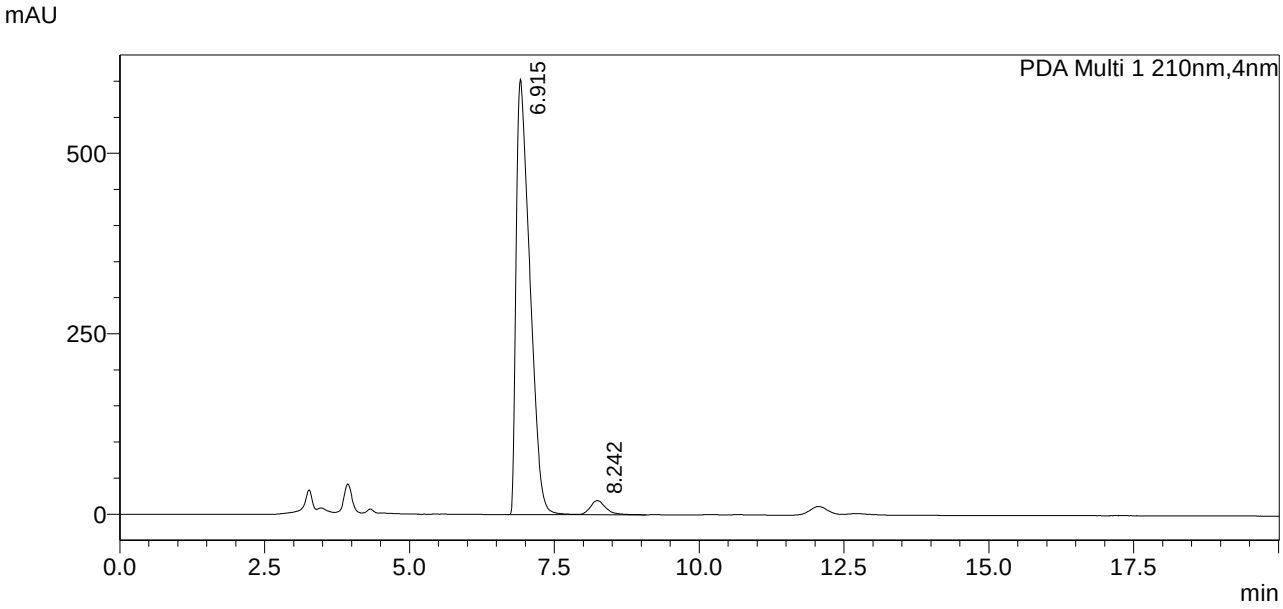


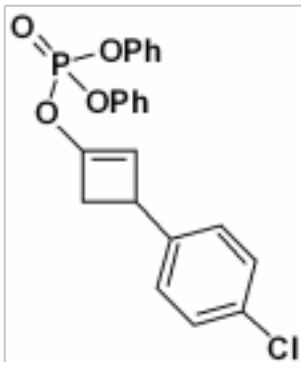
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	6.915	9962642	603076	96.422		V	
2	8.242	369708	19590	3.578		V	
Total		10332350	622666				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: wsw-1-10-1		
Sample ID	:		
Data Filename	: wsw-1-10-1.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-8-81ac.lcb		
Vial #	: 1-32	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 8/9/2020 6:34:39 AM	Acquired by	: System Administrator
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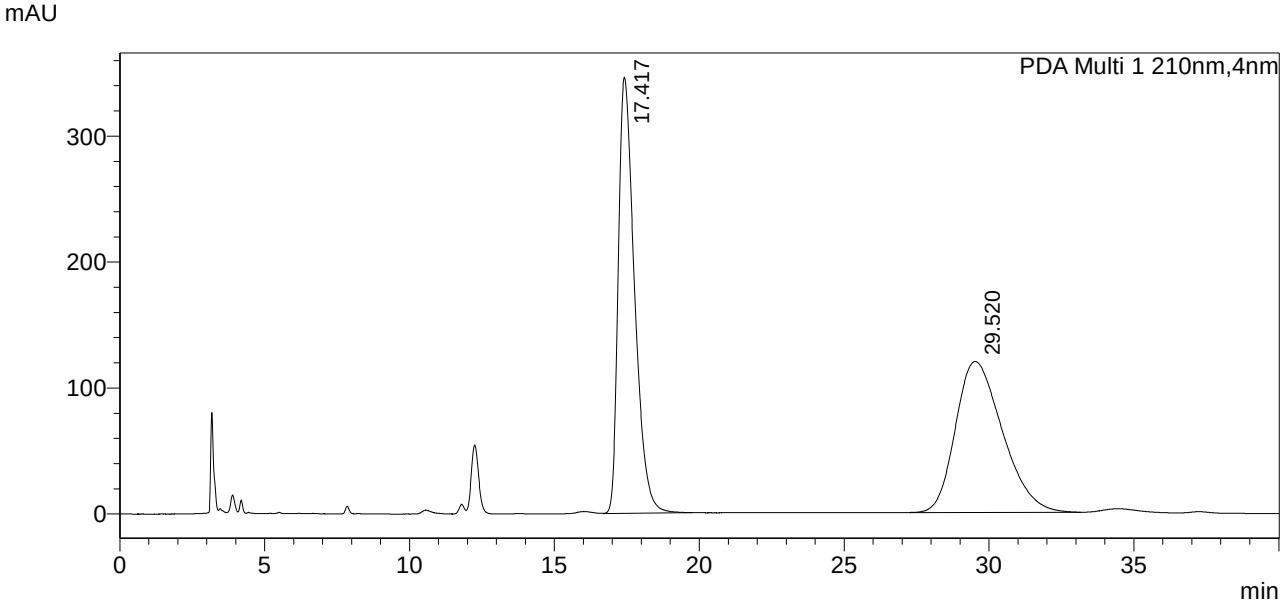


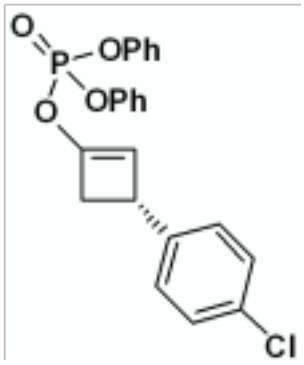
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	17.417	13476708	346008	49.946			
2	29.520	13505743	119847	50.054			
Total		26982451	465855				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-38-2		
Sample ID	:		
Data Filename	: w-1-38-2.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex; 40 min.lcm		
Batch Filename	: ZJ-1-89.lcb		
Vial #	: 1-3	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 9/4/2020 12:17:41 AM	Acquired by	: System Administrator
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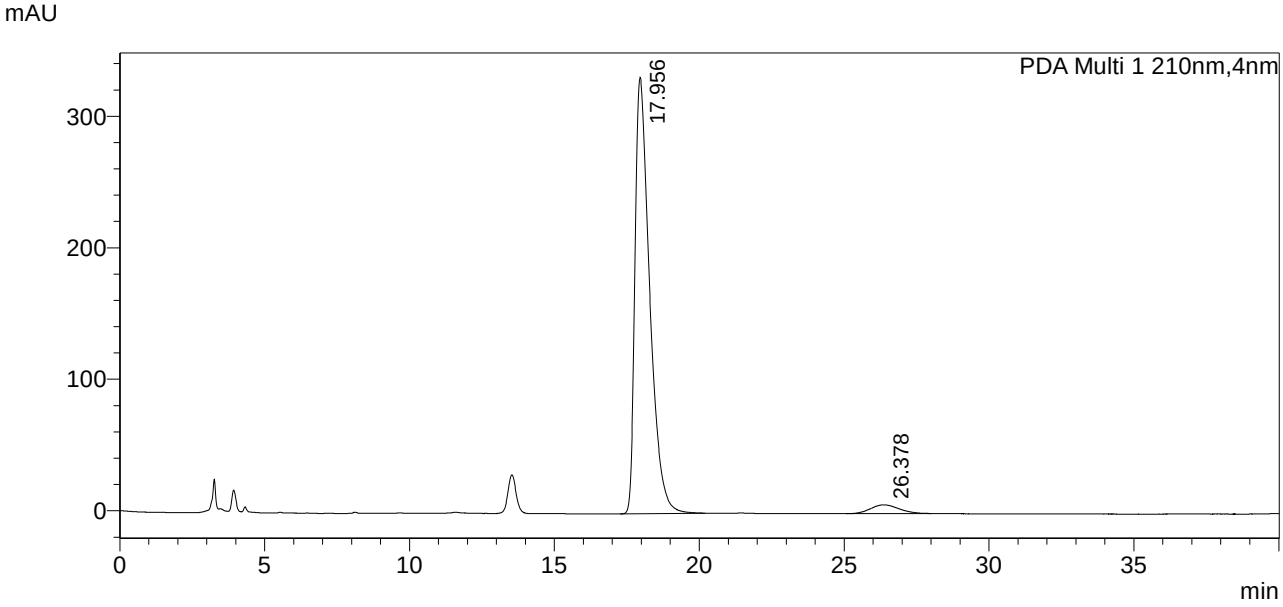


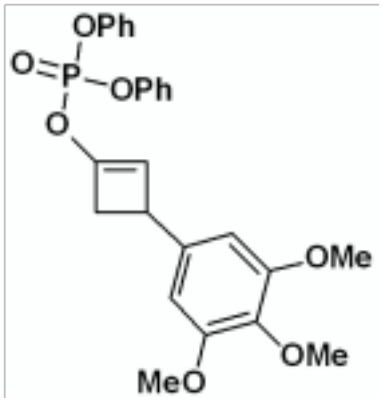
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	17.956	11710884	331764	96.261			
2	26.378	454938	6661	3.739			
Total		12165822	338426				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: wsw-1-7-1-1-1		
Sample ID	:		
Data Filename	: wsw-1-7-1-1-1.lcd		
Method Filename	: OZ-H;1 ml; 10% IPA in Hex; 80 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-92	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 9/2/2020 8:26:32 AM	Acquired by	: System Administrator
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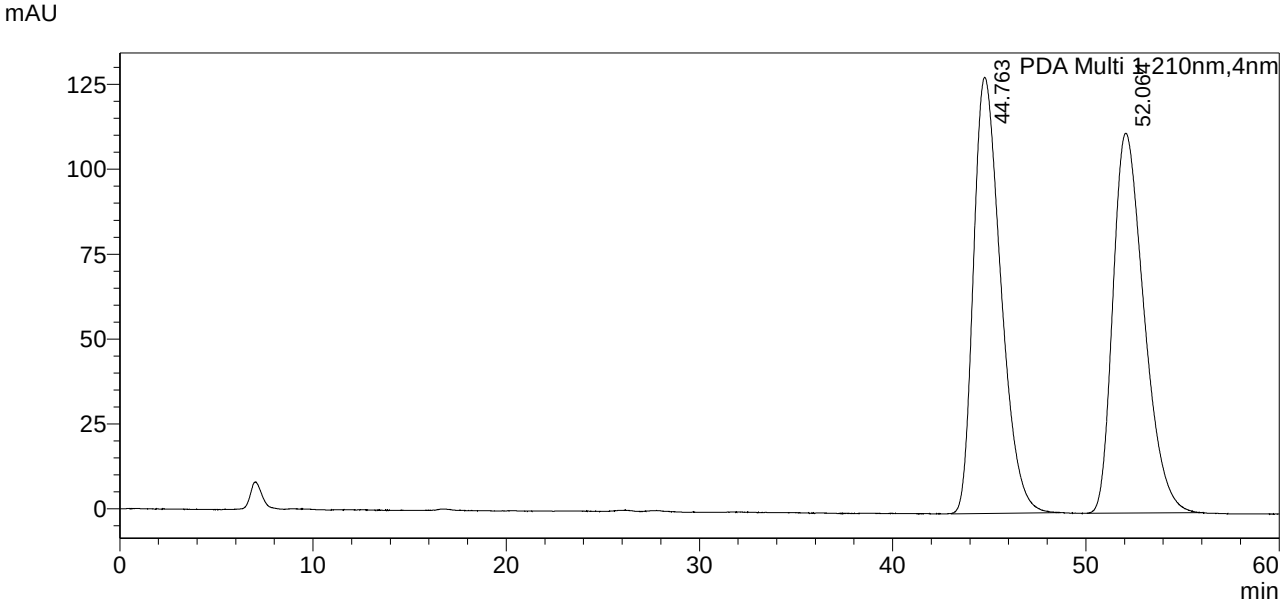


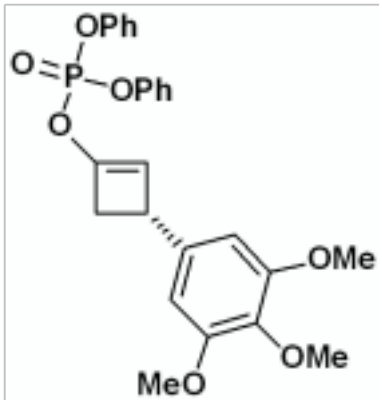
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	44.763	12629993	128426	50.236		S	
2	52.064	12511376	111871	49.764		S	
Total		25141369	240296				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-4-93ac		
Sample ID	:		
Data Filename	: zcx-4-93ac001.lcd		
Method Filename	: OZ-H;1 ml; 10% IPA in Hex; 80 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-93	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 9/1/2020 7:33:16 PM	Acquired by	: System Administrator
Date Processed	: 9/1/2020 8:53:20 PM	Processed by	: System Administrator

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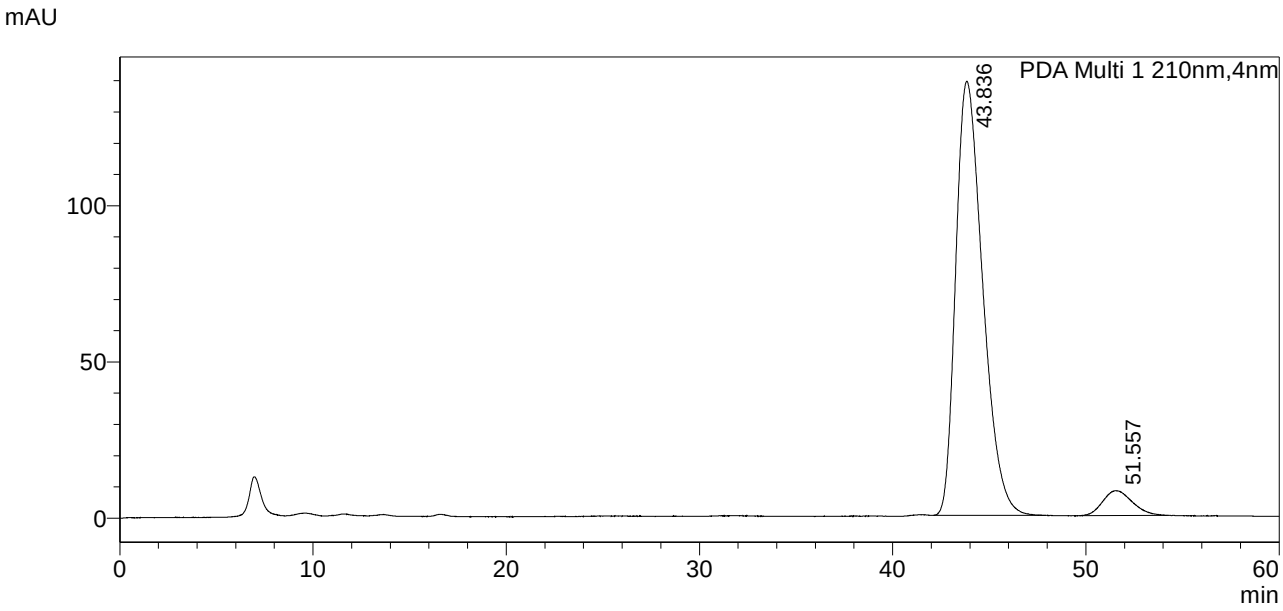


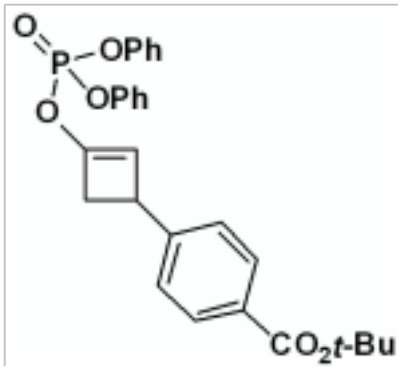
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	43.836	13479704	138931	94.037		SV	
2	51.557	854720	7985	5.963		S	
Total		14334425	146915				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-9-15ac AD		
Sample ID	:		
Data Filename	: zcx-9-15ac AD.lcd		
Method Filename	: AD-H;1 ml; 20% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-68	Sample Type	: Unknown
Injection Volume	: 10 uL		
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Date Processed	: 10/13/2020 8:17:54 PM	Processed by	: System Administrator

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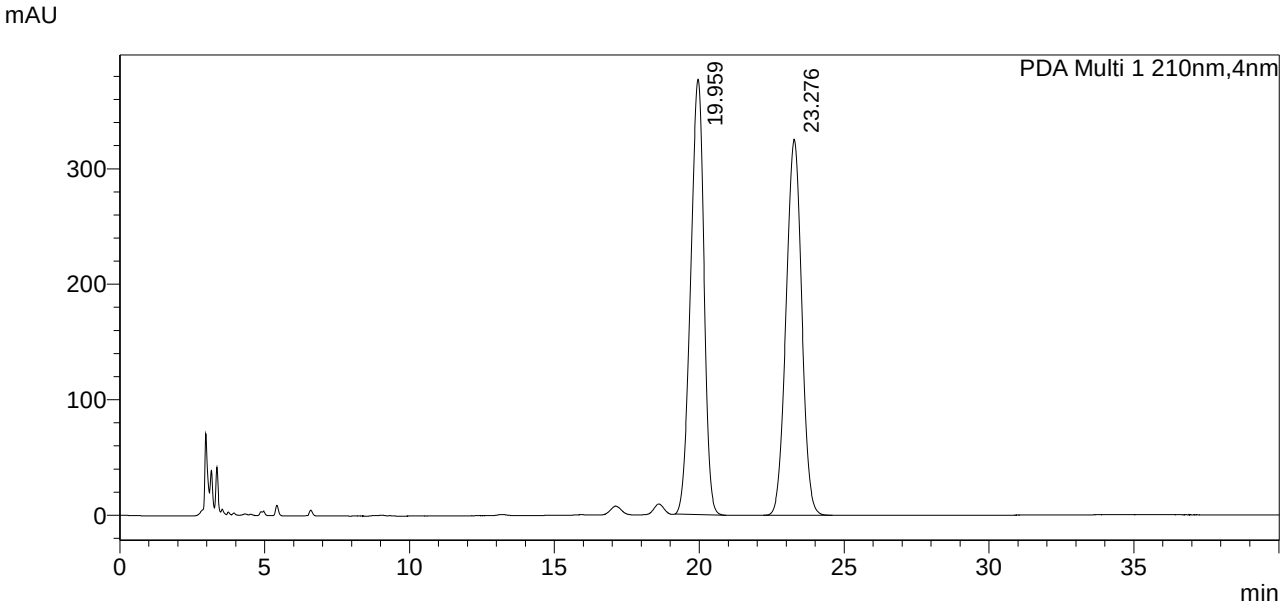


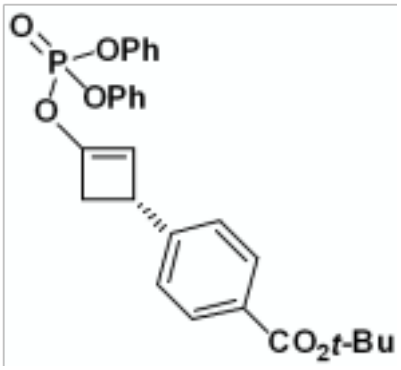
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	19.959	12041382	376739	49.649			
2	23.276	12211554	325618	50.351			
Total		24252936	702356				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-9-23ac		
Sample ID	:		
Data Filename	: zcx-9-23ac001.lcd		
Method Filename	: AD-H;1 ml; 20% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-18	Sample Type	: Unknown
Injection Volume	: 10 uL		
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Date Processed	: 10/18/2020 10:14:57 AM	Processed by	: System Administrator

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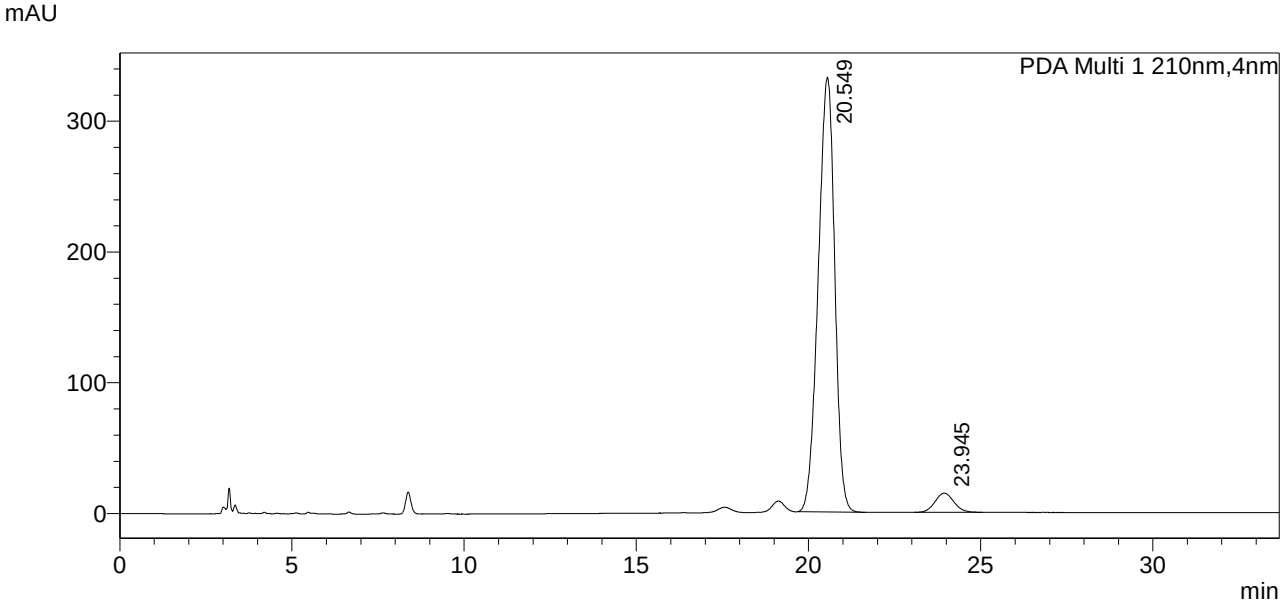


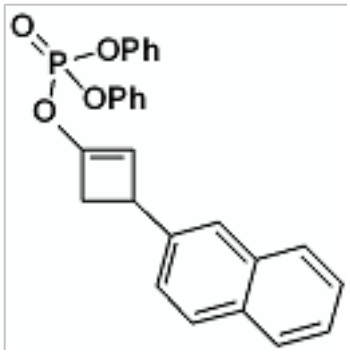
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	20.549	11044940	332257	95.178			
2	23.945	559557	14701	4.822			
Total		11604496	346958				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-8-191ac		
Sample ID	:		
Data Filename	: zcx-8-191ac002.lcd		
Method Filename	: OJ-H;1 ml; 40% IPA in Hex;50 min.lcm		
Batch Filename	: zcx-8-188ac.lcb		
Vial #	: 1-5	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/4/2020 6:51:14 PM	Acquired by	: System Administrator
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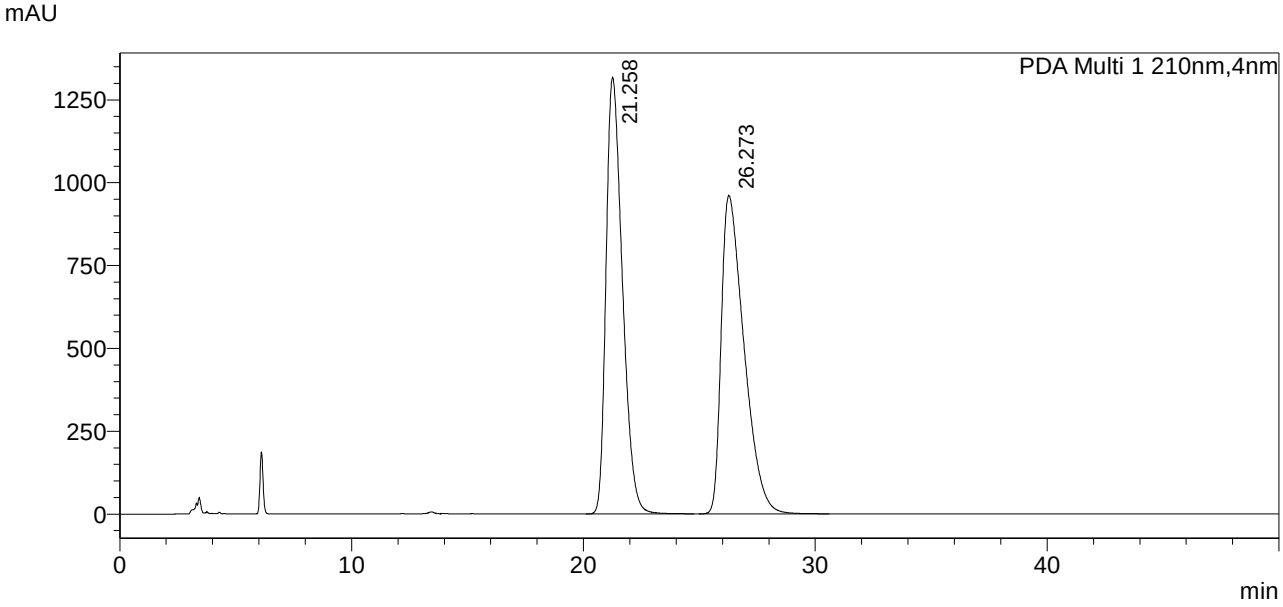


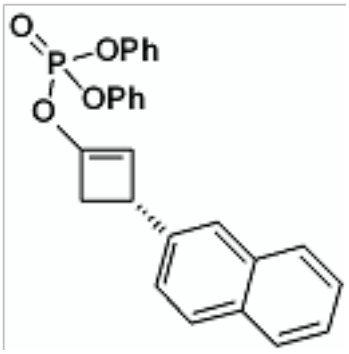
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	21.258	64609006	1317358	49.626			
2	26.273	65582178	960549	50.374		S	
Total		130191184	2277907				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-8-193ac		
Sample ID	:		
Data Filename	: zcx-8-193ac002.lcd		
Method Filename	: OJ-H;1 ml; 40% IPA in Hex;50 min.lcm		
Batch Filename	: zcx-8-188ac.lcb		
Vial #	: 1-6	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/4/2020 7:41:46 PM	Acquired by	: System Administrator
Date Processed	: 10/4/2020 8:31:49 PM	Processed by	: System Administrator

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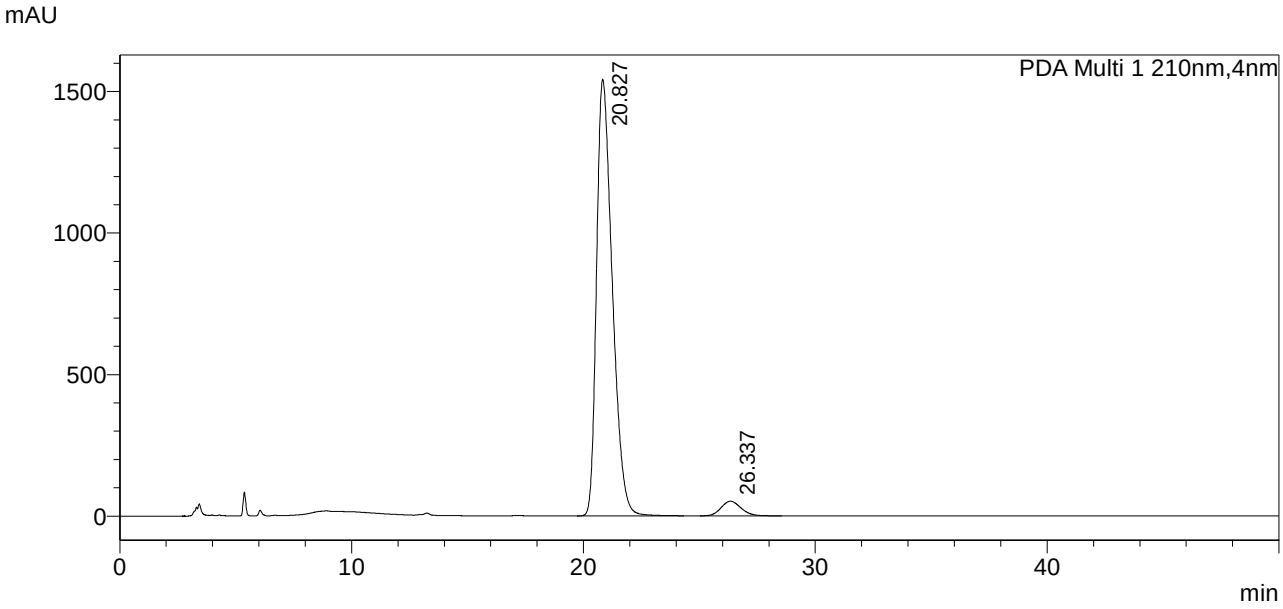


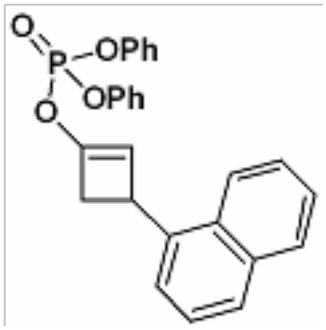
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	20.827	72777069	1541987	95.925		S	
2	26.337	3091792	51635	4.075		S	
Total		75868862	1593622				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-54-1 odh 10%		
Sample ID	:		
Data Filename	: w-1-54-1 odh 10%.lcd		
Method Filename	: OD-H;1 ml; 10% IPA in Hex; 40 min.lcm		
Batch Filename	: w-1-54-1 odh		
Vial #	: 1-4	Sample Type	: Unknown
Injection Volume	: 10 uL		
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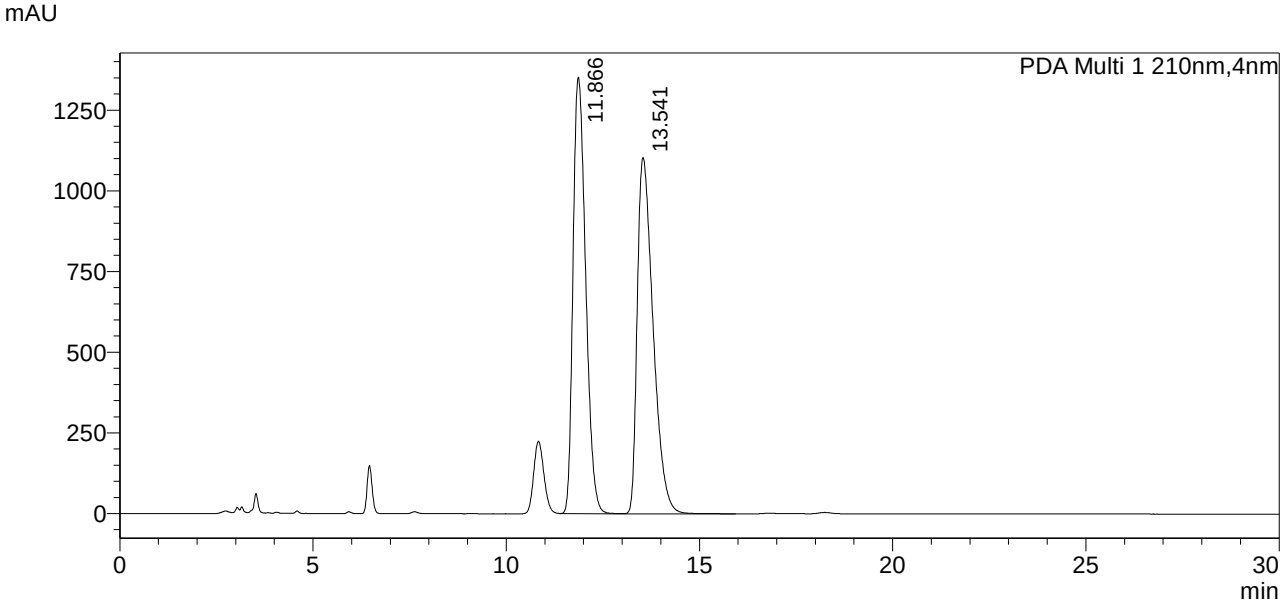


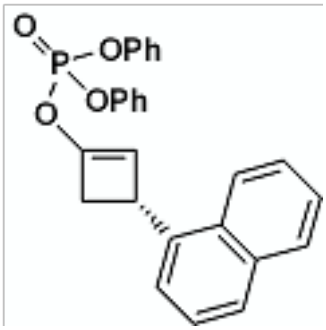
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	11.866	30859421	1351950	49.507			
2	13.541	31473851	1103407	50.493		V	
Total		62333272	2455357				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-56-1 odh		
Sample ID	:		
Data Filename	: w-1-56-1 odh.lcd		
Method Filename	: OD-H;1 ml; 10% IPA in Hex; 40 min.lcm		
Batch Filename	: w-1-56-1 odh		
Vial #	: 1-3	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/16/2020 12:44:51 AM	Acquired by	: System Administrator
Date Processed	: 10/16/2020 1:24:53 AM	Processed by	: System Administrator

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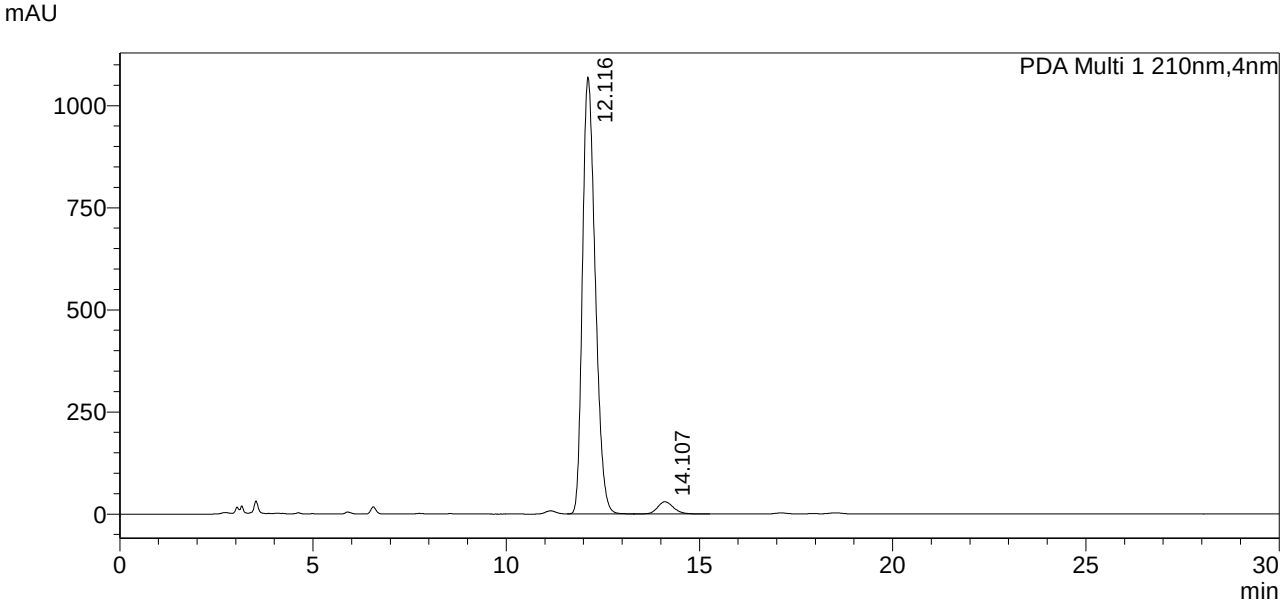


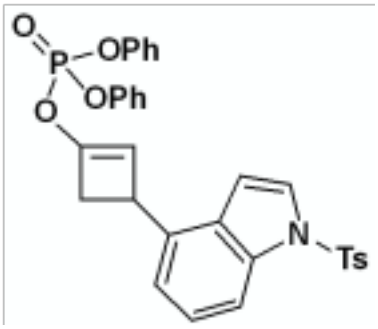
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.116	24623294	1069048	96.584			
2	14.107	870853	29984	3.416		V	
Total		25494147	1099031				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-9-19ac		
Sample ID	:		
Data Filename	: zcx-9-19ac.lcd		
Method Filename	: AD-H;1 ml; 40% IPA in Hex;60 min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-16	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/19/2020 4:55:54 PM	Acquired by	: System Administrator
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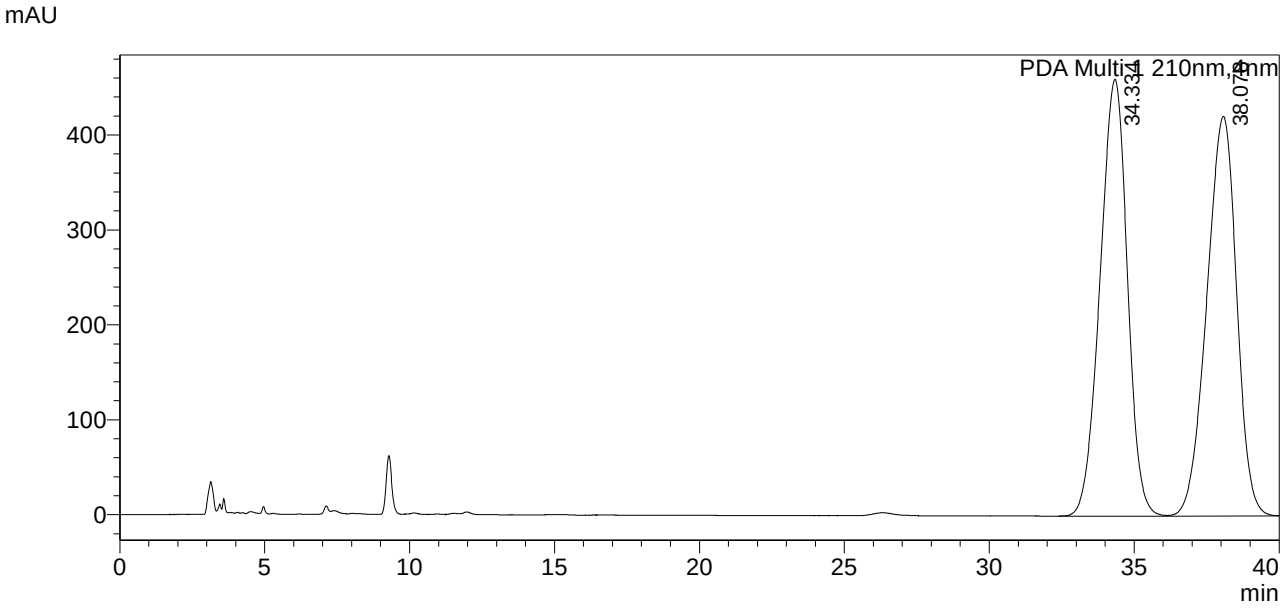
<Chromatogram>



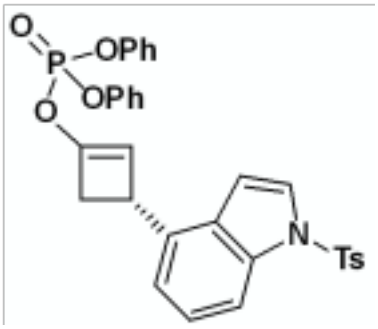
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	34.334	30126377	460054	49.971		V	
2	38.078	30161860	421062	50.029		SV	
Total		60288236	881117				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-9-24ac		
Sample ID	:		
Data Filename	: zcx-9-24ac001.lcd		
Method Filename	: AD-H;1 ml; 40% IPA in Hex;60 min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-20	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/20/2020 12:31:00 AM	Acquired by	: System Administrator
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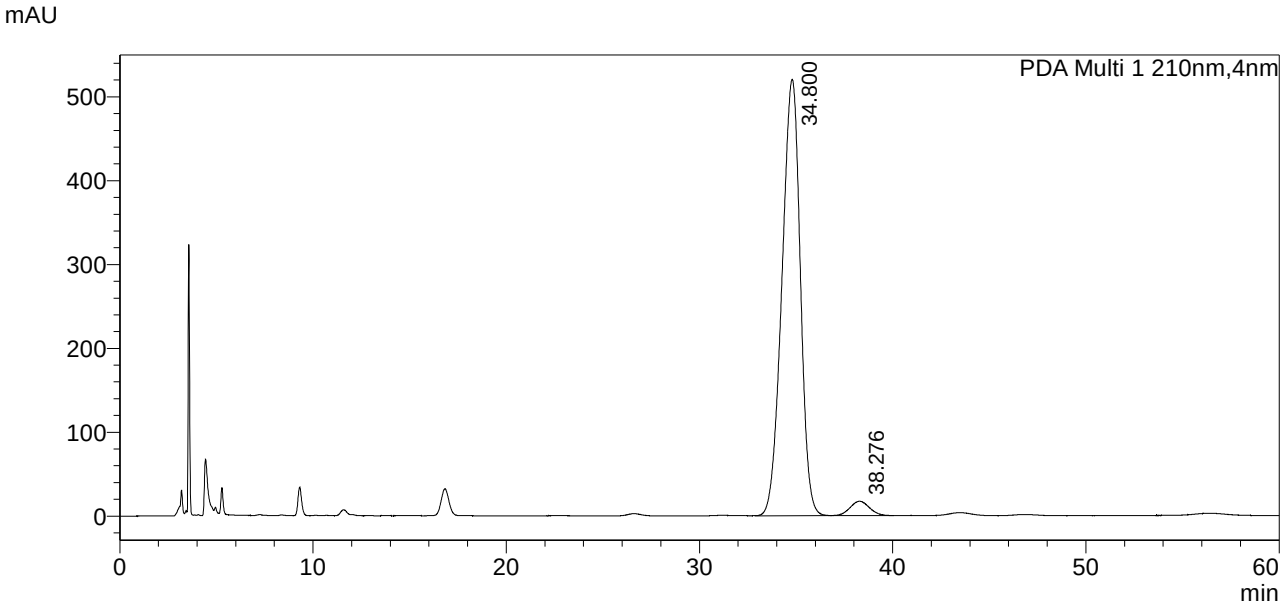


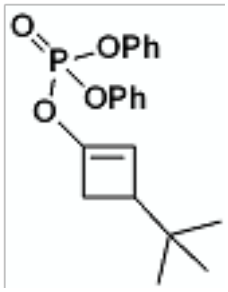
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	34.800	34400277	520415	96.607		V	
2	38.276	1208091	17151	3.393		V	
Total		35608368	537565				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-8-190ac AD		
Sample ID	:		
Data Filename	: zcx-8-190ac AD.lcd		
Method Filename	: AD-H; 1 ml; 5%IPA in Hex; 40min.lcm		
Batch Filename	: zcx-8-188ac.lcb		
Vial #	: 1-65	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/5/2020 10:58:09 AM	Acquired by	: System Administrator
Date Processed	: 10/5/2020 11:38:12 AM	Processed by	: System Administrator

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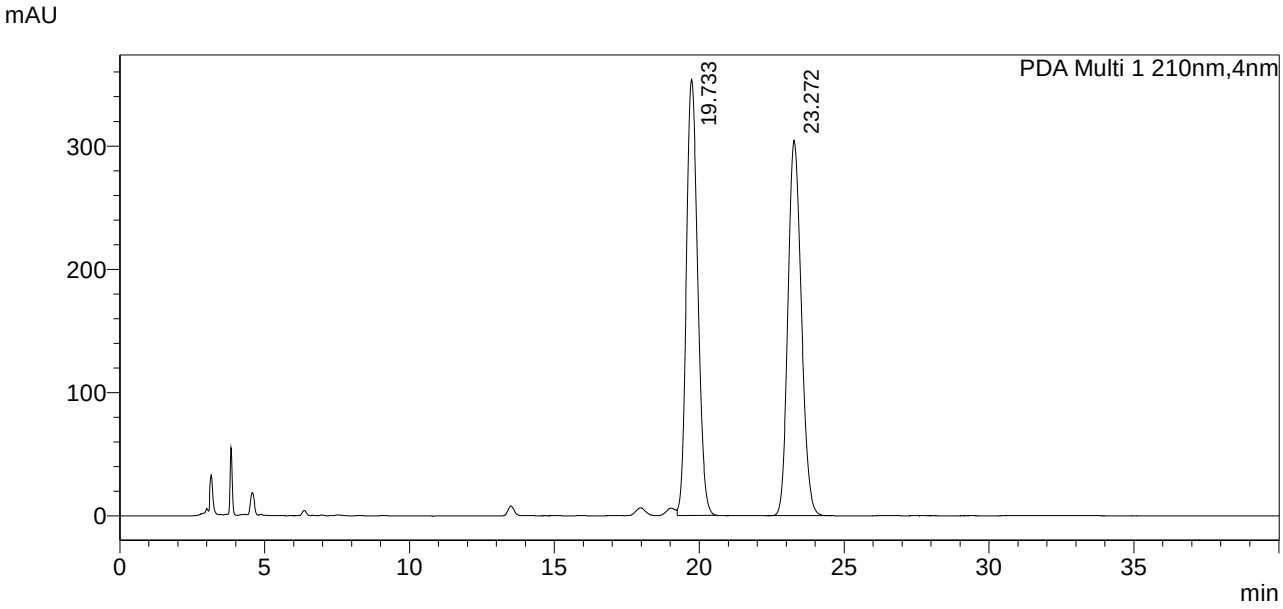


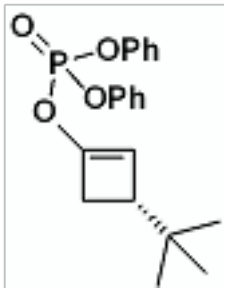
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	19.733	9647918	353667	49.578			
2	23.272	9812280	304598	50.422			
Total		19460198	658265				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-8-194ac AD		
Sample ID	:		
Data Filename	: zcx-8-194ac AD.lcd		
Method Filename	: AD-H; 1 ml; 5%IPA in Hex; 40min.lcm		
Batch Filename	: zcx-8-188ac.lcb		
Vial #	: 1-66	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/5/2020 3:01:11 PM	Acquired by	: System Administrator
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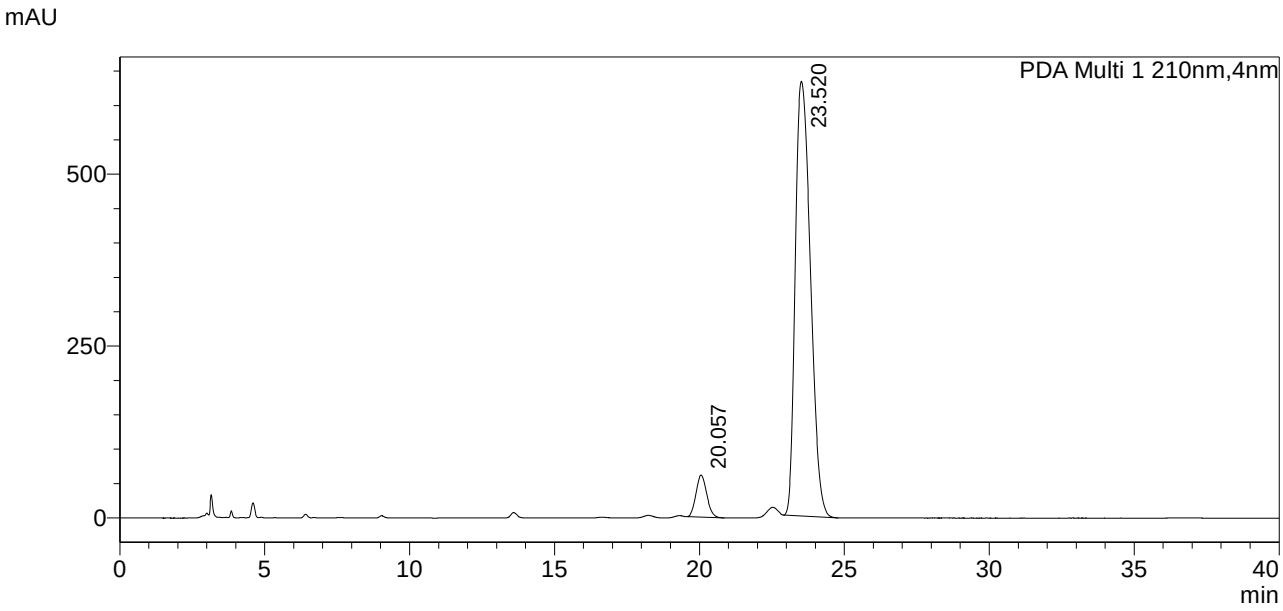


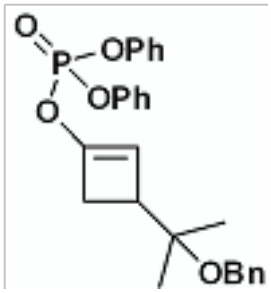
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	20.057	1572259	60971	6.395			
2	23.520	23013204	632321	93.605			
Total		24585463	693291				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-61-1 odh 10%		
Sample ID	:		
Data Filename	: w-1-61-1 odh 10%.lcd		
Method Filename	: OD-H;1 ml; 10% IPA in Hex; 40 min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-1	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 11/2/2020 6:00:05 PM	Acquired by	: System Administrator
Date Processed	: 11/2/2020 6:40:07 PM	Processed by	: System Administrator

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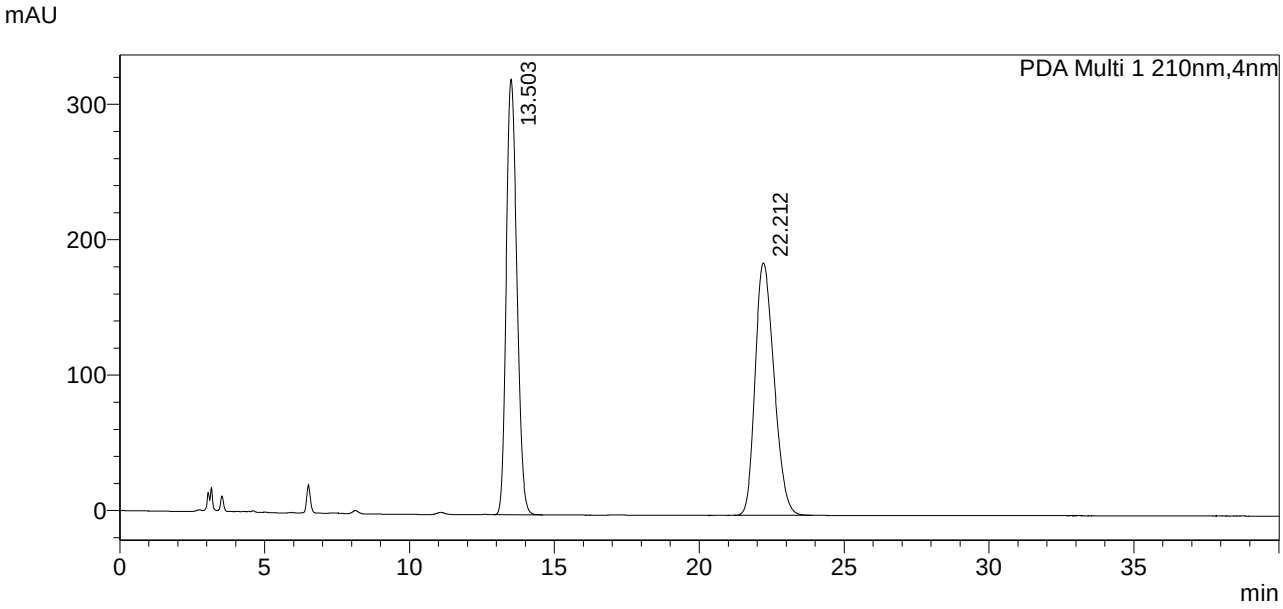


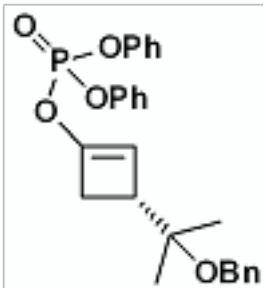
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.503	8217860	321558	49.271			
2	22.212	8461186	186389	50.729			
Total		16679046	507947				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-64-1		
Sample ID	:		
Data Filename	: w-1-64-1.lcd		
Method Filename	: OD-H;1 ml; 10% IPA in Hex; 40 min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-2	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 11/3/2020 3:02:41 PM	Acquired by	: System Administrator
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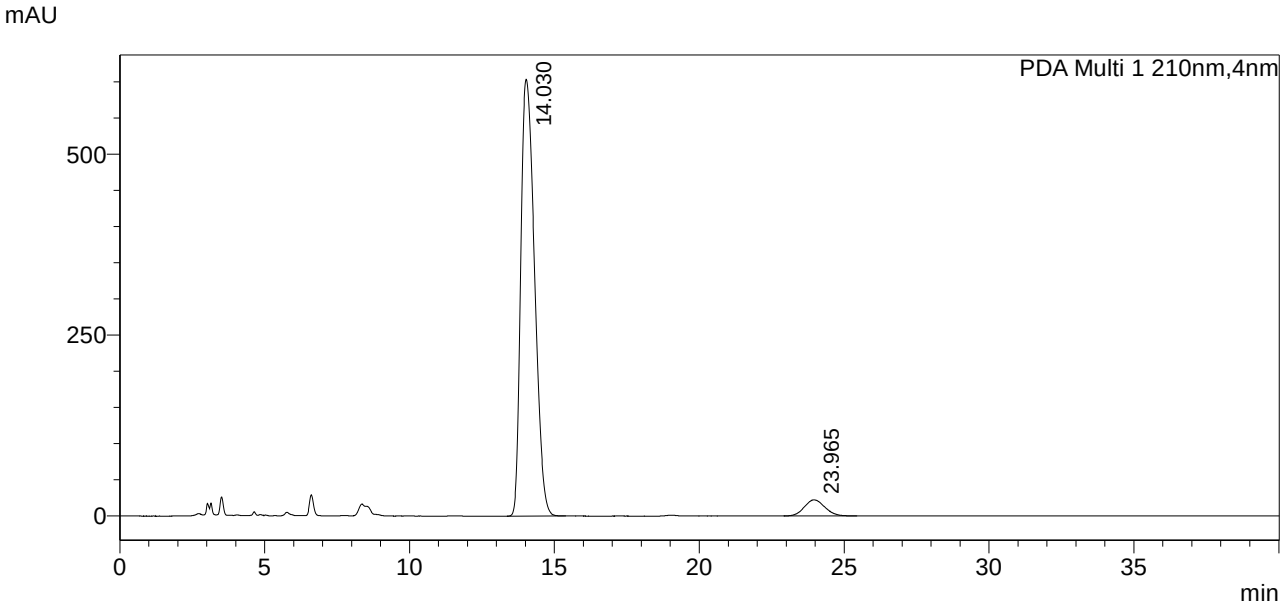


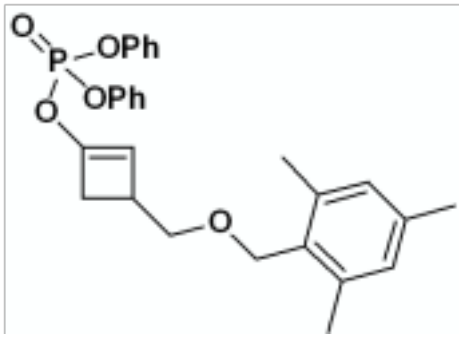
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.030	20003424	603559	94.807			
2	23.965	1095602	22214	5.193		SV	
Total		21099026	625773				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-53-1 ojh 10%		
Sample ID	:		
Data Filename	: w-1-53-1.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-8-188ac.lcb		
Vial #	: 1-3	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/10/2020 2:10:55 AM	Acquired by	: System Administrator
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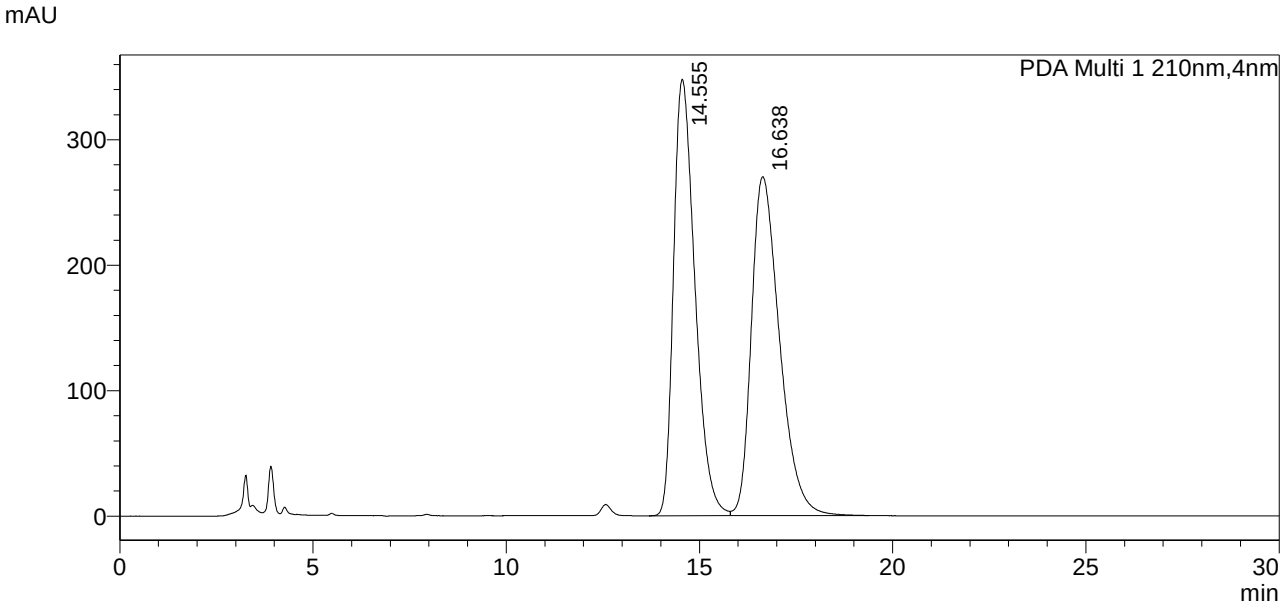


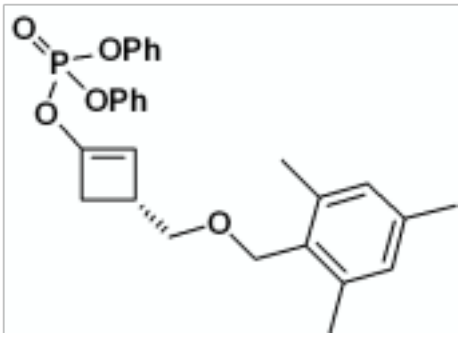
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.555	13424563	347891	49.516			
2	16.638	13686807	270219	50.484		V	
Total		27111370	618110				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-52-1-1 ojh 10%		
Sample ID	:		
Data Filename	: w-1-52-1-1.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-8-188ac.lcb		
Vial #	: 1-2	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/10/2020 1:10:07 AM	Acquired by	: System Administrator
Date Processed	: 10/10/2020 1:50:10 AM	Processed by	: System Administrator

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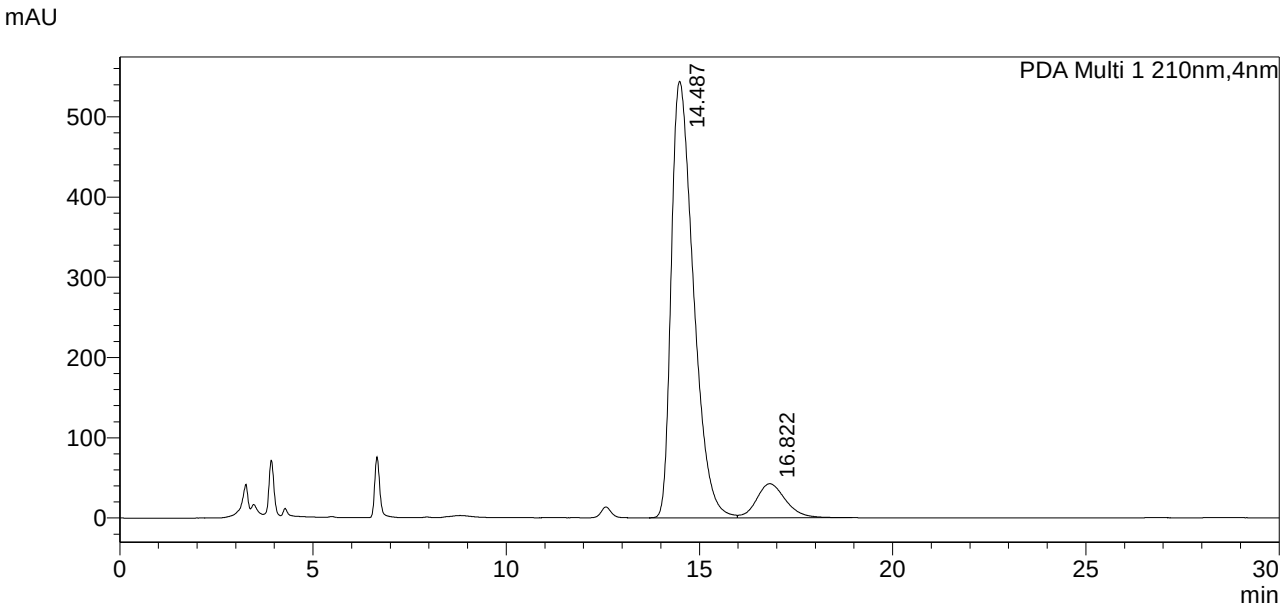


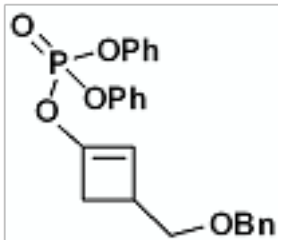
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.487	21703620	543789	90.682			
2	16.822	2230231	42434	9.318		SV	
Total		23933851	586223				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: wsw-1-24-1		
Sample ID	:		
Data Filename	: wsw-1-24-1-1.lcd		
Method Filename	: OJ-H;1 ml; 5% IPA in Hex;80 min.lcm		
Batch Filename	: zcx-8-81ac.lcb		
Vial #	: 1-1	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 8/23/2020 10:56:41 AM	Acquired by	: System Administrator
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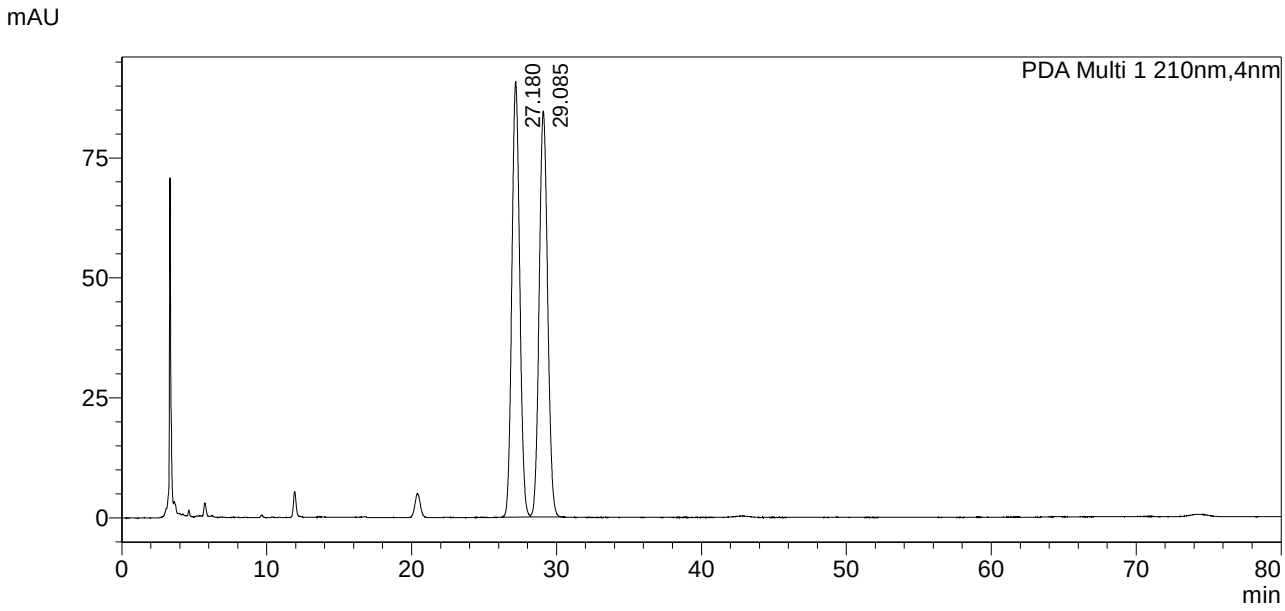


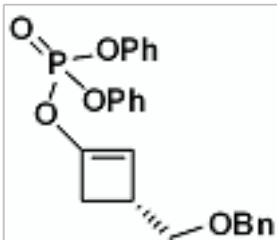
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	27.180	3421314	90803	49.947			
2	29.085	3428570	84642	50.053		V	
Total		6849884	175445				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-31-2		
Sample ID	:		
Data Filename	: w-1-31-2.lcd		
Method Filename	: OJ-H;1 ml; 5% IPA in Hex;80 min.lcm		
Batch Filename	: zcx-8-81ac.lcb		
Vial #	: 1-63	Sample Type	: Unknown
Injection Volume	: 10 uL		
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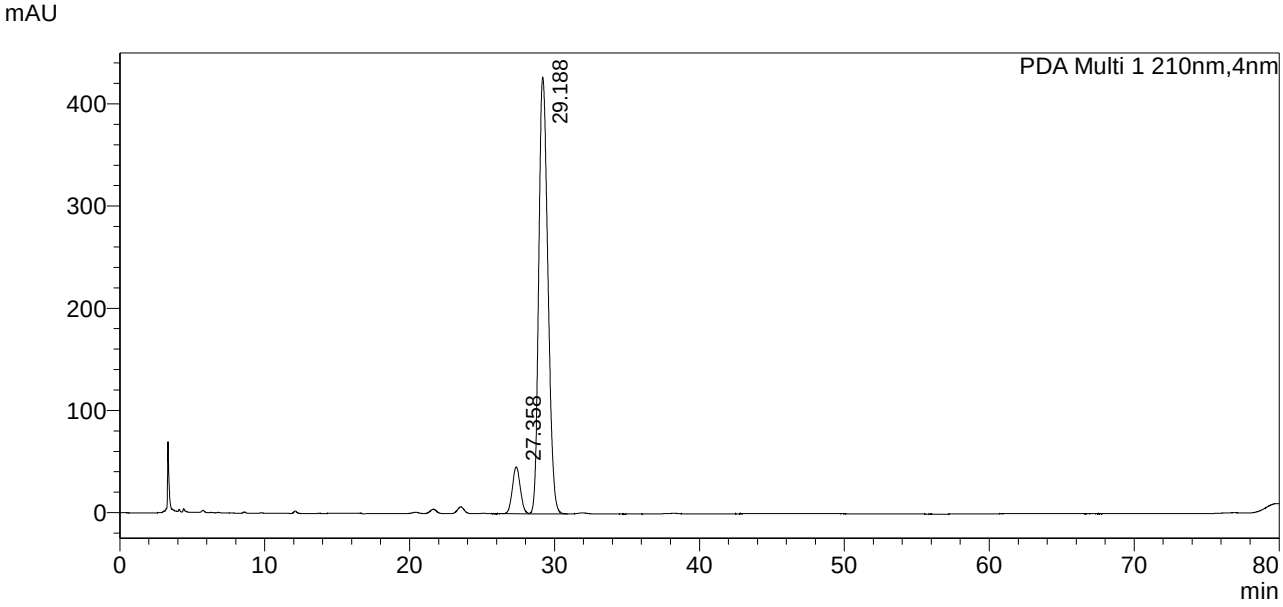


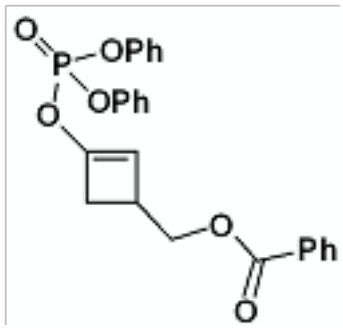
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	27.358	1748461	45780	8.506			
2	29.188	18807982	426953	91.494		V	
Total		20556443	472733				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-4-86ac		
Sample ID	:		
Data Filename	: zcx-4-86ac002.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;70 min.lcm		
Batch Filename	: zcx-9-109.lcb		
Vial #	: 1-46	Sample Type	: Unknown
Injection Volume	: 10 uL		
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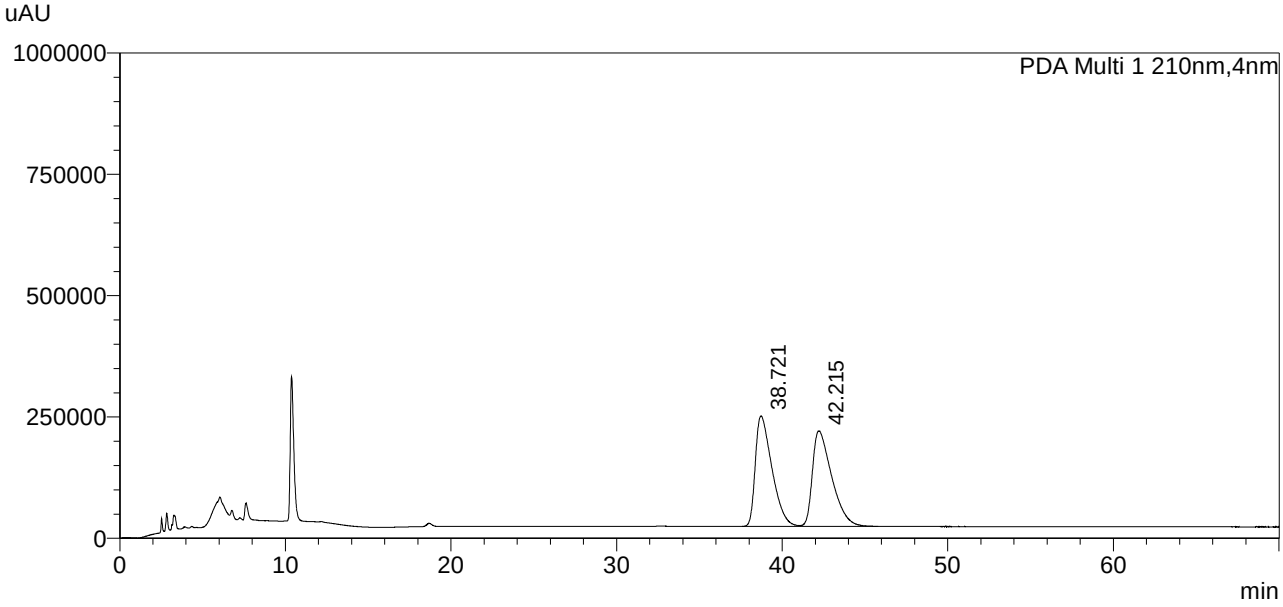


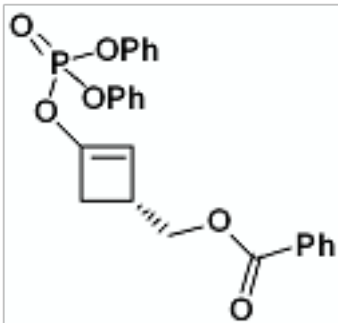
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	38.721	15876765	227712	49.887			
2	42.215	15948650	196861	50.113		V	
Total		31825415	424573				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-9-152ac		
Sample ID	:		
Data Filename	: zcx-9-152ac.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;70 min.lcm		
Batch Filename	: zcx-9-109.lcb		
Vial #	: 1-47	Sample Type	: Unknown
Injection Volume	: 10 uL		
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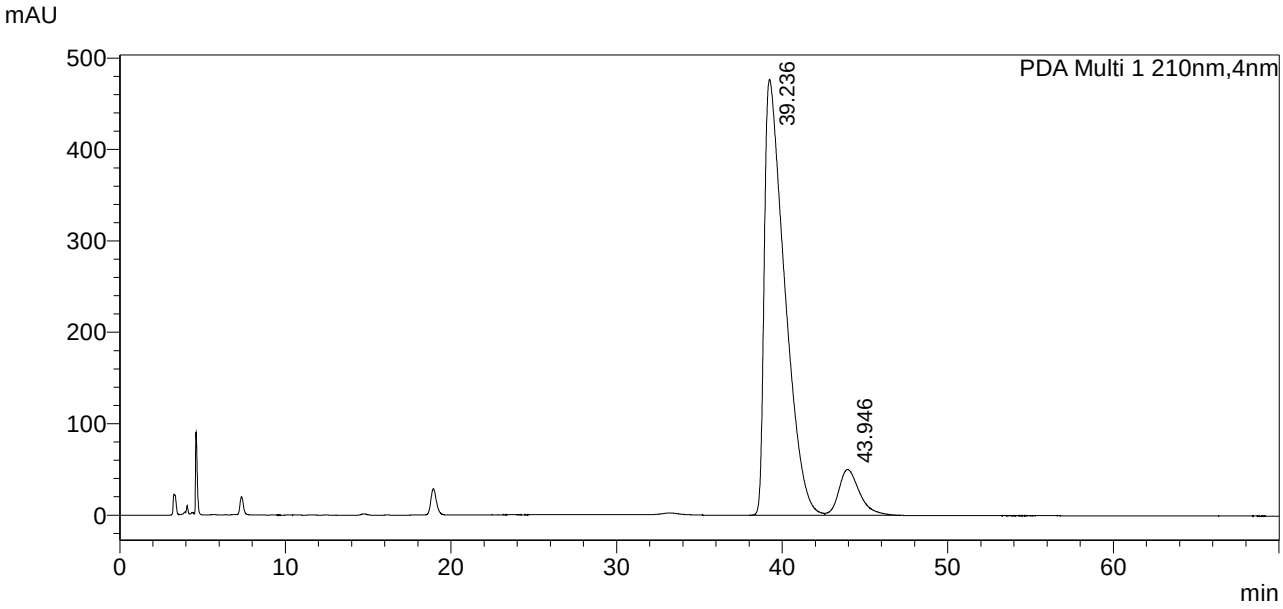


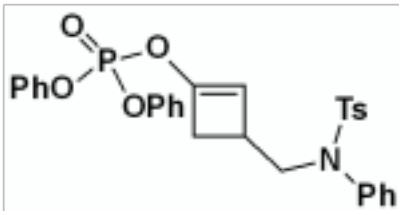
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	39.236	40832720	476910	90.341			
2	43.946	4365691	50065	9.659		V	
Total		45198411	526975				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-2-140-1		
Sample ID	:		
Data Filename	: zcx-2-140-1-1.lcd		
Method Filename	: 6; IA;1ml;10% IPA in Hex;120 min.lcm		
Batch Filename	: 2.lcb		
Vial #	: 1-1	Sample Type	: Unknown
Injection Volume	: 10 uL		
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Date Processed	: 12/5/2020 3:17:42 PM	Processed by	: System Administrator

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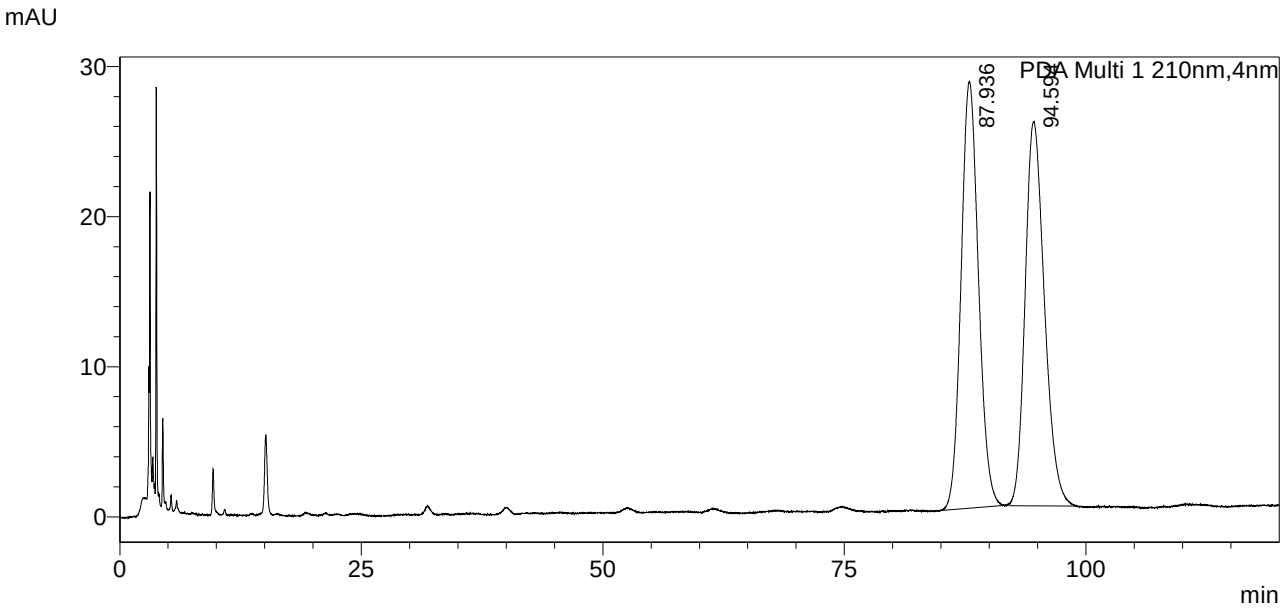


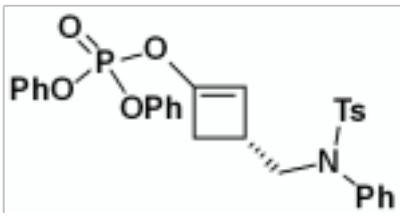
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	87.936	3558876	28431	49.966			
2	94.594	3563762	25600	50.034		S	
Total		7122637	54031				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-87-1-1		
Sample ID	:		
Data Filename	: wsw-1-87-1-1.lcd		
Method Filename	: 6; IA;1ml;10% IPA in Hex;120 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-9	Sample Type	: Unknown
Injection Volume	: 10 uL		
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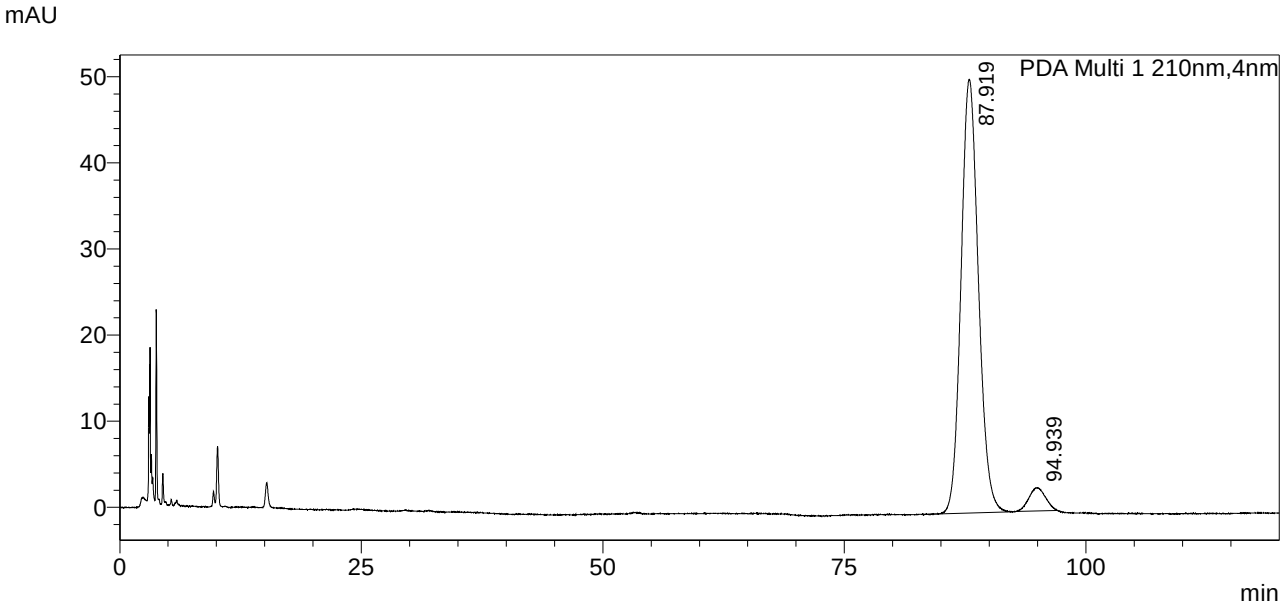


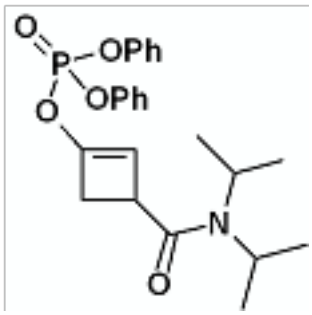
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	87.919	6310280	50347	95.083			
2	94.939	326354	2718	4.917			
Total		6636633	53065				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: wsw-1-69		
Sample ID	:		
Data Filename	: wsw-1-69.lcd		
Method Filename	: 6; IA;1ml;3% IPA in Hex;80 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-50	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 11/9/2020 9:19:43 PM	Acquired by	: System Administrator
Date Processed	: 11/9/2020 10:39:46 PM	Processed by	: System Administrator

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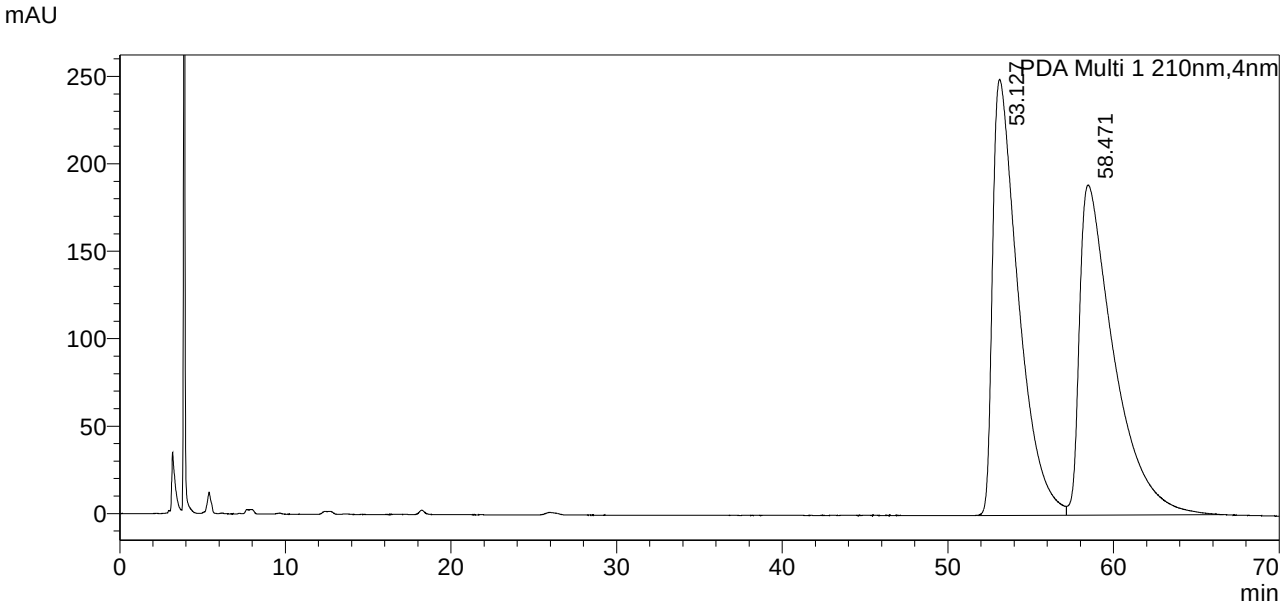


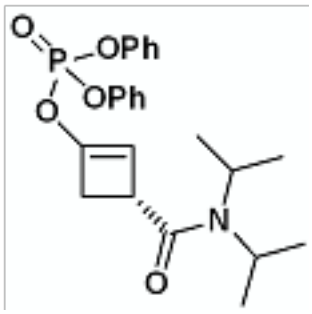
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	53.127	27040812	249382	49.738		V	
2	58.471	27325658	188801	50.262		SV	
Total		54366470	438183				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-9-50ac		
Sample ID	:		
Data Filename	: zcx-9-50ac.lcd		
Method Filename	: 6; IA;1ml;3% IPA in Hex;80 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-51	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 11/9/2020 10:40:17 PM	Acquired by	: System Administrator
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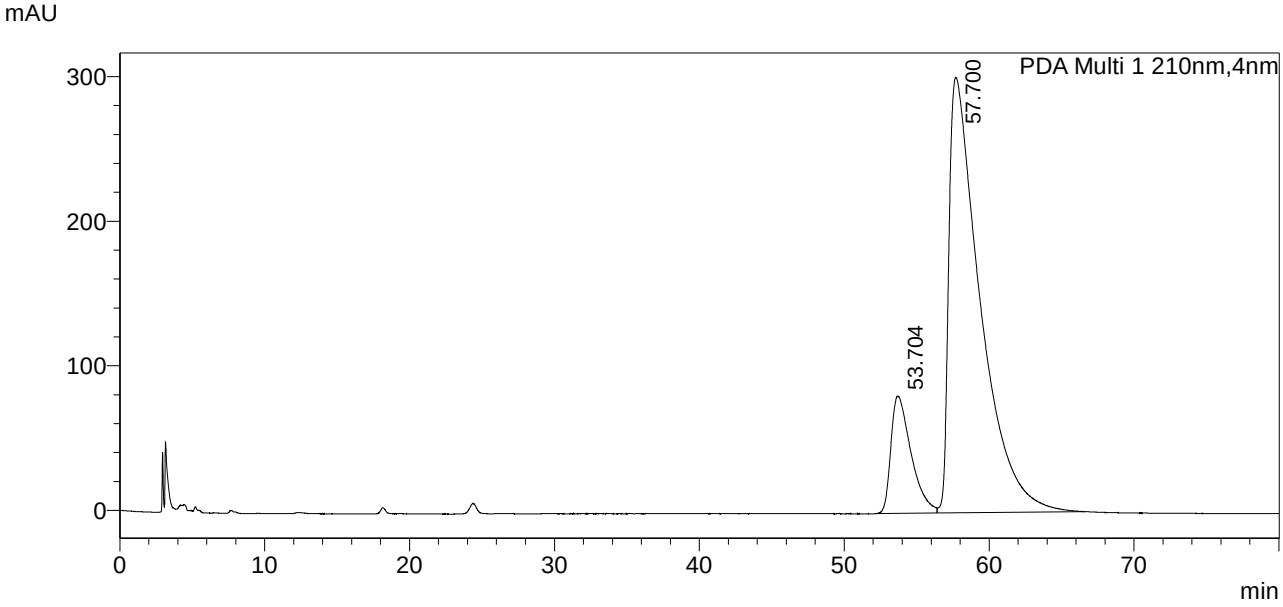
<Chromatogram>



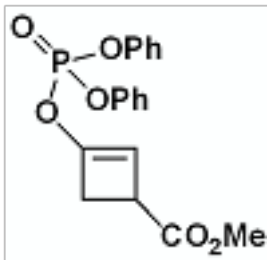
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	53.704	7900795	81239	14.882			
2	57.700	45190295	301192	85.118		V	
Total		53091091	382431				

SHIMADZU LabSolutions

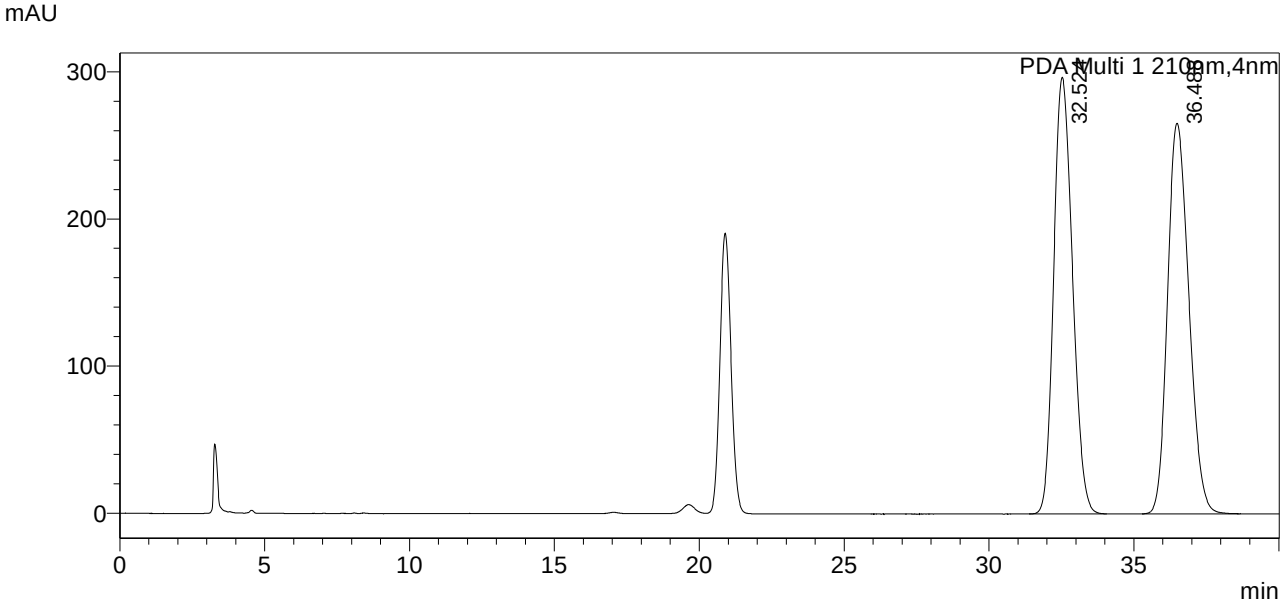
Analysis Report



<Sample Information>

Sample Name	: zcx-9-35ac IC		
Sample ID	:		
Data Filename	: zcx-9-35ac IC.lcd		
Method Filename	: IC,1ml 10%IPA in Hex;40min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-46	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 10/28/2020 5:00:19 PM	Acquired by	: System Administrator
Date Processed	: 10/28/2020 5:40:22 PM	Processed by	: System Administrator

<Chromatogram>



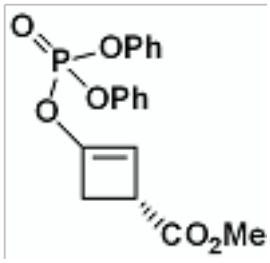
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	32.524	13385551	296796	49.575			
2	36.488	13614875	265569	50.425			
Total		27000426	562366				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-9-31ac IC		
Sample ID	:		
Data Filename	: zcx-9-31ac IC.lcd		
Method Filename	: IC,1ml 10%IPA in Hex;40min.lcm		
Batch Filename	: zcx-9-15ac.lcb		
Vial #	: 1-46	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 11/6/2015 1:19:00 PM	Acquired by	: System Administrator
Date Processed	: 11/6/2015 1:59:03 PM	Processed by	: System Administrator

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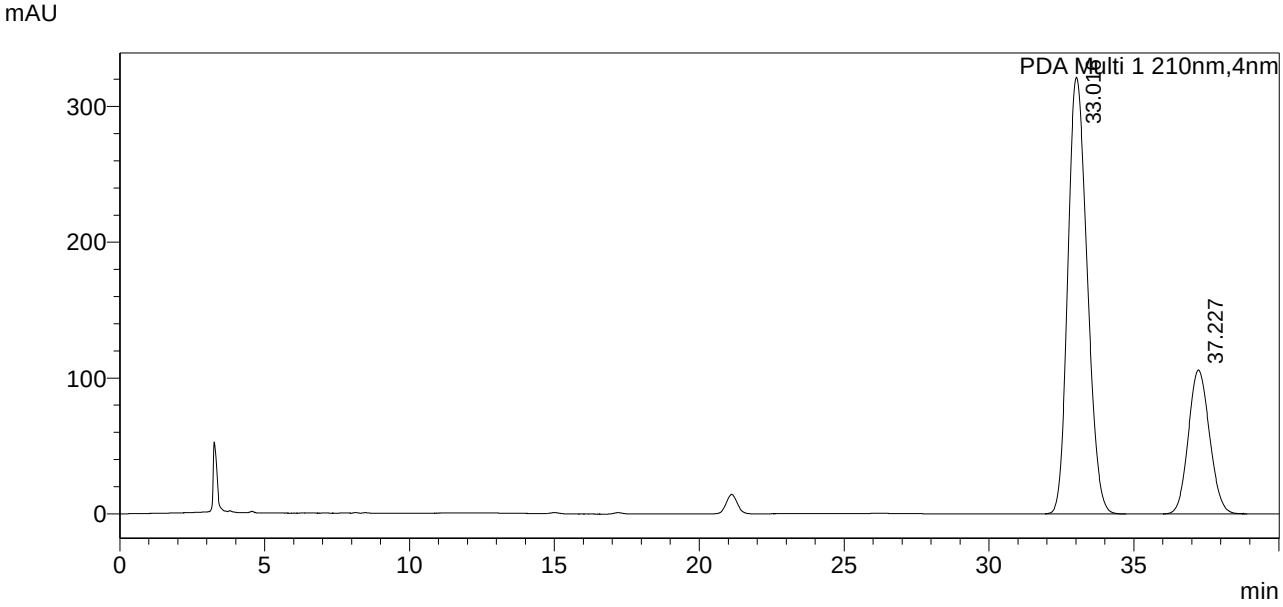


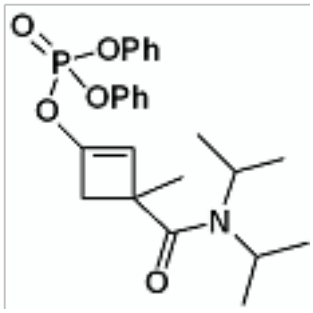
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	33.016	14946416	321483	73.489		SV	
2	37.227	5391822	106070	26.511		V	
Total		20338238	427553				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-4-96ac2-1 OZ		
Sample ID	:		
Data Filename	: zcx-4-96ac2-1 OZ.lcd		
Method Filename	: OZ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: zcx-4-96ac2.lcb		
Vial #	: 1-5	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 11/7/2018 2:35:17 AM	Acquired by	: System Administrator
Date Processed	: 11/7/2018 3:15:20 AM	Processed by	: System Administrator

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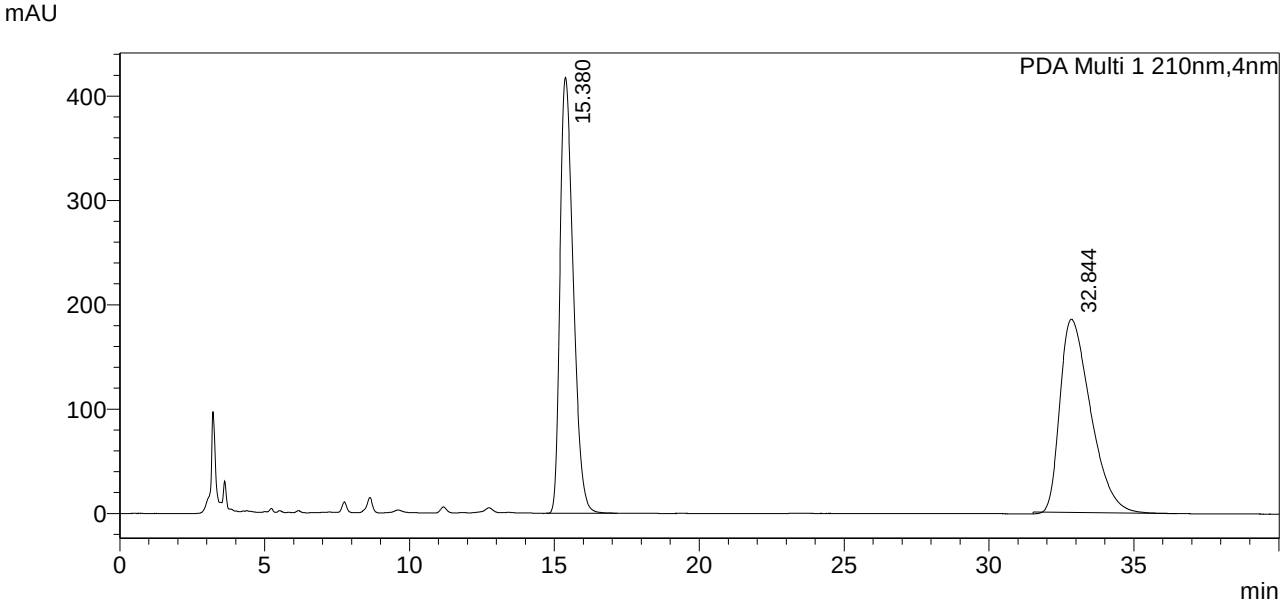


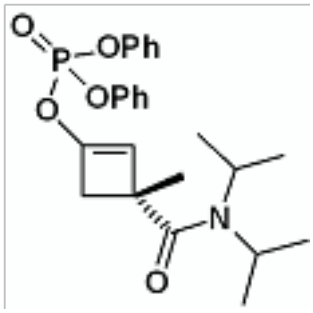
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.380	13277289	417839	49.419			
2	32.844	13589645	185204	50.581			
Total		26866934	603043				

SHIMADZU LabSolutions

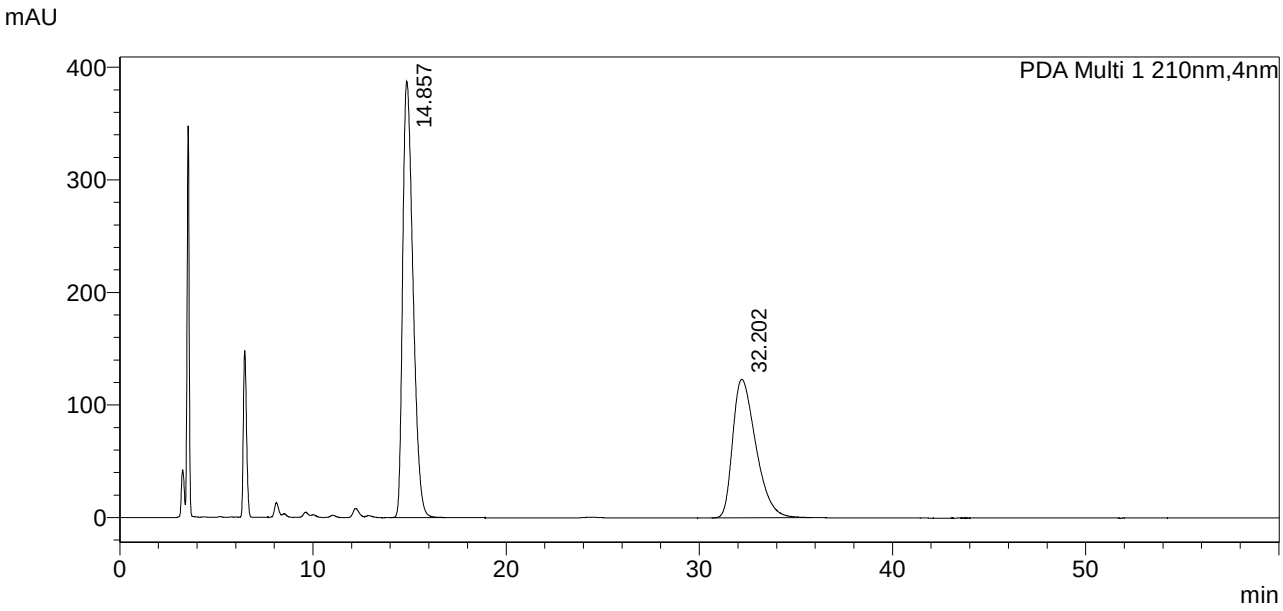
Analysis Report



<Sample Information>

Sample Name	: zcx-9-90ac		
Sample ID	:		
Data Filename	: zcx-9-90ac.lcd		
Method Filename	: OZ-H;1 ml; 10% IPA in Hex;60 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-79	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 11/22/2020 12:34:55 AM	Acquired by	: System Administrator
Date Processed	: 11/22/2020 1:34:58 AM	Processed by	: System Administrator

<Chromatogram>



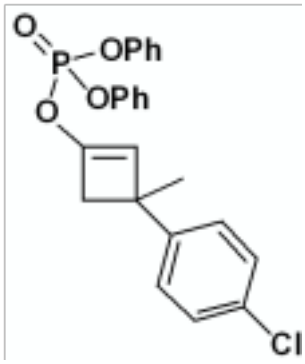
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.857	14412414	387497	58.483		S	
2	32.202	10231360	123076	41.517		S	
Total		24643774	510573				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: w-1-17-1		
Sample ID	:		
Data Filename	: w-1-17-1.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-78	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 9/2/2020 2:47:45 PM	Acquired by	: System Administrator
Date Processed	: 9/2/2020 3:27:47 PM	Processed by	: System Administrator

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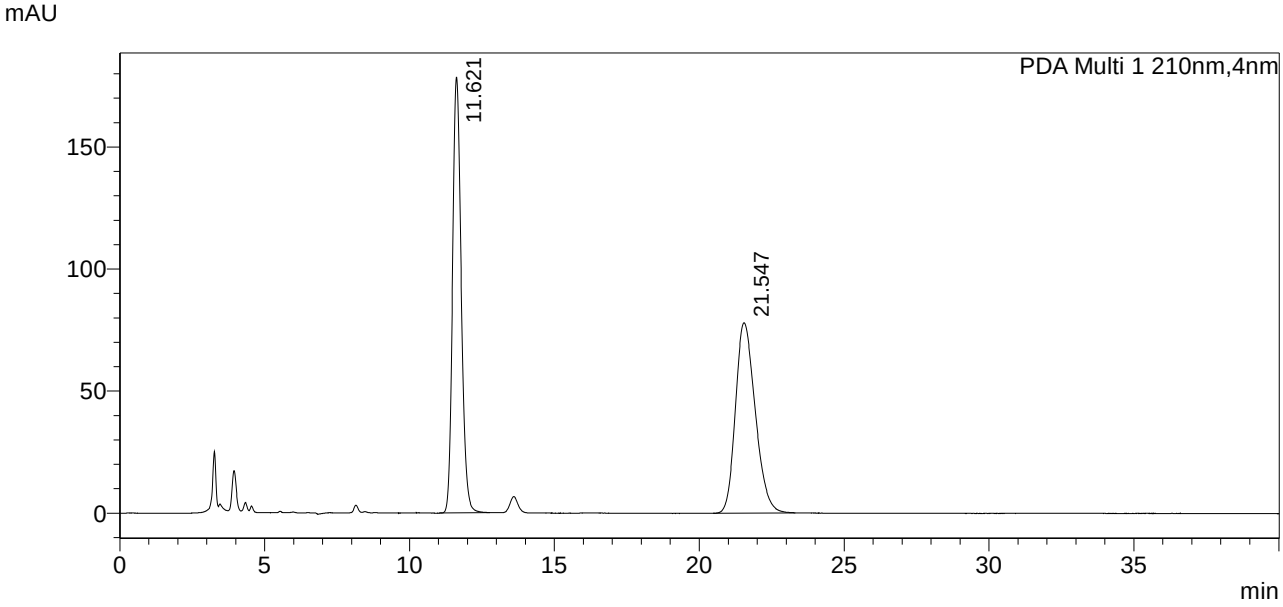


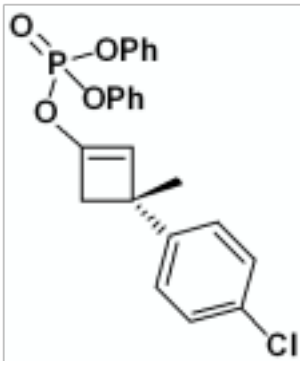
<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	11.621	3698064	178444	49.978			
2	21.547	3701264	77985	50.022		S	
Total		7399328	256429				

SHIMADZU LabSolutions

Analysis Report



<Sample Information>

Sample Name	: zcx-4-70ac		
Sample ID	:		
Data Filename	: zcx-4-70ac.lcd		
Method Filename	: OJ-H;1 ml; 10% IPA in Hex;40 min.lcm		
Batch Filename	: 1.lcb		
Vial #	: 1-79	Sample Type	: Unknown
Injection Volume	: 10 uL		
Date Acquired	: 9/2/2020 3:28:16 PM	Acquired by	: System Administrator
Date Processed	: 9/2/2020 4:08:18 PM	Processed by	: System Administrator

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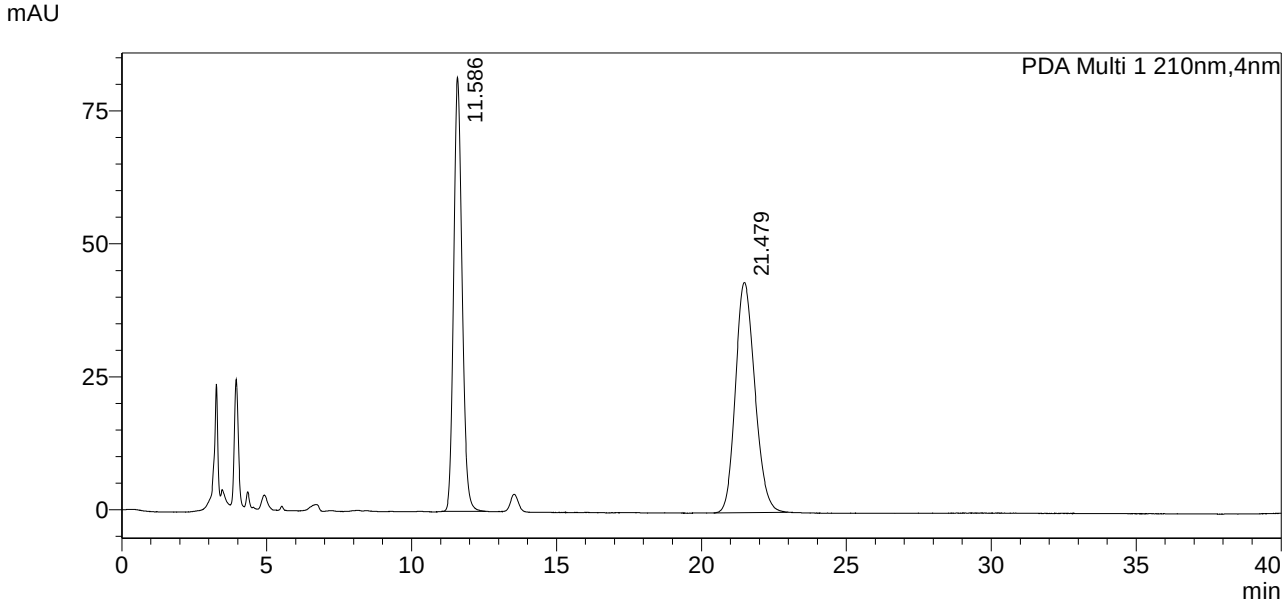

<Peak Table>

PDA Ch1 210nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	11.586	1658899	81600	45.182			
2	21.479	2012705	43303	54.818			
Total		3671604	124903				