

**Asymmetric construction of pyrido[1,2-*a*]-1*H*-indole derivatives via a
gold-catalyzed cycloisomerization**

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Supporting Information

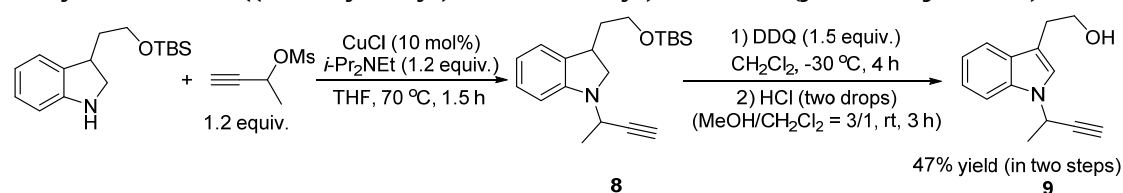
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1. General Information

^1H NMR, ^{13}C NMR, and ^{19}F NMR spectra were recorded in CDCl_3 using a Bruker AM 300 MHz NMR spectrometer (^1H at 300 MHz, ^{13}C at 75 MHz, ^{19}F at 282 MHz) or a Bruker AM 400 MHz NMR spectrometer (^1H at 400 MHz, ^{13}C at 100 MHz, ^{19}F at 376 MHz) or a Bruker AM 500 MHz NMR spectrometer (^1H at 500 MHz, ^{13}C at 125 MHz) using TMS (^1H , $\delta = 0$), residual CHCl_3 (7.26 ppm) in CDCl_3 , CDCl_3 (^{13}C CDCl_3 , 77.0 ppm), and CFCl_3 (^{19}F CFCl_3 , $\delta = 0$) as the internal standards, respectively. IR spectra were recorded with a Perkin–Elmer 983G instrument. Elemental analyses were measured with a Carlo-Erba EA1110 elementary analysis instrument. Mass spectrometry was performed with an HP 5989A system. High-resolution mass spectrometry was determined with a Finnigan MAT 8430 or Bruker APEXIII instrument. IPrAuCl , and AgPF_6 were purchased from *Strem*. AgSbF_6 was purchased from *Strem and Aladdin*. CHCl_3 was stirred with CaH_2 and distilled right before use. Petroleum ether (60-90 $^\circ\text{C}$) was used for chromatography on silica gel unless noted otherwise. Other commercially available chemicals including indoles were purchased and used without additional purification unless noted otherwise. Disubstituted indoles¹⁻² and 3-ethylindole³ were prepared according to the literature procedures. *N*-propargylindoles⁴ was prepared according to the literature procedures.

2. Synthesis of 2-((but-3-yn-2-yl)-1*H*-indol-3-yl)ethanol **9** (jf-5-088, jf-5-089)



To an oven-dried Schlenk tube were added CuCl (0.0700 g, 0.7 mmol), 3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)indoline (1.9200 g, 7 mmol), and THF (25 mL) under nitrogen atmosphere sequentially. The suspension was stirred for 5 min at room temperature, after which *i*-Pr₂NEt (1.42 mL, *d* = 0.782 g/mL, 1.1074 g, 8.4 mmol) was added dropwise in 4 min. The resulting suspension was allowed to stir for 10 min, and a solution of but-3-yn-2-yl methanesulfonate (1.2445 g, 8.4 mmol) in THF (10 mL) was added over the period of 10 min. The reaction was complete after being stirred at 70 °C for 1.5 h as monitored by TLC. After filtration through a short column of celite (3 cm × 2 cm) [eluent: ethyl acetate (10 mL × 4)] and evaporation, the crude product was purified by column chromatography on silica gel to afford **8** (2.0438 g) [eluent: petroleum ether/ethyl acetate = 50/1] as a liquid which was used in the next step without further purification.

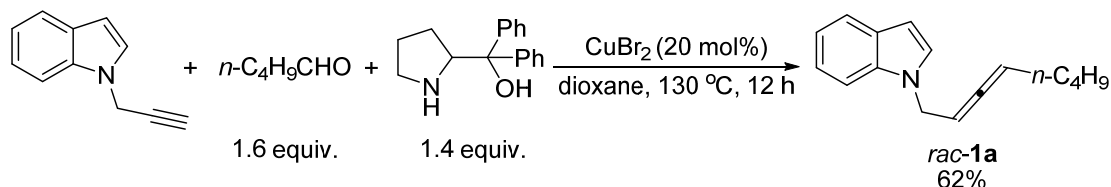
To an oven-dried Schlenk tube were added **8** (2.0438 g) and DCM (60 mL) under nitrogen atmosphere sequentially. Then the solution was cooled to -30 °C, and DDQ (2.0415 g, 9 mmol) was added. The reaction was complete after being stirred at -30 °C for 4 h as monitored by TLC. The resulting mixture was filtrated through a pad of celite (3 cm × 2 cm) [eluent: ethyl acetate (20 mL × 3)] and washed sequentially with saturated NaHCO₃ (20 mL × 3), water (20 mL), brine, and dried over anhydrous Na₂SO₄. After filtration and evaporation, the residue was purified by column chromatography on silica gel to afford 1-(but-3-yn-2-yl)-3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1*H*-indole (1.0526 g) [eluent: petroleum ether/ethyl acetate = 50/1] as a liquid, which was used in the next step without further purification.

To a round-bottomed flask were added the crude product and 9 mL of mixed solvent (*V*_{MeOH}/*V*_{DCM} = 3/1), and HCl (2 drops) sequentially. The reaction was

complete after being stirred at room temperature for 3 h as monitored by TLC. The resulting mixture was quenched with H₂O (20 mL) and extracted with ethyl acetate (20 mL). The organic layer was separated and the aqueous layer was extracted with ethyl acetate (10 mL × 2). The combined organic layer was washed with brine and dried over anhydrous Na₂SO₄. After filtration and evaporation, the crude product was purified by column chromatography on silica gel to afford **9** (0.6890 g, 47%) [eluent: petroleum ether/ethyl acetate = 3/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.61 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.41 (d, *J* = 8.1 Hz, 1H, Ar-H), 7.28-7.20 (m, 2H, Ar-H), 7.13 (t, *J* = 7.4 Hz, 1H, Ar-H), 5.35-5.20 (m, 1H, CH), 3.90 (t, *J* = 6.5 Hz, 2H, OCH₂), 3.03 (t, *J* = 6.3 Hz, 2H, CH₂), 2.47 (d, *J* = 1.8 Hz, 1H, ≡CH), 1.74 (d, *J* = 6.9 Hz, 3H, CH₃), 1.55 (s, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 135.2, 128.4, 123.2, 121.6, 119.2, 119.1, 111.7, 109.4, 82.2, 72.7, 62.3, 43.0, 28.5, 22.2; IR (neat) ν (cm⁻¹) 3394, 3288, 3051, 2985, 2935, 2116, 1612, 1553, 1462, 1398, 1360, 1297, 1227, 1195, 1157, 1091, 1075, 1045, 1012; MS (70 ev, EI) *m/z* (%) 214 (M⁺ + 1, 5.26), 213 (M⁺, 36.41), 182 (100); HRMS calcd for C₁₄H₁₆NO⁺[M⁺ + H]: 214.1226, Found: 214.1225.

3. Synthesis of racemic *N*-allenyl indoles⁵⁻⁶

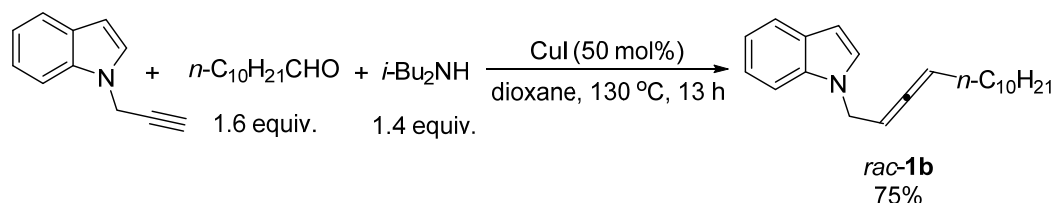
3.1 Synthesis of 1-(octa-2,3-dienyl)-1*H*-indole *rac*-**1a** (jf-1-117)



Typical Procedure I: To a flame-dried Schlenk tube with a polytetrafluoroethylene plug were added CuBr₂ (0.3606 g, 1.6 mmol, 99%), α,α-diphenylprolinol (2.8918 g, 11.2 mmol, 98%), 1-(prop-2-ynyl)-1*H*-indole (1.2404 g, 8 mmol), pentanal (1.4 mL, d = 0.81 g/mL, 1.134 g, 12.8 mmol, 98%), and dioxane (24 mL) sequentially. The Schlenk tube was then sealed by screwing the polytetrafluoroethylene plug tightly with the outlet connected to the vacuum line. The reaction was complete after being stirred in an oil bath preheated at 130 °C for 12 h as monitored by TLC. The resulting mixture was cooled to room temperature, diluted with diethyl ether and washed with an aqueous solution of hydrochloric acid (1.2 M). The organic layer was separated

and the aqueous layer was extracted with diethyl ether. The combined organic layer was washed with brine and dried over anhydrous Na_2SO_4 . After filtration and evaporation, the residue was purified by column chromatography on silica gel to afford *rac*-**1a** (1.1087 g, 62%) [eluent: petroleum ether] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.62 (d, J = 8.1 Hz, 1H, Ar-H), 7.36 (dd, J_1 = 8.1 Hz, J_2 = 0.9 Hz, 1H, Ar-H), 7.22-7.13 (m, 1H, Ar-H), 7.13-7.06 (m, 2H, Ar-H), 6.48 (dd, J_1 = 3.2 Hz, J_2 = 0.8 Hz, 1H, Ar-H), 5.31-5.15 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.68 (dd, J_1 = 6.5 Hz, J_2 = 2.9 Hz, 2H, NCH_2), 2.02-1.88 (m, 2H, CH_2), 1.36-1.22 (m, 4H, $\text{CH}_2 \times 2$), 0.87 (t, J = 7.1 Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 204.4, 135.9, 128.7, 127.5, 121.3, 120.9, 119.3, 109.7, 101.2, 93.5, 87.9, 46.0, 31.1, 28.2, 22.1, 13.8; IR (neat) ν (cm^{-1}) 3056, 2957, 2929, 2858, 1964, 1511, 1484, 1464, 1396, 1378, 1334, 1313, 1253, 1180, 1051, 1012; MS (70 ev, EI) m/z (%) 226 ($\text{M}^+ + 1$, 4.34), 225 (M^+ , 30.42), 182 (100); HRMS calcd for $\text{C}_{16}\text{H}_{19}\text{N}$ [M^+]: 225.1517, Found: 225.1517.

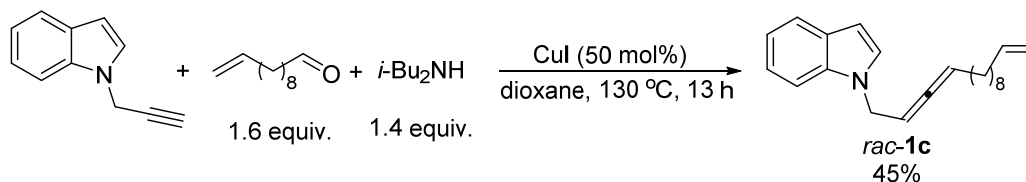
3.2 Synthesis of 1-(tetradeca-2,3-dienyl)-1*H*-indole *rac*-**1b** (jf-2-009)



Following **Typical Procedure I**, the reaction of CuI (0.3842 g, 2 mmol, 99%), diisobutylamine (0.98 mL, $d = 0.74$ g/mL, 0.7237 g, 5.6 mmol), 1-(prop-2-ynyl)-1*H*-indole (0.6204 g, 4 mmol), undecanal (1.0910 g, 6.4 mmol), and dioxane (8 mL) for 13 h at 130 °C afforded *rac*-**1b** (0.9233 g, 75%) [eluent: petroleum ether/diethyl ether = 200/1] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.61 (d, J = 7.8 Hz, 1H, Ar-H), 7.35 (d, J = 8.4 Hz, 1H, Ar-H), 7.22-7.13 (m, 1H, Ar-H), 7.13-7.04 (m, 2H, Ar-H), 6.47 (dd, J_1 = 3.2 Hz, J_2 = 0.8 Hz, 1H, Ar-H), 5.29-5.14 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.66 (dd, J_1 = 6.3 Hz, J_2 = 2.7 Hz, 2H, NCH_2), 2.00-1.87 (m, 2H, CH_2), 1.40-1.14 (m, 16H, $\text{CH}_2 \times 8$), 0.88 (t, J = 6.8 Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 204.5, 136.0, 128.8, 127.5, 121.4, 120.9, 119.3, 109.7, 101.3, 93.5, 87.9, 46.0, 31.9, 29.6, 29.4, 29.3, 29.1, 29.0, 28.6, 22.7, 14.1; IR (neat) ν (cm^{-1}) 3056, 2925, 2853, 1964, 1613, 1512, 1484, 1464, 1395, 1378, 1335, 1313, 1250, 1180, 1123, 1087,

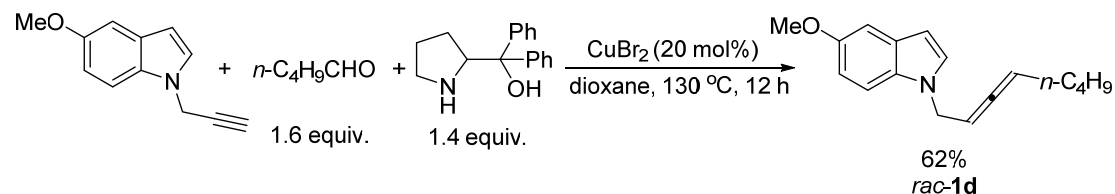
1055, 1012; MS (70 ev, EI) m/z (%) 310 ($M^+ + 1$, 8.13), 309 (M^+ , 30.46), 130 (100); HRMS calcd for $C_{22}H_{31}N$ [M^+]: 309.2457, Found: 309.2458.

3.3 Synthesis of 1-(tetradeca-2,3,13-trienyl)-1*H*-indole *rac*-**1c** (jf-2-029)



Following **Typical Procedure I**, the reaction of CuI (0.3840 g, 2 mmol, 99%), diisobutylamine (0.98 mL, $d = 0.74$ g/mL, 0.7237 g, 5.6 mmol), 1-(prop-2-ynyl)-1*H*-indole (0.6210 g, 4 mmol), undecenal (1.1020 g, 6.4 mmol, 97%), and dioxane (8 mL) for 13 h at 130 °C afforded *rac*-**1c** (0.5547 g, 45%) [eluent: petroleum ether] as a liquid: 1H NMR (300 MHz, $CDCl_3$) δ 7.61 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.34 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.19 (t, $J = 7.7$ Hz, 1H, Ar-H), 7.13-7.05 (m, 2H, Ar-H), 6.48 (dd, $J_1 = 3.2$ Hz, $J_2 = 0.8$ Hz, 1H, Ar-H), 5.88-5.73 (m, 1H, CH=), 5.30-5.15 (m, 2H, CH=C=CH), 5.05-4.89 (m, 2H, =CH₂), 4.67 (dd, $J_1 = 6.0$ Hz, $J_2 = 2.7$ Hz, 2H, NCH₂), 2.09-1.97 (m, 2H, CH₂), 1.99-1.88 (m, 2H, CH₂), 1.47-1.19 (m, 12H, CH₂ $\times$ 6); ^{13}C NMR (75 MHz, $CDCl_3$) δ 204.4, 139.1, 135.9, 128.7, 127.5, 121.3, 120.8, 119.3, 114.1, 109.6, 101.2, 93.5, 87.9, 45.9, 33.8, 29.4, 29.3, 29.1, 29.0, 28.93, 28.86, 28.5; IR (neat) ν (cm^{-1}) 3057, 2977, 2925, 2852, 1964, 1640, 1613, 1512, 1484, 1464, 1396, 1334, 1313, 1254, 1180, 1012; MS (70 ev, EI) m/z (%) 308 ($M^+ + 1$, 5.38), 307 (M^+ , 20.24), 130 (100); HRMS calcd for $C_{22}H_{29}N$ [M^+]: 307.2300, Found: 307.2302.

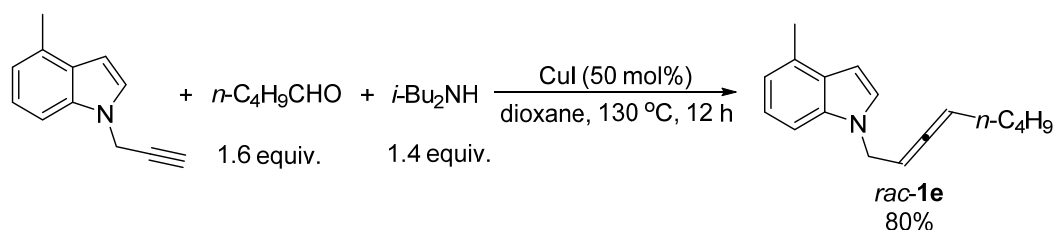
3.4 Synthesis of 5-methoxy-1-(octa-2,3-dienyl)-1*H*-indole *rac*-**1d** (jf-1-196)



Following **Typical Procedure I**, the reaction of CuBr₂ (0.1338 g, 0.6 mmol, 99%), α,α -diphenylprolinol (1.0845 g, 4.2 mmol, 98%), 5-methoxy-1-(prop-2-ynyl)-1*H*-indole (0.5552 g, 3 mmol), pentanal (0.52 mL, $d =$

0.81 g/mL, 0.4212 g, 4.8 mmol, 98%), and dioxane (9.0 mL) for 12 h at 130 °C afforded *rac*-**1d** (0.4760 g, 62%) [eluent: petroleum ether/diethyl ether = 200/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.25 (d, *J* = 8.7 Hz, 1H, Ar-H), 7.09 (d, *J* = 3.0 Hz, 2H, Ar-H), 6.86 (dd, *J*₁ = 8.7 Hz, *J*₂ = 2.4 Hz, 1H, Ar-H), 6.41 (d, *J* = 3.0 Hz, 1H, Ar-H), 5.32-5.13 (m, 2H, CH=C=CH), 4.66 (dd, *J*₁ = 6.3 Hz, *J*₂ = 2.7 Hz, 2H, NCH₂), 3.85 (s, 3H, OCH₃), 2.07-1.86 (m, 2H, CH₂), 1.37-1.22 (m, 4H, CH₂ × 2), 0.88 (t, *J* = 5.9 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.4, 154.0, 131.4, 129.1, 128.1, 111.7, 110.4, 102.6, 100.8, 93.5, 88.0, 55.9, 46.2, 31.1, 28.2, 22.1, 13.8; IR (neat) ν (cm⁻¹) 3101, 2991, 2958, 2929, 2868, 2855, 2829, 1964, 1622, 1575, 1486, 1447, 1394, 1378, 1336, 1295, 1237, 1183, 1151, 1131, 1089, 1033; MS (70 ev, EI) *m/z* (%) 256 (M⁺+1, 11.16), 225 (M⁺, 53.83), 212 (100); HRMS calcd for C₁₇H₂₁NO [M⁺]: 255.1623, Found: 255.1622.

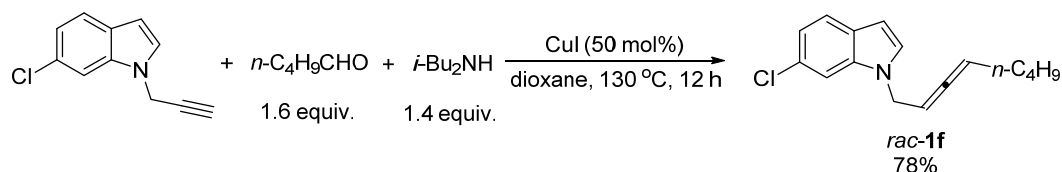
3.5 Synthesis of 4-methyl-1-(octa-2,3-dienyl)-1*H*-indole *rac*-**1e** (jf-2-034)



Typical Procedure II: To a flame-dried Schlenk tube with a polytetrafluoroethylene plug were added CuI (0.3849 g, 2 mmol, 99%), diisobutylamine (0.98 mL, d = 0.74 g/mL, 0.7237 g, 5.6 mmol), 4-methyl-1-(prop-2-ynyl)-1*H*-indole (0.6739 g, 4 mmol)/dioxane (2 mL), pentanal (0.68 mL, d = 0.81 g/mL, 0.5504 g, 6.4 mmol, 98%), and dioxane (6 mL) sequentially. The Schlenk tube was then sealed by screwing the polytetrafluoroethylene plug tightly with the outlet connected to the vacuum line. The reaction was complete after being stirred in an oil bath preheated at 130 °C for 12 h as monitored by TLC. The resulting mixture was cooled to room temperature and diluted with diethyl ether and washed with an aqueous solution of hydrochloric acid (1.2 M). The organic layer was separated and the aqueous layer was extracted with diethyl ether. The combined organic layer was washed with brine and dried over anhydrous Na₂SO₄. After

filtration and evaporation, the residue was purified by column chromatography on silica gel to afford *rac-1e* (0.7584 g, 80%) [eluent: petroleum ether/diethyl ether = 200/1] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.18 (d, J = 8.4 Hz, 1H, Ar-H), 7.11 (d, J = 7.2 Hz, 1H, Ar-H), 7.07 (d, J = 3.0 Hz, 1H, Ar-H), 6.89 (d, J = 6.6 Hz, 1H, Ar-H), 6.49 (dd, J_1 = 3.2 Hz, J_2 = 0.8 Hz, 1H, Ar-H), 5.33-5.12 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.64 (dd, J_1 = 6.0 Hz, J_2 = 2.7 Hz, 2H, NCH_2), 2.54 (s, 3H, CH_3), 2.05-1.90 (m, 2H, CH_2), 1.37-1.17 (m, 4H, $\text{CH}_2 \times 2$), 0.87 (t, J = 7.1 Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 204.4, 135.7, 130.3, 128.6, 126.8, 121.5, 119.5, 107.3, 99.7, 93.4, 88.0, 46.1, 31.1, 28.2, 22.1, 18.7, 13.8; IR (neat) ν (cm^{-1}) 3050, 2957, 2927, 2858, 1964, 1605, 1585, 1514, 1493, 1456, 1423, 1398, 1378, 1338, 1297, 1246, 1200, 1158, 1136, 1069, 1051; MS (70 ev, EI) m/z (%) 240 ($\text{M}^+ + 1$, 7.89), 239 (M^+ , 37.75), 196 (100); HRMS calcd for $\text{C}_{17}\text{H}_{21}\text{N}$ [M^+]: 239.1674, Found: 239.1676.

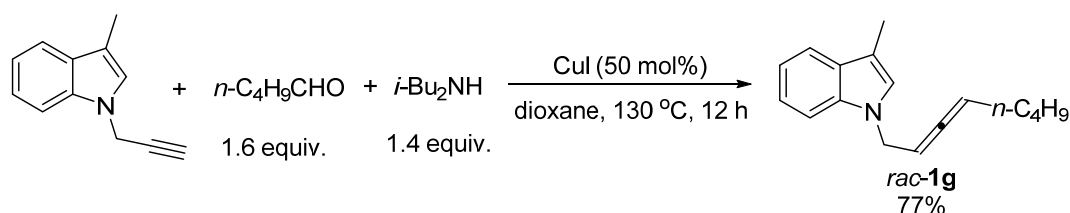
3.6 Synthesis of 6-chloro-1-(octa-2,3-dienyl)-1*H*-indole *rac-1f* (jf-2-060)



Following **Typical Procedure I**, the reaction of CuI (0.3830 g, 2 mmol, 99%), diisobutylamine (0.98 mL, d = 0.74 g/mL, 0.7237 g, 5.6 mmol), 6-chloro-1-(prop-2-ynyl)-1*H*-indole (0.7582 g, 4 mmol), pentanal (0.68 mL, d = 0.81 g/mL, 0.5504 g, 6.4 mmol, 98%), and dioxane (8 mL) for 12 h at 130 °C afforded *rac-1f* (0.8068 g, 78%) [eluent: petroleum ether] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.49 (d, J = 8.4 Hz, 1H, Ar-H), 7.34 (s, 1H, Ar-H), 7.13-6.99 (m, 2H, Ar-H), 6.44 (d, J = 3.0 Hz, 1H, Ar-H), 5.28-5.13 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.66-4.53 (m, 2H, NCH_2), 2.03-1.85 (m, 2H, CH_2), 1.37-1.16 (m, 4H, $\text{CH}_2 \times 2$), 0.86 (t, J = 6.9 Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 204.4, 136.4, 128.4, 127.4, 127.3, 121.6, 120.0, 109.9, 101.4, 93.9, 87.6, 46.1, 31.1, 28.2, 22.1, 13.8; IR (neat) ν (cm^{-1}) 2957, 2928, 2858, 1964, 1689, 1611, 1564, 1508, 1465, 1392, 1338, 1313, 1269, 1240, 1204, 1182, 1126, 1101, 1063, 1053; MS (70 ev, EI) m/z (%) 262 ($\text{M}^+(\text{}^{37}\text{Cl}) + 1$, 1.69), 261 ($\text{M}^+(\text{}^{37}\text{Cl})$, 9.78), 260 ($\text{M}^+(\text{}^{35}\text{Cl}) + 1$, 5.93), 259 ($\text{M}^+(\text{}^{35}\text{Cl})$, 25.88), 216 (100); HRMS

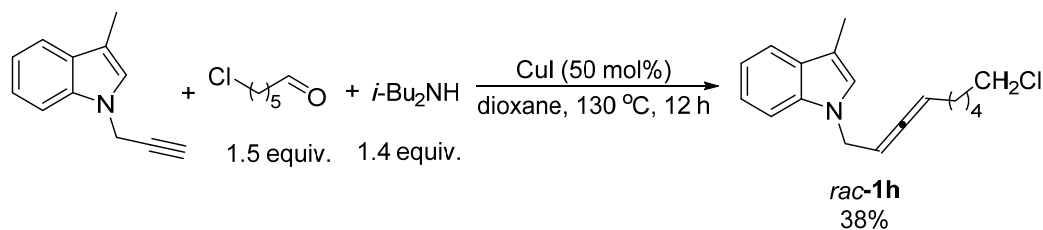
calcd for $C_{16}H_{18}N^{35}Cl$ [M^+]: 259.1128, Found: 259.1128.

3.7 Synthesis of 3-methyl-1-(octa-2,3-dienyl)-1H-indole *rac*-1g (jf-2-080)



Following **Typical Procedure II**, the reaction of CuI (0.3850 g, 2 mmol, 99%), diisobutylamine (0.98 mL, $d = 0.74$ g/mL, 0.7237 g, 5.6 mmol), 3-methyl-1-(prop-2-ynyl)-1H-indole (0.6758 g, 4 mmol)/dioxane (2 mL), pentanal (0.68 mL, $d = 0.81$ g/mL, 0.5504 g, 6.4 mmol, 98%), and dioxane (6 mL) for 12 h at 130 °C afforded *rac*-1g (0.7384 g, 77%) [eluent: petroleum ether] as a liquid: 1H NMR (300 MHz, $CDCl_3$) δ 7.55 (dd, $J_1 = 7.8$ Hz, $J_2 = 0.6$ Hz, 1H, Ar-H), 7.31 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.19 (td, $J_1 = 7.4$ Hz, $J_2 = 1.4$ Hz, 1H, Ar-H), 7.09 (td, $J_1 = 7.4$ Hz, $J_2 = 0.9$ Hz, 1H, Ar-H), 6.87 (s, 1H, Ar-H), 5.30-5.15 (m, 2H, $CH=C=CH$), 4.62 (dd, $J_1 = 5.9$ Hz, $J_2 = 3.2$ Hz, 2H, NCH_2), 2.32 (d, $J = 0.9$ Hz, 3H, CH_3), 2.06-1.90 (m, 2H, CH_2), 1.38-1.23 (m, 4H, $CH_2 \times 2$), 0.88 (t, $J = 7.1$ Hz, 3H, CH_3); ^{13}C NMR (75 MHz, $CDCl_3$) δ 204.4, 136.3, 129.0, 125.2, 121.3, 119.0, 118.6, 110.4, 109.5, 93.3, 88.1, 45.7, 31.2, 28.3, 22.1, 13.9, 9.6; IR (neat) ν (cm^{-1}) 3055, 2956, 2928, 2859, 1964, 1614, 1560, 1482, 1466, 1386, 1329, 1252, 1179, 1126, 1104, 1013; MS (70 ev, EI) m/z (%) 240 ($M^+ + 1$, 7.35), 239 (M^+ , 40.31), 144 (100); HRMS calcd for $C_{17}H_{21}N$ [M^+]: 239.1674, Found: 239.1676.

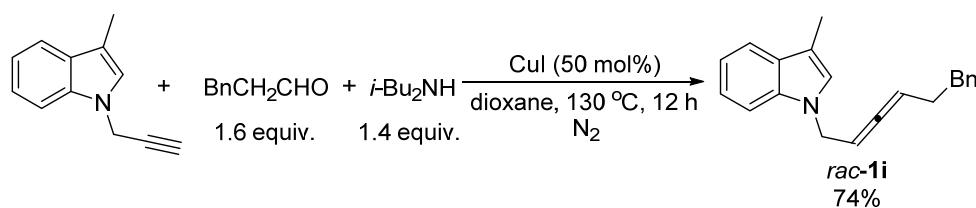
3.8 Synthesis of 1-(9-chloronona-2,3-dienyl)-3-methyl-1H-indole *rac*-1h (jf-2-149)



Following **Typical Procedure II**, the reaction of CuI (0.3837 g, 2 mmol, 99%), diisobutylamine (0.98 mL, $d = 0.74$ g/mL, 0.7237 g, 5.6 mmol), 3-methyl-1-(prop-2-ynyl)-1H-indole (0.6751 g, 4 mmol)/dioxane (2 mL),

6-chlorohexanal (0.8025 g, 6.4 mmol), and dioxane (6 mL) for 12 h at 130 °C afforded *rac*-**1h** (0.4410 g, 38%, 98% purity) [eluent: petroleum ether/diethyl ether = 200/1] as a liquid: ¹H NMR (400 MHz, CDCl₃) δ 7.55 (d, *J* = 7.6 Hz, 1H, Ar-H), 7.30 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.19 (t, *J* = 7.6 Hz, 1H, Ar-H), 7.09 (t, *J* = 7.2 Hz, 1H, Ar-H), 6.87 (s, 1H, Ar-H), 5.32-5.14 (m, 2H, CH=C=CH), 4.63 (dd, *J*₁ = 6.4 Hz, *J*₂ = 2.8 Hz, 2H, NCH₂), 3.49 (t, *J* = 6.8 Hz, 2H, CH₂Cl), 2.32 (s, 3H, CH₃), 2.00-1.92 (m, 2H, CH₂), 1.76-1.68 (m, 2H, CH₂), 1.44-1.27 (m, 4H, CH₂ × 2); ¹³C NMR (100 MHz, CDCl₃) δ 204.4, 136.3, 129.0, 125.2, 121.3, 119.0, 118.6, 110.4, 109.4, 93.0, 88.4, 45.6, 45.0, 32.4, 28.3, 28.1, 26.2, 9.6; IR (neat) ν (cm⁻¹) 3054, 2933, 2859, 1963, 1614, 1558, 1481, 1466, 1386, 1363, 1329, 1257, 1179, 1126, 1102, 1038, 1013; MS (70 ev, EI) *m/z* (%) 289 (M⁺(³⁷Cl), 5.57), 287 (M⁺(³⁵Cl), 14.93), 144 (100); HRMS calcd for C₁₈H₂₂N³⁵Cl [M⁺]: 287.1441, Found: 287.1438.

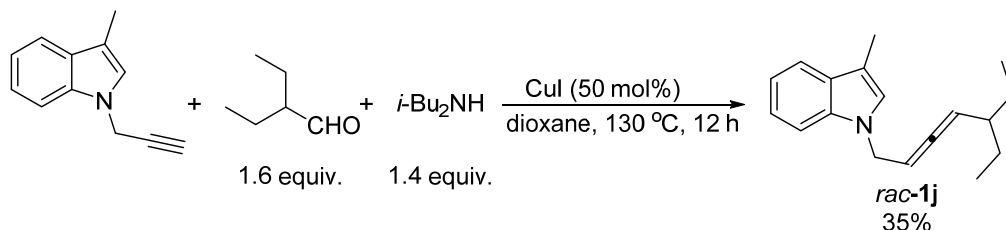
3.9 Synthesis of 3-methyl-1-(6-phenylhexa-2,3-dienyl)-1*H*-indole *rac*-**1i** (jf-3-019)



Following **Typical Procedure II**, the reaction of CuI (0.3845 g, 2 mmol, 99%), diisobutylamine (0.98 mL, *d* = 0.74 g/mL, 0.7237 g, 5.6 mmol), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (0.6762 g, 4 mmol)/dioxane (2 mL), 3-phenylpropanal (0.8591 g, 6.4 mmol), and dioxane (6 mL) for 12 h at 130 °C afforded *rac*-**1i** (0.8396 g, 74%) [eluent: petroleum ether/diethyl ether = 200/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.30-7.22 (m, 3H, Ar-H), 7.22-7.05 (m, 5H, Ar-H), 6.81 (d, *J* = 0.9 Hz, 1H, Ar-H), 5.26-5.17 (m, 2H, CH=C=CH), 4.57-4.50 (m, 2H, NCH₂), 2.59 (t, *J* = 7.7 Hz, 2H, CH₂Ph), 2.35-2.19 (m, 5H, CH₃ + CH₂); ¹³C NMR (75 MHz, CDCl₃) δ 204.5, 141.5, 136.2, 128.9, 128.5, 128.3, 125.9, 125.2, 121.3, 119.0, 118.6, 110.4, 109.4, 92.5, 88.6, 45.4, 35.2, 30.3, 9.6; IR (neat) ν (cm⁻¹) 3084, 3057, 3026, 2916, 2858, 1965, 1614, 1603, 1583, 1559, 1496, 1481, 1465, 1454, 1386, 1329, 1257, 1209, 1180, 1126, 1105, 1078, 1030, 1013; MS (70 ev, EI) *m/z* (%) 288 (M⁺+1, 1.3), 287 (M⁺, 6.0), 196 (100); HRMS calcd for

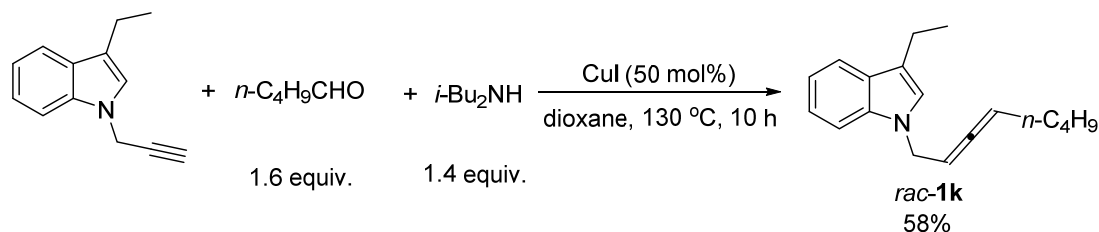
C₂₁H₂₁N [M⁺]: 287.1674, Found: 287.1674.

3.10 Synthesis of 1-(5-ethylhepta-2,3-dienyl)-3-methyl-1H-indole *rac*-1j (jf-3-092)



Following **Typical Procedure II**, the reaction of CuI (0.3850 g, 2 mmol, 99%), diisobutylamine (0.98 mL, *d* = 0.74 g/mL, 0.7237 g, 5.6 mmol), 3-methyl-1-(prop-2-ynyl)-1H-indole (0.6779 g, 4 mmol)/dioxane (2 mL), 2-ethylbutanal (0.82 mL, *d* = 0.814 g/mL, 0.6675 g, 6.4 mmol, 97%), and dioxane (6 mL) for 12 h at 130 °C afforded *rac*-1j (0.3548 g, 35%) [eluent: petroleum ether] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, *J* = 7.5 Hz, 1H, Ar-H), 7.32 (d, *J* = 8.1 Hz, 1H, Ar-H), 7.19 (t, *J* = 7.4 Hz, 1H, Ar-H), 7.09 (t, *J* = 7.4 Hz, 1H, Ar-H), 6.89 (s, 1H, Ar-H), 5.31-5.20 (m, 1H, one proton of CH=C=CH), 5.10-4.97 (m, 1H, one proton of CH=C=CH), 4.70-4.59 (m, 2H, NCH₂), 2.32 (s, 3H, Ar-CH₃), 1.93-1.75 (m, 1H, CH), 1.50-1.16 (m, 4H, CH₂ × 2), 0.85 (t, *J* = 7.1 Hz, 6H, CH₃ × 2); ¹³C NMR (75 MHz, CDCl₃) δ 204.2, 136.3, 129.0, 125.2, 121.3, 118.9, 118.6, 110.4, 109.4, 97.0, 88.1, 45.8, 42.8, 27.6, 27.3, 11.6, 11.5, 9.6; IR (neat) *v* (cm⁻¹) 3056, 2961, 2921, 2873, 1963, 1615, 1558, 1482, 1466, 1386, 1329, 1256, 1179, 1126, 1013; MS (70 ev, EI) *m/z* (%) 254 (M⁺+1, 4.81), 253 (M⁺, 24.75), 224 (100); HRMS calcd for C₁₈H₂₃N [M⁺]: 253.1830, Found: 253.1832.

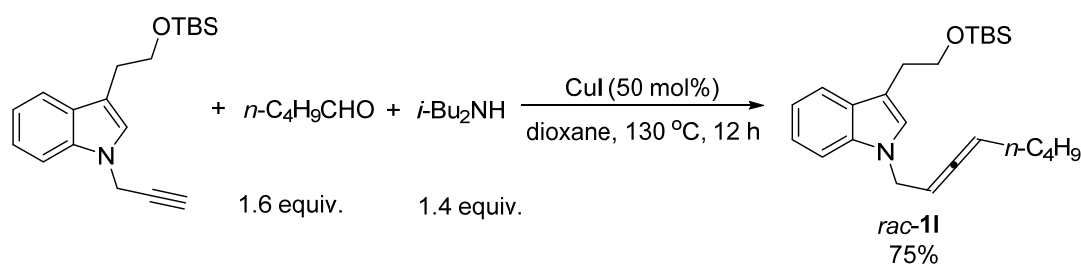
3.11 Synthesis of 3-ethyl-1-(octa-2,3-dienyl)-1H-indole *rac*-1k (jf-3-074)



Following **Typical Procedure II**, the reaction of CuI (0.3758 g, 2 mmol, 99%), diisobutylamine (0.98 mL, *d* = 0.74 g/mL, 0.7235 g, 5.6 mmol), 3-ethyl-1-(prop-2-ynyl)-1H-indole (0.7222 g, 4 mmol)/dioxane (2 mL), pentanal (0.69

mL, $d = 0.81$ g/mL, 0.5616 g, 6.4 mmol, 98%), and dioxane (6 mL) for 10 h at 130 °C afforded *rac*-**1k** (0.5763 g, 58%) [eluent: petroleum ether/ethyl acetate = 100/1] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.59 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.31 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.19 (t, $J = 6.9$ Hz, 1H, Ar-H), 7.08 (t, $J = 7.1$ Hz, 1H, Ar-H), 6.88 (s, 1H, Ar-H), 5.31-5.16 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.63 (dd, $J_1 = 6.0$ Hz, $J_2 = 2.7$ Hz, 2H, NCH_2), 2.77 (q, $J = 7.5$ Hz, 2H, Ar- CH_2), 2.03-1.91 (m, 2H, CH_2), 1.40-1.22 (m, 7H, $\text{CH}_2 \times 2 + \text{CH}_3$), 0.88 (t, $J = 7.1$ Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 204.4, 136.4, 128.1, 124.0, 121.3, 119.0, 118.5, 117.6, 109.5, 93.3, 88.1, 45.8, 31.1, 28.3, 22.1, 18.3, 14.5, 13.9; IR (neat) ν (cm^{-1}) 3055, 2960, 2929, 2871, 2856, 1964, 1614, 1556, 1467, 1417, 1392, 1371, 1333, 1314, 1270, 1177, 1126, 1105, 1064, 1013; MS (70 ev, EI) m/z (%) 254 ($\text{M}^+ + 1$, 9.84), 253 (M^+ , 50.58), 210 (100); HRMS calcd for $\text{C}_{18}\text{H}_{23}\text{N}$ [M^+]: 253.1830, Found: 253.1832.

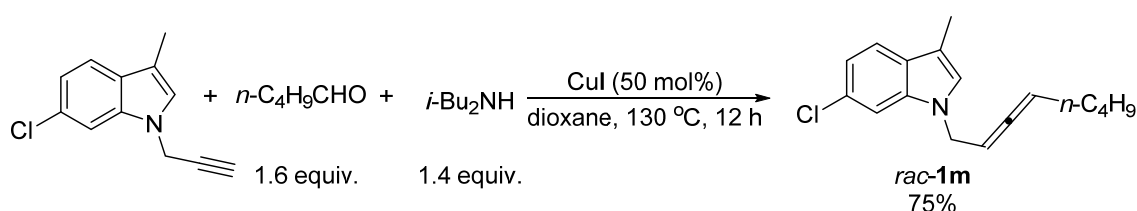
3.12 Synthesis of 3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1-(octa-2,3-dienyl)-1*H*-indole *rac*-**1l** (jf-3-058)



Following **Typical Procedure II**, the reaction of CuI (0.5712 g, 3 mmol, 99%), diisobutylamine (1.46 mL, $d = 0.74$ g/mL, 1.0853 g, 8.4 mmol), 3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1-(prop-2-ynyl)-1*H*-indole (1.8820 g, 6 mmol)/dioxane (2 mL), pentanal (1.02 mL, $d = 0.81$ g/mL, 0.8262 g, 9.6 mmol, 98%), and dioxane (10 mL) for 12 h at 130 °C afforded *rac*-**1l** (1.7205 g, 75%) [eluent: petroleum ether/ethyl acetate = 100/1] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.62 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.36 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.23 (t, $J = 7.5$ Hz, 1H, Ar-H), 7.13 (t, $J = 7.1$ Hz, 1H, Ar-H), 6.99 (s, 1H, Ar-H), 5.34-5.16 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.68 (dd, $J_1 = 5.7$ Hz, $J_2 = 3.3$ Hz, 2H, NCH_2), 3.90 (t, $J = 7.5$ Hz, 2H, CH_2), 3.02 (t, $J = 7.5$ Hz, 2H, CH_2), 2.09-1.93 (m, 2H, CH_2), 1.43-1.27 (m, 4H, $\text{CH}_2 \times$

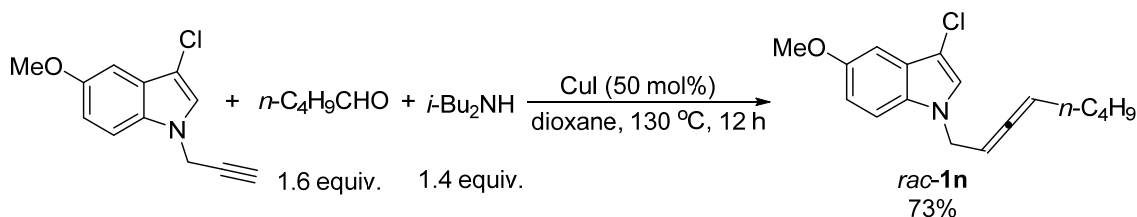
2), 1.00-0.86 (m, 12H, CH₃ + CH₃ × 3), 0.075 (s, 6H, CH₃ × 2); ¹³C NMR (75 MHz, CDCl₃) δ 204.4, 136.1, 128.4, 125.6, 121.3, 119.0, 118.7, 111.8, 109.6, 93.3, 88.0, 64.0, 45.8, 31.2, 29.0, 28.3, 26.0, 22.1, 18.4, 13.9, -5.29; IR (neat) ν (cm⁻¹) 3056, 2956, 2928, 2857, 1964, 1614, 1553, 1470, 1386, 1360, 1332, 1255, 1215, 1174, 1093, 1053, 1013; MS (70 ev, EI) *m/z* (%) 384 (M⁺+1, 9.69), 383 (M⁺, 31.68), 208 (100); HRMS calcd for C₂₄H₃₇NOSi [M⁺]: 383.2644, Found: 383.2646.

3.13 Synthesis of 6-chloro-3-methyl-1-(octa-2,3-dienyl)-1*H*-indole *rac*-**1m** (jf-2-191)



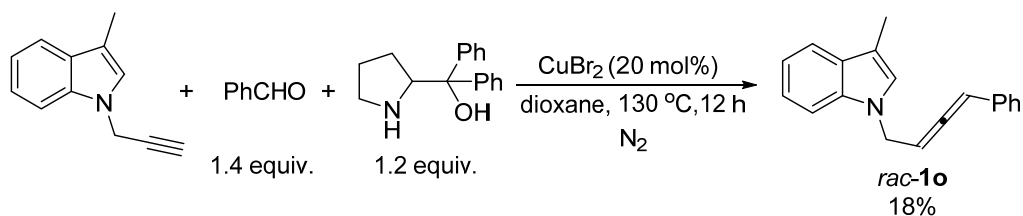
Following **Typical Procedure II**, the reaction of CuI (0.3850 g, 2 mmol, 99%), diisobutylamine (0.98 mL, d = 0.74 g/mL, 0.7237 g, 5.6 mmol), 6-chloro-3-methyl-1-(prop-2-ynyl)-1*H*-indole (0.8148 g, 4 mmol)/dioxane (2 mL), pentanal (0.70 mL, d = 0.81 g/mL, 0.5670 g, 6.4 mmol, 98%), and dioxane (6 mL) for 12 h at 130 °C afforded *rac*-**1m** (0.8200 g, 75%) [eluent: petroleum ether] as a liquid: ¹H NMR (400 MHz, CDCl₃) δ 7.44 (d, *J* = 8.4 Hz, 1H, Ar-H), 7.30 (d, *J* = 1.6 Hz, 1H, Ar-H), 7.05 (dd, *J*₁ = 8.4 Hz, *J*₂ = 2.0 Hz, 1H, Ar-H), 6.86 (s, 1H, Ar-H), 5.26-5.15 (m, 2H, CH=C=CH), 4.60-4.55 (m, 2H, NCH₂), 2.28 (s, 3H, CH₃), 2.02-1.91 (m, 2H, CH₂), 1.34-1.22 (m, 4H, CH₂ × 2), 0.87 (t, *J* = 7.0 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.5, 136.7, 127.6, 127.4, 126.0, 119.8, 119.3, 110.7, 109.6, 93.7, 87.7, 45.8, 31.2, 28.2, 22.1, 13.8, 9.5; IR (neat) ν (cm⁻¹) 2957, 2928, 2860, 1965, 1612, 1552, 1468, 1386, 1362, 1326, 1243, 1177, 1135, 1067; MS (70 ev, EI) *m/z* (%) 275 (M⁺(³⁷Cl), 27.33), 273 (M⁺(³⁵Cl), 83.53), 230 (100); HRMS calcd for C₁₇H₂₀N³⁵Cl [M⁺]: 273.1284, Found: 273.1284.

3.14 Synthesis of 3-chloro-5-methoxy-1-(octa-2,3-dienyl)-1*H*-indole *rac*-**1n** (jf-3-082)



Following **Typical Procedure II**, the reaction of CuI (0.2891 g, 1.5 mmol, 99%), diisobutylamine (0.73 mL, $d = 0.74$ g/mL, 0.5426 g, 4.2 mmol), 3-chloro-5-methoxy-1-(prop-2-ynyl)-1*H*-indole (0.6598 g, 3 mmol)/dioxane (2 mL), pentanal (0.52 mL, $d = 0.81$ g/mL, 0.4212 g, 4.8 mmol, 98%), and dioxane (4 mL) for 12 h at 130 °C afforded *rac*-**1n** (0.6375 g, 73%) [eluent: petroleum ether/ethyl acetate = 100/1] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.22 (d, $J = 8.7$ Hz, 1H, Ar-H), 7.06 (s, 1H, Ar-H), 7.02 (d, $J = 2.7$ Hz, 1H, Ar-H), 6.89 (dd, $J_1 = 8.9$ Hz, $J_2 = 2.6$ Hz, 1H, Ar-H), 5.27-5.15 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.65-4.55 (m, 2H, NCH_2), 3.87 (s, 3H, OCH_3), 2.01-1.86 (m, 2H, CH_2), 1.34-1.17 (m, 4H, $\text{CH}_2 \times 2$), 0.87 (t, $J = 7.1$ Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 204.5, 154.5, 130.3, 126.2, 124.5, 113.3, 111.0, 104.1, 99.3, 93.8, 87.6, 55.7, 46.2, 31.1, 28.2, 22.1, 13.8; IR (neat) ν (cm^{-1}) 3123, 2956, 2929, 2856, 1964, 1624, 1576, 1489, 1451, 1388, 1334, 1292, 1252, 1220, 1177, 1126, 1089, 1035; MS (70 eV, EI) m/z (%) 292 ($\text{M}^+(\text{}^{37}\text{Cl}) + 1$, 1.17), 291 ($\text{M}^+(\text{}^{37}\text{Cl})$, 5.79), 290 ($\text{M}^+(\text{}^{35}\text{Cl}) + 1$, 5.79), 289 ($\text{M}^+(\text{}^{35}\text{Cl})$, 16.88), 254 (100); HRMS calcd for $\text{C}_{17}\text{H}_{20}\text{NO}^{35}\text{Cl}$ [M^+]: 289.1233, Found: 289.1235.

3.15 Synthesis of 3-methyl-1-(4-phenylbuta-2,3-dienyl)-1*H*-indole *rac*-**1o** (jf-2-157)

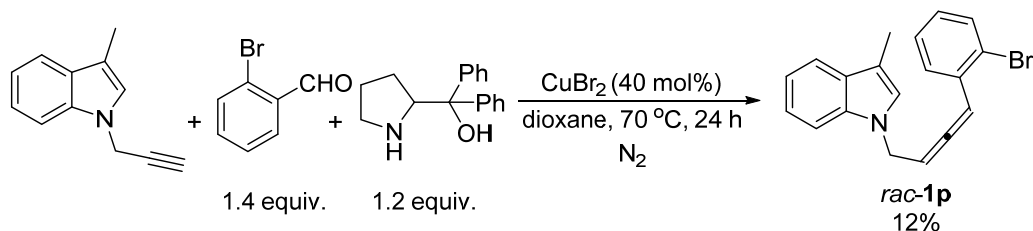


Following **Typical Procedure II**, the reaction of CuBr_2 (0.1818 g, 0.8 mmol, 99%), α,α -diphenylprolinol (1.2142 g, 4.8 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (0.6764 g, 4 mmol)/dioxane (2 mL), benzaldehyde (0.5997 g, 5.6 mmol), and dioxane (4 mL) for 12 h at 130 °C afforded *rac*-**1o** (0.1868 g, 18%)

[eluent: petroleum ether] as a liquid: ^1H NMR (400 MHz, CDCl_3) δ 7.57 (d, J = 8.0 Hz, 1H, Ar-H), 7.33-7.16 (m, 7H, Ar-H), 7.11 (t, J = 7.2 Hz, 1H, Ar-H), 6.90 (s, 1H, Ar-H), 6.27 (dt, J_1 = 6.4 Hz, J_2 = 2.3 Hz, 1H, CH=), 5.68 (q, J = 6.7 Hz, 1H, CH=), 4.75 (dd, J_1 = 6.8 Hz, J_2 = 2.4 Hz, 2H, NCH_2), 2.32 (s, 3H, CH_3); ^{13}C NMR (100 MHz, CDCl_3) δ 205.7, 136.2, 133.5, 129.1, 128.6, 127.3, 127.0, 125.1, 121.5, 119.1, 118.8, 110.9, 109.5, 96.4, 92.1, 45.3, 9.6; IR (neat) ν (cm^{-1}) 3050, 3030, 2916, 2856, 1950, 1614, 1597, 1495, 1481, 1465, 1386, 1364, 1328, 1265, 1178, 1126, 1101, 1072, 1041, 1013; MS (70 ev, EI) m/z (%) 260 ($\text{M}^+ + 1$, 14.68), 259 (M^+ , 76.85), 258 (100); HRMS calcd for $\text{C}_{19}\text{H}_{17}\text{N}$ [M^+]: 259.1361, Found: 259.1361.

3.16 Synthesis of 1-(4-(2-bromophenyl)buta-2,3-dienyl)-3-methyl-1H-indole

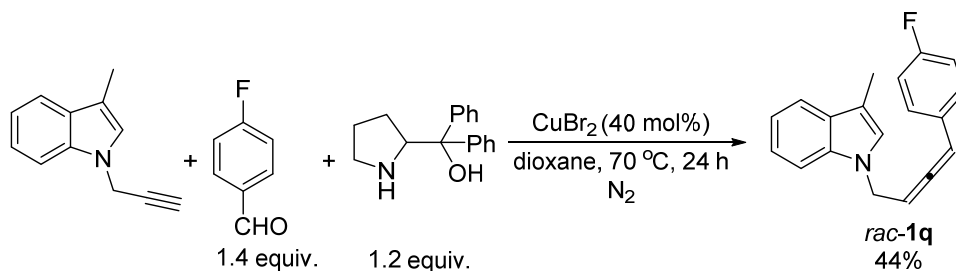
rac-**1p** (**jf**-2-172)



Typical Procedure III: To a flame-dried Schlenk tube with a rubber plug were added CuBr_2 (0.5458 g, 2.4 mmol, 99%), α,α -diphenylprolinol (1.8600 g, 7.2 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1H-indole (1.0143 g, 6 mmol)/dioxane (2 mL), 2-bromobenzaldehyde (1.6380 g, 8.4 mmol, 95%), and dioxane (7 mL) sequentially under nitrogen atmosphere. The reaction was complete after being stirred in an oil bath preheated at 70 $^\circ\text{C}$ for 24 h as monitored by TLC. The resulting mixture was diluted with ether, and washed with an aqueous solution of hydrochloric acid (1.2 M). The organic layer was separated, and the aqueous layer was extracted with ether. The combined organic layer was washed with brine and dried over anhydrous Na_2SO_4 . After filtration and evaporation, the residue was purified by chromatography on silica gel to afford *rac*-**1p** (0.2463 g, 12%) [eluent: petroleum ether] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.57 (d, J = 7.5 Hz, 1H, Ar-H), 7.51 (d, J = 7.8 Hz, 1H, Ar-H), 7.34-7.25 (m, 2H, Ar-H), 7.23-6.98 (m, 4H, Ar-H), 6.89 (s, 1H, Ar-H), 6.74 (dt, J_1 = 6.2 Hz, J_2 = 2.4 Hz, 1H, CH=), 5.72 (q, J = 6.6 Hz, 1H, CH=), 4.76 (dd, J_1 = 6.8 Hz,

$J_2 = 2.3$ Hz, 2H, NCH₂), 2.32 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 206.5, 136.2, 132.99, 132.95, 129.1, 128.65, 128.56, 127.4, 125.1, 122.6, 121.6, 119.1, 118.9, 111.1, 109.4, 95.5, 92.4, 45.1, 9.6; IR (neat) ν (cm⁻¹) 3054, 2916, 2883, 2859, 1951, 1614, 1588, 1561, 1465, 1439, 1403 1385, 1364, 1328, 1287, 1260, 1178, 1126, 1022; MS (70 ev, EI) m/z (%) 339 (M⁺(⁸¹Br), 28.38), 337 (M⁺(⁷⁹Br), 30.63), 168 (100); HRMS calcd for C₁₉H₁₆N⁷⁹Br [M⁺]: 337.0466, Found: 337.0464.

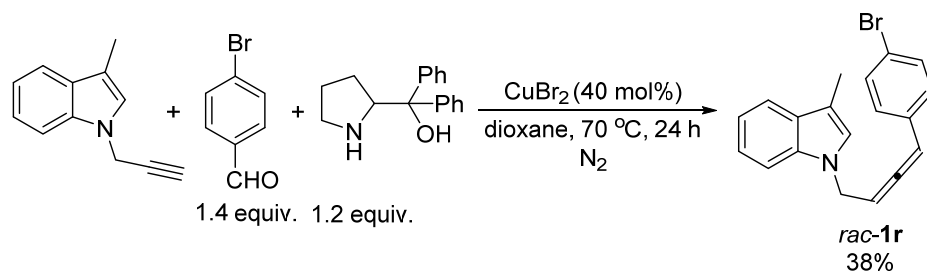
3.17 Synthesis of 1-(4-(4-fluorophenyl)buta-2,3-dienyl)-3-methyl-1H-indole *rac*-**1q** (jf-3-033)



Following **Typical Procedure III**, the reaction of CuBr₂ (0.5461 g, 2.4 mmol, 99%), α,α -diphenylprolinol (1.8580 g, 7.2 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1H-indole (1.0110 g, 6 mmol)/dioxane (2 mL), 4-fluorobenzaldehyde (1.0394 g, 8.4 mmol, 99%), and dioxane (7 mL) for 24 h at 70 °C afforded *rac*-**1q** (0.7268 g, 44%) [eluent: petroleum ether/ethyl acetate = 200/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.56 (d, $J = 7.5$ Hz, 1H, Ar-H), 7.26 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.21-7.06 (m, 4H, Ar-H), 6.93 (t, $J = 8.7$ Hz, 2H, Ar-H), 6.84 (s, 1H, Ar-H), 6.19 (dt, $J_1 = 5.9$ Hz, $J_2 = 2.5$ Hz, 1H, CH=), 5.64 (q, $J = 6.5$ Hz, 1H, CH=), 4.68 (dd, $J_1 = 6.8$ Hz, $J_2 = 2.6$ Hz, 2H, NCH₂), 2.30 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 205.3 (d, $J = 2.0$ Hz), 162.0 (d, $J = 245.4$ Hz), 136.1, 129.4 (d, $J = 3.5$ Hz), 129.1, 128.4 (d, $J = 8.3$ Hz), 125.1, 121.5, 119.1, 118.8, 115.5 (d, $J = 22.1$ Hz), 110.9, 109.4, 95.5, 92.4, 45.2, 9.5; ¹⁹F NMR (282 MHz, CDCl₃) δ -115.2; IR (neat) ν (cm⁻¹) 3048, 2917, 2887, 2861, 1950, 1889, 1603, 1506, 1481, 1464, 1386, 1328, 1299, 1264, 1226, 1178, 1156, 1126, 1092, 1041, 1013; MS (70 ev, EI) m/z (%) 278 (M⁺+1, 11.19), 277 (M⁺, 59.28), 167 (100); HRMS calcd for C₁₉H₁₆NF [M⁺]: 277.1267, Found: 277.1266.

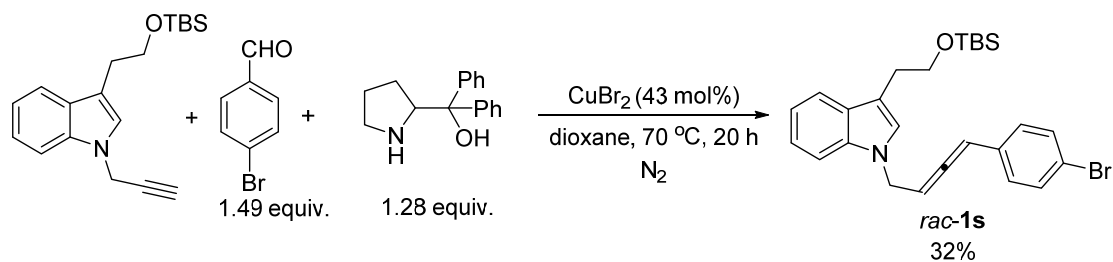
3.18 Synthesis of 1-(4-(4-bromophenyl)buta-2,3-dienyl)-3-methyl-1H-indole

***rac*-1r (jf-3-017)**



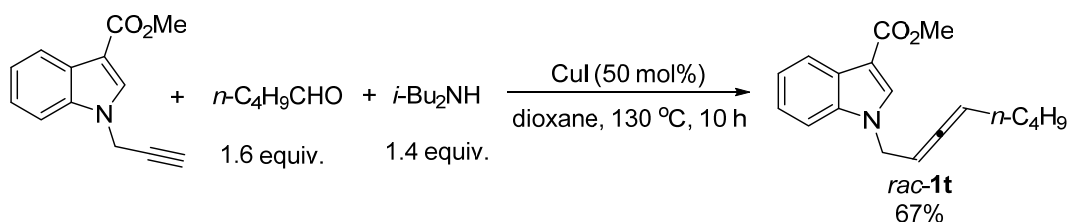
Following **Typical Procedure III**, the reaction of CuBr₂ (0.5466 g, 2.4 mmol, 99%), α,α -diphenylprolinol (1.8580 g, 7.2 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.0133 g, 6 mmol)/dioxane (2 mL), 4-bromobenzaldehyde (1.5548 g, 8.4 mmol, 99%), and dioxane (7 mL) for 24 h at 70 °C afforded *rac*-1r (0.7616 g, 38%) [eluent: petroleum ether (800 mL) to petroleum ether/diethyl ether = 200/1 (800 mL)] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, J = 7.5 Hz, 1H, Ar-H), 7.35 (d, J = 8.7 Hz, 2H, Ar-H), 7.25 (d, J = 8.1 Hz, 1H, Ar-H), 7.17 (td, J_1 = 7.4 Hz, J_2 = 1.0 Hz, 1H, Ar-H), 7.11 (t, J = 7.4 Hz, 1H, Ar-H), 7.02 (d, J = 8.4 Hz, 2H, Ar-H), 6.84 (s, 1H, Ar-H), 6.15 (dt, J_1 = 6.3 Hz, J_2 = 2.4 Hz, 1H, ArCH=), 5.64 (q, J = 6.5 Hz, 1H, CH=), 4.69 (dd, J_1 = 6.8 Hz, J_2 = 2.3 Hz, 2H, NCH₂), 2.30 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 205.6, 136.1, 132.4, 131.6, 129.1, 128.4, 125.0, 121.6, 120.9, 119.1, 118.9, 111.0, 109.4, 95.7, 92.6, 45.0, 9.6; IR (neat) ν (cm⁻¹) 3046, 2916, 2883, 2859, 1951, 1614, 1586, 1487, 1464, 1386, 1363, 1328, 1262, 1177, 1126, 1095, 1069, 1042, 1010; MS (70 ev, EI) m/z (%) 339 (M⁺(⁸¹Br), 18.41), 337 (M⁺(⁷⁹Br), 17.35), 168 (100); HRMS calcd for C₁₉H₁₆N⁷⁹Br [M⁺]: 337.0466, Found: 337.0463.

3.19 Synthesis of 1-(4-(4-bromophenyl)buta-2,3-dienyl)-3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1*H*-indole *rac*-1s (jf-3-085)



Following **Typical Procedure III**, the reaction of CuBr₂ (0.9005 g, 4 mmol, 99%), α,α -diphenylprolinol (3.0970 g, 12 mmol, 98%), 3-(2-((*tert*-butyldimethylsilyl)oxy)-ethyl)-1-(prop-2-ynyl)-1*H*-indole (2.9504 g, 9.4 mmol)/dioxane (2 mL), 4-bromobenzaldehyde (2.6154 g, 14 mmol, 99%), and dioxane (13 mL) for 20 h at 70 °C afforded *rac*-**1s** (1.4622 g, 32%) [eluent: petroleum ether/diethyl ether = 50/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.61 (d, *J* = 7.5 Hz, 1H, Ar-H), 7.41 (d, *J* = 8.1 Hz, 2H, Ar-H), 7.31 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.21 (td, *J*₁ = 7.4 Hz, *J*₂ = 1.0 Hz, 1H, Ar-H), 7.14 (dd, *J*₁ = 7.7 Hz, *J*₂ = 1.1 Hz, 1H, Ar-H), 7.09 (d, *J* = 8.4 Hz, 1H, Ar-H), 6.98 (s, 1H, Ar-H), 6.22 (td, *J*₁ = 6.0 Hz, *J*₂ = 2.5 Hz, 1H, =CH), 5.72 (q, *J* = 6.6 Hz, 2H, CH=), 4.79 (dd, *J*₁ = 6.6 Hz, *J*₂ = 2.7 Hz, 2H, NCH₂), 3.85 (t, *J* = 7.4 Hz, 2H, CH₂), 2.99 (t, *J* = 7.5 Hz, 2H, CH₂), 0.92 (m, 9H, CH₃ $\times$ 3), 0.05 (s, 6H, CH₃ $\times$ 2); ¹³C NMR (75 MHz, CDCl₃) δ 205.7, 136.1, 132.5, 131.7, 128.6, 128.5, 125.5, 121.6, 121.0, 119.2, 119.0, 112.5, 109.5, 95.8, 92.6, 63.9, 45.2, 28.9, 26.0, 18.4, -5.28; IR (neat) ν (cm⁻¹) 3045, 2953, 2927, 2856, 1952, 1614, 1588, 1488, 1465, 1387, 1356, 1332, 1254, 1174, 1094, 1010; MS (70 ev, EI) *m/z* (%) 484 (M⁺(⁸¹Br) + 1, 4.70), 483 (M⁺(⁸¹Br), 13.28), 482 (M⁺(⁷⁹Br) + 1, 5.57), 481 (M⁺(⁷⁹Br), 13.49), 167 (100); HRMS calcd for C₂₆H₃₂⁷⁹BrNOSi [M⁺]: 481.1437, Found: 481.1434.

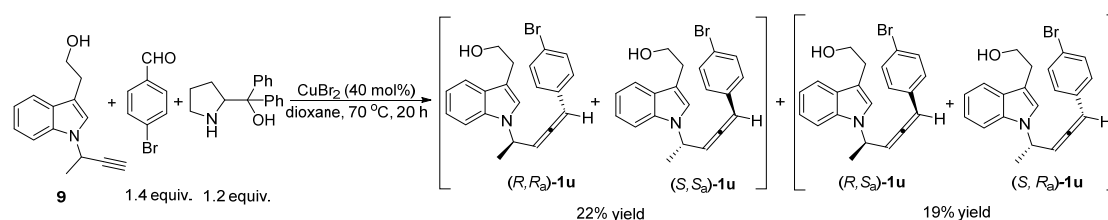
3.20 Synthesis of methyl 1-(octa-2,3-dienyl)-1*H*-indole-3-carboxylate *rac*-**1t** (jf-3-112)



Following **Typical Procedure II**, the reaction of CuI (0.5720 g, 3 mmol, 99%), diisobutylamine (1.47 mL, *d* = 0.74 g/mL, 0.7237 g, 8.4 mmol), methyl 1-(prop-2-ynyl)-1*H*-indole-3-carboxylate (1.2780 g, 6 mmol)/dioxane (2 mL), pentanal (1.04 mL, *d* = 0.81 g/mL, 0.8424 g, 9.6 mmol, 98%), and dioxane (10 mL) for 10 h at 130 °C afforded *rac*-**1t** (1.1348 g, 67%) [eluent: petroleum ether/ ethyl

acetate = 15/1] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 8.24-8.07 (m, 1H, Ar-H), 7.83 (s, 1H, Ar-H), 7.41-7.31 (m, 1H, Ar-H), 7.31-7.18 (m, 2H, Ar-H), 5.35-5.12 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.68 (dd, $J_1 = 5.9$ Hz, $J_2 = 2.9$ Hz, 2H, NCH_2), 3.90 (s, 3H, OCH_3), 2.01-1.81 (m, 2H, CH_2), 1.36-1.13 (m, 4H, $\text{CH}_2 \times 2$), 0.85 (t, $J = 6.3$ Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 204.6, 165.4, 136.4, 134.1, 126.8, 122.6, 121.8, 121.6, 110.2, 107.0, 94.2, 87.0, 50.8, 46.3, 31.0, 28.0, 22.0, 13.7; IR (neat) ν (cm^{-1}) 3120, 3054, 2955, 2925, 2872, 1965, 1705, 1615, 1537, 1486, 1466, 1381, 1340, 1267, 1239, 1179, 1121, 1091, 1029, 1014; MS (70 ev, EI) m/z (%) 284 ($\text{M}^+ + 1$, 9.91), 283 (M^+ , 48.42), 180 (100); HRMS calcd for $\text{C}_{18}\text{H}_{21}\text{NO}_2$ [M^+]: 283.1572, Found: 283.1570.

3.21 Synthesis of (*R,R*)-2-((5-(4-bromophenyl)penta-3,4-dien-2-yl)-1*H*-indol-3-yl)ethanol (*R,R*)-1u, (*S,S*)-2-((5-(4-bromophenyl)penta-3,4-dien-2-yl)-1*H*-indol-3-yl)ethanol (*S,S*)-1u, (*R,S*)-2-((5-(4-bromophenyl)penta-3,4-dien-2-yl)-1*H*-indol-3-yl)-ethanol (*R,S*)-1u, and (*S,R*)-2-((5-(4-bromophenyl)penta-3,4-dien-2-yl)-1*H*-indol-3-yl)-ethanol (*S,R*)-1u (jf-5-116)



Following **Typical Procedure III**, the reaction of CuBr_2 (0.4500 g, 2.0 mmol, 99%), α,α -diphenylprolinol (1.5482 g, 6 mmol, 98%), **9** (1.0625 g, 5 mmol)/dioxane (2 mL), 4-bromobenzaldehyde (1.2974 g, 7 mmol, 99%), and dioxane (5.5 mL) for 20 h at 70 $^\circ\text{C}$ afforded ((*R,R*)-**1u** + (*S,S*)-**1u**) (0.4172 g, 22%) (0.2329 g) and ((*R,S*)-**1u** + (*S,R*)-**1u**) (0.3735 g, 19%) [first round eluent: petroleum ether/ ethyl acetate = 8/1 (450 mL) to 6/1 (500 mL) to 5/1 (500 mL); second round eluent: petroleum ether/ ethyl acetate = 8/1 (500 mL) to 5/1 (500 mL)].

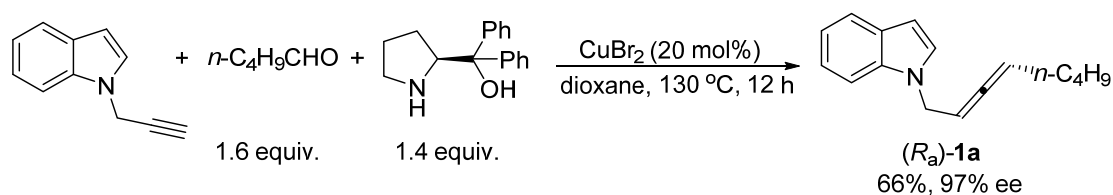
((*R,R*)-**1u** + (*S,S*)-**1u**): liquid; ^1H NMR (300 MHz, CDCl_3) δ 7.59 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.45-7.31 (m, 3H, Ar-H), 7.28-7.17 (m, 1H, Ar-H), 7.17-6.96 (m, 4H, Ar-H), 6.25 (dd, $J_1 = 6.2$ Hz, $J_2 = 2.9$ Hz, 1H, $=\text{CH}$), 5.80 (t, $J = 5.9$ Hz, 1H, $\text{CH}=\text{CH}$), 5.23-5.07

(m, 1H, NCH), 3.85 (t, $J = 6.5$ Hz, 2H, OCH₂), 3.00 (t, $J = 6.3$ Hz, 2H, CH₂), 1.80-1.58 (m, 4H, CH₃ + OH); ¹³C NMR (75 MHz, CDCl₃) δ 204.6, 136.1, 132.6, 131.7, 128.2, 122.7, 121.7, 121.0, 119.2, 119.1, 111.6, 109.7, 98.3, 96.9, 62.6, 50.1, 28.7, 20.2; IR (neat) ν (cm⁻¹) 3396, 3048, 2972, 2926, 2852, 1950, 1611, 1488, 1460, 1427, 1361, 1312, 1224, 1193, 1069, 1045, 1010; MS (70 ev, EI) m/z (%) 383 ($M^+(\text{}^{81}\text{Br})$, 8.15), 381 ($M^+(\text{}^{79}\text{Br})$, 7.37), 363 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M^+]: 381.0728, Found: 381.0725.

((*R,S*_a)-**1u** + (*S,R*_a)-**1u**): liquid; ¹H NMR (300 MHz, CDCl₃) δ 7.60 (d, $J = 7.5$ Hz, 1H, Ar-H), 7.47-7.27 (m, 3H, Ar-H), 7.27-6.98 (m, 5H, Ar-H), 6.25 (dd, $J_1 = 6.6$ Hz, $J_2 = 2.1$ Hz, 1H, =CH), 5.77 (t, $J = 6.0$ Hz, 1H, CH=), 5.28-5.08 (m, 1H, NCH), 3.84 (t, $J = 6.3$ Hz, 2H, OCH₂), 2.99 (t, $J = 6.3$ Hz, 2H, CH₂), 1.78-1.53 (m, 4H, CH₃ + OH); ¹³C NMR (75 MHz, CDCl₃) δ 204.7, 136.0, 132.4, 131.7, 128.3, 128.2, 122.7, 121.7, 121.0, 119.2, 119.1, 111.5, 109.8, 98.2, 96.8, 62.6, 50.0, 28.7, 20.1; IR (neat) ν (cm⁻¹) 3391, 3048, 2976, 2929, 1950, 1611, 1488, 1460, 1427, 1361, 1224, 1193, 1068, 1045, 1010; MS (70 ev, EI) m/z (%) 383 ($M^+(\text{}^{81}\text{Br})$, 14.64), 381 ($M^+(\text{}^{79}\text{Br})$, 14.61), 212 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M^+]: 381.0728, Found: 381.0726.

4. Synthesis of optically active *N*-allenylindoles⁵

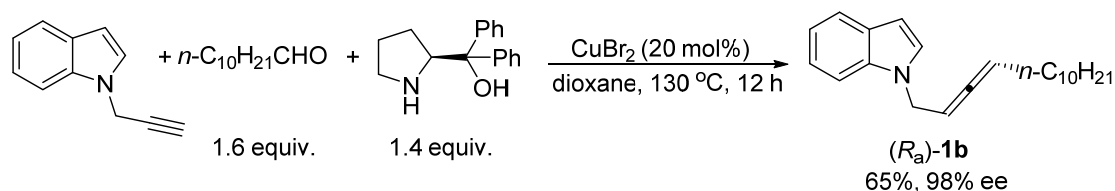
4.1 Synthesis of (*R*_a)-1-(octa-2,3-dienyl)-1*H*-indole (*R*_a)-**1a**. (jf-1-155)



Following **Typical Procedure I**, the reaction of CuBr₂ (0.6823 g, 3 mmol, 99%), (*S*)- α,α -diphenylprolinol (5.4215 g, 21 mmol, 98%), 1-(prop-2-ynyl)-1*H*-indole (2.3249 g, 15 mmol), pentanal (2.6 mL, $d = 0.81$ g/mL, 2.1060 g, 24 mmol, 98%), and dioxane (45 mL) for 12 h at 130 °C afforded (*R*_a)-**1a** (2.2244 g, 66%) [eluent: petroleum ether] as a liquid: 97% ee (HPLC conditions: Chiralcel AD-H column, *n*-hexane/*i*-PrOH = 200/1, 0.7 mL/min, $\lambda = 214$ nm, t_R (major) = 6.9 min, t_R (minor) = 6.5 min); $[\alpha]_D^{20} = -38.2$ ($c = 0.945$, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.62 (d, J

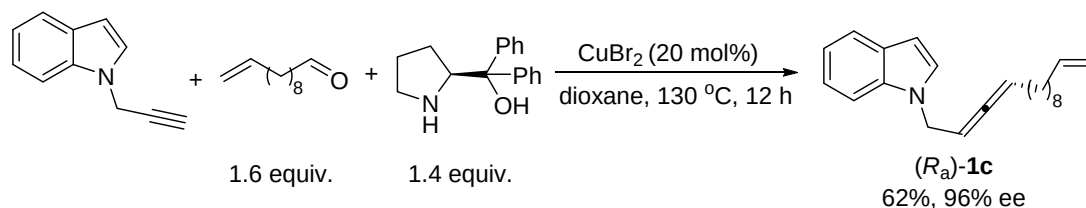
= 7.8 Hz, 1H, Ar-H), 7.37 (dd, $J_1 = 8.1$ Hz, $J_2 = 0.9$ Hz, 1H, Ar-H), 7.20 (td, $J_1 = 7.5$ Hz, $J_2 = 1.2$ Hz, 1H, Ar-H), 7.16-7.05 (m, 2H, Ar-H), 6.49 (dd, $J_1 = 3.0$ Hz, $J_2 = 0.9$ Hz, 1H, Ar-H), 5.32-5.13 (m, 2H, CH=C=CH), 4.70 (dd, $J_1 = 6.2$ Hz, $J_2 = 2.9$ Hz, 2H, NCH₂), 2.03-1.86 (m, 2H, CH₂), 1.38-1.20 (m, 4H, CH₂ × 2), 0.87 (t, $J = 7.1$ Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.5, 136.0, 128.8, 127.5, 121.3, 120.9, 119.3, 109.7, 101.3, 93.5, 87.9, 45.9, 31.1, 28.2, 22.1, 13.8; IR (neat) ν (cm⁻¹) 3056, 2951, 2928, 2858, 1963, 1613, 1511, 1484, 1464, 1420, 1396, 1378, 1334, 1313, 1253, 1180, 1123, 1088, 1054, 1012; MS (70 ev, EI) m/z (%) 226 (M⁺+1, 3.48), 225 (M⁺, 20.97), 130 (100); HRMS calcd for C₁₆H₁₉N [M⁺]: 225.1517, Found: 225.1517.

4.2 Synthesis of (*R*_a)-1-(tetradeca-2,3-dienyl)-1*H*-indole (*R*_a)-1b. (jf-2-008)



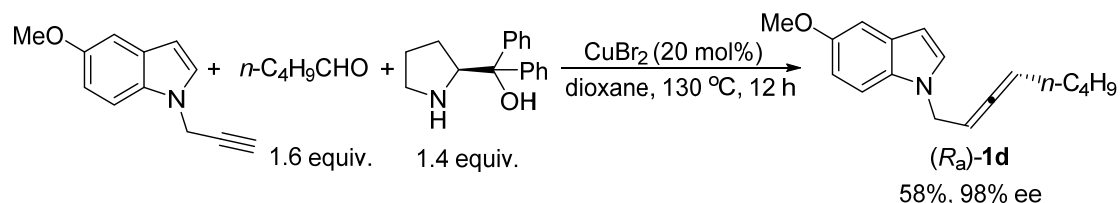
Following **Typical Procedure I**, the reaction of CuBr₂ (0.3629 g, 1.6 mmol, 99%), (*S*)-α,α-diphenylprolinol (2.8914 g, 11.2 mmol, 98%), 1-(prop-2-ynyl)-1*H*-indole (1.2405 g, 8 mmol), undecanal (2.1831 g, 12.8 mmol), and dioxane (24 mL) for 12 h at 130 °C afforded (*R*_a)-1b (1.6153 g, 65%) [eluent: petroleum ether /diethyl ether = 200/1] as a liquid: 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 200/1, 0.7 mL/min, λ = 214 nm, t_R (major) = 15.4 min, t_R (minor) = 14.8 min); $[\alpha]_D^{20} = -30.4$ ($c = 1.355$, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.61 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.34 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.19 (td, $J_1 = 7.6$ Hz, $J_2 = 1.3$ Hz, 1H, Ar-H), 7.13-7.03 (m, 2H, Ar-H), 6.47 (dd, $J_1 = 3.3$ Hz, $J_2 = 0.6$ Hz, 1H, Ar-H), 5.29-5.15 (m, 2H, CH=C=CH), 4.66 (dd, $J_1 = 6.2$ Hz, $J_2 = 2.9$ Hz, 2H, NCH₂), 2.02-1.86 (m, 2H, CH₂), 1.37-1.17 (m, 16H, CH₂ × 8), 0.88 (t, $J = 6.6$ Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.4, 135.9, 128.7, 127.5, 121.3, 120.9, 119.3, 109.7, 101.2, 93.5, 87.9, 46.0, 31.9, 29.6, 29.4, 29.3, 29.1, 29.0, 28.6, 22.7, 14.1; IR (neat) ν (cm⁻¹) 3056, 2925, 2853, 1964, 1613, 1575, 1512, 1485, 1464, 1396, 1335, 1313, 1254, 1180, 1123, 1080, 1055, 1012; MS (70 ev, EI) m/z (%) 310 (M⁺+1, 3.52), 309 (M⁺, 14.88), 130 (100); HRMS calcd for C₂₂H₃₁N [M⁺]: 309.2457, Found: 309.2457.

4.3 Synthesis of (*R_a*)-1-(tetradeca-2,3,13-trienyl)-1*H*-indole (*R_a*)-1c (jf-2-065)



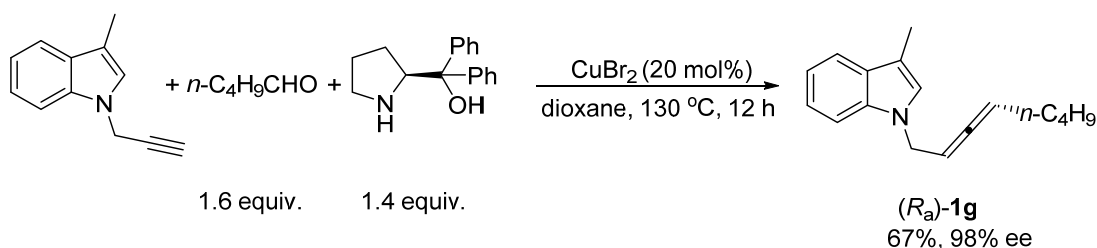
Following **Typical Procedure I**, the reaction of CuBr₂ (0.3621 g, 1.6 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.8918 g, 11.2 mmol, 98%), 1-(prop-2-ynyl)-1*H*-indole (1.2391 g, 8 mmol), undecenal (2.1914 g, 12.8 mmol, 98%), and dioxane (24 mL) for 12 h at 130 °C afforded (*R_a*)-1c (1.5325 g, 62%) [eluent: petroleum ether] as a liquid: 96% ee (HPLC conditions: Chiralcel OJ-H column, *n*-hexane/*i*-PrOH = 100/1, 1.0 mL/min, λ = 214 nm, t_R (major) = 13.2 min, t_R (minor) = 13.9 min); $[\alpha]_D^{20}$ = -30.7 (c = 1.75, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.62 (d, J = 7.8 Hz, 1H, Ar-H), 7.35 (d, J = 8.1 Hz, 1H, Ar-H), 7.19 (td, J_1 = 7.6 Hz, J_2 = 1.0 Hz, 1H, Ar-H), 7.14-7.03 (m, 2H, Ar-H), 6.48 (d, J = 3.0 Hz, 1H, Ar-H), 5.90-5.72 (m, 1H, CH=), 5.30-5.14 (m, 2H, CH=C=CH), 5.05-4.88 (m, 2H, =CH₂), 4.68 (dd, J_1 = 6.3 Hz, J_2 = 2.7 Hz, 2H, NCH₂), 2.08-1.99 (m, 2H, CH₂), 1.99-1.87 (m, 2H, CH₂), 1.43-1.15 (m, 12H, CH₂ $\times$ 6); ¹³C NMR (75 MHz, CDCl₃) δ 204.4, 139.2, 136.0, 128.7, 127.5, 121.3, 120.9, 119.3, 114.1, 109.7, 101.2, 93.5, 87.9, 46.0, 33.8, 29.4, 29.3, 29.1, 29.01, 28.96, 28.9, 28.5; IR (neat) ν (cm⁻¹) 3058, 2975, 2925, 2853, 1965, 1640, 1613, 1512, 1485, 1464, 1396, 1335, 1313, 1253, 1180, 1012; MS (70 ev, EI) m/z (%) 308 (M^+ +1, 6.80), 307 (M^+ , 29.80), 130 (100); HRMS calcd for C₂₂H₂₉N [M^+]: 307.2300, Found: 307.2301.

4.4 Synthesis of (*R_a*)-5-methoxy-1-(octa-2,3-dienyl)-1*H*-indole (*R_a*)-1d (jf-1-192)



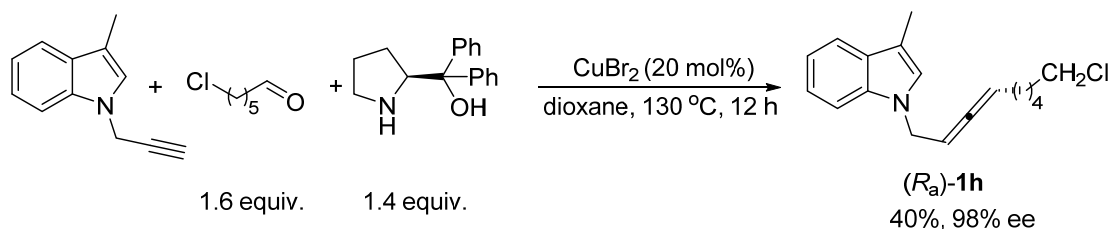
Following **Typical Procedure I**, the reaction of CuBr₂ (0.2736 g, 1.2 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.1681 g, 8.4 mmol, 98%), 5-methoxy-1-(prop-2-ynyl)-1*H*-indole (1.1107 g, 6 mmol), pentanal (1.04 mL, d = 0.81 g/mL, 0.8424 g, 9.6 mmol, 98%), and dioxane (18 mL) for 12 h at 130 °C

4.7 Synthesis of (*R_a*)-3-methyl-1-(octa-2,3-dienyl)-1*H*-indole (*R_a*)-1g (jf-2-081)



Following **Typical Procedure II**, the reaction of CuBr₂ (0.3646 g, 1.6 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.8903 g, 11.2 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.3565 g, 8 mmol)/dioxane (2 mL), pentanal (1.39 mL, *d* = 0.81 g/mL, 1.1259 g, 12.8 mmol, 98%), and dioxane (22 mL) for 12 h at 130 °C afforded (*R_a*)-**1g** (1.2777 g, 67%) [eluent: petroleum ether] as a liquid: 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 100/1, 0.5 mL/min, λ = 214 nm, *t_R* (major) = 18.8 min, *t_R* (minor) = 17.5 min); [α]_D²⁰ = -37.9 (*c* = 1.23, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, *J* = 5.7 Hz, 1H, Ar-H), 7.31 (d, *J* = 6.0 Hz, 1H, Ar-H), 7.19 (t, *J* = 5.4 Hz, 1H, Ar-H), 7.09 (t, *J* = 5.6 Hz, 1H, Ar-H), 6.88 (s, 1H, Ar-H), 5.28-5.16 (m, 2H, CH=C=CH), 4.63 (dd, *J*₁ = 4.7 Hz, *J*₂ = 2.3 Hz, 2H, NCH₂), 2.32 (s, 3H, CH₃), 2.06-1.92 (m, 2H, CH₂), 1.36-1.22 (m, 4H, CH₂ × 2), 0.88 (t, *J* = 5.3 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.4, 136.3, 129.0, 125.2, 121.3, 118.9, 118.6, 110.4, 109.5, 93.3, 88.1, 45.7, 31.2, 28.3, 22.1, 13.9, 9.6; IR (neat) ν (cm⁻¹) 3055, 2956, 2928, 2859, 1964, 1614, 1558, 1482, 1466, 1386, 1363, 1329, 1255, 1179, 1126, 1104, 1041, 1013; MS (70 ev, EI) *m/z* (%) 240 (*M*⁺+1, 9.23), 239 (*M*⁺, 45.55), 196 (100); HRMS calcd for C₁₇H₂₁N [*M*⁺]: 239.1674, Found: 239.1674.

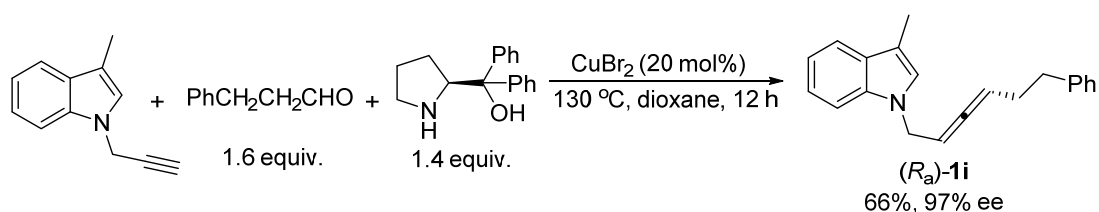
4.8 Synthesis of (*R_a*)-1-(9-chloronona-2,3-dienyl)-3-methyl-1*H*-indole (*R_a*)-1h (jf-2-140)



Following **Typical Procedure II**, the reaction of CuBr₂ (0.2728 g, 1.2 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.1683 g, 8.4 mmol, 98%),

3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.0034 g, 6 mmol)/dioxane (2 mL), 6-chlorohexanal (1.2916 g, 9.6 mmol), and dioxane (16 mL) for 12 h at 130 °C afforded (*R*_a)-**1h** (0.7006 g, 40%, 97% purity) [eluent: petroleum ether/diethyl ether = 200/1] as a liquid: 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 100/1, 1.0 mL/min, λ = 254 nm, *t*_R (major) = 14.9 min, *t*_R (minor) = 15.6 min); $[\alpha]_{\text{D}}^{20}$ = -30.3 (*c* = 0.92, CHCl₃); ¹H NMR (400 MHz, CDCl₃) δ 7.55 (d, *J* = 7.6 Hz, 1H, Ar-H), 7.30 (d, *J* = 8.4 Hz, 1H, Ar-H), 7.19 (t, *J* = 7.6 Hz, 1H, Ar-H), 7.09 (t, *J* = 7.2 Hz, 1H, Ar-H), 6.87 (s, 1H, Ar-H), 5.32-5.12 (m, 2H, CH=C=CH), 4.63 (dd, *J*₁ = 6.4 Hz, *J*₂ = 2.8 Hz, 2H, NCH₂), 3.49 (t, *J* = 6.8 Hz, 2H, CH₂Cl), 2.32 (s, 3H, CH₃), 2.00-1.91 (m, 2H, CH₂), 1.76-1.67 (m, 2H, CH₂), 1.44-1.27 (m, 4H, CH₂ × 2); ¹³C NMR (100 MHz, CDCl₃) δ 204.4, 136.3, 128.9, 125.2, 121.3, 119.0, 118.6, 110.4, 109.4, 93.0, 88.4, 45.6, 45.0, 32.4, 28.3, 28.1, 26.2, 9.6; IR (neat) ν (cm⁻¹) 3054, 2932, 2860, 1964, 1614, 1559, 1481, 1465, 1386, 1329, 1257, 1209, 1180, 1126, 1104, 1040, 1013; MS (70 ev, EI) *m/z* (%) 289 (M⁺(³⁷Cl), 9.90), 287 (M⁺(³⁵Cl), 28.45), 144 (100); HRMS calcd for C₁₈H₂₂N³⁵Cl [M⁺]: 287.1441, Found: 287.1440.

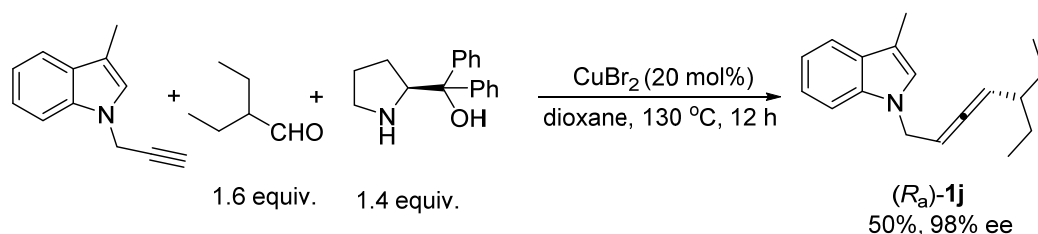
4.9 Synthesis of (*R*_a)-3-methyl-1-(6-phenylhexa-2,3-dienyl)-1*H*-indole (*R*_a)-**1i** (jf-3-018)



Following **Typical Procedure II**, the reaction of CuBr₂ (0.2727 g, 1.2 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.1687 g, 8.4 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.0173 g, 6 mmol)/dioxane (2 mL), 3-phenylpropanal (1.3154 g, 9.6 mmol), and dioxane (16 mL) for 12 h at 130 °C afforded (*R*_a)-**1i** (1.1060 g, 66%) [eluent: petroleum ether/diethyl ether = 200/1] as a liquid: 97% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.7 mL/min, λ = 254 nm, *t*_R (major) = 15.1 min, *t*_R (minor) = 13.2 min); $[\alpha]_{\text{D}}^{20}$ = -21.0 (*c* = 1.17, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, *J* = 7.5 Hz, 1H, Ar-H),

7.30-7.23 (m, 3H, Ar-H), 7.22-7.05 (m, 5H, Ar-H), 6.81 (s, 1H, Ar-H), 5.28-5.13 (m, 2H, CH=C=CH), 4.58-4.47 (m, 2H, NCH₂), 2.59 (t, $J = 7.7$ Hz, 2H, CH₂Ph), 2.37-2.17 (m, 5H, CH₂ + CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.4, 141.4, 136.2, 128.9, 128.5, 128.3, 125.9, 125.2, 121.3, 119.0, 118.6, 110.4, 109.4, 92.5, 88.6, 45.4, 35.2, 30.3, 9.6; IR (neat) ν (cm⁻¹) 3084, 3057, 3026, 2916, 2858, 1965, 1614, 1603, 1579, 1555, 1496, 1481, 1466, 1454, 1386, 1329, 1257, 1209, 1180, 1126, 1104, 1077, 1031, 1013; MS (70 ev, EI) m/z (%) 288 (M⁺+1, 2.3), 287 (M⁺, 7.3), 196 (100); HRMS calcd for C₂₁H₂₁N [M⁺]: 287.1674, Found: 287.1672.

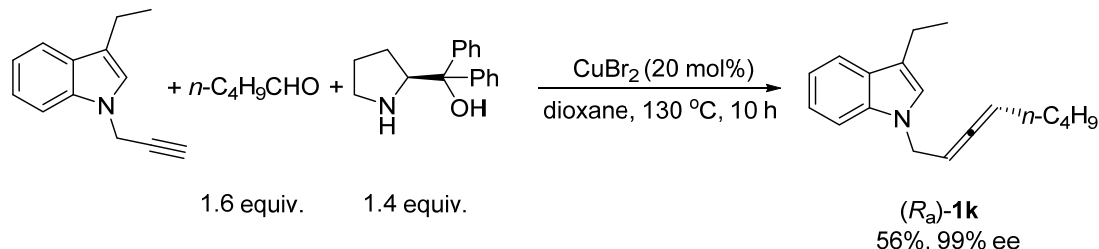
4.10 Synthesis of (*R_a*)-1-(5-ethylhepta-2,3-dienyl)-3-methyl-1*H*-indole (*R_a*)-**1j** (jf-3-093)



Following **Typical Procedure II**, the reaction of CuBr₂ (0.2735 g, 1.2 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.1690 g, 8.4 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.0122 g, 6 mmol)/dioxane (2 mL), 2-ethylbutanal (1.2 mL, $d = 0.814$ g/mL, 0.9917 g, 9.6 mmol, 97%), and dioxane (16 mL) for 12 h at 130 °C afforded (*R_a*)-**1j** (0.7625 g, 50%) [eluent: petroleum ether] as a liquid: 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 200/1, 0.5 mL/min, $\lambda = 214$ nm, t_R (major) = 26.2 min, t_R (minor) = 25.1 min); $[\alpha]_D^{20} = -40.5$ ($c = 1.38$, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.31 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.25-7.15 (m, 1H, Ar-H), 7.12-7.05 (m, 1H, Ar-H), 6.87 (s, 1H, Ar-H), 5.28-5.20 (m, 1H, one proton of CH=C=CH), 5.08-4.97 (m, 1H, one proton of CH=C=CH), 4.63 (dd, $J_1 = 6.5$ Hz, $J_2 = 2.6$ Hz, 2H, NCH₂), 2.31 (s, 3H, Ar-CH₃), 1.91-1.76 (m, 1H, CH), 1.51-1.15 (m, 4H, CH₂ $\times$ 2), 0.84 (t, $J = 7.4$ Hz, 6H, CH₃ $\times$ 2); ¹³C NMR (75 MHz, CDCl₃) δ 204.2, 136.3, 129.0, 125.2, 121.3, 118.9, 118.6, 110.4, 109.4, 97.0, 88.1, 45.8, 42.8, 27.6, 27.3, 11.6, 11.5, 9.6; IR (neat) ν (cm⁻¹) 3055, 2961, 2920, 2873, 1963, 1614, 1561, 1482, 1466, 1385, 1329, 1256, 1208, 1179,

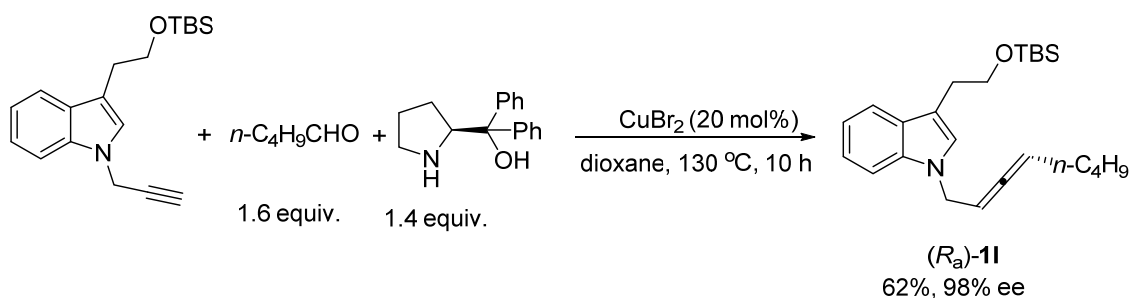
1126, 1104, 1013, 1013; MS (70 ev, EI) m/z (%) 254 ($M^+ + 1$, 3.57), 253 (M^+ , 22.43), 224 (100); HRMS calcd for $C_{18}H_{23}N$ [M^+]: 253.1830, Found: 253.1829.

4.11 Synthesis of (*R_a*)-3-ethyl-1-(octa-2,3-dienyl)-1*H*-indole (*R_a*)-1k (jf-3-073)



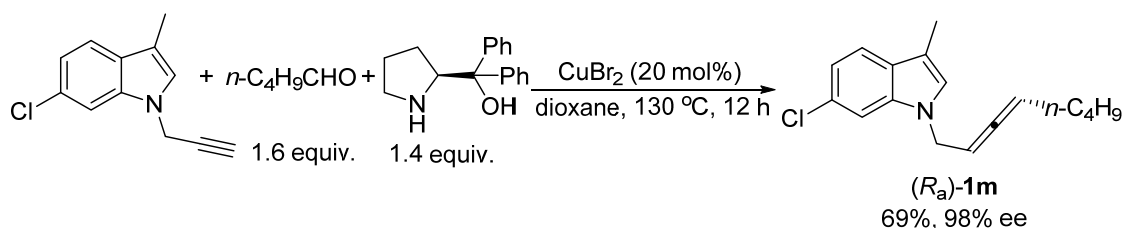
Following **Typical Procedure II**, the reaction of $CuBr_2$ (0.2745 g, 1.2 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.1682 g, 8.4 mmol, 98%), 3-ethyl-1-(prop-2-ynyl)-1*H*-indole (1.0992 g, 6 mmol)/dioxane (2 mL), pentanal (1.04 mL, $d = 0.81 \text{ g/mL}$, 0.8424 g, 9.6 mmol, 98%), and dioxane (16 mL) for 10 h at 130 °C afforded (*R_a*)-**1k** (0.8537 g, 56%) [eluent: petroleum ether/ethyl acetate = 100/1] as a liquid: 99% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 200/1, 1.0 mL/min, $\lambda = 214 \text{ nm}$, t_R (major) = 12.7 min, t_R (minor) = 12.1 min); $[\alpha]_D^{20} = -33.5$ ($c = 1.26$, $CHCl_3$); 1H NMR (300 MHz, $CDCl_3$) δ 7.59 (d, $J = 7.8 \text{ Hz}$, 1H, Ar-H), 7.31 (d, $J = 8.1 \text{ Hz}$, 1H, Ar-H), 7.19 (t, $J = 7.7 \text{ Hz}$, 1H, Ar-H), 7.08 (t, $J = 7.5 \text{ Hz}$, 1H, Ar-H), 6.88 (s, 1H, Ar-H), 5.30-5.15 (m, 2H, $CH=C=CH$), 4.63 (dd, $J_1 = 6.2 \text{ Hz}$, $J_2 = 2.9 \text{ Hz}$, 2H, NCH_2), 2.77 (q, $J = 7.5 \text{ Hz}$, 2H, Ar- CH_2), 2.05-1.88 (m, 2H, CH_2), 1.39-1.21 (m, 7H, $CH_2 \times 2 + CH_3$), 0.88 (t, $J = 7.1 \text{ Hz}$, 3H, CH_3); ^{13}C NMR (75 MHz, $CDCl_3$) δ 204.4, 136.4, 128.1, 124.1, 121.3, 119.0, 118.5, 117.6, 109.6, 93.3, 88.1, 45.8, 31.2, 28.3, 22.1, 18.3, 14.6, 13.9; IR (neat) ν (cm^{-1}) 3055, 2960, 2929, 2871, 2856, 1964, 1614, 1557, 1481, 1467, 1418, 1392, 1371, 1333, 1314, 1270, 1207, 1177, 1128, 1105, 1063, 1013; MS (70 ev, EI) m/z (%) 254 ($M^+ + 1$, 10.50), 253 (M^+ , 61.79), 158 (100); HRMS calcd for $C_{18}H_{23}N$ [M^+]: 253.1830, Found: 253.1831.

4.12 Synthesis of (*R_a*)-3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1-(octa-2,3-dienyl)-1*H*-indole (*R_a*)-1l (jf-3-056)



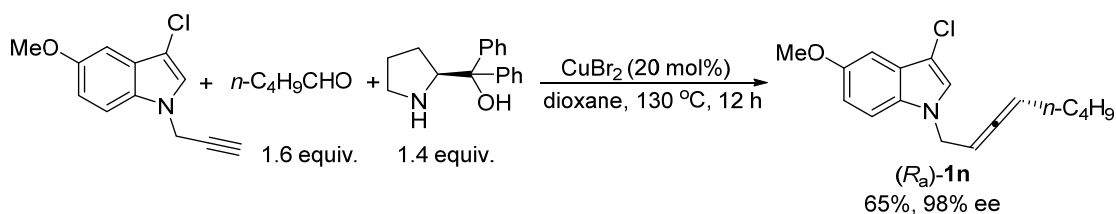
Following **Typical Procedure II**, the reaction of CuBr_2 (0.3592 g, 1.6 mmol, 99%), $(S)\text{-}\alpha,\alpha\text{-diphenylprolinol}$ (2.8918 g, 11.2 mmol, 98%), 3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1-(prop-2-ynyl)-1*H*-indole (2.5108 g, 8 mmol) (2 mL), pentanal (1.4 mL, $d = 0.81 \text{ g/mL}$, 1.1232 g, 12.8 mmol, 98%), and dioxane (22 mL) for 10 h at 130 °C afforded $(R_a)\text{-11}$ (1.8994 g, 62%) [eluent: petroleum ether/ethyl acetate = 100/1] as a liquid: 98% ee (HPLC conditions: Chiralcel IB-H column, *n*-hexane/*i*-PrOH = 100/0, 1.0 mL/min, $\lambda = 214 \text{ nm}$, t_R (major) = 36.2 min, t_R (minor) = 32.0 min); $[\alpha]_D^{20} = -24.1$ ($c = 1.09$, CHCl_3); ^1H NMR (300 MHz, CDCl_3) δ 7.63 (d, $J = 7.8 \text{ Hz}$, 1H, Ar-H), 7.36 (d, $J = 8.1 \text{ Hz}$, 1H, Ar-H), 7.23 (td, $J_1 = 7.5 \text{ Hz}$, $J_2 = 0.6 \text{ Hz}$, 1H, Ar-H), 7.13 (t, $J = 7.4 \text{ Hz}$, 1H, Ar-H), 6.99 (s, 1H, Ar-H), 5.34-5.20 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.68 (dd, $J_1 = 5.9 \text{ Hz}$, $J_2 = 3.2 \text{ Hz}$, 2H, NCH_2), 3.90 (t, $J = 7.5 \text{ Hz}$, 2H, CH_2), 3.02 (t, $J = 7.5 \text{ Hz}$, 2H, CH_2), 2.10-1.91 (m, 2H, CH_2), 1.44-1.25 (m, 4H, $\text{CH}_2 \times 2$), 1.02-0.86 (m, 12H, $\text{CH}_3 + \text{CH}_3 \times 3$), 0.08 (s, 6H, $\text{CH}_3 \times 2$); ^{13}C NMR (75 MHz, CDCl_3) δ 204.4, 136.2, 128.4, 125.6, 121.3, 119.0, 118.7, 111.8, 109.6, 93.3, 88.0, 64.0, 45.8, 31.2, 29.0, 28.3, 26.0, 22.1, 18.4, 13.9, -5.3; IR (neat) ν (cm^{-1}) 3056, 2928, 2856, 1965, 1615, 1555, 1469, 1386, 1360, 1332, 1255, 1215, 1174, 1093, 1053, 1013; MS (70 eV, EI) m/z (%) 384 ($\text{M}^+ + 1$, 15.85), 383 (M^+ , 51.96), 208 (100); HRMS calcd for $\text{C}_{24}\text{H}_{37}\text{NOSi}$ [M^+]: 383.2644, Found: 383.2643.

4.13 Synthesis of $(R_a)\text{-6-chloro-3-methyl-1-(octa-2,3-dienyl)-1H-indole}$ ($R_a\text{-1m}$) (jf-2-190)



Following **Typical Procedure II**, the reaction of CuBr₂ (0.3645 g, 1.6 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.8910 g, 11.2 mmol, 98%), 6-chloro-3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.6302 g, 8 mmol)/dioxane (2 mL), pentanal (1.4 mL, d = 0.81 g/mL, 1.134 g, 12.8 mmol, 98%), and dioxane (22 mL) for 12 h at 130 °C afforded (*R_a*)-**1m** (1.5115 g, 69%) [eluent: petroleum ether] as a liquid: 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 100/1, 0.5 mL/min, λ = 254 nm, t_R (major) = 13.6 min, t_R (minor) = 13.0 min); $[\alpha]_D^{20}$ = -15.9 (c = 1.27, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.43 (d, J = 8.4 Hz, 1H, Ar-H), 7.29 (s, 1H, Ar-H), 7.04 (d, J = 8.4 Hz, 1H, Ar-H), 6.83 (s, 1H, Ar-H), 5.29-5.06 (m, 2H, CH=C=CH), 4.62-4.47 (m, 2H, NCH₂), 2.27 (s, 3H, CH₃), 2.04-1.86 (m, 2H, CH₂), 1.36-1.20 (m, 4H, CH₂ $\times$ 2), 0.93-0.81 (m, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.4, 136.6, 127.6, 127.4, 126.0, 119.8, 119.2, 110.6, 109.6, 93.7, 87.7, 45.8, 31.2, 28.2, 22.1 13.9, 9.5; IR (neat) ν (cm⁻¹) 2956, 2928, 2859, 1965, 1612, 1552, 1468, 1386, 1362, 1326, 1243, 1177, 1135, 1067; MS (70 ev, EI) m/z (%) 275 (M⁺(³⁷Cl), 24.87), 273 (M⁺(³⁵Cl), 77.10), 272 (100); HRMS calcd for C₁₇H₂₀³⁵ClN [M⁺]: 273.1284, Found: 273.1283.

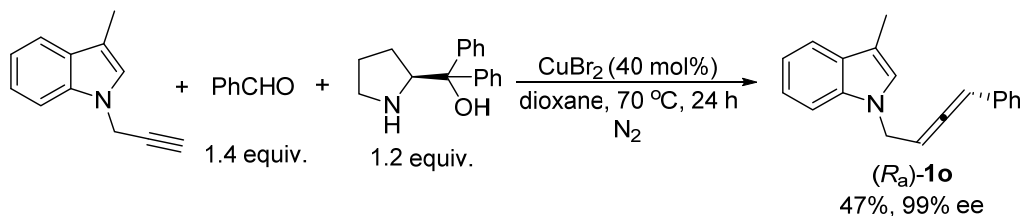
4.14 Synthesis of (*R_a*)-3-chloro-5-methoxy-1-(octa-2,3-dienyl)-1*H*-indole (*R_a*)-**1n** (jf-3-083)



Following **Typical Procedure II**, the reaction of CuBr₂ (0.2234 g, 1 mmol, 99%), (*S*)- α,α -diphenylprolinol (1.8078 g, 7 mmol, 98%), 3-chloro-5-methoxy-1-(prop-2-ynyl)-1*H*-indole (1.0985 g, 5 mmol)/dioxane (2 mL),

pentanal (0.87 mL, d = 0.81 g/mL, 0.7047 g, 8 mmol, 98%), and dioxane (13 mL) for 12 h at 130 °C afforded (*R_a*)-**1n** (0.9410 g, 65%) [eluent: petroleum ether/ethyl acetate = 100/1] as a liquid: 98% ee (HPLC conditions: Chiralcel OJ-H column, *n*-hexane/*i*-PrOH = 98/2, 3.0 mL/min, λ = 214 nm, *t_R* (major) = 9.0 min, *t_R* (minor) = 8.6 min); [α]_D²⁰ = -34.3 (*c* = 1.165, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.22 (d, *J* = 9.0 Hz, 1H, Ar-H), 7.05 (s, 1H, Ar-H), 7.02 (d, *J* = 2.7 Hz, 1H, Ar-H), 6.89 (dd, *J*₁ = 9.0 Hz, *J*₂ = 2.4 Hz, 1H, Ar-H), 5.27-5.14 (m, 2H, CH=C=CH), 4.64-4.56 (m, 2H, NCH₂), 3.87 (s, 3H, OCH₃), 2.02-1.85 (m, 2H, CH₂), 1.35-1.20 (m, 4H, CH₂ × 2), 0.87 (t, *J* = 6.6 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.5, 154.5, 130.3, 126.3, 124.5, 113.3, 111.0, 104.1, 99.4, 93.8, 87.6, 55.8, 46.2, 31.1, 28.2, 22.1, 13.8; IR (neat) ν (cm⁻¹) 3123, 2956, 2929, 2858, 1964, 1624, 1575, 1488, 1451, 1388, 1334, 1292, 1252, 1220, 1177, 1126, 1089, 1035; MS (70 ev, EI) *m/z* (%) 292 (M⁺(³⁷Cl) + 1, 1.35), 291 (M⁺(³⁷Cl), 6.66), 290 (M⁺(³⁵Cl) + 1, 4.55), 289 (M⁺(³⁵Cl), 20.64), 254 (100); HRMS calcd for C₁₇H₂₀NO³⁵Cl [M⁺]: 289.1233, Found: 289.1235.

4.15 Synthesis of (*R_a*)-3-methyl-1-(4-phenylbuta-2,3-dienyl)-1*H*-indole (*R_a*)-**1o** (jf-2-153)

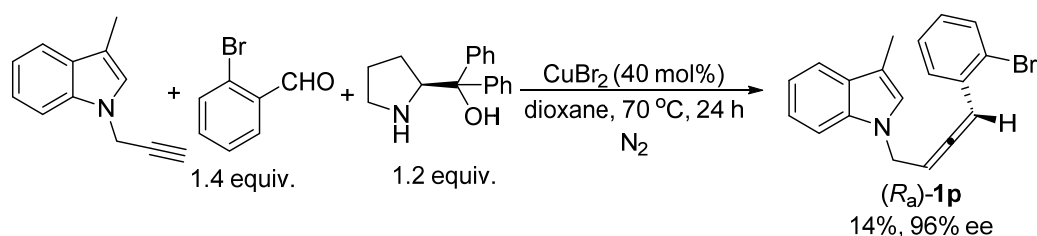


Following **Typical Procedure III**, the reaction of CuBr₂ (0.7280 g, 3.2 mmol, 99%), (*S*)-α,α-diphenylprolinol (2.4288 g, 9.6 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.3524 g, 8 mmol)/dioxane (2 mL), benzaldehyde (1.1872 g, 11.2 mmol), and dioxane (10 mL) for 24 h at 70 °C afforded (*R_a*)-**1o** (0.9693 g, 47%) [eluent: petroleum ether] as a liquid: 99% ee (HPLC conditions: Chiralcel AD-H column, *n*-hexane/*i*-PrOH = 99/1, 0.7 mL/min, λ = 214 nm, *t_R* (major) = 8.4 min, *t_R* (minor) = 7.7 min); [α]_D²⁰ = -192.0 (*c* = 0.835, CHCl₃); ¹H NMR (400 MHz, CDCl₃) δ 7.57 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.35-7.17 (m, 7H, Ar-H), 7.12 (t, *J* = 7.4 Hz, 1H, Ar-H), 6.92 (s, 1H, Ar-H), 6.28 (dt, *J*₁ = 6.1 Hz, *J*₂ =

2.6 Hz, 1H, CH=), 5.70 (q, $J = 6.7$ Hz, 1H, CH=), 4.77 (dd, $J_1 = 6.8$ Hz, $J_2 = 2.4$ Hz, 2H, NCH₂), 2.32 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ 205.7, 136.2, 133.5, 129.1, 128.6, 127.3, 127.0, 125.1, 121.6, 119.1, 118.8, 110.9, 109.5, 96.4, 92.2, 45.3, 9.6; IR (neat) ν (cm⁻¹) 3054, 3030, 2916, 2860, 1950, 1614, 1595, 1557, 1495, 1481, 1464, 1386, 1328, 1265, 1178, 1126, 1102, 1071, 1040, 1012; MS (70 ev, EI) m/z (%) 260 ($M^+ + 1$, 10.67), 259 (M^+ , 54.40), 144 (100); HRMS calcd for C₁₉H₁₇N [M^+]: 259.1361, Found: 259.1359.

4.16 Synthesis of (*R_a*)-1-(4-(2-bromophenyl)buta-2,3-dienyl)-3-methyl-1*H*-indole

(*R_a*)-1p (jf-2-169)

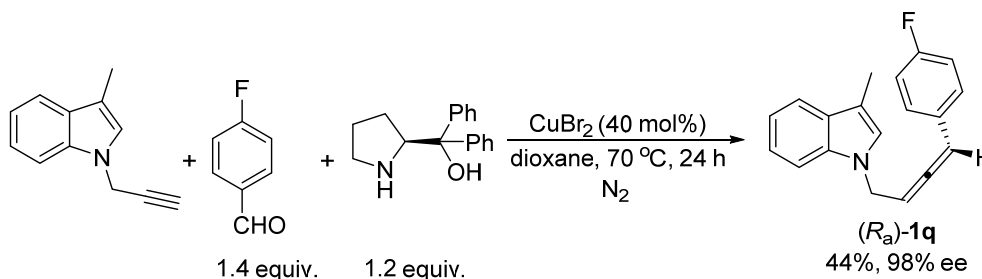


Following **Typical Procedure III**, the reaction of CuBr₂ (0.7280 g, 3.2 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.4290 g, 9.6 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.3523 g, 8 mmol)/dioxane (2 mL), 2-bromobenzaldehyde (2.1842 g, 11.2 mmol, 95%), and dioxane (10 mL) for 24 h at 70 °C afforded (*R_a*)-1p (0.3916 g, 14%) [eluent: petroleum ether] as a liquid: 96% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.7 mL/min, $\lambda = 254$ nm, t_R (major) = 21.0 min, t_R (minor) = 20.0 min); $[\alpha]_D^{20} = -101.4$ ($c = 0.93$, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.57 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.51 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.34-7.25 (m, 2H, Ar-H), 7.22-7.08 (m, 3H, Ar-H), 7.07-6.98 (m, 1H, Ar-H), 6.89 (s, 1H, Ar-H), 6.74 (dt, $J_1 = 6.6$ Hz, $J_2 = 2.4$ Hz, 1H, ArCH=), 5.71 (q, $J = 6.7$ Hz, 1H, CH=), 4.76 (dd, $J_1 = 6.9$ Hz, $J_2 = 2.4$ Hz, 2H, NCH₂), 2.32 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 206.5, 136.2, 133.0, 132.9, 129.1, 128.65, 128.56, 127.4, 125.1, 122.6, 121.6, 119.1, 118.9, 111.1, 109.4, 95.5, 92.4, 45.1, 9.6; IR (neat) ν (cm⁻¹) 3054, 2915, 2884, 2859, 1951, 1614, 1587, 1561, 1465, 1439, 1401 1385, 1363, 1328, 1287, 1260, 1178, 1123, 1022; MS (70 ev, EI) m/z (%) 339 (M^+ (⁸¹Br), 28.78), 337 (M^+ (⁷⁹Br), 29.02), 168 (100); HRMS calcd for C₁₉H₁₆N⁷⁹Br [M^+]:

337.0466, Found: 337.0466.

4.17 Synthesis of (*R_a*)-1-(4-(4-fluorophenyl)buta-2,3-dienyl)-3-methyl-1*H*-indole

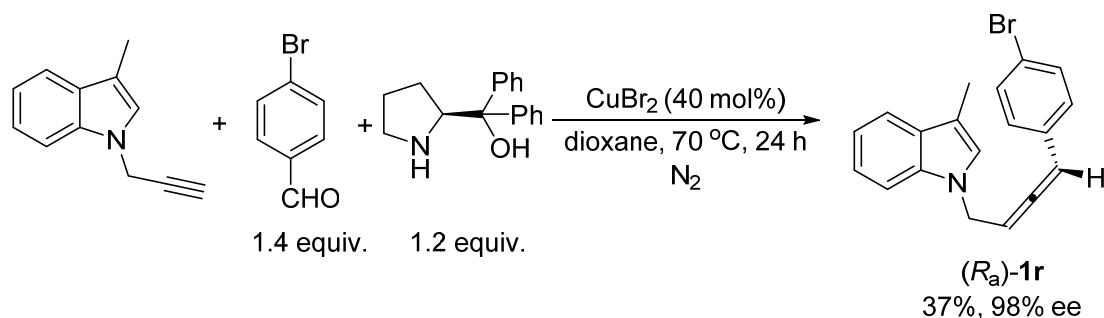
(*R_a*)-1**q** (jf-3-031)



Following **Typical Procedure III**, the reaction of CuBr_2 (0.5436 g, 2.4 mmol, 99%), (*S*)- α,α -diphenylprolinol (1.8543 g, 7.2 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.0105 g, 6 mmol)/dioxane (2 mL), 4-fluorobenzaldehyde (1.0429 g, 8.4 mmol, 99%), and dioxane (7 mL) for 24 h at 70 °C afforded (*R_a*)-1**q** (0.7275 g, 44%) [eluent: petroleum ether/ethyl acetate = 200/1] as a liquid: 98% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 100/1, 0.5 mL/min, λ = 254 nm, t_R (major) = 11.4 min, t_R (minor) = 11.0 min); $[\alpha]_D^{20}$ = -174.4 (c = 1.3, CHCl_3); ^1H NMR (300 MHz, CDCl_3) δ 7.57 (d, J = 7.5 Hz, 1H, Ar-H), 7.30 (d, J = 7.8 Hz, 1H, Ar-H), 7.24-7.08 (m, 4H, Ar-H), 6.97 (t, J = 8.7 Hz, 2H, Ar-H), 6.90 (s, 1H, Ar-H), 6.24 (dt, J_1 = 6.3 Hz, J_2 = 2.6 Hz, 1H, CH=), 5.69 (q, J = 6.6 Hz, 1H, CH=), 4.76 (dd, J_1 = 6.6 Hz, J_2 = 2.4 Hz, 2H, NCH_2), 2.32 (s, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 205.4 (d, J = 2.0 Hz), 162.0 (d, J = 244.7 Hz), 136.2, 129.4 (d, J = 3.5 Hz), 129.1, 128.4 (d, J = 8.3 Hz), 125.1, 121.6, 119.1, 118.8, 115.5 (d, J = 21.4 Hz), 111.0, 109.4, 95.5, 92.4, 45.3, 9.6; ^{19}F NMR (282 MHz, CDCl_3) δ -115.2; IR (neat) ν (cm^{-1}) 3048, 2917, 2887, 2861, 1950, 1886, 1680, 1604, 1505, 1481, 1464, 1386, 1328, 1299, 1264, 1226, 1178, 1156, 1126, 1092, 1041, 1013; MS (70 eV, EI) m/z (%) 278 ($\text{M}^+ + 1$, 17.45), 277 (M^+ , 91.01), 144 (100); HRMS calcd for $\text{C}_{19}\text{H}_{16}\text{NF}$ [M^+]: 277.1267, Found: 277.1267.

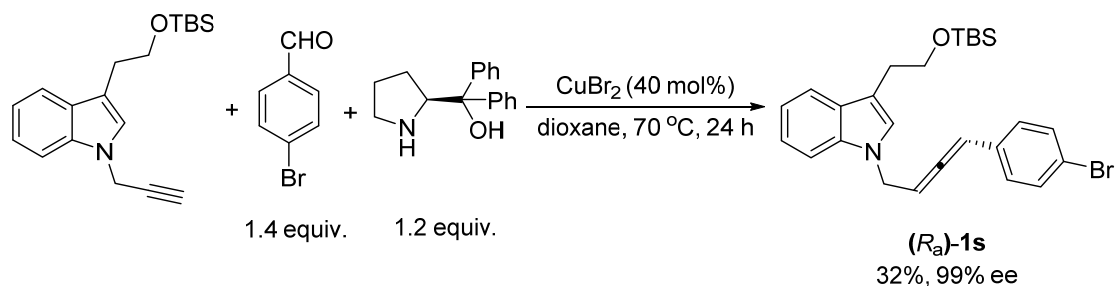
4.18 Synthesis of (*R_a*)-1-(4-(4-bromophenyl)buta-2,3-dienyl)-3-methyl-1*H*-indole

(*R_a*)-1**r** (jf-3-016)



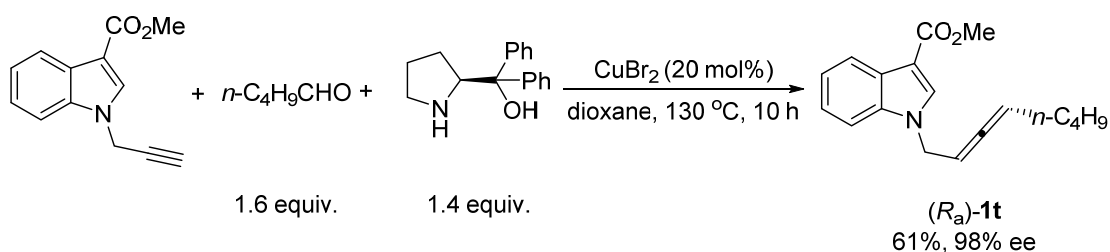
Following **Typical Procedure III**, the reaction of CuBr_2 (0.5472 g, 2.4 mmol, 99%), (*S*)- α,α -diphenylprolinol (1.8591 g, 7.2 mmol, 98%), 3-methyl-1-(prop-2-ynyl)-1*H*-indole (1.0145 g, 6 mmol)/dioxane (2 mL), 4-bromobenzaldehyde (1.5543 g, 8.4 mmol, 99%), and dioxane (7 mL) for 24 h at 70 °C afforded (*R*_a)-**1r** (0.7435 g, 37%) [eluent: petroleum ether (800 mL) to petroleum ether/diethyl ether = 200/1 (800 mL)] as a liquid: 98% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 95/5, 0.7 mL/min, λ = 214 nm, t_R (major) = 6.9 min, t_R (minor) = 6.6 min); $[\alpha]_D^{20}$ = -153.7 (c = 1.065, CHCl_3); ^1H NMR (300 MHz, CDCl_3) δ 7.53 (d, J = 7.8 Hz, 1H, Ar-H), 7.31 (d, J = 8.4 Hz, 2H, Ar-H), 7.25-7.05 (m, 3H, Ar-H), 6.96 (d, J = 8.4 Hz, 2H, Ar-H), 6.77 (s, 1H, Ar-H), 6.13-6.04 (m, 1H, CH=), 5.58 (q, J = 6.5 Hz, 1H, CH=), 4.61 (dd, J_1 = 6.9 Hz, J_2 = 2.4 Hz, 2H, NCH_2), 2.28 (s, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 205.5, 136.1, 132.4, 131.6, 129.0, 128.4, 125.0, 121.5, 120.8, 119.0, 118.8, 110.9, 109.3, 95.6, 92.5, 44.9, 9.5; IR (neat) ν (cm^{-1}) 3046, 2915, 2885, 2859, 1951, 1614, 1586, 1559, 1487, 1464, 1386, 1363, 1328, 1262, 1177, 1126, 1095, 1069, 1042, 1010; MS (70 ev, EI) m/z (%) 339 ($\text{M}^+(\text{}^{81}\text{Br})$, 21.61), 337 ($\text{M}^+(\text{}^{79}\text{Br})$, 20.59), 168 (100); HRMS calcd for $\text{C}_{19}\text{H}_{16}\text{N}^{79}\text{Br}$ [M^+]: 337.0466, Found: 337.0468.

4.19 Synthesis of (*R*_a)-1-(4-(4-bromophenyl)buta-2,3-dienyl)-3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1*H*-indole (*R*_a)-**1s** (jf-3-086)



Following **Typical Procedure III**, the reaction of CuBr₂ (1.0820 g, 4.8 mmol, 99%), (*S*)- α,α -diphenylprolinol (3.7166 g, 14.4 mmol, 98%), 3-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-1-(prop-2-ynyl)-1*H*-indole (3.7652 g, 12 mmol)/dioxane (2 mL), 4-bromobenzaldehyde (3.1388 g, 16.8 mmol, 99%), and dioxane (16 mL) for 24 h at 70 °C afforded (*R*_a)-**1s** (1.8278 g, 32%) [eluent: petroleum ether/diethyl ether = 50/1] as a liquid: 99% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 200/1, 0.7 mL/min, λ = 254 nm, *t*_R (major) = 9.5 min, *t*_R (minor) = 9.0 min); [α]_D²⁰ = -111.3 (*c* = 0.87, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.62 (d, *J* = 8.1 Hz, 1H, Ar-H), 7.42 (d, *J* = 8.1 Hz, 2H, Ar-H), 7.32 (d, *J* = 8.1 Hz, 1H, Ar-H), 7.22 (t, *J* = 7.5 Hz, 1H, Ar-H), 7.18-7.05 (m, 3H, Ar-H), 6.99 (s, 1H, Ar-H), 6.29-6.16 (m, 1H, =CH), 5.73 (q, *J* = 6.6 Hz, 1H, CH=), 4.80 (dd, *J*₁ = 6.8 Hz, *J*₂ = 2.6 Hz, 2H, NCH₂), 3.86 (t, *J* = 7.4 Hz, 2H, CH₂), 3.00 (t, *J* = 7.4 Hz, 2H, CH₂), 0.93 (m, 9H, CH₃ $\times$ 3), 0.06 (s, 6H, CH₃ $\times$ 2); ¹³C NMR (75 MHz, CDCl₃) δ 205.7, 136.0, 132.4, 131.7, 128.52, 128.46, 125.5, 121.6, 121.0, 119.2, 119.0, 112.4, 109.5, 95.8, 92.6, 63.9, 45.1, 28.9, 26.0, 18.4, -5.3; IR (neat) ν (cm⁻¹) 3055, 2953, 2927, 2856, 1952, 1613, 1583, 1488, 1465, 1387, 1360, 1332, 1254, 1174, 1094, 1010; MS (70 ev, EI) *m/z* (%) 484 (M⁺(⁸¹Br) + 1, 5.26), 483 (M⁺(⁸¹Br), 10.68), 482 (M⁺(⁷⁹Br) + 1, 3.84), 481 (M⁺(⁷⁹Br), 16.21), 167 (100); HRMS calcd for C₂₆H₃₂⁷⁹BrNOSi [M⁺]: 481.1437, Found: 481.1435.

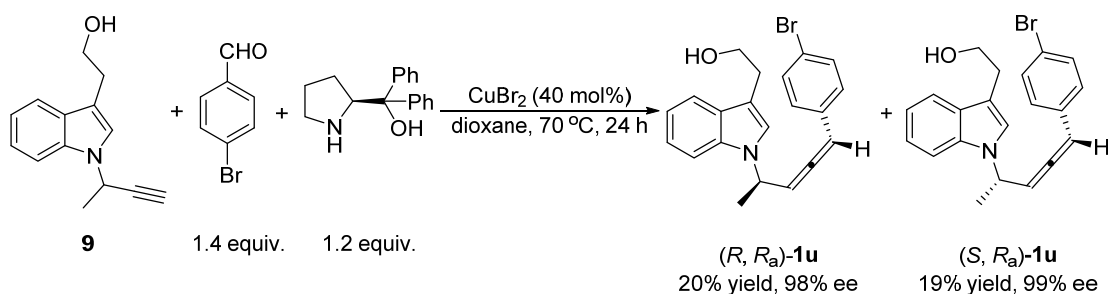
4.20 Synthesis of methyl (*R*_a)-1-(octa-2,3-dienyl)-1*H*-indole-3-carboxylate (*R*_a)-**1t** (jf-3-111)



Following **Typical Procedure II**, the reaction of CuBr₂ (0.2725 g, 1.2 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.1681 g, 8.4 mmol, 98%), methyl

1-(prop-2-ynyl)-1*H*-indole-3-carboxylate (1.2782 g, 6 mmol)/dioxane (2 mL), pentanal (1.04 mL, d = 0.81 g/mL, 0.8424 g, 9.6 mmol, 98%), and dioxane (16 mL) for 10 h at 130 °C afforded (*R*_a)-**1t** (1.0435 g, 61%) [eluent: petroleum ether/ ethyl acetate = 15/1] as a liquid: 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.5 mL/min, λ = 214 nm, *t*_R (major) = 25.6 min, *t*_R (minor) = 26.7 min); [α]_D²⁰ = -45.3 (*c* = 1.19, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 8.22-8.13 (m, 1H, Ar-H), 7.84 (s, 1H, Ar-H), 7.41-7.31 (m, 1H, Ar-H), 7.31-7.22 (m, 2H, Ar-H), 5.32-5.17 (m, 2H, CH=C=CH), 4.69 (dd, *J*₁ = 6.2 Hz, *J*₂ = 2.9 Hz, 2H, NCH₂), 3.90 (s, 3H, OCH₃), 2.00-1.82 (m, 2H, CH₂), 1.34-1.13 (m, 4H, CH₂ × 2), 0.85 (t, *J* = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 204.7, 165.4, 136.5, 134.1, 126.8, 122.6, 121.8, 121.7, 110.2, 107.1, 94.2, 87.0, 50.9, 46.4, 31.0, 28.1, 22.0, 13.8; IR (neat) ν (cm⁻¹) 3120, 3054, 2951, 2928, 2856, 1965, 1698, 1615, 1533, 1487, 1465, 1380, 1339, 1266, 1237, 1177, 1121, 1090, 1031; MS (70 ev, EI) *m/z* (%) 284 (*M*⁺+1, 10.12), 283 (*M*⁺, 49.94), 224 (100); HRMS calcd for C₁₈H₂₁NO₂ [*M*⁺]: 283.1572, Found: 283.1573.

4.21 Synthesis of (*R*, *R*_a)-2-((5-(4-bromophenyl)penta-3,4-dien-2-yl)-1*H*-indol-3-yl)ethanol (*R*, *R*_a)-**1u** and (*S*, *R*_a)-2-((5-(4-bromophenyl)penta-3,4-dien-2-yl)-1*H*-indol-3-yl)ethanol (*S*, *R*_a)-**1u** (jf-5-117)



Following **Typical Procedure III**, the reaction of CuBr₂ (0.6300 g, 2.8 mmol, 99%), (*S*)- α,α -diphenylprolinol (2.1657 g, 8.4 mmol, 98%), **9** (1.4754 g, 7 mmol)/dioxane (2 mL), 4-bromobenzaldehyde (1.8330 g, 9.8 mmol, 99%), and dioxane (8.5 mL) for 24 h at 70 °C afforded (*R*, *R*_a)-**1u** (0.5117 g), (*S*, *R*_a)-**1u** (0.2574 g), mixture of [(*R*, *R*_a)-**1u** and (*S*, *R*_a)-**1u**] (0.2675 g) [eluent: petroleum ether/ ethyl acetate = 8/1 (450 mL) to 6/1 (500 mL) to 5/1 (500 mL)], then the mixture was purified by column

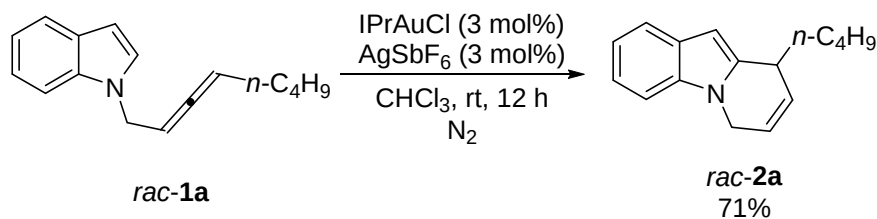
chromatography on silica gel again to afford (*R*, *R*_a)-**1u** (0.0210 g) and (*S*, *R*_a)-**1u** (0.2408 g) [eluent: petroleum ether/ ethyl acetate = 8/1 (500 mL) to 5/1 (500 mL)]

(*R*, *R*_a)-**1u** (0.5327 g, 20%) as a liquid: 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 1.0 mL/min, λ = 254 nm, t_R (major) = 17.6 min, t_R (minor) = 21.1 min); $[\alpha]_D^{20}$ = -32.4 (c = 0.875, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.60 (d, J = 7.8 Hz, 1H, Ar-H), 7.46-7.35 (m, 3H, Ar-H), 7.27-7.18 (m, 1H, Ar-H), 7.16-7.03 (m, 4H, Ar-H), 6.27 (dd, J_1 = 6.5 Hz, J_2 = 2.9 Hz, 1H, =CH), 5.81 (t, J = 6.2 Hz, 1H, CH=), 5.27-5.10 (m, 1H, NCH), 3.87 (t, J = 6.3 Hz, 2H, OCH₂), 3.02 (t, J = 6.5 Hz, 2H, CH₂), 1.68 (d, J = 6.9 Hz, 3H, CH₃), 1.57 (s, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 204.6, 136.2, 132.6, 131.8, 128.3, 122.7, 121.8, 121.0, 119.3, 119.1, 111.6, 109.8, 98.4, 97.0, 62.6, 50.1, 28.8, 20.3; IR (neat) ν (cm⁻¹) 3391, 3048, 2976, 2930, 1950, 1611, 1488, 1461, 1427, 1360, 1312, 1224, 1194, 1069, 1045, 1010; MS (70 ev, EI) m/z (%) 383 (M⁺(⁸¹Br), 7.30), 381 (M⁺(⁷⁹Br), 5.85), 363 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M⁺]: 381.0728, Found: 381.0728.

(*S*, *R*_a)-**1u** (0.4982 g, 19%) as a liquid: 99% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 1.0 mL/min, λ = 254 nm, t_R (major) = 35.9 min, t_R (minor) = 18.2 min); $[\alpha]_D^{20}$ = -275.8 (c = 1.030, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.61 (d, J = 7.8 Hz, 1H, Ar-H), 7.46-7.29 (m, 3H, Ar-H), 7.26-7.00 (m, 5H, Ar-H), 6.27 (dd, J_1 = 6.5 Hz, J_2 = 2.6 Hz, 1H, =CH), 5.79 (t, J = 6.0 Hz, 1H, CH=), 5.30-5.10 (m, 1H, NCH), 3.96-3.77 (m, 2H, OCH₂), 3.01 (t, J = 6.5 Hz, 2H, CH₂), 1.67 (d, J = 6.6 Hz, 3H, CH₃), 1.51 (s, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 204.8, 136.1, 132.4, 131.8, 128.4, 128.3, 122.8, 121.8, 121.0, 119.3, 119.1, 111.6, 109.8, 98.2, 96.8, 62.6, 50.1, 28.8, 20.1; IR (neat) ν (cm⁻¹) 3391, 3048, 2976, 2929, 1950, 1611, 1488, 1460, 1427, 1361, 1224, 1193, 1068, 1045, 1010; MS (70 ev, EI) m/z (%) 383 (M⁺(⁸¹Br), 13.20), 381 (M⁺(⁷⁹Br), 13.20), 212 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M⁺]: 381.0728, Found: 381.0729.

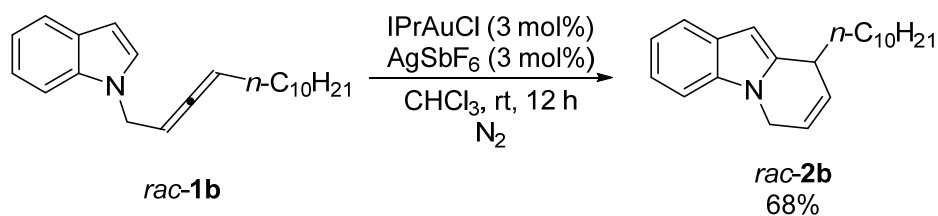
5. Gold(I) catalyzed cyclization of racemic *N*-allenylindoles

5.1 Synthesis of 9-butyl-6,9-dihydropyrido[1,2-*a*]indole *rac*-2a (jf-2-026)



Typical Procedure IV: To an oven-dried Schlenk tube were added IPrAuCl (0.0197 g, weighed in a glove box, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, weighed in a glove box, 0.03 mmol, 98%), *rac-1a* (0.2554 g, 1 mmol), and CHCl₃ (5 mL) under nitrogen atmosphere sequentially. The reaction was complete after being stirred at room temperature for 12 h as monitored by TLC. After filtration through a short column of silica gel (3 cm × 2 cm) [eluent: DCM (8 mL × 4)] and evaporation, the crude product was purified by column chromatography on silica gel to afford *rac-2a* (0.1600 g, 71%) [eluent: petroleum ether] as a powder solid: m.p. 39.2-42.9 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.62-7.55 (m, 1H, Ar-H), 7.30 (d, *J* = 7.5 Hz, 1H, Ar-H), 7.22-7.08 (m, 2H, Ar-H), 6.35-6.25 (m, 1H, Ar-H), 6.09-5.94 (m, 2H, =CH × 2), 4.63-4.52 (m, 2H, NCH₂), 3.79-3.66 (m, 1H, CH), 1.87-1.70 (m, 2H, CH₂), 1.43-1.17 (m, 4H, CH₂ × 2), 0.94-0.79 (m, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 138.5, 135.5, 128.3, 127.6, 120.2, 120.1, 119.8, 108.8, 96.8, 41.8, 36.4, 34.2, 28.0, 22.8, 14.0; IR (KBr) ν (cm⁻¹) 3043, 2956, 2929, 2858, 1667, 1541, 1472 1456, 1420, 1362, 1329, 1315, 1225, 1184, 1169, 1014; MS (70 ev, EI) *m/z* (%) 226 (M⁺+1, 9.74), 225 (M⁺, 46.55), 168 (100); HRMS calcd for C₁₆H₁₉N [M⁺]: 225.1517, Found: 225.1519.

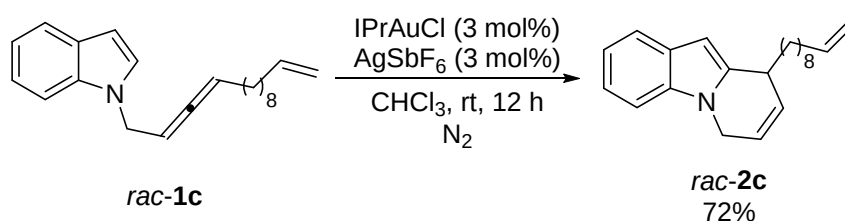
5.2 Synthesis of 9-decyl-6,9-dihydropyrido[1,2-*a*]indole *rac-2b* (jf-2-012)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), *rac-1b* (0.3099 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac-2b* (0.2116 g, 68%) [eluent: petroleum

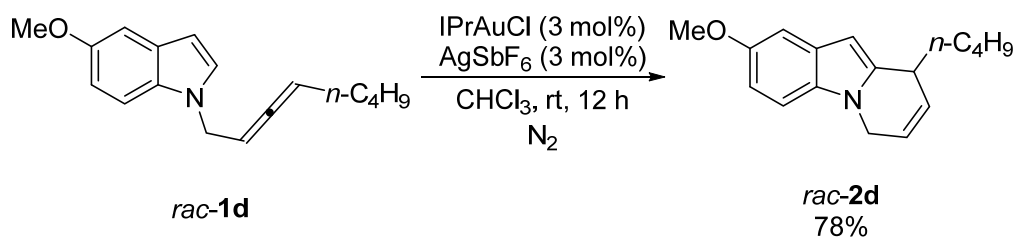
ether/diethyl ether = 100/1] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.59 (d, $J = 7.2$ Hz, 1H, Ar-H), 7.29 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.21-7.07 (m, 2H, Ar-H), 6.32 (s, 1H, Ar-H), 6.10-5.92 (m, 2H, $=\text{CH} \times 2$), 4.67-4.52 (m, 2H, NCH_2), 3.78-3.65 (m, 1H, CH), 1.88-1.70 (m, 2H, CH_2), 1.44-1.15 (m, 16H, $\text{CH}_2 \times 8$), 0.88 (t, $J = 6.6$ Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 138.5, 135.5, 128.3, 127.6, 120.2, 120.1, 119.8, 108.8, 96.8, 41.8, 36.7, 34.3, 31.9, 29.8, 29.6, 29.58, 29.53, 29.3, 25.8, 22.7, 14.1; IR (neat) ν (cm^{-1}) 3042, 2924, 2854, 1667, 1541, 1471, 1456, 1421, 1362, 1315, 1227, 1185, 1170, 1012; MS (70 ev, EI) m/z (%) 310 ($\text{M}^+ + 1$, 8.77), 309 (M^+ , 38.48), 168 (100); HRMS calcd for $\text{C}_{22}\text{H}_{31}\text{N}$ [M^+]: 309.2457, Found: 309.2458.

5.3 Synthesis of 9-(dec-9-enyl)-6,9-dihydropyrido[1,2-*a*]indole *rac*-2c (jf-2-037)



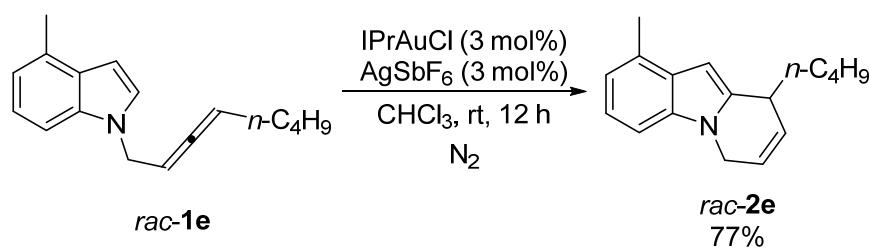
Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac*-1c (0.3101 g, 1 mmol), and CHCl_3 (5 mL) for 12 h at room temperature afforded *rac*-2c (0.2385 g, 72%, 93% purity) [eluent: petroleum ether] as a liquid: ^1H NMR (300 MHz, CDCl_3) δ 7.57 (d, $J = 6.6$ Hz, 1H, Ar-H), 7.24 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.18-7.05 (m, 2H, Ar-H), 6.29 (s, 1H, ArH), 6.02-5.88 (m, 2H, $=\text{CH} \times 2$), 5.86-5.70 (m, 1H, $\text{CH}=\text{CH}_2$), 5.03-4.87 (m, 2H, $=\text{CH}_2$), 4.56-4.46 (m, 2H, NCH_2), 3.74-3.58 (m, 1H, CH), 2.07-1.95 (m, 2H, CH_2), 1.81-1.69 (m, 2H, CH_2), 1.40-1.19 (m, 12H, $\text{CH}_2 \times 6$); ^{13}C NMR (75 MHz, CDCl_3) δ 139.1, 138.3, 135.4, 128.3, 127.5, 120.2, 120.1, 119.7, 114.1, 108.7, 96.8, 41.7, 36.6, 34.2, 33.7, 29.7, 29.43, 29.41, 29.0, 28.8, 25.8; IR (neat) ν (cm^{-1}) 3044, 2926, 2854, 1668, 1640, 1612, 1539, 1471, 1456, 1418, 1362, 1316, 1227, 1185, 1170, 1151; MS (70 ev, EI) m/z (%) 308 ($\text{M}^+ + 1$, 7.47), 307 (M^+ , 32.57), 168 (100); HRMS calcd for $\text{C}_{22}\text{H}_{29}\text{N}$ [M^+]: 307.2300, Found: 307.2398.

5.4 Synthesis of 9-butyl-2-methoxy-6,9-dihydropyrido[1,2-*a*]indole *rac*-2d (jf-2-004)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, 0.03 mmol, 98%), *rac-1d* (0.2526 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac-2d* (0.1971 g, 78%) [eluent: petroleum ether/diethyl ether = 100/1 to 50/1] as a powder solid: m.p. 82.1-84.5 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.16 (d, *J* = 9.0 Hz, 1H, Ar-H), 7.06 (d, *J* = 2.1 Hz, 1H, Ar-H), 6.82 (dd, *J*₁ = 8.7 Hz, *J*₂ = 2.4 Hz, 1H, Ar-H), 6.24 (s, 1H, Ar-H), 6.06-5.91 (m, 2H, =CH × 2), 4.59-4.46 (m, 2H, NCH₂), 3.85 (s, 3H, OCH₃), 3.74-3.62 (m, 1H, CH), 1.85-1.70 (m, 2H, CH₂), 1.40-1.16 (m, 4H, CH₂ × 2), 0.86 (t, *J* = 6.9 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 154.3, 139.1, 130.8, 128.6, 127.4, 120.1, 110.1, 109.4, 101.9, 96.4, 55.9, 41.8, 36.3, 34.3, 27.9, 22.8, 14.0; IR (KBr) ν (cm⁻¹) 2957, 2925, 2857, 1617, 1483, 1450, 1425, 1367, 1349, 1333, 1320, 1280, 1237, 1210, 1185, 1166, 1138, 1122, 1032; MS (70 ev, EI) *m/z* (%) 256 (M⁺+1, 5.20), 255 (M⁺, 30.22), 198 (100); HRMS calcd for C₁₇H₂₁NO [M⁺]: 255.1623, Found: 255.1621.

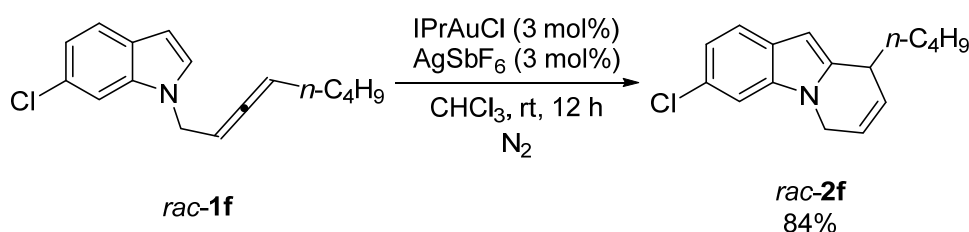
5.5 Synthesis of 9-butyl-1-methyl-6,9-dihydropyrido[1,2-*a*]indole *rac-2e* (jf-2-045)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0194 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), *rac-1e* (0.2368 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac-2e* (0.1900 g, 77%, 96% purity) [eluent: petroleum ether] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.18-7.03 (m, 2H, Ar-H), 6.92 (d, *J* = 6.9 Hz, 1H, Ar-H), 6.32 (s, 1H, Ar-H), 6.12-5.92 (m, 2H, =CH × 2), 4.66-4.52 (m, 2H, NCH₂), 3.80-3.64 (m, 1H, CH), 2.55 (s, 3H, CH₃), 1.88-1.72

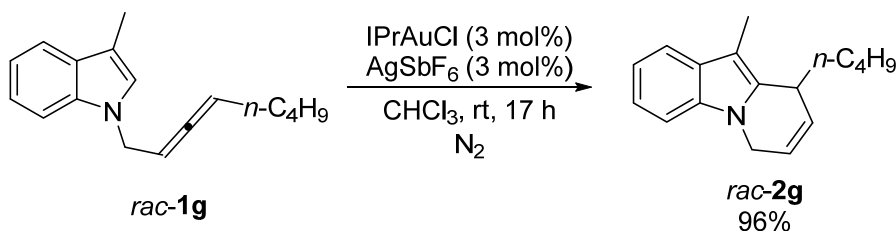
(m, 2H, CH₂), 1.42-1.18 (m, 4H, CH₂ × 2), 0.87 (t, *J* = 6.9 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 137.9, 135.1, 129.2, 128.1, 127.6, 120.4, 120.2, 120.0, 106.4, 95.3, 41.9, 36.5, 34.3, 28.0, 22.8, 18.7, 14.0; IR (neat) ν (cm⁻¹) 3044, 2956, 2929, 2858, 1668, 1585, 1538, 1495, 1456, 1429, 1362, 1319, 1240, 1174, 1155, 1101, 1079, 1032; MS (70 ev, EI) *m/z* (%) 240 (M⁺+1, 6.58), 239 (M⁺, 30.01), 182 (100); HRMS calcd for C₁₇H₂₁N [M⁺]: 239.1674, Found: 239.1673.

5.6 Synthesis of 9-butyl-3-chloro-6,9-dihydropyrido[1,2-*a*]indole *rac*-2f (jf-2-107)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac*-1f (0.2604 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac*-2f (0.2252 g, 84%, 98% purity) [eluent: petroleum ether] as a powder solid: m.p. 53.4-55.4 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.45 (d, *J* = 8.7 Hz, 1H, Ar-H), 7.24 (s, 1H, Ar-H), 7.06 (dd, *J*₁ = 8.3 Hz, *J*₂ = 2.0 Hz, 1H, Ar-H), 6.26 (s, 1H, Ar-H), 6.03-5.87 (m, 2H, =CH × 2), 4.55-4.40 (m, 2H, NCH₂), 3.75-3.57 (m, 1H, CH), 1.76 (q, *J* = 7.0 Hz, 2H, CH₂), 1.40-1.12 (m, 4H, CH₂ × 2), 0.85 (t, *J* = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 139.2, 135.8, 127.4, 126.7, 126.1, 120.5, 120.2, 119.8, 108.8, 96.9, 41.8, 36.2, 34.1, 27.9, 22.8, 14.0; IR (KBr) ν (cm⁻¹) 3041, 2956, 2931, 2858, 1667, 1607, 1569, 1540, 1475, 1456, 1417, 1352, 1319, 1276, 1223, 1169, 1121, 1101, 1063; MS (70 ev, EI) *m/z* (%) 261 (M⁺(³⁷Cl), 13.36), 259 (M⁺(³⁵Cl), 41.40), 202 (100); HRMS calcd for C₁₆H₁₈³⁵ClN [M⁺]: 259.1128, Found: 259.1128.

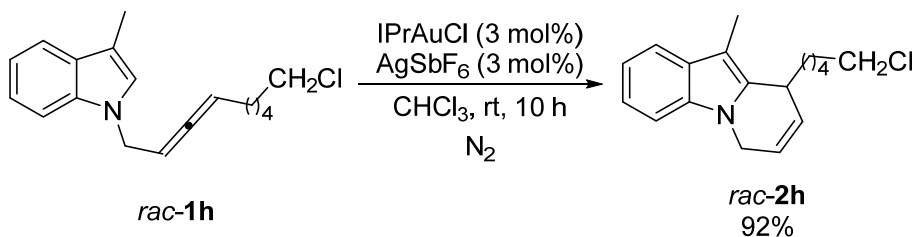
5.7 Synthesis of 9-butyl-10-methyl-6,9-dihydropyrido[1,2-*a*]indole *rac*-2g (jf-2-097)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac-1g* (0.2389 g, 1 mmol), and CHCl₃ (5 mL) for 17 h at room temperature afforded *rac-2g* (0.2292 g, 96%) [eluent: petroleum ether] as a powder solid: m.p. 40.1-41.1 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.26 (d, *J* = 8.4 Hz, 1H, Ar-H), 7.22-7.07 (m, 2H, Ar-H), 6.14-5.97 (m, 2H, =CH × 2), 4.64-4.50 (m, 2H, NCH₂), 3.82-3.68 (m, 1H, CH), 2.30 (s, 3H, CH₃), 1.85-1.67 (m, 2H, CH₂), 1.36-1.18 (m, 3H, CH₂ + one proton of CH₂), 1.16-1.02 (m, 1H, one proton of CH₂), 0.83 (t, *J* = 7.2 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.2, 134.0, 128.8, 127.8, 120.7, 120.2, 119.0, 117.8, 108.5, 104.1, 42.0, 35.6, 33.2, 27.6, 22.8, 14.0, 8.9; IR (neat) ν (cm⁻¹) 3042, 2951, 2929, 2858, 1662, 1615, 1568, 1462, 1426, 1384, 1369, 1329, 1313, 1241, 1196, 1169, 1011; MS (70 ev, EI) *m/z* (%) 240 (M⁺+1, 6.68), 239 (M⁺, 33.76), 182 (100); HRMS calcd for C₁₇H₂₁N [M⁺]: 239.1674, Found: 239.1673.

5.8 Synthesis of 9-(5-chloropentyl)-10-methyl-6,9-dihydropyrido[1,2-a]indole

rac-2h (jf-2-152)

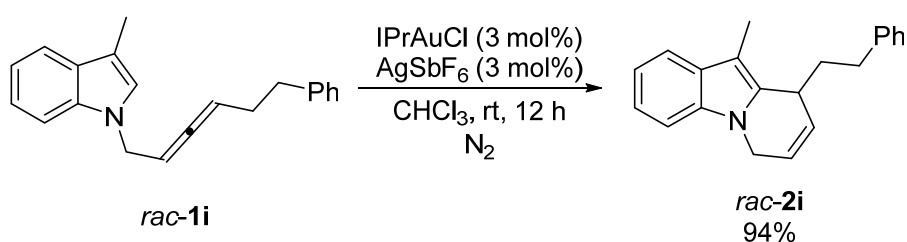


Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0194 g, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, 0.03 mmol, 98%), *rac-1h* (0.2886 g, 1 mmol), and CHCl₃ (5 mL) afforded *rac-2h* (0.2654 g, 92%) [eluent: petroleum ether] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.56-7.50 (m, 1H, Ar-H), 7.26-7.21 (m, 1H, Ar-H), 7.19-7.08 (m, 2H, Ar-H), 6.09-5.93 (m, 2H, =CH × 2), 4.66-4.40 (m, 2H, NCH₂), 3.81-3.70 (m, 1H, CH), 3.44 (t, *J* = 6.6 Hz, 2H, CH₂Cl), 2.29 (s, 3H, CH₃), 1.84-1.61 (m, 4H, CH₂ × 2),

1.44-1.23 (m, 3H, CH₂ + one proton of CH₂), 1.15-1.00 (m, 1H, one proton of CH₂); ¹³C NMR (75 MHz, CDCl₃) δ 135.2, 133.5, 128.7, 127.5, 120.9, 120.3, 119.0, 117.8, 108.5, 104.1, 45.0, 42.0, 35.5, 33.1, 32.4, 26.9, 24.6, 8.9; IR (neat) ν (cm⁻¹) 3042, 2934, 2858, 1665, 1615, 1568, 1471, 1461, 1385, 1368, 1328, 1312, 1240, 1197, 1169, 1054, 1011; MS (70 ev, EI) *m/z* (%) 290 (M⁺(³⁷Cl) + 1, 1.26), 289 (M⁺(³⁷Cl), 6.87), 288 (M⁺(³⁵Cl) + 1, 4.36), 287 (M⁺(³⁵Cl), 20.42), 182 (100); HRMS calcd for C₁₈H₂₂N³⁵Cl [M⁺]: 287.1441, Found: 287.1440.

5.9 Synthesis of 10-methyl-9-phenethyl-6,9-dihydropyrido[1,2-*a*]indole *rac*-2i

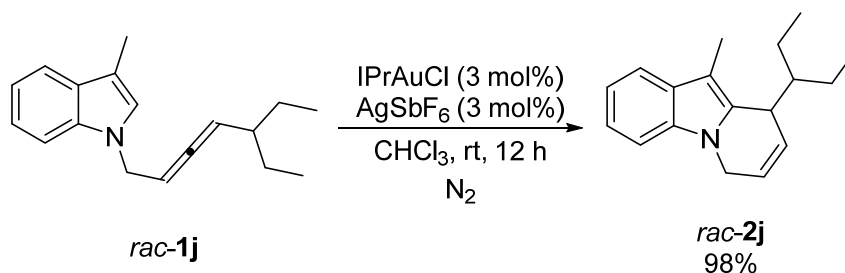
(jf-3-030)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0194 g, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, 0.03 mmol, 98%), *rac*-1i (0.2881 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac*-2i (0.2706 g, 94%) [eluent: petroleum ether/diethyl ether = 50/1] as a needle solid: m.p. 91.5-92.2 °C (DCM/hexane); ¹H NMR (300 MHz, CDCl₃) δ 7.56 (d, *J* = 7.2 Hz, 1H, Ar-H), 7.30-7.04 (m, 8H, Ar-H), 6.16-6.01 (m, 2H, =CH × 2), 4.66-4.51 (m, 2H, NCH₂), 3.89-3.72 (m, 1H, CH), 2.65-2.51 (m, 1H, one proton of PhCH₂), 2.45-2.33 (m, 1H, one proton of PhCH₂), 2.30 (s, 3H, CH₃), 2.20-1.93 (m, 2H, CH₂); ¹³C NMR (75 MHz, CDCl₃) δ 142.0, 135.2, 133.1, 128.7, 128.2, 127.0, 125.7, 121.2, 120.3, 119.0, 117.8, 108.5, 104.2, 41.8, 37.3, 32.9, 31.5, 8.9; IR (KBr) ν (cm⁻¹) 3030, 2947, 2917, 2859, 1667, 1601, 1579, 1500, 1471, 1462, 1369, 1313, 1238, 1197, 1167, 1119, 1083; MS (70 ev, EI) *m/z* (%) 288 (M⁺+1, 4.84), 287 (M⁺, 21.40), 182 (100); Anal. Calcd. for C₂₁H₂₁N (%): C 87.76, H 7.37, N 4.87, Found: C 87.65, H 7.35, N 4.66.

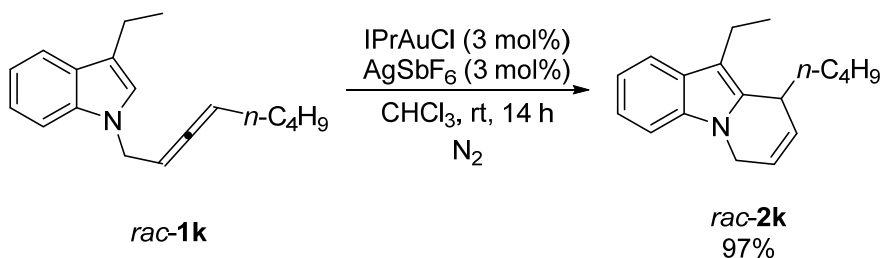
5.10 Synthesis of 10-methyl-9-(pentan-3-yl)-6,9-dihydropyrido[1,2-*a*]indole *rac*-2j

(jf-3-094)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac-1j* (0.2530 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac-2j* (0.2481 g, 98%) [eluent: petroleum ether] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.55 (d, *J* = 6.9 Hz, 1H, Ar-H), 7.24 (d, *J* = 7.2 Hz, 1H, Ar-H), 7.20-7.08 (m, 2H, Ar-H), 6.13-5.95 (m, 2H, =CH × 2), 4.59-4.50 (m, 2H, NCH₂), 4.00-3.82 (m, 1H, CH), 2.30 (s, 3H, Ar-CH₃), 1.86-1.69 (m, 1H, CH), 1.67-1.51 (m, 1H, one proton of CH₂), 1.43-1.25 (m, 1H, one proton of CH₂), 1.12 (t, *J* = 7.4 Hz, 3H, CH₃), 1.02 (quint, *J* = 7.2 Hz, 2H, CH₂), 0.65 (t, *J* = 7.5 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.2, 134.1, 128.9, 124.2, 122.0, 120.1, 118.9, 117.7, 108.4, 103.8, 47.5, 42.2, 35.1, 23.7, 23.0, 12.5, 12.2, 9.0; IR (neat) ν (cm⁻¹) 3042, 2959, 2928, 2873, 1665, 1613, 1567, 1462, 1425, 1385, 1368, 1312, 1241, 1198, 1173, 1058, 1012; MS (70 ev, EI) *m/z* (%) 254 (*M*⁺+1, 3.21), 253 (*M*⁺, 15.57), 182 (100); HRMS calcd for C₁₈H₂₃N [*M*⁺]: 253.1830, Found: 253.1830.

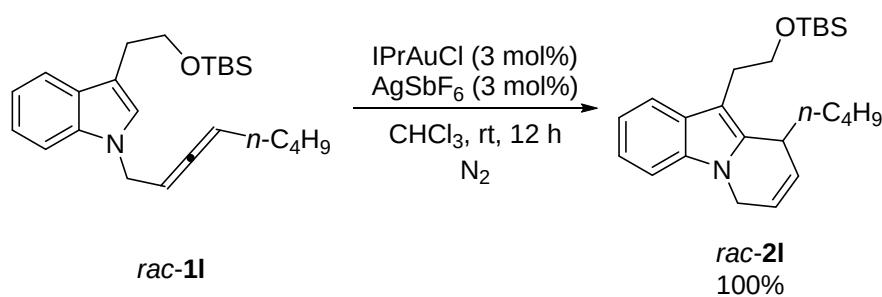
5.11 Synthesis of 9-butyl-10-ethyl-6,9-dihydropyrido[1,2-*a*]indole *rac-2k* (jf-3-077)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac-1k* (0.2564 g, 1 mmol), and CHCl₃ (5 mL) for 14 h at room temperature afforded *rac-2k* (0.2485 g, 97%) [eluent: petroleum ether/diethyl ether = 50/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.60 (d, *J* = 7.2 Hz, 1H, Ar-H), 7.25 (d, *J* = 7.2 Hz, 1H, Ar-H), 7.20-7.07 (m, 2H, Ar-H), 6.09-5.95 (m,

2H, =CH $\times$ 2), 4.60-4.48 (m, 2H, NCH₂), 3.85-3.66 (m, 1H, CH), 2.78 (q, J = 7.5 Hz, 2H, Ar-CH₂), 1.84-1.61 (m, 2H, CH₂), 1.38-1.17 (m, 6H, CH₂ + one proton of CH₂ + CH₃), 1.15-0.97 (m, 1H, one proton of CH₂), 0.83 (t, J = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.5, 133.3, 127.9, 127.8, 120.7, 120.2, 119.0, 118.2, 111.0, 108.6, 42.0, 36.3, 33.3, 27.3, 22.8, 17.7, 15.4, 14.0; IR (neat) ν (cm⁻¹) 3042, 2959, 2929, 2857, 1666, 1612, 1566, 1471, 1456, 1423, 1372, 1331, 1314, 1235, 1193, 1169, 1126, 1069, 1015; MS (70 ev, EI) m/z (%) 254 (M⁺+1, 6.31), 253 (M⁺, 30.62), 196 (100); HRMS calcd for C₁₈H₂₃N [M⁺]: 253.1830, Found: 253.1829.

5.12 Synthesis of 9-butyl-10-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-6,9-dihydro-pyrido[1,2-*a*]indole *rac*-**2I** (**jf-3-060**)

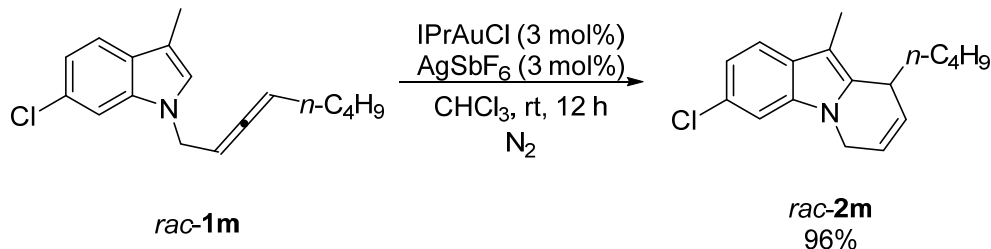


Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0193 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), *rac*-**1I** (0.3838 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac*-**2I** (0.3836 g, 100%) [eluent: petroleum ether/diethyl ether = 100/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.59 (d, J = 7.2 Hz, 1H, Ar-H), 7.27 (d, J = 8.1 Hz, 1H, Ar-H), 7.22-7.09 (m, 2H, Ar-H), 6.14-6.00 (m, 2H, =CH $\times$ 2), 4.65-4.48 (m, 2H, NCH₂), 3.93-3.75 (m, 3H, OCH₂ + CH), 3.03 (t, J = 8.0 Hz, 2H, Ar-CH₂), 1.84-1.67 (m, 2H, CH₂), 1.37-1.19 (m, 3H, CH₂ + one proton of CH₂), 1.17-1.02 (m, 1H, one proton of CH₂), 0.92 (s, 9H, CH₃ $\times$ 3), 0.83 (t, J = 7.1 Hz, 3H, CH₃), 0.06 (s, 3H, CH₃), 0.05 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.4, 134.9, 128.3, 127.8, 120.7, 120.3, 119.2, 118.1, 108.7, 105.2, 63.8, 42.1, 36.4, 33.2, 28.6, 27.4, 26.0, 22.8, 18.4, 14.0, -5.24, -5.28; IR (KBr) ν (cm⁻¹) 3043, 2955, 2929, 2857, 1665, 1613, 1566, 1471, 1461, 1425, 1370, 1330, 1314, 1254, 1213, 1191, 1169, 1094, 1067, 1014; MS (70 ev, EI) m/z (%) 384 (M⁺+1, 16.36), 383 (M⁺, 54.53), 238 (100); HRMS calcd for C₂₄H₃₇NOSi [M⁺]: 383.2644, Found:

383.2642.

5.13 Synthesis of 9-butyl-3-chloro-10-methyl-6,9-dihydropyrido[1,2-*a*]indole

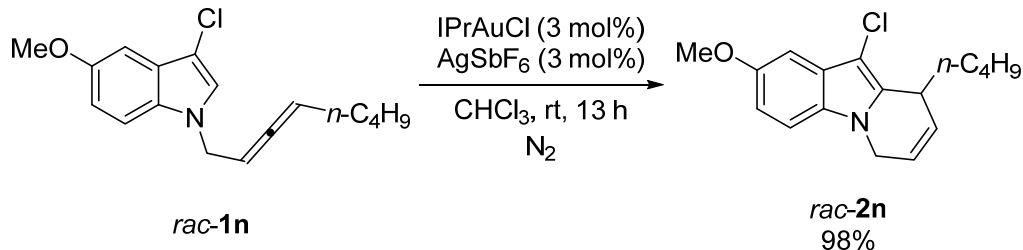
rac-**1m** (jf-3-003)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0197 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac*-**1m** (0.2762 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac*-**2m** (0.2647 g, 96%) [eluent: petroleum ether] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.43 (d, *J* = 6.3 Hz, 1H, Ar-H), 7.24 (d, *J* = 1.5 Hz, 1H, Ar-H), 7.07 (dd, *J*₁ = 6.3 Hz, *J*₂ = 1.8 Hz, 1H, Ar-H), 6.10-5.98 (m, 2H, =CH × 2), 4.58-4.46 (m, 2H, NCH₂), 3.78-3.66 (m, 1H, CH), 2.27 (s, 3H, CH₃), 1.81-1.69 (m, 2H, CH₂), 1.35-1.18 (m, 3H, CH₂ + one proton of CH₂), 1.14-1.01 (m, 1H, one proton of CH₂), 0.83 (t, *J* = 5.3 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.6, 134.7, 127.7, 127.4, 126.2, 120.4, 119.5, 118.6, 108.6, 104.4, 42.0, 35.4, 33.3, 27.5, 22.7, 14.0, 8.8; IR (neat) ν (cm⁻¹) 3039, 2953, 2924, 2858, 1839, 1665, 1608, 1584, 1556, 1474, 1463, 1417, 1385, 1364, 1342, 1319, 1281, 1233, 1198, 1169, 1101, 1066, 1050, 1001; MS (70 ev, EI) *m/z* (%) 276 (M⁺(³⁷Cl) + 1, 1.33), 275 (M⁺(³⁷Cl), 10.67), 274 (M⁺(³⁵Cl) + 1, 5.96), 273 (M⁺(³⁵Cl), 30.66), 216 (100); HRMS calcd for C₁₇H₂₀N³⁵Cl [M⁺]: 273.1284, Found: 273.1282.

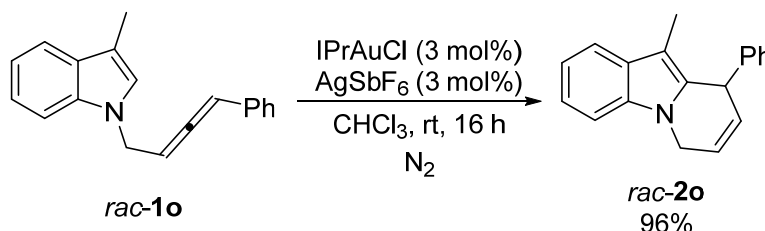
5.14 Synthesis of 9-butyl-10-chloro-2-methoxy-6,9-dihydropyrido[1,2-*a*]indole

rac-**2n** (jf-3-090)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), *rac*-**1n** (0.2902 g, 1 mmol), and CHCl₃ (5 mL) for 13 h at room temperature afforded *rac*-**2n** (0.2839 g, 98%) [eluent: petroleum ether/diethyl ether = 20/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.16 (d, *J* = 9.0 Hz, 1H, Ar-H), 7.03 (d, *J* = 2.4 Hz, 1H, Ar-H), 6.85 (dd, *J*₁ = 8.7 Hz, *J*₂ = 2.4 Hz, 1H, Ar-H), 6.06-5.96 (m, 2H, =CH × 2), 4.57-4.48 (m, 2H, NCH₂), 3.88 (s, 3H, OMe), 3.82-3.73 (m, 1H, CH), 2.03-1.76 (m, 2H, CH₂), 1.37-1.19 (m, 3H, CH₂ + one proton of CH₂), 1.15-0.98 (m, 1H, one proton of CH₂), 0.84 (t, *J* = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 154.8, 133.8, 129.3, 127.1, 126.0, 120.2, 111.8, 109.9, 99.5, 98.8, 55.8, 42.1, 33.9, 33.1, 27.4, 22.6, 14.0; IR (neat) ν (cm⁻¹) 3036, 3008, 2950, 2925, 2868, 1619, 1577, 1486, 1450, 1370, 1342, 1287, 1220, 1185, 1164, 1030; MS (70 ev, EI) *m/z* (%) 292 (M⁺(³⁷Cl) + 1, 1.97), 291 (M⁺(³⁷Cl), 10.79), 290 (M⁺(³⁵Cl) + 1, 5.54), 289 (M⁺(³⁵Cl), 35.41), 232 (100); HRMS calcd for C₁₇H₂₀NO³⁵Cl [M⁺]: 289.1233, Found: 289.1232.

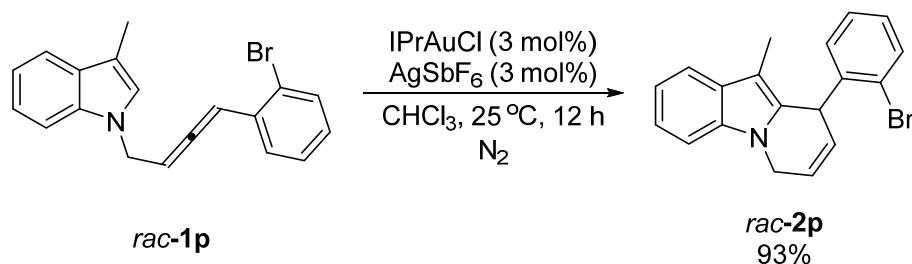
5.15 Synthesis of 10-methyl-9-phenyl-6,9-dihydropyrido[1,2-*a*]indole *rac*-**2o** (jf-2-162)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0039 g, 0.006 mmol, 95%), AgSbF₆ (0.0021 g, 0.006 mmol, 98%), *rac*-**1o** (0.0526 g, 0.2 mmol), and CHCl₃ (5 mL) for 16 h at room temperature afforded *rac*-**2o** (0.0504 g, 96%) [eluent: petroleum ether/ethyl acetate = 100/1] as a powder solid: m.p. 153.8-154.8 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.52 (d, *J* = 7.5 Hz, 1H, Ar-H), 7.33 (d, *J* = 8.1 Hz, 1H, Ar-H), 7.29-7.08 (m, 7H, Ar-H), 6.12-5.96 (m, 2H, =CH × 2), 4.86-4.60 (m, 3H, NCH₂ + CH), 1.97 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 143.3, 135.2, 132.2, 128.7, 128.6, 128.0, 127.8, 126.5, 120.6, 119.2, 119.0, 118.1, 108.7, 105.9, 41.9, 40.6, 8.6; IR (KBr) ν (cm⁻¹) 3041, 3022, 2912, 2854, 1654,

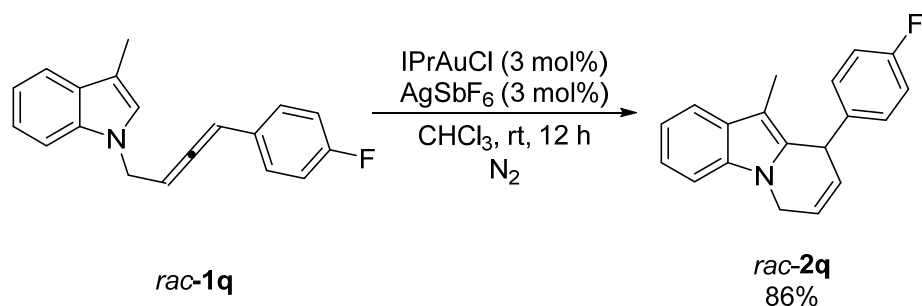
1618, 1600, 1577, 1561, 1489, 1471, 1463, 1453, 1426, 1390, 1369, 1314, 1240, 1199, 1183, 1166, 1074, 1027, 1009; MS (70 ev, EI) m/z (%) 260 ($M^+ + 1$, 19.71), 259 (100); HRMS calcd for $C_{19}H_{17}N$ [M^+]: 259.1361, Found: 259.1359.

5.16 Synthesis of 9-(2-bromophenyl)-10-methyl-6,9-dihydropyrido[1,2-*a*]indole *rac*-2p (jf-2-182)



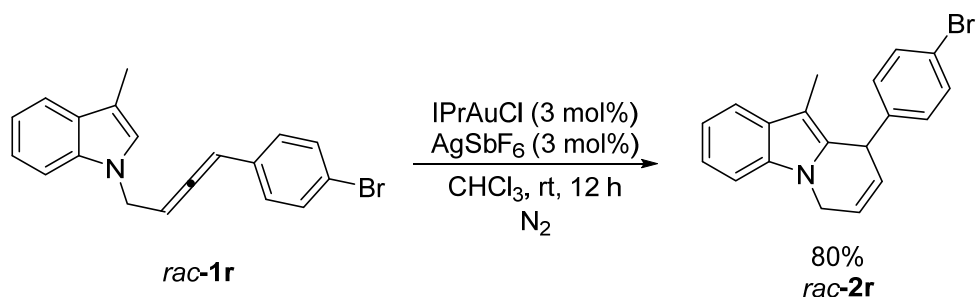
Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0038 g, 0.006 mmol, 95%), AgSbF₆ (0.0021 g, 0.006 mmol, 98%), *rac*-1p (0.0678 g, 0.2 mmol), and CHCl₃ (5 mL) for 12 h at 25 °C afforded *rac*-2p (0.0631 g, 93%) [eluent: petroleum ether] as a powder solid: m.p. 135.7-136.6 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.55 (t, J = 8.3 Hz, 2H, Ar-H), 7.36 (d, J = 7.5 Hz, 1H, Ar-H), 7.27-6.98 (m, 4H, Ar-H), 6.78 (d, J = 7.2 Hz, 1H, Ar-H), 6.08 (q, J = 10.5 Hz, 2H, =CH × 2), 5.50-5.26 (m, 1H, CH), 4.78 (d, J = 19.2 Hz, 1H, one proton of NCH₂), 4.67 (d, J = 19.2 Hz, 1H, one proton of NCH₂), 1.93 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 142.4, 135.3, 132.6, 132.0, 130.1, 128.6, 128.1, 128.0, 125.9, 123.2, 120.8, 119.6, 119.4, 118.2, 108.8, 106.2, 41.9, 39.6, 8.4; IR (KBr) ν (cm⁻¹) 3045, 2913, 2885, 2853, 1611, 1585, 1559, 1460, 1432, 1386, 1366, 1315, 1307, 1262, 1242, 1200, 1173, 1044, 1023, 1010; MS (70 ev, EI) m/z (%) 339 (M^+ (⁸¹Br), 79.29), 337 (M^+ (⁷⁹Br), 100); HRMS calcd for $C_{19}H_{16}N^{79}\text{Br}$ [M^+]: 337.0466, Found: 337.0466.

5.17 Synthesis of 9-(4-fluorophenyl)-10-methyl-6,9-dihydropyrido[1,2-*a*]indole *rac*-2q (jf-3-037)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac*-**1q** (0.2816 g, 1 mmol), and CHCl₃ (5 mL) for 12 h at room temperature afforded *rac*-**2q** (0.2433 g, 86%) [eluent: petroleum ether/diethyl ether = 50/1] as a powder solid: m.p. 115.3-116.7 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.52 (d, *J* = 7.5 Hz, 1H, Ar-H), 7.32 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.25-7.17 (m, 1H, Ar-H), 7.17-7.04 (m, 3H, Ar-H), 6.93 (t, *J* = 8.7 Hz, 2H, Ar-H), 6.07-5.95 (m, 2H, =CH × 2), 4.83-4.58 (m, 3H, NCH₂ + CH), 1.96 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 161.4 (d, *J* = 243.3 Hz), 139.0 (d, *J* = 2.8 Hz), 135.2, 131.9, 129.3 (d, *J* = 7.6 Hz), 128.6, 127.8, 120.8, 119.3, 119.2, 118.1, 115.4 (d, *J* = 21.4 Hz), 108.7, 105.9, 41.8, 39.7, 8.6; ¹⁹F NMR (282 MHz, CDCl₃) δ -108.7; IR (KBr) ν (cm⁻¹) 3041, 2939, 2909, 2887, 2852, 2883, 1665, 1654, 1603, 1561, 1506, 1472, 1462, 1388, 1369, 1319, 1293, 1280, 1227, 1167, 1156, 1093, 1011; MS (70 ev, EI) *m/z* (%) 278 (M⁺+1, 19.43), 277 (100); Anal. Calcd. for C₁₉H₁₆FN (%): C 82.28, H 5.82, N 5.05, Found: C 82.25, H 5.87, N 4.96.

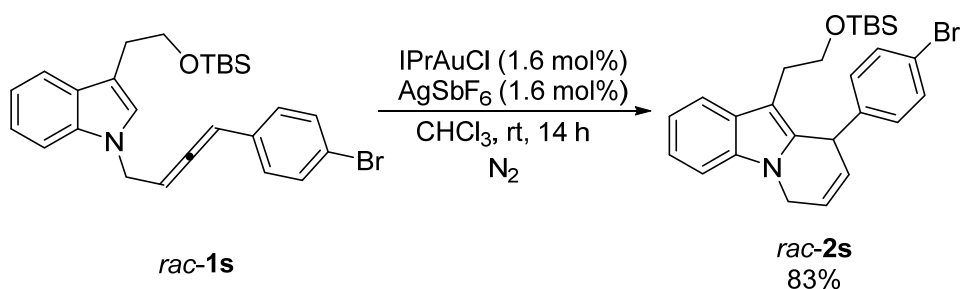
5.18 Synthesis of 9-(4-bromophenyl)-10-methyl-6,9-dihydropyrido[1,2-*a*]indole *rac*-**2r** (jf-3-021)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0194 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), *rac*-**1r** (0.3390 g, 1 mmol), and CHCl₃ (5

mL) for 12 h at room temperature afforded *rac-2r* (0.2712 g, 80%) [eluent: petroleum ether/diethyl ether = 50/1] as a needle solid: m.p. 152.0-154.3 °C (DCM/hexane); ¹H NMR (300 MHz, CDCl₃) δ 7.51 (d, *J* = 8.1 Hz, 1H, Ar-H), 7.38-7.25 (m, 3H, Ar-H), 7.24-7.08 (m, 2H, Ar-H), 6.95 (d, *J* = 8.1 Hz, 2H, Ar-H), 6.06-5.88 (m, 2H, =CH × 2), 4.79-4.50 (m, 3H, NCH₂ + CH), 1.94 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 142.3, 135.2, 131.7, 131.5, 129.5, 128.6, 127.3, 120.8, 120.2, 119.43, 119.36, 118.1, 108.7, 106.0, 41.8, 39.9, 8.6; IR (KBr) ν (cm⁻¹) 3044, 2963, 2916, 2861, 1561, 1485, 1461, 1426, 1402, 1385, 1367, 1313, 1263, 1241, 1200, 1180, 1166, 1067, 1008; MS (70 ev, EI) *m/z* (%) 340 (M⁺(⁸¹Br) + 1, 20.90), 339 (M⁺(⁸¹Br), 91.05), 338 (M⁺(⁷⁹Br) + 1, 100), 337 (M⁺(⁷⁹Br), 85.87); Anal. Calcd. for C₁₉H₁₆BrN (%): C 67.47, H 4.77, N 4.14, Found: C 67.20, H 4.77, N 4.00.

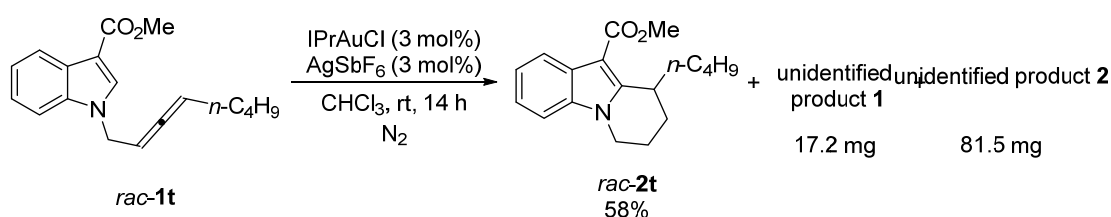
5.19 Synthesis of 9-(4-bromophenyl)-10-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-6,9-dihydropyrido[1,2-*a*]indole *rac-2s* (jf-3-124)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0296 g, 0.045 mmol, 95%), AgSbF₆ (0.0158 g, 0.045 mmol, 98%), *rac-1s* (1.3720 g, 2.8 mmol), and CHCl₃ (15 mL) for 14 h at room temperature afforded *rac-2s* (1.1381 g, 83%) [eluent: petroleum ether/diethyl ether = 100/1] as a powder solid: m.p. 109.4-110.4 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.56 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.34 (t, *J* = 8.4 Hz, 3H, Ar-H), 7.21 (t, *J* = 7.4 Hz, 1H, Ar-H), 7.13 (t, *J* = 7.4 Hz, 1H, Ar-H), 7.00 (d, *J* = 8.1 Hz, 2H, Ar-H), 6.07-5.94 (m, 2H, =CH × 2), 4.95-4.83 (m, 1H, CH), 4.76 (d, *J* = 18.3 Hz, 1H, one proton of NCH₂), 4.65 (d, *J* = 17.7 Hz, 1H, one proton of NCH₂), 3.62-3.46 (m, 1H, one proton of OCH₂), 3.29 (td, *J*₁ = 9.3 Hz, *J*₂ = 5.4 Hz, 1H, one proton of OCH₂), 2.82-2.61 (m, 2H, Ar-CH₂), 0.83 (s, 9H, CH₃ × 3), -0.08 (s, 3H, CH₃), -0.10 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃)

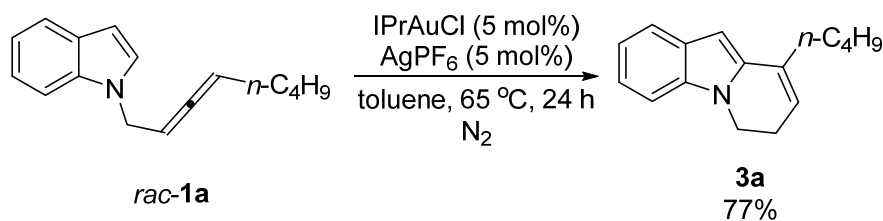
δ 143.0, 135.4, 132.6, 131.8, 129.5, 128.3, 127.5, 121.0, 120.5, 119.6, 119.3, 118.5, 108.9, 107.4, 63.0, 41.9, 39.9, 28.1, 26.0, 18.4, -5.38, -5.44; IR (KBr) ν (cm⁻¹) 3054, 2951, 2928, 2856, 1485, 1470, 1401, 1387, 1369, 1314, 1291, 1251, 1168, 1087, 1011; MS (70 ev, EI) m/z (%) 484 (M⁺(⁸¹Br) + 1, 6.16), 483 (M⁺(⁸¹Br), 18.98), 482 (M⁺(⁷⁹Br) + 1, 6.88), 481 (M⁺(⁷⁹Br), 18.33), 336 (100); Anal. Calcd. for C₂₆H₃₂BrNOSi (%): C 64.72, H 6.68, N 2.90, Found: C 64.70, H 6.68, N 2.66.

5.20. Synthesis of methyl 9-butyl-6,9-dihydropyrido[1,2-*a*]indole-10-carboxylate *rac*-**2t** (jf-4-174)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0198 g, 0.03 mmol, 95%), AgSbF₆ (0.0107 g, 0.03 mmol, 98%), *rac*-**1t** (0.2845 g, 1 mmol), and CHCl₃ (5 mL) for 14 h at room temperature afforded *rac*-**2t** (0.1648 g, 58%), unidentified product **1** (17.2 mg), and unidentified product **2** (81.5 mg) [eluent: petroleum ether/ethyl acetate = 15/1 (500 mL) to 7/1 (400 mL)] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 8.15 (d, J = 7.2 Hz, 1H, Ar-H), 7.34-7.08 (m, 3H, Ar-H), 6.13-5.85 (m, 2H, =CH $\times$ 2), 4.56-4.38 (m, 2H, NCH₂), 4.36-4.23 (m, 1H, CH), 3.91 (s, 3H, OCH₃), 1.95-1.71 (m, 2H, CH₂), 1.43-1.14 (m, 3H, CH₂ + one proton of CH₂), 1.11-0.91 (m, 1H, one proton of CH₂), 0.82 (t, J = 7.2 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 165.7, 147.2, 135.3, 127.7, 126.7, 122.0, 121.7, 121.3, 119.4, 108.9, 101.3, 50.5, 42.1, 35.7, 34.5, 27.7, 22.5, 13.9; IR (neat) ν (cm⁻¹) 3050, 2951, 2924, 2860, 1692, 1531, 1455, 1435, 1379, 1356, 1314, 1257, 1209, 1158, 1116, 1040, 1017; MS (70 ev, EI) m/z (%) 284 (M⁺ + 1, 13.54), 283 (M⁺, 59.70), 226 (100); HRMS calcd for C₁₈H₂₁NO₂ [M⁺]: 283.1572, Found: 283.1575.

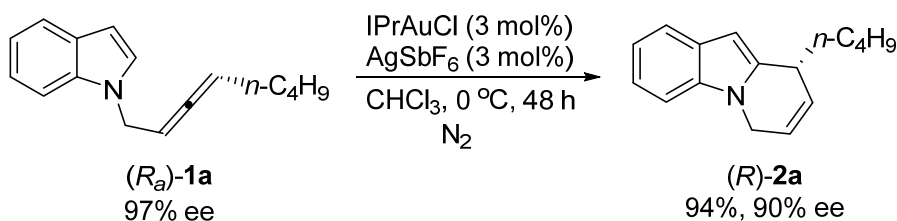
6. Synthesis of 9-butyl-6,7-dihydropyrido[1,2-*a*]indole **3a** (jf-4-067)



To an oven-dried Schlenk tube were added IPrAuCl (0.0065 g, weighed in a glove box, 0.01 mmol, 95%), AgPF₆ (0.0026 g, weighed in a glove box, 0.01 mmol, 99%), *rac*-**1a** (0.0453 g, 0.2 mmol), and toluene (5 mL) at room temperature under nitrogen atmosphere sequentially. The reaction was complete after being stirred at 65 °C for 24 h as monitored by TLC. After filtration through a short column of silica gel (3 cm × 2 cm) [eluent: DCM (5 mL × 4)] and evaporation, the crude product was purified by column chromatography on silica gel to afford **3a** (0.0351 g, 77%) [eluent: petroleum ether] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.57 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.24 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.21-7.13 (m, 1H, Ar-H), 7.08-7.01 (m, 1H, Ar-H), 6.44 (s, 1H, Ar-H), 5.72 (t, *J* = 4.4 Hz, 1H, =CH), 4.03 (t, *J* = 7.2 Hz, 2H, NCH₂), 2.64-2.50 (m, 2H, CH₂), 2.43 (t, *J* = 7.7 Hz, 2H, CH₂), 1.66-1.53 (m, 2H, CH₂), 1.46-1.32 (m, 2H, CH₂), 0.94 (t, *J* = 7.4 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 136.8, 136.6, 132.1, 128.3, 121.6, 120.5, 119.43, 119.37, 108.6, 97.2, 39.5, 32.2, 31.0, 24.1, 22.5, 14.0; IR (KBr) ν (cm⁻¹) 3053, 2956, 2930, 2859, 1456, 1414, 1382, 1360, 1335, 1312, 1248, 1161, 1010; MS (70 ev, EI) *m/z* (%) 226 (M⁺+1, 11.14), 225 (M⁺, 63.85), 183 (100); HRMS calcd for C₁₆H₁₉N [M⁺]: 225.1517, Found: 225.1517.

7. Gold(I) catalyzed cyclization of axially chiral *N*-allenylindoles

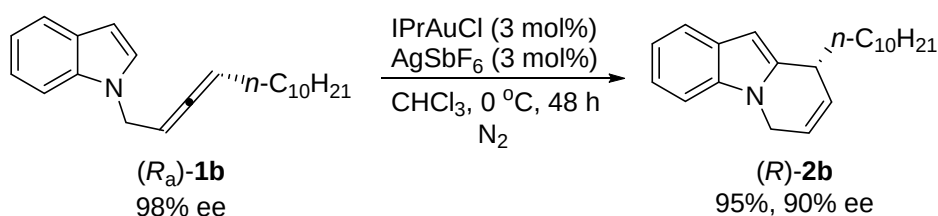
7.1 Synthesis of (*R*)-9-butyl-6,9-dihydropyrido[1,2-*a*]indole (*R*)-**2a** (jf-2-023)



Typical Procedure V: To an oven-dried Schlenk tube were added IPrAuCl (0.0196 g, weighed in a glove box, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, weighed in a glove

box, 0.03 mmol, 98%), (*R_a*)-**1a** (0.2228 g, 1 mmol), and CHCl₃ (25 mL) at room temperature under nitrogen atmosphere sequentially. The reaction was complete after being stirred at 0 °C for 48 h as monitored by TLC. Filtration through a short column of silica gel (3 cm × 2 cm) [eluent: petroleum ether (10 mL × 5)] and evaporation afforded (*R*)-**2a** (0.2092 g, 94%) as a powder solid: m.p. 61.8-63.3 °C (without recrystallization); 90% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 100/1, 1.0 mL/min, λ = 214 nm, *t_R* (major) = 8.3 min, *t_R* (minor) = 7.8 min); ¹H NMR (300 MHz, CDCl₃) δ 7.59 (d, *J* = 6.9 Hz, 1H, Ar-H), 7.29 (d, *J* = 8.4 Hz, 1H, Ar-H), 7.20-7.08 (m, 2H, Ar-H), 6.32 (s, 1H, Ar-H), 6.09-5.92 (m, 2H, =CH × 2), 4.66-4.50 (m, 2H, NCH₂), 3.81-3.61 (m, 1H, CH), 1.86-1.73 (m, 2H, CH₂), 1.41-1.18 (m, 4H, CH₂ × 2), 0.86 (t, *J* = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 138.4, 135.5, 128.3, 127.5, 120.2, 120.1, 119.7, 108.7, 96.8, 41.8, 36.4, 34.2, 27.9, 22.8, 14.0; IR (KBr) ν (cm⁻¹) 2959, 2949, 2924, 2859, 1535, 1467, 1459, 1419, 1362, 1313, 1227, 1183, 1169, 1154, 1010, 1000; MS (70 ev, EI) *m/z* (%) 226 (*M*⁺+1, 8.18), 225 (*M*⁺, 40.51), 168 (100); HRMS calcd for C₁₆H₁₉N [*M*⁺]: 225.1517, Found: 225.1517.

7.2 Synthesis of (*R*)-9-decyl-6,9-dihydropyrido[1,2-*a*]indole (*R*)-**2b** (jf-2-015)



To an oven-dried Schlenk tube were added IPrAuCl (0.0196 g, weighed in a glove box, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, weighed in a glove box, 0.03 mmol, 98%), (*R_a*)-**1b** (0.3078 g, 1 mmol), and CHCl₃ (25 mL) under nitrogen atmosphere sequentially. The reaction was complete after being stirred at 0 °C for 48 h as monitored by TLC. Filtration through a short column of neutral alumina (2 cm × 2 cm) [eluent: DCM (8 mL × 4)] and evaporation. The crude product was then purified by column chromatography on neutral alumina to afford (*R*)-**2b** (0.2936 g, 95%) [eluent: petroleum ether] as a liquid: 90% ee (HPLC conditions: Chiralcel OD-H

column, *n*-hexane/*i*-PrOH = 100/1, 1.0 mL/min, λ = 214 nm, t_R (major) = 7.5 min, t_R (minor) = 8.0 min); $[\alpha]_D^{20}$ = -86.0 (c = 0.86, THF); ^1H NMR (300 MHz, CDCl_3) δ 7.58 (d, J = 6.9 Hz, 1H, Ar-H), 7.27 (d, J = 7.5 Hz, 1H, Ar-H), 7.19-7.07 (m, 2H, Ar-H), 6.31 (s, 1H, Ar-H), 6.07-5.92 (m, 2H, =CH $\times$ 2), 4.63-4.50 (m, 2H, NCH_2), 3.78-3.61 (m, 1H, CH), 1.85-1.70 (m, 2H, CH_2), 1.38-1.16 (m, 16H, $\text{CH}_2 \times 8$), 0.87 (t, J = 6.6 Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 138.4, 135.5, 128.3, 127.5, 120.2, 120.1, 119.7, 108.7, 96.8, 41.8, 36.7, 34.3, 31.9, 29.8, 29.63, 29.58, 29.53, 29.3, 25.8, 22.7, 14.1; IR (neat) ν (cm^{-1}) 3043, 2924, 2853, 1668, 1541, 1471, 1456, 1419, 1362, 1316, 1227, 1185, 1170, 1150, 1012; MS (70 eV, EI) m/z (%) 310 ($\text{M}^+ + 1$, 9.95), 309 (M^+ , 41.78), 168 (100); HRMS calcd for $\text{C}_{22}\text{H}_{31}\text{N}$ [M^+]: 309.2457, Found: 309.2458.

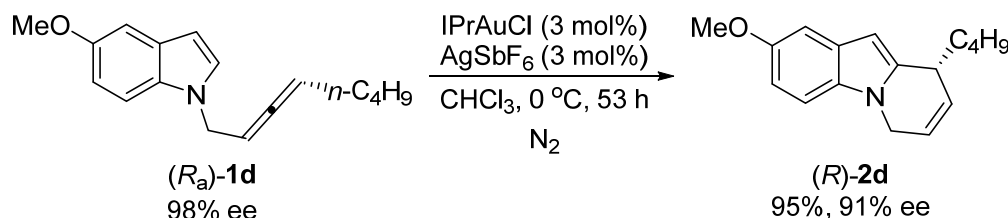
7.3 Synthesis of (*R*)-9-(dec-9-enyl)-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2c (jf-2-066)



Following **Typical Procedure V**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, 0.03 mmol, 98%), (*R_a*)-**1c** (0.3075 g, 1 mmol), and CHCl₃ (25 mL) for 51 h at 0 °C afforded (*R*)-**2c** (0.2941 g, 96%) as a liquid: 92% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 100/1, 1.0 mL/min, λ = 214 nm, t_R (major) = 8.8 min, t_R (minor) = 9.3 min); $[\alpha]_D^{20}$ = -86.7 (c = 1.095, CHCl_3); ^1H NMR (300 MHz, CDCl_3) δ 7.58 (dd, J_1 = 6.9 Hz, J_2 = 1.2 Hz, 1H, Ar-H), 7.28 (d, J = 7.8 Hz, 1H, Ar-H), 7.19-7.07 (m, 2H, Ar-H), 6.31 (s, 1H, ArH), 6.08-5.92 (m, 2H, CH=CH), 5.88-5.71 (m, 1H, CH=), 5.05-4.86 (m, 2H, =CH₂), 4.63-4.51 (m, 2H, NCH_2), 3.78-3.64 (m, 1H, CH), 2.02 (q, J = 7.0 Hz, 2H, CH_2), 1.84-1.69 (m, 2H, CH_2), 1.41-1.15 (m, 12H, $\text{CH}_2 \times 6$); ^{13}C NMR (75 MHz, CDCl_3) δ 139.2, 138.4, 135.4, 128.2, 127.5, 120.2, 120.1, 119.7, 114.1, 108.8, 96.7, 41.8, 36.6, 34.2, 33.8, 29.7, 29.45, 29.42, 29.1, 28.9, 25.8; IR (neat) ν (cm^{-1}) 3044, 2926, 2854, 1668, 1640,

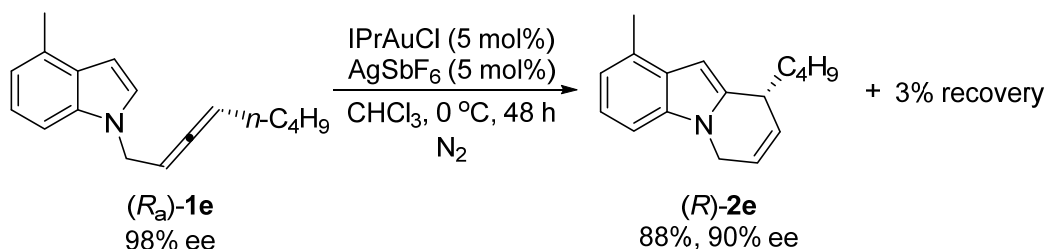
1542, 1471, 1456, 1419, 1362, 1316, 1227, 1185, 1170; MS (70 ev, EI) m/z (%) 308 ($M^+ + 1$, 9.70), 307 (M^+ , 35.39), 168 (100); HRMS calcd for $C_{22}H_{29}N$ [M^+]: 307.2300, Found: 307.2303.

7.4 Synthesis of (*R*)-9-butyl-2-methoxy-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2d (jf-1-198)



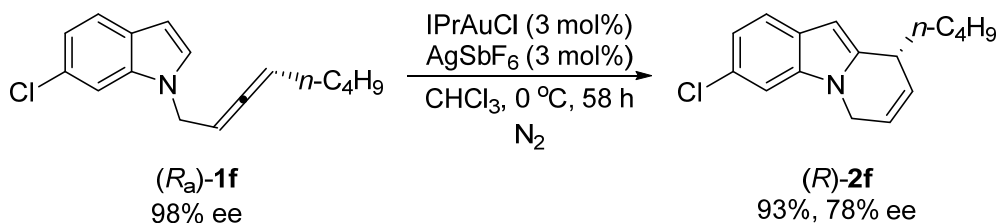
Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R_a*)-**1d** (0.2561 g, 1 mmol), and CHCl₃ (25 mL) for 53 h at 0 °C afforded (*R*)-**2d** (0.2424 g, 95%) [eluent: petroleum ether/ethyl acetate = 50/1] as a powder solid: m.p. 105.3-105.8 °C (without recrystallization); 91% ee (HPLC conditions: Chiralcel AD-H column, *n*-hexane/*i*-PrOH = 95/5, 1.0 mL/min, λ = 214 nm, t_R (major) = 9.9 min, t_R (minor) = 8.6 min); ¹H NMR (300 MHz, CDCl₃) δ 7.16 (d, J = 9.0 Hz, 1H, Ar-H), 7.06 (d, J = 2.4 Hz, 1H, Ar-H), 6.82 (dd, J_1 = 8.7 Hz, J_2 = 2.7 Hz, 1H, Ar-H), 6.24 (s, 1H, Ar-H), 6.08-5.89 (m, 2H, =CH $\times$ 2), 4.60-4.49 (m, 2H, NCH₂), 3.85 (s, 3H, OCH₃), 3.75-3.60 (m, 1H, CH), 1.86-1.70 (m, 2H, CH₂), 1.40-1.15 (m, 4H, CH₂ $\times$ 2), 0.86 (t, J = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 154.4, 139.1, 130.9, 128.6, 127.4, 120.1, 110.2, 109.4, 101.9, 96.5, 55.9, 41.8, 36.3, 34.3, 27.9, 22.8, 14.0; IR (KBr) ν (cm⁻¹) 3045, 2961, 2940, 2923, 2856, 1616, 1483, 1448, 1367, 1278, 1238, 1210, 1167, 1137, 1118, 1034; MS (70 ev, EI) m/z (%) 255 (M^+ , 99.46), 213 (100); HRMS calcd for $C_{17}H_{21}NO$ [M^+]: 255.1623, Found: 255.1622.

7.5 Synthesis of (*R*)-9-butyl-1-methyl-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2e (jf-2-039)



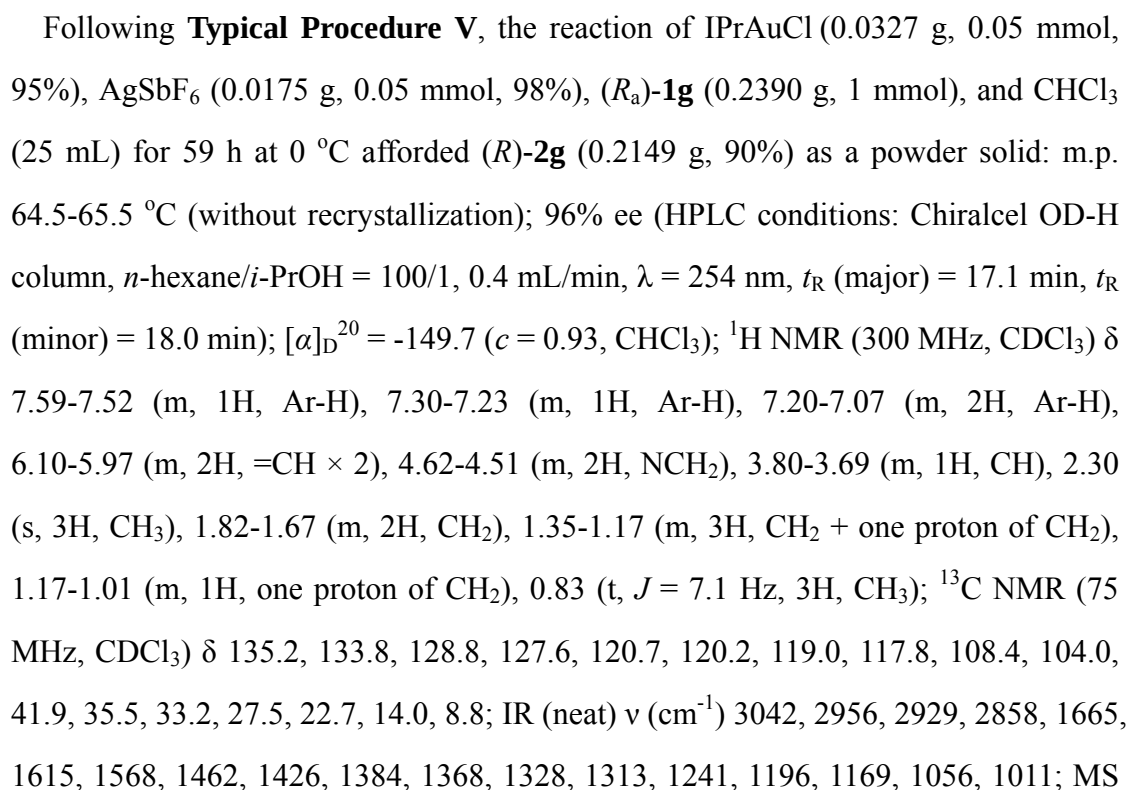
Following **Typical Procedure V**, the reaction of IPrAuCl (0.0326 g, 0.05 mmol, 95%), AgSbF₆ (0.0176 g, 0.05 mmol, 98%), (*R_a*)-**1e** (0.2389 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2e** (0.2308 g, 88%, 91% purity) as a liquid: 90% ee (HPLC conditions: Chiralcel OJ-H column, *n*-hexane/*i*-PrOH = 95/5, 0.6 mL/min, λ = 214 nm, *t_R* (major) = 9.8 min, *t_R* (minor) = 12.2 min); ¹H NMR (300 MHz, CDCl₃) δ 7.09-6.99 (m, 2H, Ar-H), 6.94-6.85 (m, 1H, Ar-H), 6.28 (s, 1H, Ar-H), 5.95-5.83 (m, 2H, =CH × 2), 4.41 (d, *J* = 4.5 Hz, 2H, NCH₂), 3.74-3.56 (m, 1H, CH), 2.53 (s, 3H, CH₃), 1.75 (q, *J* = 7.1 Hz, 2H, CH₂), 1.38-1.13 (m, 4H, CH₂ × 2), 0.85 (t, *J* = 6.9 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 137.7, 135.1, 129.0, 128.0, 127.3, 120.4, 120.1, 119.9, 106.4, 95.2, 41.8, 36.4, 34.2, 27.9, 22.8, 18.7, 14.0; IR (neat) ν (cm⁻¹) 3049, 2956, 2928, 2858, 1536, 1491, 1455, 1432, 1360, 1319, 1235, 1156; MS (70 ev, EI) *m/z* (%) 240 (*M*⁺+1, 22.62), 239 (*M*⁺, 52.14), 182 (100); HRMS calcd for C₁₇H₂₁N [*M*⁺]: 239.1674, Found: 239.1676.

7.6 Synthesis of (*R*)-9-butyl-3-chloro-6,9-dihydropyrido[1,2-*a*]indole (*R*)-**2f** (jf-2-062)



Following **Typical Procedure V**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), (*R_a*)-**1f** (0.2594 g, 1 mmol), and CHCl₃ (25 mL) for 58 h at 0 °C afforded (*R*)-**2f** (0.2408 g, 93%) as a powder solid: m.p. 77.5-78.9 °C (without recrystallization); 78% ee (HPLC conditions: Chiralcel OZ-H column, *n*-hexane/*i*-PrOH = 100/0, 1 mL/min, λ = 214 nm, *t_R* (major) = 22.4

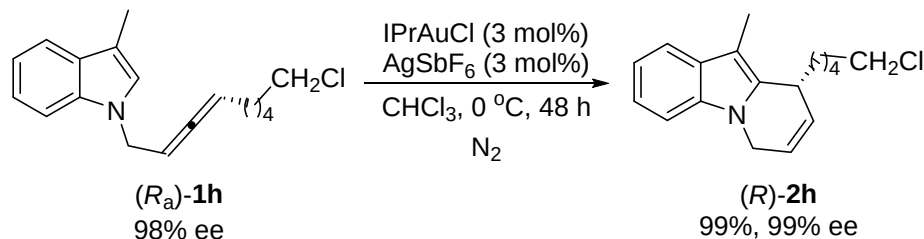
7.7 Synthesis of (*R*)-9-butyl-10-methyl-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2g (jf-2-096)



(70 ev, EI) m/z (%) 240 ($M^+ + 1$, 5.34), 239 (M^+ , 29.45), 182 (100); HRMS calcd for $C_{17}H_{21}N$ [M^+]: 239.1674, Found: 239.1672.

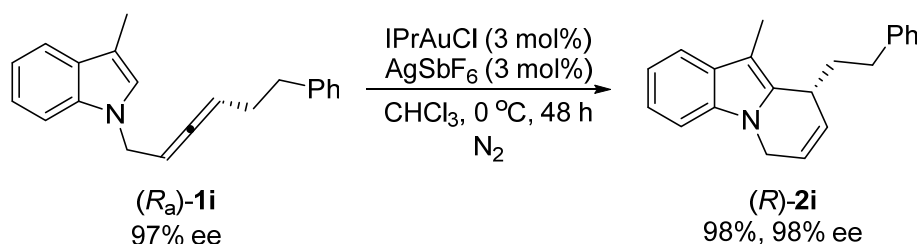
7.8 Synthesis of (*R*)-9-(5-chloropentyl)-10-methyl-6,9-dihydropyrido[1,2-*a*]indole

(*R*)-2h (jf-2-144)



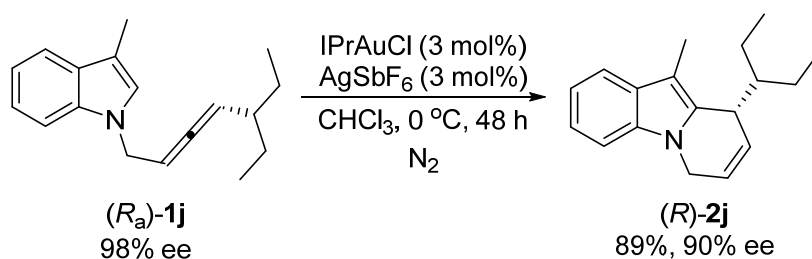
Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R_a*)-**1h** (0.2862 g, 1 mmol, 97%), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2h** (0.2849 g, 99%, 96% purity) [eluent: petroleum ether] as a liquid: 99% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 100/1, 0.7 mL/min, λ = 254 nm, t_R (major) = 7.2 min, t_R (minor) = 7.8 min); $[\alpha]_D^{20}$ = -136.7 (c = 1.41, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.55-7.47 (m, 1H, Ar-H), 7.20-7.06 (m, 3H, Ar-H), 6.00-5.89 (m, 2H, =CH $\times$ 2), 4.51-4.38 (m, 2H, NCH₂), 3.72-3.63 (m, 1H, CH), 3.37 (t, J = 6.6 Hz, 2H, CH₂Cl), 2.26 (s, 3H, CH₃), 1.82-1.52 (m, 4H, CH₂ $\times$ 2), 1.39-1.15 (m, 3H, CH₂ + one proton of CH₂), 1.15-0.96 (m, 1H, one proton of CH₂); ¹³C NMR (75 MHz, CDCl₃) δ 135.1, 133.4, 128.7, 127.3, 120.8, 120.2, 119.0, 117.7, 108.4, 104.0, 44.9, 41.8, 35.4, 33.0, 32.4, 26.8, 24.5, 8.8; IR (neat) ν (cm⁻¹) 3042, 2934, 2858, 1666, 1613, 1568, 1471, 1462, 1385, 1368, 1328, 1313, 1284, 1240, 1197, 1169, 1150, 1122, 1054, 1011; MS (70 ev, EI) m/z (%) 290 ($M^+ (^{37}\text{Cl}) + 1$, 1.00), 289 ($M^+ (^{37}\text{Cl})$, 5.11), 288 ($M^+ (^{35}\text{Cl}) + 1$, 3.17), 287 ($M^+ (^{35}\text{Cl})$, 16.00), 182 (100); HRMS calcd for $C_{18}H_{22}N^{35}\text{Cl}$ [M^+]: 287.1441, Found: 287.1438.

7.9 Synthesis of (*R*)-10-methyl-9-phenethyl-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2i (jf-3-065)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), (*R_a*)-**1i** (0.2856 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2i** (0.2794 g, 98%) [eluent: petroleum ether/diethyl ether = 50/1] as a needle solid: m.p. 101.1-102.2 °C (DCM/hexane); 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 95/5, 0.7 mL/min, λ = 254 nm, *t_R* (major) = 11.9 min, *t_R* (minor) = 12.9 min); [α]_D²⁰ = -141.7 (*c* = 0.78, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.56 (d, *J* = 7.2 Hz, 1H, Ar-H), 7.30-7.07 (m, 8H, Ar-H), 6.17-6.00 (m, 2H, =CH × 2), 4.60 (d, *J* = 3.6 Hz, 2H, NCH₂), 3.89-3.77 (m, 1H, CH), 2.66-2.51 (m, 1H, one proton of PhCH₂), 2.46-2.33 (m, 1H, one proton of PhCH₂), 2.30 (s, 3H, CH₃), 2.20-1.98 (m, 2H, CH₂); ¹³C NMR (75 MHz, CDCl₃) δ 142.1, 135.3, 133.2, 128.9, 128.3, 127.2, 125.7, 121.3, 120.4, 119.1, 117.9, 108.5, 104.4, 42.0, 37.4, 33.0, 31.6, 8.9; IR (KBr) ν (cm⁻¹) 3026, 2947, 2921, 2858, 1601, 1577, 1560, 1494, 1471, 1463, 1425, 1386, 1369, 1328, 1312, 1240, 1197, 1167, 1122, 1080; MS (70 ev, EI) *m/z* (%) 288 (M⁺+1, 4.32), 287 (M⁺, 21.04), 182 (100); Anal. Calcd. for C₂₁H₂₁N (%): C 87.76, H 7.37, N 4.87, Found: C 87.76, H 7.29, N 4.67.

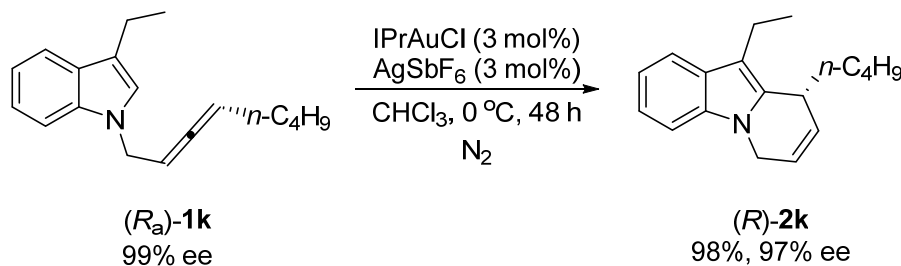
7.10 Synthesis of (*R*)-10-methyl-9-(pentan-3-yl)-6,9-dihydropyrido[1,2-*a*]indole (*R*)-**2j** (jf-3-095)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R_a*)-**1j** (0.2520 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2j** (0.2239 g, 89%) [eluent: petroleum ether] as

a liquid: 90% ee (HPLC conditions: Chiralcel OZ-H column, *n*-hexane/*i*-PrOH = 100/0, 1.0 mL/min, λ = 214 nm, t_R (major) = 11.4 min, t_R (minor) = 10.4 min); $[\alpha]_D^{20}$ = -145.8 (c = 0.89, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.54 (d, J = 7.5 Hz, 1H, Ar-H), 7.24 (d, J = 7.5 Hz, 1H, Ar-H), 7.21-7.07 (m, 2H, Ar-H), 6.14-5.94 (m, 2H, =CH $\times$ 2), 4.66-4.42 (m, 2H, NCH₂), 3.98-3.80 (m, 1H, CH), 2.30 (s, 3H, Ar-CH₃), 1.84-1.70 (m, 1H, CH), 1.65-1.52 (m, 1H, one proton of CH₂), 1.42-1.24 (m, 1H, one proton of CH₂), 1.12 (t, J = 7.4 Hz, 3H, CH₃), 1.02 (quint, J = 7.2 Hz, 2H, CH₂), 0.65 (t, J = 7.5 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.2, 134.1, 128.9, 124.2, 122.0, 120.1, 118.9, 117.8, 108.4, 103.8, 47.5, 42.3, 35.1, 23.7, 23.0, 12.5, 12.2, 9.0; IR (neat) ν (cm⁻¹) 3042, 2959, 2928, 2873, 1665, 1567, 1462, 1426, 1385, 1369, 1312, 1241, 1198, 1173, 1122, 1094, 1058, 1012; MS (70 ev, EI) m/z (%) 254 (M⁺+1, 3.24), 253 (M⁺, 15.66), 182 (100); HRMS calcd for C₁₈H₂₃N [M⁺]: 253.1830, Found: 253.1832.

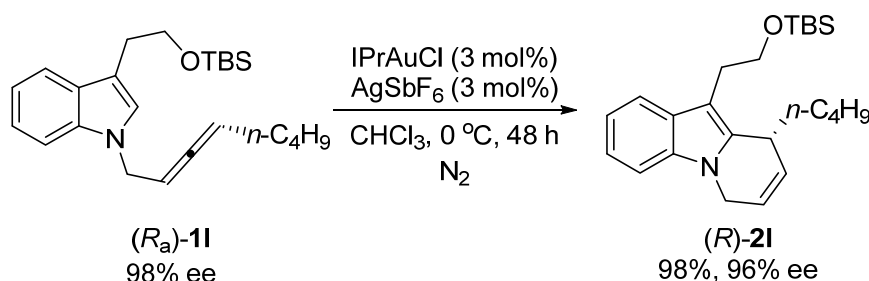
7.11 Synthesis of (*R*)-9-butyl-10-ethyl-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2k (jf-3-075)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0197 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R*_a)-**1k** (0.2541 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2k** (0.2501 g, 98%) [eluent: petroleum ether/diethyl ether = 50/1] as a liquid: 97% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 95/5, 1.0 mL/min, λ = 214 nm, t_R (major) = 4.4 min, t_R (minor) = 4.9 min); $[\alpha]_D^{20}$ = -185.9 (c = 1.05, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.60 (d, J = 6.6 Hz, 1H, Ar-H), 7.25 (d, J = 7.5 Hz, 1H, Ar-H), 7.20-7.07 (m, 2H, Ar-H), 6.11-5.97 (m, 2H, =CH $\times$ 2), 4.61-4.49 (m, 2H, NCH₂), 3.83-3.70 (m, 1H, CH), 2.78 (q, J = 7.5 Hz, 2H, Ar-CH₂), 1.82-1.68 (m, 2H, CH₂), 1.35-1.18 (m, 6H, CH₂ +

one proton of CH₂ + CH₃), 1.15-1.00 (m, 1H, one proton of CH₂), 0.83 (t, *J* = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.5, 133.3, 127.9, 127.8, 120.7, 120.2, 119.0, 118.2, 111.0, 108.6, 42.0, 36.2, 33.2, 27.3, 22.8, 17.7, 15.4, 14.0; IR (neat) ν (cm⁻¹) 3042, 2959, 2929, 2857, 1665, 1612, 1565, 1471, 1456, 1423, 1372, 1331, 1315, 1235, 1193, 1169, 1126, 1069, 1015; MS (70 ev, EI) *m/z* (%) 254 (M⁺+1, 7.59), 253 (M⁺, 33.67), 196 (100); HRMS calcd for C₁₈H₂₃N [M⁺]: 253.1830, Found: 253.1829.

7.12 Synthesis of (*R*)-9-butyl-10-(2-((*tert*-butyldimethylsilyl)oxy)-ethyl)-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2I (jf-3-057)

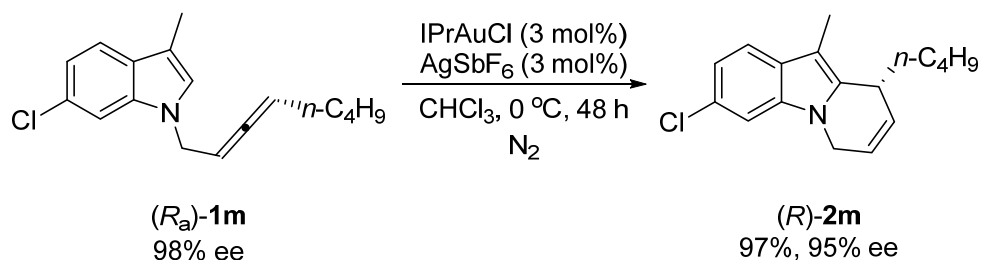


Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, 0.03 mmol, 98%), (*R*_a)-**1I** (0.3796 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2I** (0.3749 g, 98%) [eluent: petroleum ether/ethyl acetate = 100/1] as a liquid: 96% ee (HPLC conditions: Chiralcel IF-H column, *n*-hexane/*i*-PrOH = 100/0, 1.0 mL/min, λ = 214 nm, *t*_R (major) = 10.2 min, *t*_R (minor) = 10.9 min); [α]_D²⁰ = -118.8 (*c* = 0.825, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.60 (d, *J* = 7.2 Hz, 1H, Ar-H), 7.28 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.22-7.10 (m, 2H, Ar-H), 6.14-6.00 (m, 2H, =CH × 2), 4.64-4.48 (m, 2H, NCH₂), 3.94-3.72 (m, 3H, OCH₂ + CH), 3.04 (t, *J* = 8.0 Hz, 2H, CH₂), 1.79 (q, *J* = 6.9 Hz, 2H, CH₂), 1.39-1.19 (m, 3H, CH₂ + one proton of CH₂), 1.17-1.02 (m, 1H, one proton of CH₂), 0.93 (s, 9H, CH₃ × 3), 0.85 (t, *J* = 6.9 Hz, 3H, CH₃), 0.06 (s, 6H, CH₃ × 2); ¹³C NMR (75 MHz, CDCl₃) δ 135.4, 134.9, 128.3, 127.7, 120.7, 120.3, 119.2, 118.1, 108.6, 105.2, 63.8, 42.1, 36.4, 33.2, 28.6, 27.4, 26.0, 22.8, 18.4, 14.0, -5.24, -5.29; IR (neat) ν (cm⁻¹) 3043, 2955, 2929, 2857, 1666, 1611, 1565, 1471, 1461, 1425, 1370, 1330, 1314, 1254,

1213, 1191, 1169, 1093, 1067, 1014; MS (70 ev, EI) m/z (%) 384 ($M^+ + 1$, 18.59), 383 (M^+ , 56.82), 238 (100); HRMS calcd for $C_{24}H_{37}NOSi$ [M^+]: 383.2644, Found: 383.2644.

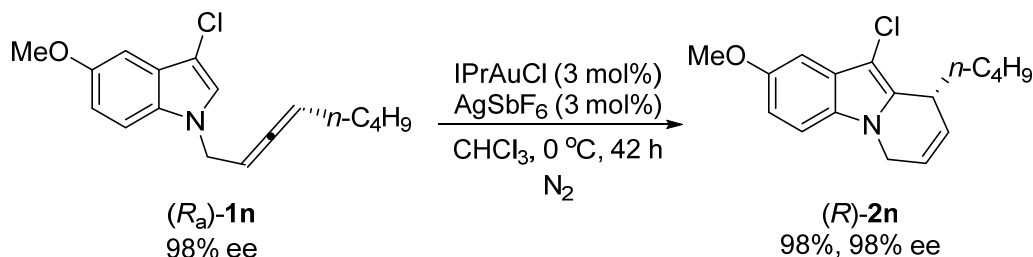
7.13 Synthesis of (*R*)-9-butyl-3-chloro-10-methyl-6,9-dihydropyrido[1,2-*a*]indole

(*R*)-2m (jf-2-200)



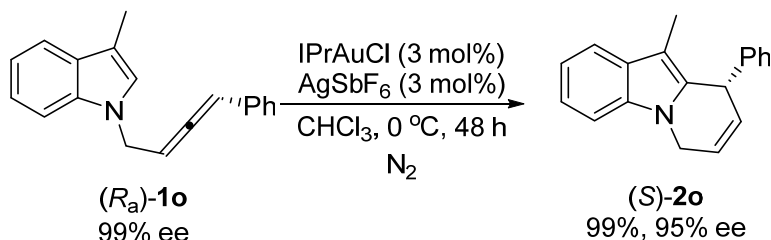
Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0194 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R_a*)-**1m** (0.2736 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2m** (0.2067 g, 97%) [eluent: petroleum ether] as a liquid: 95% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 100/1, 1.0 mL/min, λ = 254 nm, t_R (major) = 5.0 min, t_R (minor) = 6.2 min); [α]_D²⁰ = -122.7 (c = 0.99, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.41 (d, J = 8.4 Hz, 1H, Ar-H), 7.22 (s, 1H, Ar-H), 7.06 (dd, J_1 = 8.4 Hz, J_2 = 1.5 Hz, 1H, Ar-H), 6.12-5.93 (m, 2H, =CH $\times$ 2), 4.58-4.37 (m, 2H, NCH₂), 3.75-3.64 (m, 1H, CH), 2.25 (s, 3H, CH₃), 1.79-1.63 (m, 2H, CH₂), 1.36-1.15 (m, 3H, CH₂ + one proton of CH₂), 1.15-0.98 (m, 1H, one proton of CH₂), 0.83 (t, J = 6.9 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.5, 134.7, 127.6, 127.3, 126.1, 120.4, 119.5, 118.6, 108.5, 104.3, 42.0, 35.4, 33.2, 27.5, 22.7, 14.0, 8.8; IR (neat) ν (cm⁻¹) 3040, 2956, 2929, 2858, 1854, 1667, 1611, 1560, 1475, 1462, 1422, 1385, 1365, 1322, 1281, 1236, 1198, 1169, 1068, 1003; MS (70 ev, EI) m/z (%) 275 (M^+ (³⁷Cl), 11.56), 273 (M^+ (³⁵Cl), 32.44), 216 (100); HRMS calcd for $C_{17}H_{20}N^{35}Cl$ [M^+]: 273.1284, Found: 273.1284.

7.14 Synthesis of (*R*)-9-butyl-10-chloro-2-methoxy-6,9-dihydropyrido[1,2-*a*]indole (*R*)-2n (jf-3-084)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R_a*)-**1n** (0.2888 g, 1 mmol), and CHCl₃ (25 mL) for 42 h at 0 °C afforded (*R*)-**2n** (0.2818 g, 98%) [eluent: petroleum ether/diethyl ether = 20/1] as a prism solid: m.p. 98.7-99.3 °C (DCM/hexane): 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 95/5, 0.5 mL/min, λ = 214 nm, *t_R* (major) = 10.0 min, *t_R* (minor) = 11.8 min); [α]_D²⁰ = -181.4 (*c* = 0.87, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.17 (d, *J* = 8.7 Hz, 1H, Ar-H), 7.03 (d, *J* = 2.4 Hz, 1H, Ar-H), 6.85 (dd, *J*₁ = 8.7 Hz, *J*₂ = 2.4 Hz, 1H, Ar-H), 6.08-5.98 (m, 2H, =CH × 2), 4.54 (d, *J* = 3.6 Hz, 2H, NCH₂), 3.88 (s, 3H, OMe), 3.83-3.74 (m, 1H, CH), 2.03-1.76 (m, 2H, CH₂), 1.37-1.18 (m, 3H, CH₂ + one proton of CH₂), 1.18-0.99 (m, 1H, one proton of CH₂), 0.84 (t, *J* = 7.1 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 154.8, 133.8, 129.3, 127.1, 126.0, 120.2, 111.8, 109.9, 99.5, 98.8, 55.8, 42.2, 33.9, 33.1, 27.4, 22.6, 14.0; IR (KBr) ν (cm⁻¹) 3035, 3008, 2950, 2925, 2860, 1661, 1620, 1576, 1486, 1466, 1450, 1426, 1371, 1340, 1287, 1220, 1185, 1164, 1030; MS (70 ev, EI) *m/z* (%) 291 (M⁺(³⁷Cl), 12.33), 289 (M⁺(³⁵Cl), 34.06), 232 (100); Anal. Calcd. for C₁₇H₂₀ClN (%): C 70.46, H 6.96, N 4.83, Found: C 70.45, H 6.96, N 4.60.

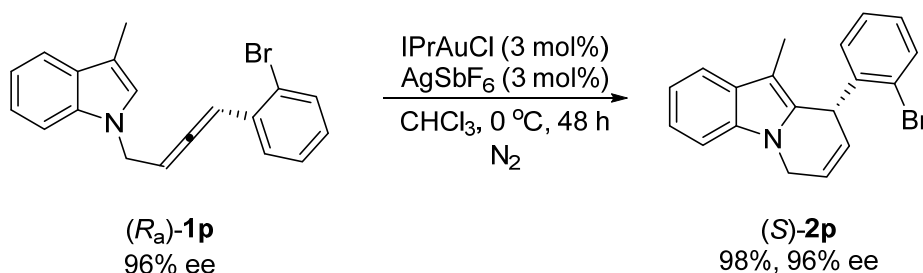
7.15 Synthesis of (*S*)-10-methyl-9-phenyl-6,9-dihydropyrido[1,2-*a*]indole (*S*)-**2o** (jf-2-158)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), (*R_a*)-**1o** (0.2591 g, 1 mmol), and CHCl₃

(25 mL) for 48 h at 0 °C afforded (*S*)-**2o** (0.2575 g, 99%) [eluent: petroleum ether] as a powder solid: m.p.143.8-146.3 °C (without recrystallization); 95% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 100/1, 0.7 mL/min, λ = 254 nm, t_R (major) = 9.9 min, t_R (minor) = 10.6 min); $[\alpha]_D^{20}$ = -207.1 (c = 1.03, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.52 (d, J = 7.8 Hz, 1H, Ar-H), 7.32 (d, J = 8.1 Hz, 1H, Ar-H), 7.28-7.09 (m, 7H, Ar-H), 6.10-5.96 (m, 2H, =CH $\times$ 2), 4.86-4.58 (m, 3H, NCH₂ + CH), 1.97 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 143.3, 135.2, 132.2, 128.7, 128.6, 128.0, 127.8, 126.4, 120.6, 119.2, 119.0, 118.0, 108.7, 105.9, 41.9, 40.5, 8.6; IR (KBr) ν (cm⁻¹) 3050, 3024, 2912, 2857, 1488, 1470, 1459, 1452, 1418, 1388, 1367, 1315, 1242, 1197, 1167; MS (70 ev, EI) m/z (%) 260 (M^+ +1, 19.64), 259 (M^+ , 100); HRMS calcd for C₁₉H₁₇N [M^+]: 259.1361, Found: 259.1361.

7.16 Synthesis of (*S*)-9-(2-bromophenyl)-10-methyl-6,9-dihydropyrido-[1,2-*a*]indole (*S*)-**2p** (jf-2-174)

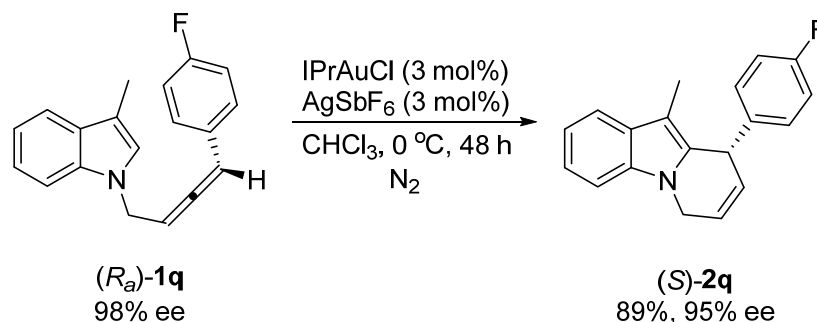


Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0194 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), (*R_a*)-**1p** (0.3287 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*S*)-**2p** (0.3220 g, 98%) [eluent: petroleum ether] as a powder solid: m.p. 91.1-92.1 °C (without recrystallization); 96% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.7 mL/min, λ = 254 nm, t_R (major) = 9.6 min, t_R (minor) = 12.7 min); $[\alpha]_D^{20}$ = -131.7 (c = 0.625, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.55 (t, J = 8.0 Hz, 2H, Ar-H), 7.35 (d, J = 8.1 Hz, 1H, Ar-H), 7.27-6.98 (m, 4H, Ar-H), 6.78 (d, J = 7.2 Hz, 1H, Ar-H), 6.08 (q, J = 10.7 Hz, 2H, =CH $\times$ 2), 5.49-5.30 (m, 1H, CH), 4.78 (d, J = 19.8 Hz, 1H, one proton of NCH₂), 4.66 (d, J = 19.5 Hz, 1H, one proton of NCH₂), 1.93 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 142.4, 135.3, 132.6, 131.9, 130.0, 128.6, 128.1, 128.0, 125.8, 123.1, 120.8,

119.5, 119.4, 118.2, 108.7, 106.1, 41.8, 39.5, 8.4; IR (KBr) ν (cm⁻¹) 3045, 2913, 1471, 1460, 1438, 1432, 1386, 1366, 1315, 1307, 1266, 1241, 1200, 1172, 1044, 1023, 1010; MS (70 ev, EI) m/z (%) 339 (M⁺(⁸¹Br), 76.10), 337 (M⁺(⁷⁹Br), 100); HRMS calcd for C₁₉H₁₆N⁷⁹Br [M⁺]: 337.0466, Found: 337.0467.

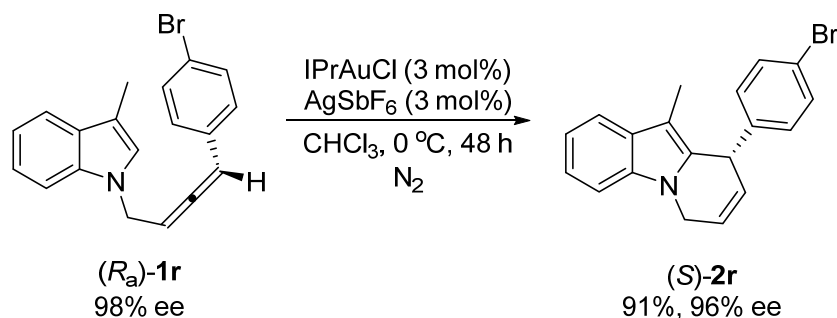
7.17 Synthesis of

(*S*)-9-(4-fluorophenyl)-10-methyl-6,9-dihydropyrido[1,2-*a*]indole (*S*)-2q (jf-3-034)



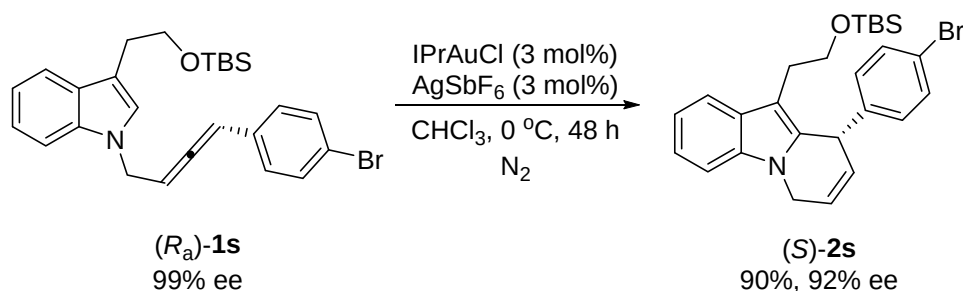
Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0194 g, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, 0.03 mmol, 98%), (*R_a*)-**1q** (0.2800 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*S*)-**2q** (0.2500 g, 89%) [eluent: petroleum ether/diethyl ether = 50/1] as a needle solid: m.p. 123.1-124.2 °C (DCM/hexane); 95% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 95/5, 1.0 mL/min, λ = 214 nm, t_R (major) = 9.3 min, t_R (minor) = 7.8 min); $[\alpha]_D^{20}$ = -205.1 (c = 1.20, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.51 (d, J = 7.8 Hz, 1H, Ar-H), 7.29 (d, J = 7.8 Hz, 1H, Ar-H), 7.23-7.16 (m, 1H, Ar-H), 7.16-7.09 (m, 1H, Ar-H), 7.09-7.01 (m, 2H, Ar-H), 6.90 (t, J = 8.6 Hz, 2H, Ar-H), 6.03-5.91 (m, 2H, =CH $\times$ 2), 4.82-4.51 (m, 3H, NCH₂ + CH), 1.95 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 161.4 (d, J = 243.4 Hz), 139.0 (d, J = 2.8 Hz), 135.2, 131.9, 129.2 (d, J = 7.6 Hz), 128.6, 127.7, 120.8, 119.3, 119.2, 118.1, 115.4 (d, J = 21.4 Hz), 108.7, 105.9, 41.8, 39.7, 8.6; ¹⁹F NMR (282 MHz, CDCl₃) δ -117.0; IR (KBr) ν (cm⁻¹) 1601, 1561, 1505, 1472, 1461, 1414, 1388, 1370, 1315, 1279, 1245, 1223, 1168, 1156, 1093, 1012; MS (70 ev, EI) m/z (%) 278 (M⁺+1, 18.95), 277 (M⁺, 100); Anal. Calcd. for C₁₉H₁₆FN (%): C 82.28, H 5.82, N 4.93, Found: C 82.15, H 5.82, N 4.93.

7.18 Synthesis of (*S*)-9-(4-bromophenyl)-10-methyl-6,9-dihydropyrido[1,2-*a*]indole (*S*)-2r (jf-3-020)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0102 g, 0.03 mmol, 98%), (*R_a*)-**1r** (0.3390 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*S*)-**2r** (0.3089 g, 91%) [eluent: petroleum ether/diethyl ether = 100/ 1] as a needle solid: m.p. 156.5-157.2 °C (DCM/hexane); 96% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.7 mL/min, λ = 254 nm, *t_R* (major) = 11.7 min, *t_R* (minor) = 9.5 min); [α]_D²⁰ = -227.2 (*c* = 1.02, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.52 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.40-7.30 (m, 3H, Ar-H), 7.25-7.18 (m, 1H, Ar-H), 7.14 (t, *J* = 7.1 Hz, 1H, Ar-H), 7.01 (d, *J* = 8.4 Hz, 2H, Ar-H) 6.09-5.96 (m, 2H, =CH × 2), 4.84-4.59 (m, 3H, NCH₂ + CH), 1.96 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 142.4, 135.3, 131.7, 131.5, 129.5, 128.6, 127.4, 120.9, 120.3, 119.5, 119.4, 118.2, 108.7, 106.1, 41.9, 40.0, 8.6; IR (KBr) ν (cm⁻¹) 3038, 1485, 1473, 1462, 1427, 1402, 1388, 1370, 1319, 1245, 1201, 1180, 1165, 1149, 1101, 1069, 1008; MS (70 ev, EI) *m/z* (%) 339 (M⁺(⁸¹Br), 80.04), 337 (M⁺(⁷⁹Br), 100); Anal. Calcd. for C₁₉H₁₆BrN (%): C 67.47, H 4.77, N 4.14, Found: C 67.23, H 4.91, N 3.96.

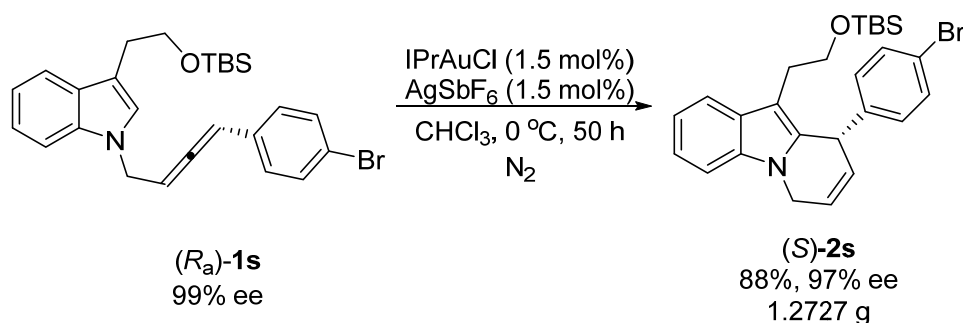
7.19 Synthesis of (*S*)-9-(4-bromophenyl)-10-(2-((*tert*-butyldimethylsilyl)oxy)-ethyl)-6,9-dihydropyrindo[1,2-*a*]indole (*S*)-**2s** (jf-3-096)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol,

95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R_a*)-**1s** (0.4824 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*S*)-**2s** (0.4328 g, 90%) [eluent: petroleum ether/ethyl acetate = 50/1] as a powder solid: m.p. 66.3-68.7 °C (without recrystallization); 92% ee (HPLC conditions: Chiralcel IF-H column, *n*-hexane/*i*-PrOH = 100/0, 1.0 mL/min, λ = 214 nm, *t_R* (major) = 22.3 min, *t_R* (minor) = 24.9 min); [α]_D²⁰ = -184.9 (*c* = 0.73, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.60 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.38 (t, *J* = 7.7 Hz, 3H, Ar-H), 7.25 (t, *J* = 7.5 Hz, 1H, Ar-H), 7.17 (t, *J* = 7.4 Hz, 1H, Ar-H), 7.04 (d, *J* = 8.4 Hz, 2H, Ar-H), 6.12-5.99 (m, 2H, =CH × 2), 4.96-4.87 (m, 1H, CH), 4.81 (d, *J* = 18.3 Hz, 1H, one proton of NCH₂), 4.69 (d, *J* = 18.9 Hz, 1H, one proton of NCH₂), 3.65-3.50 (m, 1H, one proton of OCH₂), 3.31 (td, *J*₁ = 9.5 Hz, *J*₂ = 5.7 Hz, 1H, one proton of OCH₂), 2.85-2.65 (m, 2H, Ar-CH₂), 0.86 (s, 9H, CH₃ × 3), -0.06 (s, 3H, CH₃), -0.07 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 143.0, 135.4, 132.6, 131.8, 129.5, 128.3, 127.5, 121.0, 120.5, 119.6, 119.3, 118.5, 108.9, 107.4, 63.0, 41.9, 39.9, 28.1, 26.0, 18.4, -5.38, -5.44; IR (KBr) ν (cm⁻¹) 3047, 2951, 2926, 2856, 1586, 1485, 1471, 1459, 1422, 1403, 1388, 1373, 1359, 1317, 1256, 1247, 1212, 1169, 1109, 1068, 1011; MS (70 ev, EI) *m/z* (%) 484 (M⁺(⁸¹Br) + 1, 6.86), 483 (M⁺(⁸¹Br), 20.43), 482 (M⁺(⁷⁹Br) + 1, 7.54), 481 (M⁺(⁷⁹Br), 19.74), 336 (100); Anal. Calcd. for C₂₆H₃₂BrNOSi (%): C 64.72, H 6.68, N 2.90, Found: C 64.74, H 6.69, N 2.69.

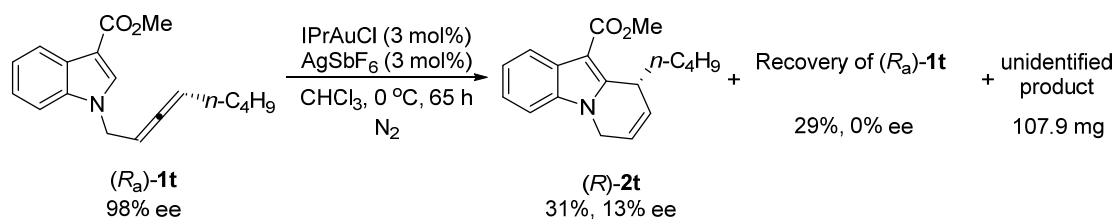
Gram-scale



To an oven-dried three-neck bottle were added IPrAuCl (0.0296 g, 0.045 mmol, 95%), AgSbF₆ (0.0158 g, 0.045 mmol, 98%), and CHCl₃ (40 mL) under nitrogen atmosphere sequentially. After stirring at room temperature for 15 min, the reaction was cooled down to 0 °C and then (*R_a*)-**1s** (1.4450 g, 0.5 mmol), and CHCl₃ (35 mL)

were added. The reaction was complete after being stirred at 0 °C for 50 h as monitored by TLC. After filtration through a short column of silica gel eluted with DCM (15 mL $\times$ 4) and evaporation, the crude product was then purified by column chromatography on silica gel to afford (*S*)-**2s** (1.2727 g, 88%) [eluent: petroleum ether/diethyl ether = 100/1] as a powder solid: 97% ee (HPLC conditions: Chiralcel IF-H column, *n*-hexane/*i*-PrOH = 100/0, 1.0 mL/min, λ = 214 nm, t_R (major) = 20.0 min, t_R (minor) = 22.7 min); $[\alpha]_D^{20}$ = -187.1 (c = 0.93, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.60 (d, J = 7.8 Hz, 1H, Ar-H), 7.38 (t, J = 7.5 Hz, 3H, Ar-H), 7.24 (t, J = 7.5 Hz, 1H, Ar-H), 7.16 (t, J = 7.4 Hz, 1H, Ar-H), 7.03 (d, J = 8.4 Hz, 2H, Ar-H), 6.12-5.99 (m, 2H, =CH $\times$ 2), 4.96-4.87 (m, 1H, CH), 4.80 (d, J = 18.6 Hz, 1H, one proton of NCH₂), 4.69 (d, J = 18.9 Hz, 1H, one proton of NCH₂), 3.63-3.50 (m, 1H, one proton of OCH₂), 3.31 (td, J_1 = 9.5 Hz, J_2 = 5.7 Hz, 1H, one proton of OCH₂), 2.85-2.65 (m, 2H, Ar-CH₂), 0.85 (s, 9H, CH₃ $\times$ 3), -0.066 (s, 3H, CH₃), -0.076 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 142.9, 135.4, 132.6, 131.8, 129.5, 128.3, 127.5, 121.0, 120.5, 119.6, 119.3, 118.5, 108.9, 107.4, 63.0, 41.9, 39.9, 28.1, 26.0, 18.4, -5.38, -5.44.

7.20 Synthesis of methyl (*R*)-9-butyl-6,9-dihydropyrido[1,2-*a*]indole-10-carboxylate (*R*)-**2t** (jf-4-173)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0104 g, 0.03 mmol, 98%), (*R_a*)-**1t** (0.2865 g, 1 mmol), and CHCl₃ (25 mL) for 65 h at 0 °C afforded (*R*)-**2t** (0.0911 g, 31%, 98% purity), recovery of (*R_a*)-**1t** (0.0814 g, 29%), and unidentified product (107.9 mg) [eluent: petroleum ether/ethyl acetate = 15/1 (500 mL) to 7/1 (400 mL)].

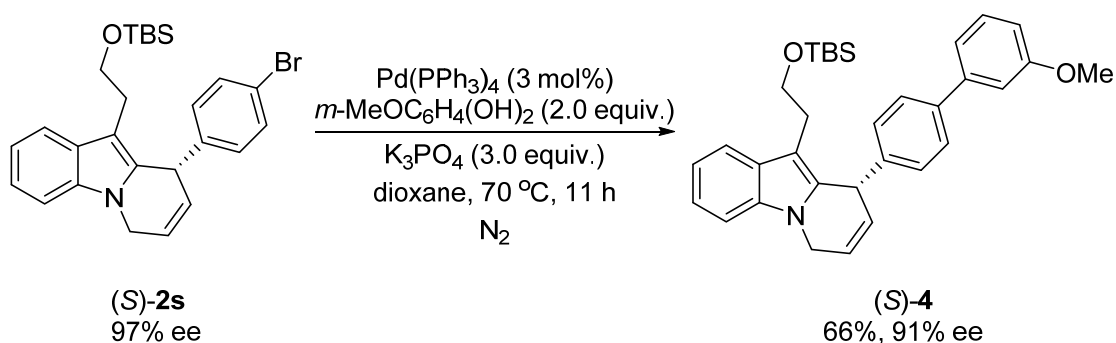
(*R*)-**2t** as a liquid: 13% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 90/10, 0.7 mL/min, λ = 214 nm, t_R (major) = 5.7 min, t_R (minor) =

6.7 min); $[\alpha]_D^{20} = -36.1$ ($c = 1.19$, CHCl_3); ^1H NMR (300 MHz, CDCl_3) δ 8.16 (d, $J = 7.2$ Hz, 1H, Ar-H), 7.36-7.13 (m, 3H, Ar-H), 6.18-5.97 (m, 2H, $=\text{CH} \times 2$), 4.68-4.46 (m, 2H, NCH_2), 4.40-4.27 (m, 1H, CH), 3.93 (s, 3H, OCH_3), 1.99-1.77 (m, 2H, CH_2), 1.41-1.16 (m, 3H, CH_2 + one proton of CH_2), 1.13-0.97 (m, 1H, one proton of CH_2), 0.83 (t, $J = 7.1$ Hz, 3H, CH_3); ^{13}C NMR (75 MHz, CDCl_3) δ 165.9, 147.4, 135.4, 128.0, 126.8, 122.1, 121.8, 121.4, 119.5, 109.0, 101.4, 50.6, 42.3, 35.8, 34.6, 27.8, 22.6, 14.0; IR (neat) ν (cm^{-1}) 3045, 2956, 2925, 2858, 1694, 1532, 1457, 1435, 1378, 1356, 1315, 1259, 1209, 1159, 1114, 1040; MS (70 eV, EI) m/z (%) 284 ($\text{M}^+ + 1$, 13.70), 283 (M^+ , 62.11), 226 (100); HRMS calcd for $\text{C}_{18}\text{H}_{21}\text{NO}_2$ [M^+]: 283.1572, Found: 283.1573.

Recovery of (R_a)-**1t** as a liquid: 0% ee (HPLC conditions: Chiralcel OD-H column, n -hexane/ i -PrOH = 90/10, 0.5 mL/min, $\lambda = 214$ nm, t_R (major) = 25.0 min, t_R (minor) = 23.9 min); ^1H NMR (300 MHz, CDCl_3) δ 8.22-8.13 (m, 1H, Ar-H), 7.84 (s, 1H, Ar-H), 7.41-7.32 (m, 1H, Ar-H), 7.30-7.20 (m, 2H, Ar-H), 5.33-5.14 (m, 2H, $\text{CH}=\text{C}=\text{CH}$), 4.69 (dd, $J_1 = 6.0$ Hz, $J_2 = 2.7$ Hz, 2H, NCH_2), 3.90 (s, 3H, OCH_3), 2.00-1.82 (m, 2H, CH_2), 1.32-1.14 (m, 4H, $\text{CH}_2 \times 2$), 0.85 (t, $J = 7.1$ Hz, 3H, CH_3).

8. Syntheses of simplified analogues of (-)-Goniomitine.

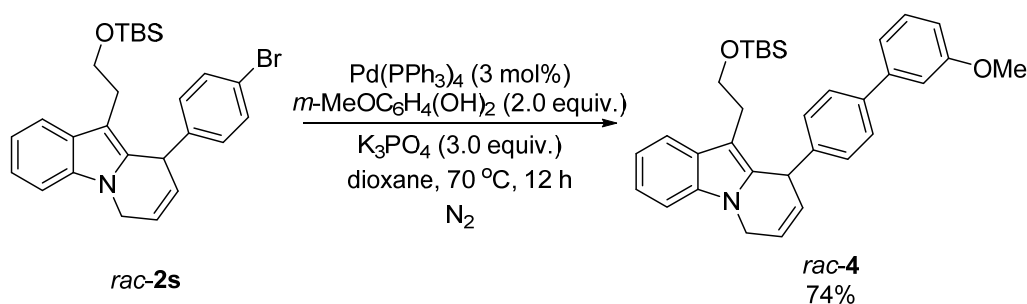
8.1 Synthesis of (*S*)-10-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-9-(3'-methoxy-[1,1'-biphenyl]-4-yl)-6,9-dihydropyrido[1,2-*a*]indole (*S*)-**4**⁷ (jf-3-140)



To an oven-dried Schlenk tube were added K_3PO_4 (127.4 mg, 0.4 mmol), $\text{Pd(PPh}_3)_4$ (7.2 mg, 0.006 mmol), (*S*)-**2s** (97.0 mg, 0.2 mmol), 3-methoxyphenylboronic acid

(62.6 mg, 0.4 mmol), and dioxane (2 mL) under nitrogen atmosphere sequentially. The reaction was complete after being stirred at 70 °C for 11 h as monitored by TLC. The resulting mixture was diluted with H₂O (5 mL) and DCM (5 mL). The organic layer was separated and the aqueous layer was extracted with DCM (5 mL × 2). The combined organic layer was washed with brine and dried over anhydrous Na₂SO₄. After filtration and evaporation, the residue was purified by column chromatography on silica gel to afford (*S*)-**4** (67.2 mg, 66%) [eluent: petroleum ether/ethyl acetate = 50/1] as a liquid: 91% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 100/1, 0.5 mL/min, λ = 214 nm, *t*_R (major) = 15.8 min, *t*_R (minor) = 19.8 min); [α]_D²⁰ = -207.5 (*c* = 1.14, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.58 (d, *J* = 7.5 Hz, 1H, Ar-H), 7.47 (d, *J* = 8.4 Hz, 2H, Ar-H), 7.35 (d, *J* = 7.7 Hz, 1H, Ar-H), 7.31 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.26-7.09 (m, 5H, Ar-H), 7.09-7.04 (m, 1H, Ar-H), 6.87 (ddd, *J*₁ = 8.3 Hz, *J*₂ = 2.6 Hz, *J*₃ = 0.9 Hz, 1H, Ar-H), 6.17-5.99 (m, 2H, CH=CH), 5.02-4.91 (m, 1H, CH), 4.81 (d, *J* = 17.4 Hz, 1H, one proton of NCH₂), 4.69 (d, *J* = 17.4 Hz, 1H, one proton of NCH₂), 3.84 (s, 3H, OCH₃), 3.64-3.50 (m, 1H, one proton of OCH₂), 3.34 (td, *J*₁ = 9.3 Hz, *J*₂ = 5.6 Hz, 1H, one proton of OCH₂), 2.89-2.68 (m, 2H, Ar-CH₂), 0.80 (s, 9H, CH₃ × 3), -0.012 (s, 3H, CH₃), -0.013 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 159.9, 143.1, 142.3, 139.5, 135.4, 133.1, 129.7, 128.4, 128.1, 127.9, 127.5, 120.8, 119.6, 119.5, 119.0, 118.5, 112.7, 112.6, 108.8, 107.2, 63.0, 55.2, 42.0, 40.1, 28.2, 26.0, 18.3, -5.4; IR (neat) ν (cm⁻¹) 3044, 2951, 2928, 2855, 1600, 1566, 1471, 1460, 1403, 1370, 1317, 1295, 1254, 1213, 1169, 1093, 1032, 1015; MS (70 ev, EI) *m/z* (%) 510 (M⁺+1, 17.52), 509 (M⁺, 43.55), 364 (100); HRMS calcd for C₃₃H₃₉NO₂Si [M⁺]: 509.2750, Found: 509.2752.

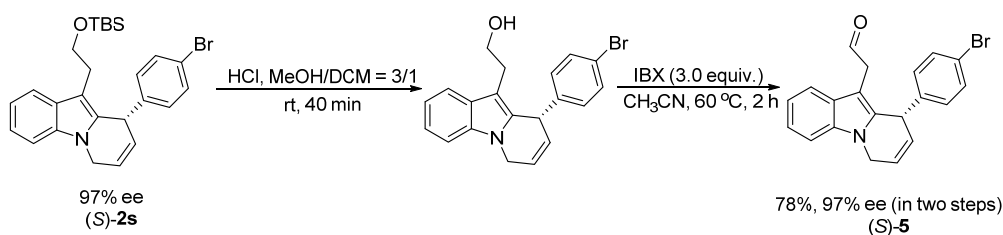
8.2 Synthesis of 10-(2-((*tert*-butyldimethylsilyl)oxy)ethyl)-9-(3'-methoxy-[1,1'-biphenyl]-4-yl)-6,9-dihydropyrido[1,2-*a*]indole *rac*-**4**⁷ (jf-3-158).



Following the preparation of (*S*)-**4**, the reaction of K₃PO₄ (128.0 mg, 0.6 mmol), Pd(PPh₄)₃ (7.3 mg, 0.006 mmol), *rac*-**2s** (96.6 mg, 0.2 mmol), 3-methoxyphenylboronic acid (63.0 mg, 0.4 mmol), and dioxane (2 mL) for 12 h at 70 °C afforded *rac*-**4** (75.2 mg, 74%) [eluent: petroleum ether/ethyl acetate = 50/1] as a powder solid: m.p. 97.3-98.7 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.58 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.46 (d, *J* = 8.1 Hz, 2H, Ar-H), 7.37-7.27 (m, 2H, Ar-H), 7.25-7.08 (m, 5H, Ar-H), 7.08-7.04 (m, 1H, Ar-H), 6.85 (ddd, *J*₁ = 8.1 Hz, *J*₂ = 2.4 Hz, *J*₃ = 0.6 Hz, 1H, Ar-H), 6.12-5.96 (m, 2H, CH=CH), 5.00-4.89 (m, 1H, CH), 4.78 (d, *J* = 17.4 Hz, 1H, one proton of NCH₂), 4.65 (d, *J* = 17.4 Hz, 1H, one proton of NCH₂), 3.82 (s, 3H, OCH₃), 3.62-3.50 (m, 1H, one proton of OCH₂), 3.34 (td, *J*₁ = 9.5 Hz, *J*₂ = 5.7 Hz, 1H, one proton of OCH₂), 2.90-2.69 (m, 2H, Ar-CH₂), 0.81 (s, 9H, CH₃ × 3), -0.012 (s, 3H, CH₃), -0.013 (s, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 159.9, 143.1, 142.3, 139.5, 135.4, 133.1, 129.7, 128.4, 128.1, 127.9, 127.5, 120.8, 119.54, 119.49, 119.0, 118.5, 112.7, 112.6, 108.8, 107.2, 63.0, 55.2, 42.0, 40.1, 28.2, 26.0, 18.3, -5.4; IR (neat) ν (cm⁻¹) 3052, 3028, 3002, 2925, 2854, 1608, 1584, 1566, 1471, 1459, 1437, 1402, 1369, 1315, 1297, 1256, 1210, 1169, 1087, 1055, 1030, 1014; MS (70 ev, EI) *m/z* (%) 510 (M⁺+1, 13.58), 509 (M⁺, 33.87), 364 (100); HRMS calcd for C₃₃H₃₉NO₂Si [M⁺]: 509.2750, Found: 509.2751.

8.3 Synthesis of (*S*)-9-(4-bromophenyl)-6,9-dihydropyrido[1,2-*a*]indole-

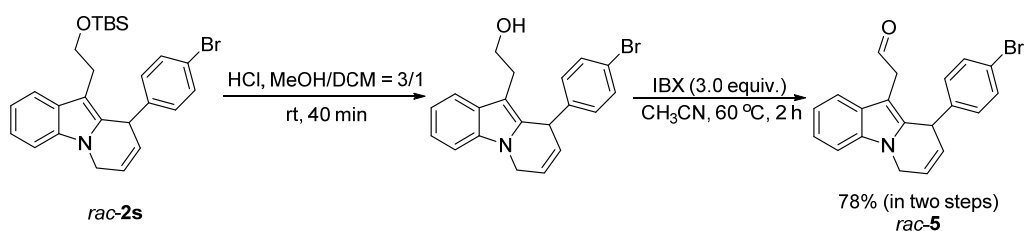
10-acetaldehyde (*S*)-**5**⁸⁻⁹ (jf-3-136, jf-3-137)



To a reaction tube were added (*S*)-**2s** (96.9 mg, 0.2 mmol), $V_{\text{MeOH}}/V_{\text{DCM}} = 3/1$ (4 mL), and HCl (30 μL) sequentially. The reaction was complete after being stirred at room temperature for 40 min as monitored by TLC. The resulting mixture was diluted with H_2O (10 mL) and ethyl acetate (10 mL). The organic layer was separated and the aqueous layer was extracted with ethyl acetate (10 mL $\times$ 2). The combined organic layer was washed with brine and dried over anhydrous Na_2SO_4 . After filtration and evaporation, the crude product was submitted to the next step without further purification.

To a reaction tube were added the crude product prepared above, acetonitrile (4 mL), and IBX (0.1680 g, 0.6 mmol) sequentially. The reaction was complete after being stirred at 60 $^\circ\text{C}$ for 2 h as monitored by TLC. After filtration through a short column of celite, eluted with DCM (8 mL $\times$ 4), and evaporation, the crude product was then purified by column chromatography on silica gel to afford (*S*)-**5** (0.0573 g, 78%) [eluent: petroleum ether/ethyl acetate = 10/1] as an oil: 97% ee (HPLC conditions: Chiralcel OZ-H column, *n*-hexane/*i*-PrOH = 95/5, 1.0 mL/min, $\lambda = 214$ nm, t_{R} (major) = 18.5 min, t_{R} (minor) = 28.4 min); $[\alpha]_{\text{D}}^{20} = -150.9$ ($c = 1.055$, CHCl_3); ^1H NMR (300 MHz, CDCl_3) δ 9.26 (dd, $J_1 = 3.0$ Hz, $J_2 = 1.8$ Hz, 1H, CHO), 7.47 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.38 (d, $J = 8.4$ Hz, 3H, Ar-H), 7.26 (td, $J_1 = 7.5$ Hz, $J_2 = 1.1$ Hz, 1H, Ar-H), 7.16 (td, $J_1 = 7.4$ Hz, $J_2 = 1.0$ Hz, 1H, Ar-H), 7.00 (dt, $J_1 = 8.9$ Hz, $J_2 = 2.3$ Hz, 2H, Ar-H), 6.12-5.93 (m, 2H, CH=CH), 4.87-4.64 (m, 3H, $\text{NCH}_2 + \text{CH}$), 3.58 (dd, $J_1 = 16.7$ Hz, $J_2 = 2.0$ Hz, 1H, one proton of Ar- CH_2), 3.27 (dd, $J_1 = 16.4$ Hz, $J_2 = 3.2$ Hz, 1H, one proton of Ar- CH_2); ^{13}C NMR (75 MHz, CDCl_3) δ 198.7, 141.9, 135.4, 134.2, 132.0, 129.6, 128.0, 127.0, 121.6, 120.8, 120.3, 119.2, 117.9, 109.2, 100.6, 41.9, 39.9, 39.4; IR (neat) ν (cm^{-1}) 3045, 2818, 2716, 1712, 1485, 1472, 1458, 1404, 1370, 1318, 1292, 1243, 1170, 1072, 1010; MS (70 ev, EI) m/z (%) 367 ($\text{M}^+(\text{}^{81}\text{Br})$, 8.47), 365 ($\text{M}^+(\text{}^{79}\text{Br})$, 8.81), 167 (100); HRMS calcd for $\text{C}_{20}\text{H}_{16}\text{}^{79}\text{BrNO}$ [M^+]: 365.0415, Found: 365.0417.

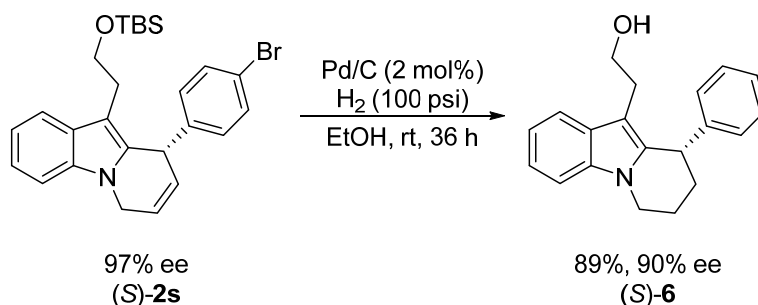
8.4 Synthesis of 9-(4-bromophenyl)-6,9-dihydropyrido[1,2-*a*]indole-10-acetaldehyde *rac*-5⁸⁻⁹ (**jf-3-133**, **jf-3-134**)



Following the preparation of (*S*)-5, the reaction of *rac*-2s (96.0 mg, 0.2 mmol), $V_{\text{MeOH}}/V_{\text{DCM}} = 3/1$ (4 mL), and HCl (30 μL) for 40 min at room temperature afforded the crude product. Then the reaction of the crude product, acetonitrile (4 mL), and IBX (0.1683 g, 0.6 mmol) for 2 h at 60 °C afforded *rac*-5 (0.0571 g, 78%) [eluent: petroleum ether/ethyl acetate = 10/1] as an oil: ^1H NMR (300 MHz, CDCl_3) δ 9.27 (t, $J = 2.4$ Hz, 1H, CHO), 7.47 (d, $J = 7.8$ Hz, 1H, Ar-H), 7.38 (d, $J = 8.4$ Hz, 3H, Ar-H), 7.26 (t, $J = 7.5$ Hz, 1H, Ar-H), 7.17 (t, $J = 7.5$ Hz, 1H, Ar-H), 7.01 (d, $J = 8.1$ Hz, 2H, Ar-H), 6.13-5.93 (m, 2H, CH=CH), 4.88-4.63 (m, 3H, $\text{NCH}_2 + \text{CH}$), 3.59 (dd, $J_1 = 16.4$ Hz, $J_2 = 1.7$ Hz, 1H, one proton of Ar- CH_2), 3.28 (dd, $J_1 = 16.5$ Hz, $J_2 = 3.3$ Hz, 1H, one proton of Ar- CH_2); ^{13}C NMR (75 MHz, CDCl_3) δ 198.7, 141.9, 135.4, 134.2, 132.0, 129.6, 128.0, 127.1, 121.6, 120.9, 120.4, 119.2, 117.9, 109.2, 100.7, 42.0, 39.9, 39.4; IR (neat) ν (cm^{-1}) 3045, 2860, 2837, 2730, 1723, 1488, 1471, 1456, 1411, 1372, 1309, 1244, 1178, 1168, 1071, 1011; MS (70 ev, EI) m/z (%) 367 ($\text{M}^+(\text{}^{81}\text{Br})$, 53.50), 365 ($\text{M}^+(\text{}^{79}\text{Br})$, 45.56), 336 (100); HRMS calcd for $\text{C}_{20}\text{H}_{16}\text{}^{79}\text{BrNO}$ [M^+]: 365.0415, Found: 365.0413.

8.5 Synthesis of (*S*)-9-phenyl-6,7,8,9-tetrahydropyrido[1,2-*a*]indole-10-ethanol

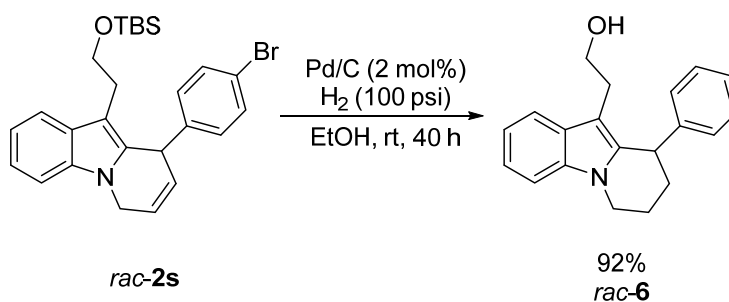
(*S*)-6 (jf-3-121)



To a conical flask were added (*S*)-2s (96.2 mg, 0.2 mmol), Pd/C (10% on C, dry, 4.4 mg, 0.04 mmol), and EtOH (1 mL) sequentially. The conical flask was placed in an autoclave and charged with H_2 (100 psi) with stirring at room temperature for 36 h.

After filtration through a short column of silica gel eluted with EtOAc (5 mL $\times$ 4) and evaporation, the crude product was then purified by column chromatography on silica gel to afford (*S*)-**6** (0.0519 g, 89%) [eluent: petroleum ether/ethyl acetate = 5/1] as a liquid: 90% ee (HPLC conditions: Chiralcel OZ-H column, *n*-hexane/*i*-PrOH = 95/5, 1.0 mL/min, λ = 214 nm, t_R (major) = 16.3 min, t_R (minor) = 27.6 min); $[\alpha]_D^{20}$ = -38.0 (c = 1.00, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.57 (d, J = 8.1 Hz, 1H, Ar-H), 7.34 (d, J = 7.8 Hz, 1H, Ar-H), 7.29-7.09 (m, 5H, Ar-H), 7.05 (d, J = 6.9 Hz, 2H, Ar-H), 4.52 (t, J = 4.8 Hz, 1H, Ar-CH), 4.28 (dt, J_1 = 11.7 Hz, J_2 = 4.8 Hz, 1H, one proton of OCH₂), 4.02-3.89 (m, 1H, one proton of OCH₂), 3.65-3.46 (m, 2H, Ar-CH₂), 2.82-2.52 (m, 2H, NCH₂), 2.31-2.17 (m, 1H, one proton of CH₂), 2.15-1.99 (m, 2H, CH₂), 1.97-1.84 (m, 1H, one proton of CH₂) 1.25 (brs, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 144.9, 136.1, 135.6, 128.3, 128.0, 126.4, 120.8, 119.5, 118.3, 108.9, 106.9, 62.4, 42.4, 38.8, 30.6, 27.6, 19.0; IR (neat) ν (cm⁻¹) 3390, 3057, 3025, 2943, 2865, 1601, 1590, 1490, 1462, 1449, 1362, 1322, 1256, 1241, 1203, 1156, 1034, 1013; MS (70 ev, EI) m/z (%) 292 (M^+ +1, 5.83), 291 (M^+ , 28.55), 260 (100); HRMS calcd for C₂₀H₂₁NO [M^+]: 291.1623, Found: 291.1621.

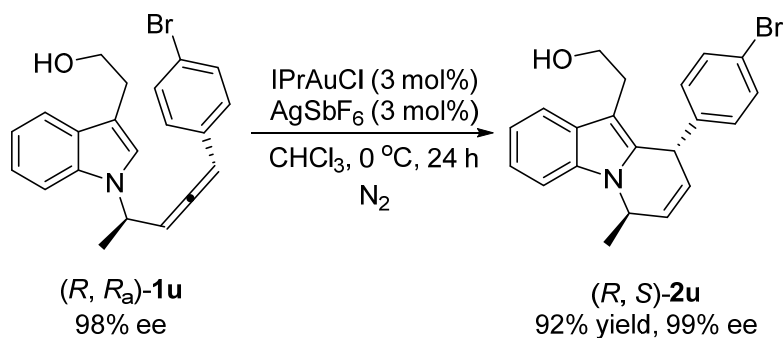
8.6 Synthesis of 9-phenyl-6,7,8,9-tetrahydropyrido[1,2-*a*]indole-10-ethanol *rac*-6 (jf-3-125)



Following the preparation of (*S*)-**6**, the reaction of *rac*-**2s** (94.8 mg, 0.2 mmol), Pd/C (10% on C, dry, 4.2 mg, 0.04 mmol), EtOH (1 mL), and H₂ (100 psi) for 40 h at room temperature afforded *rac*-**6** (0.0524 g, 92%) [eluent: petroleum ether/ethyl acetate = 4/1] as a liquid: ¹H NMR (300 MHz, CDCl₃) δ 7.57 (d, J = 7.8 Hz, 1H, Ar-H), 7.34 (d, J = 7.8 Hz, 1H, Ar-H), 7.29-7.09 (m, 5H, Ar-H), 7.05 (d, J = 6.6 Hz, 2H, Ar-H), 4.52 (t, J = 4.8 Hz, 1H, Ar-CH), 4.28 (dt, J_1 = 11.7 Hz, J_2 = 4.8 Hz, 1H,

one proton of OCH₂), 4.02-3.89 (m, 1H, one proton of OCH₂), 3.65-3.46 (m, 2H, Ar-CH₂), 2.82-2.52 (m, 2H, NCH₂), 2.31-2.17 (m, 1H, one proton of CH₂), 2.15-1.99 (m, 2H, CH₂), 1.97-1.84 (m, 1H, one proton of CH₂) 1.25 (brs, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 144.9, 136.1, 135.7, 128.3, 128.0, 126.4, 120.8, 119.5, 118.3, 108.9, 106.9, 62.5, 42.4, 38.8, 30.6, 27.6, 19.0; IR (neat) ν (cm⁻¹) 3390, 3056, 3025, 2943, 2866, 1601, 1491, 1462, 1449, 1362, 1322, 1256, 1241, 1203, 1156, 1034, 1013; MS (70 ev, EI) *m/z* (%) 292 (M⁺+1, 7.33), 291 (M⁺, 32.13), 260 (100); HRMS calcd for C₂₀H₂₁NO [M⁺]: 291.1623, Found: 291.1624.

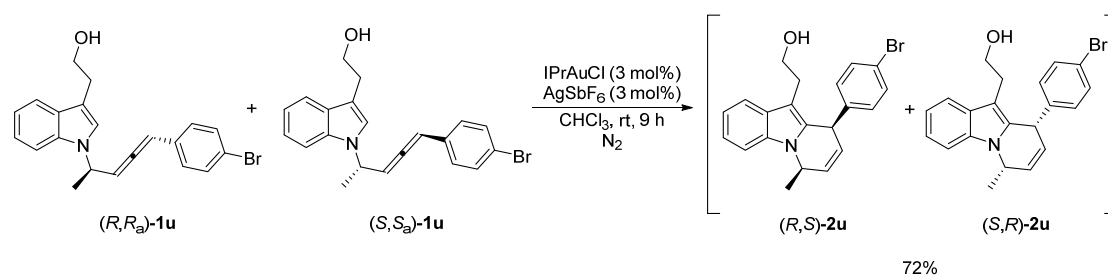
8.7 Synthesis of (*R, S*)-2-(9-(4-bromophenyl)-6-methyl-6,9-dihydropyrido[1,2-*a*]indol-10-yl)ethanol (*R, S*)-**2u** (jf-5-119)



Typical Procedure VI: To an oven-dried Schlenk tube were added IPrAuCl (0.0195 g, weighed in a glove box, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, weighed in a glove box, 0.03 mmol, 98%), (*R, R_a*)-**1u** (0.3720 g, 1 mmol), and CHCl₃ (25 mL) under nitrogen atmosphere sequentially. The reaction was complete after being stirred at 0 °C for 24 h as monitored by TLC. After filtration through a short column of silica gel (3 cm × 2 cm) [eluent: ethyl acetate (8 mL × 4)] and evaporation, the crude product was purified by column chromatography on silica gel to afford (*R, S*)-**2u** (0.3434 g, 92%) [eluent: petroleum ether/ethyl acetate = 5/1] as a foamy solid: m.p. 57.1-59.2 °C (without recrystallization); 99% ee (HPLC conditions: Chiralcel IA-H column, *n*-hexane/*i*-PrOH = 90/10, 0.5 mL/min, λ = 254 nm, *t_R* (major) = 18.5 min, *t_R* (minor) = 21.2 min); [α]_D²⁰ = -270.8 (*c* = 0.975, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.56 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.45-7.32 (m, 3H, Ar-H), 7.25-7.17 (m, 1H, Ar-H), 7.16-7.08 (m, 1H, Ar-H), 7.01-6.94 (m, 2H, Ar-H), 5.98 (ddd, *J*₁ = 10.2 Hz, *J*₂ = 3.8

Hz, $J_3 = 2.3$ Hz, 1H, =CH), 5.80 (ddd, $J_1 = 10.2$ Hz, $J_2 = 3.4$ Hz, $J_3 = 1.6$ Hz, 1H, =CH), 5.18-5.06 (m, 1H, CH), 4.83 (q, $J = 2.7$ Hz, 1H, NCH), 3.60-3.30 (m, 2H, OCH₂), 2.78-2.62 (m, 1H, one proton of CH₂), 2.54-2.39 (m, 1H, one proton of CH₂), 1.53 (d, $J = 6.6$ Hz, 3H, CH₃), 1.30 (s, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 143.2, 134.4, 133.0, 131.7, 129.8, 128.8, 126.0, 125.7, 120.9, 120.4, 119.4, 118.5, 110.5, 107.2, 62.2, 47.8, 40.2, 27.9, 22.0; IR (neat) ν (cm⁻¹) 3390, 3042, 2963, 2929, 2873, 1486, 1460, 1403, 1353, 1316, 1239, 1169, 1099, 1038, 1011; MS (70 ev, EI) m/z (%) 383 ($M^+ (^{81}\text{Br})$, 37.29), 381 ($M^+ (^{79}\text{Br})$, 36.80), 350 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M^+]: 381.0728, Found: 381.0728.

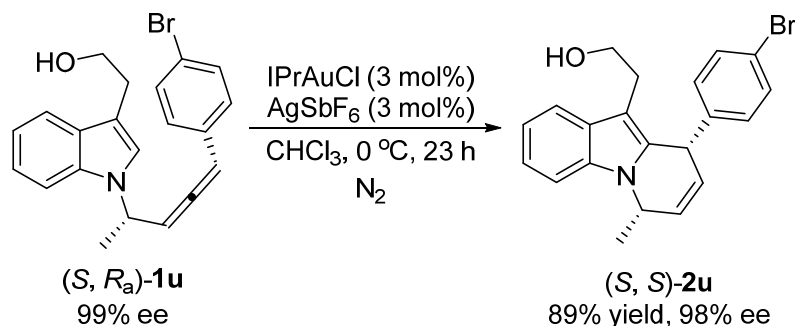
8.8 Synthesis of (*R,S*)-2-(9-(4-bromophenyl)-6-methyl-6,9-dihydropyrido[1,2-*a*]indol-10-yl)ethanol (*R,S*)-2u, and (*S,R*)-2-(9-(4-bromophenyl)-6-methyl-6,9-dihydropyrido[1,2-*a*]indol-10-yl)ethanol (*S,R*)-2u (jf-5-120-2)



Following **Typical Procedure VI**, the reaction of IPrAuCl (0.0038 g, 0.006 mmol, 95%), AgSbF₆ (0.0020 g, 0.006 mmol, 98%), ((*R,R_a*)-**1u** + (*S,S_a*)-**1u**) (0.0745 g, 0.2 mmol), and CHCl₃ (5 mL) for 9 h at room temperature afforded ((*R,S*)-**2u** + (*S,R*)-**2u**) (0.0534 g, 72%) [eluent: petroleum ether/diethyl ether = 2/1 (300 mL) to 1/1 (300 mL)] as an oil: ¹H NMR (300 MHz, CDCl₃) δ 7.56 (d, $J = 8.1$ Hz, 1H, Ar-H), 7.46-7.32 (m, 3H, Ar-H), 7.27-7.17 (m, 1H, Ar-H), 7.16-7.08 (m, 1H, Ar-H), 7.03-6.93 (m, 2H, Ar-H), 6.05-5.92 (m, 1H, =CH), 5.87-5.73 (m, 1H, =CH), 5.20-5.05 (m, 1H, CH), 4.91-4.75 (m, 1H, NCH), 3.60-3.31 (m, 2H, OCH₂), 2.76-2.62 (m, 1H, one proton of CH₂), 2.55-2.40 (m, 1H, one proton of CH₂), 1.53 (d, $J = 6.3$ Hz, 3H, CH₃), 1.28 (s, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 143.2, 134.4, 133.1, 131.8, 129.8, 128.9, 126.1, 125.8, 120.9, 120.5, 119.5, 118.5, 110.5, 107.3, 62.3, 47.9, 40.3,

27.9, 22.0; IR (neat) ν (cm⁻¹) 3396, 3040, 2968, 2928, 2877, 1485, 1460, 1403, 1352, 1316, 1285, 1238, 1167, 1098, 1071, 1039, 1011; MS (70 ev, EI) m/z (%) 383 ($M^+(\text{}^{81}\text{Br})$, 35.18), 381 ($M^+(\text{}^{79}\text{Br})$, 34.96), 350 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M^+]: 381.0728, Found: 381.0728.

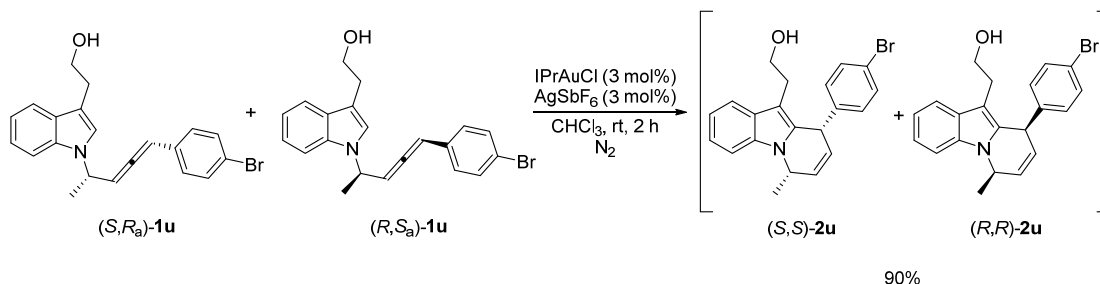
8.9 Synthesis of (*S,S*)-2-(9-(4-bromophenyl)-6-methyl-6,9-dihydropyrido[1,2-*a*]indol-10-yl)ethanol (*S,S*)-**2u** (jf-5-123)



Following **Typical Procedure VI**, the reaction of IPrAuCl (0.0195 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), (*S, R_a*)-**1u** (0.3740 g, 1 mmol), and CHCl₃ (25 mL) for 23 h at 0 °C afforded (*S, S*)-**2u** (0.3321 g, 89%) [eluent: petroleum ether/diethyl ether = 2/1 (300 mL) to 1/1 (300 mL)] as a foamy solid: m.p. 55.9-58.1 °C (without recrystallization); 98% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.5 mL/min, λ = 254 nm, t_R (major) = 49.6 min, t_R (minor) = 22.0 min); $[\alpha]_D^{20}$ = -103.8 (c = 0.900, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.59 (d, J = 7.5 Hz, 1H, Ar-H), 7.46-7.31 (m, 3H, Ar-H), 7.27-7.18 (m, 1H, Ar-H), 7.18-7.09 (m, 1H, Ar-H), 7.07-6.95 (m, 2H, Ar-H), 6.14-5.82 (m, 2H, CH=CH), 5.08-4.80 (m, 2H, CH + NCH), 3.68-3.40 (m, 2H, OCH₂), 2.87-2.60 (m, 2H, CH₂), 1.66 (d, J = 6.6 Hz, 3H, CH₃), 1.43 (s, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 142.4, 134.6, 132.8, 131.9, 129.3, 128.3, 126.5, 126.0, 121.0, 120.4, 119.5, 118.5, 109.8, 106.4, 62.3, 48.2, 39.7, 27.7, 22.6; IR (neat) ν (cm⁻¹) 3391, 3044, 2973, 2929, 2873, 1666, 1609, 1586, 1562, 1486, 1462, 1427, 1403, 1353, 1317, 1292, 1265, 1240, 1170, 1071, 1039, 1010; MS (70 ev, EI) m/z (%) 384 ($M^+(\text{}^{81}\text{Br})$ + 1, 6.10), 383 ($M^+(\text{}^{81}\text{Br})$, 31.52), 382 ($M^+(\text{}^{79}\text{Br})$ + 1, 8.06), 381 ($M^+(\text{}^{79}\text{Br})$, 29.99), 350 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M^+]: 381.0728, Found: 381.0729.

8.10 Synthesis of (*S,S*)-2-(9-(4-bromophenyl)-6-methyl-6,9-dihydropyrido[1,2-*a*]

indol-10-yl)ethanol (*S,S*)-2u and (*R,R*)-2-(9-(4-bromophenyl)-6-methyl-6,9-dihydropyrido[1,2-*a*]indol-10-yl)ethanol (*R,R*)-2u (jf-5-124)

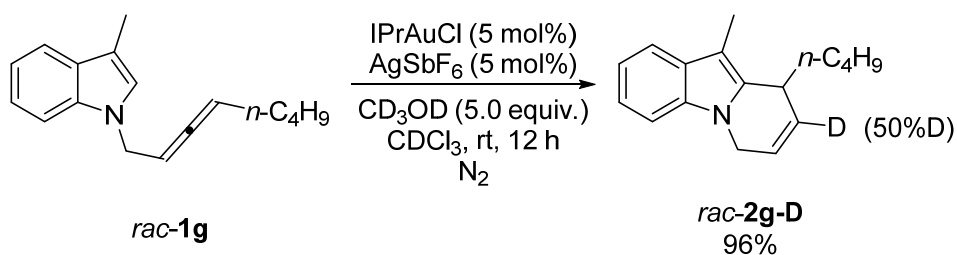


Following **Typical Procedure VI**, the reaction of IPrAuCl (0.0038 g, 0.006 mmol, 95%), AgSbF₆ (0.0020 g, 0.006 mmol, 98%), ((*S,R_a*)-**1u** + (*R,S_a*)-**1u**) (0.0771 g, 0.2 mmol), and CHCl₃ (5 mL) for 2 h at room temperature afforded ((*S,S*)-**1u** + (*R,R*)-**2u**) (0.0693 g, 90%) [eluent: petroleum ether/diethyl ether = 2/1 (300 mL) to 1/1 (300 mL)] as a foamy solid: m.p. 48.9-51.0 °C (without recrystallization); ¹H NMR (300 MHz, CDCl₃) δ 7.59 (d, *J* = 8.1 Hz, 1H, Ar-H), 7.45-7.33 (m, 3H, Ar-H), 7.27-7.18 (m, 1H, Ar-H), 7.18-7.10 (m, 1H, Ar-H), 7.07-6.95 (m, 2H, Ar-H), 6.08-5.90 (m, 2H, CH=CH), 5.08-4.83 (m, 2H, CH + NCH), 3.68-3.41 (m, 2H, OCH₂), 2.87-2.60 (m, 2H, CH₂), 1.66 (d, *J* = 6.6 Hz, 3H, CH₃), 1.35 (s, 1H, OH); ¹³C NMR (75 MHz, CDCl₃) δ 142.5, 134.6, 132.8, 131.9, 129.3, 128.3, 126.6, 126.1, 121.0, 120.5, 119.5, 118.5, 109.8, 106.4, 62.4, 48.2, 39.7, 27.7, 22.7; IR (neat) ν (cm⁻¹) 3391, 3042, 2926, 2870, 2853, 1486, 1461, 1425, 1403, 1353, 1317, 1292, 1264, 1240, 1170, 1099, 1071, 1039, 1010; MS (70 ev, EI) *m/z* (%) 384 (M⁺(⁸¹Br) + 1, 8.43), 383 (M⁺(⁸¹Br), 35.81), 382 (M⁺(⁷⁹Br) + 1, 8.80), 381 (M⁺(⁷⁹Br), 34.47), 350 (100); HRMS calcd for C₂₁H₂₀NO⁷⁹Br [M⁺]: 381.0728, Found: 381.0732.

9. Deuterium-labeling experiment and Parallel reactions

9.1 Preparation of 9-butyl-10-methyl-6,9-dihydropyrido[1,2-*a*]indole-8-*D*

rac-2g-D. (jf-3-170)

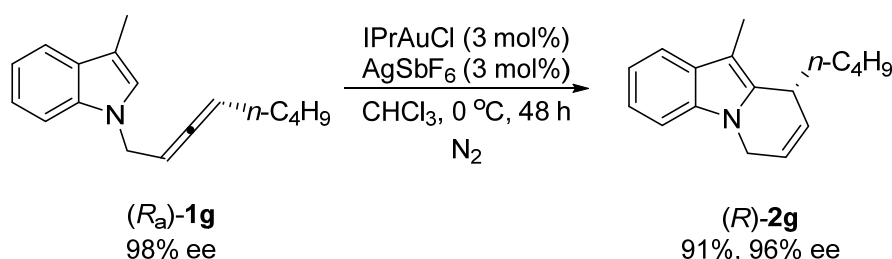


To a oven-dried Schlenk tube were added IPrAuCl (0.0165 g, weighed in a glove box, 0.025 mmol, 95%), AgSbF₆ (0.0088 g, weighed in a glove box, 0.025 mmol, 98%), *rac*-**1g** (0.1194 g, 0.5 mmol), CDCl₃ (2.5 mL), and CD₃OD (104 μL, d = 0.888 g/mL, 92.4 mg, 2.5 mmol, 99%) under nitrogen atmosphere sequentially. The resulting mixture was stirred at room temperature for 12 h and complete as monitored by TLC. After transferred to a pear-shaped bottle with DCM and evaporated, the crude product was then purified by column chromatography on silica gel to afford *rac*-**2g-D** (0.1155 g, 96%, 50% D) [eluent: petroleum ether] as a powder solid: ¹H NMR (300 MHz, CDCl₃) δ 7.54 (d, *J* = 8.4 Hz, 1H, Ar-H), 7.23 (t, *J* = 6.5 Hz, 1H, Ar-H), 7.20-7.07 (m, 2H, Ar-H), 6.09-5.97 (m, 1.5H, =CH × 1.5), 4.63-4.45 (m, 2H, NCH₂), 3.83-3.64 (m, 1H, CH), 2.30 (s, 3H, CH₃), 1.83-1.65 (m, 2H, CH₂), 1.37-1.18 (m, 3H, CH₂ + one proton of CH₂), 1.17-1.00 (m, 1H, one proton of CH₂), 0.83 (t, *J* = 6.9 Hz, 3H, CH₃); ¹³C NMR (75 MHz, CDCl₃) δ 135.2, 133.9, 128.8, 127.4 (t, *J*_{C-D} = 24.5), 120.7, 120.2, 119.0, 117.8, 108.4, 104.1, 41.9, 35.5, 33.2, 27.5, 22.7, 14.0, 8.8; ¹³C NMR (75 MHz, CDCl₃) the following signals are discernible for *rac*-**2g** δ 127.7, 120.5, 33.1; IR (neat) ν (cm⁻¹) 3044, 2956, 2929, 2858, 1657, 1615, 1568, 1471, 1462, 1425, 1384, 1369, 1313, 1239, 1195, 1169, 1123, 1056, 1012; MS (70 ev, EI) *m/z* (%) 241 (*M*⁺ + 1, 2.41), 240 (*M*⁺, 16.74), 182 (100); HRMS calcd for C₁₇H₂₀DN [*M*⁺]: 240.1737, Found: 240.1737.

9.2 Parallel reactions

Synthesis of (*R*)-9-butyl-10-methyl-6,9-dihydropyrido[1,2-*a*]indole (*R*)-**2g**

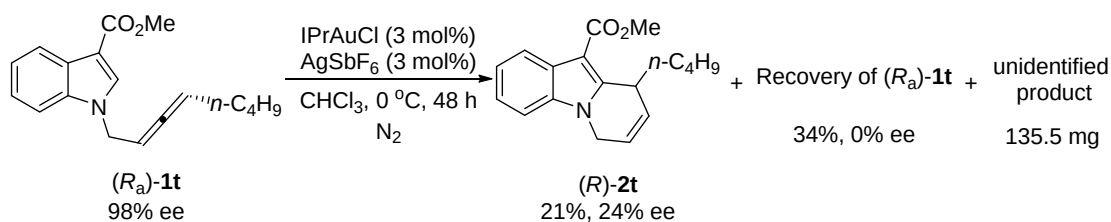
(jf-5-026)



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0105 g, 0.03 mmol, 98%), (*R*_a)-**1g** (0.2363 g, 1 mmol), and CHCl₃

(25 mL) for 48 h at 0 °C afforded (*R*)-**2g** (0.2153 g, 91%) [eluent: petroleum ether/ ethyl acetate = 100/1] as a powder solid: 96% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 100/1, 0.4 mL/min, λ = 254 nm, t_R (major) = 17.3 min, t_R (minor) = 18.3 min); ^1H NMR (300 MHz, CDCl_3) δ 7.55 (d, J = 7.5 Hz, 1H, Ar-H), 7.26 (d, J = 6.6 Hz, 1H, Ar-H), 7.20-7.07 (m, 2H, Ar-H), 6.16-5.95 (m, 2H, =CH $\times$ 2), 4.64-4.50 (m, 2H, NCH₂), 3.85-3.65 (m, 1H, CH), 2.30 (s, 3H, CH₃), 1.88-1.65 (m, 2H, CH₂), 1.39-1.00 (m, 4H, CH₂ $\times$ 2), 0.83 (t, J = 7.1 Hz, 3H, CH₃).

Synthesis of methyl (*R*)-9-butyl-6,9-dihydropyrido[1,2-*a*]indole-10-carboxylate (*R*)-2t** (jf-5-025)**



Following **Typical Procedure IV**, the reaction of IPrAuCl (0.0196 g, 0.03 mmol, 95%), AgSbF₆ (0.0106 g, 0.03 mmol, 98%), (*R_a*)-**1t** (0.2857 g, 1 mmol), and CHCl₃ (25 mL) for 48 h at 0 °C afforded (*R*)-**2t** (0.0593 g, 21%), recovery of (*R_a*)-**1t** (0.0970 g, 34%), and unidentified product (135.5 mg) [eluent: petroleum ether/ ethyl acetate = 15/1 (450 mL) to 10/1 (200 mL)].

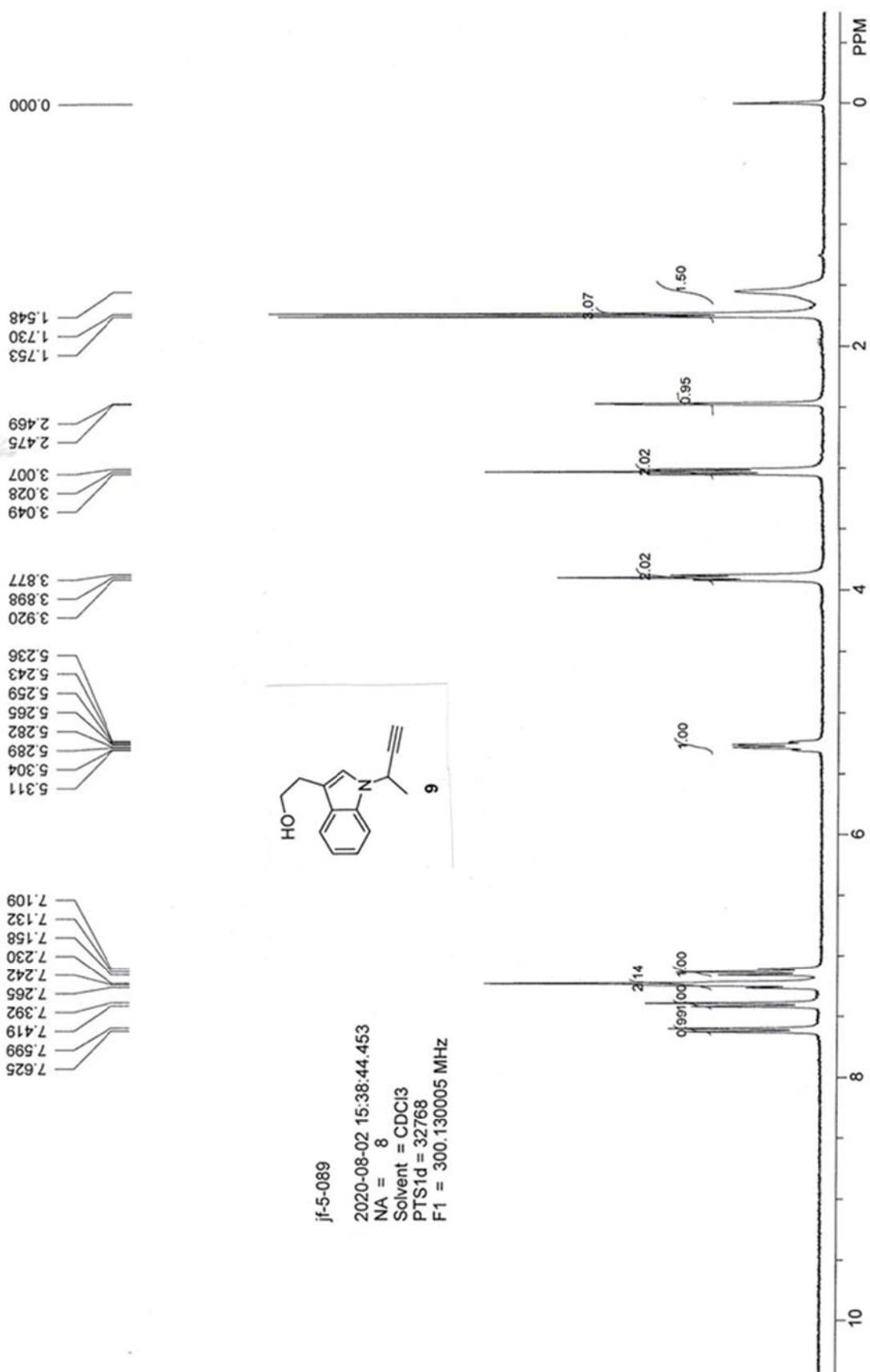
(*R*)-**2t** as a liquid: 24% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.7 mL/min, λ = 214 nm, t_R (major) = 8.4 min, t_R (minor) = 9.8 min); ^1H NMR (300 MHz, CDCl_3) δ 8.16 (d, J = 7.2 Hz, 1H, Ar-H), 7.37-7.14 (m, 3H, Ar-H), 6.21-5.90 (m, 2H, =CH $\times$ 2), 4.73-4.45 (m, 2H, NCH₂), 4.41-4.25 (m, 1H, CH), 3.93 (s, 3H, OCH₃), 1.99-1.77 (m, 2H, CH₂), 1.45-1.18 (m, 3H, CH₂ + one proton of CH₂), 1.13-0.96 (m, 1H, one proton of CH₂), 0.83 (t, J = 7.2 Hz, 3H, CH₃).

Recovery of (*R_a*)-**1t** as a liquid: 0% ee (HPLC conditions: Chiralcel OD-H column, *n*-hexane/*i*-PrOH = 90/10, 0.5 mL/min, λ = 214 nm, t_R (major) = 26.7 min, t_R (minor) = 25.8 min); ^1H NMR (300 MHz, CDCl_3) δ 8.22-8.09 (m, 1H, Ar-H), 7.85 (s, 1H, Ar-H), 7.42-7.32 (m, 1H, Ar-H), 7.31-7.15 (m, 2H, Ar-H), 5.34-5.16 (m, 2H, CH=C=CH), 4.70 (dd, J_1 = 6.0 Hz, J_2 = 2.4 Hz, 2H, NCH₂), 3.90 (s, 3H, OCH₃),

2.00-1.84 (m, 2H, CH₂), 1.35-1.15 (m, 4H, CH₂ × 2), 0.85 (t, $J = 6.3$ Hz, 3H, CH₃).

10. References

1. H.-G. Cheng, L.-Q. Lu, T. Wang, Q.-Q. Yang, X.-P. Liu, Y. Li, Q.-H. Deng, J.-R. Chen and W.-J. Xiao, *Angew. Chem. Int. Ed.*, 2013, **52**, 3250.
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jf-5-089

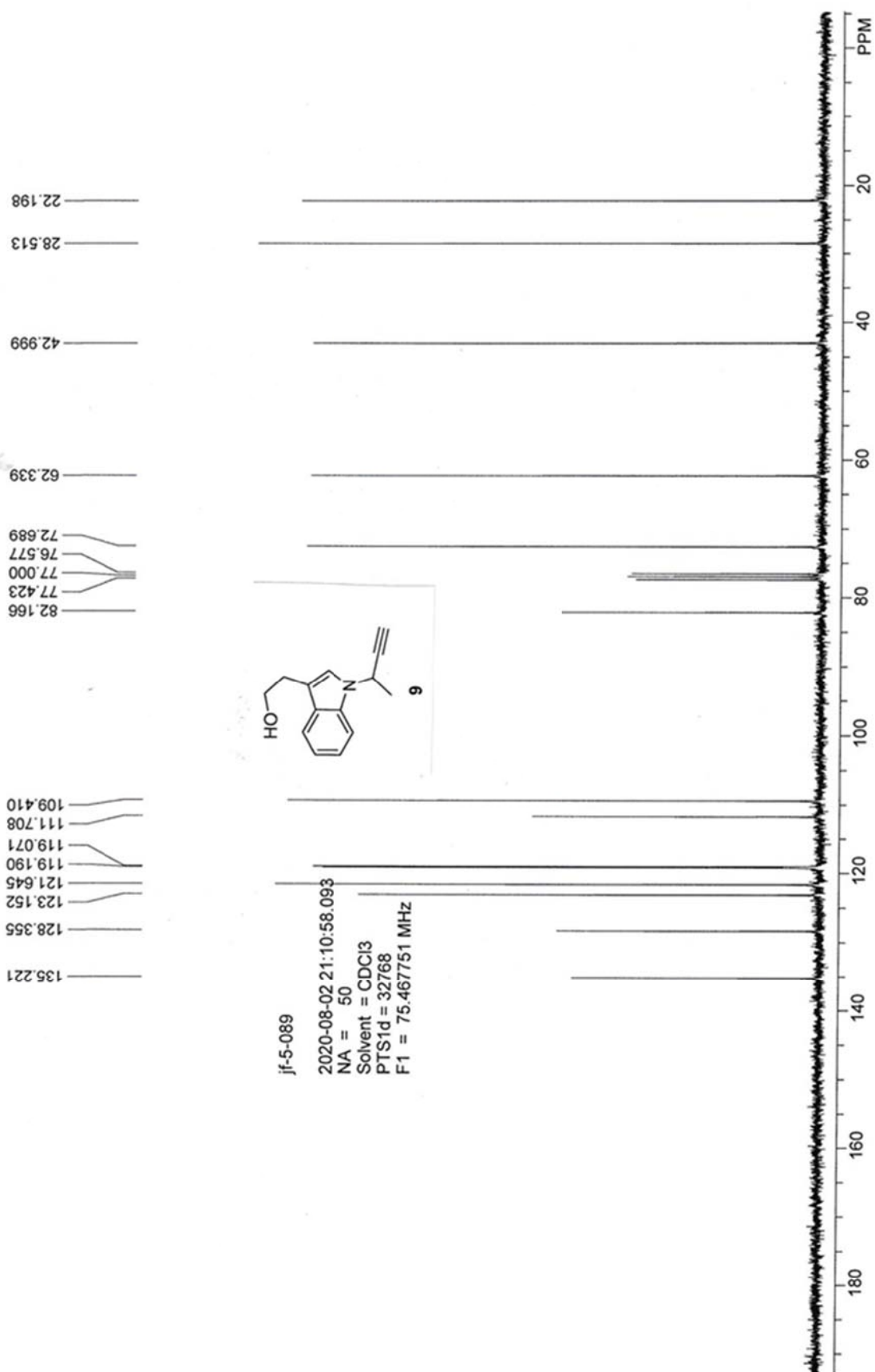
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F1 = 300.130005 MHz



jf-5-089

2020-08-02 21:10:58.093

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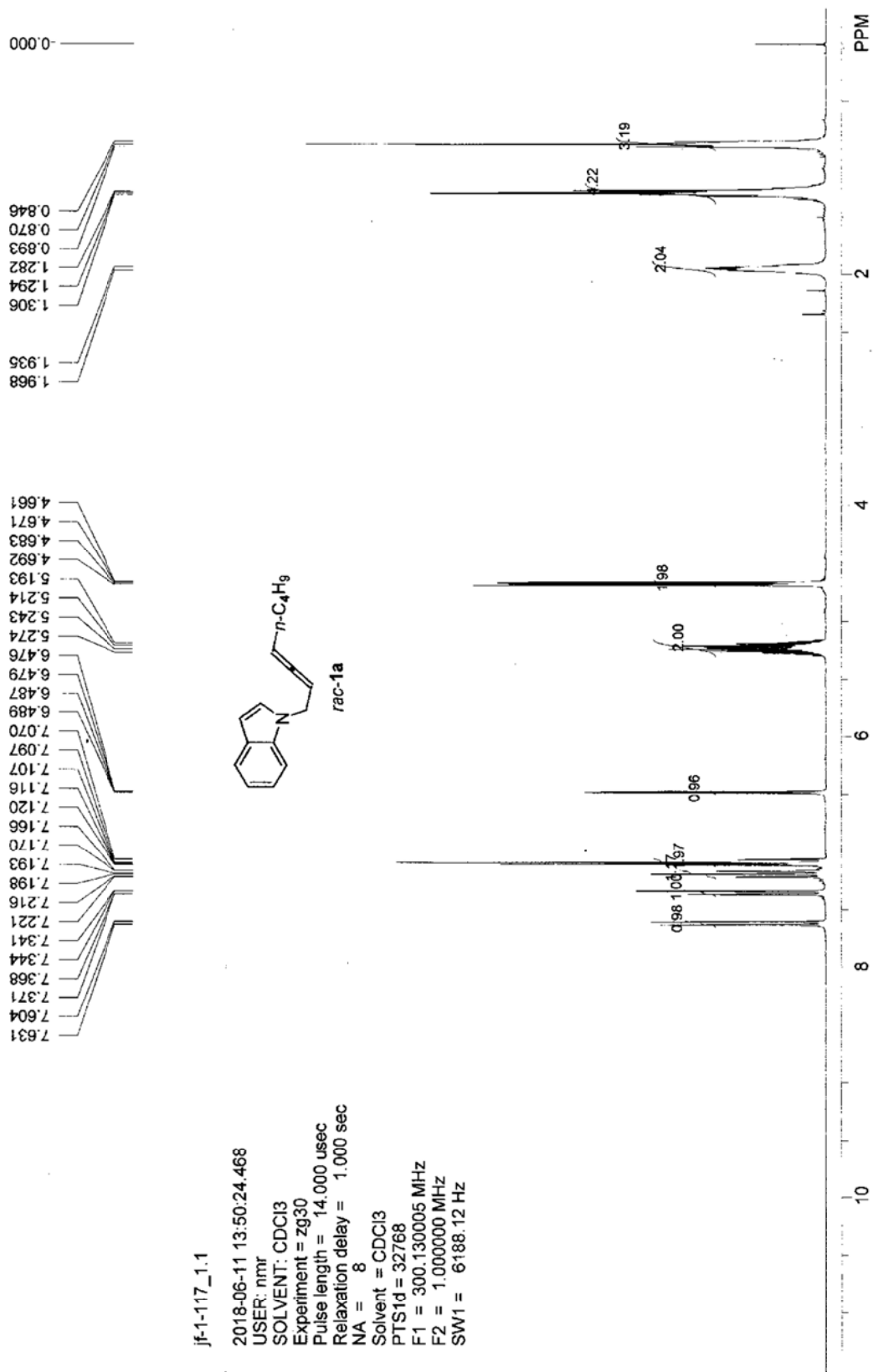
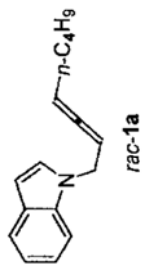
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F1 = 75.467751 MHz

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 Relaxation delay = 1.000 sec
 NA = 8
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 300.130005 MHz
 F2 = 1.000000 MHz
 SW1 = 6188.12 Hz



jf-1-117_2.1

2018-06-11 14:06:41.671

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 256

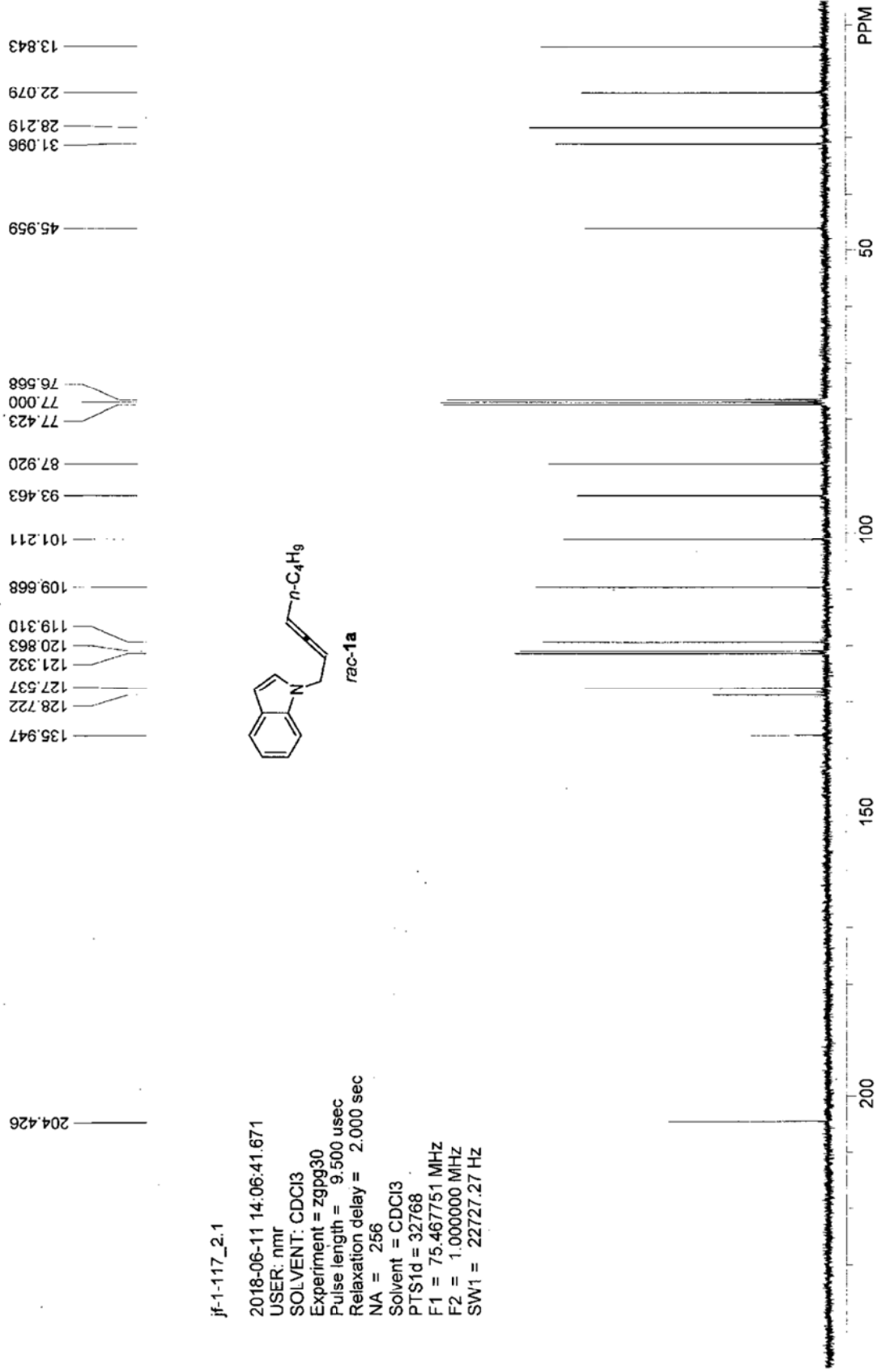
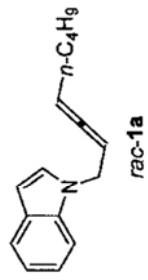
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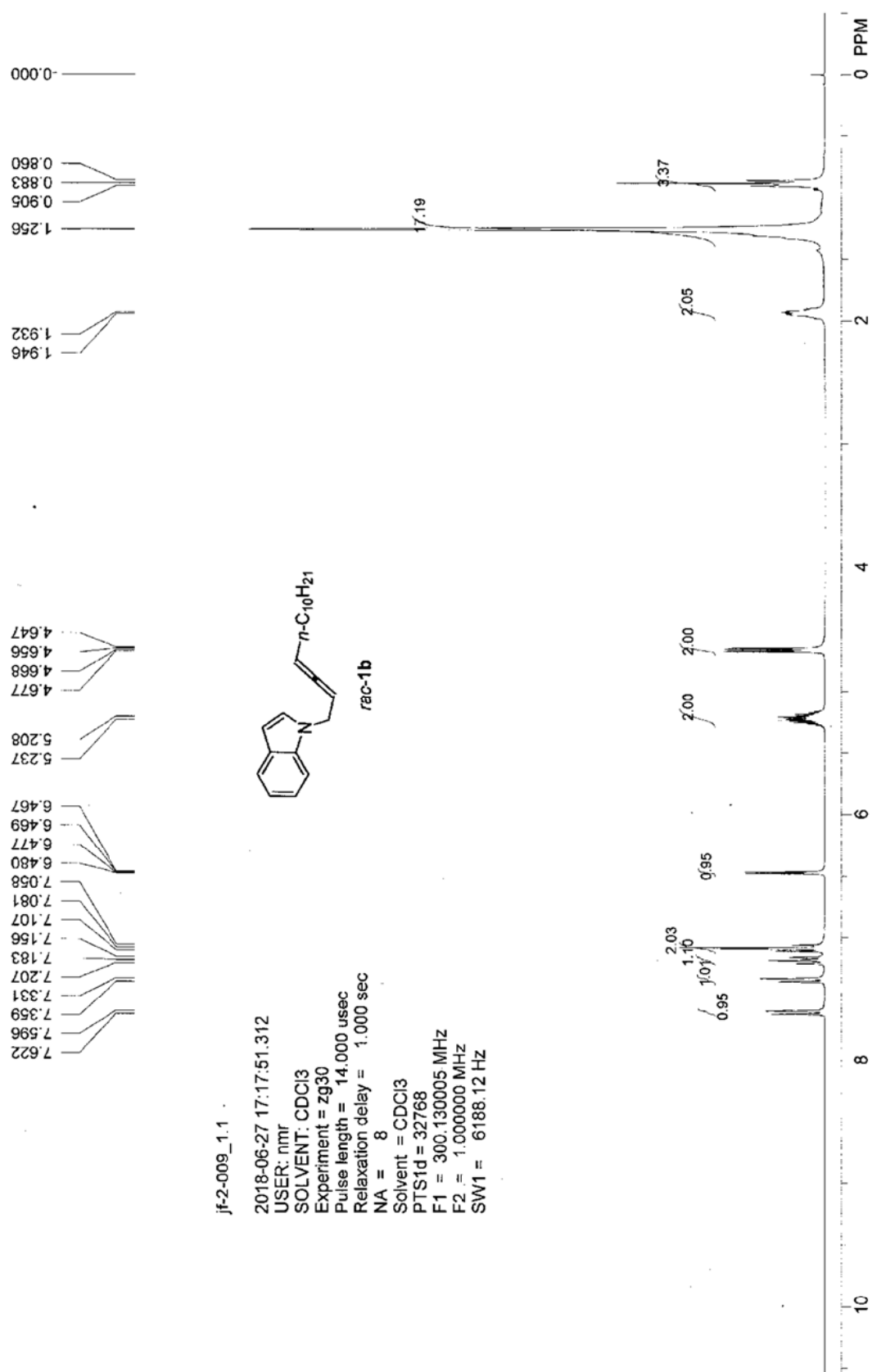
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F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz





jf-2-009_2.1

2018-06-27 17:41:23.125

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 387

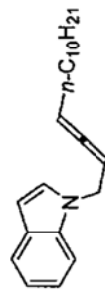
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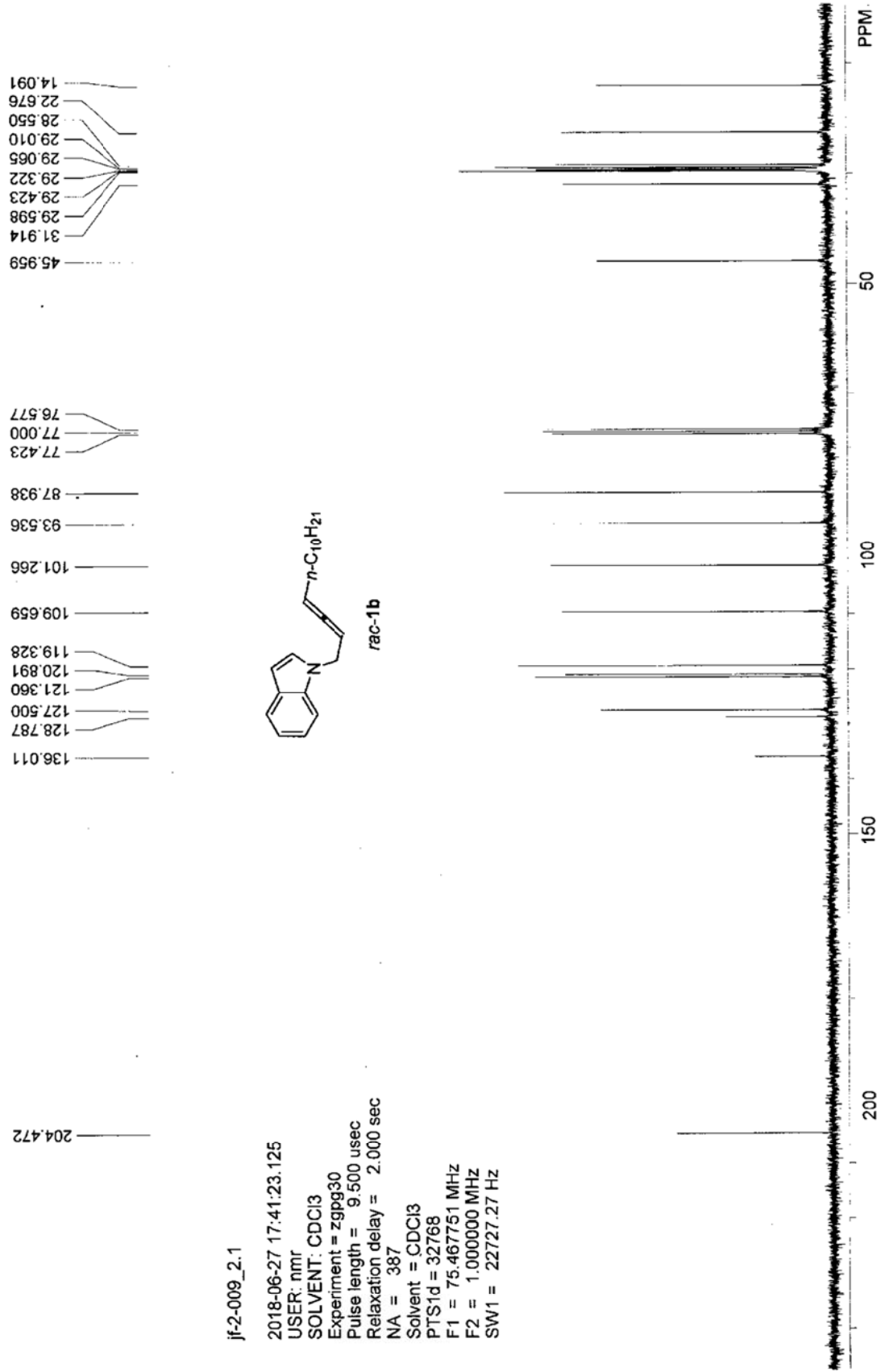
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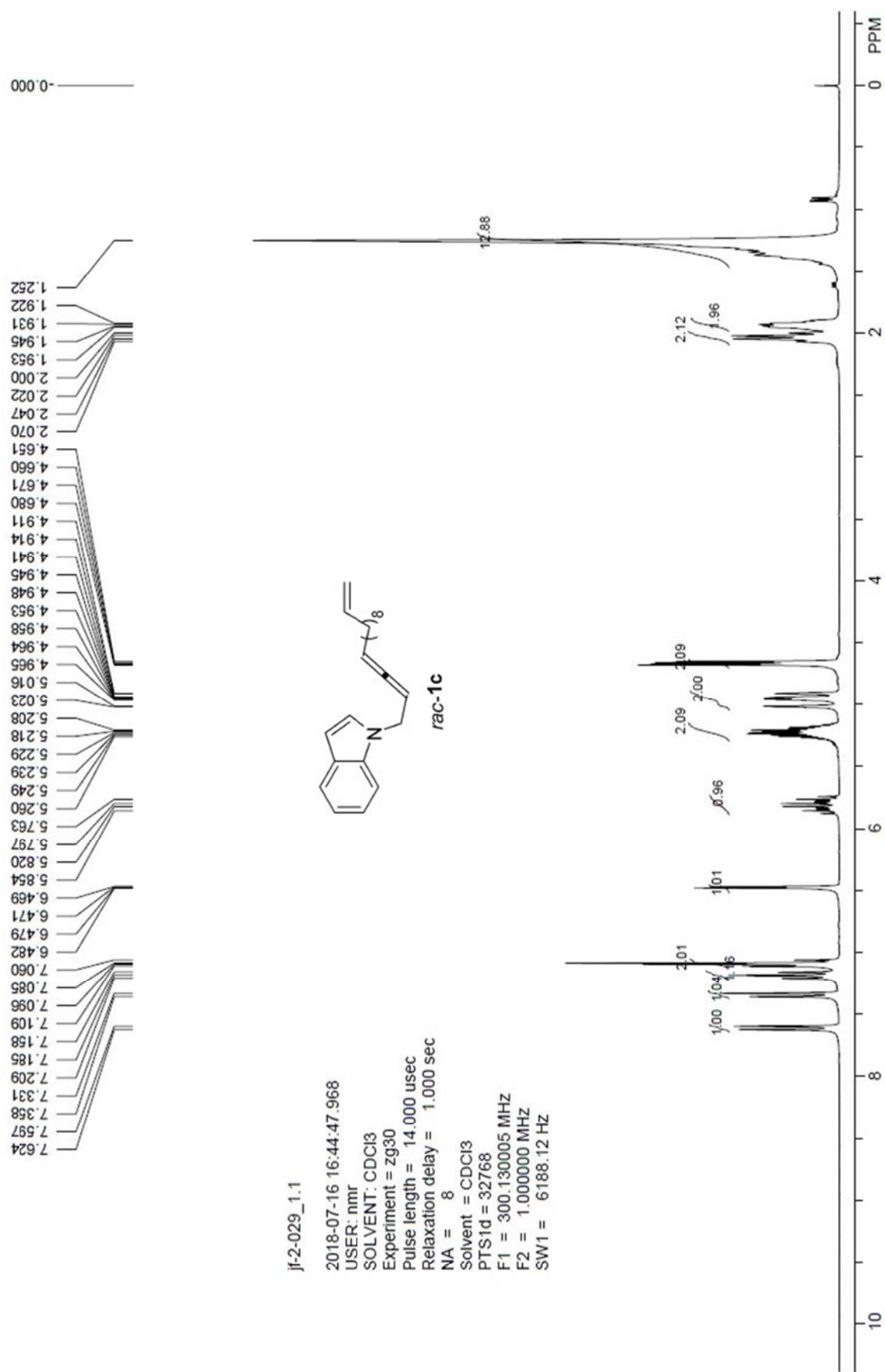
F2 = 1.000000 MHz

SW1 = 22727.27 Hz



rac-1b





jf-2-029_2.1

2018-11-07 16:17:15.812

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

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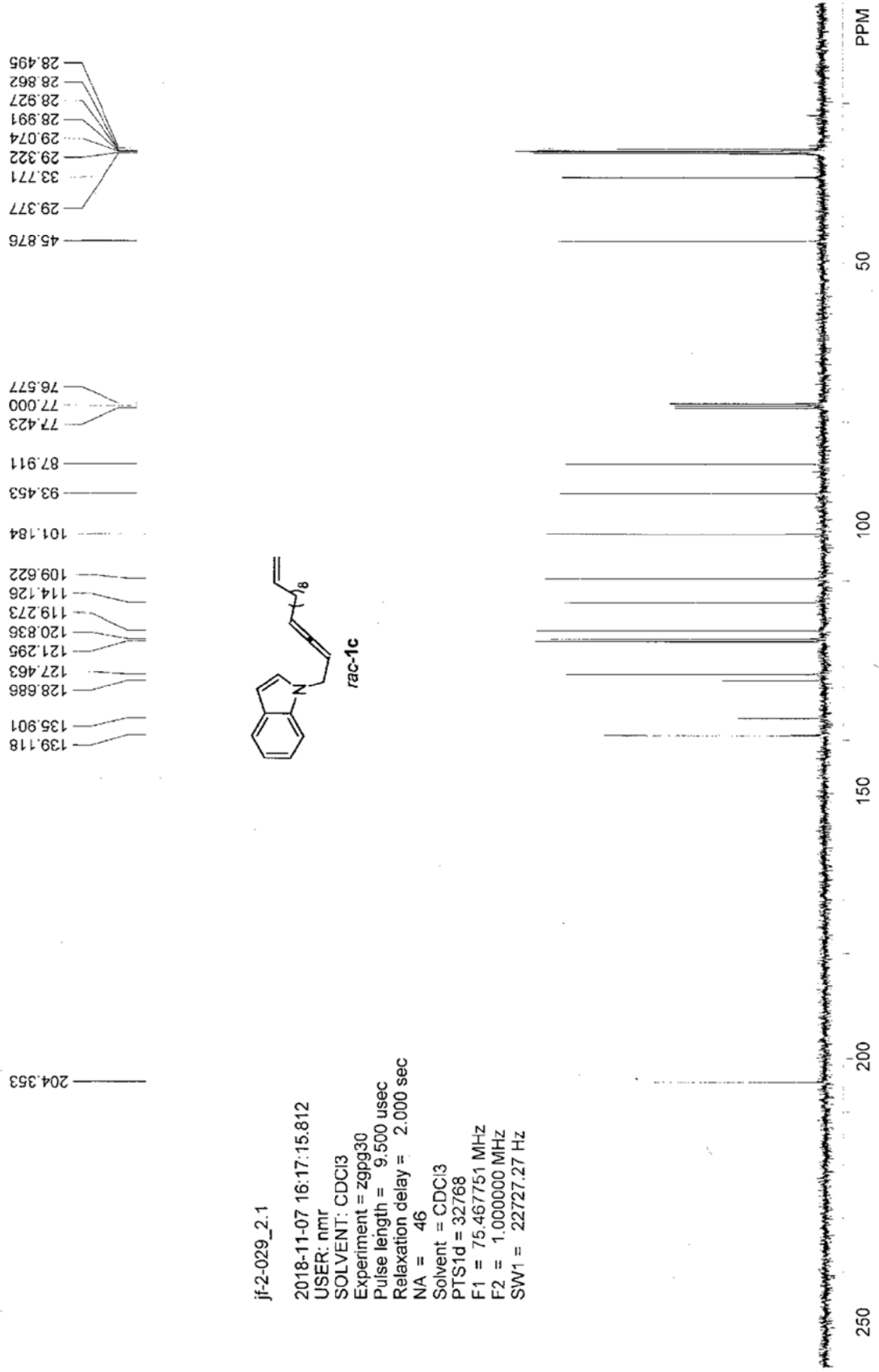
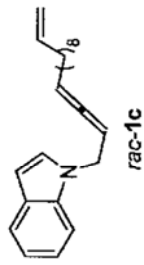
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



jf-1-196_1.1

2018-06-13 09:49:26.265

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

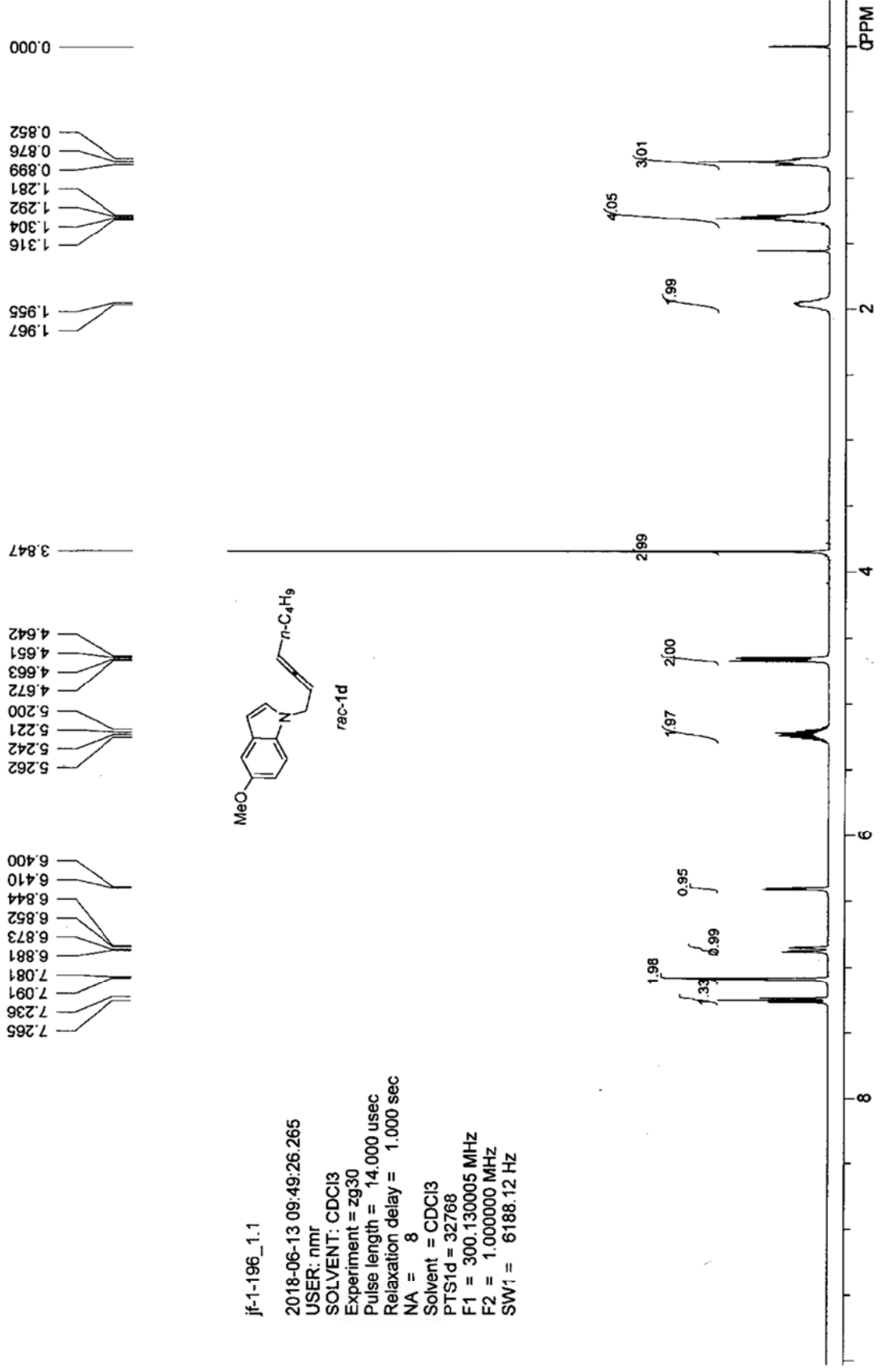
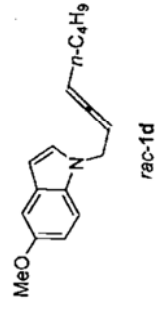
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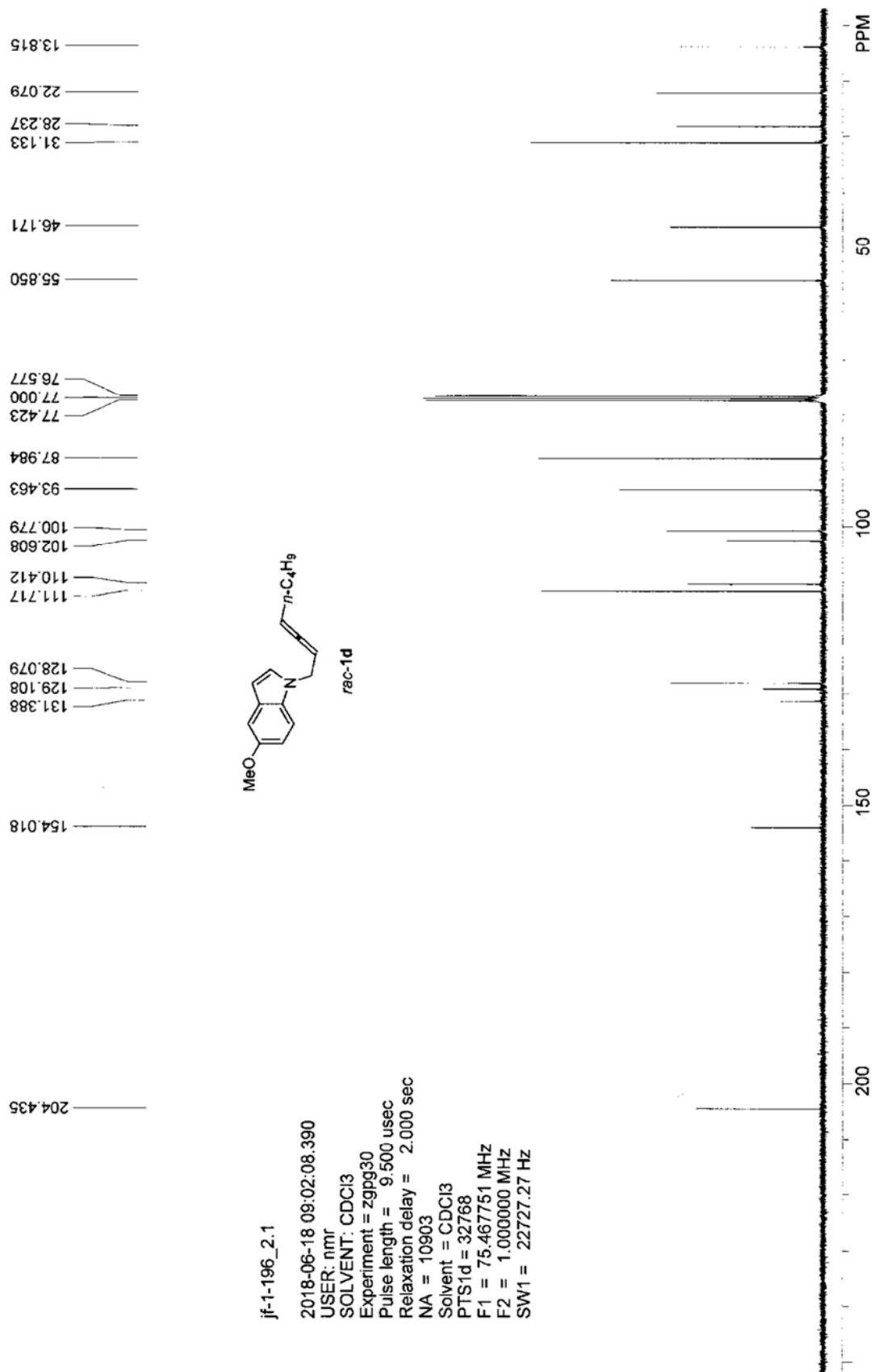
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F1 = 300.130005 MHz

F2 = 1.000000 MHz

SWH = 6188.12 Hz





jf-1-196_2.1

2018-06-18 09:02:08.390

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 10903

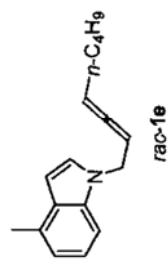
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F1 = 75.467751 MHz

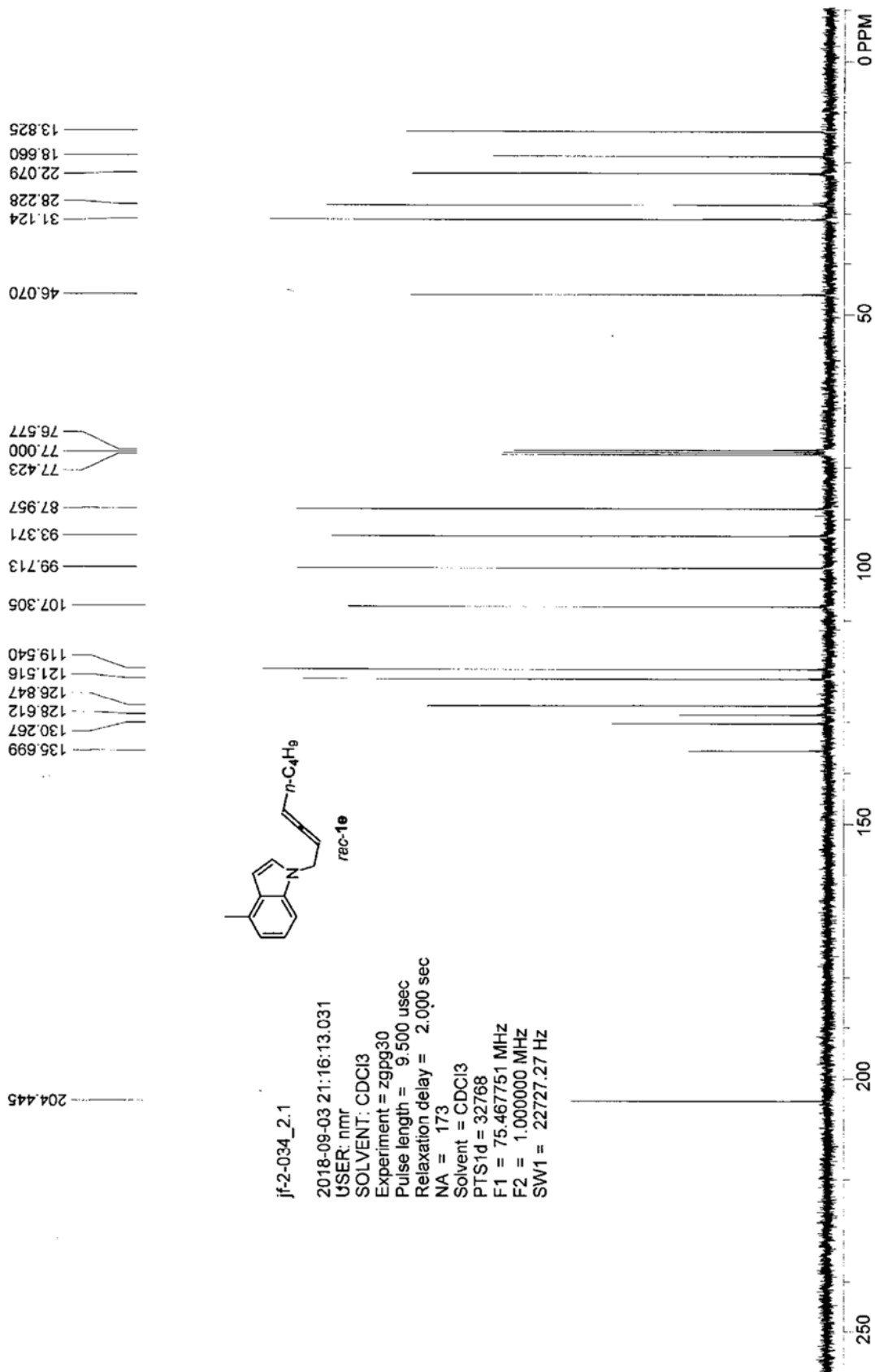
F2 = 1.000000 MHz

SW1 = 22727.27 Hz

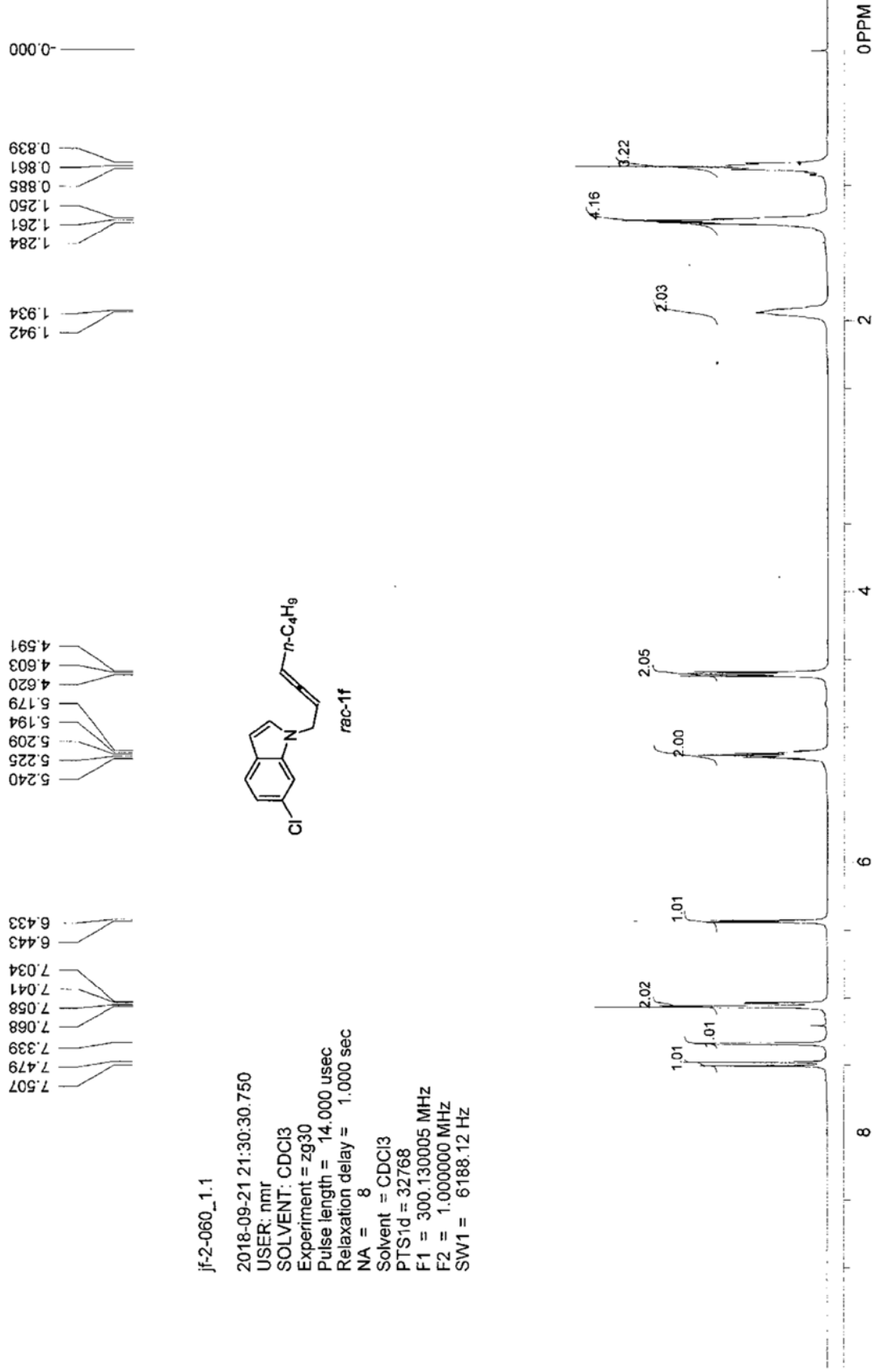


FZ = 1.000000 MHz
SW1 = 6188.12 Hz

 $NA = 8$



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 SOLVENT: CDCl3
 Experiment = zgpg30
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 Relaxation delay = 2.000 sec
 NA = 173
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz



jf2-060_1.1

2018-09-21 21:30:30.750

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

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Relaxation delay = 1.000 sec

NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

jf-2-060_2.1

2018-09-21 21:37:31.093

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 102

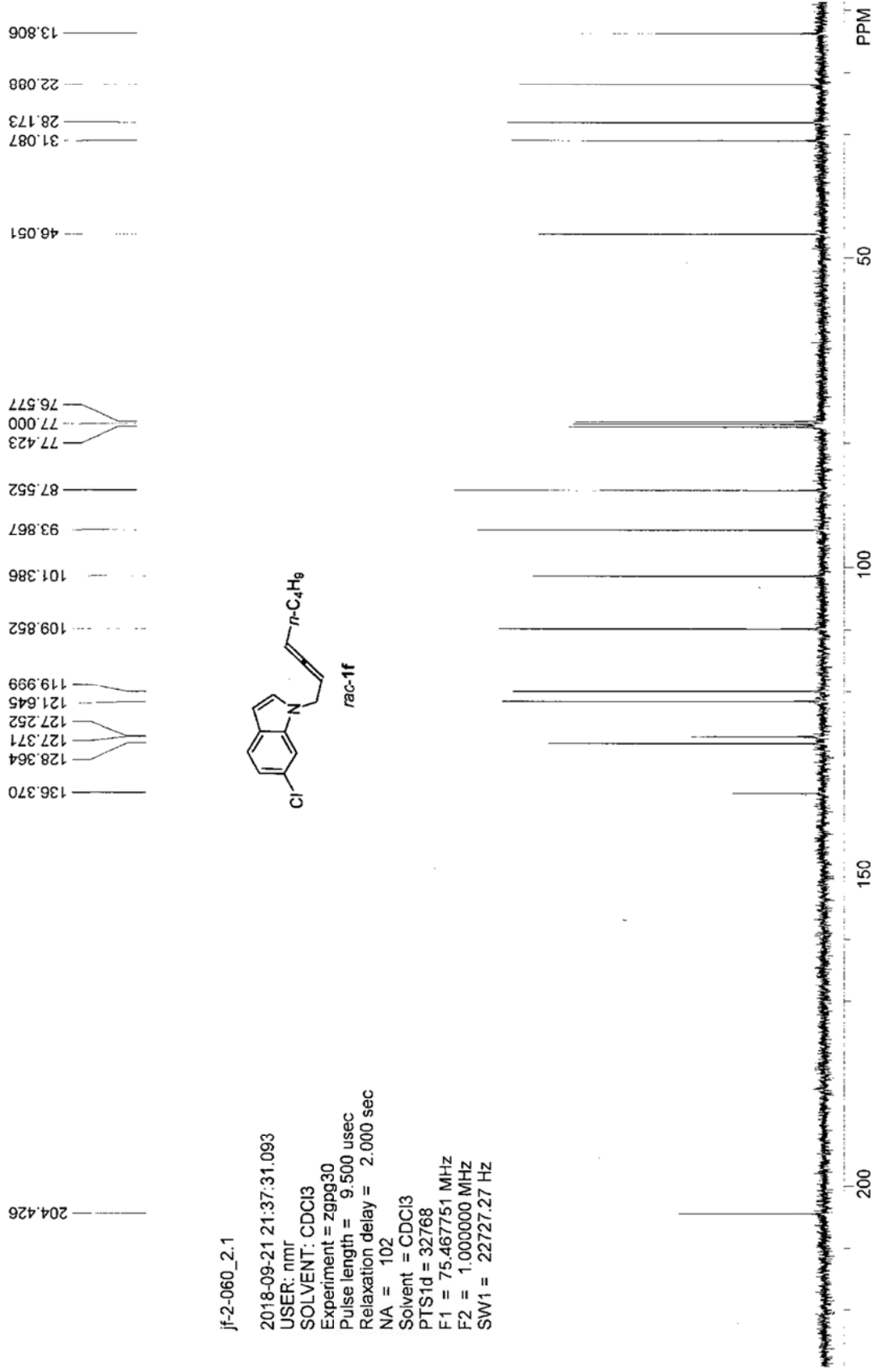
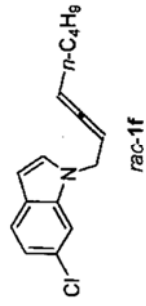
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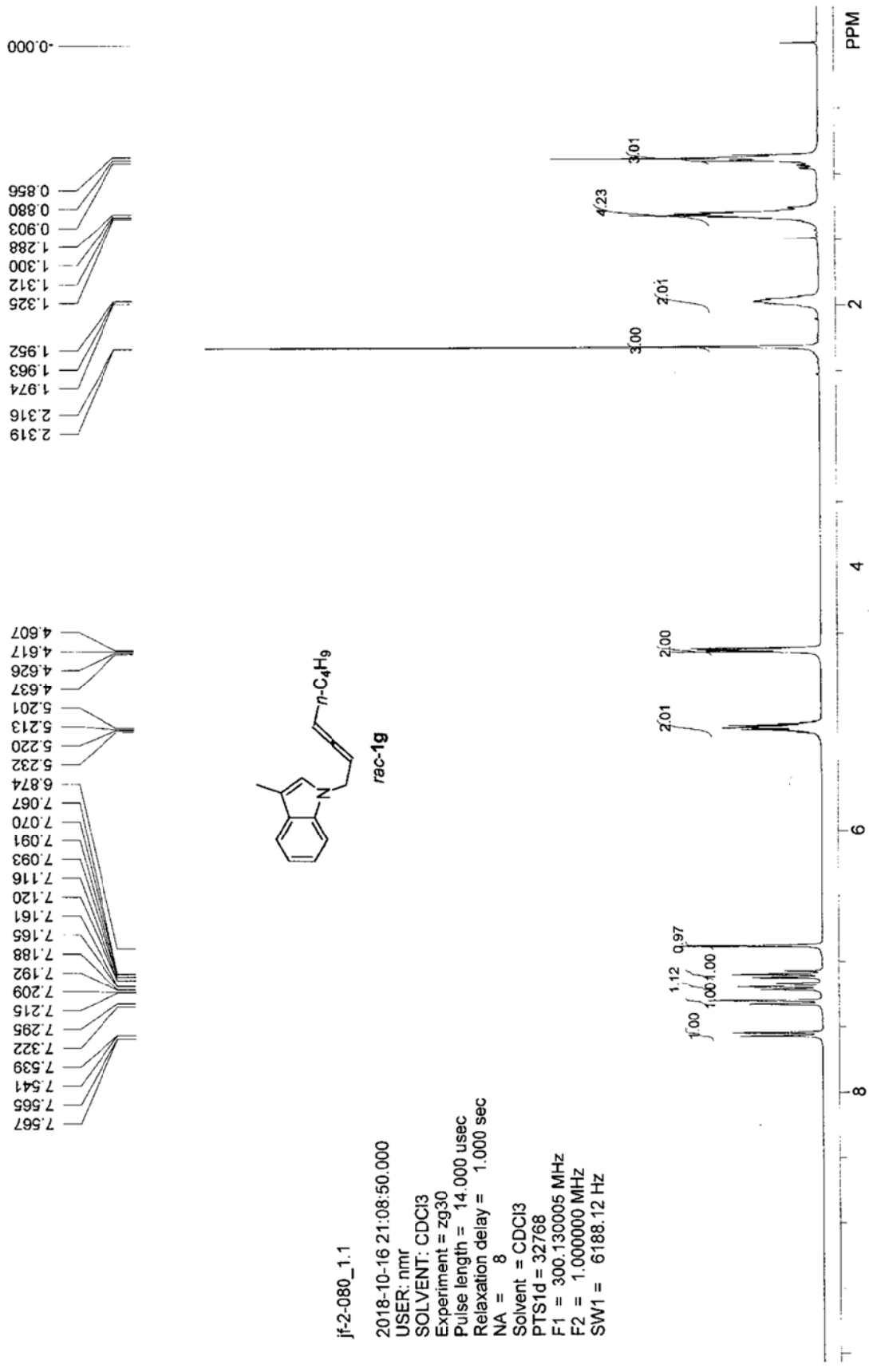
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F1 = 75.467751 MHz

F2 = 1.000000 MHz

SWH = 22727.27 Hz





jl-2-080_1.1

2018-10-16 21:08:50.000

USER: nmr

SOLVENT: CDCl3

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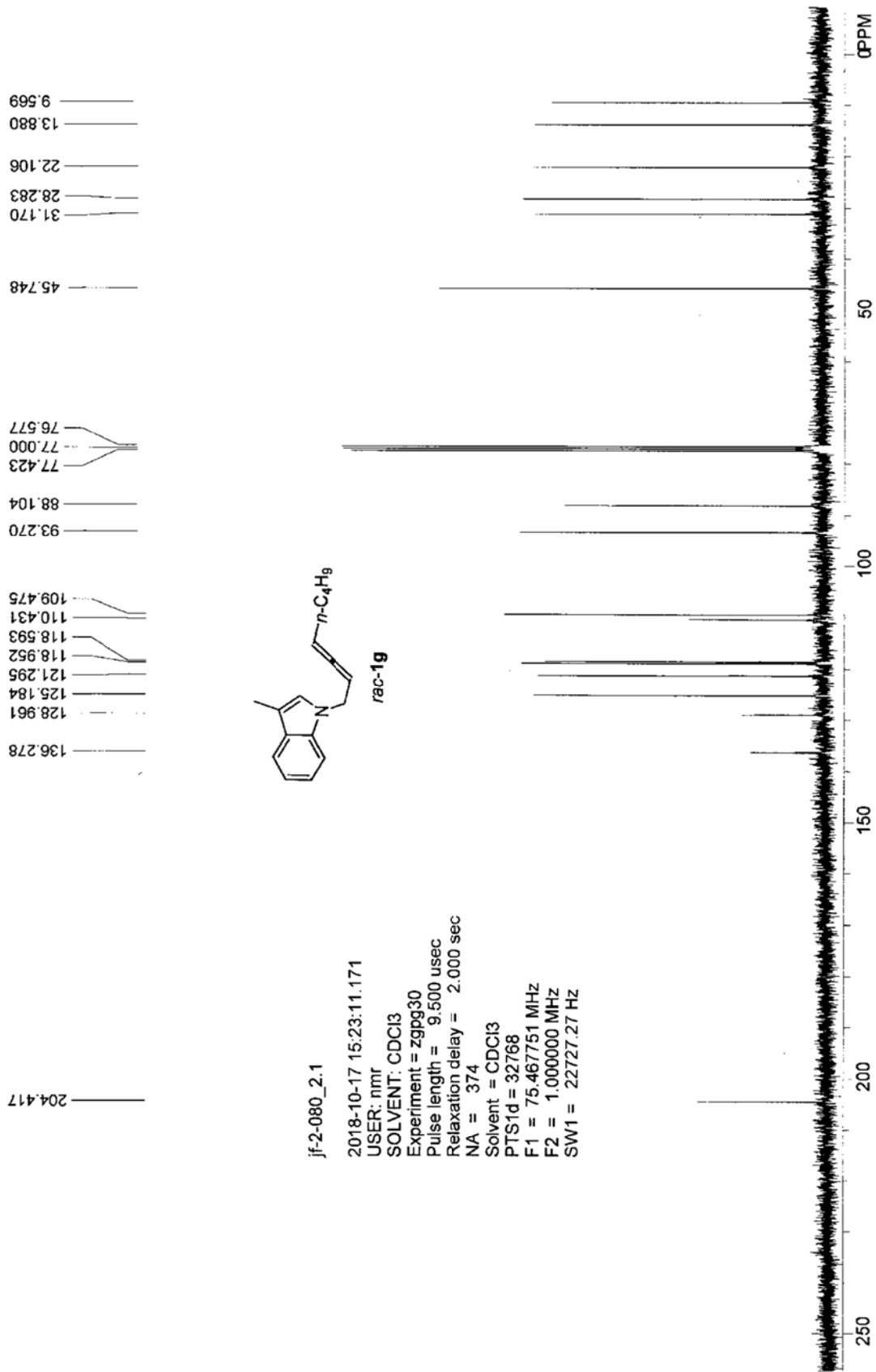
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PTS1d = 32768

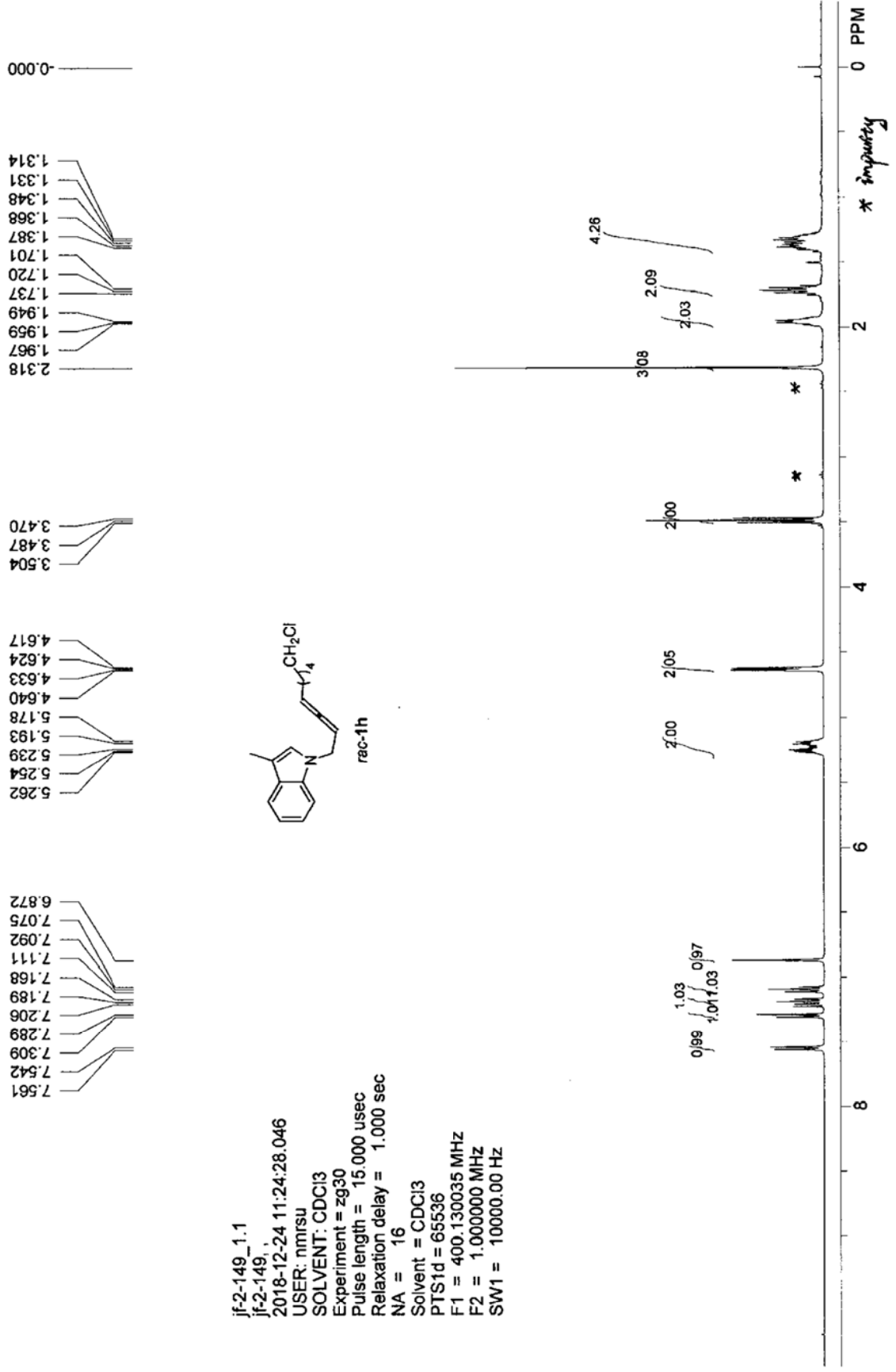
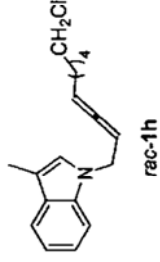
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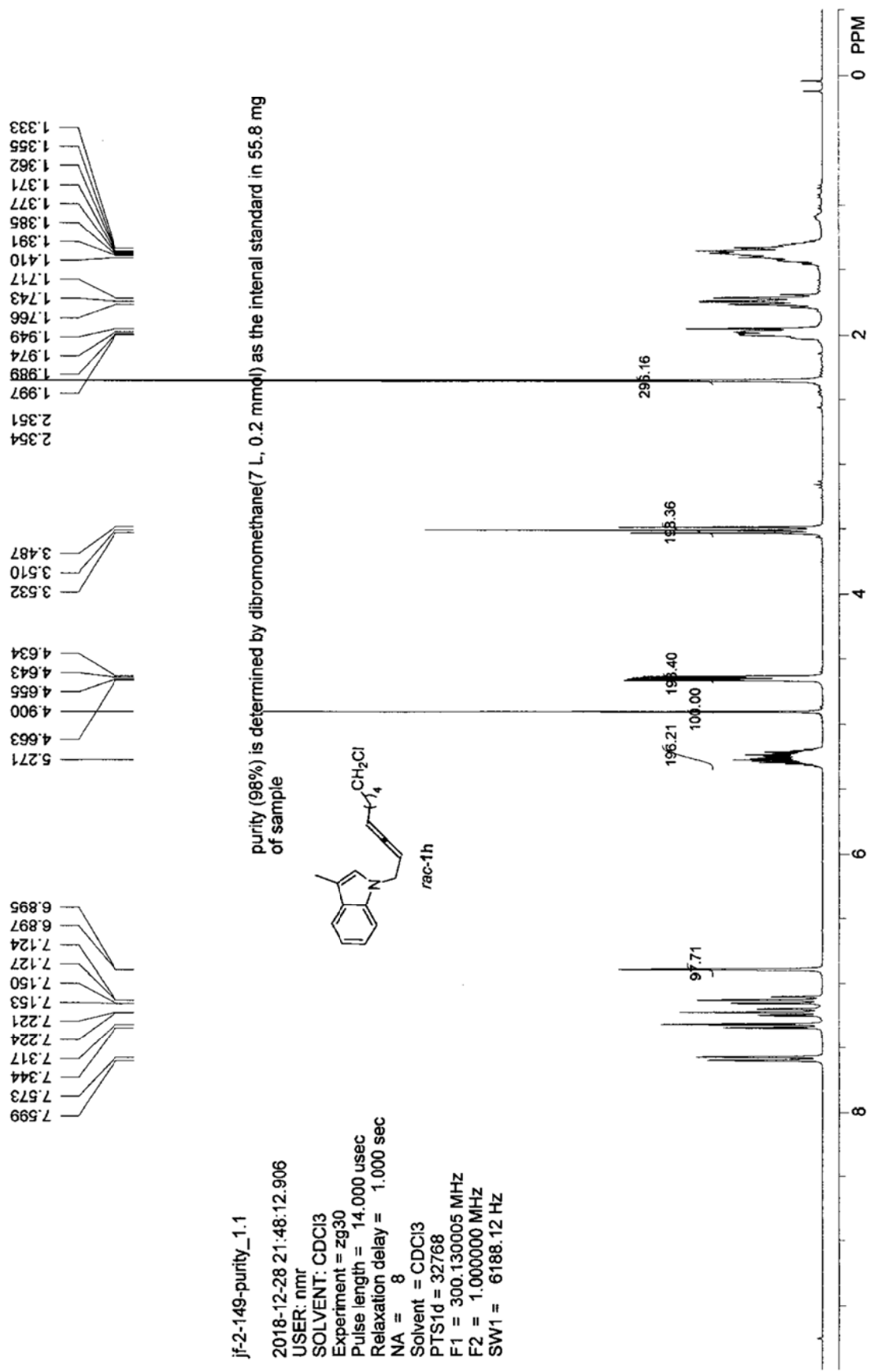
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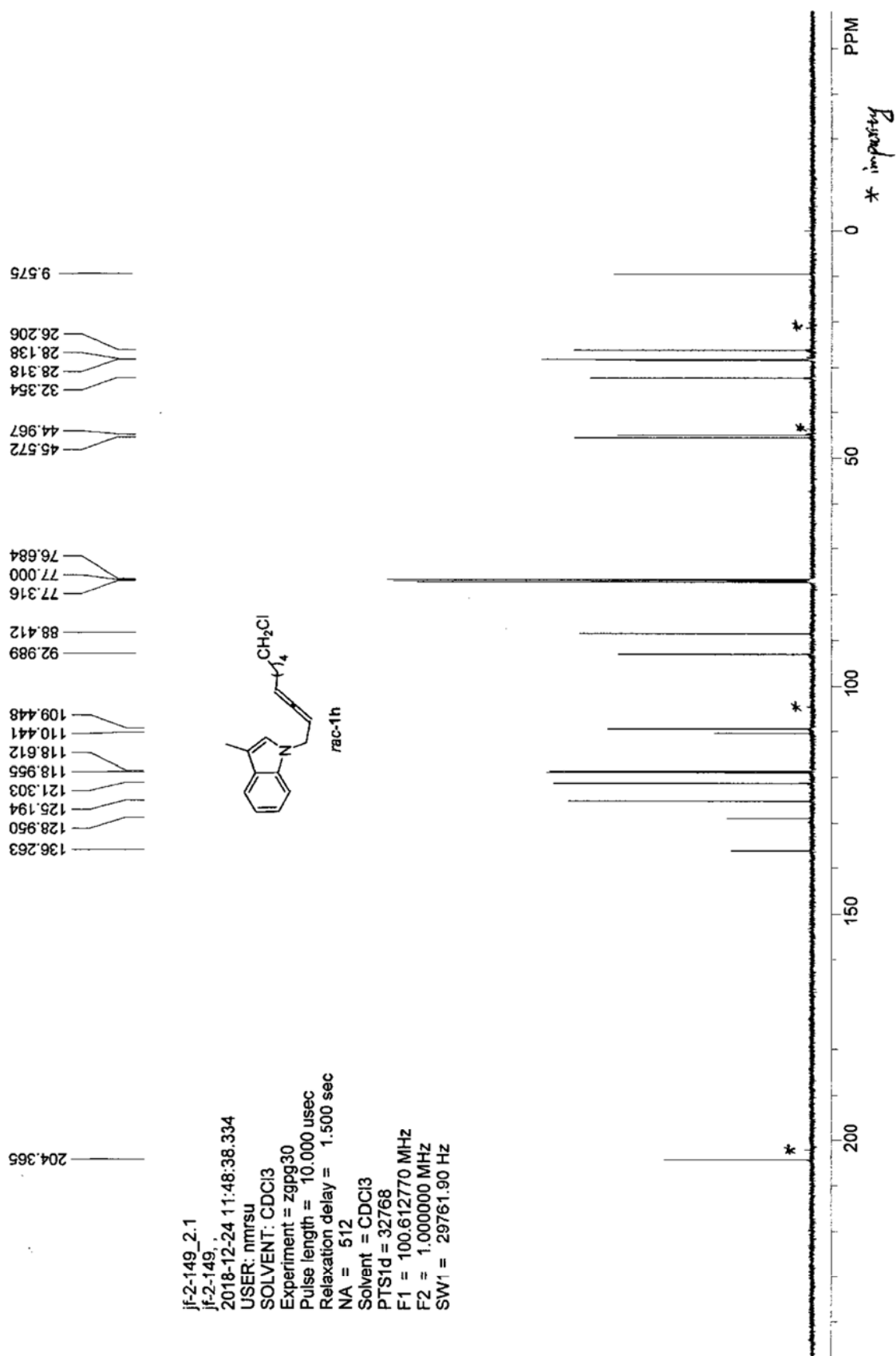
SW1 = 6188.12 Hz



jf-2-149 1.1
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 SW1 = 10000.00 Hz







jf-3-019_1.1

2019-03-04 11:11:41.015

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

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Relaxation delay = 1.000 sec

NA = 8

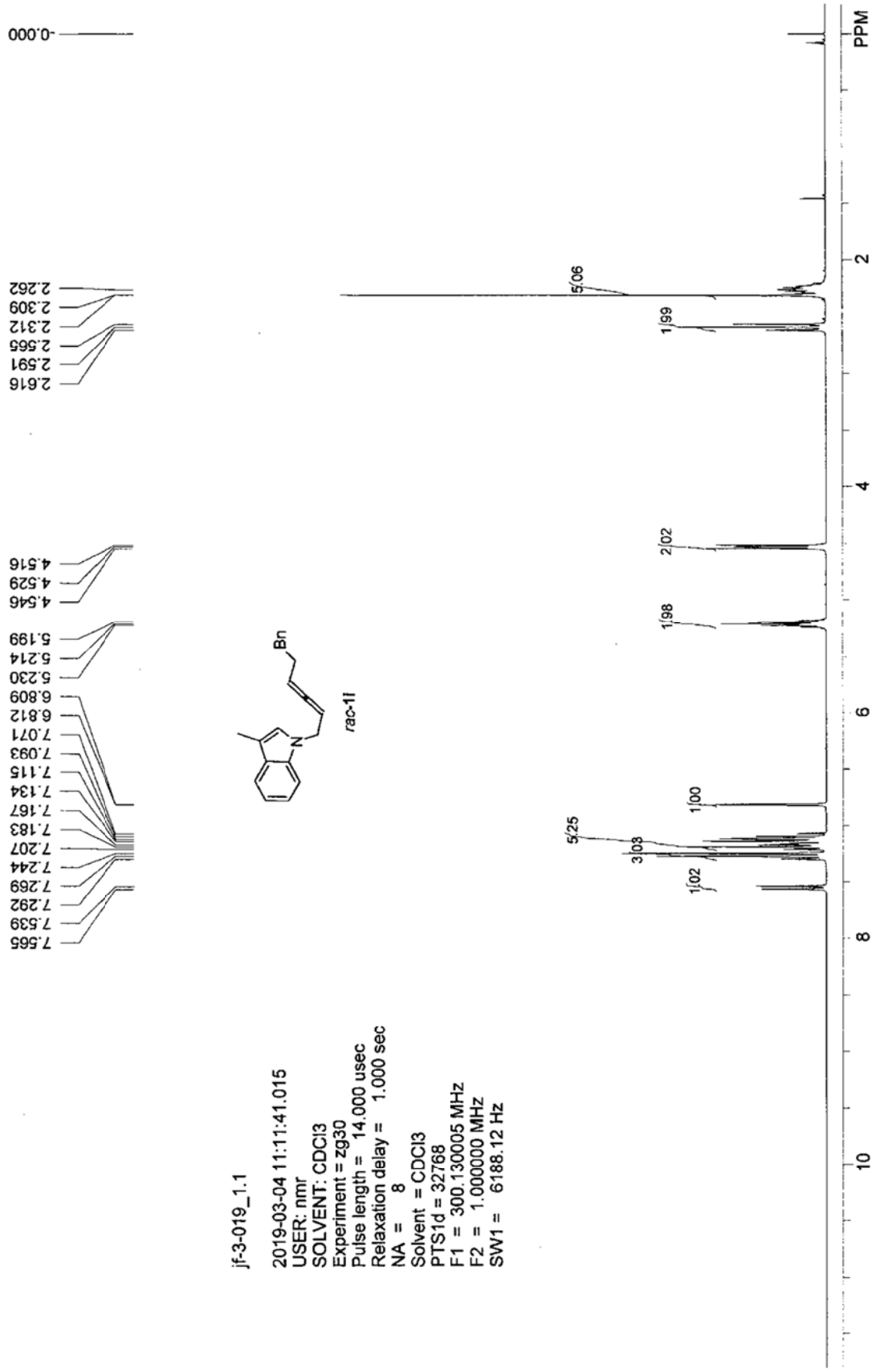
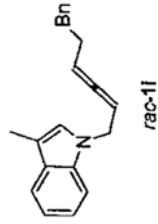
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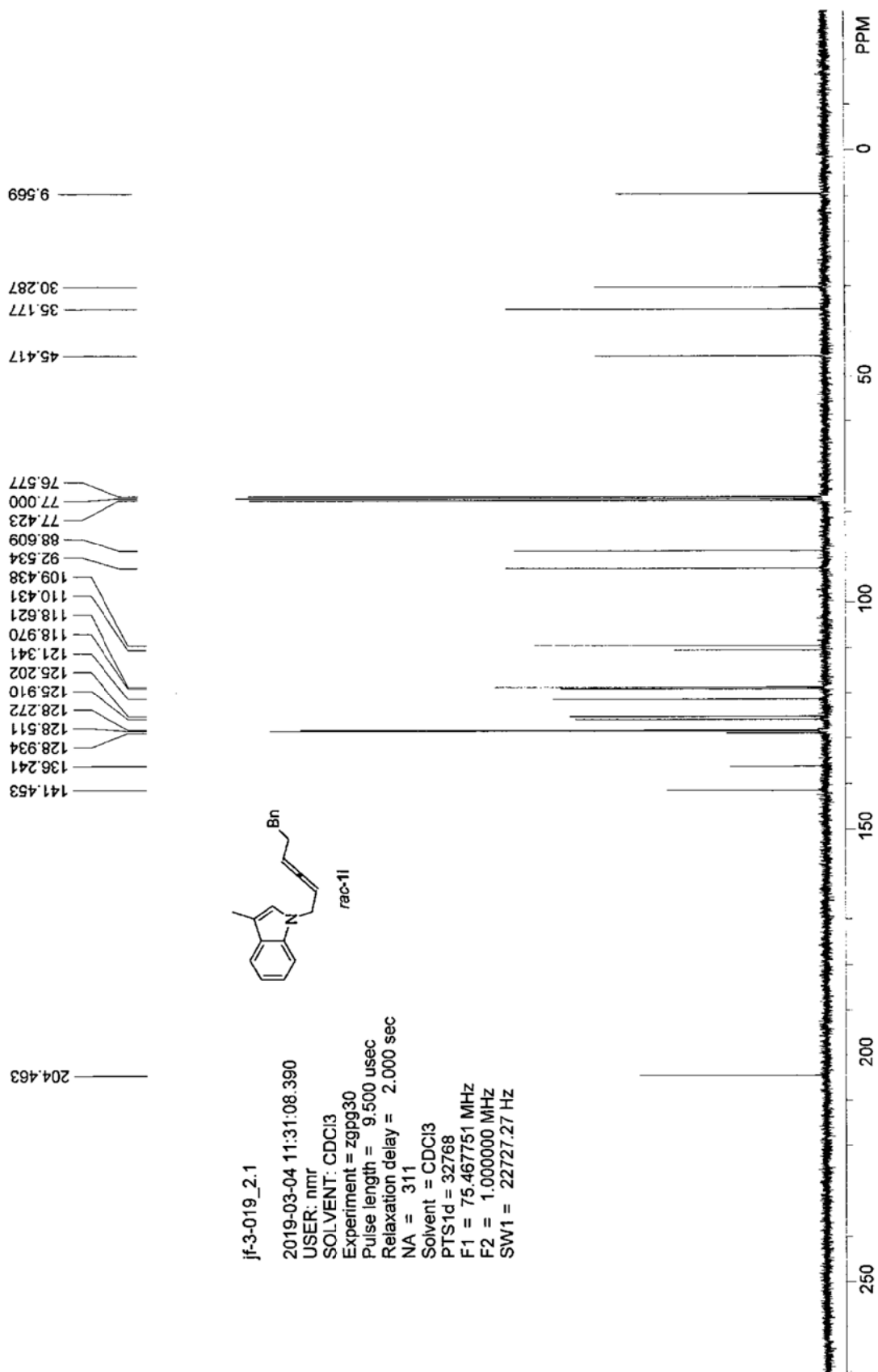
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F2 = 1.000000 MHz

SWH = 6188.12 Hz





jf-3-019_2.1

2019-03-04 11:31:08.390

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 311

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

jf-3-092_1.1

2019-05-09 21:28:56.484

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SOLVENT: CDCl₃

Experiment = zg30

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Relaxation delay = 1.000 sec

NA = 8

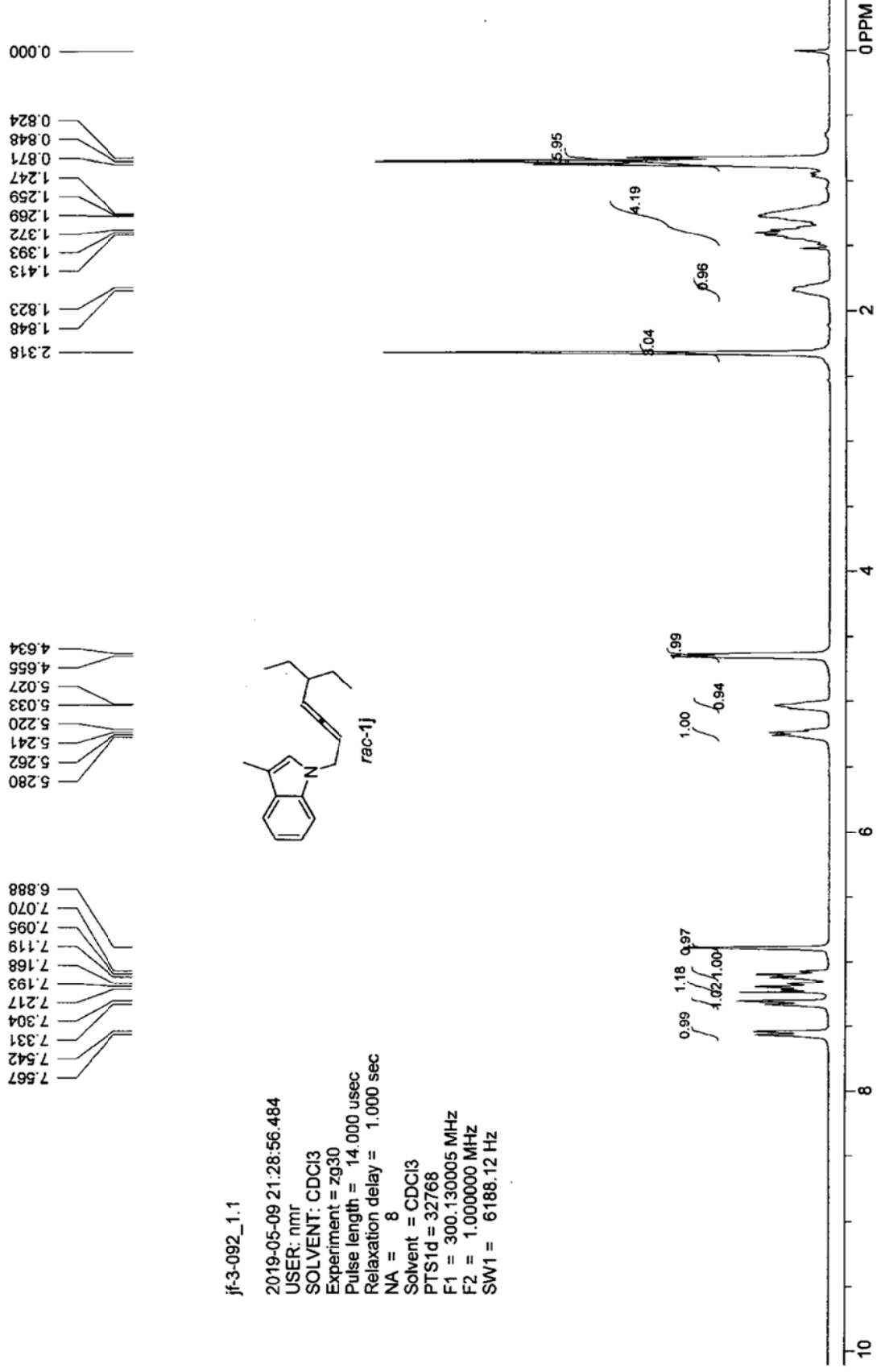
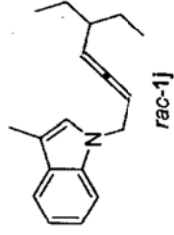
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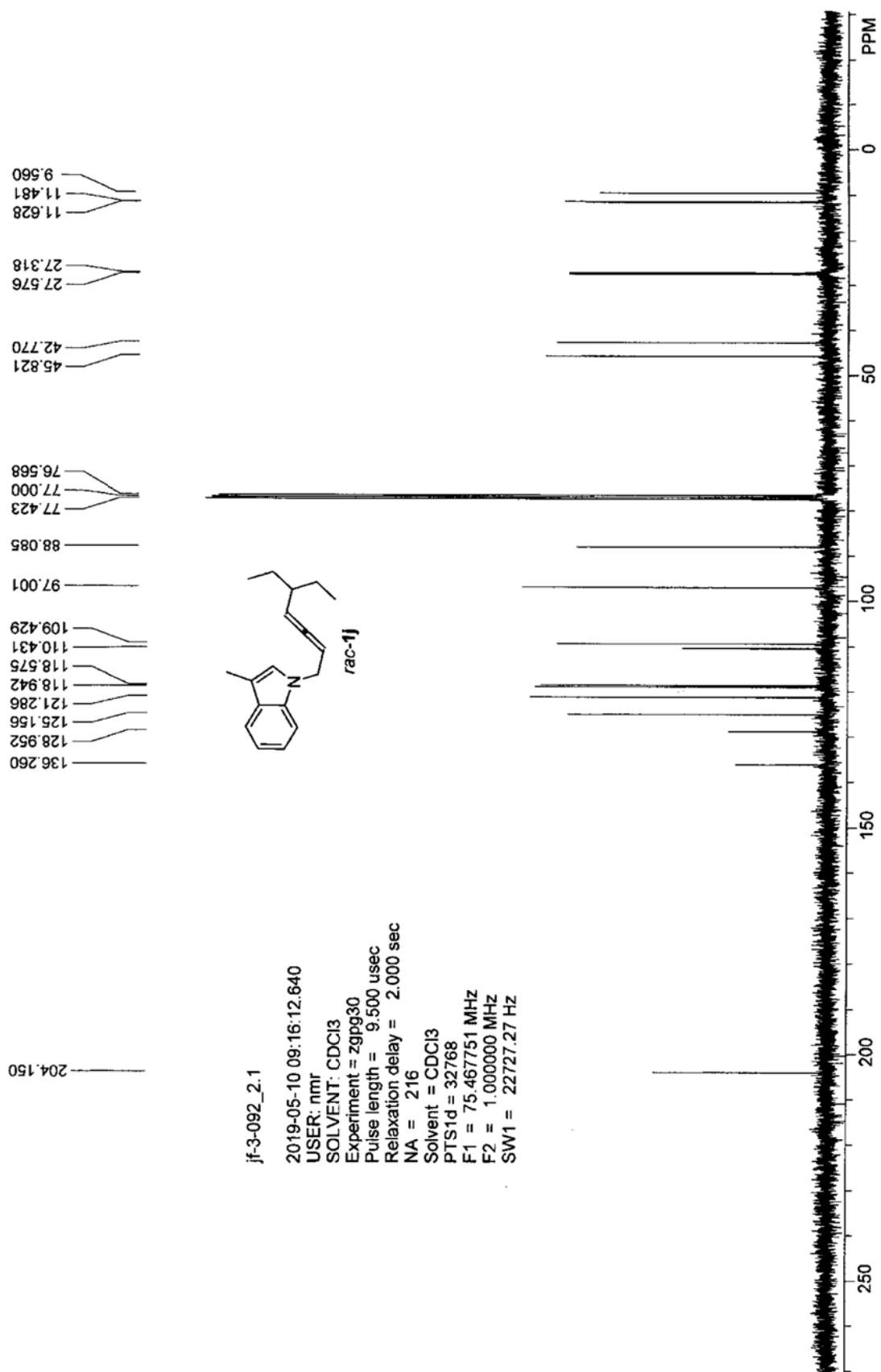
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F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jf-3-092_2.1

2019-05-10 09:16:12.640

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SOLVENT: CDCl₃

Experiment = zgpg30

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Relaxation delay = 2.000 sec

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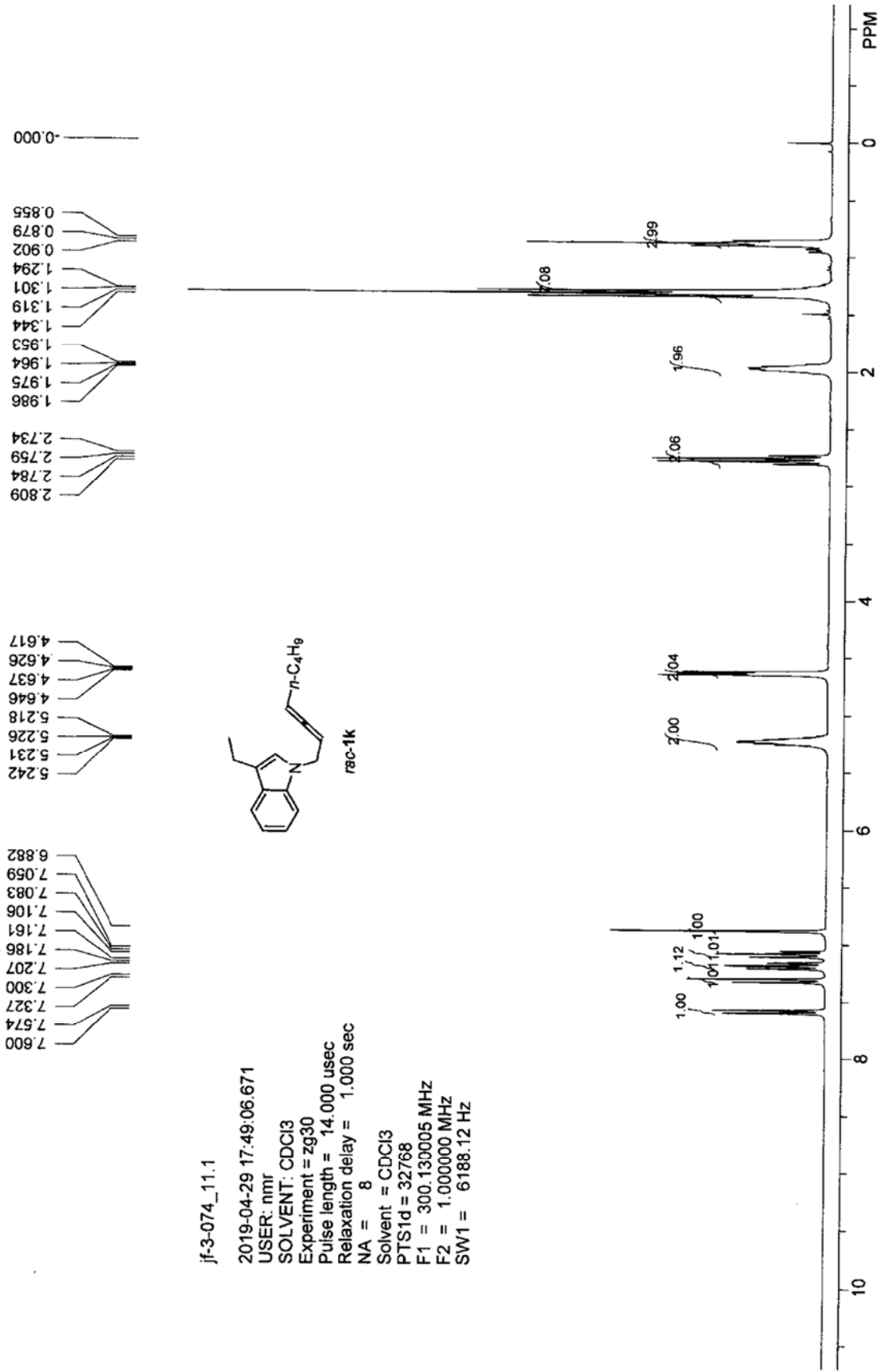
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SW1 = 22727.27 Hz



jf-3-074_11.1

2019-04-29 17:49:06.671

USER: nmr

SOLVENT: CDCl3

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

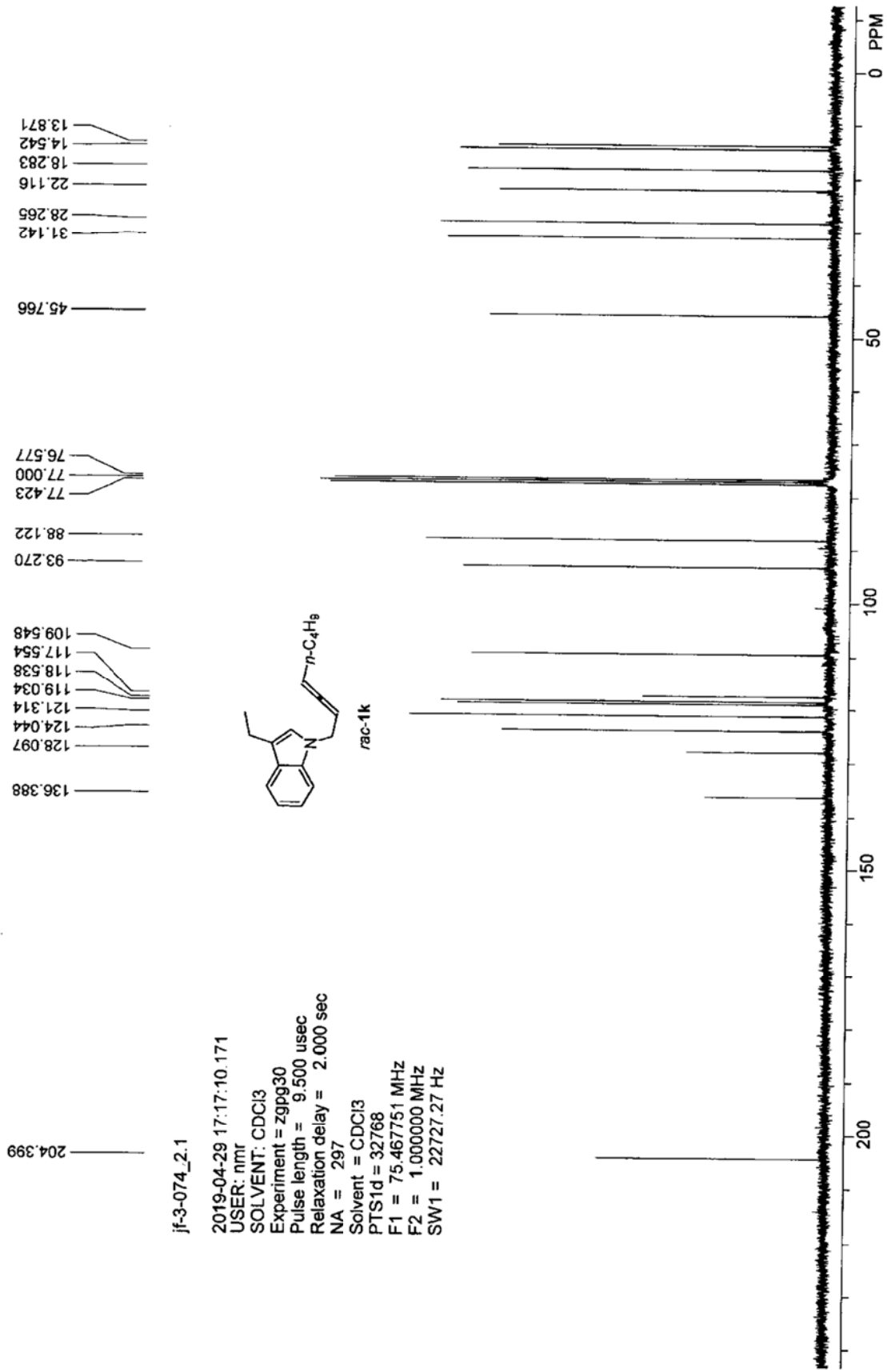
Solvent = CDCl3

PTS1d = 32768

F1 = 300.130005 MHz

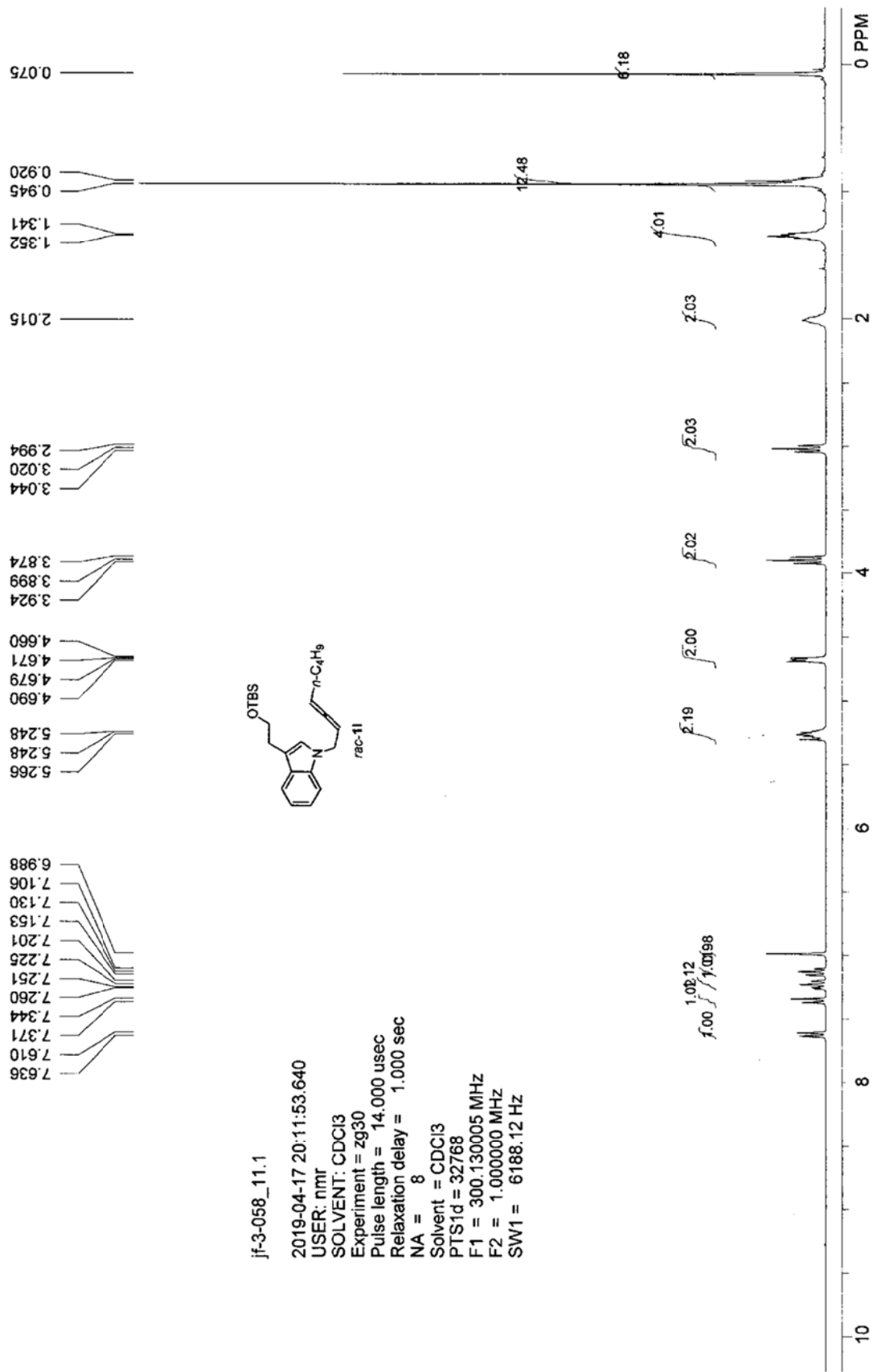
F2 = 1.000000 MHz

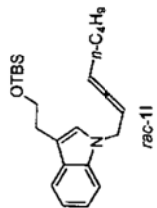
SW1 = 6188.12 Hz

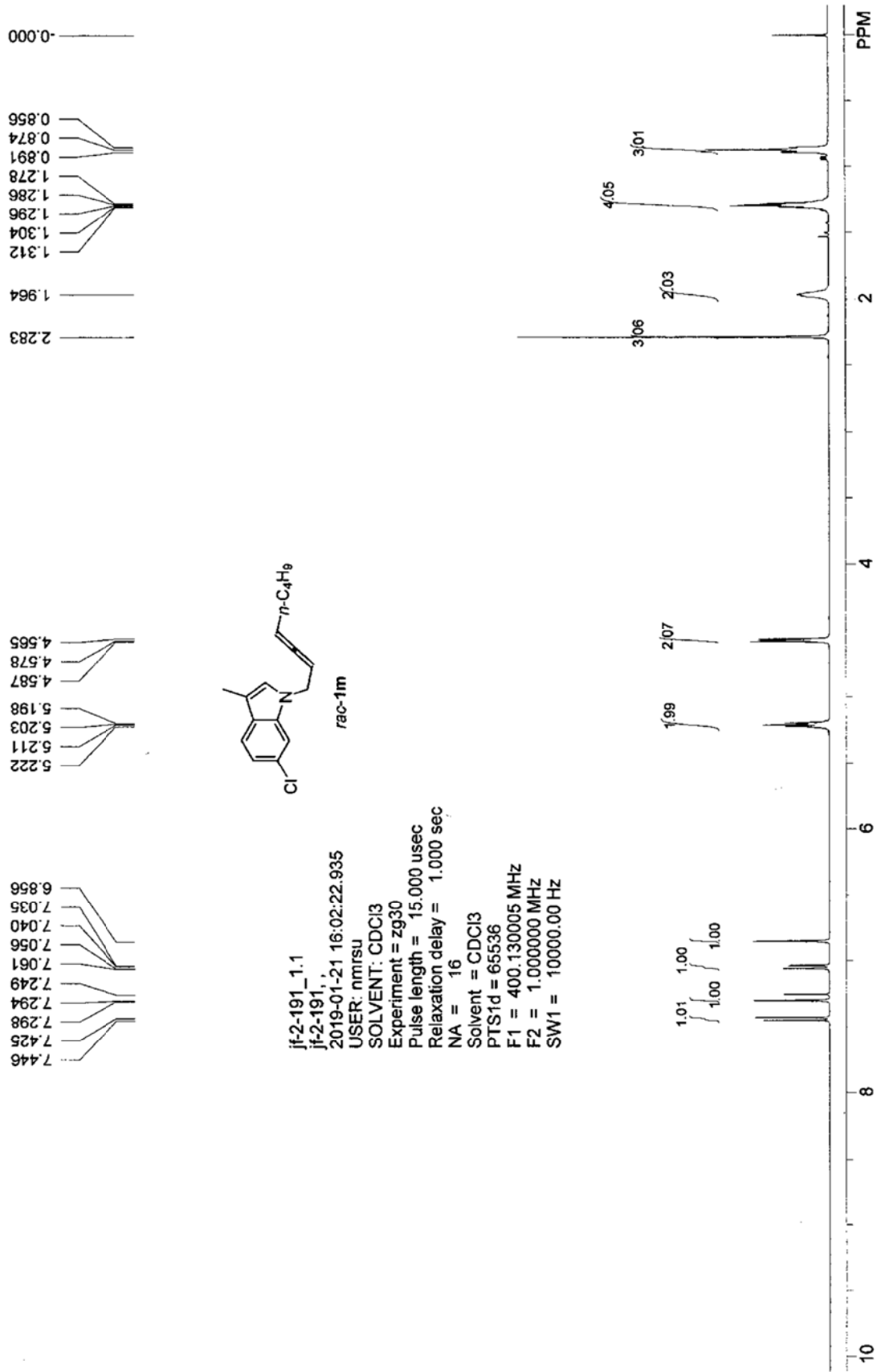


jf-3-074_2.1

2019-04-29 17:17:10.171
 USER: nmr
 SOLVENT: CDCl3
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 297
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz







if-2-191_1.1
if-2-191_1
2019-01-21 16:02:22.935
USER: nmrsu
SOLVENT: CDCl3
Experiment = zg30
Pulse length = 15.000 usec
Relaxation delay = 1.000 sec
NA = 16
Solvent = CDCl3
PTS1d = 65536
F1 = 400.130005 MHz
F2 = 1.000000 MHz
SW1 = 10000.00 Hz

jf-2-191_2.1

2019-01-17 17:09:04.031

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 716

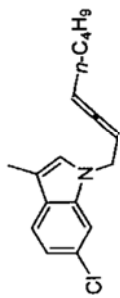
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



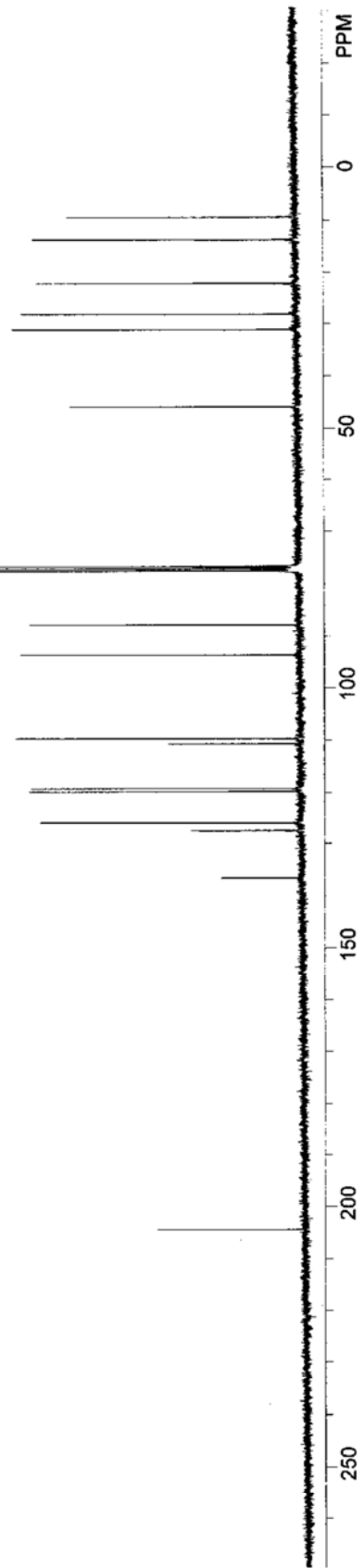
31.160
28.247
22.116
13.843
9.459

45.849

76.577
77.423
77.000
87.736
93.683

109.631
110.660
119.255
119.815
125.965
127.445
127.683
136.673

204.454



jf-3-082_1.1

2019-05-07 10:32:54.203

USER: nmr

SOLVENT: CDCl3

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

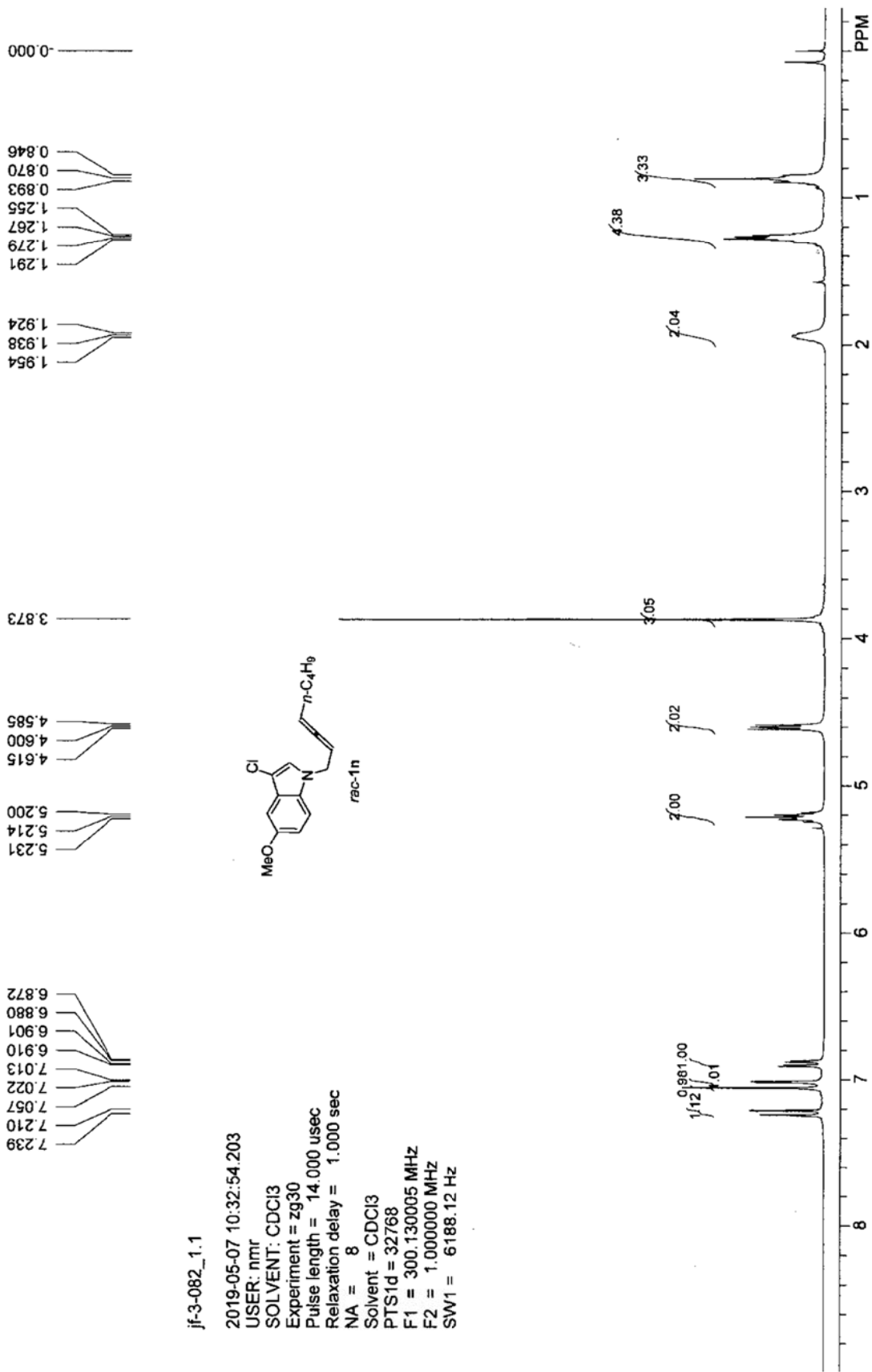
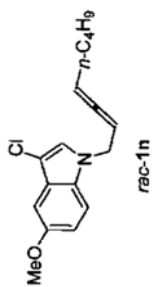
Solvent = CDCl3

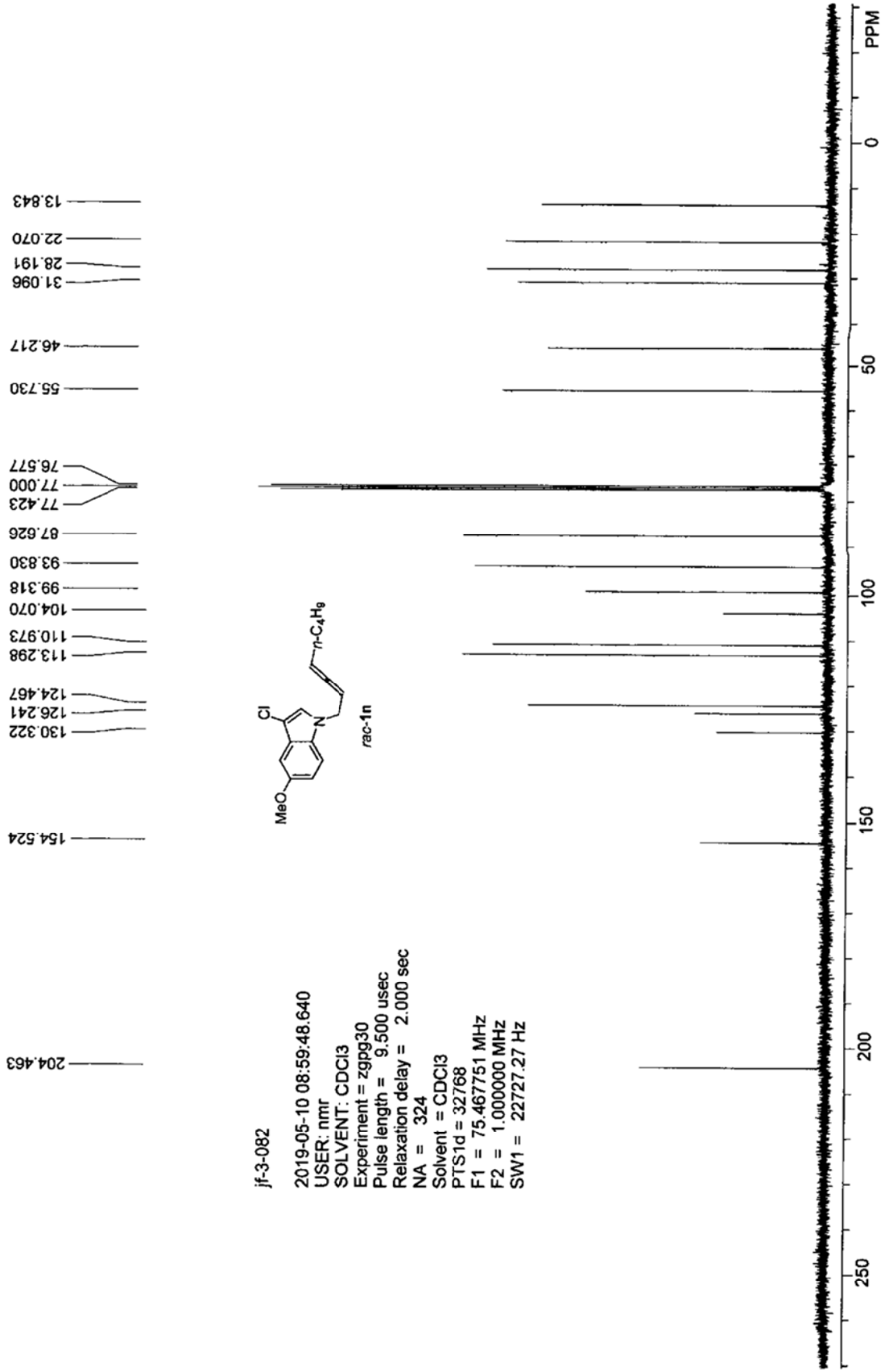
PTSD = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

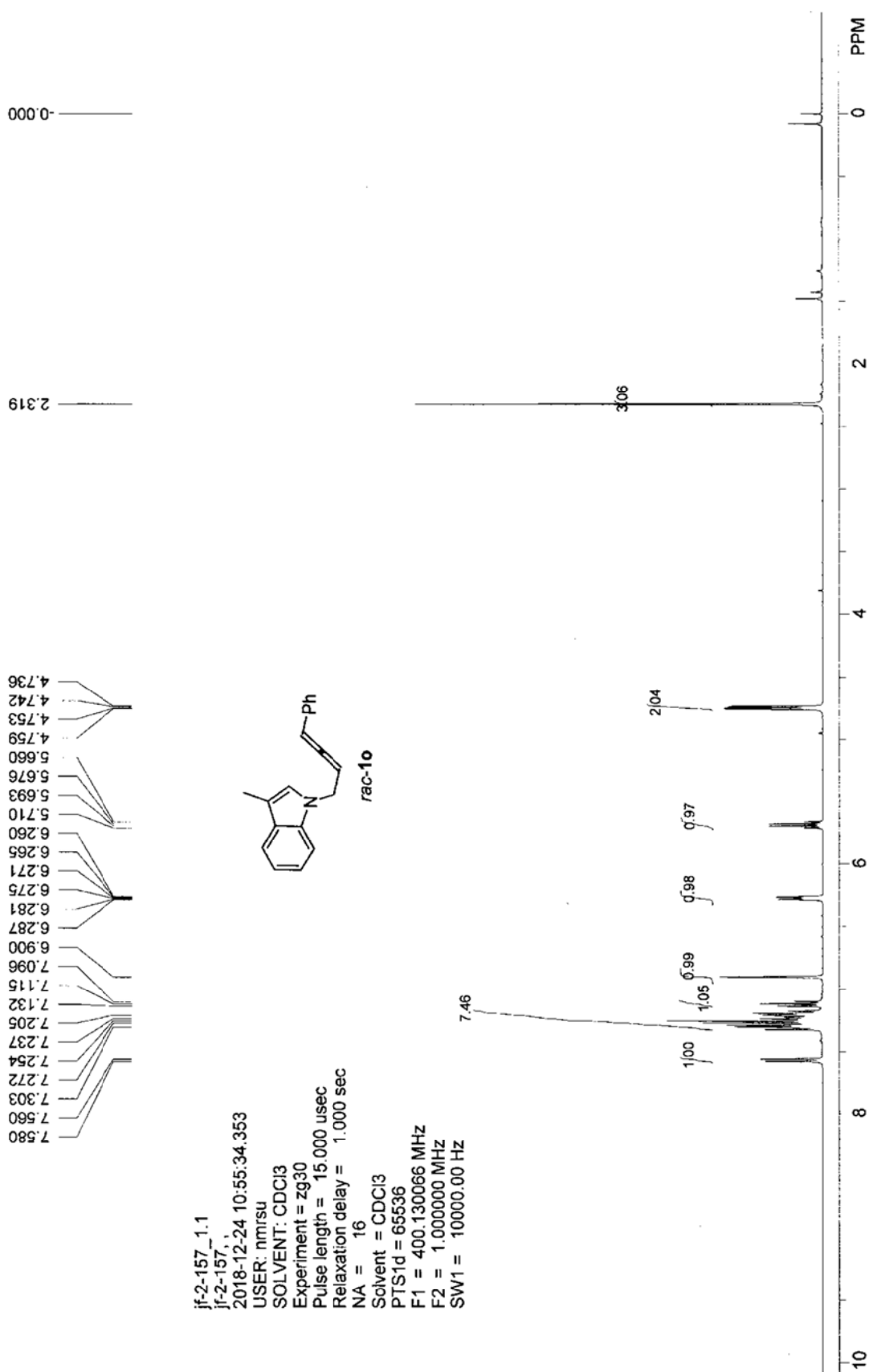
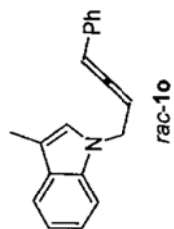


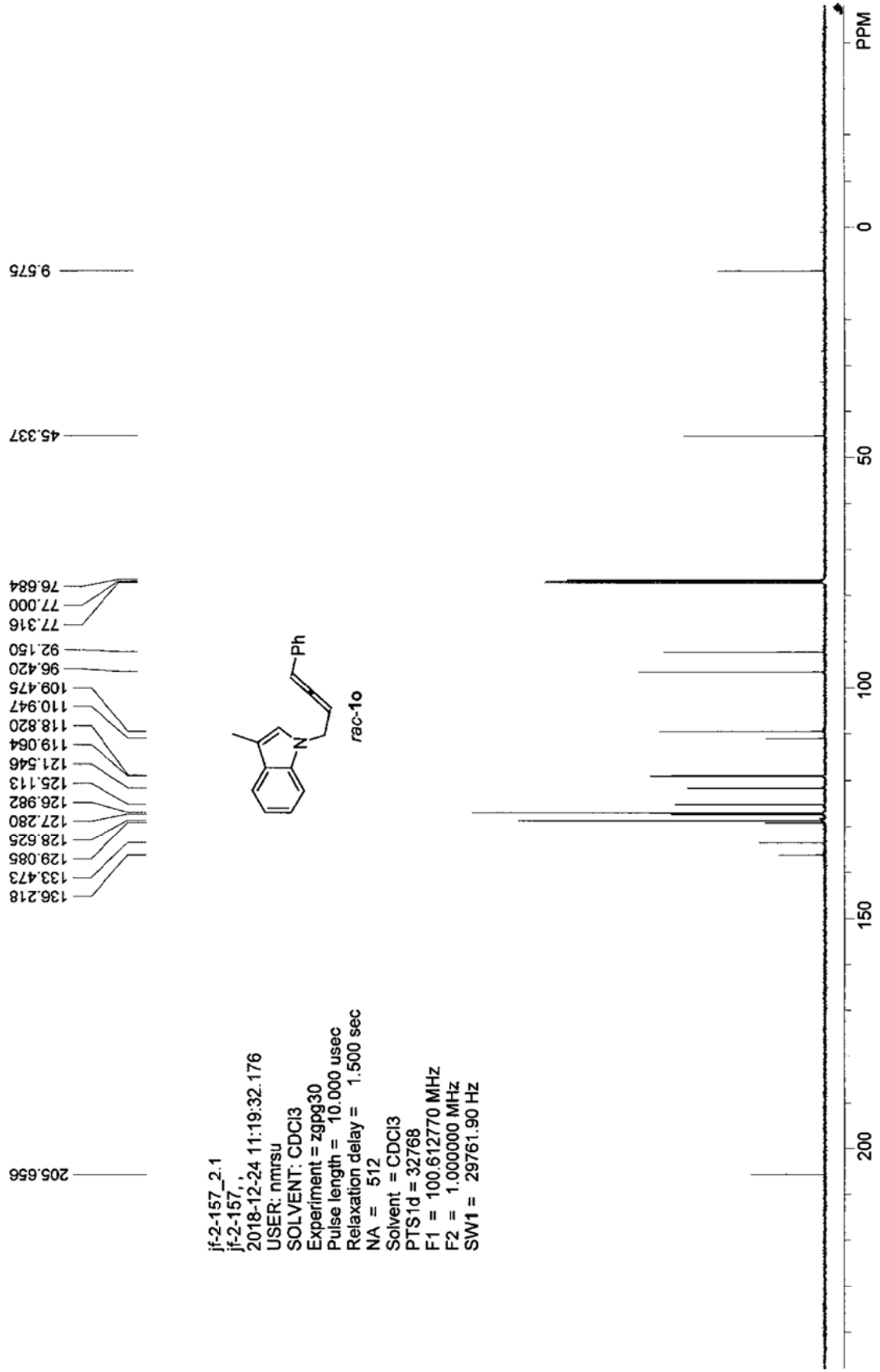


jf-3-082

2019-05-10 08:59:48.640
 USER: nmr
 SOLVENT: CDCl3
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 324
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz

jf-2-157_1.1
 jf-2-157_1
 2018-12-24 10:55:34.353
 USER: nmrsu
 SOLVENT: CDCl3
 Experiment = zg30
 Pulse length = 15.000 usec
 Relaxation delay = 1.000 sec
 NA = 16
 Solvent = CDCl3
 PTS1d = 65536
 F1 = 400.130066 MHz
 F2 = 1.000000 MHz
 SW1 = 10000.00 Hz





if-2-157_2.1
if-2-157_1
2018-12-24 11:19:32.176
USER: nmrsu
SOLVENT: CDCl3
Experiment = zgpg30
Pulse length = 10.000 usec
Relaxation delay = 1.500 sec
NA = 512
Solvent = CDCl3
PTS1d = 32768
F1 = 100.612770 MHz
F2 = 1.000000 MHz
SW1 = 29761.90 Hz

ji-2-172_1.1

2017-01-09 10:21:12.531

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

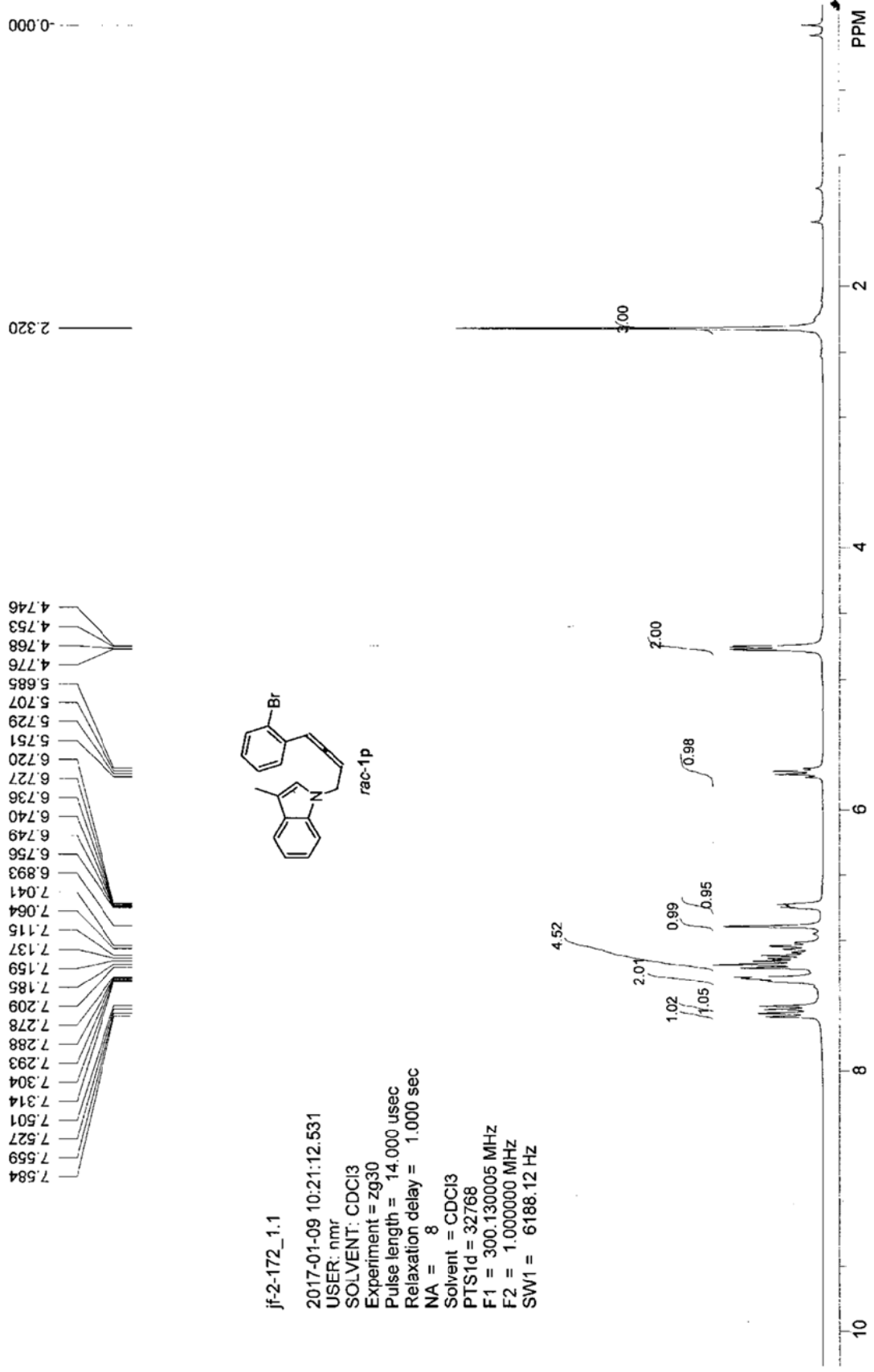
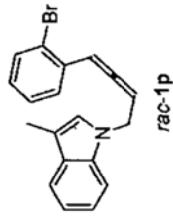
Solvent = CDCl₃

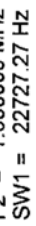
PTS1d = 32768

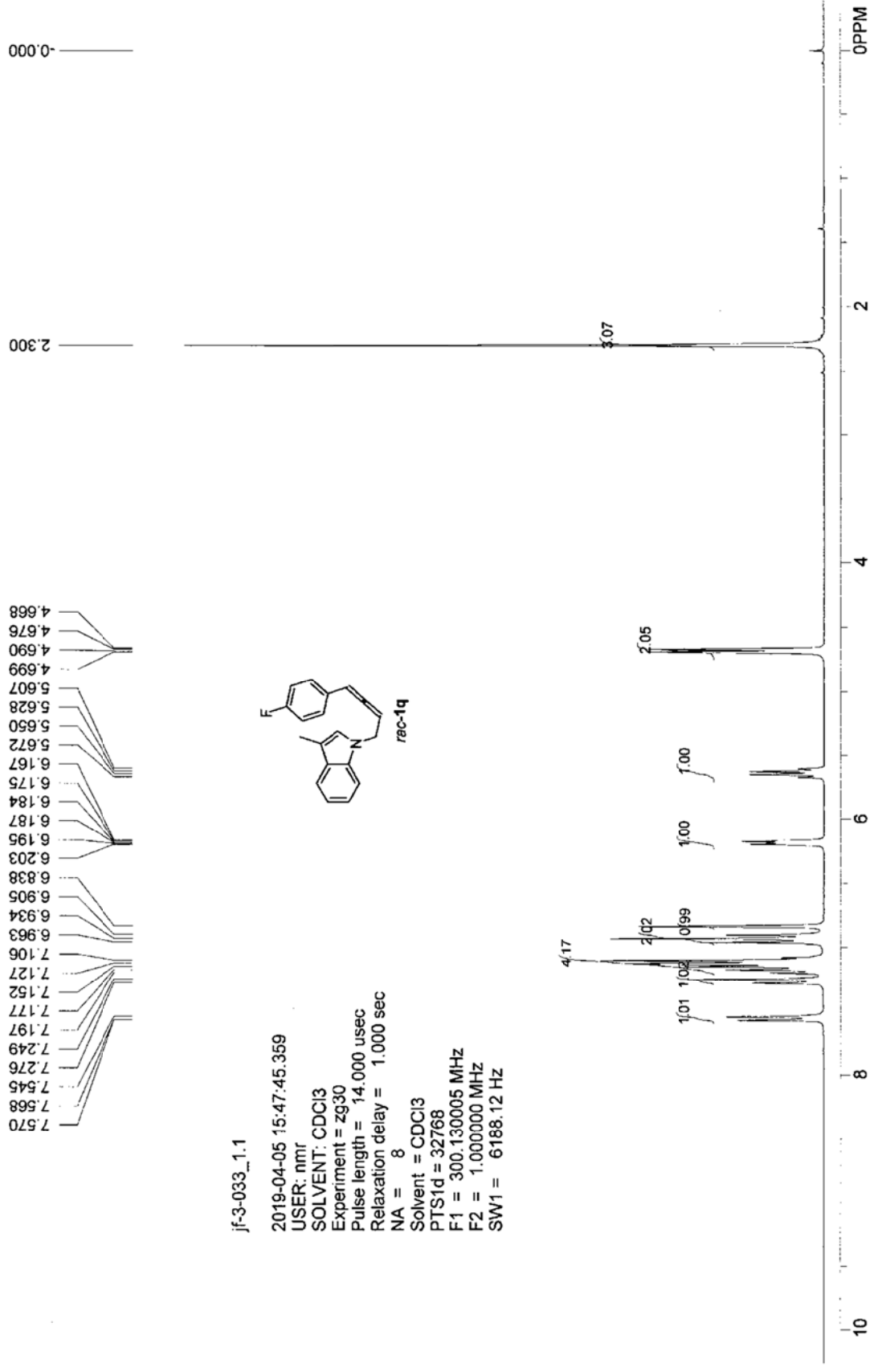
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

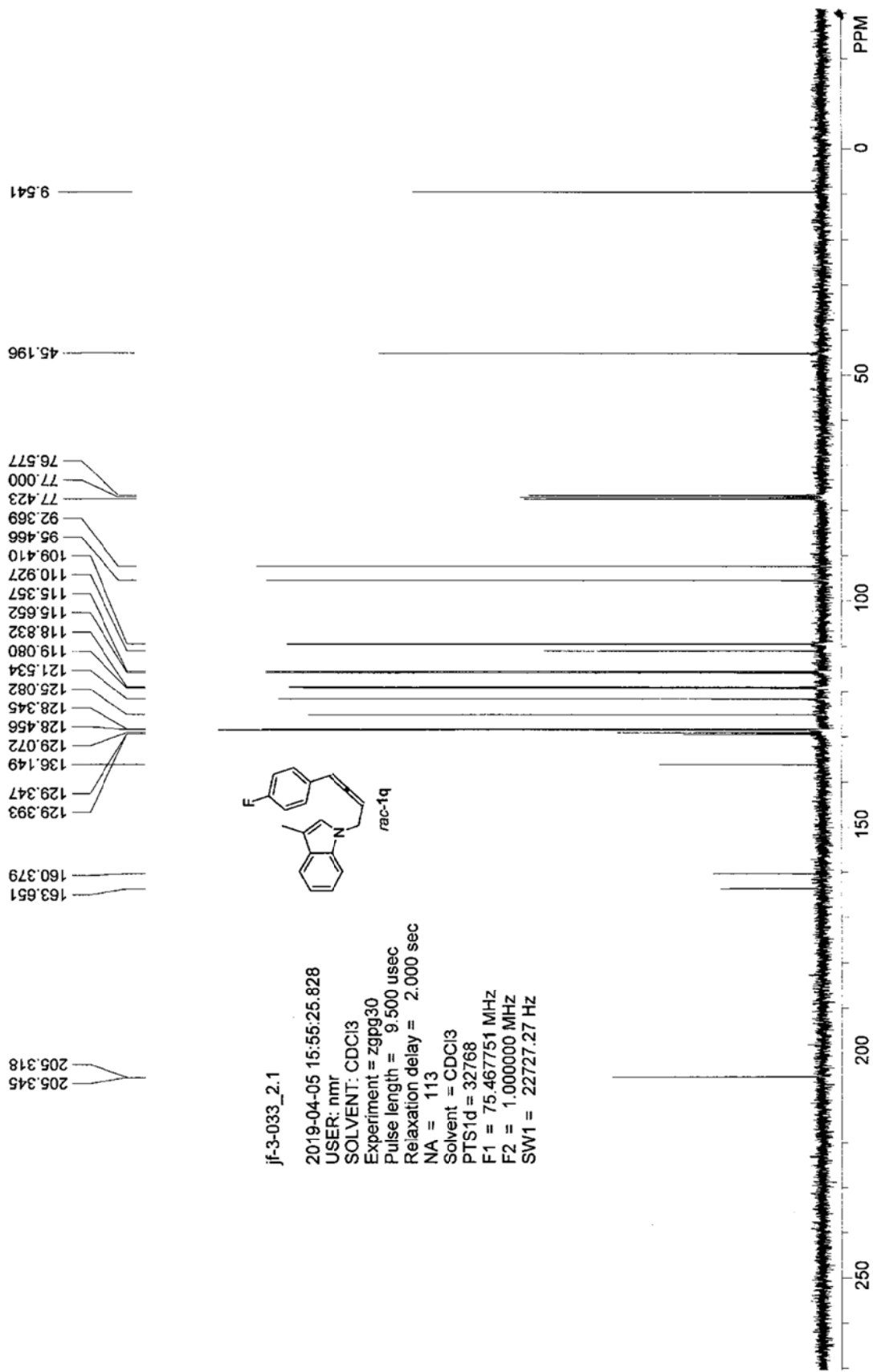






jf-3-033_1.1

2019-04-05 15:47:45.359
 USER: nmf
 SOLVENT: CDCl3
 Experiment = zg30
 Pulse length = 14.000 usec
 Relaxation delay = 1.000 sec
 NA = 8
 Solvent = CDCl3
 P1 = 32768
 F1 = 300.130005 MHz
 F2 = 1.000000 MHz
 SW1 = 6188.12 Hz



jf-3-033_2.1

2019-04-05 15:55:25.828

USER: nmf

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 113

Solvent = CDCl₃

PTS1d = 32768

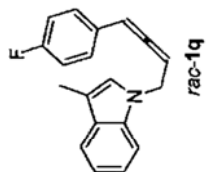
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

0.000

-115.215



jf-3-033_4.1

2019-04-06 09:22:32.859
USER: nmr
SOLVENT: CDCl₃
Experiment = zgfhgqn
Pulse length = 13.500 usec
Relaxation delay = 1.000 sec
NA = 16
Solvent = CDCl₃
PTS1d = 65536
F1 = 282.404358 MHz
F2 = 1.000000 MHz
SW1 = 66964.29 Hz

PPM

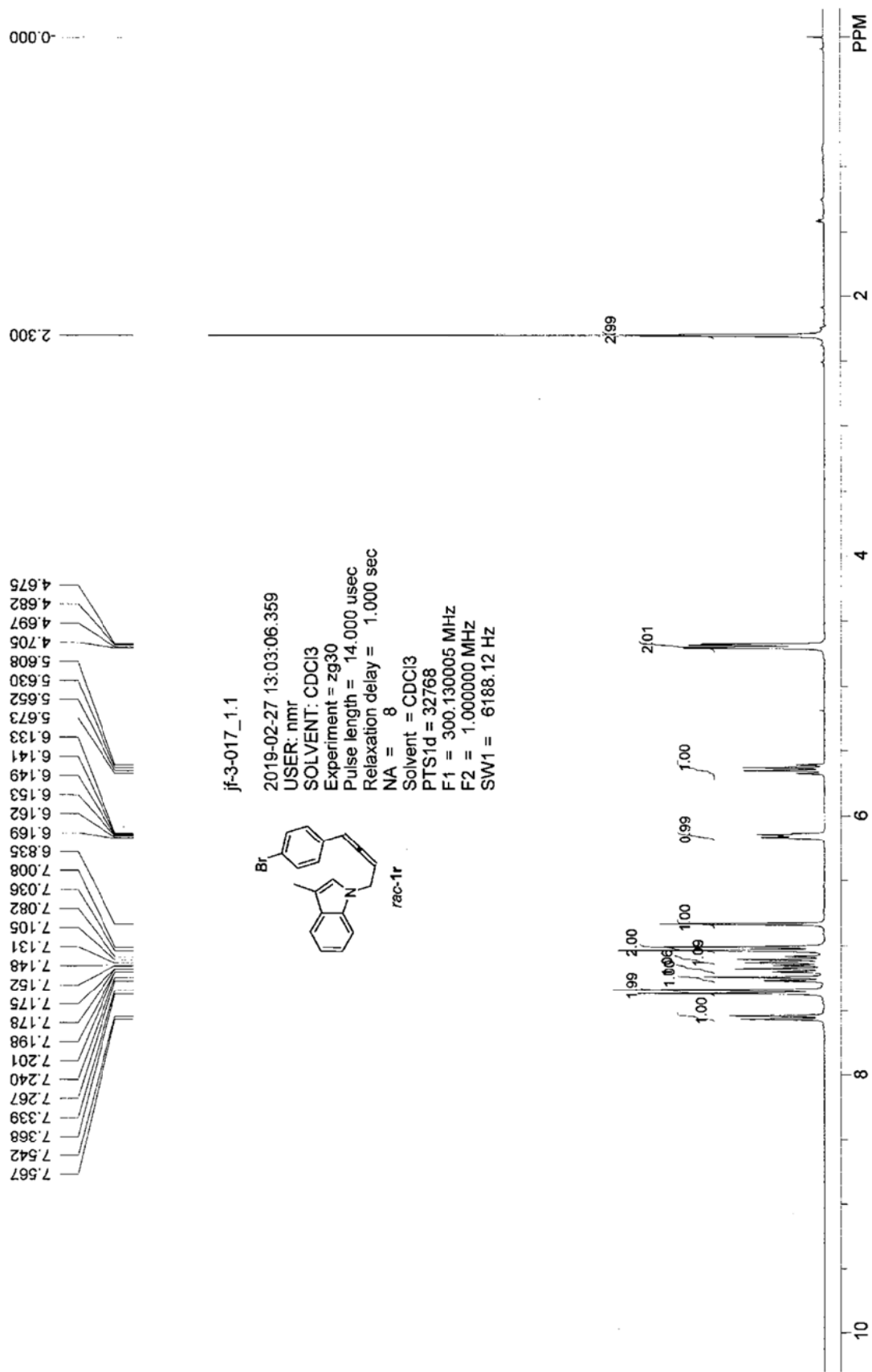
-200

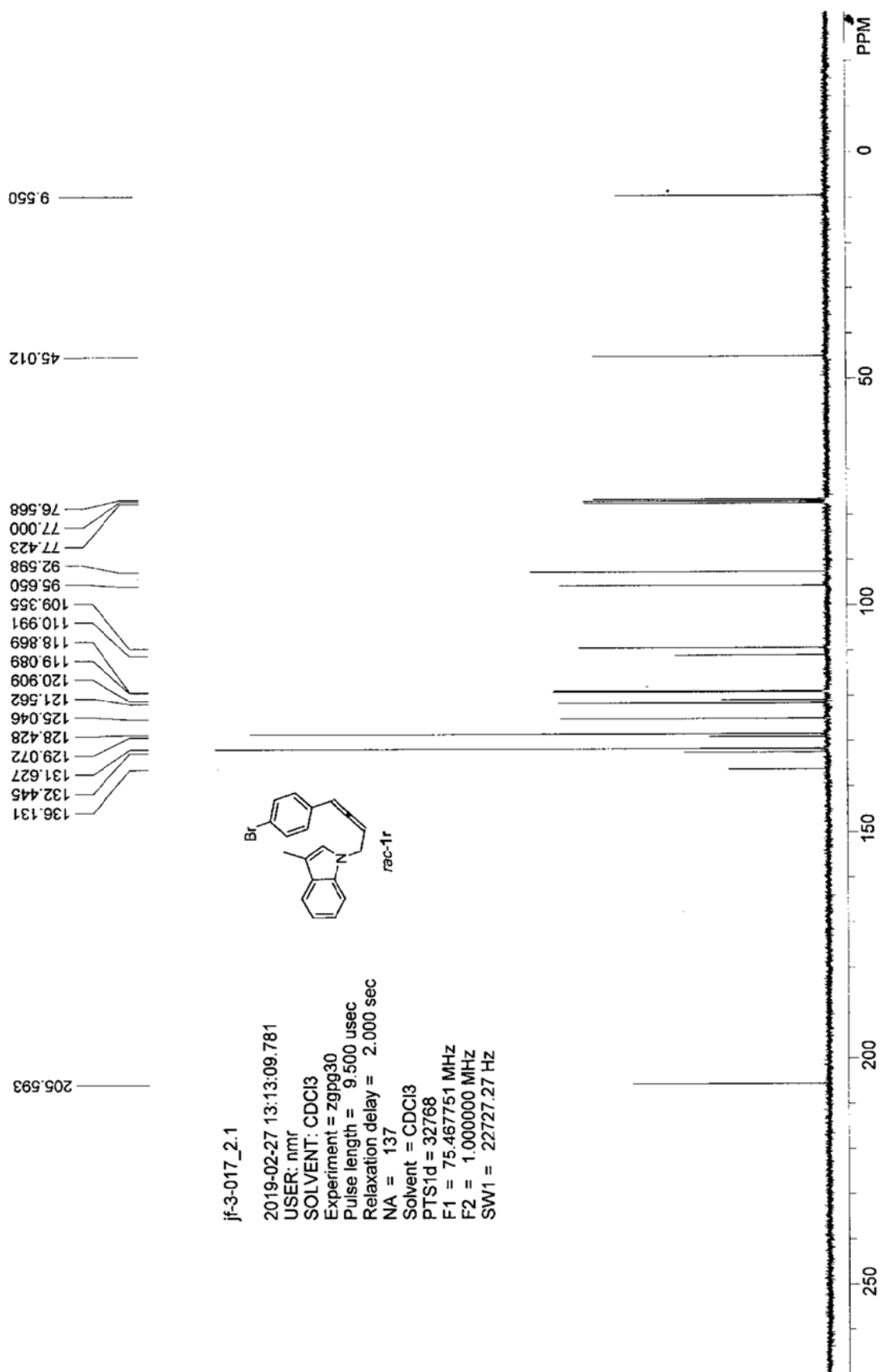
-150

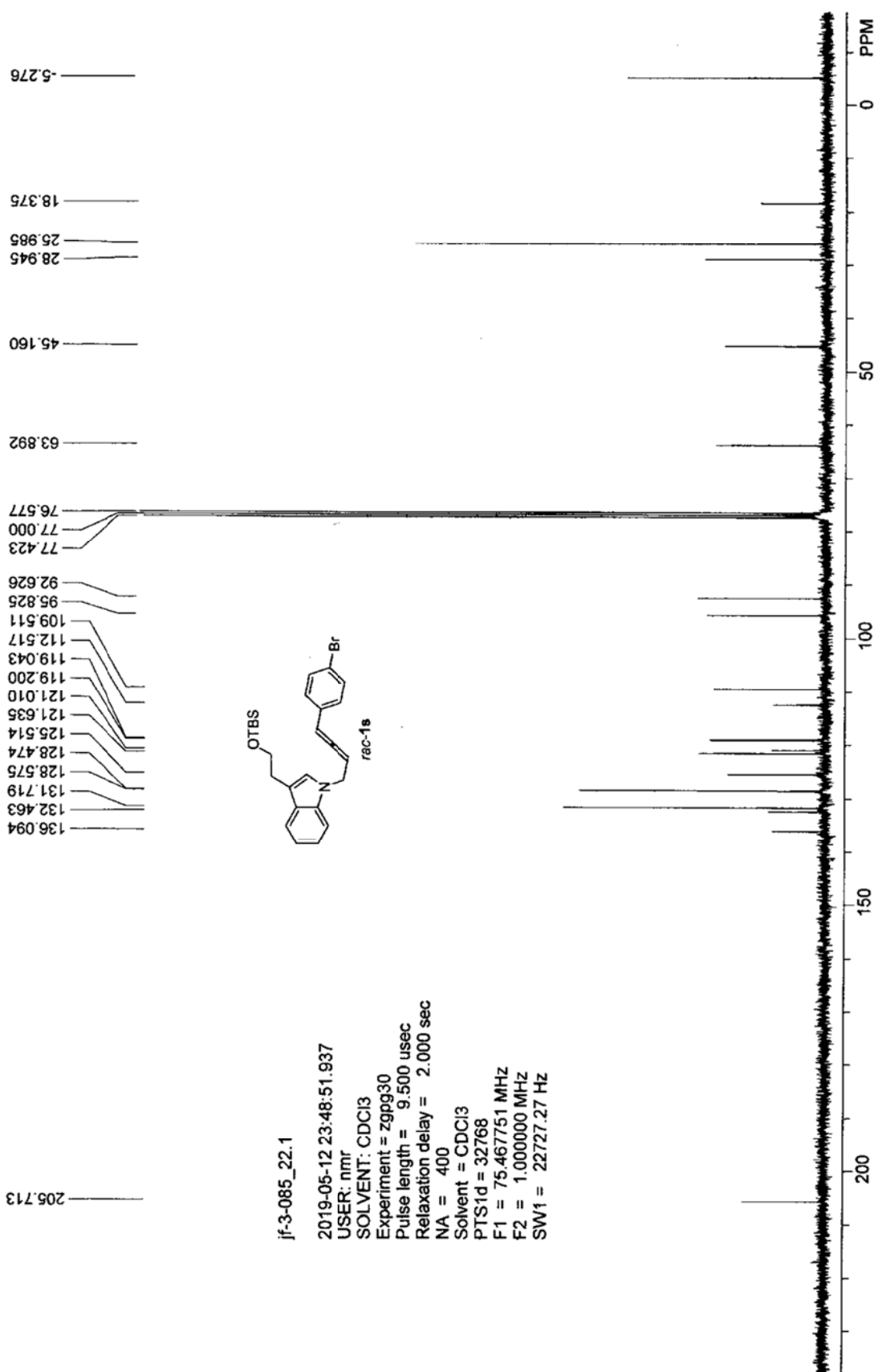
-100

-50

0







jf-3-085_22.1

2019-05-12 23:48:51.937

USER: nmf

SOLVENT: CDCl3

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 400

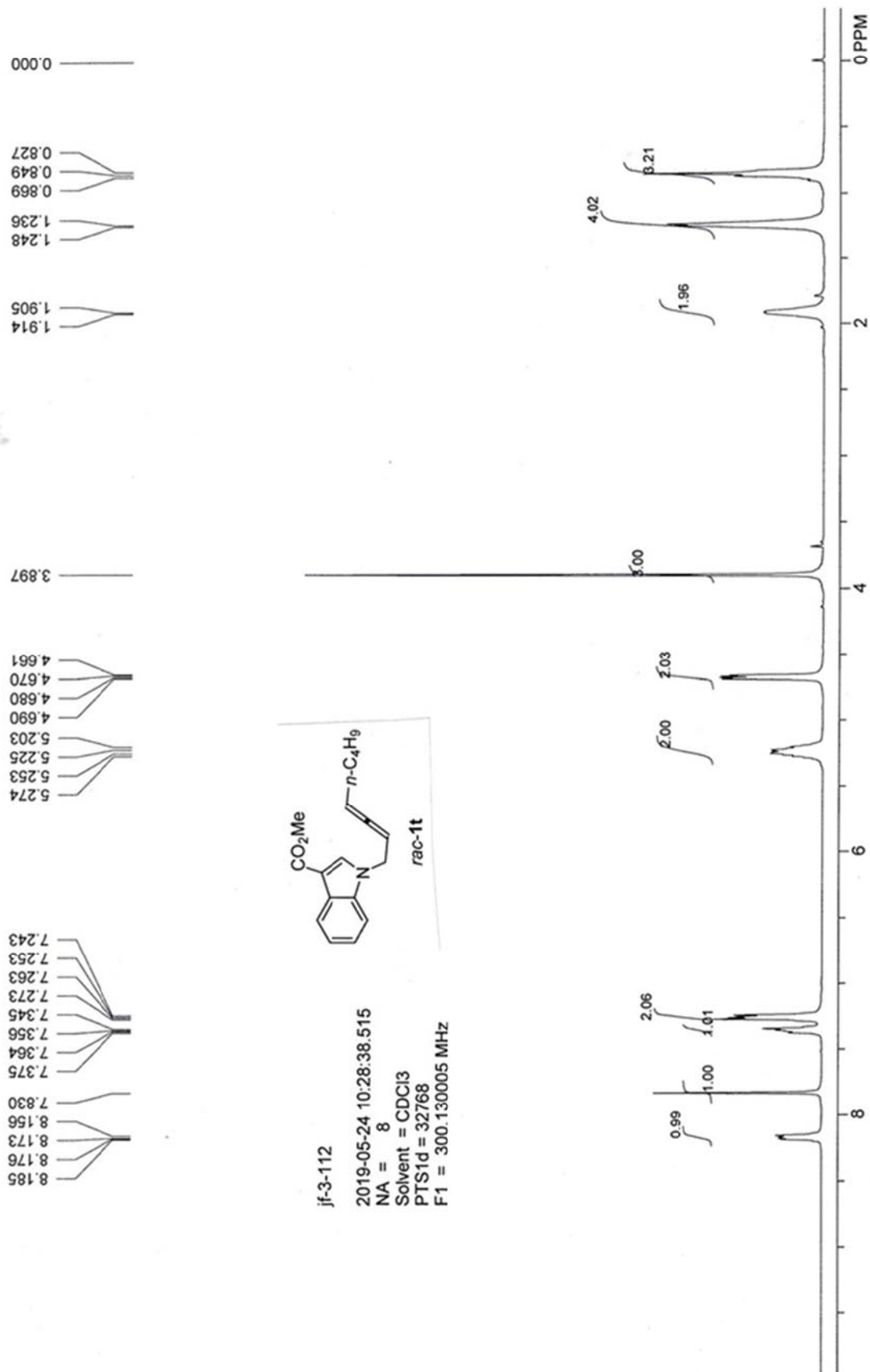
Solvent = CDCl3

PTSD = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SWH = 22727.27 Hz



jf-3-112

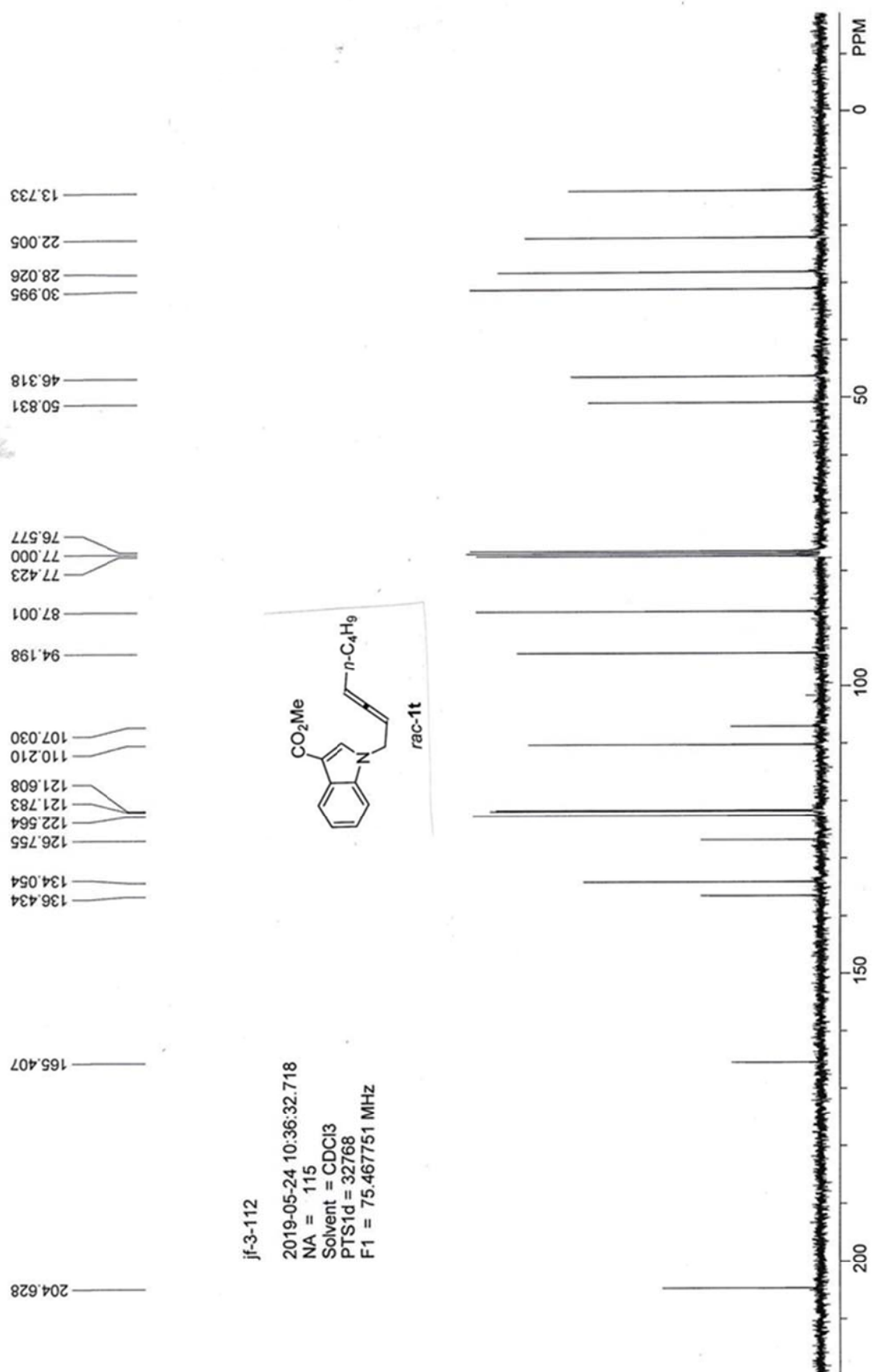
2019-05-24 10:28:38.515

NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz



jf-3-112

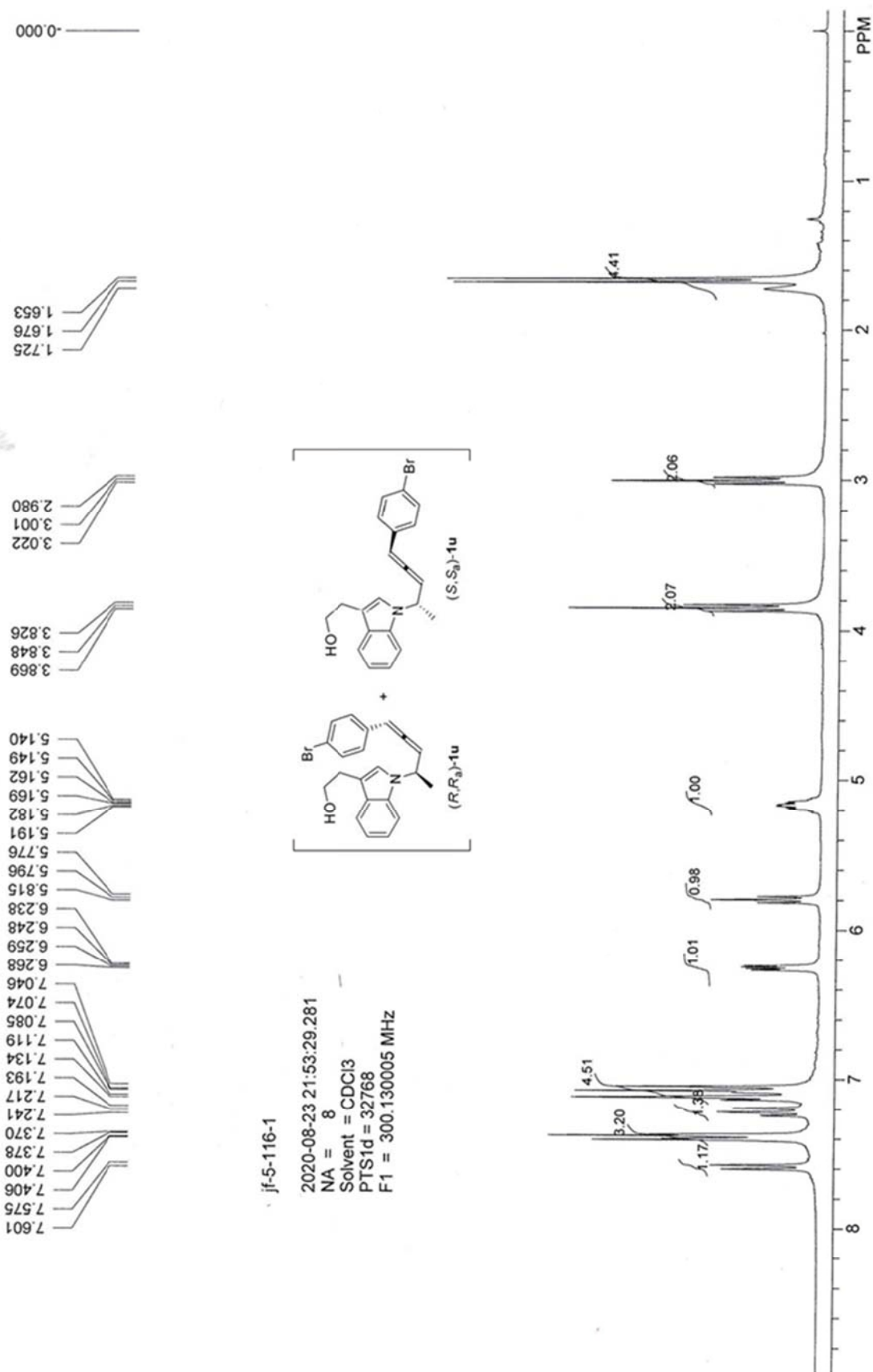
2019-05-24 10:36:32.718

NA = 115

Solvent = CDCl₃

PTSD = 32768

F1 = 75.467751 MHz



jf-5-116-1

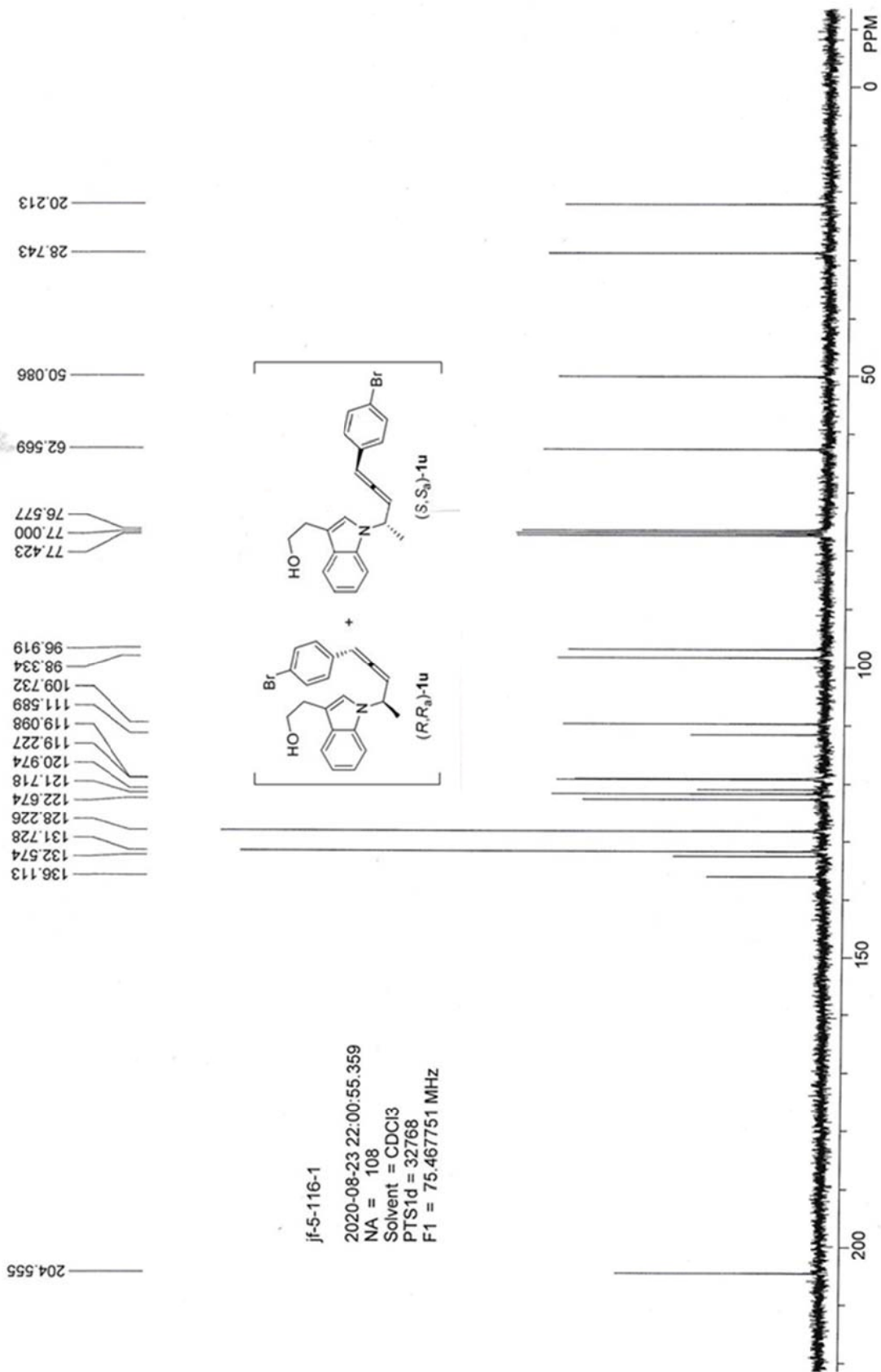
2020-08-23 21:53:29.281

NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz



jf-5-116-1
 2020-08-23 22:00:55.359
 NA = 108
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 75.467751 MHz

Jf-5-116-2

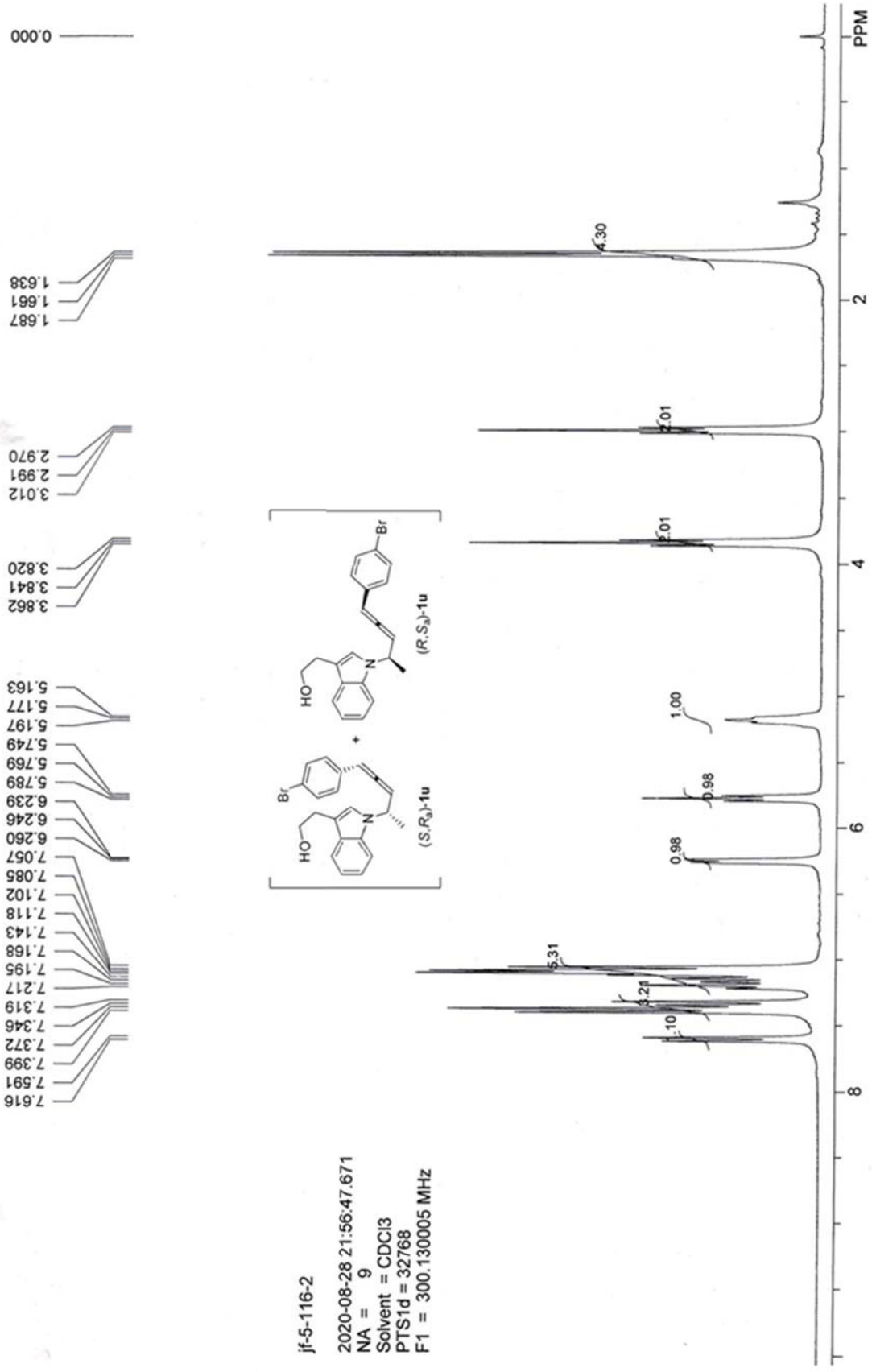
2020-08-28 21:56:47.671

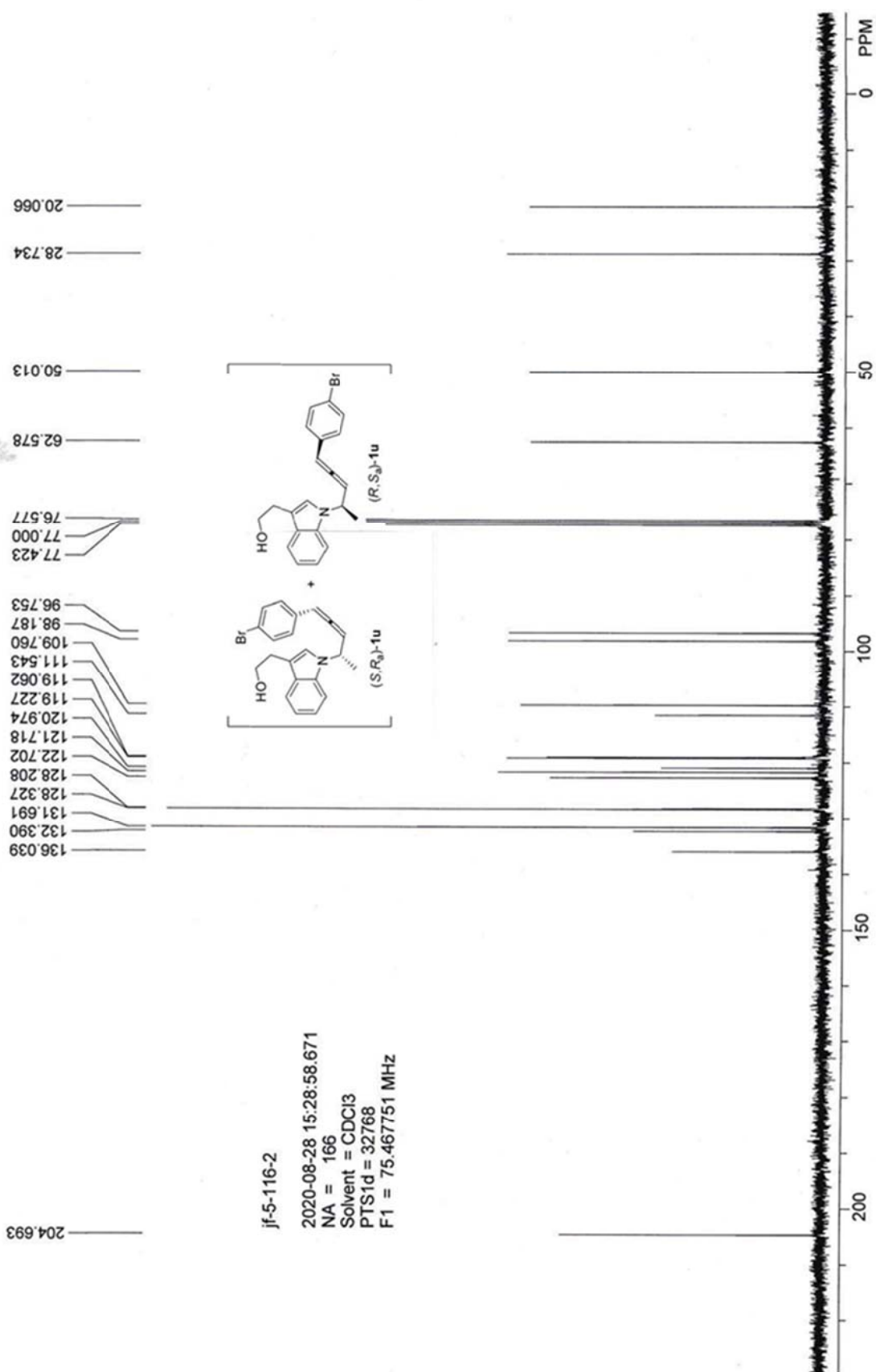
NA = 9

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz





jf-5-116-2

2020-08-28 15:28:58.671

NA = 166

Solvent = CDCl3

PTS1d = 32768

F1 = 75.467751 MHz

jt-1-155_1.1

2018-05-08 21:42:04.281

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

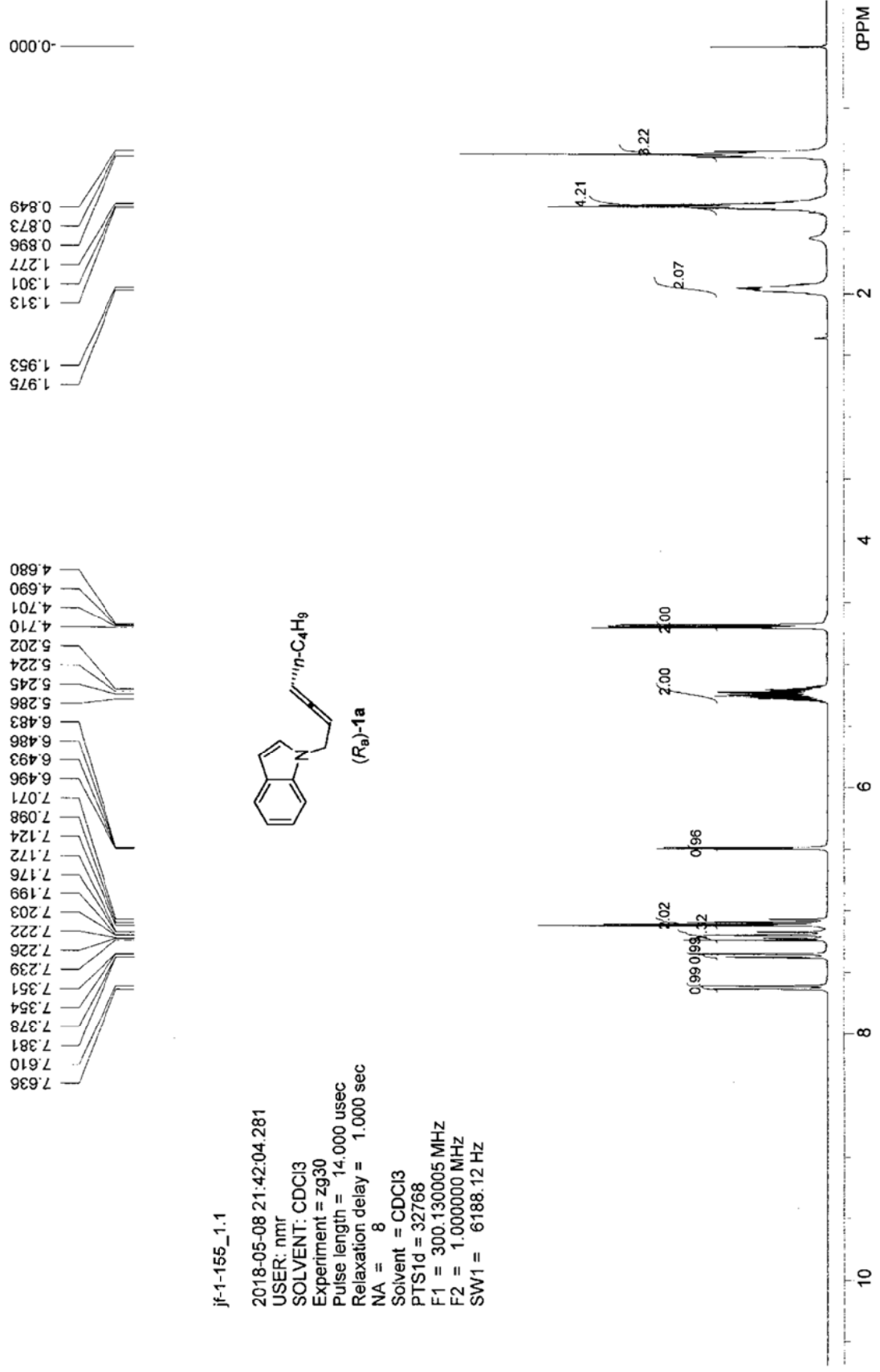
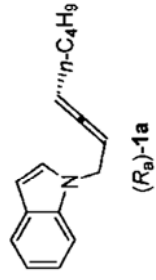
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-1-155_2.1

2018-06-13 19:43:53.578

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 2150

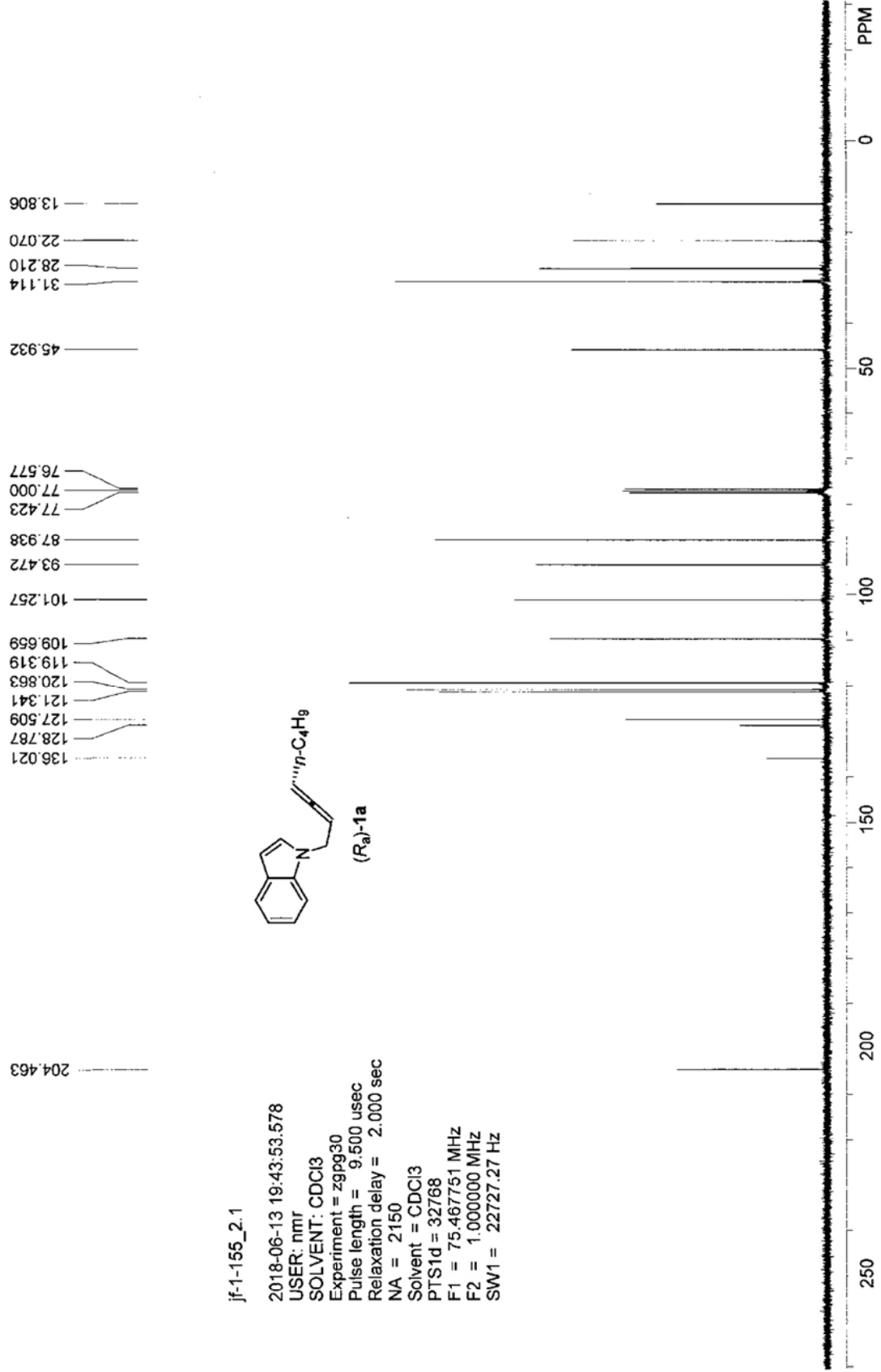
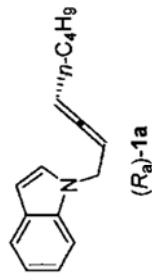
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



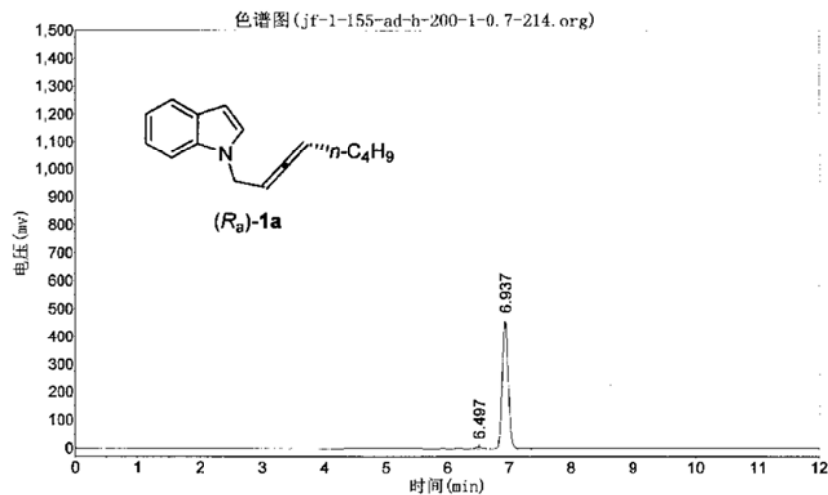
jf-1-155-ad-h-200-1-0.7-214

实验时间: 2018-05-18, 11:23:52

报告时间: 2018-05-18, 15:32:01

谱图文件: D:\zhuguangjiong\jf\20180518\jf-1-155-ad-h-200-1-0.7-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		6.497	6550.627	40616.551	1.2829
2		6.937	458458.469	3125256.500	98.7170
总计			465009.096	3165873.051	100.0000

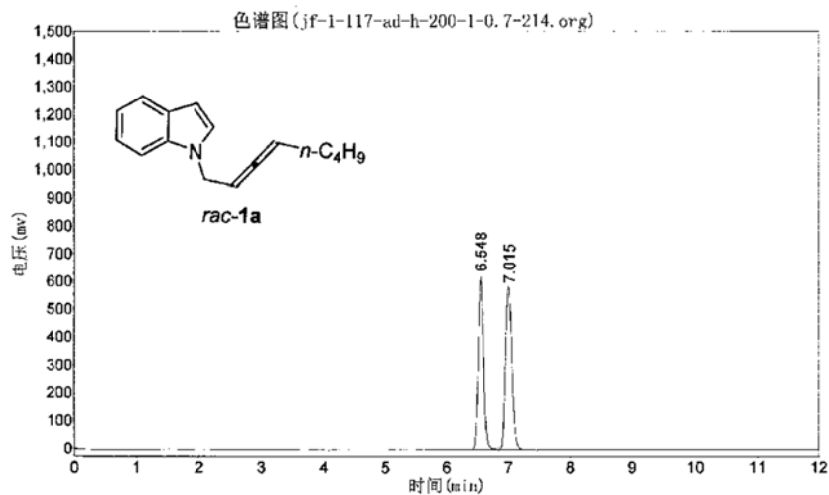
jf-1-117-ad-h-200-1-0.7-214

实验时间: 2018-05-18, 10:54:14

报告时间: 2018-05-1

谱图文件: D:\zhuguang\jiong\jf\20180518\jf-1-117-ad-h-200-1-0.7-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		6.548	600066.250	3953276.250	48.1530
2		7.015	584220.375	4256541.500	51.8470
总计			1184286.625	8209817.750	100.0000

jf-2-008_1.1

2018-06-23 20:52:35.796

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

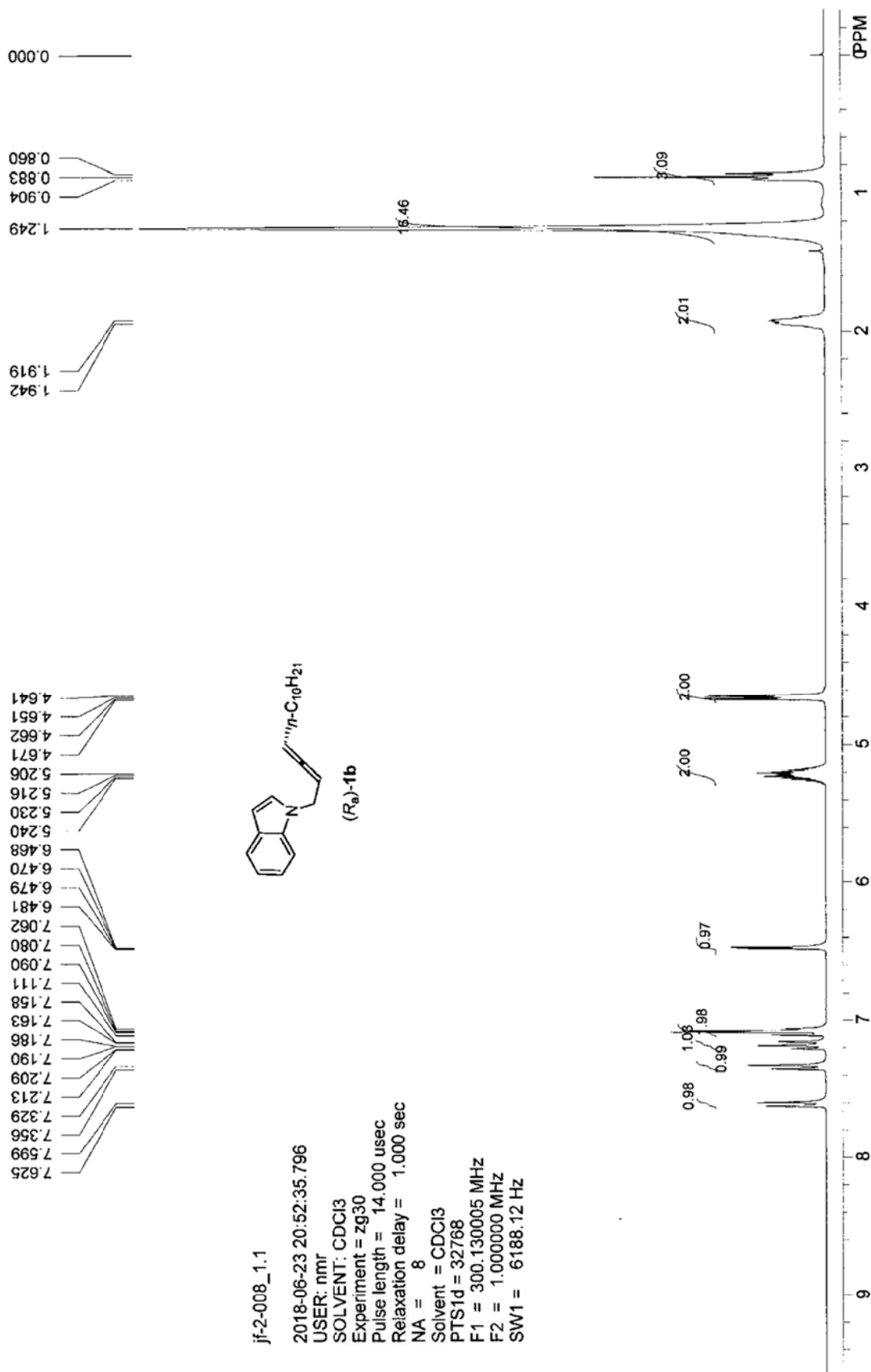
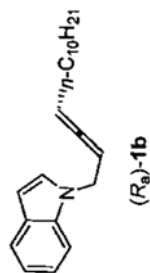
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-2-008_2.1

2018-06-23 21:30:18.000

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 624

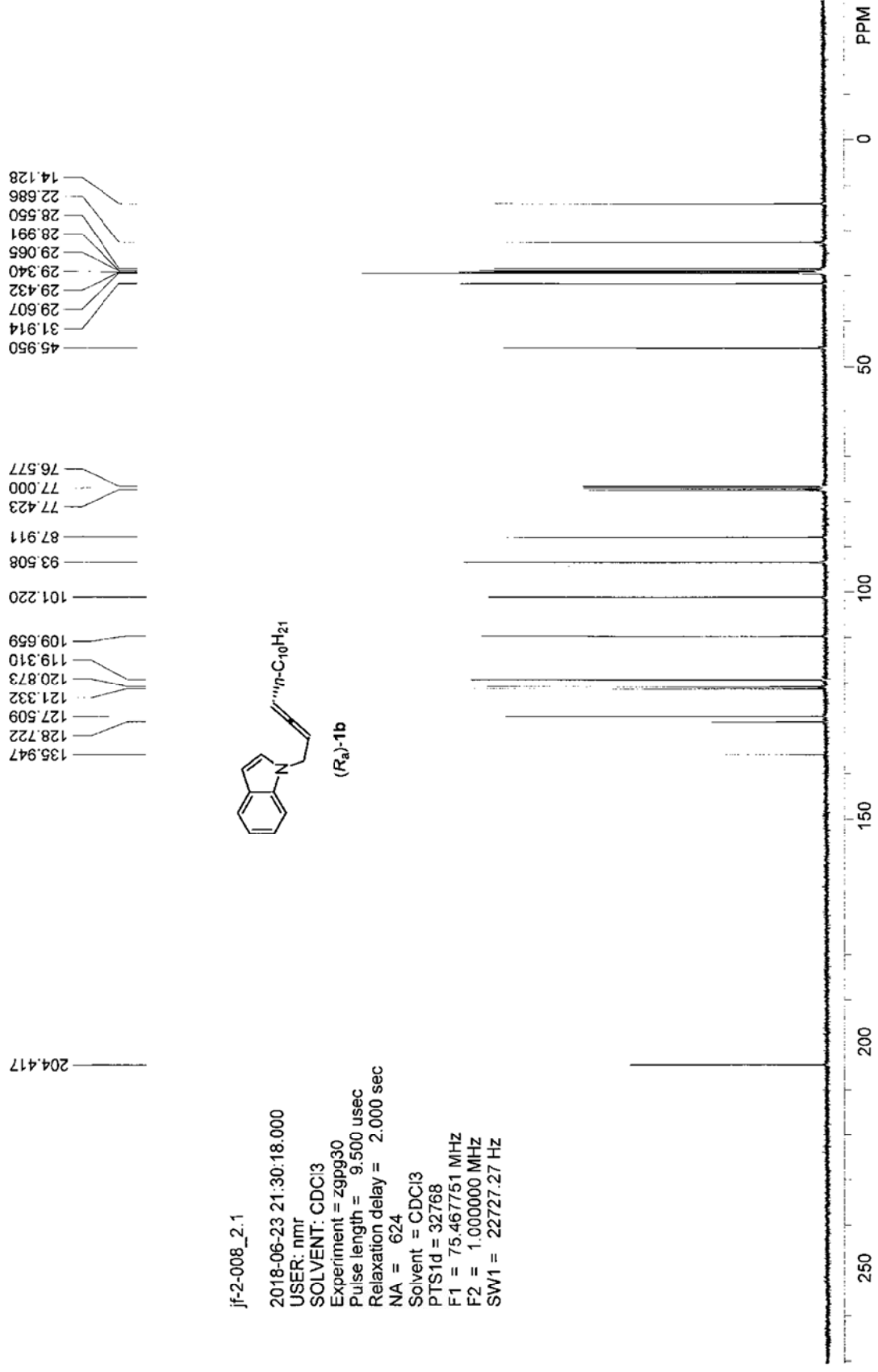
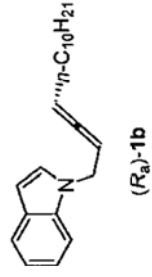
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

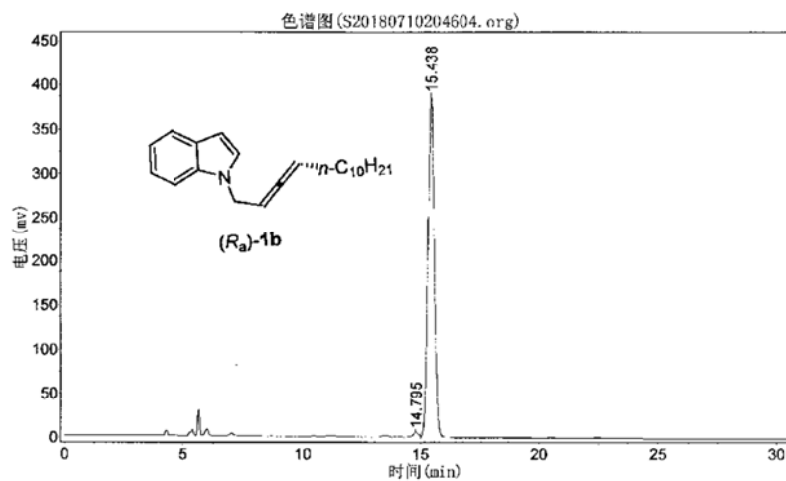


jf-2-008

实验时间: 2018-07-10, 20:46:04
 谱图文件: D:\浙大智达\N2000\样品\S20180710204604.org
 方法文件: D:\浙大智达\N2000\d.jx.mtd

实验者: jf
 报告时间: 2018-07-10, 21:19:16
 积分方法: 面积归一法

实验内容简介:
 od-ll, n-hexanc/i-PrOH = 200/1, 0.7, 214



分析结果表

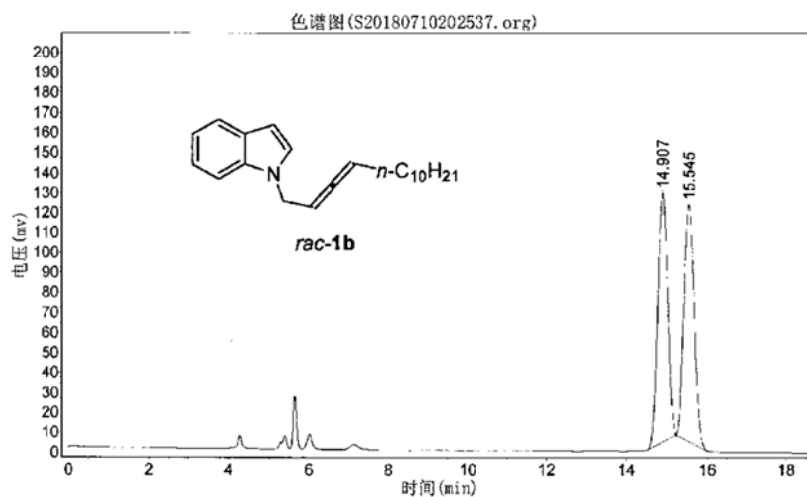
峰号	峰名	保留时间	峰高	峰面积	含量
1		14.795	5025.257	82230.117	1.1333
2		15.438	386057.656	7173386.000	98.8667
总计			391082.914	7255616.117	100.0000

jf-2-009

实验时间: 2018-07-10, 20:25:37
谱图文件: D:\浙大智达\N2000\样品\S20180710202537.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-07-10, 20:48:32
积分方法: 面积归一法

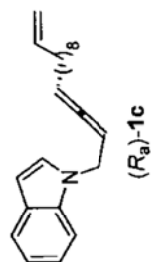
实验内容简介:
od-H, n-hexane/i-PrOH = 200/1, 0.7, 214



分析结果表

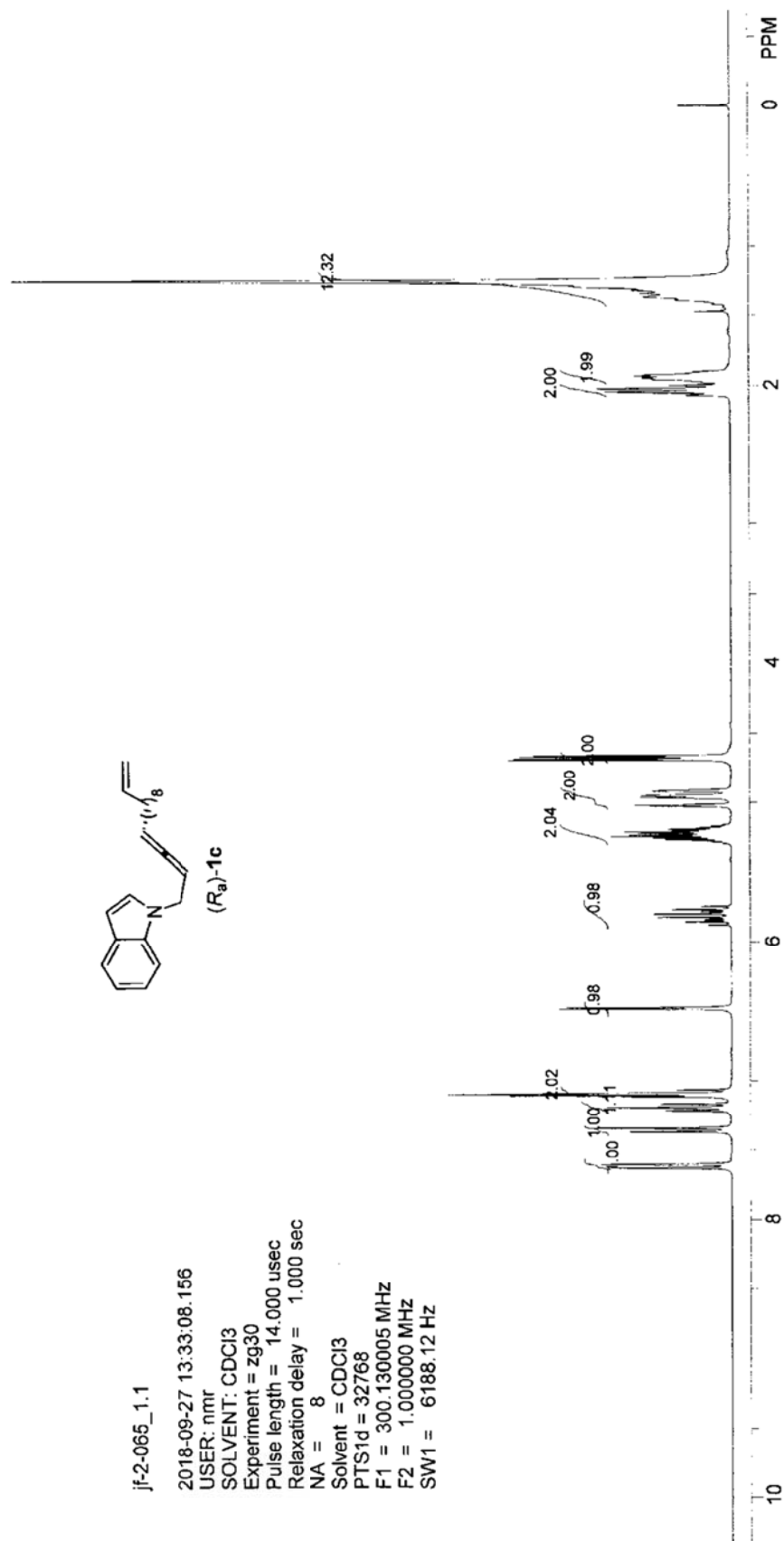
峰号	峰名	保留时间	峰高	峰面积	含量
1		14.907	124962.844	2110827.000	50.0497
2		15.545	118739.664	2106637.500	49.9503
总计			243702.508	4217464.500	100.0000

7.628
 7.602
 7.365
 7.338
 7.217
 7.193
 7.190
 7.166
 7.163
 7.117
 7.114
 7.106
 7.094
 7.068
 7.064
 6.484
 6.474
 5.857
 5.822
 5.800
 5.766
 5.254
 5.243
 5.233
 5.222
 5.213
 5.024
 5.018
 4.967
 4.961
 4.955
 4.950
 4.946
 4.943
 4.916
 4.912
 4.909
 4.690
 4.681
 4.669
 4.660
 2.071
 2.049
 2.024
 2.002
 1.948
 1.934
 1.323
 1.297
 1.253



jf-2-065_1.1

2018-09-27 13:33:08.156
 USER: nmr
 SOLVENT: CDCl₃
 Experiment = zg30
 Pulse length = 14.000 usec
 Relaxation delay = 1.000 sec
 NA = 8
 Solvent = CDCl₃
 PTS1d = 32768
 F1 = 300.130005 MHz
 F2 = 1.000000 MHz
 SW1 = 6188.12 Hz



jf-2-065_2.1

2018-09-27 18:37:59.218

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 664

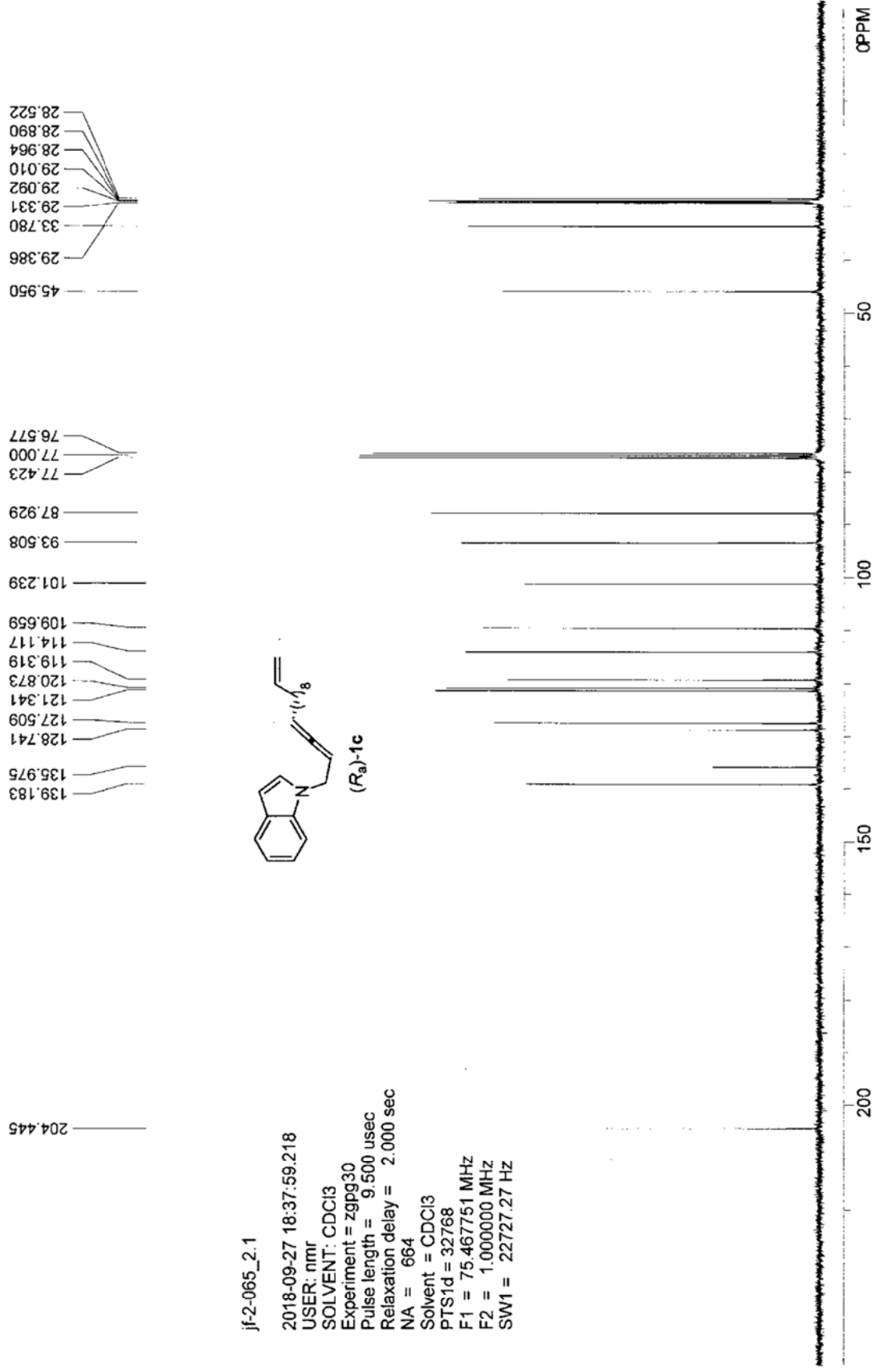
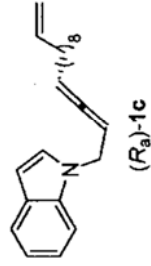
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

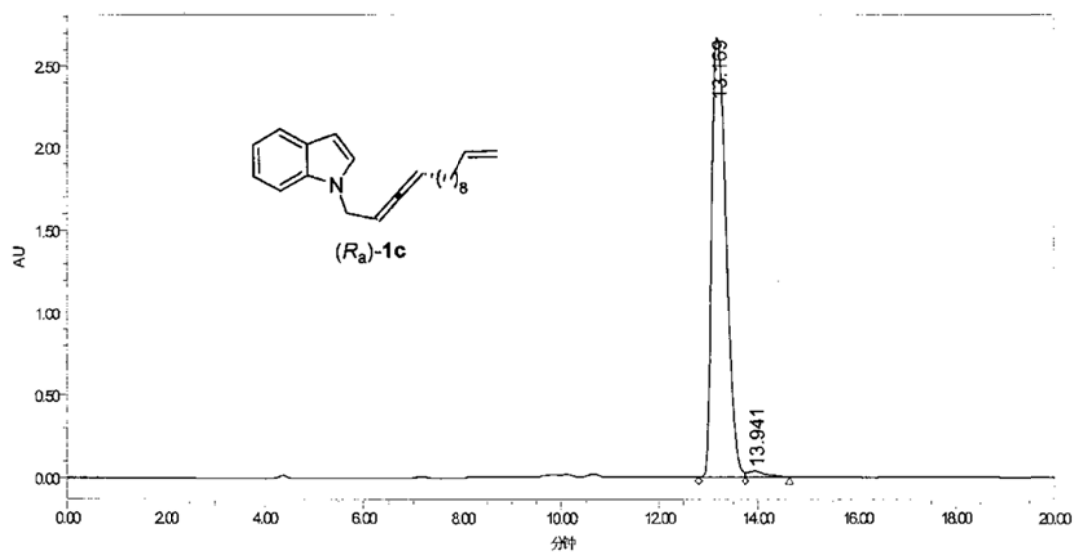
F2 = 1.000000 MHz

SW1 = 22727.27 Hz



SAMPLE INFORMATION

Sample Name:	jf-2-065-q-h-100-1-1-214	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2018/9/29 18:25:36 CST
Vial:	999	Acq. Method:	zg1001
Injection #:	58	Date Processed:	2018/9/29 19:23:10 CST
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	20.00 Minutes	Channel Desc.:	W2489 ChA.214nm
Column Type:		Sample Set Name:	



	RT (min)	Area (10 ⁴ sec)	%Area	Height (10 ⁴)	% Height
1	13.169	53560404	98.23	2574196	98.63
2	13.941	964866	1.77	37065	1.37

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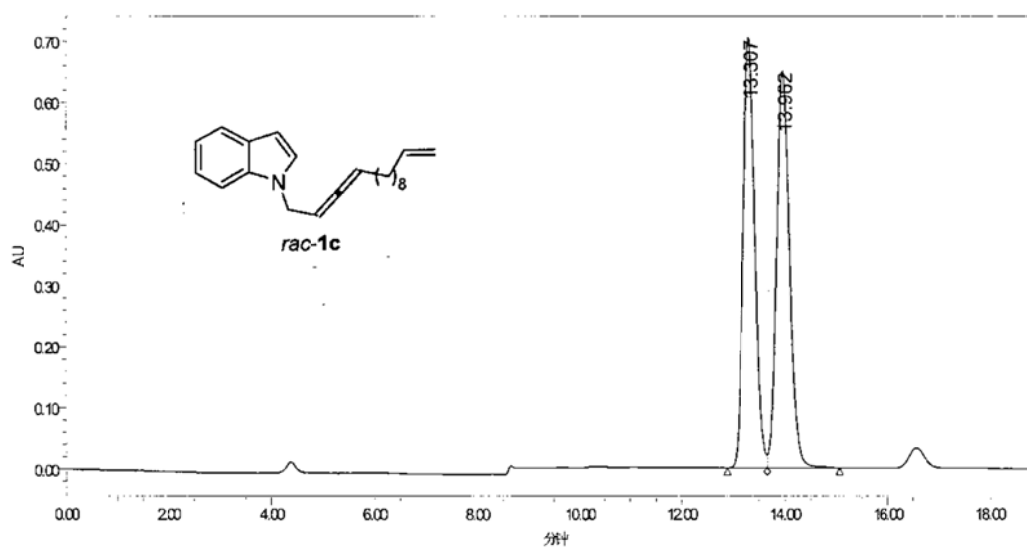
Project Name: defaults for copy

Reported by User: Breeze user (Breeze)



SAMPLE INFORMATION

Sample Name:	jf-2-057-qh-100-1-1-214	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2018/9/29 18:05:36 CST
Vial:	999	Acq. Method:	zgj1001
Injection #:	57	Date Processed:	2018/9/29 19:22:54 CST
Injection Volume:	10.00 u	Channel Name:	V2489 ChA
Run Time:	80.00 Minutes	Channel Desc.:	V2489 ChA.214nm
Column Type:		Sample Set Name:	



	RT (min)	Area (峰面积)	%Area	Height (峰高)	% Height
1	13.307	11026414	49.65	706177	52.04
2	13.952	11181075	50.35	660892	47.96

Report Method: Individual Report ASC

Page: 1 (共计 1)

Printed: 2018/9/29

19:23:21 PRC

jf-1-192_1.1

2018-06-11 12:11:55.921

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

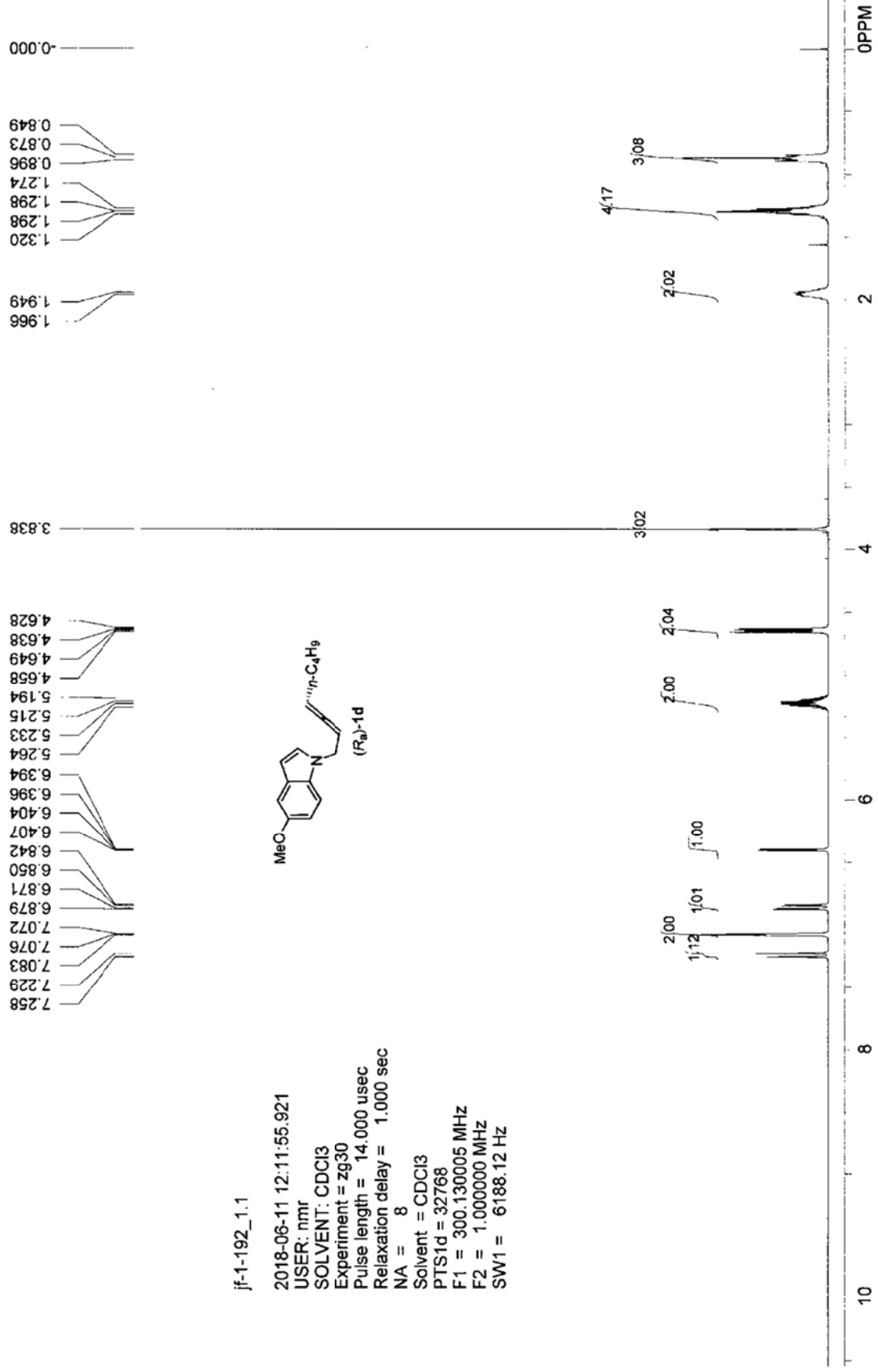
Solvent = CDCl₃

PTSD = 32768

F1 = 300.130005 MHz

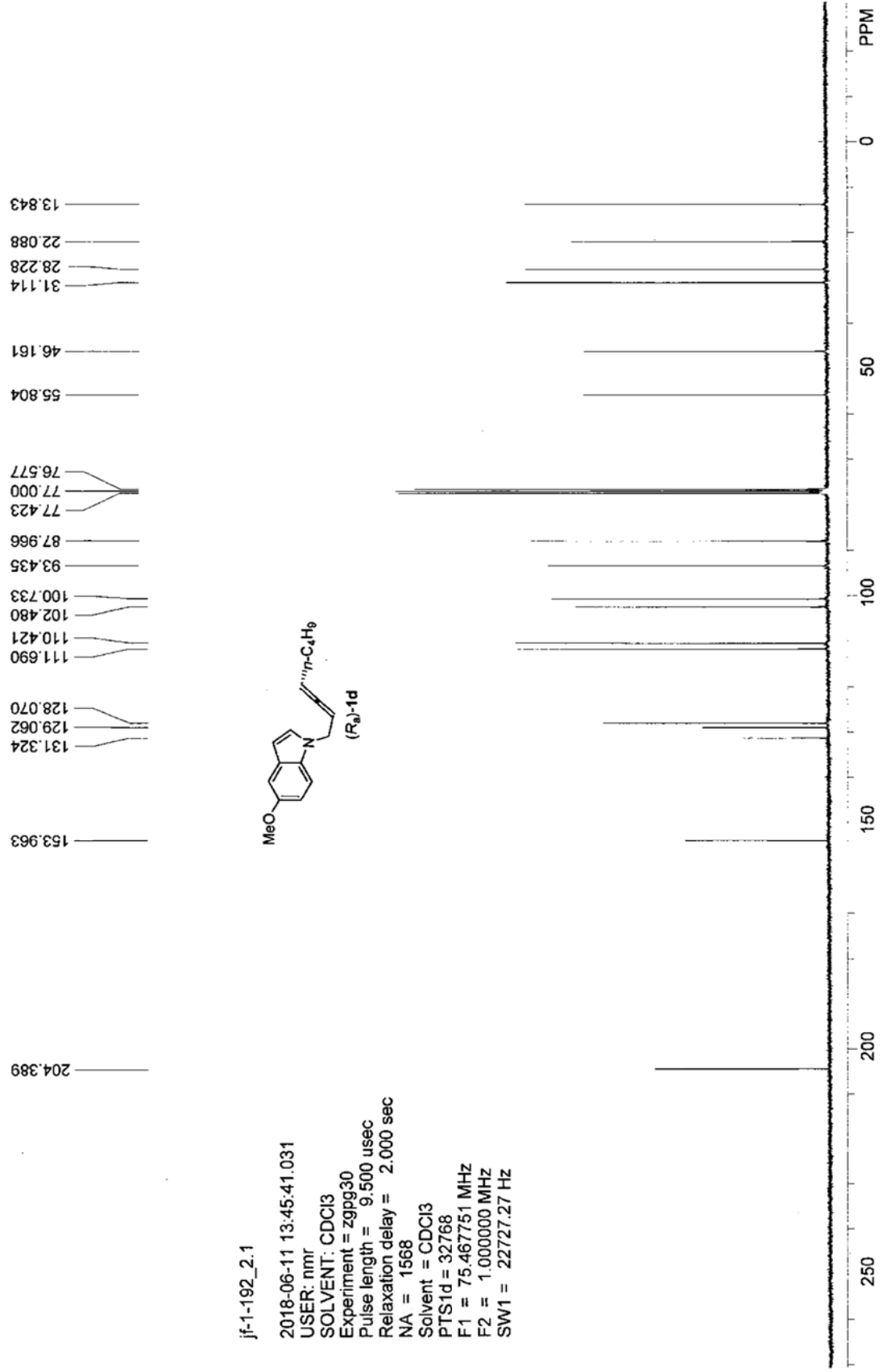
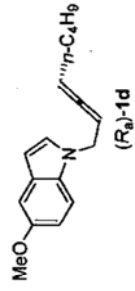
F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-1-192_2.1

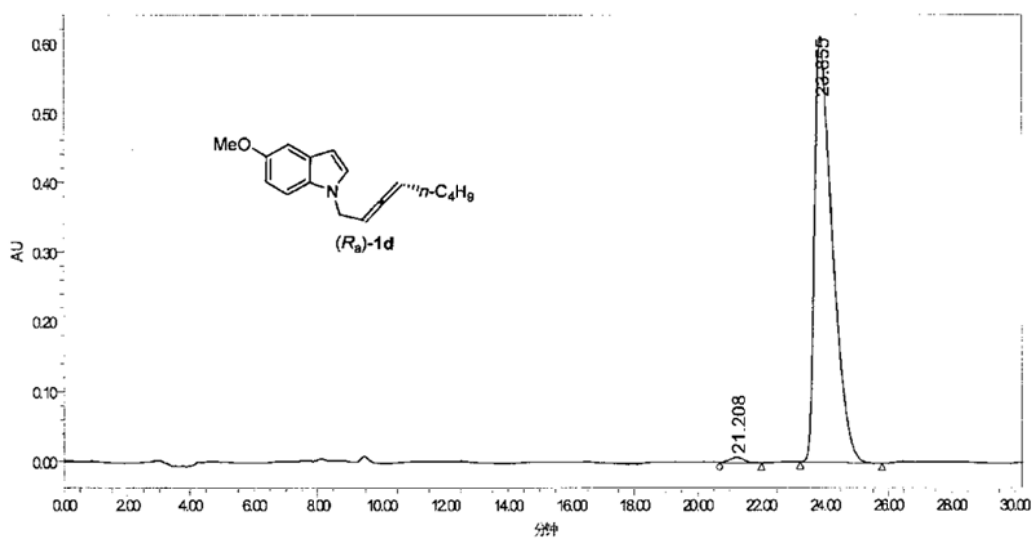
2018-06-11 13:45:41.031
USER: nmr
SOLVENT: CDCl3
Experiment = zgpg30
Pulse length = 9.500 usec
Relaxation delay = 2.000 sec
NA = 1568
Solvent = CDCl3
PTS1d = 32768
F1 = 75.467751 MHz
F2 = 100.0000 MHz
SW1 = 22727.27 Hz



SAMPLE INFORMATION

Sample Name: jf-1-192-qh-95-5-1214
Sample Type: 未知
Vial: 999
Injection #: 27
Injection Volume: 10.00 μ l
Run Time: 35.00 Minutes
Column Type:

Acquired By: Breeze
Date Acquired: 2018/6/22 11:07:05 CST
Acq. Method: zg95
Date Processed: 2018/6/22 14:52:48 CST
Channel Name: W2489 ChA
Channel Desc.: W2489 ChA.214nm
Sample Set Name:



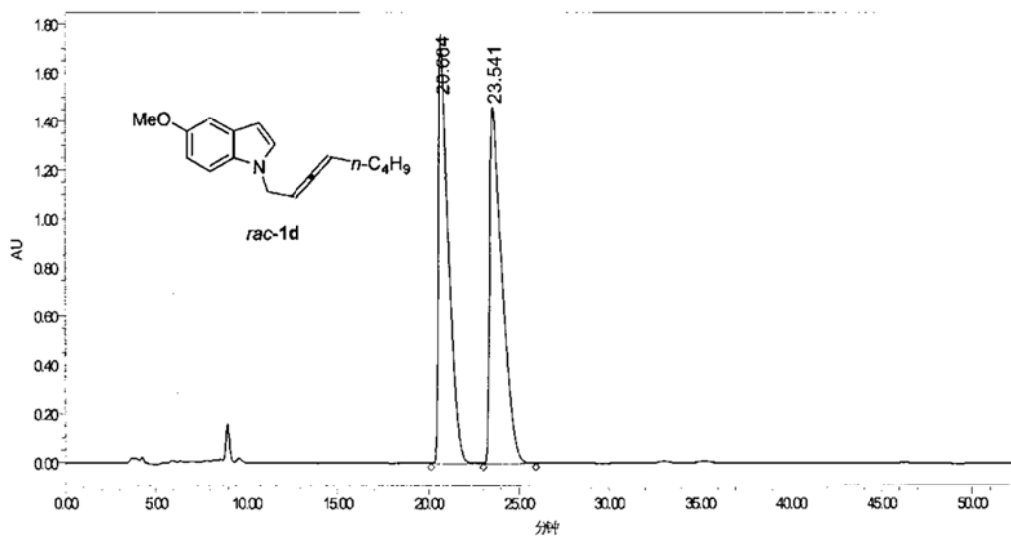
	RT (min)	Area (#sec)	%Area	Hight (%)	% Hight
1	21.208	282123	1.15	8222	1.33
2	23.855	2429422	98.85	61189	98.67

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Project Name: defaults for copy
Reported by User: Breeze user (Breeze)



SAMPLE INFORMATION

Sample Name:	Jf-1-196-qh-95-5-1-214	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2018/6/22 10:11:45 CST
Vial:	999	Acq. Method:	zgj95
Injection #:	26	Date Processed:	2018/6/22 14:52:36 CST
Injection Volume:	10.00 ul	Channel Name:	W2489 ChA
Run Time:	75.00 Minutes	Channel Desc.:	W2489 ChA 214nm
Column Type:		Sample Set Name:	



	RT (min)	Area (峰sec)	%Area	Height (峰)	% Height
1	20.664	70746576	49.98	1761612	54.62
2	23.541	70761906	50.01	1463673	45.38

jf-2-030_1.1

2018-07-12 19:39:36.375

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

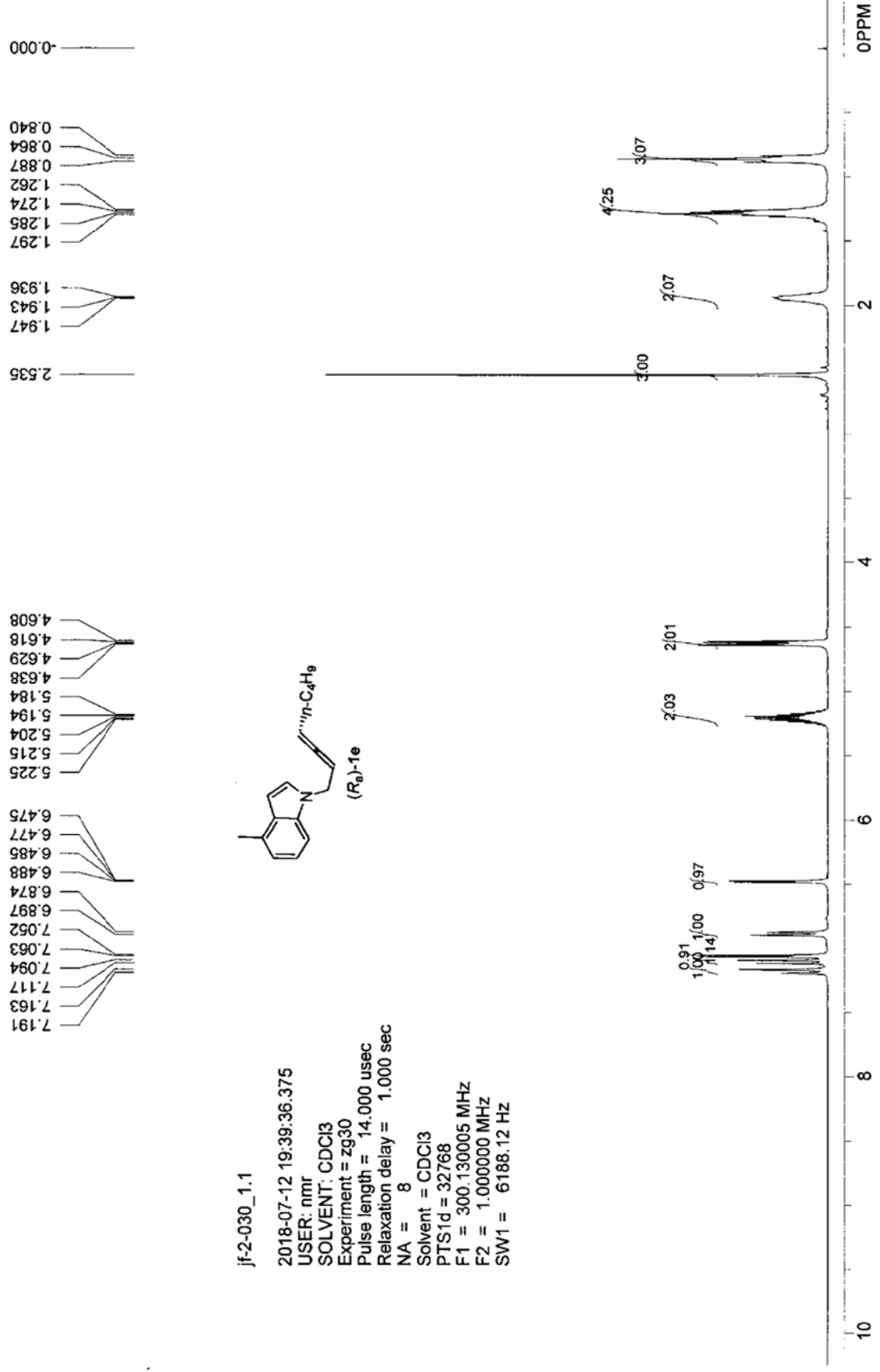
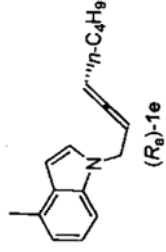
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-2-030-chundu_1.1

2018-09-05 15:05:16.187

USER: nmf

SOLVENT: CDCl₃

Experiment: zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

Solvent = CDCl₃

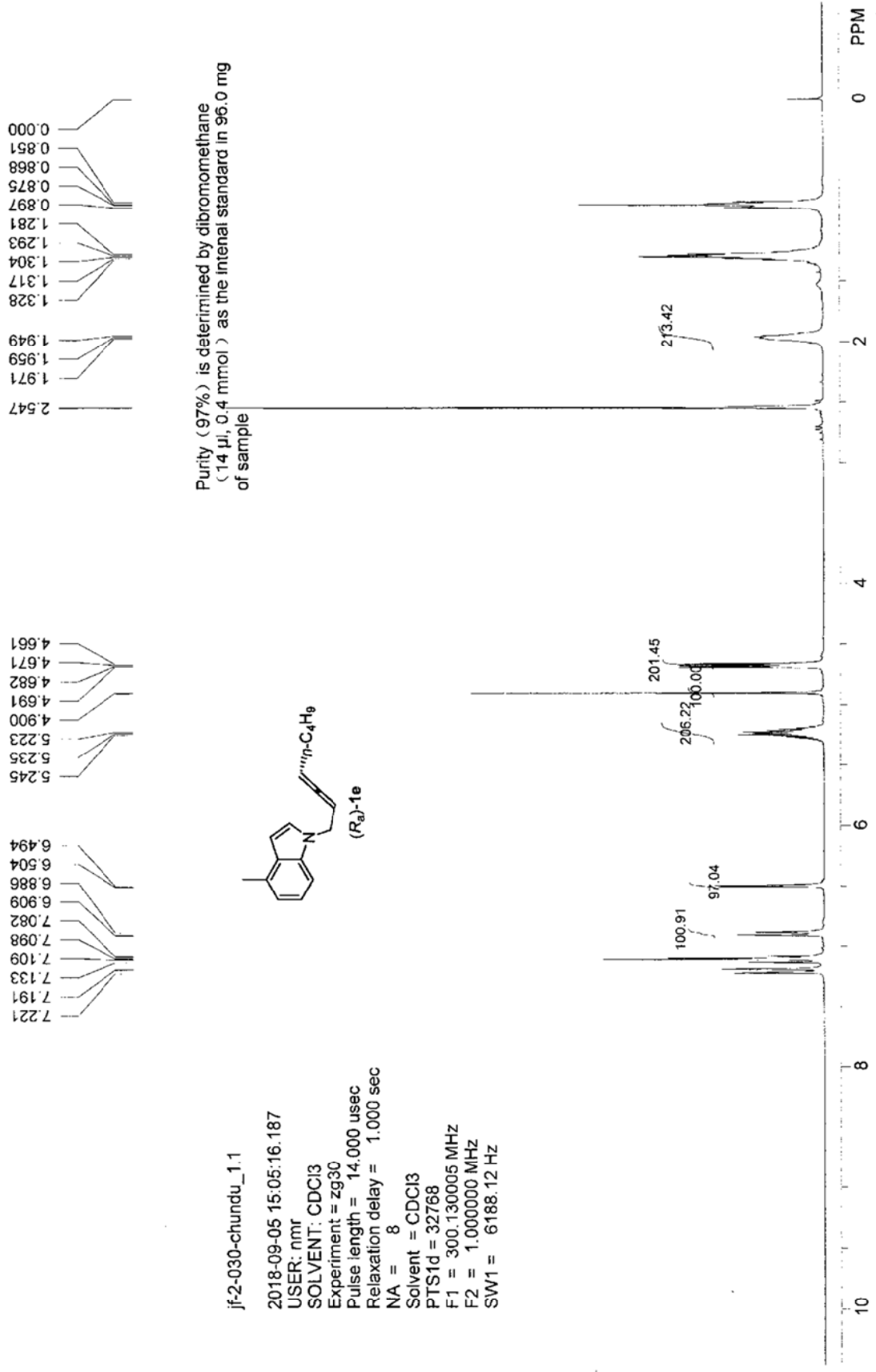
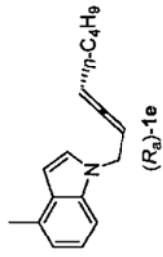
PTS1d = 32768

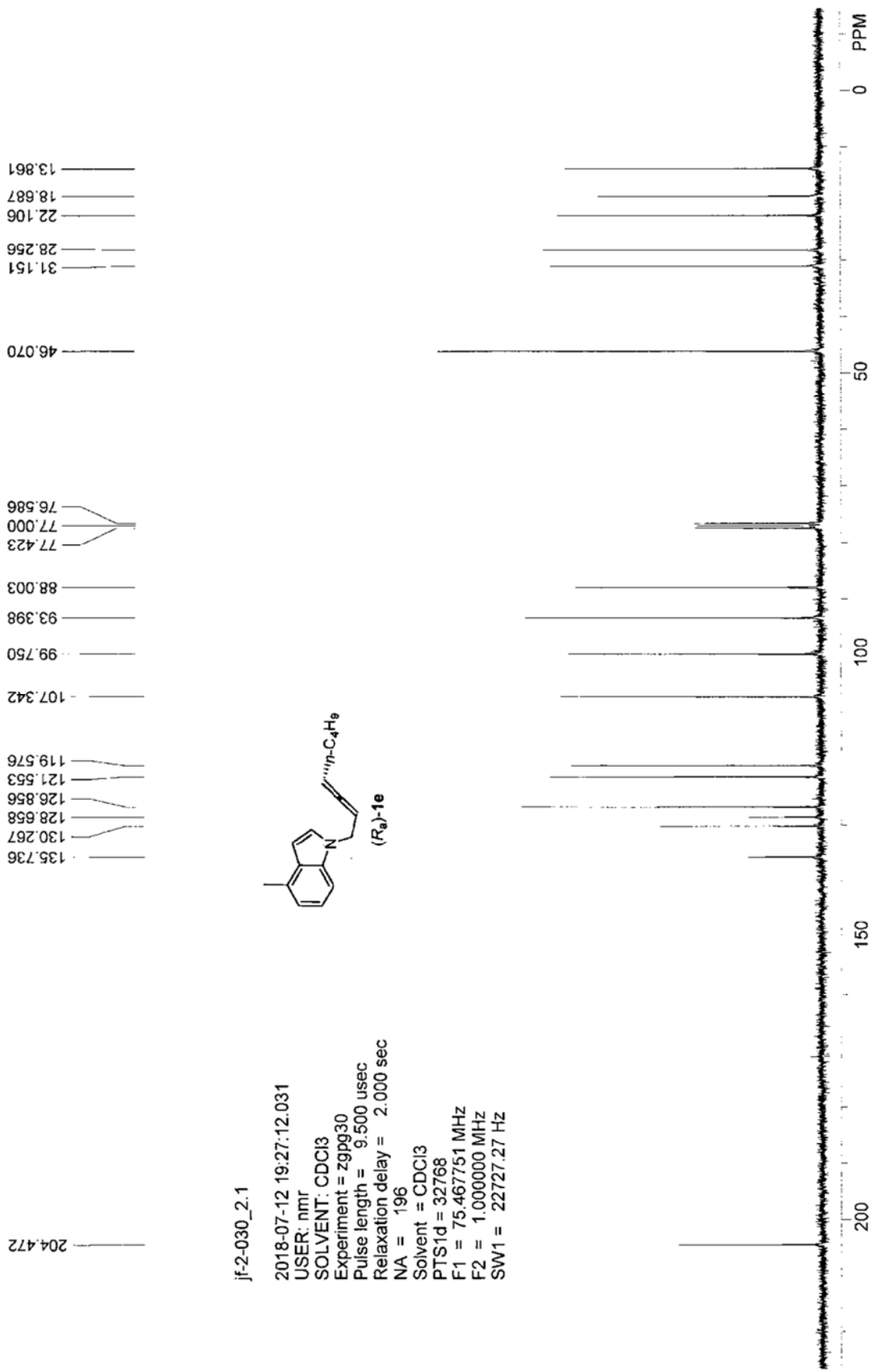
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

Purity (97%) is determined by dibromomethane
(14 μ l, 0.4 mmol) as the internal standard in 96.0 mg
of sample





jf-2-030_2.1

2018-07-12 19:27:12.031

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 196

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

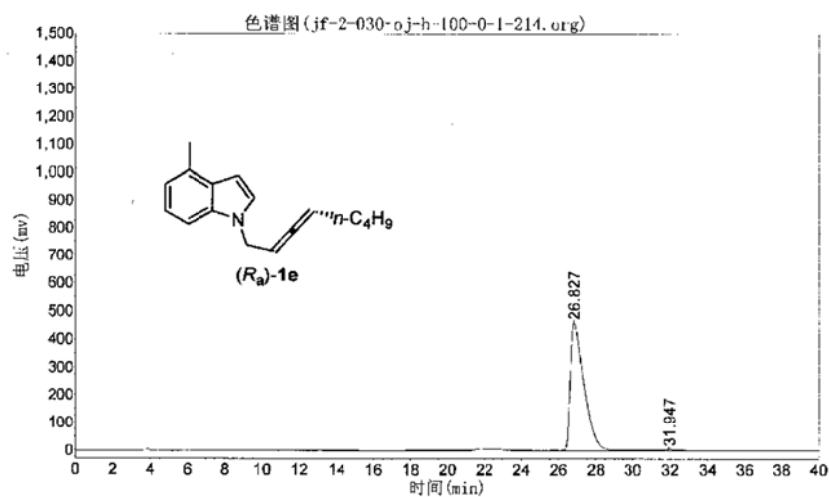
jf-2-030-oj-h-100-0-1-214

实验时间: 2018-09-11, 13:59:20

报告时间: 2018-09-11, 17:27:22

谱图文件: D:\zhuguangjiong\jf\20180911\jf-2-030-oj-h-100-0-1-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		26.827	459280.188	23665290.000	99.0893
2		31.947	4054.544	217489.078	0.9107
总计			463334.732	23882779.078	100.0000

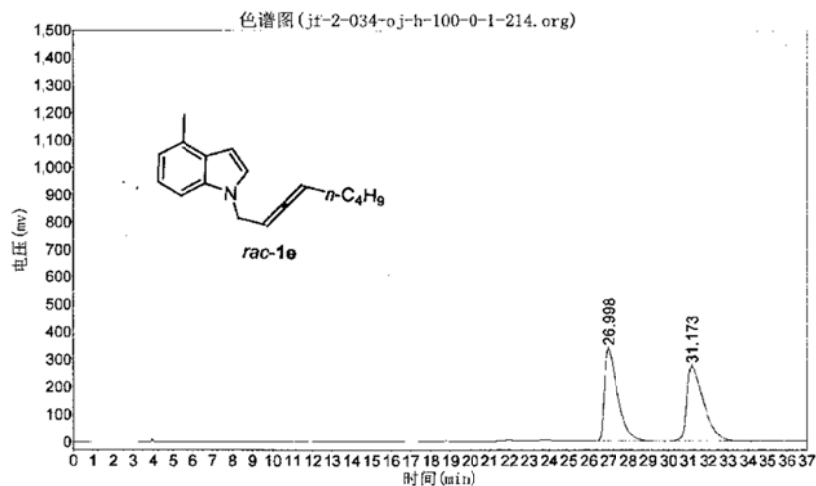
jf-2-034-oj-h-100-0-1-214

实验时间: 2018-09-11, 13:18:32

报告时间: 2018-09-11, 17:28:08

谱图文件: D:\zhuguangjiong\jf\20180911\jf-2-034-oj-h-100-0-1-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		26.998	337095.250	16141427.000	50.0089
2		31.173	272200.156	16135701.000	49.9911
总计			609295.406	32277128.000	100.0000

jf-2-061_1.1

2018-09-23 10:13:37.812

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

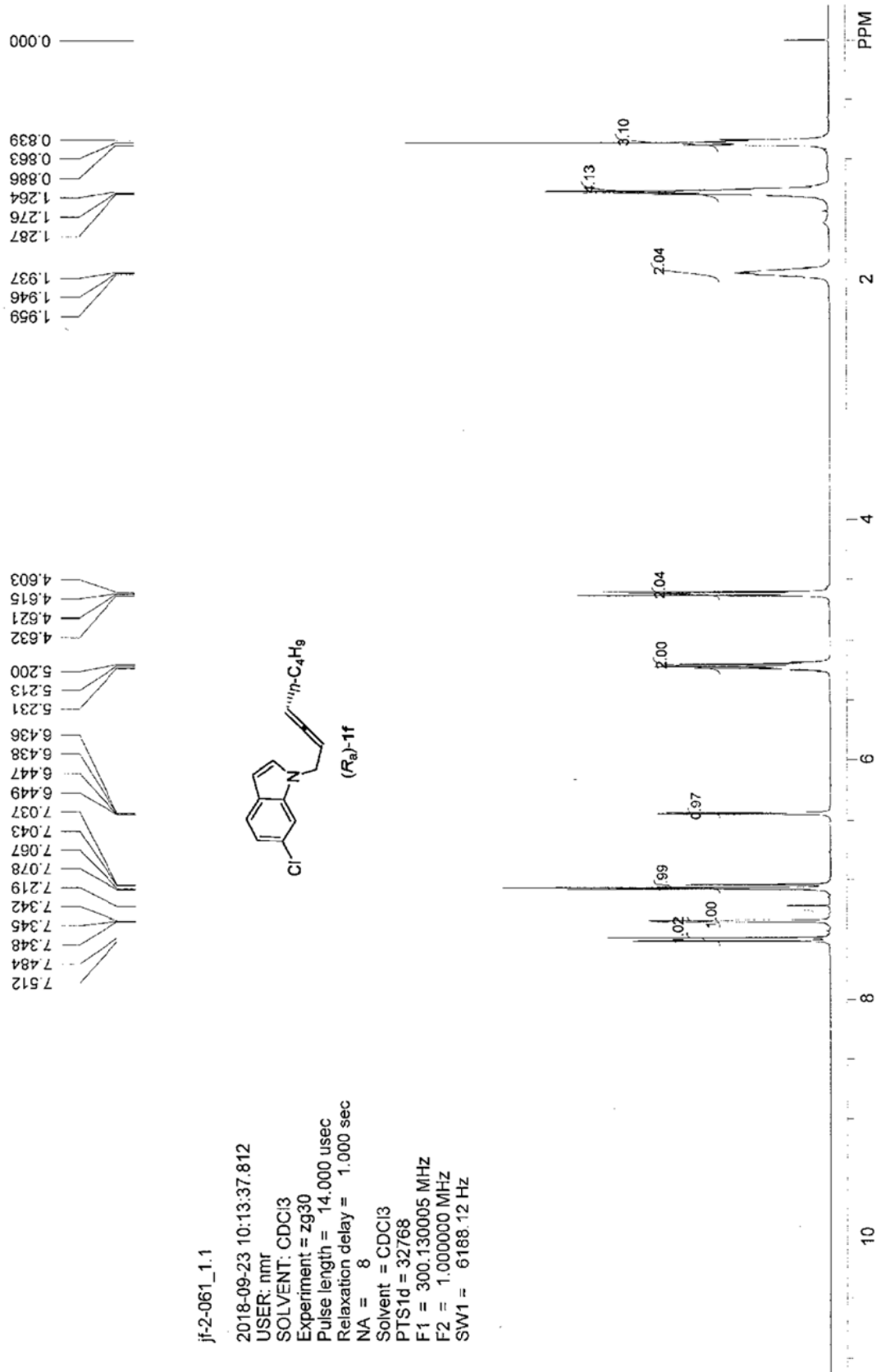
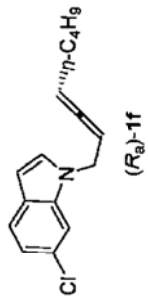
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-2-061_2.1

2018-09-23 09:55:05.234

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 300

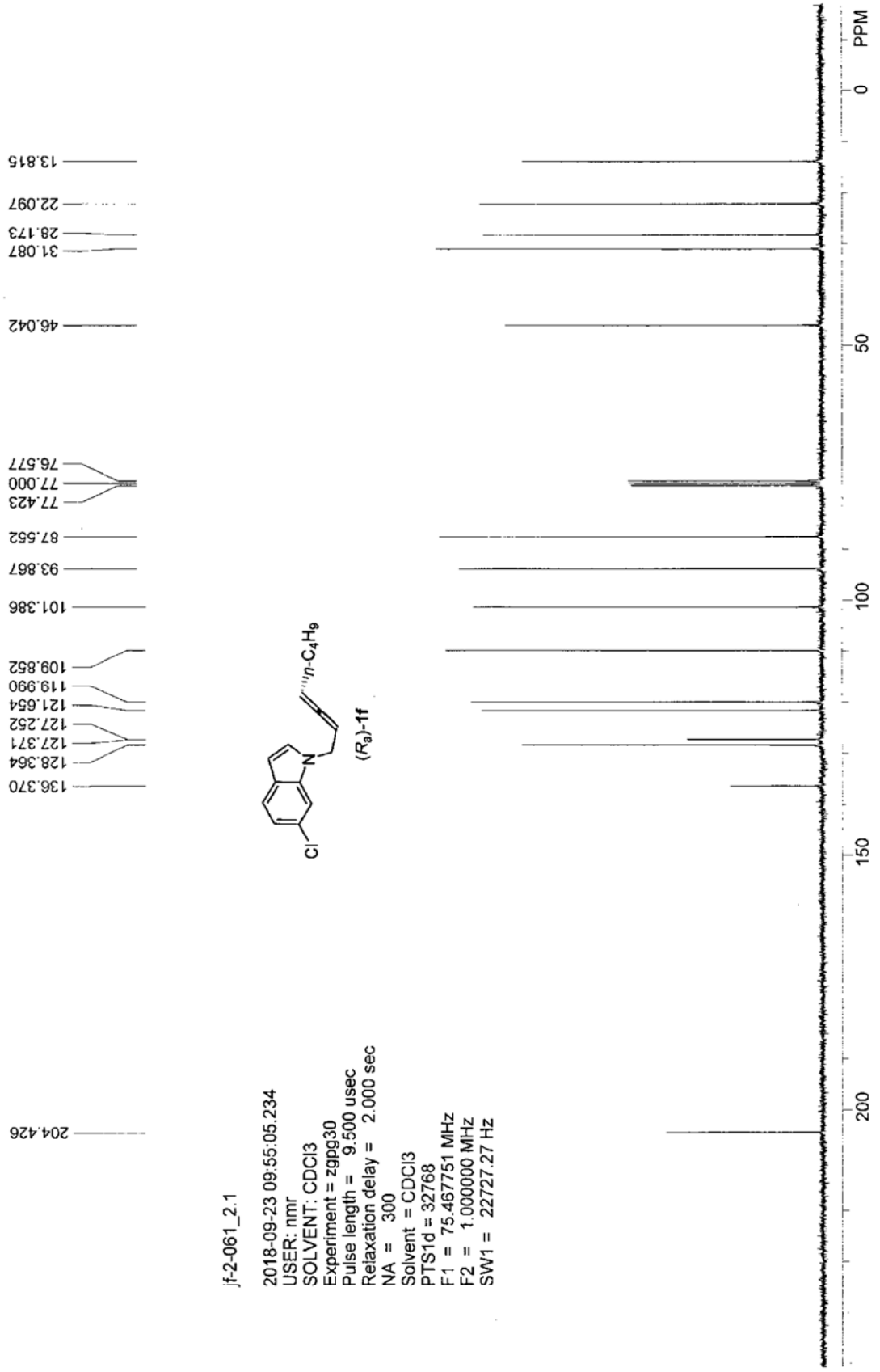
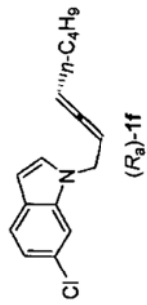
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

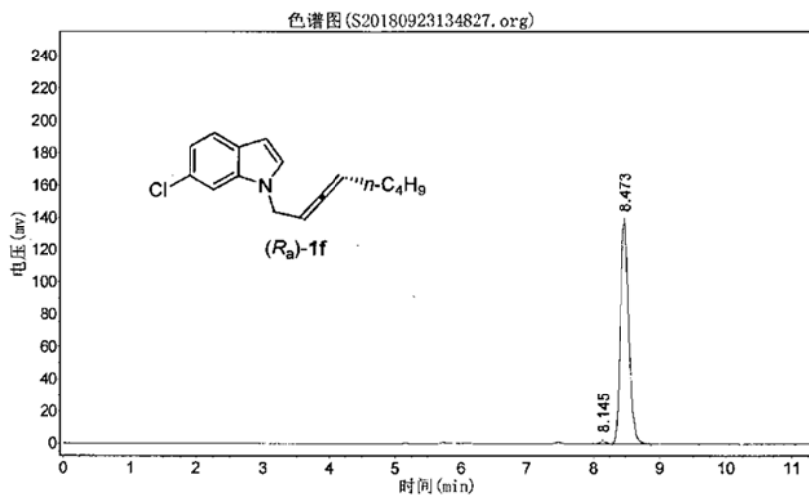


jf-2-061

实验时间: 2018-09-23, 13:48:27
 谱图文件: D:\浙大智达\N2000\样品\S20180923134827.org
 方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
 报告时间: 2018-09-23, 14:01:30
 积分方法: 面积归一法

实验内容简介:
 od-ll, n-hexane/i-PrOH = 20/1, 0.6, 254



分析结果表

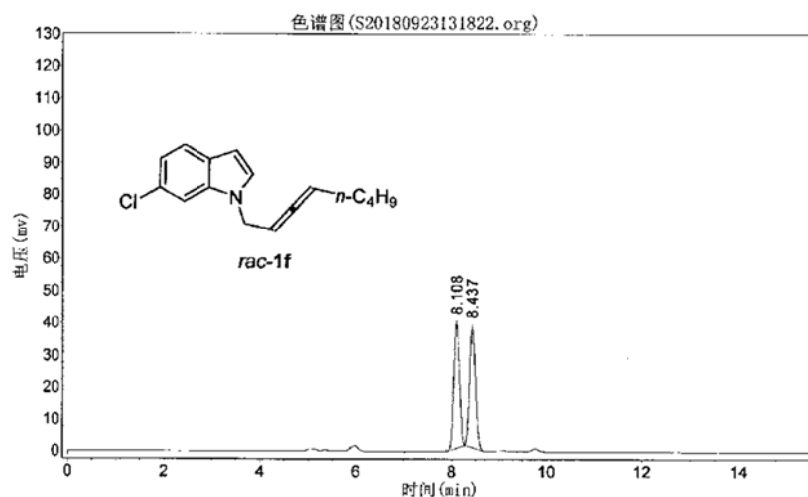
峰号	峰名	保留时间	峰高	峰面积	含量
1		8.145	1300.869	10567.610	0.8316
2		8.473	137773.656	1260234.875	99.1684
总计			139074.525	1270802.485	100.0000

jf-2-060

实验时间: 2018-09-23, 13:18:22
谱图文件: D:\浙大智达\N2000\样品\S20180923131822.org
方法文件: D:\浙大智达\N2000\djx.mtd

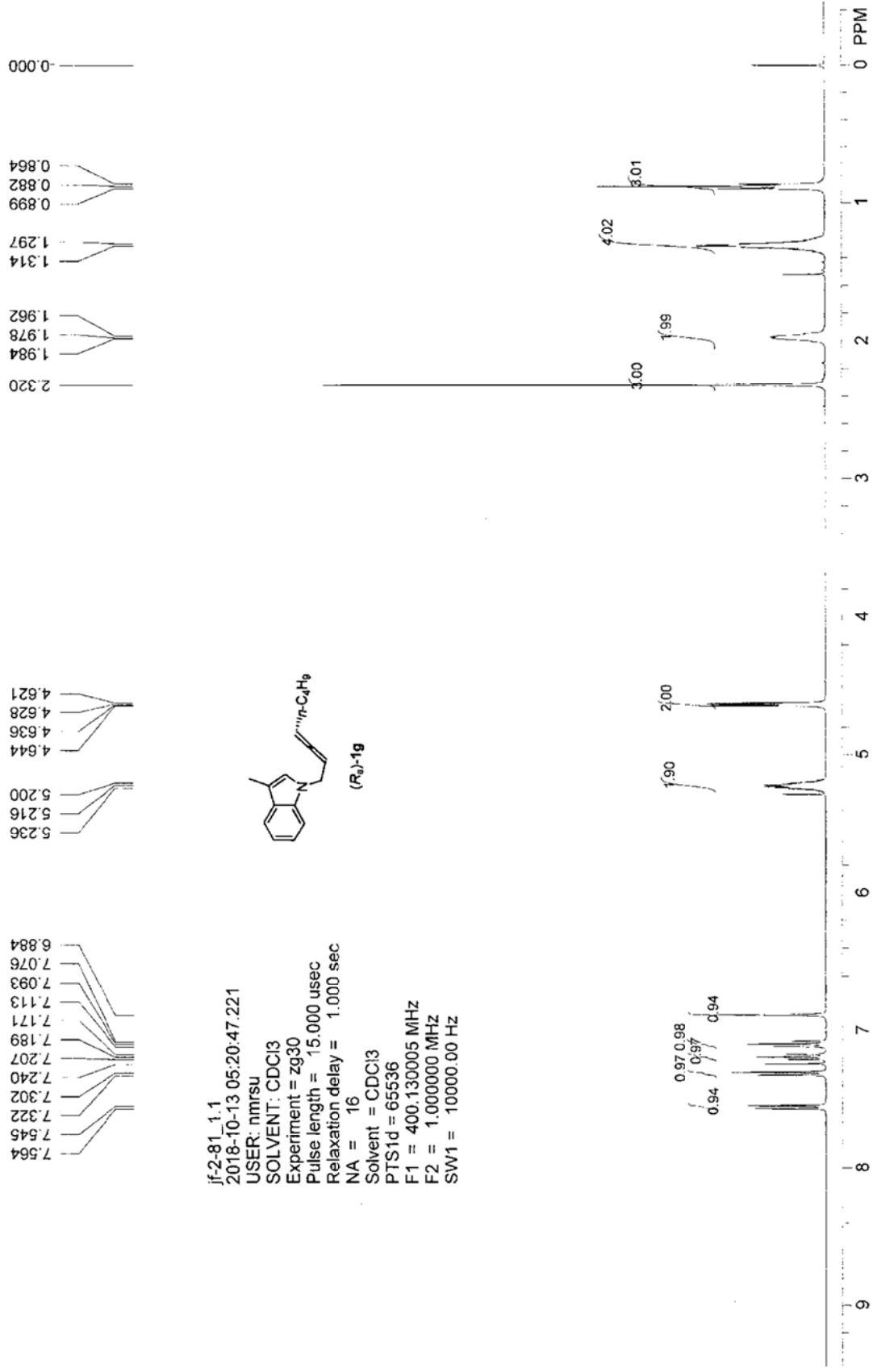
实验者: jf
报告时间: 2018-09-23, 13:52:21
积分方法: 面积归一法

实验内容简介:
od-i, n-hexane/i-PrOH = 20/1, 0.6, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		8.108	38811.453	324656.031	49.7408
2		8.437	37423.965	328039.188	50.2592
总计			76235.418	652695.219	100.0000



jf-2-81_1.1
 2018-10-13 05:20:47.221
 USER: nmrsu
 SOLVENT: CDCl3
 Experiment = zg30
 Pulse length = 15.000 usec
 Relaxation delay = 1.000 sec
 NA = 16
 Solvent = CDCl3
 PTS1d = 65536
 F1 = 400.130005 MHz
 F2 = 1.000000 MHz
 SW1 = 10000.00 Hz

ji-2-081_2.1

2018-10-17 09:43:52.156

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 11560

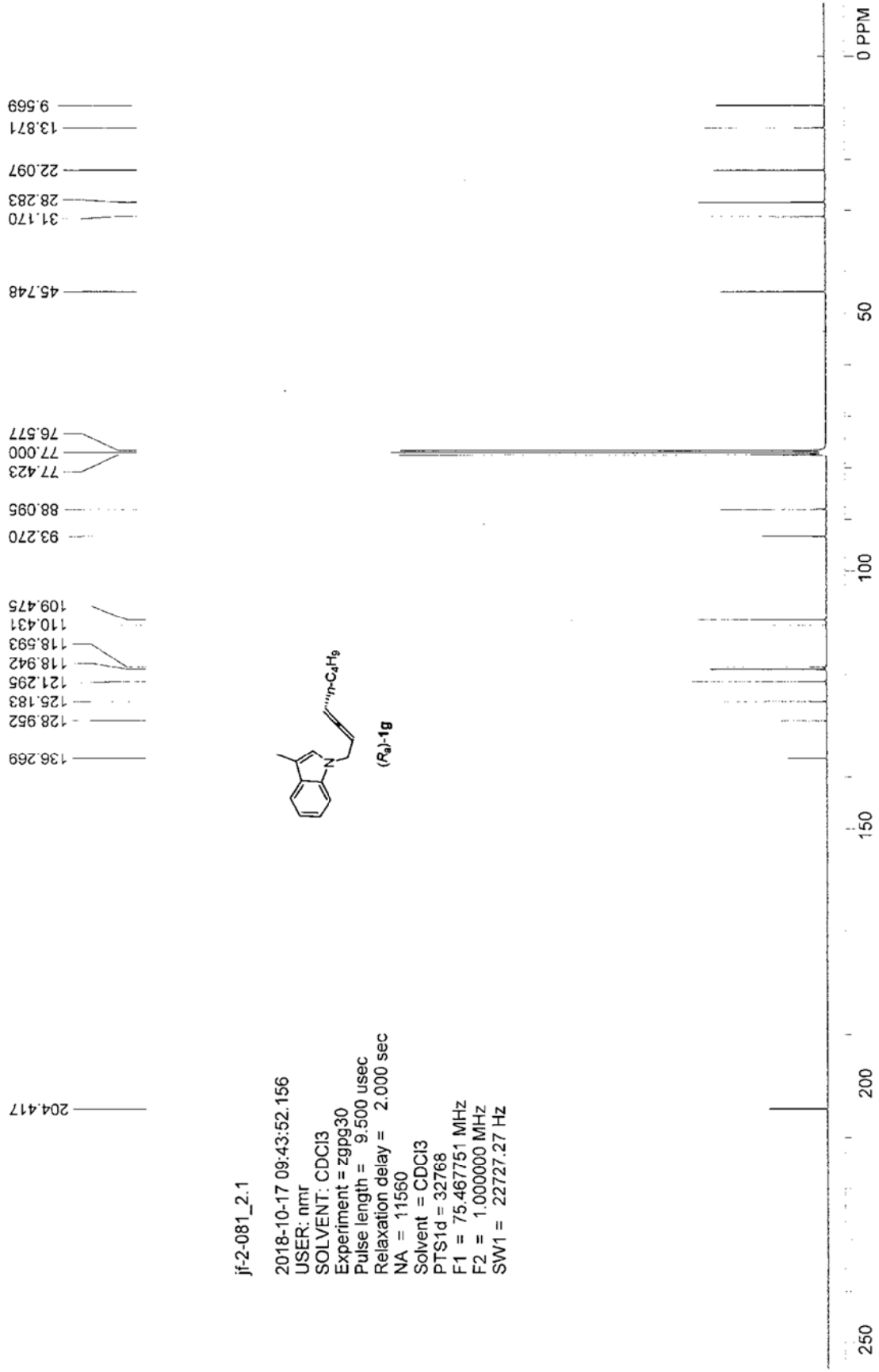
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

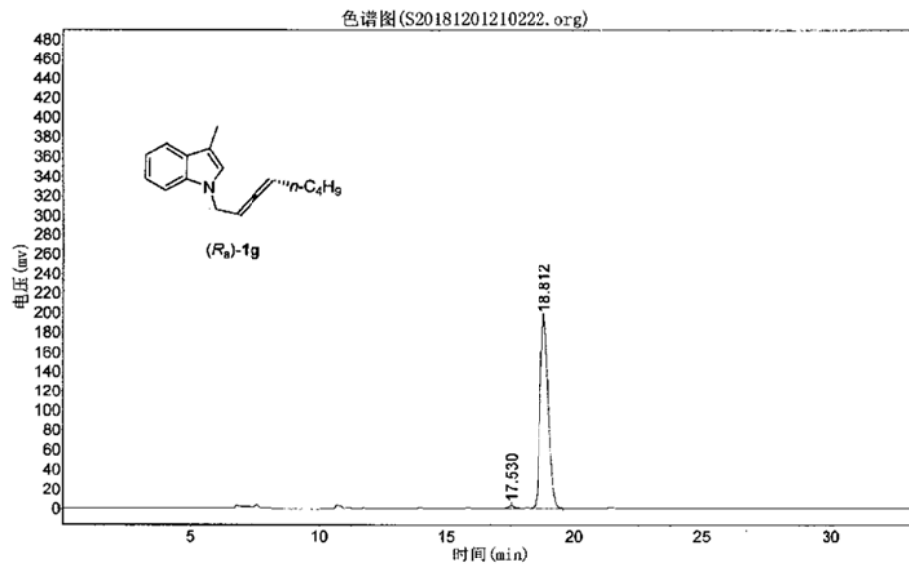


jf-2-081

实验时间: 2018-12-01, 21:02:22
谱图文件: D:\浙大智达\N2000\样品\S20181201210222. org
方法文件: D:\浙大智达\N2000\djx. mtd

实验者: jf
报告时间: 2019-03-26, 13:06:21
积分方法: 面积归一法

实验内容简介:
od-l, n-hexane/i-PrOH = 100/1, 0.5, 214



分析结果表

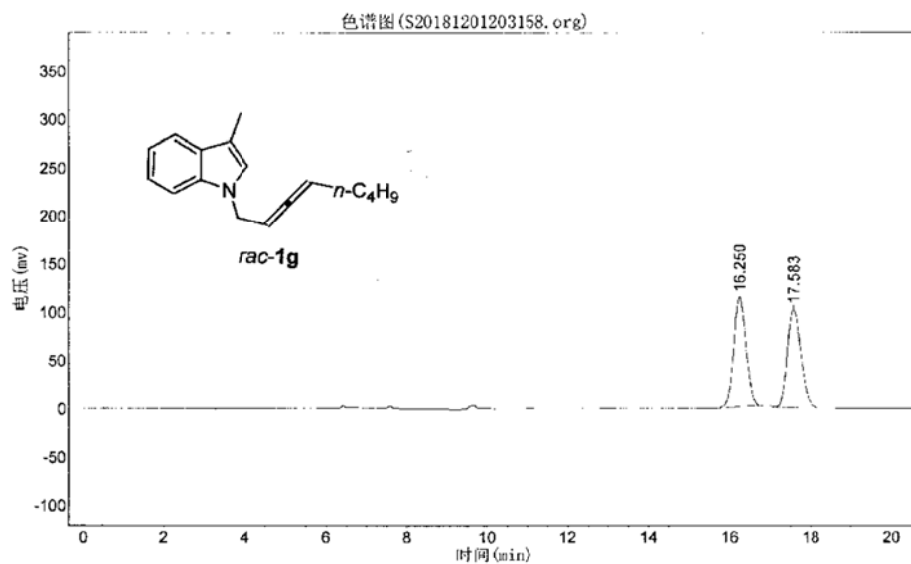
峰号	峰名	保留时间	峰高	峰面积	含量
1		17.530	1894.339	36207.355	0.8110
2		18.812	194880.563	4428530.500	99.1890
总计			196774.901	4464737.855	100.0000

jf-2-080

实验时间: 2018-12-01, 20:31:58
谱图文件: D:\浙大智达\N2000\样品\S20181201203158.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-12-01, 20:57:49
积分方法: 面积归一法

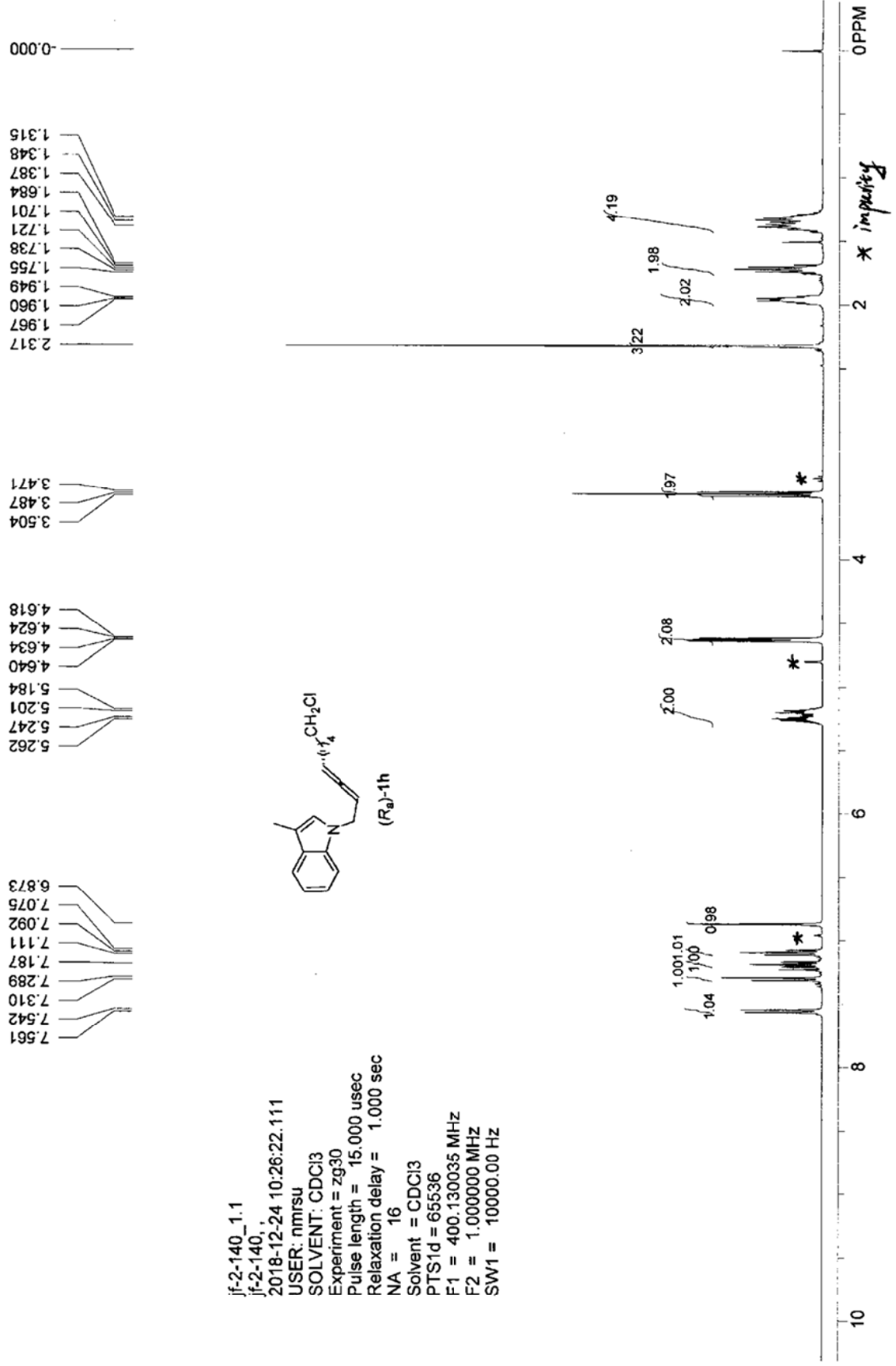
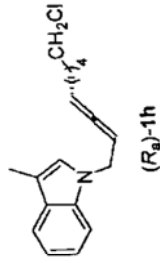
实验内容简介:
OD-H, n-hexane/i-PrOH = 100/1, 0.5, 214

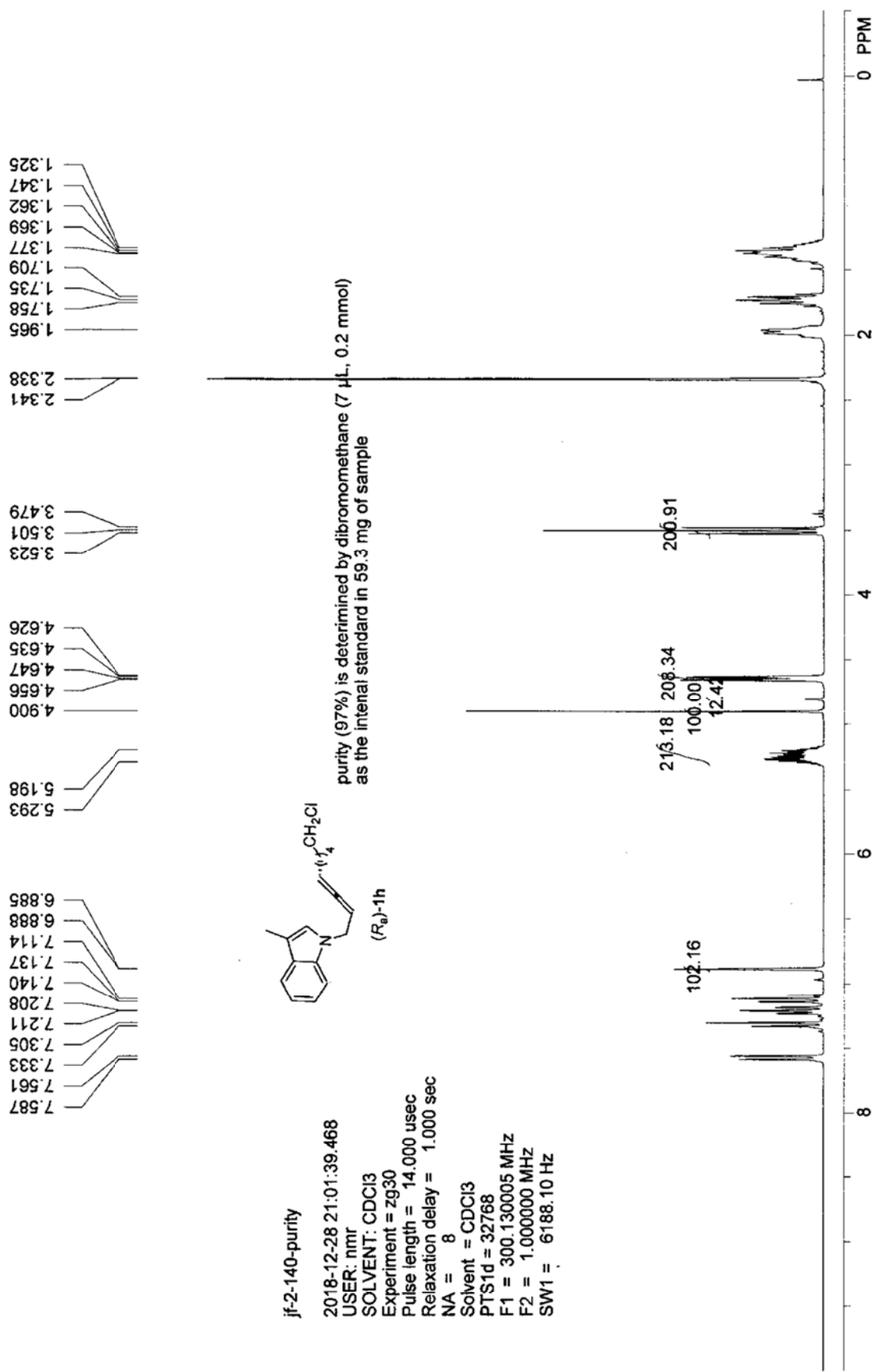


分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		16.250	113337.664	2361383.500	50.0570
2		17.583	102322.461	2356004.250	49.9430
总计			215660.125	4717387.750	100.0000

if-2-140_1.1
 if-2-140_1
 2018-12-24 10:26:22.111
 USER: nmrsu
 SOLVENT: CDCl₃
 Experiment = zg30
 Pulse length = 15,000 usec
 Relaxation delay = 1,000 sec
 NA = 16
 Solvent = CDCl₃
 PTS1d = 65536
 F1 = 400.130035 MHz
 F2 = 1,000000 MHz
 SW1 = 10000.00 Hz





purity (97%) is determined by dibromomethane (7 μ L, 0.2 mmol)
as the internal standard in 59.3 mg of sample

jt-2-140-purity

2018-12-28 21:01:39.468

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

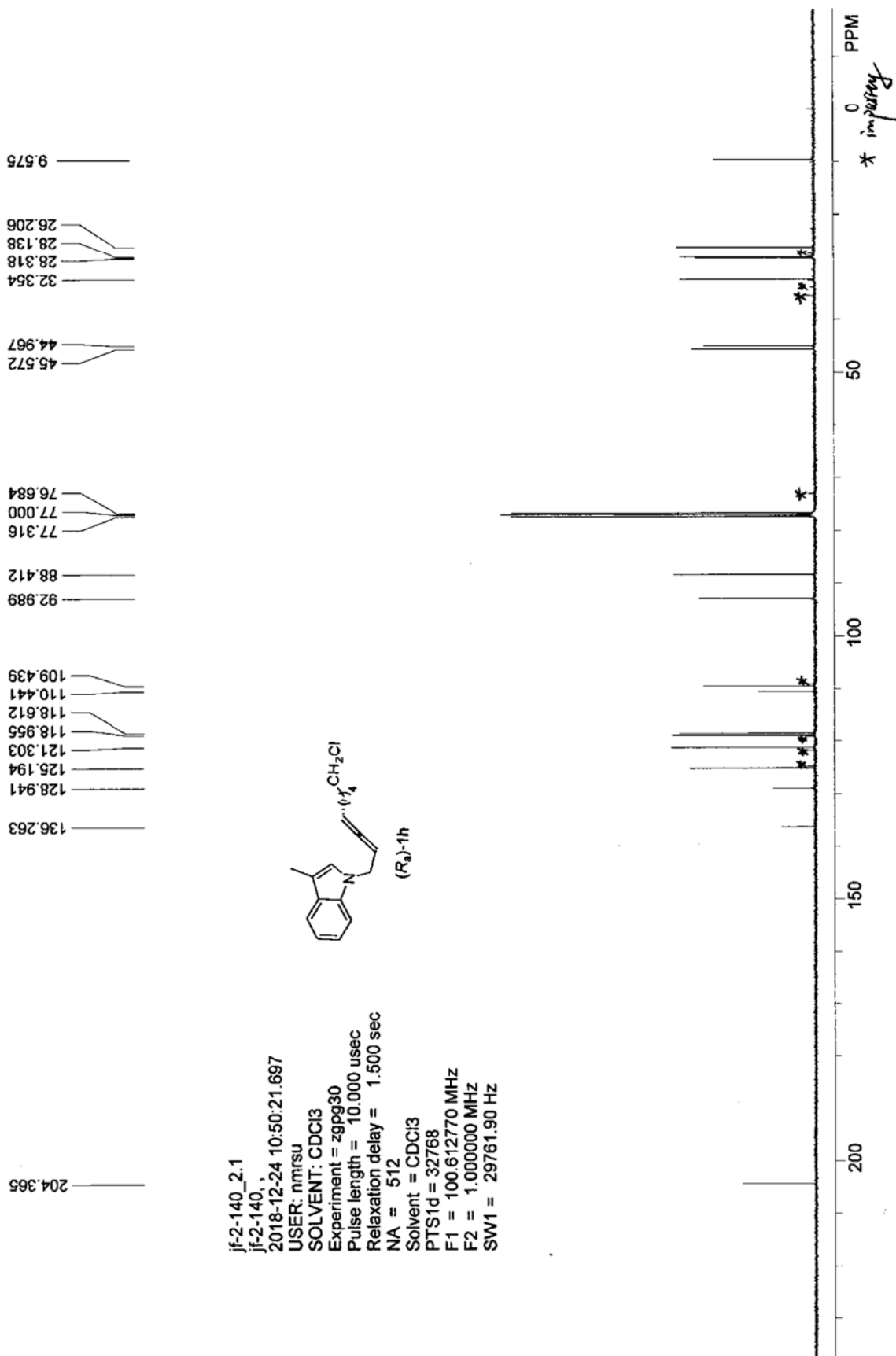
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.10 Hz

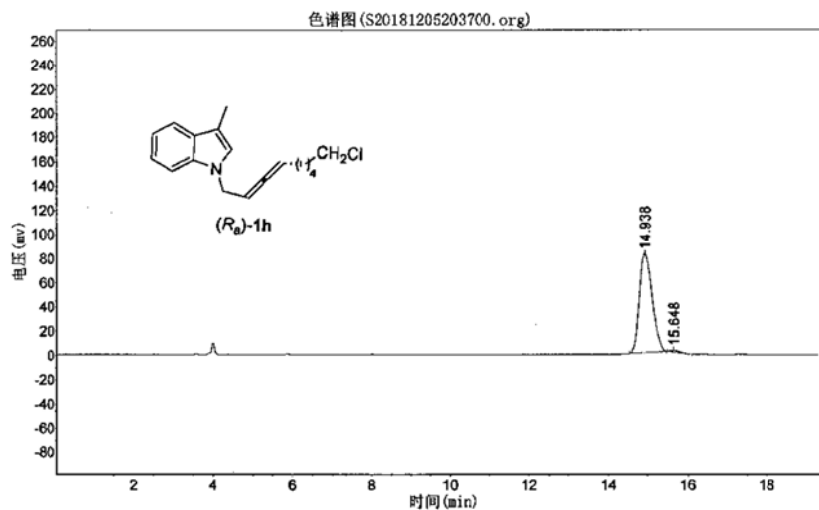


jf-2-140

实验时间: 2018-12-05, 20:37:00
 谱图文件: D:\浙大智达\N2000\样品\S20181205203700.org
 方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
 报告时间: 2018-12-05, 21:59:55
 积分方法: 面积归一法

实验内容简介:
 od-H, n-hexane/i-PrOH = 100/1, 1.0, 254



分析结果表

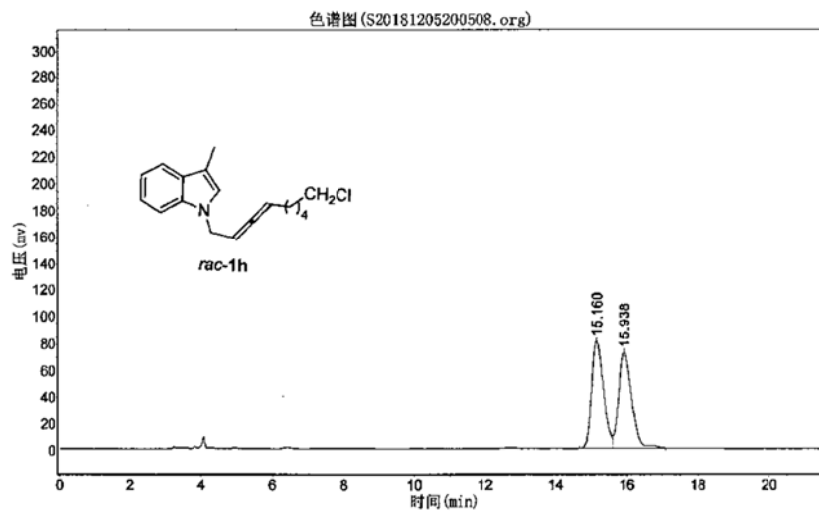
峰号	峰名	保留时间	峰高	峰面积	含量
1		14.938	81651.016	1794848.500	98.9537
2		15.648	1267.406	18978.699	1.0463
总计			82918.422	1813827.199	100.0000

jf-2-149

实验时间: 2018-12-05, 20:05:08
谱图文件: D:\浙大智达\N2000\样品\S20181205200508.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-12-05, 21:53:33
积分方法: 面积归一法

实验内容简介:
od-H, n-hexane/i-PrOH = 100/1, 1.0, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		15.160	80705.750	1870816.875	49.5970
2		15.938	72716.227	1901219.000	50.4030
总计			153421.977	3772035.875	100.0000

jf-3-018_11.1

2019-03-04 10:27:11.750

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

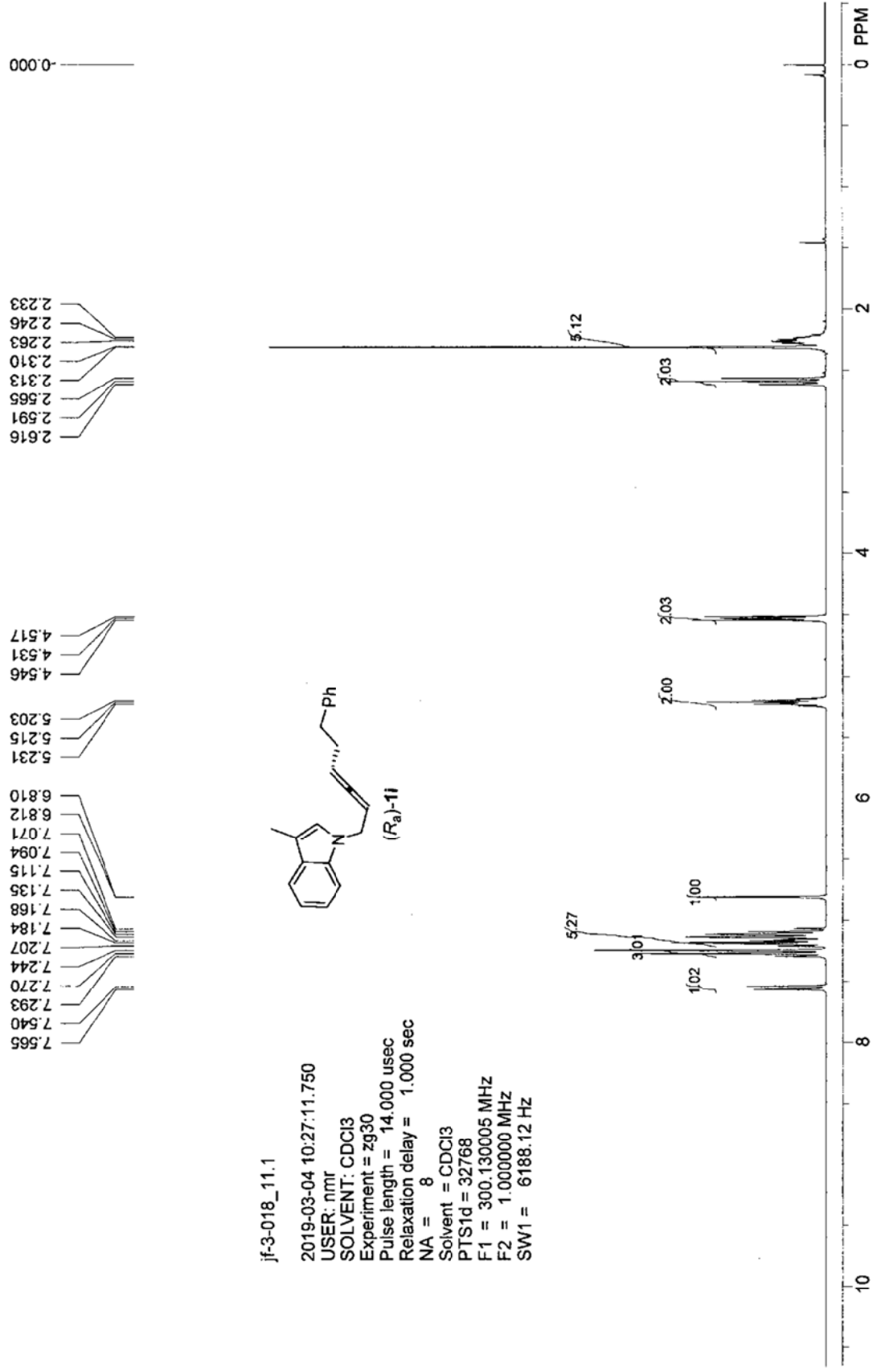
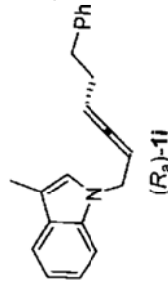
Solvent = CDCl₃

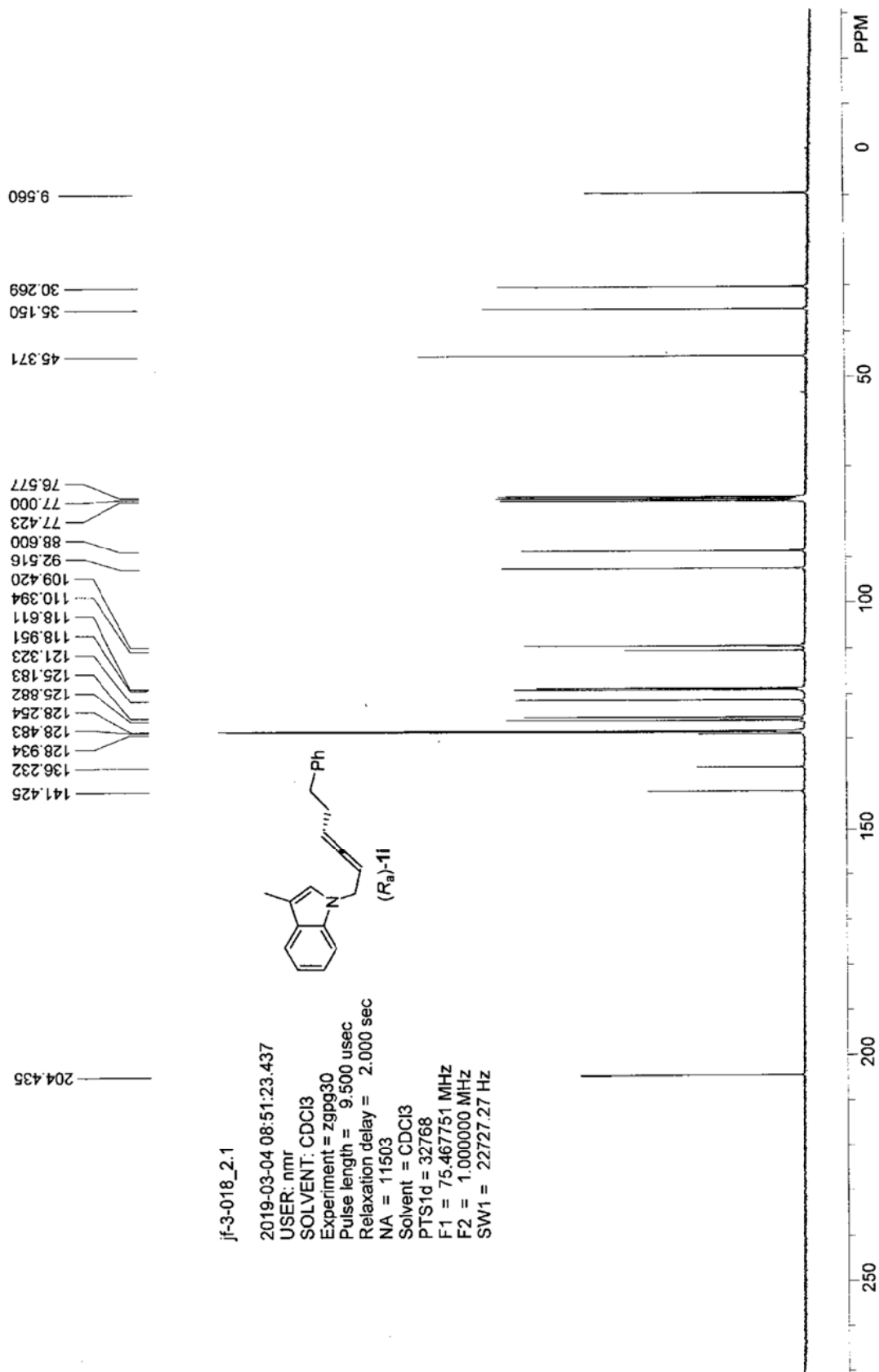
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



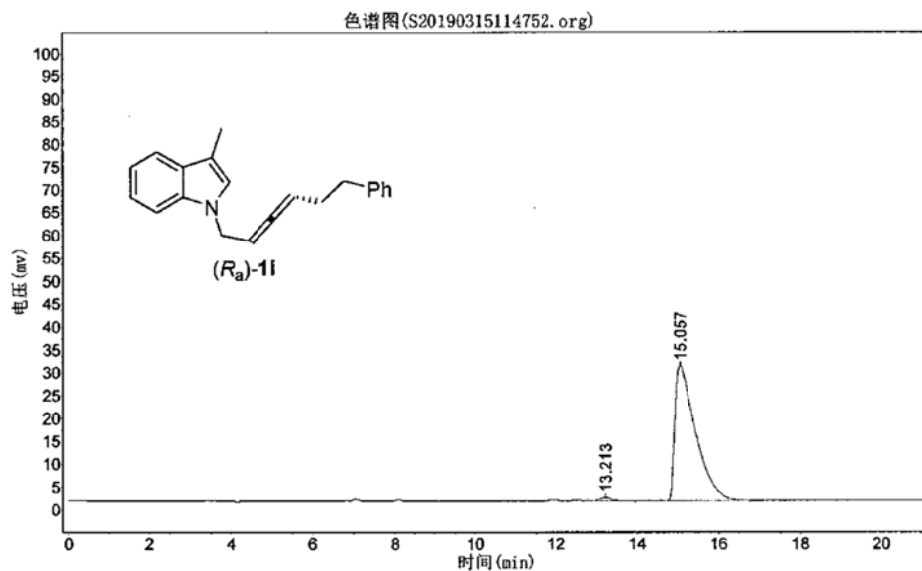


jf-3-018

实验时间: 2019-03-15, 11:47:52
谱图文件: D:\浙大智达\N2000\样品\S20190315114752. org
方法文件: D:\浙大智达\N2000\djx. mtd

实验者: jf
报告时间: 2019-03-15, 13:12:51
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0. 7, 254



分析结果表

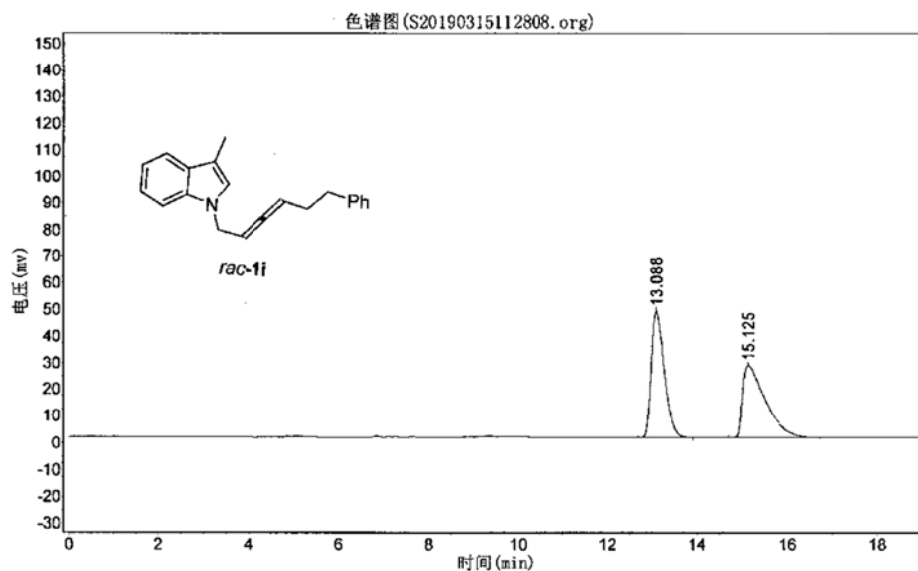
峰号	峰名	保留时间	峰高	峰面积	含量
1		13.213	799.362	15104.655	1.4136
2		15.057	29589.570	1053417.750	98.5864
总计			30388.932	1068522.405	100.0000

jf-3-019

实验时间: 2019-03-15, 11:28:08
谱图文件: D:\浙大智达\N2000\样品\S20190315112808.org
方法文件: D:\浙大智达\N2000\djx.mtd

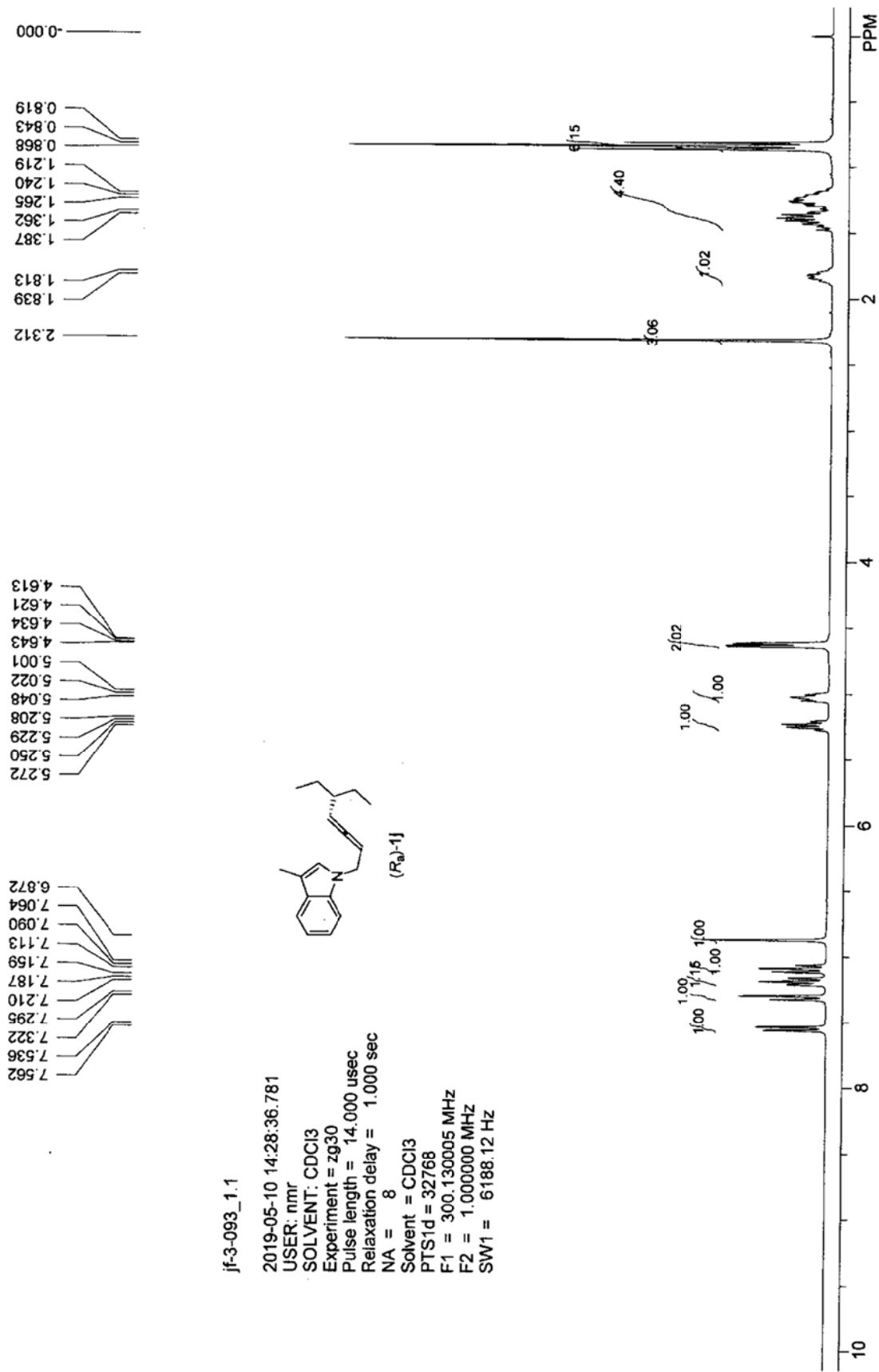
实验者: jf
报告时间: 2019-03-15, 13:08:30
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.7, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		13.088	47537.207	942730.313	50.0716
2		15.125	27094.576	940032.500	49.9284
总计			74631.783	1882762.813	100.0000



jf-3-093_1.1

2019-05-10 14:28:36.781

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

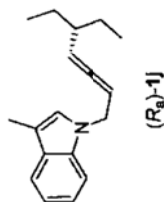
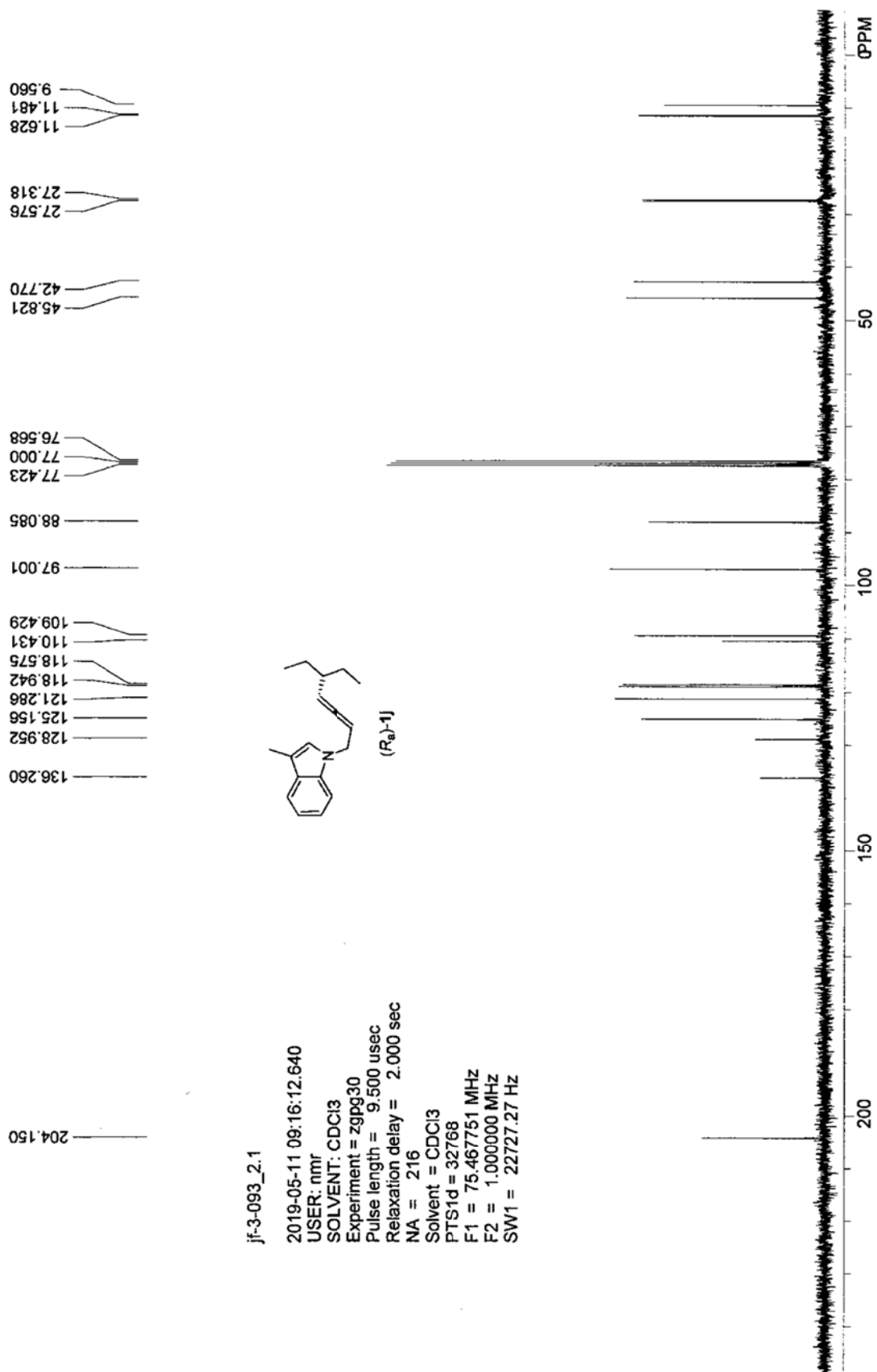
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-3-093_2.1

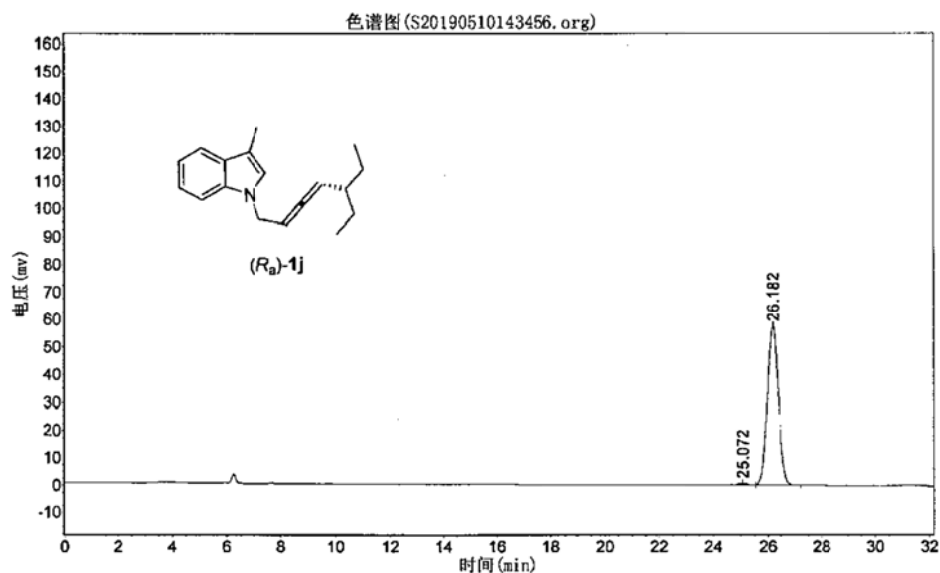
2019-05-11 09:16:12.640
 USER: nmf
 SOLVENT: CDCl3
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 216
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz

jf-3-093

实验时间: 2019-05-10, 14:34:56
谱图文件: D:\浙大智达\N2000\样品\S20190510143456.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-05-10, 15:08:51
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 200/1, 0.5, 214



分析结果表

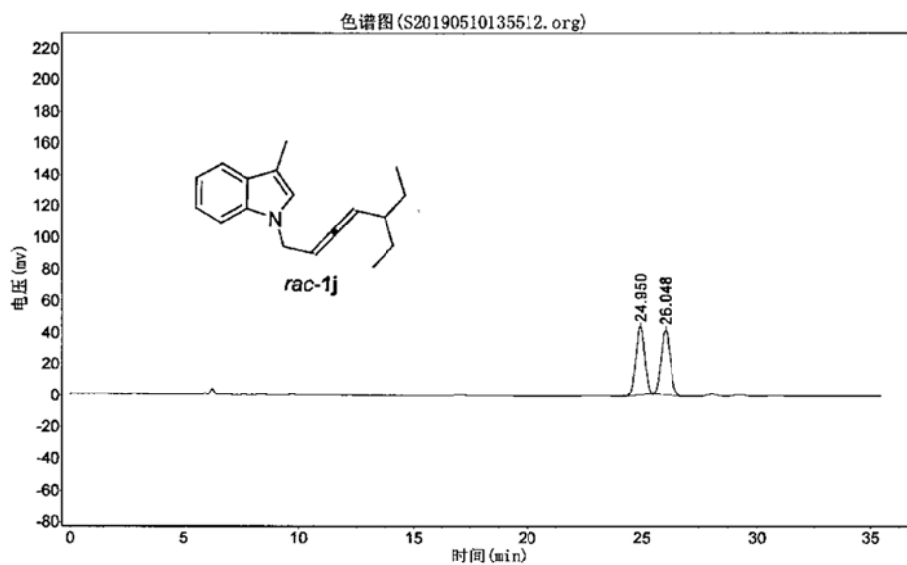
峰号	峰名	保留时间	峰高	峰面积	含量
1		25.072	735.653	18265.891	1.0860
2		26.182	57452.762	1663650.875	98.9140
总计			58188.415	1681916.766	100.0000

jf-3-092

实验时间: 2019-05-10, 13:55:12
谱图文件: D:\浙大智达\N2000\样品\S20190510135512.org
方法文件: D:\浙大智达\N2000\d.jx.mtd

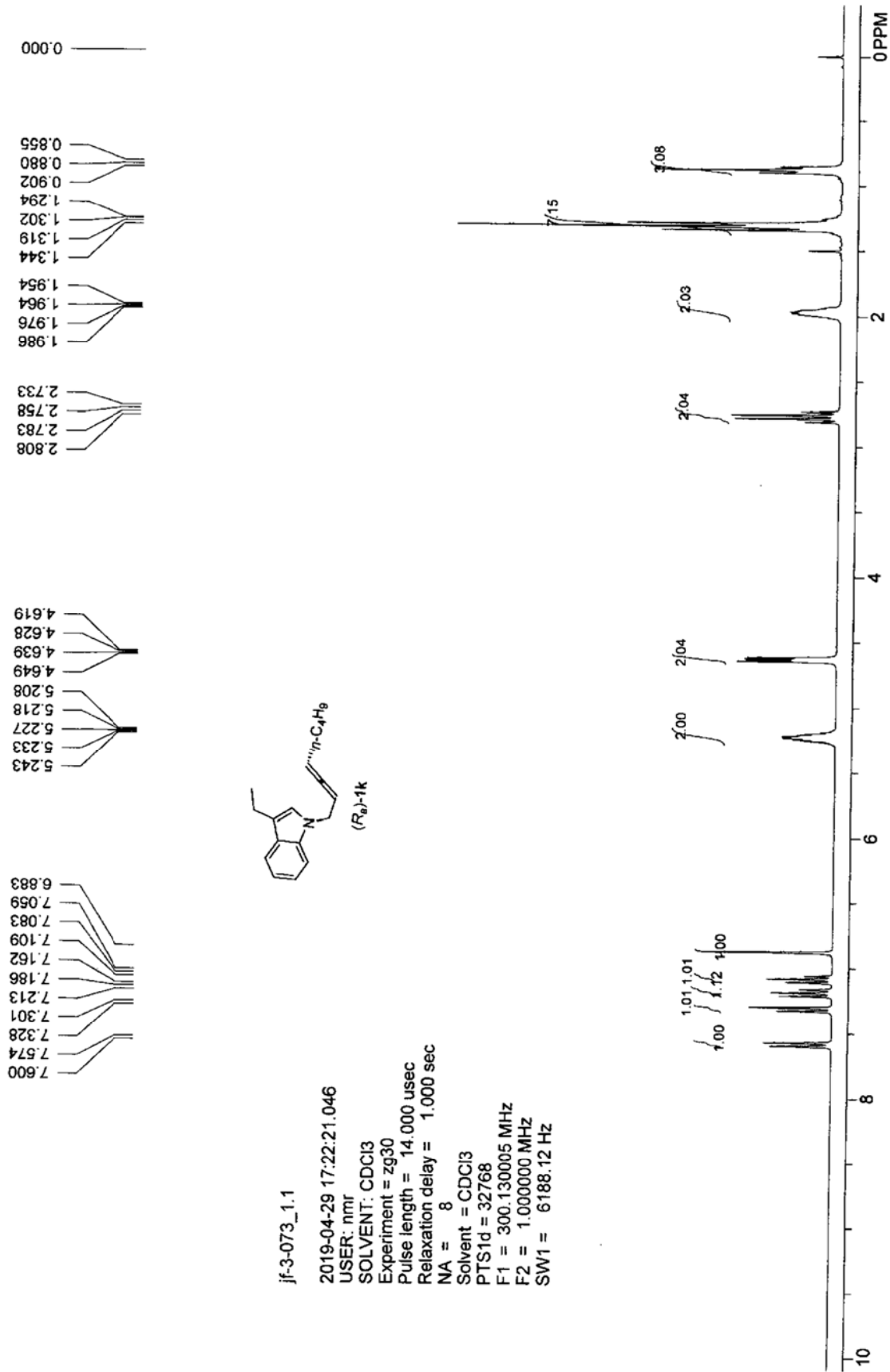
实验者: jf
报告时间: 2019-05-10, 15:06:57
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 200/1, 0.5, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		24.950	43364.660	1165965.375	50.0998
2		26.048	41332.988	1161318.250	49.9002
总计			84697.648	2327283.625	100.0000



jf-3-073_1.1

2019-04-29 17:22:21.046

USER: nmr

SOLVENT: CDCl3

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

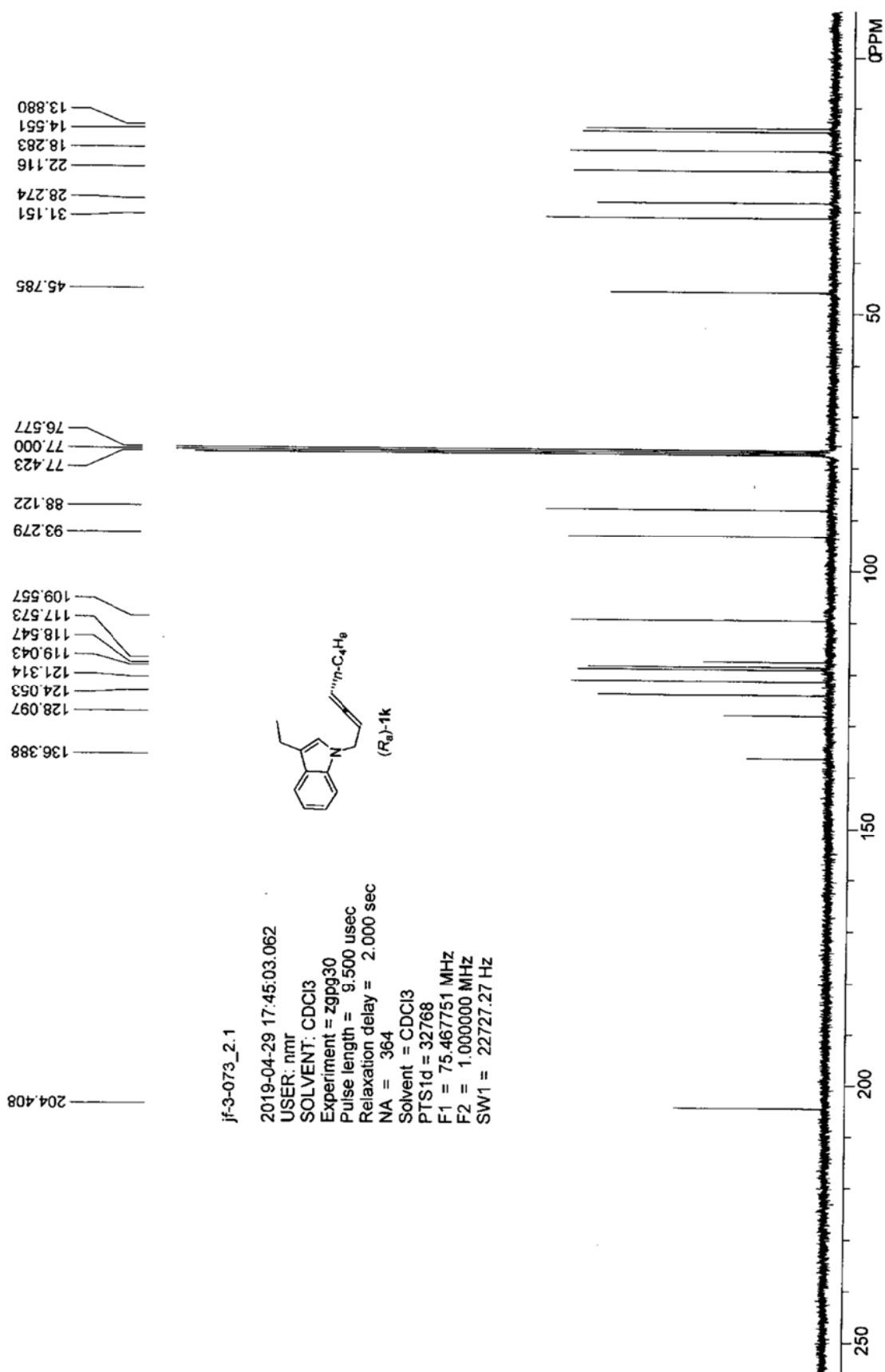
Solvent = CDCl3

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



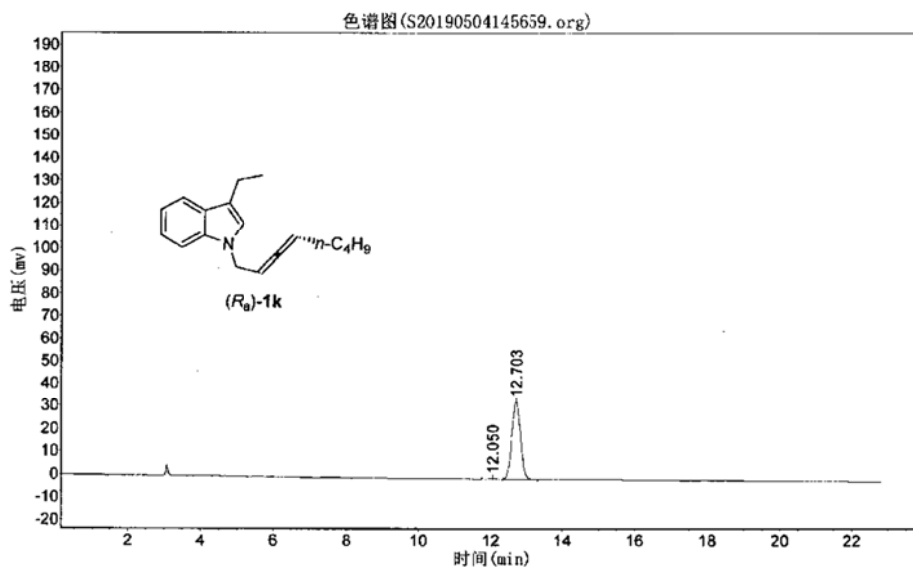
jf-3-073_2.1
 2019-04-29 17:45:03.062
 USER: nmr
 SOLVENT: CDCl₃
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 364
 Solvent = CDCl₃
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz

jf-3-073

实验时间: 2019-05-04, 14:56:59
谱图文件: D:\浙大智达\N2000\样品\S20190504145659.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-05-04, 17:58:38
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 200/1, 1.0, 214



分析结果表

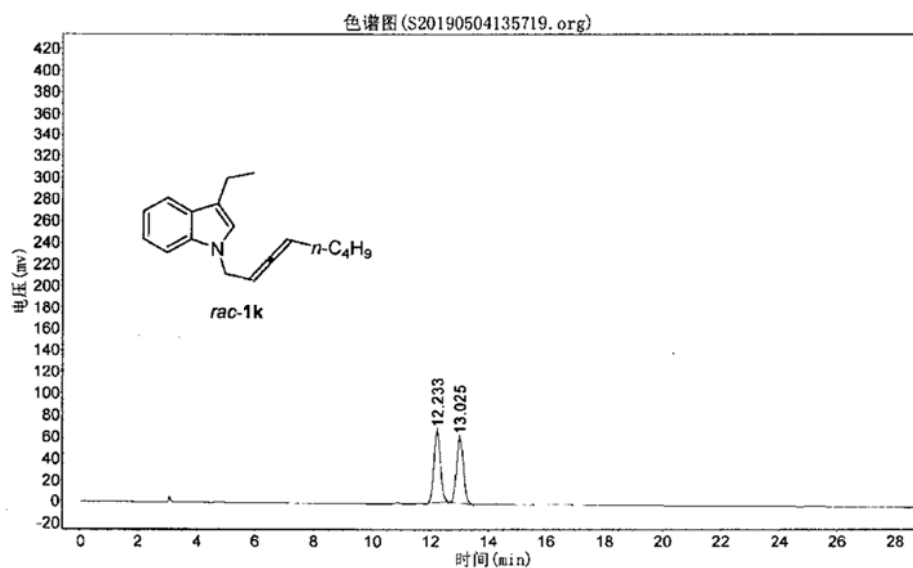
峰号	峰名	保留时间	峰高	峰面积	含量
1		12.050	219.680	2907.099	0.5185
2		12.703	33962.777	557729.563	99.4815
总计			34182.458	560636.661	100.0000

jf-3-074

实验时间: 2019-05-04, 13:57:19
谱图文件: D:\浙大智达\N2000\样品\S20190504135719.org
方法文件: D:\浙大智达\N2000\djx.mtd

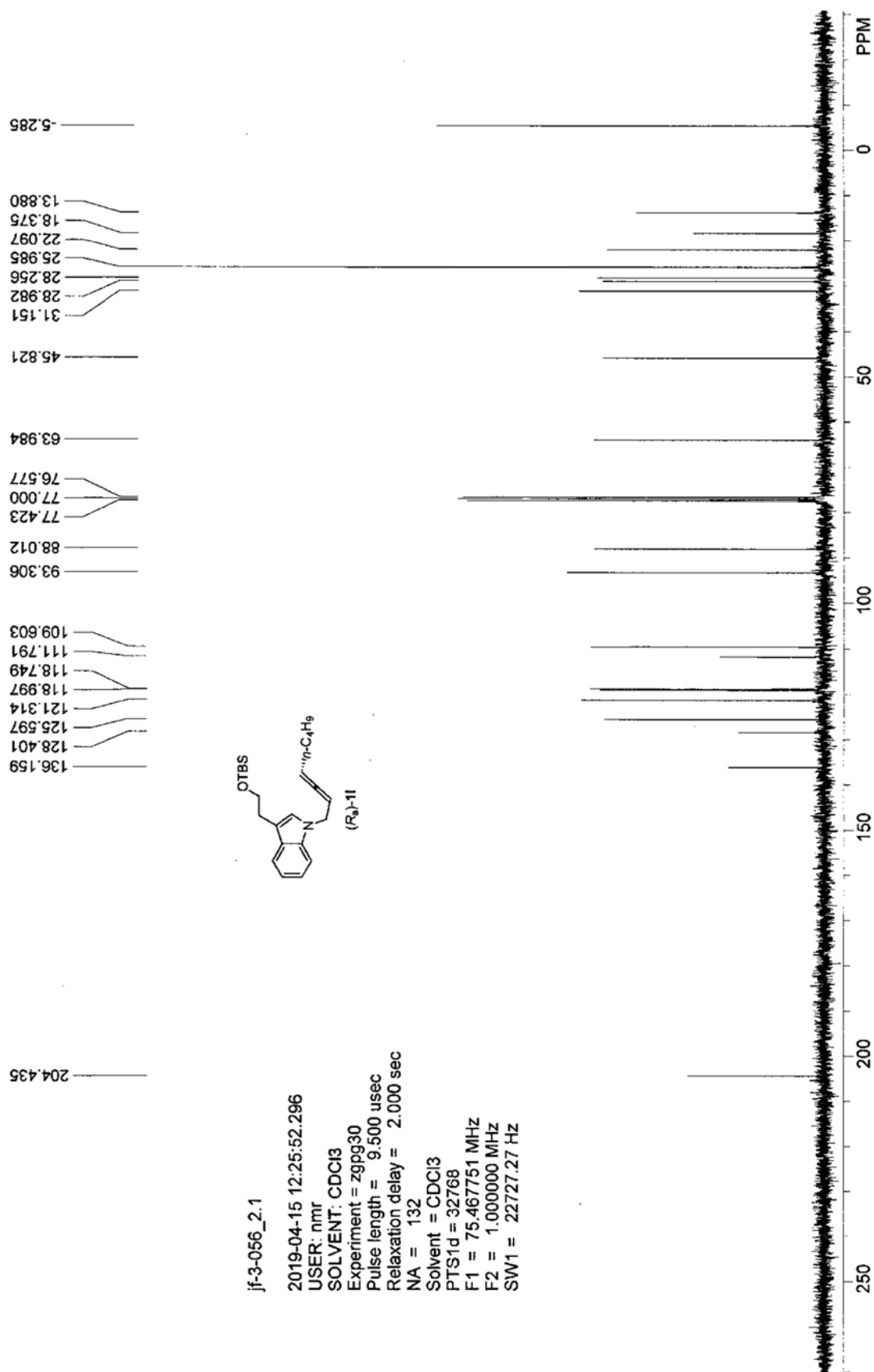
实验者: jf
报告时间: 2019-05-04, 15:00:46
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 200/1, 1.0, 214



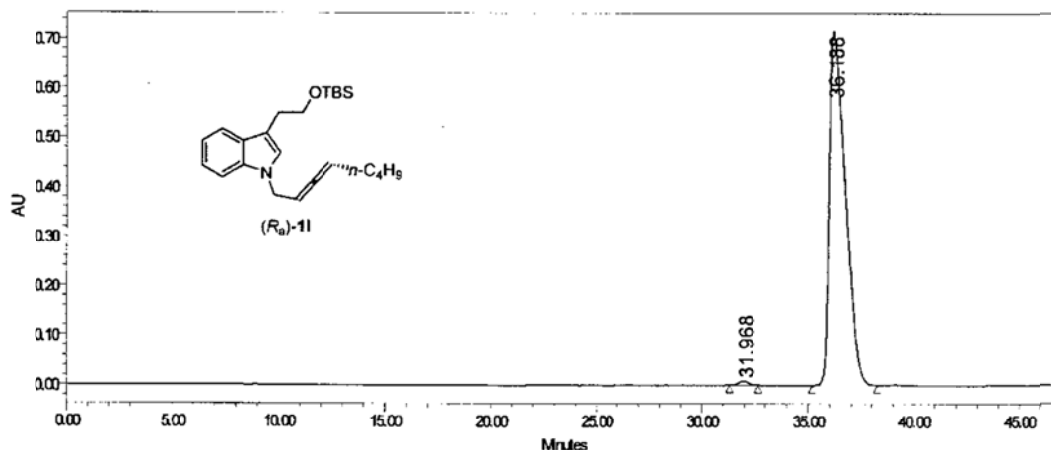
分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		12.233	65802.266	1037234.250	50.6075
2		13.025	60332.977	1012333.000	49.3925
总计			126135.242	2049567.250	100.0000



SAMPLE INFORMATION

Sample Name:	JF-3-056-B-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	ZGJ100
Injection#:	9	Processing Method:	111
Injection Volume:	10.00 µl	Channel Name:	V02489 ChA
Run Time:	50.0 Minutes	Proc. Chnl. Descr.:	V02489 ChA.214nm
Date Acquired:	4/28/2019 6:37:46 PM EDT		
Date Processed:	4/29/2019 9:18:04 PM EDT		



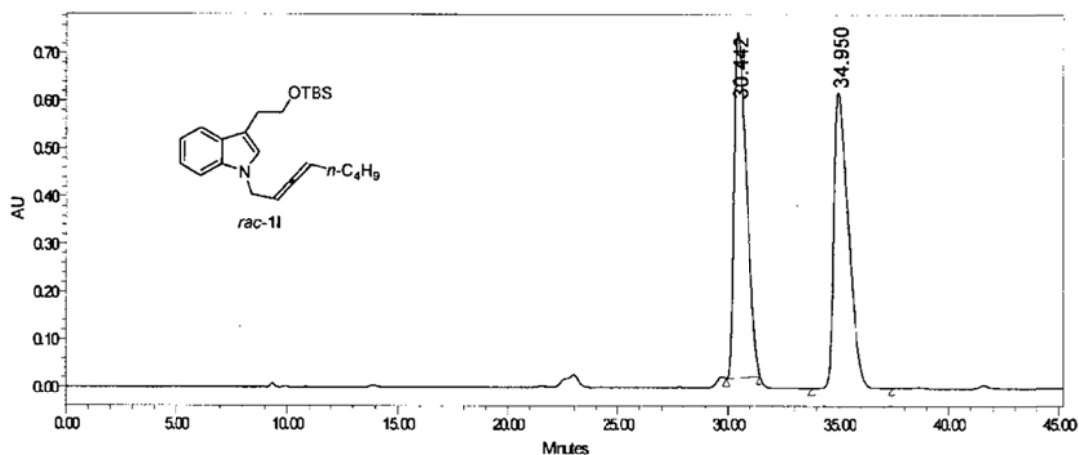
Channel: V02489 ChA; Processed Channel: V02489 ChA.214nm; Result Id: 1126; Processing Method: 11

Processed Channel Descr.: V02489 ChA.214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	V02489 ChA.214nm	31.968	289640	0.78	8363
2	V02489 ChA.214nm	36.188	36976617	99.22	716510

SAMPLE INFORMATION

Sample Name:	JF-3-058-IB-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	ZG1100
Injection#:	8	Processing Method:	111
Injection Volume:	10.00 uL	Channel Name:	V2489 ChA
Run Time:	60.0 Minutes	Proc. Chnl. Descr.:	V2489 ChA.214nm
Date Acquired:	4/28/2019 5:50:56 PM EDT		
Date Processed:	4/28/2019 7:23:32 PM EDT		



Channel: V2489 ChA; Processed Channel: V2489 ChA.214nm; Result Id: 1086; Processing Method: 11

Processed Channel Descr.: V2489 ChA.214nm

	Processed Channel Descr.	RT	Area	%Area	Hight
1	V2489 ChA.214nm	30.442	28669025	50.35	726520
2	V2489 ChA.214nm	34.950	28273083	49.65	621392

Reported by User: System
Report Method: Injection Summary Report
Report Method ID: 1029 1029
Page: 1 of 1

Project Name: HPLC_1525
Date Printed: 4/29/2019
9:18:20 PM America/New_York

jf-2-190_1.1

2019-01-16 16:16:39.796

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

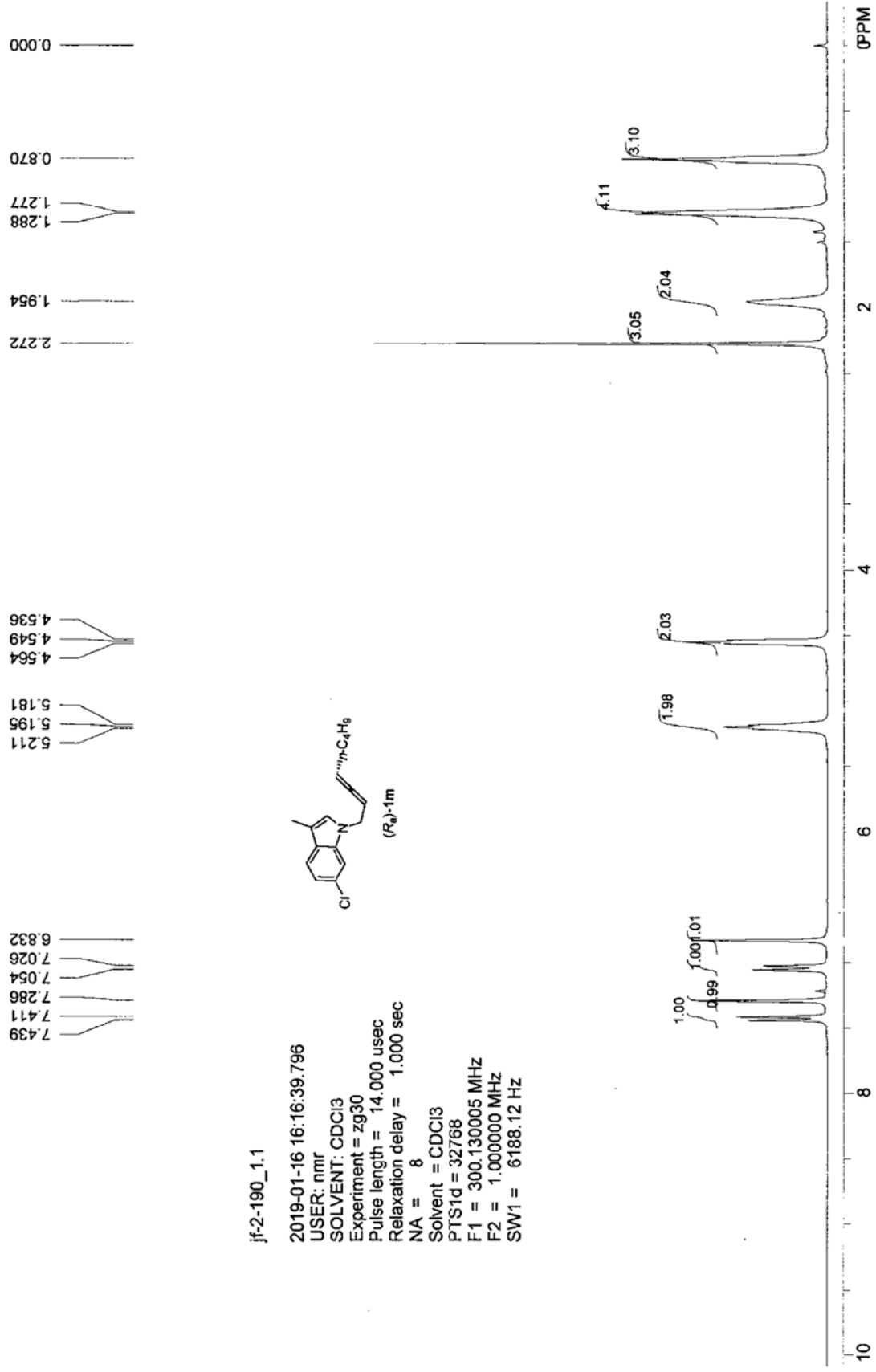
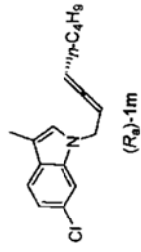
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jt-2-190_2.1

2019-01-16 16:28:40.375

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 178

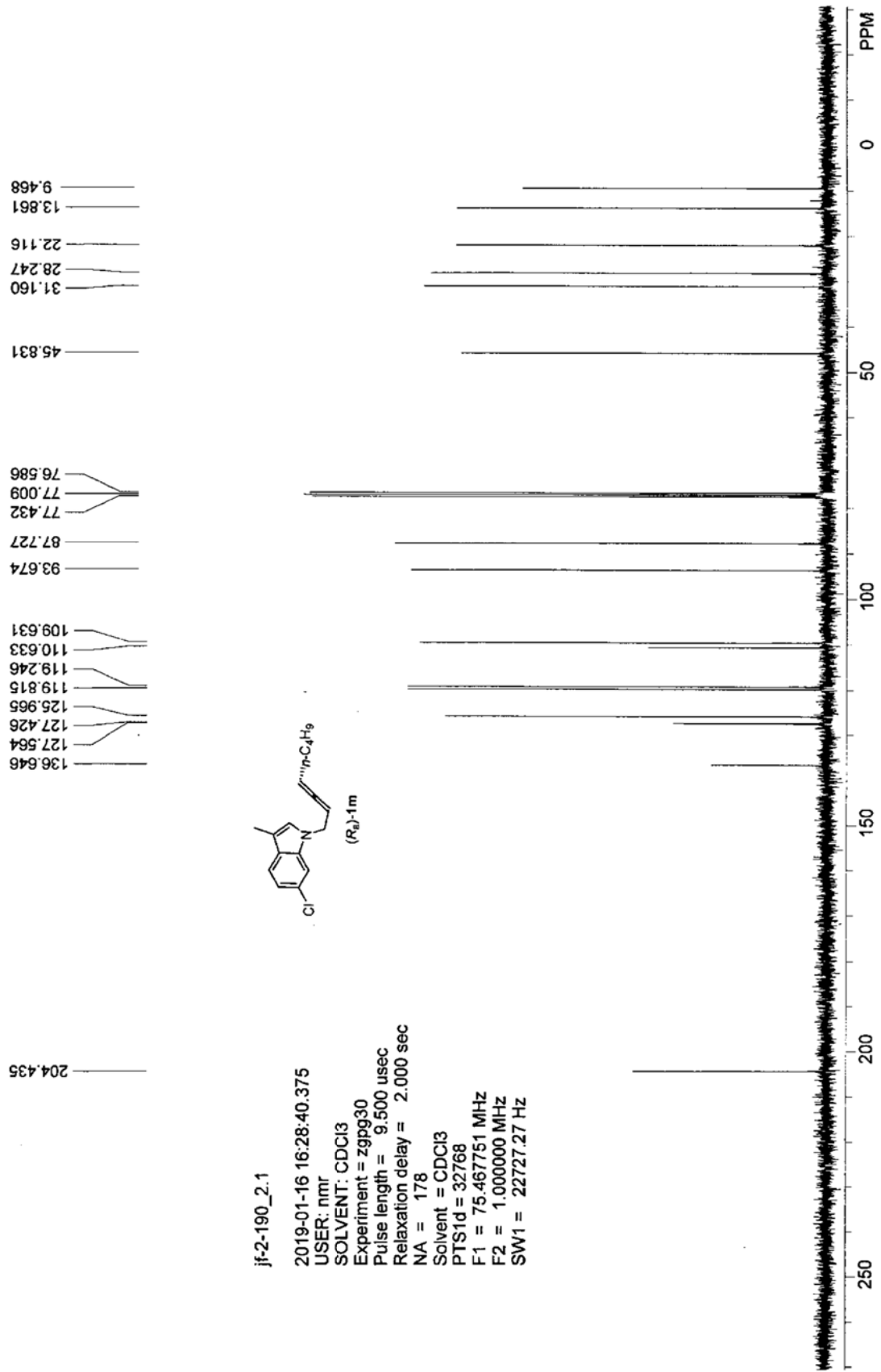
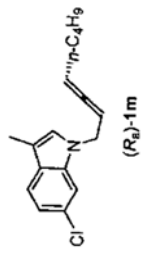
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

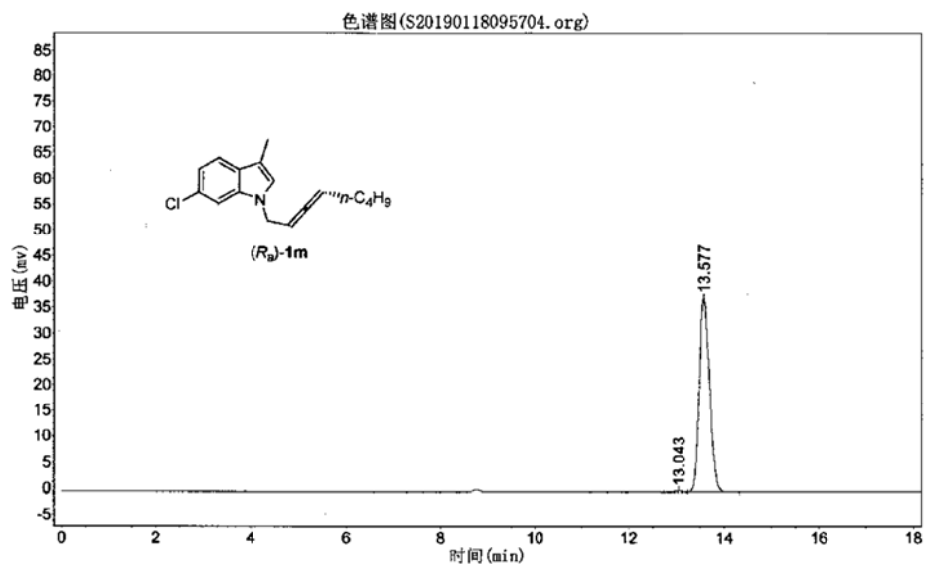


jf-2-190

实验时间: 2019-01-18, 9:57:04
谱图文件: D:\浙大智达\N2000\样品\S20190118095704.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-01-18, 10:32:24
积分方法: 面积归一法

实验内容简介:
OD, n-hexane/i-PrOH = 100/1, 0.5, 254



分析结果表

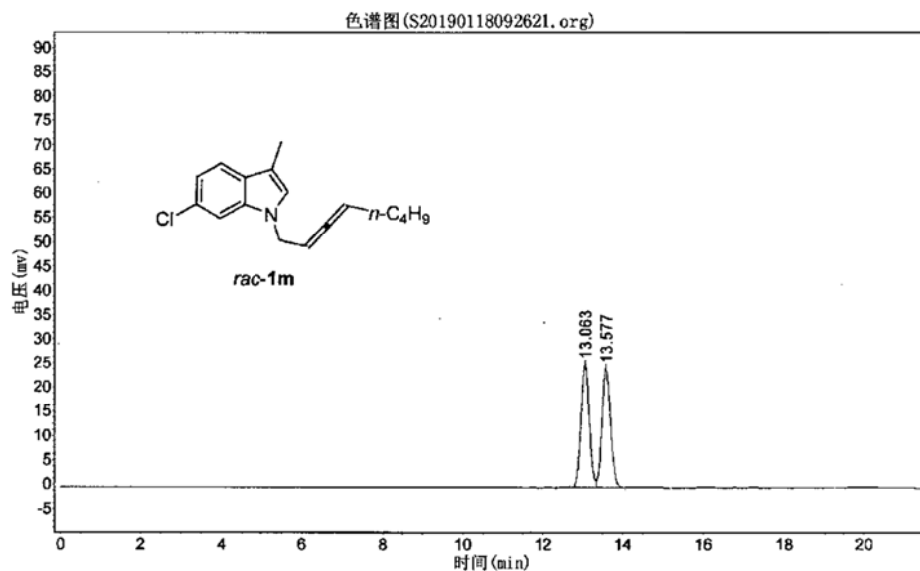
峰号	峰名	保留时间	峰高	峰面积	含量
1		13.043	320.753	4455.119	0.7924
2		13.577	37554.258	557744.813	99.2076
总计			37875.011	562199.931	100.0000

jf-2-191

实验时间: 2019-01-18, 9:26:21
谱图文件: D:\浙大智达\N2000\样品\S20190118092621.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-01-18, 10:36:36
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 100/1, 0.5, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		13.063	25586.842	361937.313	49.6575
2		13.577	24708.260	366930.469	50.3425
总计			50295.102	728867.781	100.0000

jf-3-083_1.1

2019-06-05 15:49:27.500

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

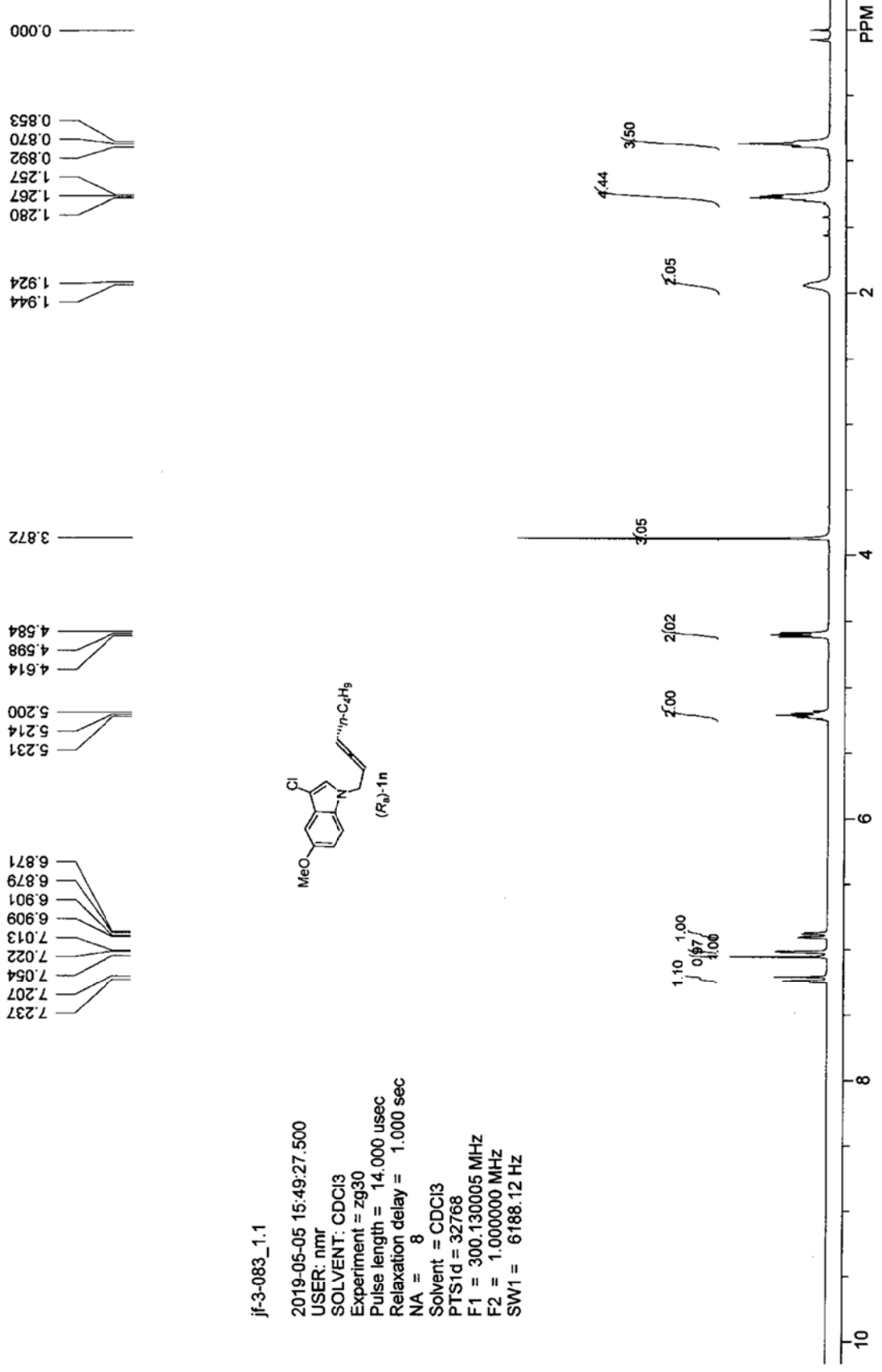
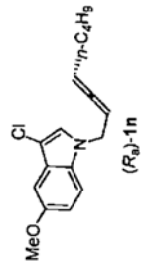
Solvent = CDCl₃

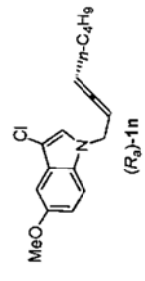
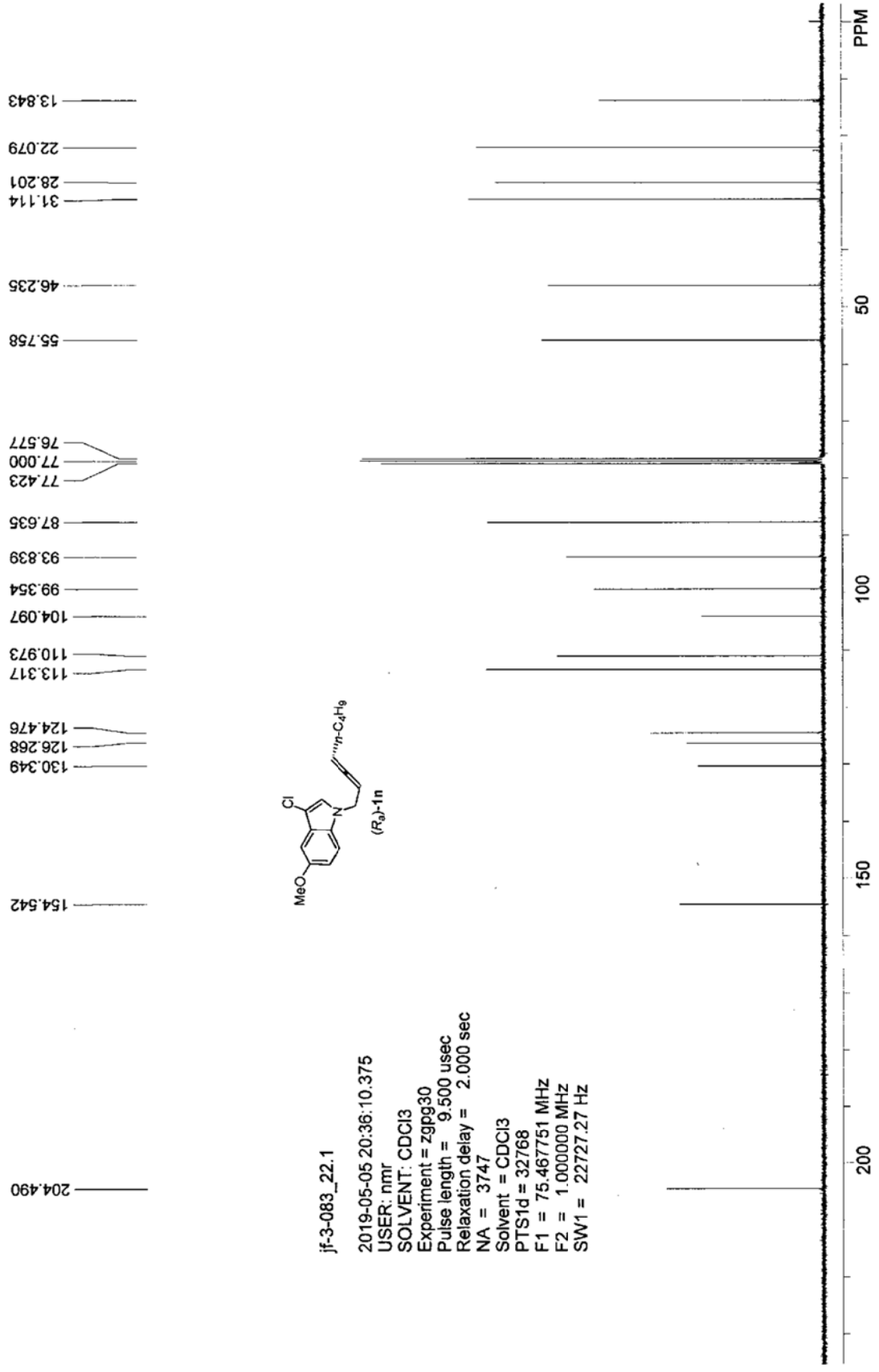
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

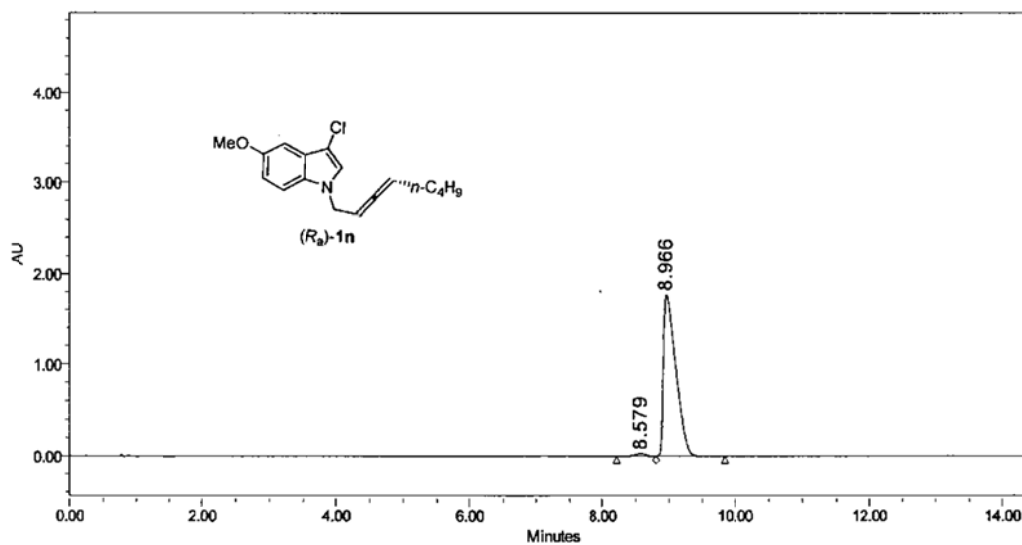




jf-3-083_22.1
2019-05-05 20:36:10.375
USER: nmr
SOLVENT: CDCl3
Experiment = zgpg30
Pulse length = 9.500 usec
Relaxation delay = 2.000 sec
NA = 3747
Solvent = CDCl3
PTS1d = 32768
F1 = 75.467751 MHz
F2 = 1.000000 MHz
SW1 = 22727.27 Hz

SAMPLE INFORMATION

Sample Name:	jf-3-083	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1:F,4	Acq. Method Set:	upc_pda_2019m
Injection #:	1	Processing Method:	TEST
Injection Volume:	1.00 ul	Channel Name:	PDA Ch2 214nm@4.8nm
Run Time:	50.0 Minutes	Proc. Chnl. Descr.:	PDA Ch2 214nm@4.8nm
Date Acquired:	6/18/2019 1:27:51 PM CST		
Date Processed:	6/20/2019 1:10:44 PM CST		



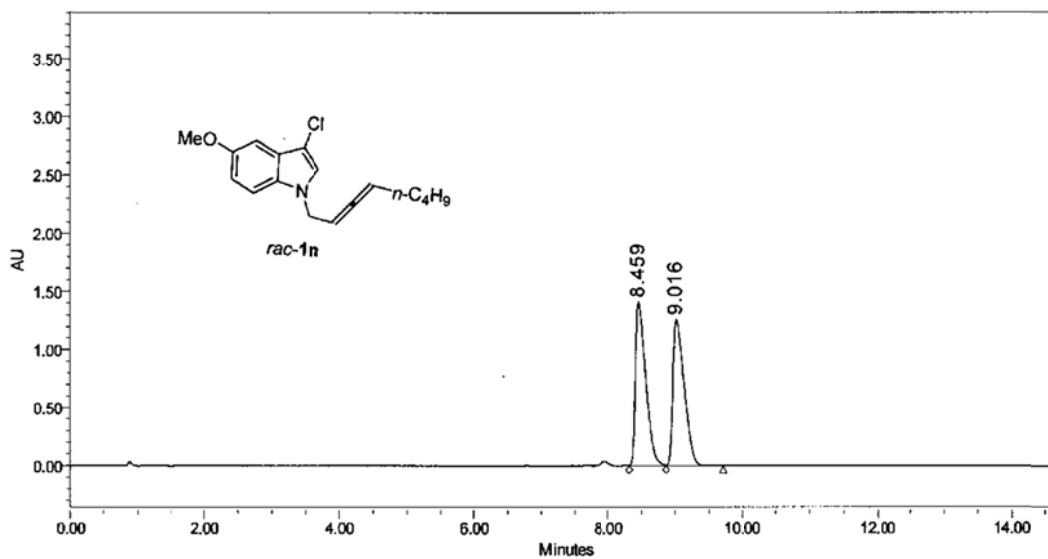
	RT	Peak Type	Height	Width (sec)	Area	% Area
1	8.579	Unknown	28229	35.500	275604	1.20
2	8.966	Unknown	1774506	61.800	22673777	98.80

Reported by User: System
Report Method: Default Individual Report
Report Method ID: 13742
Page: 1 of 1

Project Name: TEST
Date Printed:
6/20/2019
1:13:33 PM PRC

SAMPLE INFORMATION

Sample Name:	jf-3-082-rac-oj-3-98-2	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1:F,2	Acq. Method Set:	upc_pda_2019m
Injection #:	1	Processing Method:	TEST
Injection Volume:	1.00 ul	Channel Name:	PDA Ch2 214nm@4.8nm
Run Time:	50.0 Minutes	Proc. Chnl. Descr.:	PDA Ch2 214nm@4.8nm
Date Acquired:	6/18/2019 1:11:48 PM CST		
Date Processed:	6/20/2019 1:09:40 PM CST		

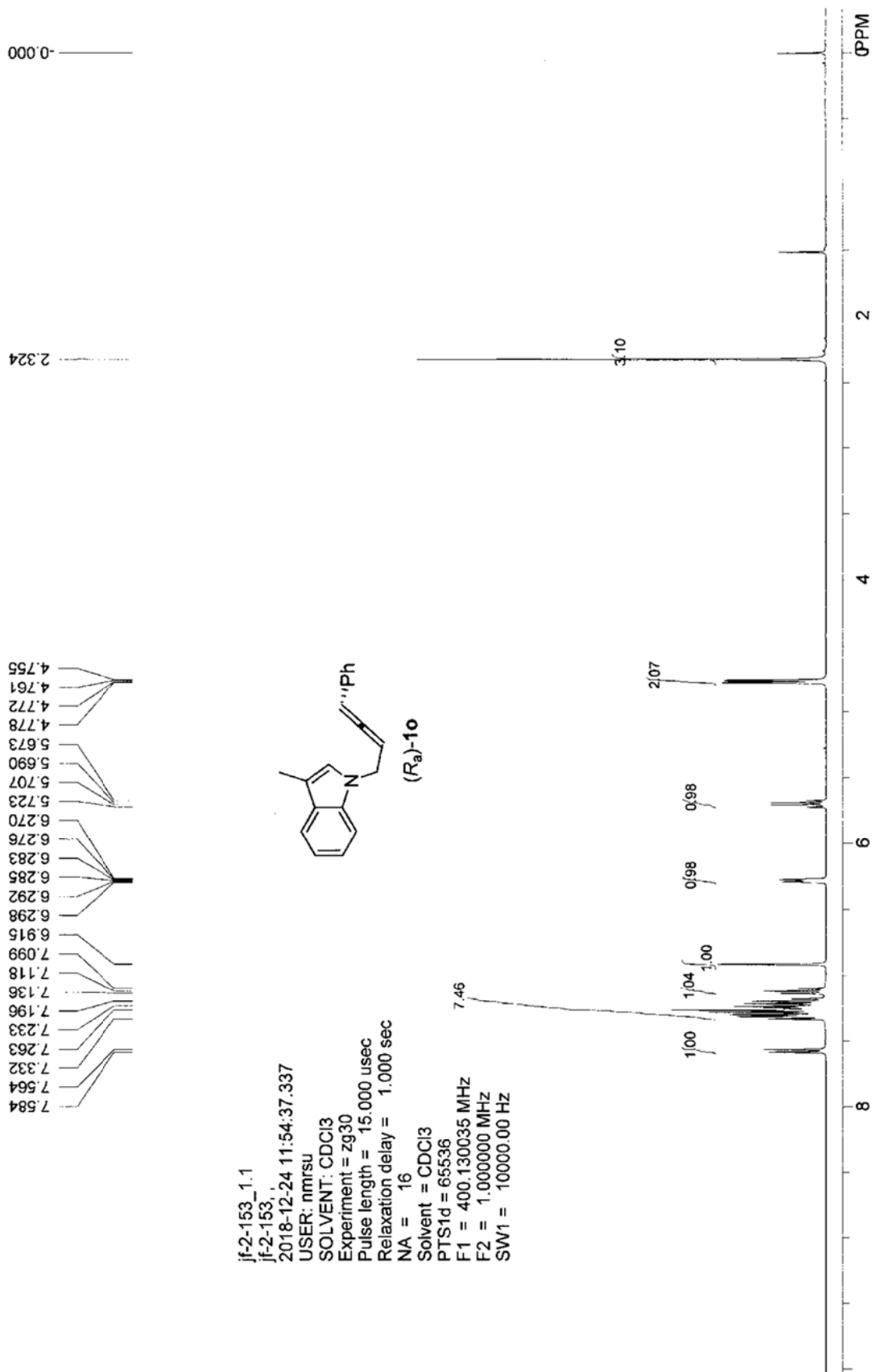
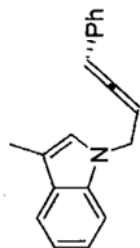


	RT	Peak Type	Height	Width (sec)	Area	% Area
1	8.459	Unknown	1419057	32.600	15111263	50.53
2	9.016	Unknown	1267336	51.150	14793421	49.47

Reported by User: System
Report Method: Default Individual Report
Report Method ID: 13742
Page: 1 of 1

Project Name: TEST
Date Printed:
6/20/2019
1:13:47 PM PRC

jf-2-153_1.1
 jf-2-153_1
 2018-12-24 11:54:37.337
 USER: nmrsu
 SOLVENT: CDCl3
 Experiment = zg30
 Pulse length = 15.000 usec
 Relaxation delay = 1.000 sec
 NA = 16
 Solvent = CDCl3
 PTS1d = 65536
 F1 = 400.130035 MHz
 F2 = 1.000000 MHz
 SW1 = 10000.00 Hz



jf-2-153_2.1

2018-12-20 11:07:47.093

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 1050

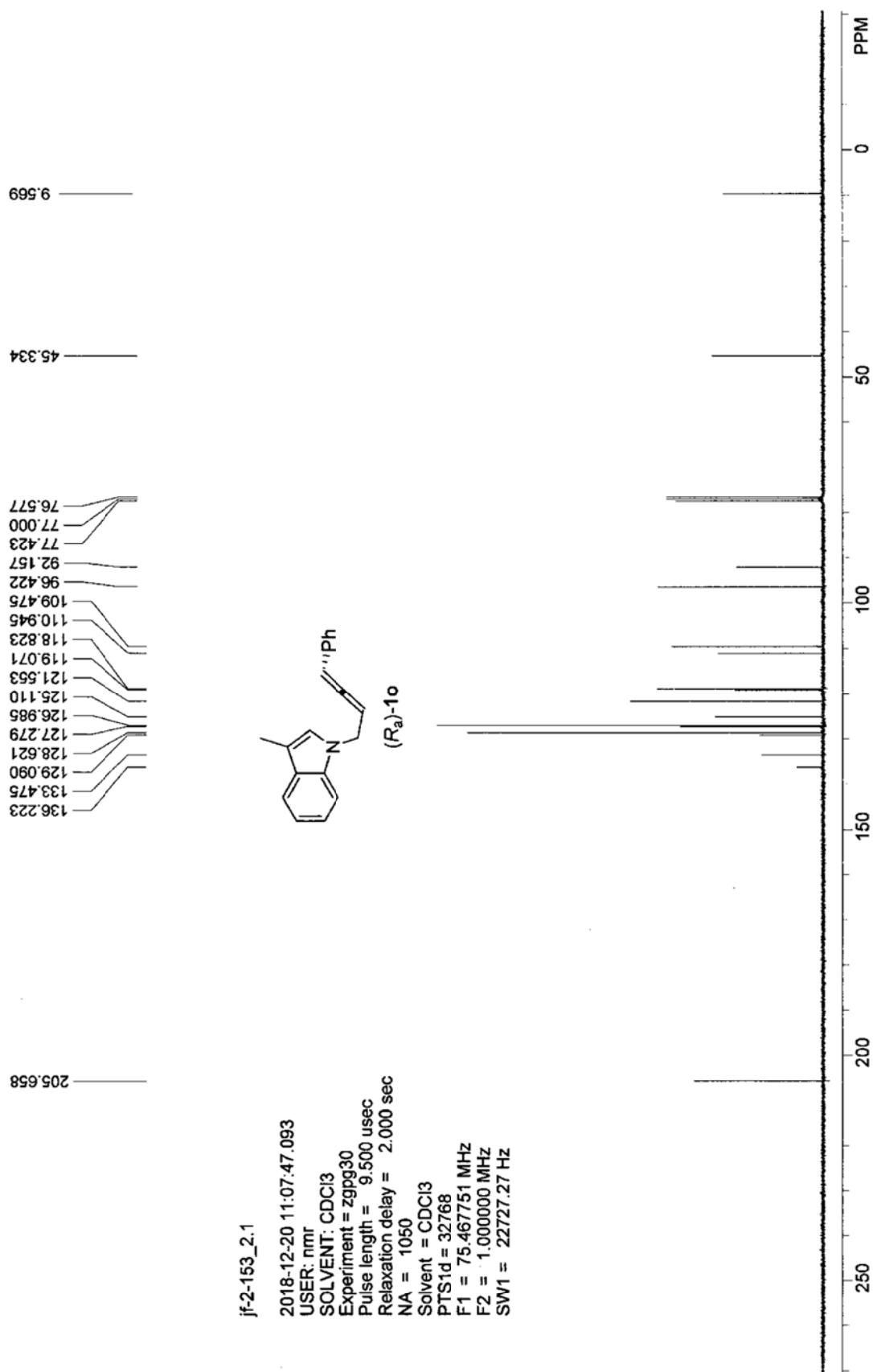
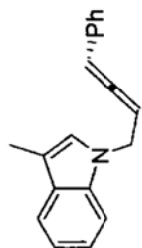
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1,000000 MHz

SW1 = 22727.27 Hz

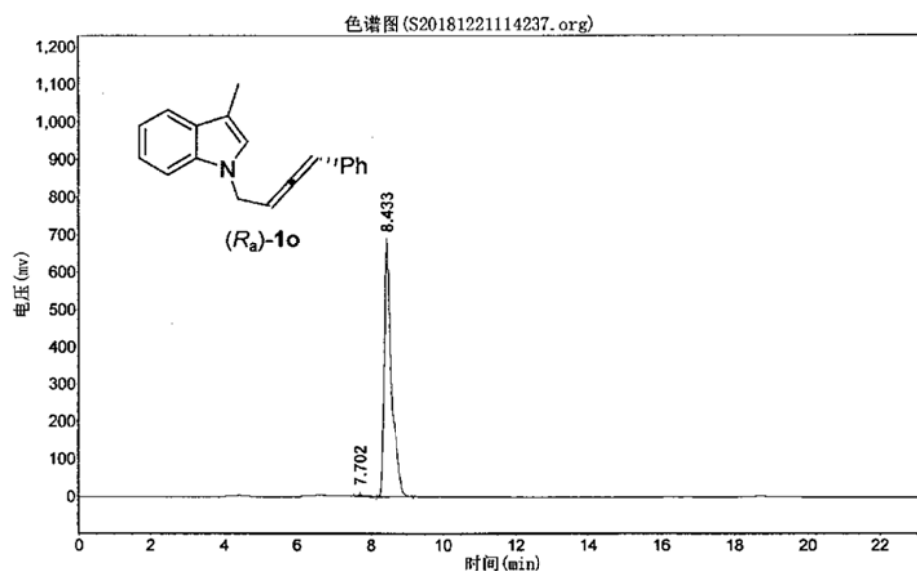


jf-2-153

实验时间: 2018-12-21, 11:42:37
谱图文件: D:\浙大智达\N2000\样品\S20181221114237.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-12-21, 12:38:55
积分方法: 面积归一法

实验内容简介:
AD, n-hexane/i-PrOH = 99/1, 0.7, 214



分析结果表

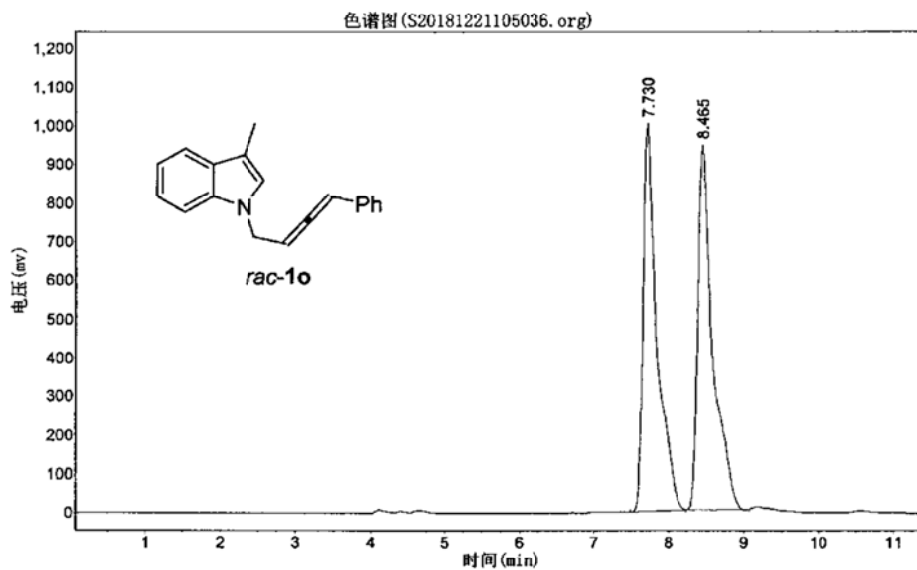
峰号	峰名	保留时间	峰高	峰面积	含量
1		7.702	3376.311	44261.047	0.4620
2		8.433	681389.188	9536051.000	99.5380
总计			684765.498	9580312.047	100.0000

jf-2-157

实验时间: 2018-12-21, 10:50:36
谱图文件: D:\浙大智达\N2000\样品\S20181221105036. org
方法文件: D:\浙大智达\N2000\djx. mtd

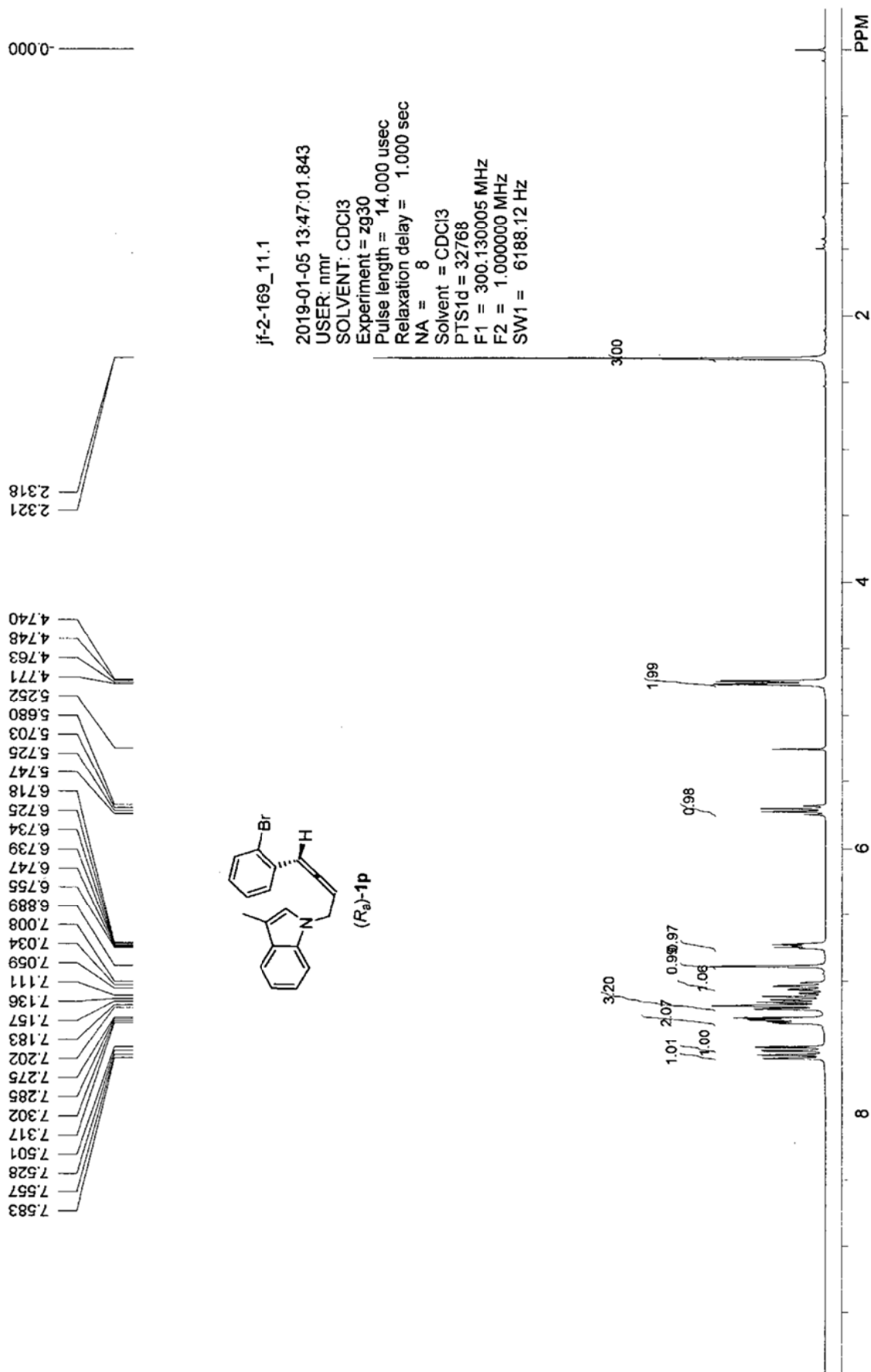
实验者: jf
报告时间: 2018-12-21, 12:35:15
积分方法: 面积归一法

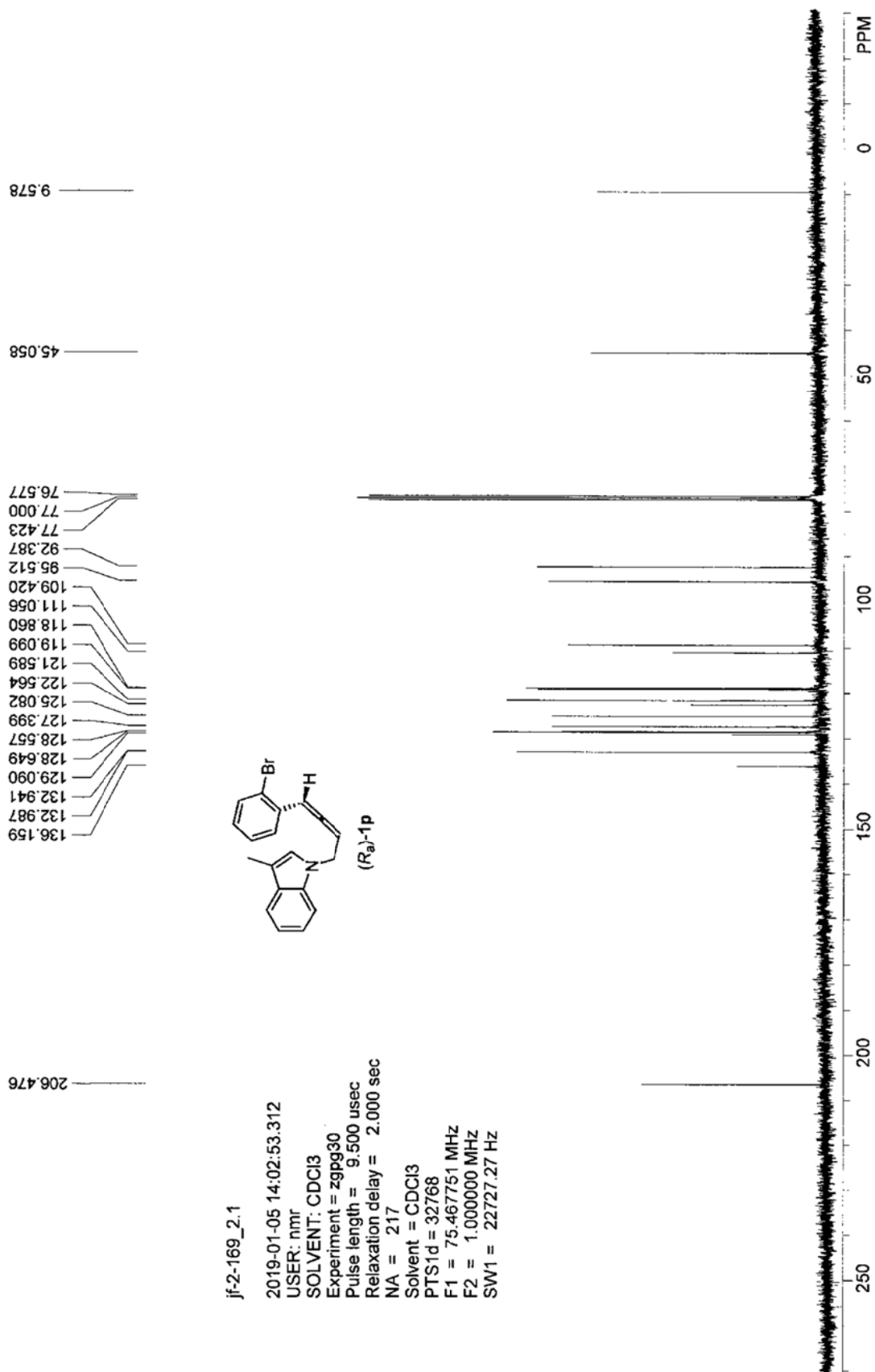
实验内容简介:
AD, n-hexane/i-PrOH = 99/1, 0. 7, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		7. 730	994593. 875	12781228. 000	49. 8731
2		8. 465	935218. 875	12846270. 000	50. 1269
总计			1929812. 750	25627498. 000	100. 0000





jf-2-169_2.1

2019-01-05 14:02:53.312

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 217

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

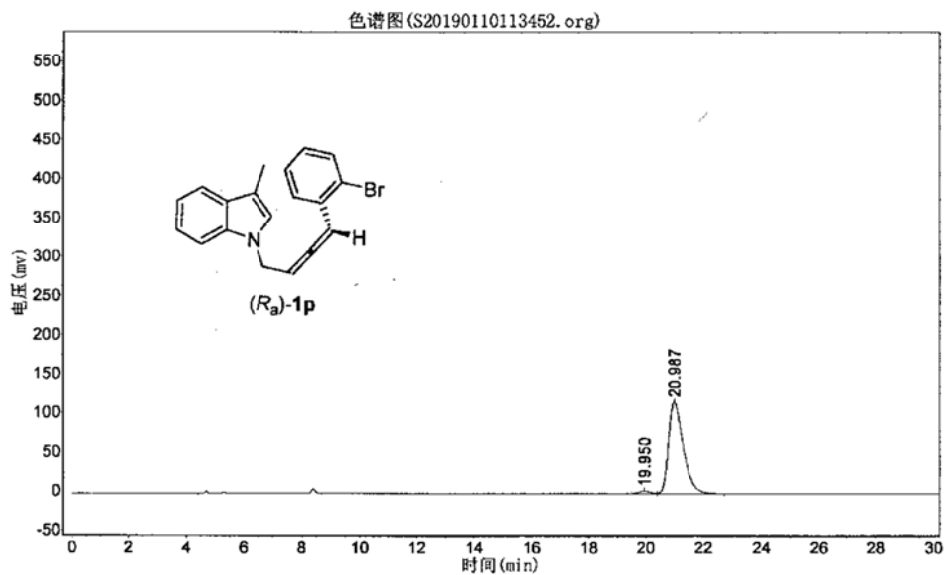
SW1 = 22727.27 Hz

jf-2-169

实验时间: 2019-01-10, 11:34:52
谱图文件: D:\浙大智达\N2000\样品\S20190110113452.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-01-10, 12:29:42
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.7, 254



分析结果表

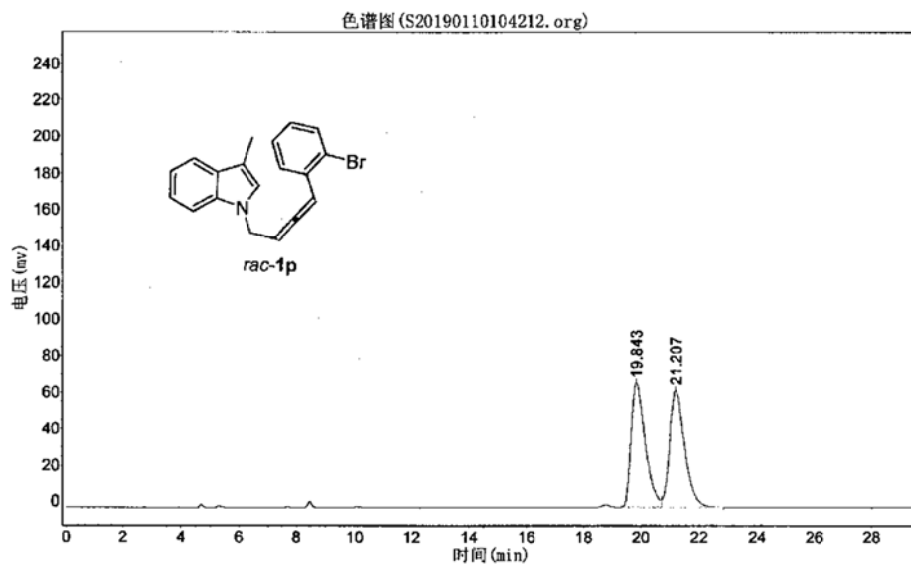
峰号	峰名	保留时间	峰高	峰面积	含量
1		19.950	2718.615	86753.391	2.0472
2		20.987	116535.891	4150971.000	97.9528
总计			119254.506	4237724.391	100.0000

jf-2-172

实验时间: 2019-01-10, 10:42:12
谱图文件: D:\浙大智达\N2000\样品\S20190110104212.org
方法文件: D:\浙大智达\N2000\djx.mtd

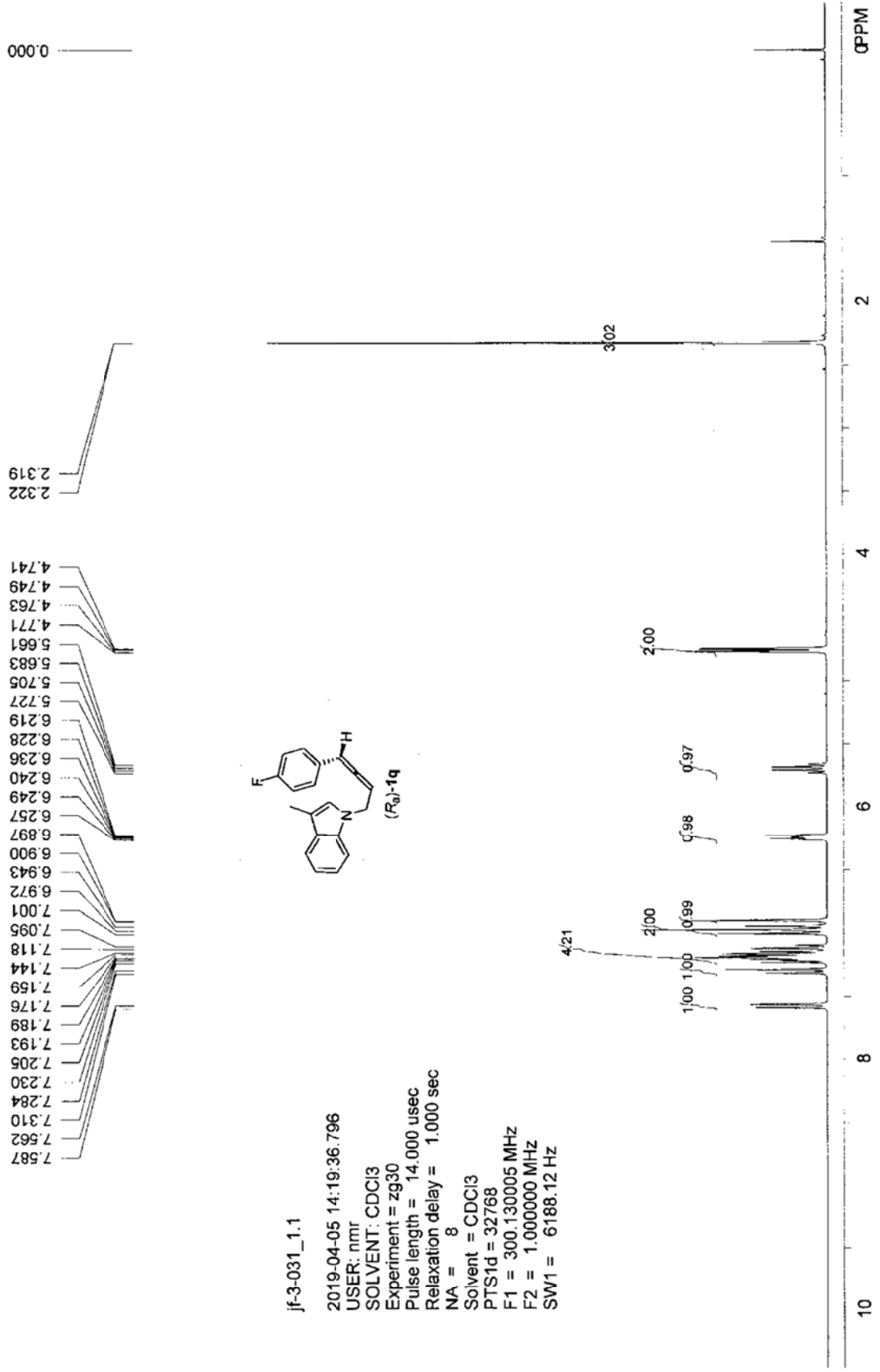
实验者: jf
报告时间: 2019-01-10, 12:31:31
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.7, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		19.843	68290.195	2334392.250	49.6334
2		21.207	64551.098	2368880.500	50.3666
总计			132841.293	4703272.750	100.0000



jf-3-031_1.1

2019-04-05 14:19:36.796

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

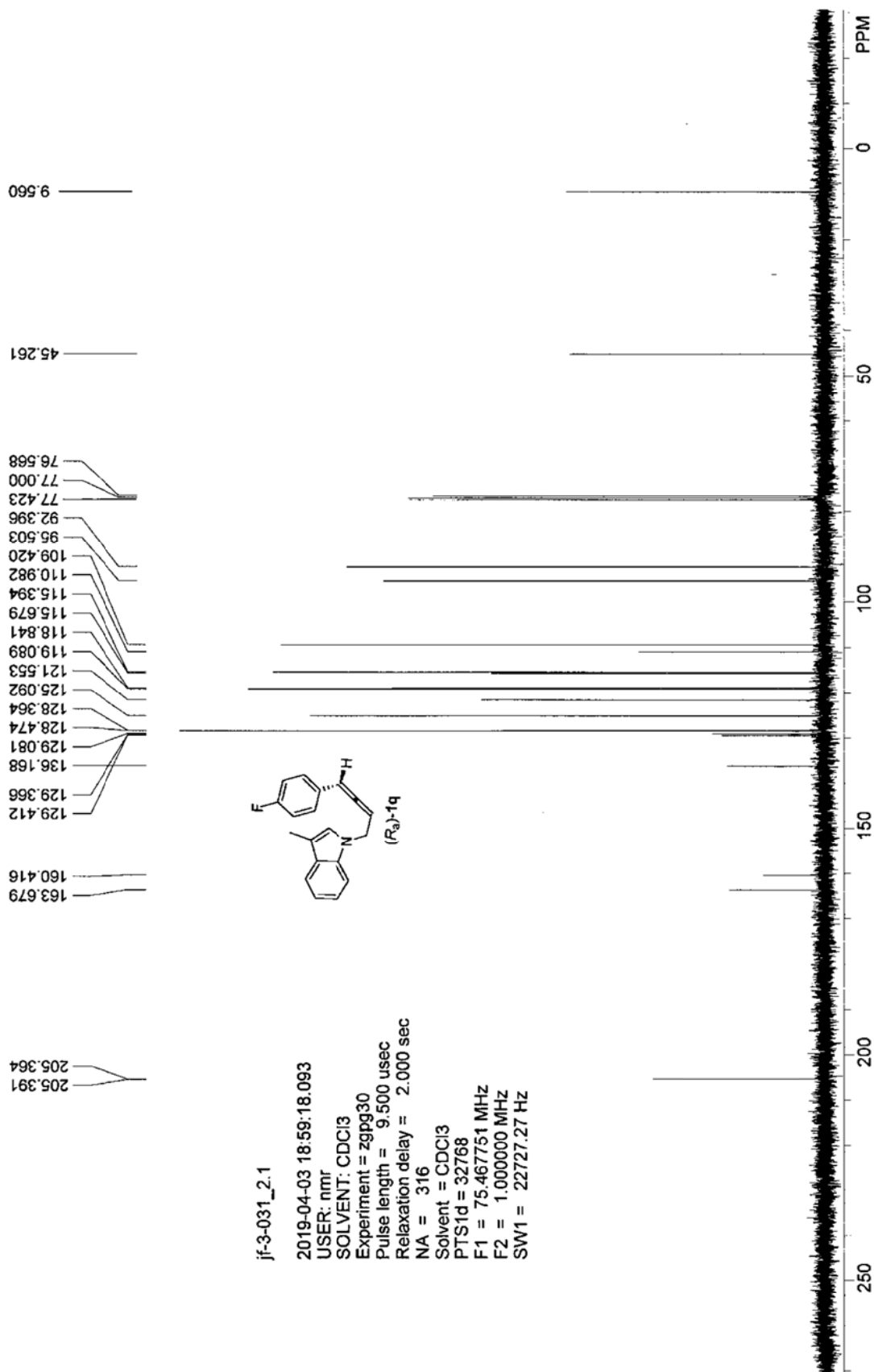
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-3-031_2.1

2019-04-03 18:59:18.093

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 316

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

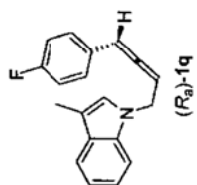
F2 = 1.000000 MHz

SW1 = 22727.27 Hz

0.000

jf-3-031_4.1

2019-04-15 09:16:27.296
USER: nmr
SOLVENT: CDCl3
Experiment = zgfgnqn
Pulse length = 13.500 usec
Relaxation delay = 1.000 sec
NA = 16
Solvent = CDCl3
PTS1d = 65536
F1 = 282.404358 MHz
F2 = 1.000000 MHz
SW1 = 66964.29 Hz



-115.204

PPM

-200

-150

-100

-50

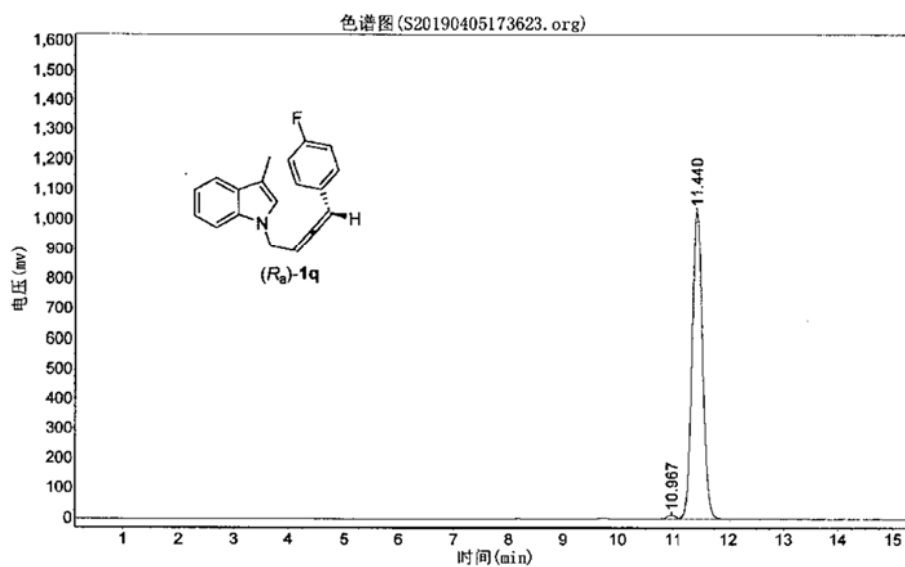
0

jf-3-031

实验时间: 2019-04-05, 17:36:23
谱图文件: D:\浙大智达\N2000\样品\S20190405173623.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-04-05, 17:53:40
积分方法: 面积归一法

实验内容简介:
ia, n-hexane/i-PrOH = 100/1, 0.5, 254



分析结果表

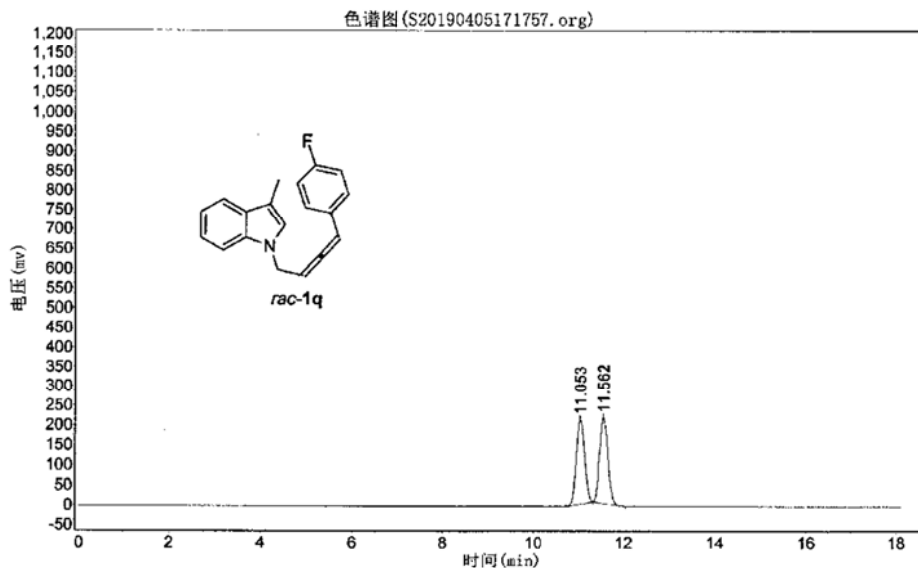
峰号	峰名	保留时间	峰高	峰面积	含量
1		10.967	12917.351	152454.438	1.1143
2		11.440	1030561.688	13529443.000	98.8857
总计			1043479.038	13681897.438	100.0000

jf-3-033

实验时间: 2019-04-05, 17:17:57
谱图文件: D:\浙大智达\N2000\样品\S20190405171757.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-04-05, 17:39:39
积分方法: 面积归一法

实验内容简介:
ia, n-hexane/i-PrOH = 100/1, 0.5, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		11.053	212771.875	2700423.000	49.5927
2		11.562	215981.672	2744780.500	50.4073
总计			428753.547	5445203.500	100.0000

jf-3-016_1.1

2019-02-27 11:24:14.406

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

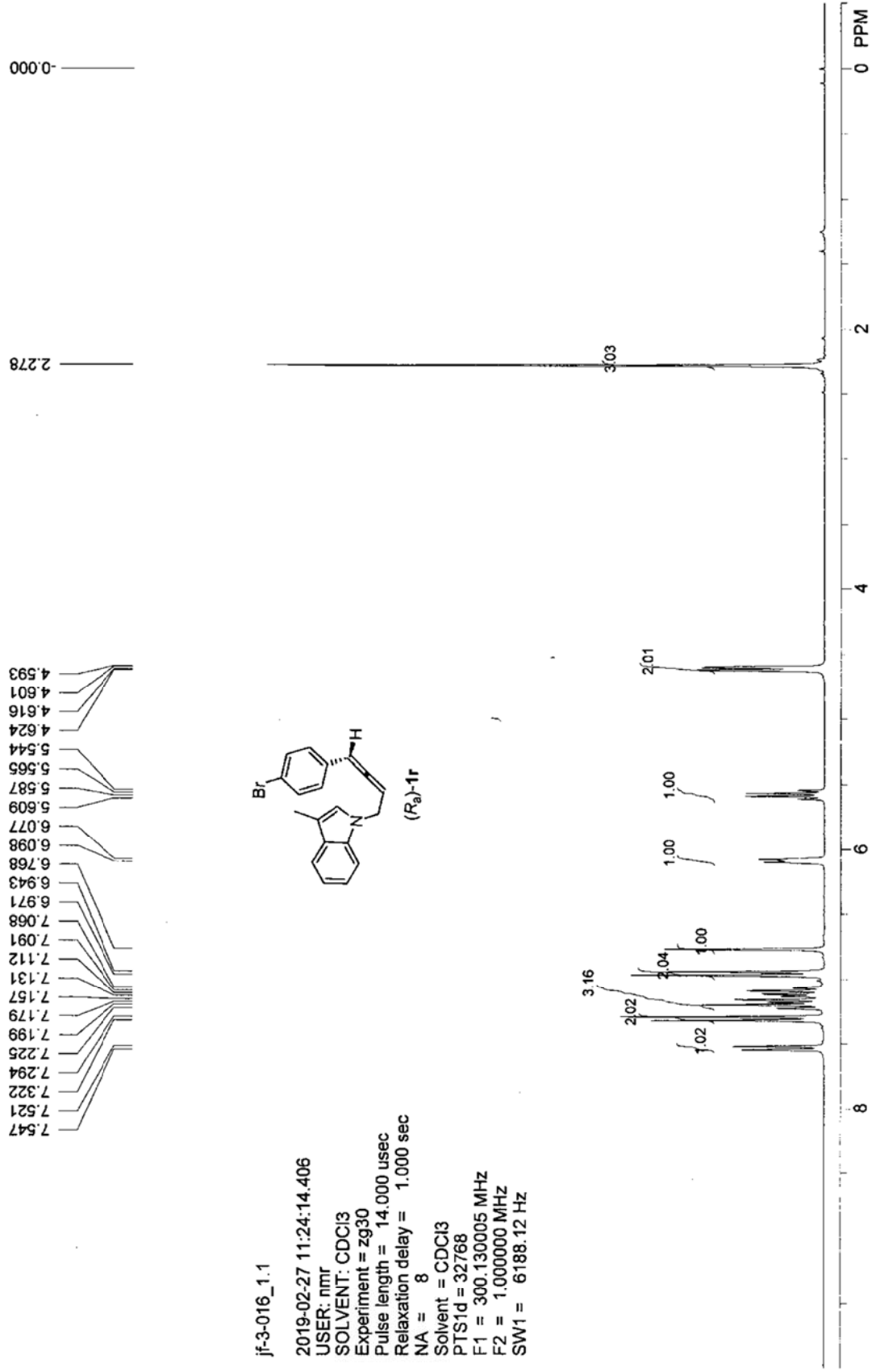
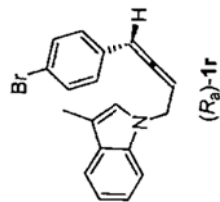
Solvent = CDCl₃

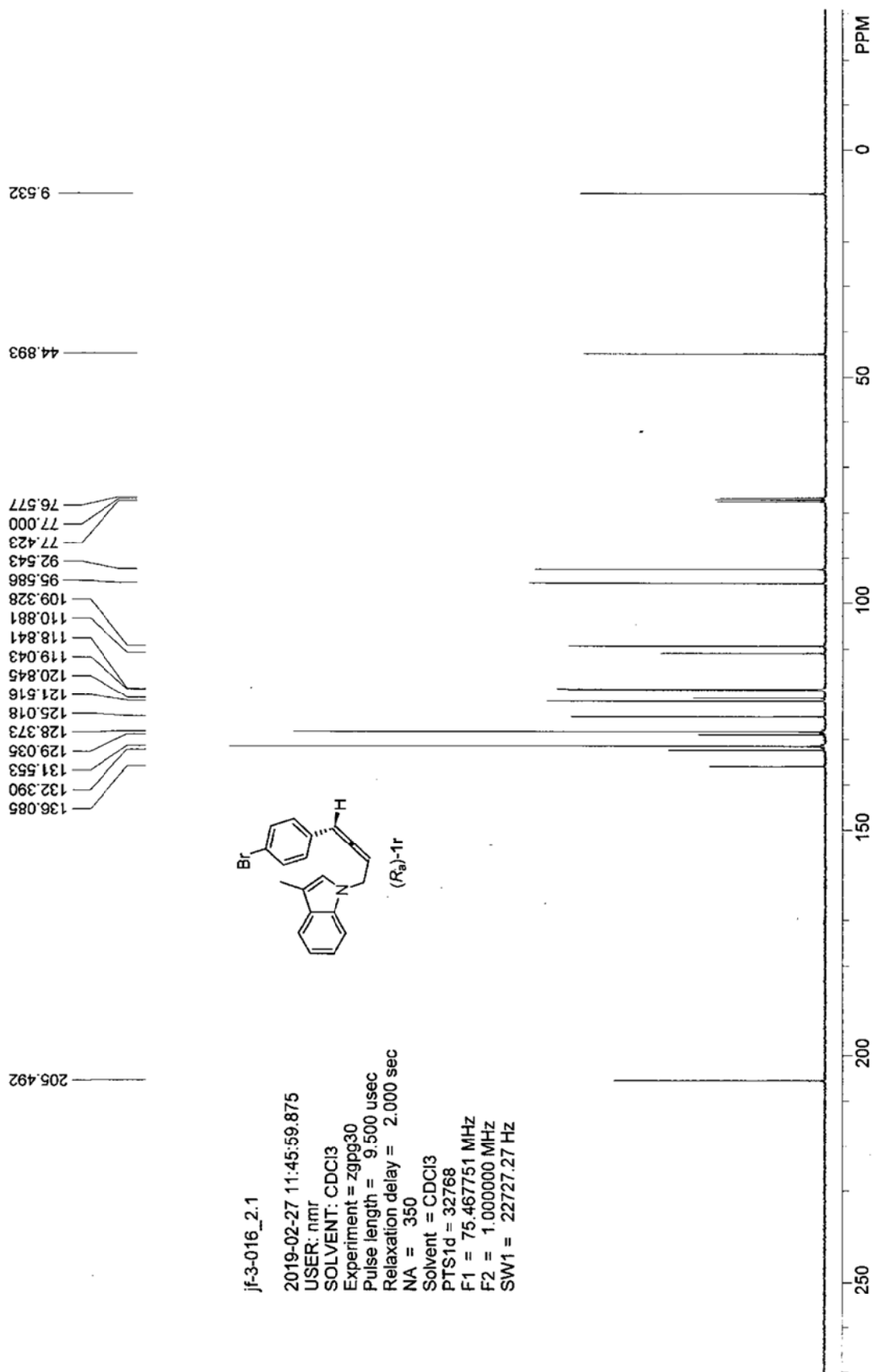
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



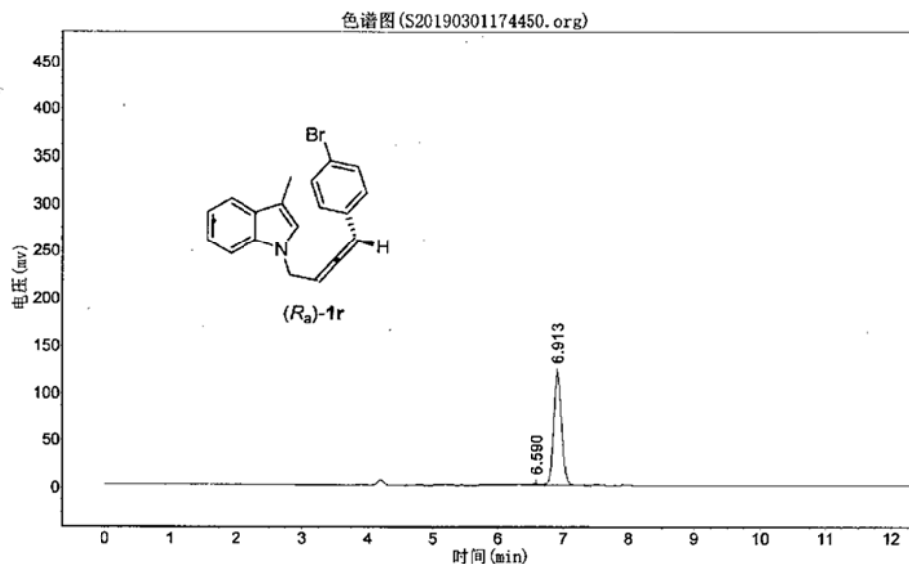


jf-3-016

实验时间: 2019-03-01, 17:44:50
谱图文件: D:\浙大智达\N2000\样品\S20190301174450.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-03-01, 18:03:59
积分方法: 面积归一法

实验内容简介:
ia,n-hexane/i-PrOH = 95/5, 0.7, 214



分析结果表

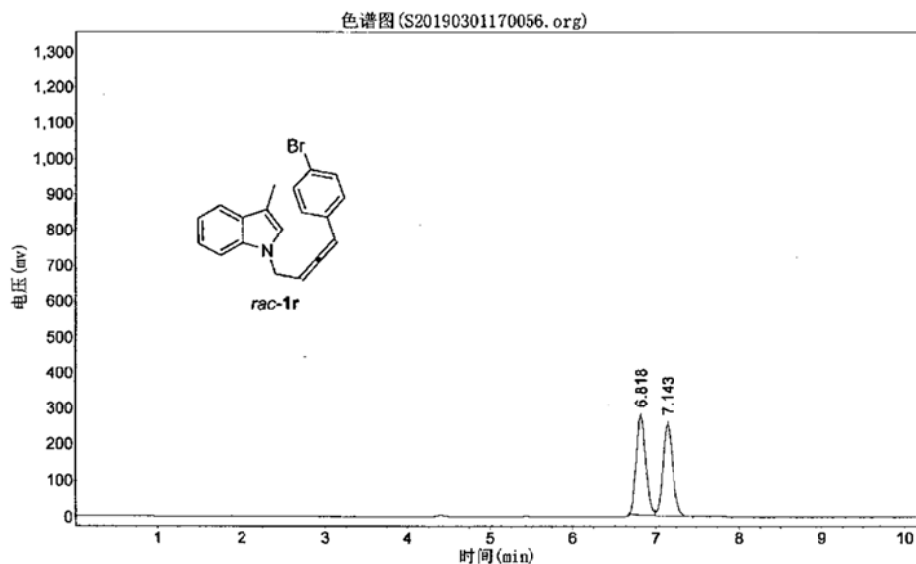
峰号	峰名	保留时间	峰高	峰面积	含量
1		6.590	1009.766	8176.603	0.8267
2		6.913	118586.102	980940.563	99.1733
总计			119595.867	989117.165	100.0000

jf-3-017

实验时间: 2019-03-01, 17:00:56
谱图文件: D:\浙大智达\N2000\样品\S20190301170056.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-03-01, 17:38:23
积分方法: 面积归一法

实验内容简介:
ia,n-hexane/i-PrOH = 95/5, 0.7, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		6.818	270851.531	2150464.500	50.7985
2		7.143	250713.391	2082854.750	49.2015
总计			521564.922	4233319.250	100.0000

2019-05-09 10:39:38.265

SOLVENT:

Pulse length = 14.9

Relaxation delay = 1.000 sec
NA = 8

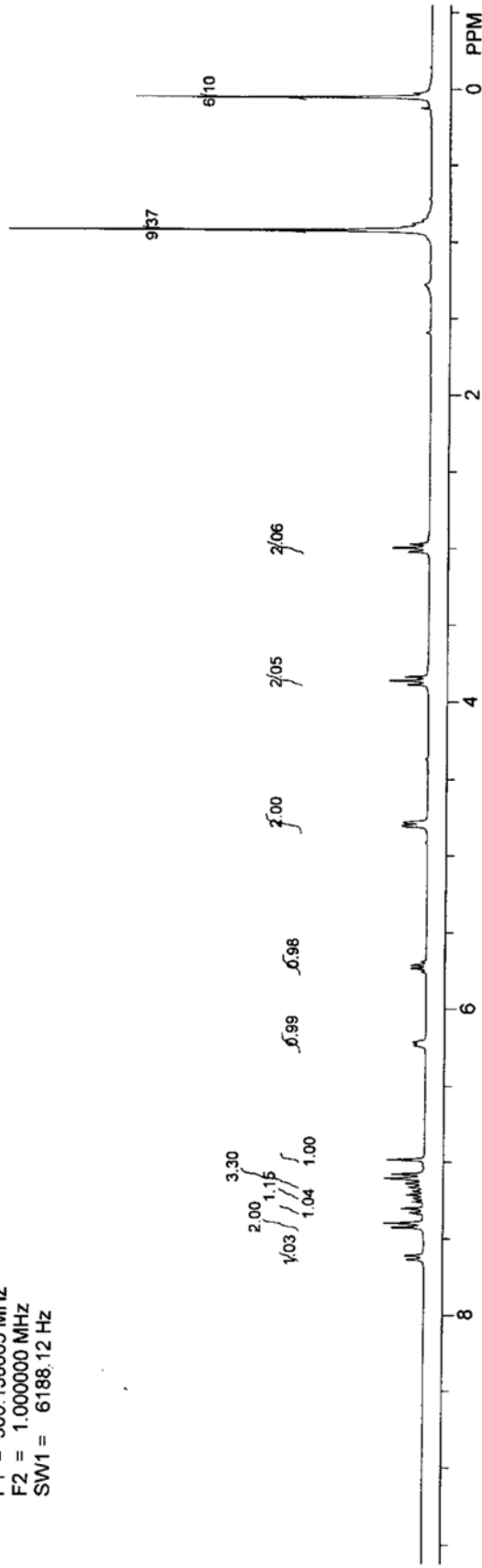
PTS1d = 32

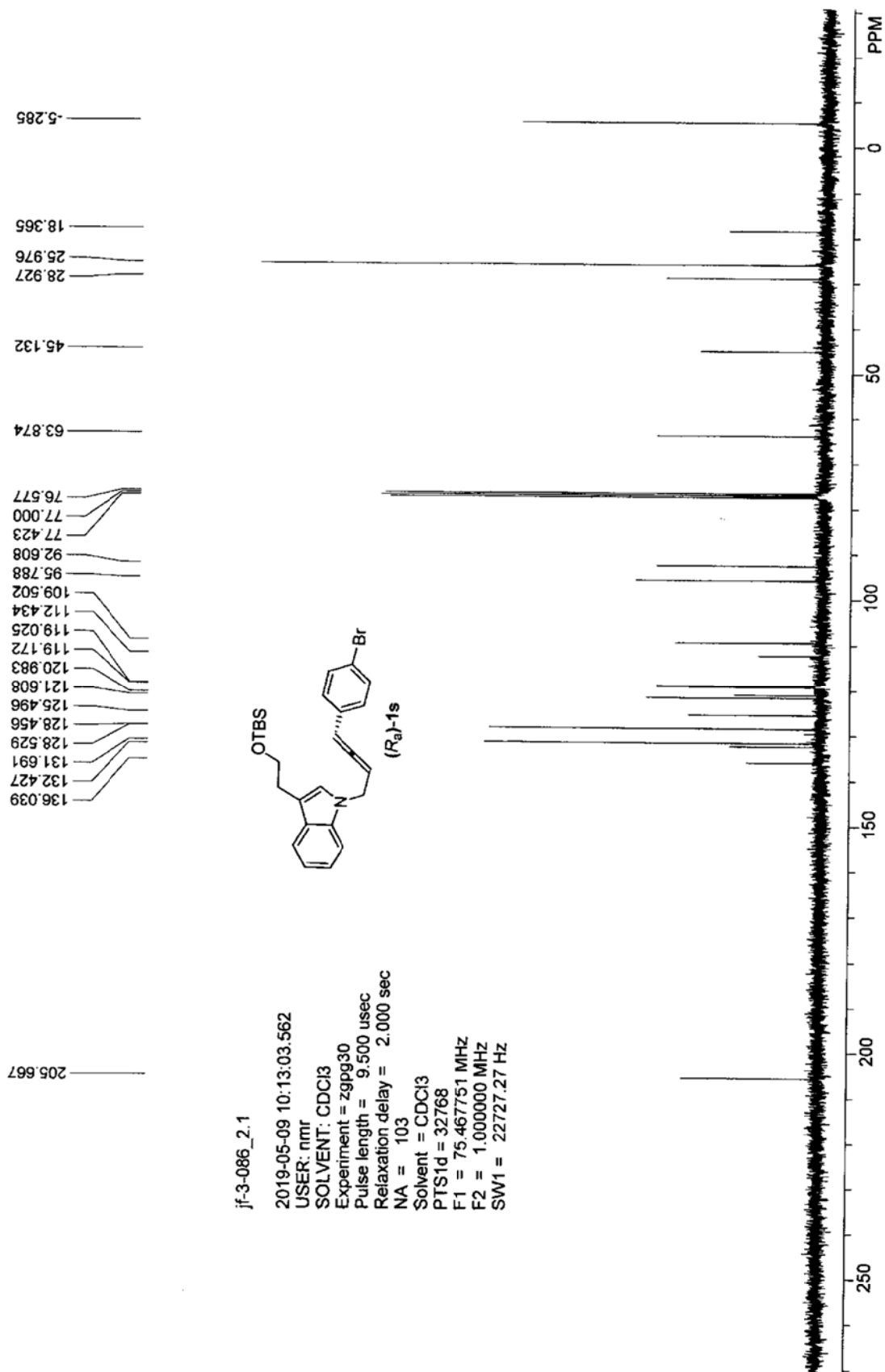
$$F1 = 300.130005$$

SWI = 6188.12 HZ

Cc1ccc(cc1)/C=C/[C@H]2Cc3ccccc3n2CC[Si](C)(C)C(C)(C)C

(R_a)-1s





ji-3-086_2.1

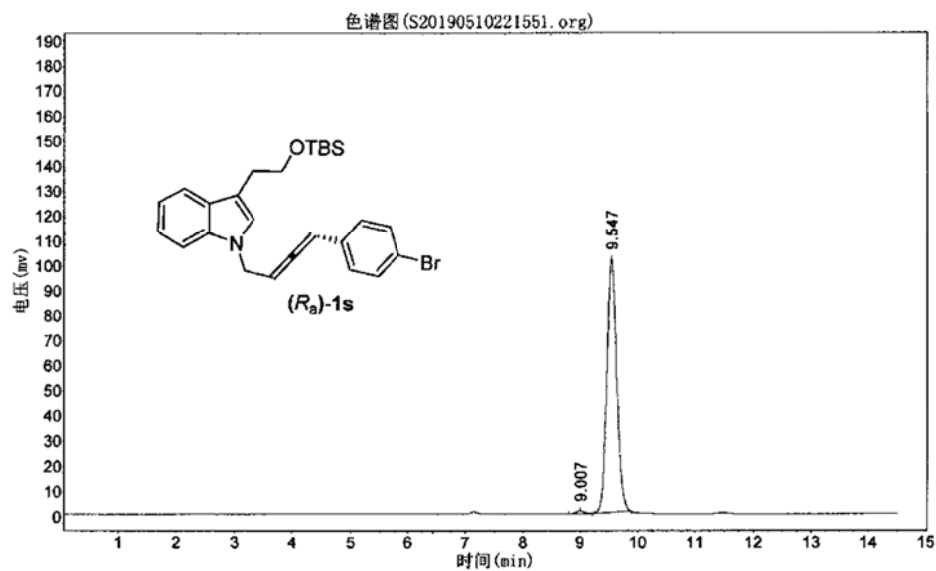
2019-05-09 10:13:03.562
 USER: nmir
 SOLVENT: CDCl3
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 103
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz

jf-3-086

实验时间: 2019-05-10, 22:15:51
谱图文件: D:\浙大智达\N2000\样品\S20190510221551.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-05-10, 22:33:51
积分方法: 面积归一法

实验内容简介:
1a, n-hexane/i-PrOH = 200/1, 0.7, 254



分析结果表

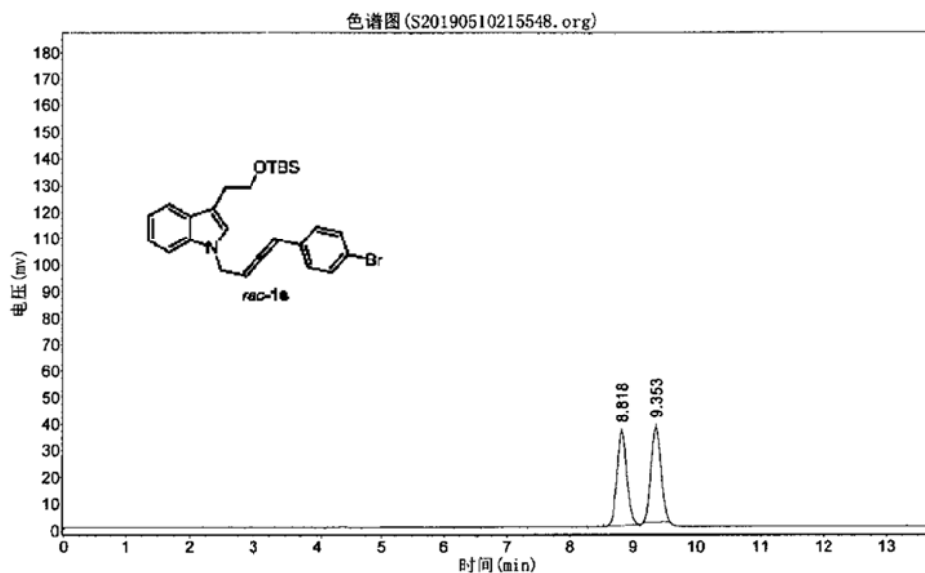
峰号	峰名	保留时间	峰高	峰面积	含量
1		9.007	864.045	8699.901	0.7097
2		9.547	100842.844	1217236.375	99.2903
总计			101706.889	1225936.276	100.0000

jf-3-085

实验时间: 2019-05-10, 21:55:48
谱图文件: D:\浙大智达\N2000\样品\S20190510215548.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-05-10, 22:12:48
积分方法: 面积归一法

实验内容简介:
1a, n-hexane/i-PrOH = 200/1, 0.7, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		8.818	34930.078	382395.313	49.6410
2		9.353	35449.820	387926.844	50.3590
总计			70379.898	770322.156	100.0000

jf-3-111

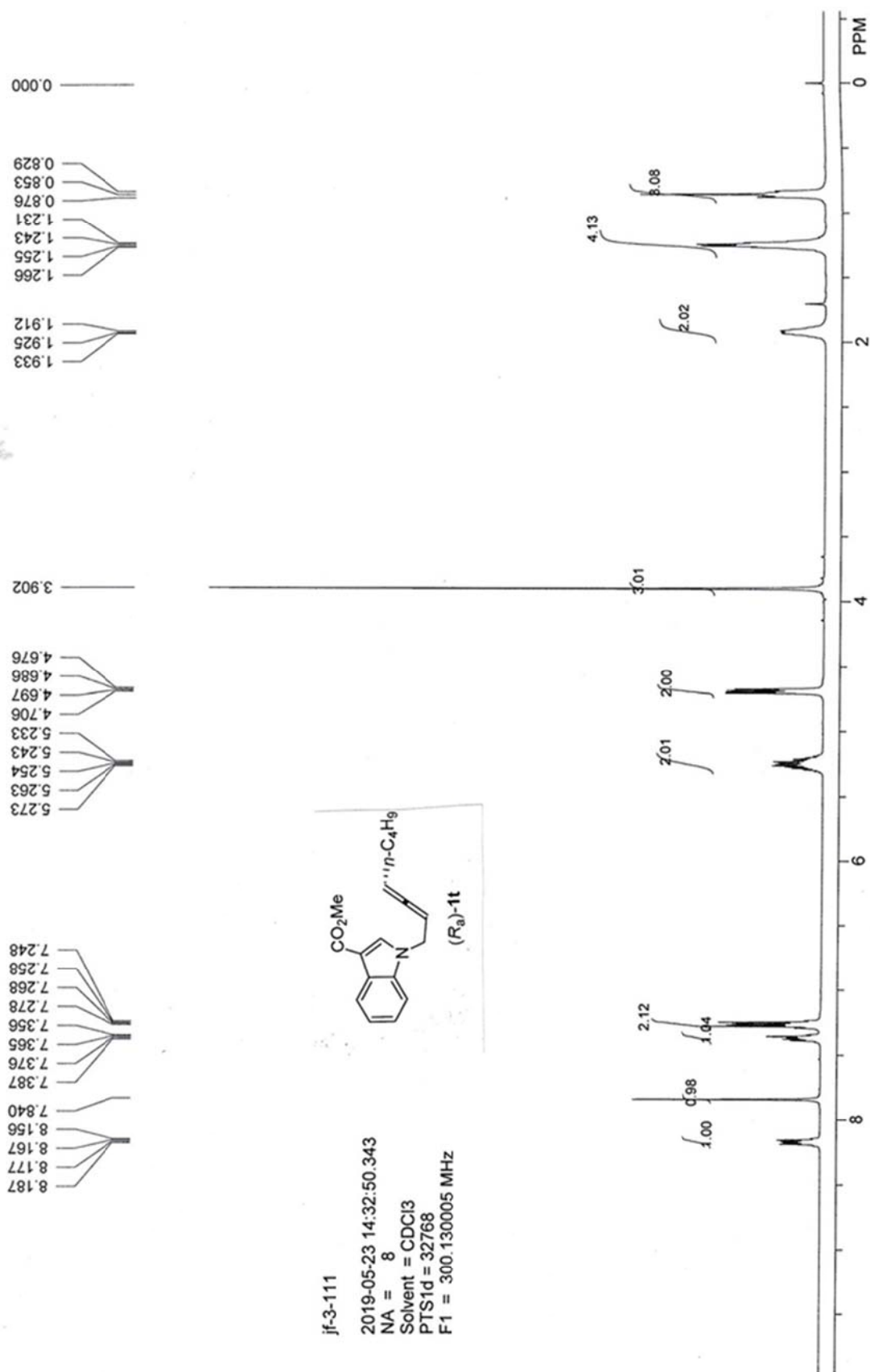
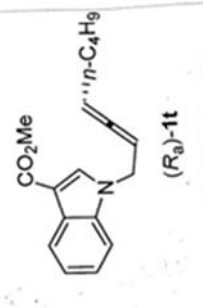
2019-05-23 14:32:50.343

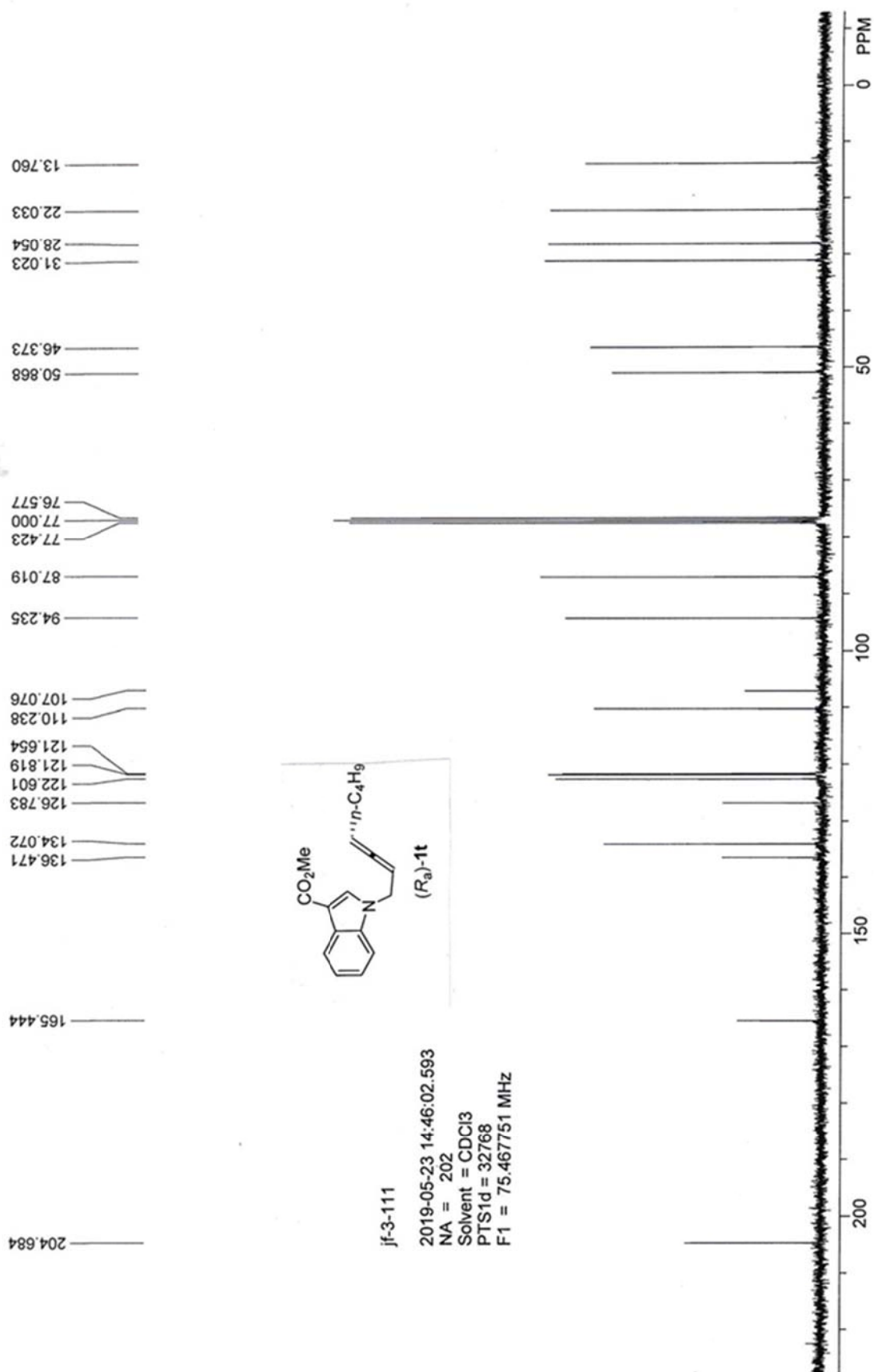
NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz



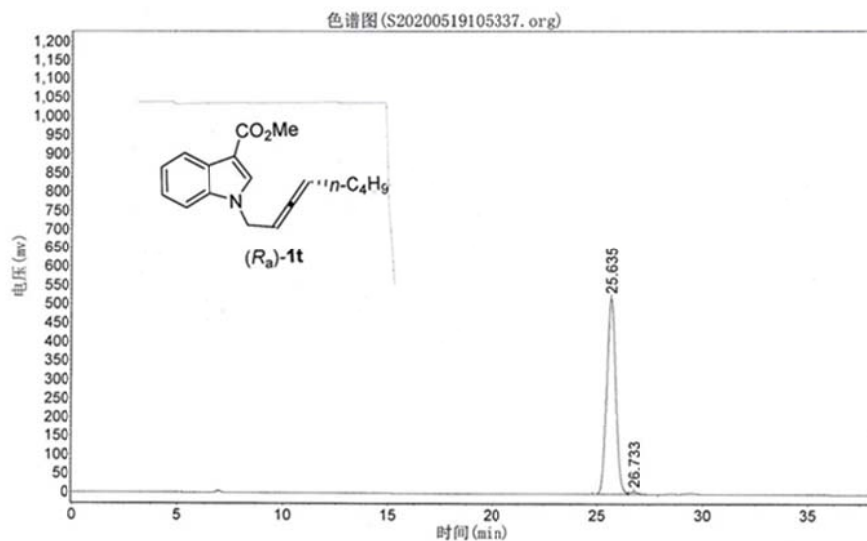


jf-3-111

实验时间: 2020-05-19, 10:53:37
谱图文件: D:\浙大智达\N2000\样品\S20200519105337.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-05-19, 12:33:40
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.5, 214



分析结果表

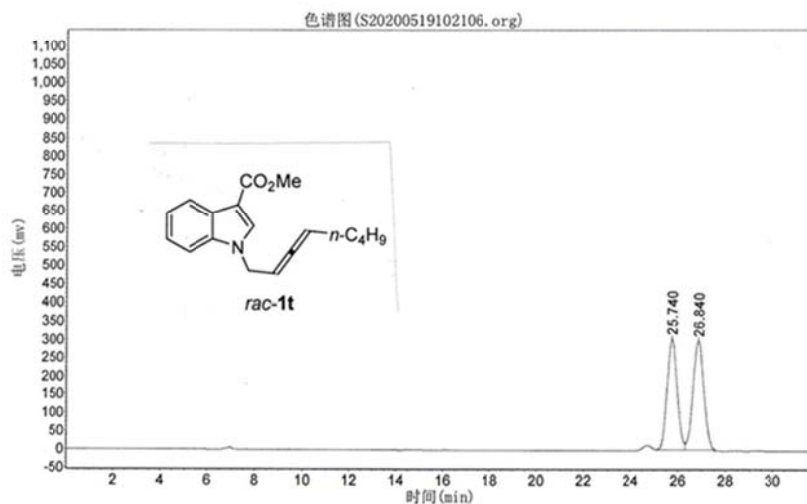
峰号	峰名	保留时间	峰高	峰面积	含量
1		25.635	517827.188	15417536.000	98.8937
2		26.733	5712.896	172470.844	1.1063
总计			523540.084	15590006.844	100.0000

jf-3-112

实验时间: 2020-05-19, 10:21:06
 谱图文件: D:\浙大智达\N2000\样品\S20200519102106.org
 方法文件: D:\浙大智达\N2000\djx.mtd

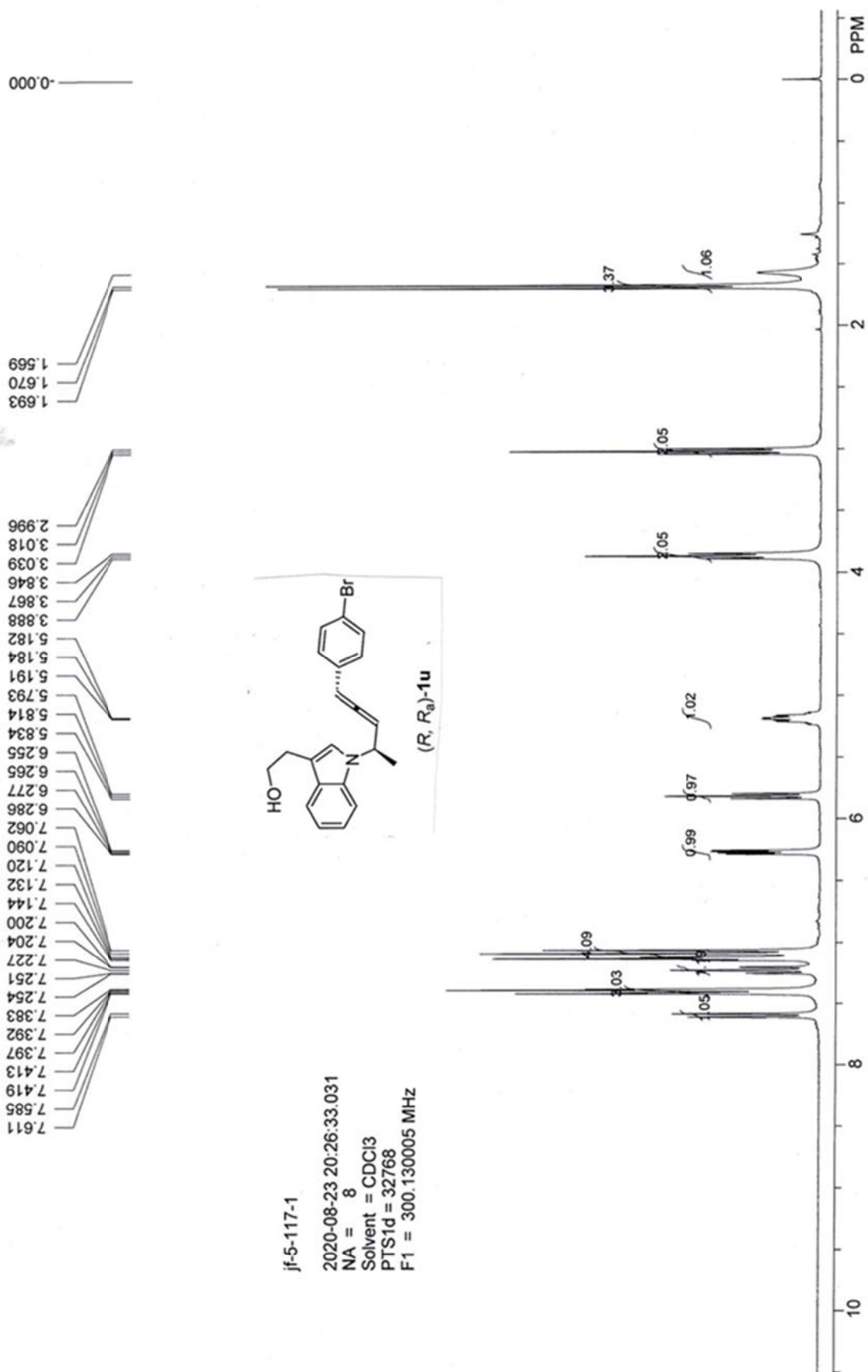
实验者: jf
 报告时间: 2020-05-19, 12:40:43
 积分方法: 面积归一法

实验内容简介:
 od, n-hexane/i-PrOH = 90/10, 0.5, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		25.740	302774.969	884655.000	48.5545
2		26.840	298169.438	9373410.000	51.4455
总计			600944.406	18220065.000	100.0000





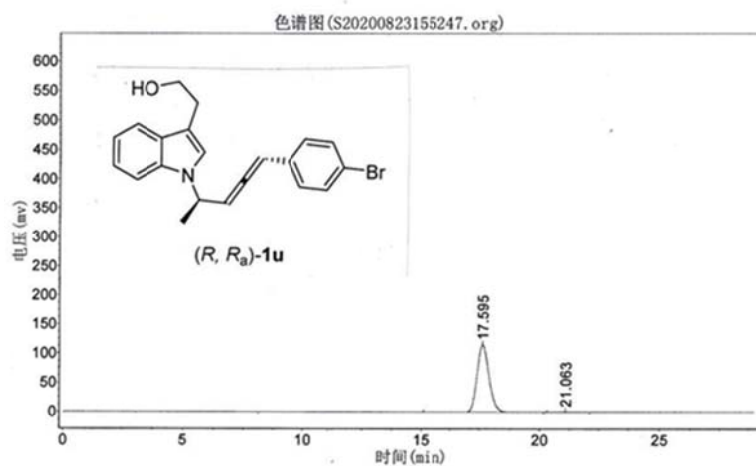
F1 = 75.467751 MHz

jf-5-117-1

实验时间: 2020-08-23, 15:52:47
谱图文件: D:\浙大智达\N2000\样品\S20200823155247.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-08-23, 18:28:43
积分方法: 面积归一法

实验内容简介:
OD-H, n-hexane/i-PrOH = 90/10, 1.0, 254



分析结果表

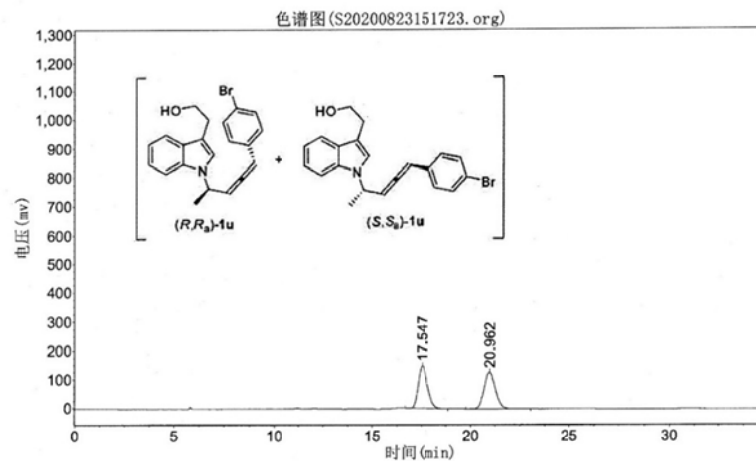
峰号	峰名	保留时间	峰高	峰面积	含量
1		17.595	114882.648	4000157.500	99.1567
2		21.063	872.019	34020.348	0.8433
总计			115754.668	4034177.848	100.0000

jf-5-116-1

实验时间: 2020-08-23, 15:17:23
谱图文件: D:\浙大智达\N2000\样品\S20200823151723.org
方法文件: D:\浙大智达\N2000\djx.mtd

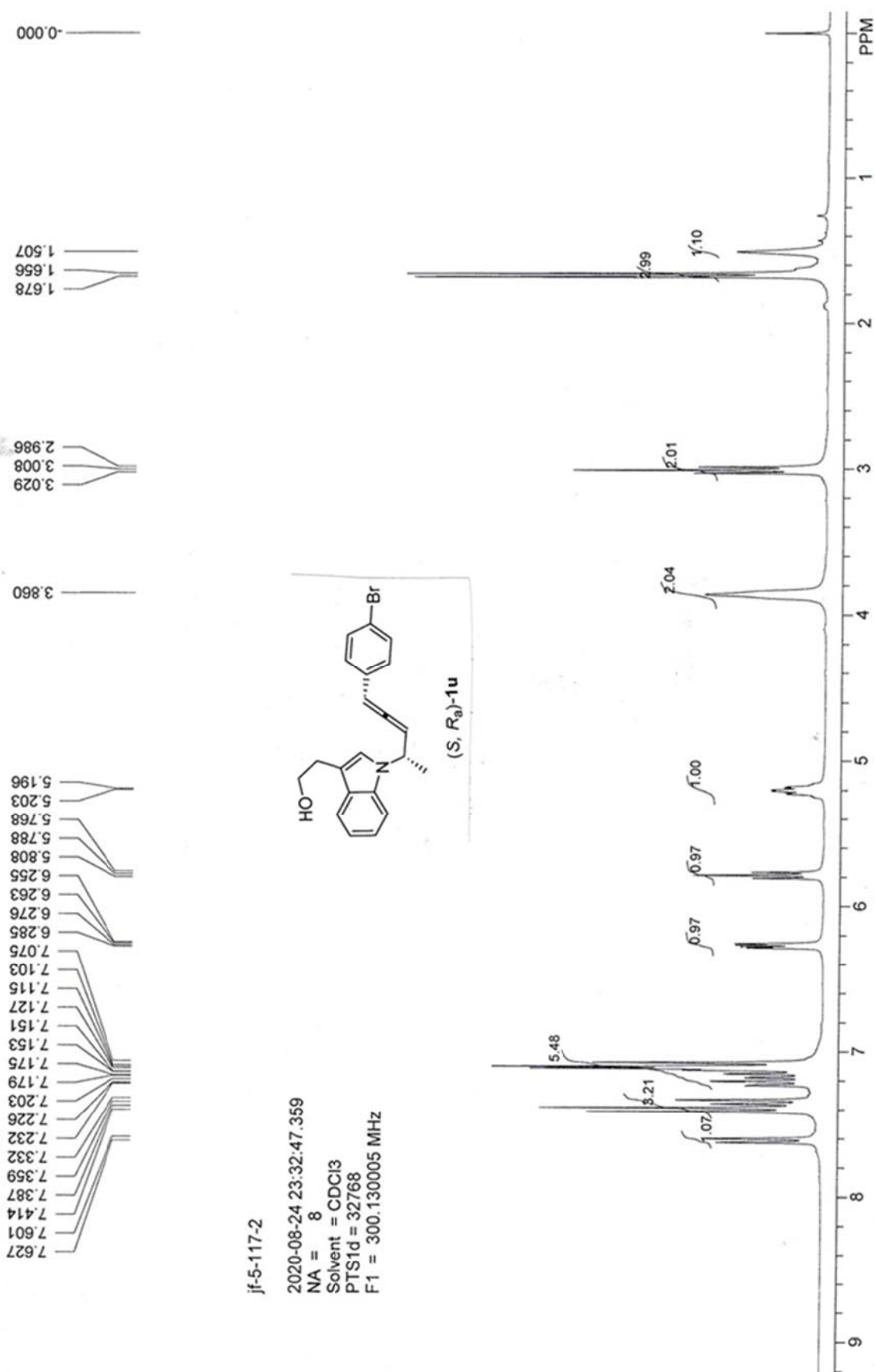
实验者: jf
报告时间: 2020-08-23, 18:30:20
积分方法: 面积归一法

实验内容简介:
OD-H, n-hexane/i-PrOH = 90/10, 1.0, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		17.547	146482.031	4955288.000	49.5083
2		20.962	126074.859	5053708.000	50.4917
总计			272556.891	10008996.000	100.0000



jf-5-117-2

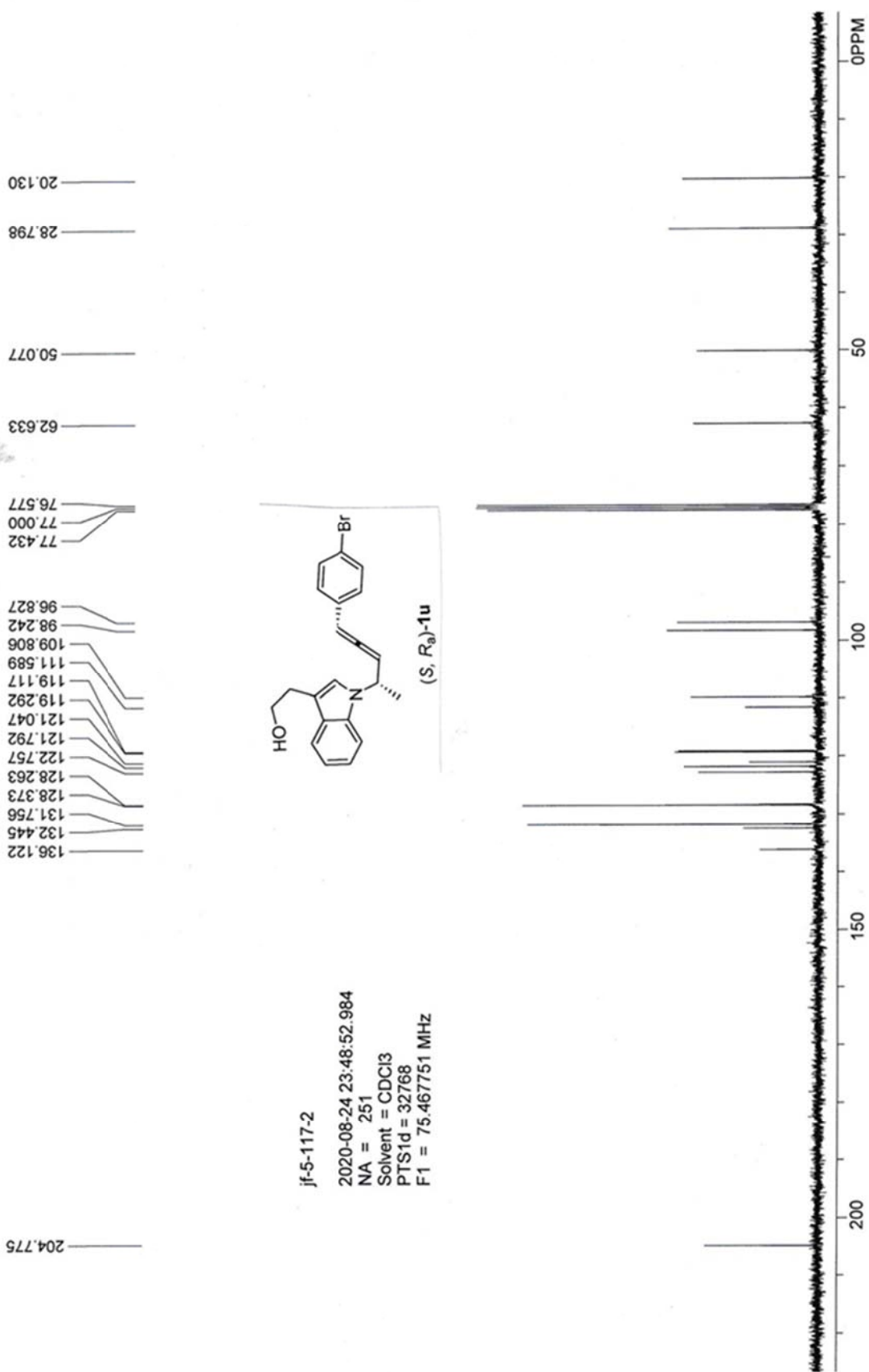
2020-08-24 23:32:47.359

NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz



jf-5-117-2

2020-08-24 23:48:52.984

NA = 251

Solvent = CDCl₃

PTS1d = 32768

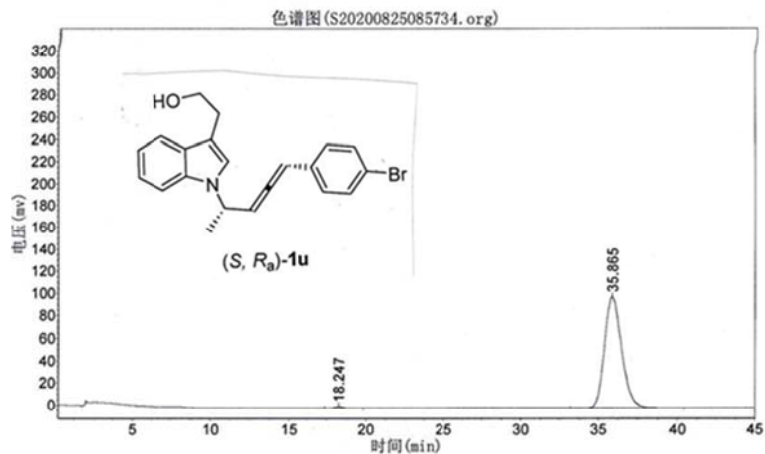
F1 = 75.467751 MHz

jf-5-117-2

实验时间: 2020-08-25, 8:57:34
谱图文件: D:\浙大智达\N2000\样品\S20200825085734.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-08-25, 9:44:43
积分方法: 面积归一法

实验内容简介:
od-H, n-hexane/i-PrOH = 90/10, 1.0, 254



分析结果表

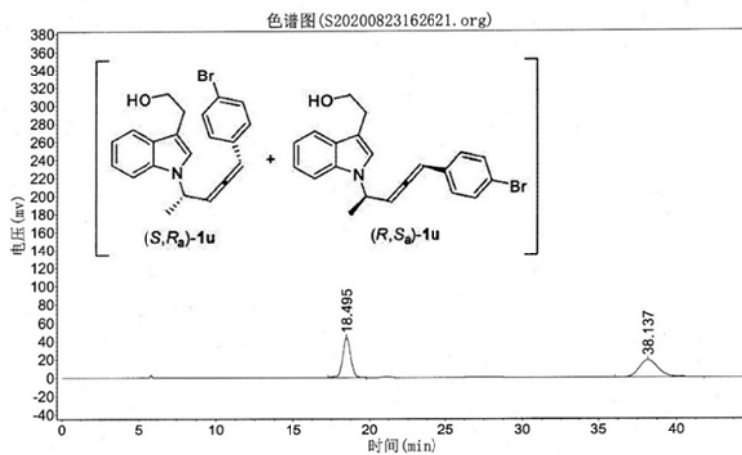
峰号	峰名	保留时间	峰高	峰面积	含量
1		18.247	1496.564	46197.156	0.6132
2		35.865	98654.328	7487584.500	99.3868
总计			100150.892	7533781.656	100.0000

jf-5-116-2

实验时间: 2020-08-23, 16:26:21
谱图文件: D:\浙大智达\N2000\样品\S20200823162621.org
方法文件: D:\浙大智达\N2000\djx.mtd

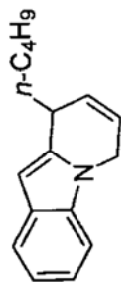
实验者: jf
报告时间: 2020-08-23, 18:23:57
积分方法: 面积归一法

实验内容简介:
OD-H, n-hexane/i-PrOH = 90/10, 1.0, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		18.495	43026.918	1562052.125	50.1923
2		38.137	18605.803	1550085.500	49.8077
总计			61632.721	3112137.625	100.0000



rac-2a

jf-2-026_1.1

2018-07-18 12:18:02.359

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

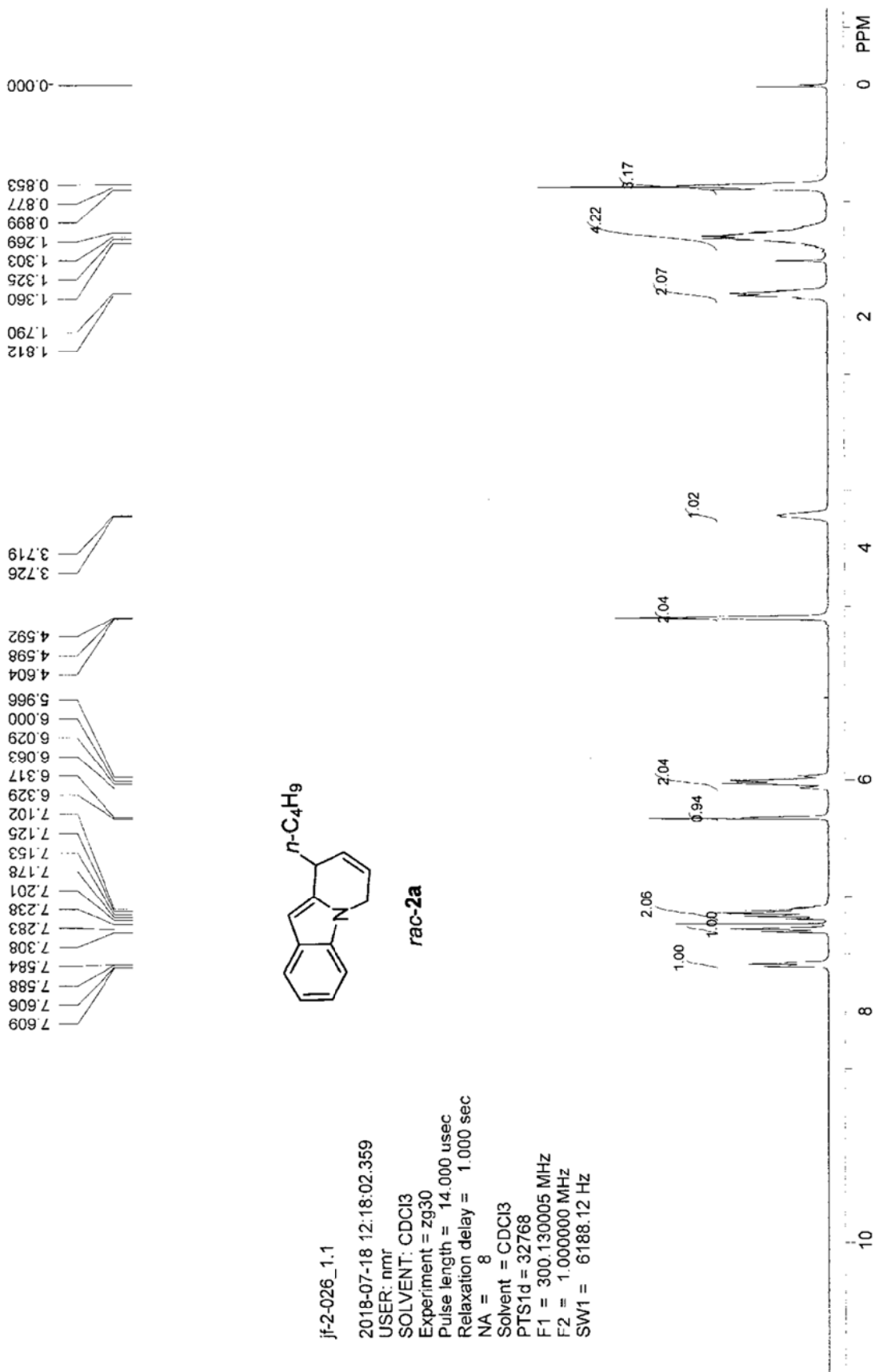
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-2-026_2.1

2018-07-18 13:13:45.171

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 932

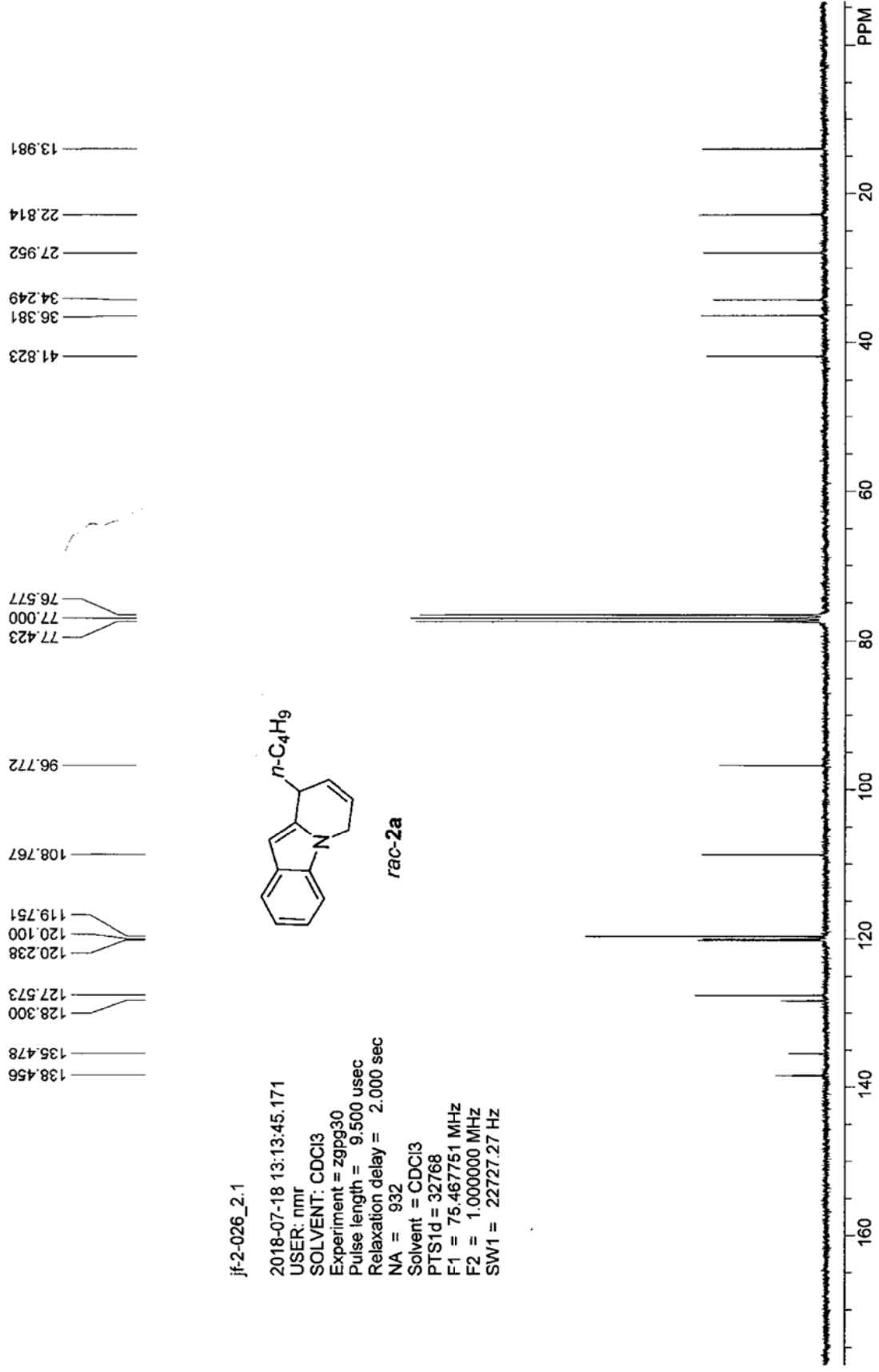
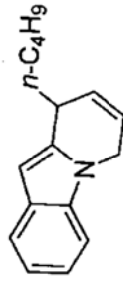
Solvent = CDCl₃

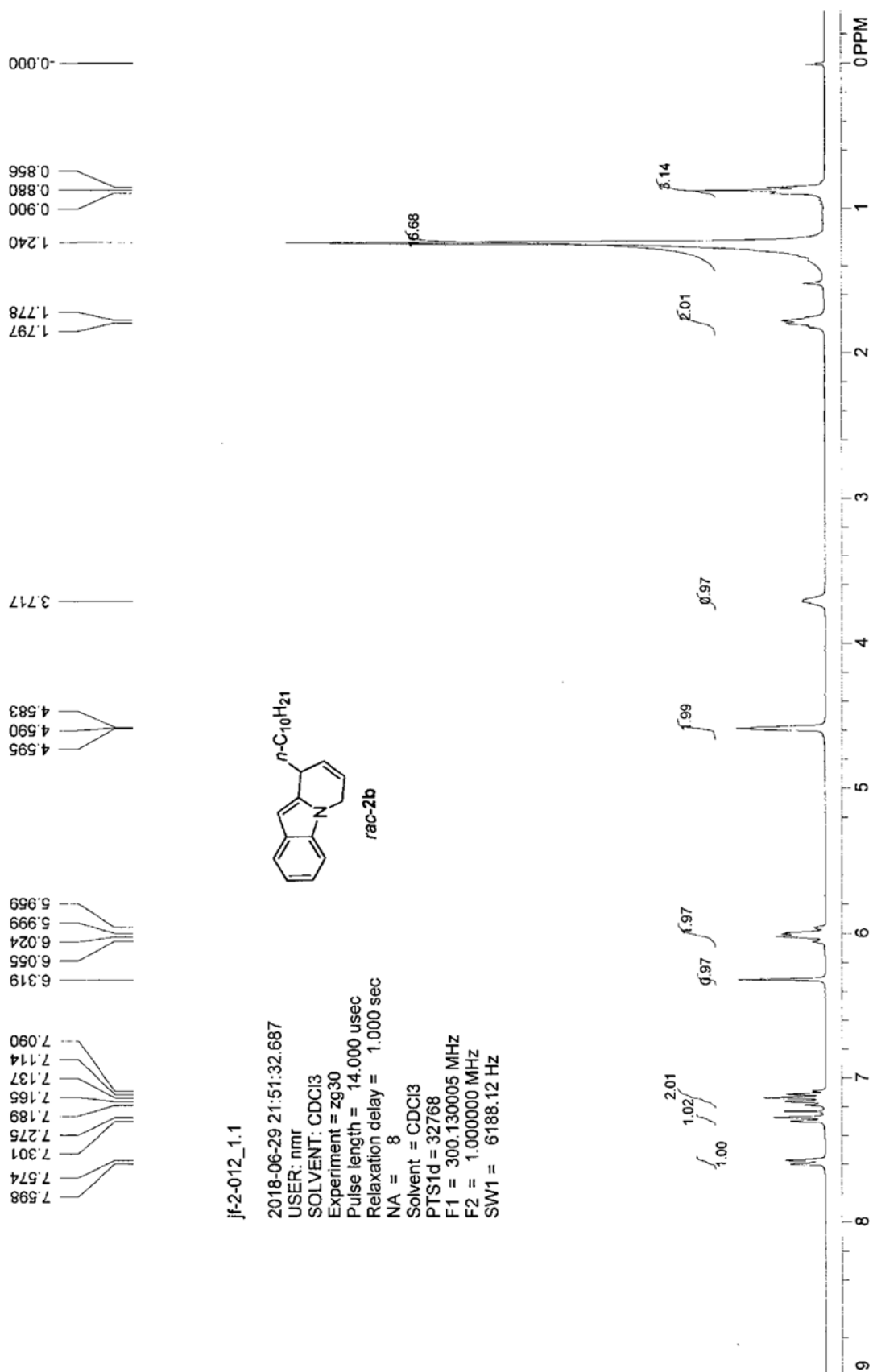
PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

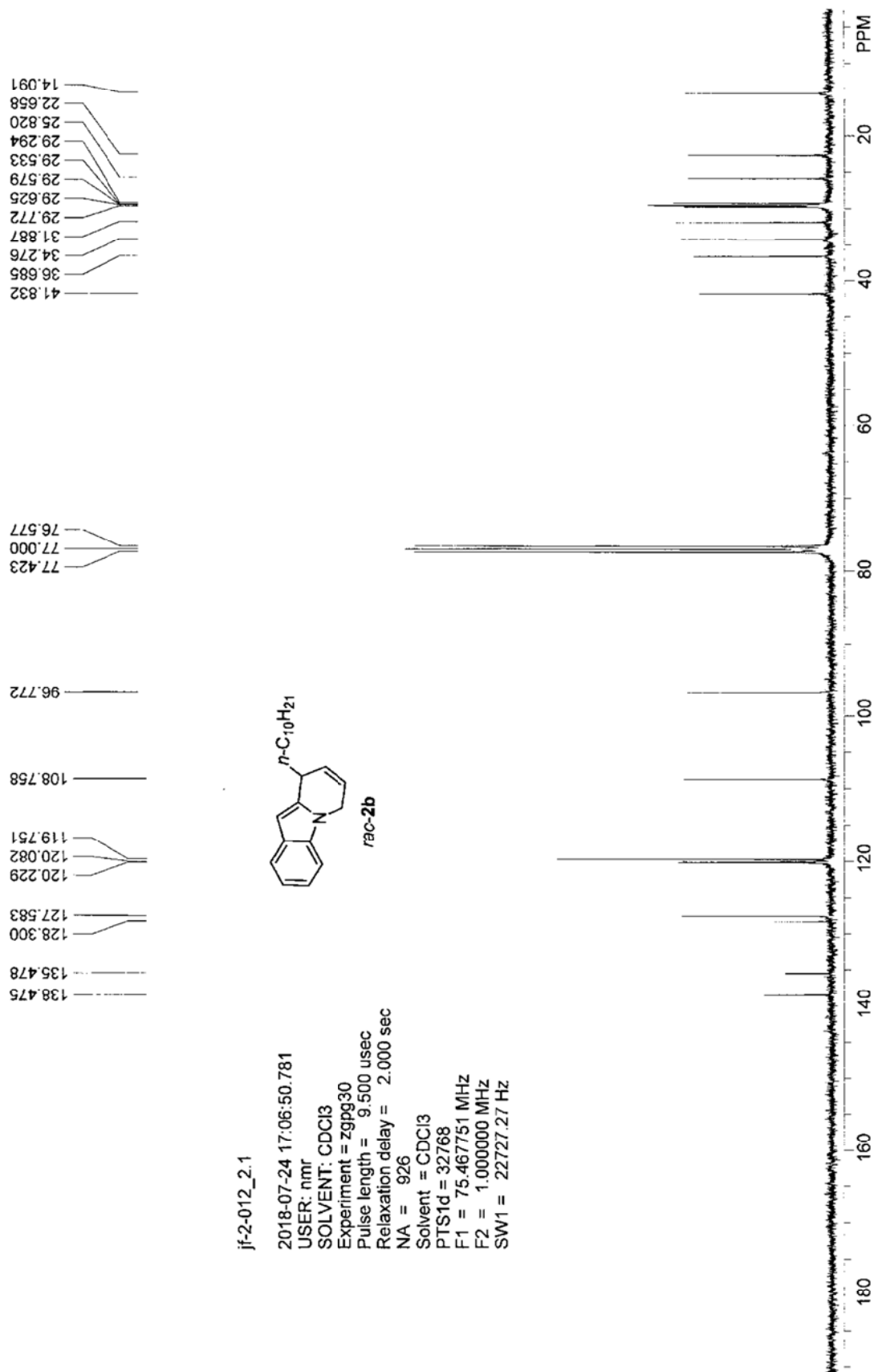
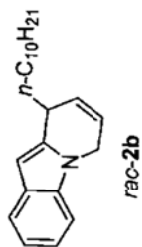
SW1 = 22727.27 Hz





jf-2-012_2.1

2018-07-24 17:06:50.781
USER: nmr
SOLVENT: CDCl₃
Experiment = zgpg30
Pulse length = 9.500 usec
Relaxation delay = 2.000 sec
NA = 926
Solvent = CDCl₃
PTS1d = 32768
F1 = 75.467751 MHz
F2 = 1.000000 MHz
SW1 = 22727.27 Hz



jf-2-037_1.1

2018-07-20 16:18:37.109

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

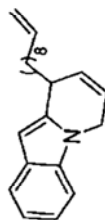
Solvent = CDCl₃

PTS1d = 32768

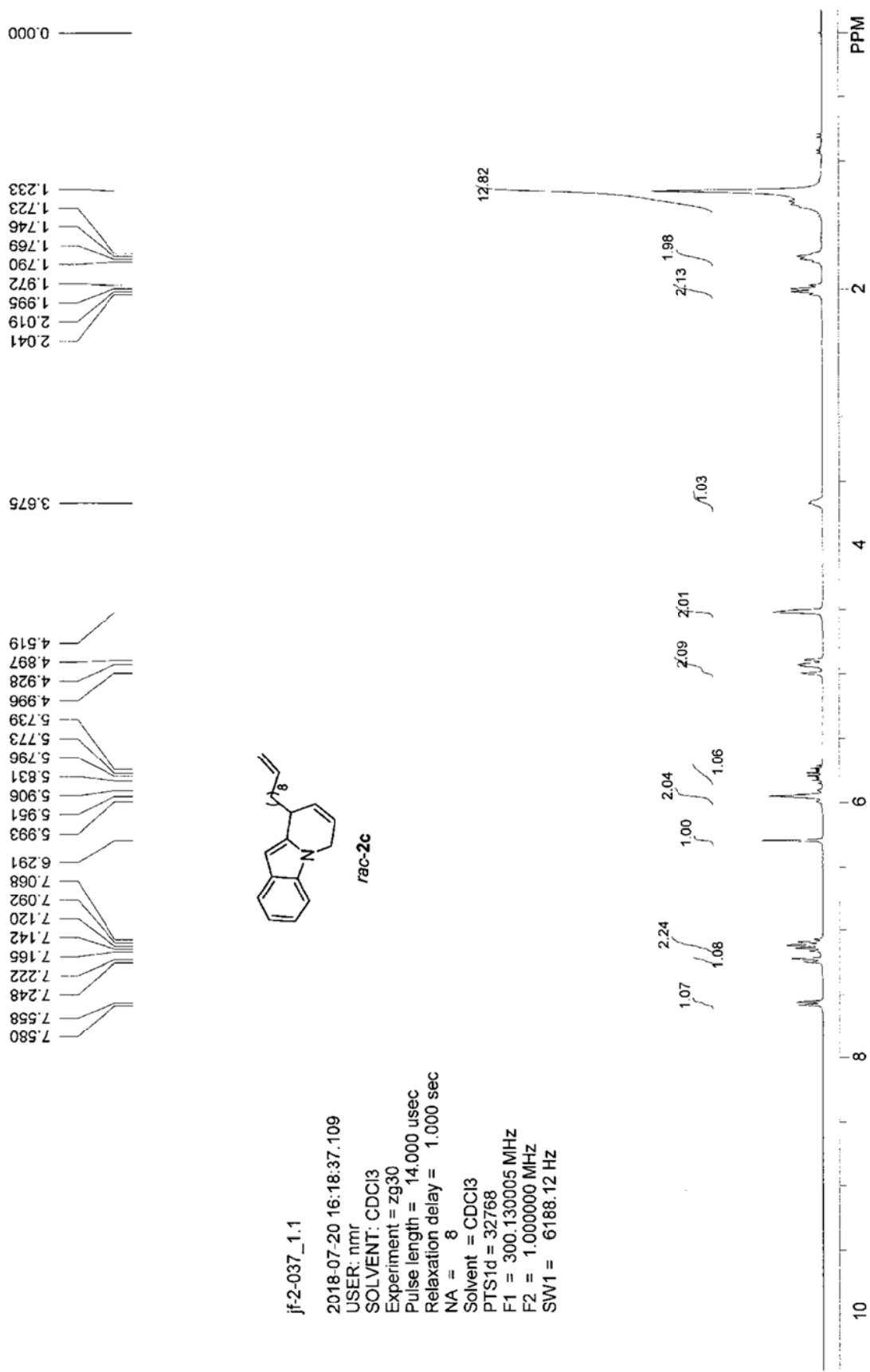
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



rac-2c



jf-2-037_2.1

2018-07-20 16:25:33.921

USER: nmf

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 93

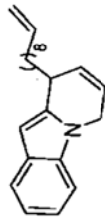
Solvent = CDCl₃

PTS1d = 32768

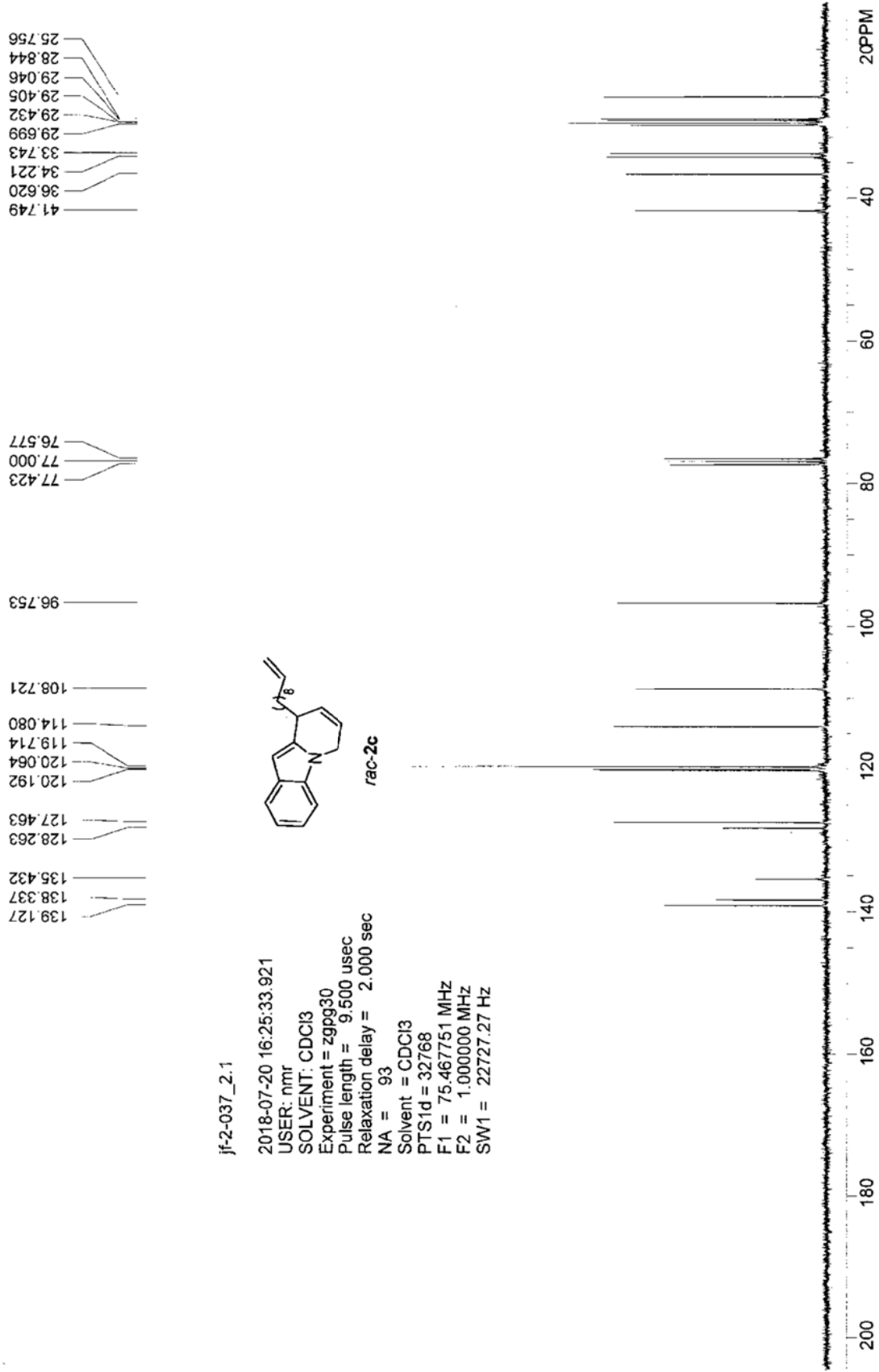
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



rac-2c



jf-2-004_1.1

2018-06-15 15:33:39.828

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

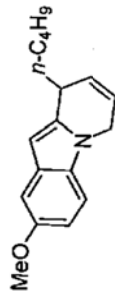
Solvent = CDCl₃

PTS1d = 32768

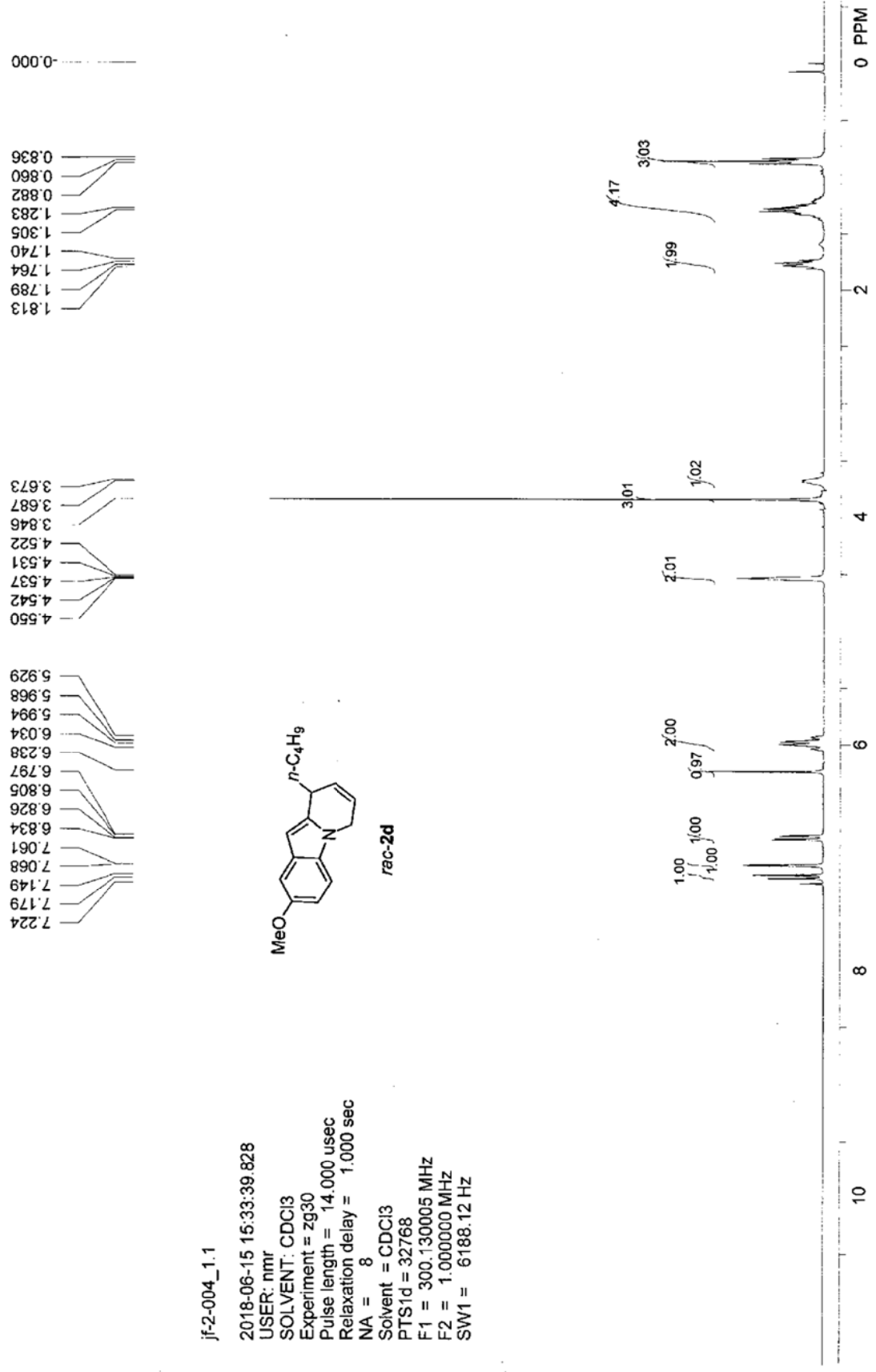
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



rac-2d



jf-2-004_2.1

2018-06-15 16:14:50.218

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 671

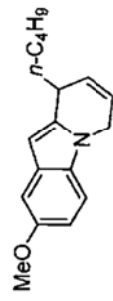
Solvent = CDCl₃

PTS1d = 32768

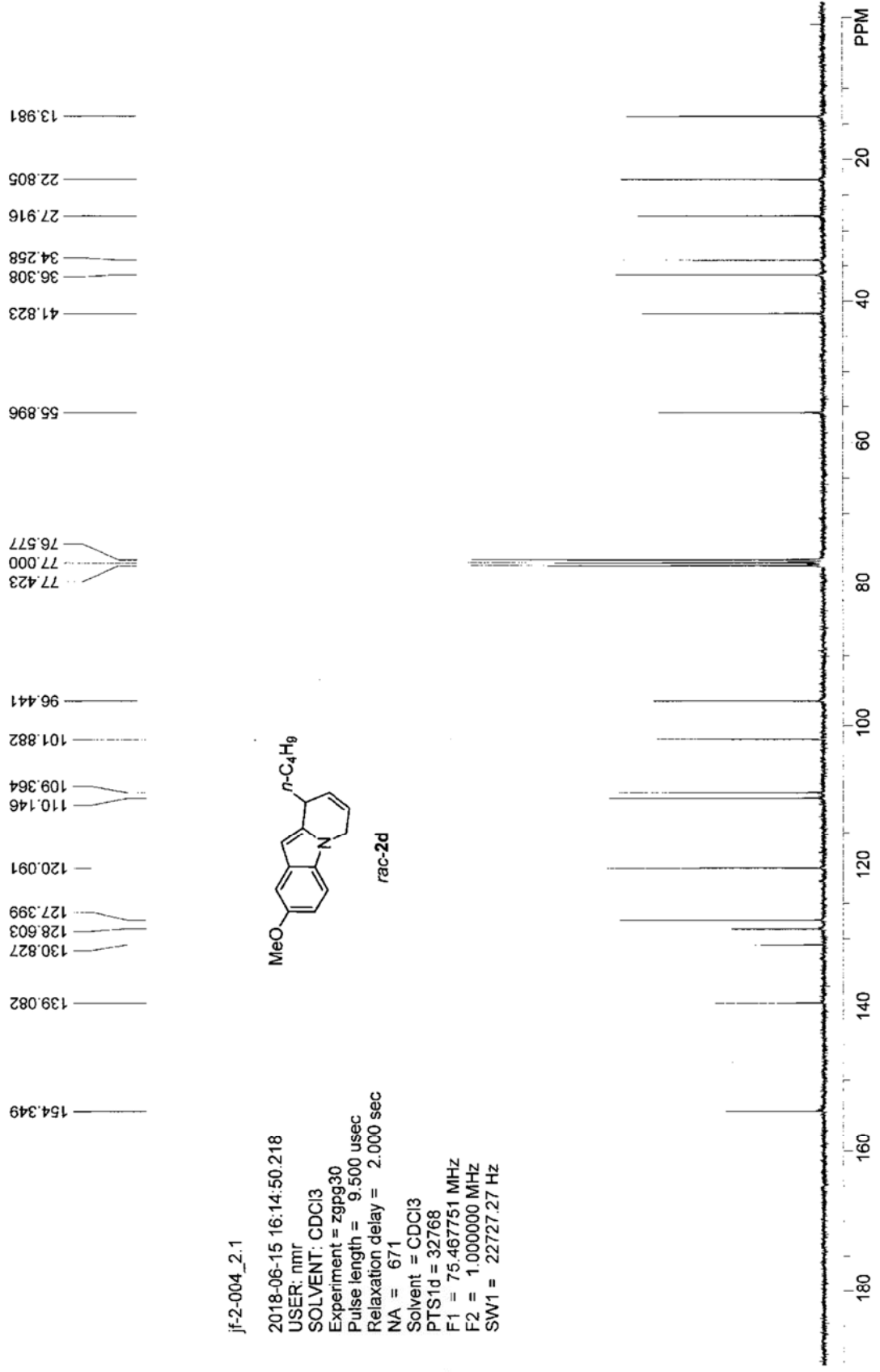
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



rac-2d



jf-2-045_1.1

2018-09-28 09:38:19.890

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

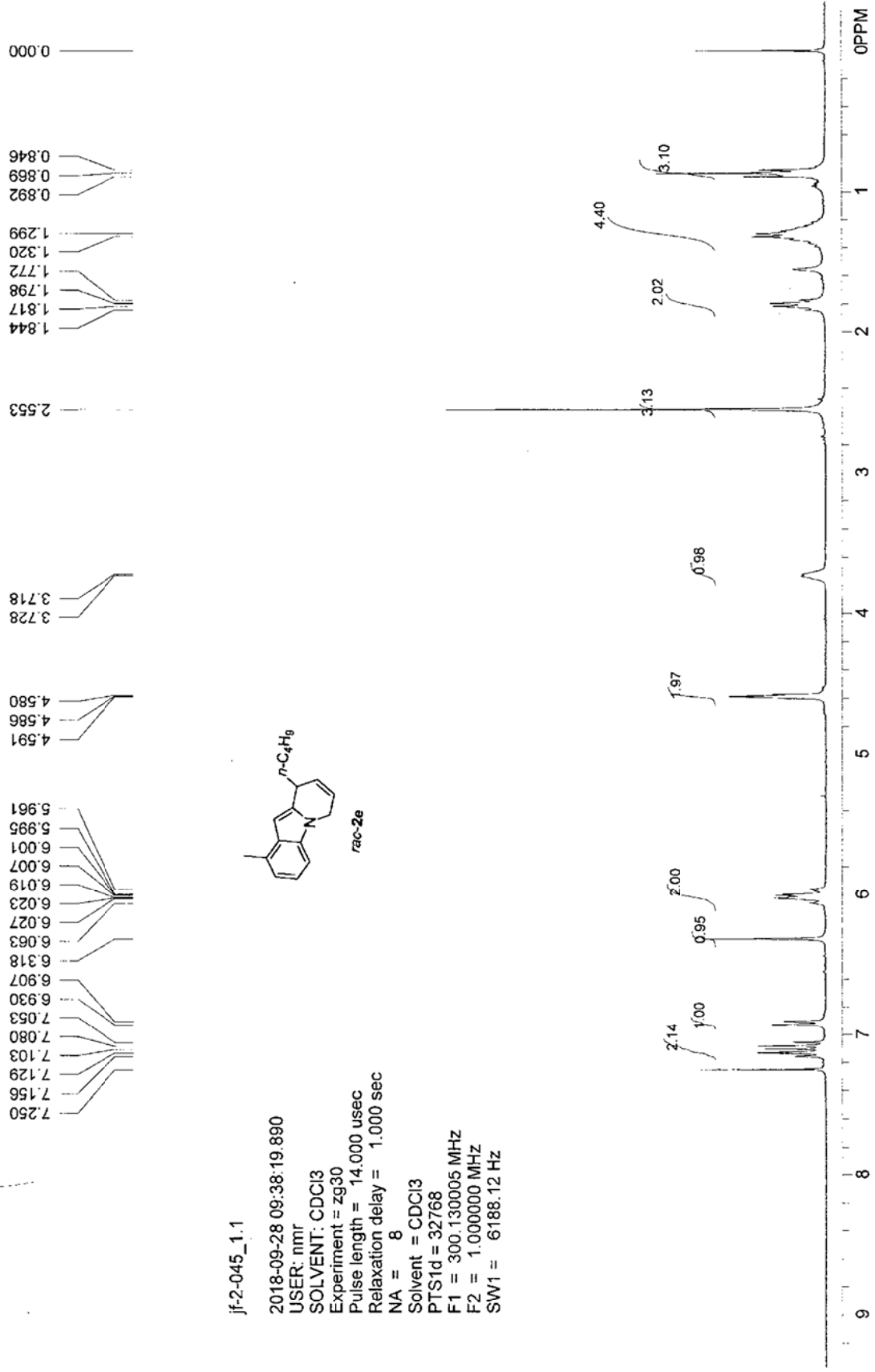
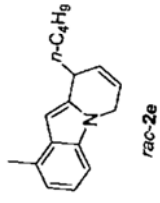
Solvent = CDCl₃

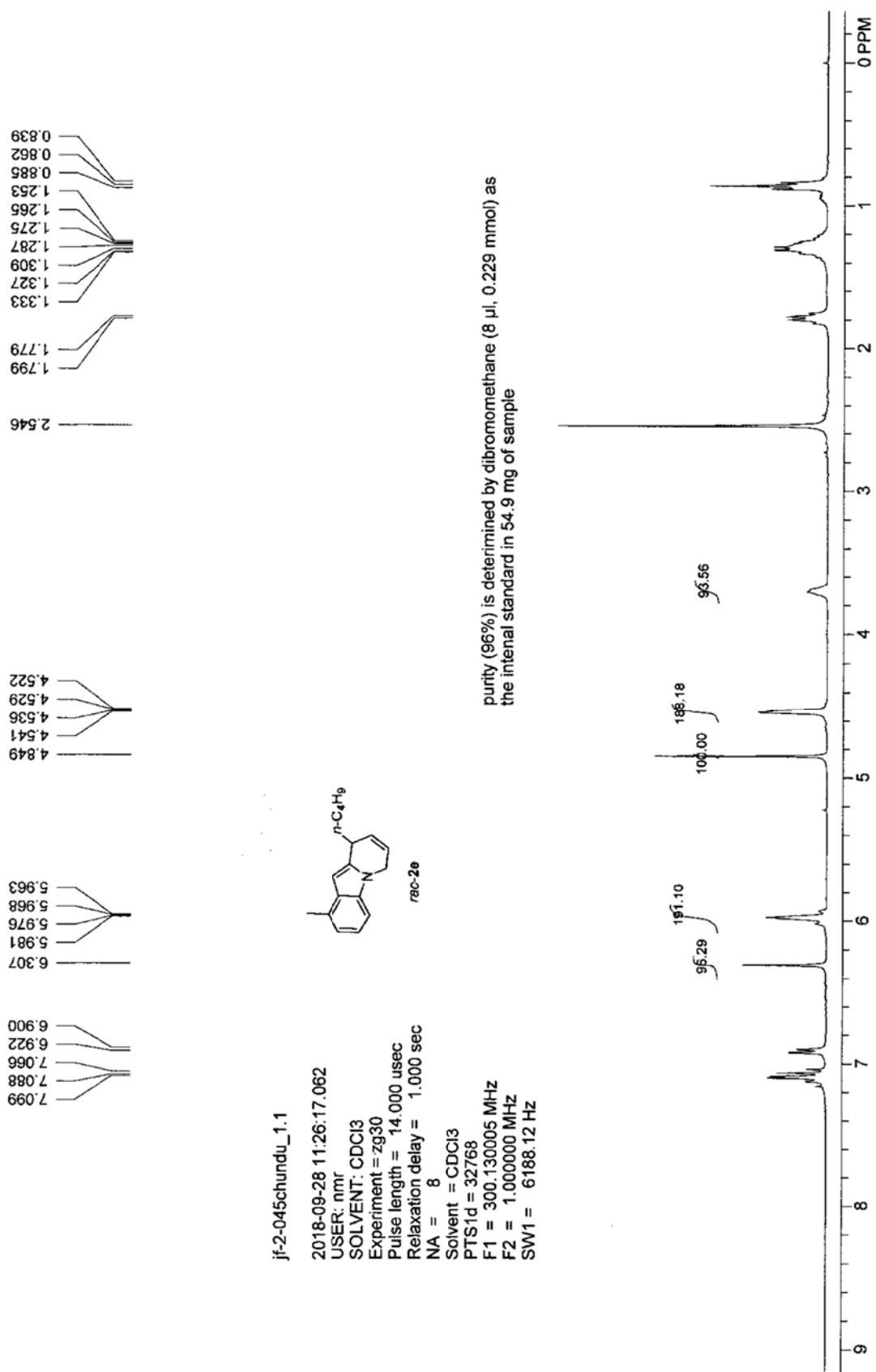
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jf-2-045_2.1

2018-09-06 23:03:06.062

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 231

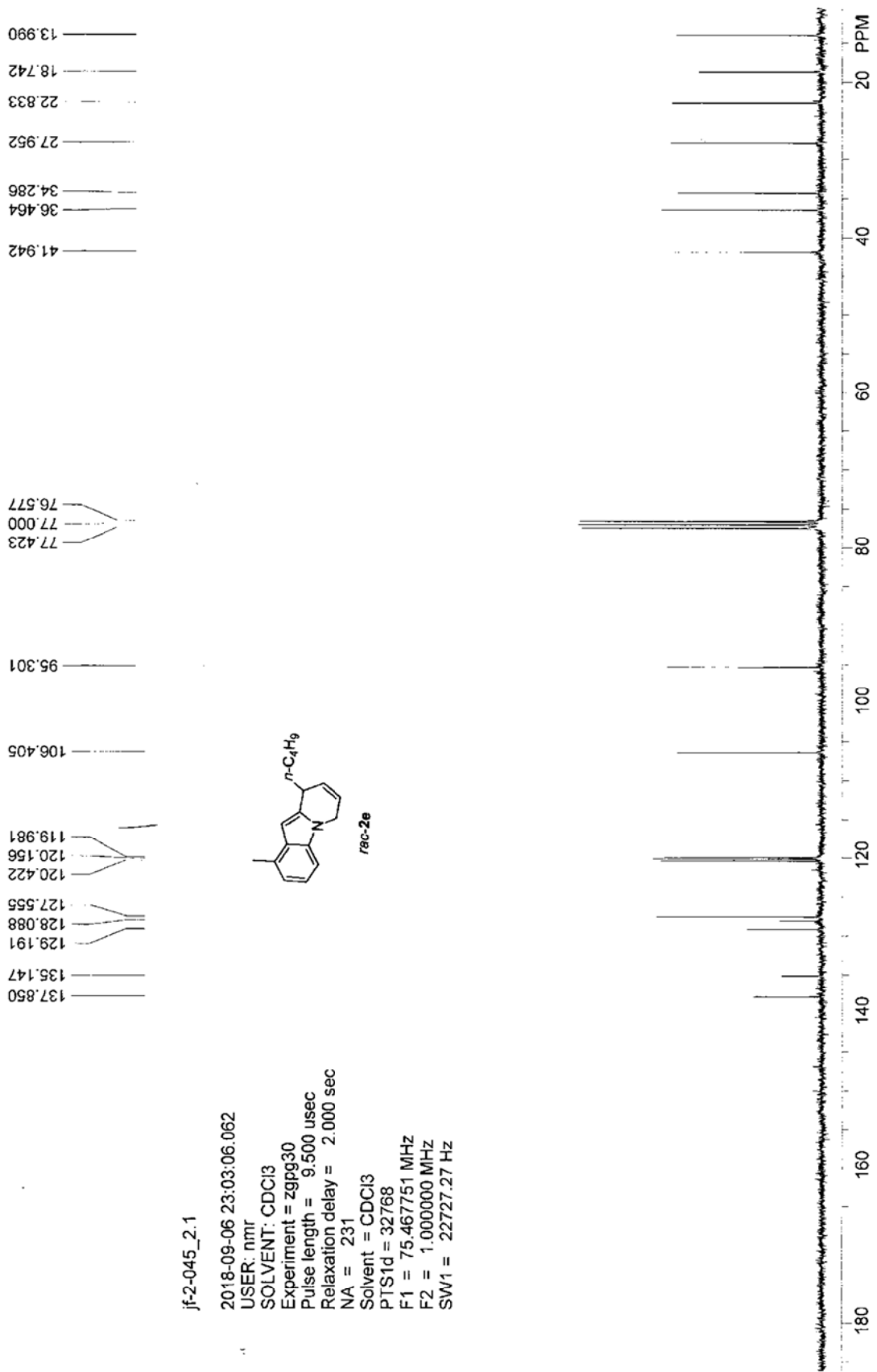
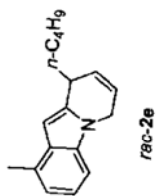
Solvent = CDCl₃

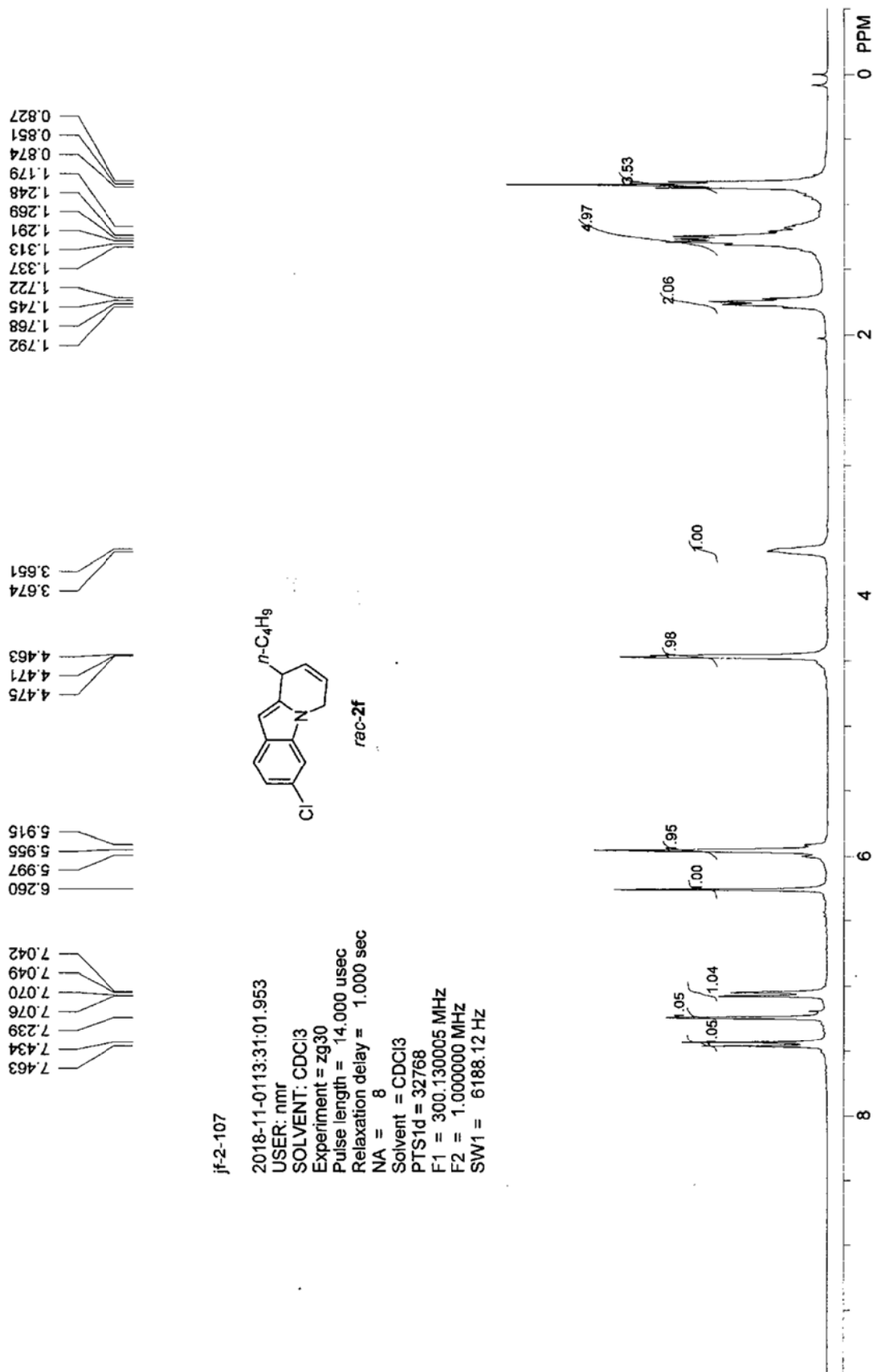
PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

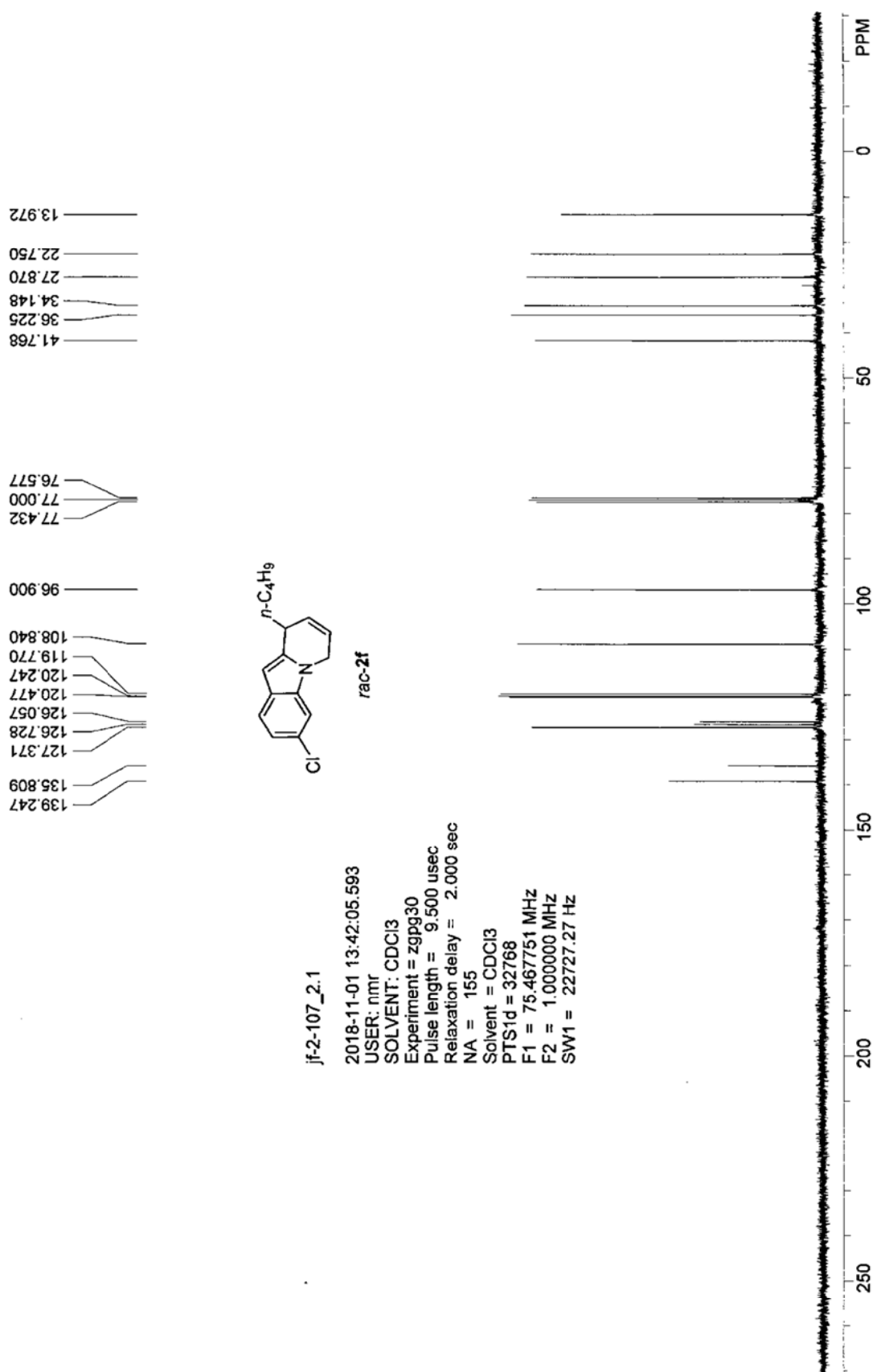
SW1 = 22727.27 Hz

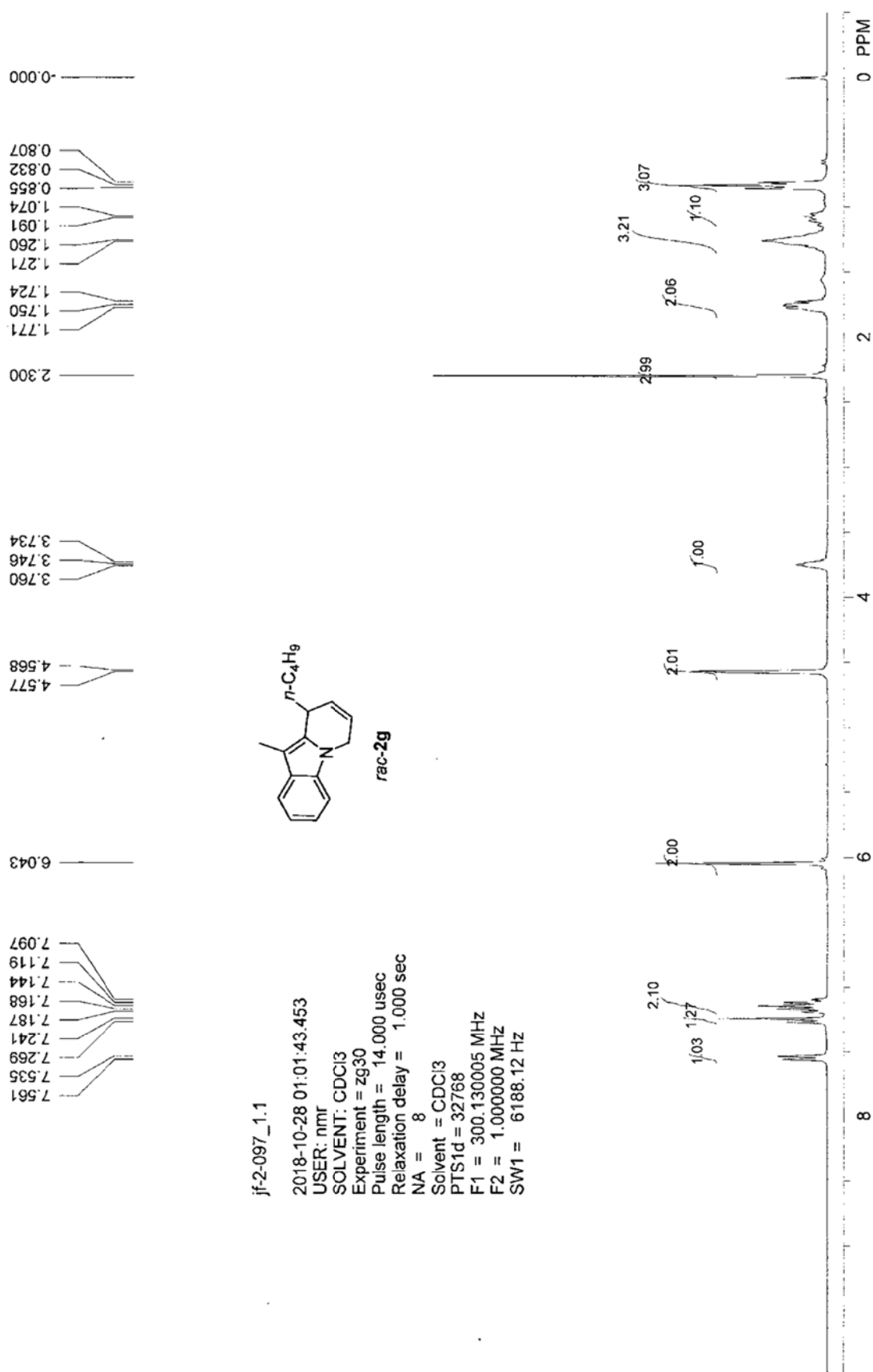


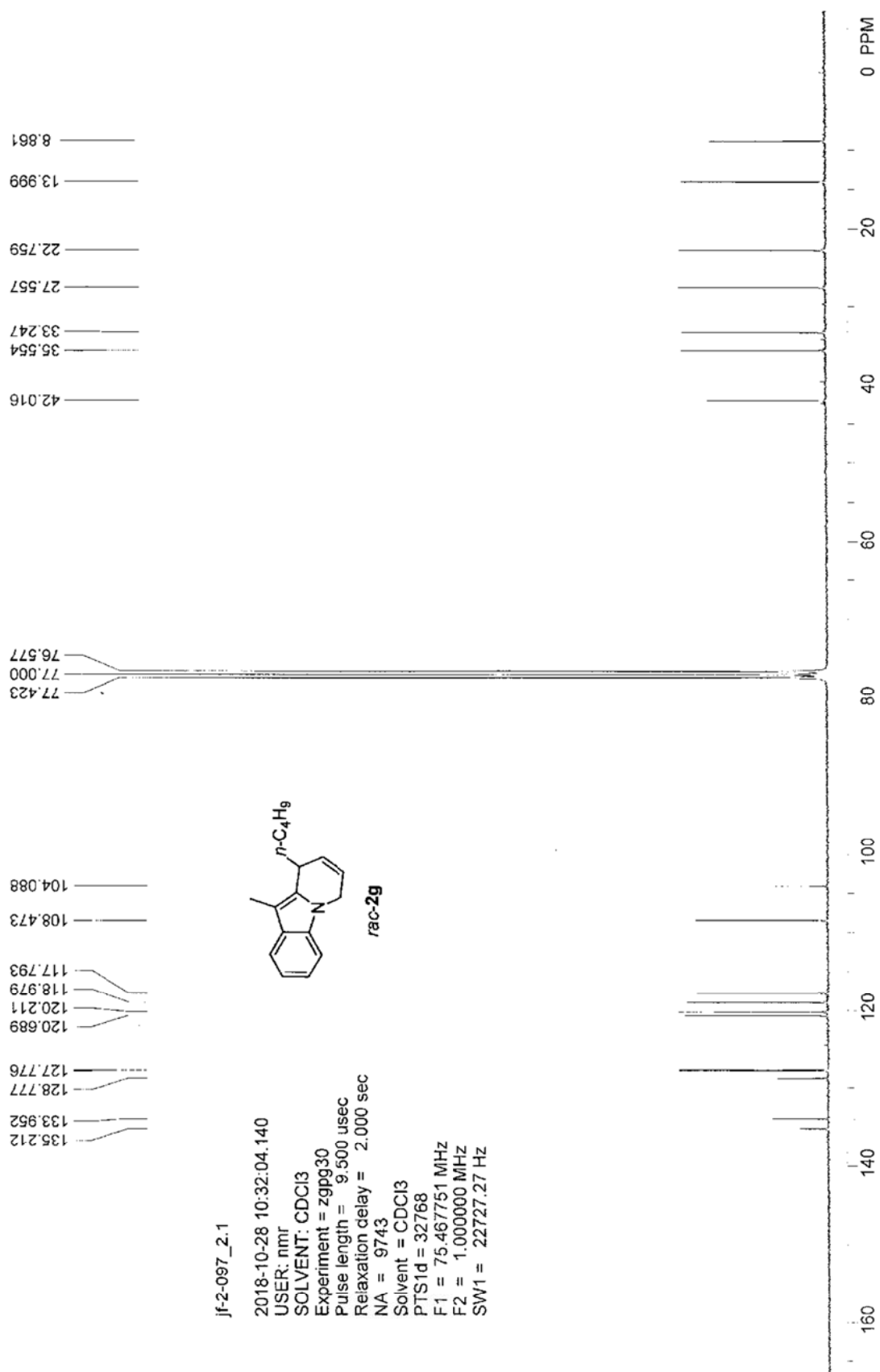


jf-2-107

2018-11-01 13:31:01.953
 USER: nmr
 SOLVENT: CDCl₃
 Experiment = zg30
 Pulse length = 14,000 usec
 Relaxation delay = 1,000 sec
 NA = 8
 Solvent = CDCl₃
 PTS1d = 32768
 F1 = 300.130005 MHz
 F2 = 1,000000 MHz
 SW1 = 6188.12 Hz







jjf-2-152_1.1

2018-12-08 16:58:23.765

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

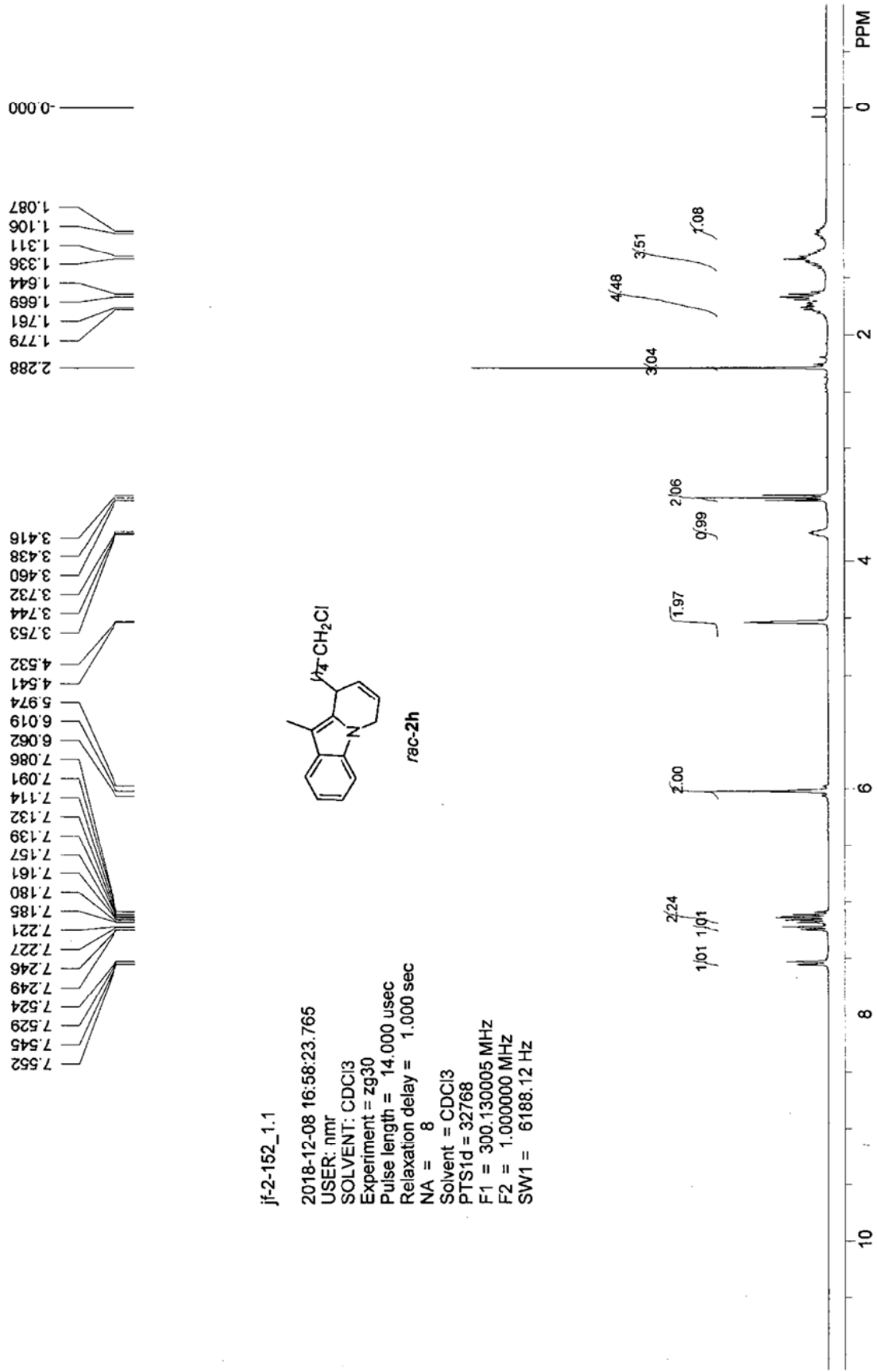
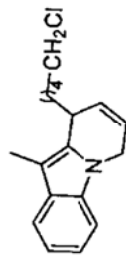
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-2-152_2.1

2018-12-08 17:05:33.562

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 105

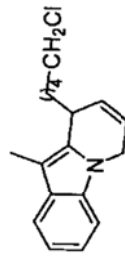
Solvent = CDCl₃

PTS1d = 32768

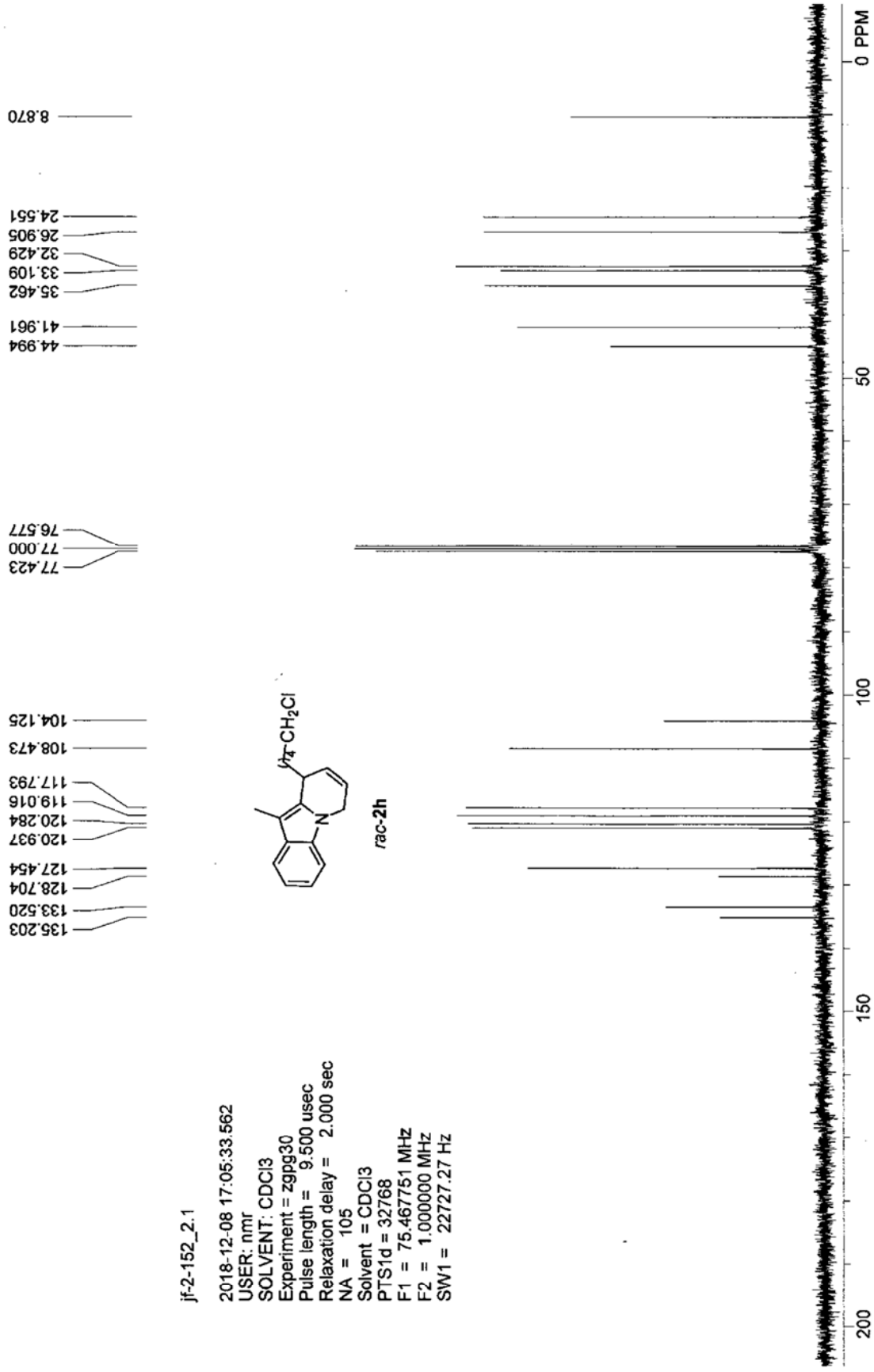
F1 = 75.467751 MHz

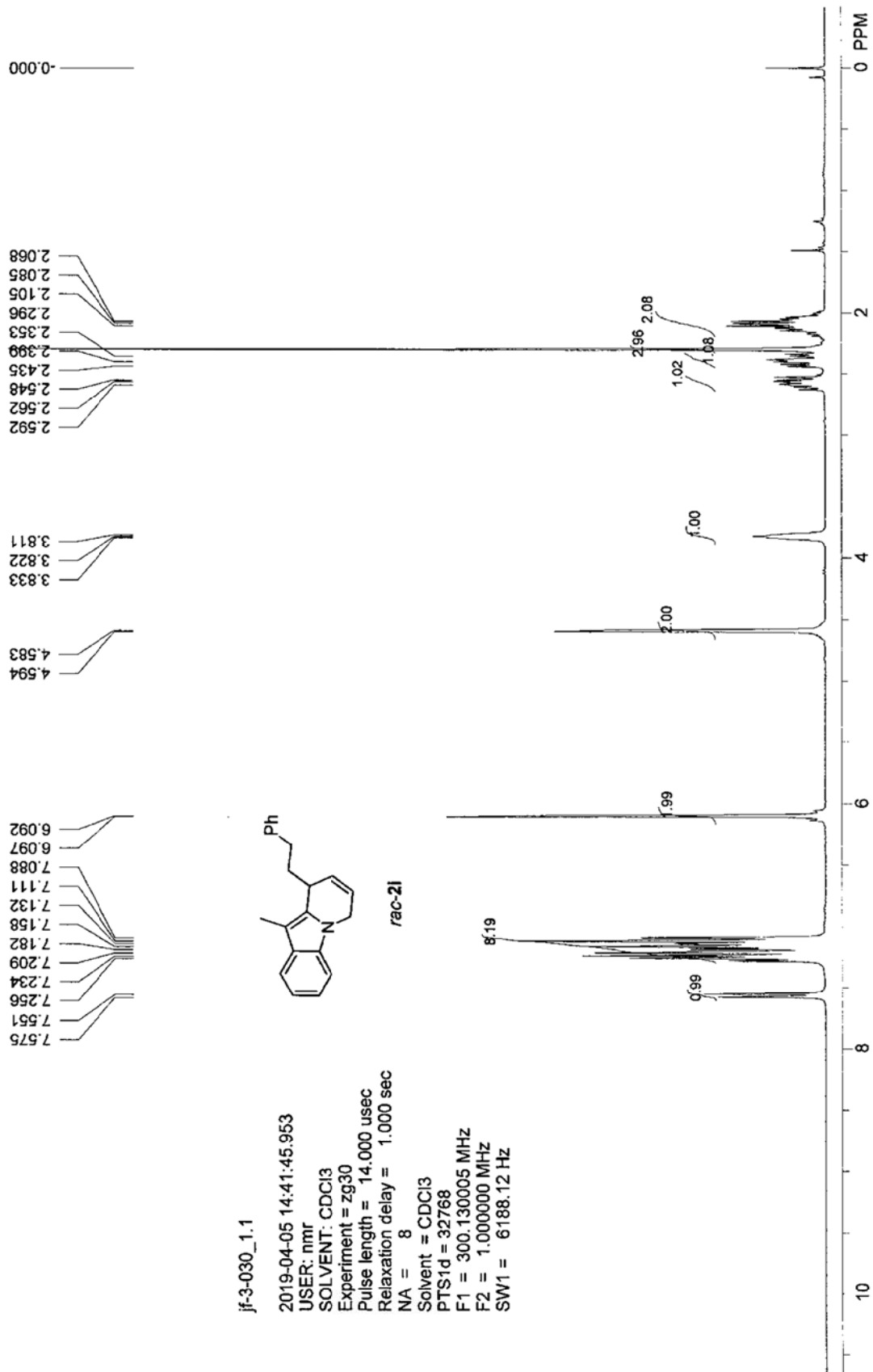
F2 = 1.000000 MHz

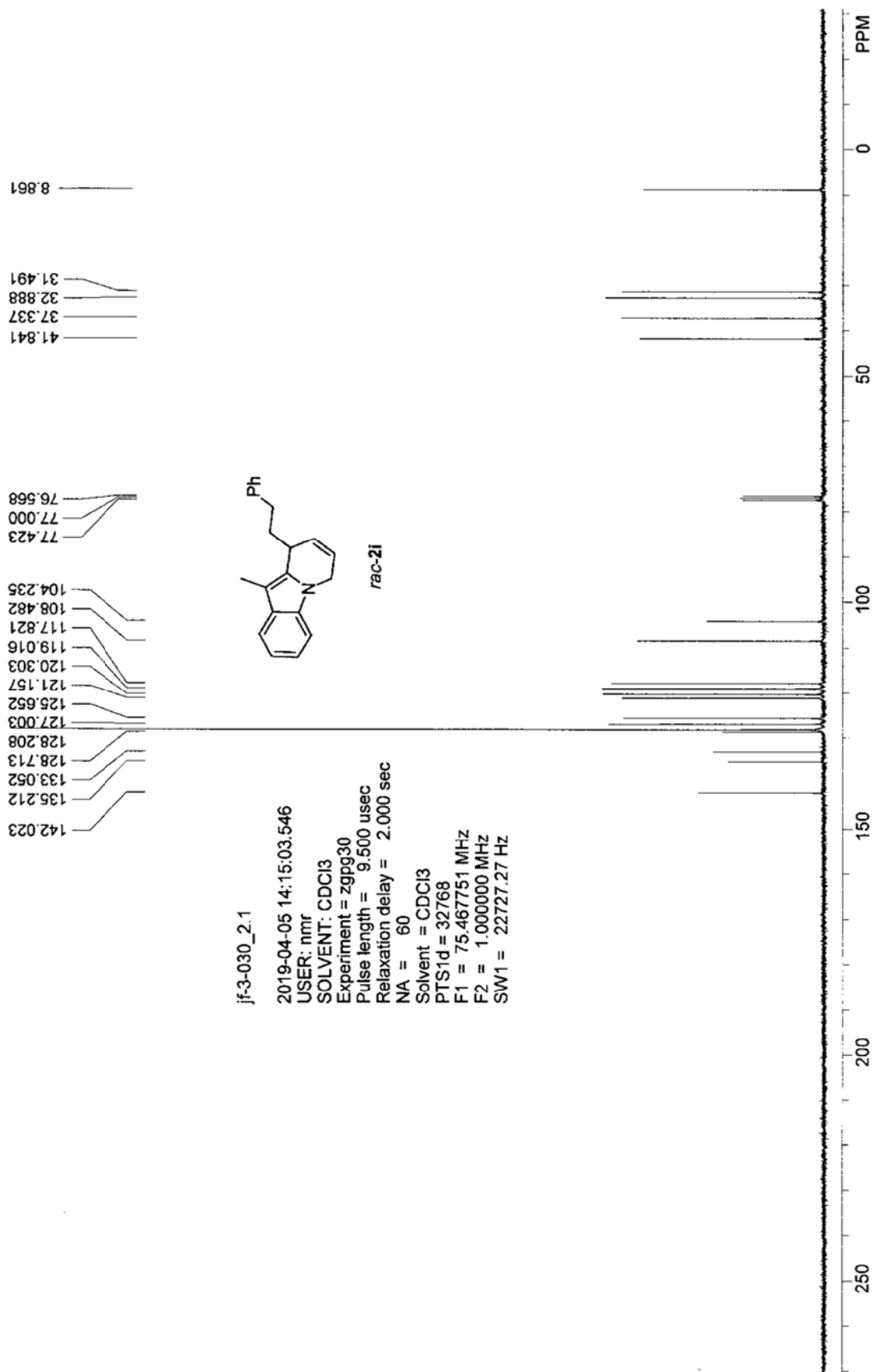
SW1 = 22727.27 Hz



rac-2h







jf-3-094_11.1

2019-05-14 22:46:47.125

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

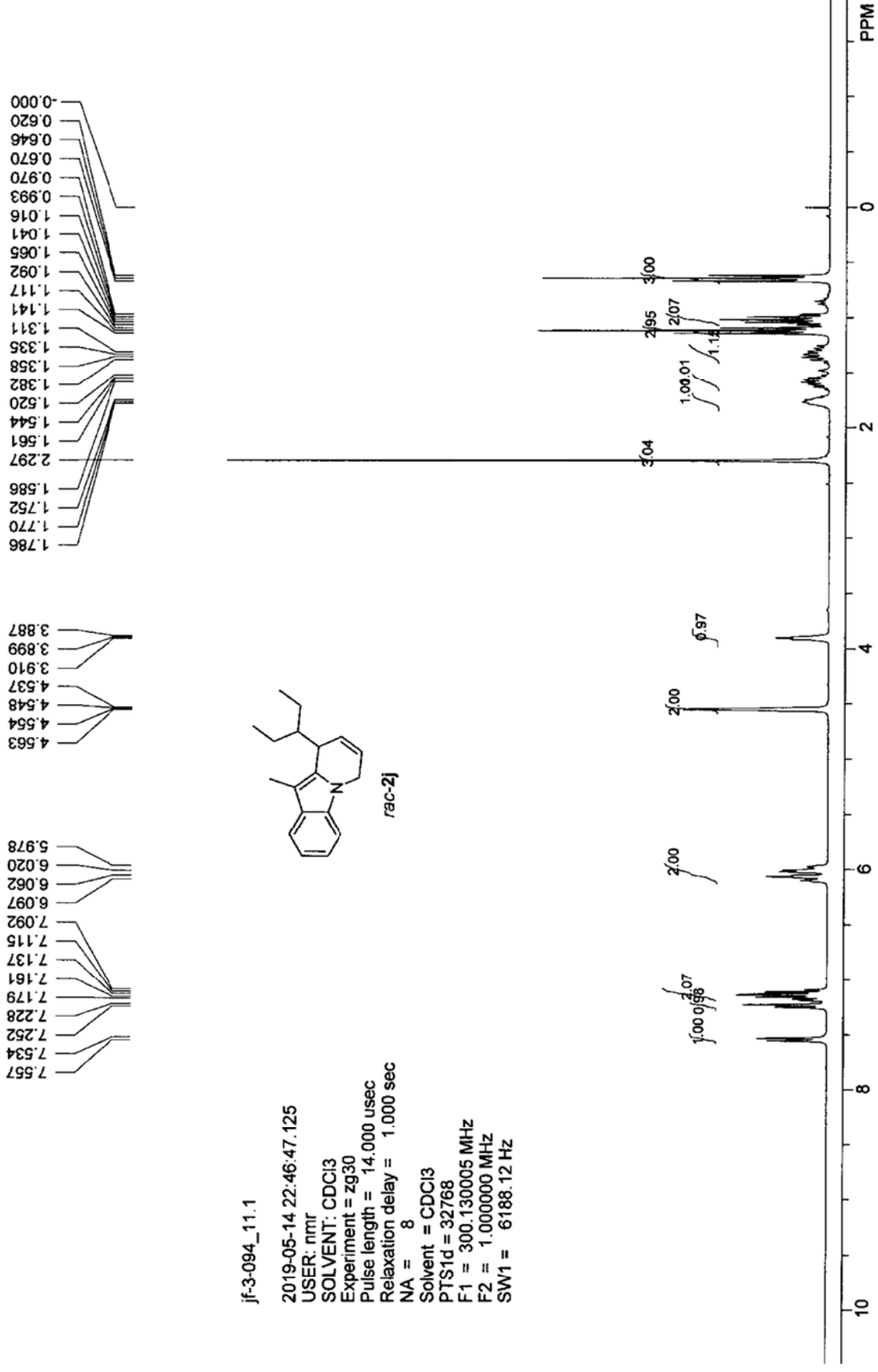
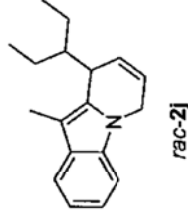
Solvent = CDCl₃

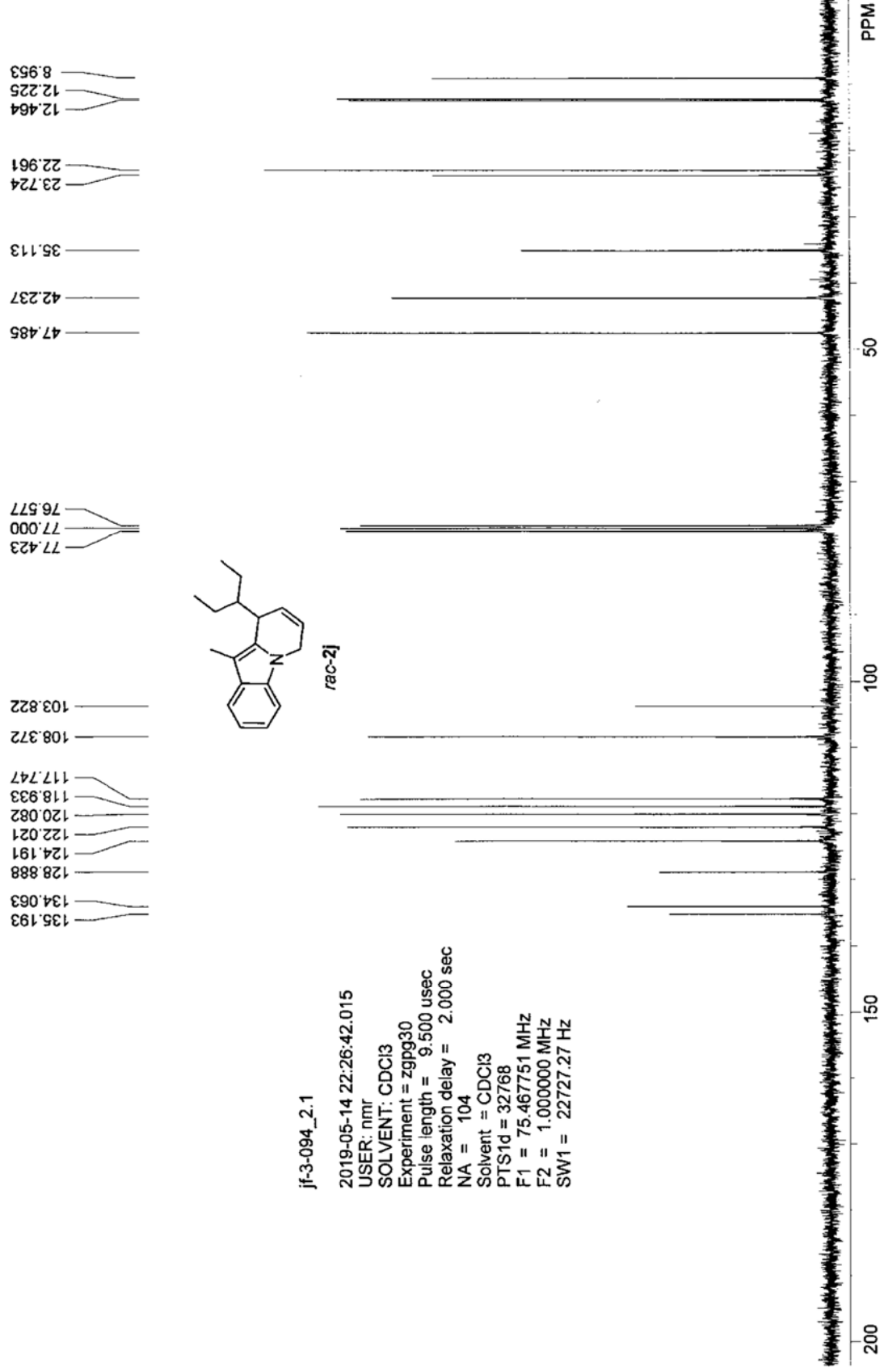
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jf-3-094_2.1

2019-05-14 22:26:42.015

USER: nmf

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 104

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

jf-3-077_1.1

2019-05-04 18:23:34.375

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

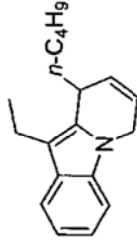
Solvent = CDCl₃

PTS1d = 32768

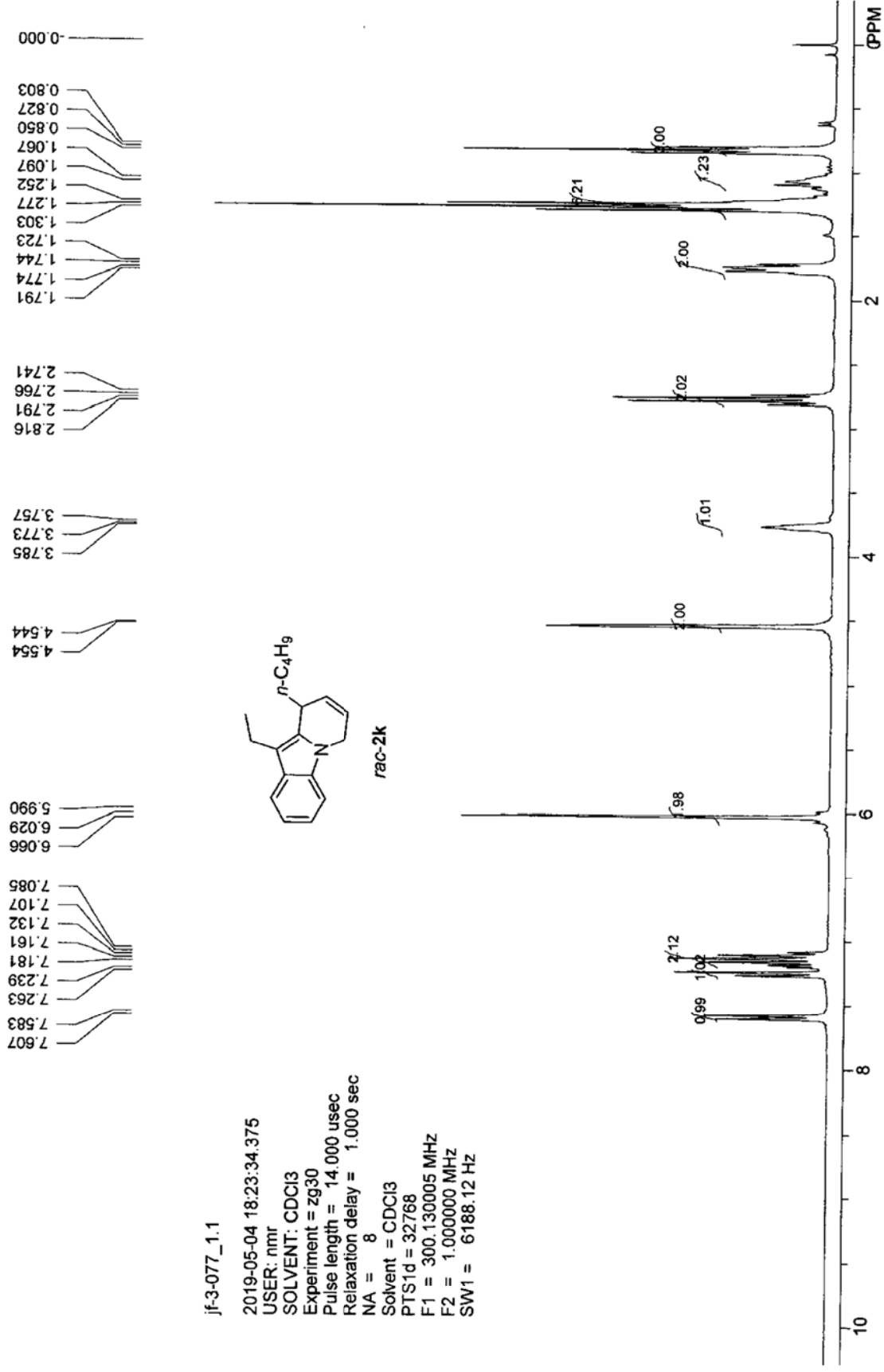
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



rac-2k



jt-3-077_2.1

2019-05-04 19:04:07.359

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 657

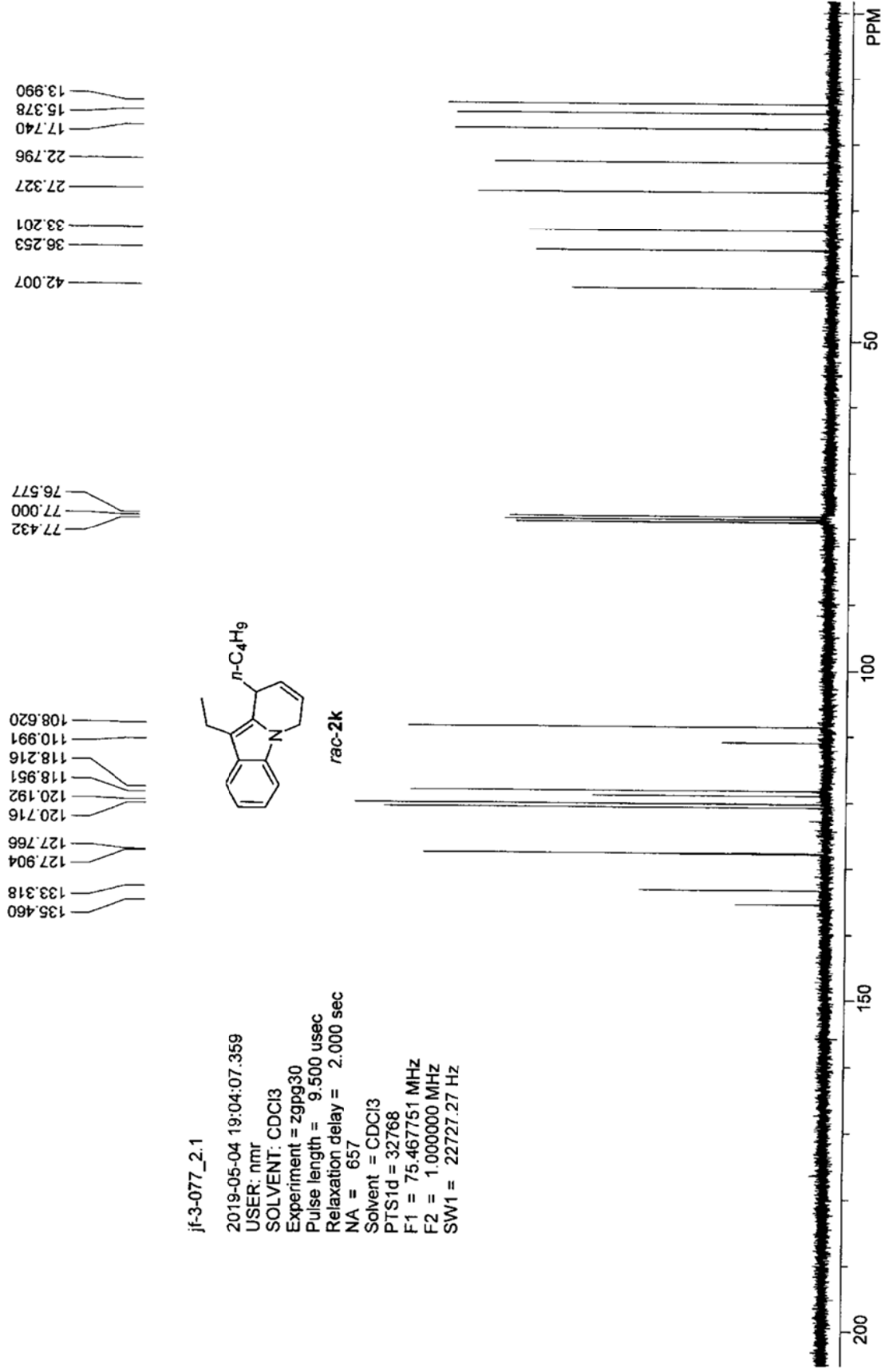
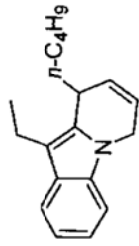
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

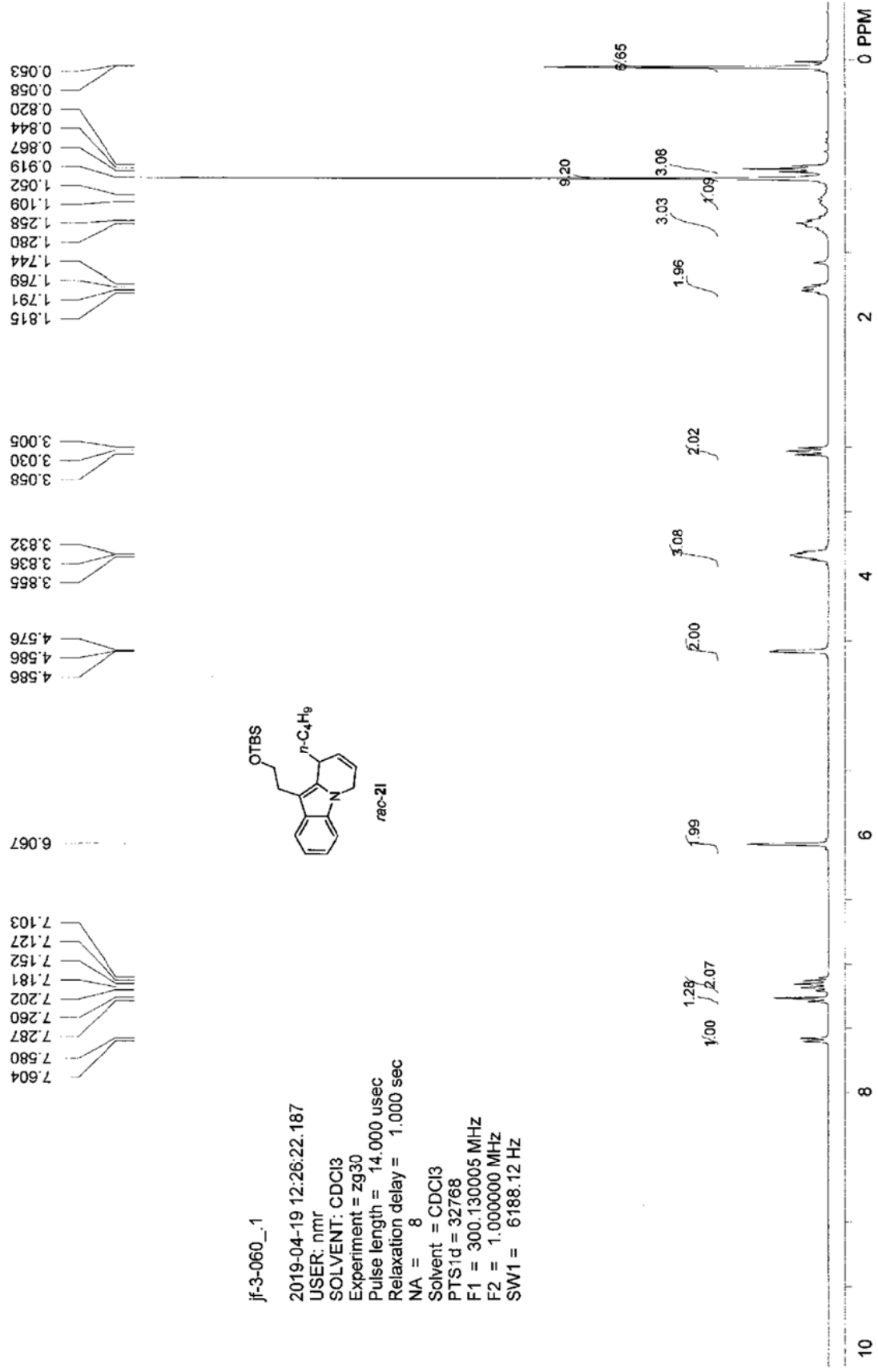
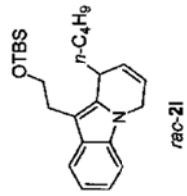


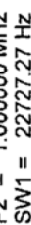
QTBS

C=CCC1=CC=C2C(=C1)C(=C(C2)C)C3=CC=CC=C3

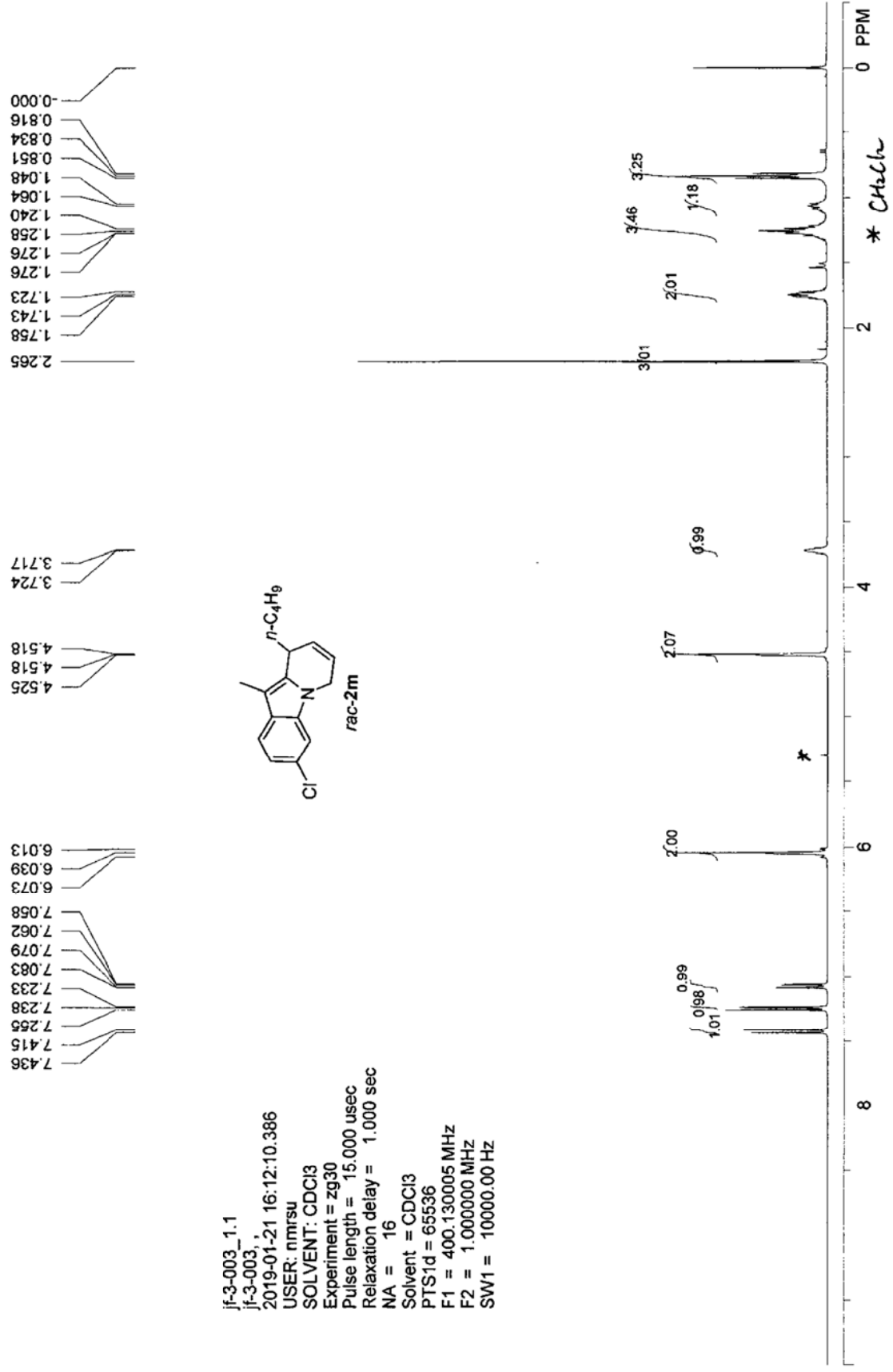
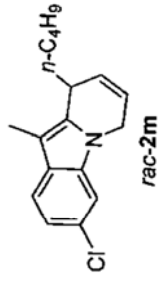
rac-21

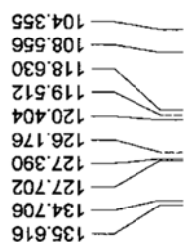
rac-21



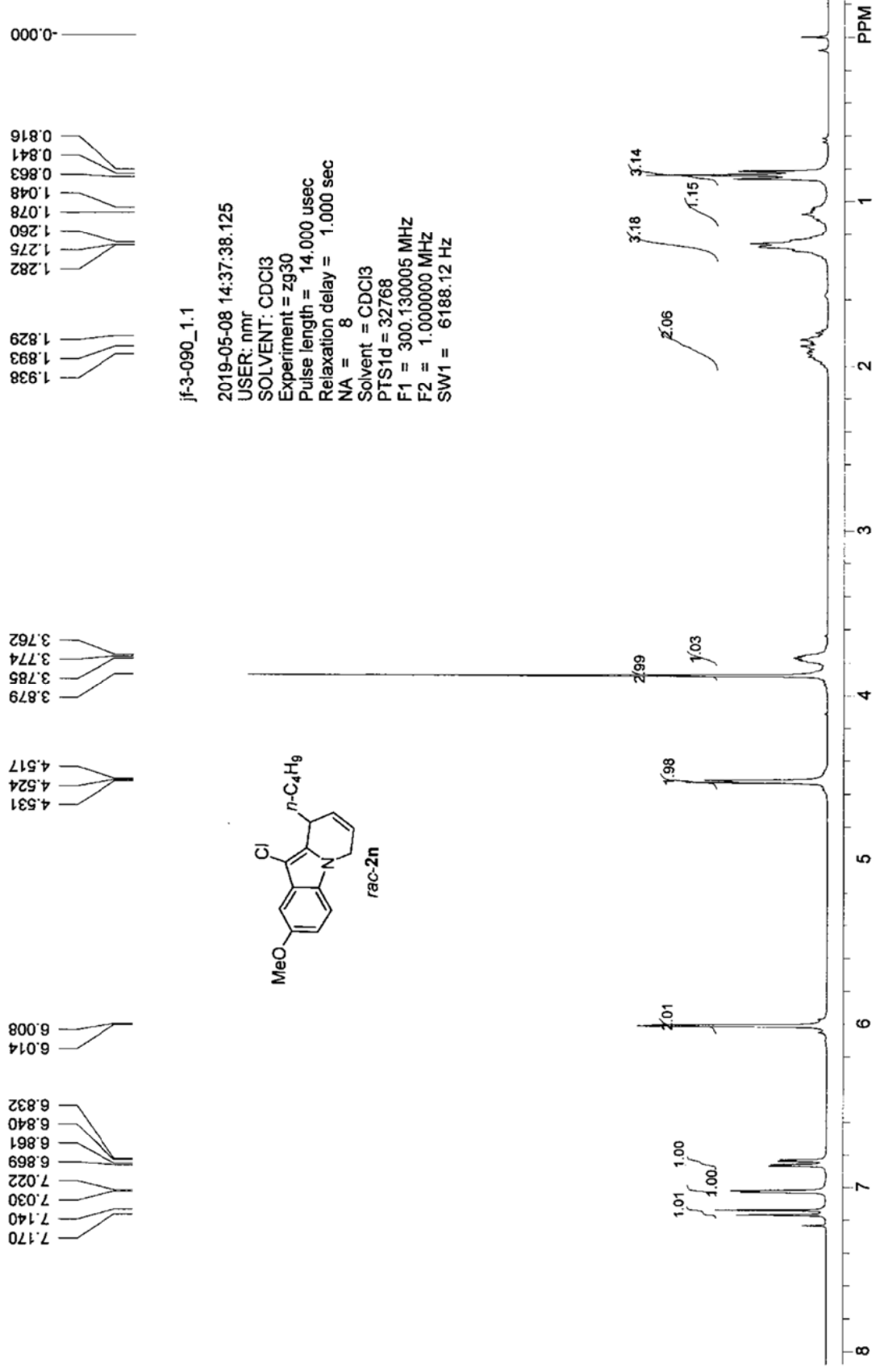


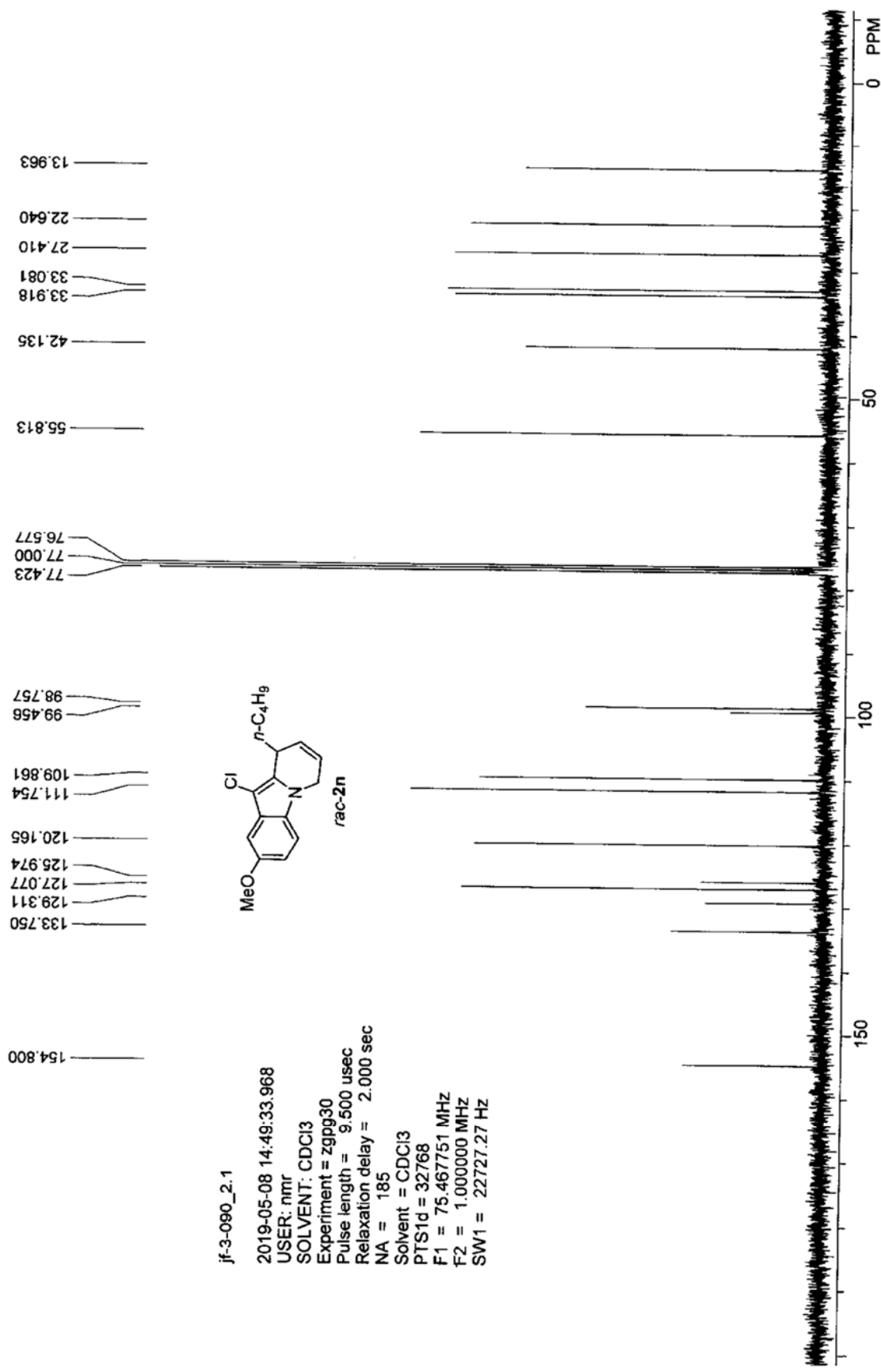
jf-3-003_1.1
 jf-3-003,
 2019-01-21 16:12:10.386
 USER: nmrsu
 SOLVENT: CDCl₃
 Experiment = zg30
 Pulse length = 15.000 usec
 Relaxation delay = 1.000 sec
 NA = 16
 Solvent = CDCl₃
 P1 = 65536
 F1 = 400.130005 MHz
 F2 = 1.000000 MHz
 SW1 = 10000.00 Hz





SW1 = 22727.27 Hz





jf-3-090_2.1

2019-05-08 14:49:33.968

USER: nmr

SOLVENT: CDCl3

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 185

Solvent = CDCl3

PTSD = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

jf-2-162_1.1

2018-12-28 20:12:22.968

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

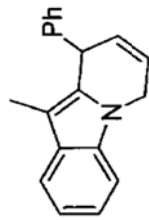
Solvent = CDCl₃

PTS1d = 32768

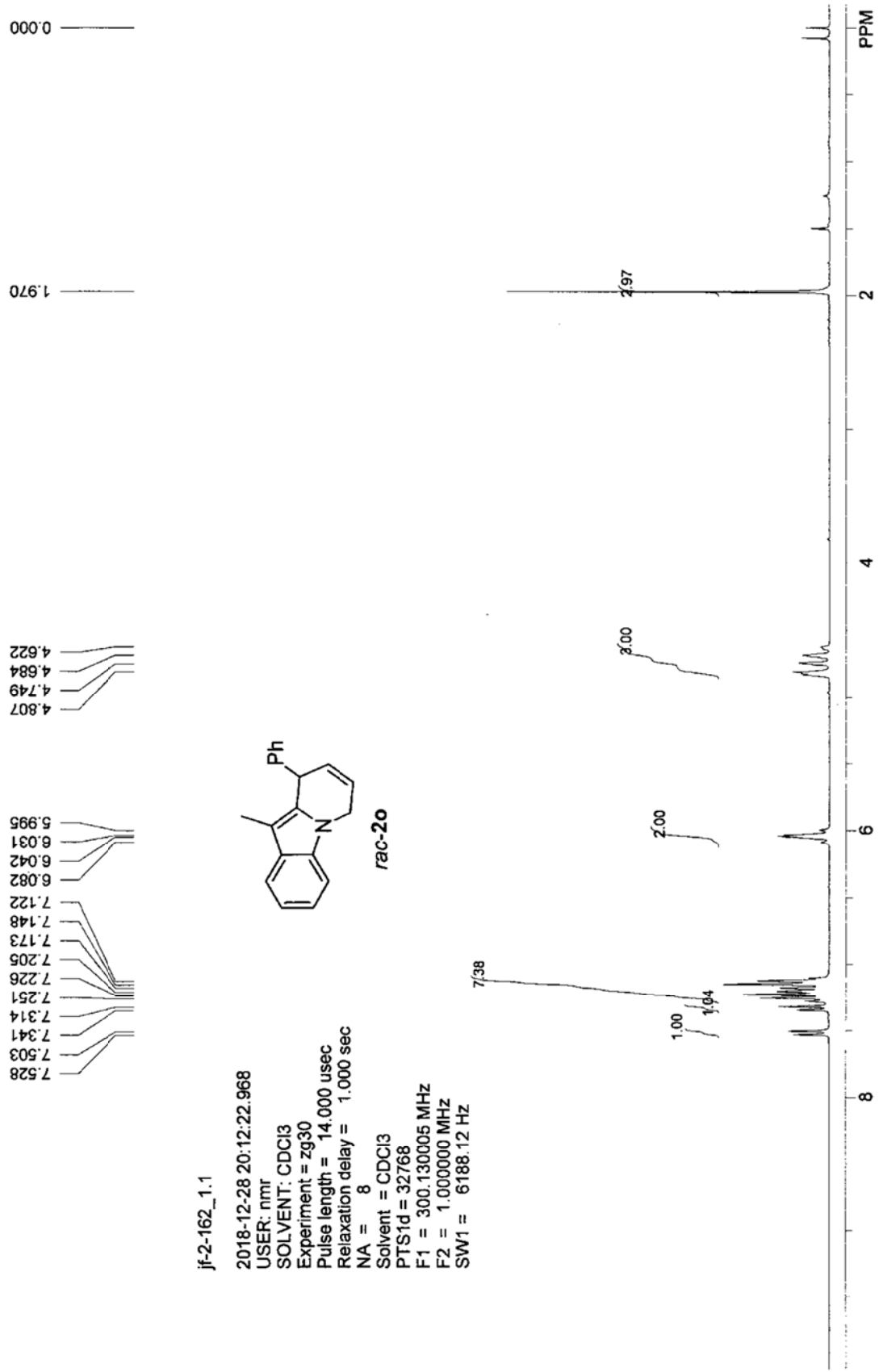
F1 = 300.130005 MHz

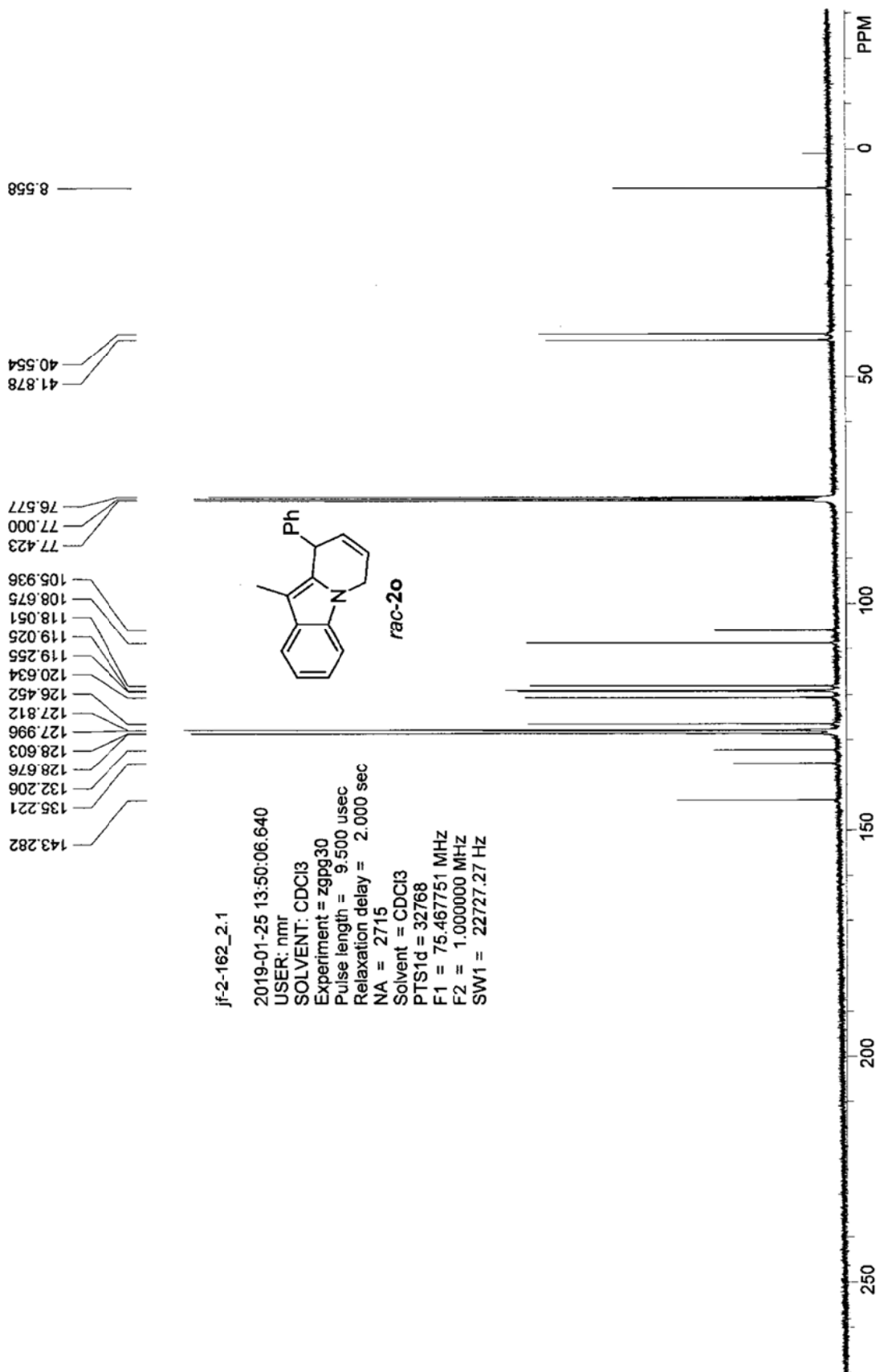
F2 = 1.000000 MHz

SW1 = 6188.12 Hz



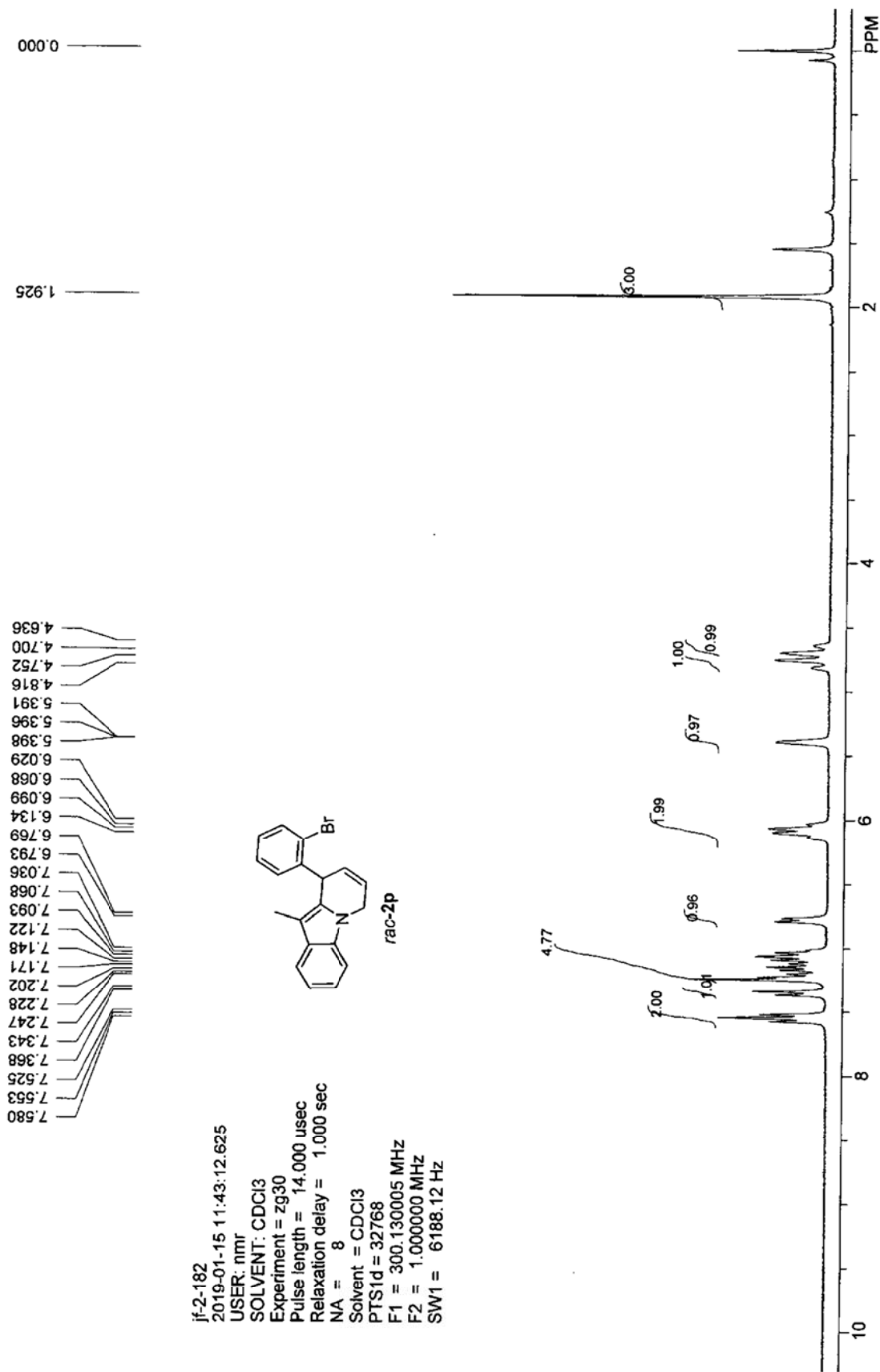
rac-2o

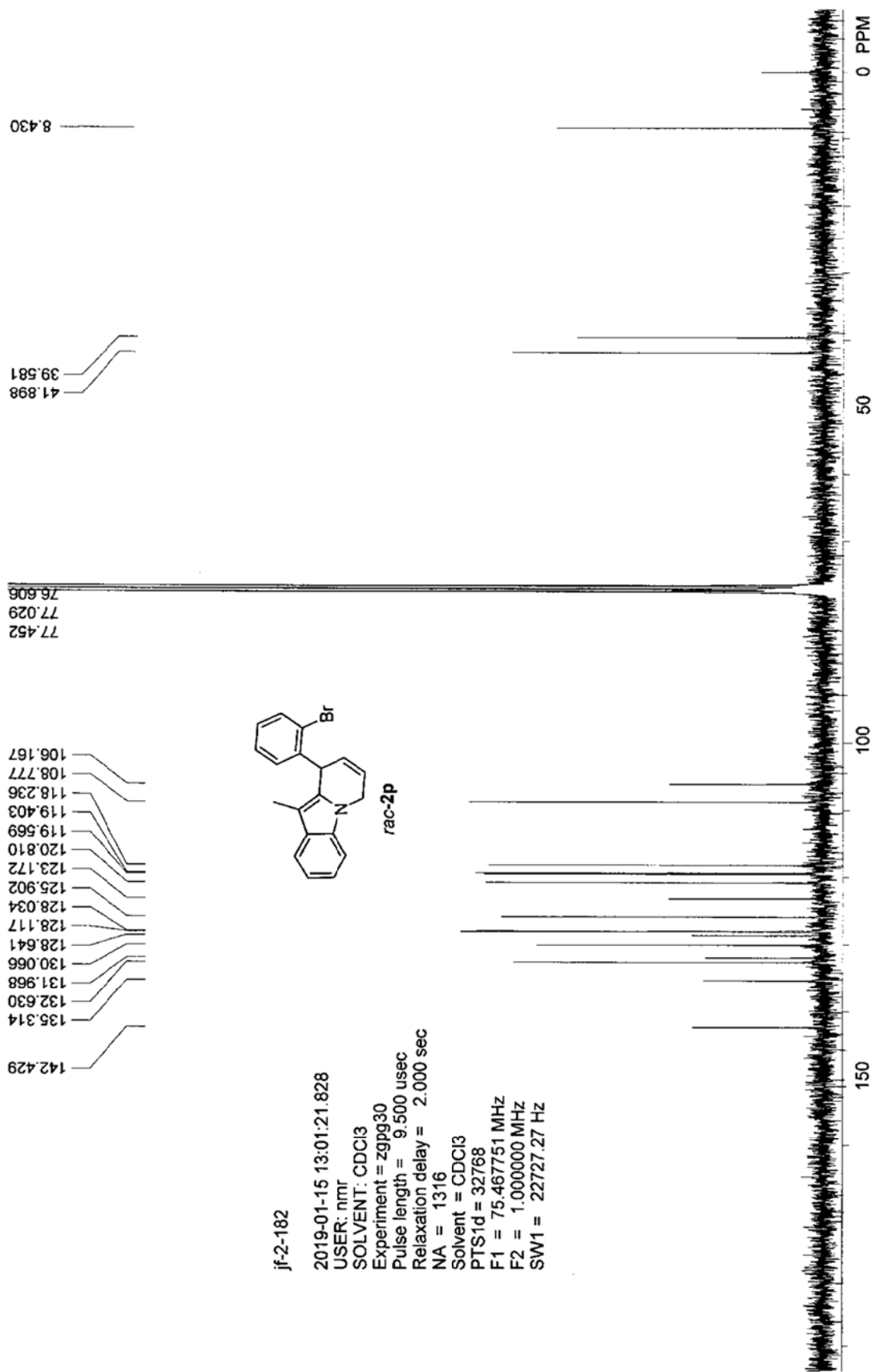




jf-2-162_2.1

2019-01-25 13:50:06.640
 USER: nmr
 SOLVENT: CDCl₃
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 2715
 Solvent = CDCl₃
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz





if-2-182

2019-01-15 13:01:21.828

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 1316

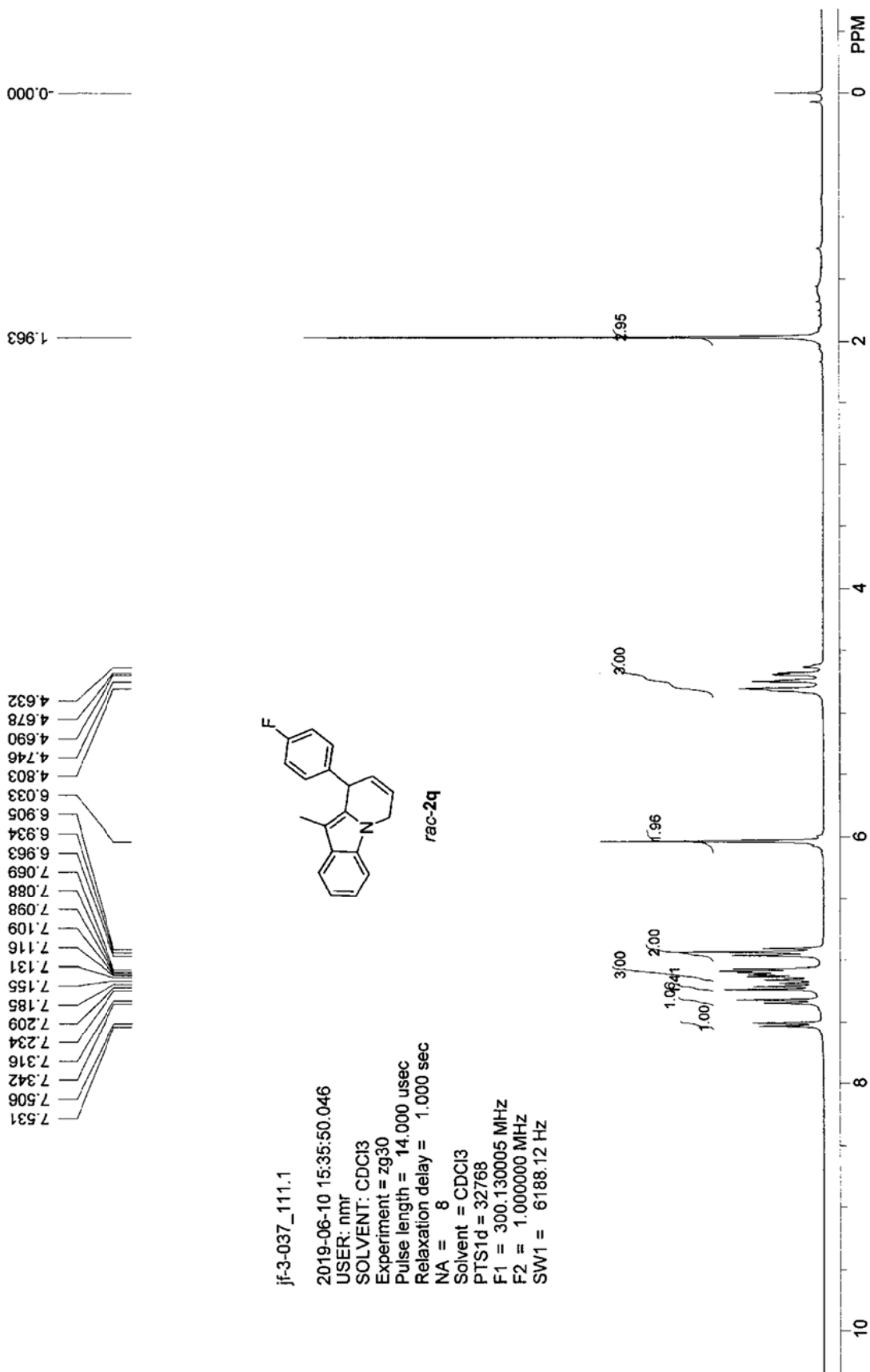
Solvent = CDCl₃

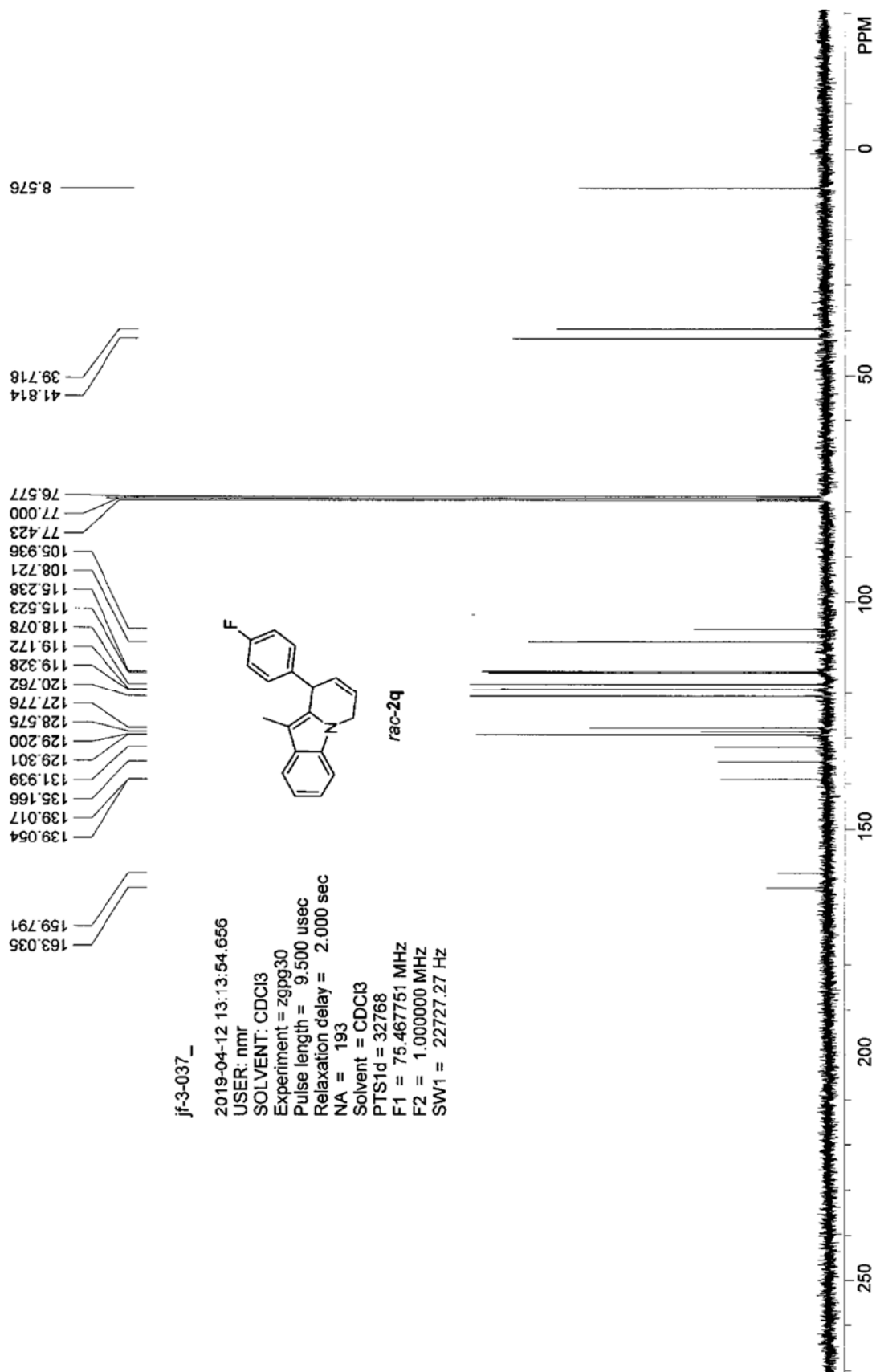
PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz





0.000

jf-3-037_4.1

2019-04-16 08:52:10.125

USER: nmr

SOLVENT: CDCl₃

Experiment = zgfgnq

Pulse length = 13.500 usec

Relaxation delay = 1.000 sec

NA = 2

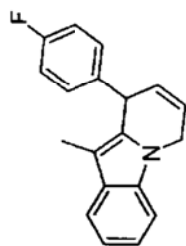
Solvent = CDCl₃

PTS1d = 65536

F1 = 282.404358 MHz

F2 = 1.000000 MHz

SW1 = 66964.29 Hz



rac-2q

-108.725

PPM

-150

-100

-50

0

f-3-021_111.1

2019-04-08 14:07:19.109

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

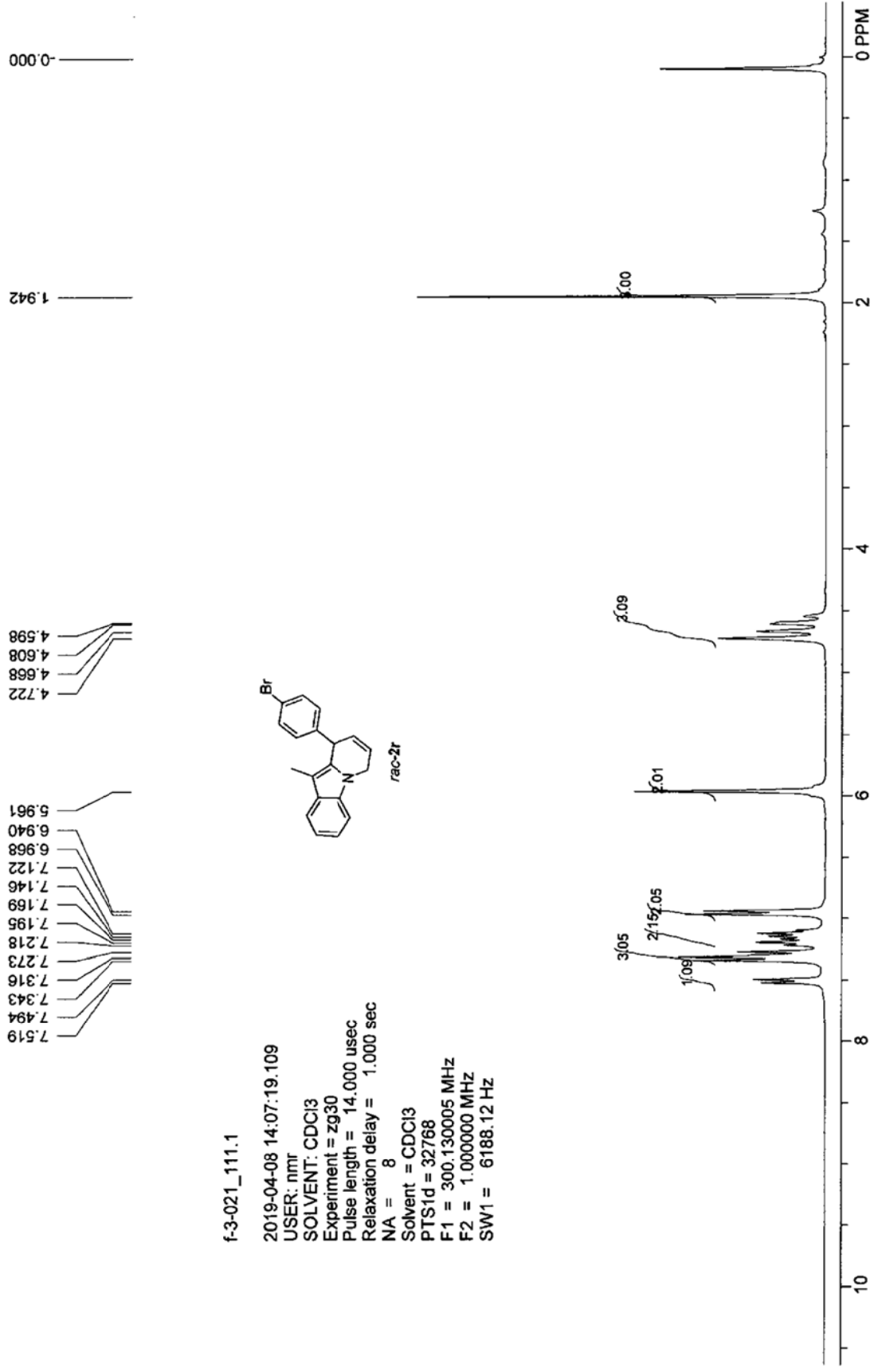
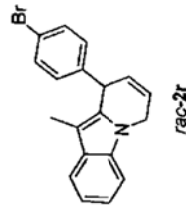
Solvent = CDCl₃

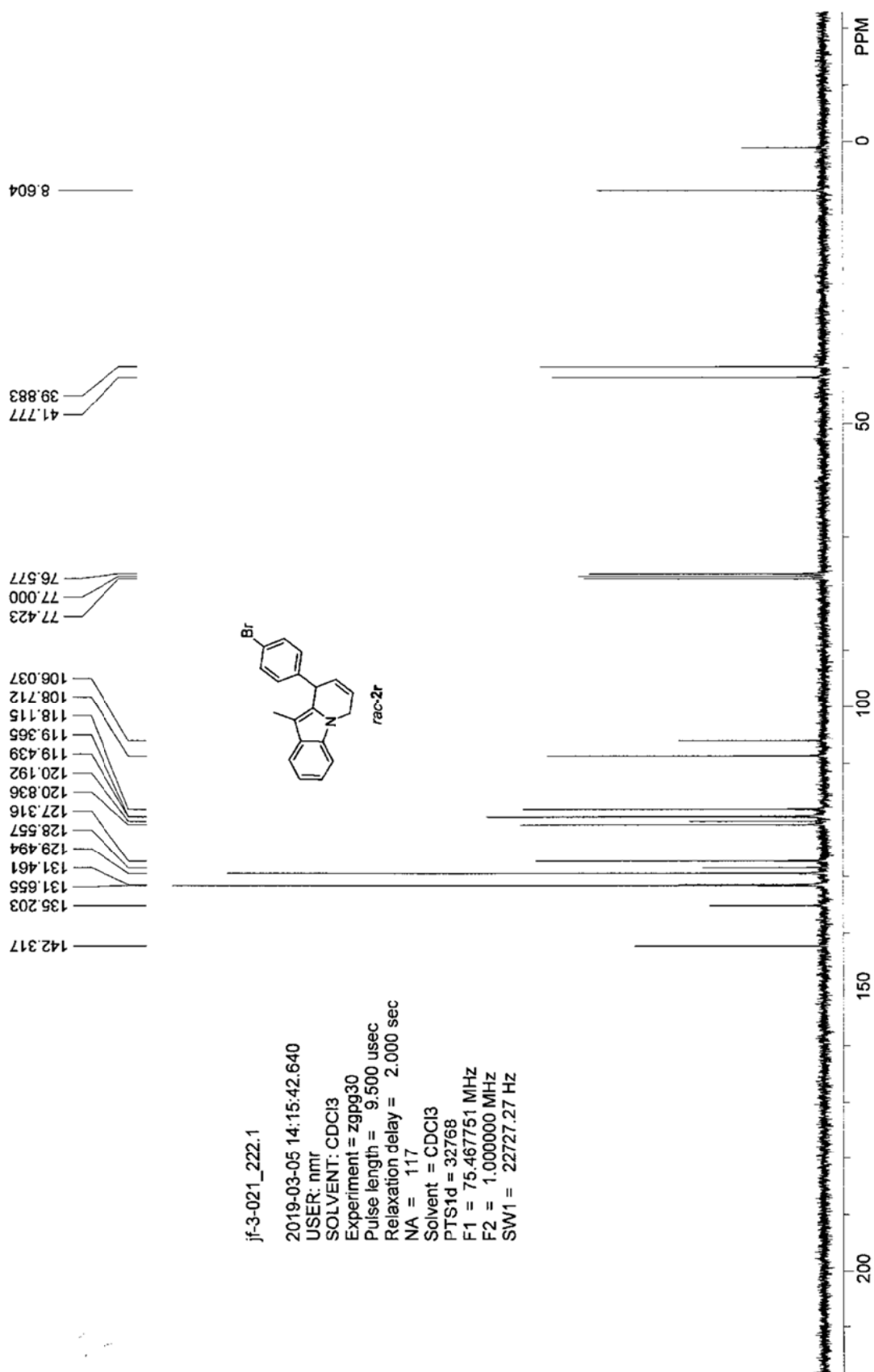
PTSD = 32768

F1 = 300.130005 MHz

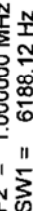
F2 = 1.000000 MHz

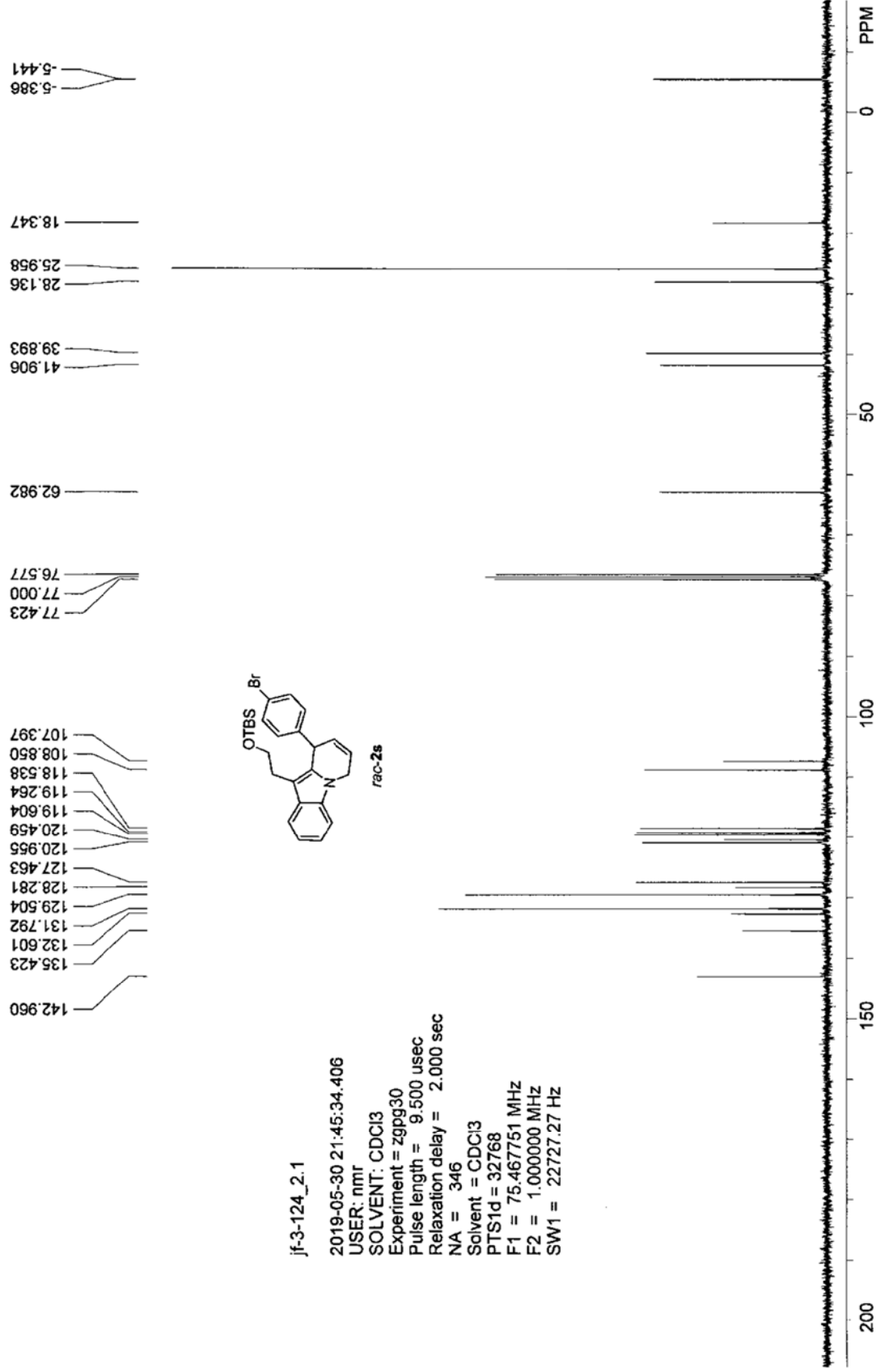
SWH = 6188.12 Hz

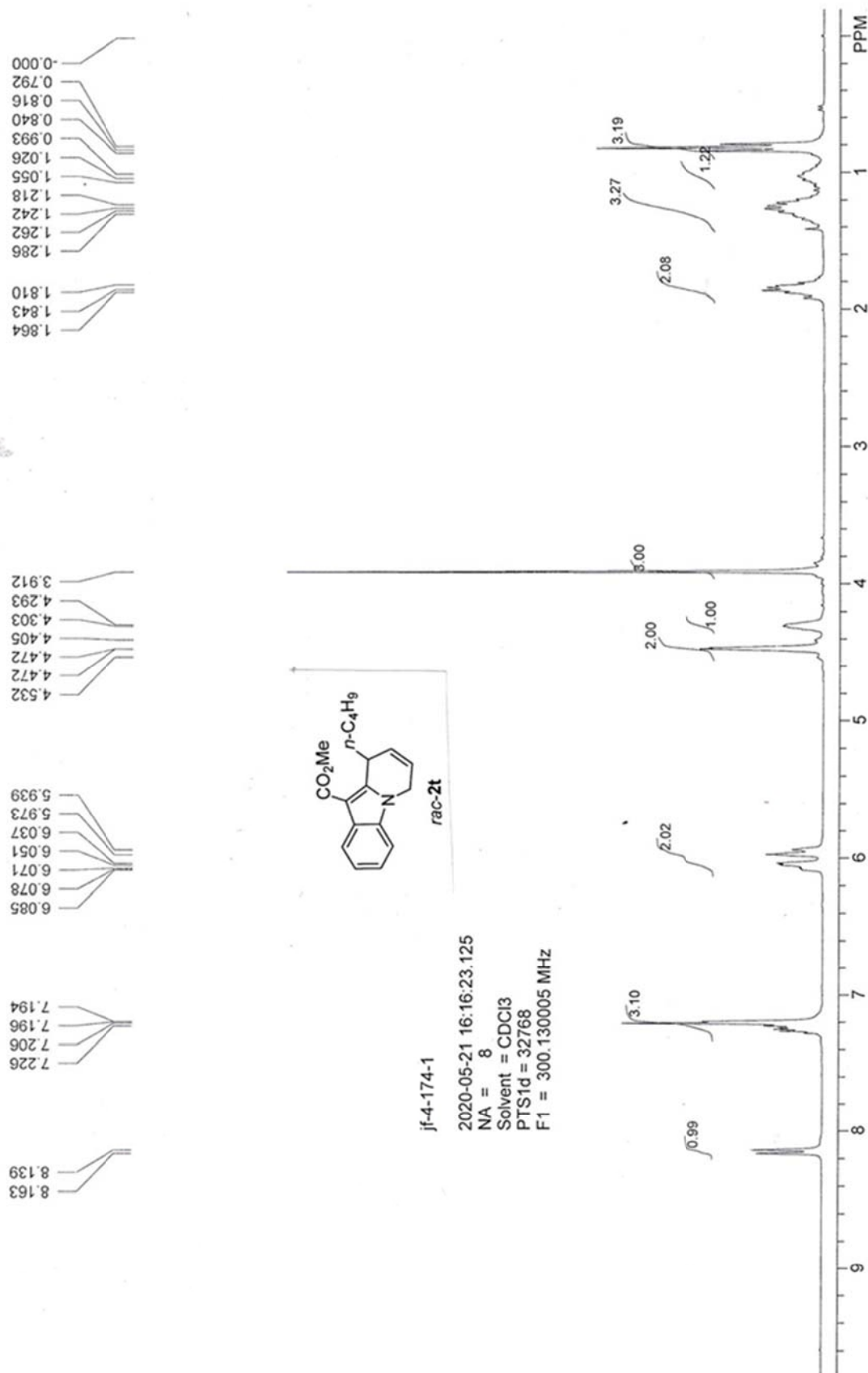


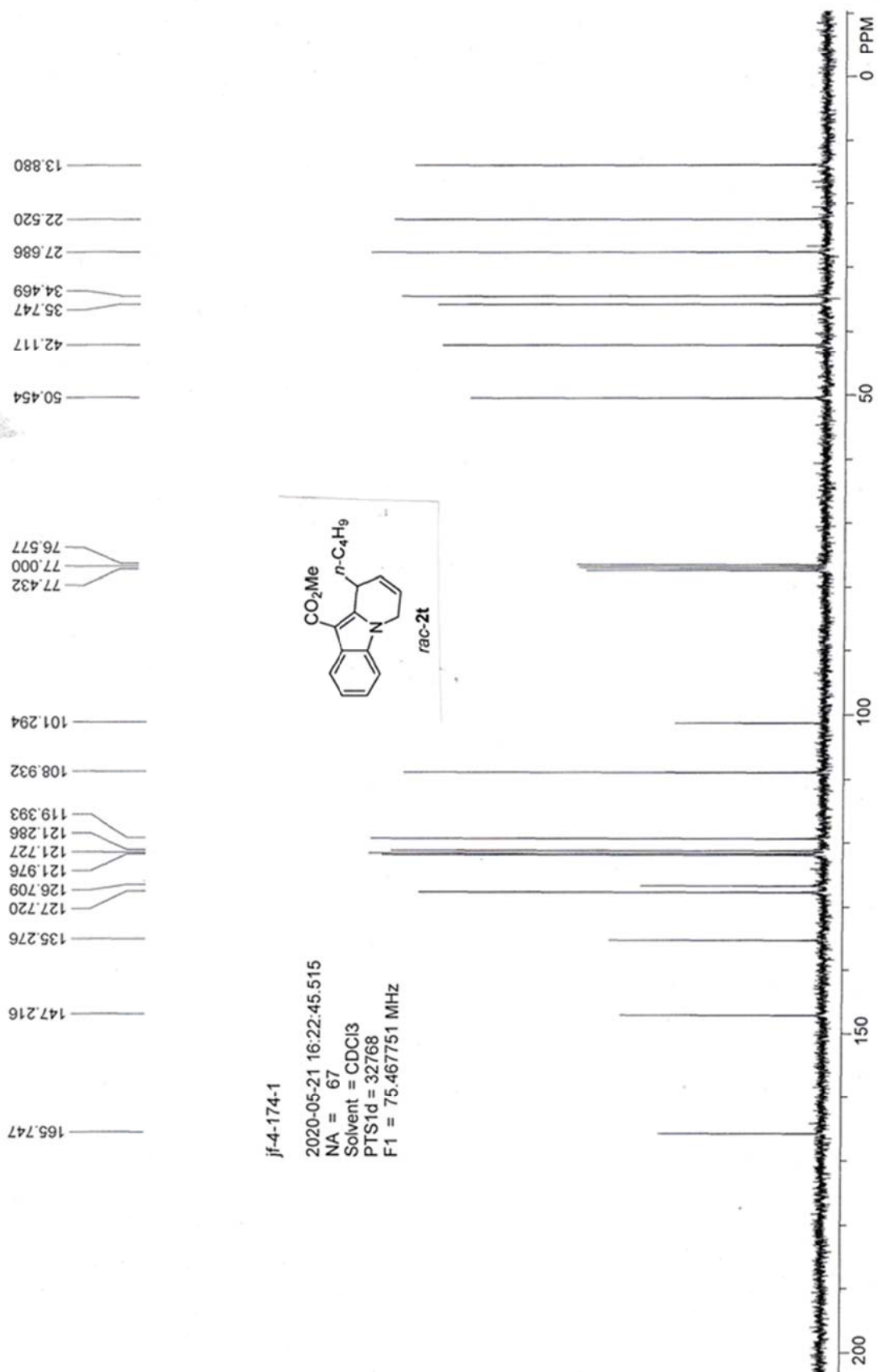


jf-3-021_222.1
2019-03-05 14:15:42.640
USER: nmr
SOLVENT: CDCl3
Experiment = zgpg30
Pulse length = 9.500 usec
Relaxation delay = 2.000 sec
NA = 117
Solvent = CDCl3
PTS1d = 32768
F1 = 75.467751 MHz
F2 = 1.000000 MHz
SW1 = 22727.27 Hz









jf-4-174-1

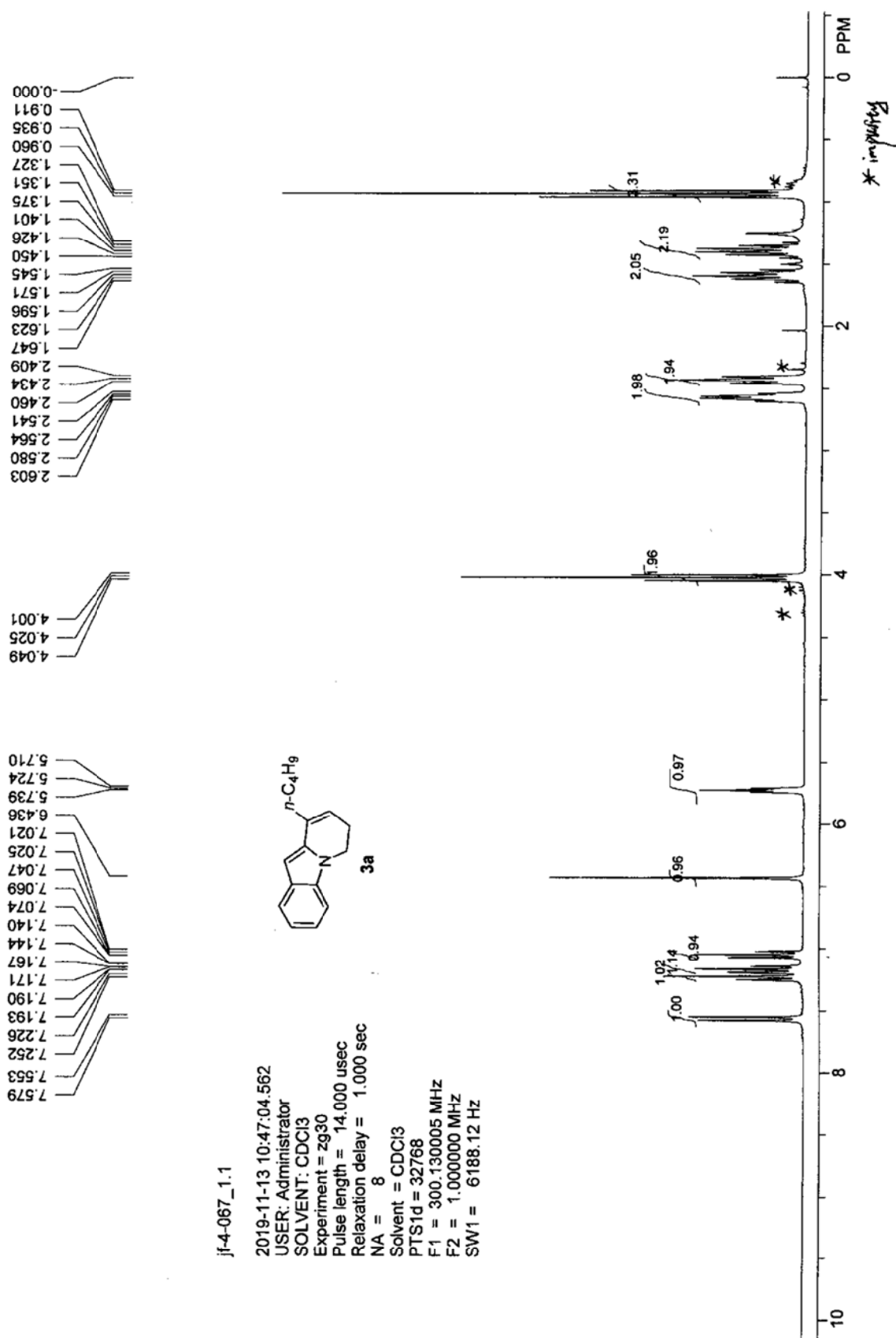
2020-05-21 16:22:45.515

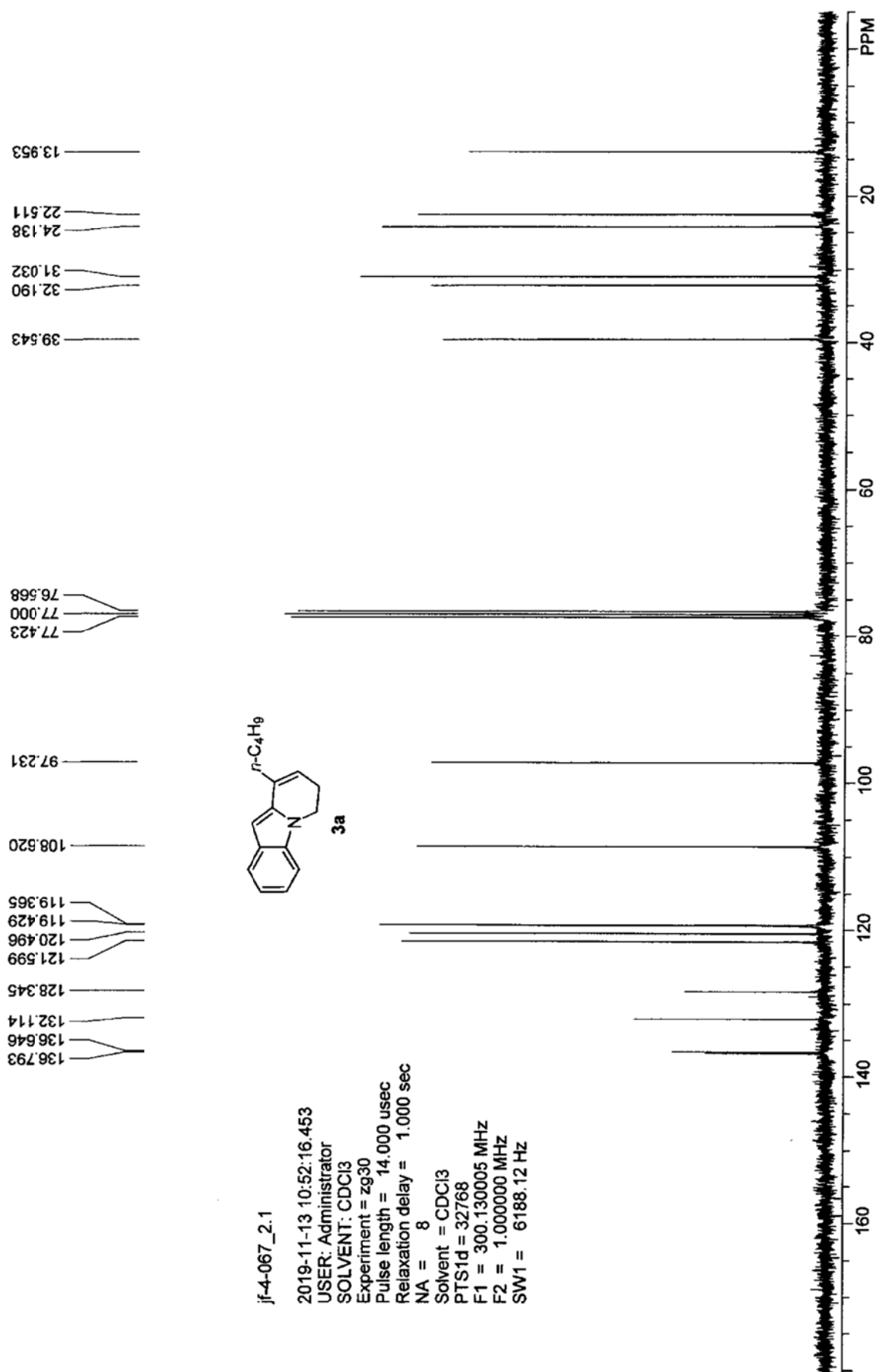
NA = 67

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz





jf-2-023_1.1

2018-07-10 16:28:11.031

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

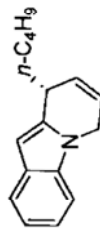
Solvent = CDCl₃

PTSD = 32768

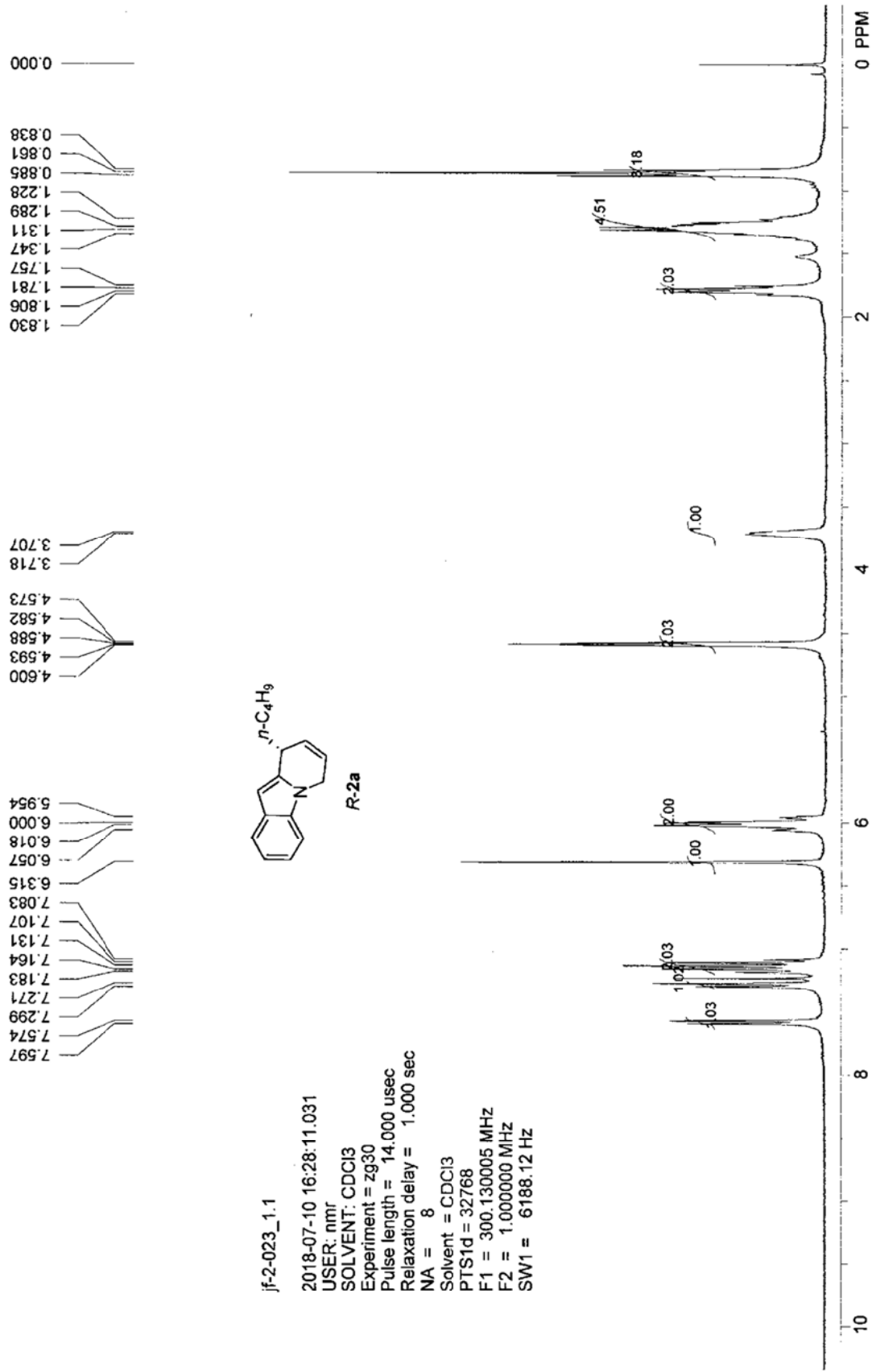
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SWH = 6188.12 Hz



R-2a



jf-2-023_2.1

2018-07-10 21:37:43.921

USER: nmf

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 84

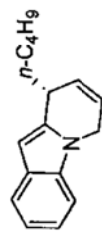
Solvent = CDCl₃

PTS1d = 32768

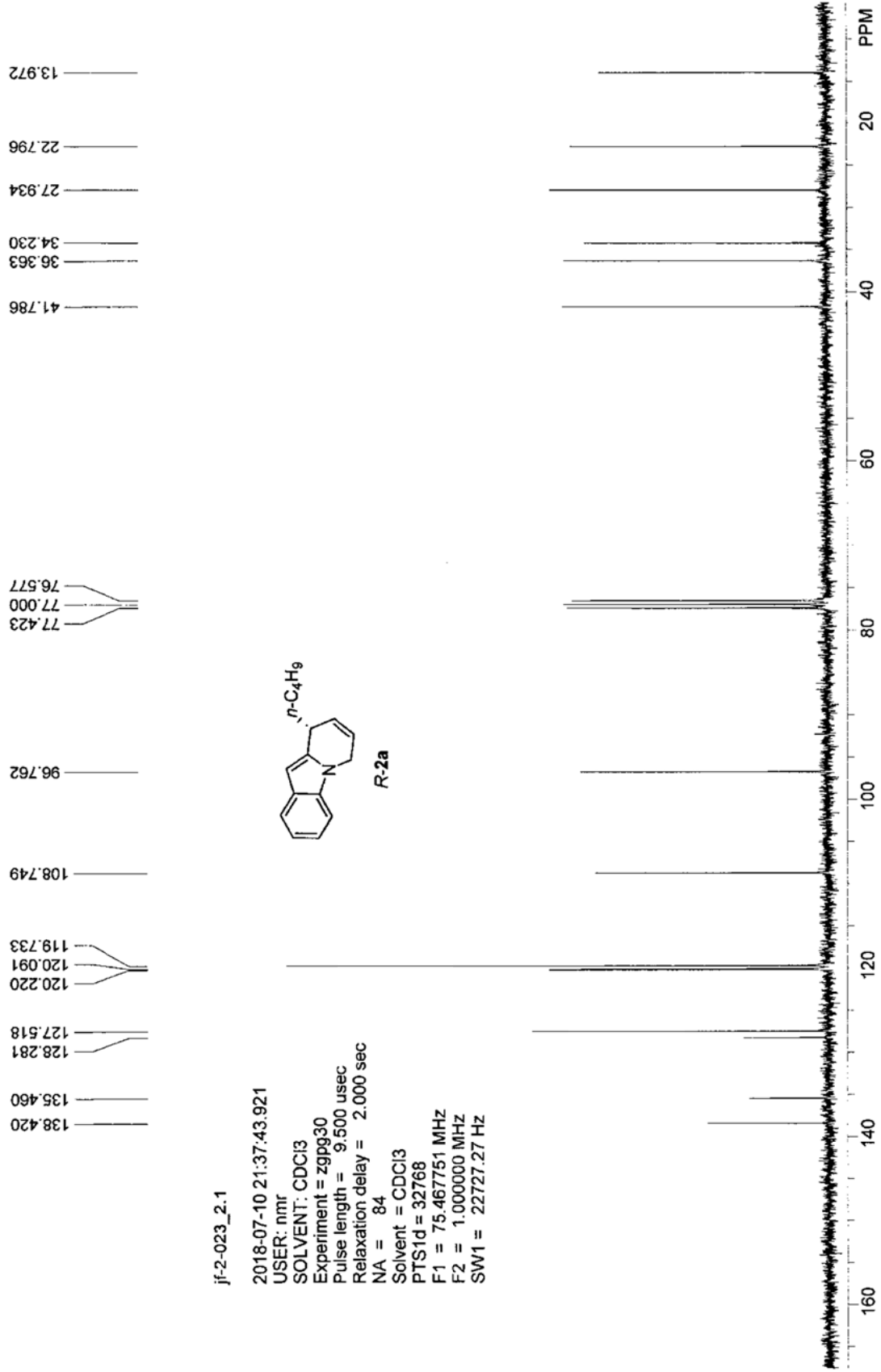
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



R-2a

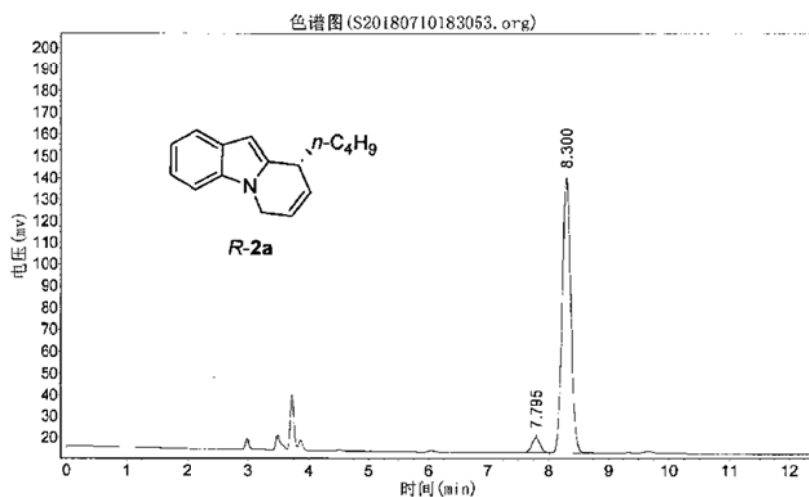


jf-2-023

实验时间: 2018-07-10, 18:30:53
谱图文件: D:\浙大智达\N2000\样品\S20180710183053.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jif
报告时间: 2018-07-10, 20:22:38
积分方法: 面积归一法

实验内容简介:
od-H, n-hexane/i-PrOH = 100/1, 1, 214



分析结果表

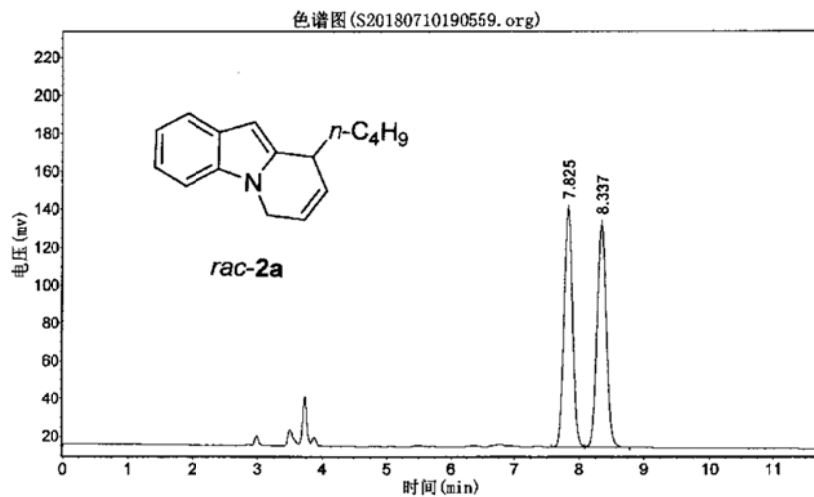
峰号	峰名	保留时间	峰高	峰面积	含量
1		7.795	6932.048	65231.785	4.9002
2		8.300	127378.266	1265982.375	95.0998
总计			134310.314	1331214.160	100.0000

jf-2-026

实验时间: 2018-07-10, 19:05:59
谱图文件: D:\浙大智达\N2000\样品\S20180710190559.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-07-10, 20:25:19
积分方法: 面积归一法

实验内容简介:
od-I, n-hexane/i-PrOH = 100/1, 1, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		7.825	126056.820	1159691.750	49.7334
2		8.337	117834.695	1172125.375	50.2666
总计			243891.516	2331817.125	100.0000

jf-2-015_1.1

2018-07-24 15:39:52.625

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

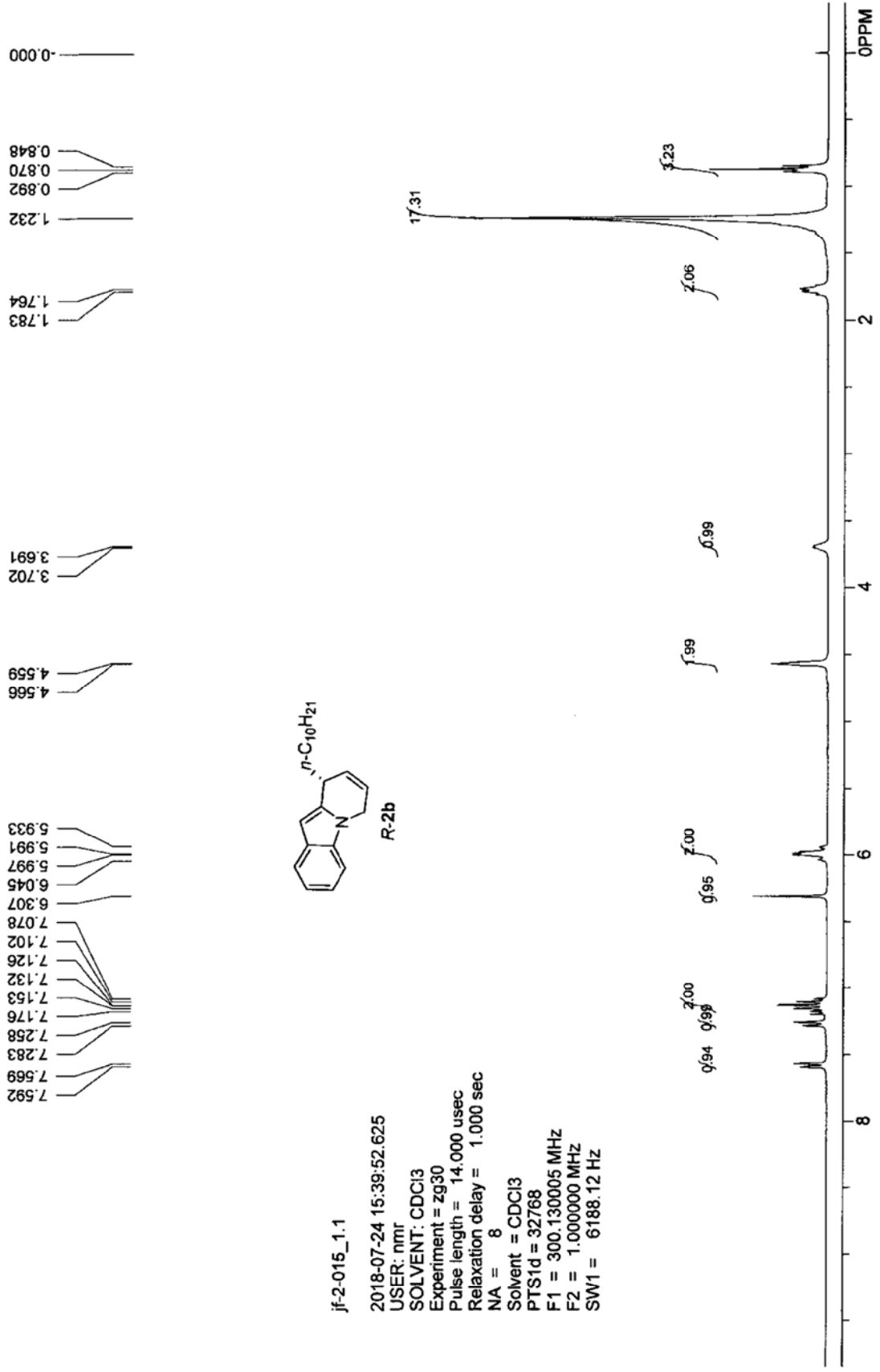
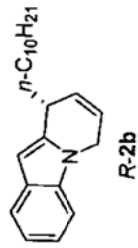
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-2-015_2.1

2018-07-24 15:54:39.421

USER: nmf

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 145

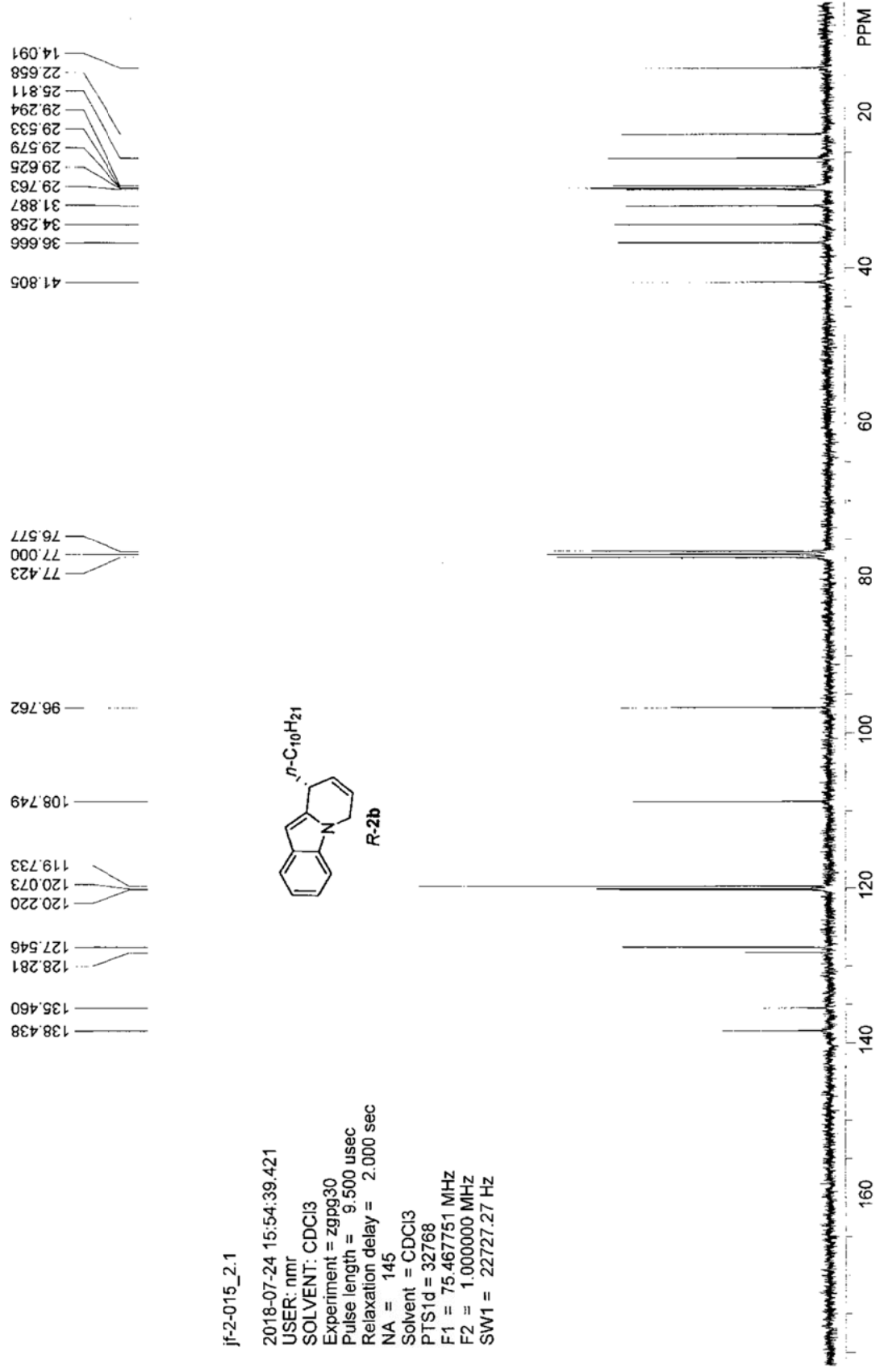
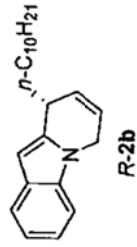
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

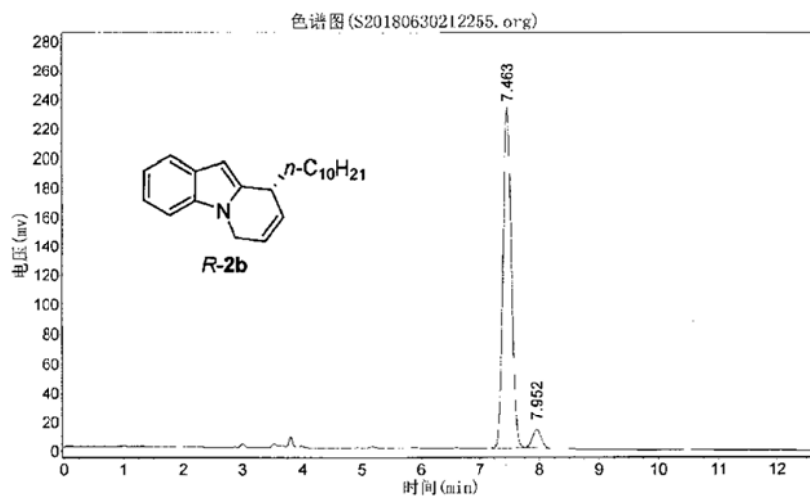


jf-2-015

实验时间: 2018-06-30, 21:22:55
谱图文件: D:\浙大智达\N2000\样品\S20180630212255.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-06-30, 21:38:04
积分方法: 面积归一法

实验内容简介:
OD: H, n hexane/i-PrOH = 100/1, 1.0, 2/4



分析结果表

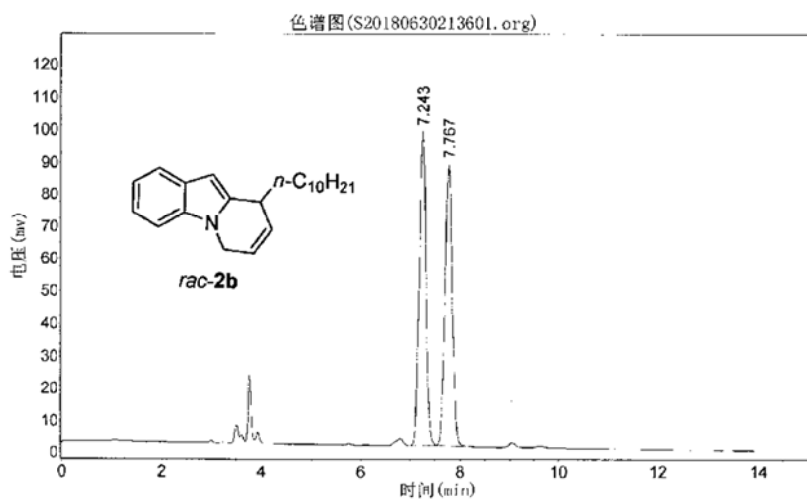
峰号	峰名	保留时间	峰高	峰面积	含量
1		7.463	229949.484	2274792.750	94.8523
2		7.952	12446.812	123454.156	5.1477
总计			242396.296	2398246.906	100.0000

jf-2-012

实验时间: 2018-06-30, 21:36:01
谱图文件: D:\浙大智达\N2000\样品\S20180630213601.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-06-30, 21:52:50
积分方法: 面积归一法

实验内容简介:
OD-h, n-hexane/i-PrOH = 100/1, 1.0, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		7.243	96253.953	914269.875	50.4090
2		7.767	86400.266	899433.438	49.5910
总计			182654.219	1813703.313	100.0000

jf-2-066_1

2018-09-29 22:09:29.406

USER: nmir

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

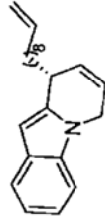
Solvent = CDCl₃

PTS1d = 32768

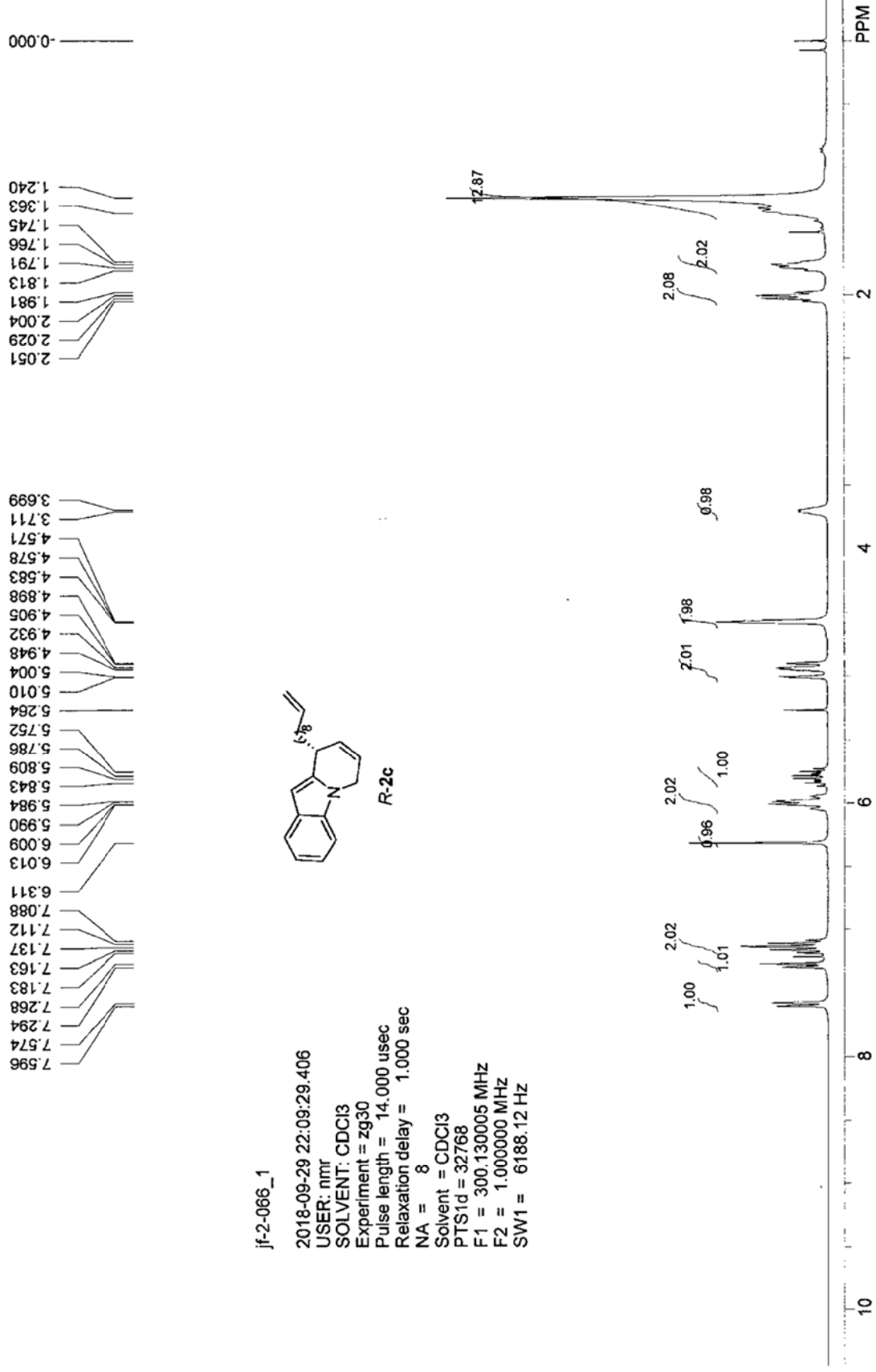
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



R-2c



jf-2-066_2.1

2018-10-16 22:00:07.640

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 673

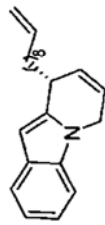
Solvent = CDCl₃

PTS1d = 32768

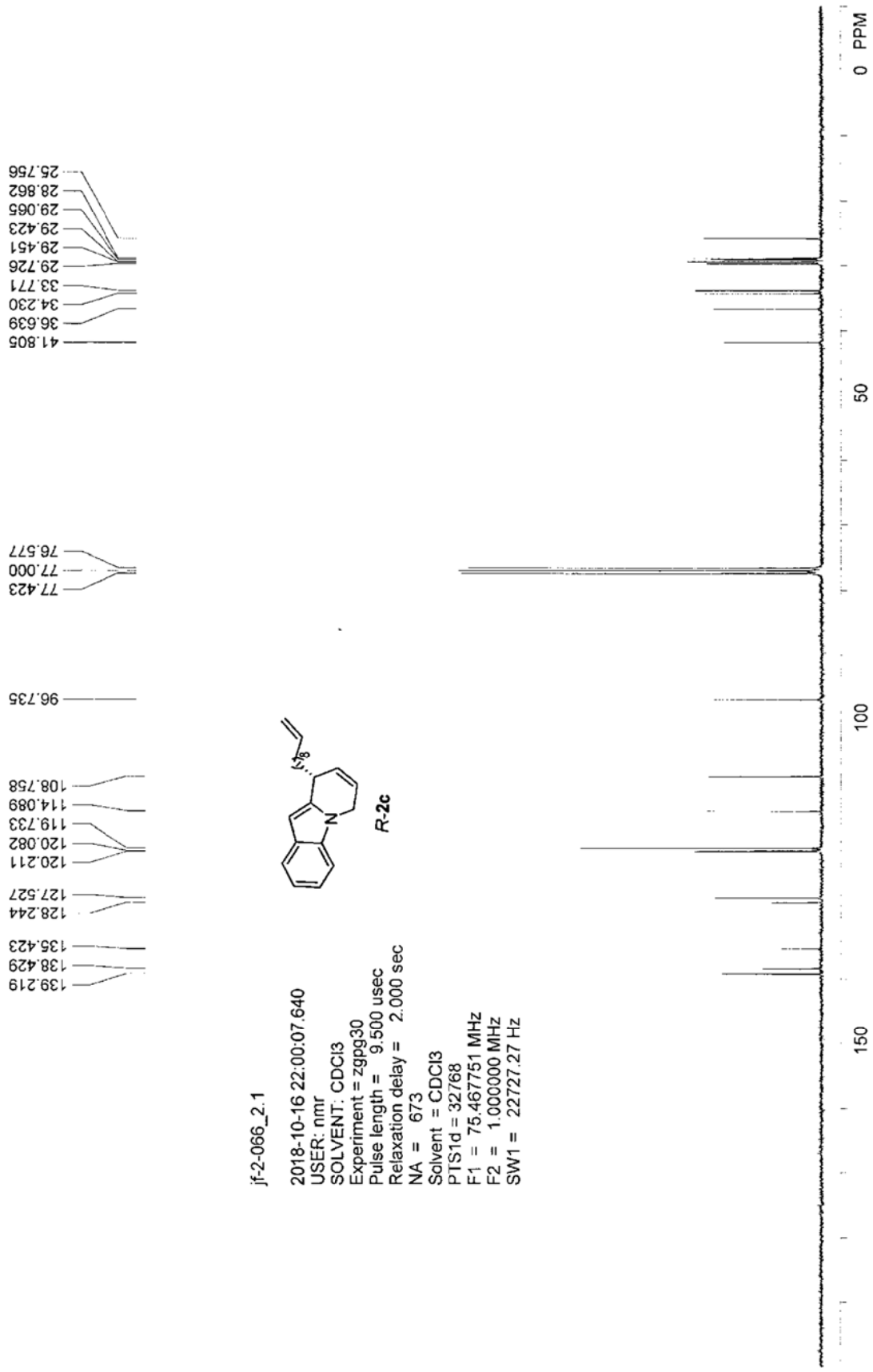
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



R-2c

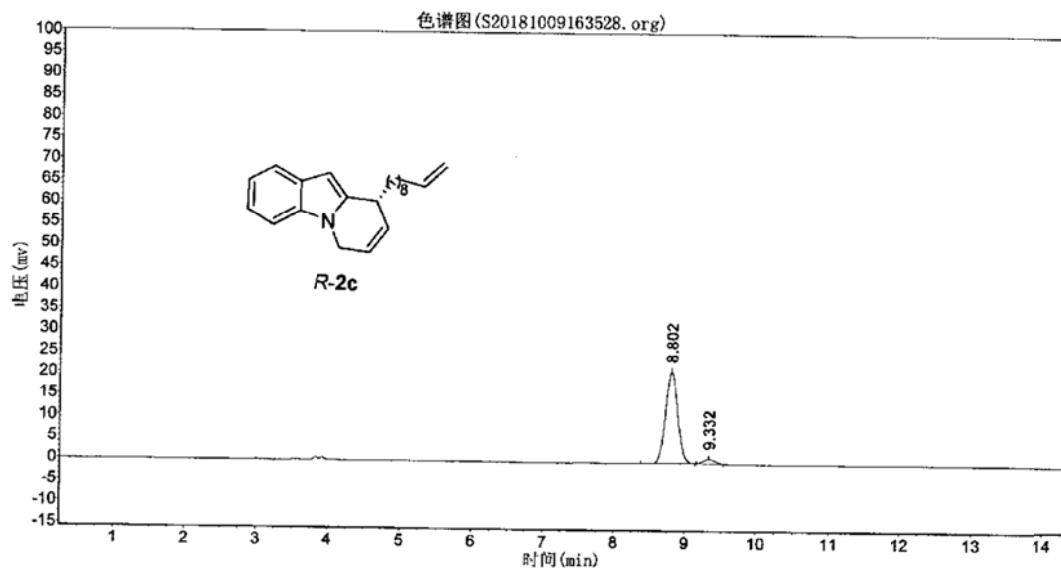


jf-2-066

实验时间: 2018-10-09, 16:35:28
谱图文件: D:\浙大智达\N2000\样品\S20181009163528.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-11-13, 15:21:41
积分方法: 面积归一法

实验内容简介:
od-H, n-hexane/i-PrOH = 100/1, 1.0, 214



分析结果表

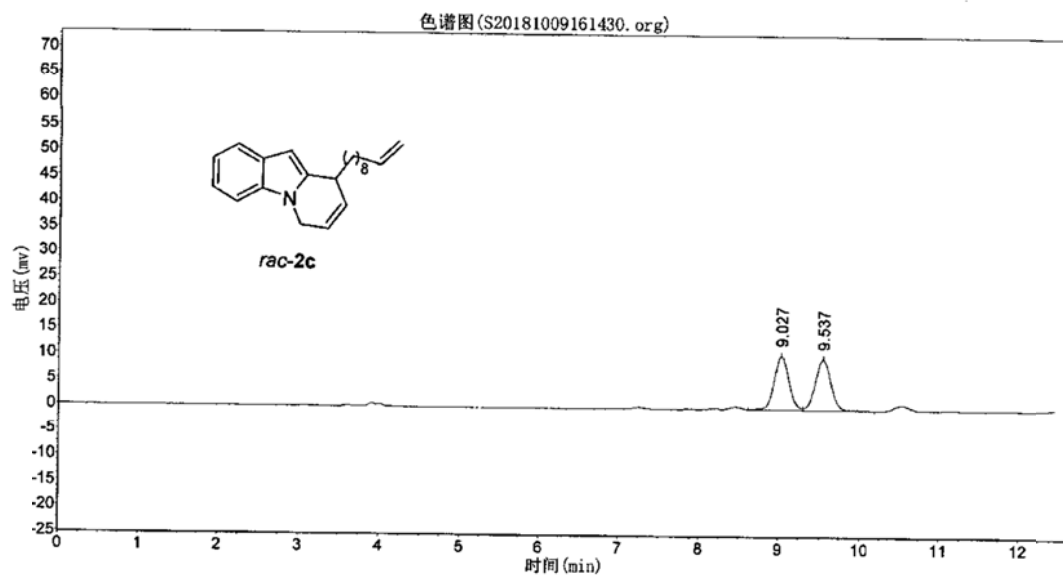
峰号	峰名	保留时间	峰高	峰面积	含量
1		8.802	21281.363	255511.766	95.8335
2		9.332	986.432	11108.700	4.1665
总计			22267.796	266620.466	100.0000

jf-2-037

实验时间: 2018-10-09, 16:14:30
 谱图文件: D:\浙大智达\N2000\样品\S20181009161430.org
 方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
 报告时间: 2019-11-13, 15:25:18
 积分方法: 面积归一法

实验内容简介:
 od-H, n-hexane/i-PrCH = 100/1, 1.0, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		9.027	10504.213	131674.938	49.6421
2		9.537	9912.612	133573.734	50.3579
总计			20416.825	265248.672	100.0000

jf-1-198_1.1

2018-07-18 14:50:33.375

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

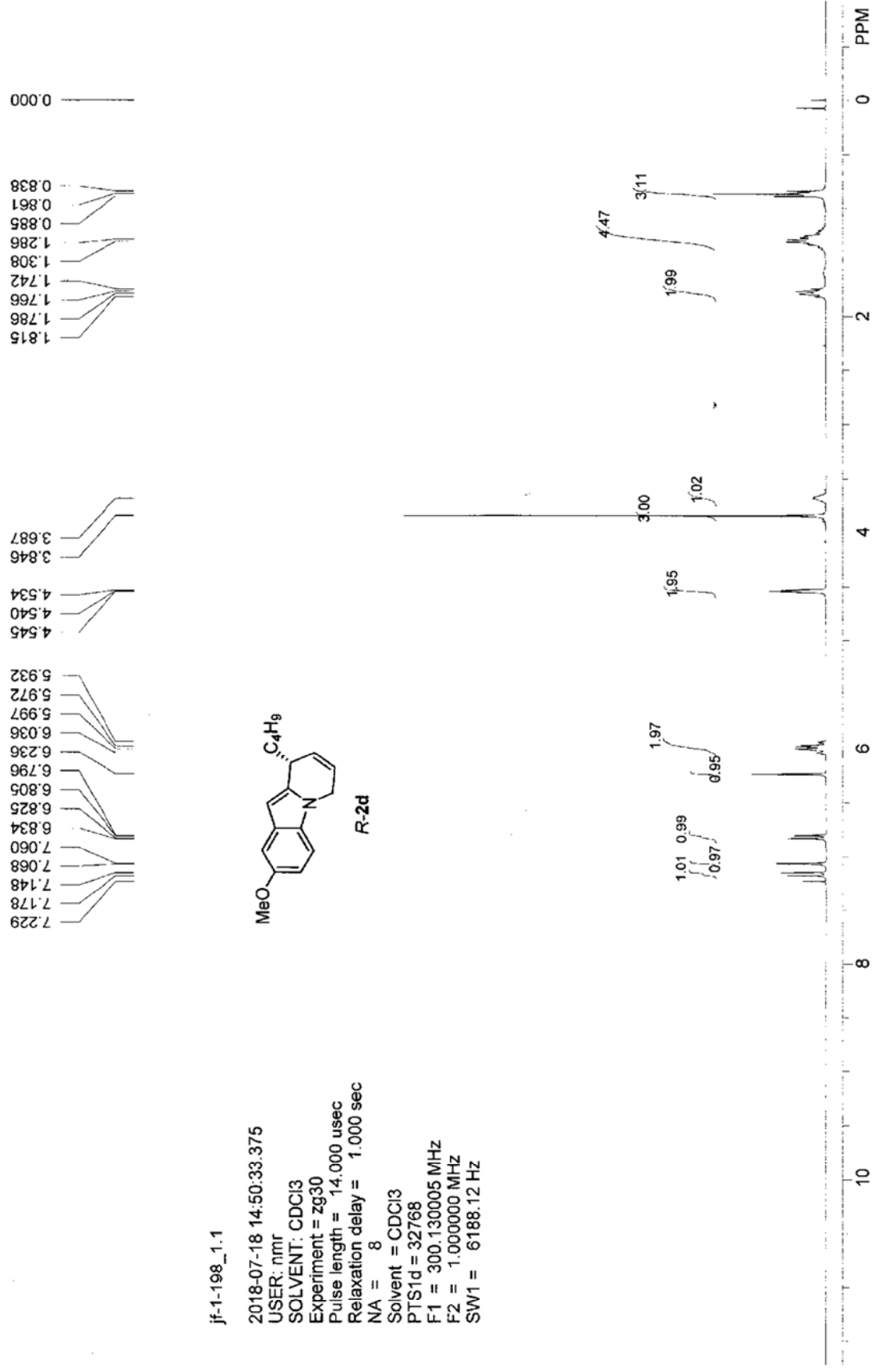
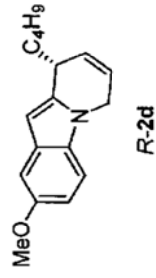
Solvent = CDCl₃

PTSD = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



if-1-198_2.1

2018-07-18 13:35:07.703

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation d

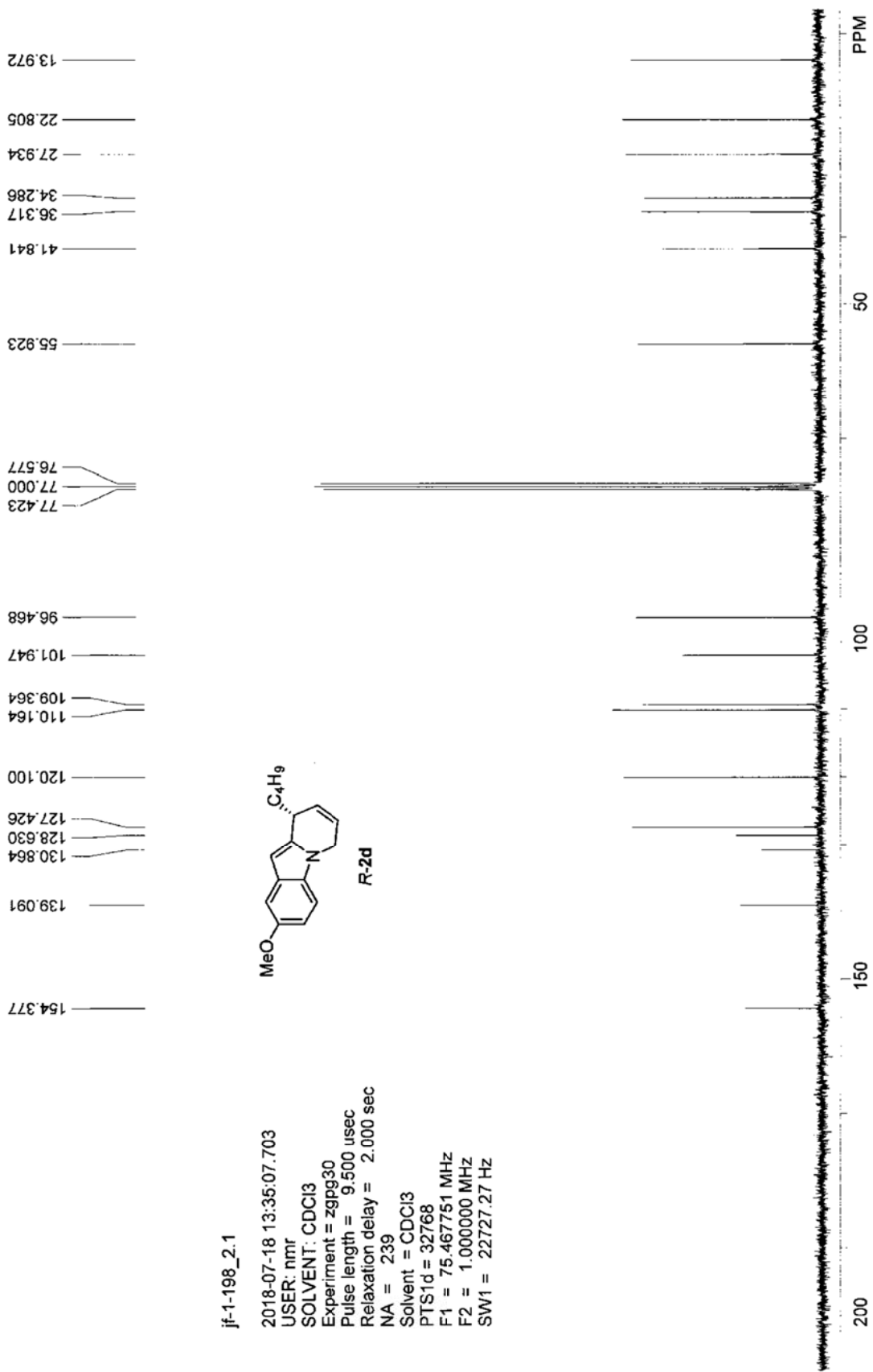
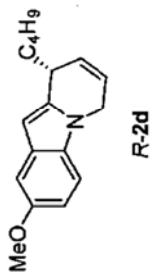
NA = 239

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz
SW1 = 22727.27 Hz



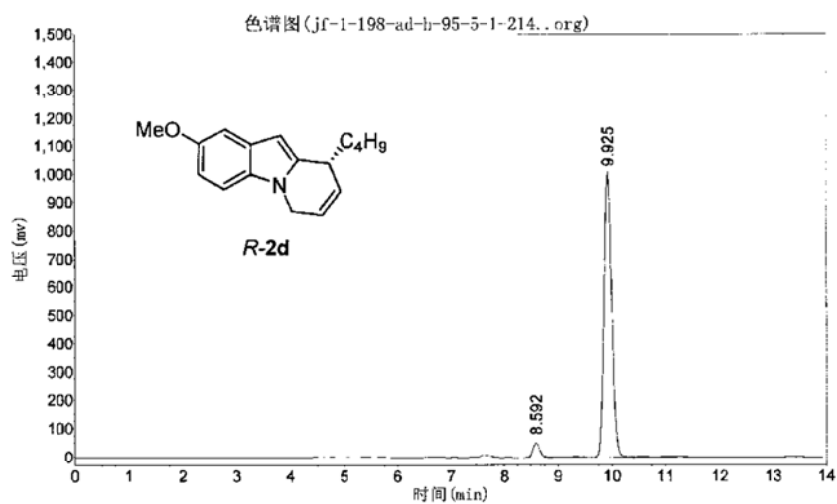
jf-1-198-ad-h-95-5-1-214

实验时间: 2018-06-21, 12:30:06

报告时间: 2018-06-21, 18:29:25

谱图文件: D:\zhuguangjiong\jf\20180621\jf-1-198-ad-h-95-5-1-214..org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		8.592	50883.992	443449.688	4.2782
2		9.925	998328.125	9921953.000	95.7218
总计			1049212.117	10365402.688	100.0000

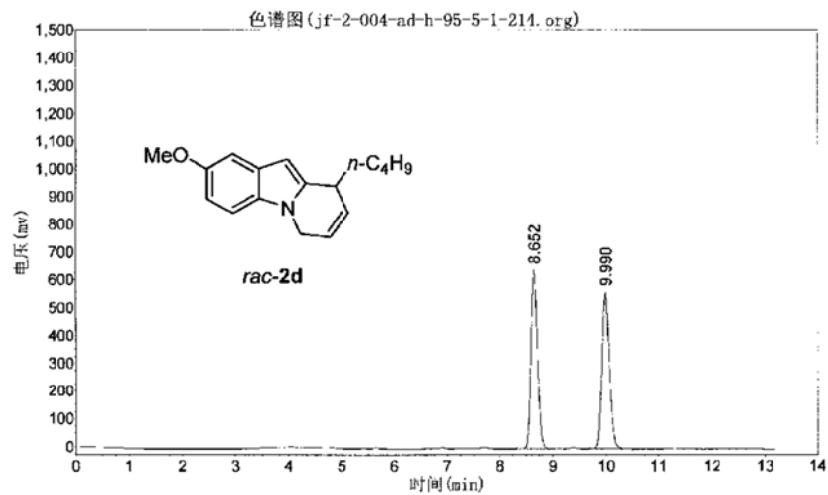
jf-2-004-ad-h-95-5-1-214

实验时间: 2018-06-21, 11:24:11

报告时间: 2018-06-21, 18:30:38

谱图文件: D:\zhuguangji\ong\jf\20180621\jf-2-004-ad-h-95-5-1-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		8.652	637217.875	5573784.500	50.2454
2		9.990	557189.375	5519331.500	49.7546
总计			1194407.250	11093116.000	100.0000

jf-2-039_1.1

2018-07-23 10:30:25.984

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

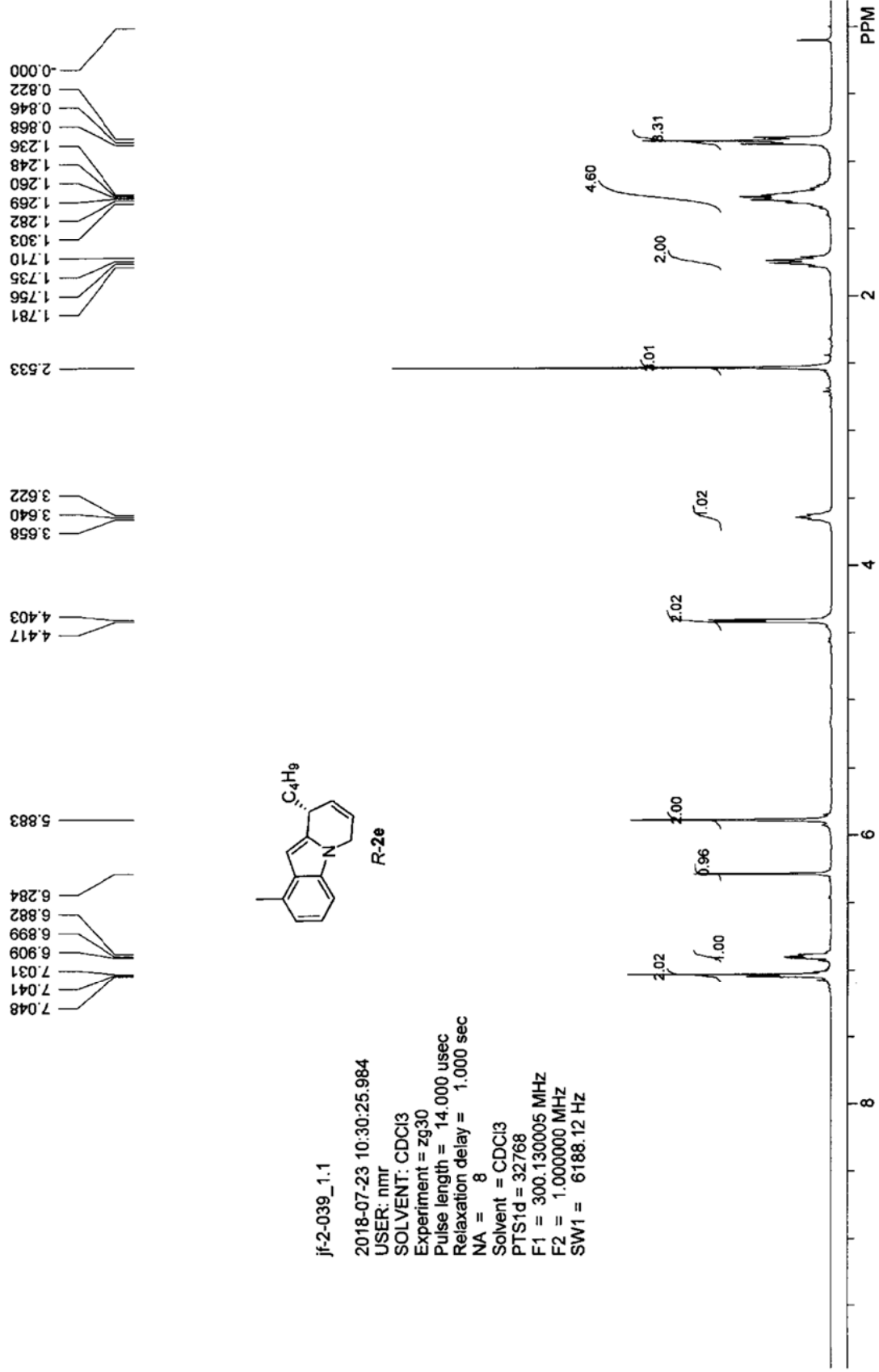
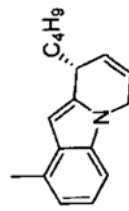
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jt-2-039chundu_1.1

2018-09-02 14:08:11.828

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

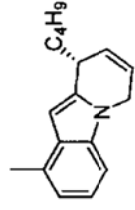
Solvent = CDCl₃

PTS1d = 32768

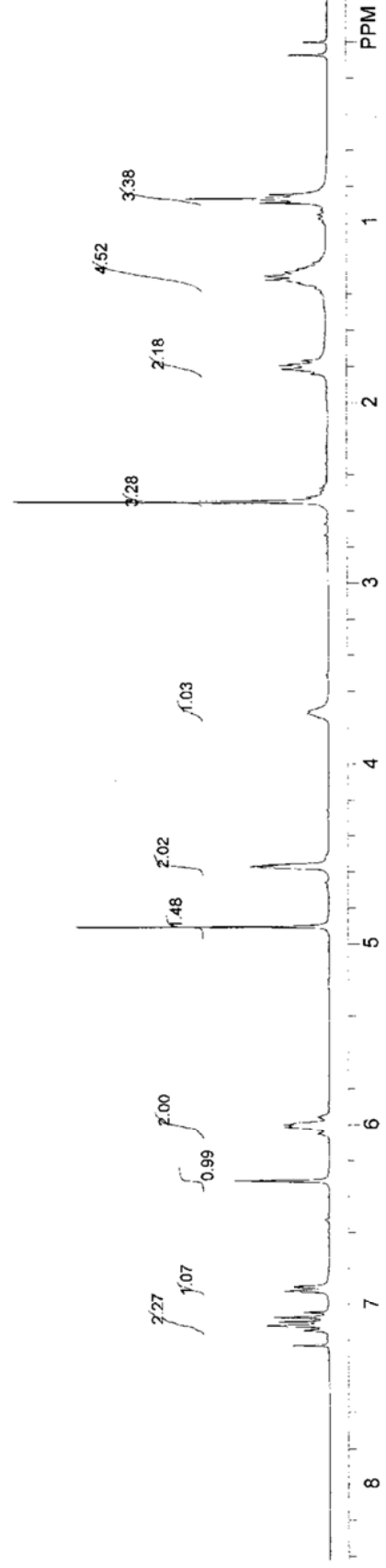
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



Purity (91%) is determined by dibromomethane
(10 µl, 0.29 mmol) as the internal standard in 50.8 mg
of sample



Jf-2-039_2.1

2018-07-23 10:35:54.453

USER: nmf

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 70

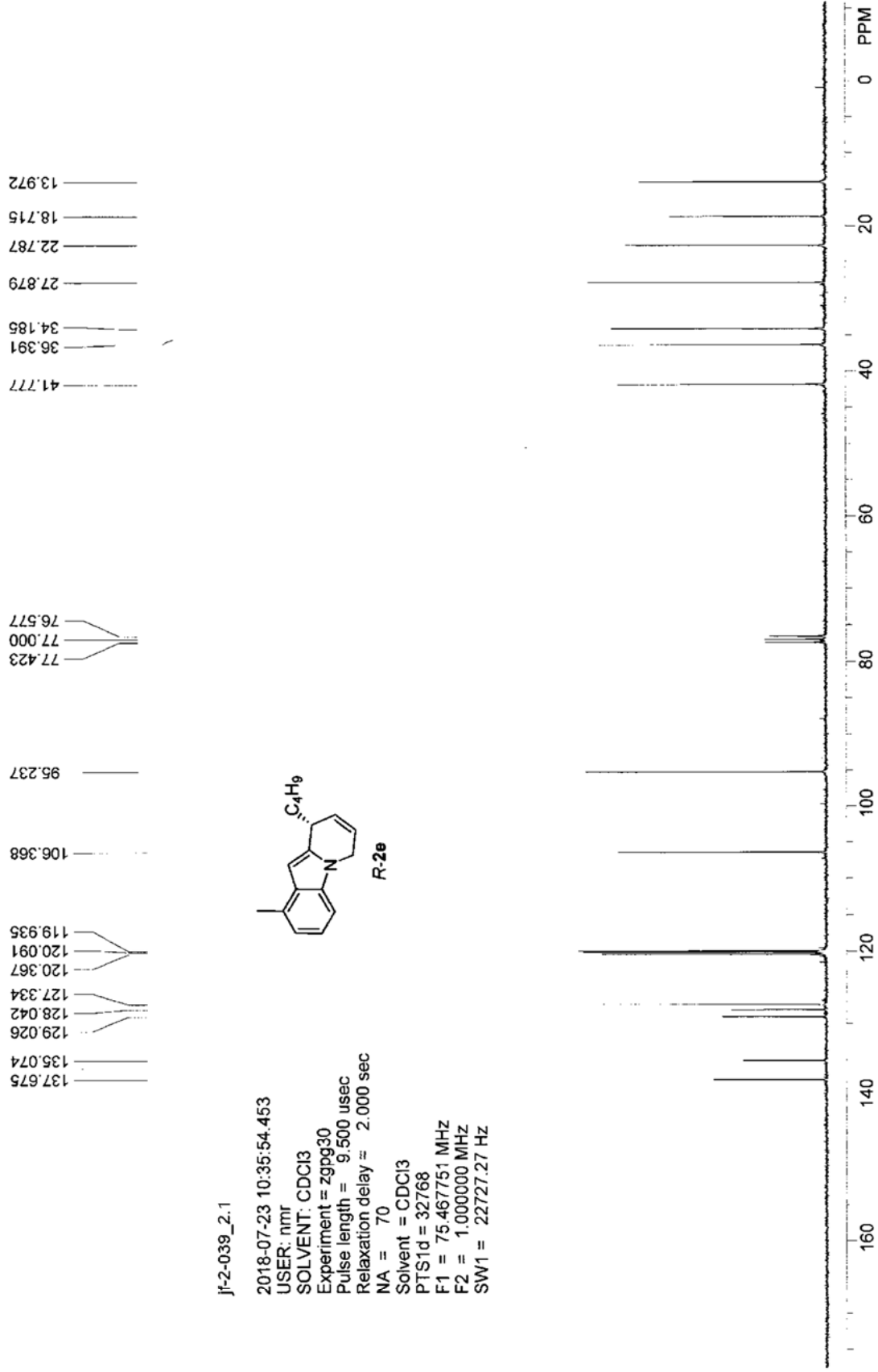
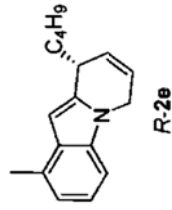
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



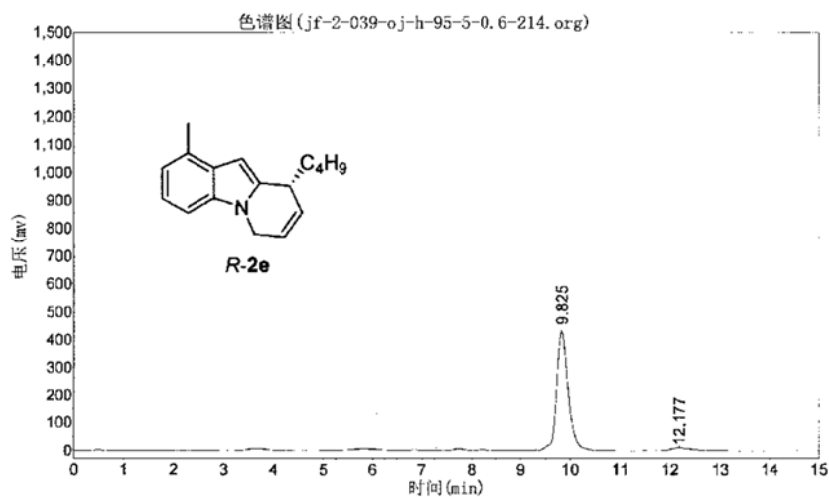
jf-2-039-oj-h-95-5-0.6-214

实验时间: 2018-07-23, 17:35:11

报告时间: 2018-07-23, 18:57:18

谱图文件: D:\zhuguangji\ong\jf\20180723\jf-2-039-oj-h-95-5-0.6-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		9.825	429159.875	7128186.000	94.8342
2		12.177	10283.476	388289.844	5.1658
总计			439443.351	7516475.844	100.0000

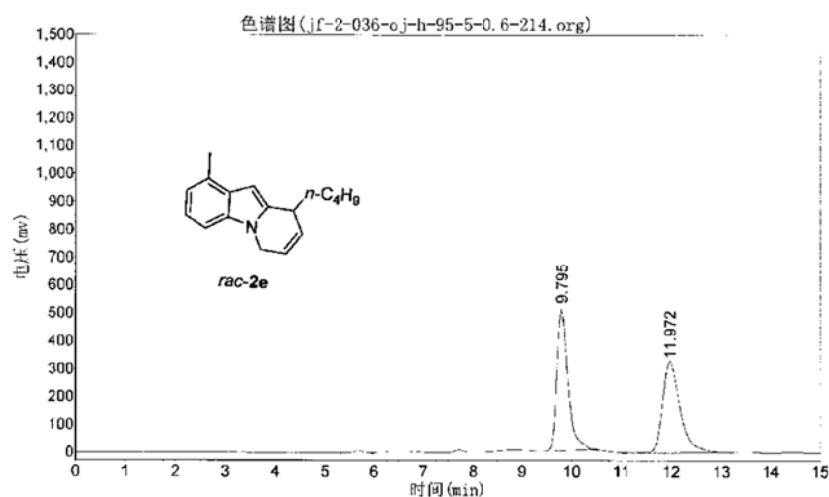
jf-2-036-oj-h-95-5-0.6-214

实验时间: 2018-07-23, 17:03:03

报告时间: 2018-07-23, 18:56:23

谱图文件: D:\zhuguangji\ong\jif\20180723\jf-2-036-oj-h-95-5-0.6-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		9.795	500864.156	7928337.500	50.0015
2		11.972	326163.969	7927857.000	49.9985
总计			827028.125	15856194.500	100.0000

jf-2-062_1.1

2018-09-26 15:33:08.578

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

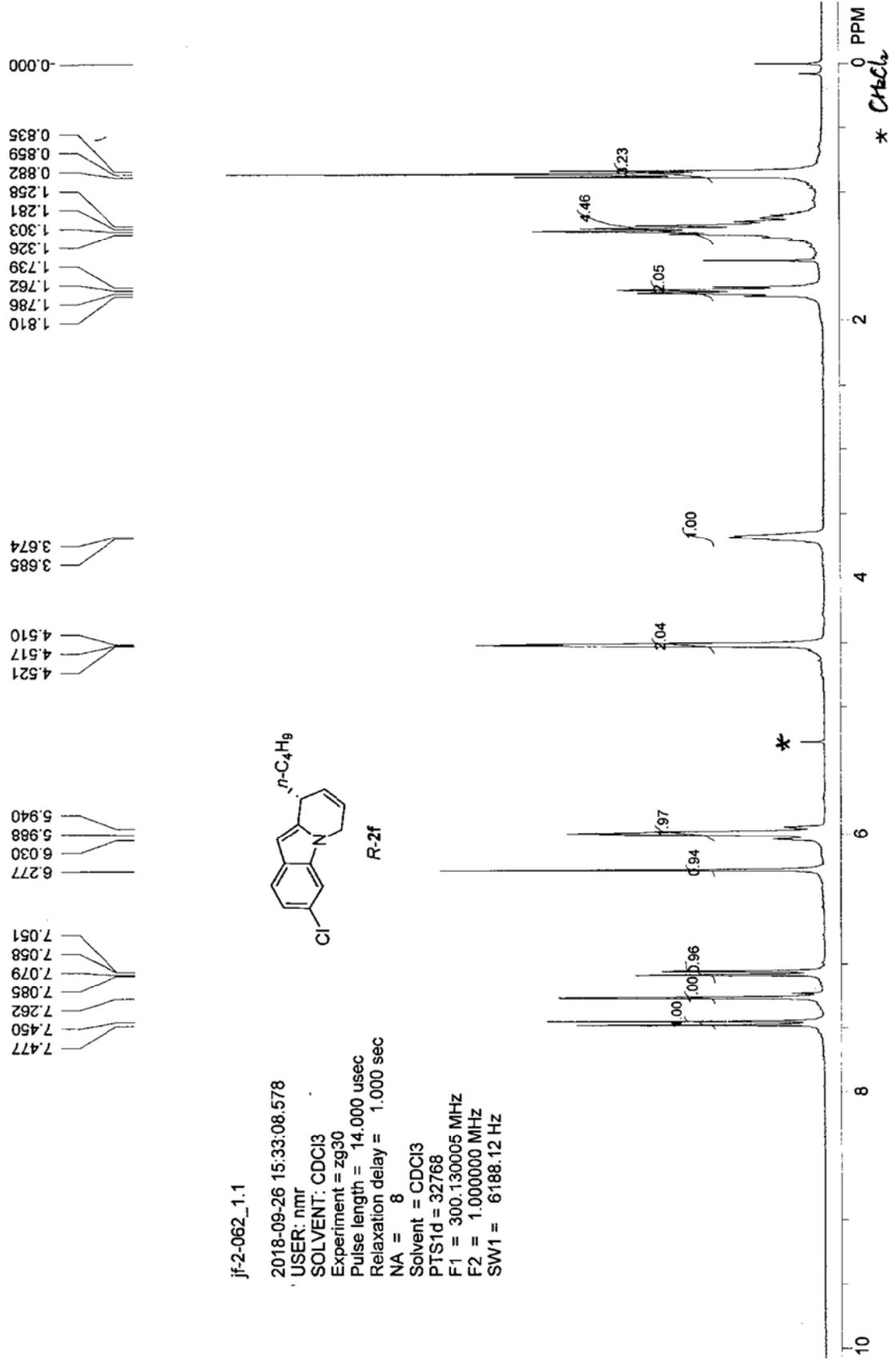
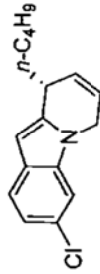
Solvent = CDCl₃

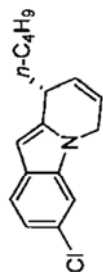
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jf-2-062

2018-09-26 16:20:25.500

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 299

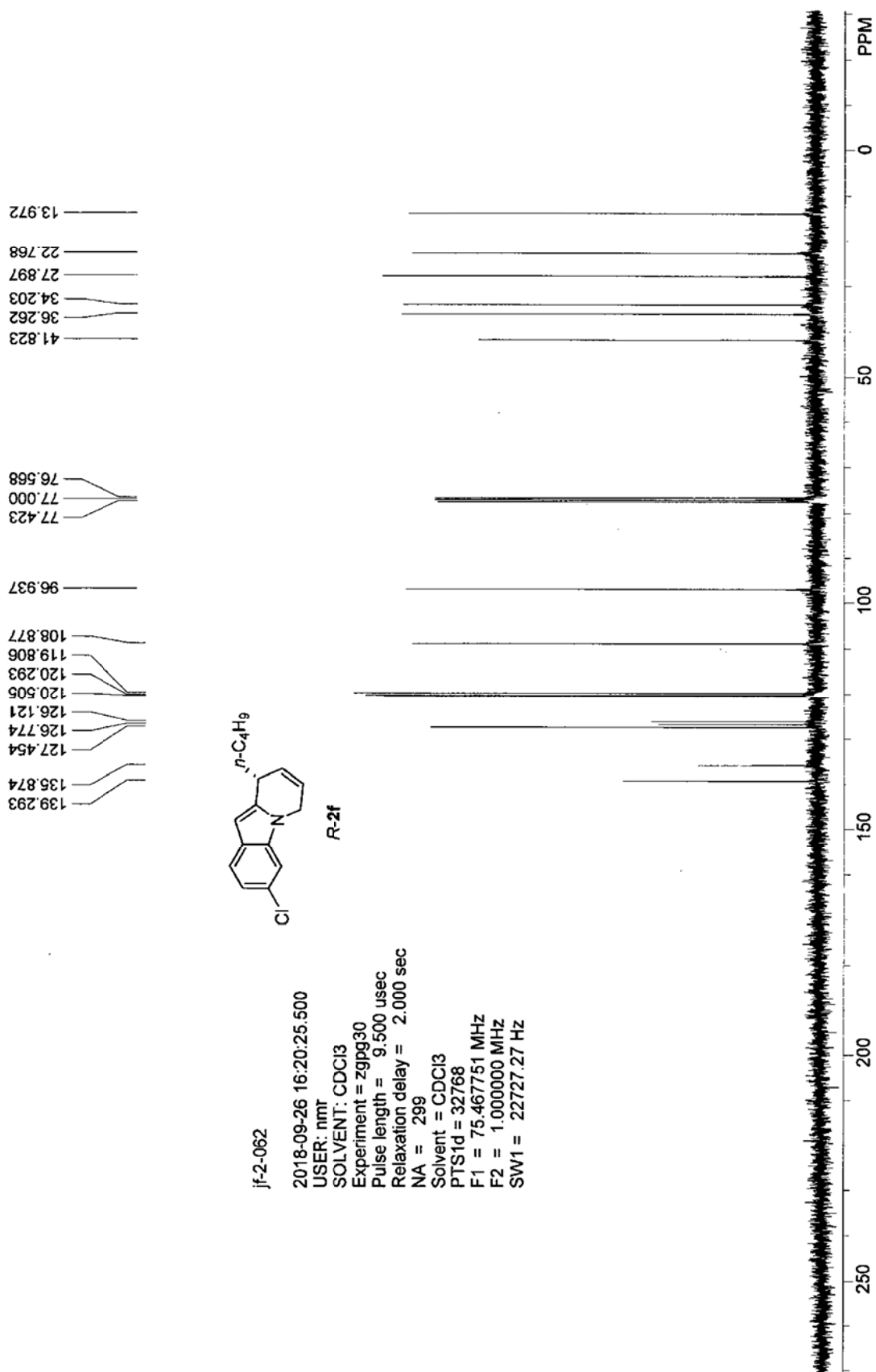
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



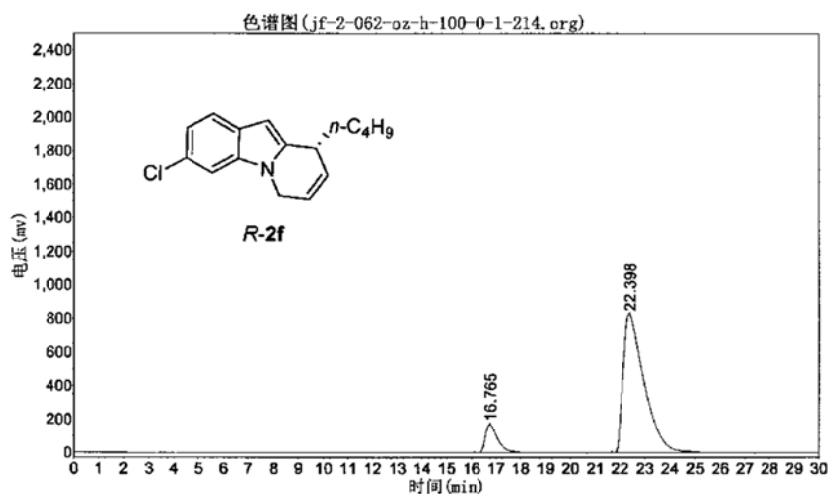
jf-2-062-oz-h-100-0-1-214

实验时间: 2018-09-29, 16:01:09

报告时间: 2018-09-29, 18:22:17

谱图文件: D:\zhuguangjiong\jf\20180929\jf-2-062-oz-h-100-0-1-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		16.765	170821.219	5924574.500	10.8687
2		22.398	829361.500	48586100.000	89.1313
总计			1000182.719	54510674.500	100.0000

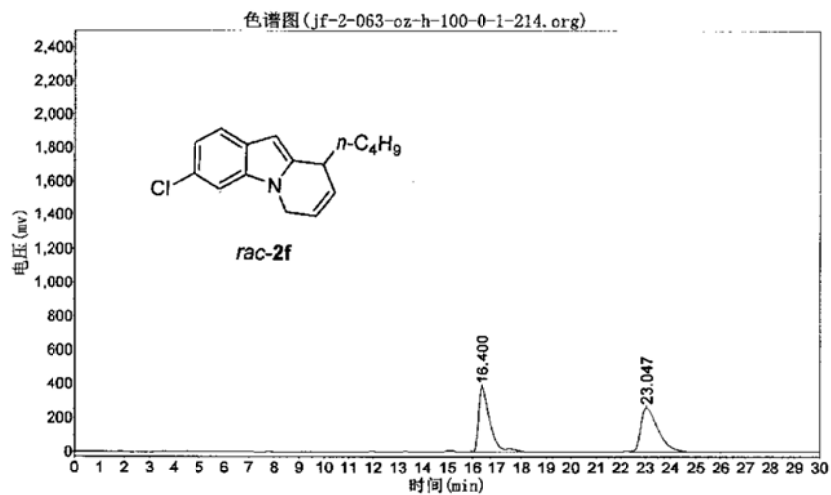
jf-2-063-oz-h-100-0-1-214

实验时间: 2018-09-29, 15:26:45

报告时间: 2018-09-29, 18:21:41

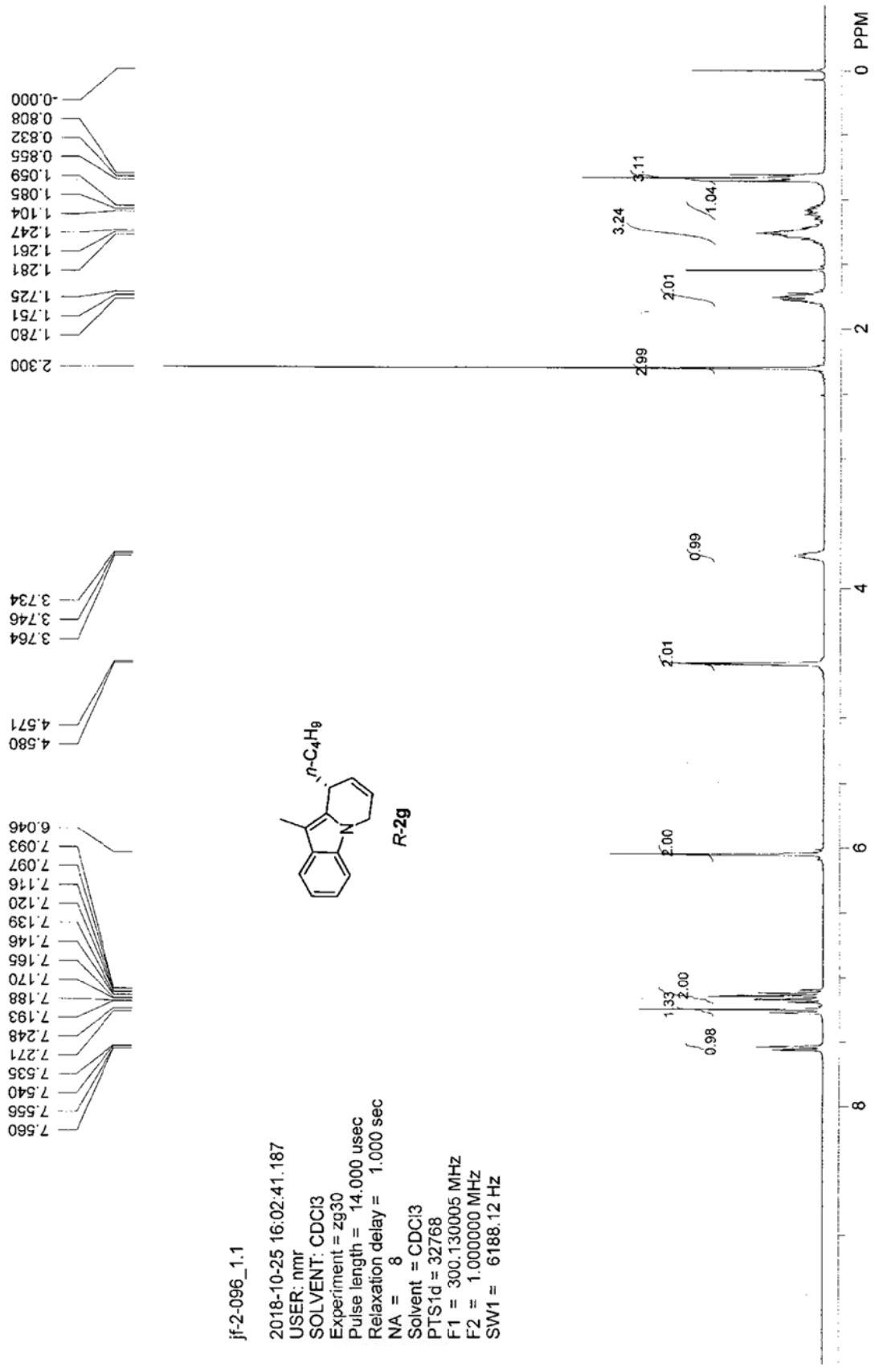
谱图文件: D:\zhuguangjiong\jf\20180929\jf-2-063-oz-h-100-0-1-214.org

实验内容简介:



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		16.400	382431.438	12647115.000	50.0486
2		23.047	261258.469	12622542.000	49.9514
总计			643689.906	25269657.000	100.0000



jf-2-096_1.1

2018-10-25 16:02:41.187

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

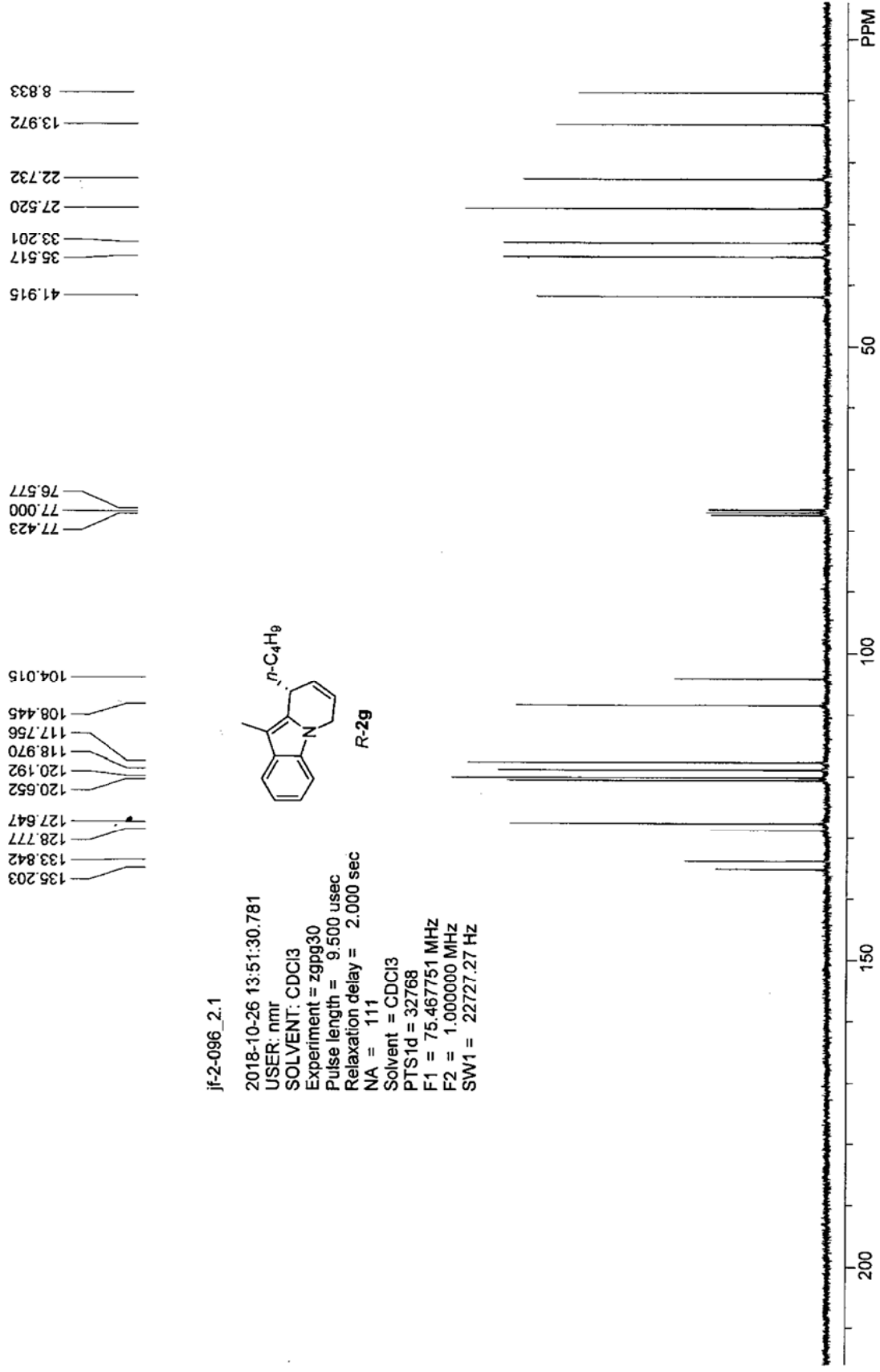
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-2-096_2.1

2018-10-26 13:51:30.781

USER: nmr

SOLVENT: CDCl3

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 111

Solvent = CDCl3

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

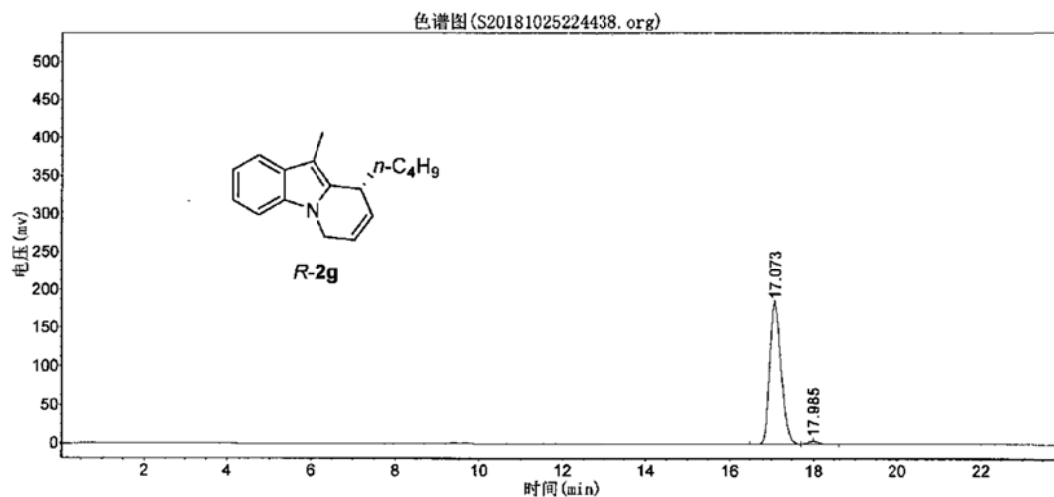
SW1 = 22727.27 Hz

jf-2-096

实验时间: 2018-10-25, 22:44:38
谱图文件: D:\浙大智达\N2000\样品\S20181025224438.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-11-13, 21:41:11
积分方法: 面积归一法

实验内容简介:
od-H, n-hexane/i-PrOH = 100/1, 0.4, 254



分析结果表

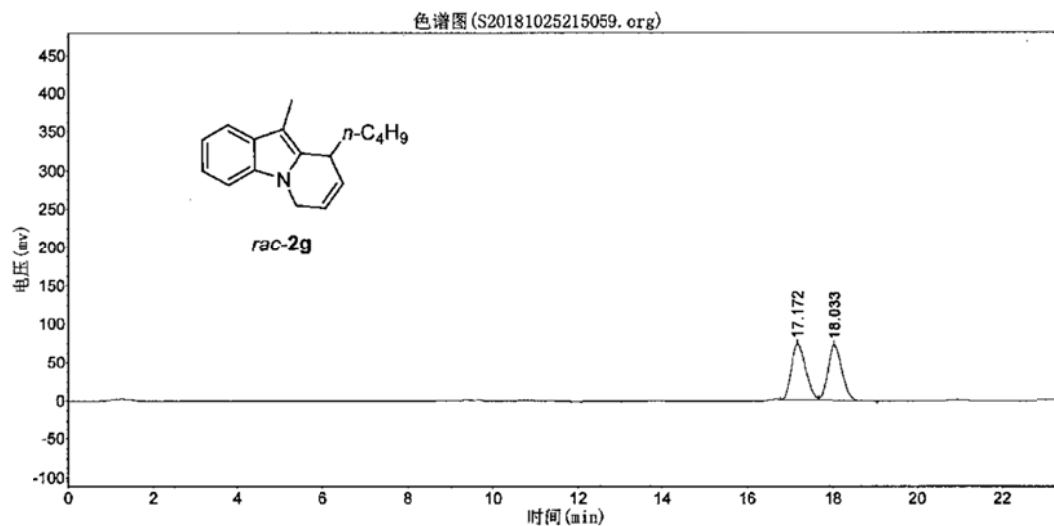
峰号	峰名	保留时间	峰高	峰面积	含量
1		17.073	182440.531	3464835.250	98.1705
2		17.985	3529.913	64571.457	1.8295
总计			185970.445	3529406.707	100.0000

jf-2-097

实验时间: 2018-10-25, 21:50:59
谱图文件: D:\浙大智达\N2000\样品\S20181025215059.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-11-13, 21:45:25
积分方法: 面积归一法

实验内容简介:
od-H, n-hexane/i-PrOH = 100/1, 0.4, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		17.172	73097.867	1658753.500	49.7618
2		18.033	72283.656	1674633.625	50.2382
总计			145381.523	3333387.125	100.0000

jf-2-144_1.1

2018-12-25 14:52:09.171

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

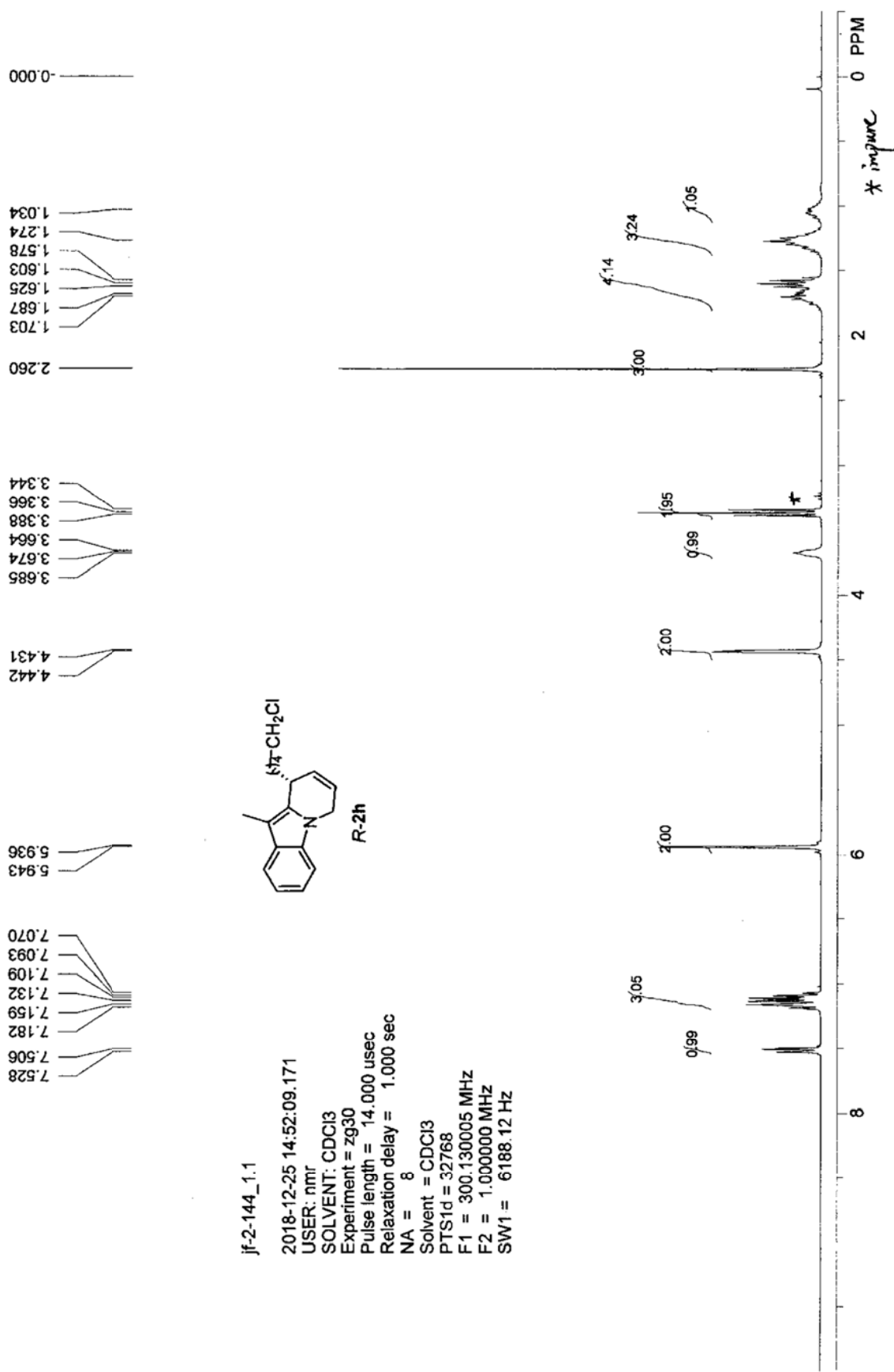
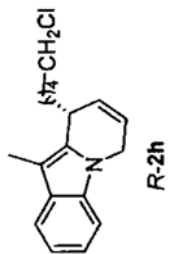
Solvent = CDCl₃

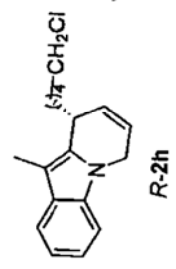
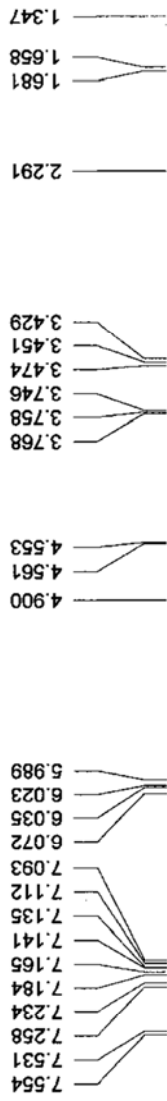
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

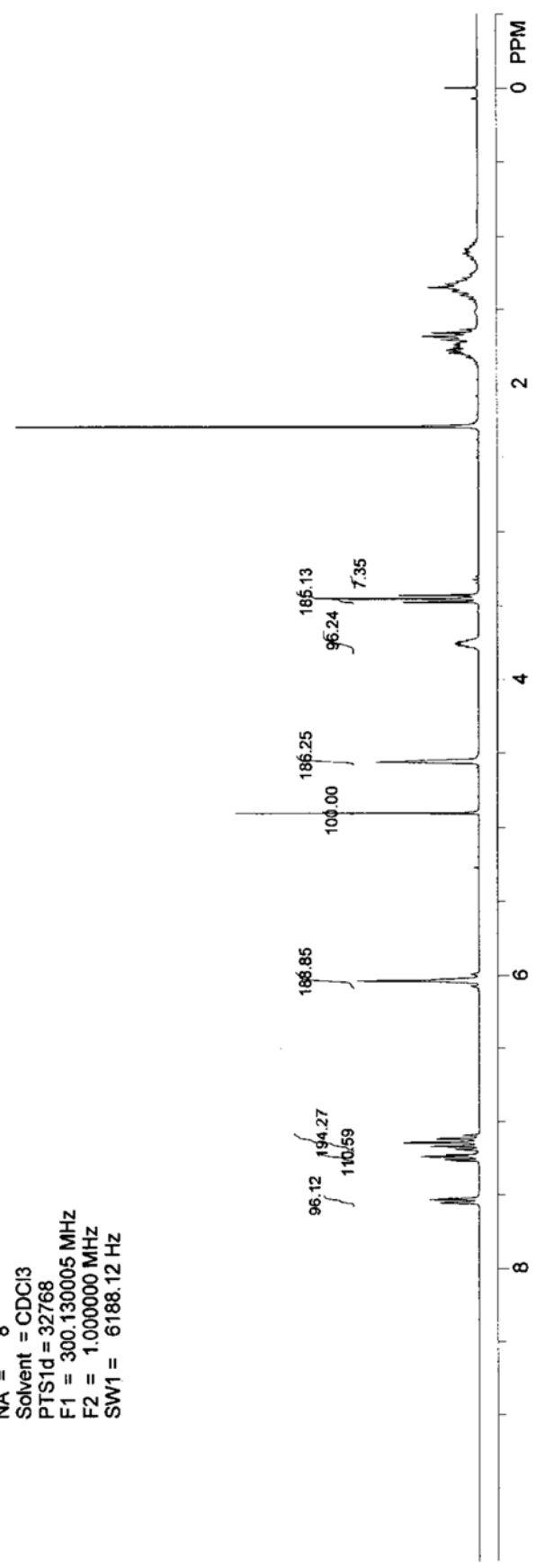


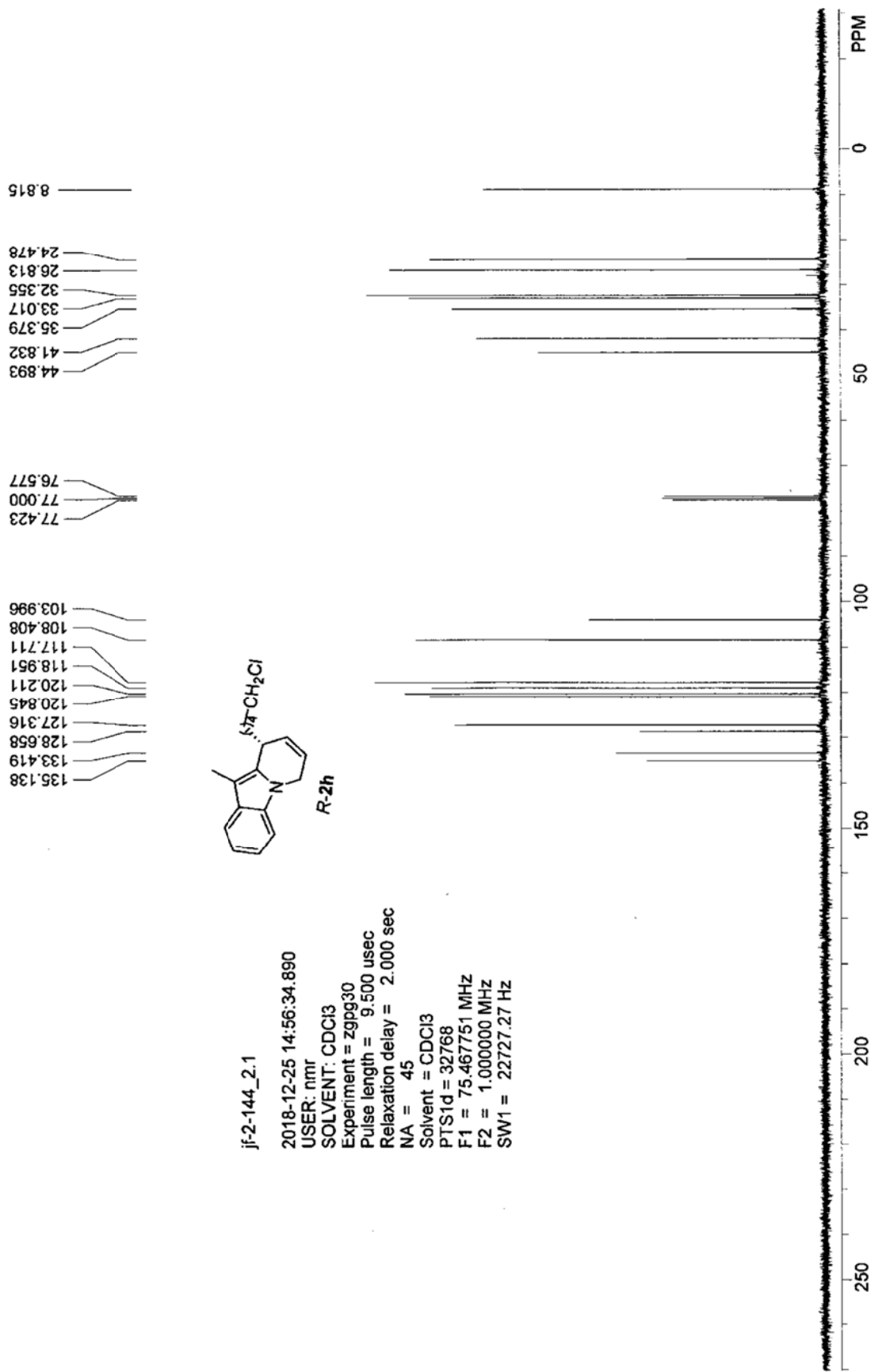


if-2-144-purity

2018-12-28 21:54:41.546
 USER: nmir
 SOLVENT: CDCl3
 Experiment = zg30
 Pulse length = 14.000 usec
 Relaxation delay = 1.000 sec
 NA = 8
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 300.130005 MHz
 F2 = 1.000000 MHz
 SW1 = 6188.12 Hz

purity (96%) is determined by dibromomethane(7 μ L, 0.2 mmol) as the internal standard in 55.8 mg of sample



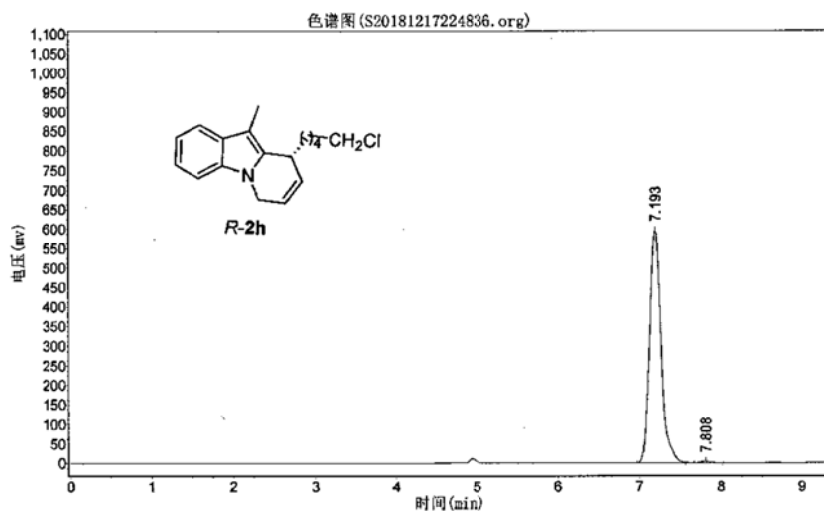


jf-2-144

实验时间: 2018-12-17, 22:48:36
谱图文件: D:\浙大智达\N2000\样品\S20181217224836.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-12-17, 23:03:30
积分方法: 面积归一法

实验内容简介:
IA, n-hexane/i-PrOH = 100/1, 0.7, 254



分析结果表

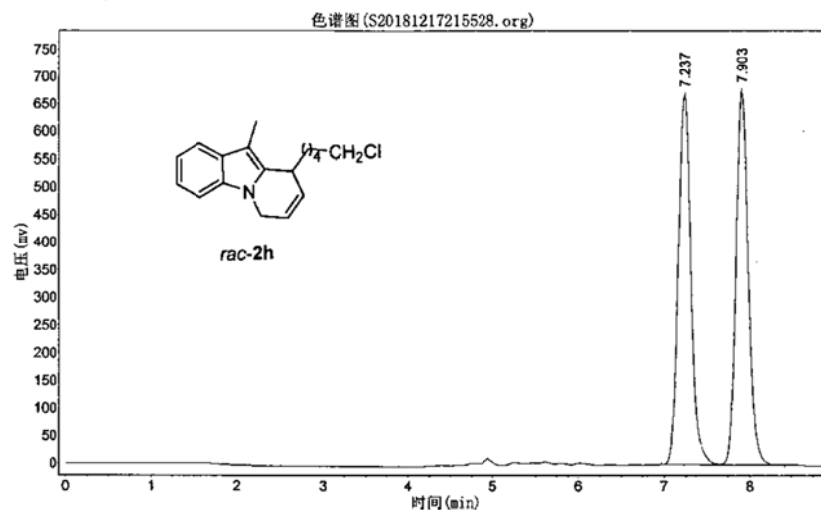
峰号	峰名	保留时间	峰高	峰面积	含量
1		7.193	596055.250	5739957.000	99.2745
2		7.808	4944.250	41945.203	0.7255
总计			600999.500	5781902.203	100.0000

jf-2-152

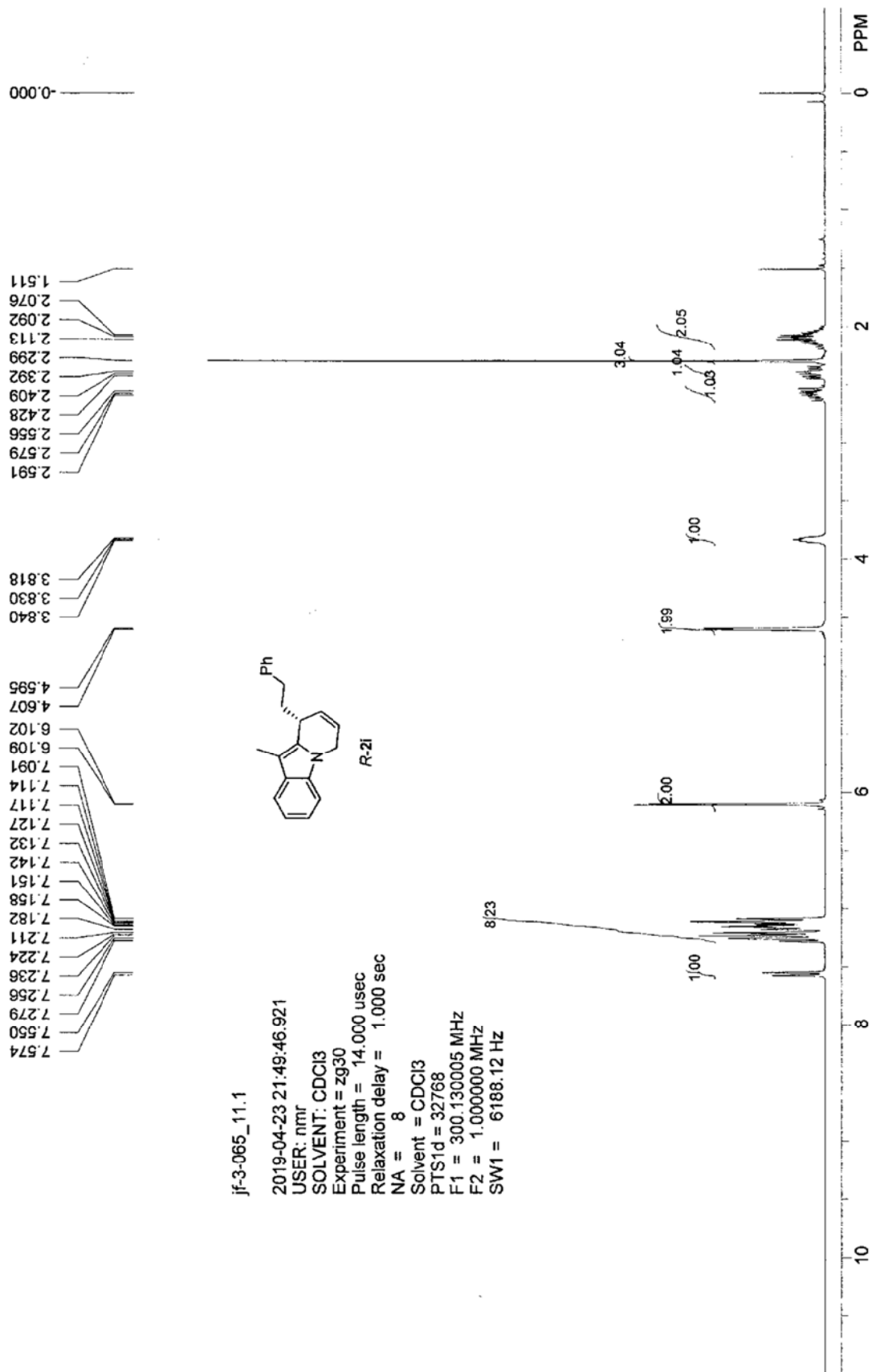
实验时间: 2018-12-17, 21:55:28
谱图文件: D:\浙大智达\N2000\样品\S20181217215528.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-12-17, 23:05:57
积分方法: 面积归一法

实验内容简介:
IA, n-hexane/i-PrOH = 100/1, 0.7, 254



分析结果表					
峰号	峰名	保留时间	峰高	峰面积	含量
1		7.237	666976.375	6778395.000	50.4837
2		7.903	675224.625	6648491.000	49.5163
总计			1342201.000	13426886.000	100.0000



jf-3-065_11.1

2019-04-23 21:49:46.921

USER: nmr

SOLVENT: CDCl3

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

Solvent = CDCl3

PTSD = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

jf-3-065_2.1

2019-04-23 21:39:02.218

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 111

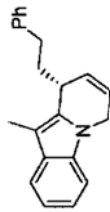
Solvent = CDCl₃

PTS1d = 32768

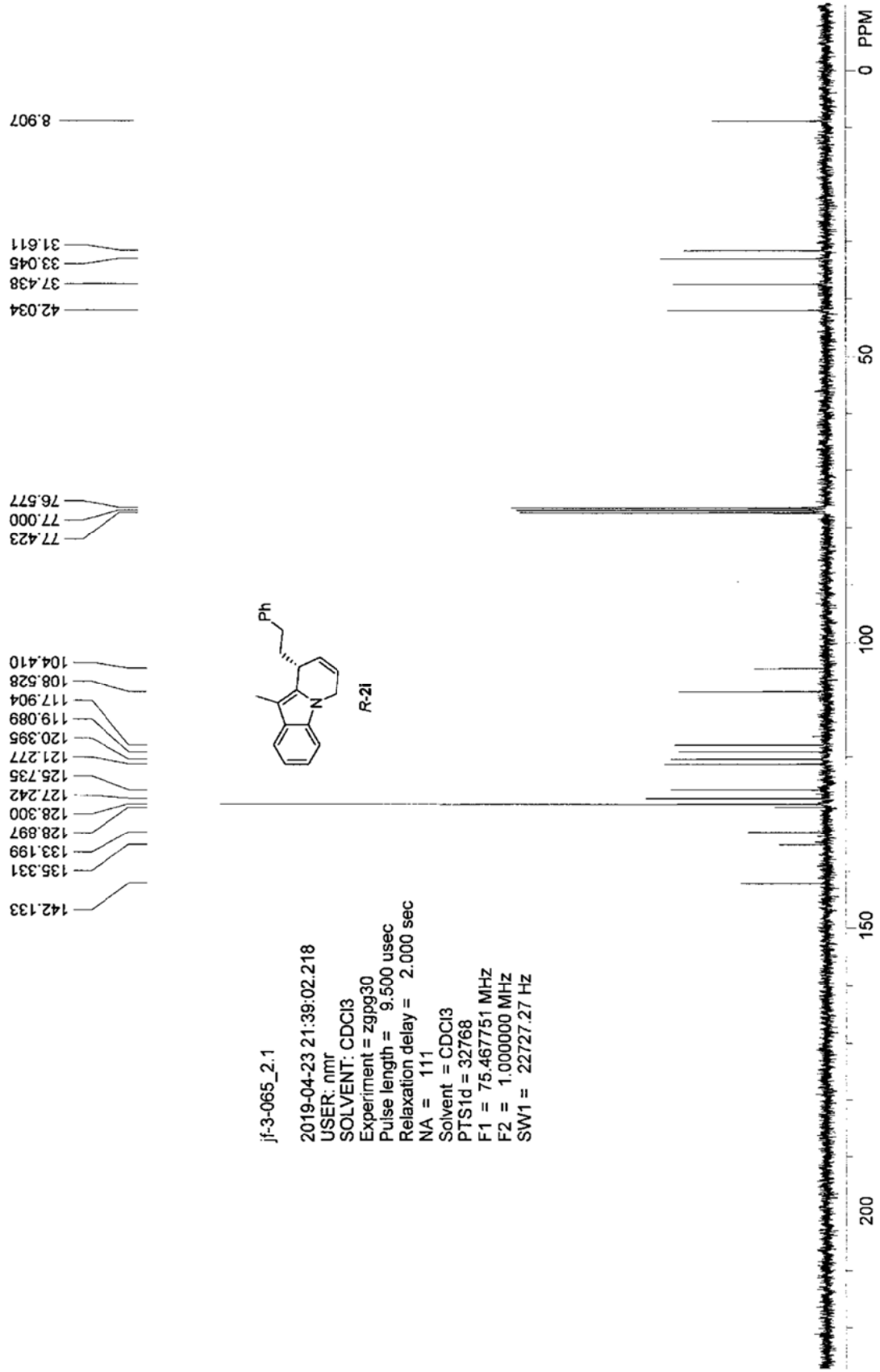
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



R-21

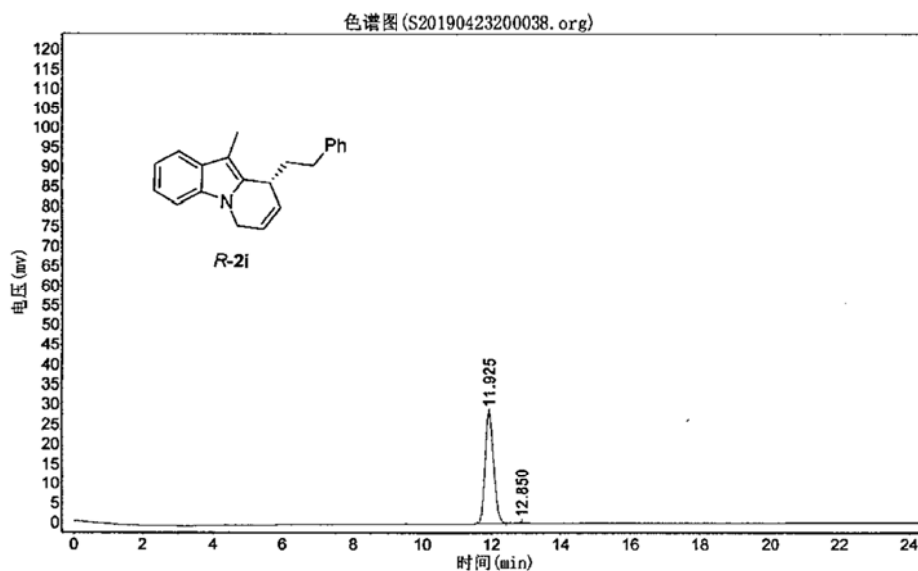


jf-3-065

实验时间: 2019-04-23, 20:00:38
谱图文件: D:\浙大智达\N2000\样品\S20190423200038.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-04-23, 21:55:15
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 95/5, 0.7, 254



分析结果表

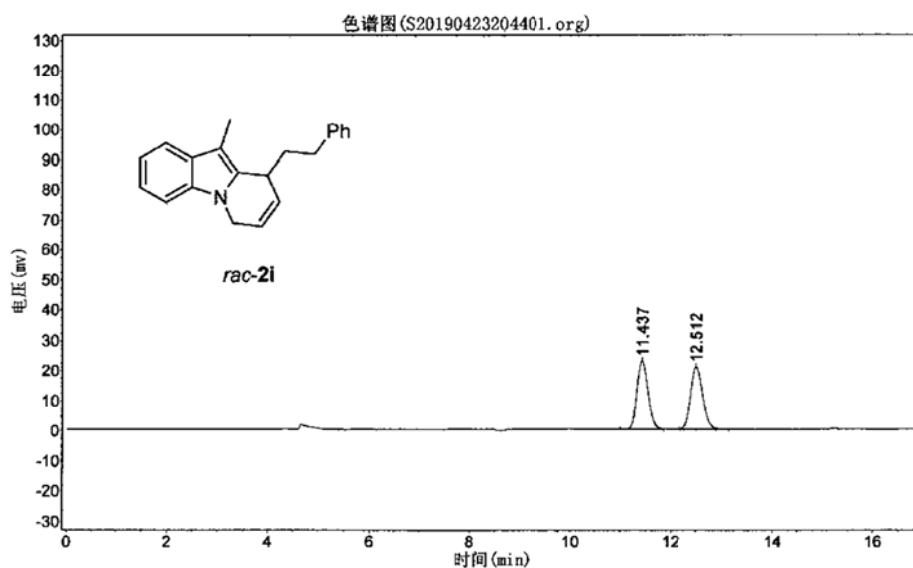
峰号	峰名	保留时间	峰高	峰面积	含量
1		11.925	28254.723	480391.094	99.0361
2		12.850	305.214	4675.650	0.9639
总计			28559.936	485066.744	100.0000

jf-3-030

实验时间: 2019-04-23, 20:44:01
谱图文件: D:\浙大智达\N2000\样品\S20190423204401.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: 30
报告时间: 2019-04-23, 21:57:54
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 95/5, 0.7, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		11.437	22686.373	339313.313	50.1361
2		12.512	20679.621	337470.688	49.8639
总计			43365.994	676784.000	100.0000

jf-3-095_1.1

2019-05-14 22:30:51.421

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

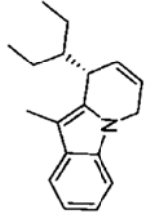
Solvent = CDCl₃

PTSD = 32768

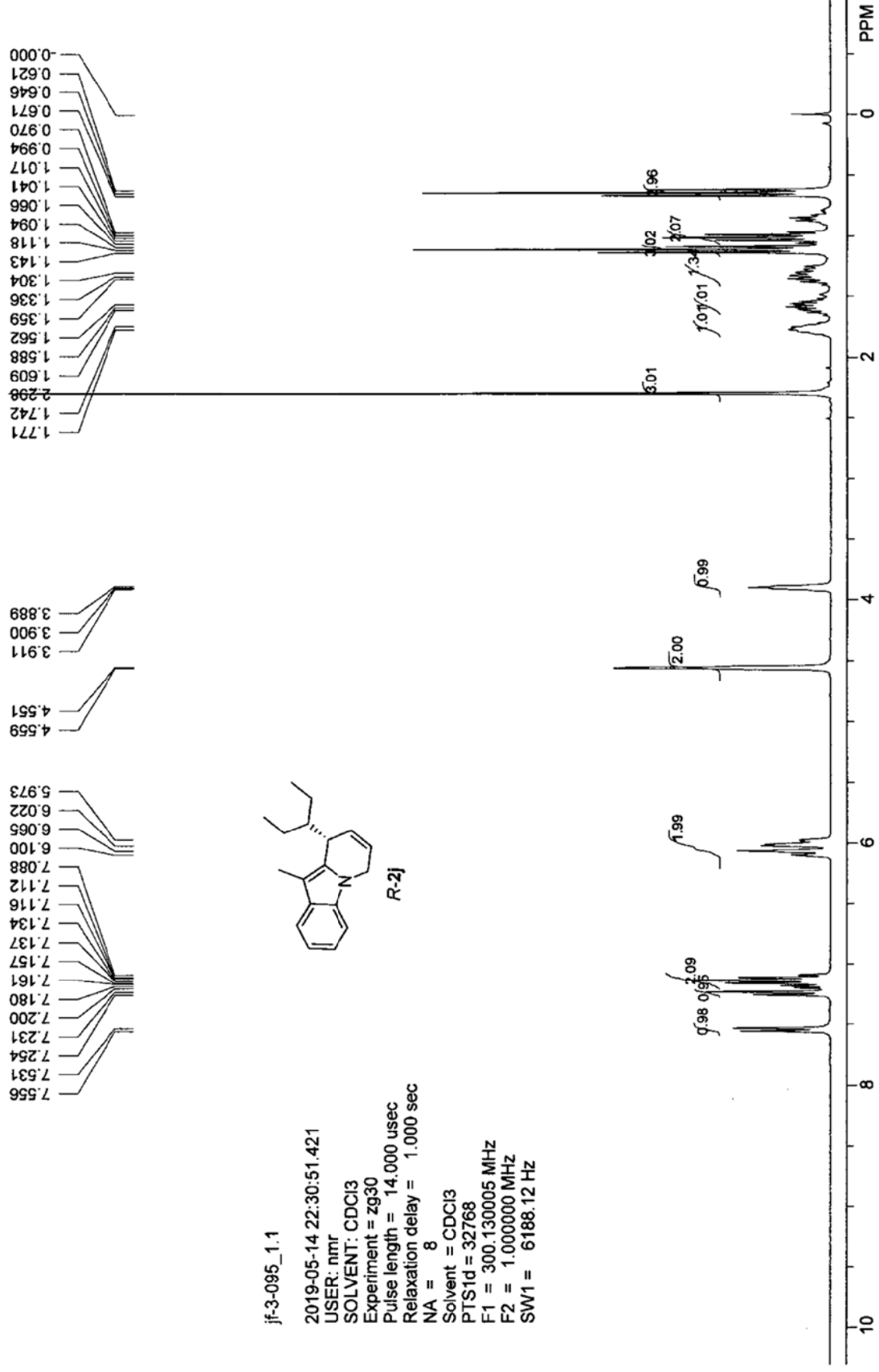
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SWH = 6188.12 Hz



R-2j



jf-3-095_2.1

2019-05-14 22:43:04.890

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 195

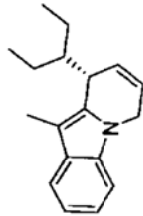
Solvent = CDCl₃

PTS1d = 32768

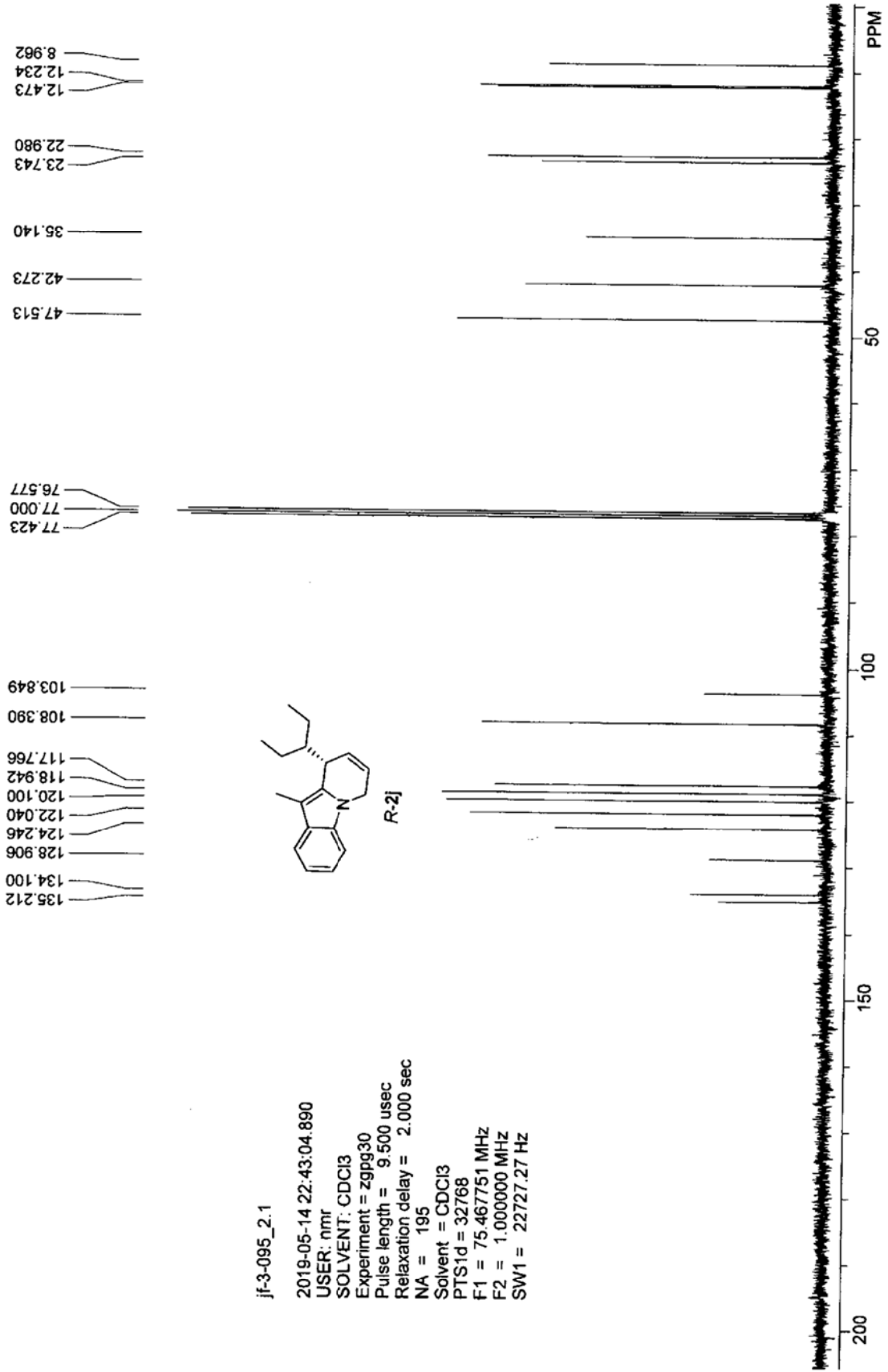
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

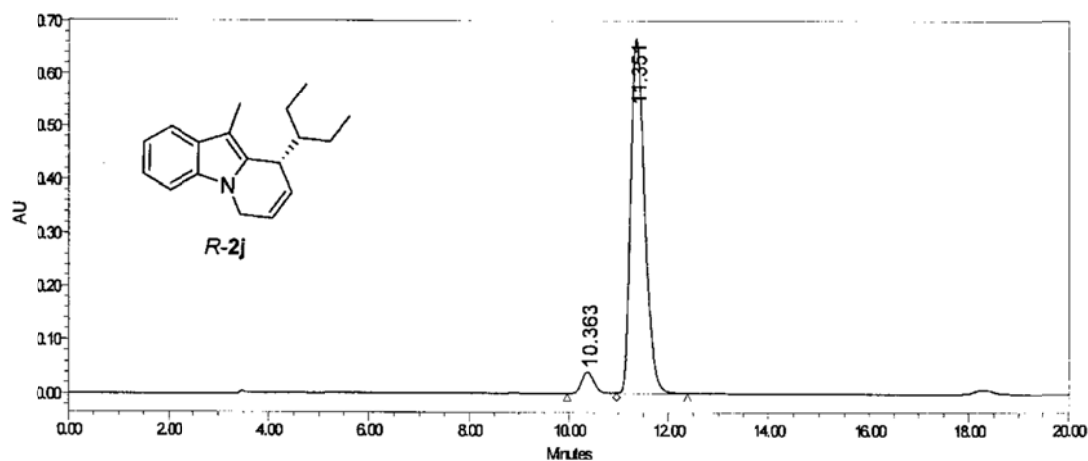


R-2j



SAMPLE INFORMATION

Sample Name:	JF3-095-02-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Val:	1	Acq. Method Set:	ZG/100
Injection#:	11	Processing Method:	111
Injection Volume:	10.00 μ l	Channel Name:	V2489 ChA
Run Time:	20.0 Minutes	Proc. Chnl. Descr.:	V2489 ChA.214nm
Date Acquired:	5/22/2019 7:38:31 PM EDT		
Date Processed:	5/22/2019 10:24:36 PM EDT		



Channel: V2489 ChA; Processed Channel: V2489 ChA.214nm; Result Id: 1404; Processing Method: 11

Processed Channel Descr.: V2489 ChA.214nm

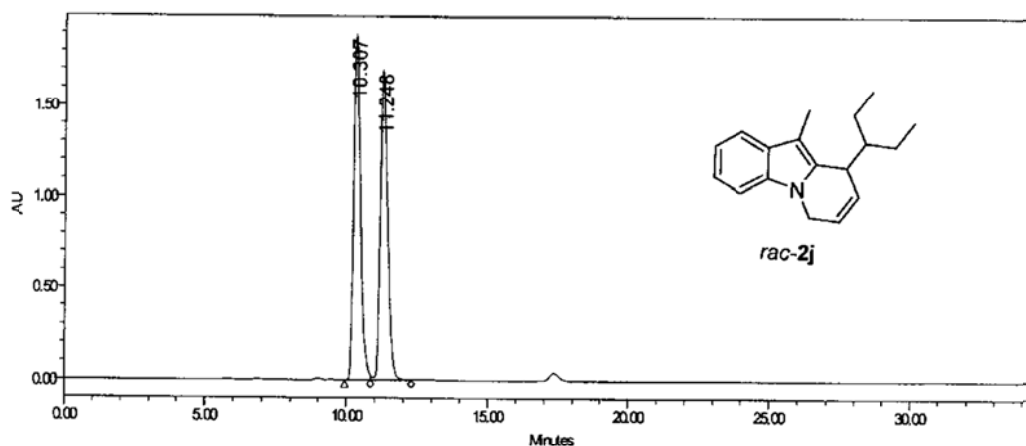
	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA.214nm	10.363	707155	5.20	41008
2	V2489 ChA.214nm	11.351	12904436	94.80	667098

Reported by User: System
Report Method: Injection Summary Report
Report Method ID: 1029 1029
Page: 1 of 1

Project Name: HPLC_1525
Date Printed: 5/22/2019
10:25:55 PM America/New_York

SAMPLE INFORMATION

Sample Name:	jf-3-094-cz-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	ZGJ100
Injection#:	9	Processing Method:	111
Injection Volume:	10.00 uL	Channel Name:	V2489 ChA
Run Time:	60.0 Minutes	Proc. Chnl. Descr.:	V2489 ChA 214nm
Date Acquired:	5/22/2019 6:38:53 PM EDT		
Date Processed:	5/22/2019 10:25:10 PM EDT		



Channel: V2489 ChA; Processed Channel: V2489 ChA 214nm; Result Id: 1405; Processing Method: 11

Processed Channel Descr.: V2489 ChA 214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA 214nm	10.307	31444767	50.85	1901440
2	V2489 ChA 214nm	11.248	30394358	49.15	1699535

jf-3-075_1.1

2019-05-04 17:51:57.421

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

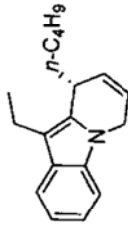
Solvent = CDCl₃

PTS1d = 32768

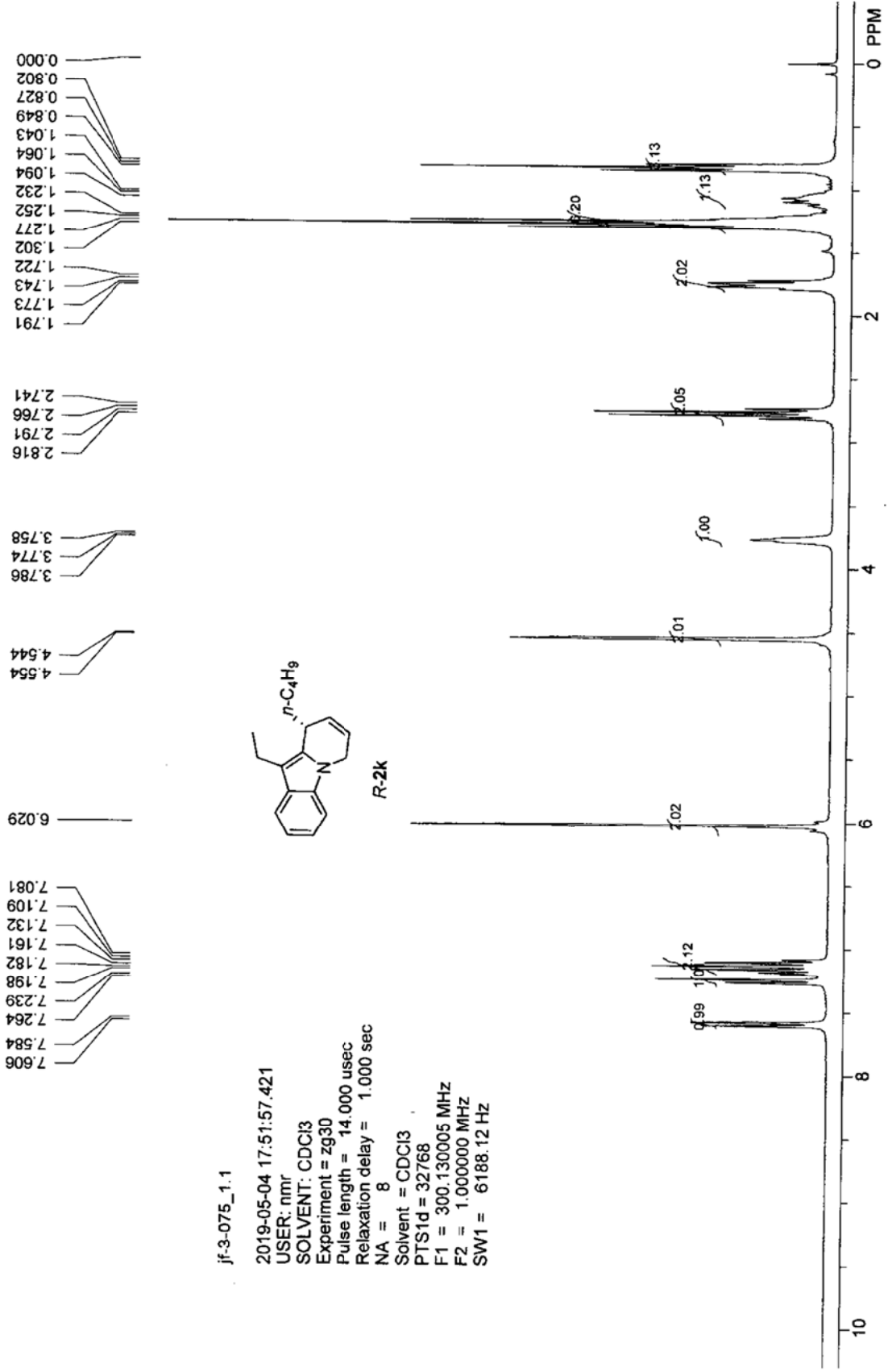
F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



R-2k



jf-3-075_2.1

2019-05-04 18:18:55.953

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 443

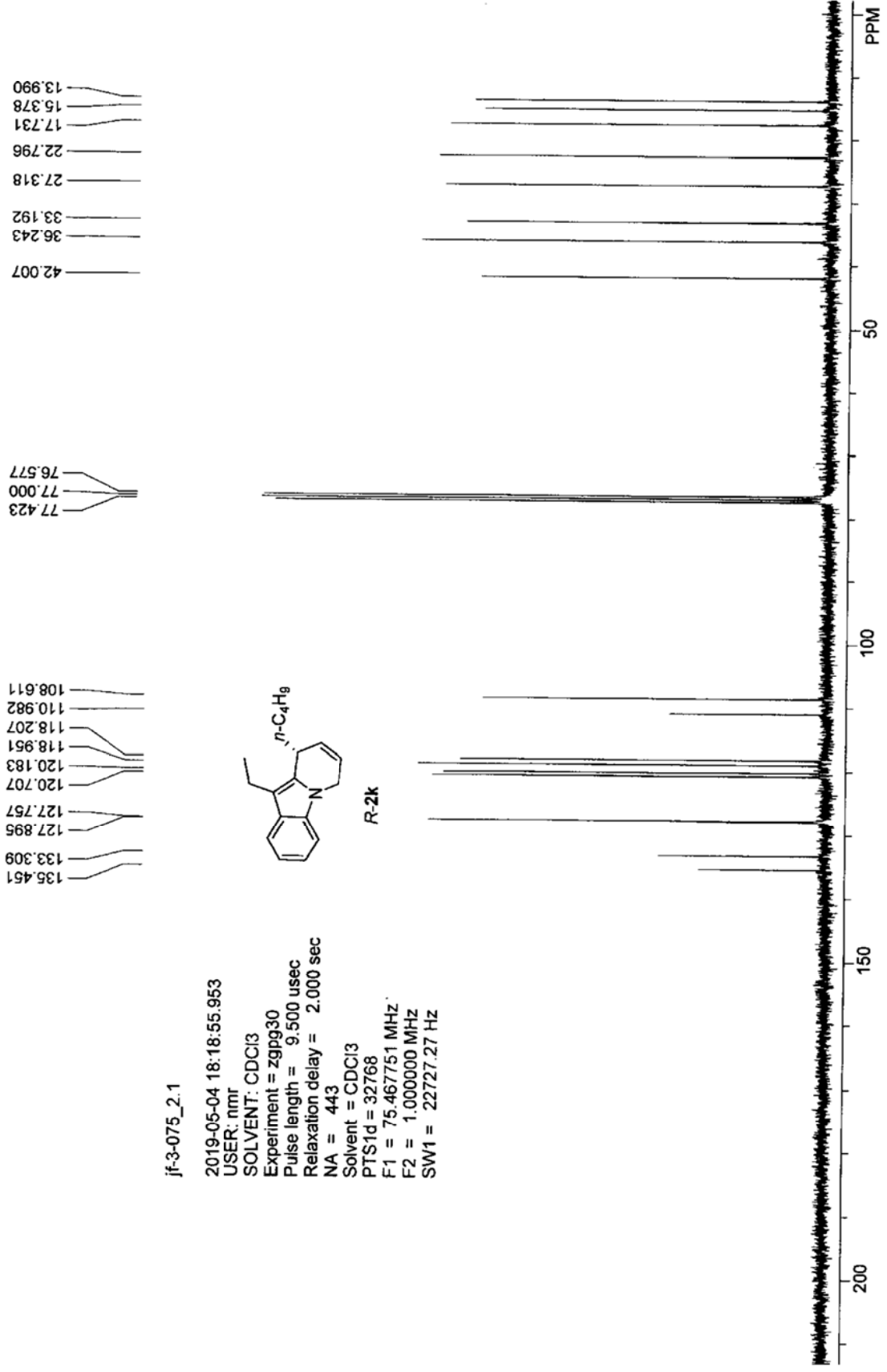
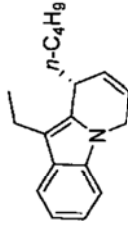
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

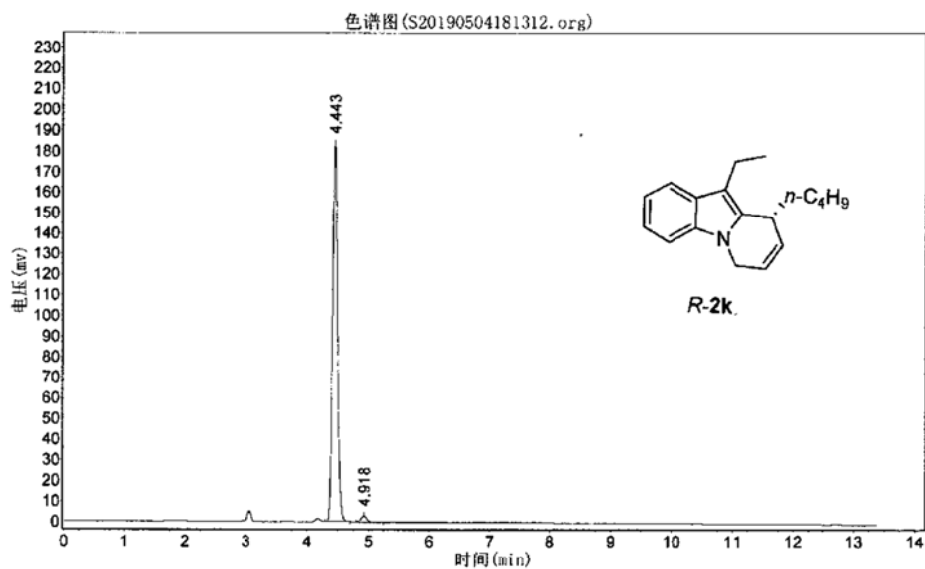


jf-3-075

实验时间: 2019-05-04, 18:13:12
谱图文件: D:\浙大智达\N2000\样品\S20190504181312.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-05-04, 18:28:03
积分方法: 面积归一法

实验内容简介:
od,n-hexane/i-PrOH = 95/5, I. 0, 214



分析结果表

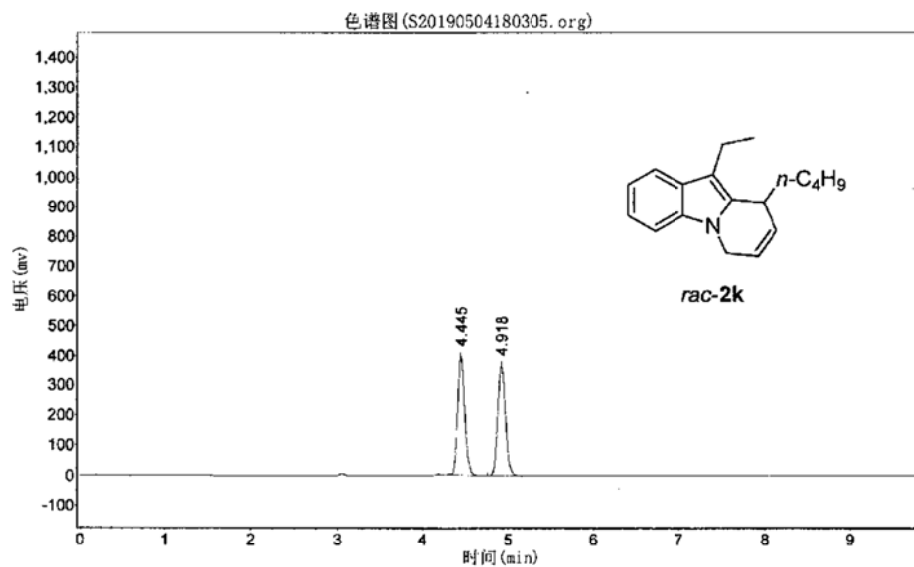
峰号	峰名	保留时间	峰高	峰面积	含量
1		4.443	183596.484	1026928.625	98.2911
2		4.918	2916.195	17853.949	1.7089
总计			186512.679	1044782.574	100.0000

jf-3-077

实验时间: 2019-05-04, 18:03:05
谱图文件: D:\浙大智达\N2000\样品\S20190504180305.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-05-04, 18:15:20
积分方法: 面积归一法

实验内容简介:
od,n-hexane/i-PrOH = 95/5, 1.0, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		4.445	397677.344	2287410.000	49.8355
2		4.918	370122.875	2302510.750	50.1645
总计			767800.219	4589920.750	100.0000

jf-3-057_1.1

2019-04-18 20:21:12.406

USER: nmir

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

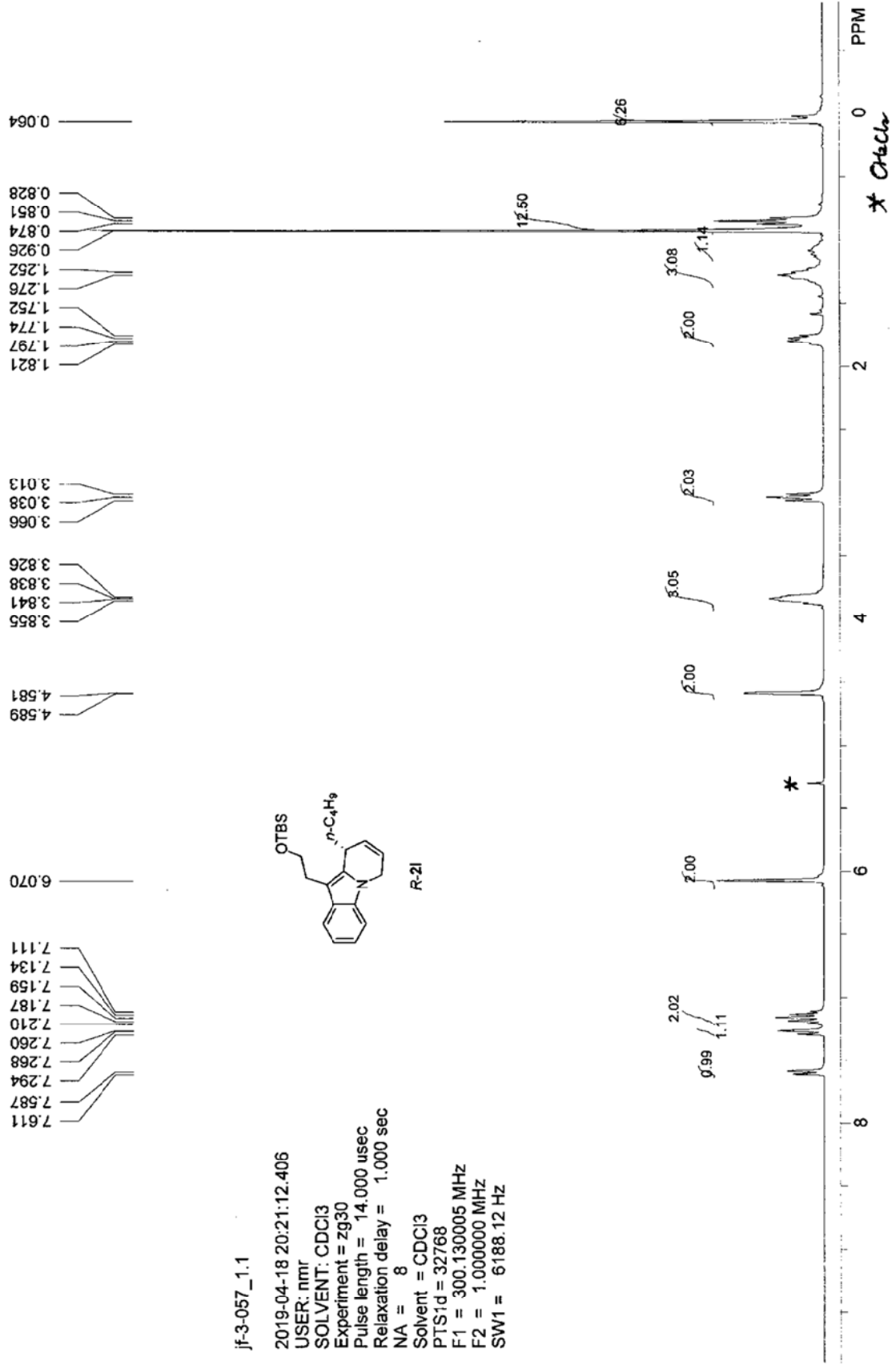
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

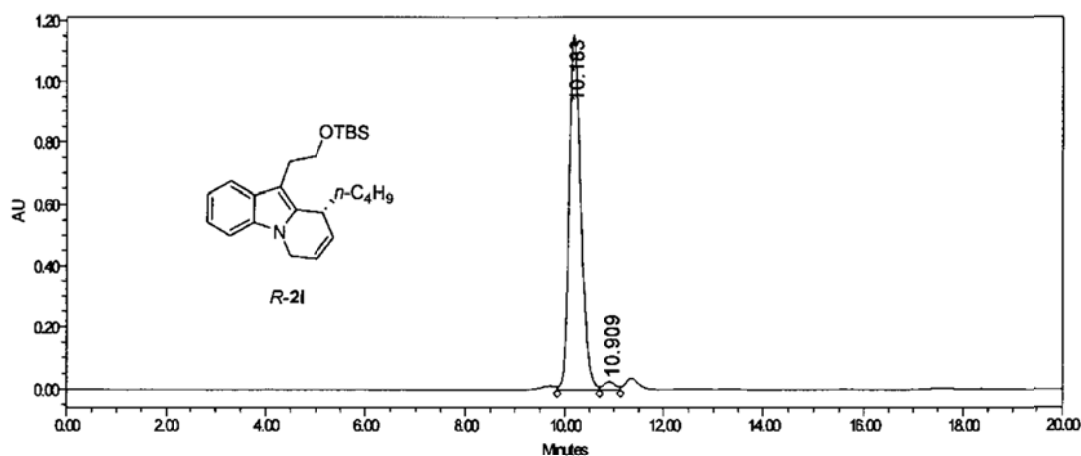
SW1 = 6188.12 Hz





SAMPLE INFORMATION

Sample Name:	JF-3-057-F-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	ZG100
Injection#:	19	Processing Method:	111
Injection Volume:	10.00 μ l	Channel Name:	V2489 ChA
Run Time:	20.0 Minutes	Proc. Chl. Descr.:	V2489 ChA.214nm
Date Acquired:	4/29/2019 8:45:46 PM EDT		
Date Processed:	4/29/2019 9:17:04 PM EDT		



Channel: V2489 ChA; Processed Channel: V2489 ChA.214nm; Result Id: 1124; Processing Method: 11

Processed Channel Descr.: V2489 ChA.214nm

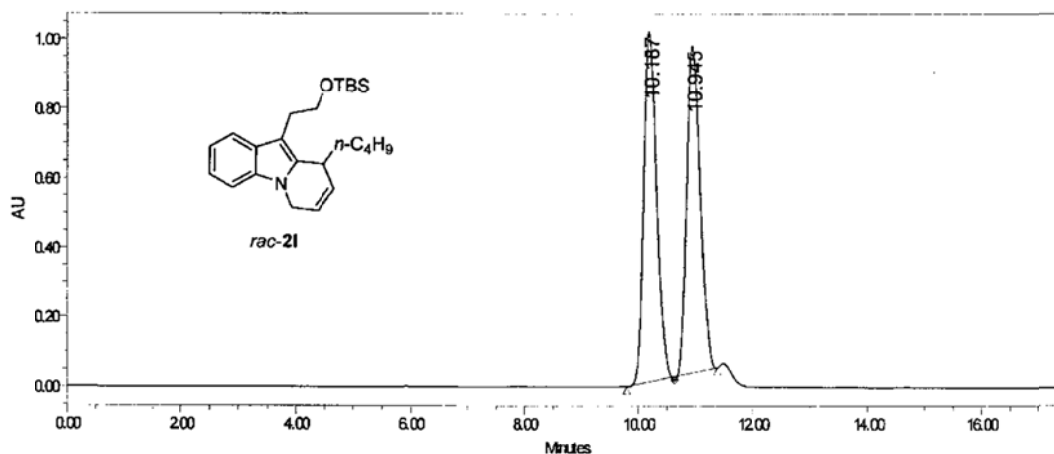
	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA.214nm	10.183	18787915	97.80	1154771
2	V2489 ChA.214nm	10.909	423601	2.20	25318

Reported by User: System
Report Method: Injection Summary Report
Report Method ID: 1029 1029
Page: 1 of 1

Project Name: HPLC_1525
Date Printed: 4/29/2019
9:19:25 PM America/New_York

SAMPLE INFORMATION

Sample Name:	JF-3-050-F-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	ZGJ100
Injection#:	18	Processing Method:	111
Injection Volume:	10.00 μ l	Channel Name:	V2489 ChA
Run Time:	200.0 Minutes	Proc. Chl. Descr.:	V2489 ChA.214nm
Date Acquired:	4/29/2019 8:26:52 PM EDT		
Date Processed:	4/29/2019 9:17:34 PM EDT		



Channel: V2489 ChA; Processed Channel: V2489 ChA.214nm; Result Id: 1125; Processing Method: 11

Processed Channel Descr.: V2489 ChA.214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA.214nm	10.187	15777055	50.06	1009220
2	V2489 ChA.214nm	10.945	15738033	49.94	942521

jf-2-200

2019-01-20 21:58:23.750

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

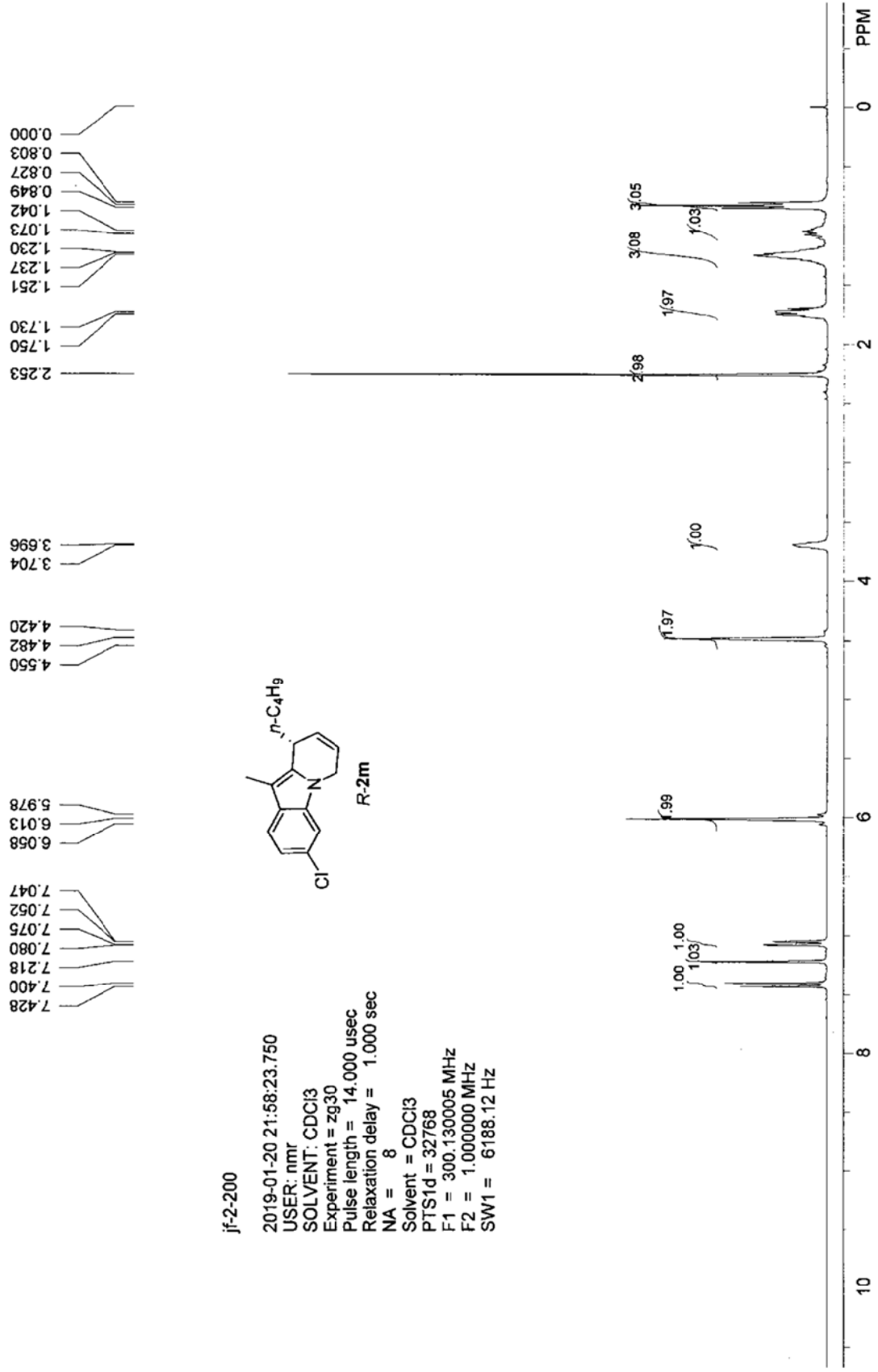
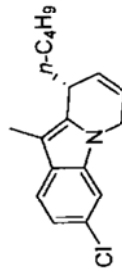
Solvent = CDCl₃

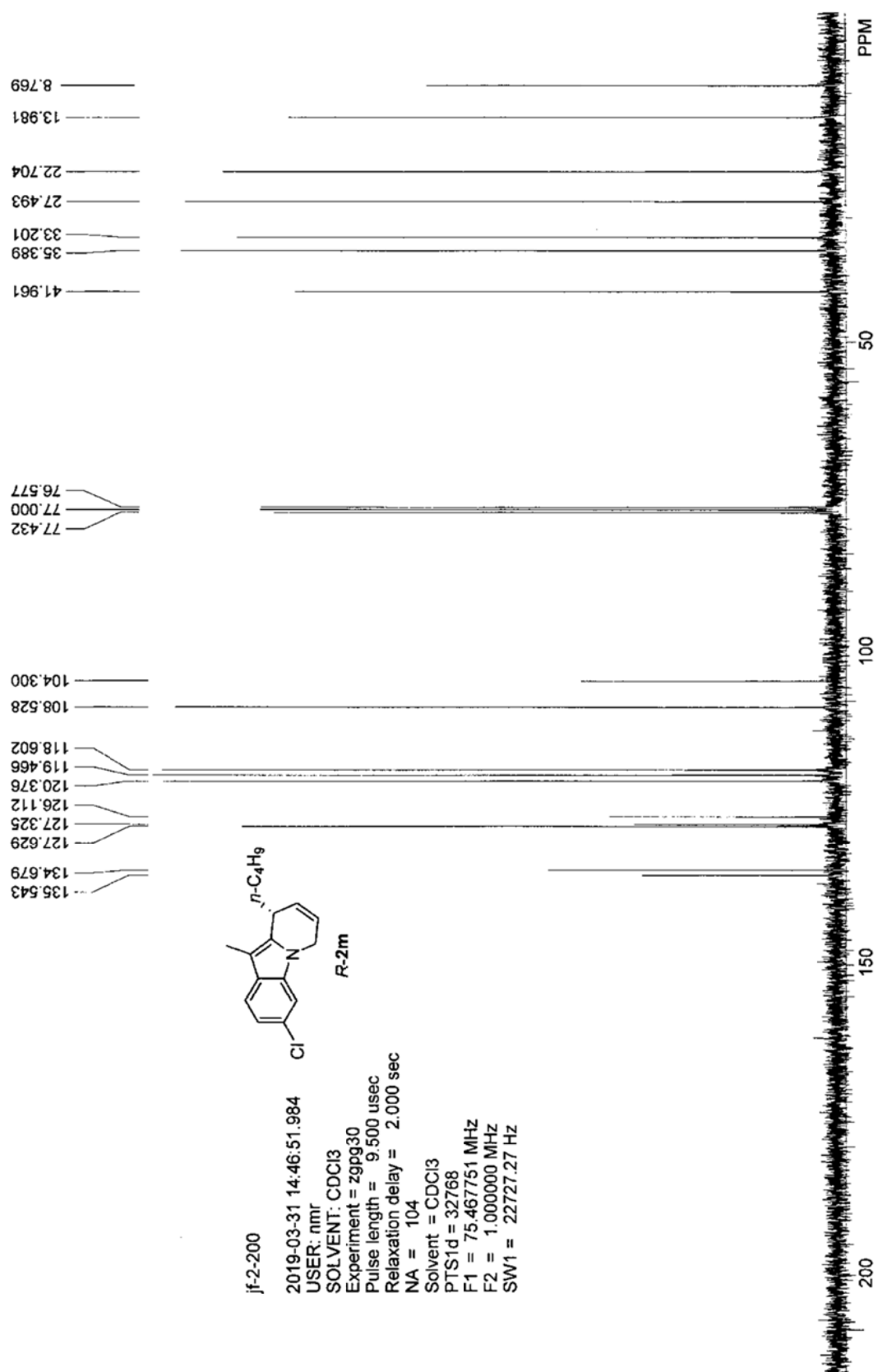
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



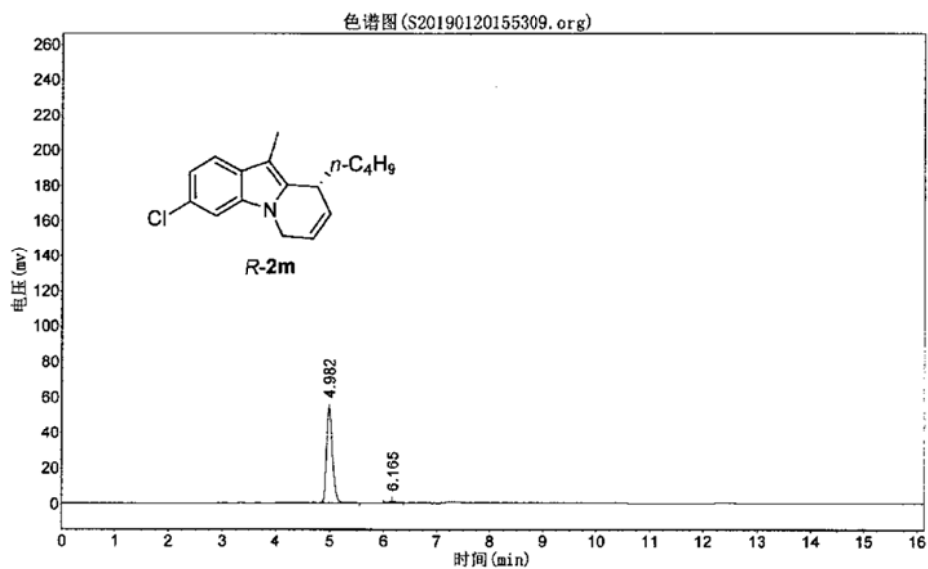


jf-2-200

实验时间: 2019-01-20, 15:53:09
谱图文件: D:\浙大智达\N2000\样品\S20190120155309.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-11-13, 21:55:03
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 100/1, 1.0, 254



分析结果表

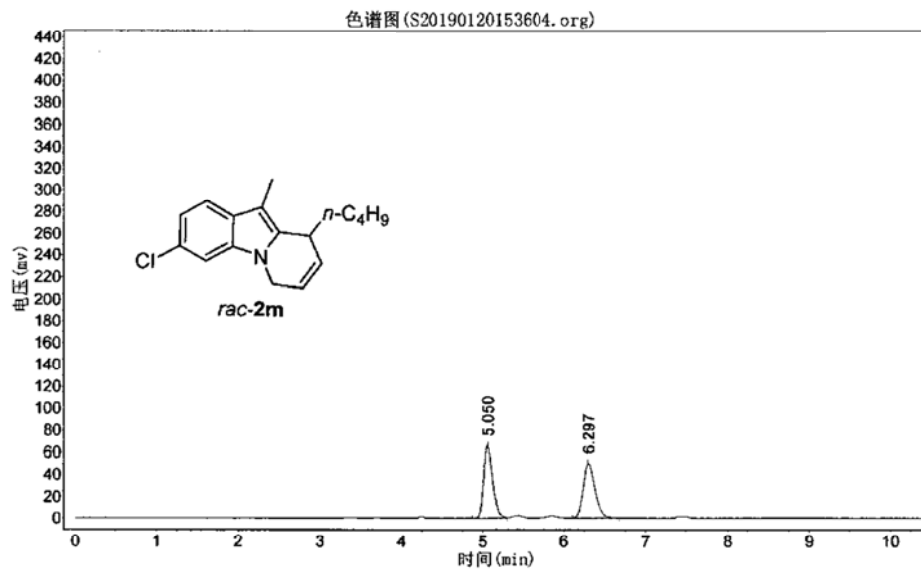
峰号	峰名	保留时间	峰高	峰面积	含量
1		4.982	53587.926	410560.844	97.3700
2		6.165	1151.276	11089.398	2.6300
总计			54739.202	421650.242	100.0000

jf-3-003

实验时间: 2019-01-20, 15:36:04
谱图文件: D:\浙大智达\N2000\样品\S20190120153604.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-01-20, 15:49:02
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 100/1, 1.0, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		5.050	65469.352	495104.719	50.0374
2		6.297	49762.418	494365.250	49.9626
总计			115231.770	989469.969	100.0000

jf-3-084_1.1

2019-05-08 13:57:03.531

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

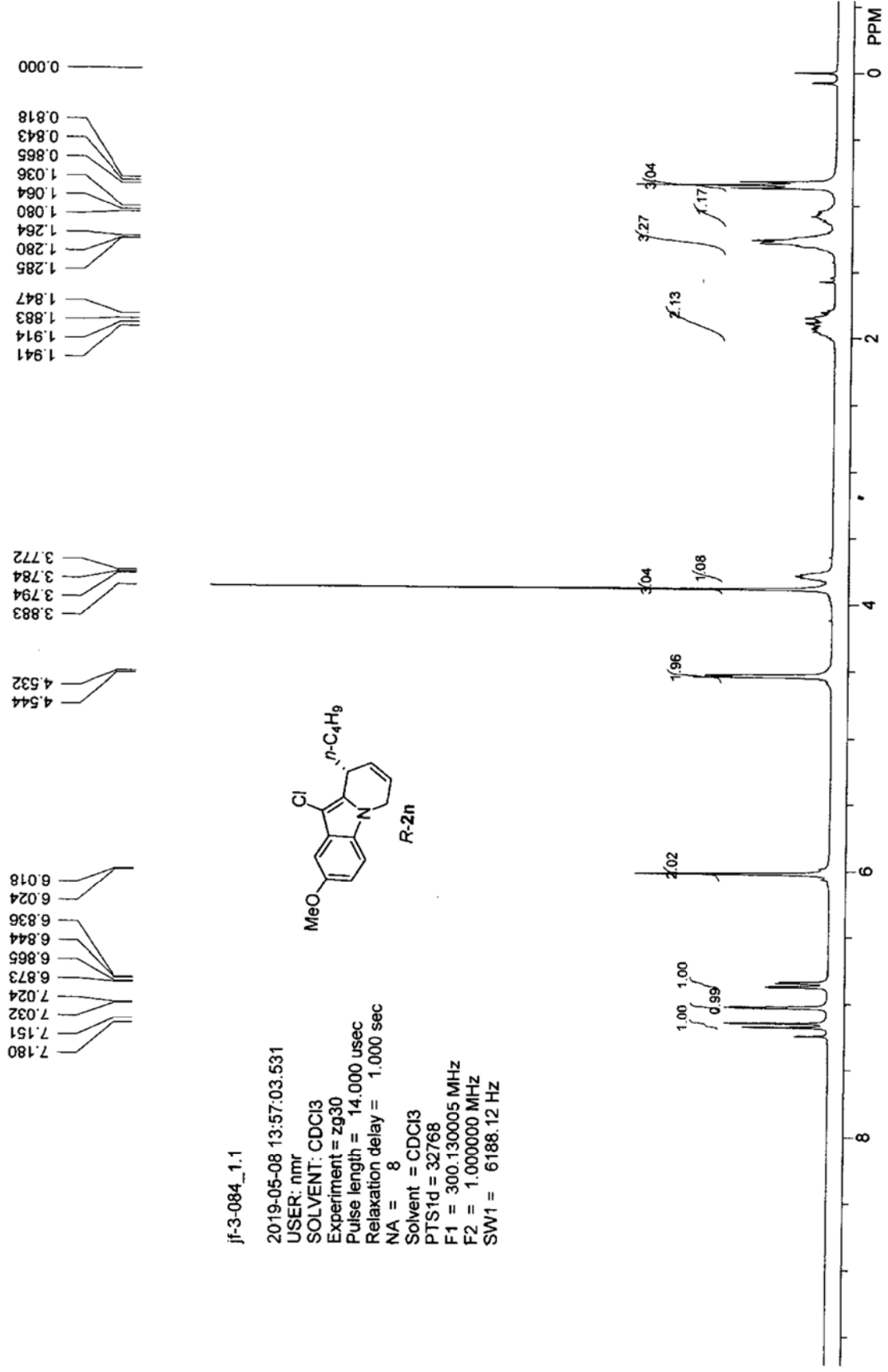
Solvent = CDCl₃

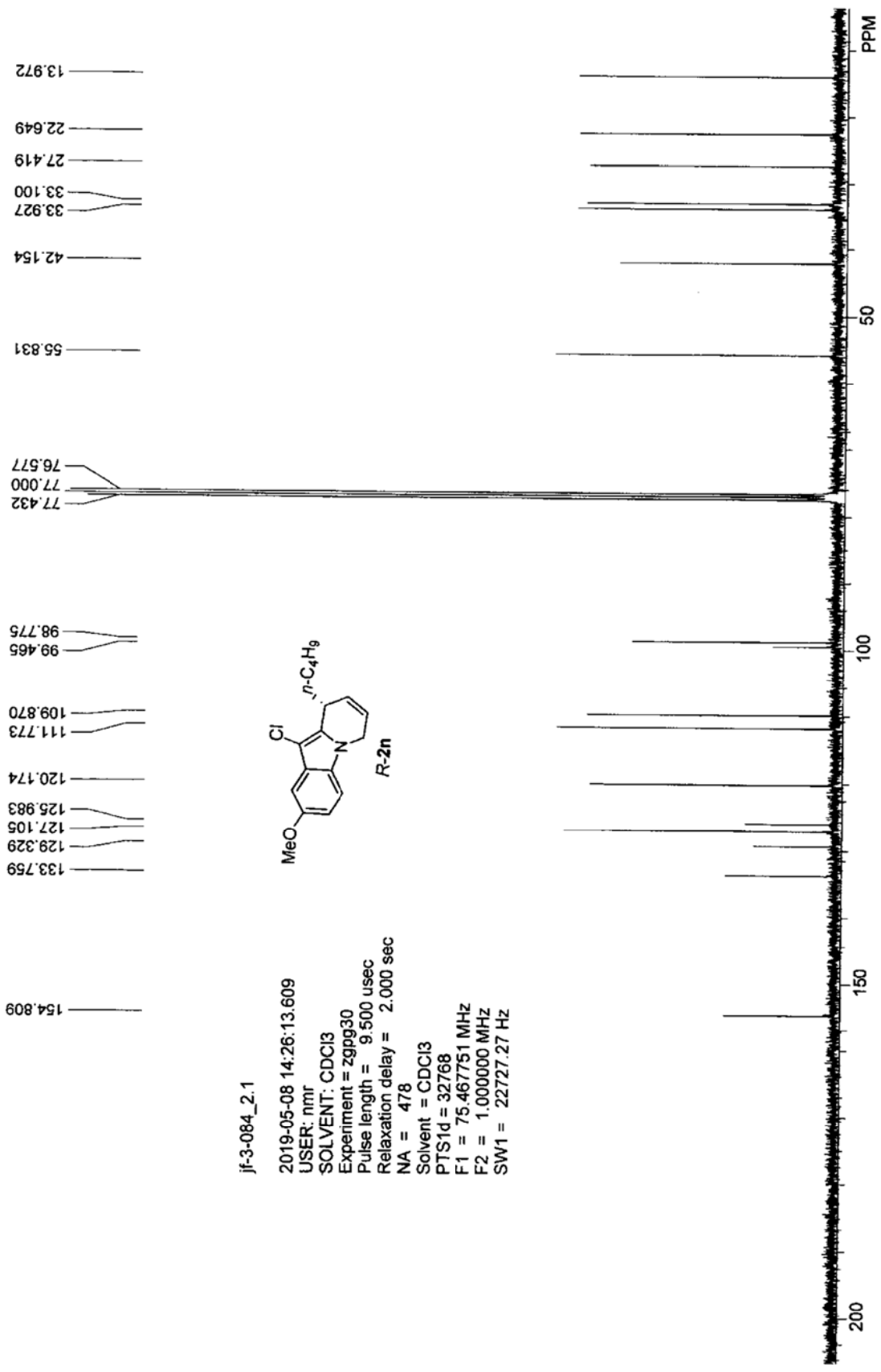
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jf-3-084_2.1

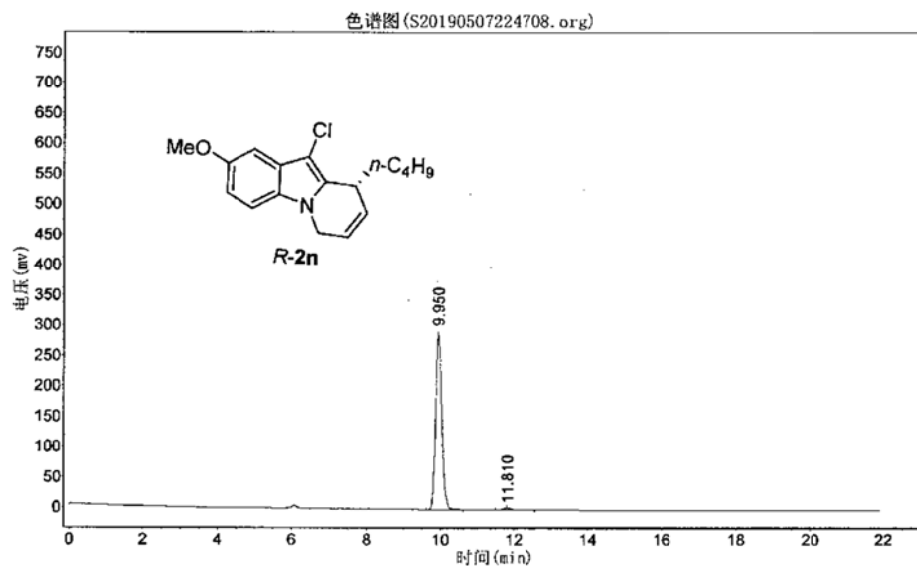
2019-05-08 14:26:13.609
 USER: nmr
 SOLVENT: CDCl3
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 478
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz

jf-3-084

实验时间: 2019-05-07, 22:47:08
谱图文件: D:\浙大智达\N2000\样品\S20190507224708. org
方法文件: D:\浙大智达\N2000\djx. mld

实验者: jf
报告时间: 2019-05-07, 23:11:06
积分方法: 面积归一法

实验内容简介:
od. n-hexane/i-PrOH = 95/5, 0. 5, 214



分析结果表

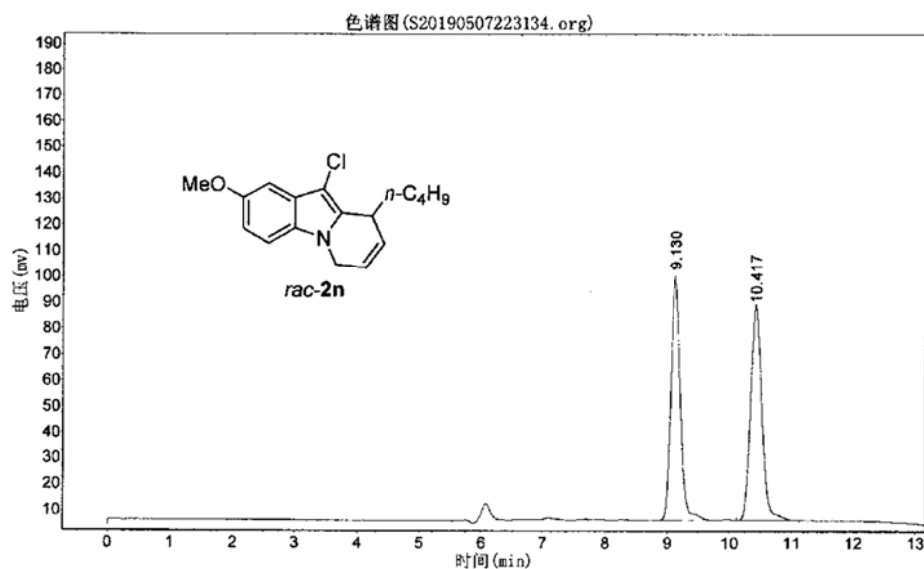
峰号	峰名	保留时间	峰高	峰面积	含量
1		9.950	286309.719	3396254.750	99.1369
2		11.810	2505.949	29569.541	0.8631
总计			288815.668	3425824.291	100.0000

jf-3-090

实验时间: 2019-05-07, 22:31:34
谱图文件: D:\浙大智达\N2000\样品\S20190507223134.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-05-07, 22:51:43
积分方法: 面积归一法

实验内容简介:
od,n-hexane/i-PrOH = 95/5, 0.5, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		9.130	92939.141	1034501.688	50.0649
2		10.417	81985.625	1031818.250	49.9351
总计			174924.766	2066319.938	100.0000

jf-2-158_1.1

2018-12-25 14:47:18.093

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

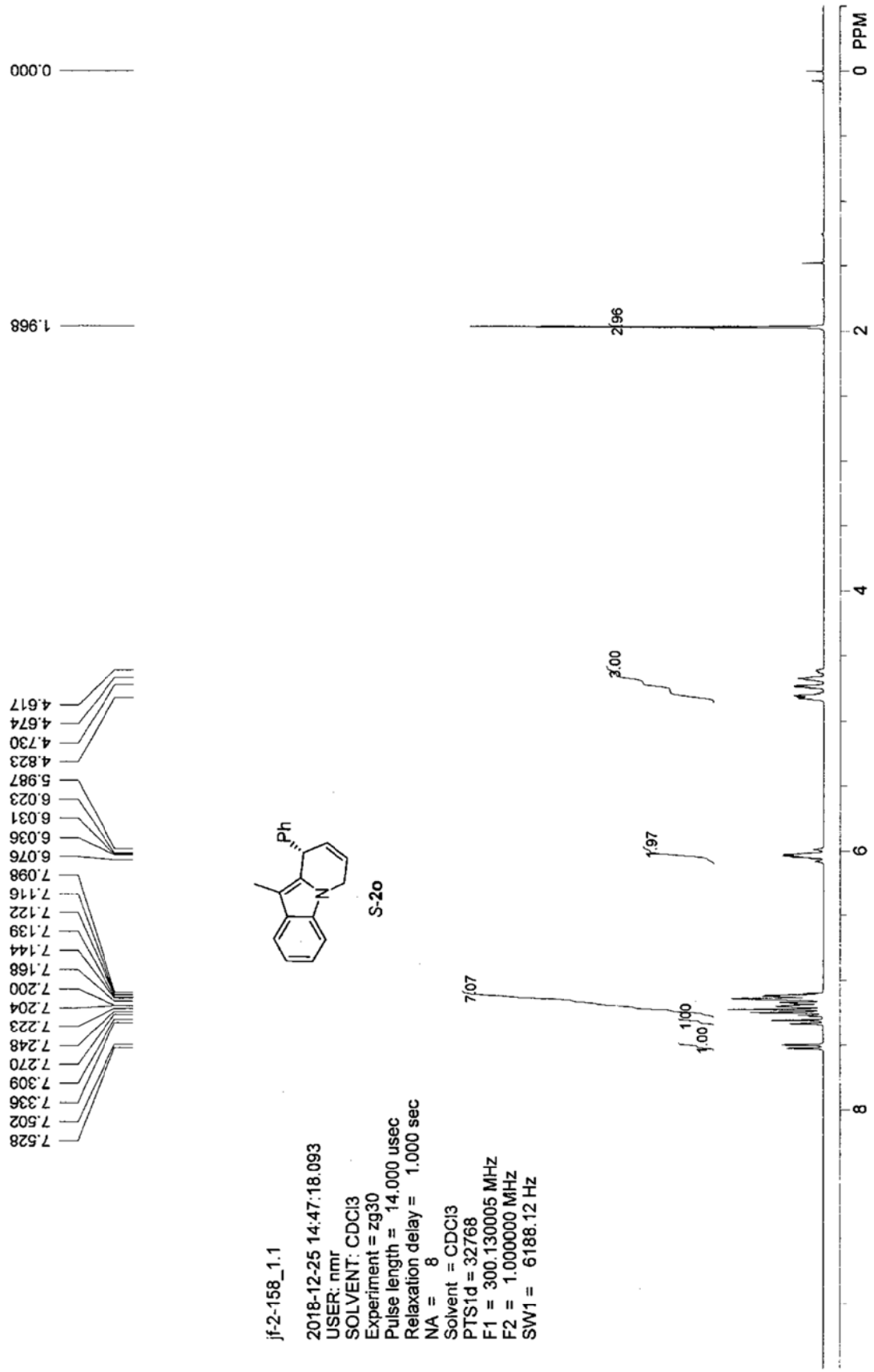
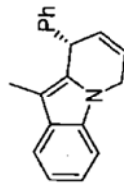
Solvent = CDCl₃

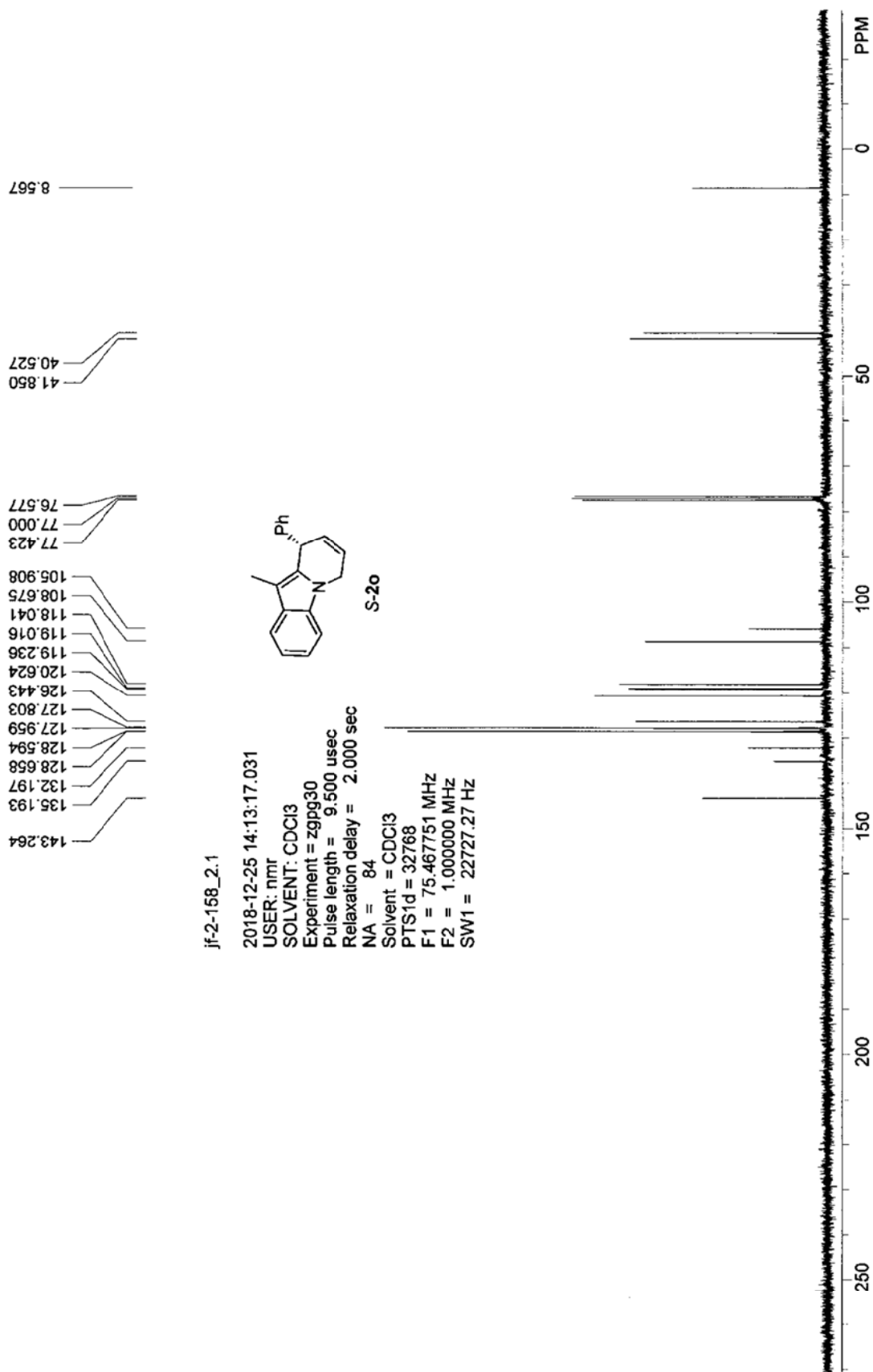
PTSD = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SWH = 6188.12 Hz





jf-2-158_2.1

2018-12-25 14:13:17.031

USER: nmir

SOLVENT: CDCl3

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 84

Solvent = CDCl3

PTSD = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

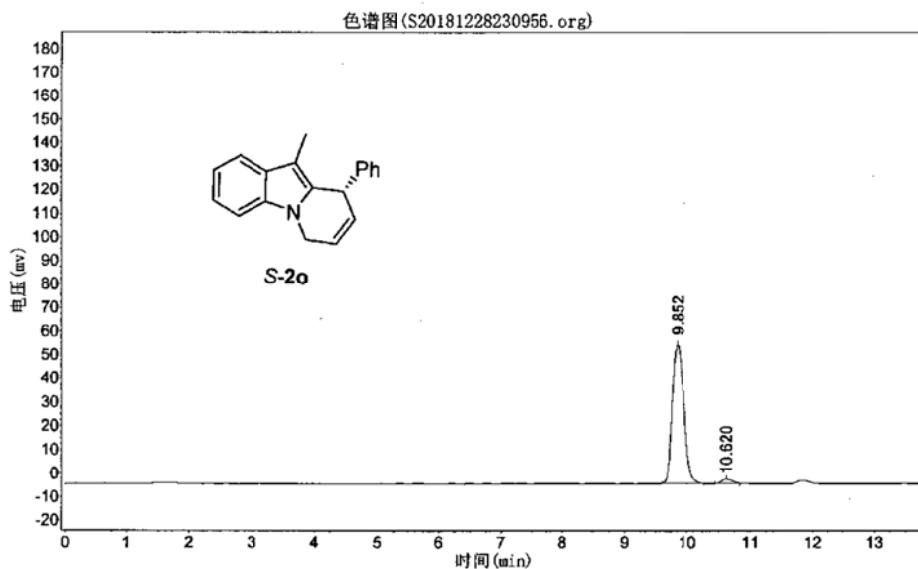
SW1 = 22727.27 Hz

jf-2-158

实验时间: 2018-12-28, 23:09:56
谱图文件: D:\浙大智达\N2000\样品\S20181228230956.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-12-28, 23:39:39
积分方法: 面积归一法

实验内容简介:
ia, n-hexane/i-PrOH = 100/1, 0.7, 254



分析结果表

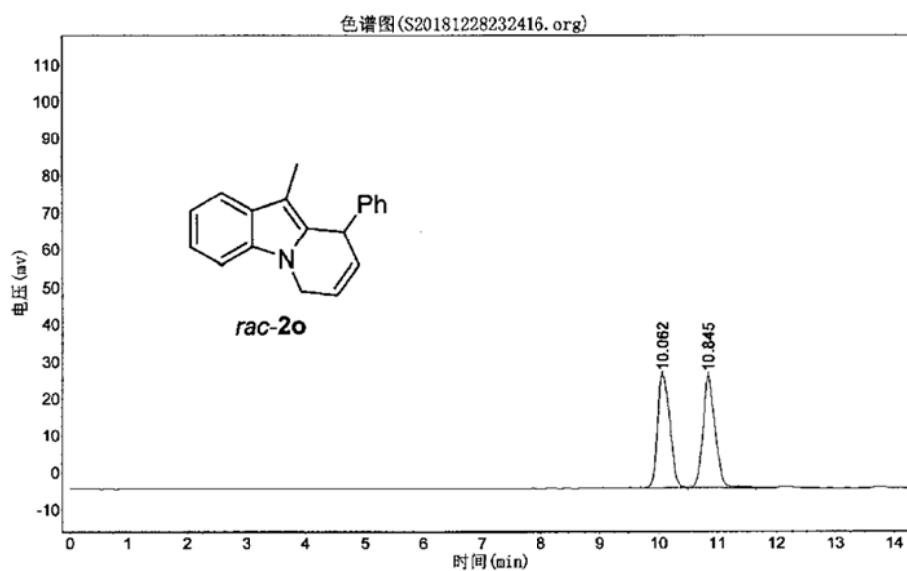
峰号	峰名	保留时间	峰高	峰面积	含量
1		9.852	58514.051	761684.063	97.5062
2		10.620	1683.175	19481.045	2.4938
总计			60197.225	781165.107	100.0000

jf-2-162

实验时间: 2018-12-28, 23:24:16
谱图文件: D:\浙大智达\N2000\样品\S20181228232416.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2018-12-28, 23:42:28
积分方法: 面积归一法

实验内容简介:
ia, r-hexane/i-PrOH = 100/1, 0.7, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		10.062	30378.490	436356.813	50.7925
2		10.845	30080.557	422739.313	49.2075
总计			60459.047	859096.125	100.0000

ji-2-174_11.1

2019-01-15 11:38:01.968

USER: nmr

SOLVENT: CDCl3

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

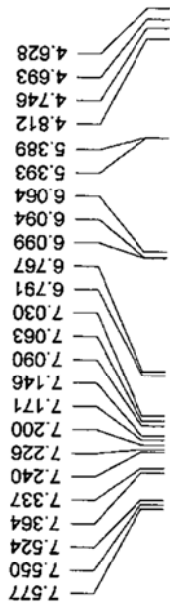
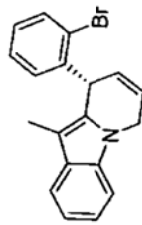
Solvent = CDCl3

PTS1d = 32768

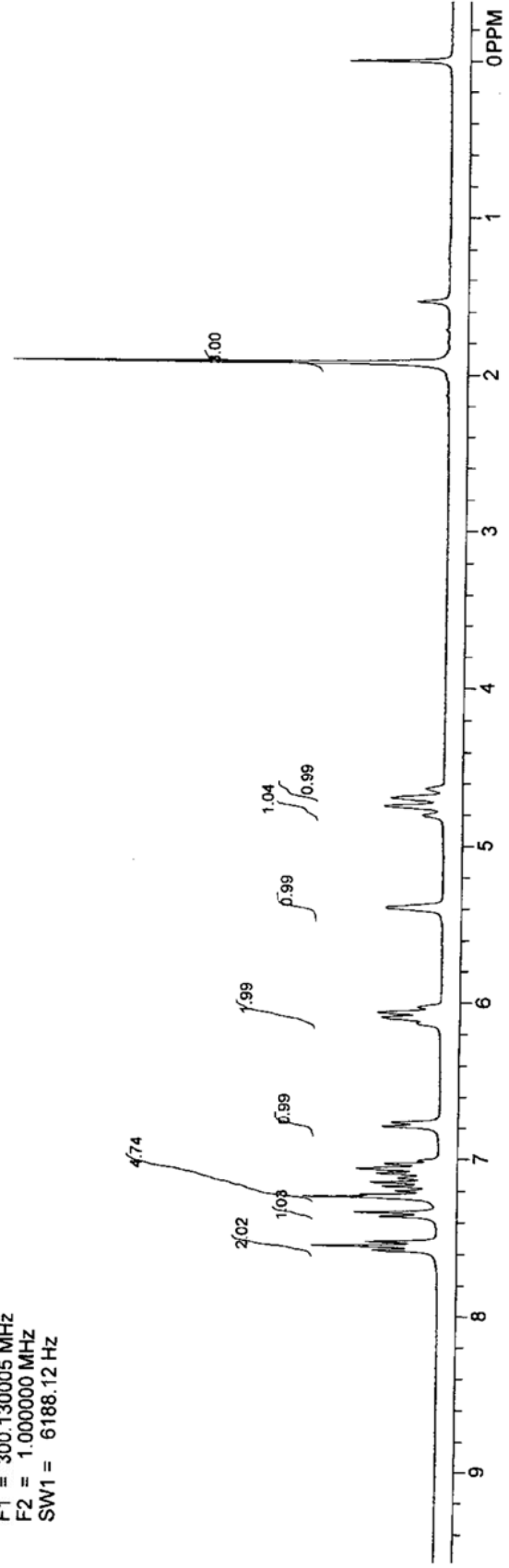
F1 = 300.130005 MHz

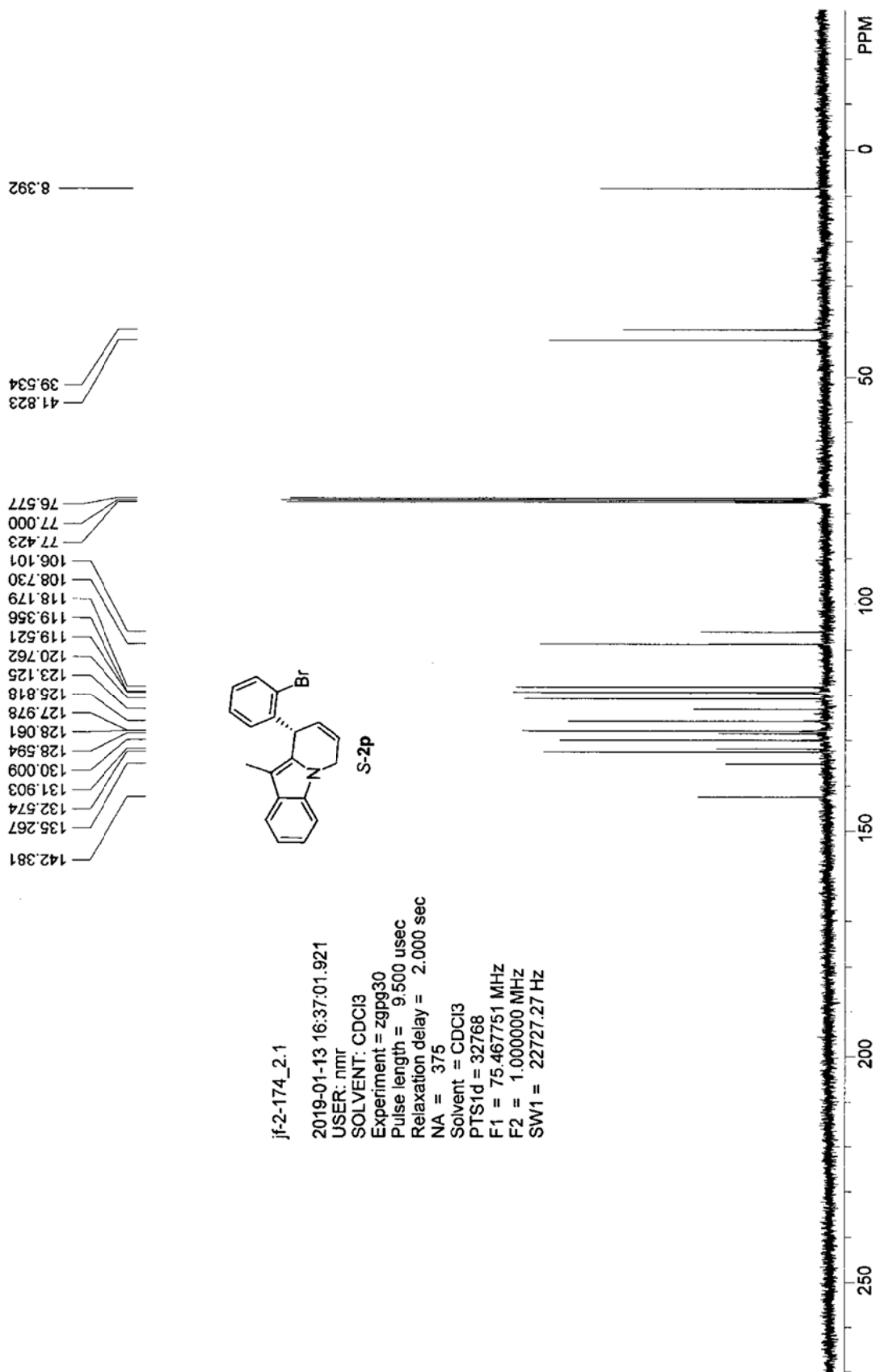
F2 = 1.000000 MHz

SW1 = 6188.12 Hz



1.925
0.000





jf-2-174_2.1

2019-01-13 16:37:01.921

USER: nmr

SOLVENT: CDCl3

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 375

Solvent = CDCl3

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

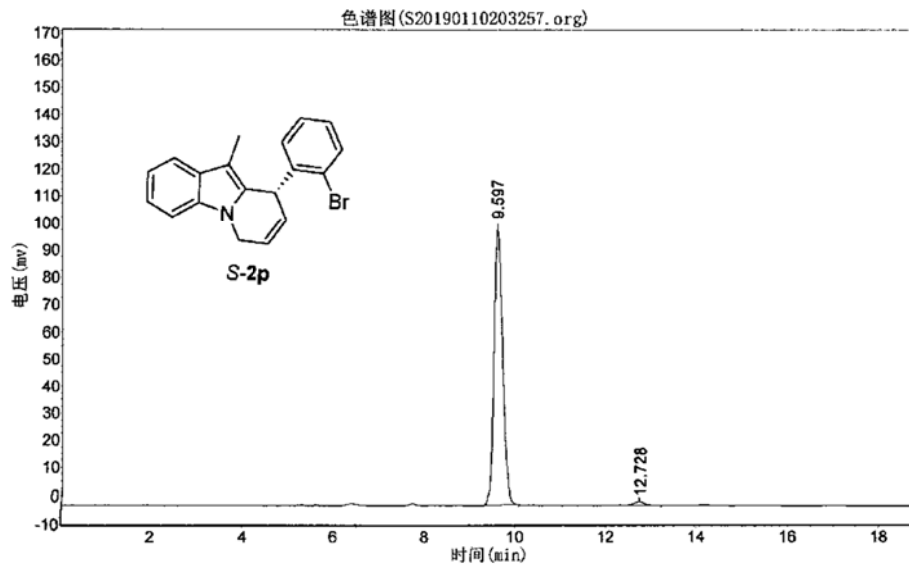
SW1 = 22727.27 Hz

jf-2-174

实验时间: 2019-01-10, 20:32:57
谱图文件: D:\浙大智达\N2000\样品\S20190110203257.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-01-10, 20:54:25
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.7, 254



分析结果表

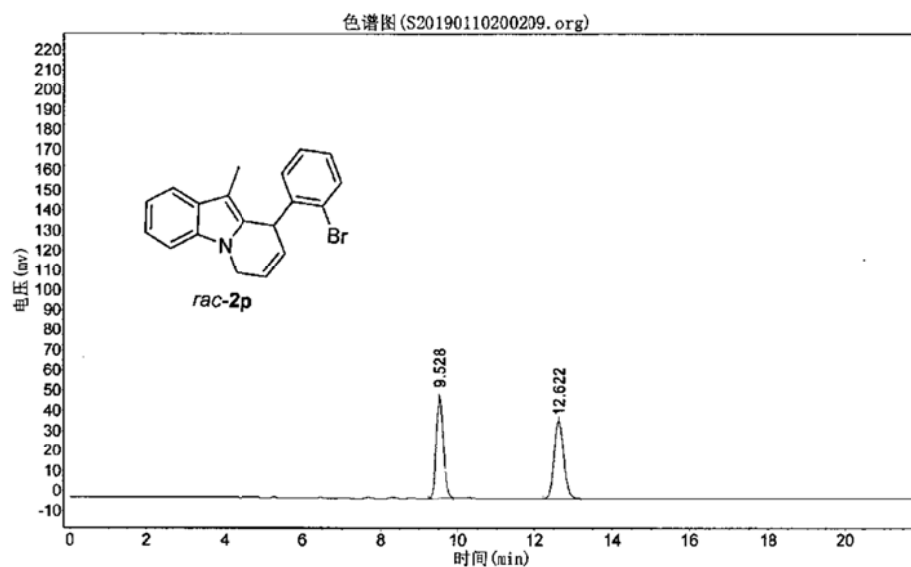
峰号	峰名	保留时间	峰高	峰面积	含量
1		9.597	101252.500	1324026.875	98.2498
2		12.728	1328.548	23586.201	1.7502
总计			102581.048	1347613.076	100.0000

jf-2-182

实验时间: 2019-01-10, 20:02:09
谱图文件: D:\浙大智达\N2000\样品\S20190110200209.org
方法文件: D:\浙大智达\N2000\djx.mtd

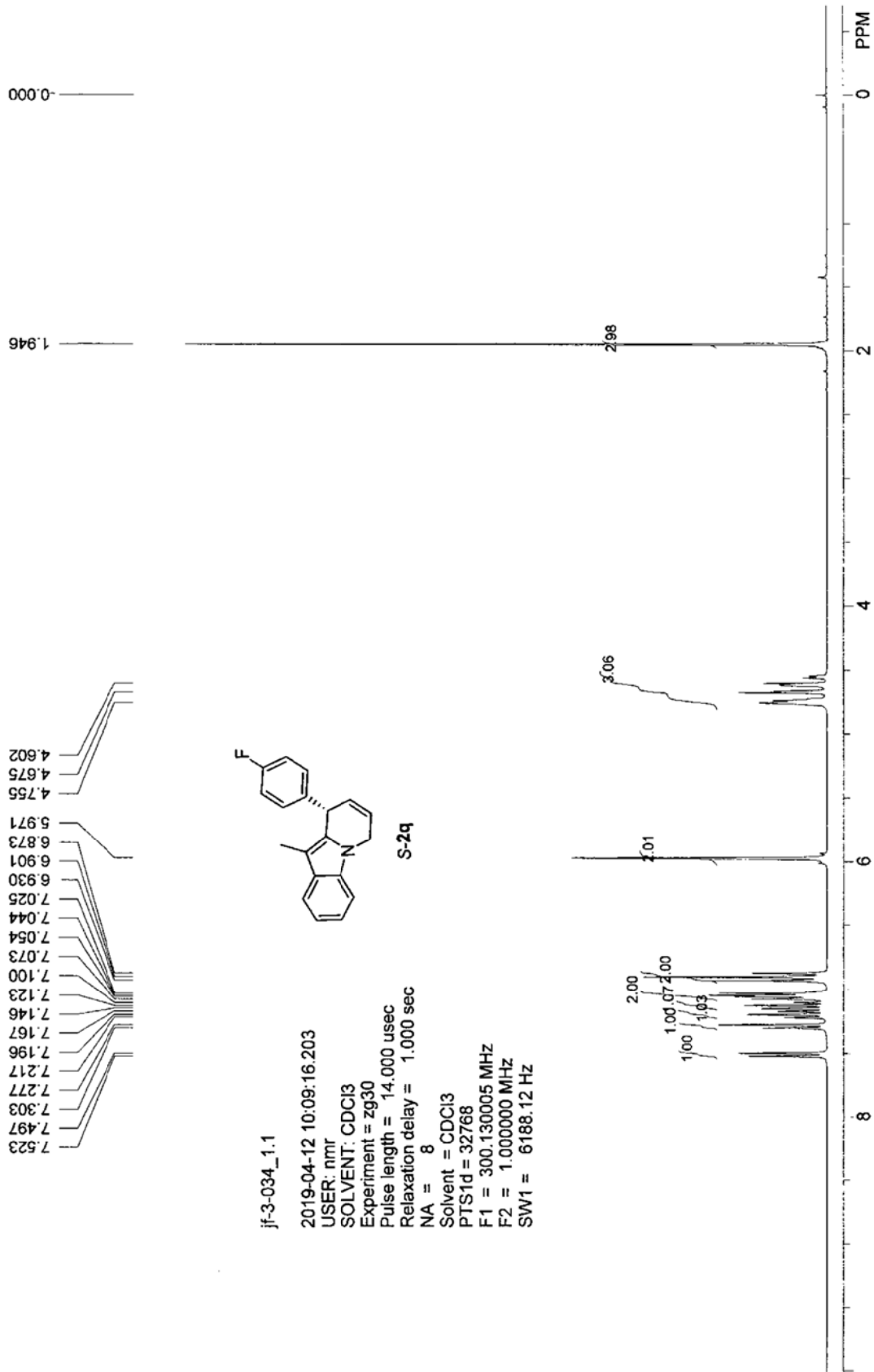
实验者: jf
报告时间: 2019-01-10, 20:27:13
积分方法: 面积归一法

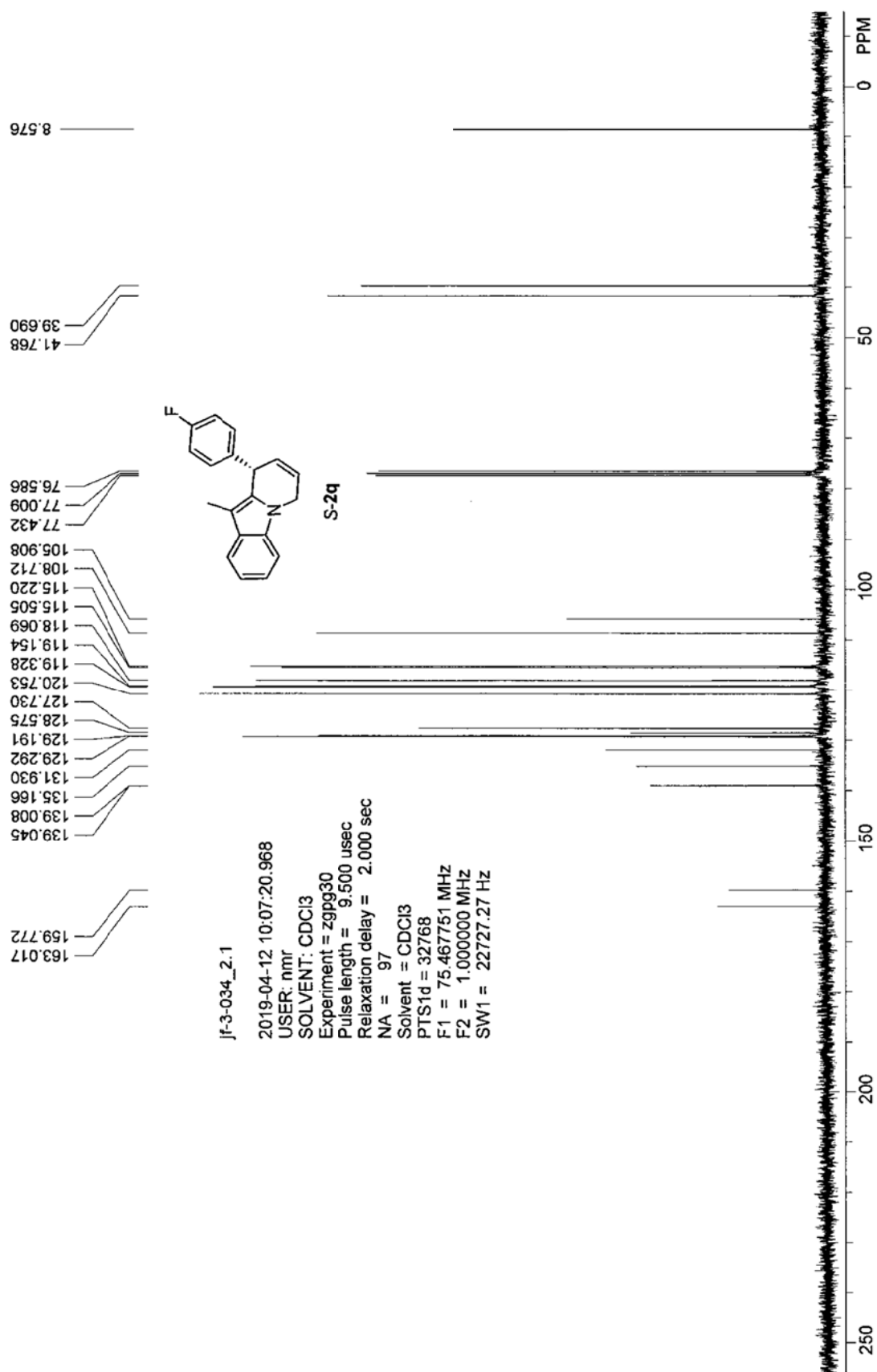
实验内容简介:
od,n-hexane/i-PrOH = 90/10, 0.7, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		9.528	50245.449	648797.000	49.2446
2		12.622	38988.070	668702.875	50.7554
总计			89233.520	1317499.875	100.0000





0.000

-116.959

jf-3-034_4.1

2019-04-15 09:25:50.906

USER: nmr

SOLVENT: CDCl₃

Experiment = zgfhgqn

Pulse length = 13.500 usec

Relaxation delay = 1.000 sec

NA = 16

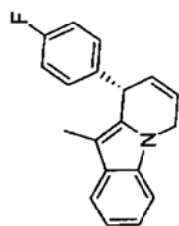
Solvent = CDCl₃

PTS1d = 65536

F1 = 282.404358 MHz

F2 = 1.000000 MHz

SW1 = 66964.29 Hz



S-2q

PPM

-200

-150

-100

-50

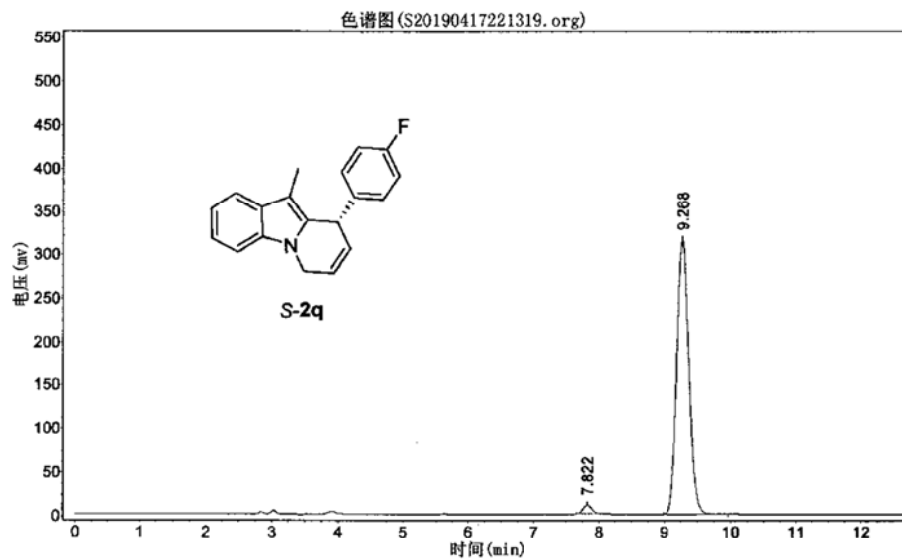
0

jf-3-034

实验时间: 2019-04-17, 22:13:19
谱图文件: D:\浙大智达\N2000\样品\S20190417221319.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-04-17, 22:29:21
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 95/5, 1.0, 214



分析结果表

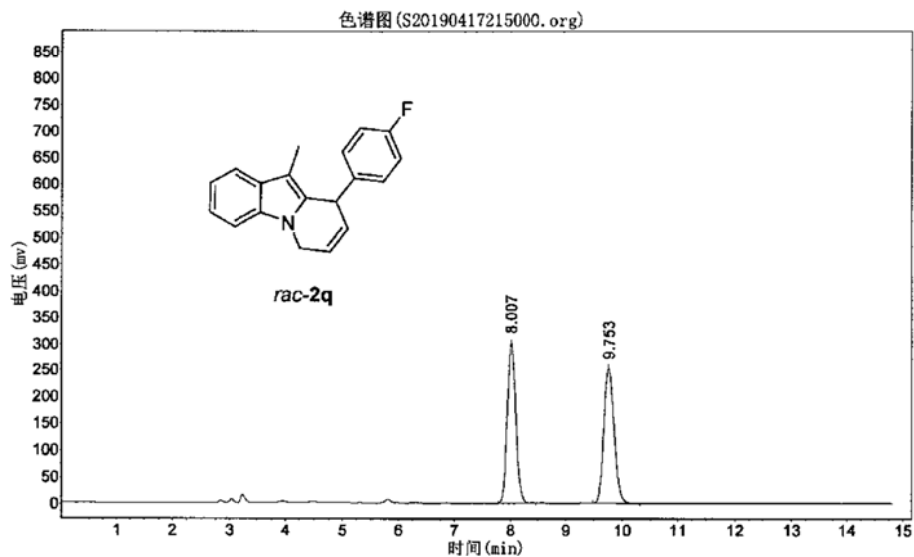
峰号	峰名	保留时间	峰高	峰面积	含量
1		7.822	10232.706	101584.008	2.4730
2		9.268	314864.063	4006058.500	97.5270
总计			325096.769	4107642.508	100.0000

jf-3-037

实验时间: 2019-04-17, 21:50:00
谱图文件: D:\浙大智达\N2000\样品\S20190417215000.org
方法文件: D:\浙大智达\N2000\djx.mtd

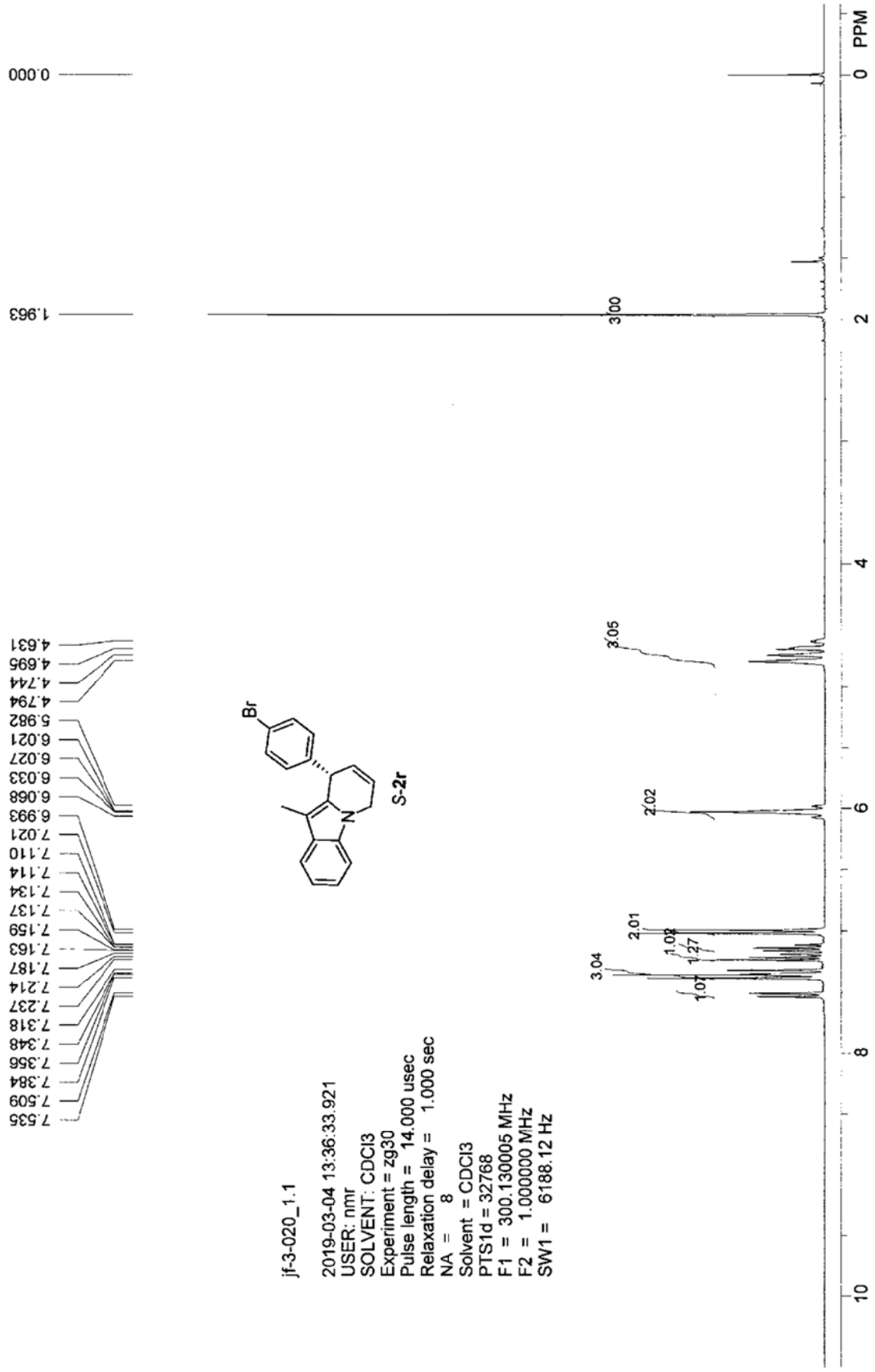
实验者: jf
报告时间: 2019-04-17, 22:07:14
积分方法: 面积归一法

实验内容简介:
OD, n-hexane/i-PrOH = 95/5, 1.0, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		8.007	300605.156	3133754.750	49.3676
2		9.753	251914.344	3214042.000	50.6324
总计			552519.500	6347796.750	100.0000



jf-3-020_1.1

2019-03-04 13:36:33.921

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz

Jf-3-020_2.1

2019-03-04 14:37:21.718

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 1025

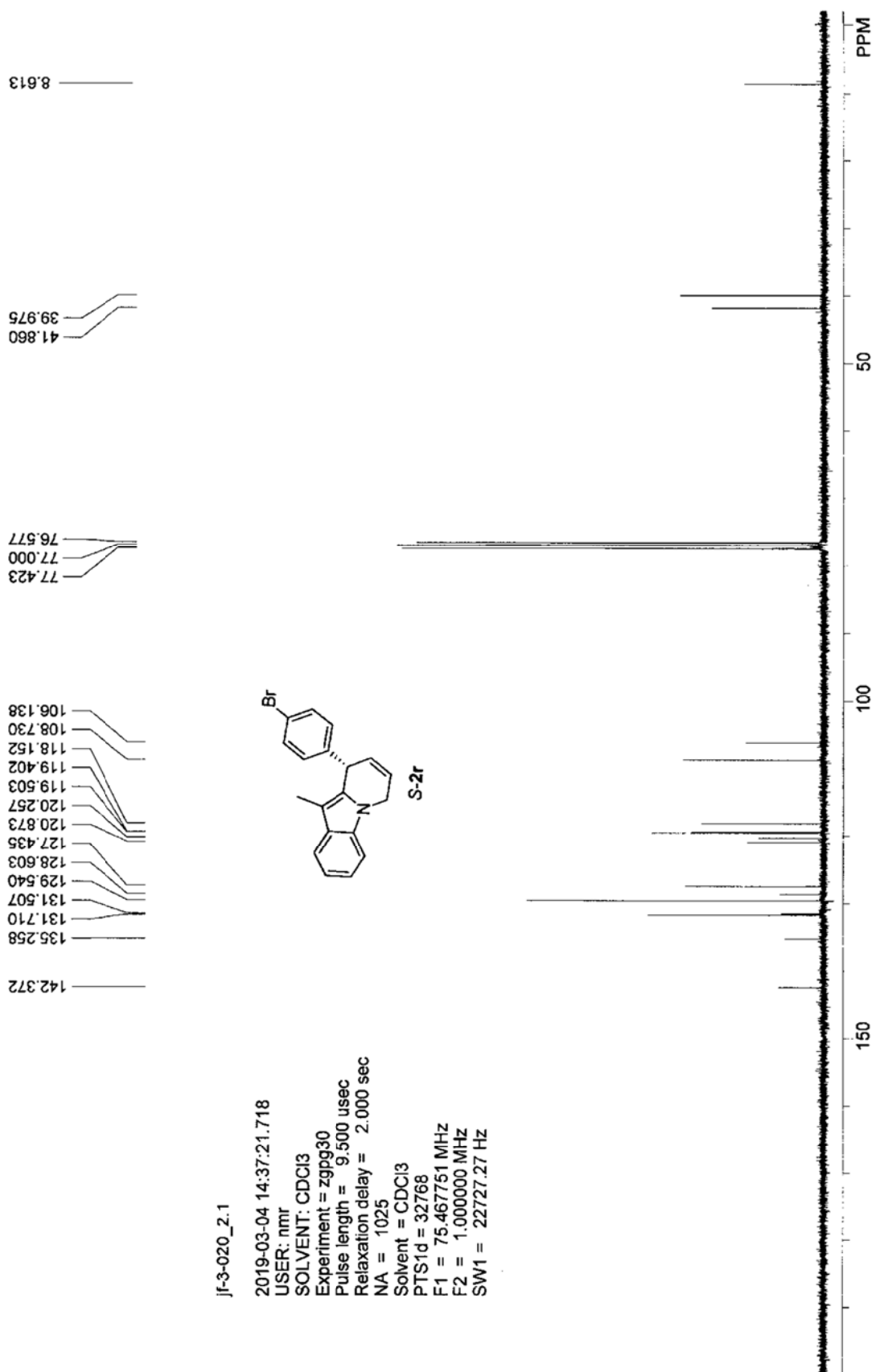
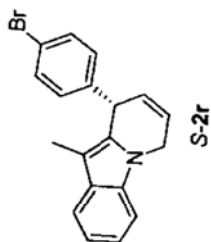
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

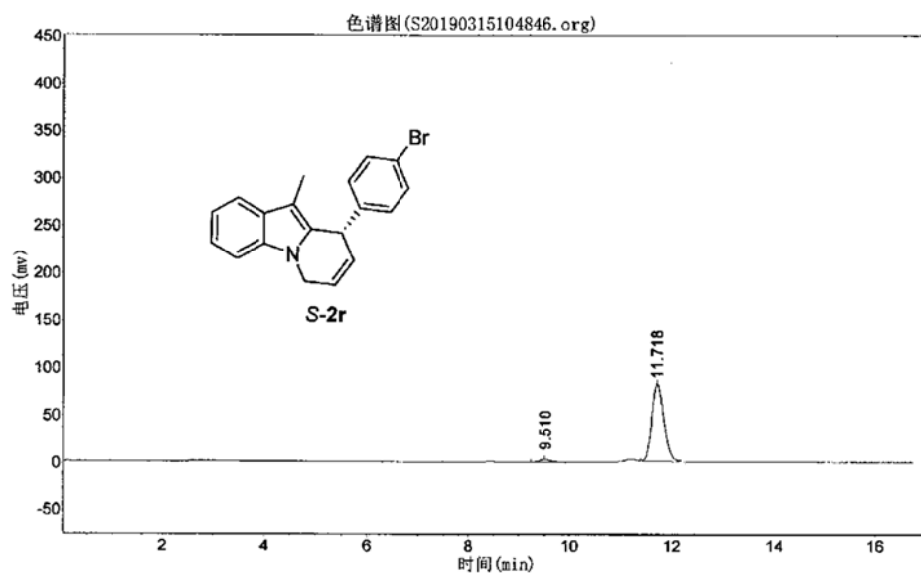


jf-3-020

实验时间: 2019-03-15, 10:48:16
谱图文件: D:\浙大智达\N2000\样品\S20190315104846.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-03-15, 11:10:36
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.7, 254



分析结果表

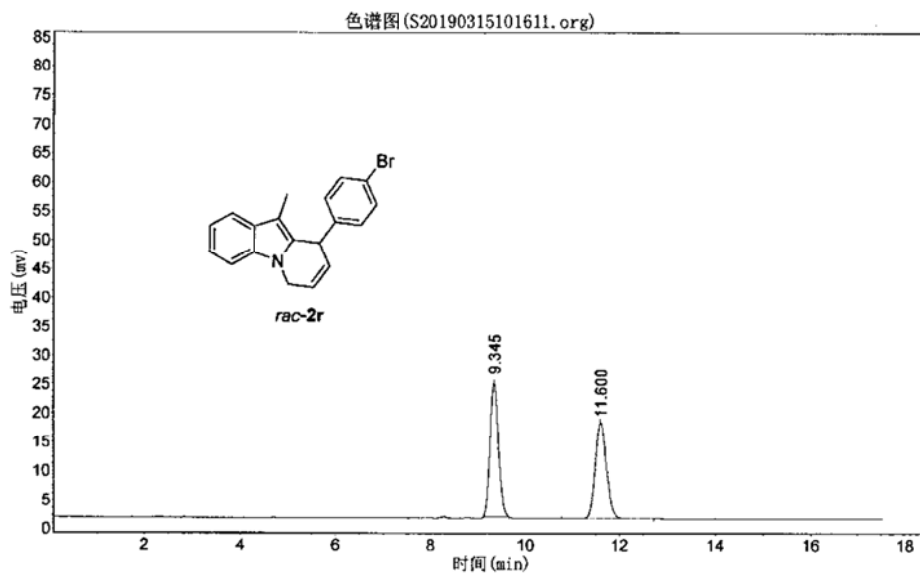
峰号	峰名	保留时间	峰高	峰面积	含量
1		9.510	2047.599	25743.447	1.9239
2		11.718	81314.156	1312318.500	98.0761
总计			83361.755	1338061.947	100.0000

jf-3-021

实验时间: 2019-03-15, 10:16:11
谱图文件: D:\浙大智达\N2000\样品\S20190315101611.org
方法文件: D:\浙大智达\N2000\djx.mtd

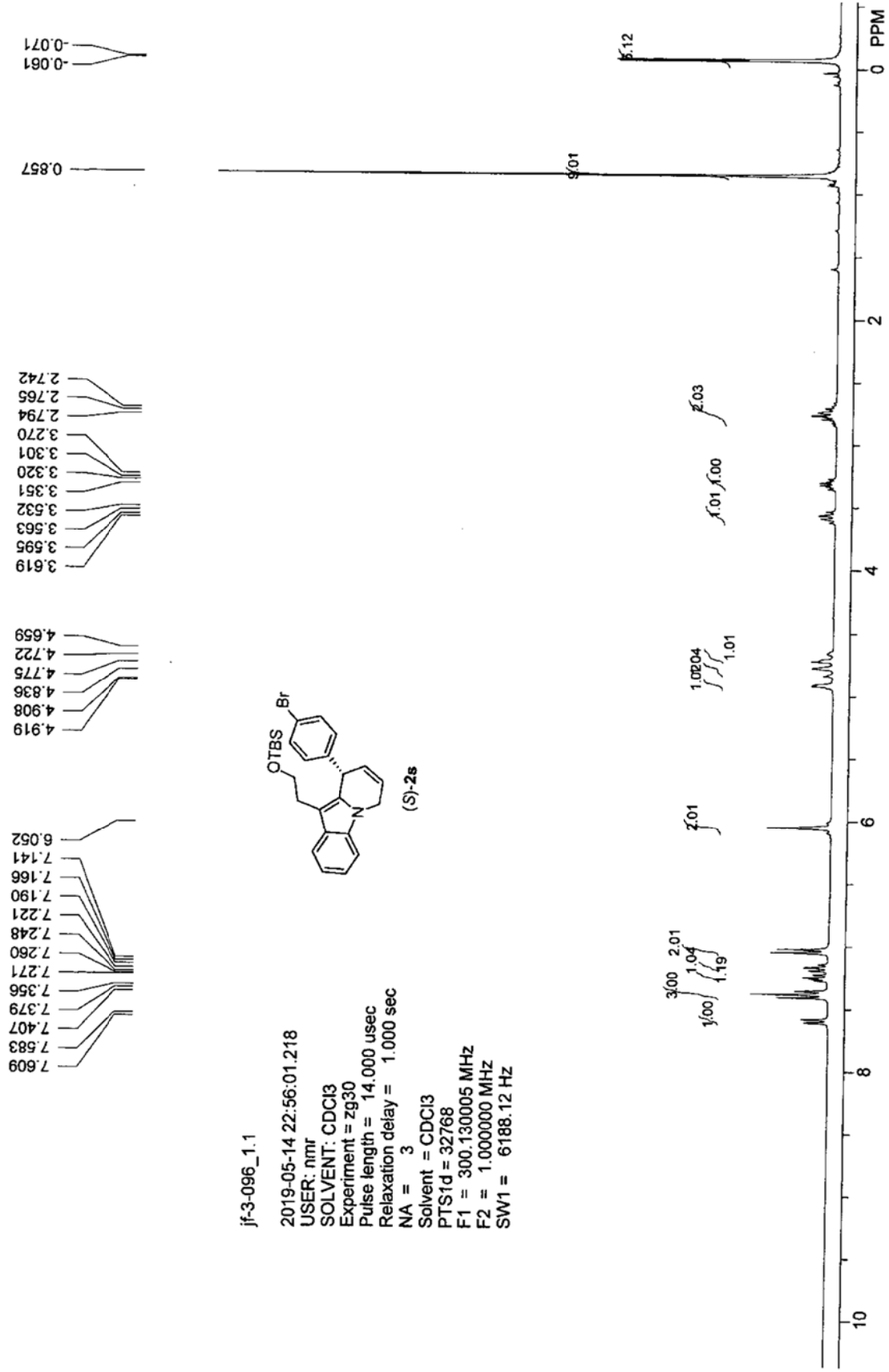
实验者: jf
报告时间: 2019-03-15, 10:43:18
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.7, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		9.345	22995.117	285223.875	50.8220
2		11.600	16691.217	275997.781	49.1780
总计			39686.334	561221.656	100.0000



if-3-096_1.1

2019-05-14 22:56:01.218

USER: nmf

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 3

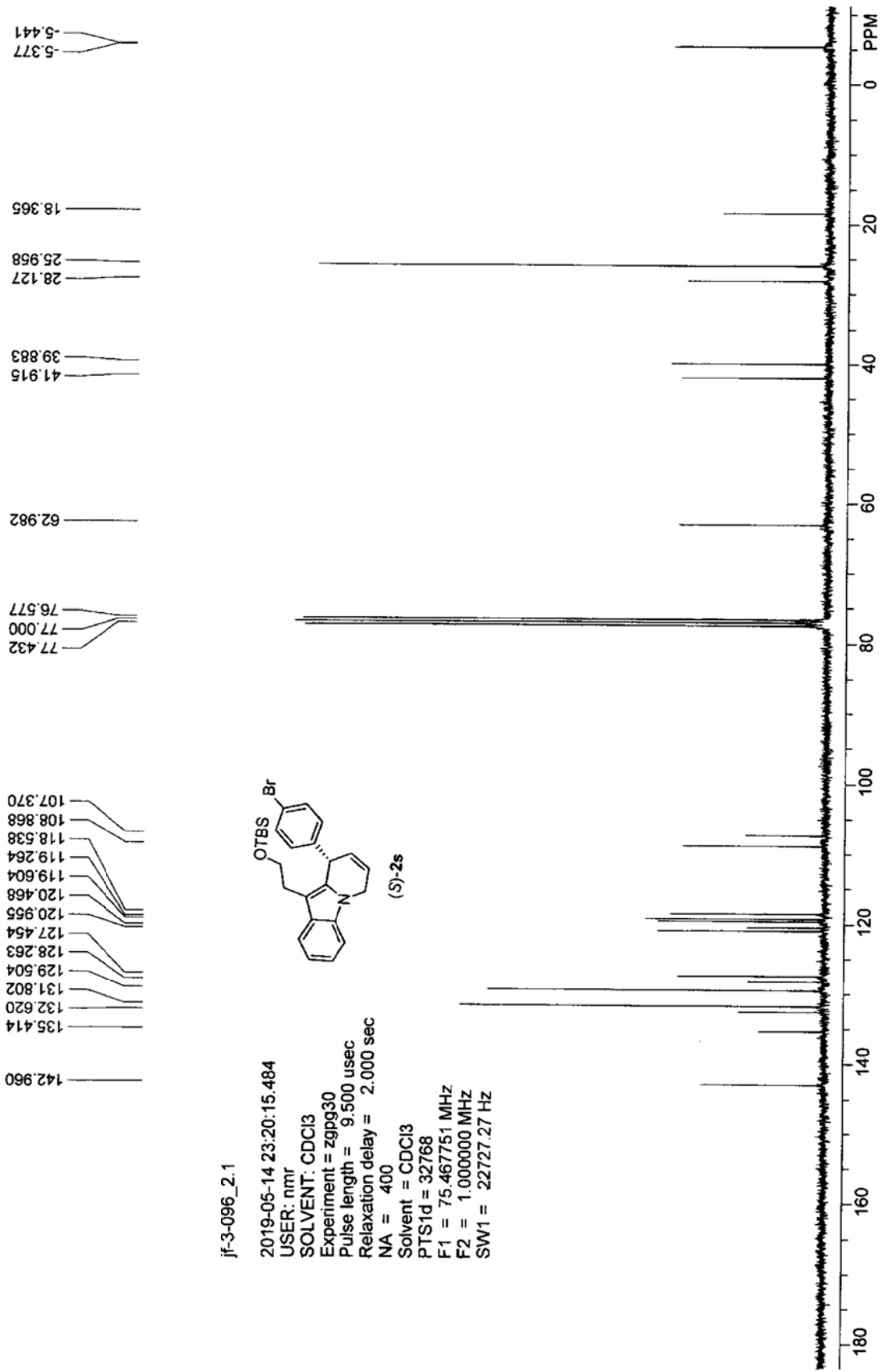
Solvent = CDCl₃

PTSD = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SWH = 6188.12 Hz



jf-3-096_2.1

2019-05-14 23:20:15.484

USER: nmf

SOLVENT: CDCl3

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 400

Solvent = CDCl3

PTS1d = 32768

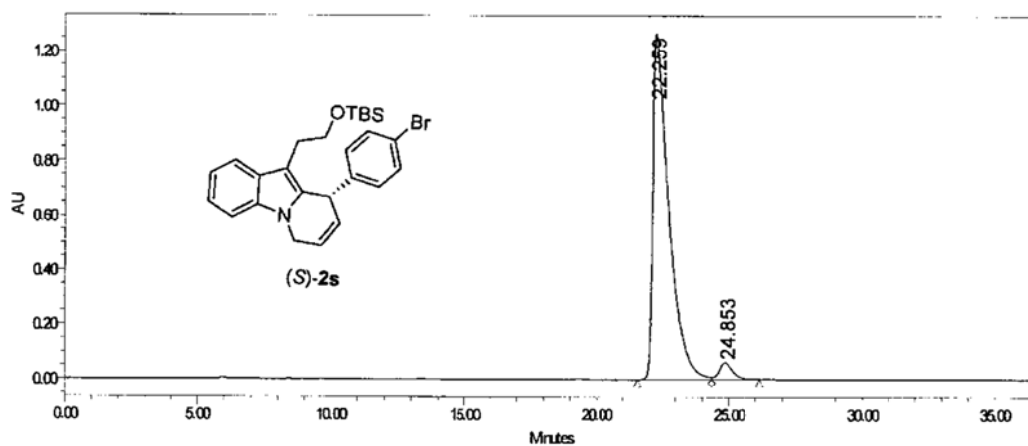
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

SAMPLE INFORMATION

Sample Name:	jf-3-096-jf100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Val:	1	Acq. Method Set:	ZGJ100
Injection#:	23	Processing Method:	111
Injection Volume:	10.00 µl	Channel Name:	V2489 ChA
Run Time:	60.0 Minutes	Proc. Chnl. Descr.:	V2489 ChA 214nm
Date Acquired:	5/24/2019 6:51:06 PM EDT		
Date Processed:	5/24/2019 9:41:15 PM EDT		



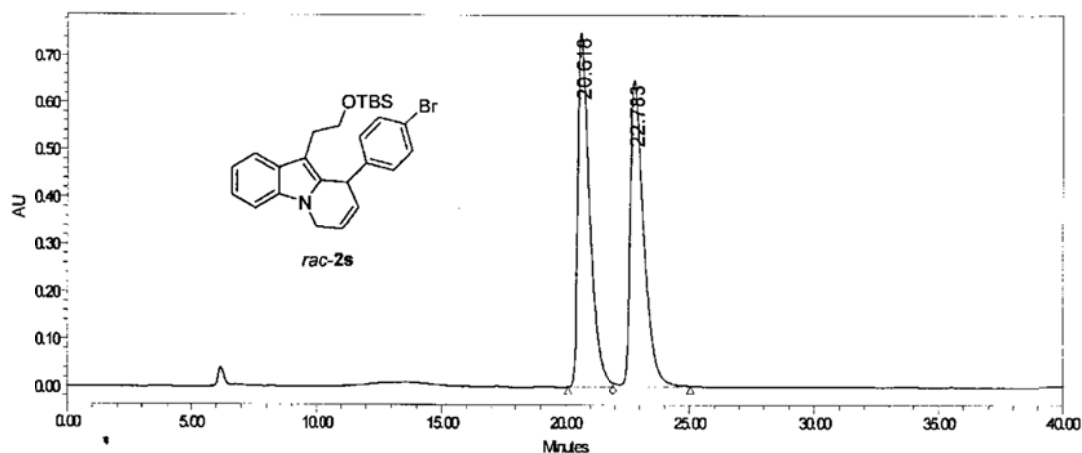
Channel: V2489 ChA; Processed Channel: V2489 ChA 214nm; Result Id: 1442; Processing Method: 11

Processed Channel Descr.: V2489 ChA 214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA 214nm	22.259	52849065	96.00	1271914
2	V2489 ChA 214nm	24.853	2201217	4.00	62267

SAMPLE INFORMATION

Sample Name:	jf-3-097-jf-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	ZGJ100
Injection#:	24	Processing Method:	111
Injection Volume:	10.00 μ l	Channel Name:	W2489 ChA
Run Time:	40.0 Minutes	Proc. Chl. Descr.:	W2489 ChA.214nm
Date Acquired:	5/24/2019 7:28:33 PM EDT		
Date Processed:	5/24/2019 9:41:49 PM EDT		



Channel: W2489 ChA; Processed Channel: W2489 ChA.214nm; Result Id: 1443; Processing Method: 11

Processed Channel Descr.: W2489 ChA.214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	W2489 ChA.214nm	20.618	24579324	50.49	749950
2	W2489 ChA.214nm	22.783	24098763	49.51	646916

2019-05-28 22:27:48.671

SOLVENT: CDCl₃

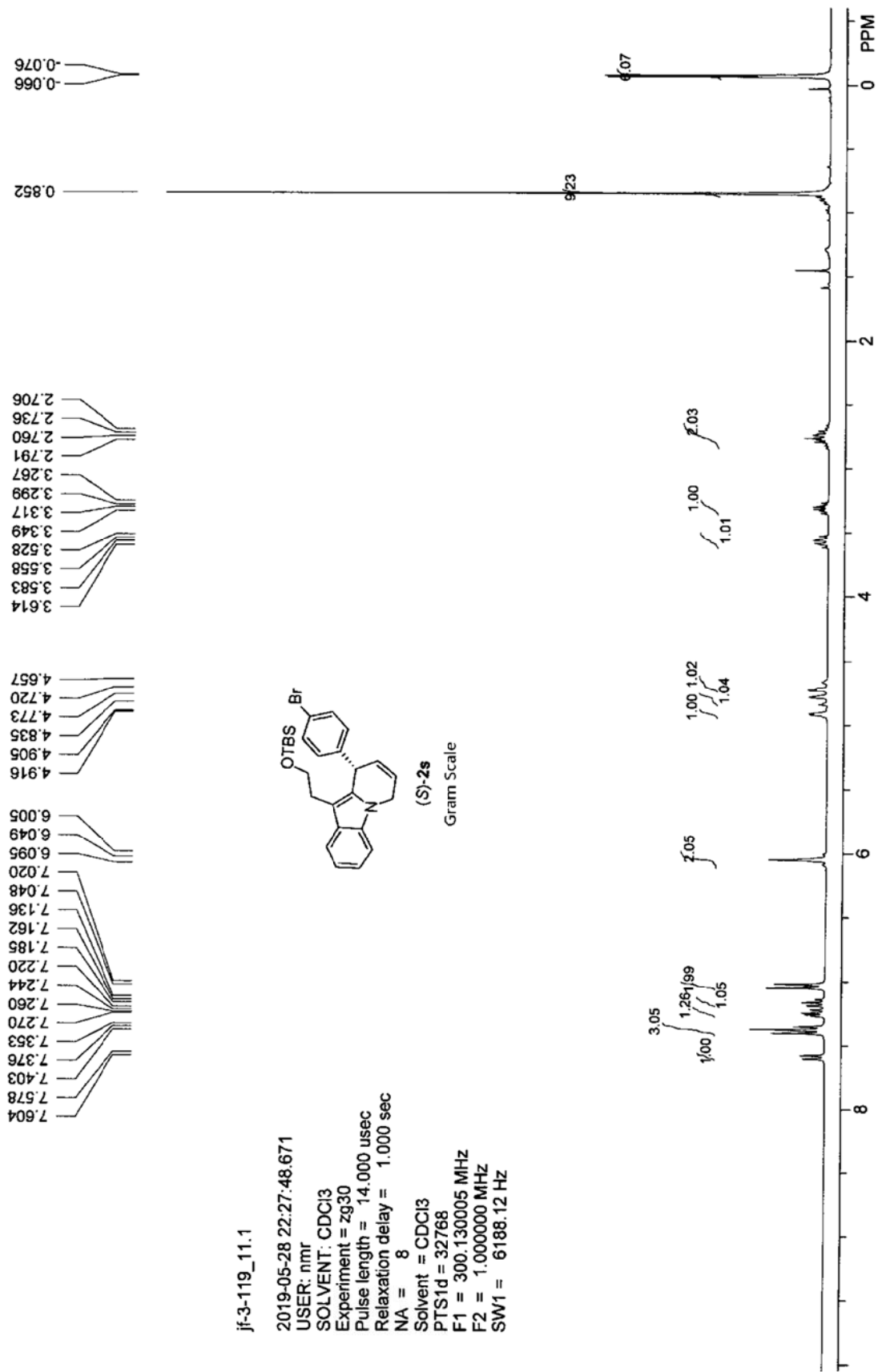
Pulse length = 14.000 usec

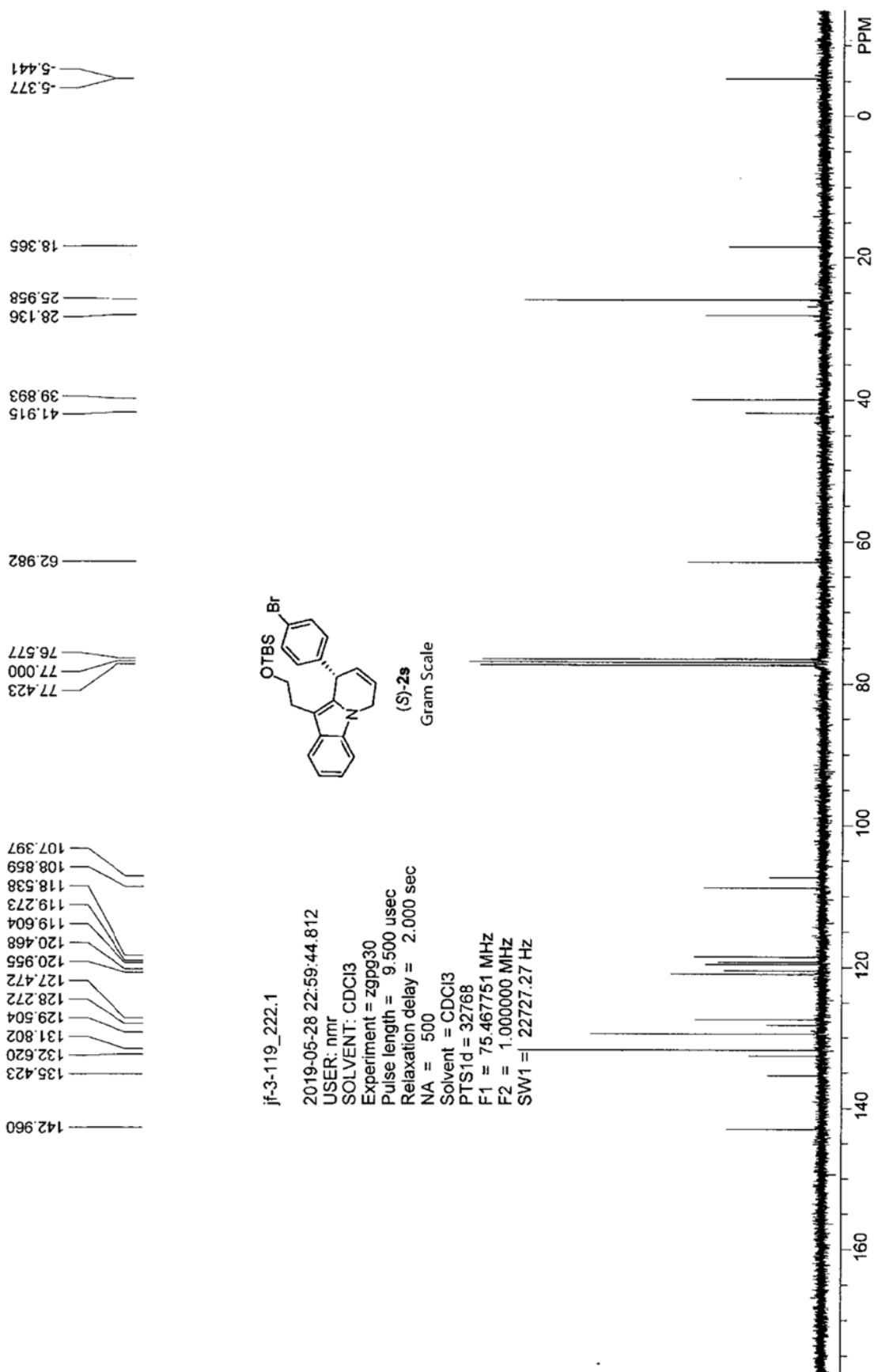
 $NA = 8$

PTS1d = 32768

F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jf-3-119_222.1

2019-05-28 22:59:44.812

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 500

Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

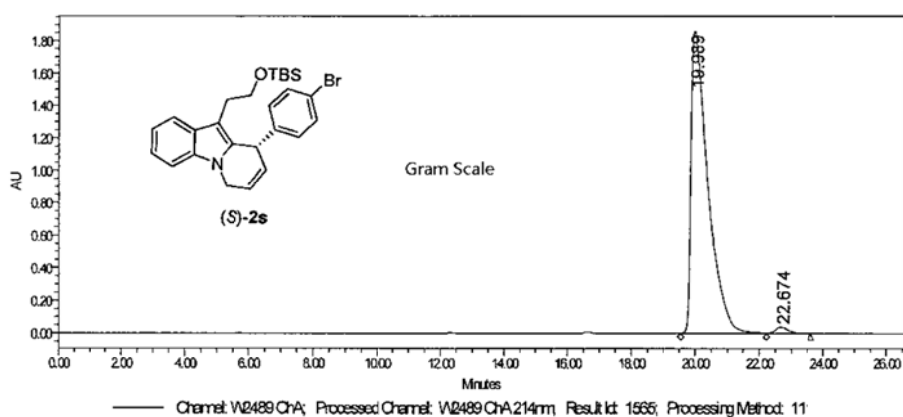
SW1 = 22727.27 Hz

(S)-2s

Gram Scale

SAMPLE INFORMATION

Sample Name:	JF3-119-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	ZG100
Injection#:	29	Processing Method:	111
Injection Volume:	10.00 μ	Channel Name:	W2489 ChA
Run Time:	30.0 Minutes	Proc. Chl. Descr.:	W2489 ChA.214nm
Date Acquired:	5/30/2019 7:04:54 PM EDT		
Date Processed:	5/30/2019 8:29:01 PM EDT		

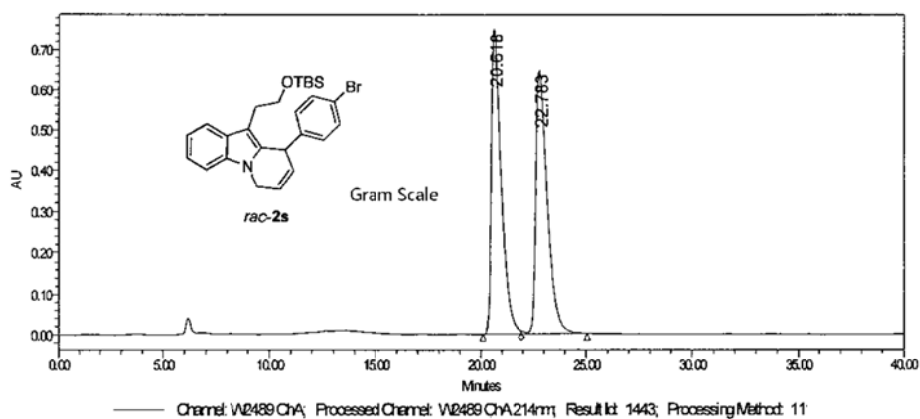


Processed Channel Descr.: W2489 ChA.214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	W2489 ChA.214nm	19.989	66932629	98.43	1863150
2	W2489 ChA.214nm	22.674	106606	1.57	39090

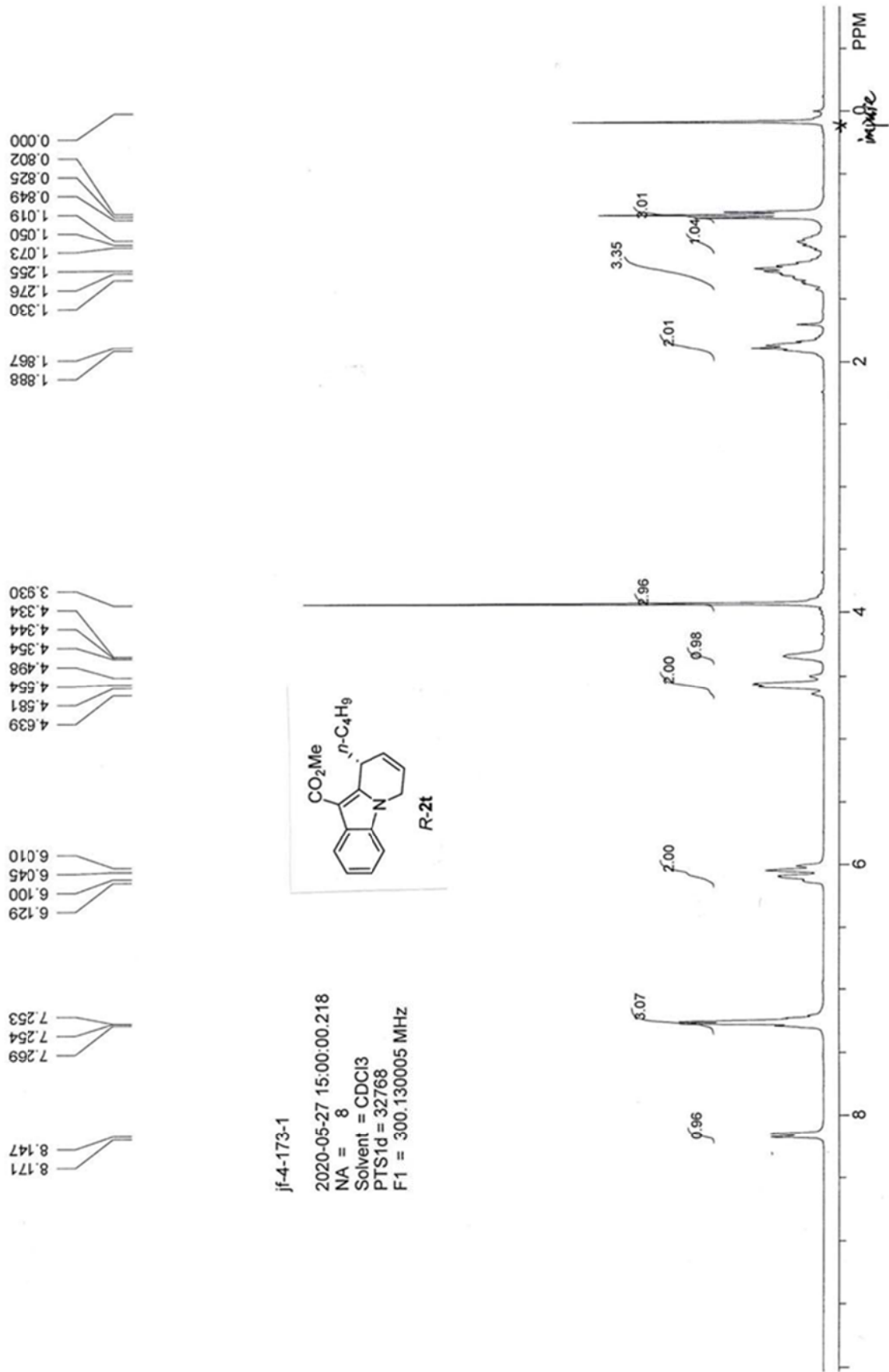
SAMPLE INFORMATION

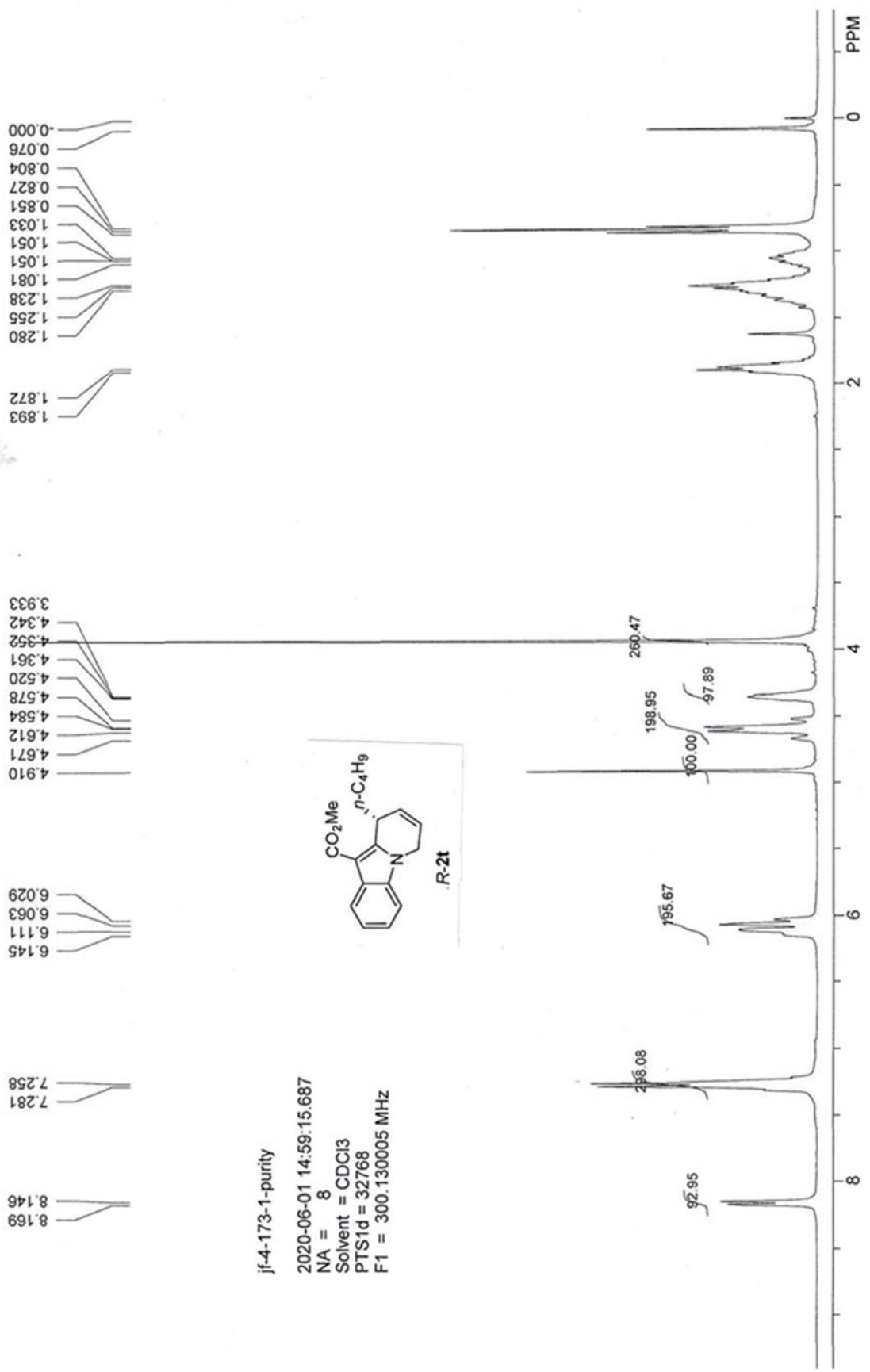
Sample Name:	JF3-0974F-100-0-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ZGJ100
Vial:	1	Acq. Method Set:	111
Injection#:	24	Processing Method:	111
Injection Volume:	10.00 µl	Channel Name:	W2489 ChA
Run Time:	40.0 Minutes	Proc. Chnl. Descr.:	W2489 ChA 214nm
Date Acquired:	5/24/2019 7:28:33 PM EDT		
Date Processed:	5/24/2019 9:41:49 PM EDT		



Processed Channel Descr.: W2489 ChA 214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	W2489 ChA 214nm	20.618	24579324	50.48	748650
2	W2489 ChA 214nm	22.783	24098763	49.51	646916





jf-4-173-1-purity

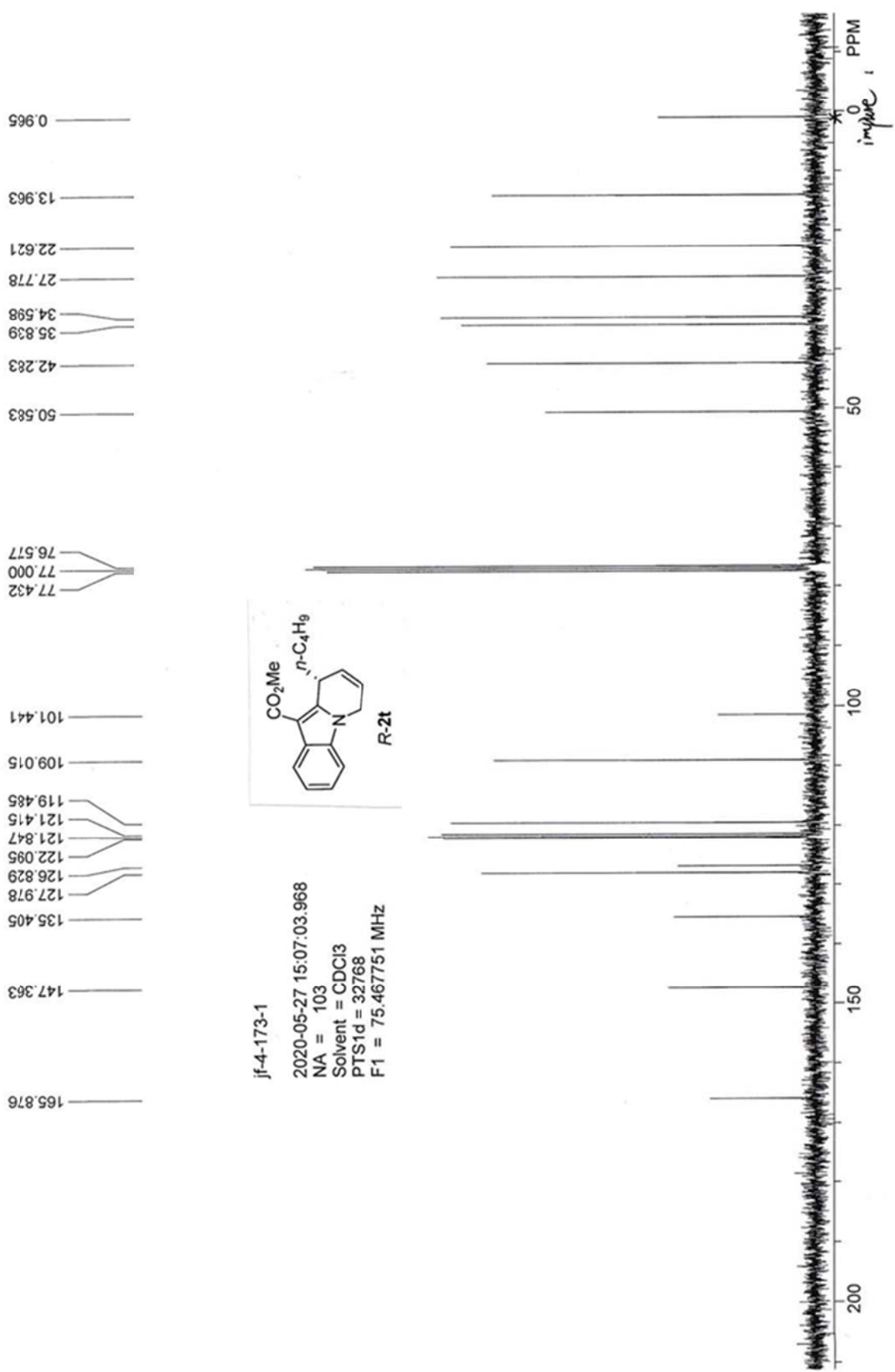
2020-06-01 14:59:15.687

NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz



jf-4-173-1

2020-05-27 15:07:03.968

NA = 103

Solvent = CDCl3

PTS1d = 32768

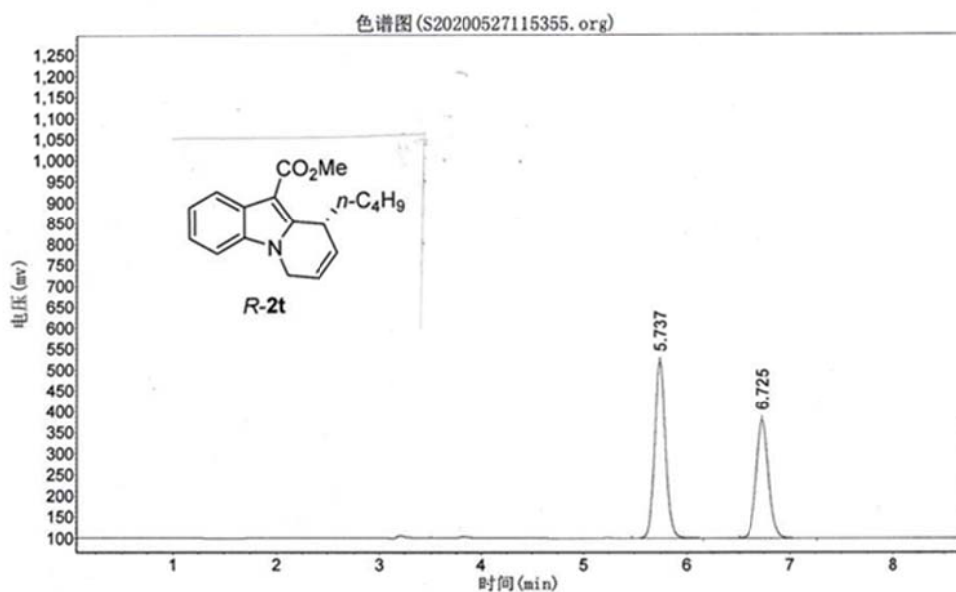
F1 = 75.467751 MHz

jf-4-173-1

实验时间: 2020-05-27, 11:53:55
谱图文件: D:\浙大智达\N2000\样品\S20200527115355.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-05-27, 12:03:48
积分方法: 面积归一法

实验内容简介:
ia, n-hexane/i-PrOH = 90/10, 0.7, 214



分析结果表

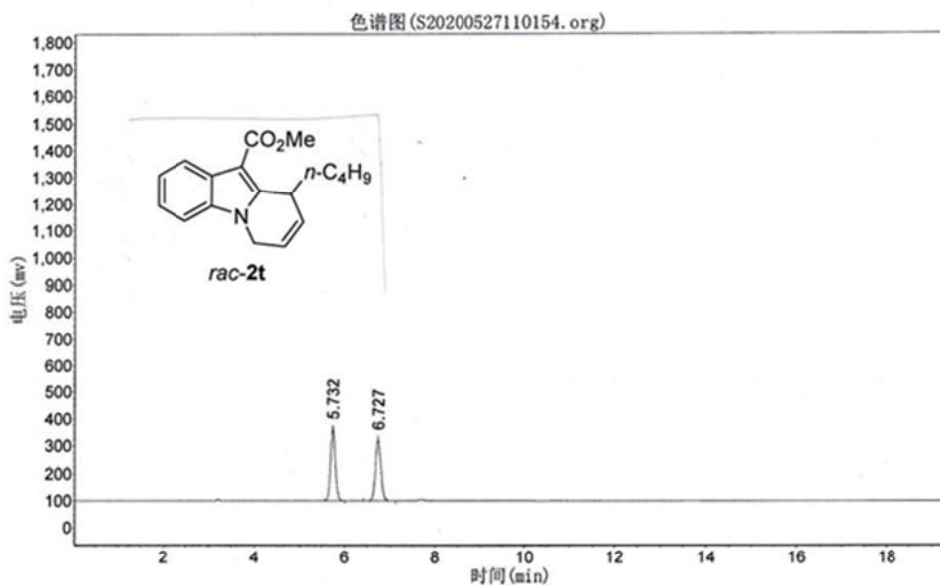
峰号	峰名	保留时间	峰高	峰面积	含量
1		5.737	418210.844	3019584.500	56.5661
2		6.725	278275.625	2318564.500	43.4339
总计			696486.469	5338149.000	100.0000

jf-4-174-1

实验时间: 2020-05-27, 11:01:54
 谱图文件: D:\浙大智达\N2000\样品\S20200527110154.org
 方法文件: D:\浙大智达\N2000\djx.mtd

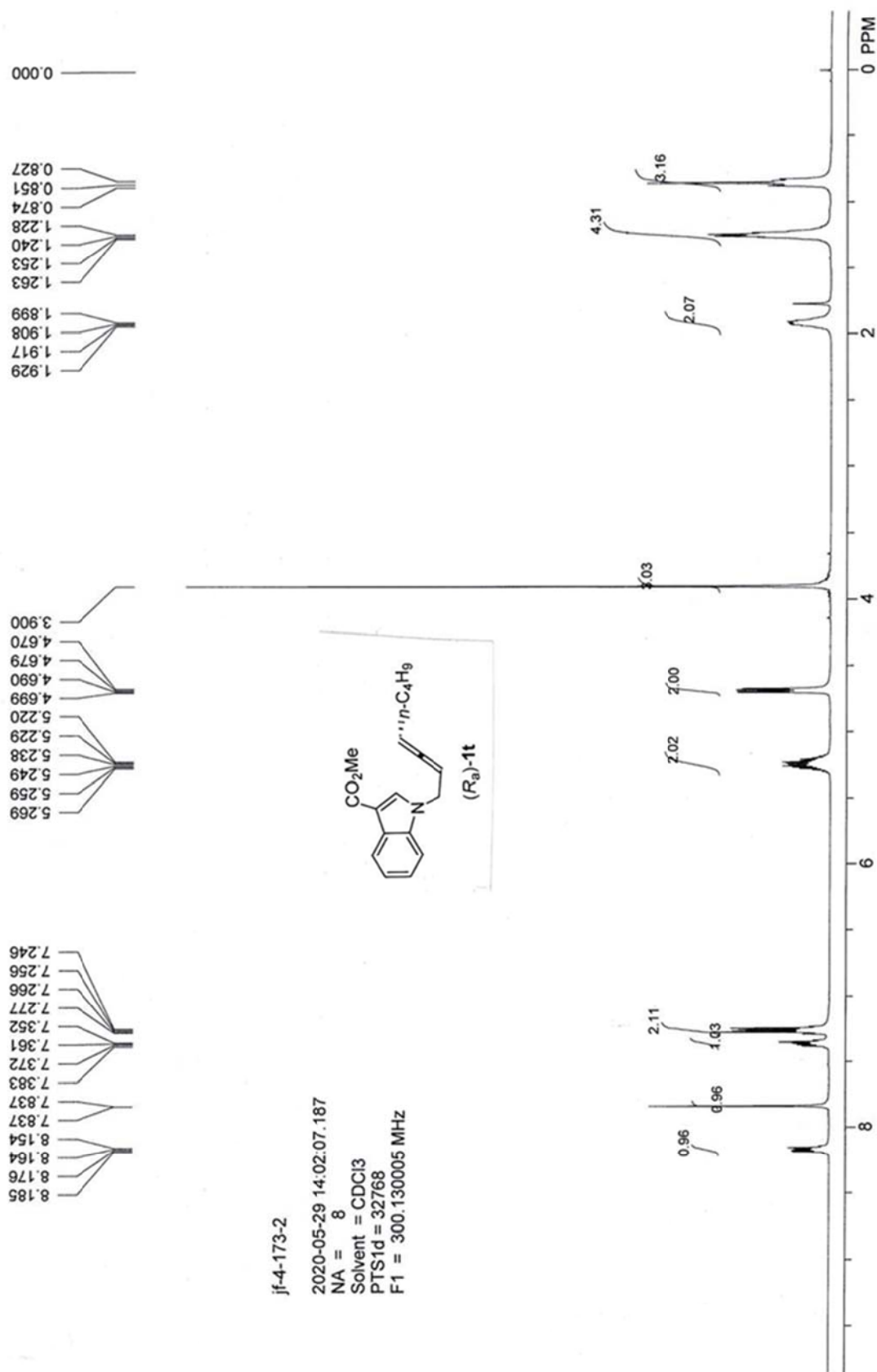
实验者: jf
 报告时间: 2020-05-27, 11:56:20
 积分方法: 面积归一法

实验内容简介:
 ia, n-hexane/i-PrOH = 90/10, 0.7, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		5.732	261362.781	1918391.375	50.5729
2		6.727	222631.875	1874928.000	49.4271
总计			483994.656	3793319.375	100.0000



jf-4-173-2

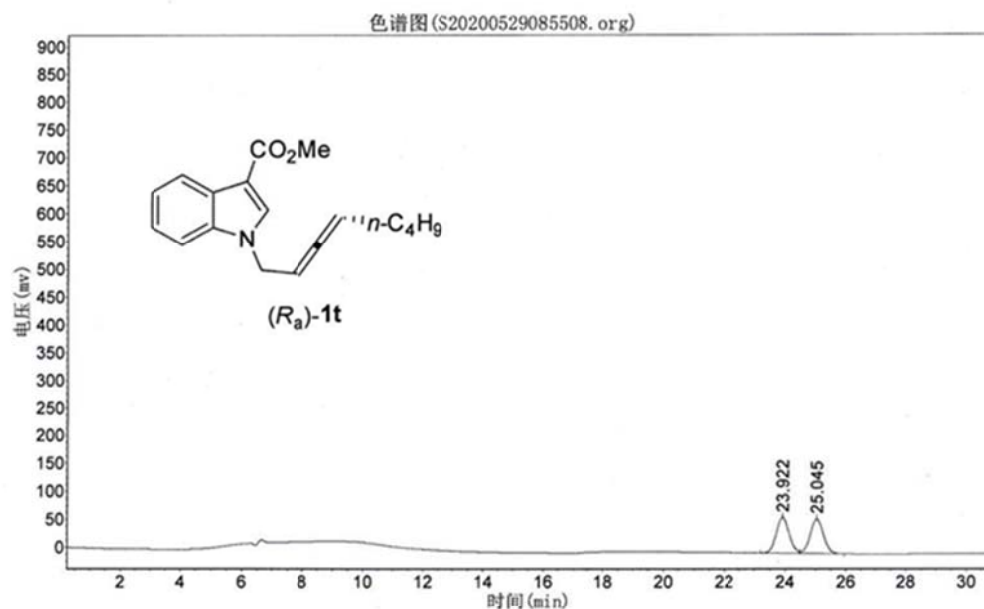
2020-05-29 14:02:07.187
 NA = 8
 Solvent = CDCl₃
 PTS1d = 32768
 F1 = 300.130005 MHz

jf-4-173-2

实验时间: 2020-05-29, 8:55:08
谱图文件: D:\浙大智达\N2000\样品\S20200529085508.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-05-29, 9:27:59
积分方法: 面积归一法

实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.5, 214



分析结果表

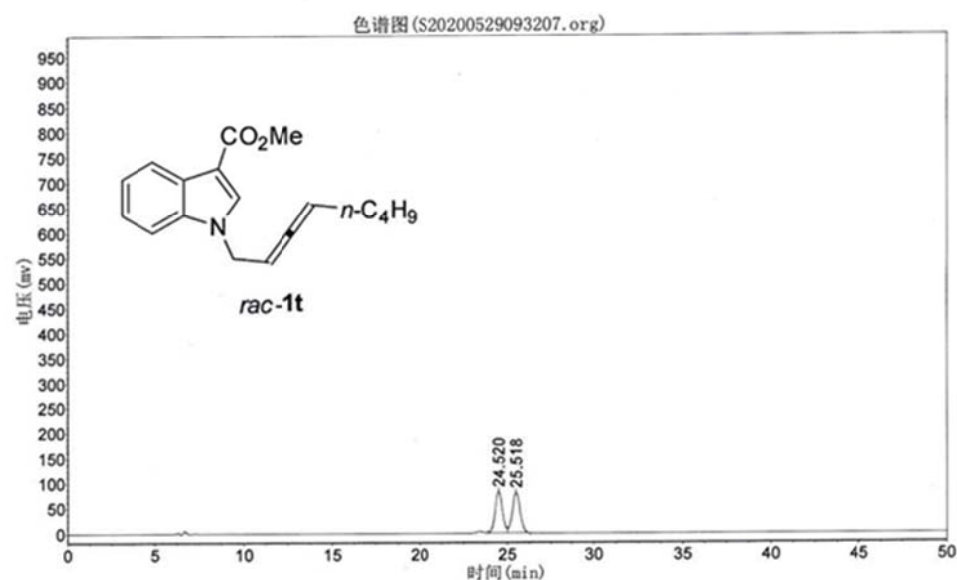
峰号	峰名	保留时间	峰高	峰面积	含量
1		23.922	63919.250	1868836.625	49.6373
2		25.045	61894.434	1896150.500	50.3627
总计			125813.684	3764987.125	100.0000

jf-3-112

实验时间: 2020-05-29, 9:32:07
谱图文件: D:\浙大智达\N2000\样品\S20200529093207.org
方法文件: D:\浙大智达\N2000\djx.mtd

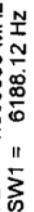
实验者: jf
报告时间: 2020-09-13, 18:38:28
积分方法: 面积归一法

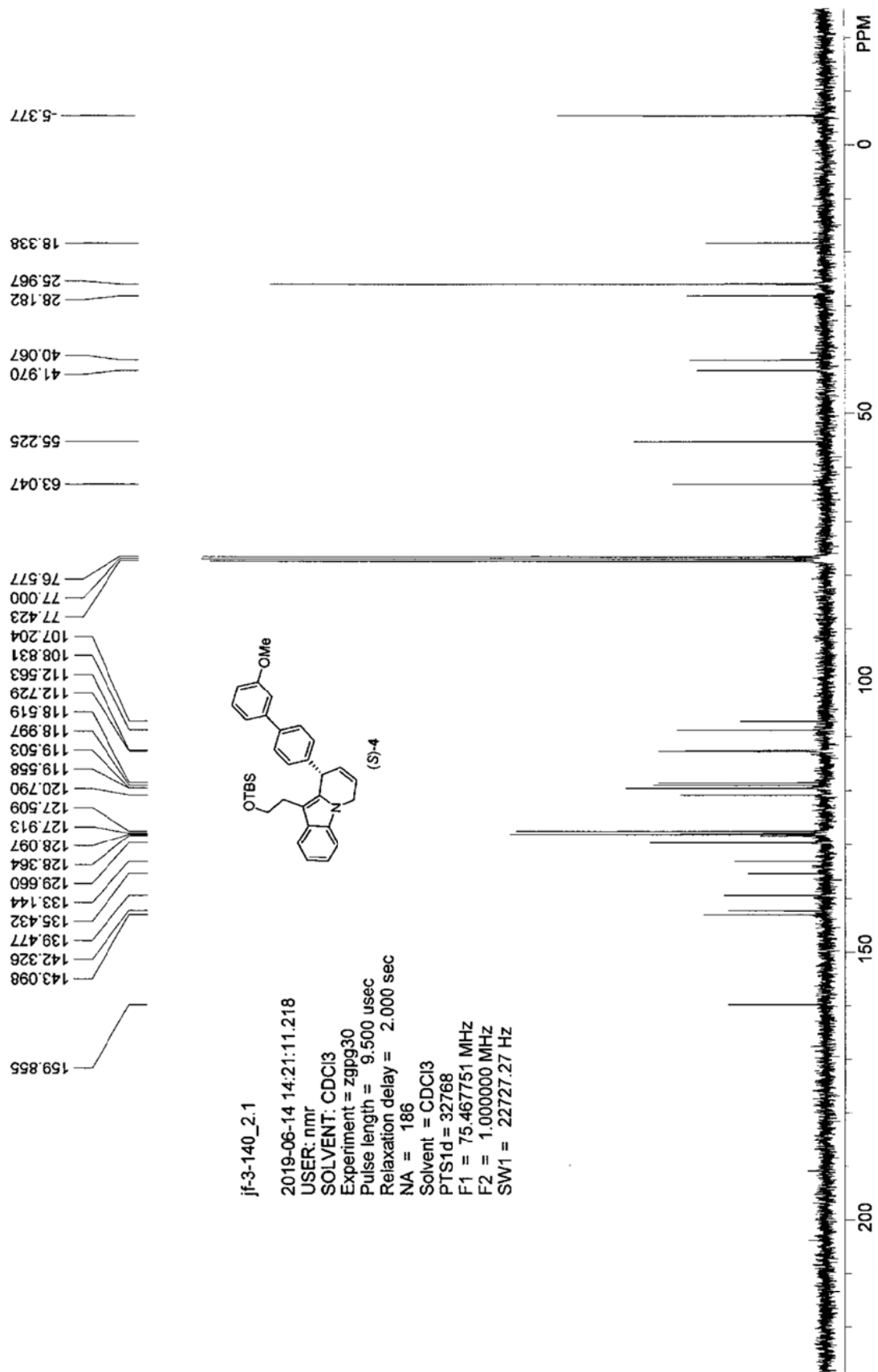
实验内容简介:
od, n-hexane/i-PrOH = 90/10, 0.5, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		24.520	81369.563	2359160.000	49.0409
2		25.518	79835.367	2451435.000	50.9591
总计			161204.930	4810595.000	100.0000





if-3-140_2.1

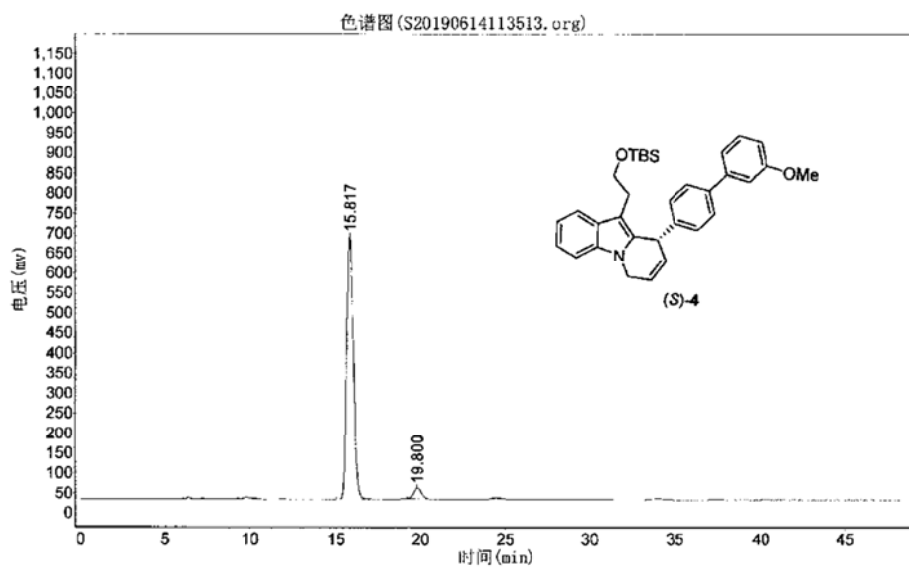
2019-06-14 14:21:11.218
 USER: nmr
 SOLVENT: CDCl₃
 Experiment = zgpg30
 Pulse length = 9.500 usec
 Relaxation delay = 2.000 sec
 NA = 186
 Solvent = CDCl₃
 PTS1d = 32768
 F1 = 75.467751 MHz
 F2 = 1.000000 MHz
 SW1 = 22727.27 Hz

jf-3-140

实验时间: 2019-06-14, 11:35:13
谱图文件: D:\浙大智达\N2000\样品\S20190614113513.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2019-06-14, 12:28:14
积分方法: 面积归一法

实验内容简介:
ia, a hexane/i-PrOH = 100/1, 0.5, 214



分析结果表

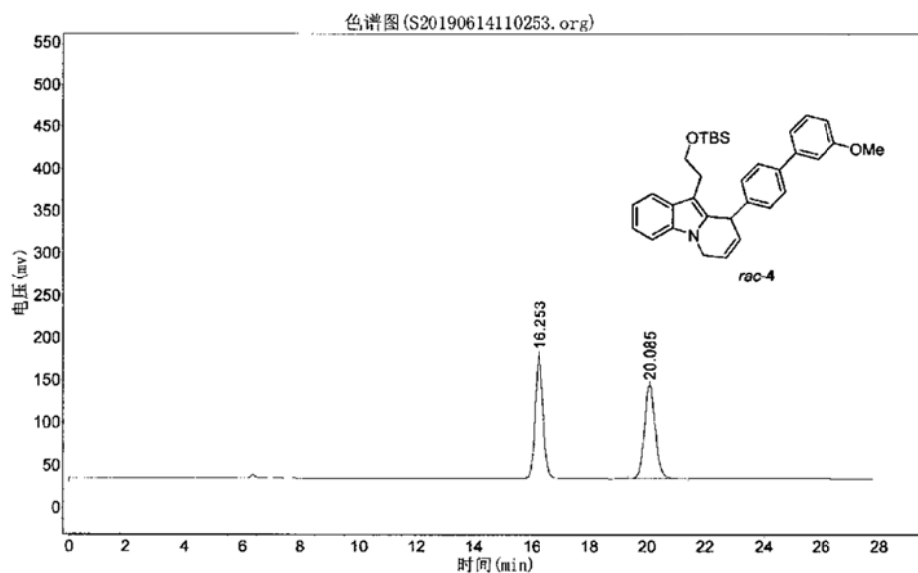
峰号	峰名	保留时间	峰高	峰面积	含量
1		15.817	657689.063	18151676.000	95.3860
2		19.800	27621.441	878027.188	4.6140
总计			685310.504	19029703.188	100.0000

jf-3-139

实验时间: 2019-06-14, 11:02:53
谱图文件: D:\浙大智达\N2000\样品\S20190614110253.org
方法文件: D:\浙大智达\N2000\djx.mtd

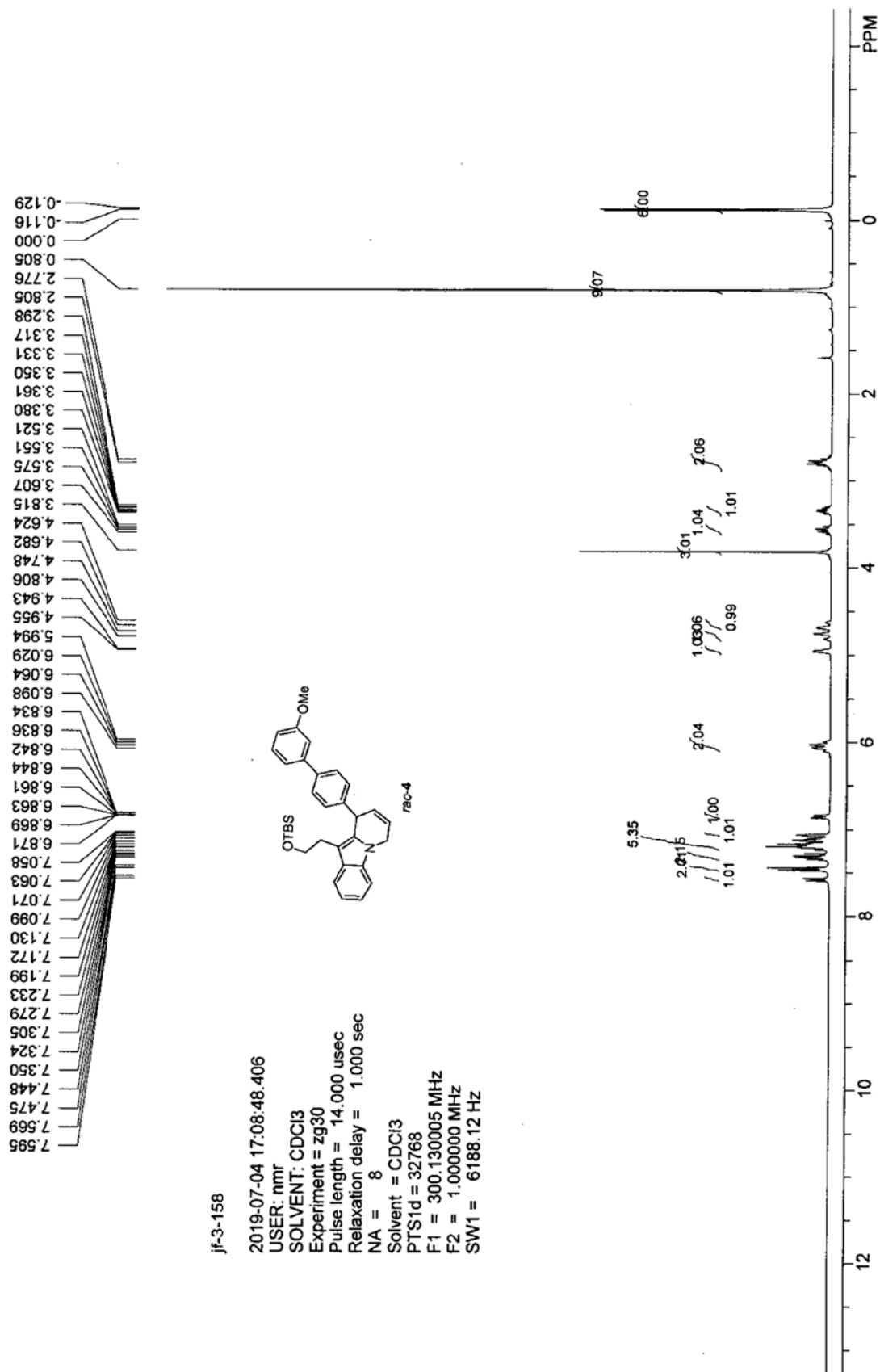
实验者: jf
报告时间: 2019-06-14, 11:37:39
积分方法: 面积归一法

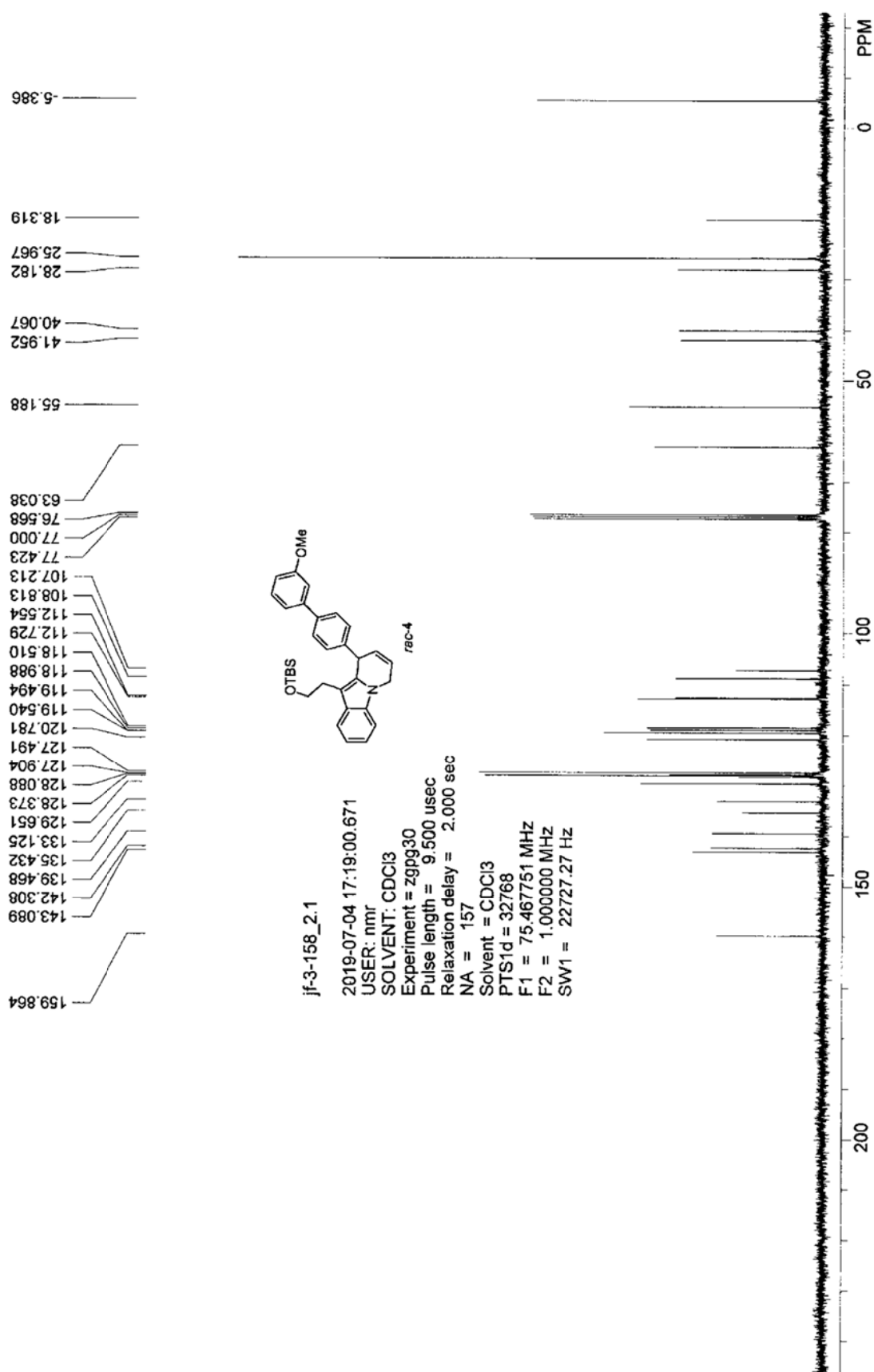
实验内容简介:
ia, n-hexane/i-PrOH = 100/1, 0.5, 214

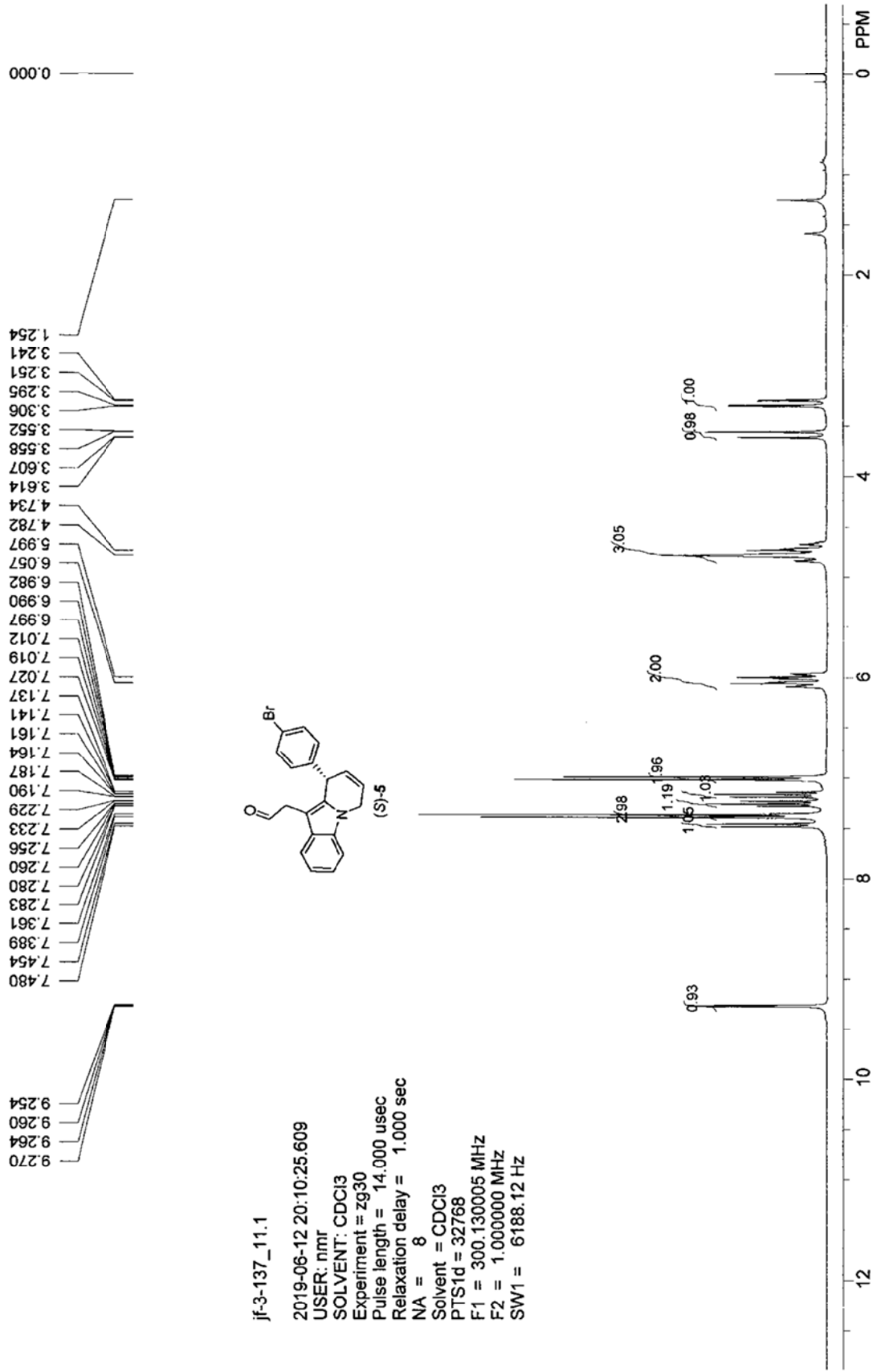


分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		16.253	145316.078	2903197.250	50.4508
2		20.085	109694.234	2851317.500	49.5492
总计			255010.313	5754514.750	100.0000







jf-3-137_11.1

2019-06-12 20:10:25.609

USER: nmr

SOLVENT: CDCl3

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

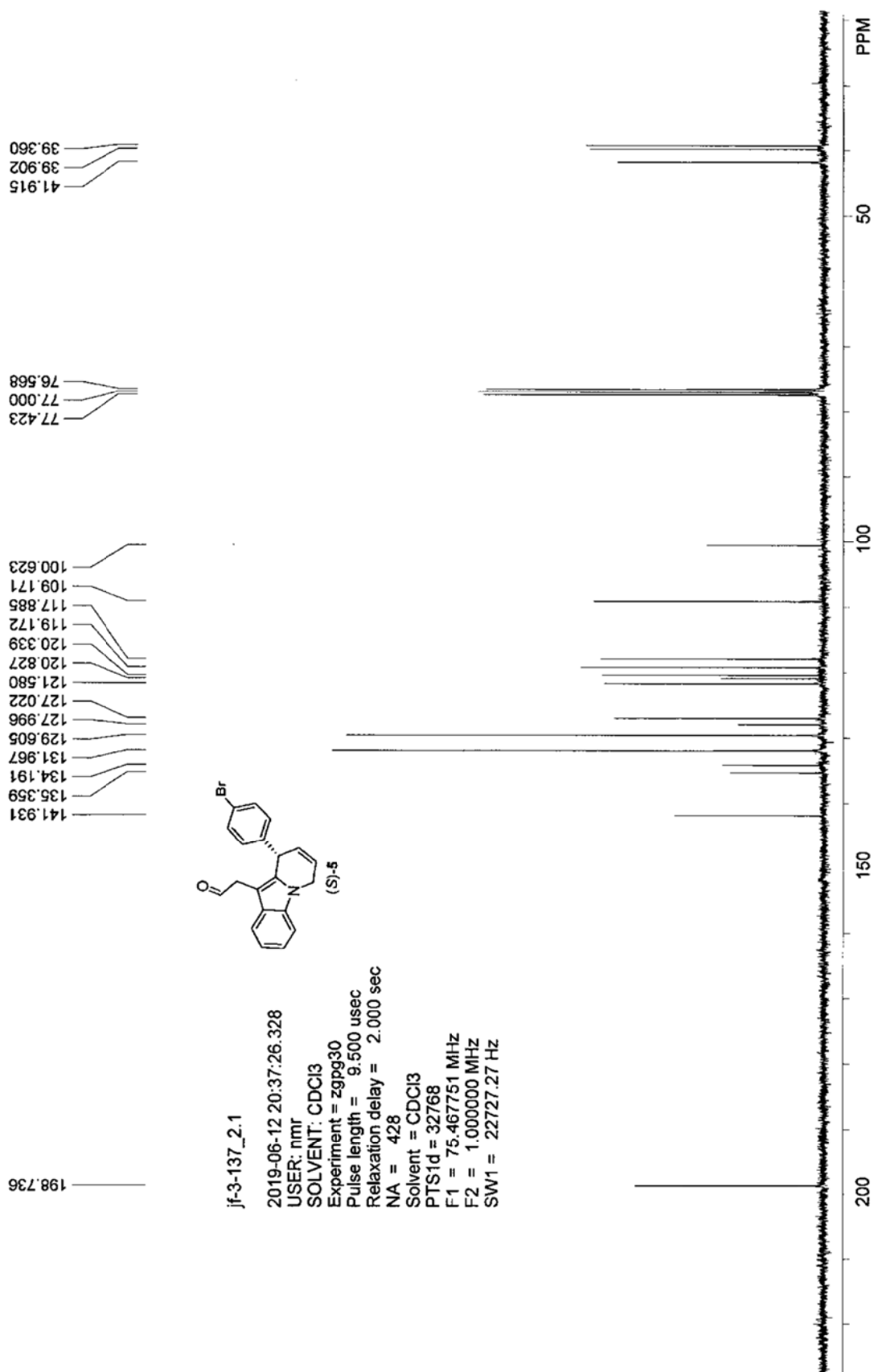
Solvent = CDCl3

PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz



jf-3-137_2.1

2019-06-12 20:37:26.328

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 428

Solvent = CDCl₃

PTS1d = 32768

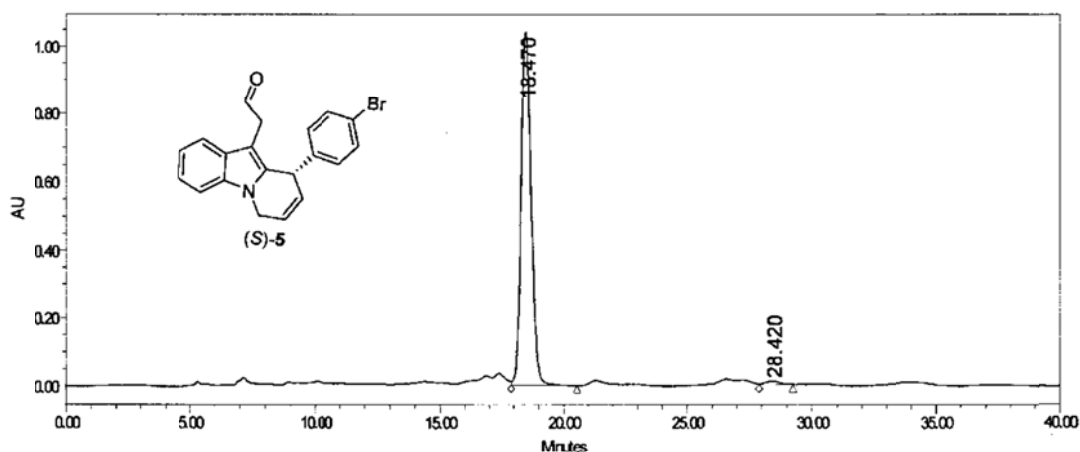
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

SAMPLE INFORMATION

Sample Name:	jf-3-137-α-h-95-5-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	zg95
Injection#:	13	Processing Method:	111
Injection Volume:	10.00 µl	Channel Name:	V2489 ChA
Run Time:	40.0 Minutes	Proc. Chrt. Descr.:	V2489 ChA.214nm
Date Acquired:	6/14/2019 4:32:51 PM EDT		
Date Processed:	6/14/2019 8:45:42 PM EDT		



Channel: V2489 ChA; Processed Channel: V2489 ChA.214nm; Result Id: 1707; Processing Method: 11

Processed Channel Descr.: V2489 ChA.214nm

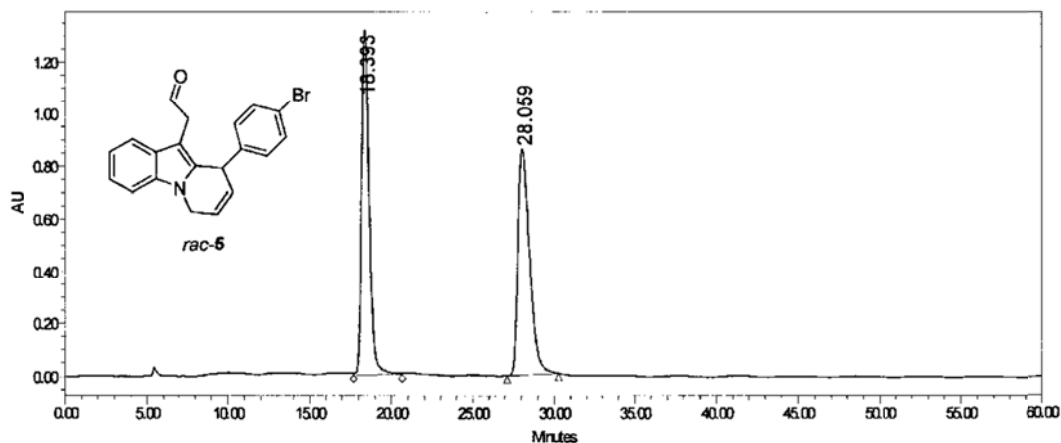
	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA.214nm	18.470	28897983	98.62	1038615
2	V2489 ChA.214nm	28.420	403798	1.38	9848

Reported by: User: System
Report Method: Injection Summary Report
Report Method ID: 1029 1029
Page: 1 of 1

Project Name: HPLC_1525
Date Printed: 6/14/2019
8:47:15 PM America/New_York

SAMPLE INFORMATION

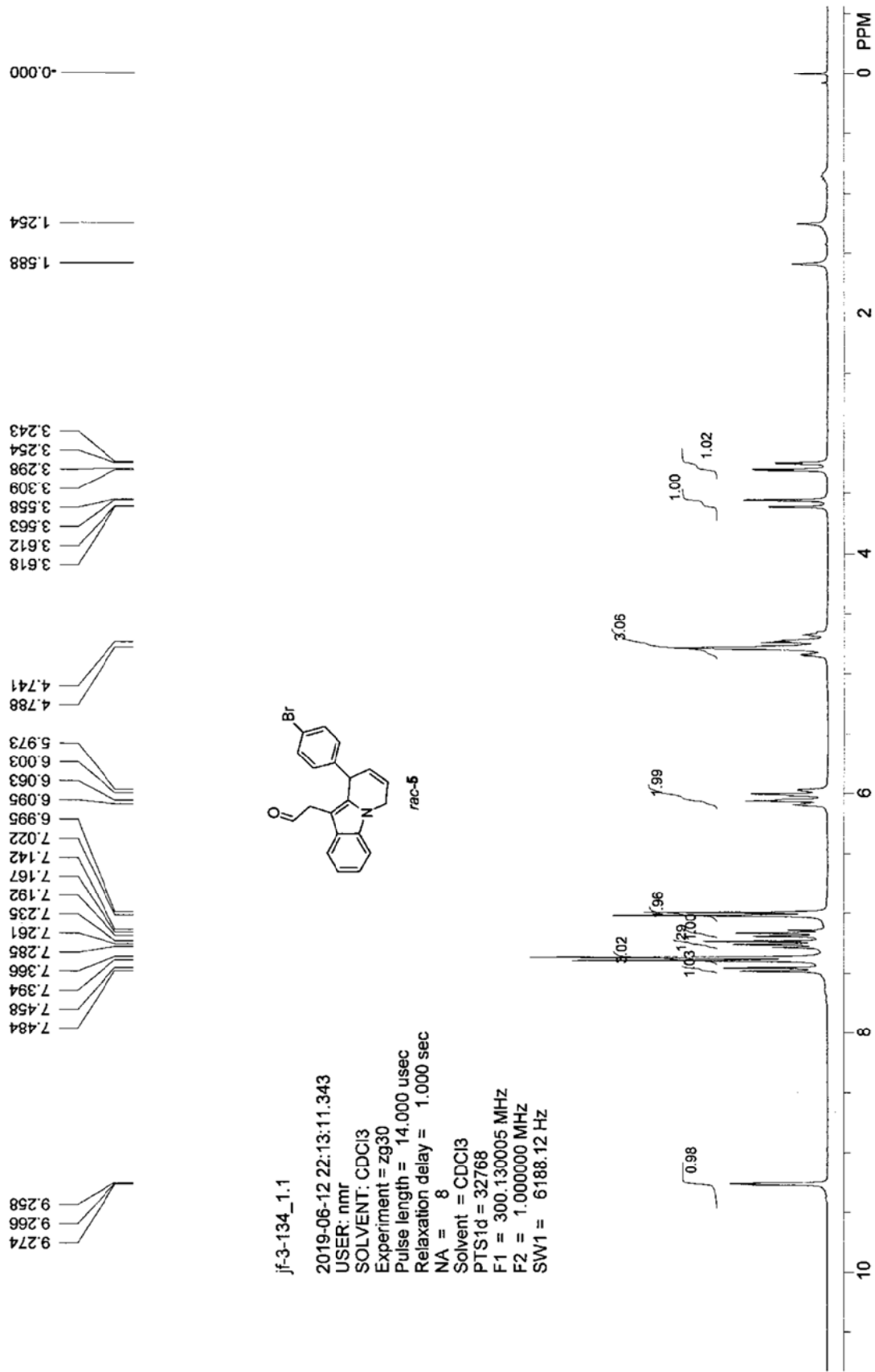
Sample Name:	jf-3-134-czh-95-5-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	zg95
Injection#:	12	Processing Method:	111
Injection Volume:	10.00 µl	Channel Name:	V2489 ChA
Run Time:	60.0 Minutes	Proc. Chnl. Descr.:	V2489 ChA.214nm
Date Acquired:	6/14/2019 2:20:21 PM EDT		
Date Processed:	6/14/2019 8:43:49 PM EDT		

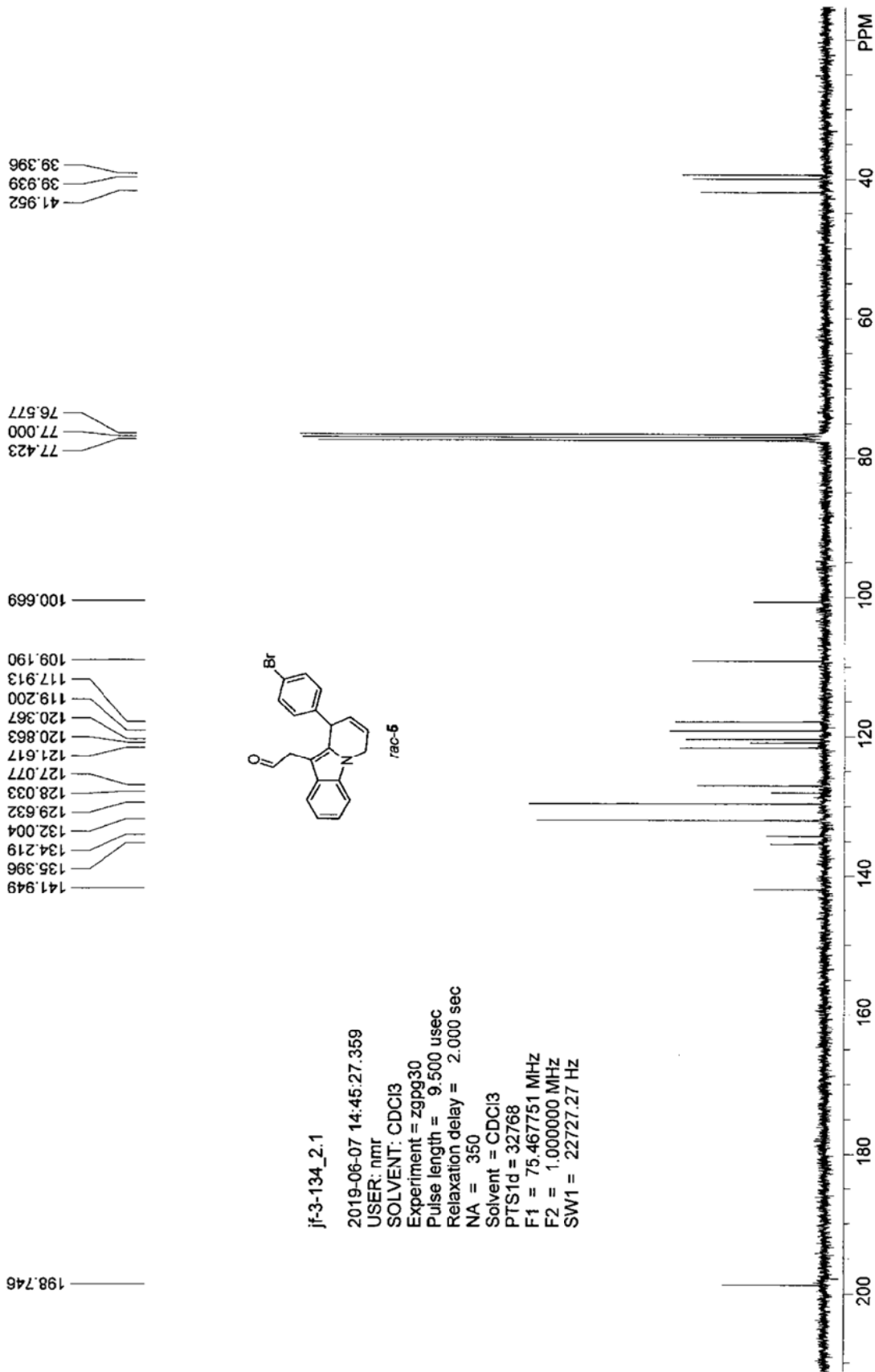


Channel: V2489 ChA; Processed Channel: V2489 ChA.214nm; Result Id: 1706; Processing Method: 11

Processed Channel Descr.: V2489 ChA.214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA.214nm	18.393	42378585	49.84	1319321
2	V2489 ChA.214nm	28.059	42655462	50.16	860473





jf-3-134_2.1

2019-06-07 14:45:27.359
USER: nmr
SOLVENT: CDCl3
Experiment = zgpg30
Pulse length = 9.500 usec
Relaxation delay = 2.000 sec
NA = 350
Solvent = CDCl3
PTS1d = 32768
F1 = 75.467751 MHz
F2 = 1.000000 MHz
SW1 = 22727.27 Hz

jf-3-121_111.1

2019-06-04 11:43:20.750

USER: nmr

SOLVENT: CDCl₃

Experiment = zq30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

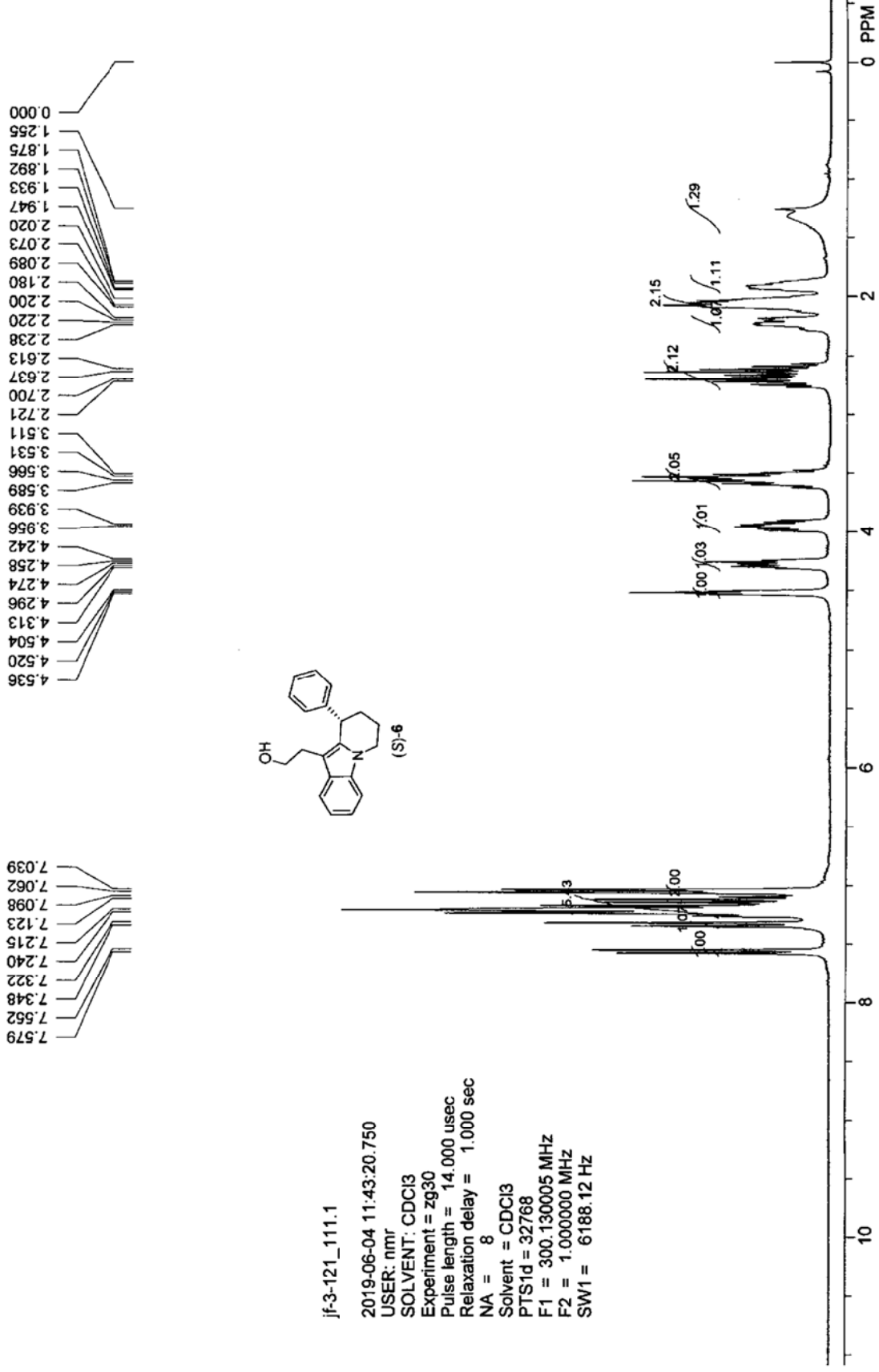
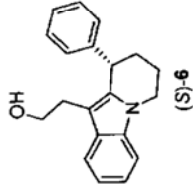
Solvent = CDCl₃

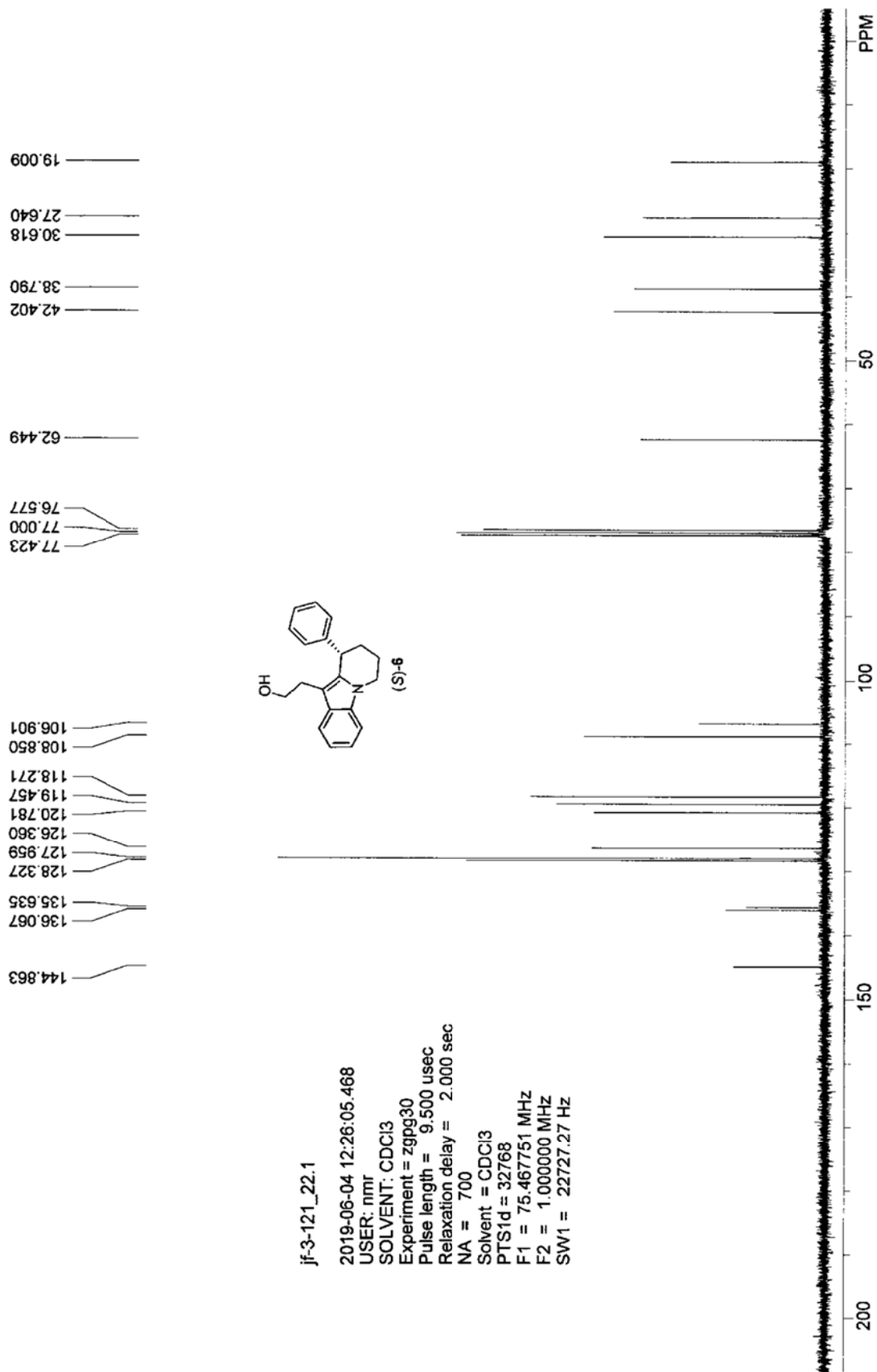
PTS1d = 32768

F1 = 300.130005 MHz

F2 = 1.000000 MHz

SW1 = 6188.12 Hz





jf-3-121_22.1

2019-06-04 12:26:05.468

USER: nmr

SOLVENT: CDCl3

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 700

Solvent = CDCl3

PTS1d = 32768

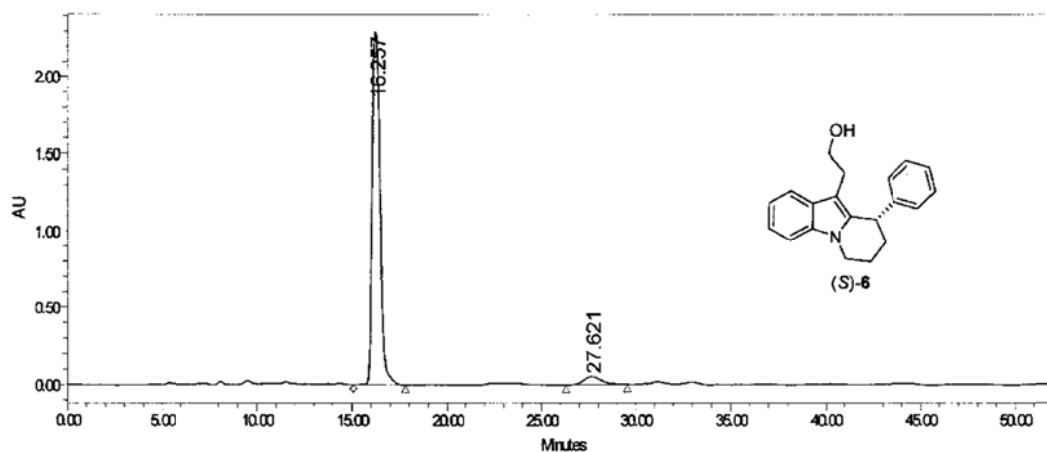
F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz

SAMPLE INFORMATION

Sample Name:	jf3-121-azh95-5-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	zg95
Injection#:	11	Processing Method:	111
Injection Volume:	10.00 µl	Channel Name:	W2489 ChA
Run Time:	60.0 Minutes	Proc. Chl. Descr.:	W2489 ChA.214nm
Date Acquired:	6/14/2019 1:23:00 PM EDT		
Date Processed:	6/14/2019 8:43:28 PM EDT		



Channel: W2489 ChA; Processed Channel: W2489 ChA.214nm; Result Id: 1705; Processing Method: 11

Processed Channel Descr.: W2489 ChA.214nm

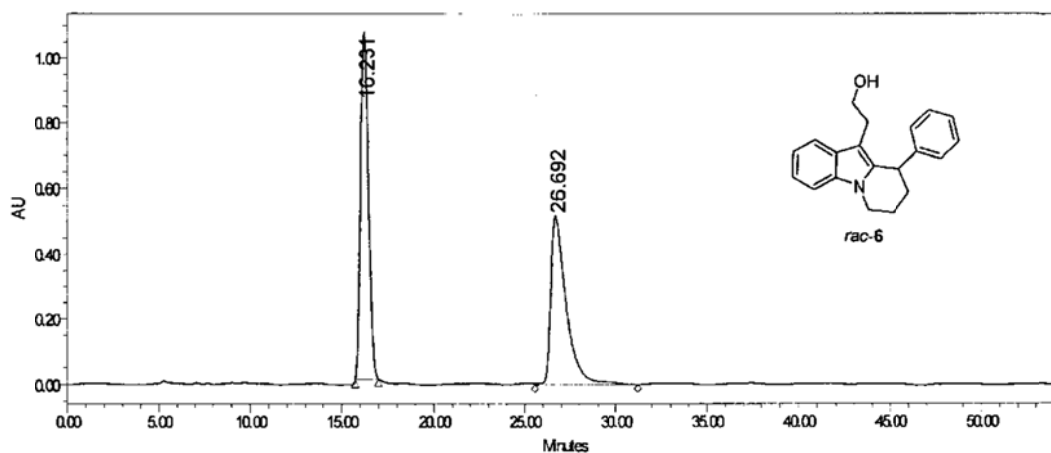
	Processed Channel Descr.	RT	Area	%Area	Height
1	W2489 ChA.214nm	16.257	66283184	94.95	2298893
2	W2489 ChA.214nm	27.621	3523061	5.05	52275

Reported by User: System
Report Method: Injection Summary Report
Report Method ID: 1029 1029
Page: 1 of 1

Project Name: HPLC_1525
Date Printed: 6/14/2019
8:46:30 PM America/New_York

SAMPLE INFORMATION

Sample Name:	jf3-125-azh-95-5-1-214	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	1	Acq. Method Set:	zg95
Injection#:	10	Processing Method:	111
Injection Volume:	10.00 µl	Channel Name:	V2489 ChA
Run Time:	60.0 Minutes	Proc. Chnl. Descr.:	V2489 ChA.214nm
Date Acquired:	6/14/2019 12:26:53 PM EDT		
Date Processed:	6/14/2019 8:42:53 PM EDT		



Channel: V2489 ChA; Processed Channel: V2489 ChA.214nm; Result Id: 1704; Processing Method: 11

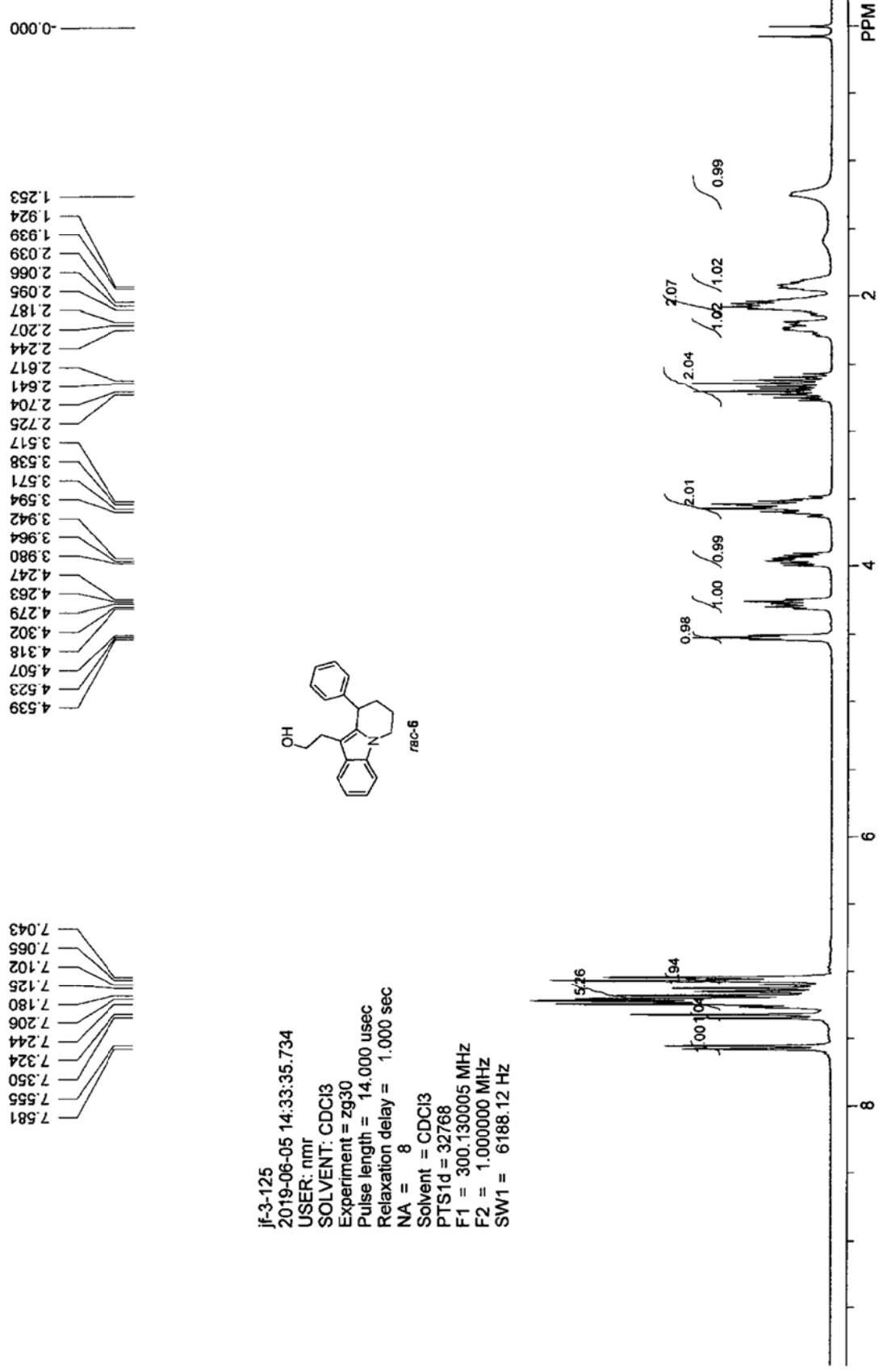
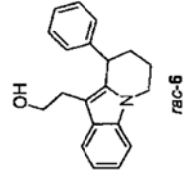
Processed Channel Descr.: V2489 ChA.214nm

	Processed Channel Descr.	RT	Area	%Area	Height
1	V2489 ChA.214nm	16.231	31414736	50.76	1064852
2	V2489 ChA.214nm	26.692	30472914	49.24	518554

Reported by User: System
Report Method: Injection Summary Report
Report Method ID: 1029 1029
Page: 1 of 1

Project Name: HPLC_1525
Date Printed: 6/14/2019
8:45:57 PM America/New_York

jf-3-125
 2019-06-05 14:33:35.734
 USER: nmf
 SOLVENT: CDCl3
 Experiment = zg30
 Pulse length = 14.000 usec
 Relaxation delay = 1.000 sec
 NA = 8
 Solvent = CDCl3
 PTS1d = 32768
 F1 = 300.130005 MHz
 F2 = 1.000000 MHz
 SW1 = 6188.12 Hz



jf-3-125_22.1

2019-06-05 14:43:56.593

USER: nmr

SOLVENT: CDCl₃

Experiment = zgpg30

Pulse length = 9.500 usec

Relaxation delay = 2.000 sec

NA = 157

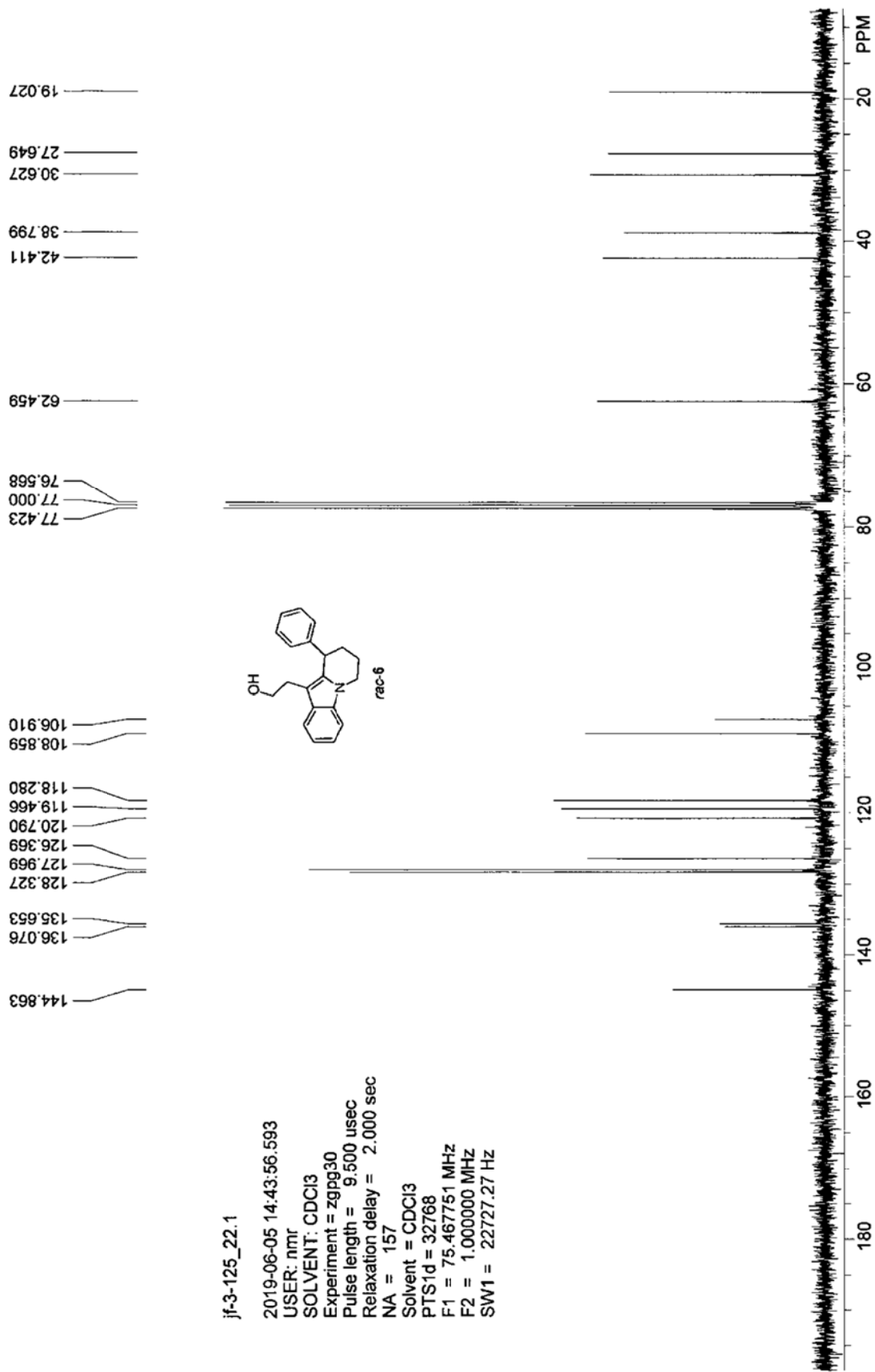
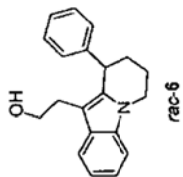
Solvent = CDCl₃

PTS1d = 32768

F1 = 75.467751 MHz

F2 = 1.000000 MHz

SW1 = 22727.27 Hz



jt-5-119

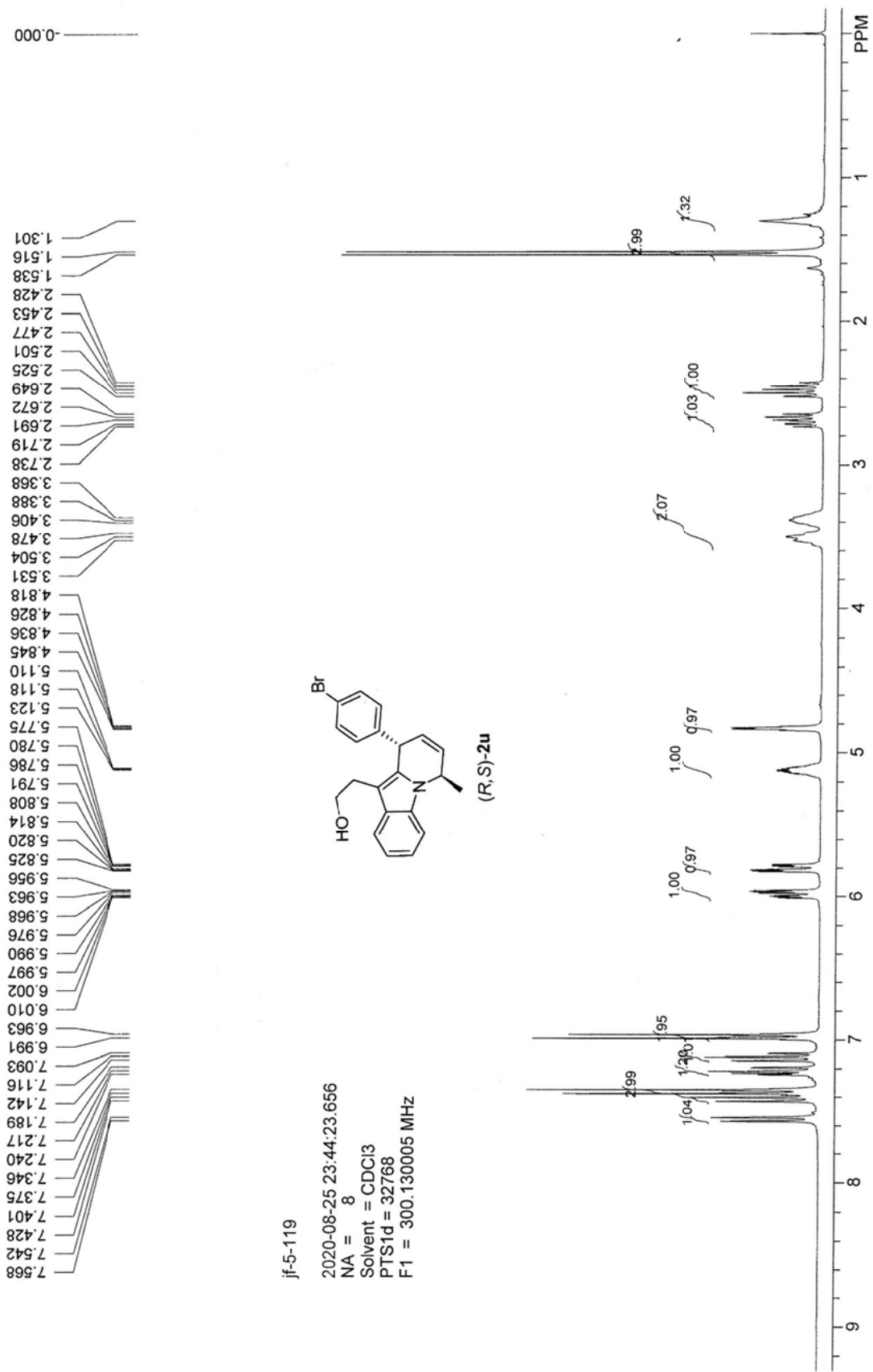
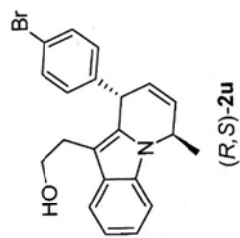
2020-08-25 23:44:23.656

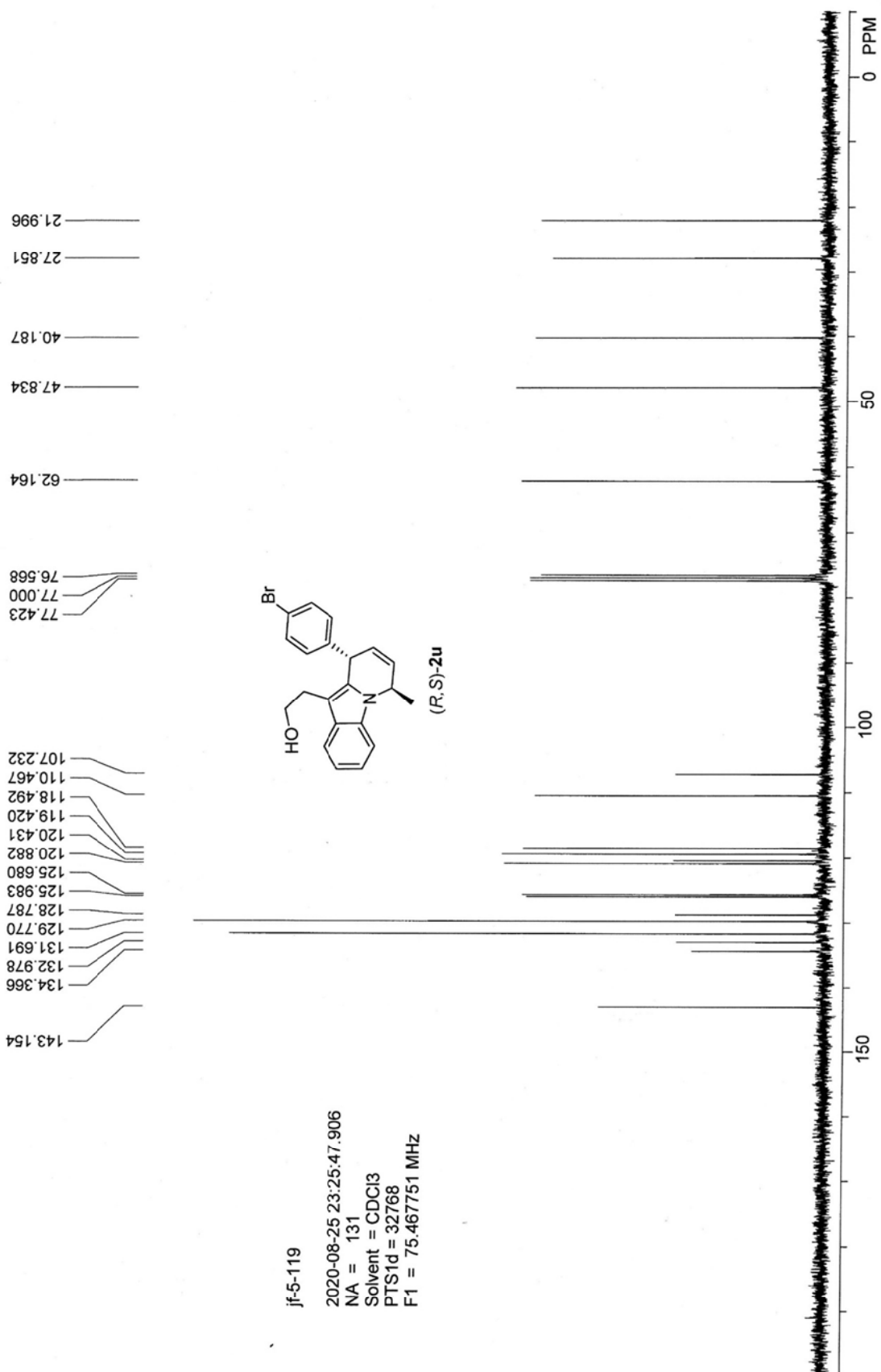
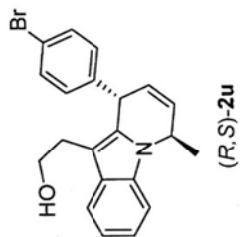
NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz





jf-5-119

2020-08-25 23:25:47.906

NA = 131

Solvent = CDCl3

PTS1d = 32768

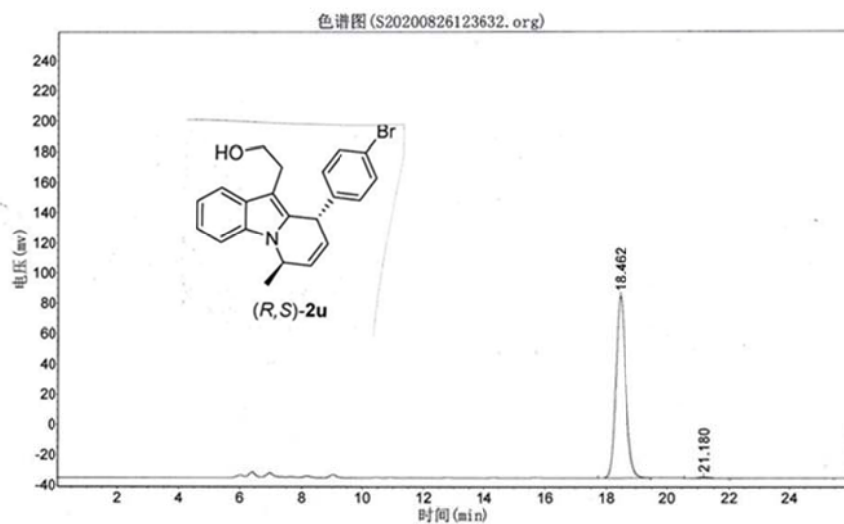
F1 = 75.467751 MHz

jf-5-119

实验时间: 2020-08-26, 12:36:32
谱图文件: D:\浙大智达\N2000\样品\S20200826123632.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-08-26, 13:09:59
积分方法: 面积归一法

实验内容简介:
1a-h, n-hexane/i-PrOH = 90/10, 0.5, 254



分析结果表

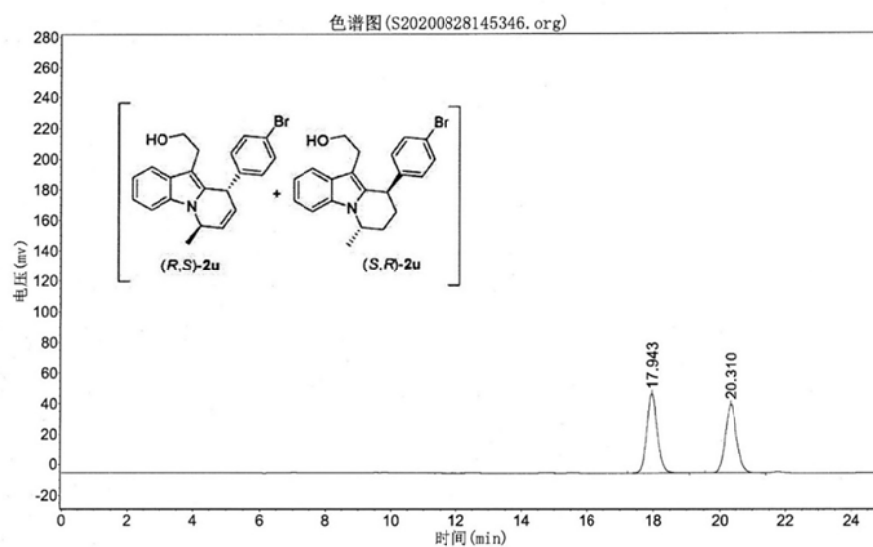
峰号	峰名	保留时间	峰高	峰面积	含量
1		18.462	119845.000	2755509.500	99.3952
2		21.180	753.668	16767.461	0.6048
总计			120598.668	2772276.961	100.0000

jf-5-120-2

实验时间: 2020-08-28, 14:53:46
谱图文件: D:\浙大智达\N2000\样品\S20200828145346.org
方法文件: D:\浙大智达\N2000\djx.mtd

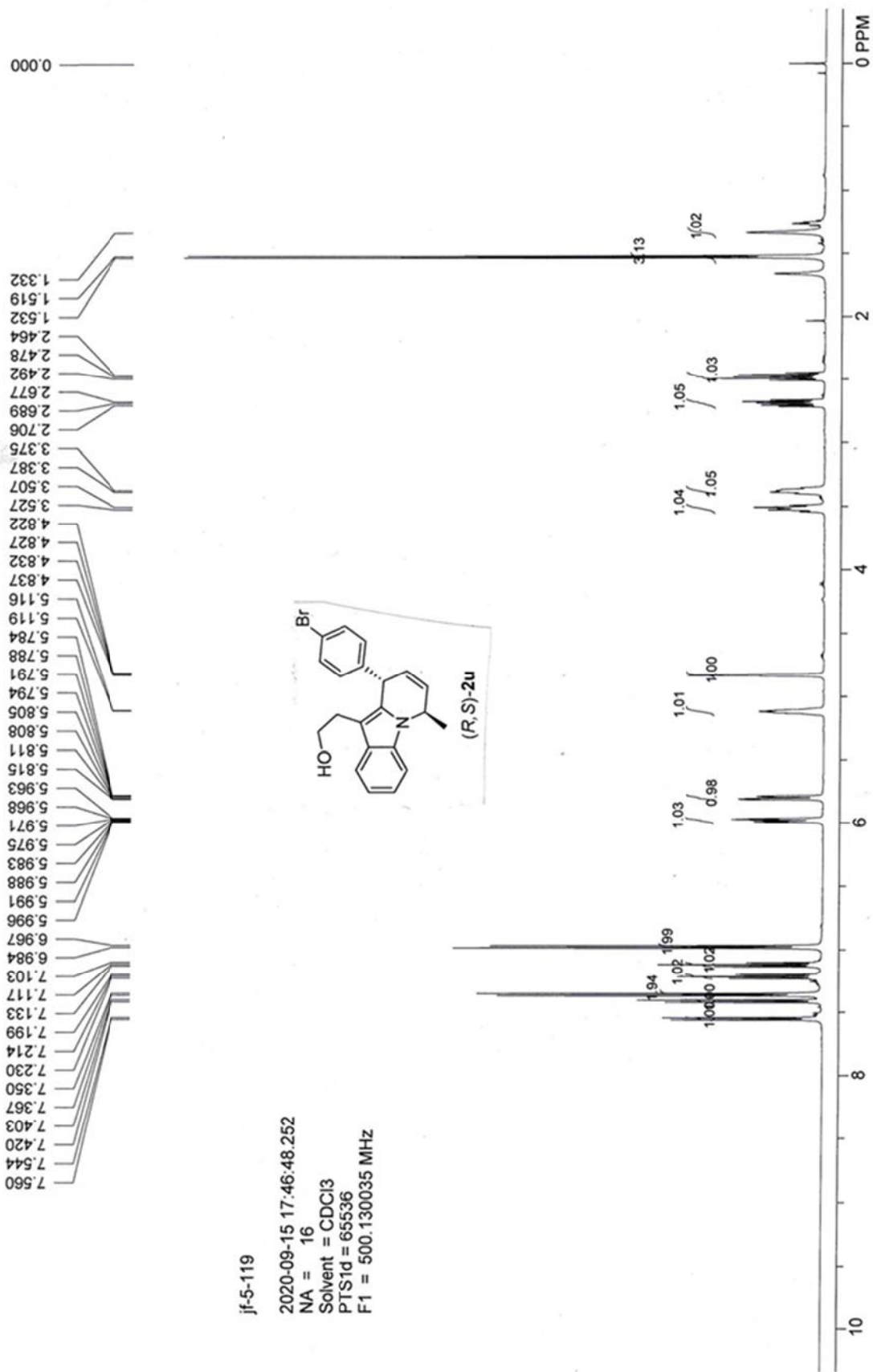
实验者: jf
报告时间: 2020-08-28, 15:27:38
积分方法: 面积归一法

实验内容简介:
ia-h, n-hexane/i-PrOH = 90/10, 0.5, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		17.943	52239.355	1145330.000	50.5363
2		20.310	45460.883	1121022.375	49.4637
总计			97700.238	2266352.375	100.0000



jf-5-119

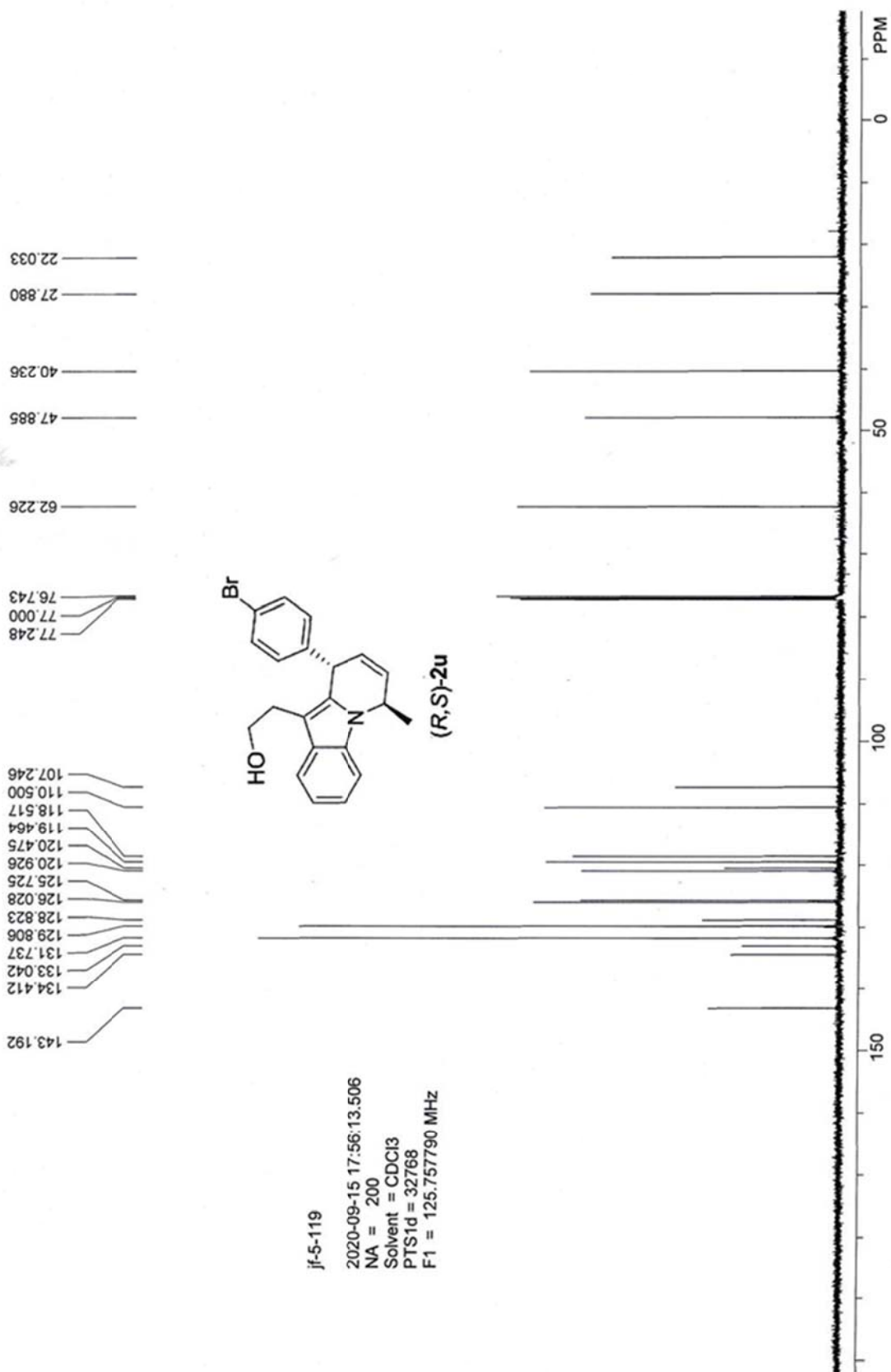
2020-09-15 17:46:48.252

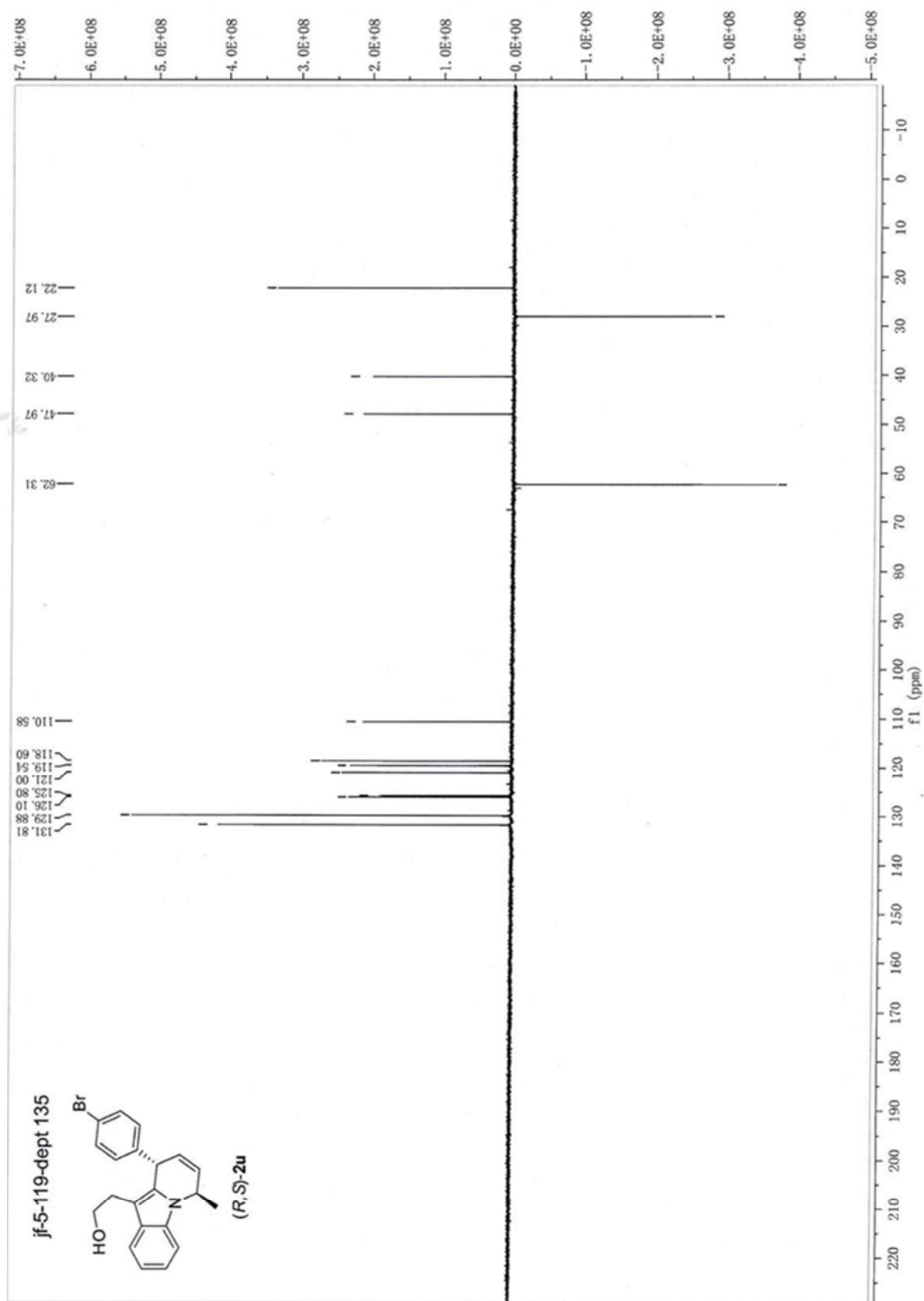
NA = 16

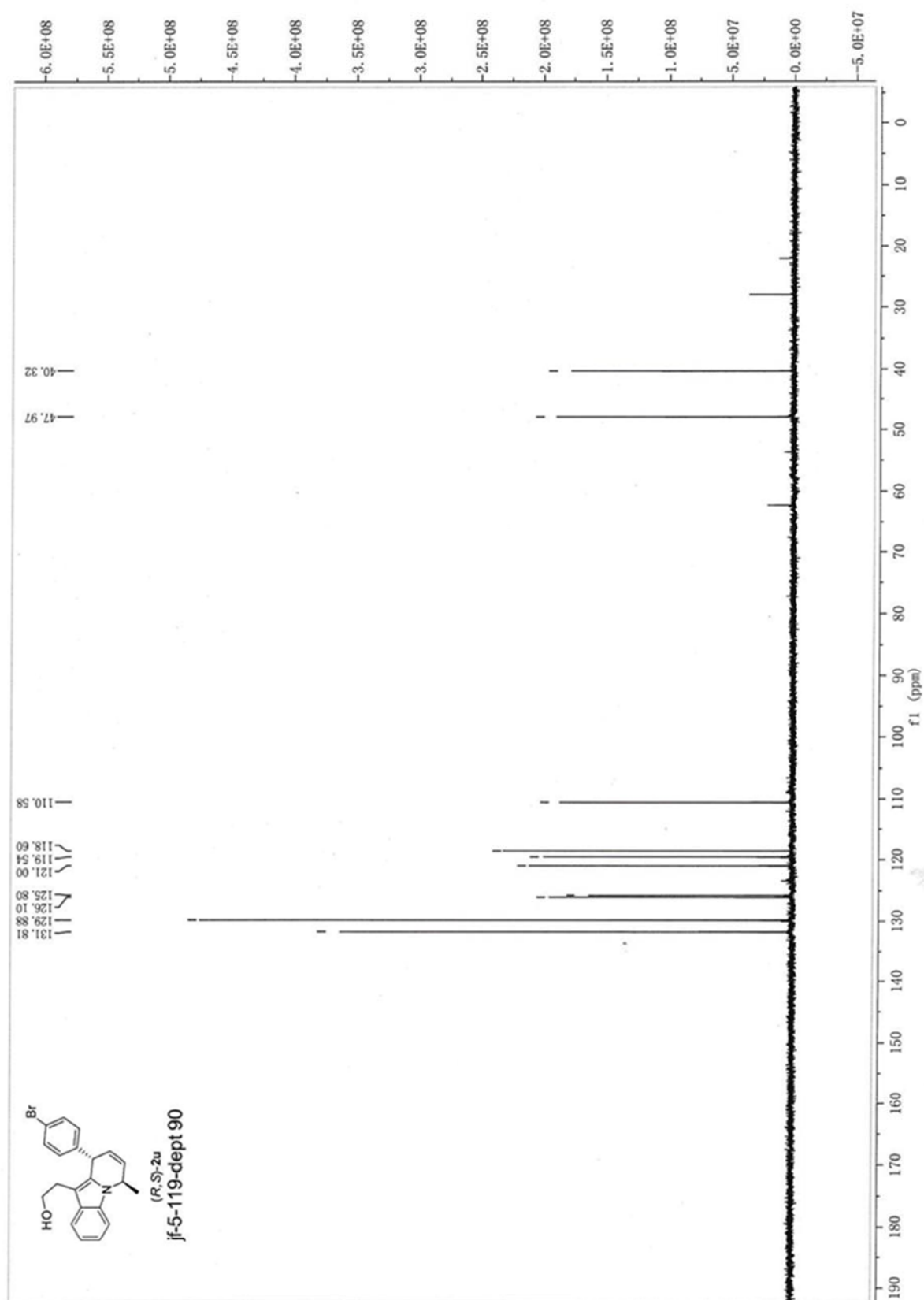
Solvent = CDCl3

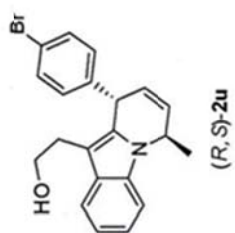
PTS1d = 65536

F1 = 500.130035 MHz

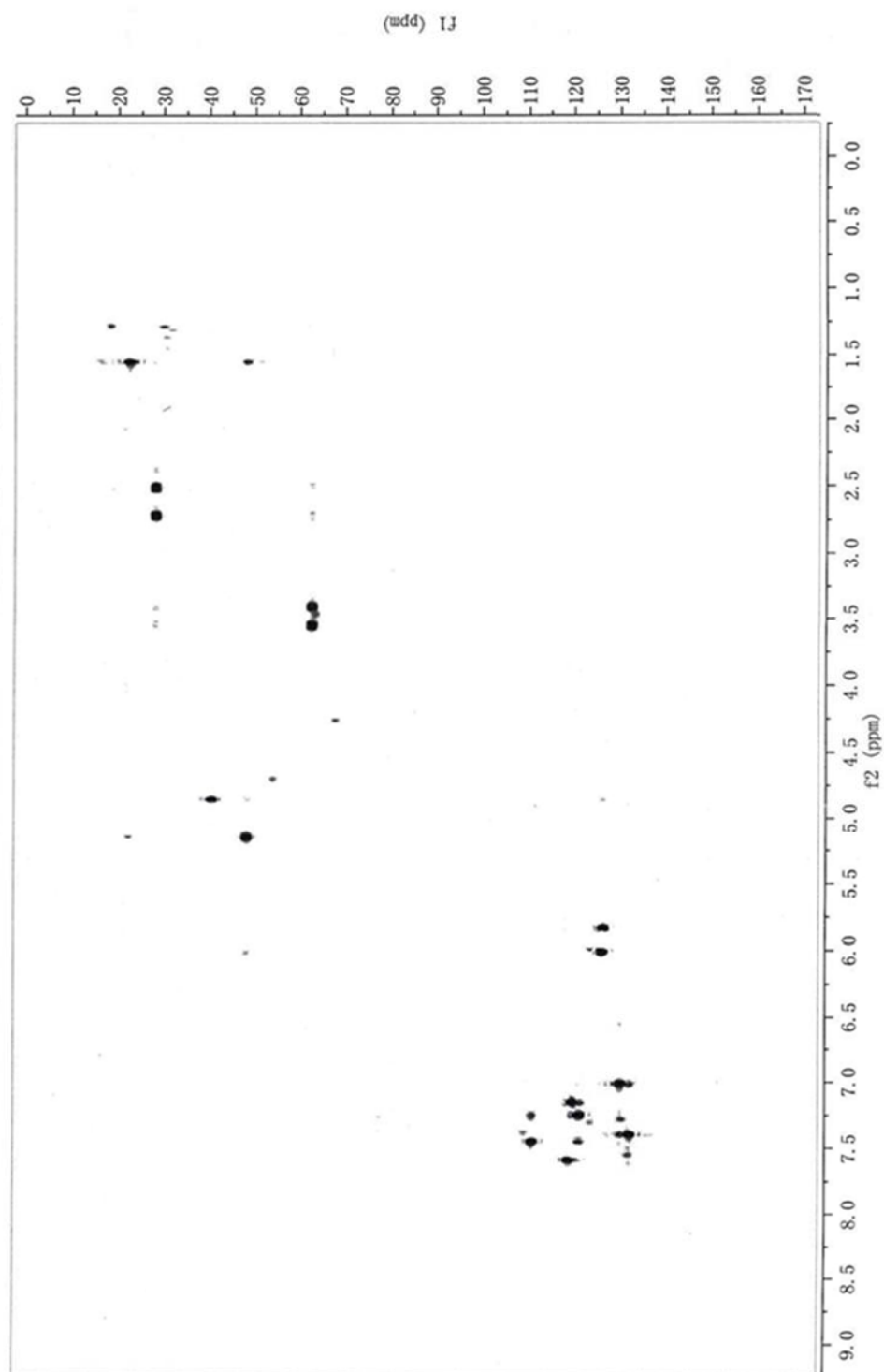


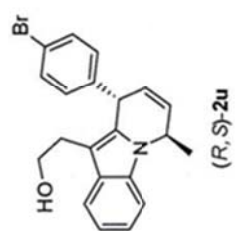




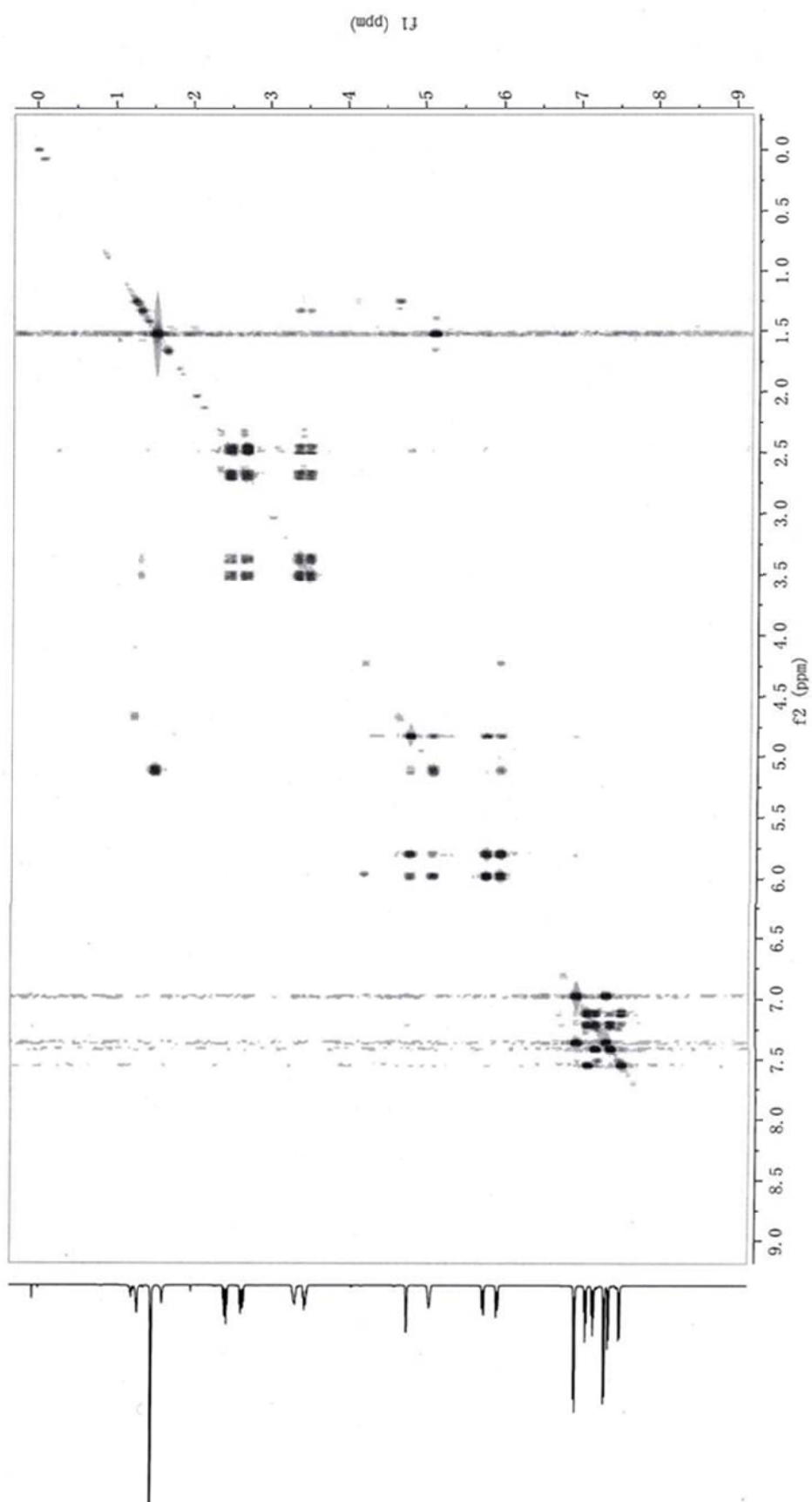


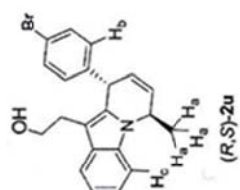
jf-5-119-HSQC





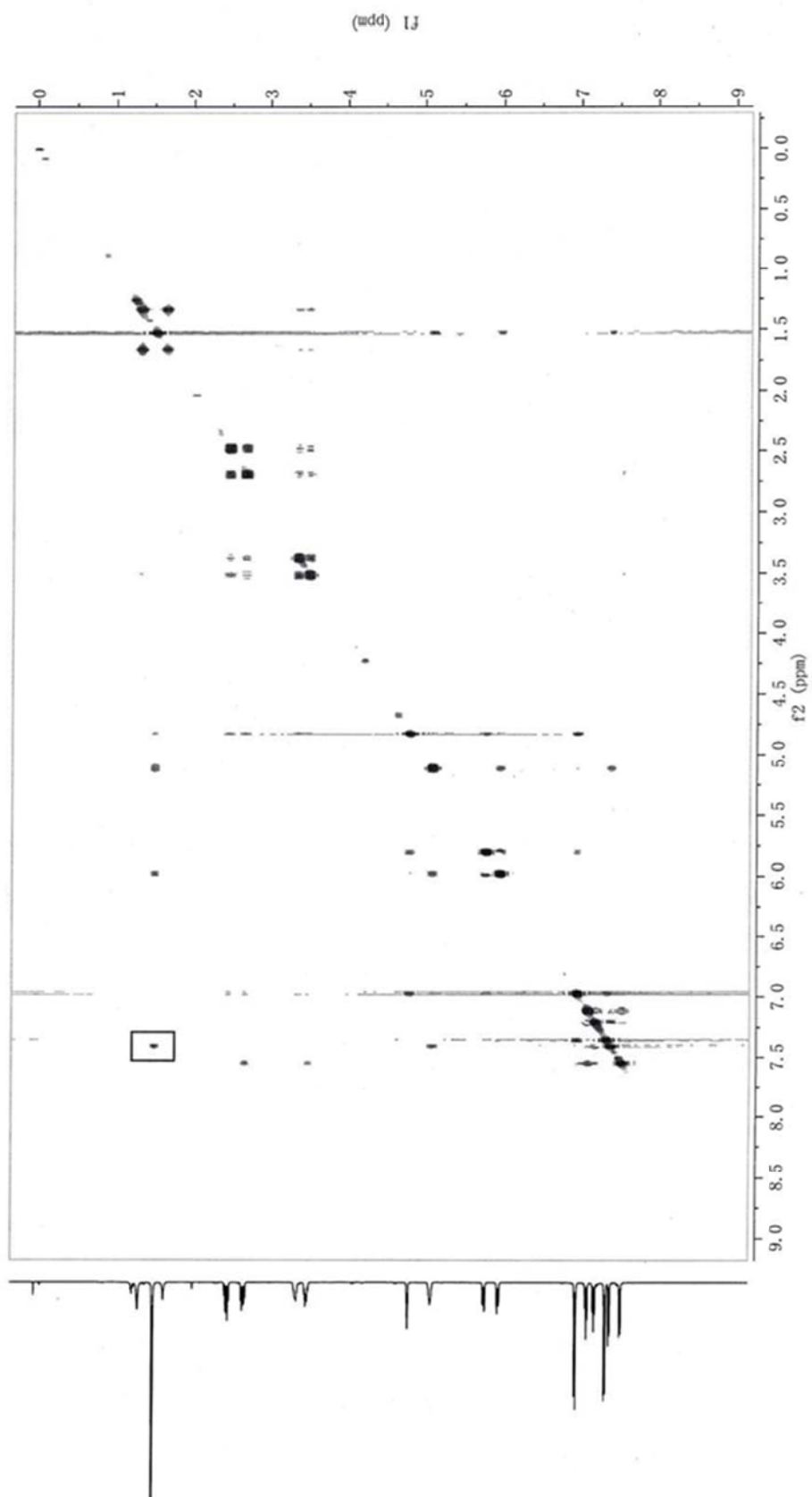
jf5-119-cosy

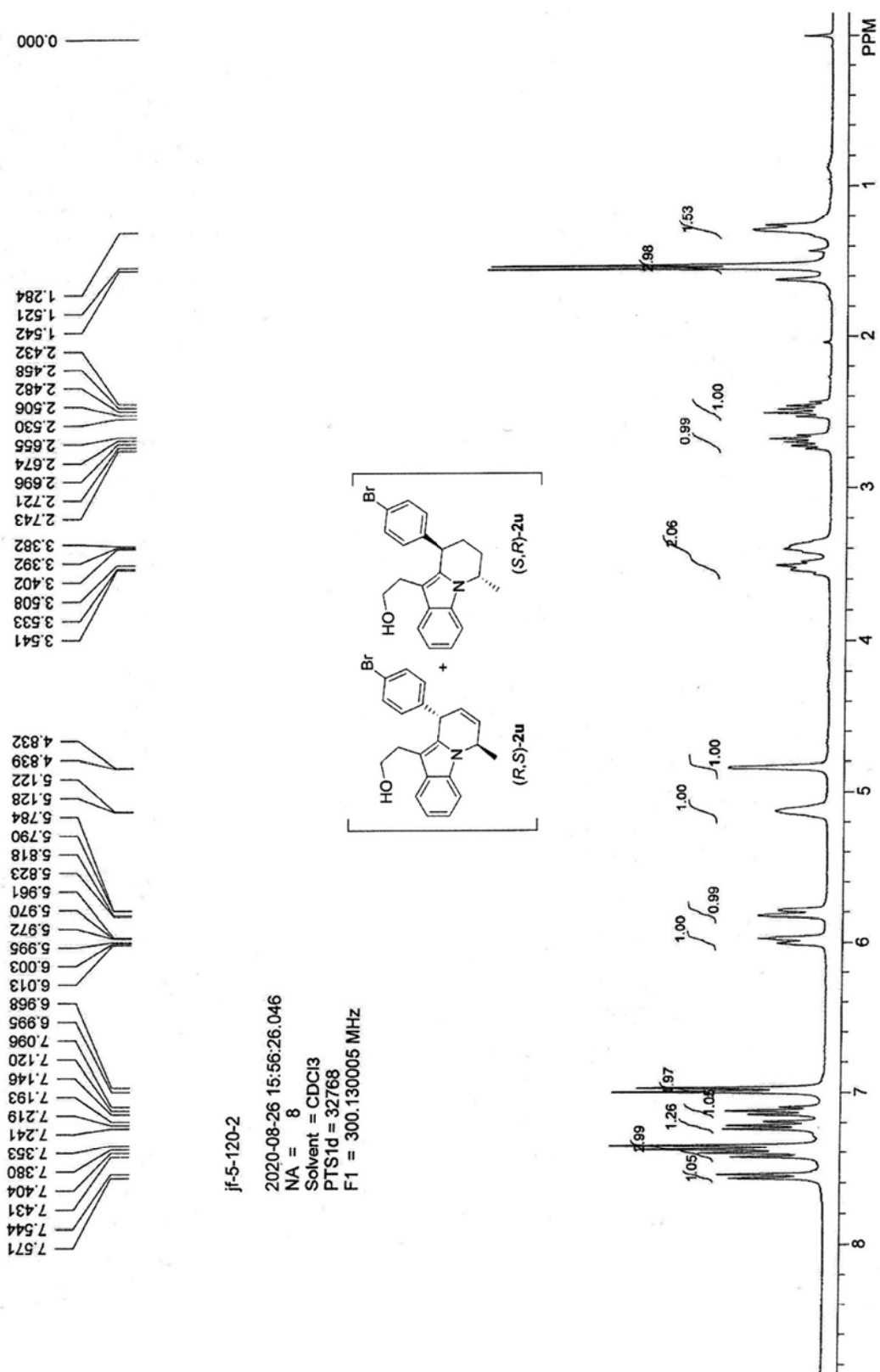




jf5-119-noesy

The absolute configuration was determined by the analysis of NOE between H_a, H_b and H_c





if-5-120-2

2020-08-26 15:56:26.046

NA = 8

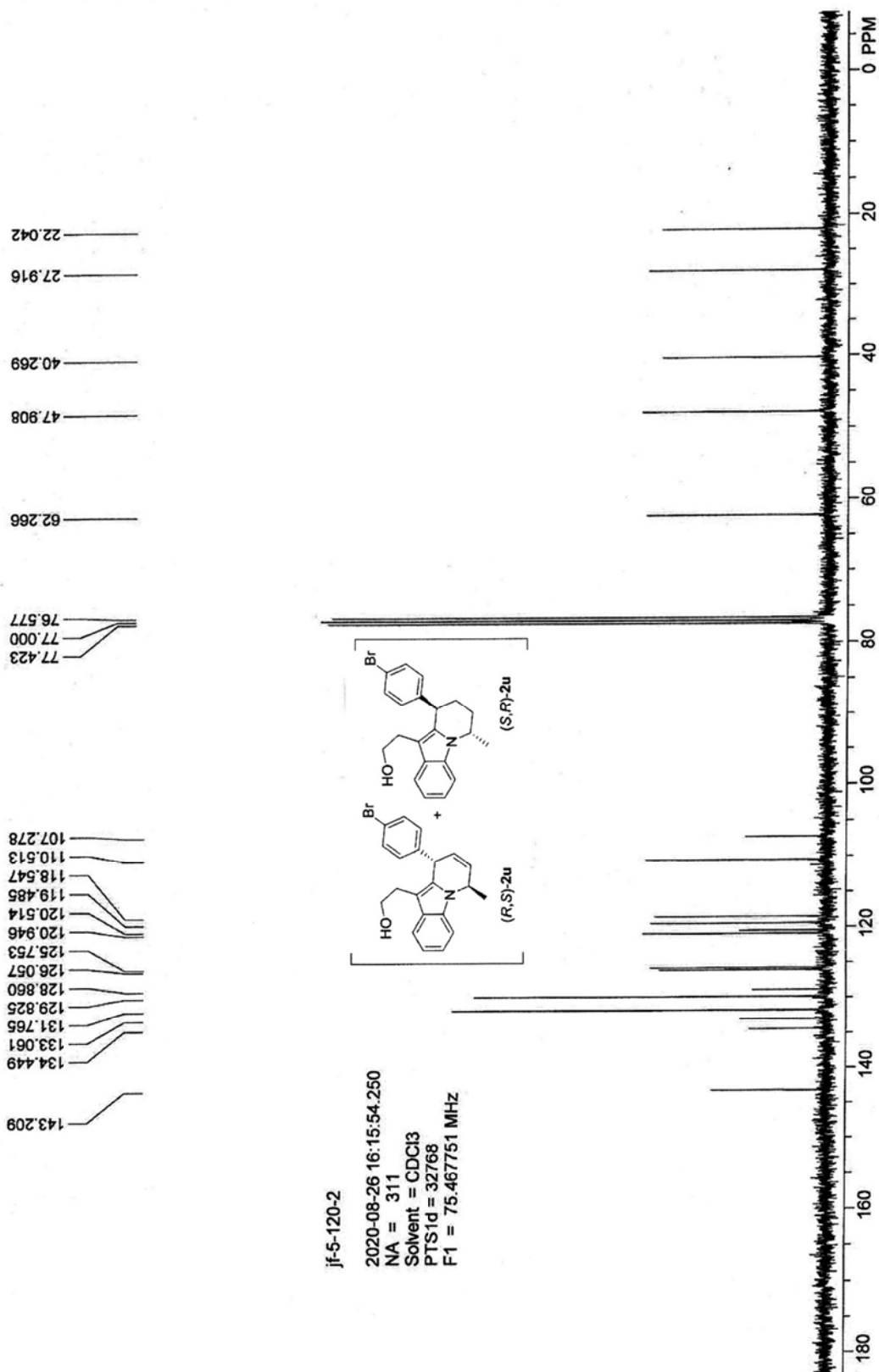
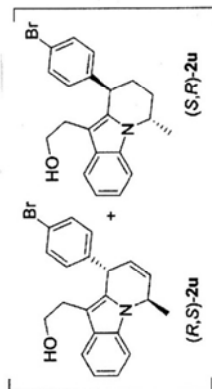
Solvent = CDCl₃

PTSD = 32768

F1 = 300.130005 MHz

jf-5-120-2

2020-08-26 16:15:54.250
NA = 311
Solvent = CDCl3
PTS1d = 32768
F1 = 75.467751 MHz



jf-5-123

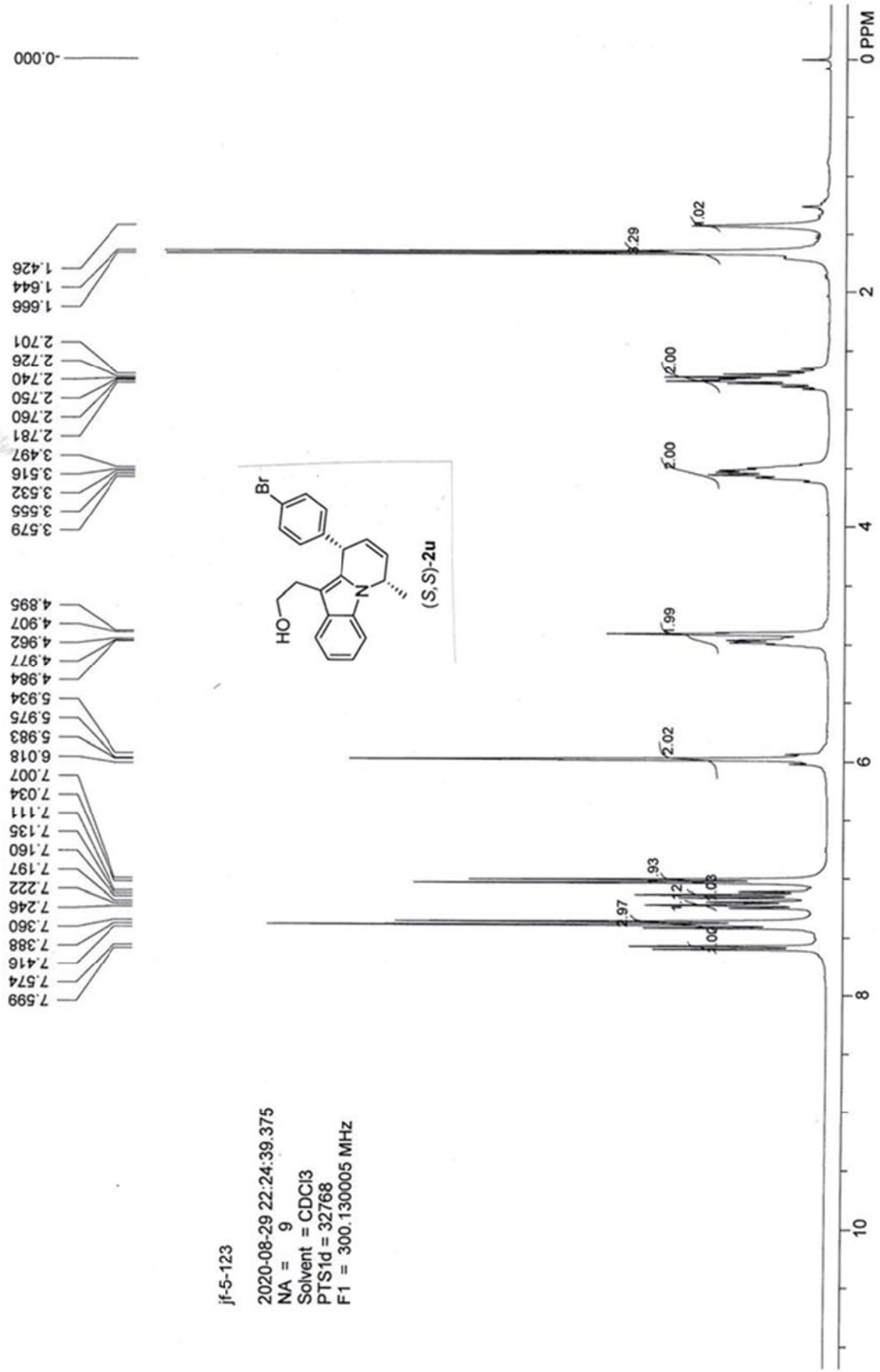
2020-08-29 22:24:39.375

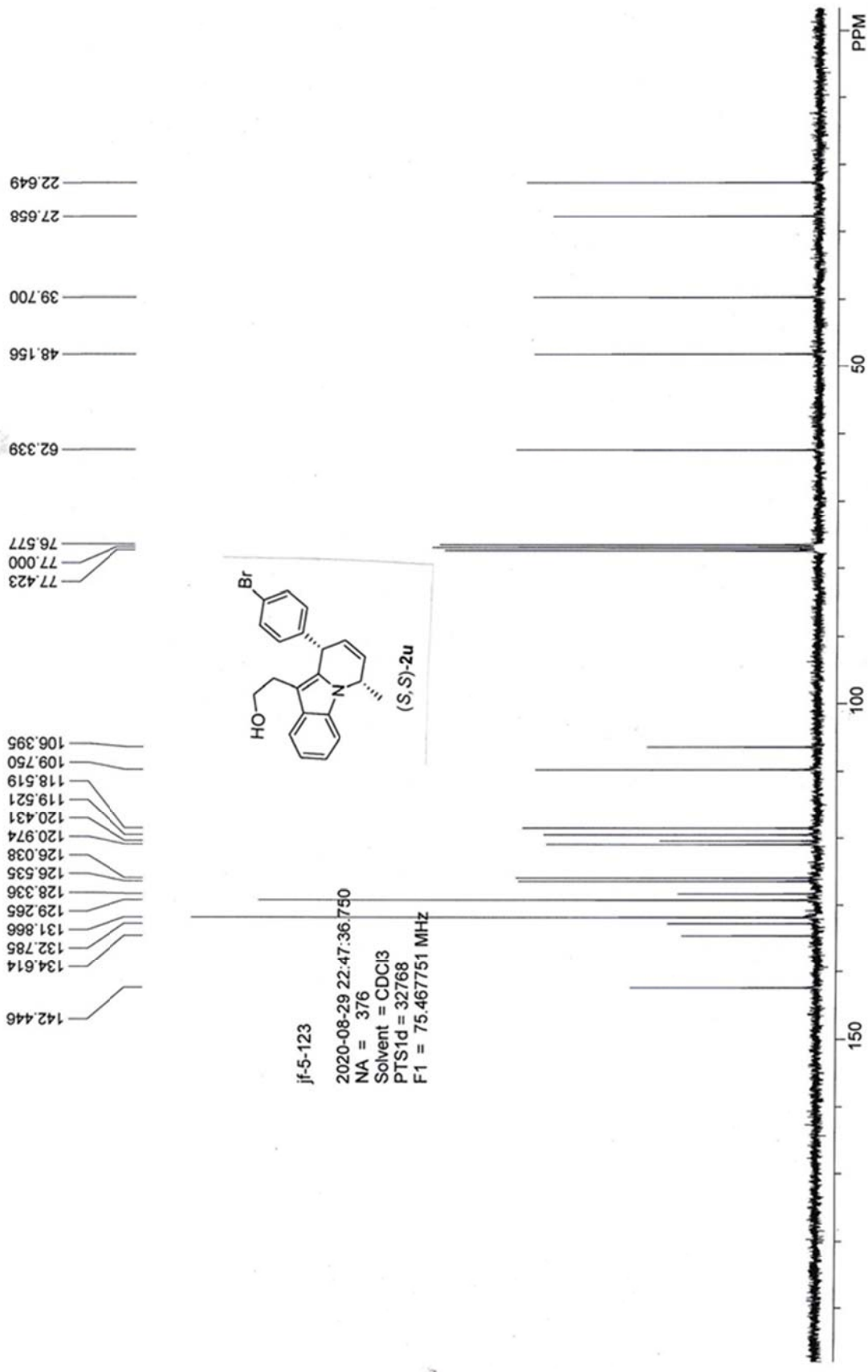
NA = 9

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz





Jf-5-123

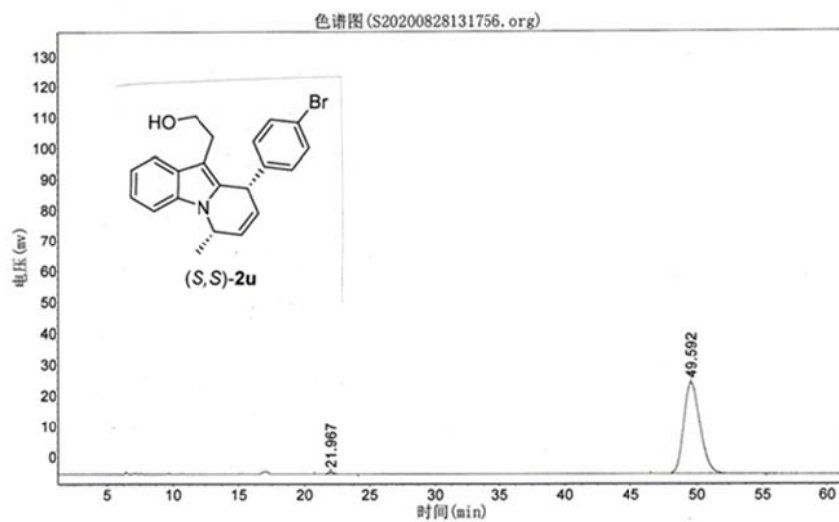
2020-08-29 22:47:36.750
NA = 376
Solvent = CDCl3
PTS1d = 32768
F1 = 75.467751 MHz

jf-5-123

实验时间: 2020-08-28, 13:17:56
谱图文件: D:\浙大智达\N2000\样品\S20200828131756.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-08-28, 14:25:15
积分方法: 面积归一法

实验内容简介:
od-h, n-hexane/i-PrOH = 90/10 0.5, 254



分析结果表

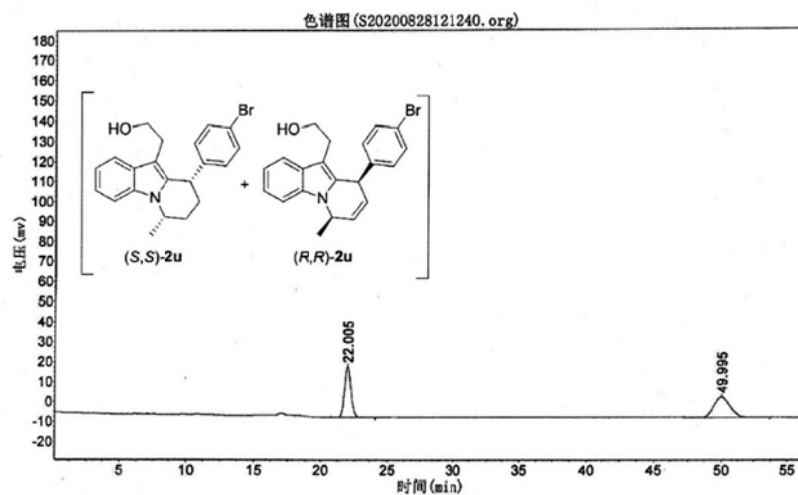
峰号	峰名	保留时间	峰高	峰面积	含量
1		21.967	625.189	21345.367	0.8380
2		49.592	29620.104	2525772.750	99.1620
总计			30245.293	2547118.117	100.0000

jf-5-124

实验时间: 2020-08-28, 12:12:40
谱图文件: D:\浙大智达\N2000\样品\S20200828121240.org
方法文件: D:\浙大智达\N2000\djx.mtd

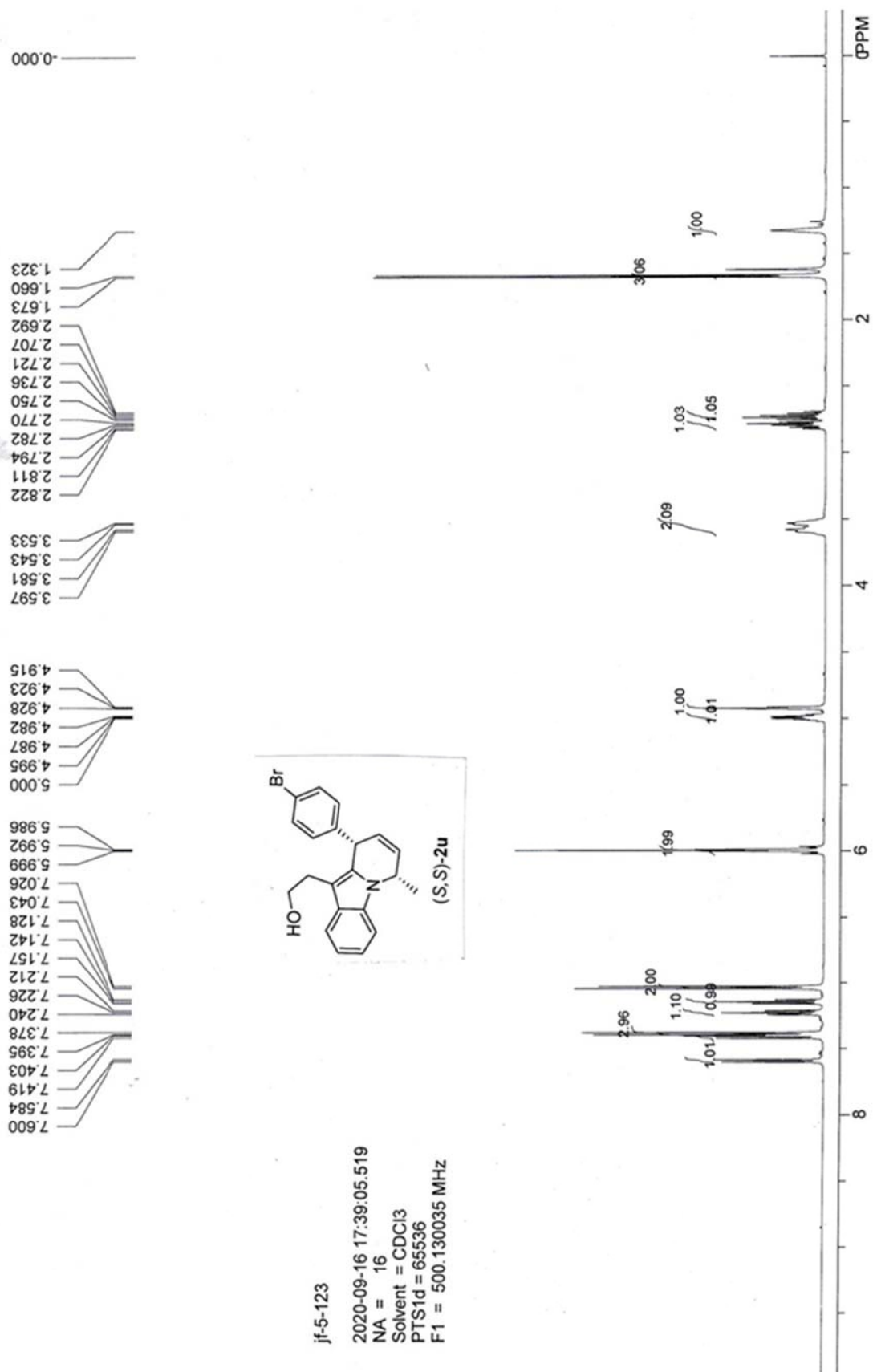
实验者: jf
报告时间: 2020-08-28, 13:11:09
积分方法: 面积归一法

实验内容简介:
od-h, n-hexane/i-PrOH = 90/10, 0.5, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		22.005	25665.793	865941.125	49.6035
2		49.995	10280.941	879785.125	50.3965
总计			35946.734	1745726.250	100.0000



jf-5-123

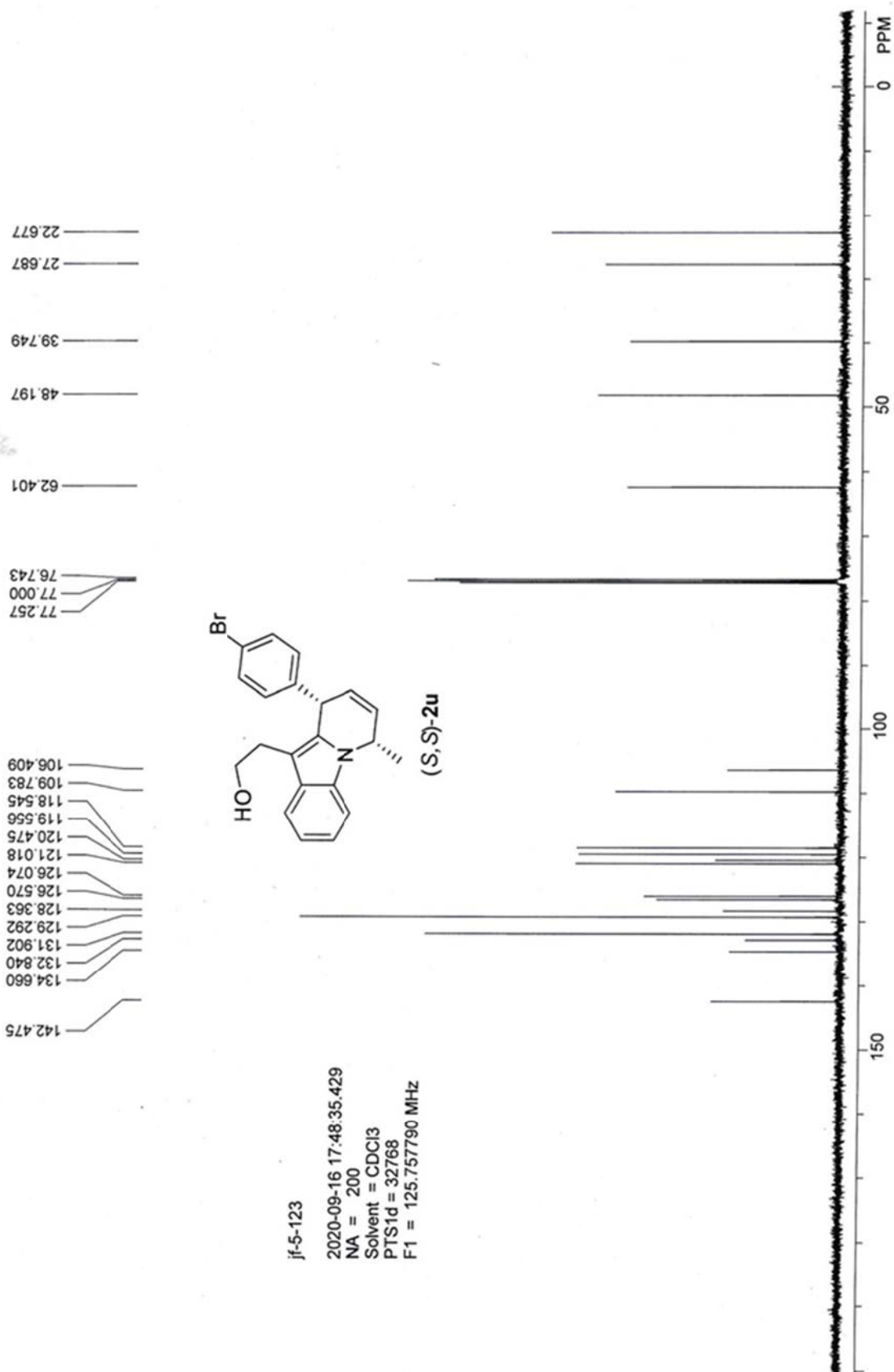
2020-09-16 17:39:05.519

NA = 16

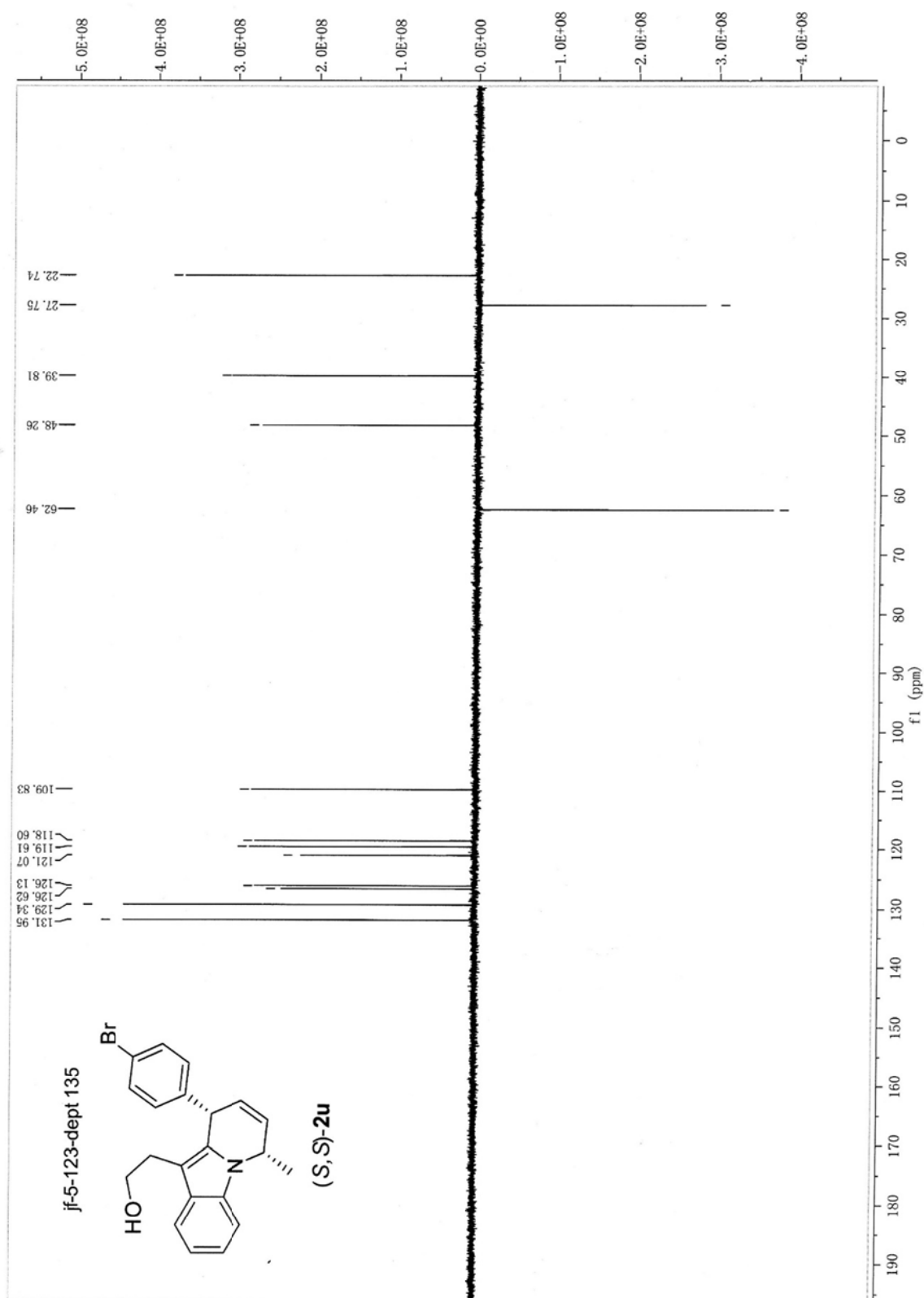
Solvent = CDCl₃

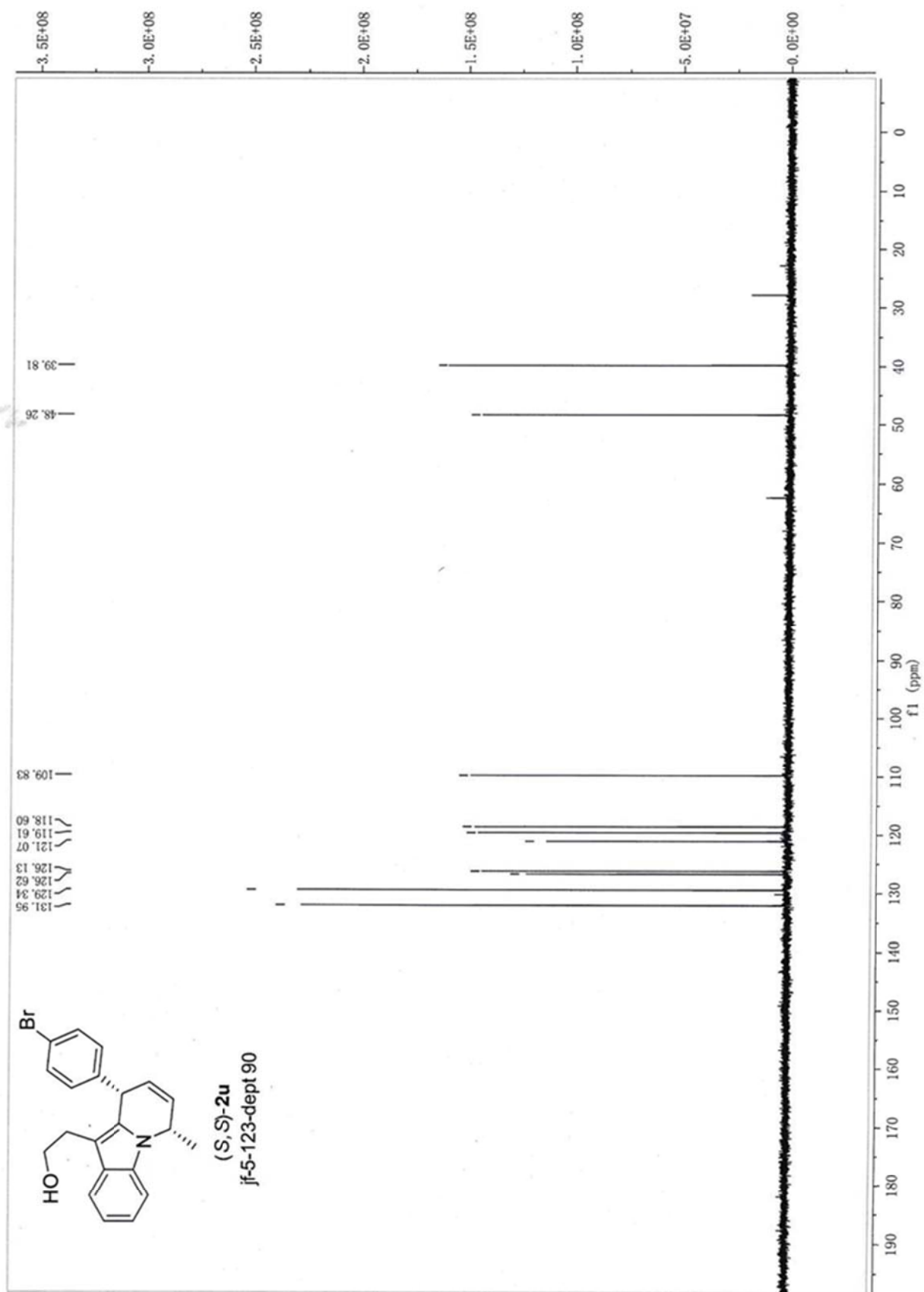
PTS1d = 65536

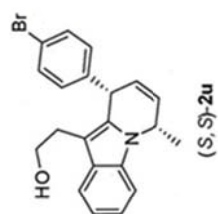
F1 = 500.130035 MHz



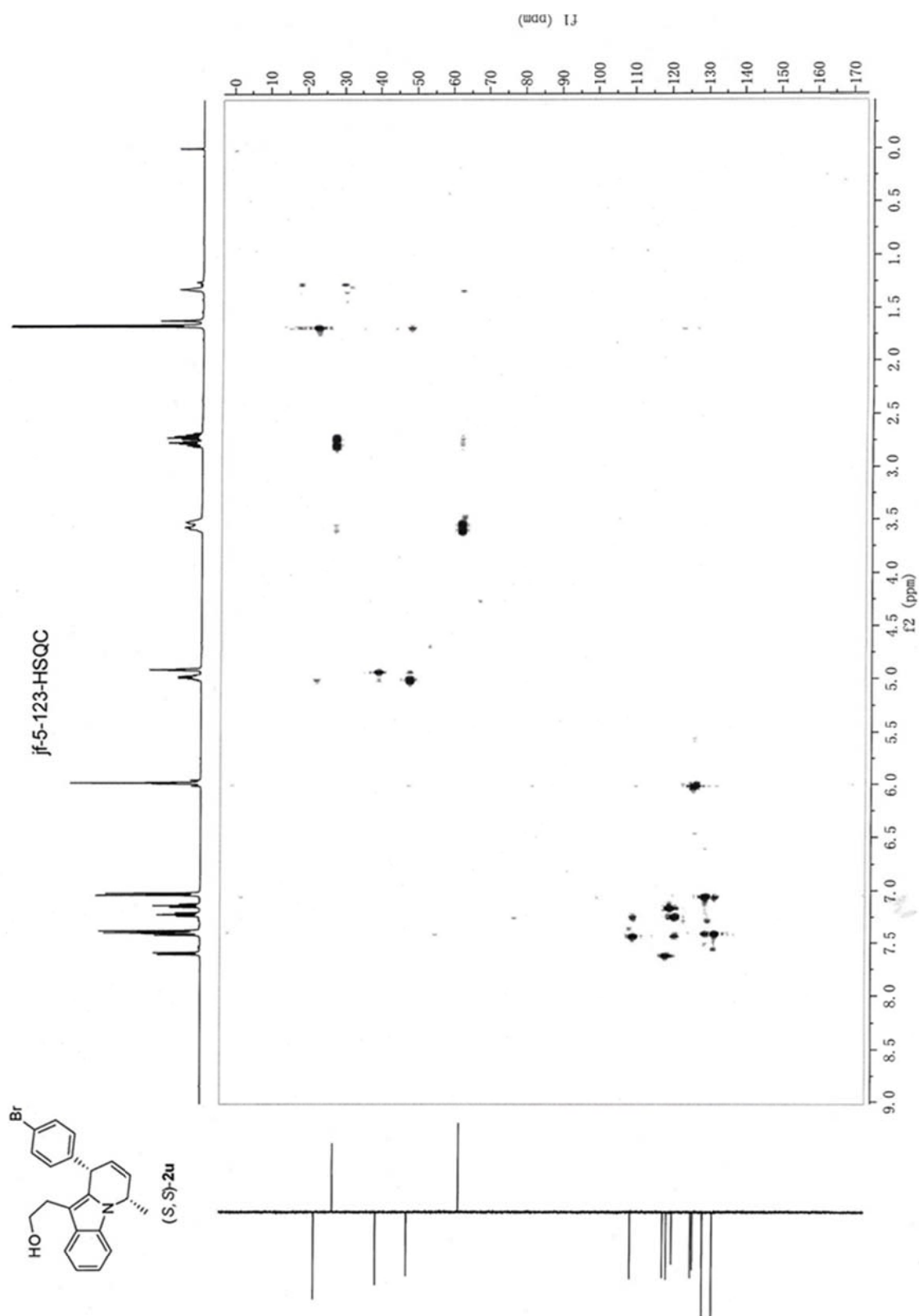
jt-5-123
 2020-09-16 17:48 35.429
 NA = 200
 Solvent = CDCl₃
 PTS1d = 32768
 F1 = 125.757790 MHz

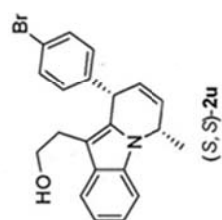




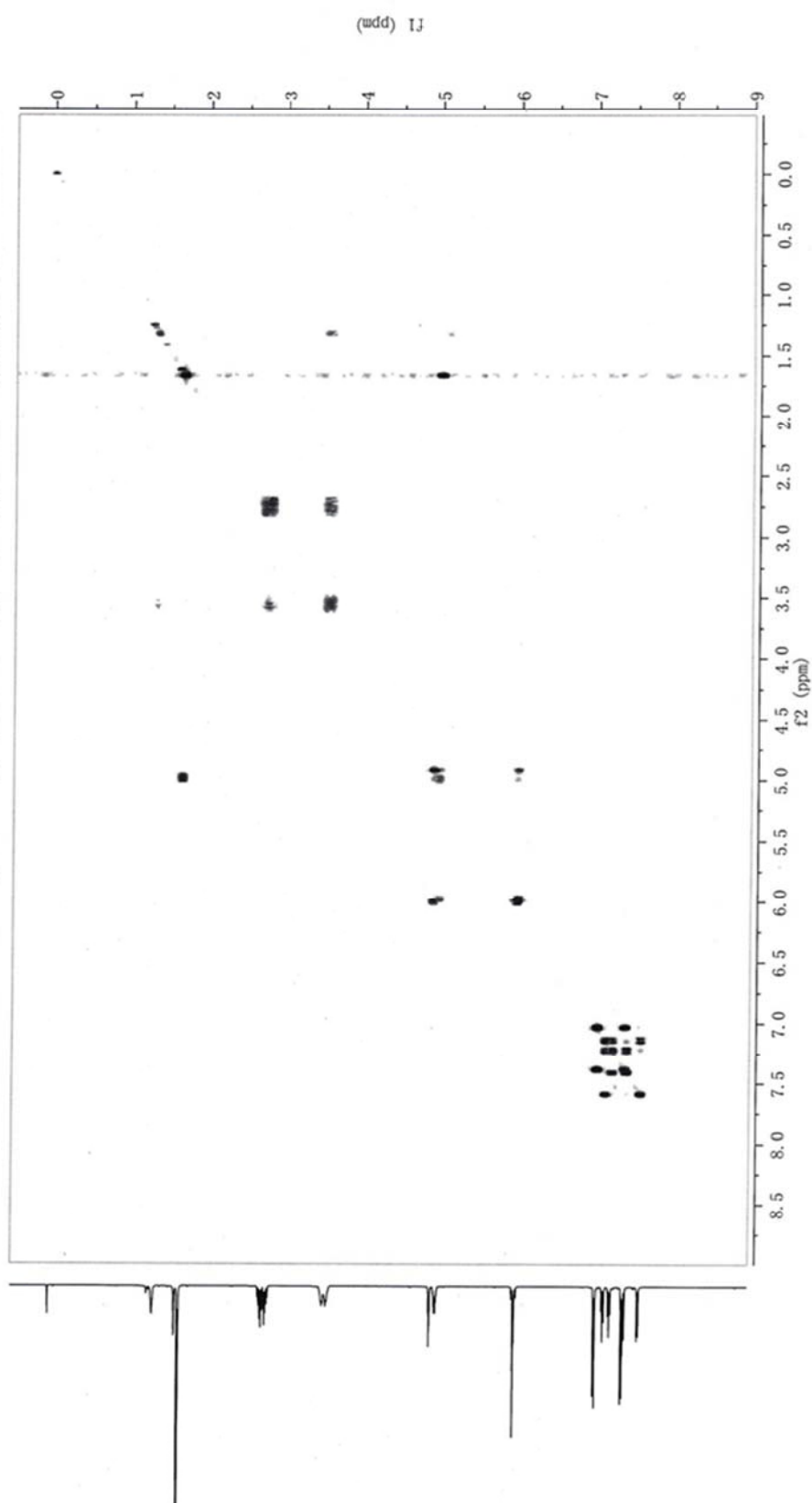


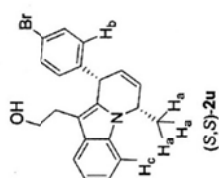
ff-5-123-HSQC





if-5-123-cosy

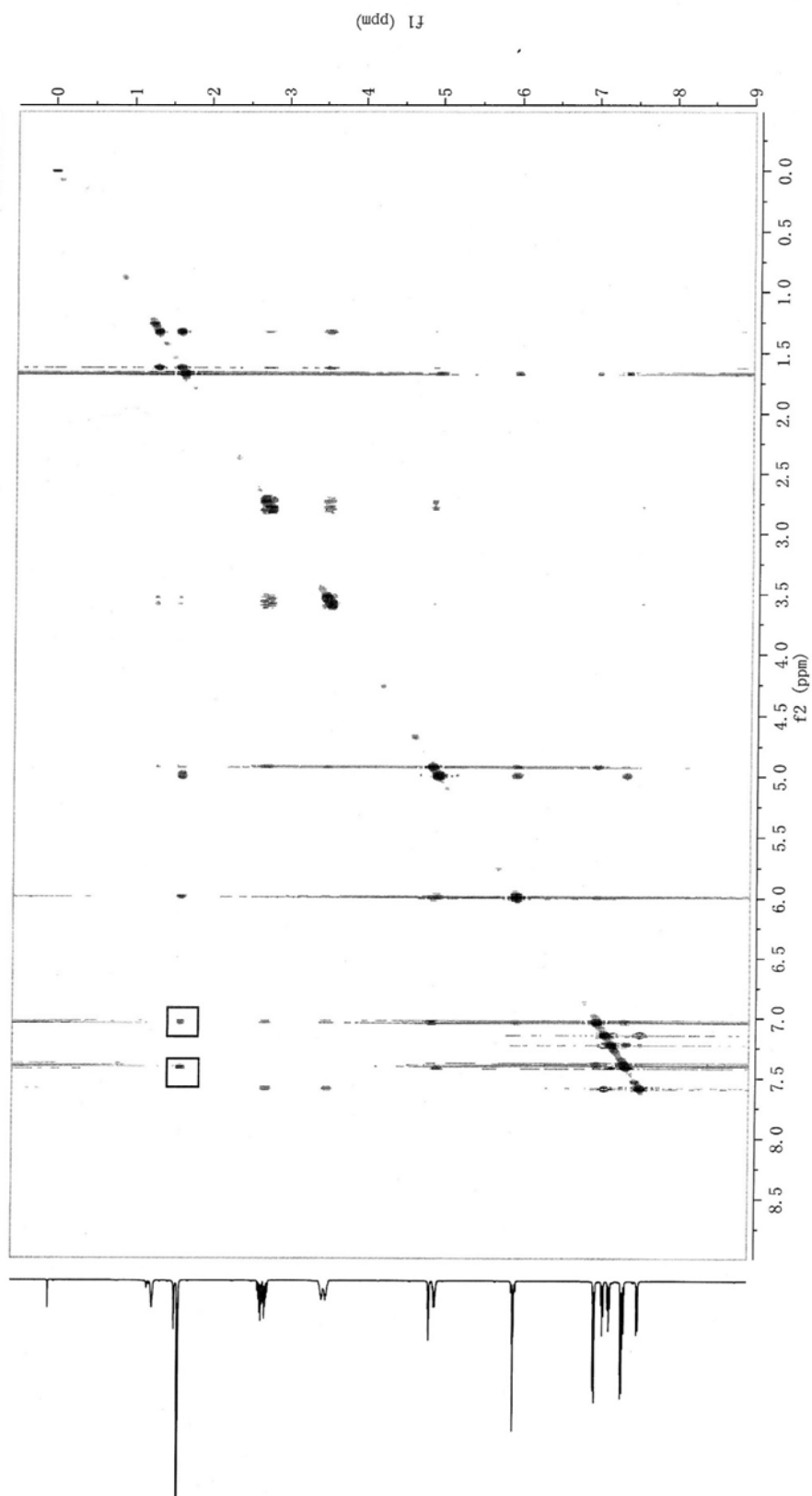




(S,S)-2u

The absolute configuration was determined by the analysis of NOE between H_a , H_b and H_c

jf-5-123-noesy



jf-5-124

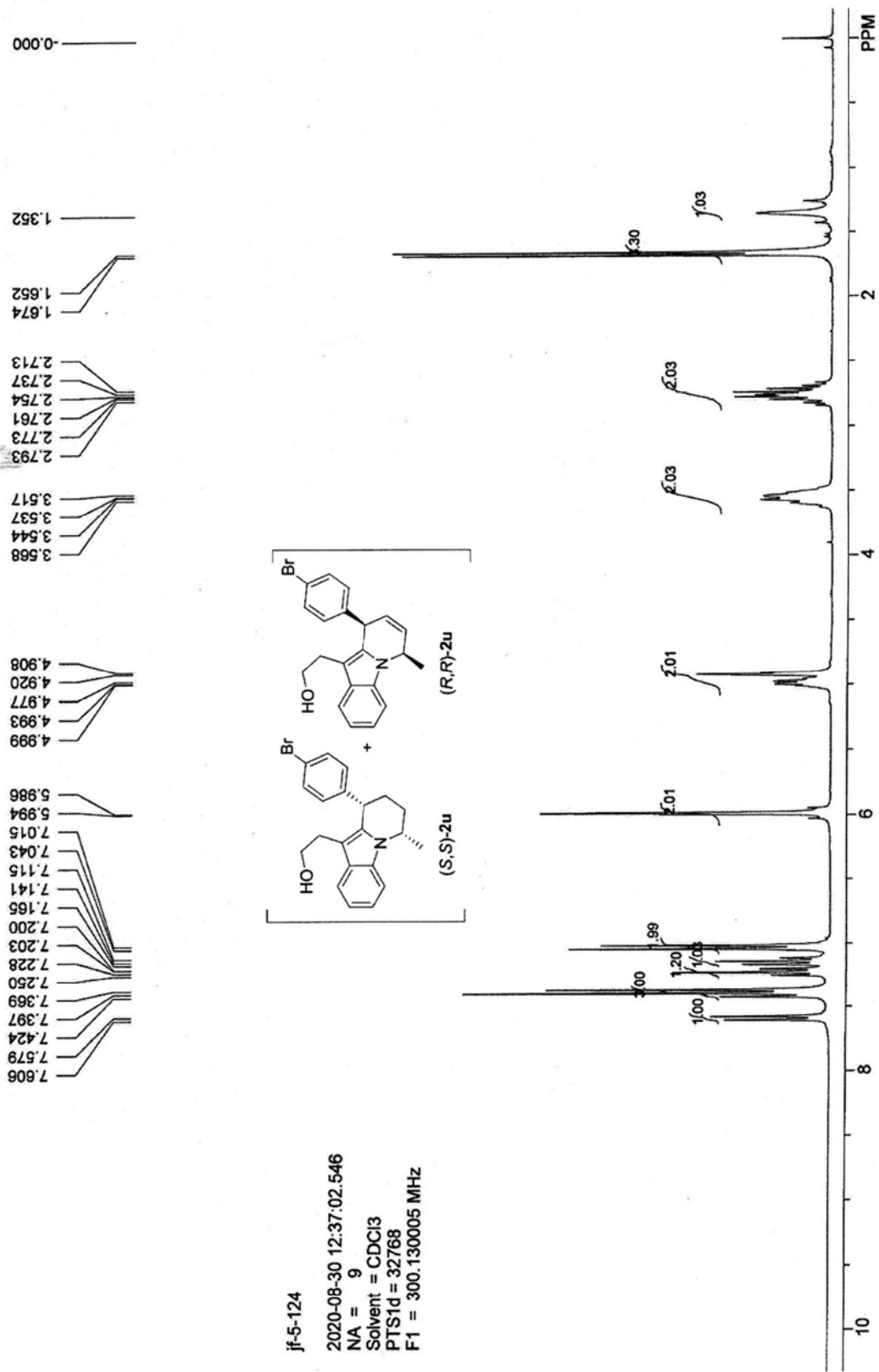
2020-08-30 12:37:02.546

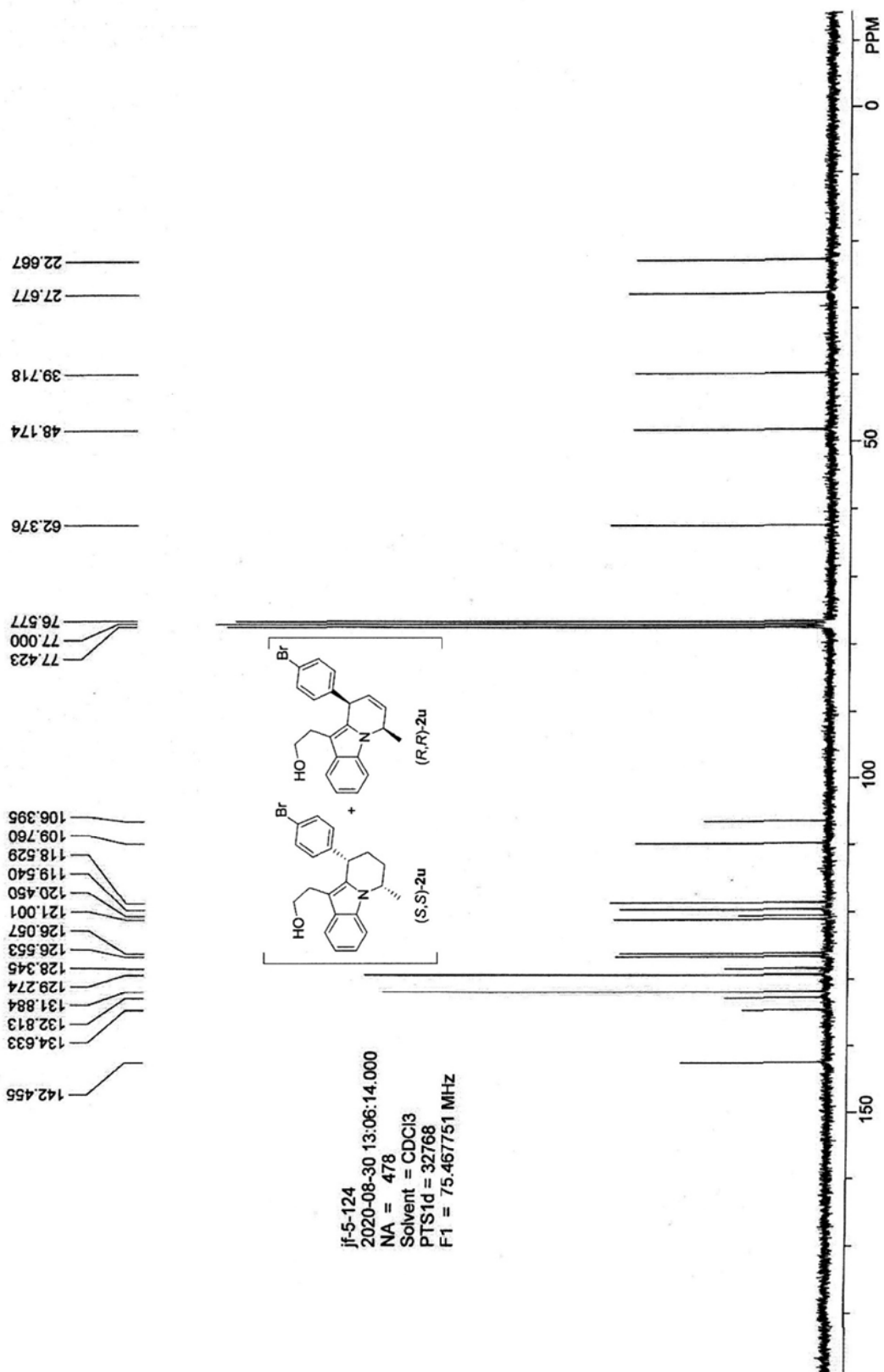
NA = 9

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz





jf-3-170_11.1

2019-07-10 18:43:04.937

USER: nmr

SOLVENT: CDCl₃

Experiment = zg30

Pulse length = 14.000 usec

Relaxation delay = 1.000 sec

NA = 8

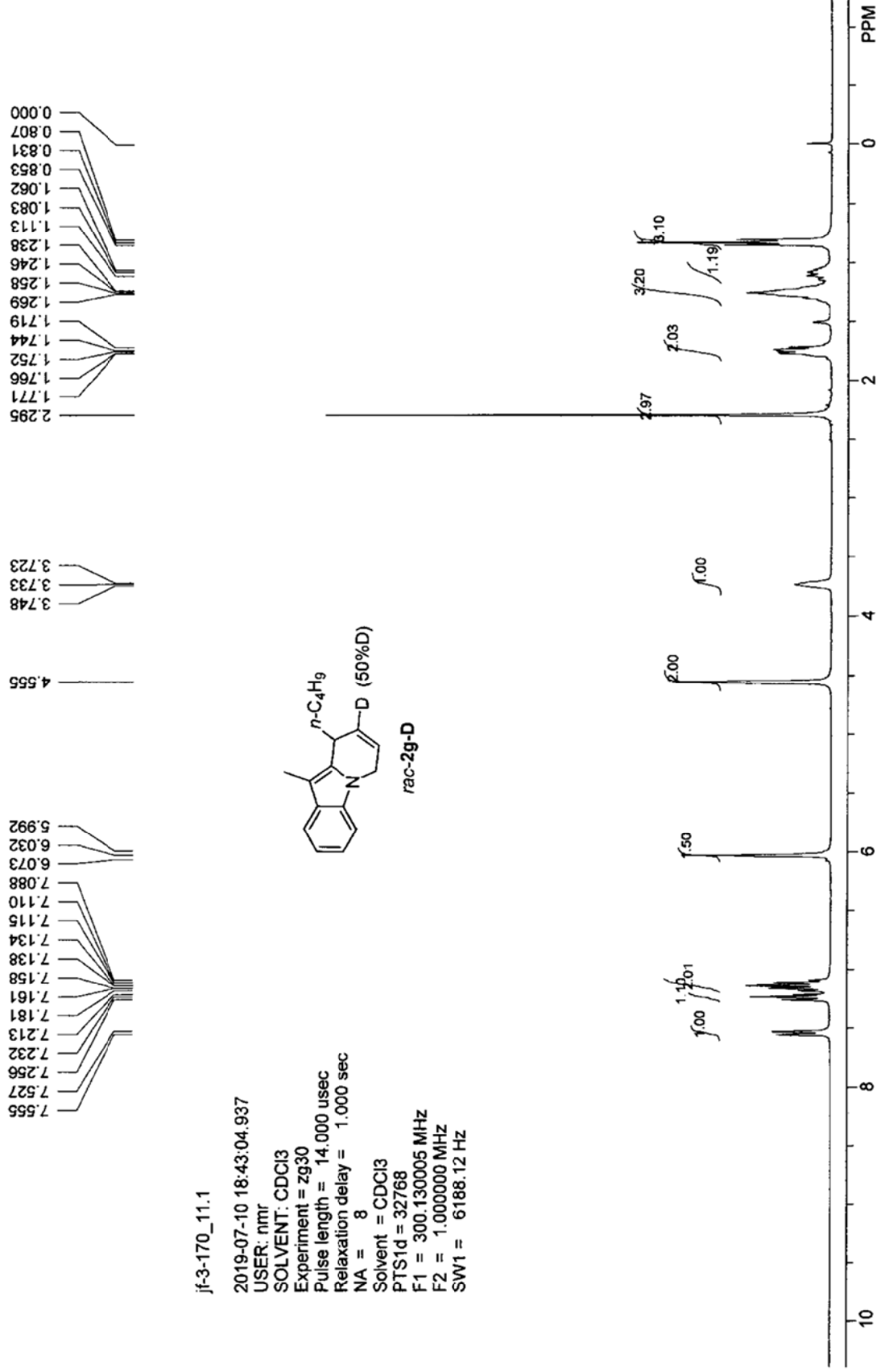
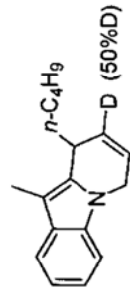
Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

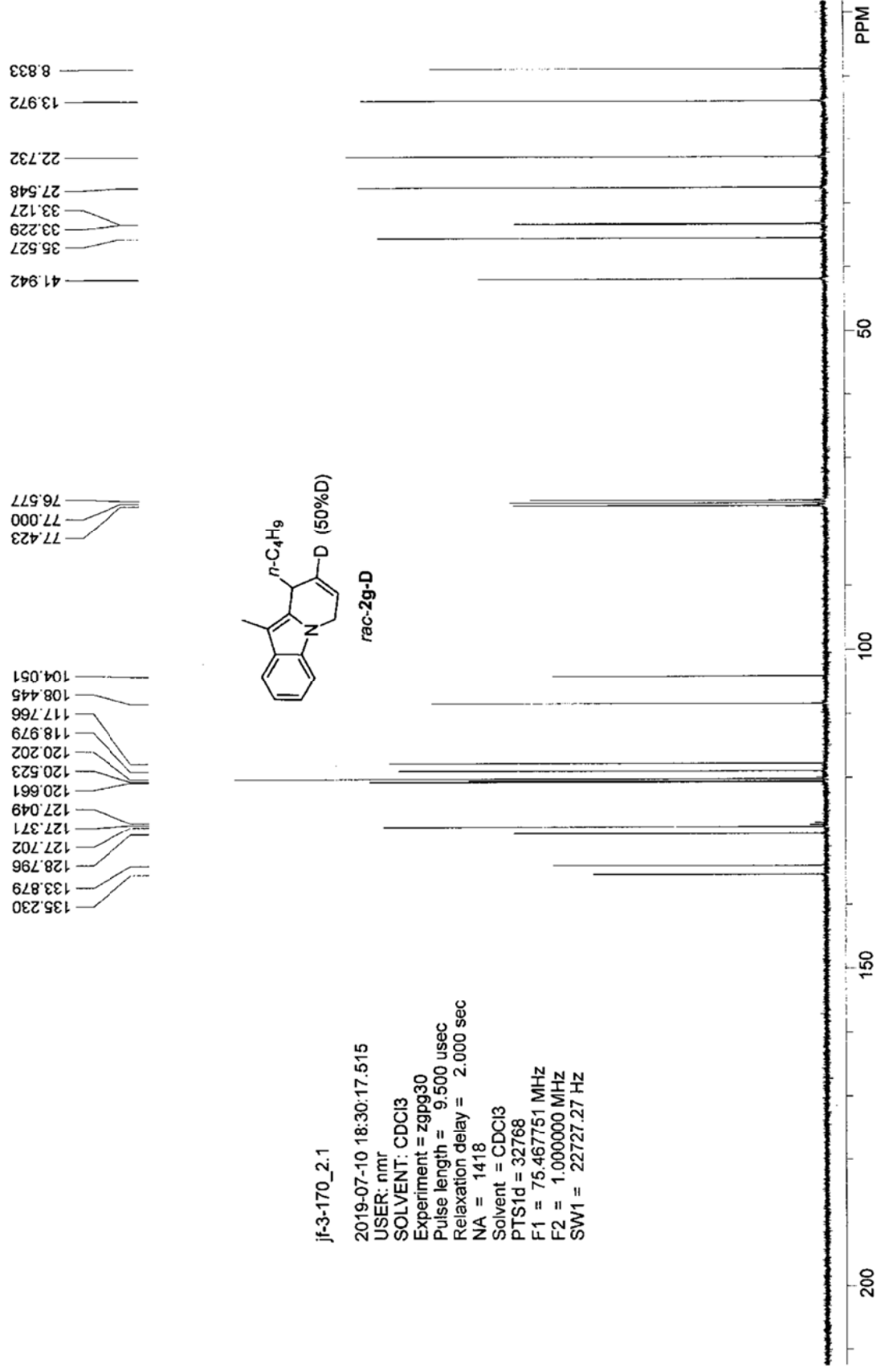
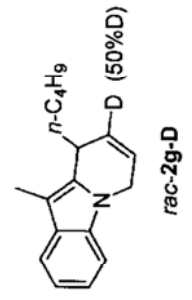
F2 = 1.000000 MHz

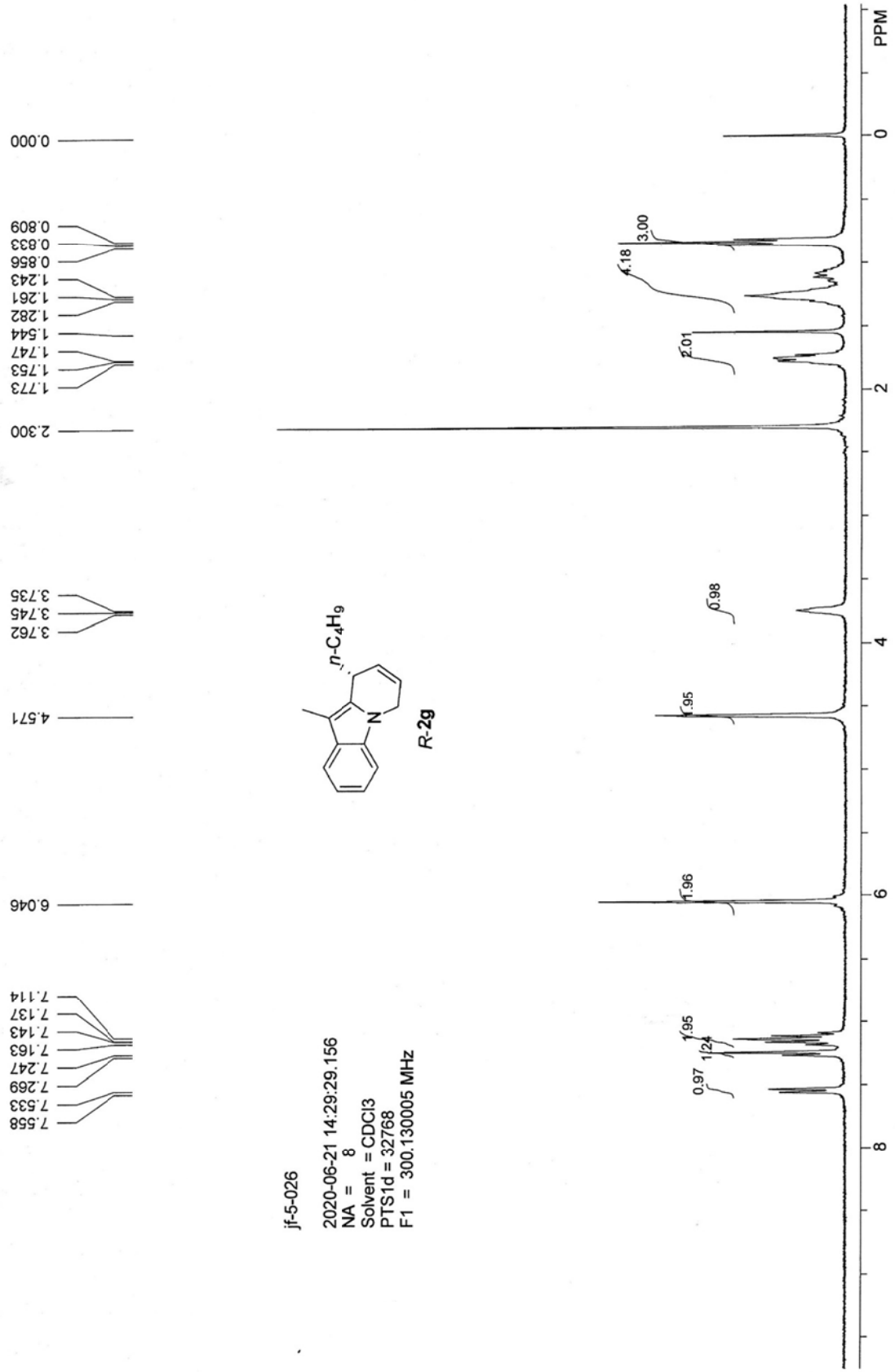
SW1 = 6188.12 Hz



jf-3-170_2.1

2019-07-10 18:30:17.515
USER: nmr
SOLVENT: CDCl₃
Experiment = zgpg30
Pulse length = 9.500 usec
Relaxation delay = 2.000 sec
NA = 1418
Solvent = CDCl₃
PTS1d = 32768
F1 = 75.467751 MHz
F2 = 1.000000 MHz
SW1 = 22727.27 Hz





jl-5-026

2020-06-21 14:29:29.156

NA = 8

Solvent = CDCl₃

PTS1d = 32768

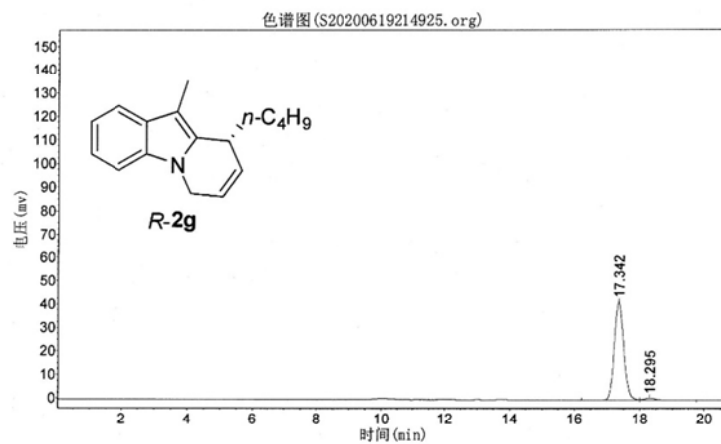
F1 = 300.130005 MHz

jf-5-026

实验时间: 2020-06-19, 21:49:25
谱图文件: D:\浙大智达\N2000\样品\S20200619214925.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-10-07, 13:10:59
积分方法: 面积归一法

实验内容简介:
od-H, n-hexane/i-PrOH = 100/1, 0.4, 254



分析结果表

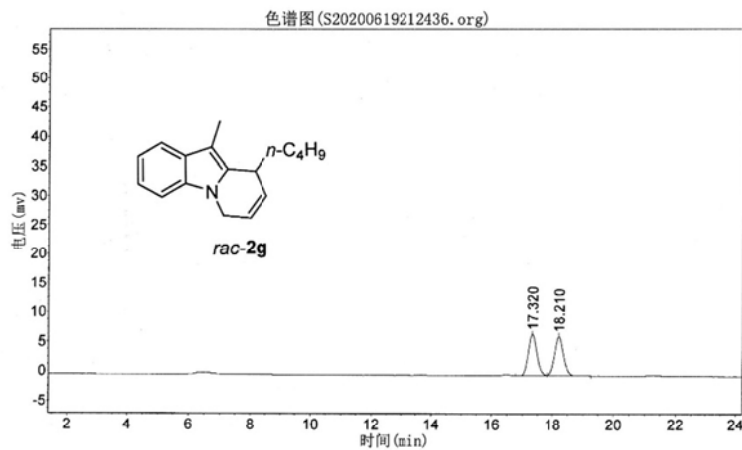
峰号	峰名	保留时间	峰高	峰面积	含量
1		17.342	41500.578	823340.188	97.8554
2		18.295	814.613	18043.951	2.1446
总计			42315.191	841384.139	100.0000

jf-2-097-0619

实验时间: 2020-06-19, 21:24:36
谱图文件: D:\浙大智达\N2000\样品\S20200619212436.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-06-19, 22:08:54
积分方法: 面积归一法

实验内容简介:
OD-H, n-hexane/i-PrOH = 100/1, 0.4, 254



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		17.320	6929.225	138574.953	50.7164
2		18.210	6519.636	134659.922	49.2836
总计			13448.860	273234.875	100.0000

jf-5-025-1

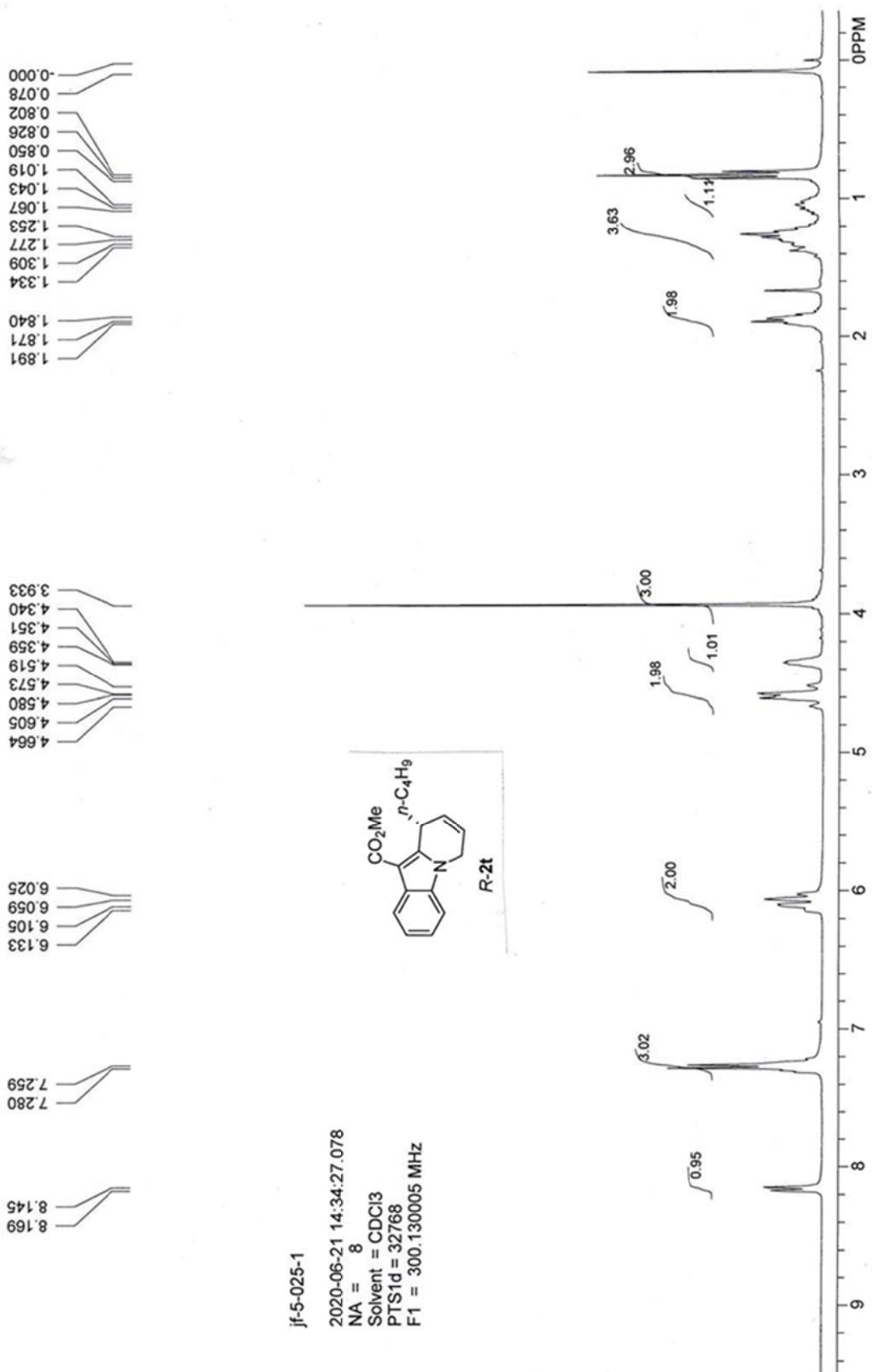
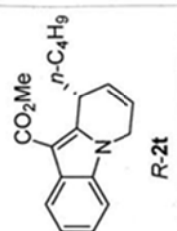
2020-06-21 14:34:27.078

NA = 8

Solvent = CDCl₃

PTS1d = 32768

F1 = 300.130005 MHz

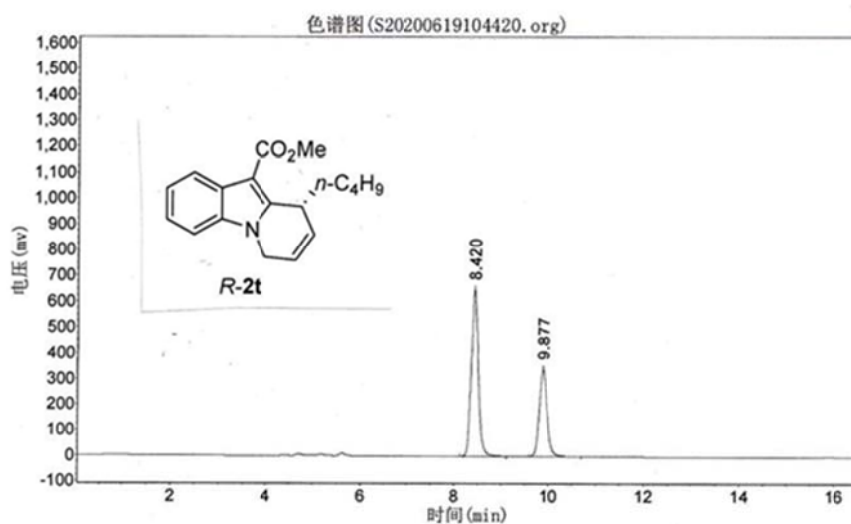


jf-5-025-1

实验时间: 2020-06-19, 10:44:20
谱图文件: D:\浙大智达\N2000\样品\S20200619104420.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-06-19, 11:03:19
积分方法: 面积归一法

实验内容简介:
OD-H, n-hexane/i-PrOH = 90/10, 0.7, 214



分析结果表

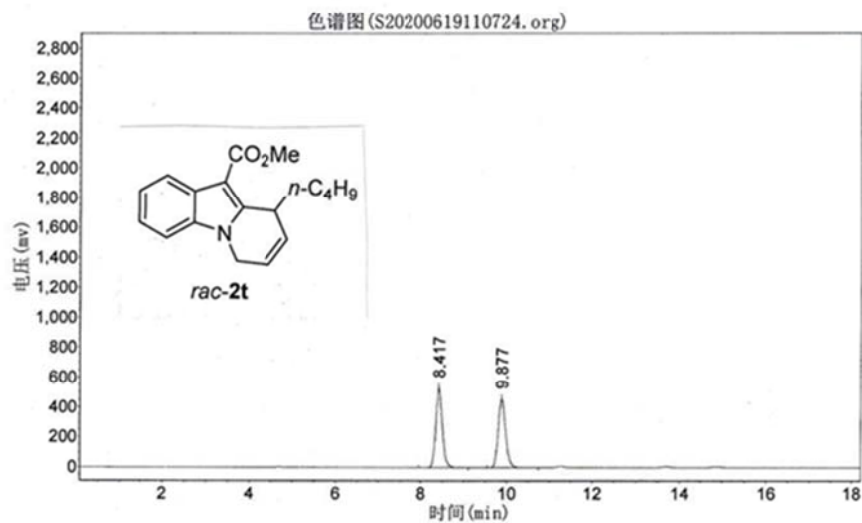
峰号	峰名	保留时间	峰高	峰面积	含量
1		8.420	646405.625	6669780.500	62.1773
2		9.877	340081.563	4057247.500	37.8227
总计			986487.188	10727028.000	100.0000

jf-4-174-1

实验时间: 2020-06-19, 11:07:24
 谱图文件: D:\浙大智达\N2000\样品\S20200619110724.org
 方法文件: D:\浙大智达\N2000\djx.mtd

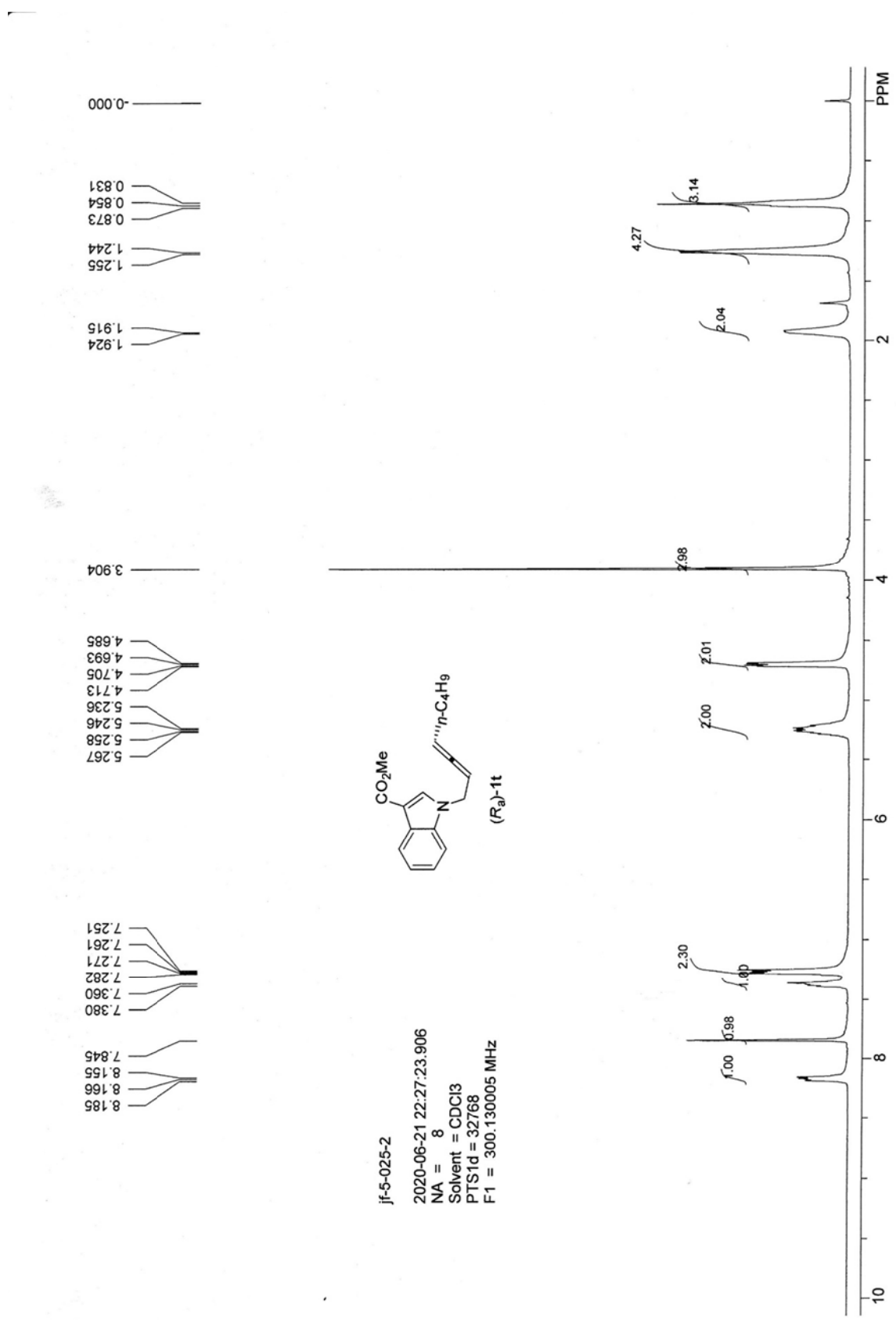
实验者: jf
 报告时间: 2020-06-19, 11:32:11
 积分方法: 面积归一法

实验内容简介:
 OD-H, n-hexane/i-PrOH = 90/10, 0.7, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		8.417	529681.625	5579407.000	50.5149
2		9.877	455515.313	5465655.500	49.4851
总计			985196.938	11045062.500	100.0000



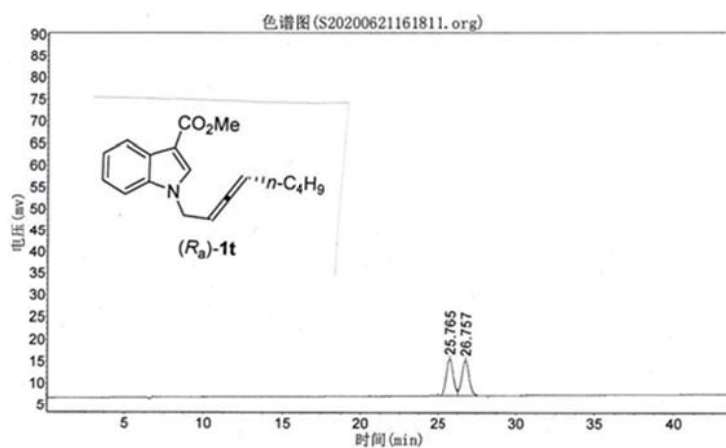
jf-5-025-2
2020-06-21 22:27:23.906
NA = 8
Solvent = CDCl₃
PTSD = 32768
F1 = 300.130005 MHz

jf-5-025-2

实验时间: 2020-06-21, 16:18:11
谱图文件: D:\浙大智达\N2000\样品\S20200621161811.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-06-21, 17:07:06
积分方法: 面积归一法

实验内容简介:
OD-H, n-hexane/i-PrOH = 90/10, 0.5, 214



分析结果表

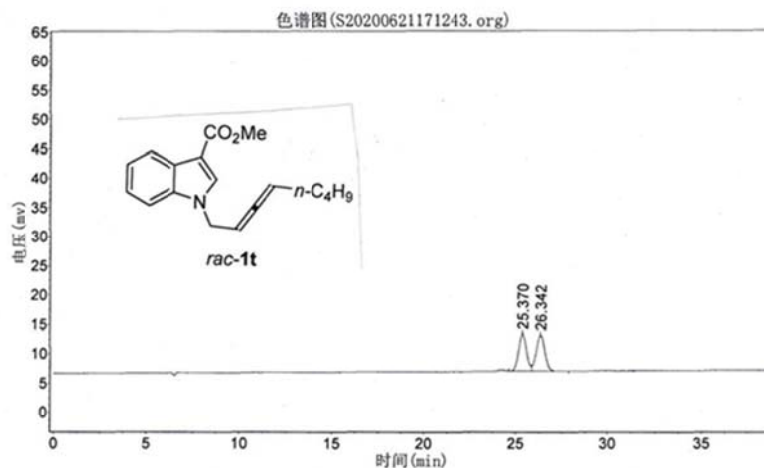
峰号	峰名	保留时间	峰高	峰面积	含量
1		25.765	8295.294	254018.875	49.7509
2		26.757	7942.925	256562.656	50.2491
总计			16238.219	510581.531	100.0000

jf-3-112

实验时间: 2020-06-21, 17:12:43
谱图文件: D:\浙大智达\N2000\样品\S20200621171243.org
方法文件: D:\浙大智达\N2000\djx.mtd

实验者: jf
报告时间: 2020-06-21, 18:10:14
积分方法: 面积归一法

实验内容简介:
OD-II, n-hexane/i-PrOH = 90/10, 0.5, 214



分析结果表

峰号	峰名	保留时间	峰高	峰面积	含量
1		25.370	6233.678	186407.172	48.7367
2		26.342	6127.121	196070.625	51.2633
总计			12360.798	382477.797	100.0000