Vinylogous Michael addition-triggerd Quadruple Cascade for the Enantioselective Generation of Multiple Quaternary Stereocenters

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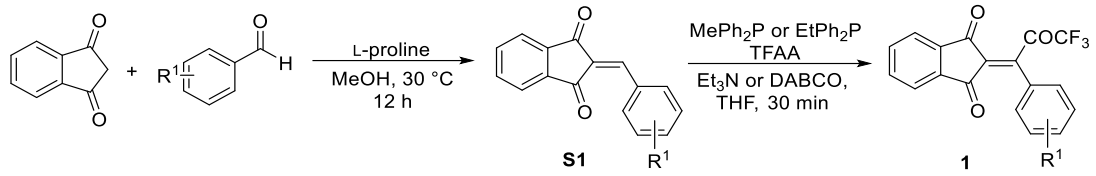
I. General Information

All solvents and reagents were used as purchased from commercial suppliers without further purification. Starting materials and catalysts which were not commercially available were synthesized by the previously reported methods. Analytical thin layer chromatography (TLC) was performed on precoated alumina-backed silica gel plates (Merck 60 F254, 0.2 mm thickness) which were developed using UV florescence and iodine. Flash-chromatography was performed on silica gel (Merck Kieselgel 60Å 230-400 mesh). Melting points were measured on a hotstage meting point apparatus and are uncorrected. IR spectra were recorded on a Perkin Elmer 500 spectrometer and only selected peaks are shown. ^{1}H-NMR spectra were recorded on a Bruker Avance 400 MHz spectrometer, while ^{13}C-NMR spectra were recorded on a 100 MHz instrument. Chemical shifts are reported in δ ppm referenced to an internal TMS standard for ^{1}H-NMR and chloroform-d (δ = 77.0 ppm) for ^{13}C-NMR. In some cases, while the chloroform-d couldn't dissolve the analyst well, the acetone-d_6 was applied instead. The chemical shifts refer to an internal acetone-d_6 standard for ^{1}H-NMR (δ = 2.05 ppm) and for ^{13}C-NMR (δ = 29.8 ppm). HRMS spectra were recorded on JEOL SX-102A. For transferring liquids on a microliter scale, a micropipette (VITLAB C121) of 2-20 μL capacity was used. The X-ray diffraction measurements were carried out at 298 K on a KAPPA APEX II CCD area detector system equipped with a graphite monochromator and a Mo-Kα fine-focus sealed tube (k = 0.71073 Å). Optical rotations were measured in CH_2Cl_2 on a JASCO co. DIP-1000 digital polarimeter with a 50 mm cell (c given in g/100 mL). The known fully substituted substituted enones **1a**, and **1c-1l** were synthesized following the procedure reported earlier by our group.[1,2] The compound **1b** and other oxindole derived vinylogous nucleophiles **2a-2p** were synthesized following the procedure mentioned in this supporting information.

II. Experimental procedures

General Synthesis of 1:



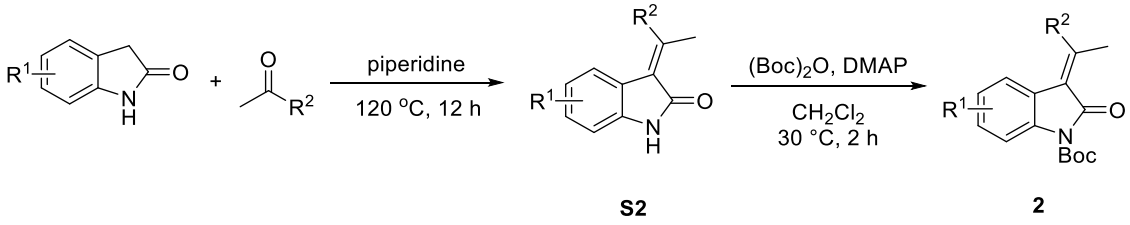
General procedure A (GP-A) for the preparation of S1:

A dry and argon-flushed 50 mL round-bottomed flask equipped with a magnetic stir bar was sequentially charged with 1,3-indanedione (10.0 mmol), L-proline (0.3 equiv), appropriately substituted benzaldehyde (1.1 equiv) and methanol (20 mL). The reaction mixture was stirred for 12 hours at 30 °C. Thereafter, the resulting slurry was filtered and the residue was washed with methanol until it was free from any residual starting materials to get the pure product **S1**.

General procedure B (GP-B) for the preparation of 1:

A dry and nitrogen-flushed 25 mL round-bottomed flask, equipped with a magnetic stirring bar and a septum, was sequentially charged with a solution of **S1** (1.5 mmol), $EtPh_2P$ (0.15 equiv), TFAA (1.3 equiv) and Et_3N (1.4 equiv) in THF (7.5 mL). The reaction mixture was stirred for 30 minutes at 30 °C. Thereafter, the solvent was removed by evaporation *in vacuo*. Purification by flash chromatography furnished **1.**

General synthesis of 2:



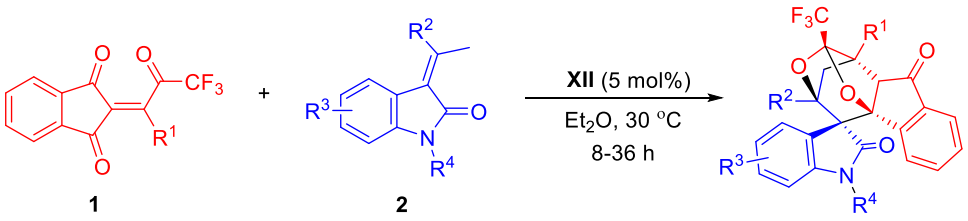
General procedure C (GP-C) for the preparation of S2:

An ace pressure tube with a magnetic stir bar was sequentially with indolin-2-one (10.0 mmol) in piperidine (0.8 equiv), acetophenone derivative (3.0 equiv) and the resulting mixture was heated to 160 °C for 12 hours. Upon completion of reaction, the resulting dark solution was cooled to 30 °C and stirred for 30 min. The crude residue was purified by silica gel flash chromatography (Hexanes/EtOAc =1:9) to obtain **S2**.

General procedure D (GP-D) for the preparation of 2:

To a solution of **S2** (5 mmol) in DCM (20 mL) was added a solution of $(Boc)_2O$ (1.1 equiv) diluted in DCM (5 mL) and DMAP (0.5 equiv) and stirred for 2 hours. Then the reaction mixture was concentrated *in vacuo* and the residue was purified by silica gel flash chromatography (Hexanes/DCM = 5: 1) to obtain **2**.

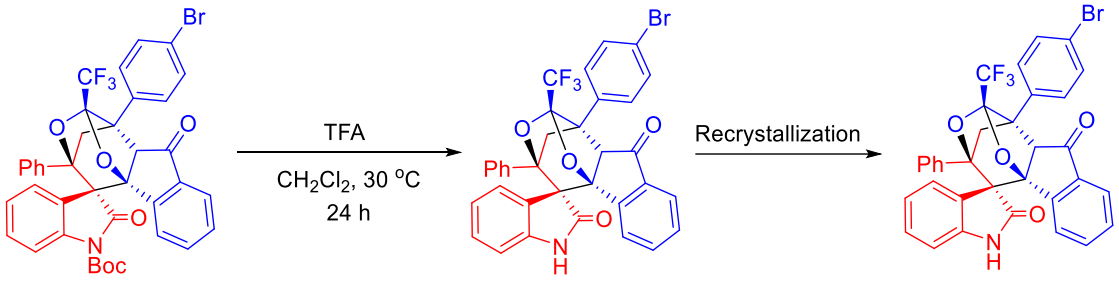
General experimental procedure E for the synthesis of cascade product 3:



>25:1, d.r

A capped glass vial equipped with a magnetic stir bar was charged with **1** (0.1 mmol), **2** (1.0 equiv), catalyst **QN-T** (5 mol%) and Et_2O (0.5 mL) and stirred at 30 °C. The progress of the reaction was monitored by TLC and ^1H NMR data analysis. After the completion of reaction, 2N HCl (2 mL) was added and extracted twice with DCM (2.5 mL). The combined organic extracts were concentrated *in vacuo* and the residue was subjected to flash column chromatography over silica gel (hexanes/ethyl acetate) to afford pure adduct **3**.

Typical experimental procedure for the deprotection of 3aa:

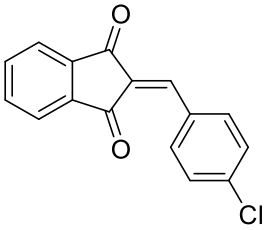


3aa (80% *ee*) **4aa**(60% yield, 80% *ee*) **4aa** (99% *ee*)

To a solution of enantiomerically enriched **3aa** (0.053 mmol, 39.5 mg, 80% ee) in DCM (0.5 mL) was added TFA (1.0 equiv, 4.06 µL) and the reaction mixture was stirred at 30 °C for 24 hours. Afterwards, the reaction mixture was directly subjected to flash column chromatography on silica gel (EtOAc/Hex = 1:6) to afford **4aa** as a white solid (60% yield, 20.5 mg).

III. Analytical data for all new compounds

2-(4-Chlorobenzylidene)-1*H*-indene-1,3(2*H*)-dione (S1b)



Following the GP-A, **S1b** was obtained as a green solid (2.42 g, 90% yield) from 1,3-indanedione (1.46 g, 10.0 mmol), L-proline (0.345 g, 0.3 equiv) and 4-chlorobenzaldehyde (1.54 g, 1.1 equiv) in methanol (20.0 mL) at 30 °C after 12 hours.

R_f = 0.37 (DCM/Hex = 1/1), mp.: 180.8-182.0 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.43 (d, J = 8.6 Hz, 2H), 8.00-8.03 (m, 2H), 7.82-7.84 (m, 3H), 7.48 (d, J = 8.5 Hz, 2H).

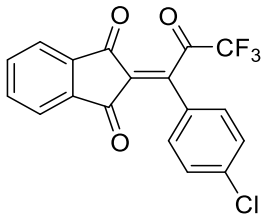
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 190.0, 189.0, 145.2, 142.5, 140.1, 139.5, 135.5, 135.3, 131.5, 129.4, 129.1, 123.41, 123.40.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3085, 1689, 1592, 830, 733.

HRMS (EI) calcd for $C_{16}H_9{}^{35}ClO_2$, [M] (268.0291) found: 268.0292 (100).

HRMS (EI) calcd for $C_{16}H_9{}^{37}ClO_2$, [M] (270.0262) found: 270.0267 (28).

2-(1-(4-Chlorophenyl)-3,3,3-trifluoro-2-oxopropylidene)-1*H*-indene-1,3(2*H*)-dione (1b)



Following the GP-B, **1b** was obtained as a green solid (0.492 g, 90%) from **S1b** (0.403 g, 1.5 mmol), $EtPh_2P$ (46.9 μL, 0.15 equiv), TFAA (273.7 μL, 1.3 equiv) and Et_3N (298.1 μL, 1.4 equiv) in THF (7.5 mL) at 30 ℃ after 30 minutes and purification by flash chromatography (DCM/Hex = 1/3)

R_f = 0.41 (DCM/Hex = 1/1), mp.: 141.0-141.1 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.00-8.03 (m, 2H), 7.87-7.93 (m, 2H), 7.61 (d, J = 8.7 Hz, 2H), 7.49 (d, J = 8.6 Hz, 2H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 189.2, 187.2 (q, J = 38.6 Hz), 185.6, 149.8, 143.3, 139.44, 139.36, 136.7, 136.3, 131.7, 130.8, 129.2, 125.7, 124.04, 124.02, 115.1

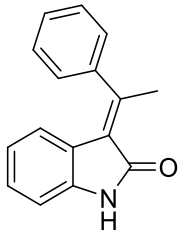
(q, J = 291.7 Hz).

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 1745, 1690, 1617, 1588, 1218, 749.

HRMS (EI) for $C_{18}H_8{}^{35}ClF_3O_3$, [M] (364.0114) found: 364.0115 (100).

HRMS (EI) for $C_{18}H_8{}^{37}ClF_3O_3$, [M] (366.0085) found: 366.010 (33).

(*E*)-3-(1-Phenylethylidene)indolin-2-one (S2a)



Following the GP-C, **S2a** was obtained as an orange solid (1.60 g, 68% yield) from indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and acetophenone (3.5 mL, 3.0 equiv).

R_f = 0.70 (EtOAc/Hex = 1/4), mp.: 194.9-195.6 °C.

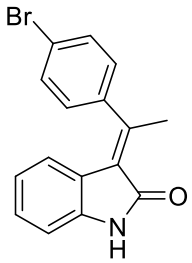
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 9.11 (s, 1H), 7.40-7.53 (m, 3H), 7.29 (dd, J = 7.6, 1.4 Hz, 2H), 7.07 (pt, J = 7.6 Hz, 1H), 6.84 (d, J = 7.6 Hz, 1H), 6.61 (pt, J = 7.6 Hz, 1H), 6.13 (d, J = 7.6 Hz, 1H), 2.81 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.5, 155.6, 143.1, 139.9, 129.3, 128.5, 128.2, 126.6, 124.0, 123.5, 123.2, 121.4, 109.6, 23.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3200, 1694, 1611, 1464, 1331, 1220.

HRMS (ESI) for $C_{16}H_{14}NO$, $[M+H]^+$ (236.1070) found: 236.1075.

(*E*)-3-(1-(4-Bromophenyl)ethylidene)indolin-2-one (S2b)



Following the GP-C, **S2b** was obtained as a yellow solid (1.96 g, 62% yield) from indolin-2-one (1.33 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 4'-bromoacetophenone (4.1 mL, 3.0 equiv).

R_f = 0.27 (EtOAc/Hex = 1/4), mp.: 230.4-230.7 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.63 (s, 1H), 7.62 (dt, J = 8.4 Hz, 2.1 Hz, 2H), 7.19 (d, J = 8.4, 2.2 Hz, 2H), 7.10 (td, J = 7.6, 0.7 Hz, 1H), 6.83 (d, J = 7.8 Hz,

1H), 6.67 (td, J = 7.7, 0.8 Hz, 1H), 6.23 (d, J = 7.9 Hz, 1H), 2.76 (s, 3H).

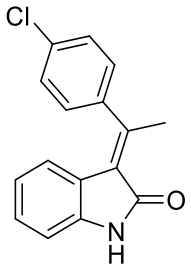
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.0, 153.6, 141.7, 139.7, 132.4, 128.4, 124.1, 123.1, 123.0, 122.5, 121.4, 109.5, 22.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3154, 3072, 2826, 1690, 1610, 1466, 1333, 1226, 1094, 823, 748, 540.

HRMS (ESI) for $C_{16}H_{13}NO^{79}Br$, $[M+H]^+$ (314.0175) found: 314.0179 (100).

HRMS (ESI) for $C_{16}H_{13}NO^{81}Br$, $[M+H]^+$ (316.0155) found: 316.0161 (99).

(*E*)-3-(1-(4-Chlorophenyl)ethylidene)indolin-2-one (S2c)



Following the GP-C, **S2c** was obtained as a yellow solid (1.96 g, 73% yield) from indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 4'-chloroacetophenone (4.0 mL, 3.0 equiv).

R_f = 0.27 (EtOAc/Hex = 1/4), mp.: 194.5-194.7 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 9.07 (s, 1H), 7.46 (d, J = 8.4 Hz, 2H), 7.25 (d, J = 8.3 Hz, 2H), 7.10 (t, J = 7.7 Hz, 1H), 6.85 (d, J = 7.8 Hz, 1H), 6.66 (t, J = 7.6 Hz, 1H), 6.23 (d, J = 7.5 Hz, 1H), 2.77 (s, 3H).

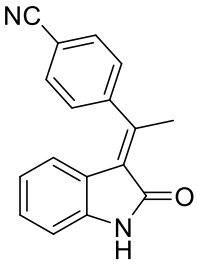
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.1, 153.7, 141.2, 139.8, 134.4, 129.5, 128.4, 128.1, 124.2, 123.0, 121.4, 109.5, 22.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3176, 3076, 2905, 2808, 1688, 1611, 1466, 1331, 1226, 1096, 785, 747.

HRMS (ESI) for $C_{16}H_{13}NO^{35}Cl$, $[M+H]^+$ (270.0680) found: 270.0686 (100).

HRMS (ESI) for $C_{16}H_{13}NO^{37}Cl$, $[M+H]^+$ (272.0651) found: 272.0682 (39).

(*E*)-4-(1-(2-Oxoindolin-3-ylidene)ethyl)benzonitrile (S2d)



Following the GP-C, **S2d** was obtained as an orange solid (0.28 g, 11% yield) from

indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 4-acetylbenzonitrile (4.3 mL, 3.0 equiv).

R_f = 0.15 (EtOAc/Hex = 1/4), mp.: 249.9-250.0 °C.

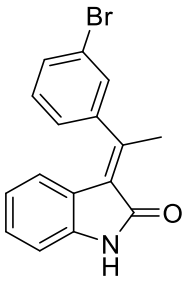
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.16 (s, 1H), 7.81 (dt, J = 8.2, 1.8 Hz, 2H), 7.44 (dt, J = 8.3, 2.2 Hz, 2H), 7.12 (td, J = 8.0, 0.7 Hz, 1H), 6.65 (td, J = 7.7, 0.9 Hz, 1H), 6.05 (d, J = 7.8 Hz, 1H), 2.78 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 169.2, 151.8, 147.5, 139.8, 133.2, 129.0, 127.6, 124.4, 123.0, 122.6, 121.6, 118.4, 112.4, 109.6, 22.2.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3175,3085, 2896, 2817, 1692, 1613, 1603, 1466, 1331, 1226, 1189, 843, 752.

HRMS (ESI) for $C_{17}H_{13}N_2O$, $[M+H]^+$ (261.1022) found: 261.1031.

(*E*)-3-(1-(3-Bromophenyl)ethylidene)indolin-2-one (S2e)



Following the GP-C, **S2e** was obtained as a yellow solid (3.06 g, 98% yield) from indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 3'-bromoacetophenone (4.1 mL, 3.0 equiv).

R_f = 0.30 (EtOAc/Hex = 1/4), mp.: 171.7-172.1 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 9.15 (s, 1H), 7.58 (d, J = 8.0 Hz, 1H), 7.44 (s, 1H), 7.36 (t, J = 7.8 Hz, 1H), 7.23 (d, J = 7.6 Hz, 1H), 7.10 (t, J = 7.7 Hz, 1H), 6.86 (d, J = 7.7 Hz, 1H), 6.66 (t, J = 7.7 Hz, 1H), 6.17 (d, J = 8.0 Hz, 1H), 2.77 (s, 3H).

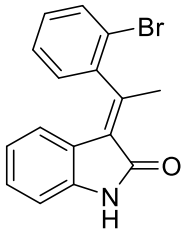
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.1, 153.0, 144.8, 140.0, 131.4, 130.8, 129.5, 128.5, 125.2, 124.3, 123.1, 123.0, 121.4, 109.6, 22.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3204, 3081, 1697, 1613, 1466,1333, 1226, 1107, 789, 748, 693, 546.

HRMS (ESI) for $C_{16}H_{13}NO^{79}Br$, $[M+H]^+$ (314.0175) found: 314.0182 (100).

HRMS (ESI) for $C_{16}H_{13}NO^{81}Br$, $[M+H]^+$ (316.0155) found: 316.0163 (98).

(*E*)-3-(1-(2-Bromophenyl)ethylidene)indolin-2-one (S2f)



Following the GP-C, **S2f** was obtained as a yellow solid (1.00 g, 32% yield) from indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 2'-bromoacetophenone (4.1 mL, 3.0 equiv).

R_f = 0.32 (EtOAc/Hex = 1/4), mp.: 178.2-178.9 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.58 (s, 1H), 7.73 (dd, J = 7.5, 0.6 Hz, 1H), 7.44 (td, J = 7.5, 0.9 Hz, 1H), 7.32 (td, J = 7.7, 1.6 Hz, 1H), 7.19 (dd, J = 7.5, 1.6 Hz, 1H), 7.09 (td, J = 7.5, 0.6 Hz, 1H), 6.83 (d, J = 7.8 Hz, 1H), 6.63 (td, J = 7.7, 0.9 Hz, 1H), 5.86 (d, J = 7.8 Hz, 1H), 2.77 (s, 3H).

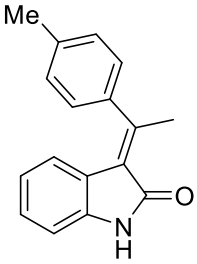
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 169.8, 152.9, 143.2, 139.7, 133.5, 129.6, 128.5, 128.4, 127.9, 124.7, 123.1, 122.8, 121.7,120.1, 109.4, 21.4.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3224, 3068, 2930, 1698, 1636, 1617, 1590, 1465, 1427, 1334, 1225, 1006, 784, 584.

HRMS (ESI) for $C_{16}H_{13}NO^{79}Br$, $[M+H]^+$ (314.0175) found: 314.0182 (100).

HRMS (ESI) for $C_{16}H_{13}NO^{81}Br$, $[M+H]^+$ (316.0155) found: 316.0162 (99).

(*E*)-3-(1-(*p*-Tolyl)ethylidene)indolin-2-one (S2g)



Following the GP-C, **S2g** was obtained as a yellow solid (1.64 g, 67% yield) from indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 4'-methylacetophenone (4.2 mL, 3.0 equiv).

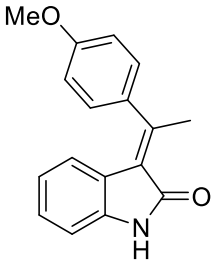
R_f = 0.32 (EtOAc/Hex = 1/4), mp.: 194.7-195.0 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.65 (s, 1H), 7.28 (d, J = 7.8 Hz, 2H), 7.20 (d, J = 7.8 Hz, 2H), 7.01 (t, J = 7.6 Hz, 1H), 6.82 (d, J = 7.7 Hz, 1H), 6.63 (t, J = 7.7 Hz, 1H), 6.26 (d, J = 7.5 Hz, 1H), 2.79 (s, 3H), 2.45 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.1, 155.9, 140.0, 139.6, 138.3, 129.8, 128.0, 126.5, 123.59, 123.55, 123.1, 121.2, 109.2, 33.0, 21.4.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3198, 3081, 2914, 1692, 1612, 1467, 1333, 1227, 1106, 817m 736.
HRMS (ESI) for $C_{17}H_{16}NO$, $[M+H]^+$ (250.1226) found: 250.1232.

(*E*)-3-(1-(4-Methoxyphenyl)ethylidene)indolin-2-one (S2h)



Following the GP-C, **S2h** was obtained as a yellow solid (1.72 g, 65% yield) from indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 4'-methoxyacetophenone (4.2 mL, 3.0 equiv).

R_f = 0.22 (EtOAc/Hex = 1/4); mp.: 182.8-183.4 °C.

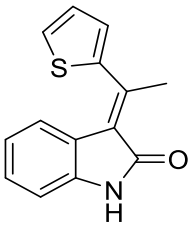
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.90 (s, 1H), 7.26 (d, J = 8.4 Hz, 2H), 7.07 (t, J = 7.6 Hz, 1H), 7.00 (d, J = 8.6 Hz, 2H), 6.84 (d, J = 7.9 Hz, 1H), 6.65 (t, J = 7.7 Hz, 1H), 6.36 (d, J = 7.8 Hz, 1H), 3.89 (s, 3H), 2.79 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.3, 159.8, 155.6, 139.6, 135.1, 128.3, 127.9, 123.7, 123.6, 122.9, 121.2, 114.4, 109.3, 55.3, 23.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3185, 3076, 2967, 2839, 1691, 1612, 1509, 1467, 1334, 1246, 1179, 829, 749, 573.

HRMS (ESI) for $C_{17}H_{16}NO_2$, $[M+H]^+$ (266.1176) found: 266.1183.

(*E*)-3-(1-(Thiophen-2-yl)ethylidene)indolin-2-one (S2i)



Following the GP-C, **S2i** was obtained as a yellow solid (0.56 g, 24% yield) from indolin-2-one (1.30 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and 2-acetylthiophene (3.2 mL, 3.0 equiv).

R_f = 0.31 (EtOAc/Hex = 1/4), mp.: 193.0-194.0 °C.

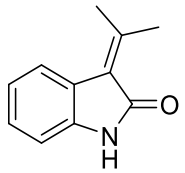
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.90 (s, 1H), 7.50 (d, J = 4.9 Hz, 1H), 7.18 (dd, J = 3.3, 0.5 Hz, 1H), 7.09-7.14 (m, 2H), 6.80 (d, J =7.8 Hz, 1H), 6.70-6.76 (m, 2H), 2.81 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 169.8, 147.4, 143.7, 139.7, 128.6, 127.5, 127.3, 126.6, 125.4, 123.2, 122.9, 121.4, 109.4, 23.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3163, 3046, 2901, 2817, 1692, 1611, 1465, 1335, 1227, 748, 706.

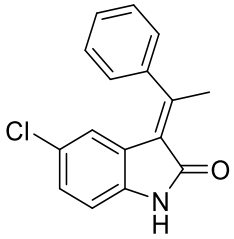
HRMS (ESI) for $C_{14}H_{12}NOS$, $[M+H]^+$ (242.0634) found: 242.0641.

3-(propan-2-ylidene)indolin-2-one (S2j)



Prepared according to the literature report.[3]

(*E*)-5-Chloro-3-(1-phenylethylidene)indolin-2-one (S2k)



Following the GP-C, **S2k** was obtained as an orange solid (0.81 g, 30% yield) from 5-chlorooxindole (1.70 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and acetophenone (3.5 mL, 3.0 equiv).

R_f = 0.25 (EtOAc/Hex = 1/4), mp.: 188.2-188.5 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 9.42 (s, 1H), 7.44-7.54 (m, 3H), 7.25 (dd, J = 7.6, 1.4 Hz, 2H), 7.07 (dd, J = 7.6 Hz, 1H), 6.78 (d, J = 7.6 Hz, 1H), 6.04 (d, J = 7.6 Hz, 1H), 2.79 (s, 3H).

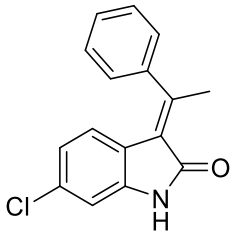
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.2, 157.6, 142.2, 138.2, 129.3, 128.8, 127.8, 126.5, 126.2, 124.7, 123.3, 123.2, 110.3, 22.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3173, 3081, 2940, 2843, 1698, 1616, 1467, 1438, 1303, 1221, 1077, 814, 761.

HRMS (ESI) for $C_{16}H_{13}NO^{35}Cl$, $[M+H]^+$ (270.0680) found: 270.0687 (100).

HRMS (ESI) for $C_{16}H_{13}NO^{37}Cl$, $[M+H]^+$ (272.0651) found: 272.0662 (33).

(*E*)-6-Chloro-3-(1-phenylethylidene)indolin-2-one (S2l)



Following the GP-C, **S2l** was obtained as a yellow solid (1.19 g, 44% yield) from 6-chloro-2-oxindole (1.70 g, 10.0 mmol), piperidine (0.7 mL, 0.8 equiv) and acetophenone (3.5 mL, 3.0 equiv).

R_f = 0.42 (EtOAc/Hex = 1/4), mp.: 199.9-200.1 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.91 (s, 1H), 7.43-7.52 (m, 3H), 7.27 (dd, J = 7.7, 1.6 Hz, 2H), 6.85 (d, J = 1.8 Hz, 1H), 6.58 (dd, J = 8.4, 1.7 Hz, 1H), 6.03 (d, J = 8.4 Hz, 1H), 2.80 (s, 3H).

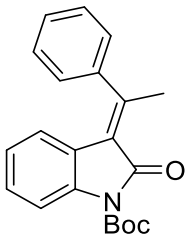
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 170.1, 156.4, 142.6, 140.5, 133.6, 129.2, 128.6, 126.3, 124.0, 123.0, 121.8, 121.3, 109.8, 22.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3117, 3032, 1692, 1607, 1443, 1323, 1228, 1066, 812, 717, 698.

HRMS (ESI) for $C_{16}H_{13}NO^{35}Cl$, $[M+H]^+$ (270.0680) found: 270.0686 (100).

HRMS (ESI) for $C_{16}H_{13}NO^{37}Cl$, $[M+2+H]^+$ (272.0651) found: 272.0660 (33).

***tert*-butyl(*E*)-2-oxo-3-(1-phenylethylidene)indoline-1-carboxylate (2a):**



Following the GP-D, **2a** was obtained as a yellow solid (1.31 g, 58% yield) from **S2a** (1.60 g, 6.76 mmol), $(Boc)_2O$ (2.0 mL, 1.2 equiv) and DMAP (417.5 mg, 0.5 equiv) in DCM (22.0 mL).

R_f = 0.23 (EtOAc/Hex = 1/20), mp.: 75.1-76.3 °C.

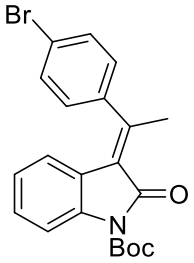
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.81 (d, J = 7.9 Hz, 1H), 7.41-7.52 (m, 3H), 7.25 (dd, J = 7.9, 1.3 Hz, 2H), 7.15 (td, J = 7.9, 1.3 Hz, 1H), 6.72 (td, J = 7.9, 1.3 Hz, 1H), 6.18 (d, J = 7.9 Hz, 1H), 2.78 (s, 3H), 1.68 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 166.3, 156.7, 149.7, 143.1, 138.4, 129.5, 128.7, 128.4, 126.4, 123.4, 123.2, 122.8, 122.6, 114.5, 84.2, 28.3, 23.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2980, 1725, 1600, 1462, 1353, 1304, 1153, 1094.

HRMS (ESI) for $C_{21}H_{21}NO_3Na$, $[M+Na]^+$ (358.1414) found: 358.1420.

***tert*-Butyl-(*E*)-3-(1-(4-bromophenyl)ethylidene)-2-oxoindoline-1-carboxylate (2b)**



Following the GP-D, **2b** was obtained as a yellow solid (0.65 g, 79%) from **S2b** (0.63 g, 2.0 mmol), $(Boc)_2O$ (0.6 mL, 1.2 equiv) and DMAP (122.2 mg, 0.5 equiv) in DCM (22.0 mL).

R_f = 0.27 (EtOAc/Hex = 1/40), mp.: 113.0-113.9 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.82 (d, J = 8.2 Hz, 1H), 7.62 (d, J = 8.2 Hz, 2H), 7.17 (pt, J = 7.8 Hz, 1H), 7.15 (pd, J = 8.2 Hz, 2H), 6.78 (t, J = 7.7 Hz, 1H), 6.28 (d, J = 7.8 Hz, 1H), 2.74 (s, 3H), 1.67 (s, 9H).

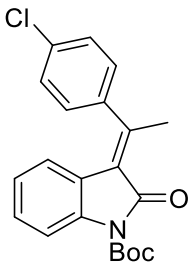
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.9, 154.5, 149.4, 141.7, 138.3, 132.6, 128.7, 128.2, 123.3, 122.74, 122.66, 122.6, 122.5, 114.5, 84.1, 28.1, 23.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3081, 2983, 2923, 1780, 1741, 1623, 1603, 1480, 1463, 1369, 1350, 1302, 1254, 1154, 1096, 788, 749, 450.

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{79}Br$, $[M+Na]^+$ (436.0519) found: 436.0529 (99).

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{81}Br$, $[M+Na]^+$ (438.0498) found: 438.0511 (100).

***tert*-Butyl-(*E*)-3-(1-(4-chlorophenyl)ethylidene)-2-oxoindoline-1-carboxylate (2c)**



Following the GP-D, **2c** was obtained as a yellow solid (0.81 g, 55%) from **S2c** (1.10 g, 4.0 mmol), $(Boc)_2O$ (1.1 mL, 1.2 equiv) and DMAP (246.8 mg, 0.5 equiv) in DCM (44.0 mL).

R_f = 0.30 (EtOAc/Hex = 1/40), mp.: 125.7-126.0 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.82 (d, J = 8.2 Hz, 1H), 7.46 (d, J = 8.3 Hz, 2H), 7.21 (d, J = 8.4 Hz, 2H), 7.17 (t, J = 8.1, 1H), 6.77 (t, J = 7.6, 1H), 6.27 (d, J = 8.0 Hz, 1H), 2.75 (s, 3H), 1.68 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.9, 154.6, 149.4, 141.2, 138.3, 134.5,

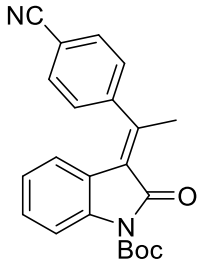
123.0, 128.5, 128.0, 123.3, 122.8, 122.7, 122.5, 114.5, 84.1, 28.1, 23.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3094, 2983, 2940, 1780, 1744, 1625, 1601, 1463, 1369, 1350, 1302, 1254, 1154, 1096, 788, 750, 554.

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{35}Cl$, $[M+Na]^+$ (392.1024) found: 392.1031 (100).

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{37}Cl$, $[M+Na]^+$ (394.0994) found: 394.1008 (34).

***tert*-Butyl (*E*)-3-(1-(4-cyanophenyl)ethylidene)-2-oxoindoline-1-carboxylate (2d)**



Following the GP-D, **2d** was obtained as a yellow solid (0.40 g, 30%) from **S2d** (1.30 g, 3.7 mmol), $(Boc)_2O$ (1.0 mL, 1.2 equiv) and DMAP (228.3 mg, 0.5 equiv) in DCM (40.0 mL).

R_f = 0.05 (EtOAc/Hex = 1/40), mp.: 175.5-175.7 °C.

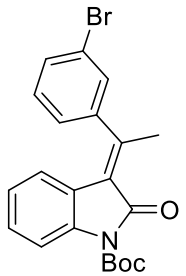
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.79-7.84 (m, 3H), 7.40 (d, J = 8.0 Hz, 2H), 7.20 (t, J = 7.9, 1H), 6.76 (t, J = 7.7 Hz, 1H), 6.09 (d, J = 8.0 Hz, 1H), 2.76 (s, 3H), 1.68 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.6, 152.6, 149.3, 147.5, 138.6, 133.3, 129.0, 127.5, 123.4, 123.2, 122.4, 122.1, 118.3, 114.7, 112.5, 84.3, 28.1, 23.1.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2982, 2927, 2231, 1779, 1740, 1603, 1463, 1349, 1302, 1253, 1153, 1097, 842, 749.

HRMS (ESI) for $C_{22}H_{20}N_2O_3Na$, $[M+Na]^+$ (383.1366) found: 383.1374.

***tert*-Butyl-(*E*)-3-(1-(3-bromophenyl)ethylidene)-2-oxoindoline-1-carboxylate (2e)**



Following the GP-D, **2e** was obtained as a yellow solid (0.65 g, 78%) from **S2e** (0.63 g, 2.0 mmol), $(Boc)_2O$ (0.6 mL, 1.2 equiv) and DMAP (122.2 mg, 0.5 equiv) in DCM (22.0 mL).

R_f = 0.28 (EtOAc/Hex = 1/40), mp.: 54.0-55.0 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.82 (d, J = 8.2 Hz, 1H), 7.59 (dd, J = 8.1, 0.9 Hz, 1H), 7.41 (m, 1H), 7.36 (t, J = 7.8 Hz, 1H), 7.16-7.20 (m, 2H), 6.78 (t, J = 7.7 Hz, 1H), 6.22 (d, J = 7.5 Hz, 1H), 2.75 (s, 3H), 1.67 (s, 9H).

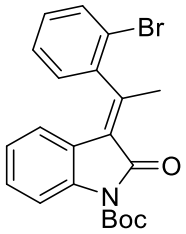
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.9, 153.9, 149.4, 144.8, 138.4, 131.6, 131.0, 129.3, 128.7, 125.1, 123.4, 123.3, 122.9, 122.7, 122.5, 114.6, 84.2, 28.2, 23.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3085, 2983, 2927, 1781, 1736, 1602, 1463, 1369,1349, 1303, 1253, 1153, 1096, 788. 748, 461.

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{79}Br$, $[M+Na]^+$ (436.0519) found: 436.0525 (99).

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{81}Br$, $[M+Na]^+$ (438.0498) found: 438.0507 (100).

***tert*-Butyl-(*E*)-3-(1-(2-bromophenyl)ethylidene)-2-oxoindoline-1-carboxylate (2f)**



Following the GP-D, **2f** was obtained as a white solid (0.76 g, 61%) from **S2f** (0.94 g, 3.0 mmol), $(Boc)_2O$ (0.9 mL, 1.2 equiv) and DMAP (183.3 mg, 0.5 equiv) in DCM (33.0 mL).

R_f = 0.30 (EtOAc/Hex = 1/40), mp.: 56.5-56.7 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.83 (d, J = 8.2 Hz, 1H), 7.72 (dd, J = 7.9, 0.8 Hz, 1H), 7.43 (t, J = 7.5 Hz, 1H), 7.31 (t, J = 7.8 Hz, 1H), 7.12-7.22 (m, 2H), 6.75 (t, J = 7.7 Hz, 1H), 5.93 (d, J = 7.8 Hz, 1H), 2.75 (s, 3H), 1.67 (s, 9H).

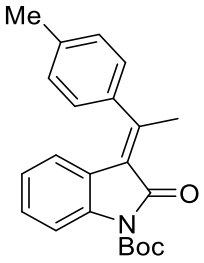
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.9, 153.9, 149.5, 143.2, 138.3, 133.6, 129.7, 128.6, 128.5, 127.6, 123.9, 123.7, 123.3, 122.6, 122.3, 120.0, 114.5, 84.1, 28.2, 22.3.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3072, 2981, 2927, 1783, 1744, 1603, 1463, 1369, 1351, 1302, 1254, 1153, 1096, 746, 598.

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{79}Br$, $[M+Na]^+$ (436.0519) found: 436.0525 (100).

HRMS (ESI) for $C_{21}H_{20}NO_3Na^{81}Br$, $[M+Na]^+$ (438.0498) found: 438.0508 (99).

***tert*-Butyl (*E*)-2-oxo-3-(1-(*p*-tolyl)ethylidene)indoline-1-carboxylate (2g)**



Following the GP-D, **2g** was obtained as a yellow solid (0.18 g, 58%) from **S2g** (1.30 g, 0.9 mmol), $(Boc)_2O$ (0.25 mL, 1.2 equiv) and DMAP (55.5 mg, 0.5 equiv) in DCM (10.0 mL).

R_f = 0.33 (EtOAc/Hex = 1/40), mp.: 70.4-71.2 °C.

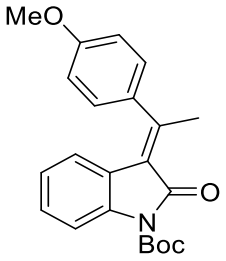
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.81 (d, J = 8.2 Hz, 1H), 7.27 (d, J = 8.0 Hz, 2H), 7.12-7.16 (m, 3H), 6.74 (t, J = 7.7, 1H), 6.31 (dd, J = 7.9 Hz, 1H), 2.76 (s, 3H), 2.43 (s, 3H), 1.68 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 166.1, 156.8, 149.5, 139.8, 138.5, 138.0, 129.8, 128.0, 126.3, 123.1, 122.5, 122.2, 114.3, 83.8, 28.1, 23.8, 21.3.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2981, 2929, 1781, 1740, 1601, 1463, 1368, 1350, 1302, 1282, 1253, 1154, 1095, 1002, 970, 845, 818, 787, 748, 703.

HRMS (EI) for $C_{22}H_{23}NO_3$, [M] (349.1678) found: 349.1678.

tert-Butyl (*E*)-3-(1-(4-methoxyphenyl)ethylidene)-2-oxoindoline-1-carboxylate (2h)



Following the GP-D, **2h** was obtained as a yellow solid (0.45 g, 49%) from **S2h** (0.91 g, 2.5 mmol), $(Boc)_2O$ (0.7 mL, 1.2 equiv) and DMAP (0.15 g, 0.5 equiv) in DCM (28.0 mL).

R_f = 0.17 (EtOAc/Hex = 1/40), mp.: 99.0-100.0 °C.

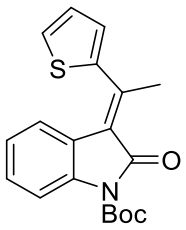
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.81 (d, J = 8.0 Hz, 1H), 7.22 (d, J = 8.4 Hz, 2H), 7.15 (t, J = 8.0 Hz, 1H), 7.0 (d, J = 8.4 Hz, 2H), 6.76 (t, J = 7.7 Hz, 1H), 6.4 (d, J = 8.0 Hz, 1H), 3.88 (s, 3H), 2.76 (s, 3H), 1.67 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 166.1, 160.0, 156.7, 149.5, 138.0, 135.0, 128.1, 128.0, 123.2, 123.1, 122.4, 122.2, 114.5, 114.3, 83.8, 55.3, 28.1, 23.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2983, 2931, 1779, 1738, 1601, 1510, 1476, 1463, 1369, 1350, 1303, 1250, 1154, 1095, 835, 748.

HRMS (ESI) for $C_{22}H_{23}NO_4Na$, $[M+Na]^+$ (388.1519) found: 388.1526.

***tert*-Butyl (*E*)-2-oxo-3-(1-(thiophen-2-yl)ethylidene)indoline-1-carboxylate (2i)**



Following the GP-D, **2i** was obtained as a yellow solid (0.79 g, 58%) from **S2i** (1.36 g, 4.0 mmol), $(Boc)_2O$ (2.3 mL, 1.2 equiv) and DMAP (0.62 g, 0.5 equiv) in DCM (22.0 mL).

R_f = 0.30 (EtOAc/Hex = 1/40), mp.: 121.6-122.5 °C.

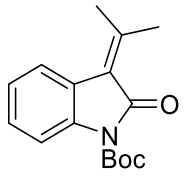
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.82 (d, J = 8.2 Hz, 1H), 7.51 (d, J = 4.9 Hz, 1H), 7.19 (t, J = 7.7 Hz, 1H), 7.11-7.15 (m, 2H), 6.83 (t, J = 7.7 Hz, 1H), 6.76 (d, J = 7.8, 1.3 Hz, 1H), 2.80 (s, 3H), 1.67 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.8, 149.5, 148.3, 143.7, 138.3, 128.7, 127.7, 126.6, 124.1, 123.3, 122.9, 122.4, 114.5, 84.1, 28.2, 24.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2979, 1737, 1601, 1458, 1344, 1301, 1254, 1153, 1096, 747, 706.

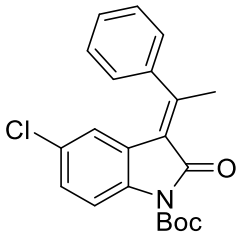
HRMS (ESI) for $C_{19}H_{19}NO_3NaS$, $[M+Na]^+$ (364.0978) found: 364.0986.

***tert*-Butyl 2-oxo-3-(propan-2-ylidene)indoline-1-carboxylate (2j)**



Prepared following the reported method.[3]

***tert*-Butyl-(*E*)-5-chloro-2-oxo-3-(1-phenylethylidene)indoline-1-carboxylate (2k)**



Following the GP-D, **2k** was obtained as a yellow colored solid (786.1 mg, 97%) from **S2k** (0.81 g, 2.2 mmol), $(Boc)_2O$ (0.62 mL, 1.2 equiv) and DMAP (0.14 g, 0.5 equiv)

in DCM (24.0 mL).

R_f = 0.30 (EtOAc/Hex = 1/40), mp.: 165.9-166.9 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.77 (d, J = 8.8 Hz, 1H), 7.46-7.53 (m, 3H), 7.23 (dd, J = 7.0, 1.2 Hz, 2H), 7.11 (dd, J = 9.0, 1.6 Hz, 1H), 6.07 (d, J = 1.3 Hz, 1H), 2.79 (s, 3H), 1.67 (s, 9H).

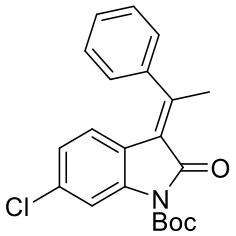
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.5, 158.6, 149.4, 142.3, 136.6, 129.5, 129.0, 128.7, 128.0, 126.0, 124.4, 122.7, 121.7, 115.5, 84.3, 28.2, 23.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2979, 1780, 1746, 1624, 1466, 1369, 1338, 1297, 1271, 1155, 1118, 819, 768, 563.

HRMS (EI) for $C_{21}H_{20}{}^{35}ClNO_3$, [M] (369.1132) found: 369.1130 (100).

HRMS (EI) for $C_{21}H_{20}{}^{37}ClNO_3$, [M] (371.1102) found: 371.1103 (42).

tert-Butyl (_E_)-6-chloro-2-oxo-3-(1-phenylethylidene)indoline-1-carboxylate (2l)



Following the GP-D, **2l** was obtained as a yellow solid (0.295 g, 39%) from **S2l** (0.73 g, 2.0 mmol), $(Boc)_2O$ (0.6 mL, 1.2 equiv) and DMAP (0.12 g, 0.5 equiv) in DCM (22.0 mL).

R_f = 0.32 (EtOAc/Hex = 1/40), mp.: 114.7-115.9 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.89 (d, J = 2.0 Hz, 1H), 7.43-7.51 (m, 3H), 7.23 (dd, J = 7.8, 1.7 Hz, 2H), 6.70 (dd, J = 8.5, 2.0 Hz, 1H), 6.07 (d, J = 8.5 Hz, 1H), 2.77 (s, 3H), 1.68 (s, 9H).

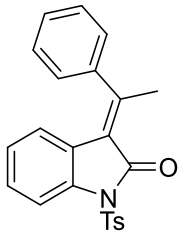
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.6, 157.2, 149.3, 142.6, 138.9, 133.9, 129.4, 128.7, 126.2, 123.38, 123.37, 121.7, 121.4, 115.0, 84.5, 28.1, 23.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2979, 2927, 1781, 1744, 1728, 1599, 1468, 1427, 1369, 1347, 1301, 1277, 1248, 1152, 1114, 818, 763, 547.

HRMS (EI) for $C_{21}H_{20}{}^{35}ClNO_3$, [M] (369.1132) found: 369.1130 (100).

HRMS (EI) for $C_{21}H_{20}{}^{37}ClNO_3$, [M] (371.1102) found: 371.1103 (37).

(_E_)-3-(1-Phenylethylidene)-1-tosylindolin-2-one (2m)



A dry argon-flushed 25 mL round-bottomed flask equipped with a magnetic stir bar was charged with **S2a** (0.470 g, 2.0 mmol) in anhydrous THF (22.0 mL), then NaH (72.0 mg, 1.5 equiv) and TsCl (1.16 g, 3.0 equiv) were added to the flask with iced-bath and stirred for 12 hours. Afterwards, the reaction mixture was concentrated *in vacuo* and the residue was purified by silica gel flash chromatography (EtOAc/Hex = 1:5) to obtain **2m** as a yellow solid (0.236 g, 30%).

R_f = 0.4 (EtOAc/Hex = 1/5), mp.: 196.8-197.1 °C.

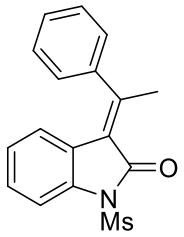
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.03 (d, J = 8.1 Hz, 2H), 7.95 (d, J = 8.2 Hz, 1H), 7.45-7.41 (m, 3H), 7.33 (d, J = 7.8 Hz, 2H), 7.16-7.20 (m, 3H), 6.73 (t, J = 7.7 Hz, 1H), 6.17 (d, J = 8.0 Hz, 1H), 2.69 (s, 3H), 2.42 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 166.0, 158.0, 145.3, 142.3, 137.5, 135.8, 129.7, 129.3, 128.7, 128.7, 127.9, 126.0, 123.6, 123.2, 123.0, 121.5, 113.0, 23.7, 21.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2909, 1736, 1618, 1376, 1243, 1179.

HRMS (ESI) for $C_{23}H_{20}NO_3S$, $[M+H]^+$ (390.1158) found: 390.1164.

(*E*)-1-(Methylsulfonyl)-3-(1-phenylethylidene)indolin-2-one (2n)



A dry argon-flushed 25 mL round-bottomed flask equipped with a magnetic stir bar was charged with **S2a** (0.470 g, 2.0 mmol) in anhydrous THF (22.0 mL) and then NaH (72.0 mg, 1.5 equiv) and MsCl (312.7 μL, 2.0 equiv) were added to the flask with iced-bath and stirred overnight. Then the reaction mixture was concentrated *in vacuo* and the residue was purified by silica gel flash chromatography (Hexanes/EtOAc = 1:7) to afford **2n** as a yellow solid (0.820 g, 13%).

R_f = 0.375 (EtOAc/Hex = 1/7), mp.: 137.4-138.0 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.78 (d, J = 8.3 Hz, 1H), 7.53-7.45 (m, 3H), 7.26 (dd, J = 7.6, 2.1 Hz, 2H), 7.15 (t, J = 7.9 Hz, 1H), 6.76 (t, J = 7.7 Hz, 1H), 6.23 (d,

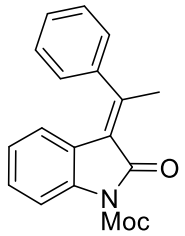
J = 7.8 Hz, 1H), 3.48 (s, 3H), 2.79 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 167.0, 158.9, 142.2, 137.2, 129.4, 128.9, 128.7, 126.0, 123.8, 123.0, 122.9, 113.0, 41.8, 23.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3438, 3048, 3022, 2939, 1944, 1911, 1876, 1804, 1732, 1624, 1560, 1491, 1457, 1441, 1356, 1324, 1158, 743, 701.

HRMS (ESI) for $C_{17}H_{16}NO_3S$, $[M+H]^+$ (314.0845) found: 314.0853.

(*E*)-Methyl-2-oxo-3-(1-phenylethylidene)indoline-1-carboxylate (2o):



To a solution of **S2a** (0.235 g, 1.0 mmol) in CH_3CN (7.0 mL) was added a solution of $(Moc)_2O$ (0.2 mL, 2.0 equiv) in CH_3CN (3.0 mL) and DMAP (36.7 mg, 0.3 equiv) and stirred for 4 hours. Then the reaction mixture was quenched with 2N HCl (5 mL) and extracted with dichloromethane (3 x 5 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered and then concentrated *in vacuo* and the residue was purified by silica gel flash chromatography (EtOAc/Hex = 1:15) to obtain **2o** as a yellow solid (0.161 g, 55%).

R_f = 0.4 (EtOAc/Hex = 1/5), mp.: 138.9-139.5 °C.

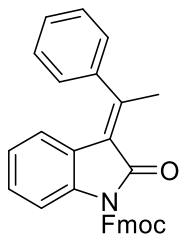
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 7.90 (d, *J* = 8.2 Hz, 1H), 7.48-7.43 (m, 3H), 7.24 (d, *J* = 7.2 Hz, 2H), 7.14 (t, *J* = 7.8 Hz, 1H), 6.73 (t, *J* = 7.6 Hz, 1H), 6.19 (d, *J* = 7.8 Hz, 1H), 4.03 (s, 3H), 2.77 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 165.6, 157.0, 151.6, 142.5, 137.6, 129.1, 128.5, 128.2, 126.1, 123.4, 123.0, 122.4, 122.0, 114.4, 53.5, 23.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2954, 1736, 1618, 1303, 1247.

HRMS (ESI) for $C_{18}H_{15}NO_3Na$, $[M+Na]^+$ (316.0944) found: 316.0952.

(*E*)-(9*H*-Fluoren-9-yl)methyl-2-oxo-3-(1-phenylethylidene)indoline-1-carboxylate (2p)



A dry and argon-flushed 25 mL round-bottomed flask equipped with a magnetic stir bar was charged with **S2a** (0.470 g, 2.0 mmol) in anhydrous THF (22.0 mL) and then NaH (72.0 mg, 1.5 equiv) and FmocCl (791.9 mg, 1.5 equiv) were added to the flask with iced-bath and stirred overnight. Then the reaction mixture was concentrated *in vacuo* and the residue was purified by silica gel flash chromatography (EtOAc/Hex = 1:7) to obtain **2p** as a yellow solid (0.532 g, 58%).

R_f = 0.5 (EtOAc/Hex = 1/7), mp.: 173.6-174.4 °C.

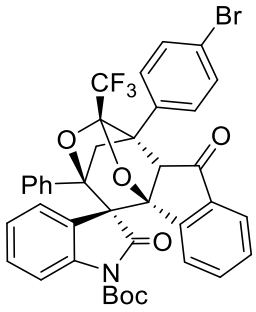
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 7.82 (d, J = 7.4 Hz, 2H), 7.79 (d, J = 7.5 Hz, 2H), 7.62 (d, J = 8.4 Hz, 1H), 7.52-7.46 (m, 3H), 7.43 (t, J = 7.3 Hz, 2H), 7.35 (td, J = 7.5, 1.3 Hz, 2H), 7.28 (dd, J = 7.8, 1.5 Hz, 2H), 7.07 (td, J = 8.4, 0.9 Hz, 1H), 6.73 (td, J = 7.7, 0.9 Hz, 1H), 6.19 (d, J = 7.5 Hz, 1H), 4.73 (d, J = 7.0 Hz, 2H), 4.46 (t, J = 7.0, 1H), 2.84 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 165.8, 157.3, 151.2, 143.5, 142.8, 141.4, 137.7, 129.4, 128.6, 128.4, 127.9, 127.3, 126.3, 125.4, 123.6, 123.2, 122.7, 122.2, 120.0, 114.6, 68.9, 46.7, 23.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3464, 3054, 3026, 2972, 2952, 2928, 2893, 1952, 1904, 1882, 1782, 1734, 1623, 1601, 1463, 1451, 1383, 758, 702.

HRMS (ESI) for $C_{31}H_{23}NO_3Na$, $[M+Na]^+$ (480.1570) found: 480.1580.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3aa)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 8 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc /Hex = 1/15), **3aa** was obtained as a white solid (60.3 mg, 81%).

R_f = 0.50 (/Hex = 1/5), mp.: 195.7-196.4 °C, $[\alpha]_D^{23}$ = 1.1 (c = 0.5 in CH_2Cl_2),

HPLC: 81% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00

mL/min, λ= 246 nm, t_{minor} = 5.15 min, t_{major} = 7.30 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.17 (d, J = 7.5, 1.3 Hz, 1H), 7.76 (d, J = 7.5 Hz, 1H), 7.58 (d, J = 7.7, 0.7 Hz, 1H), 7.54-7.56 (d, 2H), 7.49-7.50 (d, 2H), 7.46 (td, J = 7.5, 0.6 Hz, 1H), 7.38 (td, J = 7.8, 1.4 Hz, 1H), 7.31 (td, J = 7.6, 0.9 Hz, 1H), 7.29 (td, J = 7.6, 1.0 Hz, 1H), 7.17 (m, 1H), 7.07-7.14 (m, 4H), 6.17 (d, J = 7.6 Hz, 1H), 4.67 (s, 1H), 3.86 (d, J = 12.0 Hz, 1H), 2.78 (d, J = 12.4 Hz, 1H), 1.54 (s, 9H).

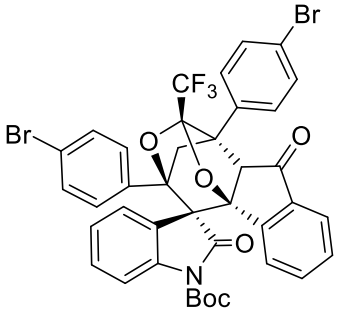
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 197.3, 172.3, 148.2, 143.8, 139.3, 137.5, 135.4, 134.9, 132.2, 131.5, 131.2 (q, J = 2.1 Hz), 130.8, 129.8, 128.9, 128.7, 127.8, 125.7, 125.6, 125.1, 124.4, 122.7, 120.6 (q, J = 282.2 Hz), 114.5, 113.5 (q, J = 34.5 Hz), 90.7, 89.3, 85.2, 64.9, 62.9, 56.8, 47.0, 28.1.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2984, 1793, 1736, 1605, 1466, 1151, 1079, 761.

HRMS (ESI) for $C_{39}H_{29}{}^{79}BrF_3NO_6Na$, $[M+Na]^+$ (766.1023) found: 766.1027.

HRMS (ESI) for $C_{39}H_{29}{}^{81}BrF_3NO_6Na$, $[M+Na]^+$ (768.1002) found: 768.1008.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-2',3a'-bis(4-bromophenyl)-2,4'-dioxo-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ab)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2b** (41.4 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 12 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ab** was obtained as a white solid (73.2 mg, 86%).

R_f = 0.52 (EtOAc/Hex = 1/5), mp.: 207.5-208.8 °C, $[\alpha]_D^{25}$ = 25.3 (c = 0.5 in CH_2Cl_2), **HPLC**: 84% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 5.52 min, t_{major} = 8.24 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.14 (d, J = 7.6 Hz, 1H), 7.75 (d, J = 7.6 Hz, 1H), 7.60 (d, J = 7.6 Hz, 1H), 7.60 (d, J = 8.2 Hz, 2H), 7.39-7.48 (m, 4H), 7.32 (t, J = 7.6 Hz, 1H), 7.29 (t, J = 7.5 Hz, 1H), 7.24 (d, J = 9.1 Hz, 2H), 7.00 (d, J = 8.8 Hz, 2H), 6.13 (d, J = 7.5 Hz, 1H), 4.62 (s, 1H), 3.82 (d, J = 12.0 Hz, 1H), 2.73 (d, J = 12.0

Hz, 1H), 1.55 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 196.9, 172.1, 147.8, 143.4, 139.1, 137.3, 134.8, 134.4, 131.8, 131.40, 131.00, 130.99, 130.8, 130.7, 130.0, 128.7, 127.3, 125.14, 125.12, 125.05, 124.5, 124.2, 122.9, 122.6, 120.3 (q, J = 282.0 Hz), 114.6, 113.4 (q, J = 34.5 Hz), 90.5, 88.7, 85.4, 64.7, 62.6, 56.5, 46.8, 28.0.

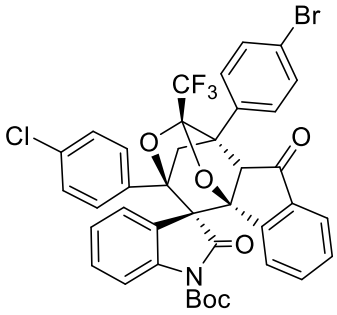
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3107, 2945, 2839, 1787, 1736, 1471, 1395, 1342, 1309, 1248, 1187, 1150, 077, 1048, 823, 761, 614, 518.

HRMS (ESI) for $C_{39}H_{28}NO_6{}^{79}Br_2F_3Na$, $[M+Na]^+$ (844.0128) found: 844.0132 (50).

HRMS (ESI) for $C_{39}H_{28}NO_6{}^{79}Br^{81}B_rF_3Na$, $[M+Na]^+$ (846.0107) found: 846.0107 (100).

HRMS (ESI) for $C_{39}H_{28}NO_6{}^{81}Br_2F_3Na$, $[M+Na]^+$ (848.0087) found: 848.0099 (55).

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2'-(4-chlorophenyl)-2,4'-dioxo-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ac)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2c** (36.9 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 14 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ac** was obtained as a white solid (71.0 mg, 88%).

R_f = 0.60 (EtOAc/Hex = 1/5), mp.: 194.3-195.4 °C, $[\alpha]_D^{25}$ = 38.0 (c = 0.5 in CH_2Cl_2), **HPLC**: 82% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 5.71 min, t_{major} = 8.57 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.15 (d, J = 7.6 Hz, 1H), 7.75 (d, J = 7.9 Hz, 1H), 7.61 (d, J = 8.4 Hz, 1H), 7.54-7.56 (m, 2H), 7.40-7.49 (m, 4H), 7.32 (pt, J = 7.3 Hz, 1H), 7.29 (pt, J = 7.1 Hz, 1H), 7.04-7.10 (m, 4H), 6.15 (d, J = 7.6 Hz, 1H), 4.64 (s, 1H), 3.84 (d, J = 11.9 Hz, 1H), 2.74 (d, J = 11.9 Hz, 1H), 1.56 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 196.9, 172.0, 147.8, 143.4, 139.1, 137.3, 134.8, 134.6, 133.9, 131.8, 131.4, 131.0, 130.6, 129.9, 128.7, 127.8, 125.1, 125.14,

125.09, 125.01, 124.1, 122.6, 120.2 (q, J = 282.0 Hz), 114.5, 113.4 (q, J = 34.6 Hz), 90.5, 88.7, 85.3, 64.7, 62.5, 56.5, 46.8, 27.9.

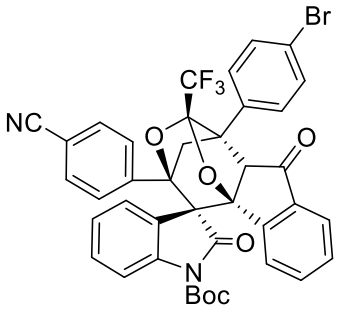
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2975, 2932, 1786, 1738, 1605, 1495, 1478, 1466, 1371, 1342, 1312, 1289, 1250, 1187, 1150, 1078, 1050, 914, 880, 824, 761, 613, 519.

HRMS (ESI) for $C_{39}H_{28}NO_6{}^{35}Cl^{79}BrF_3Na$, $[M+Na]^+$ (800.0633) found: 800.0637 (71).

HRMS (ESI) for $C_{39}H_{28}NO_6{}^{35}Cl^{81}BrF_3Na$, $[M+Na]^+$ (802.0612) found: 802.0626 (100).

HRMS (ESI) for $C_{39}H_{28}NO_6{}^{37}Cl^{81}BrF_3Na$, $[M+Na]^+$ (804.0583) found: 804.0614 (29).

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2'-(4-cyanophenyl)-2,4'-dioxo-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ad)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2d** (36.0 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 12 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ad** was obtained as a white solid (51.8 mg, 65%).

R_f = 0.40 (EtOAc/Hex = 1/5), mp.: 173.1-174.6 °C, $[\alpha]_D^{25}$ = 48.9 (c = 0.5 in CH_2Cl_2),

HPLC: 98% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 90:10, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 9.16 min, t_{major} = 18.93 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.14 (d, J = 7.6 Hz, 1H), 7.76 (d, J = 7.6 Hz, 1H), 7.67 (d, J = 8.1 Hz, 1H), 7.55 (d, J = 8.7 Hz, 2H), 7.45-7.49 (m, 3H), 7.42 (t, J = 7.9 Hz, 1H), 7.29-7.35 (m, 4H), 7.05 (d, J = 7.8 Hz, 1H), 6.97 (t, J = 7.8 Hz, 1H), 6.17 (d, J = 8.0 Hz, 1H), 4.65 (s, 1H), 3.84 (d, J = 11.9 Hz, 1H), 2.75 (d, J = 12.0 Hz, 1H), 1.57 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 197.0, 171.8, 148.0, 143.4, 139.1, 137.5, 137.3, 134.9, 131.8, 131.7, 131.4, 131.01, 131.00, 130.7, 130.0, 129.2, 128.7, 125.14, 125.08, 125.06, 124.3, 124.2, 122.6, 121.9, 120.3 (q, J = 282.1 Hz), 114.4, 113.3 (q, J = 34.7 Hz), 90.6, 88.4, 85.4, 64.7, 62.5, 56.5, 46.7, 28.0.

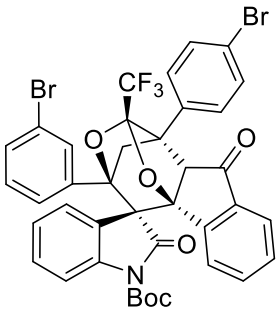
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3081, 2982, 2936, 2232, 1786, 1739, 1605, 1480, 1371, 1342, 1311,

1289, 1252, 1187, 1150, 1077, 1050, 833, 767, 614.

HRMS (ESI) for $C_{40}H_{28}N_2O_6F_3Na^{79}Br$, $[M+Na]^+$ (791.0975) found: 791.0981 (93).

HRMS (ESI) for $C_{40}H_{28}N_2O_6F_3Na^{81}Br$, $[M+Na]^+$ (793.0955) found: 793.0969 (100).

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'S,9a'*R*)-2'-(3-bromophenyl)-3a'-(4-bromophenyl)-2,4'-dioxo-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ae)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2e** (41.4 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 9 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ae** was obtained as a white solid (54.5 mg, 64%).

R_f = 0.52 (EtOAc/Hex = 1/5), mp.: 189.5-192.1 °C, $[\alpha]_D^{25}$ = 45.6 (*c* = 0.5 in CH_2Cl_2), **HPLC**: 82% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 5.14 min, t_{major} = 7.11 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.14 (d, *J* = 7.6 Hz, 1H), 7.76 (d, *J* = 7.6 Hz, 1H), 7.66 (d, *J* = 8.1 Hz, 1H), 7.55 (d, *J* = 8.7 Hz, 2H), 7.44-7.49 (m, 3H), 7.42 (t, *J* = 9.2 Hz, 1H), 7.25-7.39 (m, 4H), 7.05 d, *J* = 7.8 Hz, 1H), 7.0 (t, *J* = 7.8 Hz, 1H), 6.17 (d, *J* = 8.0 Hz, 1H), 4.65 (s, 1H), 3.84 (d, *J* = 11.9 Hz, 1H), 2.75 (d, *J* = 11.9 Hz, 1H), 1.57 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.0, 171.8, 148.0, 143.4, 139.1, 137.5, 137.3, 134.9, 131.8, 131.7, 131.4, 131.0, 131.00, 130.69, 130.00, 129.2, 128.7, 125.2, 125.08, 125.06, 124.5, 124.3, 124.2, 121.9, 121.7, 120.3 (q, *J* = 282.1 Hz), 114.4, 113.3 (q, *J* = 34.7 Hz), 90.6, 88.4, 85.4, 64.7, 62.5, 56.5, 46.7, 28.0.

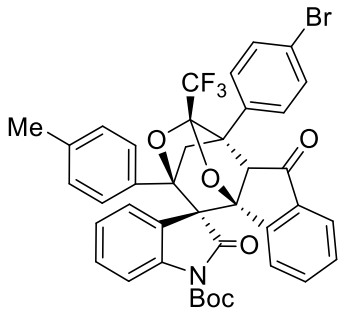
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3085, 2984, 2933, 1787, 1738, 1605, 1495, 1478, 1466, 1395, 1371, 1343, 289, 1255, 1204, 1187, 1150, 1078, 1050, 1035, 881, 837, 787, 761, 747, 519.

HRMS (ESI) for $C_{39}H_{28}NO_6^{79}Br_2F_3Na$, $[M+Na]^+$ (844.0128) found: 844.0135 (49).

HRMS (ESI) for $C_{39}H_{28}NO_6^{79}Br^{81}B_rF_3Na$, $[M+Na]^+$ (846.0107) found: 846.0117 (100).

HRMS (ESI) for $C_{39}H_{28}NO_6{}^{81}Br_2F_3Na$, $[M+Na]^+$ (848.0087) found: 848.0111 (57).

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2,4'-dioxo-2'-(p-tolyl)-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ag)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2g** (34.9 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 12 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ag** was obtained as a white solid (58.5 mg, 73%).

R_f = 0.55 (EtOAc/Hex = 1/5), mp.: 178.8-179.9 °C, $[\alpha]_D^{25}$ = 38.2 (c = 0.5 in CH_2Cl_2),

HPLC: 71% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 5.49 min, t_{major} = 7.01 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.16 (d, J = 7.5 Hz, 1H), 7.75 (d, J = 7.6 Hz, 1H), 7.60 (d, J = 8.1 Hz, 1H), 7.53-7.56 (m, 2H), 7.44-7.49 (m, 3H), 7.39 (t, J = 7.8 Hz, 1H), 7.31 (t, J = 7.6 Hz, 1H), 7.28 (t, J = 7.4 Hz, 1H), 6.98 (d, J = 8.0 Hz, 2H), 6.90 (d, J = 8.4 Hz, 2H), 6.14 (d, J = 7.7 Hz, 1H), 4.65 (s, 1H), 3.83 (d, J = 11.9 Hz, 1H), 2.74 (d, J = 11.9 Hz, 1H), 2.22, (s, 3H), 1.54 (s, 9H).

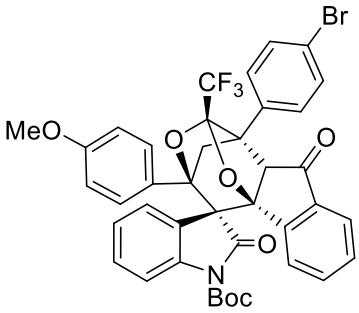
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 197.2, 172.3, 148.0, 143.7, 139.2, 138.3, 137.4, 134.7, 132.5, 132.1, 131.3, 131.1, 130.6, 129.6, 128.7, 128.3, 125.6, 125.4, 124.96, 124.95, 124.2, 122.5, 120.4 (q, J = 281.9 Hz), 114.4, 113.4 (q, J = 34.7 Hz), 90.5, 89.1, 84.9, 64.7, 62.7, 56.7, 47.0, 27.9, 21.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3059, 2980, 2930, 1787, 1736, 1605, 1466, 1371, 1343, 1310, 1290, 1255, 1184, 1150, 1077, 1050, 871, 758, 615.

HRMS (ESI) for $C_{40}H_{31}NO_6F_3Na^{79}Br$, $[M+Na]^+$ (780.1179) found: 780.1184 (92).

HRMS (ESI) for $C_{40}H_{31}NO_6F_3Na^{81}Br$, $[M+Na]^+$ (782.1159) found: 782.1173 (100).

***tert*-Butyl(2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2'-(4-methoxyphenyl)-2,4'-dioxo-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ah)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2h** (36.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 9 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ah** was obtained as a white solid (65.0 mg, 81%).

R_f = 0.42 (EtOAc/Hex = 1/5), mp.: 148.9-149.7 °C, $[\alpha]_D^{25}$ = 33.9 (*c* = 0.5 in CH_2Cl_2).

HPLC: 68% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 6.89 min, t_{major} = 9.01 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.15 (d, *J* = 7.5 Hz, 1H), 7.7 (d, *J* = 8.0 Hz, 1H), 7.6 (d, *J* = 8.0 Hz, 1H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.48 (d, *J* = 8.4 Hz, 2H), 7.45 (t, *J* = 7.7 Hz, 1H), 7.39 (t, *J* = 8.0 Hz, 1H), 7.31 (d, *J* = 7.5 Hz, 1H), 7.28 (t, *J* = 7.5 Hz, 1H), 7.01 (d, *J* = 8.8 Hz, 2H), 6.61 (d, *J* = 8.8 Hz, 2H), 6.15 (d, *J* = 8.0 Hz, 1H), 4.63 (s, 1H), 3.84 (d, *J* = 12.0 Hz, 1H), 3.70 (s, 3H), 2.73 (d, *J* = 12.0 Hz, 1H), 1.55 (s, 9H).

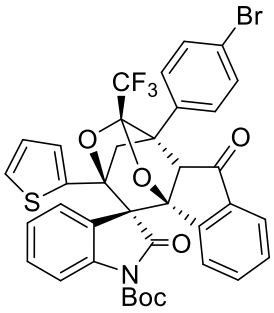
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.2, 172.3, 159.5, 148.1, 143.7, 139.3, 137.4, 134.8, 132.2, 131.3, 131.1, 130.6, 129.7, 128.7, 127.7, 127.0, 125.7, 124.99, 124.97, 124.3, 131.2 (q, *J* = 2.1 Hz), 130.8, 129.8, 128.9, 128.7, 127.8, 125.7, 125.6, 125.1, 124.4, 122.5, 120.4 (q, *J* = 282.2 Hz), 114.5, 113.5 (q, *J* = 33.9 Hz), 113.0, 90.5, 89.0, 85.0, 64.8, 62.8, 56.9, 55.2, 47.2, 28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3072, 2934, 2852, 1785, 1736, 1606, 1517, 1495, 1478, 1466, 1342, 1305, 1254, 1182, 1150, 1077, 834, 761, 612.

HRMS (ESI) for $C_{40}H_{31}NO_7F_3Na^{79}Br$, $[M+Na]^+$ (796.1128) found: 796.1125 (97).

HRMS (ESI) for $C_{40}H_{31}NO_7F_3Na^{81}Br$, $[M+Na]^+$ (798.1108) found: 798.1113 (100).

***tert*-Butyl (2'*S*,3*S*,3a'*S*,3b'*R*,8b'*S*,9a'*S*)-3a'-(4-bromophenyl)-2,4'-dioxo-2'-(thiophen-2-yl)-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ai)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2i** (34.1 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 8 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ai** was obtained as a white solid (68.3 mg, 91%).

R_f = 0.47 (EtOAc/Hex = 1/5), mp.: 197.2-198.5 °C, $[\alpha]_D^{25}$ = 20.7 (*c* = 0.5 in CH_2Cl_2),

HPLC: 34% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 98:2, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 7.59 min, t_{major} = 12.56 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.16 (d, *J* = 7.3 Hz, 1H), 7.75 (d, *J* = 7.6 Hz, 1H), 7.72 (d, *J* = 8.2 Hz, 1H), 7.56 (d, *J* = 8.7 Hz, 2H), 7.45-7.50 (m, 2H), 7.33 (t, *J* = 7.6 Hz, 2H), 7.07-7.26 (m, 5H), 6.17 (d, *J* = 7.7 Hz, 1H), 4.58 (s, 1H), 3.86 (d, *J* = 11.9 Hz, 1H), 2.89 (d, *J* = 12.4 Hz, 1H), 1.55 (s, 9H).

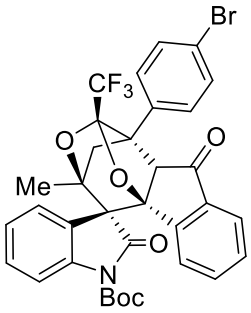
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 196.9, 171.7, 148.1, 143.4, 139.7, 137.3, 137.2, 134.8, 131.8, 131.4, 131.04, 131.02, 130.7, 130.0, 128.9, 126.3, 126.0, 125.6, 125.0, 124.2, 120.2 (q, *J* = 281.9 Hz), 114.6, 113.7 (q, *J* = 34.7 Hz), 90.5, 87.6, 85.1, 64.8, 62.3, 57.0, 48.2, 28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3076, 2980, 2936, 1787, 1736, 1605, 1466, 1397, 1342, 1312, 1289, 1253, 1186, 1150, 1076, 1033, 837, 761, 704, 633, 519.

HRMS (ESI) for $C_{37}H_{27}NO_6F_3NaS^{79}Br$, $[M+Na]^+$ (772.0587) found: 772.0590 (91).

HRMS (ESI) for $C_{37}H_{27}NO_6F_3NaS^{81}Br$, $[M+Na]^+$ (774.0566) found: 774.0573 (100).

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3aj)**



Following the GP-E, **1a** (163.7 mg, 0.4 mmol), **2j** (109.3 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (2.0 mL) and stirred for 24 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:5), **3aj** was obtained as a purple solid (71.0 mg, 26%).

R_f = 0.37 (EtOAc/Hex = 1/5), mp.: 271.0-272.0 °C, $[\alpha]_D^{22}$ = 8.2 (*c* = 0.5 in $CHCl_3$),

HPLC: 34% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 241 nm, t_{minor} = 5.65 min, t_{major} = 10.93 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.05 (d, *J* = 7.7 Hz, 1H), 8.01 (d, *J* = 8.2 Hz, 1H), 7.72 (d, *J* = 7.5 Hz, 1H), 7.61 – 7.52 (m, 3H), 7.48-7.41 (m, 3H), 7.37 (d, *J* = 8.0 Hz, 1H), 7.29 (t, *J* = 7.7 Hz, 1H), 6.11 (d, *J* = 7.7 Hz, 1H), 4.37 (s, 1H), 3.40 (d, *J* = 11.9 Hz, 1H), 2.51 (d, *J* = 12.0 Hz, 1H), 1.60 (s, 9H), 1.19 (s, 3H).

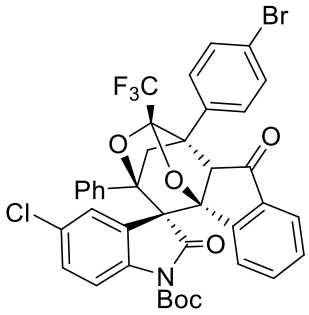
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.1, 171.9, 148.4, 143.5, 139.8, 137.4, 134.8, 132.1, 131.2, 131.0, 129.9, 128.6, 126.1, 125.6, 125.0, 124.0, 122.4, 120.3 (q, *J* = 281.8 Hz), 114.8, 113.4 (q, *J* = 34.3 Hz), 90.2, 86.0, 85.6, 65.0, 62.2, 55.5, 47.9, 28.0, 19.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2985, 2936, 1785, 1736, 1605, 1466, 1371, 1342, 1309, 1289, 1253, 1179, 1149, 1086, 1054, 838, 759, 512.

HRMS (ESI) for $C_{34}H_{27}NO_6{}^{79}BrF_3Na$, $[M+Na]^+$ (704.0866) found: 704.0872 (91).

HRMS (ESI) for $C_{34}H_{27}NO_6{}^{81}BrF_3Na$, $[M+Na]^+$ (706.0846) found: 774.0877 (100).

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-5-chloro-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ak)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2k** (36.9 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 36 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ak** was obtained as a white solid (67.0 mg, 86%).

R_f =0.45 (EtOAc/Hex = 1/5), mp.: 217.8-217.9 °C, $[\alpha]_D^{25}$ = 33.0 (*c* = 0.5 in CH_2Cl_2),

HPLC: 65% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 98:2, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 7.57 min, t_{major} = 10.78 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.16 (s, 1H), 7.76 (d, *J* = 7.5 Hz, 1H), 7.46-7.58 (m, 6H), 7.37 (dd, *J* = 9.9, 0.9 Hz, 1H), 7.33 (t, *J* = 7.6 Hz, 1H), 7.19-7.20 (m, 1H), 7.12-7.15 (m, 4H), 6.25 (d, *J* = 7.5 Hz, 1H), 4.65 (s, 1H), 3.85 (d, *J* = 12.4 Hz, 1H), 2.79 (d, *J* = 12.4 Hz, 1H), 1.54 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 196.8, 171.5, 147.7, 143.2, 137.7, 137.3, 134.9, 134.9, 131.8, 131.5, 131.0, 130.6, 130.5, 129.7, 128.7, 128.7, 127.8, 127.2, 125.4, 125.1, 124.1, 122.6, 120.2 (q, *J* = 281.7 Hz), 115.6, 113.4 (q, *J* = 34.5 Hz), 90.3, 89.1, 85.4, 64.6, 62.7, 56.8, 46.9, 28.0.

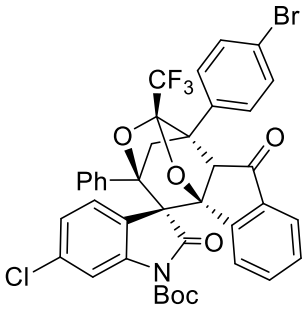
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3072, 2983, 2927, 1788, 1736, 1604, 1497, 1473, 1447, 1395, 1371, 1334, 1297, 1248, 1189, 1151, 1076, 821, 763, 520.

HRMS (ESI) for $C_{39}H_{28}NO_6Na^{35}Cl^{79}BrF_3$, $[M+Na]^+$ (800.0633) found: 800.0637 (71).

HRMS (ESI) for $C_{39}H_{28}NO_6Na^{35}Cl^{81}BrF_3$, $[M+Na]^+$ (802.0612) found: 802.0621 (100).

HRMS (ESI) for $C_{39}H_{28}NO_6Na^{37}Cl^{81}BrF_3$, $[M+Na]^+$ (804.0583) found: 804.0610 (31).

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-6-chloro-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3al)**



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2l** (36.9 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 8 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3al** was obtained as a white solid (68.5 mg, 88%).

R_f = 0.52 (EtOAc/Hex = 1/5), mp.: 216.2-217.4 °C, $[\alpha]_D^{25}$ = 47.1 (*c* = 0.5 in CH_2Cl_2), **HPLC**: 81% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 98:2, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 6.50 min, t_{major} = 11.46 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.09 (d, *J* = 8.3 Hz, 1H), 7.76 (d, *J* = 7.6 Hz, 1H), 7.69 (d, *J* = 1.4 Hz, 1H), 7.54 (d, *J* = 8.6 Hz, 2H), 7.45-7.49 (m, 3H), 7.33 (t, *J* = 7.7 Hz, 1H), 7.31 (dd, *J* = 7.9, 0.8 Hz, 1H), 7.19-7.23 (m, 1H), 7.14 (t, *J* = 7.6 Hz, 2H), 7.10 (d, *J* = 7.5 Hz, 2H), 6.24 (d, *J* = 7.7 Hz, 1H), 4.63 (s, 1H), 3.83 (d, *J* = 12.4 Hz, 1H), 2.78 (d, *J* = 11.9 Hz, 1H), 1.55 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 196.8, 171.7, 147.7, 143.3, 139.9, 137.2, 135.7, 135.0, 131.8, 131.4, 131.0, 130.6, 129.4, 128.7, 127.7, 125.4, 125.08, 125.05, 124.0, 123.9, 122.5, 120.2 (q, *J* = 281.9 Hz), 115.1, 113.3 (q, *J* = 34.6 Hz), 90.4, 85.5, 64.6, 62.7, 56.6, 46.9, 27.9.

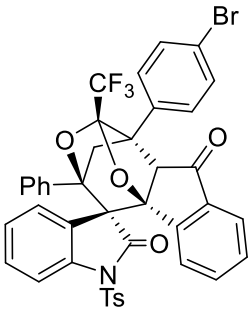
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3085, 2980, 2940, 1791, 1739, 1604, 1498, 1474, 1454, 1395, 1371, 1338, 1287, 1248, 1188, 1149, 1078, 1034, 840, 764, 616, 520.

HRMS (ESI) for $C_{39}H_{27}NO_6F_3{}^{35}Cl^{79}Br$, $[M-H]^+$ (776.0668) found: 776.0662 (74).

HRMS (ESI) for $C_{39}H_{27}NO_6F_3{}^{35}Cl^{81}Br$, $[M-H]^+$ (778.0647) found: 778.0656 (100).

HRMS (ESI) for $C_{39}H_{27}NO_6F_3{}^{37}Cl^{81}Br$, $[M-H]^+$ (780.0617) found: 780.0680 (29).

(2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-Bromophenyl)-2'-phenyl-1-tosyl-9a'-(trifluoromethyl)-2',3',3a',9a'-tetrahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-2,4'(3b'*H*)-dione (3am)



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2m** (38.9 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 40 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:5), **3am** was obtained as a yellow solid (48.7 mg, 61%).

R_f = 0.2 (EtOAc/Hex = 1/5), mp.: 268.1-268.6 °C, $[\alpha]_D^{26}$ = 26.2 (*c* = 0.5 in CH_2Cl_2),

HPLC: 14% ee, Chiralpak IB column, *n*-hexane/*i*-PrOH = 80:20, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 7.68 min, t_{major} = 10.24 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.13 (d, *J* = 7.5 Hz, 1H), 7.79 (d, *J* = 7.9 Hz, 1H), 7.68 (d, *J* = 8.4 Hz, 3H), 7.53 (d, *J* = 8.8 Hz, 2H), 7.44-7.37 (m, 4H), 7.33 (t, *J* = 7.0 Hz, 1H), 7.13-7.05 (m, 4H), 6.98-6.96 (m, 4H), 5.88 (d, *J* = 7.9 Hz, 1H), 4.46 (s, 1H), 3.75 (d, *J* = 11.9 Hz, 1H), 2.72 (d, *J* = 12.3 Hz, 1H), 2.37 (s, 3H).

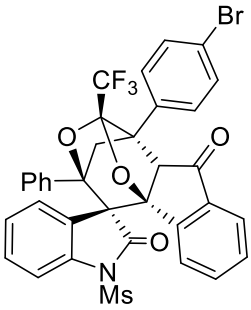
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 196.7, 172.0, 145.8, 143.0, 138.7, 137.2, 135.2, 134.6, 134.5, 131.8, 131.0, 130.9, 130.7, 130.2, 129.6, 129.3, 128.4, 128.0, 127.8, 125.7, 125.4, 125.0, 123.6, 122.6, 120.3 (q, *J* = 282.1 Hz), 113.4 (q, *J* = 34.4 Hz), 113.0, 90.5, 88.8, 64.6, 62.4, 56.6, 47.3, 21.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3069, 2934, 1732, 1603, 1464, 1388, 1237, 1192, 1091, 1077, 1032, 571.

HRMS (ESI) for $C_{41}H_{28}NO_6F_3S^{79}Br$, $[M+H]^+$ (798.0767) found: 798.0772.

HRMS (ESI) for $C_{41}H_{28}NO_6F_3S^{81}Br$, $[M+H]^+$ (800.0747) found: 800.0757.

(2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-Bromophenyl)-1-(methylsulfonyl)-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',9a'-tetrahydrospiro[indoline-3,10'-[2,8*b*]methano furo[2,3-*b*]indeno[2,1-*d*]furan]-2,4'(3b'*H*)-dione (3an)



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2n** (31.3 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 40 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc /Hex = 1/15), **3an** was obtained as a yellow solid (66.5 mg, 92%).

R_f = 0.15 (EtOAc/Hex = 1/5), mp.: 168.8-169.4 °C, $[\alpha]_D^{26}$ = 16.3 (*c* = 0.5 in CH_2Cl_2), **HPLC**: 80% ee, Chiralpak IB column, *n*-hexane/*i*-PrOH = 80:20, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 38.00 min, t_{major} = 22.33 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.22 (d, *J* = 7.1 Hz, 1H), 7.88 (d, *J* = 7.5 Hz, 1H), 7.61-7.47 (m, 6H), 7.43 (td, *J* = 7.8, 1.3 Hz, 1H), 7.38 (t, *J* = 7.5 Hz, 1H), 7.33 (t, *J* = 7.5 Hz, 1H), 7.24-7.21 (m, 1H), 7.18-7.13 (m, 4H), 6.16 (d, *J* = 7.5 Hz, 1H), 4.49 (s, 1H), 3.86 (d, *J* = 11.9 Hz, 1H), 3.01 (s, 3H), 2.85 (d, *J* = 12.4, 1H).

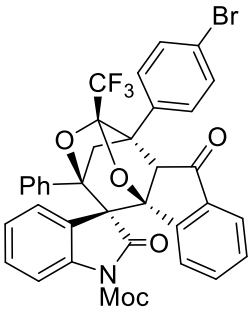
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 196.6, 172.8, 143.1, 138.4, 137.3, 135.2, 135.0, 131.7, 131.6, 131.0, 130.9, 130.7, 130.3, 129.5, 129.0, 128.0, 125.9, 125.6, 125.4, 125.3, 123.7, 122.7, 120.2 (q, *J* = 281.9 Hz), 113.5 (q, *J* = 34.7 Hz), 112.9, 90.5, 89.0, 64.5, 62.5, 57.0, 47.1, 41.2.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3454, 3062, 2989, 1918, 1816, 1733, 1604, 1464, 1375, 1329, 1304, 1262, 1240, 1183, 1168, 1077, 762, 740, 704.

HRMS (ESI) for $C_{35}H_{24}NO_6F_3S^{79}Br$, $[M+H]^+$ (722.0454) found: 722.0460.

HRMS (ESI) for $C_{35}H_{24}NO_6F_3S^{81}Br$, $[M+H]^+$ (724.0434) found: 724.0446.

Methyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*] methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ao)



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2o** (29.3 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 17 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc /Hex = 1/15), **3ao** was obtained as a yellow solid (61.8 mg, 88%).

R_f = 0.15 (EtOAc/Hex = 1/5), mp.: 241.7-242.4 °C, $[\alpha]_D^{25}$ = 77.5 (*c* = 0.5 in CH_2Cl_2),

HPLC: 64% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 16.07 min, t_{major} = 22.6 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.19 (d, *J* = 7.7 Hz, 1H), 7.76 (d, *J* = 7.5 Hz, 1H), 7.69 (d, *J* = 7.9 Hz, 1H), 7.56 (d, *J* = 8.6 Hz, 2H), 7.52-7.46 (m, 3H), 7.42 (td, *J* = 9.3, 1.3 Hz, 1H), 7.35 (td, *J* = 7.8, 1.2 Hz, 1H), 7.29 (td, *J* = 8.5, 1.0 Hz, 1H), 7.21-7.08 (m, 5H), 6.14 (t, *J* = 8.1 Hz, 1H), 4.61 (s, 1H), 3.91 (s, 3H), 3.86 (d, *J* = 11.8 Hz, 1H), 2.80 (t, *J* = 12.2 Hz, 1H).

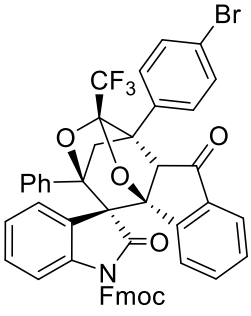
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.0, 172.1, 150.3, 143.4, 138.7, 137.3, 135.3, 134.9, 131.8, 131.4, 131.0, 130.7, 129.9, 128.9, 128.7, 127.8, 125.55, 125.50, 125.4, 125.1, 124.0, 122.6, 114.4, 90.6, 89.1, 64.6, 62.5, 56.9, 54.2, 47.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3059, 2934, 1743, 1605, 1242, 1186, 1078, 617.

HRMS (ESI) for $C_{36}H_{24}NO_6{}^{79}BrF_3$, $[M+H]^+$ (702.0734) found: 702.0734.

HRMS (ESI) for $C_{36}H_{24}NO_6{}^{81}BrF_3$, $[M+H]^+$ (704.0713) found: 704.0712.

(9*H*-Fluoren-9-yl) methyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro [indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ap)



Following the GP-E, **1a** (40.9 mg, 0.1 mmol), **2p** (45.7 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 15 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc /Hex = 1/15), **3ap** was obtained as a yellow solid (67.7 mg, 70%).

R_f = 0.25 (EtOAc/Hex = 1/7), mp.: 161.7-162.5 °C, $[\alpha]_D^{25}$ = 36.9 (*c* = 0.5 in CH_2Cl_2),

HPLC: 75% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 85:15, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 9.49 min, t_{major} = 14.14 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.18 (dd, *J* = 7.1, 1.8 Hz, 1H), 7.79-7.76 (m, 3H), 7.59-7.56 (m, 3H), 7.54-7.50 (m, 3H), 7.48-7.36 (m, 4H), 7.35-7.22 (m, 5H), 7.16-7.05 (m, 5H), 6.11 (d, *J* = 7.7 Hz, 1H), 4.67 (s, 1H), 4.64 (dd, *J* = 10.6, 6.5 Hz, 1H), 4.52 (dd, *J* = 10.6, 7.3 Hz, 1H), 4.29 (t, *J* = 6.8 Hz, 1H), 3.91 (d, *J* = 11.9 Hz, 1H), 2.83 (d, *J* = 11.9 Hz, 1H).

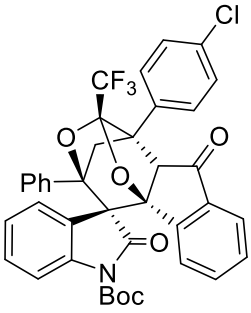
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.0, 172.1, 149.6, 143.4, 143.2, 142.8, 141.4, 141.3, 138.6, 137.4, 135.3, 134.9, 131.9, 131.4, 131.1, 130.7, 129.9, 128.9, 128.7, 128.1, 127.8, 127.3, 127.2, 125.5, 125.4, 125.1, 124.9, 124.1, 122.6, 120.3 (q, *J* = 281.7 Hz), 120.2, 114.5, 113.4 (q, *J* = 34.5 Hz), 90.6, 89.1, 69.3, 64.7, 62.6, 57.0, 47.1, 46.4.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3450, 3068, 2954, 2926, 2855, 1955, 1925, 1789, 1739, 1606, 1254, 1224, 1204, 1187, 1078, 1035, 759, 741, 703.

HRMS (ESI) for $C_{49}H_{31}NO_6F_3Na^{79}Br$, $[M+Na]^+$ (888.1179) found: 888.1187.

HRMS (ESI) for $C_{49}H_{31}NO_6F_3Na^{81}Br$, $[M+Na]^+$ (890.1159) found: 890.1174.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-chlorophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ba)**



Following the GP-E, **1b** (36.5 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 12 hours at 30 °C. After quenching the reaction, the mixture purification by flash chromatography (EtOAc/Hex = 1:15), **3ba** was obtained as a yellow solid (45.5 mg, 65%).

R_f = 0.50 (EtOAc/Hex = 1/5), mp.: 154.1-154.7 °C, $[\alpha]_D^{25}$ = 49.1 (*c* = 0.5 in CH_2Cl_2), **HPLC**: 81% ee, Chiralpak IA column, *n*-hexane/EtOH = 98:2, flow rate = 0.80 mL/min, λ= 246 nm, t_{minor} = 7.17 min, t_{major} = 11.03 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.17 (d, *J* = 7.6 Hz, 1H), 7.76 (d, *J* = 7.5 Hz, 1H), 7.55-7.59 (m, 3H), 7.46 (td, *J* = 7.5, 0.8 Hz, 1H), 7.36-7.41 (m, 3H), 7.31 (t, *J* = 7.5 Hz, 1H), 7.28 (td, *J* = 7.6, 0.9 Hz, 1H), 7.14-7.20 (m, 1H), 7.08-7.13 (m, 4H), 6.17 (d, *J* = 8.2 Hz, 1H), 4.67 (s, 1H), 3.87 (d, *J* = 11.9 Hz, 1H), 2.79 (d, *J* = 12.3 Hz, 1H), 1.54 (s, 9H).

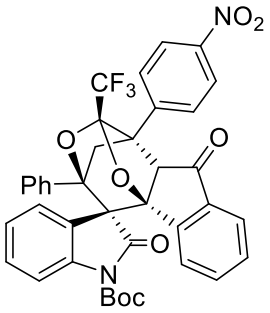
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.2, 172.2, 148.0, 143.6, 139.1, 137.4, 135.3, 134.8, 134.2, 131.5, 131.3, 130.8, 129.7, 128.7, 128.5, 127.9, 127.7, 127.6, 127.3, 125.5, 125.0, 124.2, 120.4 (q, *J* = 285.2 Hz), 114.4, 113.4 (q, *J* = 34.5 Hz), 90.5, 89.1, 85.0, 76.7, 64.6, 62.7, 56.7, 46.9, 28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2982, 2933, 1786, 1736, 1605, 1499, 1480, 1466, 1393, 1371, 1343, 1310, 1288, 1255, 1185, 1150, 1081, 1034, 838, 763, 702.

HRMS (ESI) for $C_{39}H_{29}NO_6F_3Na^{35}Cl$, $[M+Na]^+$ (722.1528) found: 722.1533.

HRMS (ESI) for $C_{39}H_{29}NO_6F_3Na^{37}Cl$, $[M+Na]^+$ (724.1498) found: 724.1523.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-nitrophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ca)**



Following the GP-E, **1c** (37.5 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 24 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ca** was obtained as a white solid (37.6 mg, 54%).

R_f = 0.37 (EtOAc/Hex = 1/5), mp.: 194.4-195.0 °C, $[\alpha]_D^{25}$ = 47.7 (*c* = 0.5 in CH_2Cl_2), **HPLC**: 77% ee, Chiralpak IA column, *n*-hexane/EtOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 8.10 min, t_{major} = 14.34 min.

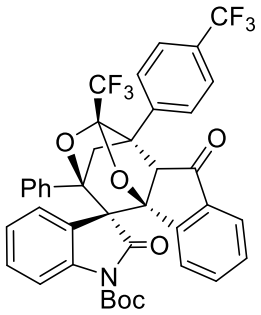
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.28 (d, J = 9.0 Hz, 2H), 8.16 (d, J = 7.2 Hz, 1H), 7.83 (d, J = 8.8 Hz, 2H), 7.77 (d, J = 7.6 Hz, 1H), 7.60 (d, J = 8.1 Hz, 1H), 7.48 (t, J = 7.5 Hz, 1H), 7.38 (td, J = 7.9, 1.2 Hz, 1H), 7.30-7.35 (m, 2H), 7.16-7.22 (m, 1H), 7.12-7.15 (m, 4H), 6.19 (d, J = 7.7 Hz, 1H), 4.75 (s, 1H), 3.96 (d, J = 11.9 Hz, 1H), 2.82 (d, J = 12.0 Hz, 1H), 1.55 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 197.0, 172.1, 147.9, 147.5, 143.5, 140.6, 139.1, 137.1, 134.98, 134.94, 131.5, 130.4, 130.4, 129.8, 128.7, 128.6, 127.7, 125.5, 125.2, 125.1, 124.3, 122.5, 120.2 (q, J = 282.9 Hz), 114.4, 113.4 (q, J = 34.7 Hz), 90.7, 89.3, 85.1, 65.1, 62.6, 56.6, 47.1, 27.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2982, 2934, 1752, 1738, 1605, 1523, 1479, 1466, 1371, 1347, 1313, 1288, 1252, 1188, 1150, 1082, 1050, 1033, 1000, 855, 770, 755, 700.

HRMS (ESI) calcd for $C_{39}H_{28}N_2O_8F_3$, $[M-H]^+$ (709.1803) found: 709.1793.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-3a'-(4-(trifluoromethyl)phenyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3da)**



Following the GP-E, **1d** (39.8 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 11 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3da** was obtained as a white solid (63.4 mg, 85%).

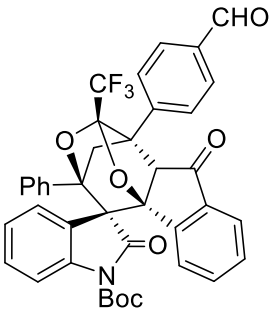
R_f = 0.50 (EtOAc/Hex = 1/5), mp.: 186.6-187.5 °C, $[\alpha]_D^{20}$ = 3.1 (c = 0.5 in CH_2Cl_2),

HPLC: 75% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 4.87 min, t_{major} = 6.46 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.17 (dd, J = 7.6, 1.3 Hz, 1H), 7.80-7.73 (m, 3H), 7.65-7.71 (m, 2H), 7.59 (d, J = 8.0 Hz, 1H), 7.46 (pt, J = 7.5 Hz, 1H), 7.39 (td, J = 8.0, 1.1 Hz, 1H), 7.26-7.32 (td, J = 7.6, 0.9 Hz, 1H), 7.29 (pt, J = 8.1 Hz, 1H), 7.21-7.14 (m, 1H), 7.08-7.15 (m, 4H), 6.18 (d, J = 7.5 Hz, 1H), 4.73 (s, 1H), 3.92 (d, J = 12.0 Hz, 1H), 2.82 (d, J = 12.0 Hz, 1H), 1.55 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 197.2, 172.3, 148.1, 143.7, 139.3, 137.5, 137.3, 135.3, 135.0, 131.5, 130.3 (q, J = 32.6 Hz), 129.9, 128.8, 128.7, 127.8, 125.7, 125.5, 125.2, 124.5 (q, J = 3.7 Hz), 124.4, 124.2 (q, J = 272.1 Hz), 120.5 (q, J = 281.9 Hz), 114.6, 113.6 (q, J = 34.7 Hz), 90.8, 89.4, 85.2, 65.2, 62.9, 56.8, 47.2, 28.1.
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2981, 1788, 1740, 1606, 1329, 1151, 1073, 767.
HRMS (ESI) for $C_{40}H_{29}F_6NO_6Na$, $[M+Na]^+$ (756.1791) found: 756.1790.

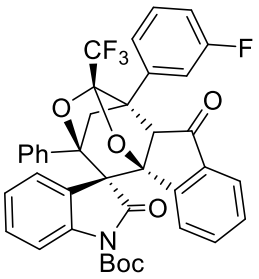
***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-formylphenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ea)**



Following the GP-E, **1e** (35.8 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 48 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ea** was obtained as a yellow solid (42.3 mg, 61%).
R_f = 0.25 (EtOAc/Hex = 1/5), mp.: 214.7-215.4 °C, $[\alpha]_D^{25}$ = 58.9 (c = 0.5 in CH_2Cl_2),
HPLC: 80% ee, Chiralpak IA column, *n*-hexane/EtOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 9.66 min, t_{major} = 16.65 min.
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 10.08 (s, 1H), 8.17 (d, J = 7.4 Hz, 1H), 7.95 (d, J = 8.3 Hz, 2H), 7.82 (d, J = 8.1 Hz, 2H), 7.77 (d, J = 7.3 Hz, 1H), 7.59 (d, J = 8.0 Hz, 1H), 7.47 (t, J = 7.5 Hz, 1H), 7.39 (t, J = 7.7 Hz, 1H), 7.28-7.34 (m, 2H), 7.16-7.20 (m, 1H), 7.09-7.13 (m, 4H), 6.19 (d, J = 7.5 Hz, 1H), 4.74 (s, 1H), 3.94 (d, J = 12.0 Hz, 1H), 2.84 (d, J = 12.4 Hz, 1H), 1.55 (s, 9H).
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 197.0, 192.0, 172.1, 148.0, 143.5, 140.0, 139.1, 137.3, 135.8, 135.1, 134.9, 131.4, 130.0, 129.8, 128.7, 128.6, 128.4, 127.6, 125.5, 125.4, 125.0, 124.2, 120.3 (q, J = 282.0 Hz), 114.4, 113.5 (q, J = 34.8 Hz), 90.7, 89.2, 85.1, 65.4, 62.8, 56.7, 47.0, 27.9.
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3063, 2983, 2931, 2738, 1786, 1736, 1708, 1608, 1478, 1466, 1391, 1371, 1342, 1312, 1288, 1250, 1186, 1150, 1081, 1033, 1001, 839, 763, 739, 717, 700.

HRMS (ESI) for $C_{40}H_{30}NO_7NaF_3$, $[M+Na]^+$ (716.1867) found: 716.1873.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'R)-3a'-(3-fluorophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3fa)**



Following the GP-E, **1f** (34.8 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 24 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3fa** was obtained as a yellow solid (48.4 mg, 68%).

R_f = 0.47 (EtOAc/Hex = 1/5), mp.: 156.0-157.2 °C, $[\alpha]_D^{25}$ = 50.6 (*c* = 0.5 in CH_2Cl_2),

HPLC: 77% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 99:1, flow rate = 0.80 mL/min, λ= 246 nm, t_{minor} = 7.90 min, t_{major} = 19.01 min.

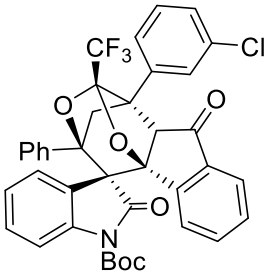
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.18 (dd, *J* = 7.5, 1.0 Hz, 1H), 7.76 (d, *J* = 7.5 Hz, 1H), 7.58 (d, *J* = 8.0 Hz, 1H), 7.46 (td, *J* = 7.5, 0.8 Hz, 1H), 7.36-7.43 (m, 4H), 7.31 (td, *J* = 7.5, 1.3 Hz, 1H), 7.28 (td, *J* = 7.5, 1.2 Hz, 1H), 7.15-7.19 (m, 1H), 7.08-7.14 (m, 5H), 6.17 (d, *J* = 7.8 Hz, 1H), 4.70 (s, 1H), 3.89 (d, *J* = 11.8 Hz, 1H), 2.79 (d, *J* = 12.3 Hz, 1H), 1.54 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 196.9, 172.2, 163.3, 160.9, 148.0, 143.6, 139.1, 137.4, 135.6, 135.5, 135.3, 134.7, 131.3, 129.7, 129.4, 128.8 (q), 128.7, 128.5, 128.3, 127.6, 125.5, 125.2, 125.00, 124.97, 124.2, 123.2, 120.4 (q, *J* = 281.9 Hz), 116.7, 116.5, 115.1, 114.9, 114.3, 113.4 (q, *J* = 34.6 Hz), 90.5, 89.1, 85.0, 64.9, 62.8, 56.7, 47.0, 27.9.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2983,2935, 1786,1736,1606,1591, 1478, 1466, 1393, 1371, 1342, 1311, 1289, 1251, 1203, 1176, 1150,1084, 1033, 763, 702.

HRMS (ESI) for $C_{39}H_{29}NO_6F_4Na$, $[M+Na]^+$ (706.1823) found: 706.1824.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(3-chlorophenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*] methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ga)**



Following the GP-E, **1g** (36.5 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 12 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ga** was obtained as a yellow solid (46.2 mg, 66%).

R_f = 0.50 (EtOAc/Hex = 1/5), mp.: 151.3-152.5 °C, $[\alpha]_D^{25}$ = 47.5 (*c* = 0.5 in CH_2Cl_2), **HPLC**: 80% ee, Chiralpak IA column, *n*-hexane/EtOH = 98:2, flow rate = 0.7 mL/min, λ= 246 nm, t_{minor} = 7.81 min, t_{major} = 10.46 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.17 (d, *J* = 7.7, 0.9 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.58 (d, *J* = 8.1 Hz, 1H), 7.62 (s, 1H), 7.58 (d, *J* = 8.1 Hz, 1H), 7.31 (td, *J* = 7.5, 0.8 Hz, 1H), 7.35-7.41 (m, 3H), 7.26-7.33 (m, 2H), 7.15-7.20 (m, 1H), 7.08-7.14 (m, 4H), 6.17 (d, *J* = 7.7 Hz, 1H), 4.69 (s, 1H), 3.88 (d, *J* = 11.9 Hz, 1H), 2.79 (d, *J* = 12.3 Hz, 1H), 1.54 (s, 9H).

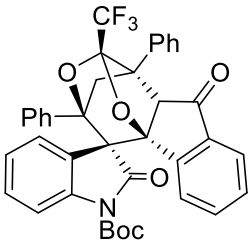
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.0, 172.1, 148.0, 143.6, 139.1, 137.4, 135.2, 135.1, 134.7, 133.5, 131.3, 129.7, 129.2, 128.9, 128.7, 128.5, 128.2, 128.0, 127.8, 127.6, 125.5, 125.0, 125.0, 124.2, 120.3 (q, *J* = 282.1 Hz), 114.4, 113.4 (q, *J* = 34.6 Hz), 90.5, 89.2, 85.2, 85.0, 84.8, 64.8, 62.7, 56.7, 46.9, 28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3062, 2982, 2934, 1786, 1736, 1603, 1479, 1466, 1393, 1371, 1342, 1312, 1289, 1255, 1203, 1187, 1150, 1080, 1050, 1034, 1002, 763, 741, 701, 615.

HRMS (ESI) for $C_{39}H_{29}NO_6F_3Na^{35}Cl$, $[M+Na]^+$ (722.1528) found: 722.1525.

HRMS (ESI) for $C_{39}H_{29}NO_6F_3Na^{37}Cl$, $[M+Na]^+$ (724.1498) found: 724.1511.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-2,4'-dioxo-2',3a'-diphenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ha)**



Following the GP-E, **1h** (33.0 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 15 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ha** was obtained as a yellow solid (45.8 mg, 66%).

R_f = 0.50 (EtOAc/Hex = 1/5), mp.: 144.5-144.8 °C, $[\alpha]_D^{25}$ = 50.1 (c = 0.5 in CH_2Cl_2), **HPLC**: 80% ee, Chiralpak IA column, *n*-hexane/EtOH = 98:2, flow rate = 0.80 mL/min, λ= 246 nm, t_{minor} = 7.09 min, t_{major} = 10.58 min.

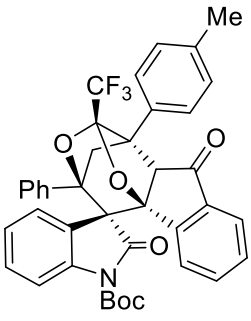
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.20 (d, J = 7.4 Hz, 1H), 7.75 (d, J = 7.5 Hz, 1H), 7.62 (d, J = 7.2 Hz, 2H), 7.58 (d, J = 8.0 Hz, 1H), 7.36-7.46 (m, 5H), 7.25-7.33 (m, 2H), 7.08-7.17 (m, 5H), 6.17 (d, J = 7.9 Hz, 1H), 4.70 (s, 1H), 3.88 (d, J = 12.4, 1H), 2.85 (d, J = 12.0, 1H), 1.54 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 197.1, 172.2, 148.0, 143.7, 139.1, 137.5, 135.5, 134.6, 132.9, 131.2, 129.6, 129.3 (q, J = 2.0 Hz), 128.8, 128.4, 128.2, 128.1, 127.9, 127.7, 127.5, 127.4, 125.6, 125.5, 124.9, 124.7, 120.4 (q, J = 281.9 Hz), 114.3, 113.5 (q, J = 34.5 Hz), 90.5, 89.1, 84.9, 65.1, 62.9, 56.7, 46.8, 28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3062, 2982, 2934, 1786, 1736, 1605, 1478, 1466, 1392, 1371, 1342, 1311, 1289, 1255, 1204, 1183, 1150, 1080, 1034, 840, 757.

HRMS (ESI) for $C_{39}H_{30}NO_6F_3Na$, $[M+Na]^+$ (688.1917) found: 688.1915.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-2,4'-dioxo-2'-phenyl-3a'-(*p*-tolyl)-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ia)**



Following the GP-E, **1i** (34.4 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 6 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ia** was obtained as a white solid (54.4 mg, 80%).

R_f = 0.50 (EtOAc/Hex = 1/5), mp.: 187.9-188.8 °C, $[\alpha]_D^{23}$ = 6.4 (*c* = 0.5 in CH_2Cl_2),

HPLC: 80% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 4.82 min, t_{major} = 6.44 min.

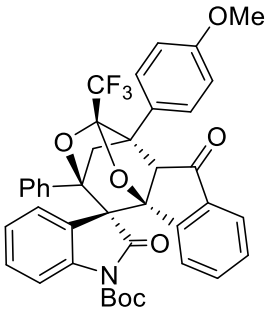
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.19 (dd, *J* = 7.5, 1.3 Hz, 1H), 7.75 (d, *J* = 7.5 Hz, 1H), 7.57 (d, *J* = 8.0 Hz, 1H), 7.49 (d, *J* = 8.1 Hz, 2H), 7.45 (pt, *J* = 7.6 Hz, 1H), 7.38 (td, *J* = 7.9, 1.3 Hz, 1H), 7.32 (d, *J* = 7.7 Hz, 1H), 7.28 (d, *J* = 7.4 Hz, 1H), 7.23 (d, *J* = 8.2 Hz, 2H), 7.20-7.06 (m, 5H), 6.16 (d, *J* = 7.5 Hz, 1H), 4.65 (s, 1H), 3.85 (d, *J* = 12.1 Hz, 1H), 2.84 (d, *J* = 12.1 Hz, 1H), 2.40 (s, 3H), 1.54 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.4, 172.4, 148.2, 143.9, 139.3, 137.9, 137.7, 135.7, 134.7, 131.3, 129.9, 129.7, 129.3 (q, *J* = 2.1 Hz), 129.0, 128.6, 128.4, 127.7, 125.9, 125.7, 125.0, 124.3, 120.7 (q, *J* = 281.6 Hz), 114.4, 113.7 (q, *J* = 34.4 Hz), 90.6, 89.2, 85.1, 64.9, 63.1, 56.9, 46.9, 28.1, 21.2.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2981, 1737, 1606, 1151, 1081, 762.

HRMS (ESI) for $C_{40}H_{32}F_3NO_6Na$, $[M+Na]^+$ (702.2074) found: 702.2075.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-methoxyphenyl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ja)**



Following the GP-E, **1j** (36.0 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 12 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ja** was obtained as a white solid (56.3 mg, 81%).

R_f = 0.37 (EtOAc/Hex = 1/5), mp.: 154.4-155.1 °C, $[\alpha]_D^{25}$ = 53.9 (*c* = 0.5 in CH_2Cl_2),

HPLC: 84% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 97:3, flow rate = 0.70 mL/min, λ= 246 nm, t_{minor} = 11.75 min, t_{major} = 14.05 min.

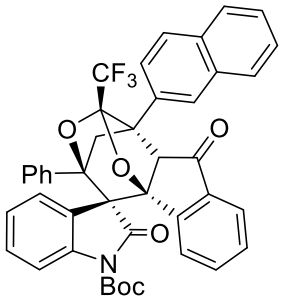
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.19 (d, *J* = 7.5 Hz, 1H), 7.76 (d, *J* = 7.5 Hz, 1H), 7.52-7.58 (m, 3H), 7.45 (t, *J* = 7.5 Hz, 1H), 7.37 (td, *J* = 7.8, 1.2 Hz, 1H), 7.30 (td, *J* = 7.5, 0.8 Hz, 2H), 7.27 (td, *J* = 7.5, 0.8 Hz, 1H), 7.08-7.18 (m, 5H), 6.95 (d, *J* = 8.9 Hz, 2H), 6.16 (d, *J* = 7.9 Hz, 1H), 4.64 (s, 1H), 3.86 (s, 3H), 2.83 (d, *J* = 12.1 Hz, 1H), 1.54 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.4, 172.3, 159.3, 148.1, 143.8, 139.2, 137.6, 135.6, 134.6, 131.2, 130.6, 129.6, 128.8, 128.4, 127.6, 125.7, 125.6, 124.9, 124.7, 124.2, 120.5 (q, *J* = 281.0 Hz), 114.3, 113.4 (q, *J* = 37.3 Hz), 90.4, 89.1, 84.9, 64.5, 62.9, 56.8, 55.2, 46.8, 28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3059, 2982, 2934, 2840, 1786, 1739, 1606, 1519, 1479, 1466, 1393, 1371, 1343, 1310, 1290, 1257, 1203, 1183, 1150, 1081, 1034, 1001, 837, 764, 741, 703.

HRMS (ESI) for $C_{40}H_{32}NO_7NaF_3$, $[M+Na]^+$ (718.2023) found: 718.2026.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(naphthalen-2-yl)-2,4'-dioxo-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3ka)**



Following the GP-E, **1k** (38.0 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 15 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3ka** was obtained as a yellow solid (49.1 mg, 70%).

R_f = 0.45 (EtOAc/Hex = 1/5), mp.: 200.2-200.7 °C, $[\alpha]_D^{25}$ = 58.6 (*c* = 0.5 in CH_2Cl_2),

HPLC: 84% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 95:5, flow rate = 0.70 mL/min, λ= 246 nm, t_{minor} = 7.59 min, t_{major} = 11.31 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.22 (d, *J* = 7.5 Hz, 1H), 8.12 (s, 1H), 7.86-7.90 (m, 3H), 7.77 (d, *J* = 7.5 Hz, 1H), 7.72 (d, *J* = 8.6 Hz, 1H), 7.60 (d, *J* = 8.0 Hz, 1H), 7.43-7.52 (m, 3H), 7.38 (td, *J* = 7.9, 1.1 Hz, 1H), 7.26-7.34 (m, 2H), 7.10-7.18 (m,

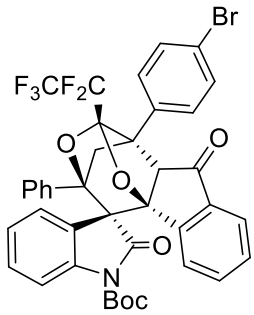
5H), 6.19 (d, *J* = 7.9 Hz, 1H), 4.78 (s, 1H), 4.00 (d, *J* = 11.9 Hz, 1H), 3.01 (d, *J* = 12.3 Hz, 1H), 1.54 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.2, 172.2, 148.1, 143.8, 139.2, 137.5, 135.5, 134.7, 132.9, 132.8, 131.2, 130.8, 129.6, 128.8, 128.5, 128.4, 127.9, 127.8, 127.6, 127.4, 126.4, 126.0, 125.64, 125.58, 125.99, 125.95, 124.2, 120.5 (q, *J* = 282.0 Hz), 114.3, 113.5 (q, *J* = 34.6 Hz), 90.6, 89.2, 84.9, 65.4, 63.3, 56.8, 47.0, 28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3059, 2981, 2934, 1786, 1736, 1605, 1478, 1466, 1393, 1371, 1343, 1311, 1288, 1248, 1203, 1184, 1150, 1079, 1033, 839, 764, 703, 479.

HRMS (ESI) for $C_{43}H_{32}NO_6F_3Na$, $[M+Na]^+$ (738.2074) found: 738.2070.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-bromophenyl)-2,4'-dioxo-9a'-(perfluoroethyl)-2'-phenyl-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3la)**



Following the GP-E, **1l** (45.9 mg, 0.1 mmol), **2a** (33.5 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 36 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3la** was obtained as a yellow solid (46.2 mg, 59%).

R_f = 0.45 (EtOAc/Hex = 1/5), mp.: 156.1-156.7 °C, $[\alpha]_D^{25}$ = 51.7 (*c* = 0.5 in CH_2Cl_2),

HPLC: 82% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 99:1, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 7.19 min, t_{major} = 14.29 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.12 (d, *J* = 7.5, 0.8 Hz, 1H), 7.76 (d, *J* = 7.6 Hz, 1H), 7.49-7.59 (m, 5H), 7.46 (td, *J* = 7.9, 0.7 Hz, 1H), 7.37 (td, *J* = 7.5, 1.3 Hz, 1H), 7.26-7.32 (m, 2H), 7.15-7.20 (m, 1H), 7.01-7.11 (m, 4H), 6.15 (d, *J* = 7.8 Hz, 1H), 4.68 (s, 1H), 3.86 (d, *J* = 11.9 Hz, 1H), 2.77 (d, *J* = 11.9 Hz, 1H), 1.55 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.1, 172.2, 148.0, 143.6, 139.1, 137.4, 1335.3, 134.8, 132.1, 131.40, 131.36, 131.3, 130.5, 129.7, 128.5, 128.0, 127.6, 125.4, 125.4, 125.39, 125.35, 124.3, 122.4, 118.5 (qt, *J* = 291.0 Hz, 33.2 Hz), 114.4, 113.4 (t, *J* = 31.7 Hz), 110.4 (tq, *J* = 262.7 Hz, 38.0 Hz), 90.8, 89.8, 85.1, 66.6, 62.1, 56.7, 46.1,

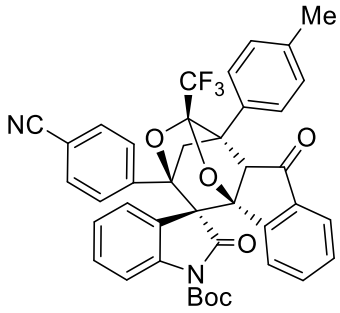
28.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3076, 2980, 2927, 1787, 1736, 1603, 1590, 1478, 1466, 1392, 1371, 1343, 1311, 1289, 1251, 1204, 1176, 1150, 1084, 1033, 1004, 840, 763, 702.

HRMS (ESI) for $C_{40}H_{29}NO_6Na^{79}BrF_5$, $[M+Na]^+$ (816.0991) found: 816.0985.

HRMS (ESI) for $C_{40}H_{29}NO_6Na^{81}BrF_5$, $[M+Na]^+$ (818.0971) found: 818.0957.

***tert*-Butyl (2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-2'-(4-cyanophenyl)-2,4'-dioxo-3a'-(p-tolyl)-9a'-(trifluoromethyl)-2',3',3a',3b',4',9a'-hexahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-1-carboxylate (3id)**



Following the GP-E, **1i** (36.0 mg, 0.1 mmol), **2d** (36.0 mg, 1.0 equiv) and catalyst **QN-T** (5 mol%) were mixed in diethyl ether (0.5 mL) and stirred for 12 hours at 30 °C. After quenching the reaction and purification by flash chromatography (EtOAc/Hex = 1:15), **3id** was obtained as a yellow solid (63.4 mg, 90%).

R_f = 0.43 (EtOAc/Hex = 1/5), mp.: 217.0-218.2 °C, $[\alpha]_D^{27}$ = 45.6 (*c* = 0.5 in CH_2Cl_2),

HPLC: 88% ee, Chiralpak IB column, *n*-hexane/*i*-PrOH = 98:2, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 15.27 min, t_{major} = 18.41 min.

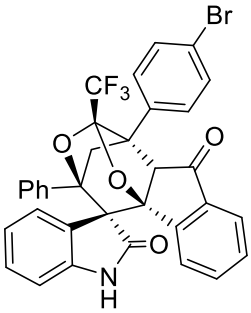
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.16 (d, *J* = 7.6 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.58 (d, *J* = 8.2 Hz, 1H), 7.40-7.49 (m, 6H), 7.23-7.35 (m, 6H), 6.14 (d, *J* = 7.9 Hz, 1H), 4.62 (s, 1H), 3.85 (d, *J* = 11.9 Hz, 1H), 2.81 (d, *J* = 11.9 Hz, 1H), 2.40 (s, 3H), 1.56 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 196.7, 171.9, 147.7, 143.3, 140.6, 138.9, 138.1, 137.4, 134.7, 131.4, 130.1, 129.2, 129.1, 128.7, 128.3, 126.5, 125.2, 125.1, 124.9, 124.0, 120.3 (q, *J* = 281.9 Hz), 118.1, 114.5, 113.4 (q, *J* = 34.7 Hz), 112.5, 90.5, 88.5, 85.6, 64.8, 62.7, 56.4, 46.4, 28.0, 21.1.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2982, 2932, 2231, 1786, 1738, 1605, 1465, 1392, 1371, 1342, 1311, 1288, 1253, 1184, 1149, 1080, 1050, 1029, 1000, 914, 834, 767, 733, 706, 615, 516.

HRMS (ESI) for $C_{41}H_{31}N_2O_6NaF_3$, $[M+Na]^+$ (727.2026) found: 727.2032.

(2'*R*,3*R*,3a'*S*,3b'*R*,8b'*S*,9a'*R*)-3a'-(4-Bromophenyl)-2'-phenyl-9a'-(trifluoromethyl)-2',3',3a',9a'-tetrahydrospiro[indoline-3,10'-[2,8*b*]methanofuro[2,3-*b*]indeno[2,1-*d*]furan]-2,4'(3b'*H*)-dione (4aa)



Following the GP-E, **3aa** (39.5 mg, 0.053 mmol, 80% ee) was dissolved in DCM (0.5 mL) at 30 ℃ and TFA (4.06 μL, 1.0 equiv) was added. After 24 hours, the mixture was directly subjected to flash chromatography (EtOAc/Hex = 1:6) to afford **4aa** as a white solid (20.5 mg, 60%).

R_f = 0.70 (EtOAc/Hex = 1/1), mp.: 173.8-174.6 °C, $[\alpha]_D^{20}$ = 35.4 (*c* = 0.5 in CH_2Cl_2), **HPLC**: 99% ee, Chiralpak IA column, *n*-hexane/*i*-PrOH = 90:10, flow rate = 1.00 mL/min, λ= 246 nm, t_{minor} = 29.76 min, t_{major} = 37.23 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.09 (d, *J* = 7.5 Hz, 1H), 7.83 (brs, 1H), 7.74 (d, *J* = 7.5 Hz, 1H), 7.50-7.56 (m, 2H), 7.46-7.50 (m, 2H), 7.44 (pt, *J* = 7.5 Hz, 1H), 7.29 (pt, *J* = 7.6 Hz, 1H), 7.26 (pt, *J* = 7.0 Hz, 1H), 7.23-7.05 (m, 6H), 6.67 (d, *J* = 7.7 Hz, 1H), 6.16 (d, *J* = 7.7 Hz, 1H), 4.62 (s, 1H), 3.89 (d, *J* = 11.8 Hz, 1H), 2.75 (d, *J* = 11.8 Hz, 1H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.7, 174.5, 143.9, 139.8, 137.4, 135.9, 134.9, 132.2, 131.4, 131.2 (q, *J* = 2.2 Hz), 130.7, 129.7, 129.5, 128.4, 127.8, 127.3, 126.0, 125.1, 124.3, 123.5, 122.6, 120.6 (q, *J* = 281.9 Hz), 113.6 (q, *J* = 34.5 Hz), 109.6, 90.6, 88.8, 64.9, 62.4, 57.0, 47.2.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3276, 3063, 2925, 1716, 1620, 1472, 1327, 1264, 1189, 1077, 1036;

HRMS (ESI) for $C_{34}H_{20}{}^{79}BrF_3NO_4$, $[M-H]^-$ (642.0533) found: 642.0532.

HRMS (ESI) for $C_{34}H_{20}{}^{81}BrF_3NO_4$, $[M-H]^-$ (644.0512) found: 644.0516.

IV. References

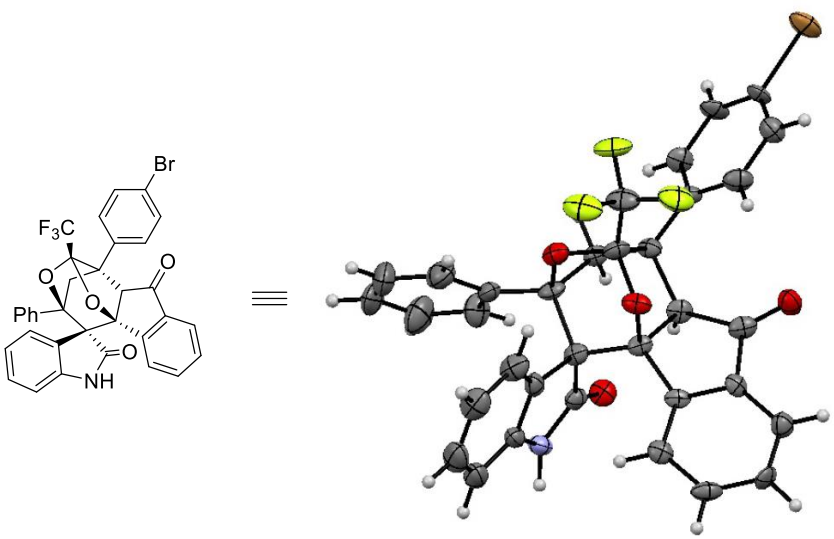
1 S. M. Yang, G. M. Reddy, T. P. Wang, Y. S. Yeh, M. Wang and W. Lin, *Chem Commun.,* 2017, **53**, 7649.

2 C.-J. Lee, C.-N. Sheu, C.-C. Tsai, Z.-Z. Wu and W. Lin, *Chem.Commun.,* 2014, **50**, 5304.

3. G. Rassu, V. Zambrano, R. Tanca, A. Sartori, L. Battistini, F. Zanardi, C. Curti and G. Casiraghi, *Eur. J. Org. Chem.*, 2012, **2012**, 466.

V. X-ray crystallographic data for 4aa

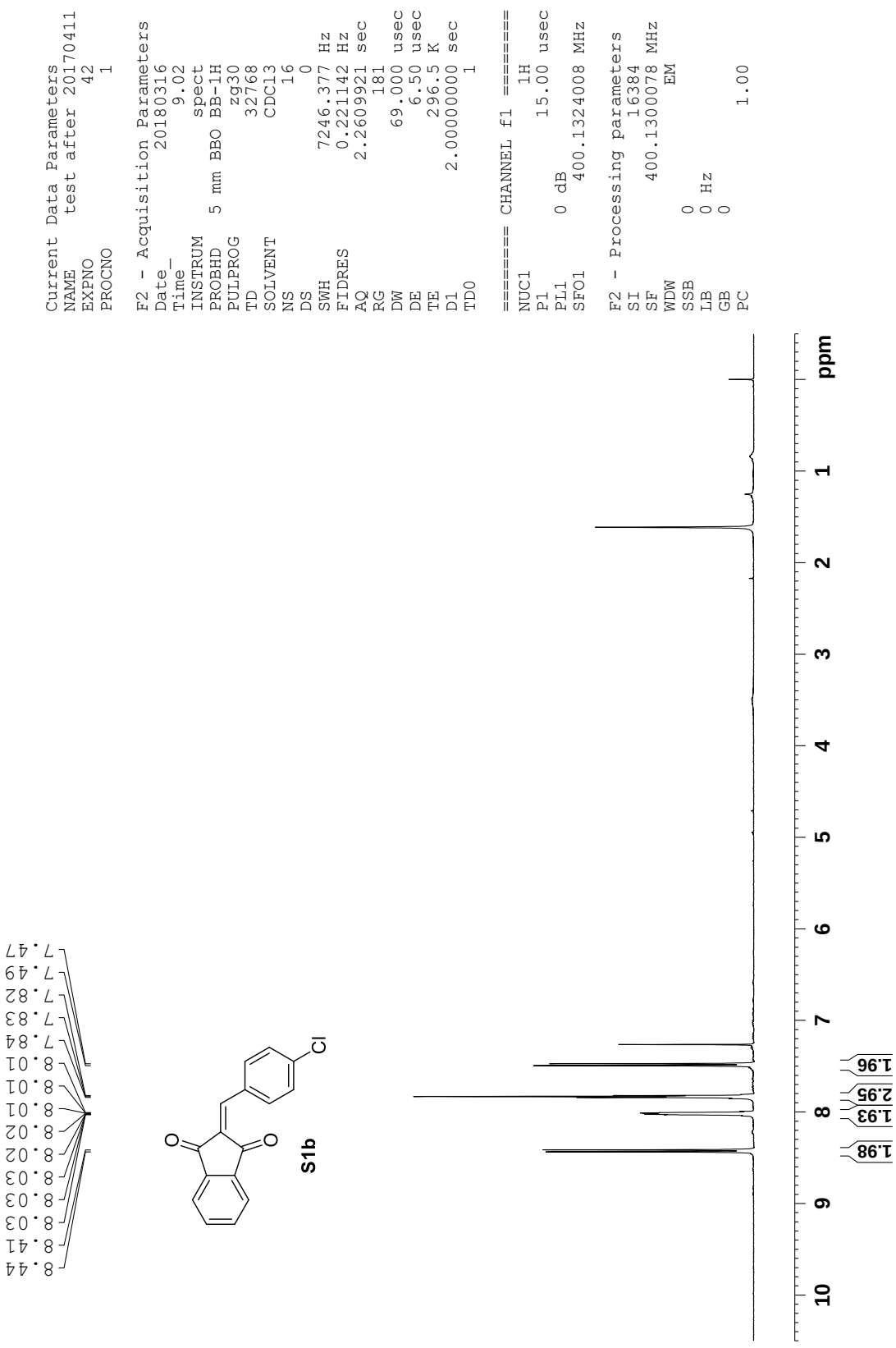
4aa (CCDC no. 1528078): The thermal ellipsoid drawn at 30% probability level.

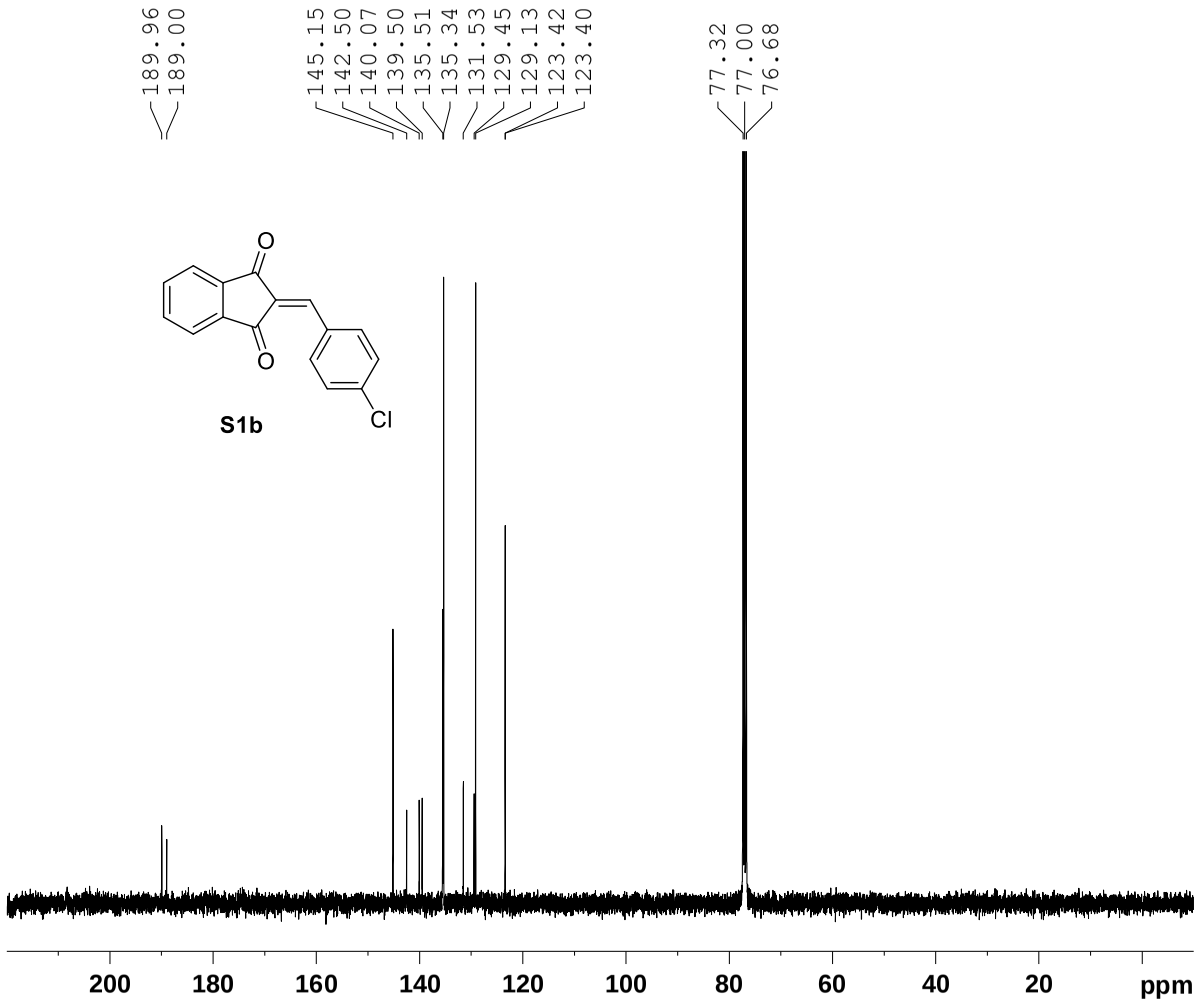


Empirical formula	C34 H21 Br F3 N O4	
Formula weight	644.43	
Temperature	200(2) K	
Wavelength	0.71073 Å	
Crystal system	Orthorhombic	
Space group	C 2 2 21	
Unit cell dimensions	a = 13.3813(11) Å	α= 90°.
	b = 16.8878(11) Å	β= 90°.
	c = 27.600(2) Å	γ = 90°.
Volume	6237.0(8) $Å^3$	
Z	8	
Density (calculated)	1.373 Mg/m^3	
Absorption coefficient	1.373 mm^{-1}	
F(000)	2608	
Crystal size	0.29 x 0.17 x 0.01 mm^3	
Theta range for data collection	2.41 to 25.05°.	
Index ranges	-15<=h<=15, -20<=k<=19, -32<=l<=32	
Reflections collected	43388	
Independent reflections	5508 [R(int) = 0.1148]	

Completeness to theta = 25.05°	99.6 %
Absorption correction	multi-scan
Max. and min. transmission	0.9864 and 0.6915
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	5508 / 0 / 388
Goodness-of-fit on F^2	1.132
Final R indices [I>2sigma(I)]	R1 = 0.0694, wR2 = 0.1358
R indices (all data)	R1 = 0.0859, wR2 = 0.1419
Absolute structure parameter	0.047(13)
Largest diff. peak and hole	0.573 and -0.626 e.$Å^{-3}$

VI. ^{1}H NMR and ^{13}C NMR spectra for all new compounds



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PROCNO                      1

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PULPROG             zgpg30
TD                     32768
SOLVENT                CDCl3
NS                      1000
DS                         0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                      4096
DW                    20.800 usec
DE                     6.50 usec
TE                    295.6 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                        1

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P1                     10.45 usec
PL1                     7.00 dB
SFO1            100.6233325 MHz

======== CHANNEL f2 ========
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NUC2                     1H
PCPD2                  90.00 usec
PL2       0 dB
PL12                   15.00 dB
PL13                   20.00 dB
SFO2            400.1316005 MHz

F2 - Processing parameters
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SF              100.6127716 MHz
WDW                       EM
SSB       0
LB                      1.00 Hz
GB        0
PC                      1.00
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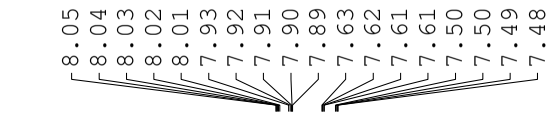
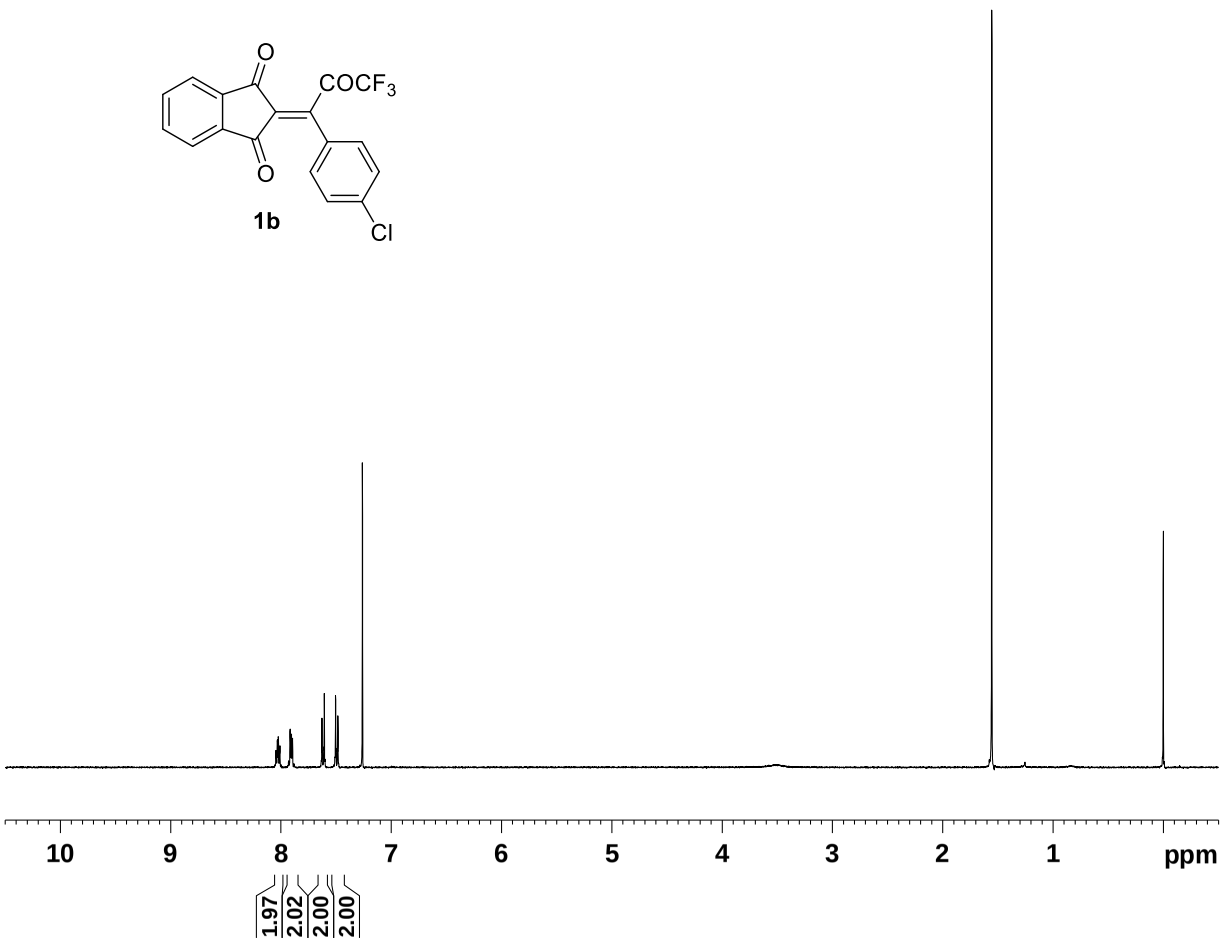


1b

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PROCNO                   1

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PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    456.1
DW                 69.000 usec
DE                  6.50 usec
TE                  297.0 K
D1             2.00000000 sec
TD0                      1

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NUC1                    1H
P1                  14.40 usec
PL1                  1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
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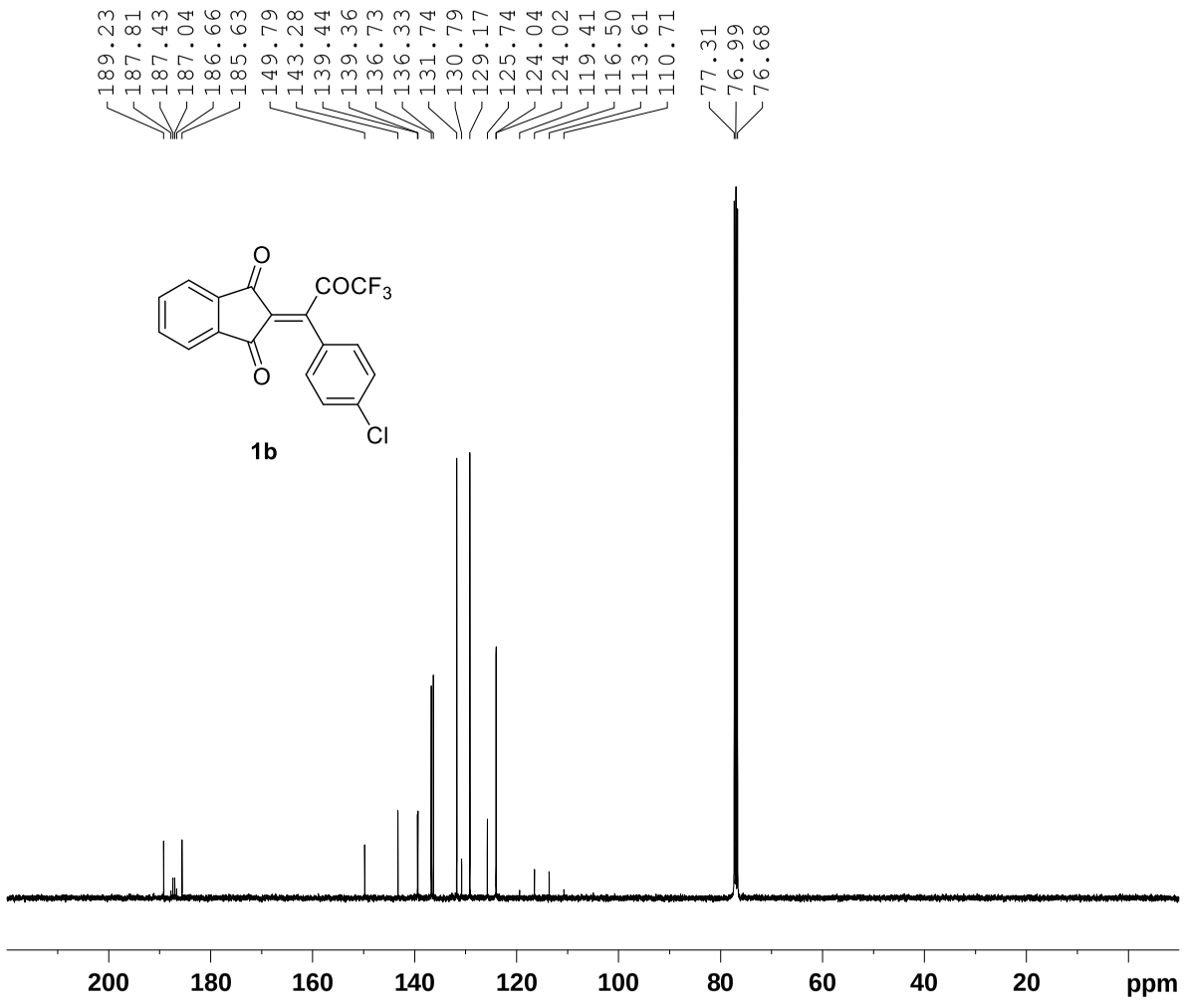


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EXPNO                   14
PROCNO                   1

F2 - Acquisition Parameters
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PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     3652
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                0.6815744 sec
RG                     4096
DW                   20.800 usec
DE                    6.50 usec
TE                   299.6 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

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SFO1           100.6233325 MHz

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PCPD2                90.00 usec
PL2       0 dB
PL12                  15.00 dB
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WDW                     EM
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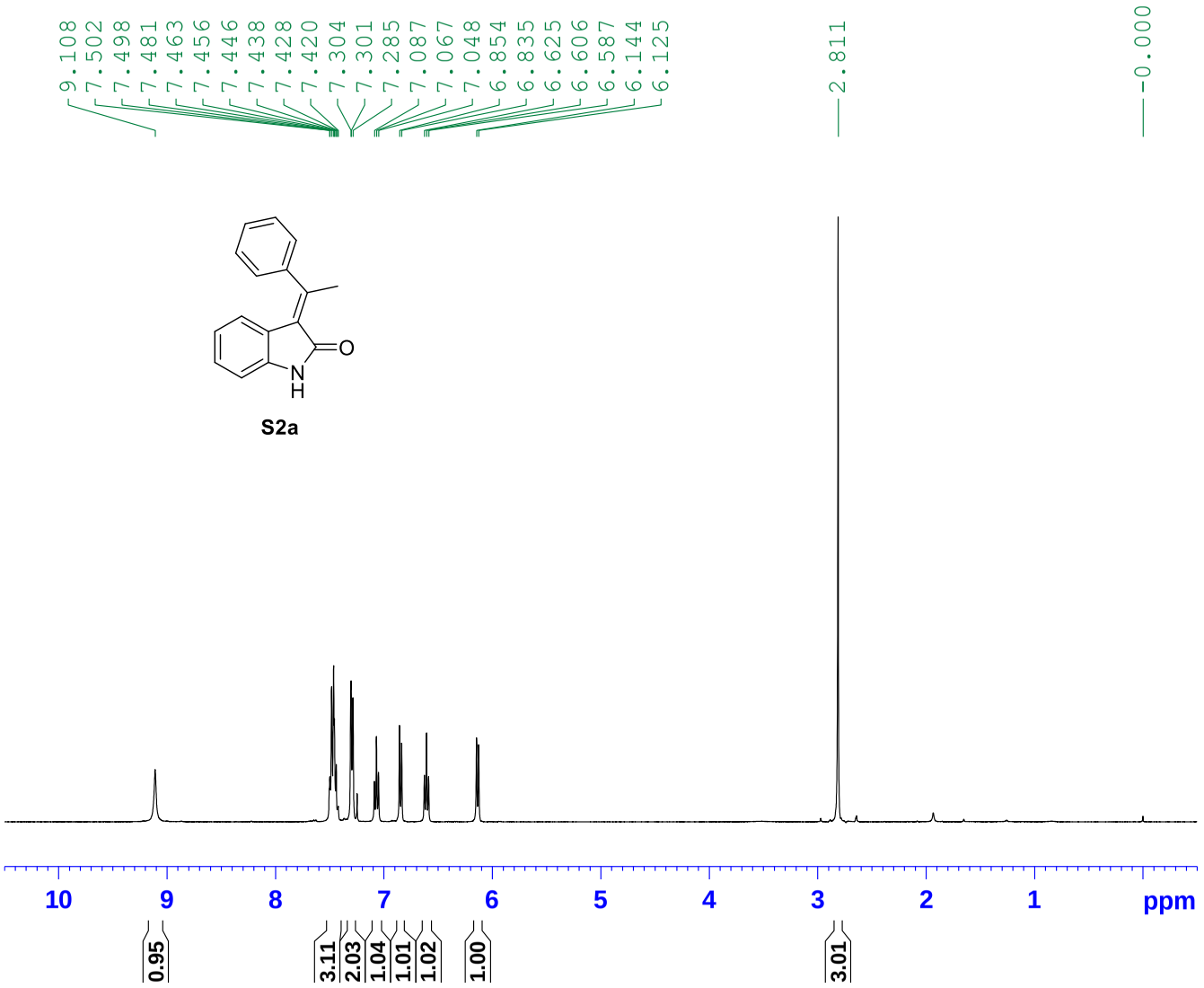

S2a

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TE                296.9 K
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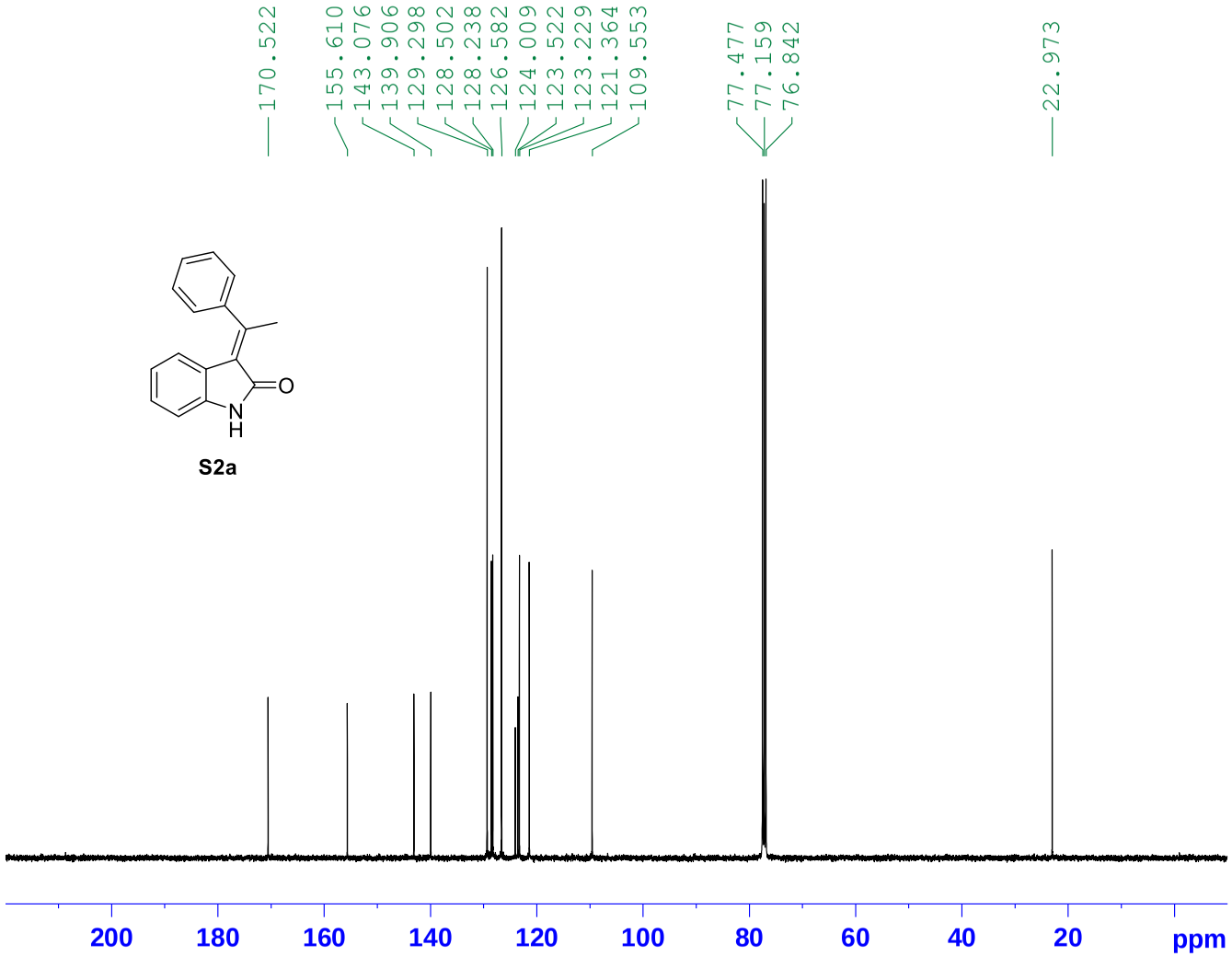


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PROCNO                 1

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DE                 6.50 usec
TE                296.9 K
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D11          0.03000000 sec
TD0                   1

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P1                  9.00 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               17.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
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SSB       0
LB                  1.00 Hz
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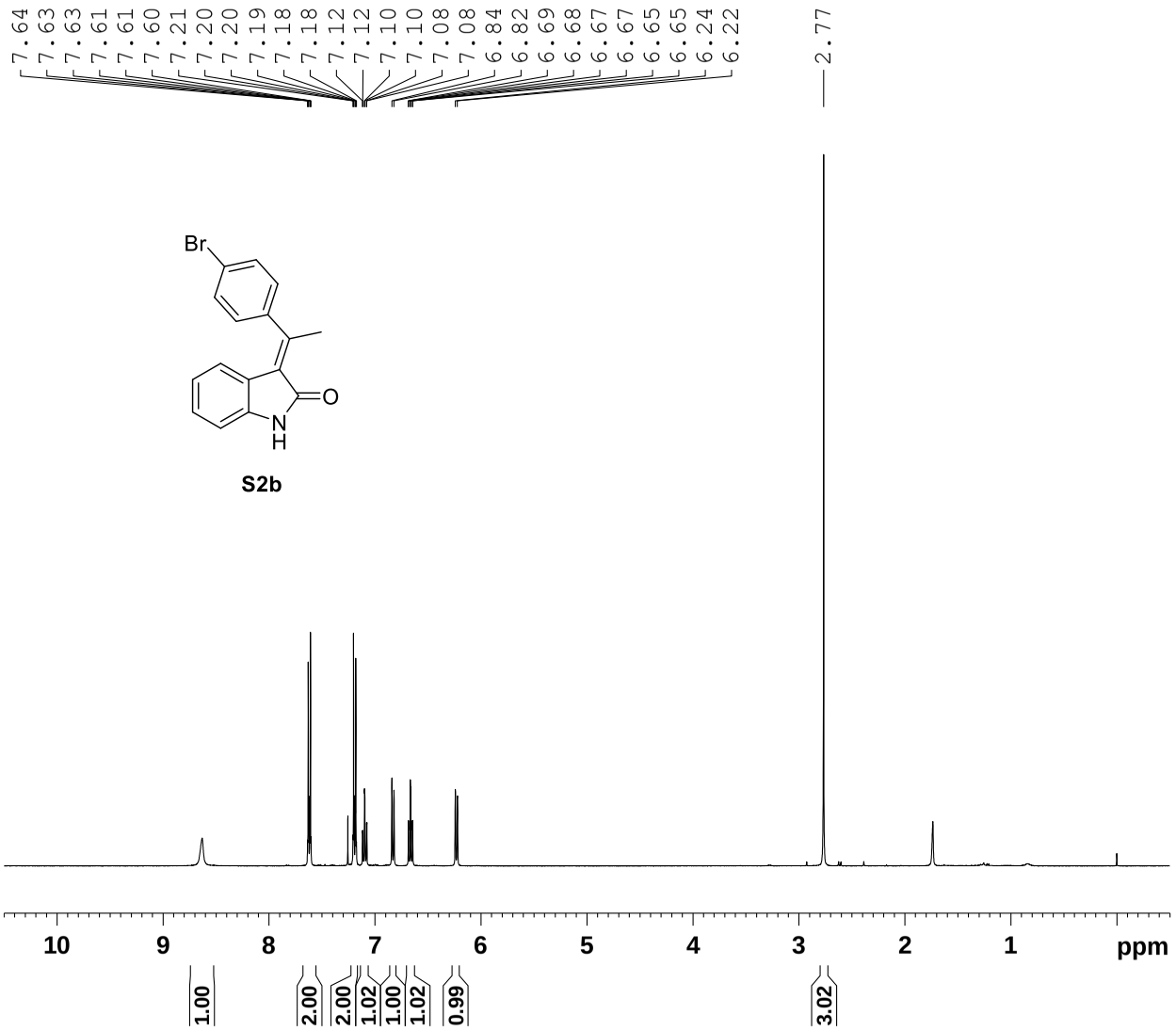


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TD0                      1

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NUC1                    1H
P1                   12.90 usec
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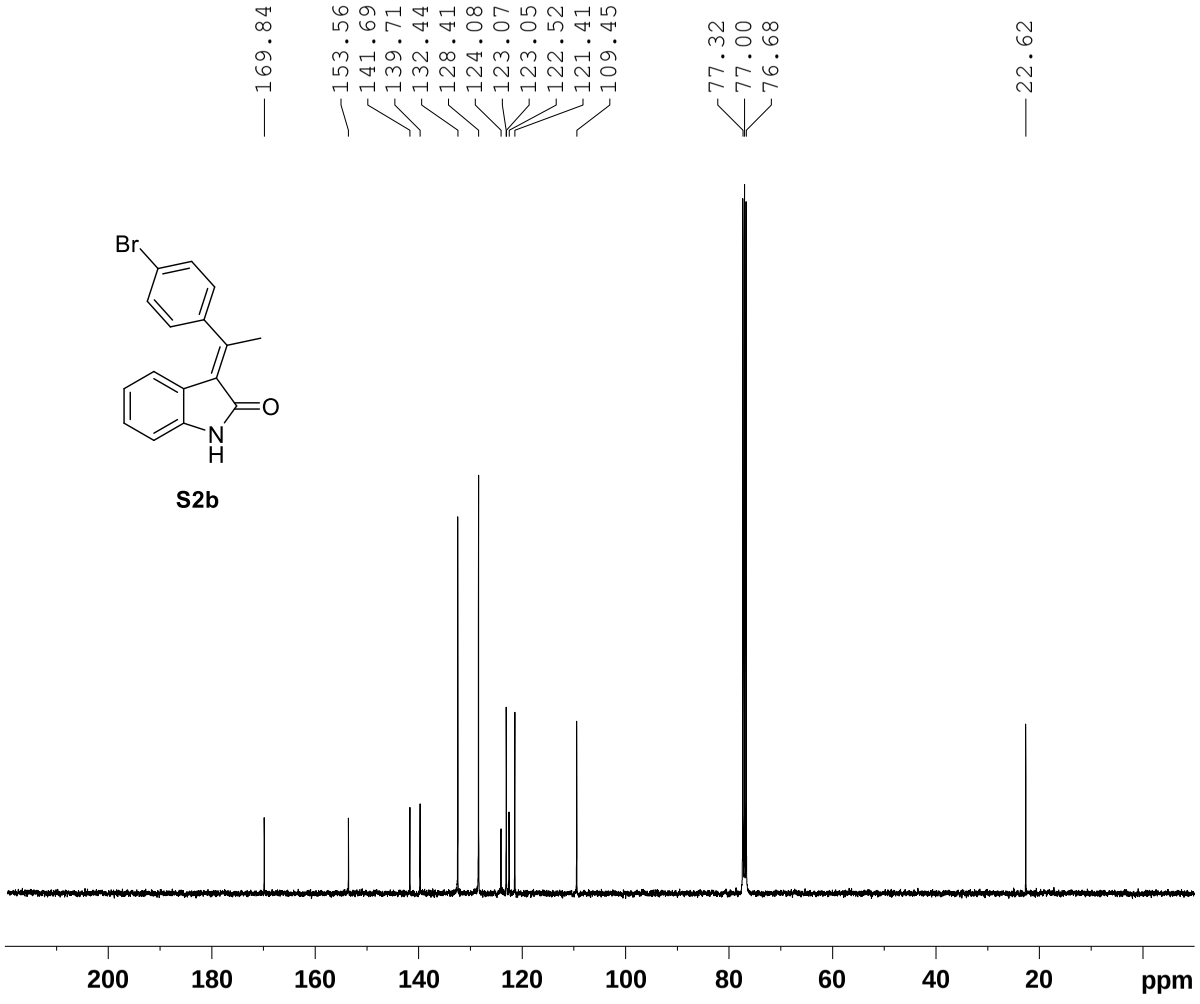


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SOLVENT              CDCl3
NS                    1102
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SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
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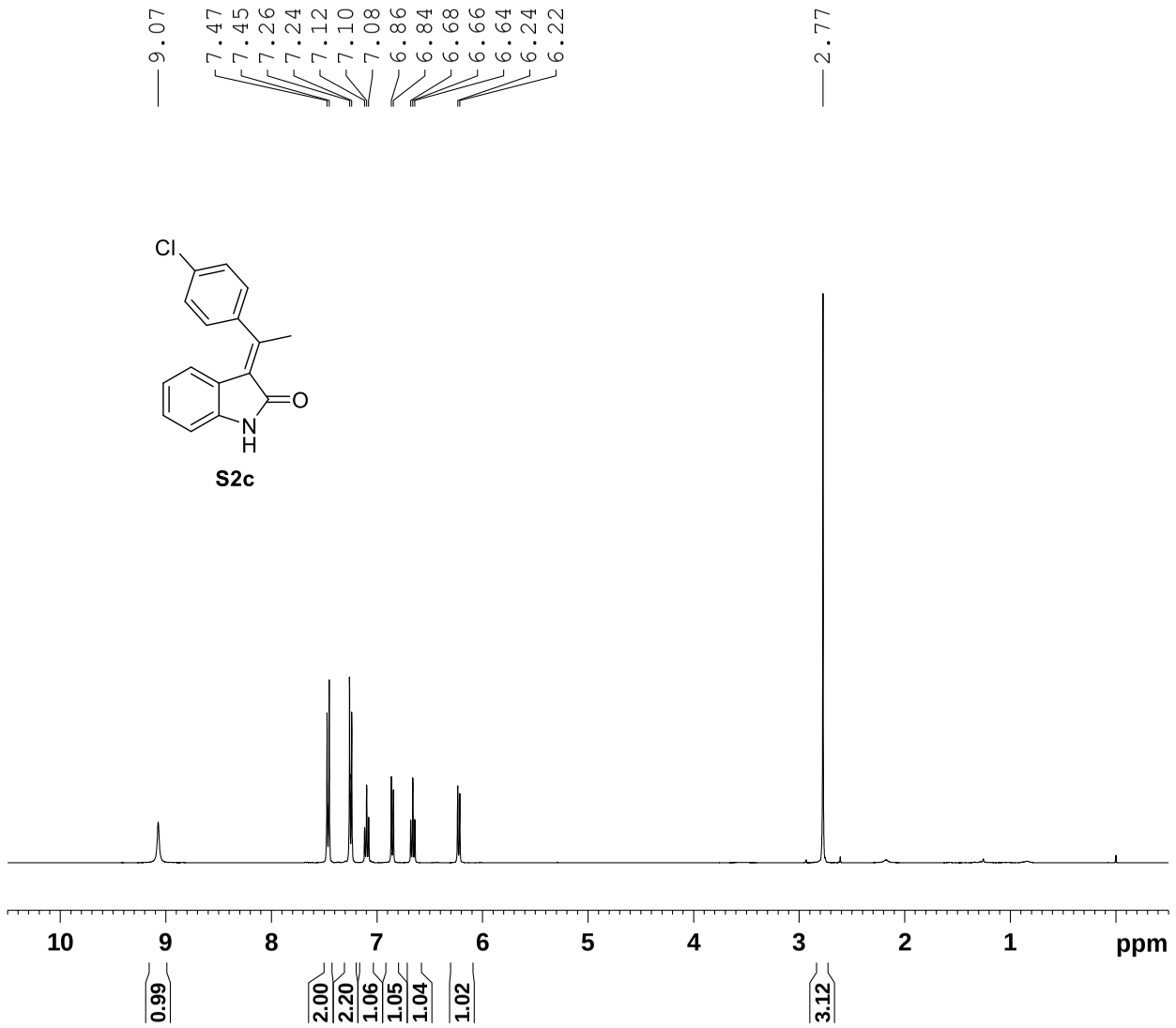
DE                   6.50 usec
TE                  298.8 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                   10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127714 MHz
WDW                    EM
SSB       0
LB                    2.00 Hz
GB        0
PC                    1.00
```



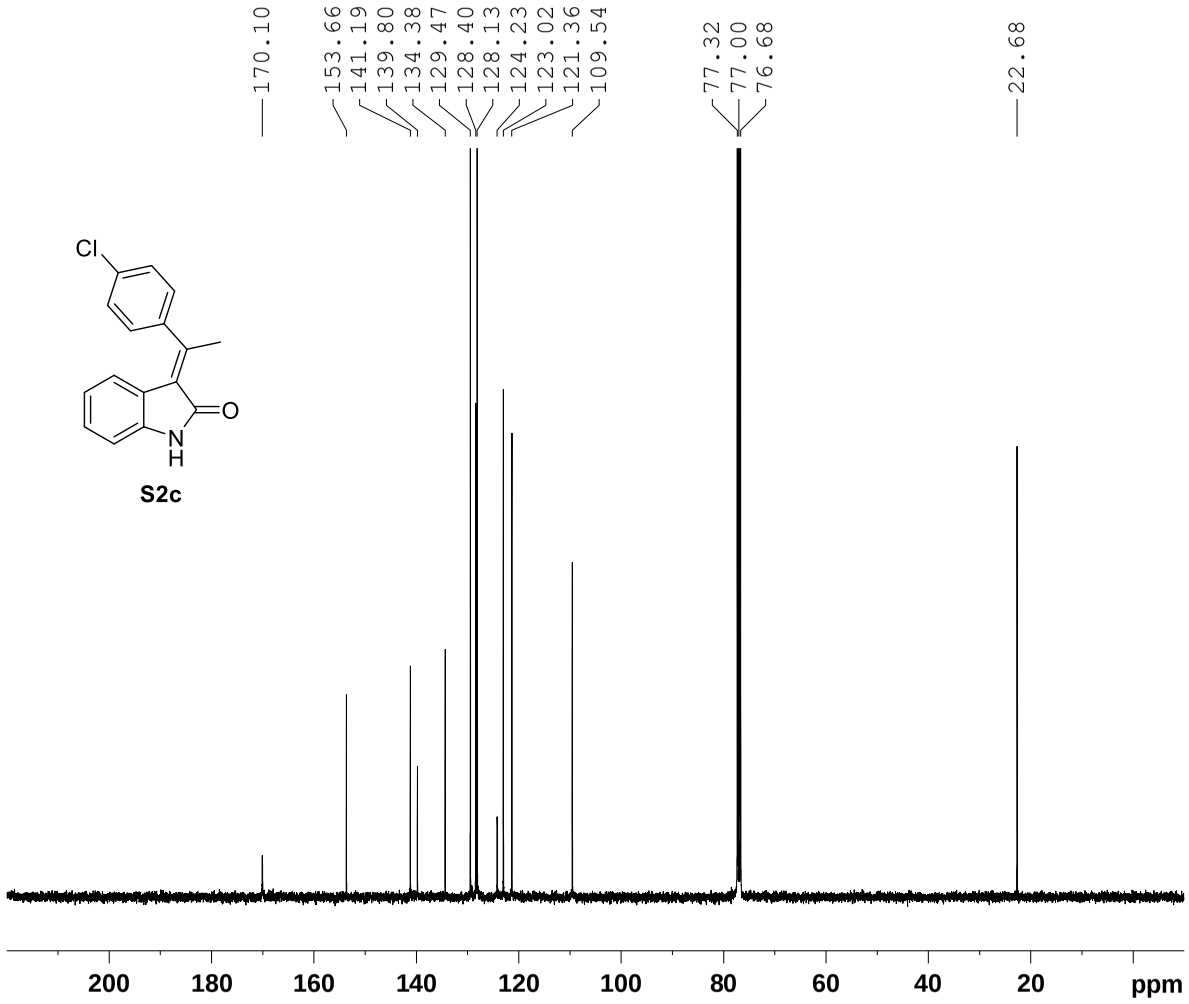
S2c

```
Current Data Parameters
NAME                  A173
EXPNO                   14
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180314
Time                 18.00
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ               2.2609921 sec
RG                     114
DW                  69.000 usec
DE                   6.50 usec
TE                  295.2 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300118 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



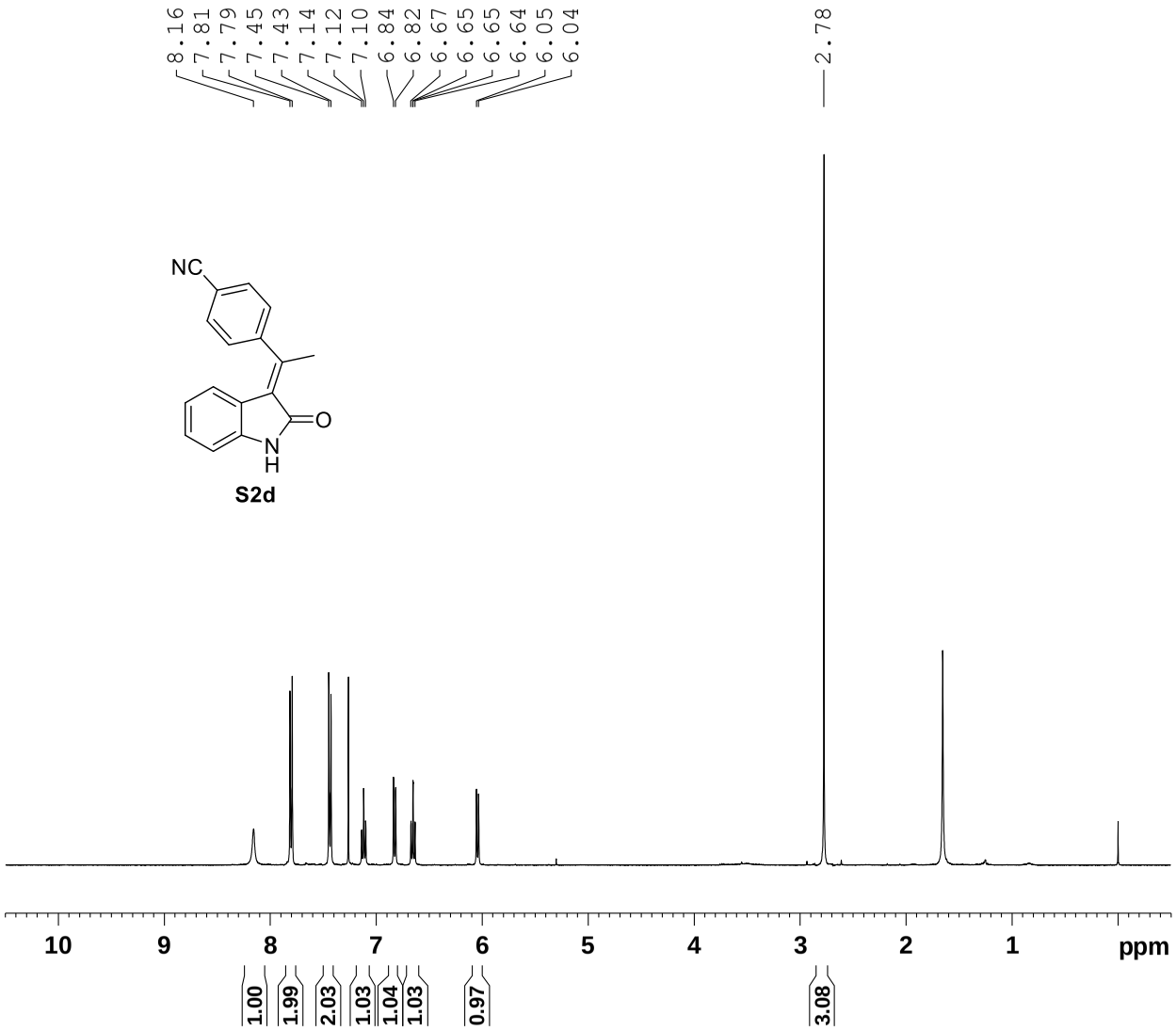

```
Current Data Parameters
NAME                  A173
EXPNO                   15
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180314
Time                  18.01
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     1640
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                0.6815744 sec
RG                     4096
DW                   20.800 usec
DE                    6.50 usec
TE                   295.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127731 MHz
WDW                     EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.00
```

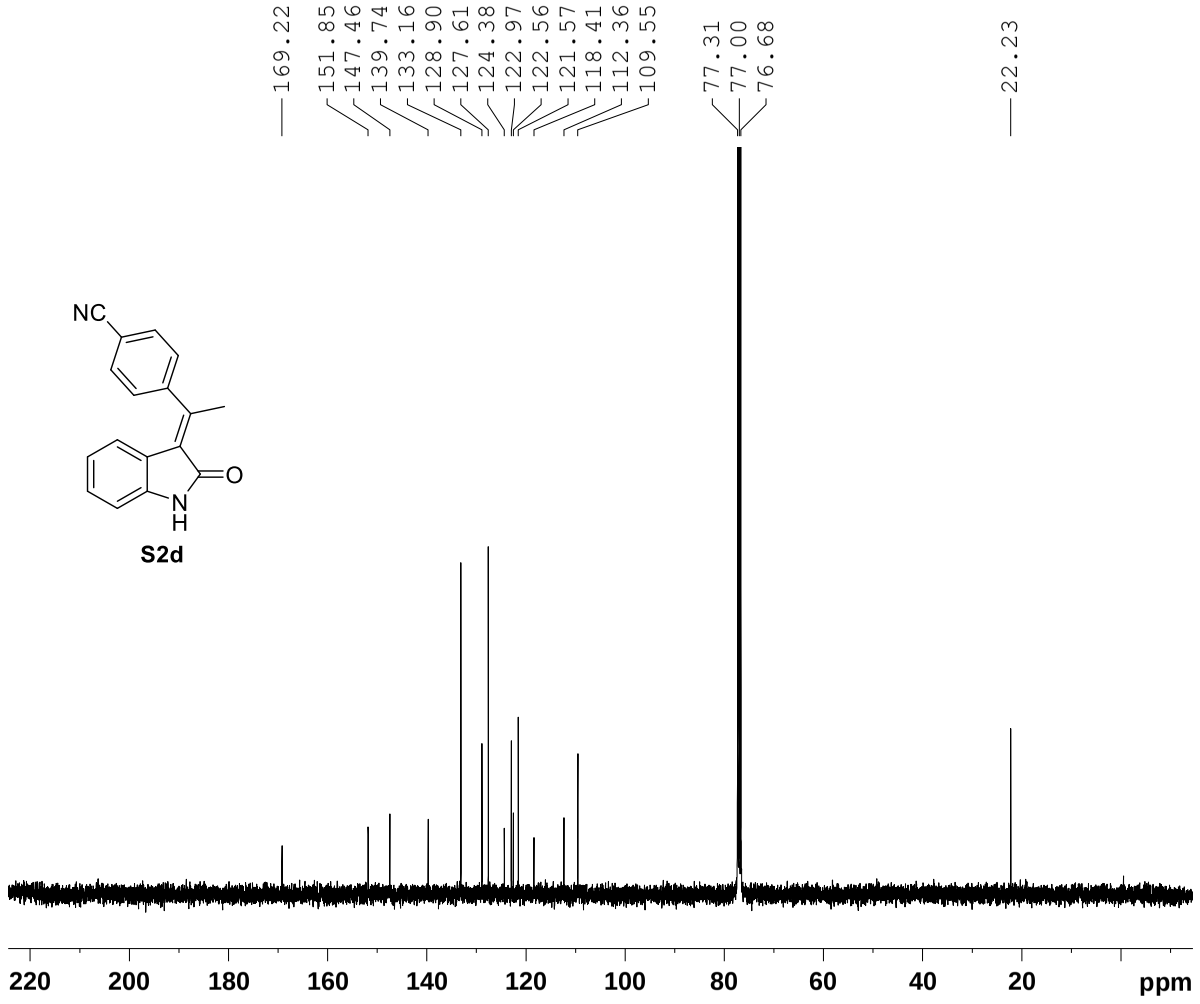



```
Current Data Parameters
NAME                  A187
EXPNO                    8
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180131
Time                 18.05
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES               0.221142 Hz
AQ                2.2609921 sec
RG                     114
DW                  69.000 usec
DE                    6.50 usec
TE                   294.6 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300078 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



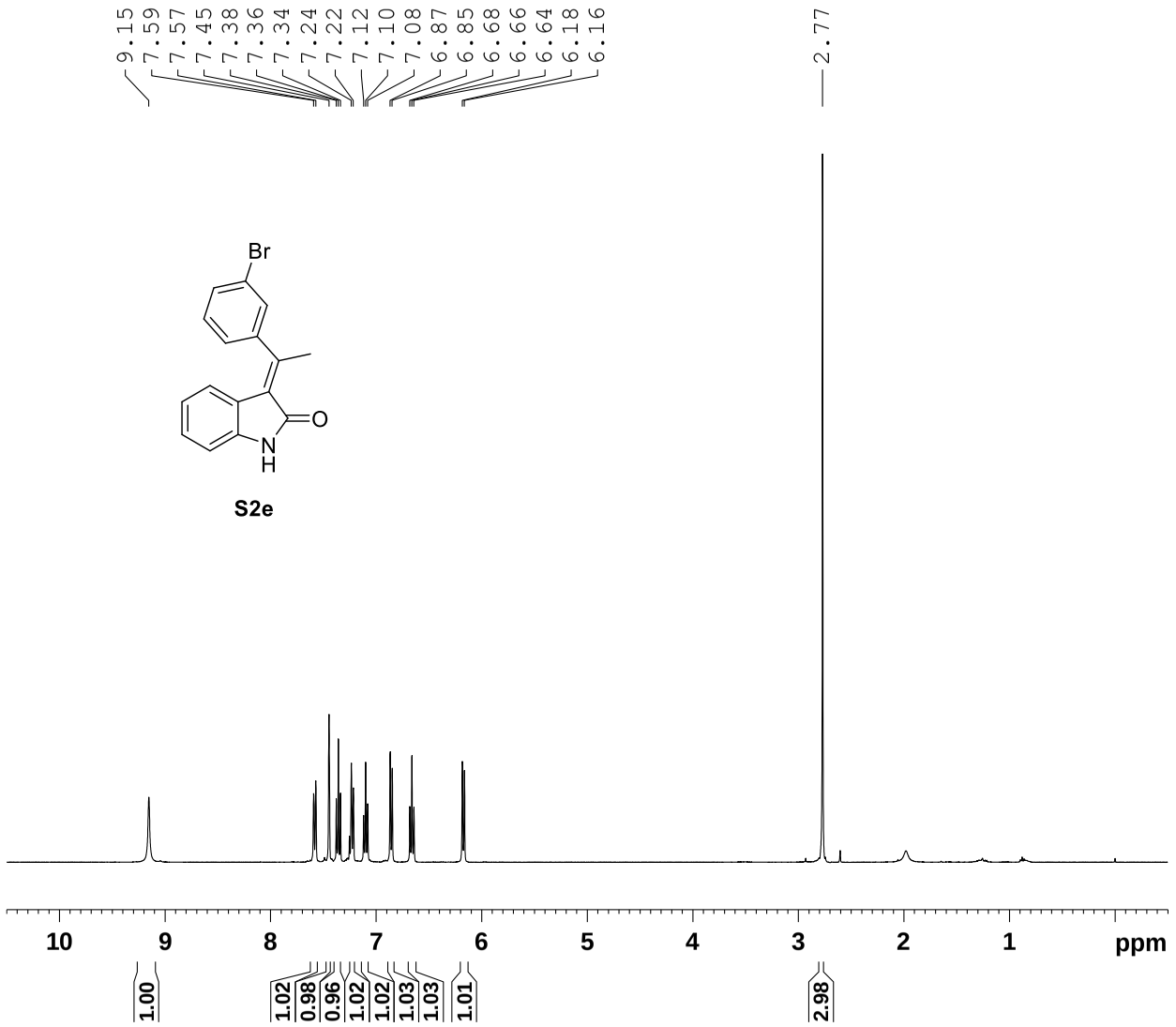

```
Current Data Parameters
NAME                  Data
EXPNO                   29
PROCNO                   1

F2 - Acquisition Parameters
Date_           20170825
Time                12.24
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                  1006
DS                     0
SWH            24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                9195.2
DW                20.800 usec
DE                 6.50 usec
TE                297.6 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF           100.6127709 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

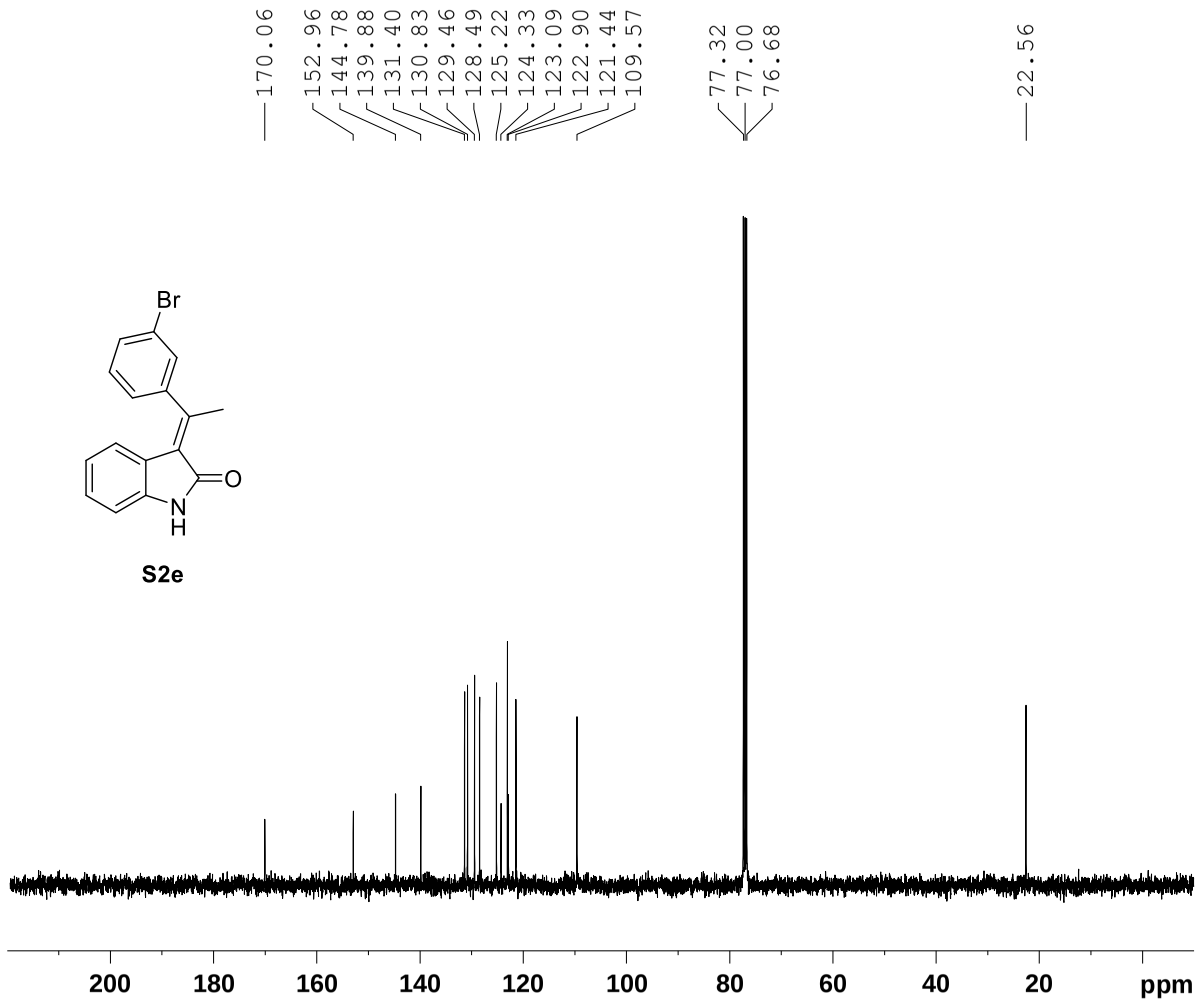



```
Current Data Parameters
NAME                  A125
EXPNO                    5
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170513
Time                 11.27
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ               2.2609921 sec
RG                     114
DW                  69.000 usec
DE                   6.50 usec
TE                  295.1 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300118 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



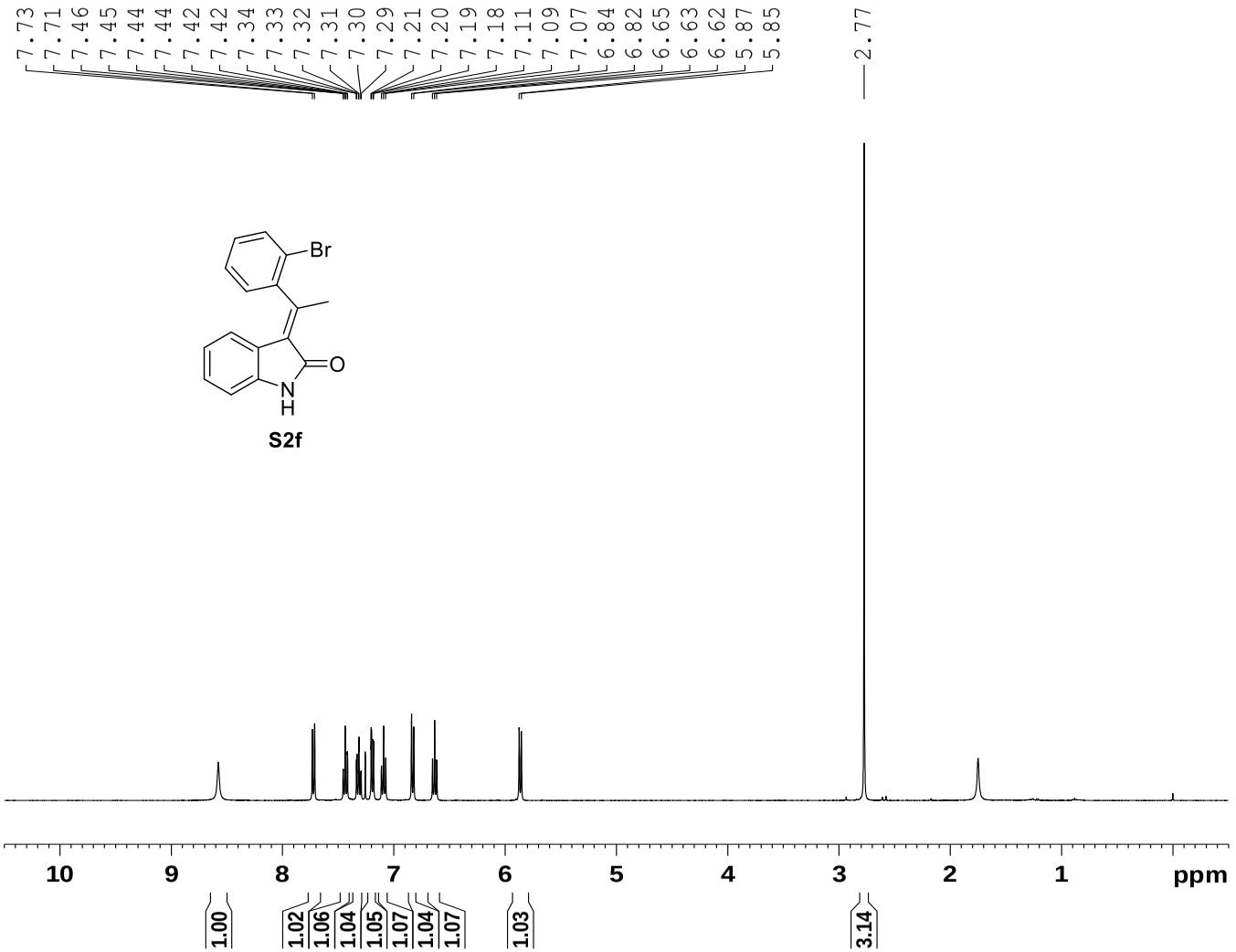

```
Current Data Parameters
NAME                  Data
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170516
Time                  17.05
INSTRUM               spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                      41
DS                       0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                    198.09
DW                   20.800 usec
DE                    6.50 usec
TE                   298.7 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                   10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127744 MHz
WDW                    EM
SSB       0
LB                    2.00 Hz
GB        0
PC                    1.00
```



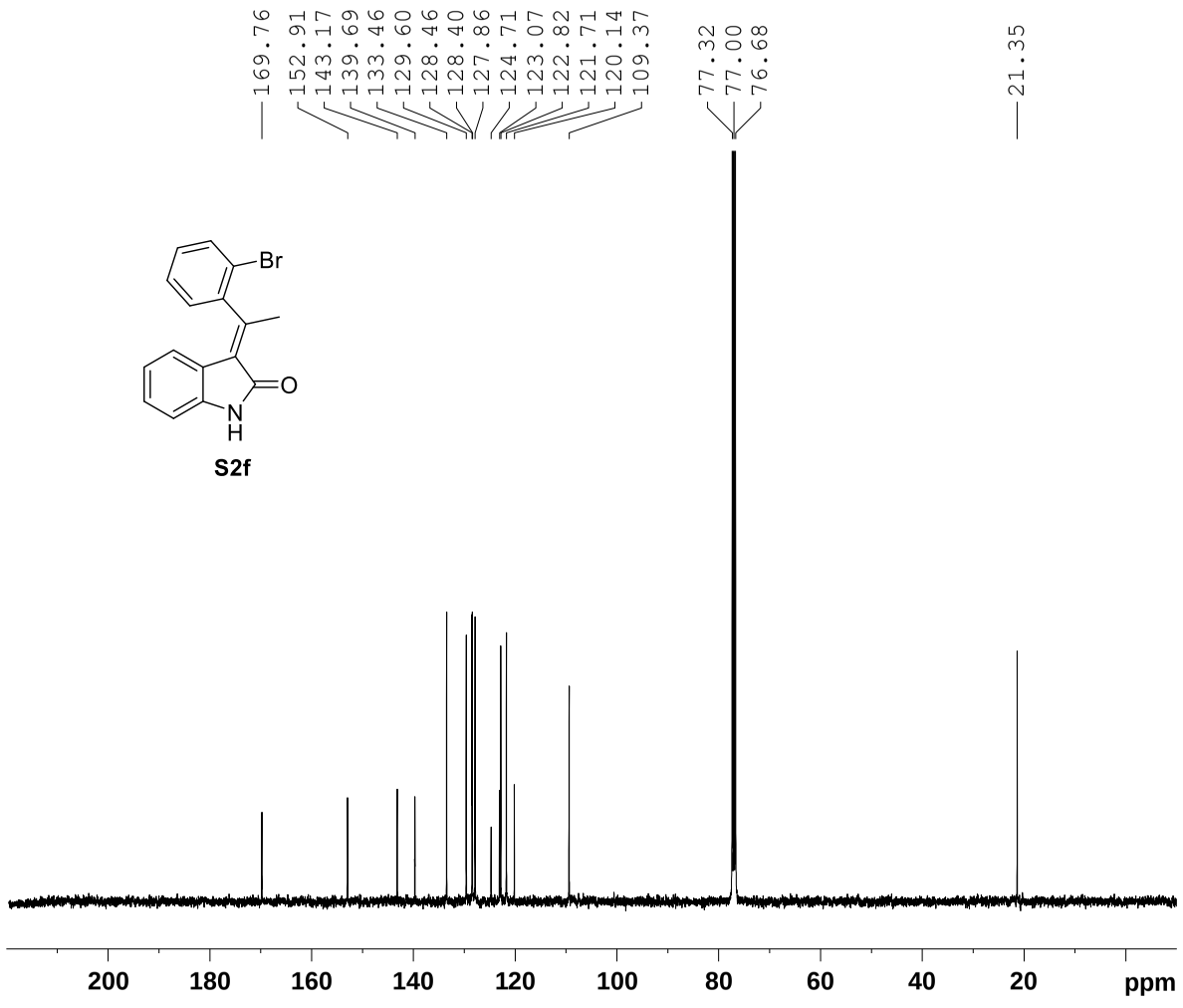
S2f

```
Current Data Parameters
NAME                  Data
EXPNO                    5
PROCNO                   1

F2 - Acquisition Parameters
Date_             20170513
Time                 11.59
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7211.539 Hz
FIDRES           0.220079 Hz
AQ               2.2719147 sec
RG                  113.31
DW                  69.333 usec
DE                  10.50 usec
TE                  298.1 K
D1             2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          400.1324008 MHz
NUC1                    1H
P1                  12.90 usec
PLW1          15.00000000 W

F2 - Processing parameters
SI                    16384
SF            400.1300109 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



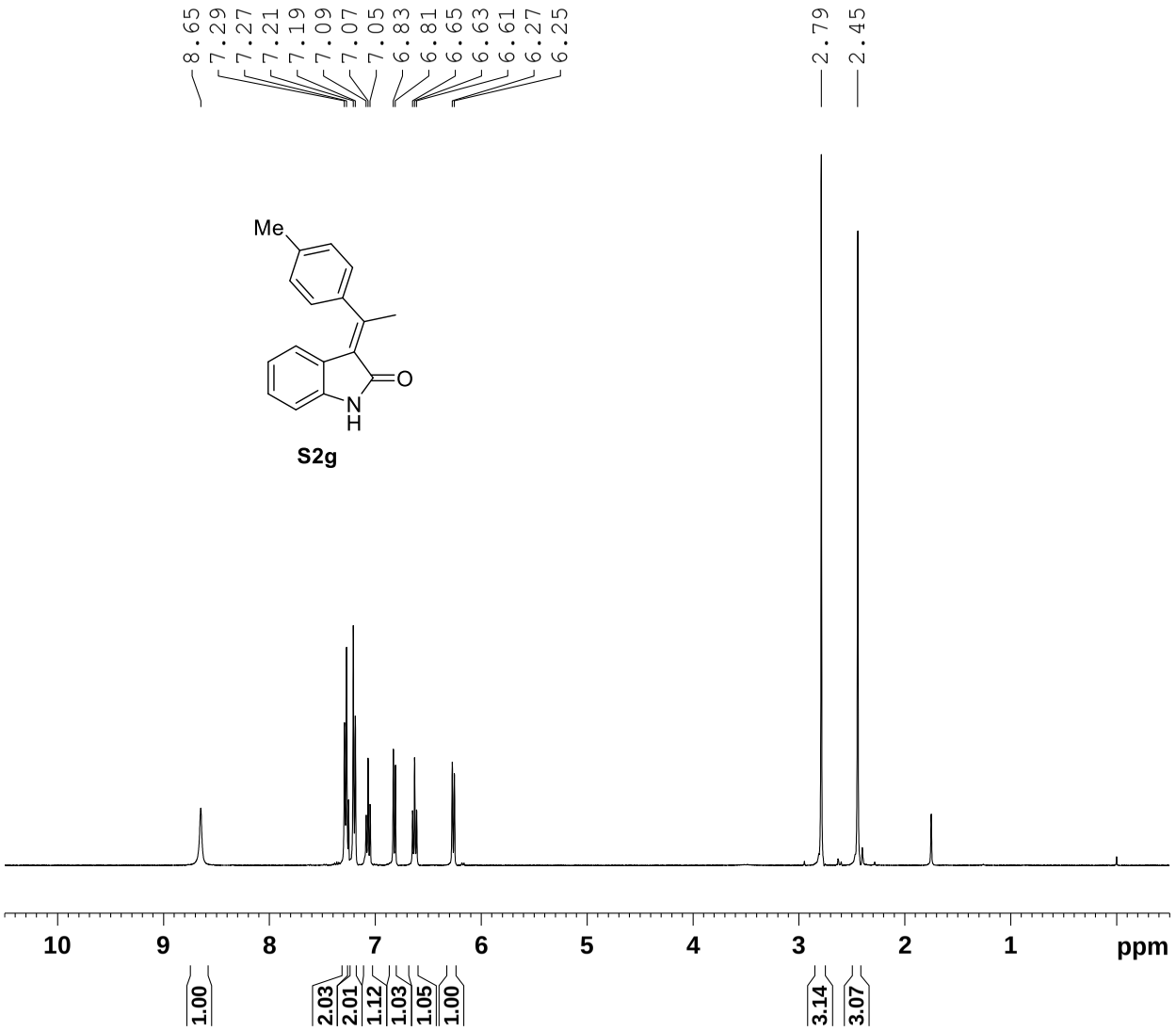

```
Current Data Parameters
NAME                  Data
EXPNO                    6
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170515
Time                 19.56
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG              zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1019
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  297.8 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6228298 MHz
NUC1                  13C
P1                  10.00 usec
PLW1          47.50000000 W

======== CHANNEL f2 ========
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          15.00000000 W
PLW12          0.33750001 W
PLW13          0.27338001 W

F2 - Processing parameters
SI                   32768
SF            100.6127722 MHz
WDW                    EM
SSB       0
LB                  2.00 Hz
GB        0
PC                  1.00
```

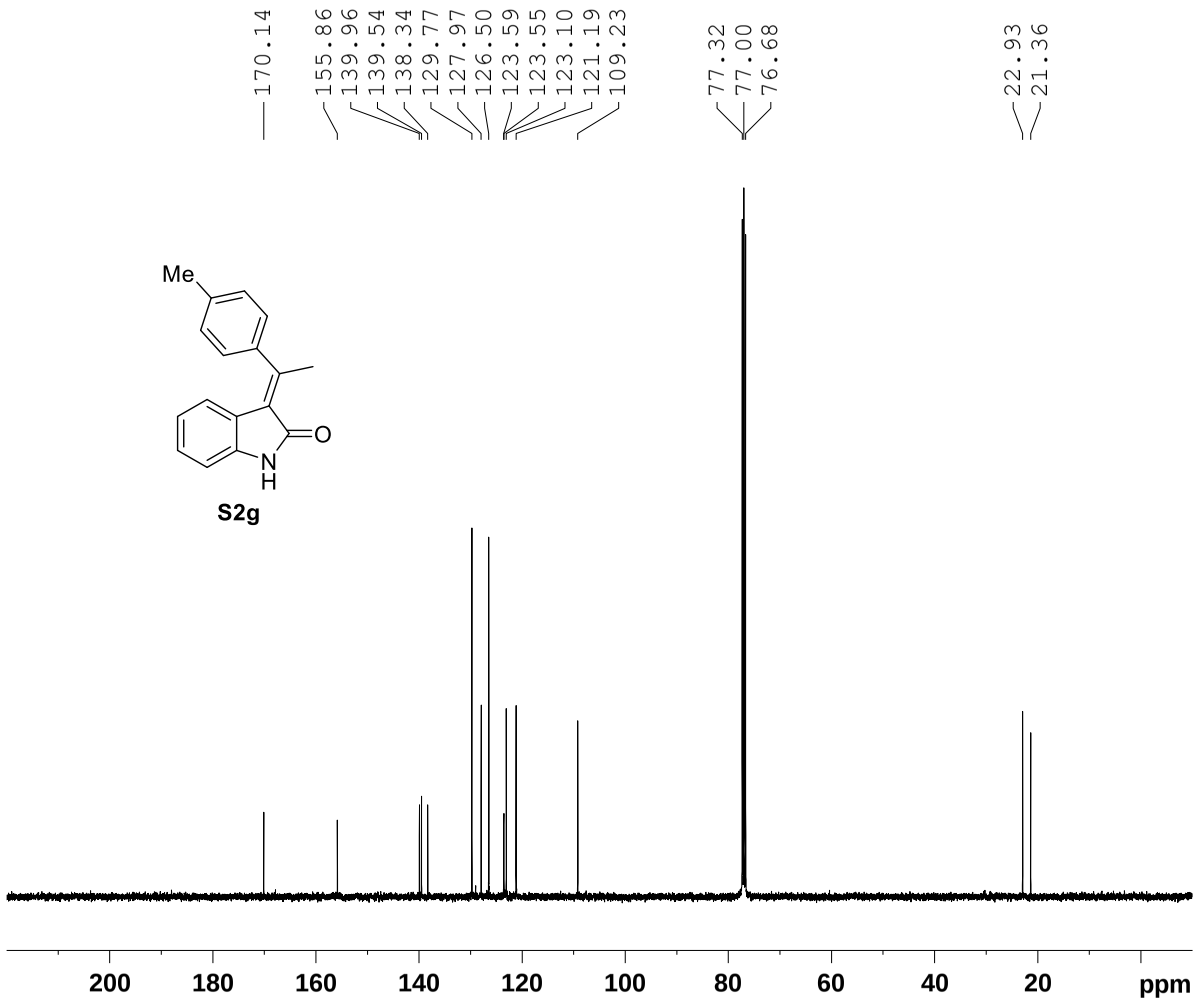



```
Current Data Parameters
NAME                  Data
EXPNO                   16
PROCNO                   1

F2 - Acquisition Parameters
Date_            20170609
Time                18.03
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    114
DW                 69.000 usec
DE                  6.50 usec
TE                 298.6 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 16.80 usec
PL1                 1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF           400.1300122 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



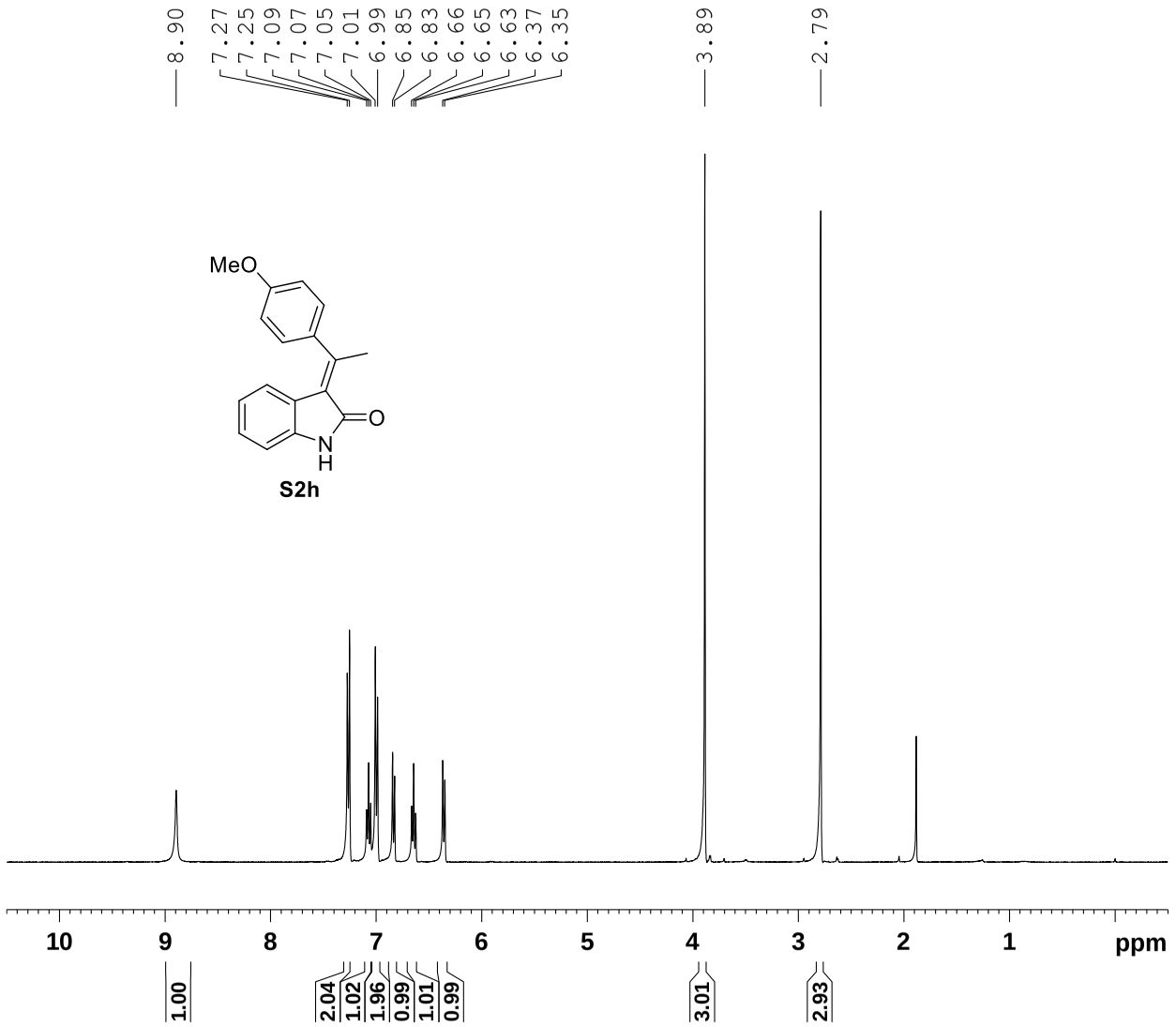

```
Current Data Parameters
NAME                  Data
EXPNO                   17
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170609
Time                  18.06
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     1236
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                     8192
DW                   20.800 usec
DE                    6.50 usec
TE                   298.8 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1           100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 15.68 dB
PL13                 20.00 dB
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF             100.6127716 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

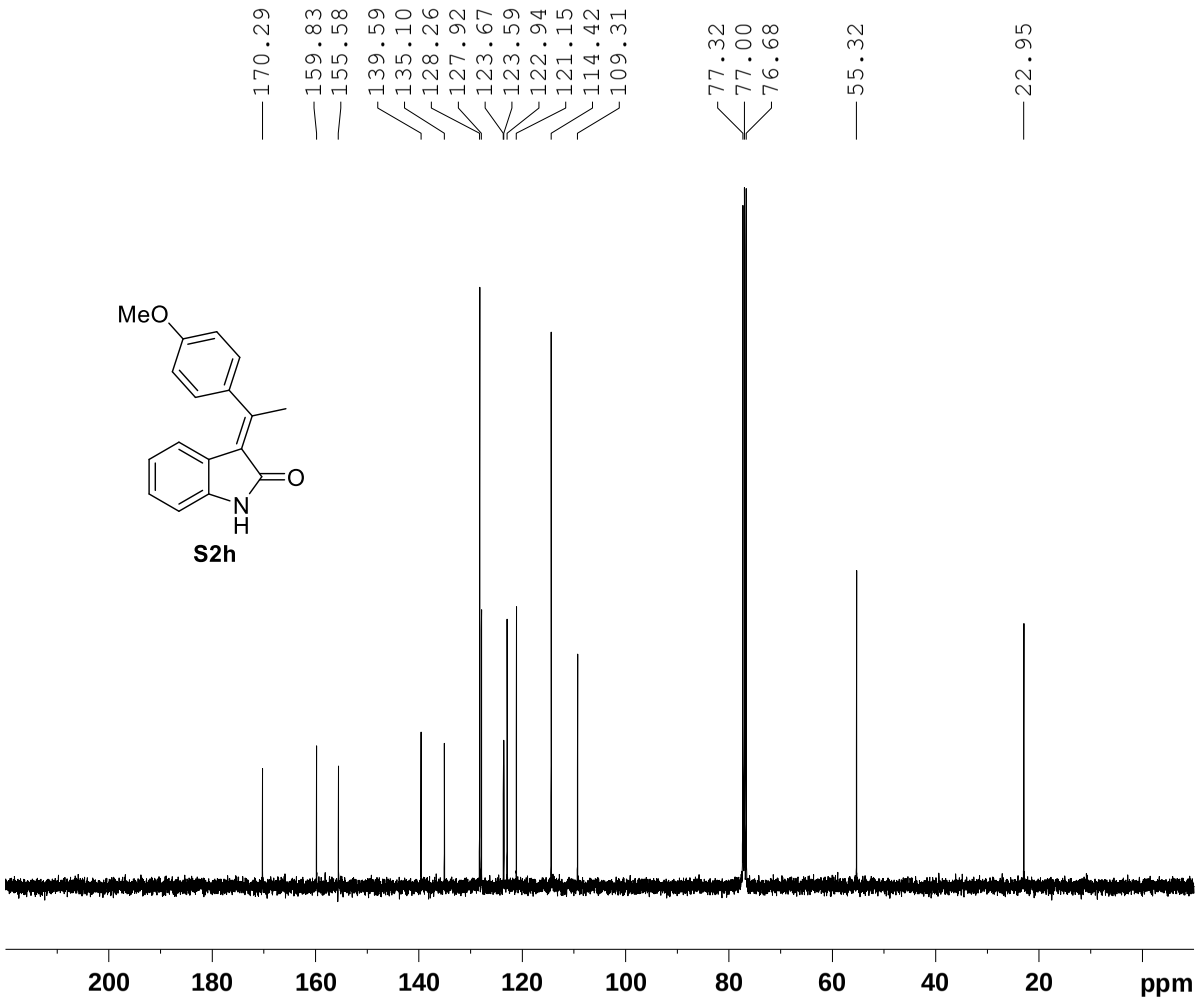



```
Current Data Parameters
NAME                  Data
EXPNO                   18
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170610
Time                 17.37
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    114
DW                 69.000 usec
DE                  6.50 usec
TE                 298.6 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                  16.80 usec
PL1                  1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF           400.1300118 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                   1.00
```



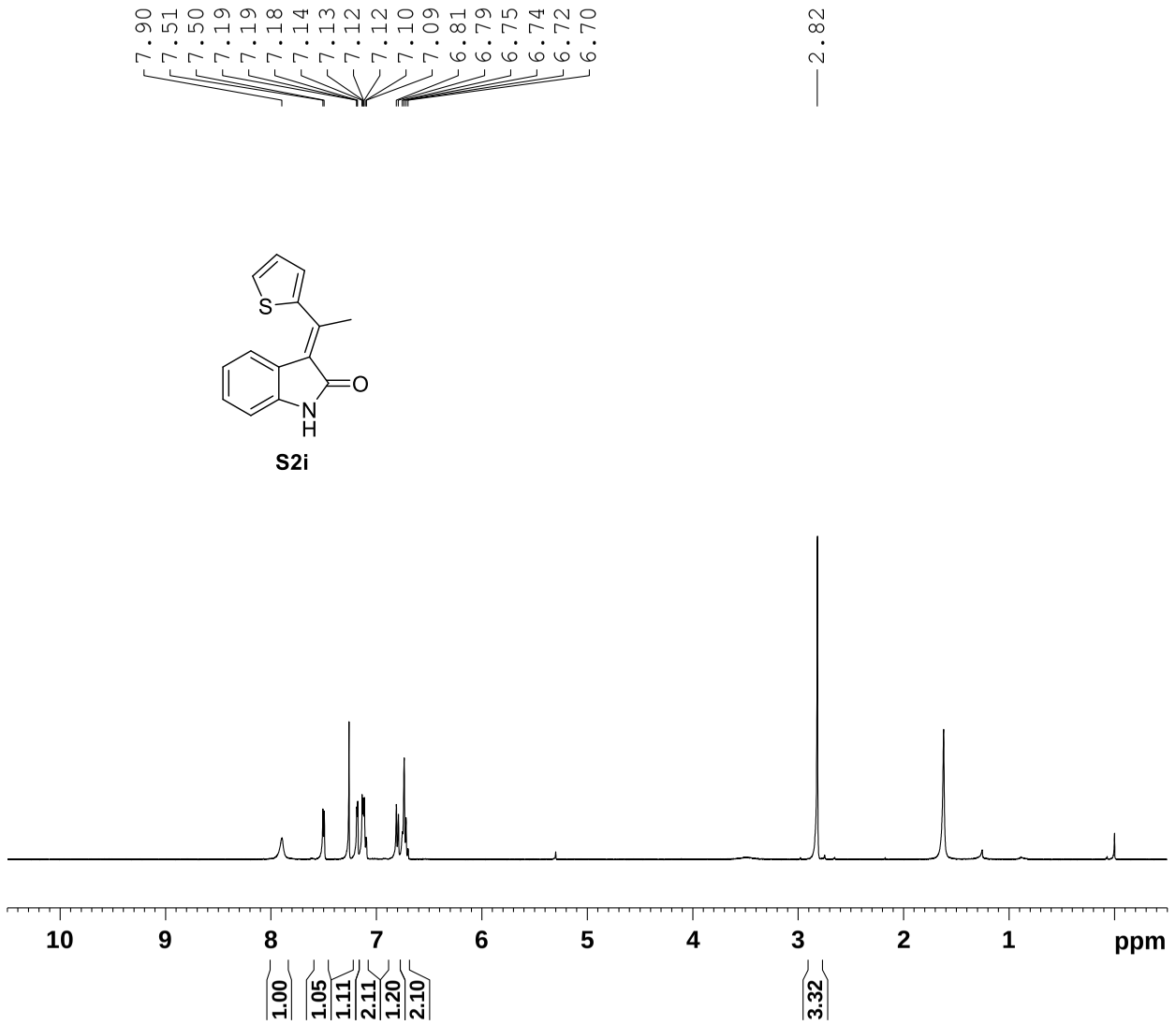

```
Current Data Parameters
NAME                  Data
EXPNO                   19
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170610
Time                  17.39
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                      470
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                0.6815744 sec
RG                   9195.2
DW                   20.800 usec
DE                    6.50 usec
TE                   298.6 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.50 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                  -0.60 dB
PL12                 15.00 dB
PL13                 18.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127731 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



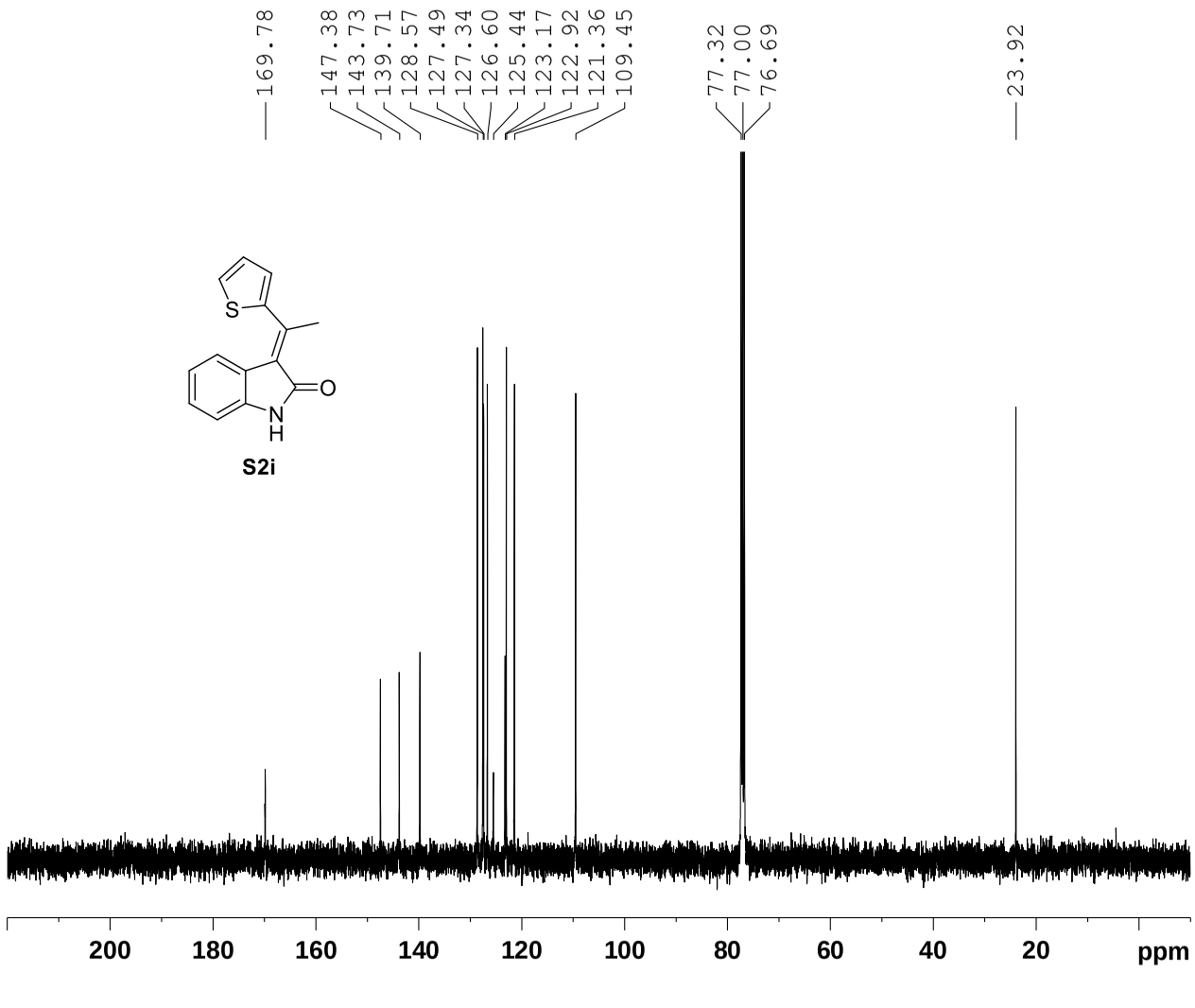
S2i

```
Current Data Parameters
NAME                  A188
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_              20171215
Time                 21.18
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES             0.221142 Hz
AQ                2.2609921 sec
RG                      256
DW                   69.000 usec
DE                    6.50 usec
TE                   296.3 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF             400.1300087 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



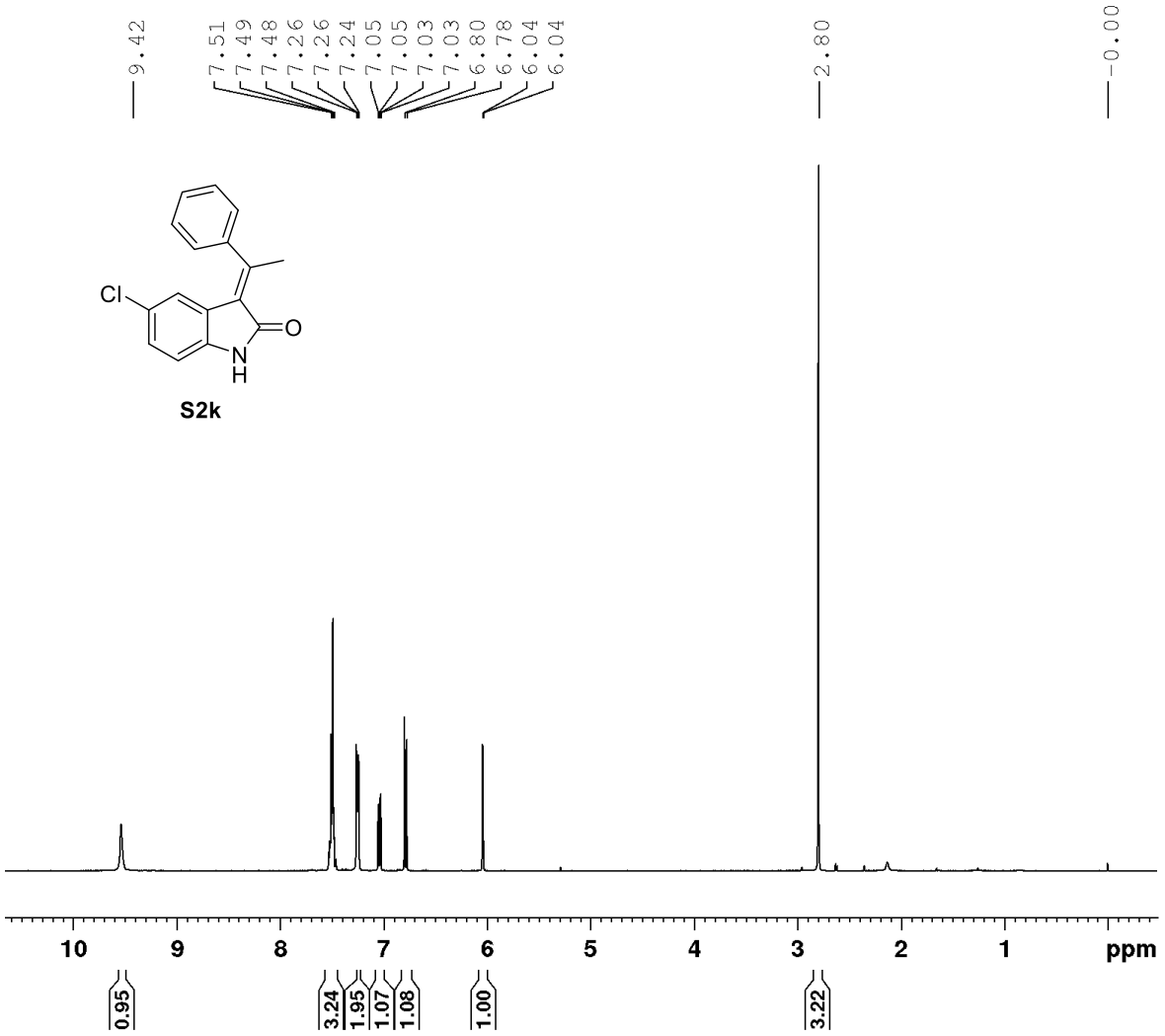

```
Current Data Parameters
NAME                  A188
EXPNO                    5
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180210
Time                 15.21
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1085
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ              0.6815744 sec
RG                    4096
DW                20.800 usec
DE                 6.50 usec
TE                 297.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                   1H
PCPD2              90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127723 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

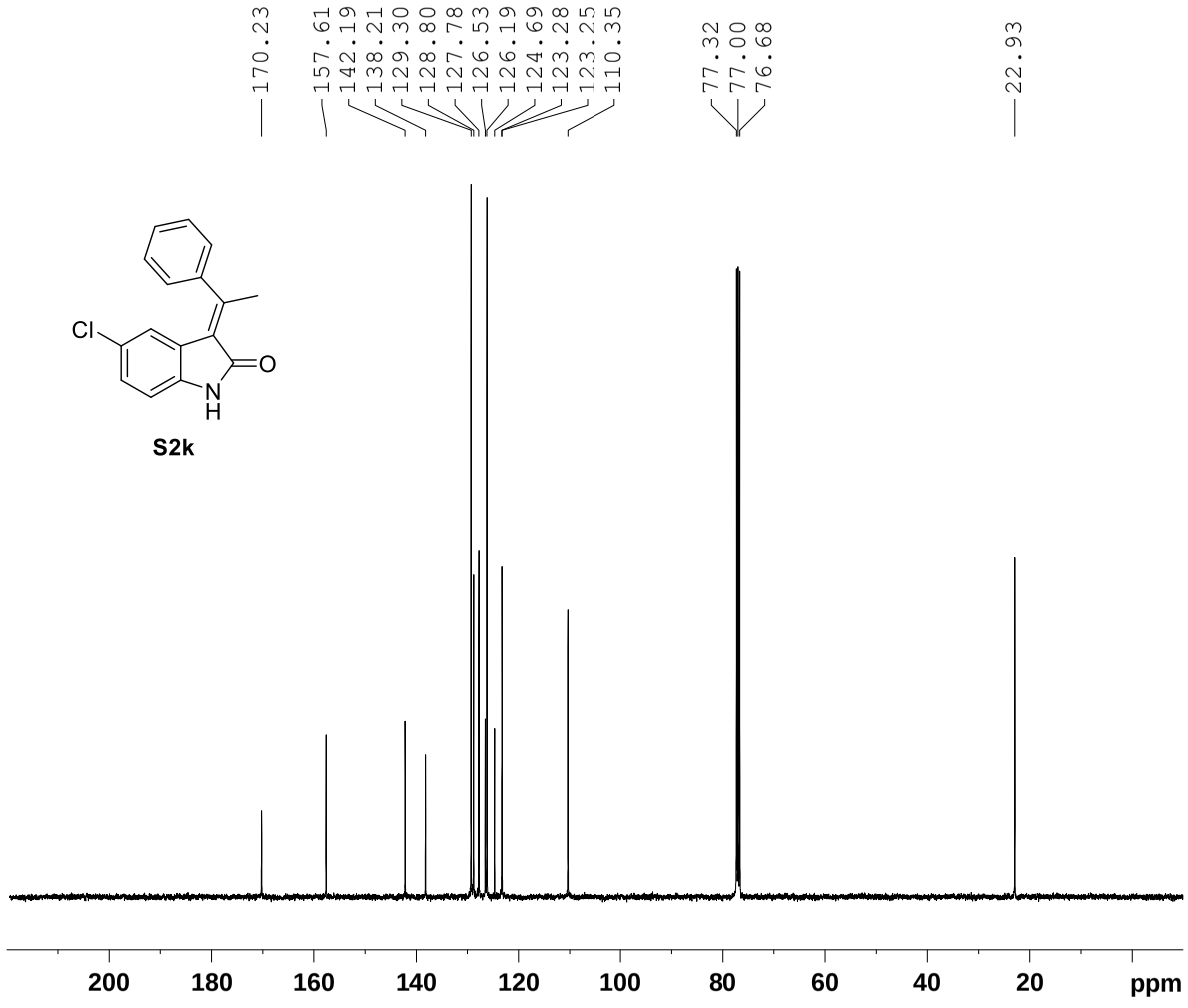



```
Current Data Parameters
NAME                  S2j
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20180504
Time                13.03
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7211.539 Hz
FIDRES           0.220079 Hz
AQ               2.2719147 sec
RG                  71.42
DW                 69.333 usec
DE                 10.50 usec
TE                 297.2 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          400.1324008 MHz
NUC1                   1H
P1                  12.90 usec
PLW1         15.00000000 W

F2 - Processing parameters
SI                  16384
SF            400.1300121 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                   1.00
```



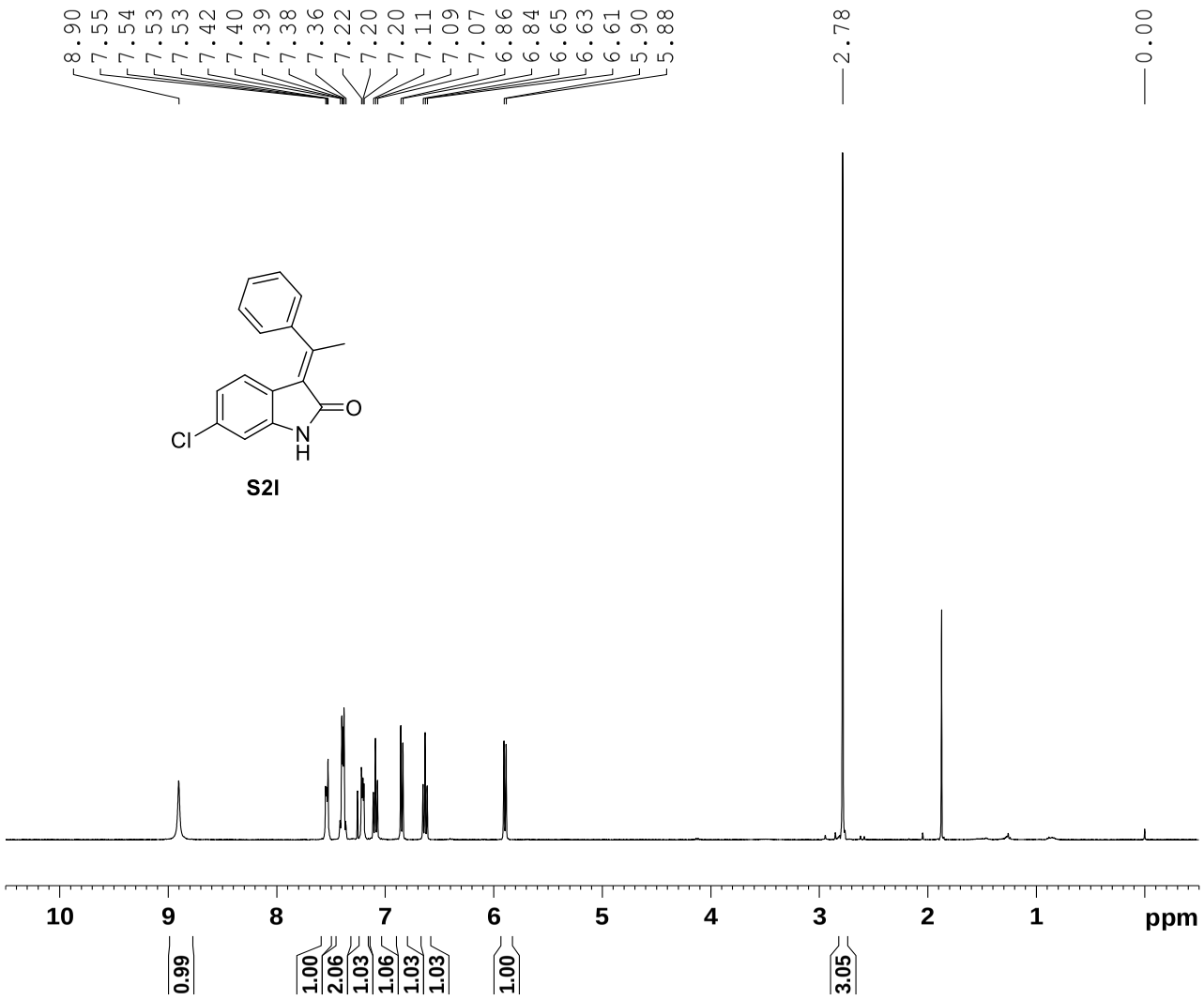

```
Current Data Parameters
NAME                  A279
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180504
Time                 13.04
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1000
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                    6.50 usec
TE                  297.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2            waltz16
PCPD2               90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127729 MHz
WDW                    EM
SSB          0
LB                   2.00 Hz
GB           0
PC                   1.00
```



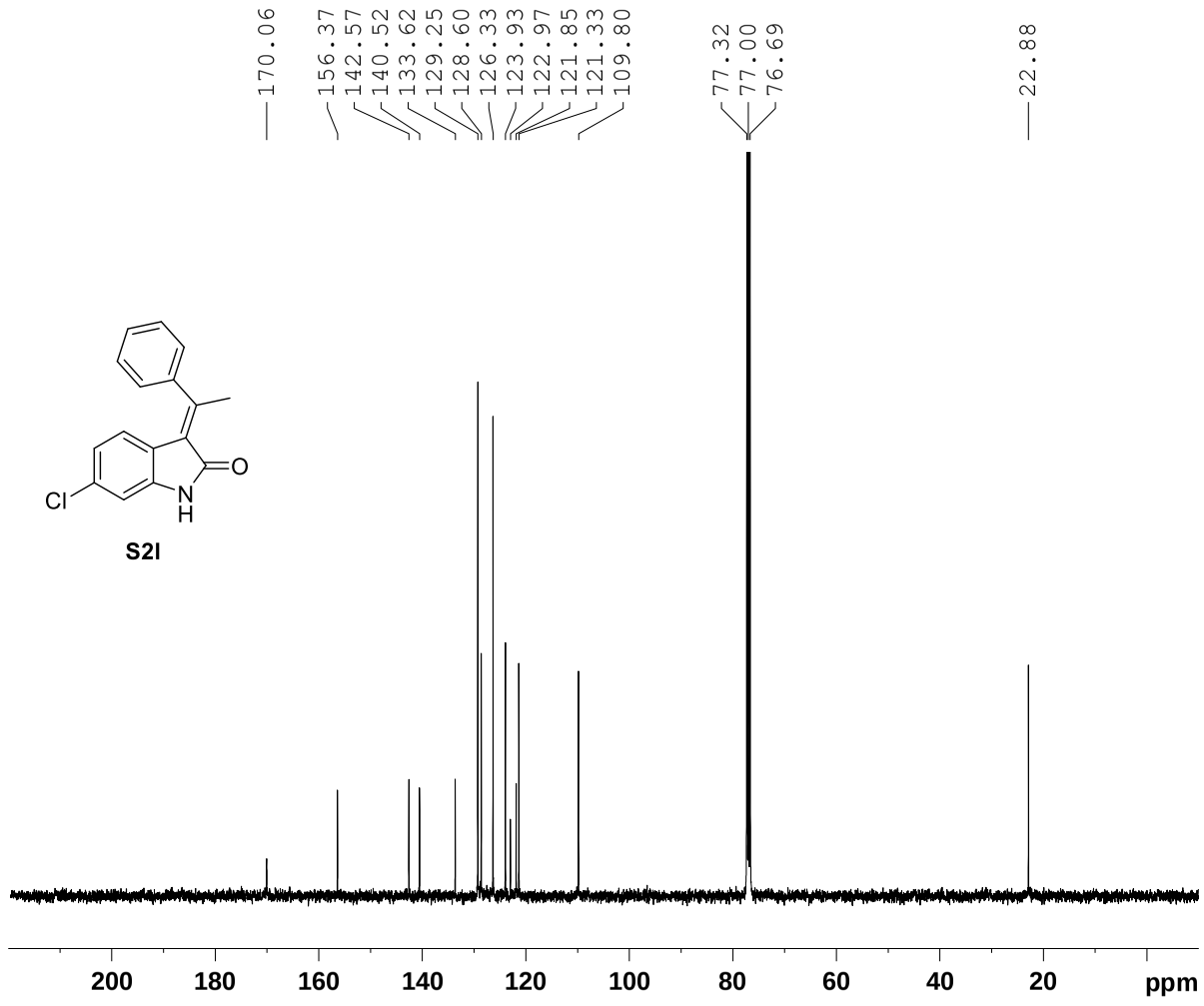
S2l

```
Current Data Parameters
NAME                  S2k
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20170508
Time                10.01
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    114
DW                 69.000 usec
DE                  6.50 usec
TE                 298.7 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.40 usec
PL1                 1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF           400.1300118 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



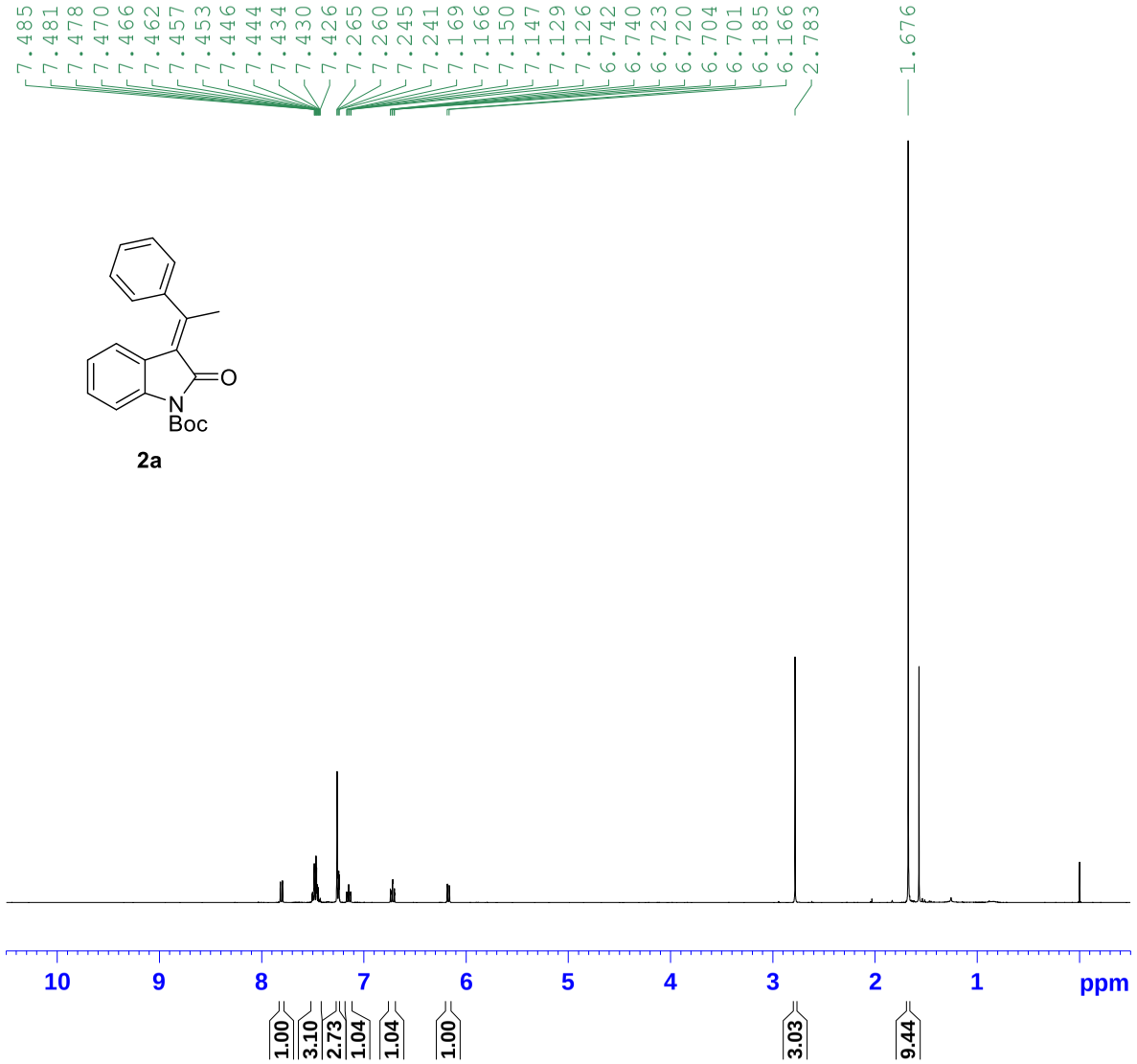

```
Current Data Parameters
NAME                  A261
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20171216
Time                 16.19
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     859
DS                       0
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127714 MHz
WDW                    EM
SSB       0
LB                    2.00 Hz
GB        0
PC                    1.00
```

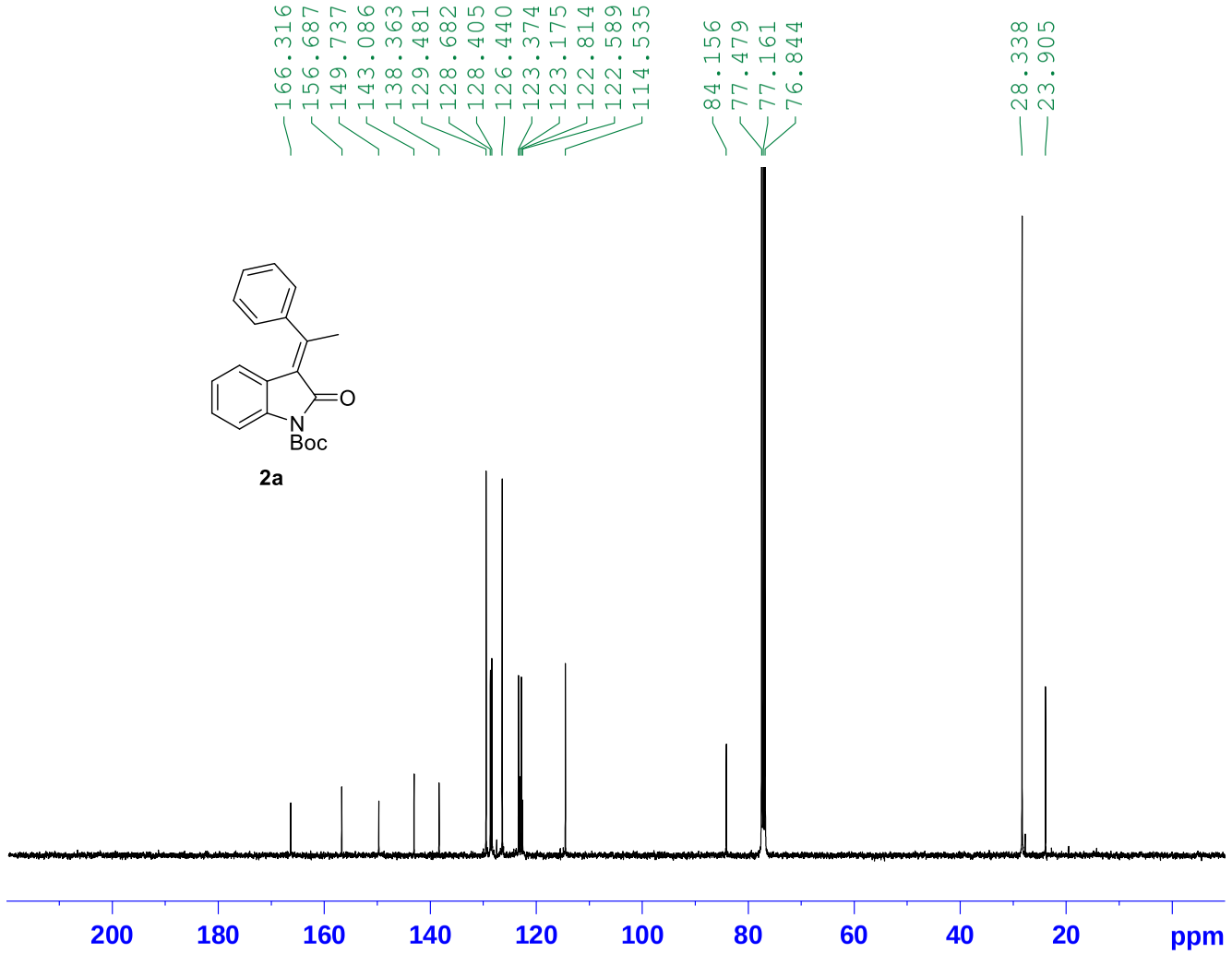



```
Current Data Parameters
NAME                       5
EXPNO                      1
PROCNO                     1

F2 - Acquisition Parameters
Date_               20170330
Time                   12.01
INSTRUM                spect
PROBHD   5 mm PABBO BB/
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7211.539 Hz
FIDRES            0.220079 Hz
AQ                2.2719147 sec
RG                   198.09
DW                   69.333 usec
DE                    10.50 usec
TE                    297.9 K
D1                2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
SFO1            400.1324008 MHz
NUC1                      1H
P1                     12.90 usec
PLW1           15.00000000 W

F2 - Processing parameters
SI                    16384
SF              400.1300096 MHz
WDW                      EM
SSB          0
LB           0 Hz
GB           0
PC                     1.00
```



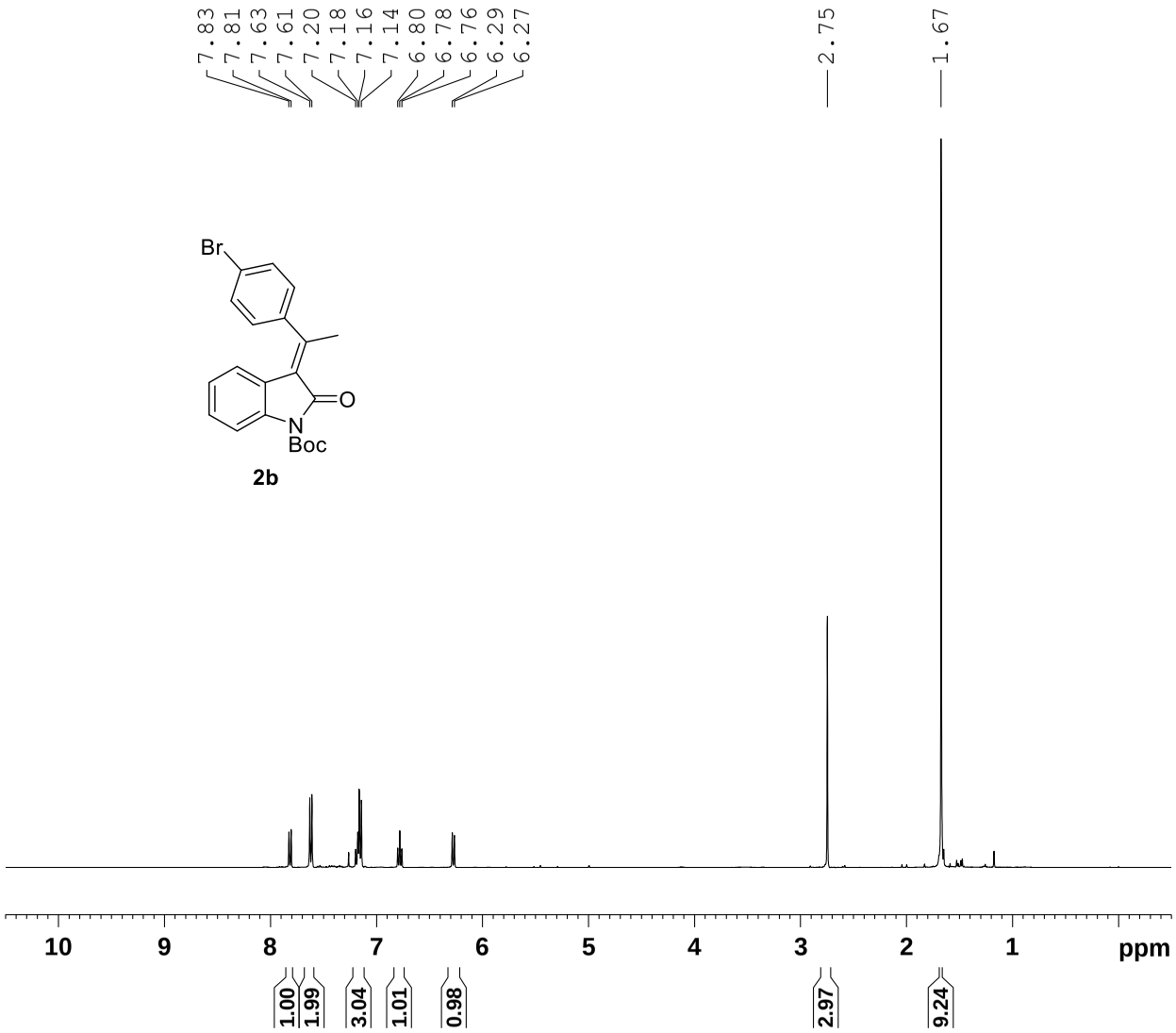

```
Current Data Parameters
NAME                   5
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170209
Time               17.09
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 32768
SOLVENT            CDCl3
NS                  2118
DS                     0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG               198.09
DW                20.800 usec
DE                 6.50 usec
TE                297.7 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1        100.6228298 MHz
NUC1                13C
P1                10.00 usec
PLW1        47.50000000 W

======== CHANNEL f2 ========
SFO2        400.1316005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2        15.00000000 W
PLW12        0.33750001 W
PLW13        0.27338001 W

F2 - Processing parameters
SI                 32768
SF          100.6127554 MHz
WDW                   EM
SSB       0
LB                 2.00 Hz
GB        0
PC                 1.00
```

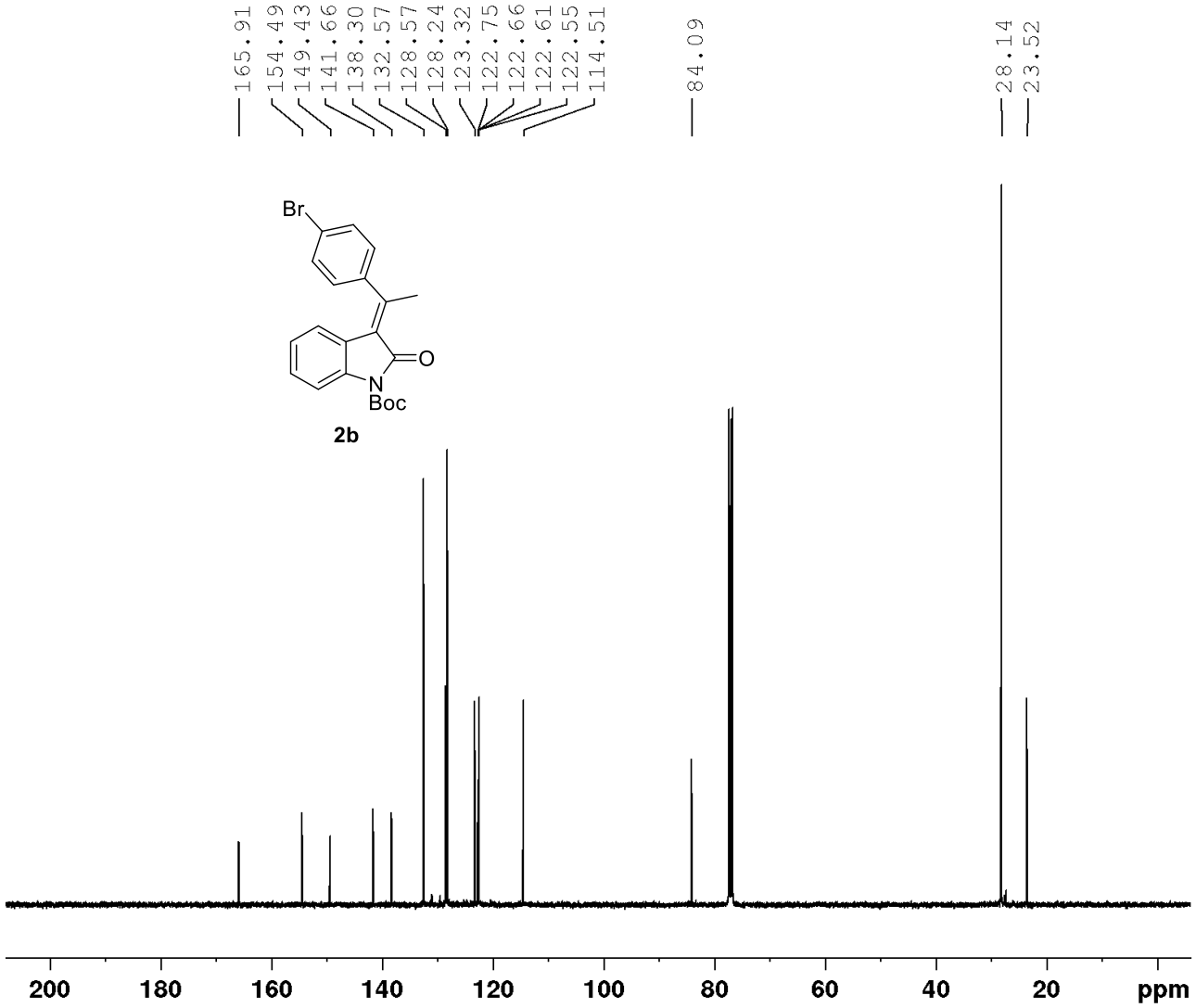



```
Current Data Parameters
NAME                  Data
EXPNO                   22
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170629
Time                  12.18
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                      114
DW                 69.000 usec
DE                  6.50 usec
TE                  297.0 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  16.80 usec
PL1                  1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                      16384
SF            400.1300083 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



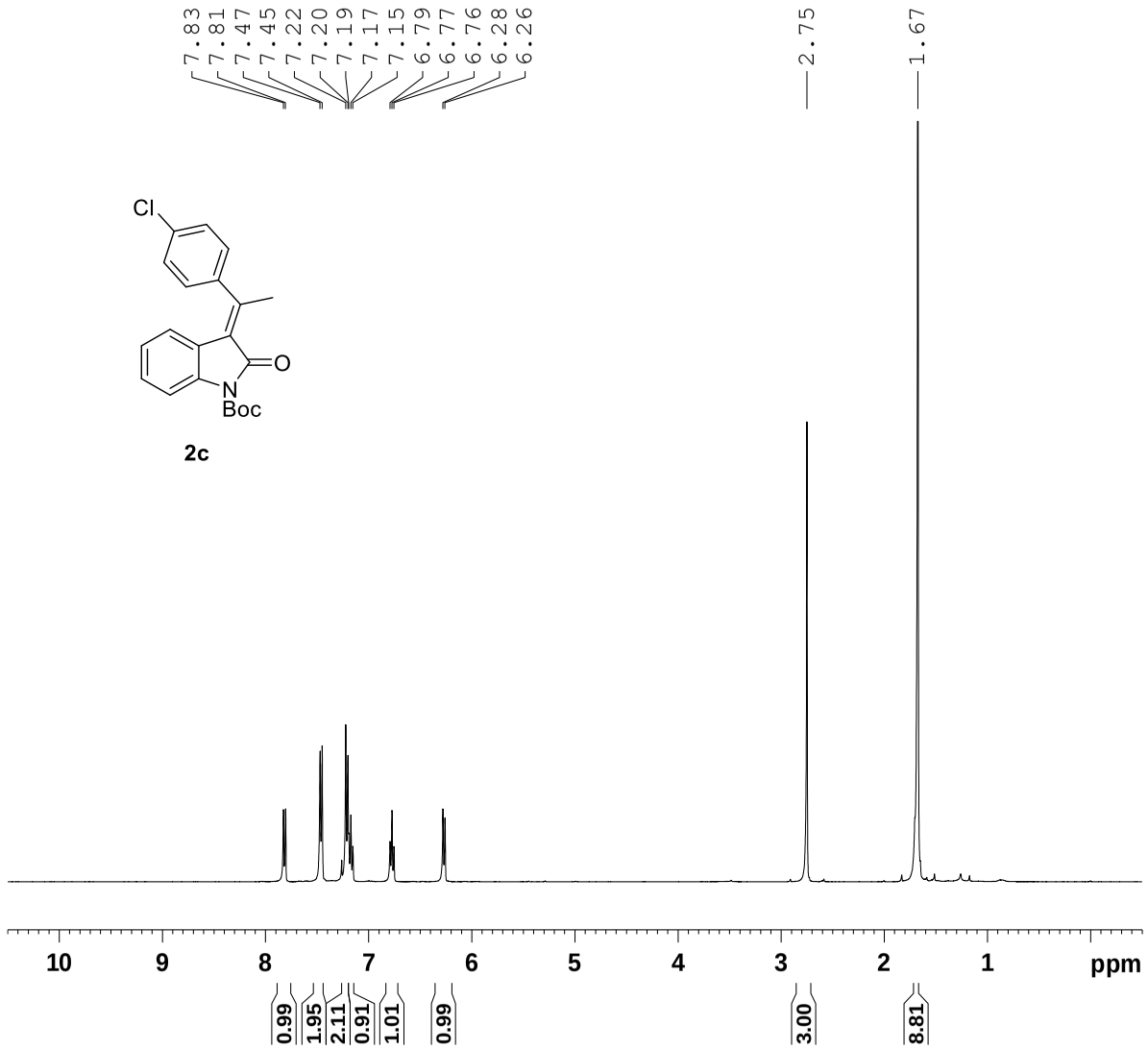

```
Current Data Parameters
NAME                  2a
EXPNO                 23
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170629
Time               12.21
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                 1236
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG               9195.2
DW               20.800 usec
DE                6.50 usec
TE                297.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.45 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2                1.80 dB
PL12              15.68 dB
PL13              20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127744 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.00
```

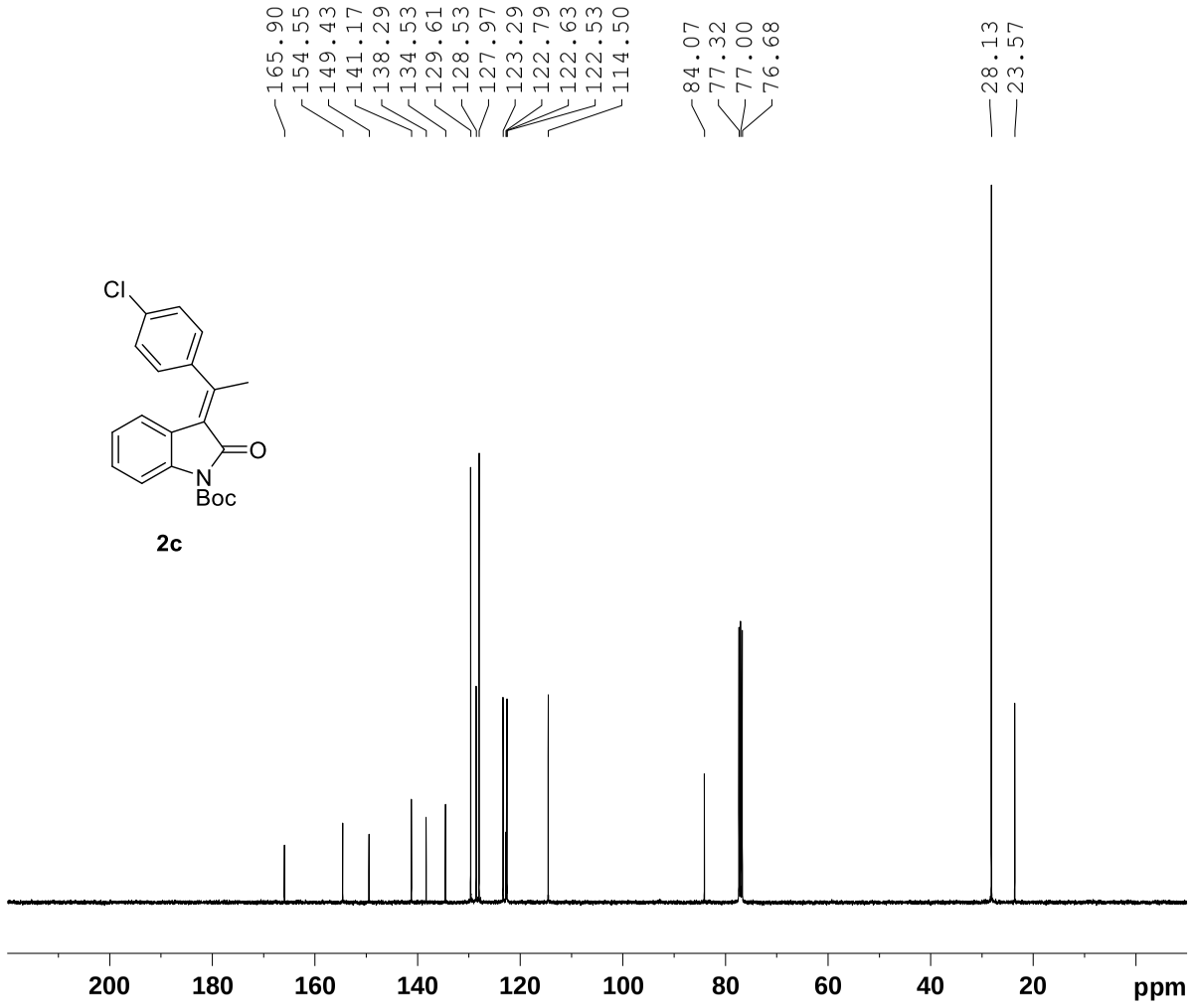



```
Current Data Parameters
NAME                  Data
EXPNO                   20
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170628
Time                 12.06
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ               2.2609921 sec
RG                    71.8
DW                69.000 usec
DE                 6.50 usec
TE                 296.9 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  16.80 usec
PL1                  1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300078 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



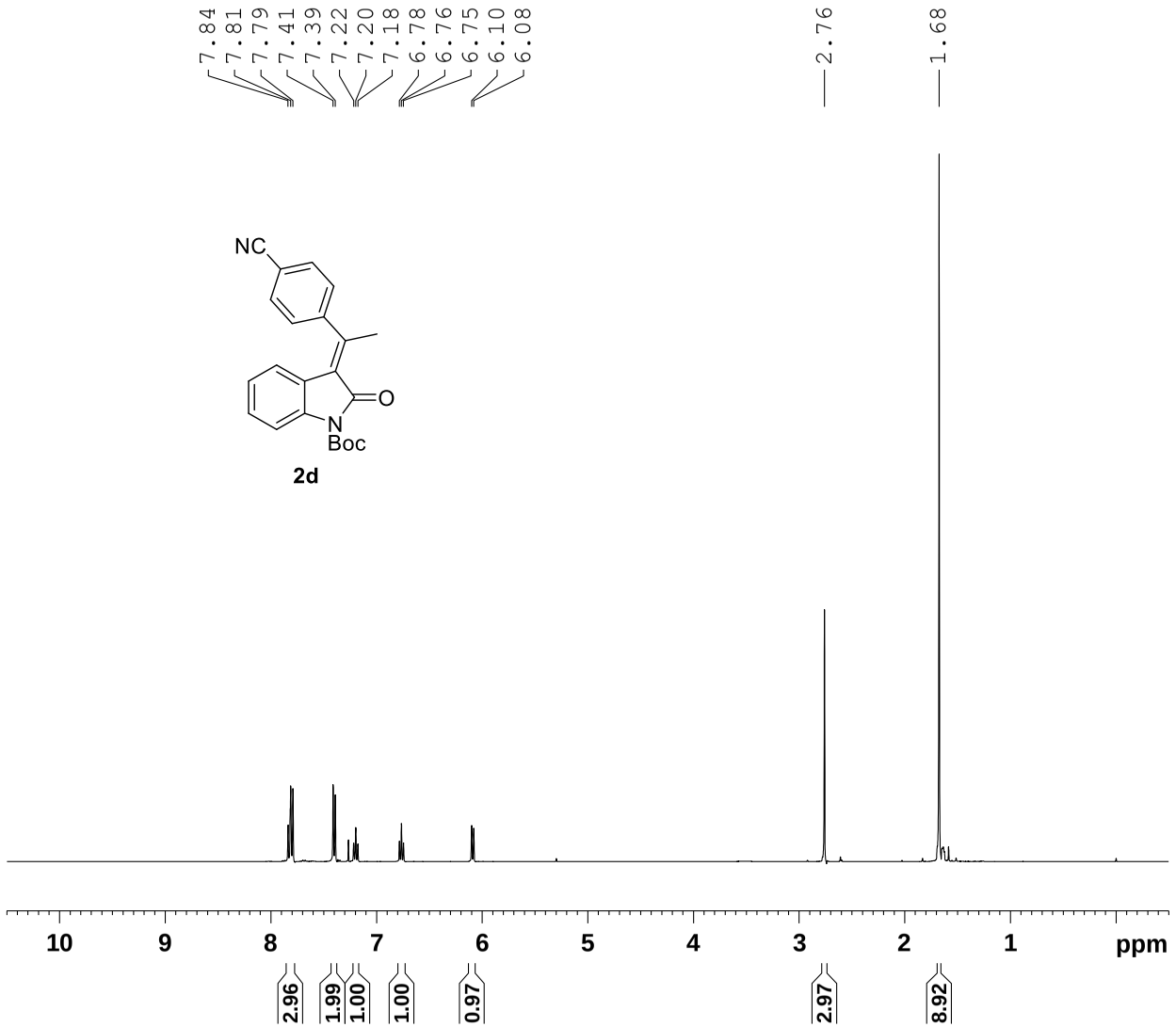

```
Current Data Parameters
NAME                  Data
EXPNO                   21
PROCNO                   1

F2 - Acquisition Parameters
Date_           20170628
Time               12.09
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                 32768
SOLVENT            CDCl3
NS                  1549
DS                     0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                 9195.2
DW                20.800 usec
DE                 6.50 usec
TE                297.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               15.68 dB
PL13               20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF           100.6127754 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```

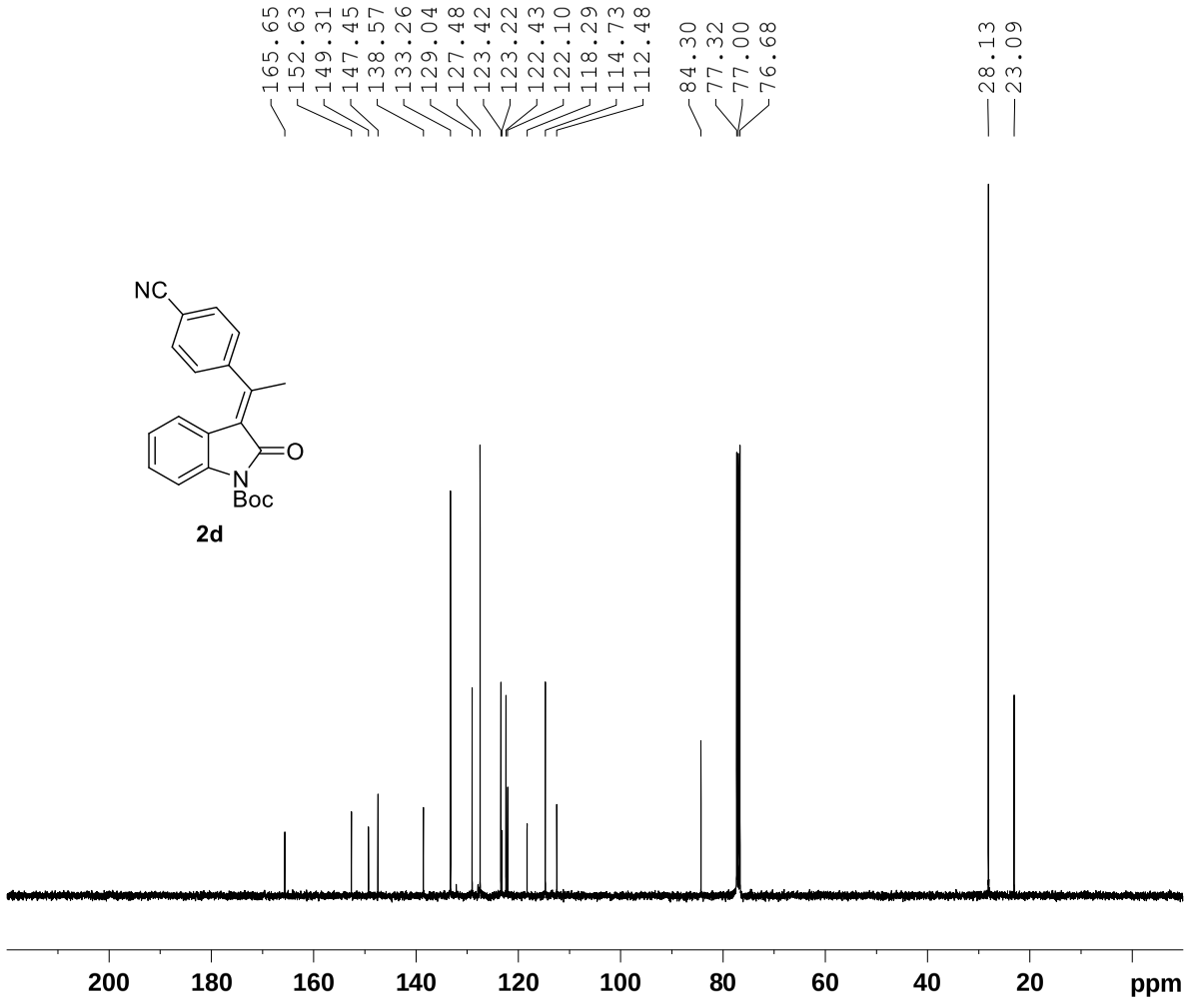



```
Current Data Parameters
NAME          Curtis-032
EXPNO                  6
PROCNO                 1

F2 - Acquisition Parameters
Date_           20171102
Time               18.14
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    32
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                   114
DW                69.000 usec
DE                 6.50 usec
TE                298.5 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1       0 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF           400.1300069 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



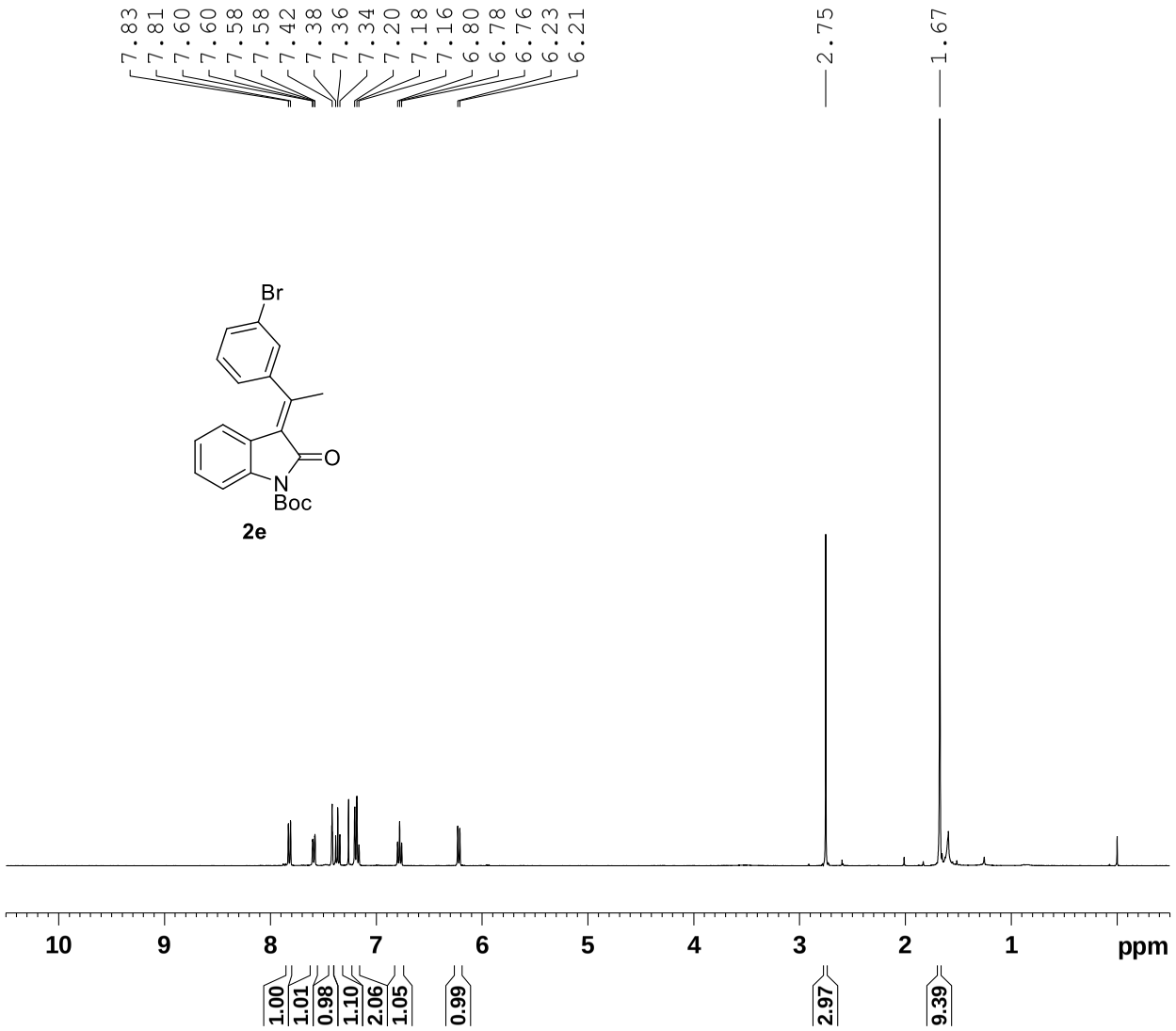

```
Current Data Parameters
NAME          Curtis-032
EXPNO                  7
PROCNO                 1

F2 - Acquisition Parameters
Date_           20171102
Time               18.16
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                 32768
SOLVENT            CDCl3
NS                  1073
DS                     0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ             0.6815744 sec
RG                  8192
DW                20.800 usec
DE                 6.50 usec
TE                298.6 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF           100.6127730 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```

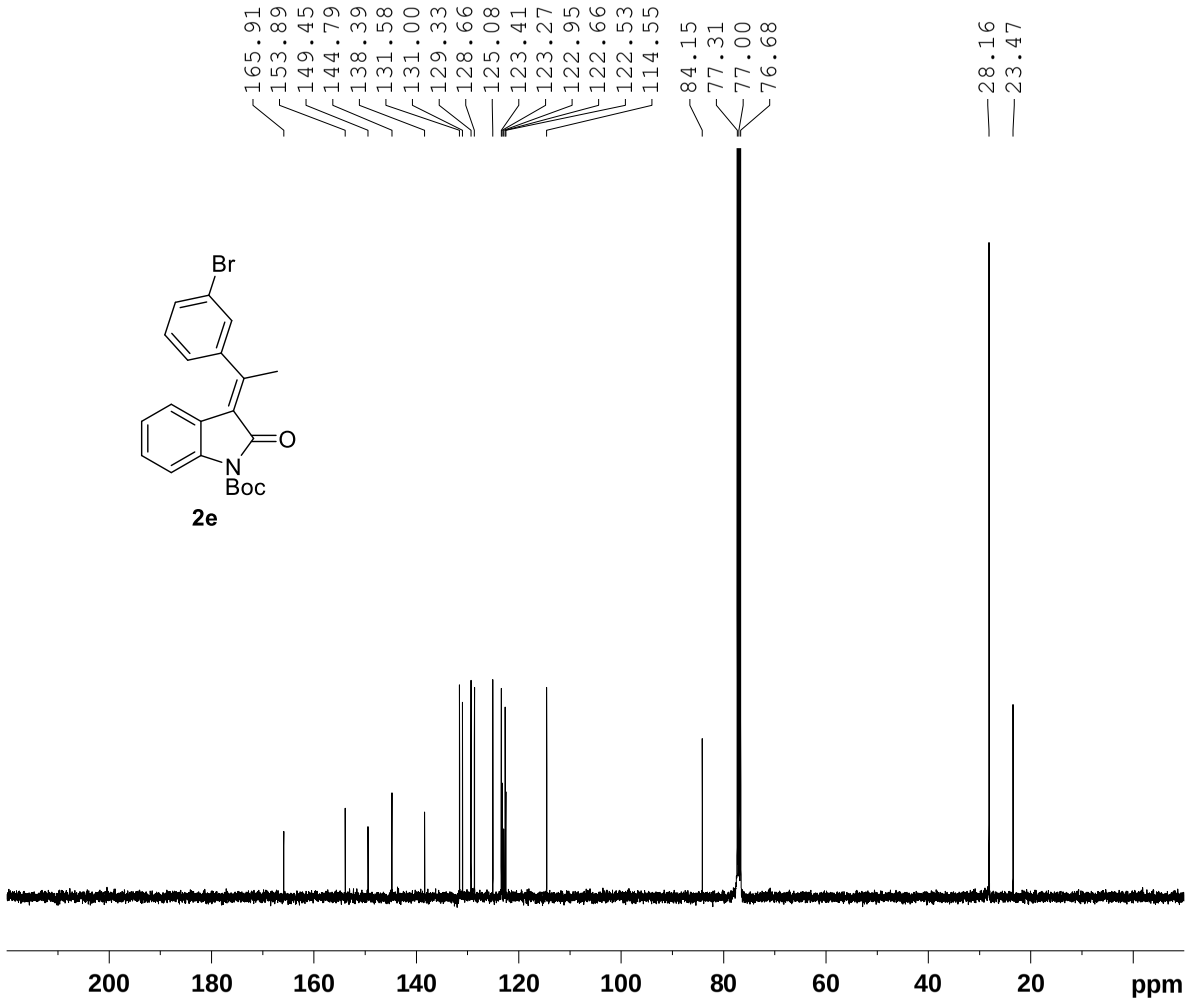



```
Current Data Parameters
NAME                  3-BrBoc
EXPNO                       6
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180309
Time                   17.58
INSTRUM                spect
PROBHD   5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        32
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                2.2609921 sec
RG                     161.3
DW                    69.000 usec
DE                     6.50 usec
TE                     296.6 K
D1                2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     15.00 usec
PL1       0 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF              400.1300087 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```



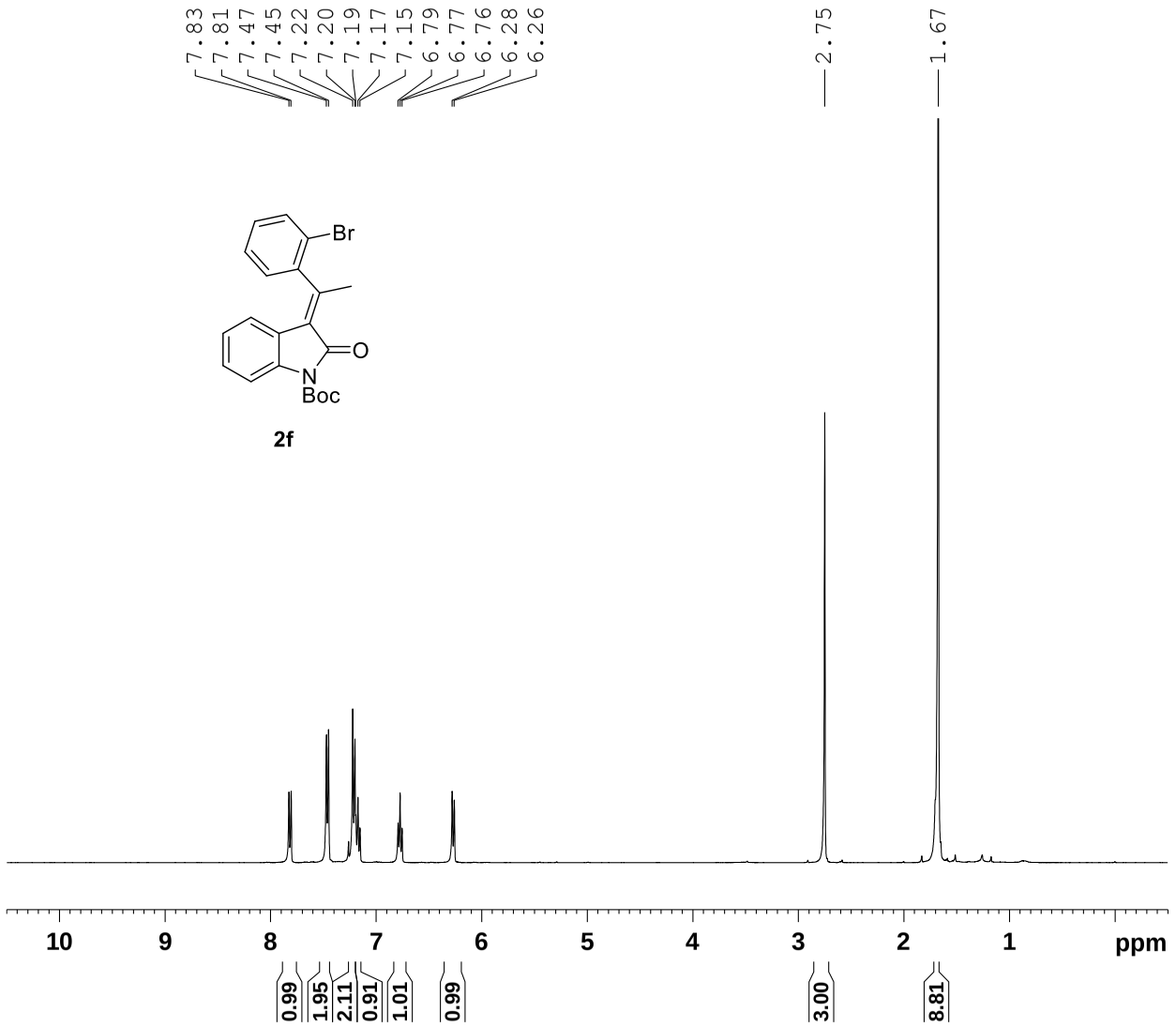

```
Current Data Parameters
NAME                  3-BrBoc
EXPNO                       7
PROCNO                      1

F2 - Acquisition Parameters
Date_              20180309
Time                  18.00
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     1500
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                0.6815744 sec
RG                    32768
DW                   20.800 usec
DE                    6.50 usec
TE                   296.8 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1           100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2            waltz16
NUC2                    1H
PCPD2                 90.00 usec
PL2       0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF             100.6127716 MHz
WDW                     EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.00
```

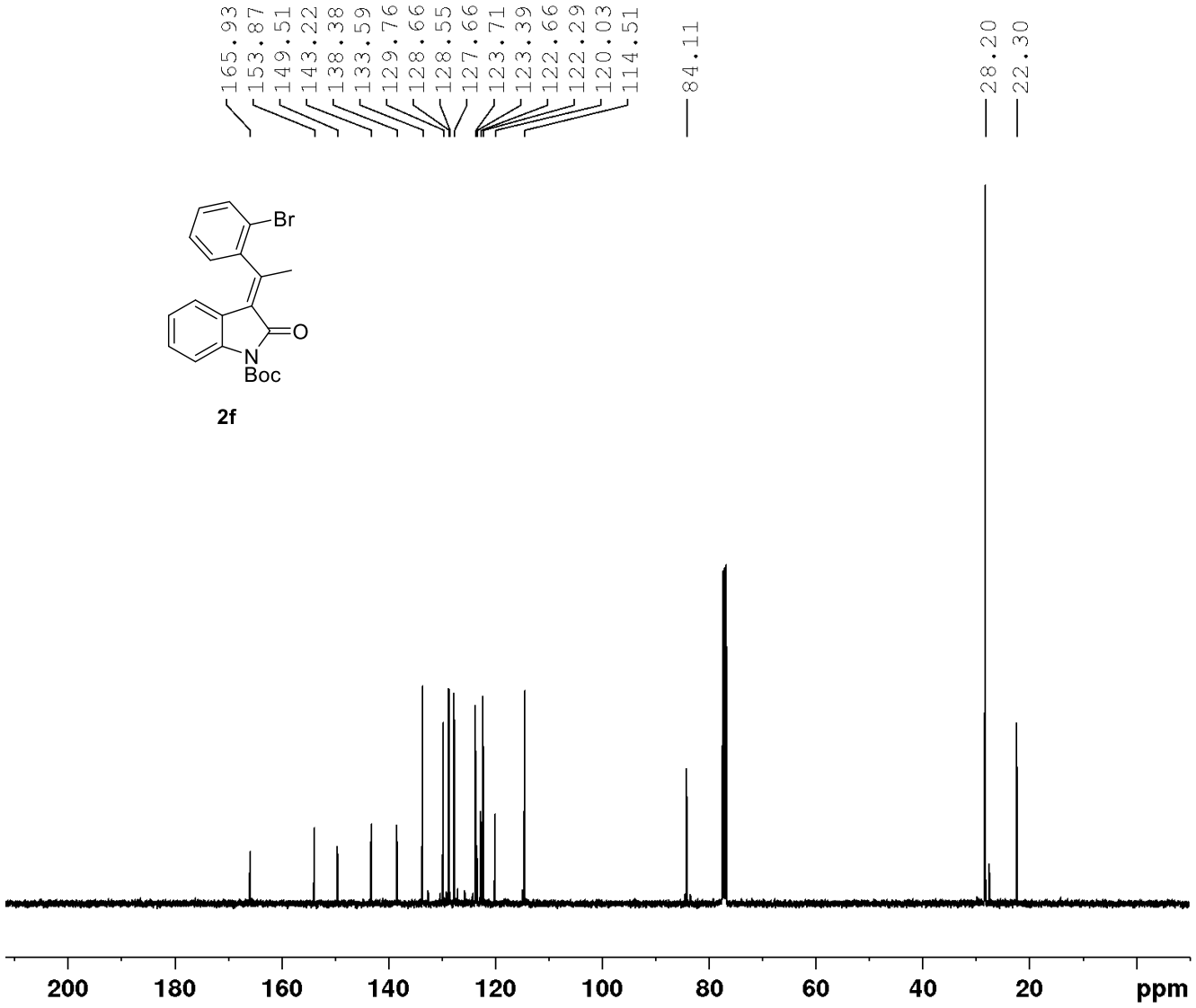



```
Current Data Parameters
NAME                  Data
EXPNO                   20
PROCNO                   1

F2 - Acquisition Parameters
Date_           20170628
Time                12.06
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ             2.2609921 sec
RG                  71.8
DW                69.000 usec
DE                 6.50 usec
TE                296.9 K
D1            2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                16.80 usec
PL1                1.80 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF          400.1300078 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



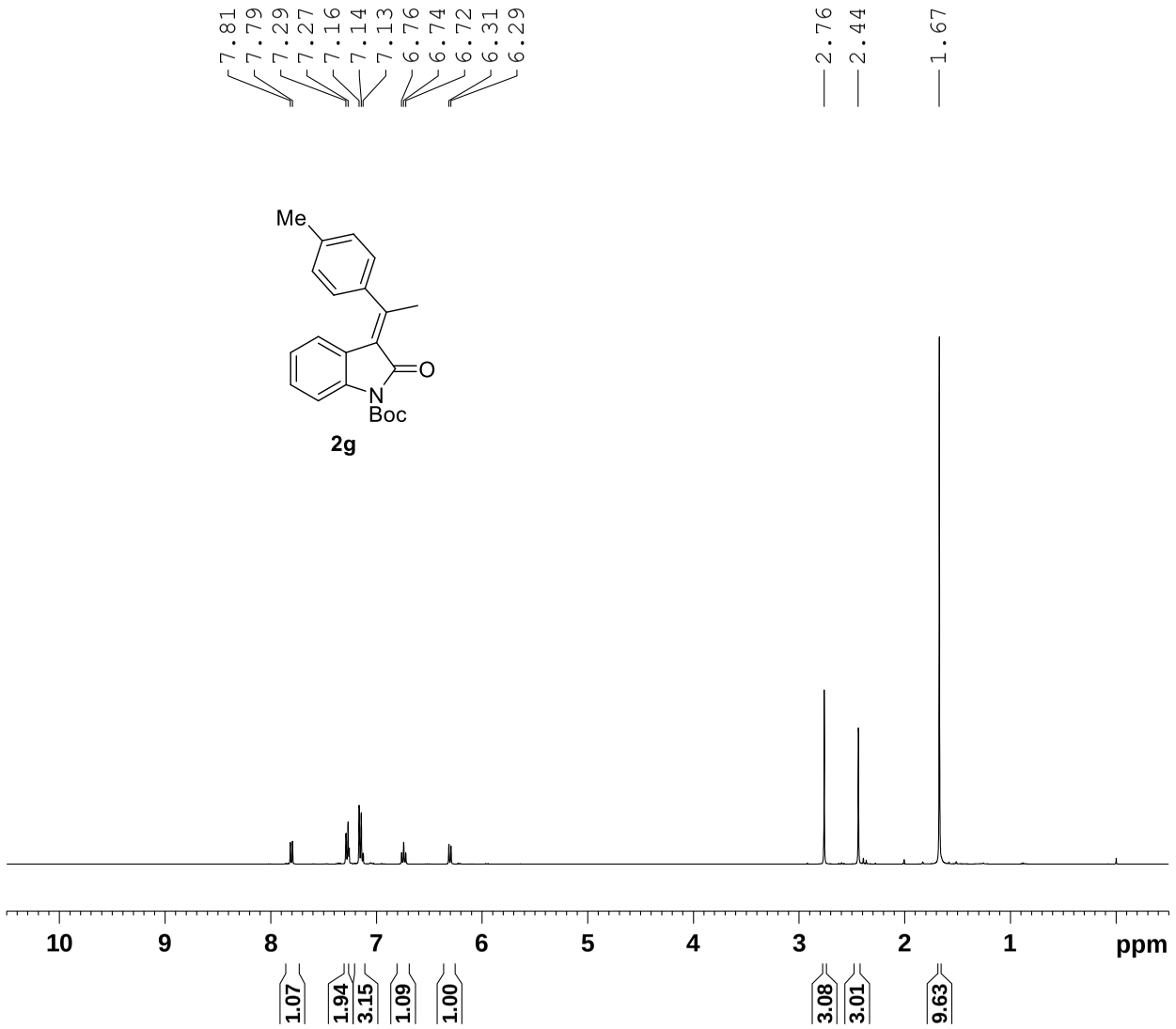

```
Current Data Parameters
NAME                  2e
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20171103
Time               18.55
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                32768
SOLVENT           CDC13
NS                  675
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                 8192
DW                20.800 usec
DE                 6.50 usec
TE                299.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.45 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2       0 dB
PL12              15.00 dB
PL13              20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127690 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```

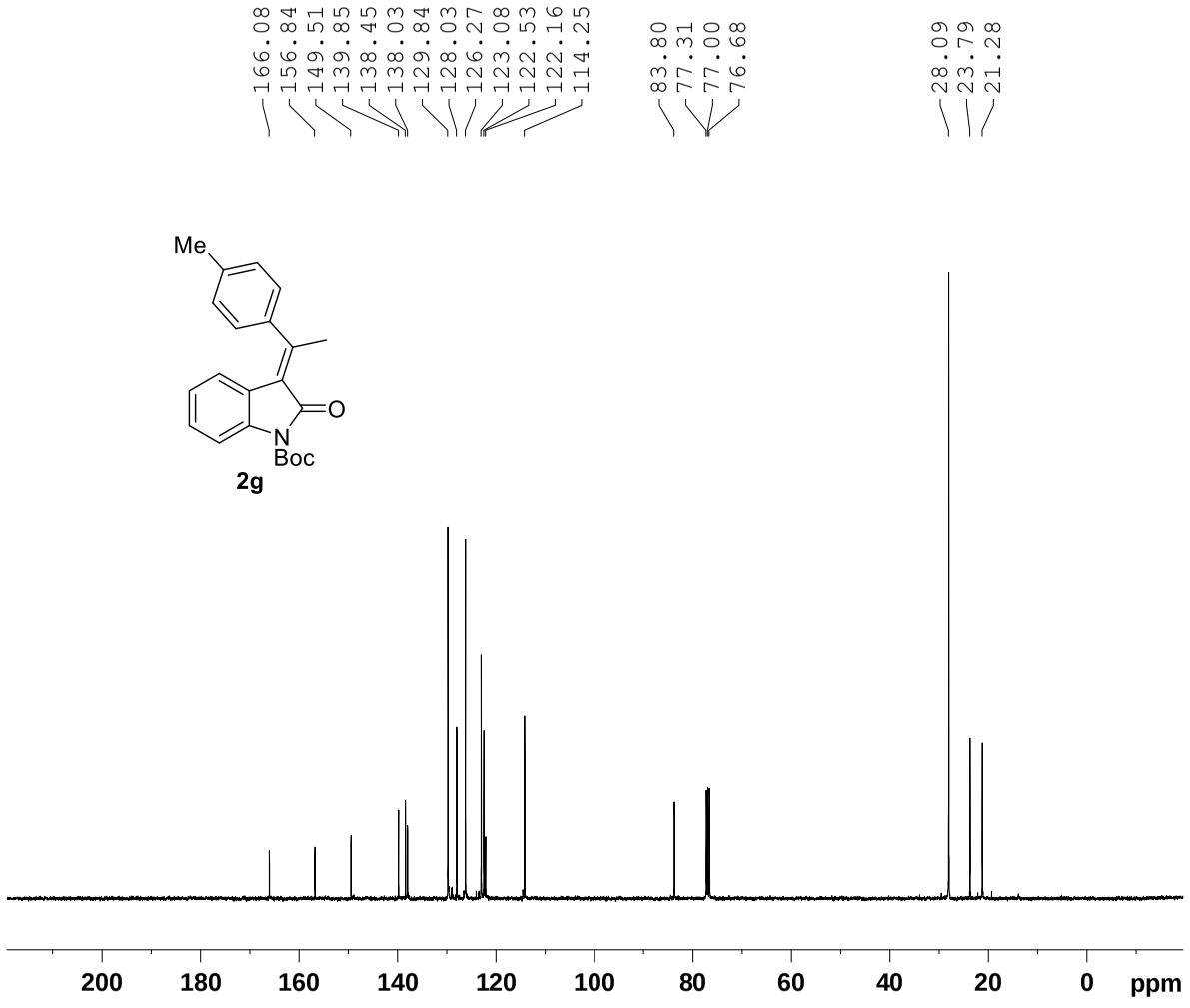



```
Current Data Parameters
NAME          Curtis-081
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180310
Time               10.49
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    32
DS                     0
SWH             7211.539 Hz
FIDRES          0.220079 Hz
AQ              2.2719147 sec
RG                  4.01
DW                69.333 usec
DE                10.50 usec
TE                297.7 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1324008 MHz
NUC1                   1H
P1                 12.90 usec
PLW1         15.00000000 W

F2 - Processing parameters
SI                 16384
SF           400.1300105 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



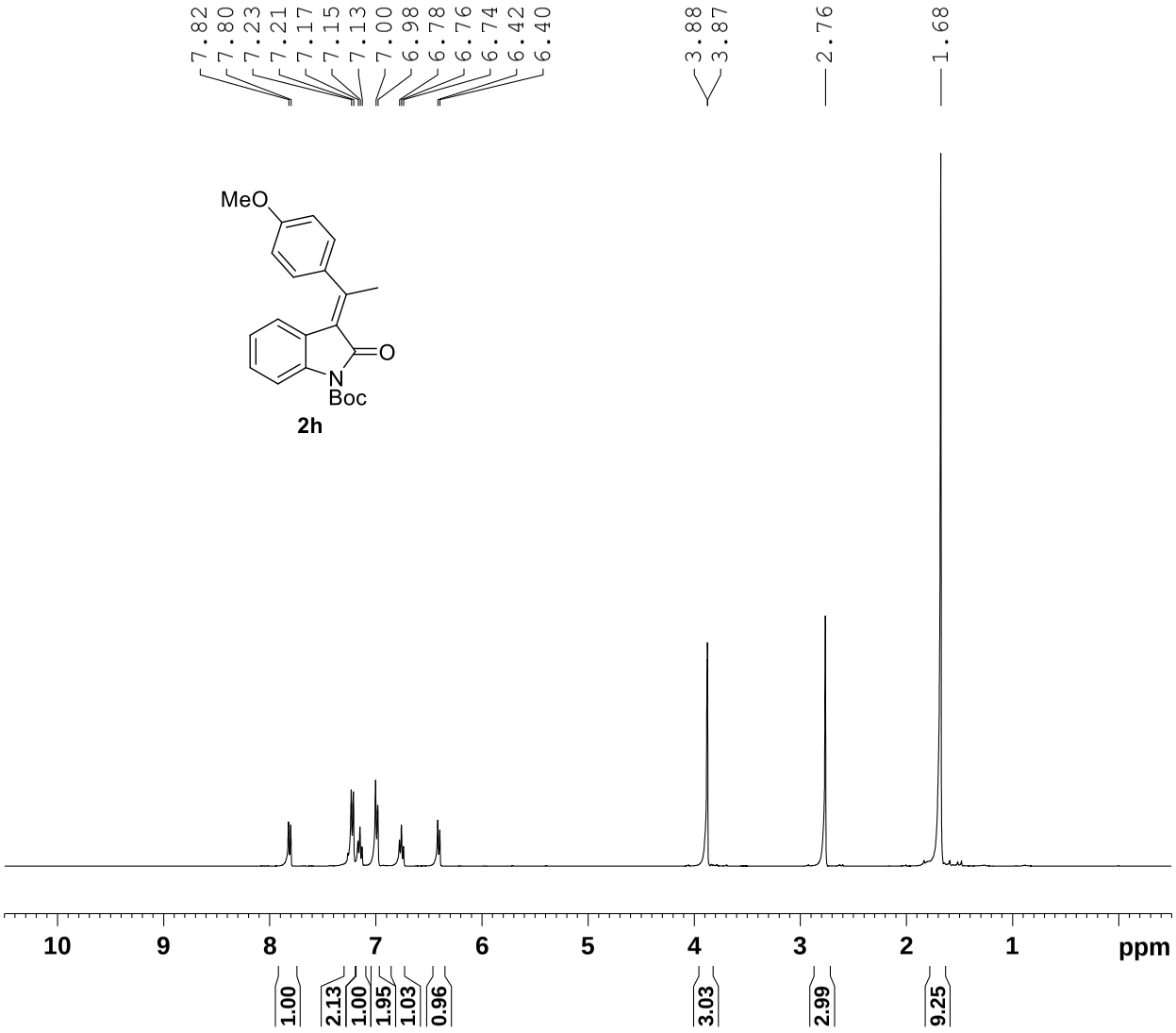

```
Current Data Parameters
NAME                  4-Me Boc
EXPNO                        3
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20180327
Time                     16.33
INSTRUM                  spect
PROBHD   5 mm PABBO BB/
PULPROG                 zgpg30
TD                       32768
SOLVENT                  CDCl3
NS                         203
DS                           0
SWH                  24038.461 Hz
FIDRES                0.733596 Hz
AQ                    0.6815744 sec
RG                       198.09
DW                       20.800 usec
DE                        6.50 usec
TE                       298.4 K
D1                   2.00000000 sec
D11                  0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1               100.6228298 MHz
NUC1                       13C
P1                       10.00 usec
PLW1                47.50000000 W

======== CHANNEL f2 ========
SFO2               400.1316005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                    90.00 usec
PLW2                15.00000000 W
PLW12                0.33750001 W
PLW13                0.27338001 W

F2 - Processing parameters
SI                       32768
SF                 100.6127821 MHz
WDW                         EM
SSB              0
LB                        2.00 Hz
GB               0
PC                        1.00
```

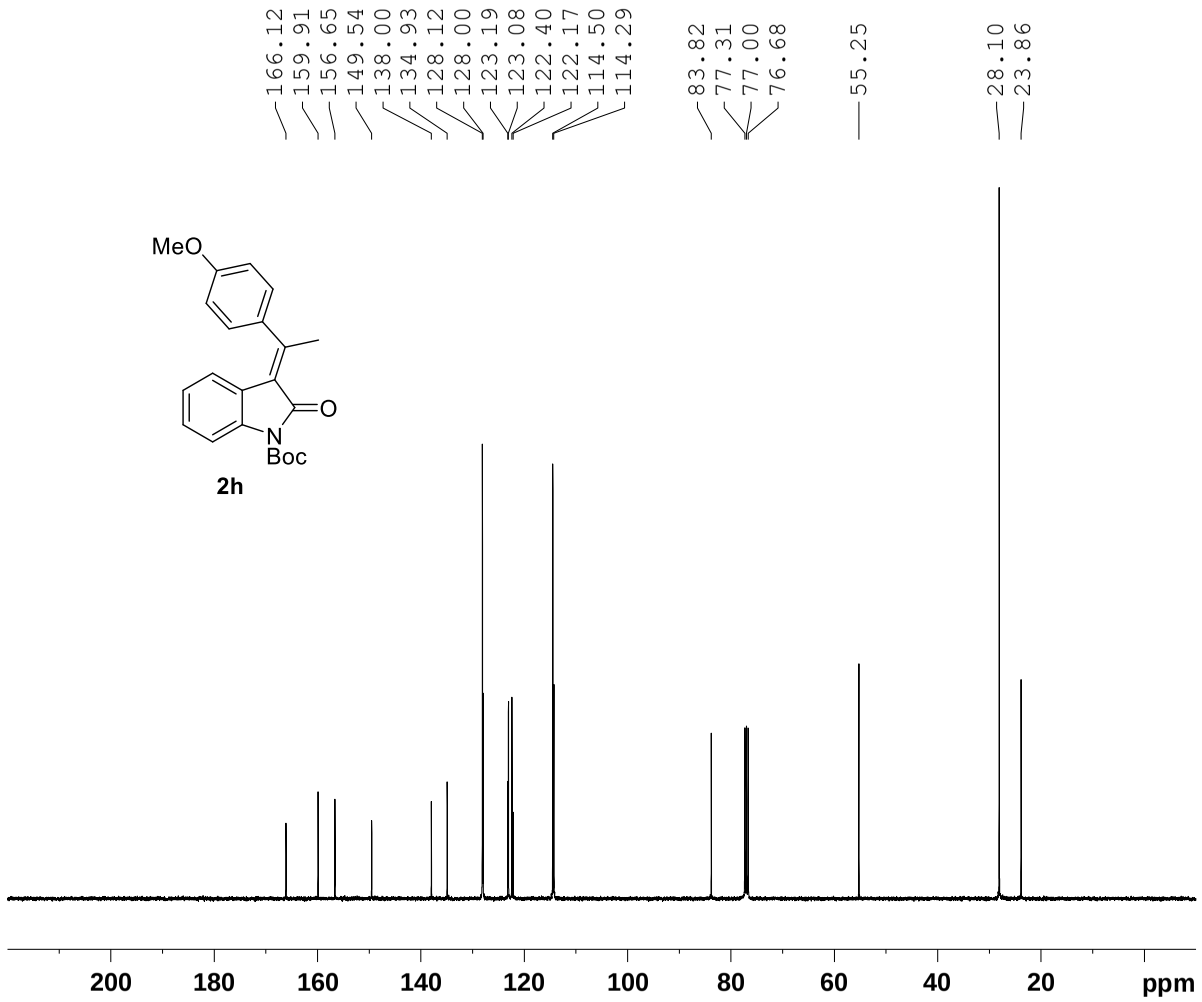



```
Current Data Parameters
NAME                  Data
EXPNO                   24
PROCNO                   1

F2 - Acquisition Parameters
Date_            20170808
Time                17.59
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                   40.3
DW                 69.000 usec
DE                  6.50 usec
TE                 297.7 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 16.80 usec
PL1                 1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF           400.1300085 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



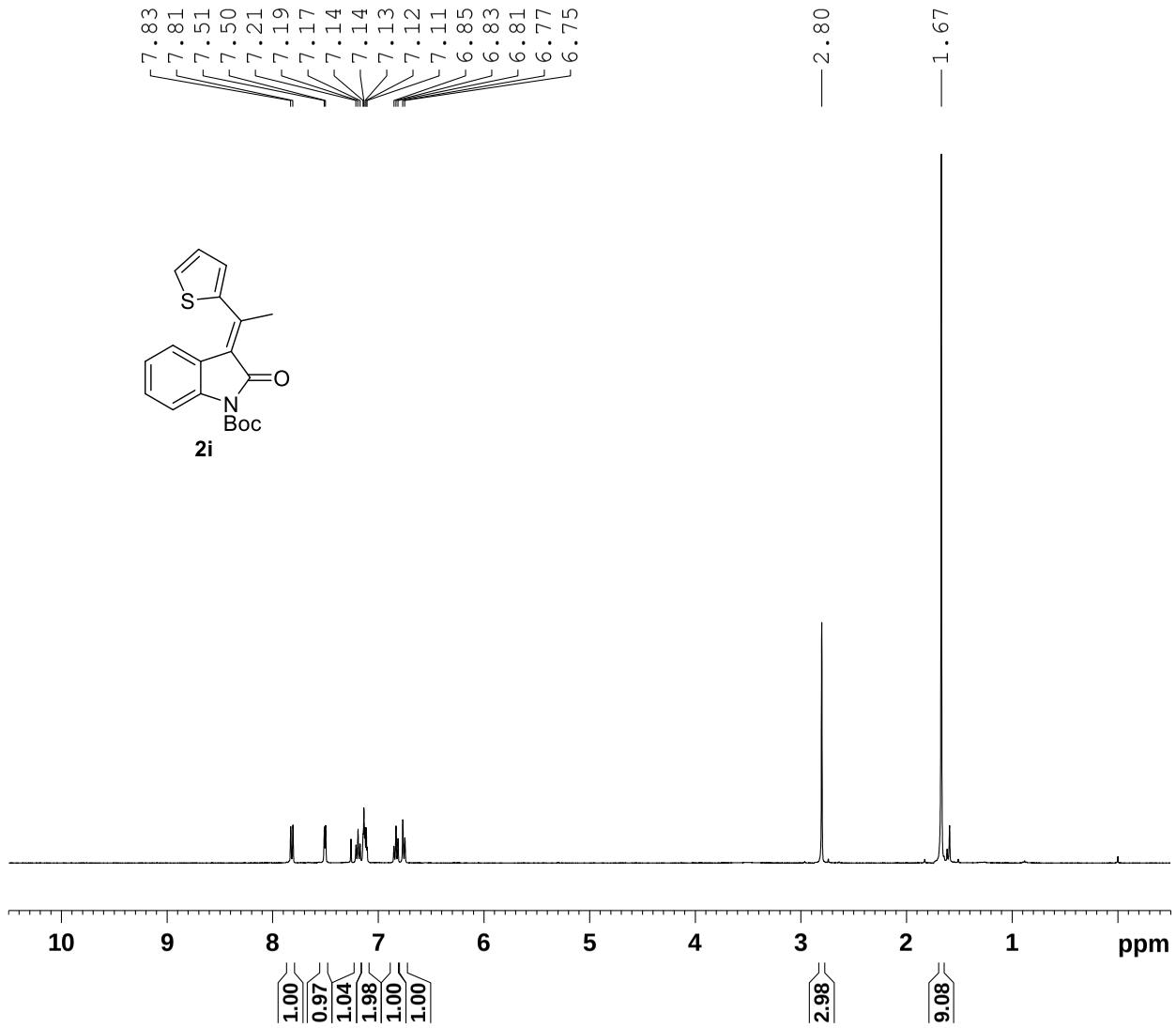

```
Current Data Parameters
NAME                  Data
EXPNO                   25
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170808
Time                  18.01
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     1298
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                     4096
DW                   20.800 usec
DE                    6.50 usec
TE                   297.7 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 15.68 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127798 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

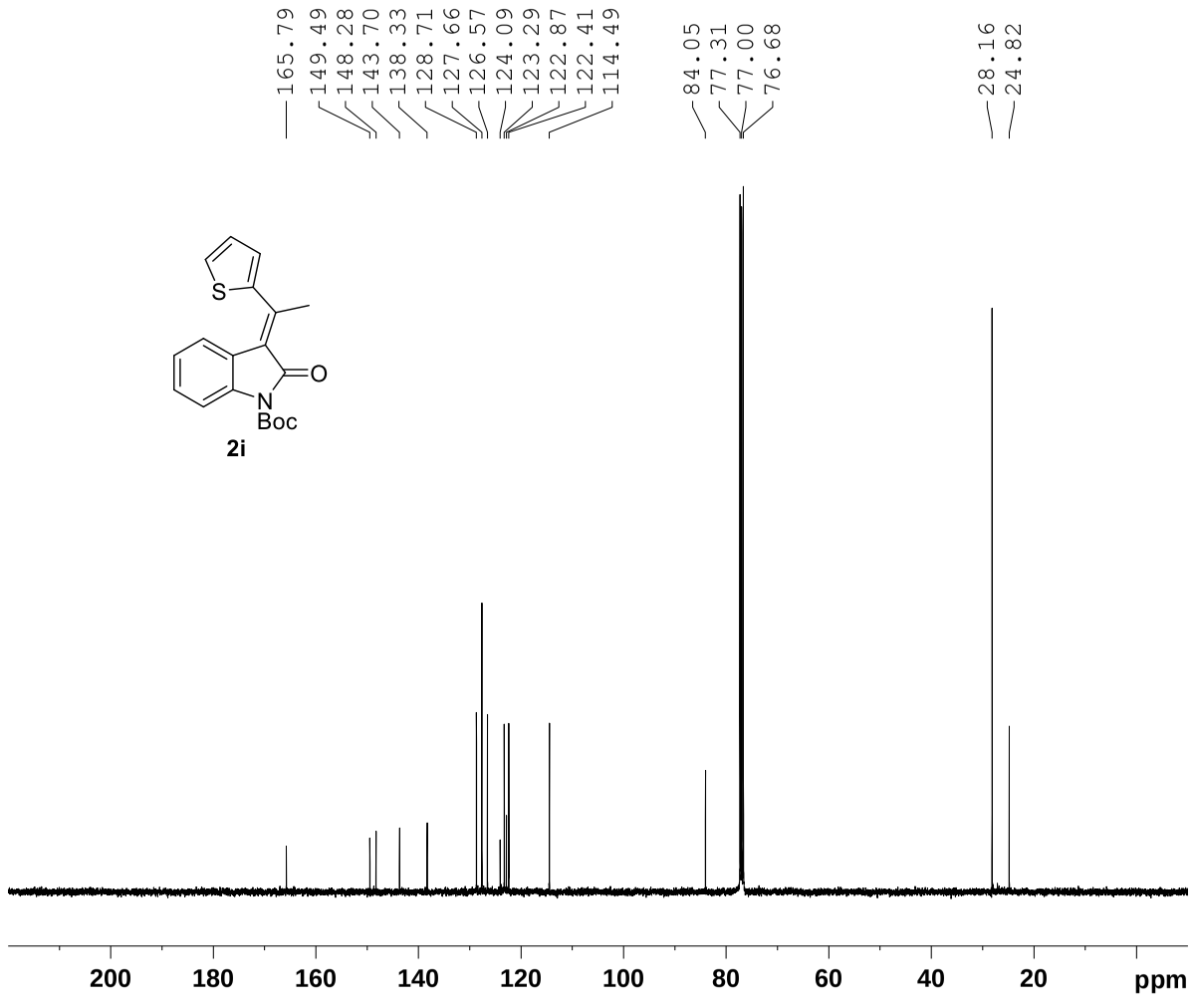



```
Current Data Parameters
NAME                  A281
EXPNO                    3
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180124
Time                 18.10
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ               2.2609921 sec
RG                     114
DW                69.000 usec
DE                 6.50 usec
TE                 298.2 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300096 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



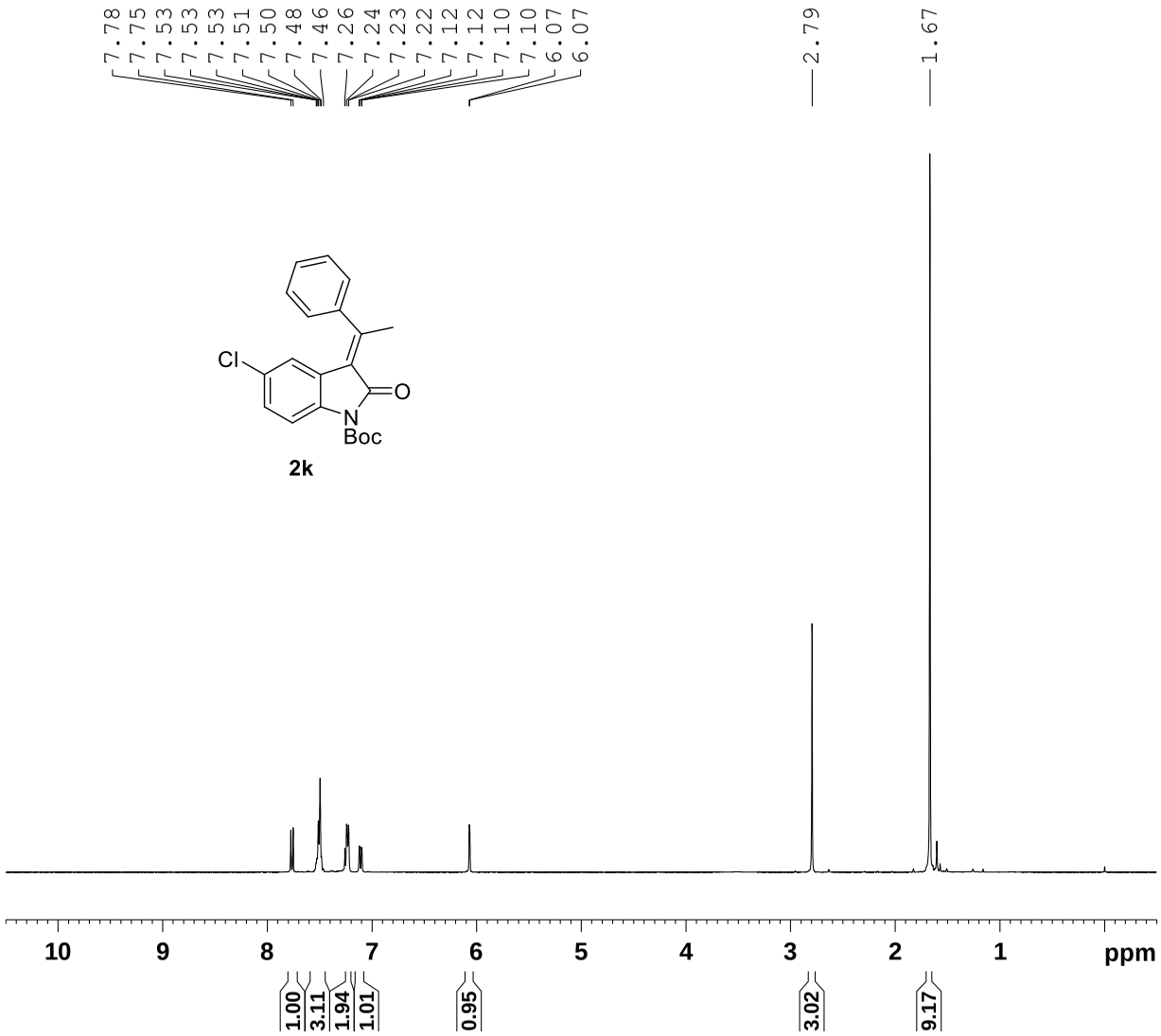

```
Current Data Parameters
NAME                  A281
EXPNO                    4
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180124
Time                 18.12
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1499
DS                       0
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  5792.6
DW                  20.800 usec
DE                   6.50 usec
TE                  298.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.45 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2               90.00 usec
PL2       0 dB
PL12                15.00 dB
PL13                20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127716 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```

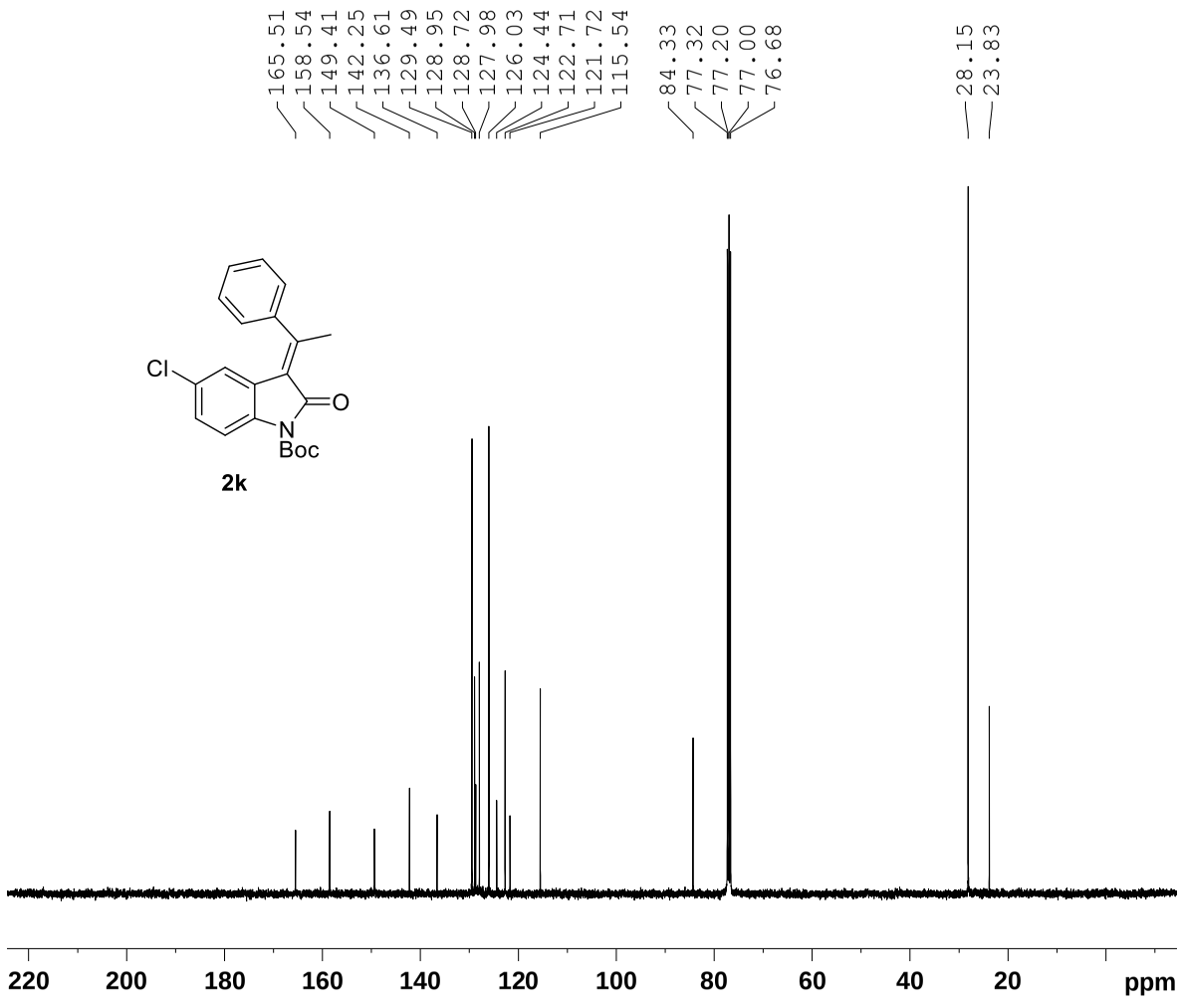



```
Current Data Parameters
NAME                  A278
EXPNO                    4
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180119
Time                 17.58
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH               7246.377 Hz
FIDRES             0.221142 Hz
AQ                2.2609921 sec
RG                      114
DW                   69.000 usec
DE                    6.50 usec
TE                   298.3 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300096 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



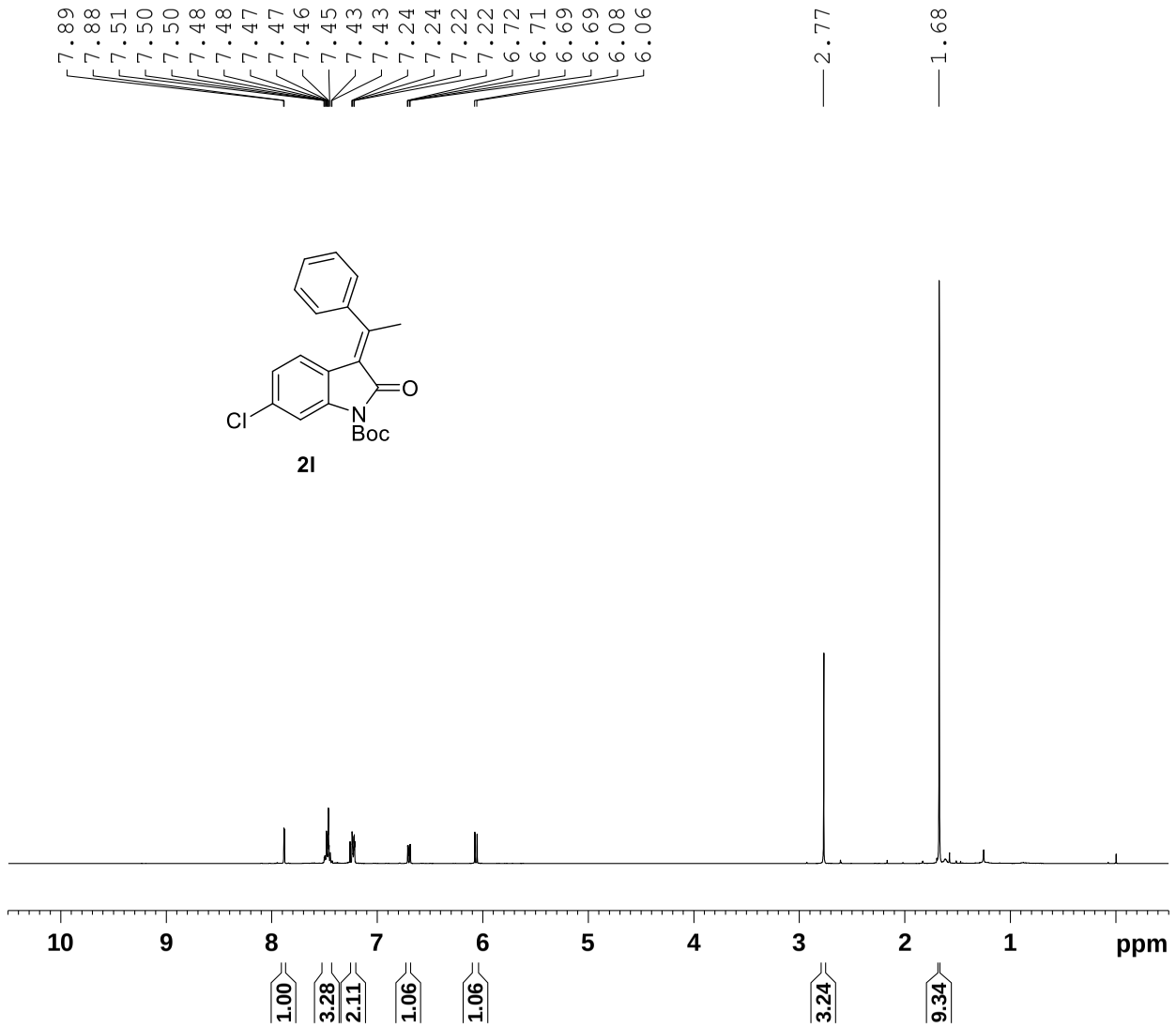

```
Current Data Parameters
NAME                  A278
EXPNO                    5
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180119
Time                 18.00
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1471
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ               0.6815744 sec
RG                  5792.6
DW                  20.800 usec
DE                   6.50 usec
TE                  298.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127709 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

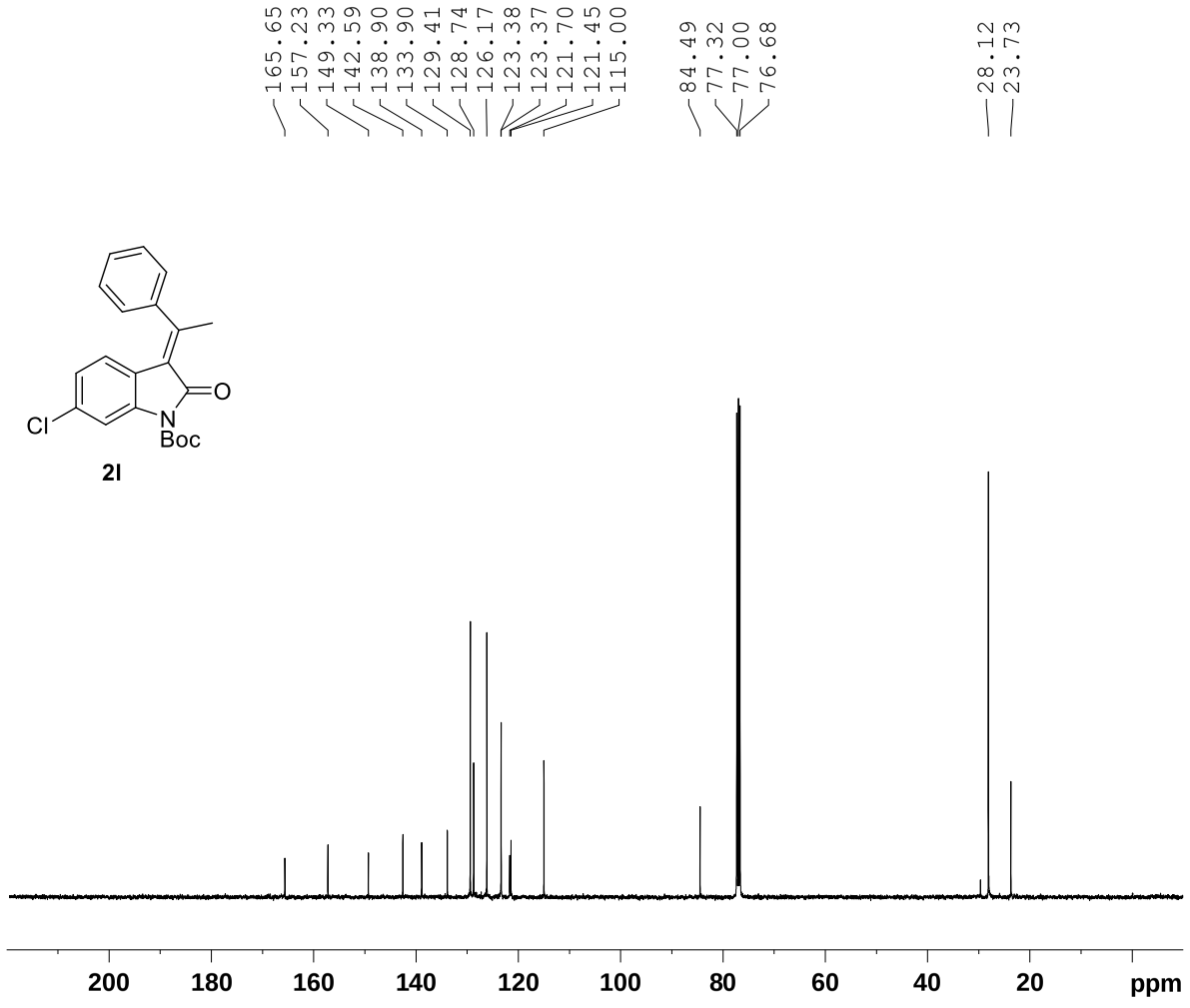



```
Current Data Parameters
NAME                  A265
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20171230
Time                 13.00
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH                7211.539 Hz
FIDRES             0.220079 Hz
AQ                2.2719147 sec
RG                    71.42
DW                   69.333 usec
DE                    10.50 usec
TE                    297.4 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           400.1324008 MHz
NUC1                   1H
P1                    12.90 usec
PLW1           15.00000000 W

F2 - Processing parameters
SI                   16384
SF             400.1300097 MHz
WDW                    EM
SSB          0
LB           0 Hz
GB           0
PC                    1.00
```



2l

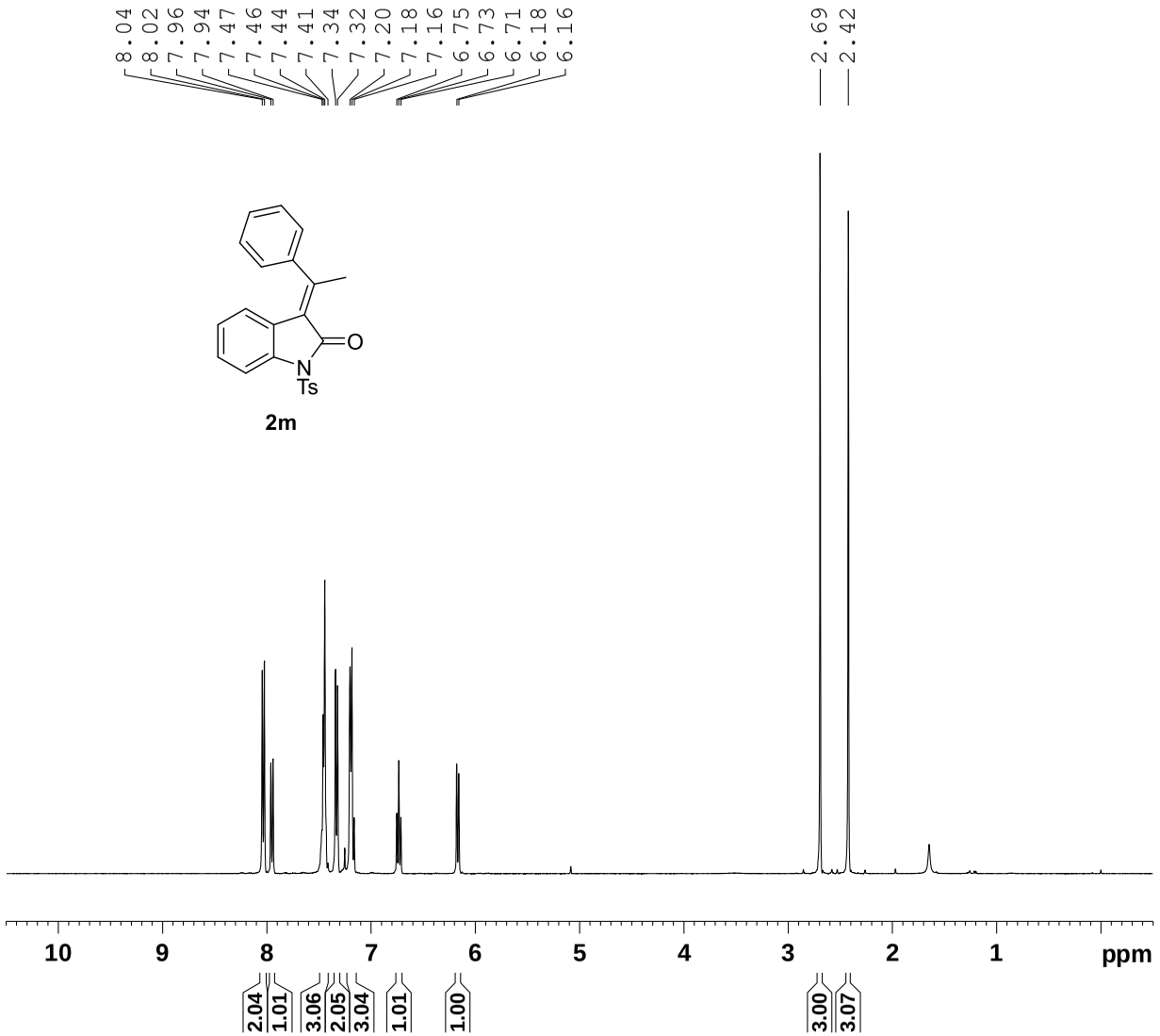
```
Current Data Parameters
NAME                  A265
EXPNO                    3
PROCNO                   1

F2 - Acquisition Parameters
Date_              20171230
Time                 13.01
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1185
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  297.6 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2            waltz16
PCPD2               90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127721 MHz
WDW                    EM
SSB          0
LB                   2.00 Hz
GB           0
PC                   1.00
```

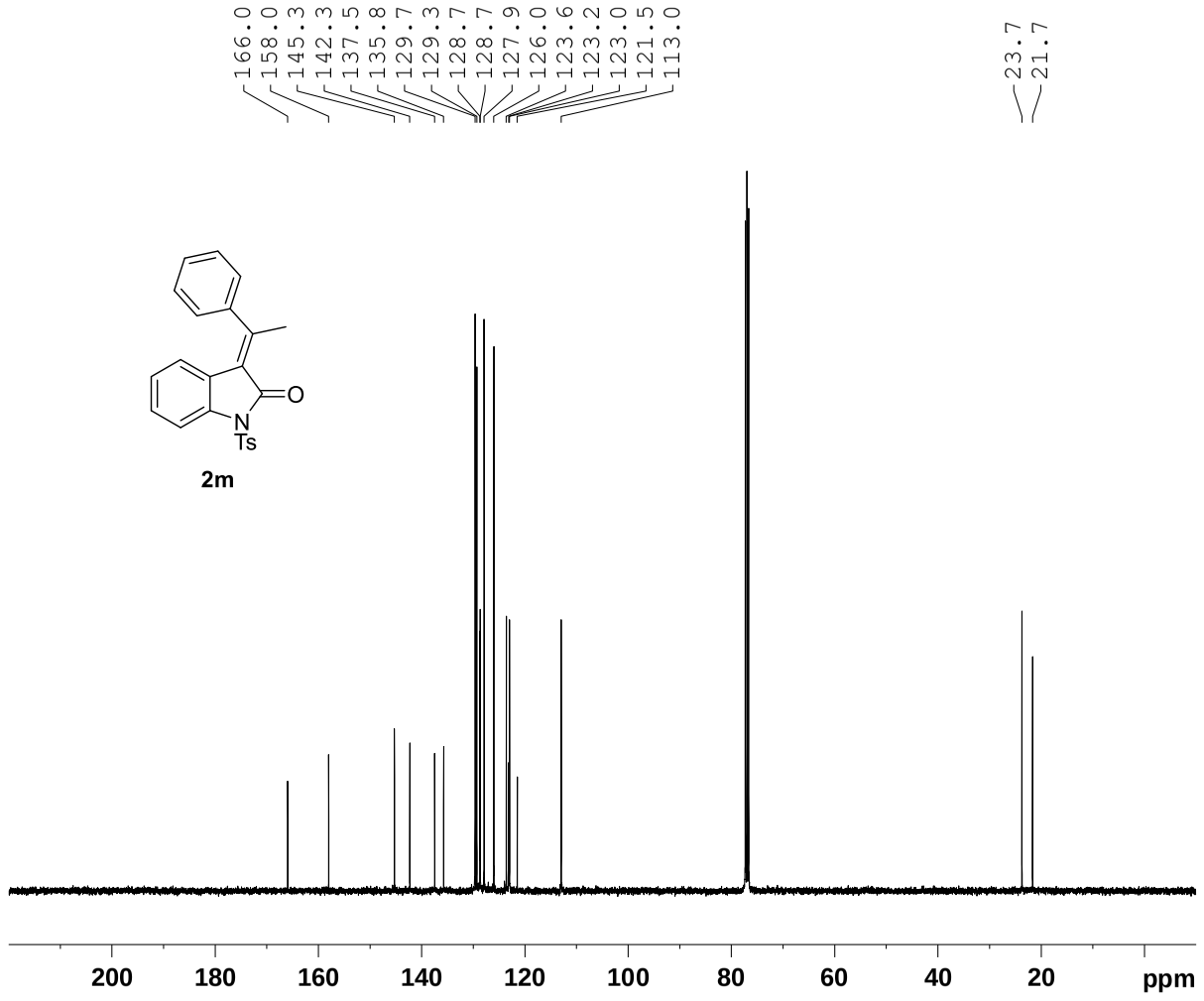



```
Current Data Parameters
NAME                  Data
EXPNO                    8
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170516
Time                 12.01
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                     114
DW                69.000 usec
DE                 6.50 usec
TE                 299.5 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.40 usec
PL1                 1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300128 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                   1.00
```



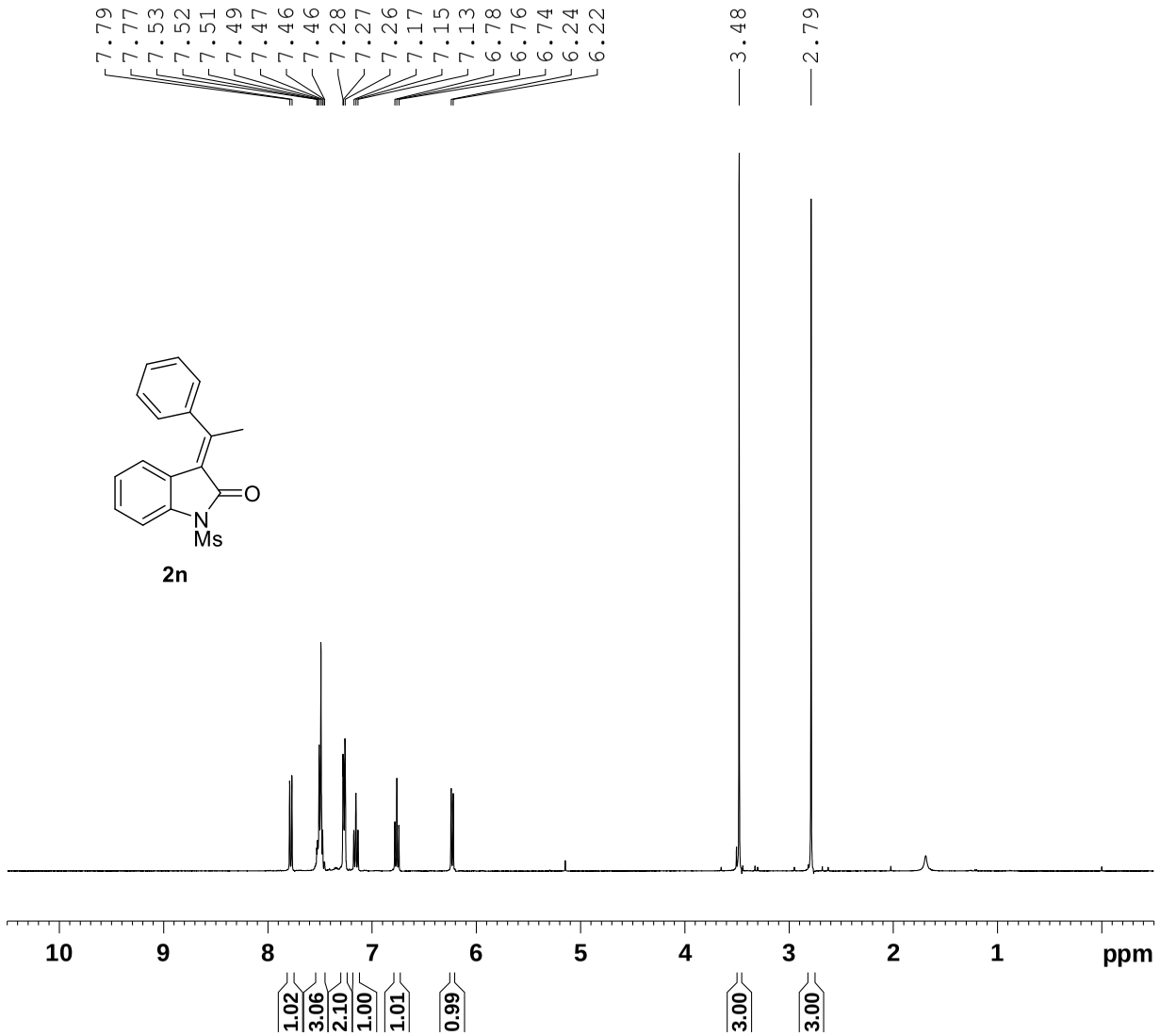

```
Current Data Parameters
NAME                  Data
EXPNO                    9
PROCNO                   1

F2 - Acquisition Parameters
Date_           20170516
Time               12.03
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                 1435
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                 4096
DW                20.800 usec
DE                 6.50 usec
TE                299.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127750 MHz
WDW                  EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

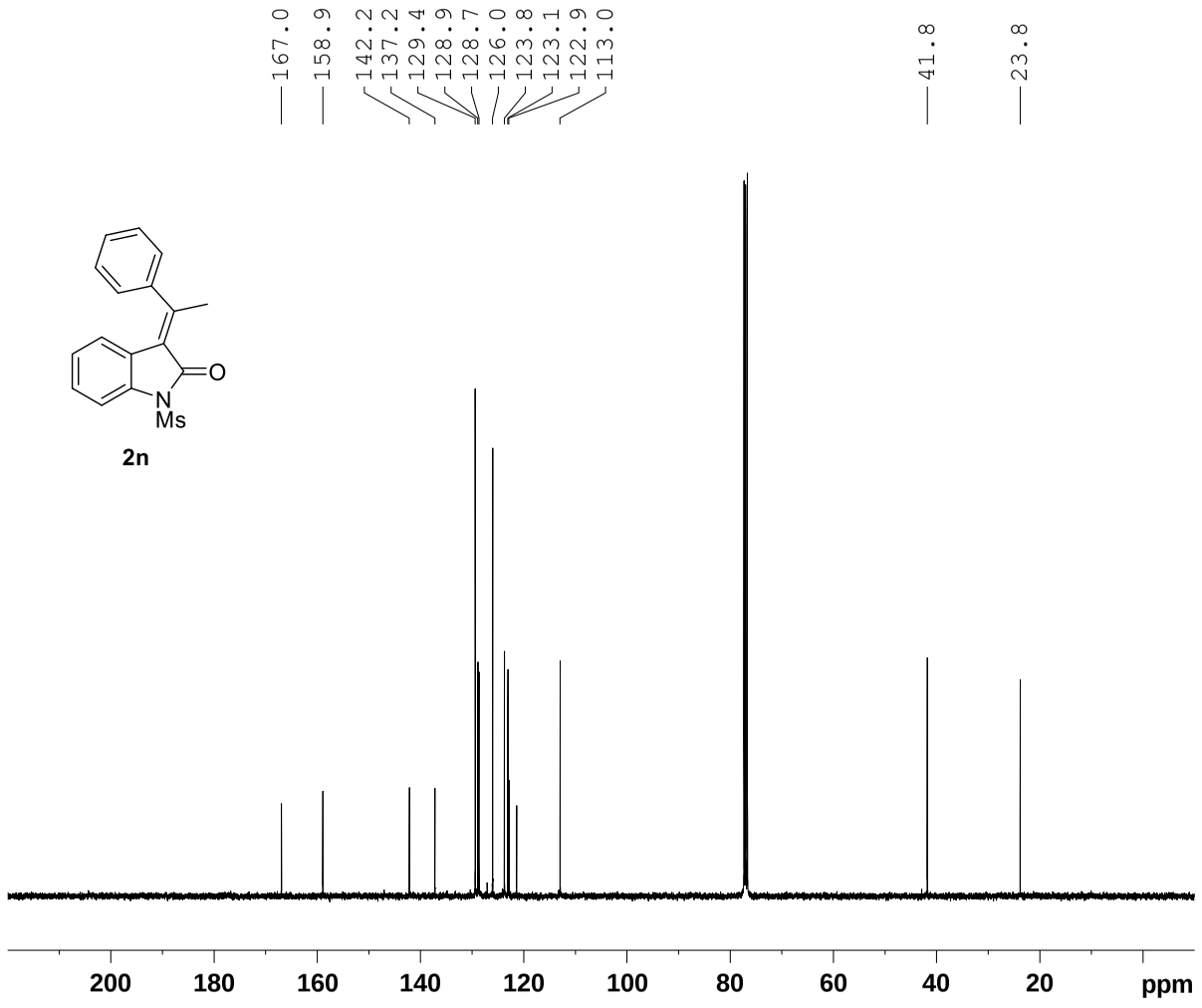



```
Current Data Parameters
NAME                  Data
EXPNO                    6
PROCNO                   1

F2 - Acquisition Parameters
Date_             20170513
Time                 15.15
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES             0.221142 Hz
AQ                2.2609921 sec
RG                     114
DW                  69.000 usec
DE                   6.50 usec
TE                  295.1 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300096 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



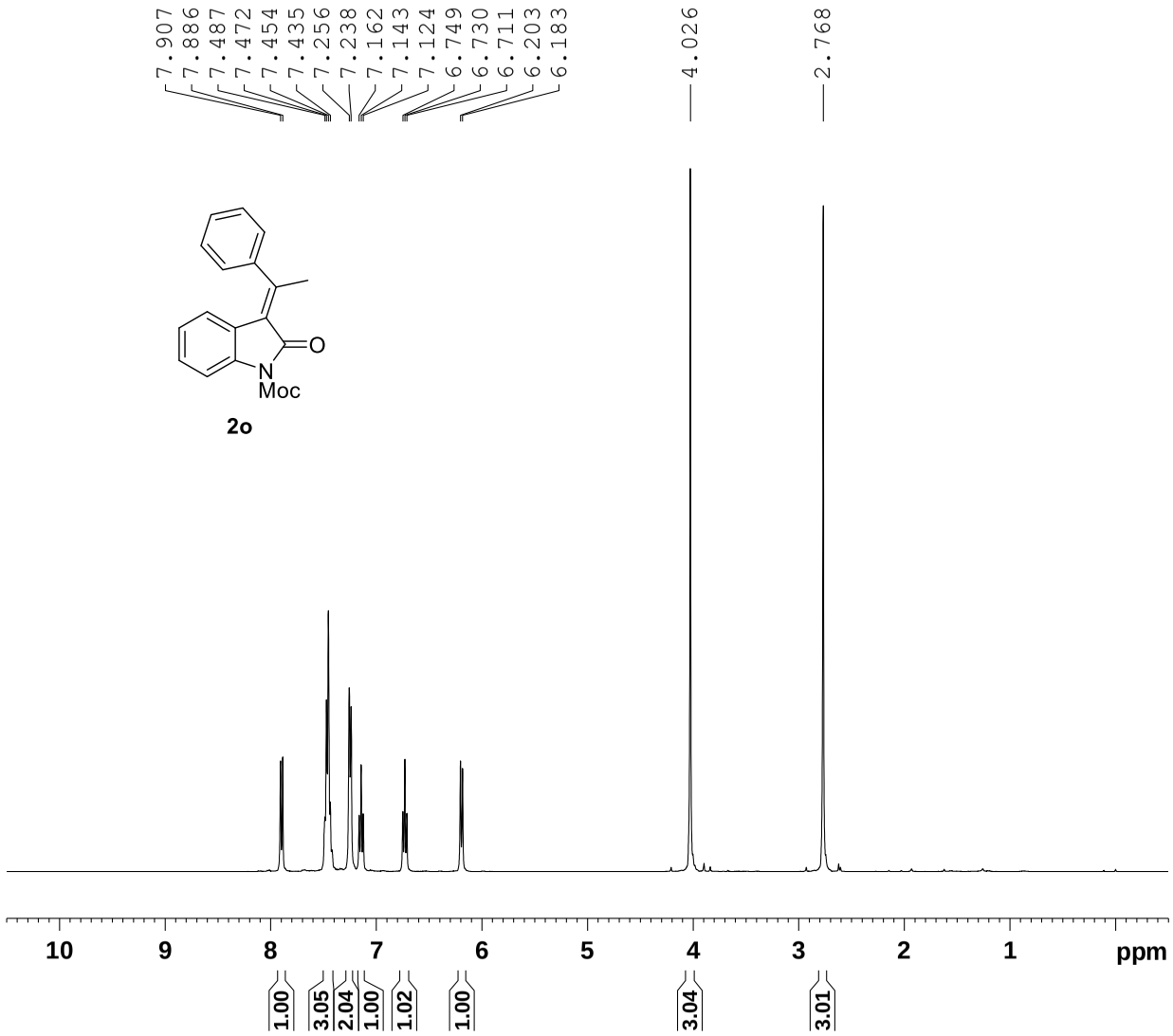

```
Current Data Parameters
NAME                  Data
EXPNO                    7
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170513
Time                 15.16
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1136
DS                       0
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  9195.2
DW                  20.800 usec
DE                   6.50 usec
TE                  295.1 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                   1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               17.00 dB
PL13               20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127757 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```



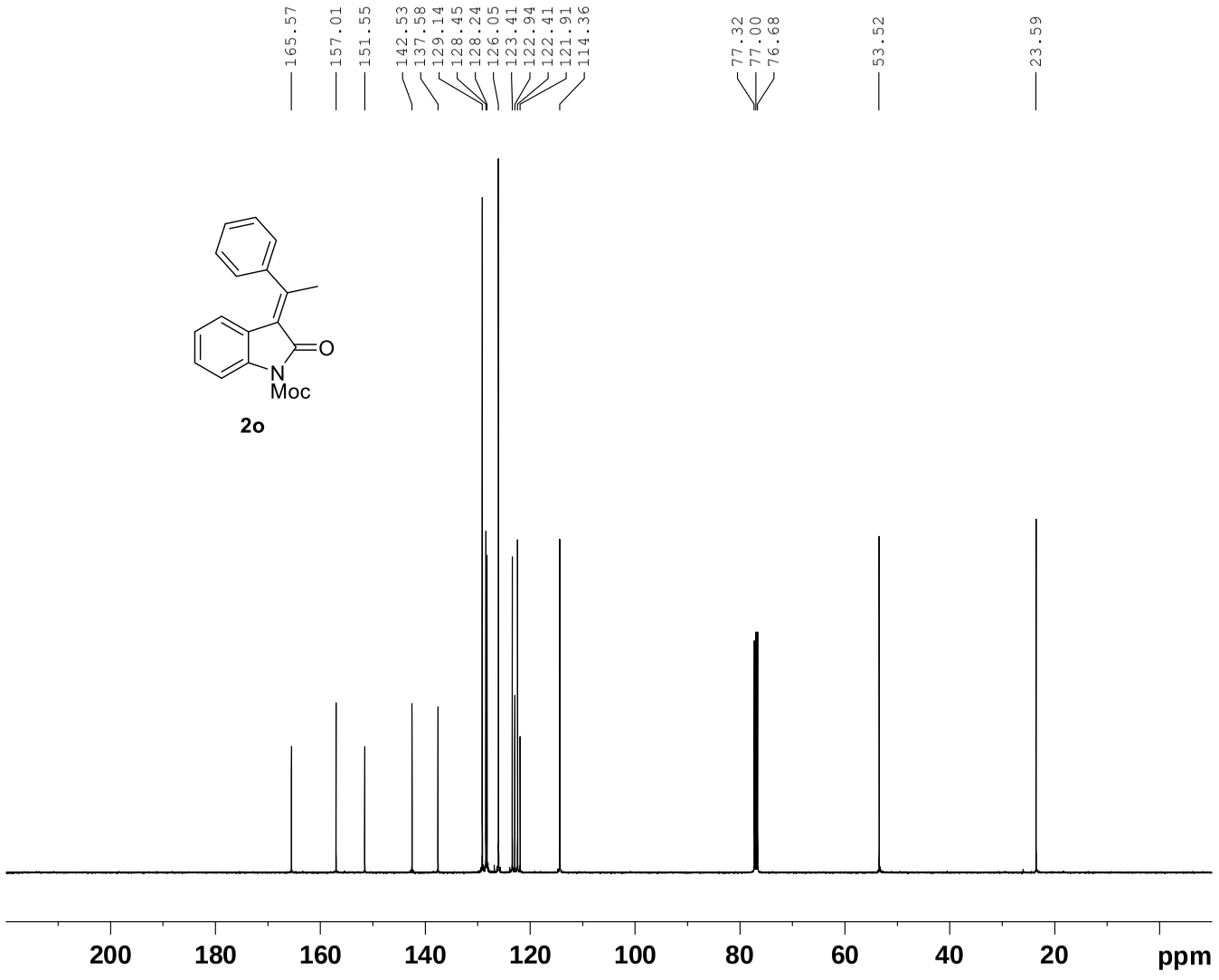
2o

```
Current Data Parameters
NAME                  test
EXPNO                   36
PROCNO                   1

F2 - Acquisition Parameters
Date_           20170314
Time                17.53
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ              2.2609921 sec
RG                     32
DW                69.000 usec
DE                 6.50 usec
TE                298.0 K
D1             2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.40 usec
PL1                 1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF           400.1300069 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



2o

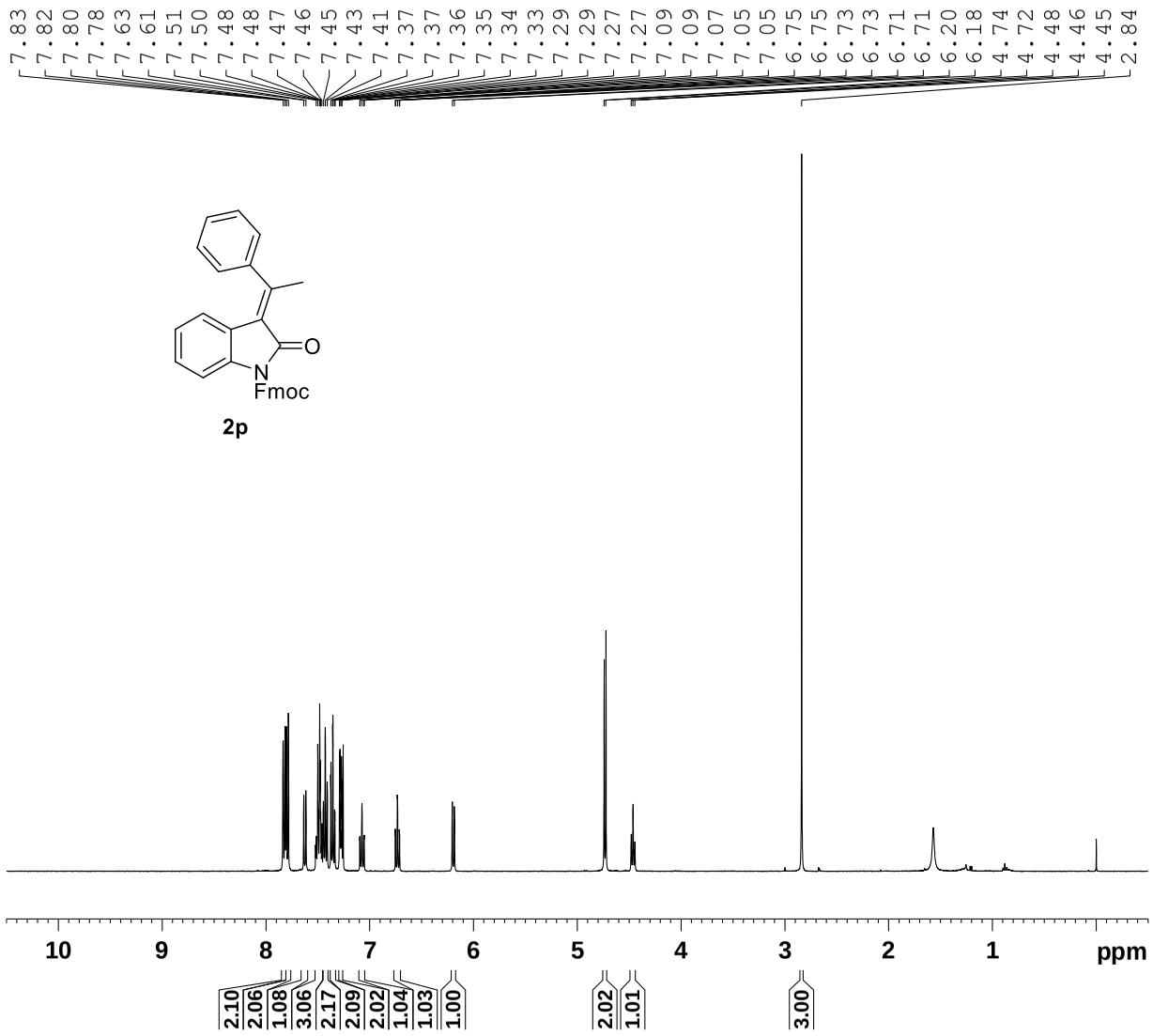
```
Current Data Parameters
NAME                  test
EXPNO                   37
PROCNO                   1

F2 - Acquisition Parameters
Date_            20170314
Time                17.55
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                   2460
DS                      0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG                   4096
DW                20.800 usec
DE                 6.50 usec
TE                 298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                   9.00 usec
PL1                  7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF          100.6127912 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```

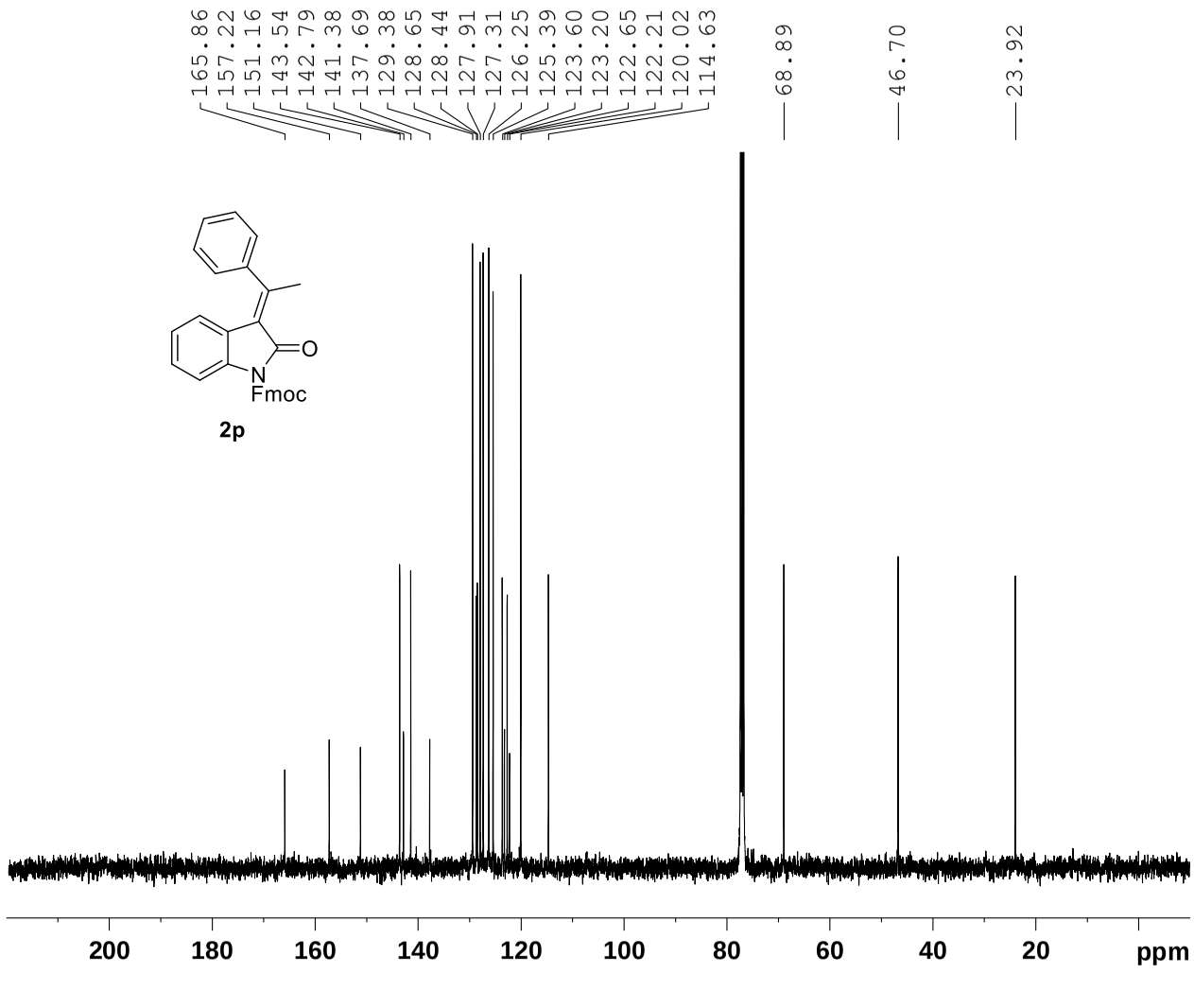



```
Current Data Parameters
NAME                  Data
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_           20170512
Time               13.01
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7211.539 Hz
FIDRES          0.220079 Hz
AQ              2.2719147 sec
RG                177.16
DW                69.333 usec
DE                10.50 usec
TE                297.7 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1324008 MHz
NUC1                   1H
P1                 12.90 usec
PLW1         15.00000000 W

F2 - Processing parameters
SI                 16384
SF           400.1300123 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



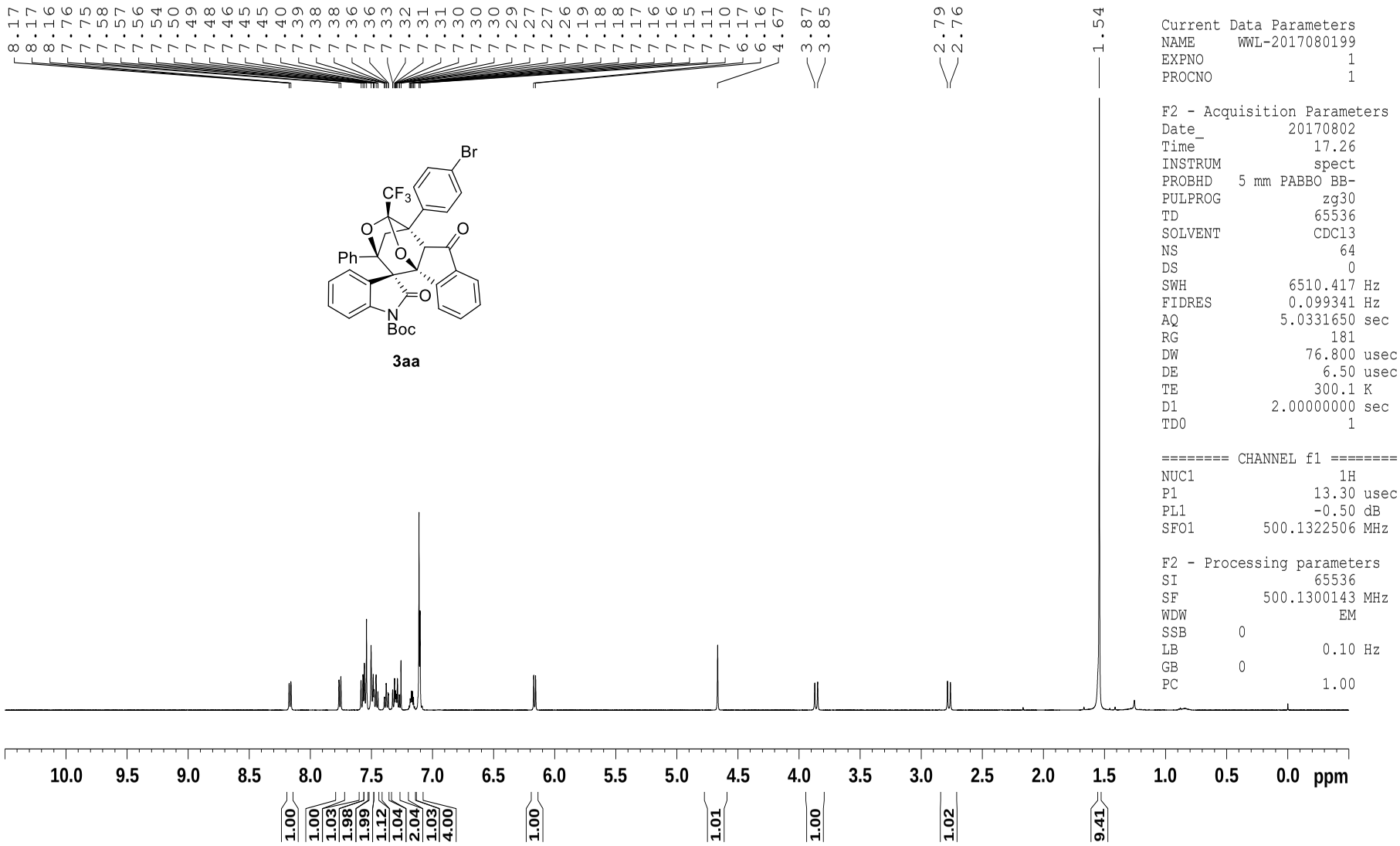

```
Current Data Parameters
NAME                  Data
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170512
Time                 13.03
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1569
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                 20.800 usec
DE                  6.50 usec
TE                  298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6228298 MHz
NUC1                    13C
P1                  10.00 usec
PLW1          47.50000000 W

======== CHANNEL f2 ========
SFO2          400.1316005 MHz
NUC2                    1H
CPDPRG[2           waltz16
PCPD2               90.00 usec
PLW2          15.00000000 W
PLW12          0.33750001 W
PLW13          0.27338001 W

F2 - Processing parameters
SI                   32768
SF            100.6127707 MHz
WDW                     EM
SSB       0
LB                   2.00 Hz
GB        0
PC                   1.00
```

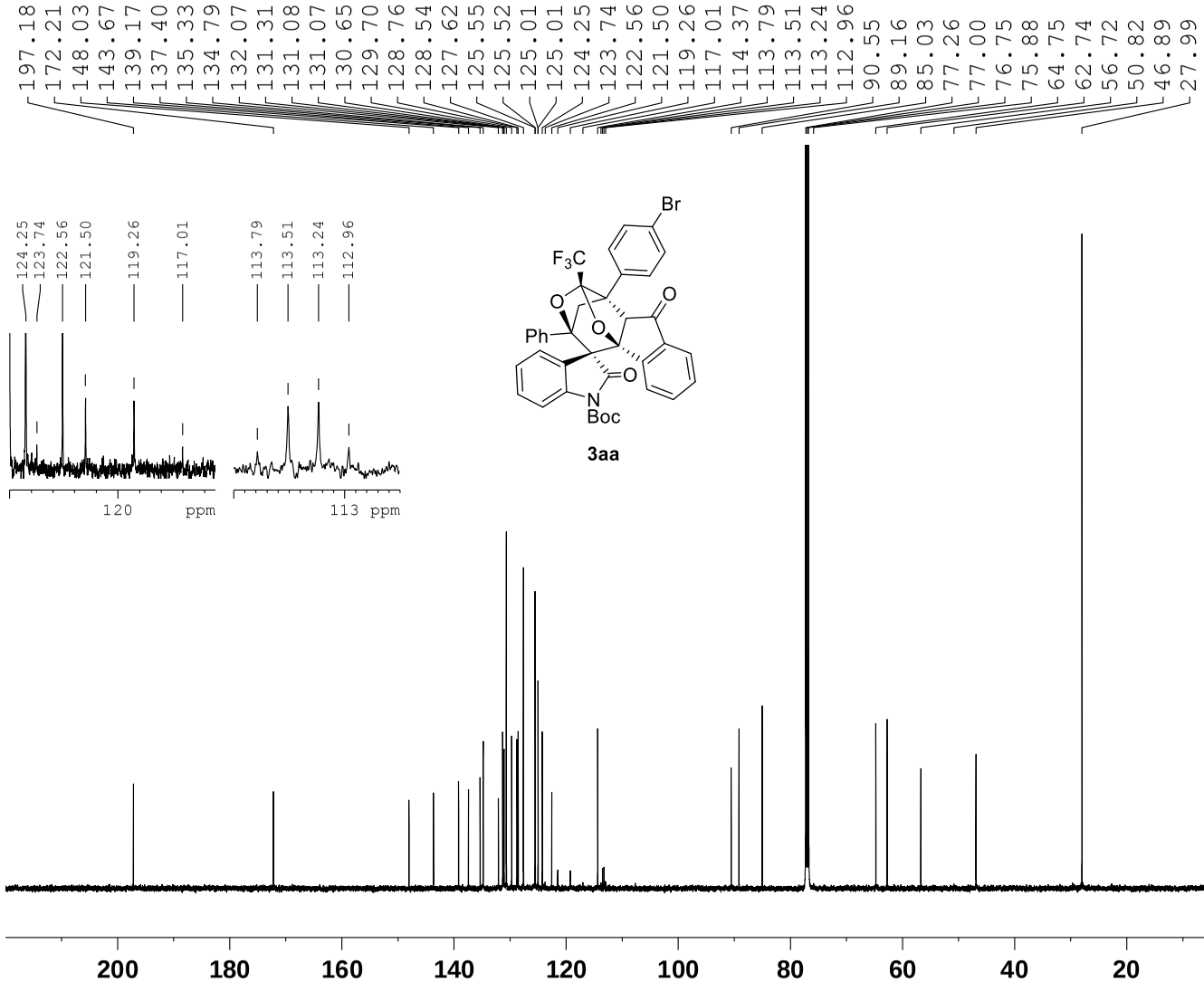



```
Current Data Parameters
NAME      WWL-2017080199
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170802
Time_              17.26
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    64
DS                     0
SWH             6510.417 Hz
FIDRES          0.099341 Hz
AQ              5.0331650 sec
RG                   181
DW                76.800 usec
DE                 6.50 usec
TE                300.1 K
D1           2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                   1H
P1                 13.30 usec
PL1                -0.50 dB
SFO1         500.1322506 MHz

F2 - Processing parameters
SI                 65536
SF           500.1300143 MHz
WDW                   EM
SSB       0
LB                 0.10 Hz
GB        0
PC                 1.00
```



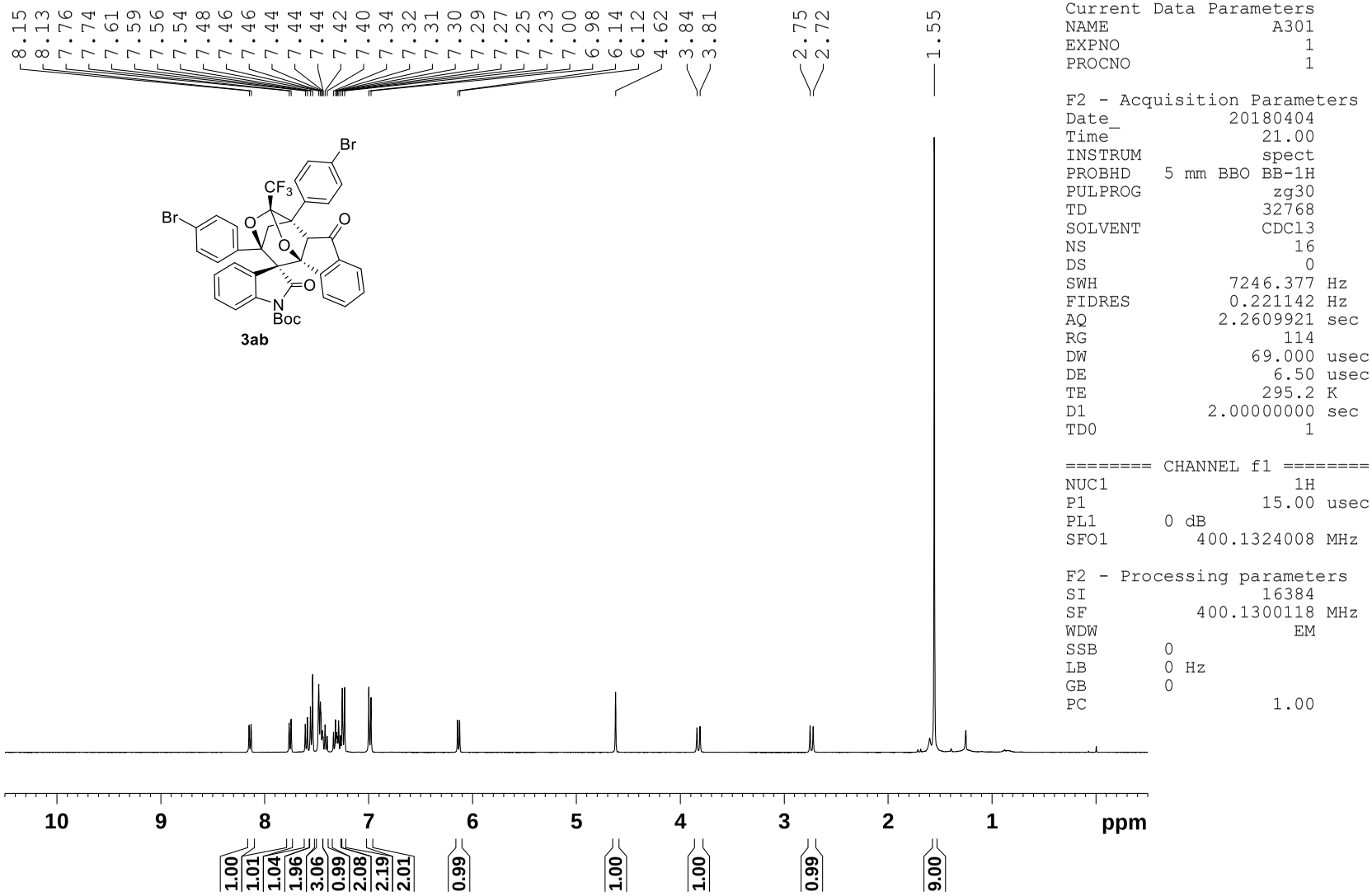

```
Current Data Parameters
NAME      WWL-2017080199
EXPNO                  6
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170803
Time               10.48
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 8000
DS                    0
SWH           30303.031 Hz
FIDRES         0.462388 Hz
AQ            1.0813440 sec
RG                 2048
DW               16.500 usec
DE                6.50 usec
TE               300.5 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.10 usec
PL1                6.00 dB
SFO1        125.7709936 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2               -0.50 dB
PL12              16.00 dB
PL13              19.00 dB
SFO2        500.1320005 MHz

F2 - Processing parameters
SI                65536
SF          125.7577894 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.00
```

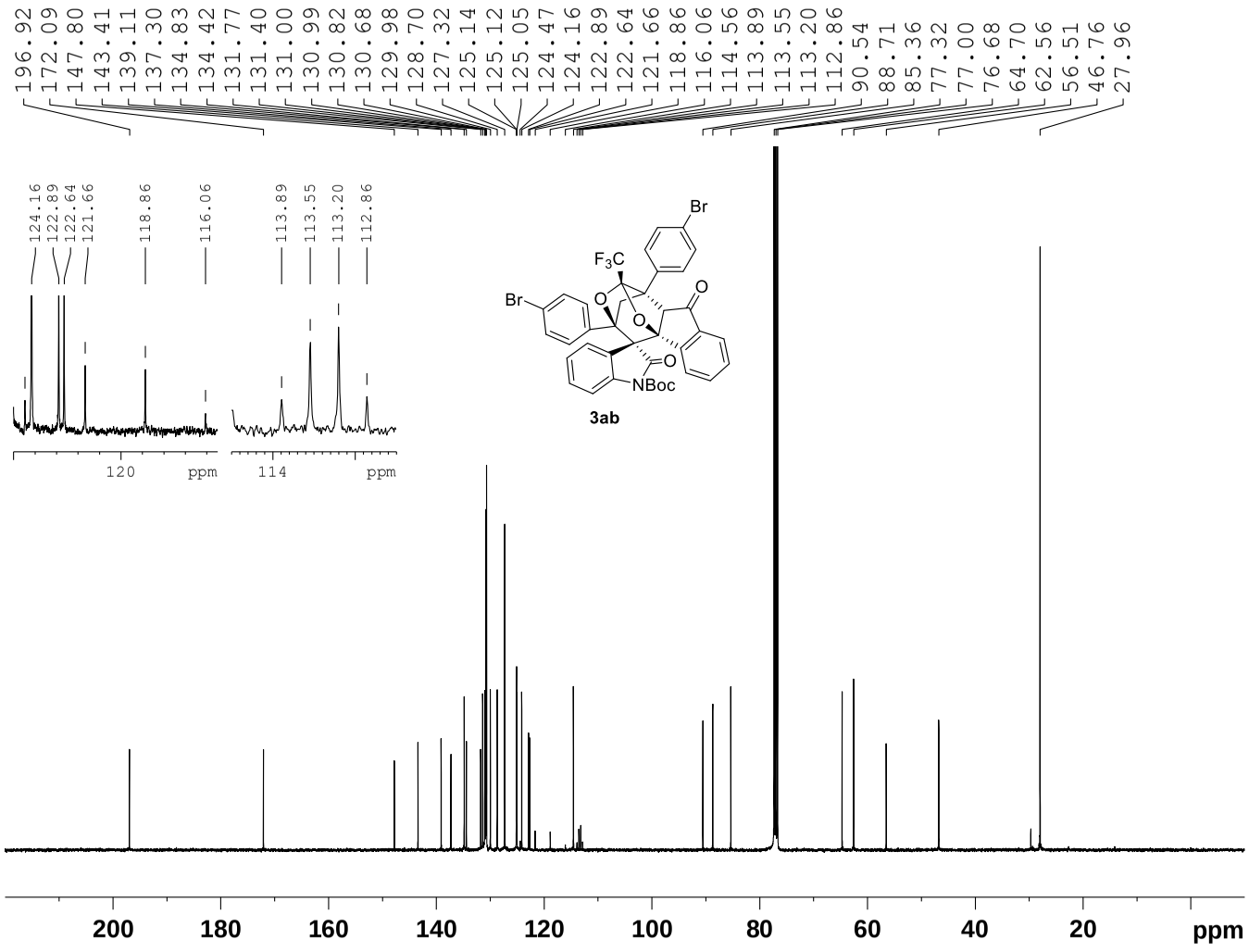



```
Current Data Parameters
NAME                  A301
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180404
Time                 21.00
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    114
DW                 69.000 usec
DE                  6.50 usec
TE                 295.2 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300118 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



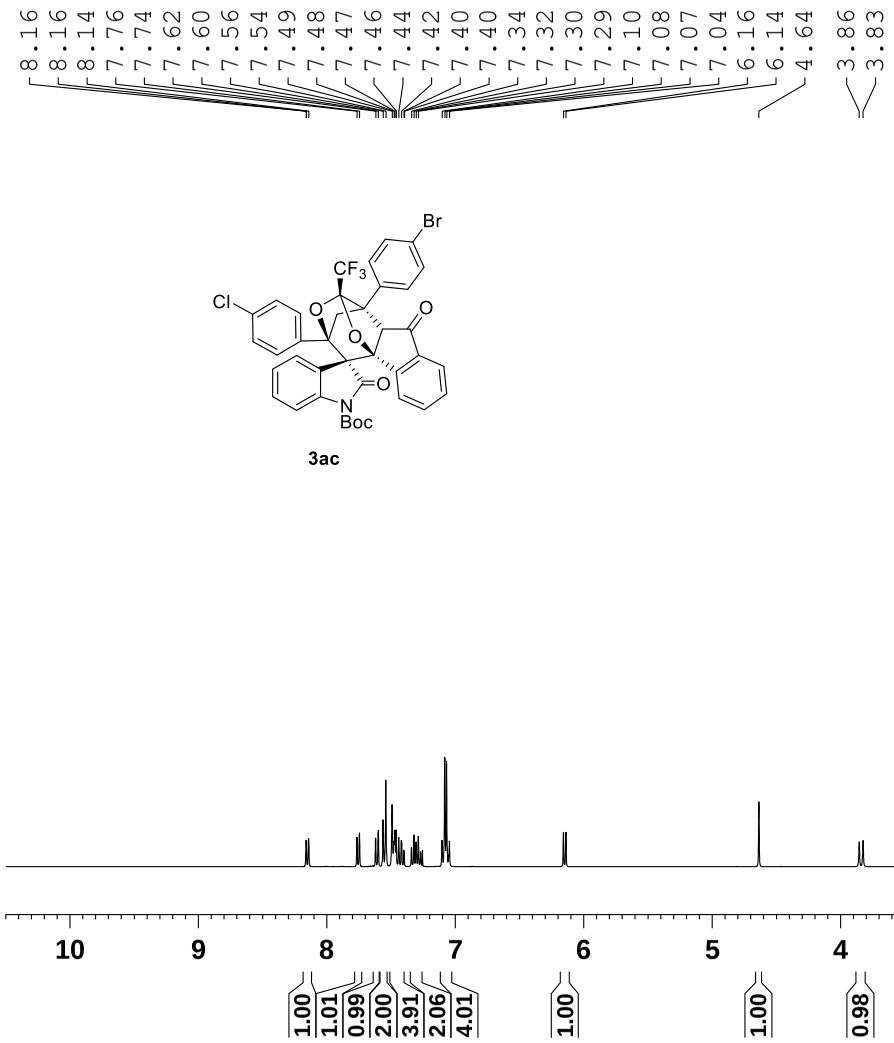

```
Current Data Parameters
NAME                  A301
EXPNO                    3
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180405
Time                 21.47
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   14740
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  5792.6
DW                 20.800 usec
DE                  6.50 usec
TE                 295.5 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.45 usec
PL1                  7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2               90.00 usec
PL2       0 dB
PL12                15.00 dB
PL13                20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127716 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```



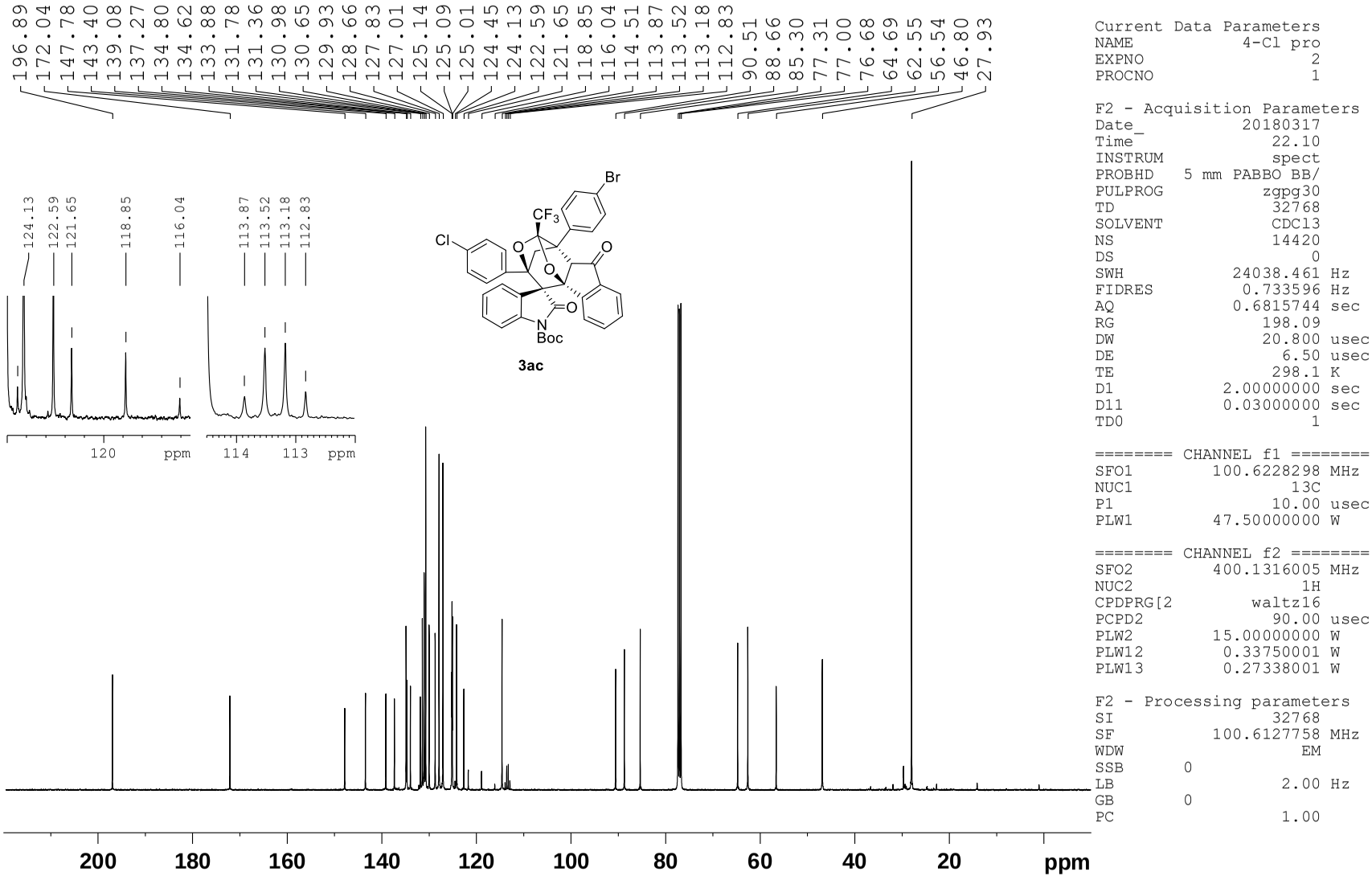
3ac

```
Current Data Parameters
NAME                 4-Cl pro
EXPNO                       1
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180317
Time                   22.08
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       32
DS                        0
SWH                7211.539 Hz
FIDRES            0.220079 Hz
AQ                2.2719147 sec
RG                    45.15
DW                   69.333 usec
DE                   10.50 usec
TE                   297.8 K
D1                2.00000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1            400.1324008 MHz
NUC1                      1H
P1                     12.90 usec
PLW1           15.00000000 W

F2 - Processing parameters
SI                        16384
SF              400.1300119 MHz
WDW                       EM
SSB          0
LB           0 Hz
GB           0
PC                      1.00
```



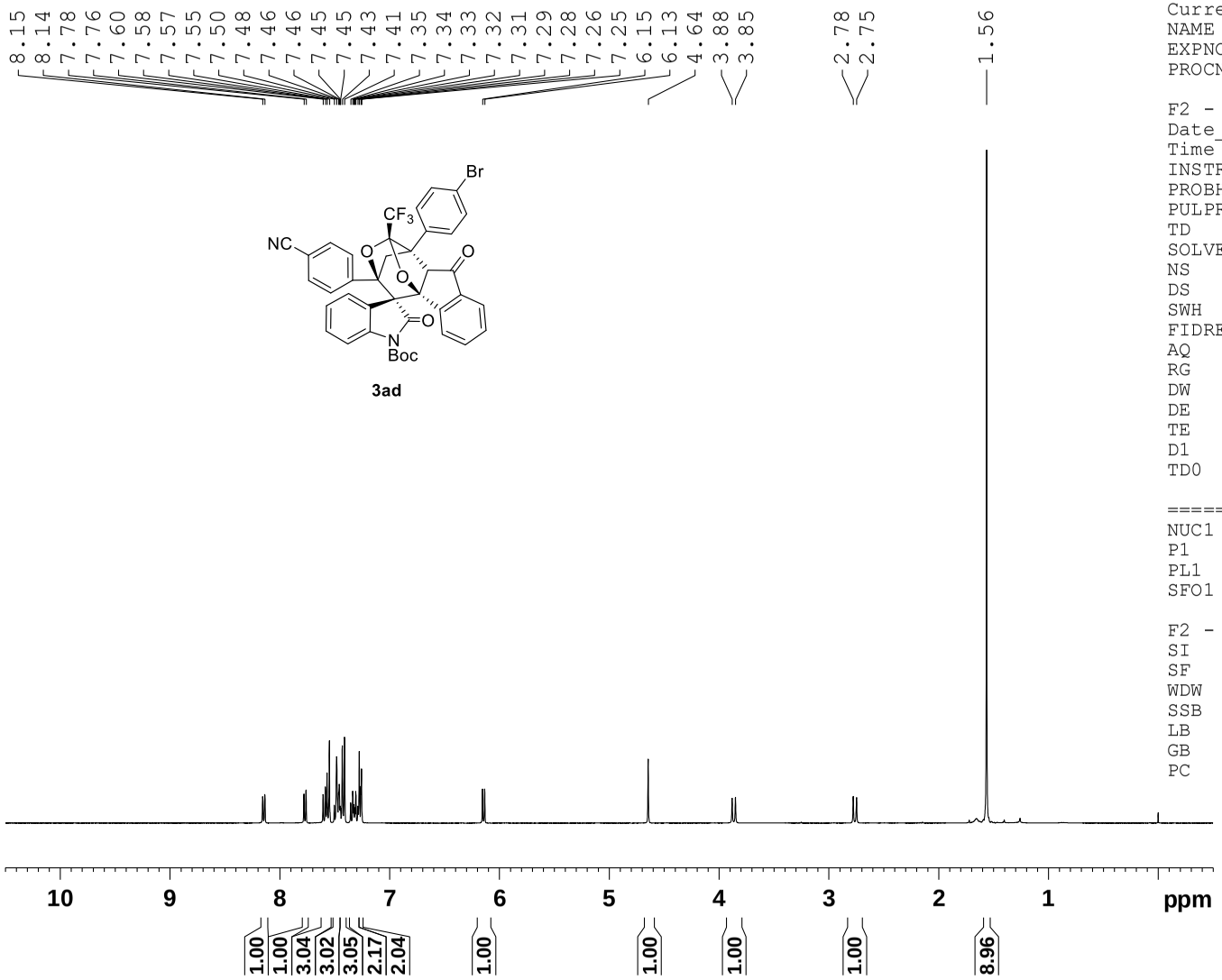

```
Current Data Parameters
NAME                  4-Cl pro
EXPNO                        2
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20180317
Time                     22.10
INSTRUM                  spect
PROBHD    5 mm PABBO BB/
PULPROG                 zgpg30
TD                       32768
SOLVENT                  CDCl3
NS                       14420
DS                           0
SWH                24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                      198.09
DW                      20.800 usec
DE                       6.50 usec
TE                      298.1 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1               100.6228298 MHz
NUC1                       13C
P1                      10.00 usec
PLW1               47.50000000 W

======== CHANNEL f2 ========
SFO2               400.1316005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                   90.00 usec
PLW2               15.00000000 W
PLW12               0.33750001 W
PLW13               0.27338001 W

F2 - Processing parameters
SI                       32768
SF                 100.6127758 MHz
WDW                         EM
SSB          0
LB                       2.00 Hz
GB           0
PC                       1.00
```

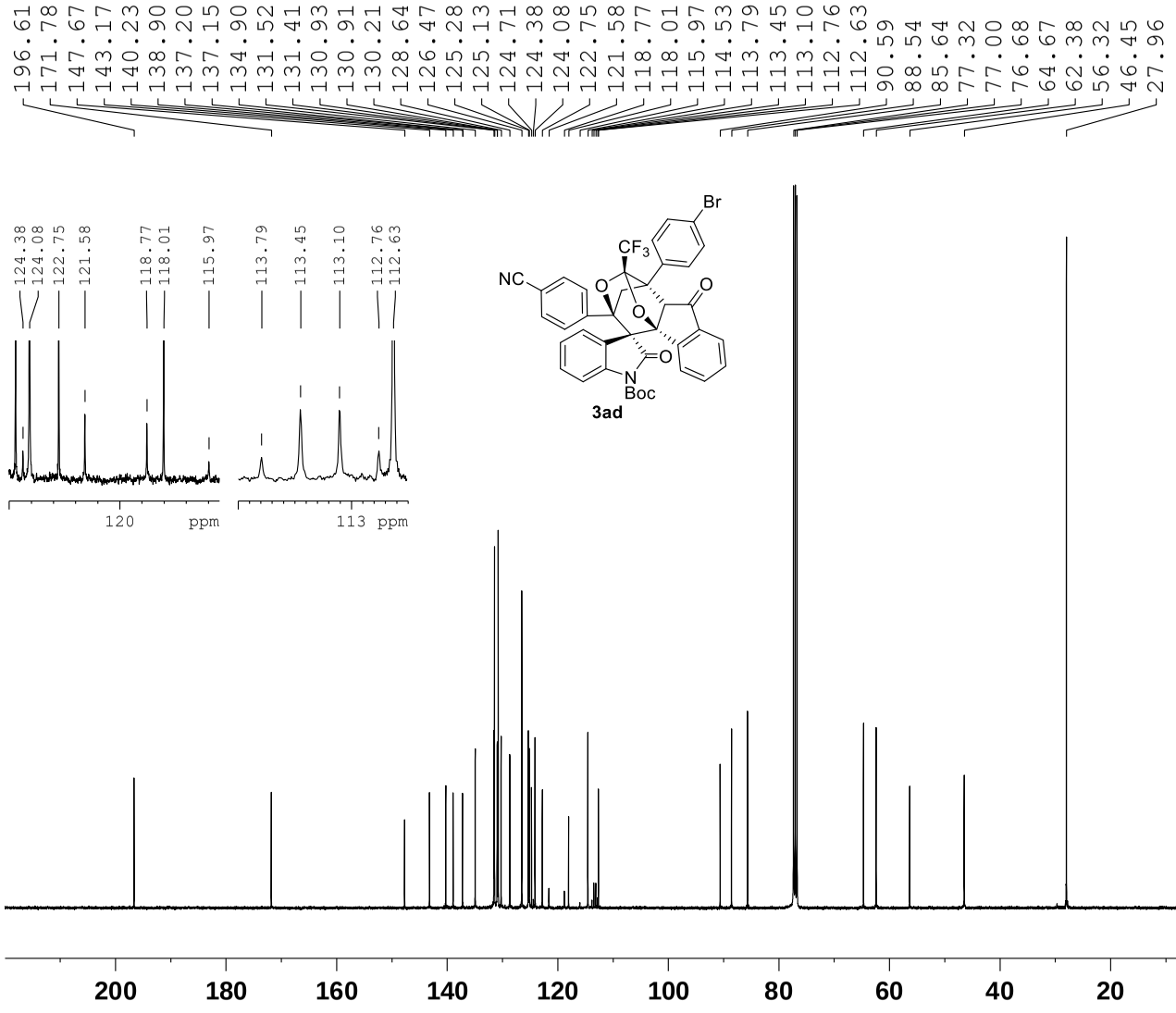



```
Current Data Parameters
NAME          Curtis-057
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20171222
Time              21.55
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            7246.377 Hz
FIDRES        0.221142 Hz
AQ            2.2609921 sec
RG                  114
DW               69.000 usec
DE                6.50 usec
TE               296.5 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 1H
P1                15.00 usec
PL1       0 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                16384
SF          400.1300087 MHz
WDW                  EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



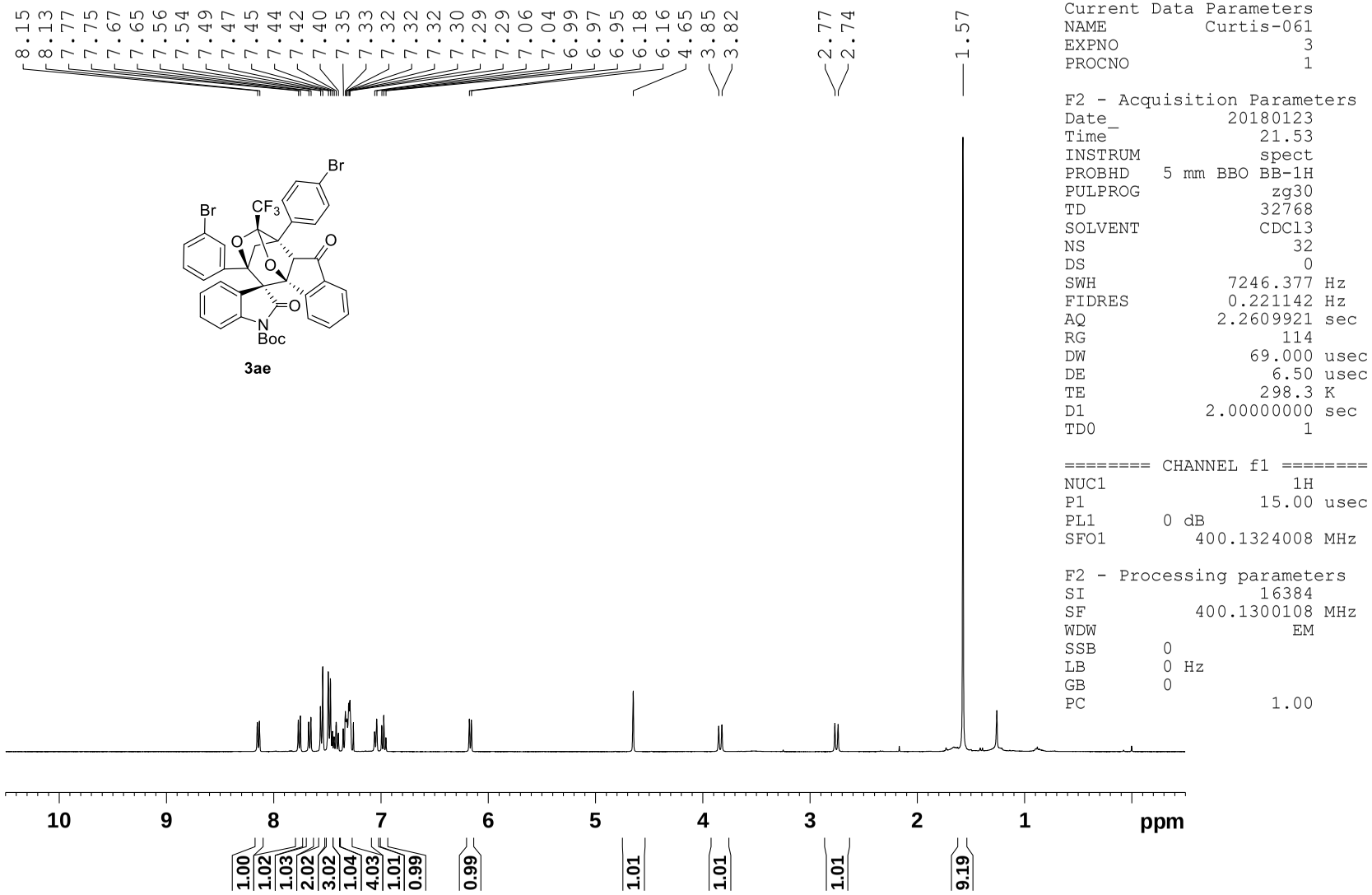

```
Current Data Parameters
NAME          Curtis-057
EXPNO                  4
PROCNO                 1

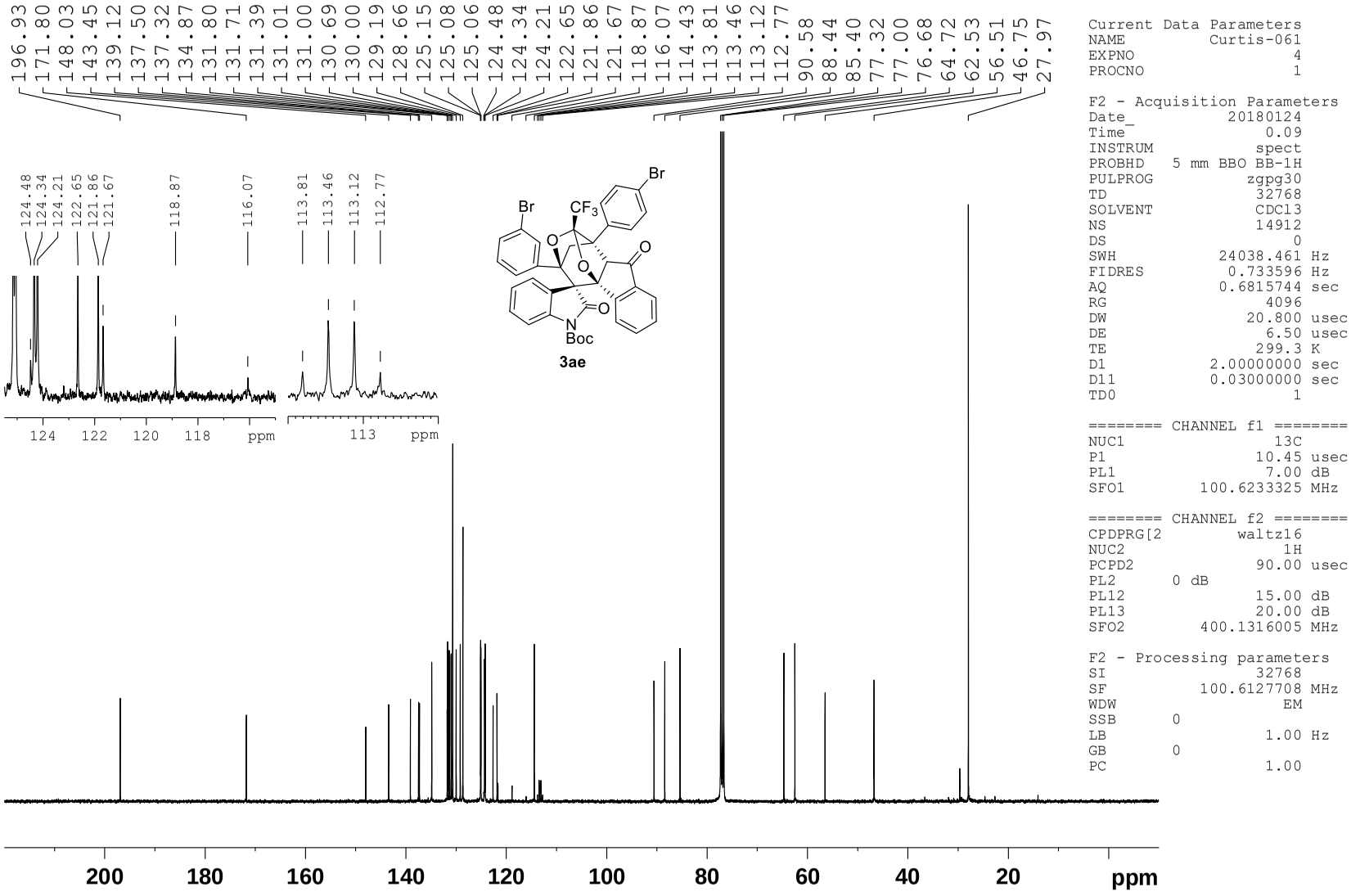
F2 - Acquisition Parameters
Date_           20171222
Time              21.57
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG         zgpg30
TD                32768
SOLVENT           CDCl3
NS                 9999
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                 4096
DW               20.800 usec
DE                6.50 usec
TE                296.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.45 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2       0 dB
PL12              15.00 dB
PL13              20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127731 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.00
```


8.15
8.13
7.77
7.75
7.67
7.65
7.56
7.54
7.49
7.47
7.45
7.44
7.42
7.40
7.35
7.33
7.32
7.32
7.32
7.30
7.29
7.29
7.06
7.04
6.99
6.97
6.95
6.18
6.16
4.65
3.85
3.82
2.77
2.74
1.57
Br
Br
CF3
O
O
O
O
N
Boc
3ae
Current Data Parameters
NAME Curtis-061
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20180123
Time 21.53
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 32
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 298.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 0 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300108 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10
9
8
7
6
5
4
3
2
1
ppm
1.00
1.02
1.03
2.02
3.02
1.04
4.03
1.01
0.99
0.99
1.01
1.01
1.01
9.19



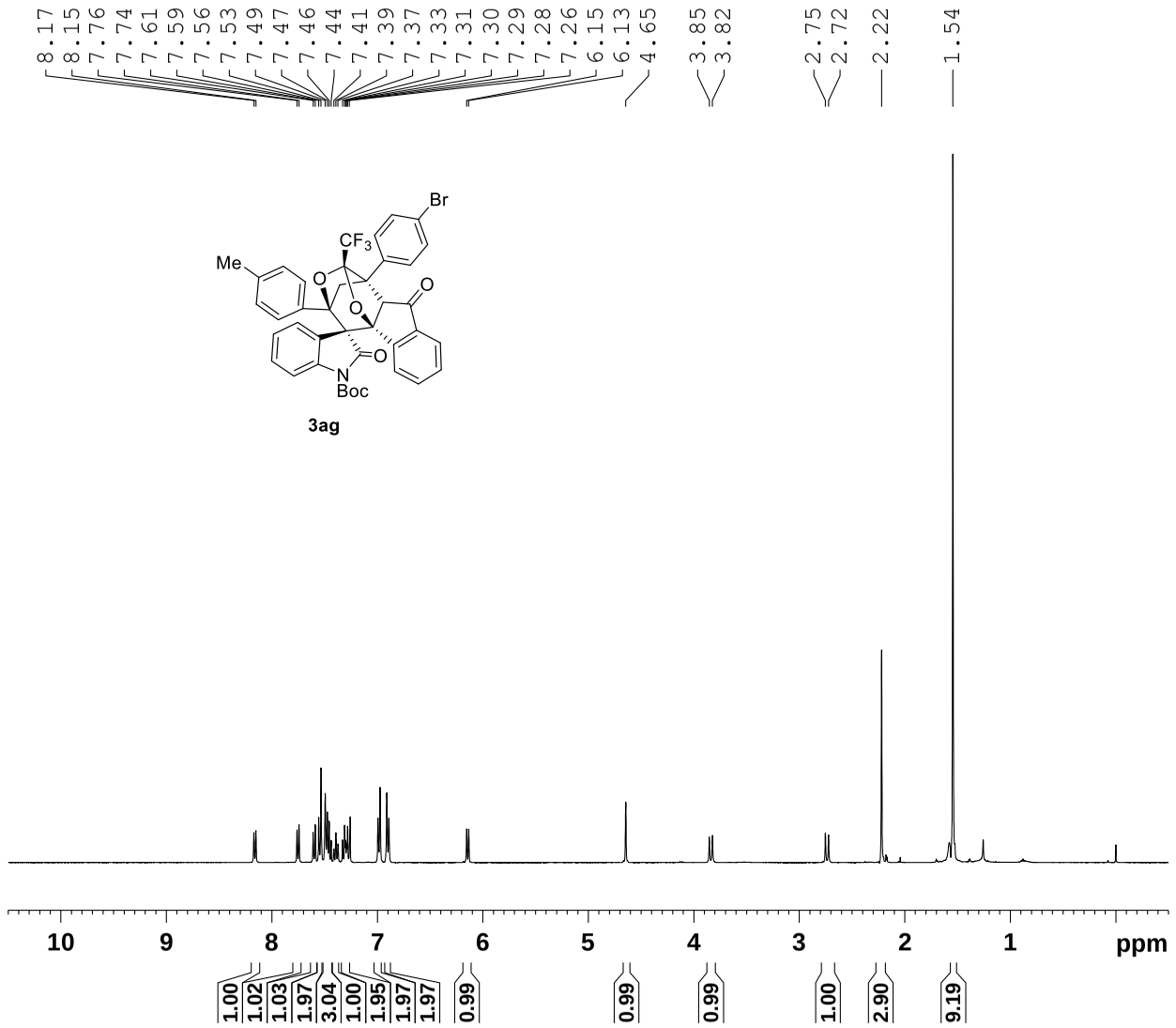
Current Data Parameters
NAME Curtis-061
EXPNO 4
PROCNO 1

F2 - Acquisition Parameters
Date_ 20180124
Time 0.09
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 14912
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 299.3 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 10.45 usec
PL1 7.00 dB
SFO1 100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0 dB
PL12 15.00 dB
PL13 20.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127708 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00

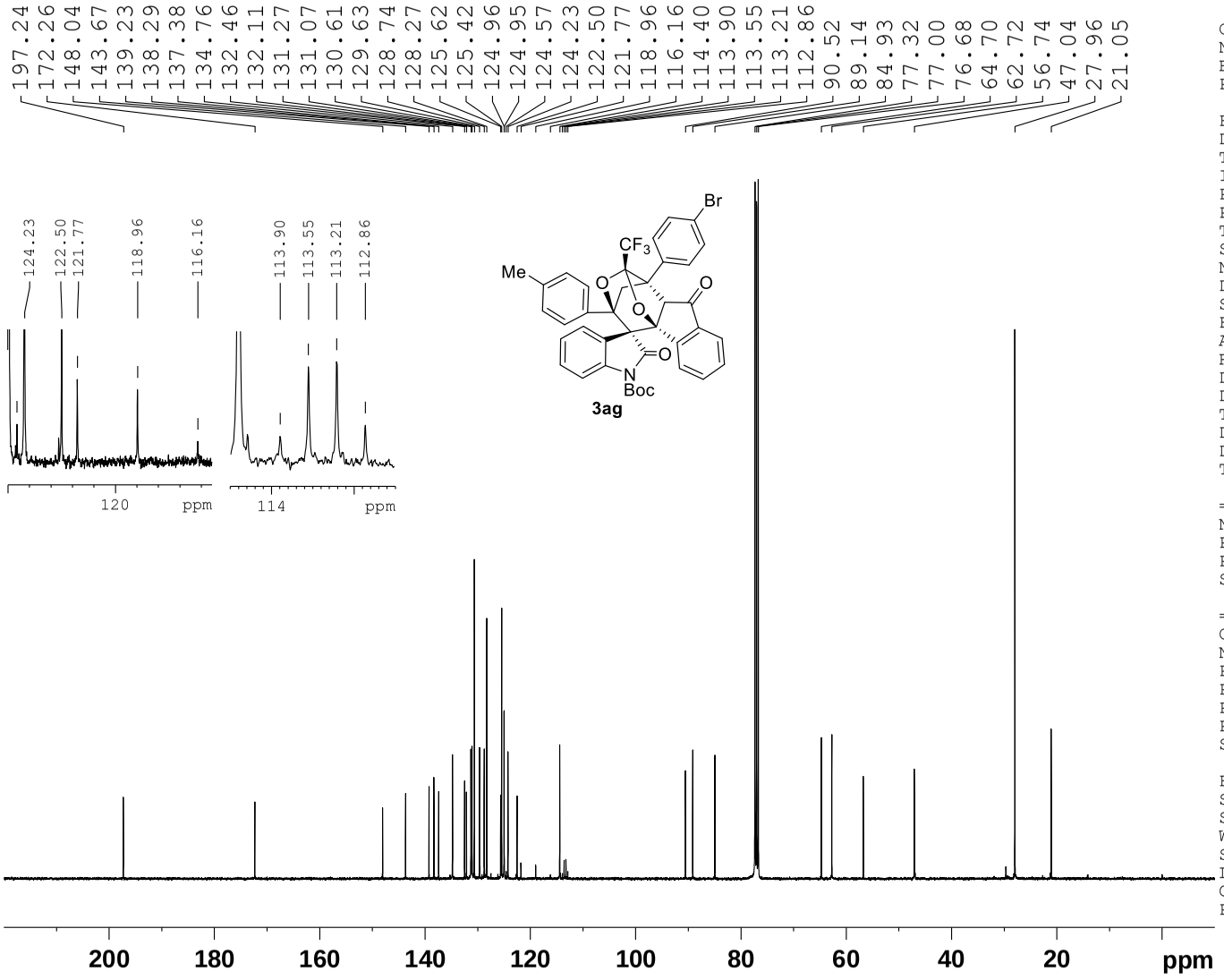



```
Current Data Parameters
NAME          Curtis-062
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180310
Time               21.49
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    32
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                   114
DW                69.000 usec
DE                 6.50 usec
TE                296.2 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1       0 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF           400.1300105 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



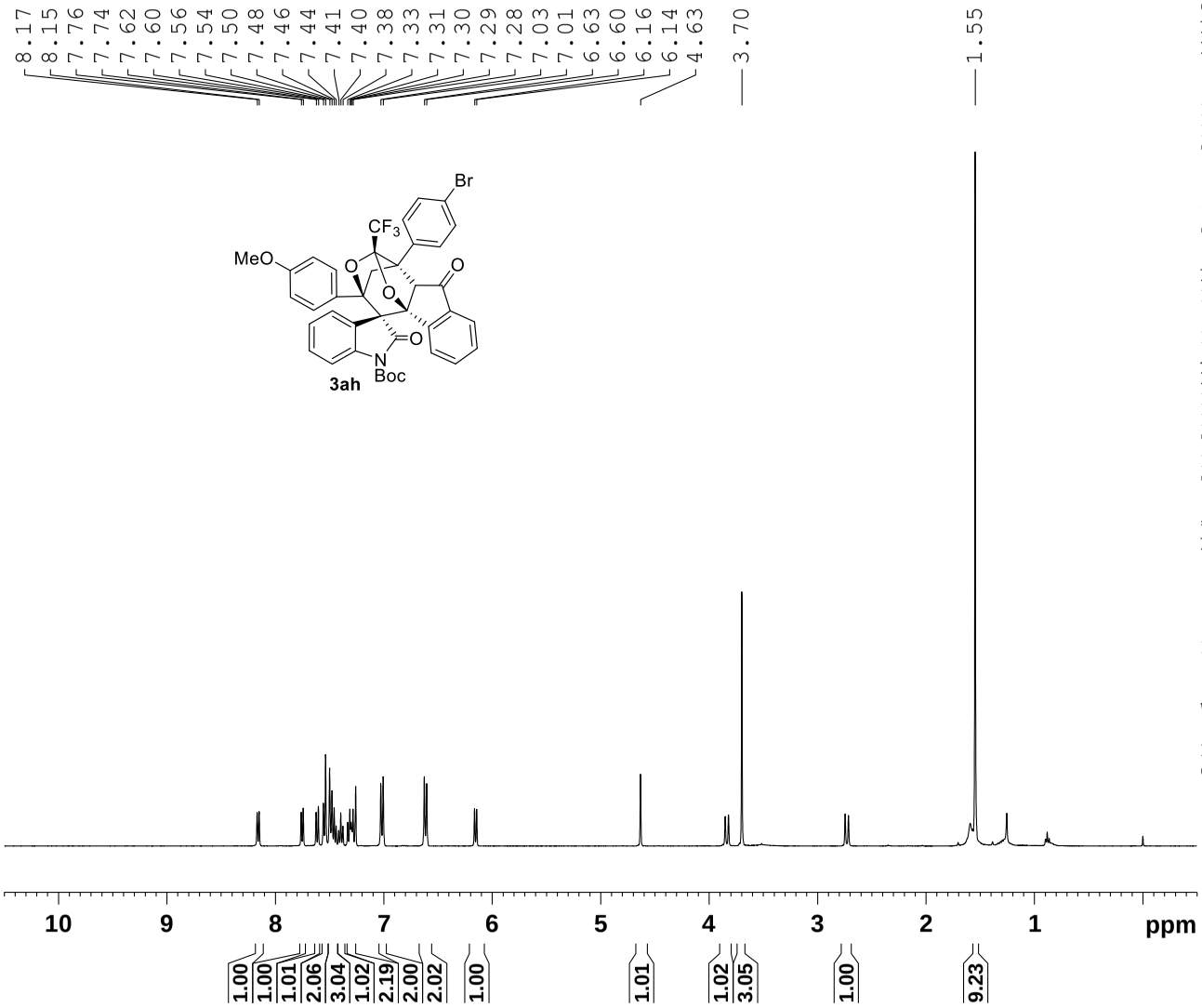

```
Current Data Parameters
NAME          Curtis-062
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180310
Time               21.52
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                 32768
SOLVENT            CDCl3
NS                 16209
DS                     0
SWH          24038.461 Hz
FIDRES        0.733596 Hz
AQ           0.6815744 sec
RG                 32768
DW              20.800 usec
DE               6.50 usec
TE               296.3 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.45 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127719 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```

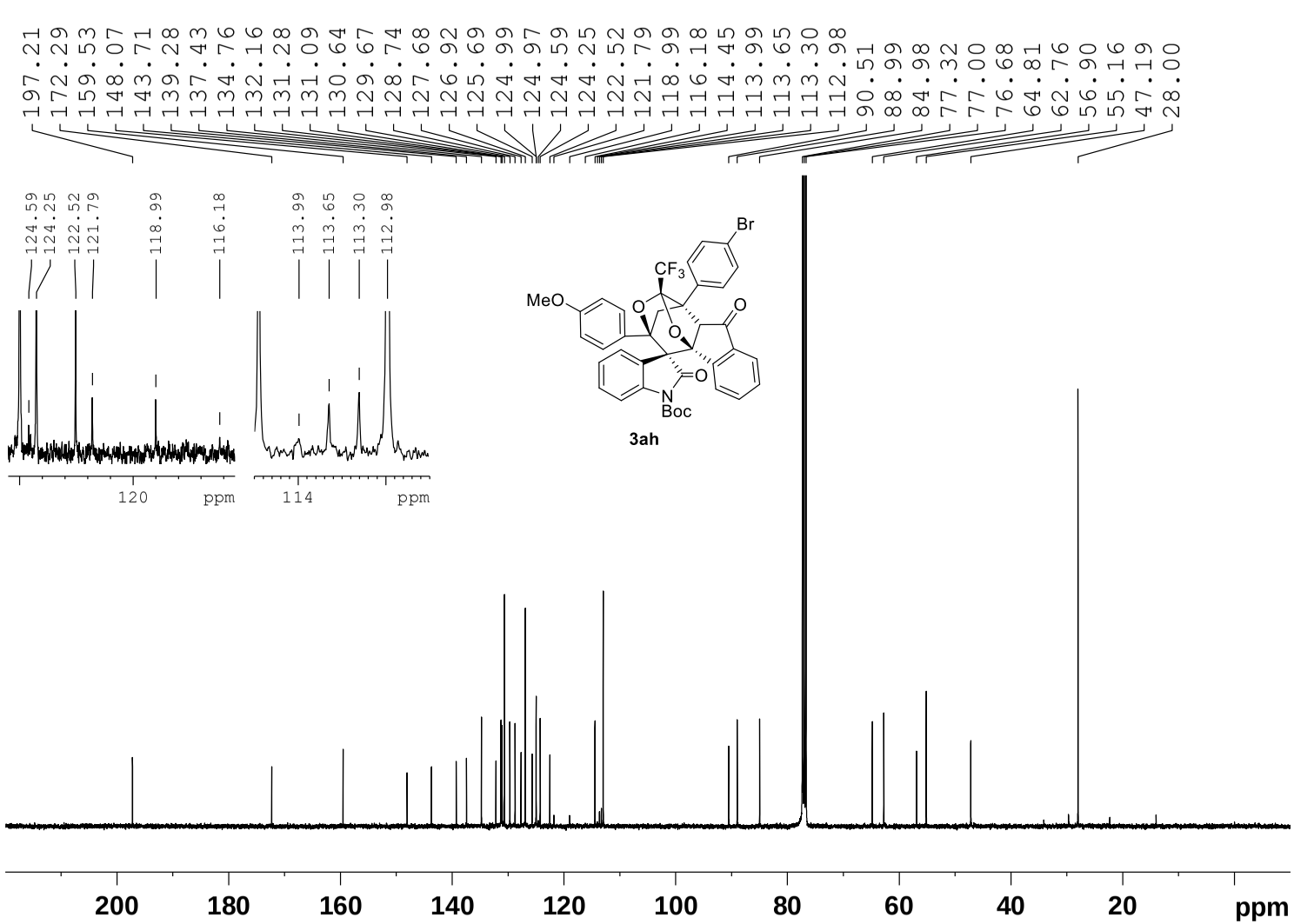



```
Current Data Parameters
NAME        4-OMeproduct
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180326
Time              22.14
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   32
DS                    0
SWH            7246.377 Hz
FIDRES        0.221142 Hz
AQ            2.2609921 sec
RG                  114
DW               69.000 usec
DE                6.50 usec
TE               300.1 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 1H
P1                15.00 usec
PL1       0 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                16384
SF          400.1300104 MHz
WDW                  EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



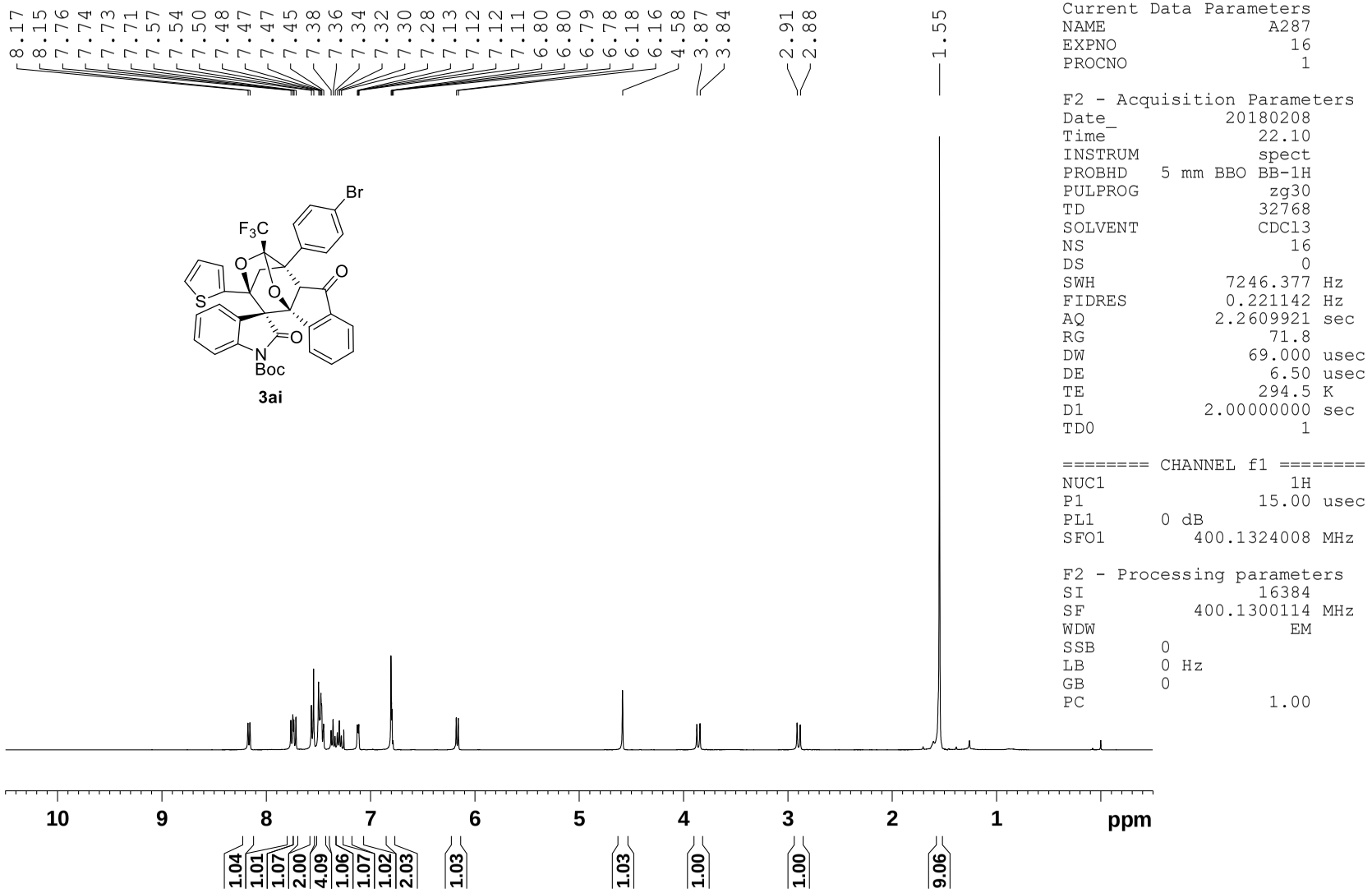

```
Current Data Parameters
NAME       4-OMeproduct
EXPNO                 4
PROCNO                1

F2 - Acquisition Parameters
Date_          20180326
Time              22.16
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG         zgpg30
TD                32768
SOLVENT           CDCl3
NS                12533
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG                32768
DW               20.800 usec
DE                6.50 usec
TE               300.1 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.45 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2       0 dB
PL12              15.00 dB
PL13              20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127686 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.00
```

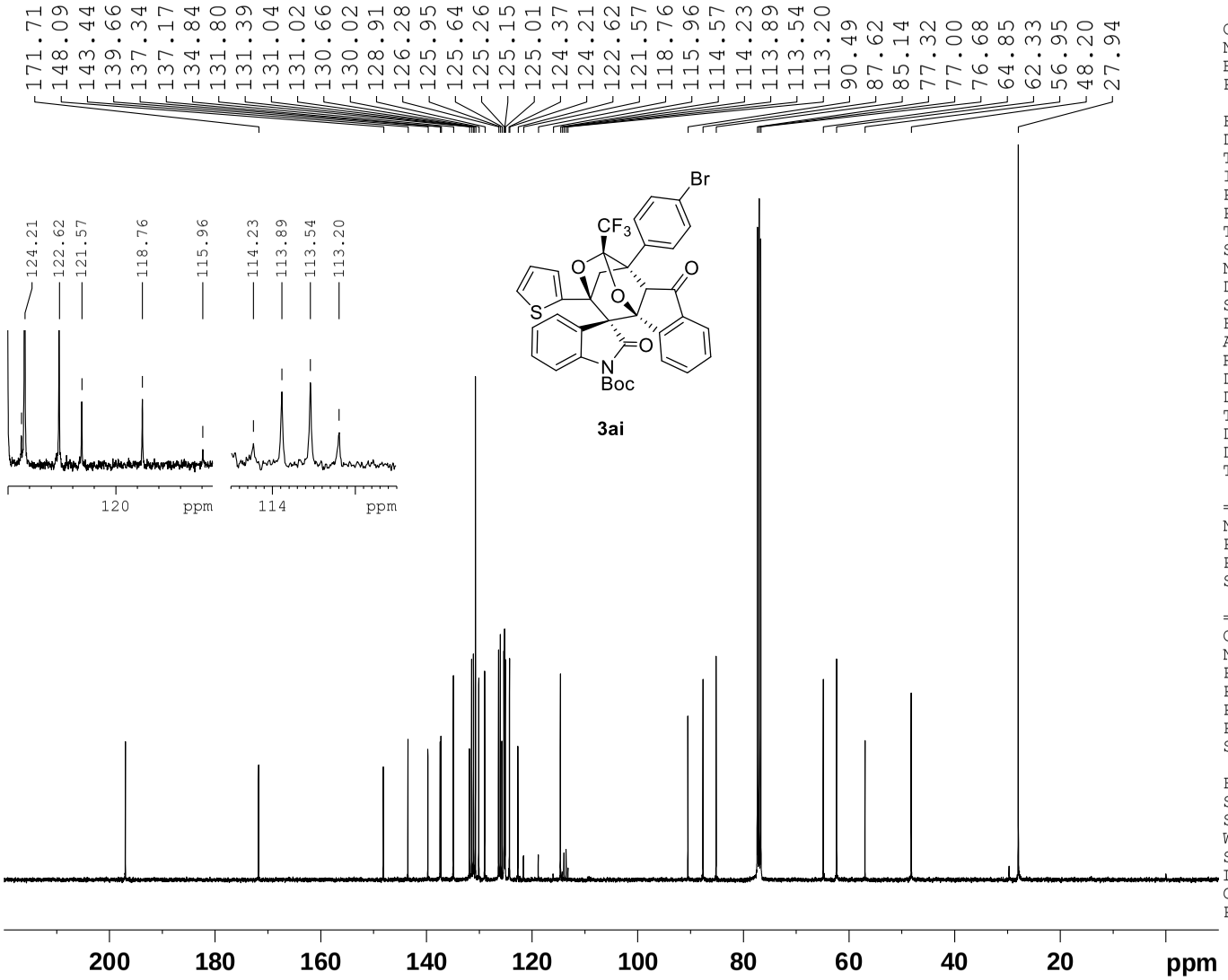



```
Current Data Parameters
NAME                  A287
EXPNO                   16
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180208
Time                 22.10
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH               7246.377 Hz
FIDRES             0.221142 Hz
AQ                2.2609921 sec
RG                     71.8
DW                   69.000 usec
DE                    6.50 usec
TE                   294.5 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF              400.1300114 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



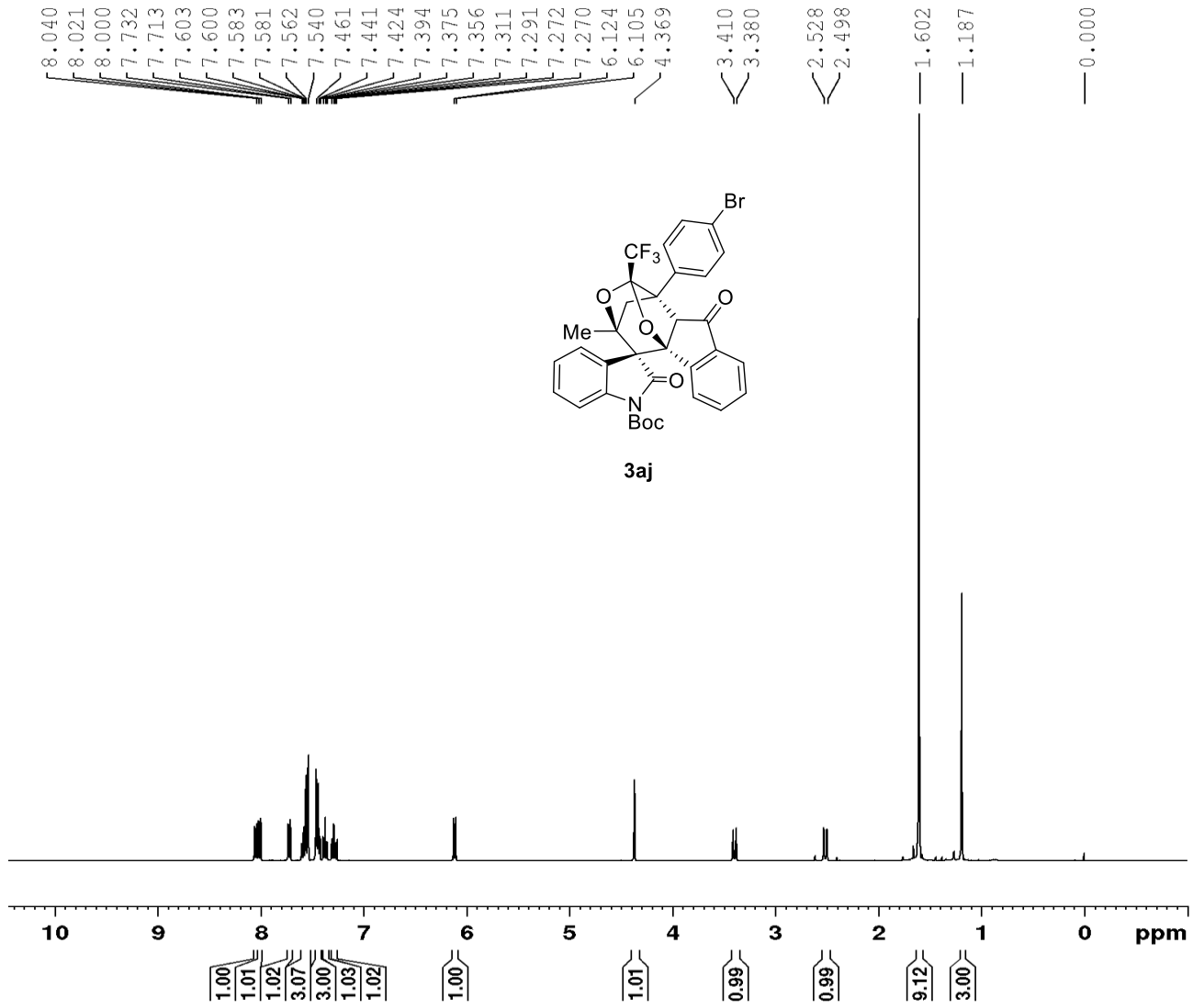

```
Current Data Parameters
NAME                  A287
EXPNO                   17
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180208
Time                 22.15
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDC13
NS                    9000
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ               0.6815744 sec
RG                    4096
DW                  20.800 usec
DE                   6.50 usec
TE                  295.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127731 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

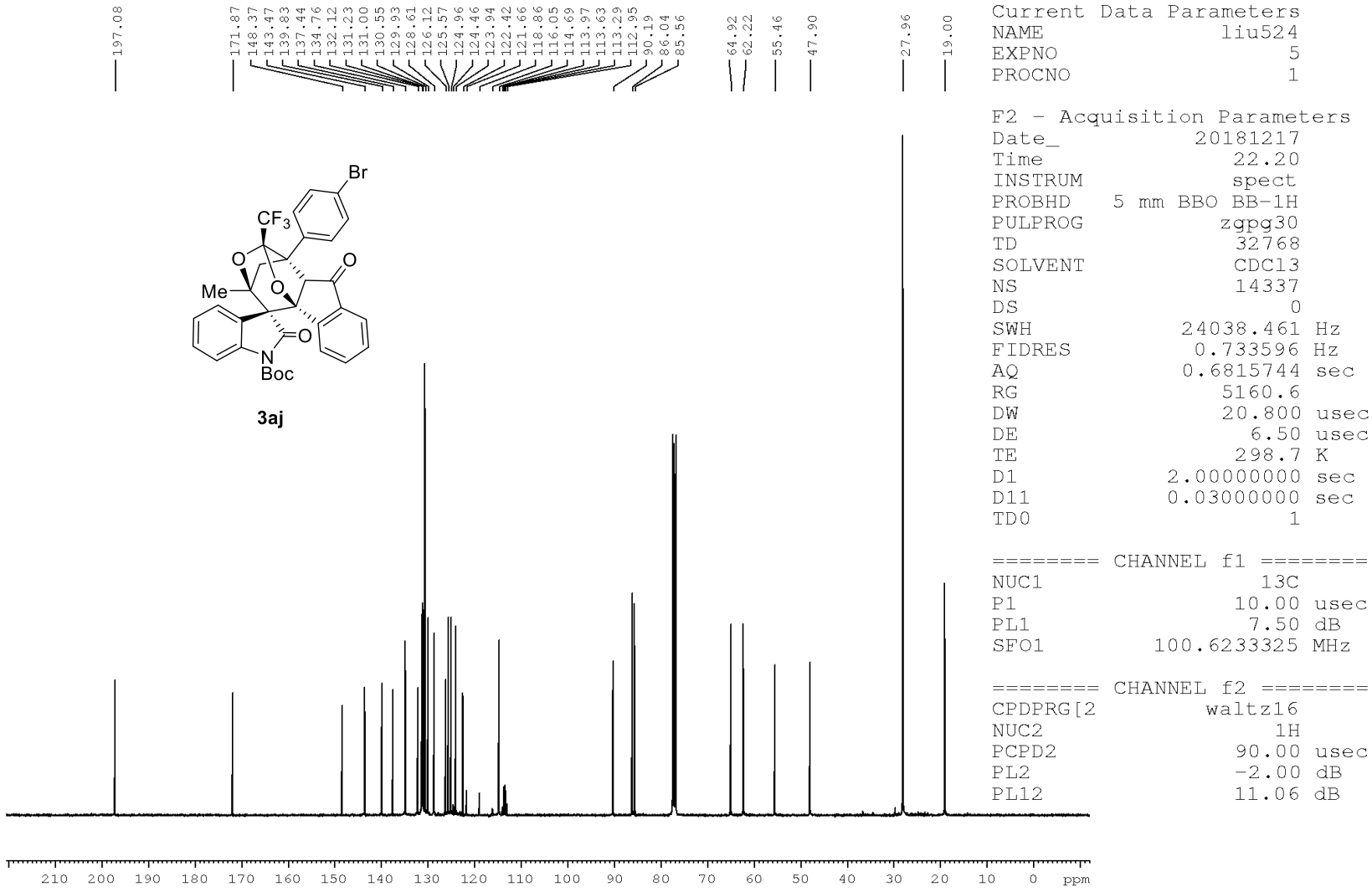



```
Current Data Parameters
NAME                  liu524
EXPNO                      2
PROCNO                     1

F2 - Acquisition Parameters
Date_              20181217
Time                 20.41
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                      64
DW                  69.000 usec
DE                   6.50 usec
TE                  298.7 K
D1             2.00000000 sec
TD0                      1

========= CHANNEL f1 =========
NUC1                    1H
P1                  15.70 usec
PL1                 -2.00 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300109 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



Current Data Parameters

NAME	liu524
EXPNO	5
PROCNO	1

F2 - Acquisition Parameters

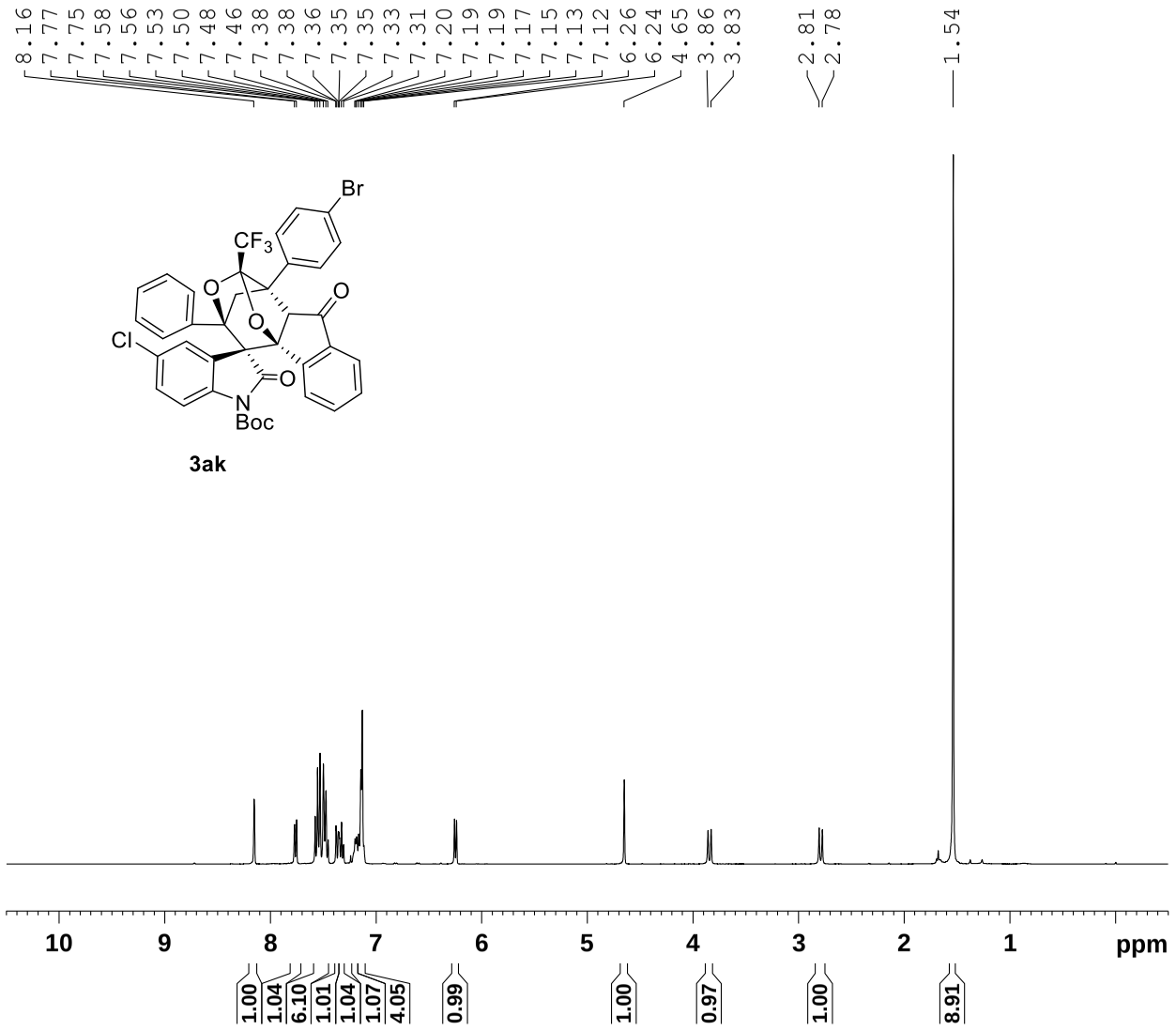
Date_	20181217
Time	22.20
INSTRUM	spect
PROBHD	5 mm BBO BB-1H
PULPROG	zgpg30
TD	32768
SOLVENT	CDCl3
NS	14337
DS	0
SWH	24038.461 Hz
FIDRES	0.733596 Hz
AQ	0.6815744 sec
RG	5160.6
DW	20.800 usec
DE	6.50 usec
TE	298.7 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

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

NUC1	13C
P1	10.00 usec
PL1	7.50 dB
SFO1	100.6233325 MHz

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

CPDPRG[2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	-2.00 dB
PL12	11.06 dB

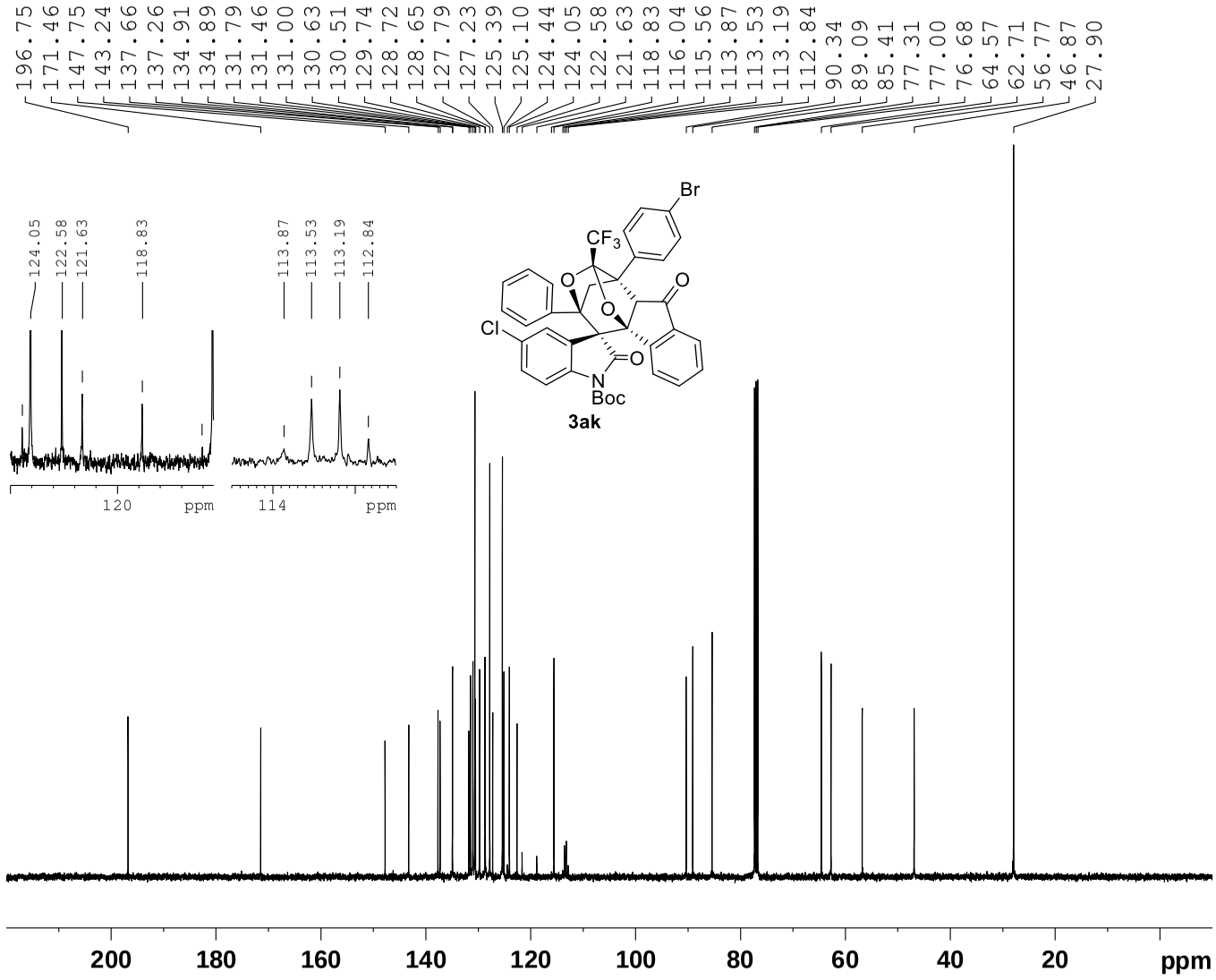



```
Current Data Parameters
NAME                  A279
EXPNO                    7
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180127
Time                 15.51
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                    35.9
DW                  69.000 usec
DE                   6.50 usec
TE                  296.3 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300163 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



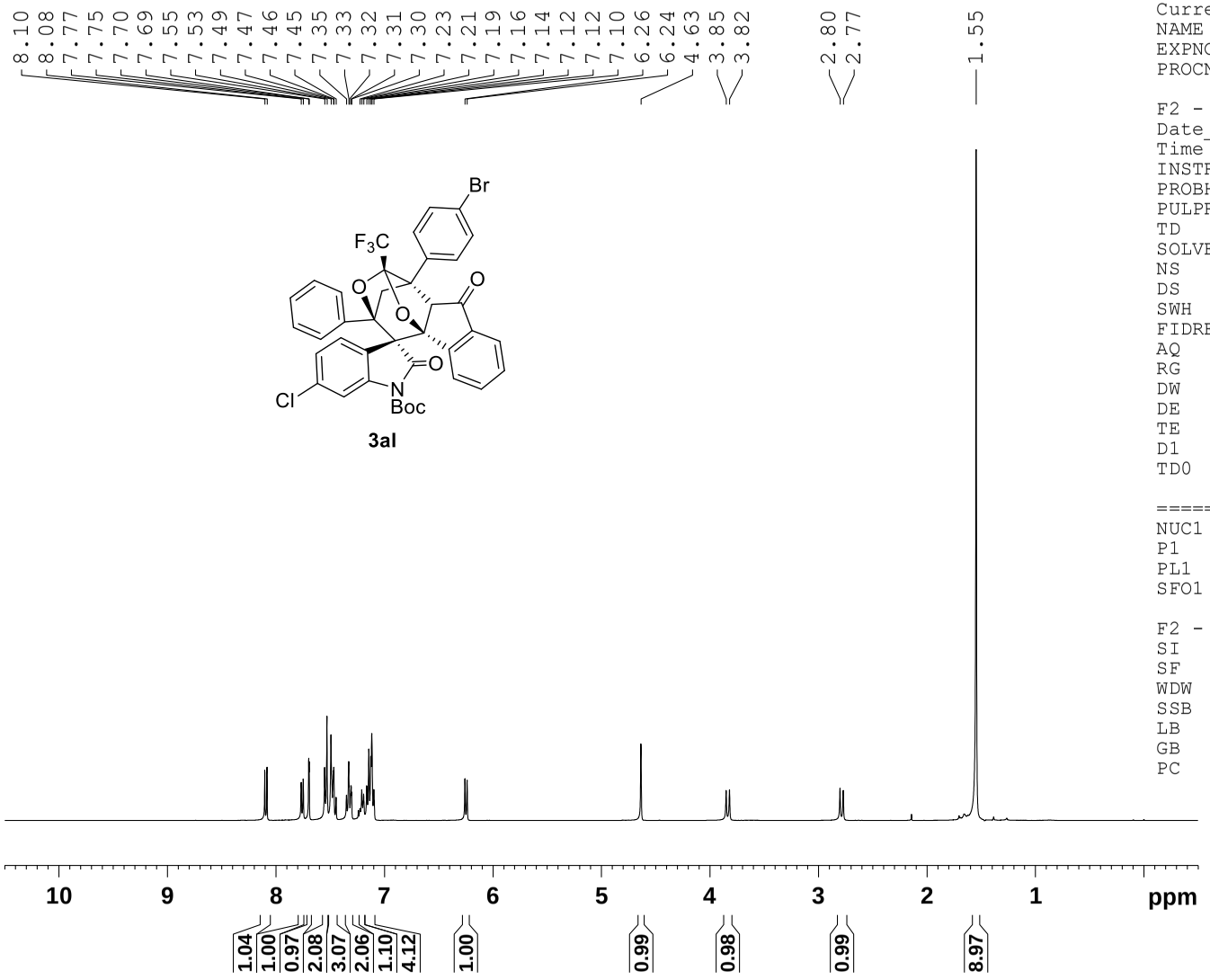

```
Current Data Parameters
NAME                  A279
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180129
Time                  9.23
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     790
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   32768
DW                  20.800 usec
DE                   6.50 usec
TE                  297.3 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2        0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127767 MHz
WDW                    EM
SSB        0
LB                    1.00 Hz
GB         0
PC                    1.00
```

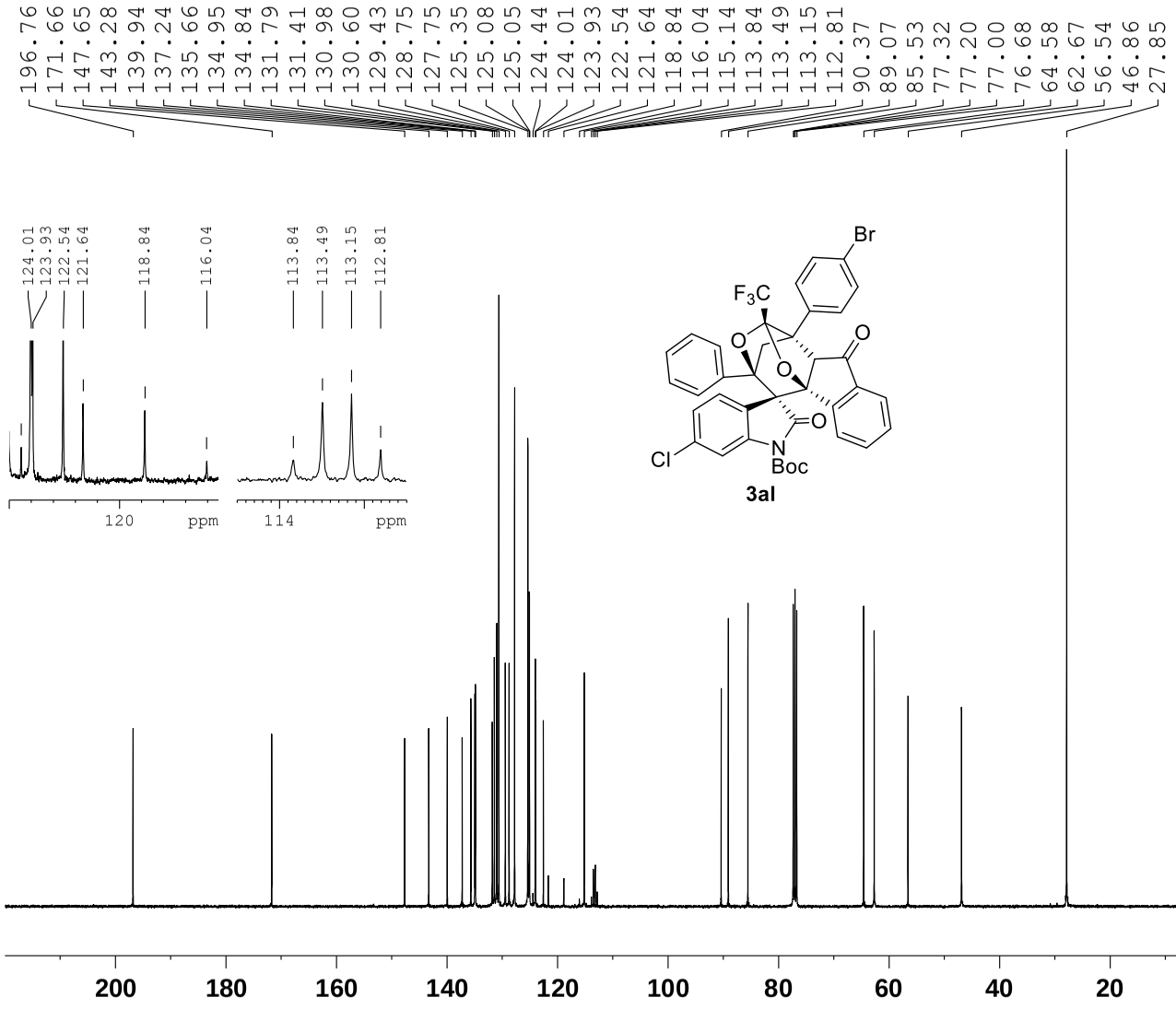



```
Current Data Parameters
NAME                  A276
EXPNO                    8
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180129
Time                 21.59
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                     35.9
DW                  69.000 usec
DE                   6.50 usec
TE                  296.8 K
D1               2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300171 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



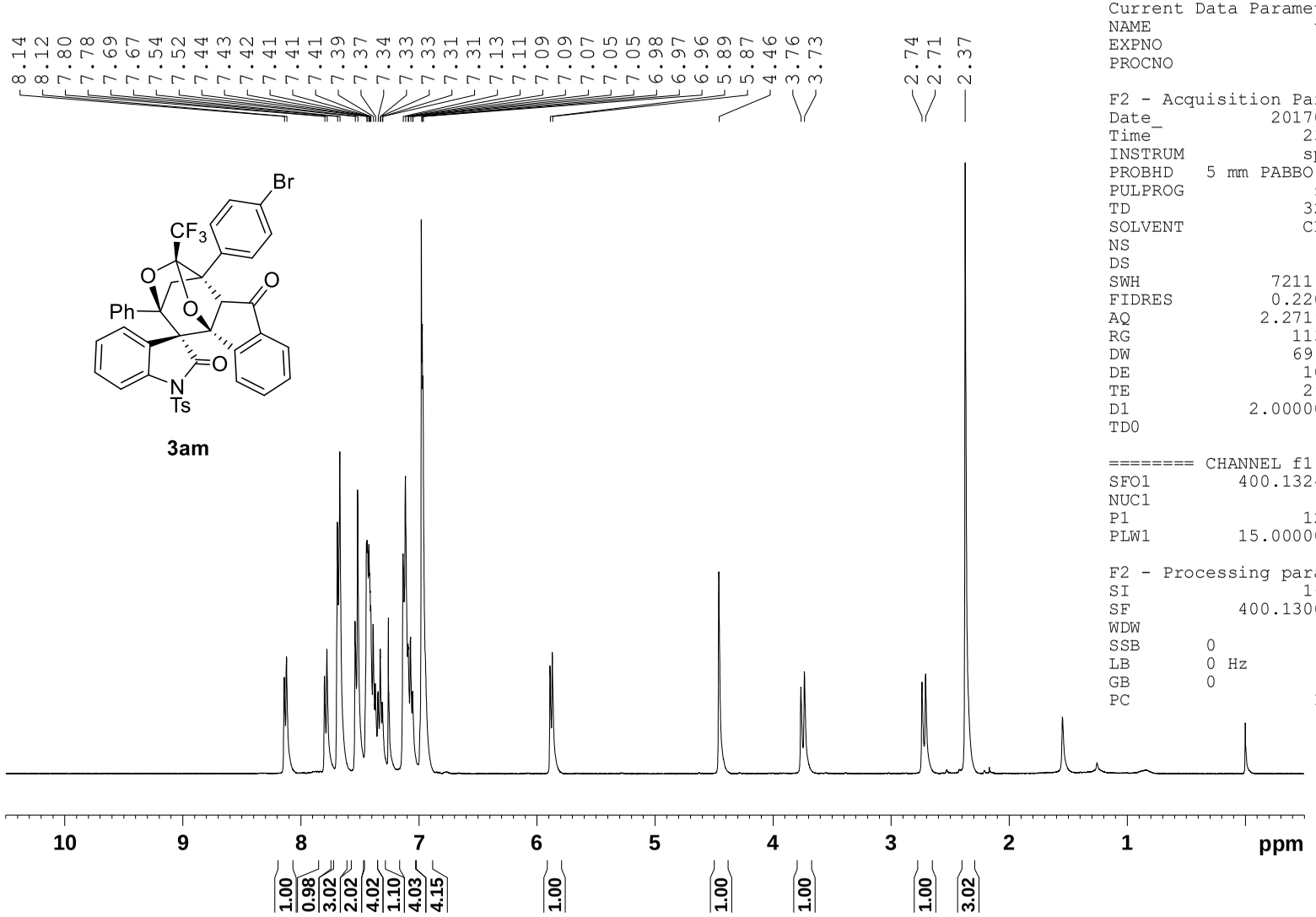

```
Current Data Parameters
NAME                  A276
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_            20180129
Time                 22.02
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG           zgpg30
TD                 32768
SOLVENT             CDCl3
NS                   5000
DS                      0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                   4096
DW                20.800 usec
DE                 6.50 usec
TE                296.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127804 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```

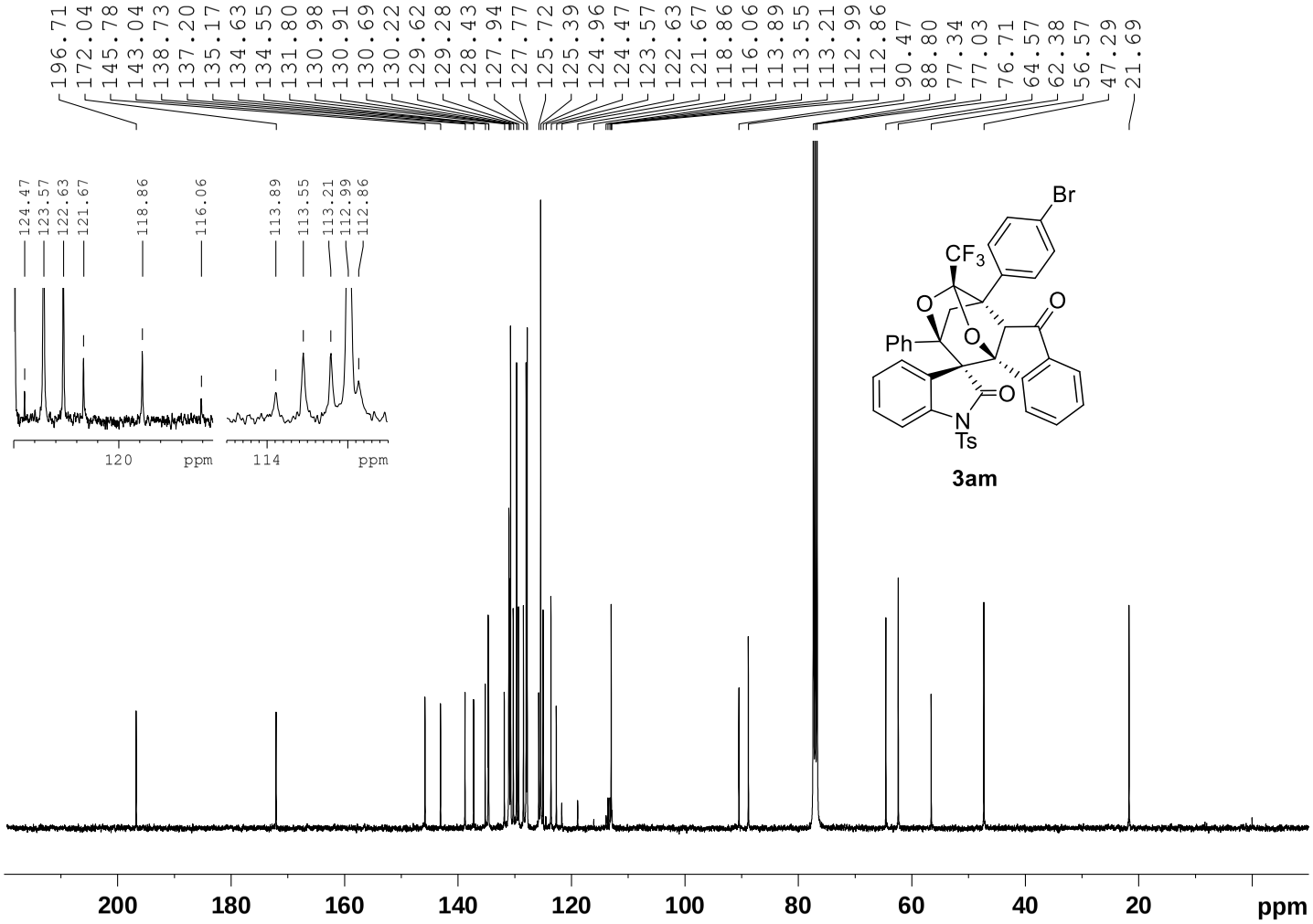



```
Current Data Parameters
NAME                  test
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170301
Time                 23.26
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      32
DS                       0
SWH               7211.539 Hz
FIDRES            0.220079 Hz
AQ                2.2719147 sec
RG                   113.31
DW                   69.333 usec
DE                   10.50 usec
TE                   297.4 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           400.1324008 MHz
NUC1                    1H
P1                   12.90 usec
PLW1           15.00000000 W

F2 - Processing parameters
SI                   16384
SF             400.1300132 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



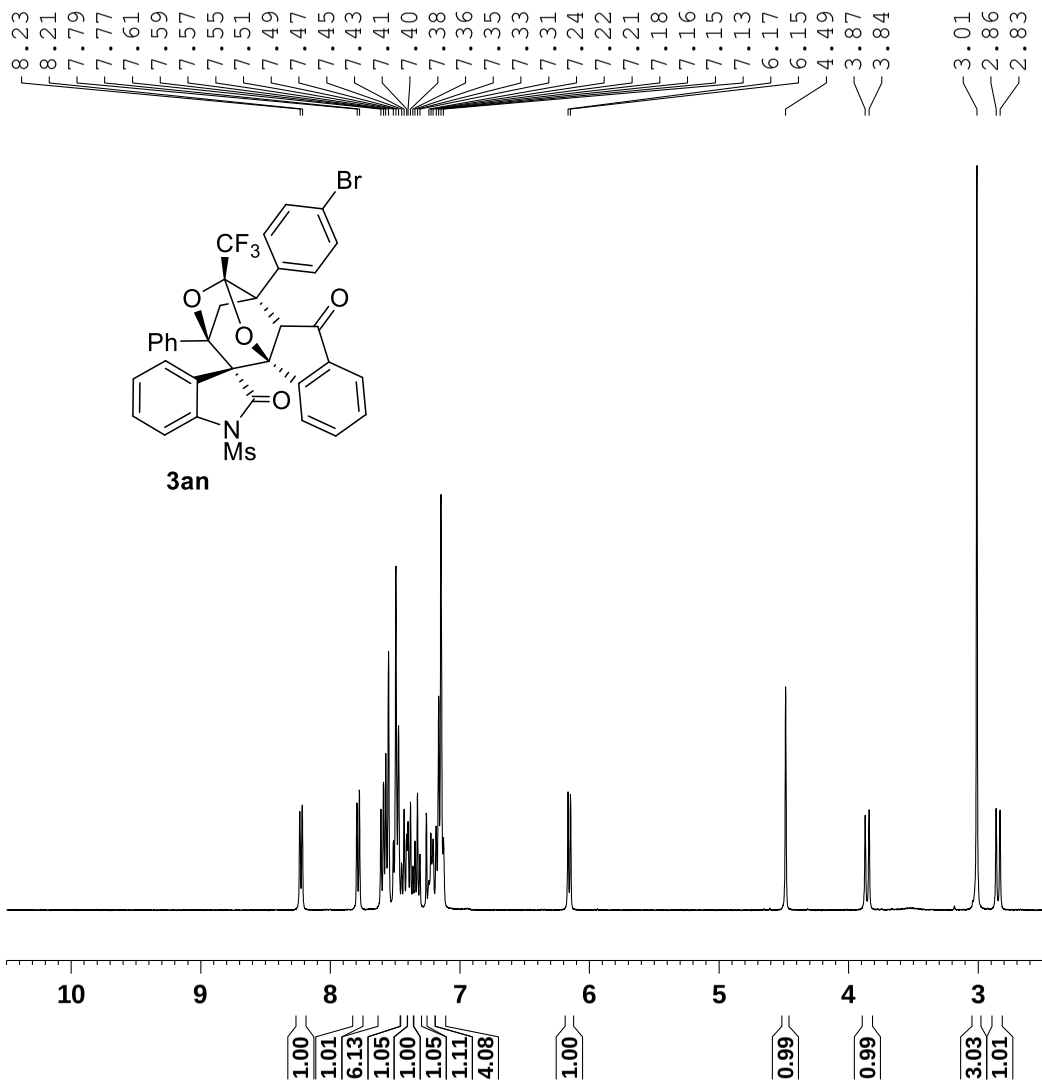

```
Current Data Parameters
NAME                  3F test
EXPNO                       3
PROCNO                      1

F2 - Acquisition Parameters
Date_                20170301
Time                    23.27
INSTRUM                 spect
PROBHD    5 mm PABBO BB/
PULPROG                zgpg30
TD                      32768
SOLVENT                 CDCl3
NS                      13767
DS                          0
SWH                24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                     198.09
DW                     20.800 usec
DE                      6.50 usec
TE                     297.4 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1            100.6228298 MHz
NUC1                     13C
P1                     10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2            400.1316005 MHz
NUC2                     1H
CPDPRG[2              waltz16
PCPD2                  90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                      32768
SF              100.6127685 MHz
WDW                        EM
SSB          0
LB                      2.00 Hz
GB           0
PC                      1.00
```

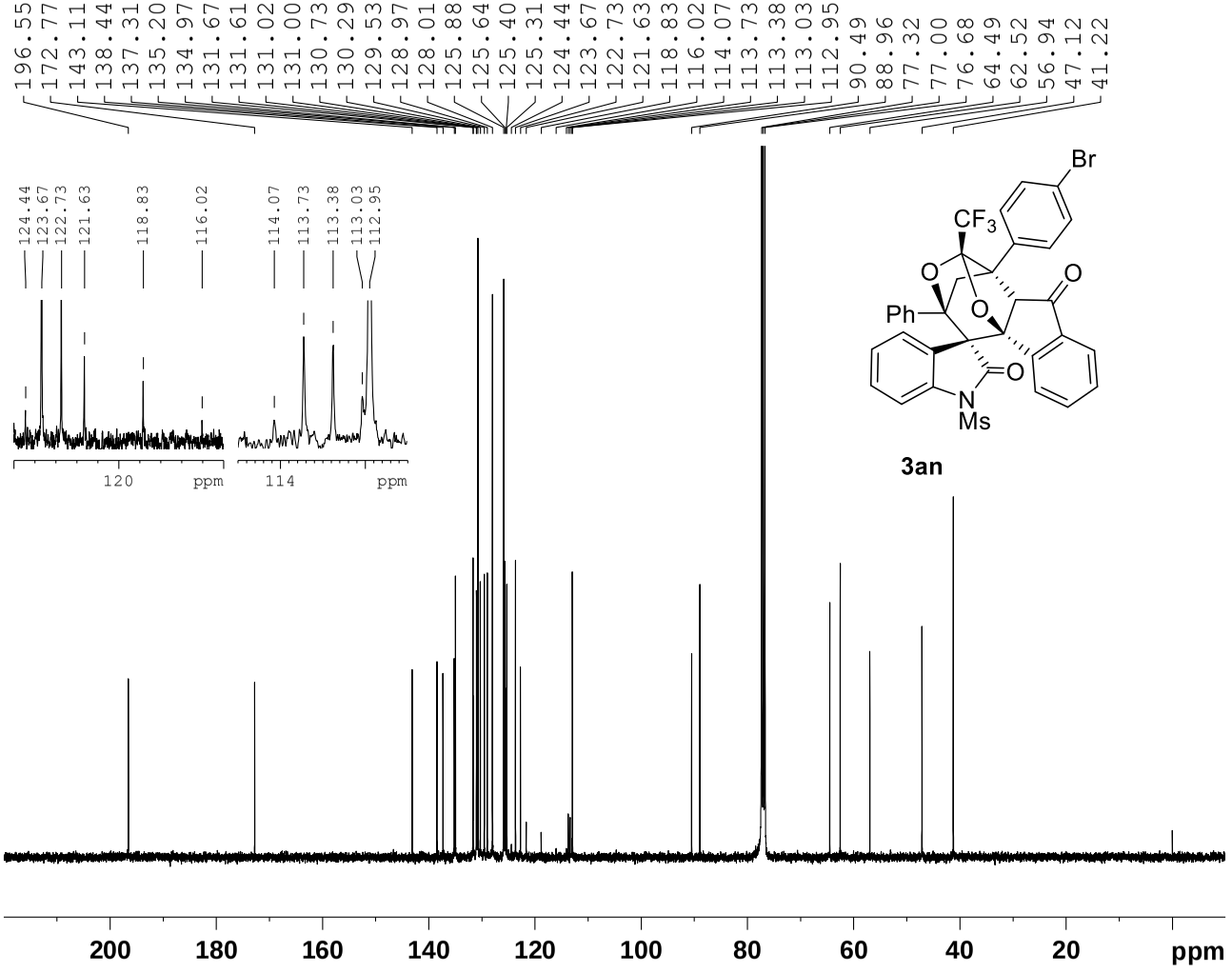



```
Current Data Parameters
NAME                  Data
EXPNO                   12
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170531
Time                 22.18
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    181
DW                 69.000 usec
DE                  6.50 usec
TE                 296.5 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                  14.40 usec
PL1                  1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF           400.1300101 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



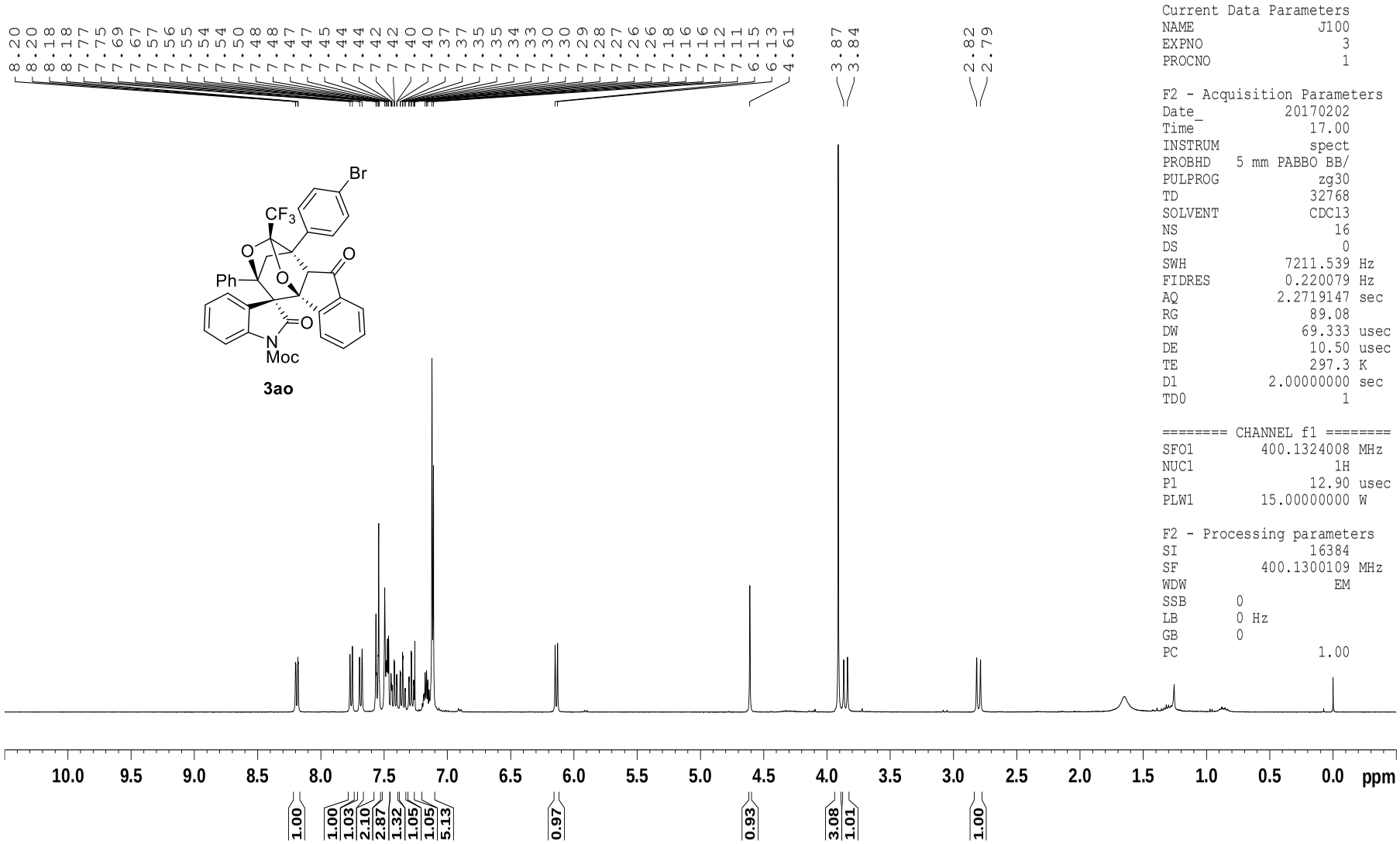

```
Current Data Parameters
NAME                  Data
EXPNO                   13
PROCNO                   1

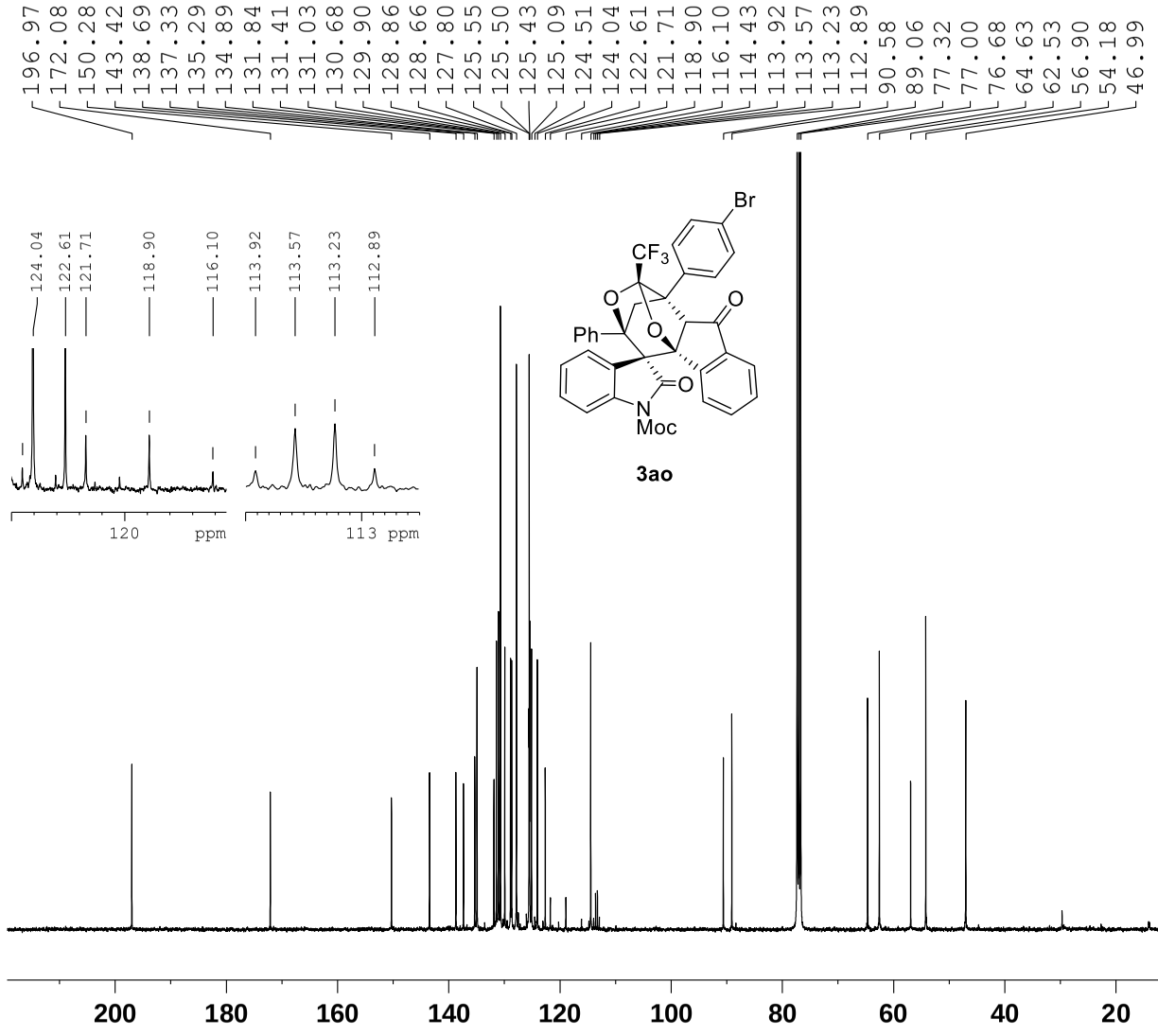
F2 - Acquisition Parameters
Date_              20170531
Time                 22.19
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                  12797
DS                      0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                 9195.2
DW                20.800 usec
DE                 6.50 usec
TE                296.6 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.50 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2                -0.60 dB
PL12               15.00 dB
PL13               18.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF           100.6127708 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```


8.20
8.20
8.18
8.18
7.77
7.75
7.69
7.67
7.57
7.56
7.55
7.54
7.54
7.50
7.48
7.48
7.47
7.47
7.45
7.44
7.44
7.42
7.42
7.40
7.40
7.37
7.37
7.35
7.35
7.34
7.33
7.30
7.30
7.29
7.28
7.27
7.26
7.26
7.18
7.16
7.16
7.12
7.11
6.15
6.13
4.61
3.87
3.84
2.82
2.79
Br
CF3
O
O
Ph
O
O
N
Moc
3ao
Current Data Parameters
NAME J100
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20170202
Time 17.00
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7211.539 Hz
FIDRES 0.220079 Hz
AQ 2.2719147 sec
RG 89.08
DW 69.333 usec
DE 10.50 usec
TE 297.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324008 MHz
NUC1 1H
P1 12.90 usec
PLW1 15.00000000 W
F2 - Processing parameters
SI 16384
SF 400.1300109 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
1.00
1.00
1.03
2.10
2.87
1.32
1.05
1.05
5.13
0.97
0.93
3.08
1.01
1.00



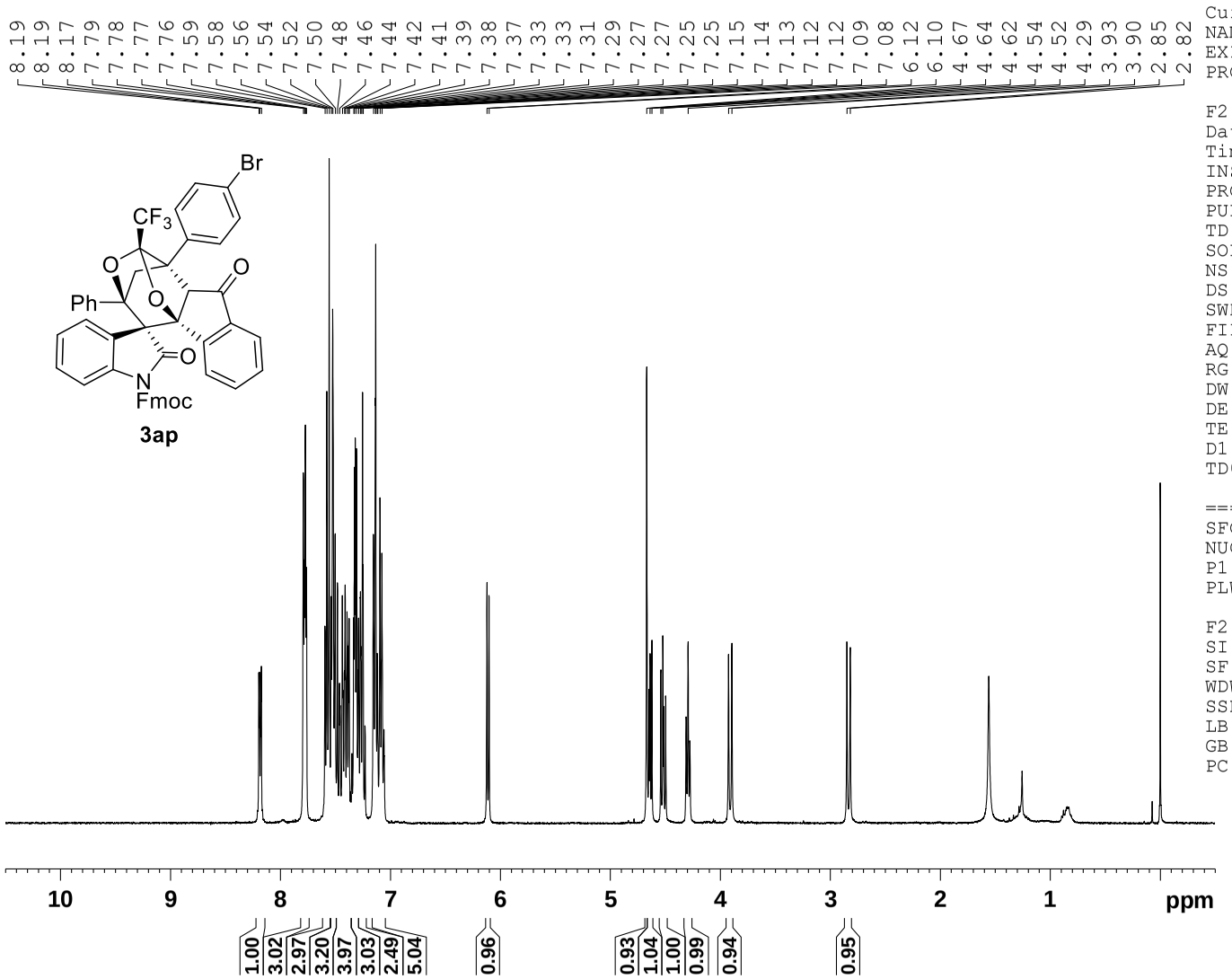

```
Current Data Parameters
NAME                  J100
EXPNO                    4
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170202
Time                 22.18
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   16032
DS                       0
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  297.5 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6228298 MHz
NUC1                  13C
P1                 10.00 usec
PLW1          47.50000000 W

======== CHANNEL f2 ========
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          15.00000000 W
PLW12          0.33750001 W
PLW13          0.27338001 W

F2 - Processing parameters
SI                   32768
SF            100.6127722 MHz
WDW                    EM
SSB       0
LB                  2.00 Hz
GB        0
PC                  1.00
```

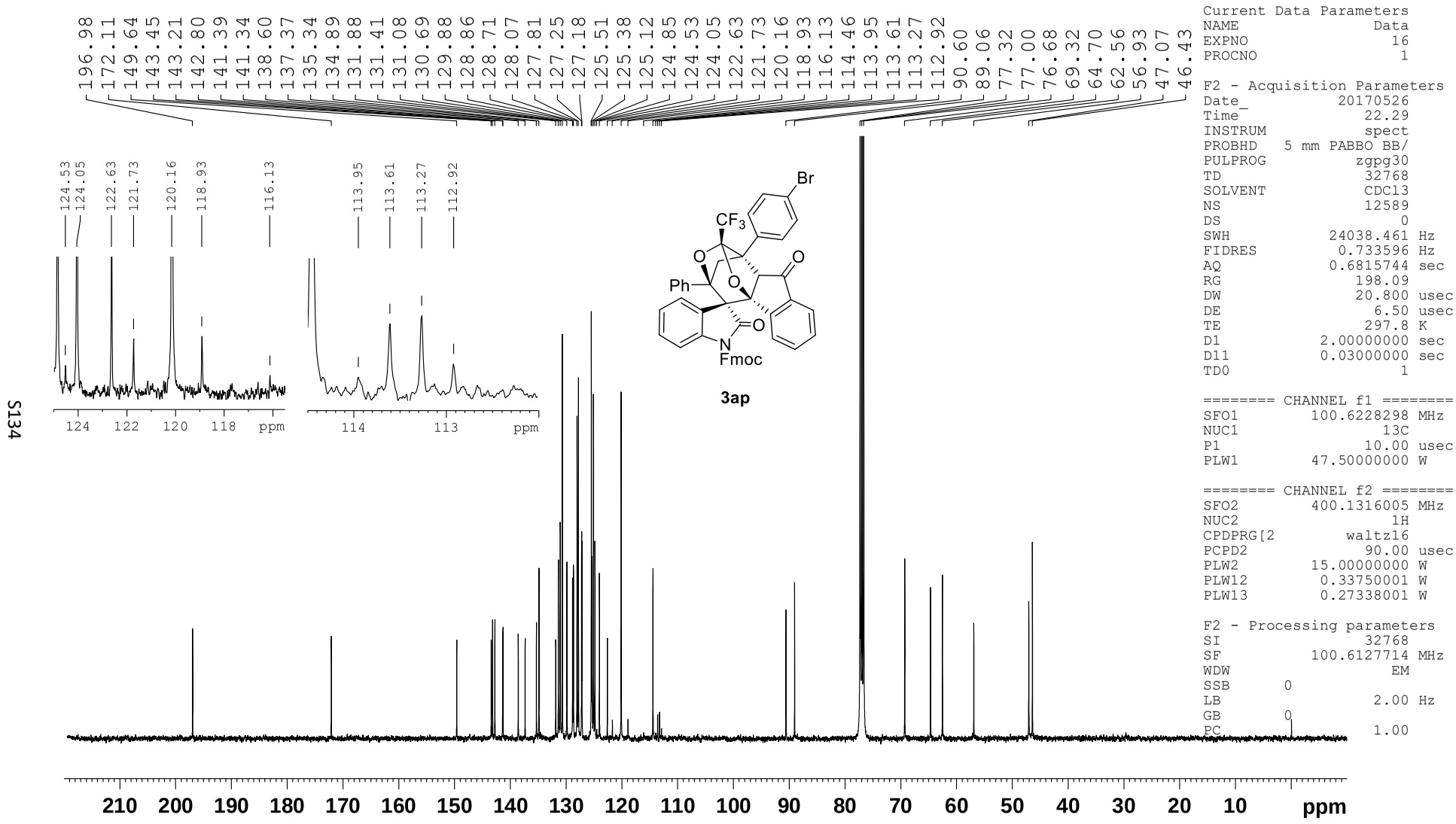



```
Current Data Parameters
NAME                  Data
EXPNO                   15
PROCNO                   1

F2 - Acquisition Parameters
Date_            20170526
Time                22.28
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7211.539 Hz
FIDRES           0.220079 Hz
AQ              2.2719147 sec
RG                 113.31
DW                 69.333 usec
DE                 10.50 usec
TE                 297.4 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         400.1324008 MHz
NUC1                   1H
P1                  12.90 usec
PLW1         15.00000000 W

F2 - Processing parameters
SI                  16384
SF           400.1300132 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                   1.00
```



Current Data Parameters

NAME	Data
EXPNO	16
PROCNO	1

F2 - Acquisition Parameters

Date_	20170526
Time	22.29
INSTRUM	spect
PROBHD	5 mm PABBO BB/
PULPROG	zgpg30
TD	32768
SOLVENT	CDCl3
NS	12589
DS	0
SWH	24038.461 Hz
FIDRES	0.733596 Hz
AQ	0.6815744 sec
RG	198.09
DW	20.800 usec
DE	6.50 usec
TE	297.8 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

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

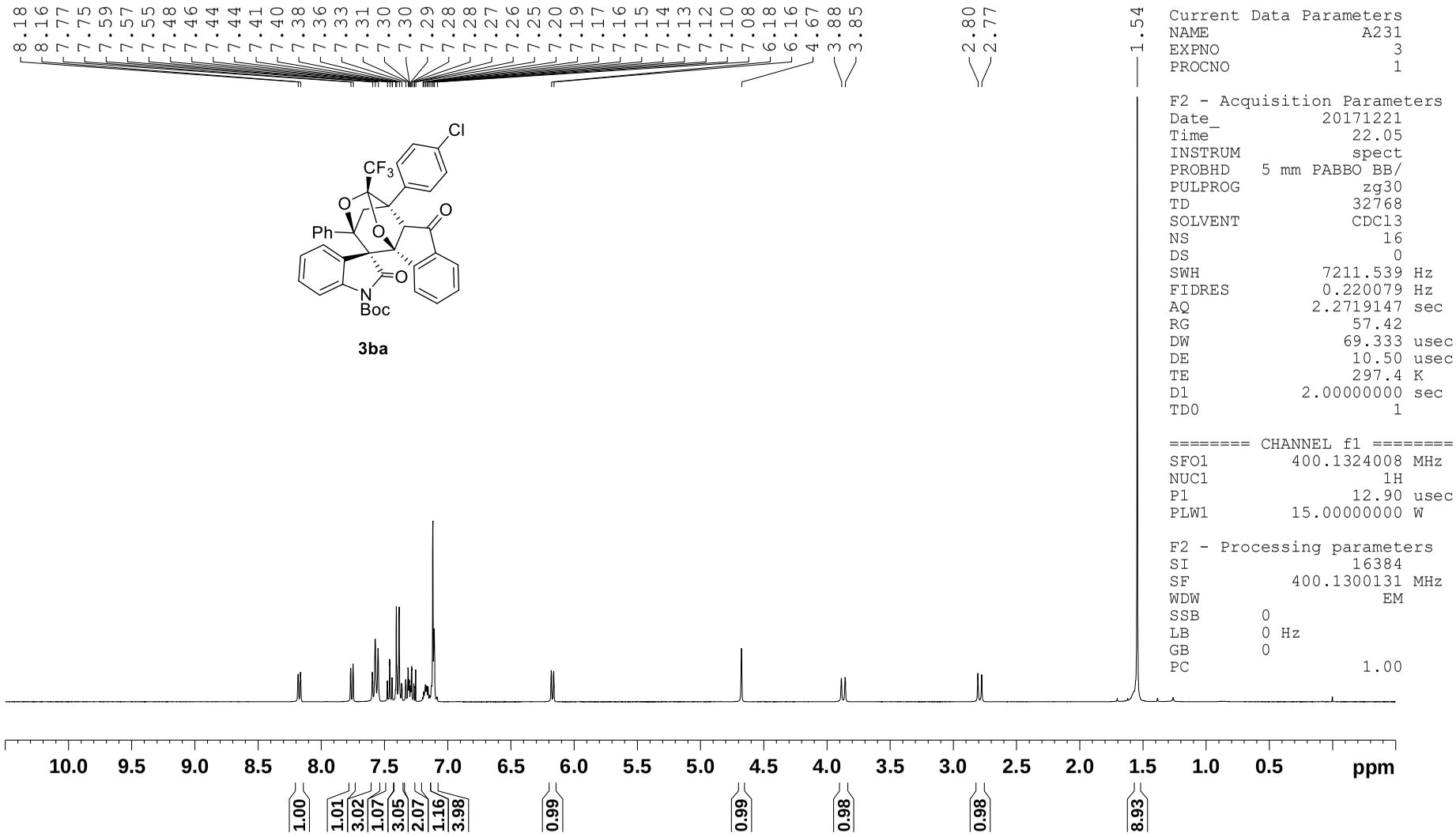
SFO1	100.6228298 MHz
NUC1	13C
P1	10.00 usec
PLW1	47.50000000 W

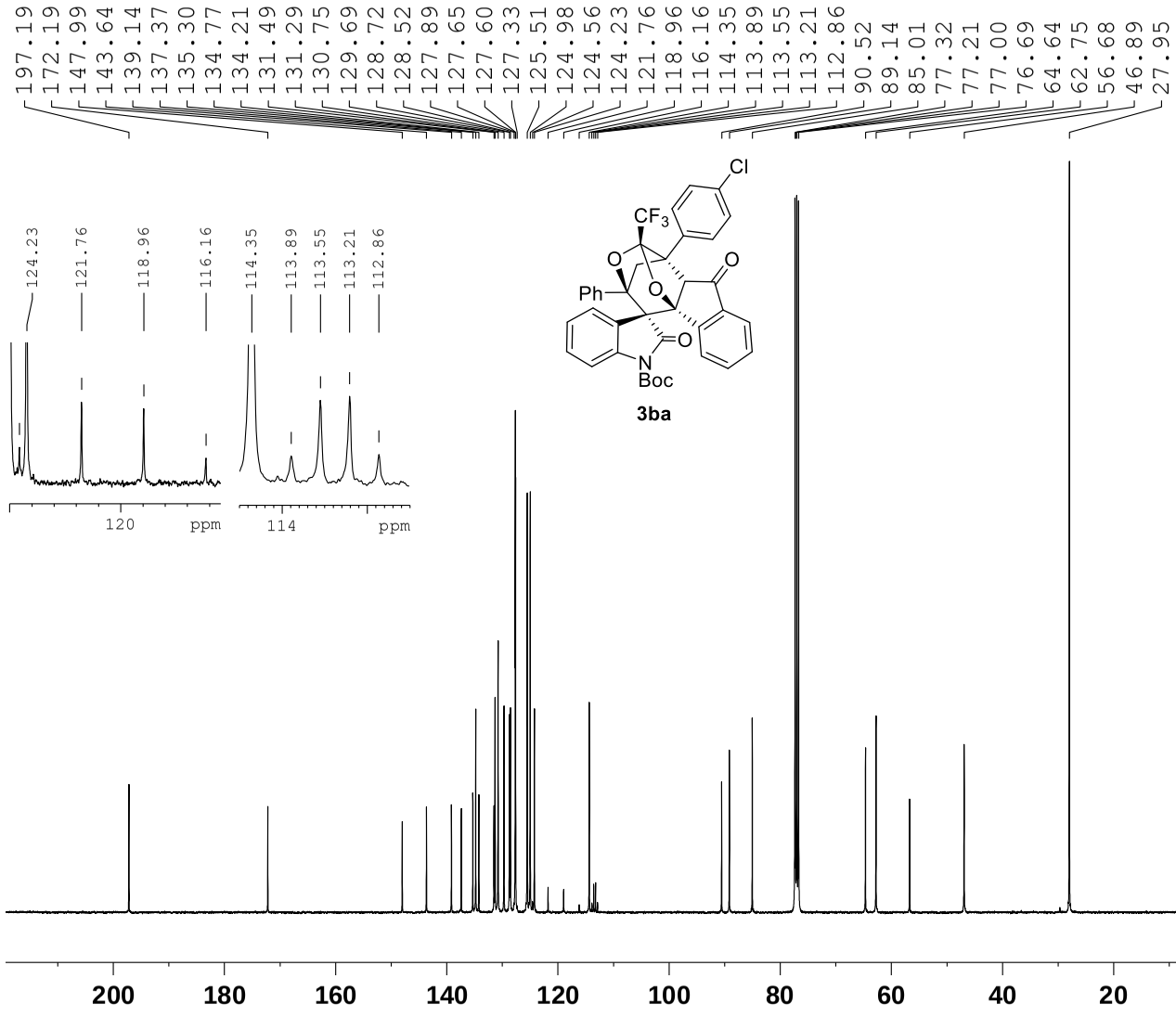
======== CHANNEL f2 ========

SFO2	400.1316005 MHz
NUC2	1H
CPDPRG[2	waltz16
PCPD2	90.00 usec
PLW2	15.00000000 W
PLW12	0.33750001 W
PLW13	0.27338001 W

F2 - Processing parameters

SI	32768
SF	100.6127714 MHz
WDW	EM
SSB	0
LB	2.00 Hz
GB	0
PC	1.00


8.18
8.16
7.77
7.75
7.59
7.57
7.55
7.48
7.46
7.44
7.44
7.41
7.40
7.38
7.36
7.33
7.31
7.30
7.30
7.29
7.28
7.28
7.27
7.26
7.25
7.20
7.19
7.17
7.16
7.15
7.14
7.13
7.12
7.10
7.08
6.18
6.16
4.67
3.88
3.85
2.80
2.77
1.54
Cl
CF3
O
O
O
Ph
O
N
Boc
3ba
Current Data Parameters
NAME A231
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20171221
Time 22.05
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7211.539 Hz
FIDRES 0.220079 Hz
AQ 2.2719147 sec
RG 57.42
DW 69.333 usec
DE 10.50 usec
TE 297.4 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324008 MHz
NUC1 1H
P1 12.90 usec
PLW1 15.00000000 W
F2 - Processing parameters
SI 16384
SF 400.1300131 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.00
1.01
3.02
1.07
3.05
2.07
1.16
3.98
0.99
0.99
0.98
0.98
8.93



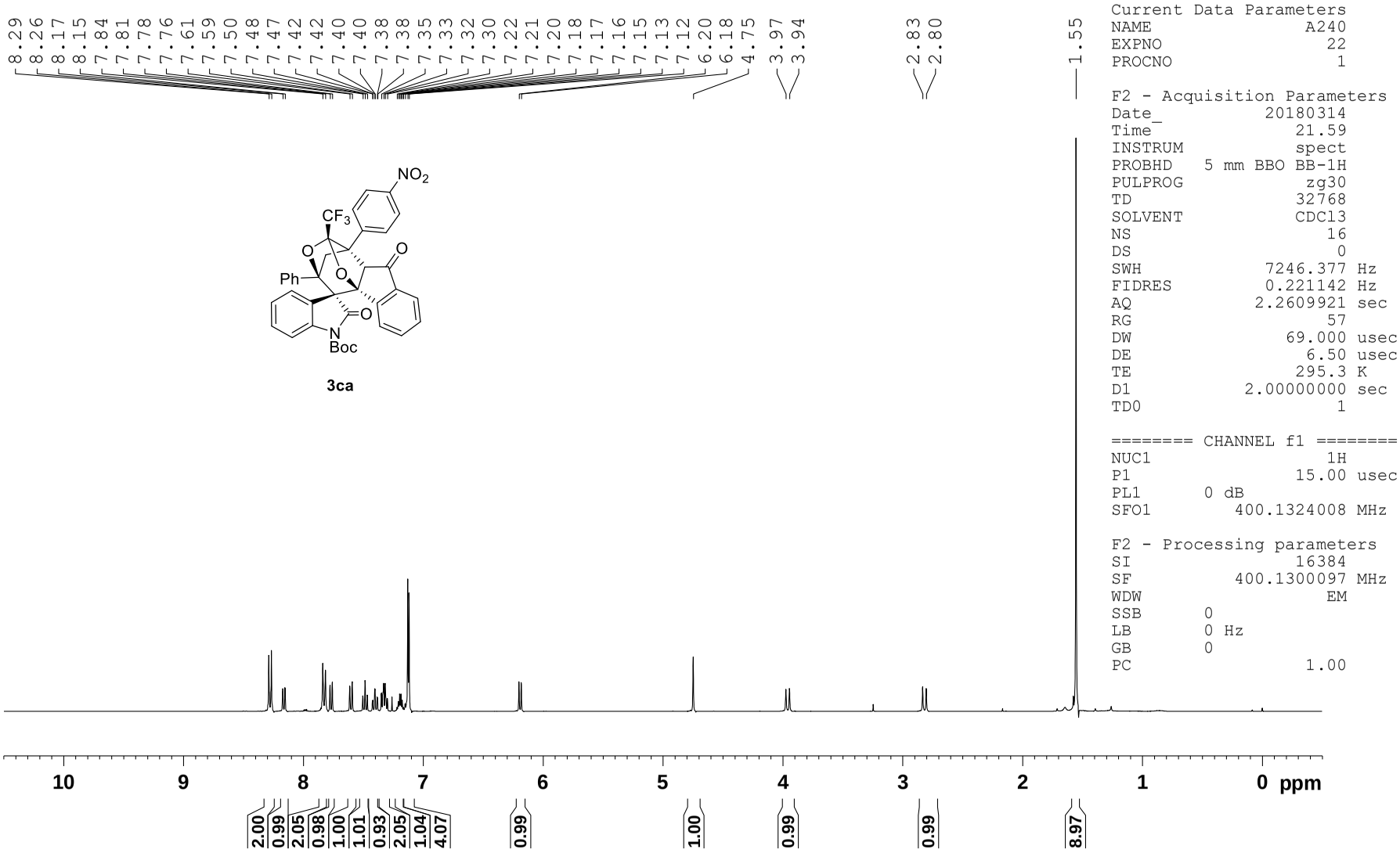

```
Current Data Parameters
NAME                  A231
EXPNO                    4
PROCNO                   1

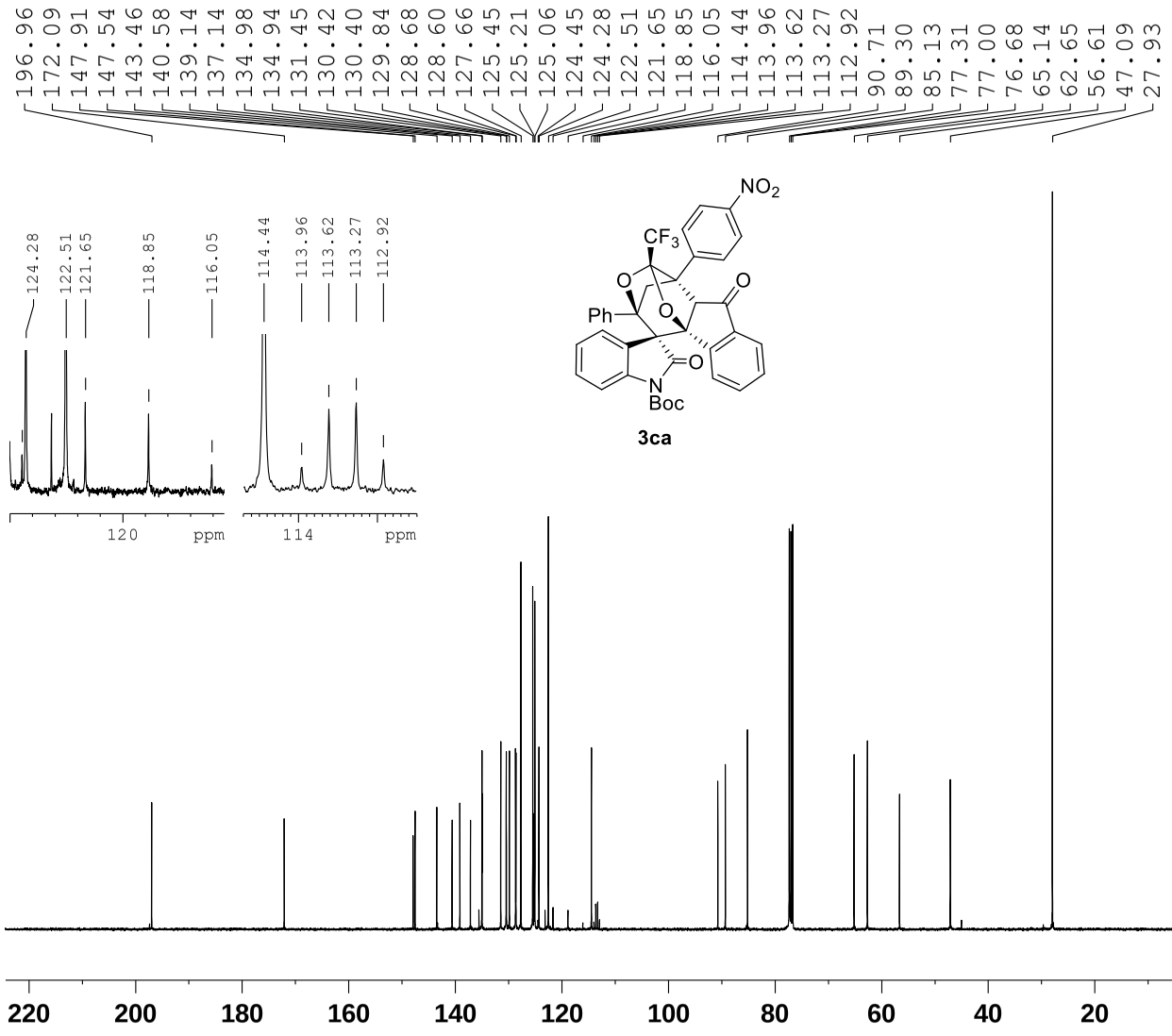
F2 - Acquisition Parameters
Date_              20171221
Time                 22.07
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   15232
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.0 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                    13C
P1                   10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                    1H
CPDPRG[2            waltz16
PCPD2                90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127736 MHz
WDW                     EM
SSB          0
LB                    2.00 Hz
GB           0
PC                    1.00
```


8.29
8.26
8.17
8.15
7.84
7.81
7.78
7.76
7.61
7.59
7.50
7.48
7.47
7.42
7.42
7.40
7.40
7.38
7.38
7.35
7.33
7.32
7.30
7.22
7.21
7.20
7.18
7.17
7.16
7.15
7.13
7.12
6.20
6.18
4.75
3.97
3.94
2.83
2.80
1.55
NO2
CF3
O
O
O
Ph
O
N
Boc
3ca
Current Data Parameters
NAME A240
EXPNO 22
PROCNO 1
F2 - Acquisition Parameters
Date_ 20180314
Time 21.59
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 57
DW 69.000 usec
DE 6.50 usec
TE 295.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 0 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300097 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10
9
8
7
6
5
4
3
2
1
0 ppm
2.00
0.99
2.05
0.98
1.00
1.01
0.93
2.05
1.04
4.07
0.99
1.00
0.99
0.99
8.97



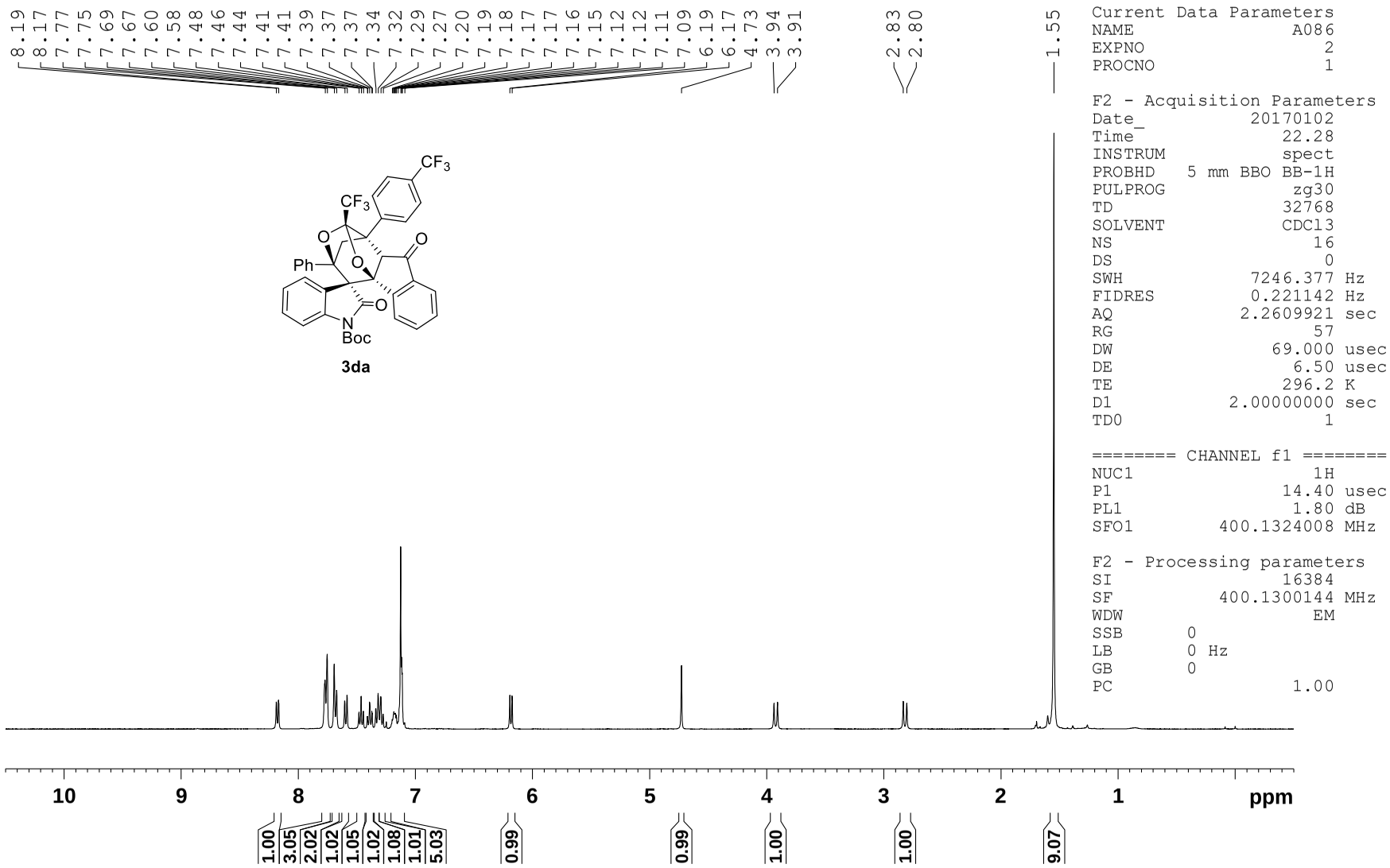

```
Current Data Parameters
NAME                  A240
EXPNO                   23
PROCNO                   1

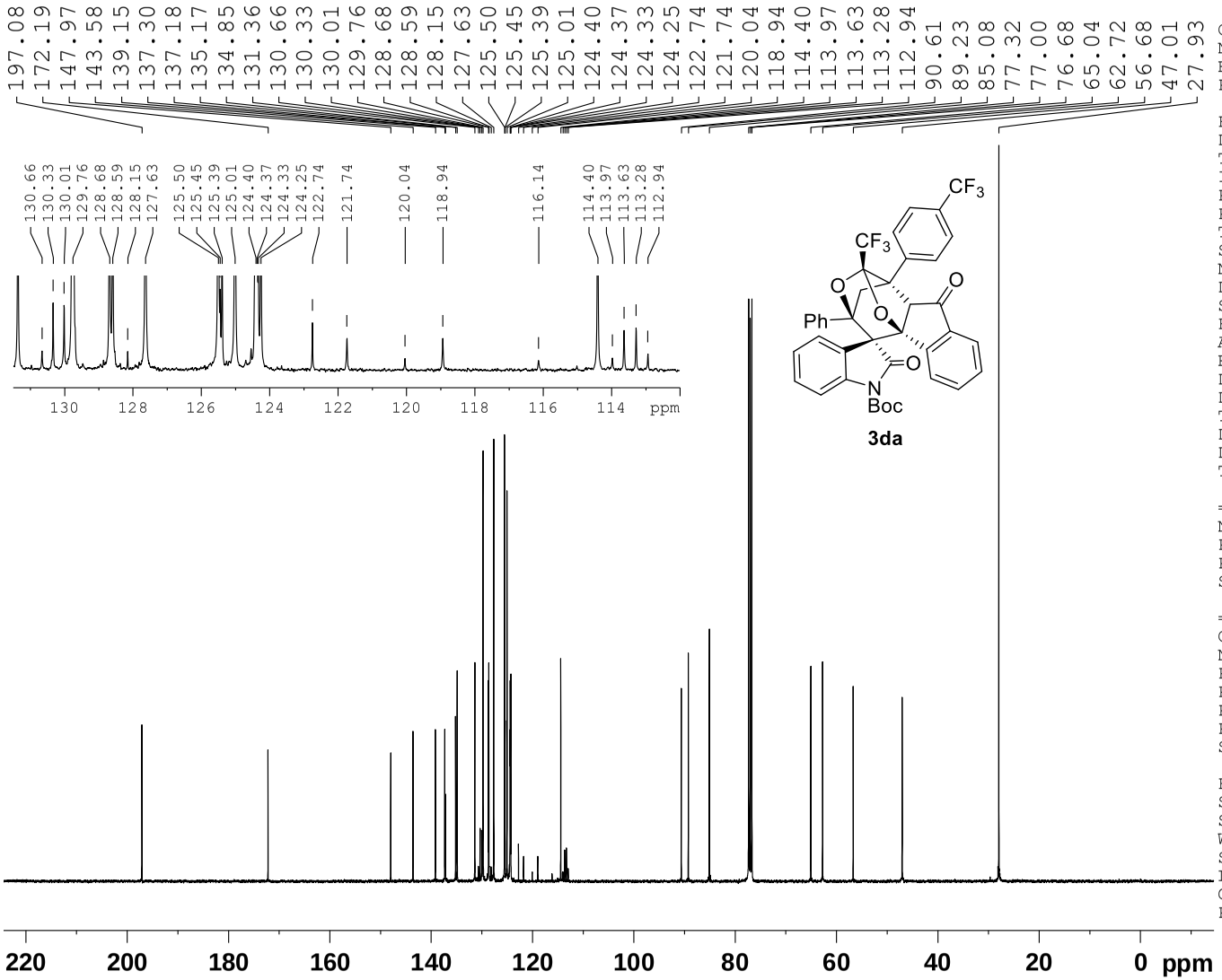
F2 - Acquisition Parameters
Date_              20180314
Time                  22.01
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    9999
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                    4096
DW                  20.800 usec
DE                   6.50 usec
TE                  295.3 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127745 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```


8.19
8.17
7.77
7.75
7.69
7.67
7.60
7.58
7.48
7.46
7.44
7.41
7.41
7.39
7.37
7.37
7.34
7.32
7.29
7.27
7.20
7.19
7.18
7.17
7.17
7.16
7.15
7.12
7.12
7.11
7.09
6.19
6.17
4.73
3.94
3.91
2.83
2.80
1.55
CF3
CF3
O
O
Ph
O
O
N
Boc
3da
Current Data Parameters
NAME A086
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20170102
Time 22.28
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 57
DW 69.000 usec
DE 6.50 usec
TE 296.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300144 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10
9
8
7
6
5
4
3
2
1
ppm
1.00
3.05
2.02
1.02
1.05
1.02
1.08
1.01
5.03
0.99
0.99
1.00
1.00
9.07



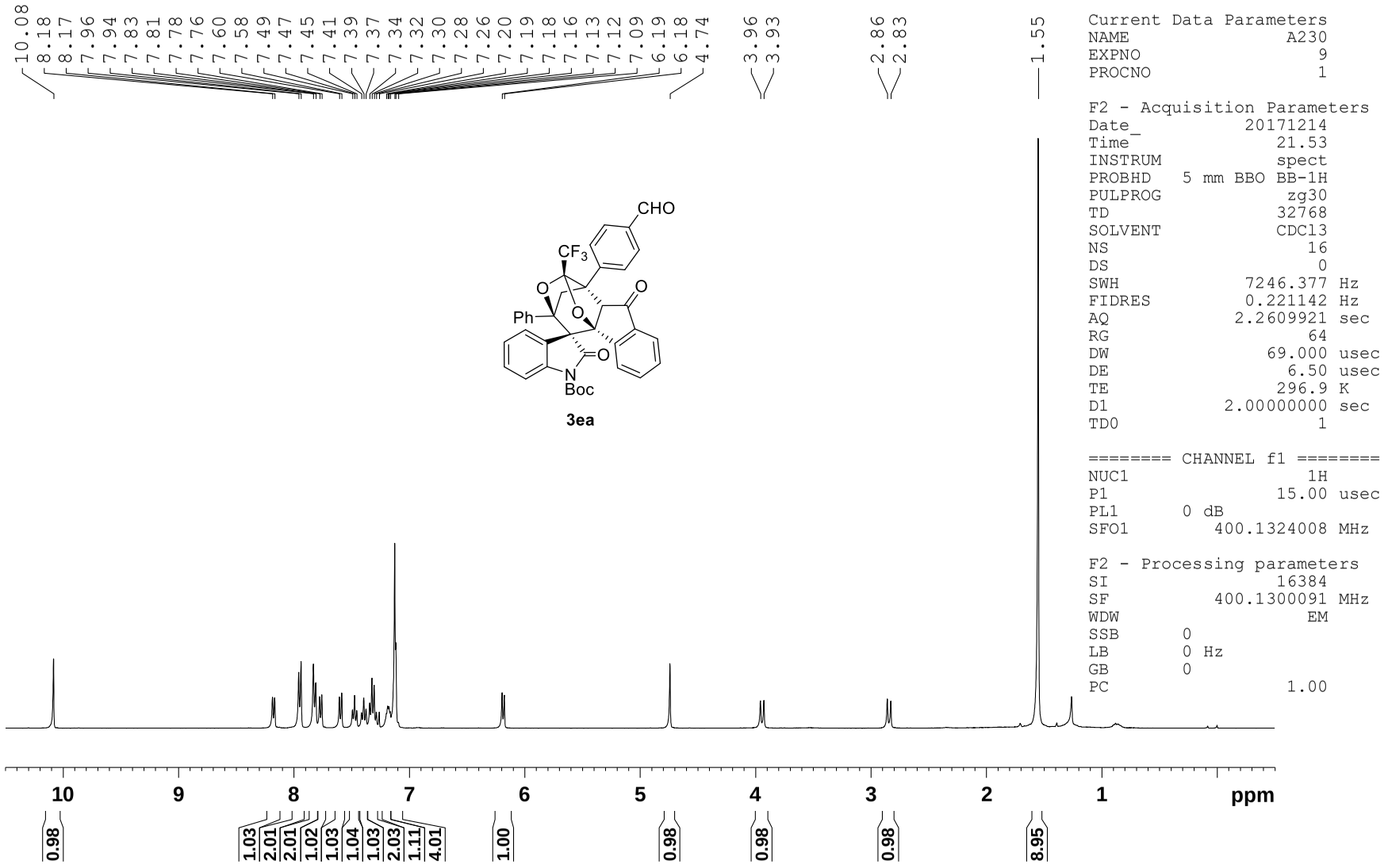

```
Current Data Parameters
NAME                  A086
EXPNO                    3
PROCNO                   1

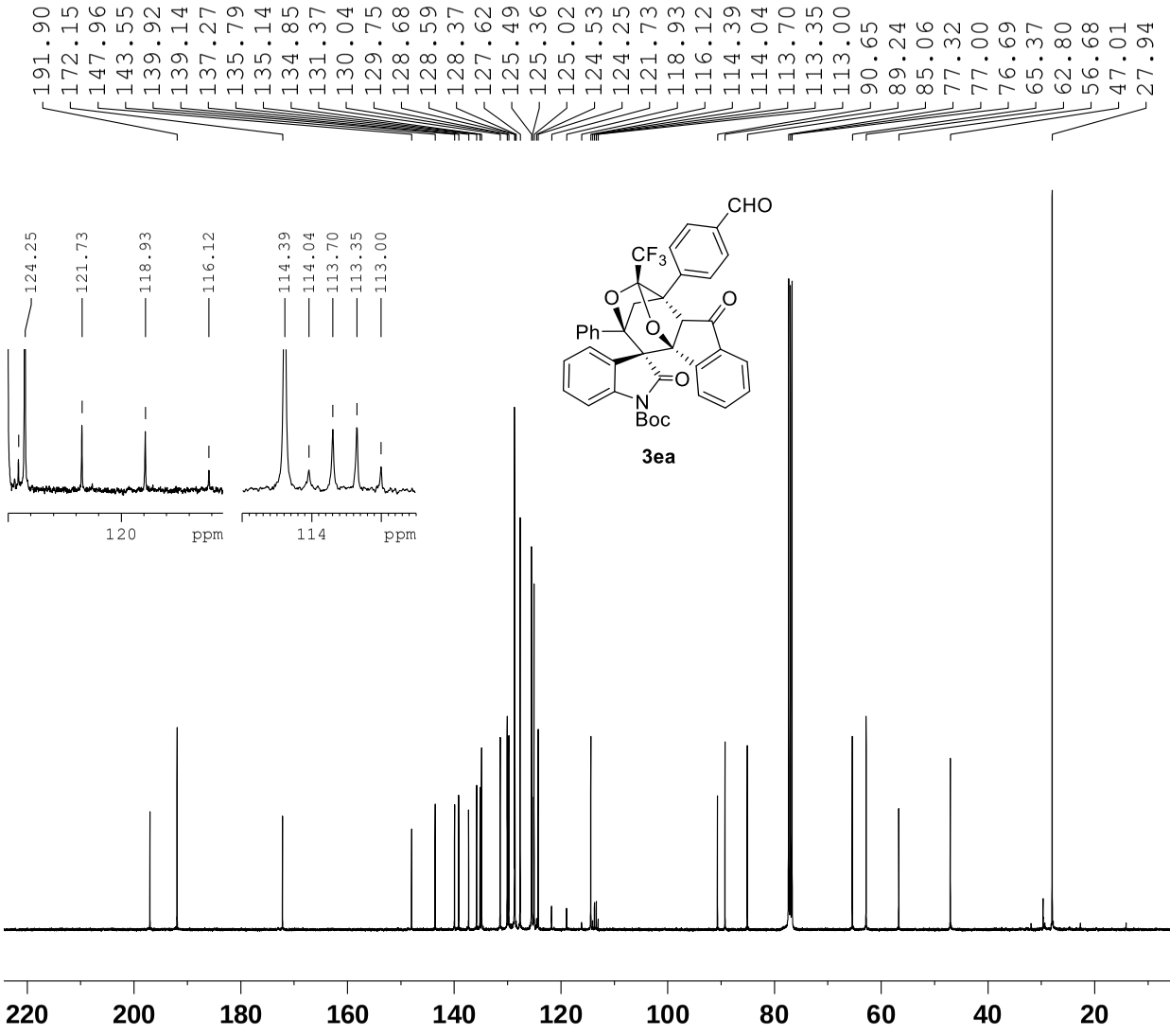
F2 - Acquisition Parameters
Date_              20170102
Time                 22.31
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   11285
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  3649.1
DW                   20.800 usec
DE                    6.50 usec
TE                   296.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                    9.00 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 17.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127735 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```


10.08
8.18
8.17
7.96
7.94
7.83
7.81
7.78
7.76
7.60
7.58
7.49
7.47
7.45
7.41
7.39
7.37
7.34
7.32
7.30
7.28
7.26
7.20
7.19
7.18
7.16
7.13
7.12
7.09
6.19
6.18
4.74
3.96
3.93
2.86
2.83
1.55
CHO
CF3
O
O
O
Ph
O
N
Boc
3ea
Current Data Parameters
NAME A230
EXPNO 9
PROCNO 1
F2 - Acquisition Parameters
Date_ 20171214
Time 21.53
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 64
DW 69.000 usec
DE 6.50 usec
TE 296.9 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 0 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300091 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10
9
8
7
6
5
4
3
2
1
ppm
0.98
1.03
2.01
2.01
1.02
1.03
1.04
1.03
2.03
1.11
4.01
1.00
0.98
0.98
0.98
8.95



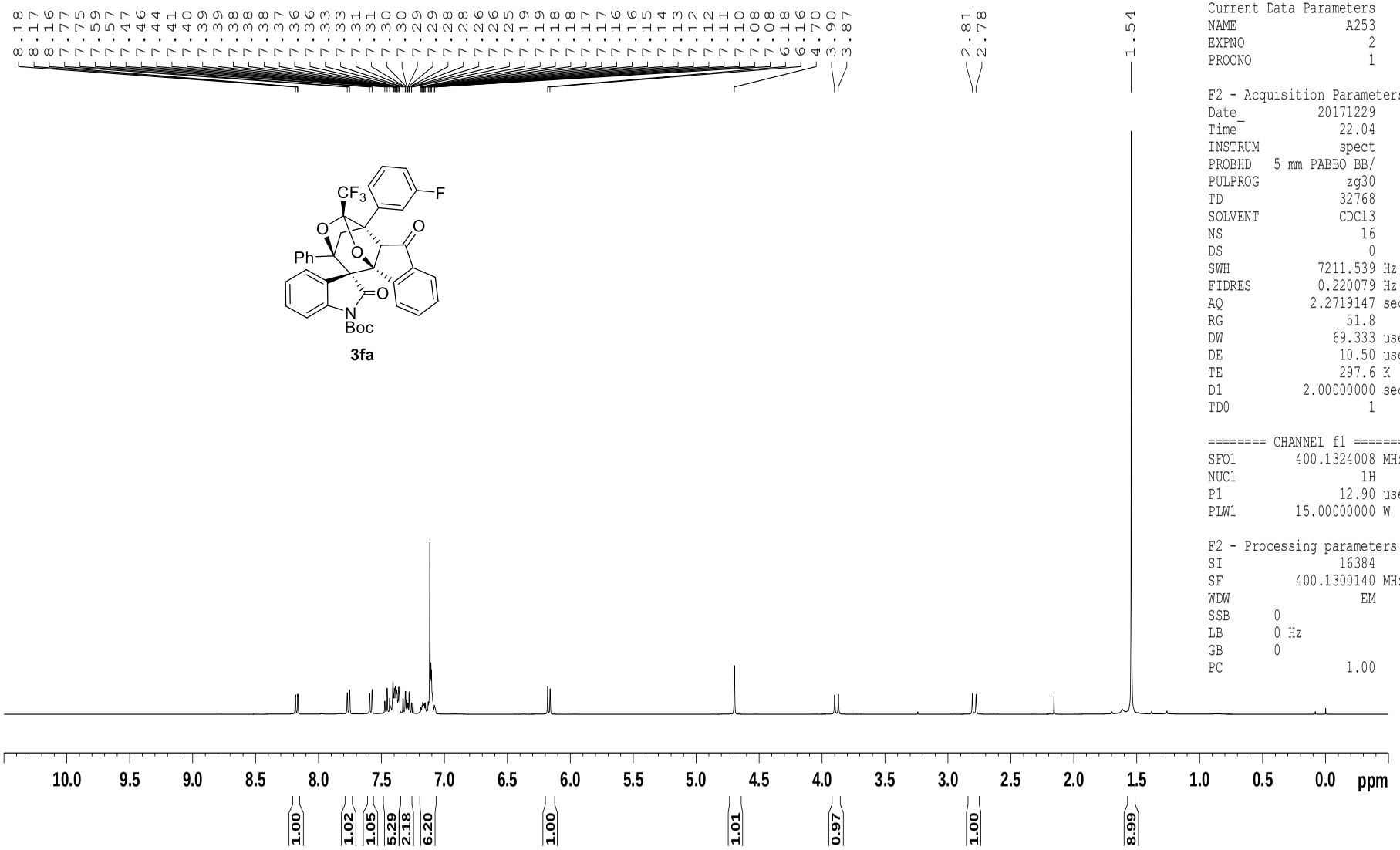

```
Current Data Parameters
NAME                  A230
EXPNO                   10
PROCNO                   1

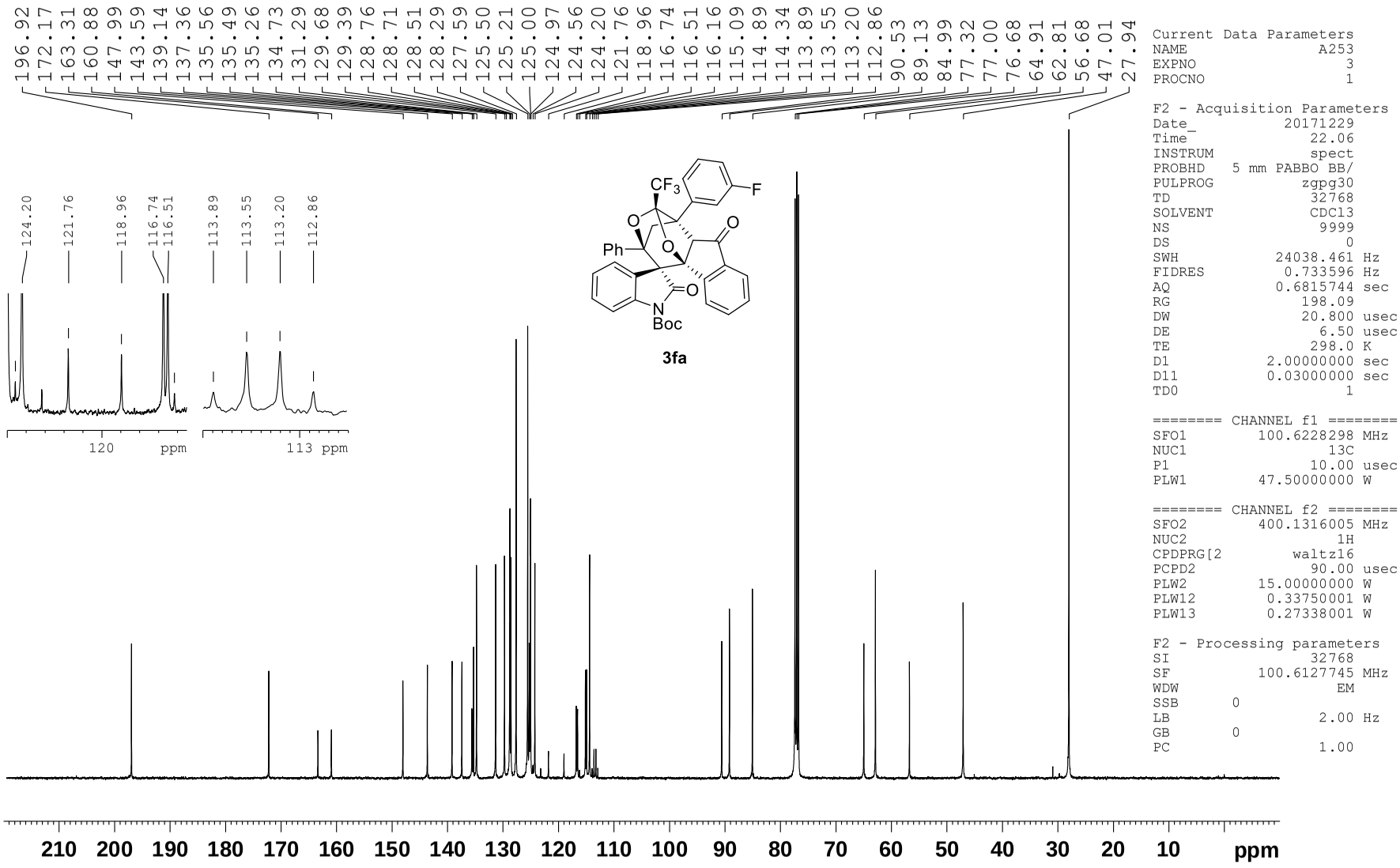
F2 - Acquisition Parameters
Date_              20171214
Time                 21.56
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   15544
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                    4096
DW                  20.800 usec
DE                   6.50 usec
TE                  297.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

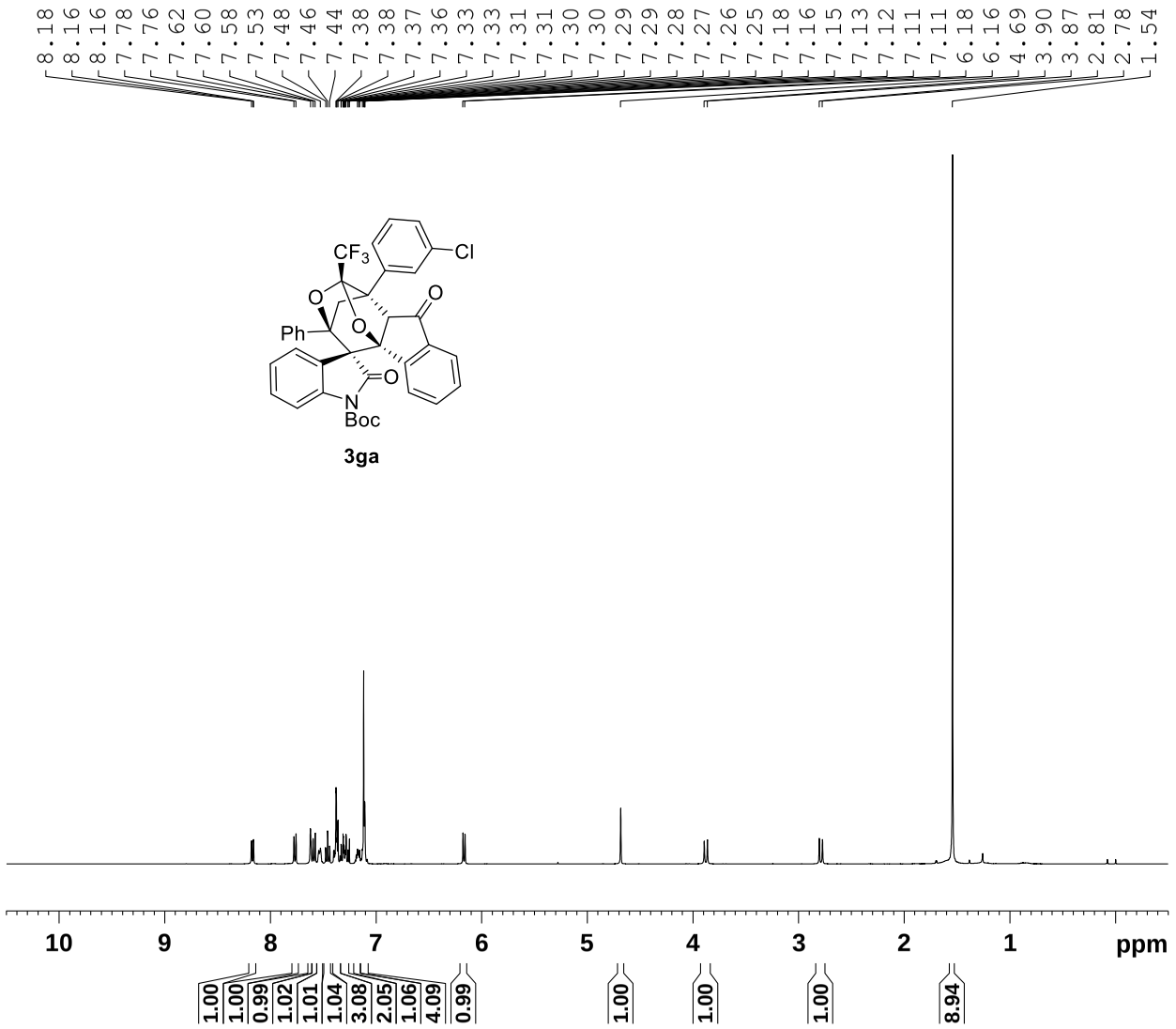
======== CHANNEL f1 ========
NUC1                   13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127738 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```


8.18 8.17 8.16 7.77 7.75 7.57 7.47 7.46 7.44 7.41 7.40 7.39 7.39 7.38 7.38 7.38 7.37 7.36 7.36 7.33 7.33 7.31 7.31 7.30 7.30 7.29 7.29 7.28 7.28 7.26 7.26 7.25 7.19 7.19 7.18 7.18 7.17 7.17 7.16 7.16 7.15 7.14 7.13 7.12 7.12 7.11 7.10 7.08 7.08 6.18 6.16 4.70 3.90 3.87
2.81 2.78
1.54
CF3
F
O
O
Ph
O
O
N
Boc
3fa
Current Data Parameters
NAME A253
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20171229
Time 22.04
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7211.539 Hz
FIDRES 0.220079 Hz
AQ 2.2719147 sec
RG 51.8
DW 69.333 usec
DE 10.50 usec
TE 297.6 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324008 MHz
NUC1 1H
P1 12.90 usec
PLW1 15.00000000 W
F2 - Processing parameters
SI 16384
SF 400.1300140 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 ppm
1.00 1.02 1.05 5.29 2.18 6.20 1.00 1.01 0.97 1.00 8.99


196.92
172.17
163.31
160.88
147.99
143.59
139.14
137.36
135.56
135.49
135.26
134.73
131.29
129.68
129.39
128.76
128.71
128.51
128.29
127.59
125.50
125.21
125.00
124.97
124.56
124.20
121.76
118.96
116.74
116.51
116.16
115.09
114.89
114.34
113.89
113.55
113.20
112.86
90.53
89.13
84.99
77.32
77.00
76.68
64.91
62.81
56.68
47.01
27.94
124.20
121.76
118.96
116.74
116.51
113.89
113.55
113.20
112.86
120 ppm
113 ppm
CF3
F
Ph
O
O
O
O
N
Boc
3fa
Current Data Parameters
NAME A253
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20171229
Time 22.06
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 9999
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 198.09
DW 20.800 usec
DE 6.50 usec
TE 298.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228298 MHz
NUC1 13C
P1 10.00 usec
PLW1 47.50000000 W
======== CHANNEL f2 ========
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 15.00000000 W
PLW12 0.33750001 W
PLW13 0.27338001 W
F2 - Processing parameters
SI 32768
SF 100.6127745 MHz
WDW EM
SSB 0
LB 2.00 Hz
GB 0
PC 1.00
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

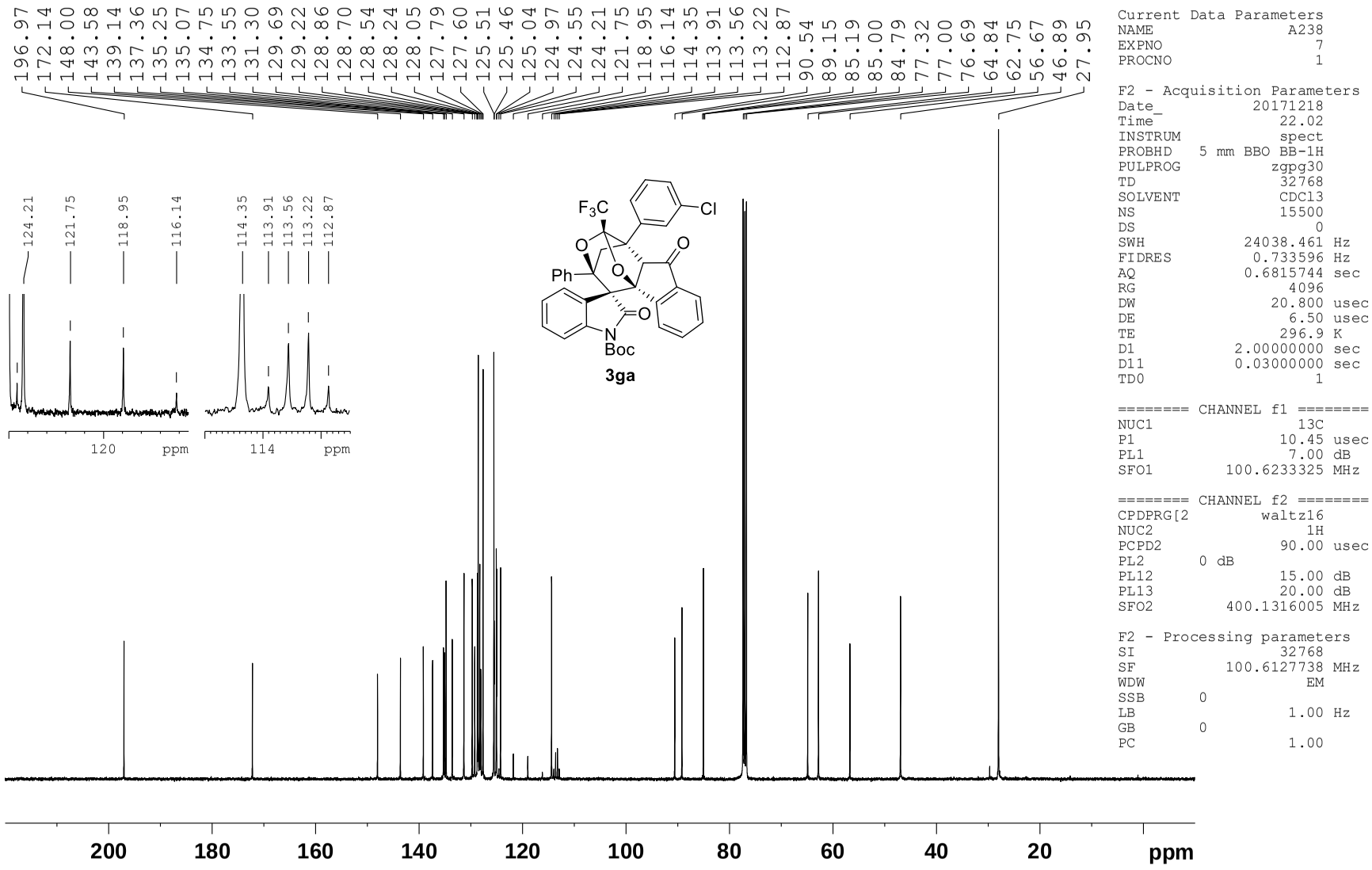



```
Current Data Parameters
NAME                  A238
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_              20171218
Time                 10.14
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7211.539 Hz
FIDRES           0.220079 Hz
AQ               2.2719147 sec
RG                   57.42
DW                  69.333 usec
DE                   10.50 usec
TE                   297.5 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          400.1324008 MHz
NUC1                    1H
P1                   12.90 usec
PLW1          15.00000000 W

F2 - Processing parameters
SI                   16384
SF            400.1300131 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



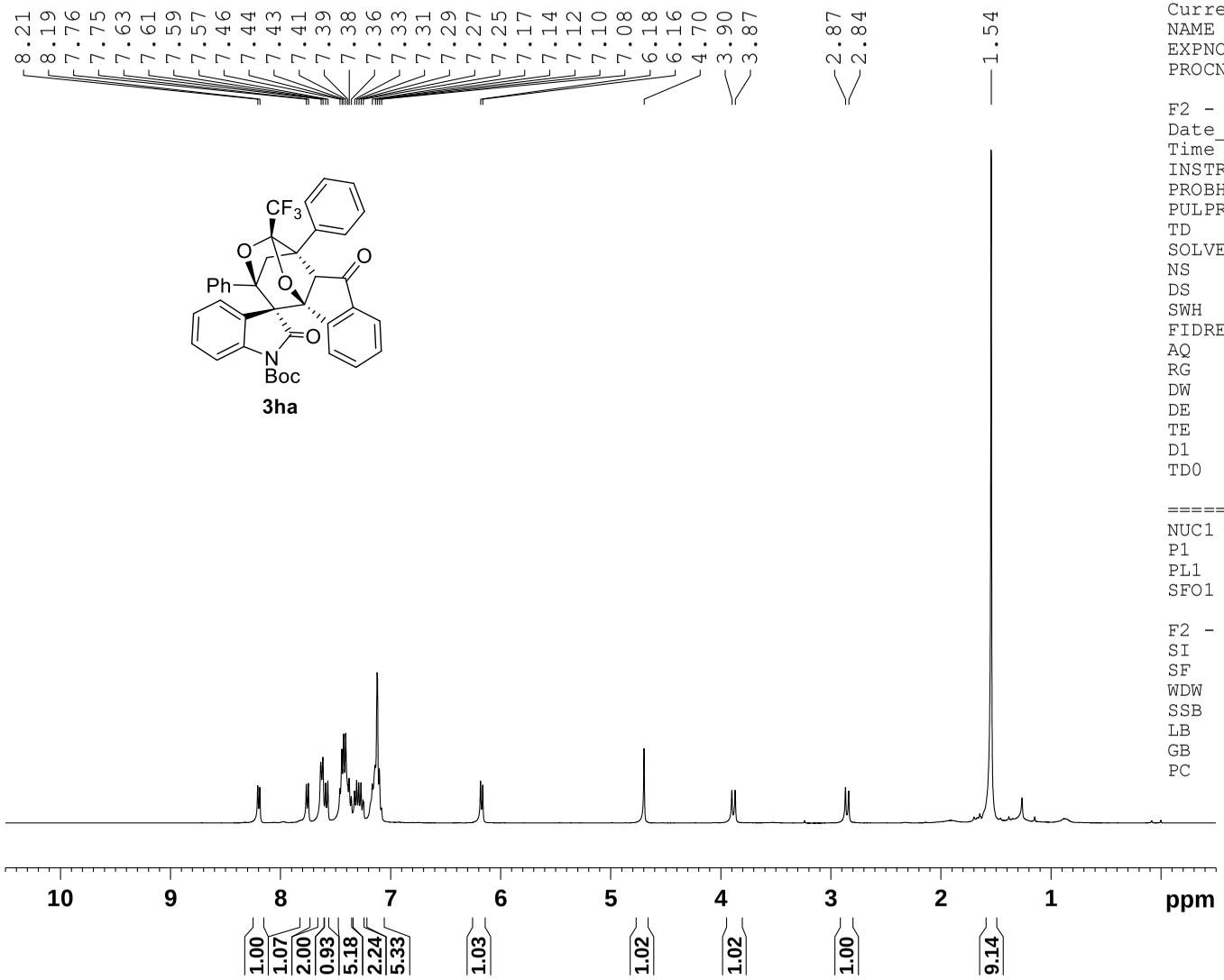
Current Data Parameters
NAME A238
EXPNO 7
PROCNO 1

F2 - Acquisition Parameters
Date_ 20171218
Time 22.02
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 15500
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 296.9 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 10.45 usec
PL1 7.00 dB
SFO1 100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0 dB
PL12 15.00 dB
PL13 20.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127738 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00

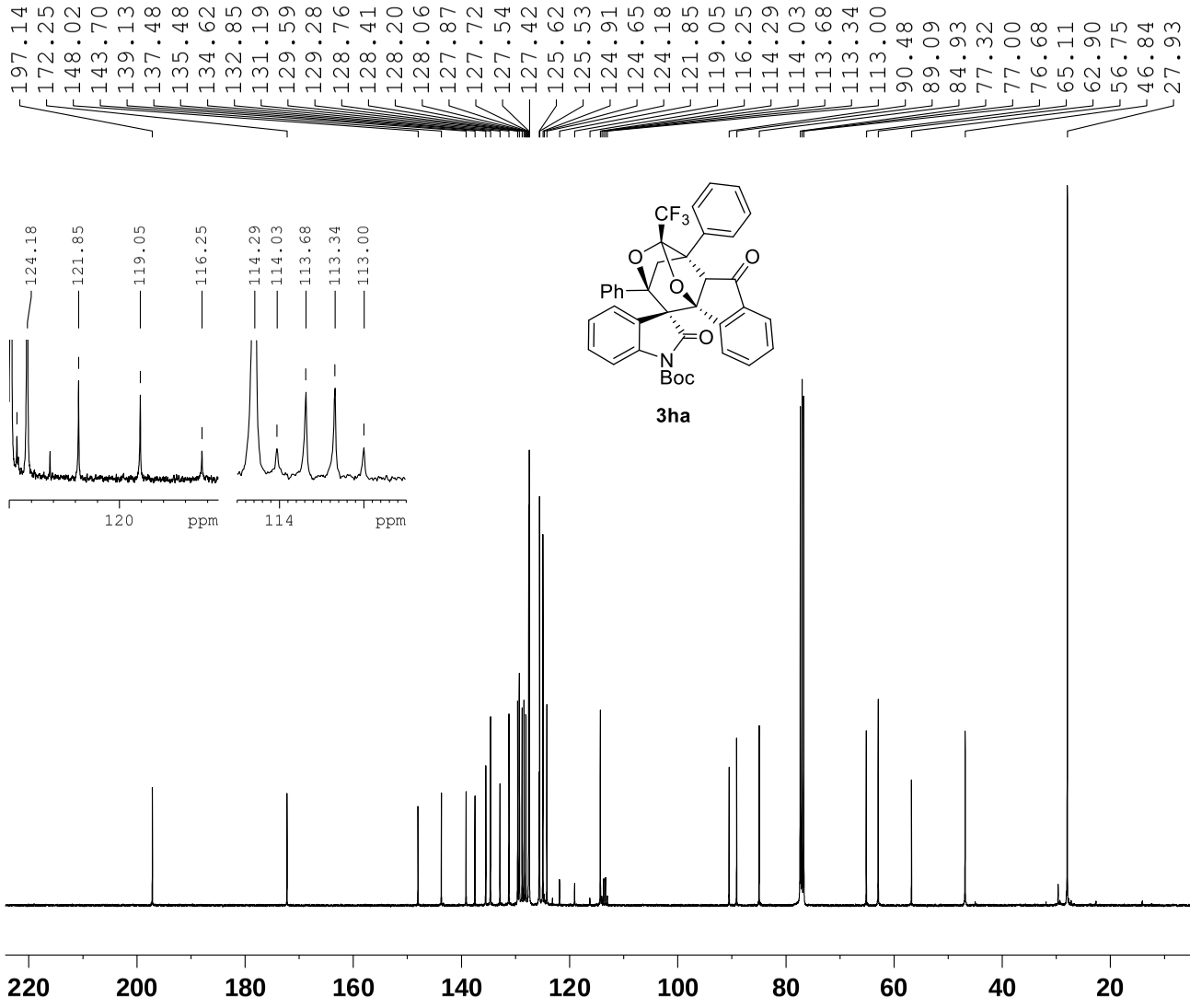



```
Current Data Parameters
NAME                  A228
EXPNO                    8
PROCNO                   1

F2 - Acquisition Parameters
Date_              20171213
Time                 21.51
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                     45.3
DW                   69.000 usec
DE                    6.50 usec
TE                   297.2 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300162 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



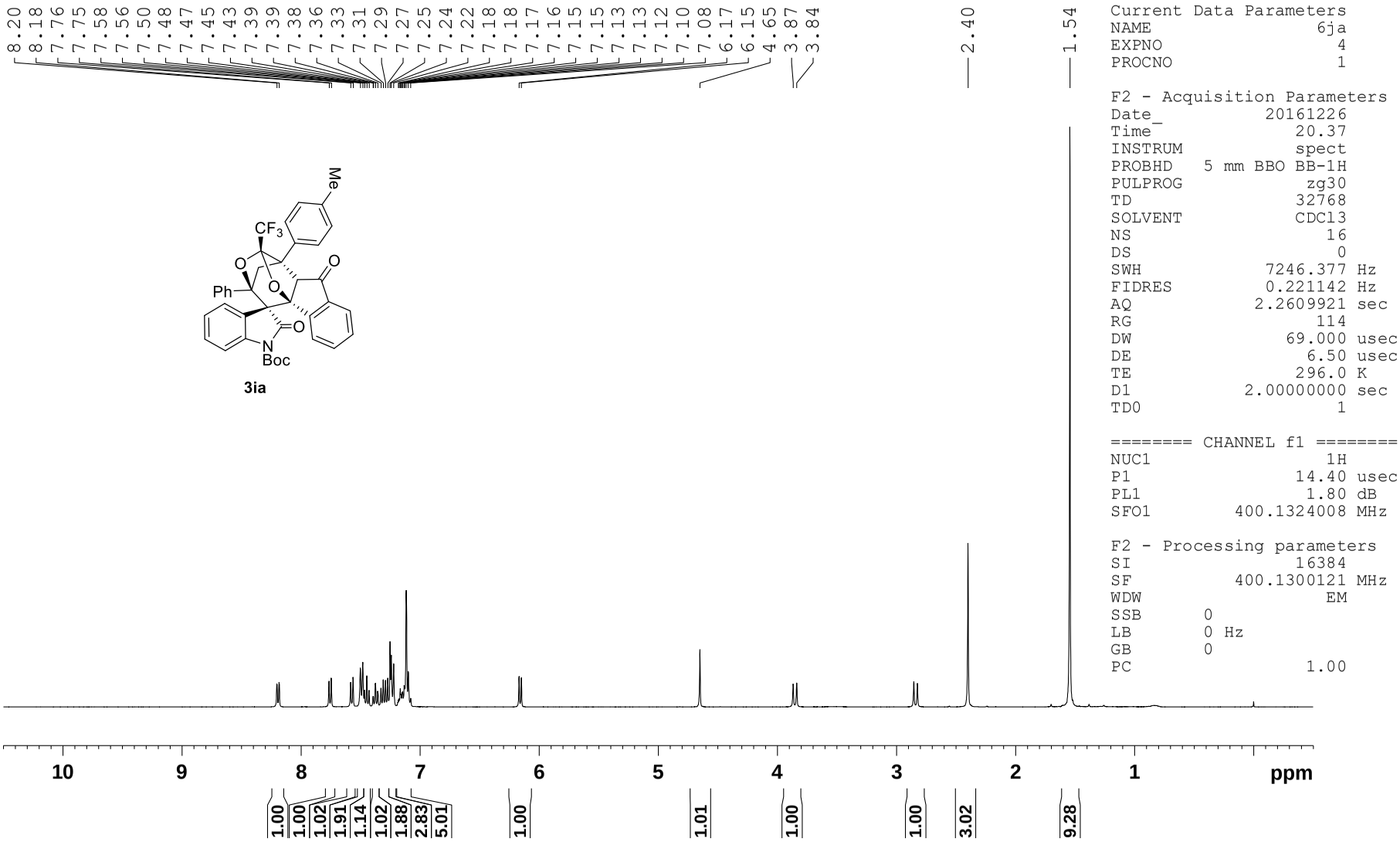

```
Current Data Parameters
NAME                  A228
EXPNO                    9
PROCNO                   1

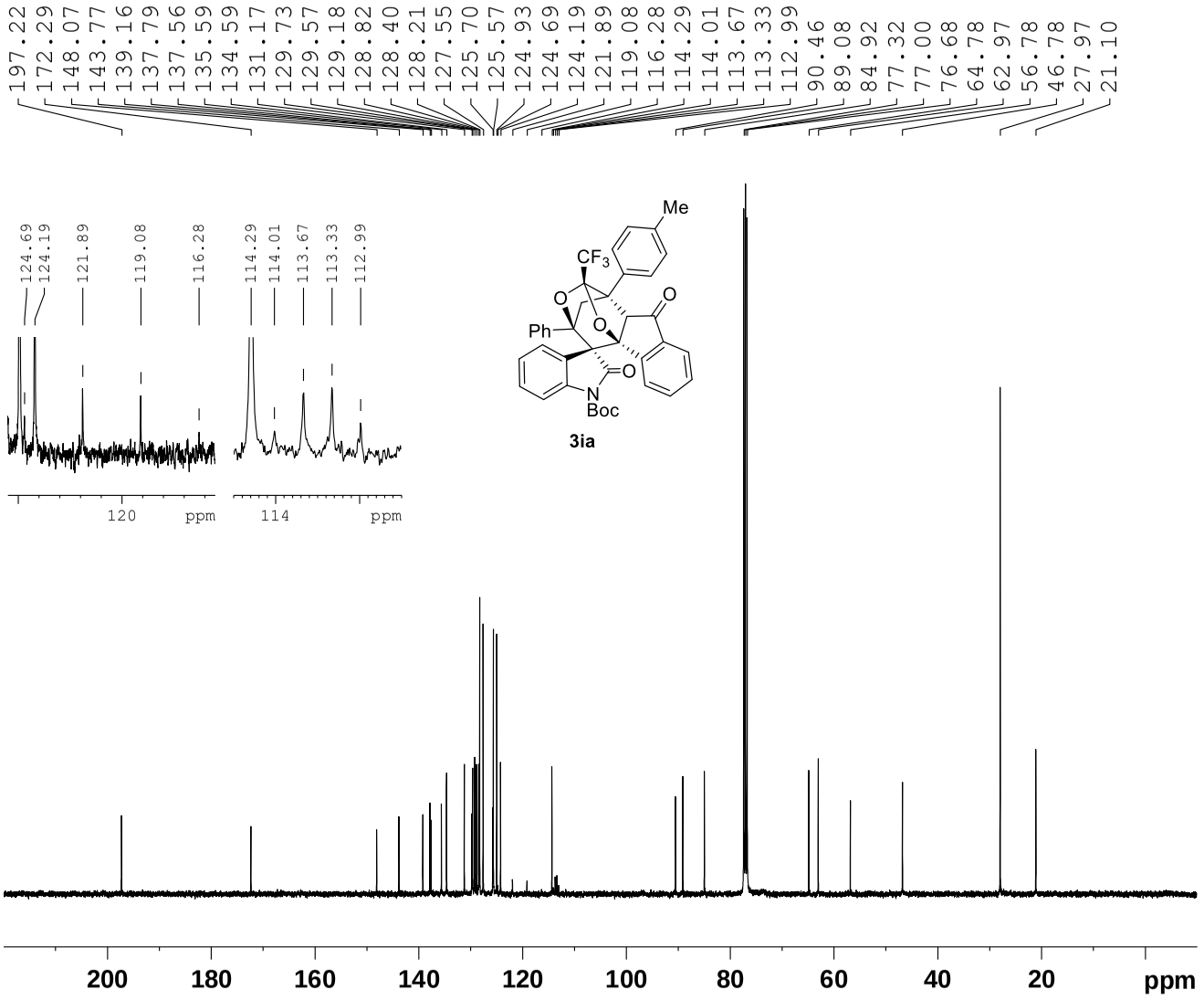
F2 - Acquisition Parameters
Date_              20171213
Time                 21.56
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   18492
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                    4096
DW                  20.800 usec
DE                   6.50 usec
TE                  297.5 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127760 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```


8.20
8.18
7.76
7.75
7.58
7.56
7.50
7.48
7.47
7.45
7.43
7.39
7.39
7.38
7.36
7.33
7.31
7.29
7.27
7.25
7.24
7.22
7.18
7.18
7.17
7.16
7.15
7.15
7.13
7.13
7.12
7.10
7.08
6.17
6.15
4.65
3.87
3.84
2.40
1.54
Me
CF3
O
O
O
Ph
O
N
Boc
3ia
Current Data Parameters
NAME 6ja
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20161226
Time 20.37
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 296.0 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300121 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10
9
8
7
6
5
4
3
2
1
ppm
1.00
1.00
1.02
1.91
1.14
1.02
1.88
2.83
5.01
1.00
1.01
1.00
1.00
3.02
9.28



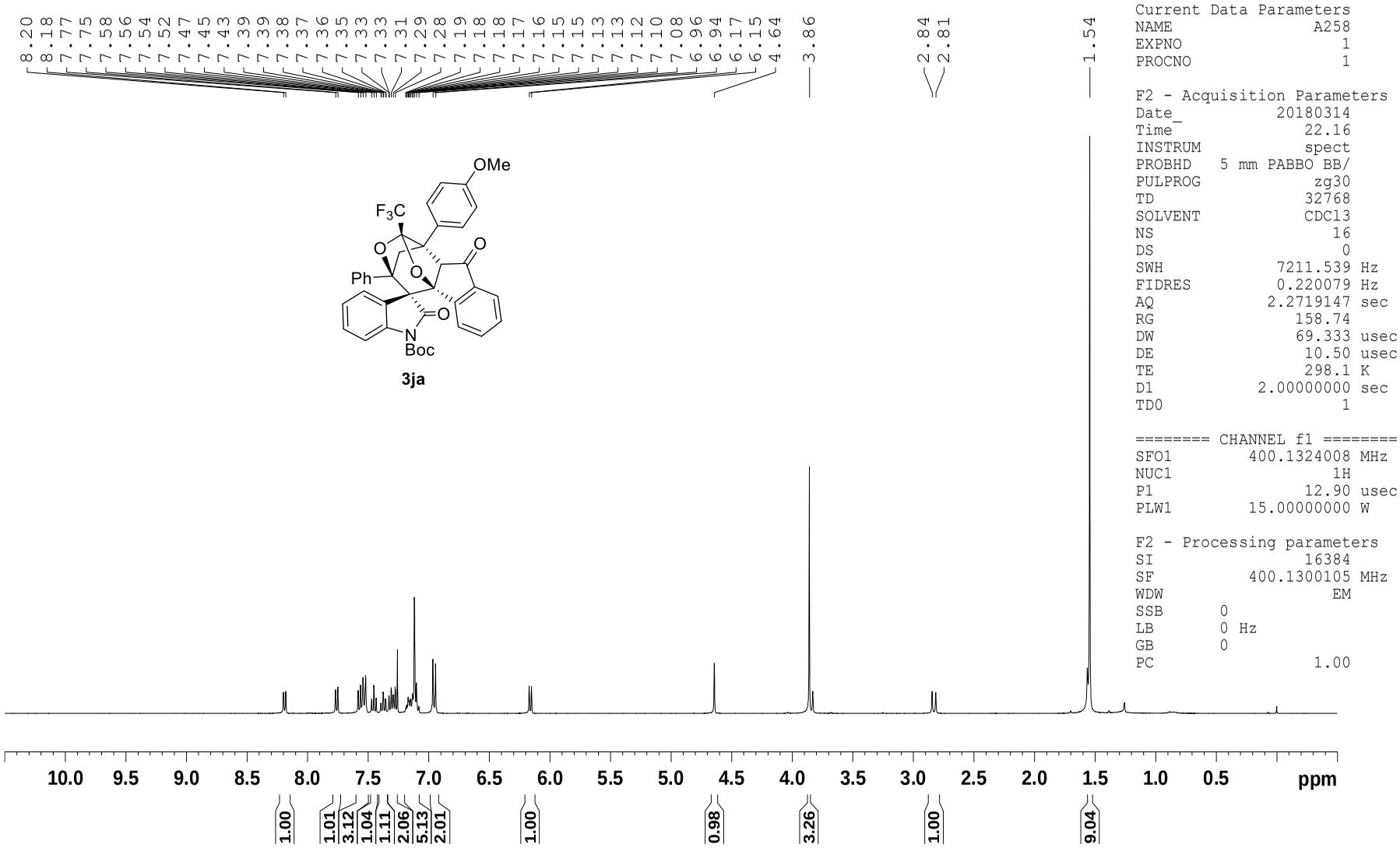

```
Current Data Parameters
NAME                  6ja
EXPNO                   6
PROCNO                  1

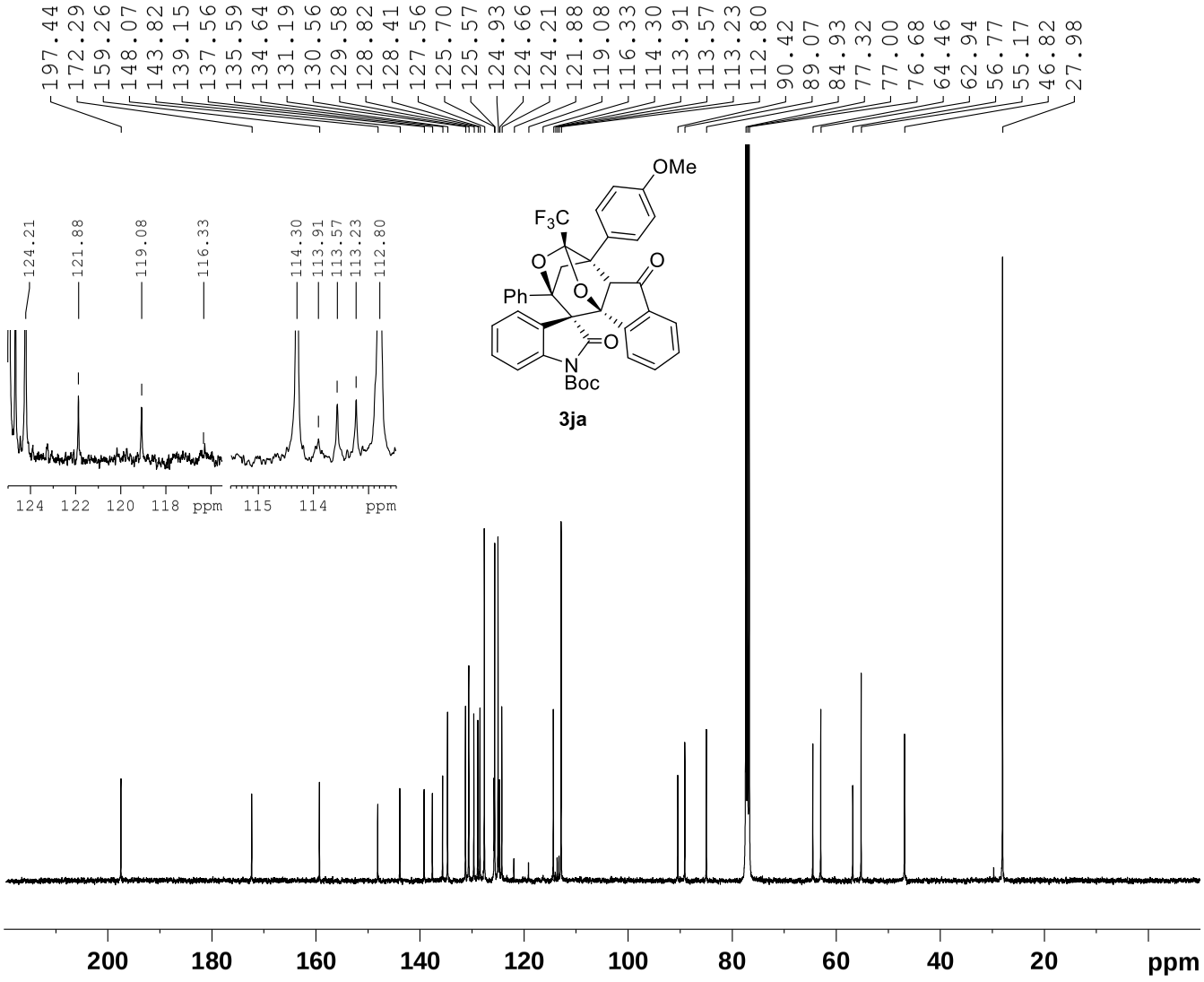
F2 - Acquisition Parameters
Date_            20170101
Time                4.53
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                  4045
DS                     0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG               5792.6
DW                20.800 usec
DE                 6.50 usec
TE                297.8 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                 13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               17.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127717 MHz
WDW                  EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```


8.20
8.18
7.77
7.75
7.58
7.56
7.54
7.52
7.47
7.45
7.43
7.39
7.39
7.38
7.37
7.36
7.35
7.33
7.33
7.31
7.29
7.28
7.19
7.18
7.18
7.17
7.16
7.15
7.15
7.13
7.13
7.12
7.10
7.08
6.96
6.94
6.17
6.15
4.64
3.86
2.84
2.81
1.54
OMe
F3C
O
O
O
Ph
O
N
Boc
3ja
Current Data Parameters
NAME A258
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20180314
Time 22.16
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7211.539 Hz
FIDRES 0.220079 Hz
AQ 2.2719147 sec
RG 158.74
DW 69.333 usec
DE 10.50 usec
TE 298.1 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324008 MHz
NUC1 1H
P1 12.90 usec
PLW1 15.00000000 W
F2 - Processing parameters
SI 16384
SF 400.1300105 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.00
1.01
3.12
1.04
1.11
2.06
5.13
2.01
1.00
0.98
3.26
1.00
9.04



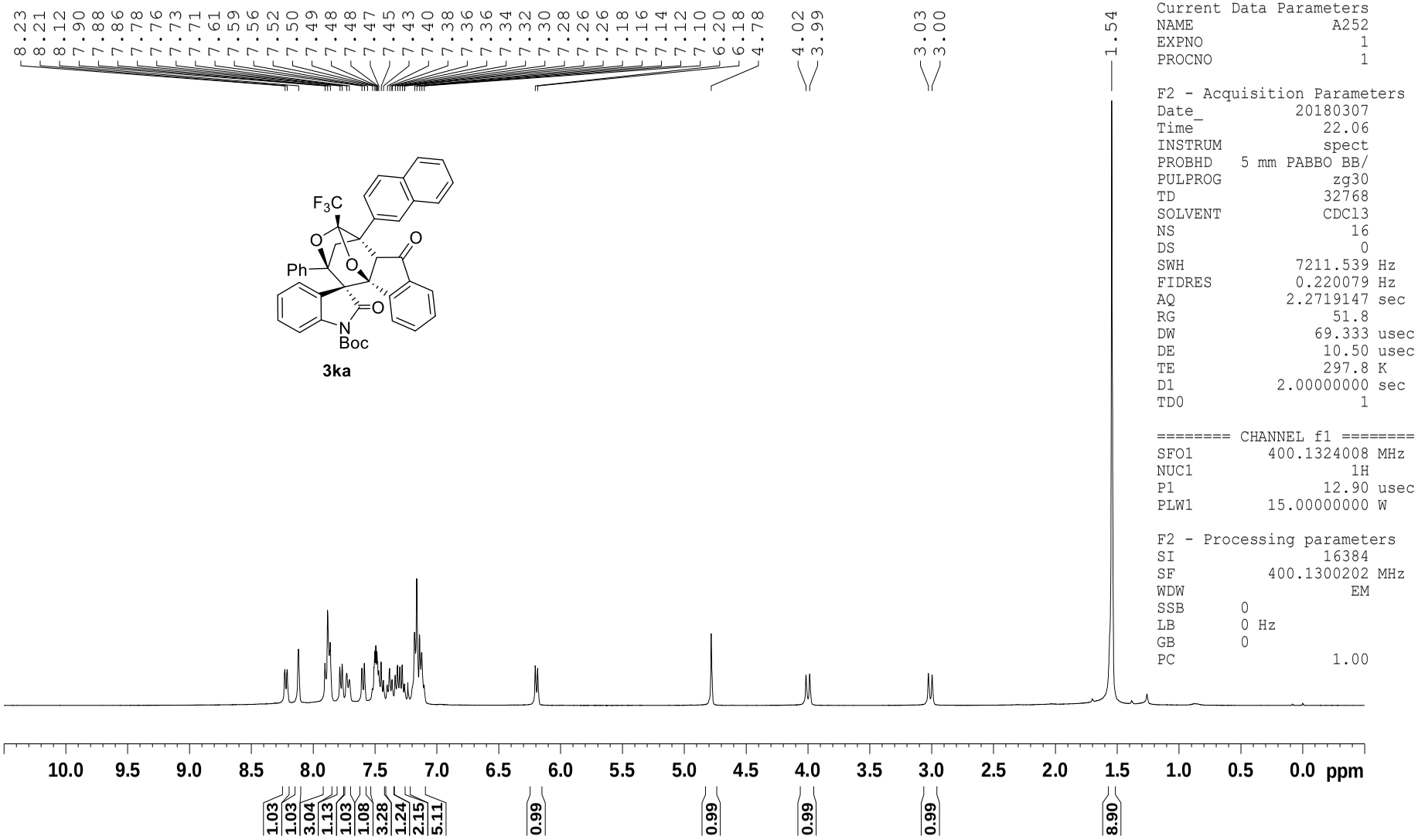

```
Current Data Parameters
NAME                  A258
EXPNO                    2
PROCNO                   1

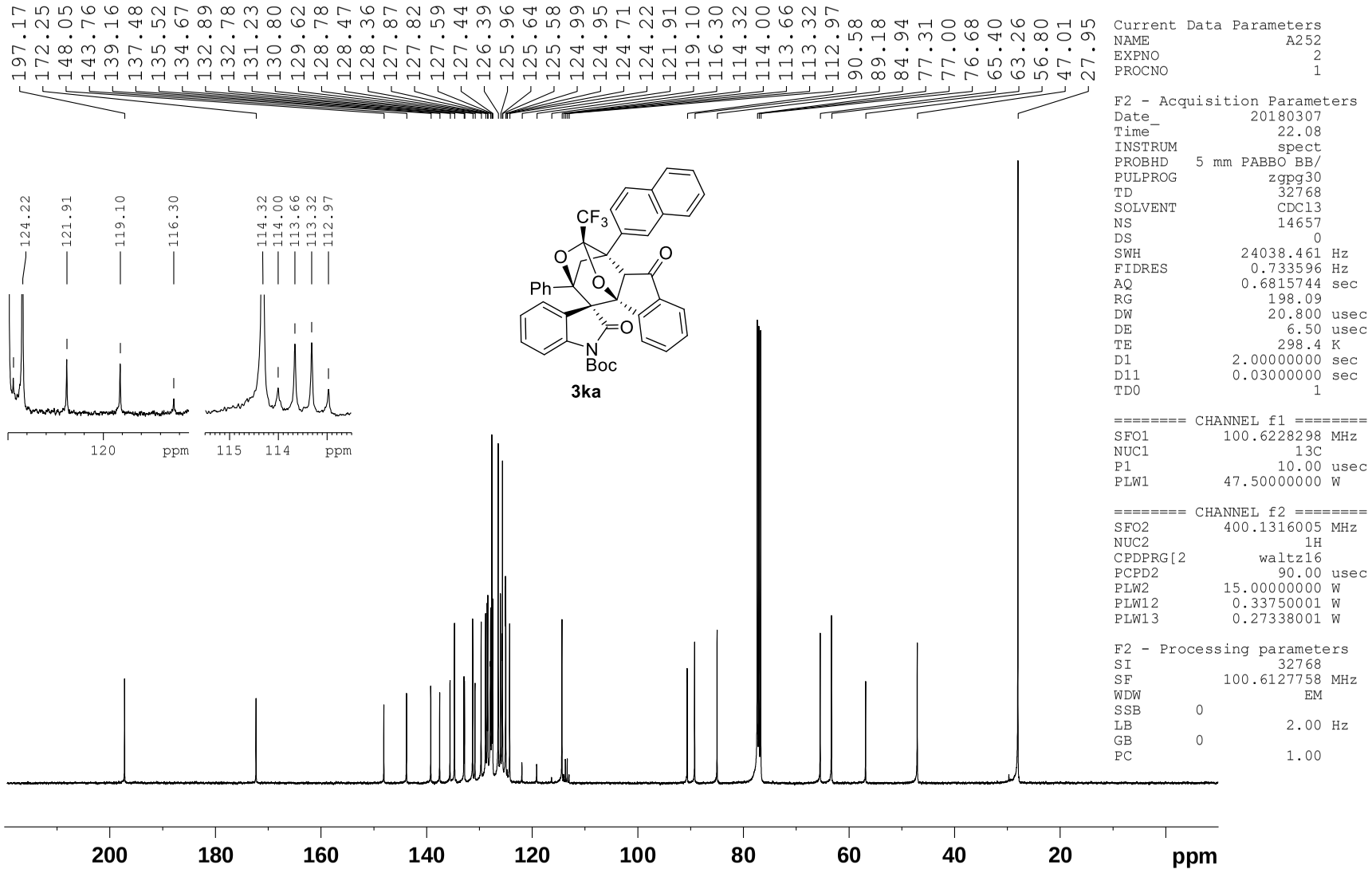
F2 - Acquisition Parameters
Date_              20180314
Time                 22.18
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   12490
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.3 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6228298 MHz
NUC1                  13C
P1                  10.00 usec
PLW1          47.50000000 W

======== CHANNEL f2 ========
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          15.00000000 W
PLW12          0.33750001 W
PLW13          0.27338001 W

F2 - Processing parameters
SI                   32768
SF            100.6127707 MHz
WDW                    EM
SSB       0
LB                  2.00 Hz
GB        0
PC                  1.00
```


8.23 8.21 8.12 7.90 7.88 7.86 7.78 7.76 7.73 7.71 7.61 7.59 7.56 7.52 7.50 7.49 7.48 7.48 7.47 7.45 7.43 7.40 7.38 7.36 7.36 7.34 7.32 7.30 7.28 7.26 7.26 7.18 7.16 7.14 7.12 7.10 6.20 6.18 4.78
4.02 3.99
3.03 3.00
1.54
F3C
O
O
O
Ph
O
O
N
Boc
3ka
Current Data Parameters
NAME A252
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20180307
Time 22.06
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7211.539 Hz
FIDRES 0.220079 Hz
AQ 2.2719147 sec
RG 51.8
DW 69.333 usec
DE 10.50 usec
TE 297.8 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324008 MHz
NUC1 1H
P1 12.90 usec
PLW1 15.00000000 W
F2 - Processing parameters
SI 16384
SF 400.1300202 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 ppm
1.03 1.03 3.04 1.13 1.03 1.08 3.28 1.24 2.15 5.11
0.99
0.99
0.99
0.99
8.90



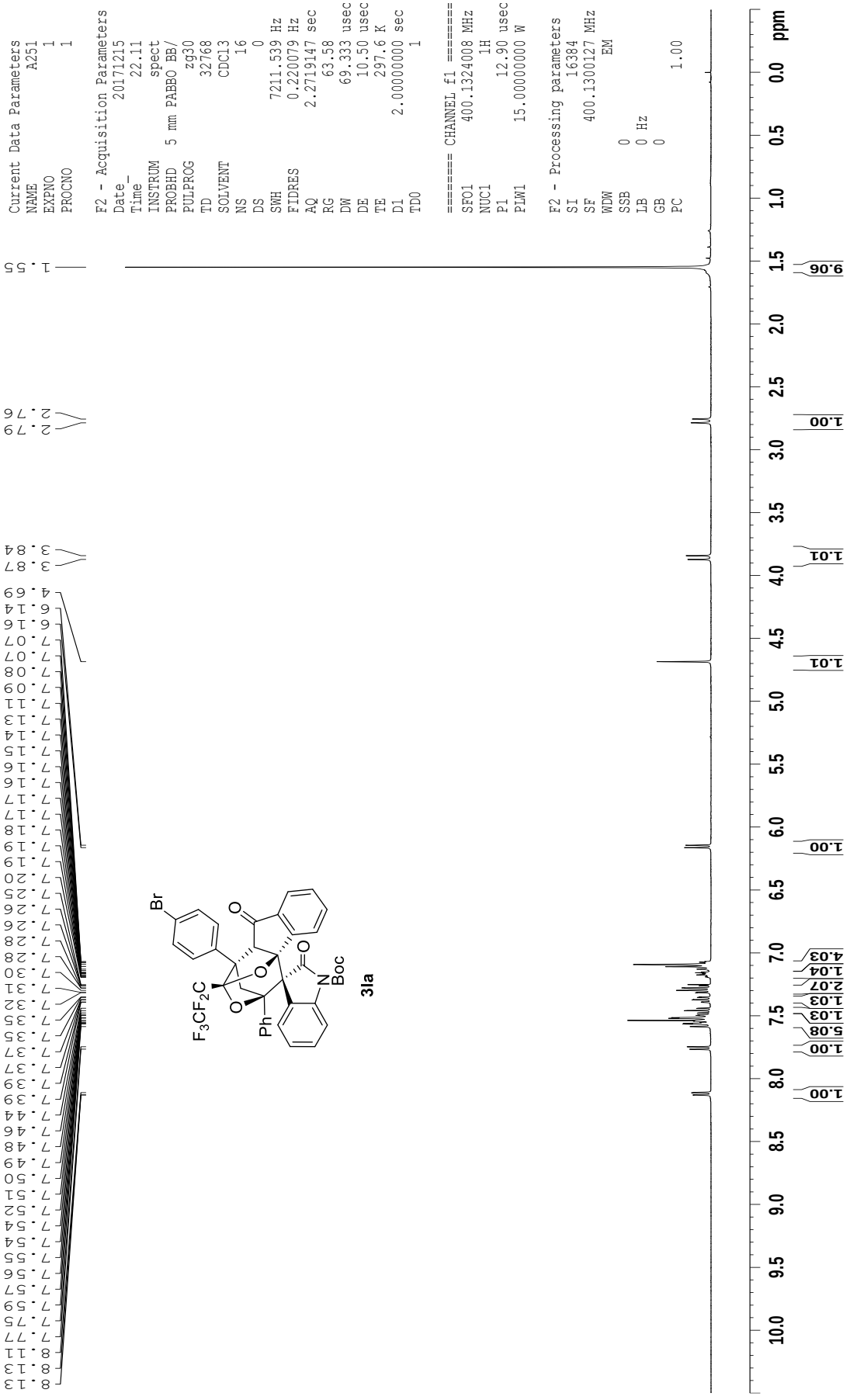
Current Data Parameters
NAME A252
EXPNO 2
PROCNO 1

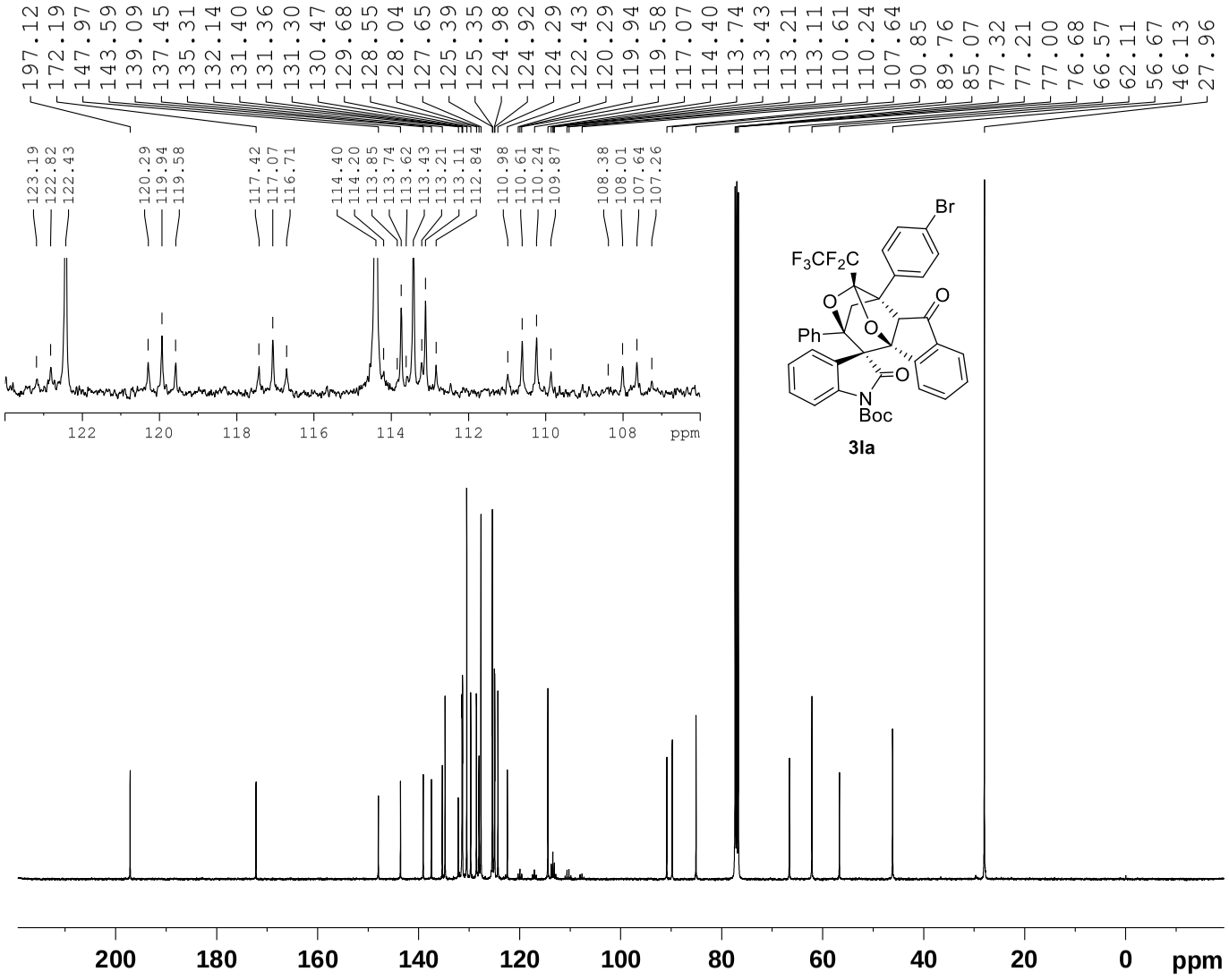
F2 - Acquisition Parameters
Date_ 20180307
Time 22.08
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 14657
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 198.09
DW 20.800 usec
DE 6.50 usec
TE 298.4 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 100.6228298 MHz
NUC1 13C
P1 10.00 usec
PLW1 47.50000000 W

======== CHANNEL f2 ========
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 15.00000000 W
PLW12 0.33750001 W
PLW13 0.27338001 W

F2 - Processing parameters
SI 32768
SF 100.6127758 MHz
WDW EM
SSB 0
LB 2.00 Hz
GB 0
PC 1.00


Current Data Parameters
NAME A251
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20171215
Time_ 22.11
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7211.539 Hz
FIDRES 0.220079 Hz
AQ 2.2719147 sec
RG 63.58
DW 69.333 usec
DE 10.50 usec
TE 297.6 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324008 MHz
NUC1 1H
P1 12.90 usec
PLW1 15.00000000 W
F2 - Processing parameters
SI 16384
SF 400.1300127 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
Br
O
O
O
N
Boc
Ph
F3CF2C
3la
ppm



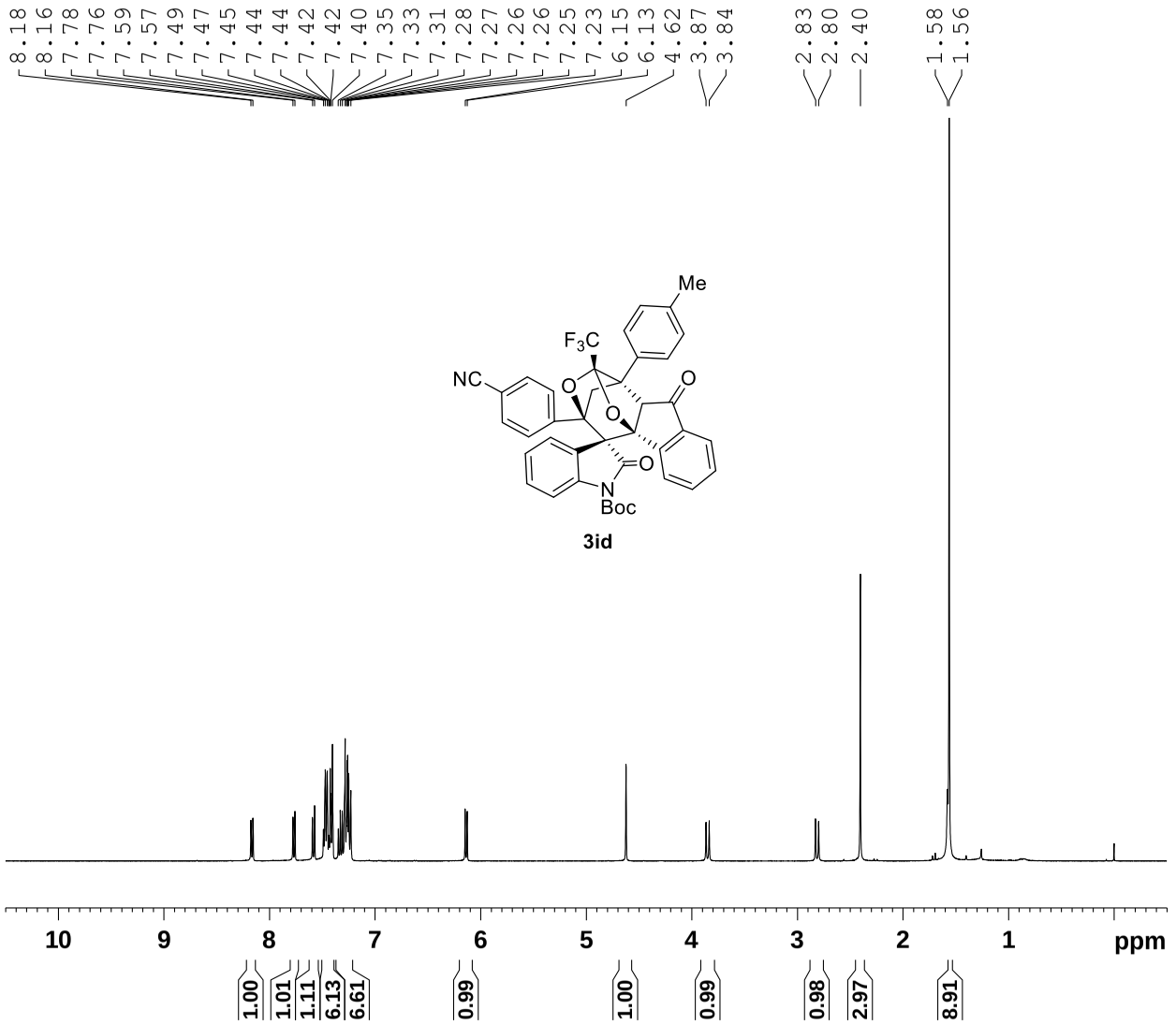
Current Data Parameters
NAME A251
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20171215
Time 22.14
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 15860
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 198.09
DW 20.800 usec
DE 6.50 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 100.6228298 MHz
NUC1 13C
P1 10.00 usec
PLW1 47.50000000 W

======== CHANNEL f2 ========
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 15.00000000 W
PLW12 0.33750001 W
PLW13 0.27338001 W

F2 - Processing parameters
SI 32768
SF 100.6127729 MHz
WDW EM
SSB 0
LB 2.00 Hz
GB 0
PC 1.00

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Current Data Parameters
NAME                  A326
EXPNO                    5
PROCNO                   1

F2 - Acquisition Paramete
Date_              20180516
Time                 21.59
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7211.539 H
FIDRES             0.220079 H
AQ                2.2719147 s
RG                   89.08
DW                  69.333 u
DE                  10.50 u
TE                  298.5 K
D1              2.00000000 s
TD0                      1

======== CHANNEL f1 =====
SFO1           400.1324008 M
NUC1                    1H
P1                   12.90 u
PLW1           15.00000000 W

F2 - Processing parameter
SI                   16384
SF             400.1300096 M
WDW                     EM
SSB          0
LB           0 Hz
GB           0
PC                    1.00
```
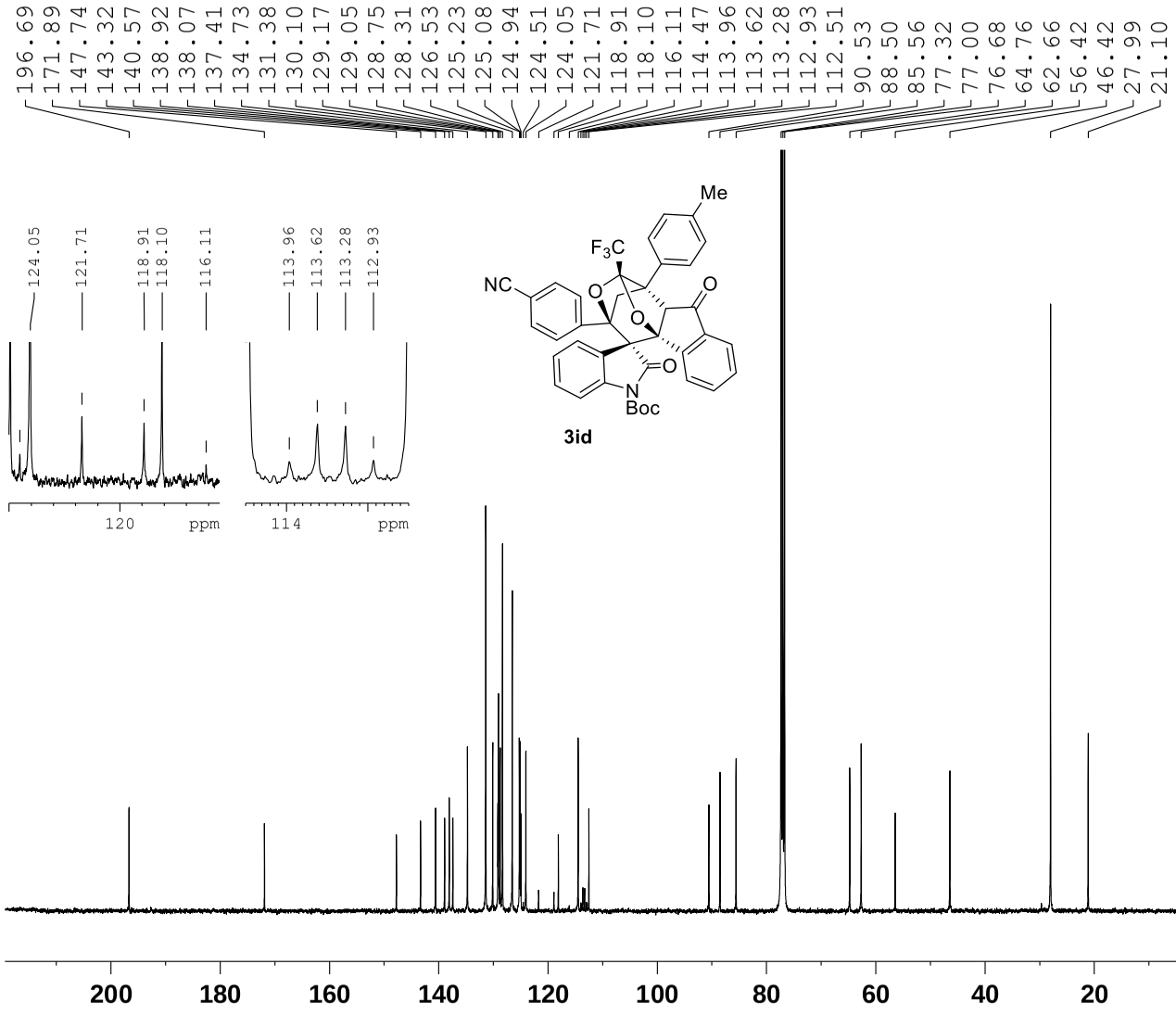
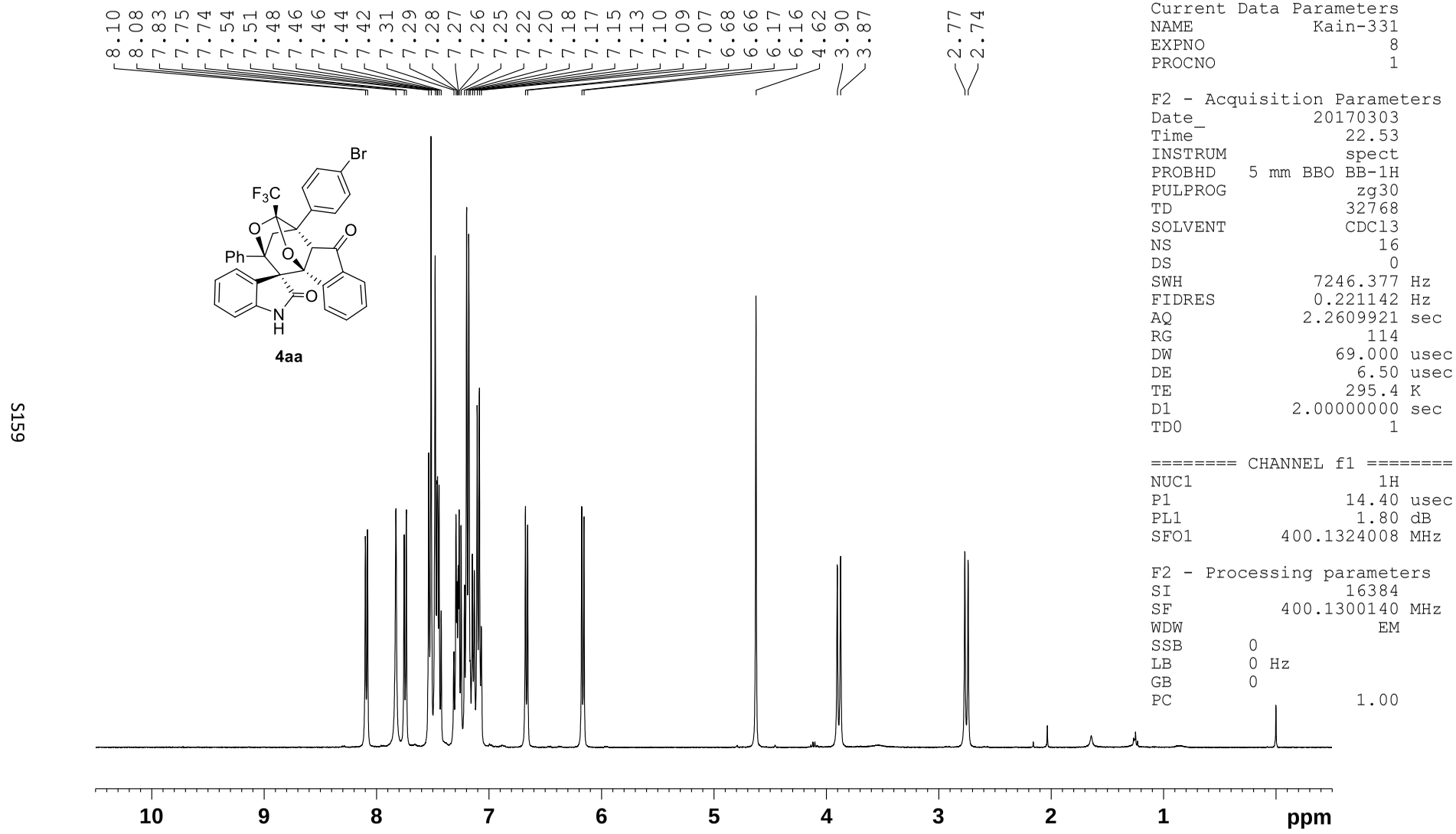
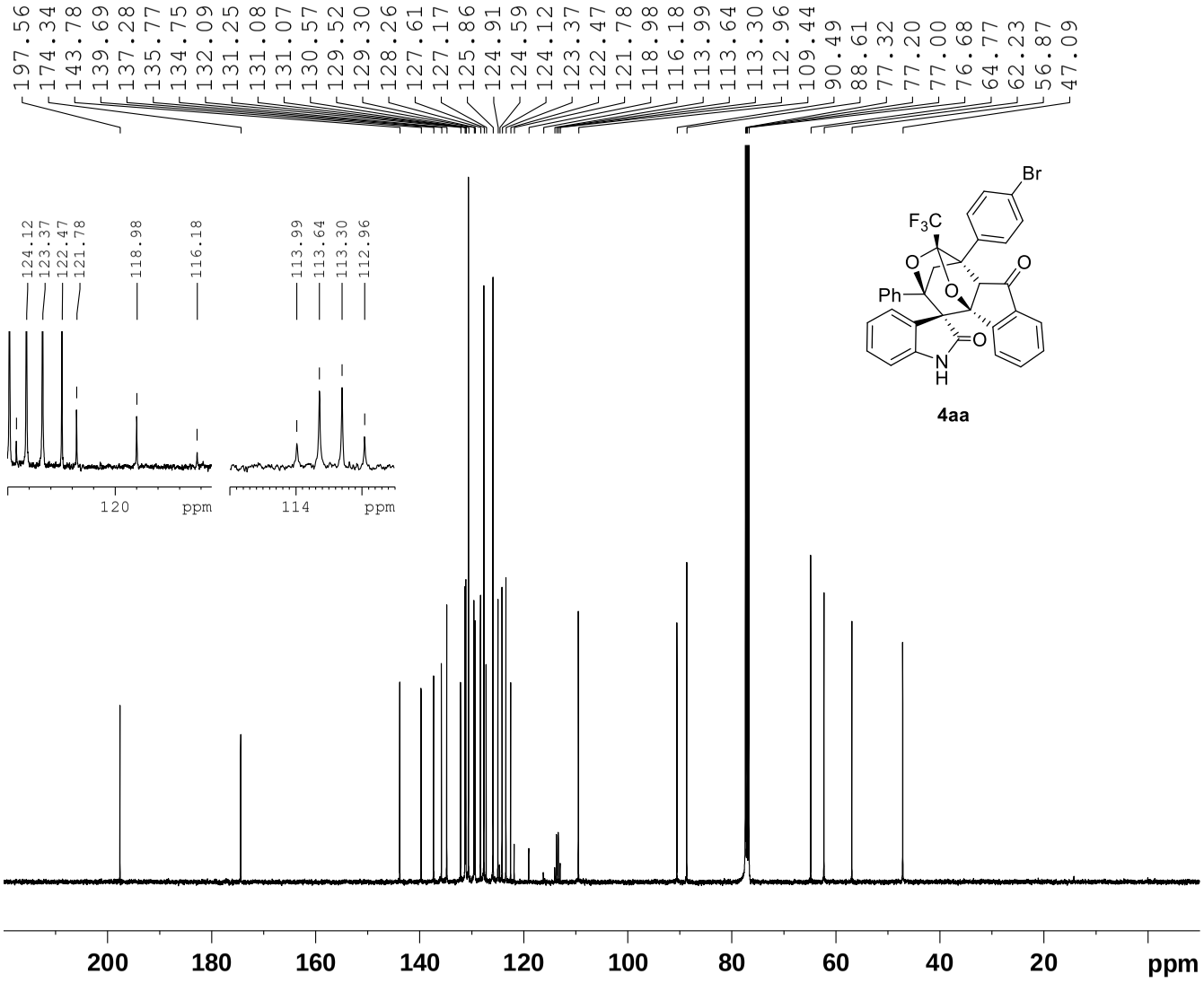




```
Current Data Parameters
NAME                  A326
EXPNO                    6
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180516
Time                 22.00
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   14469
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.9 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2            waltz16
PCPD2               90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127714 MHz
WDW                    EM
SSB          0
LB                  2.00 Hz
GB           0
PC                  1.00
```


8.10
8.08
7.83
7.75
7.74
7.54
7.51
7.48
7.46
7.46
7.44
7.42
7.31
7.29
7.28
7.27
7.26
7.25
7.22
7.20
7.18
7.17
7.15
7.13
7.10
7.09
7.07
6.68
6.66
6.17
6.16
4.62
3.90
3.87
2.77
2.74
Br
F3C
O
O
O
Ph
O
N
H
4aa
Current Data Parameters
NAME Kain-331
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20170303
Time 22.53
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 295.4 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300140 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
10
9
8
7
6
5
4
3
2
1
ppm



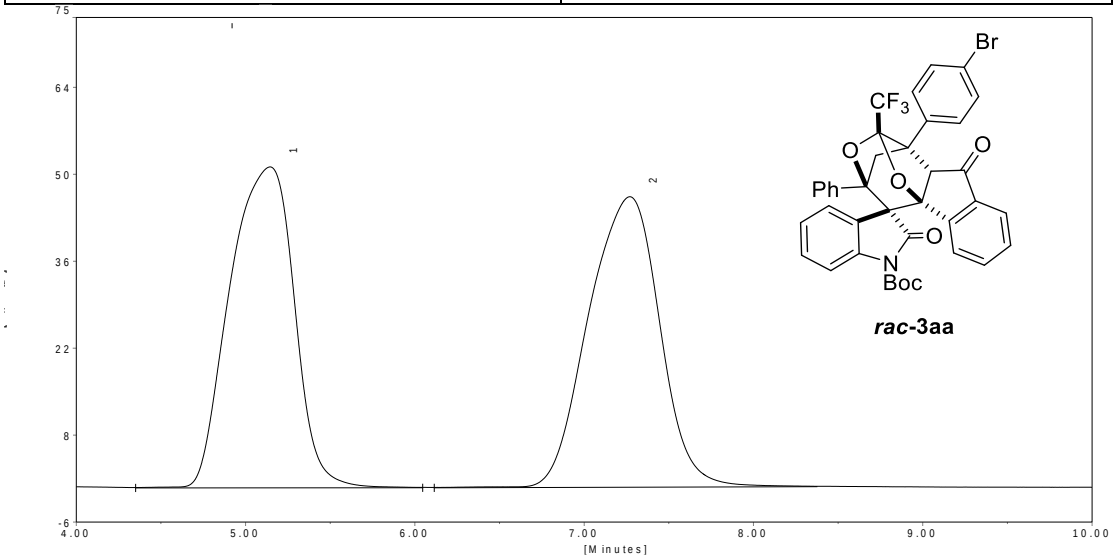
4aa

```
Current Data Parameters
NAME                  Kain-331
EXPNO                       10
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20170303
Time                     22.55
INSTRUM                  spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zgpg30
TD                       32768
SOLVENT                  CDCl3
NS                       14498
DS                           0
SWH                 24038.461 Hz
FIDRES               0.733596 Hz
AQ                   0.6815744 sec
RG                      3649.1
DW                       20.800 usec
DE                        6.50 usec
TE                       295.4 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                       13C
P1                        9.00 usec
PL1                       7.00 dB
SFO1               100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2               waltz16
NUC2                       1H
PCPD2                    90.00 usec
PL2                       1.80 dB
PL12                     17.00 dB
PL13                     20.00 dB
SFO2               400.1316005 MHz

F2 - Processing parameters
SI                       32768
SF                 100.6127731 MHz
WDW                         EM
SSB          0
LB                        1.00 Hz
GB           0
PC                        1.00
```

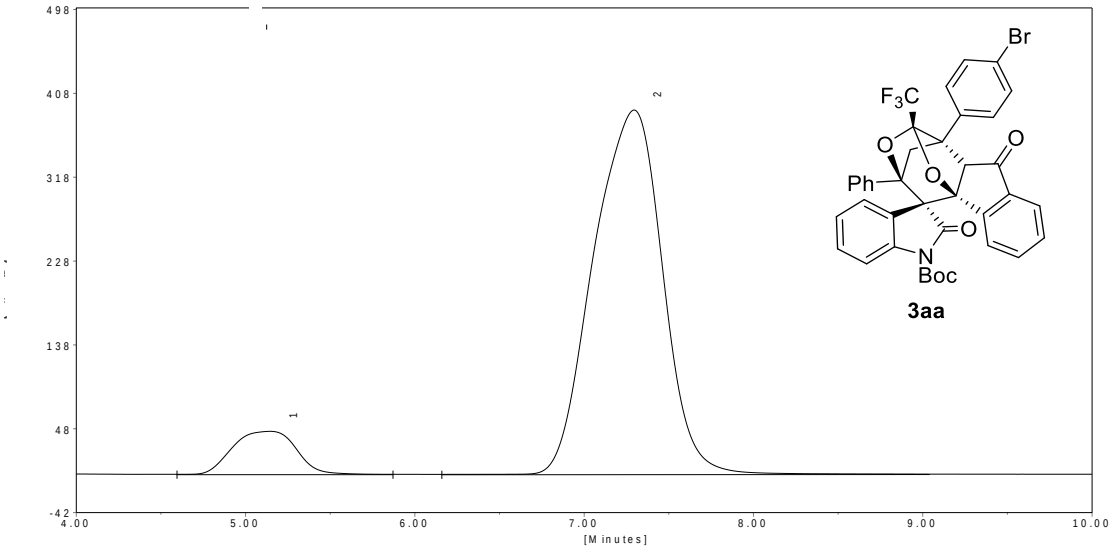
VII. HPLC chromatograms of adducts 3

HPLC Chromatogram for **3aa**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex:IPA=95:5	Detector: UV 246 nm



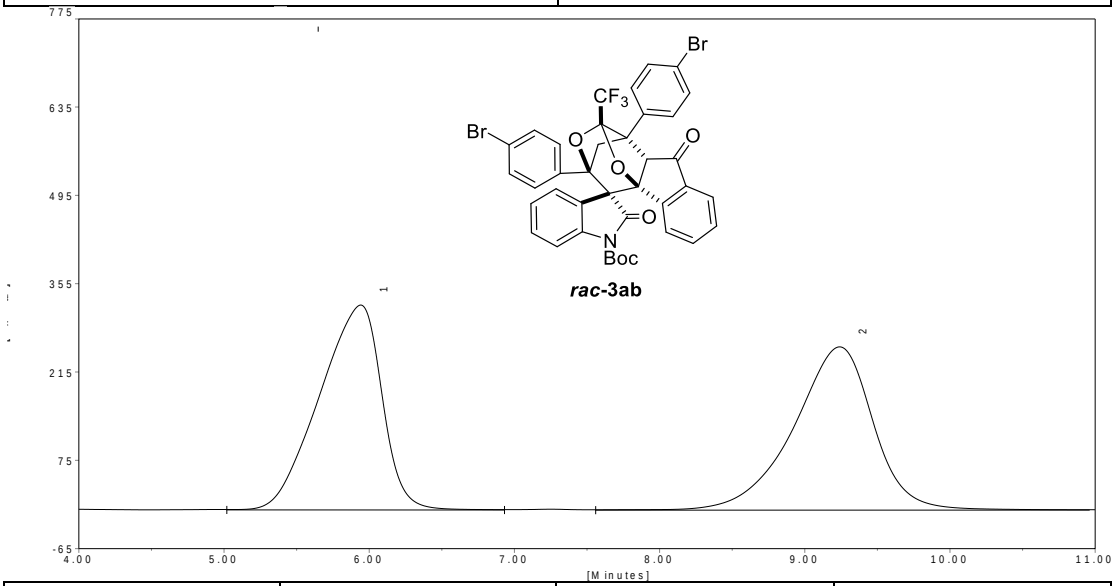
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.15	51.61	1361.43	49.9944
7.27	646.72	1361.73	50.0056



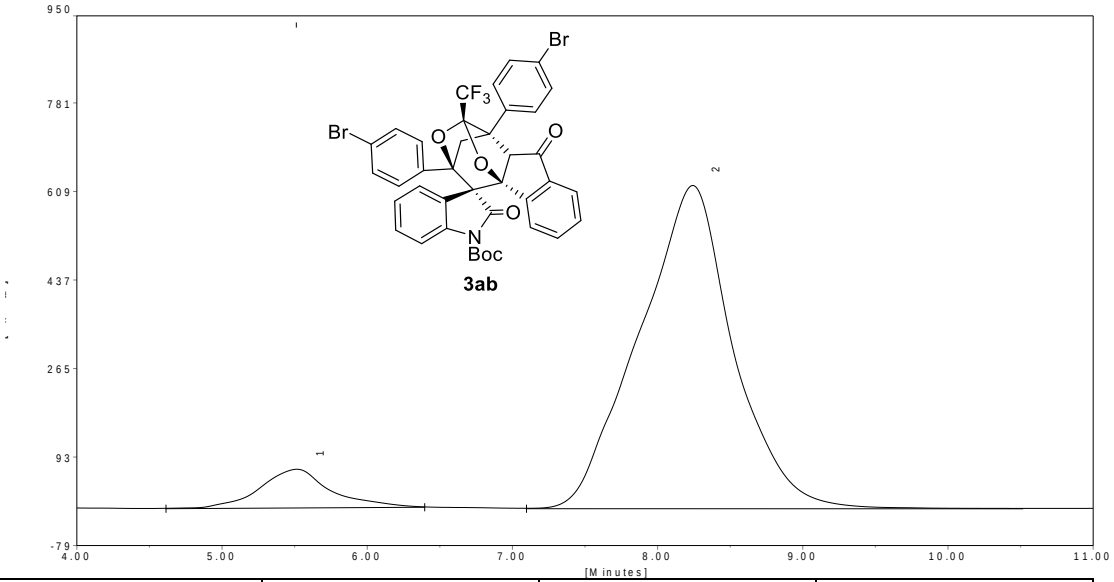
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.15	46.12	1192.36	9.7235
7.30	390.92	11070.23	90.2765

HPLC Chromatogram for **3ab**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95: 5	Detector: UV 246 nm



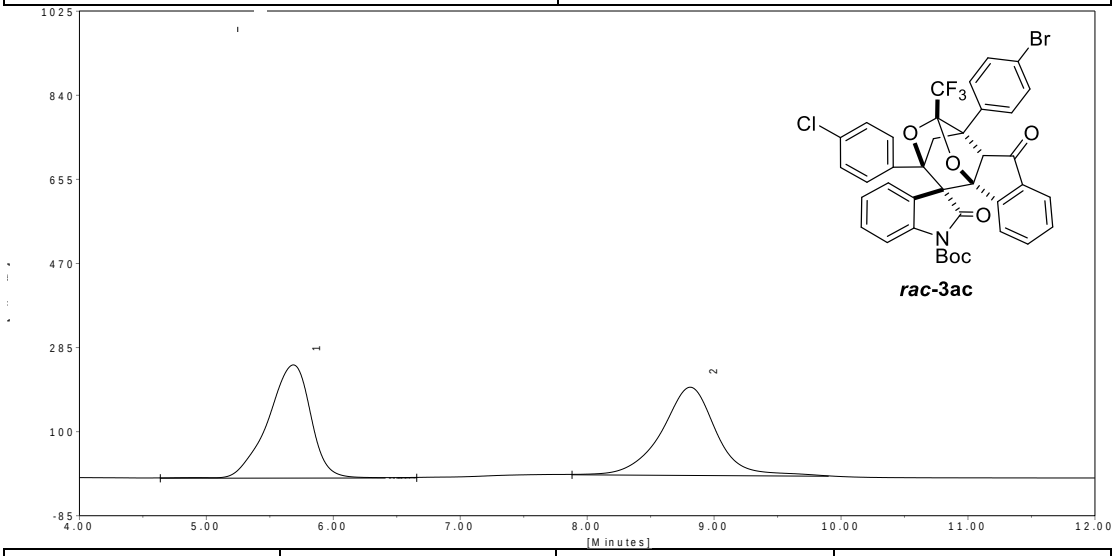
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.94	324.18	9668.60	49.6126
9.24	258.20	9819.59	50.3874



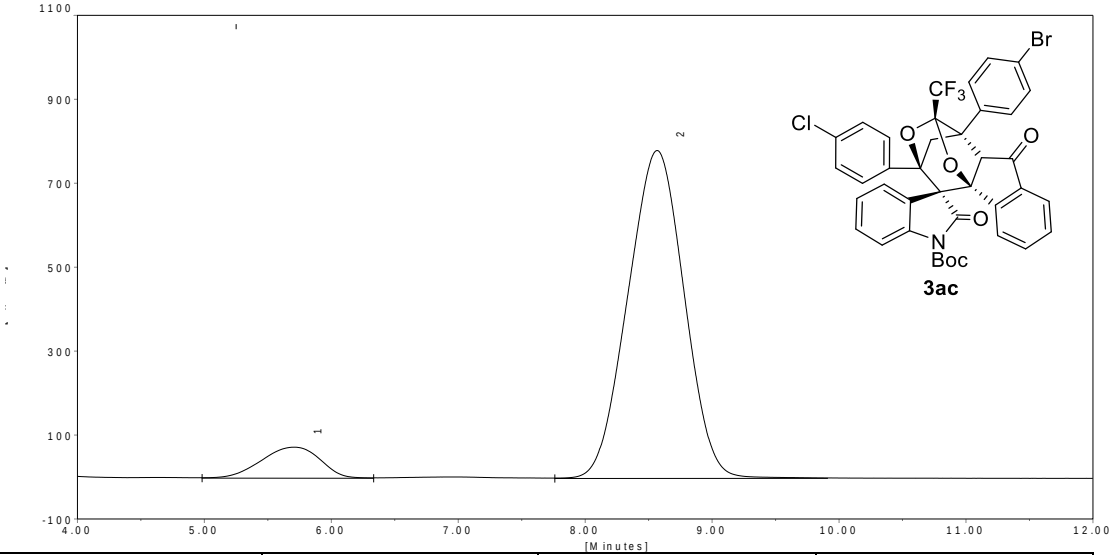
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.52	74.50	2487.44	8.1037
8.24	627.23	28207.59	91.8963

HPLC Chromatogram for **3ac**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95: 5	Detector: UV 246 nm



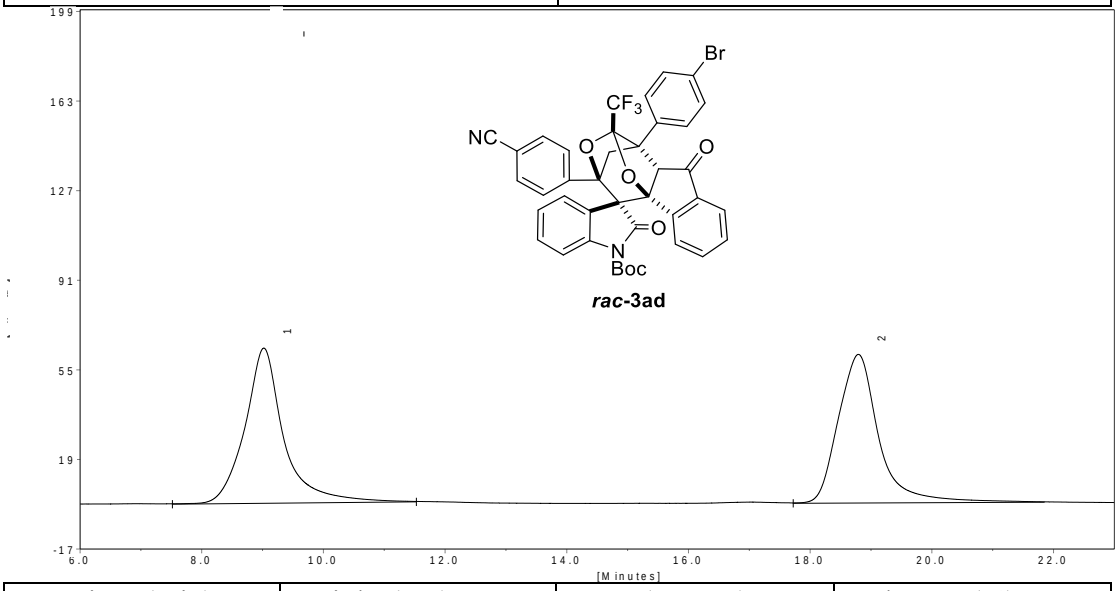
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.69	248.01	5726.70	49.9672
8.81	193.28	5734.21	50.0328



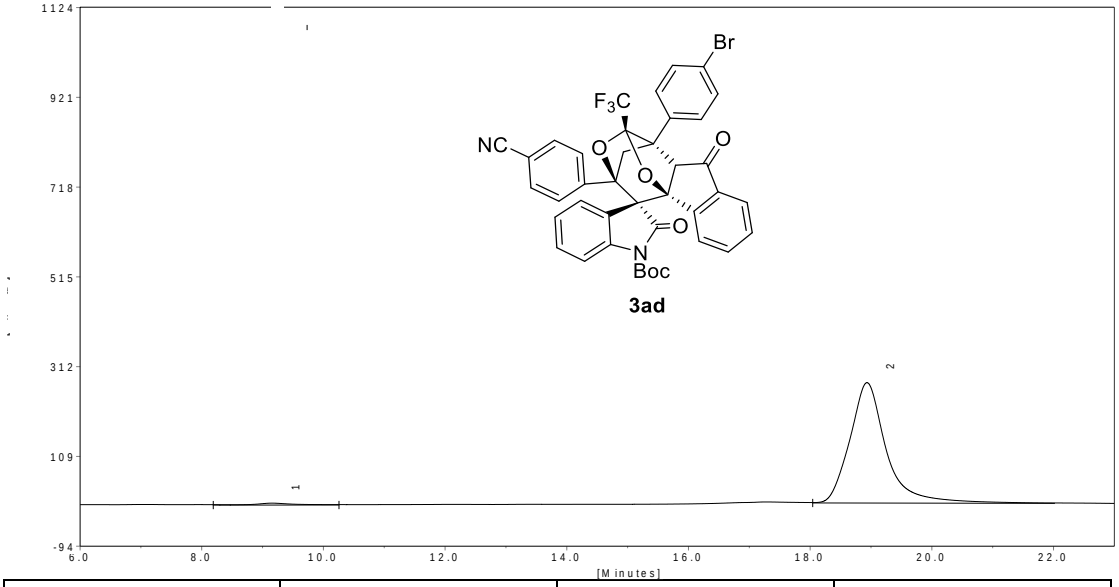
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.71	72.97	2317.94	8.8132
8.57	780.32	23982.73	91.1868

HPLC Chromatogram for **3ad**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 90: 10	Detector: UV 246 nm



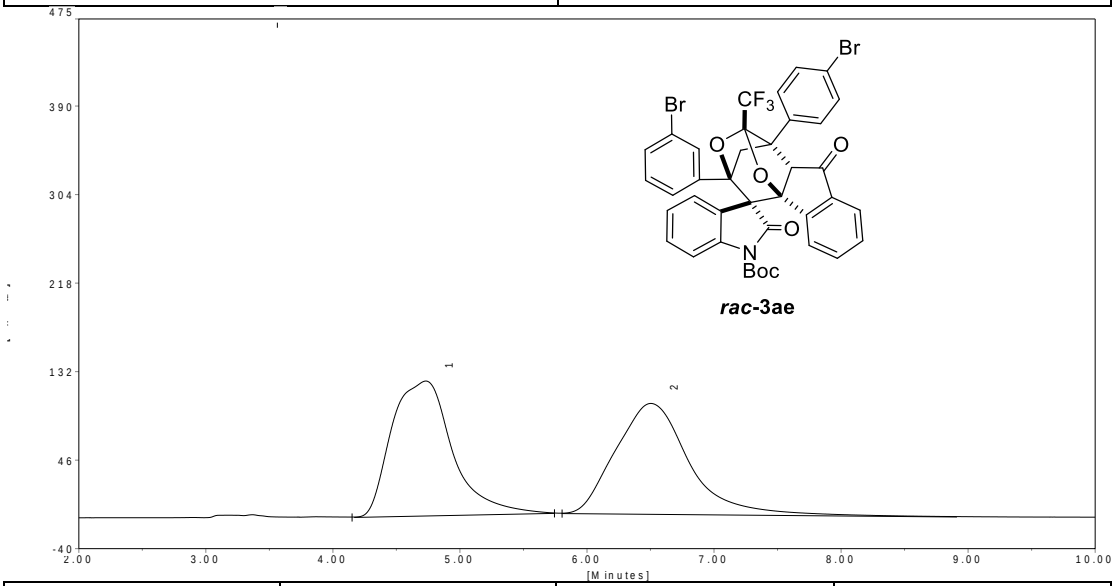
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
9.02	62.22	2740.41	50.0451
18.79	59.57	2735.47	49.9549



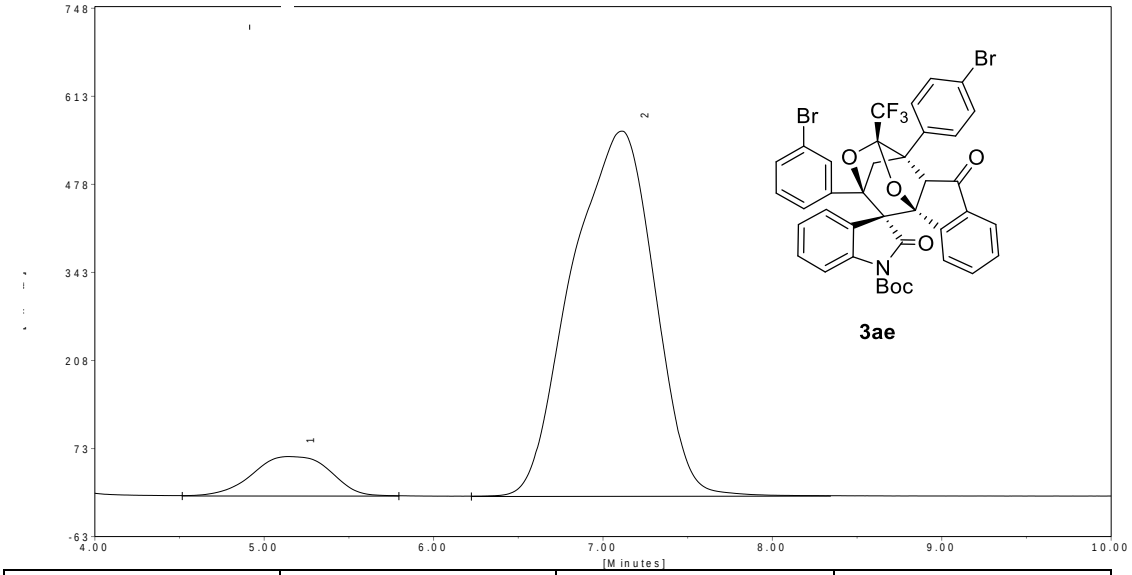
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
9.16	3.38	101.60	0.9003
18.93	271.44	11182.96	99.0997

HPLC Chromatogram for **3ae**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95: 5	Detector: UV 246 nm



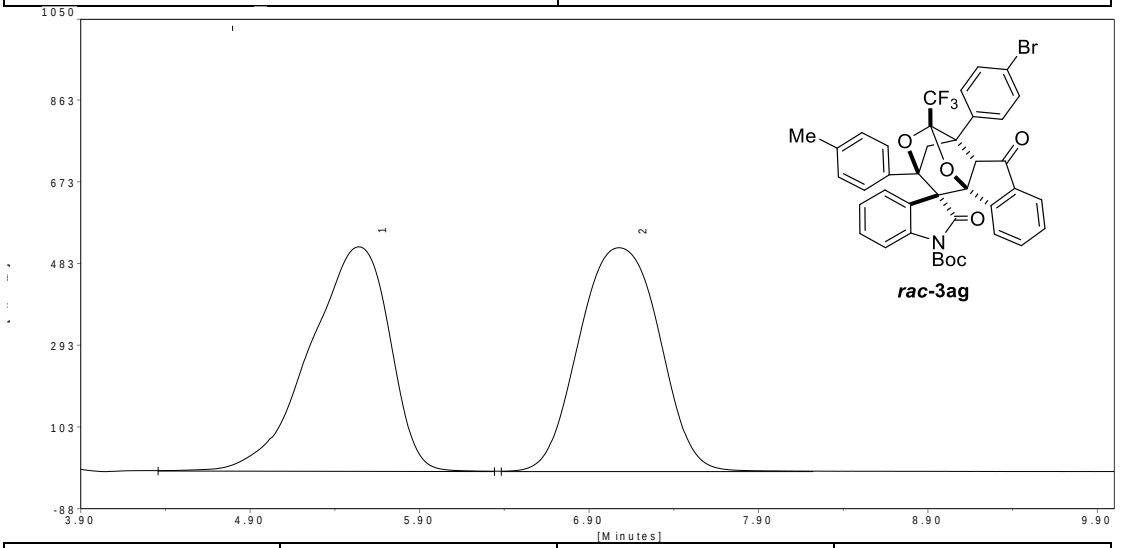
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
4.73	132.13	4539.39	49.1617
6.50	110.36	4694.19	50.8383



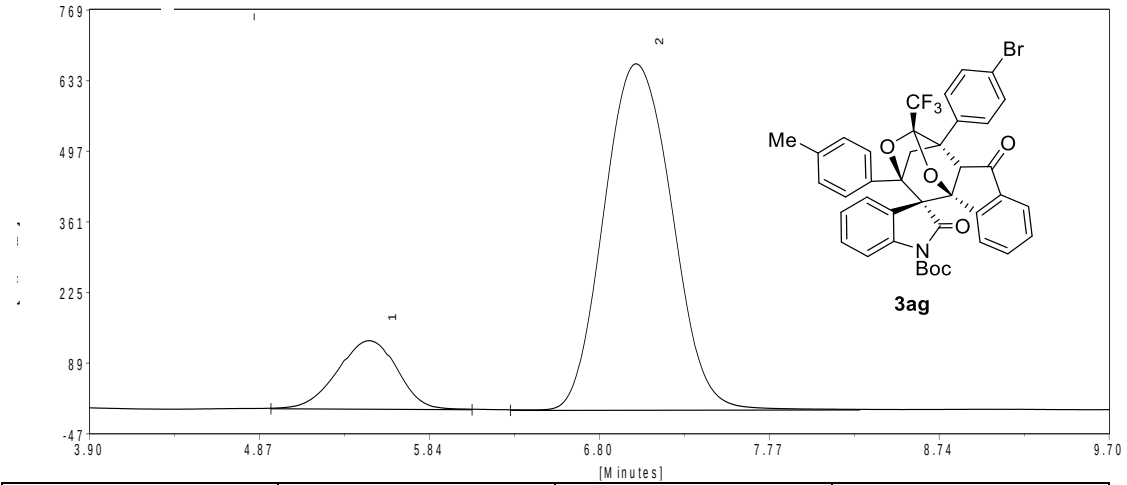
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.14	59.94	1889.23	9.0818
7.11	559.24	18913.15	90.9182

HPLC Chromatogram for **3ag**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95: 5	Detector: UV 246 nm



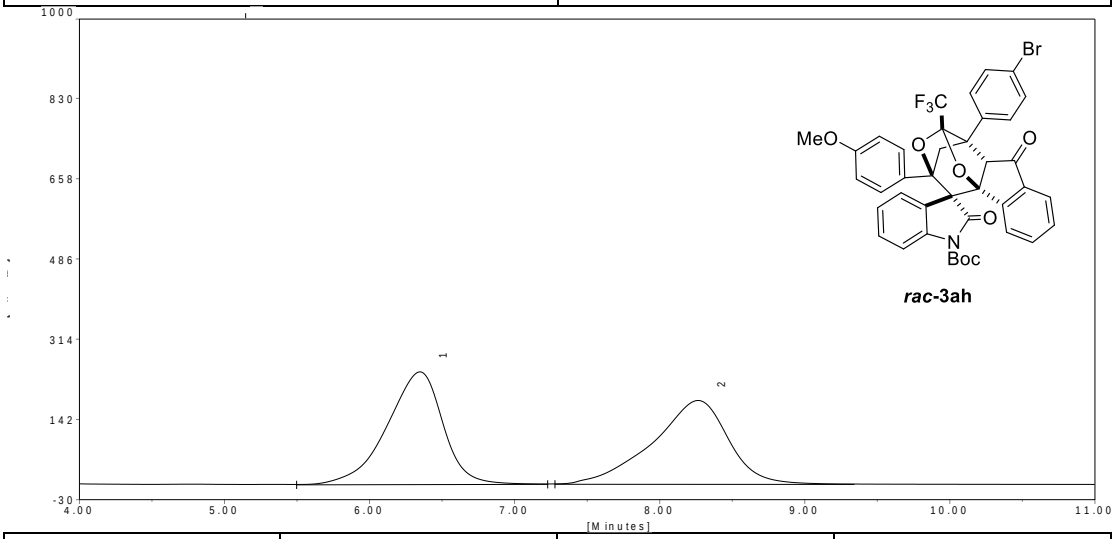
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.54	520.92	16998.70	49.9007
7.08	519.41	17066.35	50.0993



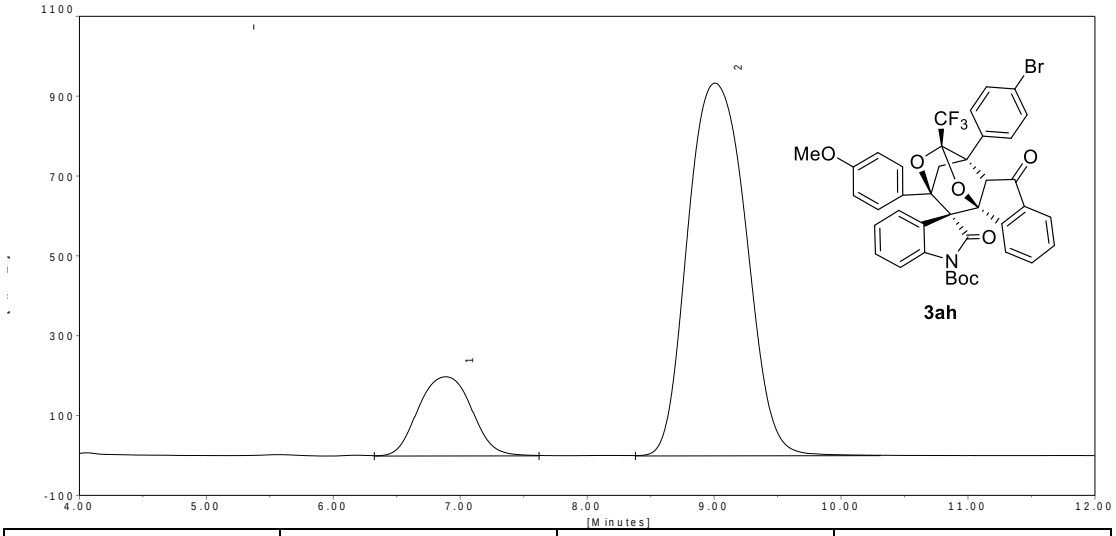
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.49	130.89	3086.93	14.7378
7.01	665.89	17858.78	85.2622

HPLC Chromatogram for **3ah**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95: 5	Detector: UV 246 nm



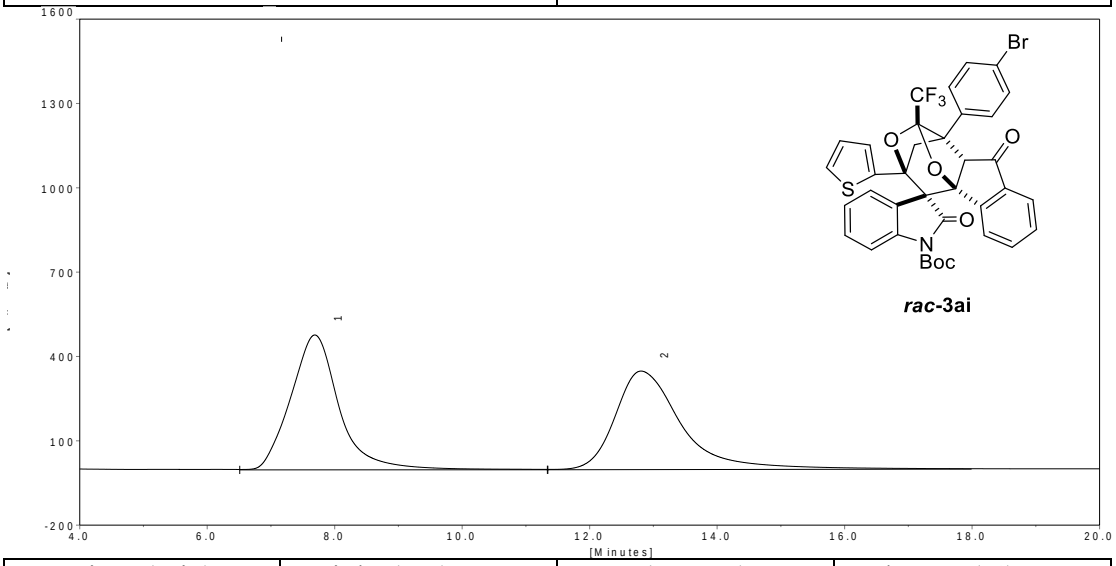
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
6.35	240.73	6438.76	49.9649
8.26	178.93	6447.80	50.0351



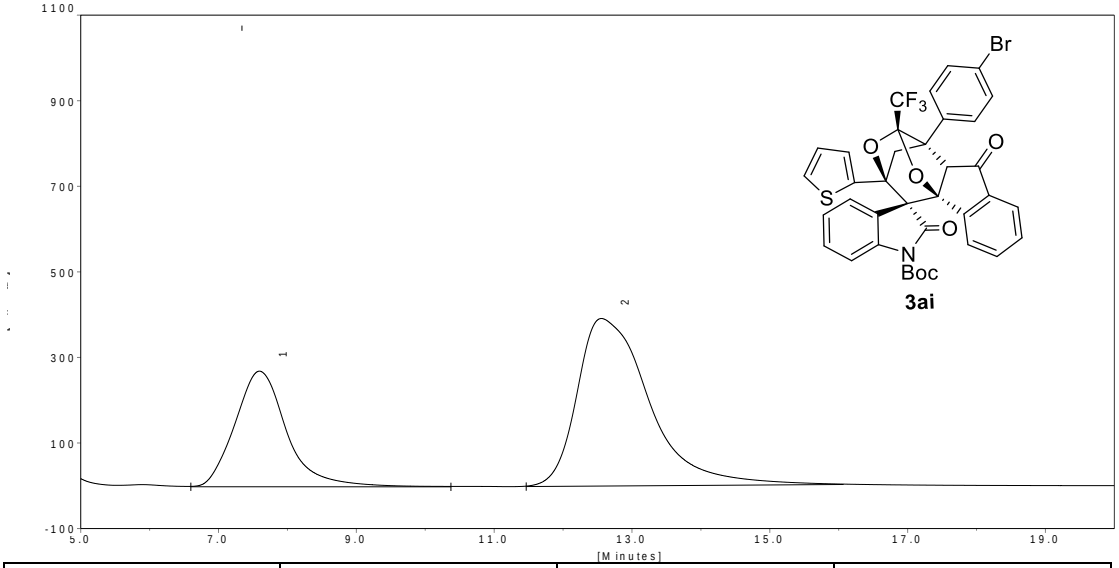
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
6.89	197.48	5728.72	16.1475
9.01	932.90	29748.74	83.8525

HPLC Chromatogram for **3ai**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 98: 2	Detector: UV 246 nm



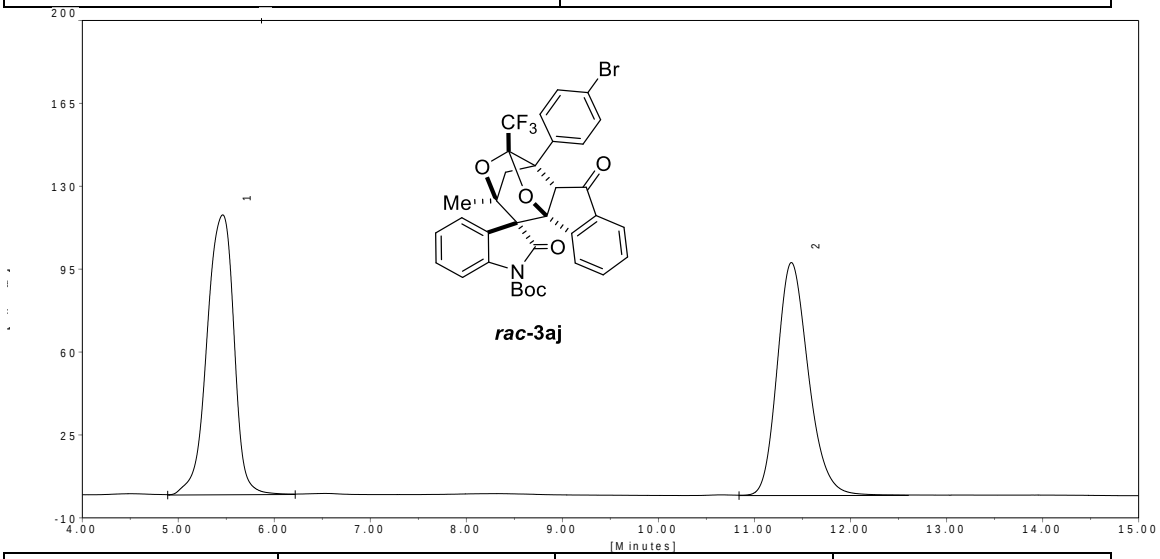
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.69	478.15	24901.30	50.0539
12.81	348.55	24847.68	49.9461



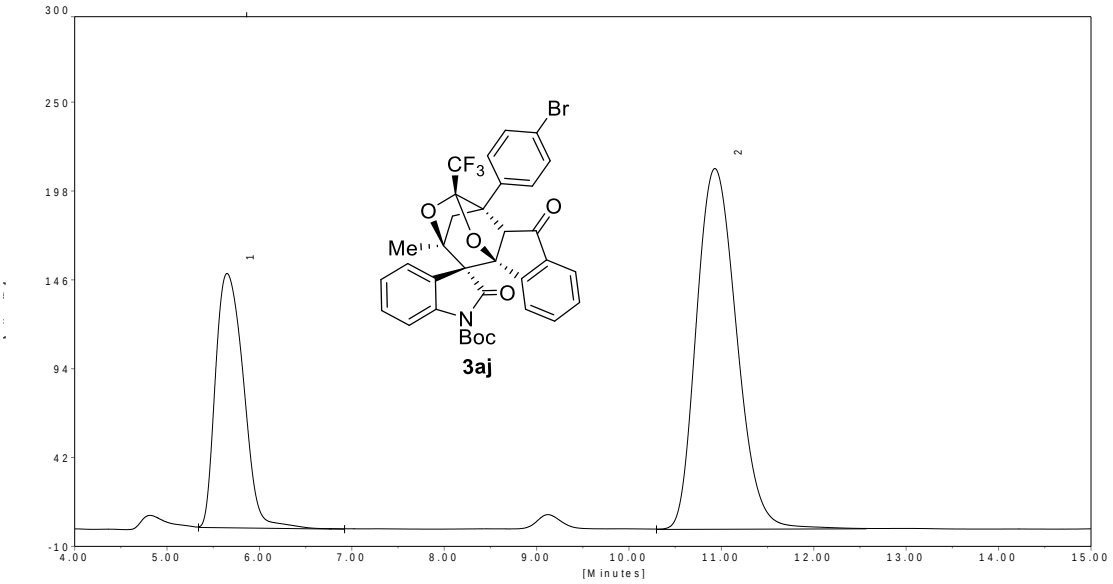
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.59	269.34	13920.60	32.9209
12.56	390.68	28364.34	67.0791

HPLC Chromatogram for **3aj**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex:IPA=95:5	Detector: UV 241 nm



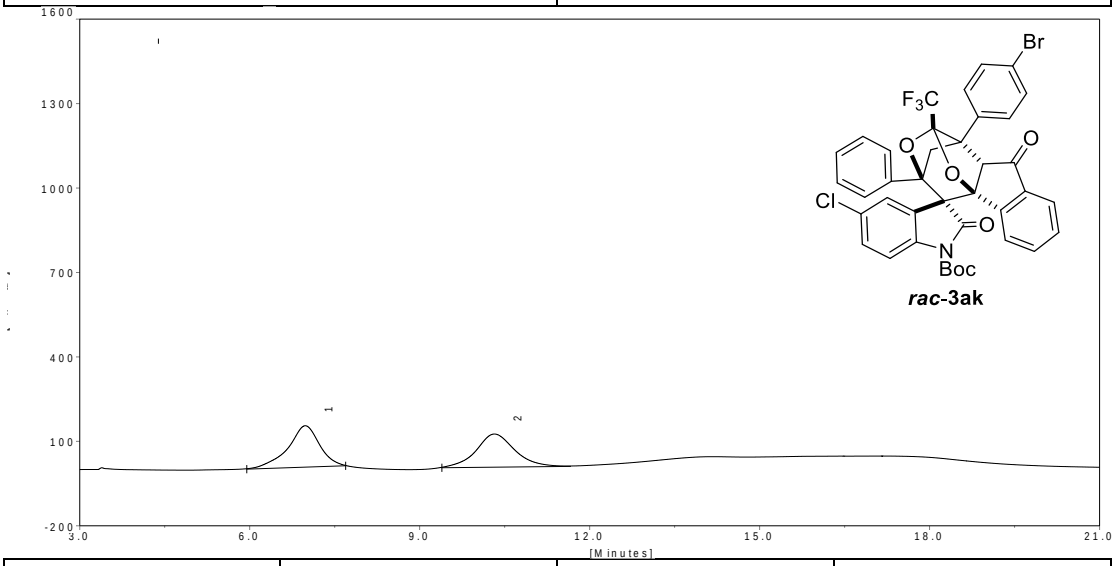
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.46	118.04	2298.81	50.9404
11.38	98.20	2213.93	49.0596



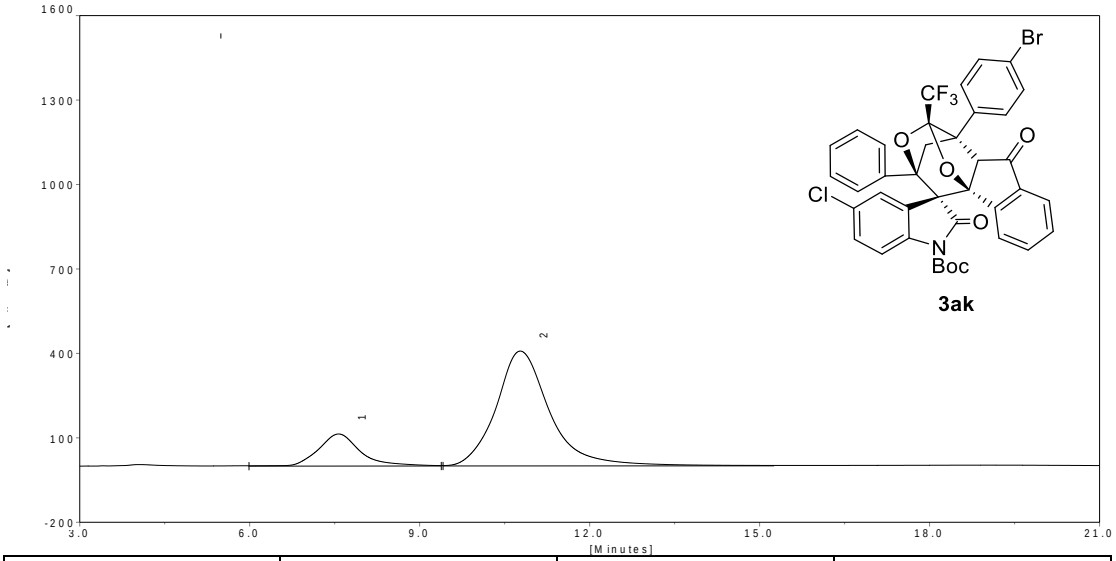
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.65	148.62	3120.74	32.9345
10.93	210.93	6354.88	67.0655

HPLC Chromatogram for **3ak**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 98: 2	Detector: UV 246 nm



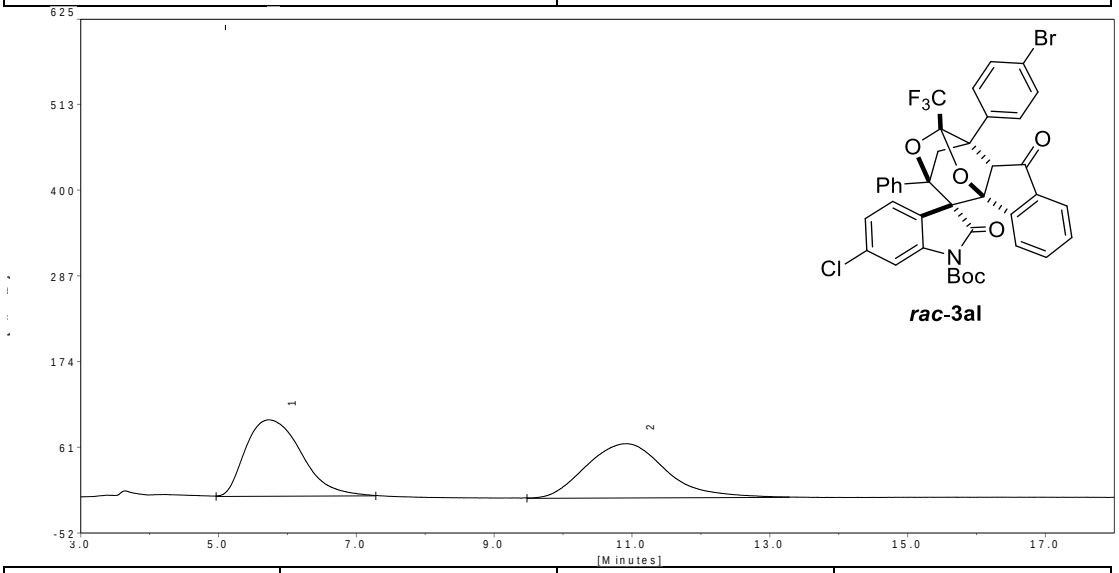
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
6.98	145.75	5565.29	50.6782
10.32	116.49	5416.33	49.3218



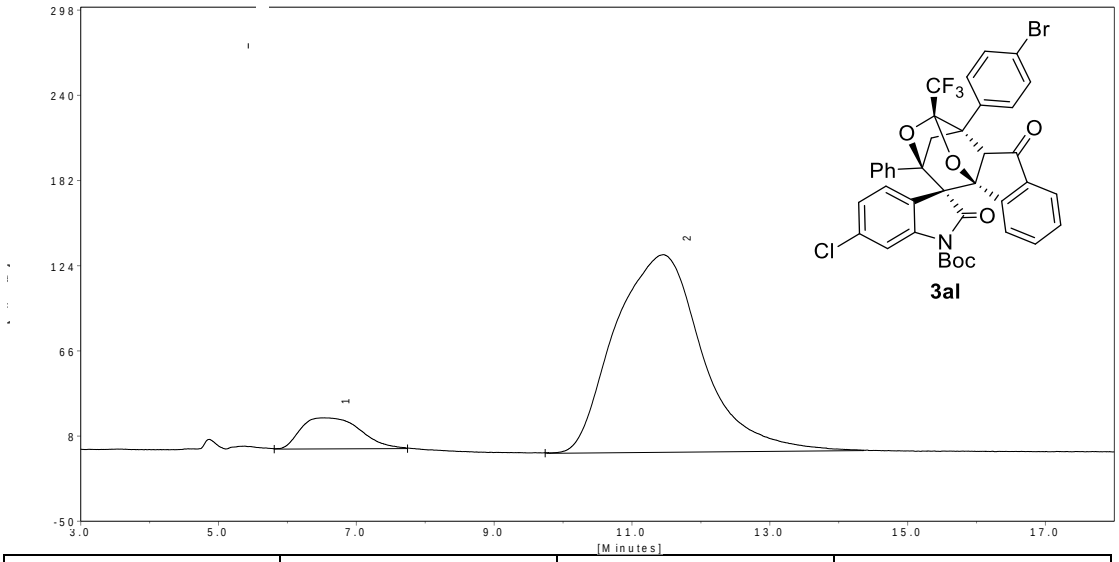
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.57	112.58	5584.76	17.3961
10.78	406.67	26518.82	82.6039

HPLC Chromatogram for **3al**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 98: 2	Detector: UV 246 nm



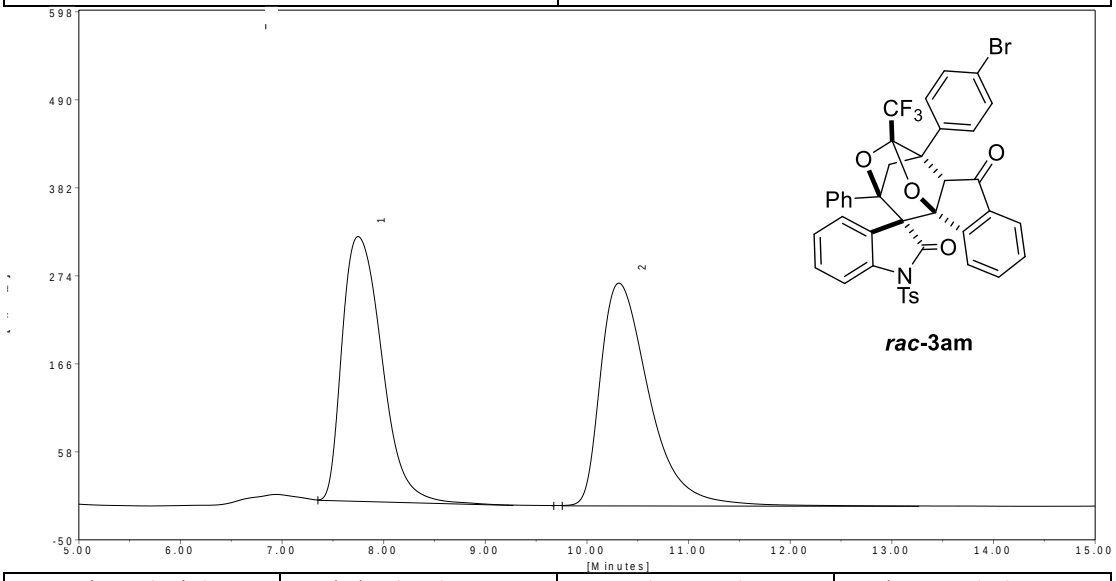
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
5.72	100.18	5616.95	49.9638
10.92	70.94	5625.09	50.0362



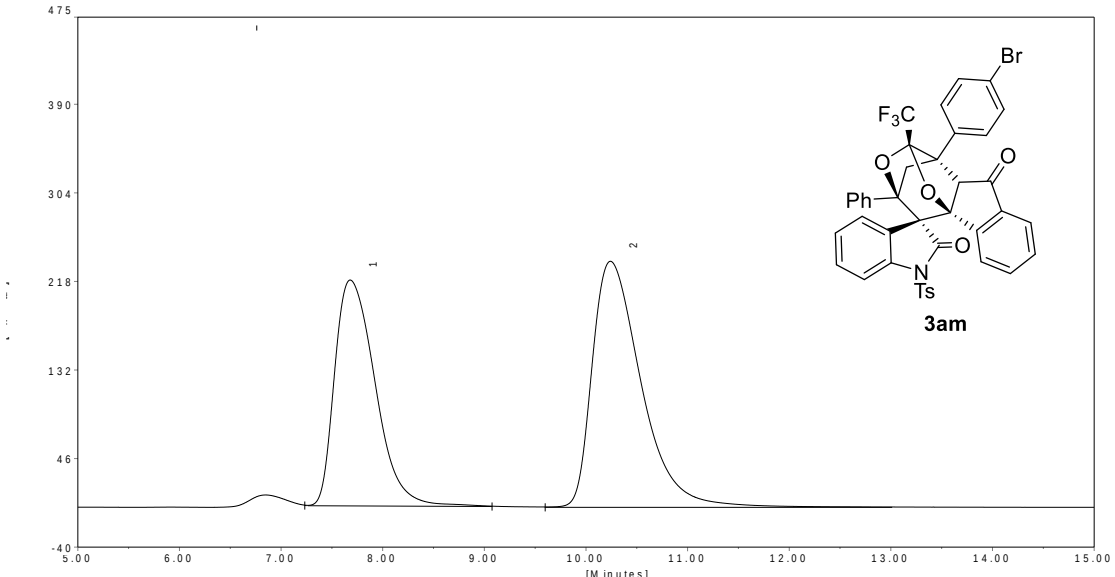
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
6.50	20.86	1231.48	9.4235
11.46	134.20	11836.80	90.5765

HPLC Chromatogram for **3am**

Column: chiralpak IB	Flow rate: 1.0 ml/min
Solvent: Hex:IPA=80:20	Detector: UV 246 nm



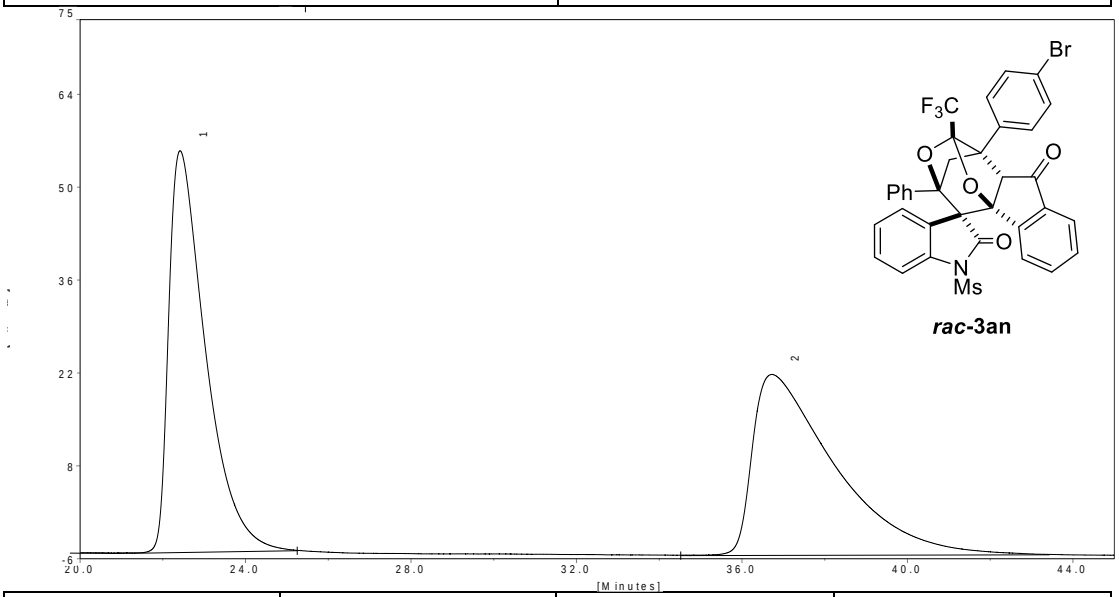
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.75	324.41	8750.93	49.1719
10.31	273.00	9045.68	50.8281



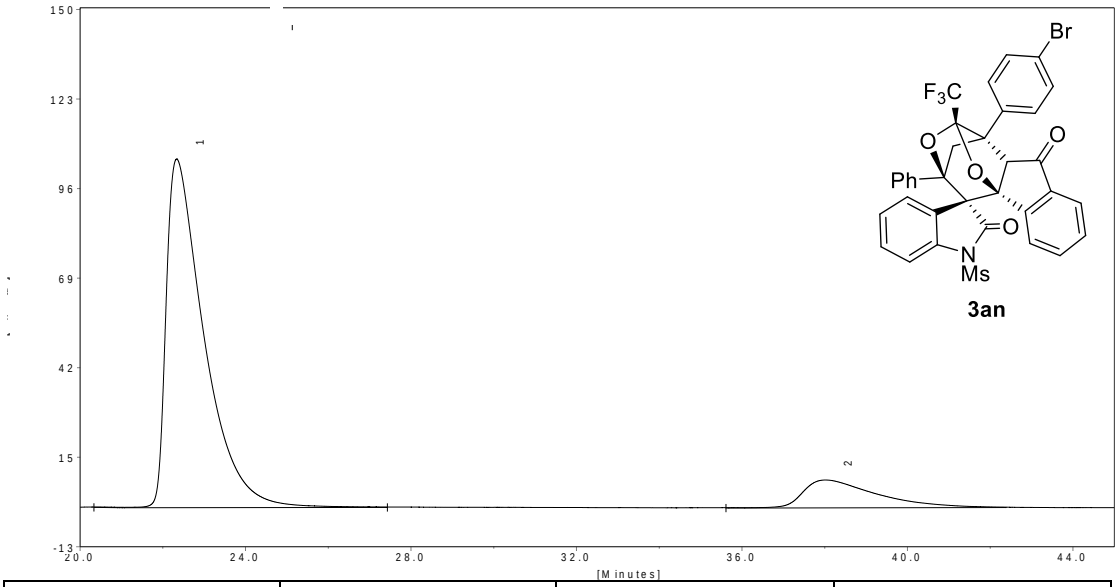
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.68	218.78	6030.72	43.1712
10.24	238.56	7938.60	56.8288

HPLC Chromatogram for **3an**

Column: chiralpak IB	Flow rate: 1.0 ml/min
Solvent: Hex:IPA=80:20	Detector: UV 246 nm



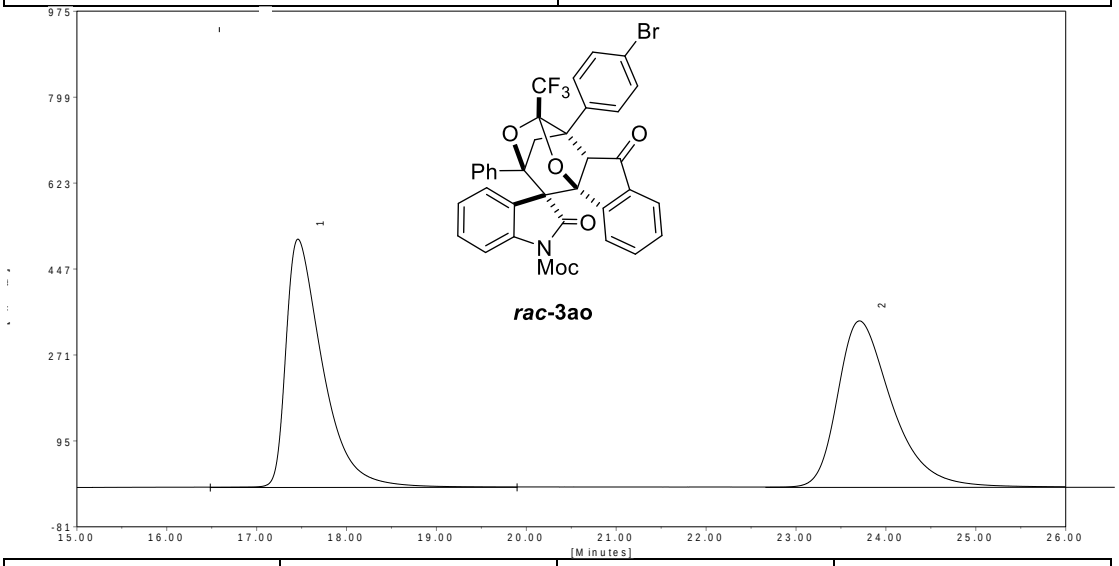
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
22.42	60.42	3715.95	49.8213
36.72	27.21	3742.61	50.1787



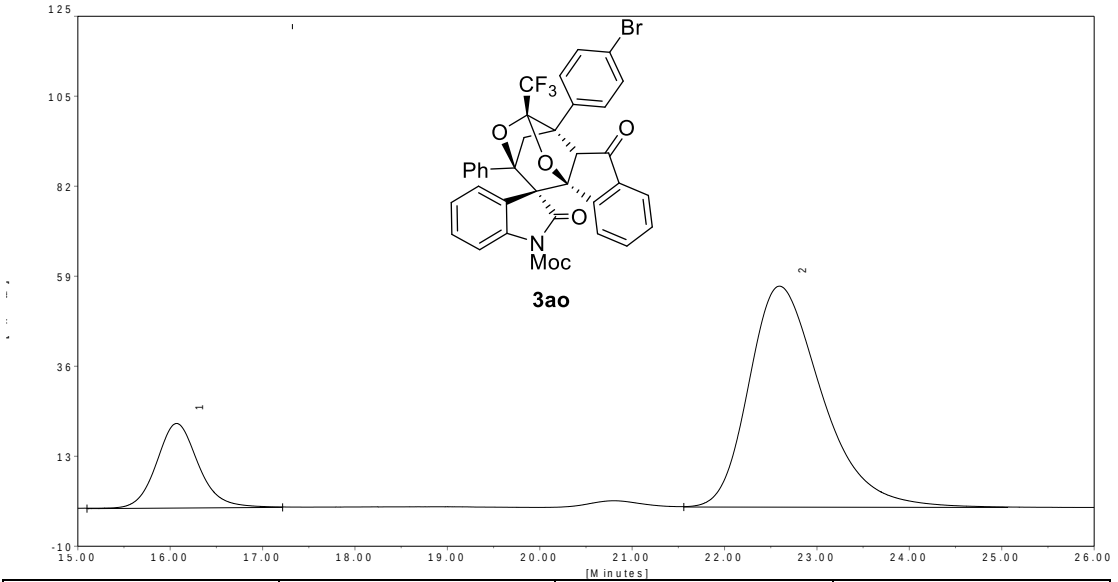
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
22.33	104.93	6619.58	86.9557
38.00	8.29	993.01	13.0443

HPLC Chromatogram for **3ao**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex:IPA=95:5	Detector: UV 246 nm



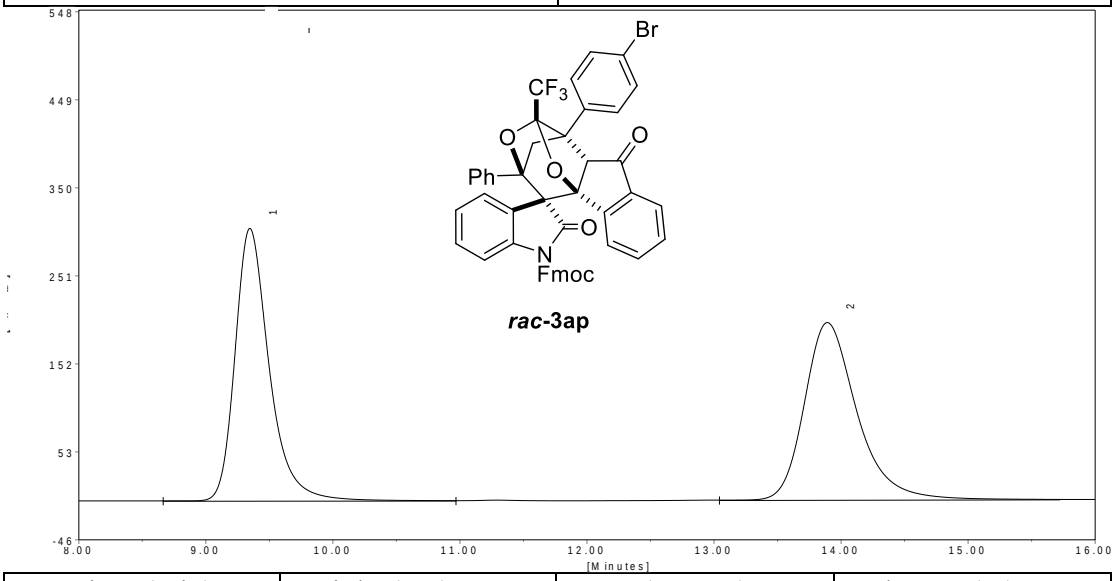
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
17.46	508.00	14301.21	50.0350
23.71	340.26	14281.18	49.9650



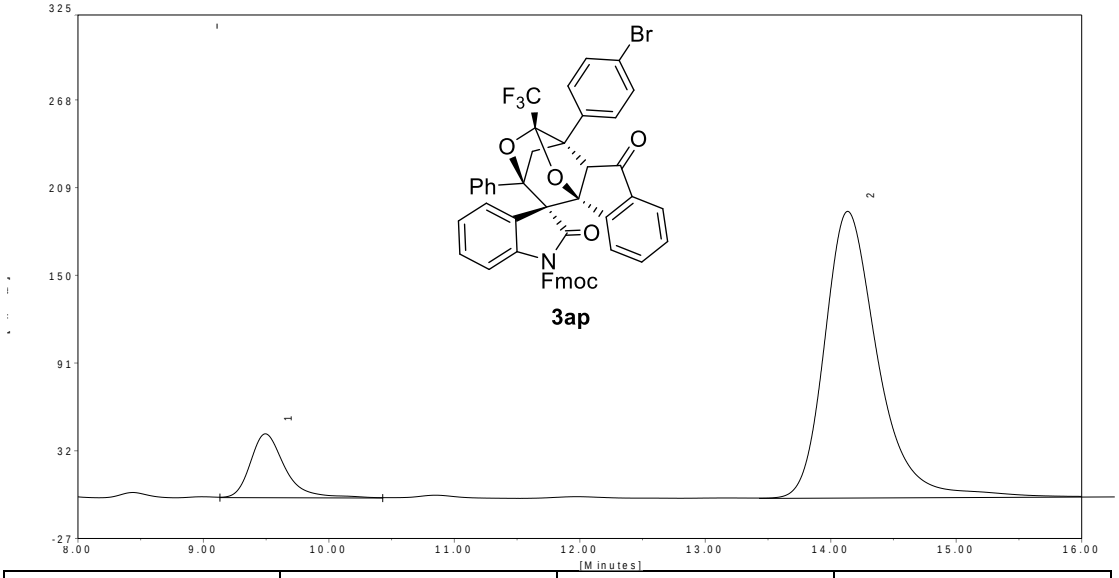
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
16.07	21.51	670.09	17.8569
22.60	56.36	3082.47	82.1431

HPLC Chromatogram for **3ap**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex:IPA=85:15	Detector: UV 246 nm



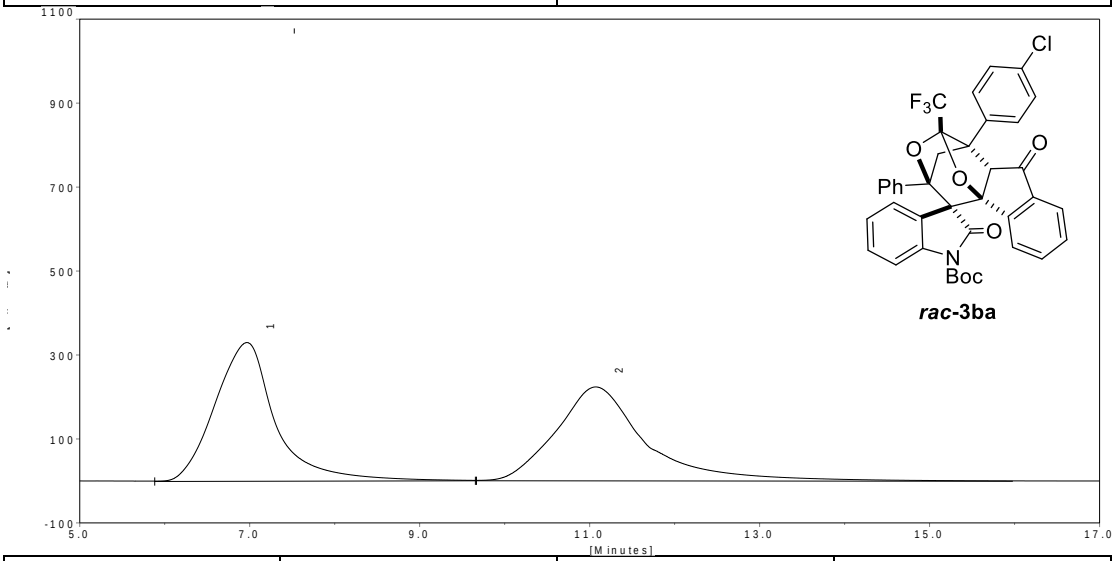
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
9.35	306.47	5722.16	49.9504
13.89	199.50	5733.52	50.0496



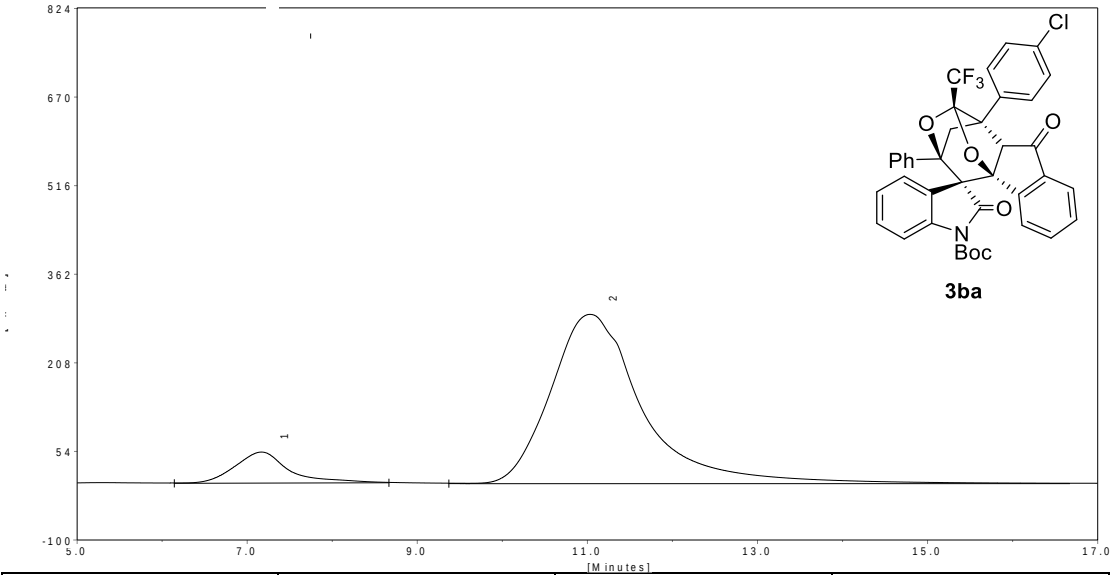
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
9.49	42.72	805.68	12.4821
14.14	192.59	5648.99	87.5179

HPLC Chromatogram for **3ba**

Column: chiralpak IA	Flow rate: 0.8 ml/min
Solvent: Hex: EtOH = 98:2	Detector: UV 246 nm



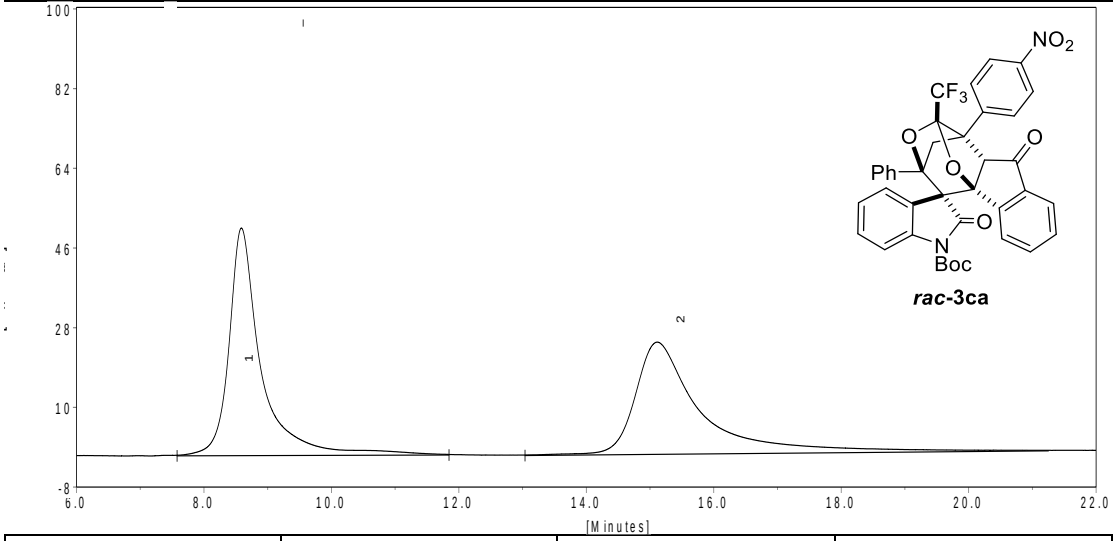
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
6.97	329.49	16209.50	50.0869
11.07	222.79	16153.28	49.9131



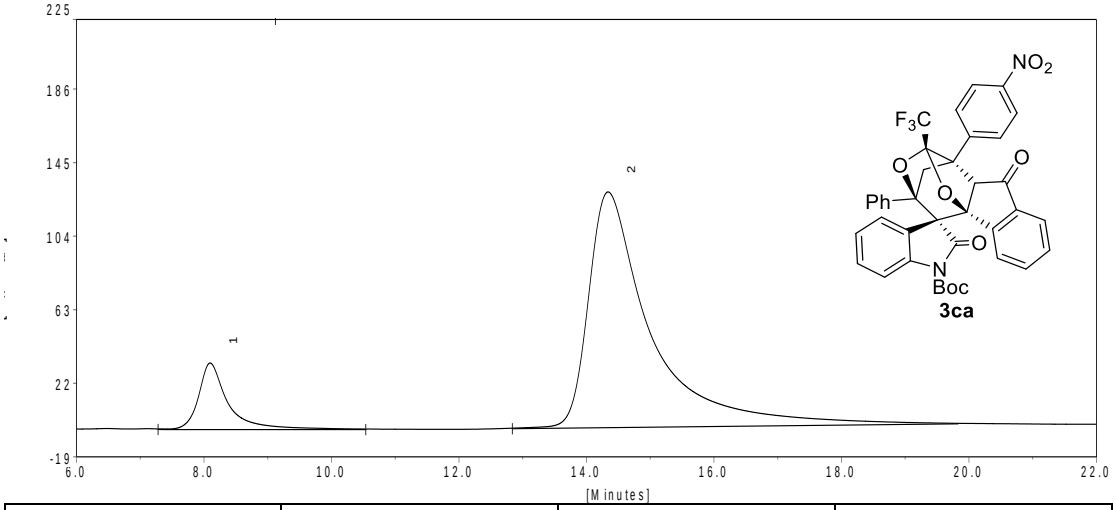
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.17	53.29	2299.49	9.4650
11.03	293.45	21995.19	90.5350

HPLC Chromatogram for **3ca**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95:5	Detector: UV 246 nm



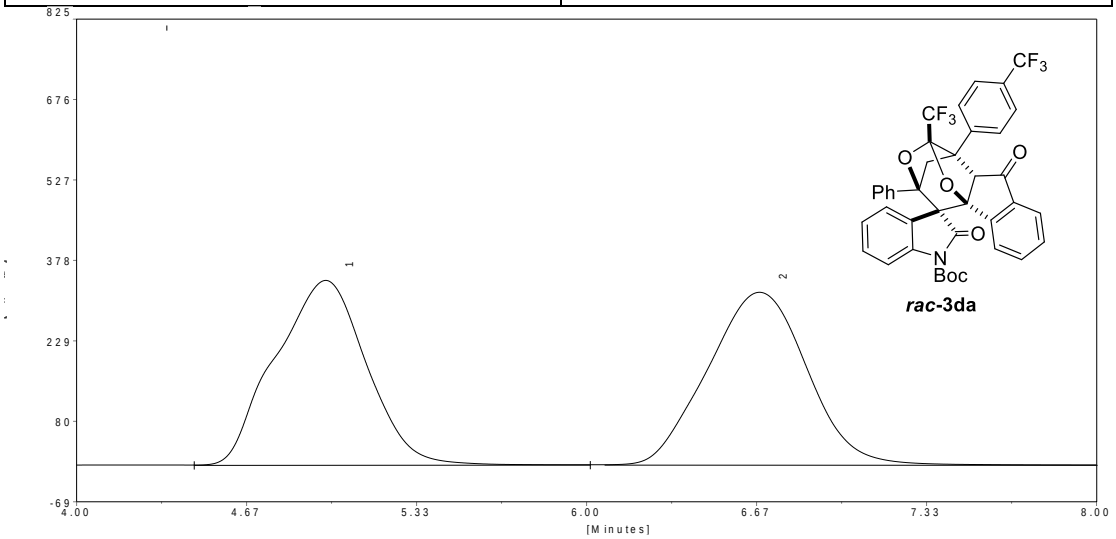
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
8.34	16.70	1786.19	50.0771
15.12	25.23	1780.69	49.9229



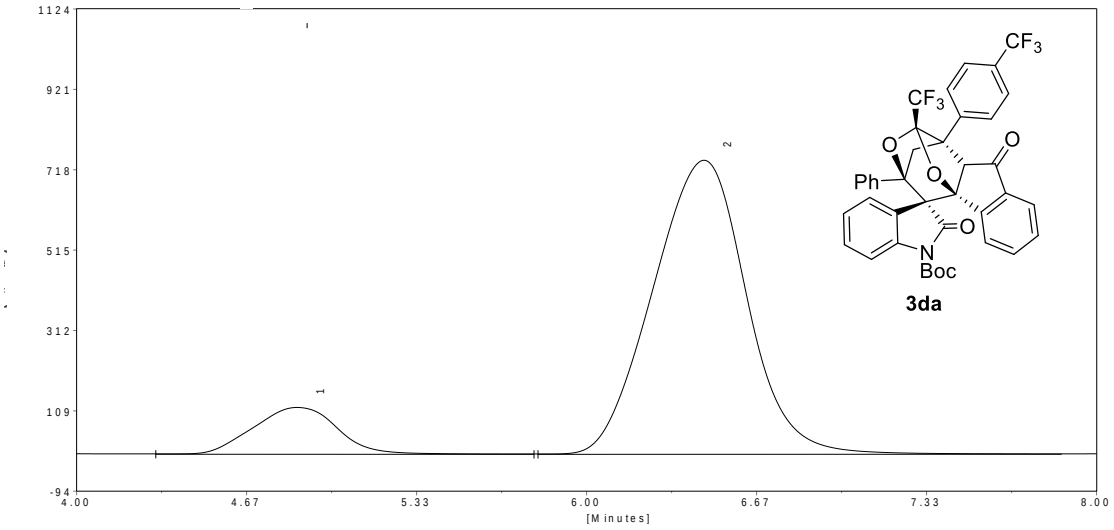
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
8.10	36.73	1145.16	11.3935
14.34	131.08	8905.78	88.6065

HPLC Chromatogram for **3da**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95:5	Detector: UV 246 nm



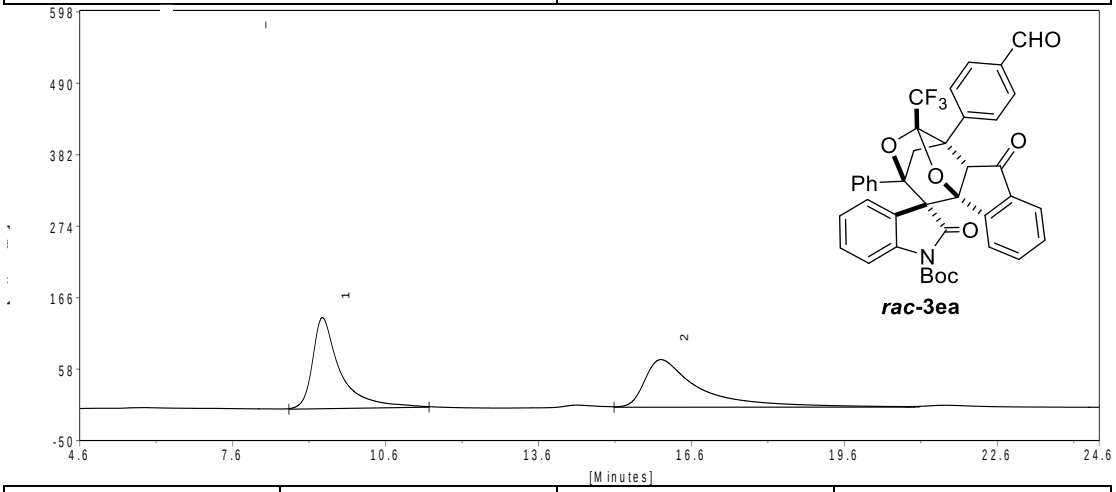
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
4.46	4.98	341.75	49.5791
6.07	6.68	319.44	50.4209



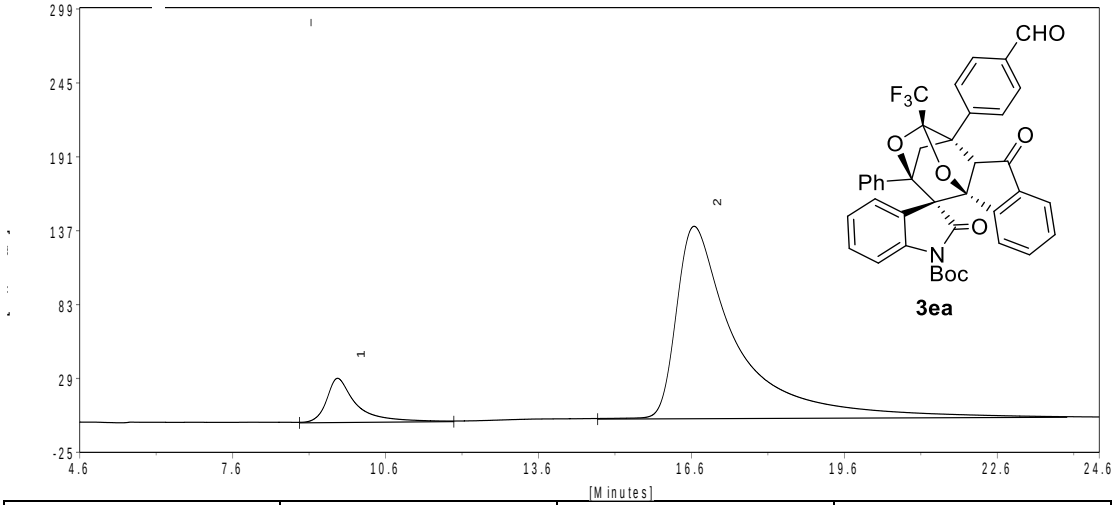
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
4.87	117.32	2659.29	12.3541
6.46	741.76	18866.19	87.6459

HPLC Chromatogram for **3ea**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: EtOH = 95:5	Detector: UV 246 nm



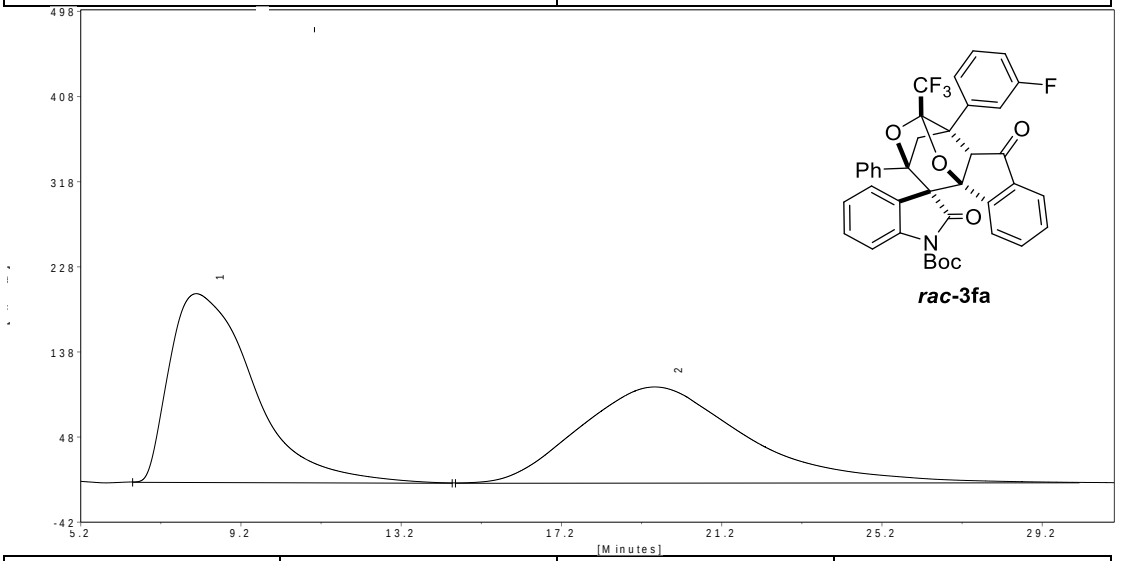
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
9.36	136.93	5088.35	50.0700
16.00	71.08	5074.12	49.9300



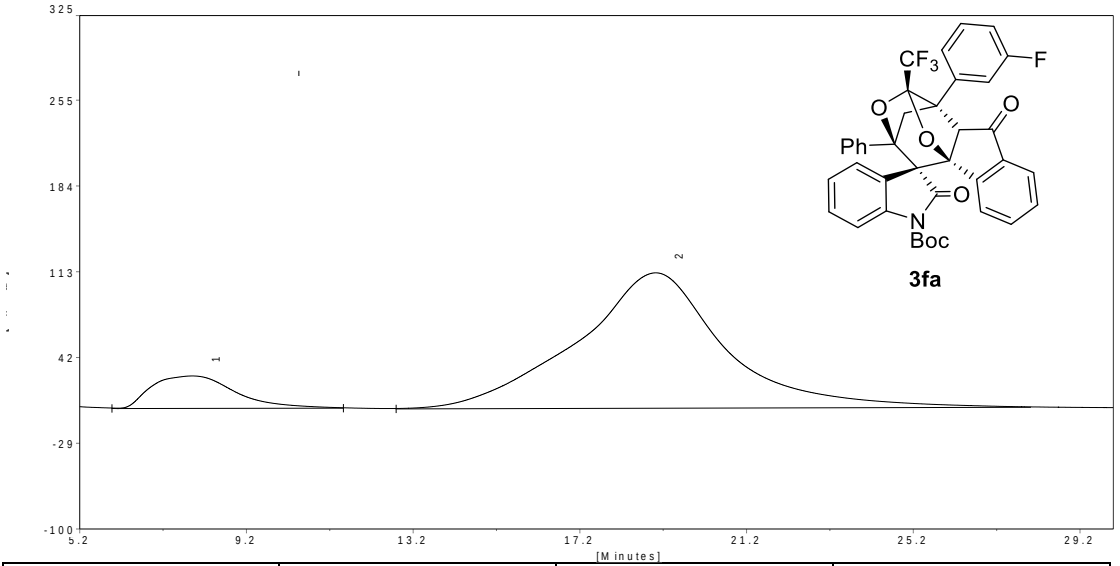
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
9.66	31.94	1255.49	9.8077
16.65	140.19	11545.56	90.1923

HPLC Chromatogram for **3fa**

Column: chiralpak IA	Flow rate: 0.8 ml/min
Solvent: Hex: IPA = 99:1	Detector: UV 246 nm



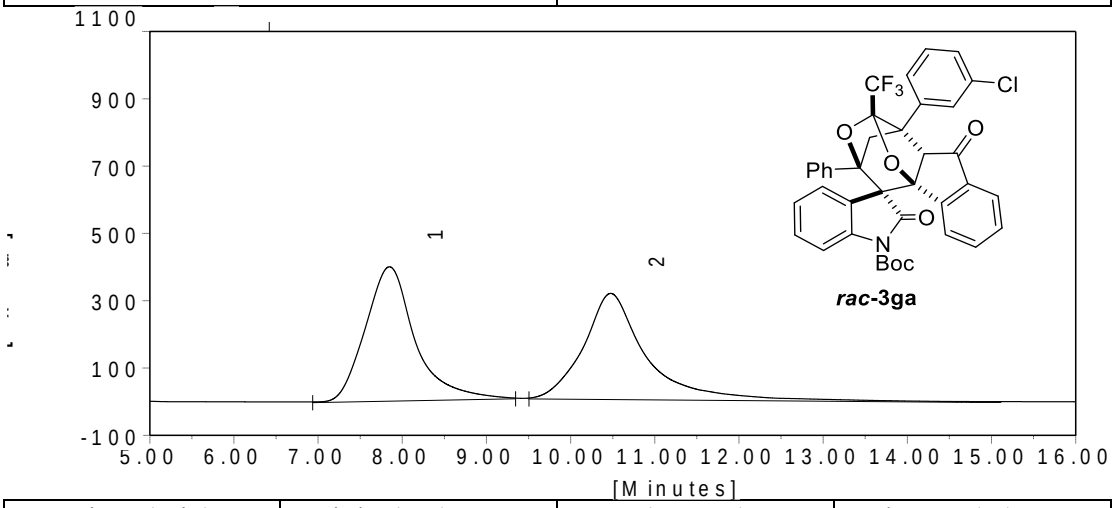
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
8.09	199.25	29006.59	50.0656
19.53	101.26	28930.59	49.9344



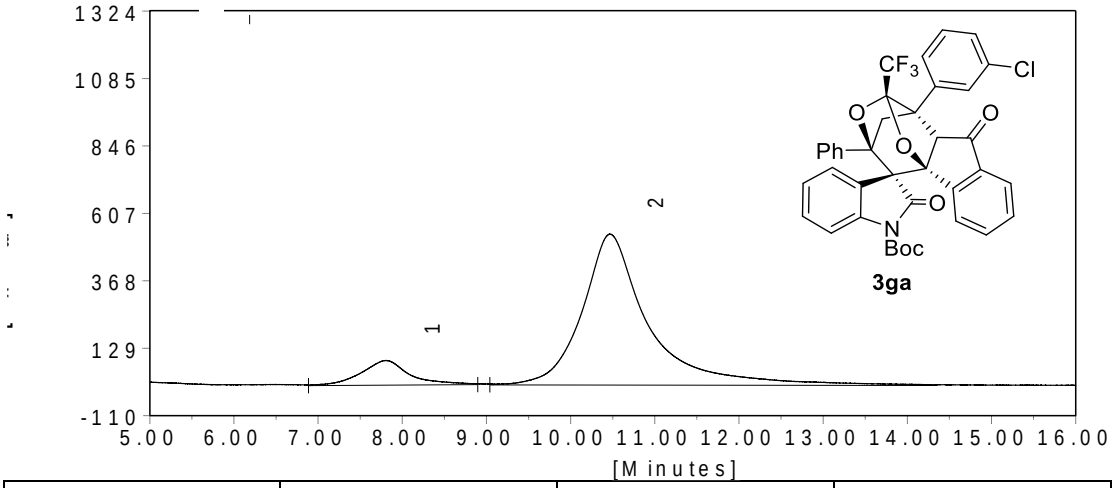
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.90	26.48	3618.58	11.7278
19.01	111.75	27236.05	88.2722

HPLC Chromatogram for **3ga**

Column: chiralpak IA	Flow rate: 0.7 ml/min
Solvent: Hex: EtOH = 98:2	Detector: UV 246 nm



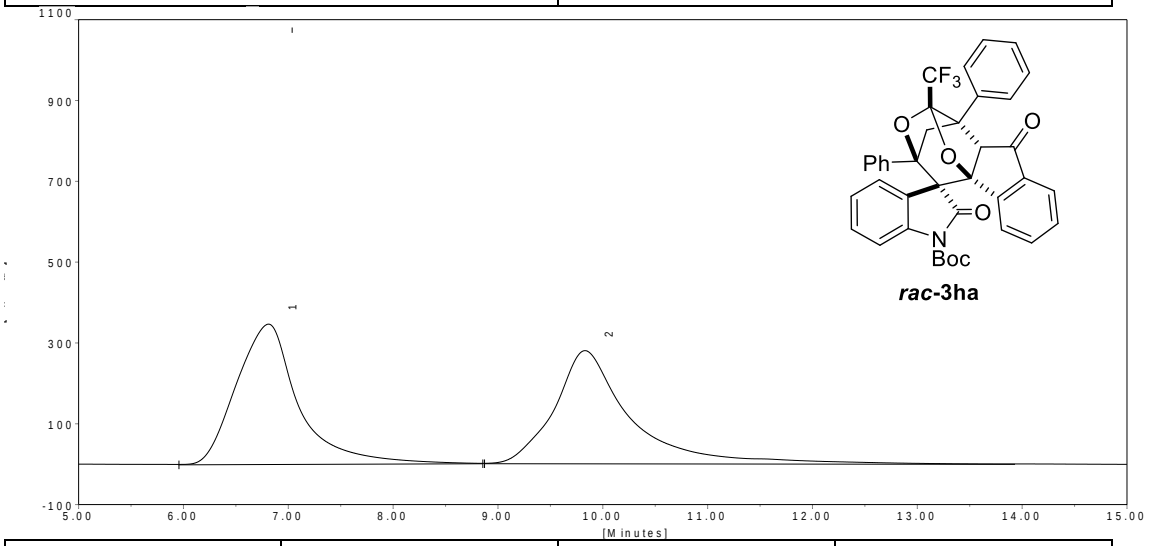
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.85	397.05	16115.25	50.3743
10.48	312.97	15875.75	49.6257



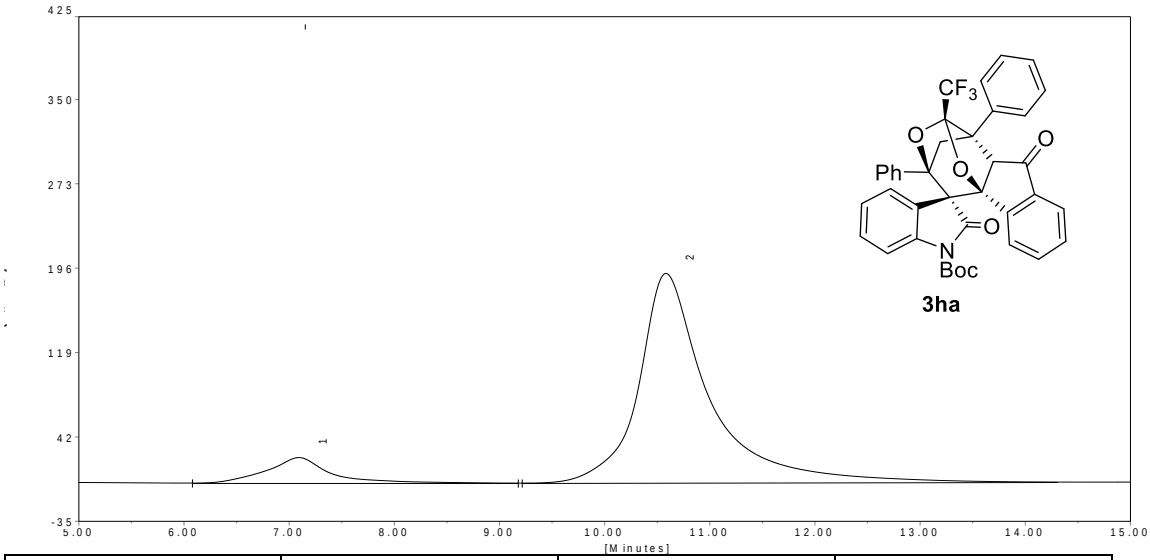
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.81	84.65	3159.01	9.9774
10.46	531.69	28502.74	90.0226

HPLC Chromatogram for **3ha**

Column: chiralpak IA	Flow rate: 0.8 ml/min
Solvent: Hex: EtOH = 98:2	Detector: UV 246 nm



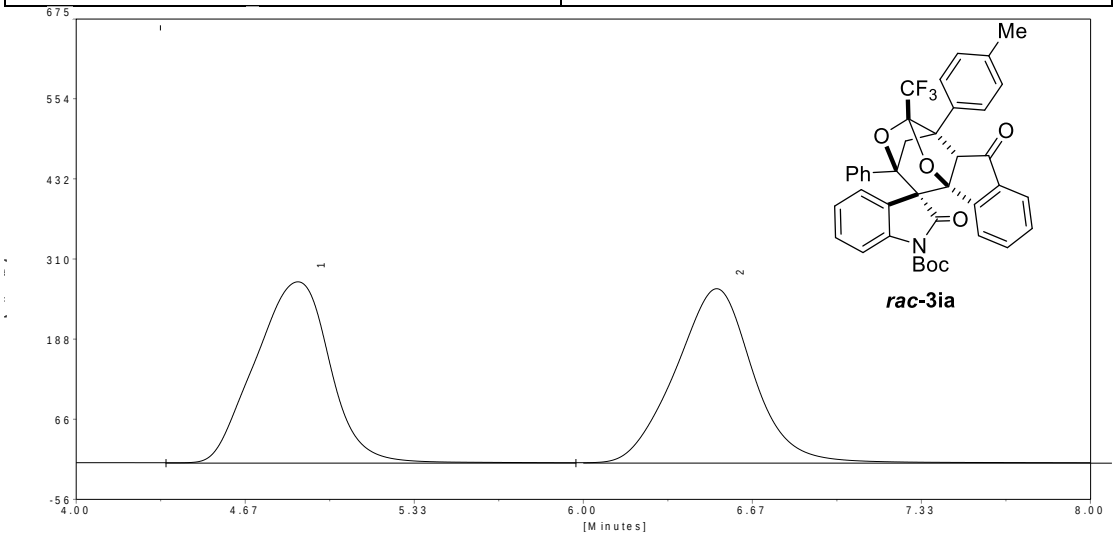
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
6.81	346.35	14208.50	50.3844
9.83	279.11	13991.70	49.6156



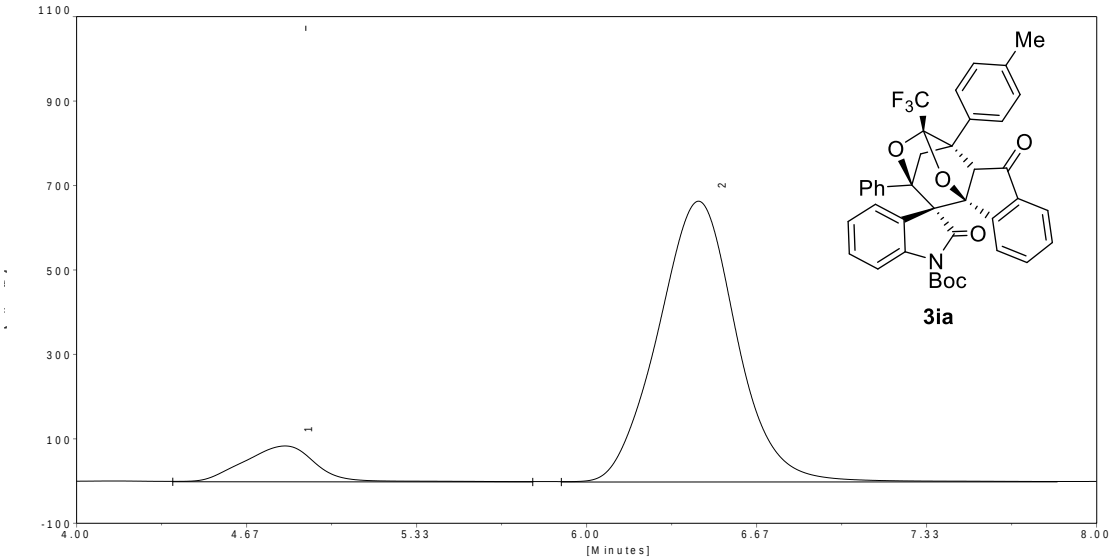
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.09	23.29	973.86	9.8111
10.58	191.06	8952.28	90.1889

HPLC Chromatogram for **3ia**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA = 95:5	Detector: UV 246 nm



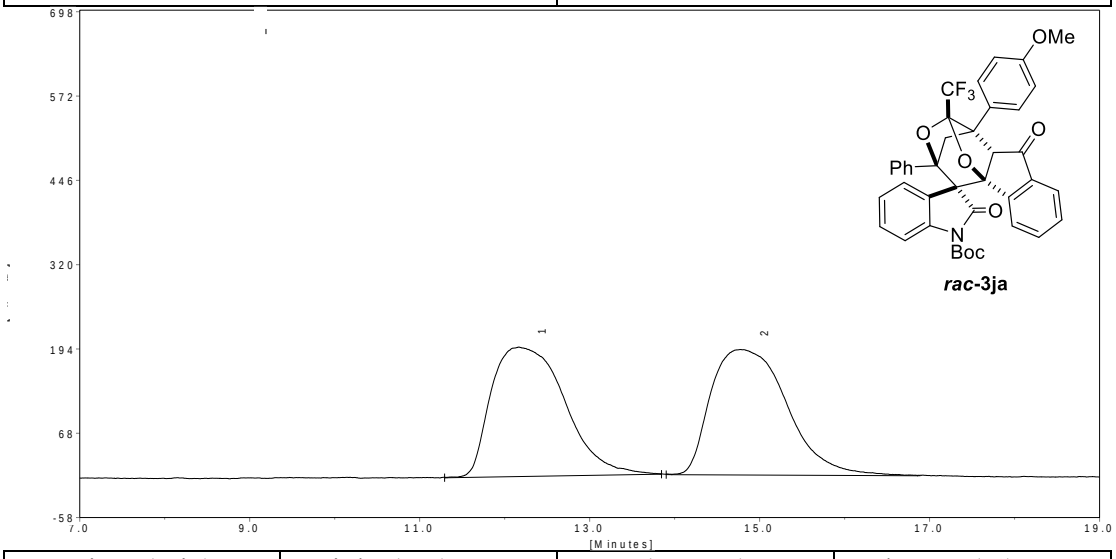
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
4.87	274.27	5530.35	50.4672
6.53	262.36	5427.95	49.5328



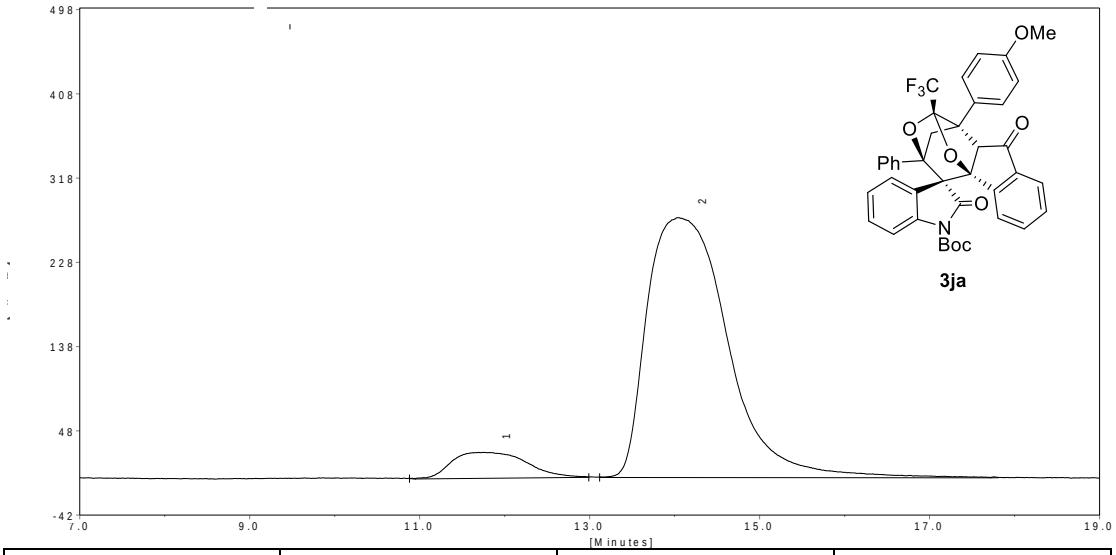
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
4.82	84.00	1596.96	10.1614
6.44	664.03	14118.90	89.8386

HPLC Chromatogram for **3ja**

Column: chiralpak IA	Flow rate: 0.7 ml/min
Solvent: Hex: IPA = 97:3	Detector: UV 246 nm



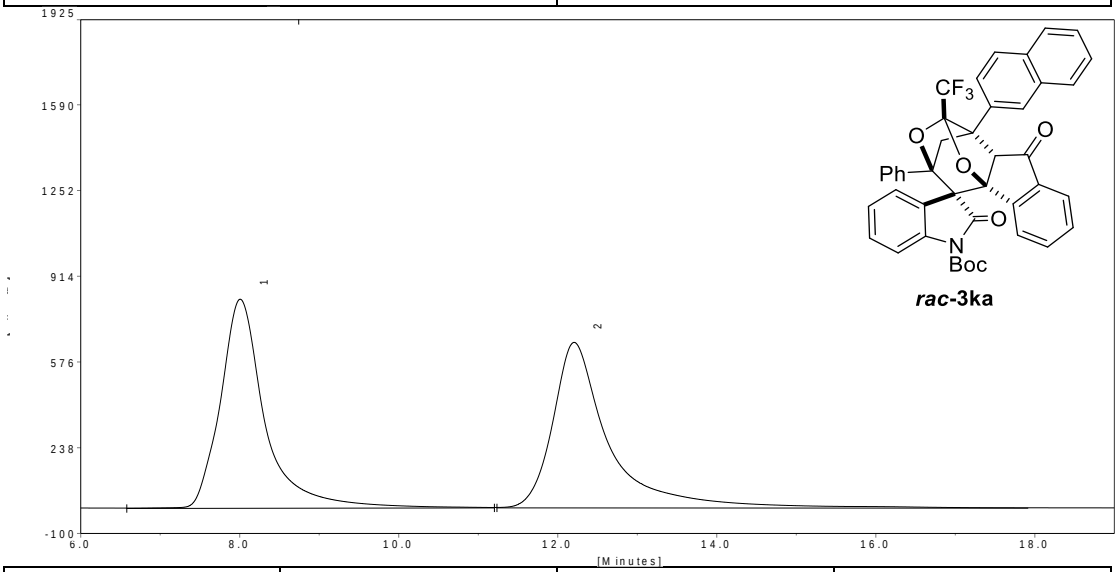
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
12.17	192.78	11541.64	49.9166
14.78	186.90	11580.20	50.0834



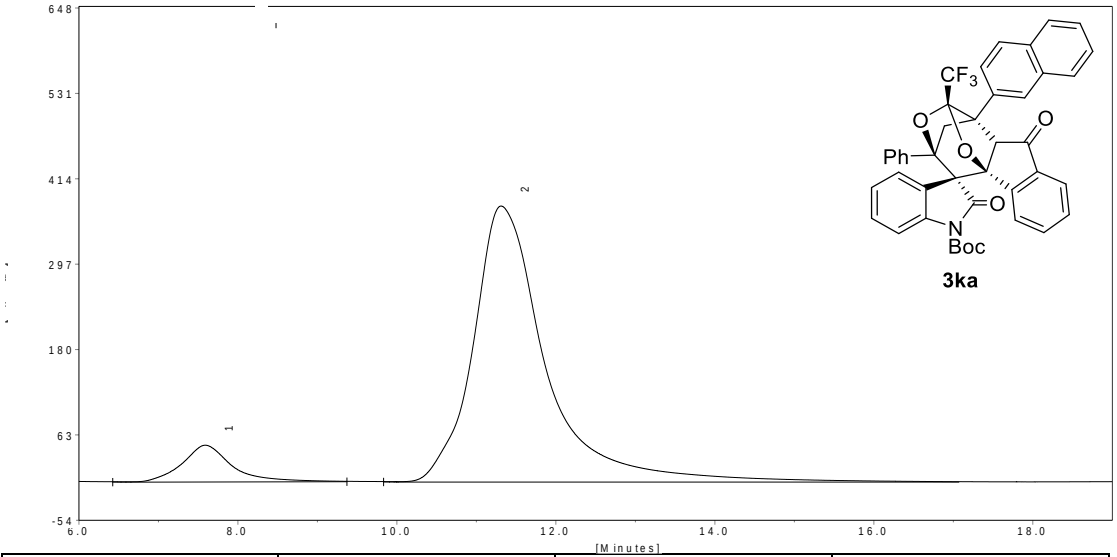
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
11.75	27.13	1617.95	8.1559
14.05	277.10	18219.89	91.8441

HPLC Chromatogram for **3ka**

Column: chiralpak IA	Flow rate: 0.7 ml/min
Solvent: Hex: EtOH = 95:5	Detector: UV 246 nm



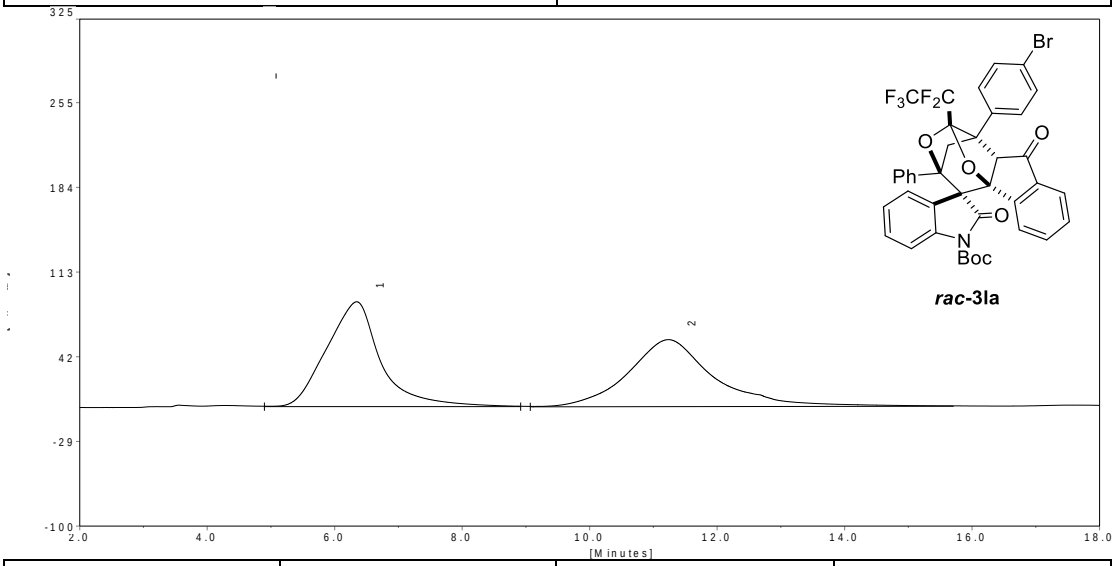
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
8.01	822.63	31873.01	50.0252
12.21	650.87	31840.84	49.9748



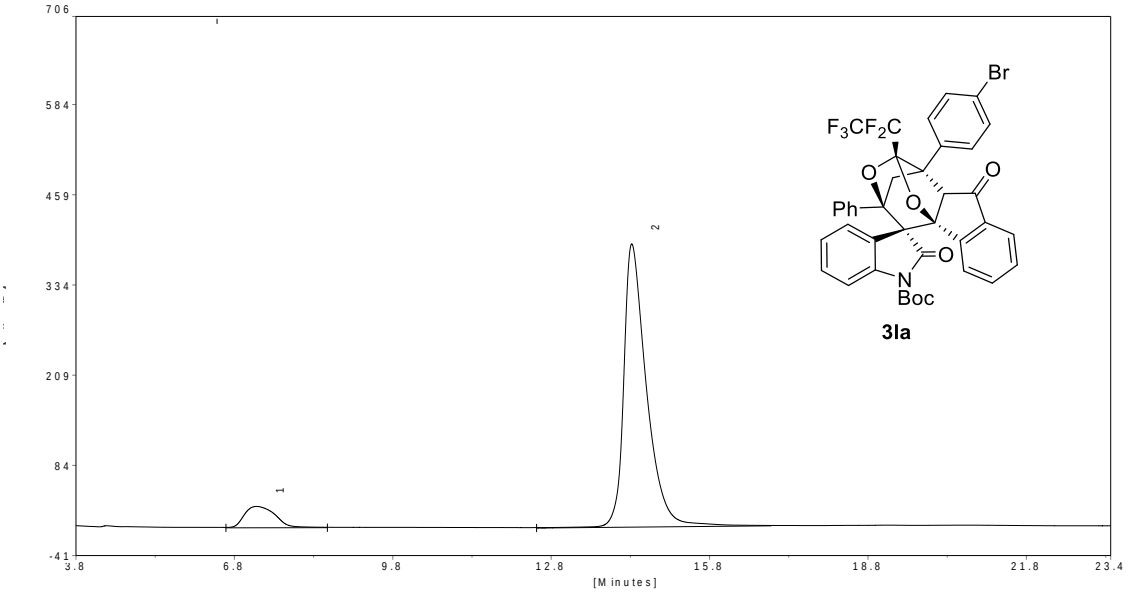
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.59	49.85	2111.82	8.1323
11.31	377.58	23856.37	91.8677

HPLC Chromatogram for **3la**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: EtOH = 99:1	Detector: UV 246 nm



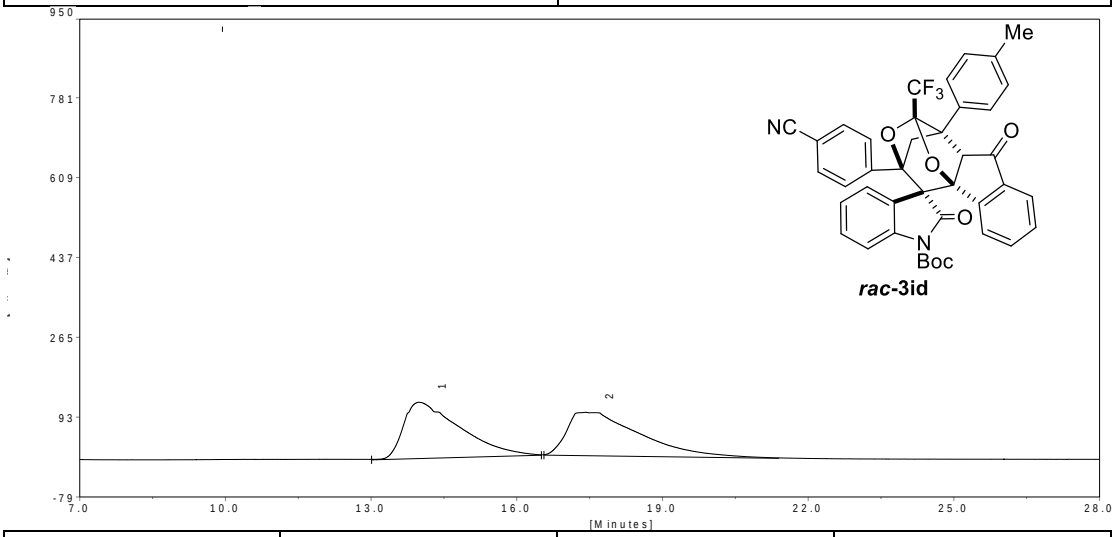
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
6.35	87.58	5128.42	49.9679
11.24	55.82	5135.02	50.0321



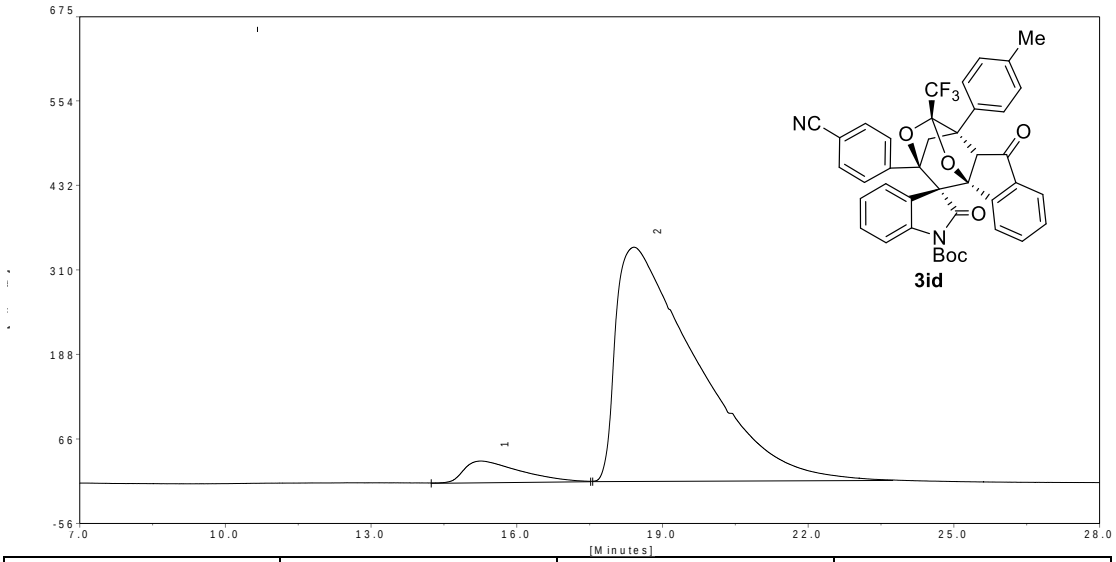
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
7.19	29.02	1146.06	8.9307
14.29	392.04	11686.77	91.0693

HPLC Chromatogram for **3id**

Column: chiralpak IB	Flow rate: 0.8 ml/min
Solvent: Hex: IPA = 98: 2	Detector: UV 246 nm



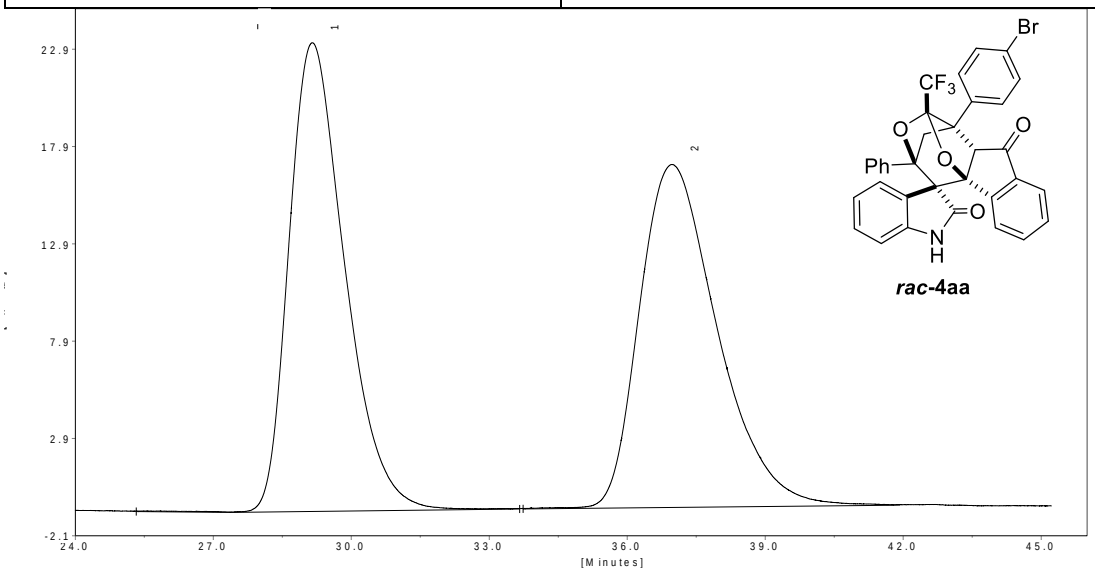
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
13.98	120.25	9609.41	50.0299
17.43	92.60	9597.94	49.9701



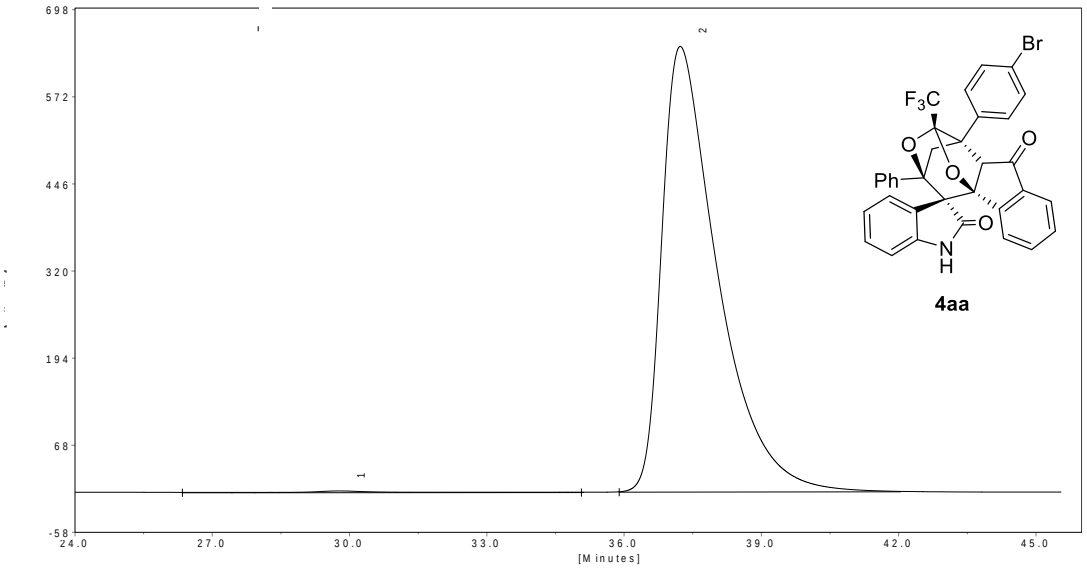
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
15.27	30.89	2428.99	5.8407
18.41	337.58	39158.60	94.1593

HPLC Chromatogram for **4aa**

Column: chiralpak IA	Flow rate: 1.0 ml/min
Solvent: Hex: IPA=90:10	Detector: UV 246 nm



Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
29.14	24.00	2000.28	49.2727
36.97	17.60	2059.33	50.7273



Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
29.76	1.94	129.87	0.2377
37.23	644.17	54499.39	99.7623