Supporting Information

Retention or Inversion in Stereospecific Nickel-Catalyzed Cross-Coupling of Benzylic Carbamates with Arylboronic Esters: Control of Absolute Stereochemistry with an Achiral Catalyst

Michael R. Harris,[†] Luke E. Hanna,[†] Margaret A. Greene,[†] Curtis E. Moore,[‡] Elizabeth R. Jarvo[†]

[†]*Department of Chemistry, 1102 Natural Sciences II, University of California, Irvine, CA 92697*
[‡]*Department of Chemistry and Biochemistry, University of California, San Diego, 9500 Gilman Drive, MC 0358, La Jolla, California 92093-0358*

I. General Procedures

All reactions were carried out under an atmosphere of N_2, or Ar when noted. All glassware was oven- or flame-dried prior to use. Tetrahydrofuran (THF), diethyl ether (Et_2O), dichloromethane (CH_2Cl_2), and toluene (PhMe) were degassed with Ar and then passed through two 4 x 36 inch columns of anhydrous neutral A-2 alumina (8 x 14 mesh; LaRoche Chemicals; activated under a flow of argon at 350 ºC for 12 h) to remove H_2O. All other solvents utilized were purchased "anhydrous" commercially, or purified as described. ^{1}H NMR spectra were recorded on Bruker DRX-400 (400 MHz ^{1}H, 100 MHz ^{13}C, 376.5 MHz ^{19}F), GN-500 (500 MHz ^{1}H, 125.7 MHz ^{13}C), or CRYO-500 (500 MHz ^{1}H, 125.7 MHz ^{13}C) spectrometers. Proton chemical shifts are reported in ppm (δ) relative to internal tetramethylsilane (TMS, δ 0.00). Data are reported as follows: chemical shift (multiplicity [singlet (s), broad singlet (br s), doublet (d), doublet of doublets (dd), triplet (t), doublet of triplets (dt), doublet of doublet of triplets (ddt), triplet of

triplets (tt), quartet (q), multiplet (m)], coupling constants [Hz], integration). Carbon chemical shifts are reported in ppm (δ) relative to TMS with the respective solvent resonance as the internal standard ($CDCl_3$, δ 77.16 ppm). Unless otherwise indicated, NMR data were collected at 25 ºC. Infrared (IR) spectra were obtained on a Perkin-Elmer Spectrum 1000 FT-IR Systems and are reported in terms of frequency of absorption (cm^{-1}). Analytical thin-layer chromatography (TLC) was performed using Silica Gel 60 F_{254} precoated plates (0.25 mm thickness). Visualization was accomplished by irradiation with a UV lamp and/or staining with $KMnO_4$, ceric ammonium molybdate (CAM), or *p*-anisaldehyde (PAA) solutions. Flash chromatography was performed using Silica Gel 60 (170-400 mesh) from Fisher Scientific. Melting points (m.p.) were obtained using a Mel-Temp melting point apparatus and are uncorrected. Optical rotations were measured on a Rudolph Research Analytical Autopol IV Automatic Polarimeter. SFC determinations of enantiopurity were performed on a Berger Analytical instrument using a Daicel™ Chiralpak® column (OD-H, OJ-H, or AD-H; 100 bar, 50 °C, 215 nm). High resolution mass spectrometry was performed by the University of California, Irvine Mass Spectrometry Center.

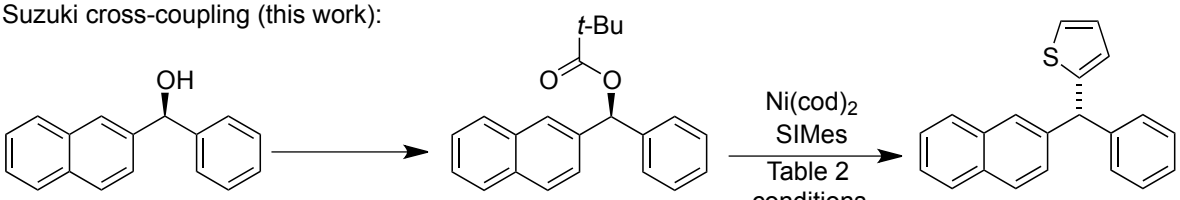
Boronic esters were prepared from the corresponding boronic acids and 2,2-dimethylpropane-1,3-diol.[1] Boronic acids were generously donated from Frontier, stored at 4 ^oC, and used as received. 1,8-bis(1,5-cyclooctadiene)nickel was purchased from Strem, stored in a glovebox freezer (–20 °C) under an atmosphere of N_2, and used as received. Tricyclohexylphosphine (PCy_3), (1,3-Bis(2,6-diisopropylphenyl)-4,5-dihydroimidazoliumtetrafluoroborate (SIMes), and tris(di-benzylideneacetone)dipalladium ($Pd_2(dba)_3$) were purchased from Strem, stored in a glovebox, and used as received. All other reagents were purchased commercially and used as received.

II. Catalyst controlled retention or inversion

A. Demonstration of stereochemical course of cross-coupling reaction

Scheme SI1. Optical rotation compared to literature data from crystal structure.

a. Suzuki cross-coupling (this work):

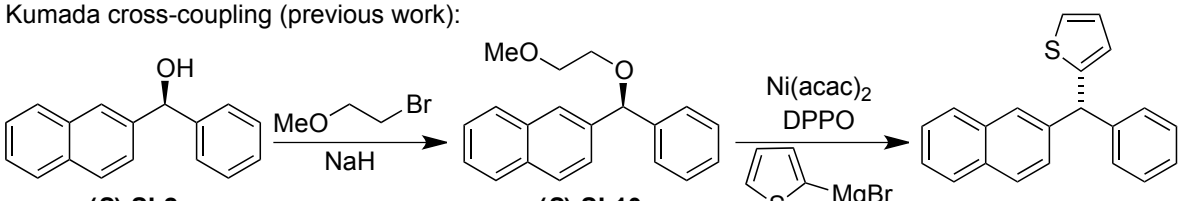


(*S*)-SI-2
$[\alpha]^{23}_D$ = +7.8
$[\alpha]^{20}_D$ = +11.2 (Ref. 2)

(*S*)-4

(*R*)-SI-9
$[\alpha]^{23}_D$ = –9.3

b. Kumada cross-coupling (previous work):



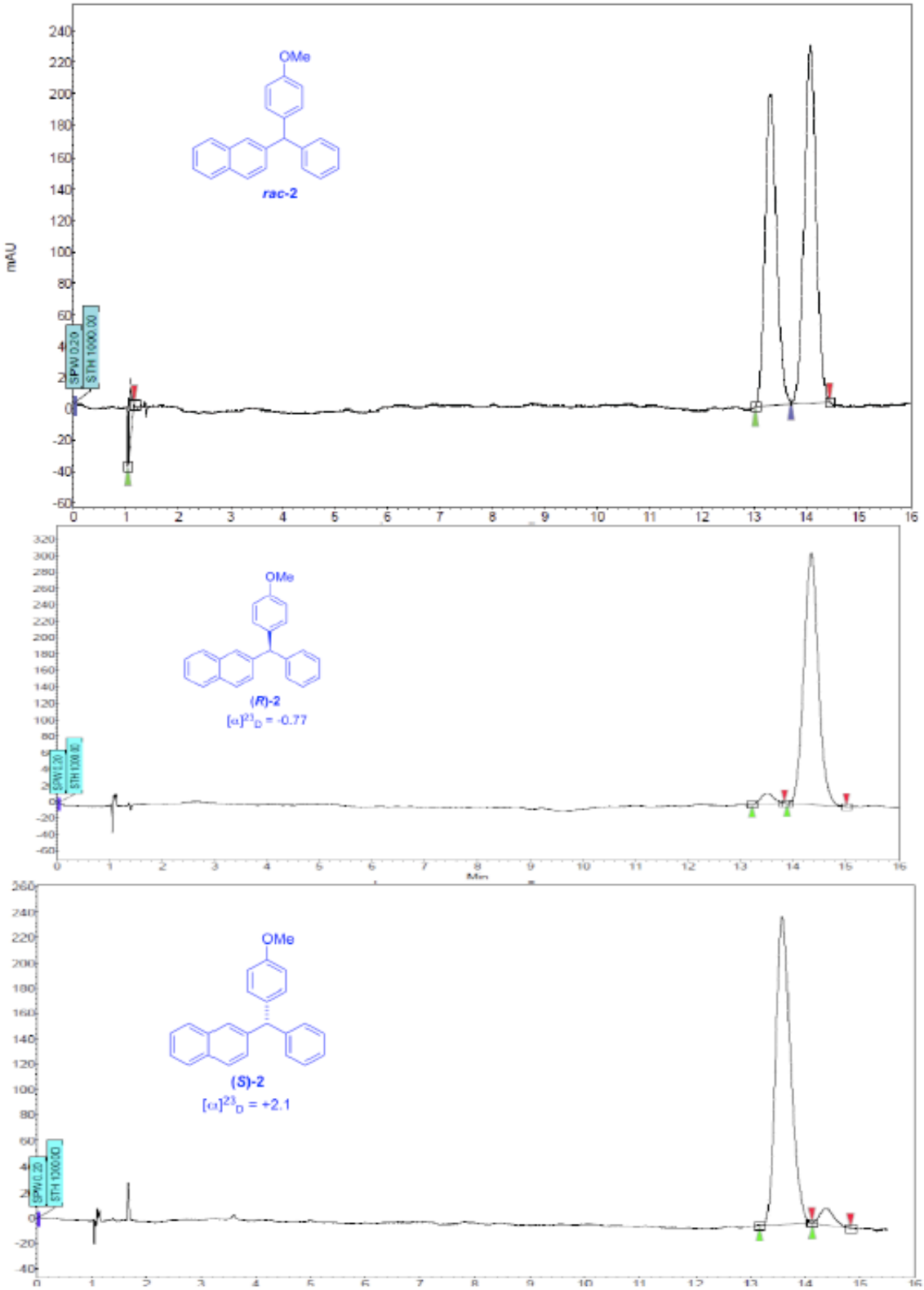
(*S*)-SI-2
$[\alpha]^{23}_D$ = +7.8
$[\alpha]^{20}_D$ = +11.2 (Ref. 2)

(*S*)-SI-10

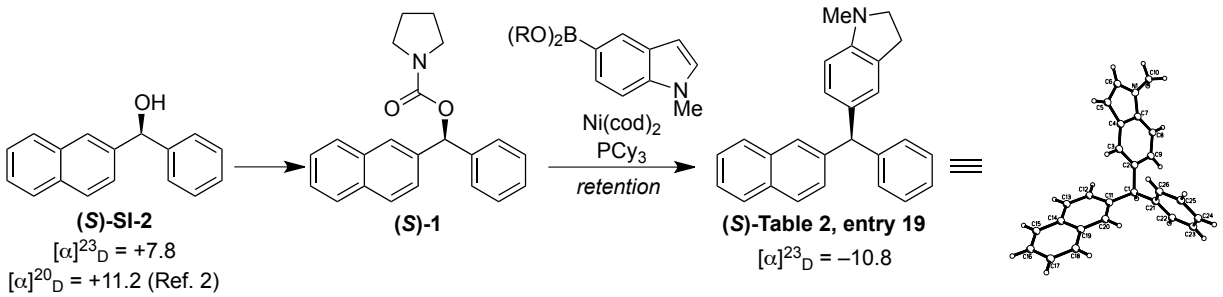
(*R*)-SI-9
$[\alpha]^{23}_D$ = –4.5 (Ref. 3)

Enantioenriched alcohol **(*S*)-SI-2** was prepared by asymmetric arylation using catalytic methyl (*S*)-(1-tritylaziridin-2-yl)diphenylmethanol (vida infra) and was assigned as the (*S*)-enantiomer by comparison of the optical rotation to the literature value.[2] Conversion to compound **(*S*)-4**, followed by stereospecific cross-coupling produced **(*R*)-SI-9**, which was assigned as the (*R*)-enantiomer by comparison of the optical rotation to the literature value.[3] This product corresponds to net inversion at the benzylic carbon during the cross-coupling reaction. In our previous work, we demonstrated that cross-coupling of Grignard reagents also results in inversion at the benzylic carbon[3] and assigned the absolute configuration of **(*R*)-SI-9** based on X-ray crystallographic analysis. The SFC traces of the products formed from the two different methods are shown below.

SFC traces (complete SFC data can be found in section X):



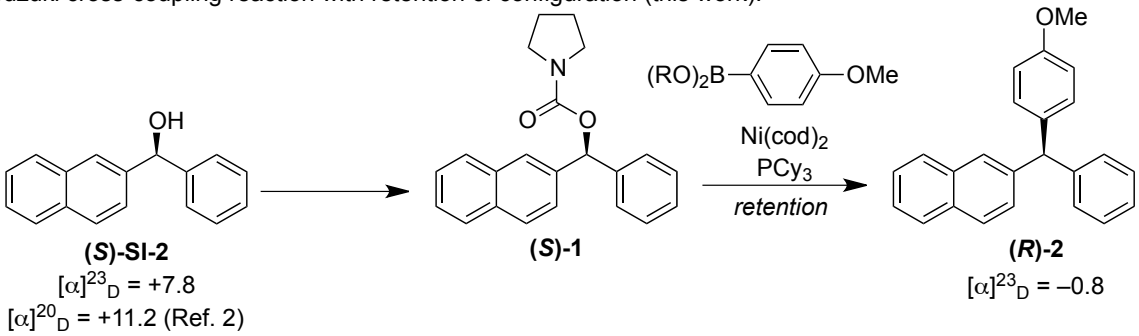
Scheme SI2. Synthesis of **(*S*)-Table 2, entry 19** as confirmed by X-ray crystallography.



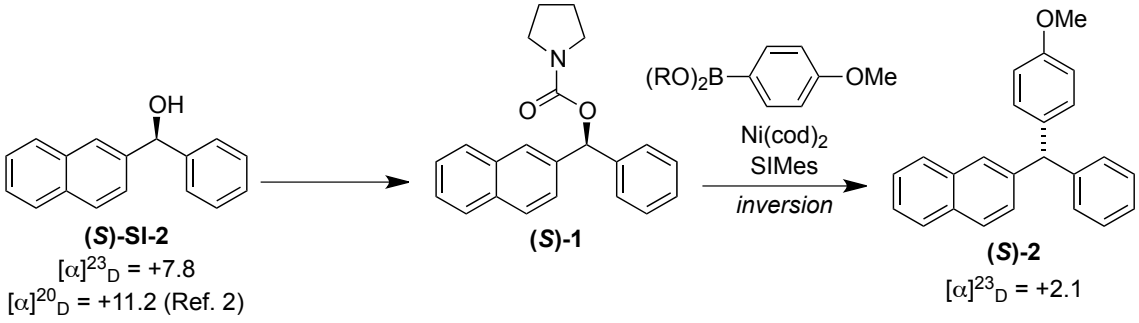
Enantioenriched alcohol **(*S*)-SI-2** was prepared by asymmetric arylation using catalytic methyl (*S*)-(1-tritylaziridin-2-yl)diphenylmethanol (vida infra) and was assigned as the (*S*)-enantiomer by comparison of the optical rotation to the literature value.[2] Conversion to compound **(*S*)-1**, followed by Suzuki cross-coupling using a nickel catalyst and phosphine ligand (Scheme SI2), produced product **(*S*)-Table 2, entry 19**, which was assigned as the (*S*)-enantiomer by X-ray crystallography. See section VIII for crystallographic data.

Scheme SI3. Selective synthesis of each enantiomer of product using different catalysts.

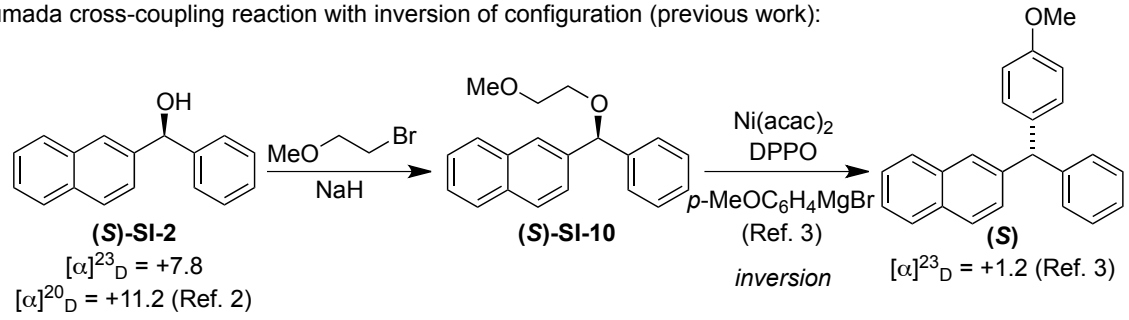
a. Suzuki cross-coupling reaction with retention of configuration (this work):



b. Suzuki cross-coupling reaction with inversion of configuration (this work):

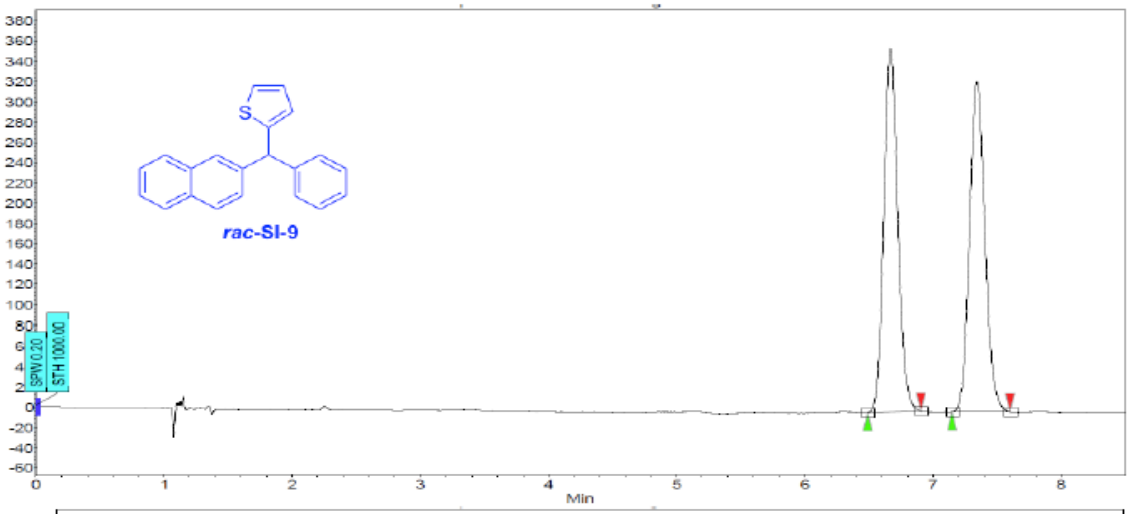


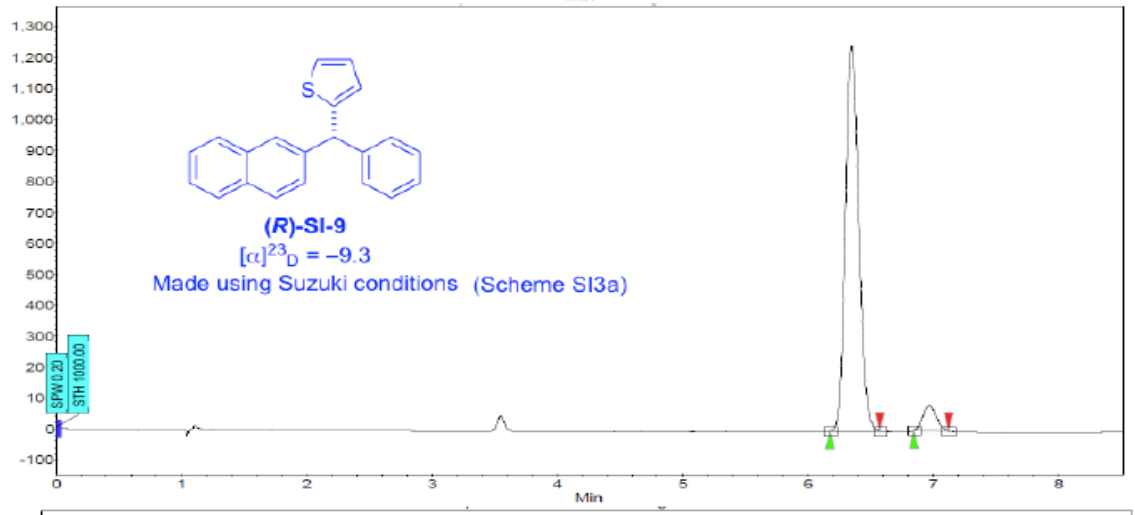
c. Kumada cross-coupling reaction with inversion of configuration (previous work):

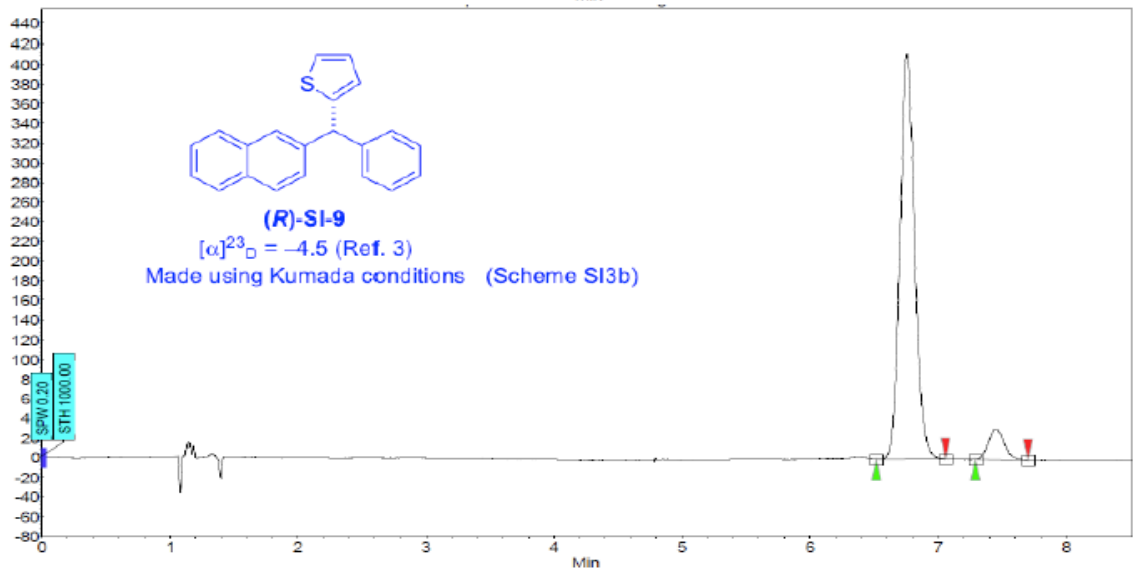


Enantioenriched alcohol **(*S*)-SI-2** was prepared by asymmetric arylation using catalytic (*S*)-(1-tritylaziridin-2-yl)diphenylmethanol (vida infra) and was assigned as the (*S*)-enantiomer by comparison of the optical rotation to the literature value.[2] Conversion to compound **(*S*)-1**, followed by Suzuki cross-coupling using a nickel catalyst and phosphine ligand (Scheme SI3a), produced product **(*R*)-2**, which was assigned as the (*R*)-enantiomer by comparison of the optical rotation to the literature value.[3] This product corresponds to retention at the benzylic carbon during the cross-coupling reaction. Suzuki cross-coupling of **(*S*)-1** using a nickel catalyst and NHC ligand (Scheme SI3b), produced product **(*S*)-2**, which was assigned as the (*S*)-enantiomer by comparison of the optical rotation to the literature value.[3] This product corresponds to net inversion at the benzylic carbon during the cross-coupling reaction. In our previous work, we demonstrated that cross-coupling of Grignard reagents also results in inversion at the benzylic carbon.[3] Comparison of these data shows that stereospecific Suzuki cross-coupling reactions can selectively form products with retention or inversion of configuration, depending on the nature of the ligand. The SFC traces of the products formed from the two different methods are shown below.

SFC traces (complete SFC data can be found in section X):



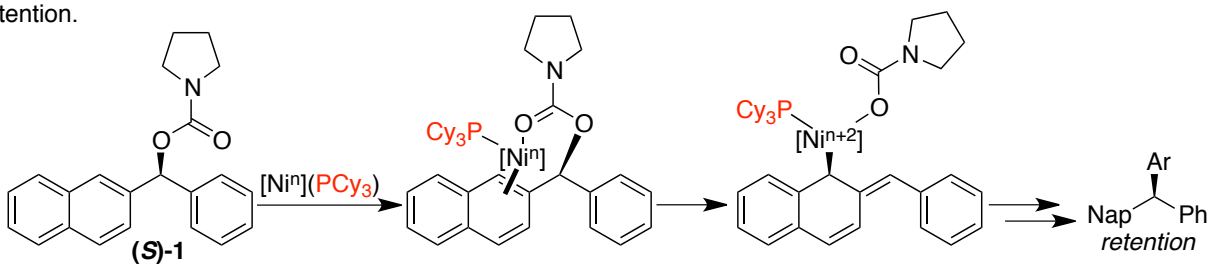




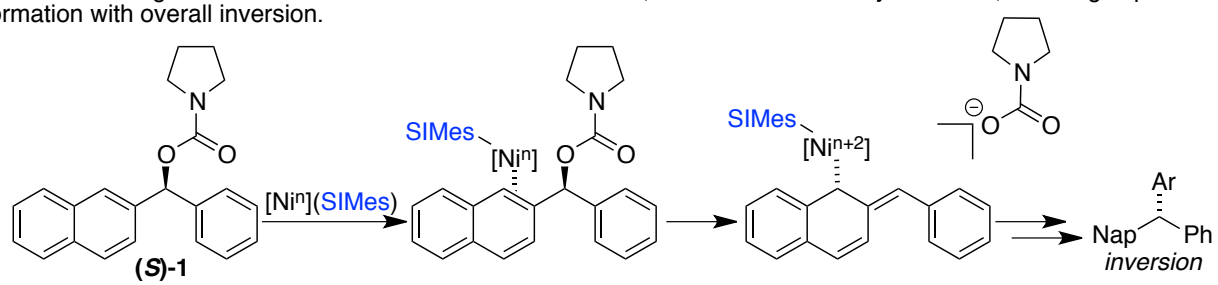
B. Mechanistic model

Scheme SI4. Proposed mechanistic model for stereodivergent pathways when employing PCy_3 and SIMes ligand.

a) With PCy_3 ligand: carbamate ligation directs syn oxidative addition, resulting in product formation with overall retention.

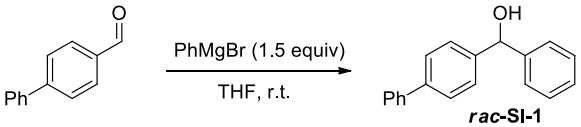


b) With SIMes ligand: oxidative addition occurs with inversion, as is more commonly observed, resulting in product formation with overall inversion.



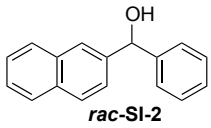
III. Synthesis and characterization of substrates

A. Representative procedure for racemic synthesis of diarylmethyl alcohols.



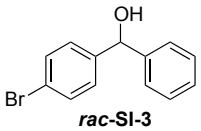
***rac*-SI-1**

***Rac*-SI-1.** In a flame-dried round-bottom flask, to a solution of biphenyl-4-carboxaldehyde (1.04 g, 5.68 mmol, 1.00 equiv) in THF (10 mL) was added phenylmagnesium bromide (0.71 M in THF, 12 mL, 8.5 mmol, 1.5 equiv). After stirring at room temperature for 4 h, saturated ammonium chloride (10 mL) was added and the reaction was extracted with EtOAc (3 x 5 mL). The combined organic layers were washed with brine (3 x 5 mL), dried over $MgSO_4$, and concentrated in vacuo to afford ***rac*-SI-1** as a white solid (1.2 g, 4.7 mmol, 55%). Analytical data is consistent with the values listed for **(*S*)-SI-1** (vide infra).



***rac*-SI-2**

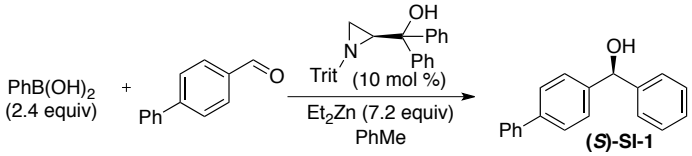
***Rac*-SI-2.** Using the representative procedure A outlined above, the following amounts of reagents were used: 2-naphthaldehyde (6.24 g, 40.0 mmol, 1.00 equiv), phenylmagnesium bromide (58 mL, 0.83 M in THF, 48 mmol, 1.2 equiv), and THF (25 mL). The reaction mixture was purified by silica gel flash column chromatography (5–20% EtOAc/hexanes) to afford the product as a white solid (6.74 g, 28.7 mmol, 72%). Analytical data is consistent with the values listed for **(*S*)-SI-2** (vide infra).



***rac*-SI-3**

***Rac*-SI-3**. Using the representative procedure A outlined above, the following amounts of reagents were used: 4-bromobenzaldehyde (1.85 g, 10.0 mmol, 1.00 equiv), phenylmagnesium bromide (7.0 mL, 1.7 M in THF, 12 mmol, 1.2 equiv), and THF (10 mL). The crude reaction mixture was purified by flash chromatography (5–20% EtOAc/hexanes) to afford the product as a white solid (1.92 g, 7.29 mmol, 73%). Analytical data is consistent with the values listed below for **(*S*)-SI-3**.

B. Representative procedure for enantioselective synthesis of diarylmethyl alcohols by asymmetric arylation.

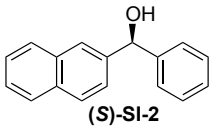


(*S*)-SI-1

Enantioenriched alcohols were prepared according to a modified procedure of Braga and co-workers.[4]

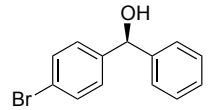
(*S*)-SI-1. To a solution of phenylboronic acid (0.732 g, 6.00 mmol, 2.40 equiv) in toluene (10 mL) was added diethylzinc (18 mL, 18 mmol, 1.0 M in toluene, 7.2 equiv), and the solution was

allowed to stir at 60 °C for 12 h. Upon cooling to room temperature, (*S*)-(1-tritylaziridin-2-yl)diphenylmethanol (0.084 g, 0.06 mmol, 0.01 equiv) was added as a solution in toluene (5 mL) and the reaction mixture was allowed to stir for 10 minutes before the addition of a solution of biphenyl-4-carboxaldehyde (0.456 g, 2.50 mmol, 1.00 equiv) in toluene (5 mL). After stirring 12 h at room temperature, 1 N hydrochloric acid (10 mL) was added and the product was extracted with EtOAc (3 x 10 mL). The combined organics were washed with brine (10 mL), dried over $MgSO_4$, and concentrated in vacuo. The product was purified by flash column chromatography (0–1% EtOAc/benzene) and then recrystallized from hexanes and EtOAc to upgrade the ee (0.488 g, 1.85 mmol, 75% yield, 96% ee). **TLC** $\mathbf{R_f}$ = 0.2 (benzene); **m.p.** = 90–92 °C; ^{1}**H NMR** (400 MHz, $CDCl_3$) δ 7.55 (m, 4H), 7.40 (m, 6H), 7.32 (m, 4H), 5.81 (s, 1H), 2.32 (d, *J* = 2.8, 1H); ^{13}**C NMR** δ (100 MHz, $CDCl_3$) δ 143.8, 142.9, 140.9, 140.6, 128.9, 128.7, 127.8, 127.4, 127.38, 127.2, 127.1, 126.7, 76.1; **IR** (neat) 3361, 3029, 1408, 1006, 763 cm^{-1}; **HRMS (**TOF MS ES+) *m / z* calcd for $C_{19}H_{16}O$ $(M + Na)^+$ 283.1099, found 283.1110; $\mathbf{[\alpha]^{23}_D}$ +4.72 (*c* 1.10, $CHCl_3$); **SFC** analysis (AD-H, 15% IPA, 3 mL/min) indicated 96% ee: t_R (major) = 18.9 minutes, t_R (minor) = 20.5 minutes.



(*S*)-SI-2

(*S*)-SI-2. Using the representative procedure B outlined above, the following amounts of reagents were used: phenylboronic acid (0.732 g, 6.00 mmol, 2.4 equiv), diethylzinc (18 mL, 18 mmol, 1.0 M in toluene), (*S*)-diphenyl(1-tritylaziridin-2-yl)methanol (116 mg, 0.250 mmol, 0.100 equiv), and 2-naphthaldhyde (0.390 g, 2.50 mmol, 1.00 equiv). The product was purified by flash chromatography (10–20% EtOAc/hexanes) to afford the product as a white solid (0.608 g, 2.59 mmol, 93%, 89% ee). The product was then recrystallized from hexanes to upgrade the ee (99% ee). Analytical data is consistent with literature values.[2] ^{1}**H NMR** (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.82 (dt, *J* = 9.2, 2.6 Hz, 2H), 7.80 (d, *J* = 8.2 Hz, 1H), 7.49–7.40 (m, 5H), 7.35 (t, *J* = 7.0 Hz, 2H), 7.29 (dt, *J* = 7.4, 1.5 Hz, 1H), 6.02 (d, *J* = 3.5 Hz, 1H), 2.29 (d, *J* = 3.5 Hz, 1H); $\mathbf{[\alpha]^{23}_D}$ +7.8 (*c* 0.92, $CHCl_3$), literature $[\alpha]^{20}_D$ +11.2 (*c* 0.83, $CHCl_3$); **SFC** analysis (OD-H, 20% 2-propanol, 3 mL/min) indicated >99% ee: t_R (major) = 6.4 min, t_R (minor) = 7.3 min.

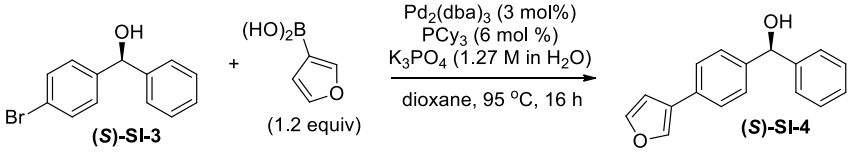


(*S*)-SI-3

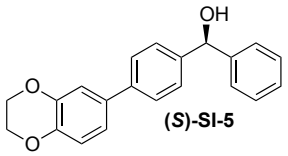
(*S*)-SI-3. Using the representative procedure B outlined above, the following amounts of reagents were used: phenylboronic acid (0.732 g, 6.00 mmol, 2.4 equiv), diethylzinc (18 mL, 18 mmol, 1.0 M in toluene), (*S*)-(1-tritylaziridin-2-yl)diphenylmethanol (116 mg, 0.250 mmol, 0.100 equiv), and 4-bromobenzaldehyde (0.463 g, 2.50 mmol, 1.00 equiv). The product was purified by flash chromatography (10–20% EtOAc/hexane) to afford the product as a white solid (0.608 g, 2.31 mmol, 93%, 92% ee). The product was then recrystallized from hexanes to yield higher enantiopurity (96% ee). Analytical data is consistent with literature values.[5] ^{1}**H NMR** (500 MHz, $CDCl_3$) δ 7.44 (d, *J* = 8.4 Hz, 2H), 7.36–7.30 (m, 4H), 7.29–7.25 (m, 1H), 7.23 (d, *J* = 8.4 Hz, 2H), 5.76 (d, *J* = 3.3 Hz, 1H), 2.34 (d, *J* = 3.3 Hz, 1H); ^{13}**C NMR** (125 MHz, $CDCl_3$) δ 143.5, 142.8, 131.7, 128.8, 128.3, 128.0, 126.6, 121.5, 75.8; $\mathbf{[\alpha]^{23}_D}$ +17.5 (*c* 1.65, $CHCl_3$); **SFC**

analysis (AD-H, 10% IPA, 2.5 mL/min) indicated 96% ee: t_R (major) = 10.4 minutes, t_R (minor) = 9.8 minutes.

C. Representative procedure for the Suzuki cross-coupling of aryl bromide ***(S)-SI-3*** *with aryl boronic acids.*

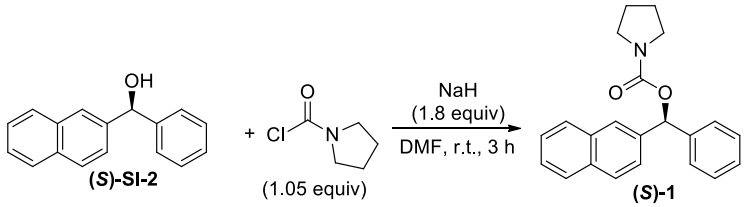


(*S*)-SI-4. The product was prepared according to a modified procedure by Fu and co-workers.[6] Tris(dibenzylideneacetone)dipalladium (55 mg, 0.060 mmol, 0.030 equiv) and tricyclohexylphosphine (39 mg, 0.14 mmol, 0.070 equiv) were weighed out into a flame dried two neck, round bottom flask inside a glovebox. The flask was fitted with septa, removed from the glovebox, and 3-furanboronic acid (0.262 g, 2.20 mmol, 1.10 equiv), **(*S*)-SI-3** (0.526 g, 2.00 mmol, 1.00 equiv), aqueous potassium phosphate (2.7 mL, 3.4 mmol, 1.3 M in H_2O, 1.7 equiv) and dioxane (6 mL) were added. The reaction flask was fitted with a reflux condenser and heated to 95 °C for 16 h. After cooling, the solvent was removed under reduced pressure. The resultant residue was purified by flash column chromatography (10–20% EtOAc/hexane) to afford **(*S*)-SI-4** as a yellow solid (0.437 g, 1.75 mmol, 87%, 97% ee). **TLC R_f** = 0.2 (4:1 hexane/EtOAc); **m.p.** = 97–99 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.70 (s, 1H), 7.45 (s, 2H), 7.43 (s, 1H), 7.37 (t, *J* = 8.2 Hz, 3H), 7.33 (t, *J* = 7.3 Hz, 3H), 7.27 (d, *J* = 7.4 Hz, 1H), 6.67 (s, 1H), 5.82 (s, 1H), 2.32 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 143.9, 143.8, 142.7, 138.6, 131.8, 128.7, 127.8, 127.1, 126.7, 126.2, 126.1, 108.9, 76.1; **IR** (neat) 3279, 1160, 1012, 780, 699 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{17}H_{14}O_2$ $(M + Na)^+$ 273.0891, found 273.0883; **$[\alpha]^{29}_D$** – 37.3 (*c* 1.00, $CHCl_3$); **SFC** analysis (OD-H, 13% IPA, 2.5 mL/min) indicated 97% ee: t_R (major) = 12.9 minutes, t_R (minor) = 14.7 minutes.

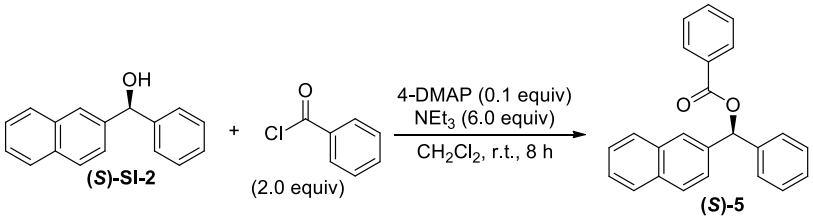


(*S*)-SI-5. Using representative procedure C outlined above, the following amounts of reagents were used: tris(dibenzylideneacetone)dipalladium (28 mg, 0.030 mmol, 0.030 equiv), tricyclohexylphosphine (20 mg, 0.07 mmol, 0.070 equiv), 1,4-benzodioxane-6-boronic acid (0.198 g, 1.10 mmol, 1.10 equiv), **(*S*)-SI-3** (0.263 g, 1.00 mmol, 1.00 equiv), aqueous potassium phosphate (1.4 mL, 1.7 mmol, 1.3 M in H_2O, 1.7 equiv) and dioxane (3 mL). The product was purified by flash column chromatography (10–30% EtOAc/hexane) to afford **(*S*)-SI-5** as a brown solid (0.296 g, 0.929 mmol, 93%, 96% ee). **TLC R_f** = 0.2 (4:1 hexane/EtOAc); **TLC R_f** = 0.3 (30% EtOAc/hexanes); **m.p.** = 108–110 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.48 (d, *J* = 7.7 Hz, 2H), 7.40 (q, *J* = 7.8 Hz, 4H), 7.34 (t, *J* = 7.2 Hz, 2H), 7.27 (d, *J* = 7.3 Hz, 1H), 7.08 (d, *J* = 1.9 Hz, 1H), 7.04 (dd, *J* = 8.5, 2.1 Hz, 1H), 6.90 (d, *J* = 8.2 Hz, 1H), 5.85 (s, 1H), 4.36 (s, 4H), 2.35 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 143.9, 143.8, 143.3, 142.5, 140.0, 134.5, 128.7, 127.7, 127.1, 127.0, 126.6, 120.2, 117.7, 115.9, 76.2, 64.6, 64.5; **IR** (neat) 3550, 1494, 1304, 1284, 1070 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{21}H_{18}O_3$ $(M + Na)^+$ 341.1154, found 341.1147; **$[\alpha]^{29}_D$** +3.1 (*c* 1.04, $CHCl_3$); **SFC** analysis (AD-H, 14% IPA, 2.5 mL/min) indicated 96%: t_R (major) = 6.9 minutes, t_R (minor) = 8.8 minutes.

D. Preparation of protected carbinols.

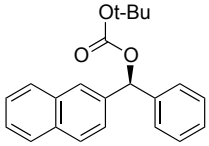


(*S*)-1. The product was prepared according to a modified procedure by Zhang and co-workers.[7] To a suspension of NaH (0.153 g, 6.37 mmol, 1.80 equiv) in DMF (3 mL) was added a solution of **(*S*)-SI-2** (0.823 g, 3.54 mmol, 1.00 equiv) in DMF (2 mL) at 0 °C. The mixture was stirred for 1 h before addition of neat 1-pyrollidinecarbonyl chloride (0.41 mL, 3.7 mmol, 1.1 equiv) at room temperature. After stirring for 3 h, the reaction was quenched with saturated aqueous ammonium chloride (6 mL), and the product was extracted with methylene chloride (3 x 10 mL). The combined organics were washed with brine (5 mL), dried over Na_2SO_4, and concentrated in vacuo. The product was purified by flash column chromatography (20% EtOAc/hexane) to afford **(*S*)-1** as a white solid (0.963 g, 2.91 mmol, 83%, 94% ee): **TLC** $\mathbf{R_f}$ = 0.2 (20% EtOAc/hexanes); **m.p.** = 151–153 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.84 (s, 1H), 7.82–7.77 (m, 3H), 7.47–7.44 (m, 3H), 7.41 (d, *J* = 7.3 Hz, 2H), 7.33 (t, *J* = 7.3 Hz, 2H), 7.27 (d, *J* = 7.4 Hz, 1H), 7.00 (s, 1H), 3.55 (t, *J* = 6.7 Hz, 2H), 3.40 (t, *J* = 6.7 Hz, 2H), 1.90 (dt, *J* = 13.3, 6.7 Hz, 2H), 1.84 (dt, *J* = 13.3, 6.7 Hz, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 154.2, 141.4 138.7, 133.2, 133.0, 128.5, 128.4 128.3, 127.8, 127.7, 127.2, 126.3, 126.2, 126.1, 125.2, 77.4, 46.4, 46.0, 25.9, 25.0; **IR** (neat) 1690, 1412, 1102, 828, 765 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{22}H_{21}NO_2$ $(M + Na)^+$ 354.1470, found 354.1463; $\mathbf{[\alpha]^{29}_D}$ +45.9 (*c* 1.15, $CHCl_3$); **SFC** analysis (OD-H, 18% IPA, 2.5 mL/min) indicated 93% ee: t_R (major) = 7.1 minutes, t_R (minor) = 6.6 minutes.



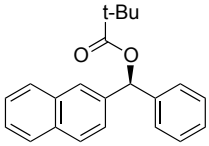
(*S*)-5. The product was prepared according to a modified procedure by Hassner and co-workers.[8] To a 25 mL round bottom flask was added alcohol **(*S*)-SI-2** (0.175 g, 0.750 mmol, 1.00 equiv), and 4-(dimethylamino)pyridine (9.0 mg, 0.075 mmol, 0.10 equiv). The flask was evacuated and backfilled with nitrogen before addition of methylene chloride (6 mL), triethylamine (0.48 mL, 4.5 mmol, 6.0 equiv), and benzoyl chloride (0.18 mL, 1.5 mmol, 2.0 equiv). After stirring for 8 h, the reaction was quenched with 1 M HCl (6 mL), and the product was extracted with methylene chloride (3 x 10 mL). The combined organics were washed with brine (10 mL), dried over $MgSO_4$, and concentrated in vacuo. The product was purified by flash column chromatography (5–10% EtOAc/hexane) to afford **(*S*)-5** as a white solid (0.177 g, 0.523 mmol, 70%, 89% ee): **TLC** $\mathbf{R_f}$ = 0.4 (10% EtOAc/hexanes); **m.p.** = 91–93 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.26 (d, *J* = 7.9 Hz, 2H), 8.00 (s, 1H), 7.91–7.90 (m, 3H), 7.66 (t, *J* = 7.2 Hz, 1H), 7.61–7.53 (m, 6H), 7.45 (t, *J* = 7.1 Hz, 2H), 7.39 (d, *J* = 7.2 Hz, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 165.7, 140.3, 137.7, 133.3, 133.2, 133.1, 130.3, 130.0, 128.7, 128.6, 128.3, 128.2, 127.8, 127.4, 126.44, 126.40, 126.3, 125.1, 77.7; **IR** (neat) 1712, 1259, 1108, 732, 700 cm^{-1};

HRMS (TOF MS ES+) *m / z* calcd for $C_{24}H_{18}O_2$ $(M + Na)^+$ 361.1205, found 361.1201; $[\alpha]^{29}_D$ +10.0 (*c* 0.99, $CHCl_3$); **SFC analysis** (OD-H, 10.0% IPA, 2.5 mL/min) indicated 89% ee: t_R (major) = 6.5 minutes, t_R (minor) = 6.3 minutes.



(*S*)-3

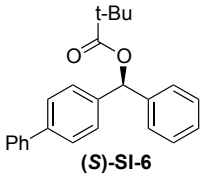
(*S*)-3. The product was prepared according to a modified procedure by Hassner and co-workers.[8] To a 25 mL round bottom flask was added alcohol **(*S*)-SI-2** (0.234 g, 1.00 mmol, 1.00 equiv), and 4-(dimethylamino)pyridine (12 mg, 0.010 mmol, 0.10 equiv). The flask was evacuated and backfilled with nitrogen before addition of methylene chloride (8 mL), triethylamine (0.10 mL, 1.2 mmol, 1.2 equiv), and di-*tert*-butyl dicarbonate (0.228 g, 1.05 mmol, 1.05 equiv). After stirring for 8 h, the reaction was quenched with 1 M HCl (6 mL), and the product was extracted with methylene chloride (3 x 10 mL). The combined organics were washed with brine (10 mL), dried over $MgSO_4$, and concentrated in vacuo. The product was purified by flash column chromatography (5–10% EtOAc/hexane) to afford **(*S*)-3** as a white solid (0.284 g, 0.849 mmol, 85%, 88% ee): **TLC** $\mathbf{R_f}$ = 0.4 (9:1 hexane/EtOAc); **m.p.** = 90–92 °C; ^{1}**H NMR** (500 MHz, $CDCl_3$) δ 7.87 (s, 1H), 7.83 (d, *J* = 7.0 Hz, 1H), 7.79 (d, *J* = 8.2 Hz, 2H), 7.48–7.45 (m, 2H), 7.43 (s, 1H), 7.41 (d, *J* = 8.3 Hz, 2H), 7.33 (t, *J* = 7.3 Hz, 2H), 7.27 (d, *J* = 7.7 Hz, 1H), 1.47 (s, 9H); ^{13}**C NMR** (125 MHz, $CDCl_3$) δ 153.1, 140.1, 137.6, 133.2, 133.1, 128.7, 128.5, 128.3, 128.1, 127.8, 127.2, 126.4, 126.3, 126.0, 125.0, 82.7, 80.0, 27.9; **IR** (neat) 1742, 1270, 1251, 1150, 1081 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{22}H_{22}O_3$ $(M + Na)^+$ 357.1467, found 357.1467; $[\alpha]^{29}_D$ –19.3 (*c* 0.90, $CHCl_3$); **SFC analysis** (AD-H, 5% IPA, 3.0 mL/min) indicated 88% ee: t_R (major) = 5.6 minutes, t_R (minor) = 6.1 minutes.



(*S*)-4

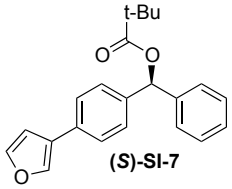
(*S*)-4. The product was prepared according to a modified procedure by Hassner and co-workers.[8] To a 25 mL round bottom flask was added alcohol **(*S*)-SI-2** (0.281 g, 1.20 mmol, 1.20 equiv), and 4-(dimethylamino)pyridine (15 mg, 0.012 mmol, 0.10 equiv). The flask was evacuated and backfilled with nitrogen before addition of methylene chloride (8 mL), triethylamine (0.19 mL, 2.6 mmol, 2.2 equiv), and trimethylacetyl chloride (0.160 mL, 1.26 mmol, 1.05 equiv). After stirring for 8 h, the reaction was quenched with 1M HCl (6 mL), and the product was extracted with methylene chloride (3 x 10 mL). The combined organics were washed with brine (10 mL), dried over $MgSO_4$, and concentrated in vacuo. The product was purified by flash column chromatography (5–10% EtOAc/hexane) to afford **(*S*)-4** as a white solid (0.334 g, 1.05 mmol, 88%, 82% ee): **TLC** $\mathbf{R_f}$ = 0.5 (10% EtOAc/hexanes); **m.p.** = 80–83 °C; ^{1}**H NMR** (500 MHz, $CDCl_3$) δ 7.82 (s, 2H), 7.79 (d, *J* = 8.8 Hz, 2H), 7.48–7.45 (m, 2H), 7.42 (d, *J* = 8.3 Hz, 1H), 7.38 (d, *J* = 7.6 Hz, 2H), 7.33 (t, *J* = 7.1 Hz, 2H), 7.28 (d, *J* = 7.6 Hz, 1H), 1.27 (s, 9H); ^{13}**C NMR** (125 MHz, $CDCl_3$) δ 177.4, 140.6, 138.0, 133.2, 133.0, 128.6, 128.5, 128.3, 127.9, 127.8, 127.1, 126.4, 126.3, 126.1, 125.0, 76.8, 39.1, 27.3; **IR** (neat) 1721, 1276, 1148, 1123, 823 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{22}H_{22}O_2$ $(M + Na)^+$ 341.1518, found 341.1526; $[\alpha]^{29}_D$ –

37.4 (*c* 1.18, $CHCl_3$); **SFC analysis** (AD-H, 5.0% IPA, 3.0 mL/min) indicated 82% ee: t_R (major) = 6.8 minutes, t_R (minor) = 7.1 minutes.



(*S*)-SI-6

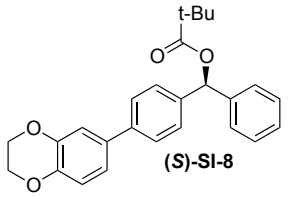
(*S*)-SI-6. The product was prepared according to a modified procedure by Zhang and co-workers.[7] NaH (500 mg, 20.8 mmol, 4.00 equiv) was suspended in 40 mL of dry DMF and cooled to 0 °C. To this solution, alcohol **(*S*)-SI-1** (1.28 g, 4.92 mmol, 1.00 equiv) in dry DMF (10 mL) was added dropwise. The mixture was allowed to stir at 0 °C for 30 minutes after which pivaloyl chloride (4.3 mL, 35 mmol, 7.0 equiv) was added dropwise. The reaction was stirred at 0 °C for 1.5 hours then warmed to room temperature and stirred for 22 hours. The reaction was quenched by consecutive addition of water (5 x 2 mL) and stirring for 3 minutes. The reaction was diluted with more water (10 mL) and the organics were extracted with EtOAc (3 x 30 mL). The combined organic layers were dried over $MgSO_4$ and the solvent was removed under reduced pressure. The crude was purified by flash chromatography (0–1% Et_2O/petroleum ether) yielding **(*S*)-SI-1** as a white solid (1.56 g, 4.53 mmol, 92%). **TLC** $\mathbf{R_f}$ = 0.4 (10% Et_2O:petroleum ether); **m.p.** = 109–110 °C; ^{1}**H NMR** (400 MHz, $CDCl_3$) δ 7.54 (dd, *J* = 6.1, 1.9 Hz, 4H), 7.35 (m, 10H), 6.87 (s, 1H), 1.27 (s, 9H); ^{13}**C NMR** (100 MHz, $CDCl_3$) δ 177.4, 140.8, 140.6, 139.8, 128.9, 128.7, 127.9, 127.8, 127.5, 127.40, 127.38, 127.2, 127.0, 76.5, 39.1, 27.3; **IR** (neat) 3029, 2974, 1722, 1275, 1138 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{24}H_{24}O_2$ $(M + Na)^+$ 367.1674, found 367.1681; $\mathbf{[\alpha]^{23}_D}$ –23.6 (*c* 1.09, $CHCl_3$); **SFC** analysis (AD-H, 10% IPA, 3 mL/min) indicated 96% ee: t_R (minor) = 4.0 minutes, t_R (major) = 6.4 minutes.



(*S*)-SI-7

(*S*)-SI-7. The product was prepared according to a modified procedure by Zhang and co-workers.[7] To a suspension of NaH (72 mg, 3.0 mmol, 2.0 equiv) in DMF (3 mL) was added a solution of **(*S*)-SI-4** (0.374 g, 1.50 mmol, 1.00 equiv) in DMF (2 mL) at 0 °C. The mixture was stirred for 1 h before addition of neat trimethylacetyl chloride (0.200 mL, 1.60 mmol, 1.05 equiv) at room temperature. After stirring for 3 h, the reaction was quenched with saturated aqueous ammonium chloride (6 mL), and the product was extracted with methylene chloride (3 x 10 mL). The combined organics were washed with brine (5 mL), dried over Na_2SO_4, and concentrated in vacuo. The product was purified by flash column chromatography (30% Et_2O/hexane) to afford **(*S*)-SI-7** as a pale yellow solid (0.427 g, 1.28 mmol, 85%, 93% ee): **TLC** $\mathbf{R_f}$ = 0.2 (4:1 hexane/Et_2O); **m.p.** = 105–108 °C; ^{1}**H NMR** (500 MHz, $CDCl_3$) δ 7.70 (s, 1H), 7.45 (s, 2H), 7.43 (s, 1H), 7.35 (s, 4H), 7.33 (s, 2H), 7.29–7.26 (m, 1H), 1.26 (s, 9H); ^{13}**C NMR** (125 MHz, $CDCl_3$) δ 177.4, 143.8, 140.6, 139.5, 138.7, 132.1, 128.6, 127.9, 127.6, 127.0, 126.2, 126.1, 108.9, 76.5, 39.0, 27.3; **IR** (neat) 1724, 1159, 1138, 757, 699 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{22}H_{22}O_3$ $(M + Na)^+$ 357.1467, found 357.1475; $\mathbf{[\alpha]^{29}_D}$ –26.0 (c 1.25, $CHCl_3$); **SFC**

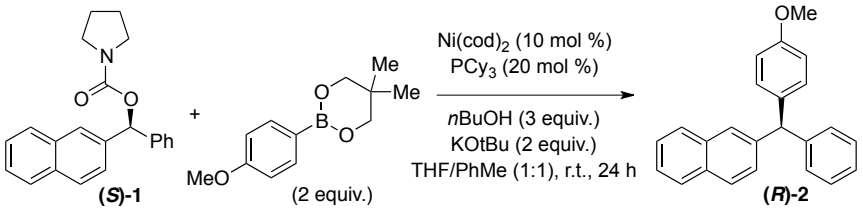
analysis (OJ-H, 8% IPA, 2.0 mL/min) indicated 93% ee: t_R (major) = 3.6 minutes, t_R (minor) = 4.2 minutes.



(*S*)-SI-8. The product was prepared according to a modified procedure by Zhang and co-workers.[7] To a suspension of NaH (35 mg, 1.4 mmol, 1.8 equiv) in DMF (3 mL) was added a solution of **(*S*)-SI-5** (0.254 g, 0.800 mmol, 1.00 equiv) in DMF (2 mL) at 0 °C. The mixture was stirred for 1 h before addition of neat trimethylacetyl chloride (0.103 mL, 0.840 mmol, 1.05 equiv) at room temperature. After stirring for 3 h, the reaction was quenched with saturated aqueous ammonium chloride (6 mL), and the product was extracted with methylene chloride (3 x 10 mL). The combined organics were washed with brine (5 mL), dried over Na_2SO_4, and concentrated in vacuo. The product was purified by flash column chromatography (30% Et_2O/hexanes) to afford **(*S*)-SI-8** as a tan solid (0.232 g, 0.576 mmol, 73%, 94% ee): **TLC R_f** = 0.1 (20% Et_2O/hexanes); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.2 Hz, 2H), 7.37–7.32 (m, 6H), 7.28 (d, *J* = 7.2 Hz, 1H), 7.08 (s, 1H), 7.04 (d, *J* = 8.4 Hz, 1H), 6.90 (d, *J* = 8.6 Hz, 1H), 6.84 (s, 1H), 4.27 (s, 4H), 1.27 (s, 9H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 177.4, 143.8, 143.4, 140.7, 140.2, 139.3, 134.4, 128.7, 127.9, 127.4, 127.0, 126.9, 120.2, 117.7, 115.9, 76.5, 64.6, 64.5, 39.0, 27.3; **IR** (neat) 1723, 1494, 1309, 1147, 1068 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{26}H_{26}O_4$ $(M + Na)^+$ 425.1729, found 425.1715; **$[\alpha]^{29}_D$** –20.3 (c 0.96, $CHCl_3$); **SFC** analysis (OD-H, 30% MeOH, 2.5 mL/min) indicated 94% ee: t_R (major) = 6.9 minutes, t_R (minor) = 8.8 minutes.

IV. Procedures for Cross-Coupling Reactions

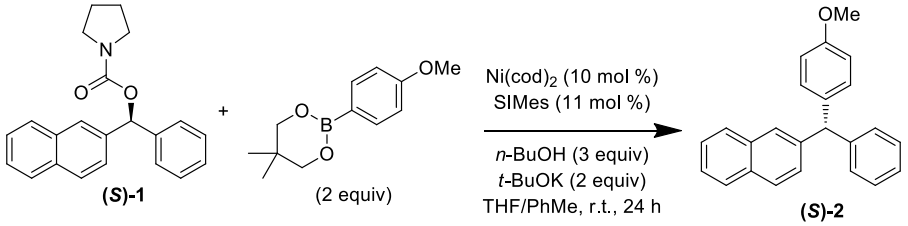
A. Procedure for the synthesis of products with retention (Table 2).



(*R*)-2. To a flame dried vial in a glovebox was added 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.20 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 µL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-methoxyphenyl)-1,3,2-dioxaborinane (88 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The reaction was stirred for 24 hours before removing the vial from the glovebox, opening to atmosphere, and running through a silica gel plug (1:1 Et_2O:hexane). The combined organics were concentrated in vacuo, internal standard (PhTMS, 0.20 mmol) was added and ^{1}H NMR yield was collected. The product was purified by flash chromatography (1–3% Et_2O/pentane) to afford **(*R*)-2** as a colorless oil. First run: (56.0 mg, 0.173 mmol, 86%, 93% ee). Second run: (56.4 mg, 0.174 mmol, 87%, 93% ee). Analytical data is consistent with literature values:[3] **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.81–7.76 (m, 1H), 7.74 (d, *J* = 8.6 Hz, 1H), 7.72–7.67 (m, 1H), 7.46 (s, 1H), 7.42 (dt, *J* = 9.5, 3.2 Hz,

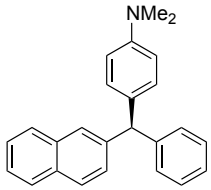
2H), 7.29 (t, J = 7.2 Hz, 3H), 7.24–7.19 (m, 1H), 7.15 (d, J = 7.2 Hz, 2H), 7.07 (d, J = 8.4 Hz, 2H), 6.83 (d, J = 8.8 Hz, 2H), 5.65 (s, 1H), 3.78 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 158.2, 144.1, 142.0, 136.0, 133.5, 132.2, 130.6, 129.6, 128.4, 128.2, 128.0, 127.9, 127.8, 127.6, 126.4, 126.1, 125.7, 113.8, 56.2, 55.3; **$[\alpha]^{23}_D$** –0.77 (*c* 2.70, $CHCl_3$); **SFC** analysis (AD-H, 15% IPA, 2.5 mL/min) indicated 93% ee: t_R (major) = 13.9 minutes, t_R (minor) = 13.2 minutes.

B. Procedure for the synthesis of products with inversion of configuration (Tables 2 and 3).



(*S*)-2. To a flame dried vial in a glovebox was added 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 µL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-methoxyphenyl)-1,3,2-dioxaborinane (88 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The reaction was stirred for 24 hours before removing the vial from the glovebox, opening to atmosphere, and running through a silica gel plug (1:1 Et_2O:hexane). The combined organics were concentrated in vacuo, internal standard (PhTMS, 0.20 mmol) was added and ^{1}H NMR yield was collected. The product was purified by flash chromatography (1–3% Et_2O/pentane) to afford **(*S*)-2** as a colorless oil. First run: (53.2 mg, 0.164 mmol, 82%, 93% ee). Second run: (56.0 mg, 0.173 mmol, 86%, 93% ee). Analytical data is consistent with the values listed above for **(*R*)-2**. **$[\alpha]^{23}_D$** +2.1 (*c* 2.70, $CHCl_3$); **SFC** analysis (AD-H, 15% IPA, 2.5 mL/min) indicated 90% ee: t_R (major) = 13.2 minutes, t_R (minor) = 13.9 minutes.

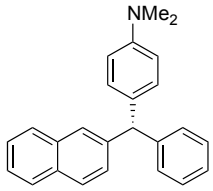
V. Characterization Data for Products



(*R*)
Table 2, entry 3

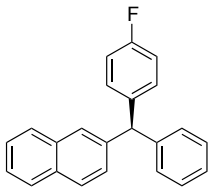
Table 2, entry 3. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.20 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 µL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-dimethylaminophenyl)-1,3,2-dioxaborinane (83 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash chromatography (1–3% Et_2O/pentane) to afford the product as a colorless oil. First run: (49.8 mg, 0.148 mmol, 80%, 90% ee). Second run: (52.6 mg, 0.167 mmol, 84%, 90% ee). Analytical data is consistent with literature values:[3] **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80–7.75 (m, 1H), 7.73 (d, J = 8.7 Hz, 1H), 7.71–7.67 (m, 1H), 7.48 (s, 1H), 7.40 (dt, J = 9.4, 3.3 Hz, 2H), 7.31 (d, J =

8.4 Hz, 1H), 7.27 (t, J = 7.6 Hz, 2H), 7.19 (t, J = 7.5 Hz, 1H), 7.16 (d, J = 7.5 Hz, 2H), 7.01 (d, J = 8.8 Hz, 2H), 6.67 (d, J = 8.8 Hz, 2H), 5.61 (s, 1H), 2.90 (s, 6H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 149.2, 144.6, 142.5, 133.6, 132.2, 131.8, 130.3, 129.6, 128.4 (2C), 128.0, 127.8, 127.7, 127.6, 126.3, 126.0, 125.6, 112.6, 56.2, 40.8; **IR** (neat) 3054, 3023, 2879, 1612, 1350 cm^{-1}; **$[\alpha]^{23}_D$** –9.43 (*c* 2.28, $CHCl_3$); **SFC** analysis (AD-H, 20% MeOH, 3 mL/min) indicated 92% ee: t_R (major) = 4.2 min, t_R (minor) = 4.8 min.



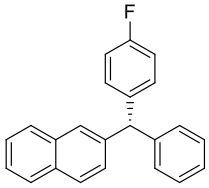
(***S***)
Table 2, entry 4

(*S*)-Table 2, entry 4. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-dimethylaminophenyl)-1,3,2-dioxaborinane (83 mg, 0.40 mmol, 2.0 equiv), **(*S*)-SI-16** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash chromatography (1–3% Et_2O/pentane) to afford the product as a colorless oil. First run: (42.1 mg, 0.125 mmol,62%, 92% ee). Second run: (53.6 mg, 79%, 0.159 mmol, 92% ee). Analytical data is consistent with the values listed above for **(*R*)-Table 2, entry 3**. **$[\alpha]^{23}_D$** +8.0 (*c* 1.00, $CHCl_3$); **SFC** analysis (AD-H, 20% MeOH, 3 mL/min) indicated 92% ee: t_R (major) = 3.9 min, t_R (minor) = 4.6 min.



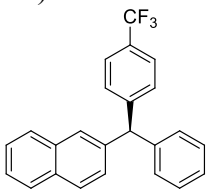
(***R***)
Table 2, entry 5

(*R*)-Table 2, entry 5. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.2 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-fluorophenyl)-1,3,2-dioxaborinane (83 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash chromatography (1–3% Et_2O/pentane) to afford the product as a colorless oil. First run: (49.8 mg, 0.159 mmol, 80%, 90% ee). Second run: (52.6 mg, 0.168 mmol, 84%, 90% ee). Analytical data is consistent with literature values:[3] **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.81–7.77 (m, 1H), 7.75 (d, J = 8.6 Hz, 1H), 7.71–7.67 (m, 1H), 7.45–7.39 (m, 3H), 7.31–7.21 (m, 4H), 7.15–7.07 (m, 4H), 6.97 (t, J = 8.8 Hz, 2H), 5.70 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 161.6 (d, J = 245 Hz), 143.6, 141.4, 139.5 (d, J = 3 Hz), 133.5, 132.3, 131.1 (d, J = 8 Hz), 129.6, 128.6, 128.1, 128.05, 127.99, 127.8, 127.7, 126.7, 126.2, 125.9, 115.3 (d, J = 21 Hz), 56.3; **$[\alpha]^{23}_D$** +4.5 (*c* 4.47, $CHCl_3$); **SFC** analysis (OJ-H, 12% IPA, 2.5 mL/min) indicated 90% ee: t_R (major) = 9.4 minutes, t_R (minor) = 8.7 minutes.



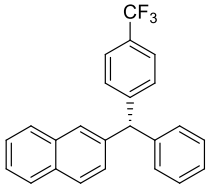
(*S*)
Table 2, entry 6

(*R*)-Table 2, entry 6. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-fluorophenyl)-1,3,2-dioxaborinane (83 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash chromatography (1–3% Et_2O/pentane) to afford the product as a colorless oil. First run: (49.8 mg, 0.159 mmol, 80%, 88% ee). Second run: (50.0 mg, 0.168 mmol, 84%, 88% ee). Analytical data is consistent with literature values:[3] **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.81–7.77 (m, 1H), 7.75 (d, J = 8.6 Hz, 1H), 7.71–7.67 (m, 1H), 7.45–7.39 (m, 3H), 7.31–7.21 (m, 4H), 7.15–7.07 (m, 4H), 6.97 (t, J = 8.8 Hz, 2H), 5.70 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 161.6 (d, J = 245 Hz), 143.6, 141.4, 139.5 (d, J = 3 Hz), 133.5, 132.3, 131.1 (d, J = 8 Hz), 129.6, 128.6, 128.1, 128.05, 127.99, 127.8, 127.7, 126.7, 126.2, 125.9, 115.3 (d, J = 21 Hz), 56.3; **$[\alpha]^{23}_D$** –3.6 (*c* 4.10, $CHCl_3$); **SFC** analysis (OJ-H, 12% IPA, 2.5 mL/min) indicated 88% ee: t_R (major) = 9.7 minutes, t_R (minor) = 10.6 minutes.



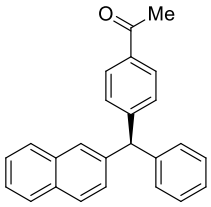
(*R*)
Table 2, entry 7

(*S*)-Table 2, entry 7. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.2 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.00 equiv), 5,5-dimethyl-2-(4-trifluoromethylphenyl)-1,3,2-dioxaborinane (103 mg, 0.400 mmol, 2.00 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (1% Et_2O/pentane) to afford the product as a colorless oil. First run: (64.4 mg, 0.178 mmol, 89%, 57% ee). Second run: (62.1 mg, 0.172 mmol, 86%, 57% ee). **TLC R_f** = 0.4 (pentane); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.85–7.79 (m, 1H), 7.77 (d, J = 8.6 Hz, 1H), 7.74–7.68 (m, 1H), 7.55 (d, J = 8.1 Hz, 2H), 7.49–7.41 (m, 3H), 7.32 (t, J = 7.4 Hz, 2H), 7.29–7.22 (m, 4H), 7.14 (d, J = 7.6 Hz, 2H), 5.75 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 148.0, 142.9, 140.6, 133.5, 132.4, 130.0, 129.6, 128.9 (q, J = 32.4 Hz), 128.7, 128.3, 128.02, 128.00, 127.9, 127.7, 126.9, 126.4, 126.1, 125.5 (q, J = 3.7 Hz), 124.4 (q, J = 271.9 Hz), 56.9; **IR** (neat) 3057, 1600, 1323, 1119 cm^{-1}; **HRMS** (TOF MS CI+) m / z calcd for $C_{15}H_{16}O$ $(M)^+$ 362.1282, found 362.1273; **$[\alpha]^{23}_D$** +4.84 (*c* 0.915, $CHCl_3$); **SFC** analysis (AD-H, 5% IPA, 2.5 mL/min) indicated 57% ee: t_R (major) = 7.7 minutes, t_R (minor) = 7.0 minutes.



(*S*)
Table 2, entry 8

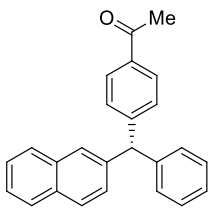
(*S*)-Table 2, entry 8. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.00 equiv), 5,5-dimethyl-2-(4-trifluoromethylphenyl)-1,3,2-dioxaborinane (103 mg, 0.400 mmol, 2.00 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (1% Et_2O/pentane) to afford the product as a colorless oil. First run: (52.8 mg, 0.146 mmol, 73%, 91% ee). Second run: (48.6 mg, 0.134 mmol, 67%, 90% ee). **TLC R_f** = 0.4 (pentane); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.85–7.79 (m, 1H), 7.77 (d, *J* = 8.6 Hz, 1H), 7.74–7.68 (m, 1H), 7.55 (d, *J* = 8.1 Hz, 2H), 7.49–7.41 (m, 3H), 7.32 (t, *J* = 7.4 Hz, 2H), 7.29–7.22 (m, 4H), 7.14 (d, *J* = 7.6 Hz, 2H), 5.75 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 148.0, 142.9, 140.6, 133.5, 132.4, 130.0, 129.6, 128.9 (q, *J* = 32.4 Hz), 128.7, 128.3, 128.02, 128.00, 127.9, 127.7, 126.9, 126.4, 126.1, 125.5 (q, *J* = 3.7 Hz), 124.4 (q, *J* = 271.9 Hz), 56.9; **IR** (neat) 3057, 1600, 1323, 1119 cm^{-1}; **HRMS** (TOF MS CI+) *m* / *z* calcd for $C_{15}H_{16}O$ $(M)^+$ 362.1282, found 362.1273; **$[\alpha]^{23}_D$** –16.5 (*c* 1.00, $CHCl_3$); **SFC** analysis (AD-H, 5% IPA, 2.5 mL/min) indicated 89% ee: t_R (major) = 6.6 minutes, t_R (minor) = 7.3 minutes.



(*R*)
Table 2, entry 9

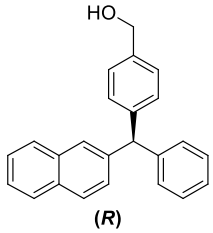
(*R*)-Table 2, entry 9. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.20 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-acetylphenyl)-1,3,2-dioxaborinane (93 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (10% EtOAc/hexanes) to afford the product as an amorphous white solid. First run: (50.8 mg, 0.151 mmol, 76%, 89% ee). Second run: (51.0 mg, 0.152 mmol, 76%, 89% ee). **TLC R_f** = 0.4 (20% EtOAc/hexanes); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.4 Hz, 2H), 7.73–7.69 (m, 1H), 7.67 (d, *J* = 8.6 Hz, 1H), 7.63–7.57 (m, 1H), 7.40–7.30 (m, 3H), 7.21 (q, *J* = 7.7 Hz, 2H), 7.19–7.10 (m, 4H), 7.05 (d, *J* = 7.5 Hz, 2H), 5.65 (s, 1H), 2.47 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.9, 149.4, 142.9, 140.7, 135.6, 133.5, 132.3, 129.9, 129.6, 128.7, 128.6, 128.3, 127.97, 127.95, 127.9, 127.7, 126.9, 126.3, 126.0, 57.0, 26.7; **IR** (neat) 3055, 2923, 1679, 1600, 1506 cm^{-1}; **HRMS** (TOF MS CI+) *m* / *z* calcd for $C_{25}H_{20}O$ $(M)^+$ 336.1514, found

3316.1514; $[\alpha]^{23}_{D}$ –17.2 (*c* 2.3, $CHCl_3$); **SFC** analysis (OD-H, 20% IPA, 3.0 mL/min) indicated 89% ee: t_R (major) = 6.3 minutes, t_R (minor) = 5.9 minutes.



(*R*)
Table 2, entry 10

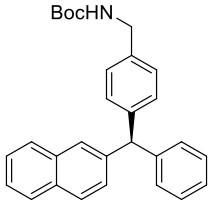
(*R*)-Table 2, entry 10. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.67 mg, 0.0220 mmol, 0.11 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 µL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-acetylphenyl)-1,3,2-dioxaborinane (93 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (10% EtOAc/hexanes) to afford the product as an amorphous white solid. First run: (66.5 mg, 0.198 mmol, 99%, 97% ee). Second run: (66.0 mg, 0.196 mmol, 98%, 97% ee). **TLC R_f** = 0.4 (20% EtOAc/hexanes); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.4 Hz, 2H), 7.73–7.69 (m, 1H), 7.67 (d, *J* = 8.6 Hz, 1H), 7.63–7.57 (m, 1H), 7.40–7.30 (m, 3H), 7.21 (q, *J* = 7.7 Hz, 2H), 7.19–7.10 (m, 4H), 7.05 (d, *J* = 7.5 Hz, 2H), 5.65 (s, 1H), 2.47 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.9, 149.4, 142.9, 140.7, 135.6, 133.5, 132.3, 129.9, 129.6, 128.7, 128.6, 128.3, 127.97, 127.95, 127.9, 127.7, 126.9, 126.3, 126.0, 57.0, 26.7; **IR** (neat) 3055, 2923, 1679, 1600, 1506 cm^{-1}; **HRMS** (TOF MS CI+) *m* / *z* calcd for $C_{25}H_{20}O$ $(M)^+$ 336.1514, found 3316.1514; **$[\alpha]^{29}_{D}$** +5.05 (*c* 1.01, $CHCl_3$); **SFC** analysis (OD-H, 20% IPA, 3.0 mL/min) indicated 97% ee: t_R (major) = 5.9 minutes, t_R (minor) = 6.5 minutes.



(*R*)
Table 2, entry 11

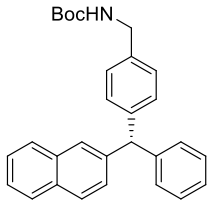
(*R*)-Table 2, entry 11. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.20 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 µL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-hydroxymethylphenyl)-1,3,2-dioxaborinane (88 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (10% EtOAc/hexane) to afford the product as an oil. First run: (51.0 mg, 0.157 mmol, 79%, 82% ee). Second run: (50.0 mg, 0.154 mmol, 77%, 81% ee). **TLC R_f** = 0.2 (20% EtOAc/hexanes); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.82–7.76 (m, 1H), 7.74 (d, J = 8.7 Hz, 1H), 7.71–7.66 (m, 1H), 7.46 (s, 1H), 7.41 (dt, *J* = 9.5, 4.4 Hz, 2H), 7.34–7.24 (m, 5H),

7.24–7.19 (m, 1H), 7.15 (d, J = 8.4 Hz, 4H), 5.69 (s, 1H), 4.64 (d, J = 4 Hz, 2H), 1.77 (t, J = 4.5 Hz, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 143.7, 143.3, 141.5, 139.1, 133.5, 132.3, 129.9, 129.6, 128.5, 128.1, 128.02, 127.96, 127.9, 127.7, 127.3, 126.6, 126.1, 125.8, 65.2, 56.8; **IR** (neat) 3330 (br), 2953, 1600, 1506 cm^{-1}; **HRMS** (TOF MS CI+) m / z calcd for $C_{24}H_{18}O$ $(M - 2H)^+$ 322.1358, found 322.1364; **[α]$^{23}_D$** –18.3 (c 1.66, $CHCl_3$); **SFC** analysis (AD-H, 30% MeOH, 2.5 mL/min) indicated 89% ee: t_R (major) = 4.3 minutes, t_R (minor) = 6.1 minutes.



(***R***)
Table 2, entry 13

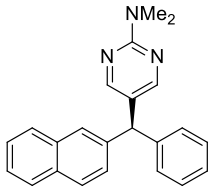
(*R*)-Table 2, entry 12. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.2 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-{[(tert-butoxycarbonyl)amino]methyl}phenyl)-1,3,2-dioxaborinane (128 mg, 0.400 mmol, 2.00 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (15–25% Et_2O/hexanes) to afford the product as a white solid. First run: (71.0 mg, 0.168 mmol, 84%, 92% ee). Second run: (70.5 mg, 0.166 mmol, 83%, 89% ee). **TLC R_f** = 0.3 (20% EtOAc/hexanes); **m.p.** = 57 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.81–7.76 (m, 1H), 7.74 (d, J = 8.6 Hz, 1H), 7.71–7.66 (m, 1H), 7.45 (s, 1H), 7.41 (dt, J = 9.5, 1.0 Hz, 2H), 7.28 (t, J = 7.4 Hz, 3H), 7.22 (d, J = 7.6 Hz, 1H), 7.19 (d, J = 8.0 Hz, 2H), 7.14 (d, J = 7.5 Hz, 2H), 7.11 (d, J = 8.0 Hz, 2H), 5.67 (s, 1H), 4.83 (br s, 1H), 4.29 (d, J = 5.1 Hz, 2H), 1.45 (s, 9H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 156.0, 143.7, 142.9, 141.5, 137.1, 133.5, 132.2, 129.9, 129.6, 128.5, 128.1, 128.01, 127.95, 127.8, 127.64, 127.59, 126.5, 126.1, 125.8, 79.5, 56.7, 44.4, 28.5; **IR** (neat) 3346, 2876, 1698, 1600, 1365 cm^{-1}; **HRMS** (TOF MS ES+) m / z calcd for $C_{29}H_{29}O_2N$ $(M + Na)^+$ 446.2096, found 446.2078; **[α]$^{23}_D$** –14.3 (c 4.4, $CHCl_3$); **SFC** analysis (AS-H, 20% MeOH, 2.5 mL/min) indicated 92% ee: t_R (major) = 4.3 minutes, t_R (minor) = 4.7 minutes.



(***S***)
Table 2, entry 14

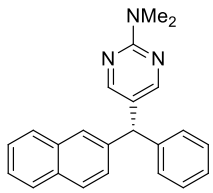
(*R*)-Table 2, entry 13. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-{[(tert-butoxycarbonyl)amino]methyl}phenyl)-1,3,2-dioxaborinane (128 mg, 0.400 mmol, 2.00 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv),

tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (15–25% Et_2O/hexanes) to afford the product as a white solid. First run: (84.0 mg, 0.198 mmol, 99%, 96% ee). Second run: (75.4 mg, 0.178 mmol, 89%, 94% ee). **TLC R_f** = 0.3 (20% EtOAc/hexanes); **m.p.** = 57 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.81–7.76 (m, 1H), 7.74 (d, *J* = 8.6 Hz, 1H), 7.71–7.66 (m, 1H), 7.45 (s, 1H), 7.41 (dt, *J* = 9.5, 1.0 Hz, 2H), 7.28 (t, *J* = 7.4 Hz, 3H), 7.22 (d, *J* = 7.6 Hz, 1H), 7.19 (d, *J* = 8.0 Hz, 2H), 7.14 (d, *J* = 7.5 Hz, 2H), 7.11 (d, *J* = 8.0 Hz, 2H), 5.67 (s, 1H), 4.83 (br s, 1H), 4.29 (d, *J* = 5.1 Hz, 2H), 1.45 (s, 9H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 156.0, 143.7, 142.9, 141.5, 137.1, 133.5, 132.2, 129.9, 129.6, 128.5, 128.1, 128.01, 127.95, 127.8, 127.64, 127.59, 126.5, 126.1, 125.8, 79.5, 56.7, 44.4, 28.5; **IR** (neat) 3346, 2876, 1698, 1600, 1365 cm^{-1}; **HRMS** (TOF MS ES+) *m* / *z* calcd for $C_{29}H_{29}O_2N$ (M + Na)$^+$ 446.2096, found 446.2078; **$[\alpha]^{29}_D$** +22.1 (*c* 1.01, $CHCl_3$); **SFC** analysis (AS-H, 20% MeOH, 2.5 mL/min) indicated 96% ee: t_R (major) = 4.5 minutes, t_R (minor) = 4.3 minutes.



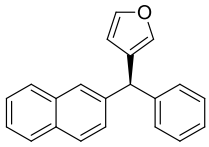
(***S***)
Table 2, entry 15

(*S*)-Table 2, entry 14. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.20 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-((dimethylamino)-5-pyrimidinylphenyl)-1,3,2-dioxaborinane (94 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (5% EtOAc/benzene) to afford the product as a white solid. First run: (58.2 mg, 0.171 mmol, 86%, 89% ee). Second run: (58.6 mg, 0.173 mmol, 86%, 89% ee). **TLC R_f** = 0.5 (5% EtOAc/benzene); **m.p.** = 45–47 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.04 (s, 2H), 7.73–7.67 (m, 1H), 7.66 (d, *J* = 8.6 Hz, 1H), 7.64–7.59 (m, 1H), 7.40 (s, 1H), 7.33 (dt, *J* = 9.5, 3.5 Hz, 2H), 7.23–7.16 (m, 3H), 7.15–7.10 (m, 1H), 7.06 (d, *J* = 7.6 Hz, 2H), 2.39 (s, 1H), 3.08 (s, 6H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 161.3, 158.5, 142.9, 140.7, 133.5, 132.3, 129.8, 128.7, 128.3, 127.9, 127.67, 127.65, 127.6, 126.8, 126.3, 125.9, 123.6, 51.7, 37.2; **IR** (neat) 3054, 3023, 2861, 1599, 1531 cm^{-1}; **HRMS** (TOF MS ES+) *m* / *z* calcd for $C_{23}H_{21}N_3$ (M + H)$^+$ 340.1814, found 340.1819; **$[\alpha]^{23}_D$** +15.7 (*c* 2.51, $CHCl_3$); **SFC** analysis (AD-H, 30% MeOH, 2.5 mL/min) indicated 89% ee: t_R (major) = 4.6 minutes, t_R (minor) = 6.4 minutes.



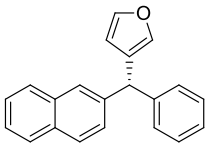
(***R***)
Table 2, entry 16

(*S*)-Table 2, entry 15. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-((dimethylamino)-5-pyrimidinylphenyl)-1,3,2-dioxaborinane (94 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (5% EtOAc/benzene) to afford the product as a white solid (50.8 mg, 0.150 mmol, 75%, 92% ee). **TLC R_f** = 0.5 (5% EtOAc/benzene); **m.p.** = 45–47 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.04 (s, 2H), 7.73–7.67 (m, 1H), 7.66 (d, *J* = 8.6 Hz, 1H), 7.64–7.59 (m, 1H), 7.40 (s, 1H), 7.33 (dt, *J* = 9.5, 3.5 Hz, 2H), 7.23–7.16 (m, 3H), 7.15–7.10 (m, 1H), 7.06 (d, *J* = 7.6 Hz, 2H), 2.39 (s, 1H), 3.08 (s, 6H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 161.3, 158.5, 142.9, 140.7, 133.5, 132.3, 129.8, 128.7, 128.3, 127.9, 127.67, 127.65, 127.6, 126.8, 126.3, 125.9, 123.6, 51.7, 37.2; **IR** (neat) 3054, 3023, 2861, 1599, 1531 cm^{-1}; **HRMS** (TOF MS ES+) *m* / *z* calcd for $C_{23}H_{21}N_3$ $(M + H)^+$ 340.1814, found 340.1819; **$[\alpha]^{29}_D$** –13.2 (*c* 0.675, $CHCl_3$); **SFC** analysis (AD-H, 30% MeOH, 2.5 mL/min) indicated 92% ee: t_R (major) = 6.1 minutes, t_R (minor) = 4.5 minutes.



(*S*)
Table 2, entry 17

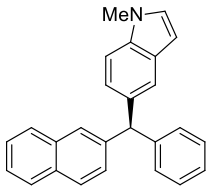
(*S*)-Table 2, entry 16. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.20 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(3-furanyl)-1,3,2-dioxaborinane (72 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (0.5–1% Et_2O/pentane) to afford the product as a white solid. First run: (45.8 mg, 0.161 mmol, 80%, 94% ee). Second run: (44.0 mg, 0.155 mmol, 78%, 94% ee). **TLC R_f** = 0.5 (1% Et_2O/pentane); **m.p.** = 65–67 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.83–7.69 (m, 3H), 7.60 (s, 1H), 7.47–7.37 (m, 3H), 7.34 (dd, *J* = 8.6, 1 Hz, 1H), 7.31–7.16 (m, 5H), 6.97 (s, 1H), 6.26 (s, 1H), 5.42 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 143.4, 143.3, 141.3, 141.1, 133.5, 132.4, 129.0, 128.6, 128.3, 128.1, 128.0, 127.7, 127.6, 127.1, 126.7, 126.2, 125.8, 111.6, 48.3; **IR** (neat) 3145, 3024, 1599, 1492 cm^{-1}; **HRMS** (TOF MS CI+) *m* / *z* calcd for $C_{21}H_{16}O$ $(M)^+$ 284.1201, found 284.1203; **$[\alpha]^{23}_D$** +22.3 (*c* 1.67, $CHCl_3$); **SFC** analysis (AD-H, 5% IPA, 2.5 mL/min) indicated 94% ee: t_R (major) = 12.2 minutes, t_R (minor) = 11.3 minutes.



(*R*)
Table 2, entry 18

(*S*)-Table 2, entry 17. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-

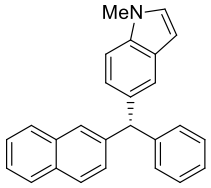
Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(3-furanyl)-1,3,2-dioxaborinane (72 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (0.5–1% Et_2O/pentane) to afford the product as a white solid. First run: (35.5 mg, 0.125 mmol, 62.5 %, 82% ee). Second run: (38.7 mg, 0.136 mmol, 68%, 84% ee). **TLC R_f** = 0.5 (1% Et_2O/pentane); **m.p.** = 65–67 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.83–7.69 (m, 3H), 7.60 (s, 1H), 7.47–7.37 (m, 3H), 7.34 (dd, *J* = 8.6, 1 Hz, 1H), 7.31–7.16 (m, 5H), 6.97 (s, 1H), 6.26 (s, 1H), 5.42 (s, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 143.4, 143.3, 141.3, 141.1, 133.5, 132.4, 129.0, 128.6, 128.3, 128.1, 128.0, 127.7, 127.6, 127.1, 126.7, 126.2, 125.8, 111.6, 48.3; **IR** (neat) 3145, 3024, 1599, 1492 cm^{-1}; **HRMS** (TOF MS CI+) *m* / *z* calcd for $C_{21}H_{16}O$ $(M)^+$ 284.1201, found 284.1203; **$[\alpha]^{29}_D$** –22.0 (*c* 1.00, $CHCl_3$); **SFC** analysis (AD-H, 5% IPA, 2.5 mL/min) indicated 84% ee: t_R (major) = 12.2 minutes, t_R (minor) = 13.4 minutes.



(*S*)
Table 2, entry 19

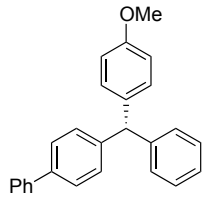
(*S*)-Table 2, entry 18. Using representative procedure A outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), tricyclohexylphosphine (11 mg, 0.040 mmol, 0.20 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5-(5,5-dimethyl-1,3,2-dioxaborinan-2-yl)-1-methyl-1*H*-indole (97 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (5–20% Et_2O/hexane, 0.5% TEA) to afford the product as a white solid. First run: (63.4 mg, 0.182 mmol, 91%, 92% ee). Second run: (61.4 mg, 0.178 mmol, 89%, 93% ee). **TLC R_f** = 0.3 (20% Et_2O/hexane); **m.p.** = 49–52 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80–7.75 (m, 1H), 7.73 (d, *J* = 8.6 Hz, 1H), 7.70–7.64 (m, 1H), 7.50 (s, 1H), 7.40 (dt, *J* = 9.3, 4.9 Hz, 2H), 7.37–7.31 (m, 2H), 7.27 (t, *J* = 7.3 Hz, 2H), 7.25–7.16 (m, 4H), 7.07 (dd, *J* = 8.7, 1.0 Hz, 1H), 6.98 (d, *J* = 2.9 Hz, 1H), 6.36 (d, *J* = 2.9 Hz, 1H), 5.83 (s, 1H), 3.72 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 144.7, 142.6, 135.6, 134.9, 133.5, 132.2, 129.8, 129.2, 128.55, 128.52, 128.4, 128.0, 127.9, 127.8, 127.6, 126.3, 126.0, 125.6, 123.9, 121.7, 109.2, 101.1, 57.1, 33.0; **IR** (neat) 3022, 2884, 1599, 1489 cm^{-1}; **HRMS** (TOF MS ES+) *m* / *z* calcd for $C_{26}H_{21}N$ $(M + Na)^+$ 370.1572, found 370.1576; **$[\alpha]^{23}_D$** –10.8 (*c* 1.00, $CHCl_3$); **SFC** analysis (AD-H, 20% MeOH, 2.5 mL/min) indicated 93% ee: t_R (major) = 8.1 minutes, t_R (minor) = 9.0 minutes.

Single crystals suitable for X-ray crystallographic analysis were grown by slow diffusion of hexane into a solution of **(*S*)-Table 2, entry 19** in benzene at 4 °C. See Section VIII for crystallographic data.



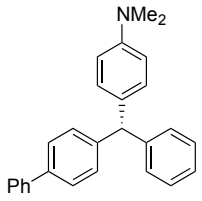
(*R*)
Table 2, entry 20

(*R*)-Table 2, entry 19. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.3 mg, 0.021 mmol, 0.11 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5-(5,5-dimethyl-1,3,2-dioxaborinan-2-yl)-1-methyl-1*H*-indole (97 mg, 0.40 mmol, 2.0 equiv), **(*S*)-1** (66 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (5–20% Et_2O/hexanes, 0.5% TEA) to afford the product as a white solid. First run: (41.5 mg, 0.119 mmol, 57%, 92% ee). Second run: (57.0 mg, 0.164 mmol, 82%, 92% ee). Analytical data is consistent with the values listed above for **(*S*)-Table 2, entry 12**. $[\alpha]^{23}_{D}$ +6.0 (*c* 0.9, $CHCl_3$); **SFC** analysis (AD-H, 20% MeOH, 2.5 mL/min) indicated 93% ee: t_R (major) = 8.9 minutes, t_R (minor) = 8.1 minutes.



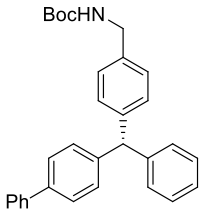
(*R*)
Table 3, entry 1

(*R*)-Table 3, entry 1. Using representative procedure B above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.3 mg, 0.0210 mmol, 0.11 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5,5-dimethyl-2-(4-methoxyphenyl)-1,3,2-dioxaborinane (88 mg, 0.40 mmol, 2.0 equiv), **(*S*)-SI-6** (69 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (1–3% Et_2O/hexanes) to afford the product as a colorless oil. First run: (54.8 mg, 0.156 mmol, 78%, 81% ee). Second run: (55.8 mg, 0.159 mmol, 80%, 81% ee). **TLC** $\mathbf{R_f}$ = 0.4 (10% Et_2O/Hexanes); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.2, 2H), 7.51 (d, *J* = 7.1, 2H), 7.42 (t, *J* = 7.1, 2H), 7.29 (m, 3H), 7.19 (m, 5H), 7.06 (d, *J* = 7.8, 2H), 6.83 (d, *J* = 8.2, 2H) 5.53 (s, 1H), 3.78 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 158.2, 144.3, 143.5, 141.0, 139.2, 136.2, 130.5, 129.9, 129.5, 128.9, 128.5, 128.3, 127.15, 127.14, 126.4, 113.9, 55.9, 55.4; **IR** (neat) 3020, 2996, 1508, 1244, 1030 cm^{-1}; **HRMS** (TOF MS ES+) *m / z* calcd for $C_{26}H_{22}O$ $(M + Na)^+$ 350.1671, found 367.1679; $\mathbf{[\alpha]^{23}_{D}}$ +1.2 (*c* 1.01, $CHCl_3$), **SFC** analysis (AD-H, 10% MeOH, 2.5 mL/min) indicated 84% ee: t_R (minor) = 21.5 minutes, t_R (major) = 19.8 minutes.



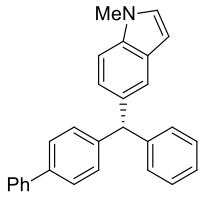
(*R*)
Table 3, entry 2

(*R*)-Table 3, entry 2. Using representative procedure B above, the following amounts and reagents: 1,8-bis(1,5-cyclooctadiene)nickel (8.3 mg, 0.030 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (12 mg, 0.030 mmol, 0.10 equiv), potassium *tert*-butoxide (64 mg, 0.60 mmol, 2.0 equiv), 4-(5,5-dimethyl-1,3,2-dioxaborinan-2-yl)-*N,N*-dimethylaniline (134 mg, 0.600 mmol, 2.00 equiv), **(*S*)-SI-6** (103 mg, 0.300 mmol, 1.00 equiv) and 1-butanol (54 μL, 0.90 mmol, 3.00 equiv). Purified by flash column chromatography (0–10% Et_2O/hexanes) to afford **(*R*)-8,** as a light yellow oil (55 mg, 0.15 mmol, 75%). **TLC R_f** = 0.3 (10% Et_2O/Hexanes); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.57 (d, *J* = 7.2, 2H), 7.49 (d, *J* = 8.2, 2H), 7.41 (t, *J* = 7.7, 2H), 7.29 (m, 3H), 7.27 (s, 1H) 7.21 (m, 5H), 7.02 (dd, *J* = 8.6, 2H) 6.67 (d, *J* = 8.9, 2H), 6.4 (d, *J* = 2.8, 1H), 5.5 (s, 1H), 2.9 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 149.2, 144.7, 143.9, 141.1, 139.0, 131.9, 130.2, 129.9, 129.5, 128.8, 128.4, 127.20, 127.15, 127.1, 126.3, 112.7, 55.7, 40.8; **IR** (neat) 3024, 2841, 2360, 1613, 1485, 1347, 763 cm^{-1}; **HRMS** (TOF MS EI+) *m / z* calcd for $C_{27}H_{25}O$ $(M + Na)^+$ 364.2065, found 364.2061; **$[\alpha]^{23}_D$** –2.9 (*c* 1.07, $CHCl_3$); **SFC** analysis (AD-H, 16% MeOH, 3.0 mL/min) indicated 79% ee: t_R (minor) = 26.3 minutes, t_R (major) = 11.6 minutes.



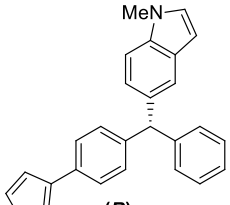
(*S*)
Table 3, entry 3

tert-butyl 4-([1,1'-biphenyl]-4-yl(phenyl)methyl)benzylcarbamate (10). Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.67 mg, 0.022 mmol, 0.11 equiv), potassium *tert*-butoxide (45 mg, 0.4 mmol, 2.0 equiv), *tert*-butyl 4-(5,5-dimethyl-1,3,2-dioxaborinan-2-yl)benzylcarbamate (127.3 mg, 0.200 mmol, 2.00 equiv), **S-SI-6** (68.9 mg, 0.200 mmol, 1.00 equiv) and 1-butanol (54 μL, 0.60 mmol, 3.0 equiv). Purified by flash column chromatography (0–15 % EtOAc/Hexane) to afford to afford the desired triarylmethane as a clear colorless oil (48.5 mg, 54%); **TLC R_f** = 0.1 (9:1 Hexanes:EtOAc); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.57 (dd, *J* = 1.5, *J* = 8.4, 2H), 7.51 (d, *J* = 8.3, 2H), 7.39 (t, *J* = 7.5, 2H), 7.29 (m, 3H), 7.25 (m, 3H), 7.15 (m, 6H), 5.56 (s, 1H), 4.82 (s, 1H), 4.30 (d, *J* = 5.3, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 156.0, 143.9, 143.13, 143.05, 140.9, 139.3, 137.1, 129.9, 129.8, 129.5, 128.9, 128.5, 127.6, 127.3, 127.16, 127.14, 126.5, 56.3, 44.3, 28.5; **IR** (neat) 3294, 3028, 1695, 1486, 1316, 1016, 757 cm^{-1}; **HRMS** (TOF MS EI+) *m / z* calcd for $C_{31}H_{31}NO_2$ $[M+Na]^+$ 472.2253, found 472.2261. **$[\alpha]^{29}_D$** – 8.2 **SFC** analysis (AS-H, 20% MeOH, 2.5 mL/min) indicated 92% ee: t_R (major) = 6.86 minutes, t_R (minor) = 7.47 minutes.



(*R*)
Table 3, entry 4

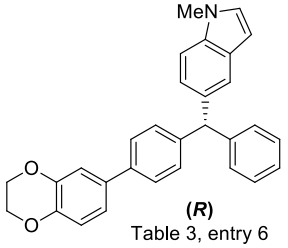
(*R*)-Table 3, entry 3. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5-(5,5-dimethyl-1,3,2-dioxaborinan-2-yl)-1-methyl-1*H*-indole (97 mg, 0.40 mmol, 2.0 equiv), **(*S*)-SI-6** (69 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified by flash column chromatography (5–20% Et_2O/hexane, 0.5% TEA) to afford the product as a white solid. First run: (61.0 mg, 0.163mmol, 82%, 96% ee). Second run: (37.8 mg, 0.101 mmol, 51%, 96% ee). **TLC R_f** = 0.3 (10% EtOAc/hexanes); **m.p.** = 54–55 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.4, 2H), 7.49 (d, *J* = 8.2, 2H), 7.37 (t, *J* = 7.4, 2H), 7.27 (m, 3H), 7.26 (s, 1H) 7.22 (m, 9H), 7.07 (dd, *J* = 1.3, 8.6, 1H) 6.87 (d, *J* = 3.0, 1H), 6.37 (d, *J* = 2.8, 1H), 5.70 (s, 1H), 3.73 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 144.9, 144.2, 141.1, 138.9, 135.6, 135.1, 130.1, 129.7, 129.2, 128.8, 128.6, 128.4, 127.17, 127.15, 127.0, 126.2, 123.8, 121.6, 109.2, 101.1, 56.7, 32.9; **IR** (neat) 3025, 2360, 1486, 1449, 1246, 1006, 760 cm^{-1}; **HRMS** submitted; **$[\alpha]^{23}_D$** –5.2; **SFC** analysis (AD-H, 25% MeOH, 2.5 mL/min) indicated 96% ee: t_R (major) = 11.3 minutes, t_R (minor) = 16.1 minutes.



(*R*)
Table 3, entry 5

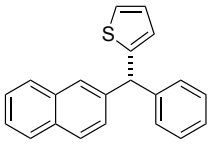
(*R*)-Table 3, entry 4. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-Bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5-(5,5-dimethyl-1,3,2-dioxaborinan-2-yl)-1-methyl-1*H*-indole (97 mg, 0.40 mmol, 2.0 equiv), **(*S*)-SI-7** (67 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified twice by flash column chromatography (6% Et_2O/hexane and then 60% benzene/pentane) to afford the desired triarylmethane as a white solid. First run: (58.5 mg, 0.161 mmol, 80%, 87% ee). Second run: (58.5 mg, 0.161 mmol, 80%, 87% ee). **TLC R_f** = 0.6 (40% pentane/benzene); **m.p.** = 149–151 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.59 (s, 1H), 7.34 (s, 1H), 7.29 (d, *J* = 8.3 Hz, 2H), 7.23 (s,1H), 7.18 (t, *J* = 7.4 Hz, 2H), 7.15–7.09 (m, 2H), 7.07 (t, *J* = 7.4 Hz, 4H), 6.95 (d, *J* = 8.6 Hz, 1H), 6.90 (d, *J* = 2.8 Hz, 1H), 6.57 (s, 1H), 6.29 (d, *J* = 2.8 Hz, 1H), 5.58 (s, 1H), 3.63 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 144.9, 143.9, 141.7, 138.5, 135.6, 135.0, 130.3, 130.1, 129.7, 129.2, 128.5, 128.3, 126.4, 126.2, 125.8, 123.7, 121.5,

109.2, 109.0, 101.1, 56.7, 33.0; **IR** (neat) 3145, 3024, 1599, 1492 cm^{-1}; $[\alpha]^{23}_{D}$ –3.1 (*c* 2.24, $CHCl_3$); **HRMS** submitted; **SFC** analysis (OJ-H, 30% MeOH, 3.0 mL/min) indicated 87% ee: t_R (major) = 23.6 minutes, t_R (minor) = 26.2 minutes.



(*R*)
Table 3, entry 6

(*R*)-Table 3, entry 5. Using representative procedure B outlined above, the following amounts of reagents were used: 1,8-bis(1,5-cyclooctadiene)nickel (5.5 mg, 0.020 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (8.27 mg, 0.0210 mmol, 0.105 equiv), potassium *tert*-butoxide (45 mg, 0.40 mmol, 2.0 equiv), 1-butanol (54 μL, 0.60 mmol, 3.0 equiv), 5-(5,5-dimethyl-1,3,2-dioxaborinan-2-yl)-1-methyl-1*H*-indole (97 mg, 0.40 mmol, 2.0 equiv), **(*S*)-SI-8** (67 mg, 0.20 mmol, 1.0 equiv), tetrahydrofuran (1 mL) and toluene (1 mL). The product was purified twice by flash column chromatography (6% EtOAc/hexanes and then 70% benzene/pentane) to afford the desired triarylmethane as a white solid. First run: (51.4 mg, 0.119 mmol, 60%, 93% ee). Second run: (52.0 mg, 0.121 mmol, 60%, 93% ee). **TLC R_f** = 0.3 (40% pentane/benzene); **m.p.** = 81–84 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.43 (s, *J* = 8.0 2H), 7.33 (s, 1H), 7.29 (t, *J* = 7.4 Hz, 2H), 7.24 (s,1H), 7.22–7.14 (m, 5H), 7.10 (s, 1H), 7.06 (dt, *J* = 8.2, 2.0 Hz, 2H), 7.01 (d, *J* = 2.7 Hz, 1H), 6.90 (d, *J* = 8.2 Hz, 1H), 6.39 (d, *J* = 2.5 Hz, 1H), 5.69 (s, 1H), 4.27 (s, 4H), 3.76 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 144.9, 143.8, 143.7, 143.1, 138.4, 135.6, 135.1, 134.8, 130.0, 129.7, 129.2, 128.6, 128.4, 126.6, 126.2, 123.8, 121.6, 120.2, 117.6, 115.8, 109.2, 101.1, 64.58, 64.56, 56.7, 33.0; **IR** (neat) 2916, 1586, 1513, 1449 cm^{-1}; **HRMS** (TOF MS ES+) *m* / *z* calcd for $C_{30}H_{25}O_2N$ $(M + Na)^+$ 454.1783, found 454.1772; $[\alpha]^{23}_{D}$ –8.2 (*c* 2.36, $CHCl_3$); **SFC** analysis (OD-H, 25% IPA, 2.5 mL/min) indicated 93% ee: t_R (major) = 23.6 minutes, t_R (minor) = 26.2 minutes.



(*R*)-SI-9

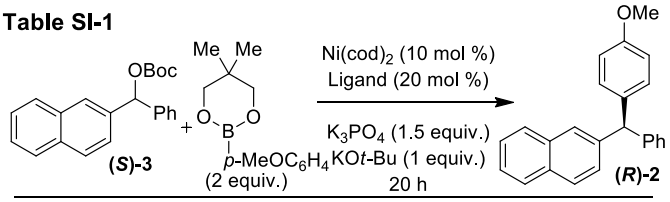
(*R*)-SI-9. Prepared according to general procedure B using the following amounts and reagents: $Ni(cod)_2$ (2.8 mg, 0.010 mmol, 0.10 equiv), 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate (3.9 mg, 0.010 mmol, 0.10 equiv), potassium *tert*-butoxide (22 mg, 0.20 mmol, 2.0 equiv), 5,5-dimethyl-2-(thiophen-2-yl)-1,3,2-dioxaborinane (39.2 mg, 0.200 mmol, 2.00 equiv), **(*S*)-1** (33.1 mg, 0.100 mmol, 1.00 equiv) and 1-butanol (27 μL, 0.30 mmol, 3.0 equiv). Purified by flash column chromatography (0–5% Et_2O/hexanes) to afford the desired triarylmethane as a yellow solid (11.4 mg, 0.0379 mmol, 38%). Analytical data is consistent with literature values.[3] **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.84–7.72 (m, 3H), 7.61 (s, 1H), 7.37–7.41 (m, 2H), 7.37 (dd, *J* = 1.6, 8.5), 7.34–7.20 (m, 6H), 6.95 (t, *J* = 4.3), 6.73 (d, *J* = 3.3), 5.84 (s, 1H); **^{13}C NMR** δ (125 MHz, $CDCl_3$) δ 147.8, 143.7, 141.4, 133.5, 132.4, 129.1,

128.6, 128.2, 128.1, 127.7, 127.5, 127.4, 126.9, 126.8, 126.7, 126.2, 125.9, 124.8, 52.3 $[\alpha]^{25}_{D}$ – 9.3 (*c* 0.57, $CHCl_3$).

VI. Tables of results using alternative ligands and bases.

Other ligands and bases were tested under reaction conditions similar to Table 1. Representative examples are shown below.

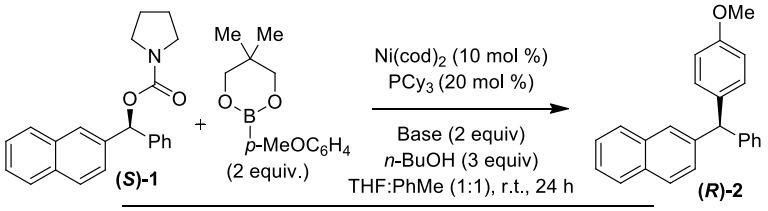
Table SI-1



Entry	ligand	yield[a]
1	DPEphos (Bis[(2-diphenylphosphino)phenyl] ether)	< 5%
2	Cy-DPEphos (Bis[(2-dicyclohexylphosphino)phenyl] ether)	< 5%
3	DPPO (1,8-bis(diphenylphosphino)octane)	13%
4	PPh_3 (triphenylphosphine)	22%
5	$P(t\text{-}Bu)_3$ tri-*tert*-butylphosphine	< 5%
6	XPhos (2-Dicyclohexylphosphino-2',4',6'-triisopropylbiphenyl)	< 5%
7	SPhos (2-Dicyclohexylphosphino-2',6'-dimethoxybiphenyl)	< 5%
8	SIPr-HBF_4 (1,3-Bis(2,6-diisopropylphenyl)-4,5-dihydroimidazolium tetrafluoroborate	31%
9	tricyclohexylphosphine	86%
10	PCy_3 tricylohexylphosphine (11 mol %)	83%
11	SIMes-HBF_4 1,3-bis(2,4,6-trimethylphenyl)-4,5-dihydroimidazolium tetrafluoroborate	84%
12	None	< 5%

[a]Determined by ^{1}H NMR analysis using an internal standard ($PhSiMe_3$).

Table SI-2



Entry	Base	yield (%)[a]	SM ee (%)[b]	product ee (%)[b]	es (%)
1	LiO*t*-Bu	8	98	53	54
2	NaO*t*-Bu	75	94	93	99
3	KO*t*-Bu	87	93	92	99

[b]Isolated yield after chromatography. [c]Determined by chiral SFC chromatography.

VII. References and Notes

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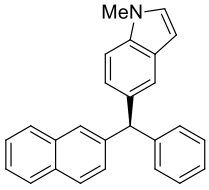
VIII. Crystallographic Data



(*S*)
Table 2, entry 19

X-ray Data Collection, Structure Solution and Refinement for **(*S*)-Table 2, entry 19.**

A colorless crystal of approximate dimensions 0.22 x 0.28 x 0.33 mm was mounted on a glass fiber and transferred to a Nonius FR-591 rotating-anode system with Bruker APEX detector (Montels Optics). The APEX2[1] program package was used to determine the unit-cell parameters and for data collection (2.0 sec/frame scan time). The raw frame data was processed using SAINT[2] and SADABS[3] to yield the reflection data file. Subsequent calculations were carried out using the SHELXTL[4] program. The diffraction symmetry was 2/*m* and the systematic absences were consistent with the monoclinic space groups $P2_1$ and $P2_1/m$. It was later determined that space group $P2_1$ was correct.

The structure was solved by direct methods and refined on F^2 by full-matrix least-squares techniques. The analytical scattering factors[5] for neutral atoms were used throughout the analysis. Hydrogen atoms were located from a difference-Fourier map and refined (x,y,z and U_{iso}).

At convergence, wR2 = 0.0770 and Goof = 1.043 for 328 variables refined against 3454 data (0.82Å), R1 = 0.0297 for those 3412 data with $I > 2.0\sigma(I)$. The absolute structure was assigned according to the methods of Parsons and Flack[6-7].

References.

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Definitions:

$wR2 = [\Sigma[w(F_o^2-F_c^2)^2] / \Sigma[w(F_o^2)^2]]^{1/2}$

$R1 = \Sigma||F_o|-|F_c|| / \Sigma|F_o|$

$Goof = S = [\Sigma[w(F_o^2-F_c^2)^2] / (n-p)]^{1/2}$ where n is the number of reflections and p is the total number of parameters refined.

The thermal ellipsoid plot is shown at the 50% probability level.

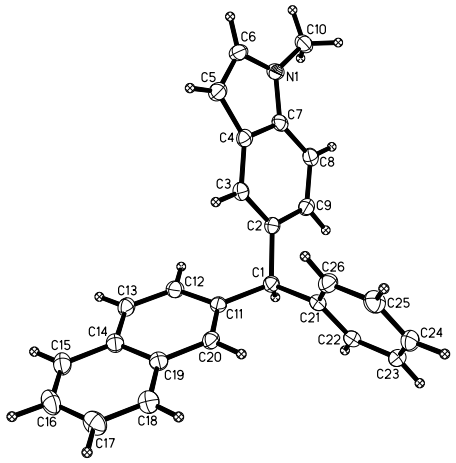


Table 1. Crystal data and structure refinement for erj10.

Identification code	erj10 (Michael Harris)	
Empirical formula	$C_{26}\ H_{21}\ N$	
Formula weight	347.44	
Temperature	173(2) K	
Wavelength	1.54178 Å	
Crystal system	Monoclinic	
Space group	$P2_1$	
Unit cell dimensions	a = 8.6116(2) Å	α= 90°.
	b = 11.5924(2) Å	β= 100.1452(7)°.
	c = 9.6267(2) Å	γ = 90°.
Volume	946.00(3) $Å^3$	
Z	2	
Density (calculated)	1.220 Mg/m^3	
Absorption coefficient	0.534 mm^{-1}	
F(000)	368	
Crystal color	colorless	
Crystal size	0.331 x 0.280 x 0.218 mm^3	
Theta range for data collection	4.666 to 69.774°	
Index ranges	$-9 \le h \le 10$, $-14 \le k \le 14$, $-11 \le l \le 11$	
Reflections collected	24745	
Independent reflections	3454 [R(int) = 0.0343]	
Completeness to theta = 67.679°	99.4 %	
Absorption correction	Semi-empirical from equivalents	

Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	3454 / 1 / 328
Goodness-of-fit on F^2	1.043
Final R indices [I>2sigma(I) = 3412 data]	R1 = 0.0297, wR2 = 0.0765
R indices (all data, 0.82Å)	R1 = 0.0302, wR2 = 0.0770
Absolute structure parameter	-0.10(16)
Largest diff. peak and hole	0.157 and -0.146 e.$Å^{-3}$

Table 2. Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters ($Å^2$x 10^3) for erj10. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
N(1)	13910(2)	6748(1)	9901(2)	23(1)
C(1)	9548(2)	10396(1)	8488(2)	19(1)
C(2)	10723(2)	9410(1)	8861(2)	19(1)
C(3)	10709(2)	8428(2)	8045(2)	20(1)
C(4)	11837(2)	7559(2)	8465(2)	20(1)
C(5)	12142(2)	6453(2)	7916(2)	25(1)
C(6)	13398(2)	6000(2)	8817(2)	26(1)
C(7)	12970(2)	7715(2)	9709(2)	21(1)
C(8)	13009(2)	8707(2)	10529(2)	22(1)
C(9)	11880(2)	9540(2)	10092(2)	21(1)
C(10)	15216(2)	6573(2)	11064(2)	28(1)
C(11)	7966(2)	10000(1)	7634(2)	19(1)
C(12)	7165(2)	9073(2)	8182(2)	22(1)
C(13)	5735(2)	8692(2)	7493(2)	24(1)
C(14)	4987(2)	9213(2)	6213(2)	22(1)
C(15)	3499(2)	8845(2)	5466(2)	27(1)
C(16)	2814(2)	9384(2)	4243(2)	31(1)
C(17)	3574(2)	10329(2)	3729(2)	31(1)
C(18)	5014(2)	10701(2)	4422(2)	26(1)
C(19)	5763(2)	10152(2)	5674(2)	21(1)
C(20)	7255(2)	10522(2)	6409(2)	21(1)
C(21)	10306(2)	11392(1)	7807(2)	20(1)
C(22)	10357(2)	12484(2)	8399(2)	21(1)
C(23)	11043(2)	13406(2)	7801(2)	25(1)
C(24)	11687(2)	13242(2)	6596(2)	28(1)
C(25)	11653(2)	12143(2)	5993(2)	29(1)
C(26)	10969(2)	11228(2)	6599(2)	24(1)

Table 3. Bond lengths [Å] and angles [°] for erj10.

N(1)-C(6)	1.369(3)
N(1)-C(7)	1.376(2)
N(1)-C(10)	1.455(2)
C(1)-C(2)	1.527(2)
C(1)-C(21)	1.529(2)
C(1)-C(11)	1.532(2)
C(1)-H(1A)	0.96(2)
C(2)-C(3)	1.382(2)
C(2)-C(9)	1.416(2)
C(3)-C(4)	1.409(2)
C(3)-H(3A)	0.96(2)
C(4)-C(7)	1.417(2)
C(4)-C(5)	1.428(2)
C(5)-C(6)	1.367(3)
C(5)-H(5A)	0.96(3)
C(6)-H(6A)	0.95(3)
C(7)-C(8)	1.392(3)
C(8)-C(9)	1.382(2)
C(8)-H(8A)	0.95(2)
C(9)-H(9A)	0.95(3)
C(10)-H(10A)	0.96(3)
C(10)-H(10B)	0.95(3)
C(10)-H(10C)	0.94(3)
C(11)-C(20)	1.370(2)
C(11)-C(12)	1.427(2)
C(12)-C(13)	1.365(3)
C(12)-H(12A)	1.00(3)
C(13)-C(14)	1.421(3)
C(13)-H(13A)	0.96(3)
C(14)-C(15)	1.420(3)
C(14)-C(19)	1.421(2)
C(15)-C(16)	1.370(3)
C(15)-H(15A)	0.97(3)
C(16)-C(17)	1.410(3)

C(16)-H(16A)	0.99(3)
C(17)-C(18)	1.371(3)
C(17)-H(17A)	0.97(3)
C(18)-C(19)	1.414(3)
C(18)-H(18A)	0.94(3)
C(19)-C(20)	1.420(2)
C(20)-H(20A)	0.97(3)
C(21)-C(22)	1.386(2)
C(21)-C(26)	1.396(3)
C(22)-C(23)	1.394(3)
C(22)-H(22A)	0.95(3)
C(23)-C(24)	1.384(3)
C(23)-H(23A)	0.95(3)
C(24)-C(25)	1.398(3)
C(24)-H(24A)	0.95(3)
C(25)-C(26)	1.390(3)
C(25)-H(25A)	0.94(3)
C(26)-H(26A)	0.94(3)

C(6)-N(1)-C(7)	108.16(15)
C(6)-N(1)-C(10)	126.79(15)
C(7)-N(1)-C(10)	125.05(16)
C(2)-C(1)-C(21)	110.53(14)
C(2)-C(1)-C(11)	113.04(14)
C(21)-C(1)-C(11)	113.75(14)
C(2)-C(1)-H(1A)	105.5(14)
C(21)-C(1)-H(1A)	108.4(14)
C(11)-C(1)-H(1A)	105.1(13)
C(3)-C(2)-C(9)	119.84(15)
C(3)-C(2)-C(1)	122.97(15)
C(9)-C(2)-C(1)	117.18(15)
C(2)-C(3)-C(4)	119.34(15)
C(2)-C(3)-H(3A)	123.2(15)
C(4)-C(3)-H(3A)	117.5(15)
C(3)-C(4)-C(7)	119.20(15)
C(3)-C(4)-C(5)	134.29(16)

C(7)-C(4)-C(5)	106.50(15)
C(6)-C(5)-C(4)	106.67(16)
C(6)-C(5)-H(5A)	126.2(17)
C(4)-C(5)-H(5A)	127.1(17)
C(5)-C(6)-N(1)	110.61(16)
C(5)-C(6)-H(6A)	130.1(16)
N(1)-C(6)-H(6A)	119.3(16)
N(1)-C(7)-C(8)	129.92(16)
N(1)-C(7)-C(4)	108.06(15)
C(8)-C(7)-C(4)	122.02(16)
C(9)-C(8)-C(7)	117.27(15)
C(9)-C(8)-H(8A)	121.0(14)
C(7)-C(8)-H(8A)	121.6(14)
C(8)-C(9)-C(2)	122.32(16)
C(8)-C(9)-H(9A)	119.6(14)
C(2)-C(9)-H(9A)	118.1(14)
N(1)-C(10)-H(10A)	109.4(18)
N(1)-C(10)-H(10B)	110.4(18)
H(10A)-C(10)-H(10B)	107(3)
N(1)-C(10)-H(10C)	111.3(17)
H(10A)-C(10)-H(10C)	110(2)
H(10B)-C(10)-H(10C)	109(2)
C(20)-C(11)-C(12)	118.63(16)
C(20)-C(11)-C(1)	123.31(16)
C(12)-C(11)-C(1)	118.00(15)
C(13)-C(12)-C(11)	121.12(16)
C(13)-C(12)-H(12A)	120.4(15)
C(11)-C(12)-H(12A)	118.5(15)
C(12)-C(13)-C(14)	121.11(16)
C(12)-C(13)-H(13A)	119.9(14)
C(14)-C(13)-H(13A)	118.9(14)
C(15)-C(14)-C(13)	122.84(17)
C(15)-C(14)-C(19)	119.03(17)
C(13)-C(14)-C(19)	118.12(16)
C(16)-C(15)-C(14)	120.77(19)
C(16)-C(15)-H(15A)	120.4(14)

C(14)-C(15)-H(15A)	118.8(14)
C(15)-C(16)-C(17)	119.96(18)
C(15)-C(16)-H(16A)	120.1(17)
C(17)-C(16)-H(16A)	120.0(17)
C(18)-C(17)-C(16)	120.64(19)
C(18)-C(17)-H(17A)	119.3(16)
C(16)-C(17)-H(17A)	120.0(16)
C(17)-C(18)-C(19)	120.72(19)
C(17)-C(18)-H(18A)	118.5(16)
C(19)-C(18)-H(18A)	120.8(16)
C(18)-C(19)-C(20)	121.68(17)
C(18)-C(19)-C(14)	118.84(17)
C(20)-C(19)-C(14)	119.47(16)
C(11)-C(20)-C(19)	121.53(16)
C(11)-C(20)-H(20A)	121.3(14)
C(19)-C(20)-H(20A)	117.1(14)
C(22)-C(21)-C(26)	118.62(16)
C(22)-C(21)-C(1)	119.87(15)
C(26)-C(21)-C(1)	121.51(15)
C(21)-C(22)-C(23)	121.02(16)
C(21)-C(22)-H(22A)	118.7(16)
C(23)-C(22)-H(22A)	120.3(16)
C(24)-C(23)-C(22)	120.19(17)
C(24)-C(23)-H(23A)	120.3(15)
C(22)-C(23)-H(23A)	119.5(15)
C(23)-C(24)-C(25)	119.38(17)
C(23)-C(24)-H(24A)	117.7(17)
C(25)-C(24)-H(24A)	122.8(17)
C(26)-C(25)-C(24)	120.04(17)
C(26)-C(25)-H(25A)	121.9(19)
C(24)-C(25)-H(25A)	118.0(19)
C(25)-C(26)-C(21)	120.75(17)
C(25)-C(26)-H(26A)	117.8(16)
C(21)-C(26)-H(26A)	121.4(16)

Table 4. Anisotropic displacement parameters ($Å^2 x\ 10^3$) for erj10. The anisotropic displacement factor exponent takes the form: $-2\pi^2[\ h^2\ a^{*2}U^{11} + ...\ + 2\ h\ k\ a^*\ b^*\ U^{12}\ ]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
N(1)	19(1)	21(1)	30(1)	4(1)	7(1)	2(1)
C(1)	19(1)	18(1)	20(1)	-1(1)	4(1)	0(1)
C(2)	18(1)	18(1)	22(1)	2(1)	5(1)	-2(1)
C(3)	19(1)	22(1)	21(1)	1(1)	4(1)	-2(1)
C(4)	20(1)	19(1)	21(1)	1(1)	7(1)	-2(1)
C(5)	26(1)	21(1)	28(1)	-2(1)	7(1)	-1(1)
C(6)	26(1)	17(1)	35(1)	0(1)	10(1)	2(1)
C(7)	17(1)	21(1)	25(1)	5(1)	7(1)	-1(1)
C(8)	19(1)	24(1)	23(1)	2(1)	3(1)	-3(1)
C(9)	22(1)	19(1)	22(1)	-1(1)	5(1)	-2(1)
C(10)	19(1)	29(1)	36(1)	6(1)	4(1)	1(1)
C(11)	17(1)	17(1)	23(1)	-2(1)	6(1)	0(1)
C(12)	21(1)	21(1)	25(1)	2(1)	5(1)	1(1)
C(13)	22(1)	21(1)	30(1)	-1(1)	10(1)	-3(1)
C(14)	19(1)	24(1)	26(1)	-7(1)	7(1)	-1(1)
C(15)	22(1)	30(1)	31(1)	-9(1)	8(1)	-4(1)
C(16)	23(1)	41(1)	30(1)	-13(1)	2(1)	-3(1)
C(17)	30(1)	41(1)	21(1)	-5(1)	-1(1)	2(1)
C(18)	28(1)	30(1)	22(1)	-2(1)	5(1)	-2(1)
C(19)	21(1)	22(1)	22(1)	-5(1)	6(1)	1(1)
C(20)	21(1)	18(1)	24(1)	-2(1)	7(1)	-1(1)
C(21)	16(1)	20(1)	23(1)	1(1)	1(1)	1(1)
C(22)	16(1)	22(1)	24(1)	0(1)	3(1)	2(1)
C(23)	22(1)	18(1)	34(1)	1(1)	1(1)	0(1)
C(24)	23(1)	25(1)	35(1)	8(1)	5(1)	-3(1)
C(25)	26(1)	32(1)	29(1)	3(1)	11(1)	-1(1)
C(26)	26(1)	21(1)	28(1)	-2(1)	7(1)	0(1)

Table 5. Hydrogen coordinates (x 10^4) and isotropic displacement parameters ($Å^2$x 10^3) for erj10.

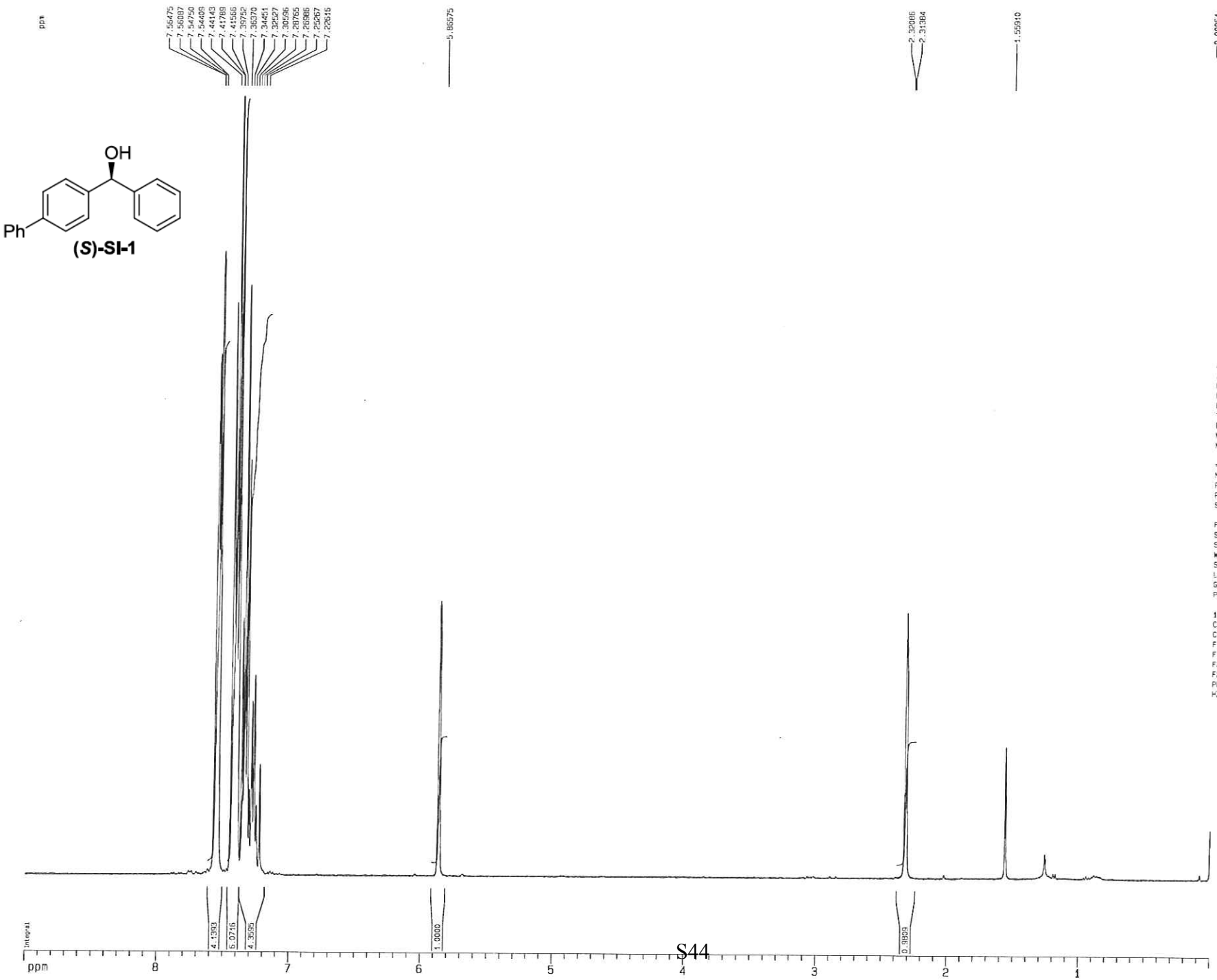
	x	y	z	U(eq)
H(1A)	9310(30)	10660(20)	9370(20)	18(5)
H(3A)	9970(30)	8310(20)	7190(30)	23(5)
H(5A)	11600(30)	6100(20)	7070(30)	35(7)
H(6A)	13920(30)	5280(20)	8790(30)	31(6)
H(8A)	13750(30)	8800(20)	11380(20)	20(5)
H(9A)	11860(30)	10220(20)	10630(20)	22(5)
H(10A)	15640(40)	5810(30)	11000(30)	45(8)
H(10B)	16050(40)	7100(30)	11000(30)	43(7)
H(10C)	14890(30)	6670(20)	11940(30)	33(6)
H(12A)	7670(30)	8710(20)	9100(30)	27(6)
H(13A)	5210(30)	8080(20)	7880(30)	25(6)
H(15A)	2970(30)	8210(20)	5840(20)	24(5)
H(16A)	1800(40)	9100(20)	3710(30)	40(7)
H(17A)	3100(30)	10700(20)	2850(30)	32(6)
H(18A)	5490(30)	11330(20)	4050(30)	31(6)
H(20A)	7740(30)	11170(20)	6020(20)	24(5)
H(22A)	9900(30)	12600(20)	9230(30)	30(6)
H(23A)	11050(30)	14150(20)	8220(30)	27(6)
H(24A)	12190(30)	13880(30)	6240(30)	37(7)
H(25A)	12100(30)	12050(30)	5180(30)	42(7)
H(26A)	10990(30)	10500(20)	6180(30)	31(6)

Table 6. Torsion angles [°] for erj10.

C(21)-C(1)-C(2)-C(3)	-100.94(18)
C(11)-C(1)-C(2)-C(3)	27.9(2)
C(21)-C(1)-C(2)-C(9)	78.04(18)
C(11)-C(1)-C(2)-C(9)	-153.15(15)
C(9)-C(2)-C(3)-C(4)	1.0(2)
C(1)-C(2)-C(3)-C(4)	179.91(15)
C(2)-C(3)-C(4)-C(7)	-0.5(2)
C(2)-C(3)-C(4)-C(5)	178.32(17)
C(3)-C(4)-C(5)-C(6)	-178.75(18)
C(7)-C(4)-C(5)-C(6)	0.14(19)
C(4)-C(5)-C(6)-N(1)	-0.1(2)
C(7)-N(1)-C(6)-C(5)	0.1(2)
C(10)-N(1)-C(6)-C(5)	-179.95(16)
C(6)-N(1)-C(7)-C(8)	179.34(18)
C(10)-N(1)-C(7)-C(8)	-0.6(3)
C(6)-N(1)-C(7)-C(4)	0.03(18)
C(10)-N(1)-C(7)-C(4)	-179.96(15)
C(3)-C(4)-C(7)-N(1)	178.98(14)
C(5)-C(4)-C(7)-N(1)	-0.11(18)
C(3)-C(4)-C(7)-C(8)	-0.4(2)
C(5)-C(4)-C(7)-C(8)	-179.48(15)
N(1)-C(7)-C(8)-C(9)	-178.51(16)
C(4)-C(7)-C(8)-C(9)	0.7(2)
C(7)-C(8)-C(9)-C(2)	-0.2(3)
C(3)-C(2)-C(9)-C(8)	-0.6(2)
C(1)-C(2)-C(9)-C(8)	-179.65(16)
C(2)-C(1)-C(11)-C(20)	-130.10(16)
C(21)-C(1)-C(11)-C(20)	-3.0(2)
C(2)-C(1)-C(11)-C(12)	52.8(2)
C(21)-C(1)-C(11)-C(12)	179.91(14)
C(20)-C(11)-C(12)-C(13)	1.3(2)
C(1)-C(11)-C(12)-C(13)	178.56(16)
C(11)-C(12)-C(13)-C(14)	-0.6(3)
C(12)-C(13)-C(14)-C(15)	-179.86(17)

C(12)-C(13)-C(14)-C(19)	-0.6(2)
C(13)-C(14)-C(15)-C(16)	179.19(17)
C(19)-C(14)-C(15)-C(16)	-0.1(3)
C(14)-C(15)-C(16)-C(17)	-1.2(3)
C(15)-C(16)-C(17)-C(18)	1.6(3)
C(16)-C(17)-C(18)-C(19)	-0.6(3)
C(17)-C(18)-C(19)-C(20)	-179.99(17)
C(17)-C(18)-C(19)-C(14)	-0.7(3)
C(15)-C(14)-C(19)-C(18)	1.0(2)
C(13)-C(14)-C(19)-C(18)	-178.26(16)
C(15)-C(14)-C(19)-C(20)	-179.66(15)
C(13)-C(14)-C(19)-C(20)	1.0(2)
C(12)-C(11)-C(20)-C(19)	-0.8(2)
C(1)-C(11)-C(20)-C(19)	-177.94(15)
C(18)-C(19)-C(20)-C(11)	178.96(16)
C(14)-C(19)-C(20)-C(11)	-0.3(2)
C(2)-C(1)-C(21)-C(22)	-122.88(16)
C(11)-C(1)-C(21)-C(22)	108.69(17)
C(2)-C(1)-C(21)-C(26)	56.5(2)
C(11)-C(1)-C(21)-C(26)	-71.9(2)
C(26)-C(21)-C(22)-C(23)	0.5(2)
C(1)-C(21)-C(22)-C(23)	179.93(15)
C(21)-C(22)-C(23)-C(24)	0.0(3)
C(22)-C(23)-C(24)-C(25)	-0.4(3)
C(23)-C(24)-C(25)-C(26)	0.3(3)
C(24)-C(25)-C(26)-C(21)	0.3(3)
C(22)-C(21)-C(26)-C(25)	-0.7(3)
C(1)-C(21)-C(26)-C(25)	179.94(17)

1H spectrum



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PROCNO	1

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TD	65536
SOLVENT	CDCl3
NS	8
DS	2
SWH	6410.256 Hz
FIDRES	0.097813 Hz
AQ	5.1118579 sec
RG	143.7
DW	78.000 usec
DE	4.50 usec
TE	298.0 K
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MCREST	0.00000000 sec
MCWRK	0.01500000 sec

======== CHANNEL f1 ========

NUC1	1H
P1	12.00 usec
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SF01	400.1328009 MHz

F2 - Processing parameters

SI	65536
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1D NMR plot parameters

CX	22.60 cm
CY	15.00 cm
F1P	9.000 ppm
F1	3601.17 Hz
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F2	0.00 Hz
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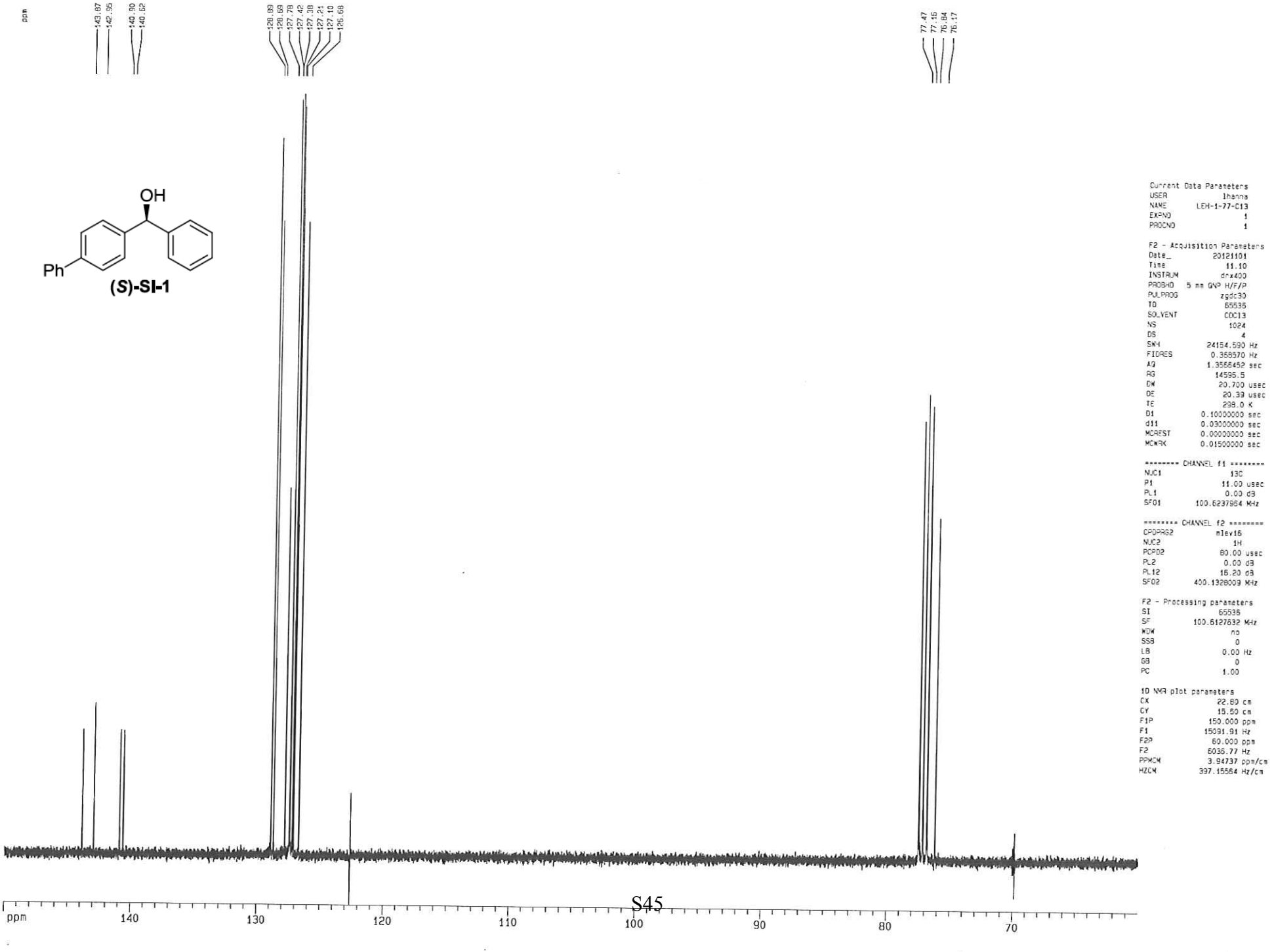
HZCM	157.94508 Hz/cm

13C spectrum with 1H decoupling



Current Data Parameters

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NAME	LEH-1-77-C13
EXPNO	1
PROCNO	1

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TD	65536
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NS	1024
DS	4
SWH	24154.590 Hz
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RG	14595.5
DW	20.700 usec
DE	20.39 usec
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d11	0.03000000 sec
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MCWRK	0.01500000 sec

======== CHANNEL f1 ========

NUC1	13C
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PL1	0.00 dB
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======== CHANNEL f2 ========

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NUC2	1H
PCPD2	80.00 usec
PL2	0.00 dB
PL12	16.20 dB
SF02	400.1328009 MHz

F2 - Processing parameters

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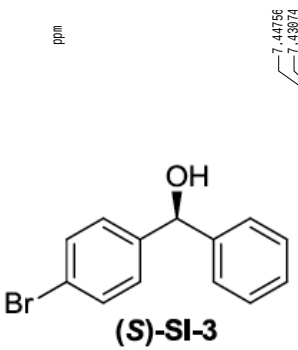
SF	100.6127632 MHz
WDW	no
SSB	0
LB	0.00 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	22.80 cm
CY	15.50 cm
F1P	150.000 ppm
F1	15091.91 Hz
F2P	60.000 ppm
F2	6035.77 Hz
PPMCM	3.94737 ppm/cm
HZCM	397.15564 Hz/cm

1H spectrum



(*S*)-SI-3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EXPNO                    1
PROCNO                   1

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Time                18.32
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TD                  81728
SOLVENT             CDCl3
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DS                       2
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RG                       5
DW                 62.400 usec
DE                  6.00 usec
TE                 298.0 K
D1              0.10000000 sec
MCREST          0.00000000 sec
MCWRK           0.01500000 sec

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P1                   7.50 usec
PL1                  1.60 dB
SFO1          500.2235015 MHz

F2 - Processing parameters
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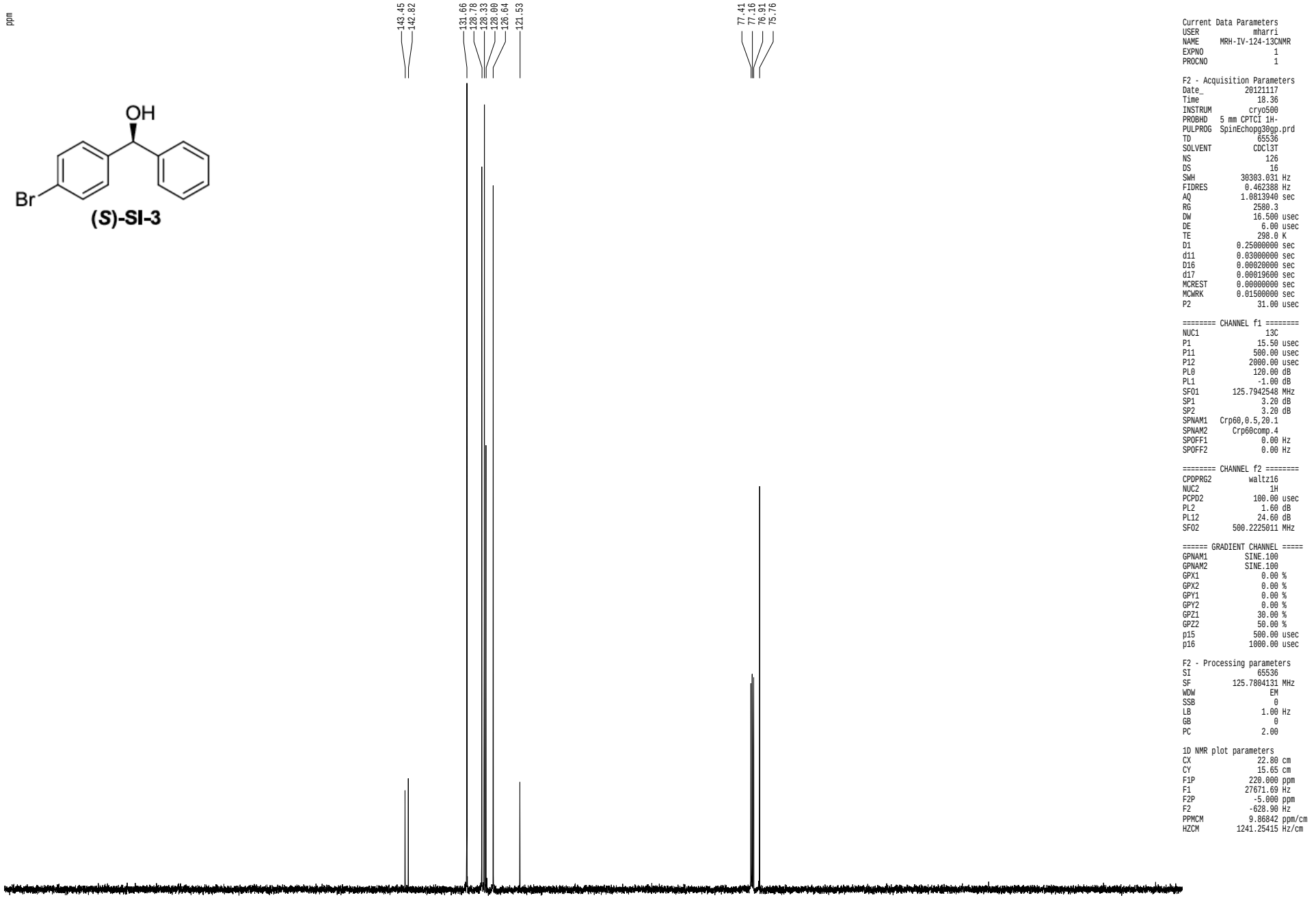
SF             500.2200406 MHz
WDW                     EM
SSB                      0
LB                   0.30 Hz
GB                       0
PC                   4.00

1D NMR plot parameters
CX                   22.80 cm
CY                   15.00 cm
F1P                  9.000 ppm
F1                 4501.98 Hz
F2P                -0.500 ppm
F2                 -250.11 Hz
PPMCM             0.41667 ppm/cm
HZCM            208.42502 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



Current Data Parameters
USER mharri
NAME MRH-IV-124-13CNMR
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121117
Time 18.36
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG SpinEchopg30gp.prd
TD 65536
SOLVENT CDCl3T
NS 126
DS 16
SWH 30303.031 Hz
FIDRES 0.462388 Hz
AQ 1.0813940 sec
RG 2580.3
DW 16.500 usec
DE 6.00 usec
TE 298.0 K
D1 0.25000000 sec
d11 0.03000000 sec
D16 0.00020000 sec
d17 0.00019600 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
P2 31.00 usec

======== CHANNEL f1 ========
NUC1 13C
P1 15.50 usec
P11 500.00 usec
P12 2000.00 usec
PL0 120.00 dB
PL1 -1.00 dB
SFO1 125.7942548 MHz
SP1 3.20 dB
SP2 3.20 dB
SPNAM1 Crp60,0.5,20.1
SPNAM2 Crp60comp.4
SPOFF1 0.00 Hz
SPOFF2 0.00 Hz

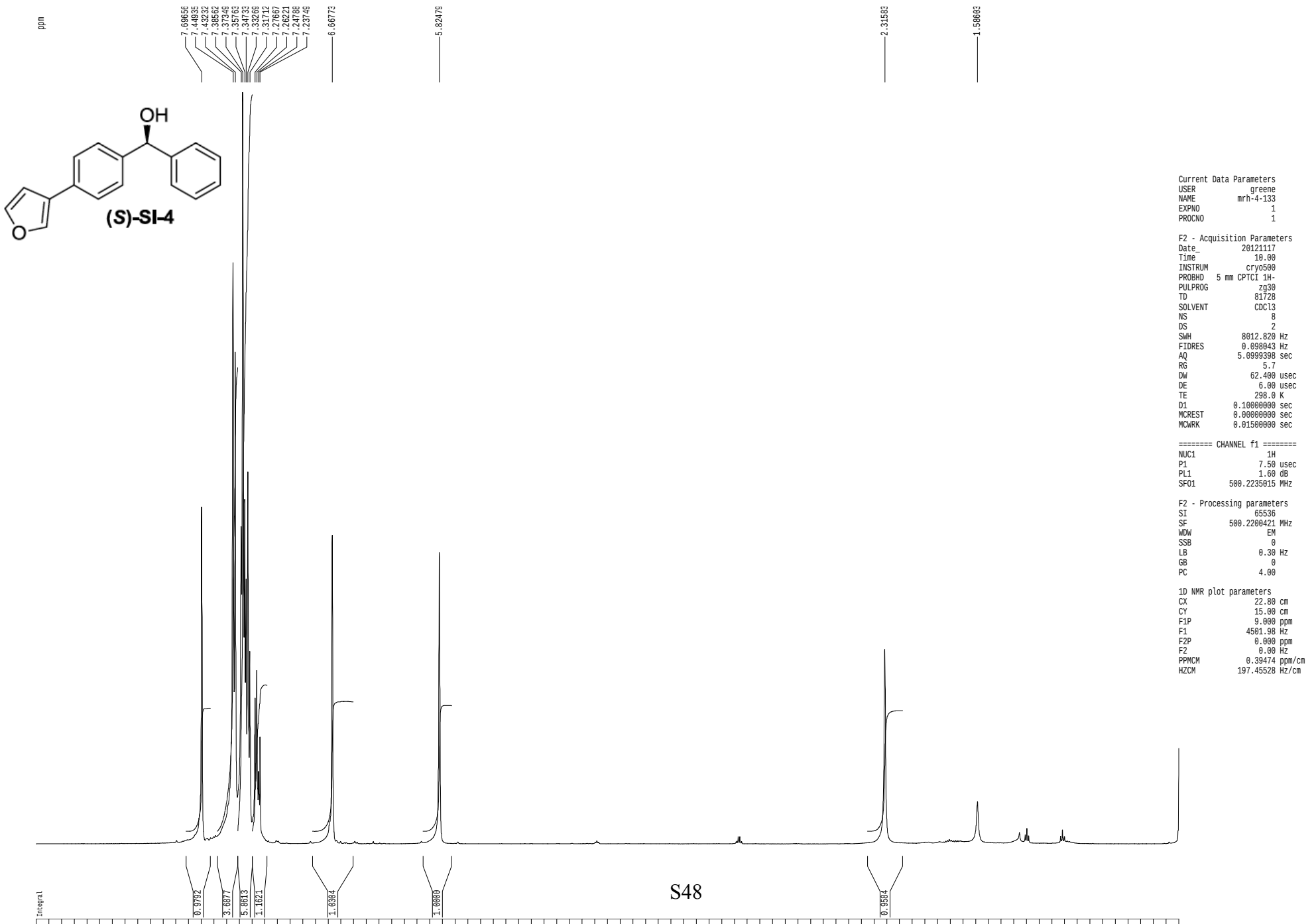
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 100.00 usec
PL2 1.60 dB
PL12 24.60 dB
SFO2 500.2225011 MHz

====== GRADIENT CHANNEL =====
GPNAM1 SINE.100
GPNAM2 SINE.100
GPX1 0.00 %
GPX2 0.00 %
GPY1 0.00 %
GPY2 0.00 %
GPZ1 30.00 %
GPZ2 50.00 %
p15 500.00 usec
p16 1000.00 usec

F2 - Processing parameters
SI 65536
SF 125.7804131 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 2.00

1D NMR plot parameters
CX 22.80 cm
CY 15.65 cm
F1P 220.000 ppm
F1 27671.69 Hz
F2P -5.000 ppm
F2 -628.90 Hz
PPMCM 9.86842 ppm/cm
HZCM 1241.25415 Hz/cm

1H spectrum



Current Data Parameters
USER greene
NAME mrh-4-133
EXPNO 1
PROCNO 1

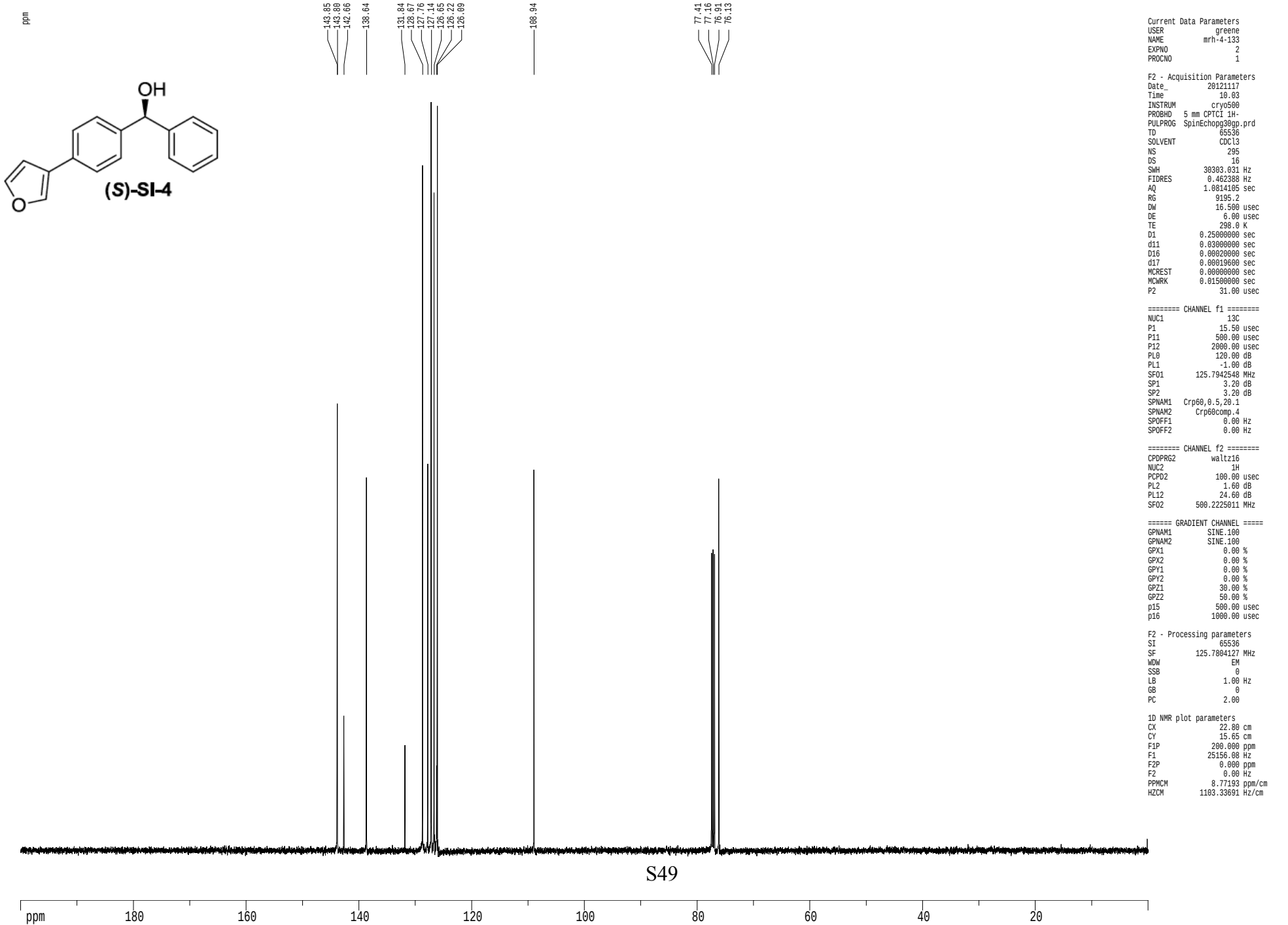
F2 - Acquisition Parameters
Date_ 20121117
Time 10.00
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 8
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0999398 sec
RG 5.7
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz

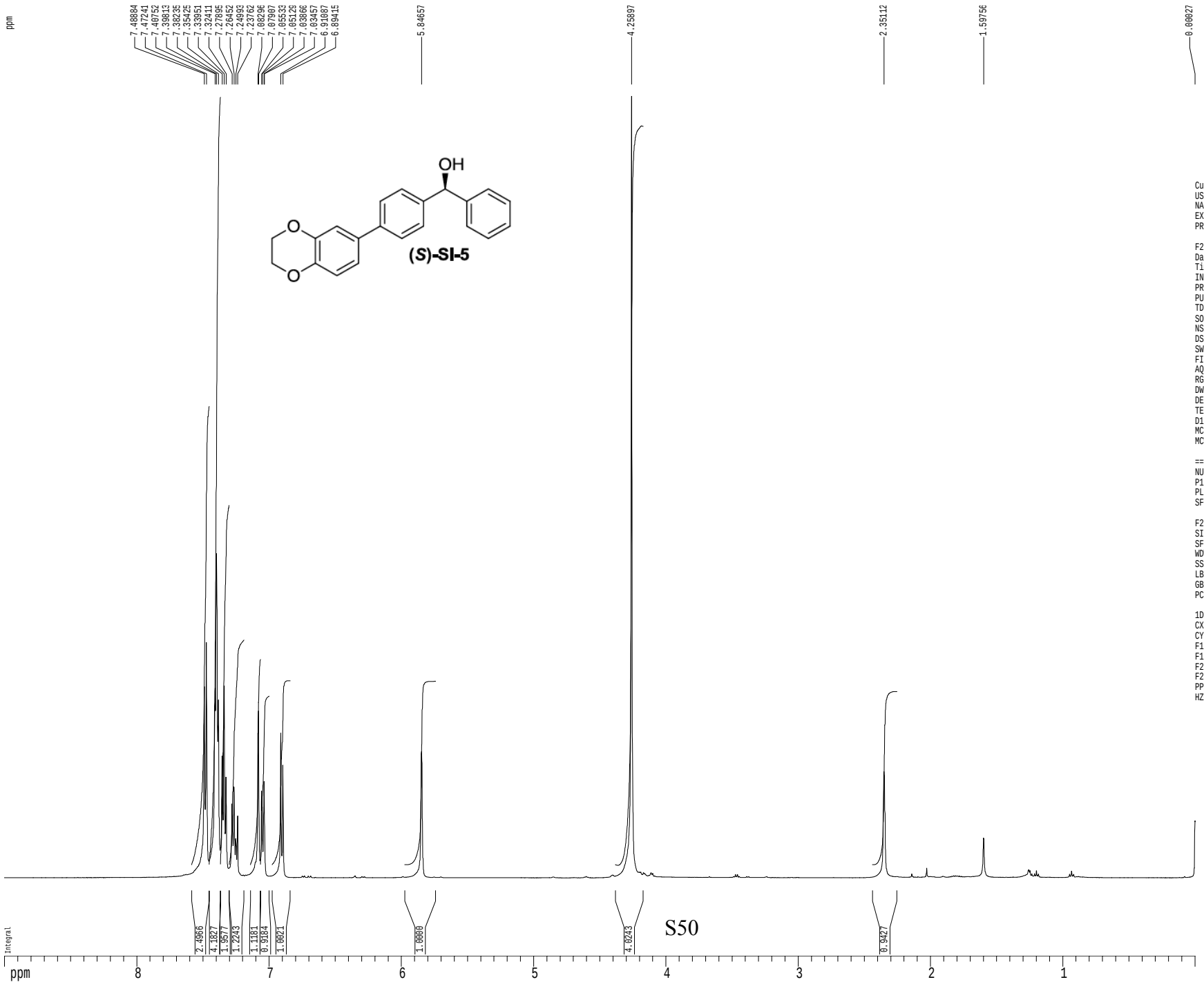
F2 - Processing parameters
SI 65536
SF 500.2200421 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 197.45528 Hz/cm

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum




```
Current Data Parameters
USER              greene
NAME           mrh-4-138
EXPNO                  1
PROCNO                 1

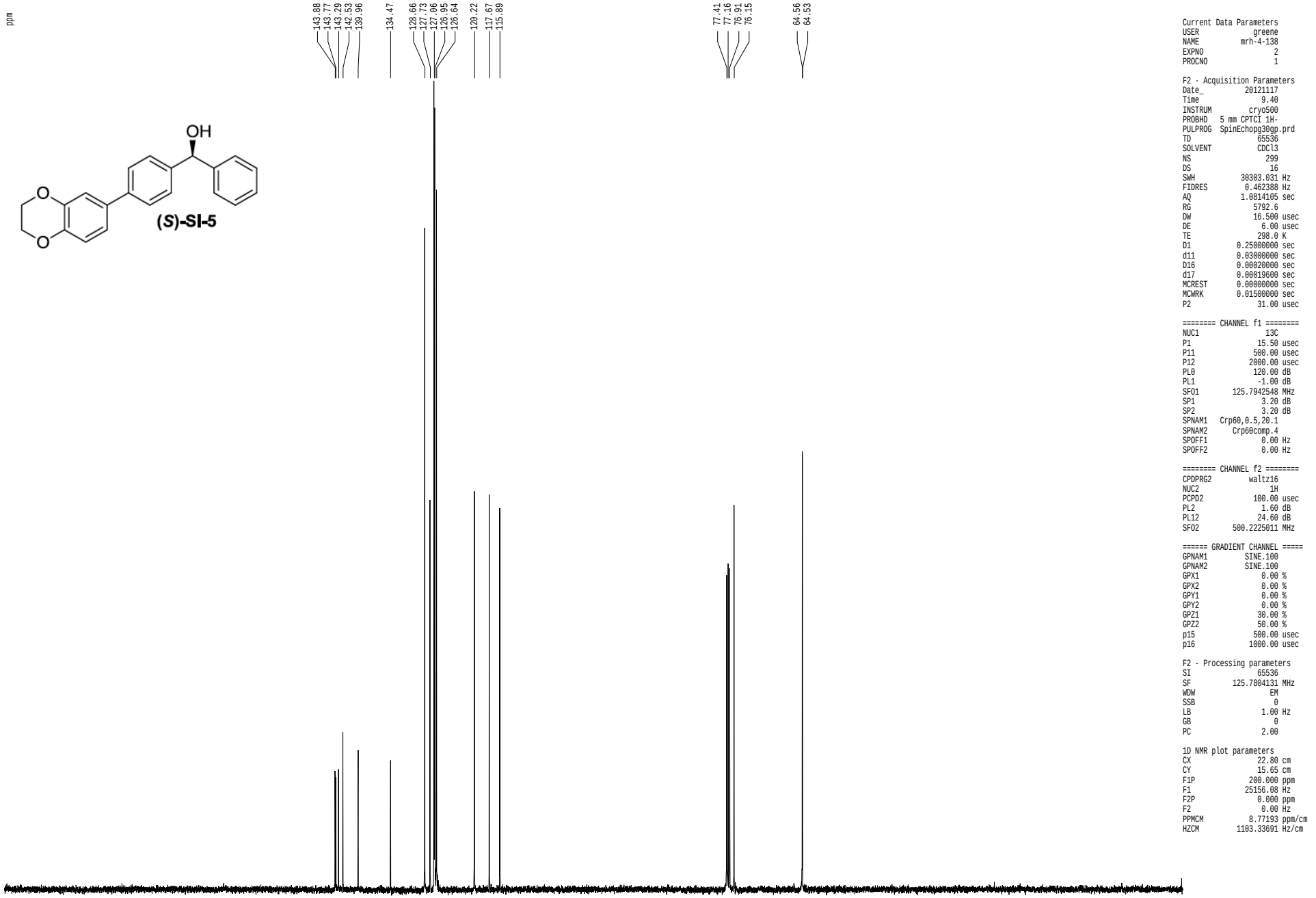
F2 - Acquisition Parameters
Date_           20121117
Time                9.35
INSTRUM          cryo500
PROBHD    5 mm CPTCI 1H-
PULPROG             zg30
TD                 81728
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8012.820 Hz
FIDRES          0.098043 Hz
AQ              5.0999398 sec
RG                   6.3
DW                62.400 usec
DE                 6.00 usec
TE                298.0 K
D1           0.10000000 sec
MCREST       0.00000000 sec
MCWRK        0.01500000 sec

======== CHANNEL f1 ========
NUC1                1H
P1                7.50 usec
PL1               1.60 dB
SFO1        500.2235015 MHz

F2 - Processing parameters
SI                 65536
SF           500.2200418 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                4.00

1D NMR plot parameters
CX                22.80 cm
CY                15.00 cm
F1P               9.000 ppm
F1              4501.98 Hz
F2P               0.000 ppm
F2                0.00 Hz
PPMCM          0.39474 ppm/cm
HZCM          197.45528 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



Current Data Parameters
USER greene
NAME mrh-4-138
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121117
Time 9.40
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG SpinEchopg30gp.prd
TD 65536
SOLVENT CDCl3
NS 299
DS 16
SWH 30303.031 Hz
FIDRES 0.462388 Hz
AQ 1.0814105 sec
RG 5792.6
DW 16.500 usec
DE 6.00 usec
TE 298.0 K
D1 0.25000000 sec
d11 0.03000000 sec
D16 0.00020000 sec
d17 0.00019600 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
P2 31.00 usec

======== CHANNEL f1 ========
NUC1 13C
P1 15.50 usec
P11 500.00 usec
P12 2000.00 usec
PL0 120.00 dB
PL1 -1.00 dB
SFO1 125.7942548 MHz
SP1 3.20 dB
SP2 3.20 dB
SPNAM1 Crp60,0.5,20.1
SPNAM2 Crp60comp.4
SPOFF1 0.00 Hz
SPOFF2 0.00 Hz

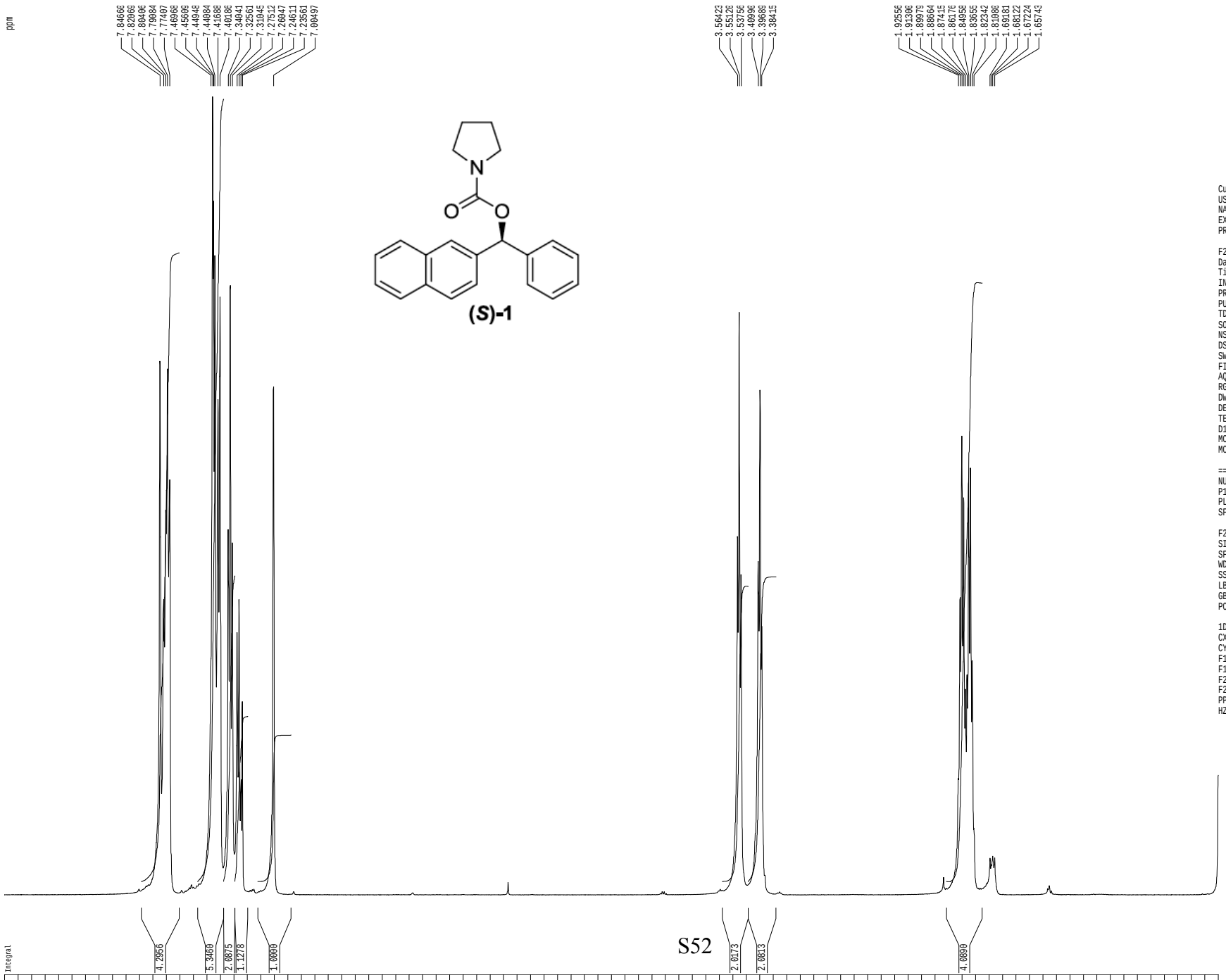
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 100.00 usec
PL2 1.60 dB
PL12 24.60 dB
SFO2 500.2225011 MHz

====== GRADIENT CHANNEL =====
GPNAM1 SINE.100
GPNAM2 SINE.100
GPX1 0.00 %
GPX2 0.00 %
GPY1 0.00 %
GPY2 0.00 %
GPZ1 30.00 %
GPZ2 50.00 %
p15 500.00 usec
p16 1000.00 usec

F2 - Processing parameters
SI 65536
SF 125.7804131 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 2.00

1D NMR plot parameters
CX 22.80 cm
CY 15.65 cm
F1P 200.000 ppm
F1 25156.08 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 8.77193 ppm/cm
HZCM 1103.33691 Hz/cm

1H spectrum



Current Data Parameters
USER greene
NAME mrh-3-259
EXPNO 1
PROCNO 1

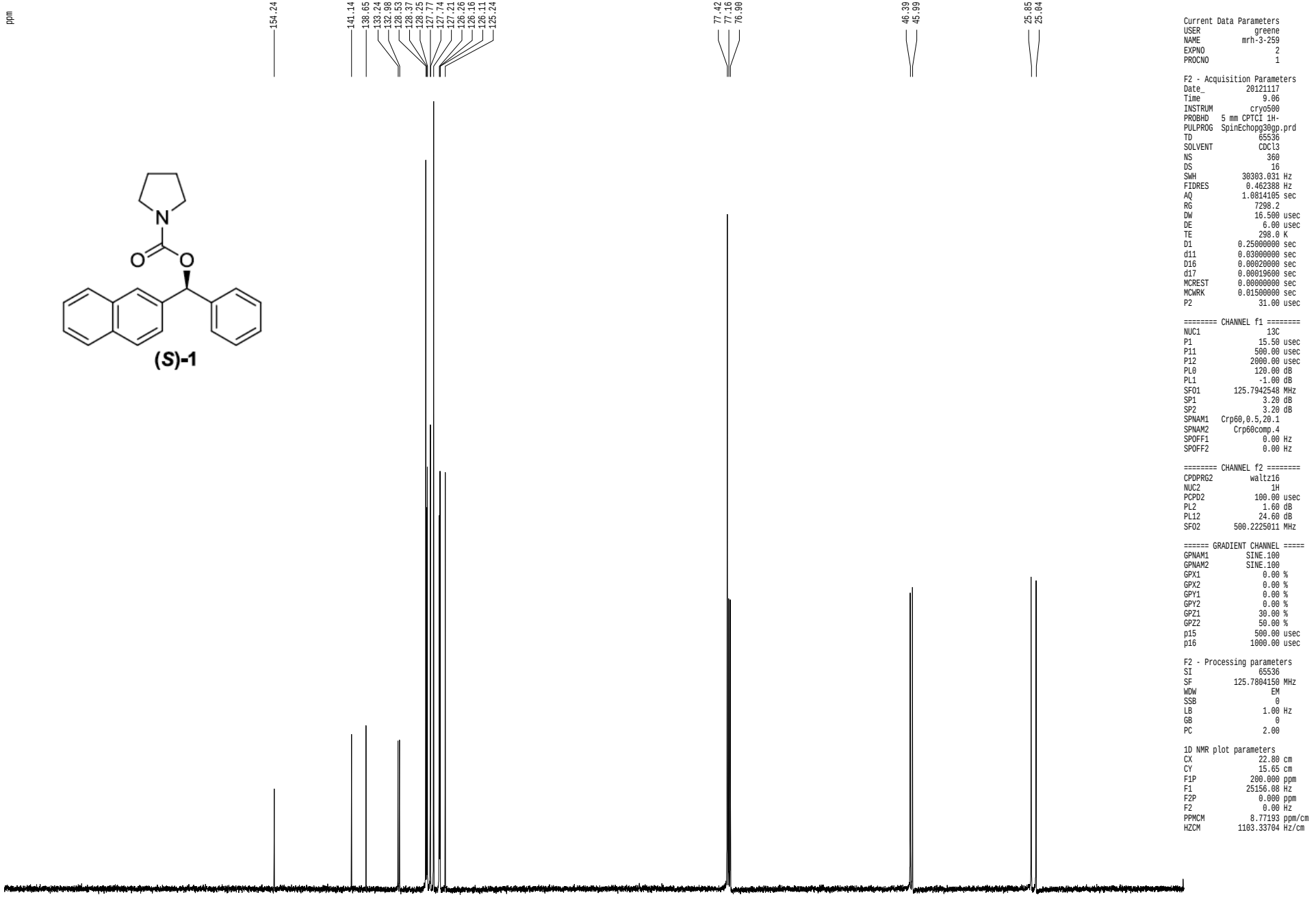
F2 - Acquisition Parameters
Date_ 20121117
Time 9.00
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 8
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0999398 sec
RG 5.7
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz

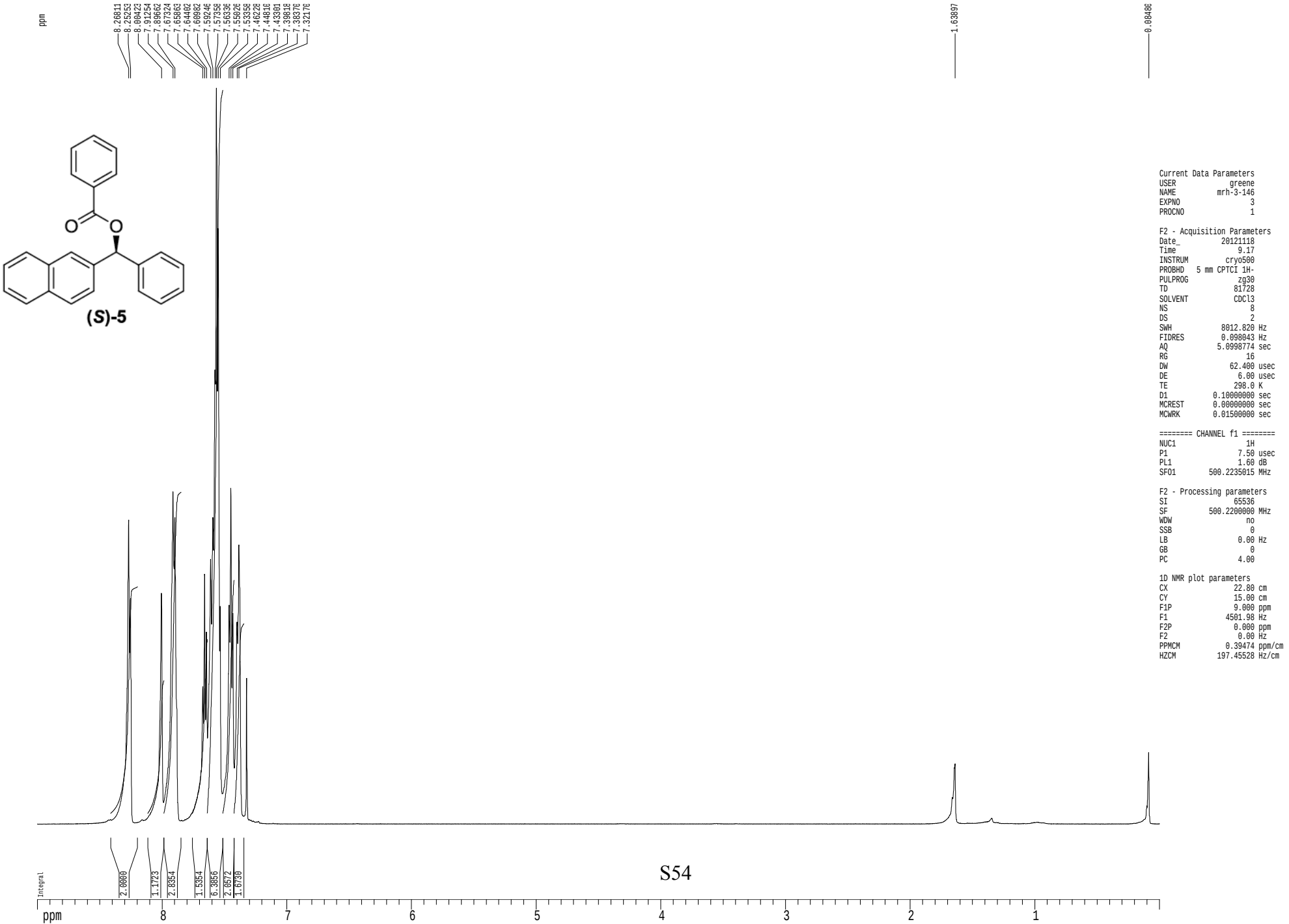
F2 - Processing parameters
SI 65536
SF 500.2200429 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 197.45528 Hz/cm

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum




```
Current Data Parameters
USER              greene
NAME           mrh-3-146
EXPNO                  3
PROCNO                 1

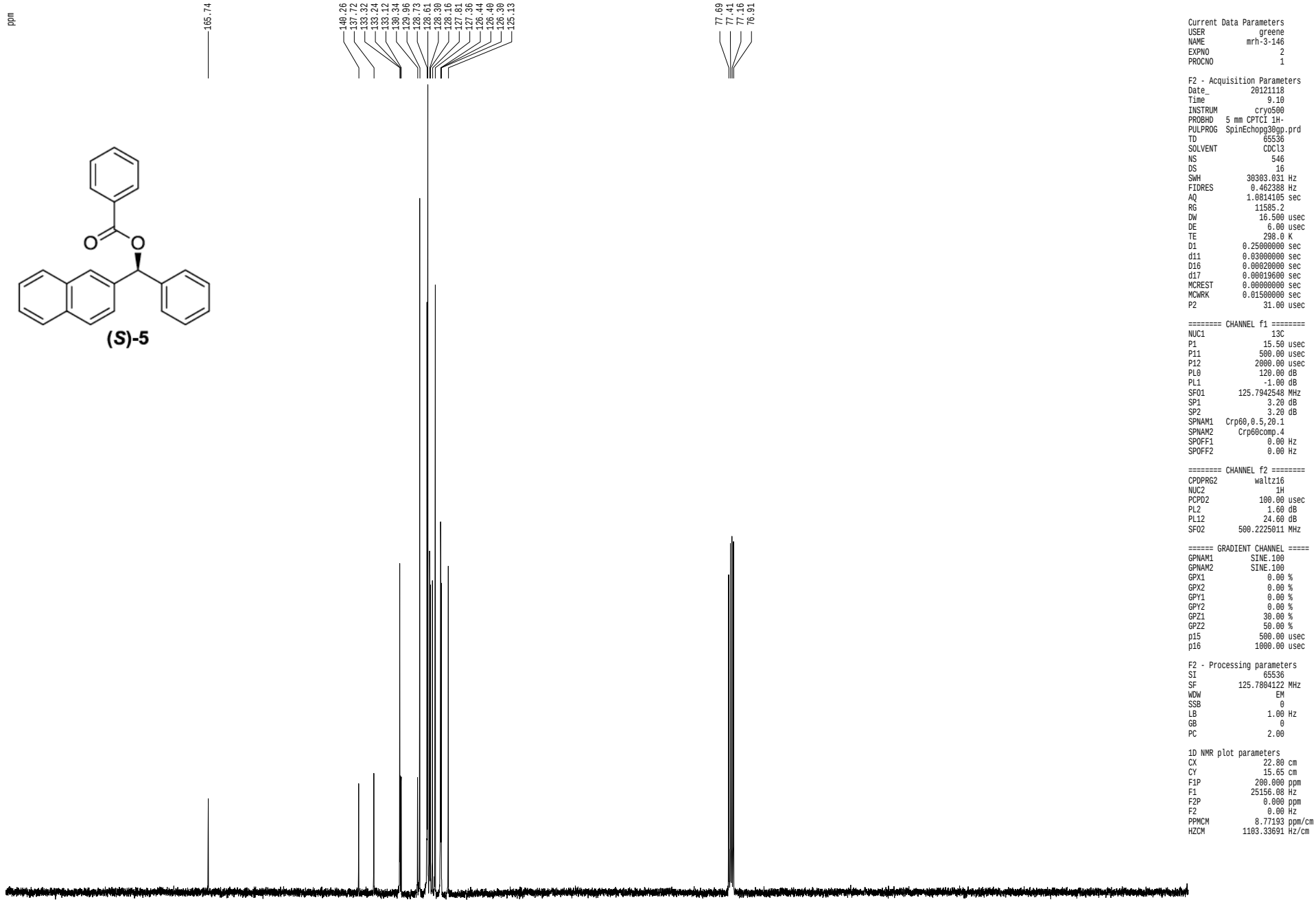
F2 - Acquisition Parameters
Date_           20121118
Time               9.17
INSTRUM         cryo500
PROBHD   5 mm CPTCI 1H-
PULPROG             zg30
TD                 81728
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8012.820 Hz
FIDRES          0.098043 Hz
AQ              5.0998774 sec
RG                    16
DW                62.400 usec
DE                 6.00 usec
TE                298.0 K
D1           0.10000000 sec
MCREST       0.00000000 sec
MCWRK        0.01500000 sec

======== CHANNEL f1 ========
NUC1                  1H
P1                 7.50 usec
PL1                1.60 dB
SFO1         500.2235015 MHz

F2 - Processing parameters
SI                 65536
SF           500.2200000 MHz
WDW                   no
SSB                    0
LB                 0.00 Hz
GB                     0
PC                 4.00

1D NMR plot parameters
CX                22.80 cm
CY                15.00 cm
F1P                9.000 ppm
F1              4501.98 Hz
F2P                0.000 ppm
F2                 0.00 Hz
PPMCM          0.39474 ppm/cm
HZCM         197.45528 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



Current Data Parameters
USER greene
NAME mrh-3-146
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121118
Time 9.10
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG SpinEchopg30gp.prd
TD 65536
SOLVENT CDCl3
NS 546
DS 16
SWH 30303.031 Hz
FIDRES 0.462388 Hz
AQ 1.0814105 sec
RG 11585.2
DW 16.500 usec
DE 6.00 usec
TE 298.0 K
D1 0.25000000 sec
d11 0.03000000 sec
D16 0.00020000 sec
d17 0.00019600 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
P2 31.00 usec

======== CHANNEL f1 ========
NUC1 13C
P1 15.50 usec
P11 500.00 usec
P12 2000.00 usec
PL0 120.00 dB
PL1 -1.00 dB
SFO1 125.7942548 MHz
SP1 3.20 dB
SP2 3.20 dB
SPNAM1 Crp60,0.5,20.1
SPNAM2 Crp60comp.4
SPOFF1 0.00 Hz
SPOFF2 0.00 Hz

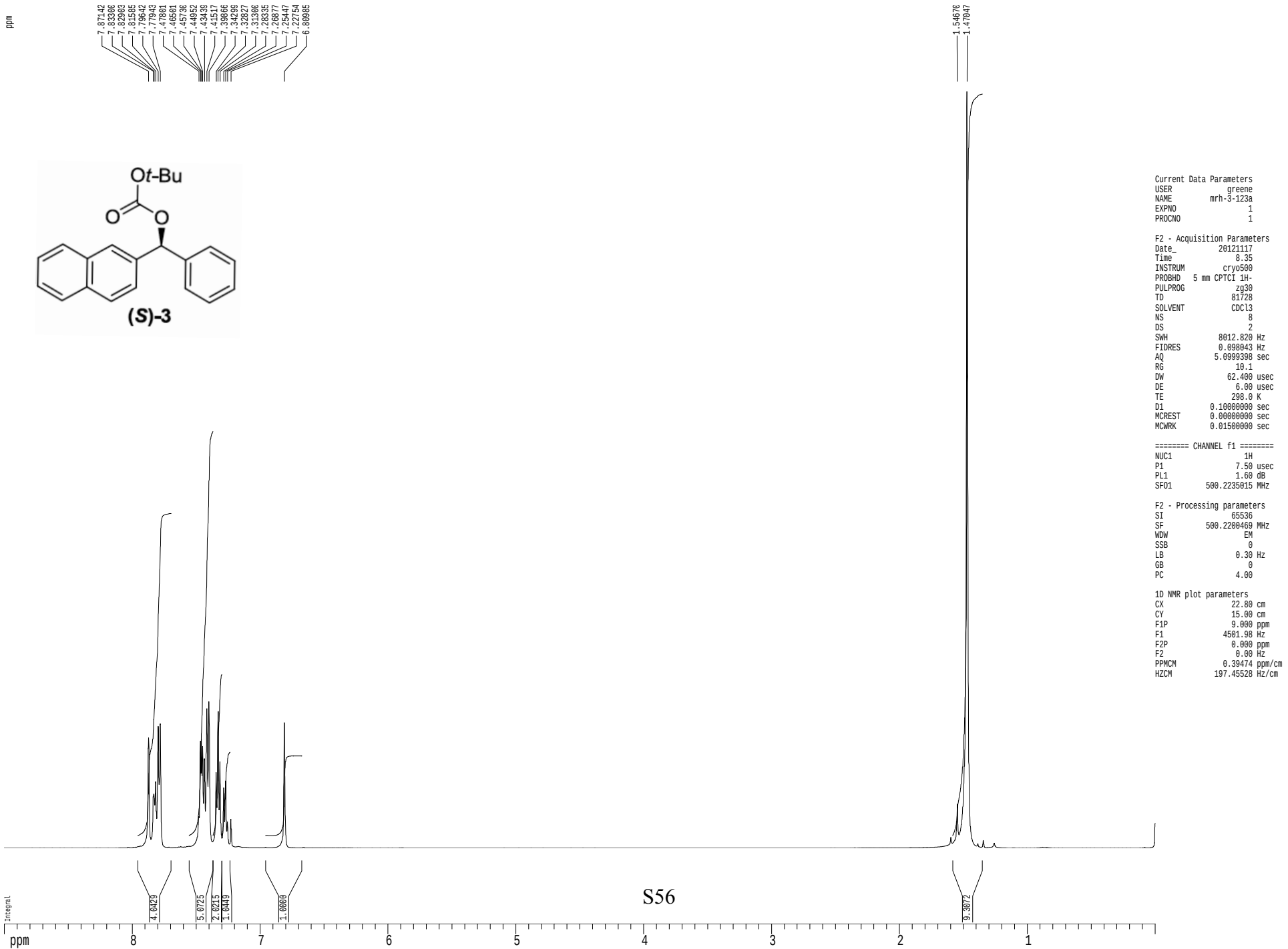
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 100.00 usec
PL2 1.60 dB
PL12 24.60 dB
SFO2 500.2225011 MHz

====== GRADIENT CHANNEL =====
GPNAM1 SINE.100
GPNAM2 SINE.100
GPX1 0.00 %
GPX2 0.00 %
GPY1 0.00 %
GPY2 0.00 %
GPZ1 30.00 %
GPZ2 50.00 %
p15 500.00 usec
p16 1000.00 usec

F2 - Processing parameters
SI 65536
SF 125.7804122 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 2.00

1D NMR plot parameters
CX 22.80 cm
CY 15.65 cm
F1P 200.000 ppm
F1 25156.08 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 8.77193 ppm/cm
HZCM 1103.33691 Hz/cm

1H spectrum



Current Data Parameters
USER greene
NAME mrh-3-123a
EXPNO 1
PROCNO 1

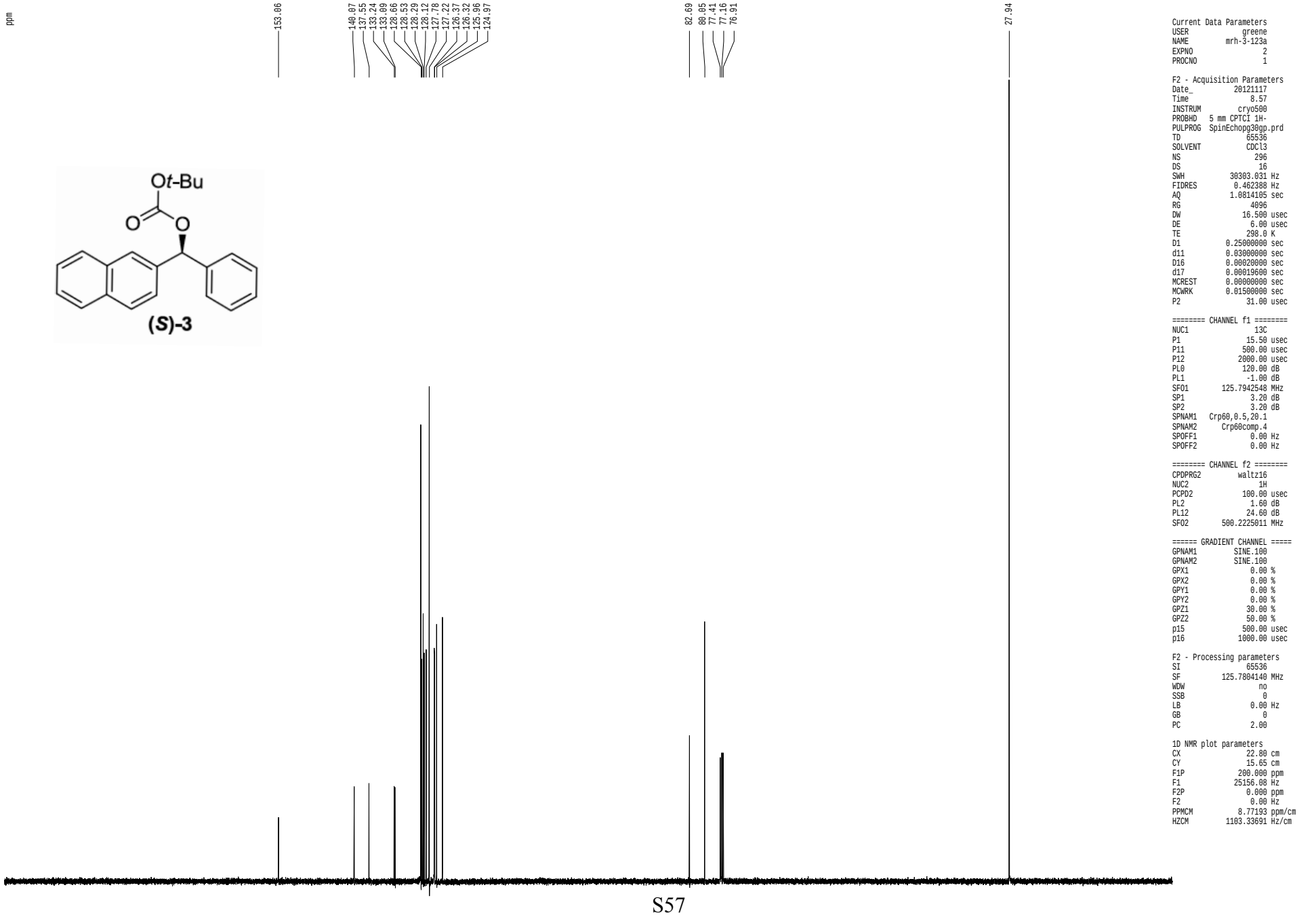
F2 - Acquisition Parameters
Date_ 20121117
Time 8.35
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 8
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0999398 sec
RG 10.1
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz

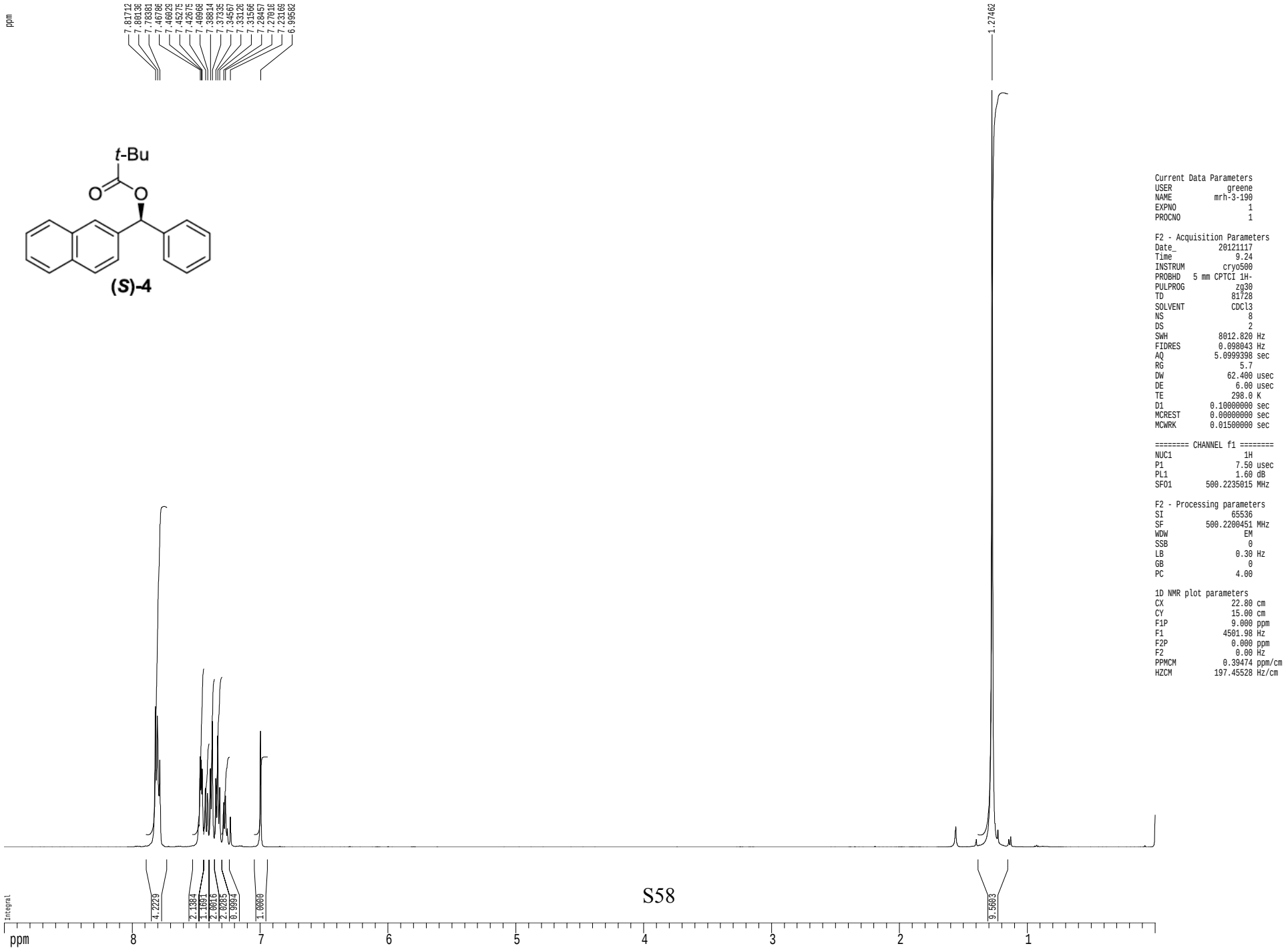
F2 - Processing parameters
SI 65536
SF 500.2200469 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 197.45528 Hz/cm

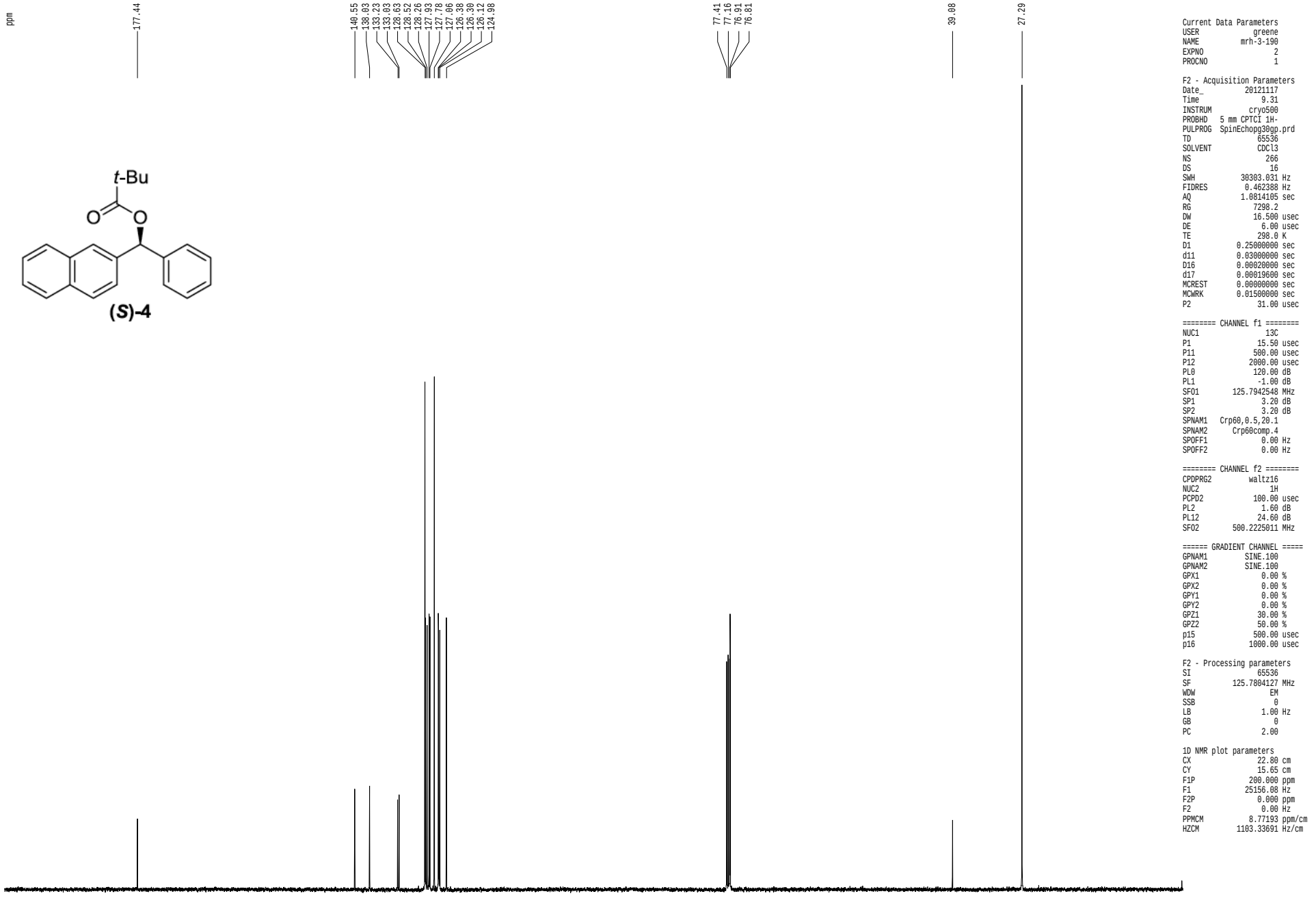
Z-restored spin-echo 13C spectrum with 1H decoupling



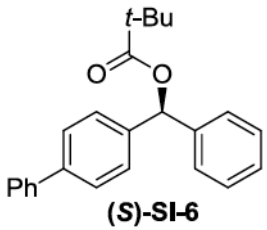
1H spectrum


ppm
7.81712
7.80138
7.78381
7.46786
7.46028
7.45275
7.42675
7.40908
7.38814
7.37335
7.34567
7.33128
7.31566
7.28457
7.27016
7.23168
6.99582
1.27462
t-Bu
O
O
(S)-4
Current Data Parameters
USER greene
NAME mrh-3-190
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20121117
Time 9.24
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 8
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0999398 sec
RG 5.7
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz
F2 - Processing parameters
SI 65536
SF 500.2200451 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 197.45528 Hz/cm
Integral
4.2229
2.1384
1.1691
2.0016
2.0285
6.9904
1.0000
9.5603
ppm
8
7
6
5
4
3
2
1

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum



(*S*)-SI-6


```
Current Data Parameters
USER                Ihanna
NAME          LEH-1-121-c2-H1
EXPNO                    1
PROCNO                   1

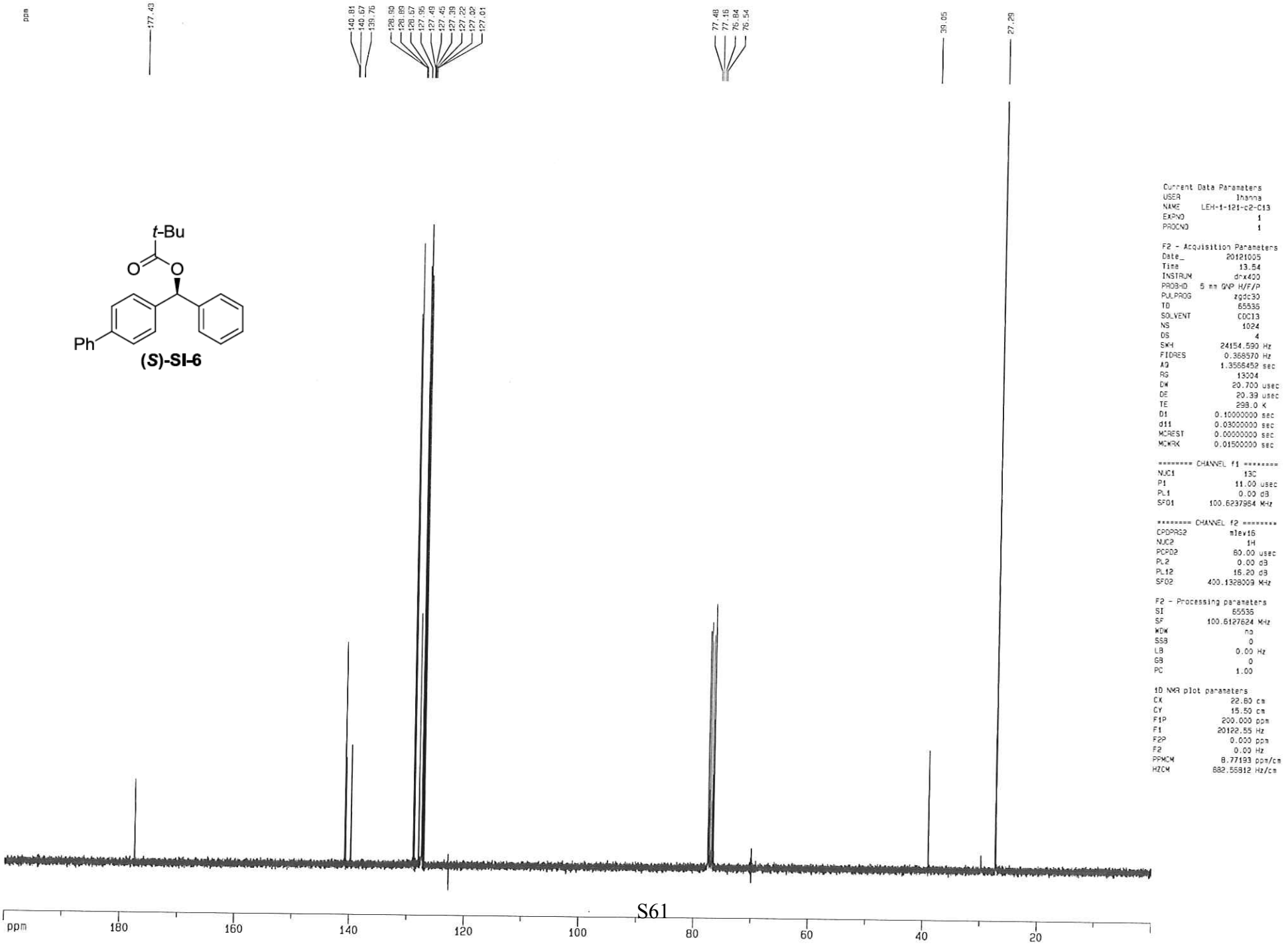
F2 - Acquisition Parameters
Date_            20121005
Time                13.58
INSTRUM           drx400
PROBHD   5 mm QNP H/F/P
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH              6410.256 Hz
FIDRES           0.097813 Hz
AQ               5.1116579 sec
RG                  90.5
DW                 78.000 usec
DE                  4.50 usec
TE                 298.0 K
D1              0.10000000 sec
MCREST          0.00000000 sec
MCWRK           0.01500000 sec

======== CHANNEL f1 ========
NUC1                 1H
P1                 12.00 usec
PL1                -0.60 dB
SFO1         400.1328009 MHz

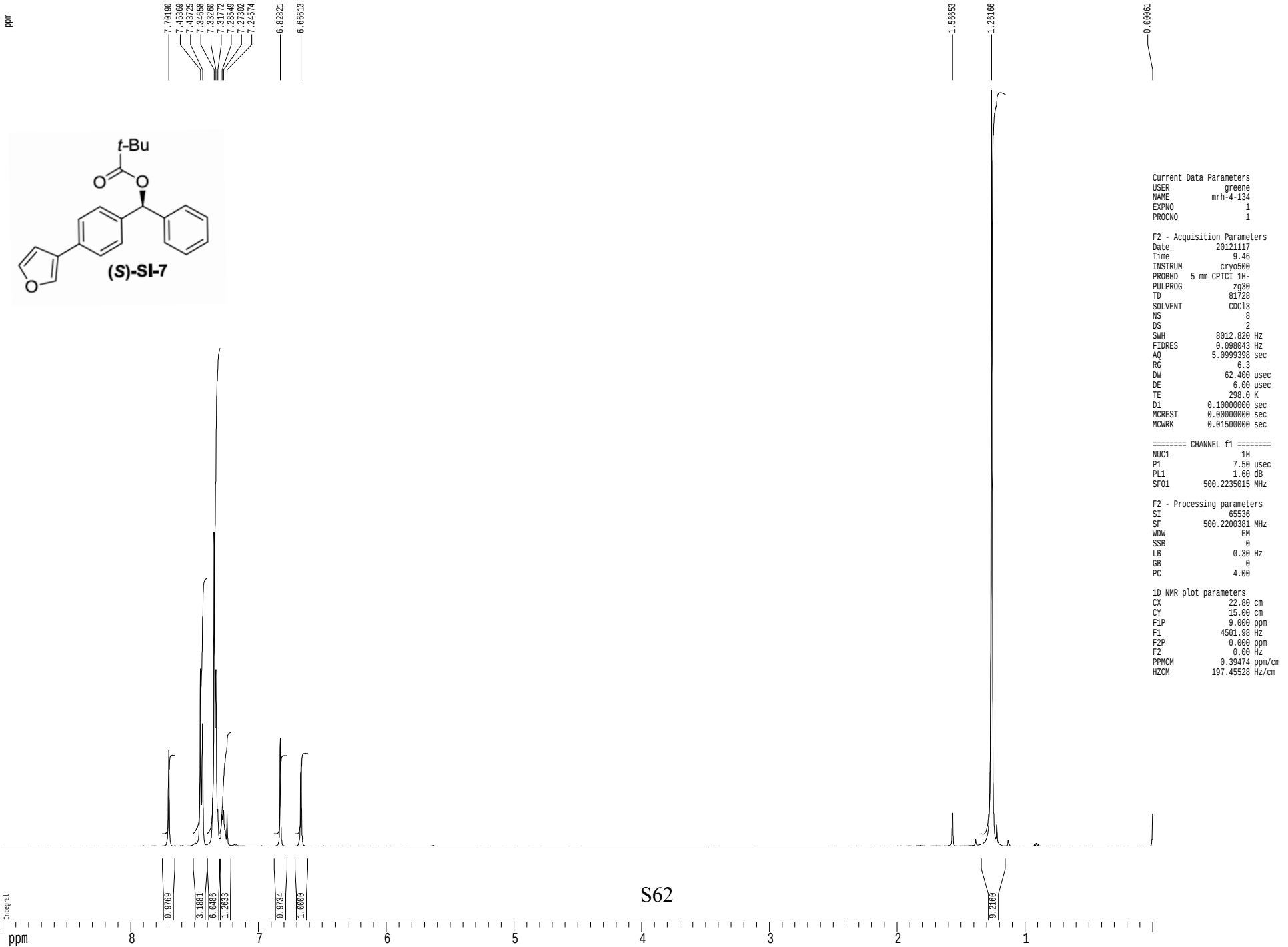
F2 - Processing parameters
SI                 65536
SF           400.1300353 MHz
WDW                  no
SSB                   0
LB                 0.00 Hz
GB                    0
PC                 2.00

1D NMR plot parameters
CX                22.80 cm
CY                15.00 cm
F1P               9.000 ppm
F1              3601.17 Hz
F2P               0.000 ppm
F2                0.00 Hz
PPMCM          0.39474 ppm/cm
HZCM          157.94508 Hz/cm
```

13C spectrum with 1H decoupling



1H spectrum



Current Data Parameters
USER greene
NAME mrh-4-134
EXPNO 1
PROCNO 1

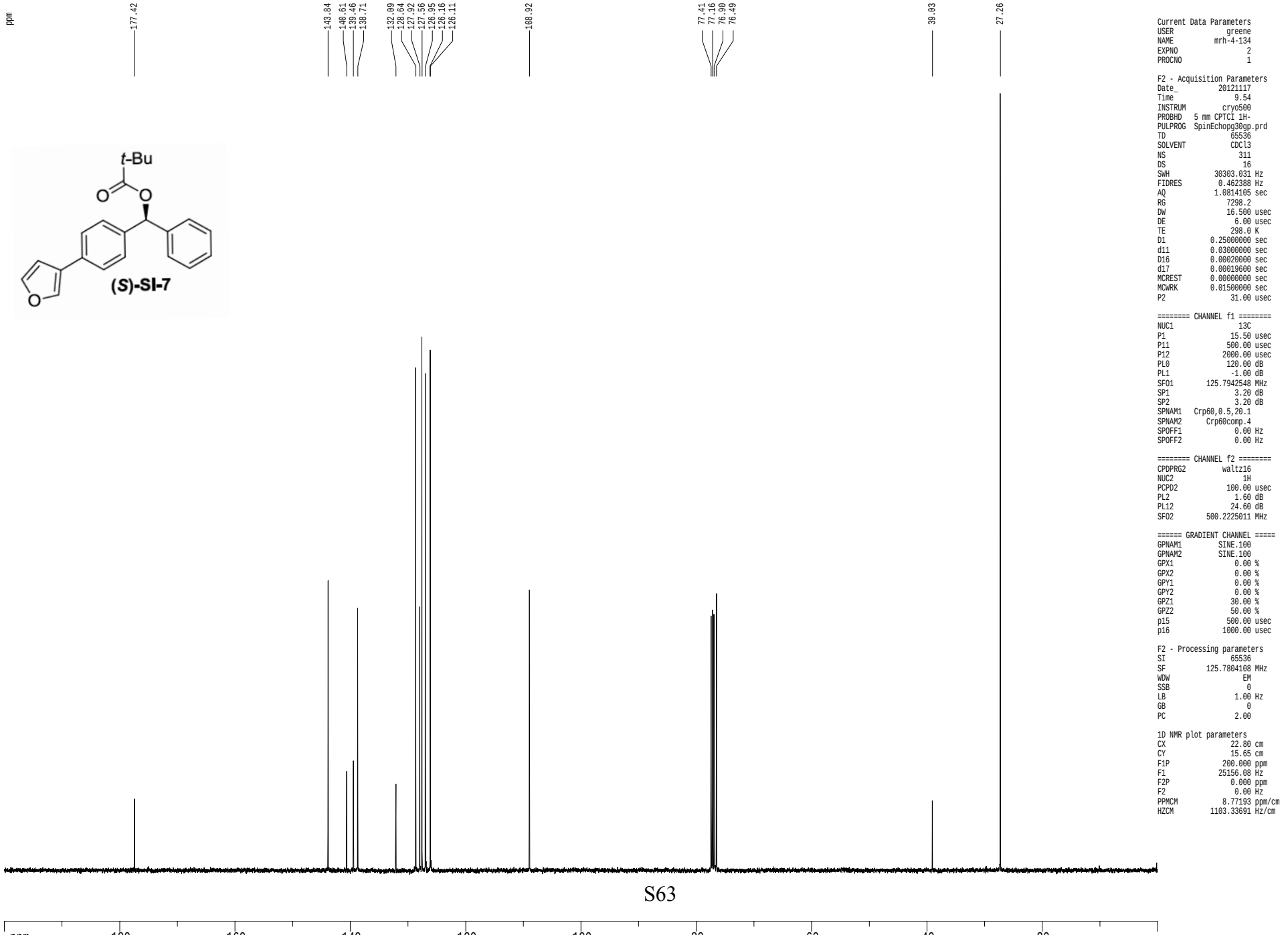
F2 - Acquisition Parameters
Date_ 20121117
Time 9.46
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 8
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0999398 sec
RG 6.3
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz

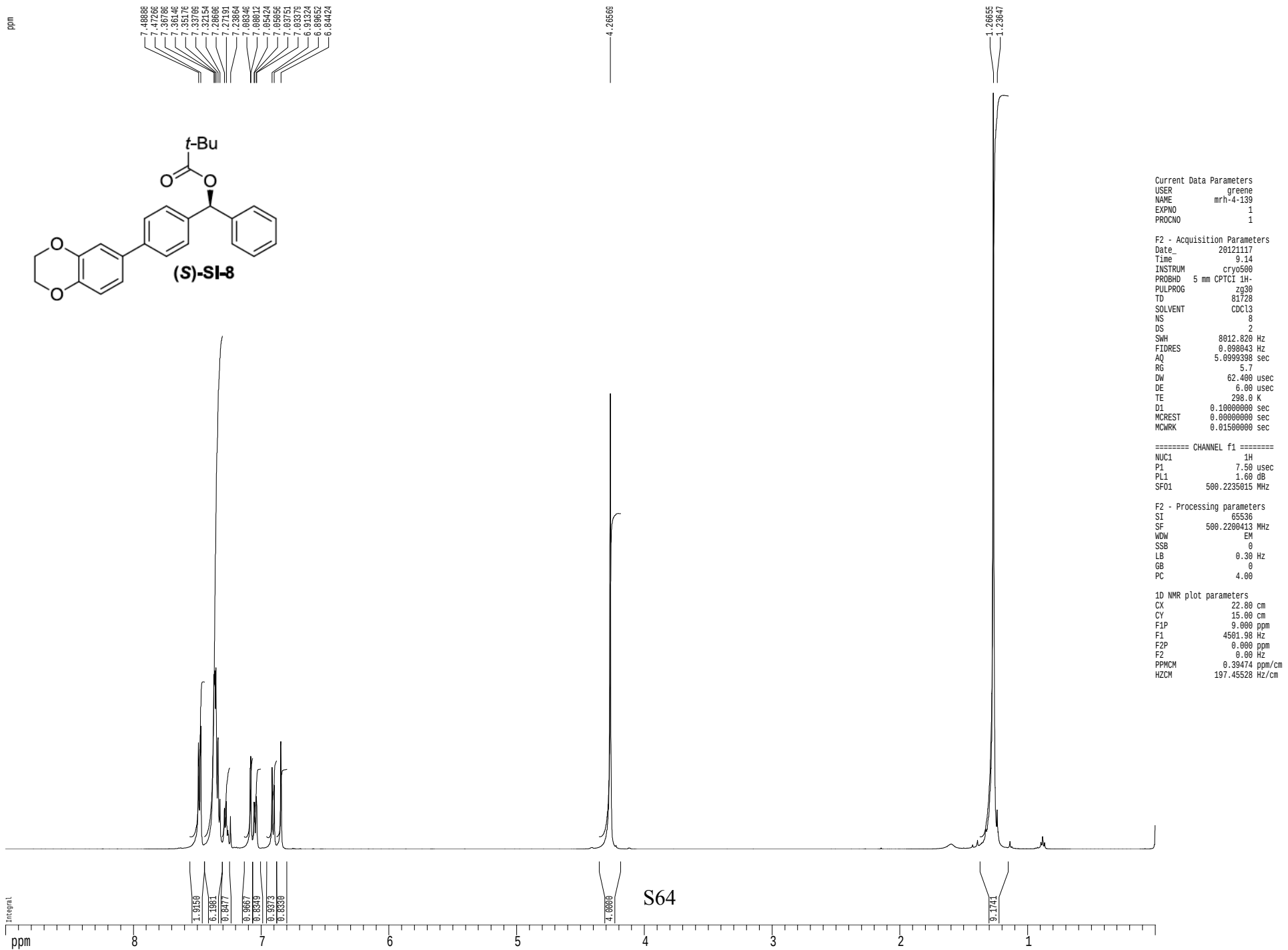
F2 - Processing parameters
SI 65536
SF 500.2200381 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 197.45528 Hz/cm

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum



Current Data Parameters
USER greene
NAME mrh-4-139
EXPNO 1
PROCNO 1

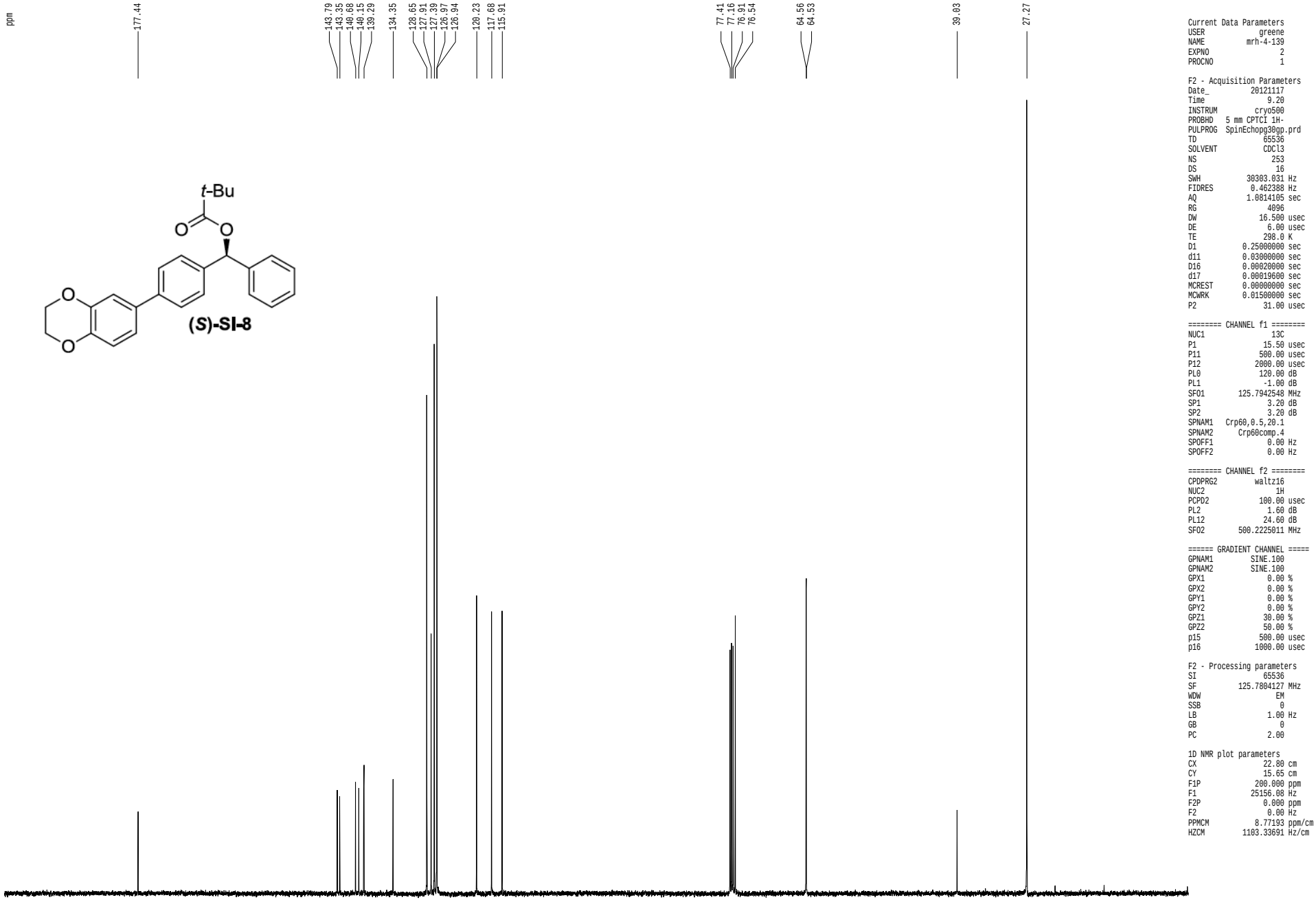
F2 - Acquisition Parameters
Date_ 20121117
Time 9.14
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 8
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0999398 sec
RG 5.7
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz

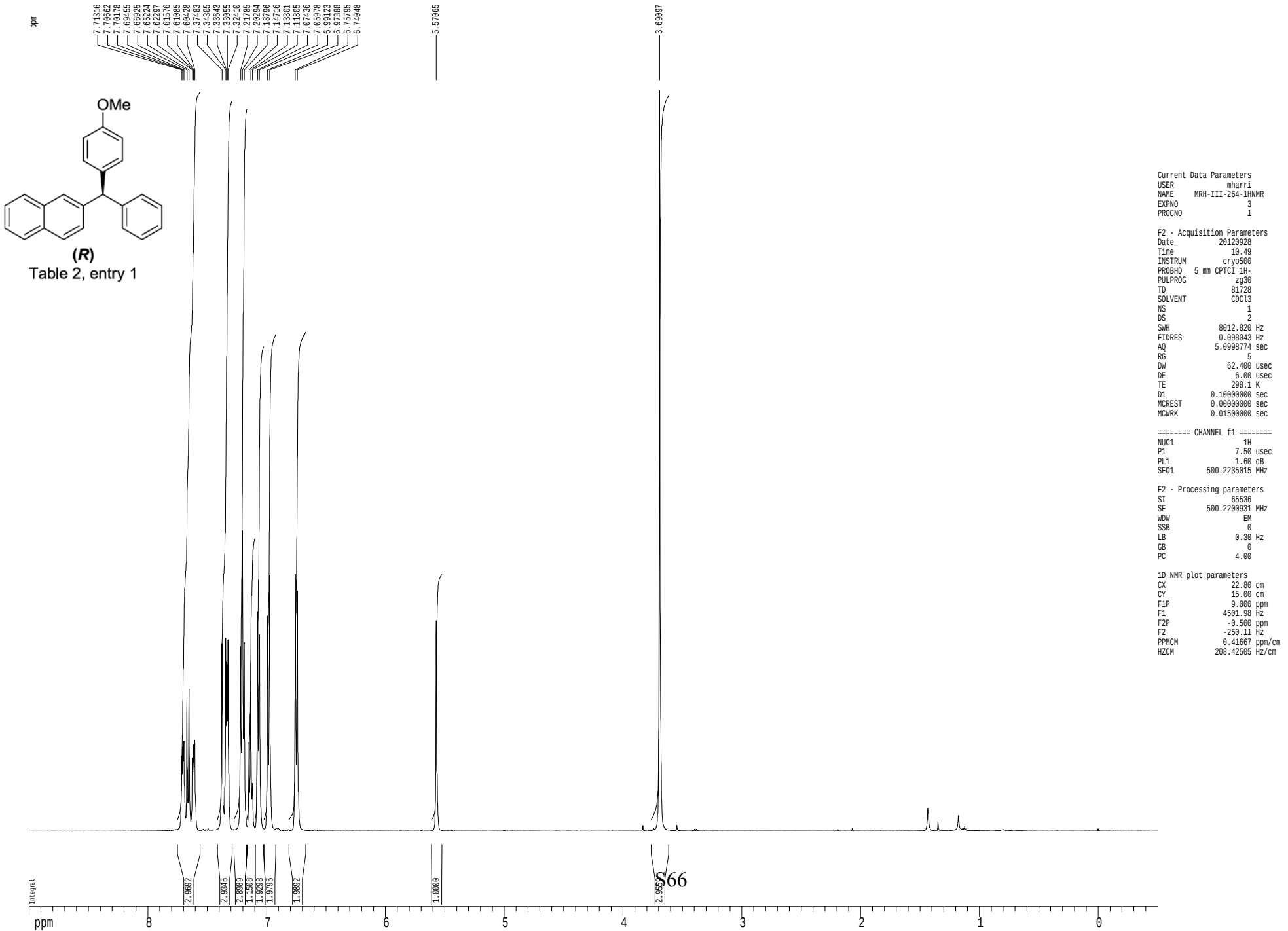
F2 - Processing parameters
SI 65536
SF 500.2200413 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 197.45528 Hz/cm

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum




```
Current Data Parameters
USER                mharri
NAME      MRH-III-264-1HNMR
EXPNO                    3
PROCNO                   1

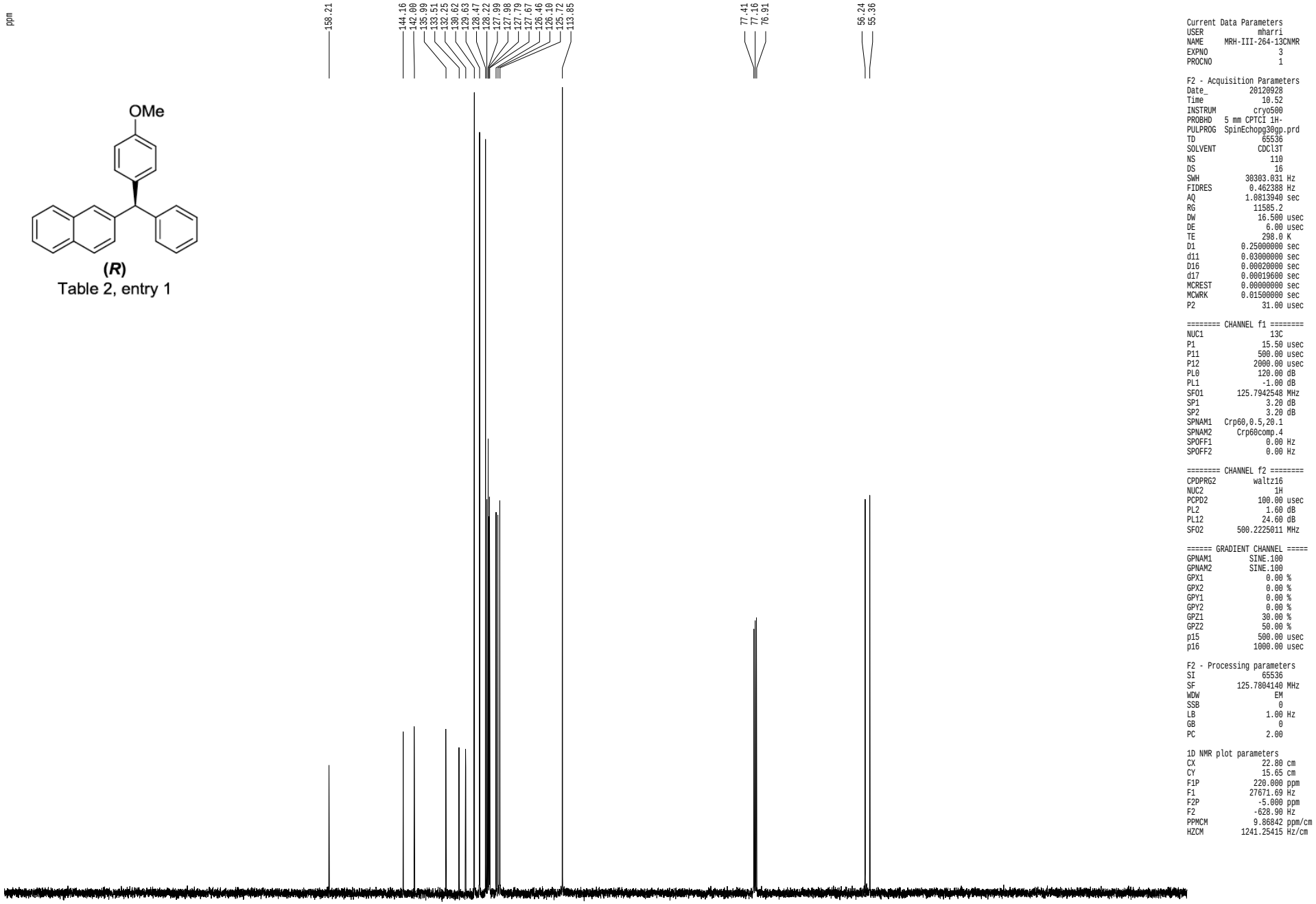
F2 - Acquisition Parameters
Date_           20120928
Time               10.49
INSTRUM          cryo500
PROBHD   5 mm CPTCI 1H-
PULPROG             zg30
TD                 81728
SOLVENT            CDCl3
NS                     1
DS                     2
SWH             8012.820 Hz
FIDRES             0.098043 Hz
AQ              5.0998774 sec
RG                     5
DW                62.400 usec
DE                 6.00 usec
TE                298.1 K
D1             0.10000000 sec
MCREST         0.00000000 sec
MCWRK          0.01500000 sec

======== CHANNEL f1 ========
NUC1                   1H
P1                  7.50 usec
PL1                 1.60 dB
SFO1         500.2235015 MHz

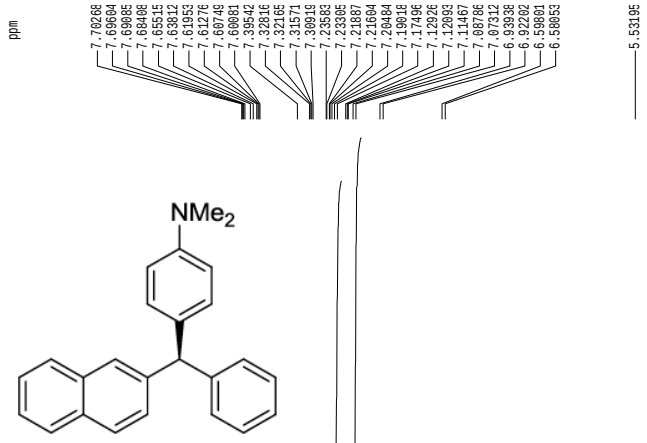
F2 - Processing parameters
SI                 65536
SF           500.2200931 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  4.00

1D NMR plot parameters
CX                 22.80 cm
CY                 15.00 cm
F1P                 9.000 ppm
F1               4501.98 Hz
F2P                -0.500 ppm
F2               -250.11 Hz
PPMCM            0.41667 ppm/cm
HZCM           208.42505 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum



(*R*)
Table 2, entry 3


```
Current Data Parameters
USER                mharri
NAME      MRH-III-269-1HNMR
EXPNO                    3
PROCNO                   1

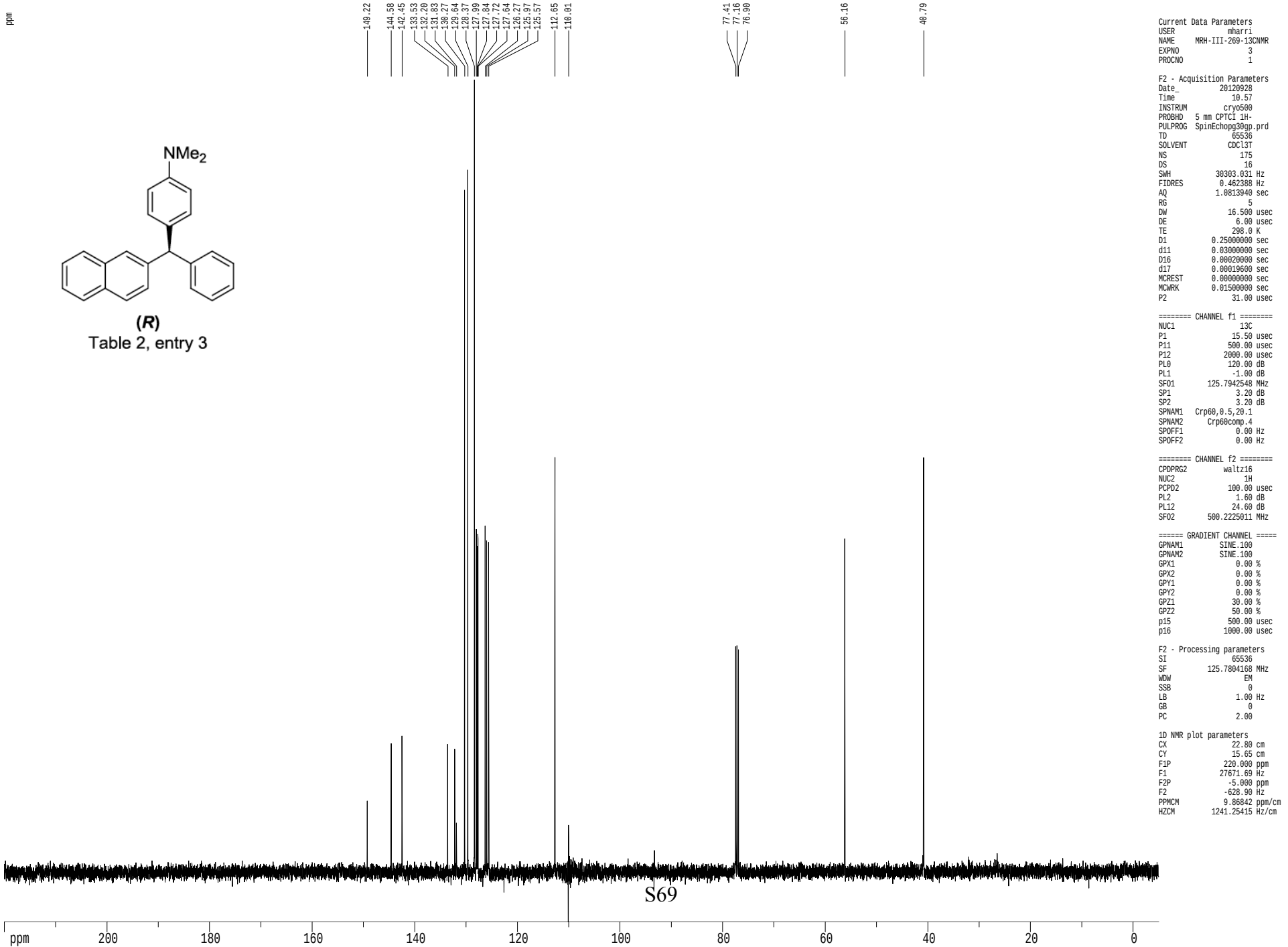
F2 - Acquisition Parameters
Date_            20120928
Time                10.55
INSTRUM          cryo500
PROBHD   5 mm CPTCI 1H-
PULPROG               zg30
TD                   81728
SOLVENT              CDCl3
NS                       1
DS                       2
SWH               8012.820 Hz
FIDRES               0.098043 Hz
AQ                5.0998774 sec
RG                       5
DW                  62.400 usec
DE                   6.00 usec
TE                  298.0 K
D1              0.10000000 sec
MCREST          0.00000000 sec
MCWRK           0.01500000 sec

======== CHANNEL f1 ========
NUC1                     1H
P1                    7.50 usec
PL1                   1.60 dB
SFO1          500.2235015 MHz

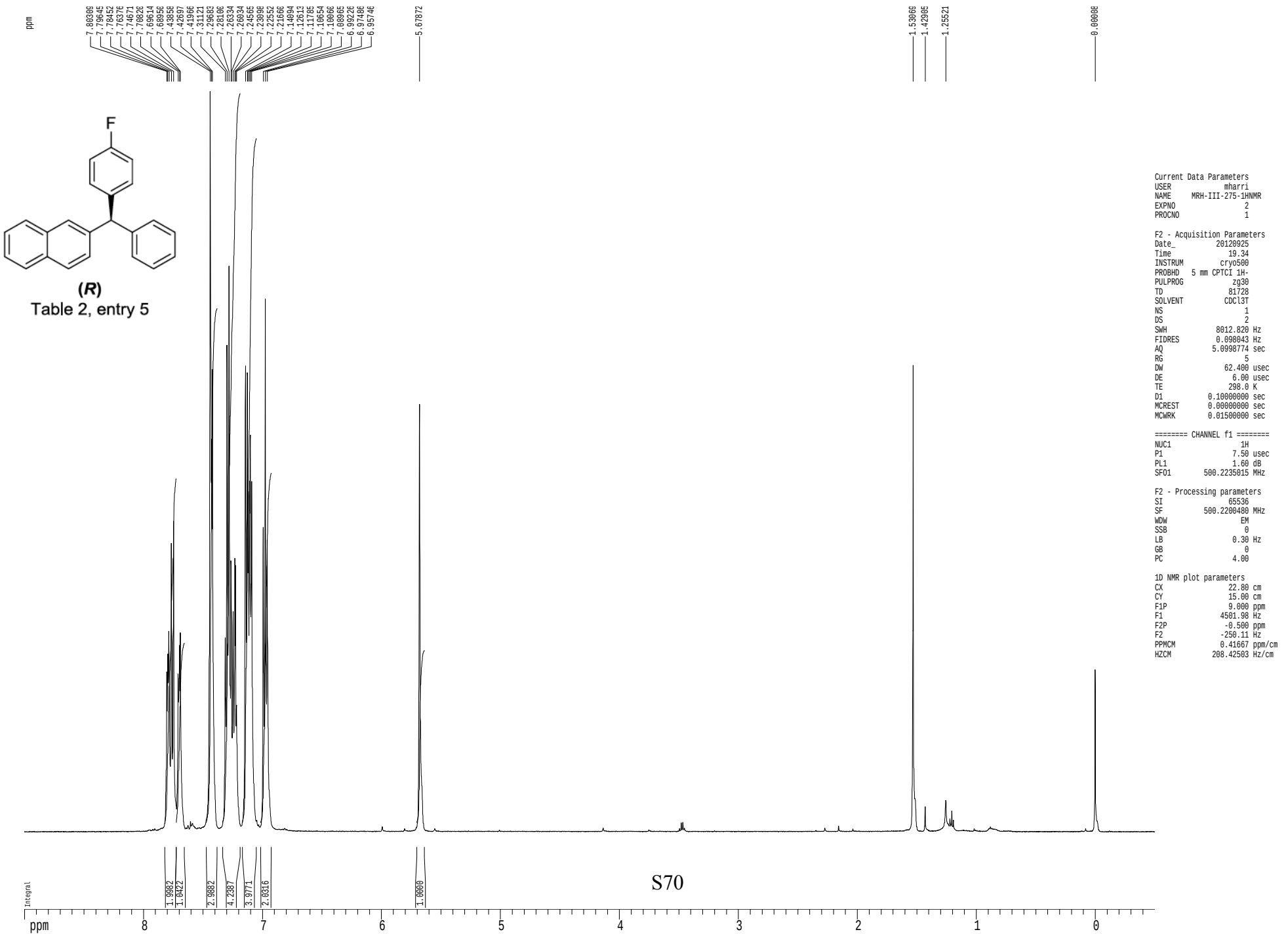
F2 - Processing parameters
SI                   65536
SF             500.2201002 MHz
WDW                     EM
SSB                      0
LB                    0.30 Hz
GB                       0
PC                    4.00

1D NMR plot parameters
CX                   22.80 cm
CY                   15.00 cm
F1P                   9.000 ppm
F1                 4501.98 Hz
F2P                  -0.500 ppm
F2                 -250.11 Hz
PPMCM              0.41667 ppm/cm
HZCM             208.42505 Hz/cm
```

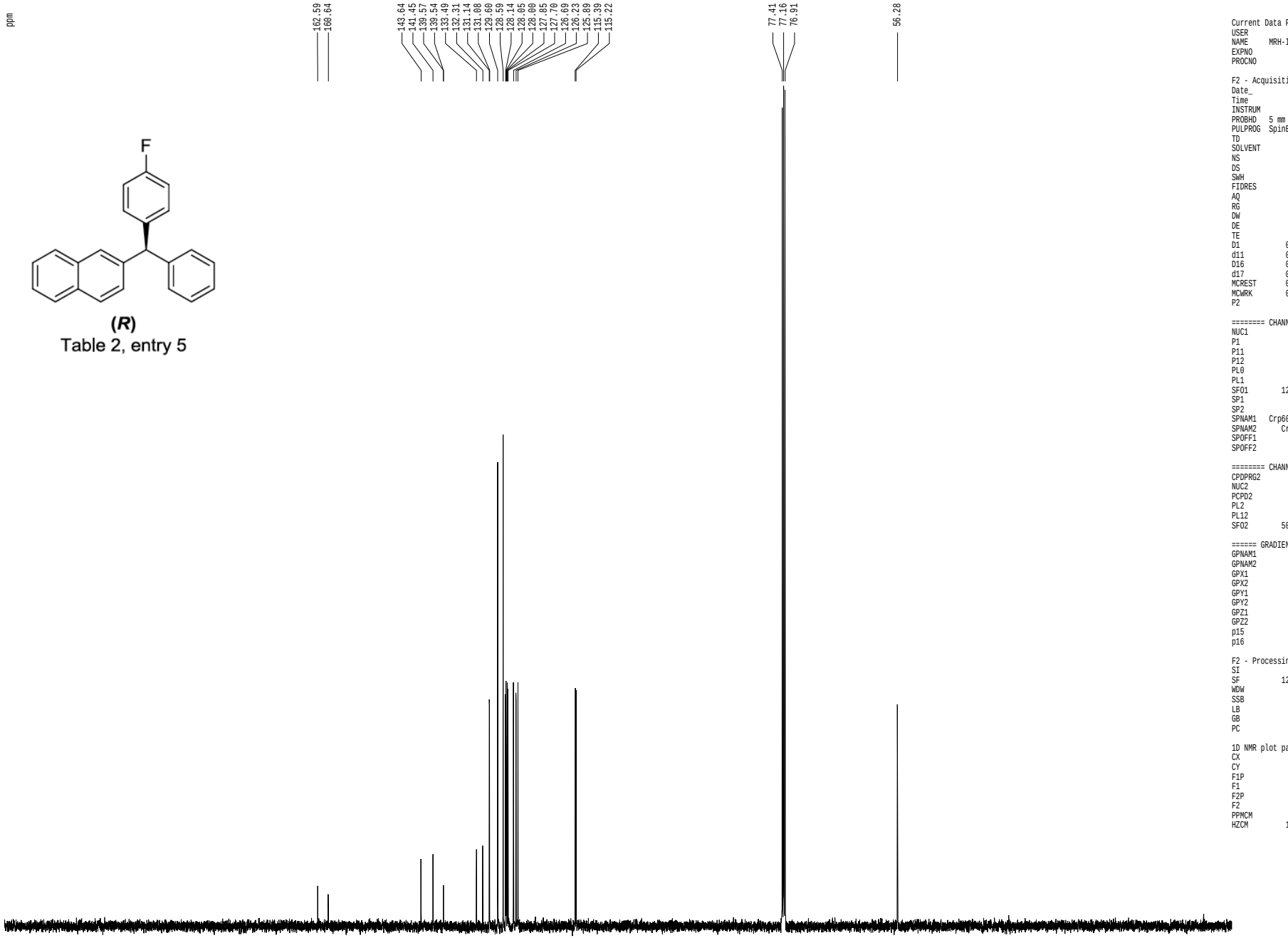
Z-restored spin-echo 13C spectrum with 1H decoupling



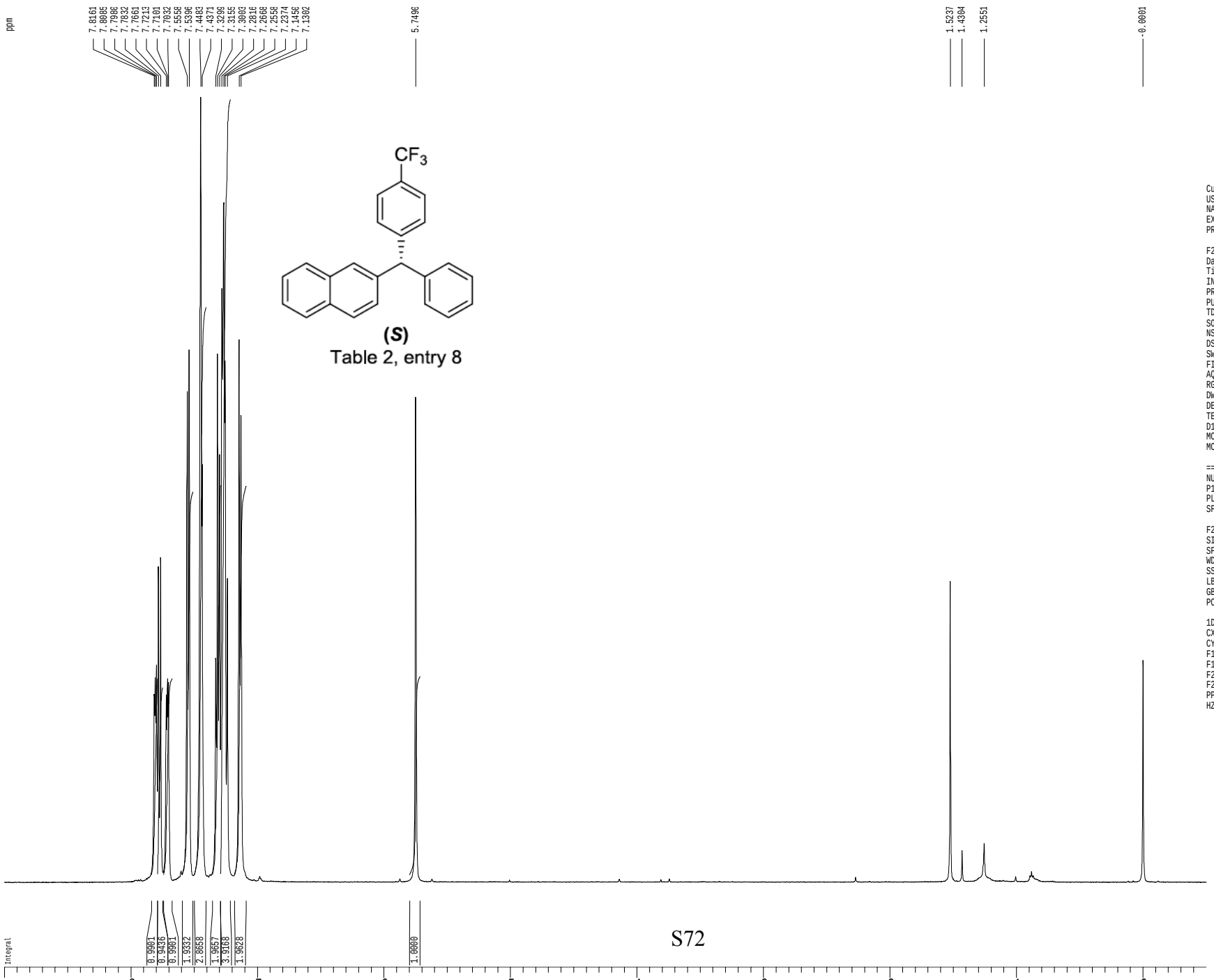
1H spectrum


ppm
7.80308
7.79645
7.78452
7.76376
7.74671
7.70828
7.69614
7.68956
7.43858
7.42697
7.41966
7.31121
7.29683
7.28106
7.26334
7.26034
7.24565
7.23098
7.22552
7.21668
7.14094
7.12613
7.11785
7.10654
7.10066
7.08965
6.99226
6.97486
6.95746
5.67872
1.53069
1.42985
1.25521
0.00008
F
(R)
Table 2, entry 5
Current Data Parameters
USER mharri
NAME MRH-III-275-1HNMR
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120925
Time 19.34
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3T
NS 1
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0998774 sec
RG 5
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz
F2 - Processing parameters
SI 65536
SF 500.2200480 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P -0.500 ppm
F2 -250.11 Hz
PPMCM 0.41667 ppm/cm
HZCM 208.42503 Hz/cm
Integral
1.9982
1.0422
2.9882
4.2387
3.9771
2.0316
1.0000
ppm
8
7
6
5
4
3
2
1
0

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum



Current Data Parameters
USER mharri
NAME MRH-IV-29-1HNMR
EXPNO 2
PROCNO 1

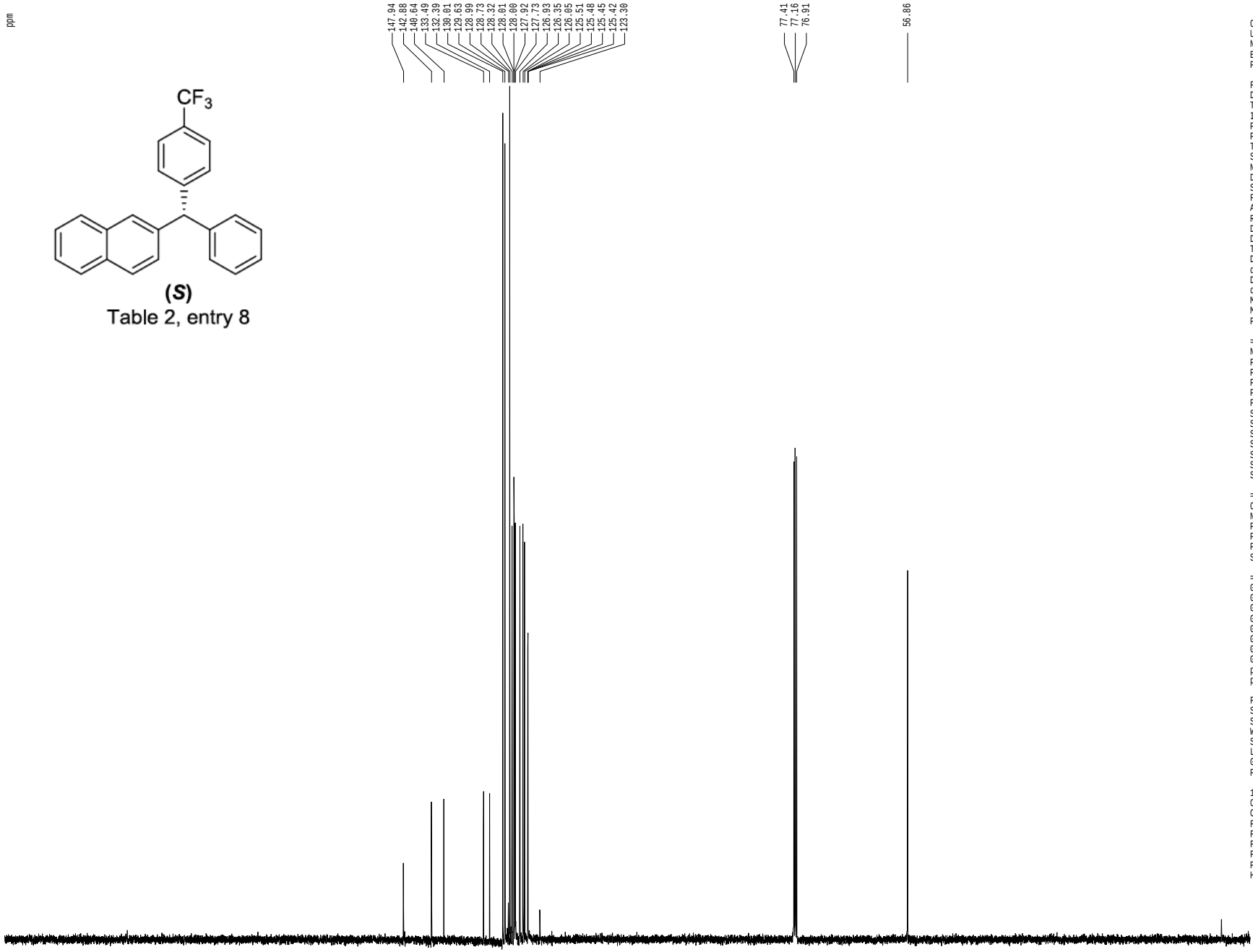
F2 - Acquisition Parameters
Date_ 20121019
Time 14.43
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 3
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0998774 sec
RG 4.5
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz

F2 - Processing parameters
SI 65536
SF 500.2200421 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P -0.500 ppm
F2 -250.11 Hz
PPMCM 0.41667 ppm/cm
HZCM 208.42502 Hz/cm

Z-restored spin-echo 13C spectrum with 1H decoupling



Current Data Parameters

USER	mharri
NAME	MRH-IV-29-13CNMR
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121019
Time	14.46
INSTRUM	cryo500
PROBHD	5 mm CPTCI 1H-
PULPROG	SpinEchopg30gp.prd
TD	65536
SOLVENT	CDCl3T
NS	317
DS	16
SWH	30303.031 Hz
FIDRES	0.462388 Hz
AQ	1.0813940 sec
RG	7298.2
DW	16.500 usec
DE	6.00 usec
TE	298.0 K
D1	0.25000000 sec
d11	0.03000000 sec
D16	0.00020000 sec
d17	0.00019600 sec
MCREST	0.00000000 sec
MCWRK	0.01500000 sec
P2	31.00 usec

======== CHANNEL f1 ========

NUC1	13C
P1	15.50 usec
P11	500.00 usec
P12	2000.00 usec
PL0	120.00 dB
PL1	-1.00 dB
SFO1	125.7942548 MHz
SP1	3.20 dB
SP2	3.20 dB
SPNAM1	Crp60,0.5,20.1
SPNAM2	Crp60comp.4
SPOFF1	0.00 Hz
SPOFF2	0.00 Hz

======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	100.00 usec
PL2	1.60 dB
PL12	24.60 dB
SFO2	500.2225011 MHz

====== GRADIENT CHANNEL =====

GPNAM1	SINE.100
GPNAM2	SINE.100
GPX1	0.00 %
GPX2	0.00 %
GPY1	0.00 %
GPY2	0.00 %
GPZ1	30.00 %
GPZ2	50.00 %
p15	500.00 usec
p16	1000.00 usec

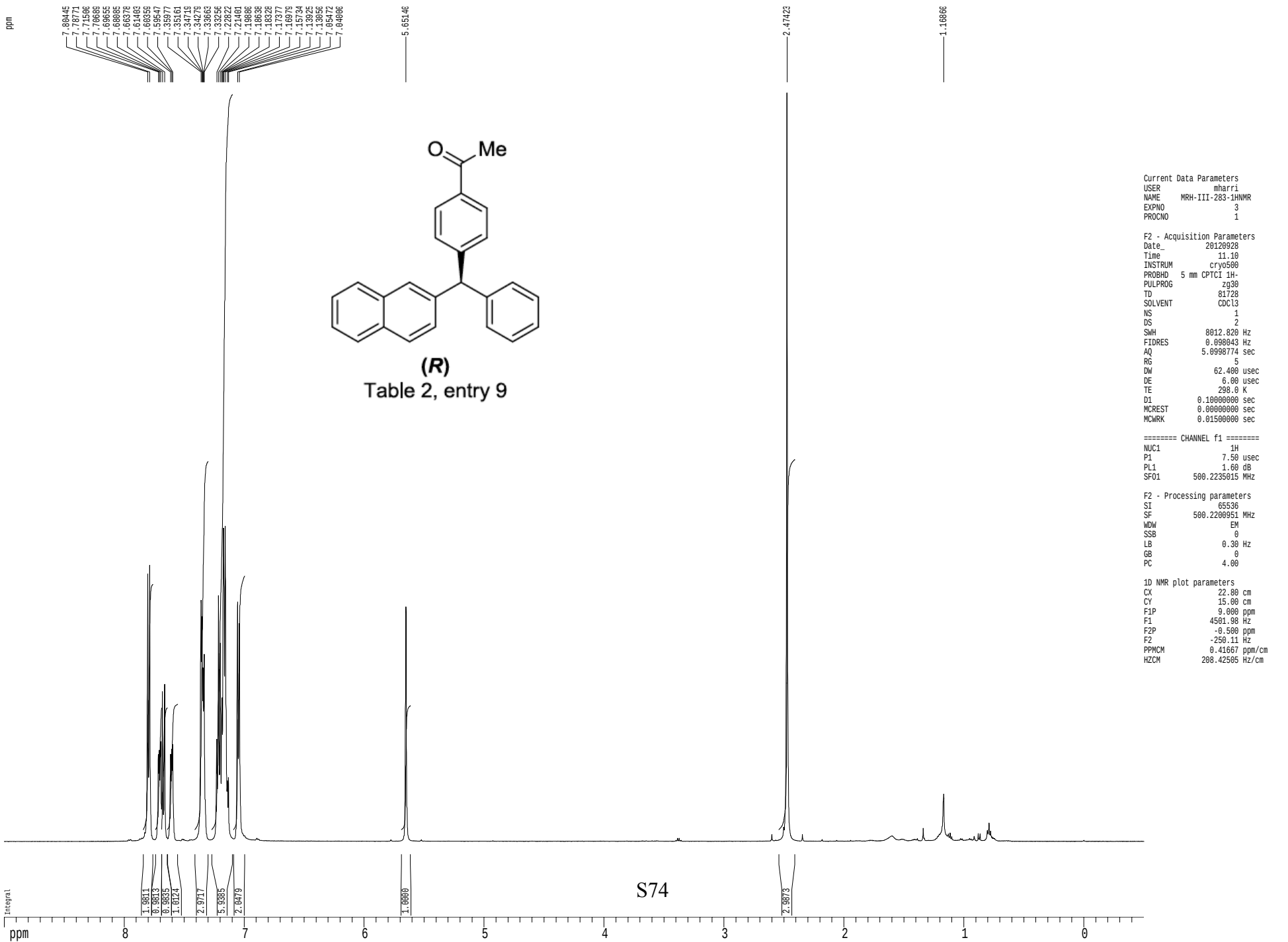
F2 - Processing parameters

SI	65536
SF	125.7804099 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	2.00

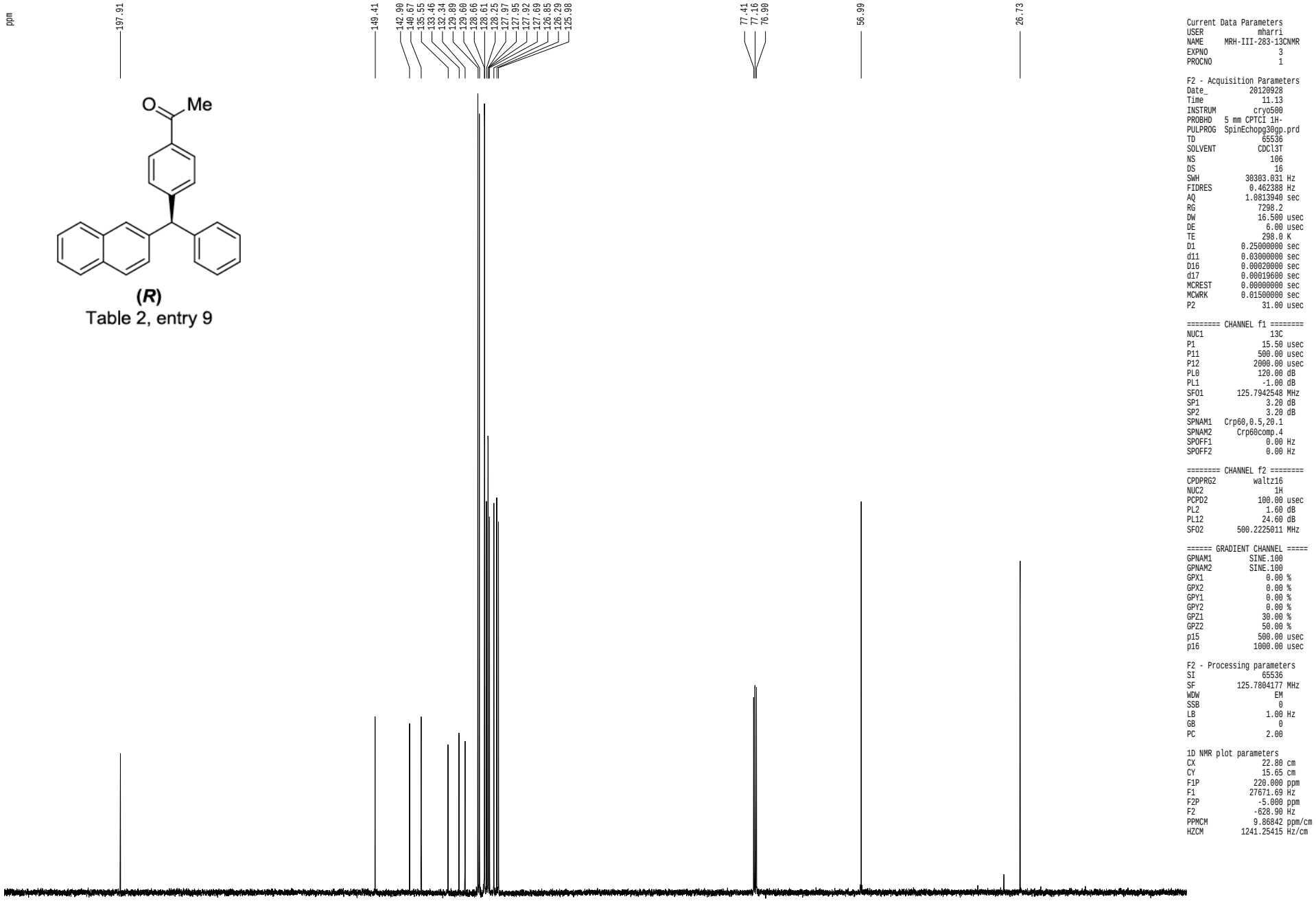
1D NMR plot parameters

CX	22.80 cm
CY	15.65 cm
F1P	220.000 ppm
F1	27671.69 Hz
F2P	-5.000 ppm
F2	-628.90 Hz
PPMCM	9.86842 ppm/cm
HZCM	1241.25415 Hz/cm

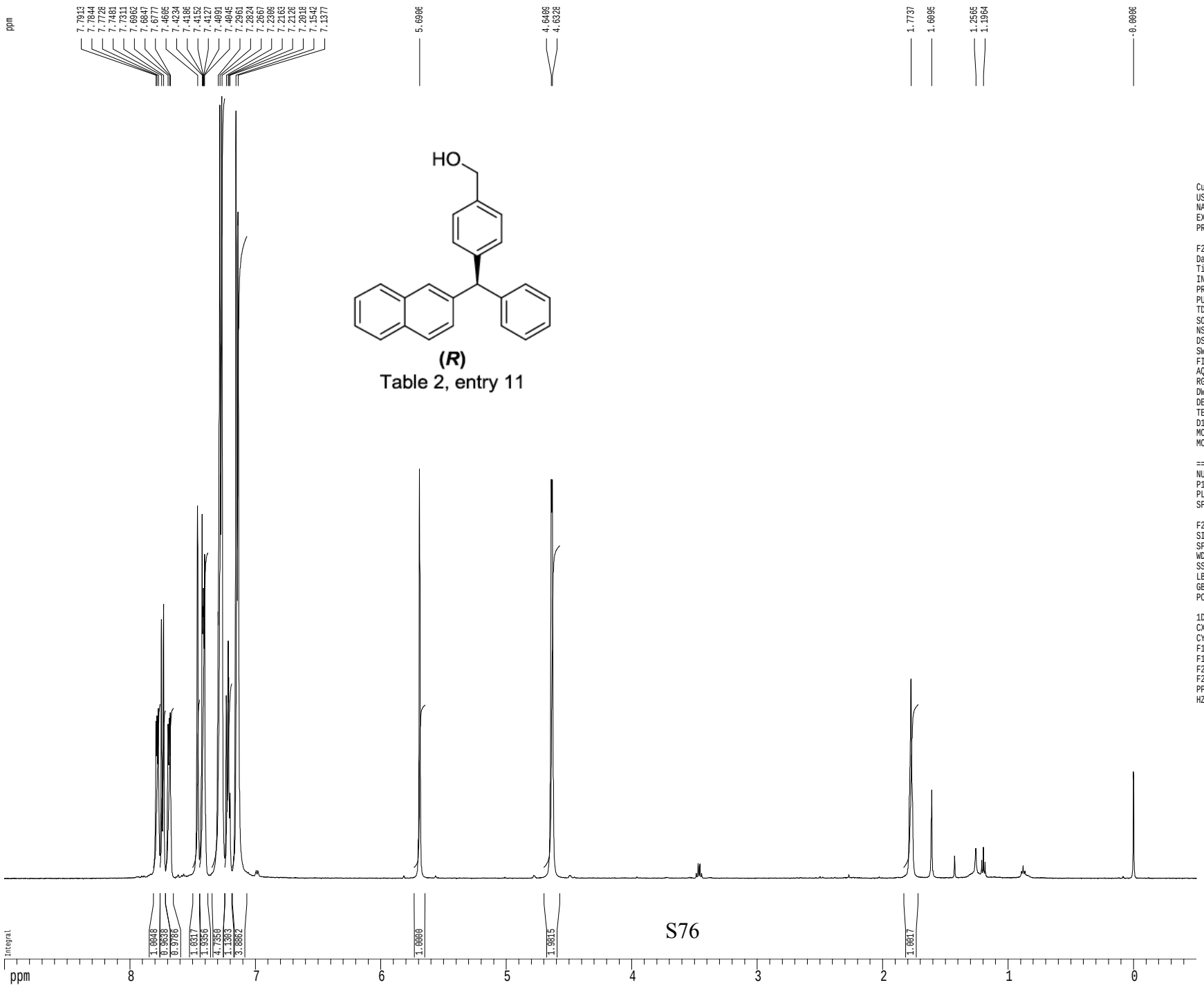
1H spectrum


ppm
7.80445
7.76771
7.71506
7.70668
7.69655
7.68085
7.66378
7.61403
7.60359
7.59547
7.35977
7.35161
7.34719
7.34279
7.33663
7.33256
7.22822
7.21401
7.19886
7.18638
7.18328
7.17377
7.16973
7.15734
7.13925
7.13056
7.05472
7.04086
5.65146
2.47423
1.68666
O
Me
(R)
Table 2, entry 9
Current Data Parameters
USER mharri
NAME MRH-III-283-1HNMR
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120928
Time 11.10
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 1
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0998774 sec
RG 5
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SF01 500.2235015 MHz
F2 - Processing parameters
SI 65536
SF 500.2200951 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P -0.500 ppm
F2 -250.11 Hz
PPMCM 0.41667 ppm/cm
HZCM 208.42505 Hz/cm
Integral
1.9811
6.9813
6.9835
1.0124
2.9717
5.9385
2.0479
1.0000
2.9873
ppm
8
7
6
5
4
3
2
1
0

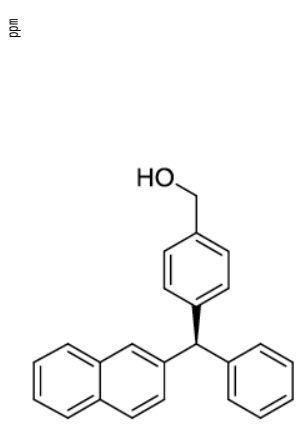
Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum


ppm
7.7913
7.7844
7.7728
7.7481
7.7311
7.6962
7.6847
7.6777
7.4685
7.4234
7.4186
7.4152
7.4127
7.4091
7.4045
7.2961
7.2824
7.2667
7.2308
7.2163
7.2128
7.2018
7.1542
7.1377
5.6096
4.6408
4.6328
1.7737
1.6095
1.2565
1.1964
0.0000
HO
(R)
Table 2, entry 11
Current Data Parameters
USER mharri
NAME MRH-IV-26-1HNMR
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20121019
Time 14.34
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 1
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0998774 sec
RG 3.2
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz
F2 - Processing parameters
SI 65536
SF 500.2200546 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P -0.500 ppm
F2 -250.11 Hz
PPMCM 0.41667 ppm/cm
HZCM 208.42503 Hz/cm
Integral
1.0048
0.9638
0.9786
1.0217
1.9356
4.7350
1.1303
3.8862
1.0000
1.9815
1.0617
ppm
8
7
6
5
4
3
2
1
0

Z-restored spin-echo 13C spectrum with 1H decoupling



(*R*)

Table 2, entry 11

Current Data Parameters
USER mharri
NAME MRH-IV-26-13CNMR
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121019
Time 14.36
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG SpinEchopg30gp.prd
TD 65536
SOLVENT CDCl3T
NS 101
DS 16
SWH 30303.031 Hz
FIDRES 0.462388 Hz
AQ 1.0813940 sec
RG 4096
DW 16.500 usec
DE 6.00 usec
TE 298.0 K
D1 0.25000000 sec
d11 0.03000000 sec
D16 0.00020000 sec
d17 0.00019600 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
P2 31.00 usec

======== CHANNEL f1 ========
NUC1 13C
P1 15.50 usec
P11 500.00 usec
P12 2000.00 usec
PL0 120.00 dB
PL1 -1.00 dB
SFO1 125.7942548 MHz
SP1 3.20 dB
SP2 3.20 dB
SPNAM1 Crp60,0.5,20.1
SPNAM2 Crp60comp.4
SPOFF1 0.00 Hz
SPOFF2 0.00 Hz

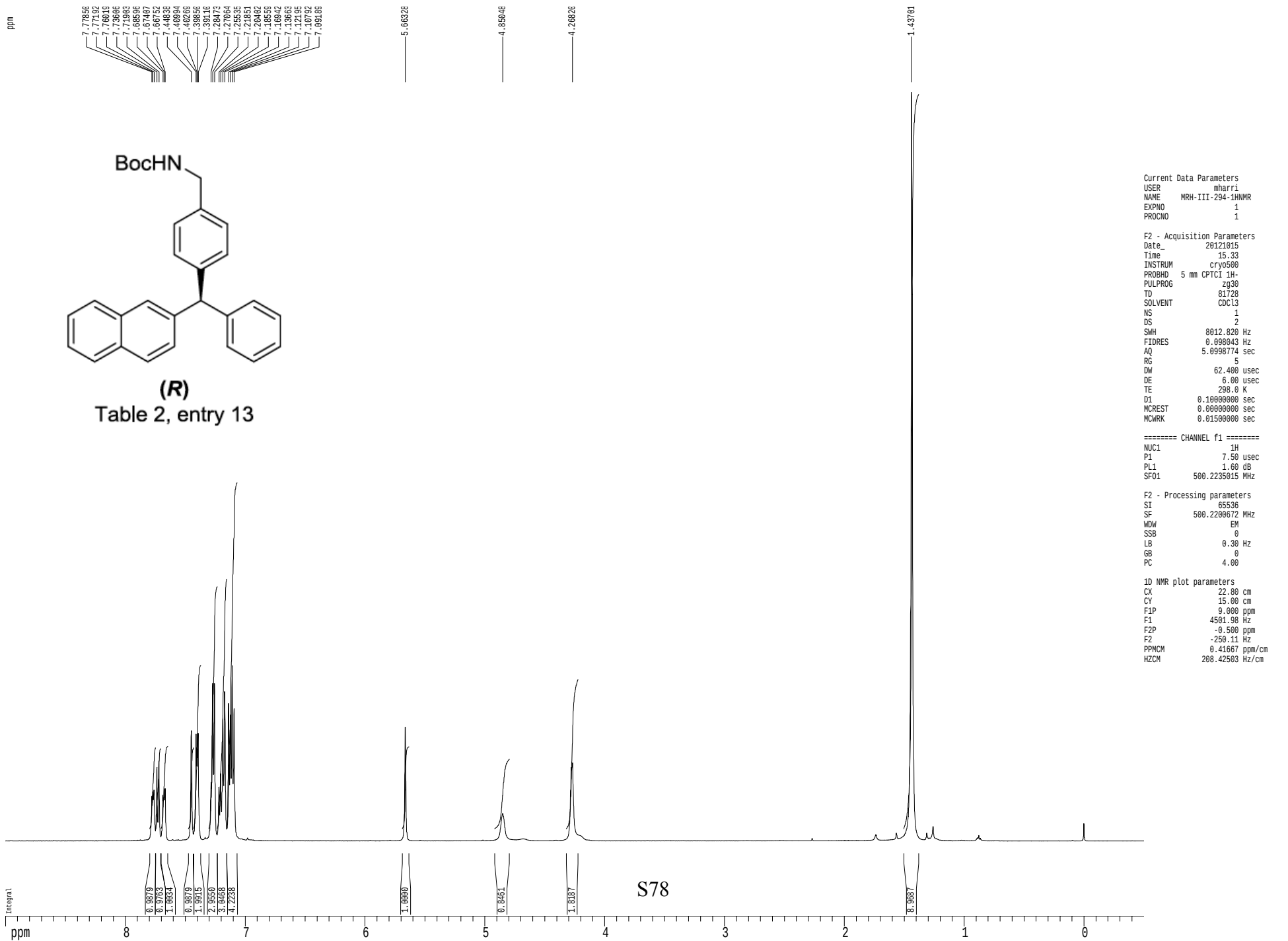
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 100.00 usec
PL2 1.60 dB
PL12 24.60 dB
SFO2 500.2225011 MHz

====== GRADIENT CHANNEL =====
GPNAM1 SINE.100
GPNAM2 SINE.100
GPX1 0.00 %
GPX2 0.00 %
GPY1 0.00 %
GPY2 0.00 %
GPZ1 30.00 %
GPZ2 50.00 %
p15 500.00 usec
p16 1000.00 usec

F2 - Processing parameters
SI 65536
SF 125.7804168 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 2.00

1D NMR plot parameters
CX 22.80 cm
CY 15.65 cm
F1P 220.000 ppm
F1 27671.69 Hz
F2P -5.000 ppm
F2 -628.90 Hz
PPMCM 9.86842 ppm/cm
HZCM 1241.25415 Hz/cm

1H spectrum




```
Current Data Parameters
USER                mharri
NAME      MRH-III-294-1HNMR
EXPNO                    1
PROCNO                   1

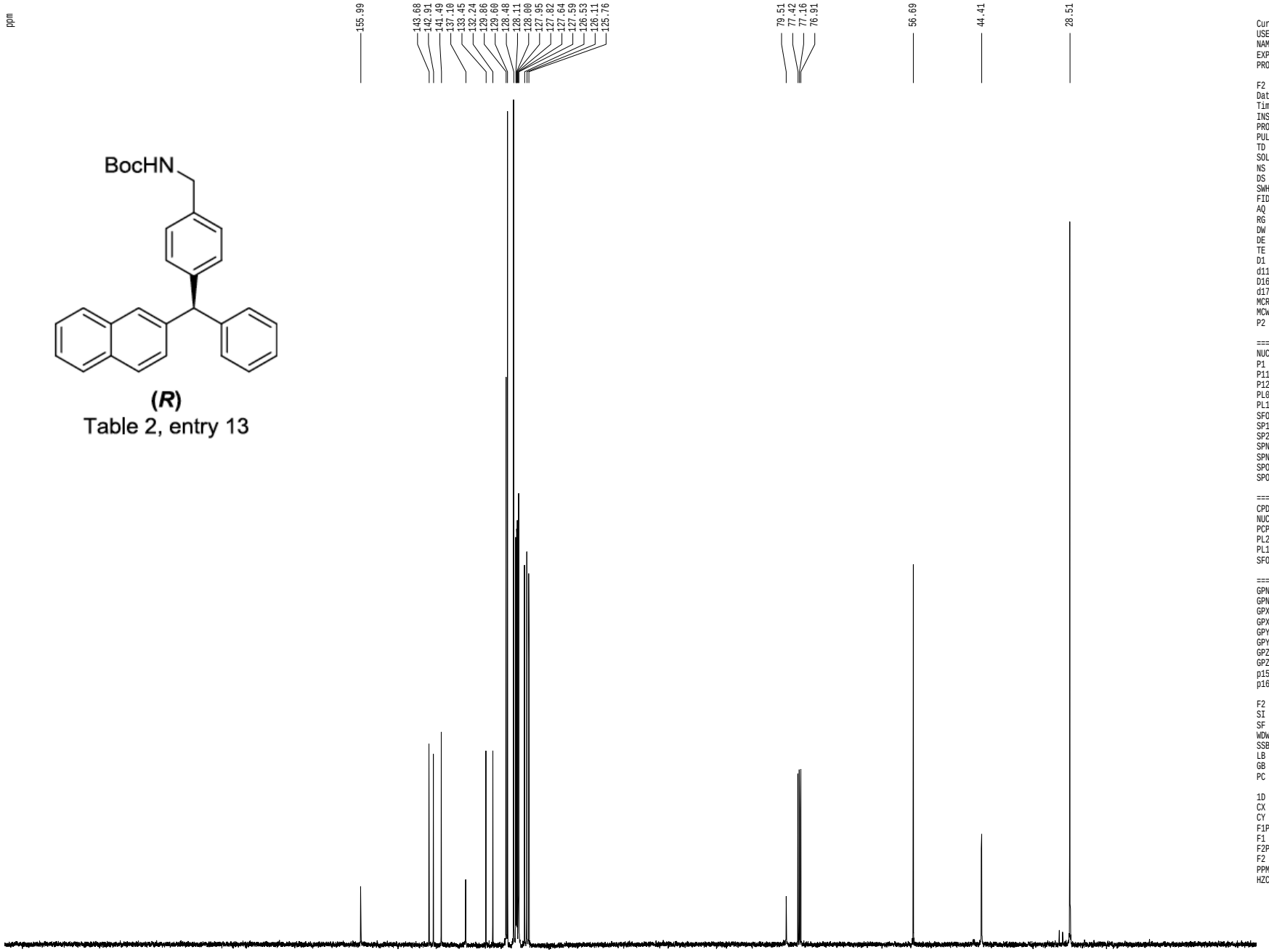
F2 - Acquisition Parameters
Date_           20121015
Time               15.33
INSTRUM          cryo500
PROBHD   5 mm CPTCI 1H-
PULPROG             zg30
TD                 81728
SOLVENT            CDCl3
NS                     1
DS                     2
SWH             8012.820 Hz
FIDRES             0.098043 Hz
AQ              5.0998774 sec
RG                     5
DW                62.400 usec
DE                 6.00 usec
TE                298.0 K
D1             0.10000000 sec
MCREST         0.00000000 sec
MCWRK          0.01500000 sec

======== CHANNEL f1 ========
NUC1                   1H
P1                  7.50 usec
PL1                 1.60 dB
SFO1         500.2235015 MHz

F2 - Processing parameters
SI                 65536
SF           500.2200672 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  4.00

1D NMR plot parameters
CX                 22.80 cm
CY                 15.00 cm
F1P                9.000 ppm
F1               4501.98 Hz
F2P               -0.500 ppm
F2               -250.11 Hz
PPMCM           0.41667 ppm/cm
HZCM          208.42503 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



Current Data Parameters
USER mharri
NAME MRH-III-294-13CNMR
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121015
Time 15.35
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG SpinEchopg30gp.prd
TD 65536
SOLVENT CDCl3T
NS 101
DS 16
SWH 30303.031 Hz
FIDRES 0.462388 Hz
AQ 1.0813940 sec
RG 5792.6
DW 16.500 usec
DE 6.00 usec
TE 298.0 K
D1 0.25000000 sec
d11 0.03000000 sec
D16 0.00020000 sec
d17 0.00019600 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
P2 31.00 usec

======== CHANNEL f1 ========
NUC1 13C
P1 15.50 usec
P11 500.00 usec
P12 2000.00 usec
PL0 120.00 dB
PL1 -1.00 dB
SFO1 125.7942548 MHz
SP1 3.20 dB
SP2 3.20 dB
SPNAM1 Crp60,0.5,20.1
SPNAM2 Crp60comp.4
SPOFF1 0.00 Hz
SPOFF2 0.00 Hz

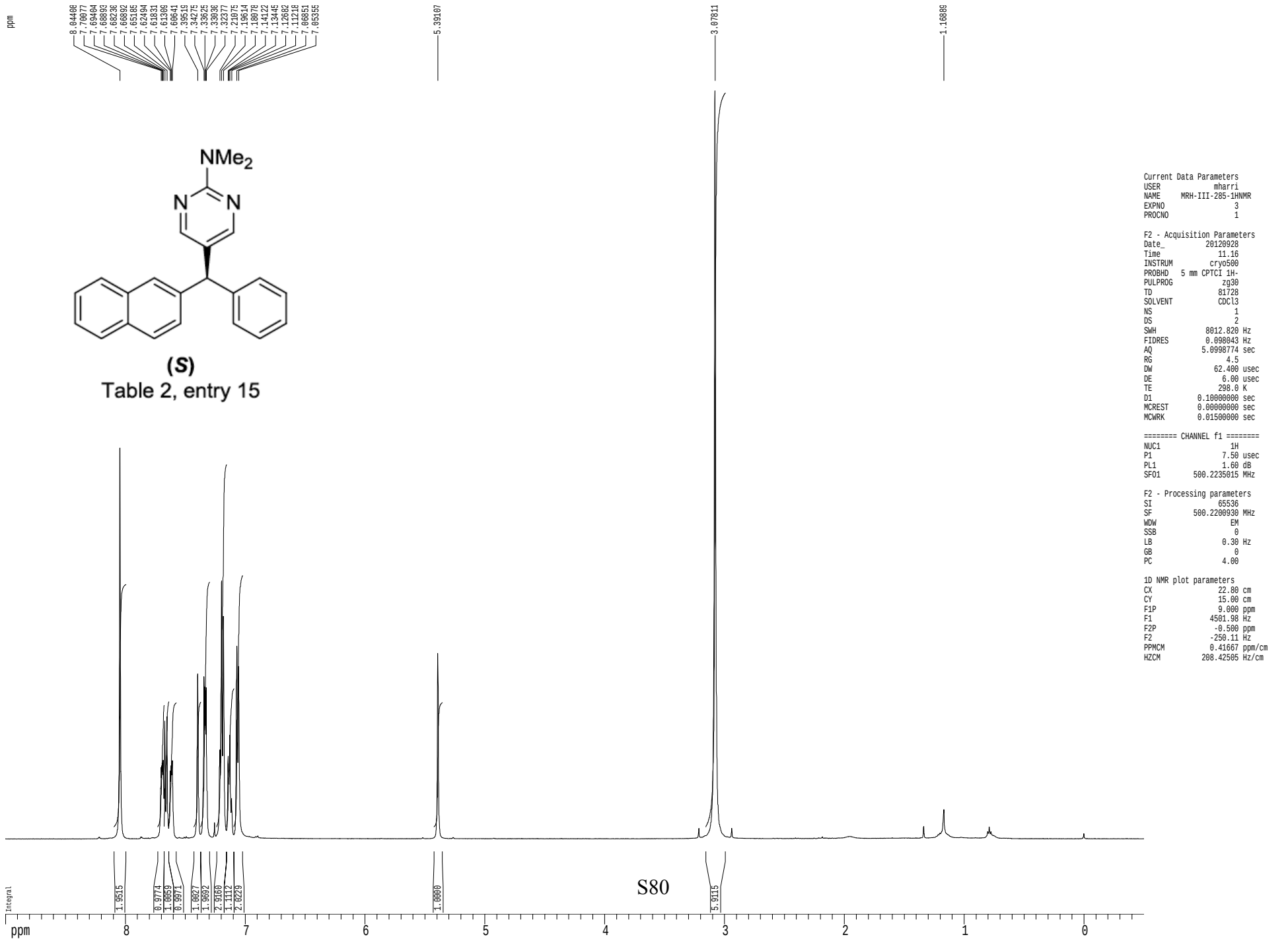
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 100.00 usec
PL2 1.60 dB
PL12 24.60 dB
SFO2 500.2225011 MHz

====== GRADIENT CHANNEL =====
GPNAM1 SINE.100
GPNAM2 SINE.100
GPX1 0.00 %
GPX2 0.00 %
GPY1 0.00 %
GPY2 0.00 %
GPZ1 30.00 %
GPZ2 50.00 %
p15 500.00 usec
p16 1000.00 usec

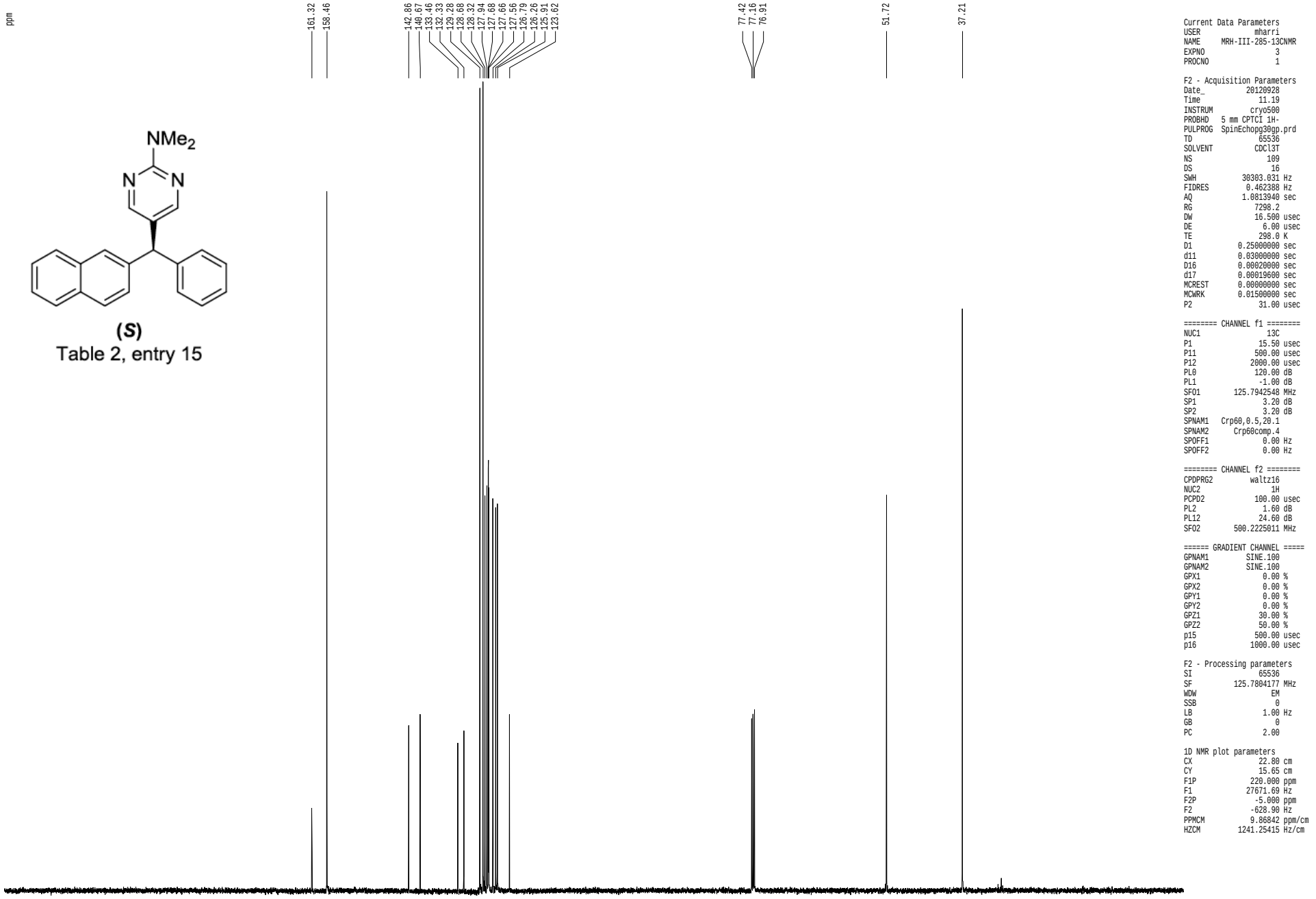
F2 - Processing parameters
SI 65536
SF 125.7804238 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 2.00

1D NMR plot parameters
CX 22.80 cm
CY 15.65 cm
F1P 220.000 ppm
F1 27671.70 Hz
F2P -5.000 ppm
F2 -628.90 Hz
PPMCM 9.86842 ppm/cm
HZCM 1241.25427 Hz/cm

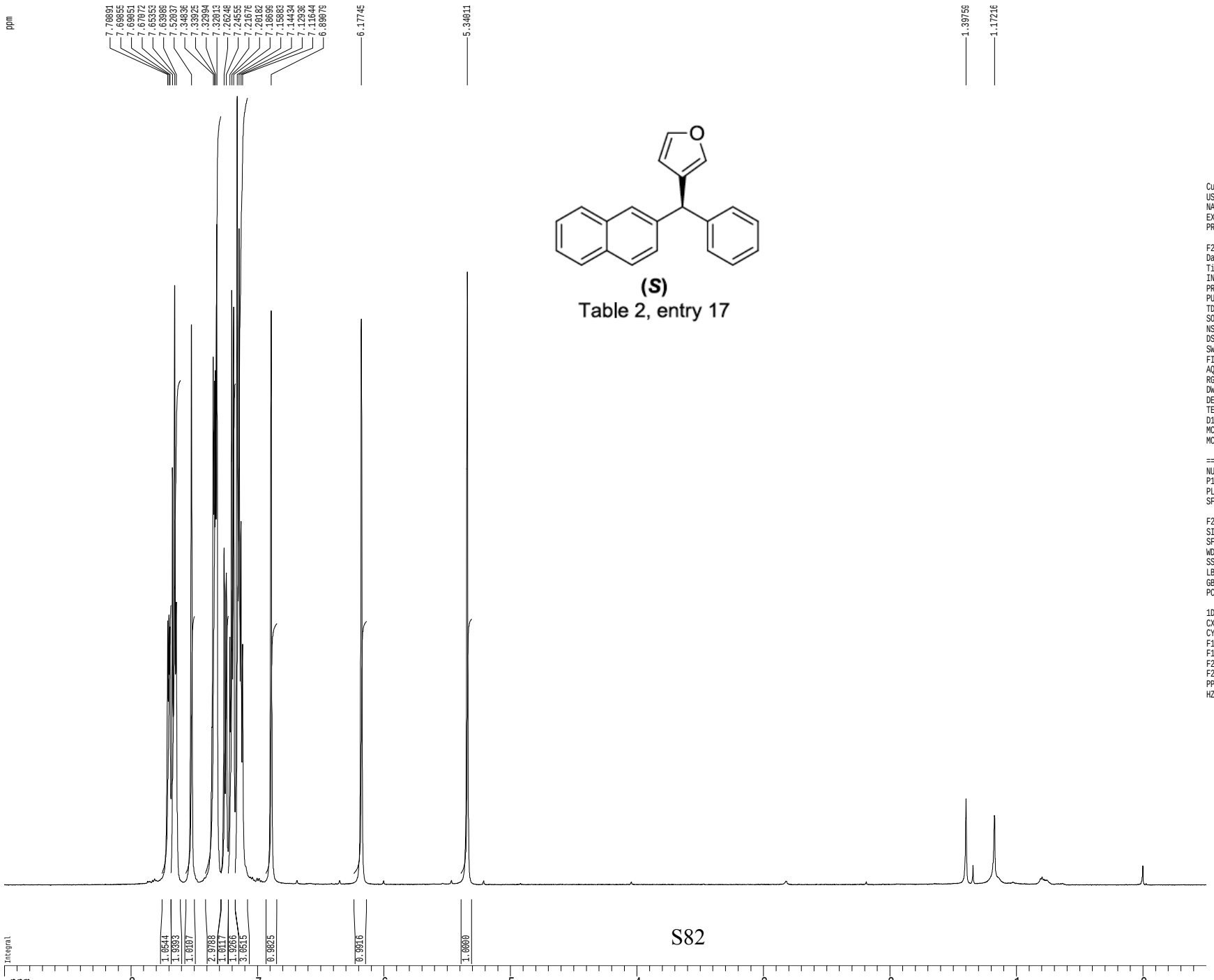
1H spectrum


ppm
8.04408
7.70077
7.69404
7.68893
7.66238
7.66892
7.65185
7.62494
7.61831
7.61308
7.60641
7.39519
7.34275
7.33625
7.33036
7.32377
7.21075
7.19614
7.18078
7.14122
7.13445
7.12662
7.11218
7.06851
7.05355
5.39107
3.07811
1.68888
NMe2
N
N
(S)
Table 2, entry 15
Current Data Parameters
USER mharri
NAME MRH-III-285-1HNMR
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120928
Time 11.16
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 1
DS 2
SWH 8012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0998774 sec
RG 4.5
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz
F2 - Processing parameters
SI 65536
SF 500.2200930 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P -0.500 ppm
F2 -250.11 Hz
PPMCM 0.41667 ppm/cm
HZCM 208.42505 Hz/cm
Integral
1.9515
6.9774
1.0059
6.9971
1.0027
1.9692
2.9160
1.1112
2.0229
1.0000
5.9115
ppm
8
7
6
5
4
3
2
1
0

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum



(*S*)

Table 2, entry 17

```
Current Data Parameters
USER                mharri
NAME      MRH-III-277-1HNMR
EXPNO                    3
PROCNO                   1

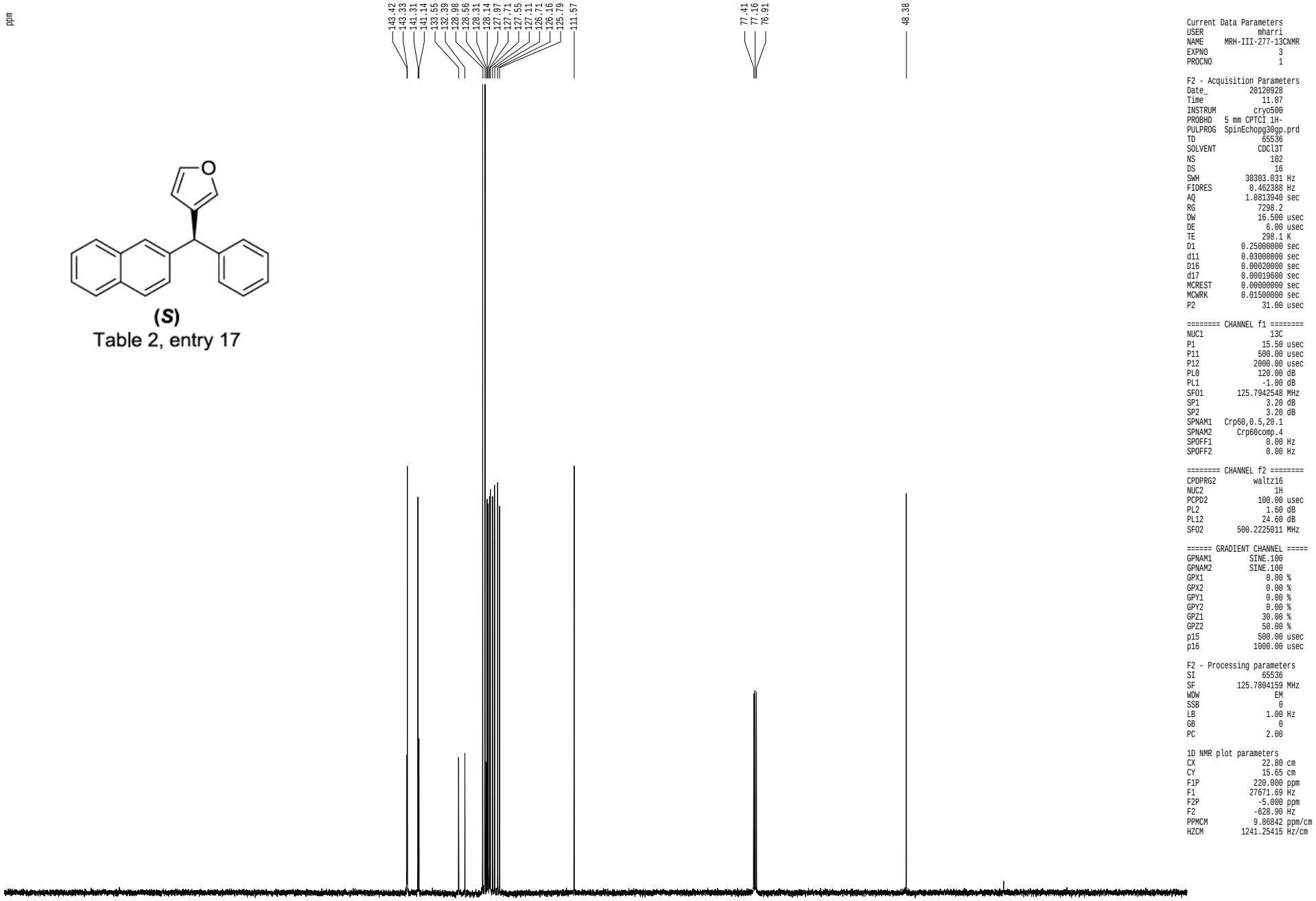
F2 - Acquisition Parameters
Date_           20120928
Time                11.03
INSTRUM          cryo500
PROBHD   5 mm CPTCI 1H-
PULPROG             zg30
TD                 81728
SOLVENT            CDCl3
NS                     1
DS                     2
SWH             8012.820 Hz
FIDRES             0.098043 Hz
AQ              5.0998774 sec
RG                     5
DW                62.400 usec
DE                 6.00 usec
TE                298.1 K
D1             0.10000000 sec
MCREST         0.00000000 sec
MCWRK          0.01500000 sec

======== CHANNEL f1 ========
NUC1                   1H
P1                  7.50 usec
PL1                 1.60 dB
SFO1         500.2235015 MHz

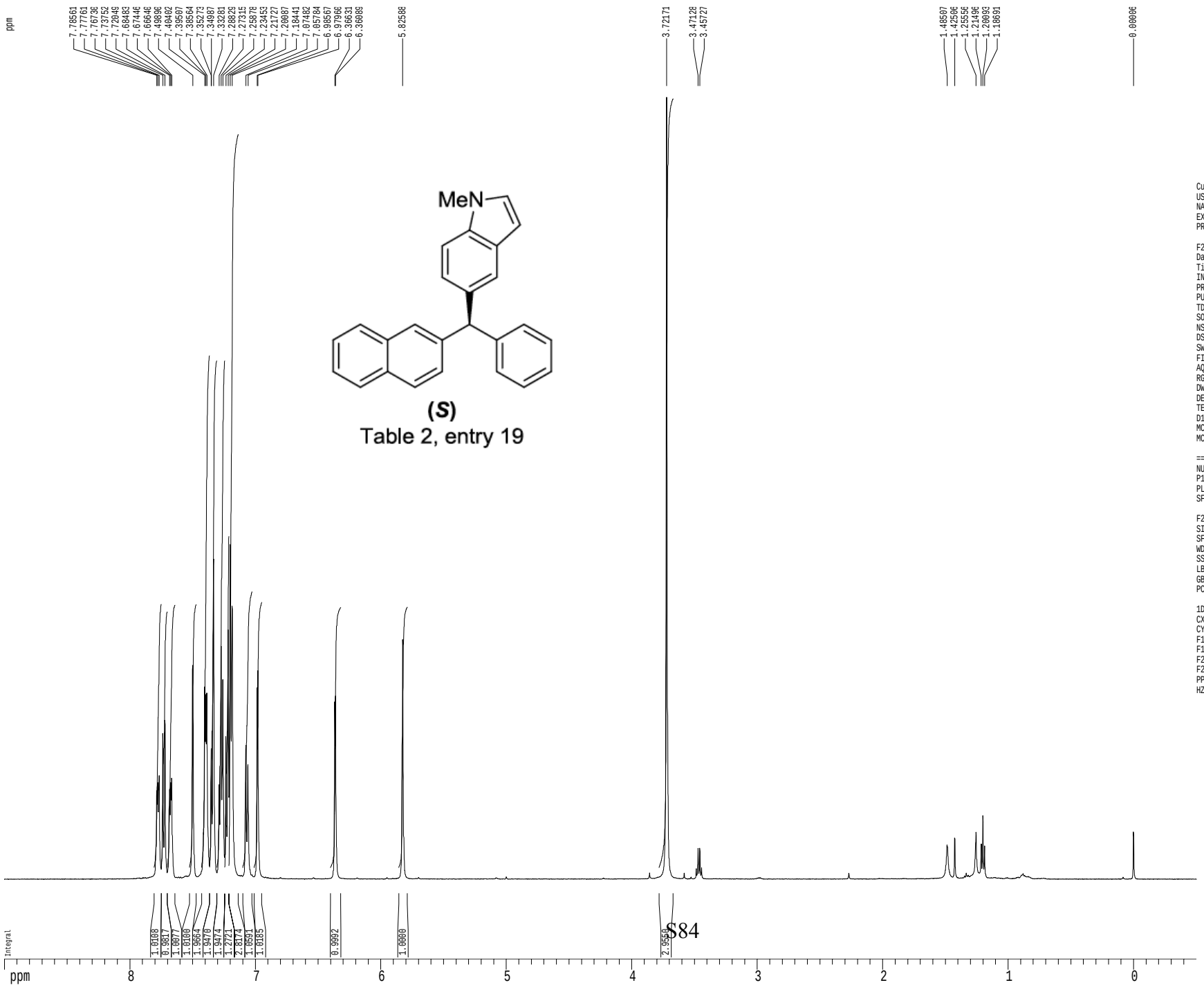
F2 - Processing parameters
SI                  65536
SF           500.2201019 MHz
WDW                    EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  4.00

1D NMR plot parameters
CX                 22.80 cm
CY                 15.00 cm
F1P                9.000 ppm
F1               4501.98 Hz
F2P               -0.500 ppm
F2               -250.11 Hz
PPMCM           0.41667 ppm/cm
HZCM          208.42505 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum




```
Current Data Parameters
USER                mharri
NAME      MRH-III-267-1HNMR
EXPNO                    1
PROCNO                   1

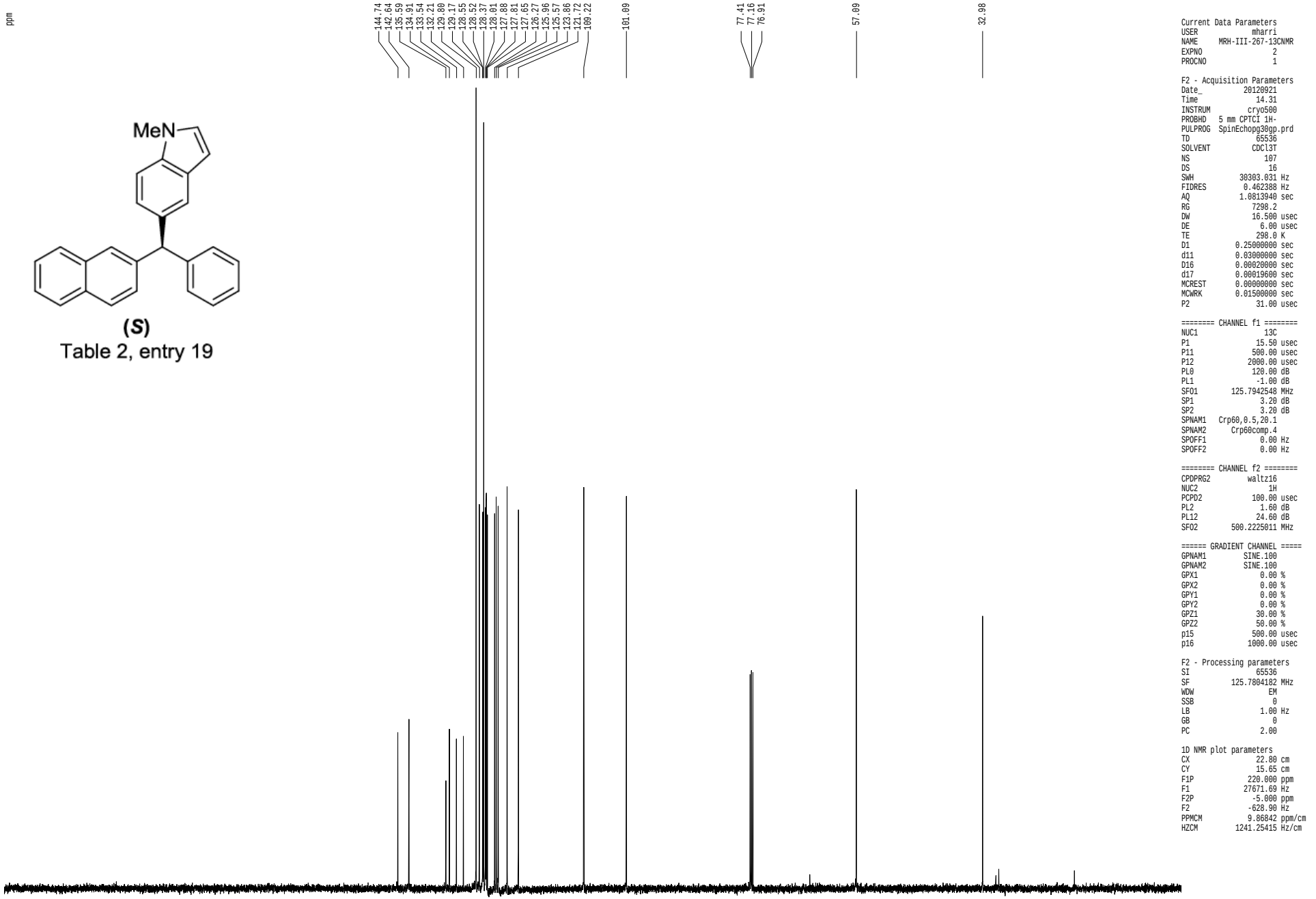
F2 - Acquisition Parameters
Date_            20120921
Time                14.29
INSTRUM          cryo500
PROBHD   5 mm CPTCI 1H-
PULPROG               zg30
TD                   81728
SOLVENT              CDCl3
NS                       1
DS                       2
SWH               8012.820 Hz
FIDRES               0.098043 Hz
AQ                5.0998774 sec
RG                     3.6
DW                  62.400 usec
DE                   6.00 usec
TE                  298.0 K
D1              0.10000000 sec
MCREST          0.00000000 sec
MCWRK           0.01500000 sec

======== CHANNEL f1 ========
NUC1                    1H
P1                   7.50 usec
PL1                  1.60 dB
SFO1          500.2235015 MHz

F2 - Processing parameters
SI                    65536
SF             500.2200670 MHz
WDW                     EM
SSB                      0
LB                    0.30 Hz
GB                       0
PC                    4.00

1D NMR plot parameters
CX                   22.80 cm
CY                   15.00 cm
F1P                   9.000 ppm
F1                 4501.98 Hz
F2P                  -0.500 ppm
F2                 -250.11 Hz
PPMCM              0.41667 ppm/cm
HZCM             208.42503 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



Current Data Parameters
USER mharri
NAME MRH-III-267-13CNMR
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20120921
Time 14.31
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG SpinEchopg30gp.prd
TD 65536
SOLVENT CDCl3T
NS 107
DS 16
SWH 30303.031 Hz
FIDRES 0.462388 Hz
AQ 1.0813940 sec
RG 7298.2
DW 16.500 usec
DE 6.00 usec
TE 298.0 K
D1 0.25000000 sec
d11 0.03000000 sec
D16 0.00020000 sec
d17 0.00019600 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
P2 31.00 usec

======== CHANNEL f1 ========
NUC1 13C
P1 15.50 usec
P11 500.00 usec
P12 2000.00 usec
PL0 120.00 dB
PL1 -1.00 dB
SFO1 125.7942548 MHz
SP1 3.20 dB
SP2 3.20 dB
SPNAM1 Crp60,0.5,20.1
SPNAM2 Crp60comp.4
SPOFF1 0.00 Hz
SPOFF2 0.00 Hz

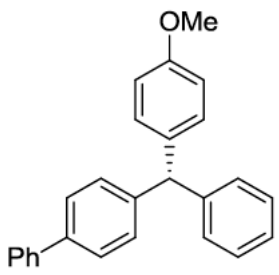
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 100.00 usec
PL2 1.60 dB
PL12 24.60 dB
SFO2 500.2225011 MHz

====== GRADIENT CHANNEL =====
GPNAM1 SINE.100
GPNAM2 SINE.100
GPX1 0.00 %
GPX2 0.00 %
GPY1 0.00 %
GPY2 0.00 %
GPZ1 30.00 %
GPZ2 50.00 %
p15 500.00 usec
p16 1000.00 usec

F2 - Processing parameters
SI 65536
SF 125.7804182 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 2.00

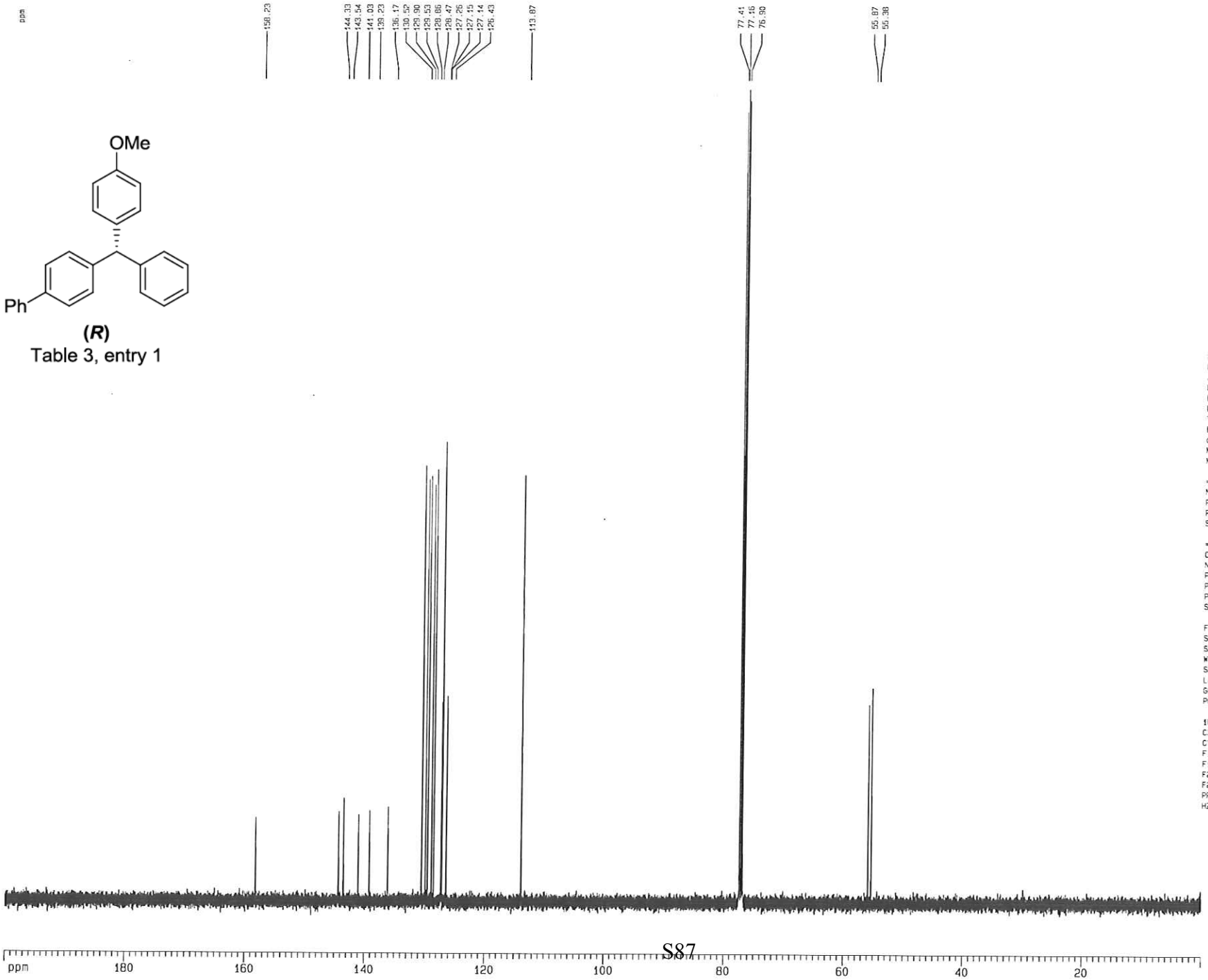
1D NMR plot parameters
CX 22.80 cm
CY 15.65 cm
F1P 220.000 ppm
F1 27671.69 Hz
F2P -5.000 ppm
F2 -628.90 Hz
PPMCM 9.86842 ppm/cm
HZCM 1241.25415 Hz/cm

1H spectrum

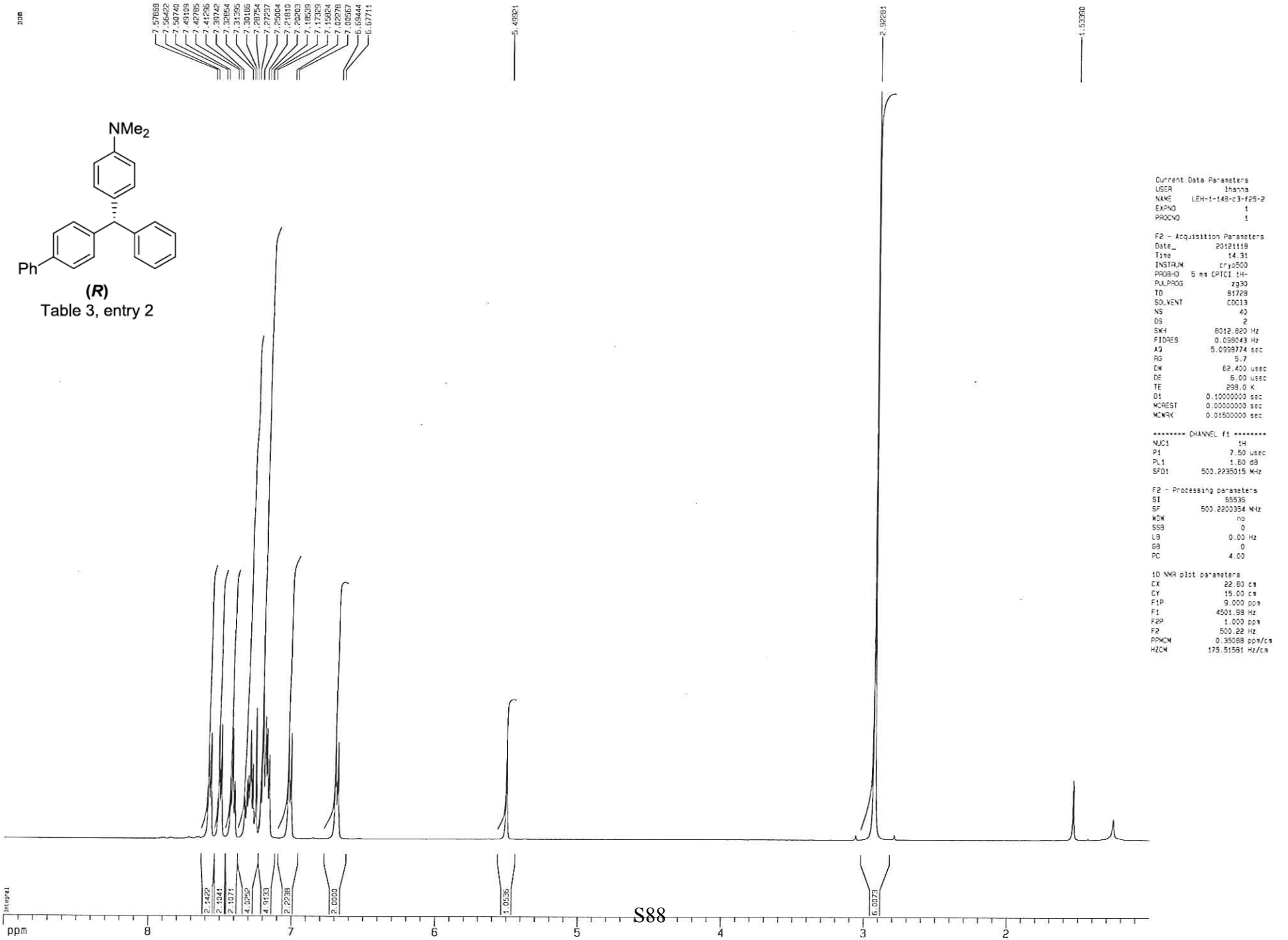


(*R*)
Table 3, entry 1

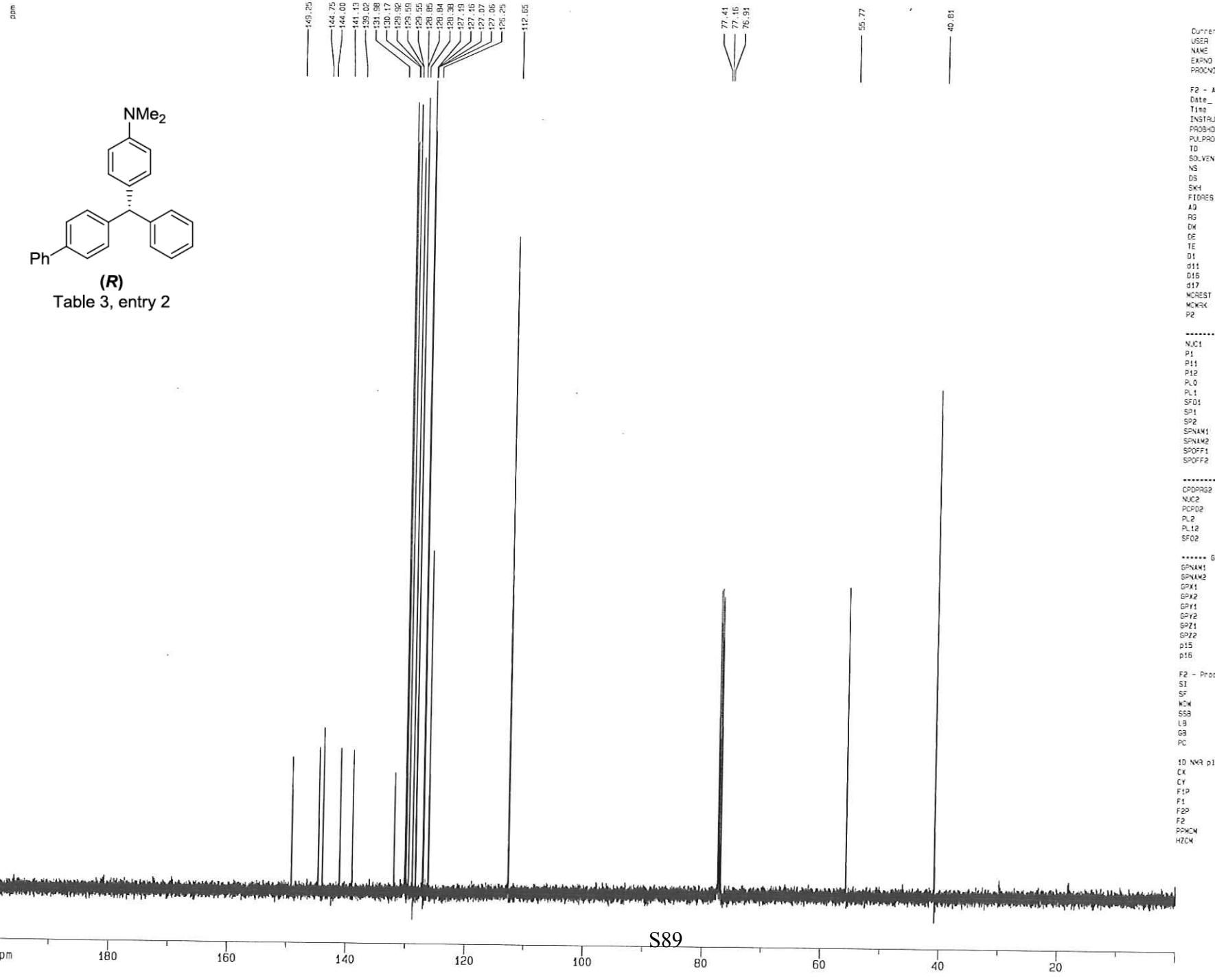
13C spectrum with 1H decoupling



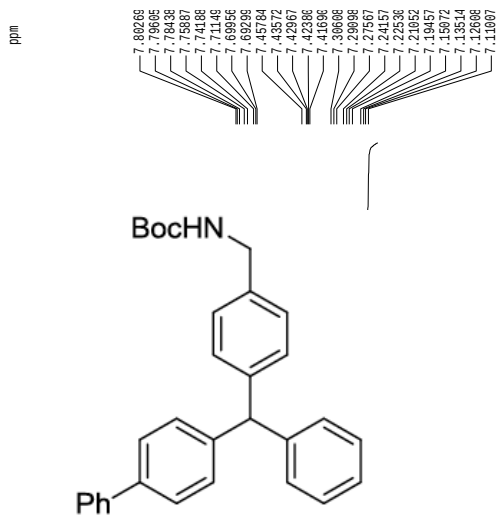
1H spectrum


ppm
7.57868
7.56452
7.50740
7.49109
7.42785
7.41296
7.39742
7.32854
7.31396
7.30186
7.28754
7.27237
7.25004
7.21810
7.20203
7.18539
7.17329
7.15824
7.02278
7.00567
6.69444
6.67711
5.49321
2.92281
1.53390
NMe2
Ph
(R)
Table 3, entry 2
Current Data Parameters
USER Ihanna
NAME LEH-1-148-c3-f25-2
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20121119
Time 14.31
INSTRUM cryo500
PROBHD 5 mm CPTCI 1H-
PULPROG zg30
TD 81728
SOLVENT CDCl3
NS 40
DS 2
SWH 6012.820 Hz
FIDRES 0.098043 Hz
AQ 5.0999774 sec
RG 5.7
DW 62.400 usec
DE 6.00 usec
TE 298.0 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.50 usec
PL1 1.60 dB
SFO1 500.2235015 MHz
F2 - Processing parameters
SI 65536
SF 500.2200354 MHz
WDW no
SSB 0
LB 0.00 Hz
GB 0
PC 4.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 4501.98 Hz
F2P 1.000 ppm
F2 500.22 Hz
PPMCM 0.35088 ppm/cm
HZCM 175.51561 Hz/cm
Integral
2.1422
2.1041
2.1071
4.0252
4.9133
2.2238
2.0000
1.0536
6.0073
ppm
8
7
6
5
4
3
2

Z-restored spin-echo 13C spectrum with 1H decoupling



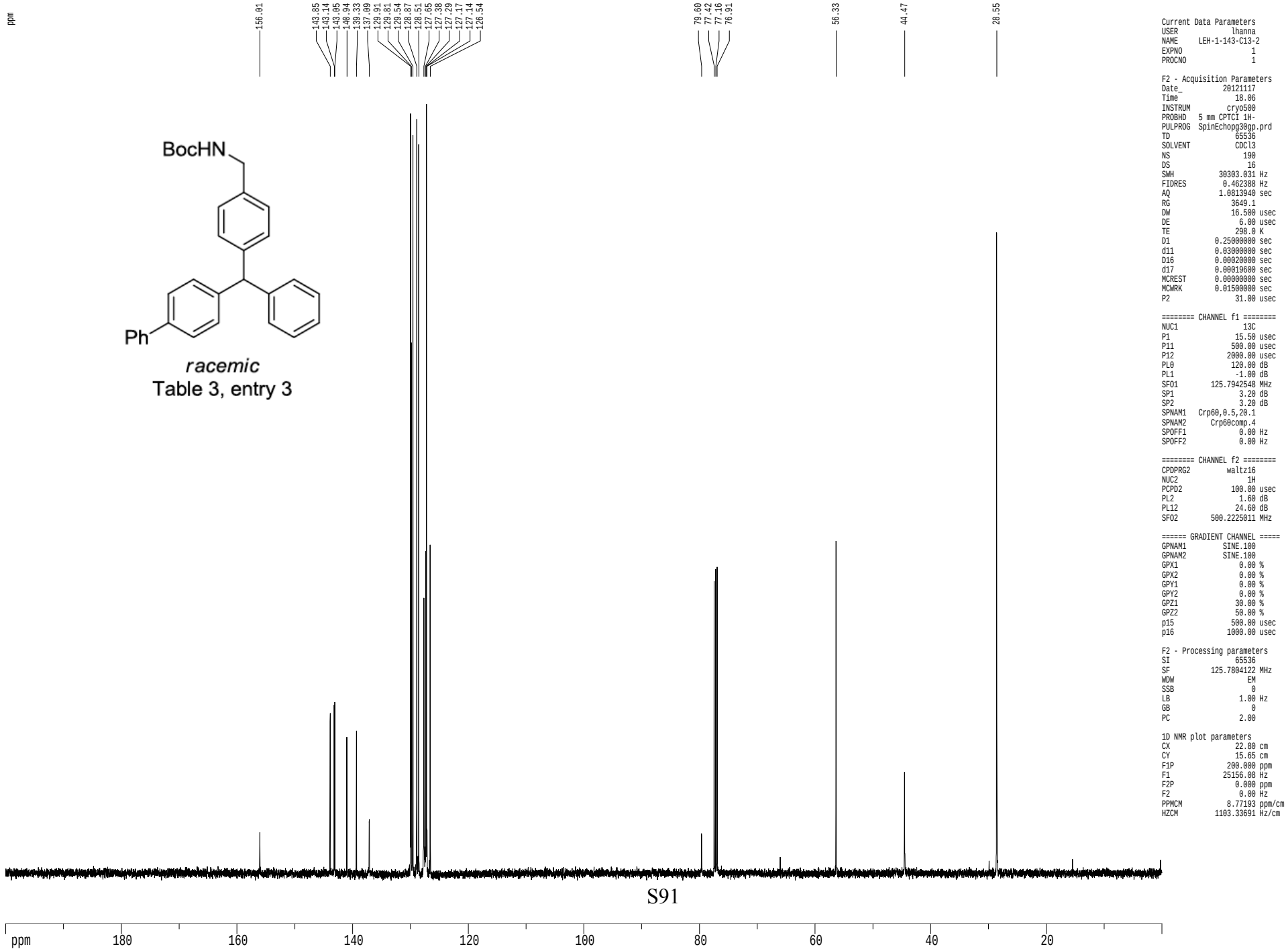
1H spectrum



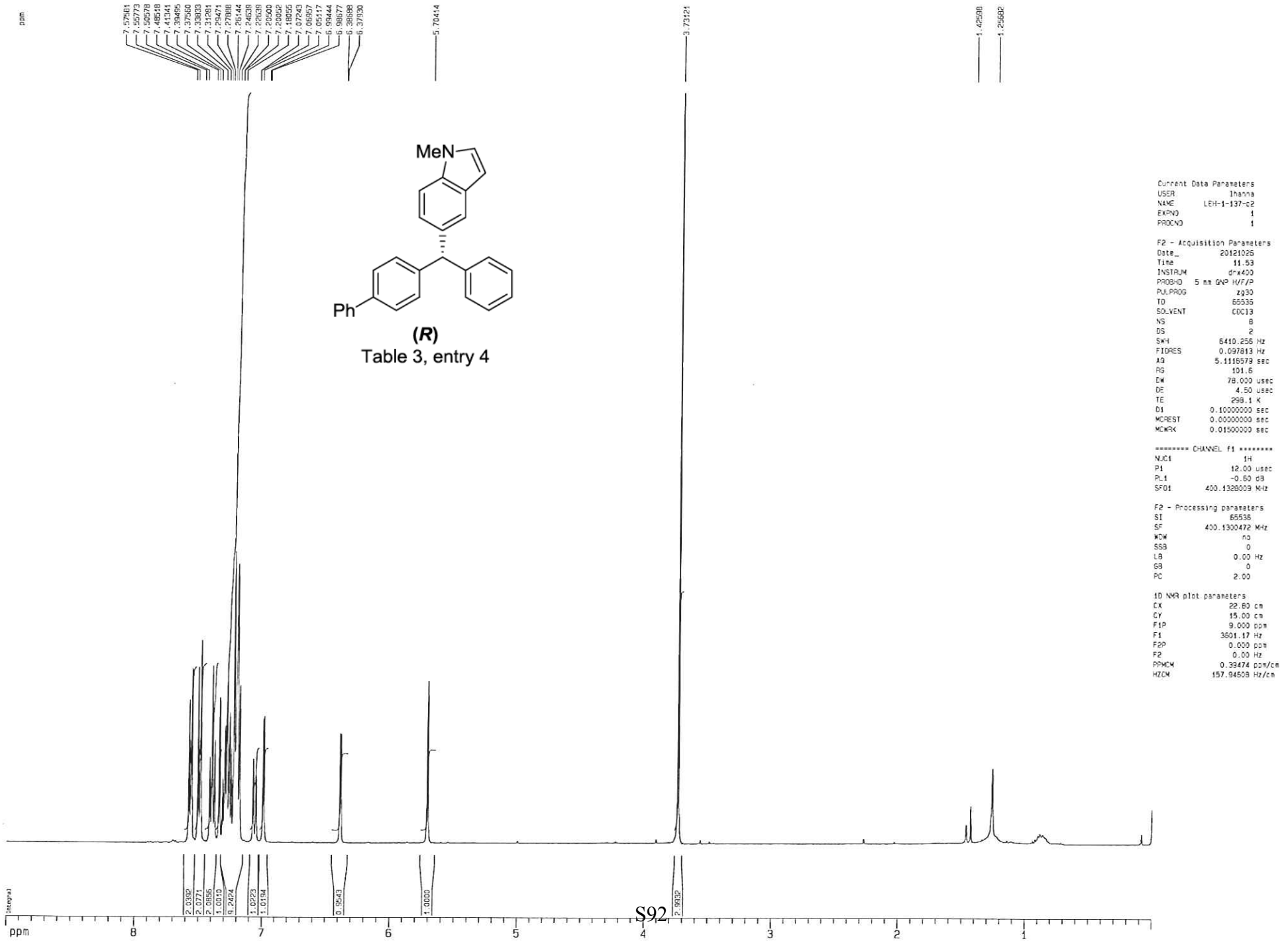
racemic

Table 3, entry 3

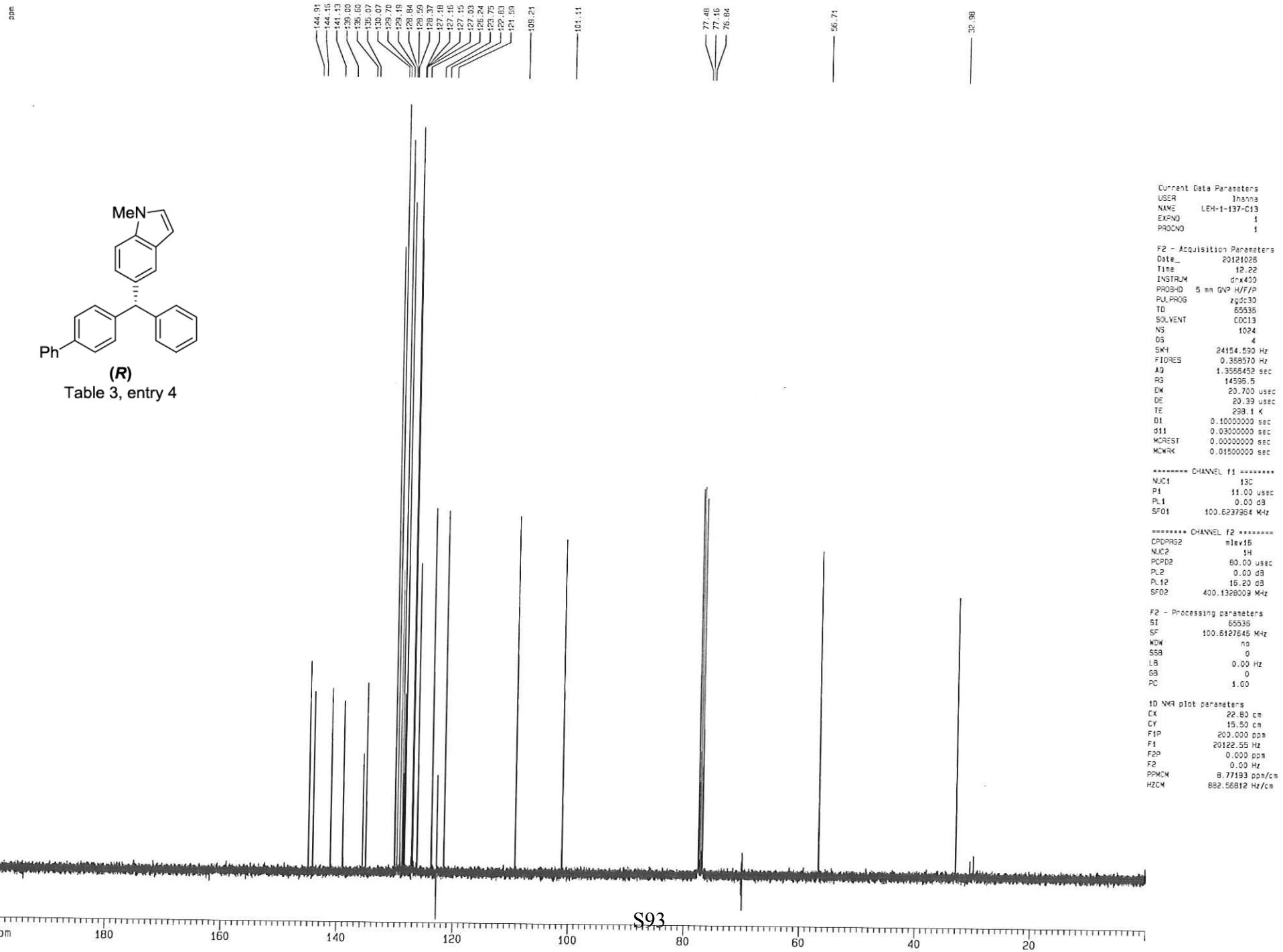
Z-restored spin-echo 13C spectrum with 1H decoupling



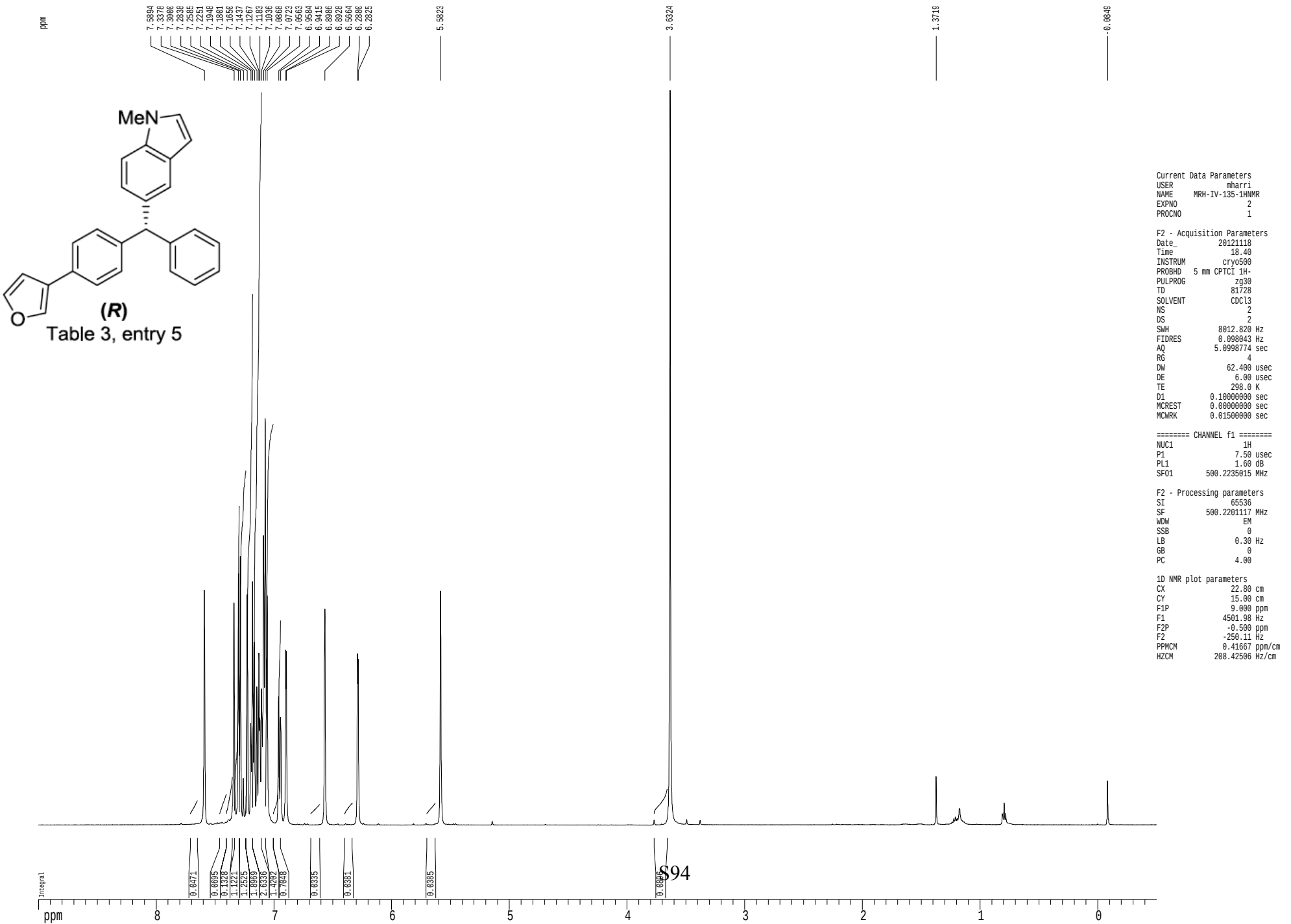
1H spectrum


ppm
7.57561
7.55773
7.50578
7.48518
7.41341
7.39495
7.37560
7.33833
7.31281
7.29471
7.27088
7.26144
7.24638
7.22639
7.20569
7.20052
7.18055
7.07243
7.06957
7.05117
6.99444
6.98677
6.38698
6.37930
5.70414
3.73121
1.42598
1.25682
MeN
Ph
(R)
Table 3, entry 4
Current Data Parameters
USER lhanna
NAME LEH-1-137-c2
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20121026
Time 11.53
INSTRUM dmx400
PROBHD 5 mm QNP H/F/P
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 8410.256 Hz
FIDRES 0.097813 Hz
AQ 5.1118579 sec
RG 101.6
DW 78.000 usec
DE 4.50 usec
TE 298.1 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 12.00 usec
PL1 -0.60 dB
SF01 400.1328009 MHz
F2 - Processing parameters
SI 65536
SF 400.1300472 MHz
WDW no
SSB 0
LB 0.00 Hz
GB 0
PC 2.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 3601.17 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 157.94508 Hz/cm
Integral
2.0392
2.0771
2.0856
1.0010
9.2474
1.0223
1.0194
0.9543
1.0000
2.9932
ppm
8
7
6
5
4
3
2
1

13C spectrum with 1H decoupling



1H spectrum




```
Current Data Parameters
USER                mharri
NAME      MRH-IV-135-1HNMR
EXPNO                    2
PROCNO                   1

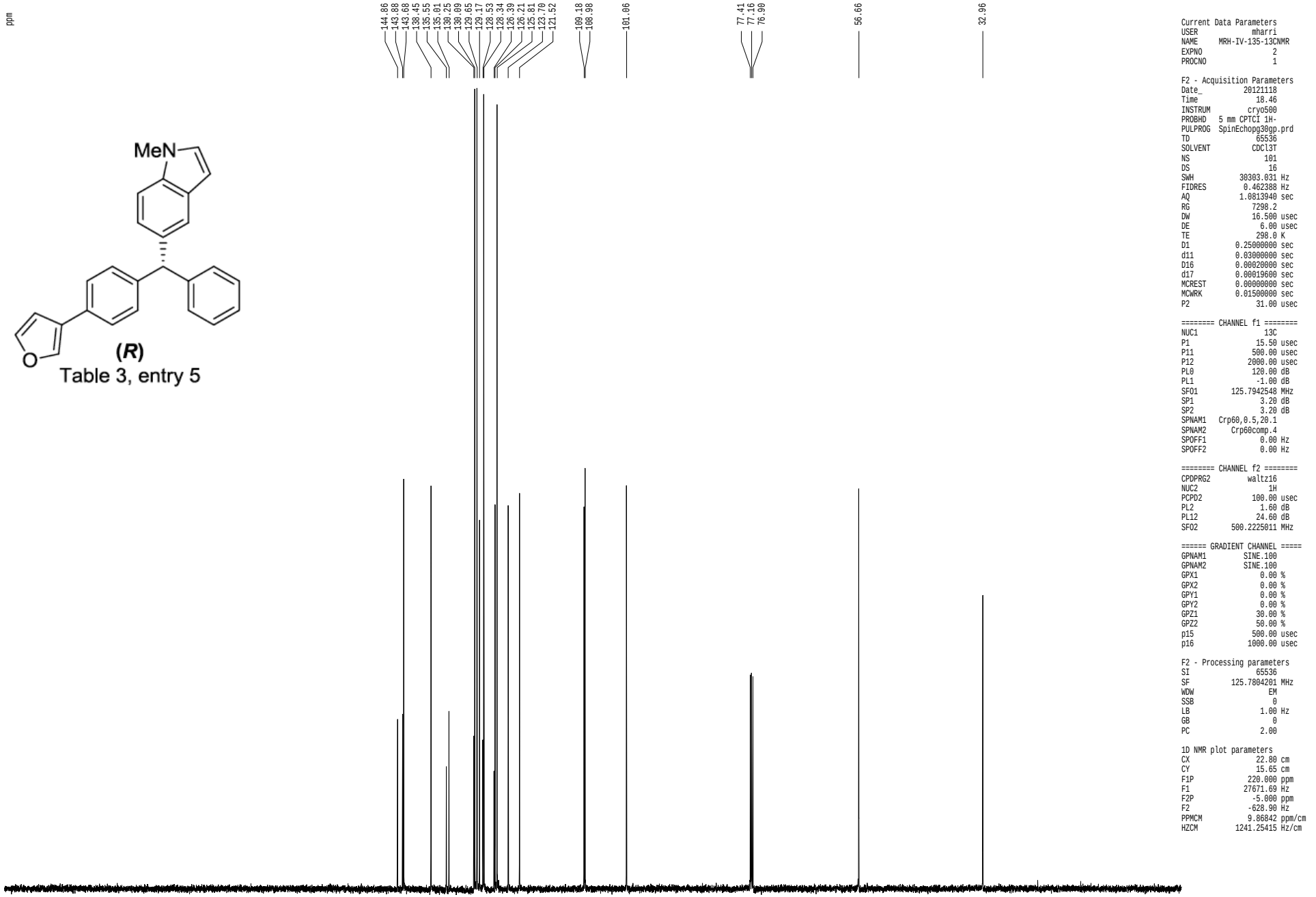
F2 - Acquisition Parameters
Date_            20121118
Time                18.40
INSTRUM           cryo500
PROBHD    5 mm CPTCI 1H-
PULPROG              zg30
TD                  81728
SOLVENT             CDCl3
NS                       2
DS                       2
SWH              8012.820 Hz
FIDRES           0.098043 Hz
AQ               5.0998774 sec
RG                       4
DW                 62.400 usec
DE                  6.00 usec
TE                 298.0 K
D1            0.10000000 sec
MCREST        0.00000000 sec
MCWRK         0.01500000 sec

======== CHANNEL f1 ========
NUC1                    1H
P1                   7.50 usec
PL1                  1.60 dB
SFO1          500.2235015 MHz

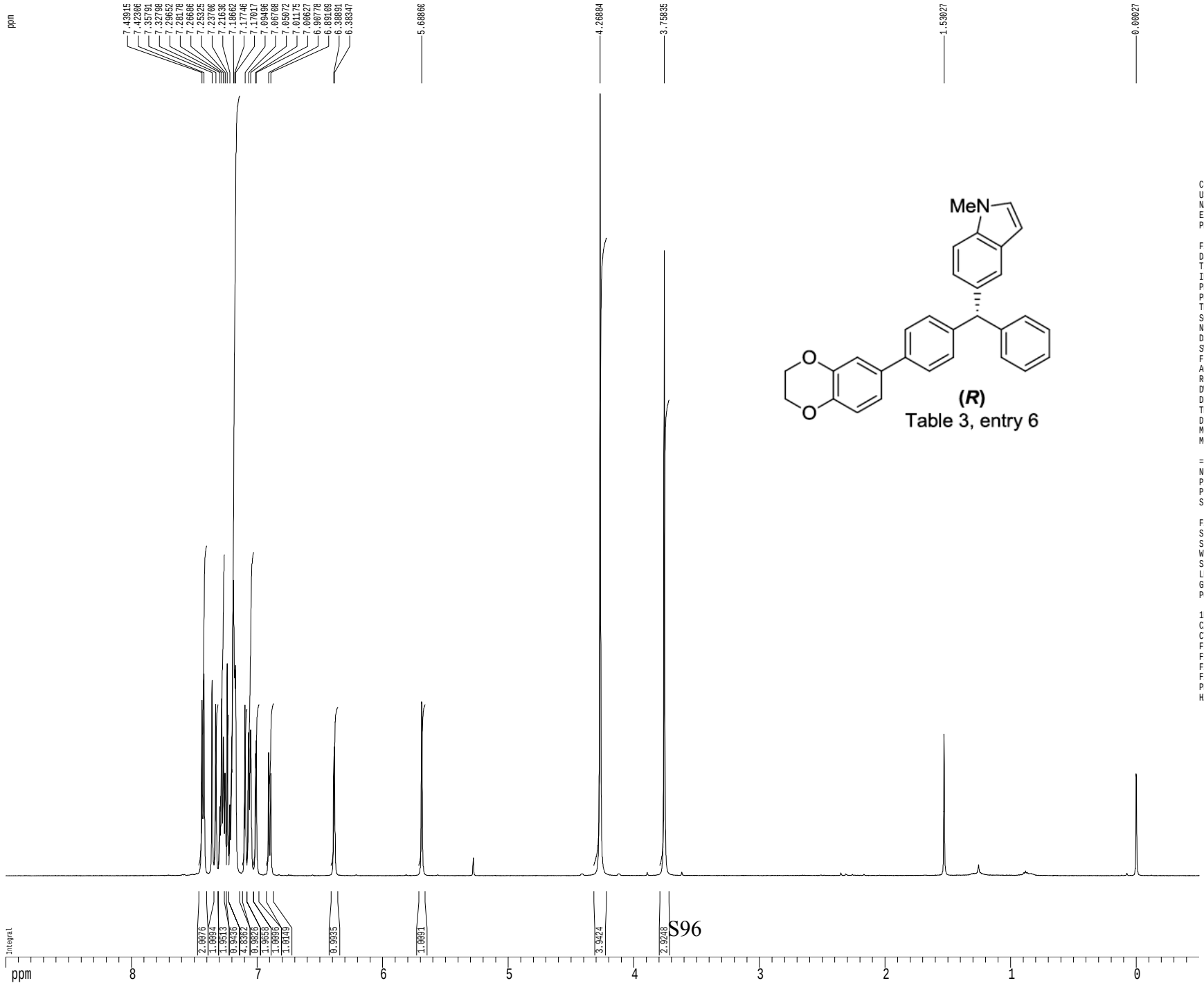
F2 - Processing parameters
SI                   65536
SF            500.2201117 MHz
WDW                     EM
SSB                      0
LB                   0.30 Hz
GB                       0
PC                   4.00

1D NMR plot parameters
CX                   22.80 cm
CY                   15.00 cm
F1P                  9.000 ppm
F1                 4501.98 Hz
F2P                -0.500 ppm
F2                 -250.11 Hz
PPMCM            0.41667 ppm/cm
HZCM           208.42506 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling



1H spectrum



(*R*)
Table 3, entry 6

```
Current Data Parameters
USER                mharri
NAME      MRH-IV-142-1HNMR
EXPNO                    3
PROCNO                   1

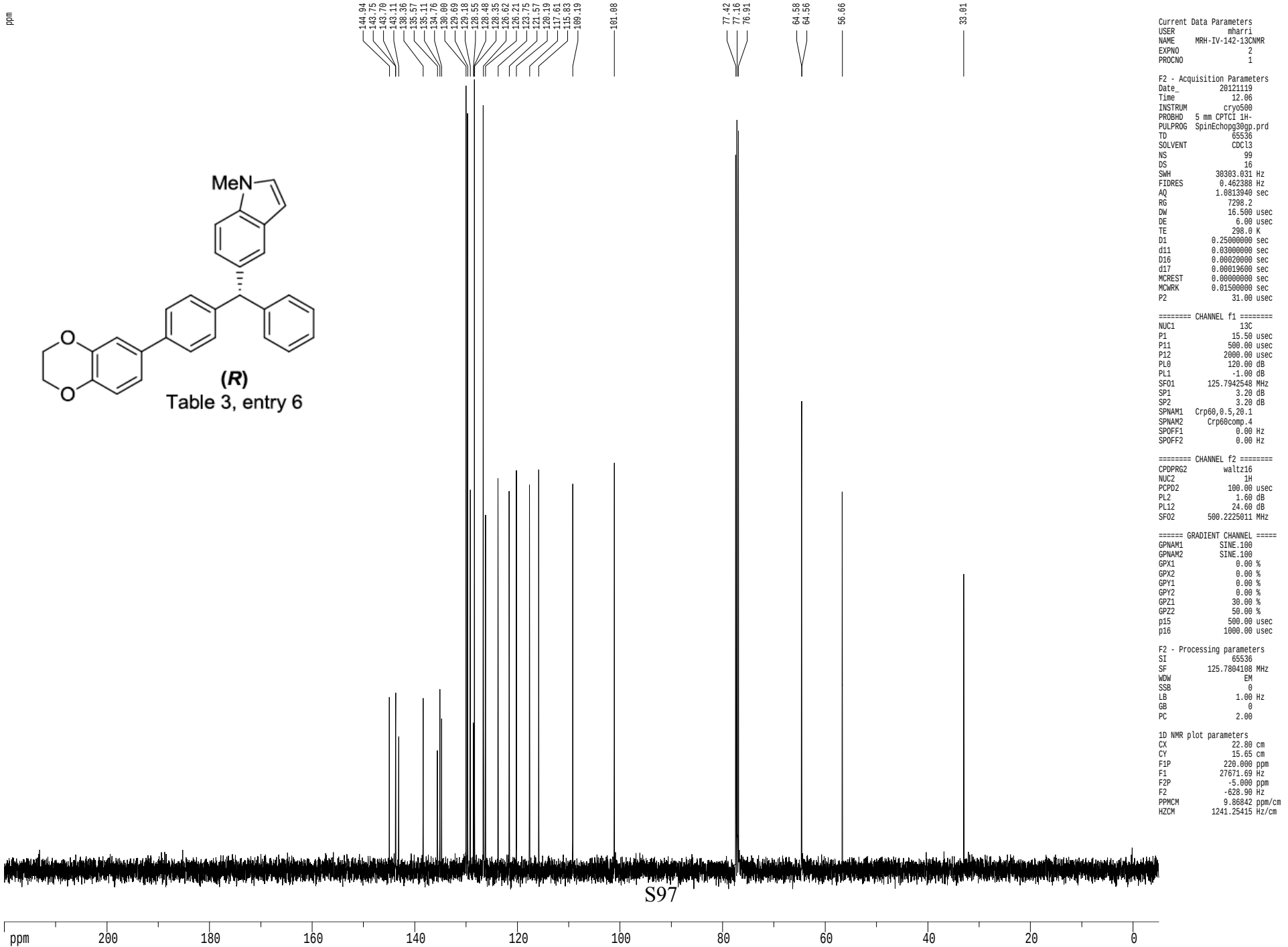
F2 - Acquisition Parameters
Date_            20121119
Time                12.04
INSTRUM          cryo500
PROBHD    5 mm CPTCI 1H-
PULPROG              zg30
TD                  81728
SOLVENT             CDCl3
NS                       4
DS                       2
SWH              8012.820 Hz
FIDRES           0.098043 Hz
AQ               5.0998774 sec
RG                      5
DW                 62.400 usec
DE                  6.00 usec
TE                298.0 K
D1             0.10000000 sec
MCREST         0.00000000 sec
MCWRK          0.01500000 sec

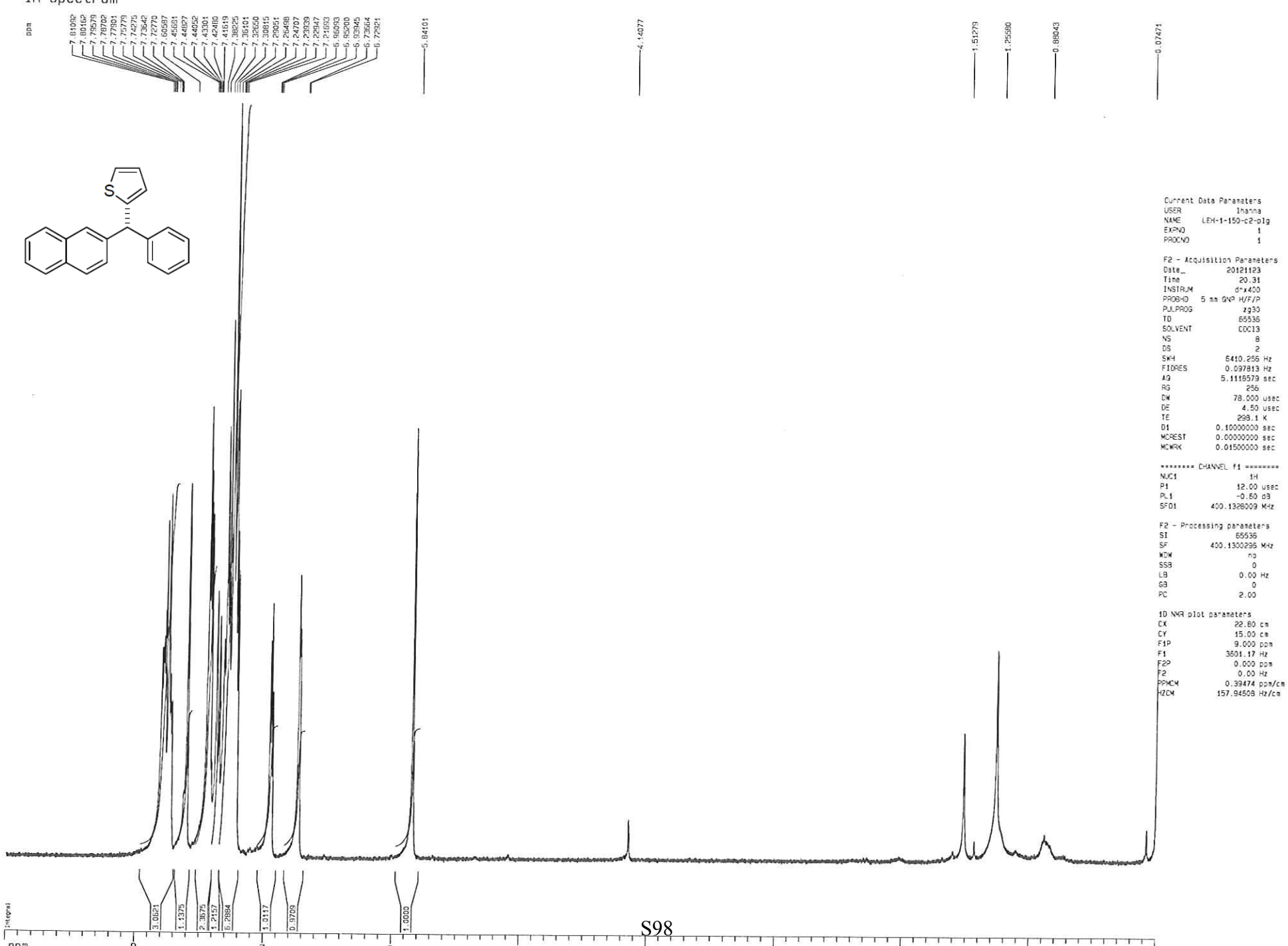
======== CHANNEL f1 ========
NUC1                   1H
P1                  7.50 usec
PL1                 1.60 dB
SFO1          500.2235015 MHz

F2 - Processing parameters
SI                    65536
SF            500.2200423 MHz
WDW                      EM
SSB                      0
LB                  0.30 Hz
GB                       0
PC                  4.00

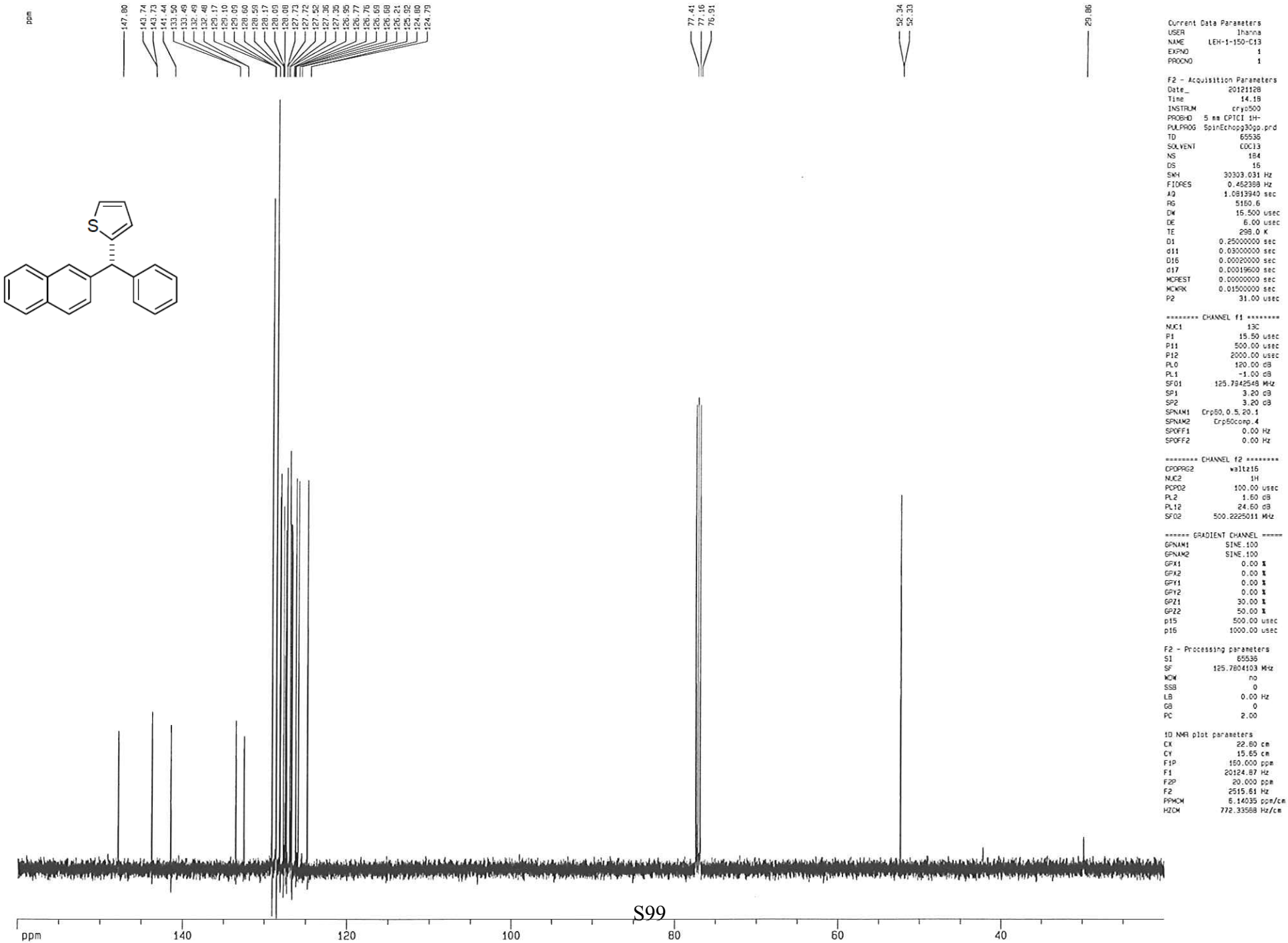
1D NMR plot parameters
CX                  22.80 cm
CY                  15.00 cm
F1P                 9.000 ppm
F1                4501.98 Hz
F2P                -0.500 ppm
F2                -250.11 Hz
PPMCM            0.41667 ppm/cm
HZCM           208.42502 Hz/cm
```

Z-restored spin-echo 13C spectrum with 1H decoupling




1H spectrum
ppm
7.81092
7.80162
7.79579
7.78702
7.77991
7.75779
7.74275
7.73642
7.72770
7.60587
7.45691
7.44927
7.44052
7.43001
7.42486
7.41519
7.38625
7.36101
7.32650
7.30815
7.29951
7.26498
7.24797
7.23939
7.22947
7.21693
6.96093
6.95200
6.93945
6.73664
6.72921
5.84101
4.14077
1.51279
1.25880
0.88043
0.07471
S
Current Data Parameters
USER lhanna
NAME LEH-1-150-c2-plg
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20121123
Time 20.31
INSTRUM dmx400
PROBHD 5 mm BNP H/F/P
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 6410.256 Hz
FIDRES 0.097813 Hz
AQ 5.1118579 sec
RG 256
DW 78.000 usec
DE 4.50 usec
TE 298.1 K
D1 0.10000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 12.00 usec
PL1 -0.60 dB
SF01 400.1328009 MHz
F2 - Processing parameters
SI 65536
SF 400.1300295 MHz
WDW no
SSB 0
LB 0.00 Hz
GB 0
PC 2.00
1D NMR plot parameters
CX 22.80 cm
CY 15.00 cm
F1P 9.000 ppm
F1 3601.17 Hz
F2P 0.000 ppm
F2 0.00 Hz
PPMCM 0.39474 ppm/cm
HZCM 157.94508 Hz/cm
Integral
3.0621
1.1375
2.3675
1.2157
6.2884
1.0117
0.9769
1.0000
ppm
8
7
6
5
4
3
2
1

Z-restored spin-echo 13C spectrum with 1H decoupling




```
Current Data Parameters
USER            Ihanna
NAME       LEH-1-150-C13
EXPNO                 1
PROCNO                1

F2 - Acquisition Parameters
Date_          20121128
Time              14.18
INSTRUM         cryo500
PROBHD  5 mm CPTCI 1H-
PULPROG  SpinEchopg30gp.prd
TD                65536
SOLVENT           CDCl3
NS                  184
DS                   16
SWH           30303.031 Hz
FIDRES        0.462398 Hz
AQ            1.0813940 sec
RG                5160.6
DW               16.500 usec
DE                6.00 usec
TE                298.0 K
D1            0.25000000 sec
d11           0.03000000 sec
D16           0.00020000 sec
d17           0.00019600 sec
MCREST        0.00000000 sec
MCWRK         0.01500000 sec
P2               31.00 usec

======== CHANNEL f1 ========
NUC1                 13C
P1                15.50 usec
P11              500.00 usec
P12             2000.00 usec
PL0              120.00 dB
PL1               -1.00 dB
SF01         125.7942548 MHz
SP1               3.20 dB
SP2               3.20 dB
SPNAM1    Crp60,0.5,20.1
SPNAM2       Crp50comp.4
SPOFF1               0.00 Hz
SPOFF2               0.00 Hz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                  1H
PCPD2            100.00 usec
PL2                1.60 dB
PL12              24.60 dB
SF02         500.2225011 MHz

====== GRADIENT CHANNEL =====
GPNAM1          SINE.100
GPNAM2          SINE.100
GPX1                 0.00 %
GPX2                 0.00 %
GPY1                 0.00 %
GPY2                 0.00 %
GPZ1                30.00 %
GPZ2                50.00 %
p15               500.00 usec
p16              1000.00 usec

F2 - Processing parameters
SI                  65536
SF           125.7804103 MHz
WDW                    no
SSB                     0
LB                   0.00 Hz
GB                      0
PC                   2.00

1D NMR plot parameters
CX                  22.60 cm
CY                  15.65 cm
F1P               150.000 ppm
F1                20124.87 Hz
F2P                20.000 ppm
F2                2515.61 Hz
PPMCM             6.14035 ppm/cm
HZCM           772.33568 Hz/cm
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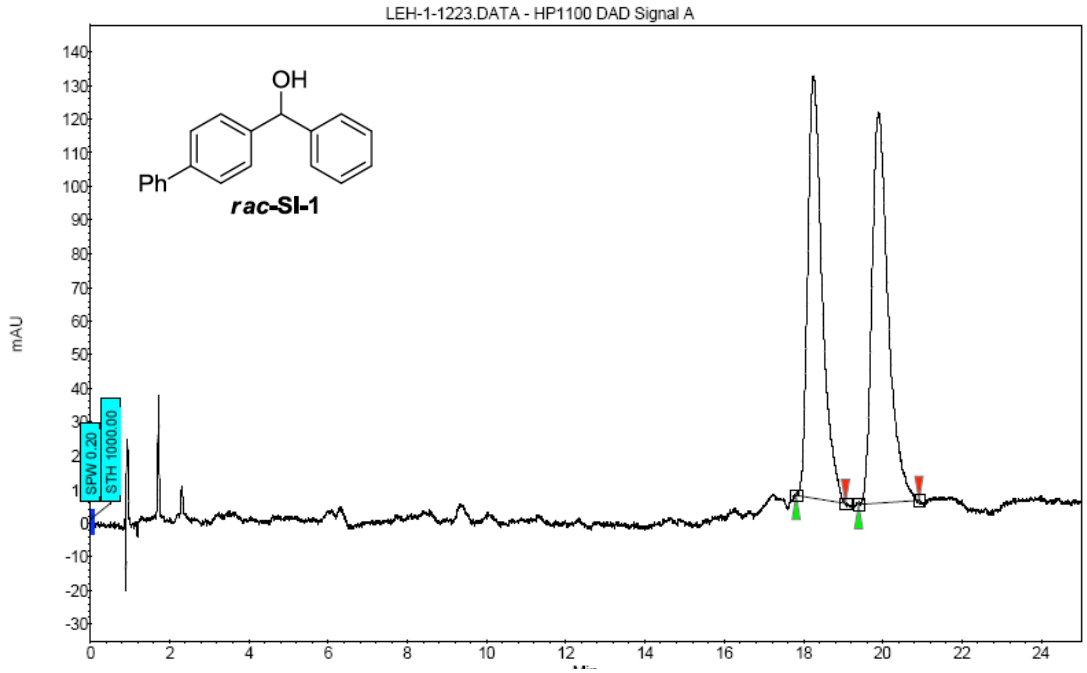
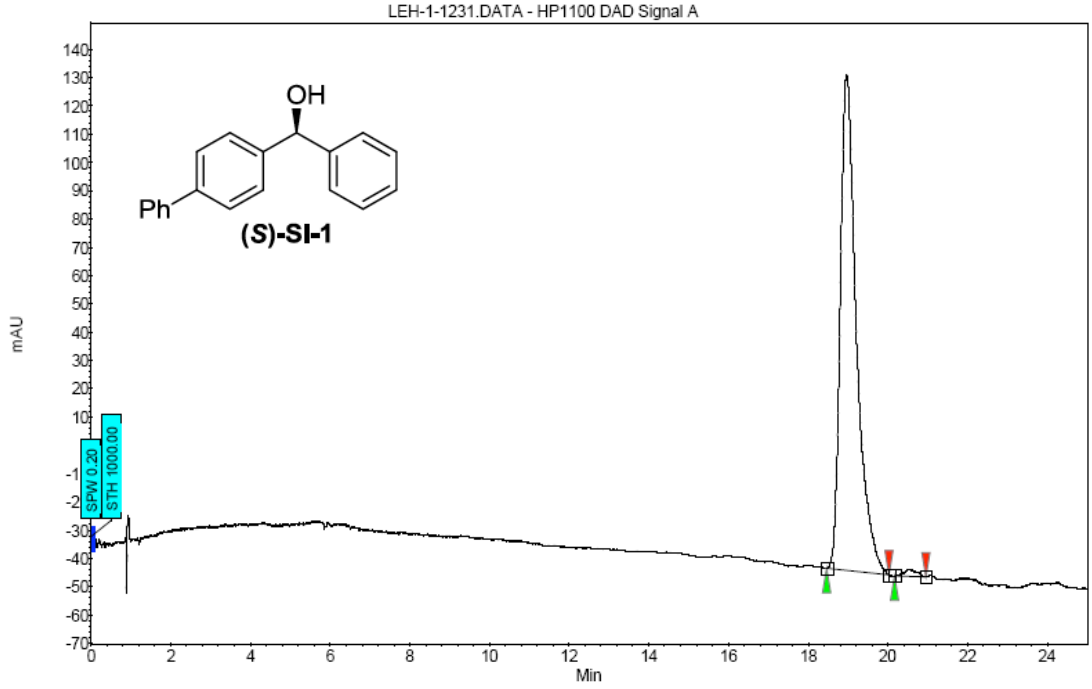
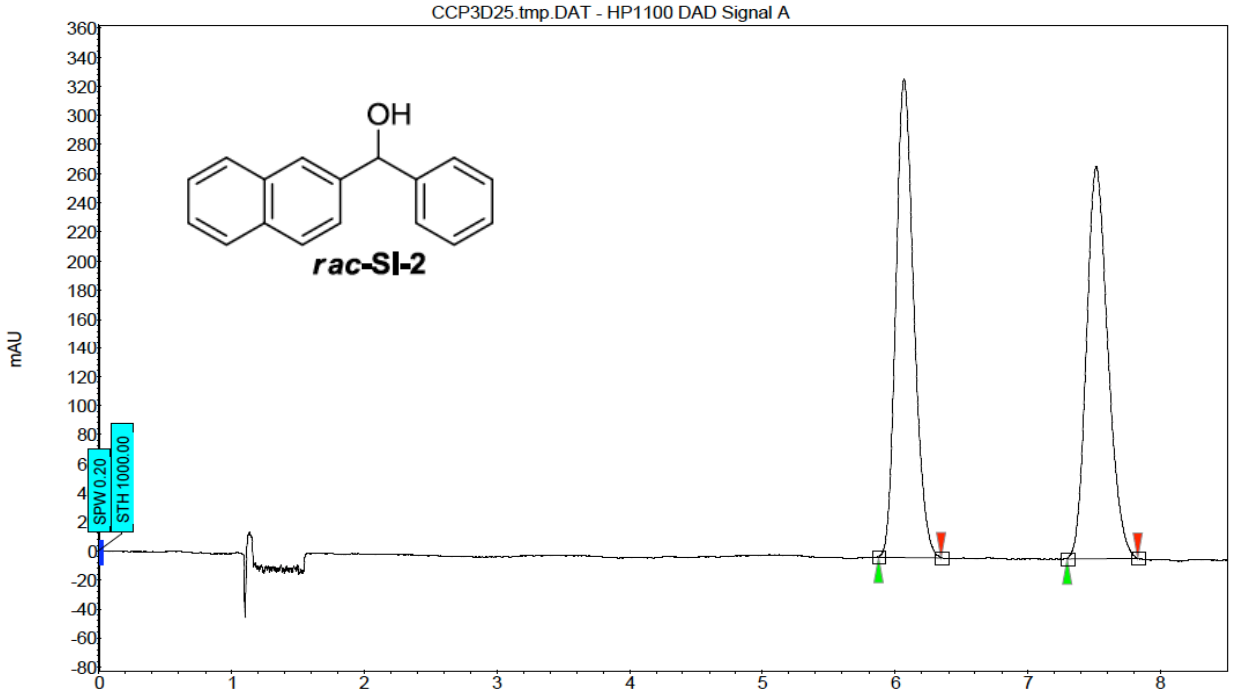
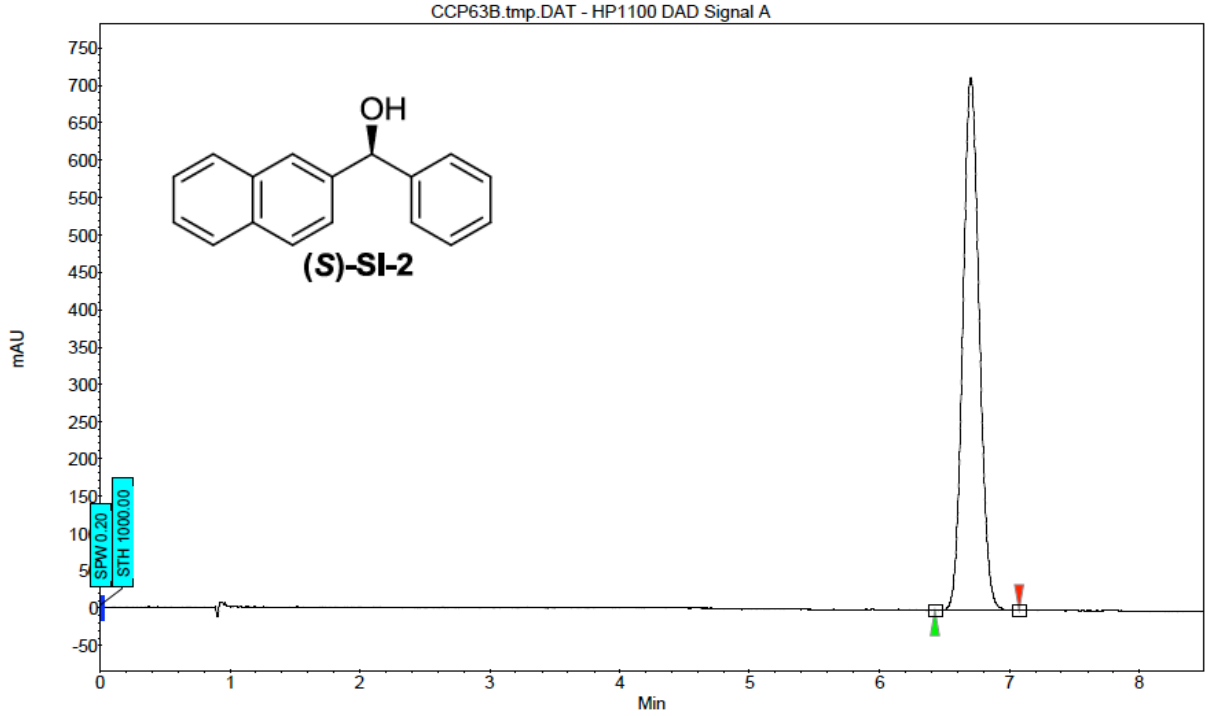


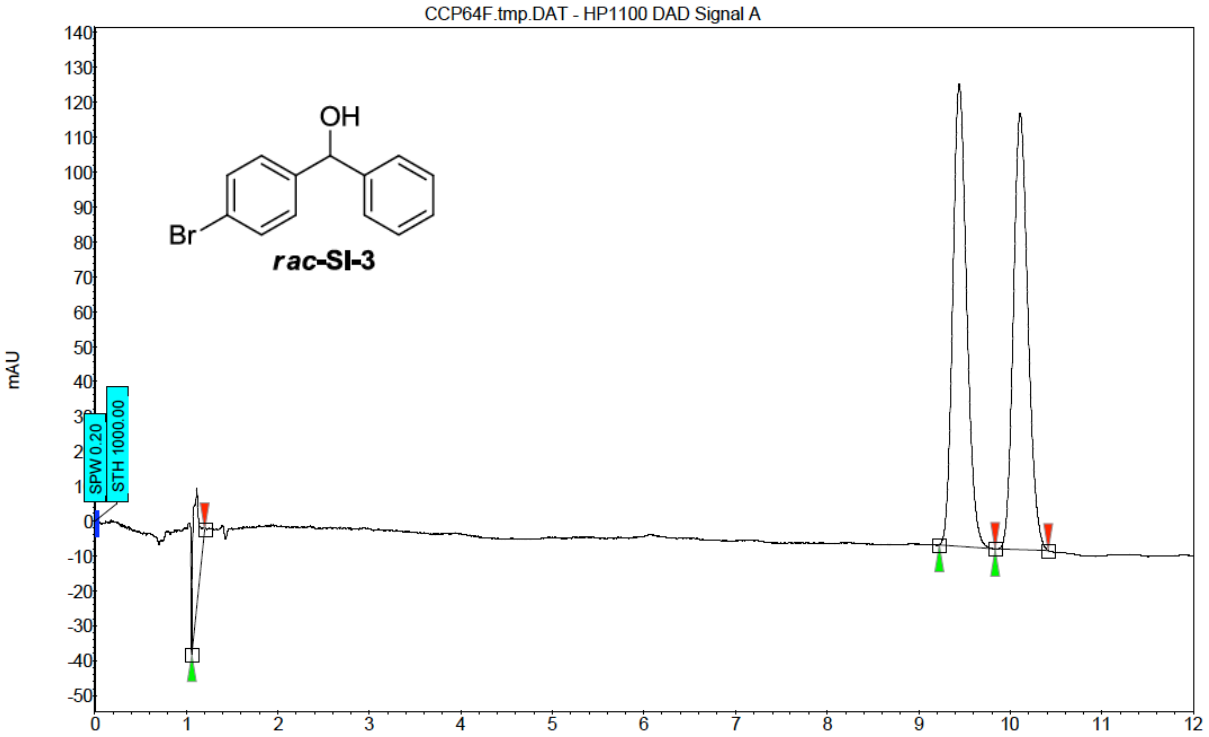


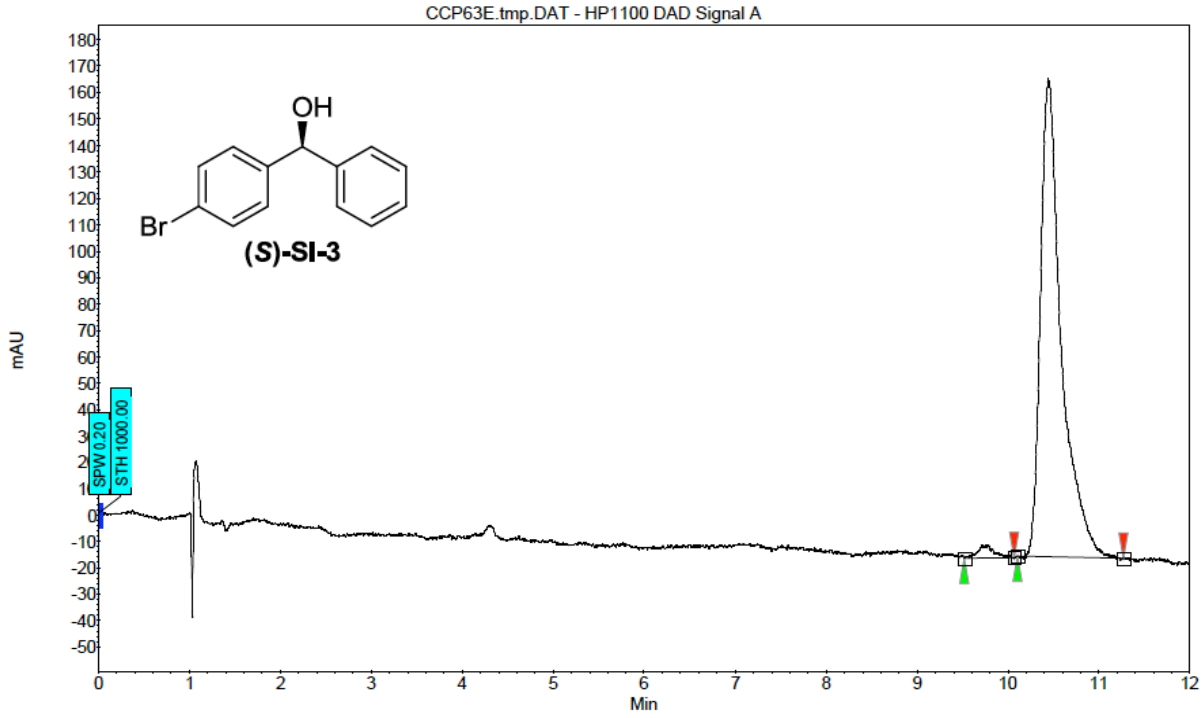
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	18.46	18.97	20.02	0.00	98.91	175.3	82.1	98.914
2	UNKNOWN	20.17	20.55	20.95	0.00	1.09	2.4	0.9	1.086
Total						100.00	177.7	83.0	100.000



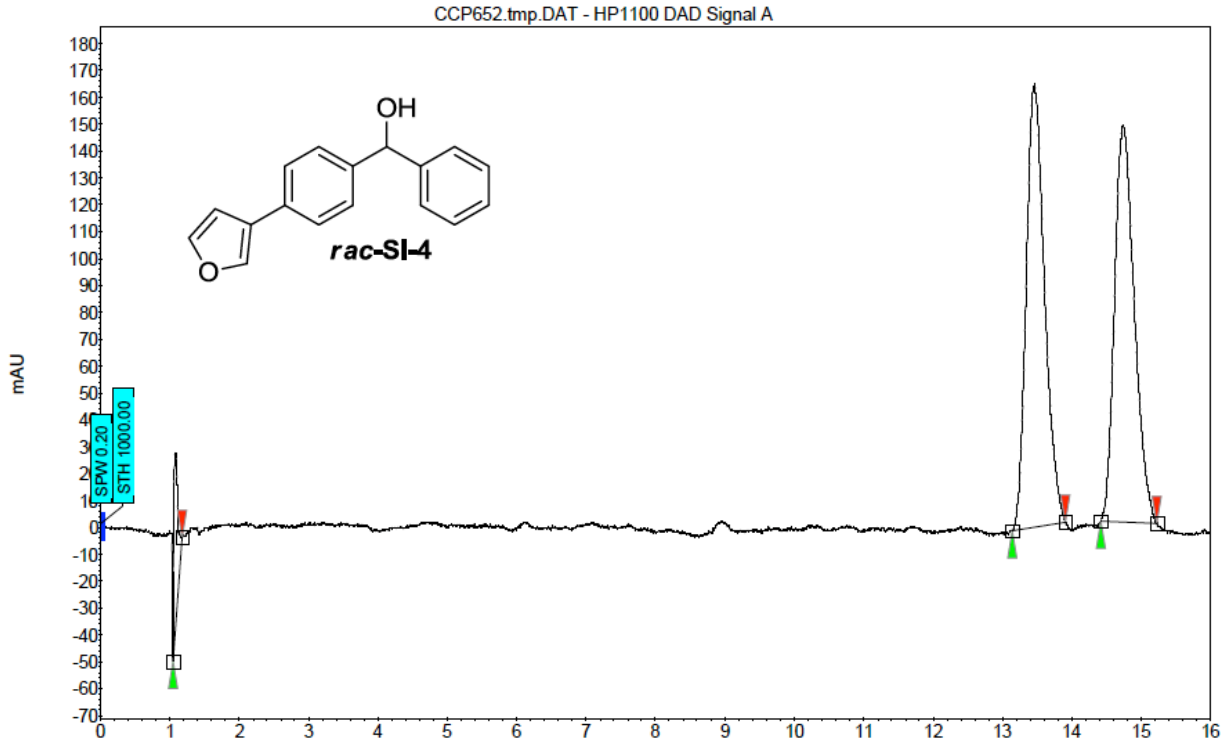


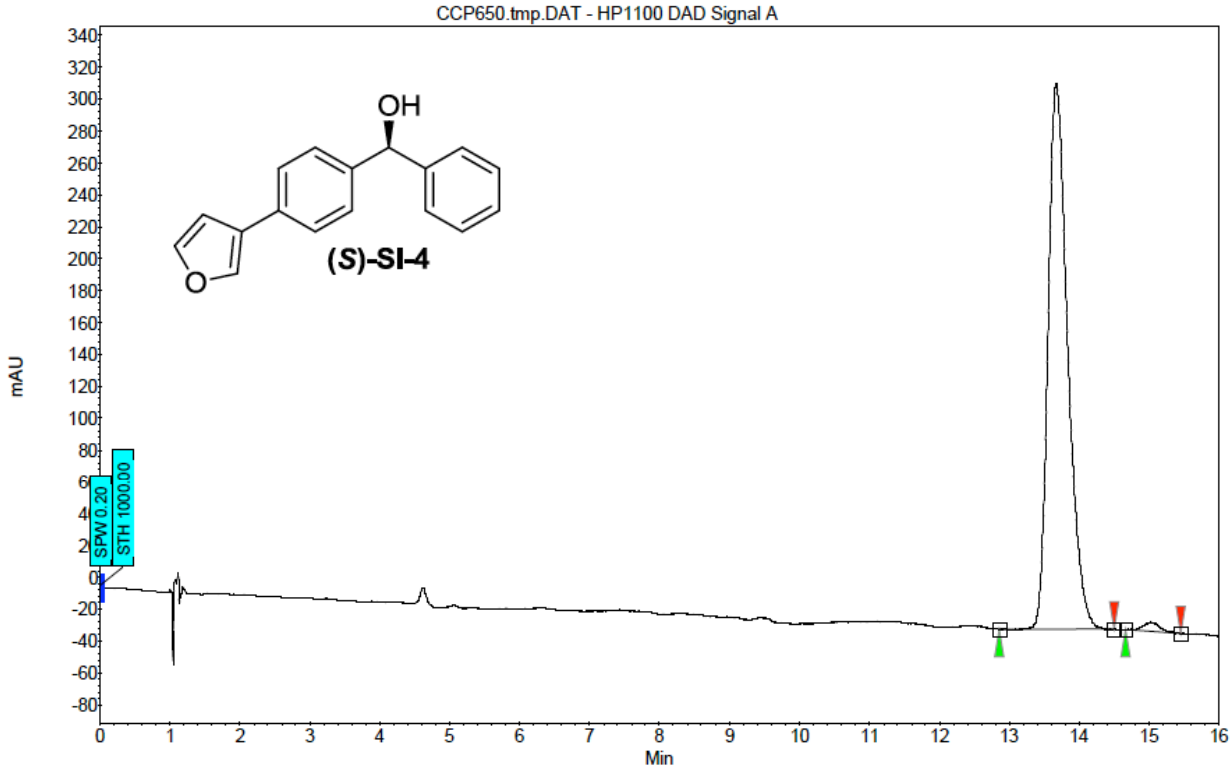
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	6.43	6.70	7.08	0.00	100.00	712.9	104.3	100.000
Total						100.00	712.9	104.3	100.000





Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
2	UNKNOWN	9.52	9.76	10.07	0.00	2.16	4.9	1.1	2.164
1	UNKNOWN	10.10	10.44	11.27	0.00	97.84	181.0	47.8	97.836
Total						100.00	185.8	48.9	100.000





Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
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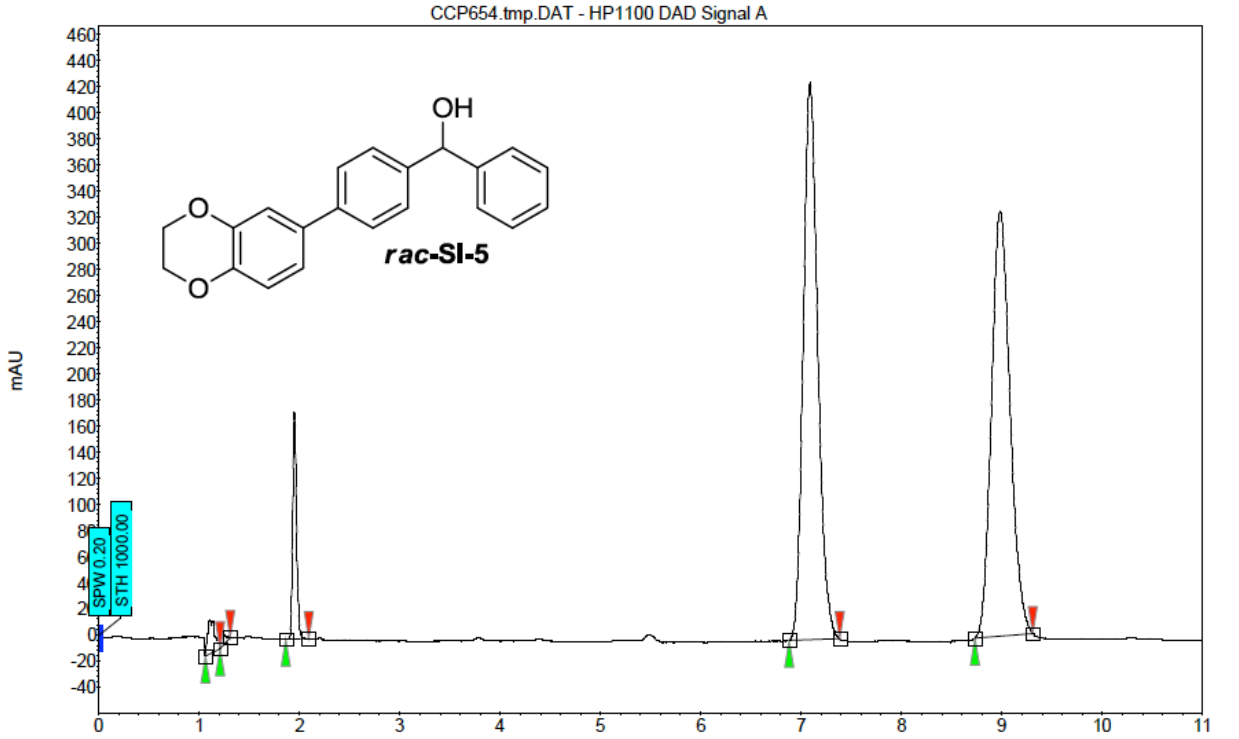
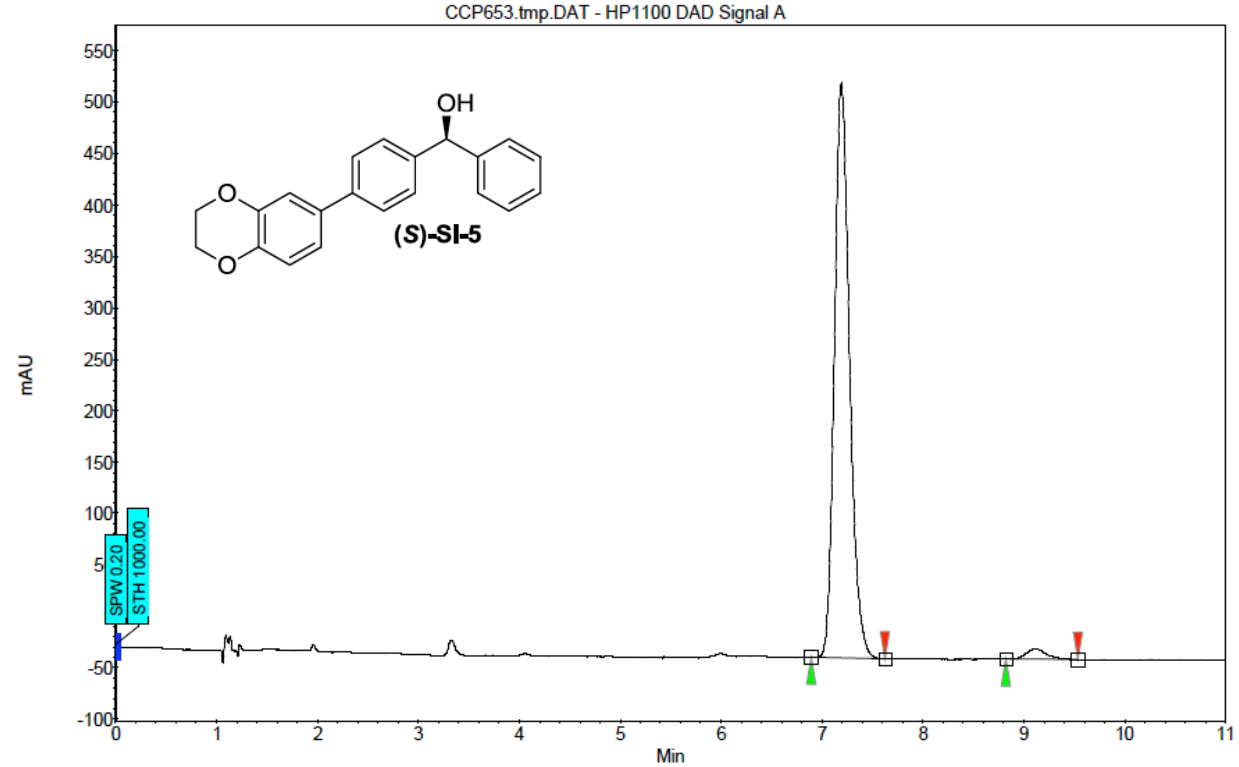
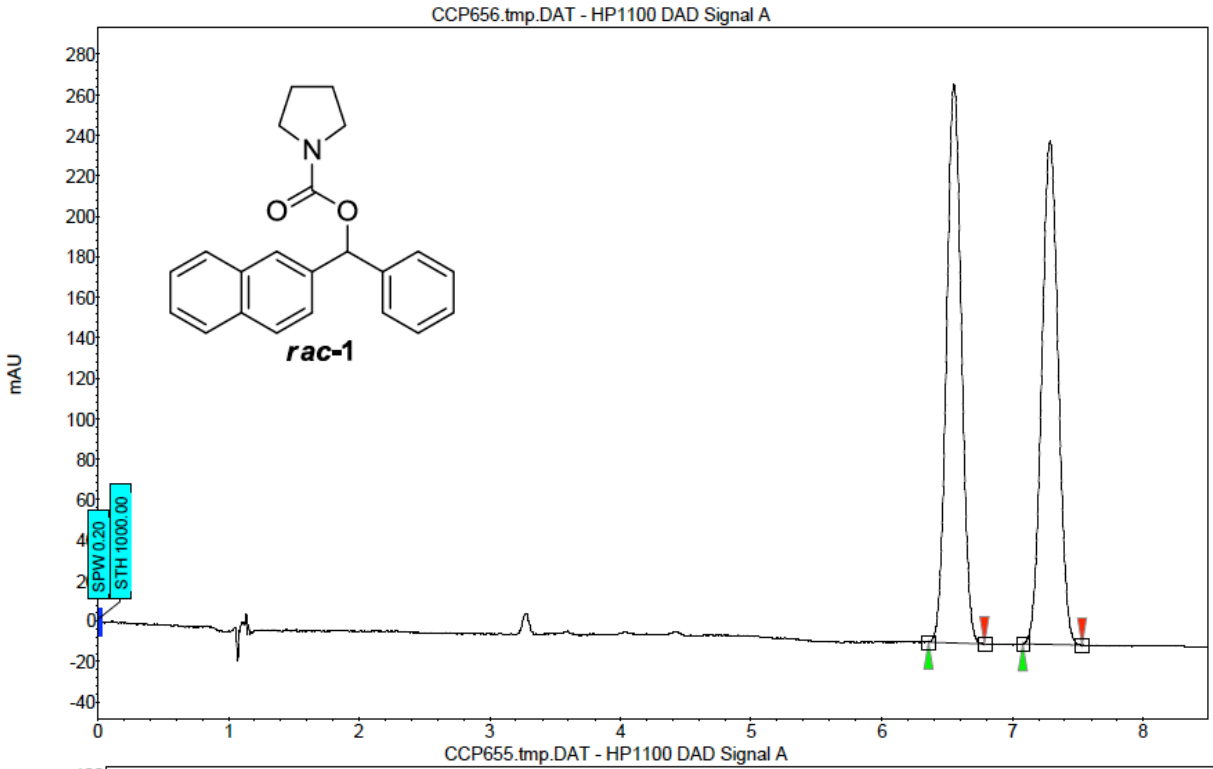
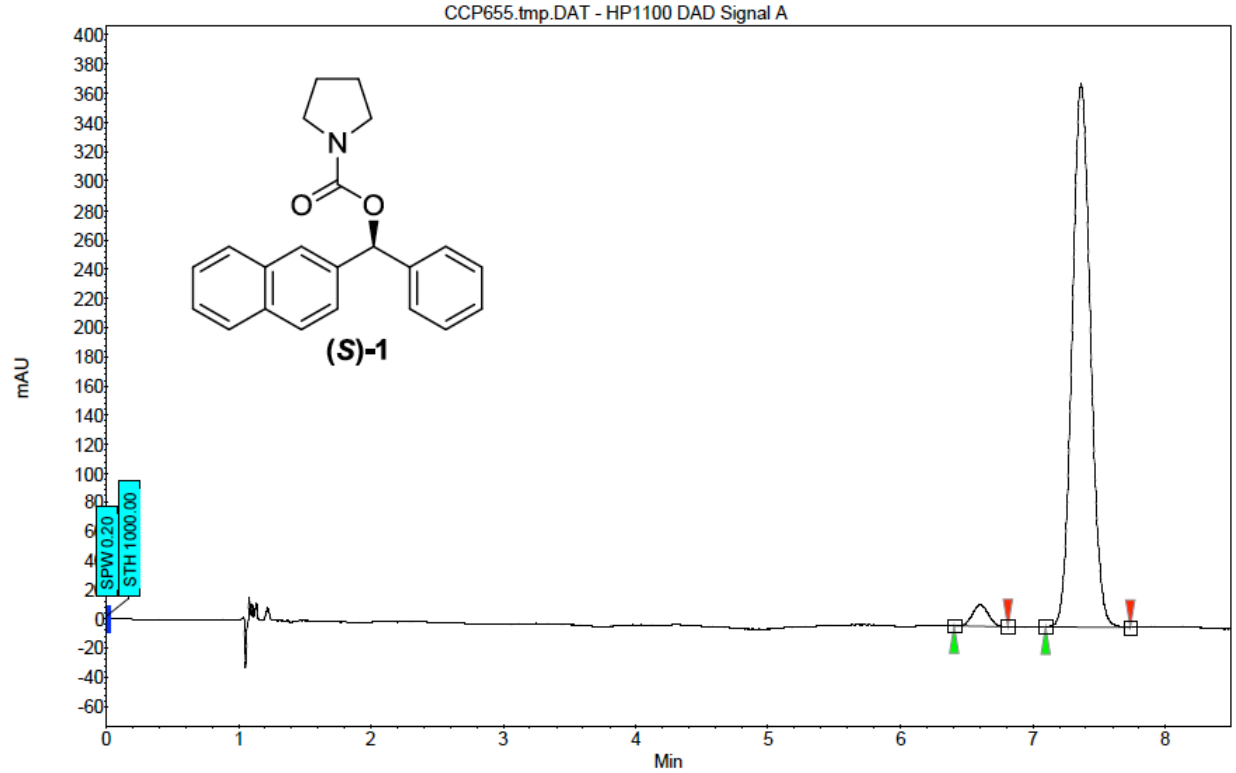
1	UNKNOWN	12.86	13.67	14.50	0.00	98.57	341.7	111.0	98.571
2	UNKNOWN	14.66	15.02	15.45	0.00	1.43	5.9	1.6	1.429
Total						100.00	347.6	112.6	100.000



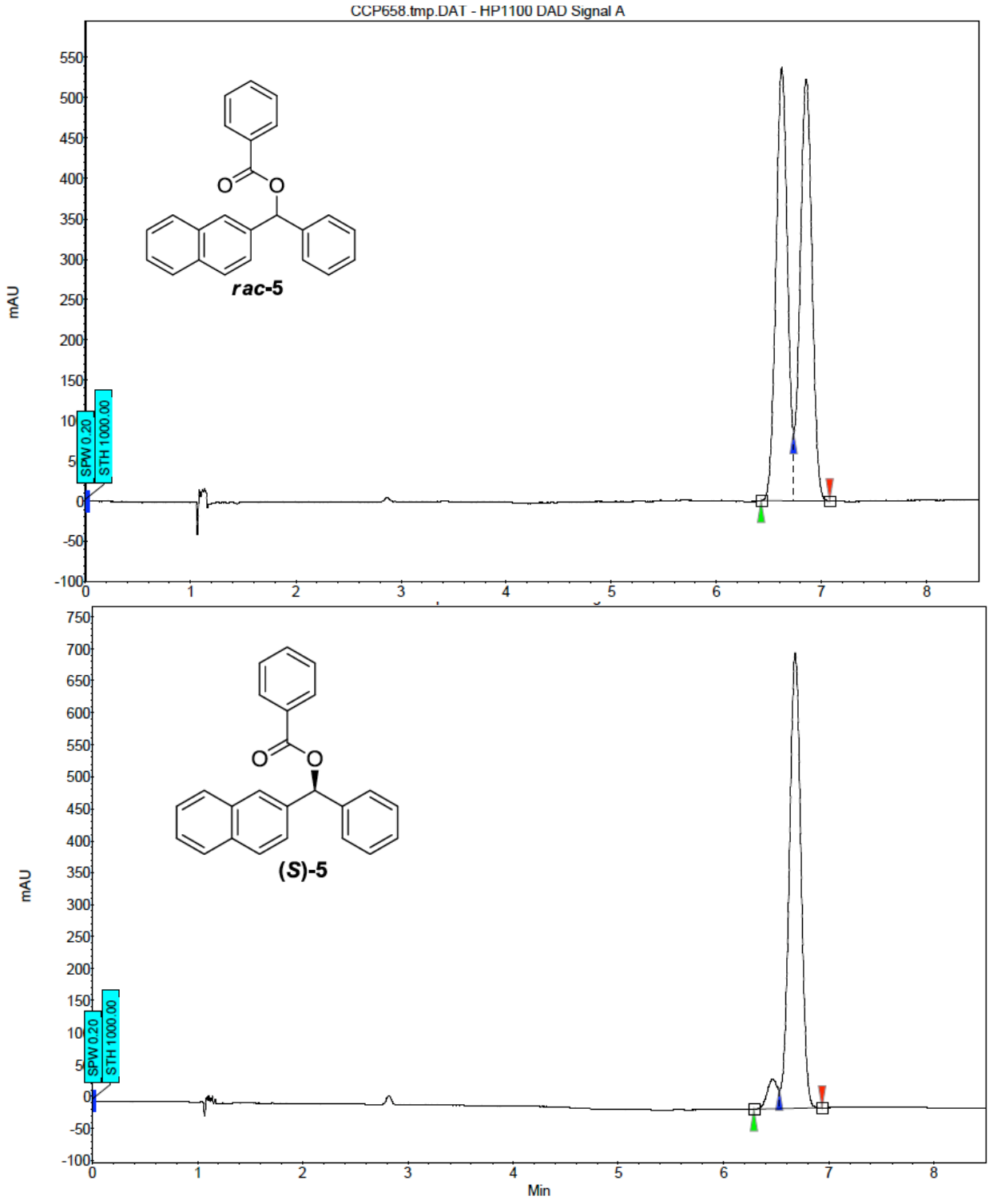


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	6.89	7.19	7.62	0.00	97.79	558.2	96.4	97.790
2	UNKNOWN	8.82	9.11	9.53	0.00	2.21	9.8	2.2	2.210
Total						100.00	568.0	98.6	100.000

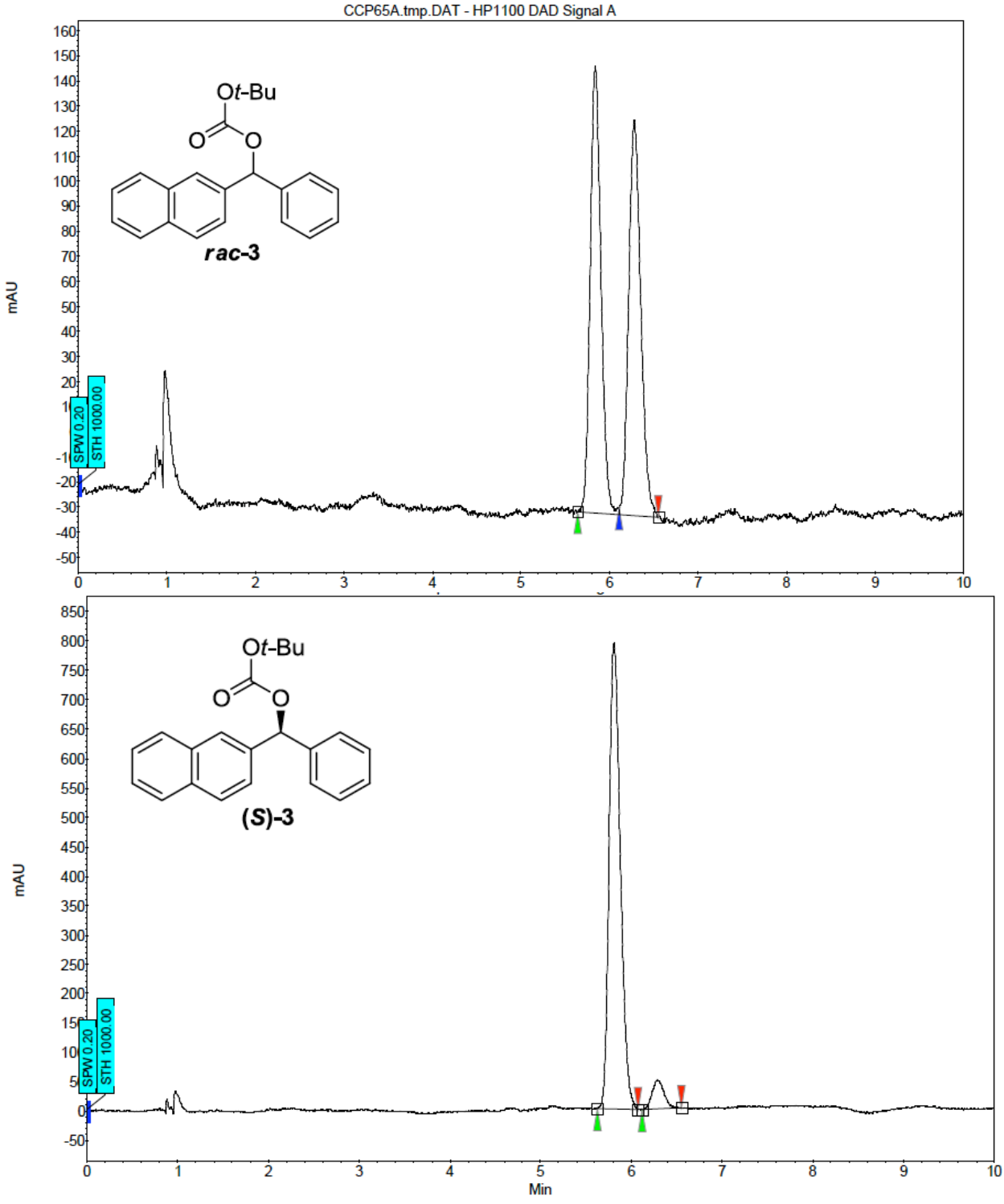




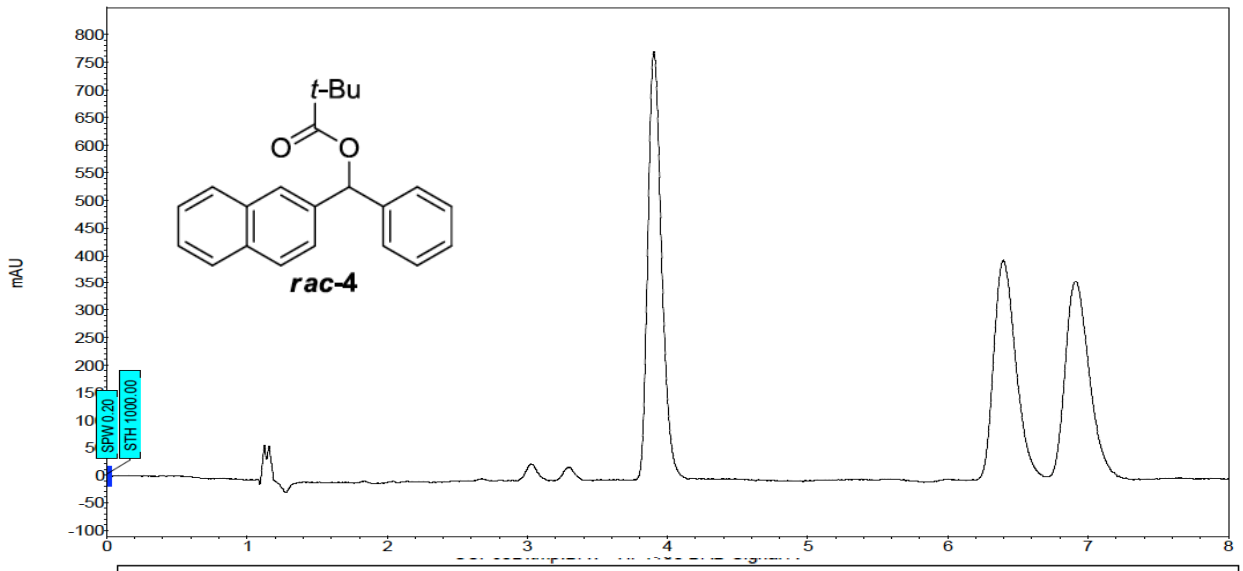
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	6.41	6.60	6.81	0.00	3.40	14.9	2.1	3.400
2	UNKNOWN	7.10	7.37	7.74	0.00	96.60	372.0	59.5	96.600
Total						100.00	386.9	61.6	100.000

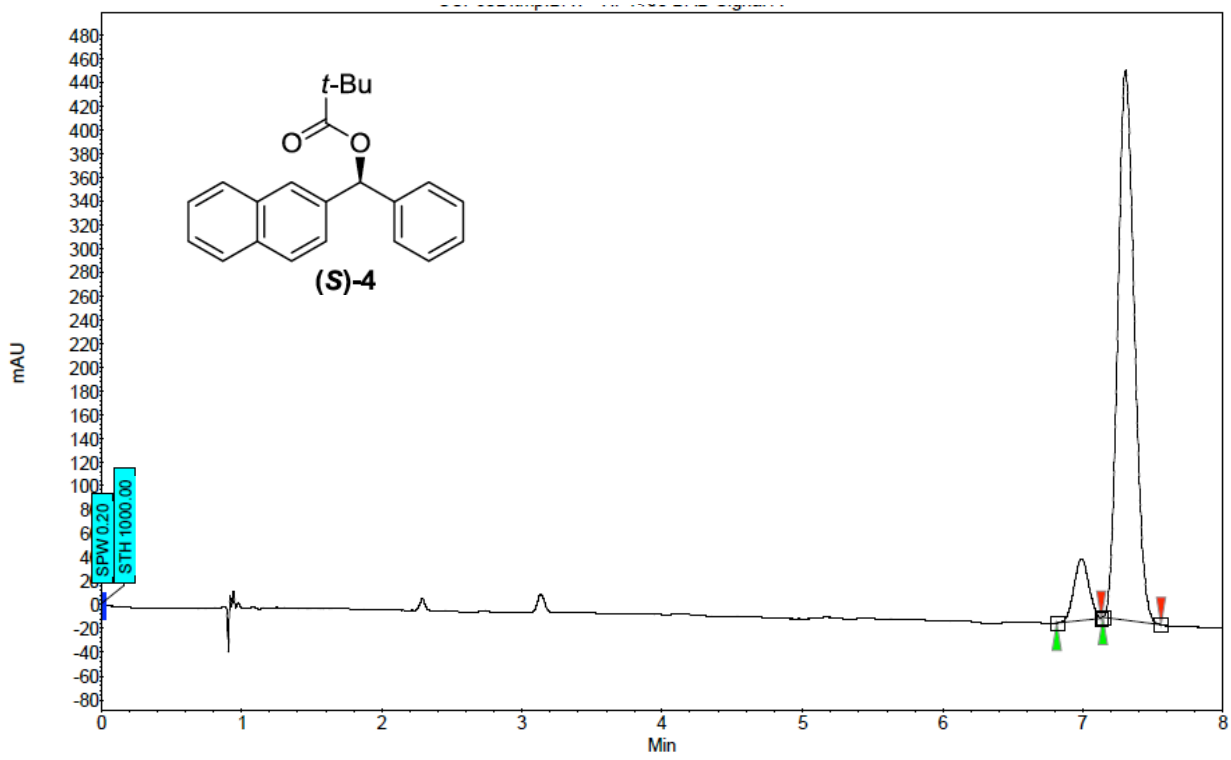


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	6.29	6.47	6.53	0.00	5.45	46.2	5.2	5.451
2	UNKNOWN	6.53	6.68	6.94	0.00	94.55	711.7	90.9	94.549
Total						100.00	757.9	96.2	100.000

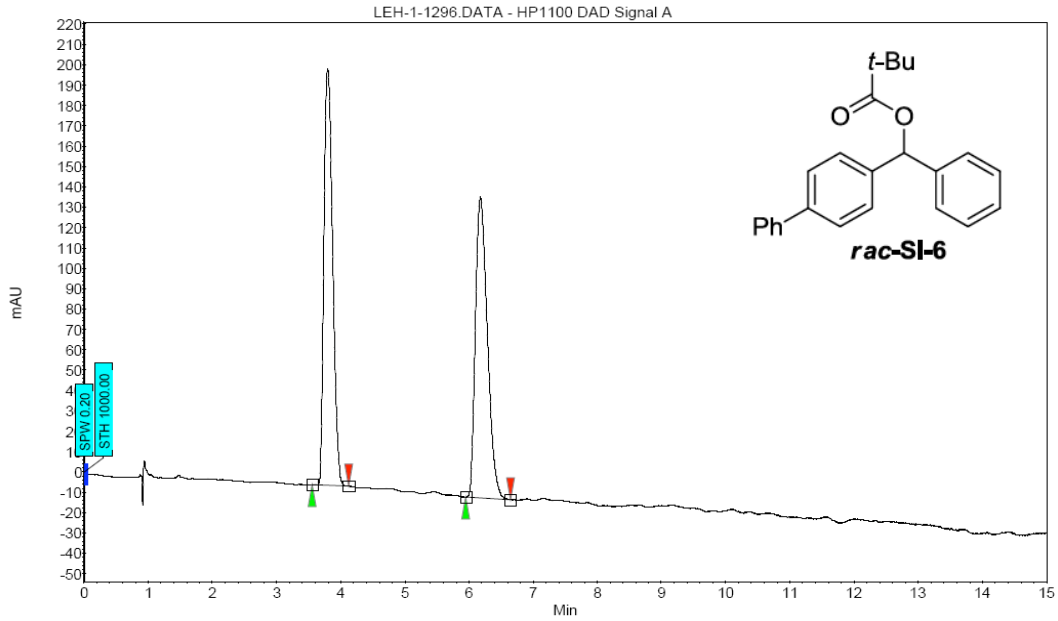


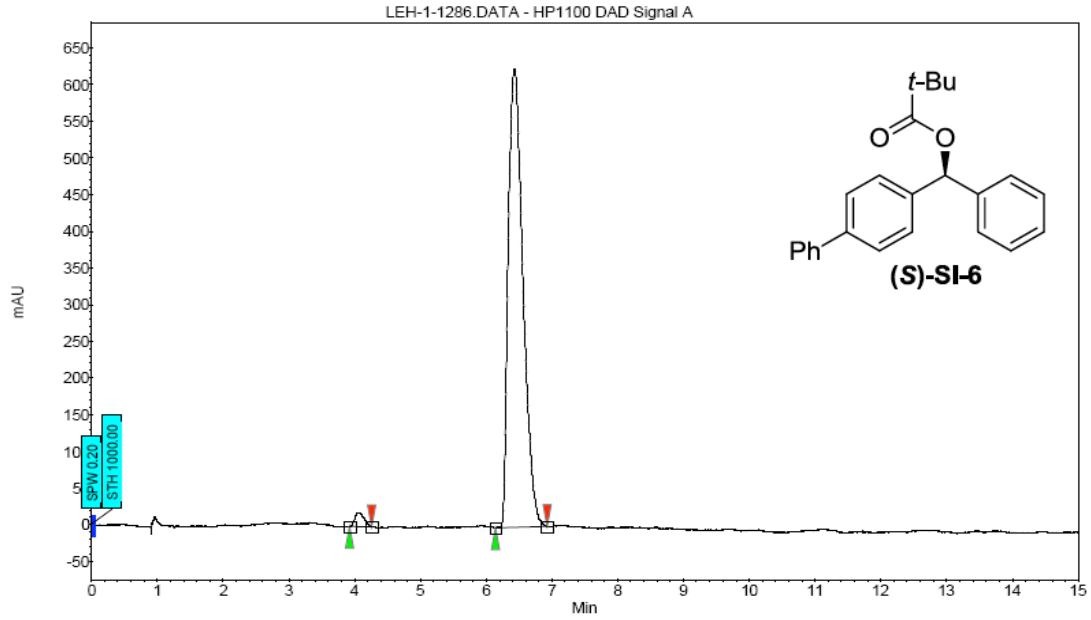
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	5.63	5.81	6.08	0.00	93.79	791.8	113.4	93.788
2	UNKNOWN	6.12	6.29	6.55	0.00	6.21	50.0	7.5	6.212
Total						100.00	841.8	120.9	100.000



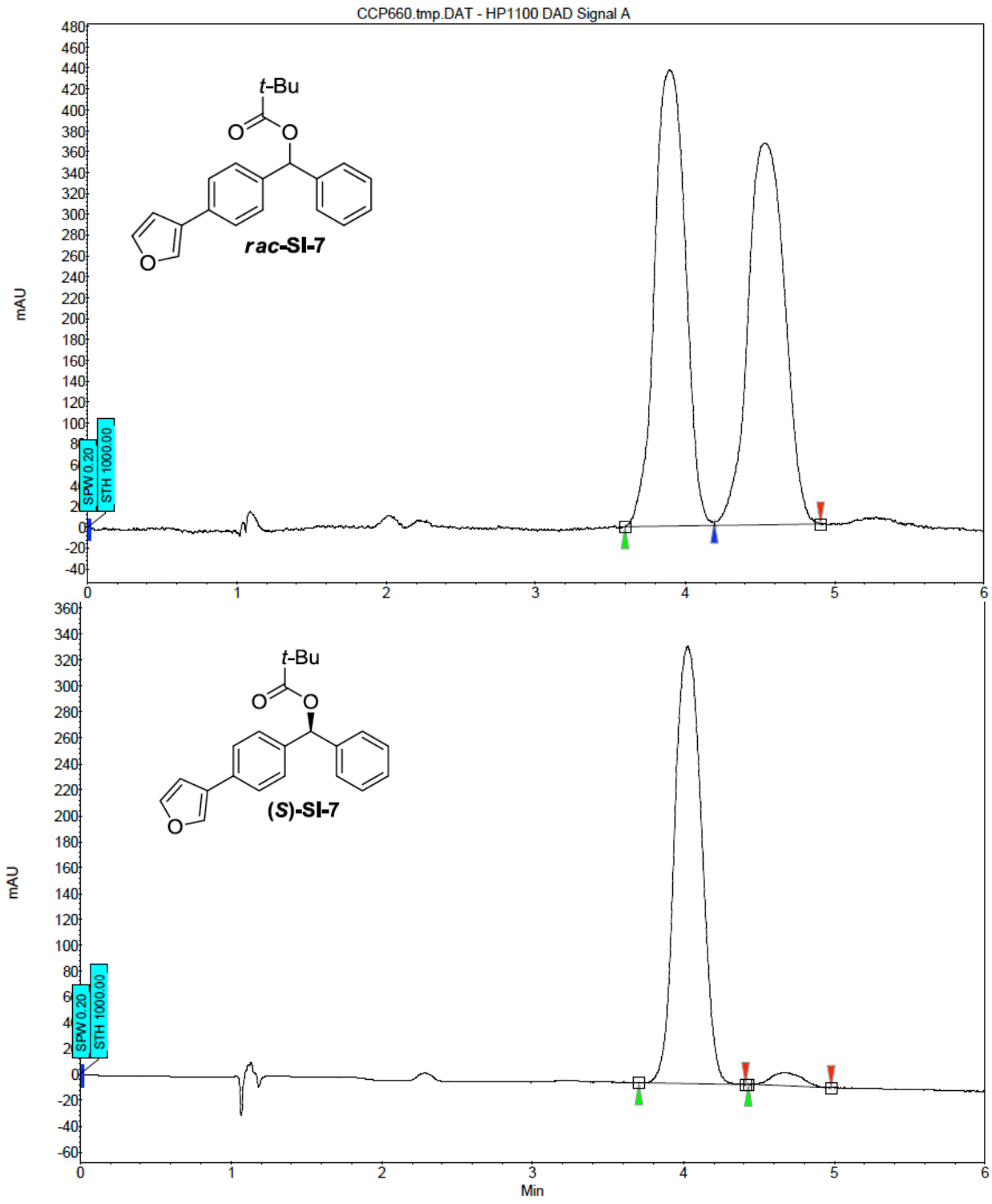


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	6.82	6.99	7.13	0.00	9.06	51.7	6.3	9.058
2	UNKNOWN	7.14	7.30	7.56	0.00	90.94	463.0	63.5	90.942
Total						100.00	514.7	69.9	100.000

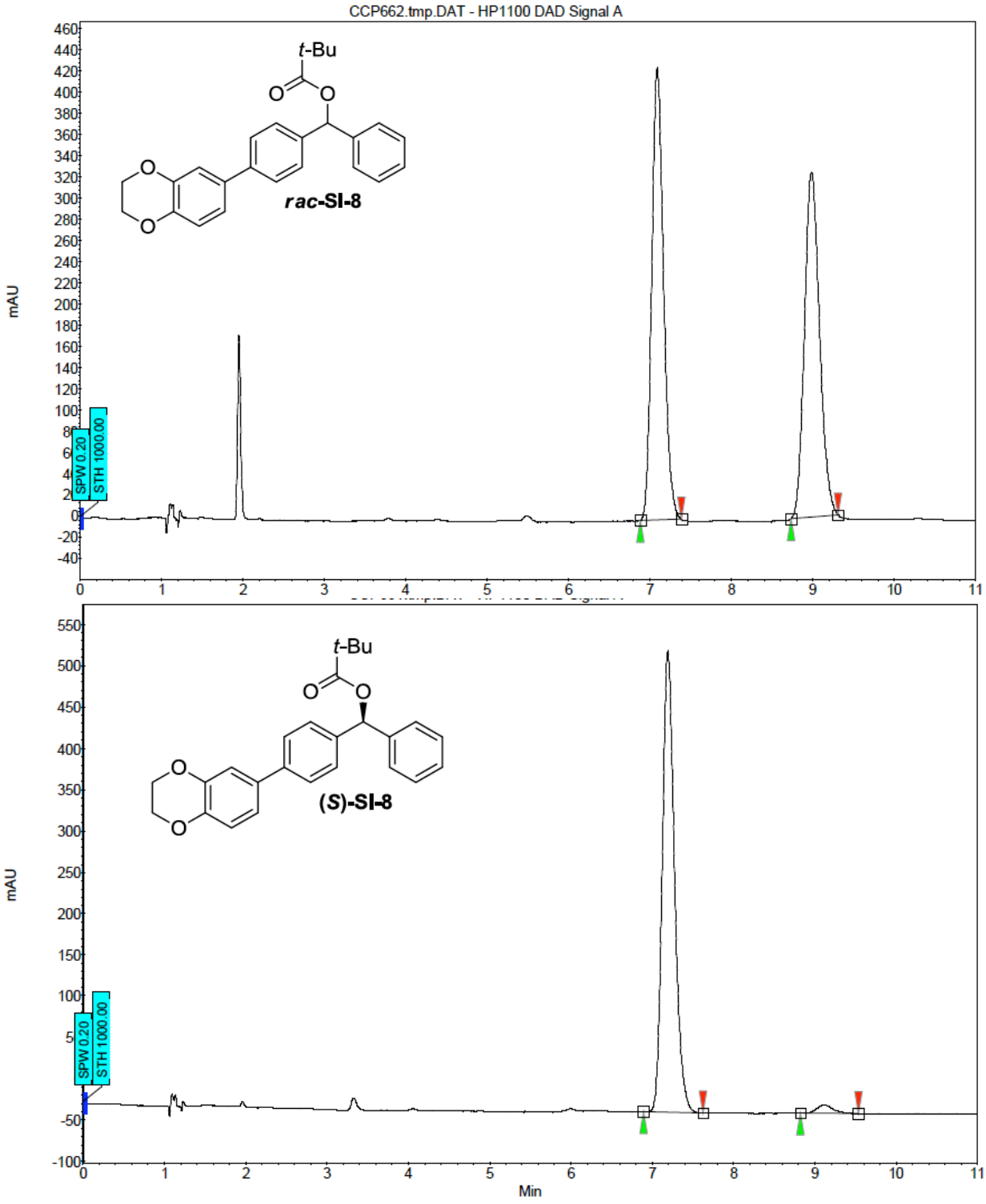




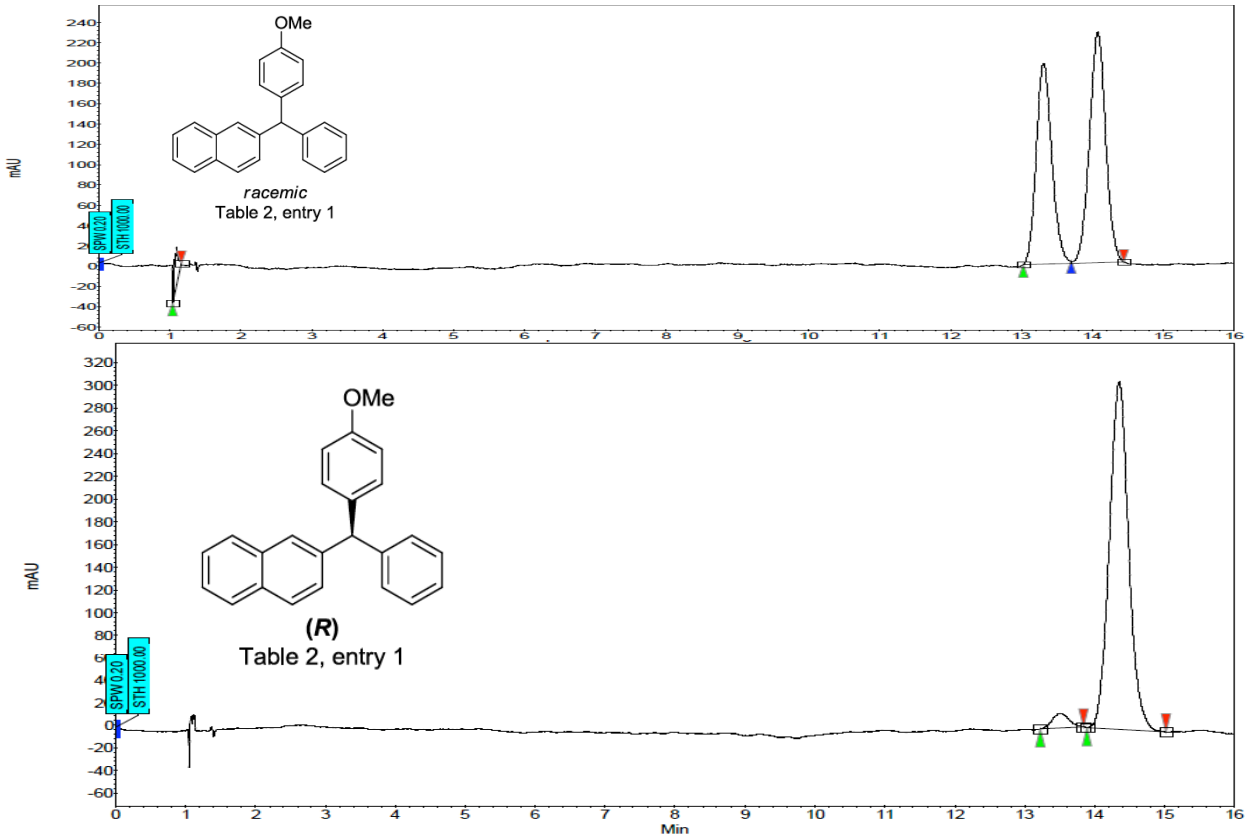
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
2	UNKNOWN	3.93	4.06	4.26	0.00	1.88	19.0	3.1	1.877
1	UNKNOWN	6.14	6.43	6.93	0.00	98.12	625.4	161.3	98.123
Total						100.00	644.3	164.4	100.000



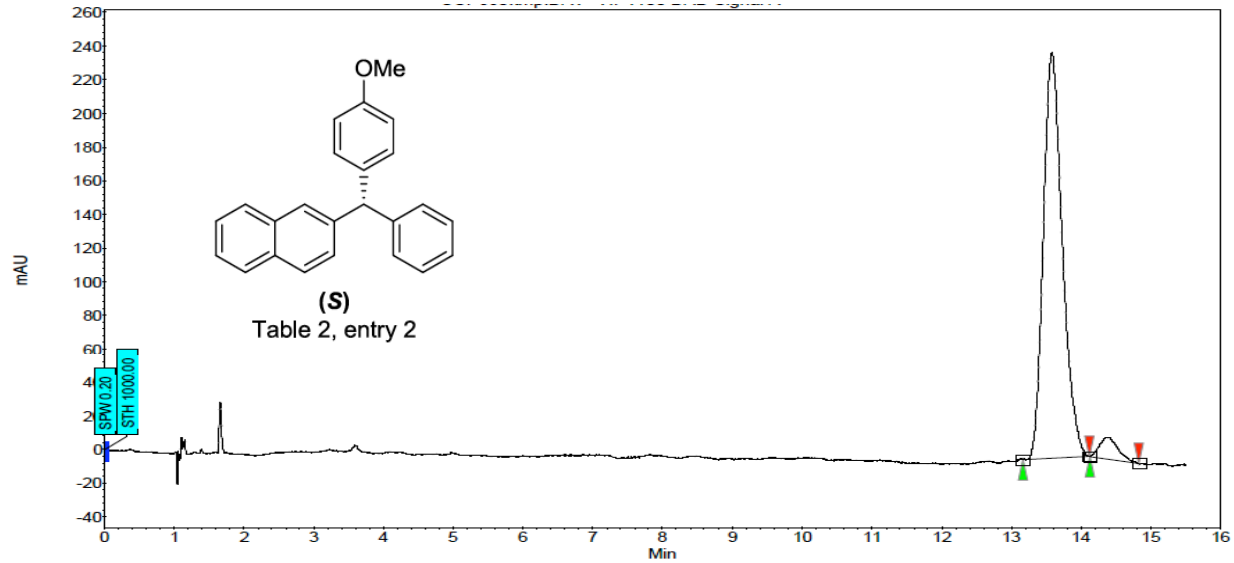
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	3.70	4.03	4.41	0.00	96.61	337.3	69.5	96.611
2	UNKNOWN	4.43	4.66	4.98	0.00	3.39	10.1	2.4	3.389
Total						100.00	347.4	71.9	100.000



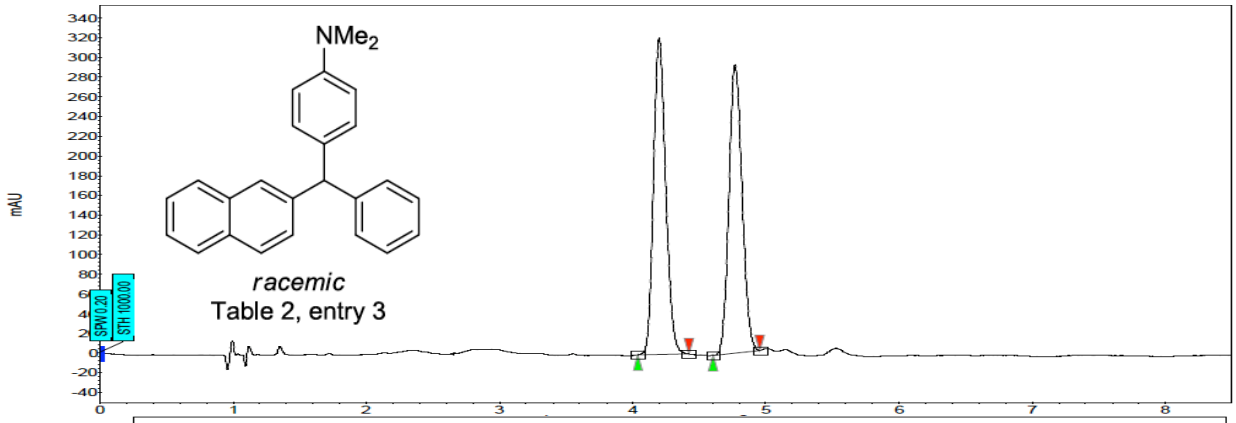
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	6.89	7.19	7.62	0.00	97.79	558.2	96.4	97.790
2	UNKNOWN	8.82	9.11	9.53	0.00	2.21	9.8	2.2	2.210
Total						100.00	568.0	98.6	100.000

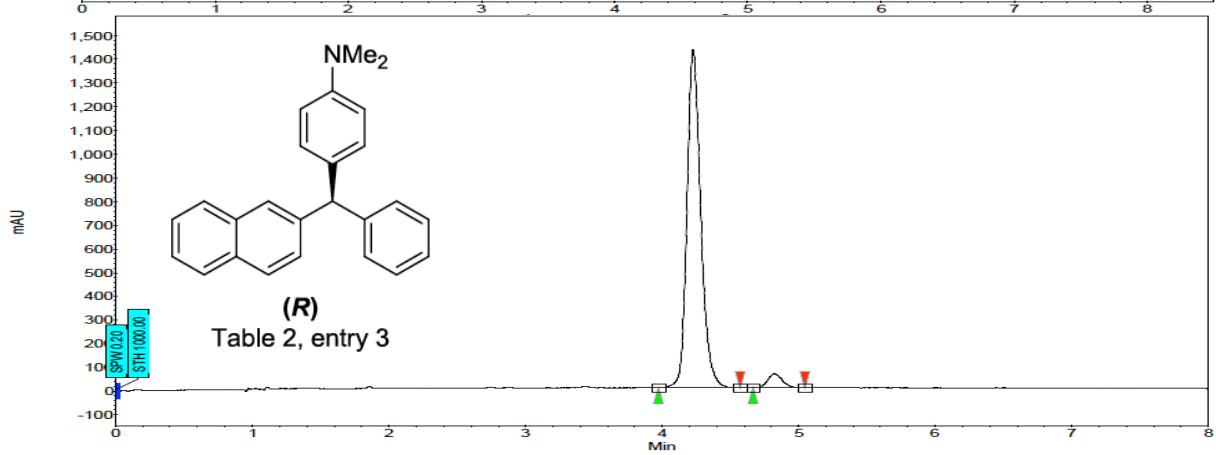


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	13.22	13.52	13.84	0.00	3.51	13.0	3.6	3.505
2	UNKNOWN	13.89	14.35	15.02	0.00	96.49	306.8	98.0	96.495
Total						100.00	319.8	101.6	100.000

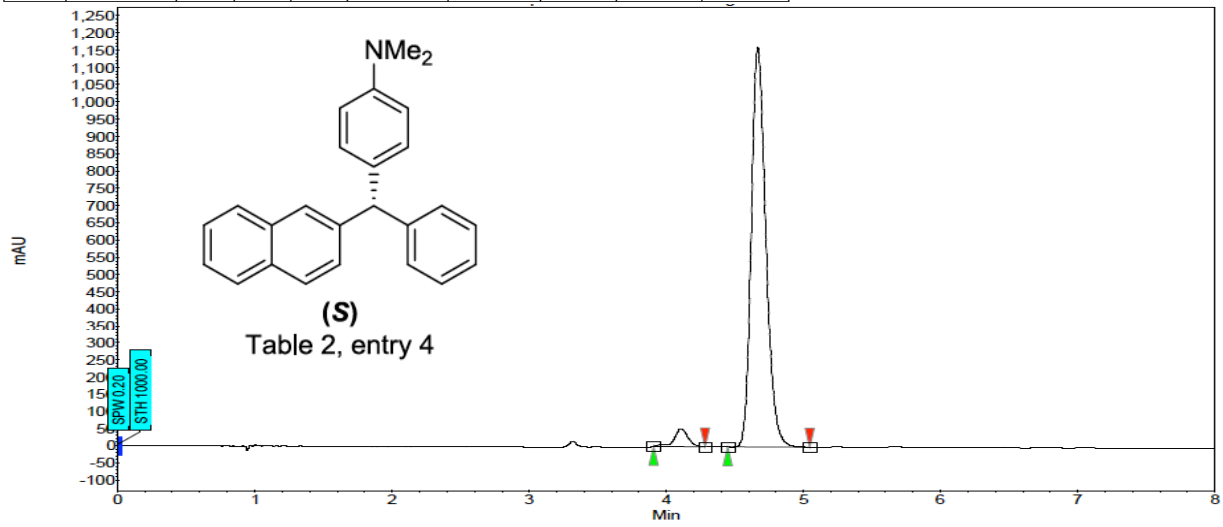


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	13.16	13.58	14.11	0.00	95.00	241.1	76.1	94.998
2	UNKNOWN	14.12	14.40	14.83	0.00	5.00	12.9	4.0	5.002
Total						100.00	254.0	80.1	100.000

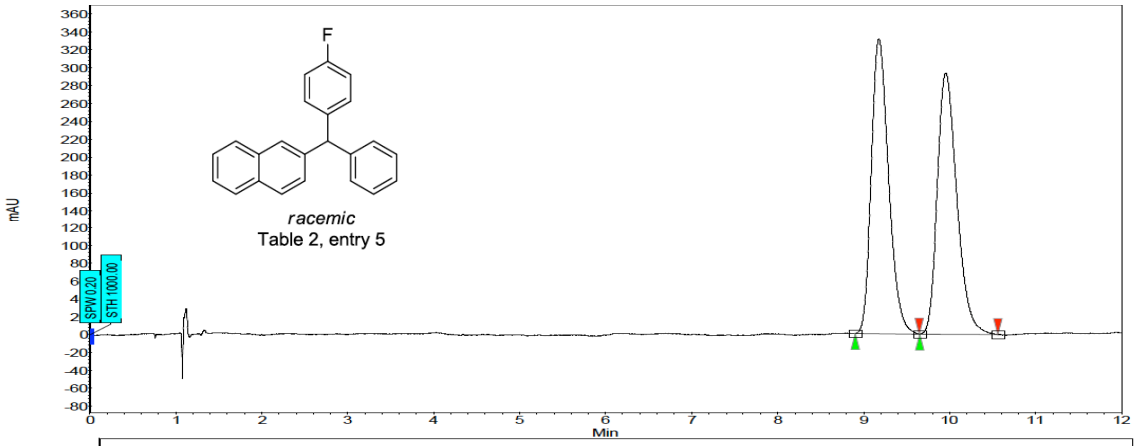


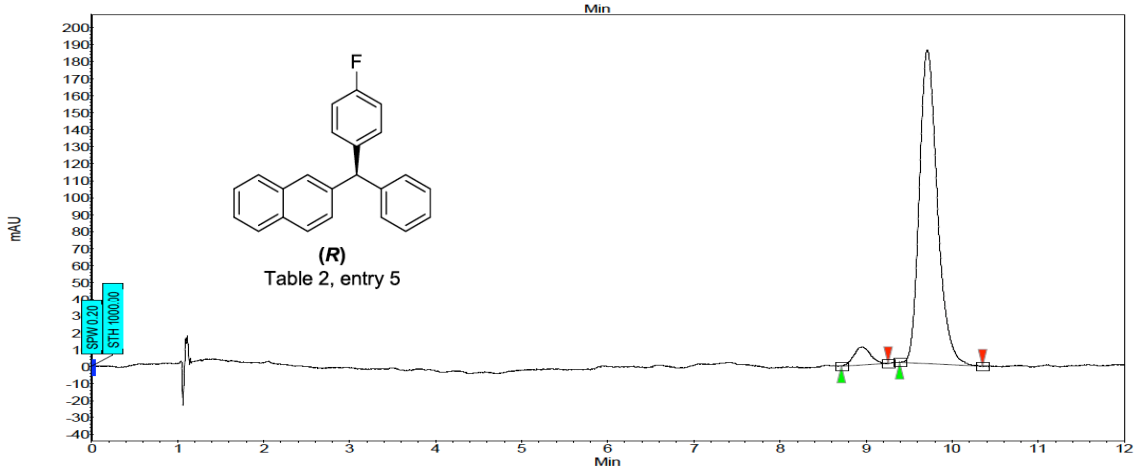


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	3.98	4.23	4.57	0.00	95.82	1425.1	166.4	95.819
2	UNKNOWN	4.67	4.83	5.05	0.00	4.18	59.1	7.3	4.181
Total						100.00	1484.1	173.7	100.000

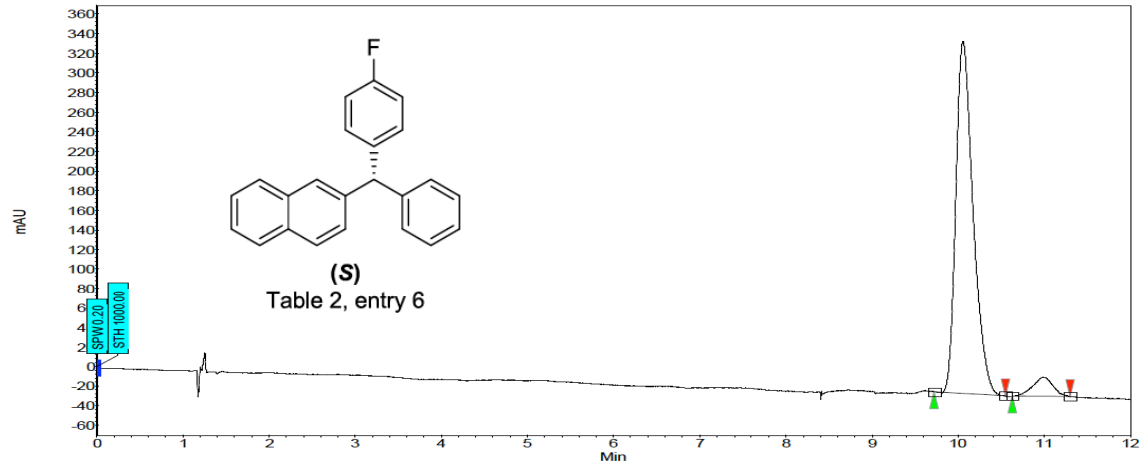


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
2	UNKNOWN	3.91	4.11	4.29	0.00	4.01	52.1	6.0	4.006
1	UNKNOWN	4.45	4.67	5.05	0.00	95.99	1160.9	143.0	95.994
Total						100.00	1213.0	148.9	100.000

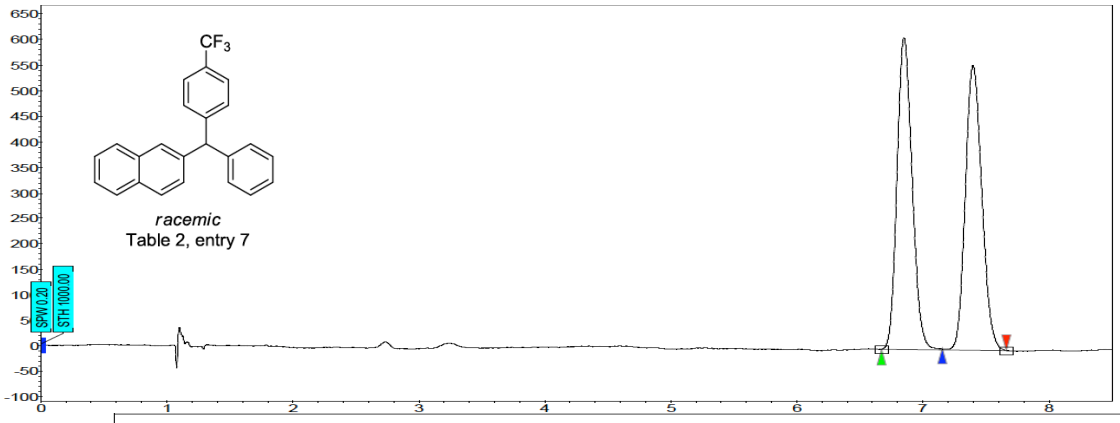


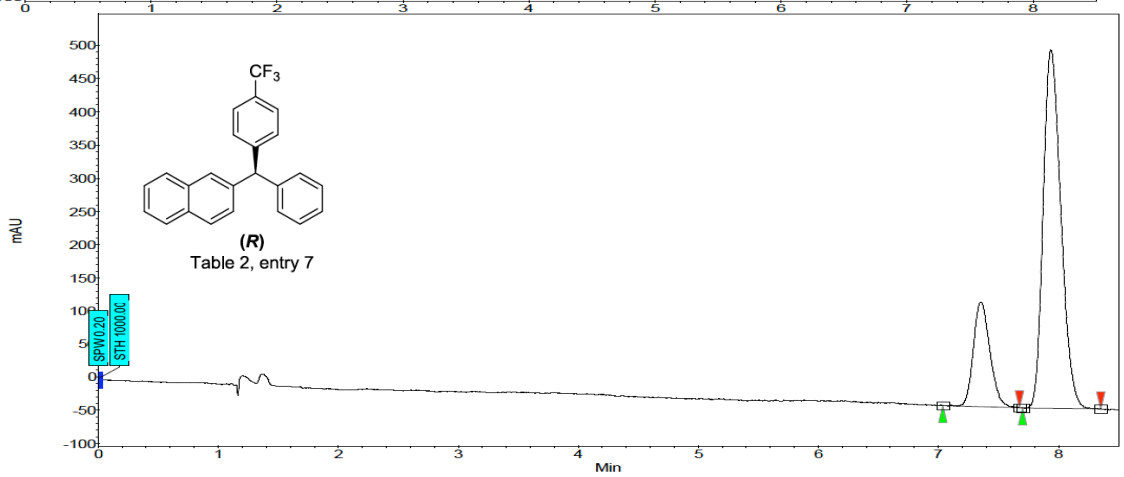


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	8.71	8.96	9.26	0.00	4.97	10.6	2.4	4.971
2	UNKNOWN	9.39	9.71	10.35	0.00	95.03	185.0	45.1	95.029
Total						100.00	195.6	47.5	100.000

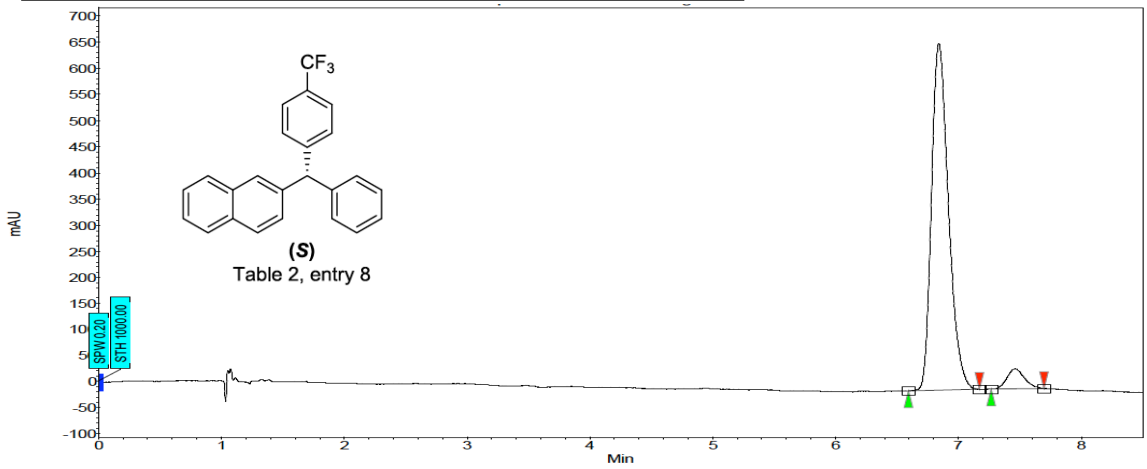


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	9.72	10.06	10.55	0.00	94.00	359.5	82.9	94.005
2	UNKNOWN	10.63	10.98	11.30	0.00	6.00	19.5	5.3	5.995
Total						100.00	379.0	88.2	100.000

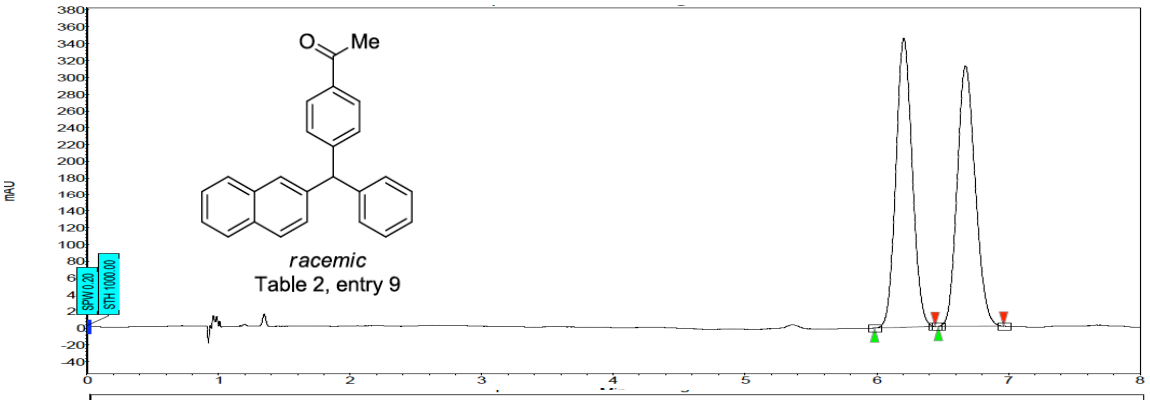


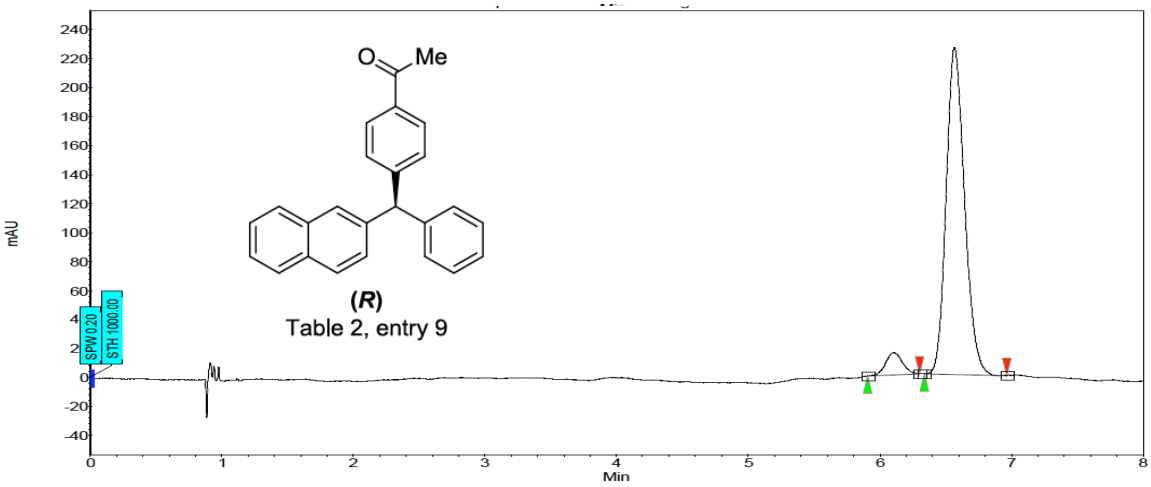


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	7.04	7.35	7.67	0.00	21.30	157.7	25.0	21.299
2	UNKNOWN	7.70	7.94	8.35	0.00	78.70	540.3	92.5	78.701
Total						100.00	698.0	117.6	100.000

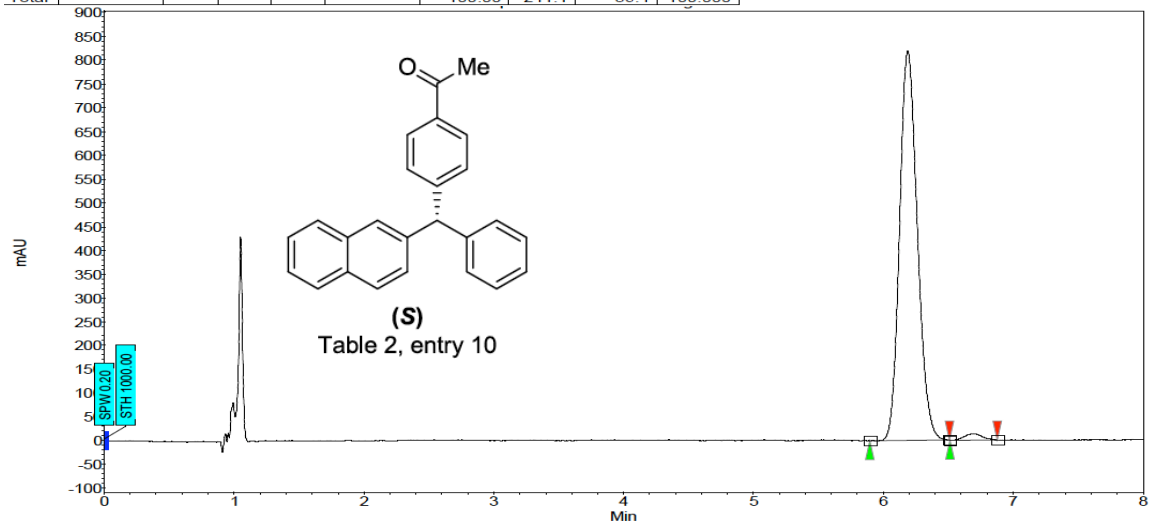


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	6.59	6.84	7.17	0.00	94.37	663.8	106.4	94.372
2	UNKNOWN	7.27	7.46	7.70	0.00	5.63	38.2	6.3	5.628
Total						100.00	702.1	112.7	100.000

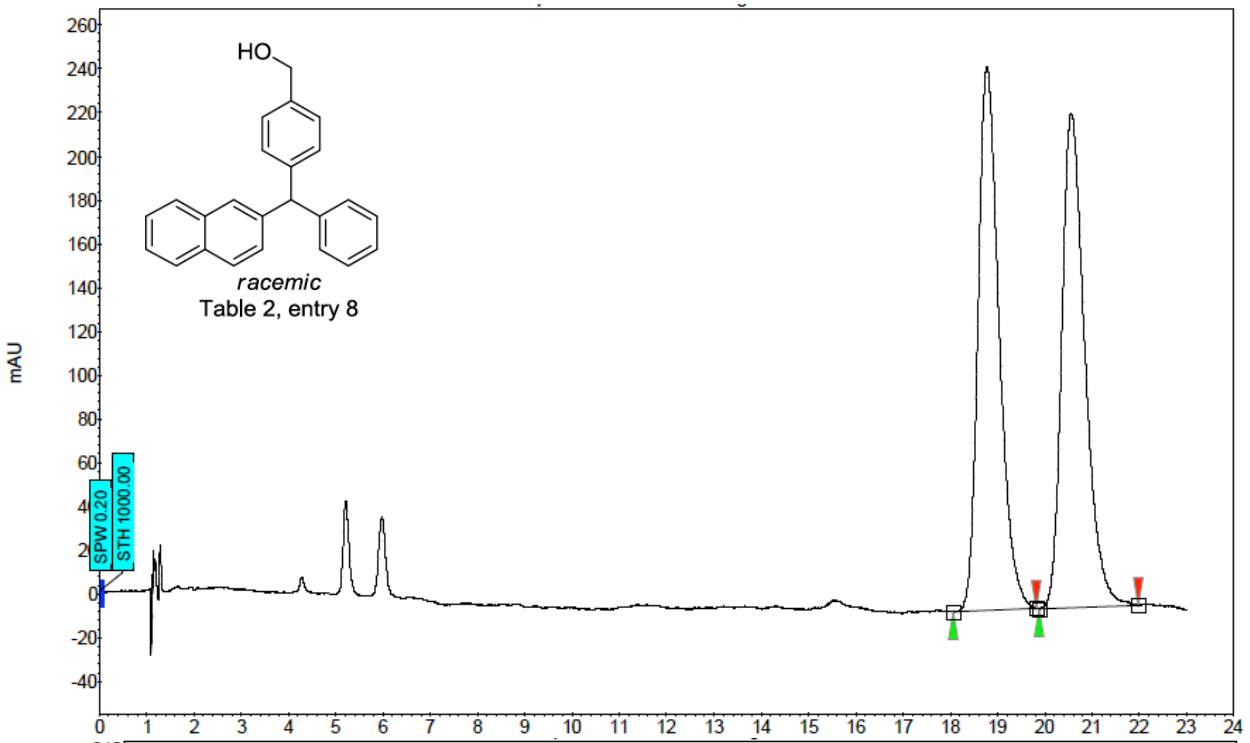


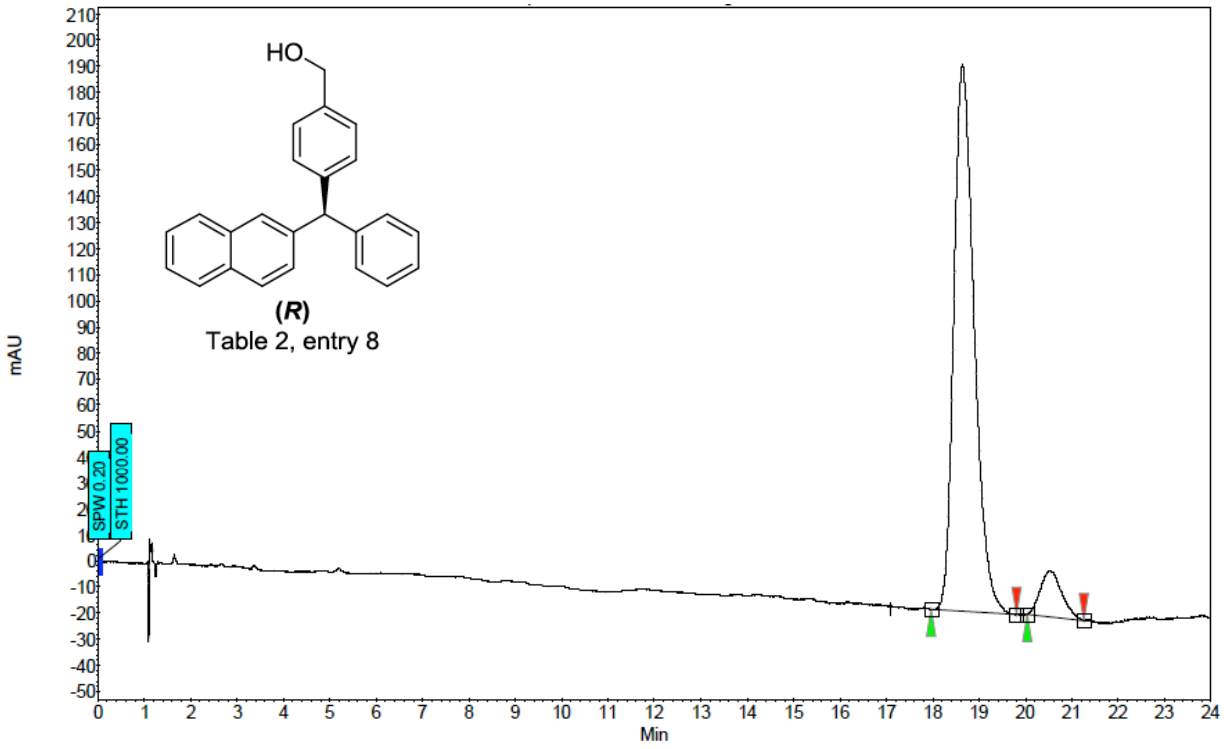


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
2	UNKNOWN	5.91	6.11	6.30	0.00	5.73	15.4	2.3	5.725
1	UNKNOWN	6.34	6.57	6.96	0.00	94.27	225.7	37.1	94.275
Total						100.00	241.1	39.4	100.000

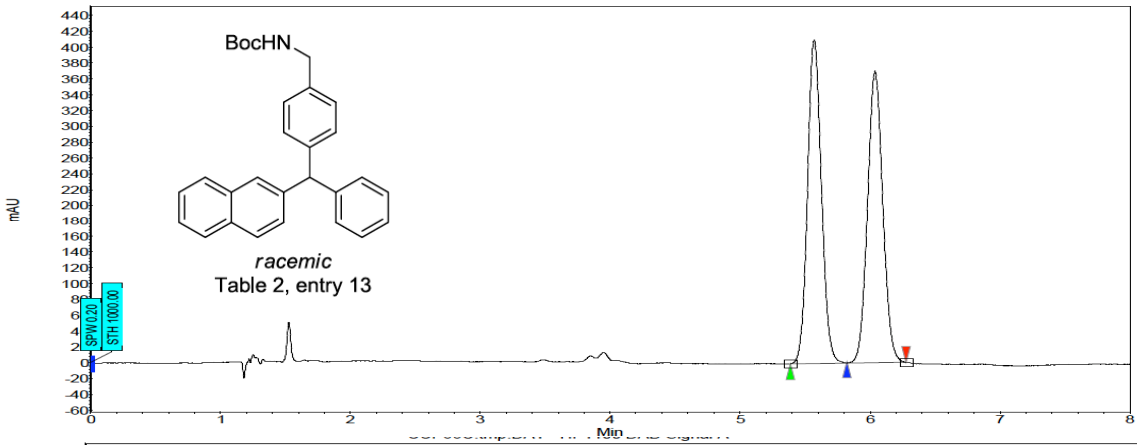


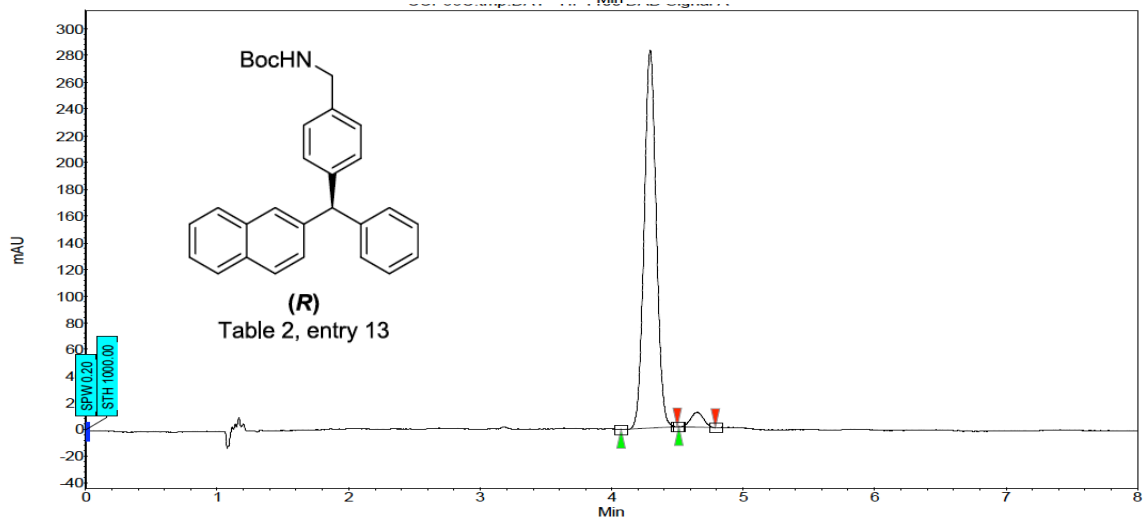
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	5.90	6.19	6.51	0.00	98.37	818.9	129.1	98.371
2	UNKNOWN	6.51	6.69	6.88	0.00	1.63	13.7	2.1	1.629
Total						100.00	832.6	131.2	100.000



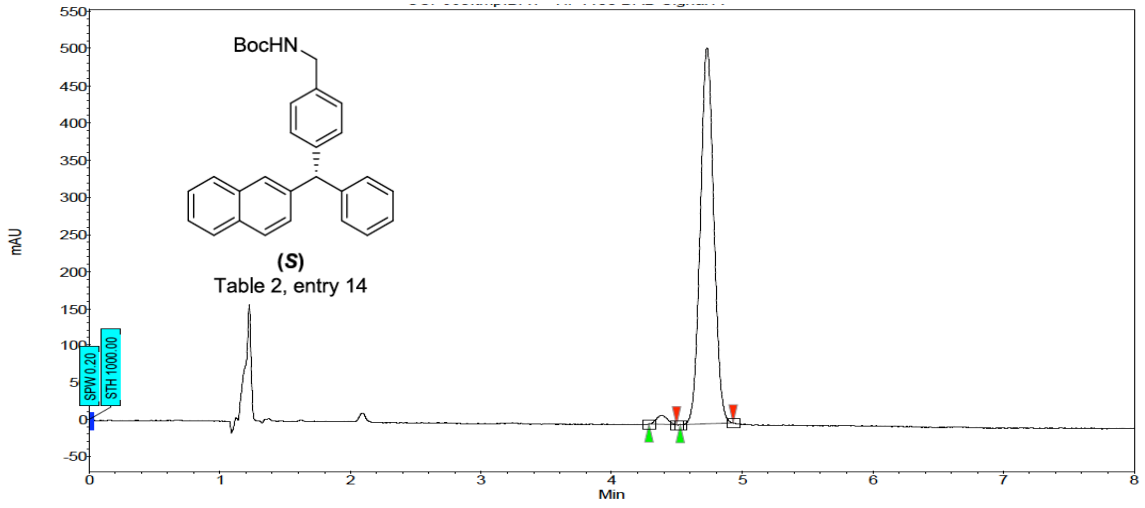


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	17.97	18.64	19.81	0.00	91.88	209.7	106.3	91.876
2	UNKNOWN	20.04	20.53	21.26	0.00	8.12	17.7	9.4	8.124
Total						100.00	227.3	115.7	100.000

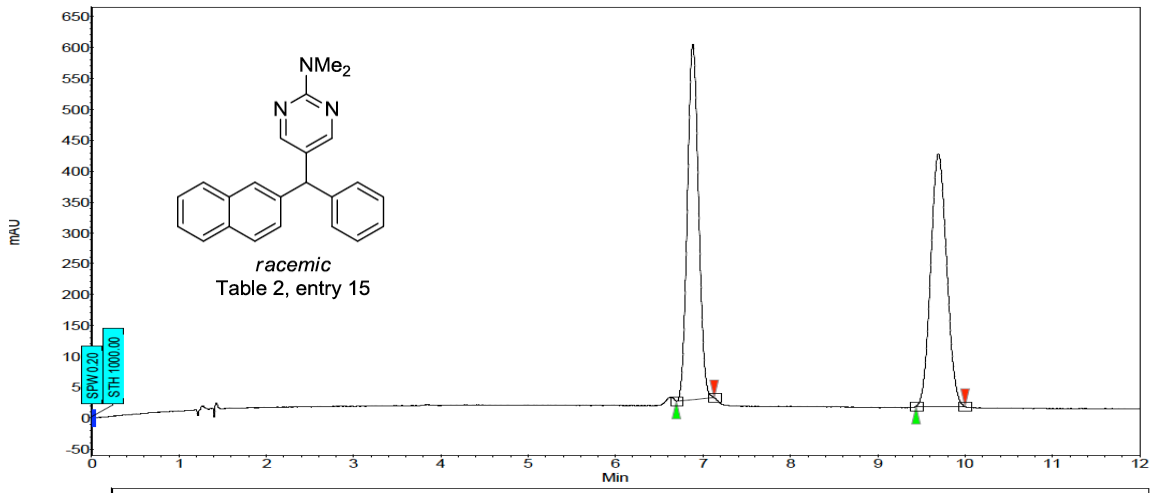


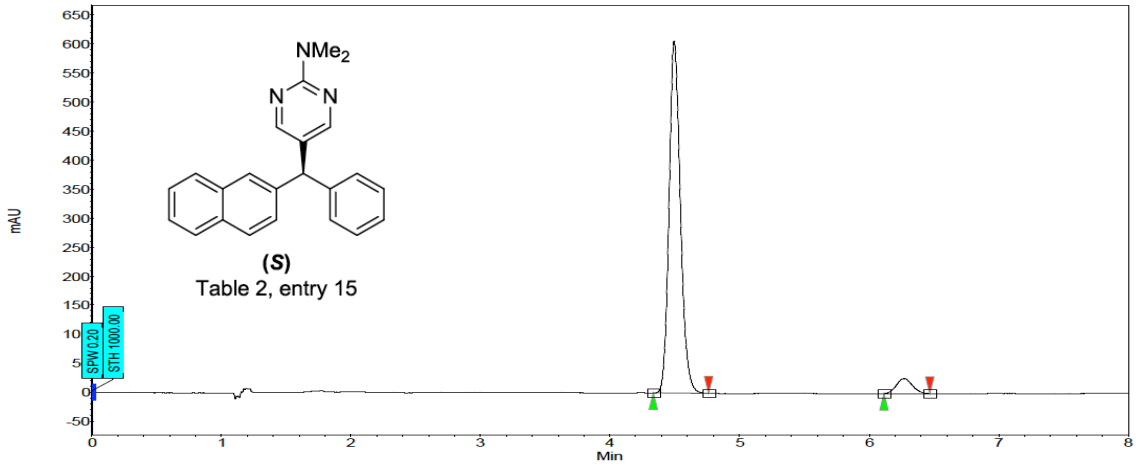


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	4.07	4.29	4.50	0.00	96.08	283.0	30.0	96.085
2	UNKNOWN	4.51	4.66	4.79	0.00	3.92	11.0	1.2	3.915
Total						100.00	294.0	31.2	100.000

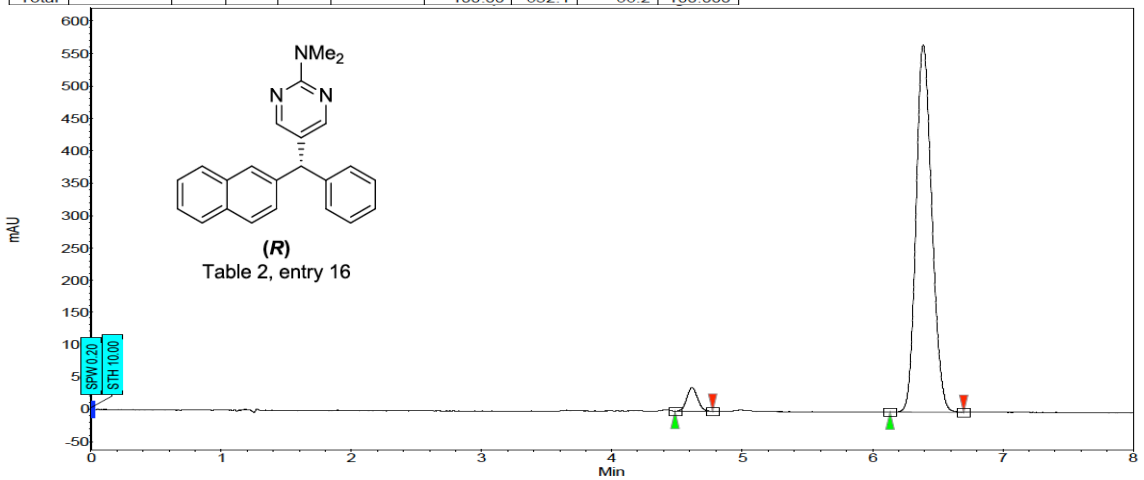


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	4.29	4.39	4.50	0.00	1.92	11.9	1.2	1.924
2	UNKNOWN	4.53	4.73	4.93	0.00	98.08	506.5	60.4	98.076
Total						100.00	518.5	61.6	100.000

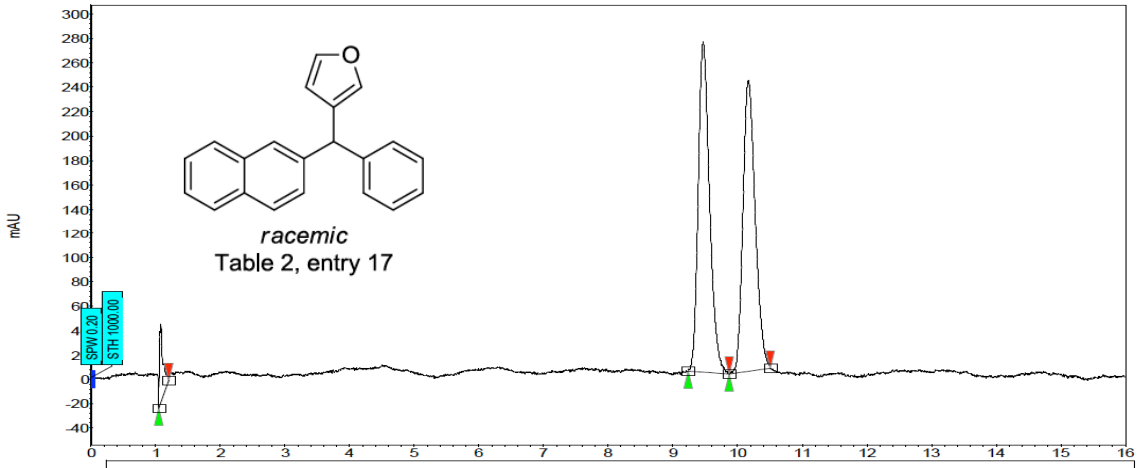


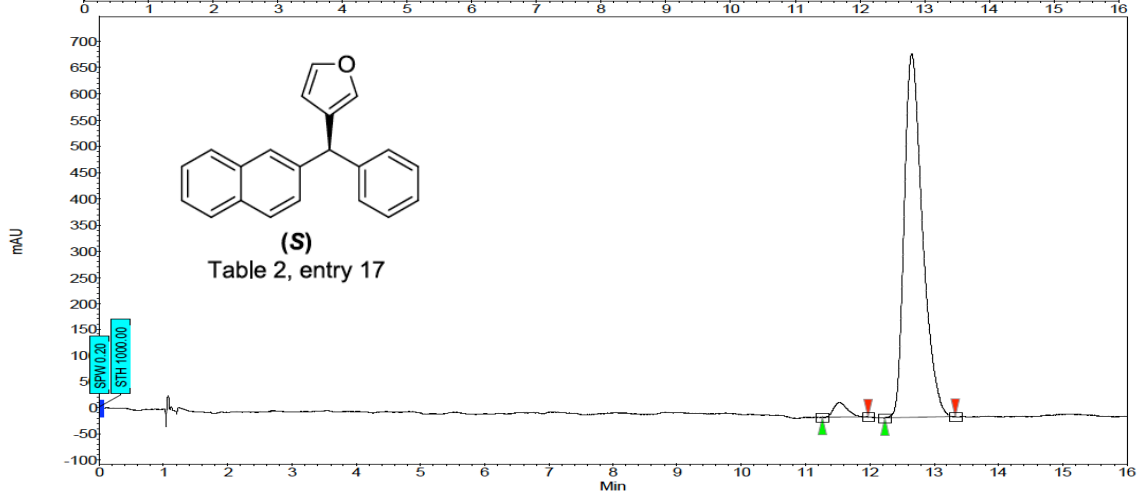


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	4.33	4.50	4.76	0.00	94.50	606.4	62.5	94.501
2	UNKNOWN	6.12	6.27	6.47	0.00	5.50	25.7	3.6	5.499
Total						100.00	632.1	66.2	100.000

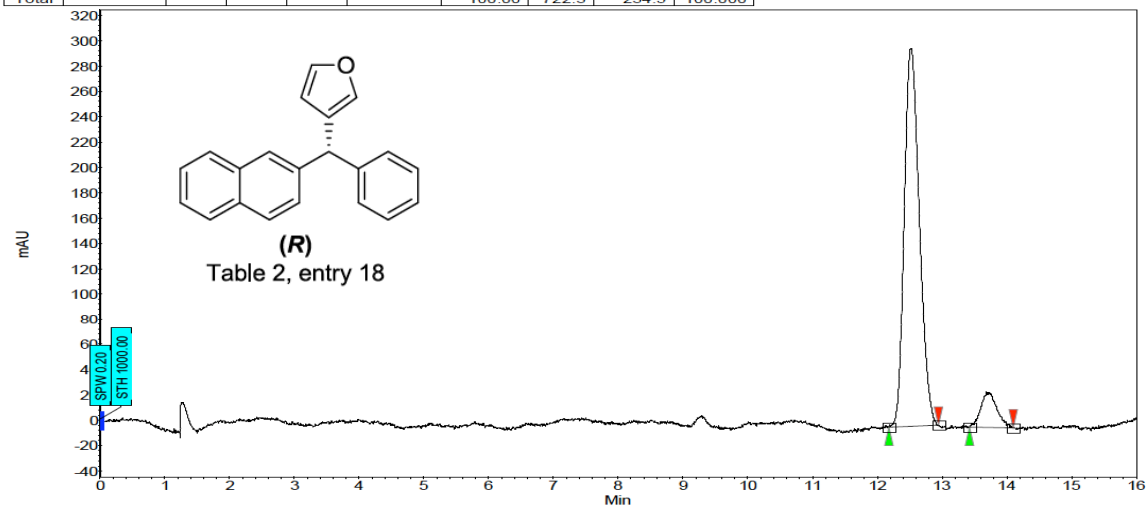


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	4.48	4.62	4.77	0.00	4.20	36.6	3.5	4.201
2	UNKNOWN	6.13	6.39	6.70	0.00	95.80	567.9	79.6	95.799
Total						100.00	604.4	83.1	100.000

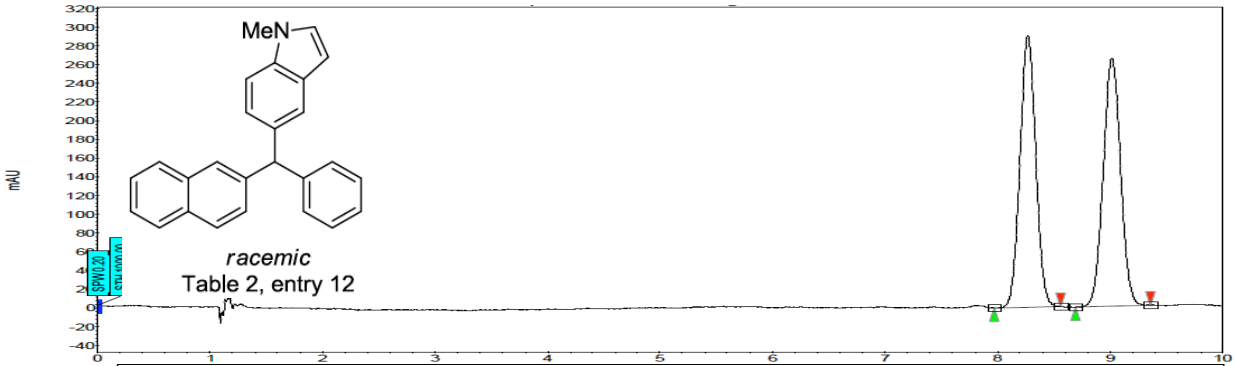


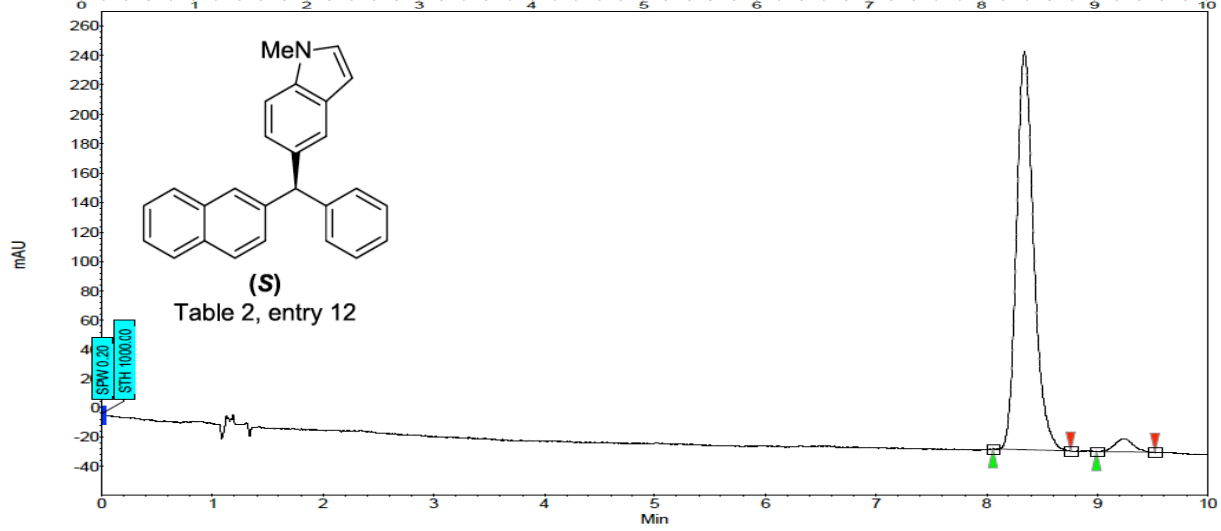


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
2	UNKNOWN	11.26	11.53	11.97	0.00	2.94	28.1	6.9	2.937
1	UNKNOWN	12.23	12.65	13.32	0.00	97.06	694.1	227.6	97.063
Total						100.00	722.3	234.5	100.000

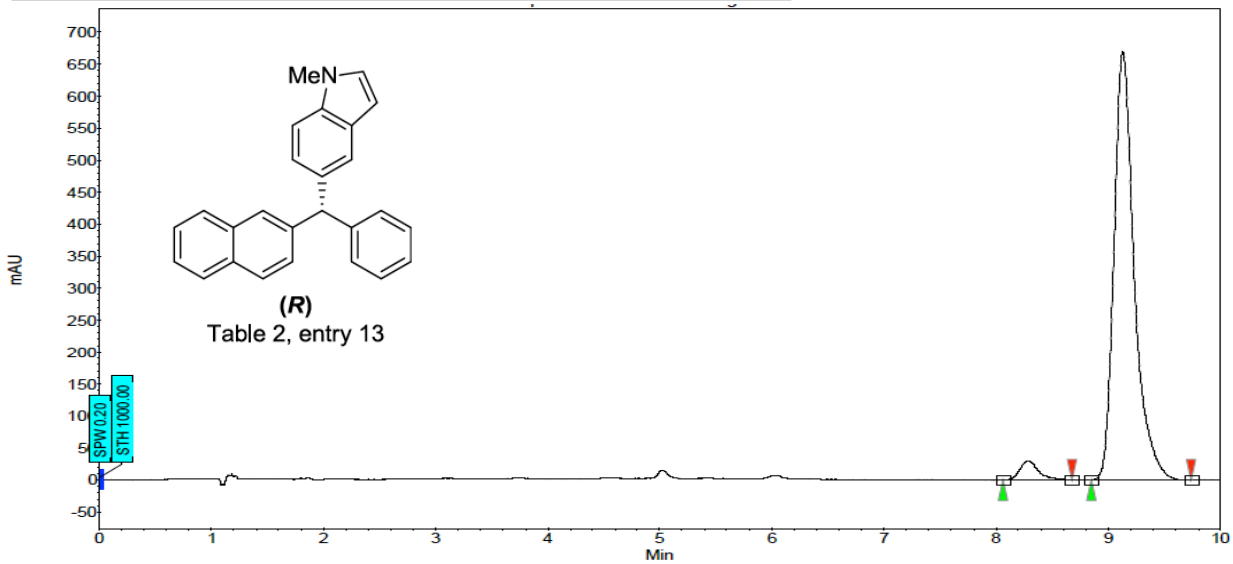


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	12.18	12.52	12.95	0.00	90.99	298.5	80.3	90.991
2	UNKNOWN	13.42	13.69	14.10	0.00	9.01	27.8	7.9	9.009
Total						100.00	326.3	88.2	100.000

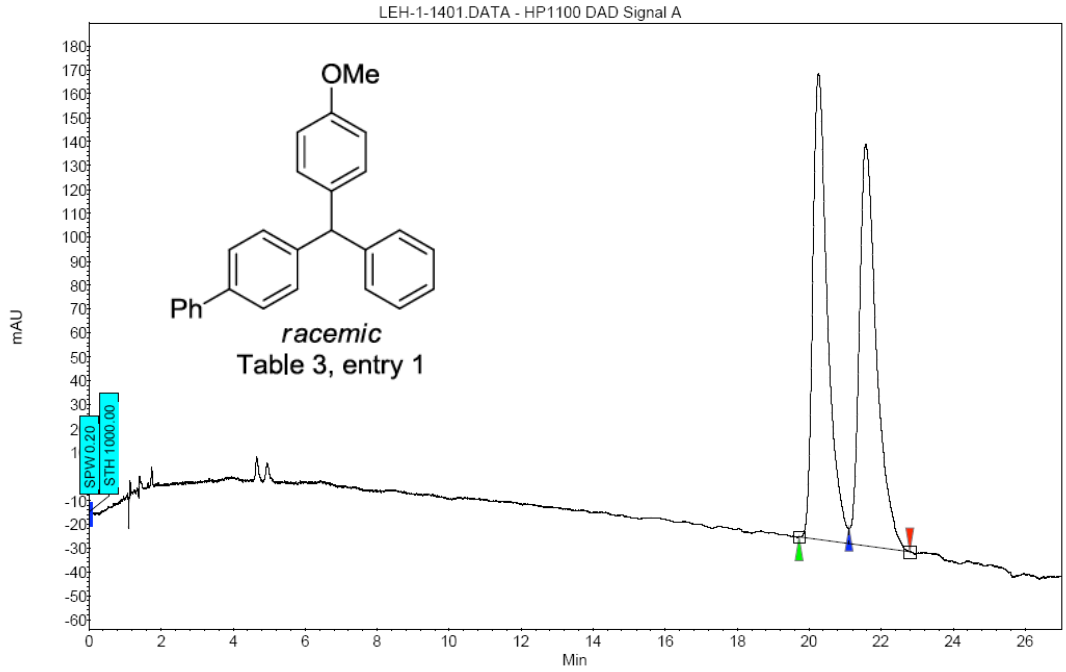


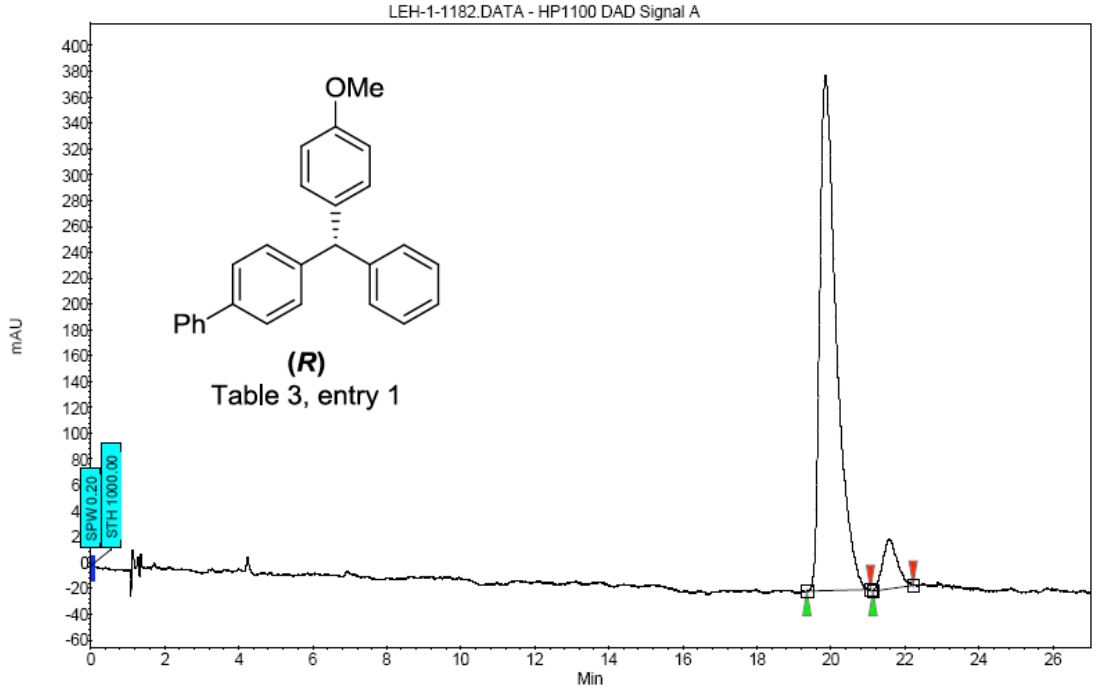


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	8.05	8.34	8.76	0.00	96.61	270.9	49.0	96.606
2	UNKNOWN	8.99	9.24	9.52	0.00	3.39	8.9	1.7	3.394
Total						100.00	279.8	50.7	100.000

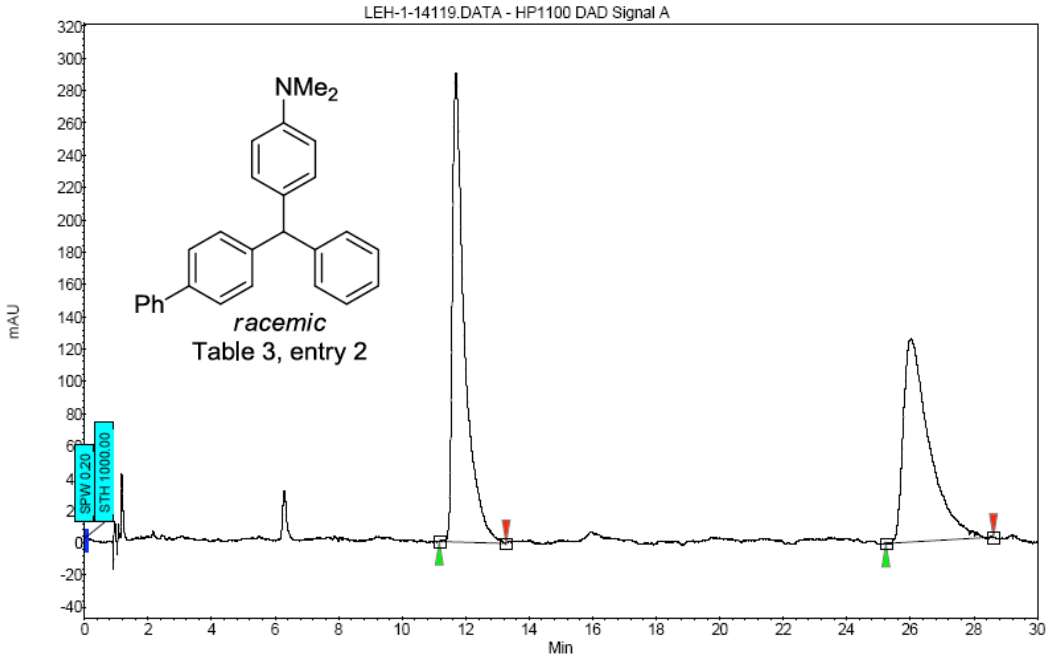


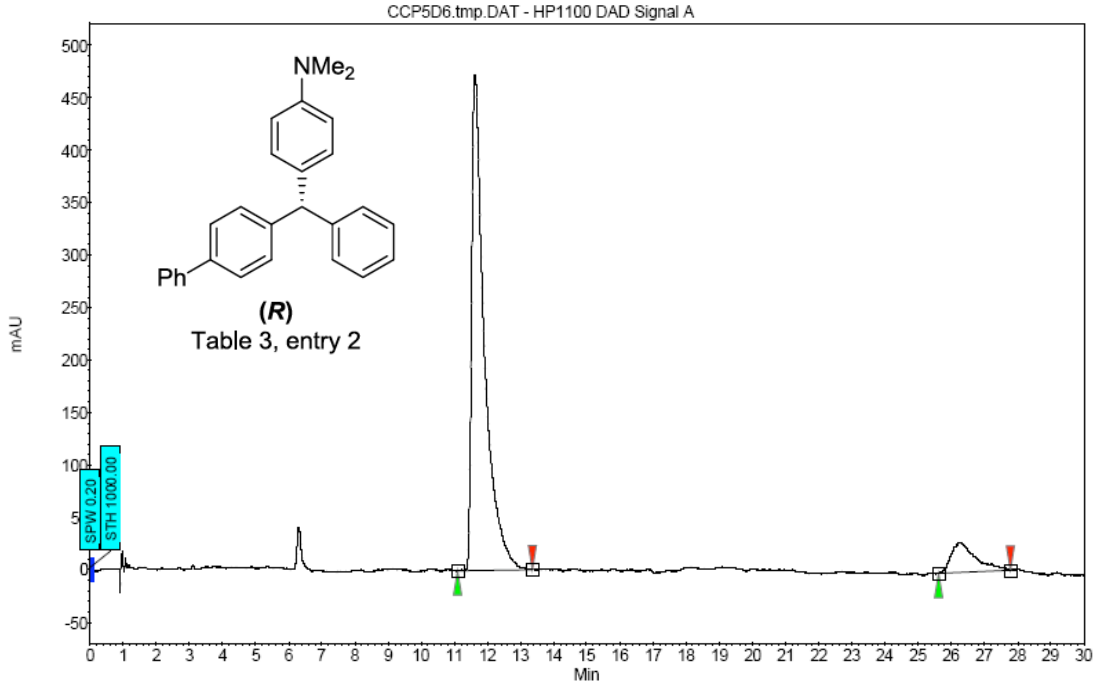
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	8.06	8.28	8.67	0.00	3.91	29.8	5.7	3.910
2	UNKNOWN	8.85	9.13	9.73	0.00	96.09	668.3	139.6	96.090
Total						100.00	698.2	145.3	100.000



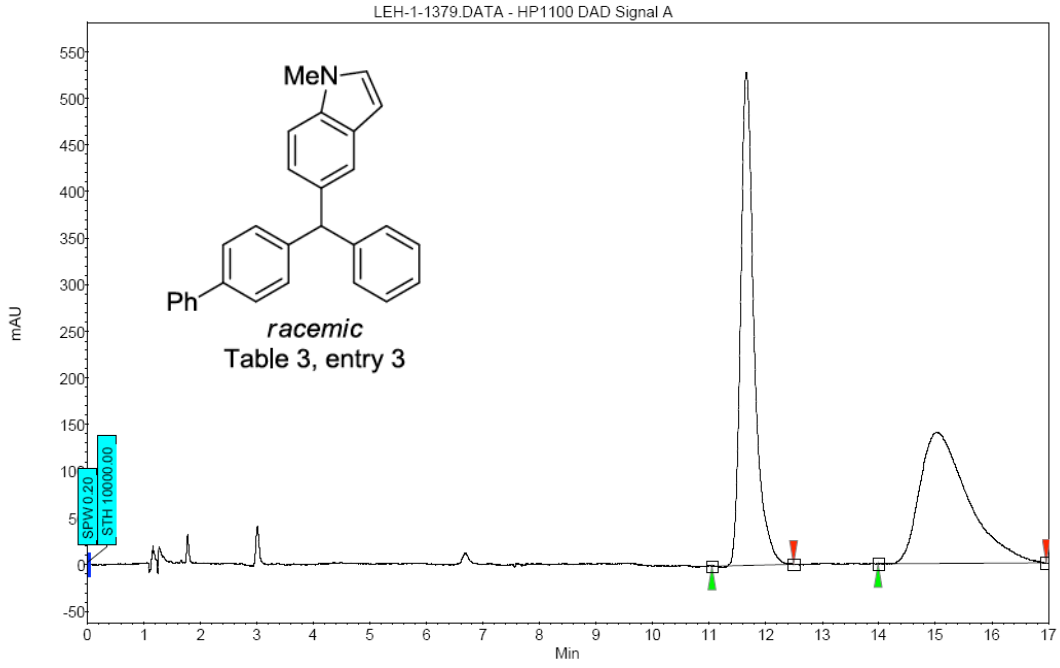


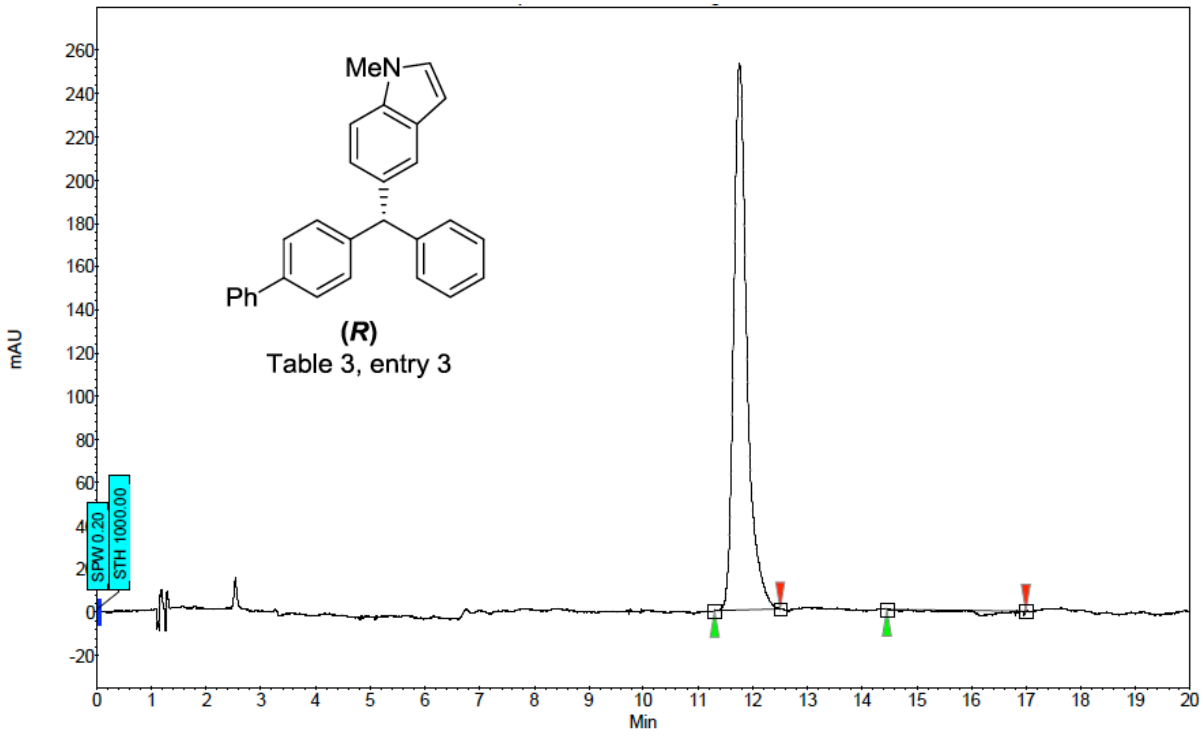
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	19.35	19.85	21.07	0.00	92.25	398.9	207.1	92.249
2	UNKNOWN	21.13	21.57	22.22	0.00	7.75	38.6	17.4	7.751
Total						100.00	437.5	224.5	100.000



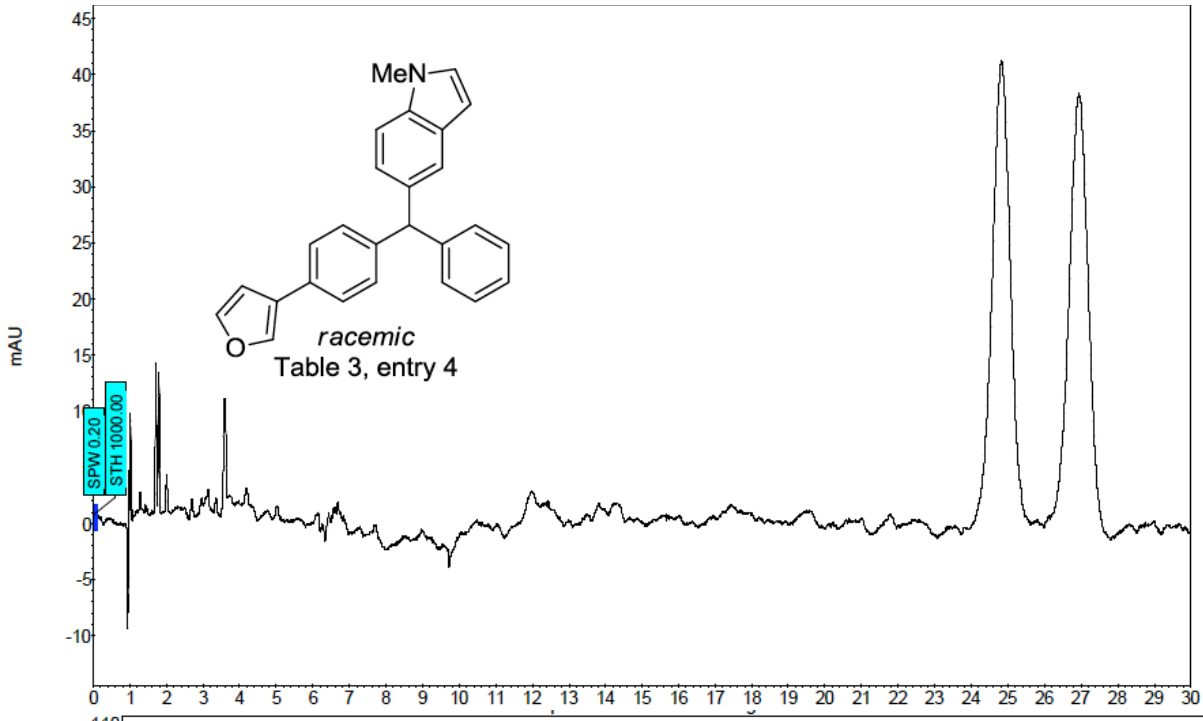


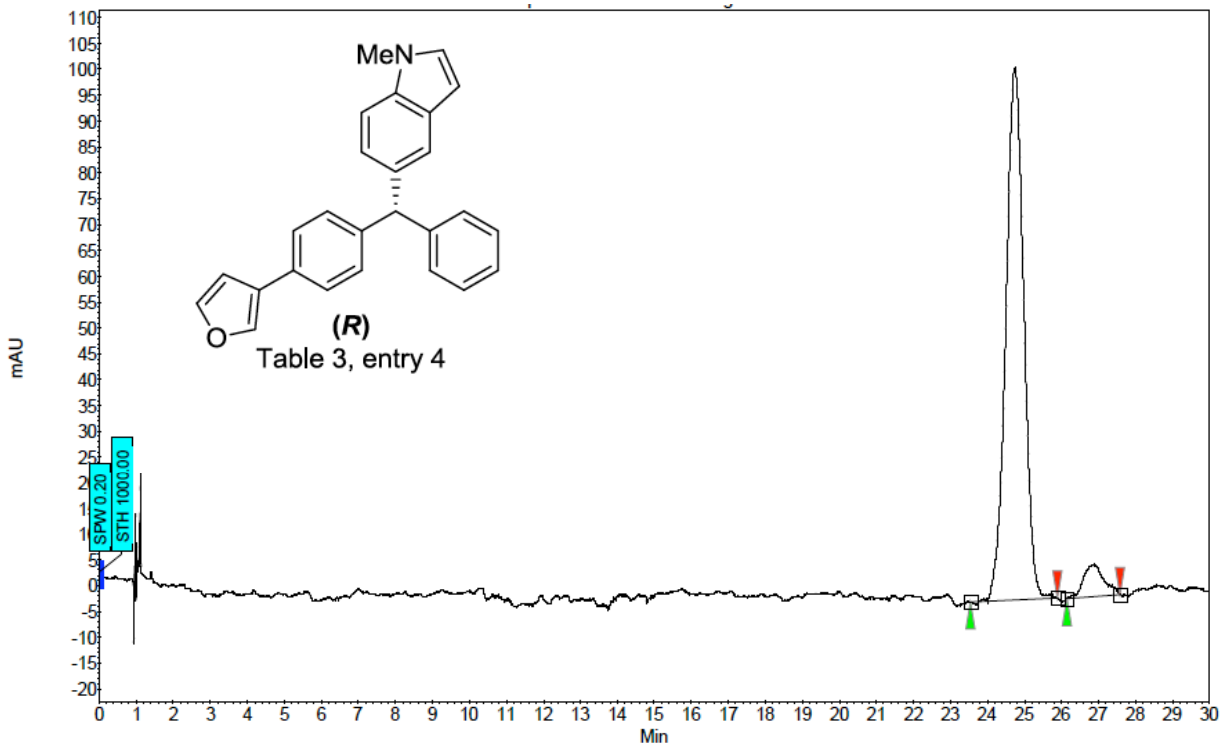
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	11.09	11.62	13.35	0.00	89.58	472.3	210.6	89.580
2	UNKNOWN	25.61	26.26	27.77	0.00	10.42	28.2	24.5	10.420
Total						100.00	500.5	235.1	100.000



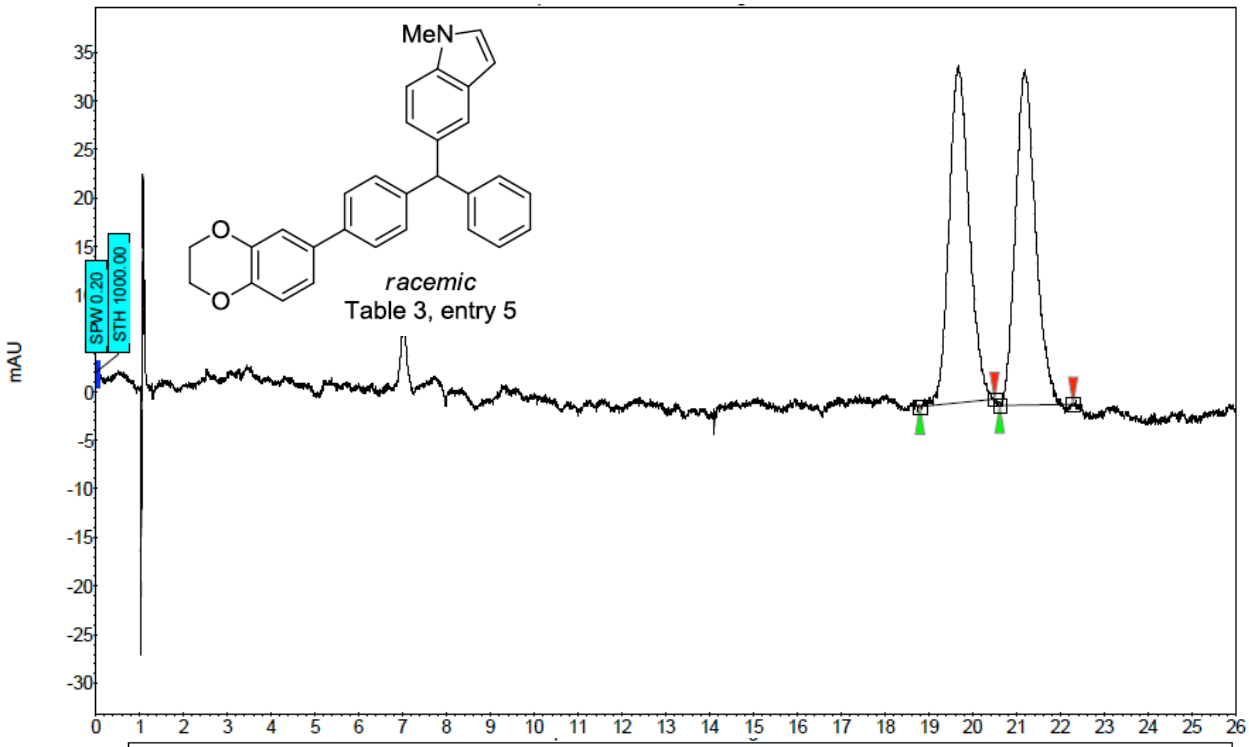


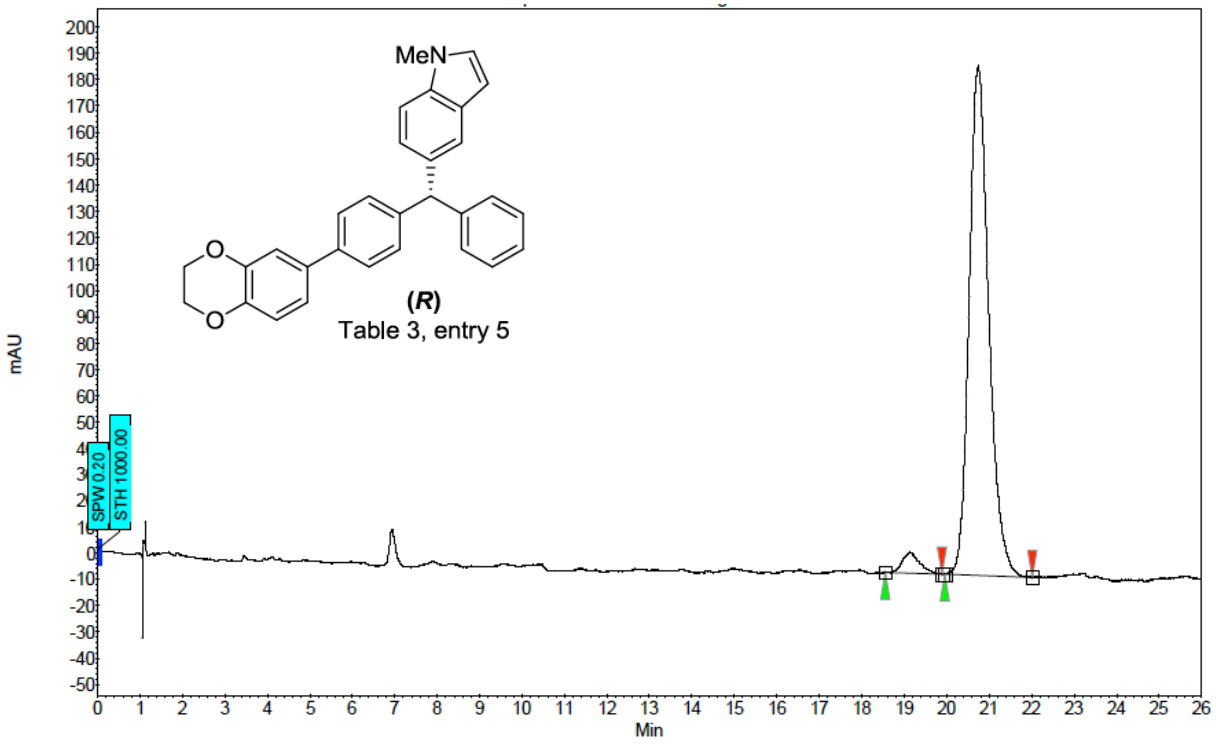
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	11.31	11.76	12.51	0.00	97.87	252.3	70.7	97.873
2	UNKNOWN	14.45	16.15	17.00	0.00	2.13	2.3	1.5	2.127
Total						100.00	254.6	72.2	100.000





Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	23.55	24.74	25.88	0.00	93.55	103.0	57.7	93.545
2	UNKNOWN	26.15	26.89	27.58	0.00	6.45	6.2	4.0	6.455
Total						100.00	109.2	61.7	100.000





Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	18.56	19.13	19.88	0.00	3.46	7.8	3.7	3.464
2	UNKNOWN	19.96	20.74	22.01	0.00	96.54	193.6	103.4	96.536
Total						100.00	201.4	107.1	100.000