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Identifying a Cobalt Catalyst for Highly Selective Hydrosilylation of Allenes

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Supporting Information

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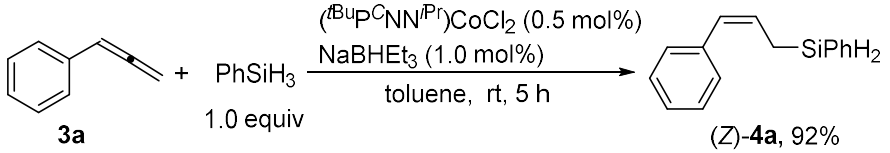
General Information: NMR spectra were recorded on Agilent 400 MHz, 600 MHz, or Varian Mercury 400 MHz. ^{19}F NMR chemical shifts were referenced to an internal $CFCl_3$ standard. Toluene was dried over sodium wire and distilled freshly before use. $PhSiH_3$ was purchased from Aladdin Industrial Corporation or Adamas Reagent, Ltd. $NaBHEt_3$ (1.0 M in THF) was purchased from Acros Organics. Room temperature in laboratory was in the range of 20 to 26 °C. The iron and cobalt complexes of phosphinite-iminopyridine (P^ONN) ligand **1**[1] and phosphine-iminopyridine (P^CNN) ligands **2a**-**2d**,[2] allenes **3a**-**3h**,[3] **3i**,[4] **3j**,[5] **3k**-**m**,[4] **3n**,[6] **3o**,[7] and **3p**[8] were prepared according to literatures.

Hydrosilylation of allenes 3 with $PhSiH_3$.

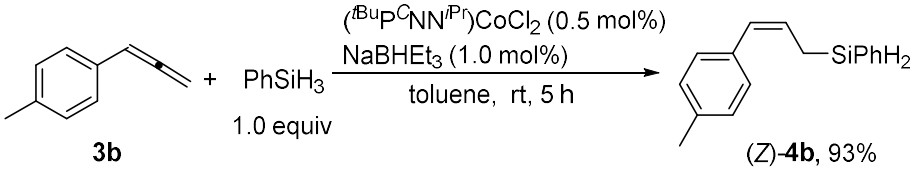
(1) Preparation of (*Z*)-(3-phenyl-2-propenyl)(phenyl)silane ((*Z*)-**4a**) (yz-4-132)



Typical Procedure: In a nitrogen filled glove box, ($^{t\text{Bu}}P^CNN^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3a** (116.2 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) were sequentially added to a 25 mL flame-dried Schlenk tube equipped with a magnetic stir bar. After being stirred at room temperature for 5 h, the solvent was then removed in vacuo. (Z)-**4a** (206.3 mg, 92%) was obtained via column chromatography on silica gel (eluent: petroleum ether (60-90 °C)) as an oil: ^1H NMR (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 6.8 Hz, 2 H, ArH), 7.43-7.27 (m, 5 H, ArH), 7.27-7.17 (m, 3 H, ArH), 6.40 (d, *J* = 11.6 Hz, 1 H, =CH), 5.81-5.71 (m, 1 H, =CH), 4.40 (t, *J* = 3.4 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}Si\text{-}H}$ = 198.0 Hz, *J* = 3.6 Hz, 0.10 H, $^{29}SiH_2$), 2.22-2.16 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.5, 135.2, 131.5, 129.8, 128.5, 128.3, 128.2, 128.0, 127.3, 126.4, 13.1; MS (EI, 70 eV) *m/z* (%) 224 (M^+, 14.90), 196 (100); IR (neat, cm^{-1}) 3011, 2133, 1491, 1427, 1153, 1115; HRMS (EI) *m/z* calcd. for $C_{15}H_{16}Si$ [M^+]: 224.1021, found: 224.1014.

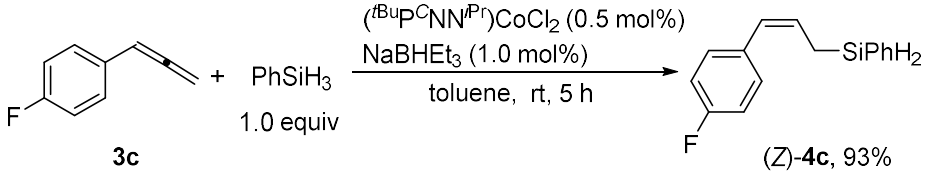
The following compounds were prepared according to **Typical Procedure**.

(2) Preparation of (*Z*)-(3-(*p*-tolyl)-2-propenyl)(phenyl)silane ((*Z*)-**4b**) (yz-4-133)



The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)CoCl$_2$ (**2b**) (2.8 mg, 0.005 mmol), **3b** (130.1 mg, 1.0 mmol), toluene (1.0 mL), PhSiH$_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and NaBHEt$_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4b** (220.6 mg, 93%) via column chromatography on silica gel (eluent: petroleum ether (60-90 °C)) as an oil: ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.60-7.55 (m, 2 H, ArH), 7.43-7.32 (m, 3 H, ArH), 7.16-7.09 (m, 4 H, ArH), 6.36 (d, *J* = 11.6 Hz, 1 H, =CH), 5.75-5.67 (m, 1 H, =CH), 4.39 (t, *J* = 3.6 Hz, 1.90 H, ^{28}SiH$_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 197.6 Hz, *J* = 3.5 Hz, 0.10 H, ^{29}SiH$_2$), 2.33 (s, 3 H, CH$_3$), 2.22-2.15 (m, 2 H, CH$_2$); ^{13}C NMR (100 MHz, CDCl$_3$) δ 136.0, 135.2, 134.6, 131.6, 129.8, 128.9, 128.4, 128.2, 128.0, 126.6, 21.1, 13.1; MS (EI, 70 eV) *m/z* (%) 238 (M$^+$, 20.05), 210 (100); IR (neat, cm^{-1}) 3010, 2133, 1510, 1426, 1115; HRMS (EI) *m/z* calcd. for C$_{16}$H$_{18}$Si [M$^+$]: 238.1178, found: 238.1182.

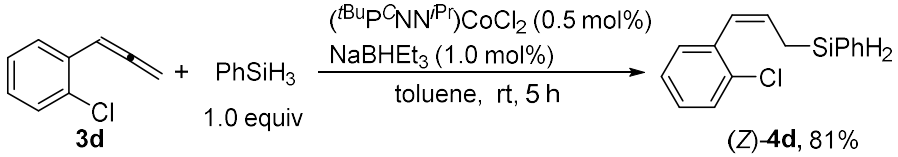
(3) Preparation of (*Z*)-(3-(4-fluorophenyl)-2-propenyl)(phenyl)silane ((*Z*)-**4c**) (yz-4-152)



The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)CoCl$_2$ (**2b**) (2.9 mg, 0.005 mmol), **3c** (134.3 mg, 1.0 mmol), toluene (1.0 mL), PhSiH$_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and NaBHEt$_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4c** (224.8 mg, 93%) via column chromatography on silica gel (eluent: petroleum ether (60-90 °C)) as an oil: ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.58-7.54 (m, 2 H, ArH), 7.44-7.32 (m, 3 H, ArH), 7.19-7.13 (m, 2 H, ArH), 7.01-6.94 (m, 2 H, ArH), 6.34 (d, *J* = 11.6 Hz, 1 H, =CH),

5.74 (dt, J = 11.6 Hz, 8.8 Hz, 1 H, =CH), 4.38 (t, J = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}Si\text{-}H}$ = 198.1 Hz, J = 3.7 Hz, 0.10 H, $^{29}SiH_2$), 2.17-2.10 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.3 (d, J = 243.9 Hz), 135.2, 133.5 (d, J = 3.8 Hz), 131.4, 130.0 (d, J = 7.8 Hz), 129.9, 128.1, 127.3, 127.2, 115.0 (d, J = 21.0 Hz), 13.0; ^{19}F NMR (376 MHz, $CDCl_3$) δ -116.4; MS (EI, 70 eV) *m/z* (%) 242 (M^+, 11.03), 107 (100); IR (neat, cm^{-1}) 3012, 2135, 1601, 1505, 1428, 1221, 1156, 1116; HRMS (EI) *m/z* calcd. for $C_{15}H_{15}FSi$ [M^+]: 242.0927, found: 242.0934.

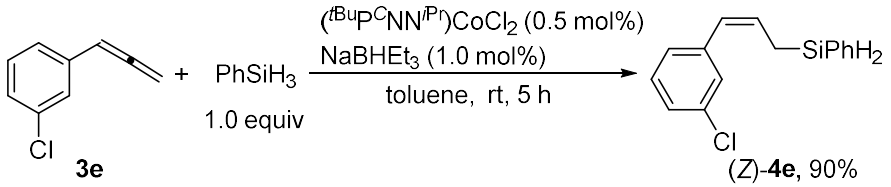
(4) Preparation of (*Z*)-(3-(2-chlorophenyl)-2-propenyl)(phenyl)silane ((*Z*)-**4d**) (yz-4-155)



3d (*Z*)-**4d**, 81%

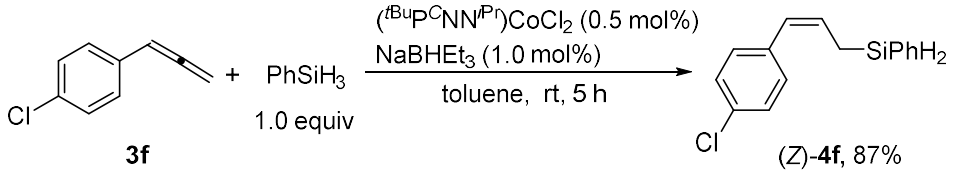
The reaction of ($^{t\text{Bu}}P^{C}NN^{i\text{P}}$)$^{r}CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3d** (150.6 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4d** (208.6 mg, 81%) via column chromatography on silica gel (eluent: petroleum ether (60-90 °C)) as an oil: ^1H NMR (400 MHz, $CDCl_3$) δ 7.57-7.52 (m, 2 H, ArH), 7.43-7.32 (m, 4 H, ArH), 7.26-7.20 (m, 1 H, ArH), 7.19-7.12 (m, 2 H, ArH), 6.46 (d, J = 11.6 Hz, 1 H, =CH), 5.89 (dt, J = 11.6 Hz, 8.8 Hz, 1 H, =CH), 4.36 (t, J = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}Si\text{-}H}$ = 198.7 Hz, J = 3.7 Hz, 0.10 H, $^{29}SiH_2$), 2.10-2.03 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 135.6, 135.2, 133.6, 131.3, 130.2, 129.9, 129.4, 128.9, 128.1, 127.9, 126.2, 125.7, 13.0; MS (EI, 70 eV) *m/z* (%) 260 (M^+ (^{37}Cl), 1.34), 258 (M^+ (^{35}Cl), 3.30), 115 (100); IR (neat, cm^{-1}) 2134, 1469, 1430, 1116, 1034; HRMS (EI) *m/z* calcd. for $C_{15}H_{15}{}^{35}ClSi$ [M^+]: 258.0632, found: 258.0621.

(5) Preparation of (*Z*)-(3-(3-chlorophenyl)-2-propenyl)(phenyl)silane ((*Z*)-**4e**) (yz-4-169)



The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3e** (150.7 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4e** (232.2 mg, 90%) via column chromatography on silica gel (eluent: petroleum ether (60-90 ºC)) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 6.4 Hz, 2 H, ArH), 7.44-7.32 (m, 3 H, ArH), 7.24-7.13 (m, 3 H, ArH), 7.08 (d, *J* = 7.2 Hz, 1 H, ArH), 6.31 (d, *J* = 11.6 Hz, 1 H, =CH), 5.80 (dt, *J* = 11.6 Hz, 9.0 Hz, 1 H, =CH), 4.39 (t, *J* = 3.4 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 198.5 Hz, *J* = 3.5 Hz, 0.10 H, $^{29}SiH_2$), 2.19-2.11 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.3, 135.2, 134.0, 131.1, 129.9, 129.3, 128.8, 128.5, 128.1, 127.0, 126.6, 126.4, 13.3; MS (EI, 70 eV) *m/z* (%) 260 (M^+ (^{37}Cl), 3.90), 258 (M^+ (^{35}Cl), 11.35), 115 (100); IR (neat, cm^{-1}) 3012, 2135, 1591, 1562, 1475, 1426, 1191, 1115; HRMS (EI) *m/z* calcd. for $C_{15}H_{15}{}^{35}ClSi$ [M^+]: 258.0632, found: 258.0640.

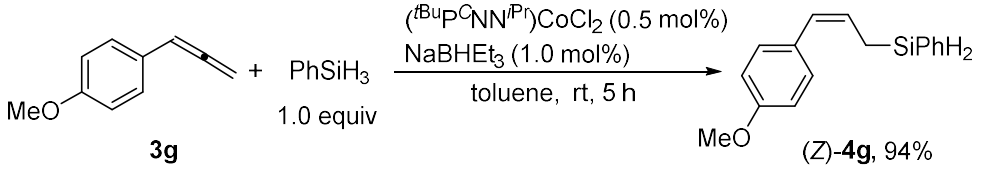
(6) Preparation of (*Z*)-(3-(4-chlorophenyl)-2-propenyl)(phenyl)silane ((*Z*)-**4f**) (yz-4-134)



The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3f** (150.7 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4f** (225.5 mg, 87%) via column chromatography on silica gel (eluent: petroleum ether (60-90 ºC)) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60-7.53 (m, 2 H, ArH), 7.45-7.32 (m, 3 H, ArH), 7.28-7.23 (m, 2 H, ArH), 7.13 (d, *J* = 8.4 Hz, 2 H, ArH), 6.33 (d, *J* = 11.6 Hz, 1 H, =CH), 5.78 (dt, *J* = 11.6 Hz, 9.2 Hz, 1 H, =CH), 4.38 (t, *J* = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 198.4 Hz, *J* = 3.6 Hz, 0.10 H, $^{29}SiH_2$), 2.18-2.11 (m, 2 H, CH_2); ^{13}C NMR

(100 MHz, $CDCl_3$) δ 135.9, 135.2, 132.0, 131.2, 129.9, 129.8, 128.3, 128.13, 128.07, 127.1, 13.2; MS (EI, 70 eV) *m/z* (%)260 (M^+ (^{37}Cl), 3.68), 258 (M^+ (^{35}Cl), 9.06), 115 (100); IR (neat, cm^{-1}) 3012, 2135, 1488, 1426, 1115, 1089, 1012; HRMS (EI) *m/z* calcd. for $C_{15}H_{15}{}^{35}ClSi$ [M^+]: 258.0632, found: 258.0623.

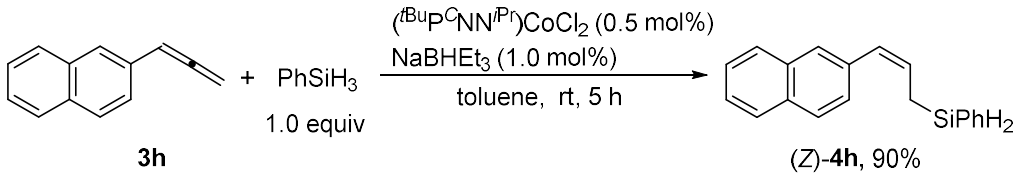
(7) Preparation of (*Z*)-(3-(4-methoxyphenyl)-2-propenyl)(phenyl)silane ((*Z*)-**4g**) (yz-4-142)



3g (*Z*)-**4g**, 94%

The reaction of ($^{t\text{Bu}}P^{C}NN^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3g** (146.1 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4g** (238.1 mg, 94%) via column chromatography on silica gel (petroleum ether (60-90 °C)/ ethyl acetate = 10/1) as an oil: ^1H NMR (400 MHz, $CDCl_3$) δ 7.60-7.56 (m, 2 H, ArH), 7.44-7.33 (m, 3 H, ArH), 7.23-7.16 (m, 2 H, ArH), 6.87-6.82 (m, 2 H, ArH), 6.33 (d, *J* = 11.6 Hz, 1 H, =CH), 5.67 (dt, *J* = 11.6 Hz, 8.8 Hz, 1 H, =CH), 4.39 (t, *J* = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}Si\text{-}H}$ = 197.9 Hz, *J* = 3.7 Hz, 0.10 H, $^{29}SiH_2$), 3.81 (s, 3 H, CH_3), 2.21-2.13 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.0, 135.2, 131.5, 130.1, 129.8, 129.7, 128.0, 127.7, 125.7, 113.5, 55.1, 13.0; MS (EI, 70 eV) *m/z* (%) 254 (M^+, 25.14), 147 (100); IR (neat, cm^{-1}) 3005, 2132, 1605, 1508, 1427, 1300, 1243, 1174, 1114, 1034; HRMS (EI) *m/z* calcd. for $C_{16}H_{18}OSi$ [M^+]: 254.1127, found: 254.1122.

(8) Preparation of (*Z*)-(3-(naphthalen-2-yl)-2-propenyl)(phenyl)silane ((*Z*)-**4h**) (yz-4-147)

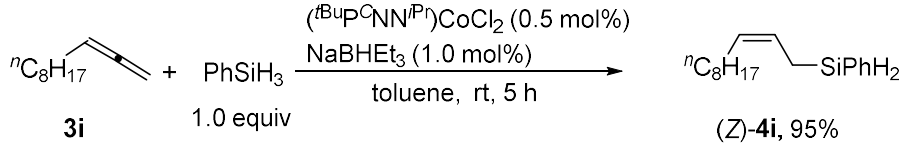


3h (*Z*)-**4h**, 90%

The reaction of ($^{t\text{Bu}}P^{C}NN^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3h** (166.3 mg, 1.0

mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4h** (246.6 mg, 90%) via column chromatography on silica gel (eluent: petroleum ether (60-90 ºC)) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79-7.68 (m, 3 H, ArH), 7.62 (s, 1 H, ArH), 7.60-7.55 (m, 2 H, ArH), 7.45-7.30 (m, 6 H, ArH), 6.53 (d, *J* = 11.2 Hz, 1 H, =CH), 5.84 (dt, *J* = 11.2 Hz, 9.2 Hz, 1 H, =CH), 4.44 (t, *J* = 3.8 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}Si\text{-}H}$ = 198.1 Hz, *J* = 3.7 Hz, 0.10 H, $^{29}SiH_2$), 2.27-2.22 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 135.3, 135.0, 133.3, 132.0, 131.5, 129.9, 128.3, 128.1, 127.87, 127.86, 127.6, 127.5, 127.1, 127.0, 126.0, 125.6, 13.4; MS (EI, 70 eV) *m/z* (%) 274 (M^+, 37.44), 167 (100); IR (neat, cm^{-1}) 3050, 3008, 2132, 1594, 1503, 1426, 1268, 1151, 1115; HRMS (EI) *m/z* calcd. for $C_{19}H_{18}Si$ [M^+]: 274.1178, found: 274.1174.

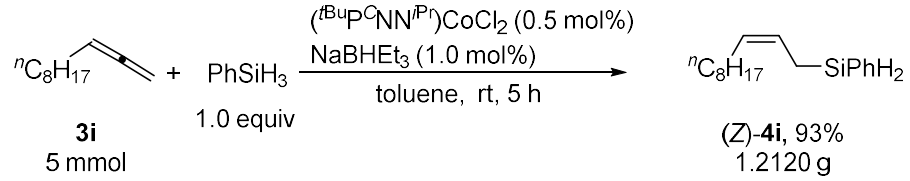
(9) Preparation of (*Z*)-(2-undecen-1-yl)(phenyl)silane ((*Z*)-**4i**) (yz-4-175)



3i (*Z*)-**4i**, 95%

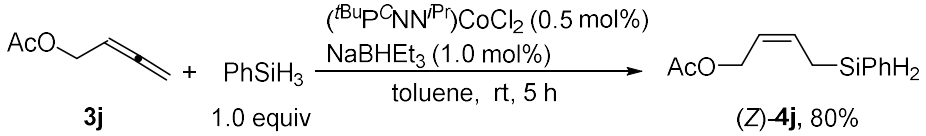
The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3i** (152.2 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4i** (246.3 mg, 95%) via column chromatography on silica gel (eluent: petroleum ether (60-90 ºC)) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (d, *J* = 6.8 Hz, 2 H, ArH), 7.43-7.31 (m, 3 H, ArH), 5.48-5.40 (m, 1 H, =CH), 5.38-5.28 (m, 1 H, =CH), 4.29 (t, *J* = 3.4 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}Si\text{-}H}$ = 196.5 Hz, *J* = 3.8 Hz, 0.10 H, $^{29}SiH_2$), 1.98-1.90 (m, 2 H, CH_2), 1.90-1.84 (m, 2 H, CH_2), 1.35-1.20 (m, 12 H, 6×CH_2), 0.88 (t, *J* = 6.6 Hz, 3 H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 135.2, 132.2, 129.69, 129.65, 127.9, 123.8, 31.9, 29.6, 29.5, 29.4, 29.3, 27.0, 22.7, 14.1, 11.7; MS (EI, 70 eV) *m/z* (%) 260 (M^+, 3.04), 107 (100); IR (neat, cm^{-1}) 2923, 2853, 2135, 1461, 1429, 1152, 1116; HRMS (EI) *m/z* calcd. for $C_{17}H_{28}Si$ [M^+]: 260.1960, found: 260.1956.

Gram scale reaction of **3i** (yz-5-004)



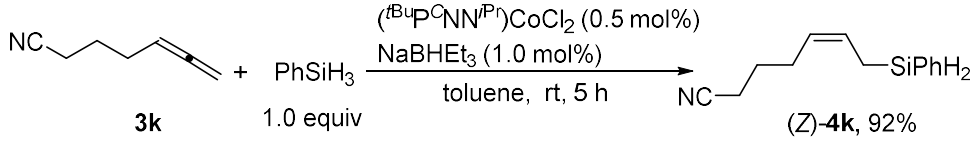
The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)$CoCl_2$ (**2b**) (14.2 mg, 0.025 mmol), **3i** (761.0 mg, 5.0 mmol), toluene (5.0 mL), $PhSiH_3$ (615 μL, d = 0.88 g/mL, 541.2 mg, 5.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 50 μL, 0.05 mmol) afforded (*Z*)-**4i** (1.2120 g, 93%) via column chromatography on silica gel (eluent: petroleum ether (60-90 ºC)) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60-7.54 (m, 2 H, ArH), 7.44-7.32 (m, 3 H, ArH), 5.48-5.39 (m, 1 H, =CH), 5.38-5.29 (m, 1 H, =CH), 4.29 (t, J = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 196.5 Hz, J = 3.5 Hz, 0.10 H, $^{29}SiH_2$), 1.98-1.91 (m, 2 H, CH_2), 1.90-1.83 (m, 2 H, CH_2), 1.35-1.20 (m, 12 H, 6×CH_2), 0.88 (t, J = 6.8 Hz, 3 H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 135.2, 132.2, 129.69, 129.66, 127.9, 123.8, 31.9, 29.6, 29.5, 29.4, 29.3, 27.0, 22.7, 14.1, 11.7.

(10) Preparation of (*Z*)-(4-acetoxy-2-butenyl)(phenyl)silane ((*Z*)-**4j**) (yz-4-165)



The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3j** (112.3 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4j** (175.6 mg, 80%) via column chromatography on silica gel (petroleum ether (60-90 ºC)/ ethyl acetate = 10/1) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59-7.54 (m, 2 H, ArH), 7.44-7.33 (m, 3 H, ArH), 5.80-5.72 (m, 1 H, =CH), 5.54-5.46 (m, 1 H, =CH), 4.50 (d, J = 6.8 Hz, 2 H, OCH_2), 4.31 (t, J = 3.8 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 198.8 Hz, J = 3.6 Hz, 0.10 H, $^{29}SiH_2$), 2.03 (s, 3 H, CH_3), 2.00-1.94 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.9, 135.2, 131.2, 130.3, 129.9, 128.0, 122.5, 59.9, 20.9, 12.6; MS (ESI) *m/z* 243 ($[M+Na]^+$), 238 ($[M+NH_4]^+$); IR (neat, cm^{-1}) 2136, 1735, 1427, 1370, 1226, 1152, 1116, 1023; HRMS (ESI) *m/z* calcd. for $C_{12}H_{20}NO_2Si$ ($[M+NH_4]^+$): 238.1258, found: 238.1256

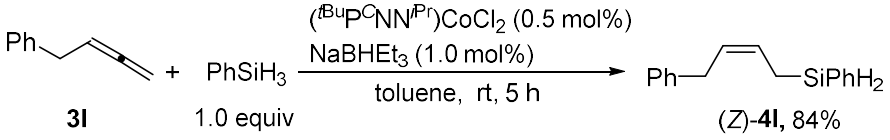
(11) Preparation of (*Z*)-(6-cyano-2-hexenyl)(phenyl)silane ((*Z*)-**4k**) (yz-4-176)



3k (*Z*)-**4k**, 92%

The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)CoCl$_2$ (**2b**) (2.8 mg, 0.005 mmol), **3k** (107.4 mg, 1.0 mmol), toluene (1.0 mL), PhSiH$_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and NaBHEt$_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4k** (197.5 mg, 92%) via column chromatography on silica gel (petroleum ether (60-90 ºC)/ ethyl acetate = 20/1) as an oil: ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.57 (d, *J* = 6.4 Hz, 2 H, ArH), 7.45-7.33 (m, 3 H, ArH), 5.62-5.53 (m, 1 H, =CH), 5.28-5.20 (m, 1 H, =CH), 4.30 (t, *J* = 3.2 Hz, 1.90 H, ^{28}SiH$_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 197.6 Hz, *J* = 3.2 Hz, 0.10 H, ^{29}SiH$_2$), 2.23 (t, *J* = 7.4 Hz, 2 H, CH$_2$CN), 2.08 (q, *J* = 7.3 Hz, 2 H, CH$_2$), 1.92-1.86 (m, 2 H, CH$_2$), 1.59 (quint, *J* = 7.3 Hz, 2 H, CH$_2$); ^{13}C NMR (100 MHz, CDCl$_3$) δ 135.3, 131.7, 129.8, 128.0, 126.6, 126.3, 119.7, 25.8, 25.2, 16.4, 12.1; MS (EI, 70 eV) *m/z* (%) 215 (M$^+$, 2.24), 107 (100); IR (neat, cm^{-1}) 3010, 2936, 2246, 2133, 1426, 1153, 1115; HRMS (EI) *m/z* calcd. for C$_{13}$H$_{17}$NSi [M$^+$]: 215.1130, found: 215.1122.

(12) Preparation of (*Z*)-(4-phenyl-2-butenyl)(phenyl)silane ((*Z*)-**4l**) (yz-4-180)

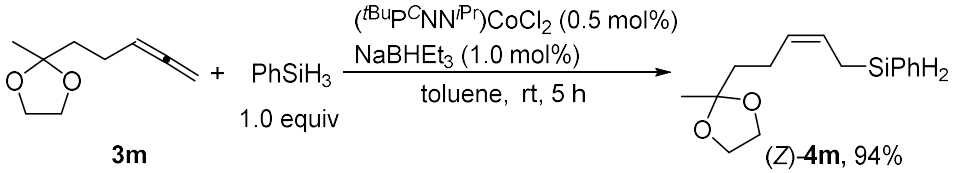


3l (*Z*)-**4l**, 84%

The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)CoCl$_2$ (**2b**) (2.8 mg, 0.005 mmol), **3l** (130.2 mg, 1.0 mmol), toluene (1.0 mL), PhSiH$_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and NaBHEt$_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4l** (199.2 mg, 84%) via column chromatography on silica gel (eluent: petroleum ether (60-90 ºC)) as an oil: ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.62-7.56 (m, 2 H, ArH), 7.43-7.32 (m, 3 H, ArH), 7.28-7.21 (m, 2 H, ArH), 7.20-7.10 (m, 3 H, ArH), 5.65-5.58 (m, 2 H, 2×=CH), 4.34 (t, *J* = 3.8 Hz, 1.90 H, ^{28}SiH$_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 197.5 Hz, *J* = 3.7 Hz, 0.10 H, ^{29}SiH$_2$), 3.31 (d, *J* = 6.8 Hz, 2 H, CH$_2$), 2.01-1.95 (m, 2 H, CH$_2$); ^{13}C NMR (100 MHz, CDCl$_3$) δ

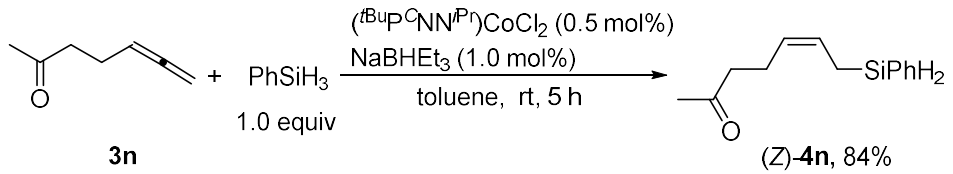
141.0, 135.3, 131.9, 129.8, 128.4, 128.0, 127.7, 125.8, 125.2, 33.2, 11.9; MS (EI, 70 eV) *m/z* (%) 238 (M^+, 2.35), 160 (100); IR (neat, cm^{-1}) 2133, 1492, 1427, 1152, 1115; HRMS (EI) *m/z* calcd. for $C_{16}H_{18}Si$ [M^+]: 238.1178, found: 238.1183.

(13) Preparation of (*Z*)-(5-(2-methyl-1,3-dioxolan-2-yl)-2-pentenyl)(phenyl)silane ((*Z*)-**4m**) (yz-4-198)



The reaction of ($^{t\text{Bu}}P^{C}NN^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3m** (154.4 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4m** (247.0 mg, 94%) via column chromatography on silica gel (petroleum ether (60-90 °C)/ ethyl acetate = 10/1) as an oil: ^1H NMR (400 MHz, $CDCl_3$) δ 7.60-7.55 (m, 2 H, ArH), 7.42-7.32 (m, 3 H, ArH), 5.50-5.42 (m, 1 H, =CH), 5.37-5.29 (m, 1 H, =CH), 4.29 (t, *J* = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}Si\text{-}H}$ = 196.8 Hz, *J* = 3.8 Hz, 0.10 H, $^{29}SiH_2$), 3.92-3.86 (m, 4 H, 2 ×OCH_2), 2.09-2.01 (m, 2 H, CH_2), 1.91-1.86 (m, 2 H, CH_2), 1.64-1.56 (m, 2 H, CH_2), 1.29 (s, 3 H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 135.2, 132.1, 129.7, 128.8, 127.9, 124.3, 109.8, 64.6, 38.8, 23.8, 21.8, 11.7; MS (ESI) *m/z* 263 ($[M+H]^+$); IR (neat, cm^{-1}) 2982, 2877, 2133, 1428, 1375, 1215, 1116, 1057; HRMS (ESI) *m/z* calcd. for $C_{15}H_{23}O_2Si$ ($[M+H]^+$): 263.1462, found: 263.1459.

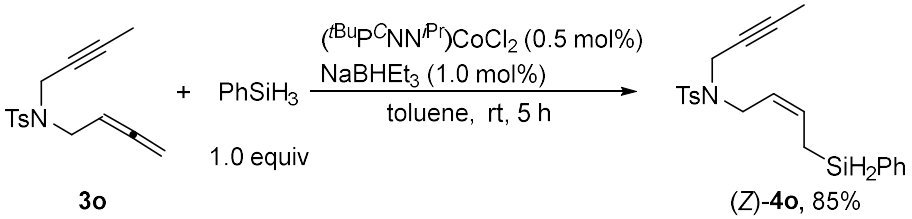
(14) Preparation of (*Z*)-(6-oxo-2-heptenyl)(phenyl)silane ((*Z*)-**4n**) (yz-5-001)



The reaction of ($^{t\text{Bu}}P^{C}NN^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3n** (110.3 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4n** (183.2 mg, 84%) via

column chromatography on silica gel (petroleum ether (60-90 °C)/ ethyl acetate = 10/1) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60-7.54 (m, 2 H, ArH), 7.43-7.32 (m, 3 H, ArH), 5.54-5.44 (m, 1 H, =CH), 5.32-5.24 (m, 1 H, =CH), 4.29 (t, *J* = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^{1}J_{^{29}Si\text{-}H}$ = 197.2 Hz, *J* = 3.6 Hz, 0.10 H, $^{29}SiH_2$), 2.32 (t, *J* = 7.4 Hz, 2 H, CH_2), 2.24-2.16 (m, 2 H, CH_2), 2.08 (s, 3 H, CH_3), 1.92-1.85 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 208.4, 135.3, 131.9, 129.7, 128.0, 127.2, 125.4, 43.3, 29.9, 21.3, 11.9; MS (EI, 70 eV) *m/z* (%) 218 (M^+, 55.02), 123 (100); IR (neat, cm^{-1}) 3009, 2132, 1713, 1427, 1359, 1157, 1115; HRMS (EI) *m/z* calcd. for $C_{13}H_{18}OSi$ [M^+]: 218.1127, found: 218.1137.

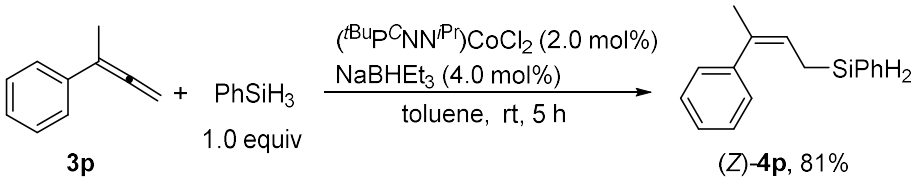
(15) Preparation of (*Z*)-*N*-tosyl-5-azanon-2-en-7-yn-1-yl(phenyl)silane ((*Z*)-**4o**) (yz-4-184)



3o (*Z*)-**4o**, 85%

The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)$CoCl_2$ (**2b**) (2.8 mg, 0.005 mmol), **3o** (275.5 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 10 μL, 0.01 mmol) afforded (*Z*)-**4o** (324.6 mg, 85%) via column chromatography on silica gel (petroleum ether (60-90 °C)/ ethyl acetate = 10/1) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.0 Hz, 2 H, ArH), 7.57-7.52 (m, 2 H, ArH), 7.45-7.33 (m, 3 H, ArH), 7.28 (d, *J* = 8.4 Hz, 2 H, ArH), 5.78-5.69 (m, 1 H, =CH), 5.32-5.25 (m, 1 H, =CH), 4.29 (t, *J* = 3.6 Hz, 1.90 H, $^{28}SiH_2$; dt, $^{1}J_{^{29}Si\text{-}H}$ = 198.8 Hz, *J* = 3.6 Hz, 0.10 H, $^{29}SiH_2$), 3.97-3.93 (m, 2 H, CH_2), 3.68 (d, *J* = 7.2 Hz, 2 H, CH_2), 2.42 (s, 3 H, CH_3), 1.98-1.91 (m, 2 H, CH_2), 1.50 (t, *J* = 2.2 Hz, 3 H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.1, 136.0, 135.2, 131.4, 130.8, 129.9, 129.1, 128.0, 127.9, 122.4, 81.4, 72.0, 42.5, 36.1, 21.5, 12.3, 3.2; MS (EI, 70 eV) *m/z* (%) 383 (M^+, 1.23), 87 (100); IR (neat, cm^{-1}) 2134, 1596, 1429, 1344, 1157, 1114, 1092; HRMS (EI) *m/z* calcd. for $C_{21}H_{25}NO_2SSi$ [M^+]: 383.1375, found: 383.1376.

(16) Preparation of (*Z*)-phenyl(3-phenyl-2-butenyl)silane ((*Z*)-**4p**) (yz-4-148)



The reaction of ($^{t\text{Bu}}$P$^{\text{C}}$NN$^{i\text{Pr}}$)$CoCl_2$ (**2b**) (11.4 mg, 0.02 mmol), **3p** (130.2 mg, 1.0 mmol), toluene (1.0 mL), $PhSiH_3$ (123 μL, d = 0.88 g/mL, 108.2 mg, 1.0 mmol), and $NaBHEt_3$ (1.0 M in THF, 40 μL, 0.04 mmol) afforded (*Z*)-**4p** (192.2 mg, 81%) via column chromatography on silica gel (petroleum ether (60-90 ºC)) as an oil: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51-7.47 (m, 2 H, ArH), 7.40-7.26 (m, 5 H, ArH), 7.23-7.18 (m, 1 H, ArH), 7.12-7.08 (m, 2 H, ArH), 5.53 (td, *J* = 8.4 Hz, 1.3 Hz, 1 H, =CH), 4.28 (t, *J* = 3.8 Hz, 1.90 H, $^{28}SiH_2$; dt, $^1J_{^{29}\text{Si-H}}$ = 196.5 Hz, *J* = 3.7 Hz, 0.10 H, $^{29}SiH_2$), 2.00 (d, *J* = 1.2 Hz, 3 H, CH_3), 1.84-1.78 (m, 2 H, CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.9, 136.0, 135.2, 132.0, 129.6, 128.1, 128.0, 127.9, 126.4, 121.6, 25.7, 12.9; MS (EI, 70 eV) *m/z* (%)238 (M^+, 39.83), 131 (100); IR (neat, cm^{-1}) 2131, 1491, 1429, 1364, 1157, 1115, 1069, 1028. HRMS (EI) *m/z* calcd. for $C_{16}H_{18}Si$ [M^+]: 238.1178, found: 238.1172.

References:

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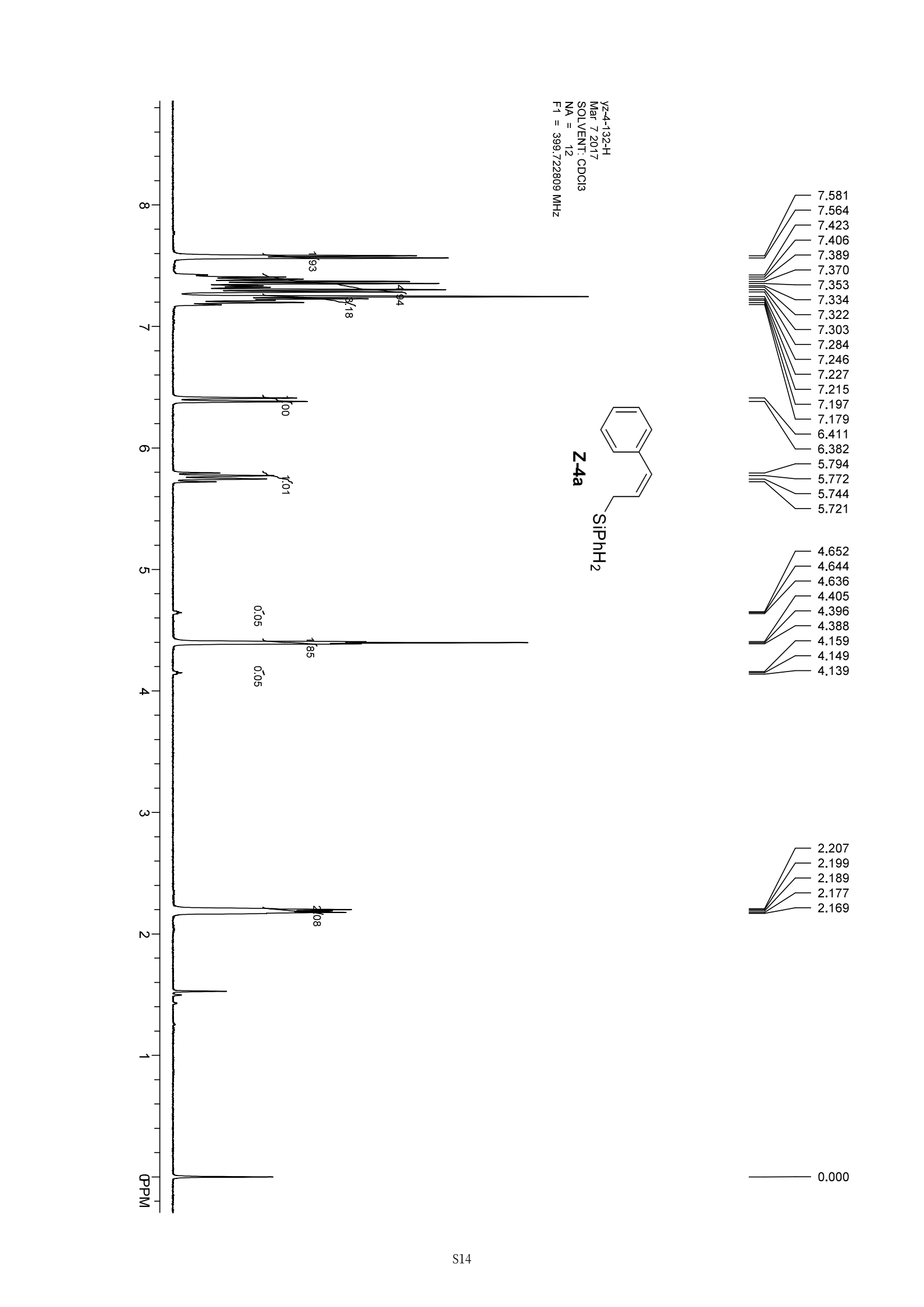
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Mar 7 2017
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7.423
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7.389
7.370
7.353
7.334
7.322
7.303
7.284
7.246
7.227
7.215
7.197
7.179
6.411
6.382
5.794
5.772
5.744
5.721
4.652
4.644
4.636
4.405
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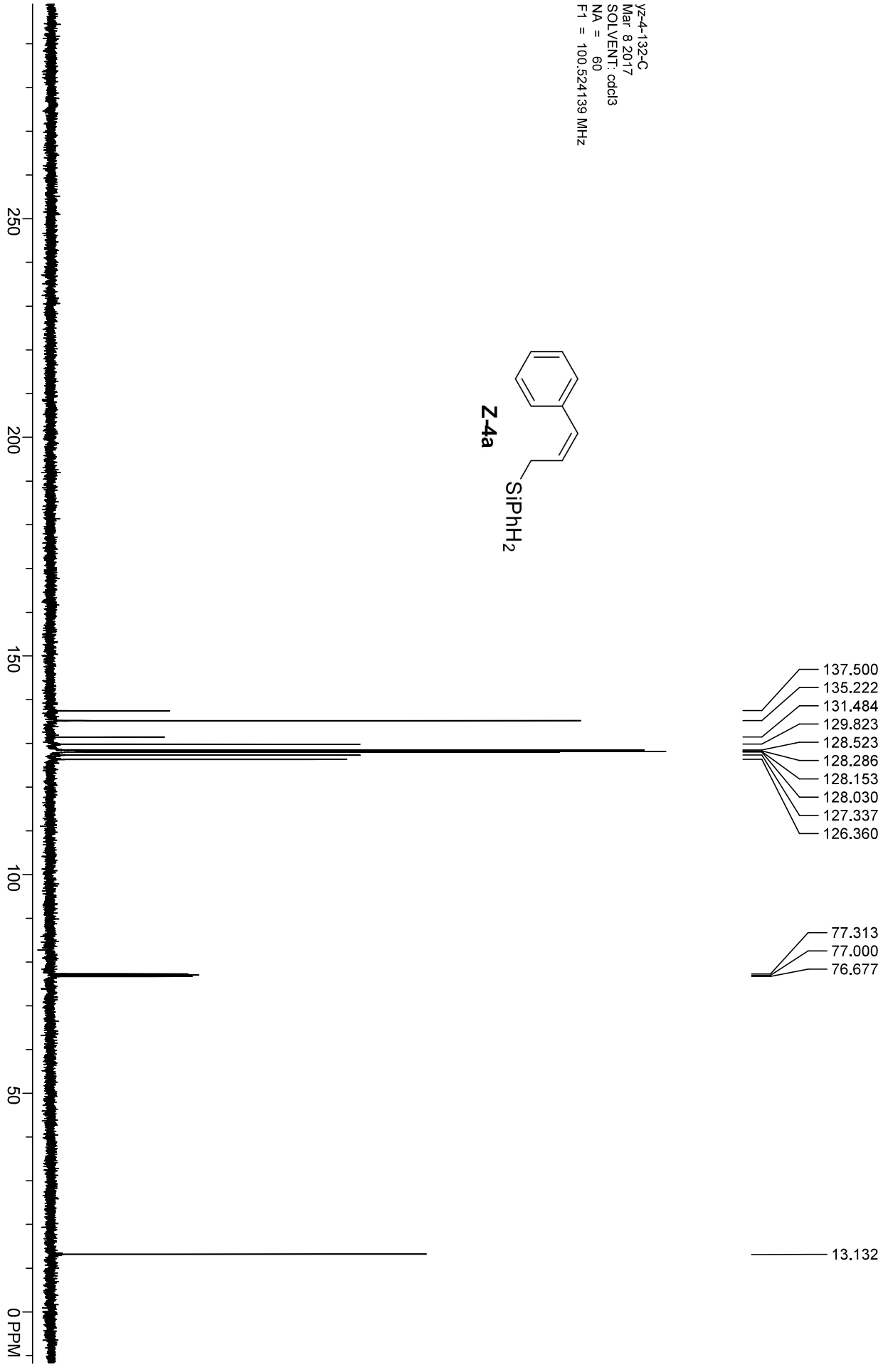
2.169
0.000
PPM


yz-4-132-C
Mar 8 2017
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13.132
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200
150
100
50
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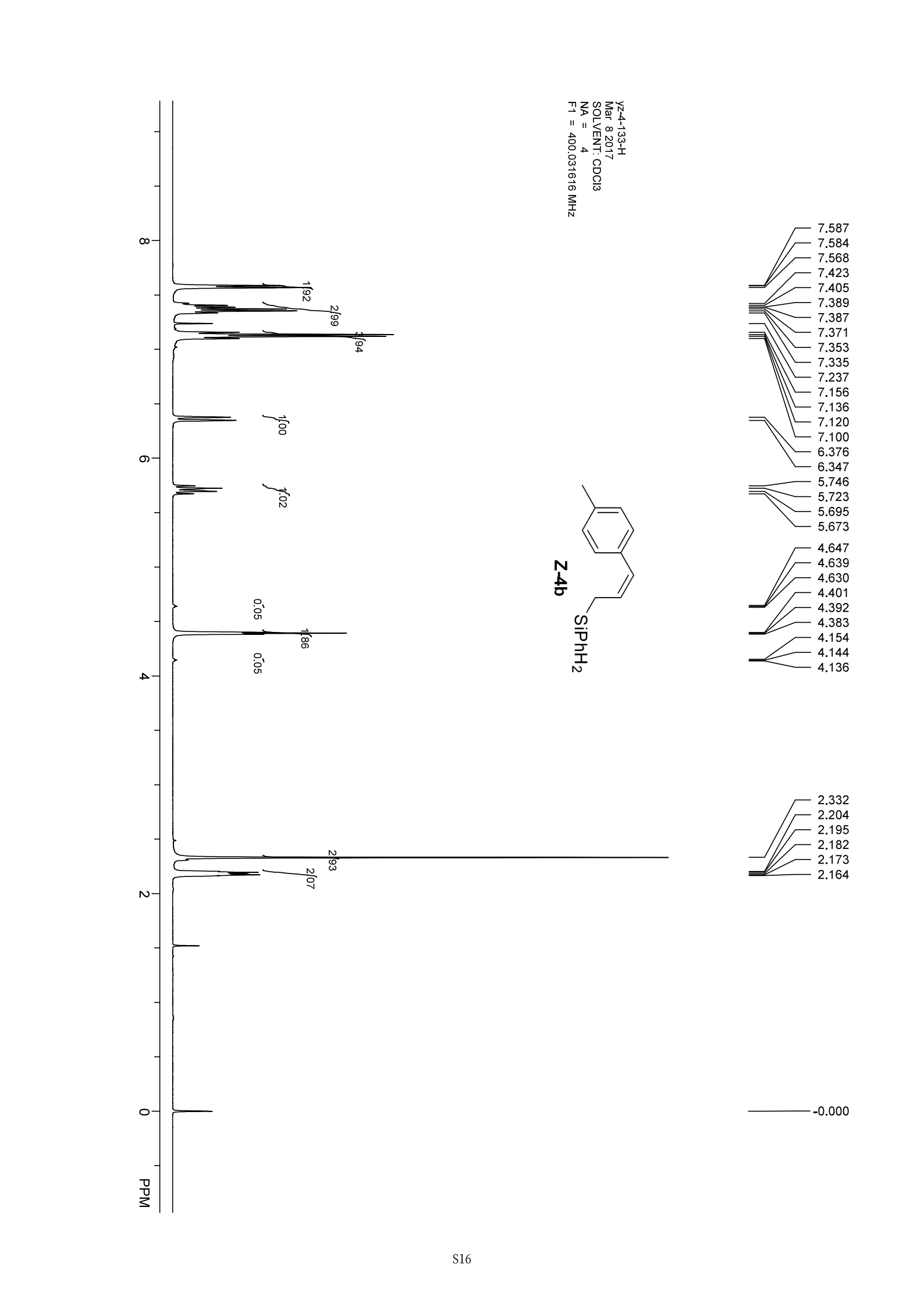
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Mar 8 2017
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4.401
4.392
4.383
4.154
4.144
4.136
2.332
2.204
2.195
2.182
2.173
2.164
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1.92
2.99
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1.00
1.02
0.05
1.86
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2.93
2.07
8
6
4
2
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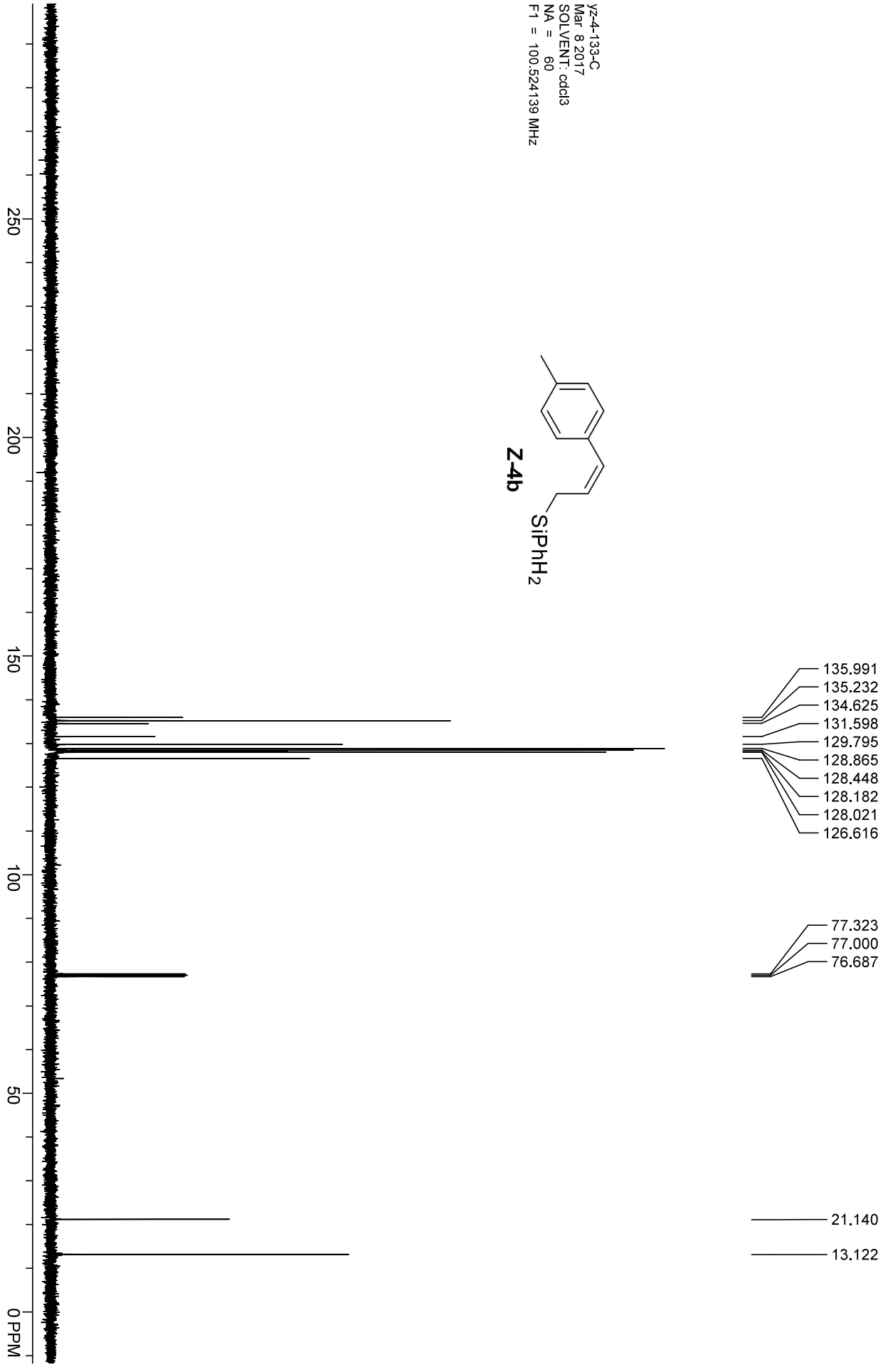
PPM


yz-4-133-C
Mar 8 2017
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129.795
128.865
128.448
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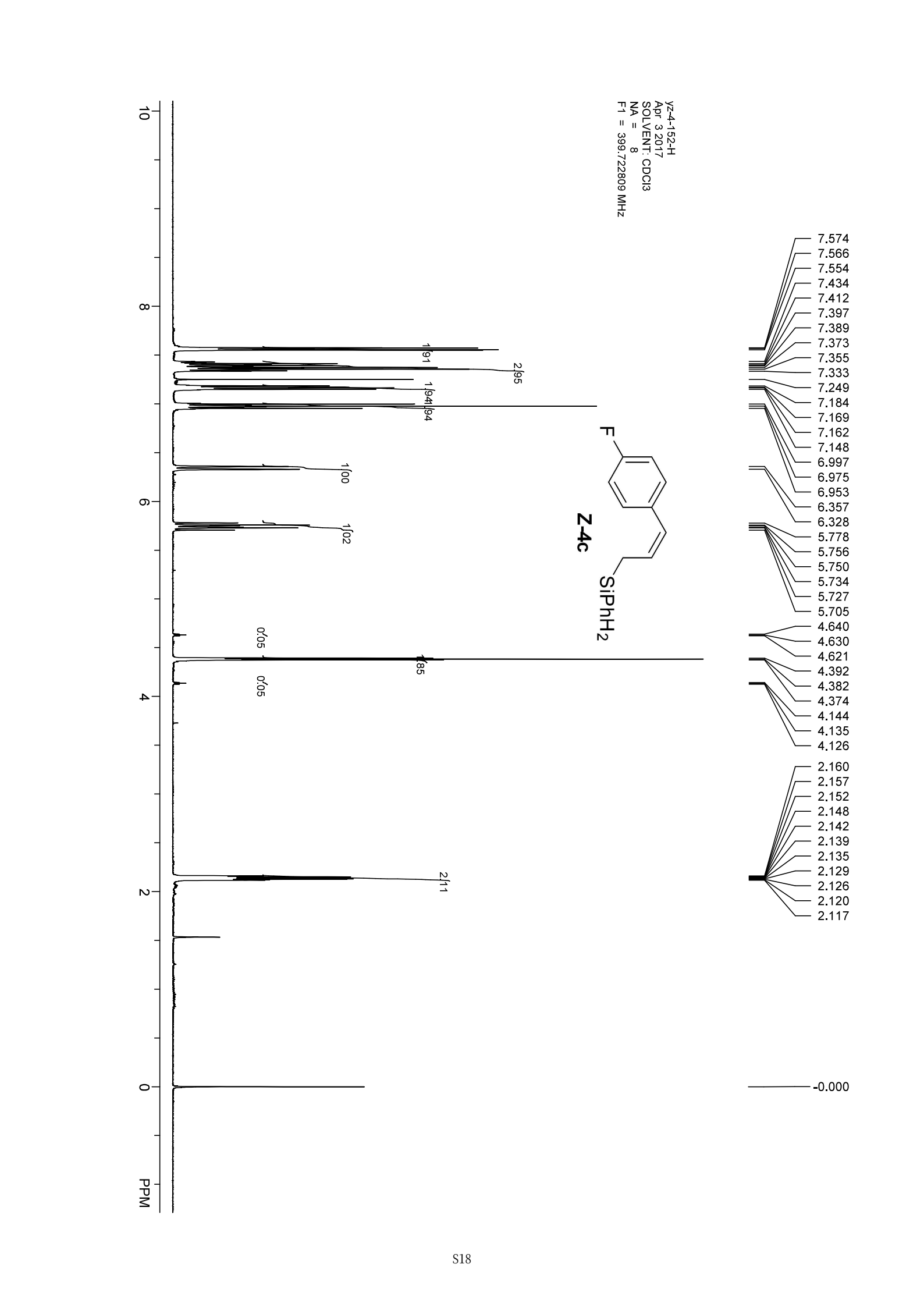
21.140
13.122
250
200
150
100
50
0 PPM


yz-4-152-H
Apr 3 2017
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7.148
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6.975
6.953
6.357
6.328
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4.382
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4.144
4.135
4.126
2.160
2.157
2.152
2.148
2.142
2.139
2.135
2.129
2.126
2.120
2.117
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1.91
2.95
1.94
1.94
1.00
1.02
0.05
0.05
1.85
2.11
10
8
6
4
2
0
PPM


yz-4-152-C
May 2 2017
SOLVENT: cdcl3
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128.053
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150
100
50
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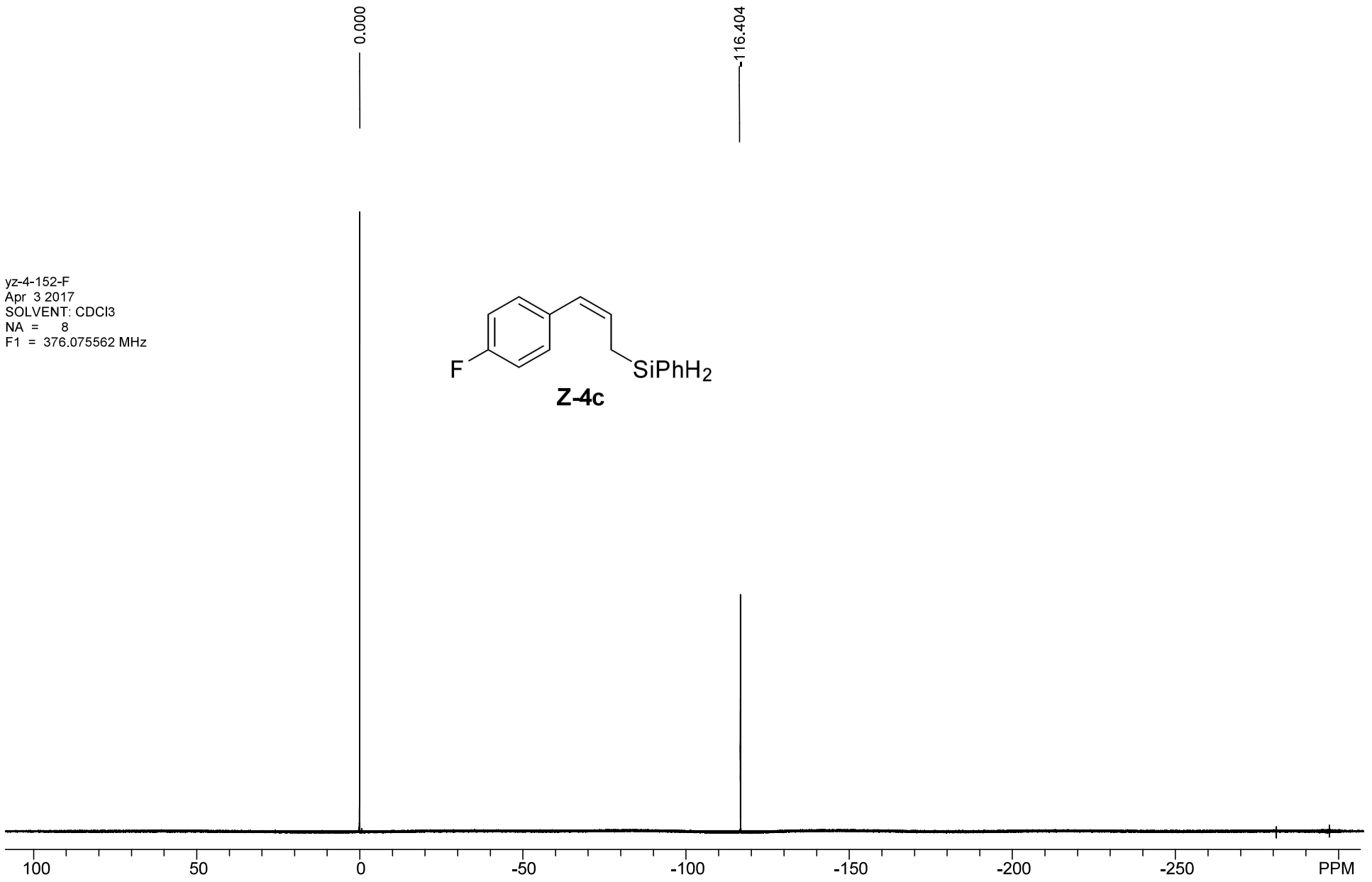
PPM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yz-4-152-F
Apr 3 2017
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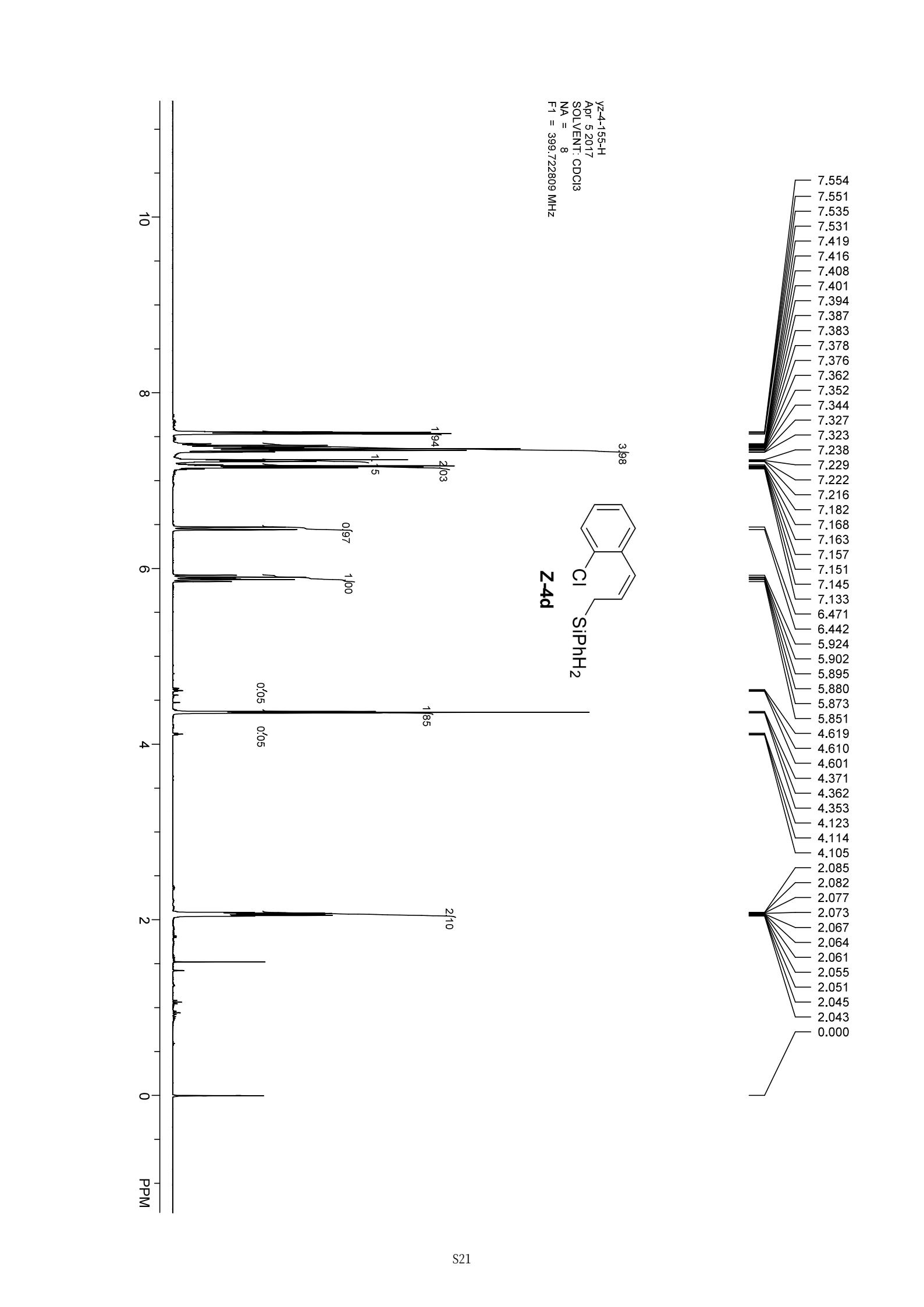
-150
-200
-250
PPM


yz-4-155-H
Apr 5 2017
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0.05
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2.10
PPM
10
8
6
4
2
0
7.554
7.551
7.535
7.531
7.419
7.416
7.408
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7.362
7.352
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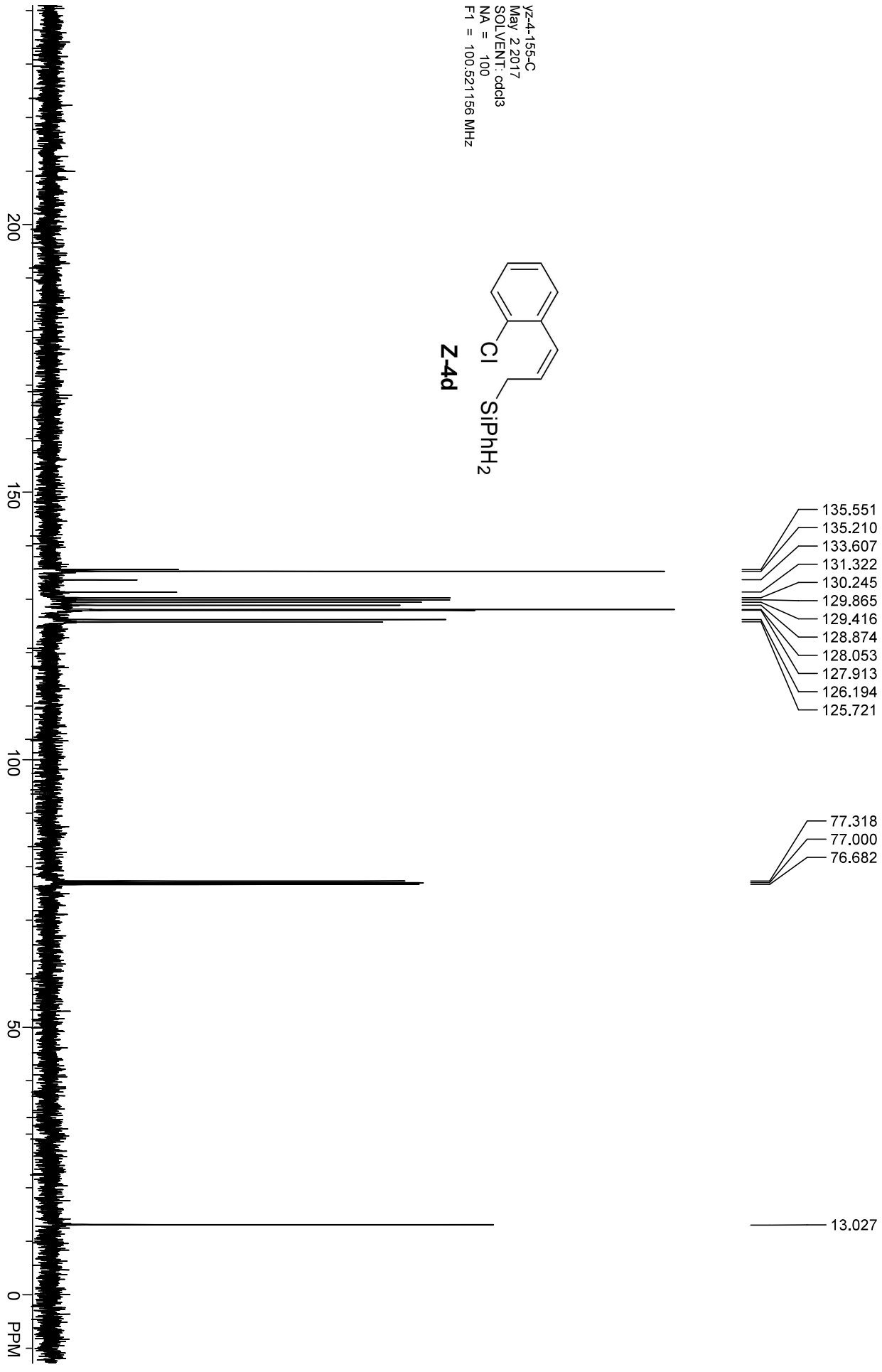
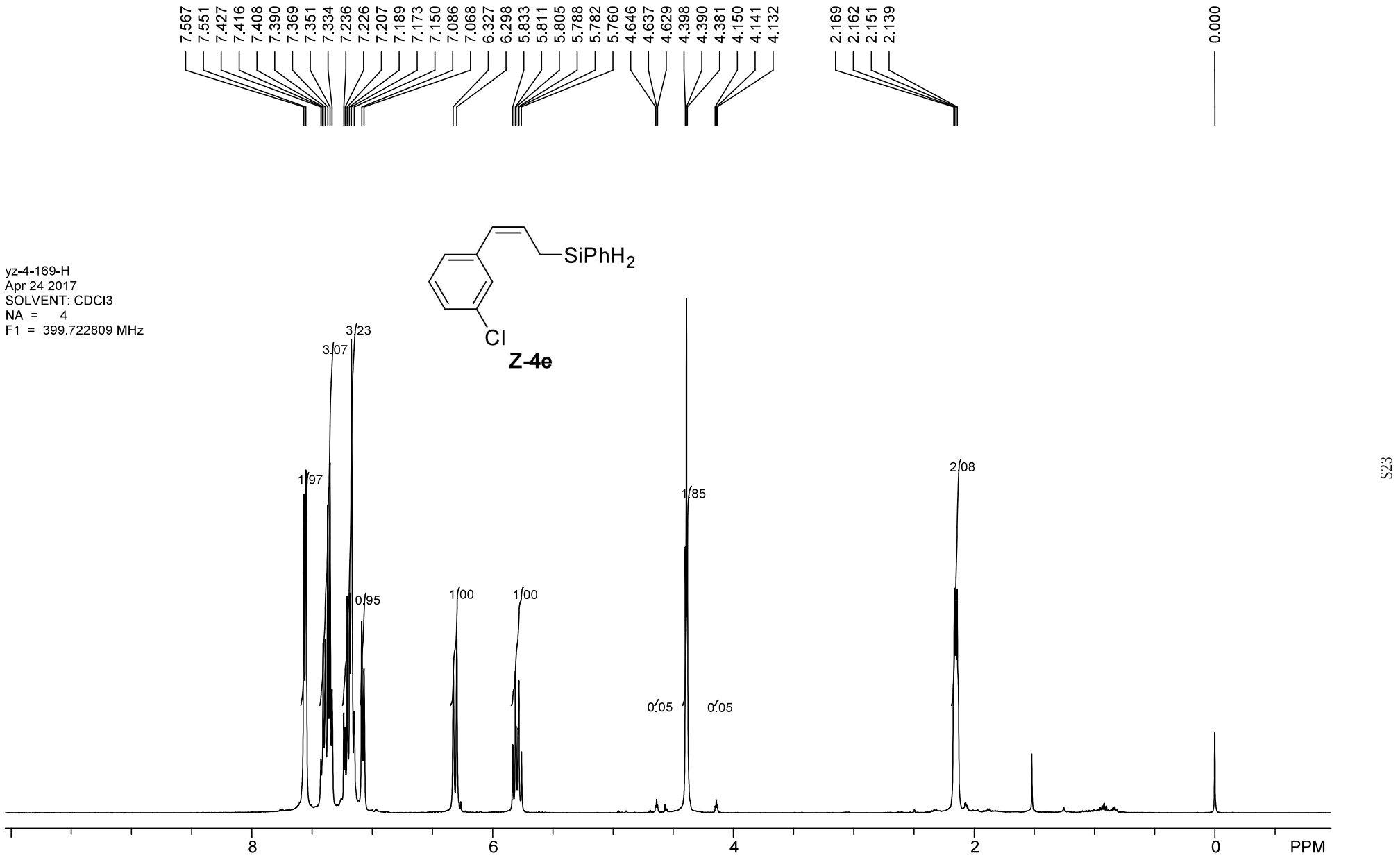
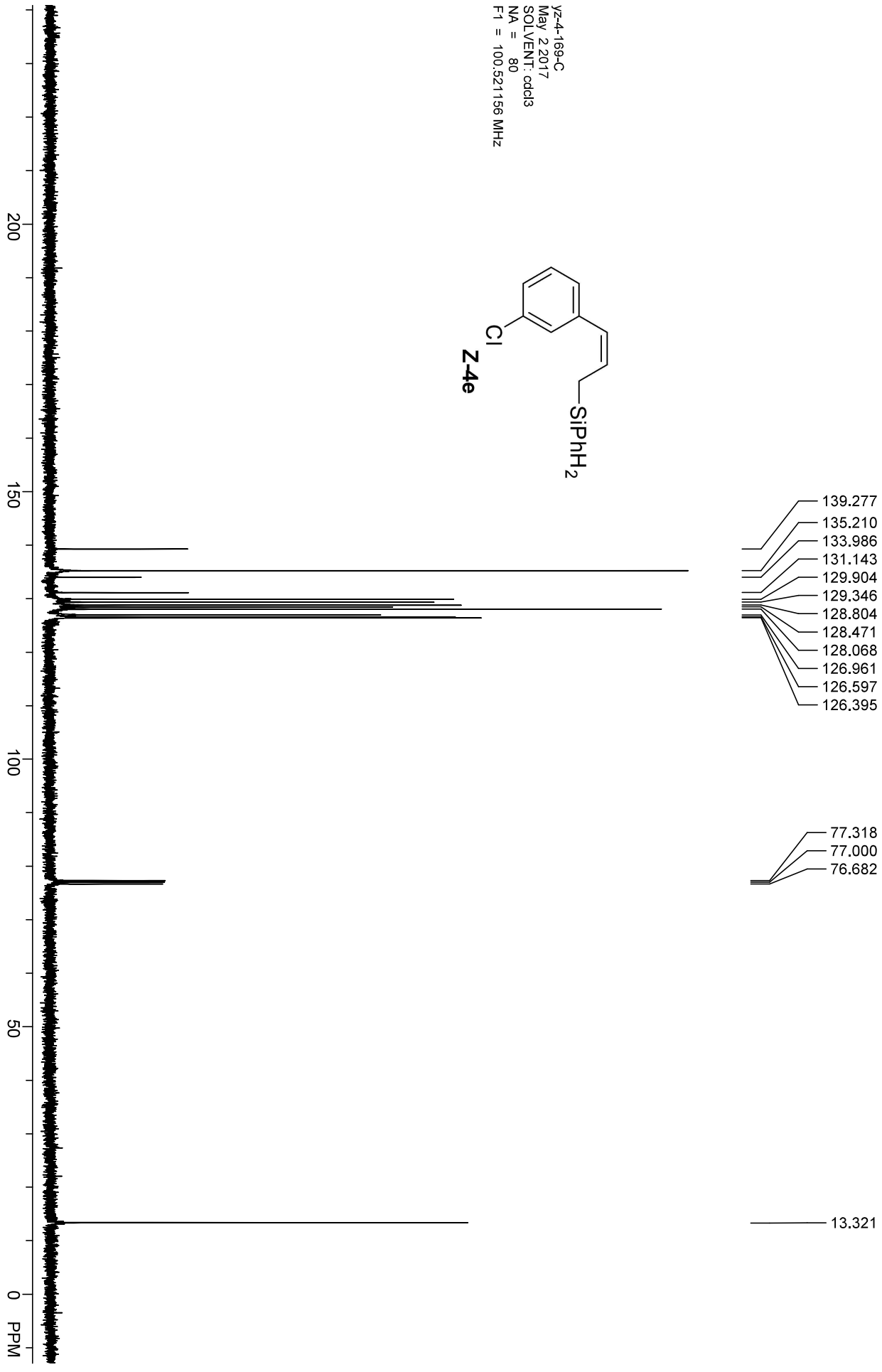
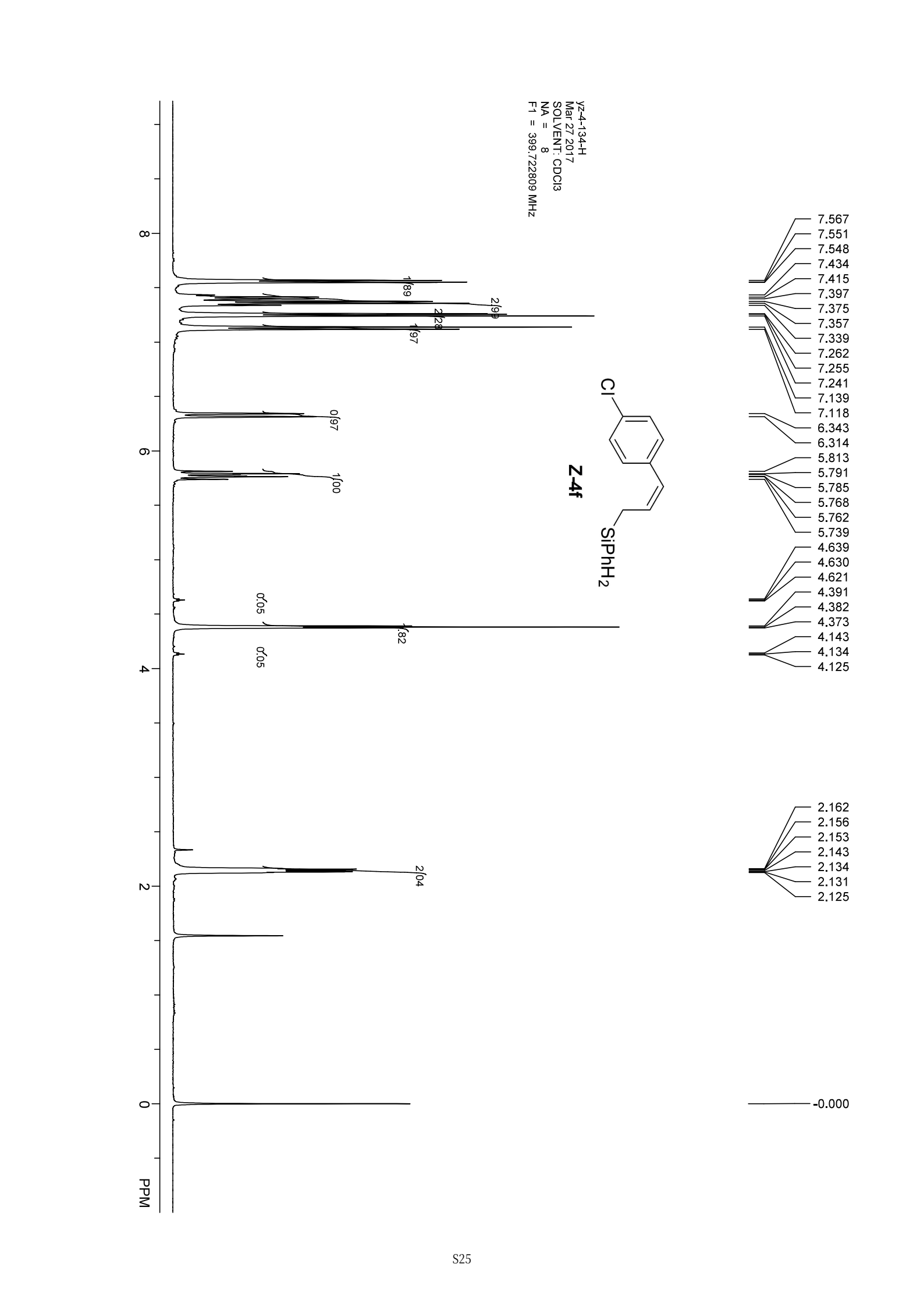
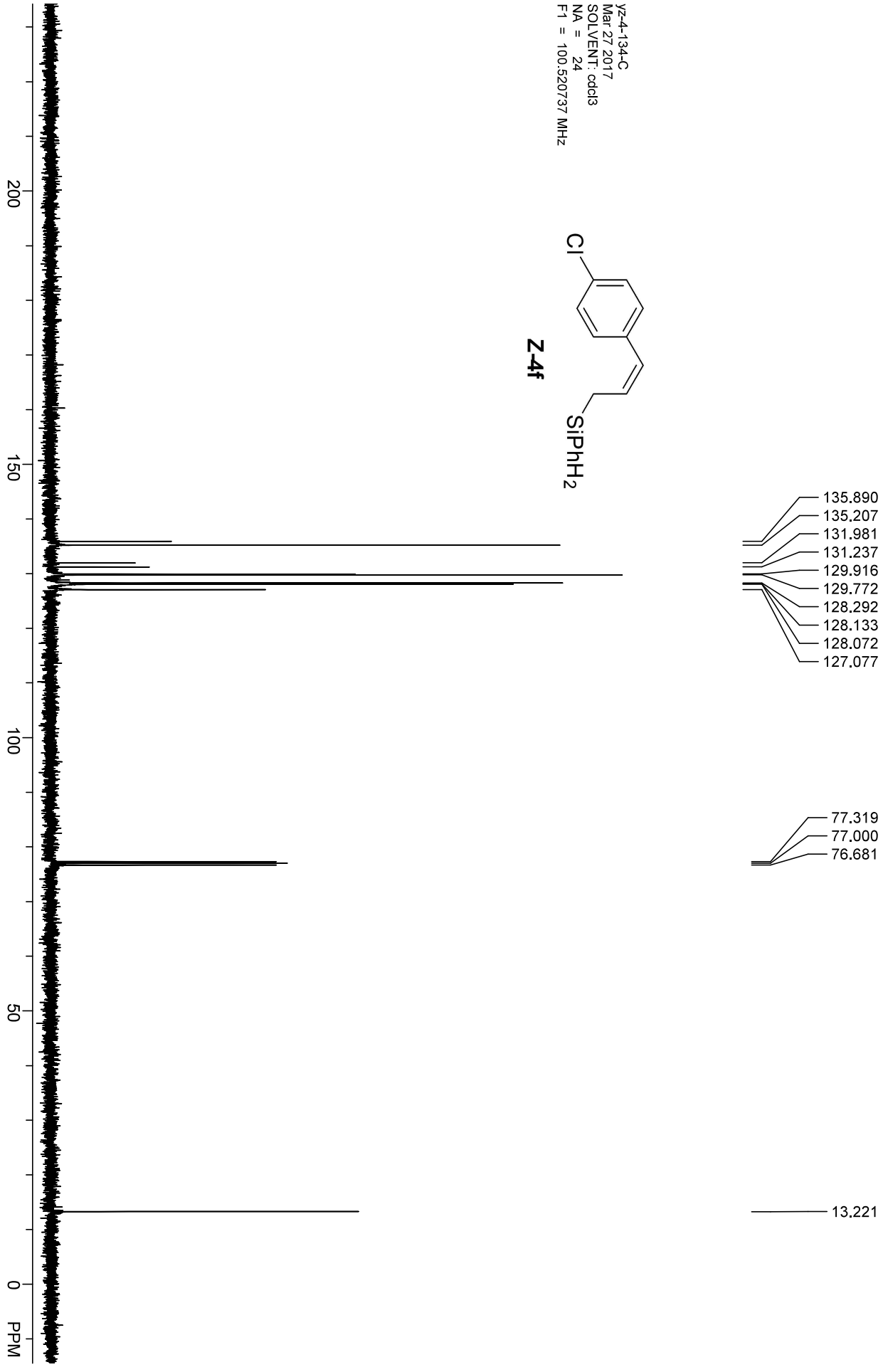
7.323
7.238
7.229
7.222
7.216
7.182
7.168
7.163
7.157
7.151
7.145
7.133
6.471
6.442
5.924
5.902
5.895
5.880
5.873
5.851
4.619
4.610
4.601
4.371
4.362
4.353
4.123
4.114
4.105
2.085
2.082
2.077
2.073
2.067
2.064
2.061
2.055
2.051
2.045
2.043
0.000

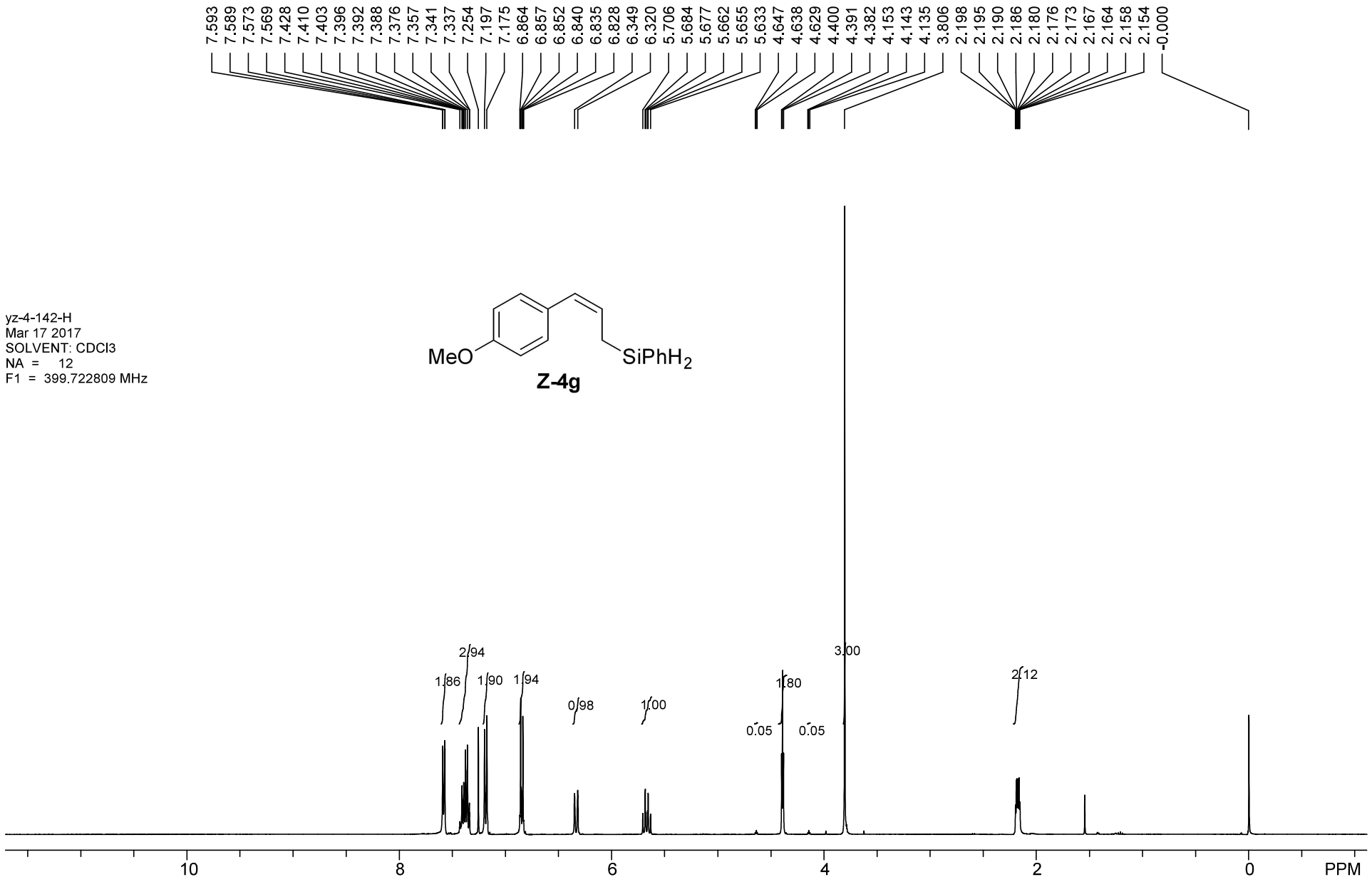

yz-4-155-C
May 2 2017
SOLVENT: cdcl3
NA = 100
F1 = 100.521156 MHz
Cl
SiPhH2
Z-4d
135.551
135.210
133.607
131.322
130.245
129.865
129.416
128.874
128.053
127.913
126.194
125.721
77.318
77.000
76.682
13.027
200
150
100
50
0
PPM

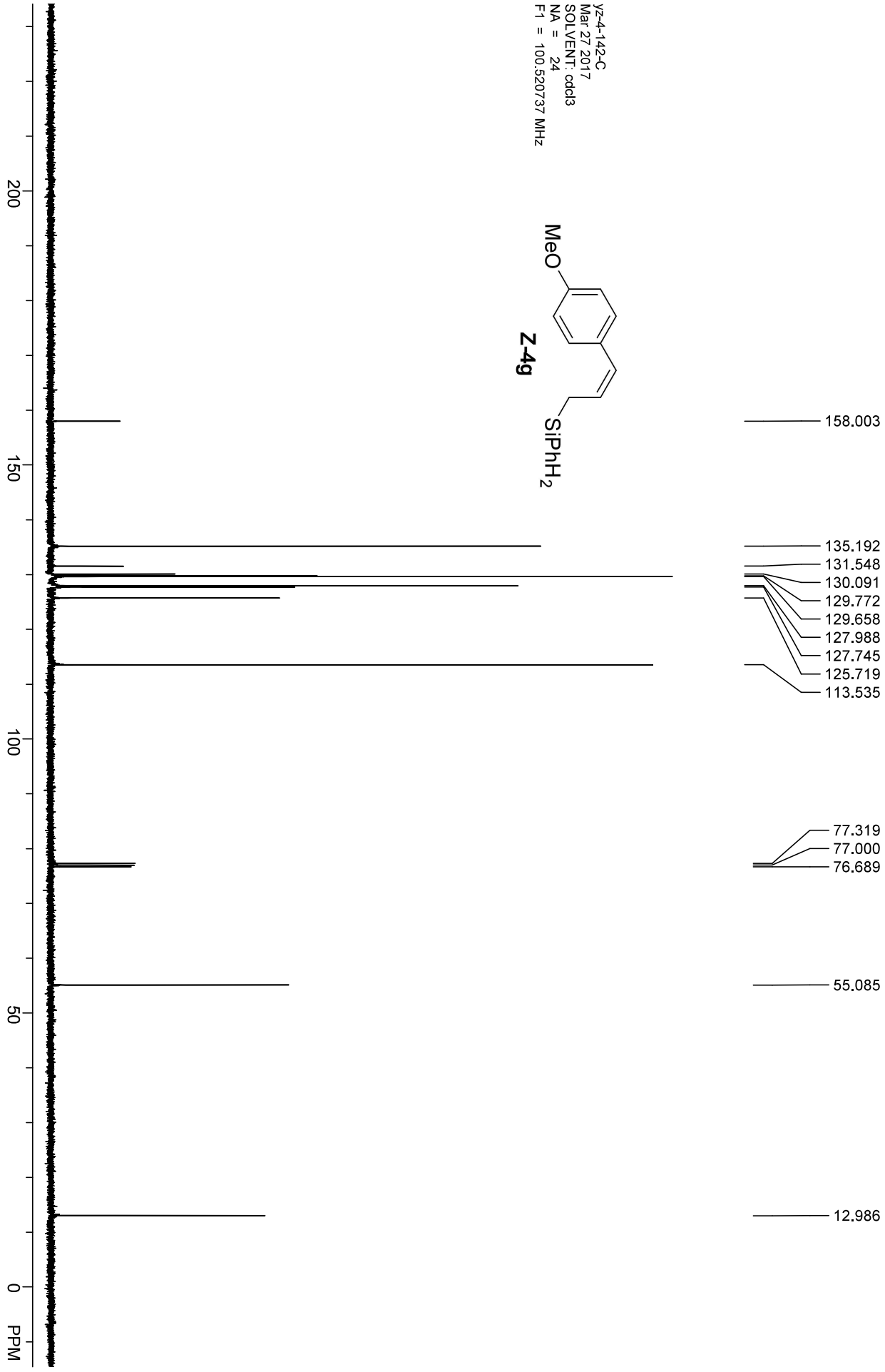

7.567
7.551
7.427
7.416
7.408
7.390
7.369
7.351
7.334
7.236
7.226
7.207
7.189
7.173
7.150
7.086
7.068
6.327
6.298
5.833
5.811
5.805
5.788
5.782
5.760
4.646
4.637
4.629
4.398
4.390
4.381
4.150
4.141
4.132
2.169
2.162
2.151
2.139
0.000
yz-4-169-H
Apr 24 2017
SOLVENT: CDCl3
NA = 4
F1 = 399.722809 MHz
SiPhH2
Cl
Z-4e
3.23
3.07
1.97
0.95
1.00
1.00
1.85
0.05
0.05
2.08
8
6
4
2
0
PPM

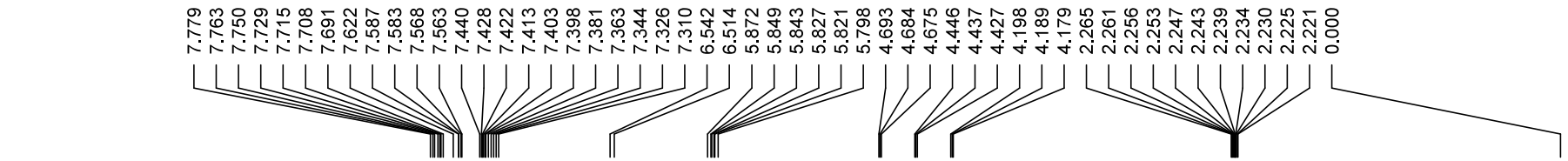

yz-4-169-C
May 2 2017
SOLVENT: cdcl3
NA = 80
F1 = 100.521156 MHz
Cl
Z-4e
SiPhH2
139.277
135.210
133.986
131.143
129.904
129.346
128.804
128.471
128.068
126.961
126.597
126.395
77.318
77.000
76.682
13.321
200
150
100
50
0
PPM

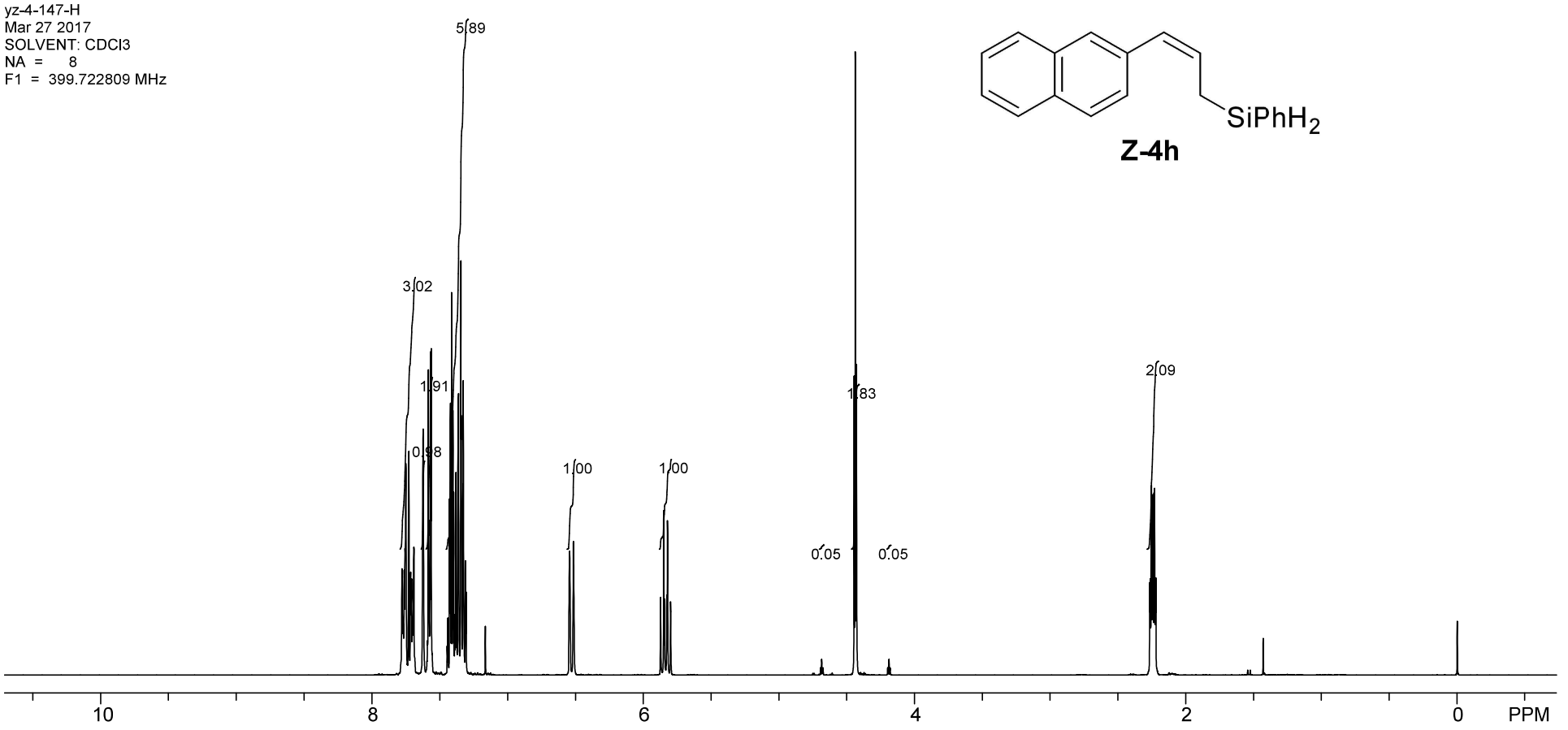

yz-4-134-H
Mar 27 2017
SOLVENT: CDCl3
NA = 8
F1 = 399.722809 MHz
Cl
SiPhH2
Z-4f
7.567
7.551
7.548
7.434
7.415
7.397
7.375
7.357
7.339
7.262
7.255
7.241
7.139
7.118
6.343
6.314
5.813
5.791
5.785
5.768
5.762
5.739
4.639
4.630
4.621
4.391
4.382
4.373
4.143
4.134
4.125
2.162
2.156
2.153
2.143
2.134
2.131
2.125
-0.000
PPM

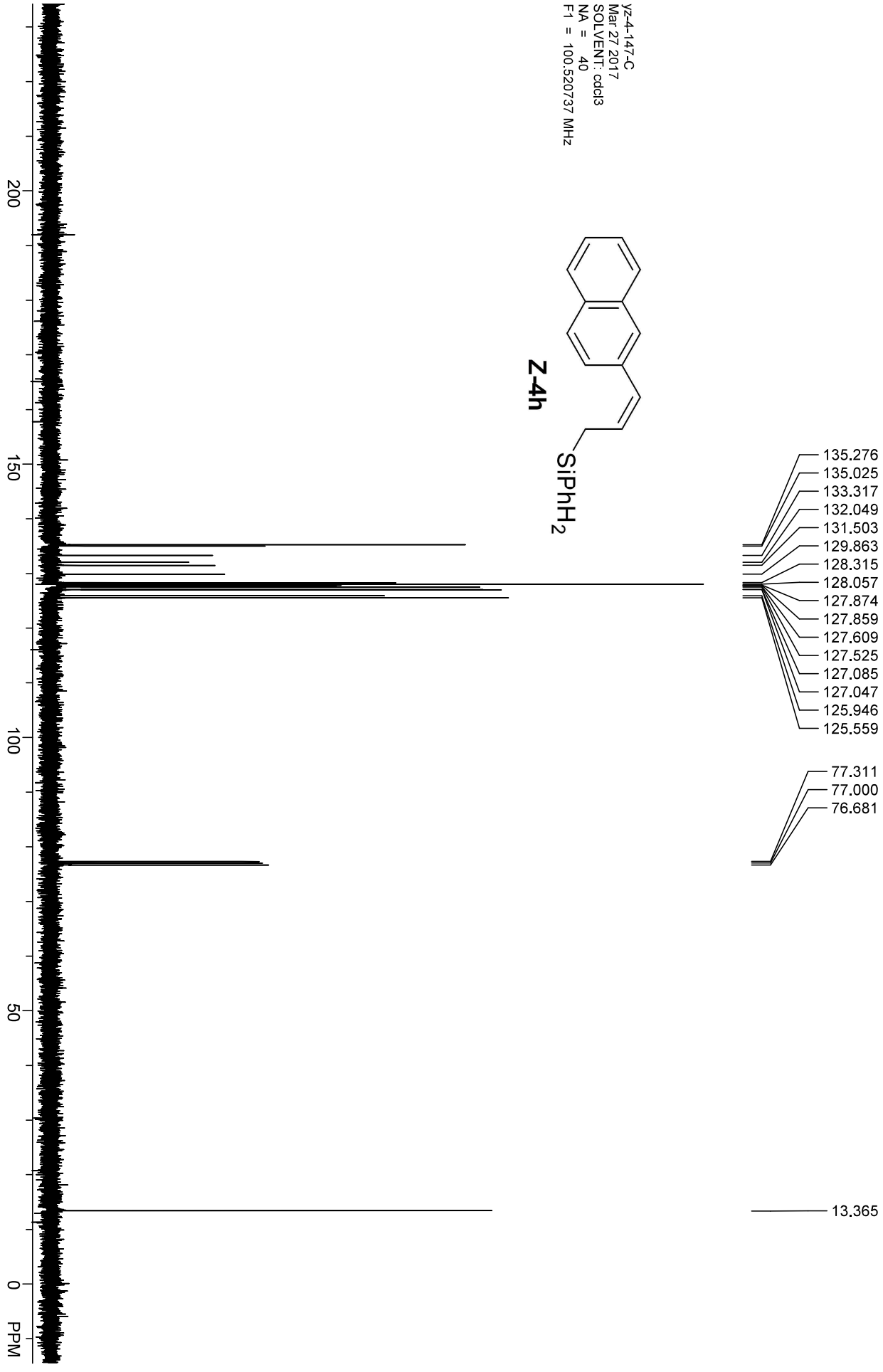

yz-4-134-C
Mar 27 2017
SOLVENT: cdcl3
NA = 24
F1 = 100.520737 MHz
Cl
SiPhH2
Z-4f
135.890
135.207
131.981
131.237
129.916
129.772
128.292
128.133
128.072
127.077
77.319
77.000
76.681
13.221
200
150
100
50
0
PPM

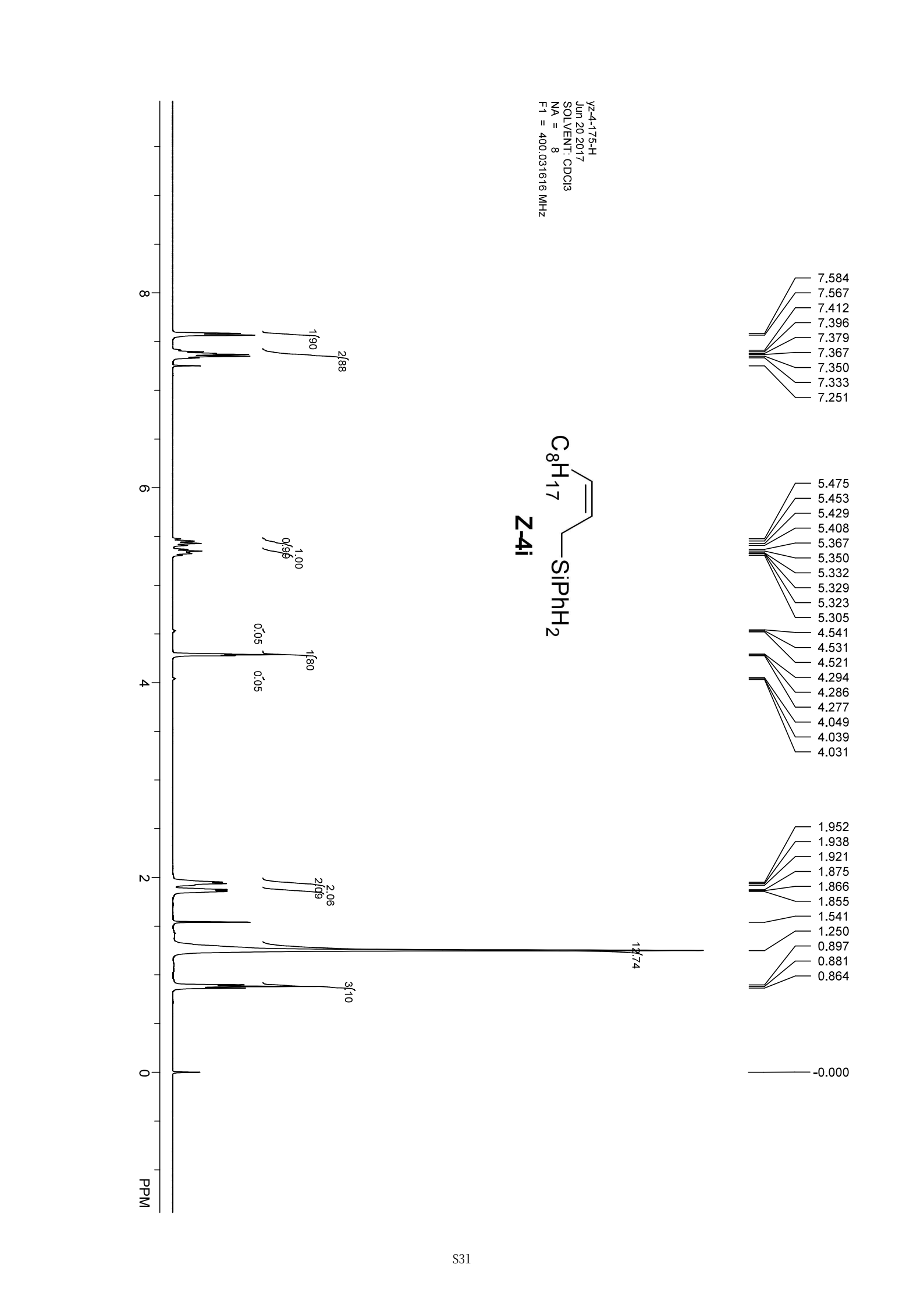

7.593
7.589
7.573
7.569
7.428
7.410
7.403
7.396
7.392
7.388
7.376
7.357
7.341
7.337
7.254
7.197
7.175
6.864
6.857
6.852
6.840
6.835
6.828
6.349
6.320
5.706
5.684
5.677
5.662
5.655
5.633
4.647
4.638
4.629
4.400
4.391
4.382
4.153
4.143
4.135
3.806
2.198
2.195
2.190
2.186
2.180
2.176
2.173
2.167
2.164
2.158
2.154
0.000
yz-4-142-H
Mar 17 2017
SOLVENT: CDCl3
NA = 12
F1 = 399.722809 MHz
MeO
SiPhH2
Z-4g
2.94
1.86
1.90
1.94
0.98
1.00
0.05
1.80
0.05
3.00
2.12
10
8
6
4
2
0
PPM

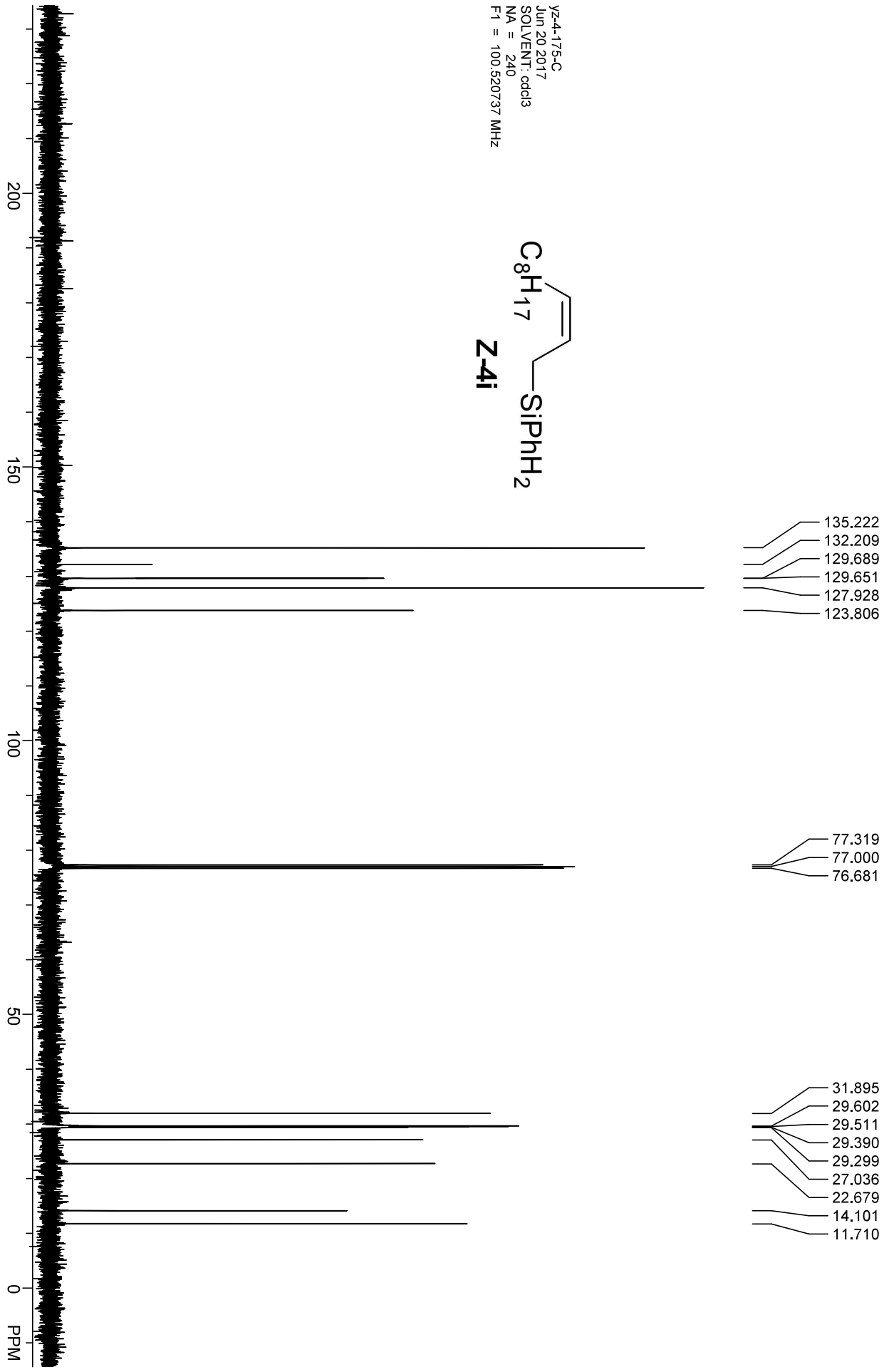

yz-4-142-C
Mar 27 2017
SOLVENT: cdcl3
NA = 24
F1 = 100.520737 MHz
MeO
SiPhH2
Z-4g
158.003
135.192
131.548
130.091
129.772
129.658
127.988
127.745
125.719
113.535
77.319
77.000
76.689
55.085
12.986
200
150
100
50
0
PPM

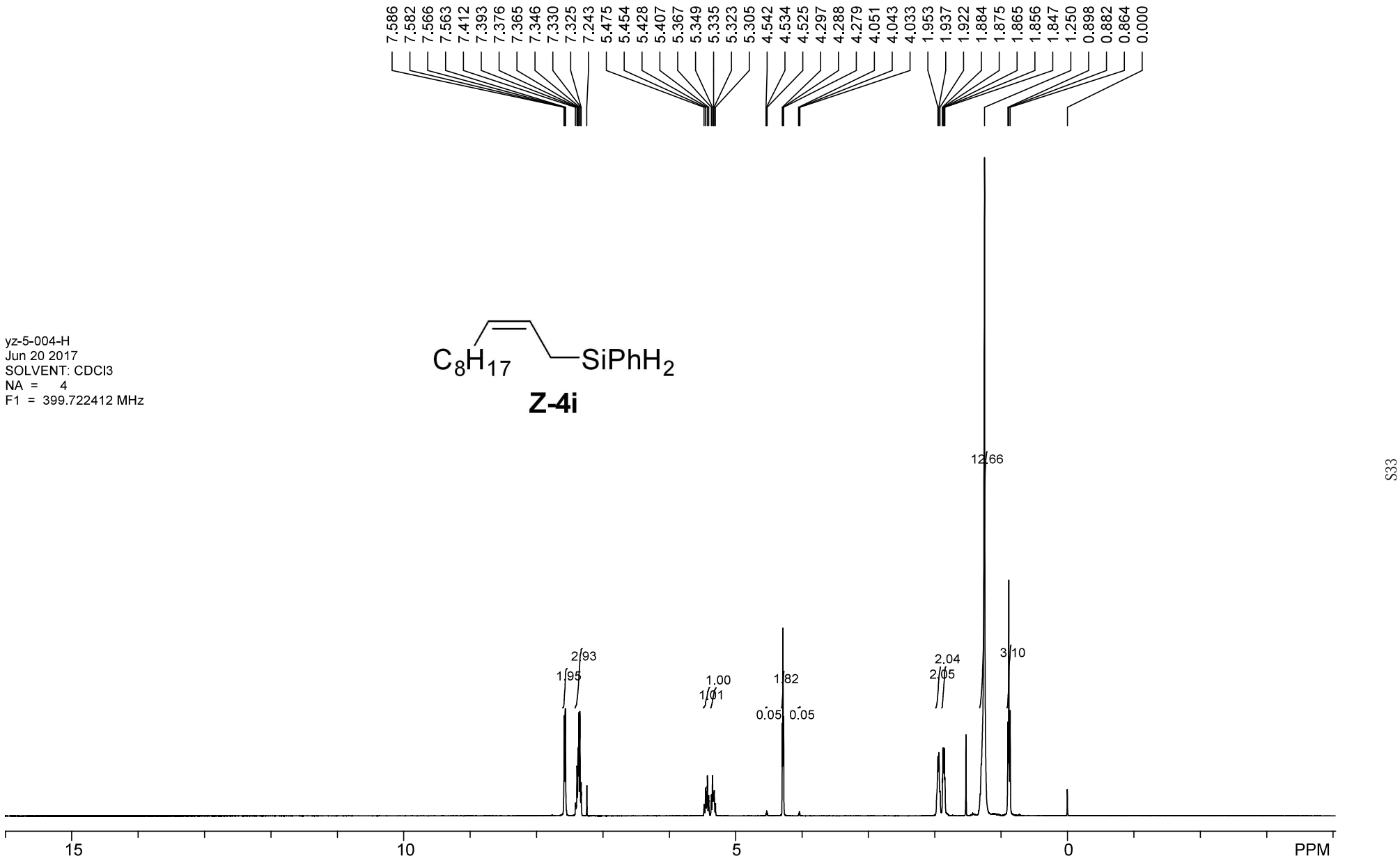

7.779
7.763
7.750
7.729
7.715
7.708
7.691
7.622
7.587
7.583
7.568
7.563
7.440
7.428
7.422
7.413
7.403
7.398
7.381
7.363
7.344
7.326
7.310
6.542
6.514
5.872
5.849
5.843
5.827
5.821
5.798
4.693
4.684
4.675
4.446
4.437
4.427
4.198
4.189
4.179
2.265
2.261
2.256
2.253
2.247
2.243
2.239
2.234
2.230
2.225
2.221
0.000

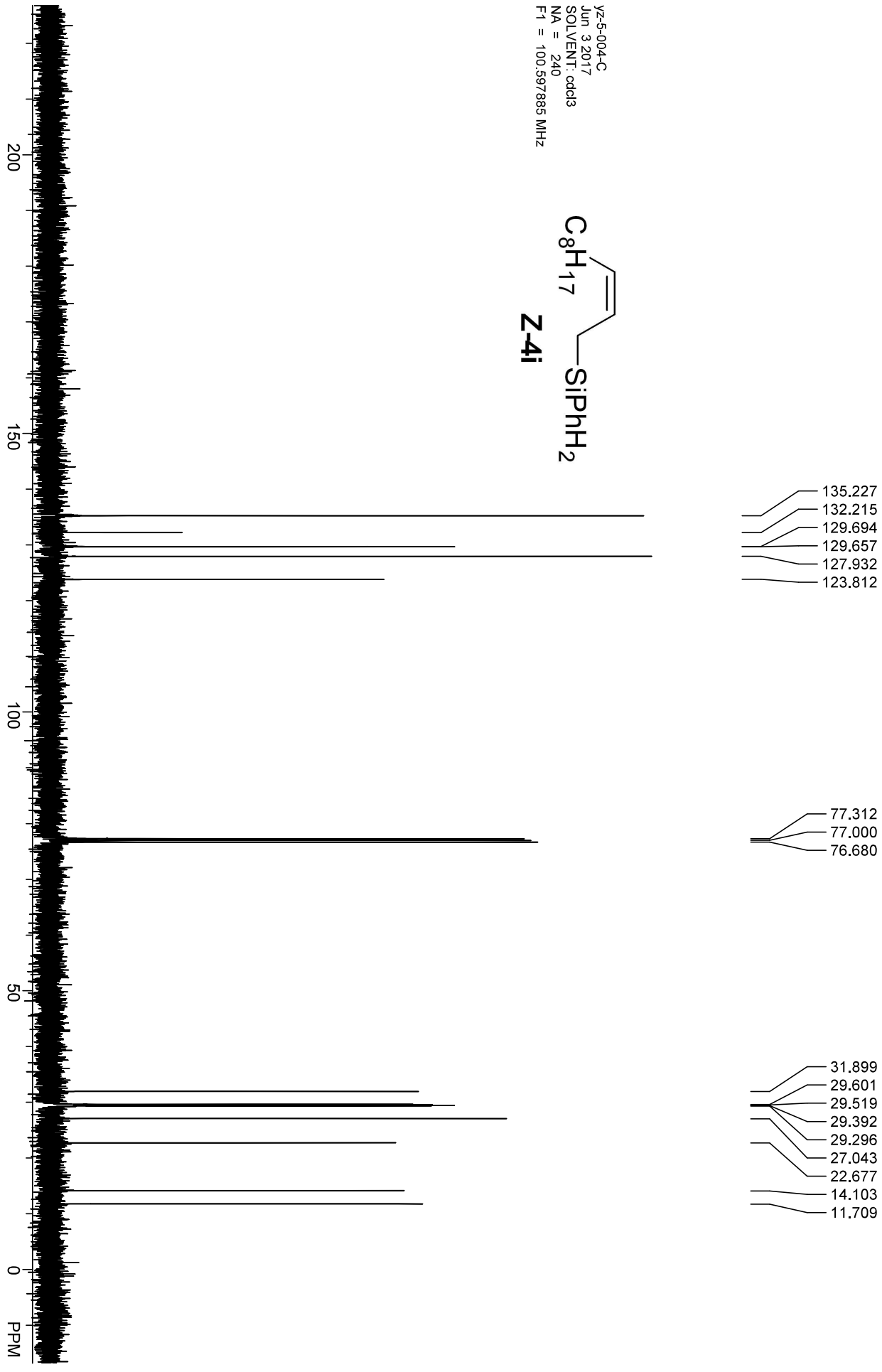

yz-4-147-H
Mar 27 2017
SOLVENT: CDCl3
NA = 8
F1 = 399.722809 MHz
5.89
3.02
1.91
0.98
1.00
1.00
0.05
1.83
0.05
2.09
SiPhH2
Z-4h
10
8
6
4
2
0
PPM

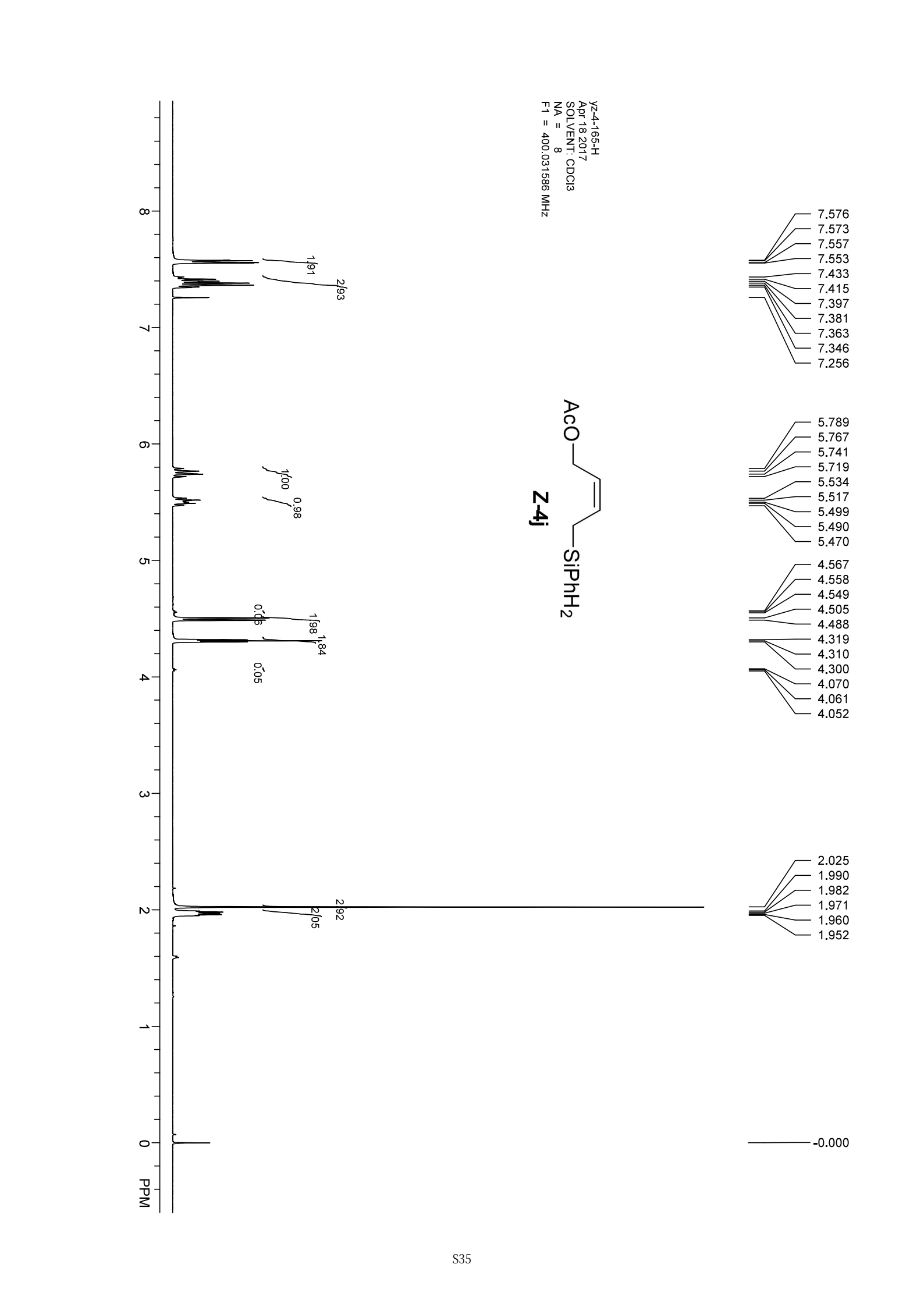

yz-4-147-C
Mar 27 2017
SOLVENT: cdcl3
NA = 40
F1 = 100.520737 MHz
Z-4h
SiPhH2
135.276
135.025
133.317
132.049
131.503
129.863
128.315
128.057
127.874
127.859
127.609
127.525
127.085
127.047
125.946
125.559
77.311
77.000
76.681
13.365
200
150
100
50
0
PPM

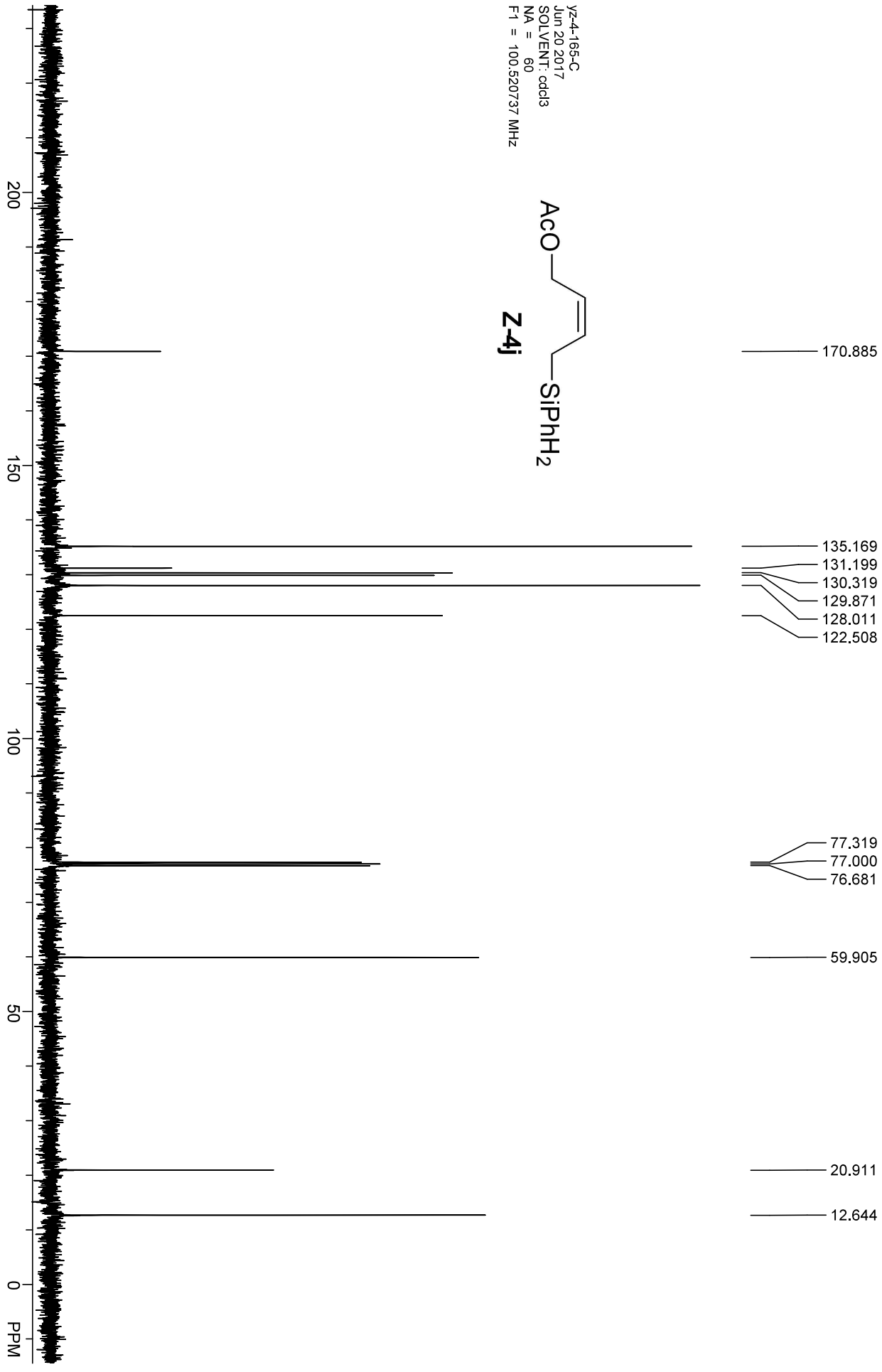

yz-4-175-H
Jun 20 2017
SOLVENT: CDCl3
NA = 8
F1 = 400.031616 MHz
C8H17
SiPhH2
Z-4i
7.584
7.567
7.412
7.396
7.379
7.367
7.350
7.333
7.251
5.475
5.453
5.429
5.408
5.367
5.350
5.332
5.329
5.323
5.305
4.541
4.531
4.521
4.294
4.286
4.277
4.049
4.039
4.031
1.952
1.938
1.921
1.875
1.866
1.855
1.541
1.250
0.897
0.881
0.864
-0.000
1.90
2.88
1.00
0.96
0.05
1.80
0.05
2.06
2.09
12.74
3.10
8
6
4
2
0
PPM

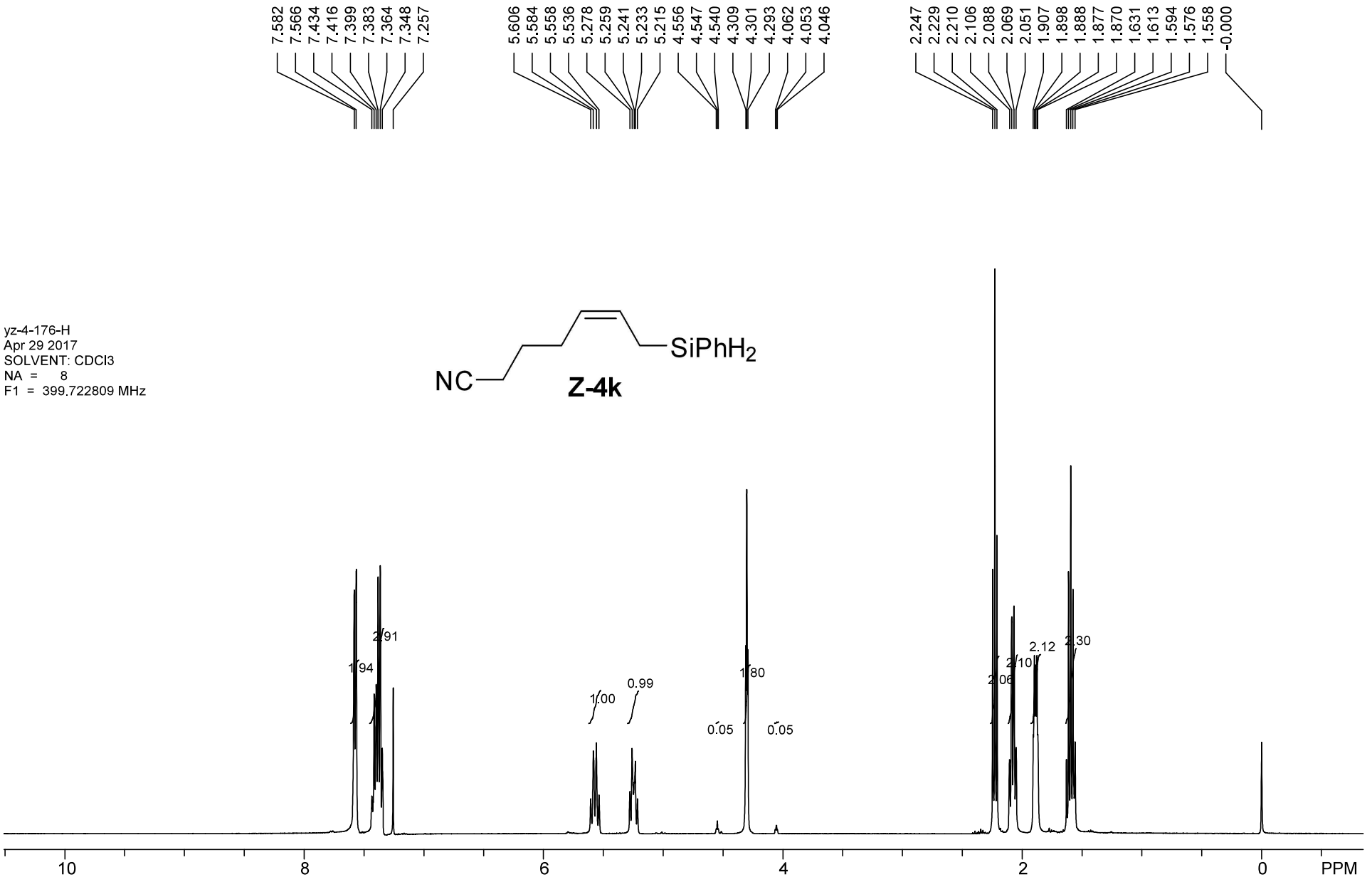

yz-4-175-C
Jun 20 2017
SOLVENT: cdcl3
NA = 240
F1 = 100.520737 MHz
C8H17
SiPhH2
Z-4i
135.222
132.209
129.689
129.651
127.928
123.806
77.319
77.000
76.681
31.895
29.602
29.511
29.390
29.299
27.036
22.679
14.101
11.710
200
150
100
50
0
PPM

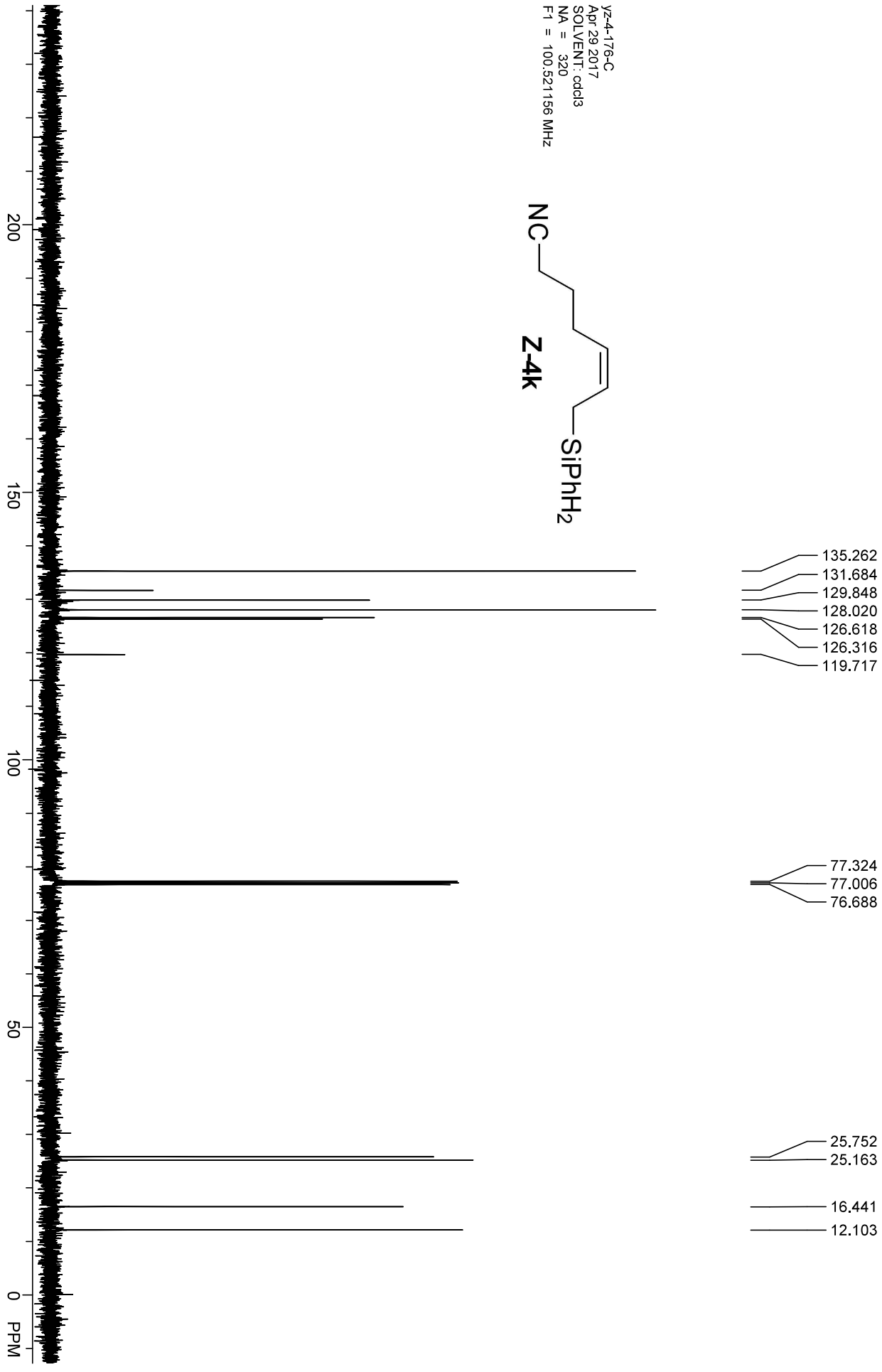

7.586
7.582
7.566
7.563
7.412
7.393
7.376
7.365
7.346
7.330
7.325
7.243
5.475
5.454
5.428
5.407
5.367
5.349
5.335
5.323
5.305
4.542
4.534
4.525
4.297
4.288
4.279
4.051
4.043
4.033
1.953
1.937
1.922
1.884
1.875
1.865
1.856
1.847
1.250
0.898
0.882
0.864
0.000
yz-5-004-H
Jun 20 2017
SOLVENT: CDCl3
NA = 4
F1 = 399.722412 MHz
C8H17
SiPhH2
Z-4i
12.66
2.93
1.95
1.00
1.01
1.82
0.05
0.05
2.04
2.05
3.10
15
10
5
0
PPM

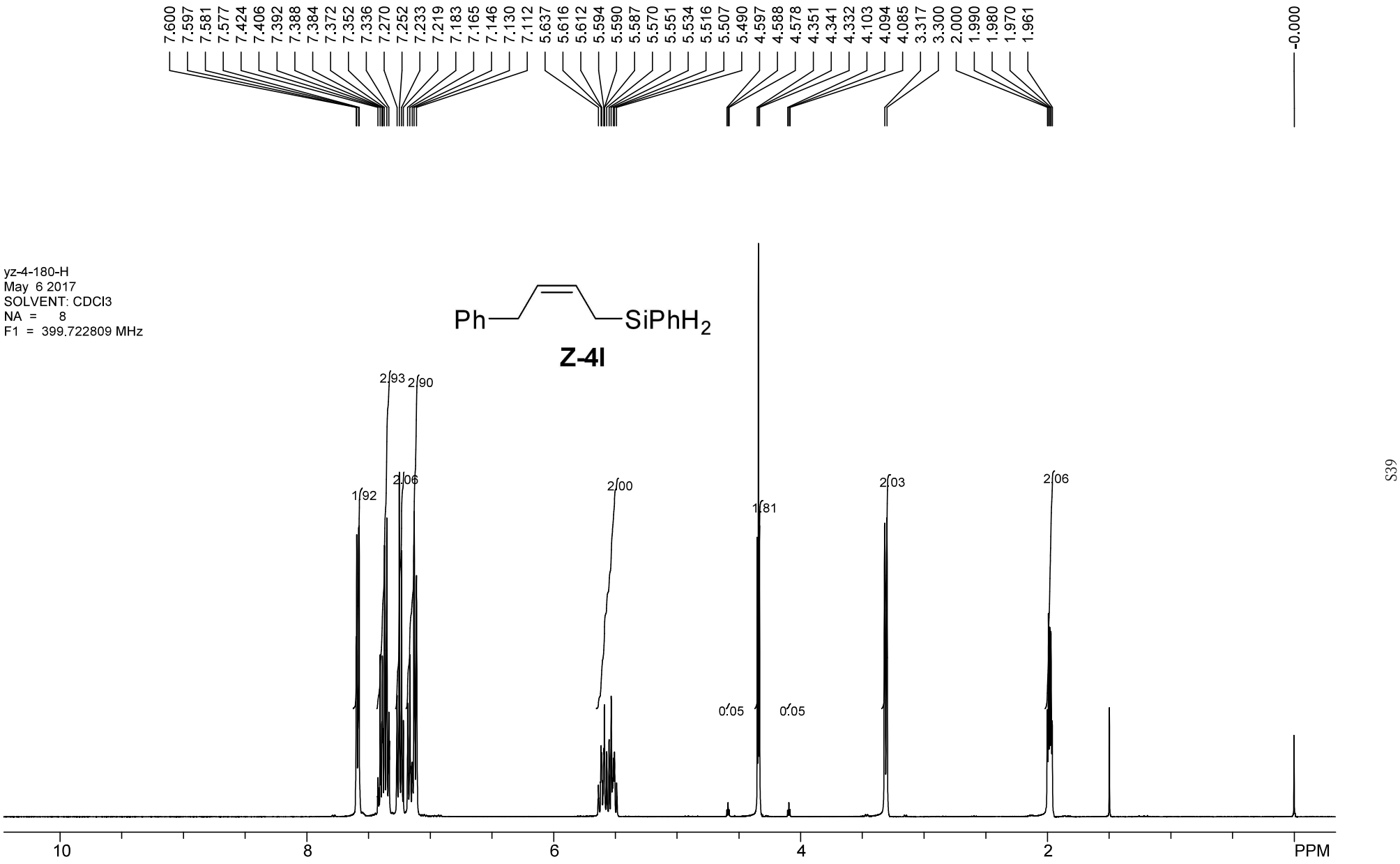

yz-5-004-C
Jun 3 2017
SOLVENT: cdcl3
NA = 240
F1 = 100.597885 MHz
C8H17
SiPhH2
Z-4i
200
150
100
50
0
PPM
135.227
132.215
129.694
129.657
127.932
123.812
77.312
77.000
76.680
31.899
29.601
29.519
29.392
29.296
27.043
22.677
14.103
11.709

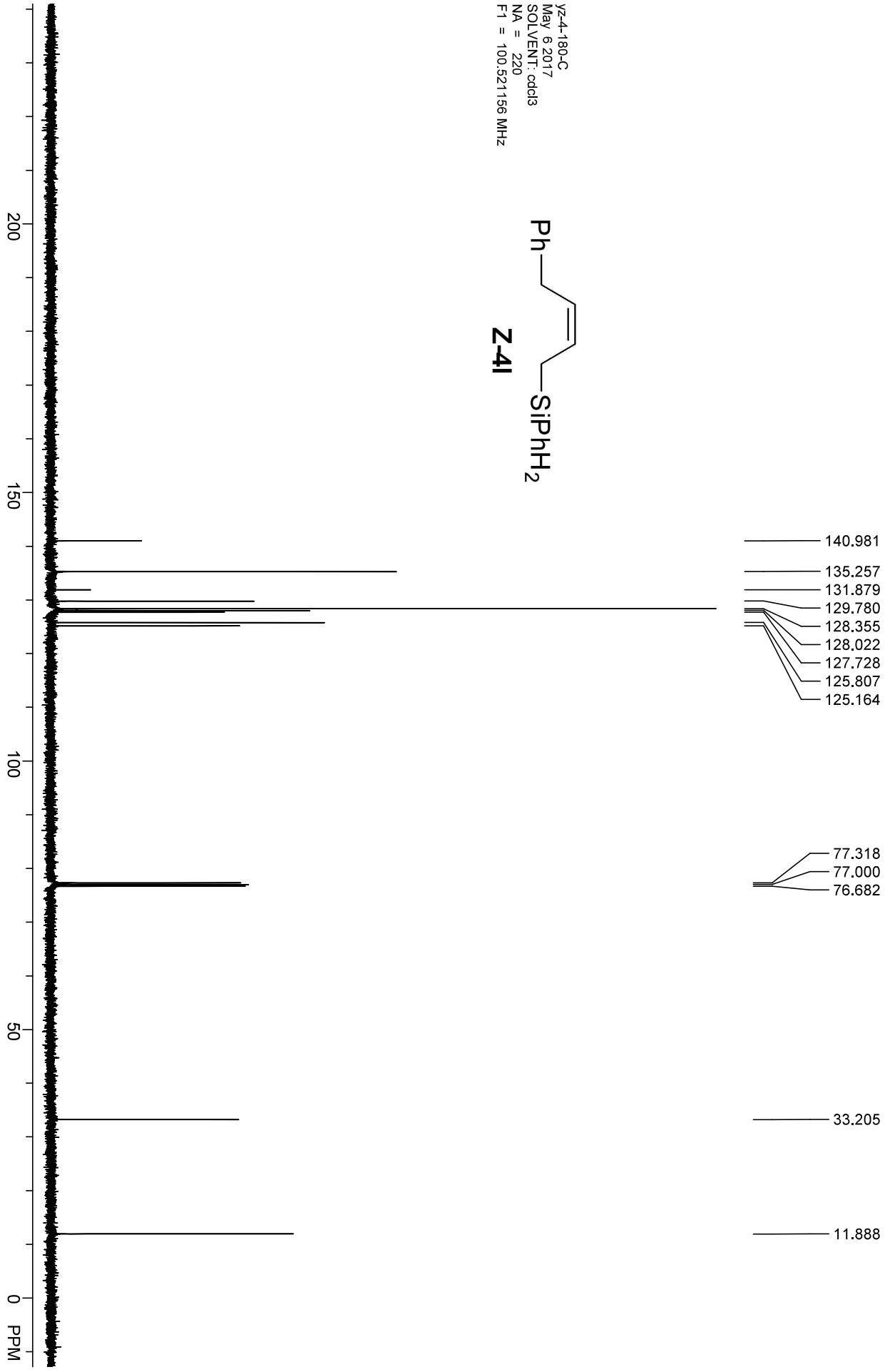

yz-4-165-H
Apr 18 2017
SOLVENT: CDCl3
NA = 8
F1 = 400.031586 MHz
AcO
SiPhH2
Z-4j
7.576
7.573
7.557
7.553
7.433
7.415
7.397
7.381
7.363
7.346
7.256
5.789
5.767
5.741
5.719
5.534
5.517
5.499
5.490
5.470
4.567
4.558
4.549
4.505
4.488
4.319
4.310
4.300
4.070
4.061
4.052
2.025
1.990
1.982
1.971
1.960
1.952
-0.000
1.91
2.93
1.00
0.98
0.06
1.98
1.84
0.05
2.92
2.05
PPM

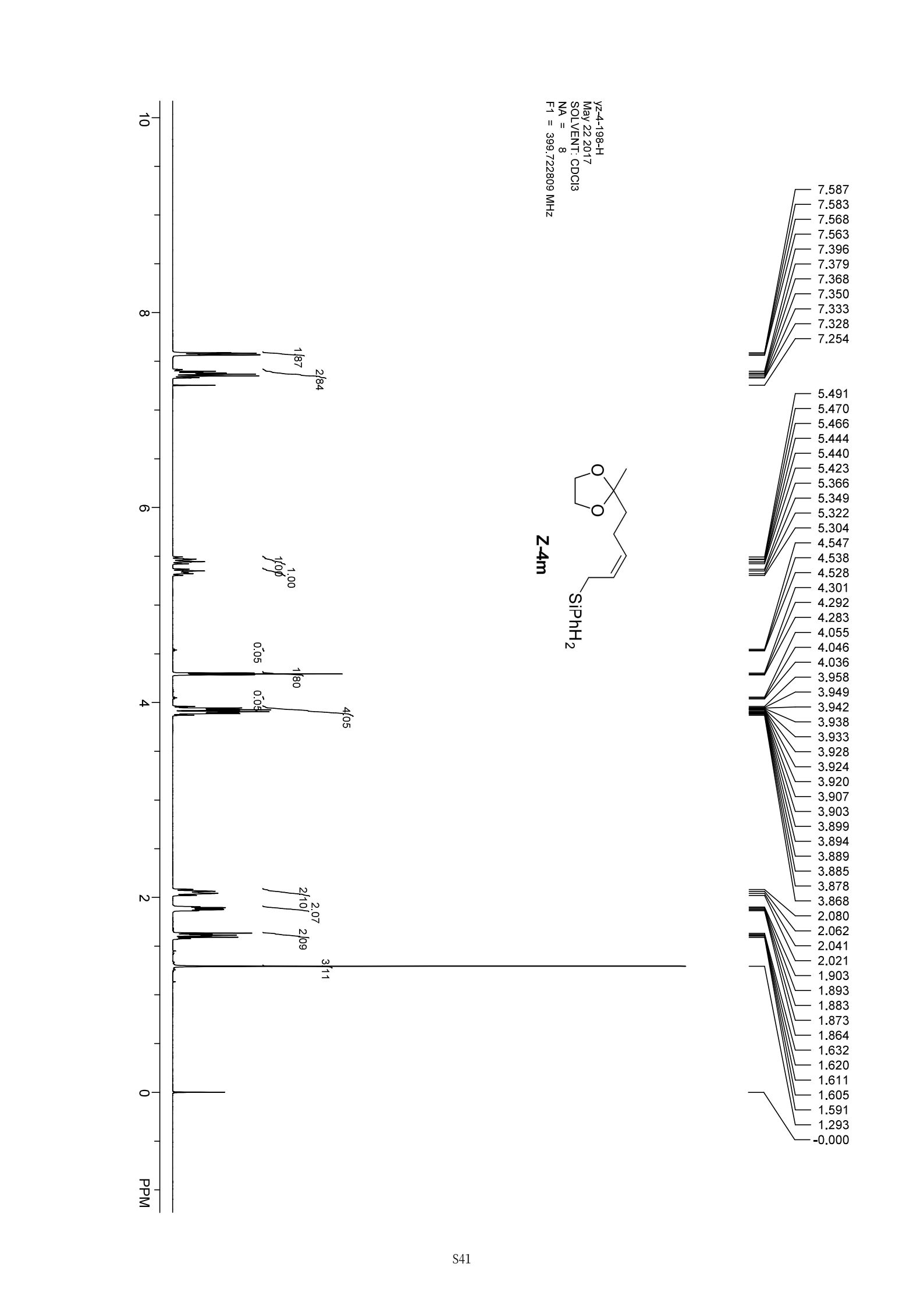

yz-4-165-C
Jun 20 2017
SOLVENT: cdcl3
NA = 60
F1 = 100.520737 MHz
AcO
SiPhH2
Z-4j
170.885
135.169
131.199
130.319
129.871
128.011
122.508
77.319
77.000
76.681
59.905
20.911
12.644
200
150
100
50
0
PPM

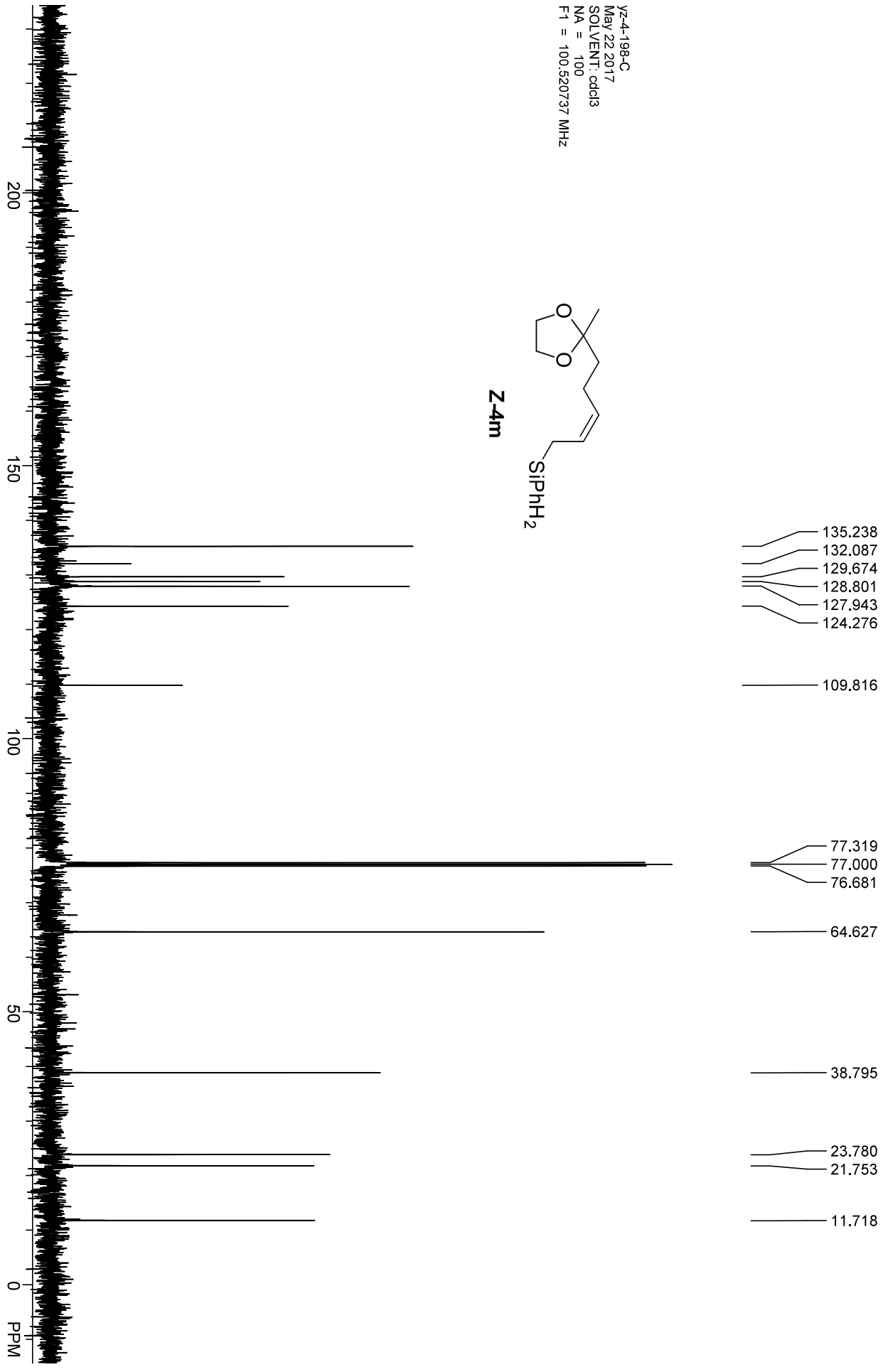

7.582
7.566
7.434
7.416
7.399
7.383
7.364
7.348
7.257
5.606
5.584
5.558
5.536
5.278
5.259
5.241
5.233
5.215
4.556
4.547
4.540
4.309
4.301
4.293
4.062
4.053
4.046
2.247
2.229
2.210
2.106
2.088
2.069
2.051
1.907
1.898
1.888
1.877
1.870
1.631
1.613
1.594
1.576
1.558
0.000
yz-4-176-H
Apr 29 2017
SOLVENT: CDCl3
NA = 8
F1 = 399.722809 MHz
NC
SiPhH2
Z-4k
1.94
2.91
1.00
0.99
0.05
1.80
0.05
2.06
2.10
2.12
2.30
10
8
6
4
2
0
PPM

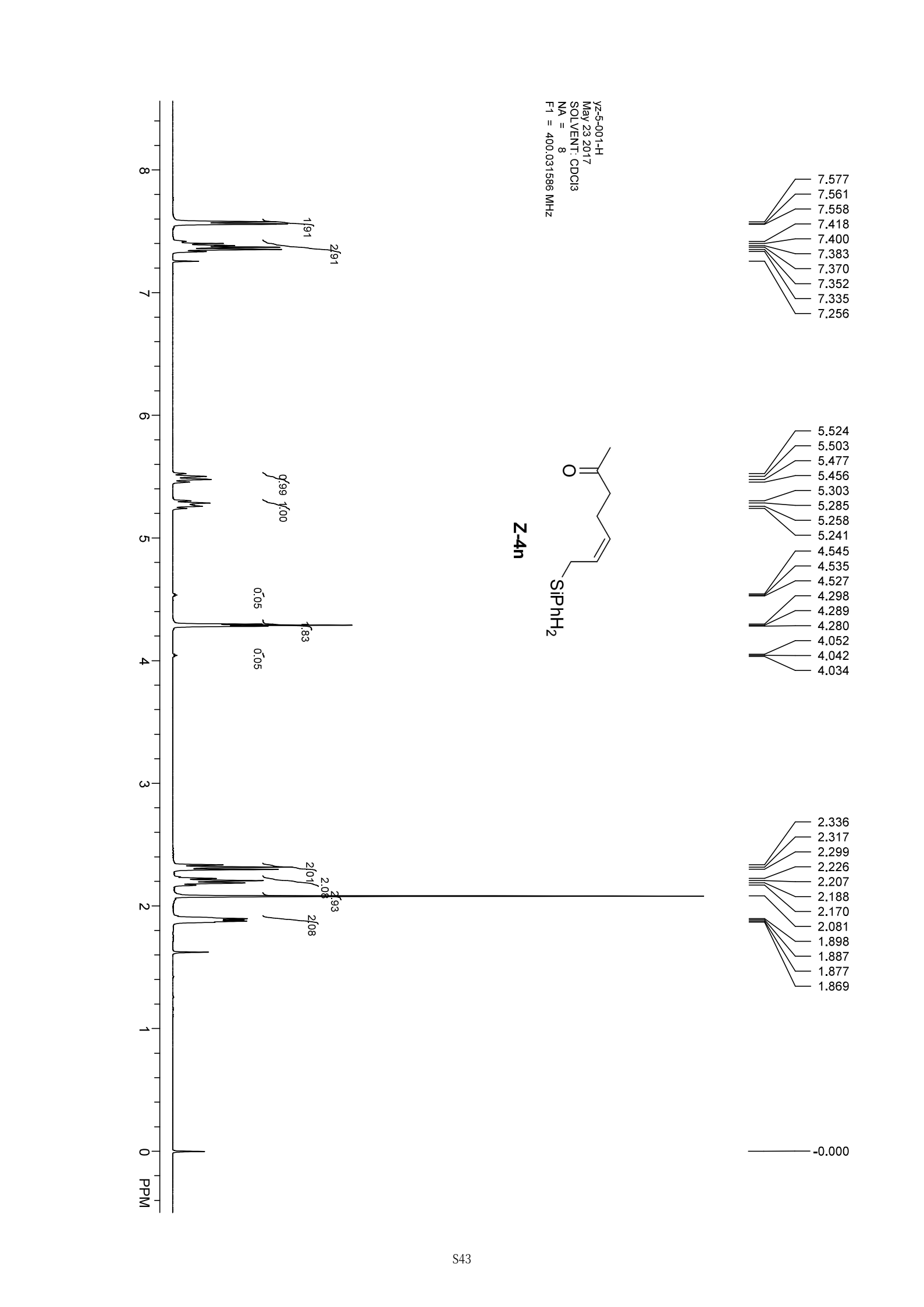

yz-4-176-C
Apr 29 2017
SOLVENT: cdcl3
NA = 320
F1 = 100.521156 MHz
NC
SiPhH2
Z-4k
135.262
131.684
129.848
128.020
126.618
126.316
119.717
77.324
77.006
76.688
25.752
25.163
16.441
12.103
200
150
100
50
0
PPM

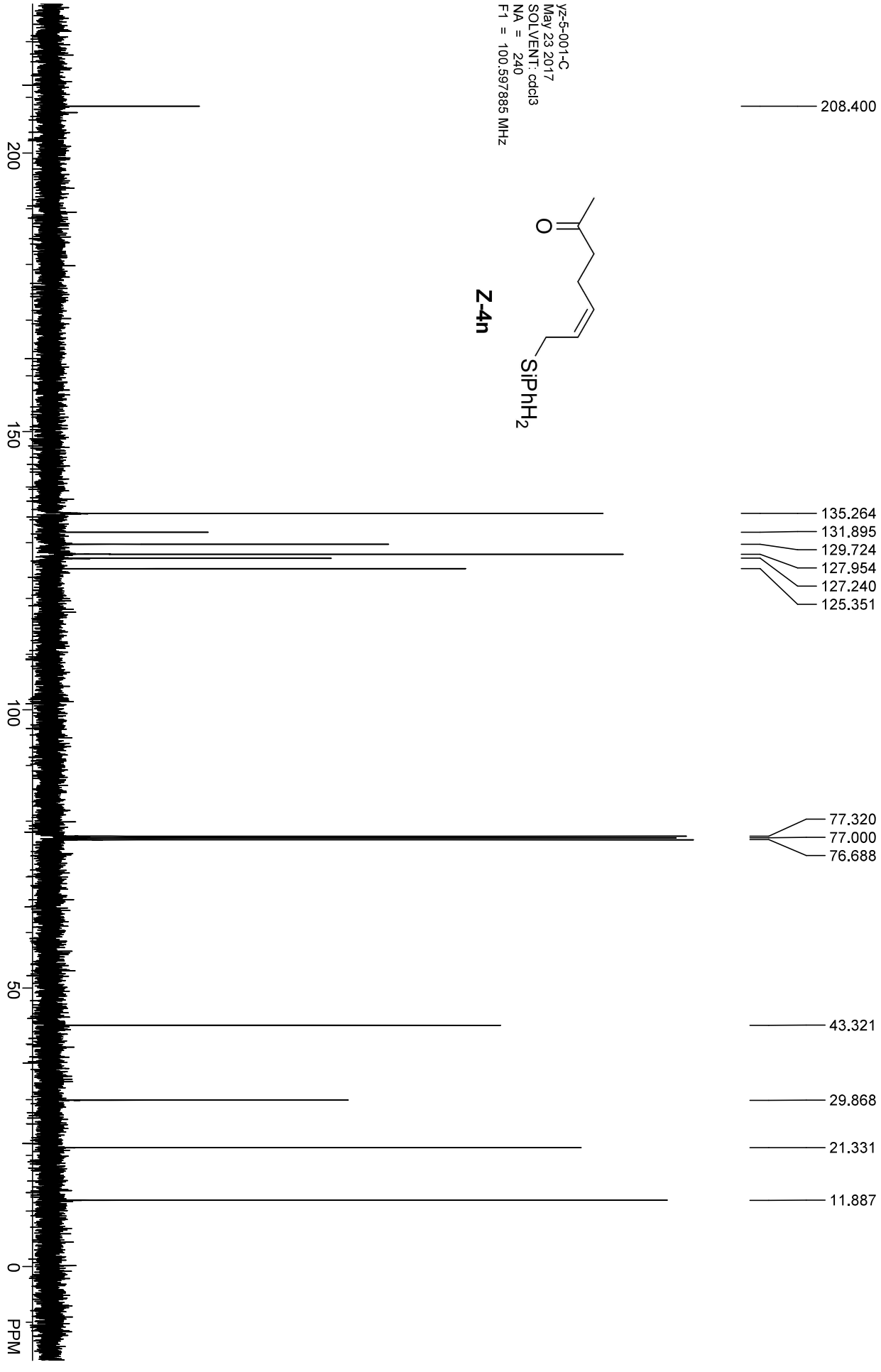

7.600
7.597
7.581
7.577
7.424
7.406
7.392
7.388
7.384
7.372
7.352
7.336
7.270
7.252
7.233
7.219
7.183
7.165
7.146
7.130
7.112
5.637
5.616
5.612
5.594
5.590
5.587
5.570
5.551
5.534
5.516
5.507
5.490
4.597
4.588
4.578
4.351
4.341
4.332
4.103
4.094
4.085
3.317
3.300
2.000
1.990
1.980
1.970
1.961
0.000
yz-4-180-H
May 6 2017
SOLVENT: CDCl3
NA = 8
F1 = 399.722809 MHz
Ph
SiPhH2
Z-4l
1.92
2.93
2.90
2.06
2.00
0.05
1.81
0.05
2.03
2.06
10
8
6
4
2
PPM

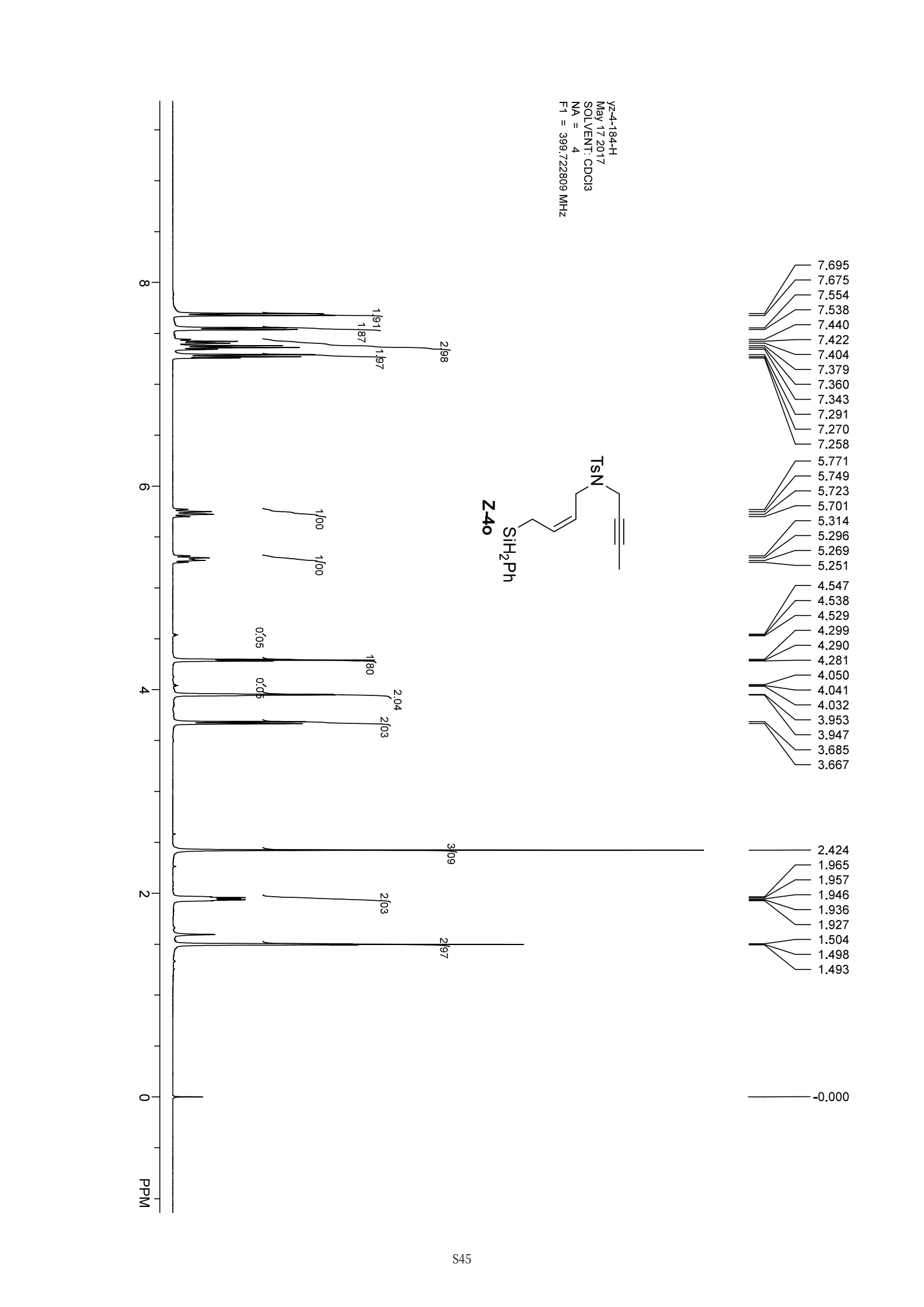

yz-4-180-C
May 6 2017
SOLVENT: cdcl3
NA = 220
F1 = 100.521156 MHz
Ph
SiPhH2
Z-4l
140.981
135.257
131.879
129.780
128.355
128.022
127.728
125.807
125.164
77.318
77.000
76.682
33.205
11.888
200
150
100
50
0
PPM

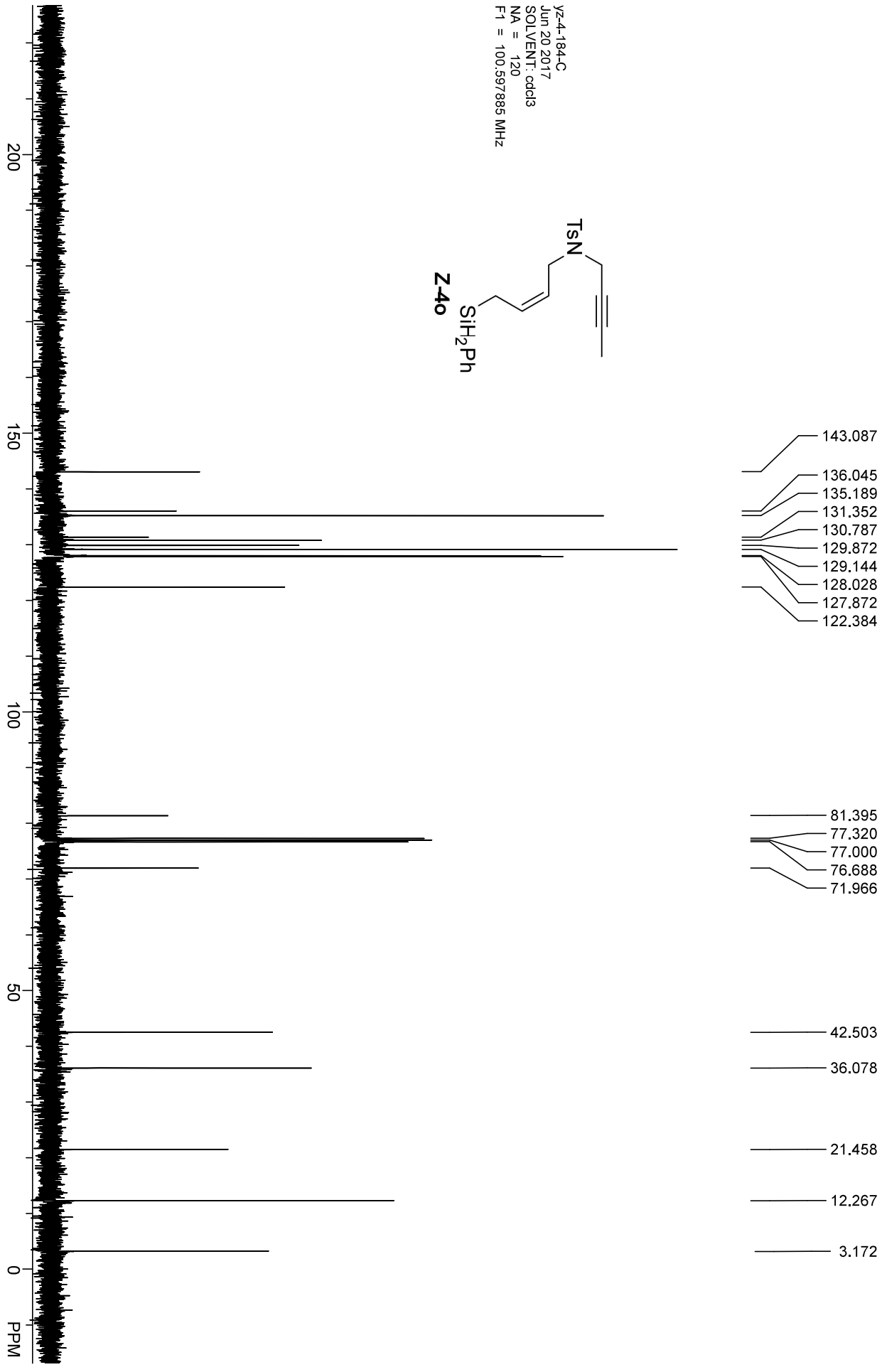

yz-4-198-H
May 22 2017
SOLVENT: CDCl3
NA = 8
F1 = 399.722809 MHz
Z-4m
SiPhH2
7.587
7.583
7.568
7.563
7.396
7.379
7.368
7.350
7.333
7.328
7.254
5.491
5.470
5.466
5.444
5.440
5.423
5.366
5.349
5.322
5.304
4.547
4.538
4.528
4.301
4.292
4.283
4.055
4.046
4.036
3.958
3.949
3.942
3.938
3.933
3.928
3.924
3.920
3.907
3.903
3.899
3.894
3.889
3.885
3.878
3.868
2.080
2.062
2.041
2.021
1.903
1.893
1.883
1.873
1.864
1.632
1.620
1.611
1.605
1.591
1.293
-0.000
1.87
2.84
1.00
1.00
0.05
1.80
0.05
4.05
2.10
2.07
2.09
3.11
10
8
6
4
2
0
PPM

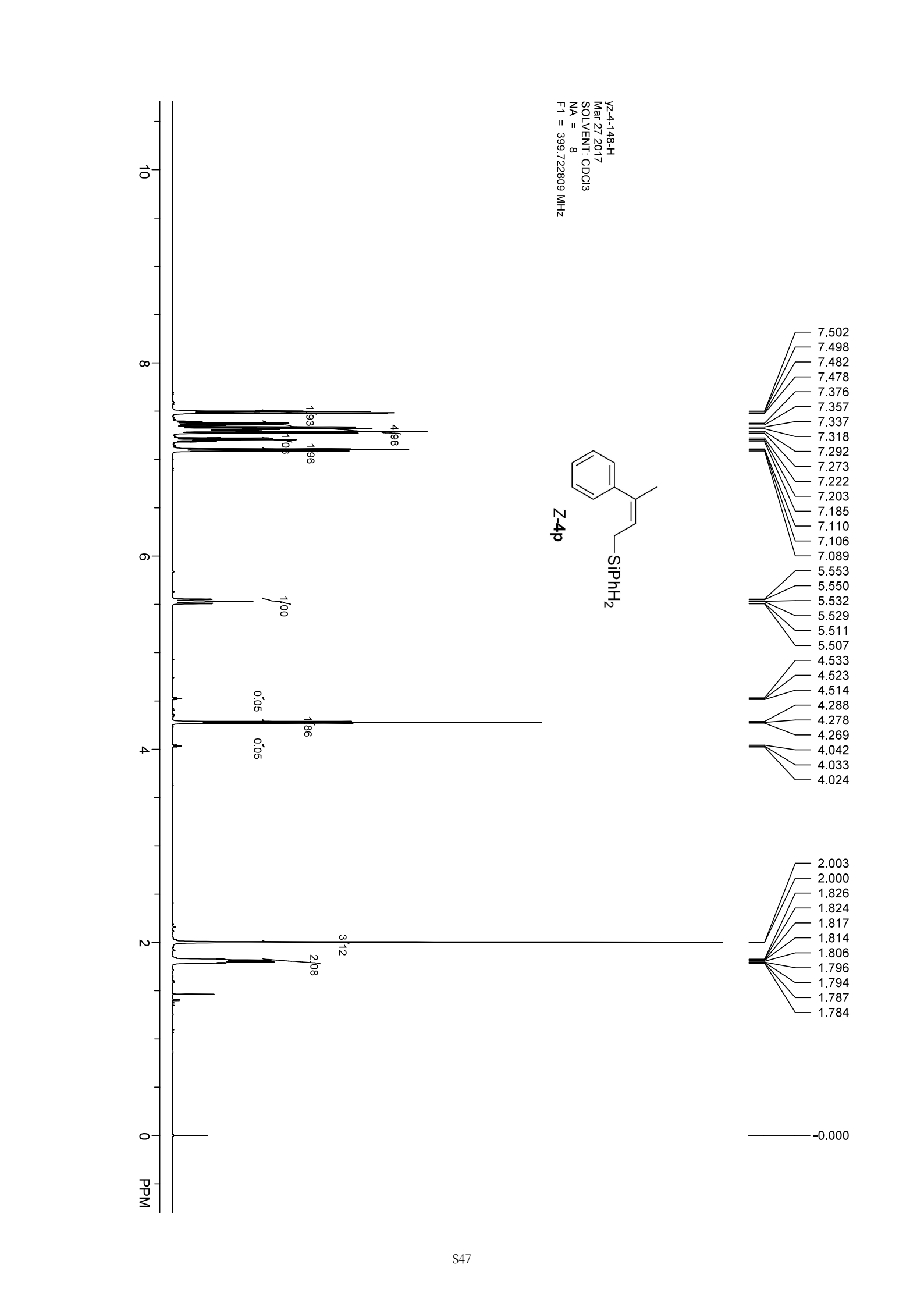

yz-4-198-C
May 22 2017
SOLVENT: cdcl3
NA = 100
F1 = 100.520737 MHz
Z-4m
SiPhH2
135.238
132.087
129.674
128.801
127.943
124.276
109.816
77.319
77.000
76.681
64.627
38.795
23.780
21.753
11.718
200
150
100
50
0
PPM


yz-5-001-H
May 23 2017
SOLVENT: CDCl3
NA = 8
F1 = 400.031586 MHz
Z-4n
SiPhH2
7.577
7.561
7.558
7.418
7.400
7.383
7.370
7.352
7.335
7.256
5.524
5.503
5.477
5.456
5.303
5.285
5.258
5.241
4.545
4.535
4.527
4.298
4.289
4.280
4.052
4.042
4.034
2.336
2.317
2.299
2.226
2.207
2.188
2.170
2.081
1.898
1.887
1.877
1.869
-0.000
PPM


yz-5-001-C
May 23 2017
SOLVENT: cdcl3
NA = 240
F1 = 100.597885 MHz
Z-4n
O
SiPhH2
208.400
135.264
131.895
129.724
127.954
127.240
125.351
77.320
77.000
76.688
43.321
29.868
21.331
11.887
200
150
100
50
0
PPM


yz-4-184-H
May 17 2017
SOLVENT: CDCl3
NA = 4
F1 = 399.722809 MHz
TsN
SiH2Ph
Z-4o
7.695
7.675
7.554
7.538
7.440
7.422
7.404
7.379
7.360
7.343
7.291
7.270
7.258
5.771
5.749
5.723
5.701
5.314
5.296
5.269
5.251
4.547
4.538
4.529
4.299
4.290
4.281
4.050
4.041
4.032
3.953
3.947
3.685
3.667
2.424
1.965
1.957
1.946
1.936
1.927
1.504
1.498
1.493
-0.000
1.91
1.87
1.97
2.98
1.00
1.00
0.05
0.05
1.80
2.04
2.03
3.09
2.03
2.97
8
6
4
2
0
PPM


yz-4-184-C
Jun 20 2017
SOLVENT: cdcl3
NA = 120
F1 = 100.597885 MHz
TsN
SiH2Ph
Z-4o
200
150
100
50
0
PPM
143.087
136.045
135.189
131.352
130.787
129.872
129.144
128.028
127.872
122.384
81.395
77.320
77.000
76.688
71.966
42.503
36.078
21.458
12.267
3.172


yz-4-148-H
Mar 27 2017
SOLVENT: CDCl3
NA = 8
F1 = 399.722809 MHz
Z-4p
SiPhH2
7.502
7.498
7.482
7.478
7.376
7.357
7.337
7.318
7.292
7.273
7.222
7.203
7.185
7.110
7.106
7.089
5.553
5.550
5.532
5.529
5.511
5.507
4.533
4.523
4.514
4.288
4.278
4.269
4.042
4.033
4.024
2.003
2.000
1.826
1.824
1.817
1.814
1.806
1.796
1.794
1.787
1.784
-0.000
1.93
4.98
1.05
1.96
1.00
0.05
1.86
0.05
3.12
2.08
10
8
6
4
2
0
PPM

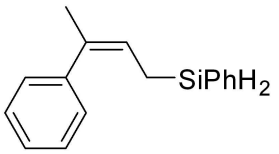
yz-4-148-NOESY

Sample Name:
yz-4-148-NOESY
Data Collected on:
OMC-NMR600-vnmrs600
Archive directory:
/home/omc/vnmrsys/data
Sample directory:
yz-4-148-NOESY_20170518_01
FidFile: NOESY_01

Pulse Sequence: NOESY
Solvent: cdcl3
Data collected on: May 18 2017

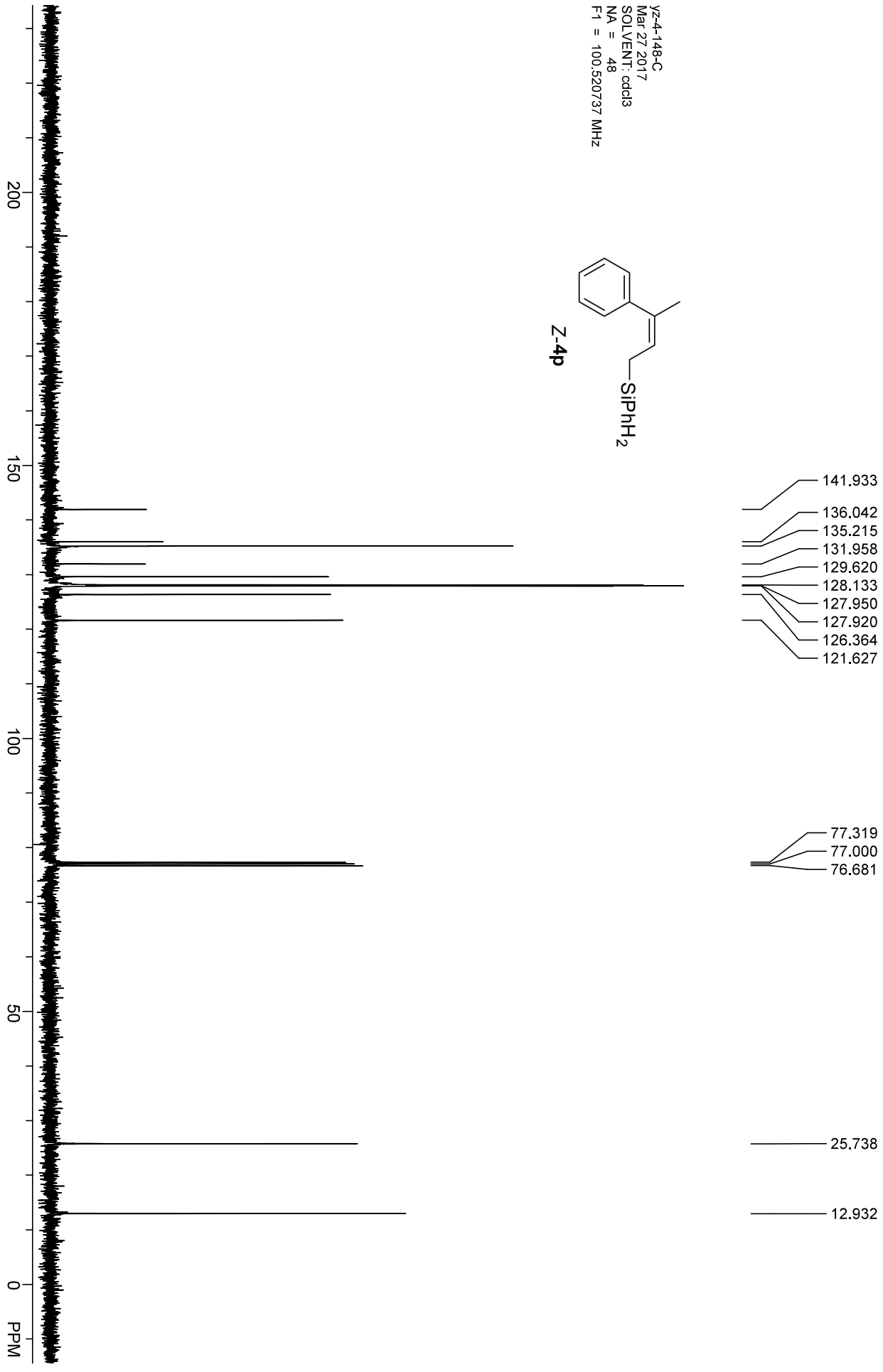
Temp. 25.0 C / 298.1 K
Operator: omc

Relax. delay 1.500 sec
Acq. time 0.262 sec
Width 7716.0 Hz
2D Width 7716.0 Hz
8 repetitions
2 x 128 increments
OBSERVE H1, 599.7751422 MHz
DATA PROCESSING
Line broadening 5.0 Hz
Gauss apodization 0.097 sec
F1 DATA PROCESSING
Gauss apodization 0.012 sec
FT size 4096 x 4096
Total time 1 hr, 19 min



Z-**4p**

Plotname: --Not assigned--


yz-4-148-C
Mar 27 2017
SOLVENT: cdcl3
NA = 48
F1 = 100.520737 MHz
Z-4p
SiPhH2
141.933
136.042
135.215
131.958
129.620
128.133
127.950
127.920
126.364
121.627
77.319
77.000
76.681
25.738
12.932
200
150
100
50
0
PPM