Supporting Information

Tandem approach to NOBIN analogues from arylhydroxylamines and diaryliodonium salts via [3,3]-sigmatropic rearrangement

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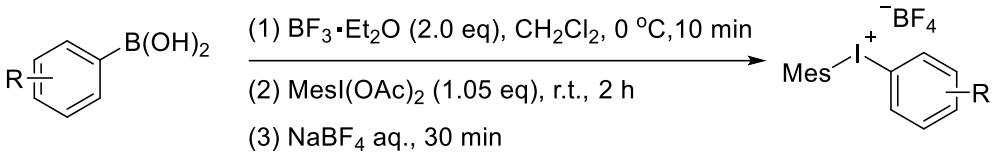
1. General remarks

All reactions were carried out in oven-dried glassware under an atmosphere of nitrogen with magnetic stirring. Solvents were dried by passage through an activated alumina column under argon. Liquids and solutions were transferred via syringe. All reactions were monitored by thin-layer chromatography (TLC) with E. Merck silica gel 60 F254 pre-coated plates (0.25 mm). Silica gel (particle size 0.032 - 0.063 mm) purchased from SiliCycle was used for flash chromatography. Optical rotations were recorded on an mrc MCP5300 automatic polarimeter. Enantiomeric excesses (**ee**) were determined by HPLC analysis on Waters HPLC units, including the following instruments: pump, Waters 1525; detector, Waters 2998; autosampler, Waters 1525; column, Chiralcel OD-H, AD-H, IA, IC.

Proton (^{1}H) and carbon (^{13}C) NMR spectra were recorded on a Bruker AV-500 spectrometer operating at 500 MHz or 400 MHz for proton and 126 MHz or 101 MHz for carbon nuclei using $CDCl_3$ or DMSO-d_6 as solvent, respectively. Chemical shifts are expressed as parts per million (δ, ppm) and are referenced to 7.26 ($CDCl_3$) for ^{1}H NMR and 77.00 ($CDCl_3$) for ^{13}C NMR. Proton signal data uses the following abbreviations: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet and *J* = coupling constant. It is noteworthy that the signal at 5.75 ppm originates from dichloromethane in some compounds' ^{1}H-NMR spectrum and the peak is unrelated to the identity of the compound. High Resolution Mass Spectrometry was performed on a Bruker Apex II mass instrument under the conditions of electrospray ionization (ESI) in both positive and negative mode.

Materials and Methods. Arylhydroxylamine substrates **1a** and **1u-1ag** were prepared according to literature procedures[1]. Diaryliodonium substrates **5a, 5h, 5l**[2]**; 5b-d, 5j**[3]**; 5e, 5f, 5r**[4]**; 5p**[5] **and 5k**[6] were prepared according to literature procedures.

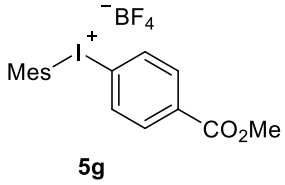
2. General procedure for the synthesis of Diaryliodonium Substrates



[Ar–I–Mes]BF_4 substrates were prepared according to the literature[4]. The indicated arylboronic acid (5 mmol, 1.0 equiv) and DCM (50 mL) were combined in an oven-dried round-bottom flask equipped with a stir bar. The mixture was cooled to 0 ºC, BF_3•OEt_2 (2.0 equiv) was added dropwise and the resulting reaction mixture was stirred for 10 min. $MesI(OAc)_2$ (5.25 mmol, 1.05 equiv) was then added as a solution in DCM (15 mL), and the mixture was warmed to room temperature while stirring for 2 h. Then the saturated aqueous $NaBF_4$ was added to quench the reaction. After 30 minutes of vigorous stirring, the aqueous layer was extracted with DCM for two times. The combined organic layers were dried over Na_2SO_4, filtered, and concentrated under vacuum. The crude residue was then recrystallized with Et_2O to give the desired product.

3. Analytical data of starting materials

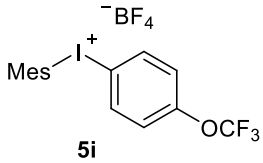
(1) methyl 4-(mesityl(tetrafluoro-λ^3-boranyl)-λ^5-iodanyl)benzoate (5g)



5g

64% yield; White solid, m.p. = 88-89 ºC; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (400 MHz, DMSO-*d*$_6$): δ 8.04-7.98 (m, 2H), 7.97-7.91 (m, 2H), 7.19 (s, 2H), 3.85 (s, 3H), 2.58 (s, 6H), 2.29 (s, 3H); ^{13}C NMR (101 MHz, DMSO-*d*$_6$): δ 165.7, 143.0, 141.5, 134.6, 132.1, 130.1, 127.7, 126.0, 123.8, 53.1, 26.7, 21.0; HRMS (ESI) m/z calcd for $[C_{17}H_{18}IO_2]^+$ $[M\text{-}BF_4^-]^+$: 381.0346, found 381.0346.

(2) tetrafluoro(mesityl(4-(trifluoromethoxy)phenyl)-λ^3-iodanyl)-λ^5-borane (5i)

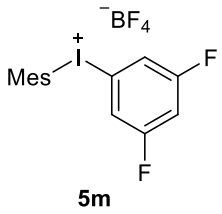


5i

85% yield; White solid, m.p. = 192-194 ºC; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (400 MHz, DMSO-*d*$_6$): δ 8.14-8.06 (m, 2H), 7.52 (dd, *J* = 9.0, 0.8 Hz, 2H), 7.25 (s, 2H), 2.61 (s, 6H), 2.31 (s, 3H); ^{13}C NMR (101 MHz, DMSO-*d*$_6$): δ 150.9 (d, $J_{C\text{-}F}$ = 1.7 Hz), 143.8, 142.1, 137.3, 130.4, 124.6, 123.3, 120.3 (q, $J_{C\text{-}F}$ = 259.6 Hz),

112.6, 26.8, 21.0; ^{19}F NMR (376 MHz, DMSO-d_6): δ -56.90 (s), -148.21 (s); HRMS (ESI) m/z calcd for $[C_{16}H_{15}F_3IO]^+$ $[M\text{-}BF_4^-]^+$: 407.0114, found 407.0119.

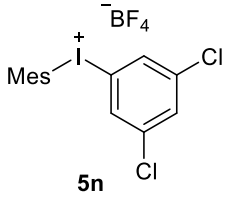
(3) ((3,5-difluorophenyl)(mesityl)-λ^3-iodanyl)tetrafluoro-λ^5-borane (5m)



5m

20% yield; White solid, m.p. = 71-73 °C; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 7.57 (s, 2H), 7.48 (t, J = 8.6 Hz, 1H), 7.18 (s, 2H), 2.59 (s, 6H), 2.29 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 163.1 (dd, $J_{C\text{-}F}$ = 254.0, 12.1 Hz), 142.9, 141.3, 130.0, 127.5, 117.4 (q, $J_{C\text{-}F}$ = 15.1 Hz), 107.4 (t, $J_{C\text{-}F}$ = 25.5 Hz), 26.7, 21.0; ^{19}F NMR (471 MHz, DMSO-d_6): δ -106.24 (s); HRMS (ESI) m/z calcd for $[C_{15}H_{14}F_2I]^+$ $[M\text{-}BF_4^-]^+$: 359.0103, found 359.0098.

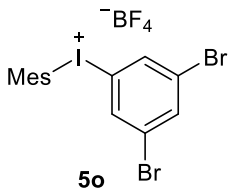
(4) ((3,5-dichlorophenyl)(mesityl)-λ^3-iodanyl)tetrafluoro-λ^5-borane (5n)



5n

51% yield; White solid, m.p. = 88-90 °C; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 7.93 (s, 2H), 7.83 (s, 1H), 7.20 (d, J = 14.1 Hz, 2H), 2.59 (s, 6H), 2.28 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 143.5, 141.9, 136.3, 132.3, 131.7, 130.2, 130.0, 124.8, 26.8, 21.0; HRMS (ESI) m/z calcd for $[C_{15}H_{14}Cl_2I]^+$ $[M\text{-}BF_4^-]^+$: 390.9512, found 390.9504.

(5) ((3,5-dibromophenyl)(mesityl)-λ^3-iodanyl)tetrafluoro-λ^5-borane (5o)

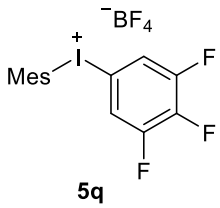


5o

48% yield; White solid, m.p. = 71-73 °C; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 8.08 (s, 2H), 7.39-7.35 (m, 1H), 7.21 (s, 2H), 2.59 (s, 6H), 2.30 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d_6): δ 143.7, 142.1, 135.4, 133.28, 133.27, 130.3, 130.2, 124.7, 26.8, 21.0; HRMS (ESI) m/z calcd for $[C_{15}H_{14}Br_2I]^+$ $[M\text{-}BF_4^-]^+$: 478.8501, found 478.8505.

(6) tetrafluoro(mesityl(3,4,5-trifluorophenyl)-λ^3-iodanyl)-λ^5-borane (5q)

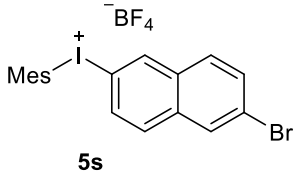
43% yield; White solid, m.p. = 164-166 °C; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 7.57 (s, 2H), 7.48 (t, J = 8.6 Hz, 1H), 7.18 (s, 2H), 2.59 (s,



5q

6H), 2.29 (s, 3H); ^{13}C NMR (101 MHz, DMSO-*d*$_6$): δ 151.4 (ddd, $J_{C\text{-}F}$ = 255.2, 10.3, 2.7 Hz), 142.8, 141.3, 141.17 (dt, $J_{C\text{-}F}$ = 253.8, 15.2 Hz), 130.0, 119.2 (dd, $J_{C\text{-}F}$ = 17.0, 6.1 Hz), 26.7, 21.0; ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -131.41 (d, *J* = 21.1 Hz), -156.32 (t, *J* = 21.2 Hz); HRMS (ESI) m/z calcd for $[C_{15}H_{13}F_3I]^+$ $[M\text{-}BF_4^-]^+$: 377.0009, found 377.0016.

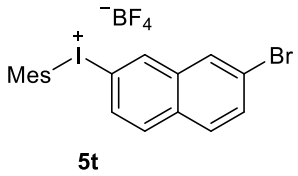
(7) ((6-bromonaphthalen-2-yl)(mesityl)-λ^3-iodanyl)tetrafluoro-λ^5-borane (5s)



5s

82% yield; Brown solid, m.p. = 117-119 °C; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 8.65 (s, 1H), 8.26 (s, 1H), 8.08-7.77 (m, 3H), 7.72 (d, *J* = 8.1 Hz, 1H), 7.11 (s, 2H), 2.62 (s, 6H), 2.22 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 142.7, 141.4, 135.1, 134.6, 132.9, 131.2, 131.0, 130.7, 130.5, 130.4, 129.9, 126.5, 122.2, 116.8, 26.8, 20.9; HRMS (ESI) m/z calcd for $[C_{19}H_{17}BrI]^+$ $[M\text{-}BF_4^-]^+$: 450.9553, found 450.9540.

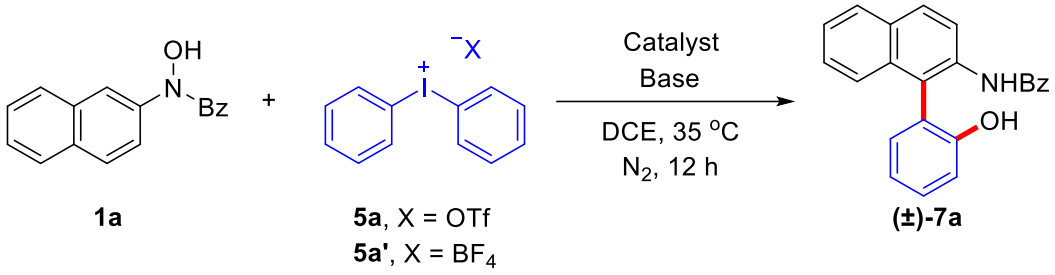
(8) ((7-bromonaphthalen-2-yl)(mesityl)-λ^3-iodanyl)tetrafluoro-λ^5-borane (5t)



5t

95% yield; Brown solid, m.p. = 122-123 °C; R_f = 0.5 (DCM/MeOH = 10/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 8.59 (s, 1H), 8.32 (s, 1H), 7.93 (dt, *J* = 7.3, 6.7 Hz, 3H), 7.77-7.70 (m, 1H), 7.12 (s, 2H), 2.63 (s, 6H), 2.24 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 142.6, 141.4, 135.4, 134.0, 132.0, 131.7, 131.3, 130.68, 130.65, 130.3, 130.0, 129.9, 121.2, 118.0, 26.8, 21.0; HRMS (ESI) m/z calcd for $[C_{19}H_{17}BrI]^+$ $[M\text{-}BF_4^-]^+$: 450.9553, found 450.9544.

4. Optimization of the reaction conditions.[a]

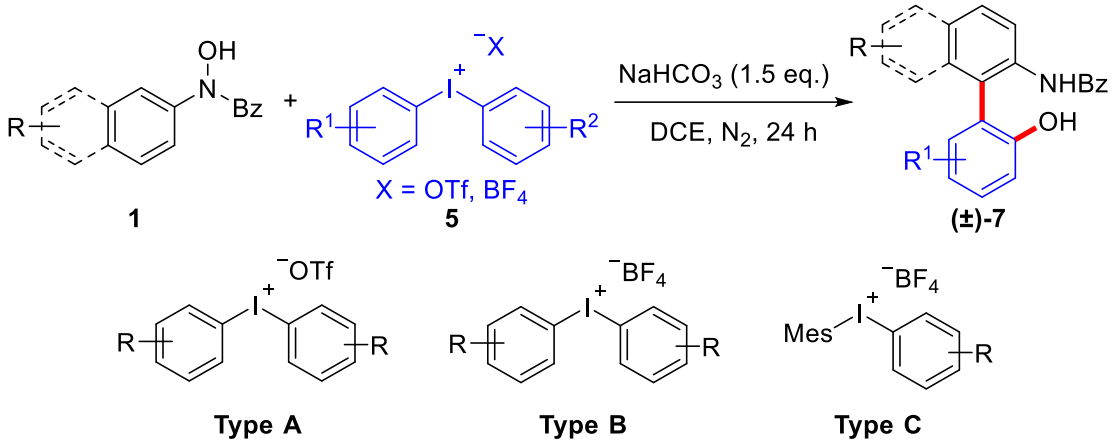


1a **5a**, X = OTf; **5a'**, X = BF_4 **(±)-7a**

entry	**5**	base	catalyst	**7a**, yield[b]
1	**5a**	Na_2CO_3	CuBr	69
2	**5a**	Na_2CO_3	CuI	67
3	**5a**	Na_2CO_3	CuOAc	71
4	**5a**	Na_2CO_3	$Cu(OTf)_2$	65
5	**5a**	Na_2CO_3	-	80
6	**5a**	$NaHCO_3$	-	62
7	**5a′**	Na_2CO_3	-	82
8	**5a′**	K_2CO_3	-	57
9	**5a′**	Cs_2CO_3	-	63
10	**5a′**	Li_2CO_3	-	trace
11	**5a′**	*t*BuONa	-	trace
12	**5a′**	*t*BuOK	-	69
13	**5a′**	K_3PO_4	-	68
14	**5a′**	$NaHCO_3$	-	90

[a]Unless otherwise noted, all reactions were carried out under the following conditions: **1a** (0.2 mmol), **5a** or **5a′** (1.2 equiv), base (1.5 equiv), catalyst (10 mol%), DCE (1 mL) at 35 °C under N_2 for 12 hours. [b]Yields of isolated products. Bz = benzoyl; DCE = 1,2-dichloroethane; Tf = trifluoromethanesulfonyl; Ac = Acetyl.

5. General procedure for the synthesis of NOBIN-type biaryls



A solution of $NaHCO_3$ (0.3 mmol, 1.5 eq.), **1** (0.2 mmol, 1.0 eq.) and **5** (0.24 mmol, 1.2 eq.) in DCE (1 mL) under N_2 atmosphere was stirred at indicated temperature until the complete consumption of **1** detected by TLC analysis. Diaryliodonium salts **5** of **Type C** were used unless otherwise noted (**Type A: 7b-7d, 7j; Type B: 7a, 7h, 7k, 7l**). The reaction mixture was filtered and evaporated under reduced pressure, and purified by column chromatography to give the desired product **7**.

Condition A: 35 °C, 12 h for products **7a, 7h, 7l, 7u-7ae**.

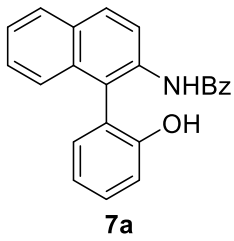
Condition B: 35 °C, 24 h for products **7b, 7f, 7m, 7k, 7r, 7s, 7af, 7ag, 7aj-7an**.

Condition C: 35 °C, 12 h then heated to 50 °C, 12 h for products **7i, 7n-7q, 7t, 7ah, 7ao-7ar**.

Condition D: 50 °C, 24 h for products **7c-7e, 7g, 7j, 7ai**.

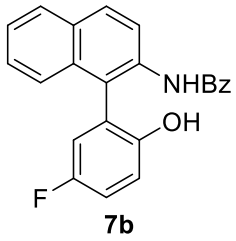
6. Analytical data of NOBIN-type biaryls

(1) *N*-(1-(2-hydroxyphenyl)naphthalen-2-yl)benzamide (7a)



61 mg, 88% yield; White solid, m.p. = 236-238 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 9.82 (s, 1H), 9.22 (s, 1H), 8.12-7.94 (m, 3H), 7.70 (d, J = 7.4 Hz, 2H), 7.59-7.40 (m, 6H), 7.38-7.31 (m, 1H), 7.24-7.18 (m, 1H), 7.14 (d, J = 8.1 Hz, 1H), 6.98 (t, J = 7.3 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 165.5, 155.4, 135.1, 133.9, 132.9, 132.8, 132.1, 131.7, 130.0, 129.5, 129.1, 128.4, 128.1, 127.5, 126.6, 126.4, 125.6, 124.5, 122.7, 119.8, 116.5; HRMS (ESI) m/z calcd for $[C_{23}H_{18}NO_2]^+$ $[M+H]^+$: 340.1332, found 340.1334.

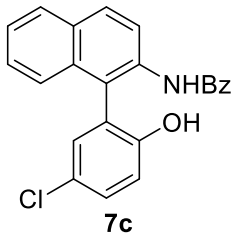
(2) *N*-(1-(5-fluoro-2-hydroxyphenyl)naphthalen-2-yl)benzamide (7b)



7b

39 mg, 54% yield; White solid, m.p. = 214-216 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.71 (s, 1H), 9.49 (s, 1H), 8.01 (dd, *J* = 12.7, 8.5 Hz, 2H), 7.92 (d, *J* = 8.7 Hz, 1H), 7.76 (d, *J* = 7.4 Hz, 2H), 7.61-7.39 (m, 6H), 7.25-7.13 (m, 1H), 7.12-7.01 (m, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 165.9, 155.7 (d, $J_{C\text{-}F}$ = 234.8 Hz), 151.9, 135.1, 134.1, 132.7, 132.0 (d, $J_{C\text{-}F}$ = 22.3 Hz), 129.6, 129.0, 128.43, 128.42, 127.7, 126.8, 126.2, 125.8, 125.4, 124.1 (d, $J_{C\text{-}F}$ = 7.9 Hz), 118.7 (d, $J_{C\text{-}F}$ = 22.7 Hz), 117.2 (d, $J_{C\text{-}F}$ = 8.2 Hz), 116.2 (d, $J_{C\text{-}F}$ = 22.5 Hz); ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -125.67 (s); HRMS (ESI) m/z calcd for $[C_{23}H_{17}FNO_2]^+$ $[M+H]^+$: 358.1238, found 358.1243.

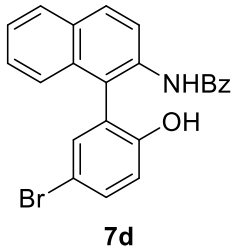
(3) *N*-(1-(5-chloro-2-hydroxyphenyl)naphthalen-2-yl)benzamide (7c)



7c

42 mg, 56% yield; White solid, m.p. = 232-234 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.89 (s, 1H), 9.48 (s, 1H), 7.99 (t, *J* = 8.1 Hz, 2H), 7.83 (d, *J* = 8.8 Hz, 1H), 7.74 -7.67 (m, 2H), 7.57-7.49 (m, 2H), 7.46 (tt, *J* = 5.8, 2.8 Hz, 4H), 7.33 (dd, *J* = 8.7, 2.7 Hz, 1H), 7.19 (d, *J* = 2.7 Hz, 1H), 7.05 (d, *J* = 8.7 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.1, 154.6, 135.2, 134.2, 132.6, 132.0, 131.94, 131.88, 129.6, 129.4, 129.0, 128.5, 128.4, 127.7, 126.8, 126.1, 125.8, 125.7, 124.9, 122.8, 117.8; HRMS (ESI) m/z calcd for $[C_{23}H_{17}ClNO_2]^+$ $[M+H]^+$: 374.0942, found 374.0944.

(4) *N*-(1-(5-bromo-2-hydroxyphenyl)naphthalen-2-yl)benzamide (7d)

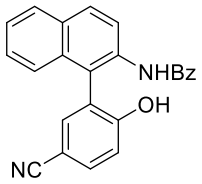


7d

51 mg, 60% yield; White solid, m.p. = 237-239 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.91 (s, 1H), 9.49 (s, 1H), 7.99 (t, *J* = 8.2 Hz, 2H), 7.83 (d, *J* = 8.8 Hz, 1H), 7.76 -7.66 (m, 2H), 7.56-7.49 (m, 2H), 7.45 (ddd, *J* = 8.7, 6.8, 4.5 Hz, 5H), 7.32 (d, *J* = 2.5 Hz, 1H), 7.00 (d, *J* = 8.7 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.1, 155.1, 135.2, 134.7, 134.2, 132.6, 132.3, 132.0, 131.9,

129.6, 128.9, 128.5, 128.4, 127.7, 126.8, 126.1, 125.8, 125.7, 125.5, 118.4, 110.3; HRMS (ESI) m/z calcd for $[C_{23}H_{17}BrNO_2]^+$ $[M+H]^+$: 418.0437, found 418.0454.

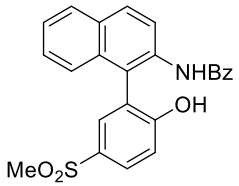
(5) *N*-(1-(5-cyano-2-hydroxyphenyl)naphthalen-2-yl)benzamide (7e)



7e

54 mg, 74% yield; White solid, m.p. = 250-251 ºC; R_f = 0.2 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.72 (s, 1H), 9.64 (s, 1H), 8.01 (t, *J* = 9.4 Hz, 2H), 7.73 (ddd, *J* = 22.4, 17.0, 8.1 Hz, 4H), 7.61 (d, *J* = 1.8 Hz, 1H), 7.53 (dd, *J* = 11.6, 7.1 Hz, 2H), 7.46 (q, *J* = 7.2 Hz, 3H), 7.40 (d, *J* = 8.4 Hz, 1H), 7.14 (d, *J* = 8.5 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.2, 160.2, 137.0, 135.2, 134.4, 134.2, 132.5, 132.0, 131.9, 129.5, 128.8, 128.7, 128.5, 127.8, 126.9, 126.2, 126.0, 124.7, 120.0, 117.2, 101.5; HRMS (ESI) m/z calcd for $[C_{24}H_{17}N_2O_2]^+$ $[M+H]^+$: 365.1285, found 365.1289.

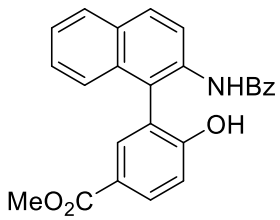
(6) *N*-(1-(2-hydroxy-5-(methylsulfonyl)phenyl)naphthalen-2-yl)benzamide (7f)



7f

81 mg, 95% yield; White solid, m.p. = 253-254 ºC; R_f = 0.1 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.91 (s, 1H), 9.49 (s, 1H), 7.99 (t, *J* = 8.2 Hz, 2H), 7.83 (d, *J* = 8.8 Hz, 1H), 7.76 -7.66 (m, 2H), 7.56-7.49 (m, 2H), 7.45 (ddd, *J* = 8.7, 6.8, 4.5 Hz, 5H), 7.32 (d, *J* = 2.5 Hz, 1H), 7.00 (d, *J* = 8.7 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.1, 155.1, 135.2, 134.7, 134.2, 132.6, 132.3, 132.0, 131.9, 129.6, 128.9, 128.5, 128.4, 127.7, 126.8, 126.1, 125.8, 125.7, 125.5, 118.4, 110.3; HRMS (ESI) m/z calcd for $[C_{24}H_{20}NO_4S]^+$ $[M+H]^+$: 418.1108, found 418.1104.

(7) methyl 3-(2-benzamidonaphthalen-1-yl)-4-hydroxybenzoate (7g)

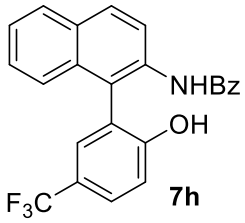


7g

42 mg, 53% yield; White solid, m.p. = 121-123 ºC; R_f = 0.1 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.54 (s, 1H), 9.50 (s, 1H), 8.00 (t, *J* = 7.8 Hz, 2H), 7.92 (dd, *J* = 8.6, 2.2 Hz, 1H), 7.85-7.78 (m, 2H), 7.69-7.64 (m, 2H), 7.55-7.48 (m, 2H), 7.46-7.41 (m, 4H), 7.12 (d, *J* = 8.6 Hz, 1H), 3.76 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.5, 166.1, 160.3, 135.2, 134.7, 134.3, 132.7, 131.93, 131.88, 131.4, 123.0, 128.8, 128.5, 128.4, 127.7, 126.8, 126.0, 125.9, 125.8,

123.2, 120.7, 116.3, 52.1; HRMS (ESI) m/z calcd for $[C_{25}H_{20}NO_4]^+$ $[M+H]^+$: 398.1387, found 398.1382.

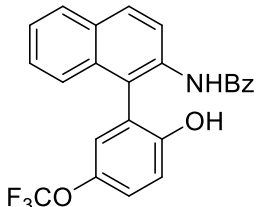
(8) *N*-(1-(2-hydroxy-5-(trifluoromethyl)phenyl)naphthalen-2-yl)benzamide (7h)



7h

72 mg, 88% yield; White solid, m.p. = 198-200 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.45 (s, 1H), 9.68 (s, 1H), 8.01 (dd, *J* = 11.0, 8.7 Hz, 2H), 7.78 (d, *J* = 8.7 Hz, 1H), 7.70 (d, J = 7.2 Hz, 2H), 7.64 (dd, *J* = 8.6, 2.0 Hz, 1H), 7.55-7.40 (m, 7H), 7.20 (d, *J* = 8.6 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.4, 159.1, 135.2, 134.3, 132.5, 132.0, 131.9, 130.4, 129.7 (d, J_{C-F} = 3.6 Hz), 128.7, 128.6, 128.5, 127.8, 127.0 (d, J_{C-F} = 3.6 Hz), 126.9, 126.4, 126.1, 125.9, 125.2 (q, J_{C-F} = 272.2 Hz), 123.8, 120.0 (q, J_{C-F} = 31.9 Hz), 116.7; ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -59.54 (s); HRMS (ESI) m/z calcd for $[C_{24}H_{17}F_3NO_2]^+$ $[M+H]^+$: 408.1206, found 408.1204.

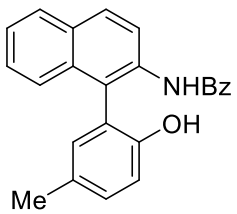
(9) *N*-(1-(2-hydroxy-5-(trifluoromethoxy)phenyl)naphthalen-2-yl)benzamide (7i)



7i

42 mg, 50% yield; White solid, m.p. = 159-161 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.98 (s, 1H), 9.56 (s, 1H), 8.00 (t, *J* = 8.4 Hz, 2H), 7.80 (d, *J* = 8.7 Hz, 1H), 7.75-7.67 (m, 2H), 7.58-7.49 (m, 2H), 7.49-7.41 (m, 4H), 7.28 (dd, *J* = 8.8, 2.7 Hz, 1H), 7.17-7.05 (m, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.1, 154.8, 140.8, 135.0, 134.2, 132.5, 132.0, 131.9, 130.0, 128.8, 128.6, 128.4, 127.7, 126.8, 126.1, 126.0, 125.9, 125.1, 124.4, 122.6, 120.7 (q, J_{C-F} = 255.1 Hz), 117.1; ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -57.26 (s); HRMS (ESI) m/z calcd for $[C_{24}H_{17}F_3NO_3]^+$ $[M+H]^+$: 424.1155, found 424.1157.

(10) *N*-(1-(2-hydroxy-5-methylphenyl)naphthalen-2-yl)benzamide (7j)

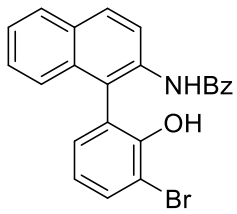


7j

43 mg, 59% yield; White solid, m.p. = 256-258 ºC; R_f = 0.3 (DCM:EA = 50:1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.60 (s, 1H), 9.13 (s, 1H), 8.05 (d, *J* = 8.8 Hz, 1H), 8.01-7.93 (m, 2H), 7.71-7.64 (m, 2H), 7.58-7.39 (m, 6H), 7.13 (dd, *J* = 8.3, 1.9 Hz, 1H), 7.05-6.94 (m, 2H), 2.23 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ

165.4, 153.0, 135.1, 133.8, 133.0, 132.9, 132.2, 131.7, 130.5, 129.2, 129.1, 128.33, 128.28, 128.0, 127.4, 126.6, 126.5, 125.5, 124.1, 122.3, 116.4, 20.6; HRMS (ESI) m/z calcd for $[C_{24}H_{20}NO_2]^+$ $[M+H]^+$: 354.1489, found 354.1491.

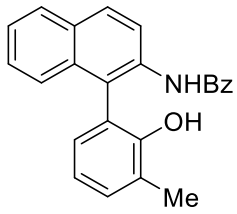
(11) *N*-(1-(3-bromo-2-hydroxyphenyl)naphthalen-2-yl)benzamide (7k)



7k

42 mg, 50% yield; White solid, m.p. = 257-258 °C; R_f = 0.5 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 9.44 (s, 1H), 9.08 (s, 1H), 8.02 (dd, J = 14.3, 8.3 Hz, 2H), 7.90 (d, J = 8.8 Hz, 1H), 7.72-7.67 (m, 2H), 7.64 (dd, J = 8.0, 1.6 Hz, 1H), 7.57-7.43 (m, 5H), 7.38 (d, J = 8.4 Hz, 1H), 7.16 (dd, J = 7.5, 1.6 Hz, 1H), 6.93 (t, J = 7.8 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 166.2, 152.1, 135.1, 134.4, 133.3, 132.7, 132.1, 131.9, 129.6, 128.9, 128.7, 128.5, 127.8, 126.9, 126.2, 126.0, 125.8, 125.4, 121.7, 112.3; HRMS (ESI) m/z calcd for $[C_{24}H_{17}BrNO_2]^+$ $[M+H]^+$: 418.0437, found 418.0438.

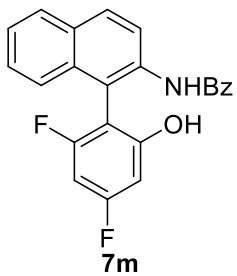
(12) *N*-(1-(2-hydroxy-3-methylphenyl)naphthalen-2-yl)benzamide (7l)



7l

26 mg, 36% yield; White solid, m.p. = 227-228 °C; R_f = 0.5 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.76 (d, J = 9.0 Hz, 1H), 8.00 (d, J = 9.1 Hz, 2H), 7.93-7.86 (m, 1H), 7.56-7.51 (m, 2H), 7.50-7.33 (m, 7H), 7.14-7.03 (m, 2H), 4.96 (s, 1H), 2.37 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 165.6, 153.1, 135.0, 134.0, 133.0, 132.2, 131.7, 131.4, 130.1, 129.2, 129.1, 128.4, 128.3, 127.4, 126.7, 126.4, 126.2, 125.6, 124.1, 123.6, 120.4, 17.3; HRMS (ESI) m/z calcd for $[C_{24}H_{20}NO_2]^+$ $[M+H]^+$: 354.1489, found 354.1490.

(13) *N*-(1-(2,4-difluoro-6-hydroxyphenyl)naphthalen-2-yl)benzamide (7m)

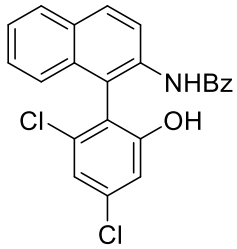


7m

50 mg, 67% yield; White solid, m.p. = 212-214 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.51 (s, 1H), 9.60 (s, 1H), 7.99 (dd, J = 17.1, 8.3 Hz, 2H), 7.89 (d, J = 8.8 Hz, 1H), 7.74 (d, J = 7.3 Hz, 2H), 7.57-7.40 (m, 6H), 6.79 (td, J = 9.5, 2.1 Hz, 1H), 6.69 (d, J = 10.5 Hz, 1H); ^{13}C NMR (126 MHz,

DMSO-d_6): δ 165.9, 163.3 (dd, $J_{C\text{-}F}$ = 184.0, 16.6 Hz), 161.3 (dd, $J_{C\text{-}F}$ = 184.2, 16.6 Hz), 158.3 (dd, $J_{C\text{-}F}$ = 13.8, 10.0 Hz), 135.5, 135.3, 132.7, 131.9, 131.6, 128.8, 128.6 (d, $J_{C\text{-}F}$ = 22.2 Hz), 127.9, 126.9, 125.7 (d, $J_{C\text{-}F}$ = 6.5 Hz), 125.5, 123.1, 108.0 (dd, $J_{C\text{-}F}$ = 19.5, 3.8 Hz), 99.4 (d, $J_{C\text{-}F}$ = 21.3 Hz), 95.2 (t, $J_{C\text{-}F}$ = 27.0 Hz); ^{19}F NMR (471 MHz, DMSO-d_6): δ -107.67 (d, J = 7.4 Hz), -110.73 (d, J = 7.5 Hz); HRMS (ESI) m/z calcd for $[C_{23}H_{16}F_2NO_2]^+$ $[M+H]^+$: 376.1144, found 376.1148.

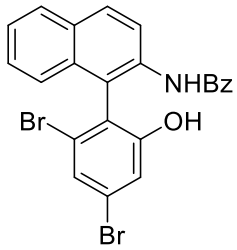
(14) *N*-(1-(2,4-dichloro-6-hydroxyphenyl)naphthalen-2-yl)benzamide (7n)



7n

48 mg, 59% yield; White solid, m.p. = 232-234 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.37 (s, 1H), 9.40 (s, 1H), 8.04-7.92 (m, 3H), 7.72-7.63 (m, 2H), 7.56-7.40 (m, 5H), 7.29 (d, J = 8.3 Hz, 1H), 7.20 (d, J = 2.0 Hz, 1H), 7.03 (d, J = 2.0 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 166.1, 158.4, 136.3, 135.5, 135.0, 133.9, 132.2, 131.9, 131.5, 128.8, 128.7, 128.5, 128.0, 126.9, 125.7, 125.5, 125.4, 125.0, 121.5, 120.0, 114.9; HRMS (ESI) m/z calcd for $[C_{23}H_{16}Cl_2NO_2]^+$ $[M+H]^+$: 408.0553, found 408.0553.

(15) *N*-1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzamide (7o)

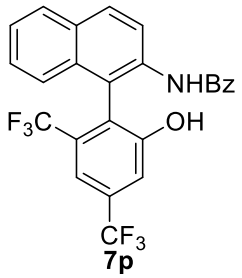


7o

49 mg, 48% yield; White solid, m.p. = 243-245 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.38 (s, 1H), 9.25 (s, 1H), 8.03-7.95 (m, 3H), 7.71-7.63 (m, 2H), 7.57-7.39 (m, 6H), 7.29-7.20 (m, 2H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 166.1, 158.5, 135.5, 134.7, 132.02, 131.96, 131.4, 128.8, 128.6, 128.5, 127.9, 127.0, 126.9, 126.7, 125.6, 125.53, 125.47, 124.6, 123.7, 122.4, 118.3; HRMS (ESI) m/z calcd for $[C_{23}H_{16}Br_2NO_2]^+$ $[M+H]^+$: 495.9542, found 495.9559.

(16) *N*-(1-(2-hydroxy-4,6-bis(trifluoromethyl)phenyl)naphthalen-2-yl)benzamide (7p)

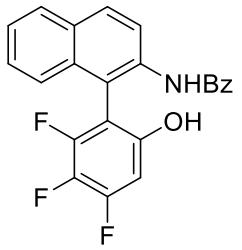
54 mg, 57% yield; White solid, m.p. = 201-203 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.69 (s, 1H), 9.28 (s, 1H), 8.05-7.95 (m, 3H), 7.61 (s, 1H), 7.59-7.54 (m, 3H), 7.54-7.46 (m, 2H), 7.41 (q, J = 7.3, 6.9 Hz, 3H), 7.12 (d, J =



7p

8.4 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 166.5, 158.5, 135.5, 134.9, 132.7, 131.9 (q, J_{C-F} = 29.0 Hz), 131.8, 131.2, 130.9 (q, J_{C-F} = 32.8 Hz), 128.8, 128.7, 128.3, 128.0, 126.8, 125.6, 125.5, 125.11 (q, J_{C-F} = 252.0 Hz), 124.8 (t, J_{C-F} = 22.7 Hz), 122.7 (d, J_{C-F} = 47.9 Hz), 120.5 (d, J_{C-F} = 50.6 Hz), 116.4, 113.5; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.01 (s), -61.65 (s); HRMS (ESI) m/z calcd for $[C_{25}H_{16}F_6NO_2]^+$ $[M+H]^+$: 476.1080, found 476.1084.

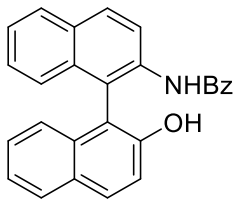
(17) *N*-(1-(2,3,4-trifluoro-6-hydroxyphenyl)naphthalen-2-yl)benzamide (7q)



7q

25 mg, 31% yield; White solid, m.p. = 235-237 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.33 (s, 1H), 9.76 (s, 1H), 8.02 (dd, J = 21.2, 8.1 Hz, 2H), 7.86 (d, J = 8.5 Hz, 1H), 7.74 (d, J = 7.1 Hz, 2H), 7.65-7.34 (m, 6H), 6.89-6.70 (m, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 166.0, 152.2 (t, J_{C-F} = 9.3 Hz), 151.1 (ddd, J_{C-F} = 61.6, 10.2, 6.2 Hz), 149.2 (ddd, J_{C-F} = 60.8, 10.0, 6.1 Hz), 135.8, 135.3, 134.5 (t, J_{C-F} = 16.3 Hz), 132.5, 131.9, 131.6, 129.1, 128.8, 128.5, 128.0, 126.5 (d, J_{C-F} = 161.7 Hz), 125.5 (d, J_{C-F} = 27.6 Hz), 122.1, 109.2 (d, J_{C-F} = 15.4 Hz), 99.7 (d, J_{C-F} = 19.1 Hz); ^{19}F NMR (471 MHz, DMSO-d_6): δ -132.06 (d, J = 23.1 Hz), -136.12 (d, J = 22.4 Hz), -174.14 (t, J = 23.2 Hz); HRMS (ESI) m/z calcd for $[C_{23}H_{15}F_3NO_2]^+$ $[M+H]^+$: 394.1049, found 394.1047.

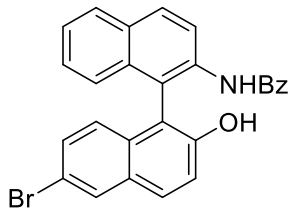
(18) *N*-(2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7r)



7r

55 mg, 71% yield; White solid, m.p. = 242-244 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 9.96 (s, 1H), 8.76 (s, 1H), 8.38 (d, J = 8.9 Hz, 1H), 8.11 (d, J = 8.9 Hz, 1H), 8.02 (dd, J = 8.4, 3.7 Hz, 2H), 7.91 (d, J = 8.0 Hz, 1H), 7.46 (dt, J = 23.4, 8.2 Hz, 3H), 7.31 (ddt, J = 23.0, 14.8, 7.4 Hz, 6H), 7.22-7.12 (m, 2H), 6.96 (d, J = 8.4 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 165.4, 153.8, 135.1, 135.0, 133.9, 133.2, 132.1, 131.5, 130.7, 129.0, 128.68, 128.65, 128.53, 128.46, 127.2, 127.1, 126.8, 126.3, 125.5, 125.1, 124.5, 123.4, 123.2, 119.0, 114.1; HRMS (ESI) m/z calcd for $[C_{27}H_{20}NO_2]^+$ $[M+H]^+$: 390.1489, found 390.1491.

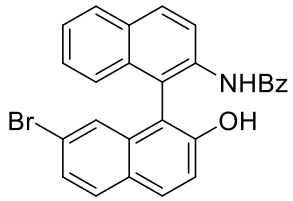
(19) *N*-(6'-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7s)



7s

64 mg, 69% yield; White solid, m.p. = 197-199 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.03 (s, 1H), 8.93 (s, 1H), 8.20 (d, J = 8.9 Hz, 1H), 8.16 (d, J = 2.1 Hz, 1H), 8.09 (d, J = 8.9 Hz, 1H), 8.02 (d, J = 8.1 Hz, 1H), 7.97 (d, J = 8.9 Hz, 1H), 7.50-7.44 (m, 3H), 7.40-7.28 (m, 6H), 7.09 (d, J = 8.5 Hz, 1H), 6.86 (d, J = 9.1 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 165.7, 154.2, 135.2, 135.1, 133.0, 132.7, 132.0, 131.6, 130.3, 129.82, 129.80, 129.7, 128.9, 128.6, 128.5, 127.4, 127.0, 126.8, 126.1, 125.6, 125.4, 124.1, 120.1, 116.1, 114.7; HRMS (ESI) m/z calcd for $[C_{27}H_{19}BrNO_2]^+$ $[M+H]^+$: 468.0594, found 468.0581.

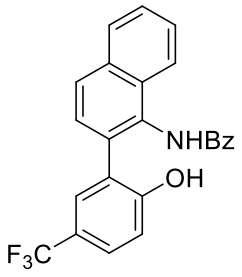
(20) *N*-(7'-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7t)



7t

62 mg, 66% yield; White solid, m.p. = 237-238 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.08 (s, 1H), 9.09 (s, 1H), 8.20-7.95 (m, 4H), 7.85 (d, J = 8.7 Hz, 1H), 7.52-7.28 (m, 9H), 7.17-7.06 (m, 2H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 165.9, 154.8, 135.4, 135.4, 135.3, 133.0, 131.9, 131.7, 130.9, 130.6, 129.0, 128.8, 128.62, 128.58, 127.5, 127.2, 127.0, 126.9, 126.5, 126.1, 125.7, 124.7, 120.8, 119.5, 113.9; HRMS (ESI) m/z calcd for $[C_{27}H_{19}BrNO_2]^+$ $[M+H]^+$: 468.0594, found 468.0600.

(21) *N*-(2-(2-hydroxy-5-(trifluoromethyl)phenyl)naphthalen-1-yl)benzamide (7u)

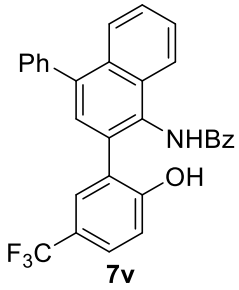


7u

42 mg, 52% yield; White solid, m.p. = 210-212 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.51 (s, 1H), 9.60 (s, 1H), 7.99 (dd, J = 17.1, 8.3 Hz, 2H), 7.89 (d, J = 8.8 Hz, 1H), 7.74 (d, J = 7.3 Hz, 2H), 7.57-7.40 (m, 6H), 6.79 (td, J = 9.5, 2.1 Hz, 1H), 6.69 (d, J = 10.5 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 167.2, 158.4, 134.9, 133.9, 133.7, 132.2, 131.9, 131.5, 129.2, 128.7, 128.5 (d, $J_{C\text{-}F}$ = 3.6 Hz), 128.4, 127.9, 127.1, 126.99, 126.97, 126.7, 126.4 (d, $J_{C\text{-}F}$ = 3.6 Hz), 125.2 (q, $J_{C\text{-}F}$ = 270.9 Hz), 124.4, 119.7 (q, $J_{C\text{-}F}$ = 31.9 Hz),

116.6; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.60 (s); HRMS (ESI) m/z calcd for $[C_{24}H_{17}F_3NO_2]^+$ $[M+H]^+$: 408.1206, found 408.1208.

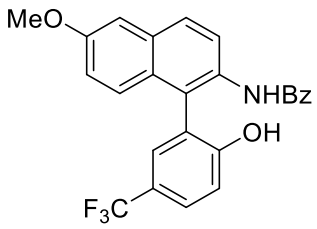
(22) *N*-(2-(2-hydroxy-5-(trifluoromethyl)phenyl)-4-phenylnaphthalen-1-yl)benza-mide (7v)



7v

50 mg, 52% yield; White solid, m.p. = 215-217 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.54 (s, 1H), 10.18 (s, 1H), 8.07 (d, J = 8.3 Hz, 1H), 7.89 (dd, J = 17.5, 7.8 Hz, 3H), 7.71 (s, 1H), 7.65-7.44 (m, 12H), 7.12 (d, J = 8.5 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 167.3, 158.4, 140.1, 138.7, 134.2 (d, $J_{C\text{-}F}$ = 198.2 Hz), 131.9, 131.5, 130.3, 129.9, 129.1, 128.8, 128.7 (d, $J_{C\text{-}F}$ = 3.1 Hz), 128.1, 128.0, 127.1, 126.9, 126.8, 126.5 (d, $J_{C\text{-}F}$ = 3.5 Hz), 126.0, 125.2 (q, $J_{C\text{-}F}$ = 268.8 Hz), 124.9, 119.9 (q, $J_{C\text{-}F}$ = 32.2 Hz), 116.7; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.59 (s); HRMS (ESI) m/z calcd for $[C_{30}H_{21}F_3NO_2]^+$ $[M+H]^+$: 484.1519, found 484.1521.

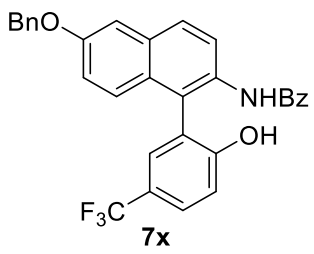
(23) *N*-(1-(2-hydroxy-5-(trifluoromethyl)phenyl)-6-methoxynaphthalen-2-yl)benzamide (7w)



7w

63 mg, 72% yield; White solid, m.p. = 171-172 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.43 (s, 1H), 9.64 (s, 1H), 7.92 (d, J = 8.8 Hz, 1H), 7.70 (d, J = 7.0 Hz, 3H), 7.64-7.59 (m, 2H), 7.54-7.47 (m, 2H), 7.45-7.40 (m, 3H), 7.34 (d, J = 9.2 Hz, 1H), 7.22-7.12 (m, 2H), 3.90 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 166.5, 159.0, 157.5, 135.3, 133.4, 132.2, 131.8, 130.9, 129.6 (d, $J_{C\text{-}F}$ = 3.7 Hz), 128.7, 127.84, 127.75, 127.5, 127.1, 126.9 (d, $J_{C\text{-}F}$ = 3.5 Hz), 125.2 (q, $J_{C\text{-}F}$ = 272.2 Hz), 124.1, 119.9 (q, $J_{C\text{-}F}$ = 32.1 Hz), 119.2, 116.6, 106.8, 55.7; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.56 (s); HRMS (ESI) m/z calcd for $[C_{25}H_{19}F_3NO_3]^+$ $[M+H]^+$: 438.1312, found 438.1315.

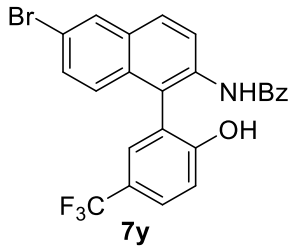
(24) *N*-(6-(benzyloxy)-1-(2-hydroxy-5-(trifluoromethyl)phenyl)naphthalen-2-yl)-benzamide (7x)



7x

64 mg, 62% yield; White solid, m.p. = 222-224 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.45 (s, 1H), 9.66 (s, 1H), 7.91 (d, *J* = 8.8 Hz, 1H), 7.76-7.66 (m, 3H), 7.62 (dd, *J* = 8.6, 2.0 Hz, 1H), 7.57-7.49 (m, 5H), 7.45-7.39 (m, 4H), 7.38-7.33 (m, 2H), 7.25-7.17 (m, 2H), 5.27 (s, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.5, 159.1, 156.5, 137.4, 135.2, 133.3, 132.3, 131.8, 130.9, 129.8 (d, J_{C-F} = 3.6 Hz), 128.9, 128.7, 128.4, 128.3, 127.94, 127.85, 127.8, 127.5, 127.1, 126.9 (d, J_{C-F} = 3.6 Hz), 125.2 (q, J_{C-F} = 271.0 Hz), 124.0, 119.9 (q, J_{C-F} = 32.0 Hz), 119.5, 116.6, 108.1, 69.9; ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -59.33 (s); HRMS (ESI) m/z calcd for $[C_{31}H_{23}F_3NO_3]^+$ $[M+H]^+$: 514.1625, found 514.1623.

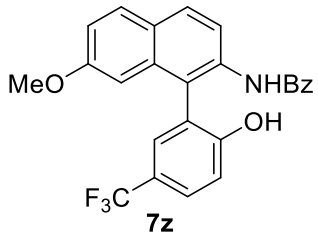
(25) *N*-(6-bromo-1-(2-hydroxy-5-(trifluoromethyl)phenyl)naphthalen-2-yl)ben-za-mide (7y)



7y

67 mg, 68% yield; White solid, m.p. = 199-201 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.51 (s, 1H), 9.72 (s, 1H), 8.30 (d, *J* = 1.9 Hz, 1H), 8.02 (d, *J* = 8.8 Hz, 1H), 7.83 (d, *J* = 8.8 Hz, 1H), 7.71-7.58 (m, 4H), 7.55-7.50 (m, 2H), 7.43 (t, *J* = 7.6 Hz, 2H), 7.36 (d, *J* = 9.0 Hz, 1H), 7.19 (d, *J* = 8.6 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.4, 159.1, 135.0, 134.9, 133.2, 131.9, 131.1, 130.6, 130.2, 129.8, 129.6 (d, J_{C-F} = 3.5 Hz), 128.7, 128.6, 127.9, 127.8, 127.7, 127.2 (d, J_{C-F} = 3.5 Hz), 125.2 (q, J_{C-F} = 271.0 Hz), 123.2, 120.0 (q, J_{C-F} = 32 Hz), 119.3, 116.7; ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -59.56 (s); HRMS (ESI) m/z calcd for $[C_{24}H_{15}BrF_3NO_2]^+$ $[M+H]^+$: 486.0311, found 486.0311.

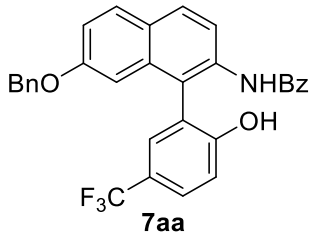
(26) *N*-(1-(2-hydroxy-5-(trifluoromethyl)phenyl)-7-methoxynaphthalen-2-yl)be-nzamide (7z)



7z

43 mg, 49% yield; White solid, m.p. = 192-194 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.47 (s, 1H), 9.59 (s, 1H), 7.93 (dd, *J* = 8.8, 4.2 Hz, 2H), 7.70-7.60 (m, 4H), 7.55-7.49 (m, 2H), 7.43 (t, *J* = 7.6 Hz, 2H), 7.24-7.17 (m, 2H), 6.74 (d, *J* = 2.4 Hz, 1H), 3.67 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.2, 156.0, 157.9, 135.2, 134.9, 133.8, 131.9, 130.2, 129.8 (d, $J_{C\text{-}F}$ = 3.5 Hz), 129.0, 128.7, 128.4, 127.7, 127.4, 126.9 (d, $J_{C\text{-}F}$ = 3.6 Hz), 125.2 (q, $J_{C\text{-}F}$ = 271.0 Hz), 123.9, 123.8, 120.0 (q, $J_{C\text{-}F}$ = 31.9 Hz), 117.2 (d, $J_{C\text{-}F}$ = 118.3 Hz), 105.3, 55.3; ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -59.58 (s); HRMS (ESI) m/z calcd for $[C_{25}H_{19}F_3NO_3]^+$ $[M+H]^+$: 438.1312, found 438.1310.

(27) *N*-(7-(benzyloxy)-1-(2-hydroxy-5-(trifluoromethyl)phenyl)naphthalen-2-yl)-benzamide (7aa)

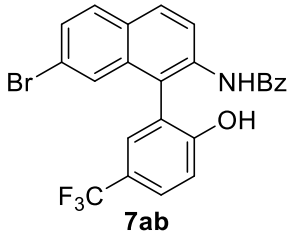


7aa

66 mg, 64% yield; White solid, m.p. = 177-179 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.41 (s, 1H), 9.57 (s, 1H), 7.93 (d, *J* = 8.9 Hz, 2H), 7.69-7.60 (m, 4H), 7.55-7.46 (m, 2H), 7.42 (t, *J* = 7.6 Hz, 2H), 7.34-7.25 (m, 6H), 7.20 (d, *J* = 8.5 Hz, 1H), 6.83 (d, *J* = 2.2 Hz, 1H), 5.01 (d, *J* = 2.4 Hz, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.2, 159.0, 157.0, 137.1, 135.2, 134.9, 133.8, 131.9, 130.2, 129.7 (d, $J_{C\text{-}F}$ = 4.0 Hz), 129.1, 128.9, 128.7, 128.3, 128.2, 127.7, 127.5, 126.9 (d, $J_{C\text{-}F}$ = 3.8 Hz), 125.2 (q, $J_{C\text{-}F}$ = 270.9 Hz), 123.9, 123.8, 120.0 (q, $J_{C\text{-}F}$ = 32.0 Hz), 118.0, 116.8, 107.1, 69.9; ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -59.53 (s); HRMS (ESI) m/z calcd for $[C_{31}H_{23}F_3NO_3]^+$ $[M+H]^+$: 514.1625, found 514.1627.

(28) *N*-(7-bromo-1-(2-hydroxy-5-(trifluoromethyl)phenyl)naphthalen-2-yl)benzamide (7ab)

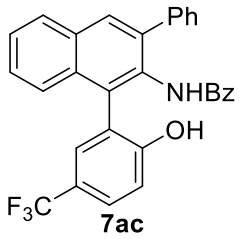
68 mg, 70% yield; White solid, m.p. = 218-220 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.55 (s, 1H), 9.75 (s, 1H), 8.07 (d, *J* = 8.8 Hz, 1H), 8.00 (d, *J* = 8.8 Hz, 1H), 7.85 (d, *J* = 8.8 Hz, 1H), 7.72-7.64 (m, 4H), 7.57-7.50 (m, 3H), 7.44 (t, *J* = 7.6 Hz, 2H), 7.21 (d, *J* = 8.6 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ



7ab

166.5, 159.1, 135.6, 135.0, 133.7, 132.0, 130.9, 130.5, 129.61 (d, $J_{C\text{-}F}$ = 3.6 Hz), 129.55, 128.9, 128.7, 128.0, 127.8, 127.3 (d, $J_{C\text{-}F}$ = 3.6 Hz), 127.1, 125.1 (q, $J_{C\text{-}F}$ = 270.9 Hz), 123.1, 120.4, 120.1 (q, $J_{C\text{-}F}$ = 32.0 Hz), 116.8; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.60 (s); HRMS (ESI) m/z calcd for $[C_{24}H_{15}BrF_3NO_2]^+$ $[M+H]^+$: 486.0311, found 486.0307.

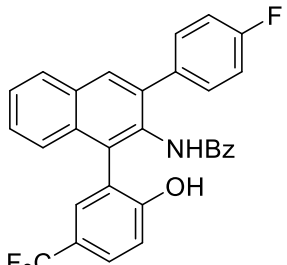
(29) *N*-(1-(2-hydroxy-5-(trifluoromethyl)phenyl)-3-phenylnaphthalen-2-yl)benzamide (7ac)



7ac

87 mg, 90% yield; White solid, m.p. = 224-225 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.30 (s, 1H), 9.82 (s, 1H), 8.11-7.99 (m, 2H), 7.66-7.59 (m, 3H), 7.58-7.54 (m, 2H), 7.50-7.36 (m, 7H), 7.34-7.28 (m, 3H), 7.14 (d, J = 8.5 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 156.0, 140.1, 139.9, 135.4, 135.3, 132.7, 132.6, 131.9, 131.4, 129.6, 129.5, 129.0, 128.6, 128.40, 128.37, 127.6, 127.5, 126.9, 126.8, 126.5, 125.3 (q, $J_{C\text{-}F}$ = 270.9 Hz), 124.8, 119.7 (q, $J_{C\text{-}F}$ = 32.1 Hz), 116.3; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.55 (s); HRMS (ESI) m/z calcd for $[C_{30}H_{21}F_3NO_2]^+$ $[M+H]^+$: 484.1519, found 484.1517.

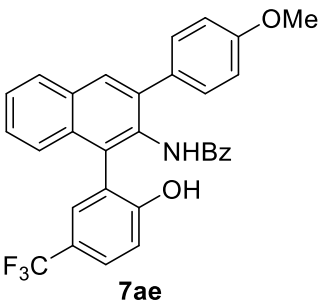
(30) *N*-(3-(4-fluorophenyl)-1-(2-hydroxy-5-(trifluoromethyl)phenyl)naphthalen-2-yl)benzamide (7ad)



7ad

85 mg, 85% yield; White solid, m.p. = 228-230 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.32 (s, 1H), 9.84 (s, 1H), 8.14-7.97 (m, 2H), 7.71-7.53 (m, 5H), 7.51-7.38 (m, 5H), 7.32 (t, J = 7.6 Hz, 2H), 7.24 (t, J = 8.9 Hz, 2H), 7.14 (d, J = 8.4 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 162.1 (d, $J_{C\text{-}F}$ = 243.9 Hz), 159.0, 138.8, 136.5, 135.3 (d, $J_{C\text{-}F}$ =2.52 Hz), 132.6 (d, $J_{C\text{-}F}$ = 15.4 Hz), 131.9, 131.5, 131.4, 129.6, 129.1, 128.6, 128.5, 127.5, 126.9, 126.8, 126.5, 125.2 (q, $J_{C\text{-}F}$ = 270.9 Hz), 124.6, 119.8 (q, $J_{C\text{-}F}$ = 31.9 Hz), 116.3, 115.3, 115.1; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.57 (s), -115.51 (s); HRMS (ESI) m/z calcd for $[C_{30}H_{20}F_4NO_2]^+$ $[M+H]^+$: 502.1425, found 502.1425.

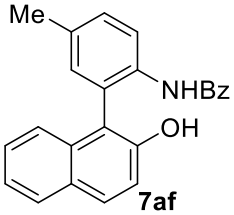
(31) *N*-(1-(2-hydroxy-5-(trifluoromethyl)phenyl)-3-(4-methoxyphenyl)naphtha-en-2-yl)benzamide (7ae)



7ae

76 mg, 74% yield; White solid, m.p. = 249-251 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.50 (s, 1H), 9.69 (s, 1H), 7.97-7.90 (m, 1H), 7.75-7.63 (m, 4H), 7.59 (d, J = 1.8 Hz, 1H), 7.50 (dq, J = 11.1, 5.8, 4.5 Hz, 6H), 7.43 (t, J = 7.6 Hz, 2H), 7.23 (d, J = 8.5 Hz, 1H), 7.16 (d, J = 8.6 Hz, 2H), 3.86 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 166.4, 159.4, 159.2, 140.0, 135.2, 133.9, 133.1, 132.2, 131.9, 131.4, 130.1, 129.8 (d, J_{C-F} = 3.6 Hz), 129.5, 128.7, 127.8, 127.1 (d, J_{C-F} = 3.4 Hz), 126.8, 126.73, 126.70, 126.1, 125.2 (q, J_{C-F} = 270.9Hz), 123.8, 120.1 (q, J_{C-F} = 32.0 Hz), 116.7, 114.6, 55.7; ^{19}F NMR (471 MHz, DMSO-d_6): δ -59.53 (s); HRMS (ESI) m/z calcd for $[C_{31}H_{23}F_3NO_3]^+$ $[M+H]^+$: 514.1625, found 514.1622.

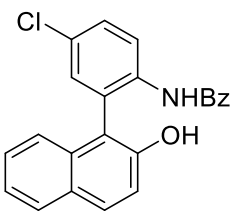
(32) *N*-(2-(2-hydroxynaphthalen-1-yl)-4-methylphenyl)benzamide (7af)



7af

27 mg, 37% yield; White solid, m.p. = 198-200 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.03 (s, 1H), 8.75 (s, 1H), 7.99 (d, J = 8.2 Hz, 1H), 7.86 (dd, J = 16.3, 8.4 Hz, 2H), 7.46-7.24 (m, 10H), 7.15 (s, 1H), 2.37 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 165.1, 152.5, 135.3, 134.6, 134.1, 133.8, 132.9, 131.9, 130.1, 129.7, 128.9, 128.8, 128.7, 128.5, 127.2, 126.9, 124.7, 124.1, 123.2, 118.6, 117.4, 21.1; HRMS (ESI) m/z calcd for $[C_{24}H_{20}NO_2]^+$ $[M+H]^+$: 354.1489, found 354.1494.

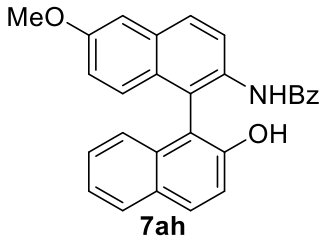
(33) *N*-(4-chloro-2-(2-hydroxynaphthalen-1-yl)phenyl)benzamide (7ag)



7ag

22 mg, 29% yield; White solid, m.p. = 223-224 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-d_6): δ 10.13 (s, 1H), 8.91 (s, 1H), 8.22-7.72 (m, 3H), 7.41 (dd, J = 73.4, 45.0 Hz, 11H); ^{13}C NMR (126 MHz, DMSO-d_6): δ 165.4, 152.8, 136.3, 135.0, 133.3, 132.04, 131.97, 130.7, 129.0, 128.8, 128.6, 128.5, 128.1, 127.4, 127.2, 126.0, 124.2, 123.3, 118.7, 115.9; HRMS (ESI) m/z calcd for $[C_{23}H_{17}ClNO_2]^+$ $[M+H]^+$: 374.0942, found 374.0938.

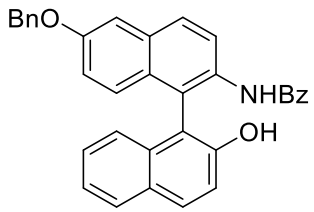
(34) *N*-(2'-hydroxy-6-methoxy-[1,1'-binaphthalen]-2-yl)benzamide (7ah)



7ah

30 mg, 35% yield; White solid, m.p. = 195-197 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.92 (s, 1H), 8.72 (s, 1H), 8.26 (d, *J* = 8.8 Hz, 1H), 7.99 (t, *J* = 8.8 Hz, 2H), 7.89 (d, *J* = 8.0 Hz, 1H), 7.50-7.40 (m, 3H), 7.39-7.16 (m, 6H), 7.10-6.91 (m, 3H), 3.88 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 165.4, 157.2, 153.6, 135.2, 134.0, 133.0, 132.8, 132.0, 130.6, 128.9, 128.6, 128.4, 127.9, 127.3, 127.2, 127.1, 125.7, 124.6, 124.0, 123.3, 119.2, 119.0, 114.4, 106.9, 55.7; HRMS (ESI) m/z calcd for $[C_{28}H_{22}NO_3]^+$ $[M+H]^+$: 420.1594, found 420.1595.

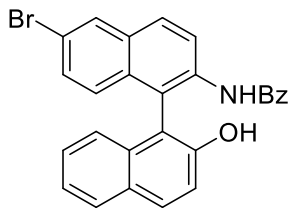
(35) *N*-(6-(benzyloxy)-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7ai)



7ai

43 mg, 43% yield; White solid, m.p. = 240-241 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.88 (s, 1H), 8.71 (s, 1H), 8.22 (d, *J* = 8.9 Hz, 1H), 8.02-7.83 (m, 3H), 7.60-7.48 (m, 3H), 7.48-7.15 (m, 11H), 7.11-6.99 (m, 2H), 6.93 (d, *J* = 8.4 Hz, 1H), 5.24 (s, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 165.4, 156.3, 153.6, 137.5, 135.2, 133.9, 133.1, 132.7, 132.0, 130.6, 128.93, 128.91, 128.6, 128.5, 128.4, 128.3, 128.0, 127.3, 127.2, 127.1, 125.7, 124.6, 124.1, 123.3, 119.5, 118.9, 114.4, 108.2, 69.8; HRMS (ESI) m/z calcd for $[C_{34}H_{26}NO_3]^+$ $[M+H]^+$: 496.1907, found 496.1911.

(36) *N*-(6-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7aj)

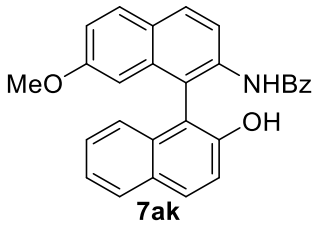


7aj

35 mg, 37% yield; White solid, m.p. = 224-226 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.97 (s, 1H), 8.80 (s, 1H), 8.39-8.25 (m, 2H), 8.09 (d, *J* = 9.0 Hz, 1H), 8.00 (d, *J* = 8.9 Hz, 1H), 7.90 (d, *J* = 8.0 Hz, 1H), 7.44 (t, *J* = 8.4 Hz, 3H), 7.35-7.16 (m, 6H), 7.07 (d, *J* = 9.0 Hz, 1H), 6.92 (d, *J* = 8.4 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 165.5, 153.8, 135.6, 135.0, 133.8, 132.7, 132.1, 131.8, 130.9, 130.3, 129.7, 128.9, 128.7, 128.63, 128.60, 127.7,

127.3, 125.5, 124.6, 124.3, 123.4, 119.0, 118.7, 113.5; HRMS (ESI) m/z calcd for $[C_{27}H_{19}BrNO_2]^+$ $[M+H]^+$: 468.0594, found 468.0595.

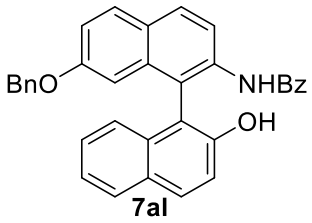
(37) *N*-(2'-hydroxy-7-methoxy-[1,1'-binaphthalen]-2-yl)benzamide (7ak)



7ak

58 mg, 68% yield; White solid, m.p. = 207-209 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.96 (s, 1H), 8.67 (s, 1H), 8.24 (d, *J* = 8.7 Hz, 1H), 8.10-7.84 (m, 4H), 7.46 (dd, *J* = 35.9, 7.4 Hz, 2H), 7.37-7.13 (m, 7H), 7.01 (d, *J* = 8.2 Hz, 1H), 6.49 (s, 1H), 3.44 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 165.3, 158.0, 153.7, 135.6, 135.1, 134.5, 133.7, 132.1, 130.8, 130.3, 129.0, 128.71, 128.68, 128.3, 127.1, 126.9, 124.5, 123.8, 123.4, 120.6, 119.0, 117.1, 114.2, 105.7, 55.2; HRMS (ESI) m/z calcd for $[C_{28}H_{22}NO_3]^+$ $[M+H]^+$: 420.1594, found 420.1595.

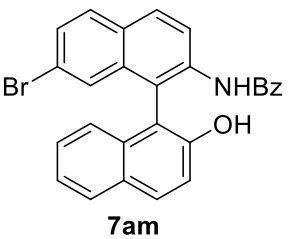
(38) *N*-(7-(benzyloxy)-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7al)



7al

61 mg, 62% yield; White solid, m.p. = 195-196 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.88 (s, 1H), 8.64 (s, 1H), 8.21 (d, *J* = 8.8 Hz, 1H), 8.01 (dd, *J* = 8.7, 7.2 Hz, 2H), 7.98-7.92 (m, 2H), 7.50-7.40 (m, 2H), 7.35-7.17 (m, 10H), 7.12 (dd, *J* = 6.6, 2.9 Hz, 2H), 6.95 (d, *J* = 8.5 Hz, 1H), 6.56 (d, *J* = 2.4 Hz, 1H), 4.78 (s, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 165.2, 157.0, 153.7, 136.9, 135.5, 135.1, 134.4, 133.7, 132.1, 130.8, 130.2, 129.0, 128.8, 128.70, 128.69, 128.3, 128.2, 127.1, 126.9, 124.5, 123.7, 123.4, 120.6, 119.0, 117.4, 114.1, 107.4, 69.8; HRMS (ESI) m/z calcd for $[C_{34}H_{26}NO_3]^+$ $[M+H]^+$: 496.1907, found 496.1905.

(39) *N*-(7-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7am)

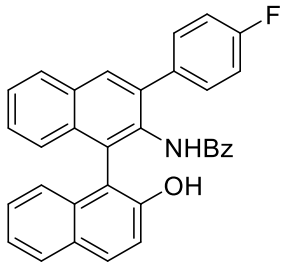


7am

49 mg, 52% yield; White solid, m.p. = 228-230 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.02 (s, 1H), 8.83 (s, 1H), 8.37 (d, *J* = 8.9 Hz, 1H), 8.13 (d, *J* = 8.9 Hz, 1H), 8.01 (dd, *J* = 8.7, 6.1 Hz, 2H), 7.92 (d, *J* = 8.0 Hz, 1H), 7.59 (dd, *J* = 8.7, 1.7 Hz, 1H), 7.50-7.38 (m, 2H), 7.32-7.18 (m, 7H), 6.96 (d, *J* = 8.4 Hz, 1H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 165.6, 153.9,

136.2, 135.0, 134.4, 133.6, 132.1, 131.1, 131.0, 130.0, 128.9, 128.8, 128.58, 128.56, 128.4, 127.9, 127.4, 127.3, 124.5, 124.2, 124.1, 123.5, 120.4, 119.0, 113.2; HRMS (ESI) m/z calcd for $[C_{27}H_{19}BrNO_2]^+$ $[M+H]^+$: 468.0594, found 468.0598.

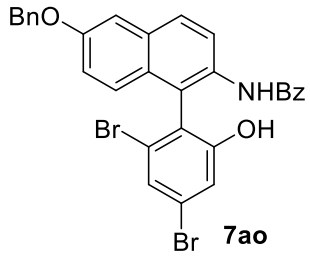
(40) *N*-(3-(4-fluorophenyl)-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (7an)



7an

73 mg, 76% yield; White solid, m.p. = 264-266 °C; R_f = 0.2 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.47 (d, *J* = 21.5 Hz, 2H), 8.09 (t, *J* = 3.9 Hz, 2H), 7.88-7.68 (m, 4H), 7.53 (t, *J* = 7.5 Hz, 1H), 7.39-7.29 (m, 3H), 7.16 (dtd, *J* = 49.2, 16.9, 16.0, 8.7 Hz, 10H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.6, 161.9 (d, $J_{C\text{-}F}$ = 243.5 Hz), 153.3, 138.7, 137.0, 135.5, 134.2, 133.64, 133.60, 132.9, 132.7, 131.4, 131.3, 131.2, 129.7, 129.3, 128.7, 128.3, 128.1, 127.4, 126.7, 126.5 (d, $J_{C\text{-}F}$ = 14,5 Hz), 126.3, 125.5, 123.0, 118.9, 116.4, 115.1 (d, $J_{C\text{-}F}$ = 21.2 Hz); ^{19}F NMR (471 MHz, DMSO-*d*$_6$): δ -115.87 (s); HRMS (ESI) m/z calcd for $[C_{33}H_{23}FNO_2]^+$ $[M+H]^+$: 484.1707, found 484.1710.

(41) *N*-(6-(benzyloxy)-1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benza-mi-de (7ao)

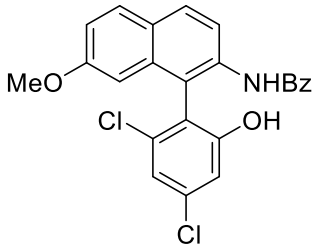


7ao

46 mg, 38% yield; White solid, m.p. = 229-230 °C; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.32 (s, 1H), 9.19 (s, 1H), 7.97-7.85 (m, 2H), 7.71-7.64 (m, 2H), 7.58-7.39 (m, 9H), 7.36 (t, *J* = 7.3 Hz, 1H), 7.19 (dd, *J* = 5.3, 1.5 Hz, 3H), 5.25 (s, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.0, 158.4, 156.4, 137.5, 135.6, 132.70, 132.67, 131.9, 128.9, 128.8, 128.4, 128.3, 127.9, 127.5, 127.4, 127.2, 126.9, 125.5, 125.3, 123.9, 122.3, 119.6, 118.3, 108.2, 69.9; HRMS (ESI) m/z calcd for $[C_{30}H_{22}Br_2NO_3]^+$ $[M+H]^+$: 601.9961, found 601.9961.

(42) *N*-(1-(2,4-dichloro-6-hydroxyphenyl)-7-methoxynaphthalen-2-yl)benzamide (7ap)

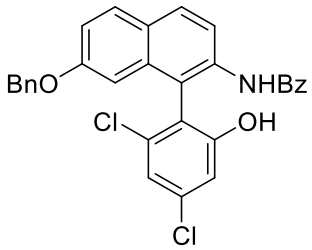
41 mg, 47% yield; White solid, m.p. = 198-200 °C; R_f = 0.3 (DCM/EA = 50/1)); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.37 (s, 1H), 9.30 (s, 1H), 7.92 (t, *J* = 8.5 Hz, 2H),



7ap

7.81 (d, *J* = 8.8 Hz, 1H), 7.67 (d, *J* = 7.2 Hz, 2H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.46 (t, *J* = 7.5 Hz, 2H), 7.25-7.15 (m, 2H), 7.03 (d, *J* = 1.9 Hz, 1H), 6.59 (d, *J* = 2.3 Hz, 1H), 3.69 (s, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.0, 158.3, 158.1, 136.3, 135.6, 135.5, 133.8, 133.5, 131.9, 130.2, 128.8, 128.5, 127.9, 126.9, 124.2, 122.4, 121.6, 120.1, 117.4, 115.0, 104.7, 55.5; HRMS (ESI) m/z calcd for $[C_{24}H_{18}Cl_2NO_3]^+$ $[M+H]^+$: 438.0658, found 438.0659.

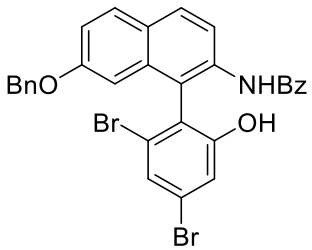
(43) *N*-(7-(benzyloxy)-1-(2,4-dichloro-6-hydroxyphenyl)naphthalen-2-yl)benzami-de (7aq)



7aq

53 mg, 52% yield; White solid, m.p. = 190-192 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.34 (s, 1H), 9.28 (s, 1H), 7.95-7.81 (m, 3H), 7.68 (d, *J* = 7.3 Hz, 2H), 7.50 (dt, *J* = 40.2, 7.4 Hz, 3H), 7.37-7.17 (m, 7H), 7.05 (d, *J* = 1.8 Hz, 1H), 6.68 (d, *J* = 2.0 Hz, 1H), 5.13-4.96 (m, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.0, 158.2, 157.2, 137.2, 136.4, 135.5, 135.5, 133.9, 133.5, 131.9, 130.2, 128.9, 128.8, 128.4, 128.3, 128.2, 127.9, 127.0, 124.2, 122.5, 121.5, 120.1, 117.8, 115.0, 106.5, 70.0; HRMS (ESI) m/z calcd for $[C_{30}H_{22}Cl_2NO_3]^+$ $[M+H]^+$: 514.0971, found 514.0974.

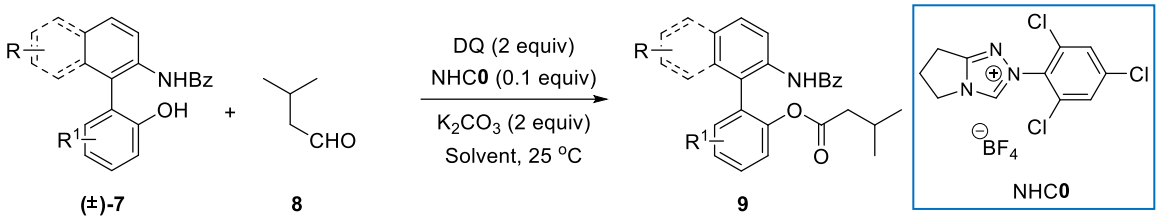
(44) *N*-(7-(benzyloxy)-1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzami-de (7ar)



7ar

59 mg, 49% yield; White solid, m.p. = 179-181 ºC; R_f = 0.3 (DCM/EA = 50/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 10.29 (s, 1H), 9.12 (s, 1H), 7.95-7.85 (m, 3H), 7.69-7.61 (m, 2H), 7.58-7.51 (m, 1H), 7.49-7.44 (m, 3H), 7.37-7.29 (m, 5H), 7.26-7.20 (m, 2H), 6.64 (d, *J* = 2.5 Hz, 1H), 5.03 (d, *J* = 2.7 Hz, 3H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.0, 158.4, 157.2, 137.2, 135.5, 135.2, 133.4, 132.0, 130.2, 128.9, 128.43, 128.35, 128.2, 127.9, 127.1, 126.9, 125.8, 125.5, 123.7, 122.4, 122.0, 118.4, 117.7, 106.5, 70.1; HRMS (ESI) m/z calcd for $[C_{30}H_{22}Br_2NO_3]^+$ $[M+H]^+$: 601.9961, found 601.9961.

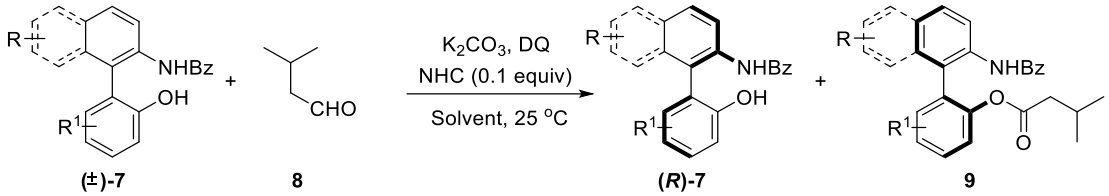
7. General procedure for the synthesis of racemic compounds 9



(±)-7 8 9

To a solution of racemic **7** (0.05 mmol, 1 eq.), NHC**0** (10 mol%), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.). The mixture was then stirred at 25 °C and monitored by TLC until **7** was full consumed. The mixture was concentrated under reduced pressure and purified by via column chromatography on silica gel (PE/EtOAc = 12/1, v/v) to give the product racemic **9.**

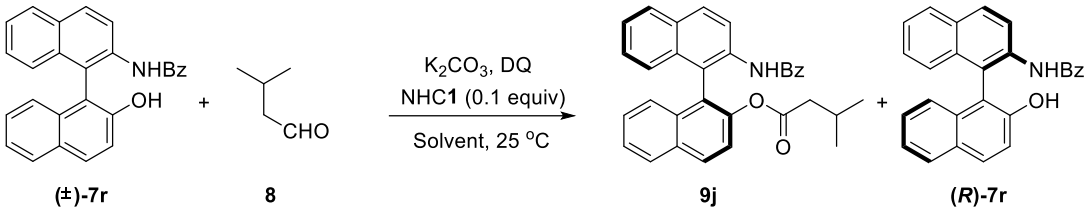
8. General procedure for the synthesis of chiral compounds 7 and 9



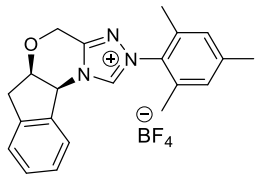
(±)-7 8 (*R*)-7 9

To a solution of racemic **7** (0.05 mmol, 1.0 eq.), NHC**1** (10 mol%), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After achieving appropriate conversion as indicated by TLC analysis of the reaction mixture, the mixture was directly purified by flash column chromatography (PE/EtOAc = 12/1→ DCM/EtOAc = 10/1, v/v) to give the recovered (***R***)-**7** and product **9.**

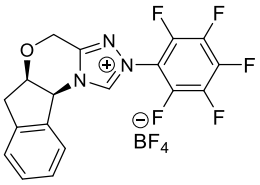
Optimization of chiral reaction conditions [a]



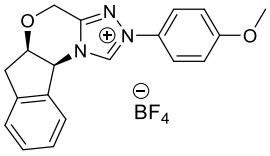
(±)-7r 8 9j (*R*)-7r



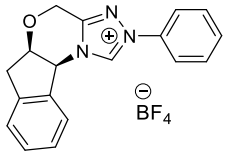
NHC1



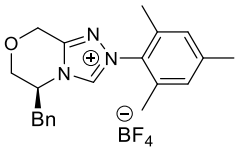
NHC2



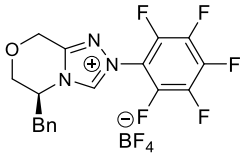
NHC3



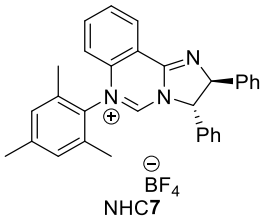
NHC4



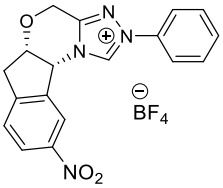
NHC5



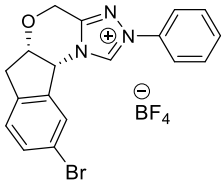
NHC6



NHC7



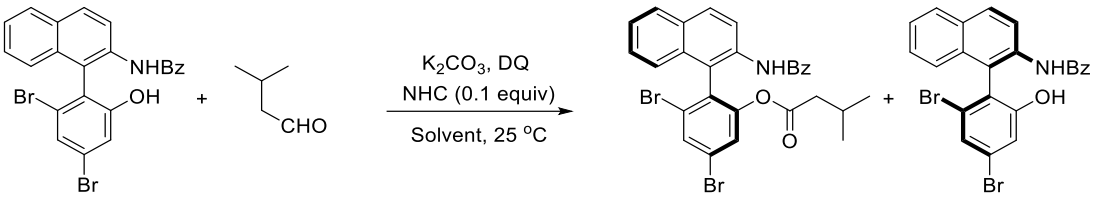
NHC8



NHC9

Entry	8	Base	Oxidant	Catalyst (10 mol%)	Solvent	Time /h	9j/Yield (%)[b]	ee (%)[c]	(*R*)-7r /Yield (%)[b]	ee (%)[c]
1	0.7 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	Toluenen (0.025M)	13	54	66	50	80
2	0.7 eq.	K_2CO_3 (1.5 eq.)	DQ (1.5 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	13	38	88	55	72
3	0.7 eq.	K_2CO_3 (1.5 eq.)	DQ (1.5 eq.)	NHC1	DCE/Toluenen = 1:3 (0.02M)	13	46	77	50	76
4	0.7 eq.	K_2CO_3 (1.5 eq.)	DQ (1.5 eq.)	NHC1	DCE (0.025M)	13	13	97	70	65
5	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.025M)	12	33	93	65	85
6	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.025M)	16	42	89	55	86
7	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.025M)	36	84	0	20	16
8	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.05M)	12	38	90	60	87
9	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.05M)	13	38	89	60	71
10	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.05M)	16	42	81	55	79
11	2 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE = 1 mL	12	33	94	60	77
12	3 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.05M)	13	33	91	40	78
13	4 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE (0.05M)	13	50	63	40	80
14	2 eq.	K_2CO_3 (1.5 eq.)	DQ (1.5 eq.)	NHC1	DCE (0.1M)	13	34	84	60	84
15	2 eq.	K_2CO_3 (1.5 eq.)	DQ (1.5 eq.)	NHC1	DCE (0.05M)	13	42	91	55	83
16	2 eq.	K_2CO_3 (1.5 eq.)	DQ (1.5 eq.)	NHC1	DCE (0.025M)	13	38	95	55	85
17	4 eq.	K_2CO_3 (2 eq.)	DQ (2 eq.)	NHC1	DCE (0.025M)	13	58	83	45	97
18	5 eq.	K_2CO_3 (2 eq.)	DQ (2 eq.)	NHC1	DCE (0.025M)	13	67	49	35	99

[a] Conditions: **7r** (0.05 mmol), **8**, base, DQ, catalyst (10 mol%), solvent, 25 °C. [b] Isolated yields after SiO_2 column chromatography. [c] Enantiomeric ratio determined via chiral-phase HPLC analysis.



(±)-7o 8 9h (*R*)-7o

Entry	8	Base	Oxidant	Catalyst (10 mol%)	Solvent	Time /h	9h/Yield (%)[b]	ee (%)[c]	(*R*)-7o /Yield (%)[b]	ee (%)[c]
1	0.6 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 2:1 (0.025M)	45	7	95	96	15
2	0.7 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 2:1 (0.025M)	45	14	95	82	15
3	0.8 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 2:1 (0.025M)	45	17	96	80	30
4	0.6 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	Toluenen (0.025M)	45	24	95	76	34
5	0.6 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	45	14	95	84	37
6	0.6 eq.	K_2CO_3 (3 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.05M)	45	24	89	72	31
7	0.7 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	Toluenen (0.025M)	43	31	93	68	43
8	0.7 eq.	K_2CO_3 (1.5 eq.)	DQ (2 eq.)	NHC1	Toluenen (0.025M)	42	24	93	72	43
9	0.7 eq.	K_2CO_3 (1.5 eq.)	DQ (1.5 eq.)	NHC1	Toluenen (0.025M)	42	44	95	52	43
15	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC2	DCE/Toluenen = 1:1 (0.025M)	40	90	6	trace	~
16	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC3	DCE/Toluenen = 1:1 (0.025M)	40	93	7	trace	~
17	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC4	DCE/Toluenen = 1:1 (0.025M)	40	trace	~	~	~
18	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC5	DCE/Toluenen = 1:1 (0.025M)	40	trace	~	~	~
19	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC6	DCE/Toluenen = 1:1 (0.025M)	40	trace	~	~	~
20	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC7	DCE/Toluenen = 1:1 (0.025M)	40	N.P.	~	~	~
21	4 eq.	K_2CO_3 (1.5 eq.)	DQ (1.2 eq.)	NHC8	DCE/Toluenen = 1:1 (0.025M)	43	90	13	4	-89
22	4 eq.	K_2CO_3 (1.5 eq.)	DQ (1.2 eq.)	NHC9	DCE/Toluenen = 1:1 (0.025M)	43	69	23	24	-97
23	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	12	11	97	88	7
24	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	24	11	97	80	29
25	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	36	18	94	80	31
26	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	40	21	95	74	31
27	1.5 eq.	K_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	48	34	92	68	47
28	1.5 eq.	DIPEA (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	36	14	97	84	25
29	1.5 eq.	DBU (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	36	14	5	72	10
30	1.5 eq.	Cs_2CO_3 (1.2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	36	59	28	38	72
31	3 eq.	K_2CO_3 (2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	60	55	56	44	98
32	4 eq.	K_2CO_3 (2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	45	38	86	52	77
33	5 eq.	K_2CO_3 (2 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen = 1:1 (0.025M)	45	48	80	48	87
34	6 eq.	K_2CO_3 (1.5 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen =3:2 (0.02M)	45	45	83	52	85
35	6 eq.	K_2CO_3 (1.5 eq.)	DQ (1.2 eq.)	NHC1	DCE/Toluenen =4:3 (0.014M)	45	48	92	48	98

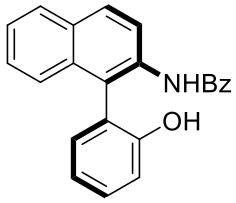
[a] Conditions: **7o** (0.05 mmol), **8**, base, DQ, catalyst (10 mol%), solvent, 25 °C. [b] Isolated yields after SiO_2 column chromatography. [c] Enantiomeric ratio determined via chiral-phase HPLC analysis.

10. Analytical data of chiral products

(1) NHC-catalyzed kinetic resolution of racemic 7a with isovaleraldehyde 8

To a solution of racemic **7a** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 12 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7a** (7 mg, 41% yield) and product **9a** (12 mg, 57% yield)**.**

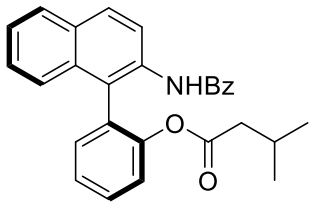
(*R*)-*N*-(1-(2-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7a)



(*R*)-7a

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.105 min, t_{minor} = 4.109 min, ee = 99%; $[\alpha]_D^{18}$ = – 0.035 (c = 0.17, $CHCl_3$).

(*S*)-2-(2-benzamidonaphthalen-1-yl)phenyl 3-methylbutanoate (9a)



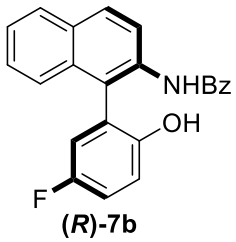
9a

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.23 (d, *J* = 9.0 Hz, 1H), 8.13 (s, 1H), 7.85 (d, *J* = 9.0 Hz, 1H), 7.80-7.76 (m, 1H), 7.67-7.59 (m, 2H), 7.47 (td, *J* = 7.8, 1.8 Hz, 1H), 7.41-7.33 (m, 2H), 7.33-7.25 (m, 5H), 7.23-7.16 (m, 2H), 1.94-1.78 (m, 2H), 1.48 (dp, *J* = 13.4, 6.7 Hz, 1H), 0.39 (dd, *J* = 6.7, 5.6 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.8, 165.4, 149.6, 134.5, 134.0, 132.5, 132.4, 131.6, 131.0, 130.1, 129.9, 129.0, 128.6, 127.9, 127.3, 127.1, 126.5, 125.4, 125.1, 122.9, 122.7, 42.8, 25.4, 21.8, 21.7; HRMS (ESI) m/z calcd for $[C_{28}H_{26}NO_3]^+$ $[M+H]^+$: 424.1907, found 424.904; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.732 min, t_{minor} = 5.139 min, ee = 71%; $[\alpha]_D^{17}$ = + 0.107 (c = 0.40, $CHCl_3$).

(2) NHC-catalyzed kinetic resolution of racemic 7b with isovaleraldehyde 8

To a solution of racemic **7b** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 ^oC. After 41 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7b** (7 mg, 39% yield) and product **9b** (13 mg, 59% yield)**.**

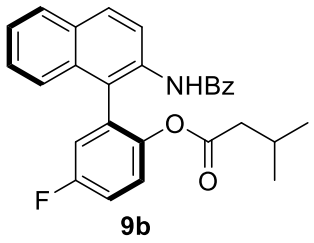
(*R*)-*N*-(1-(5-fluoro-2-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7b)



(***R***)-7b

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 10.551 min, t_{minor} = 7.507 min, ee = 99%; $[\alpha]_D^{16}$ = – 0.056 (c = 0.13, $CHCl_3$).

(*S*)-2-(2-benzamidonaphthalen-1-yl)-4-fluorophenyl 3-methylbutanoate (9b)



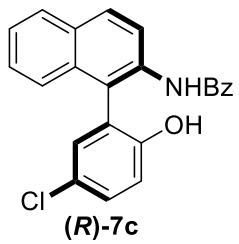
9b

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^1H NMR (500 MHz, $CDCl_3$): δ 8.18 (d, *J* = 8.9 Hz, 1H), 8.13 (s, 1H), 7.85 (d, *J* = 9.0 Hz, 1H), 7.78 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.72-7.66 (m, 2H), 7.44-7.28 (m, 5H), 7.22-7.12 (m, 3H), 6.98 (dt, *J* = 8.3, 1.8 Hz, 1H), 1.96-1.79 (m, 2H), 1.48 (dp, *J* = 13.7, 6.9 Hz, 1H), 0.39 (t, *J* = 6.5 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 173.0, 165.5, 160.8 (d, $J_{C\text{-}F}$ = 247.7 Hz), 145.6 (d, $J_{C\text{-}F}$ = 3.0 Hz), 134.3, 134.0, 132.1, 131.8, 131.8, 131.0, 129.4, 128.7, 128.0, 127.2, 126.8, 125.4, 125.1, 124.3 (d, $J_{C\text{-}F}$ = 8.9 Hz), 124.2, 122.9, 119.0 (d, $J_{C\text{-}F}$ = 23.1 Hz), 116.9 (d, $J_{C\text{-}F}$ = 23.2 Hz), 42.7, 25.4, 21.8, 21.7; ^{19}F NMR (471 MHz, $CDCl_3$): δ -114.68 (s); HRMS (ESI) m/z calcd for $[C_{28}H_{25}FNO_3]^+$ $[M+H]^+$: 442.1813, found 442.1817; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 16.691 min, t_{minor} = 9.793 min, ee = 70%; $[\alpha]_D^{15}$ = + 0.132 (c = 0.33, $CHCl_3$).

(3) NHC-catalyzed kinetic resolution of racemic 7c with isovaleraldehyde 8

To a solution of racemic **7c** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 22 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7c** (9 mg, 47% yield) and product **9c** (11 mg, 47% yield)**.**

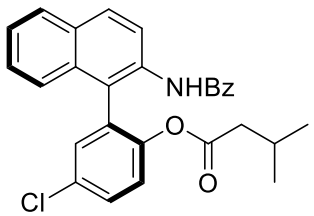
(*R*)-*N*-(1-(5-chloro-2-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7c)



(***R***)-**7c**

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.248 min, t_{minor} = 6.907 min, ee = 93%; $[\alpha]_D^{16}$ = + 0.014 (c = 0.10, $CHCl_3$).

(*S*)-2-(2-benzamidonaphthalen-1-yl)-4-chlorophenyl 3-methylbutanoate (9c)



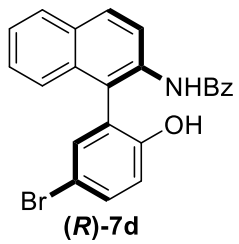
9c

White solid, m.p. = 88-90 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.20 (d, *J* = 8.9 Hz, 1H), 8.09 (s, 1H), 7.86 (d, *J* = 9.0 Hz, 1H), 7.82-7.74 (m, 1 H), 7.74-7.63 (m, 2H), 7.48-7.30 (m, 6H), 7.28 (d, *J* = 2.6 Hz, 1H), 7.21-7.16 (m, 1H), 7.13 (d, *J* = 8.7 Hz, 1H), 1.98-1.78 (m, 2H), 1.48 (dp, *J* = 13.6, 6.8 Hz, 1H), 0.39 (dd, *J* = 6.7, 5.6 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.7, 165.5, 148.2, 134.4, 134.0, 132.6, 132.2, 132.1, 131.79, 131.76, 131.0, 130.2, 129.4, 128.7, 128.0, 127.2, 126.8, 125.3, 125.1, 124.2, 122.8, 42.6, 25.4, 21.8, 21.7; HRMS (ESI) m/z calcd for $[C_{28}H_{25}ClNO_3]^+$ $[M+H]^+$: 458.1517, found 458.1517; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 17.621 min, t_{minor} = 5.961 min, ee = 95%; $[\alpha]_D^{15}$ = + 0.023 (c = 0.30, $CHCl_3$).

(4) NHC-catalyzed kinetic resolution of racemic 7d with isovaleraldehyde 8

To a solution of racemic **7d** (0.05 mmol, 1 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 45 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7d** (10 mg, 48% yield) and product **9d** (13 mg, 51% yield)**.**

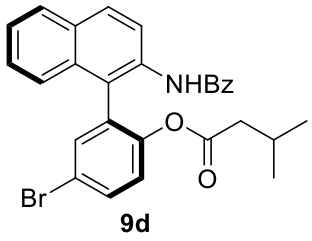
(*R*)-*N*-(1-(5-bromo-2-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7d)



(***R***)-7d

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.232 min, t_{minor} = 7.035 min, ee = 90%; $[\alpha]_D^{15}$ = + 0.030 (c = 0.13, $CHCl_3$).

(*S*)-2-(2-benzamidonaphthalen-1-yl)-4-bromophenyl 3-methylbutanoate (9d)



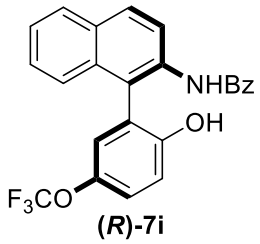
9d

Yellow solid, m.p. = 108-109 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.20 (d, *J* = 8.9 Hz, 1H), 8.08 (s, 1H), 7.86 (d, *J* = 9.0 Hz, 1H), 7.83-7.75 (m, 1H), 7.75-7.66 (m, 2H), 7.59 (dd, *J* = 8.7, 2.4 Hz, 1H), 7.46-7.30 (m, 6H), 7.21-7.16 (m, 1H), 7.07 (d, *J* = 8.6 Hz, 1H), 1.97-1.79 (m, 2H), 1.48 (hept, *J* = 6.8 Hz, 1H), 0.39 (dd, *J* = 6.7, 5.4 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.5, 165.6, 148.8, 135.1, 134.4, 134.1, 133.2, 132.1, 132.1, 131.8, 131.0, 129.4, 128.7, 128.0, 127.2, 126.8, 125.3, 125.1, 124.6, 123.7, 122.8, 120.2, 42.6, 25.4, 21.74, 21.71; HRMS (ESI) m/z calcd for $[C_{28}H_{25}BrNO_3]^+$ $[M+H]^+$: 502.1012, found 502.1012; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 24.189 min, t_{minor} = 6.577 min, ee = 88%; $[\alpha]_D^{15}$ = – 0.022 (c = 0.33, $CHCl_3$).

(5) NHC-catalyzed kinetic resolution of racemic 7i with isovaleraldehyde 8

To a solution of racemic **7i** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in Toluene (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 ^oC. After 17 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7i** (9 mg, 43% yield) and product **9e** (12 mg, 48% yield)**.**

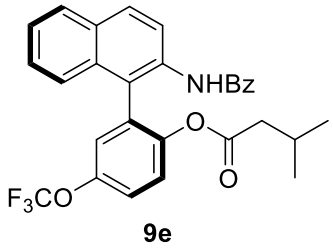
(*R*)-*N*-(1-(2-hydroxy-5-(trifluoromethoxy)phenyl)naphthalen-2-yl)benzamide ((*R*)-7i)



(***R***)-7i

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.030 min, t_{minor} = 4.103 min, ee = 90%; $[\alpha]_D^{15}$ = – 0.009 (c = 0.20, $CHCl_3$).

(*S*)-2-(2-benzamidonaphthalen-1-yl)-4-(trifluoromethoxy)phenyl 3-methylbutanoate (9e)



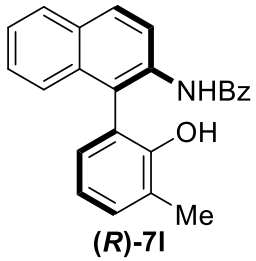
9e

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^1H NMR (500 MHz, $CDCl_3$): δ 8.20 (d, *J* = 9.0 Hz, 1H), 8.04 (s, 1H), 7.87 (d, *J* = 9.0 Hz, 1H), 7.83-7.77 (m, 1H), 7.68-7.60 (m, 2H), 7.44-7.30 (m, 6H), 7.26-7.15 (m, 3H), 1.96-1.79 (m, 2H), 1.47 (dp, *J* = 13.7, 6.8 Hz, 1H), 0.39 (t, *J* = 6.6 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.6, 165.6, 148.0, 147.5, 134.2(d, J_{C-F} = 25.7 Hz), 131.98, 131.96, 131.8, 131.1, 129.6, 128.7, 128.1, 127.1, 126.9, 125.4, 125.00, 124.96, 124.4, 123.9, 123.0, 122.7, 120.3(q, J_{C-F} = 258.1 Hz), 42.6, 25.4, 21.74, 21.70; ^{19}F NMR (471 MHz, $CDCl_3$): δ -58.19 (s); HRMS (ESI) m/z calcd for $[C_{29}H_{25}F_3NO_3]^+$ $[M+H]^+$: 508.1730, found 508.1734; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 10.849 min, t_{minor} = 5.621 min, ee = 87%; $[\alpha]_D^{15}$ = + 0.059 (c = 0.27, $CHCl_3$).

(6) NHC-catalyzed kinetic resolution of racemic 7l with isovaleraldehyde 8

To a solution of racemic **7l** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 ^oC. After 5 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7l** (8 mg, 44% yield) and product **9f** (11 mg, 50% yield)**.**

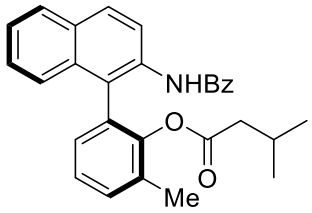
(*R*)-*N*-(1-(2-hydroxy-3-methylphenyl)naphthalen-2-yl)benzamide ((*R*)-7l)



(***R***)-**7l**

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.950 min, t_{minor} = 5.079 min, ee = 96%; $[\alpha]_D^{15}$ = – 0.062 (c = 0.30, $CHCl_3$).

(*S*)-2-(2-benzamidonaphthalen-1-yl)-6-methylphenyl 3-methylbutanoate (9f)



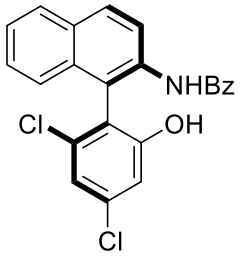
9f

White solid, m.p. = 101-103 ^oC; R_f = 0.2 (PE/EA = 15/1); ^1H NMR (500 MHz, $CDCl_3$): δ 8.30 (d, *J* = 8.9 Hz, 1H), 8.19 (s, 1H), 7.92 (d, *J* = 8.9 Hz, 1H), 7.89-7.82 (m, 1H), 7.72 (d, *J* = 7.6 Hz, 2H), 7.51-7.35 (m, 6H), 7.35-7.26 (m, 2H), 7.16 (dd, *J* = 7.4, 1.6 Hz, 1H), 2.32 (s, 3H), 1.94 (qd, *J* = 14.8, 7.1 Hz, 2H), 1.56 (dp, *J* = 13.6, 6.8 Hz, 1H), 0.48 (dd, *J* = 6.7, 3.2 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 165.4, 148.3, 134.56, 134.0, 132.4, 131.6, 131.5, 131.0, 129.8, 129.7, 128.8, 128.6, 127.9, 127.2, 127.0, 126.4, 125.5, 125.1, 42.6, 25.3, 21.83, 21.80, 16.6; HRMS (ESI) m/z calcd for $[C_{29}H_{27}NO_3]^+$ $[M+H]^+$: 438.2064, found 438.2061; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.676 min, t_{minor} = 5.285 min, ee = 75%; $[\alpha]_D^{15}$ = + 0.181 (c = 0.37, $CHCl_3$).

(7) NHC-catalyzed kinetic resolution of racemic 7n with isovaleraldehyde 8

To a solution of racemic **7n** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in Toluene (2.0 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 24 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7n** (9 mg, 43% yield) and product **9g** (11 mg, 44% yield)**.**

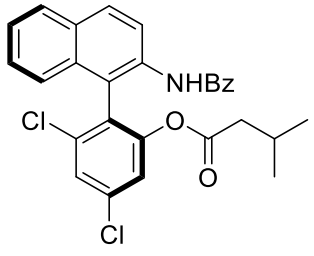
(*S*)-*N*-(1-(2,4-dichloro-6-hydroxyphenyl)naphthalen-2-yl)benzamide((*R*)-7n)



(***R***)-7n

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.199 min, t_{minor} = 6.450 min, ee = 99%; $[\alpha]_D^{15}$ = + 0.067 (c = 0.13, $CHCl_3$).

(*R*)-2-(2-benzamidonaphthalen-1-yl)-3,5-dichlorophenyl 3-methylbutanoate (9g)



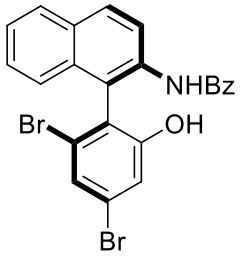
9g

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.22 (d, *J* = 8.9 Hz, 1H), 8.02 (s, 1H), 7.88 (d, *J* = 9.0 Hz, 1H), 7.79 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.71 (dt, *J* = 7.1, 1.4 Hz, 2H), 7.46-7.27 (m, 6H), 7.17-7.06 (m, 2H), 1.91-1.74 (m, 2H), 1.45 (dt, *J* = 13.7, 6.8 Hz, 1H), 0.40 (dd, *J* = 8.6, 6.7 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.3, 165.3, 151.0, 137.3, 135.5, 134.8, 134.5, 131.8, 131.6, 131.1, 129.8, 128.8, 128.22, 128.20, 128.1, 127.2, 127.0, 125.4, 124.3, 122.7, 122.2, 120.8, 42.5, 25.3, 21.77, 21.75; HRMS (ESI) m/z calcd for $[C_{28}H_{24}Cl_2NO_3]^+$ $[M+H]^+$: 492.1128, found 492.1127; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.407 min, t_{minor} = 5.223 min, ee = 90%; $[\alpha]_D^{15}$ = – 0.040 (c = 0.33, $CHCl_3$).

(8) NHC-catalyzed kinetic resolution of racemic 7o with isovaleraldehyde 8

To a solution of racemic **7o** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE/Toluene = 4/3 (3.5 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 45 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7o** (12 mg, 48% yield) and product **9h** (14 mg, 48% yield)**.**

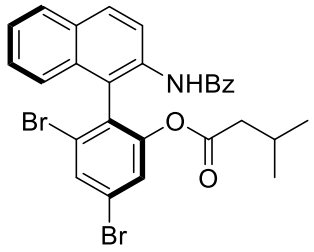
(*S*)-*N*-(1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7o)



(***R***)-**7o**

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 05/95, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.417 min, t_{minor} = 6.021 min, ee = 98%; $[\alpha]_D^{15}$ = + 0.181 (c = 0.30, $CHCl_3$).

(*R*)-2-(2-benzamidonaphthalen-1-yl)-3,5-dibromophenyl 3-methylbutanoate (9h)



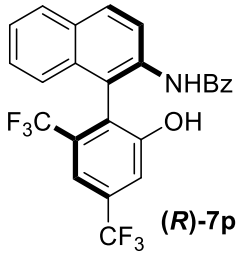
9h

White solid, m.p. = 131-133 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.31 (d, *J* = 8.9 Hz, 1H), 8.09 (s, 1H), 7.98 (d, *J* = 9.0 Hz, 1H), 7.93-7.83 (m, 2H), 7.82-7.76 (m, 2H), 7.55-7.38 (m, 6H), 7.17 (dd, *J* = 8.4, 1.1 Hz, 1H), 2.01-1.81 (m, 2H), 1.54 (dp, *J* = 13.6, 6.8 Hz, 1H), 0.50 (dd, *J* = 9.2, 6.7 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.4, 165.3, 150.9, 134.54, 134.50, 134.0, 131.8, 131.4, 131.1, 130.5, 129.8, 128.8, 128.2, 127.3, 127.2, 127.0, 125.6, 125.4, 124.2, 123.1, 122.73, 122.68, 42.4, 25.3, 21.78, 21.77; HRMS (ESI) m/z calcd for $[C_{28}H_{24}Br_2NO_3]^+$ $[M+H]^+$: 580.0117, found 580.0121; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.062 min, t_{minor} = 5.307 min, ee = 92%; $[\alpha]_D^{15}$ = – 0.042 (c = 0.37, $CHCl_3$).

(9) NHC-catalyzed kinetic resolution of racemic 7p with isovaleraldehyde 8

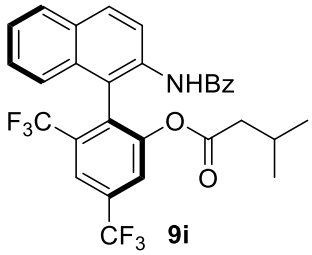
To a solution of racemic **7p** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in Toluene (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 48 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7p** (10 mg, 48% yield) and product **9i** (14 mg, 48% yield)**.**

(*R*)-*N*-(1-(2-hydroxy-4,6-bis(trifluoromethyl)phenyl)naphthalen-2-yl)benza-mide ((*R*)-7p)



R_f = 0.2 (DCM:EA = 20:1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 02/98, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.298 min, t_{minor} = 5.118 min, ee = 97%; $[\alpha]_D^{15}$ = + 0.091 (c = 0.23, $CHCl_3$).

(*S*)-2-(2-benzamidonaphthalen-1-yl)-3,5-bis(trifluoromethyl)phenyl 3-methylbu-tanoate (9i)

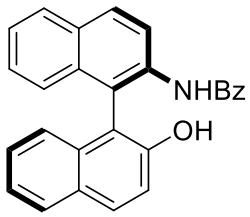


White solid, m.p. = 133-134 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.24 (d, *J* = 8.9 Hz, 1H), 8.06 (d, *J* = 1.6 Hz, 1H), 8.00 (d, *J* = 9.0 Hz, 1H), 7.96-7.86 (m, 2H), 7.78-7.70 (m, 3H), 7.53-7.45 (m, 2H), 7.40 (tdd, *J* = 8.3, 6.7, 1.5 Hz, 3H), 7.00 (dd, *J* = 8.4, 1.0 Hz, 1H), 2.06-1.85 (m, 2H), 1.56 (dq, *J* = 13.5, 6.8 Hz, 1H), 0.55 (dd, *J* = 9.2, 6.6 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.6, 165.1, 151.4, 134.6, 134.3, 133.6, 133.5, 133.3, 132.8 (q, $J_{C\text{-}F}$ = 34.4 Hz), 132.2, 131.9, 130.8, 130.2, 128.7, 128.1, 127.1, 127.0, 125.0 (d, $J_{C\text{-}F}$ = 128.5 Hz), 124.2 (q, $J_{C\text{-}F}$ = 3.8 Hz), 123.5 (d, $J_{C\text{-}F}$ = 60.2 Hz), 123.1, 122.1(t, $J_{C\text{-}F}$ = 3.9 Hz), 121.3 (d, $J_{C\text{-}F}$ = 62.5 Hz), 119.5, 42.3, 25.3, 21.8; ^{19}F NMR (471 MHz, $CDCl_3$): δ -61.41 (s), -62.88 (s); HRMS (ESI) m/z calcd for $[C_{30}H_{24}F_6NO_3]^+$ $[M+H]^+$: 560.1655, found 560.1653; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.768 min, t_{minor} = 3.126 min, ee = 79%; $[\alpha]_D^{15}$ = + 0.102 (c = 0.27, $CHCl_3$).

(10) NHC-catalyzed kinetic resolution of racemic 7r with isovaleraldehyde 8

To a solution of racemic **7r** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 13 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE:EA = 12:1→DCM:EA = 10:1, v/v) to give the recovered (***R***)-**7r** (9 mg, 45% yield) and product **9j** (12 mg, 50% yield)**.**

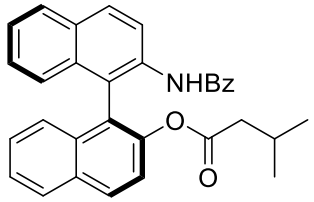
(*R*)-*N*-(2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7r)



(***R***)-**7r**

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.623 min, t_{minor} = 4.270 min, ee = 97%; $[\alpha]_D^{15}$ = + 0.425 (c = 0.33, $CHCl_3$).

(*S*)-2'-benzamido-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9j)



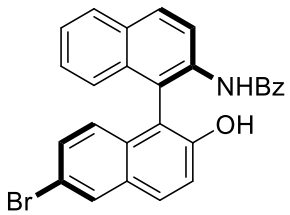
9j

White solid, m.p. = 100-102 °C; R_f = 0.2 (PE:EA = 15:1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.46 (d, *J* = 9.0 Hz, 1H), 8.13-8.00 (m, 3H), 7.92 (dq, *J* = 8.3, 1.1 Hz, 2H), 7.47-7.27 (m, 9H), 7.27-7.22 (m, 2H), 7.17 (dd, *J* = 8.4, 1.0 Hz, 1H), 2.02 (qd, *J* = 14.6, 7.1 Hz, 2H), 1.62 (dt, *J* = 13.6, 6.8 Hz, 1H), 0.54 (dd, *J* = 6.7, 5.2 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.8, 165.3, 147.3, 135.0, 134.5, 133.0, 132.7, 132.1, 131.5, 131.2, 130.7, 129.3, 128.4, 128.1, 128.0, 127.7, 126.9, 126.6, 126.4, 125.5, 125.3, 125.2, 125.0, 122.4, 122.0, 121.5, 42.8, 25.5, 21.9, 21.8; HRMS (ESI) m/z calcd for $[C_{32}H_{28}NO_3]^+$ $[M+H]^+$: 474.2064, found 474.2064; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 13/87, 1.0 mL/min, 227 nm), retention time: t_{major} = 12.215 min, t_{minor} = 14.835 min, ee = 91%; $[\alpha]_D^{15}$ = – 0.451 (c = 0.37, $CHCl_3$).

(11) NHC-catalyzed kinetic resolution of racemic 7s with isovaleraldehyde 8

To a solution of racemic **7s** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 ^oC. After 47 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7s** (10 mg, 42% yield) and product (***S***)-**9k** (14 mg, 52% yield)**.**

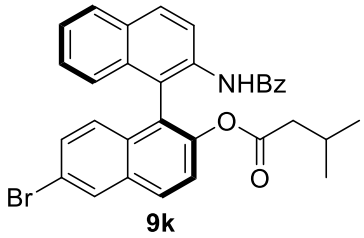
(*R*)-*N*-(6'-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7s)



(***R***)-7s

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.833 min, t_{minor} = 4.707 min, ee = 99%; $[\alpha]_D^{15}$ = + 0.299 (c = 0.20, $CHCl_3$).

(*S*)-2'-benzamido-6-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9k)



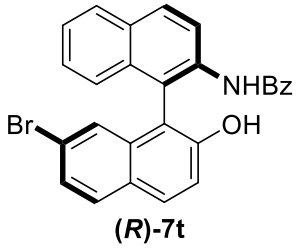
9k

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^1H NMR (500 MHz, $CDCl_3$): δ 8.31 (d, *J* = 9.0 Hz, 1H), 8.08-7.93 (m, 3H), 7.86 (dd, *J* = 21.1, 8.5 Hz, 2H), 7.49-7.41 (m, 2H), 7.40-7.25 (m, 4H), 7.25-7.17 (m, 3H), 7.12-6.99 (m, 2H), 2.02-1.88 (m, 2H), 1.55 (dt, *J* = 13.2, 6.6 Hz, 1H), 0.46 (t, *J* = 6.4 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.9, 165.3, 147.5, 135.0, 134.2, 133.1, 132.6, 131.62, 131.57, 131.2, 131.1, 130.2, 129.7, 129.5, 128.5, 128.1, 127.3, 127.0, 126.8, 125.6, 125.4, 125.1, 122.73, 122.70, 121.6, 120.7, 42.8, 25.5, 21.83, 21.81; HRMS (ESI) m/z calcd for $[C_{32}H_{27}BrNO_3]^+$ $[M+H]^+$: 552.1169, found 552.1169; HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 05/95, 1.0 mL/min, 227 nm), retention time: t_{major} = 5.250 min, t_{minor} = 6.558 min, ee = 89%; $[\alpha]_D^{15}$ = – 0.297 (c = 0.37, $CHCl_3$).

(12) NHC-catalyzed kinetic resolution of racemic 7t with isovaleraldehyde 8

To a solution of racemic **7t** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 24 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7t** (11 mg, 46% yield) and product **9l** (14 mg, 50% yield)**.**

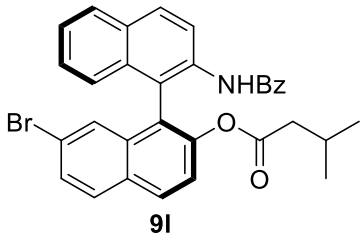
(*R*)-*N*-(7'-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7t)



(***R***)-7t

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.911 min, t_{minor} = 7.745 min, ee = 95%; $[\alpha]_D^{15}$ = + 0.207 (c = 0.27, $CHCl_3$).

(*S*)-2'-benzamido-7-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9l)



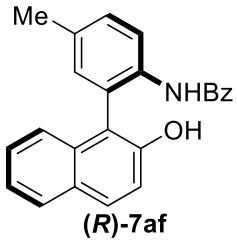
9l

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.41 (d, *J* = 9.0 Hz, 1H), 7.98-7.88 (m, 3H), 7.87-7.82 (m, 1H), 7.70 (d, *J* = 8.7 Hz, 1H), 7.43 (ddd, *J* = 9.8, 8.6, 1.8 Hz, 3H), 7.39-7.27 (m, 4H), 7.25-7.17 (m, 3H), 7.03 (dd, *J* = 8.6, 1.0 Hz, 1H), 1.92 (qd, *J* = 14.7, 7.1 Hz, 2H), 1.53 (dq, *J* = 13.6, 6.8 Hz, 1H), 0.45 (dd, *J* = 6.7, 5.0 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.6, 165.2, 148.2, 135.1, 134.5, 134.3, 132.5, 131.5, 131.2, 130.6, 130.5, 130.1, 129.8, 129.7, 128.5, 128.1, 127.5, 127.0, 126.8, 125.3, 125.1, 124.4, 122.4, 122.3, 122.1, 120.9, 42.8, 25.5, 21.84, 21.82; HRMS (ESI) m/z calcd for $[C_{32}H_{27}BrNO_3]^+$ $[M+H]^+$: 552.1169, found 552.1165; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 01/99, 1.0 mL/min, 227 nm), retention time: t_{major} = 26.493 min, t_{minor} = 21.802 min, ee = 89%; $[\alpha]_D^{15}$ = – 0.364 (c = 0.33, $CHCl_3$).

(13) NHC-catalyzed kinetic resolution of racemic 7af with isovaleraldehyde 8

To a solution of racemic **7af** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 18 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7af** (8 mg, 44% yield) and product **9m** (11 mg, 50% yield)**.**

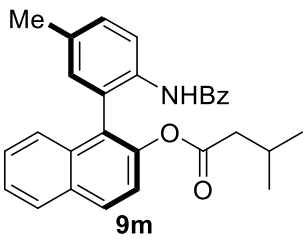
(*R*)-*N*-(2-(2-hydroxynaphthalen-1-yl)-4-methylphenyl)benzamide ((*R*)-7af)



(***R***)-7af

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.789 min, t_{minor} = 3.846 min, ee = 94%; $[\alpha]_D^{15}$ = + 0.168 (c = 0.17, $CHCl_3$).

(*S*)-1-(2-benzamido-5-methylphenyl)naphthalen-2-yl 3-methylbutanoate (9m)



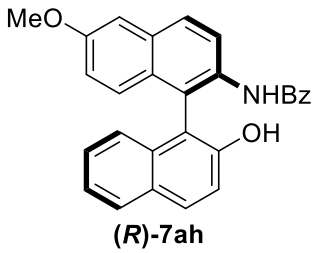
9m

White solid, m.p. = 111-113 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.23 (d, *J* = 8.3 Hz, 1H), 7.96 (d, *J* = 8.9 Hz, 1H), 7.90-7.86 (m, 1H), 7.76 (s, 1H), 7.44 (td, *J* = 7.4, 1.3 Hz, 2H), 7.38 (ddd, *J* = 8.4, 6.4, 1.4 Hz, 1H), 7.36-7.25 (m, 5H), 7.23-7.18 (m, 2H), 7.06 (d, *J* = 2.1 Hz, 1H), 2.38 (s, 3H), 2.20 (d, *J* = 7.1 Hz, 2H), 1.90 (dp, *J* = 13.6, 6.8 Hz, 1H), 0.77 (t, *J* = 6.6 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.5, 165.1, 146.3, 134.7, 134.3, 134.0, 132.8, 131.7, 131.3, 131.2, 130.2, 129.8, 128.4, 128.0, 127.5, 127.3, 126.8, 126.3, 126.1, 125.7, 123.0, 121.4, 43.0, 25.7, 22.10, 22.08, 20.9; HRMS (ESI) m/z calcd for $[C_{29}H_{28}NO_3]^+$ $[M+H]^+$: 438.2064, found 438.2045; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.683 min, t_{minor} = 3.217 min, ee = 83%; $[\alpha]_D^{15}$ = – 0.186 (c = 0.27, $CHCl_3$).

(14) NHC-catalyzed kinetic resolution of racemic 7ah with isovaleraldehyde 8

To a solution of racemic **7ah** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 24 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7ah** (9 mg, 43% yield) and product **9n** (13 mg, 52% yield)**.**

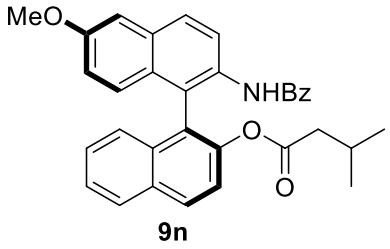
(*R*)-*N*-(2'-hydroxy-6-methoxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7ah)



(*R*)-7ah

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 16.781 min, t_{minor} = 21.000 min, ee = 99%; $[\alpha]_D^{17}$ = + 0.181 (c = 0.23, $CHCl_3$).

(*S*)-2'-benzamido-6'-methoxy-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9n)



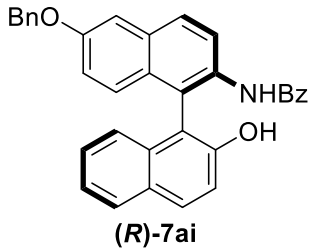
9n

Yellow solid, m.p. = 121-123 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.29 (d, *J* = 9.0 Hz, 1H), 7.96 (d, *J* = 8.7 Hz, 2H), 7.83 (t, *J* = 8.3 Hz, 2H), 7.40-7.32 (m, 3H), 7.31-7.13 (m, 7H), 6.99 (d, *J* = 9.1 Hz, 1H), 6.89 (dd, *J* = 9.2, 2.6 Hz, 1H), 3.84 (s, 3H), 1.95 (qd, *J* = 14.6, 7.1 Hz, 2H), 1.58 (dt, *J* = 13.6, 6.8 Hz, 1H), 0.59-0.41 (m, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.9, 165.3, 157.3, 147.2, 134.5, 133.0, 133.0, 132.4, 132.0, 131.4, 130.6, 128.4, 128.1, 128.0, 128.0, 127.7, 127.0, 126.9, 126.4, 125.5, 125.2, 123.2, 122.5, 121.4, 119.2, 106.2, 55.3, 42.9, 25.5, 21.90, 21.86; HRMS (ESI) m/z calcd for $[C_{33}H_{30}NO_4]^+$ $[M+H]^+$: 504.2169, found 504.2166; HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 5.494 min, t_{minor} = 9.152 min, ee = 70%; $[\alpha]_D^{15}$ = – 0.320 (c = 0.37, $CHCl_3$).

(15) NHC-catalyzed kinetic resolution of racemic 7ai with isovaleraldehyde 8

To a solution of racemic **7ai** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 11 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7ai** (11 mg, 44% yield) and product **9o** (13 mg, 45% yield)**.**

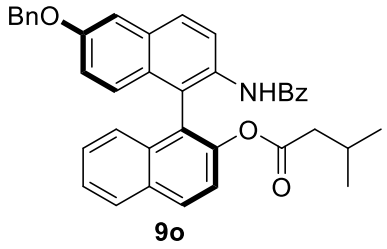
(*R*)-*N*-(6-(benzyloxy)-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7ai)



(*R*)-7ai

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 13/87, 1.0 mL/min, 227 nm), retention time: t_{major} = 17.249 min, t_{minor} = 12.977 min, ee = 91%; $[\alpha]_D^{16}$ = + 0.188 (c = 0.30, $CHCl_3$).

(*S*)-2'-benzamido-6'-(benzyloxy)-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9o)



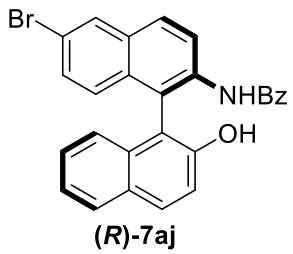
9o

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.36 (d, *J* = 8.9 Hz, 1H), 8.09-7.99 (m, 2H), 7.89 (dd, *J* = 8.8, 2.0 Hz, 2H), 7.51-7.45 (m, 2H), 7.44-7.35 (m, 6H), 7.34-7.30 (m, 3H), 7.29-7.26 (m, 2H), 7.25-7.19 (m, 2H), 7.11-6.99 (m, 2H), 5.17 (s, 2H), 2.02 (qd, *J* = 14.6, 7.1 Hz, 2H), 1.64 (dt, *J* = 13.6, 6.8 Hz, 1H), 0.55 (dd, *J* = 6.7, 4.5 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.9, 165.3, 156.5, 147.2, 136.8, 134.5, 133.1, 133.0, 132.4, 132.0, 131.4, 130.6, 128.7, 128.4, 128.2, 128.09, 128.05, 127.72, 127.65, 127.0, 126.9, 126.4, 125.6, 125.2, 123.3, 122.5, 121.4, 119.6, 107.5, 70.1, 42.9, 25.5, 21.92, 21.88; HRMS (ESI) m/z calcd for $[C_{39}H_{34}NO_4]^+$ $[M+H]^+$: 580.2482, found 580.2485; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 40/60, 1.0 mL/min, 227 nm), retention time: t_{major} = 15.448 min, t_{minor} = 17.733 min, ee = 81%; $[\alpha]_D^{15}$ = – 0.271 (c = 0.37, $CHCl_3$).

(16) NHC-catalyzed kinetic resolution of racemic 7aj with isovaleraldehyde 8

To a solution of racemic **7aj** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 24 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7aj** (10 mg, 42% yield) and product **9p** (13 mg, 46% yield)**.**

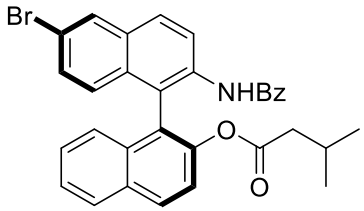
(*R*)-*N*-(6-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7aj)



(*R*)-7aj

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.461 min, t_{minor} = 3.612 min, ee = 97%; $[\alpha]_D^{16}$ = + 0.055 (c = 0.20, $CHCl_3$).

(*S*)-2'-benzamido-6'-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9p)



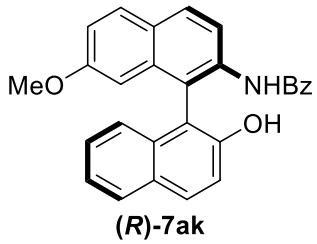
9p

White solid, m.p. = 148-149 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.42 (d, *J* = 9.0 Hz, 1H), 8.02-7.95 (m, 3H), 7.84 (dd, *J* = 10.2, 8.5 Hz, 2H), 7.38-7.12 (m, 10H), 6.95 (d, *J* = 8.9 Hz, 1H), 2.03-1.86 (m, 2H), 1.57 (dt, *J* = 13.6, 6.8 Hz, 1H), 0.48 (dd, J = 8.4, 6.7 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.8, 165.3, 147.3, 135.4, 134.2, 132.8, 132.2, 132.1, 131.6, 131.3, 131.0, 129.99, 129.98, 128.5, 128.3, 128.2, 127.9, 127.2, 126.9, 126.5, 125.3, 124.3, 123.5, 122.1, 121.5, 119.3, 42.8, 25.5, 21.9, 21.8; HRMS (ESI) m/z calcd for $[C_{32}H_{27}BrNO_3]^+$ $[M+H]^+$: 552.1169, found 552.1168; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 6.287 min, t_{minor} = 13.886 min, ee = 86%; $[\alpha]_D^{15}$ = – 0.339 (c = 0.37, $CHCl_3$).

(17) NHC-catalyzed kinetic resolution of racemic 7ak with isovaleraldehyde 8

To a solution of racemic **7ak** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 ^oC. After 18 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7ak** (9 mg, 43% yield) and product **9q** (12 mg, 48% yield)**.**

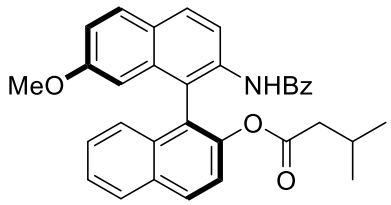
(*R*)-*N*-(2'-hydroxy-7-methoxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7ak)



(*R*)-7ak

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.325 min, t_{minor} = 4.875 min, ee = 99%; $[\alpha]_D^{15}$ = + 0.173 (c = 0.27, $CHCl_3$).

(*S*)-2'-benzamido-7'-methoxy-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9q)



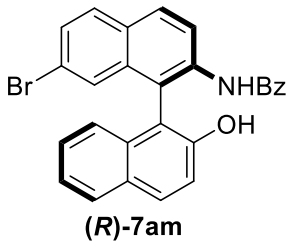
9q

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^1H NMR (500 MHz, $CDCl_3$): δ 8.25 (d, *J* = 8.9 Hz, 1H), 7.98 (d, *J* = 8.8 Hz, 1H), 7.92 (s, 1H), 7.90-7.82 (m, 2H), 7.74 (d, *J* = 8.9 Hz, 1H), 7.40-7.21 (m, 7H), 7.19-7.13 (m, 2H), 7.02 (dd, *J* = 8.9, 2.5 Hz, 1H), 6.38 (d, *J* = 2.5 Hz, 1H), 3.49 (s, 3H), 1.94 (h, *J* = 7.2 Hz, 2H), 1.56 (dt, *J* = 13.5, 6.8 Hz, 1H), 0.48 (t, *J* = 6.8 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.8, 165.2, 158.2, 147.3, 135.4, 134.6, 134.0, 132.9, 132.1, 131.4, 130.6, 129.6, 129.0, 128.4, 128.1, 127.7, 126.9, 126.7, 126.4, 125.5, 125.0, 121.6, 120.7, 119.9, 117.4, 104.3, 55.1, 42.9, 25.5, 21.87, 21.85; HRMS (ESI) m/z calcd for $[C_{33}H_{30}NO_4]^+$ $[M+H]^+$: 504.2169, found 504.2166; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 15.026 min, t_{minor} = 16.251 min, ee = 73%; $[\alpha]_D^{15}$ = – 0.155 (c = 0.27, $CHCl_3$).

(18) NHC-catalyzed kinetic resolution of racemic 7am with isovaleraldehyde 8

To a solution of racemic **7am** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 40 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7am** (10 mg, 42% yield) and product **9r** (13 mg, 46% yield)**.**

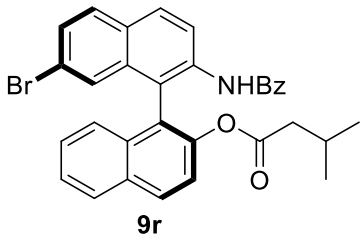
(*R*)-*N*-(7-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7am)



(***R***)-7am

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 13/87, 1.0 mL/min, 227 nm), retention time: t_{major} = 3.561 min, t_{minor} = 5.358 min, ee = 94%; $[\alpha]_D^{15}$ = + 0.179 (c = 0.33, $CHCl_3$).

(*S*)-2'-benzamido-7'-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9r)



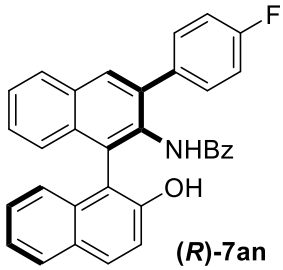
9r

White solid, m.p. = 130-132 °C; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.49 (d, *J* = 8.9 Hz, 1H), 8.13-8.05 (m, 3H), 8.00 (d, *J* = 9.0 Hz, 1H), 7.94 (dt, *J* = 8.2, 0.9 Hz, 1H), 7.79 (d, *J* = 8.7 Hz, 1H), 7.52 (dd, *J* = 8.7, 1.9 Hz, 1H), 7.49-7.38 (m, 4H), 7.37-7.30 (m, 3H), 7.28-7.20 (m, 3H), 2.04 (qd, *J* = 14.6, 7.1 Hz, 2H), 1.66 (dt, *J* = 13.6, 6.8 Hz, 1H), 0.57 (dd, *J* = 10.0, 6.7 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.8, 165.3, 147.4, 136.0, 134.2, 134.0, 132.7, 132.1, 131.6, 131.1, 129.7, 129.5, 129.2, 128.7, 128.5, 128.3, 127.9, 127.3, 126.9, 126.5, 125.2, 124.1, 122.9, 121.6, 121.20, 121.18, 42.8, 25.5, 21.86, 21.85; HRMS (ESI) m/z calcd for $[C_{32}H_{27}BrNO_3]^+$ $[M+H]^+$: 552.1169, found 552.1166; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 35/65, 1.0 mL/min, 227 nm), retention time: t_{major} = 10.402 min, t_{minor} = 15.783 min, ee = 92%; $[\alpha]_D^{15}$ = – 0.262 (c = 0.40, $CHCl_3$).

(19) NHC-catalyzed kinetic resolution of racemic 7an with isovaleraldehyde 8

To a solution of racemic **7an** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in DCE (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 ^oC. After 9 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7an** (10 mg, 42% yield) and product **9s** (12 mg, 43% yield)**.**

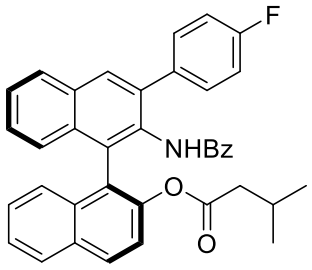
(*R*)-*N*-(3-(4-fluorophenyl)-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((*R*)-7an)



(***R***)-7an

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.782 min, t_{minor} = 24.574 min, ee = 93%; $[\alpha]_D^{15}$ = + 0.418 (c = 0.23, $CHCl_3$).

(*S*)-2'-benzamido-3'-(4-fluorophenyl)-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (9s)



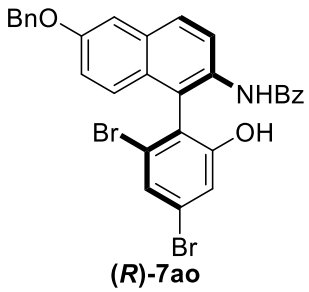
9s

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^1H NMR (500 MHz, $CDCl_3$): δ 8.16 (s, 1H), 8.02-7.92 (m, 3H), 7.82 (d, J = 8.1 Hz, 1H), 7.62-7.55 (m, 2H), 7.50 (ddd, J = 8.1, 6.7, 1.2 Hz, 1H), 7.43-7.31 (m, 4H), 7.30-7.21 (m, 3H), 7.12 (dd, J = 8.6, 7.0 Hz, 2H), 7.09-7.00 (m, 4H), 2.18-2.03 (m, 2H), 1.72 (dq, J = 13.6, 6.8 Hz, 1H), 0.56 (dd, J = 20.0, 6.7 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 173.7, 165.1, 162.0 (d, $J_{C\text{-}F}$ = 245.6 Hz), 146.5, 137.9, 136.4 (d, $J_{C\text{-}F}$ = 3.2 Hz), 134.5, 133.1, 133.0, 132.5, 132.1, 132.0, 130.9, 130.4, 130.3, 130.1 (d, $J_{C\text{-}F}$ = 8.0 Hz), 129.2, 128.1, 128.1, 127.7, 127.3, 126.7, 126.5, 126.5, 126.4, 126.3, 126.2, 125.5, 120.8, 115.0 (d, $J_{C\text{-}F}$ = 21.4 Hz), 43.1, 25.7, 21.94, 21.88; ^{19}F NMR (471 MHz, $CDCl_3$): δ -115.79 (s); HRMS (ESI) m/z calcd for $[C_{38}H_{31}FNO_3]^+$ $[M+H]^+$: 568.2282, found 568.2279; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.819 min, t_{minor} = 6.566 min, ee = 86%; $[\alpha]_D^{15}$ = – 0.221 (c = 0.33, $CHCl_3$).

(20) NHC-catalyzed kinetic resolution of racemic 7ao with isovaleraldehyde 8

To a solution of racemic **7ao** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in Toluene (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 ^oC. After 24 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7ao** (12 mg, 40% yield) and product **9t** (19 mg, 56% yield)**.**

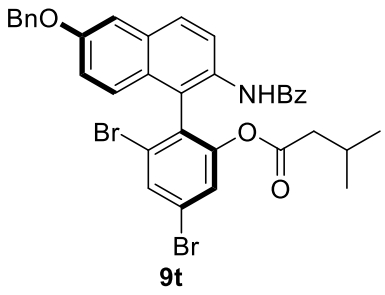
(*S*)-*N*-(6-(benzyloxy)-1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7ao)



(*R*)-7ao

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 31.947 min, t_{minor} = 24.948 min, ee = 99%; $[\alpha]_D^{15}$ = + 0.096 (c = 0.26, $CHCl_3$).

(*R*)-2-(2-benzamido-6-(benzyloxy)naphthalen-1-yl)-3,5-dibromophenyl 3-methylbutanoate (9t)



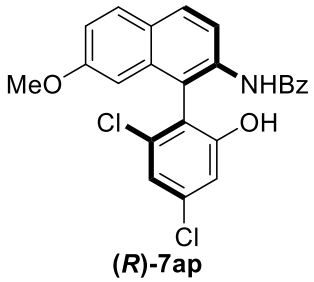
9t

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^1H NMR (500 MHz, $CDCl_3$): δ 8.24 (d, *J* = 8.9 Hz, 1H), 8.04 (s, 1H), 7.89-7.83 (m, 2H), 7.81-7.76 (m, 2H), 7.54-7.48 (m, 3H), 7.48-7.39 (m, 5H), 7.39-7.34 (m, 1H), 7.29 (d, *J* = 2.5 Hz, 1H), 7.17 (dd, *J* = 9.2, 2.6 Hz, 1H), 7.10 (d, *J* = 9.2 Hz, 1H), 5.19 (s, 2H), 2.04-1.82 (m, 2H), 1.58 (dt, *J* = 13.6, 6.8 Hz, 1H), 0.53 (dd, *J* = 8.3, 6.7 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.4, 165.2, 156.6, 150.8, 136.7, 134.6, 133.9, 132.6, 132.3, 131.7, 130.7, 128.74, 128.67, 128.6, 128.1, 127.7, 127.3, 127.2, 126.8, 125.9, 125.6, 123.5, 123.13, 123.07, 120.0, 107.7, 70.2, 42.5, 25.4, 21.9, 21.8; HRMS (ESI) m/z calcd for $[C_{35}H_{30}Br_2NO_4]^+$ $[M+H]^+$: 686.0536, found 686.0539; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 5.968 min, t_{minor} = 9.667 min, ee = 75%; $[\alpha]_D^{15}$ = – 0.061 (c = 0.30, $CHCl_3$).

(21) NHC-catalyzed kinetic resolution of racemic 7ap with isovaleraldehyde 8

To a solution of racemic **7ap** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in Toluene (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 14 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7ap** (9 mg, 41% yield) and product **9u** (12 mg, 46% yield)**.**

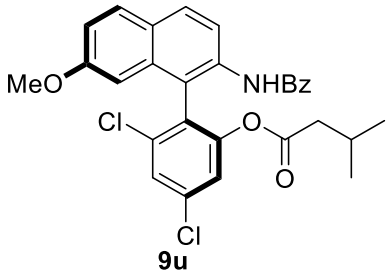
(*S*)-N-(1-(2,4-dichloro-6-hydroxyphenyl)-7-methoxynaphthalen-2-yl)benza-mide ((*R*)-7ap)



(***R***)-7ap

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 03/97, 1.0 mL/min, 227 nm), retention time: t_{major} = 12.154 min, t_{minor} = 16.686 min, ee = 84%; $[\alpha]_D^{15}$ = + 0.192 (c = 0.27, $CHCl_3$).

(*R*)-2-(2-benzamido-7-methoxynaphthalen-1-yl)-3,5-dichlorophenyl 3-methylbu-tanoate (9u)



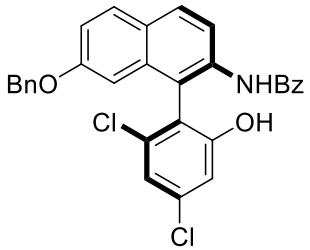
9u

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.16 (d, *J* = 8.9 Hz, 1H), 8.03 (s, 1H), 7.89 (d, *J* = 8.8 Hz, 1H), 7.82-7.74 (m, 3H), 7.56-7.48 (m, 2H), 7.47-7.40 (m, 2H), 7.23 (d, *J* = 2.1 Hz, 1H), 7.13 (dd, *J* = 8.9, 2.5 Hz, 1H), 6.44 (d, *J* = 2.5 Hz, 1H), 3.75 (s, 3H), 2.03-1.83 (m, 2H), 1.56 (dt, *J* = 13.6, 6.8 Hz, 1H), 0.51 (dd, *J* = 12.0, 6.7 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.3, 165.2, 158.5, 151.0, 137.3, 135.4, 135.3, 134.5, 133.0, 131.8, 129.8, 129.6, 128.7, 128.3, 128.2, 127.2, 126.6, 122.3, 120.3, 119.7, 117.4, 103.3, 55.3, 42.5, 25.3, 21.79, 21.78; HRMS (ESI) m/z calcd for $[C_{29}H_{26}Cl_2NO_4]^+$ $[M+H]^+$: 522.1233, found 522.1237; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 227 nm), retention time: t_{major} = 4.954 min, t_{minor} = 6.480 min, ee = 90%; $[\alpha]_D^{15}$ = – 0.046 (c = 0.40, $CHCl_3$).

(22) NHC-catalyzed kinetic resolution of racemic 7aq with isovaleraldehyde 8

To a solution of racemic **7aq** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in Toluene (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 60 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7aq** (11 mg, 44% yield) and product **9v** (13 mg, 45% yield)**.**

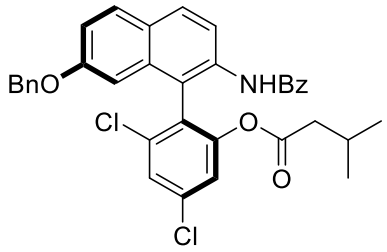
(*S*)-N-(7-(benzyloxy)-1-(2,4-dichloro-6-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7aq)



(*R*)-7aq

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 227 nm), retention time: t_{major} = 5.312 min, t_{minor} = 4.425 min, ee = 99%; $[\alpha]_D^{15}$ = + 0.194 (c = 0.40, $CHCl_3$).

(*R*)-2-(2-benzamido-7-(benzyloxy)naphthalen-1-yl)-3,5-dichlorophenyl 3-methylbutanoate (9v)



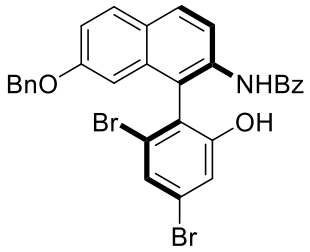
9v

Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.16 (d, *J* = 8.9 Hz, 1H), 8.03 (s, 1H), 7.88 (d, *J* = 8.9 Hz, 1H), 7.81-7.75 (m, 3H), 7.54-7.48 (m, 2H), 7.47-7.40 (m, 2H), 7.38-7.28 (m, 5H), 7.24-7.17 (m, 2H), 6.46 (d, *J* = 2.4 Hz, 1H), 5.02 (s, 2H), 1.99-1.81 (m, 2H), 1.56-1.48 (m, 1H), 0.50 (dd, *J* = 6.7, 5.1 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.3, 165.2, 157.4, 151.0, 137.2, 136.7, 135.33, 135.25, 134.5, 132.9, 131.8, 129.8, 129.5, 128.7, 128.6, 128.3, 128.1, 127.9, 127.4, 127.2, 126.6, 122.3, 120.3, 119.7, 118.0, 105.0, 70.1, 42.5, 25.3, 21.82, 21.77; HRMS (ESI) m/z calcd for $[C_{35}H_{30}Cl_2NO_4]^+$ $[M+H]^+$: 598.1546, found 598.1549; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 227 nm), retention time: t_{major} = 5.961 min, t_{minor} = 8.072 min, ee = 81%; $[\alpha]_D^{25}$ = – 0.017 (c = 0.40, $CHCl_3$).

(23) NHC-catalyzed kinetic resolution of racemic 7ar with isovaleraldehyde 8

To a solution of racemic **7ar** (0.05 mmol, 1.0 eq.), NHC**1** (0.005 mmol, 0.1 eq.), K_2CO_3 (0.10 mmol, 2.0 eq.) and DQ (0.10 mmol, 2.0 eq.) in Toluene (2 mL) was added isovaleraldehyde (0.20 mmol, 4.0 eq.) in air and the reaction was allowed to stir at 25 °C. After 17 h, the reaction mixture achieved appropriate conversion as indicated by TLC analysis, then the mixture was directly purified by flash column chromatography (PE/EA = 12/1→DCM/EA = 10/1, v/v) to give the recovered (***R***)-**7ar** (13 mg, 43% yield) and product **9w** (15 mg, 44% yield)**.**

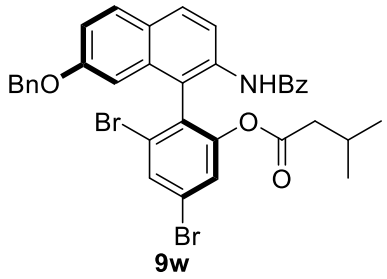
(*S*)-*N*-(7-(benzyloxy)-1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzamide ((*R*)-7ar)



(***R***)-**7ar**

R_f = 0.2 (DCM/EA = 20/1, v/v); HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 03/97, 1.0 mL/min, 227 nm), retention time: t_{major} = 11.746 min, t_{minor} = 15.393 min, ee = 89%; $[\alpha]_D^{15}$ = – 0.132 (c = 0.33, $CHCl_3$).

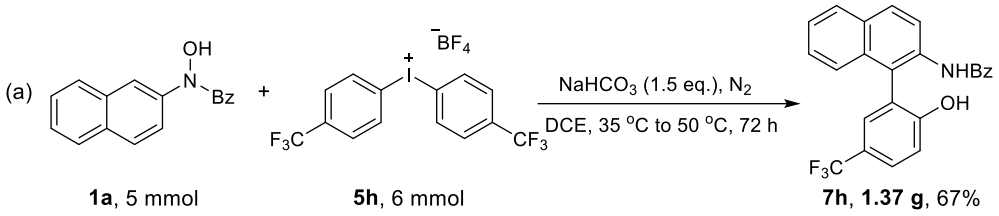
(*R*)-2-(2-benzamido-7-(benzyloxy)naphthalen-1-yl)-3,5-dibromophenyl 3-methylbutanoate (9w)



9w

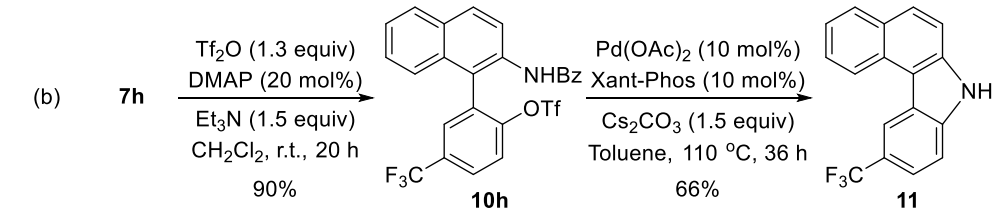
Viscous oily liquid; R_f = 0.2 (PE/EA = 15/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.17 (d, *J* = 8.9 Hz, 1H), 8.01 (s, 1H), 7.88 (d, *J* = 8.9 Hz, 1H), 7.83 (d, *J* = 1.9 Hz, 1H), 7.81-7.75 (m, 3H), 7.54-7.49 (m, 1H), 7.47 -7.42 (m, 2H), 7.38-7.30 (m, 6H), 7.21 (dd, *J* = 8.9, 2.5 Hz, 1H), 6.43 (d, *J* = 2.5 Hz, 1H), 5.02 (s, 2H), 2.01-1.80 (m, 2H), 1.54 (dq, *J* = 13.6, 6.7 Hz, 1H), 0.51 (dd, *J* = 6.7, 5.2 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 172.3, 165.2, 157.4, 150.8, 136.8, 135.0, 134.6, 134.0, 132.7, 131.8, 130.6, 129.7, 129.5, 128.7, 128.6, 127.9, 127.4, 127.3, 127.2, 126.6, 125.7, 123.0, 121.6, 120.3, 118.1, 105.0, 70.1, 42.5, 25.3, 21.83, 21.78; HRMS (ESI) m/z calcd for $[C_{35}H_{30}Br_2NO_4]^+$ $[M+H]^+$: 686.0536, found 686.0509; HPLC: the ee value was determined by HPLC analysis (Chiralcel IC, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 5.534 min, t_{minor} = 6,941 min, ee = 92%; $[\alpha]_D^{15}$ = – 0.050 (c = 0.50, $CHCl_3$).

11. Experimental procedure of large scale reactions of racemic NOBIN-type biaryls



A solution of $NaHCO_3$ (0.63 g, 7.5 mmol, 1.5 eq.), **1a** (1.32 g, 5 mmol, 1.0 eq.) and **5h** (3.03 g, 6 mmol, 1.2 eq.) in DCE (25 mL) under N_2 atmosphere was stirred at 35 ºC for 12 h, then the solution was heated to 50 ºC until the complete consumption of **1a** detected by TLC analysis. The reaction mixture was filtered and evaporated under reduced pressure, and purified by column chromatography to give the desired product **7h** (1.37 g, 67% yield).

12. Synthetic applications of the biaryl products



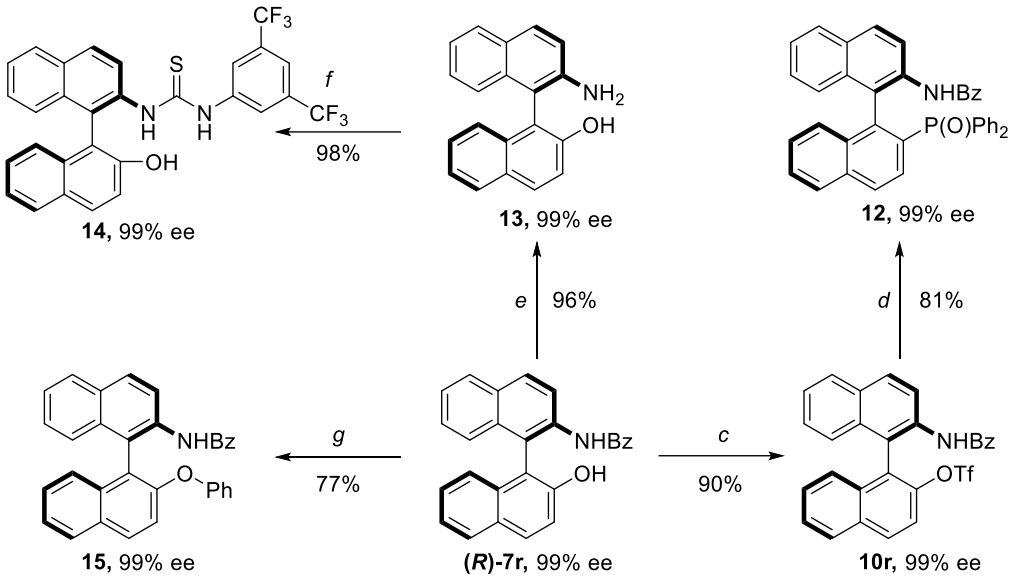
(b) General Procedure for the Synthesis of 10h[7].

To a solution of **7h** (326 mg, 0.8 mmol) and DMAP (20.5 mg, 20 mol%) in dry DCM (5.2 mL), Et_3N (168 µL, 1.5 equiv) was added at room temperature under N_2 atmosphere. The reaction mixture was stirred at 0 ºC for 5 minutes. Tf_2O (174 µL, 1.3 equiv) was added dropwise. The reaction mixture was stirred at room temperature for 20 h. The mixture solution was concentrated in vacuo. The crude residue was purified by flash chromatography on silica gel using (PE/EtOAc = 5/1) to afford 387 mg of **10h** (90%).

General Procedure for the Synthesis of 11[8].

Under N_2 atmosphere, A dried flask was charged with **10h** (67.4 mg, 0.125 mmol), Cs_2CO_3 (61.1 mg, 1.5 equiv), $Pd(OAc)_2$ (3.8 mg, 10 mol%) and Xant-Phos (7.2 mg, 10 mol%), and the mixture was added toluene (1 mL) . The mixture was stirred at 110 °C

for 36 h. The resulting solution was cooled at room temperature and evaporated under reduced pressure. The residue was purified by flash chromatography on silica gel using (PE/EtOAc = 3/1) to give 32 mg of **11** (66%).



(c) General Procedure for the Synthesis of 10r[7].

To a solution of **(*R*)-7r** (28.5 mg, 0.2 mmol) and DMAP (5.2 mg, 20 mol%) in dry DCM (1.3 mL), Et_3N (43 µL, 1.5 equiv) was added at room temperature under N_2 atmosphere. The reaction mixture was stirred at 0 ºC for 5 minutes. Tf_2O (44.2 µL, 1.3 equiv) was added dropwise. The resulting reaction mixture was stirred at room temperature for 20 h. The mixture solution was concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using (PE/EtOAc = 5/1) to give 94 mg of **10r** (90%).

(d) General Procedure for the Synthesis of 12[9]

To a solution of **10r** (74 mg, 0.14 mmol), diphenylphosphine oxide (56.6 mg, 2.0 equiv), $Pd(OAc)_2$ (3.14 mg, 0.1 equiv), and 1,3-bis(diphenylphosphino)propane (8.7 mg, 0.15 equiv) in DMSO (0.7 mL) was added diisopropylethylamine (0.12 mL, 5 equiv), and the mixture was stirred at 100 ºC for 24 h. After being cooled to mom temperature, the reaction mixture was diluted with EtOAc, washed with H_2O and dried

over Na_2SO_4. Removal of the solvent followed by column chromatography on silica gel using (PE/EtOAc = 2/1) to give 65 mg of **12** (81%).

(e) General Procedure for the Synthesis of 13[10].

A 10 mL Schlenk tube was charged with **(*R*)-7r** (38.9 mg, 0.1 mmol), KOH (20 equiv). Then EtOH (0.5 mL) was injected into the Schlenk tube under air atmosphere. The reaction tube was placed in an oil bath. After the reaction was carried out at 100 ºC for 18 h, it was cooled to room temperature and detected by TLC, which was purified by flash chromatography (silica gel, DCM/EtOAc = 50:1), affording the desired product **13** as a white solid (27 mg, 96% yield).

(f) General Procedure for the Synthesis of 14[11].

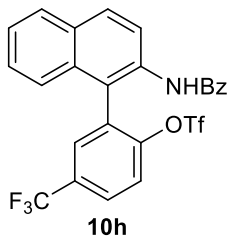
To a solution of **13** (28.5 mg, 0.1 mmol) in dry THF (3 mL), 3,5-bis(tri-fluoromethyl)phenyl isothiocyanate (1.1 equiv) was added at room temperature. The reaction mixture was stirred at 30 ºC for 12 h. The reaction progress was monitored by TLC. After completion of the reaction, the reaction mixture was concentrated under reduced pressure and the residue was purified by flash chromatography on silica gel to give 54 mg of **14** (98%).

(g) General Procedure for the Synthesis of 15[12].

To a glass culture tube equipped with a stir bar was charged **(*R*)-7r** (38.9 mg, 0.1 mmol, 1.0 equiv), $Cu(OAc)_2$ (18.7 mg, 0.10 mmol, 1.00 equiv), phenylboronic acid (24.4 mg, 0.20 mmol, 2.00 equiv), and activated 4Å molecular sieves. The tube was then charged with 2.0 mL of EtOAc and Et_3N (28.5 μL, 0.203 mmol, 2.03 equiv) via microsyringe. The reaction progress was monitored by TLC. After completion of the reaction, the reaction mixture was concentrated under reduced pressure and the residue was purified by flash chromatography (DCM) on silica gel to give 36 mg of **15** (77%).

13. Analytical data of synthetic application products

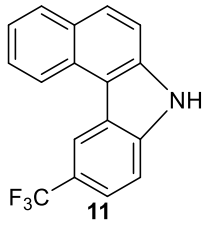
(1) 2-(2-benzamidonaphthalen-1-yl)-4-(trifluoromethyl)phenyl trifluoromethan-esulf-onate (10h)



10h

White solid, m.p. = 153-155 °C; R_f = 0.5 (PE/EA = 3/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.25 (d, *J* = 8.9 Hz, 1H), 8.06 (d, *J* = 9.0 Hz, 1H), 7.94 (d, *J* = 8.0 Hz, 1H), 7.90 (dd, *J* = 8.7, 2.1 Hz, 1H), 7.85 (d, *J* = 2.1 Hz, 1H), 7.72-.60 (m, 4H), 7.55-7.48 (m, 2H), 7.48-7.38 (m, 3H), 7.18 (d, *J* = 8.4 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 166.0, 149.8, 134.4, 134.2, 132.04, 132.02, 131.98 (q, J_{C-F} = 34.0 Hz), 131.7, 131.4, 131.1 (q, J_{C-F} = 3.5 Hz), 130.8, 128.8, 128.5, 128.0 (q, J_{C-F} = 3.5 Hz), 127.4, 126.9, 125.9, 124.3, 123.3, 123.1, 122.9 (q, J_{C-F} = 274.7 Hz), 122.5, 118.1 (q, J_{C-F} = 321.3 Hz); ^{19}F NMR (471 MHz, $CDCl_3$): δ -62.56 (s), -73.77 (s); HRMS (ESI) m/z calcd for $[C_{25}H_{16}F_6NO_4S]^+$ $[M+H]^+$: 540.0699, found 540.0703

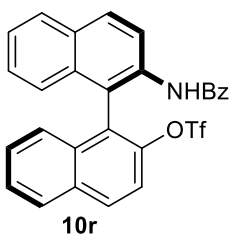
(2) 10-(trifluoromethyl)-7H-benzo[c]carbazole (11)



11

Yellow solid, m.p. = 118-119 °C; R_f = 0.3 (PE/EA = 3/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.78 (s, 1H), 8.70 (d, *J* = 8.3 Hz, 1H), 8.46 (s, 1H), 8.01 (d, *J* = 8.1 Hz, 1H), 7.88 (d, *J* = 8.8 Hz, 1H), 7.79- 7.72 (m, 1H), 7.67 (dd, *J* = 8.5, 1.0 Hz, 1H), 7.60-7.49 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 139.8, 137.8, 129.6, 129.41, 129.38, 128.5, 127.4, 125.4 (q, J_{C-F} = 272.2 Hz), 123.6, 123.4, 123.1, 122.4 (q, J_{C-F} = 31.8 Hz), 121.1 (q, J_{C-F} = 3.5 Hz), 119.4 (q, J_{C-F} = 4.2 Hz), 115.3, 112.4, 111.2; ^{19}F NMR (471 MHz, $CDCl_3$): δ -59.86 (s); HRMS (ESI) m/z calcd for $[C_{17}H_{11}F_3N]^+$ $[M+H]^+$: 286.0838, found 286.0827.

(3) (*R*)-2'-benzamido-[1,1'-binaphthalen]-2-yl trifluoromethanesulfonate (10r)

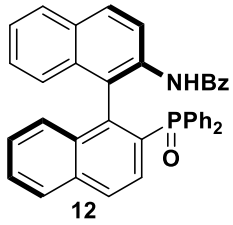


10r

White solid, m.p. = 157-158 °C; R_f = 0.4 (PE/EA = 3/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.42 (d, *J* = 9.0 Hz, 1H), 8.10-7.98 (m, 2H), 7.88 (dd, *J* = 11.4, 8.3 Hz, 2H), 7.57 (s, 1H), 7.52 (d, *J* = 9.1 Hz, 1H), 7.48-7.41 (m, 1H), 7.37 (dd, *J* = 7.6, 4.0 Hz, 2H), 7.32 (dd, *J* = 11.1, 4.0 Hz, 1H), 7.29-7.19 (m, 4H), 7.14 (t, *J* = 7.7 Hz, 2H),

7.01 (d, J = 8.5 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 165.5, 145.4, 135.2, 134.4, 132.9, 132.8, 132.4, 131.9, 131.7, 131.4, 130.4, 128.8, 128.6, 128.5, 128.4, 127.9, 127.1, 126.8, 126.7, 126.2, 125.6, 124.7, 122.4, 119.8, 119.6, 118.2 (q, J_{C-F} = 320.3 Hz); ^{19}F NMR (471 MHz, $CDCl_3$): δ -74.12 (s); HRMS (ESI) m/z calcd for $[C_{28}H_{19}F_3NO_4S]^+$ $[M+H]^+$: 522.0981, found 522.0992; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 227 nm), retention time: t_{major} = 9.259 min, t_{minor} = 7.029 min, ee = 99%; $[\alpha]_D^{15}$ = + 0.394 (c = 0.27, $CHCl_3$).

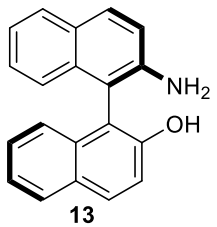
(4) (*R*)-N-(2'-(diphenylphosphoryl)-[1,1'-binaphthalen]-2-yl)benzamide (12)



12

White solid, m.p. = 96-97 °C; R_f = 0.2 (PE/EA = 2/1); ^{1}H NMR (500 MHz, $CDCl_3$): δ 10.58 (s, 1H), 7.95-7.82 (m, 4H), 7.77 (ddd, J = 24.7, 12.3, 5.1 Hz, 3H), 7.63 (d, J = 8.8 Hz, 1H), 7.47 (ddd, J = 11.5, 7.3, 5.2 Hz, 4H), 7.42-7.33 (m, 2H), 7.33 – 7.22 (m, 3H), 7.12 (tdd, J = 14.5, 9.3, 5.4 Hz, 5H), 6.86 (t, J = 7.3 Hz, 1H), 6.71 (t, J = 7.1 Hz, 1H), 6.59 (td, J = 7.7, 2.9 Hz, 2H), 6.42 (d, J = 8.4 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 166.0, 141.3 (d, J_{C-P} = 8.5 Hz), 136.2, 134.9 (d, J_{C-P} = 2.0 Hz), 134.6, 133.4 (d, J_{C-P} = 11.1 Hz), 133.0, 132.2, 132.1, 132.1, 131.2, 131.1, 131.0 (d, J_{C-P} = 61.7 Hz), 130.2 (d, J_{C-P} = 2.7 Hz), 130.0, 129.8 (d, J_{C-P} = 10.0 Hz), 129.6, 129.6, 129.5 (d, J_{C-P} = 4.9 Hz), 128.8 (d, J_{C-P} = 11.8 Hz), 128.5, 128.4 (d, J_{C-P} = 12.5 Hz), 128.3, 127.73, 127.71, 127.68, 127.62, 127.57, 127.5, 127.3 (d, J_{C-P} = 12.5 Hz), 126.6, 125.8 (d, J_{C-P} = 53.4 Hz), 124.9; ^{31}P NMR (202 MHz, $CDCl_3$): δ 28.63; HRMS (ESI) m/z calcd for $[C_{39}H_{29}NO_2P]^+$ $[M+H]^+$: 574.1930, found 574.1919; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 227 nm), retention time: t_{major} = 17.111 min, t_{minor} = 21.659 min, ee = 99%; $[\alpha]_D^{16}$ = - 0.246 (c = 0.30, $CHCl_3$).

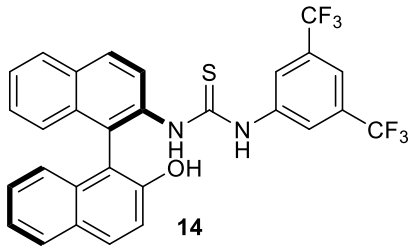
(5) (*R*)-2'-amino-[1,1'-binaphthalen]-2-ol (13)[13]



13

Analytical data are in accordance with the literature values. HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 227 nm), retention time: t_{major} = 5.662 min, t_{minor} = 9.454 min, ee = 99%; $[\alpha]_D^{16}$ = + 0.148 (c = 0.27, $CHCl_3$).

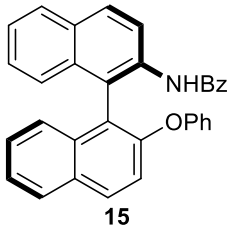
(6) (*R*)-1-(3,5-bis(trifluoromethyl)phenyl)-3-(2'-hydroxy-[1,1'-binaphthalen]-2-yl)thiourea (14)[14]



14

Analytical data are in accordance with the literature values. HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 227 nm), retention time: t_{major} = 2.814 min, t_{minor} = 3.813 min, ee = 99%; $[\alpha]_D^{18}$ = + 0.347 (c = 0.20, $CHCl_3$).

(7) (*R*)-N-(2'-phenoxy-[1,1'-binaphthalen]-2-yl)benzamide (15)



15

White solid, m.p. = 225-226 ºC; R_f = 0.5 (PE/EA = 5/1); ^{1}H NMR (500 MHz, DMSO-*d*$_6$): δ 9.16 (s, 1H), 8.04 (ddd, *J* = 23.5, 19.6, 9.1 Hz, 5H), 7.45 (dd, *J* = 14.8, 7.4 Hz, 3H), 7.34 (dt, *J* = 21.2, 7.0 Hz, 6H), 7.27 (d, *J* = 9.0 Hz, 1H), 7.20 (dd, *J* = 16.5, 8.4 Hz, 3H), 7.12 (d, *J* = 8.4 Hz, 1H), 6.99 (t, *J* = 7.3 Hz, 1H), 6.87 (d, *J* = 7.9 Hz, 2H); ^{13}C NMR (126 MHz, DMSO-*d*$_6$): δ 166.2, 156.7, 152.8, 135.4, 135.3, 133.8, 133.0, 131.8, 131.6, 131.0, 130.5, 130.2, 128.7, 128.5, 127.7, 127.4, 126.8, 126.1, 125.7, 125.5, 125.3, 125.0, 123.8, 121.3, 119.2, 119.1, 115.7; HRMS (ESI) m/z calcd for $[C_{33}H_{23}NO_2]^+$ $[M+H]^+$: 466.1802, found 466.1794; HPLC: the ee value was determined by HPLC analysis (Chiralcel IA, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 227 nm), retention time: t_{major} = 25.508 min, t_{minor} = 31.078 min, ee = 99%; $[\alpha]_D^{15}$ = - 0.435 (c = 0.60, $CHCl_3$).

14. References

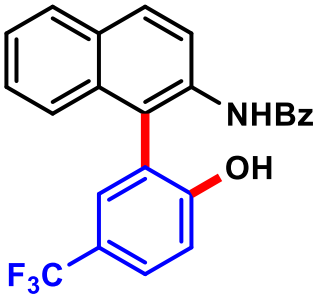
1. (*a*) H. R. Yuan, L. R. Guo, F. T. Liu, Z. C. Miao, L. Feng and H. Y. Gao, *ACS Catal*., 2019, **9**, 3906; (*b*) L. R. Guo, F. T. Liu, L. Y. Wang, H. R. Yuan, L. Feng, L. Kürti and H. Y. Gao, *Org. Lett.*, 2019, **21**, 2894.
2. M. Bielawski, D. Aili and B. Olofsson, *J. Org. Chem.*, 2008, **73**, 4602.
3. M. Bielawski, M. Z. Zhu and B. Olofsson, *Adv. Synth. Catal.*, 2007, **349**, 2610.
4. N. Ichiishi, A. J. Canty, B. F. Yates and M. S. Sanford, *Org. Lett.*, 2013, **19**, 5134.
5. P. S. Engl, A. Fedorov, C. Copéret and A. Togni, *Organometallics.*, 2016, **35**, 887.
6. T. E. Storr and M. F. Greaney, *Org. Lett.*, 2013, **15**, 1410.
7. D. R. He, C. L. Li, Q. Q. Pan, P. Guo, X. Y. Liu and X. Z. Shu, *J. Am. Chem. Soc.*, 2019, **141**, 12481.
8. L. Peng, K. Li, C. D. Xie, S. Li, D. Xu, W. L. Qin and H. L. Yan, *Angew. Chem. Int. Ed.*, 2019, **58**, 17199.
9. J. Feng, B. Li, Y. He and Z. H. Gu, *Angew. Chem. Int. Ed.*, 2016, **55**, 2186.
10. H. Deng, H. J. Li, W. G. Zhang and L. Wang, *Chem. Commun*., 2017, **53**, 10322.
11. N. Vallavoju, S. Selvakumar, S. Jockusch, M. T. Prabhakaran, M. P. Sibi and J. Sivaguru, *Adv. Synth. Catal*., 2014, **356**, 2763.
12. T. V. Nykaza, J. C. Cooper, G. Li, N. Mahieu, A. Ramirez, M. R. Luzung and A. T. Radosevich, *J. Am. Chem. Soc*., 2018, **140**, 15200.
13. L. W. Qi, S. Y. Li, S. H. Xiang, J. Wang and B. Tan, *Nature Catalysis*, 2019, **2**, 314.
14. N. Vallavoju, S. Selvakumar, S. Jockusch, M. P. Sibi and J. Sivaguru, *Angew. Chem. Int. Ed.*, 2014, **53**, 5604.

15. X-Ray crystal structure data for compound 7h and (*R*)-7o

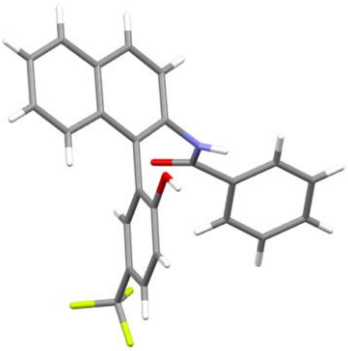
Single crystal was chosen under an optical microscope and quickly coated with high vacuum grease (Dow Corning Corporation) to prevent decomposition. Intensity data and cell parameters were recorded at 173 K on a Bruker Apex II single crystal diffractometer, employing a Mo K_α radiation (λ = 0.71073 Å) and a CCD area detector. The raw frame data were processed using SAINT and SADABS to yield the reflection data file.[1] The structure was solved using the charge-flipping algorithm, as implemented in the program *SUPERFLIP*[2] and refined by full-matrix least-squares techniques against F_o^2 using the SHELXL program[3] through the OLEX2 interface.[4] Hydrogen atoms at carbon were placed in calculated positions and refined isotropically by using a riding model. Appropriate restraints or constraints were applied to the geometry and the atomic displacement parameters of the atoms in the cluster. All structures were examined using the Addsym subroutine of PLATON[5] to ensure that no additional symmetry could be applied to the models. **CCDC 1968925** (**7h**) and **CCDC 1974649 ((*R*)-7o)** contain the supplementary crystallographic data for this paper. These data can be obtained free of charge from the Cambridge Crystallographic Data Centre.

References

1. *APEX3*, *SAINT* and *SADABS*. Bruker AXS Inc., Madison, Wisconsin, USA, 2015.
2. L. Palatinus, G and Chapuis, *J. Appl. Crystallogr.,* 2007, **40**, 786.
3. G. M. Sheldrick, *Acta. Crystallogr*. *Sect. C,* 2015, **71**, 3.
4. O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann, *J. Appl*. *Crystallogr*., 2009, **42**, 339.
5. A. L. Spek, *Acta. Crystallogr. Sect*. D., 2009, **65**, 148.



7h



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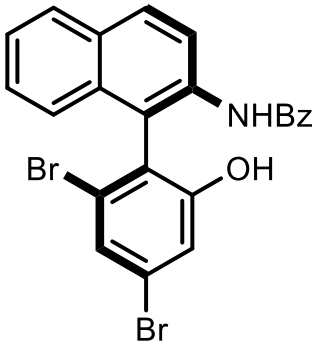
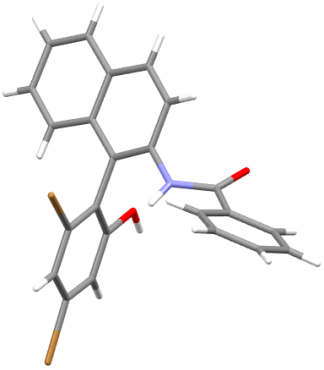
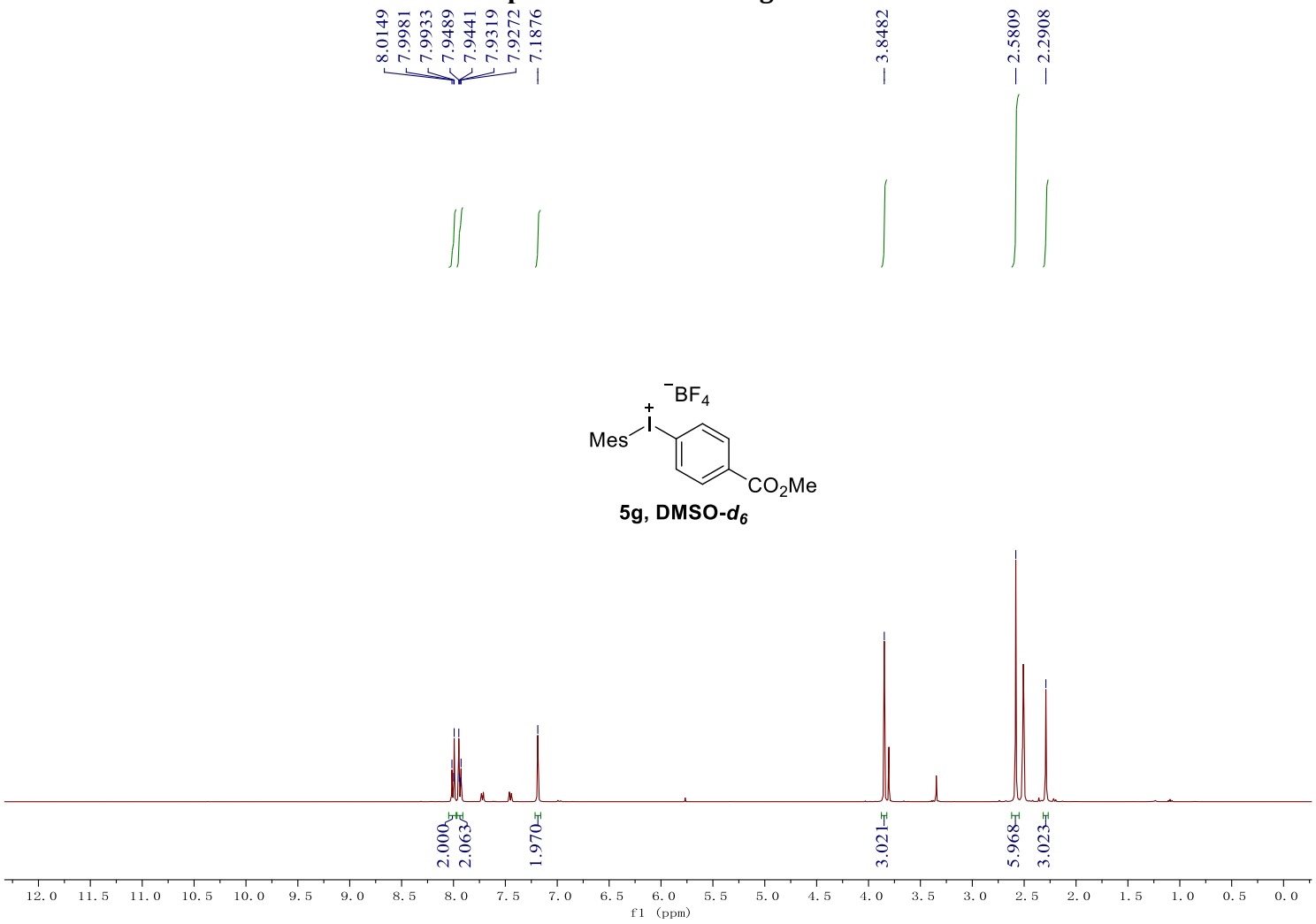


(*R*)-7o

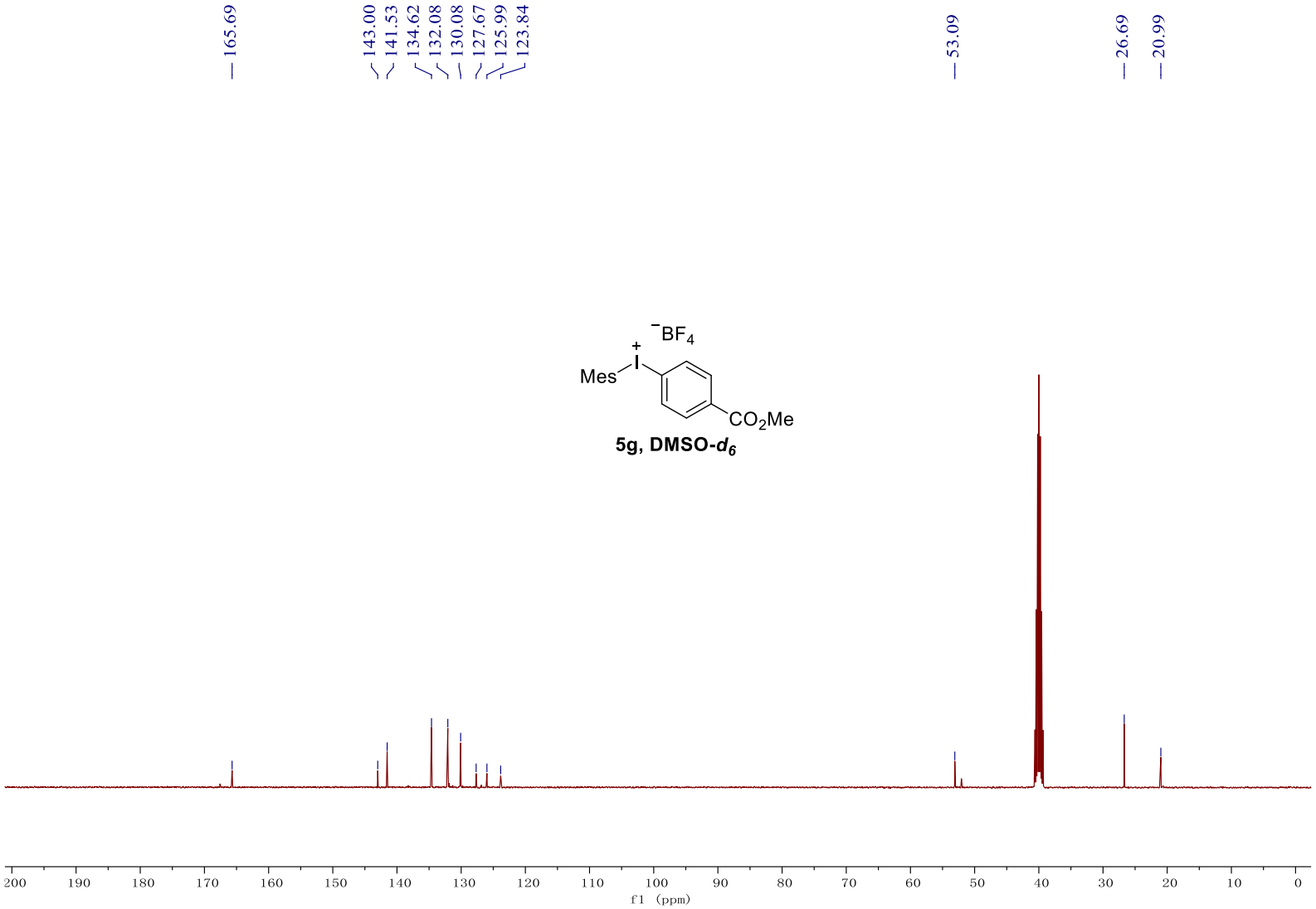


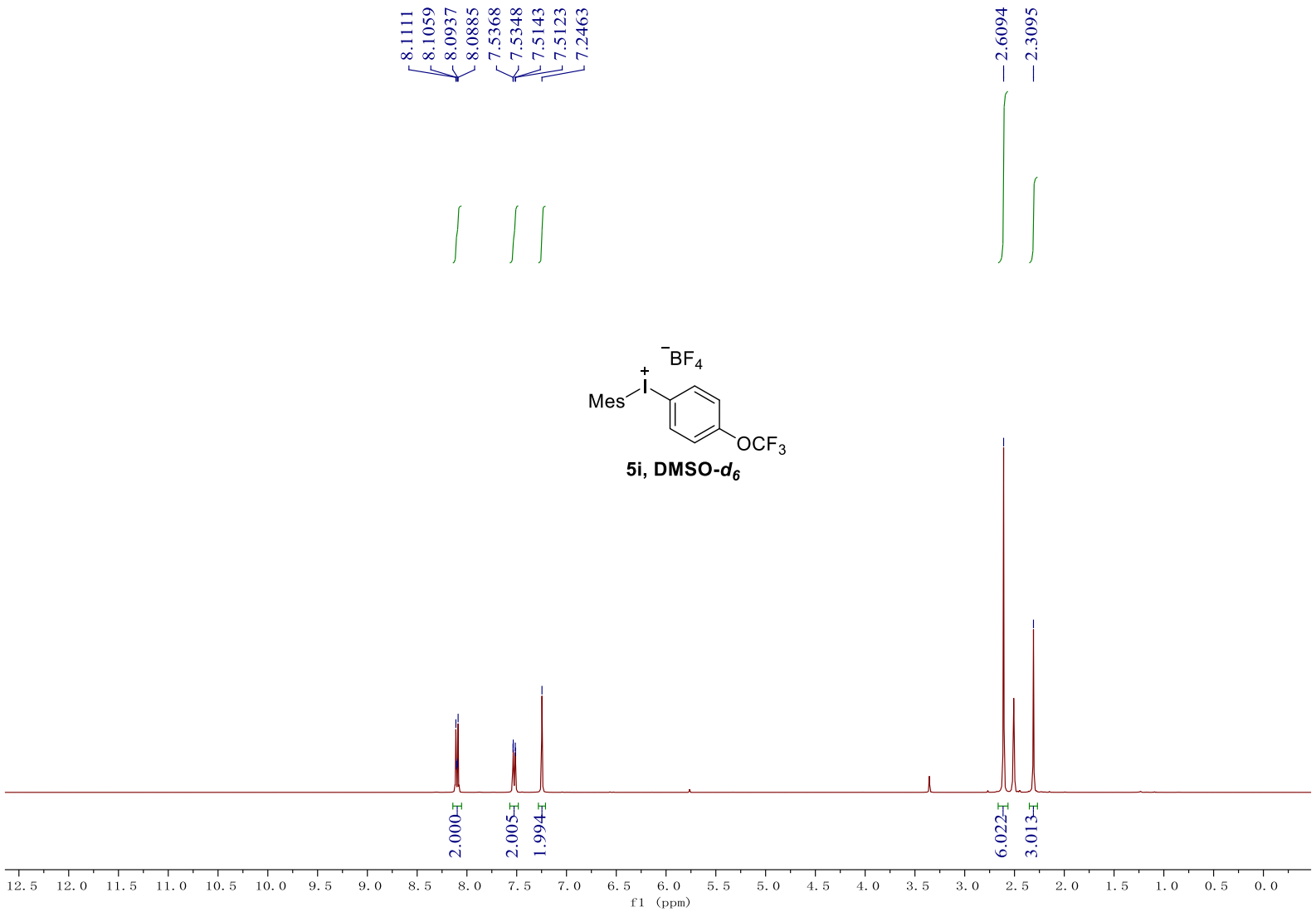
CCDC: 1974649

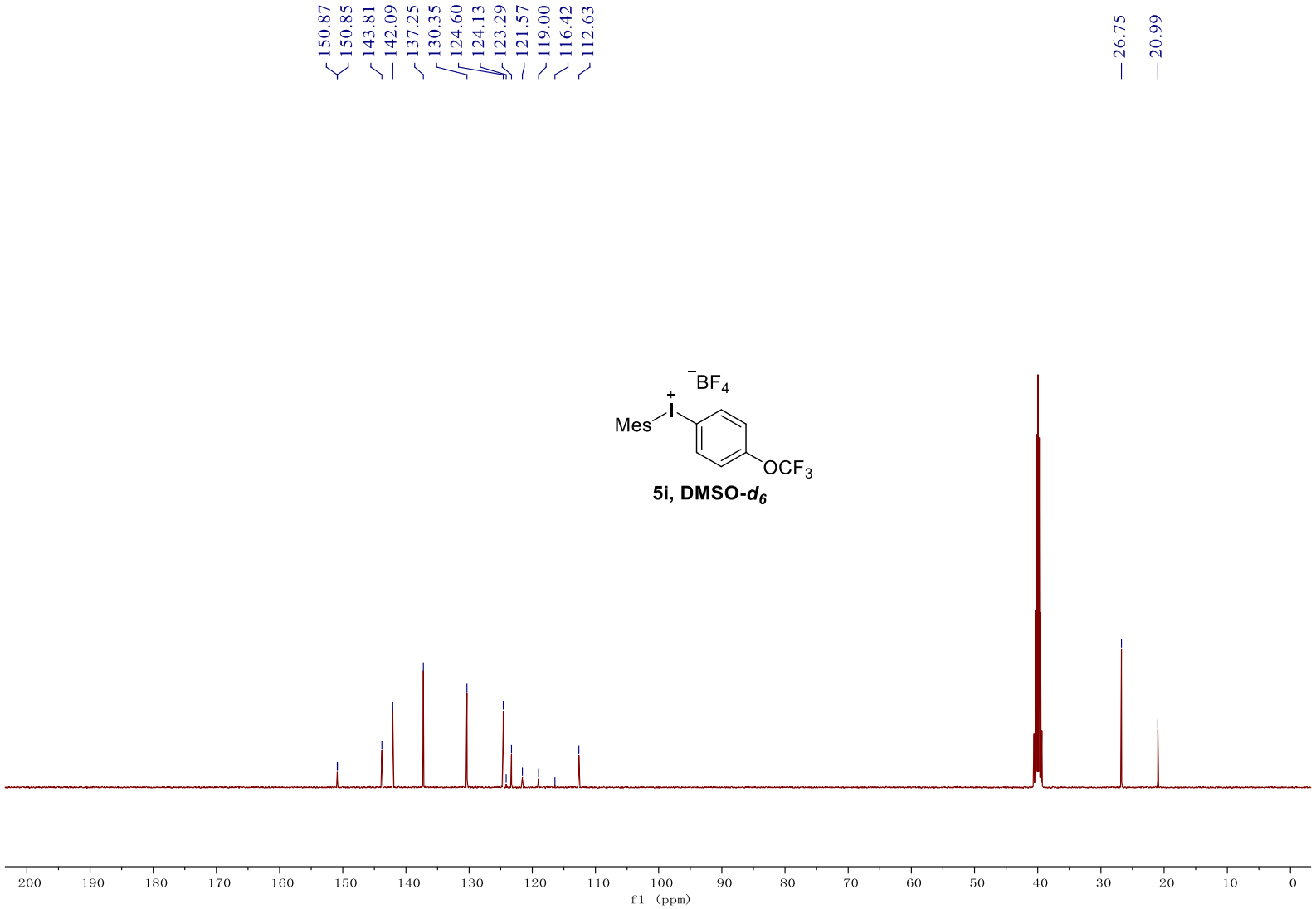
NMR spectra for the starting materials

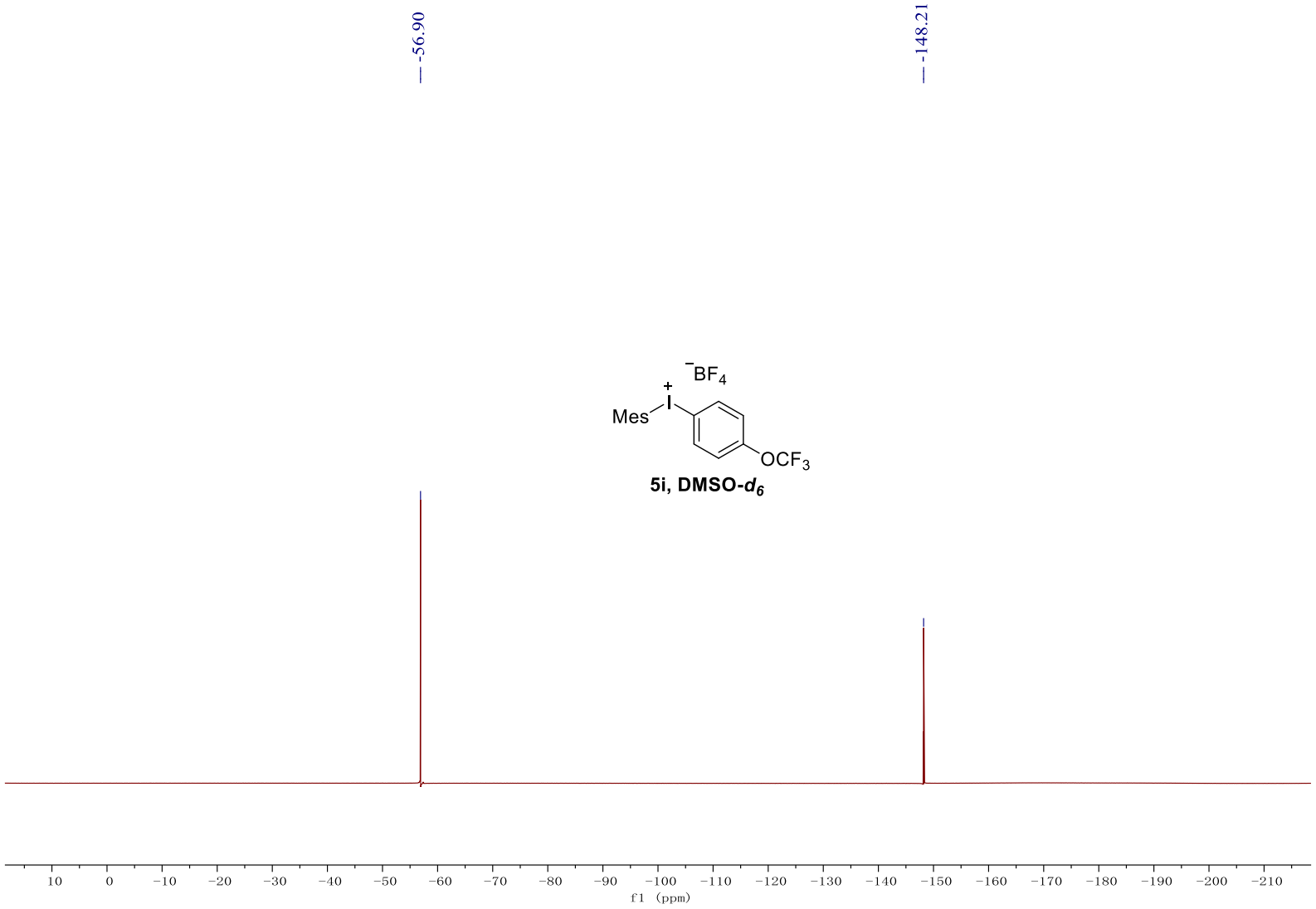


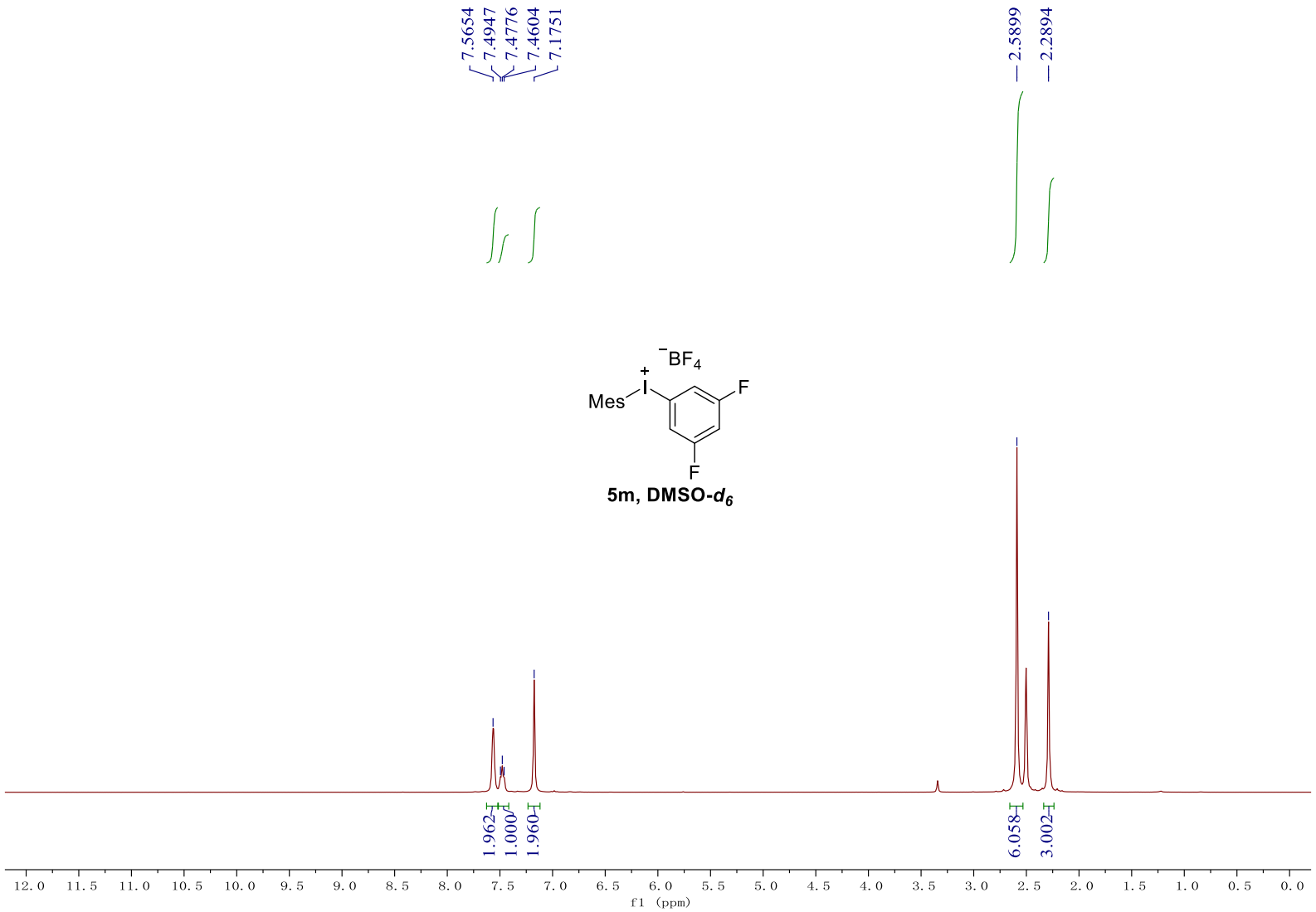
5g, DMSO-*d*$_6$

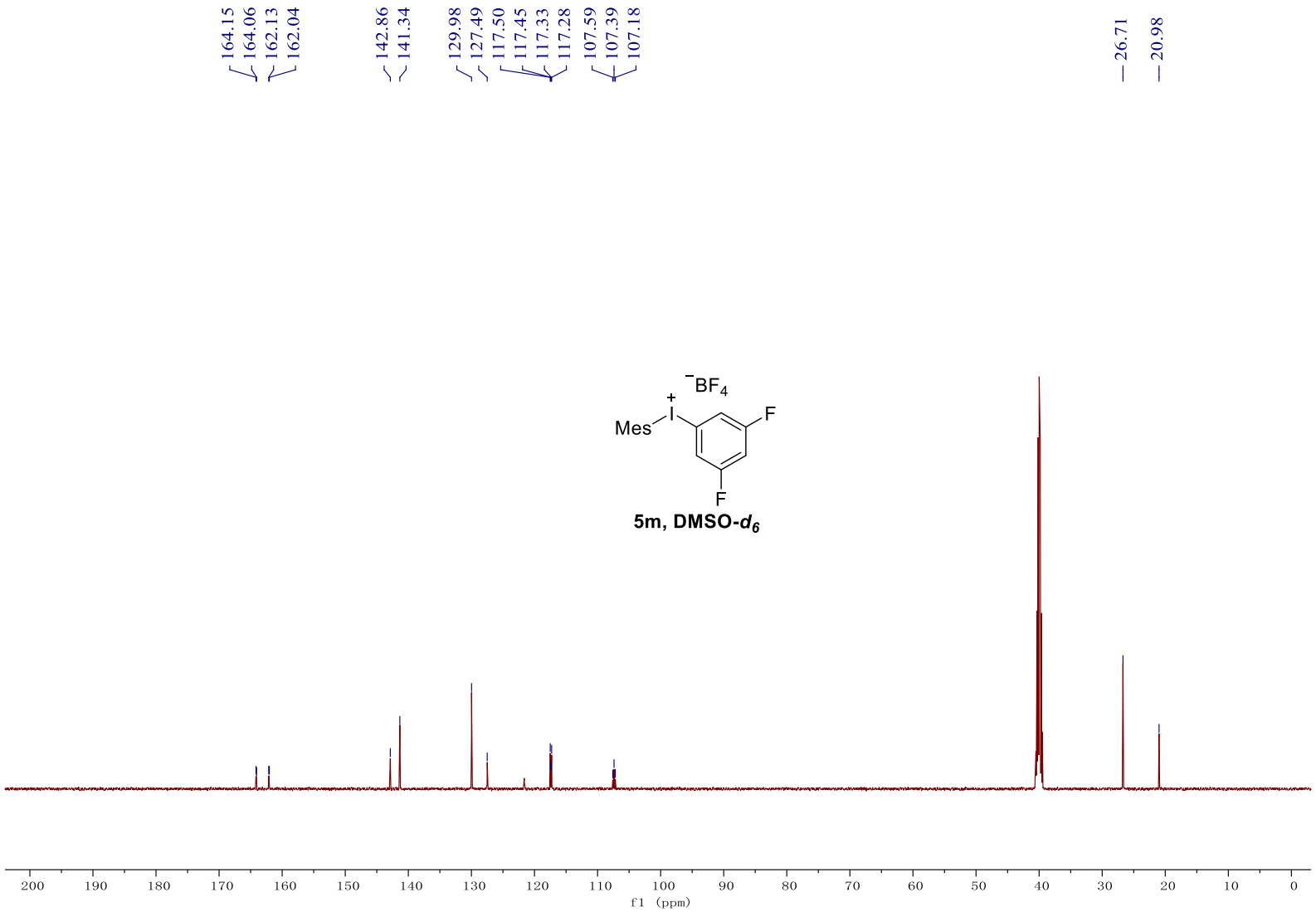

165.69
143.00
141.53
134.62
132.08
130.08
127.67
125.99
123.84
53.09
26.69
20.99
BF4
Mes
CO2Me
5g, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

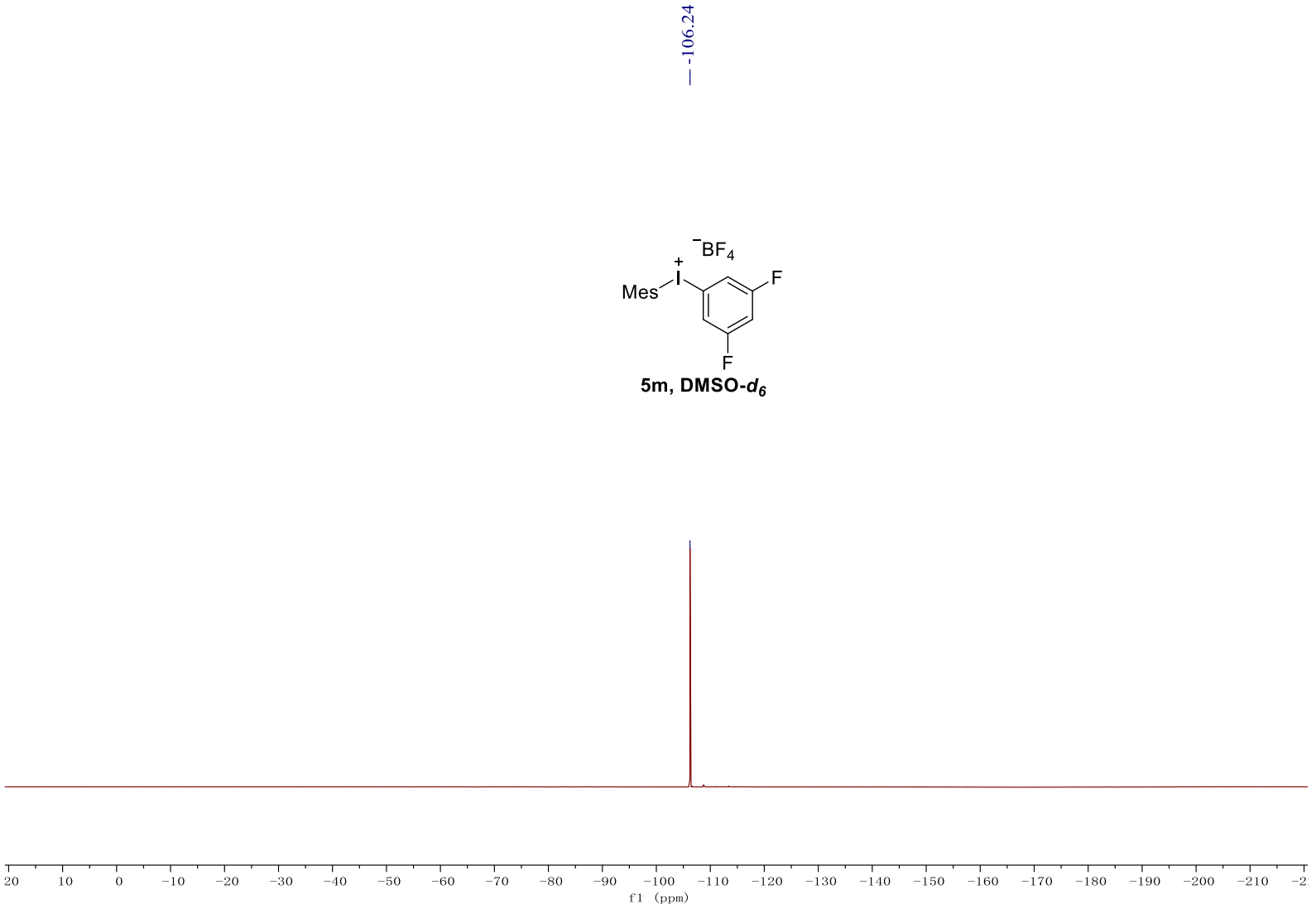

8.1111
8.1059
8.0937
8.0885
7.5368
7.5348
7.5143
7.5123
7.2463
2.6094
2.3095
BF4
Mes
OCF3
5i, DMSO-d6
2.000
2.005
1.994
6.022
3.013
f1 (ppm)


150.87
150.85
143.81
142.09
137.25
130.35
124.60
124.13
123.29
121.57
119.00
116.42
112.63
26.75
20.99
BF4
Mes
I
OCF3
5i, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

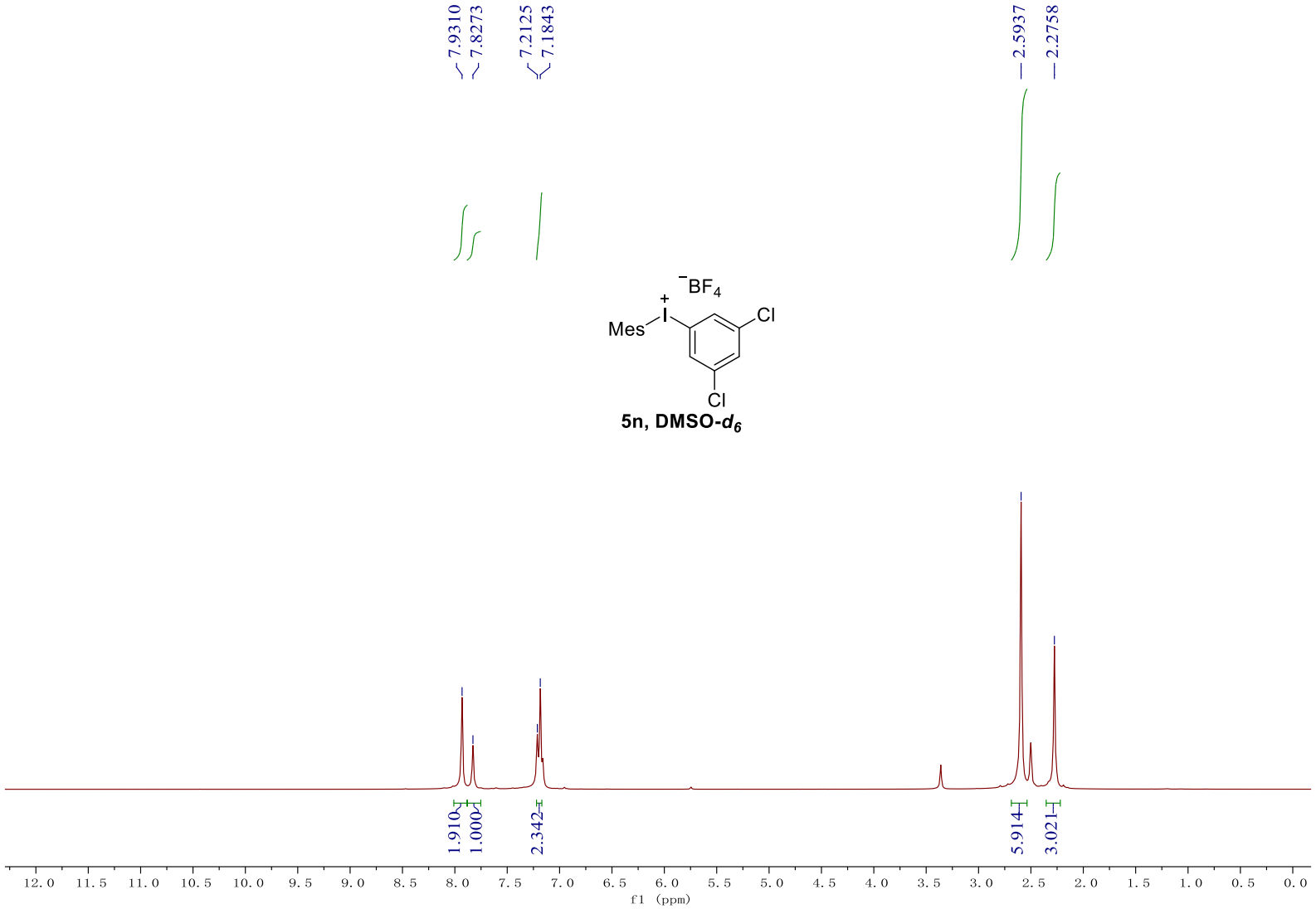

-56.90
-148.21
BF4
Mes
OCF3
5i, DMSO-d6
10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210
f1 (ppm)

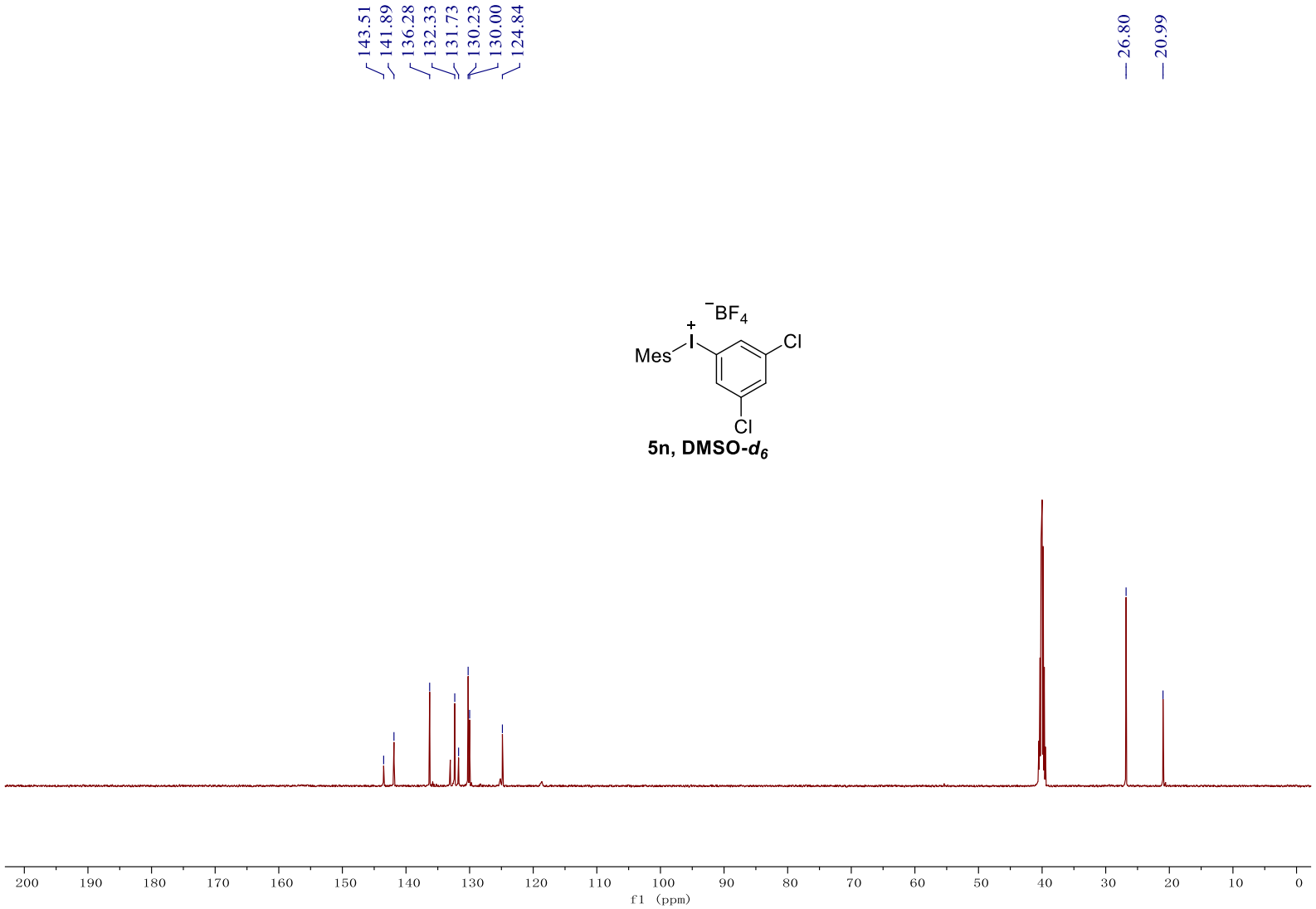

7.5654
7.4947
7.4776
7.4604
7.1751
2.5899
2.2894
BF4
Mes
F
F
5m, DMSO-d6
1.962
1.000
1.960
6.058
3.002
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

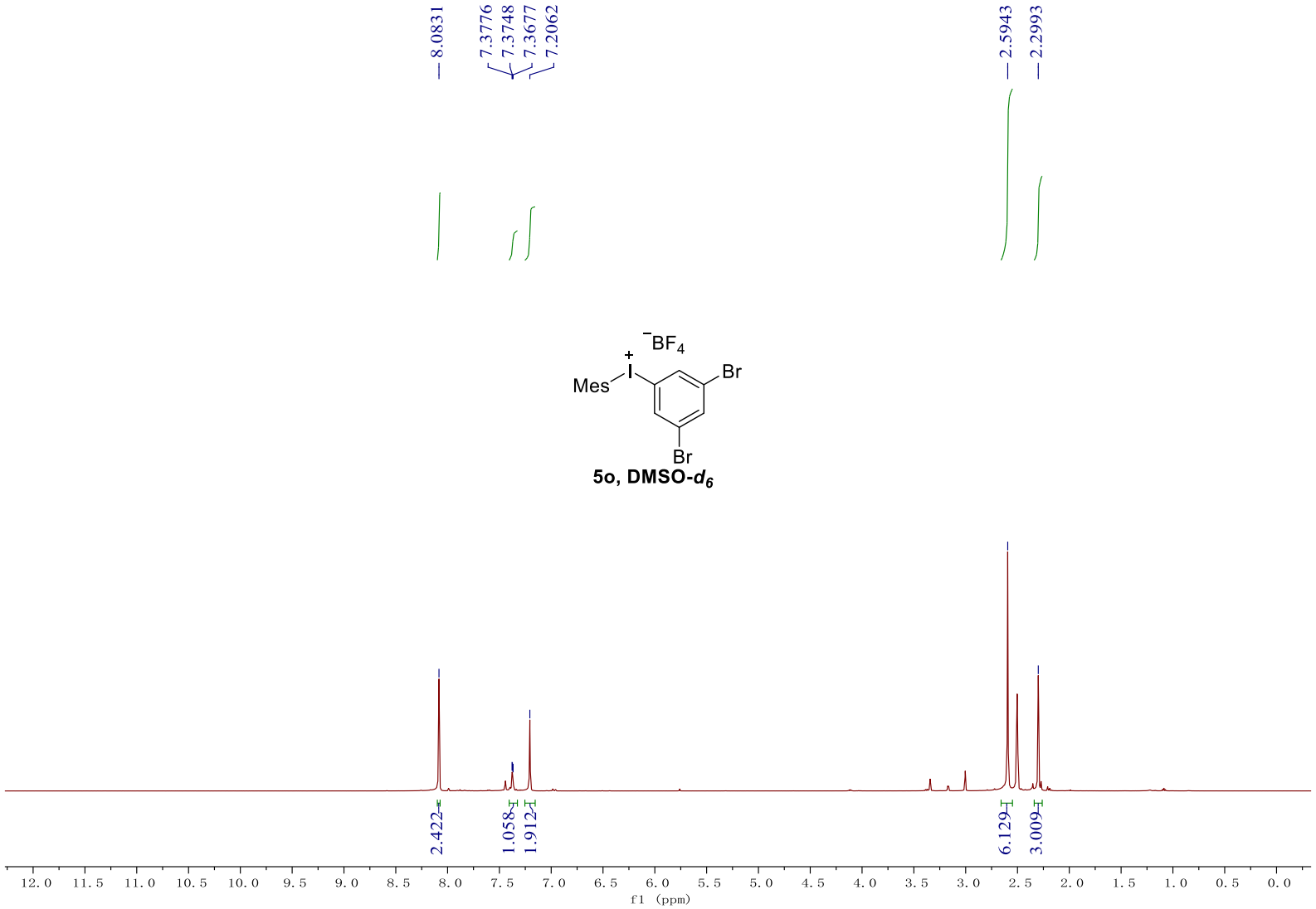

164.15
164.06
162.13
162.04
142.86
141.34
129.98
127.49
117.50
117.45
117.33
117.28
107.59
107.39
107.18
26.71
20.98
BF4
Mes
I
F
F
5m, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-106.24
BF4
Mes
I
F
F
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)

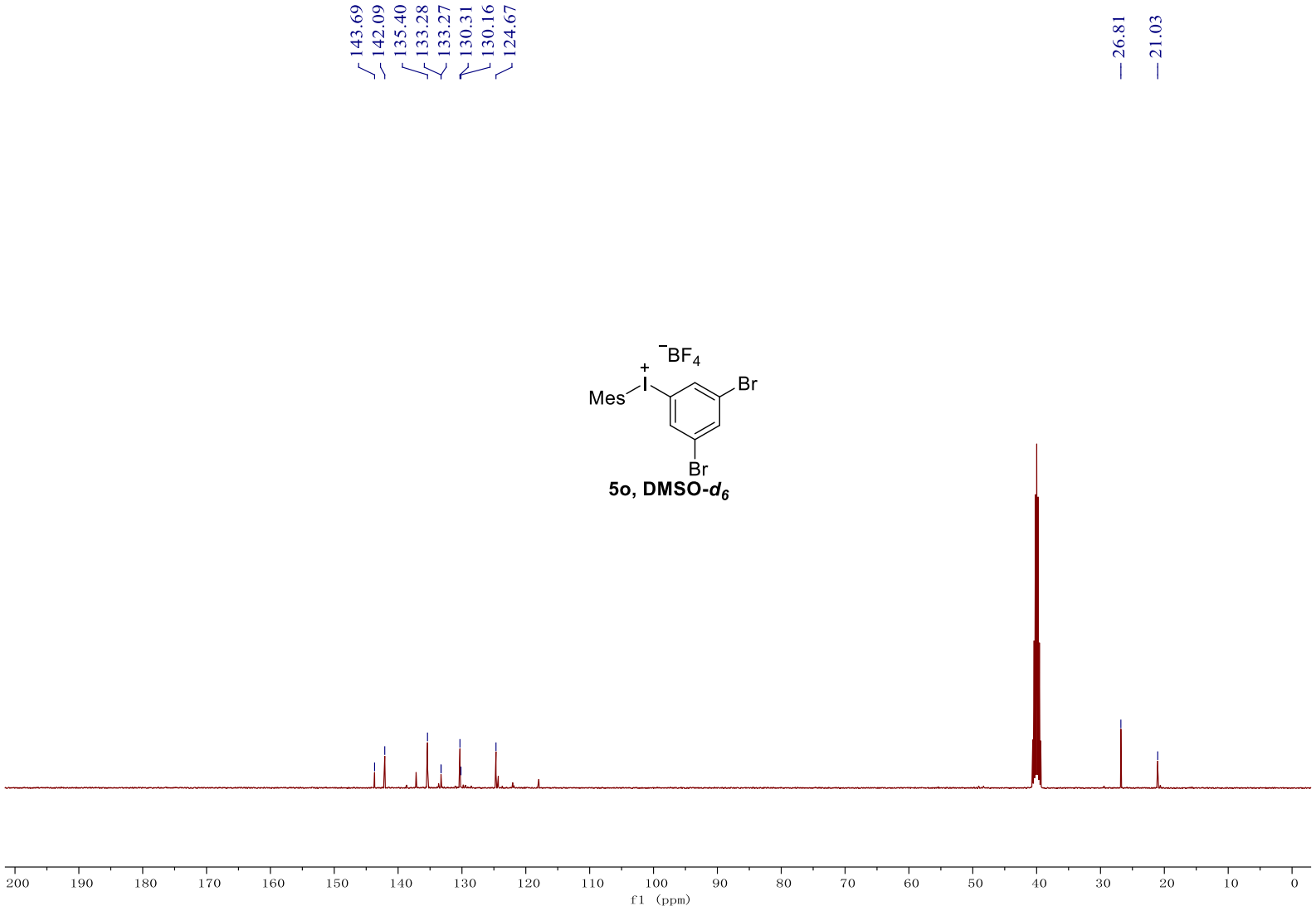
5m, DMSO-*d*$_6$


7.9310
7.8273
7.2125
7.1843
2.5937
2.2758
BF4
Mes
Cl
Cl
5n, DMSO-d6
1.910
1.000
2.342
5.914
3.021
f1 (ppm)

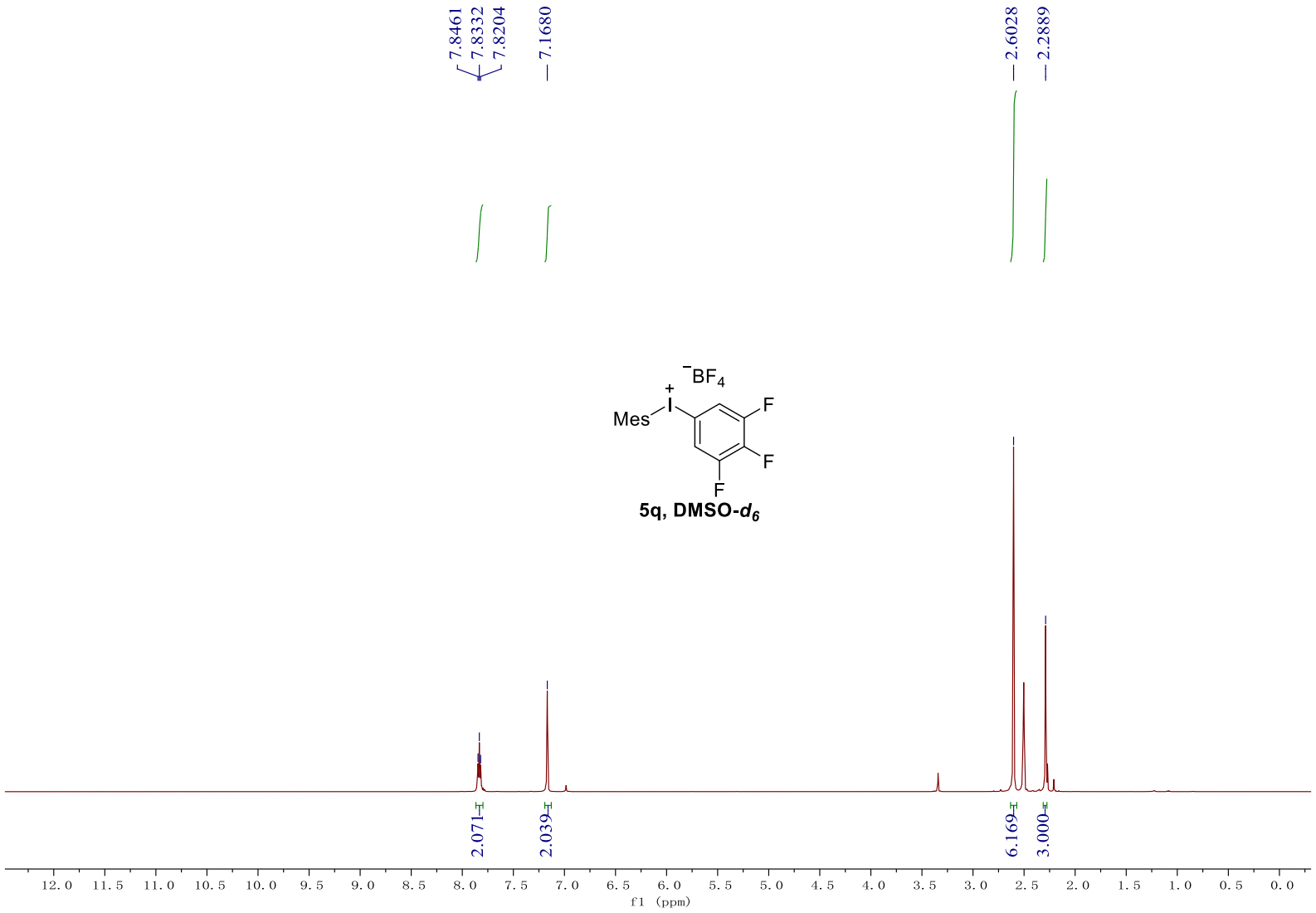

143.51
141.89
136.28
132.33
131.73
130.23
130.00
124.84
26.80
20.99
BF4
Mes
I
Cl
Cl
5n, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

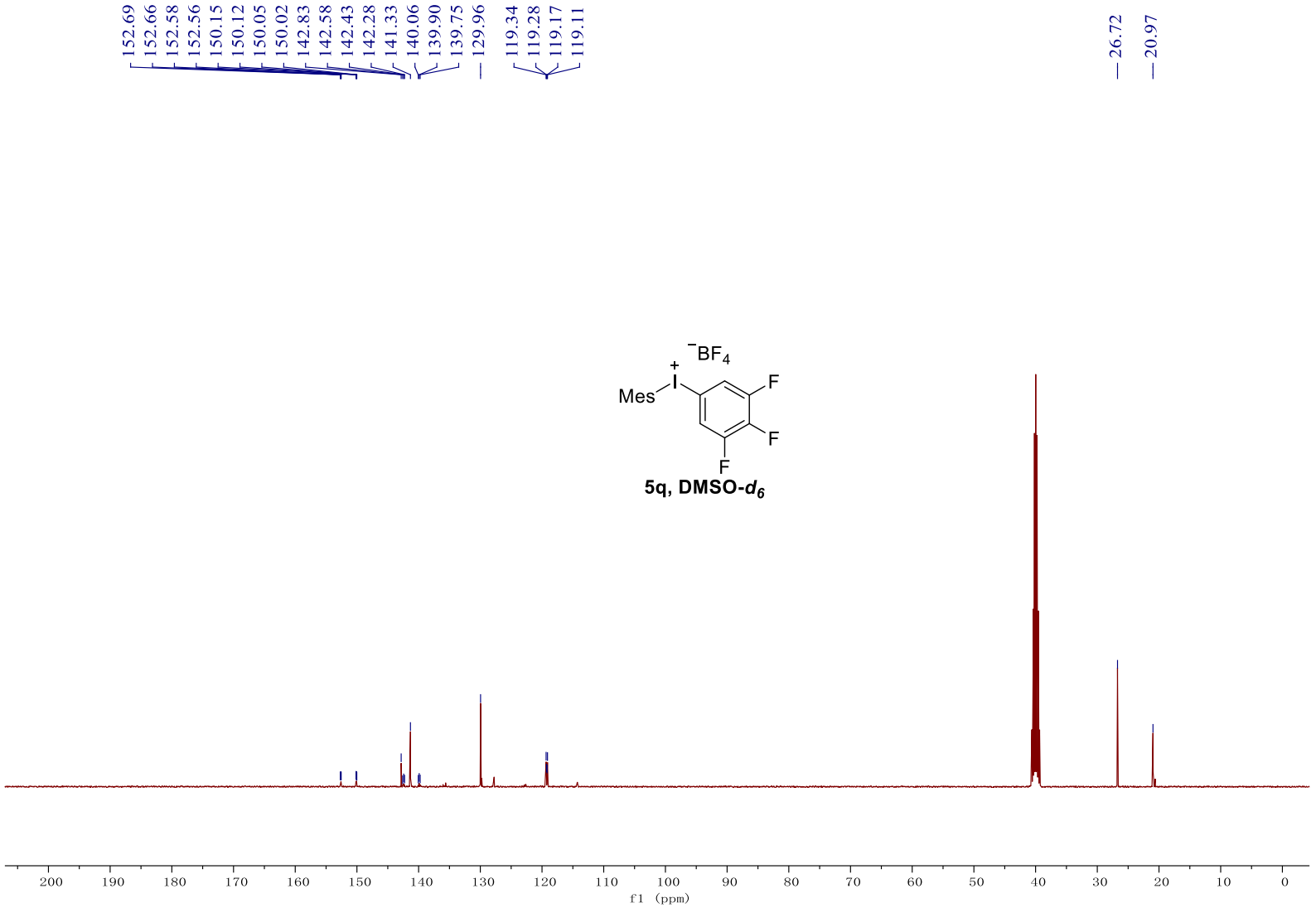

8.0831
7.3776
7.3748
7.3677
7.2062
2.5943
2.2993
BF4
Mes
Br
Br
2.422
1.058
1.912
6.129
3.009
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

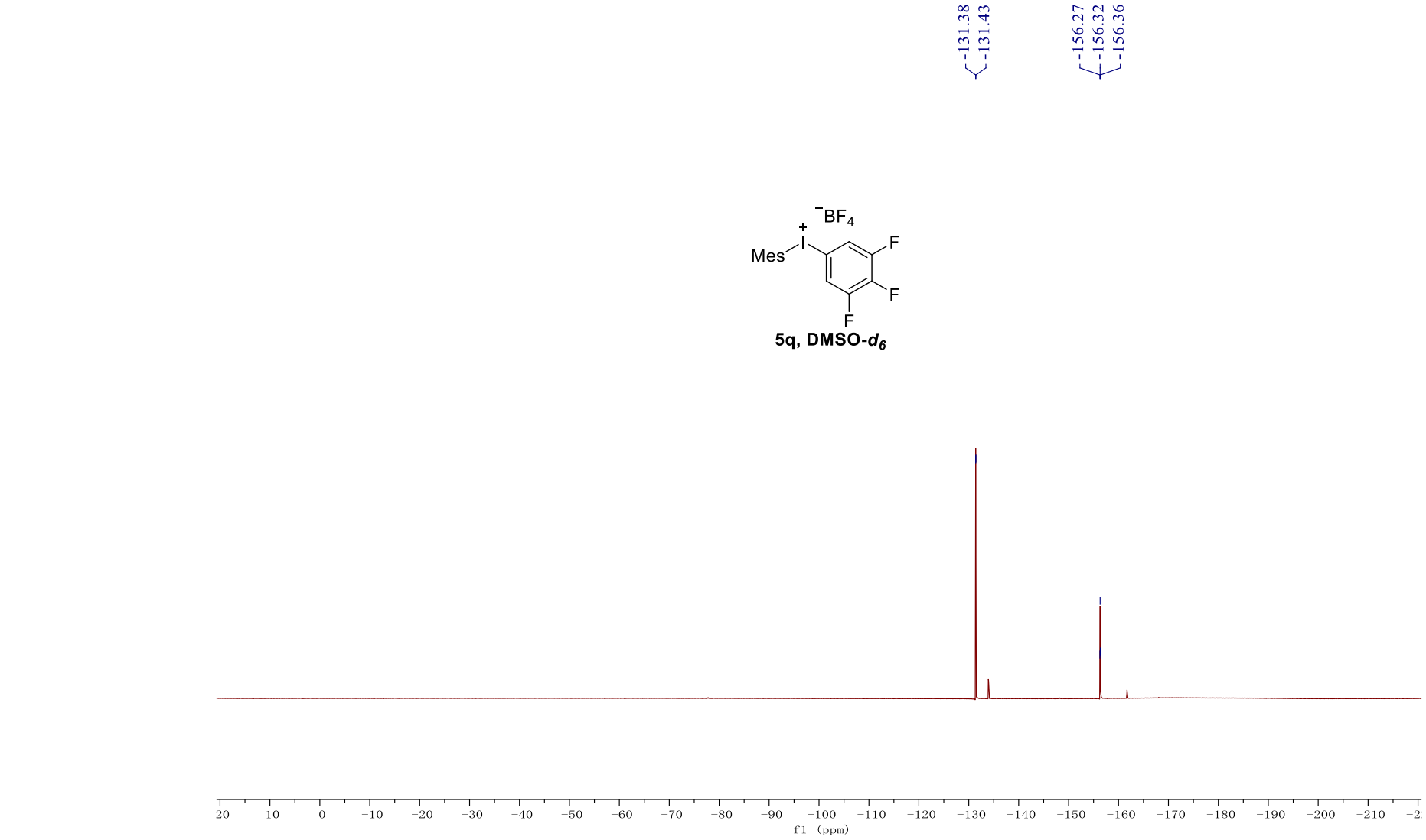
5o, DMSO-*d*$_6$

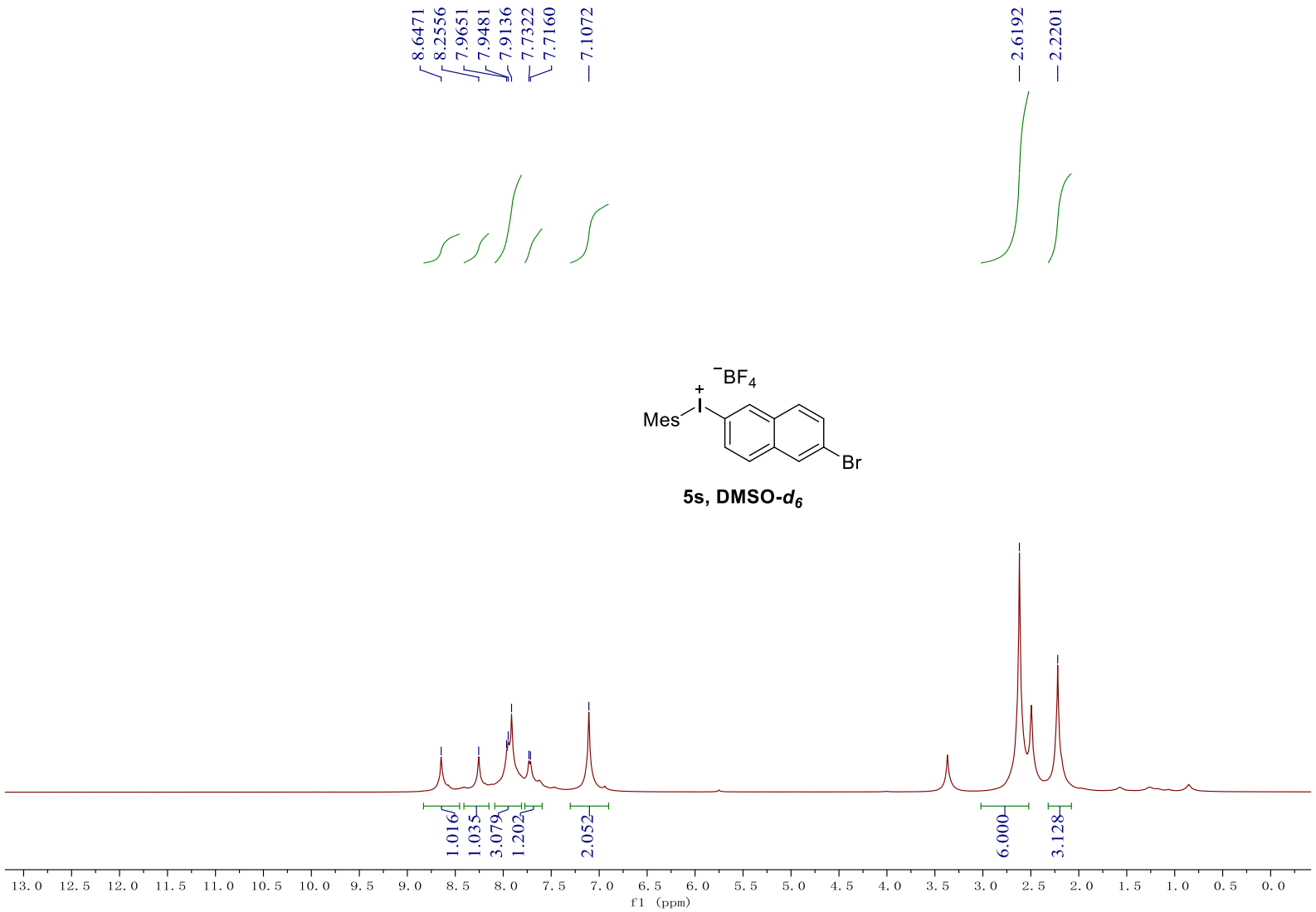

143.69
142.09
135.40
133.28
133.27
130.31
130.16
124.67
26.81
21.03
$^{-}BF_4$
$^{+}$
I
Mes
Br
Br
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

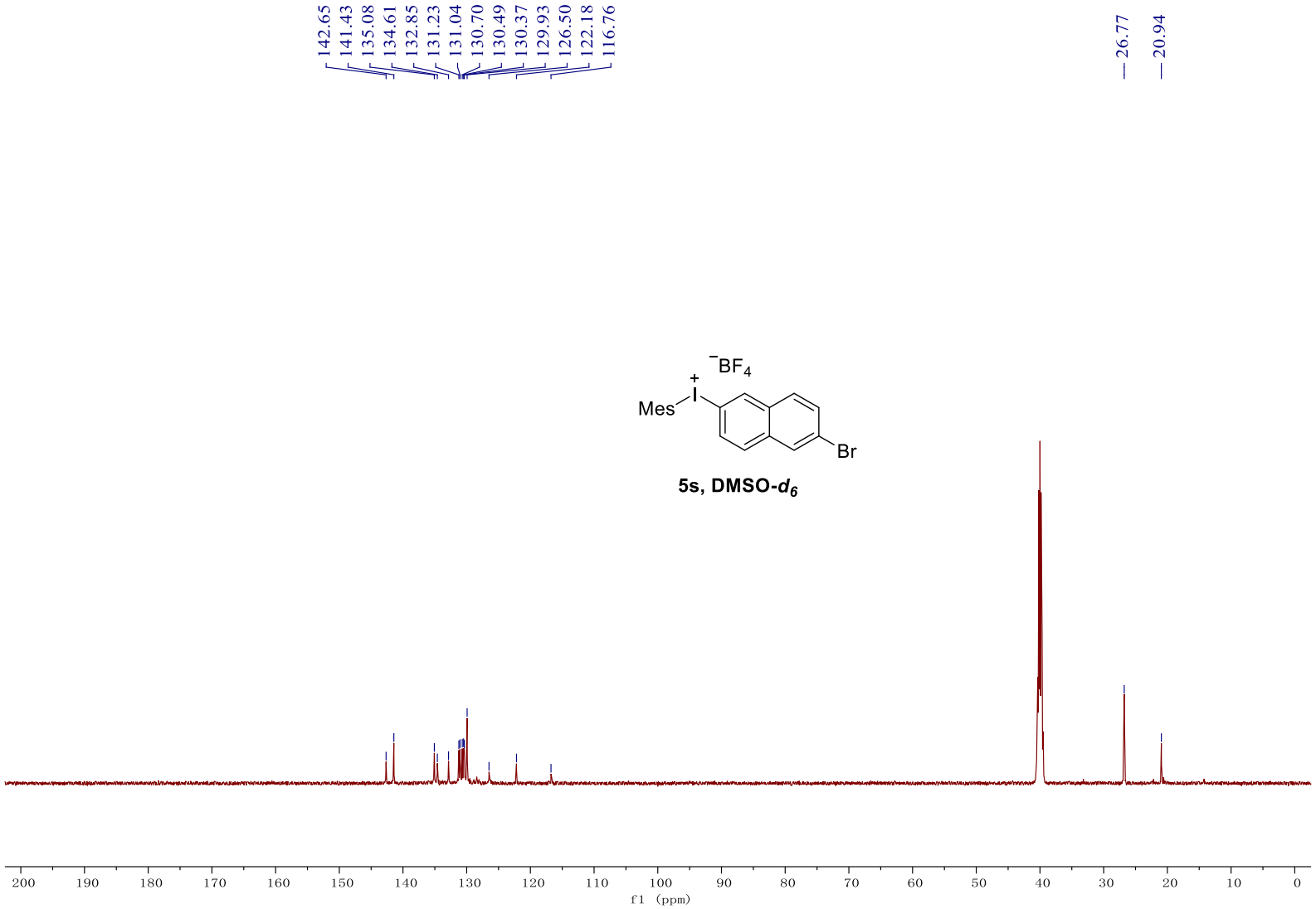
5o, DMSO-*d*$_6$

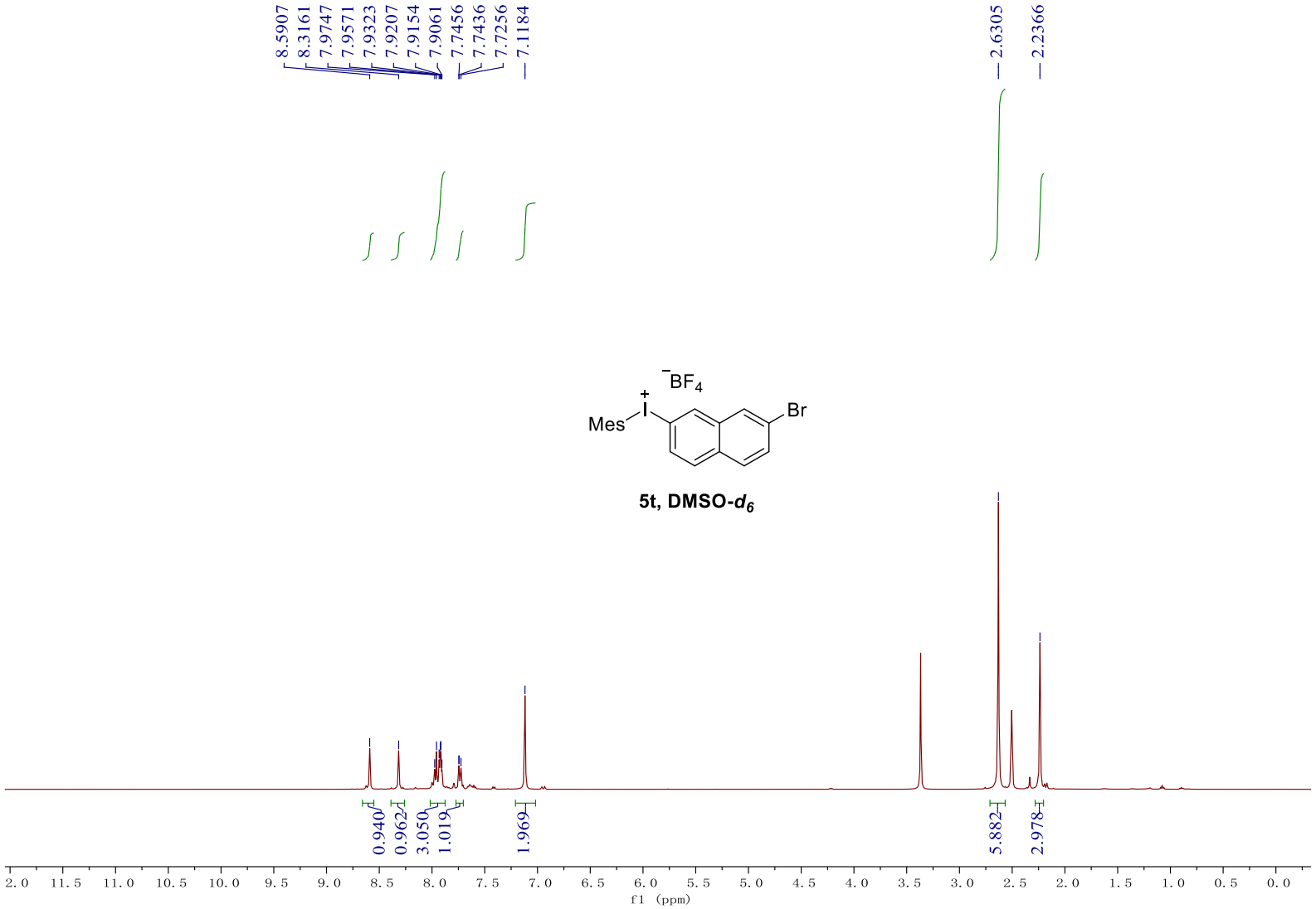

7.8461
7.8332
7.8204
7.1680
2.6028
2.2889
$^{-}BF_4$
$^{+}$
I
Mes
F
F
F
5q, DMSO-d_6
2.071
2.039
6.169
3.000
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

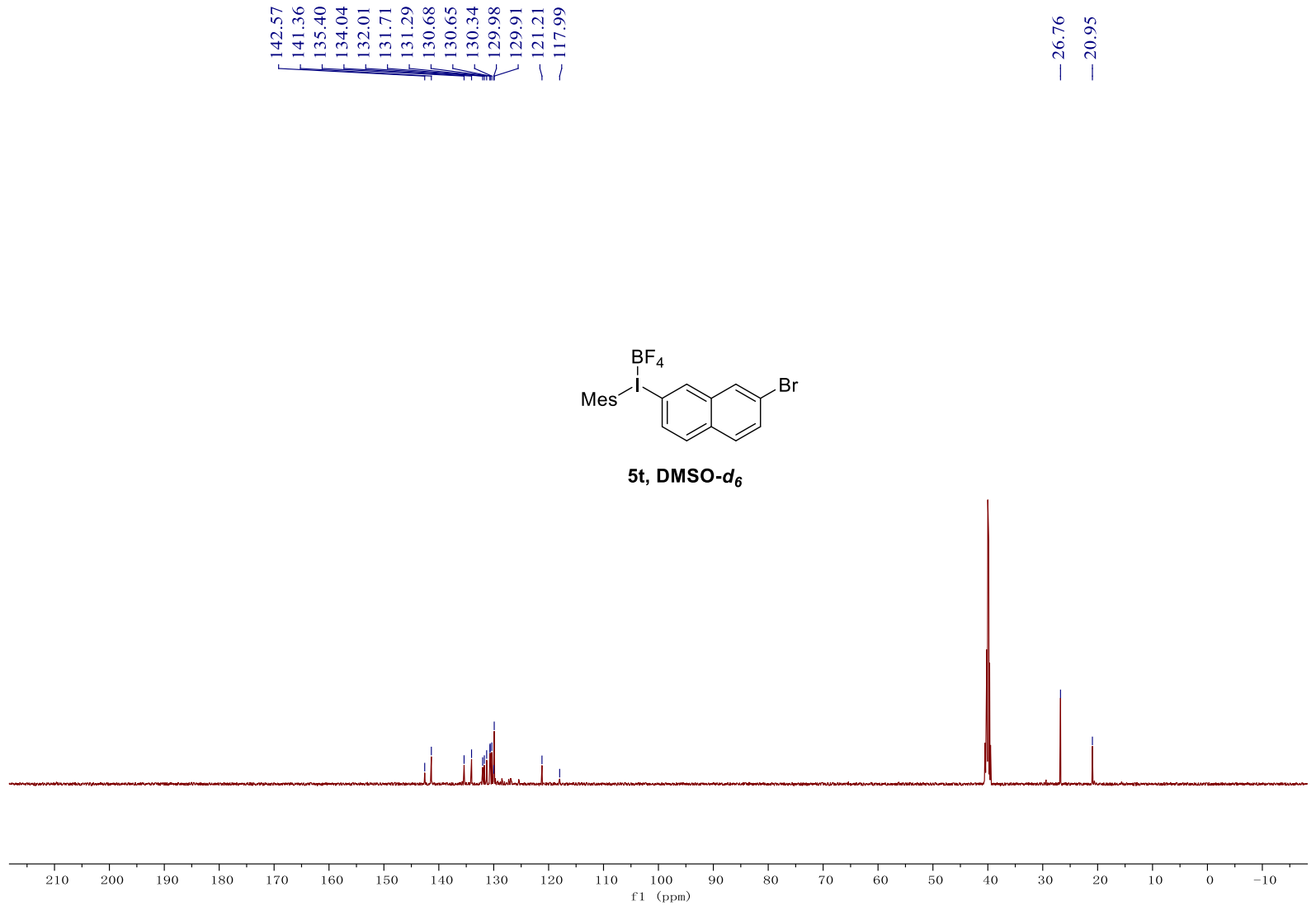

152.69
152.66
152.58
152.56
150.15
150.12
150.05
150.02
142.83
142.58
142.43
142.28
141.33
140.06
139.90
139.75
129.96
119.34
119.28
119.17
119.11
26.72
20.97
BF4
Mes
F
F
F
5q, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-131.38
-131.43
-156.27
-156.32
-156.36
BF4
Mes
I
F
F
F
5q, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

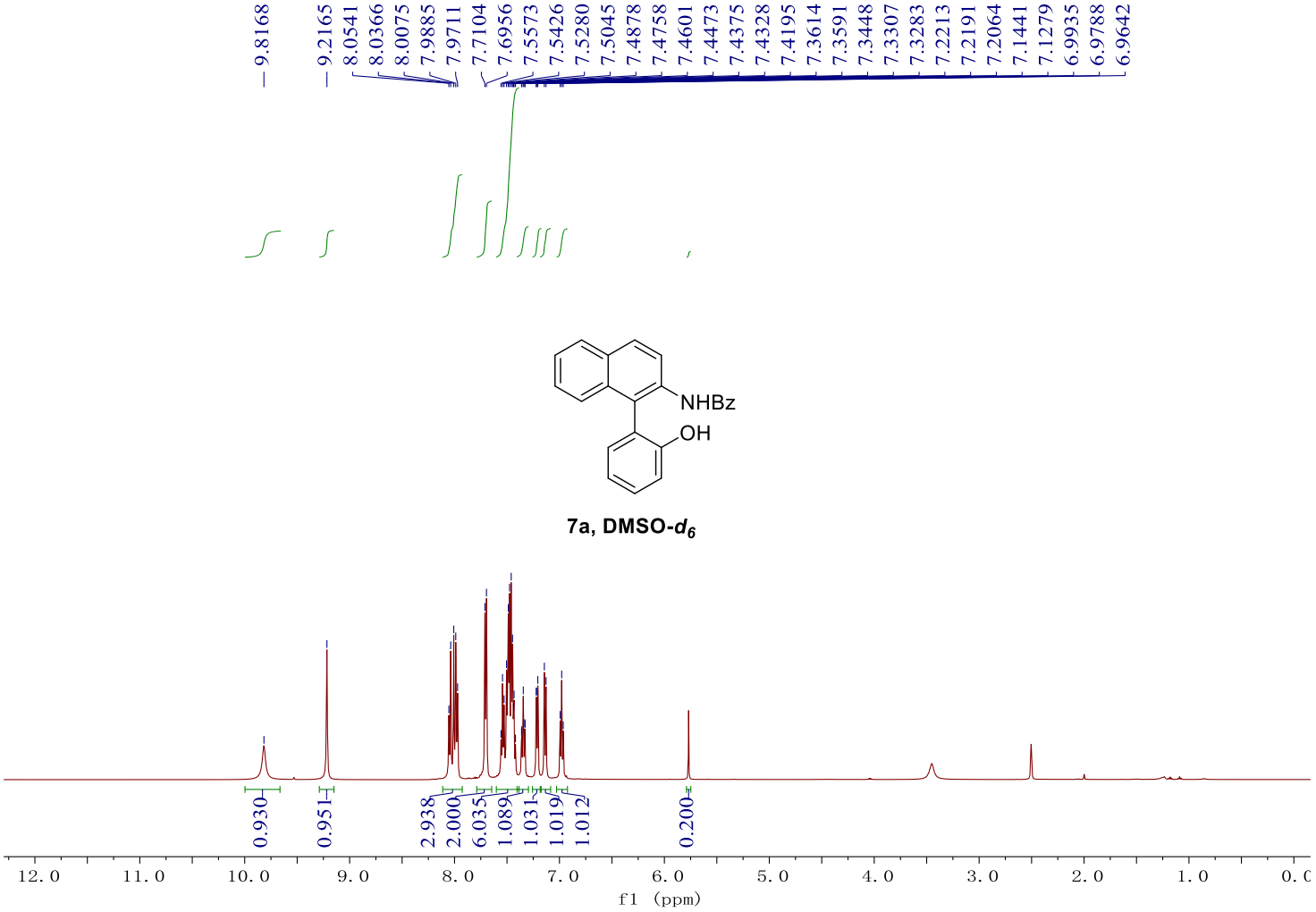

8.6471
8.2556
7.9651
7.9481
7.9136
7.7322
7.7160
7.1072
2.6192
2.2201
BF4
Mes
I
Br
5s, DMSO-d6
1.016
1.035
3.079
1.202
2.052
6.000
3.128
13.0 12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


142.65
141.43
135.08
134.61
132.85
131.23
131.04
130.70
130.49
130.37
129.93
126.50
122.18
116.76
26.77
20.94
BF4
Mes
Br
5s, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

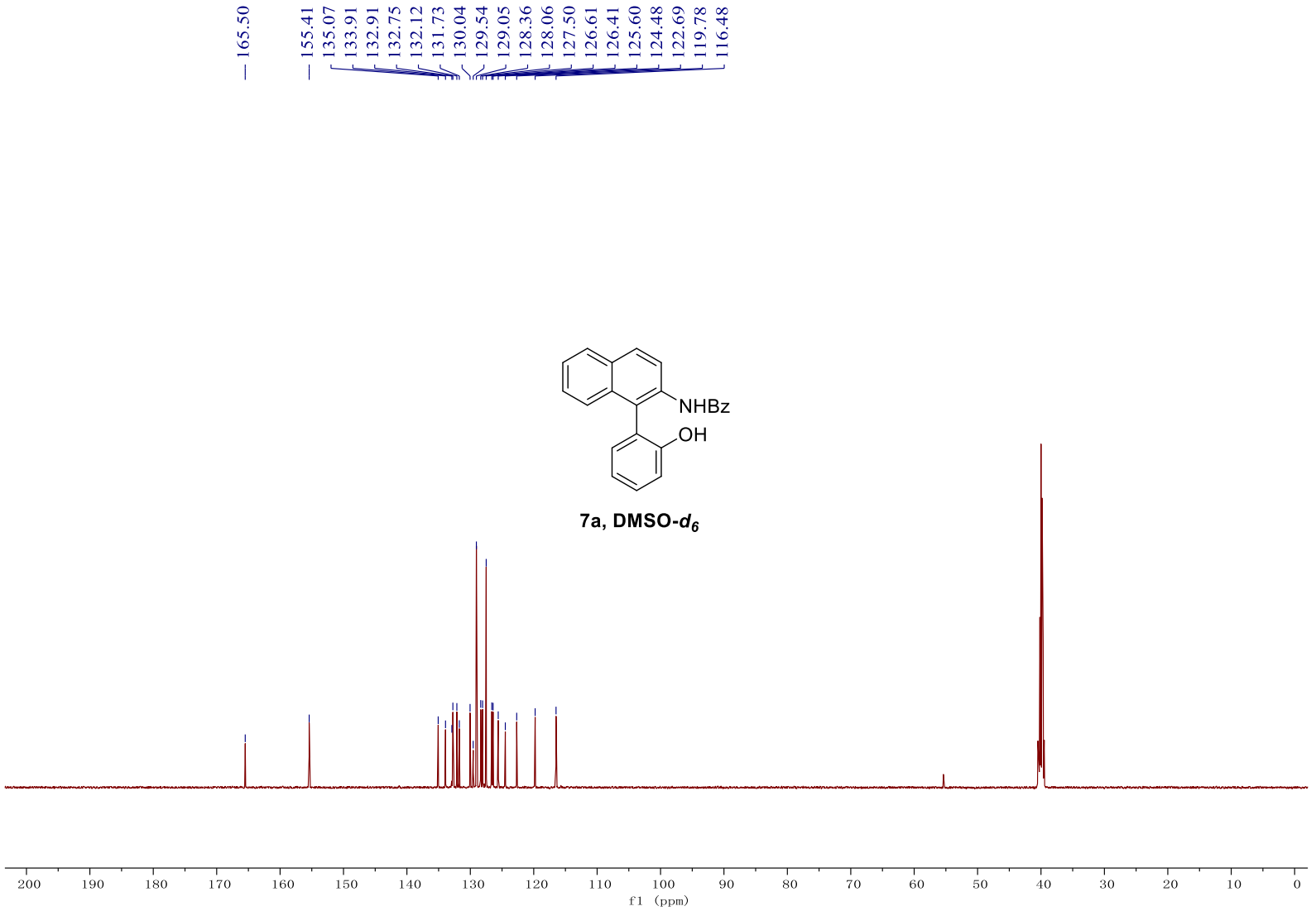

8.5907
8.3161
7.9747
7.9571
7.9323
7.9207
7.9154
7.9061
7.7456
7.7436
7.7256
7.1184
2.6305
2.2366
BF4
Mes
Br
5t, DMSO-d6
0.940
0.962
3.050
1.019
1.969
5.882
2.978
f1 (ppm)

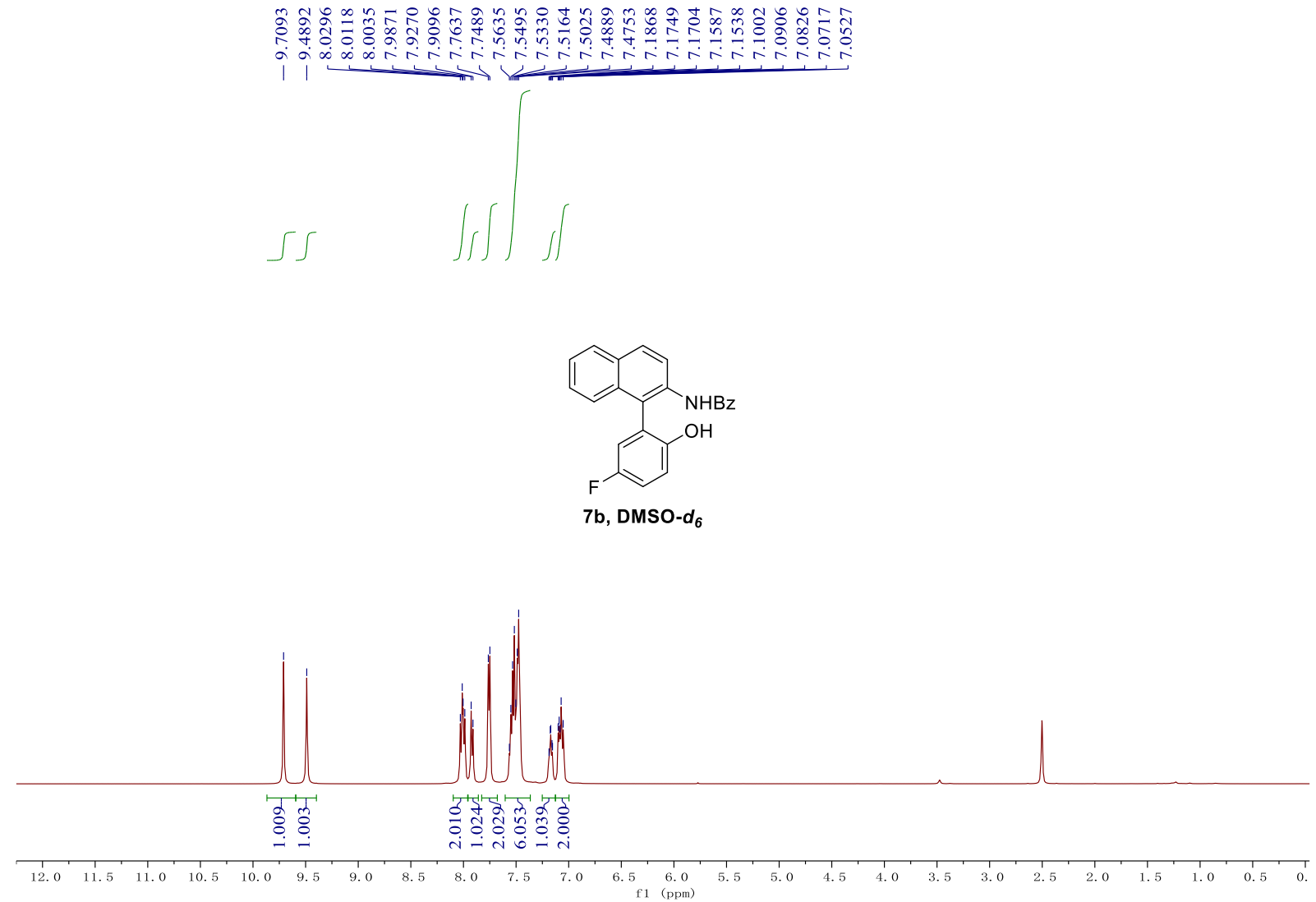

142.57
141.36
135.40
134.04
132.01
131.71
131.29
130.68
130.65
130.34
129.98
129.91
121.21
117.99
26.76
20.95
BF4
Mes
Br
5t, DMSO-d6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

NMR spectra for the products and synthetic application products

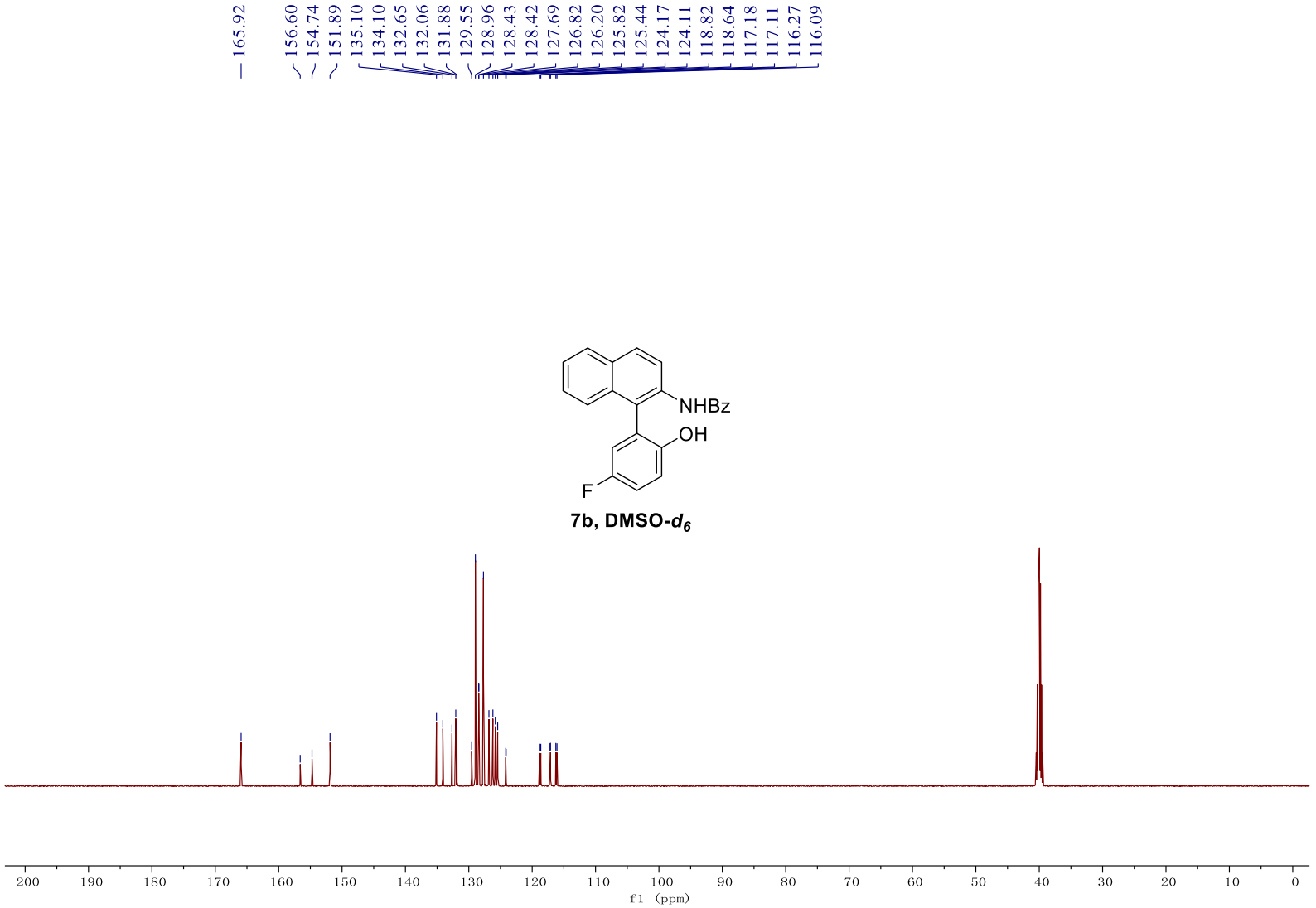


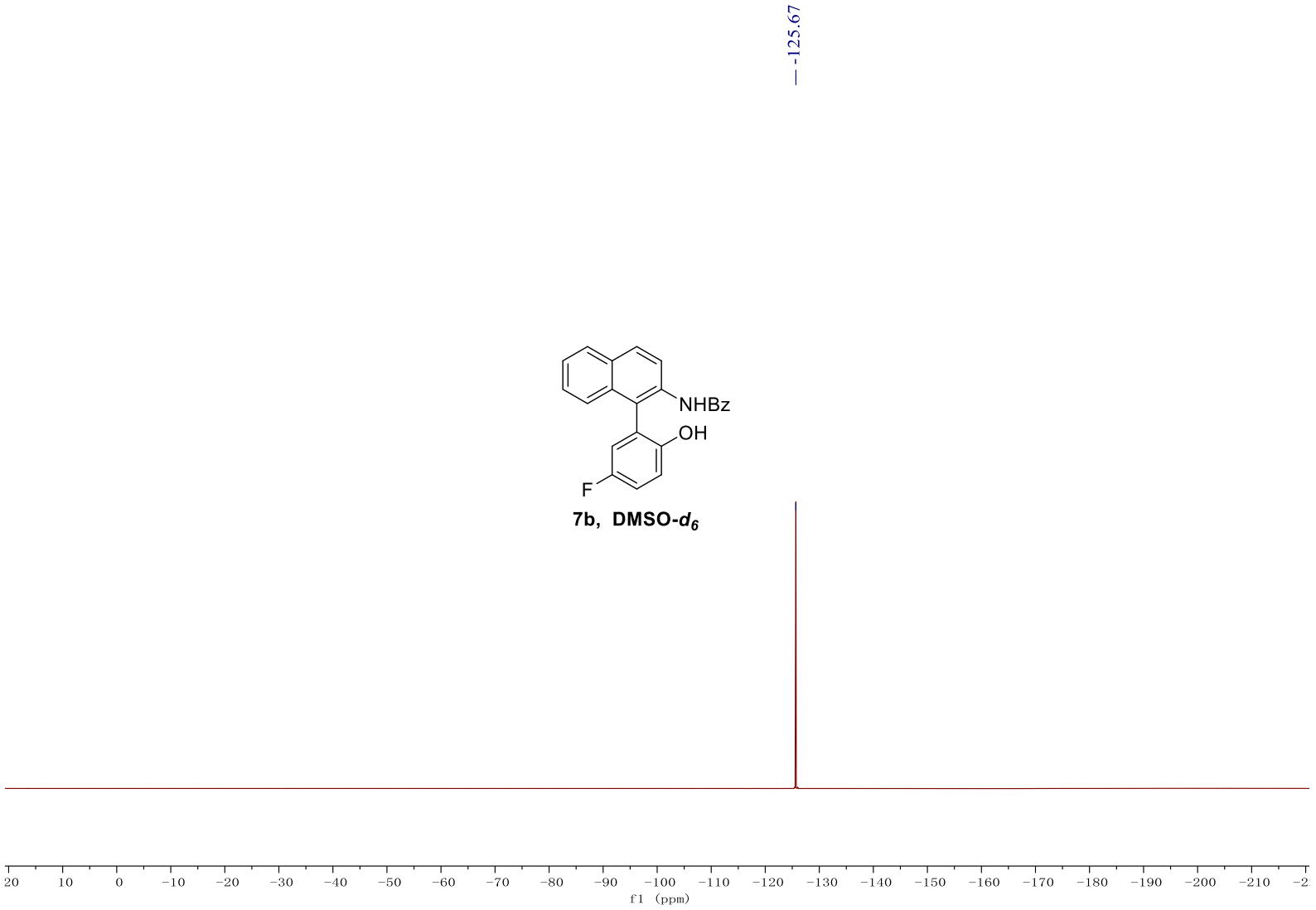
7a, DMSO-*d*$_6$

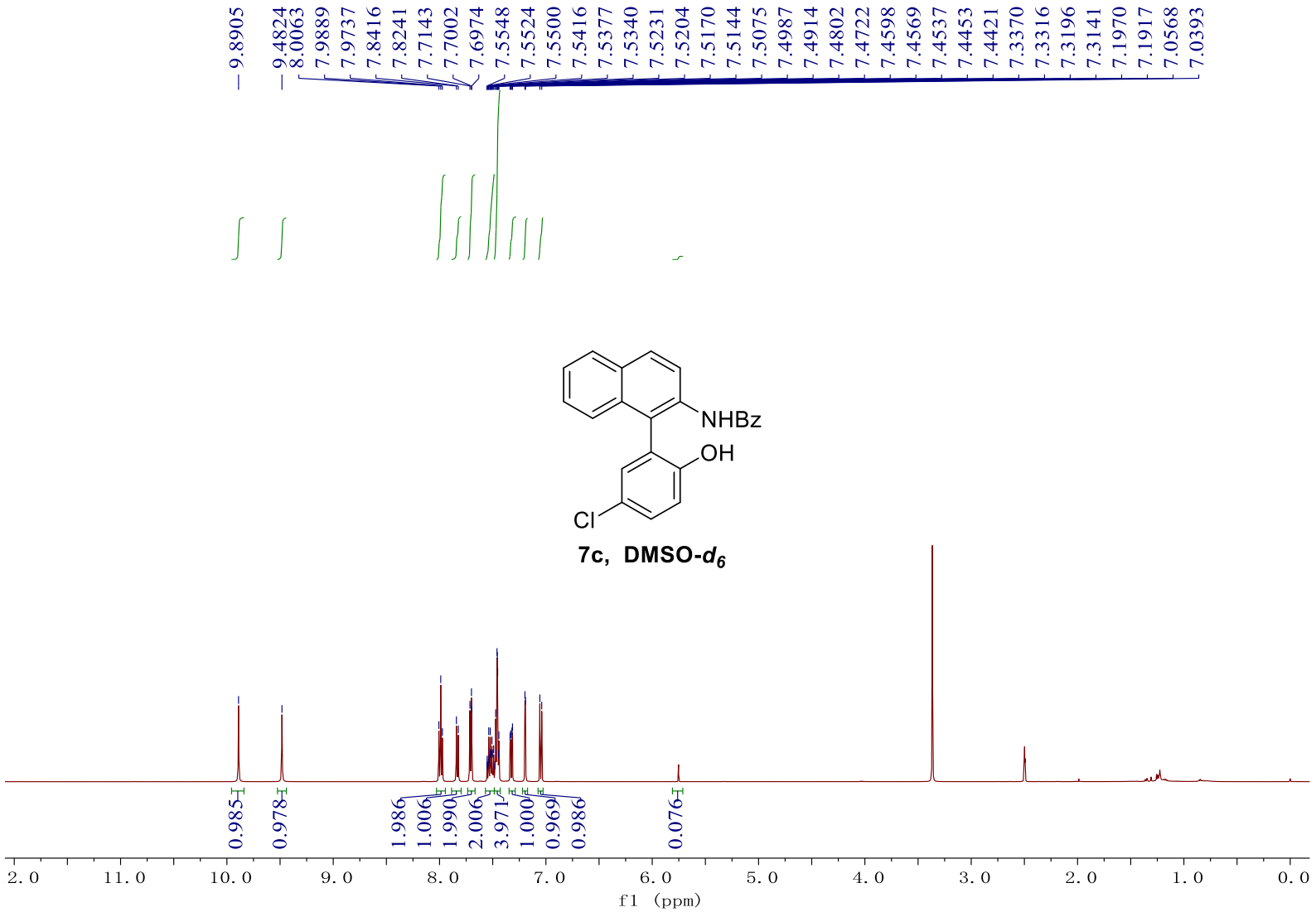

165.50
155.41
135.07
133.91
132.91
132.75
132.12
131.73
130.04
129.54
129.05
128.36
128.06
127.50
126.61
126.41
125.60
124.48
122.69
119.78
116.48
NHBz
OH
7a, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

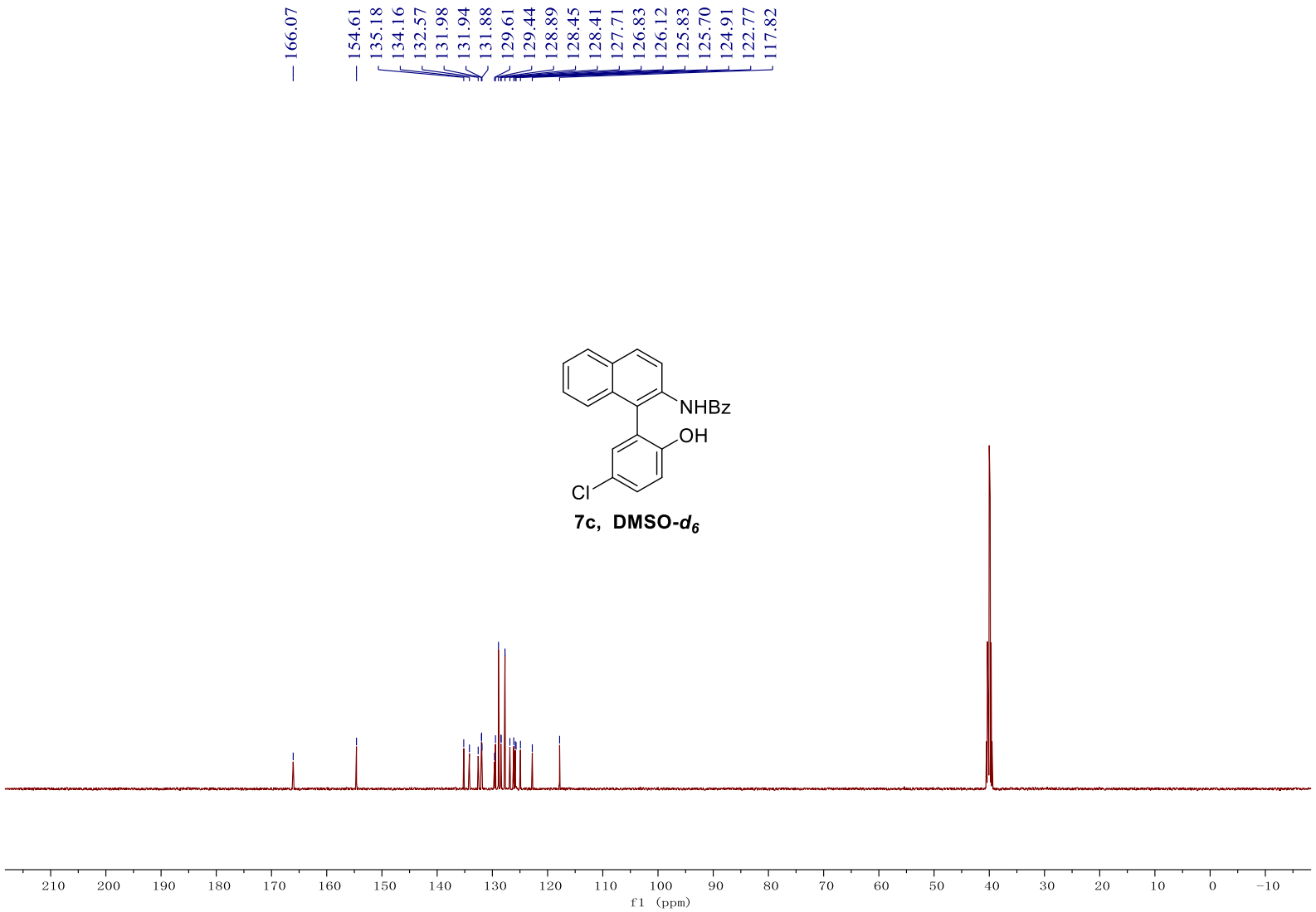

9.7093
9.4892
8.0296
8.0118
8.0035
7.9871
7.9270
7.9096
7.7637
7.7489
7.5635
7.5495
7.5330
7.5164
7.5025
7.4889
7.4753
7.1868
7.1749
7.1704
7.1587
7.1538
7.1002
7.0906
7.0826
7.0717
7.0527
NHBz
OH
F
1.009
1.003
2.010
1.024
2.029
6.053
1.039
2.000
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.
f1 (ppm)

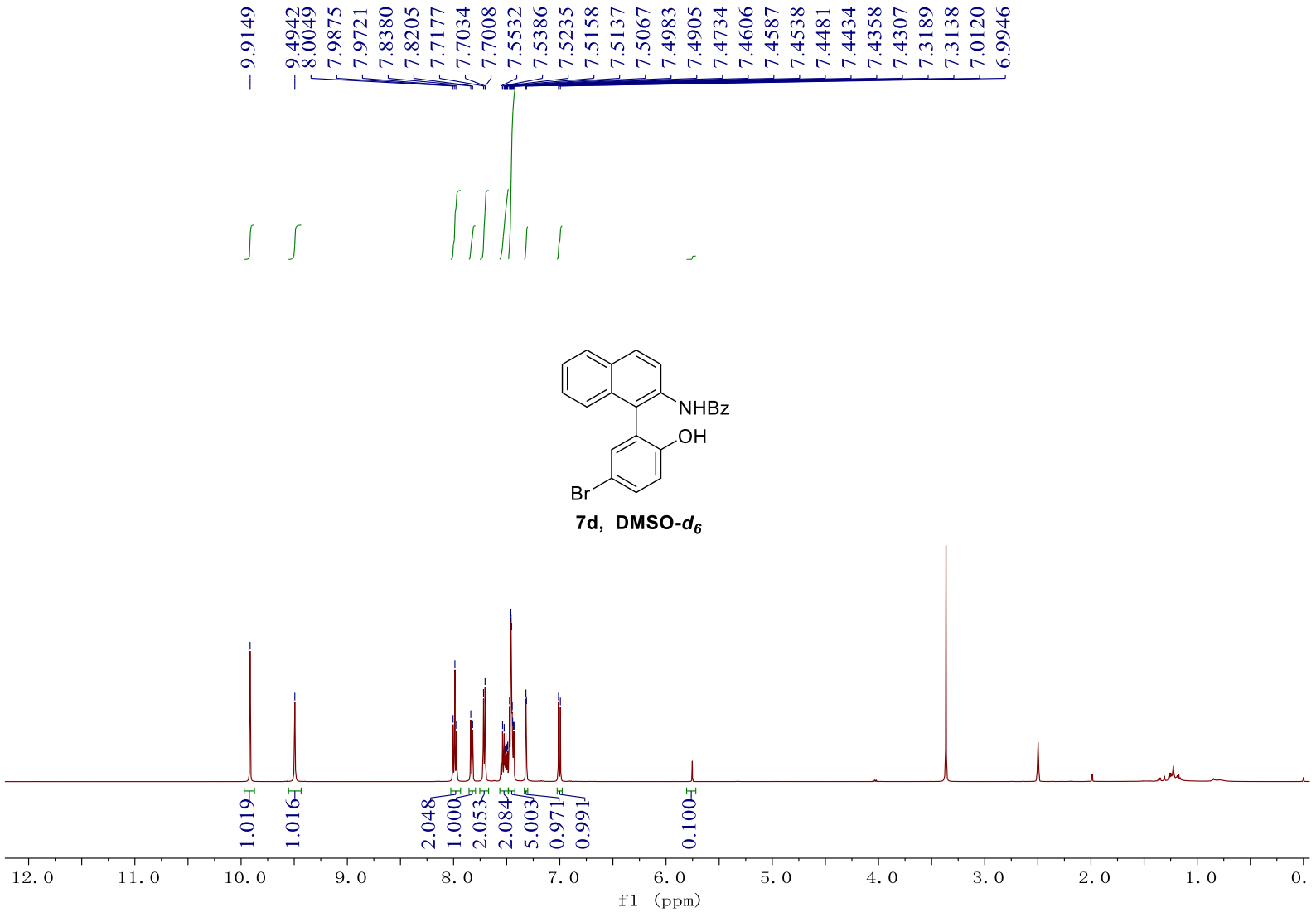
7b, DMSO-*d*$_6$

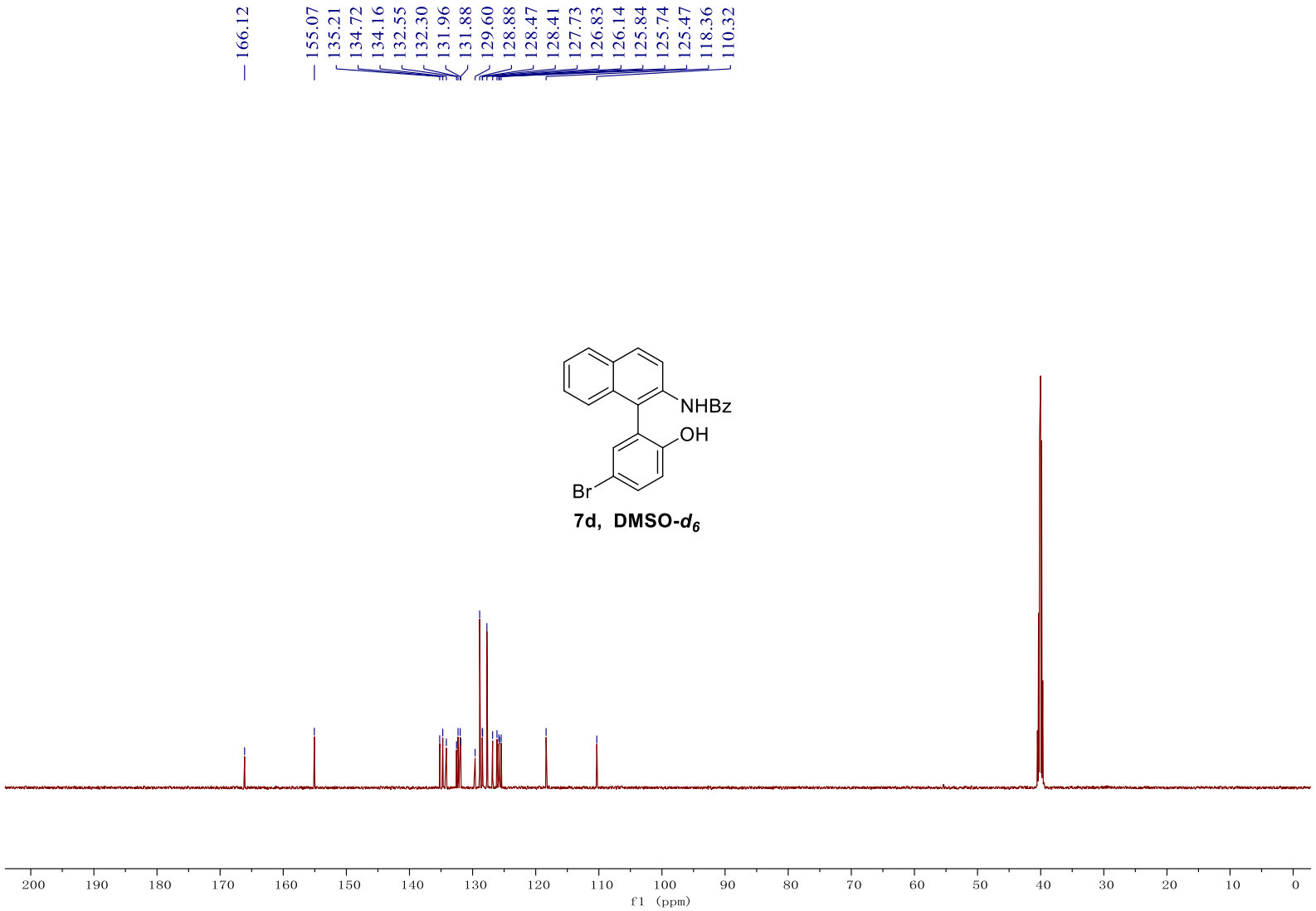

165.92
156.60
154.74
151.89
135.10
134.10
132.65
132.06
131.88
129.55
128.96
128.43
128.42
127.69
126.82
126.20
125.82
125.44
124.17
124.11
118.82
118.64
117.18
117.11
116.27
116.09
NHBz
OH
F
7b, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

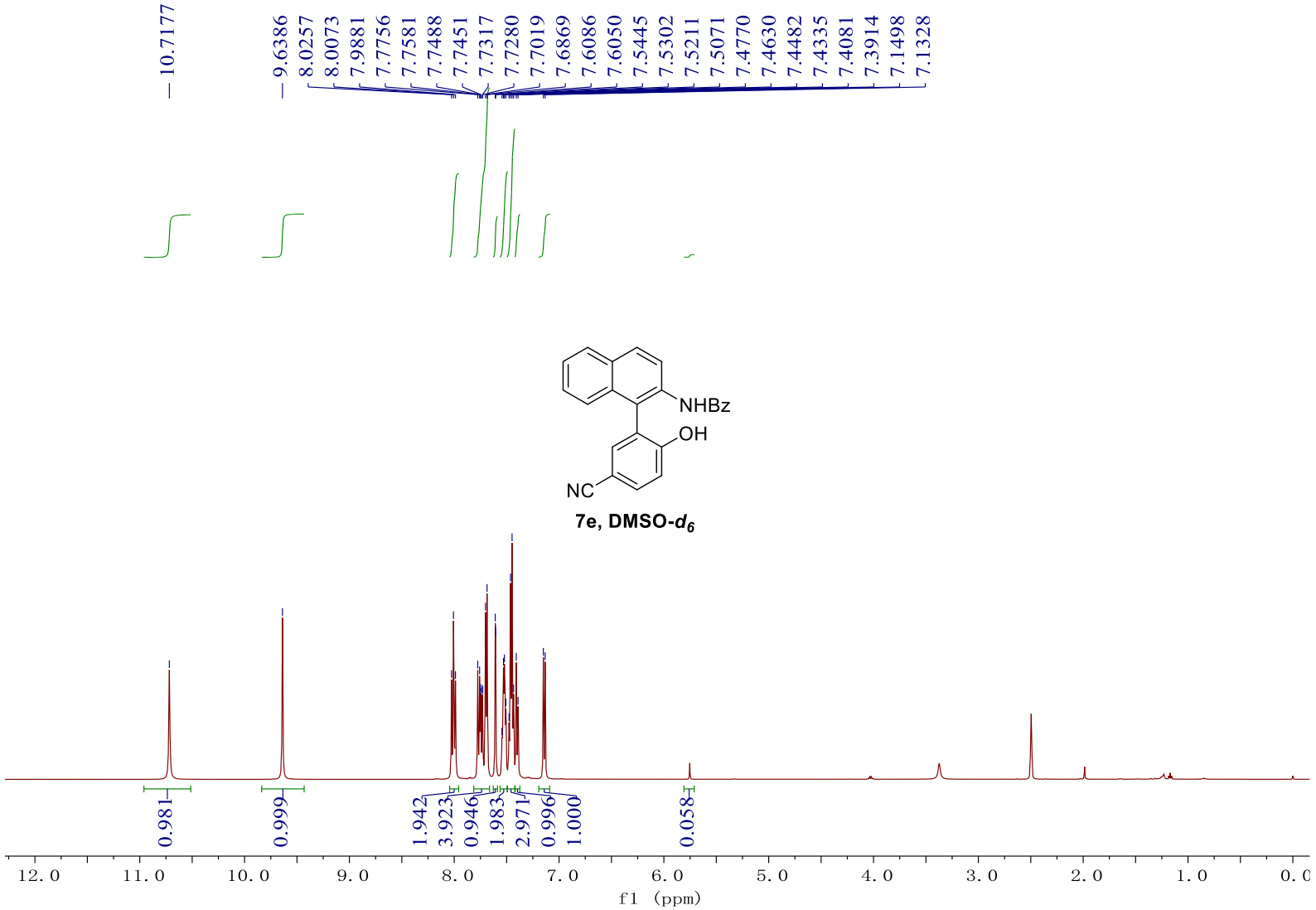

-125.67
NHBz
OH
F
7b, DMSO-d_6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

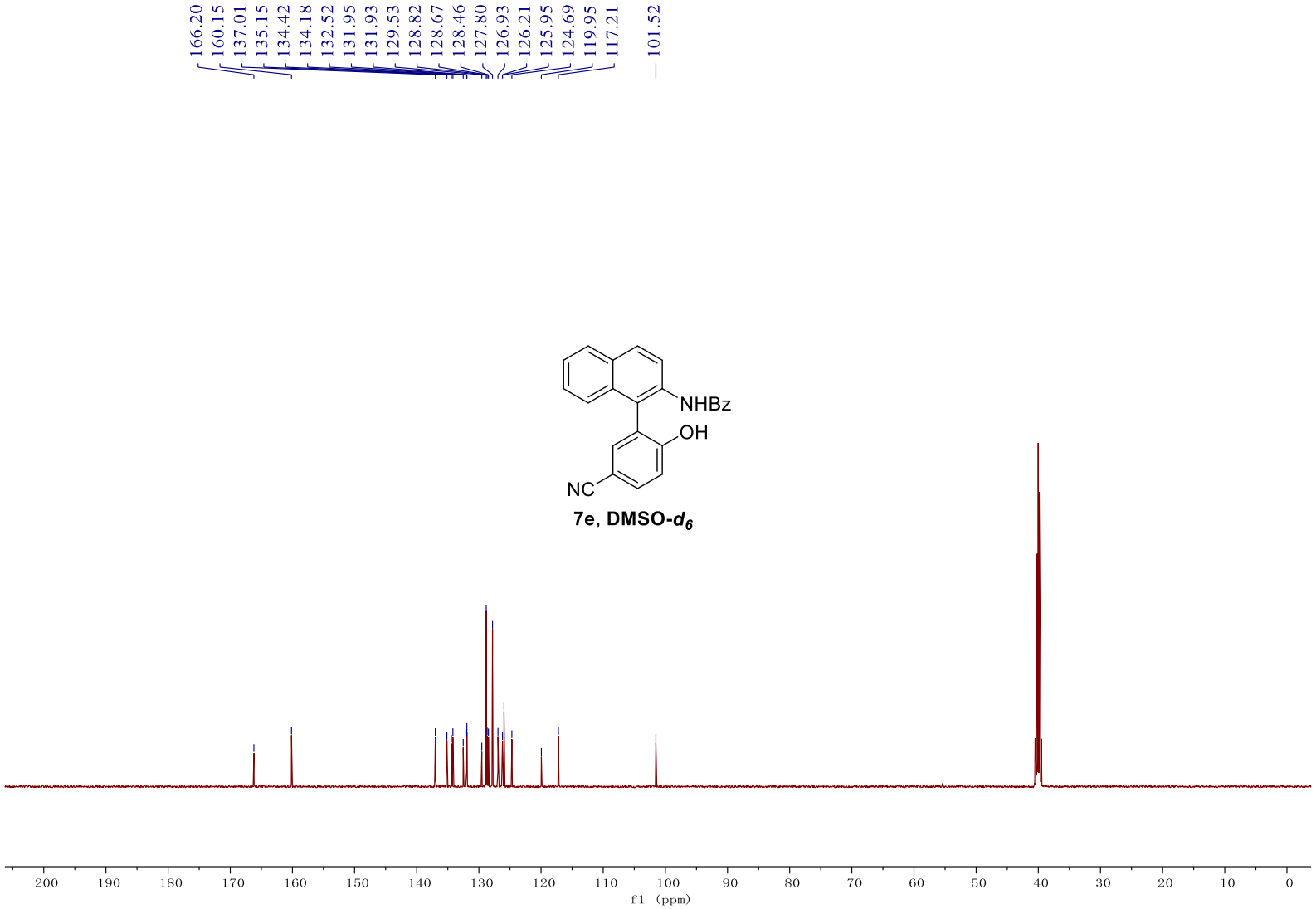

9.8905
9.4824
8.0063
7.9889
7.9737
7.8416
7.8241
7.7143
7.7002
7.6974
7.5548
7.5524
7.5500
7.5416
7.5377
7.5340
7.5231
7.5204
7.5170
7.5144
7.5075
7.4987
7.4914
7.4802
7.4722
7.4598
7.4569
7.4537
7.4453
7.4421
7.3370
7.3316
7.3196
7.3141
7.1970
7.1917
7.0568
7.0393
NHBz
OH
Cl
7c, DMSO-d6
0.985
0.978
1.986
1.006
1.990
2.006
3.971
1.000
0.969
0.986
0.076
2.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

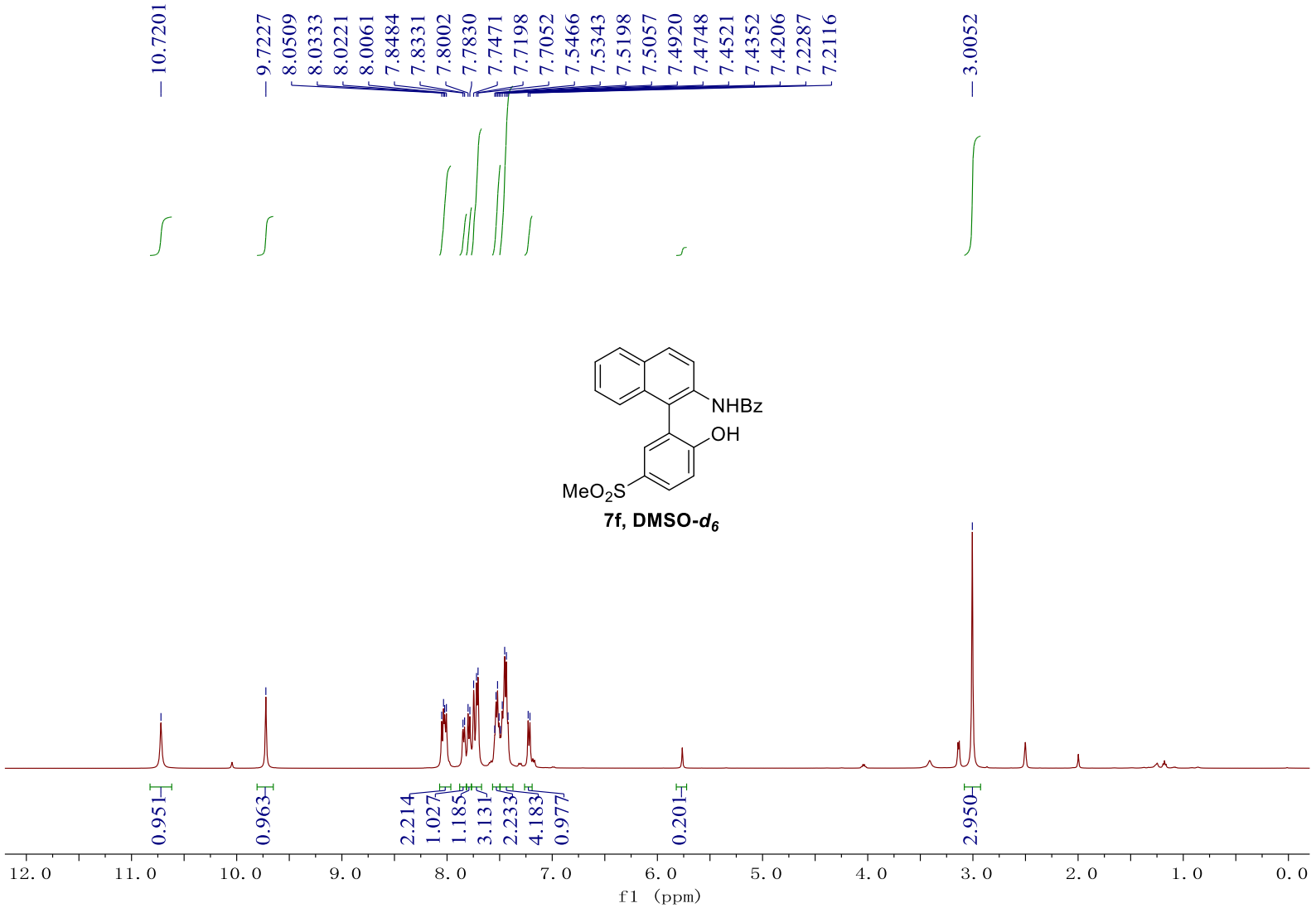

166.07
154.61
135.18
134.16
132.57
131.98
131.94
131.88
129.61
129.44
128.89
128.45
128.41
127.71
126.83
126.12
125.83
125.70
124.91
122.77
117.82
NHBz
OH
Cl
7c, DMSO-d6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

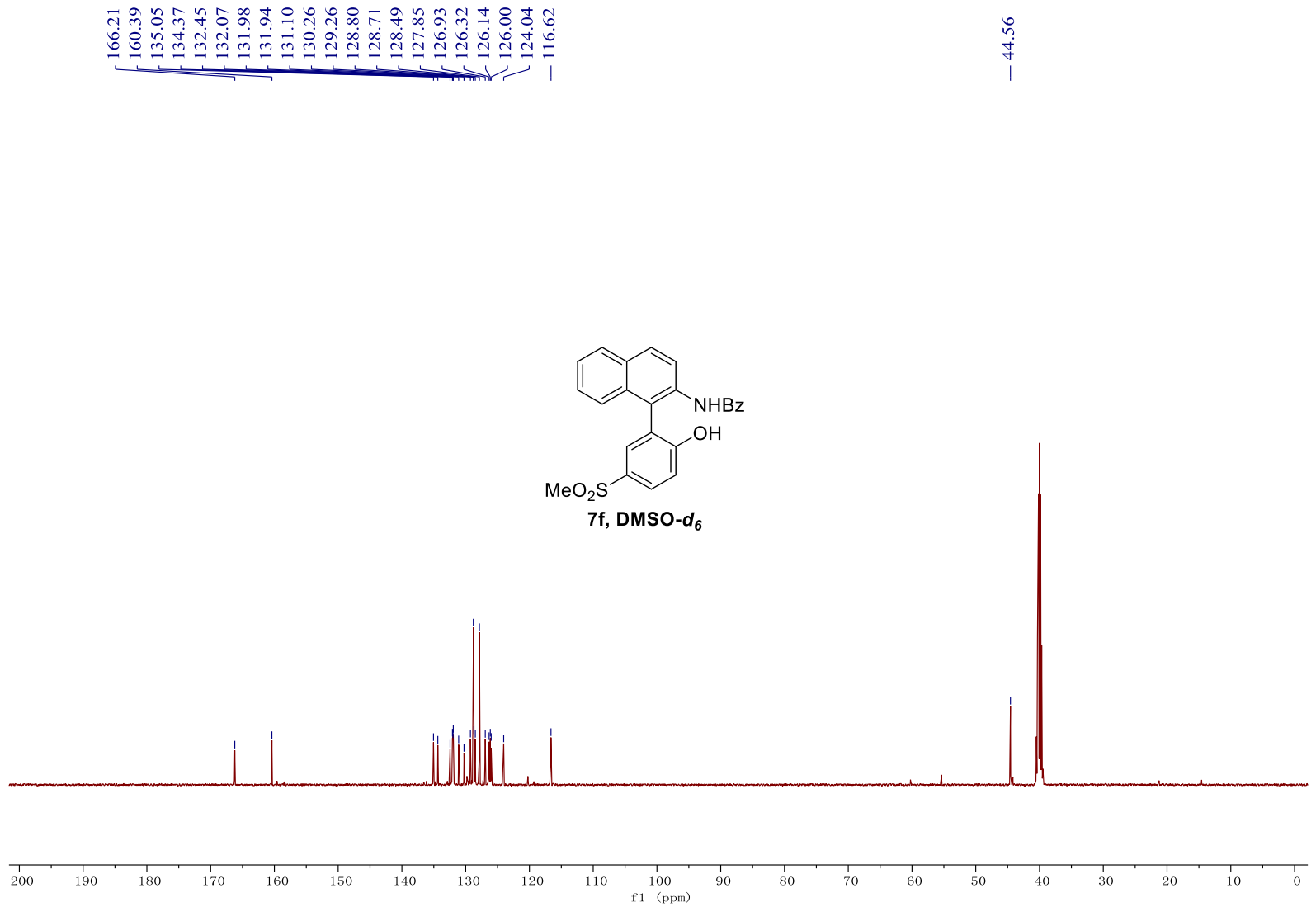

9.9149
9.4942
8.0049
7.9875
7.9721
7.8380
7.8205
7.7177
7.7034
7.7008
7.5532
7.5386
7.5235
7.5158
7.5137
7.5067
7.4983
7.4905
7.4734
7.4606
7.4587
7.4538
7.4481
7.4434
7.4358
7.4307
7.3189
7.3138
7.0120
6.9946
NHBz
OH
Br
7d, DMSO-d6
1.019
1.016
2.048
1.000
2.053
2.084
5.003
0.971
0.991
0.100
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.
f1 (ppm)

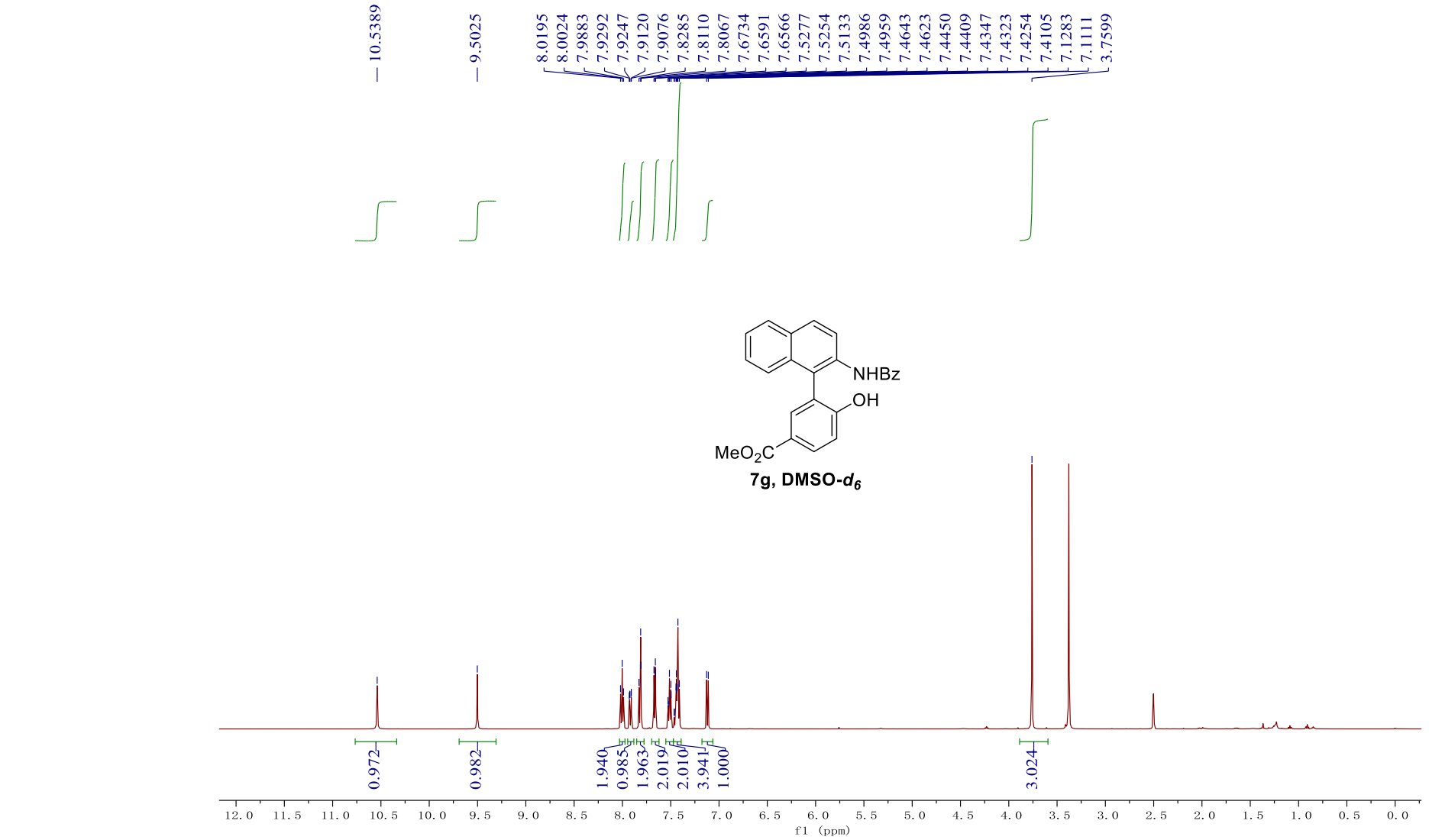

166.12
155.07
135.21
134.72
134.16
132.55
132.30
131.96
131.88
129.60
128.88
128.47
128.41
127.73
126.83
126.14
125.84
125.74
125.47
118.36
110.32
NHBz
OH
Br
7d, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

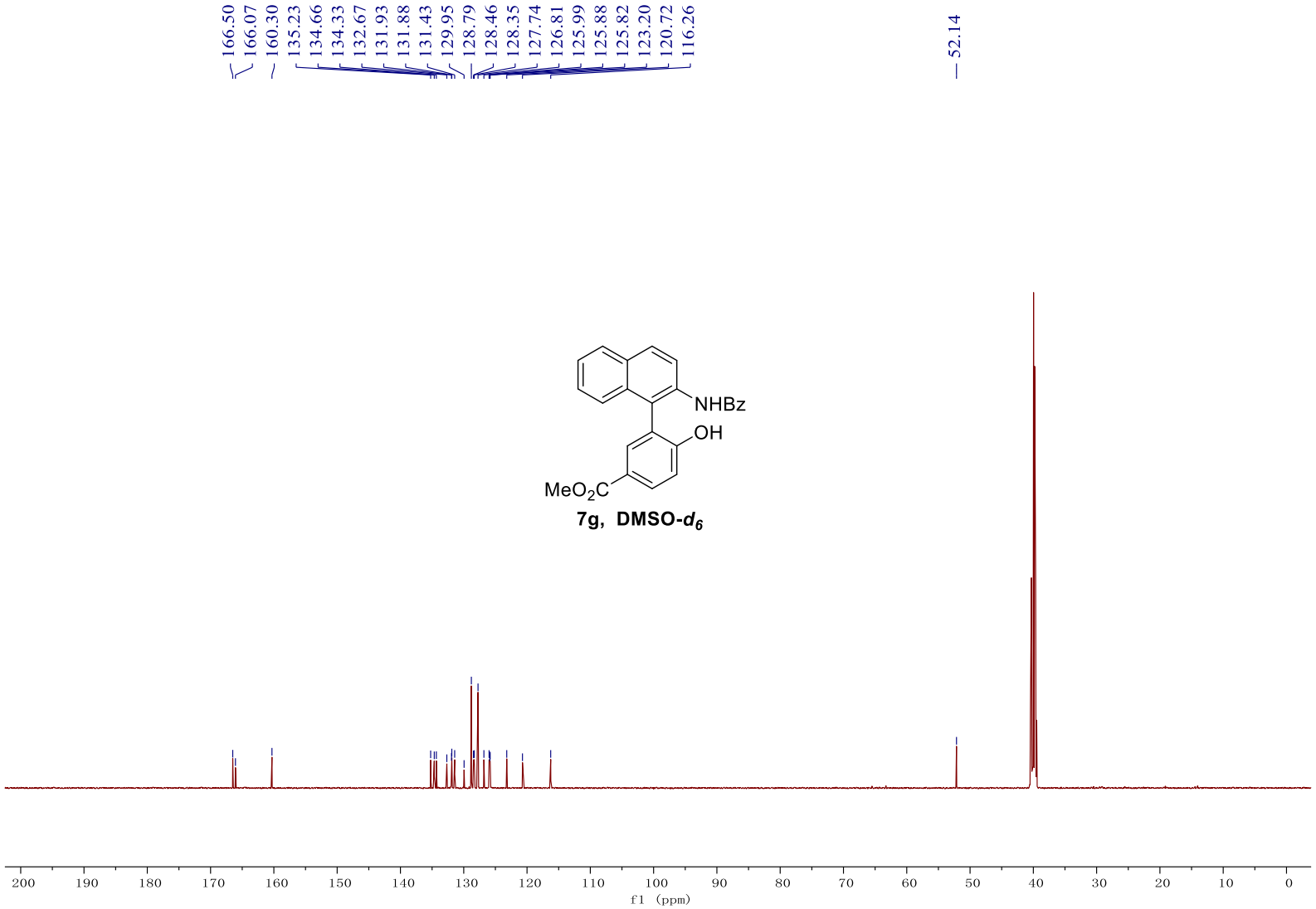

10.7177
9.6386
8.0257
8.0073
7.9881
7.7756
7.7581
7.7488
7.7451
7.7317
7.7280
7.7019
7.6869
7.6086
7.6050
7.5445
7.5302
7.5211
7.5071
7.4770
7.4630
7.4482
7.4335
7.4081
7.3914
7.1498
7.1328
NHBz
OH
NC
7e, DMSO-d6
0.981
0.999
1.942
3.923
0.946
1.983
2.971
0.996
1.000
0.058
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

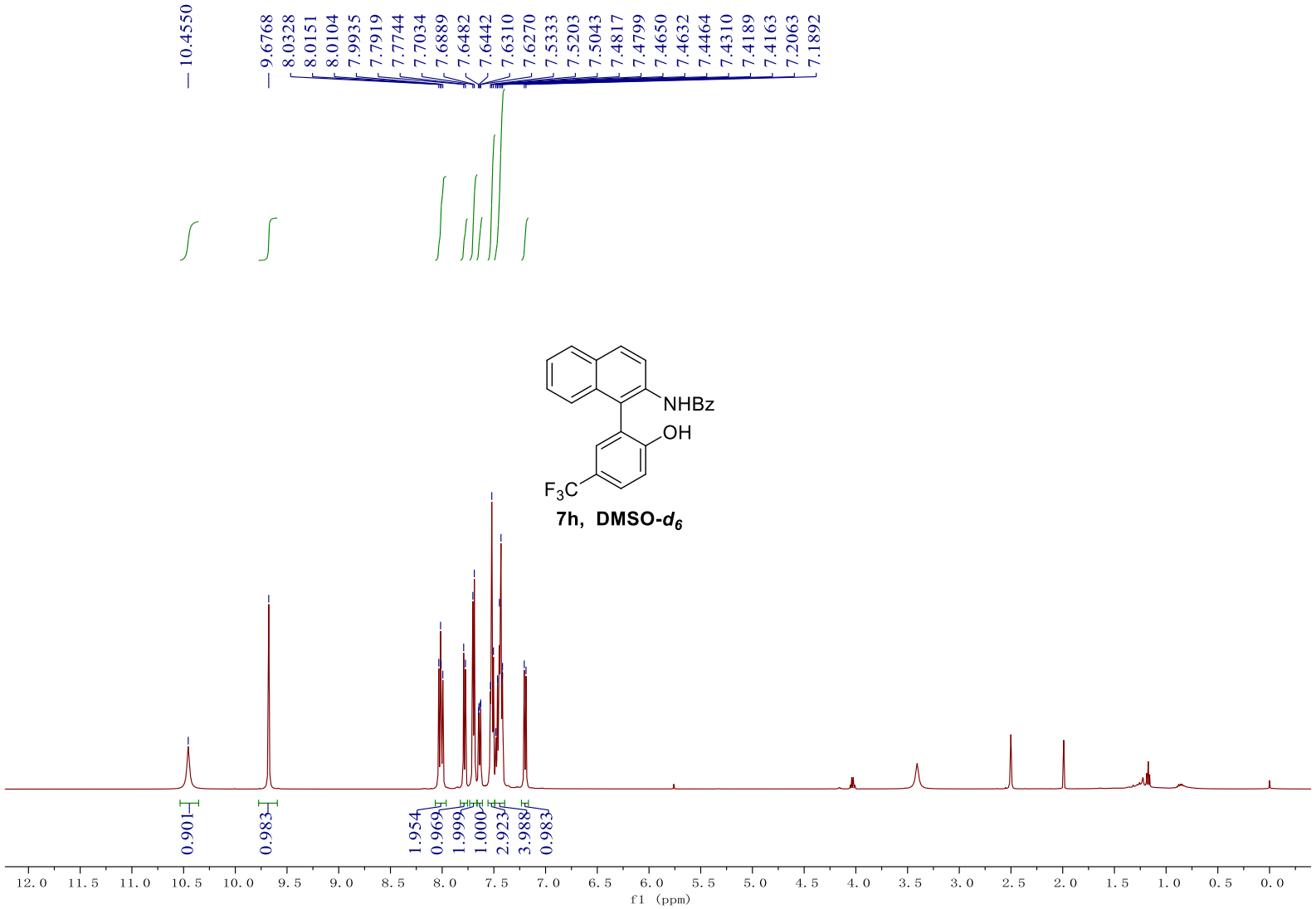

166.20
160.15
137.01
135.15
134.42
134.18
132.52
131.95
131.93
129.53
128.82
128.67
128.46
127.80
126.93
126.21
125.95
124.69
119.95
117.21
101.52
NHBz
OH
NC
7e, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

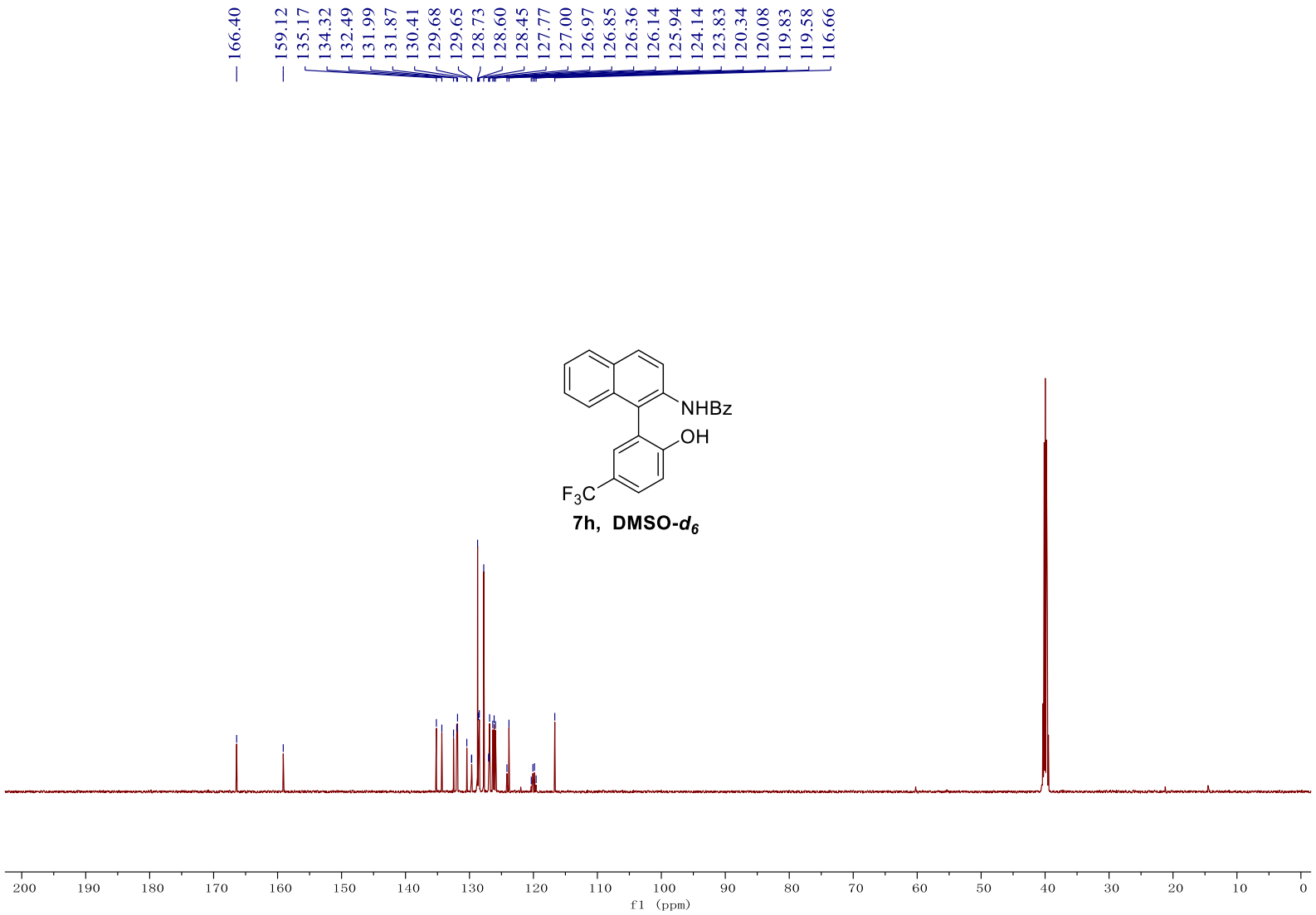

10.7201
9.7227
8.0509
8.0333
8.0221
8.0061
7.8484
7.8331
7.8002
7.7830
7.7471
7.7198
7.7052
7.5466
7.5343
7.5198
7.5057
7.4920
7.4748
7.4521
7.4352
7.4206
7.2287
7.2116
3.0052
NHBz
OH
MeO2S
7f, DMSO-d6
0.951
0.963
2.214
1.027
1.185
3.131
2.233
4.183
0.977
0.201
2.950
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

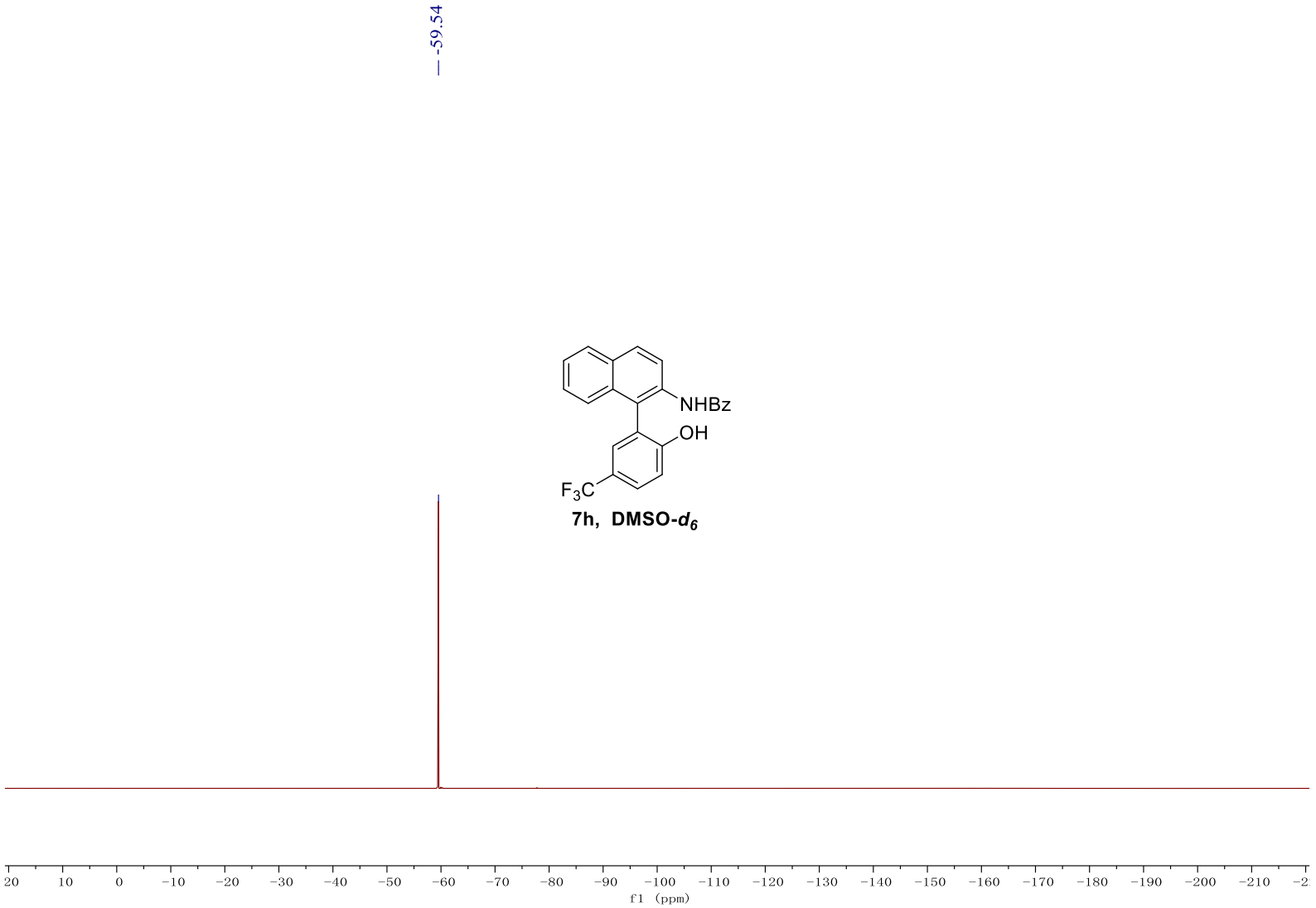

166.21
160.39
135.05
134.37
132.45
132.07
131.98
131.94
131.10
130.26
129.26
128.80
128.71
128.49
127.85
126.93
126.32
126.14
126.00
124.04
116.62
44.56
NHBz
OH
MeO2S
7f, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


10.5389
9.5025
8.0195
8.0024
7.9883
7.9292
7.9247
7.9120
7.9076
7.8285
7.8110
7.8067
7.6734
7.6591
7.6566
7.5277
7.5254
7.5133
7.4986
7.4959
7.4643
7.4623
7.4450
7.4409
7.4347
7.4323
7.4254
7.4105
7.1283
7.1111
3.7599
NHBz
OH
MeO2C
7g, DMSO-d6
0.972
0.982
1.940
0.985
1.963
2.019
2.010
3.941
1.000
3.024
f1 (ppm)

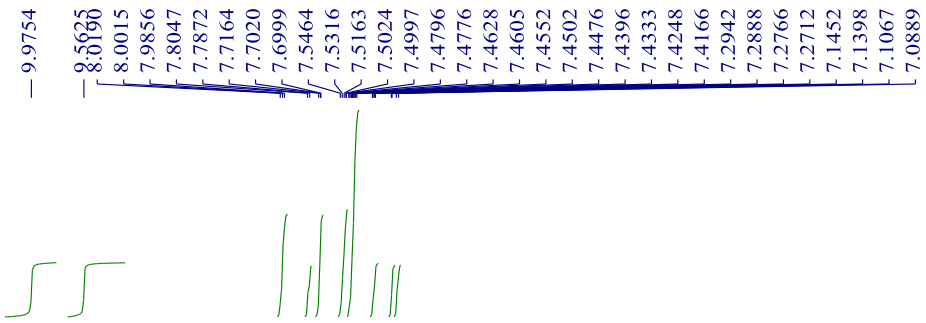

166.50
166.07
160.30
135.23
134.66
134.33
132.67
131.93
131.88
131.43
129.95
128.79
128.46
128.35
127.74
126.81
125.99
125.88
125.82
123.20
120.72
116.26
52.14
NHBz
OH
MeO2C
7g, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

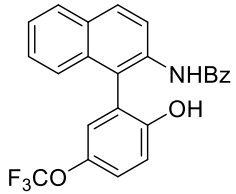

10.4550
9.6768
8.0328
8.0151
8.0104
7.9935
7.7919
7.7744
7.7034
7.6889
7.6482
7.6442
7.6310
7.6270
7.5333
7.5203
7.5043
7.4817
7.4799
7.4650
7.4632
7.4464
7.4310
7.4189
7.4163
7.2063
7.1892
NHBz
OH
F3C
7h, DMSO-d6
0.901
0.983
1.954
0.969
1.999
1.000
2.923
3.988
0.983
f1 (ppm)


166.40
159.12
135.17
134.32
132.49
131.99
131.87
130.41
129.68
129.65
128.73
128.60
128.45
127.77
127.00
126.97
126.85
126.36
126.14
125.94
124.14
123.83
120.34
120.08
119.83
119.58
116.66
NHBz
OH
F3C
7h, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

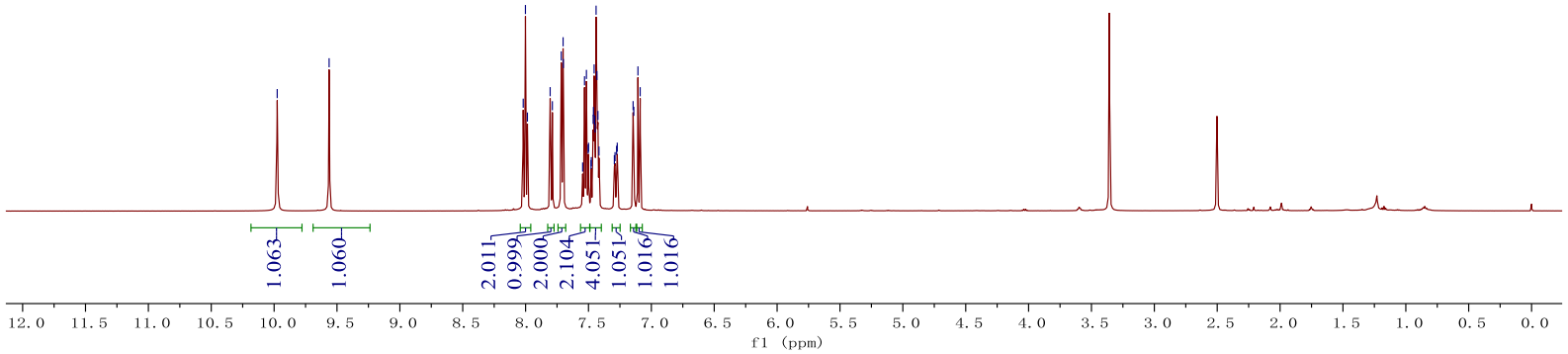

-59.54
NHBz
OH
F3C
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

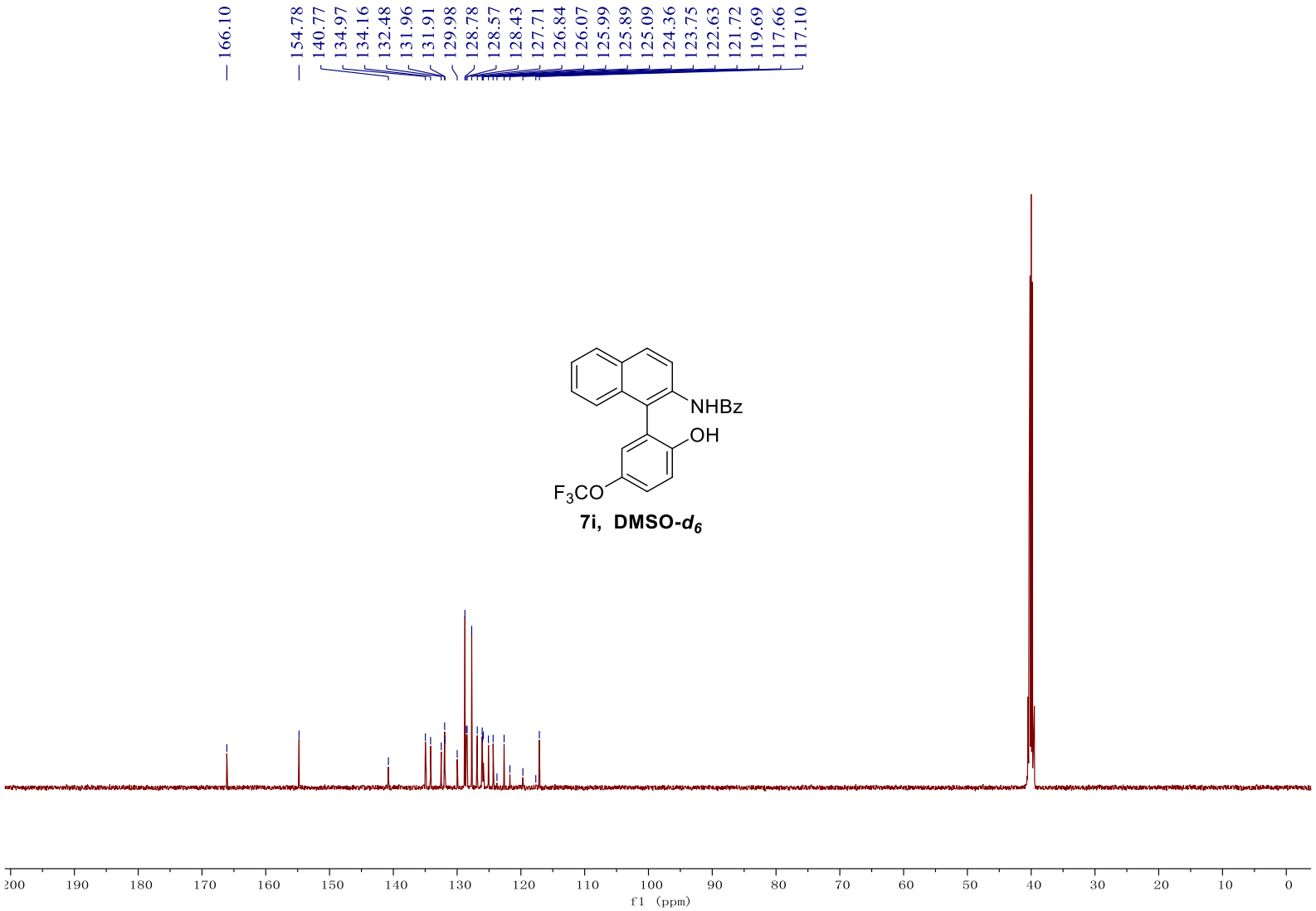
7h, DMSO-*d*$_6$

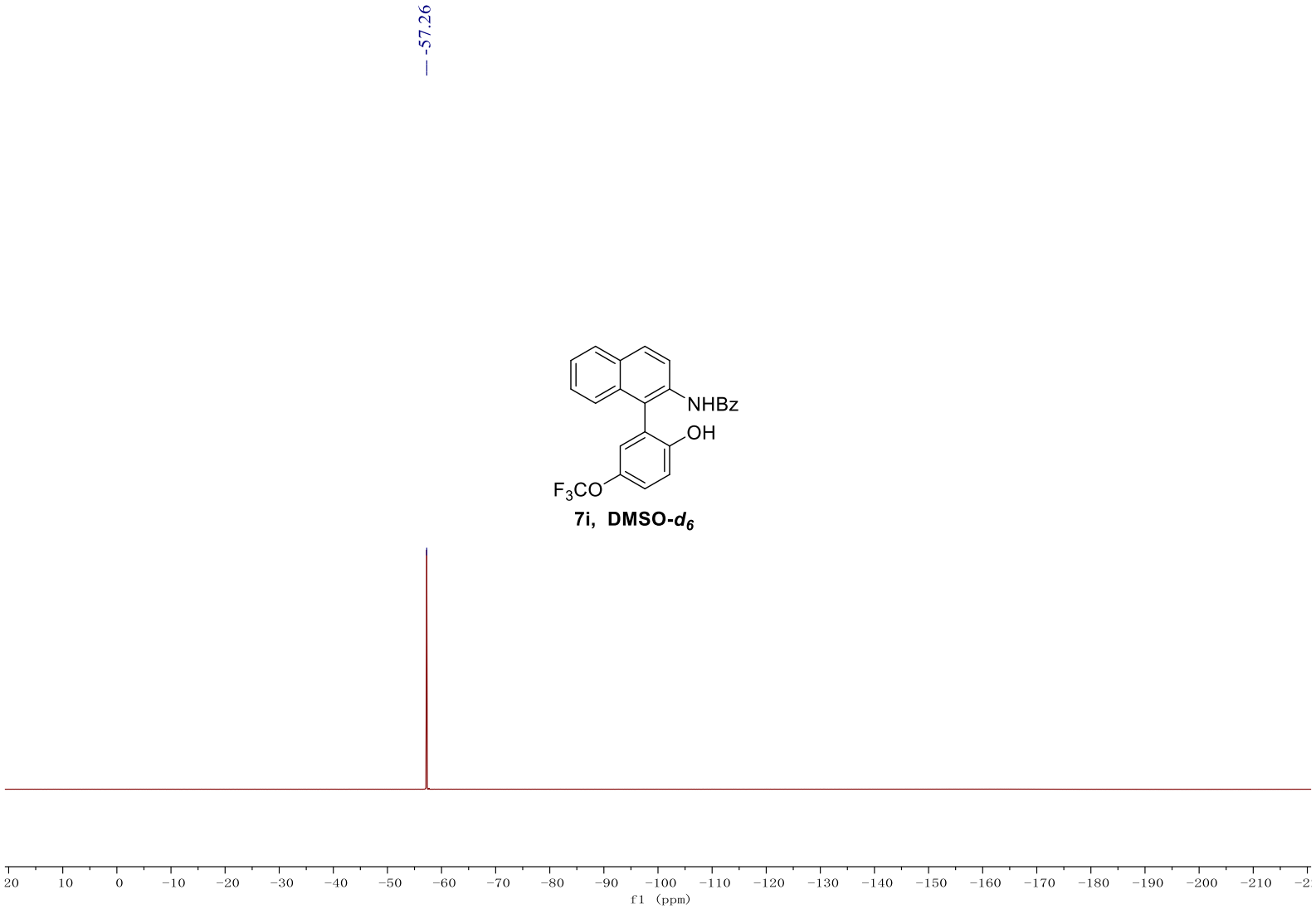

9.9754
9.5625
8.0190
8.0015
7.9856
7.8047
7.7872
7.7164
7.7020
7.6999
7.5464
7.5316
7.5163
7.5024
7.4997
7.4796
7.4776
7.4628
7.4605
7.4552
7.4502
7.4476
7.4396
7.4333
7.4248
7.4166
7.2942
7.2888
7.2766
7.2712
7.1452
7.1398
7.1067
7.0889


NHBz
OH
F3CO

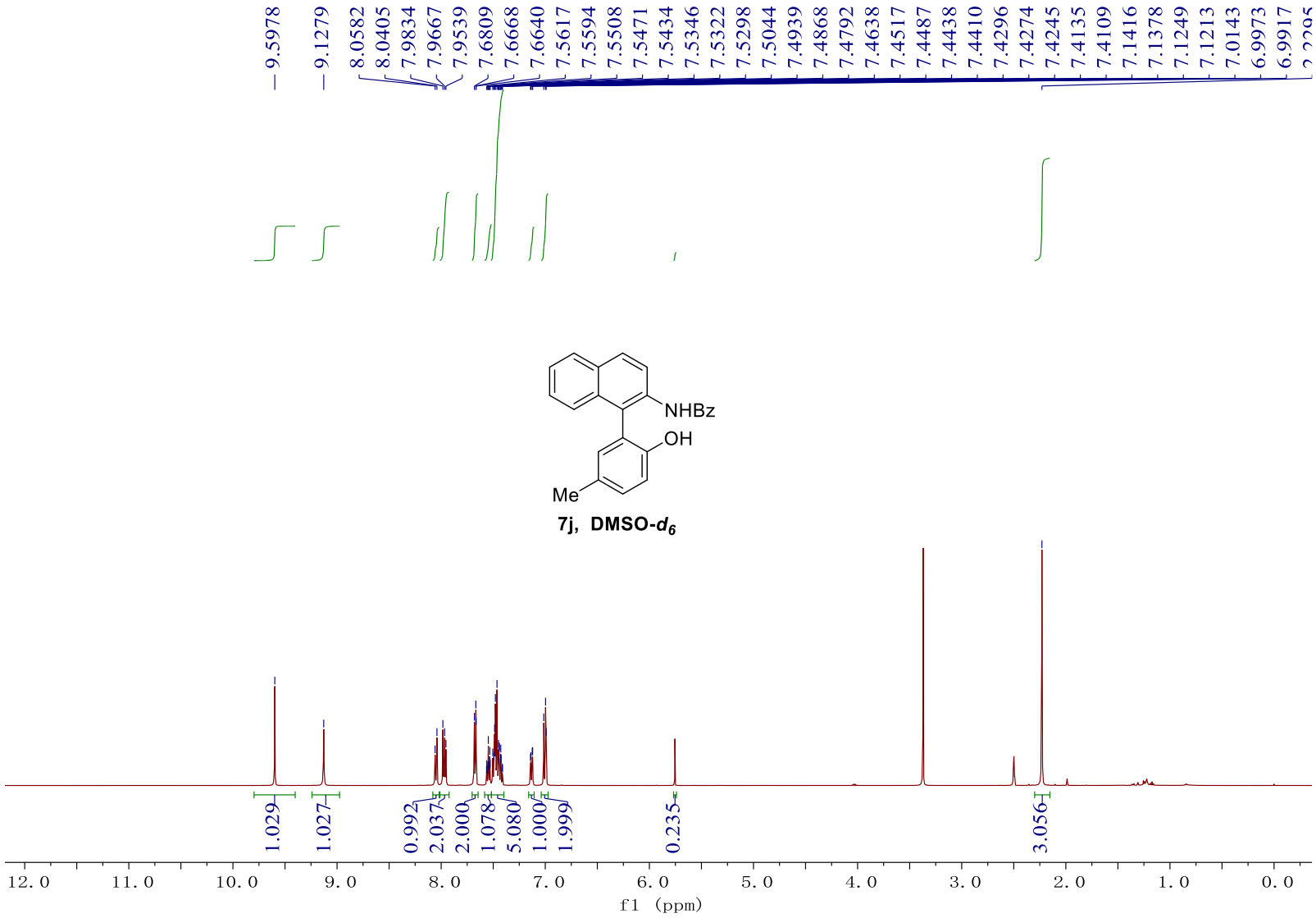
7i, DMSO-*d*$_6$

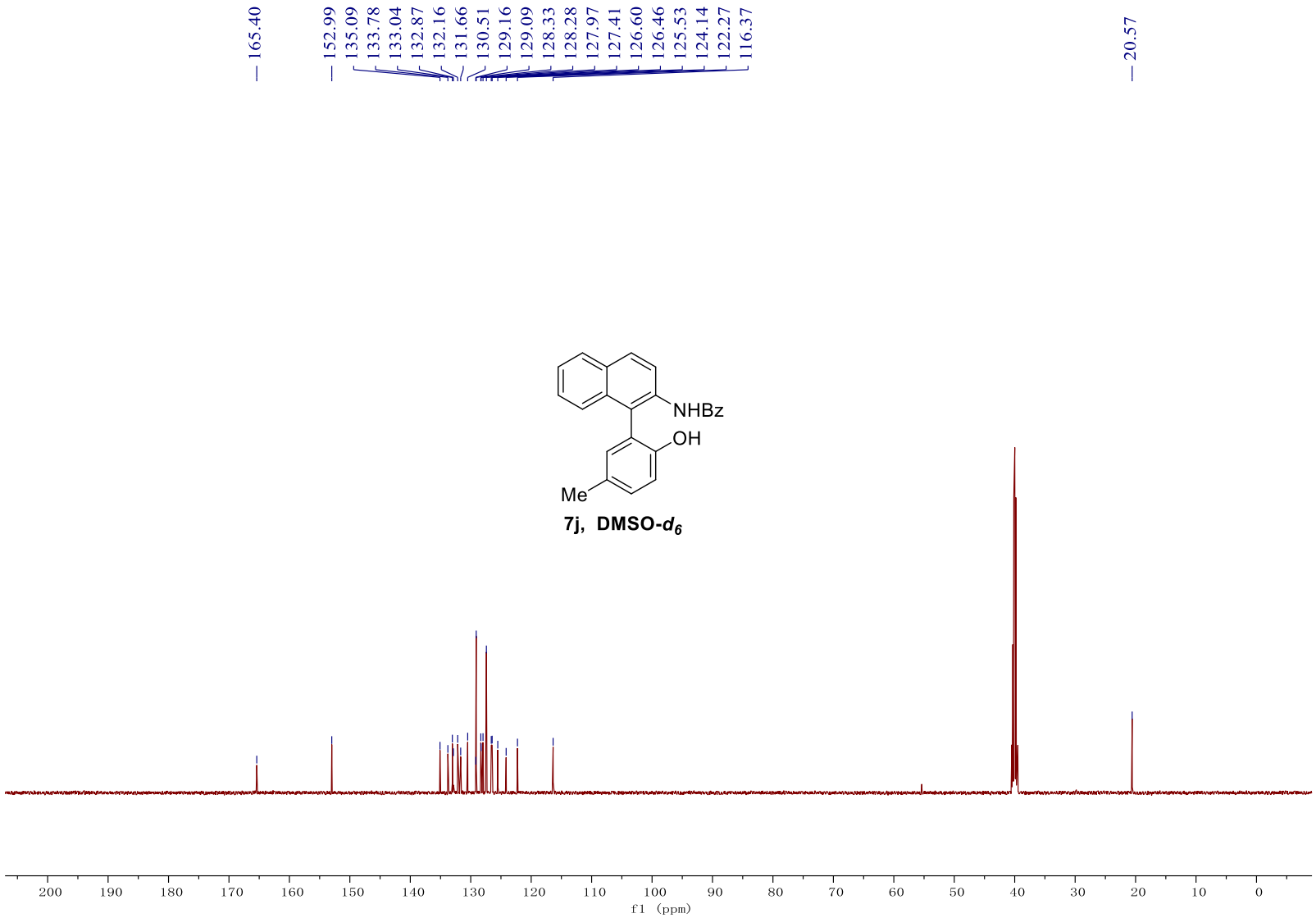

1.063
1.060
2.011
0.999
2.000
2.104
4.051
1.051
1.016
1.016
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

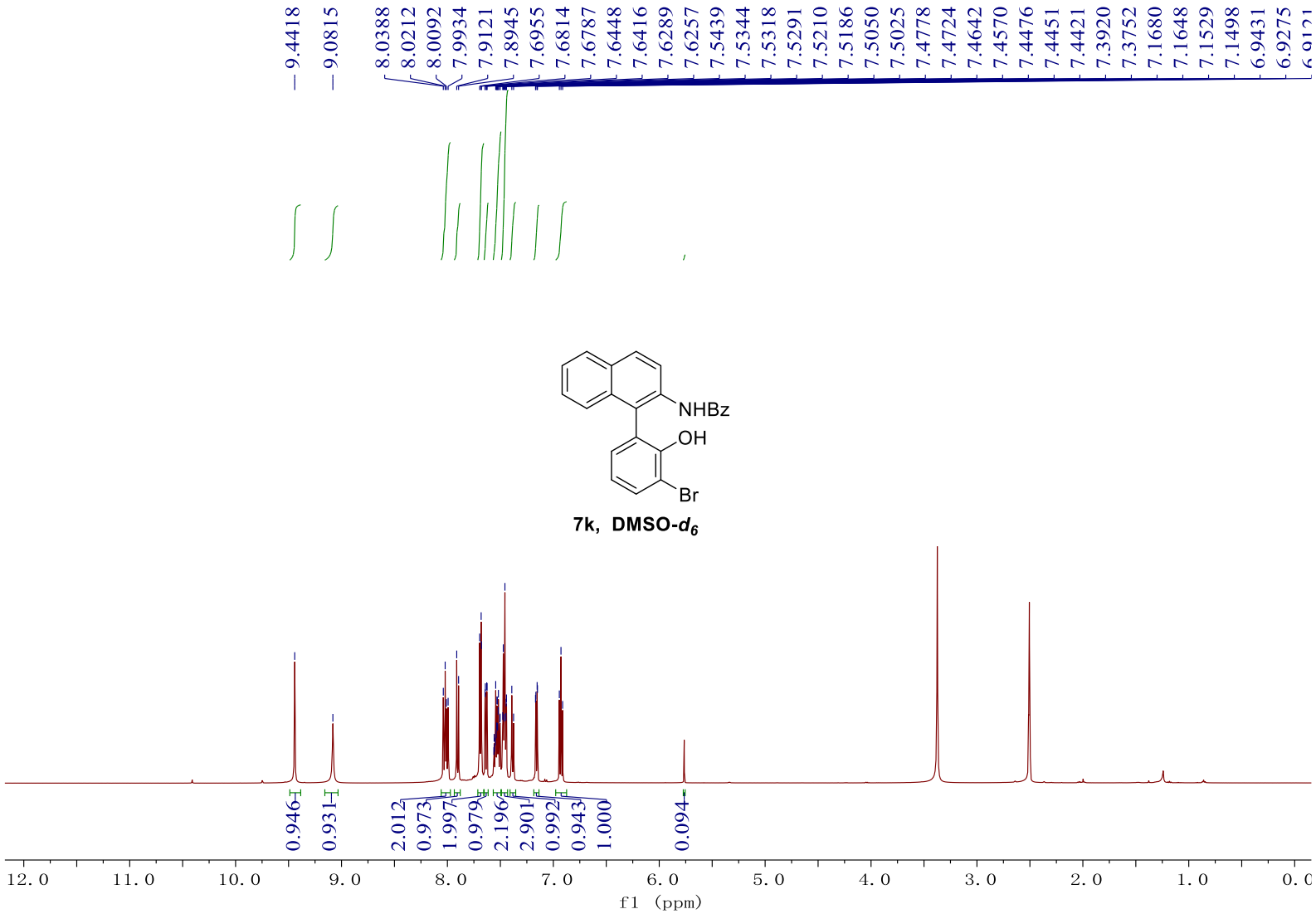

166.10
154.78
140.77
134.97
134.16
132.48
131.96
131.91
129.98
128.78
128.57
128.43
127.71
126.84
126.07
125.99
125.89
125.09
124.36
123.75
122.63
121.72
119.69
117.66
117.10
NHBz
OH
F3CO
7i, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

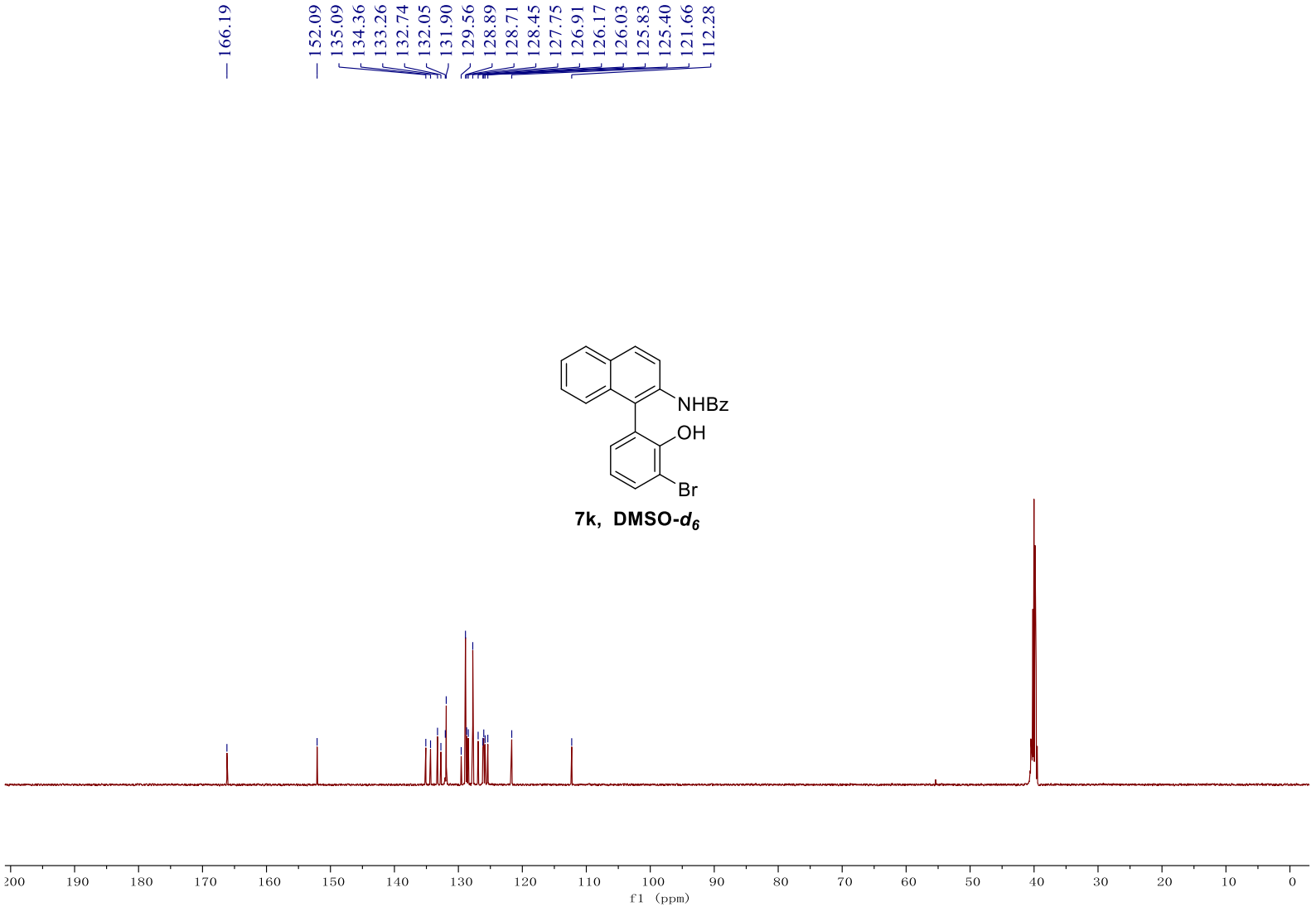

-57.26
NHBz
OH
F3CO
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)

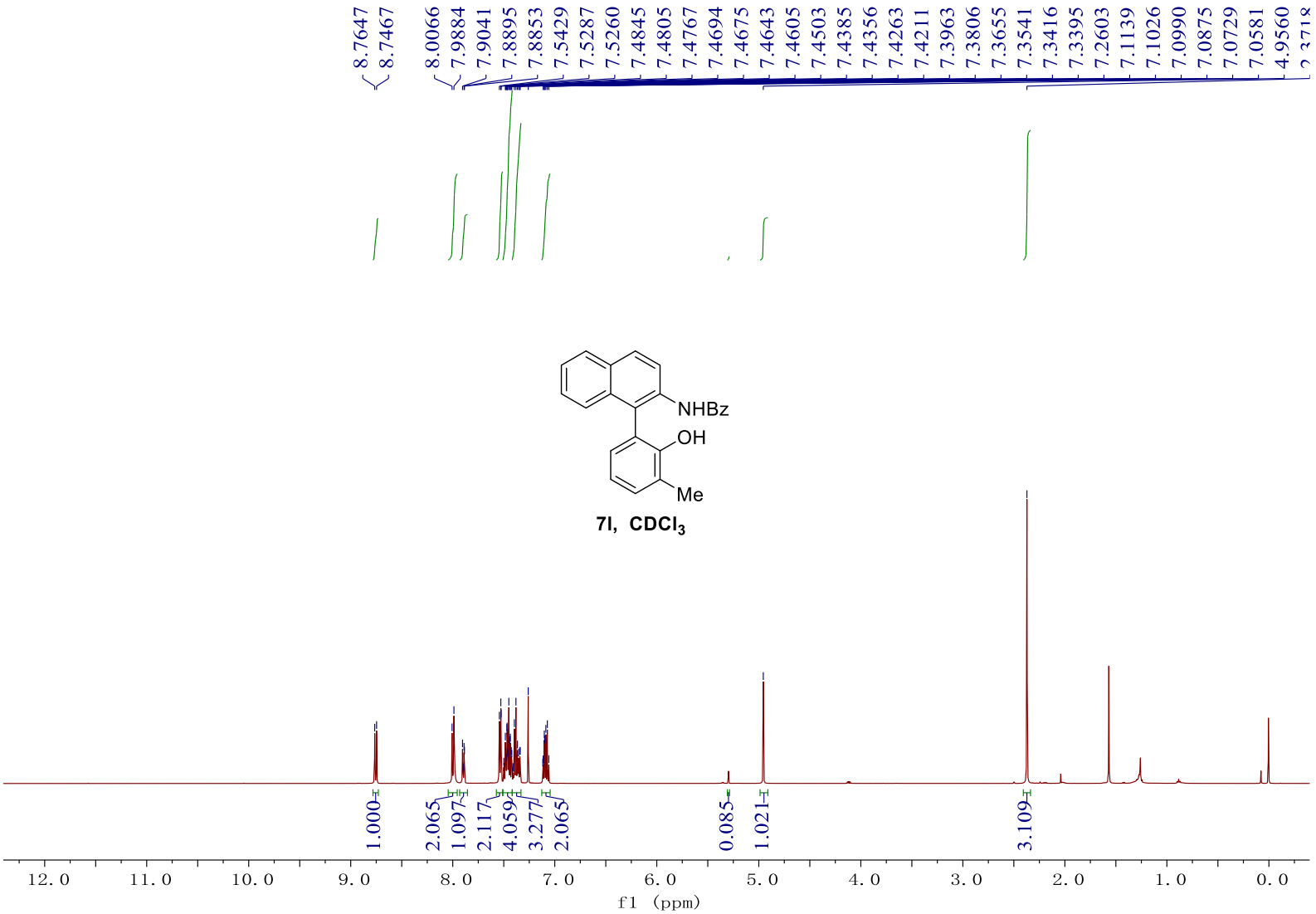
7i, DMSO-*d*$_6$

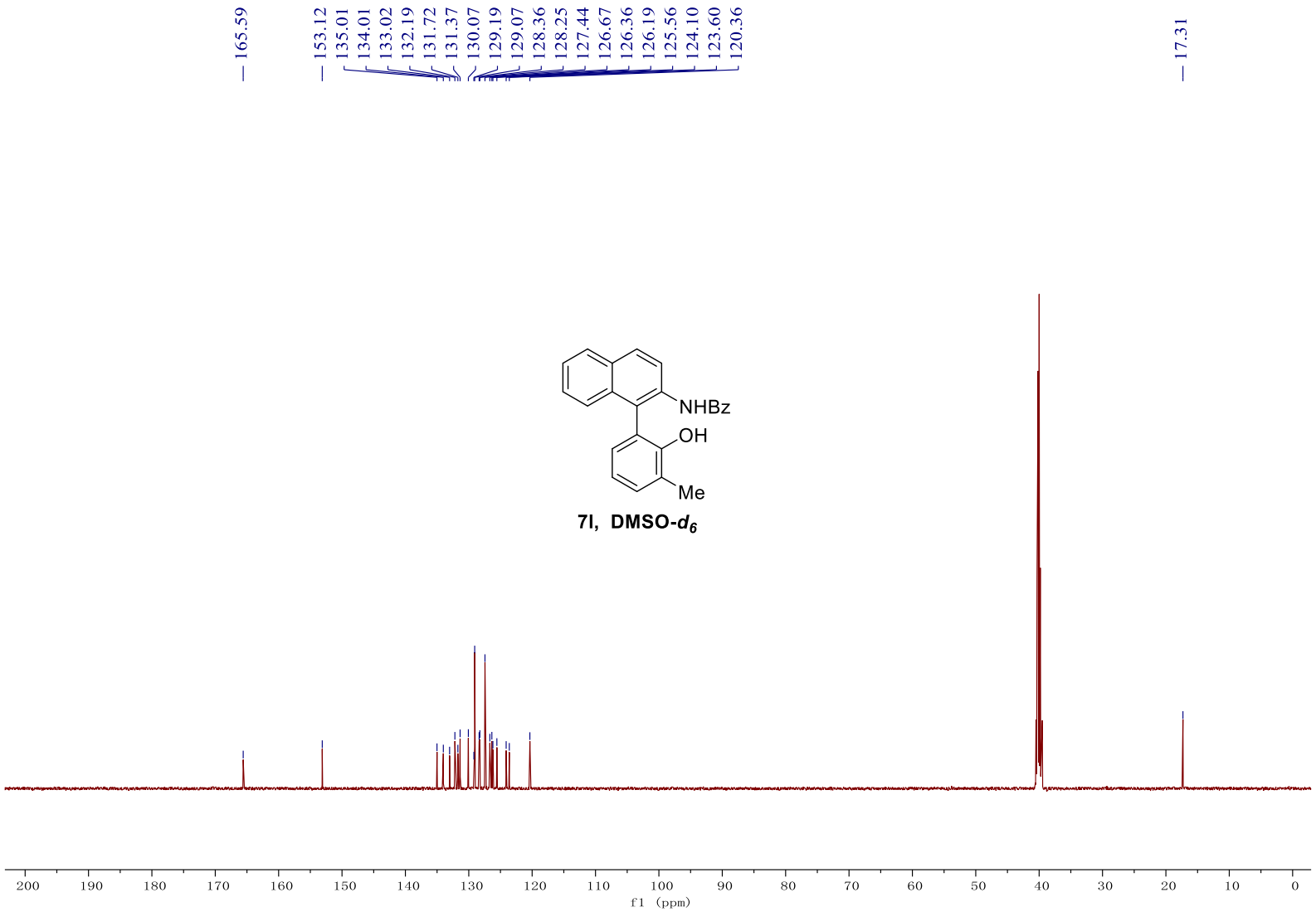

9.5978
9.1279
8.0582
8.0405
7.9834
7.9667
7.9539
7.6809
7.6668
7.6640
7.5617
7.5594
7.5508
7.5471
7.5434
7.5346
7.5322
7.5298
7.5044
7.4939
7.4868
7.4792
7.4638
7.4517
7.4487
7.4438
7.4410
7.4296
7.4274
7.4245
7.4135
7.4109
7.1416
7.1378
7.1249
7.1213
7.0143
6.9973
6.9917
NHBz
OH
Me
7j, DMSO-d6
1.029
1.027
0.992
2.037
2.000
1.078
5.080
1.000
1.999
0.235
3.056
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

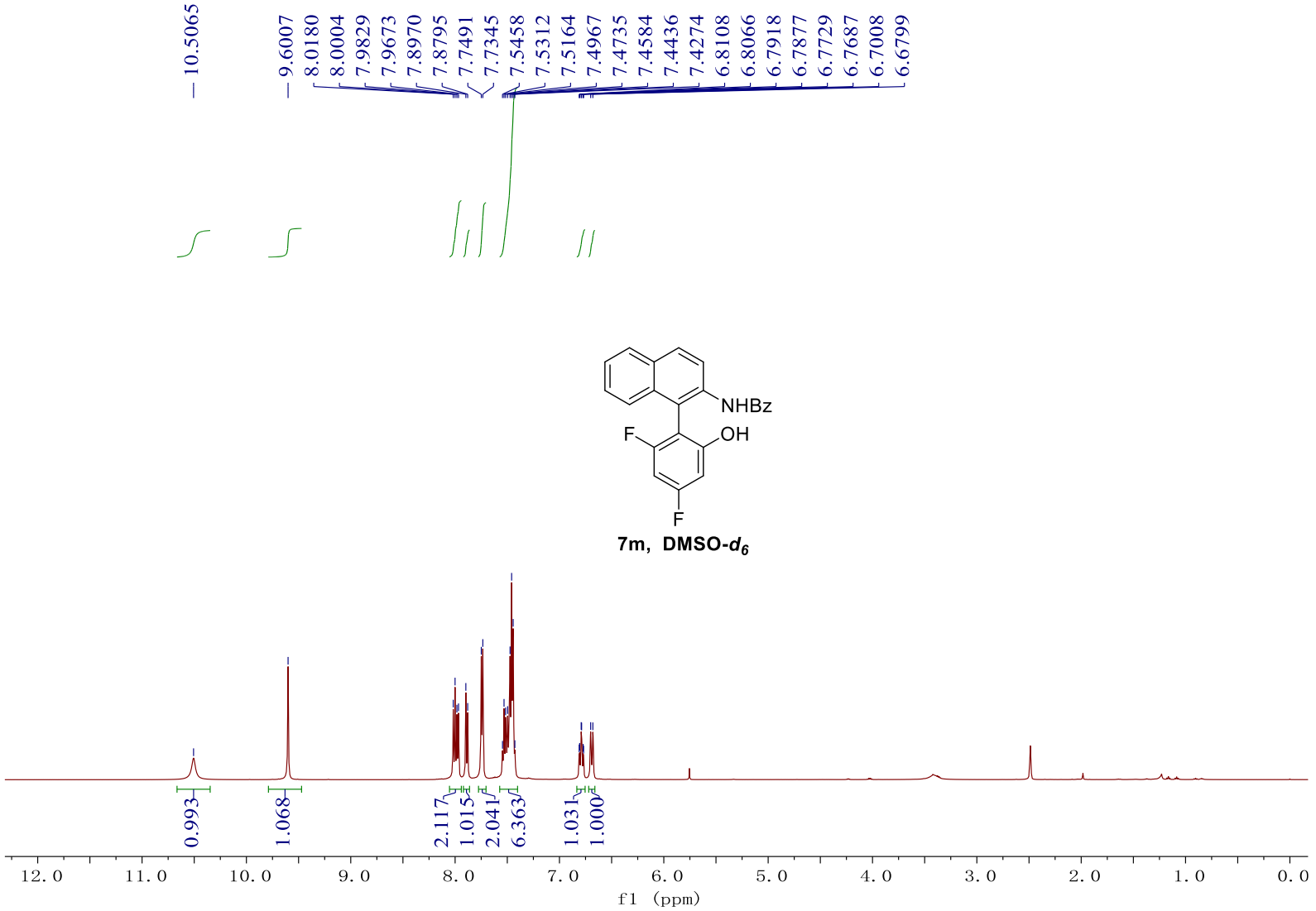

165.40
152.99
135.09
133.78
133.04
132.87
132.16
131.66
130.51
129.16
129.09
128.33
128.28
127.97
127.41
126.60
126.46
125.53
124.14
122.27
116.37
20.57
NHBz
OH
Me
7j, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

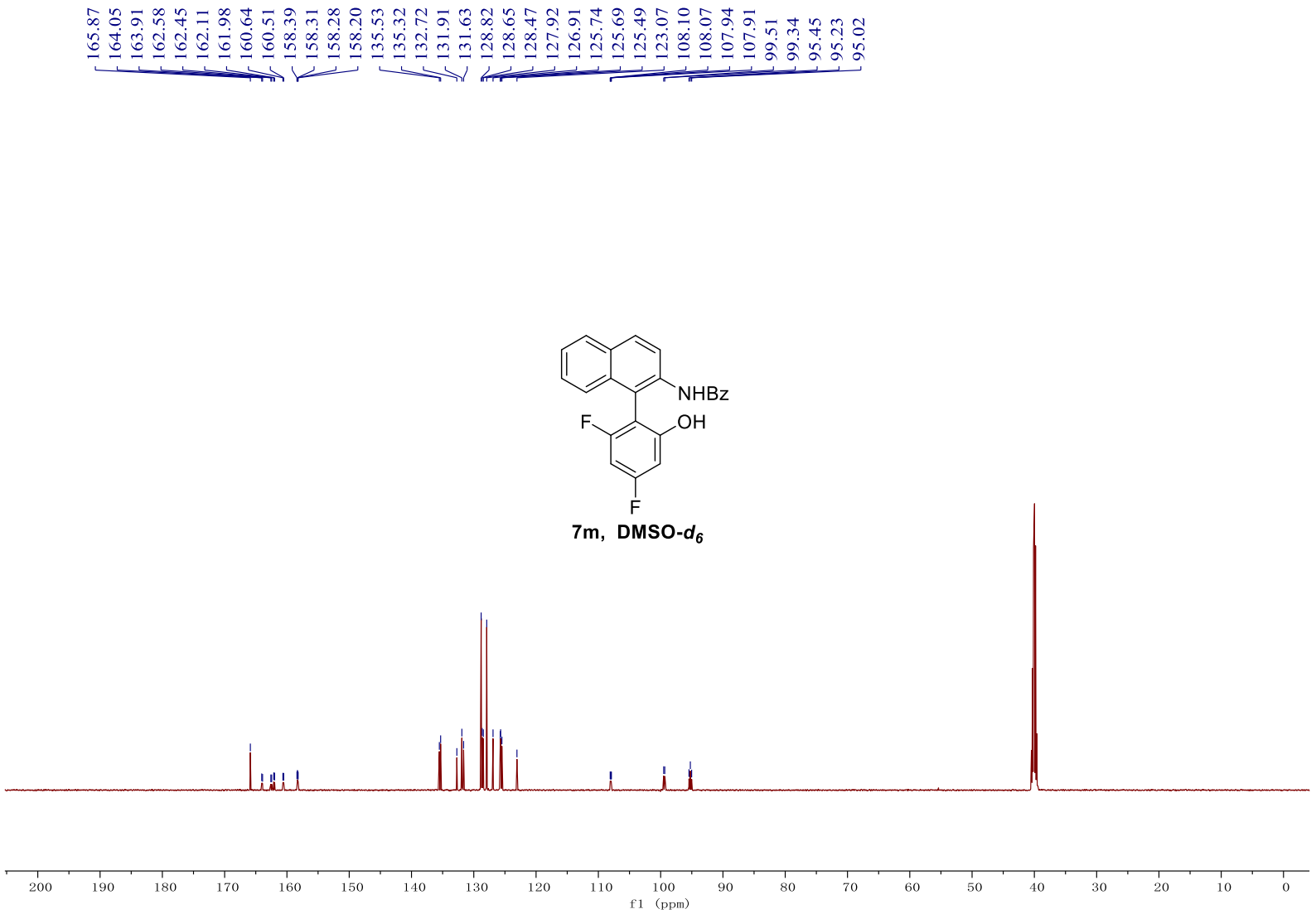

9.4418
9.0815
8.0388
8.0212
8.0092
7.9934
7.9121
7.8945
7.6955
7.6814
7.6787
7.6448
7.6416
7.6289
7.6257
7.5439
7.5344
7.5318
7.5291
7.5210
7.5186
7.5050
7.5025
7.4778
7.4724
7.4642
7.4570
7.4476
7.4451
7.4421
7.3920
7.3752
7.1680
7.1648
7.1529
7.1498
6.9431
6.9275
NHBz
OH
Br
7k, DMSO-d6
0.946
0.931
2.012
0.973
1.997
0.979
2.196
2.901
0.992
0.943
1.000
0.094
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
f1 (ppm)


166.19
152.09
135.09
134.36
133.26
132.74
132.05
131.90
129.56
128.89
128.71
128.45
127.75
126.91
126.17
126.03
125.83
125.40
121.66
112.28
NHBz
OH
Br
7k, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

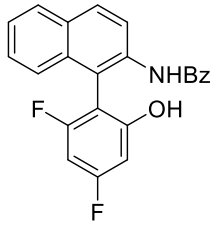

8.7647
8.7467
8.0066
7.9884
7.9041
7.8895
7.8853
7.5429
7.5287
7.5260
7.4845
7.4805
7.4767
7.4694
7.4675
7.4643
7.4605
7.4503
7.4385
7.4356
7.4263
7.4211
7.3963
7.3806
7.3655
7.3541
7.3416
7.3395
7.2603
7.1139
7.1026
7.0990
7.0875
7.0729
7.0581
4.9560
NHBz
OH
Me
7l, CDCl3
1.000
2.065
1.097
2.117
4.059
3.277
2.065
0.085
1.021
3.109
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


165.59
153.12
135.01
134.01
133.02
132.19
131.72
131.37
130.07
129.19
129.07
128.36
128.25
127.44
126.67
126.36
126.19
125.56
124.10
123.60
120.36
17.31
NHBz
OH
Me
7l, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

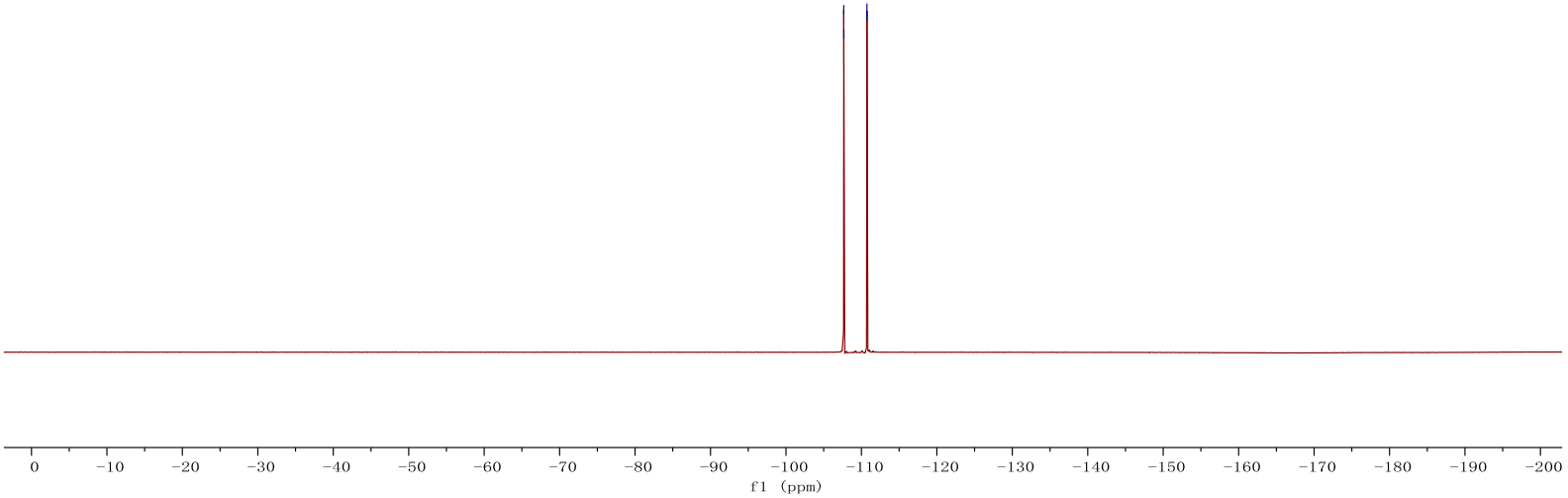

10.5065
9.6007
8.0180
8.0004
7.9829
7.9673
7.8970
7.8795
7.7491
7.7345
7.5458
7.5312
7.5164
7.4967
7.4735
7.4584
7.4436
7.4274
6.8108
6.8066
6.7918
6.7877
6.7729
6.7687
6.7008
6.6799
NHBz
F
OH
F
7m, DMSO-d6
0.993
1.068
2.117
1.015
2.041
6.363
1.031
1.000
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

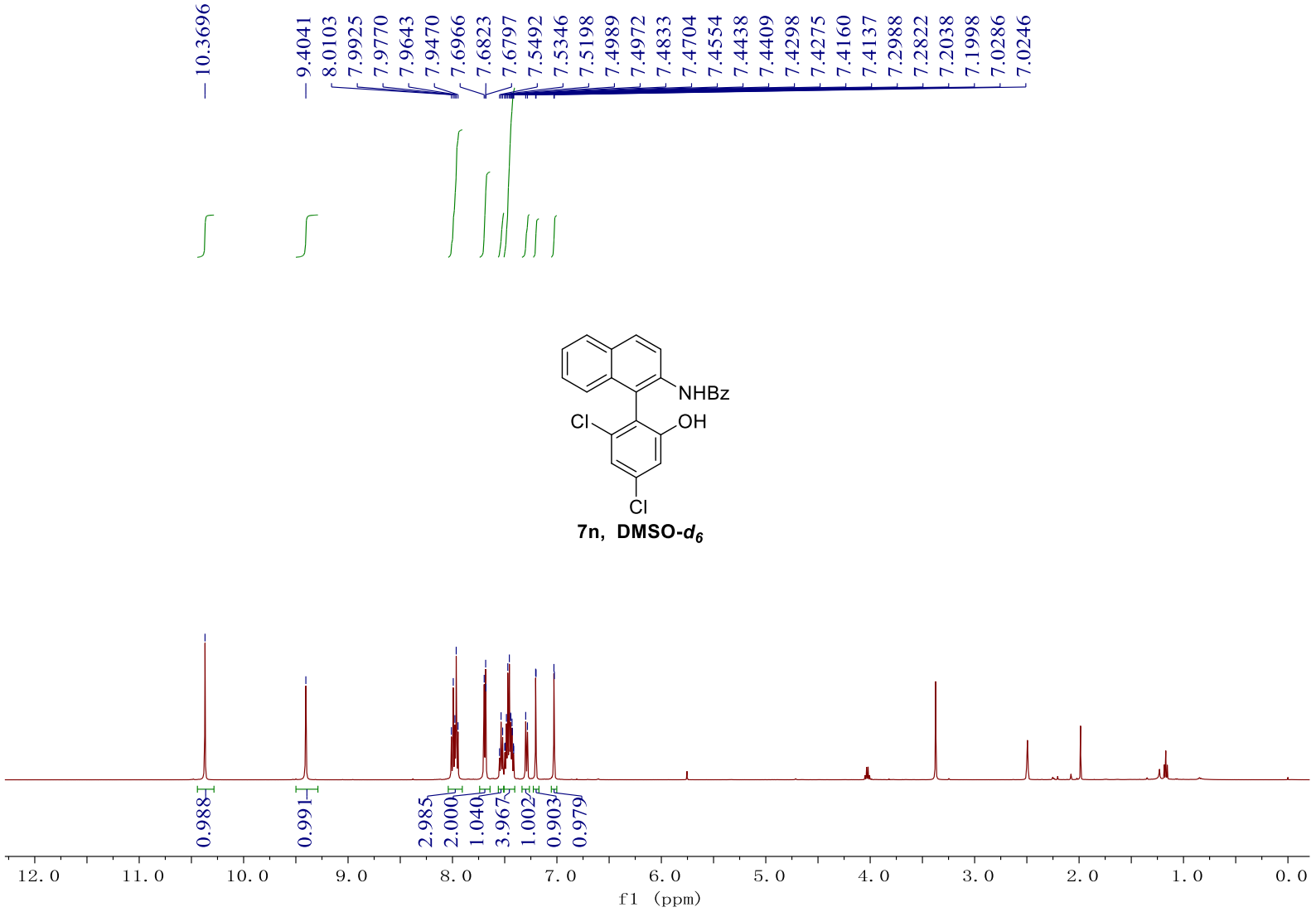

165.87
164.05
163.91
162.58
162.45
162.11
161.98
160.64
160.51
158.39
158.31
158.28
158.20
135.53
135.32
132.72
131.91
131.63
128.82
128.65
128.47
127.92
126.91
125.74
125.69
125.49
123.07
108.10
108.07
107.94
107.91
99.51
99.34
95.45
95.23
95.02
NHBz
F
OH
F
7m, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

-107.66
-107.68
-110.72
-110.73

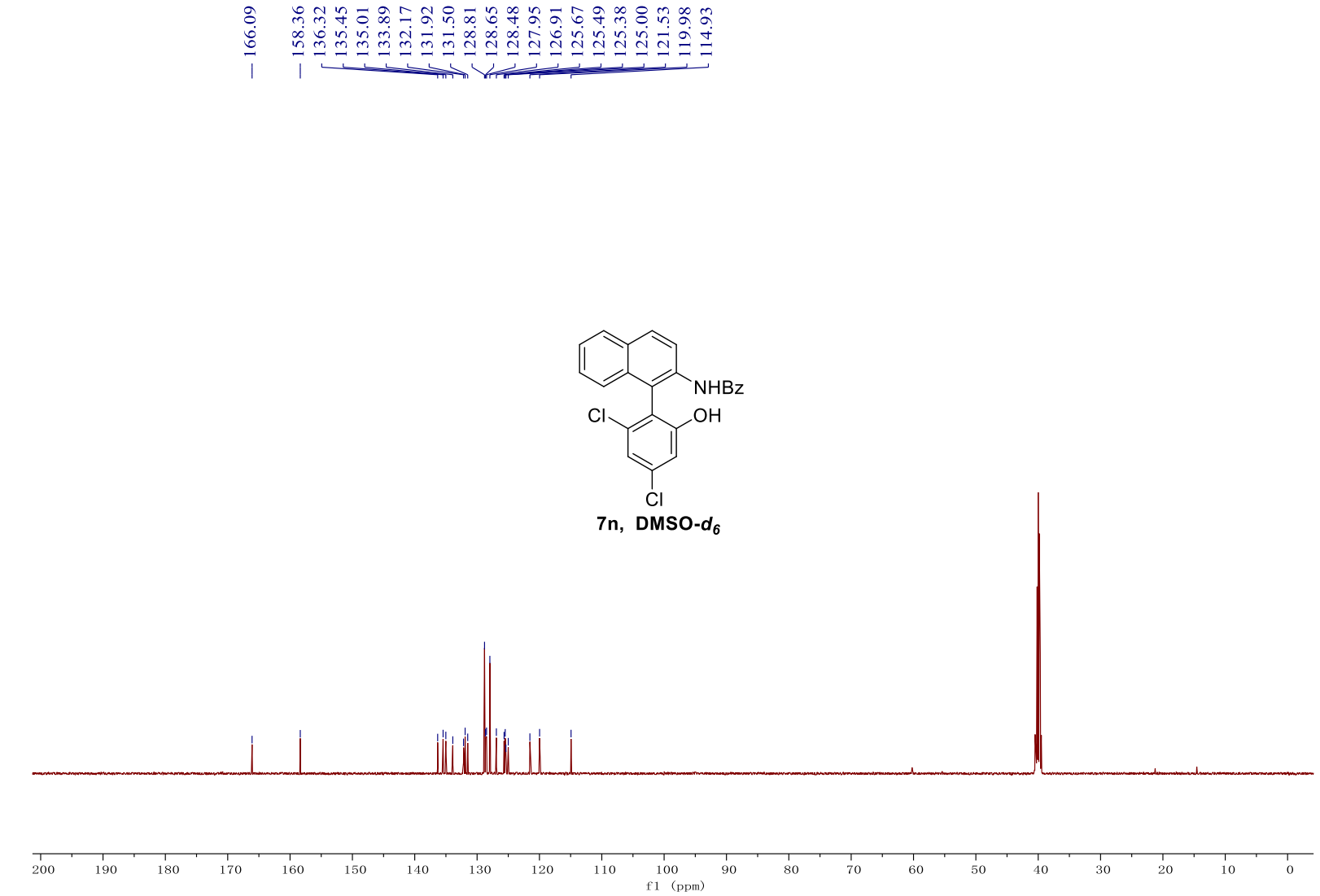


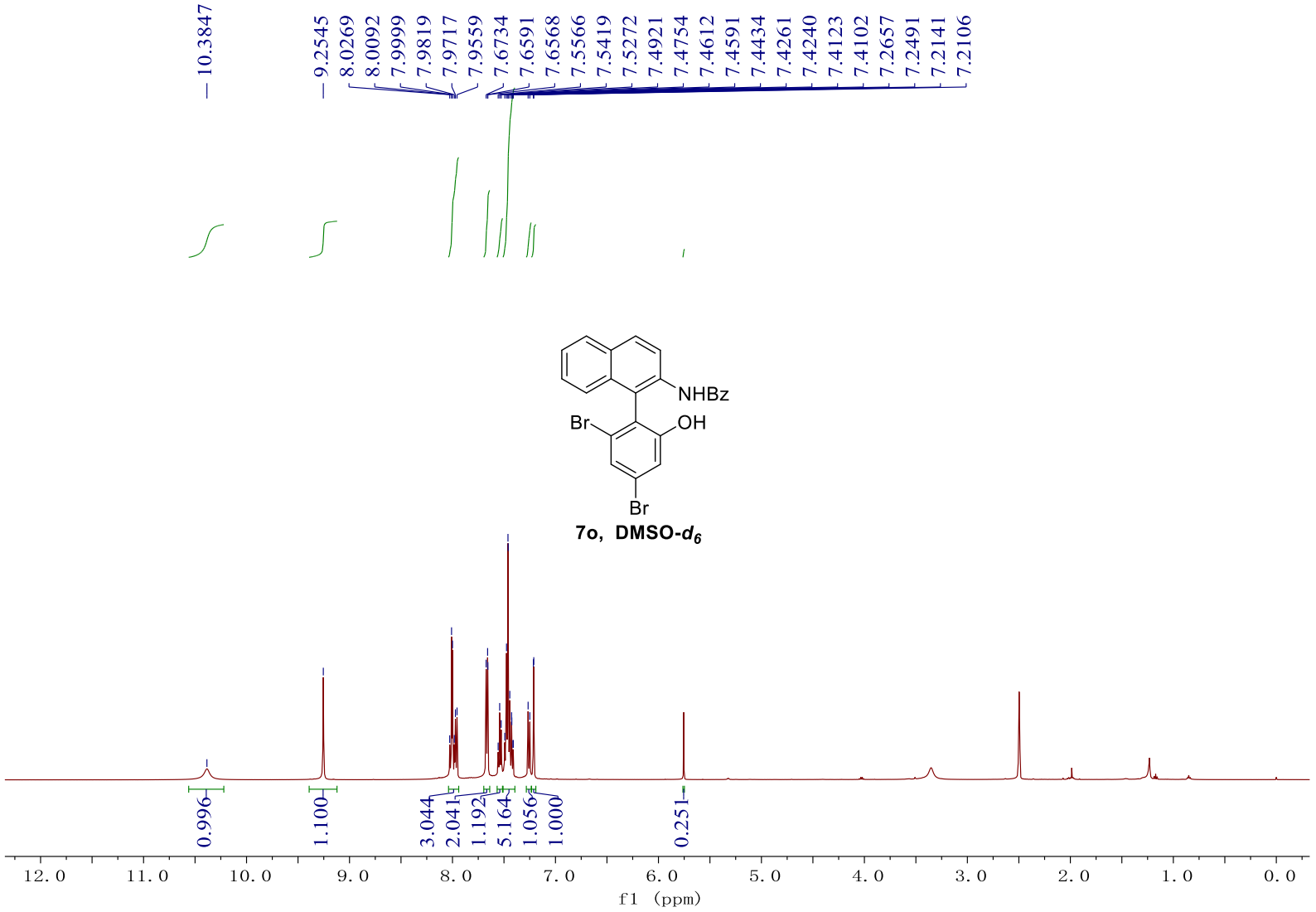
7m, DMSO-*d*$_6$

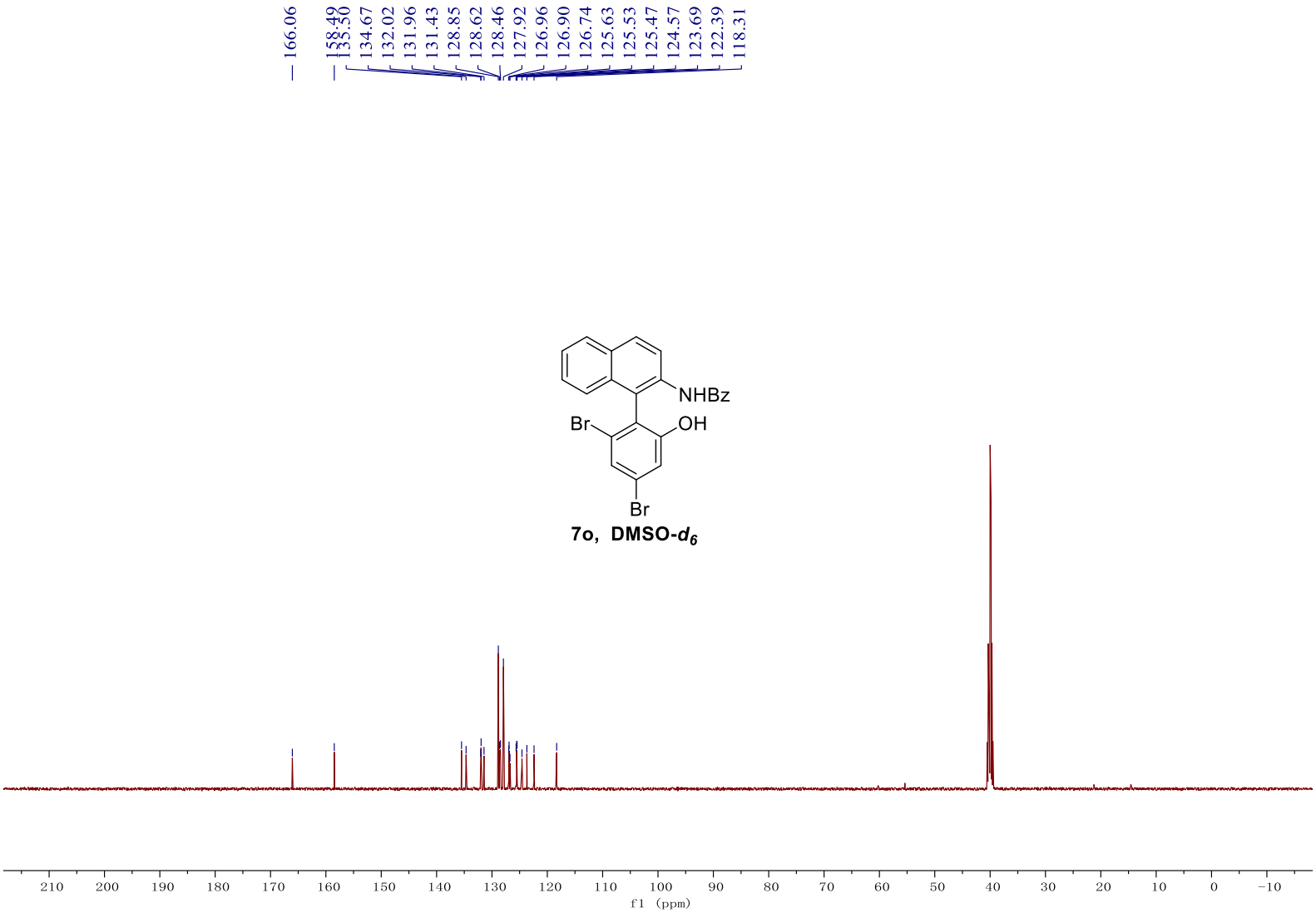


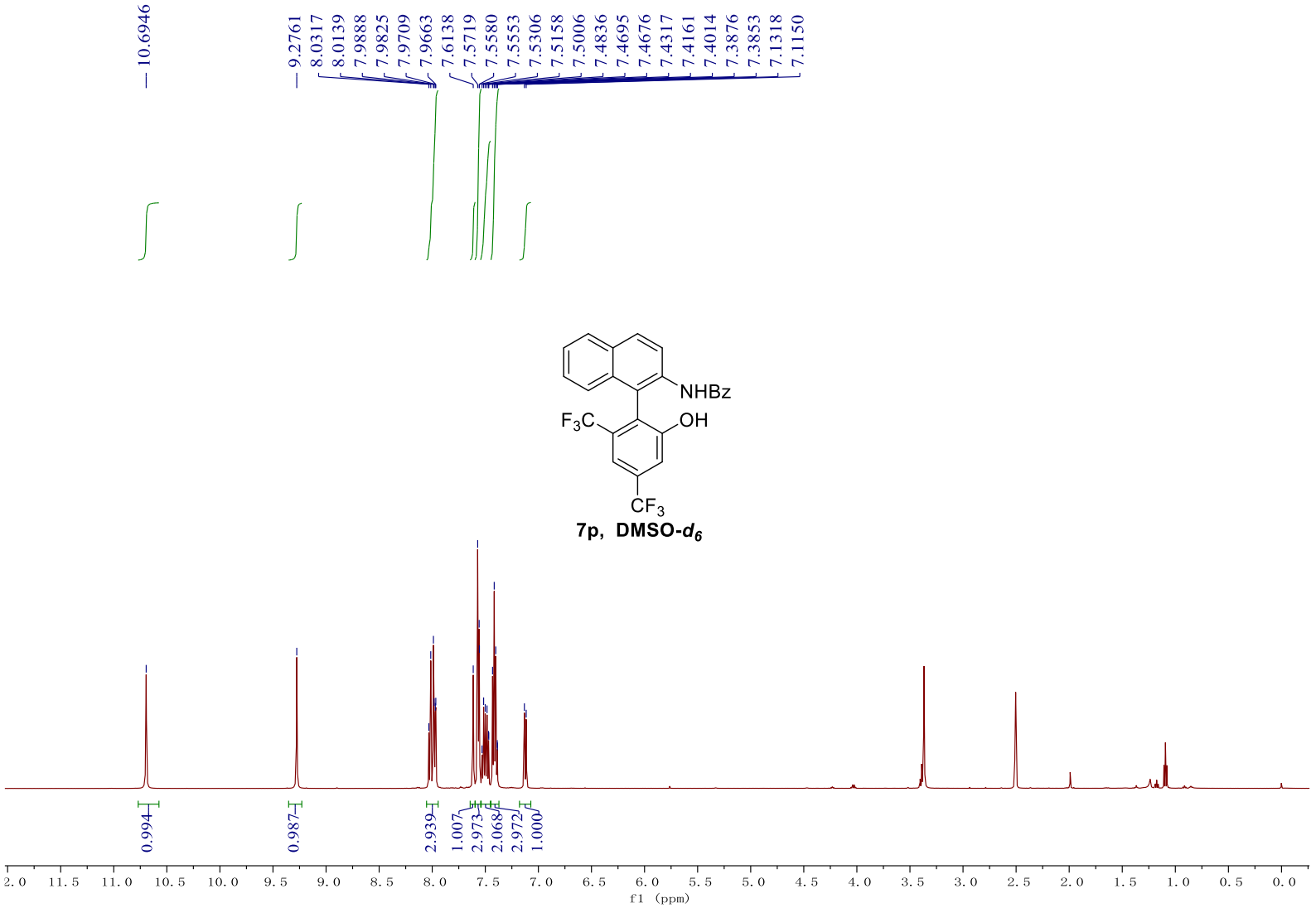

10.3696
9.4041
8.0103
7.9925
7.9770
7.9643
7.9470
7.6966
7.6823
7.6797
7.5492
7.5346
7.5198
7.4989
7.4972
7.4833
7.4704
7.4554
7.4438
7.4409
7.4298
7.4275
7.4160
7.4137
7.2988
7.2822
7.2038
7.1998
7.0286
7.0246
NHBz
Cl
OH
Cl
0.988
0.991
2.985
2.000
1.040
3.967
1.002
0.903
0.979
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

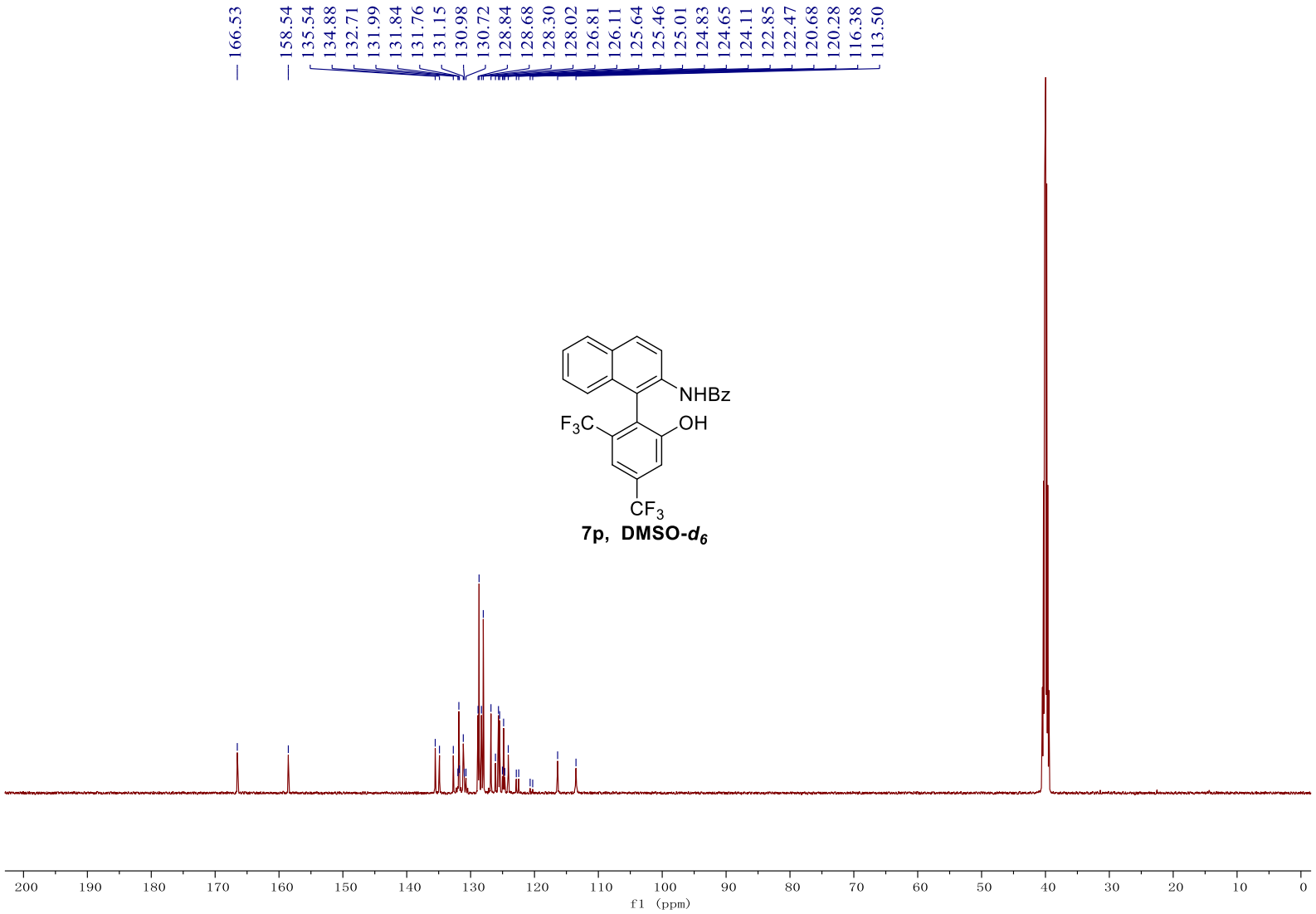
7n, DMSO-d_6

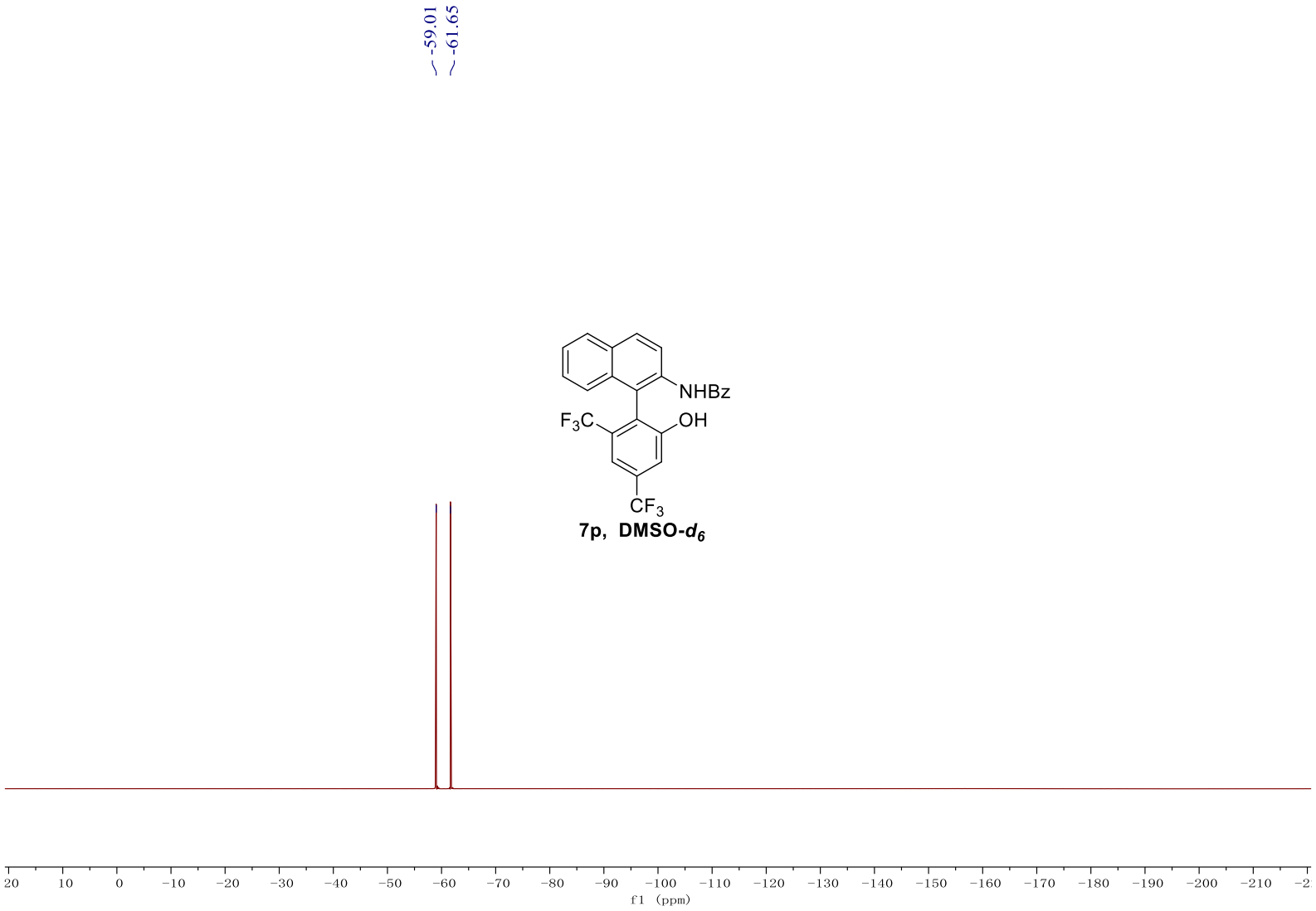

166.09
158.36
136.32
135.45
135.01
133.89
132.17
131.92
131.50
128.81
128.65
128.48
127.95
126.91
125.67
125.49
125.38
125.00
121.53
119.98
114.93
NHBz
Cl
OH
Cl
7n, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

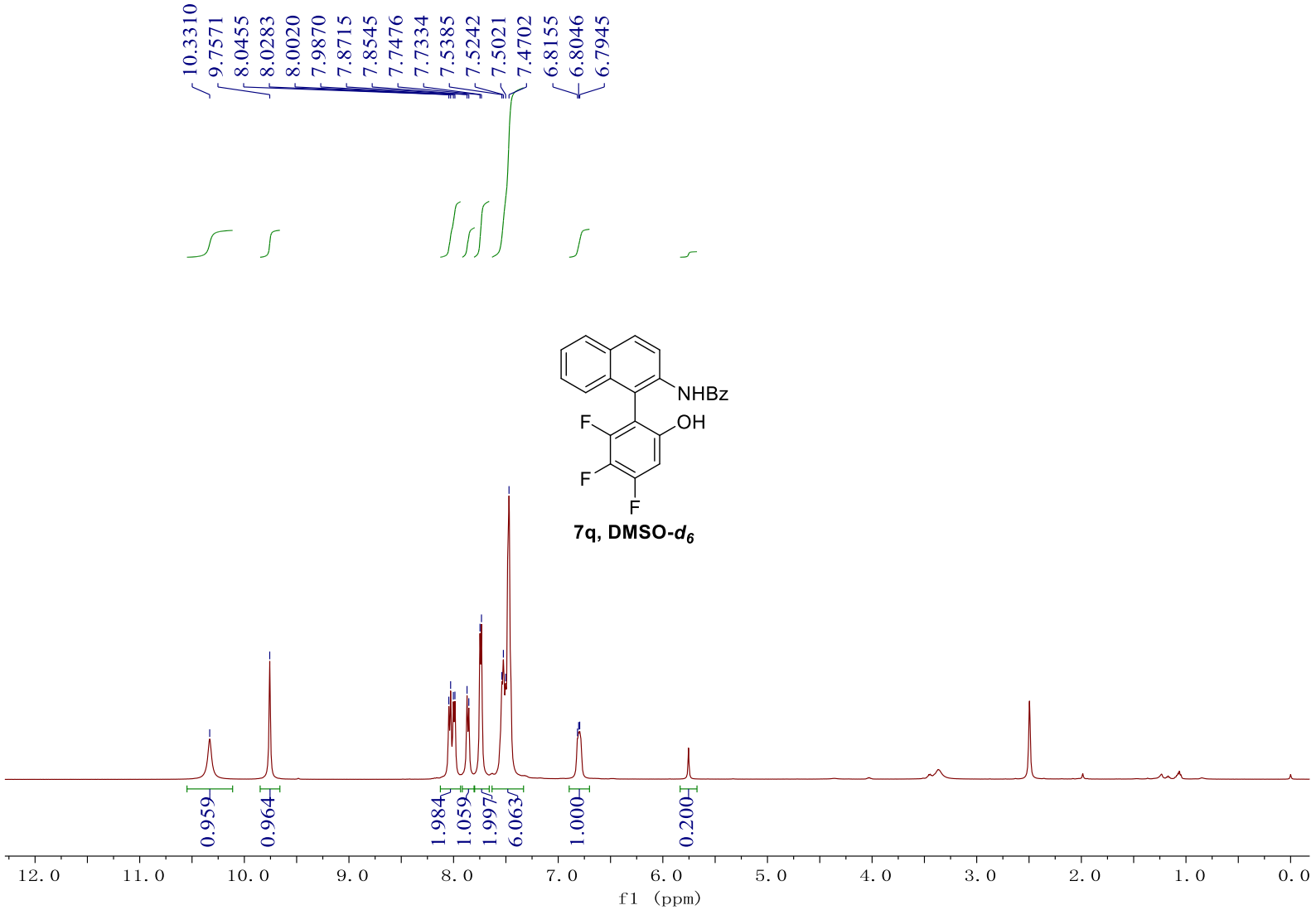

10.3847
9.2545
8.0269
8.0092
7.9999
7.9819
7.9717
7.9559
7.6734
7.6591
7.6568
7.5566
7.5419
7.5272
7.4921
7.4754
7.4612
7.4591
7.4434
7.4261
7.4240
7.4123
7.4102
7.2657
7.2491
7.2141
7.2106
NHBz
Br
OH
Br
7o, DMSO-d6
0.996
1.100
3.044
2.041
1.192
5.164
1.056
1.000
0.251
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

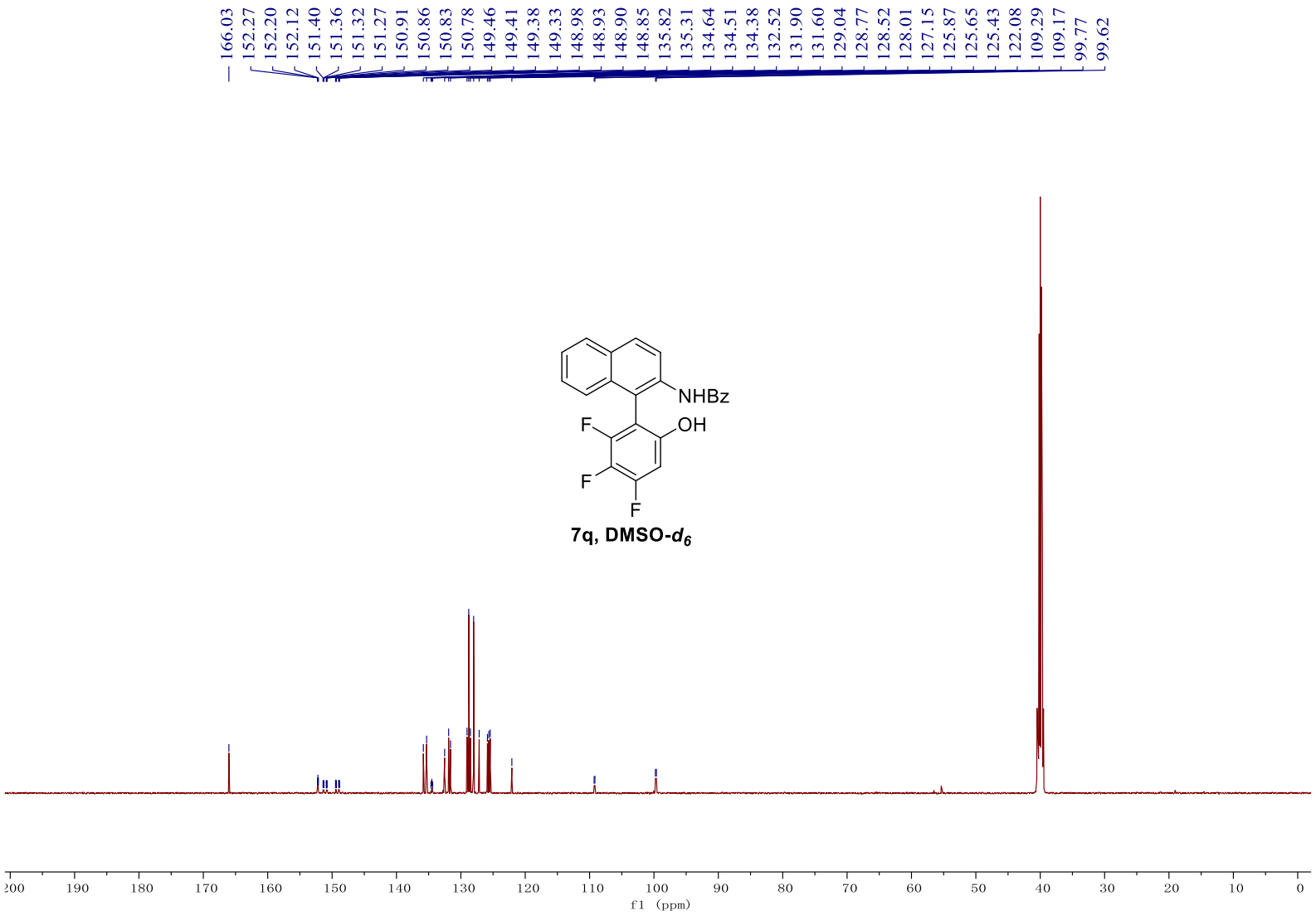

166.06
158.49
135.50
134.67
132.02
131.96
131.43
128.85
128.62
128.46
127.92
126.96
126.90
126.74
125.63
125.53
125.47
124.57
123.69
122.39
118.31
NHBz
Br
OH
Br
7o, DMSO-d6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

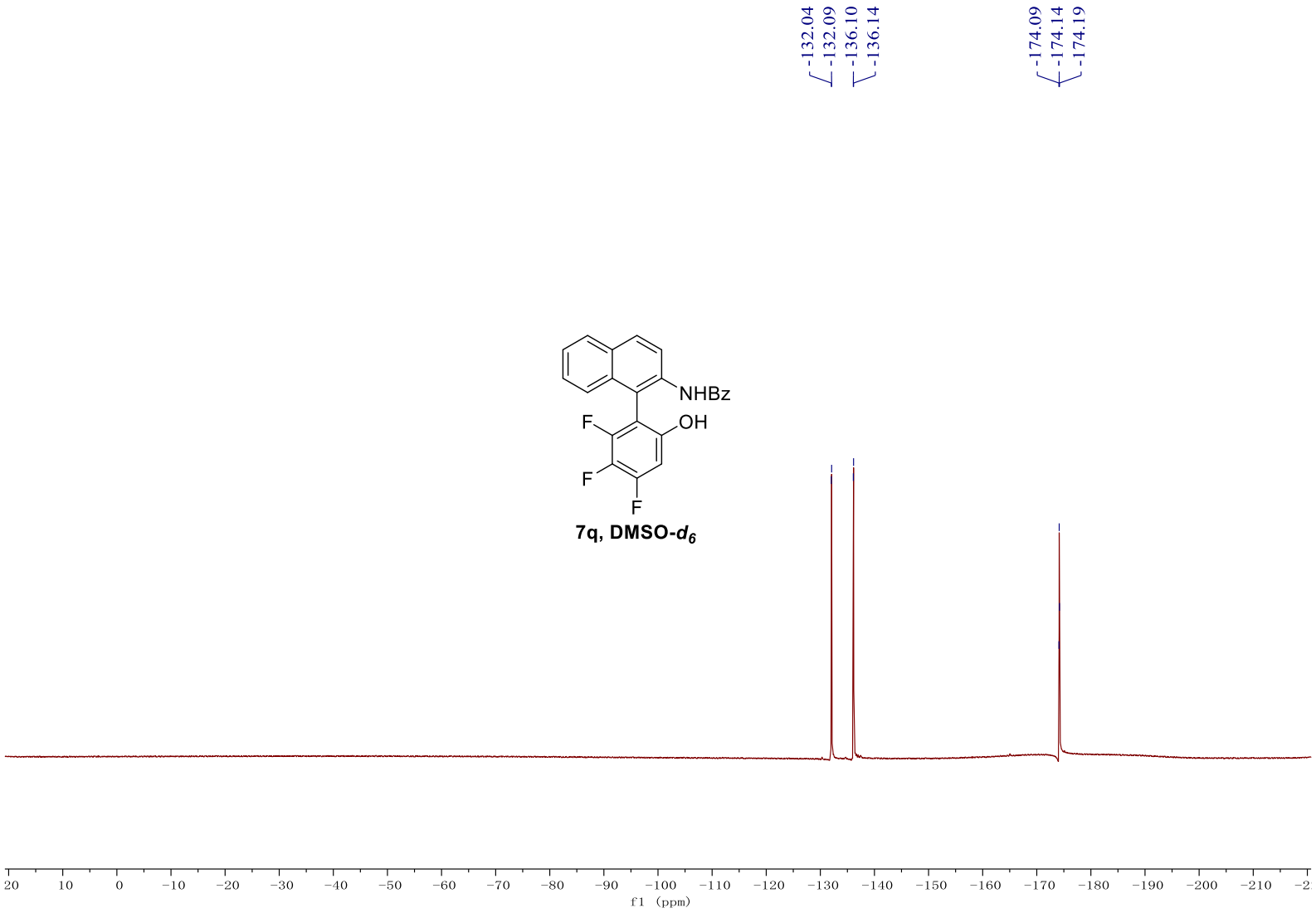

10.6946
9.2761
8.0317
8.0139
7.9888
7.9825
7.9709
7.9663
7.6138
7.5719
7.5580
7.5553
7.5306
7.5158
7.5006
7.4836
7.4695
7.4676
7.4317
7.4161
7.4014
7.3876
7.3853
7.1318
7.1150
NHBz
F3C
OH
CF3
7p, DMSO-d6
0.994
0.987
2.939
1.007
2.973
2.068
2.972
1.000
f1 (ppm)

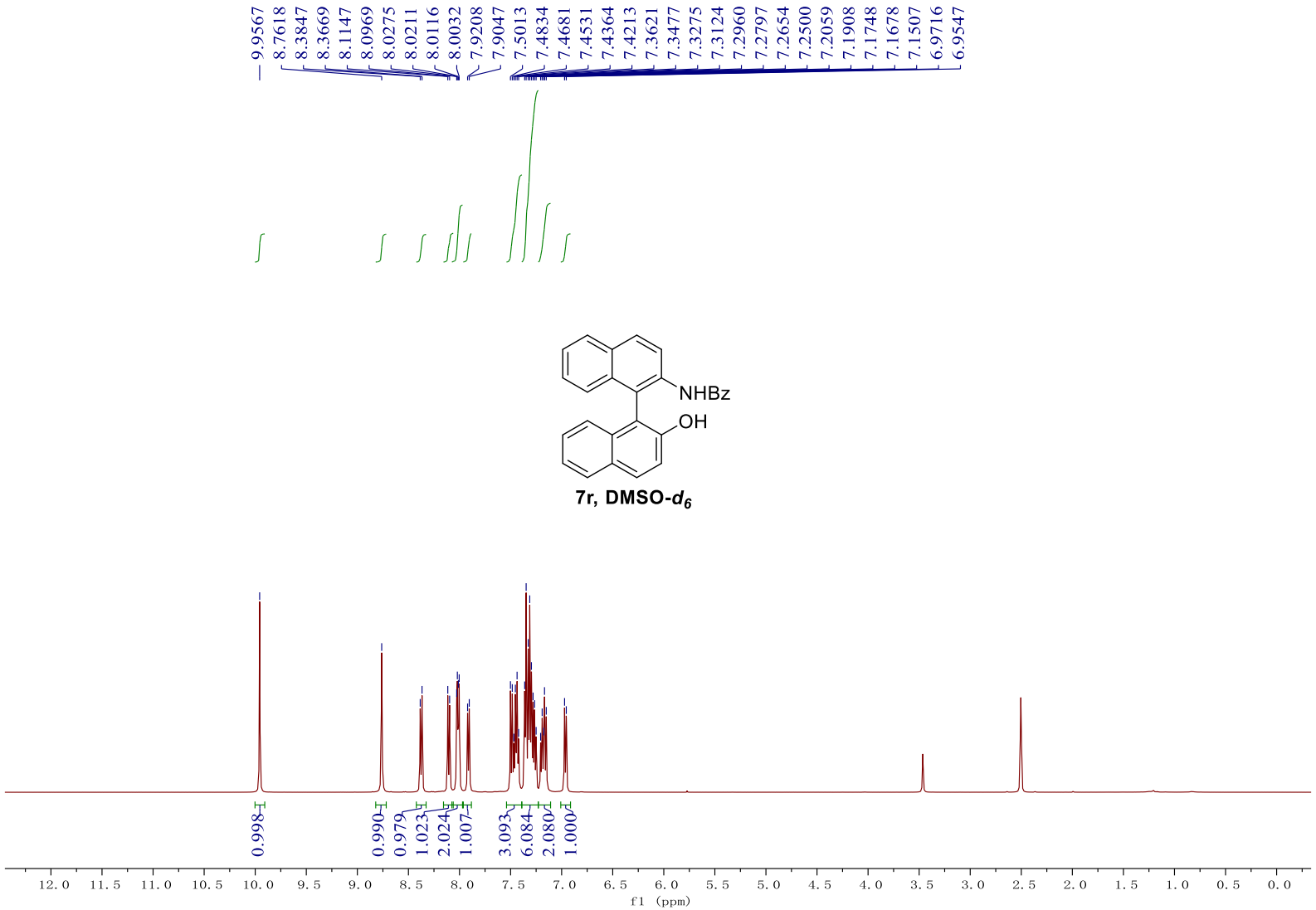

166.53
158.54
135.54
134.88
132.71
131.99
131.84
131.76
131.15
130.98
130.72
128.84
128.68
128.30
128.02
126.81
126.11
125.64
125.46
125.01
124.83
124.65
124.11
122.85
122.47
120.68
120.28
116.38
113.50
NHBz
F3C
OH
CF3
7p, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-59.01
-61.65
NHBz
F3C
OH
CF3
7p, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

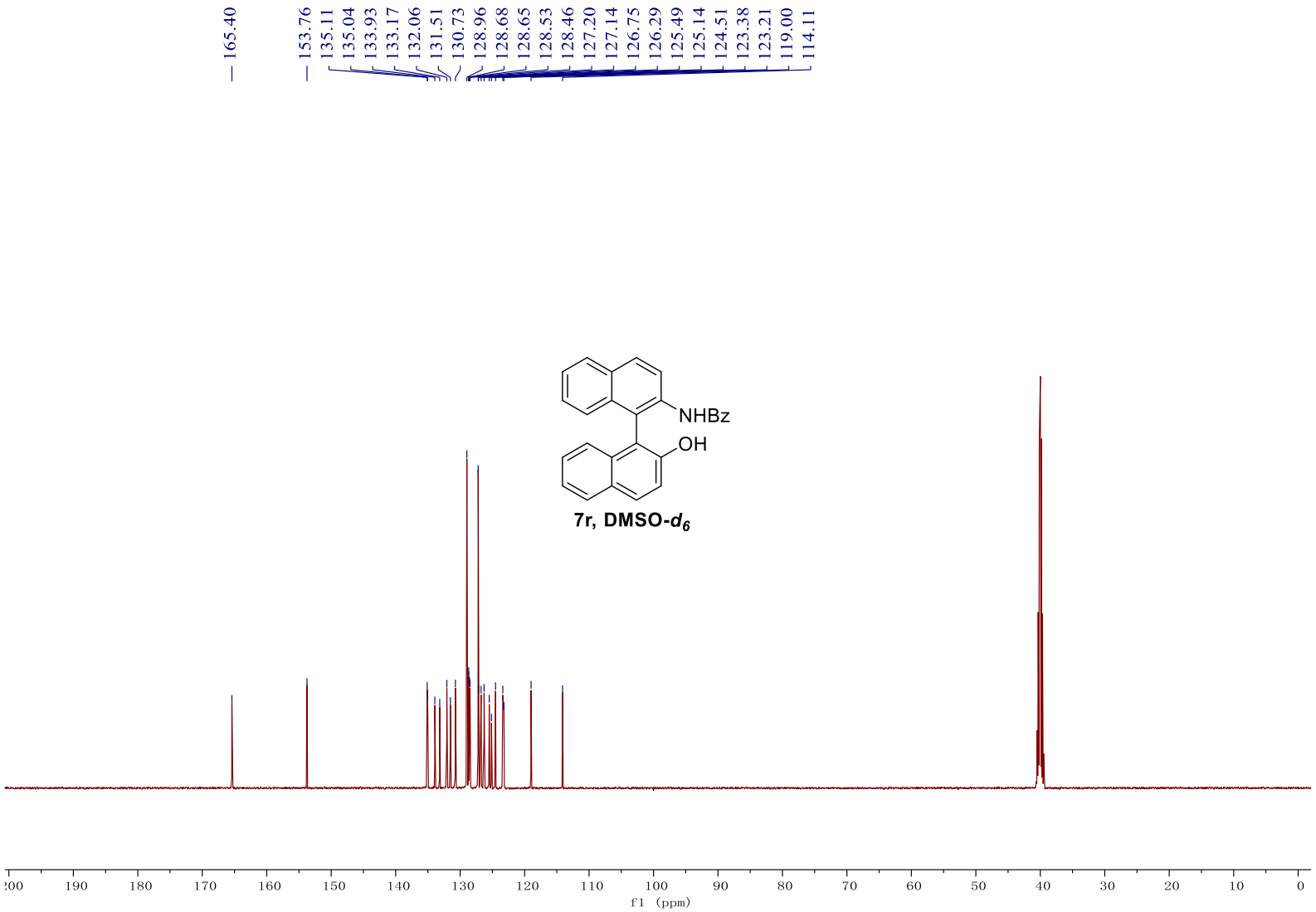

10.3310
9.7571
8.0455
8.0283
8.0020
7.9870
7.8715
7.8545
7.7476
7.7334
7.5385
7.5242
7.5021
7.4702
6.8155
6.8046
6.7945
NHBz
OH
F
F
F
7q, DMSO-d6
0.959
0.964
1.984
1.059
1.997
6.063
1.000
0.200
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

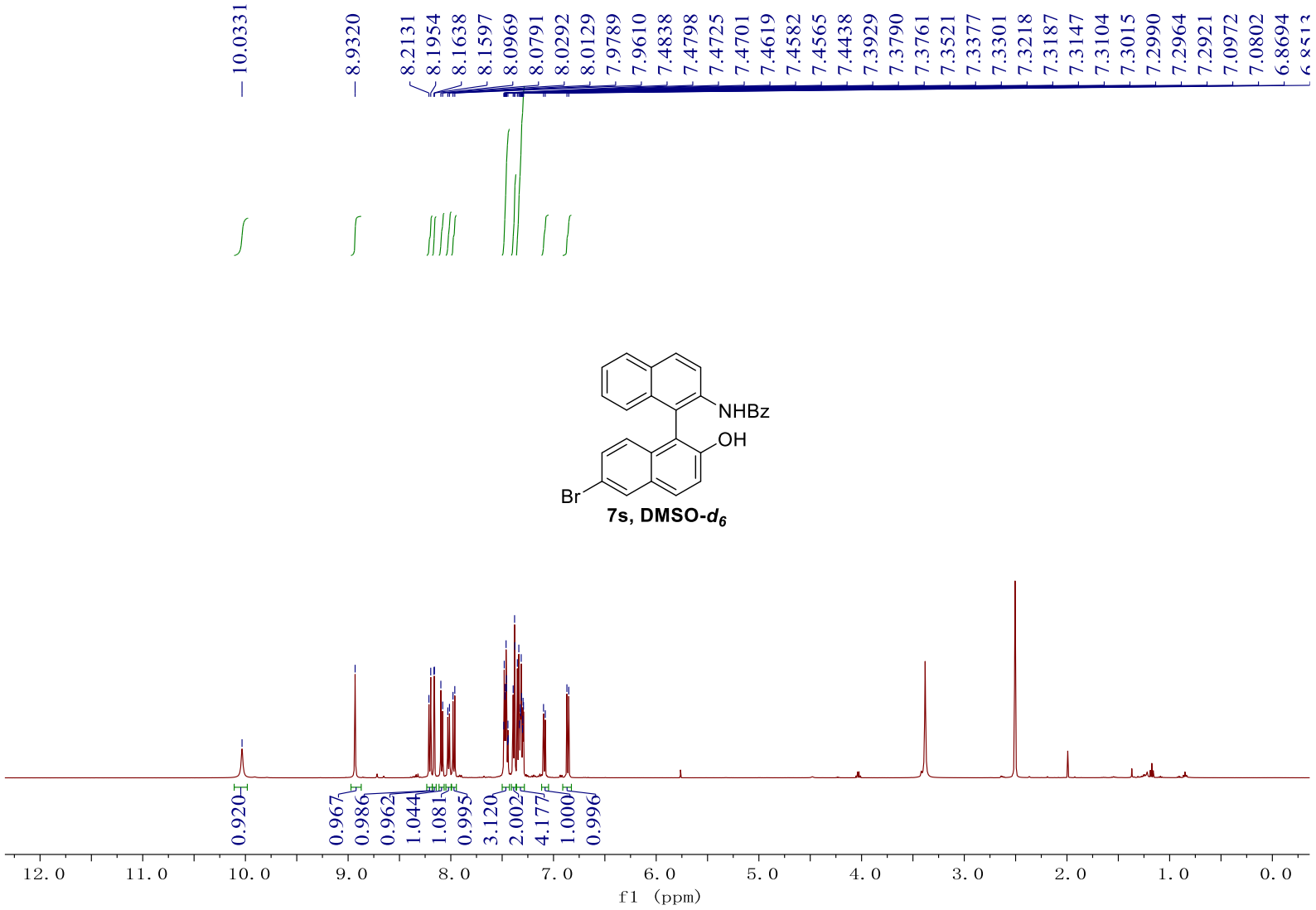

166.03
152.27
152.20
152.12
151.40
151.36
151.32
151.27
150.91
150.86
150.83
150.78
149.46
149.41
149.38
149.33
148.98
148.93
148.90
148.85
135.82
135.31
134.64
134.51
134.38
132.52
131.90
131.60
129.04
128.77
128.52
128.01
127.15
125.87
125.65
125.43
122.08
109.29
109.17
99.77
99.62
NHBz
OH
F
F
F
7q, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

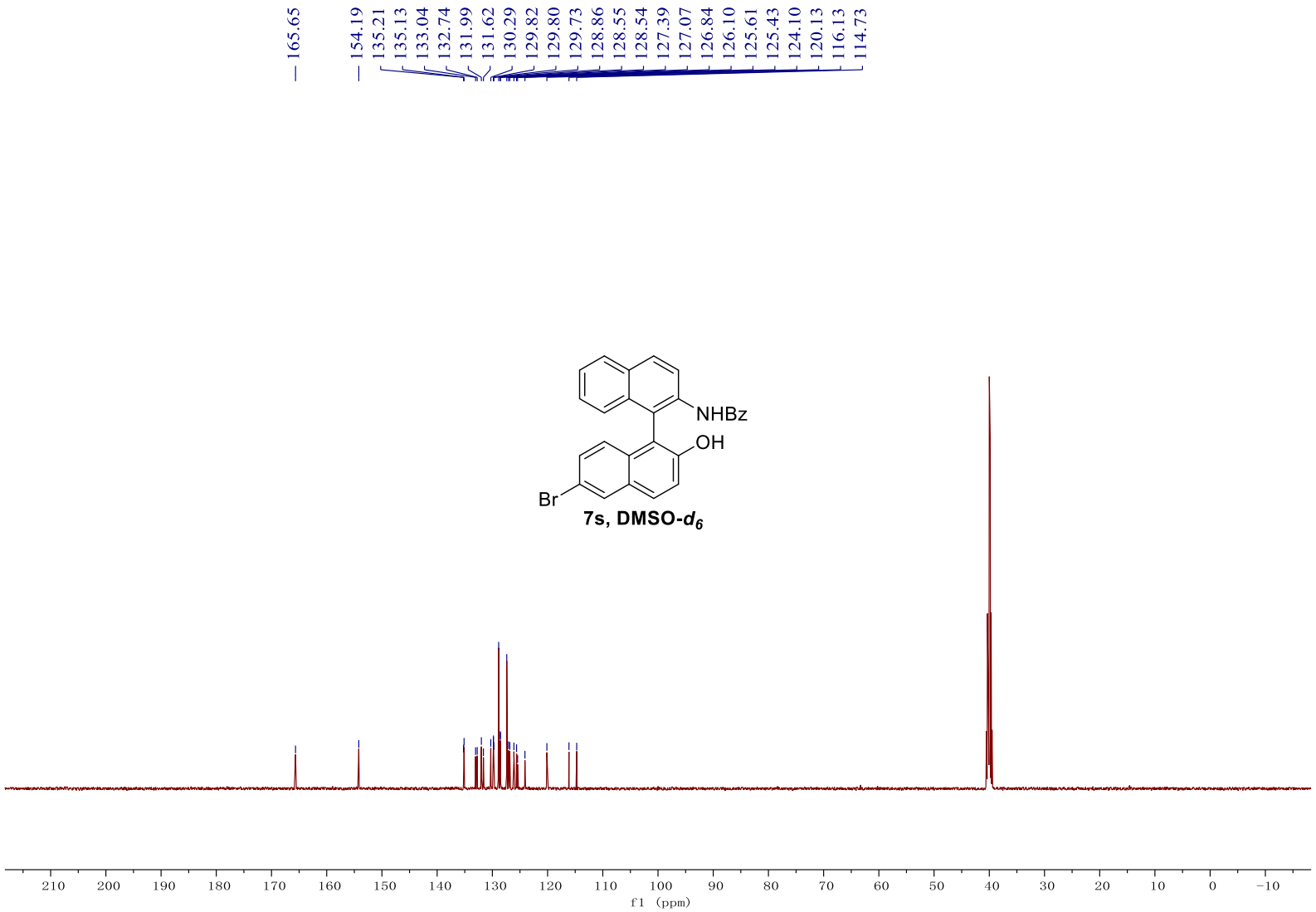

-132.04
-132.09
-136.10
-136.14
-174.09
-174.14
-174.19
NHBz
OH
F
F
F
7q, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

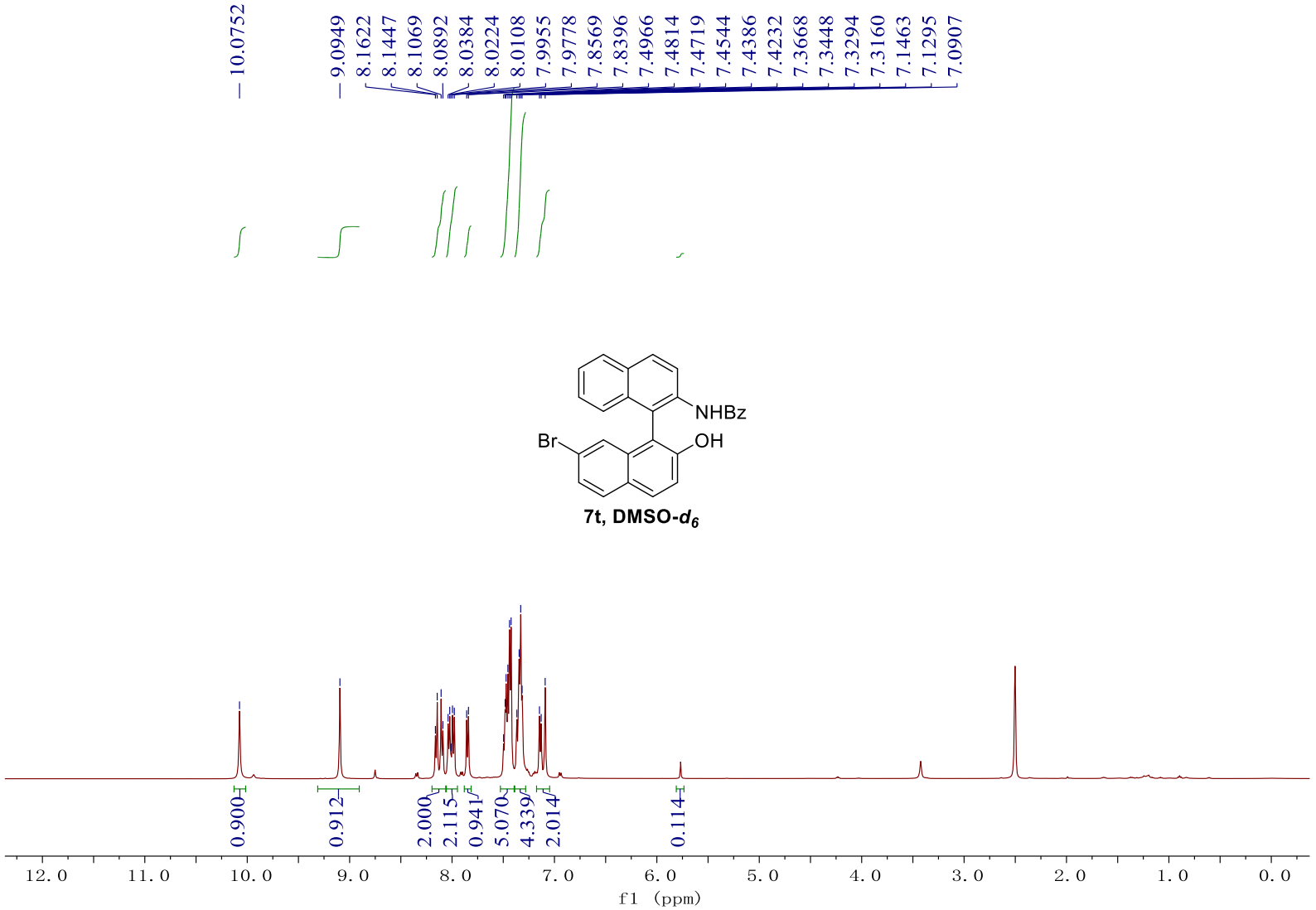

9.9567
8.7618
8.3847
8.3669
8.1147
8.0969
8.0275
8.0211
8.0116
8.0032
7.9208
7.9047
7.5013
7.4834
7.4681
7.4531
7.4364
7.4213
7.3621
7.3477
7.3275
7.3124
7.2960
7.2797
7.2654
7.2500
7.2059
7.1908
7.1748
7.1678
7.1507
6.9716
6.9547
NHBz
OH
0.998
0.990
0.979
1.023
2.024
1.007
3.093
6.084
2.080
1.000
12.0 11.5 11.0 10.5 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
f1 (ppm)

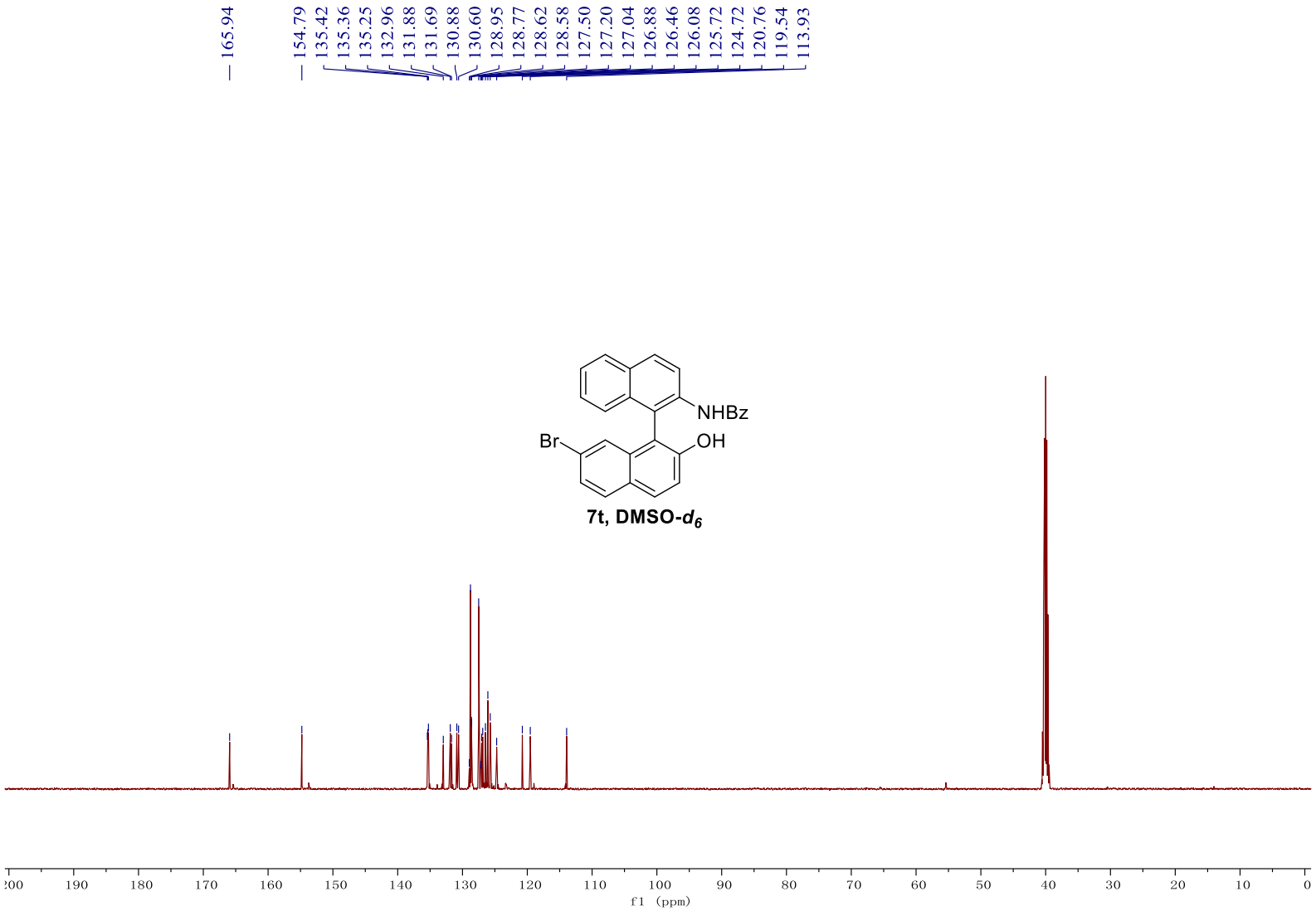
7r, DMSO-d_6

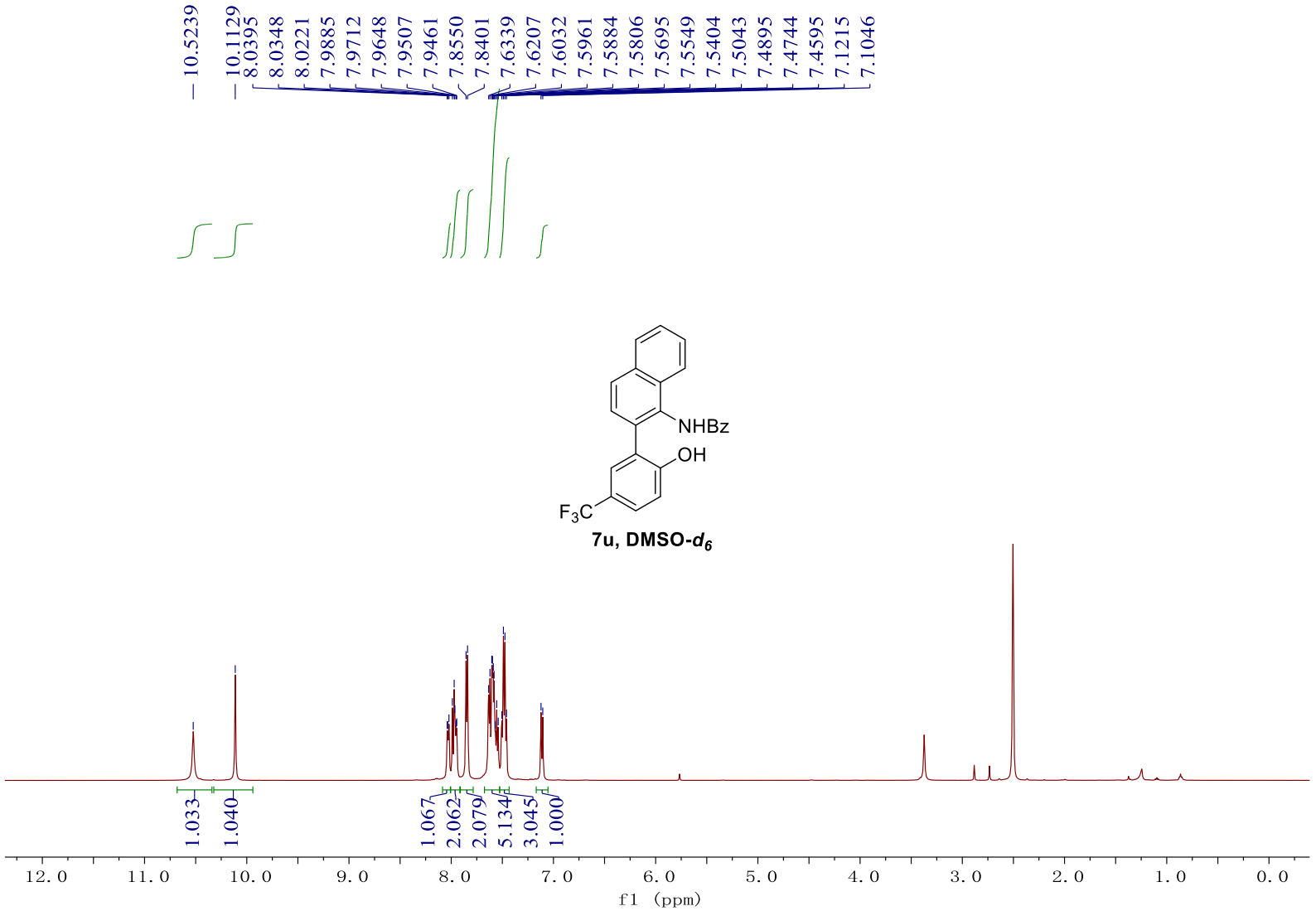

165.40
153.76
135.11
135.04
133.93
133.17
132.06
131.51
130.73
128.96
128.68
128.65
128.53
128.46
127.20
127.14
126.75
126.29
125.49
125.14
124.51
123.38
123.21
119.00
114.11
NHBz
OH
7r, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

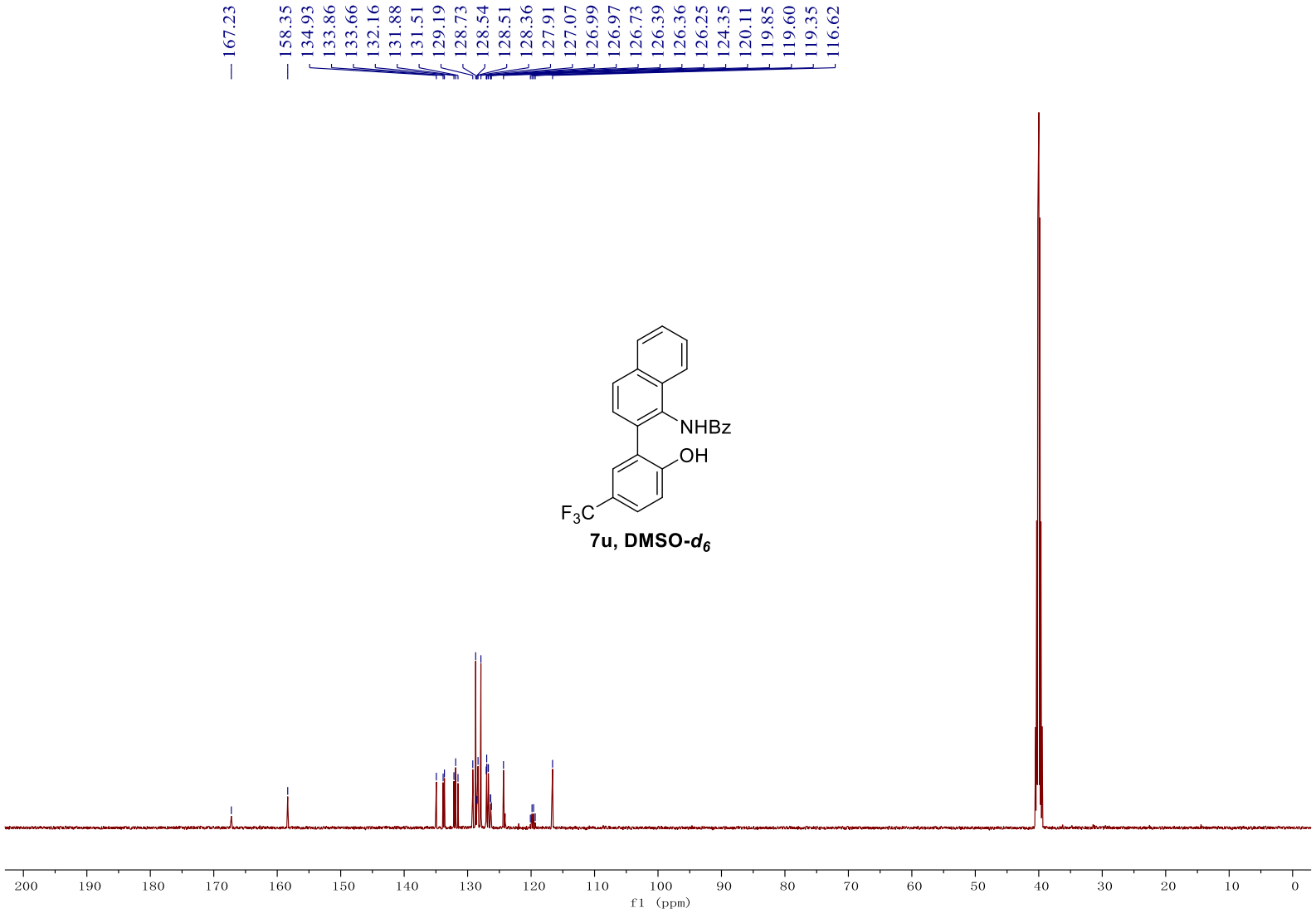

10.0331
8.9320
8.2131
8.1954
8.1638
8.1597
8.0969
8.0791
8.0292
8.0129
7.9789
7.9610
7.4838
7.4798
7.4725
7.4701
7.4619
7.4582
7.4565
7.4438
7.3929
7.3790
7.3761
7.3521
7.3377
7.3301
7.3218
7.3187
7.3147
7.3104
7.3015
7.2990
7.2964
7.2921
7.0972
7.0802
6.8694
NHBz
OH
Br
7s, DMSO-d6
0.920
0.967
0.986
0.962
1.044
1.081
0.995
3.120
2.002
4.177
1.000
0.996
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

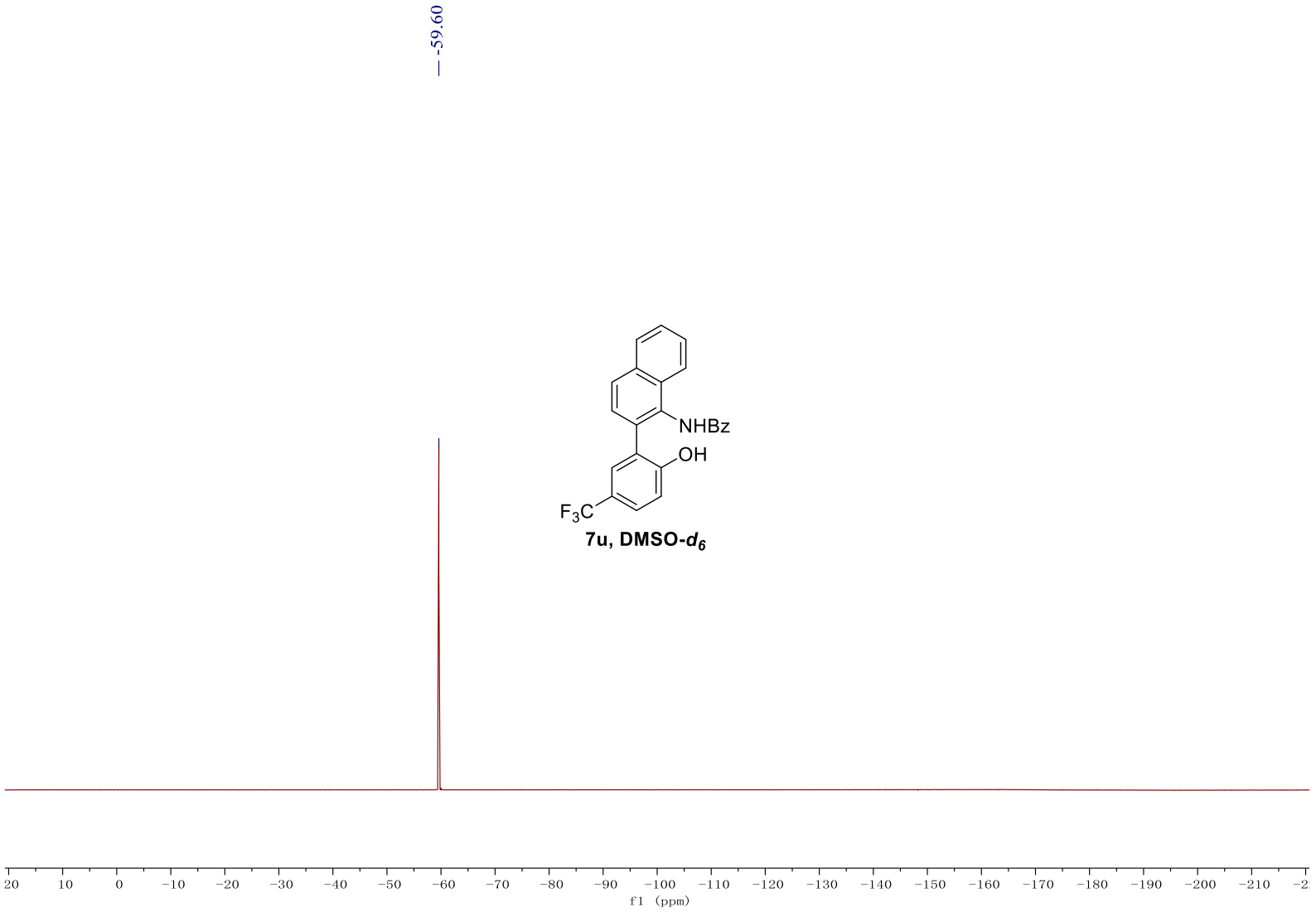

165.65
154.19
135.21
135.13
133.04
132.74
131.99
131.62
130.29
129.82
129.80
129.73
128.86
128.55
128.54
127.39
127.07
126.84
126.10
125.61
125.43
124.10
120.13
116.13
114.73
NHBz
OH
Br
7s, DMSO-d6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

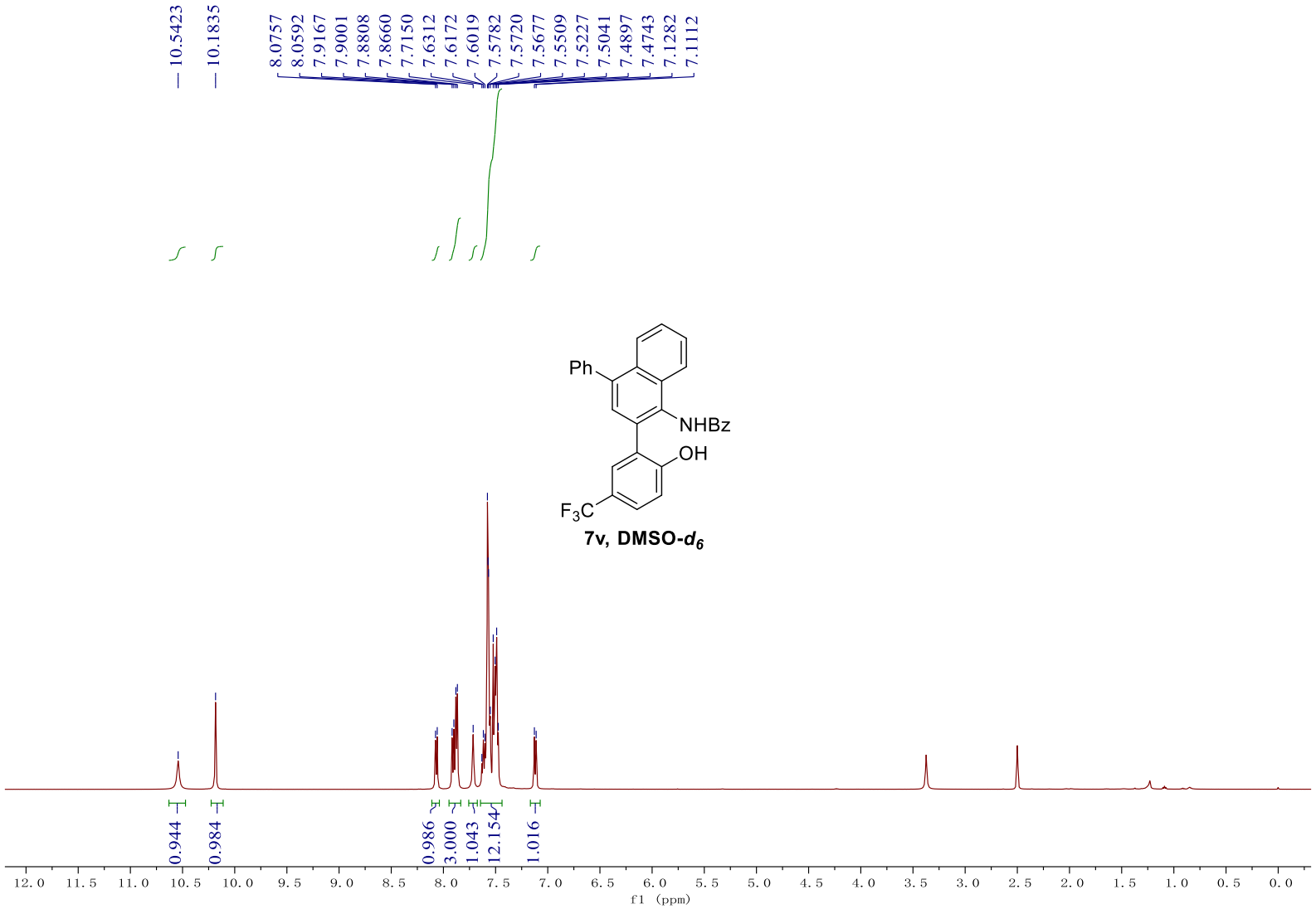

10.0752
9.0949
8.1622
8.1447
8.1069
8.0892
8.0384
8.0224
8.0108
7.9955
7.9778
7.8569
7.8396
7.4966
7.4814
7.4719
7.4544
7.4386
7.4232
7.3668
7.3448
7.3294
7.3160
7.1463
7.1295
7.0907
NHBz
Br
OH
7t, DMSO-d6
0.900
0.912
2.000
2.115
0.941
5.070
4.339
2.014
0.114
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

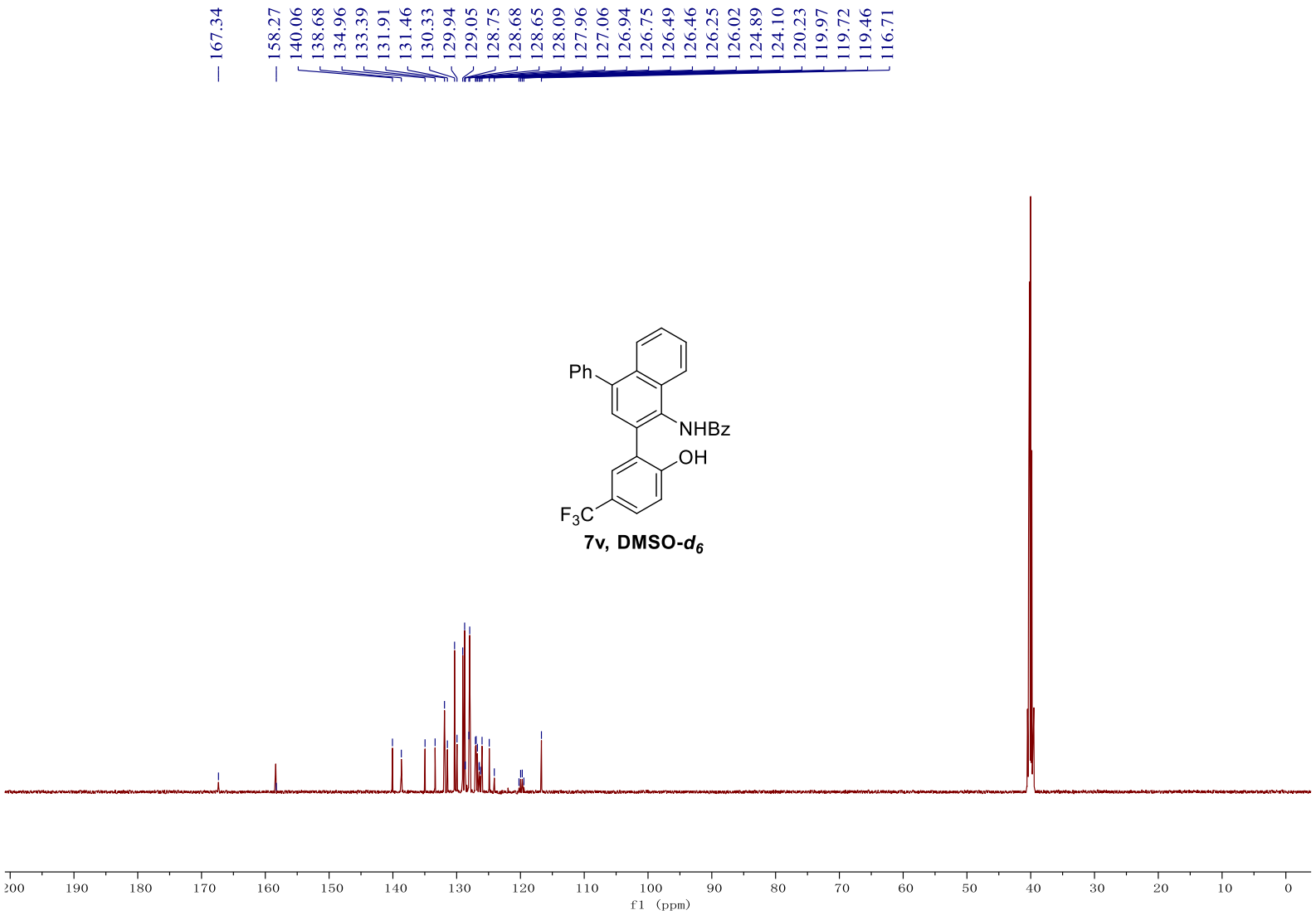

165.94
154.79
135.42
135.36
135.25
132.96
131.88
131.69
130.88
130.60
128.95
128.77
128.62
128.58
127.50
127.20
127.04
126.88
126.46
126.08
125.72
124.72
120.76
119.54
113.93
NHBz
Br
OH
7t, DMSO-d6
f1 (ppm)

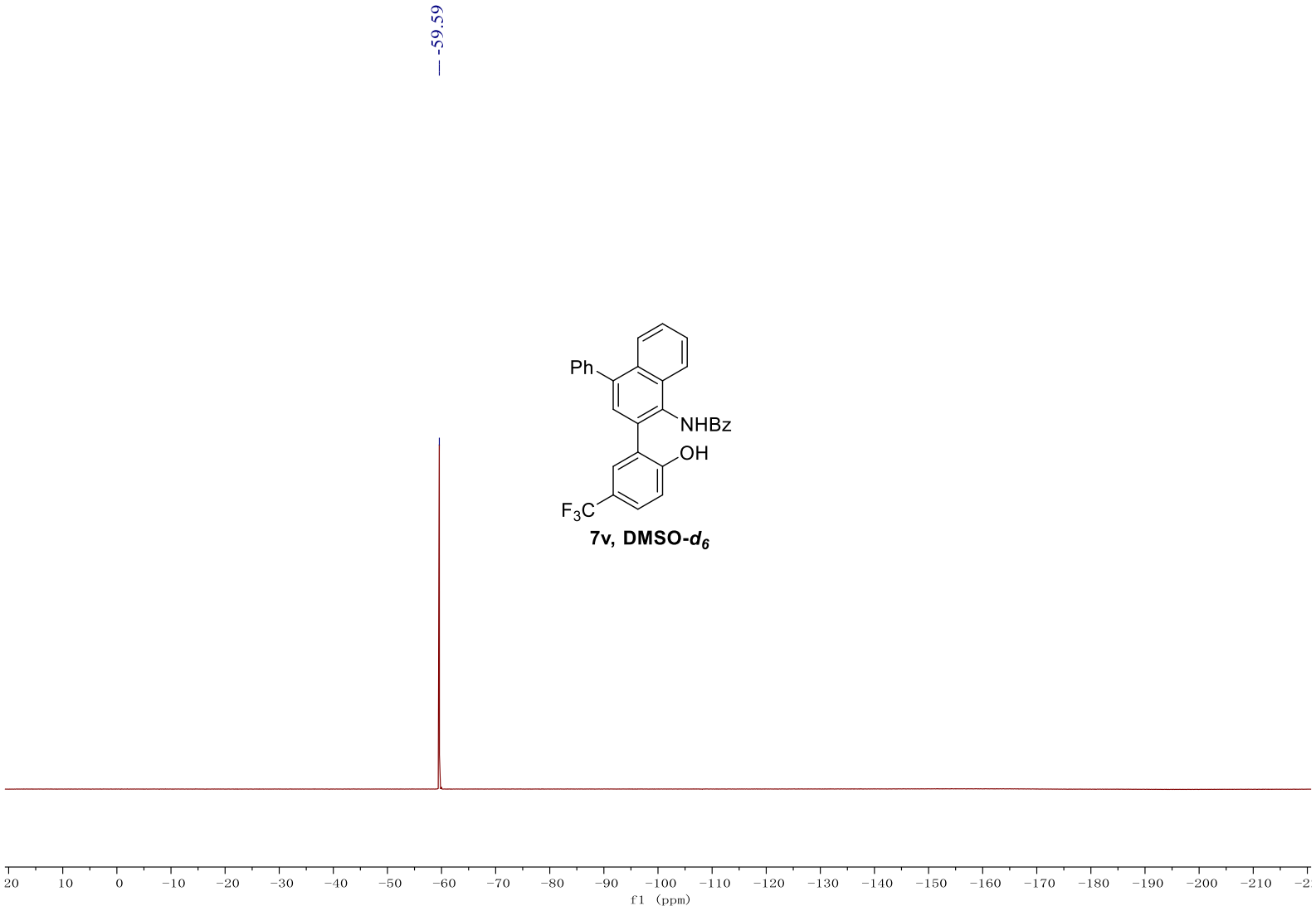

10.5239
10.1129
8.0395
8.0348
8.0221
7.9885
7.9712
7.9648
7.9507
7.9461
7.8550
7.8401
7.6339
7.6207
7.6032
7.5961
7.5884
7.5806
7.5695
7.5549
7.5404
7.5043
7.4895
7.4744
7.4595
7.1215
7.1046
NHBz
OH
F3C
7u, DMSO-d6
1.033
1.040
1.067
2.062
2.079
5.134
3.045
1.000
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


167.23
158.35
134.93
133.86
133.66
132.16
131.88
131.51
129.19
128.73
128.54
128.51
128.36
127.91
127.07
126.99
126.97
126.73
126.39
126.36
126.25
124.35
120.11
119.85
119.60
119.35
116.62
NHBz
OH
F3C
7u, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

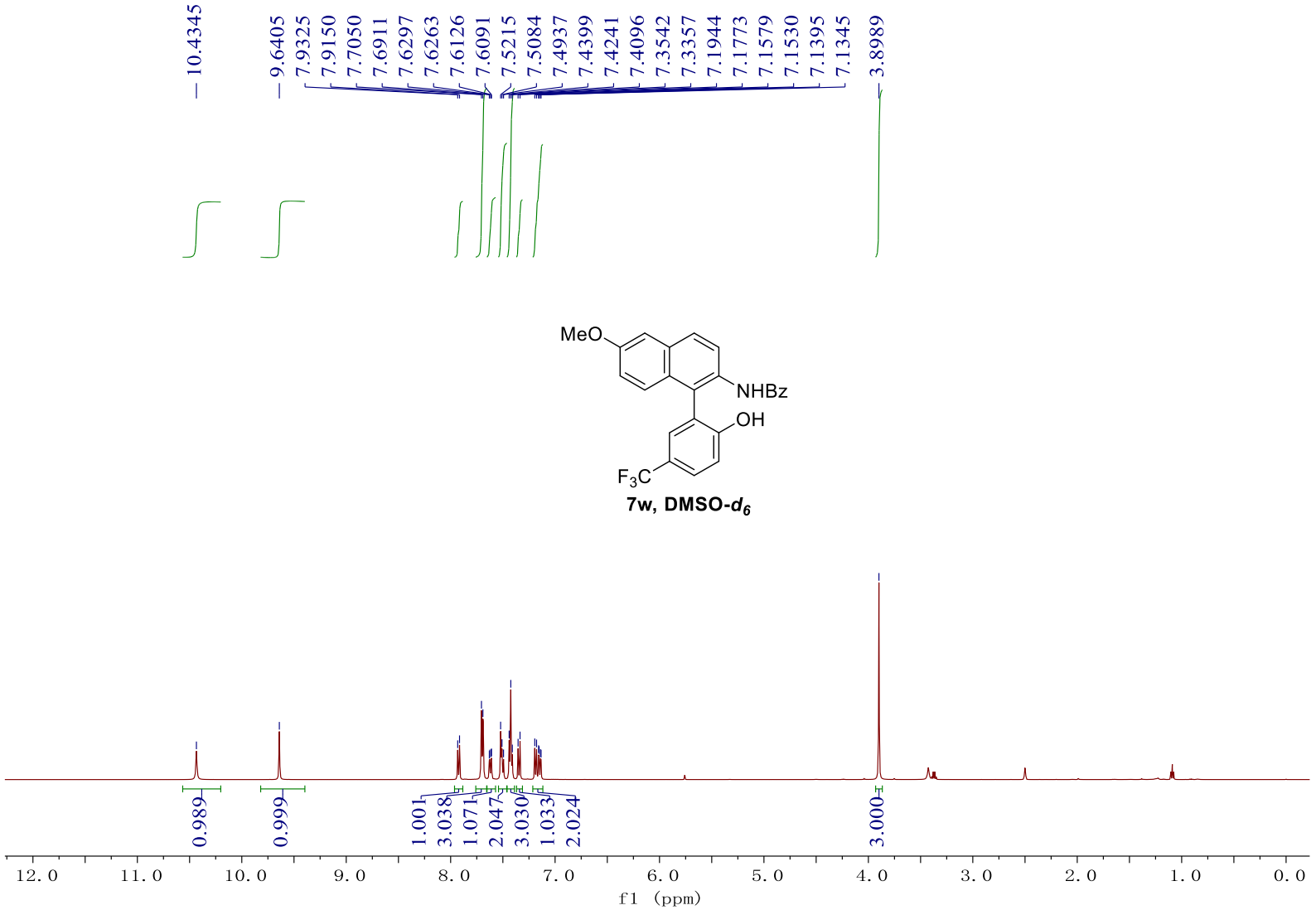

-59.60
NHBz
OH
F3C
7u, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

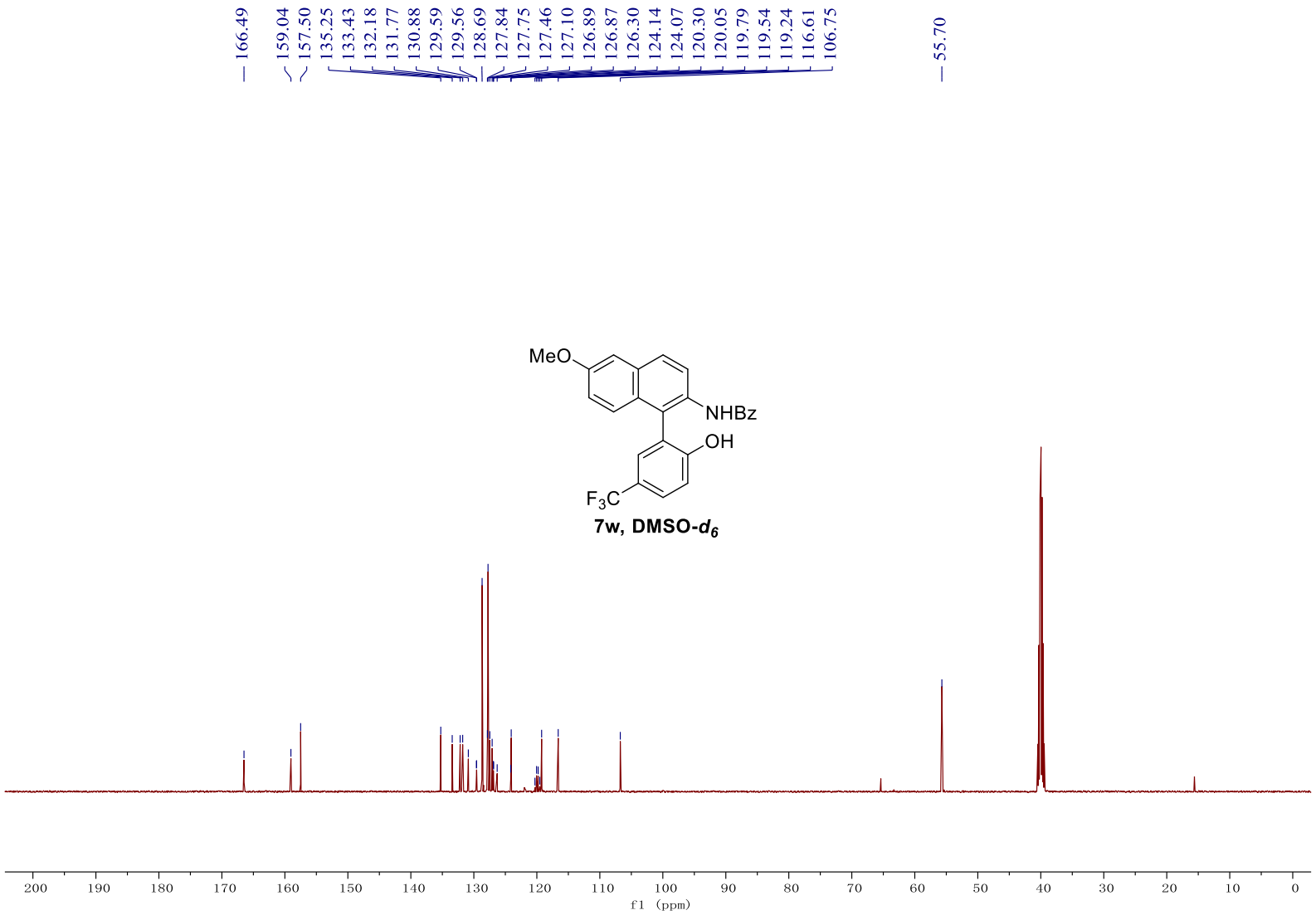

10.5423
10.1835
8.0757
8.0592
7.9167
7.9001
7.8808
7.8660
7.7150
7.6312
7.6172
7.6019
7.5782
7.5720
7.5677
7.5509
7.5227
7.5041
7.4897
7.4743
7.1282
7.1112
Ph
NHBz
OH
F3C
7v, DMSO-d6
0.944
0.984
0.986
3.000
1.043
12.154
1.016
f1 (ppm)

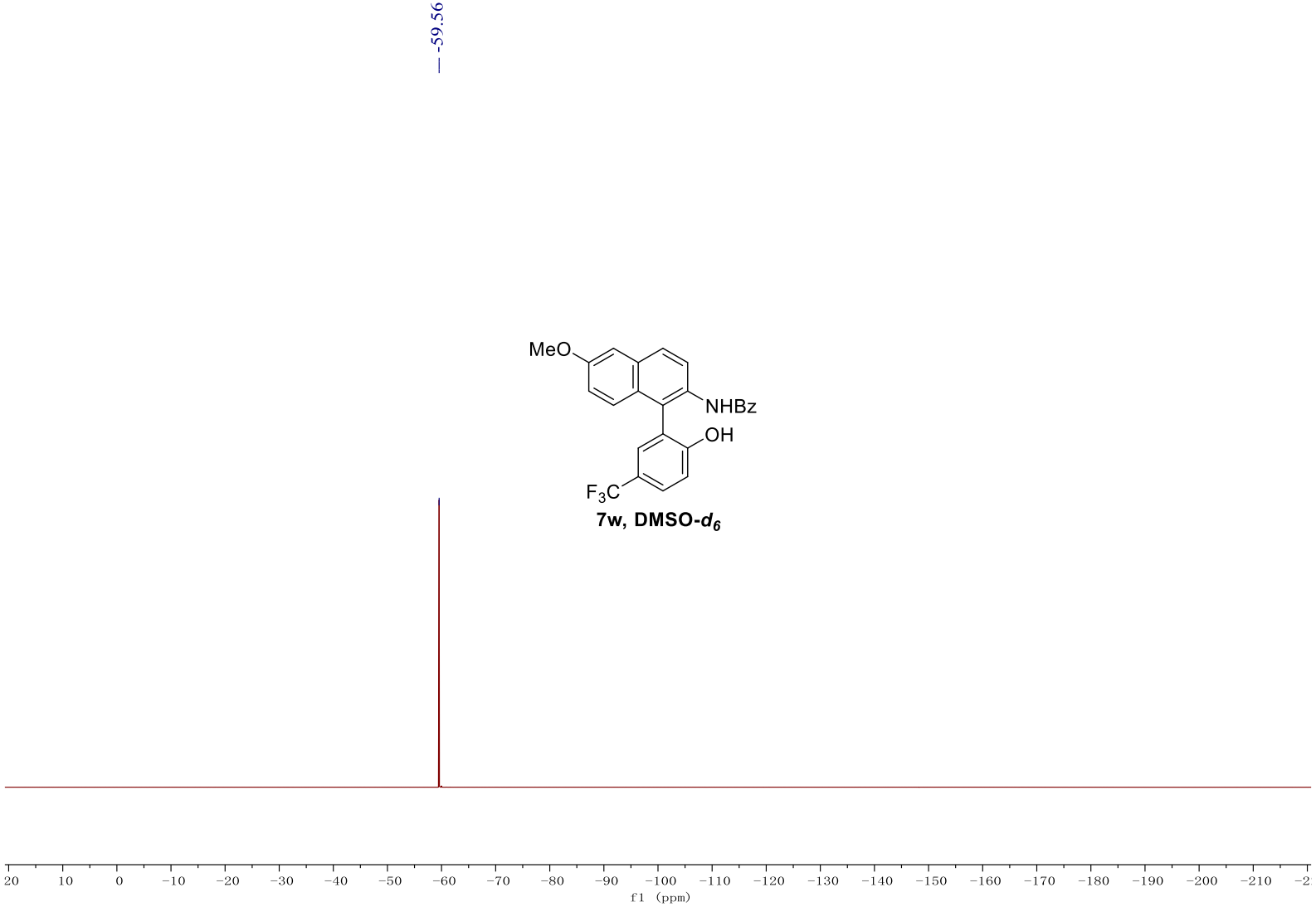

167.34
158.27
140.06
138.68
134.96
133.39
131.91
131.46
130.33
129.94
129.05
128.75
128.68
128.65
128.09
127.96
127.06
126.94
126.75
126.49
126.46
126.25
126.02
124.89
124.10
120.23
119.97
119.72
119.46
116.71
Ph
NHBz
OH
F3C
7v, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

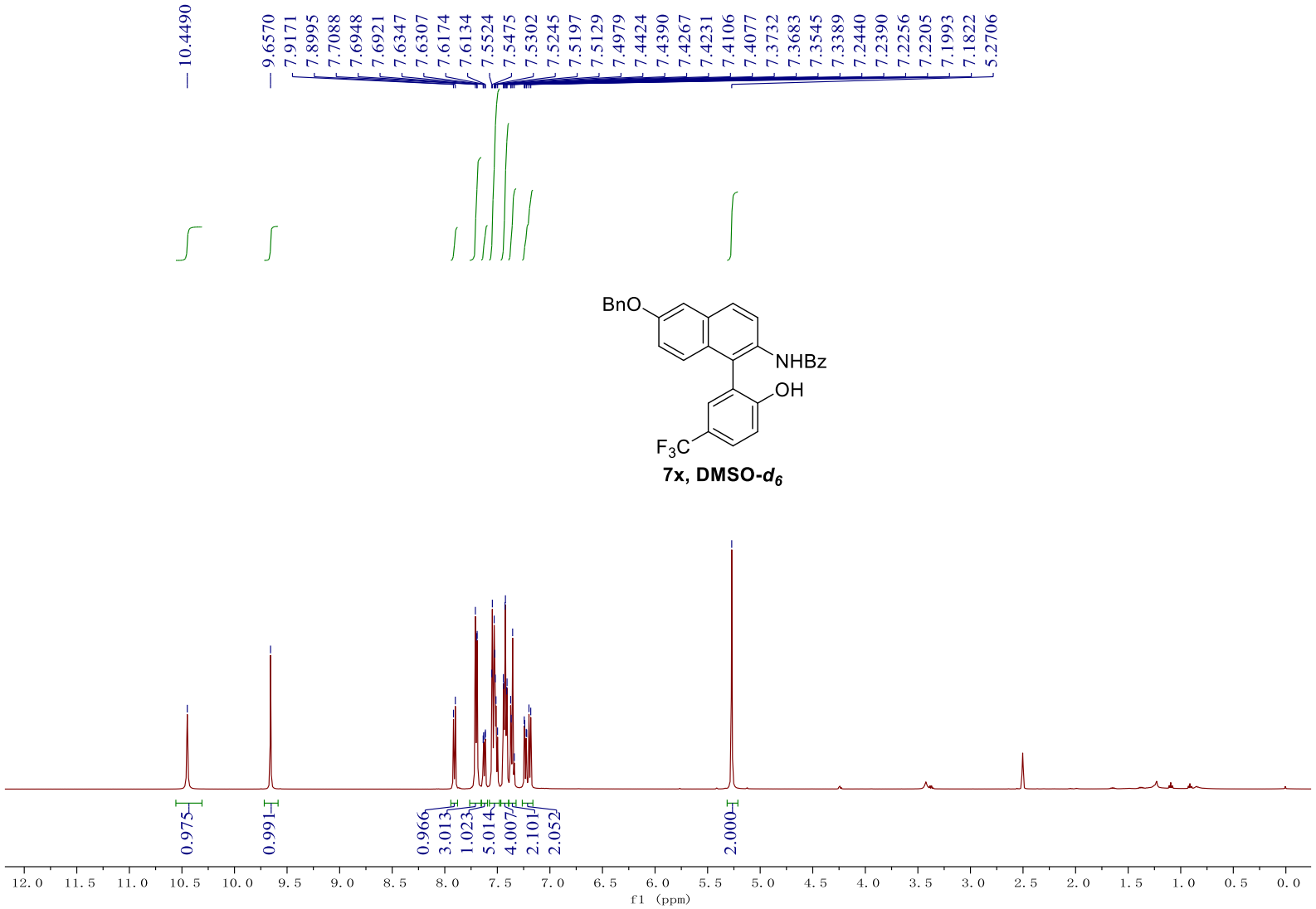

-59.59
Ph
NHBz
OH
F3C
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

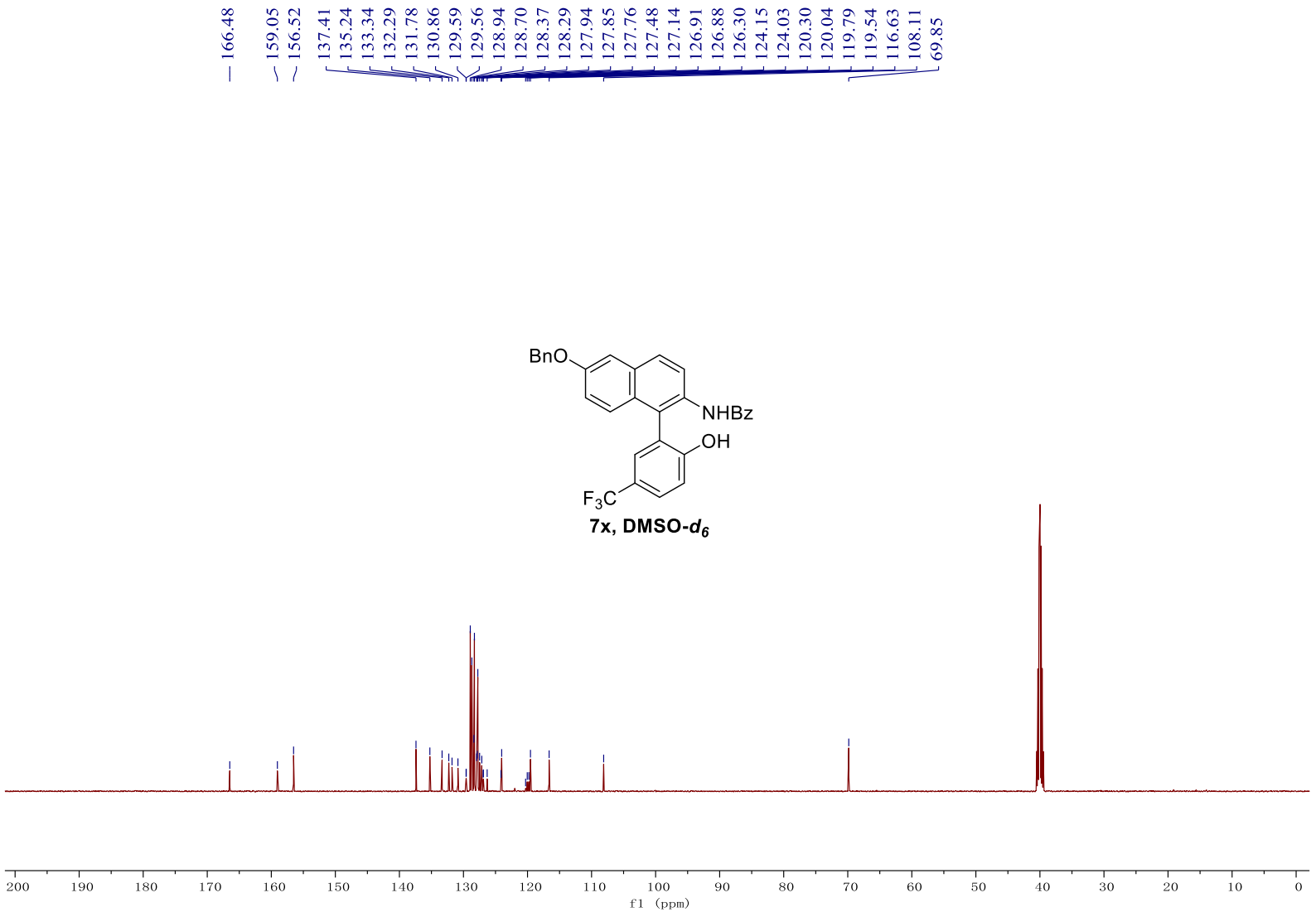
7v, DMSO-*d*$_6$

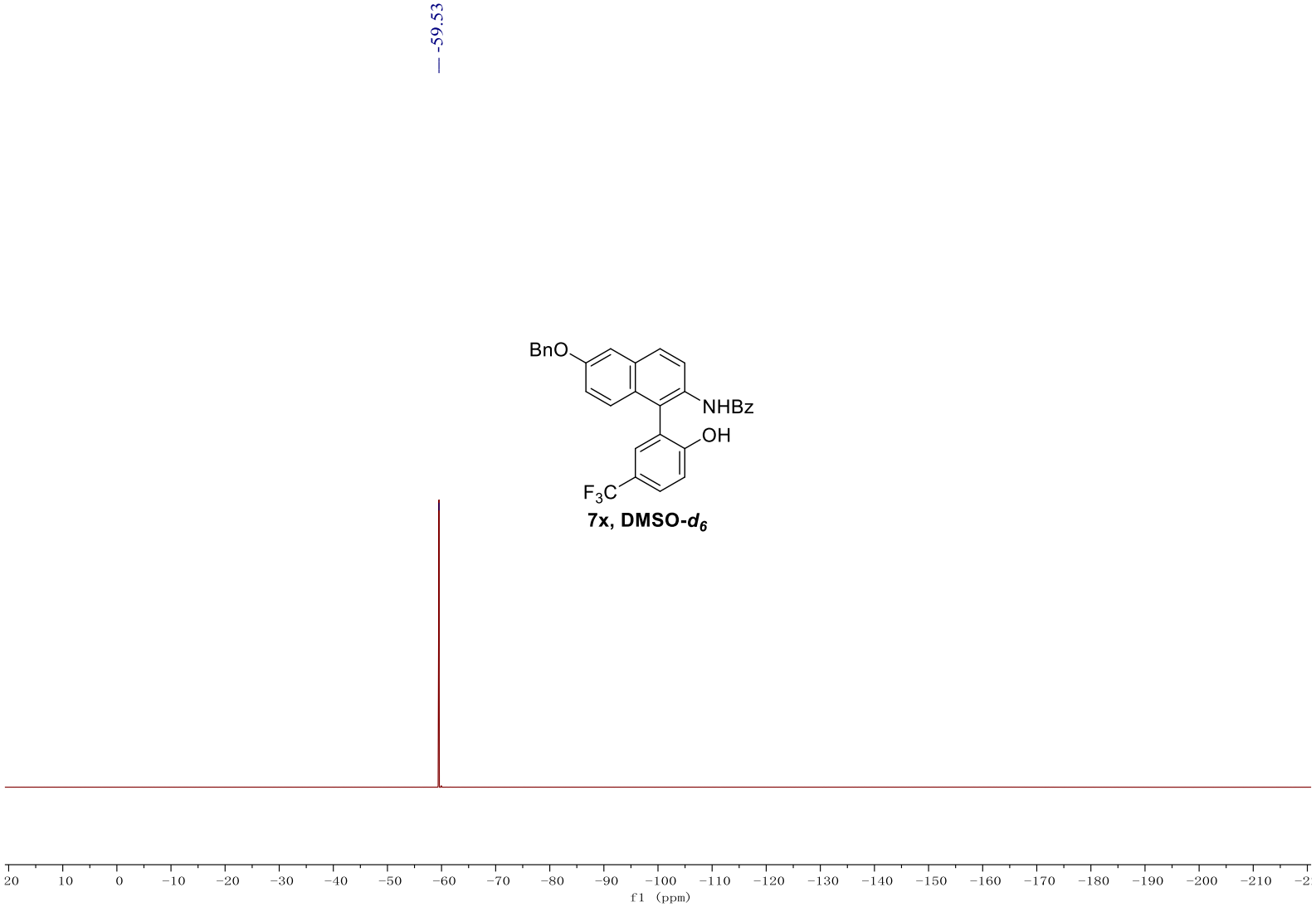

10.4345
9.6405
7.9325
7.9150
7.7050
7.6911
7.6297
7.6263
7.6126
7.6091
7.5215
7.5084
7.4937
7.4399
7.4241
7.4096
7.3542
7.3357
7.1944
7.1773
7.1579
7.1530
7.1395
7.1345
3.8989
MeO
NHBz
OH
F3C
7w, DMSO-d6
0.989
0.999
1.001
3.038
1.071
2.047
3.030
1.033
2.024
3.000
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


166.49
159.04
157.50
135.25
133.43
132.18
131.77
130.88
129.59
129.56
128.69
127.84
127.75
127.46
127.10
126.89
126.87
126.30
124.14
124.07
120.30
120.05
119.79
119.54
119.24
116.61
106.75
55.70
MeO
NHBz
OH
F3C
7w, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

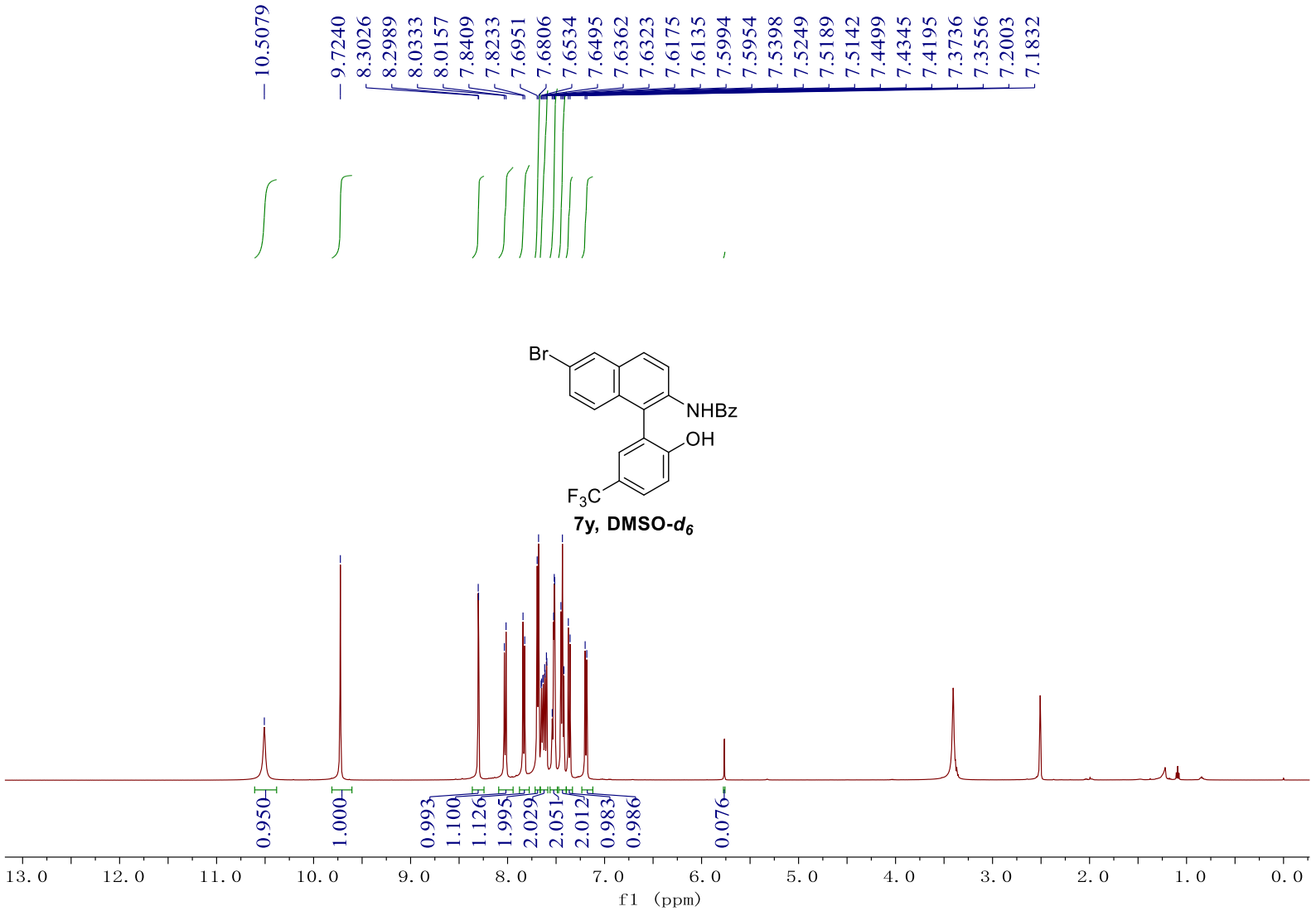

-59.56
MeO
NHBz
OH
F3C
7w, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

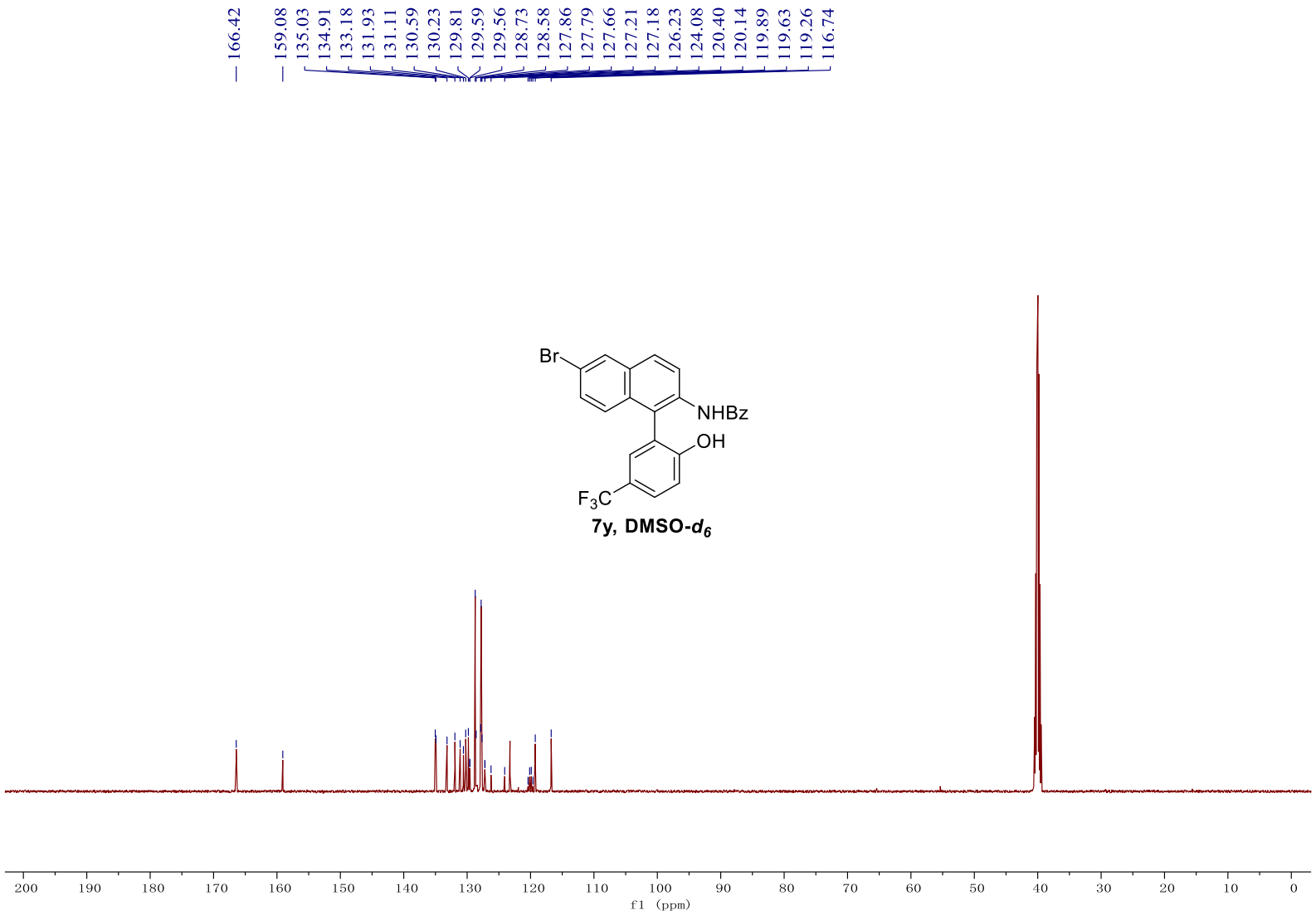

10.4490
9.6570
7.9171
7.8995
7.7088
7.6948
7.6921
7.6347
7.6307
7.6174
7.6134
7.5524
7.5475
7.5302
7.5245
7.5197
7.5129
7.4979
7.4424
7.4390
7.4267
7.4231
7.4106
7.4077
7.3732
7.3683
7.3545
7.3389
7.2440
7.2390
7.2256
7.2205
7.1993
7.1822
5.2706
BnO
NHBz
OH
F3C
7x, DMSO-d6
0.975
0.991
0.966
3.013
1.023
5.014
4.007
2.101
2.052
2.000
f1 (ppm)

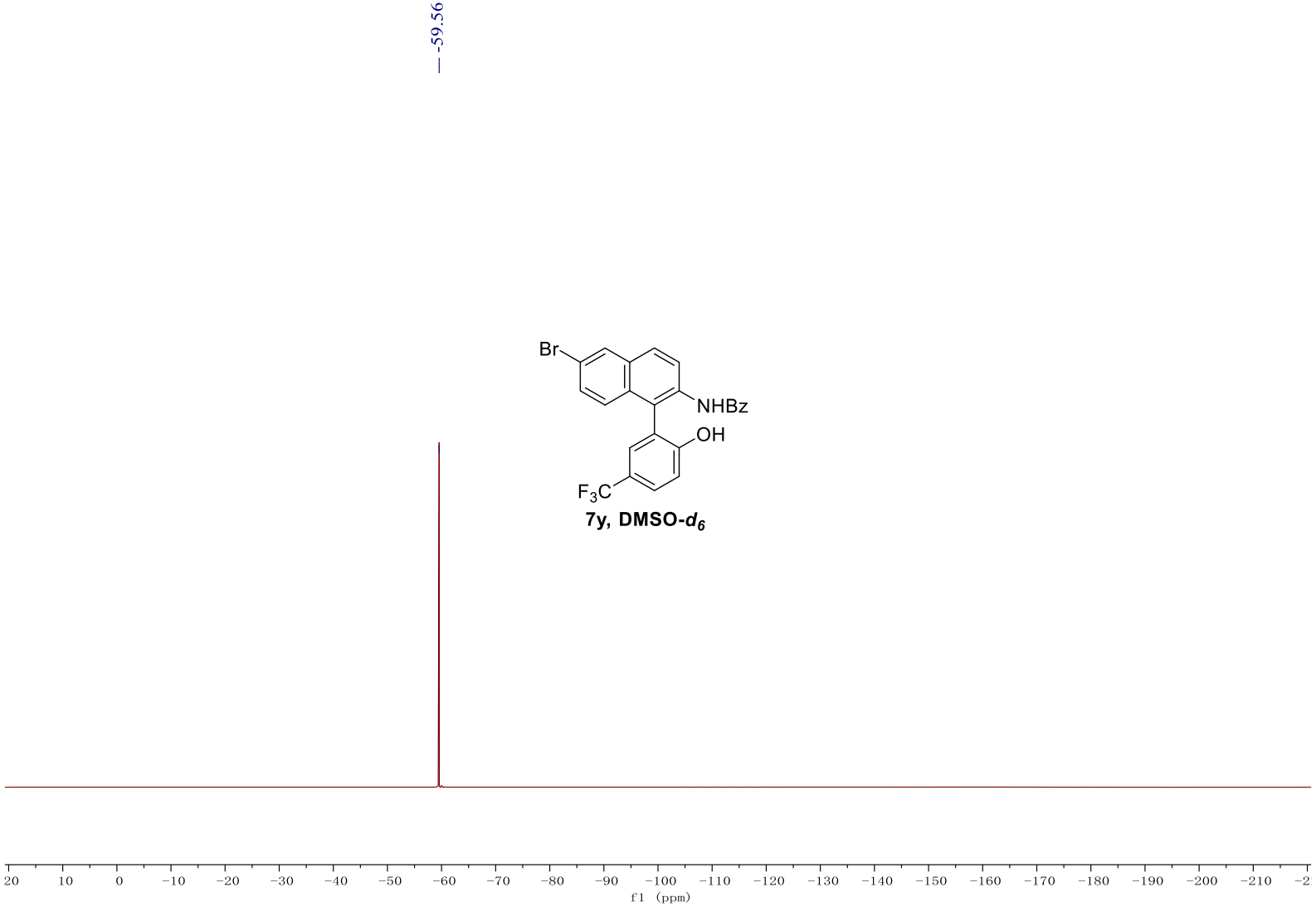

166.48
159.05
156.52
137.41
135.24
133.34
132.29
131.78
130.86
129.59
129.56
128.94
128.70
128.37
128.29
127.94
127.85
127.76
127.48
127.14
126.91
126.88
126.30
124.15
124.03
120.30
120.04
119.79
119.54
116.63
108.11
69.85
BnO
NHBz
OH
F3C
7x, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

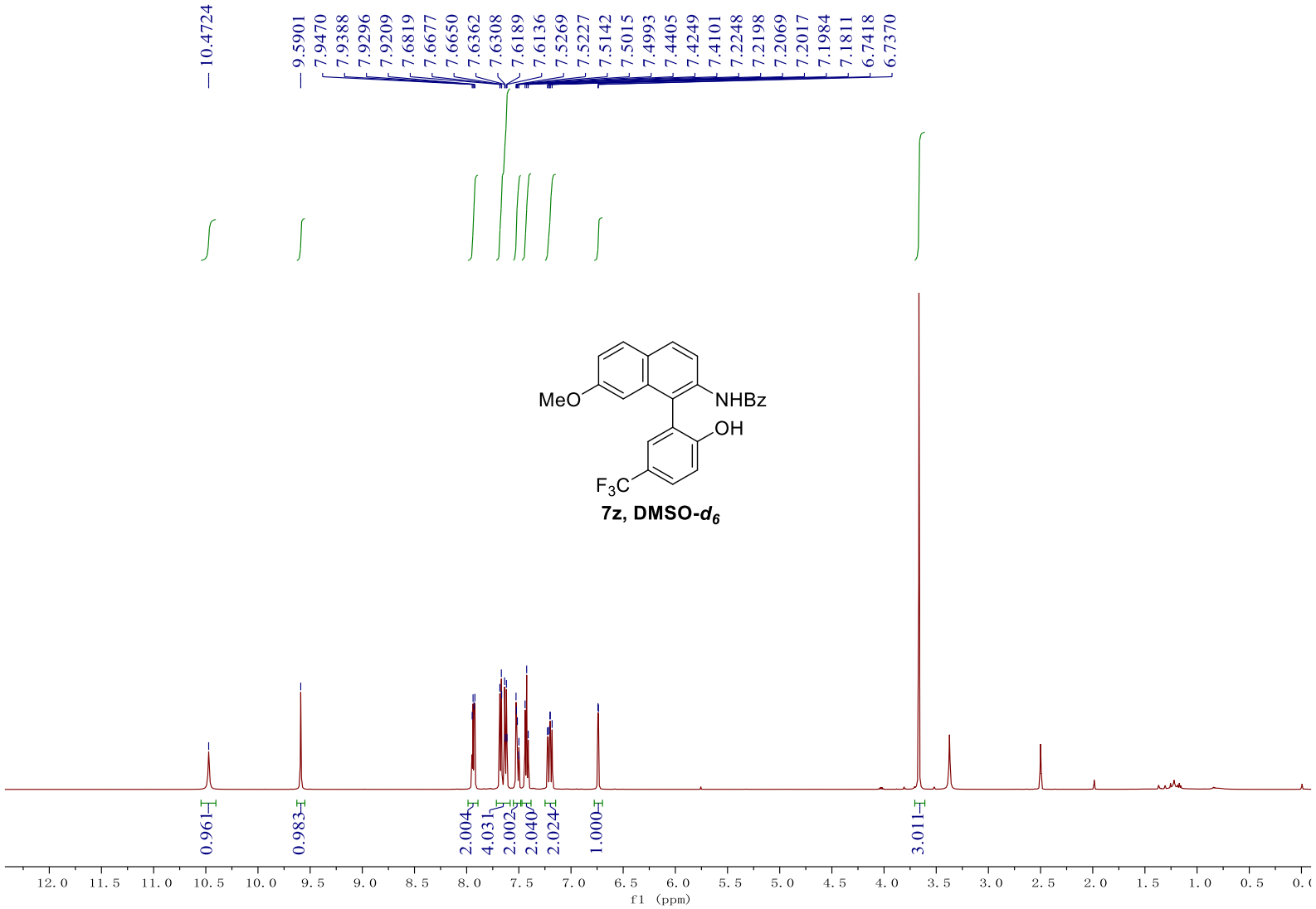

-59.53
BnO
NHBz
OH
F3C
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

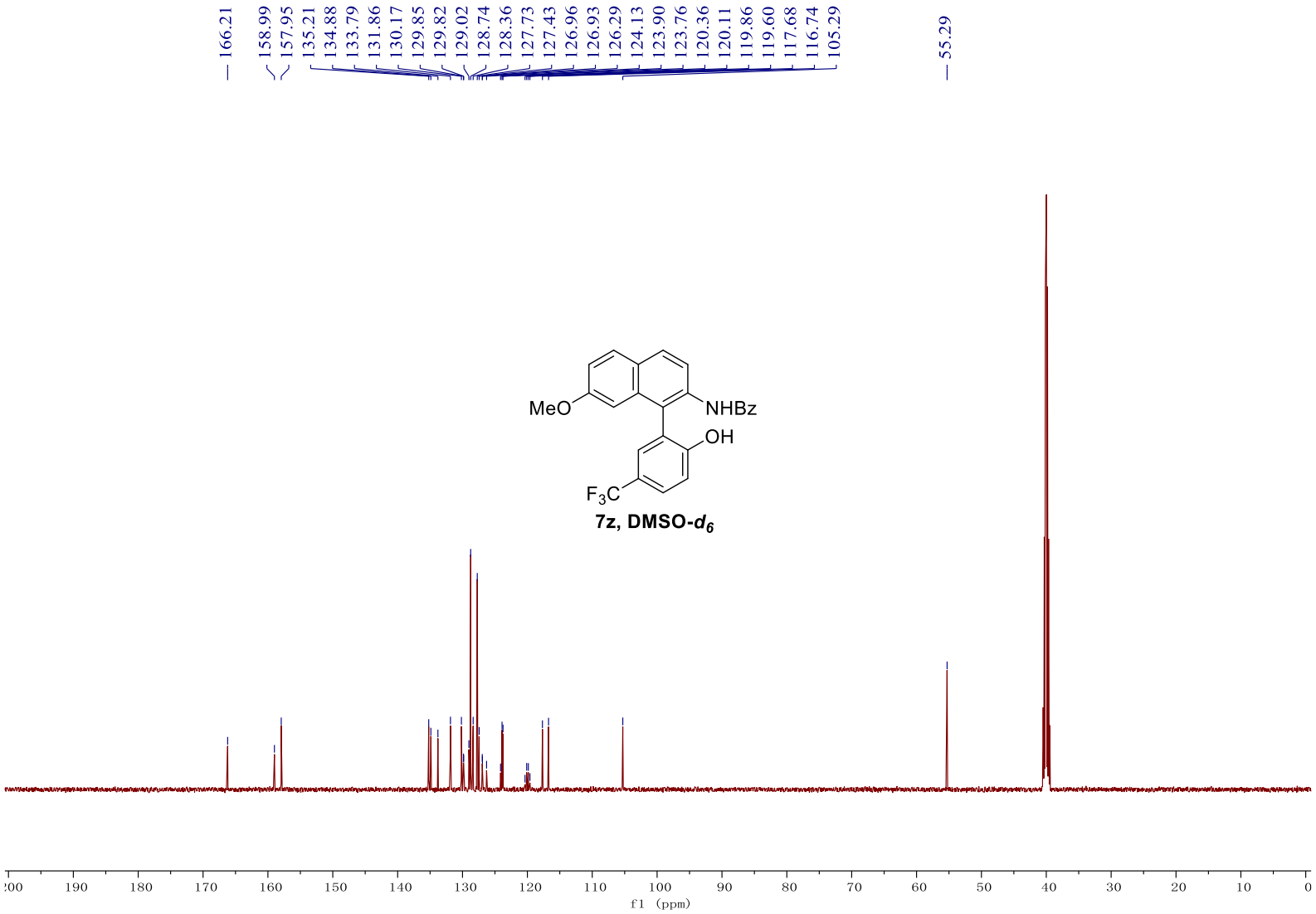
7x, DMSO-*d*$_6$

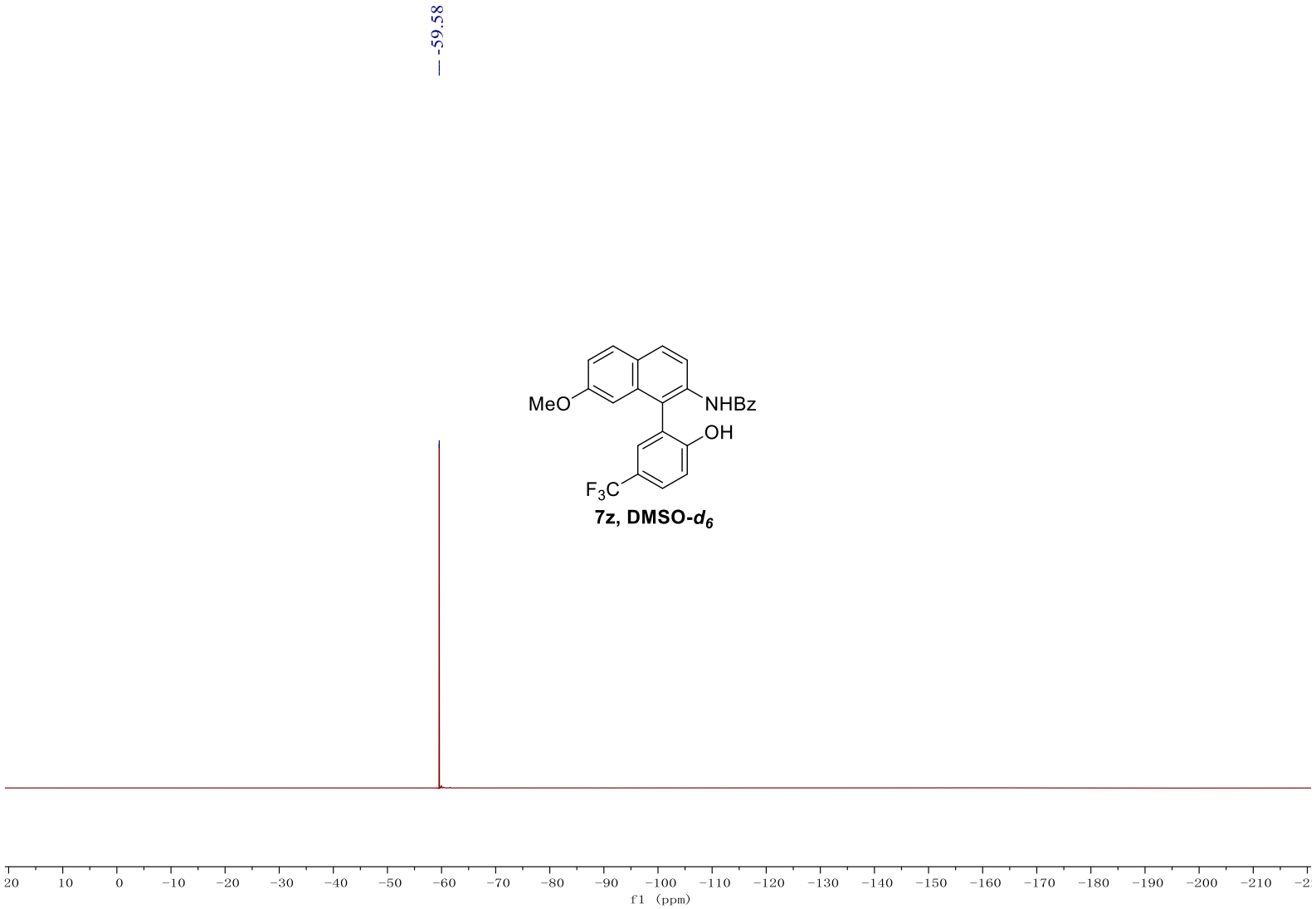

10.5079
9.7240
8.3026
8.2989
8.0333
8.0157
7.8409
7.8233
7.6951
7.6806
7.6534
7.6495
7.6362
7.6323
7.6175
7.6135
7.5994
7.5954
7.5398
7.5249
7.5189
7.5142
7.4499
7.4345
7.4195
7.3736
7.3556
7.2003
7.1832
Br
NHBz
OH
F3C
7y, DMSO-d6
0.950
1.000
0.993
1.100
1.126
1.995
2.029
2.051
2.012
0.983
0.986
0.076
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


166.42
159.08
135.03
134.91
133.18
131.93
131.11
130.59
130.23
129.81
129.59
129.56
128.73
128.58
127.86
127.79
127.66
127.21
127.18
126.23
124.08
120.40
120.14
119.89
119.63
119.26
116.74
Br
NHBz
OH
F3C
7y, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

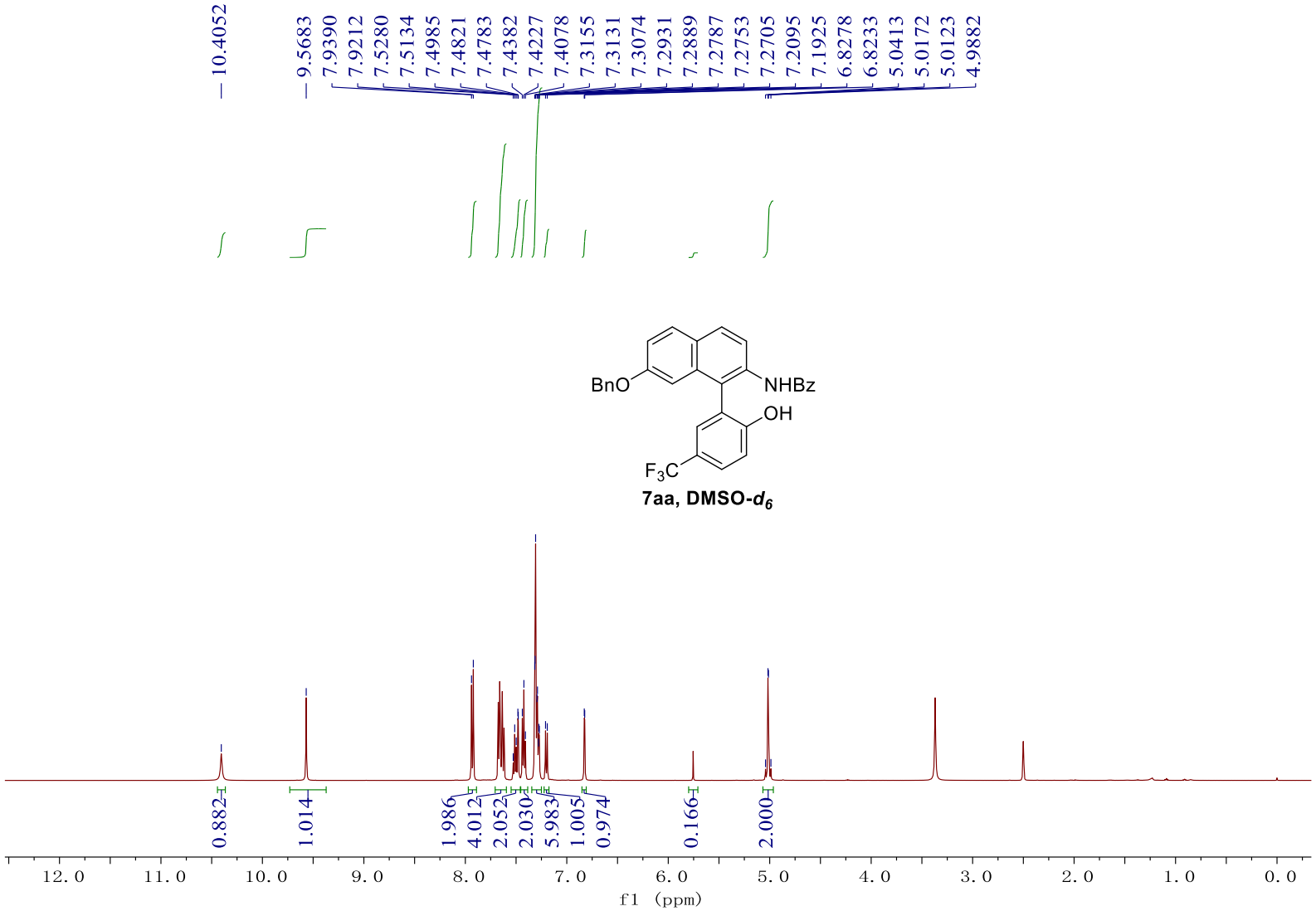

-59.56
Br
NHBz
OH
F3C
7y, DMSO-d6
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)


10.4724
9.5901
7.9470
7.9388
7.9296
7.9209
7.6819
7.6677
7.6650
7.6362
7.6308
7.6189
7.6136
7.5269
7.5227
7.5142
7.5015
7.4993
7.4405
7.4249
7.4101
7.2248
7.2198
7.2069
7.2017
7.1984
7.1811
6.7418
6.7370
MeO
NHBz
OH
F3C
7z, DMSO-d6
0.961
0.983
2.004
4.031
2.002
2.040
2.024
1.000
3.011
f1 (ppm)

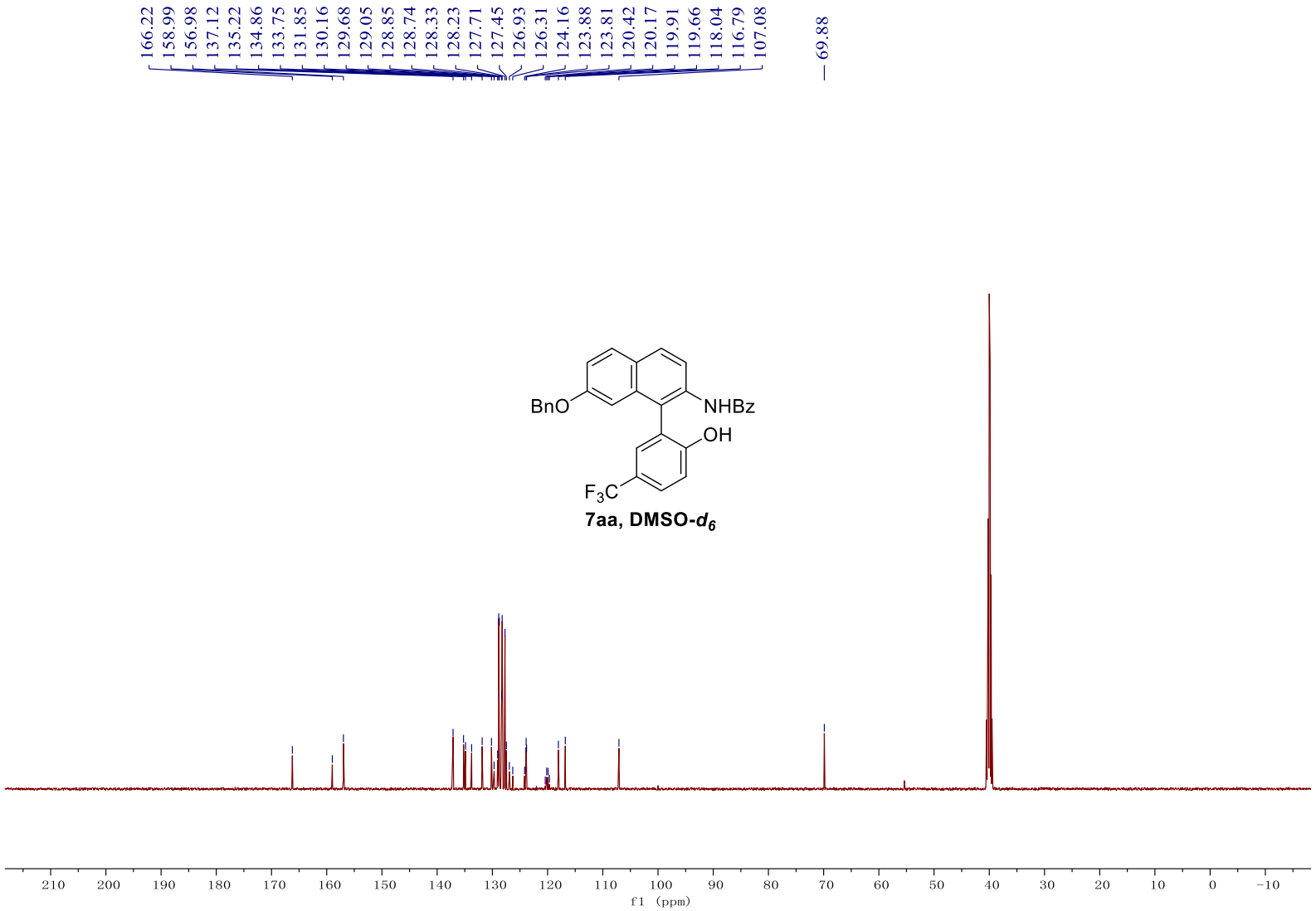

166.21
158.99
157.95
135.21
134.88
133.79
131.86
130.17
129.85
129.82
129.02
128.74
128.36
127.73
127.43
126.96
126.93
126.29
124.13
123.90
123.76
120.36
120.11
119.86
119.60
117.68
116.74
105.29
55.29
MeO
NHBz
OH
F3C
7z, DMSO-d6
f1 (ppm)

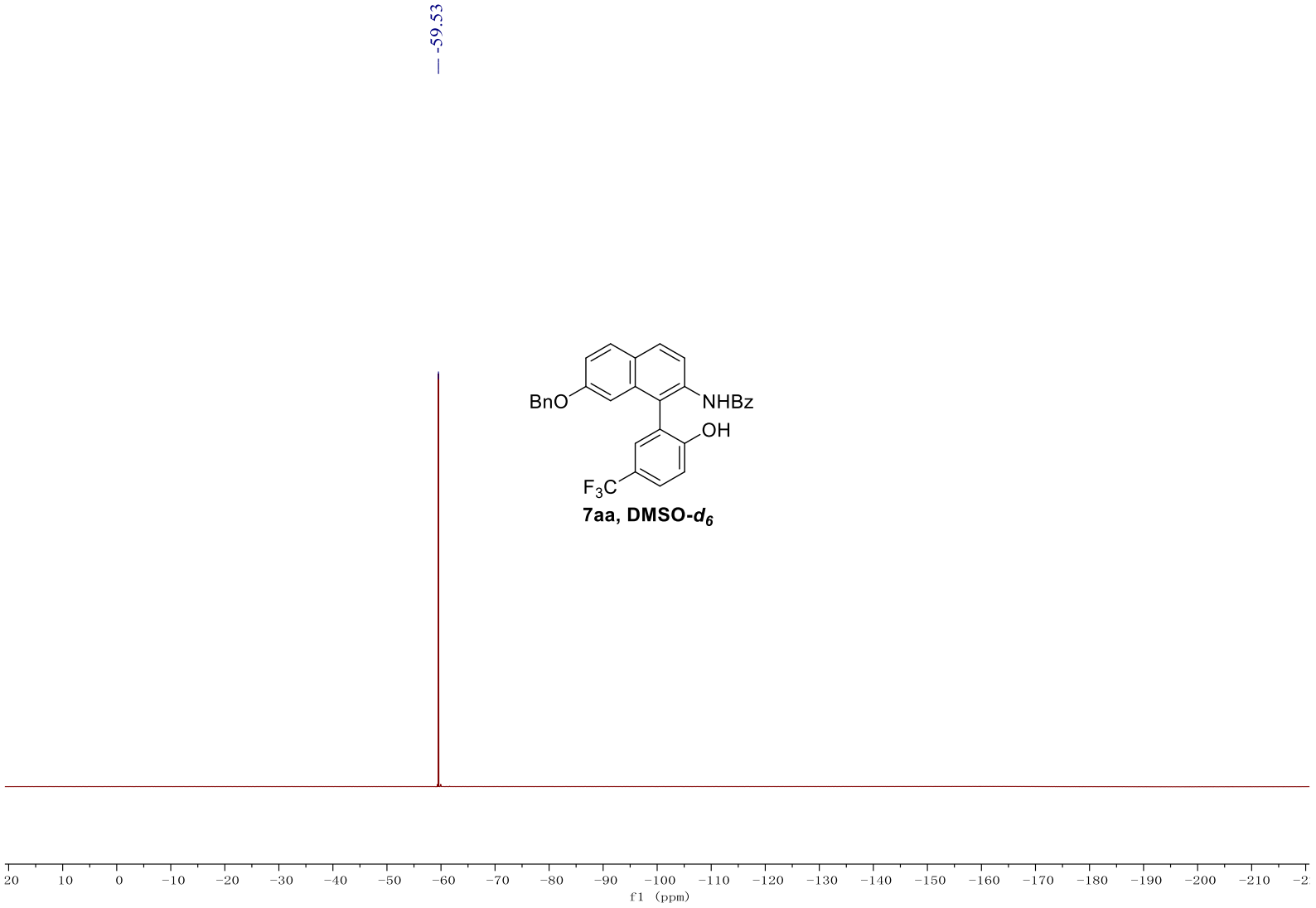

-59.58
MeO
NHBz
OH
F3C
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

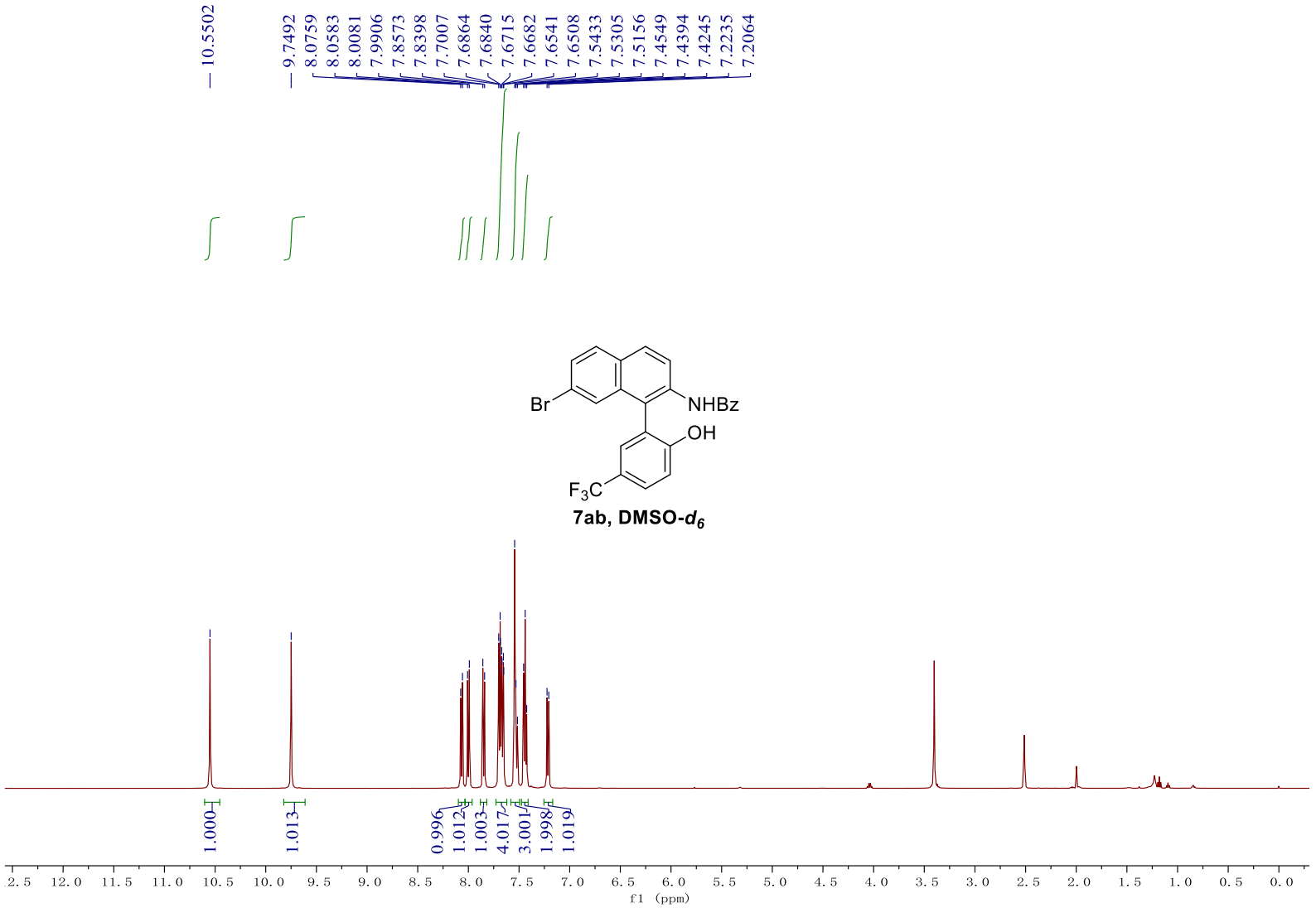
7z, DMSO-*d*$_6$

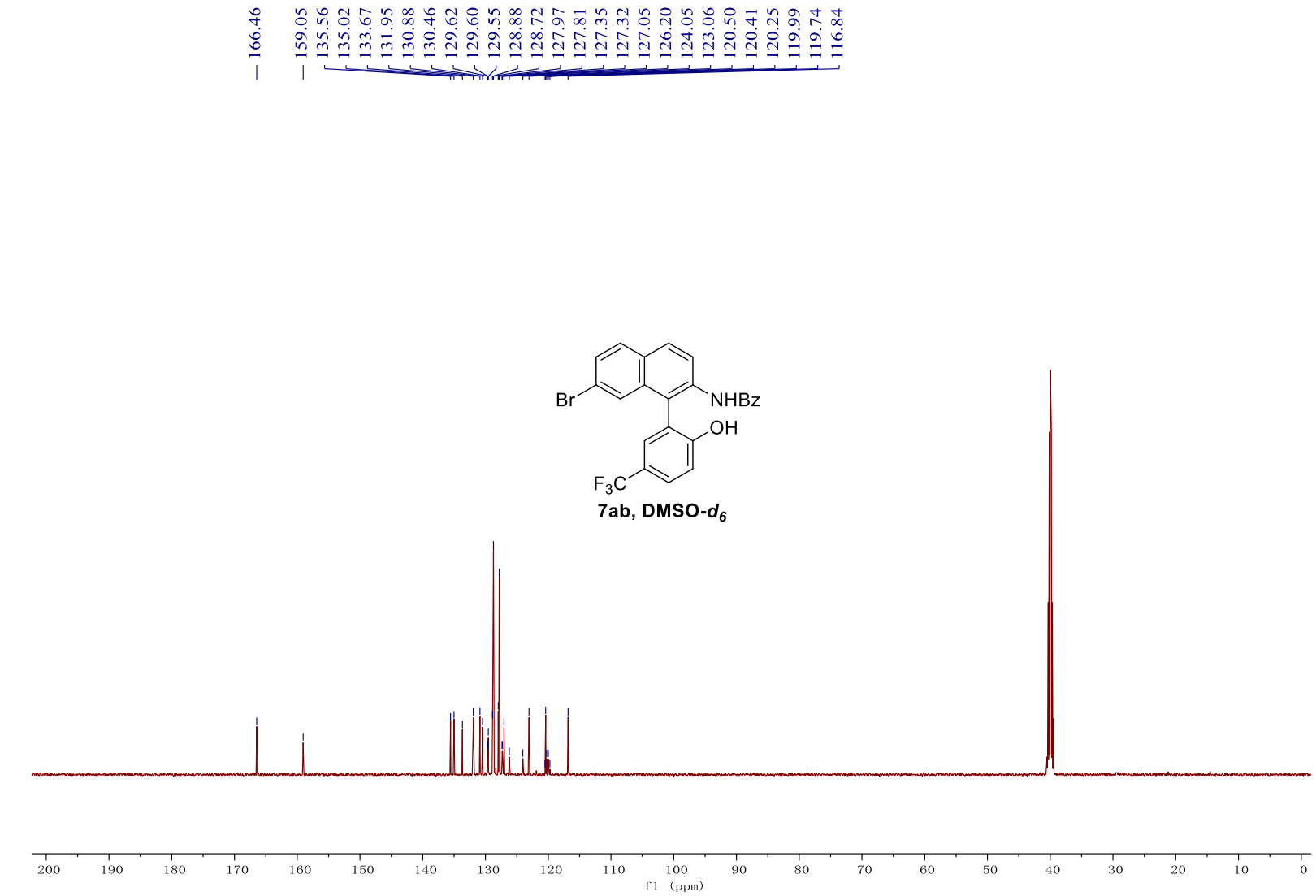

10.4052
9.5683
7.9390
7.9212
7.5280
7.5134
7.4985
7.4821
7.4783
7.4382
7.4227
7.4078
7.3155
7.3131
7.3074
7.2931
7.2889
7.2787
7.2753
7.2705
7.2095
7.1925
6.8278
6.8233
5.0413
5.0172
5.0123
4.9882
BnO
NHBz
OH
F3C
0.882
1.014
1.986
4.012
2.052
2.030
5.983
1.005
0.974
0.166
2.000
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

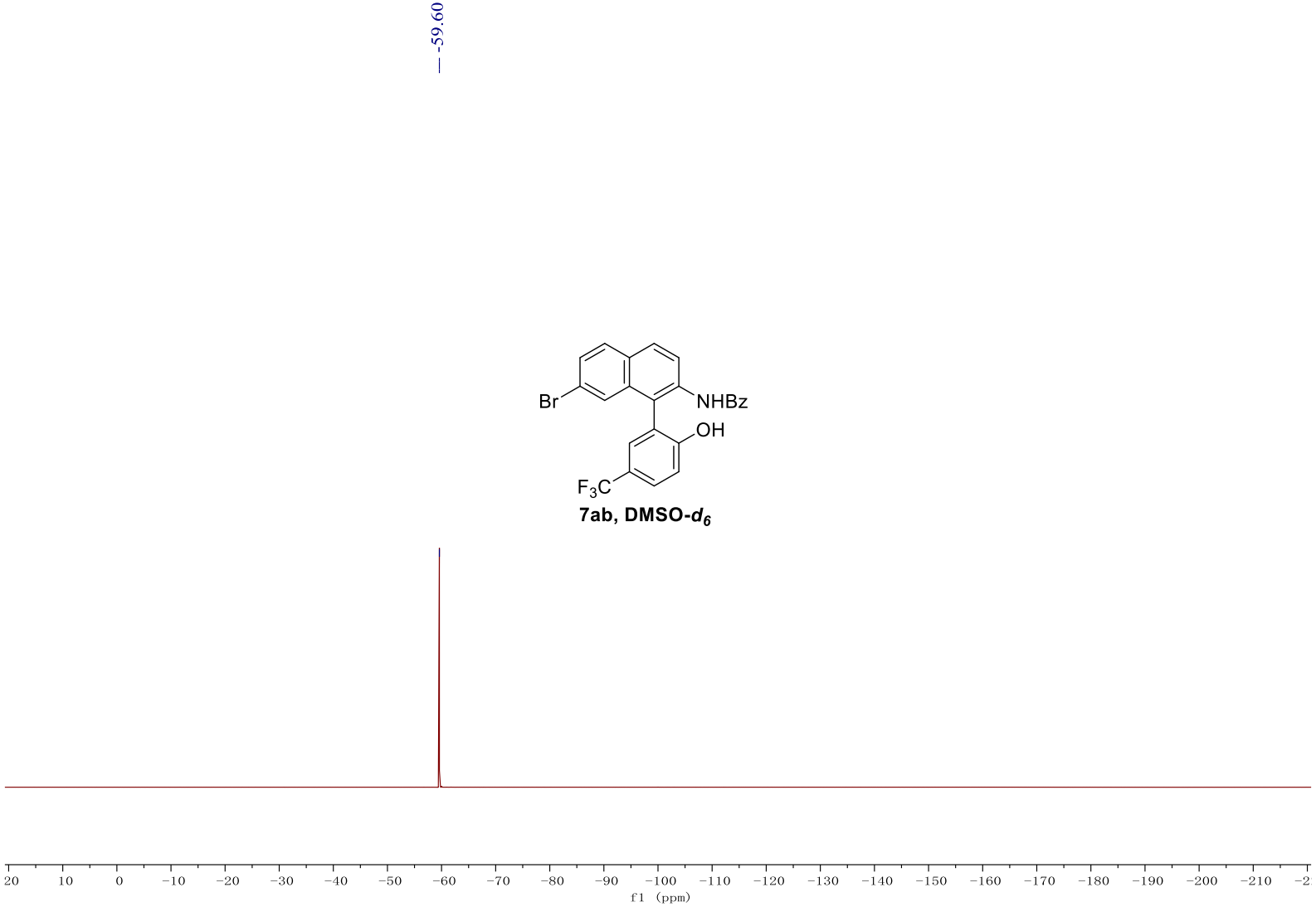
7aa, DMSO-d_6


166.22
158.99
156.98
137.12
135.22
134.86
133.75
131.85
130.16
129.68
129.05
128.85
128.74
128.33
128.23
127.71
127.45
126.93
126.31
124.16
123.88
123.81
120.42
120.17
119.91
119.66
118.04
116.79
107.08
69.88
BnO
NHBz
OH
F3C
7aa, DMSO-d6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

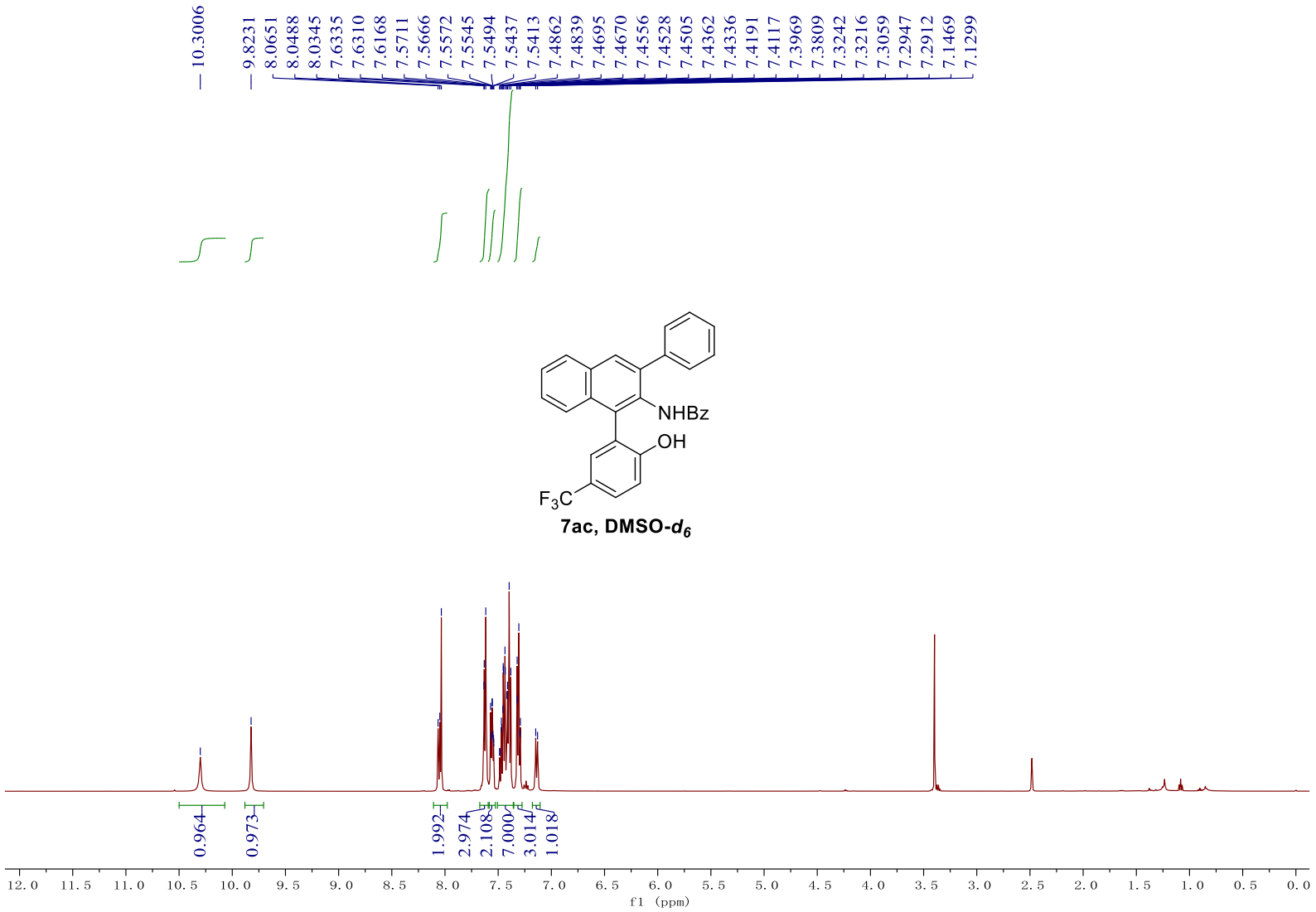

-59.53
BnO
NHBz
OH
F3C
7aa, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

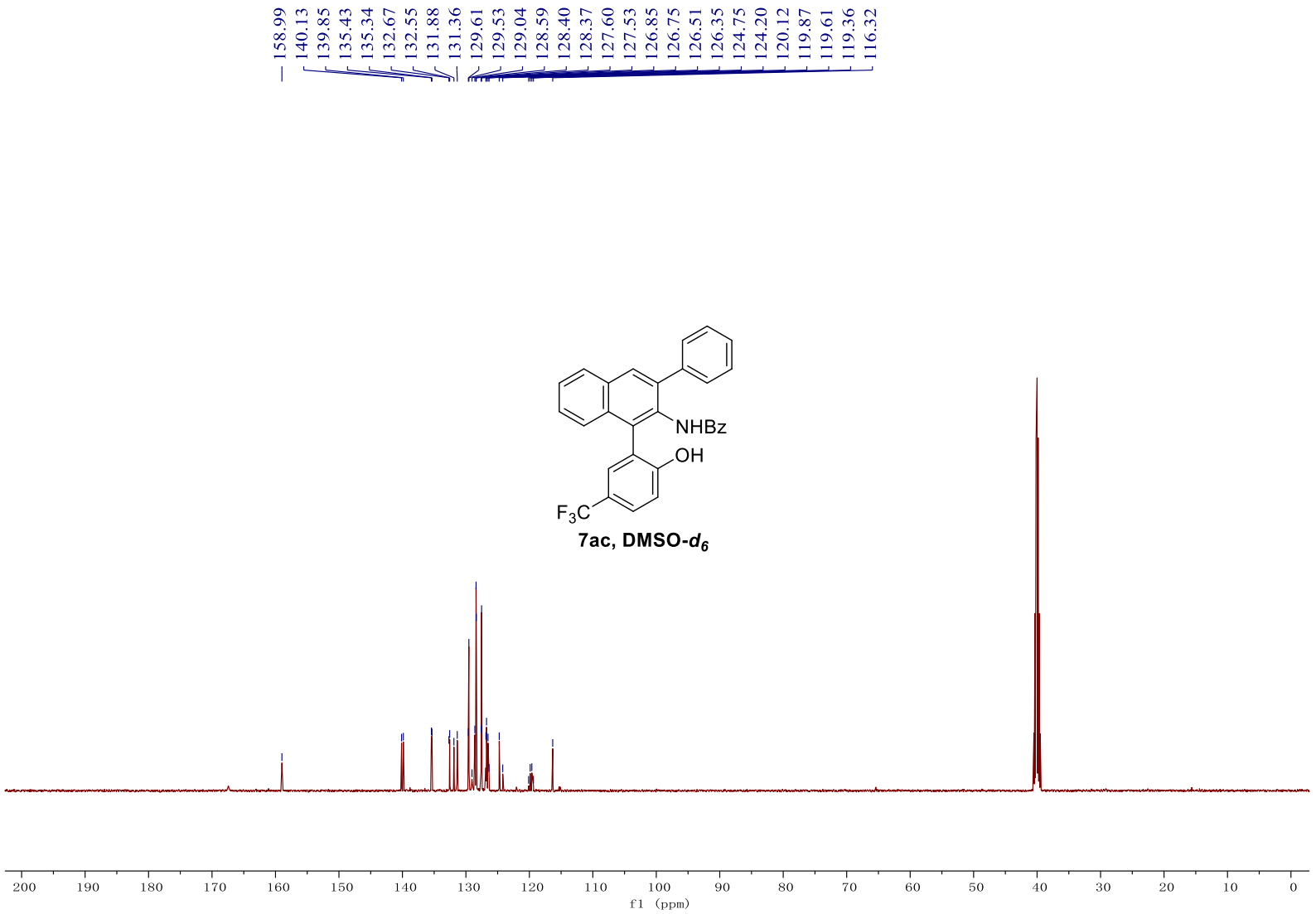

10.5502
9.7492
8.0759
8.0583
8.0081
7.9906
7.8573
7.8398
7.7007
7.6864
7.6840
7.6715
7.6682
7.6541
7.6508
7.5433
7.5305
7.5156
7.4549
7.4394
7.4245
7.2235
7.2064
Br
NHBz
OH
F3C
7ab, DMSO-d6
1.000
1.013
0.996
1.012
1.003
4.017
3.001
1.998
1.019
f1 (ppm)

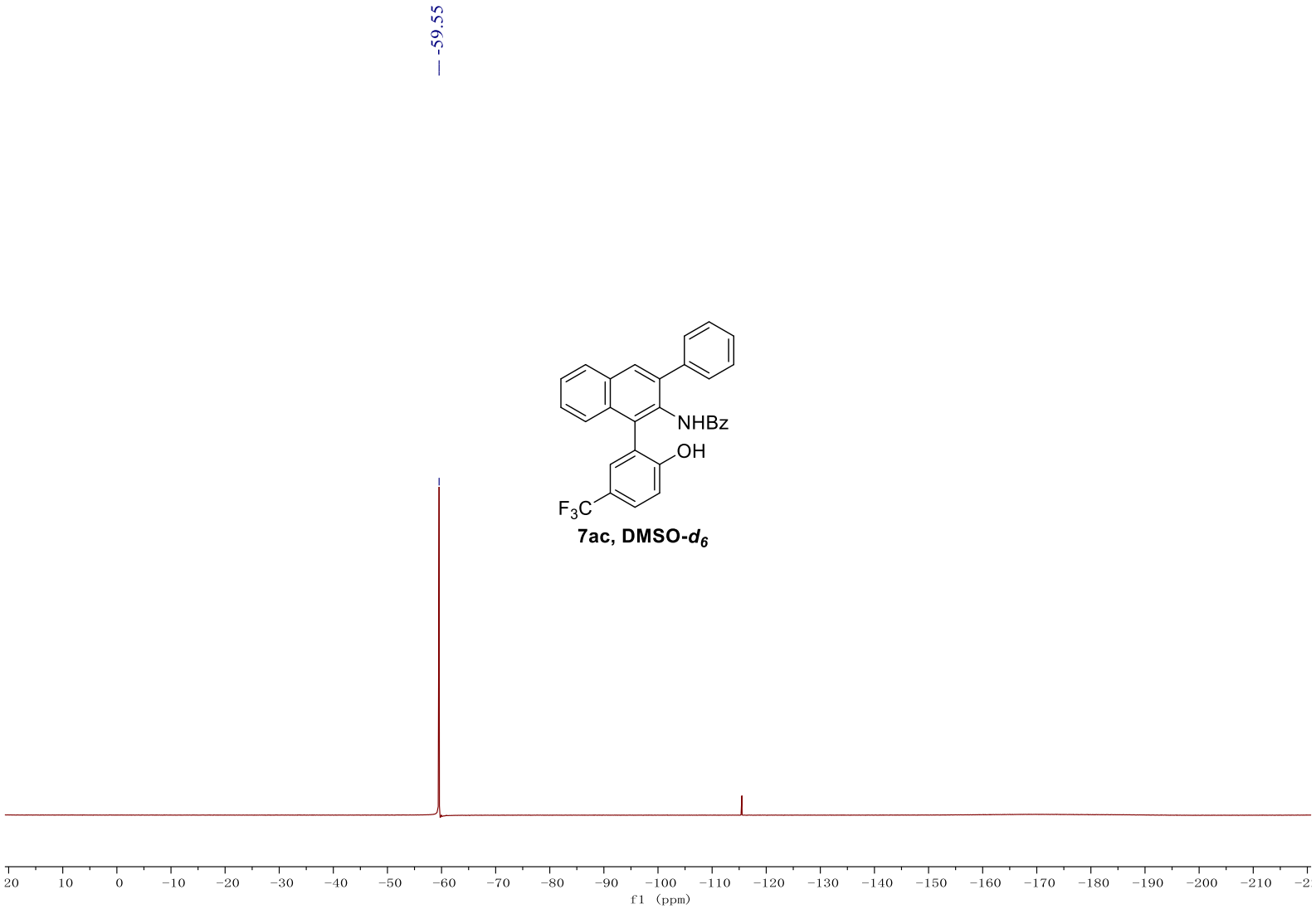

166.46
159.05
135.56
135.02
133.67
131.95
130.88
130.46
129.62
129.60
129.55
128.88
128.72
127.97
127.81
127.35
127.32
127.05
126.20
124.05
123.06
120.50
120.41
120.25
119.99
119.74
116.84
Br
NHBz
OH
F3C
7ab, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

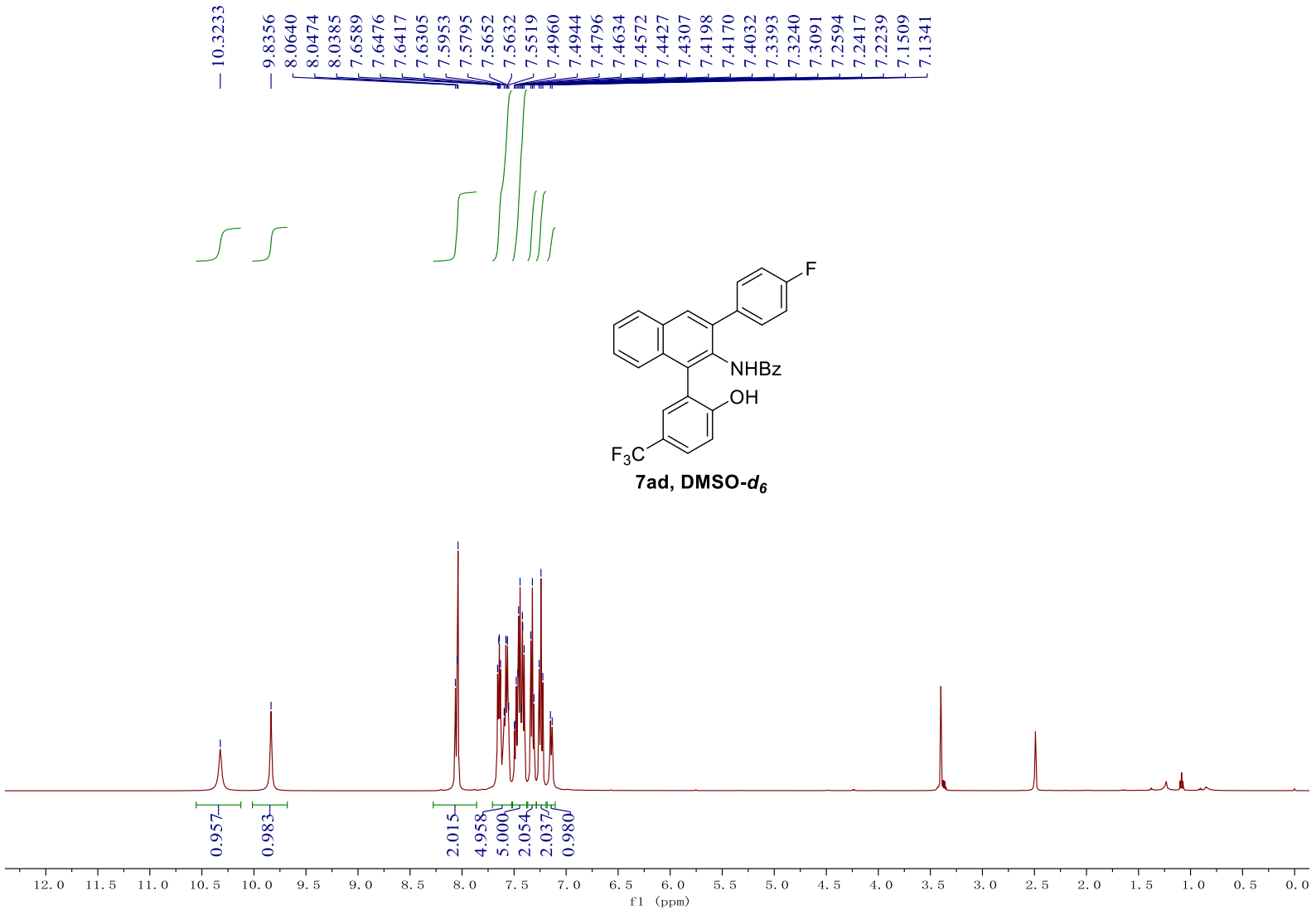

-59.60
Br
NHBz
OH
F3C
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)

7ab, DMSO-*d*$_6$

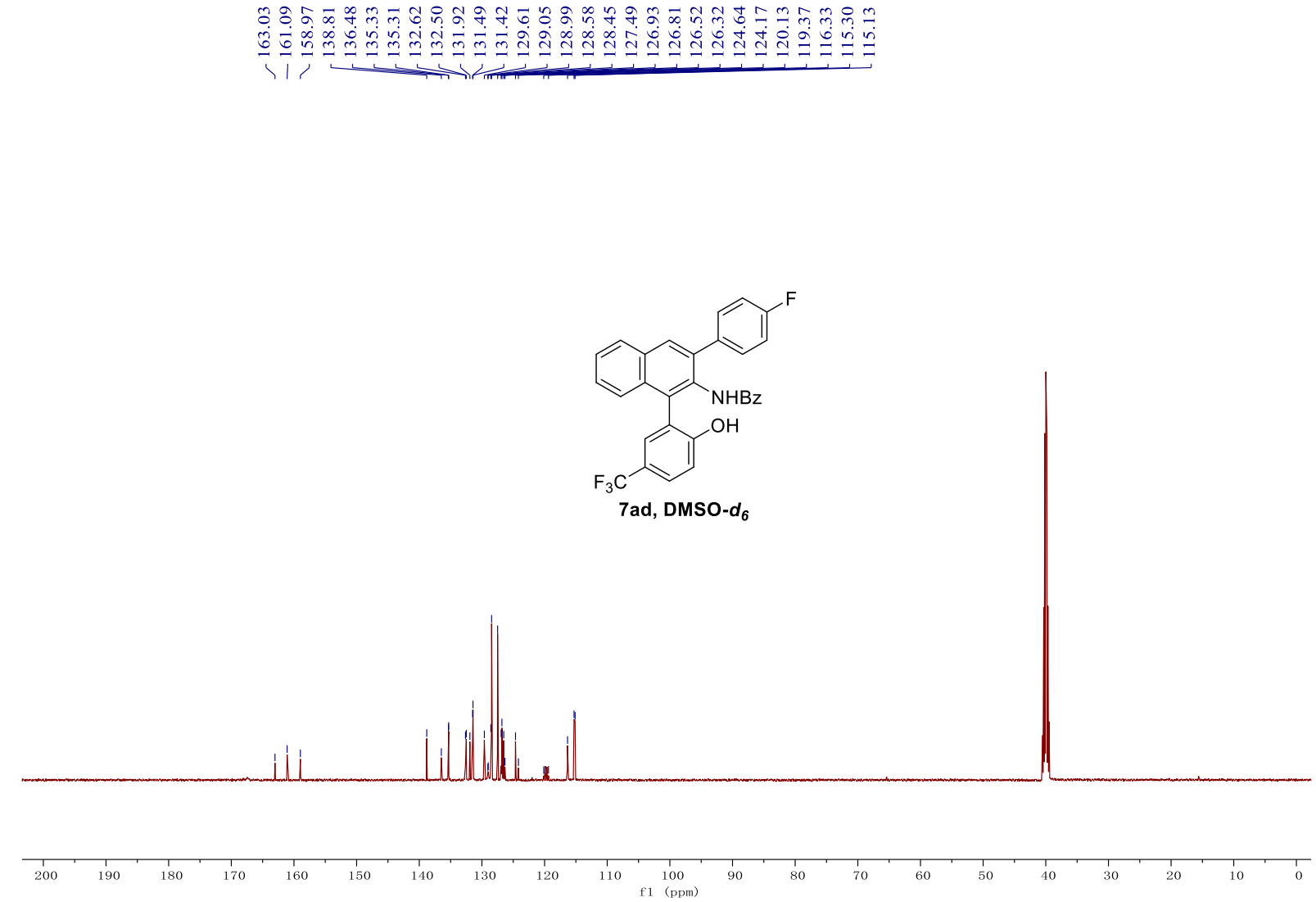

10.3006
9.8231
8.0651
8.0488
8.0345
7.6335
7.6310
7.6168
7.5711
7.5666
7.5572
7.5545
7.5494
7.5437
7.5413
7.4862
7.4839
7.4695
7.4670
7.4556
7.4528
7.4505
7.4362
7.4336
7.4191
7.4117
7.3969
7.3809
7.3242
7.3216
7.3059
7.2947
7.2912
7.1469
7.1299
NHBz
OH
F3C
7ac, DMSO-d6
0.964
0.973
1.992
2.974
2.108
7.000
3.014
1.018
12.0 11.5 11.0 10.5 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
f1 (ppm)

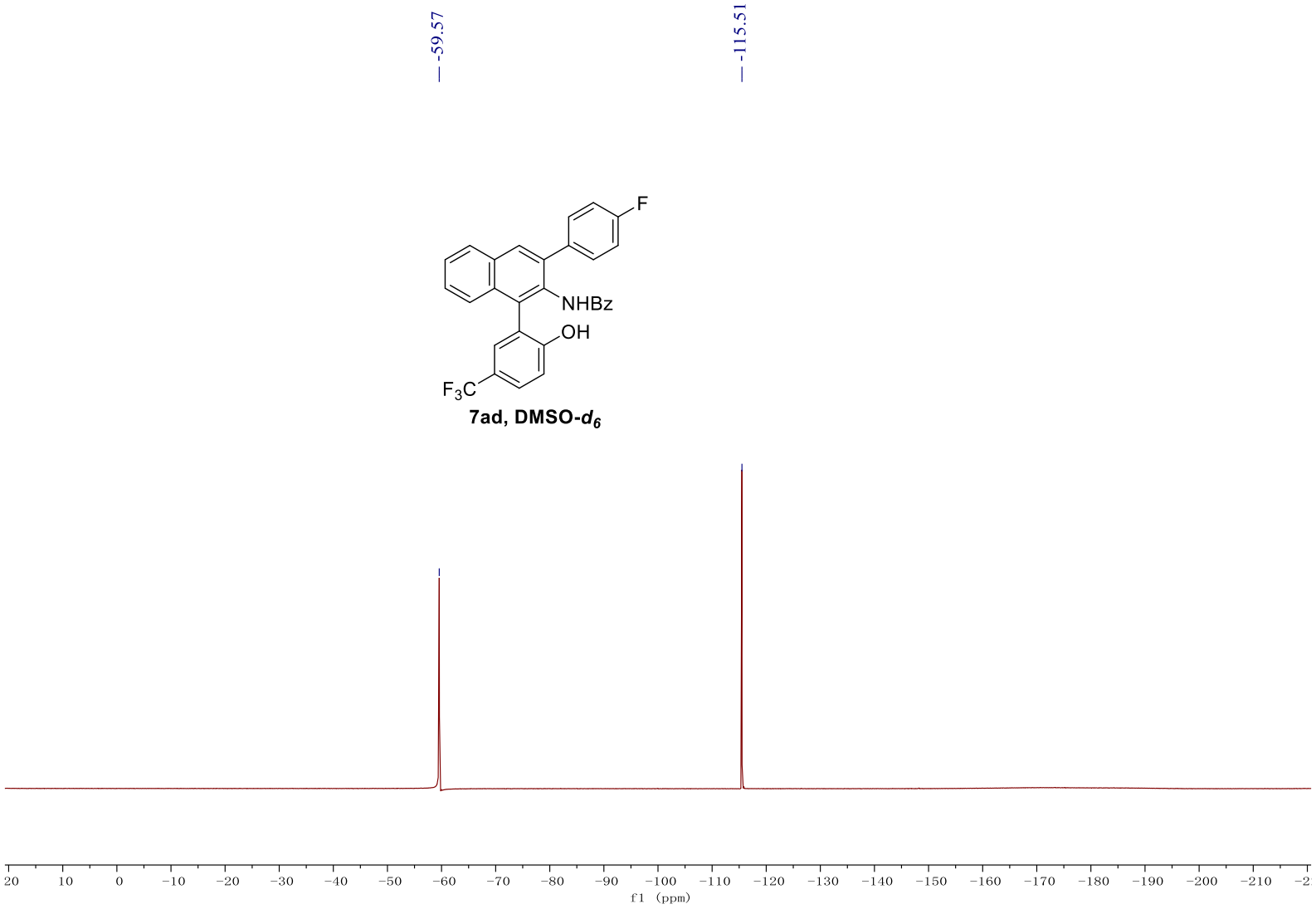

158.99
140.13
139.85
135.43
135.34
132.67
132.55
131.88
131.36
129.61
129.53
129.04
128.59
128.40
128.37
127.60
127.53
126.85
126.75
126.51
126.35
124.75
124.20
120.12
119.87
119.61
119.36
116.32
NHBz
OH
F3C
7ac, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

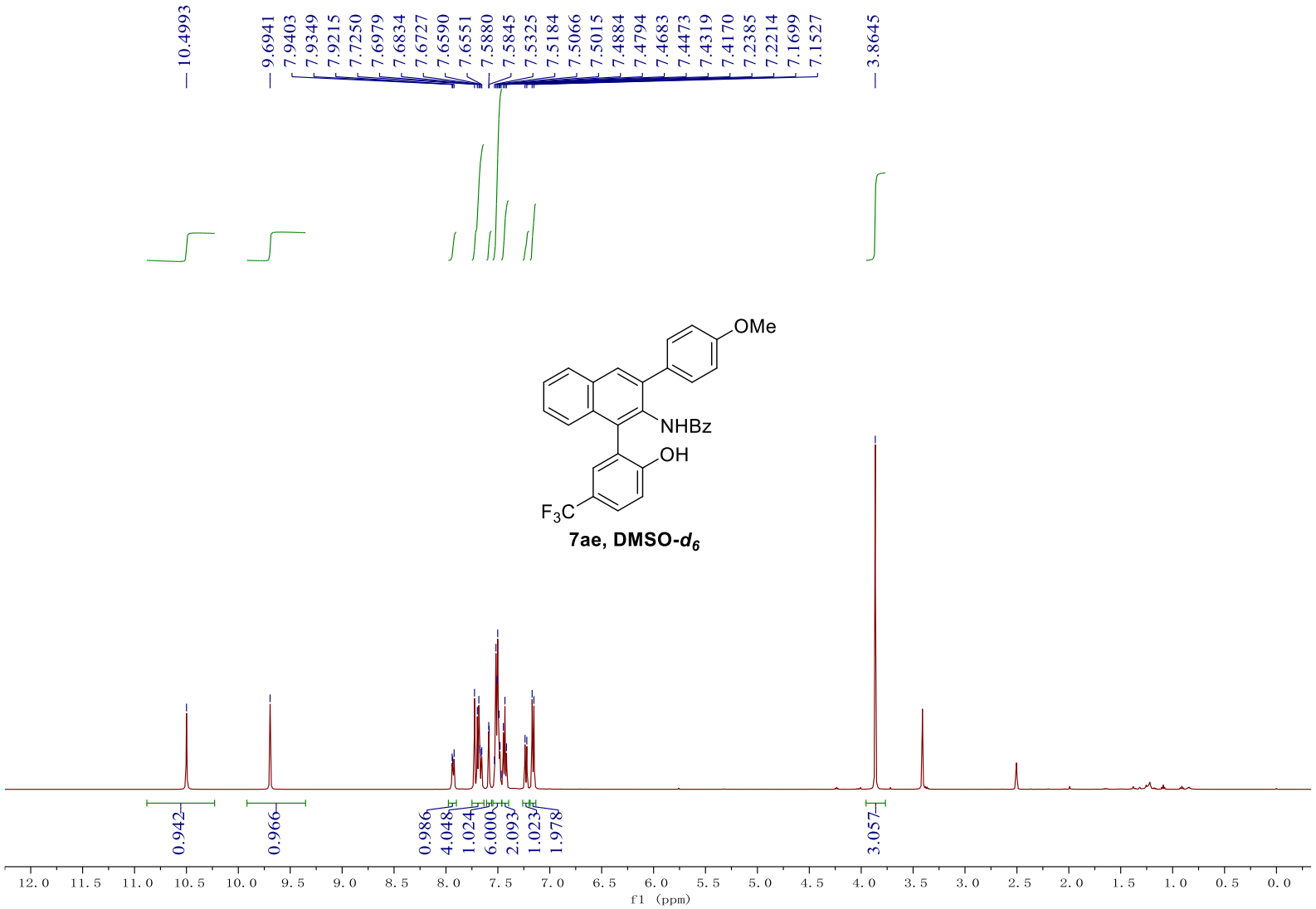

-59.55
NHBz
OH
F3C
7ac, DMSO-d6
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -2
f1 (ppm)


10.3233
9.8356
8.0640
8.0474
8.0385
7.6589
7.6476
7.6417
7.6305
7.5953
7.5795
7.5652
7.5632
7.5519
7.4960
7.4944
7.4796
7.4634
7.4572
7.4427
7.4307
7.4198
7.4170
7.4032
7.3393
7.3240
7.3091
7.2594
7.2417
7.2239
7.1509
7.1341
F
NHBz
OH
F3C
0.957
0.983
2.015
4.958
5.000
2.054
2.037
0.980
f1 (ppm)

7ad, DMSO-*d*$_6$


163.03
161.09
158.97
138.81
136.48
135.33
135.31
132.62
132.50
131.92
131.49
131.42
129.61
129.05
128.99
128.58
128.45
127.49
126.93
126.81
126.52
126.32
124.64
124.17
120.13
119.37
116.33
115.30
115.13
F
NHBz
OH
F3C
7ad, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-59.57
-115.51
F
NHBz
OH
F3C
7ad, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)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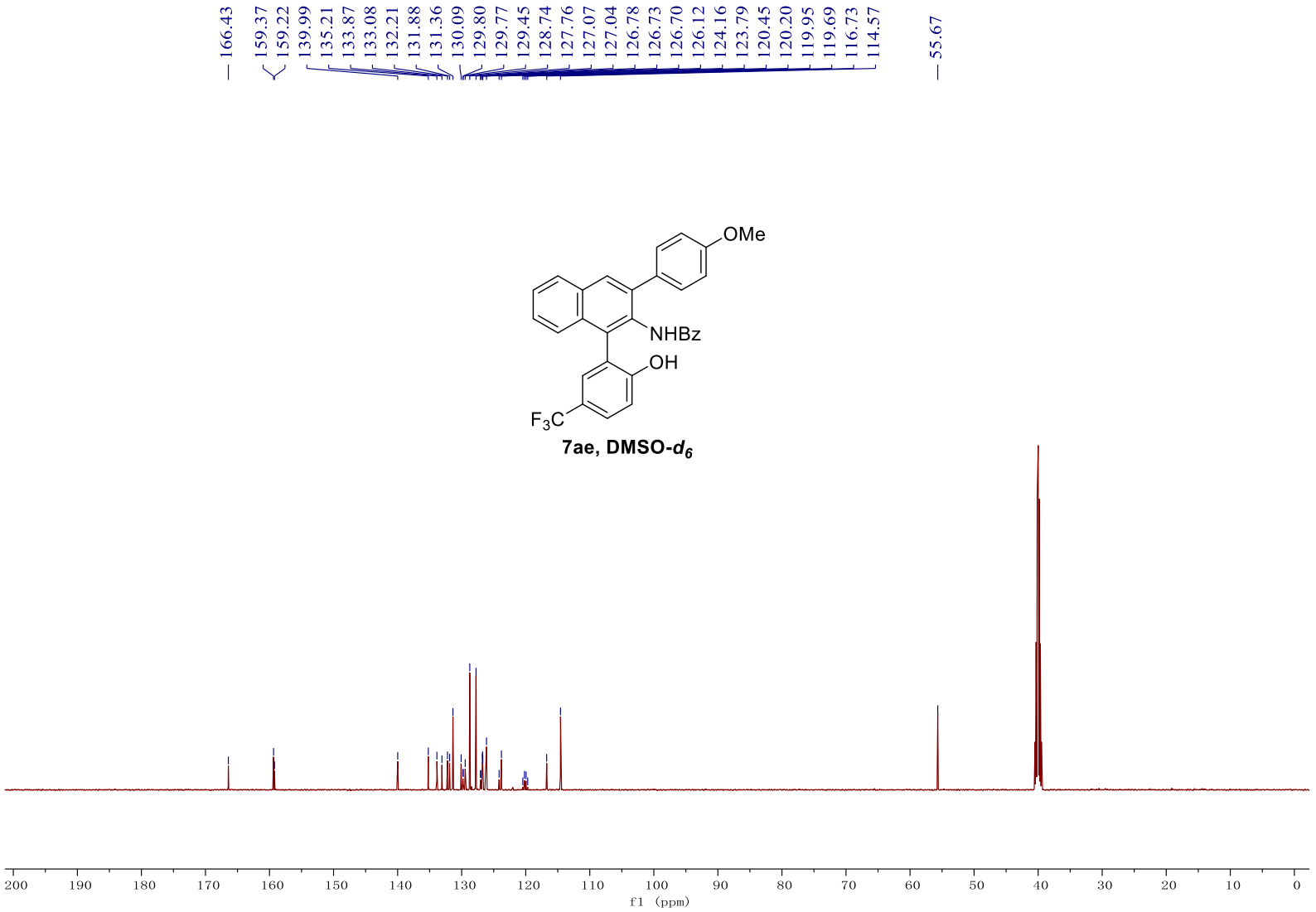
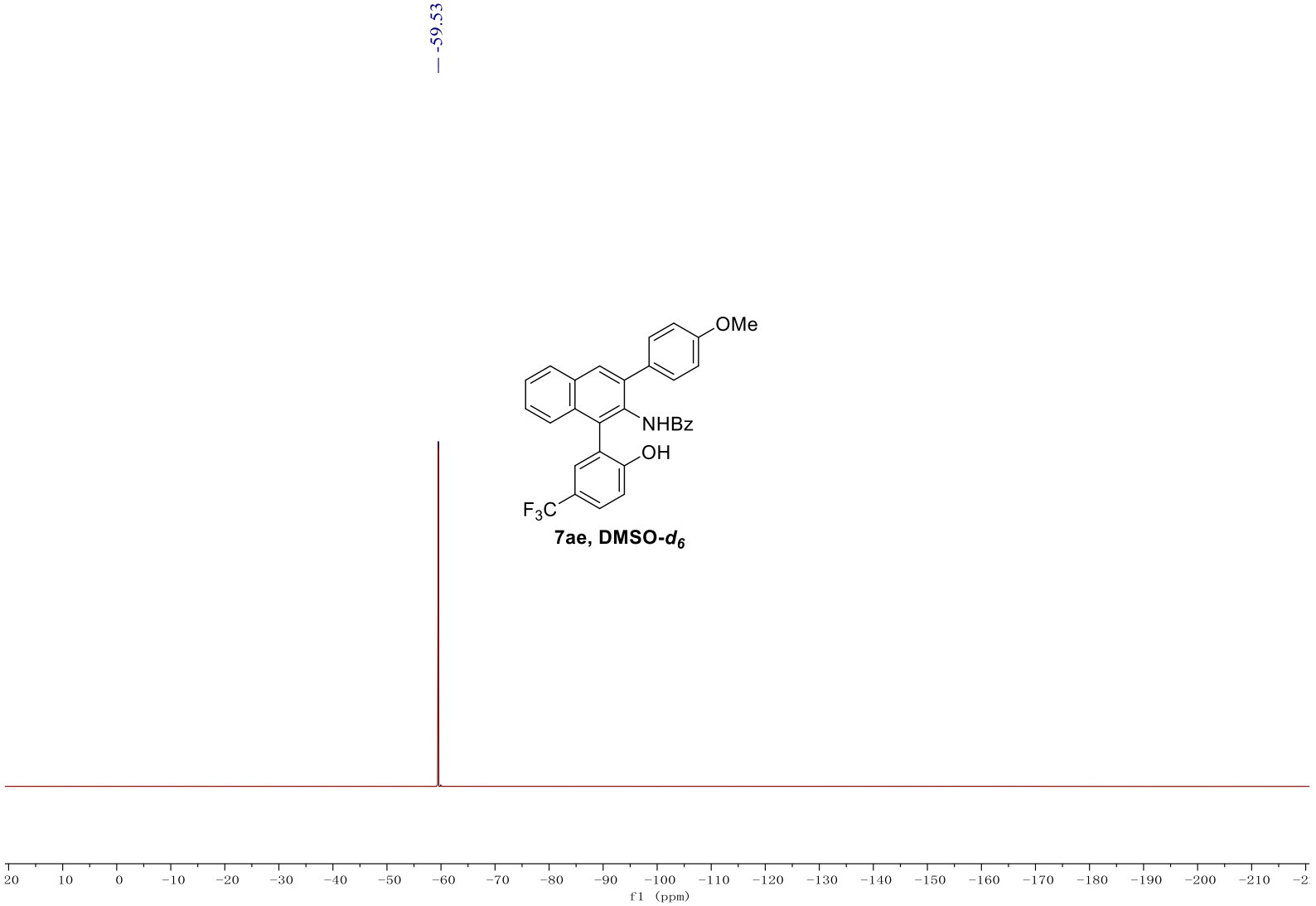
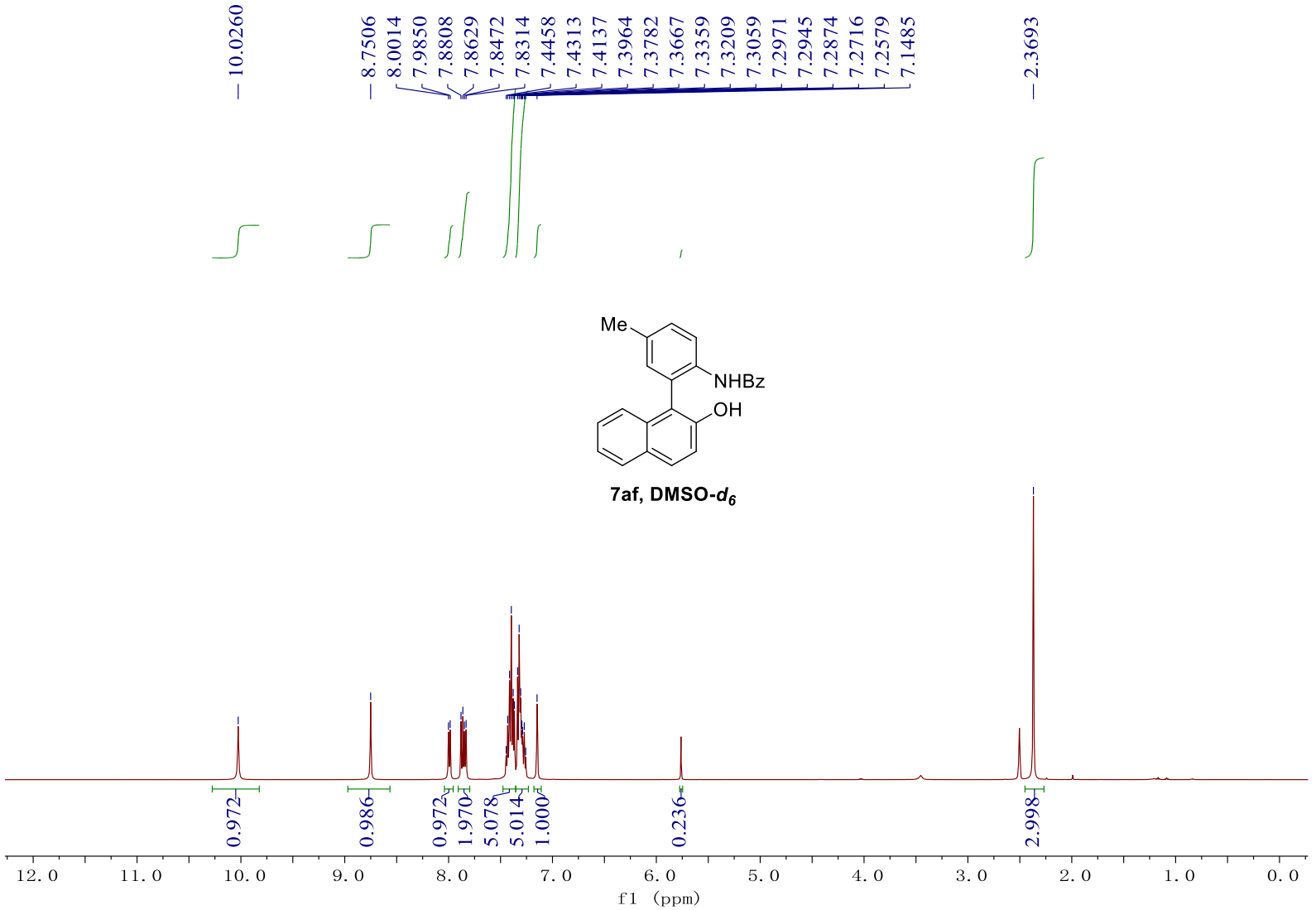
9.6941
7.9403
7.9349
7.9215
7.7250
7.6979
7.6834
7.6727
7.6590
7.6551
7.5880
7.5845
7.5325
7.5184
7.5066
7.5015
7.4884
7.4794
7.4683
7.4473
7.4319
7.4170
7.2385
7.2214
7.1699
7.1527
3.8645
OMe
NHBz
OH
F3C
7ae, DMSO-d6
0.942
0.966
0.986
4.048
1.024
6.000
2.093
1.023
1.978
3.057
f1 (ppm)


166.43
159.37
159.22
139.99
135.21
133.87
133.08
132.21
131.88
131.36
130.09
129.80
129.77
129.45
128.74
127.76
127.07
127.04
126.78
126.73
126.70
126.12
124.16
123.79
120.45
120.20
119.95
119.69
116.73
114.57
55.67
OMe
NHBz
OH
F3C
7ae, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-59.53
OMe
NHBz
OH
F3C
7ae, DMSO-d6
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)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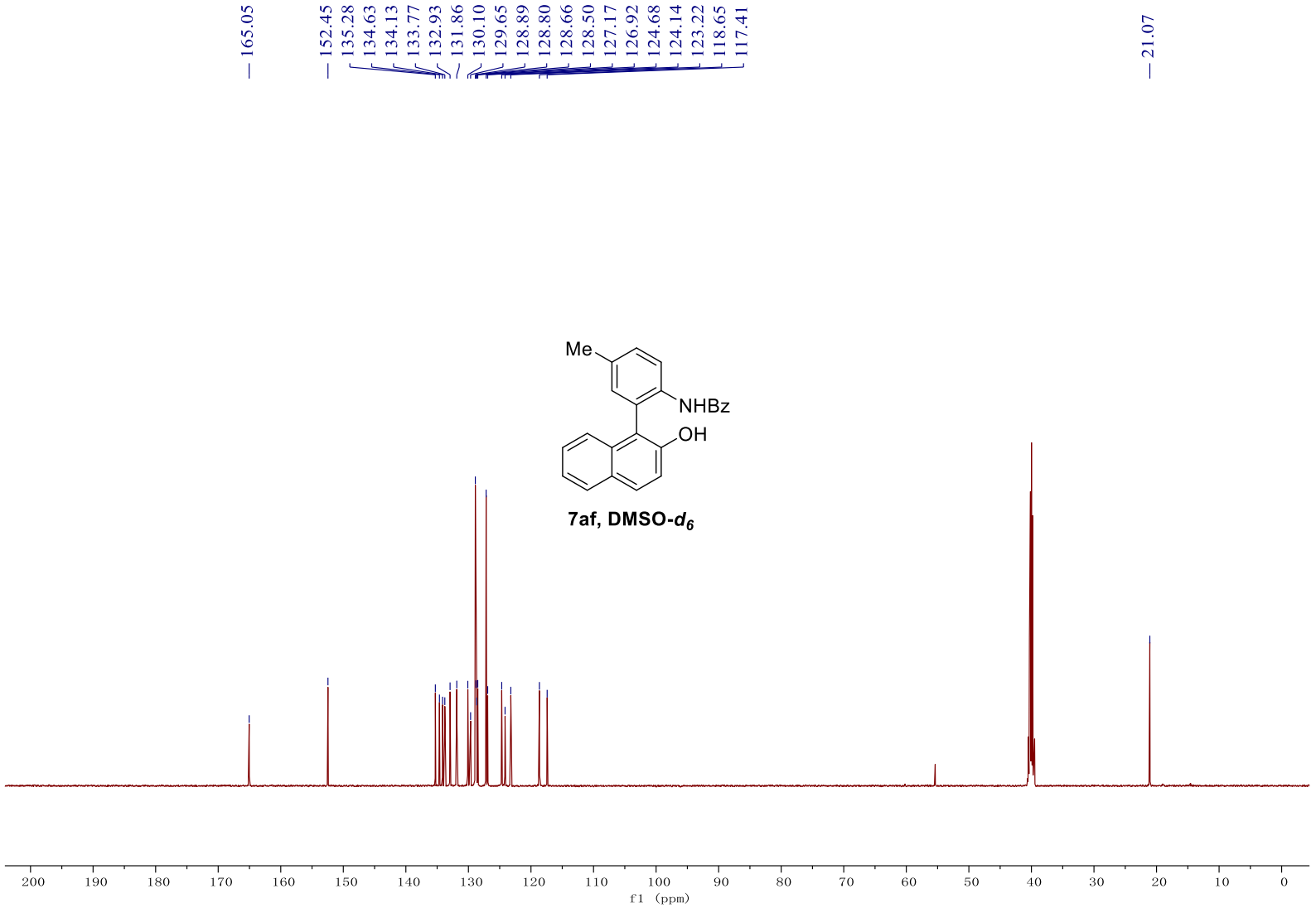
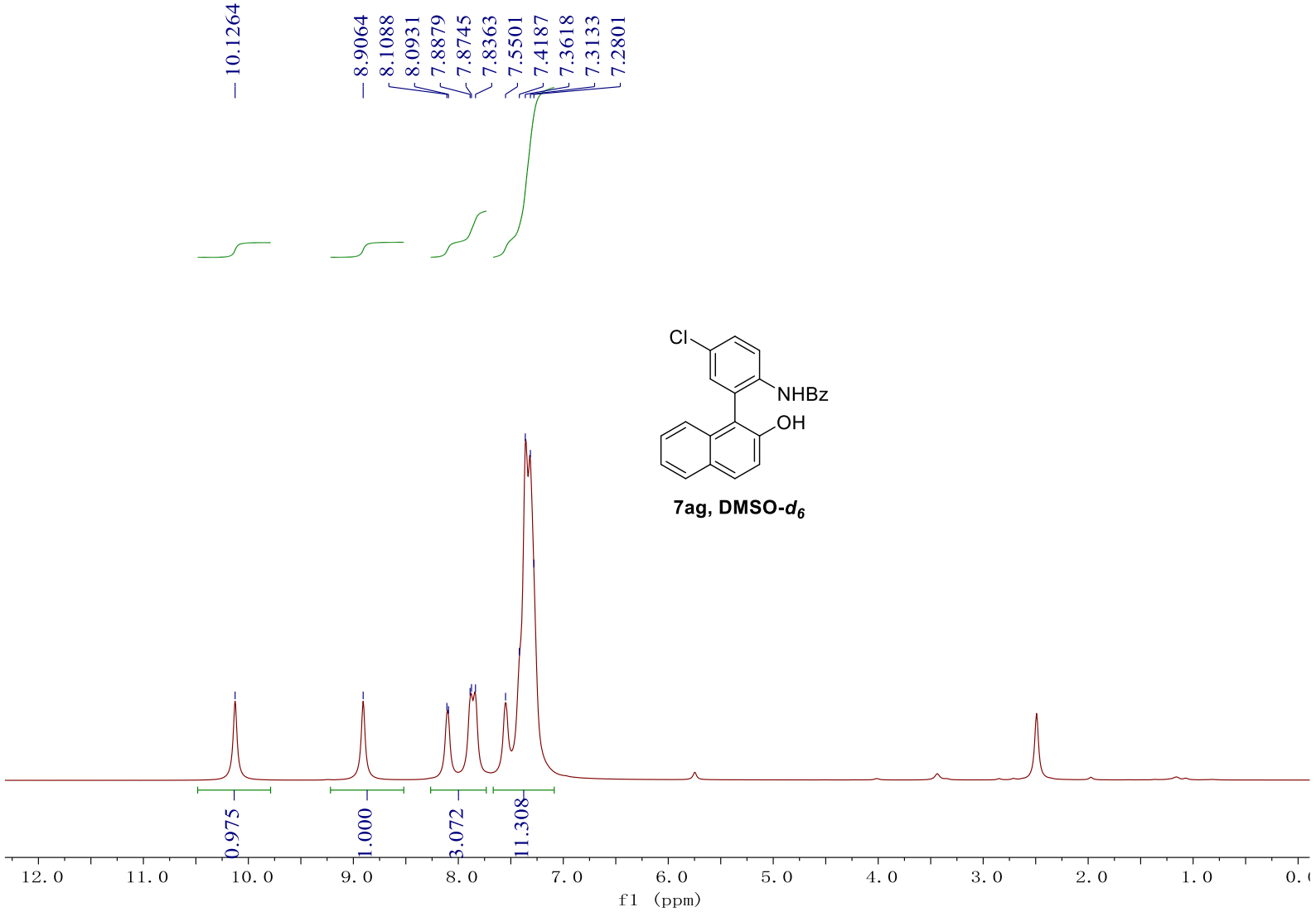
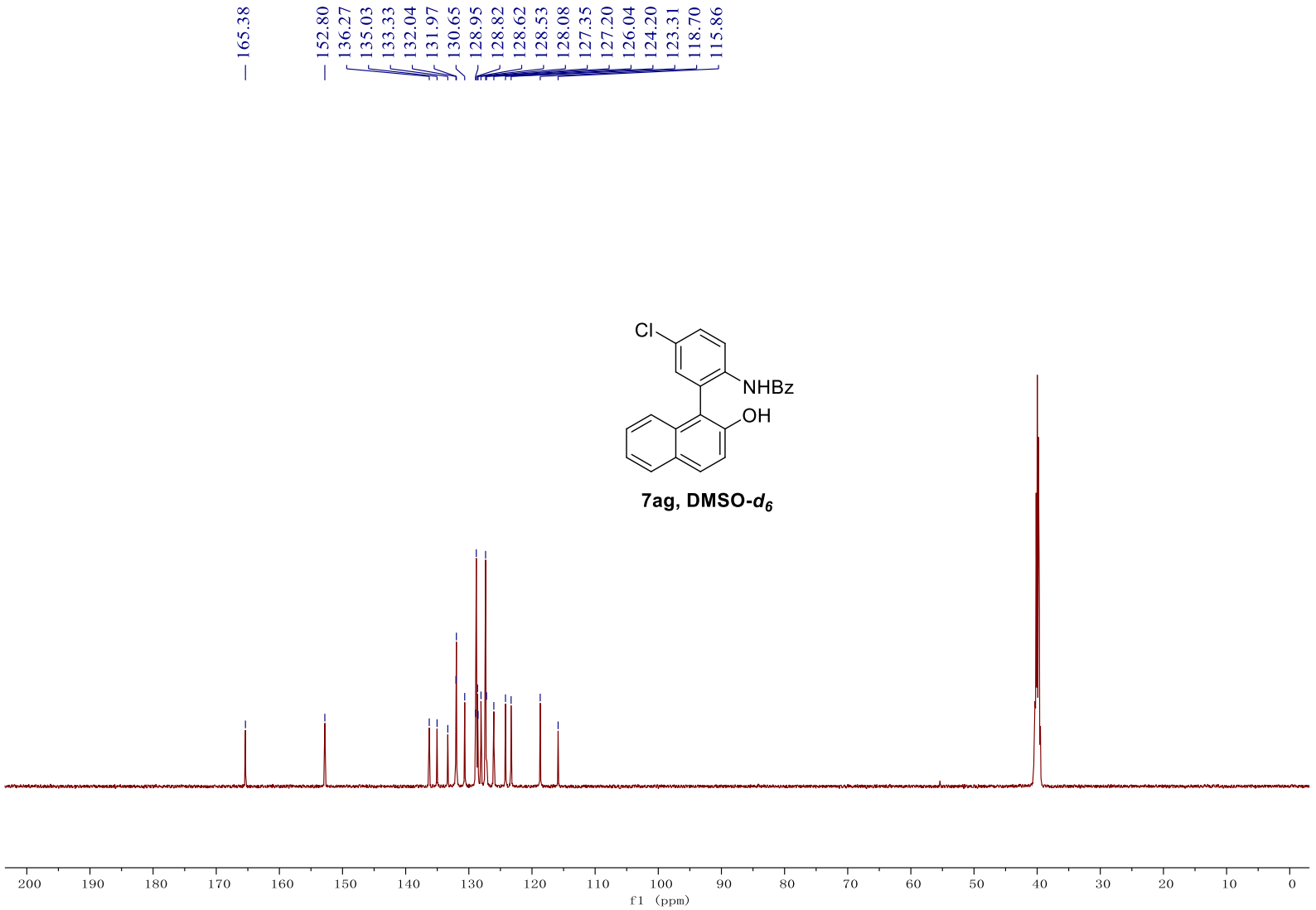
8.7506
8.0014
7.9850
7.8808
7.8629
7.8472
7.8314
7.4458
7.4313
7.4137
7.3964
7.3782
7.3667
7.3359
7.3209
7.3059
7.2971
7.2945
7.2874
7.2716
7.2579
7.1485
2.3693
Me
NHBz
OH
0.972
0.986
0.972
1.970
5.078
5.014
1.000
0.236
2.998
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

7af, DMSO-d_6


165.05
152.45
135.28
134.63
134.13
133.77
132.93
131.86
130.10
129.65
128.89
128.80
128.66
128.50
127.17
126.92
124.68
124.14
123.22
118.65
117.41
21.07
Me
NHBz
OH
7af, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


10.1264
8.9064
8.1088
8.0931
7.8879
7.8745
7.8363
7.5501
7.4187
7.3618
7.3133
7.2801
Cl
NHBz
OH
7ag, DMSO-d6
0.975
1.000
3.072
11.308
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
f1 (ppm)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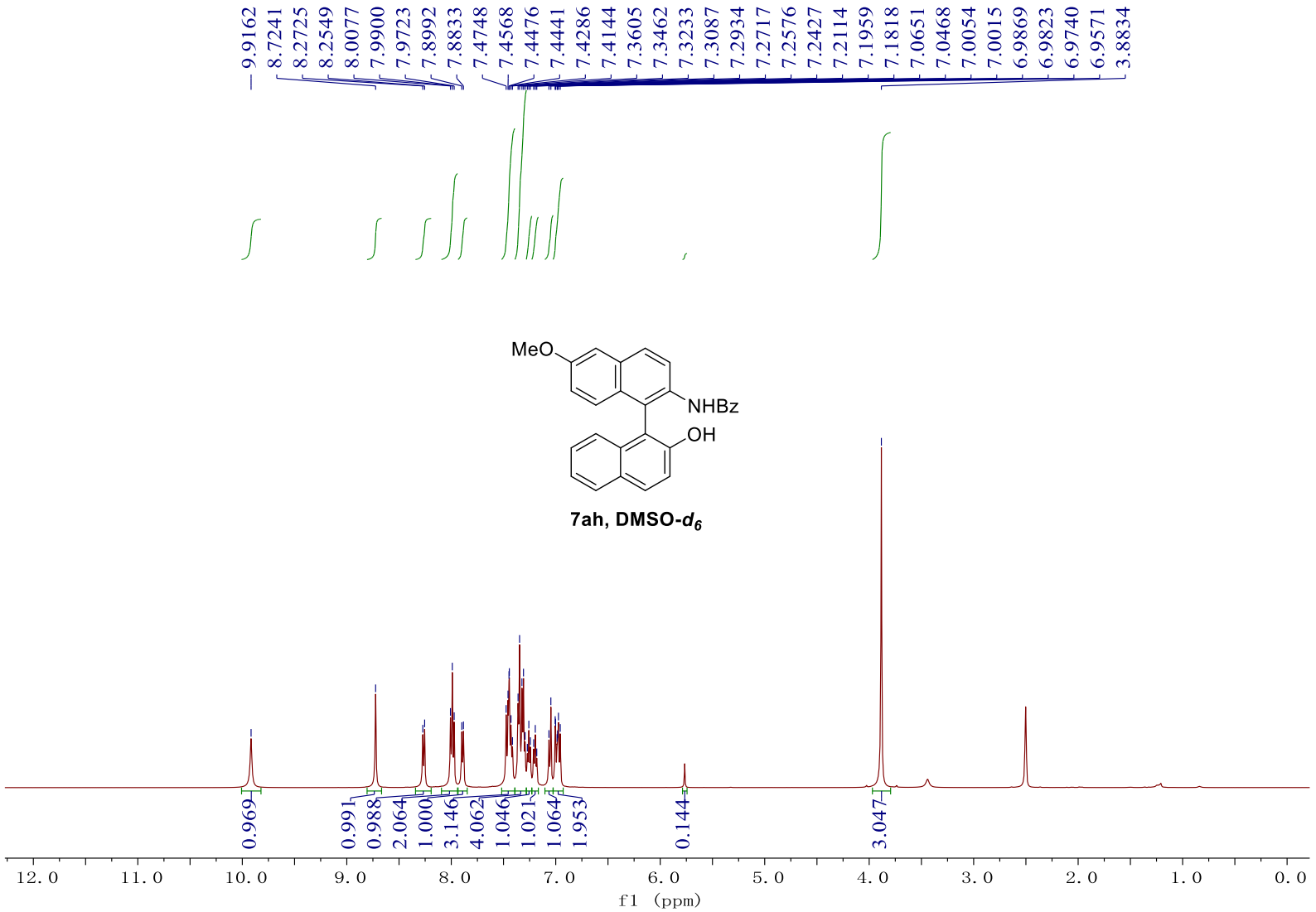
152.80
136.27
135.03
133.33
132.04
131.97
130.65
128.95
128.82
128.62
128.53
128.08
127.35
127.20
126.04
124.20
123.31
118.70
115.86
Cl
NHBz
OH
7ag, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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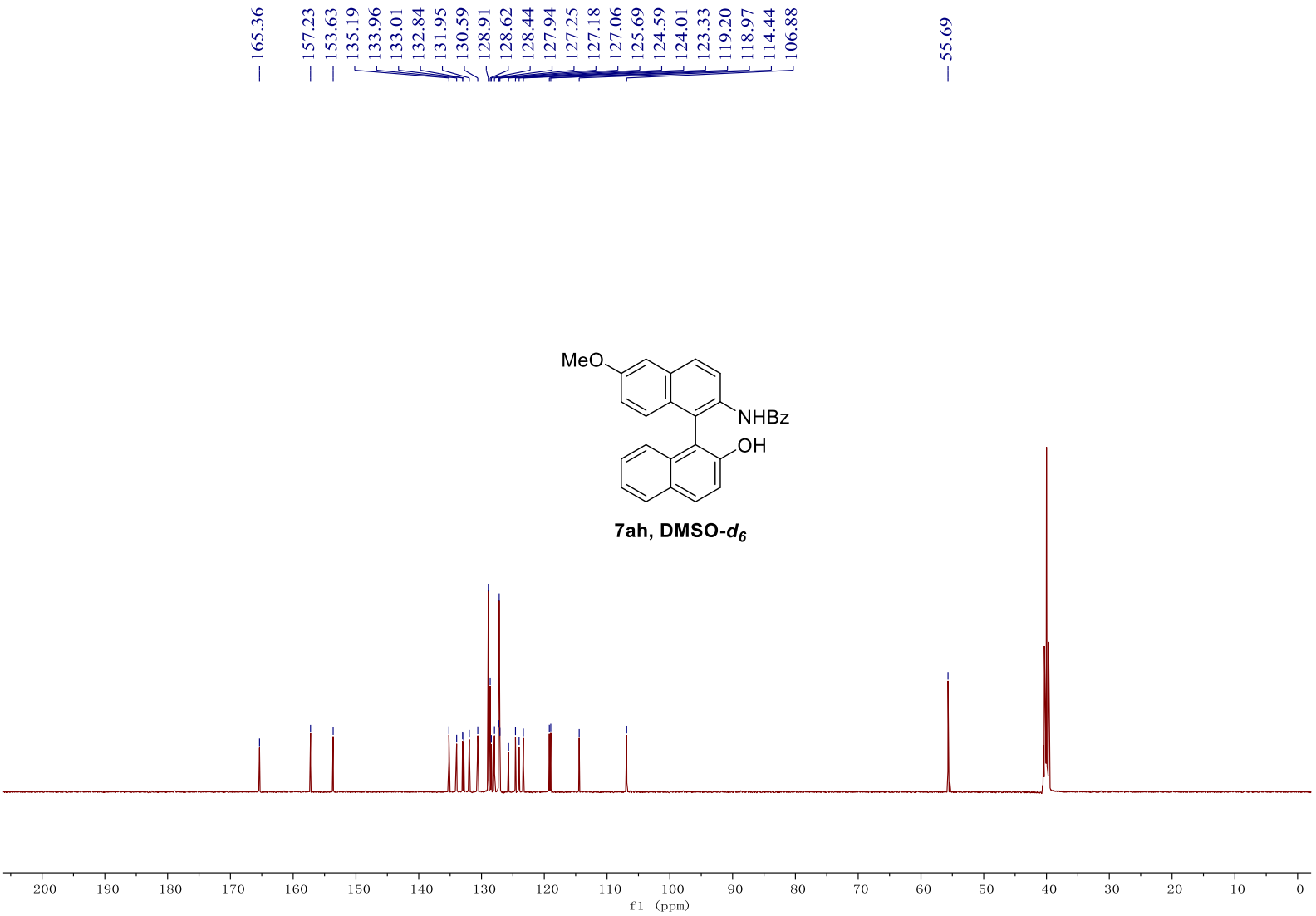
8.7241
8.2725
8.2549
8.0077
7.9900
7.9723
7.8992
7.8833
7.4748
7.4568
7.4476
7.4441
7.4286
7.4144
7.3605
7.3462
7.3233
7.3087
7.2934
7.2717
7.2576
7.2427
7.2114
7.1959
7.1818
7.0651
7.0468
7.0054
7.0015
6.9869
6.9823
6.9740
6.9571
3.8834
MeO
NHBz
OH
7ah, DMSO-d6
0.969
0.991
0.988
2.064
1.000
3.146
4.062
1.046
1.021
1.064
1.953
0.144
3.047
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)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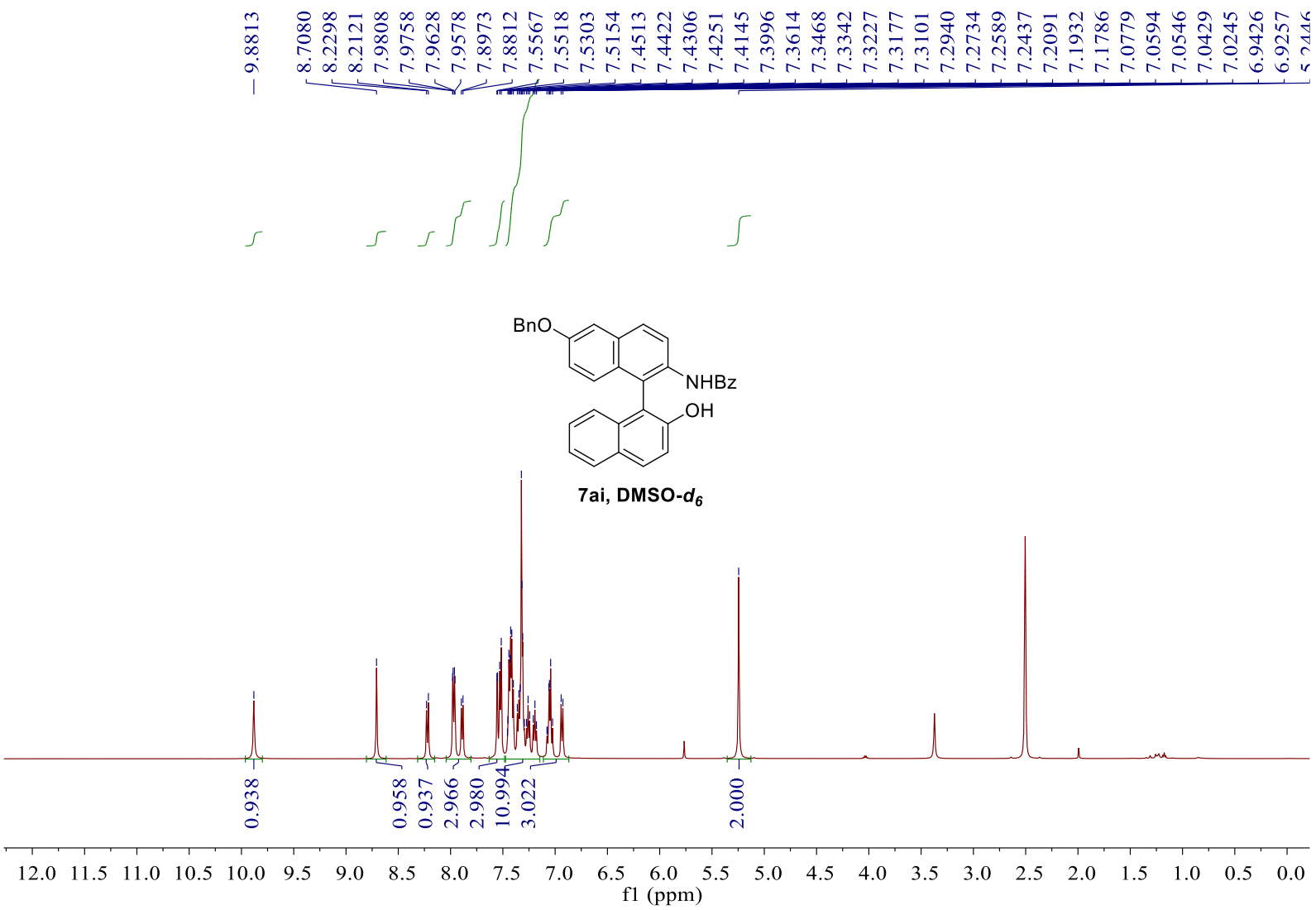
157.23
153.63
135.19
133.96
133.01
132.84
131.95
130.59
128.91
128.62
128.44
127.94
127.25
127.18
127.06
125.69
124.59
124.01
123.33
119.20
118.97
114.44
106.88
55.69
MeO
NHBz
OH
7ah, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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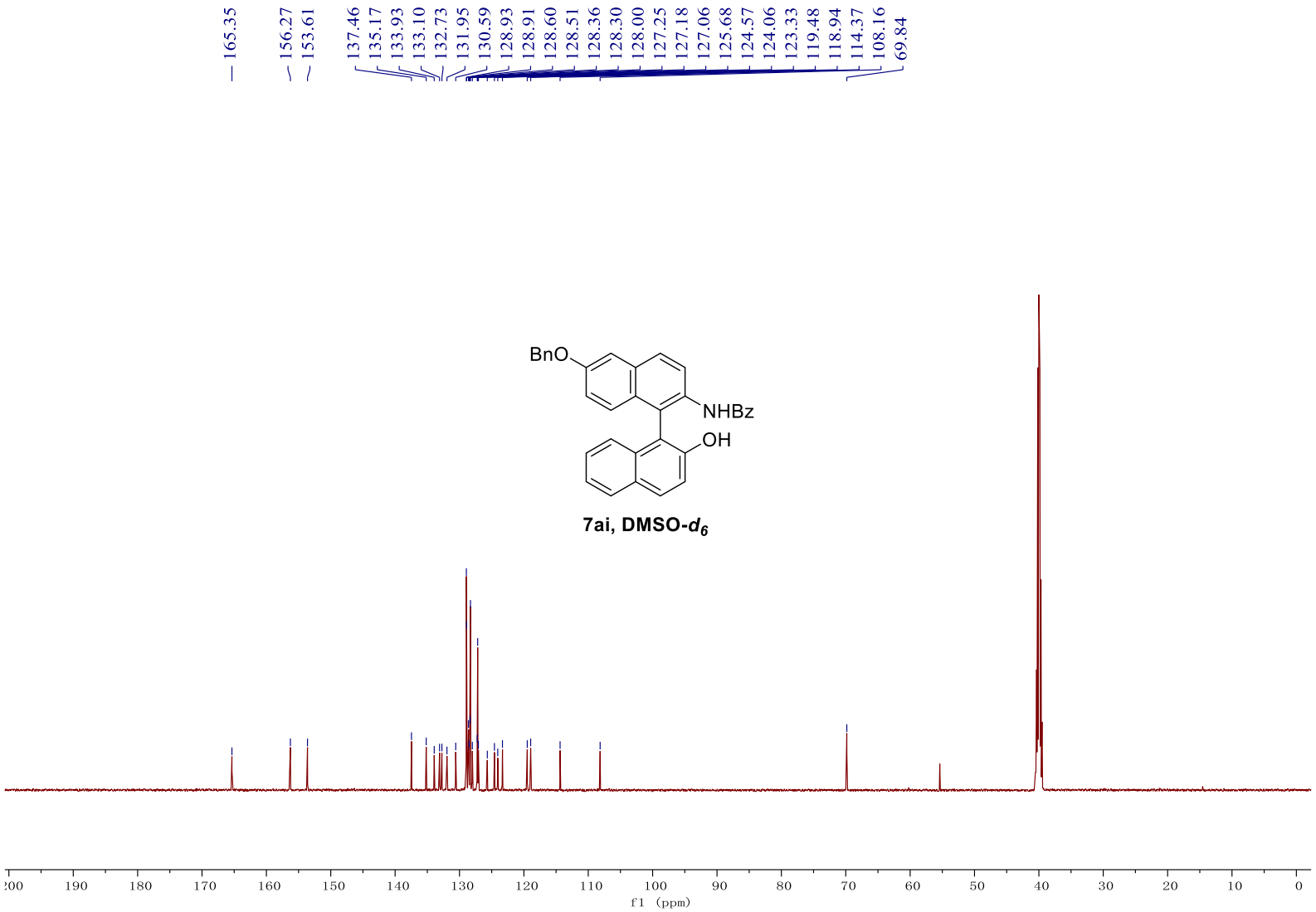
8.2298
8.2121
7.9808
7.9758
7.9628
7.9578
7.8973
7.8812
7.5567
7.5518
7.5303
7.5154
7.4513
7.4422
7.4306
7.4251
7.4145
7.3996
7.3614
7.3468
7.3342
7.3227
7.3177
7.3101
7.2940
7.2734
7.2589
7.2437
7.2091
7.1932
7.1786
7.0779
7.0594
7.0546
7.0429
7.0245
6.9426
6.9257
BnO
NHBz
OH
7ai, DMSO-d6
0.938
0.958
0.937
2.966
2.980
10.994
3.022
2.000
12.0 11.5 11.0 10.5 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
f1 (ppm)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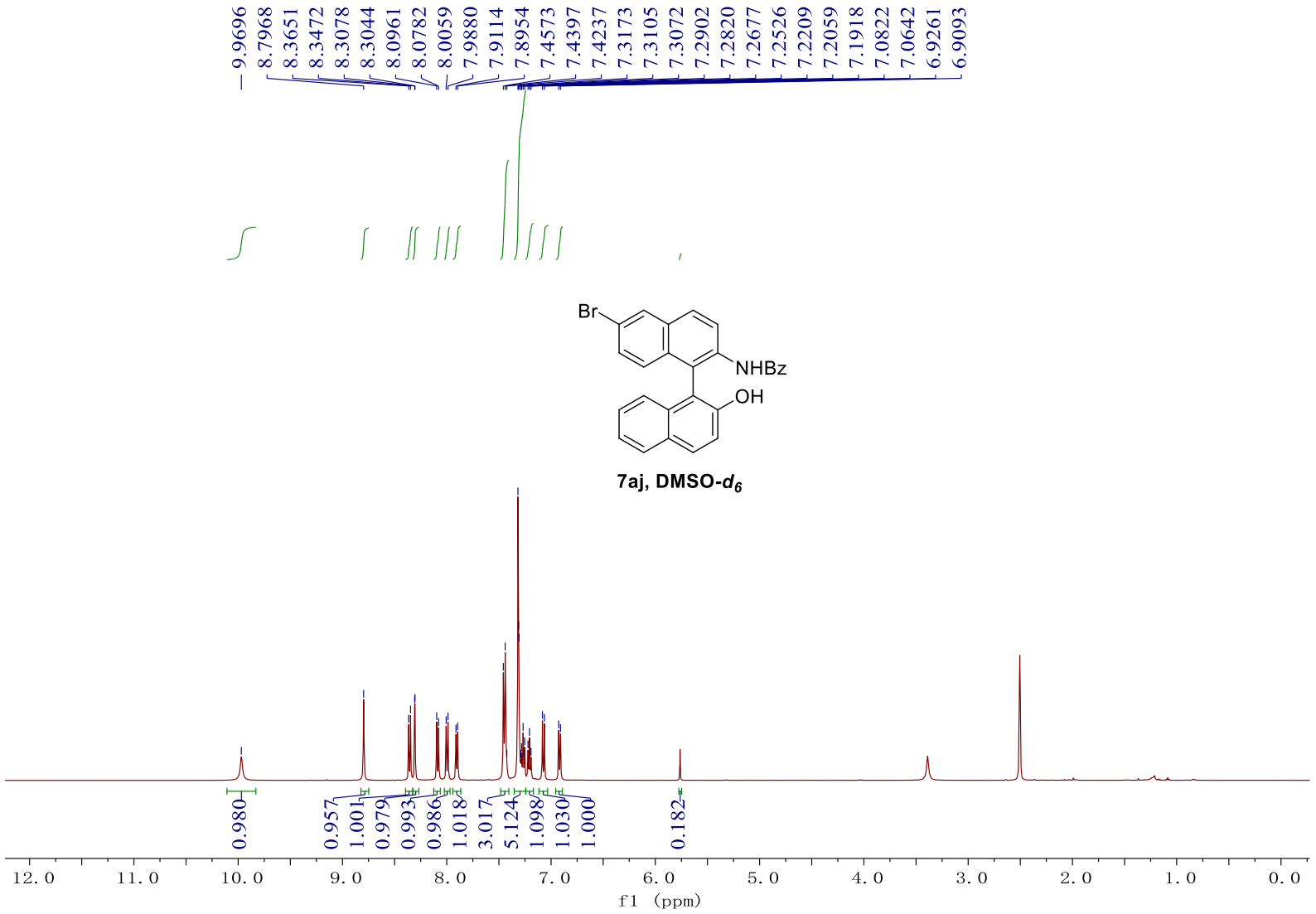
156.27
153.61
137.46
135.17
133.93
133.10
132.73
131.95
130.59
128.93
128.91
128.60
128.51
128.36
128.30
128.00
127.25
127.18
127.06
125.68
124.57
124.06
123.33
119.48
118.94
114.37
108.16
69.84
BnO
NHBz
OH
7ai, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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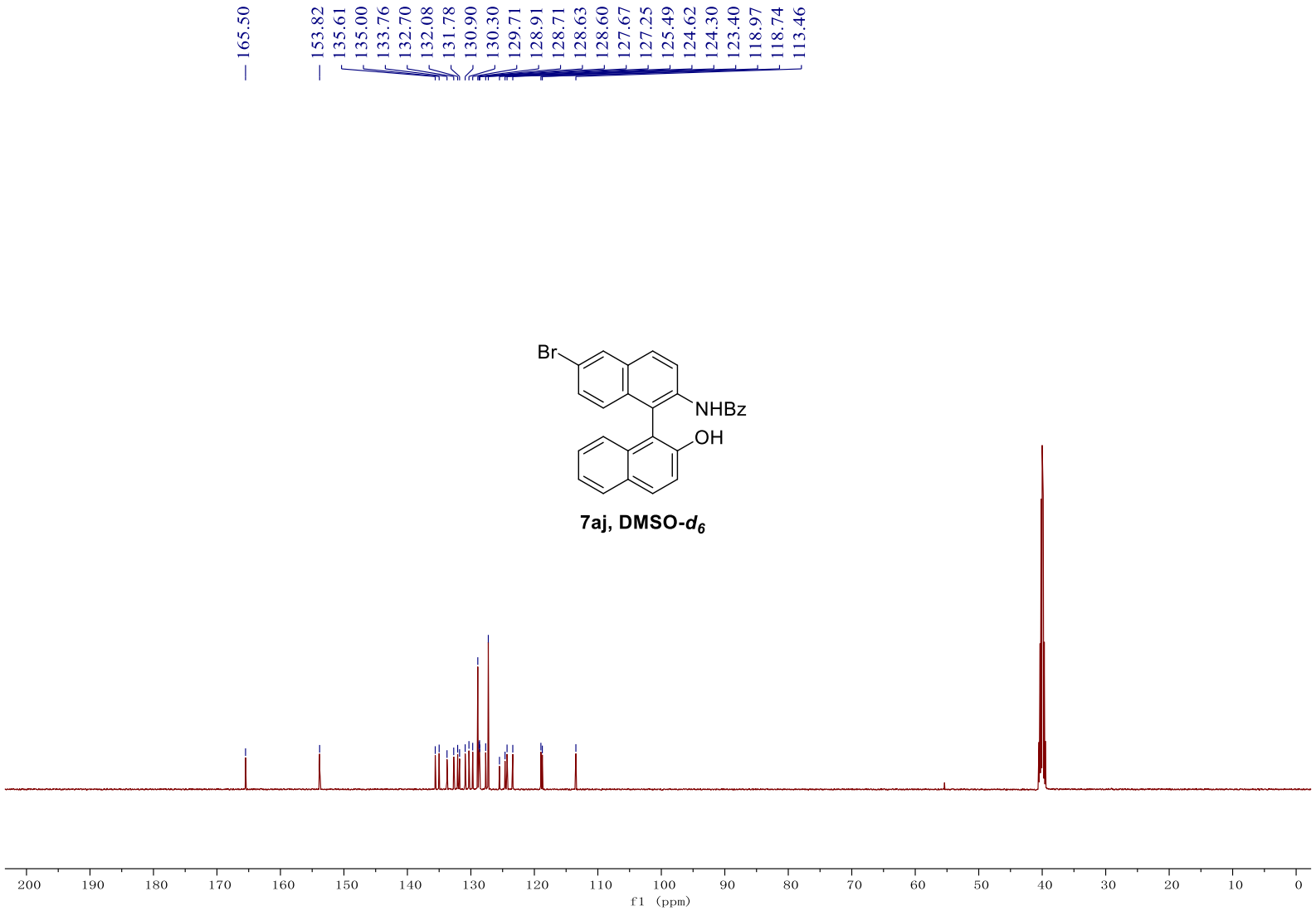
8.7968
8.3651
8.3472
8.3078
8.3044
8.0961
8.0782
8.0059
7.9880
7.9114
7.8954
7.4573
7.4397
7.4237
7.3173
7.3105
7.3072
7.2902
7.2820
7.2677
7.2526
7.2209
7.2059
7.1918
7.0822
7.0642
6.9261
6.9093
Br
NHBz
OH
7aj, DMSO-d6
0.980
0.957
1.001
0.979
0.993
0.986
1.018
3.017
5.124
1.098
1.030
1.000
0.182
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)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153.82
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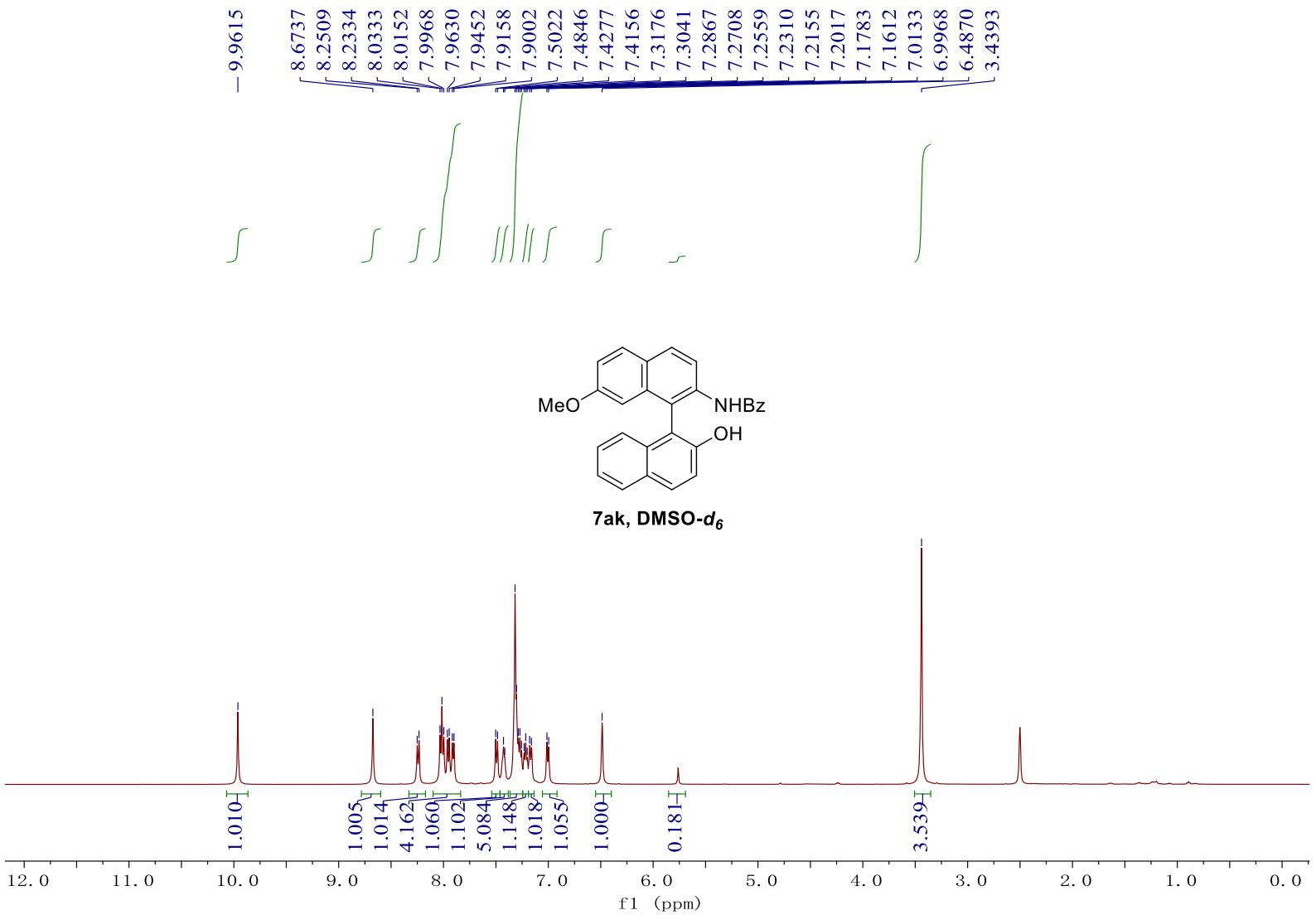
132.70
132.08
131.78
130.90
130.30
129.71
128.91
128.71
128.63
128.60
127.67
127.25
125.49
124.62
124.30
123.40
118.97
118.74
113.46
Br
NHBz
OH
7aj, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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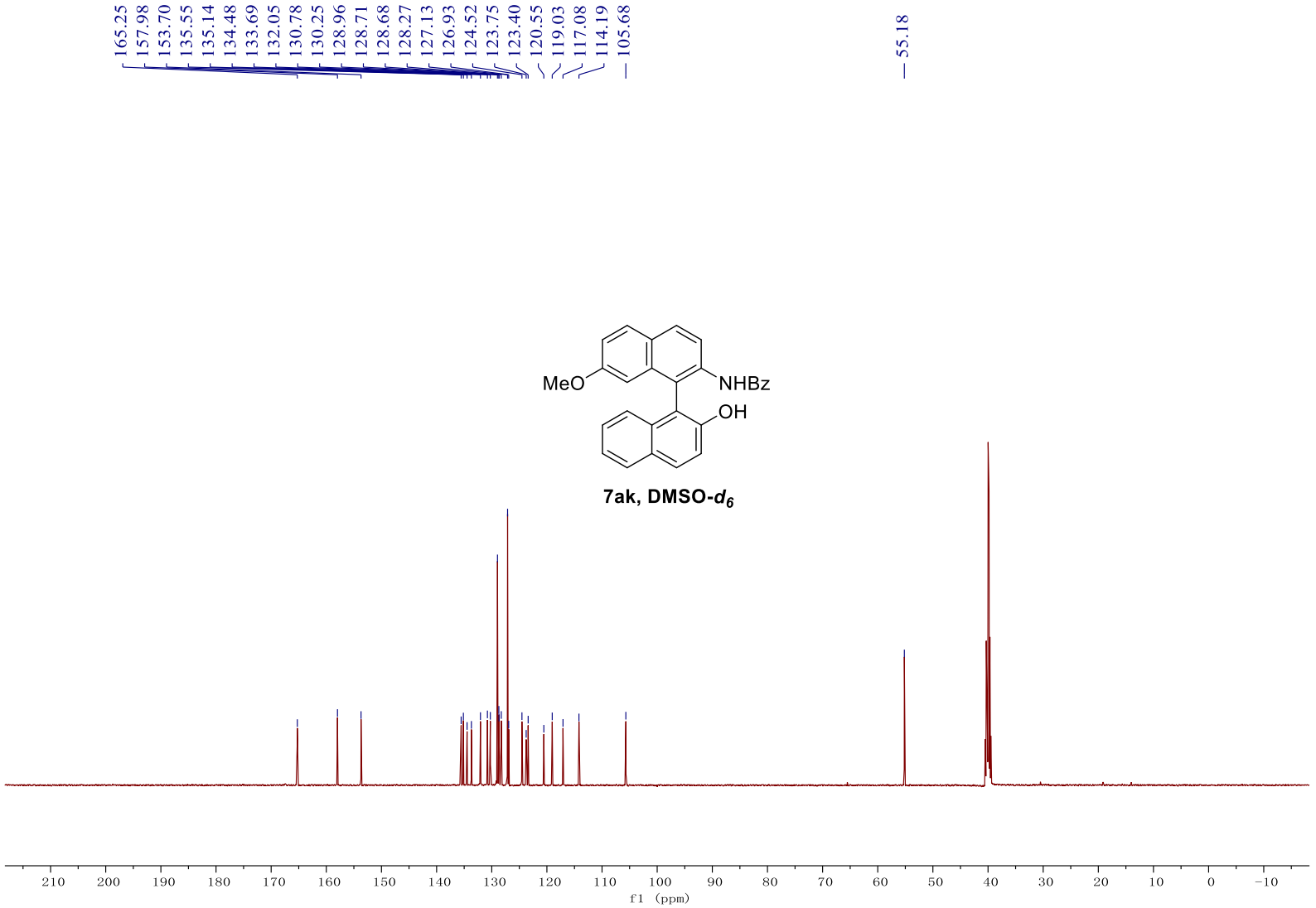
8.2334
8.0333
8.0152
7.9968
7.9630
7.9452
7.9158
7.9002
7.5022
7.4846
7.4277
7.4156
7.3176
7.3041
7.2867
7.2708
7.2559
7.2310
7.2155
7.2017
7.1783
7.1612
7.0133
6.9968
6.4870
3.4393
MeO
NHBz
OH
1.010
1.005
1.014
4.162
1.060
1.102
5.084
1.148
1.018
1.055
1.000
0.181
3.539
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

7ak, DMSO-d_6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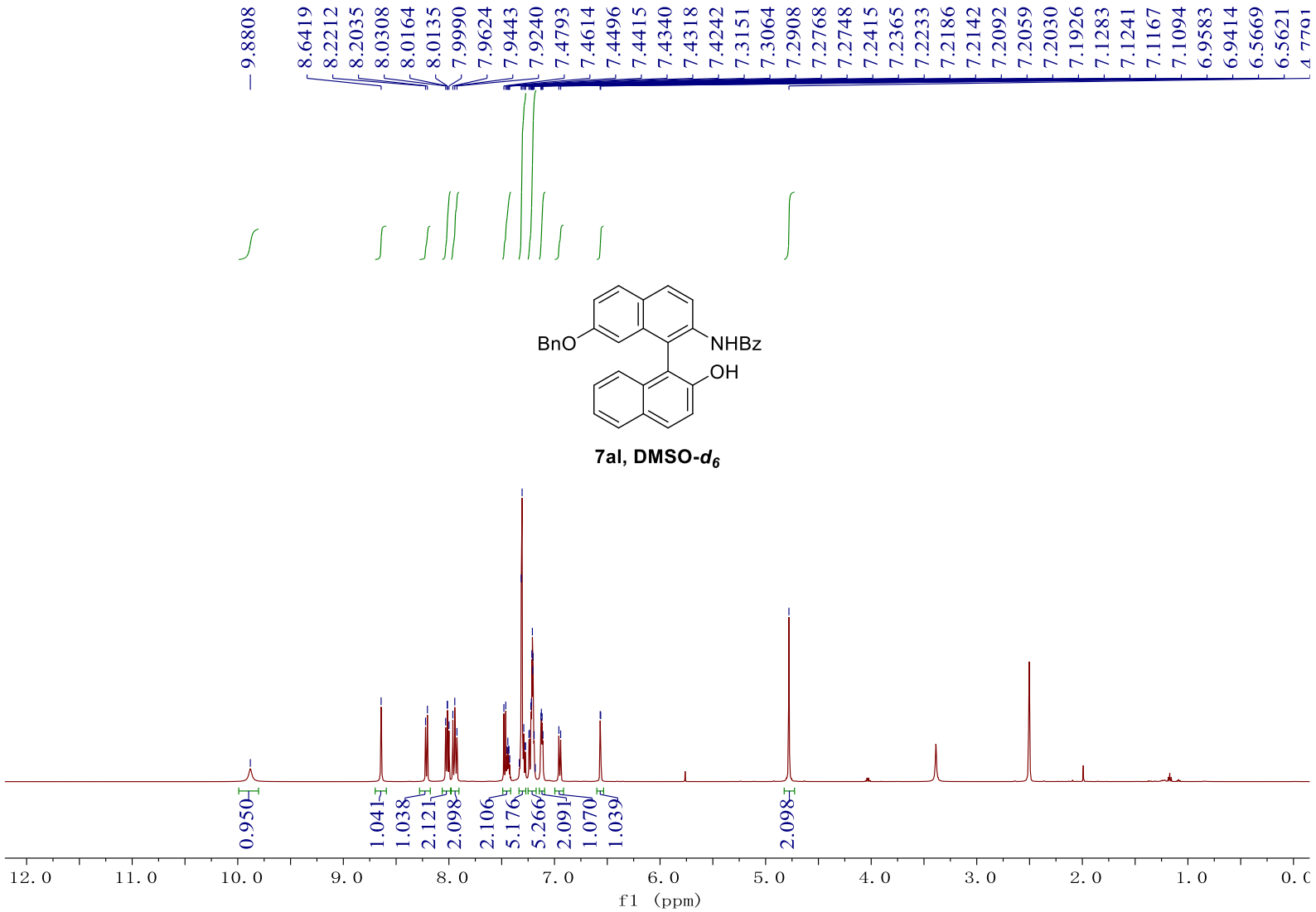
153.70
135.55
135.14
134.48
133.69
132.05
130.78
130.25
128.96
128.71
128.68
128.27
127.13
126.93
124.52
123.75
123.40
120.55
119.03
117.08
114.19
105.68
55.18
MeO
NHBz
OH
7ak, DMSO-d6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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8.0135
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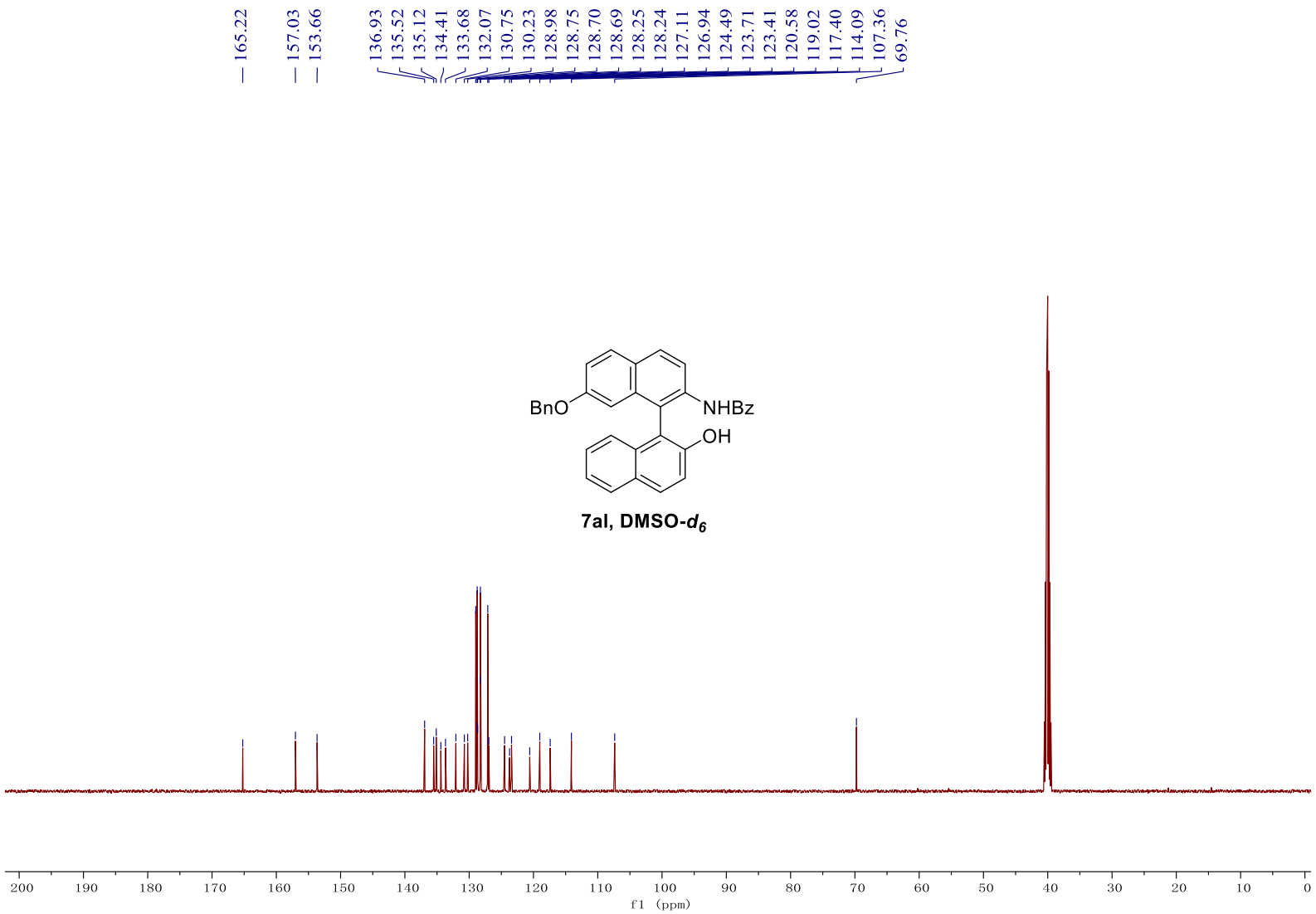
7.9624
7.9443
7.9240
7.4793
7.4614
7.4496
7.4415
7.4340
7.4318
7.4242
7.3151
7.3064
7.2908
7.2768
7.2748
7.2415
7.2365
7.2233
7.2186
7.2142
7.2092
7.2059
7.2030
7.1926
7.1283
7.1241
7.1167
7.1094
6.9583
6.9414
6.5669
6.5621
BnO
NHBz
OH
7al, DMSO-d6
0.950
1.041
1.038
2.121
2.098
2.106
5.176
5.266
2.091
1.070
1.039
2.098
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
f1 (ppm)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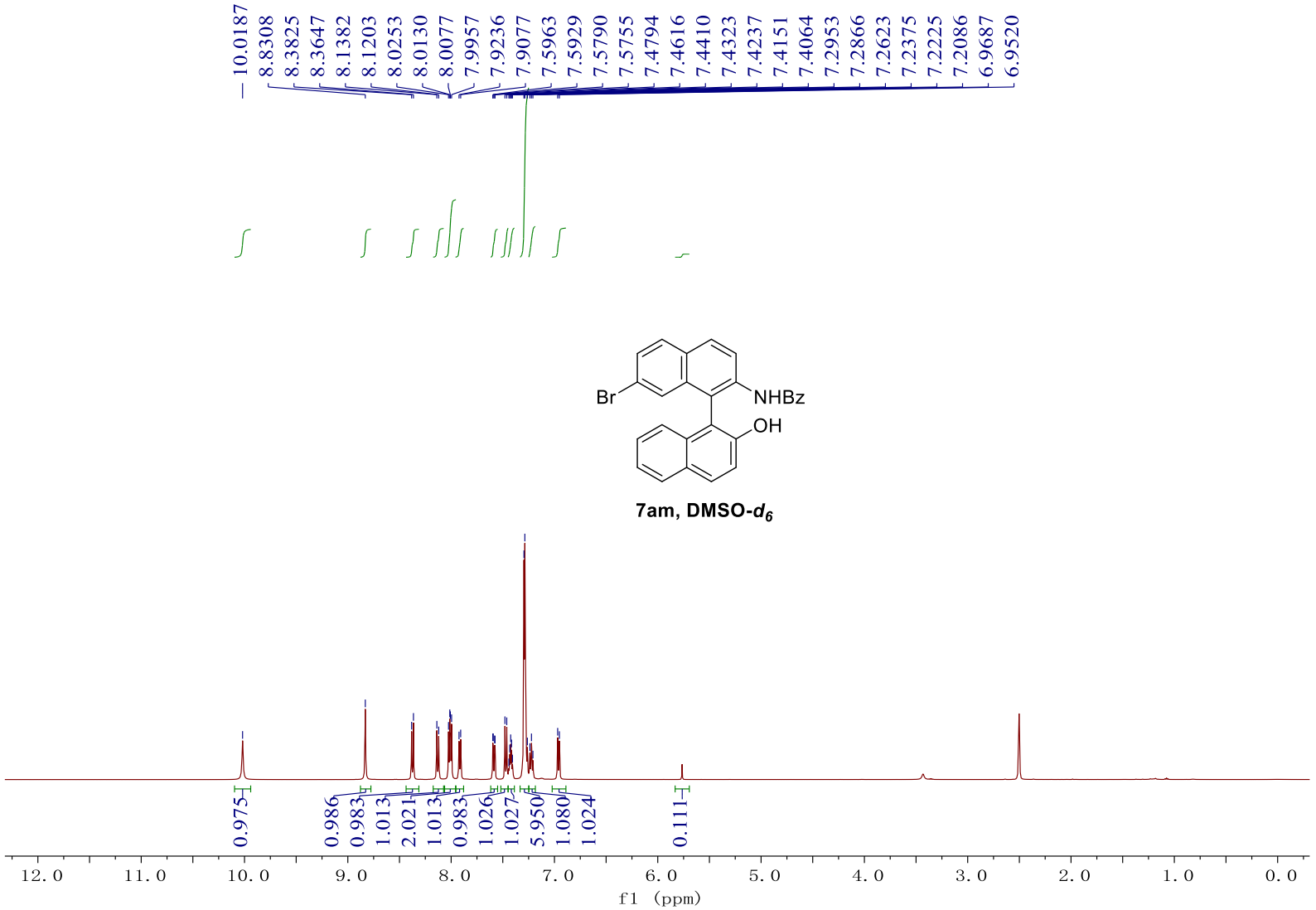
153.66
136.93
135.52
135.12
134.41
133.68
132.07
130.75
130.23
128.98
128.75
128.70
128.69
128.25
128.24
127.11
126.94
124.49
123.71
123.41
120.58
119.02
117.40
114.09
107.36
69.76
BnO
NHBz
OH
7al, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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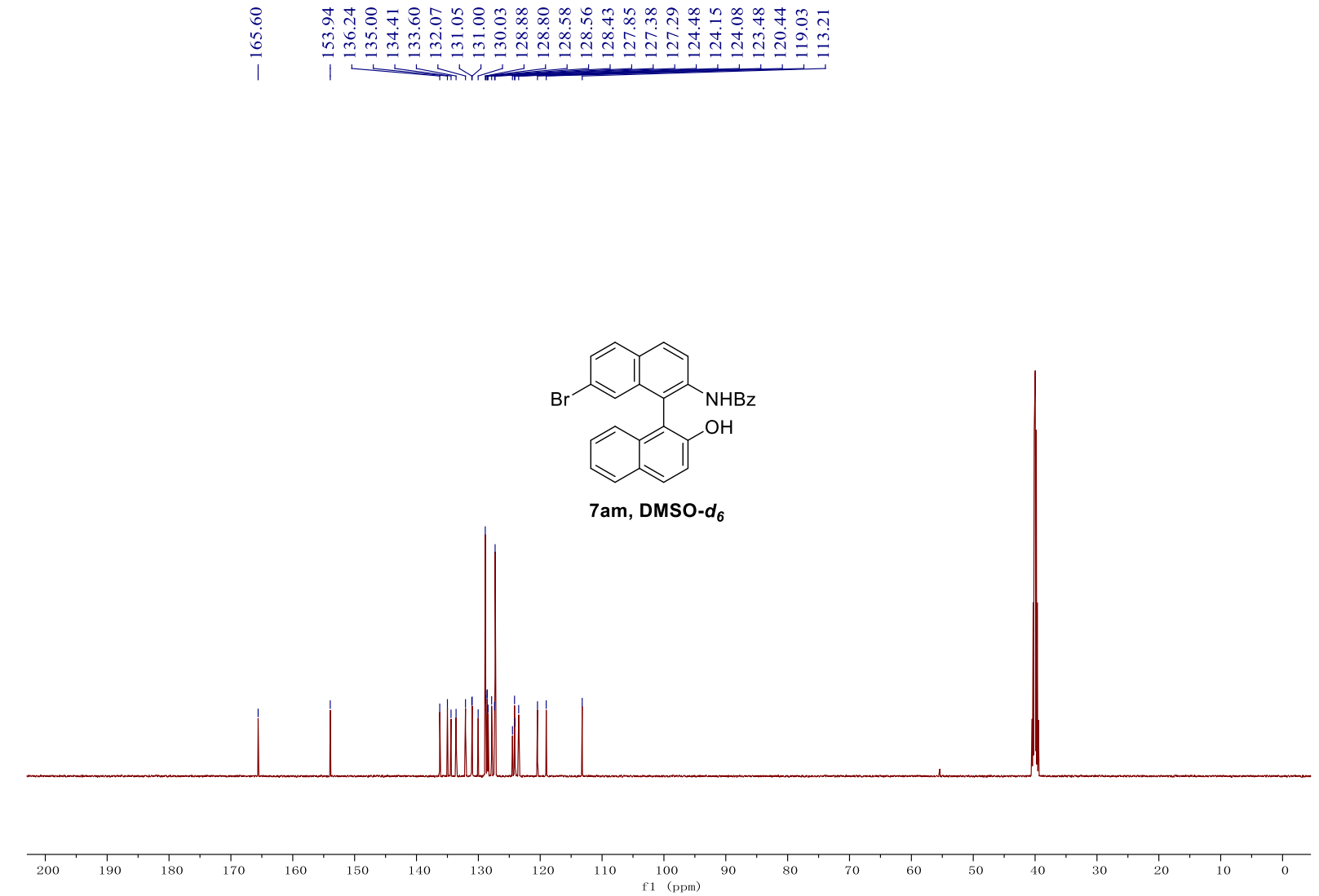
8.0253
8.0130
8.0077
7.9957
7.9236
7.9077
7.5963
7.5929
7.5790
7.5755
7.4794
7.4616
7.4410
7.4323
7.4237
7.4151
7.4064
7.2953
7.2866
7.2623
7.2375
7.2225
7.2086
6.9687
6.9520
Br
NHBz
OH
7am, DMSO-d6
0.975
0.986
0.983
1.013
2.021
1.013
0.983
1.026
1.027
5.950
1.080
1.024
0.111
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)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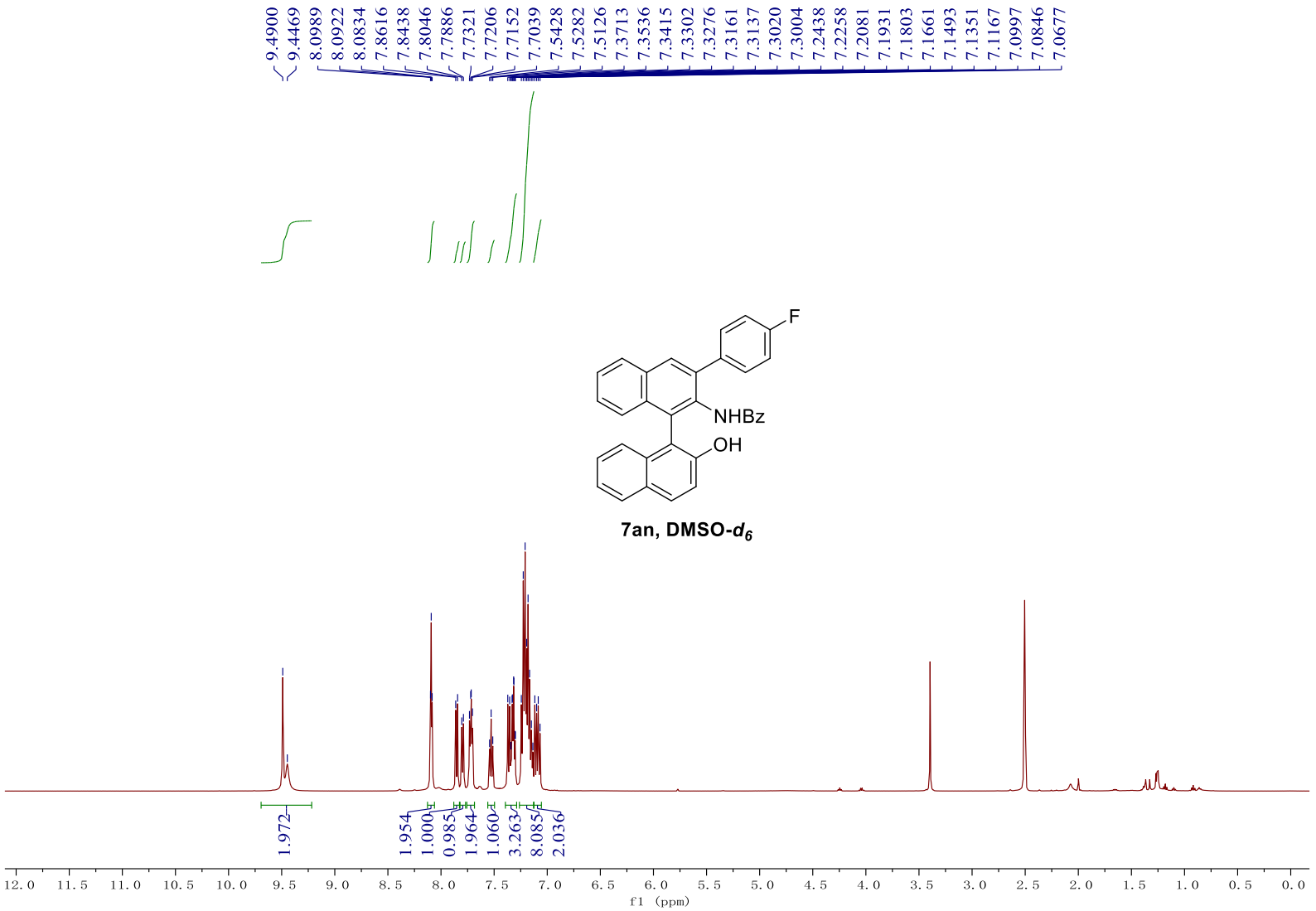
153.94
136.24
135.00
134.41
133.60
132.07
131.05
131.00
130.03
128.88
128.80
128.58
128.56
128.43
127.85
127.38
127.29
124.48
124.15
124.08
123.48
120.44
119.03
113.21
Br
NHBz
OH
7am, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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8.0834
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7.8438
7.8046
7.7886
7.7321
7.7206
7.7152
7.7039
7.5428
7.5282
7.5126
7.3713
7.3536
7.3415
7.3302
7.3276
7.3161
7.3137
7.3020
7.3004
7.2438
7.2258
7.2081
7.1931
7.1803
7.1661
7.1493
7.1351
7.1167
7.0997
7.0846
7.0677
F
NHBz
OH
7an, DMSO-d6
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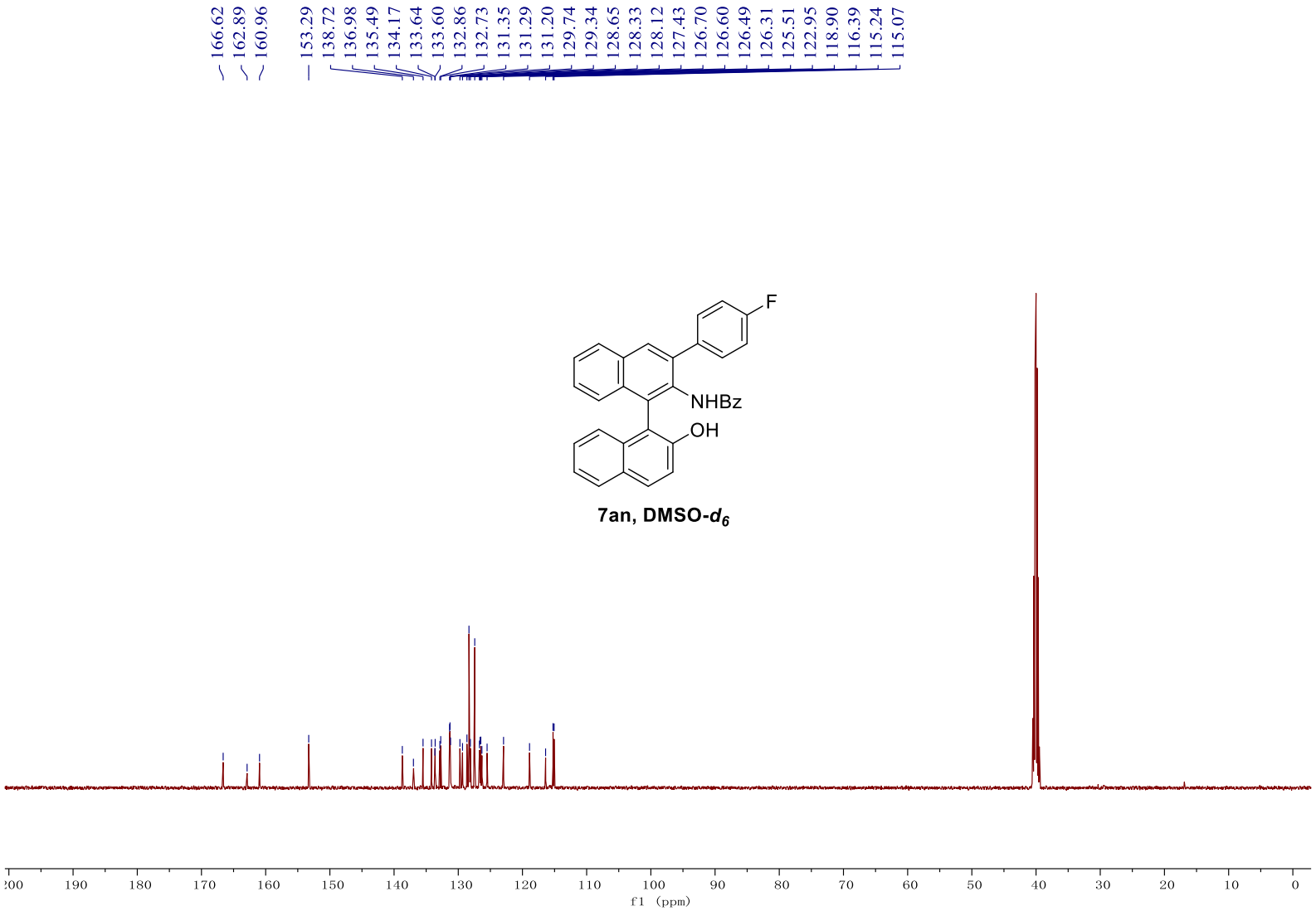
1.954
1.000
0.985
1.964
1.060
3.263
8.085
2.036
f1 (ppm)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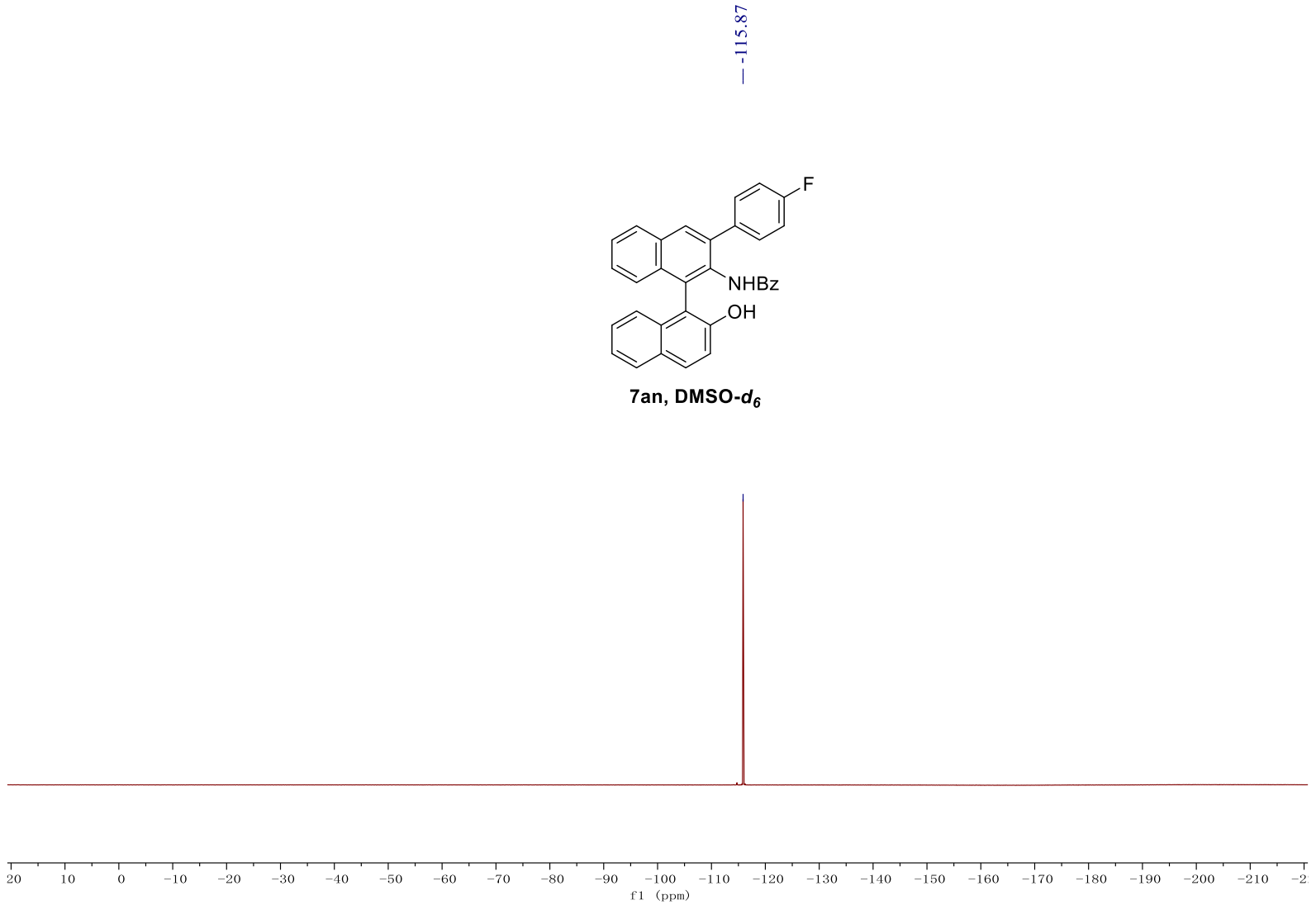
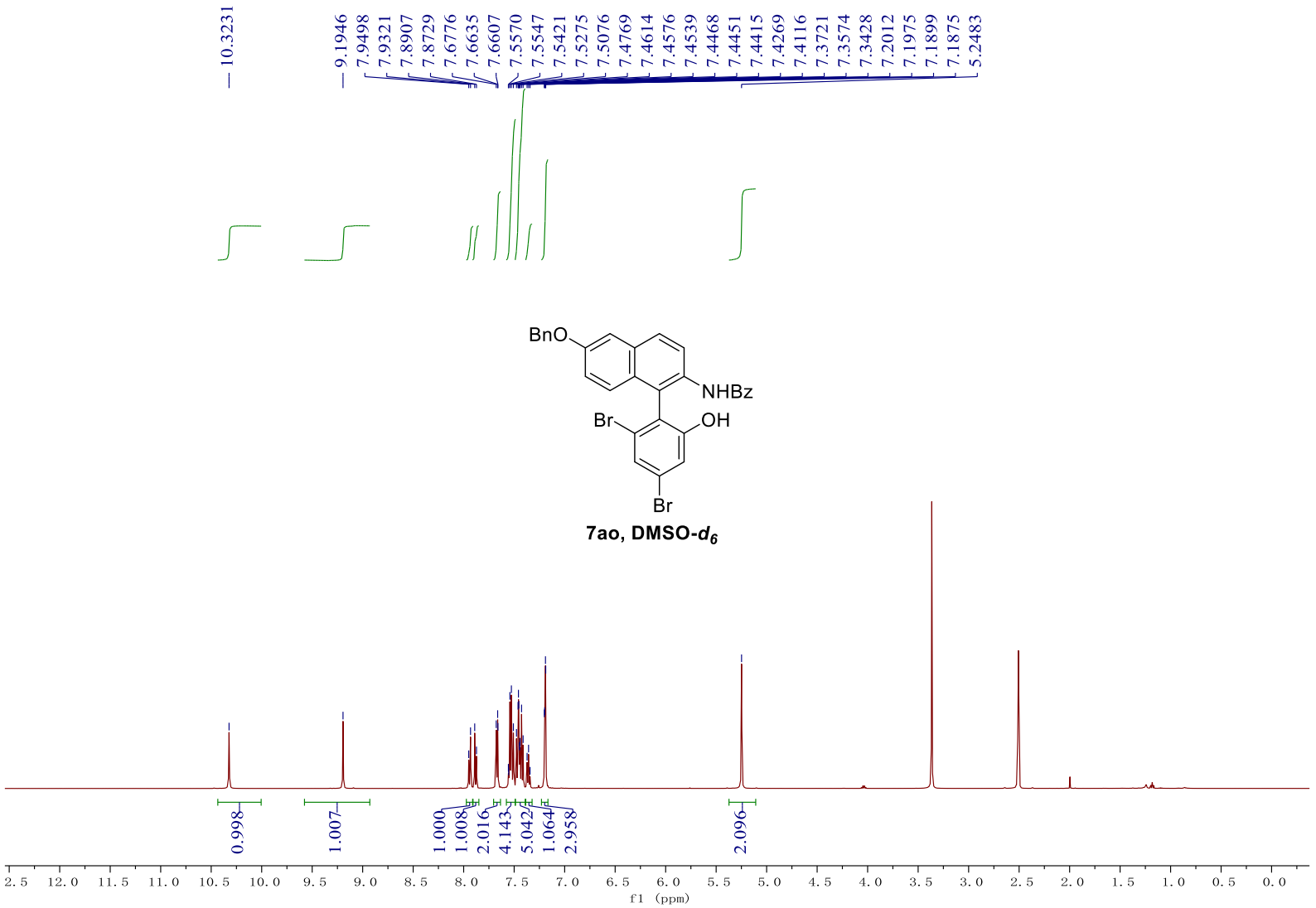
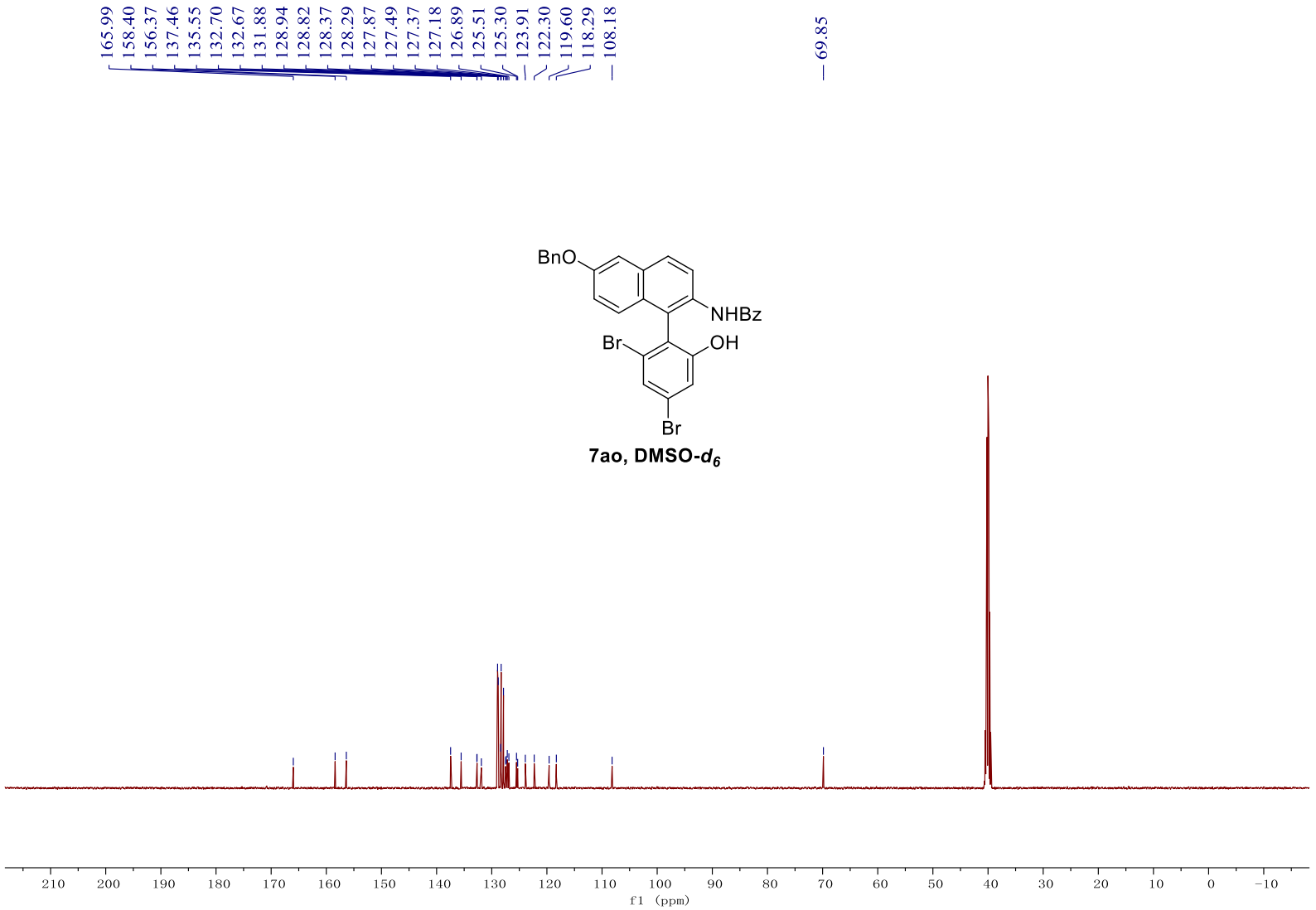
162.89
160.96
153.29
138.72
136.98
135.49
134.17
133.64
133.60
132.86
132.73
131.35
131.29
131.20
129.74
129.34
128.65
128.33
128.12
127.43
126.70
126.60
126.49
126.31
125.51
122.95
118.90
116.39
115.24
115.07
F
NHBz
OH
7an, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

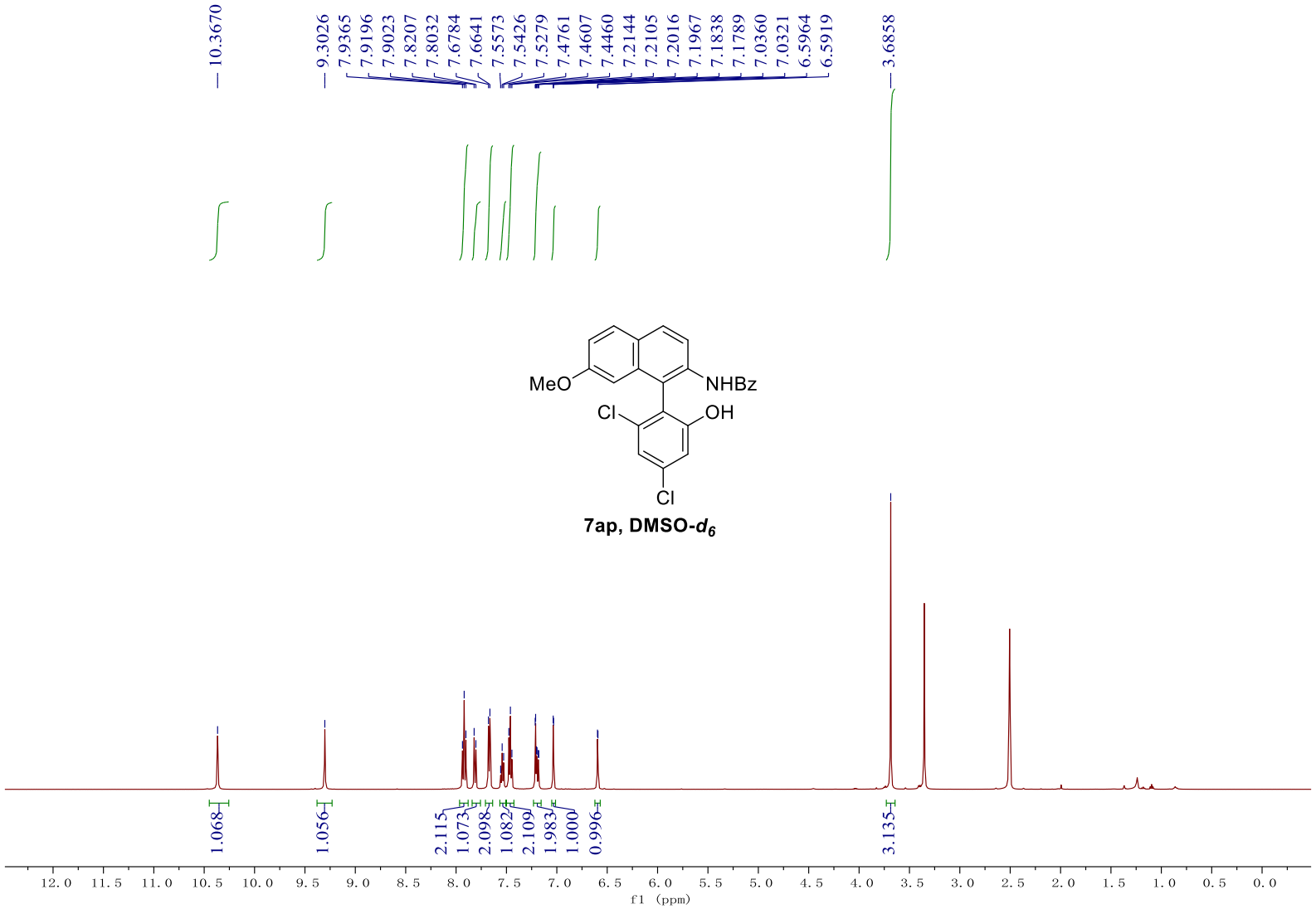

-115.87
F
NHBz
OH
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)

7an, DMSO-d_6

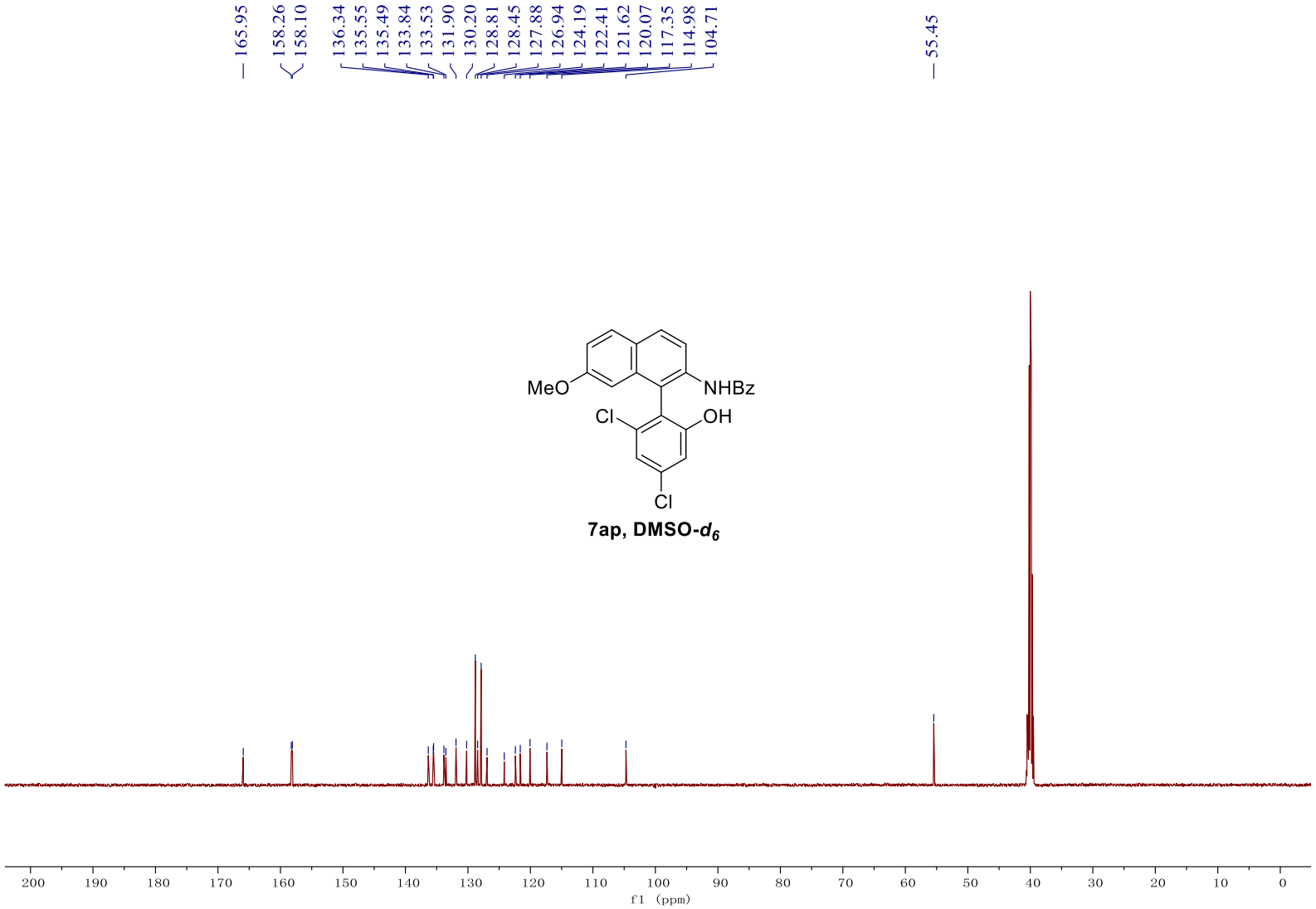

10.3231
9.1946
7.9498
7.9321
7.8907
7.8729
7.6776
7.6635
7.6607
7.5570
7.5547
7.5421
7.5275
7.5076
7.4769
7.4614
7.4576
7.4539
7.4468
7.4451
7.4415
7.4269
7.4116
7.3721
7.3574
7.3428
7.2012
7.1975
7.1899
7.1875
5.2483
BnO
NHBz
Br
OH
Br
0.998
1.007
1.000
1.008
2.016
4.143
5.042
1.064
2.958
2.096
f1 (ppm)

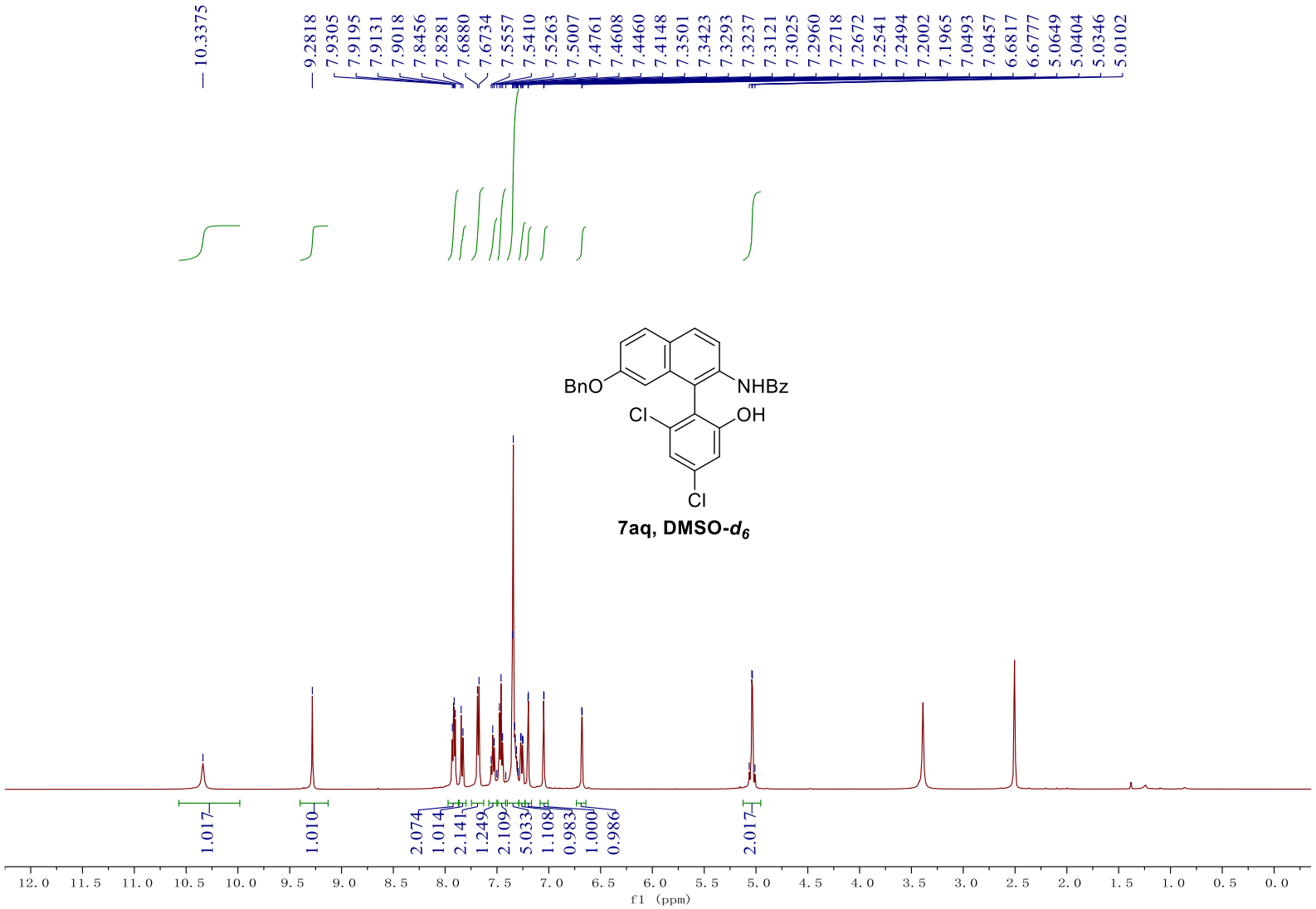
7ao, DMSO-d_6

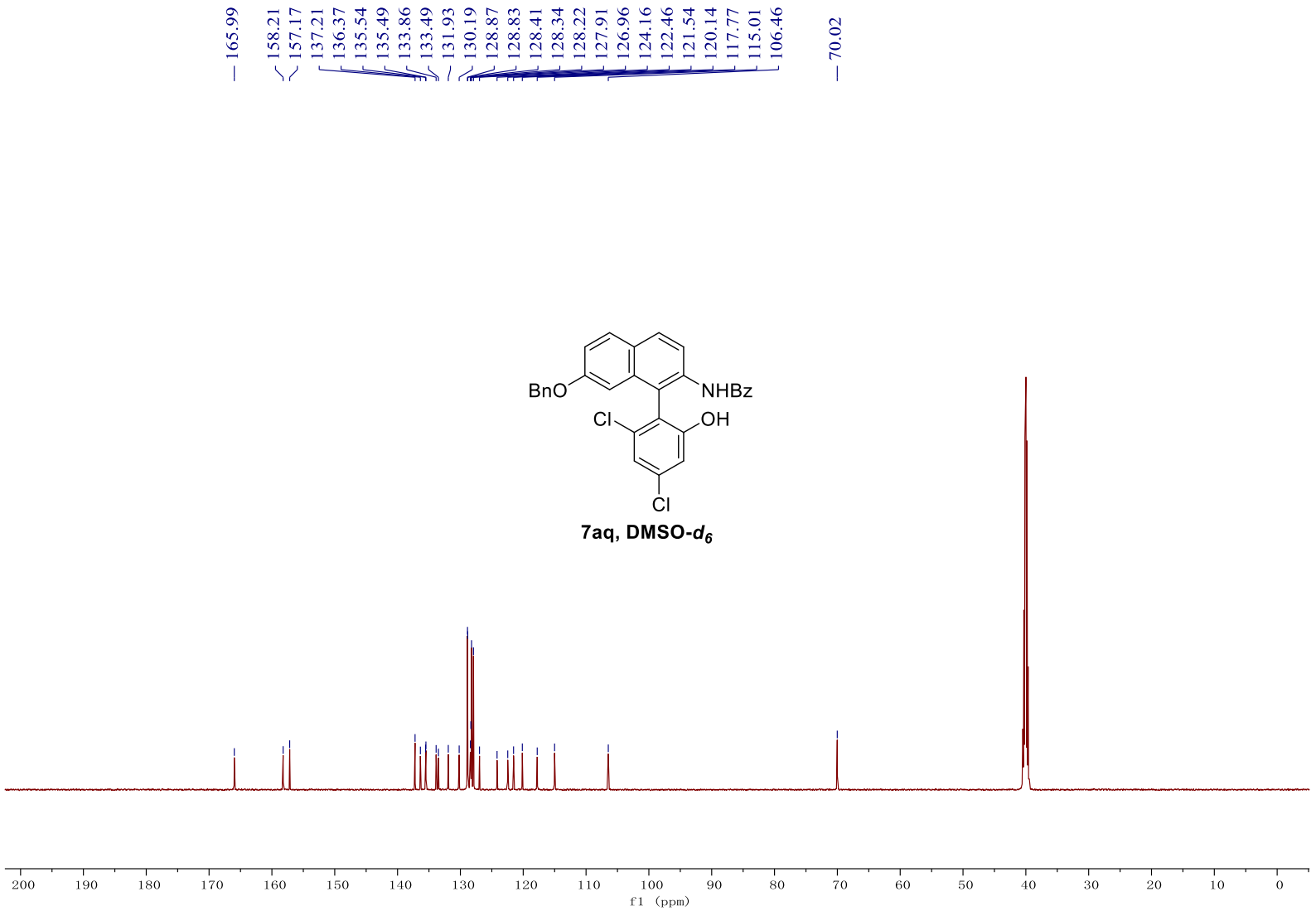

165.99
158.40
156.37
137.46
135.55
132.70
132.67
131.88
128.94
128.82
128.37
128.29
127.87
127.49
127.37
127.18
126.89
125.51
125.30
123.91
122.30
119.60
118.29
108.18
69.85
BnO
NHBz
Br
OH
Br
7ao, DMSO-d6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

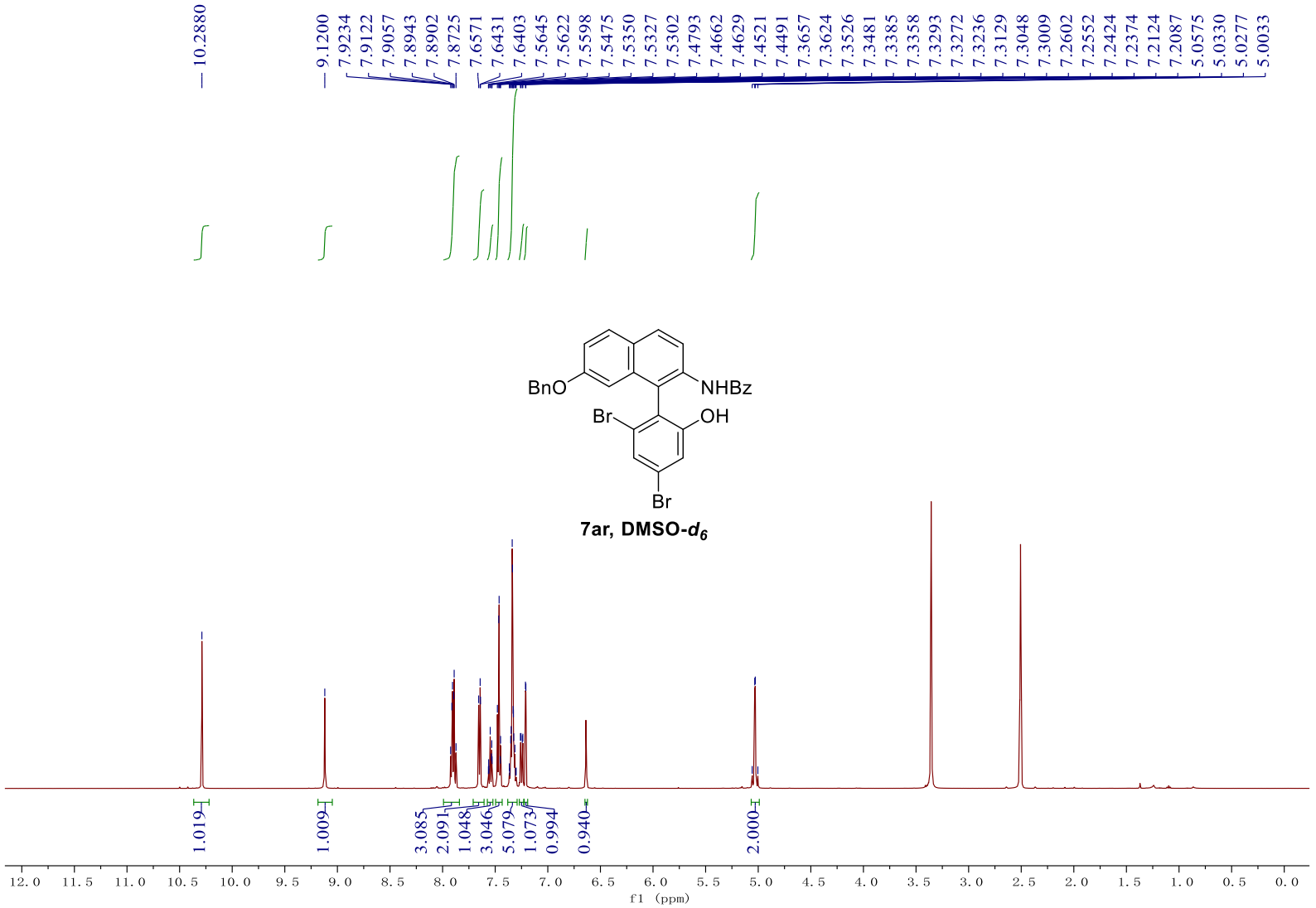

10.3670
9.3026
7.9365
7.9196
7.9023
7.8207
7.8032
7.6784
7.6641
7.5573
7.5426
7.5279
7.4761
7.4607
7.4460
7.2144
7.2105
7.2016
7.1967
7.1838
7.1789
7.0360
7.0321
6.5964
6.5919
3.6858
MeO
NHBz
Cl
OH
Cl
1.068
1.056
2.115
1.073
2.098
1.082
2.109
1.983
1.000
0.996
3.135
f1 (ppm)

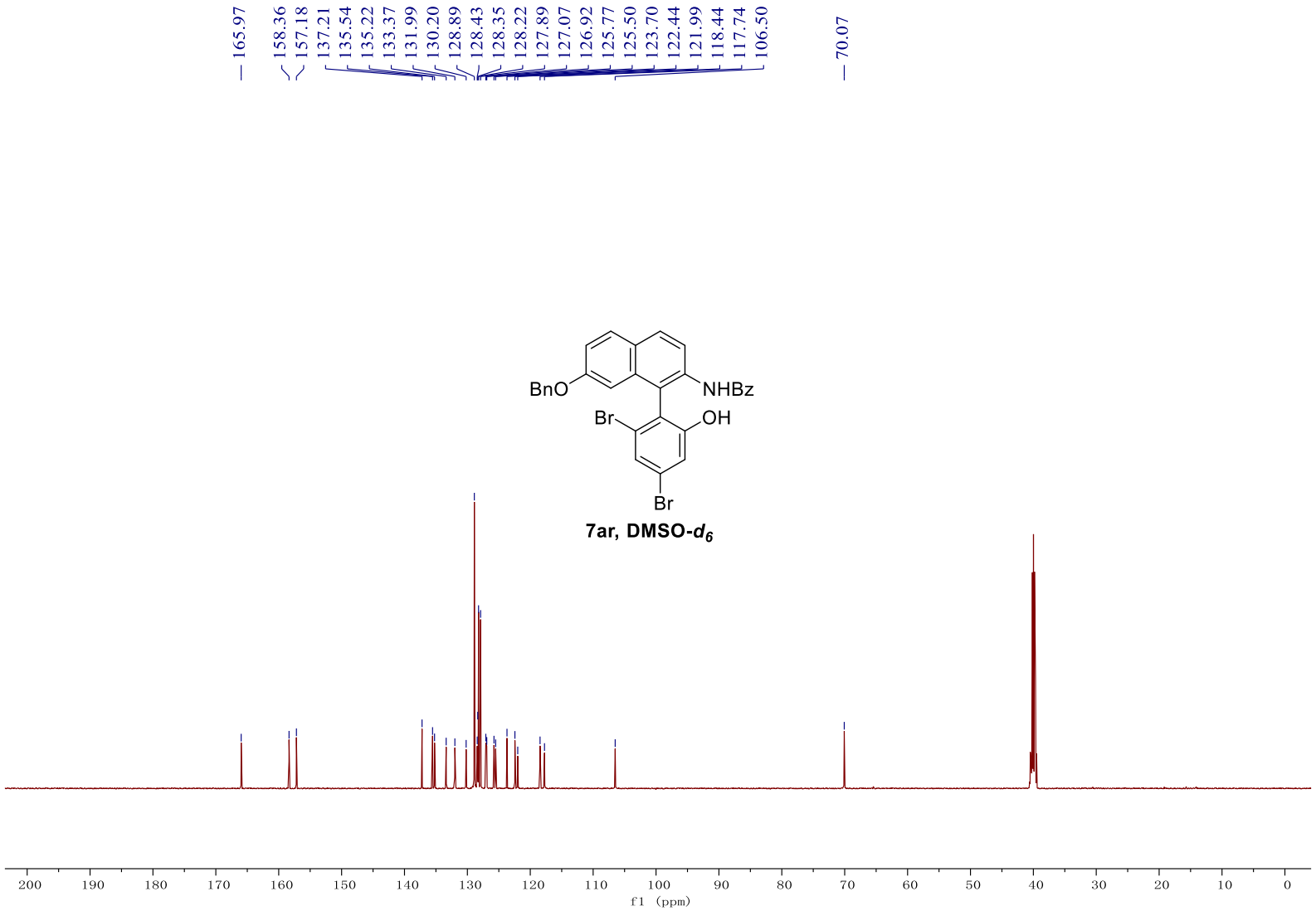
7ap, DMSO-d_6

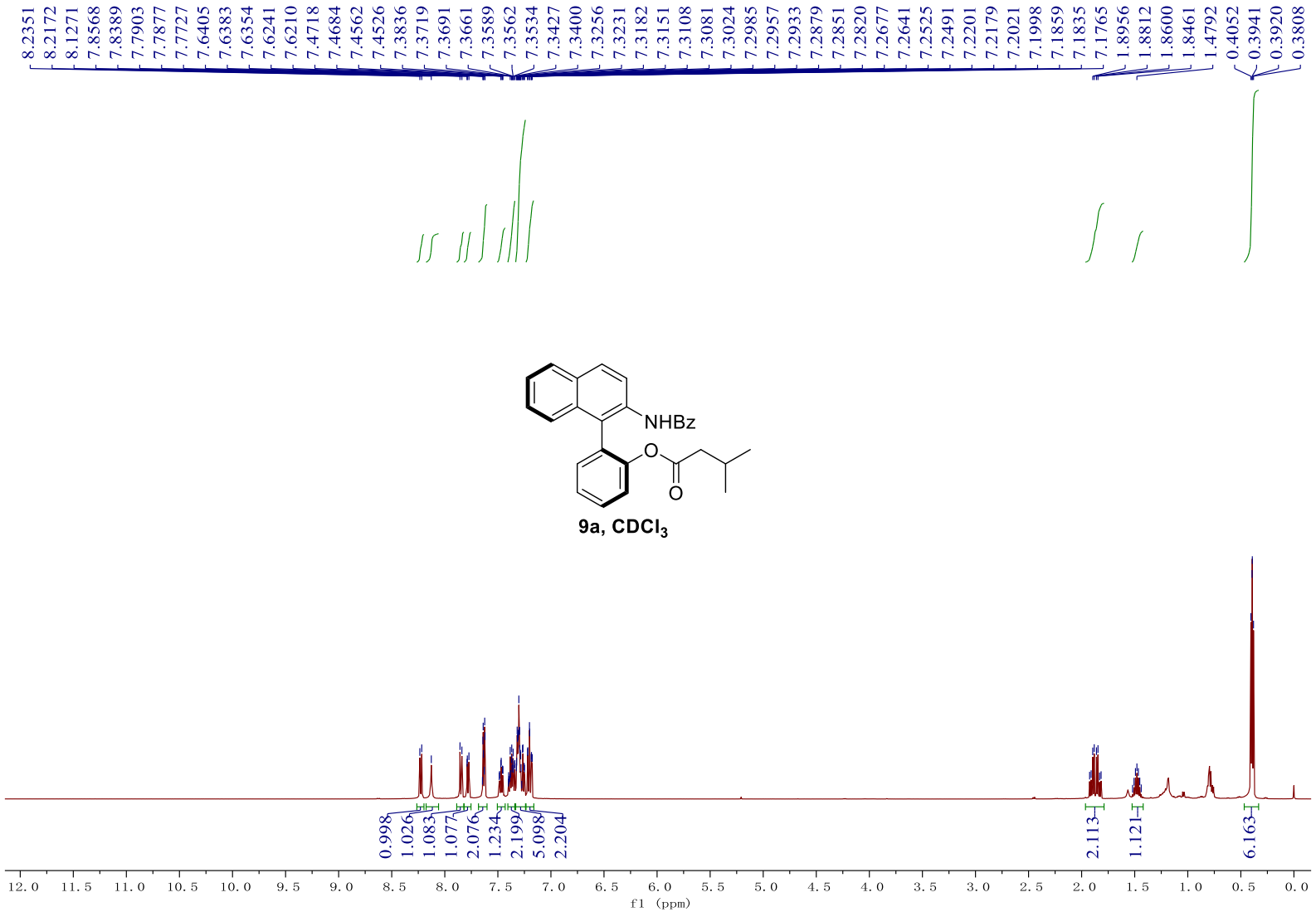

165.95
158.26
158.10
136.34
135.55
135.49
133.84
133.53
131.90
130.20
128.81
128.45
127.88
126.94
124.19
122.41
121.62
120.07
117.35
114.98
104.71
55.45
MeO
NHBz
Cl
OH
Cl
7ap, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

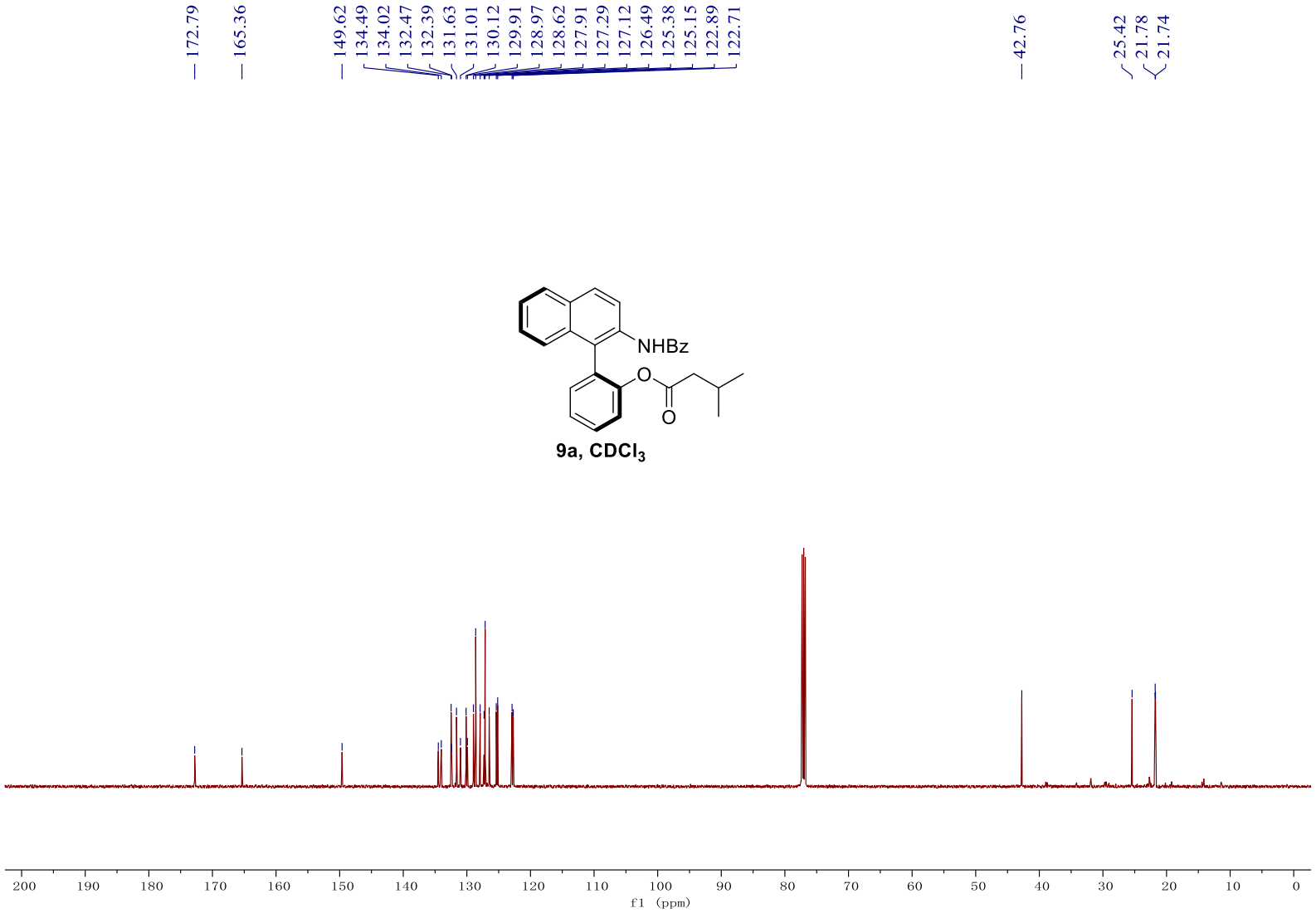

10.3375
9.2818
7.9305
7.9195
7.9131
7.9018
7.8456
7.8281
7.6880
7.6734
7.5557
7.5410
7.5263
7.5007
7.4761
7.4608
7.4460
7.4148
7.3501
7.3423
7.3293
7.3237
7.3121
7.3025
7.2960
7.2718
7.2672
7.2541
7.2494
7.2002
7.1965
7.0493
7.0457
6.6817
6.6777
5.0649
5.0404
5.0346
5.0102
BnO
NHBz
Cl
OH
Cl
7aq, DMSO-d6
1.017
1.010
2.074
1.014
2.141
1.249
2.109
5.033
1.108
0.983
1.000
0.986
2.017
12.0 11.5 11.0 10.5 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
f1 (ppm)

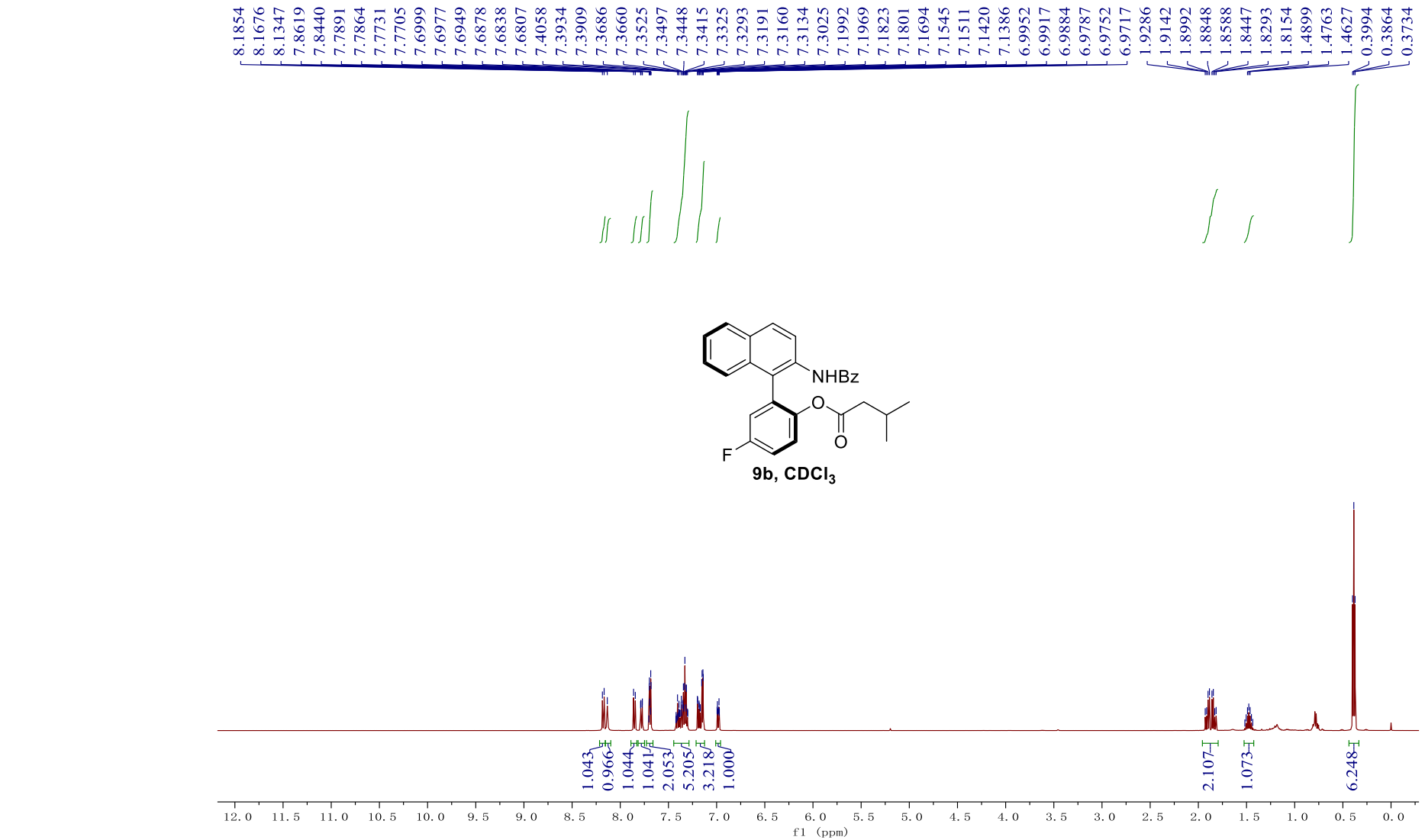

165.99
158.21
157.17
137.21
136.37
135.54
135.49
133.86
133.49
131.93
130.19
128.87
128.83
128.41
128.34
128.22
127.91
126.96
124.16
122.46
121.54
120.14
117.77
115.01
106.46
70.02
BnO
NHBz
Cl
OH
Cl
7aq, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


10.2880
9.1200
7.9234
7.9122
7.9057
7.8943
7.8902
7.8725
7.6571
7.6431
7.6403
7.5645
7.5622
7.5598
7.5475
7.5350
7.5327
7.5302
7.4793
7.4662
7.4629
7.4521
7.4491
7.3657
7.3624
7.3526
7.3481
7.3385
7.3358
7.3293
7.3272
7.3236
7.3129
7.3048
7.3009
7.2602
7.2552
7.2424
7.2374
7.2124
7.2087
5.0575
5.0330
5.0277
5.0033
BnO
NHBz
Br
OH
Br
7ar, DMSO-d6
1.019
1.009
3.085
2.091
1.048
3.046
5.079
1.073
0.994
0.940
2.000
f1 (ppm)

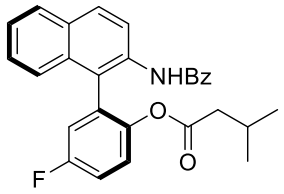

165.97
158.36
157.18
137.21
135.54
135.22
133.37
131.99
130.20
128.89
128.43
128.35
128.22
127.89
127.07
126.92
125.77
125.50
123.70
122.44
121.99
118.44
117.74
106.50
70.07
BnO
NHBz
Br
OH
Br
7ar, DMSO-d6
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.2351
8.2172
8.1271
7.8568
7.8389
7.7903
7.7877
7.7727
7.6405
7.6383
7.6354
7.6241
7.6210
7.4718
7.4684
7.4562
7.4526
7.3836
7.3719
7.3691
7.3661
7.3589
7.3562
7.3534
7.3427
7.3400
7.3256
7.3231
7.3182
7.3151
7.3108
7.3081
7.3024
7.2985
7.2957
7.2933
7.2879
7.2851
7.2820
7.2677
7.2641
7.2525
7.2491
7.2201
7.2179
7.2021
7.1998
7.1859
7.1835
7.1765
1.8956
1.8812
1.8600
1.8461
1.4792
0.4052
0.3941
0.3920
0.3808
NHBz
O
O
9a, CDCl3
0.998
1.026
1.083
1.077
2.076
1.234
2.199
5.098
2.204
2.113
1.121
6.163
12.0 11.5 11.0 10.5 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
f1 (ppm)

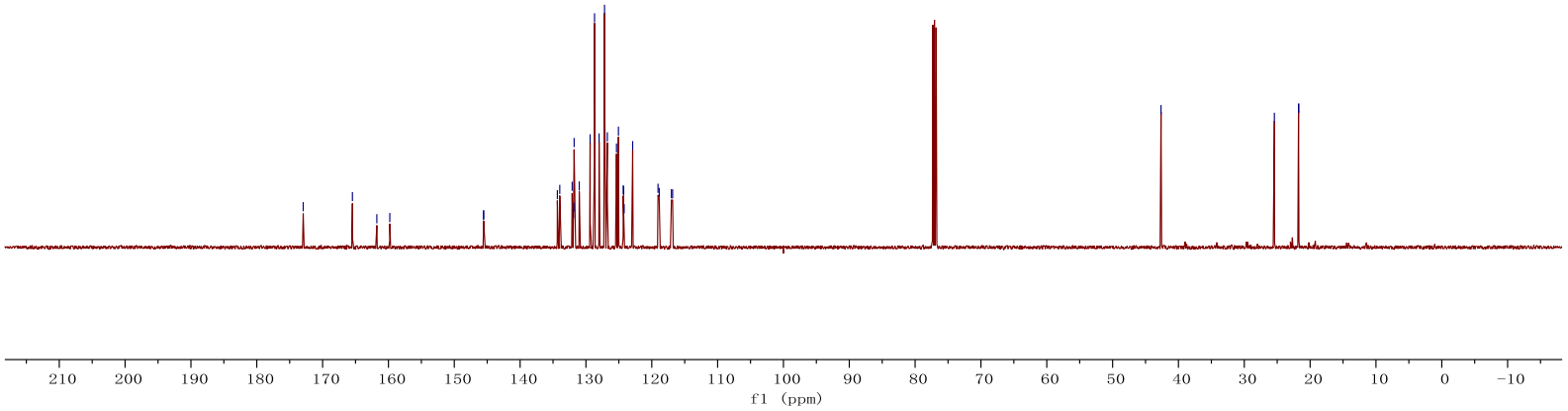

172.79
165.36
149.62
134.49
134.02
132.47
132.39
131.63
131.01
130.12
129.91
128.97
128.62
127.91
127.29
127.12
126.49
125.38
125.15
122.89
122.71
42.76
25.42
21.78
21.74
NHBz
O
O
9a, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

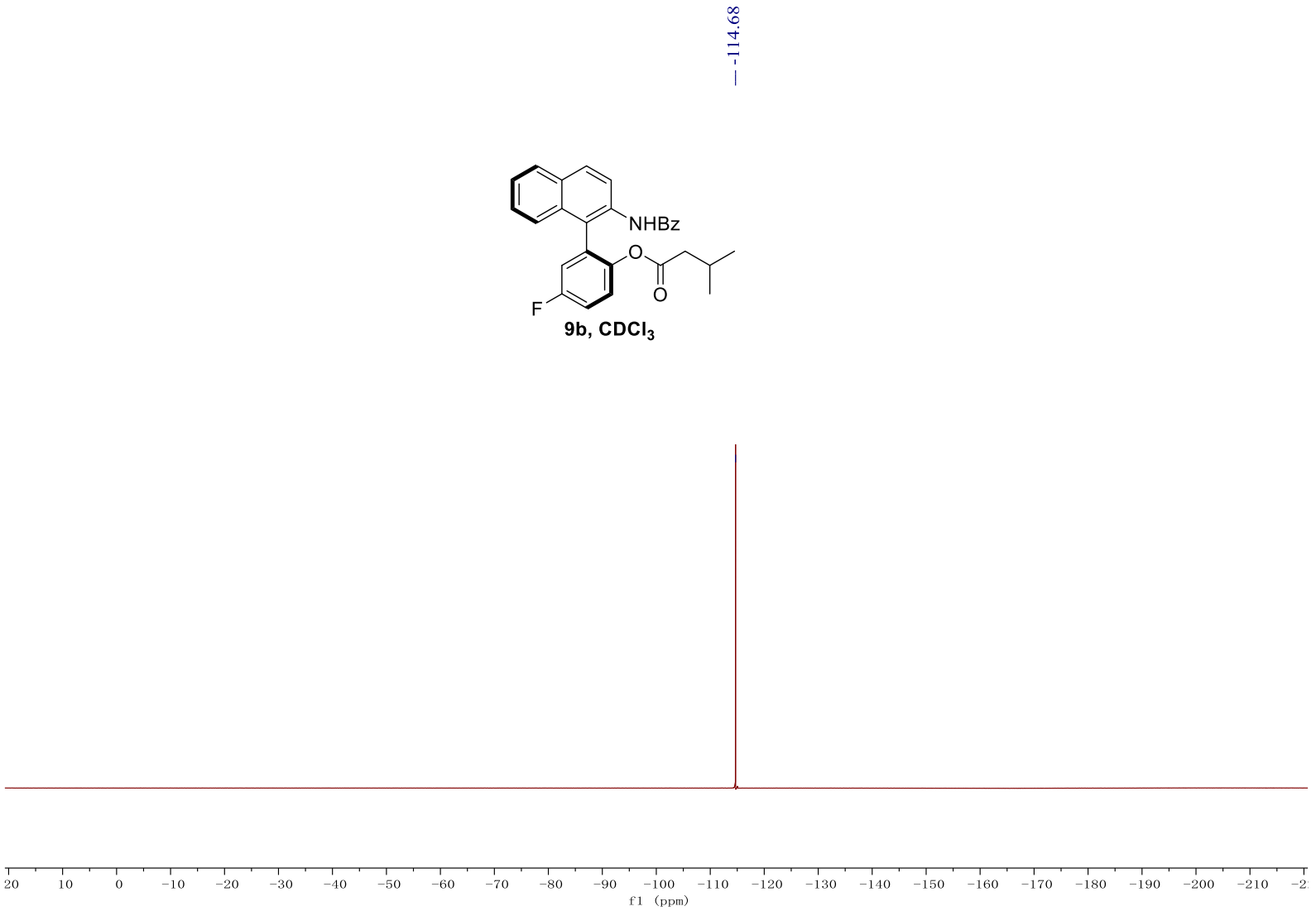

8.1854
8.1676
8.1347
7.8619
7.8440
7.7891
7.7864
7.7731
7.7705
7.6999
7.6977
7.6949
7.6878
7.6838
7.6807
7.4058
7.3934
7.3909
7.3686
7.3660
7.3525
7.3497
7.3448
7.3415
7.3325
7.3293
7.3191
7.3160
7.3134
7.3025
7.1992
7.1969
7.1823
7.1801
7.1694
7.1545
7.1511
7.1420
7.1386
6.9952
6.9917
6.9884
6.9787
6.9752
6.9717
1.9286
1.9142
1.8992
1.8848
1.8588
1.8447
1.8293
1.8154
1.4899
1.4763
1.4627
0.3994
0.3864
0.3734
NHBz
O
O
F
9b, CDCl3
1.043
0.966
1.044
1.041
2.053
5.205
3.218
1.000
2.107
1.073
6.248
12.0 11.5 11.0 10.5 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
f1 (ppm)

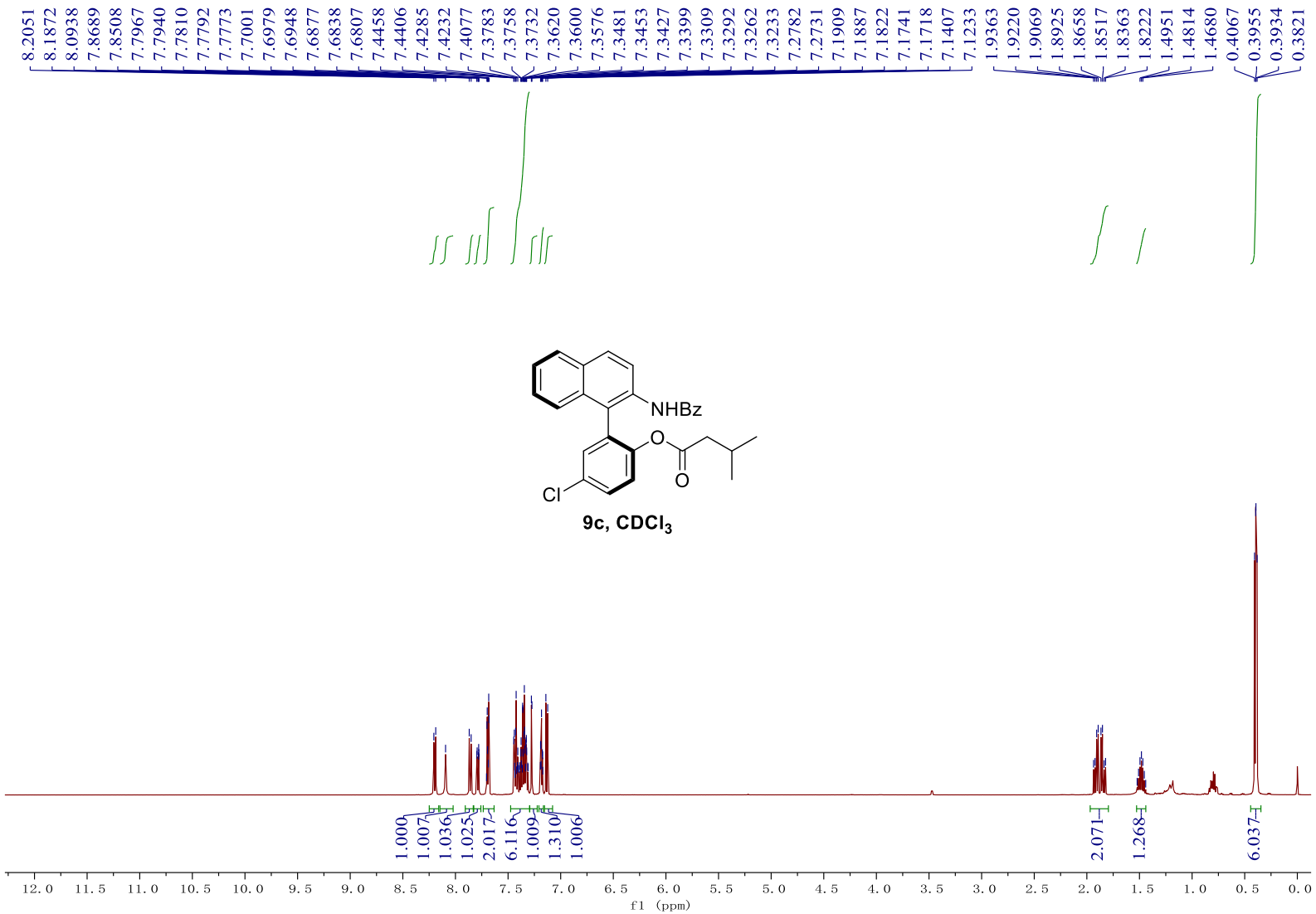

172.95
165.47
161.76
159.79
145.56
145.53
134.34
133.98
132.09
131.89
131.83
131.79
131.02
129.36
128.70
128.00
127.18
126.75
125.36
125.06
124.34
124.27
124.20
122.91
119.05
118.87
117.02
116.83
42.65
25.43
21.76
21.72

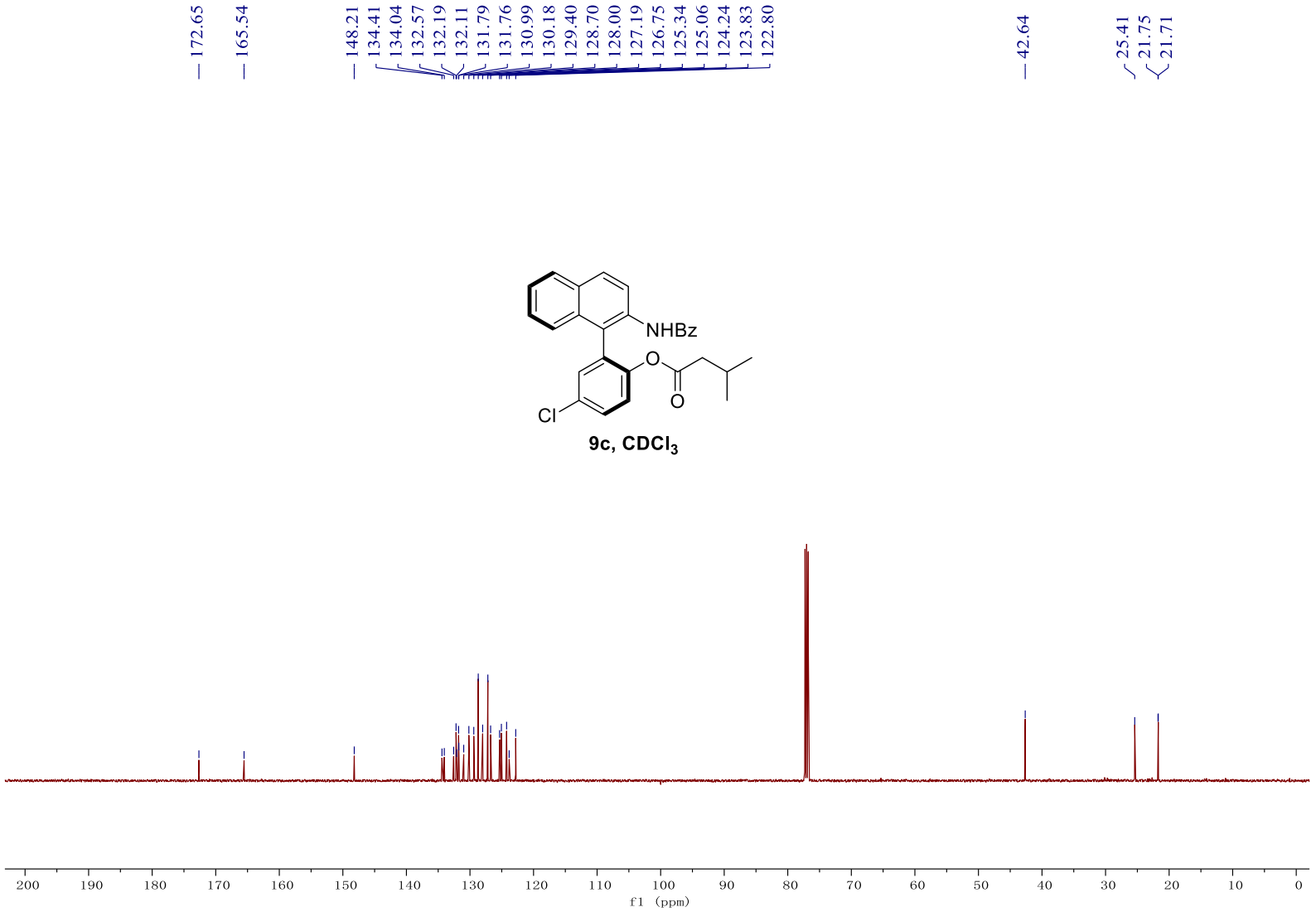

NHBz
O
O
F

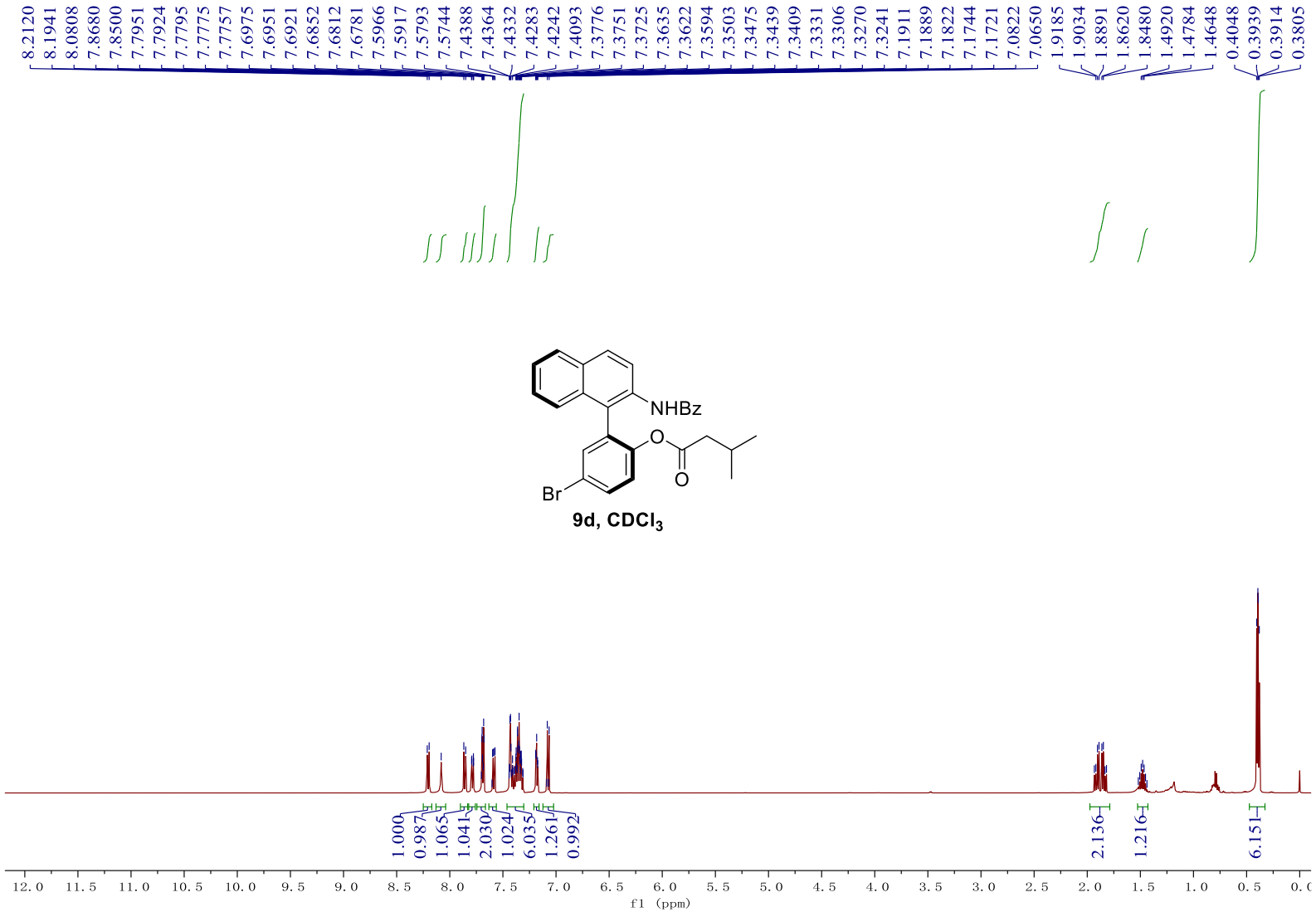
9b, $CDCl_3$

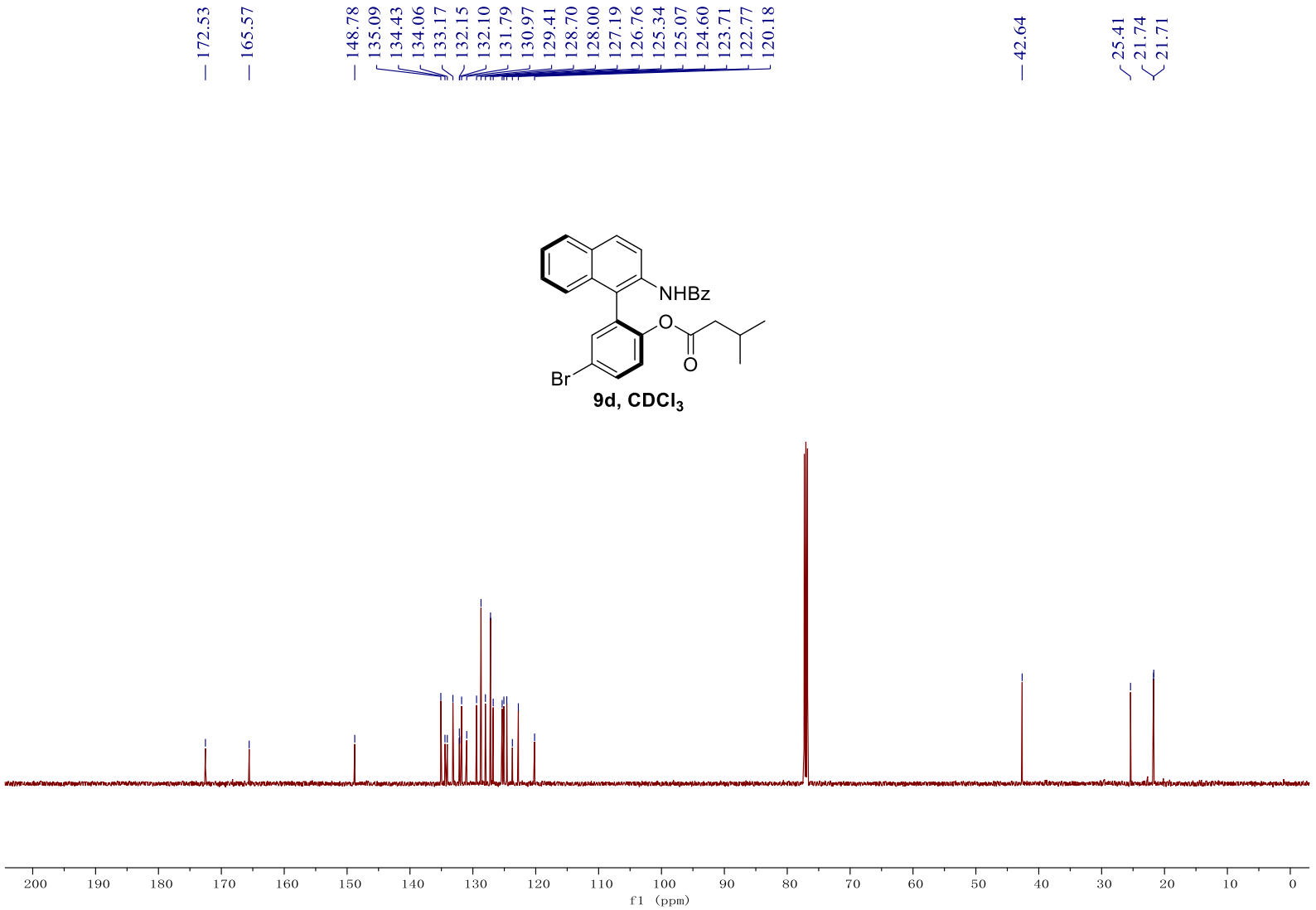

210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

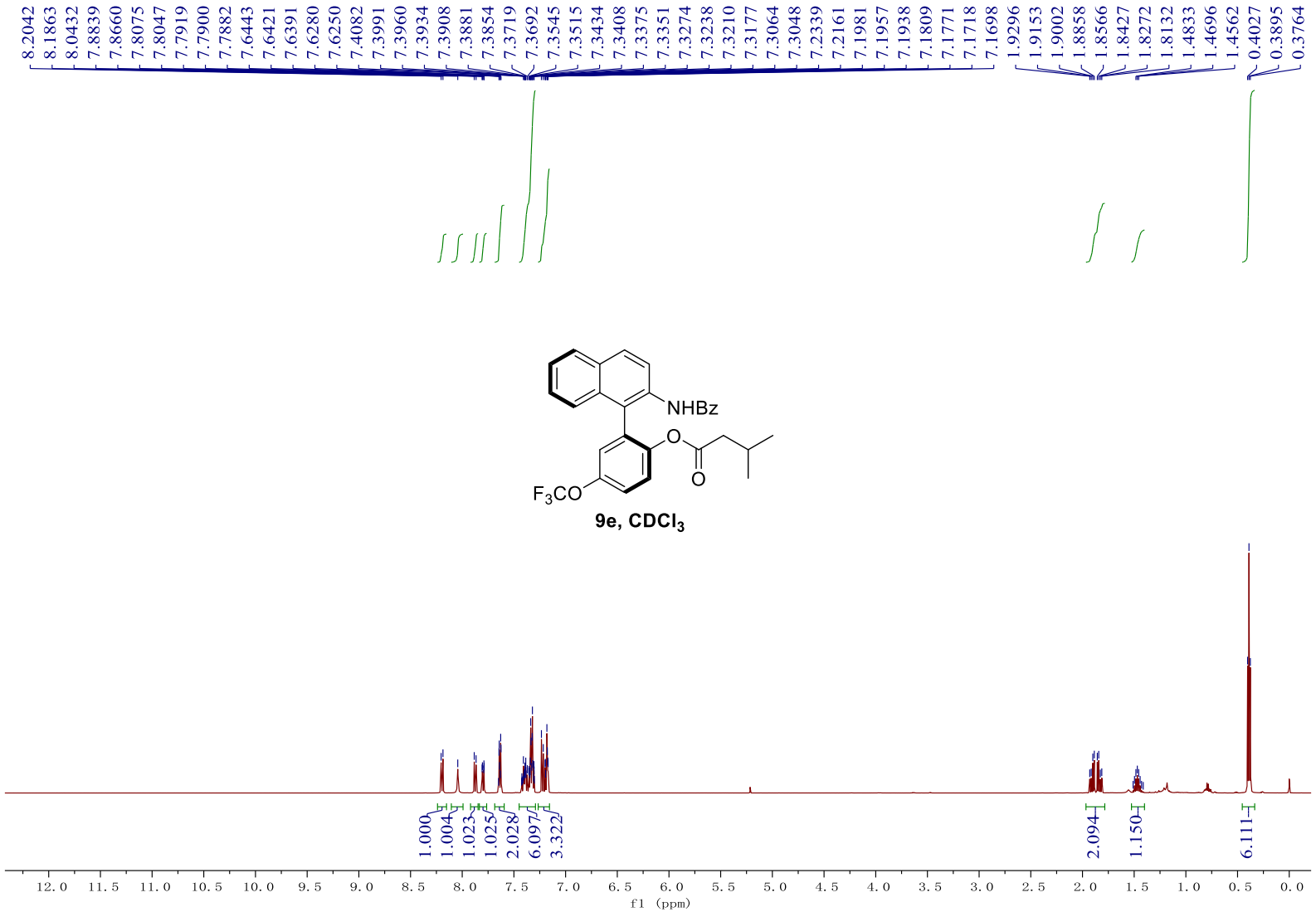

-114.68
NHBz
O
O
F
9b, CDCl3
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210
f1 (ppm)

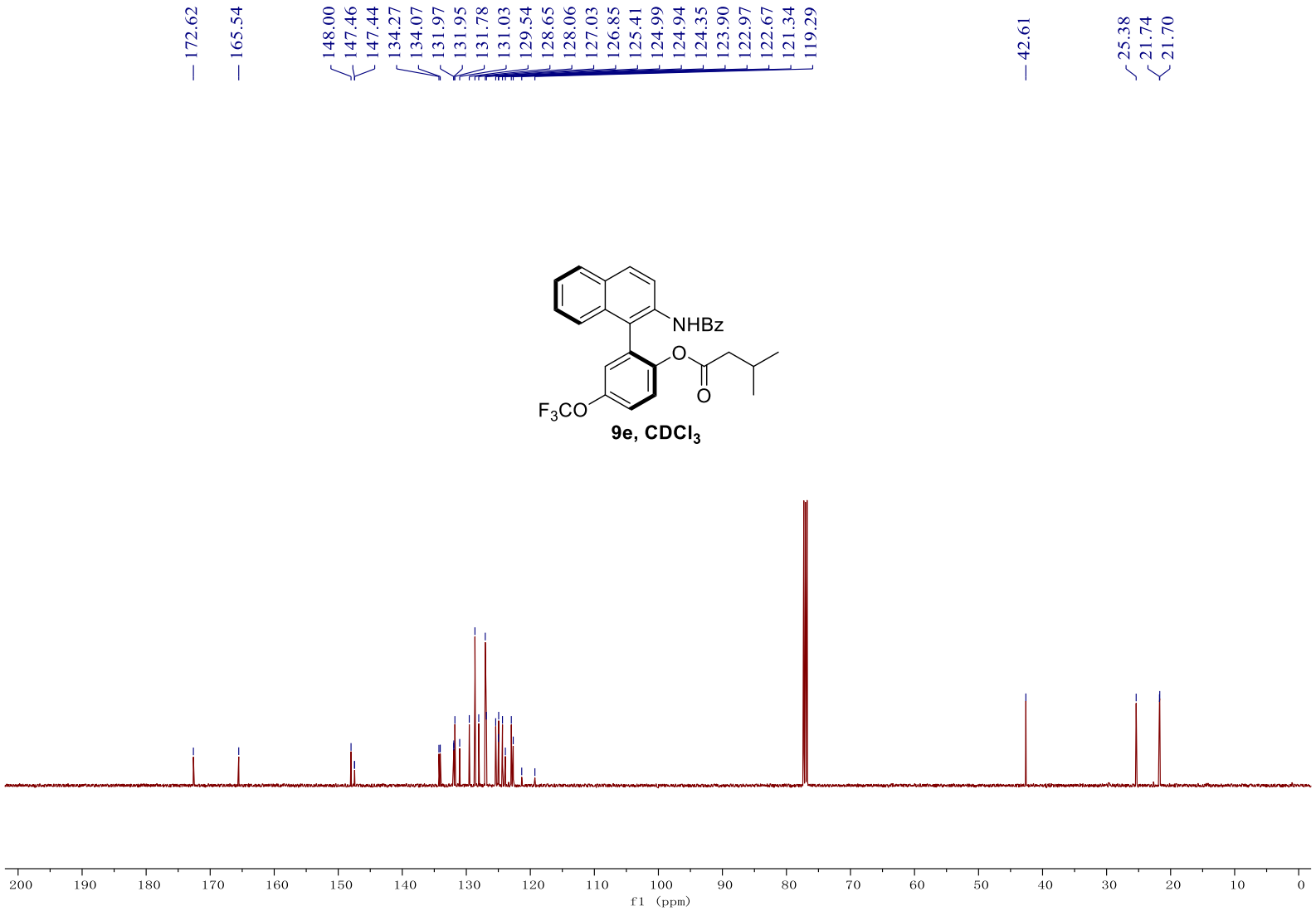

8.2051
8.1872
8.0938
7.8689
7.8508
7.7967
7.7940
7.7810
7.7792
7.7773
7.7001
7.6979
7.6948
7.6877
7.6838
7.6807
7.4458
7.4406
7.4285
7.4232
7.4077
7.3783
7.3758
7.3732
7.3620
7.3600
7.3576
7.3481
7.3453
7.3427
7.3399
7.3309
7.3292
7.3262
7.3233
7.2782
7.2731
7.1909
7.1887
7.1822
7.1741
7.1718
7.1407
7.1233
1.9363
1.9220
1.9069
1.8925
1.8658
1.8517
1.8363
1.8222
1.4951
1.4814
1.4680
0.4067
0.3955
0.3934
0.3821
NHBz
O
O
Cl
9c, CDCl3
1.000
1.007
1.036
1.025
2.017
6.116
1.009
1.310
1.006
2.071
1.268
6.037
12.0 11.5 11.0 10.5 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
f1 (ppm)


172.65
165.54
148.21
134.41
134.04
132.57
132.19
132.11
131.79
131.76
130.99
130.18
129.40
128.70
128.00
127.19
126.75
125.34
125.06
124.24
123.83
122.80
42.64
25.41
21.75
21.71
NHBz
O
O
Cl
9c, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.2120
8.1941
8.0808
7.8680
7.8500
7.7951
7.7924
7.7795
7.7775
7.7757
7.6975
7.6951
7.6921
7.6852
7.6812
7.6781
7.5966
7.5917
7.5793
7.5744
7.4388
7.4364
7.4332
7.4283
7.4242
7.4093
7.3776
7.3751
7.3725
7.3635
7.3622
7.3594
7.3503
7.3475
7.3439
7.3409
7.3331
7.3306
7.3270
7.3241
7.1911
7.1889
7.1822
7.1744
7.1721
7.0822
7.0650
1.9185
1.9034
1.8891
1.8620
1.8480
1.4920
1.4784
1.4648
0.4048
0.3939
0.3914
0.3805
NHBz
O
O
Br
9d, CDCl3
1.000
0.987
1.065
1.041
2.030
1.024
6.035
1.261
0.992
2.136
1.216
6.151
12.0 11.5 11.0 10.5 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
f1 (ppm)


172.53
165.57
148.78
135.09
134.43
134.06
133.17
132.15
132.10
131.79
130.97
129.41
128.70
128.00
127.19
126.76
125.34
125.07
124.60
123.71
122.77
120.18
42.64
25.41
21.74
21.71
NHBz
O
O
Br
9d, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.2042
8.1863
8.0432
7.8839
7.8660
7.8075
7.8047
7.7919
7.7900
7.7882
7.6443
7.6421
7.6391
7.6280
7.6250
7.4082
7.3991
7.3960
7.3934
7.3908
7.3881
7.3854
7.3719
7.3692
7.3545
7.3515
7.3434
7.3408
7.3375
7.3351
7.3274
7.3238
7.3210
7.3177
7.3064
7.3048
7.2339
7.2161
7.1981
7.1957
7.1938
7.1809
7.1771
7.1718
7.1698
1.9296
1.9153
1.9002
1.8858
1.8566
1.8427
1.8272
1.8132
1.4833
1.4696
1.4562
0.4027
0.3895
0.3764
NHBz
O
O
F3CO
9e, CDCl3
1.000
1.004
1.023
1.025
2.028
6.097
3.322
2.094
1.150
6.111
12.0 11.5 11.0 10.5 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
f1 (ppm)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147.46
147.44
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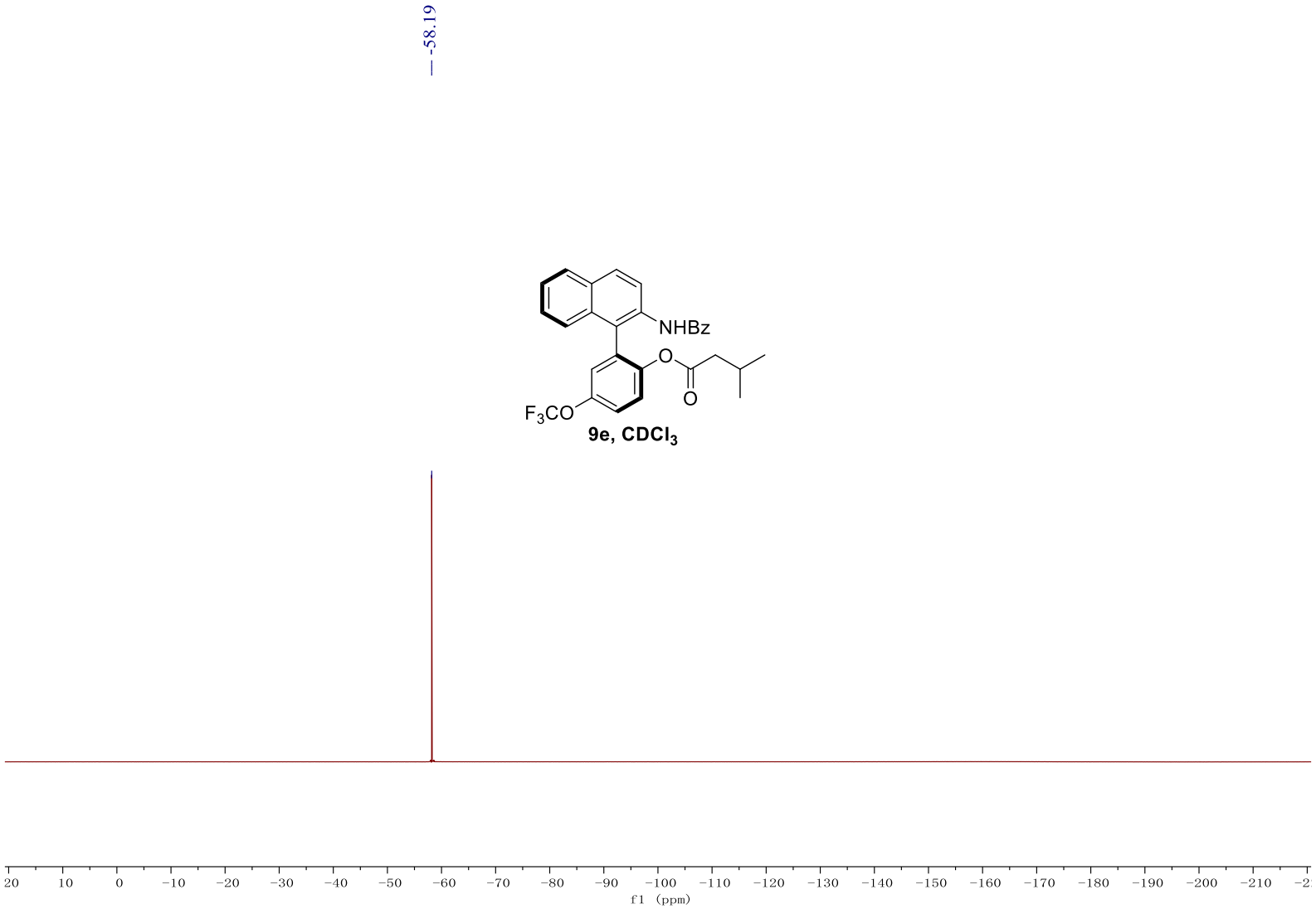
131.97
131.95
131.78
131.03
129.54
128.65
128.06
127.03
126.85
125.41
124.99
124.94
124.35
123.90
122.97
122.67
121.34
119.29
42.61
25.38
21.74
21.70
NHBz
O
O
F3CO
9e, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-58.19
NHBz
O
O
F3CO
9e, CDCl3
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
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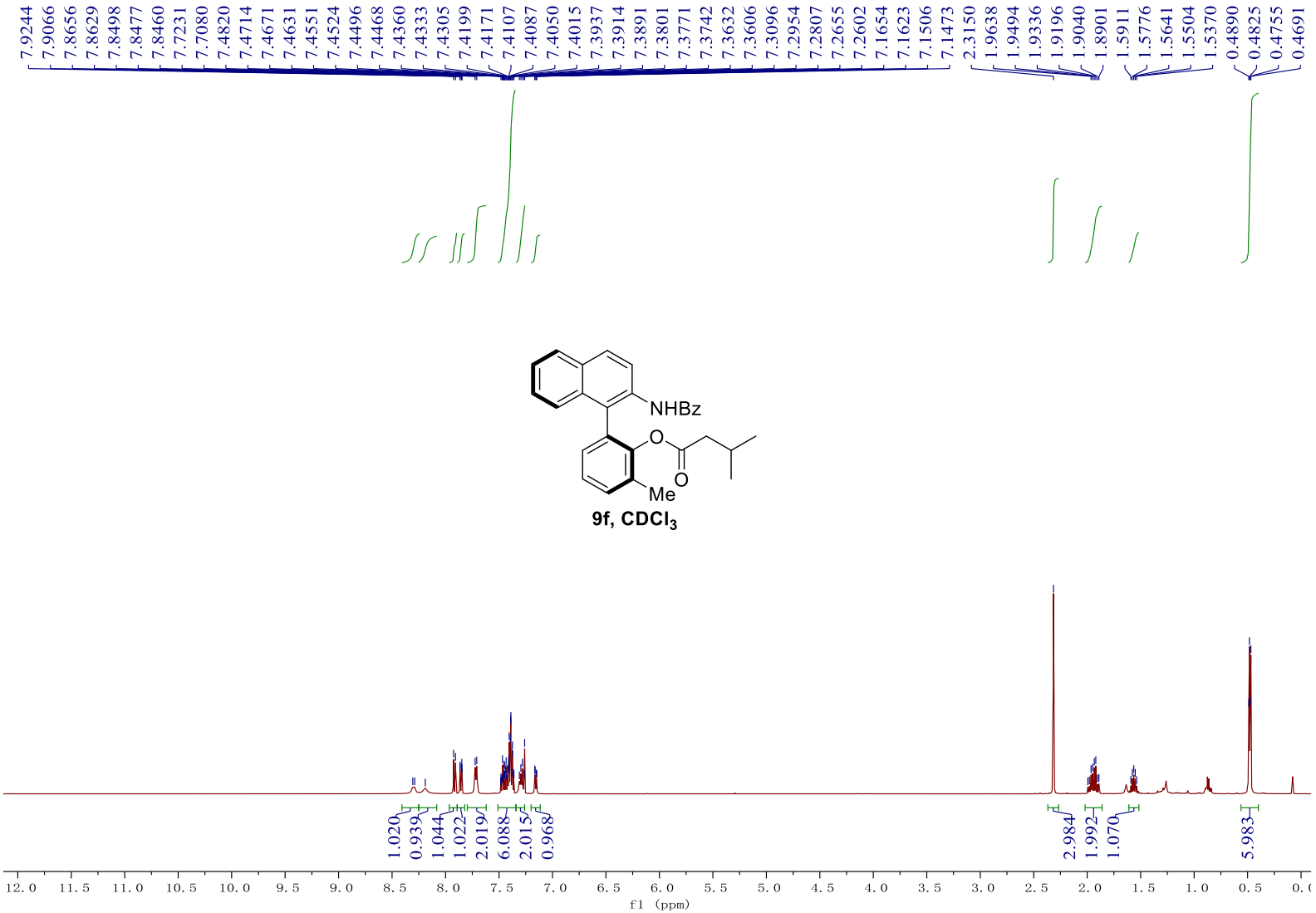
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)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7.8498
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7.8460
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7.7080
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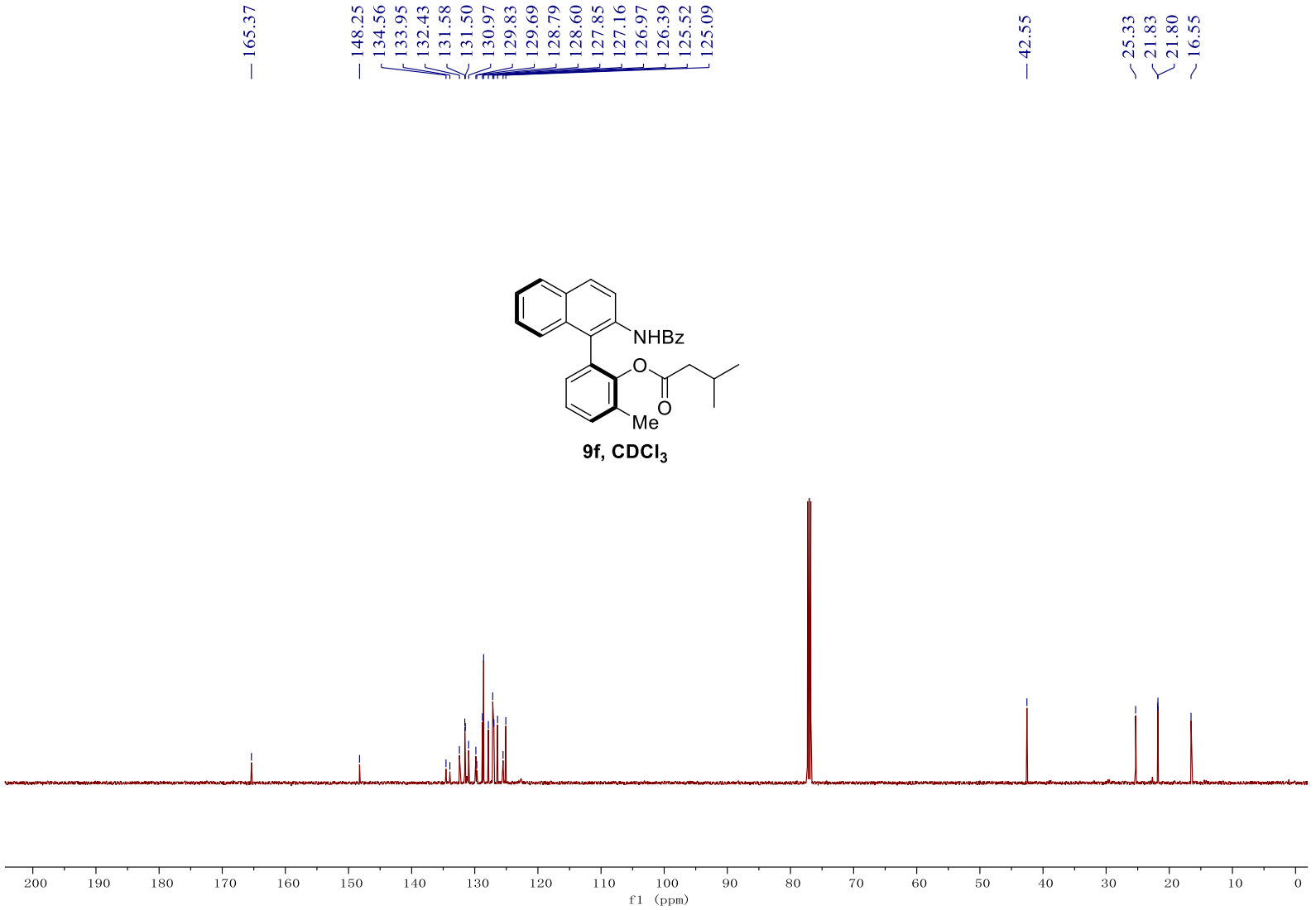
7.4714
7.4671
7.4631
7.4551
7.4524
7.4496
7.4468
7.4360
7.4333
7.4305
7.4199
7.4171
7.4107
7.4087
7.4050
7.4015
7.3937
7.3914
7.3891
7.3801
7.3771
7.3742
7.3632
7.3606
7.3096
7.2954
7.2807
7.2655
7.2602
7.1654
7.1623
7.1506
7.1473
2.3150
1.9638
1.9494
1.9336
1.9196
1.9040
1.8901
1.5911
1.5776
1.5641
1.5504
1.5370
0.4890
0.4825
0.4755
0.4691
NHBz
O
O
Me
9f, CDCl3
1.020
0.939
1.044
1.022
2.019
6.088
2.015
0.968
2.984
1.992
1.070
5.983
12.0
11.5
11.0
10.5
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
f1 (ppm)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148.25
134.56
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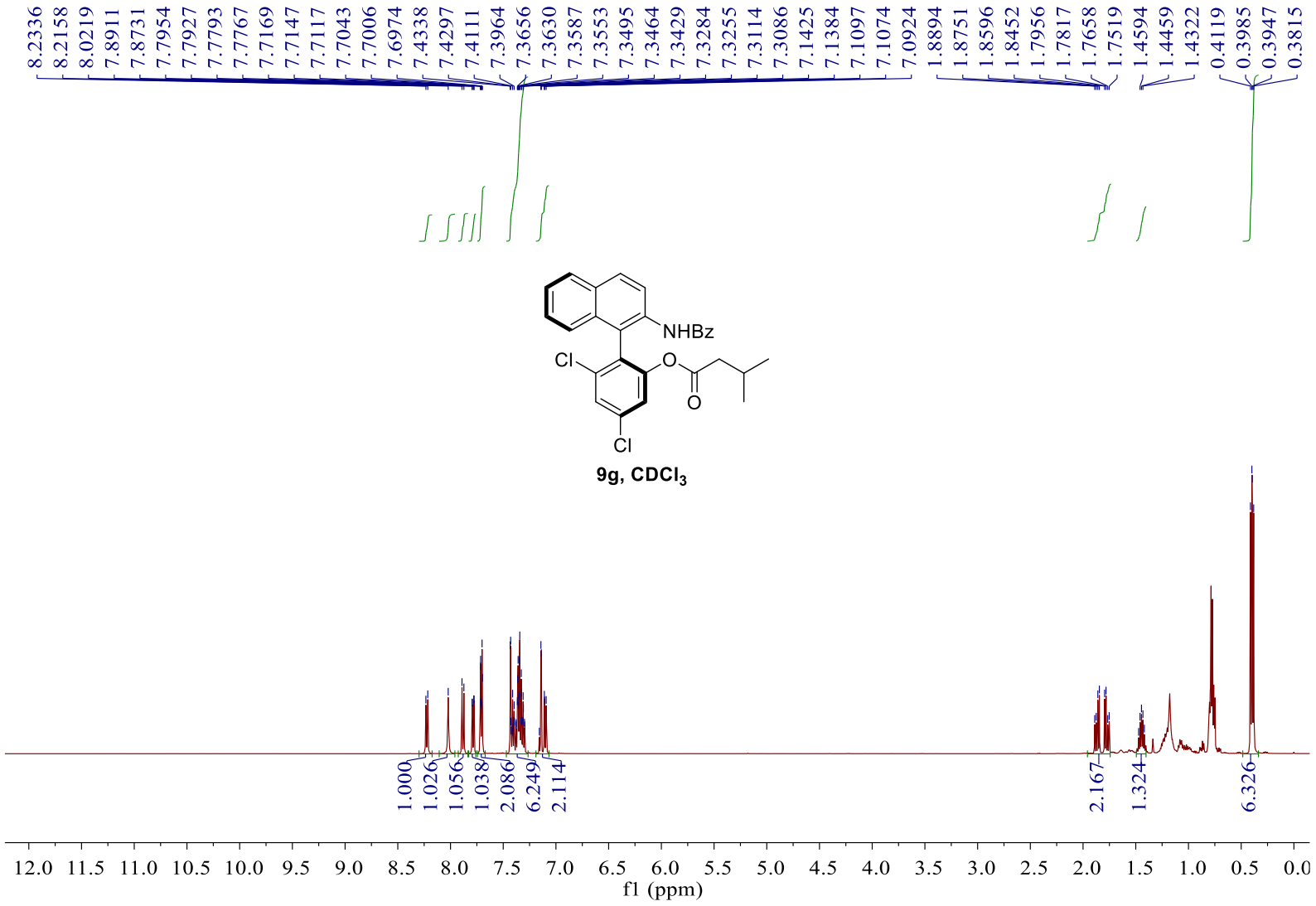
132.43
131.58
131.50
130.97
129.83
129.69
128.79
128.60
127.85
127.16
126.97
126.39
125.52
125.09
42.55
25.33
21.83
21.80
16.55
NHBz
O
O
Me
9f, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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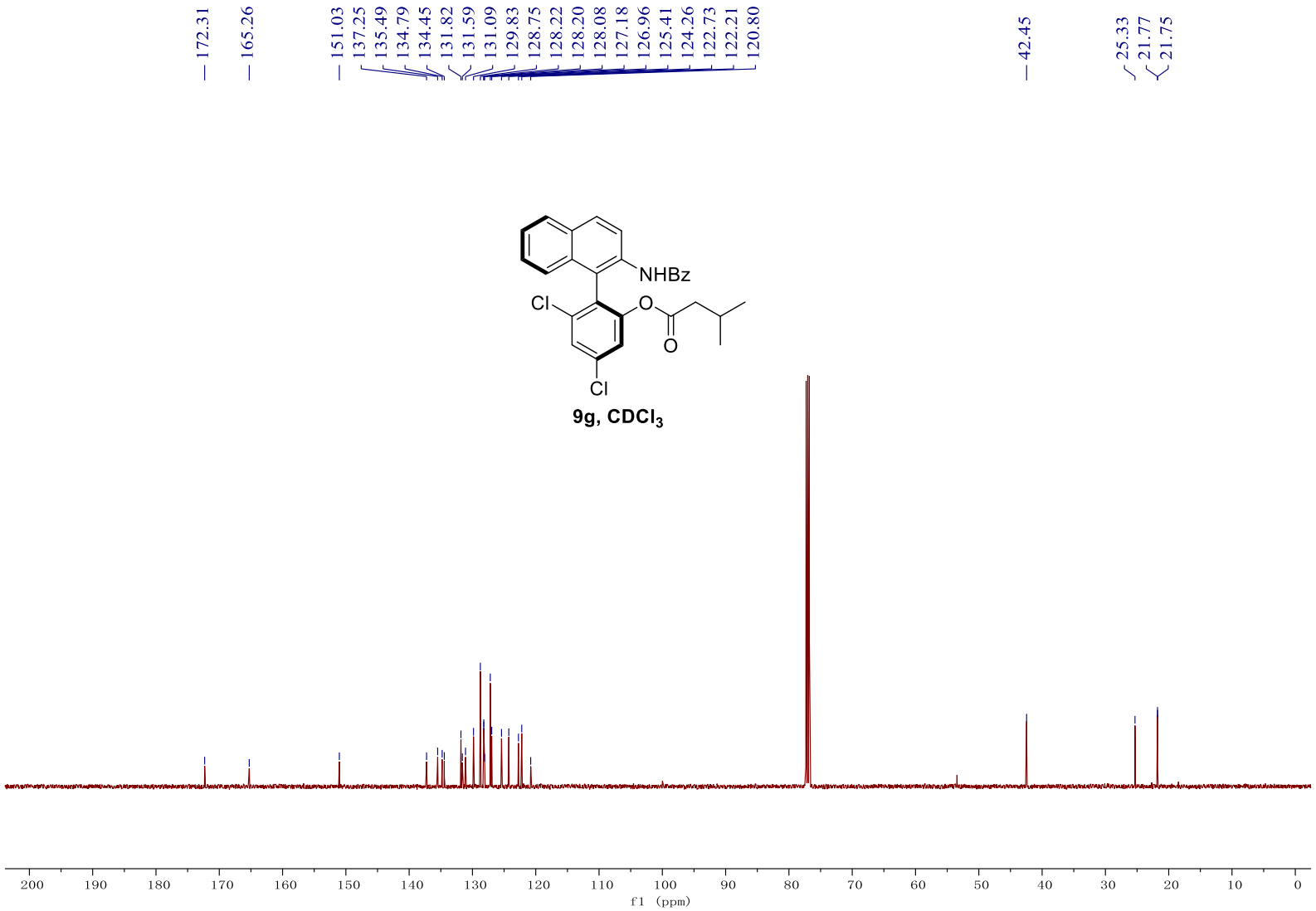
8.0219
7.8911
7.8731
7.7954
7.7927
7.7793
7.7767
7.7169
7.7147
7.7117
7.7043
7.7006
7.6974
7.4338
7.4297
7.4111
7.3964
7.3656
7.3630
7.3587
7.3553
7.3495
7.3464
7.3429
7.3284
7.3255
7.3114
7.3086
7.1425
7.1384
7.1097
7.1074
7.0924
1.8894
1.8751
1.8596
1.8452
1.7956
1.7817
1.7658
1.7519
1.4594
1.4459
1.4322
0.4119
0.3985
0.3947
0.3815
NHBz
Cl
O
O
Cl
9g, CDCl3
1.000
1.026
1.056
1.038
2.086
6.249
2.114
2.167
1.324
6.326
12.0 11.5 11.0 10.5 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
f1 (ppm)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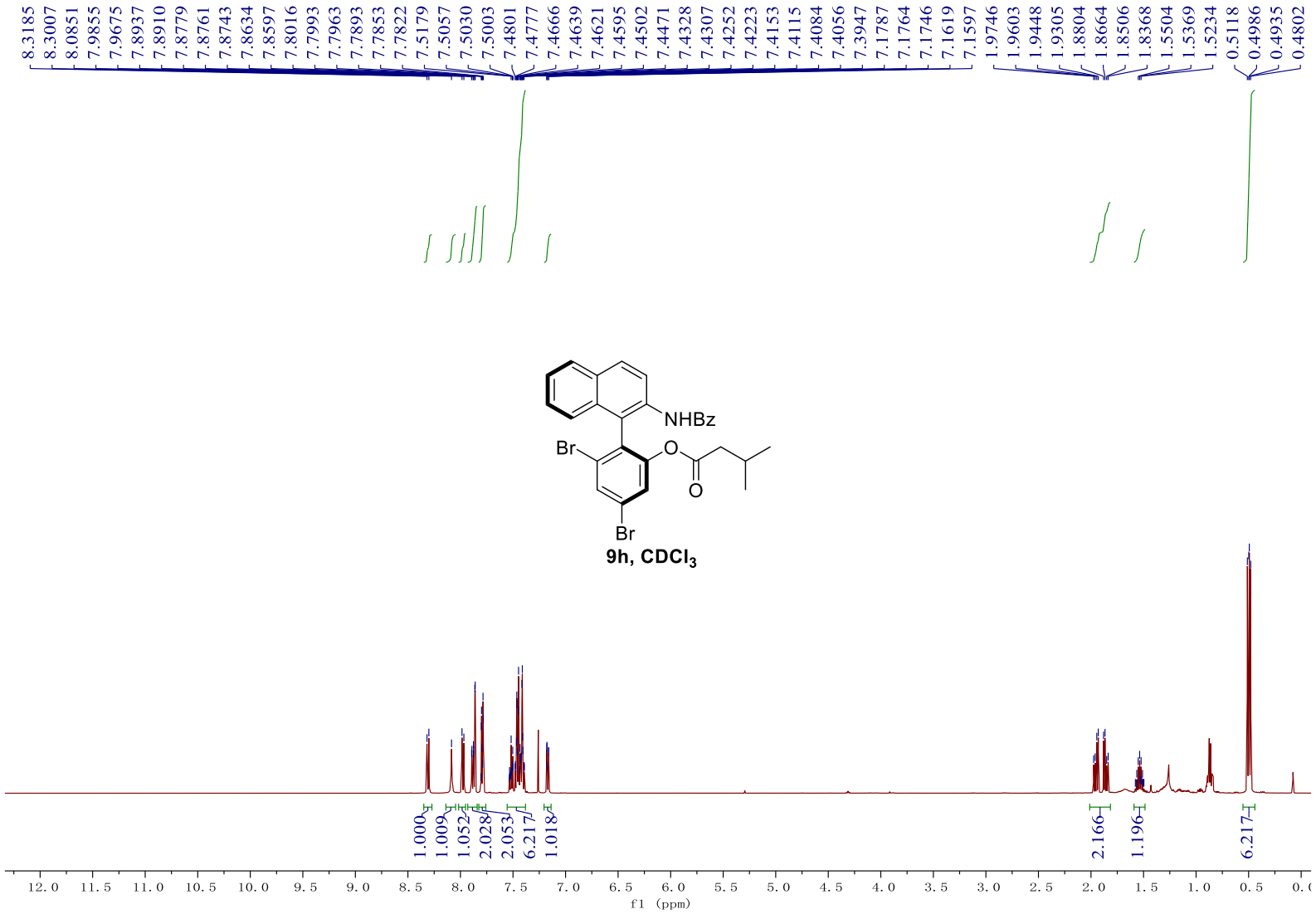
165.26
151.03
137.25
135.49
134.79
134.45
131.82
131.59
131.09
129.83
128.75
128.22
128.20
128.08
127.18
126.96
125.41
124.26
122.73
122.21
120.80
42.45
25.33
21.77
21.75
NHBz
Cl
O
O
Cl
9g, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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8.3007
8.0851
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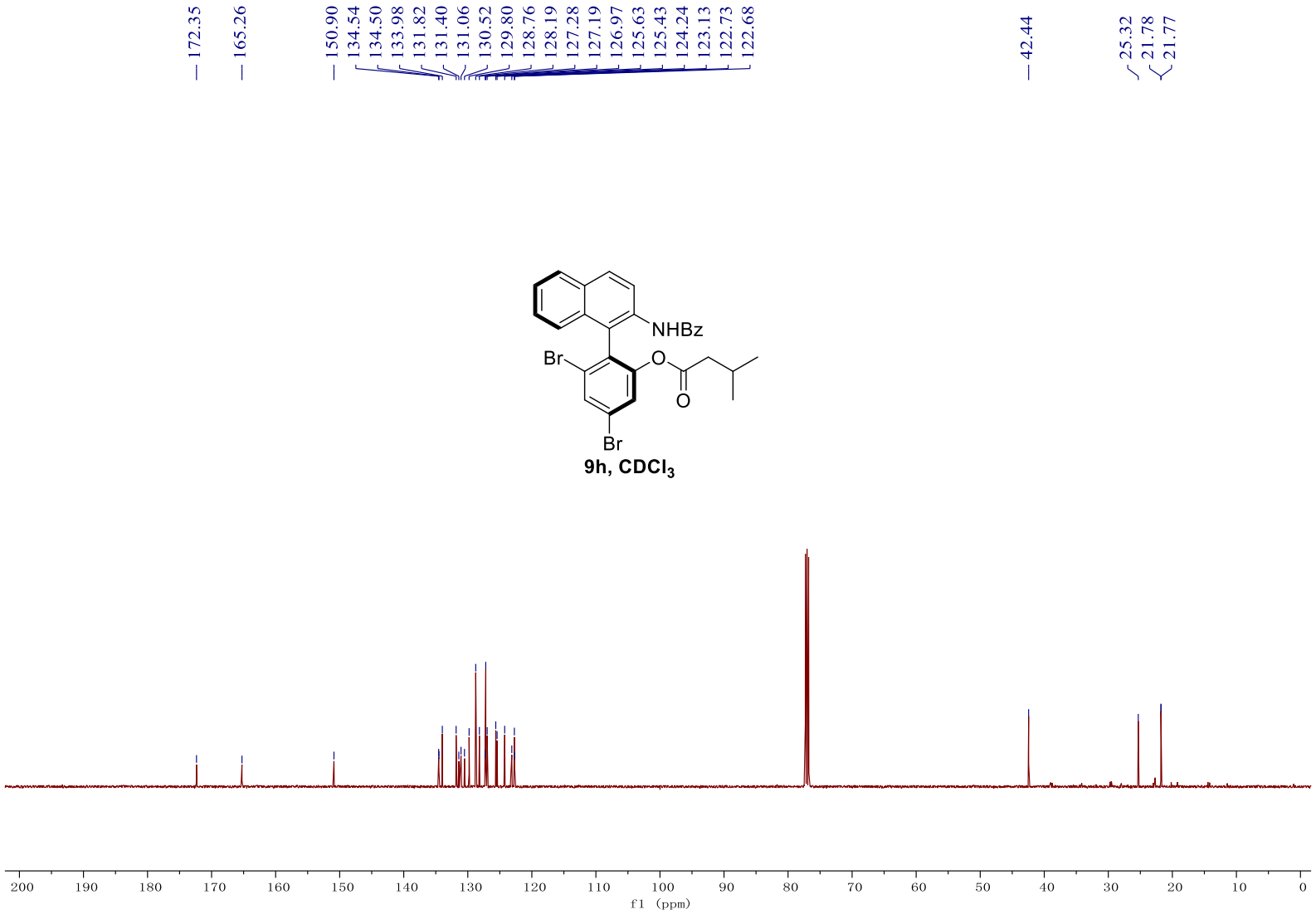
7.8910
7.8779
7.8761
7.8743
7.8634
7.8597
7.8016
7.7993
7.7963
7.7893
7.7853
7.7822
7.5179
7.5057
7.5030
7.5003
7.4801
7.4777
7.4666
7.4639
7.4621
7.4595
7.4502
7.4471
7.4328
7.4307
7.4252
7.4223
7.4153
7.4115
7.4084
7.4056
7.3947
7.1787
7.1764
7.1746
7.1619
7.1597
1.9746
1.9603
1.9448
1.9305
1.8804
1.8664
1.8506
1.8368
1.5504
1.5369
1.5234
0.5118
0.4986
0.4935
0.4802
NHBz
Br
O
O
Br
9h, CDCl3
1.000
1.009
1.052
2.028
2.053
6.217
1.018
2.166
1.196
6.217
12.0 11.5 11.0 10.5 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
f1 (ppm)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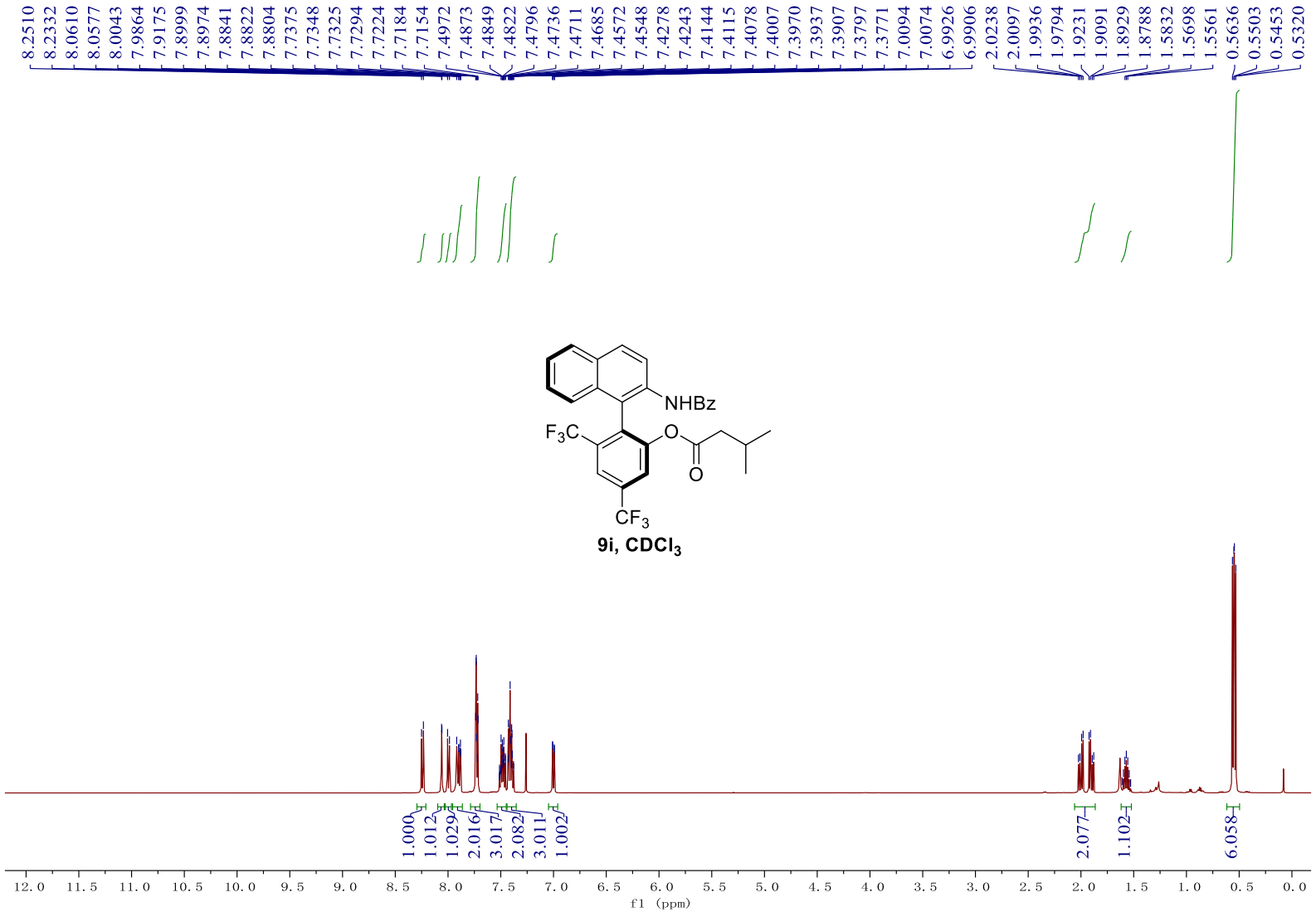
133.98
131.82
131.40
131.06
130.52
129.80
128.76
128.19
127.28
127.19
126.97
125.63
125.43
124.24
123.13
122.73
122.68
42.44
25.32
21.78
21.77
NHBz
Br
O
O
Br
9h, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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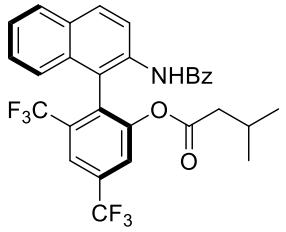
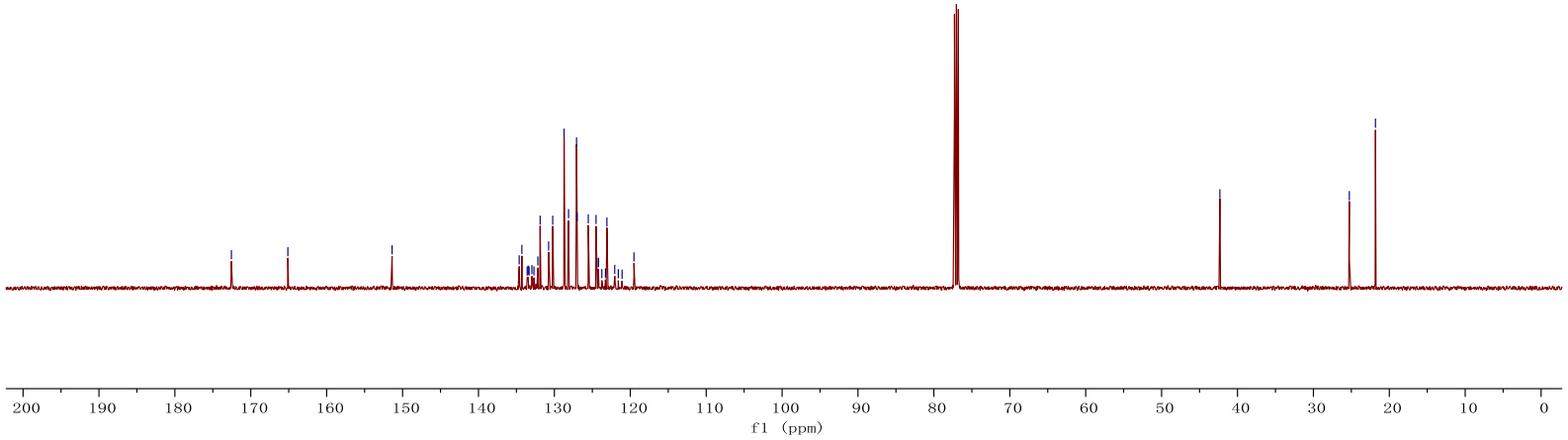
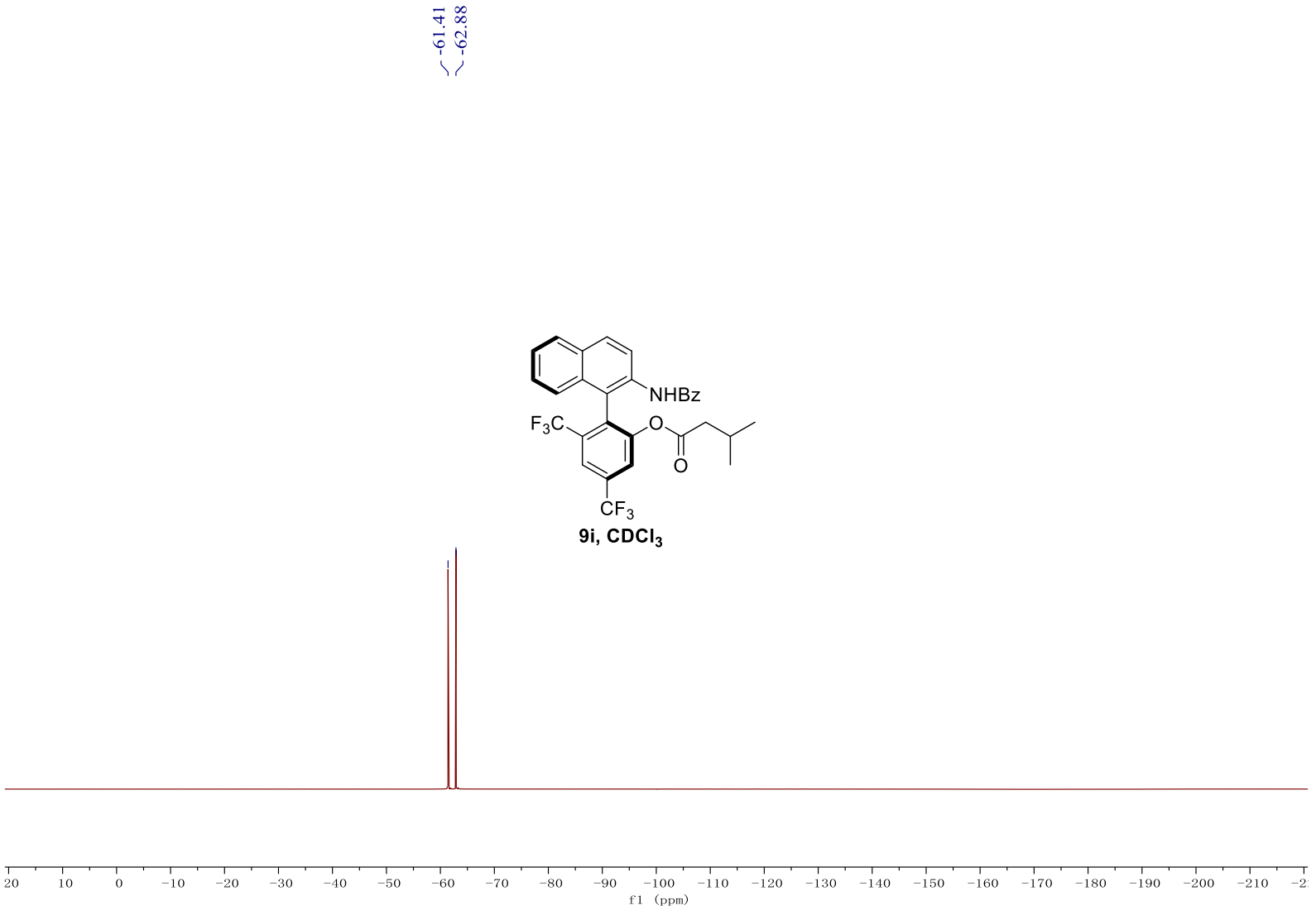
7.9175
7.8999
7.8974
7.8841
7.8822
7.8804
7.7375
7.7348
7.7325
7.7294
7.7224
7.7184
7.7154
7.4972
7.4873
7.4849
7.4822
7.4796
7.4736
7.4711
7.4685
7.4572
7.4548
7.4278
7.4243
7.4144
7.4115
7.4078
7.4007
7.3970
7.3937
7.3907
7.3797
7.3771
7.0094
7.0074
6.9926
6.9906
2.0238
2.0097
1.9936
1.9794
1.9231
1.9091
1.8929
1.8788
1.5832
1.5698
1.5561
0.5636
0.5503
0.5453
0.5320
NHBz
F3C
O
O
CF3
9i, CDCl3
1.000
1.012
1.029
2.016
3.017
2.082
3.011
1.002
2.077
1.102
6.058
12.0 11.5 11.0 10.5 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
f1 (ppm)


172.55
165.11
151.38
134.64
134.28
133.58
133.45
133.33
132.96
132.69
132.18
131.88
130.76
130.22
128.72
128.13
127.08
127.00
125.53
124.51
124.21
124.18
123.75
123.27
123.08
122.05
121.58
121.08
119.51
42.32
25.26
21.82

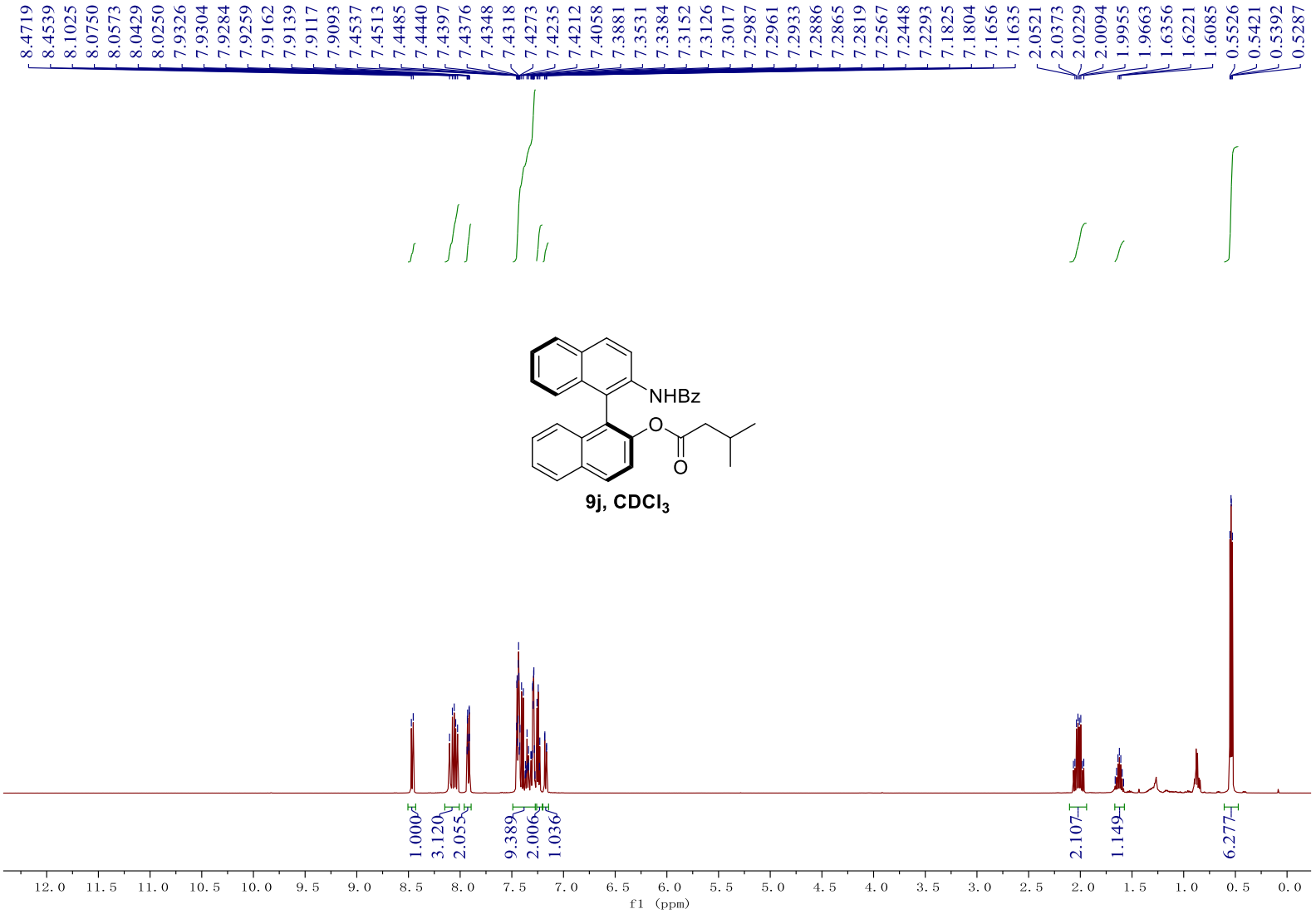

NHBz
F3C
O
O
CF3

9i, $CDCl_3$


200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-61.41
-62.88
NHBz
F3C
O
O
CF3
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210
f1 (ppm)

9i, $CDCl_3$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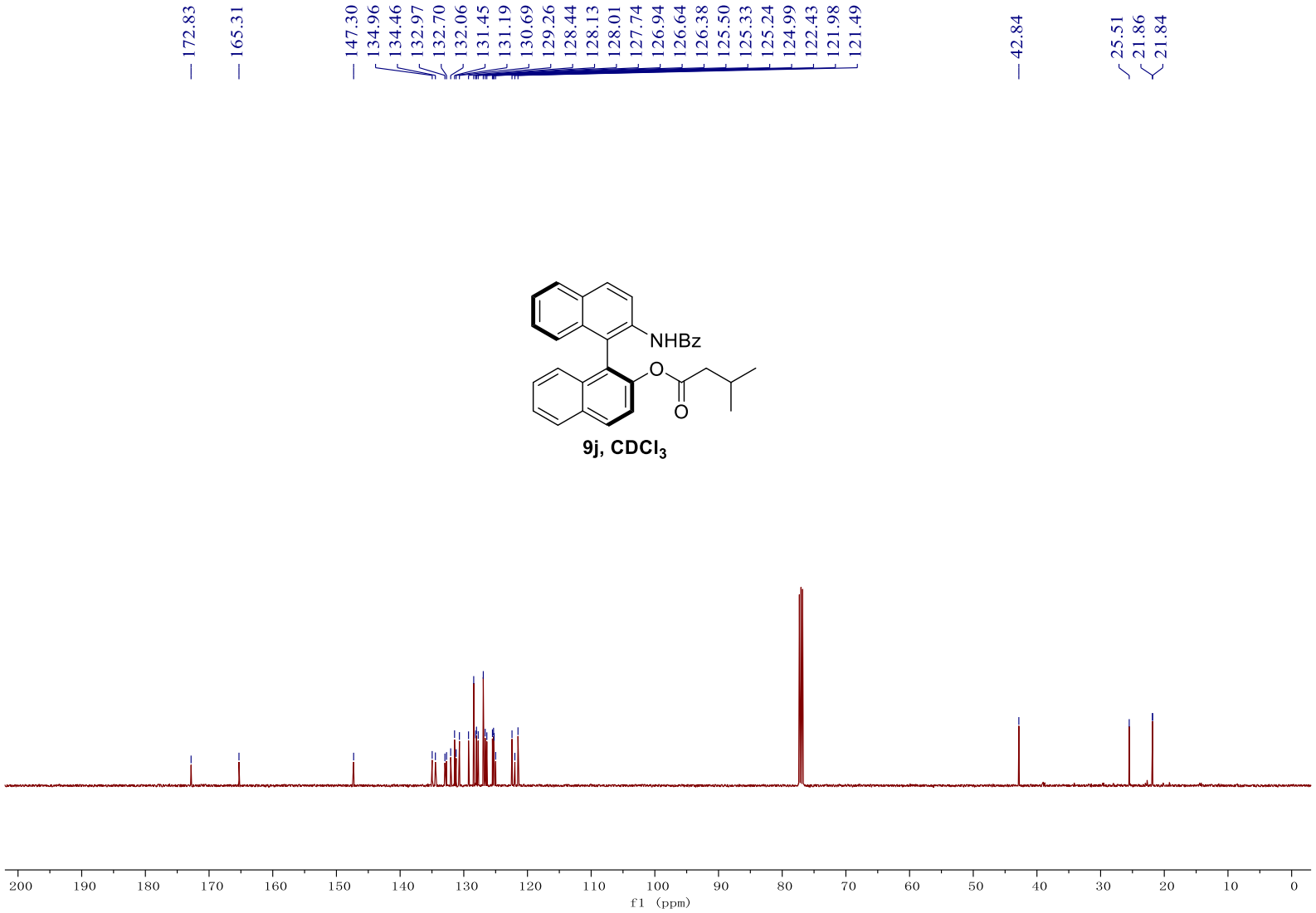
7.9259
7.9162
7.9139
7.9117
7.9093
7.4537
7.4513
7.4485
7.4440
7.4397
7.4376
7.4348
7.4318
7.4273
7.4235
7.4212
7.4058
7.3881
7.3531
7.3384
7.3152
7.3126
7.3017
7.2987
7.2961
7.2933
7.2886
7.2865
7.2819
7.2567
7.2448
7.2293
7.1825
7.1804
7.1656
7.1635
2.0521
2.0373
2.0229
2.0094
1.9955
1.9663
1.6356
1.6221
1.6085
0.5526
0.5421
0.5392
0.5287
NHBz
O
O
9j, CDCl3
1.000
3.120
2.055
9.389
2.006
1.036
2.107
1.149
6.277
12.0 11.5 11.0 10.5 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
f1 (ppm)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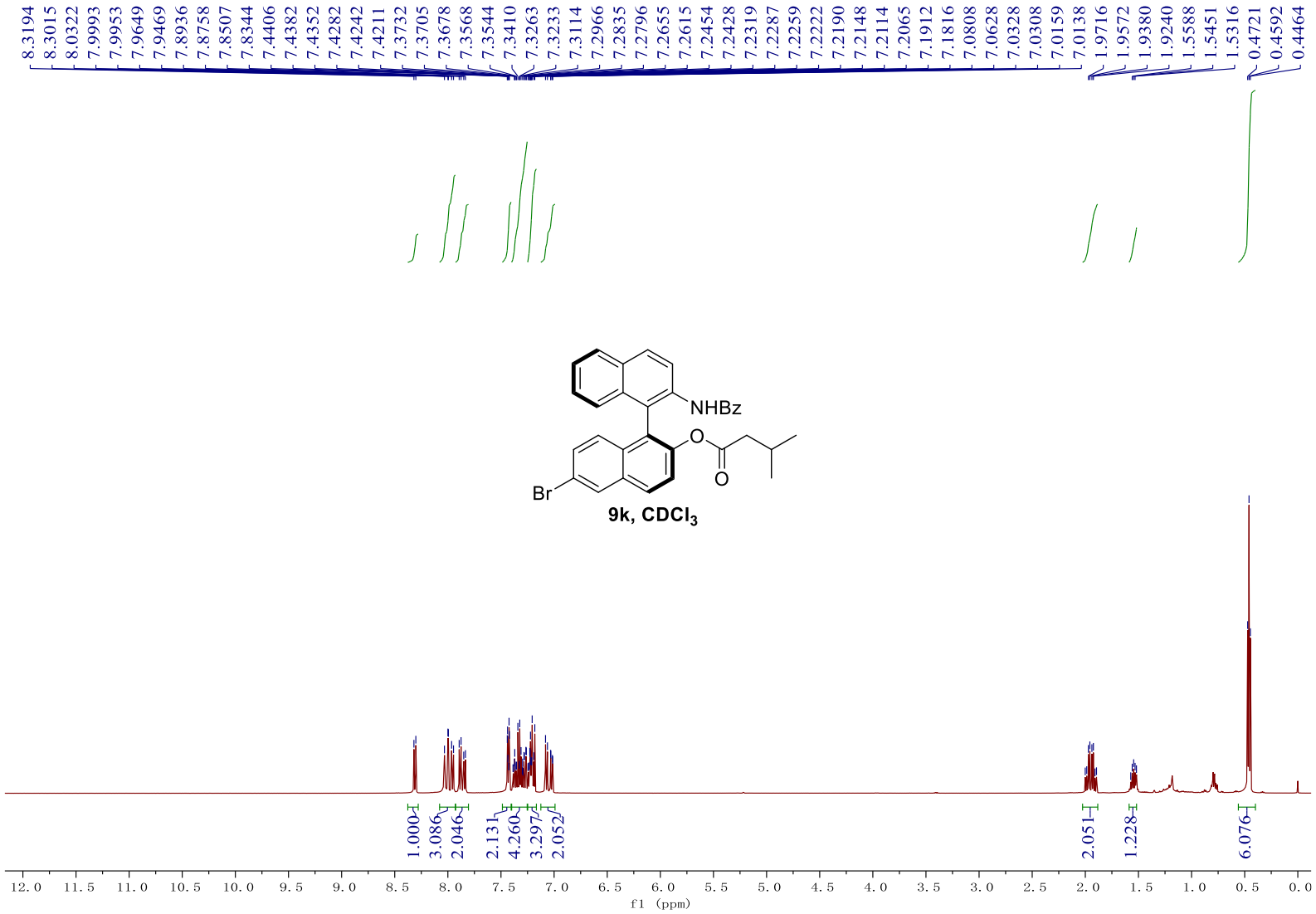
134.96
134.46
132.97
132.70
132.06
131.45
131.19
130.69
129.26
128.44
128.13
128.01
127.74
126.94
126.64
126.38
125.50
125.33
125.24
124.99
122.43
121.98
121.49
42.84
25.51
21.86
21.84
NHBz
O
O
9j, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.9953
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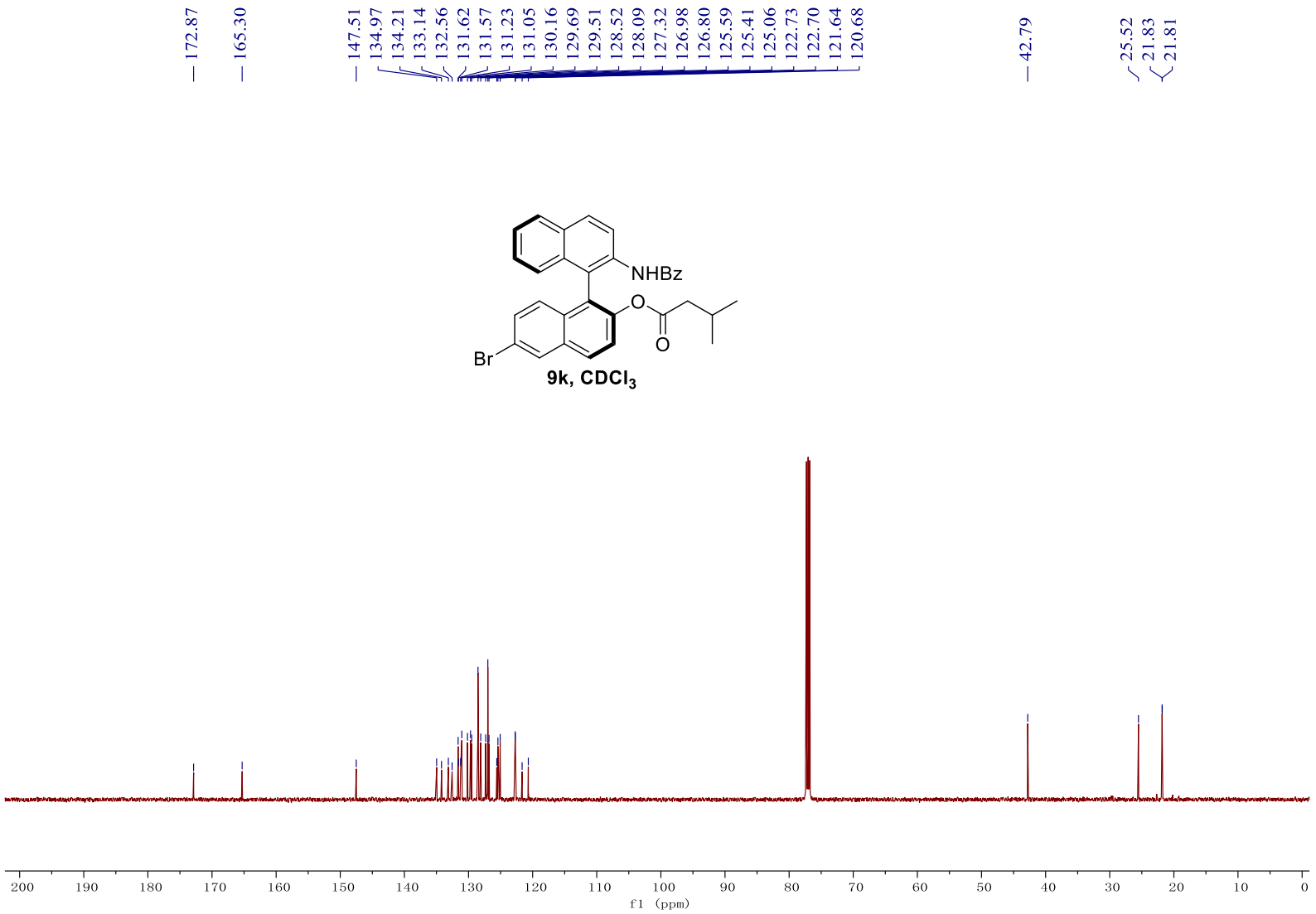
7.8507
7.8344
7.4406
7.4382
7.4352
7.4282
7.4242
7.4211
7.3732
7.3705
7.3678
7.3568
7.3544
7.3410
7.3263
7.3233
7.3114
7.2966
7.2835
7.2796
7.2655
7.2615
7.2454
7.2428
7.2319
7.2287
7.2259
7.2222
7.2190
7.2148
7.2114
7.2065
7.1912
7.1816
7.0808
7.0628
7.0328
7.0308
7.0159
7.0138
1.9716
1.9572
1.9380
1.9240
1.5588
1.5451
1.5316
0.4721
0.4592
0.4464
NHBz
O
O
Br
9k, CDCl3
1.000
3.086
2.046
2.131
4.260
3.297
2.052
2.051
1.228
6.076
12.0
11.5
11.0
10.5
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
f1 (ppm)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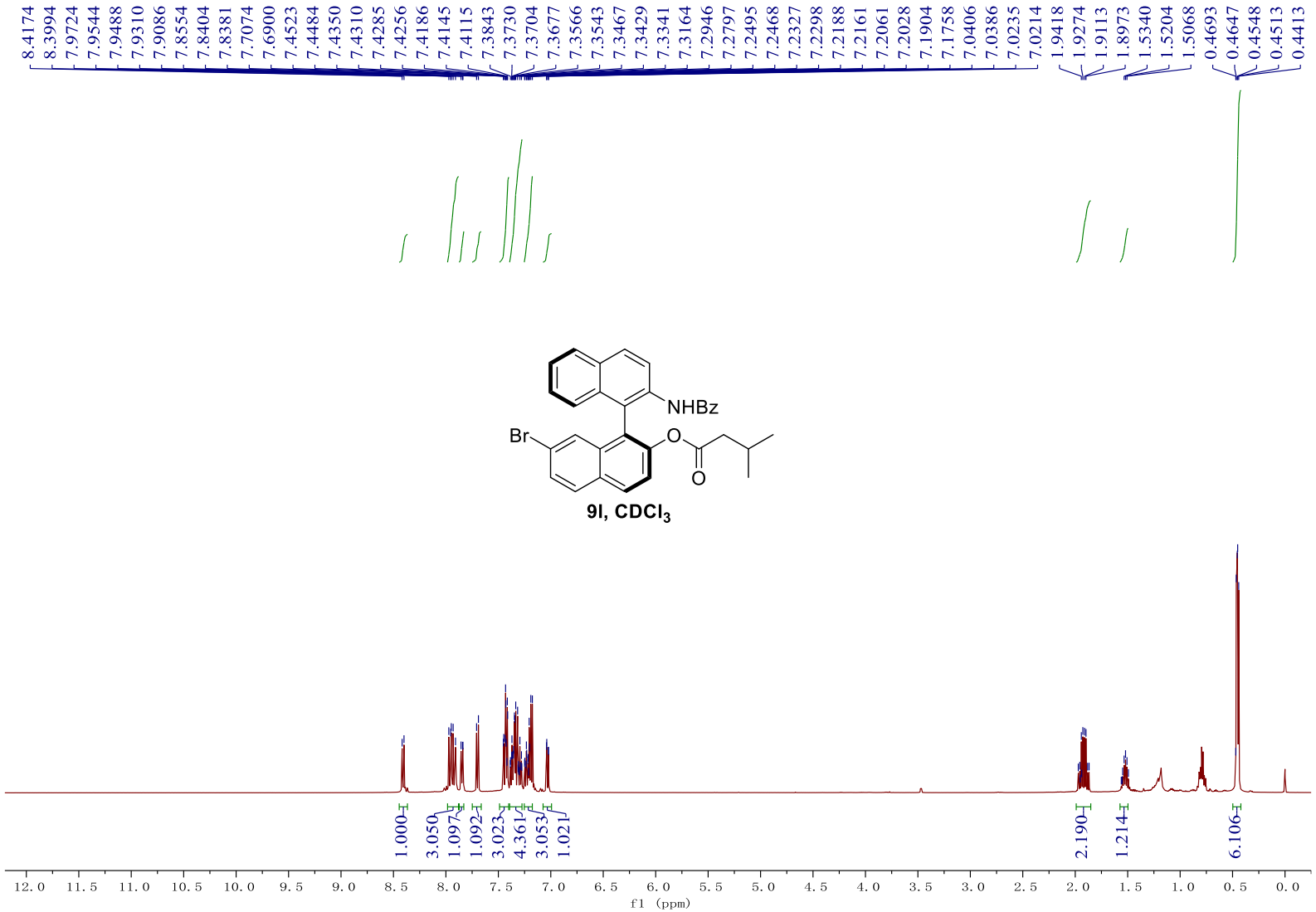
133.14
132.56
131.62
131.57
131.23
131.05
130.16
129.69
129.51
128.52
128.09
127.32
126.98
126.80
125.59
125.41
125.06
122.73
122.70
121.64
120.68
42.79
25.52
21.83
21.81
NHBz
O
O
Br
9k, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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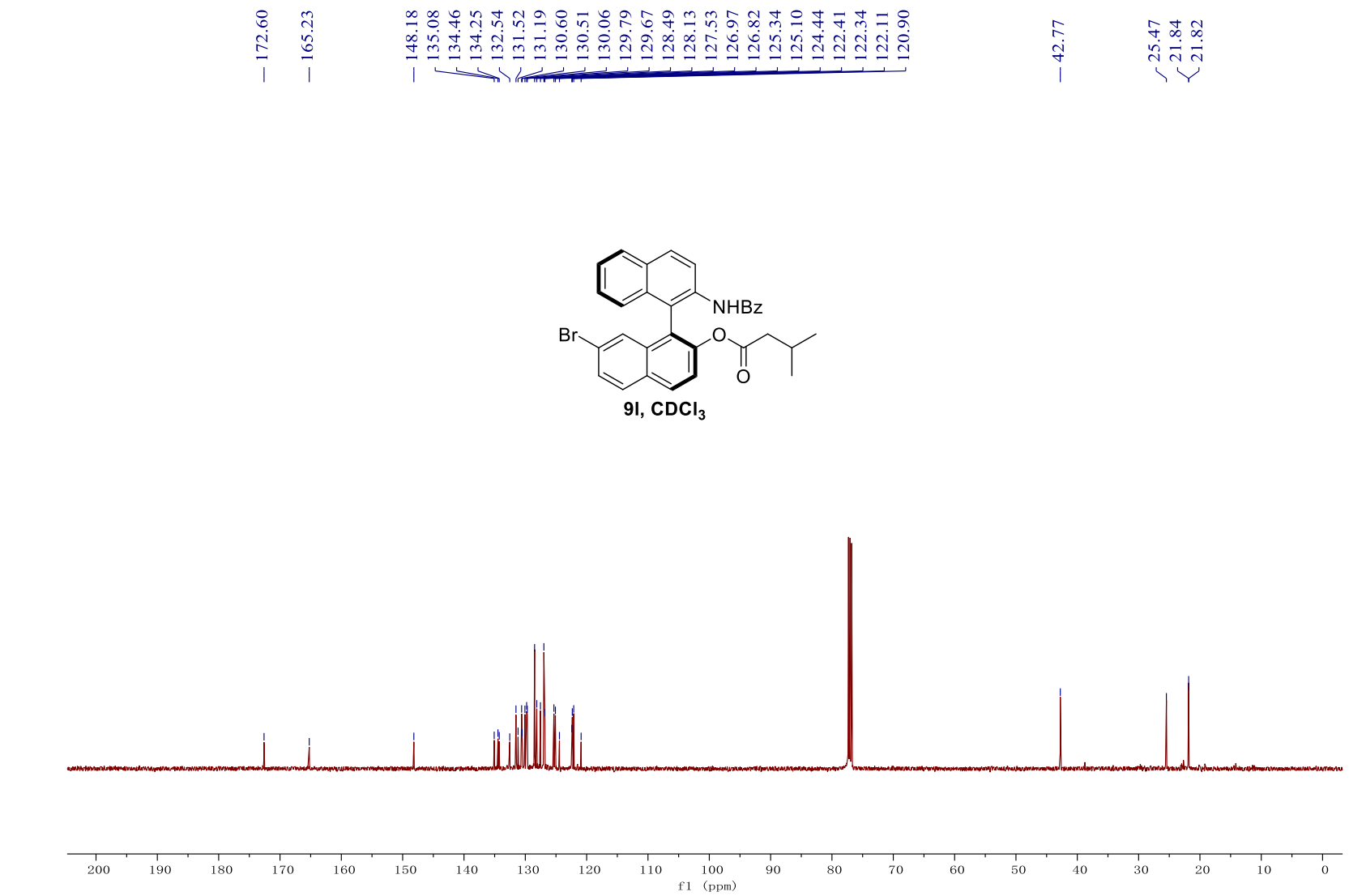
7.8381
7.7074
7.6900
7.4523
7.4484
7.4350
7.4310
7.4285
7.4256
7.4186
7.4145
7.4115
7.3843
7.3730
7.3704
7.3677
7.3566
7.3543
7.3467
7.3429
7.3341
7.3164
7.2946
7.2797
7.2495
7.2468
7.2327
7.2298
7.2188
7.2161
7.2061
7.2028
7.1904
7.1758
7.0406
7.0386
7.0235
7.0214
1.9418
1.9274
1.9113
1.8973
1.5340
1.5204
1.5068
0.4693
0.4647
0.4548
0.4513
0.4413
NHBz
Br
O
O
9l, CDCl3
1.000
3.050
1.097
1.092
3.023
4.361
3.053
1.021
2.190
1.214
6.106
12.0 11.5 11.0 10.5 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
f1 (ppm)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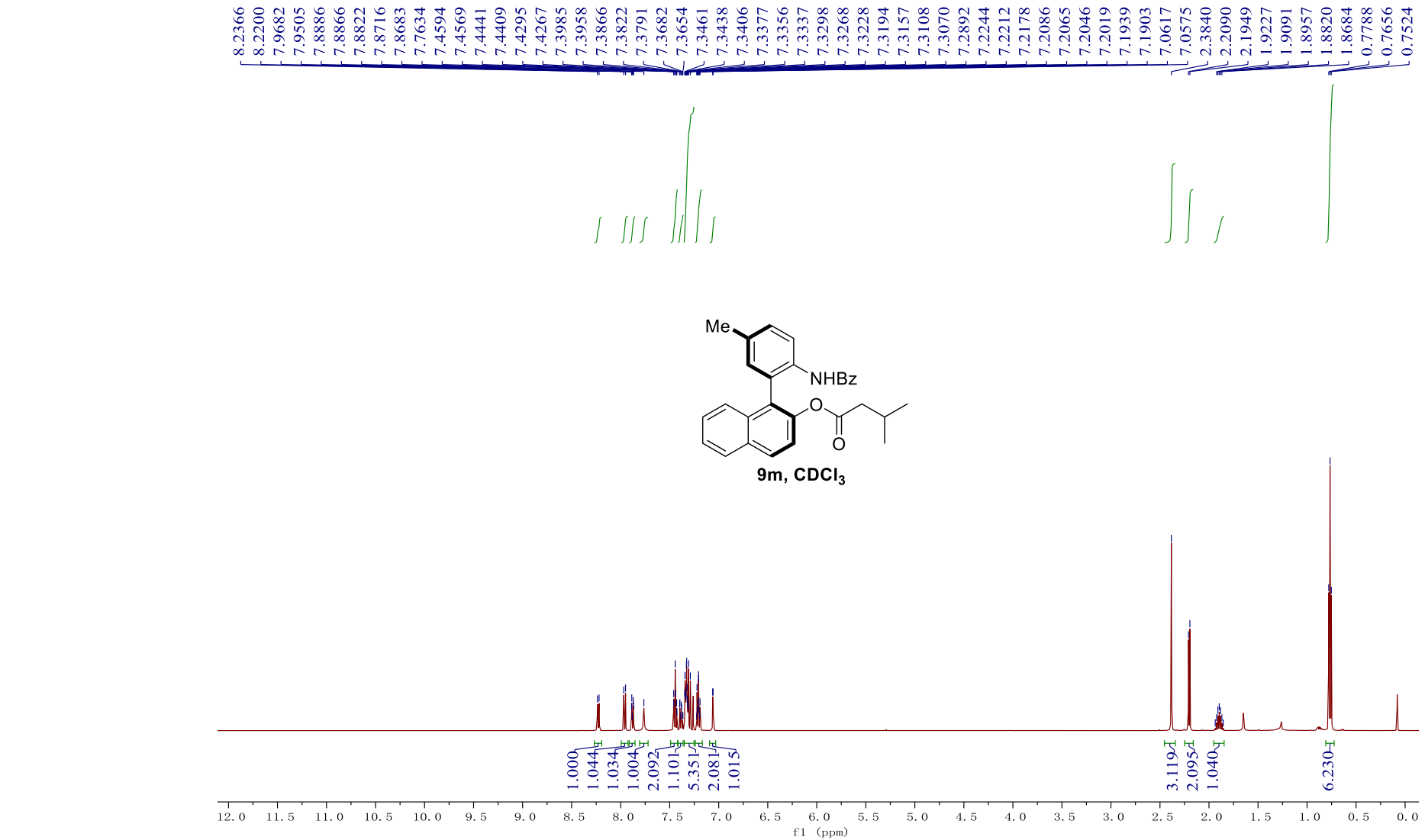
135.08
134.46
134.25
132.54
131.52
131.19
130.60
130.51
130.06
129.79
129.67
128.49
128.13
127.53
126.97
126.82
125.34
125.10
124.44
122.41
122.34
122.11
120.90
42.77
25.47
21.84
21.82
NHBz
Br
O
O
9l, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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8.2200
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7.9505
7.8886
7.8866
7.8822
7.8716
7.8683
7.7634
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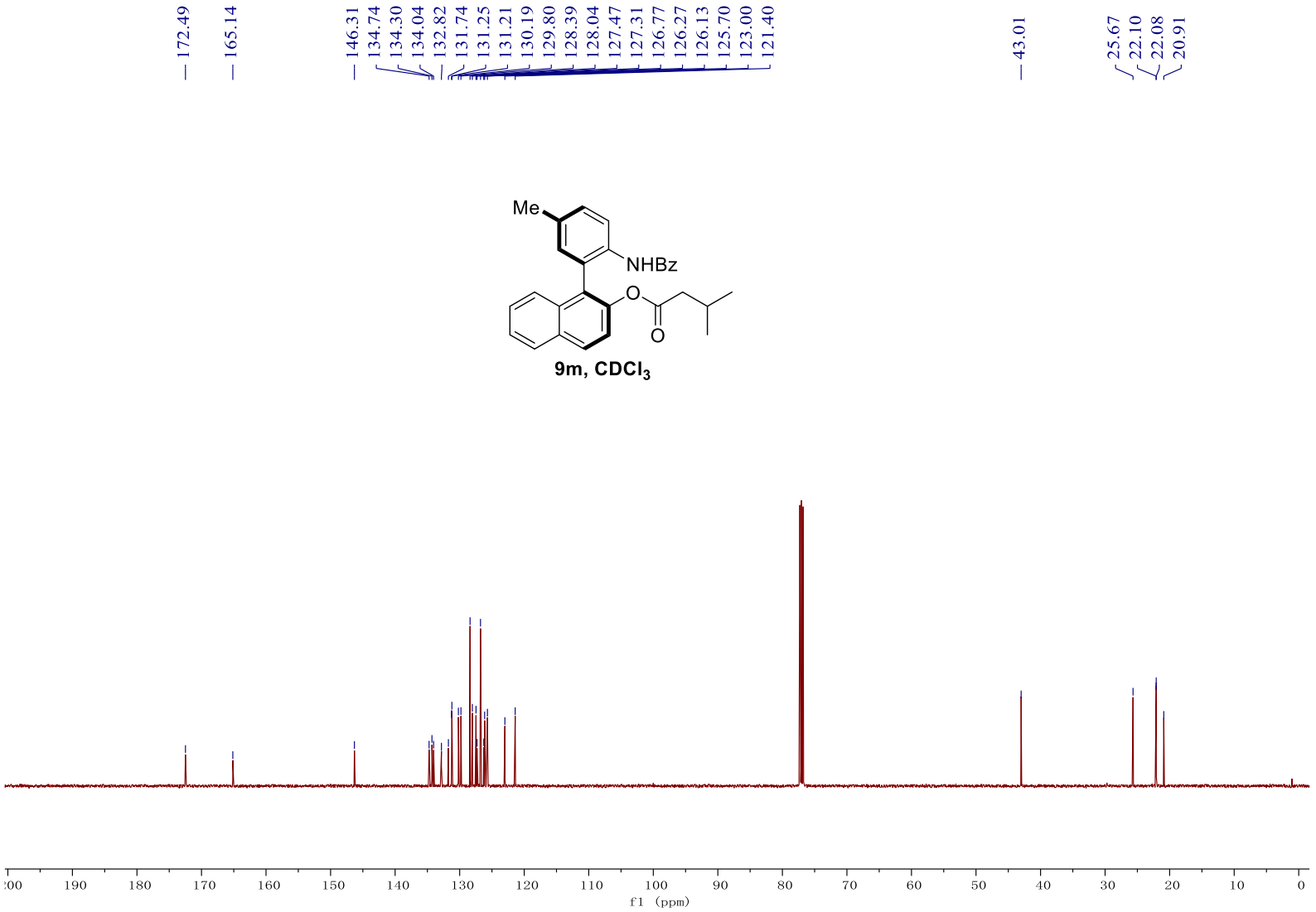
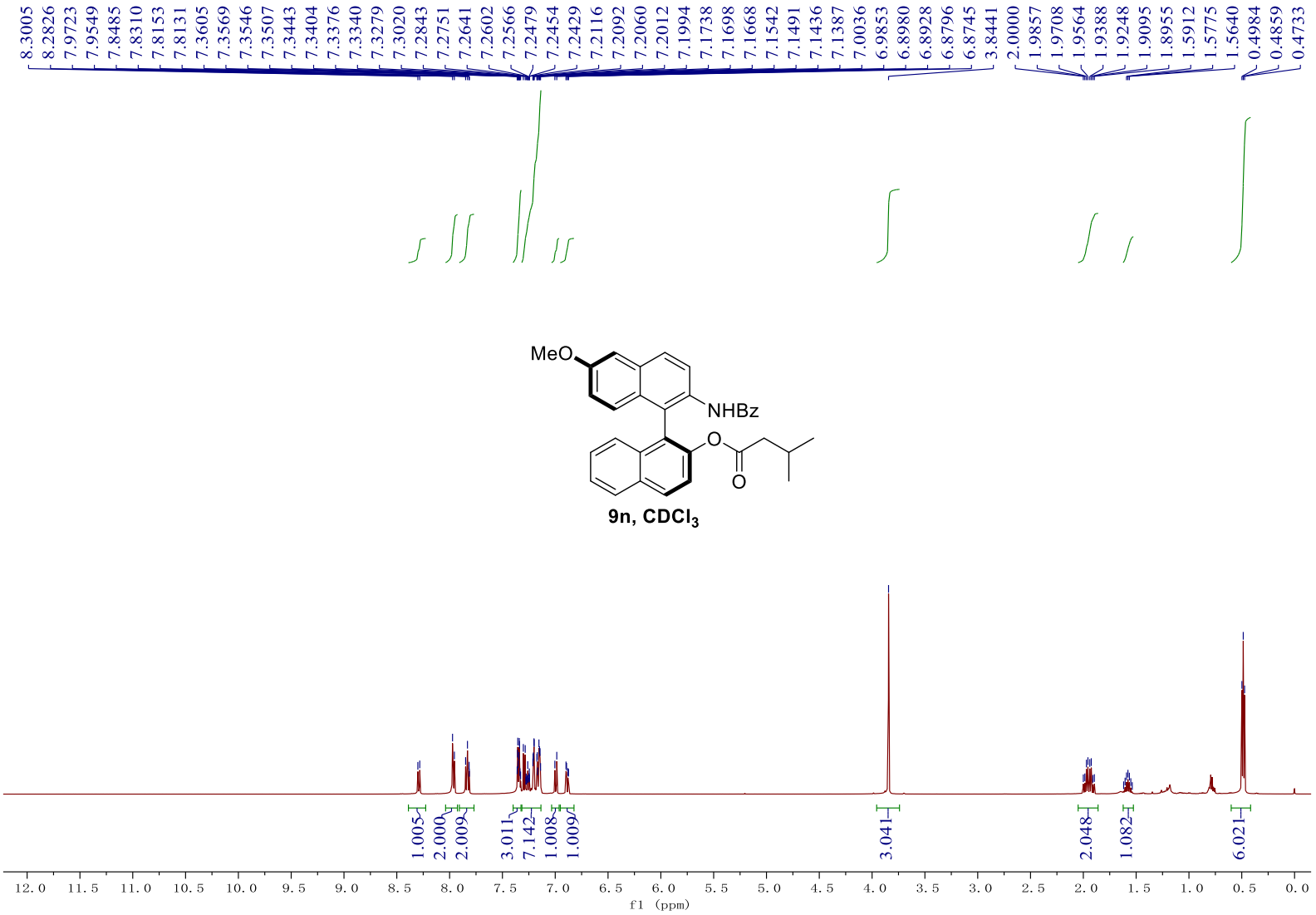
7.4569
7.4441
7.4409
7.4295
7.4267
7.3985
7.3958
7.3866
7.3822
7.3791
7.3682
7.3654
7.3461
7.3438
7.3406
7.3377
7.3356
7.3337
7.3298
7.3268
7.3228
7.3194
7.3157
7.3108
7.3070
7.2892
7.2244
7.2212
7.2178
7.2086
7.2065
7.2046
7.2019
7.1939
7.1903
7.0617
7.0575
2.3840
2.2090
2.1949
1.9227
1.9091
1.8957
1.8820
1.8684
0.7788
0.7656
0.7524
Me
NHBz
O
O
9m, CDCl3
1.000
1.044
1.034
1.004
2.092
1.101
5.351
2.081
1.015
3.119
2.095
1.040
6.230
12.0 11.5 11.0 10.5 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
f1 (ppm)


172.49
165.14
146.31
134.74
134.30
134.04
132.82
131.74
131.25
131.21
130.19
129.80
128.39
128.04
127.47
127.31
126.77
126.27
126.13
125.70
123.00
121.40
43.01
25.67
22.10
22.08
20.91
Me
NHBz
O
O
9m, CDCl3
f1 (ppm)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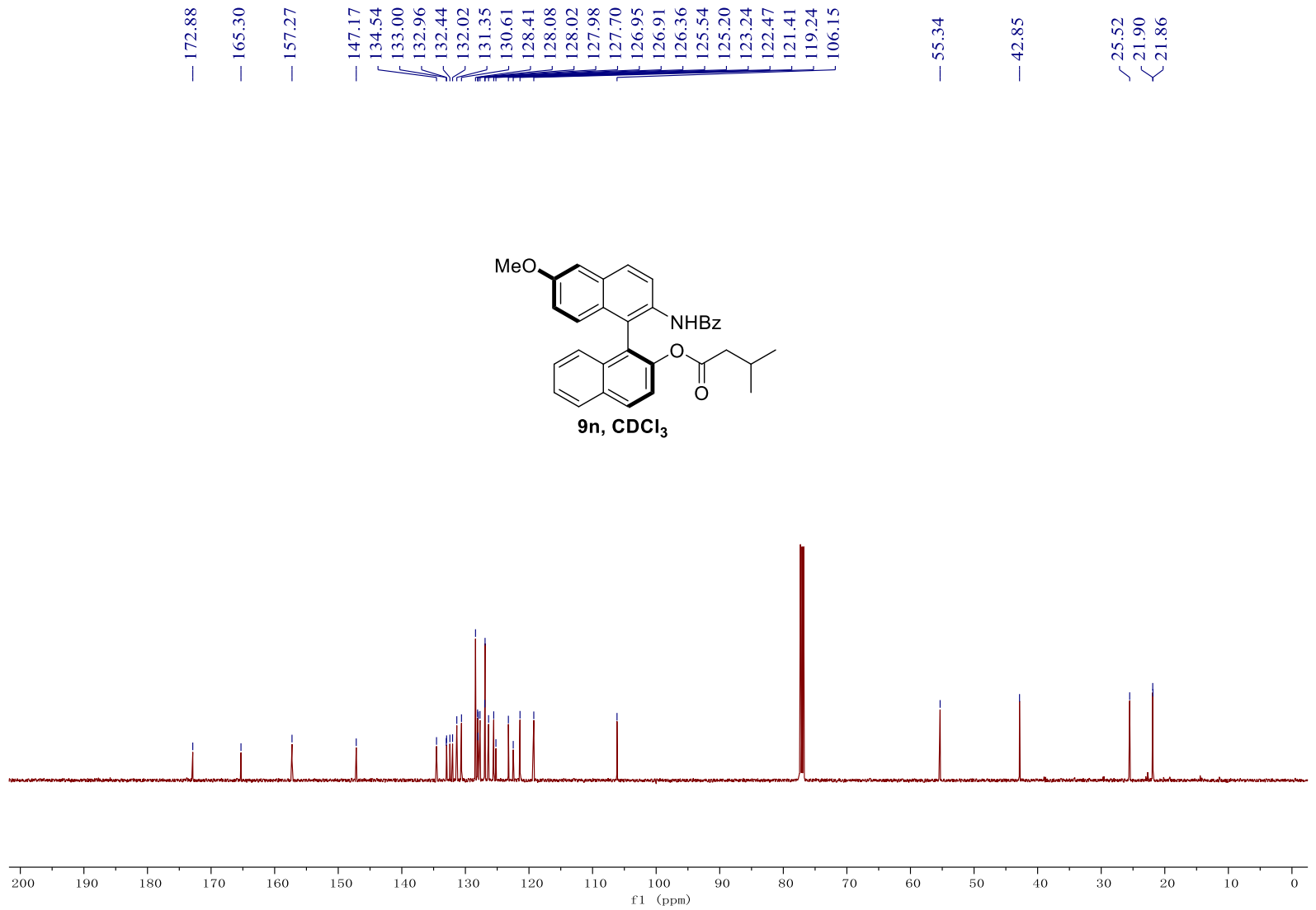
8.2826
7.9723
7.9549
7.8485
7.8310
7.8153
7.8131
7.3605
7.3569
7.3546
7.3507
7.3443
7.3404
7.3376
7.3340
7.3279
7.3020
7.2843
7.2751
7.2641
7.2602
7.2566
7.2479
7.2454
7.2429
7.2116
7.2092
7.2060
7.2012
7.1994
7.1738
7.1698
7.1668
7.1542
7.1491
7.1436
7.1387
7.0036
6.9853
6.8980
6.8928
6.8796
6.8745
3.8441
2.0000
1.9857
1.9708
1.9564
1.9388
1.9248
1.9095
1.8955
1.5912
1.5775
1.5640
0.4984
0.4859
0.4733
MeO
NHBz
O
O
9n, CDCl3
1.005
2.000
2.009
3.011
7.142
1.008
1.009
3.041
2.048
1.082
6.021
12.0 11.5 11.0 10.5 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
f1 (ppm)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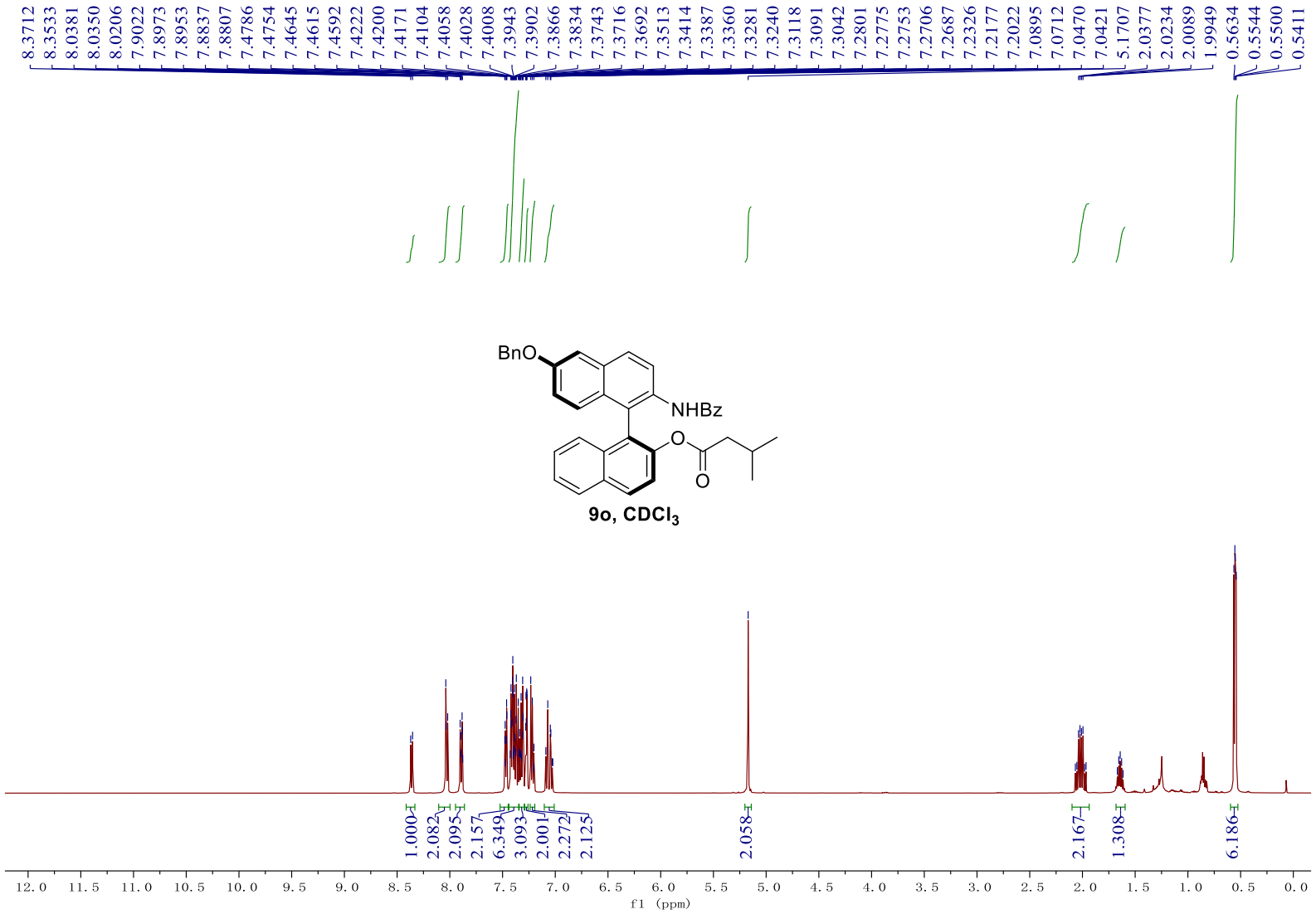
165.30
157.27
147.17
134.54
133.00
132.96
132.44
132.02
131.35
130.61
128.41
128.08
128.02
127.98
127.70
126.95
126.91
126.36
125.54
125.20
123.24
122.47
121.41
119.24
106.15
55.34
42.85
25.52
21.90
21.86
MeO
NHBz
O
O
9n, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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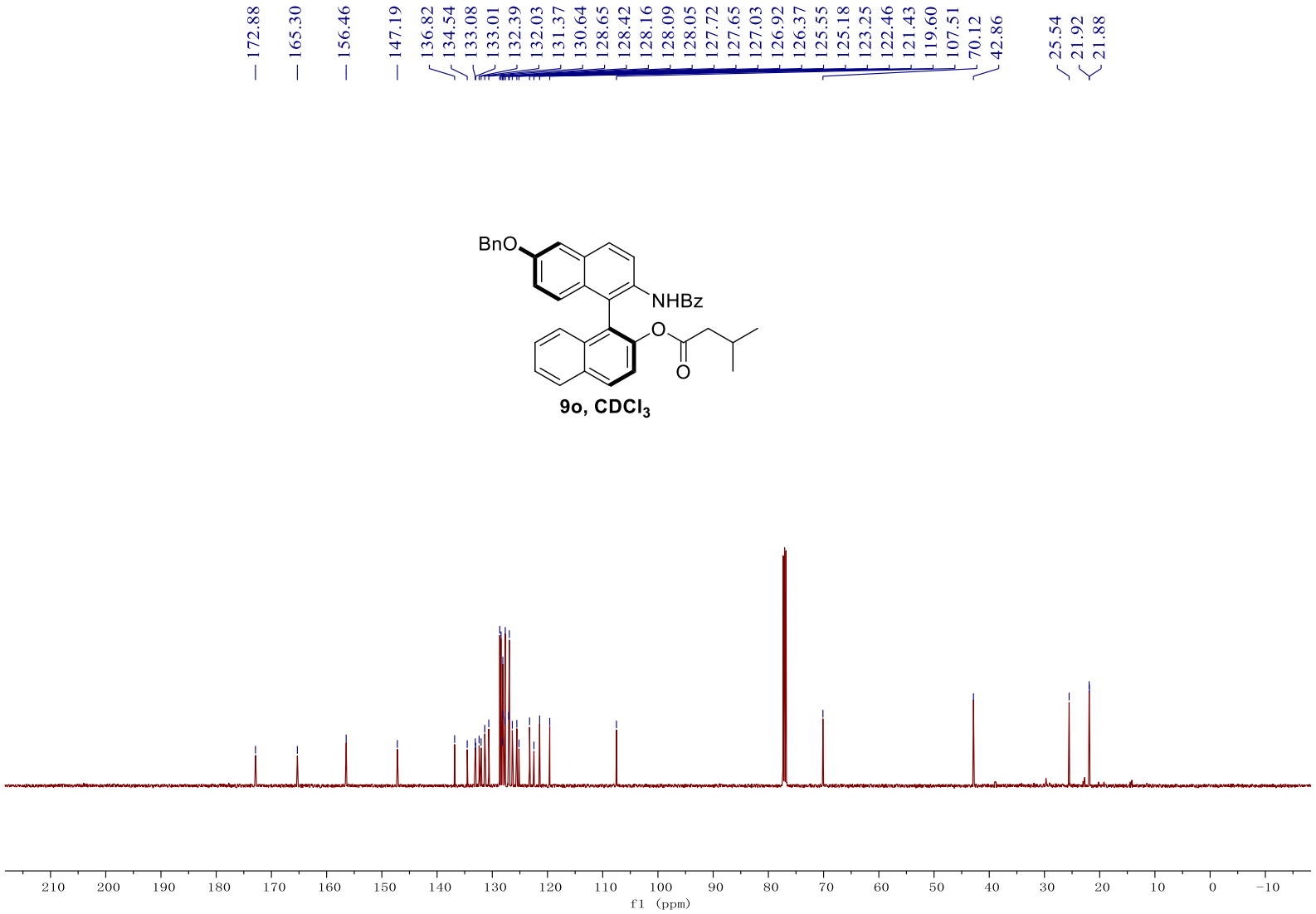
8.3533
8.0381
8.0350
8.0206
7.9022
7.8973
7.8953
7.8837
7.8807
7.4786
7.4754
7.4645
7.4615
7.4592
7.4222
7.4200
7.4171
7.4104
7.4058
7.4028
7.4008
7.3943
7.3902
7.3866
7.3834
7.3743
7.3716
7.3692
7.3513
7.3414
7.3387
7.3360
7.3281
7.3240
7.3118
7.3091
7.3042
7.2801
7.2775
7.2753
7.2706
7.2687
7.2326
7.2177
7.2022
7.0895
7.0712
7.0470
7.0421
5.1707
2.0377
2.0234
2.0089
1.9949
0.5634
0.5544
0.5500
0.5411
BnO
NHBz
O
O
9o, CDCl3
1.000
2.082
2.095
2.157
6.349
3.093
2.001
2.272
2.125
2.058
2.167
1.308
6.186
12.0 11.5 11.0 10.5 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
f1 (ppm)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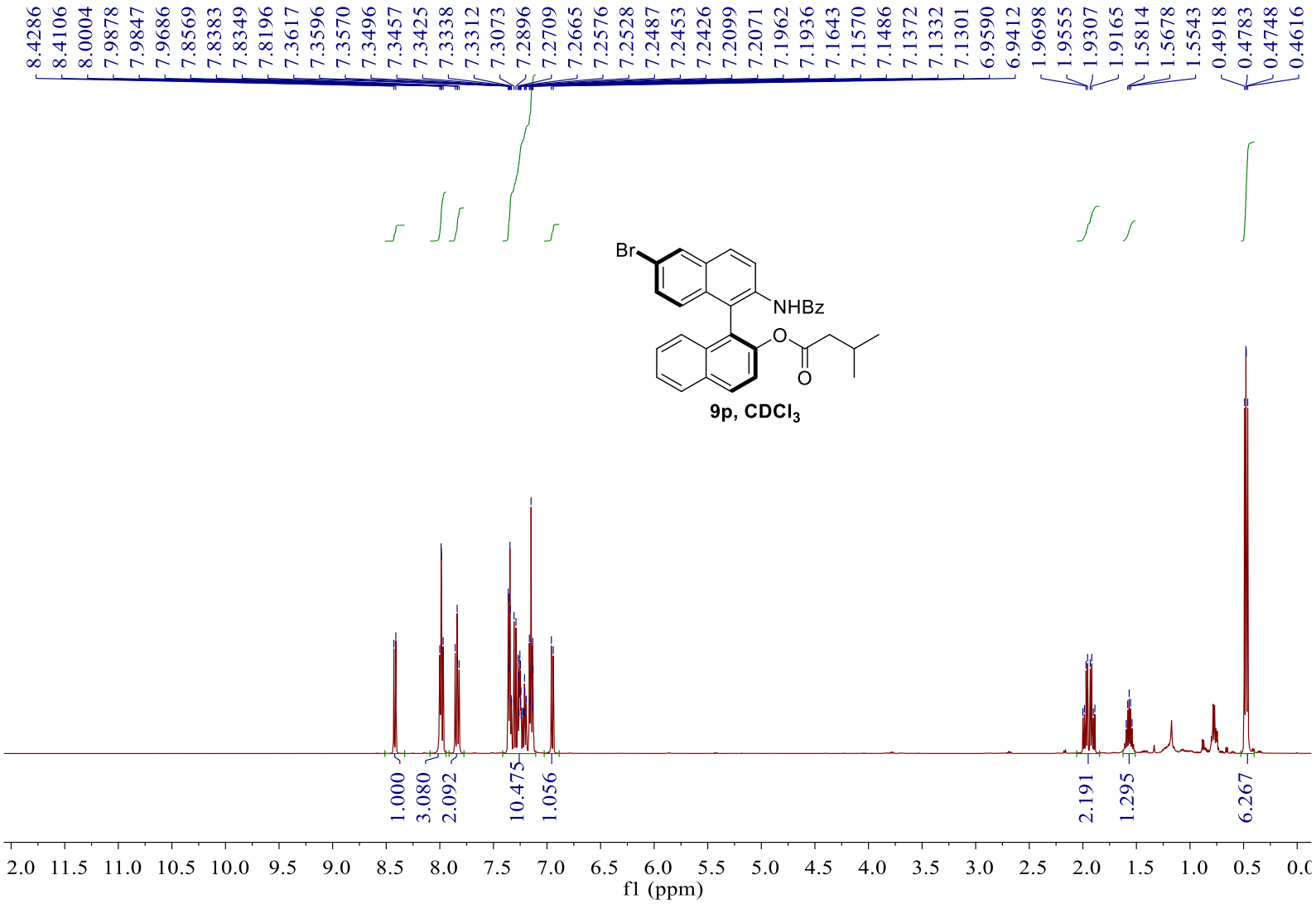
165.30
156.46
147.19
136.82
134.54
133.08
133.01
132.39
132.03
131.37
130.64
128.65
128.42
128.16
128.09
128.05
127.72
127.65
127.03
126.92
126.37
125.55
125.18
123.25
122.46
121.43
119.60
107.51
70.12
42.86
25.54
21.92
21.88
BnO
NHBz
O
O
9o, CDCl3
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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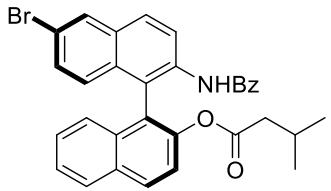
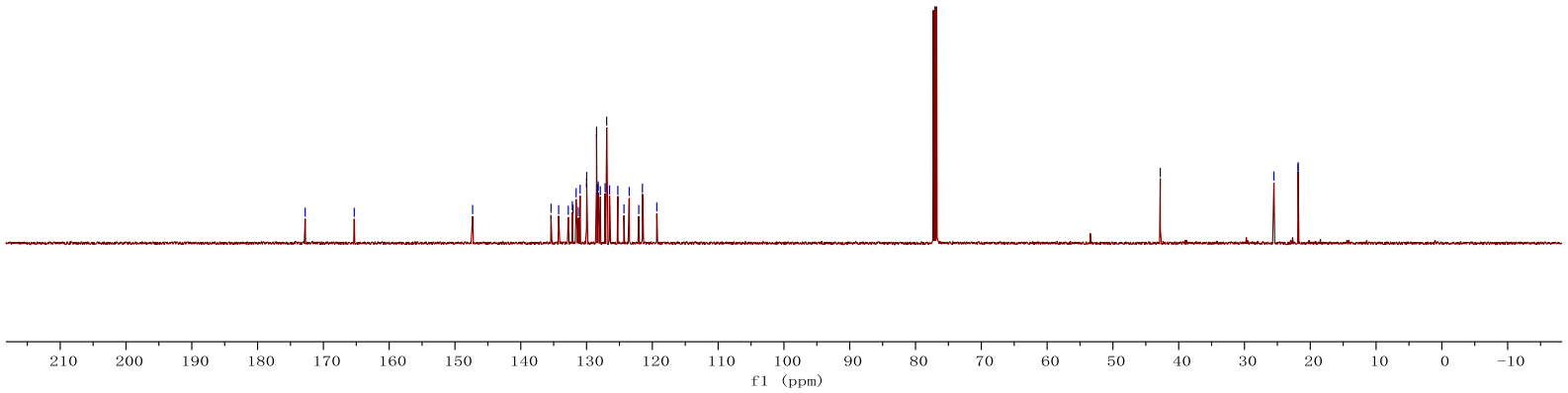
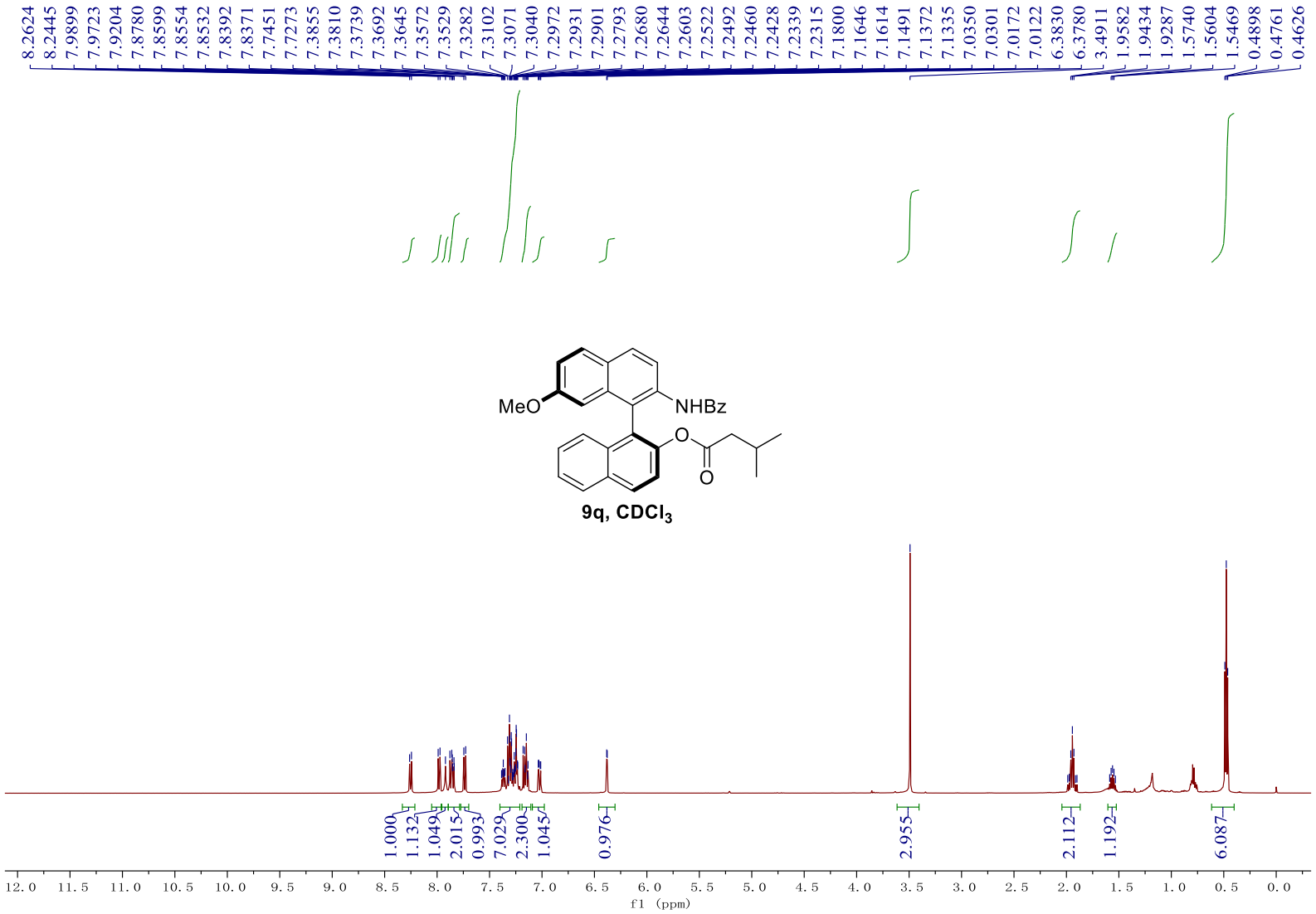
8.4106
8.0004
7.9878
7.9847
7.9686
7.8569
7.8383
7.8349
7.8196
7.3617
7.3596
7.3570
7.3496
7.3457
7.3425
7.3338
7.3312
7.3073
7.2896
7.2709
7.2665
7.2576
7.2528
7.2487
7.2453
7.2426
7.2099
7.2071
7.1962
7.1936
7.1643
7.1570
7.1486
7.1372
7.1332
7.1301
6.9590
6.9412
1.9698
1.9555
1.9307
1.9165
1.5814
1.5678
1.5543
0.4918
0.4783
0.4748
0.4616
Br
NHBz
O
O
9p, CDCl3
1.000
3.080
2.092
10.475
1.056
2.191
1.295
6.267
2.0 11.5 11.0 10.5 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
f1 (ppm)


172.77
165.31
147.32
135.40
134.24
132.78
132.17
132.05
131.59
131.25
130.98
129.99
129.98
128.48
128.30
128.23
127.90
127.18
126.94
126.50
125.25
124.32
123.52
122.07
121.50
119.33
42.80
25.53
21.86
21.84

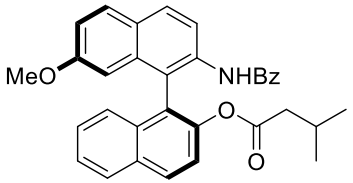

Br
NHBz
O
O

9p, $CDCl_3$

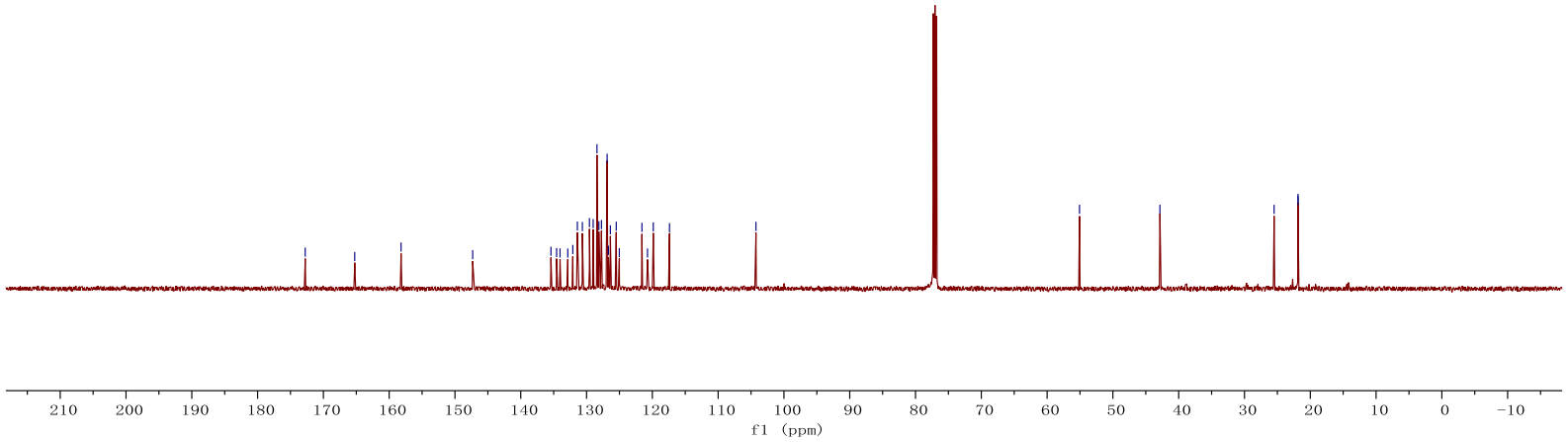

210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

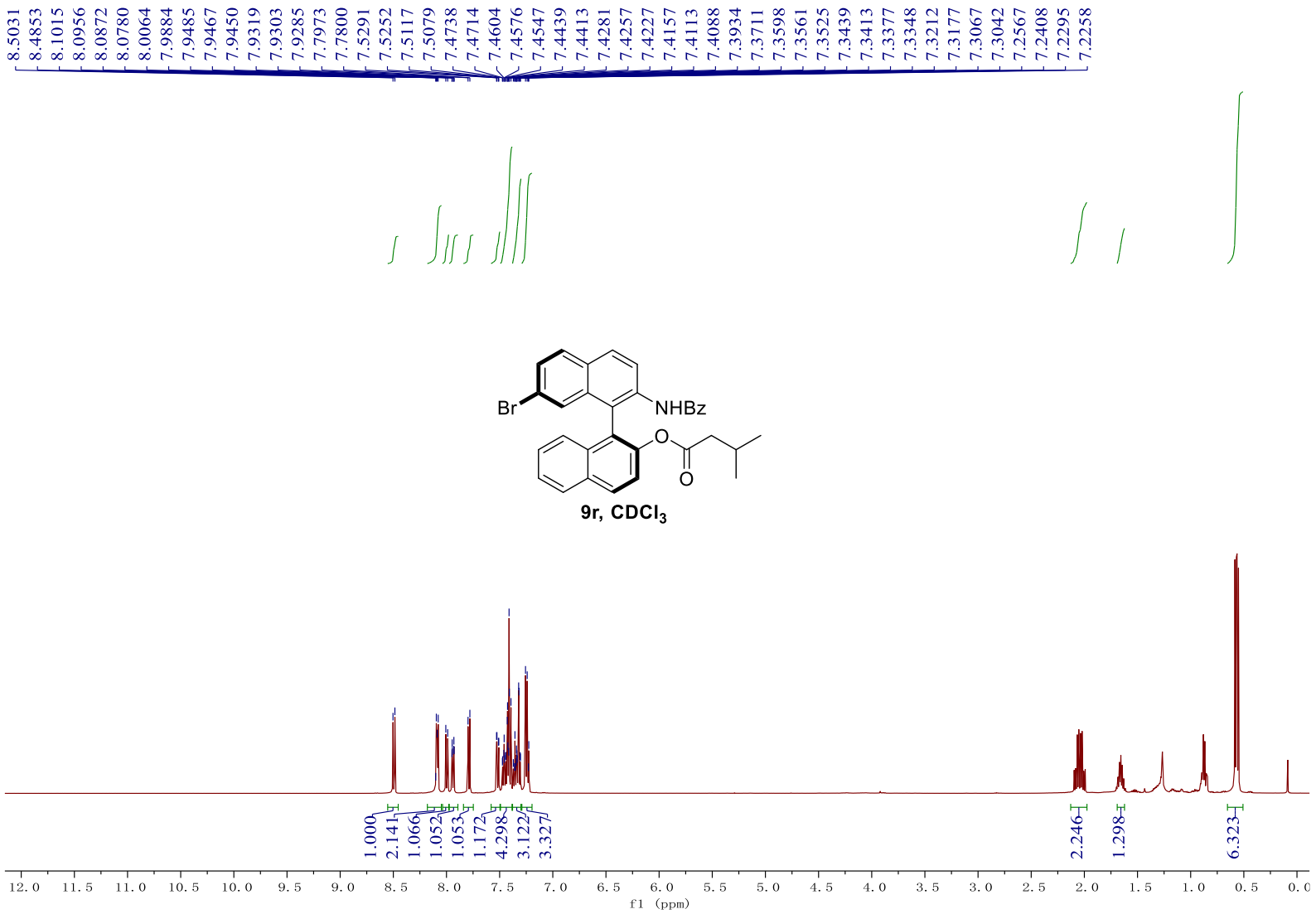

8.2624
8.2445
7.9899
7.9723
7.9204
7.8780
7.8599
7.8554
7.8532
7.8392
7.8371
7.7451
7.7273
7.3855
7.3810
7.3739
7.3692
7.3645
7.3572
7.3529
7.3282
7.3102
7.3071
7.3040
7.2972
7.2931
7.2901
7.2793
7.2680
7.2644
7.2603
7.2522
7.2492
7.2460
7.2428
7.2339
7.2315
7.1800
7.1646
7.1614
7.1491
7.1372
7.1335
7.0350
7.0301
7.0172
7.0122
6.3830
6.3780
3.4911
1.9582
1.9434
1.9287
1.5740
1.5604
1.5469
0.4898
0.4761
0.4626
MeO
NHBz
O
O
9q, CDCl3
1.000
1.132
1.049
2.015
0.993
7.029
2.300
1.045
0.976
2.955
2.112
1.192
6.087
12.0 11.5 11.0 10.5 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
f1 (ppm)


172.76
165.24
158.19
147.31
135.41
134.55
134.03
132.85
132.09
131.40
130.63
129.56
129.00
128.42
128.13
127.74
126.87
126.67
126.38
125.49
125.02
121.58
120.74
119.86
117.39
104.25
55.08
42.85
25.50
21.87
21.85


MeO
NHBz
O
O

9q, $CDCl_3$


210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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8.0872
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8.0064
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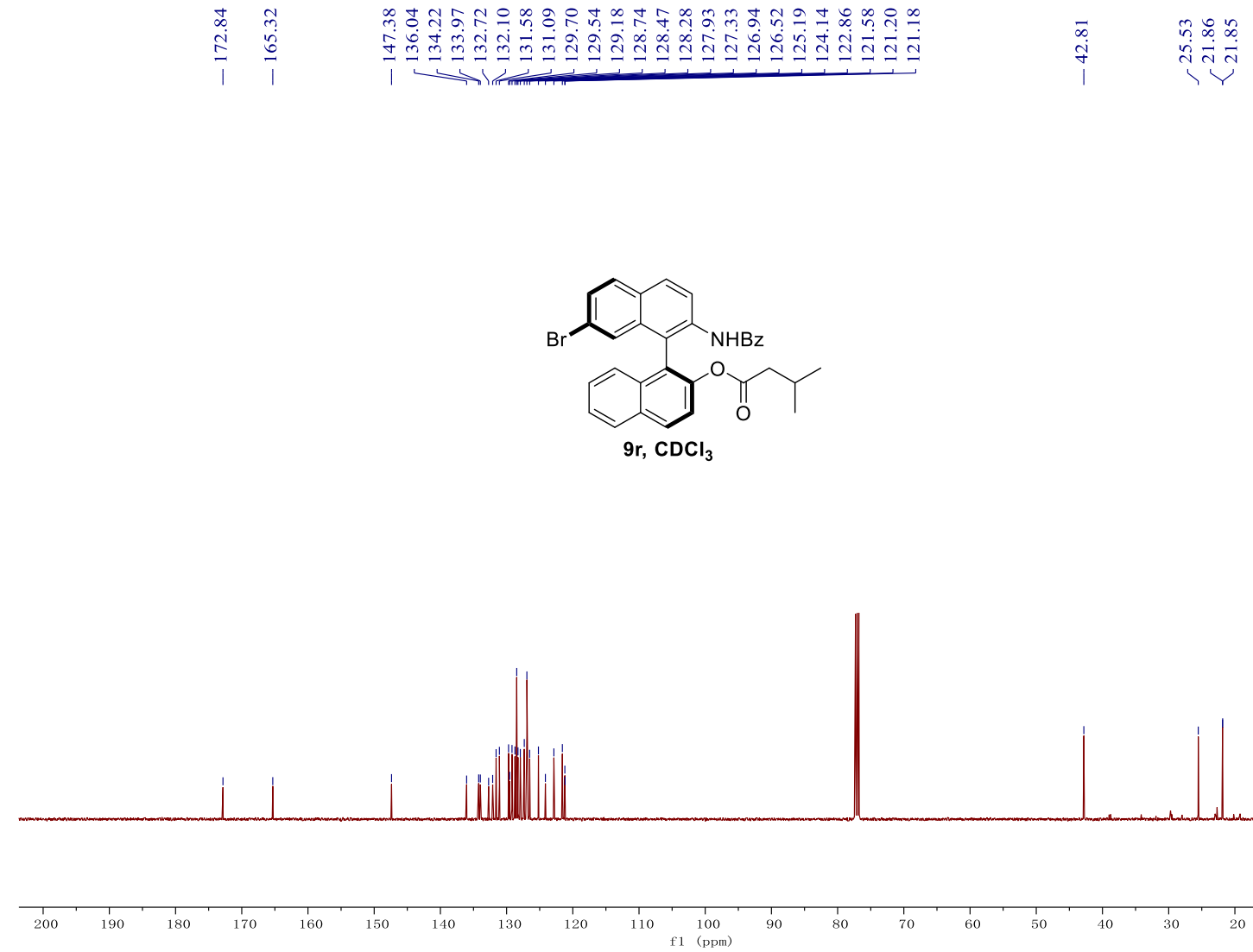
7.9485
7.9467
7.9450
7.9319
7.9303
7.9285
7.7973
7.7800
7.5291
7.5252
7.5117
7.5079
7.4738
7.4714
7.4604
7.4576
7.4547
7.4439
7.4413
7.4281
7.4257
7.4227
7.4157
7.4113
7.4088
7.3934
7.3711
7.3598
7.3561
7.3525
7.3439
7.3413
7.3377
7.3348
7.3212
7.3177
7.3067
7.3042
7.2567
7.2408
7.2295
7.2258
Br
NHBz
O
O
9r, CDCl3
1.000
2.141
1.066
1.052
1.053
1.172
4.298
3.122
3.327
2.246
1.298
6.323
12.0 11.5 11.0 10.5 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
f1 (ppm)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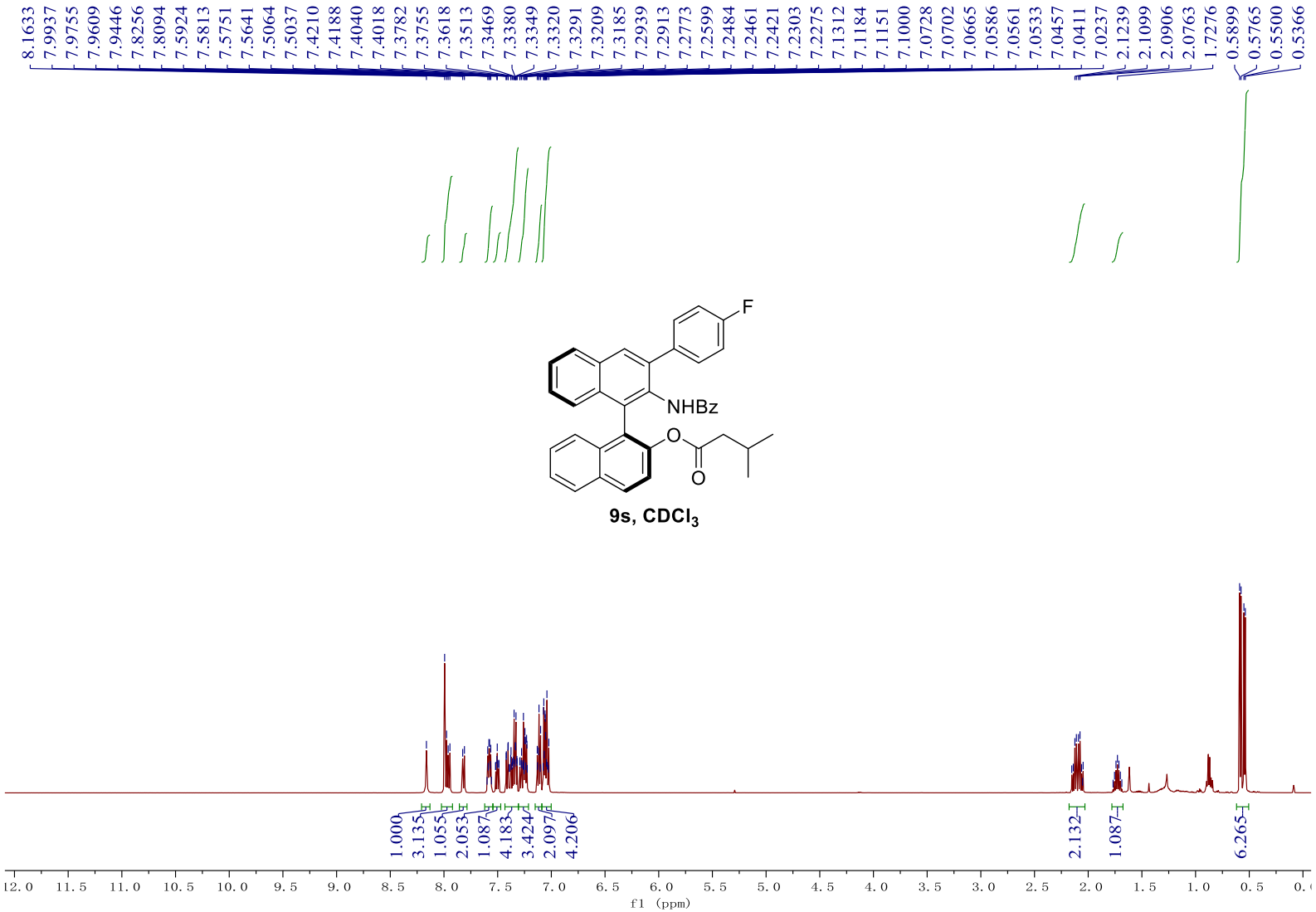
147.38
136.04
134.22
133.97
132.72
132.10
131.58
131.09
129.70
129.54
129.18
128.74
128.47
128.28
127.93
127.33
126.94
126.52
125.19
124.14
122.86
121.58
121.20
121.18
42.81
25.53
21.86
21.85
Br
NHBz
O
O
9r, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.9755
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7.8094
7.5924
7.5813
7.5751
7.5641
7.5064
7.5037
7.4210
7.4188
7.4040
7.4018
7.3782
7.3755
7.3618
7.3513
7.3469
7.3380
7.3349
7.3320
7.3291
7.3209
7.3185
7.2939
7.2913
7.2773
7.2599
7.2484
7.2461
7.2421
7.2303
7.2275
7.1312
7.1184
7.1151
7.1000
7.0728
7.0702
7.0665
7.0586
7.0561
7.0533
7.0457
7.0411
7.0237
2.1239
2.1099
2.0906
2.0763
1.7276
0.5899
0.5765
0.5500
0.5366
F
NHBz
O
O
9s, CDCl3
1.000
3.135
1.055
2.053
1.087
4.183
3.424
2.097
4.206
2.132
1.087
6.265
f1 (ppm)


173.67
165.08
162.99
161.04
146.46
137.94
136.42
136.40
134.53
133.09
133.00
132.52
132.05
131.95
130.85
130.39
130.32
130.14
130.08
129.22
128.13
128.09
127.68
127.34
126.72
126.48
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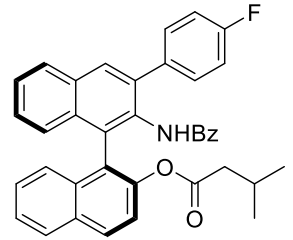
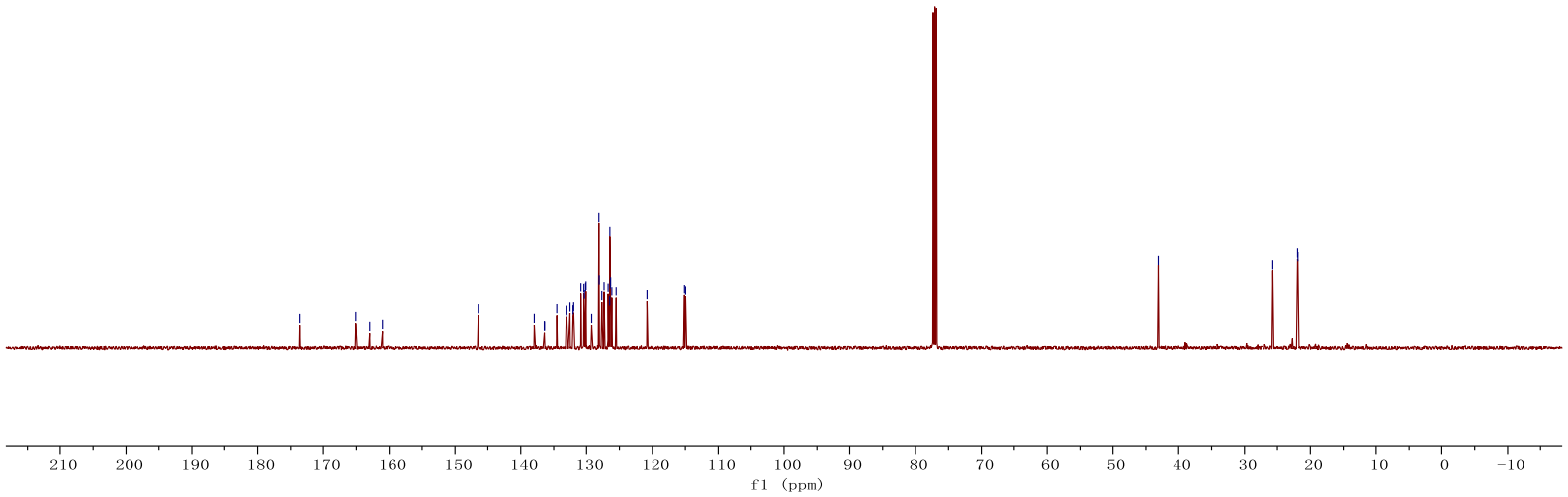
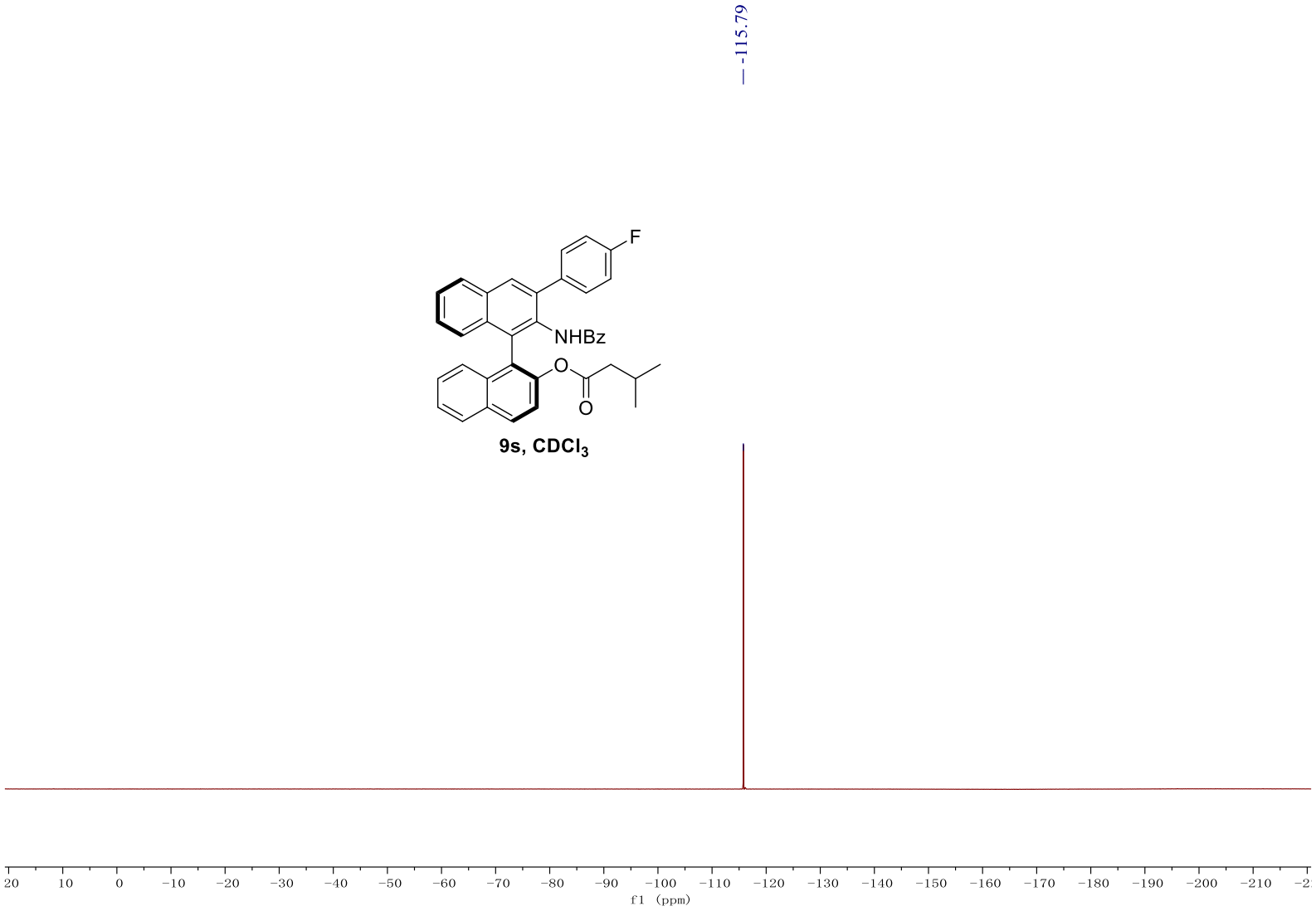
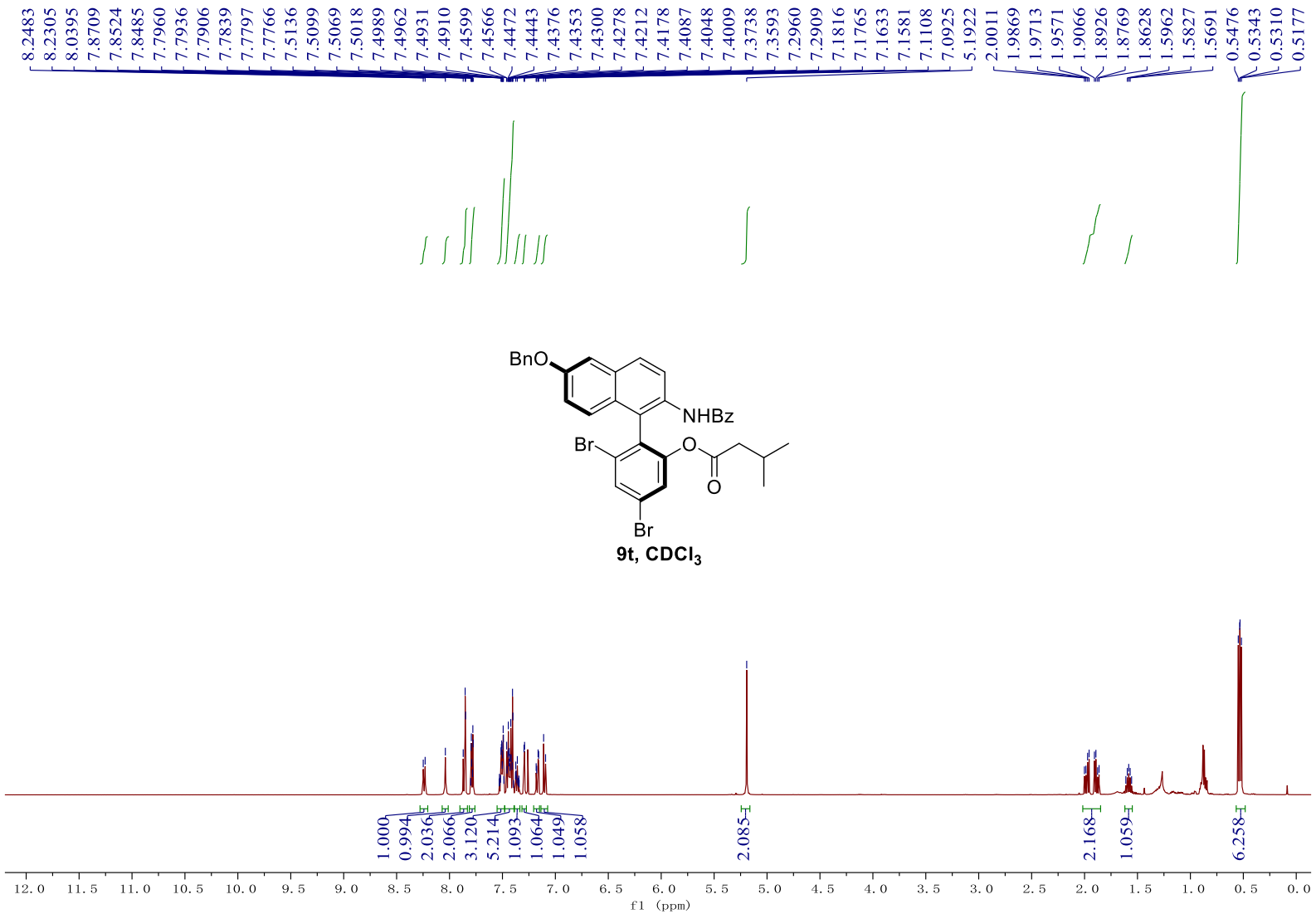
115.13
114.96
43.12
25.70
21.94
21.88


F
NHBz
O
O

9s, $CDCl_3$


210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)


-115.79
F
NHBz
O
O
9s, CDCl3
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)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8.0395
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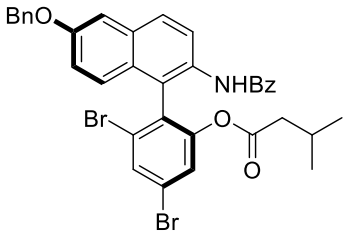
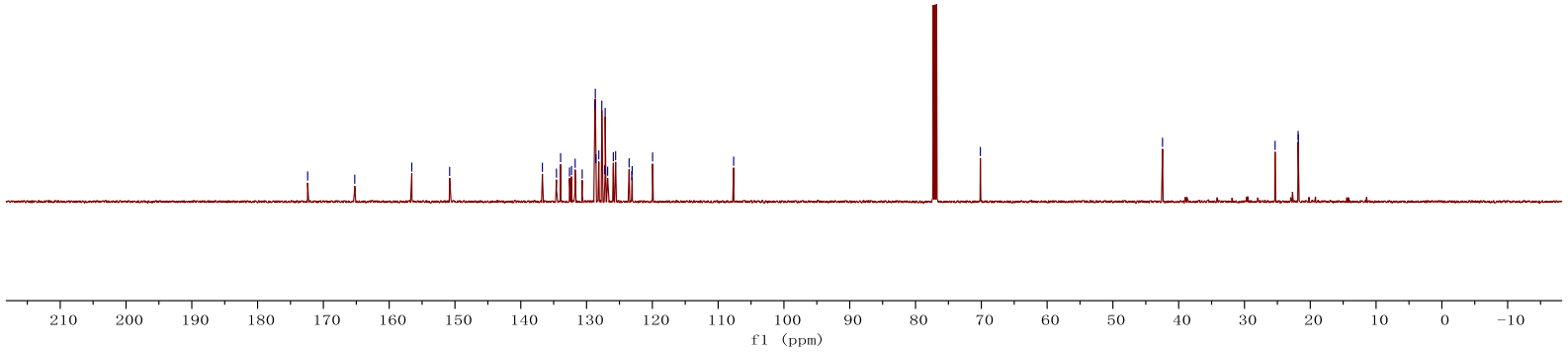
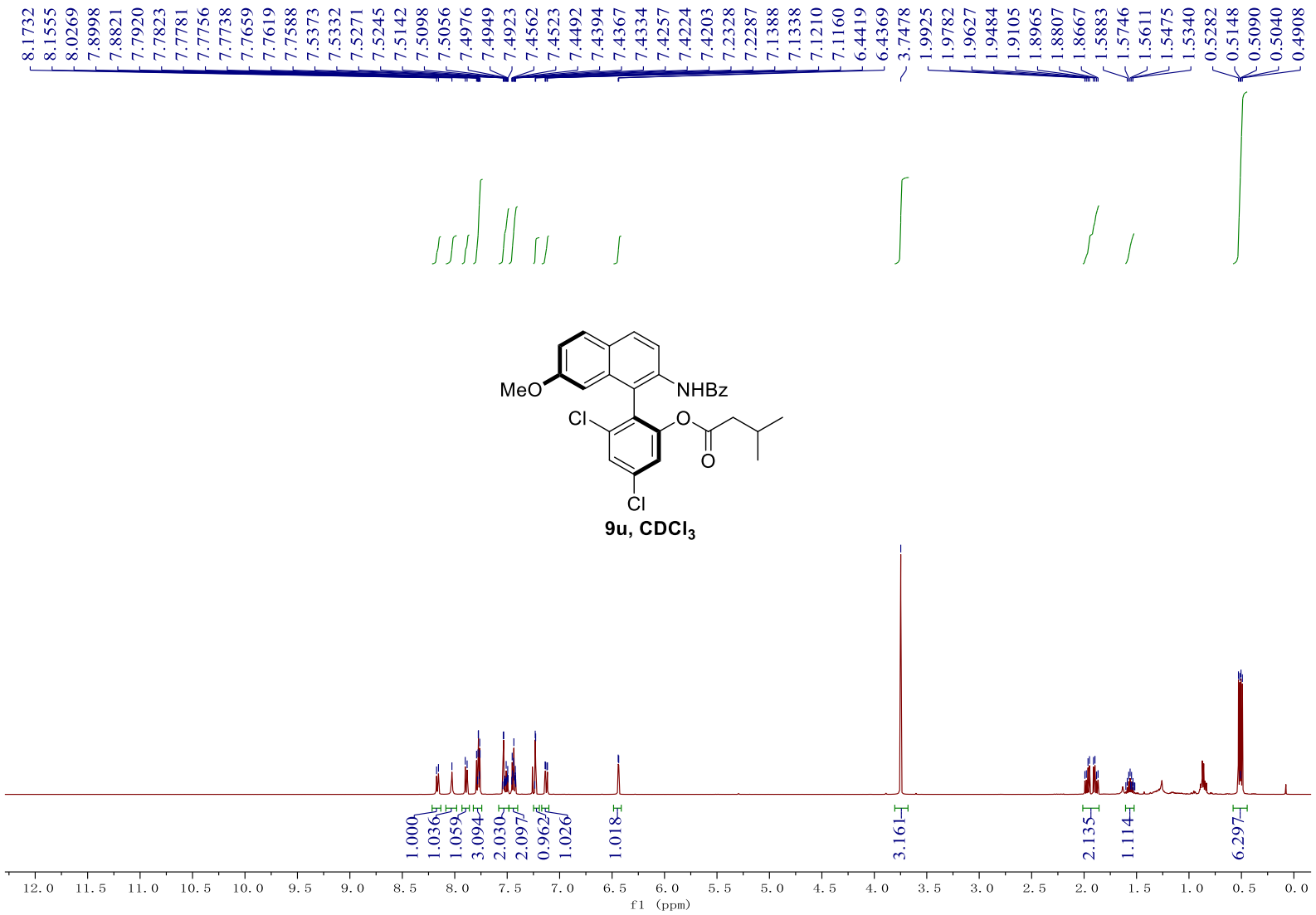
7.8524
7.8485
7.7960
7.7936
7.7906
7.7839
7.7797
7.7766
7.5136
7.5099
7.5069
7.5018
7.4989
7.4962
7.4931
7.4910
7.4599
7.4566
7.4472
7.4443
7.4376
7.4353
7.4300
7.4278
7.4212
7.4178
7.4087
7.4048
7.4009
7.3738
7.3593
7.2960
7.2909
7.1816
7.1765
7.1633
7.1581
7.1108
7.0925
5.1922
2.0011
1.9869
1.9713
1.9571
1.9066
1.8926
1.8769
1.8628
1.5962
1.5827
1.5691
0.5476
0.5343
0.5310
0.5177
BnO
NHBz
Br
O
O
Br
9t, CDCl3
1.000
0.994
2.036
2.066
3.120
5.214
1.093
1.064
1.049
1.058
2.085
2.168
1.059
6.258
12.0 11.5 11.0 10.5 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
f1 (ppm)

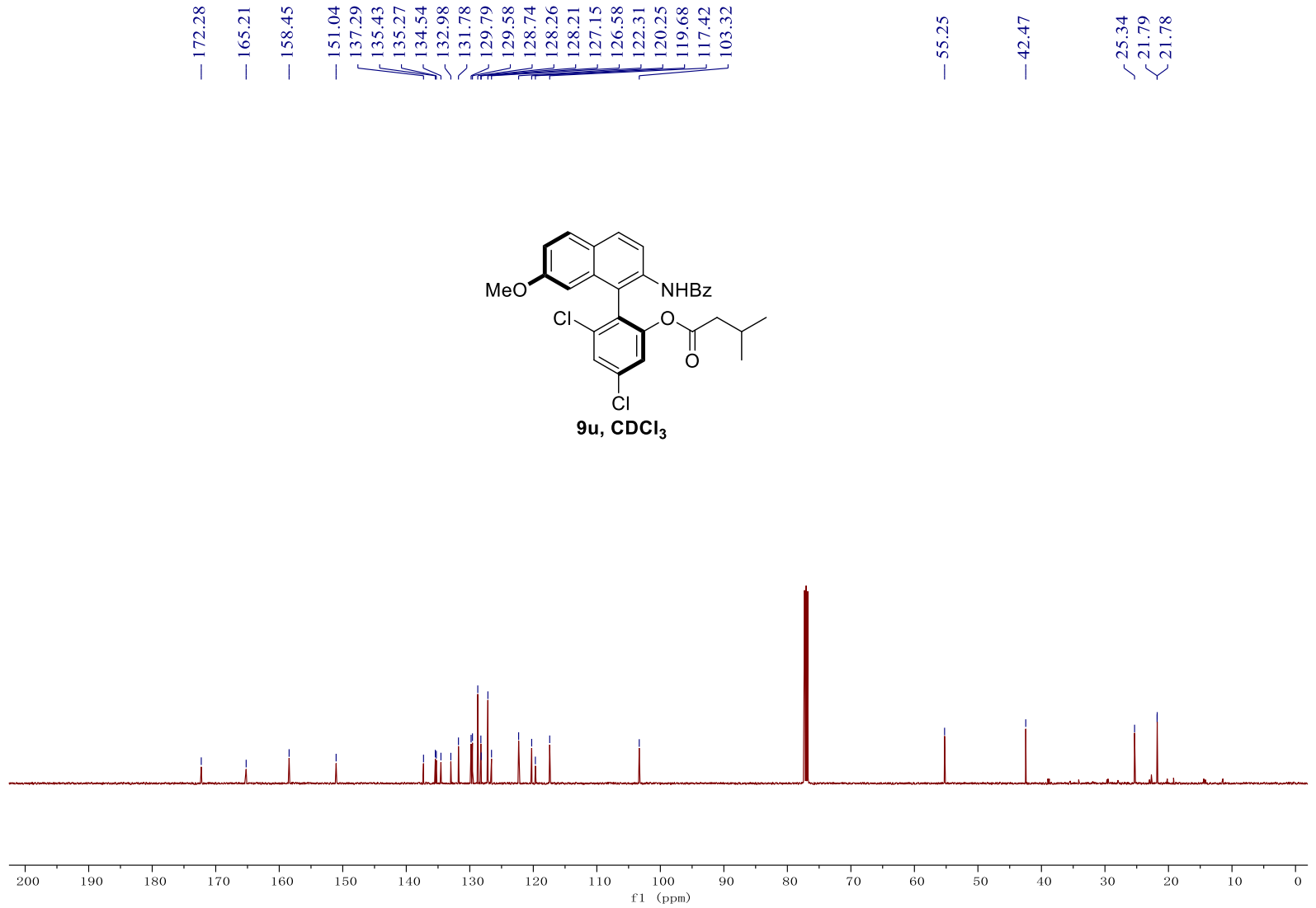

172.39
165.24
156.56
150.81
136.72
134.58
133.94
132.59
132.29
131.73
130.67
128.74
128.67
128.59
128.14
127.68
127.26
127.17
126.80
125.93
125.58
123.53
123.13
123.07
119.96
107.65
70.15
42.46
25.35
21.85
21.81

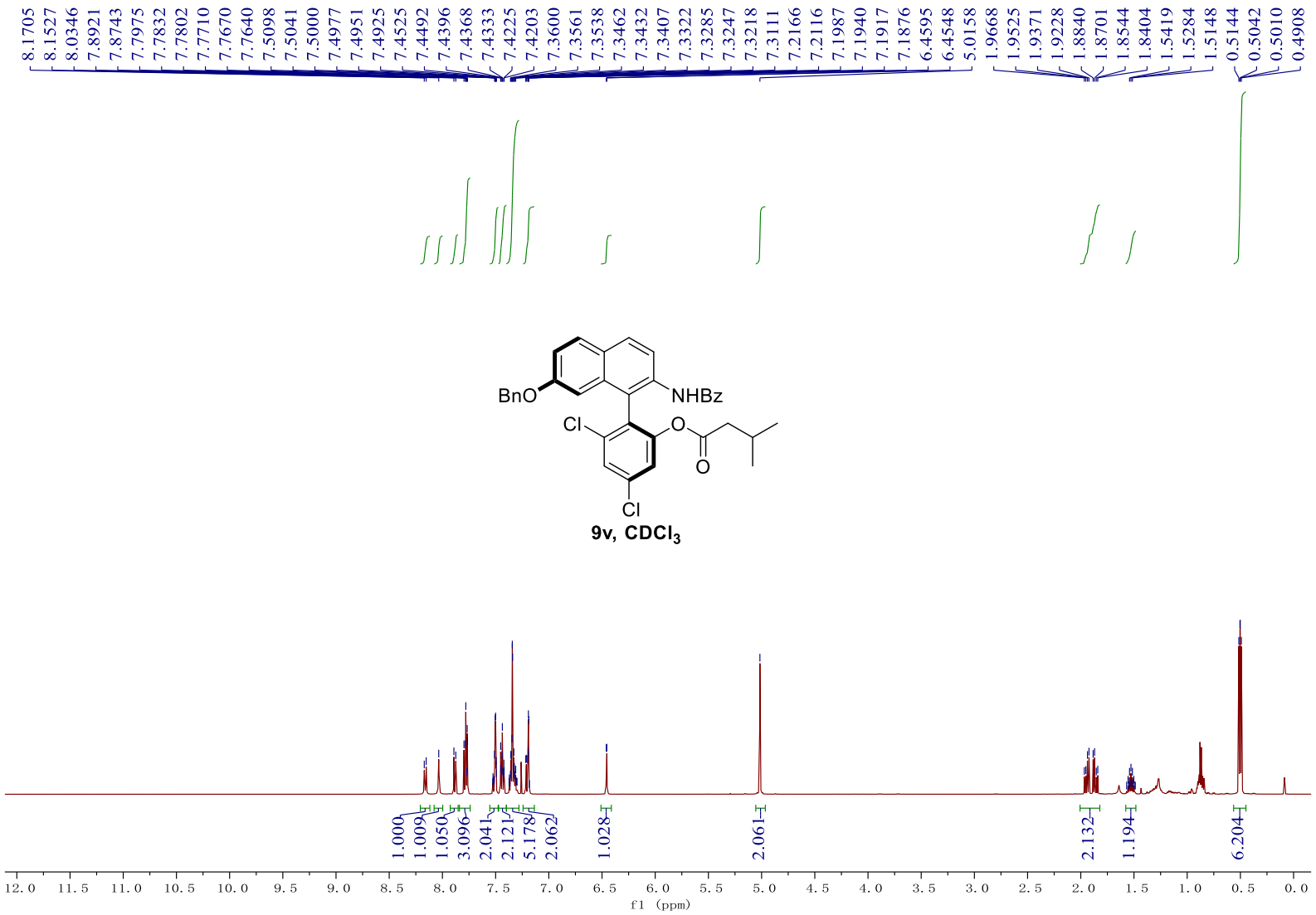

BnO
NHBz
Br
O
O
Br

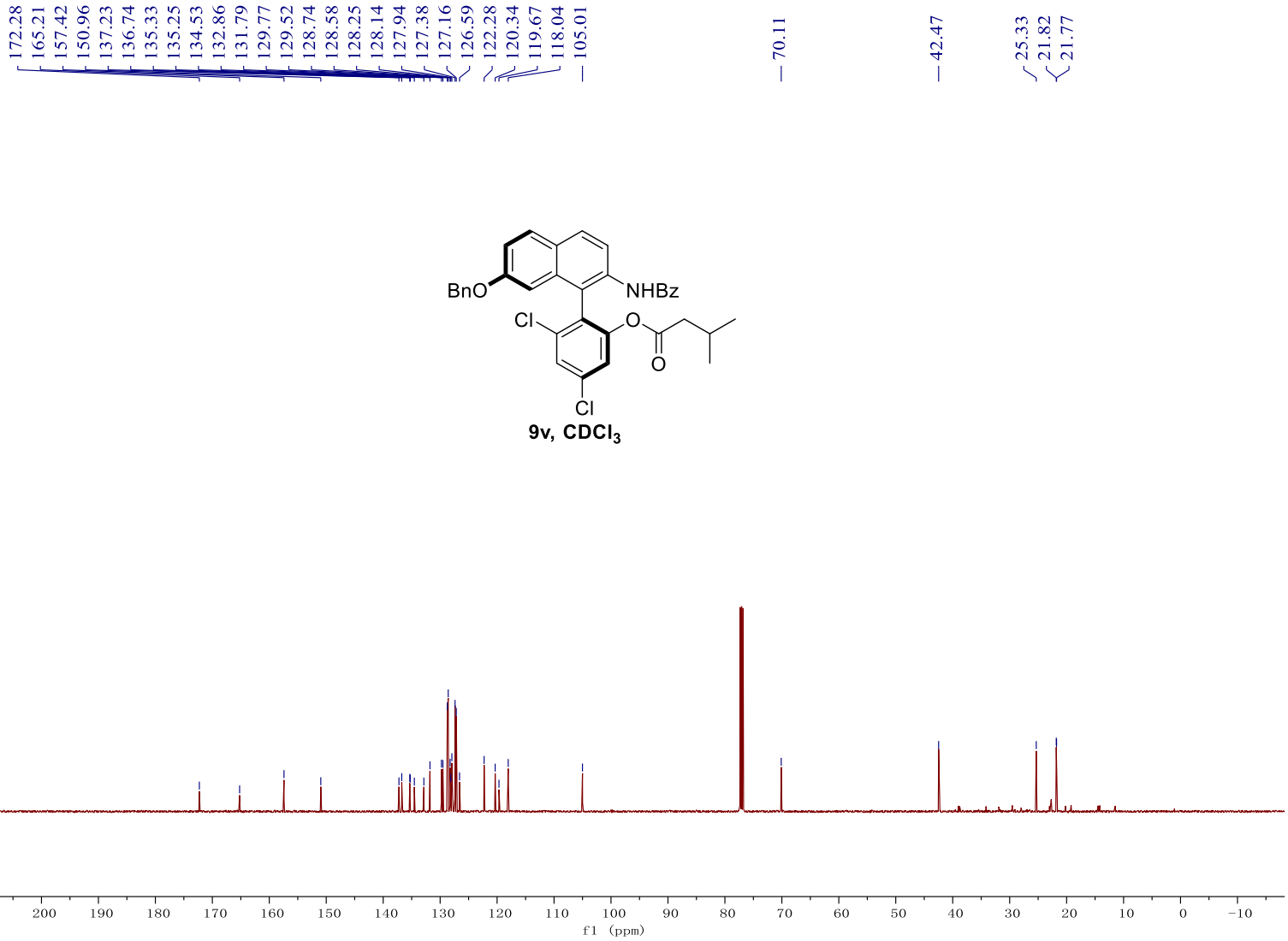
9t, $CDCl_3$

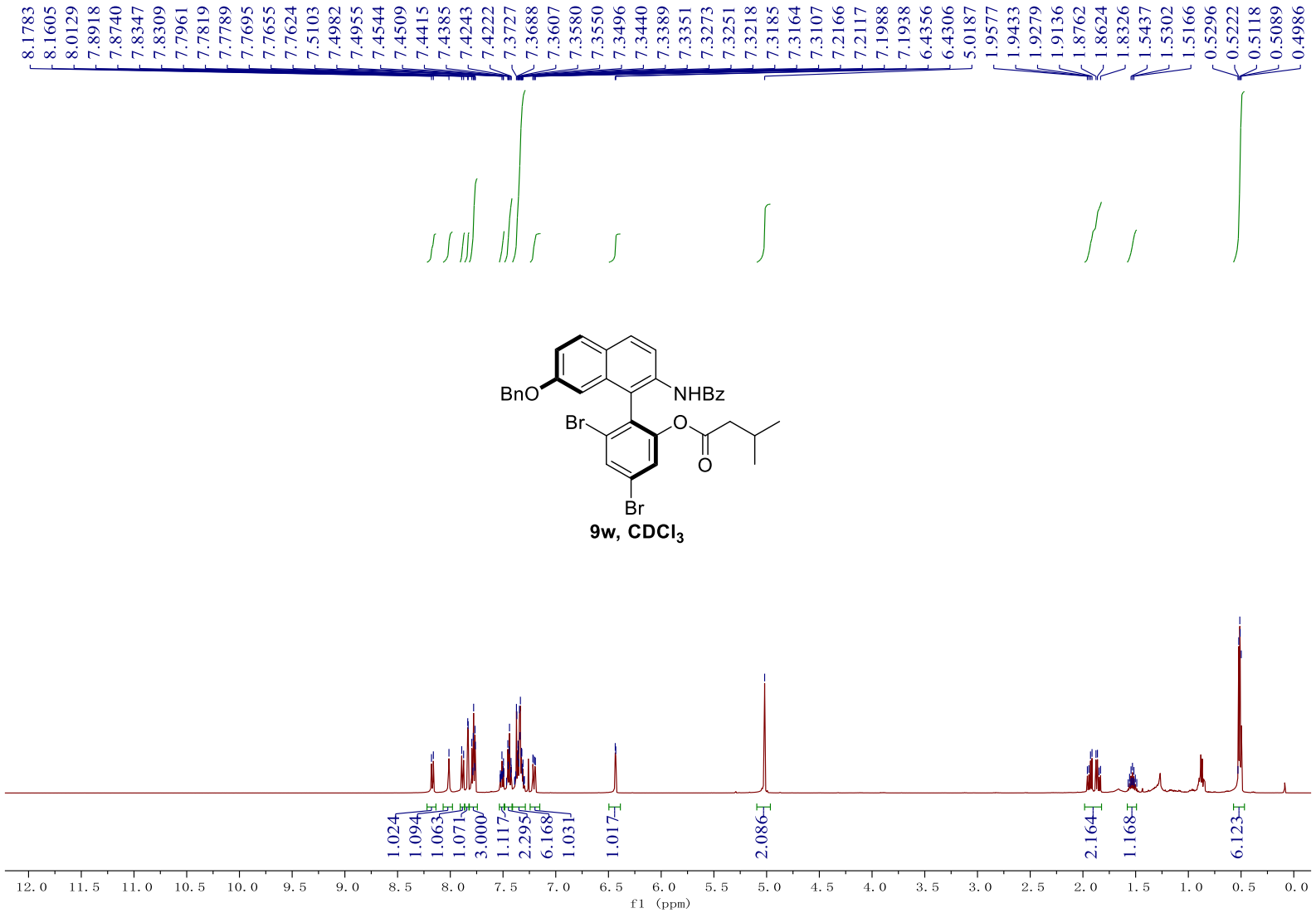

210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)


8.1732
8.1555
8.0269
7.8998
7.8821
7.7920
7.7823
7.7781
7.7756
7.7738
7.7659
7.7619
7.7588
7.5373
7.5332
7.5271
7.5245
7.5142
7.5098
7.5056
7.4976
7.4949
7.4923
7.4562
7.4523
7.4492
7.4394
7.4367
7.4334
7.4257
7.4224
7.4203
7.2328
7.2287
7.1388
7.1338
7.1210
7.1160
6.4419
6.4369
3.7478
1.9925
1.9782
1.9627
1.9484
1.9105
1.8965
1.8807
1.8667
1.5883
1.5746
1.5611
1.5475
1.5340
0.5282
0.5148
0.5090
0.5040
0.4908
MeO
NHBz
Cl
O
O
Cl
9u, CDCl3
1.000
1.036
1.059
3.094
2.030
2.097
0.962
1.026
1.018
3.161
2.135
1.114
6.297
12.0
11.5
11.0
10.5
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
f1 (ppm)

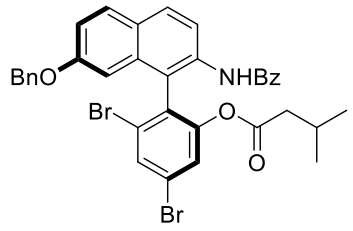

172.28
165.21
158.45
151.04
137.29
135.43
135.27
134.54
132.98
131.78
129.79
129.58
128.74
128.26
128.21
127.15
126.58
122.31
120.25
119.68
117.42
103.32
55.25
42.47
25.34
21.79
21.78
MeO
NHBz
Cl
O
O
Cl
9u, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.1705
8.1527
8.0346
7.8921
7.8743
7.7975
7.7832
7.7802
7.7710
7.7670
7.7640
7.5098
7.5041
7.5000
7.4977
7.4951
7.4925
7.4525
7.4492
7.4396
7.4368
7.4333
7.4225
7.4203
7.3600
7.3561
7.3538
7.3462
7.3432
7.3407
7.3322
7.3285
7.3247
7.3218
7.3111
7.2166
7.2116
7.1987
7.1940
7.1917
7.1876
6.4595
6.4548
5.0158
1.9668
1.9525
1.9371
1.9228
1.8840
1.8701
1.8544
1.8404
1.5419
1.5284
1.5148
0.5144
0.5042
0.5010
0.4908
BnO
NHBz
Cl
O
O
Cl
9v, CDCl3
1.000
1.009
1.050
3.096
2.041
2.121
5.178
2.062
1.028
2.061
2.132
1.194
6.204
12.0 11.5 11.0 10.5 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
f1 (ppm)

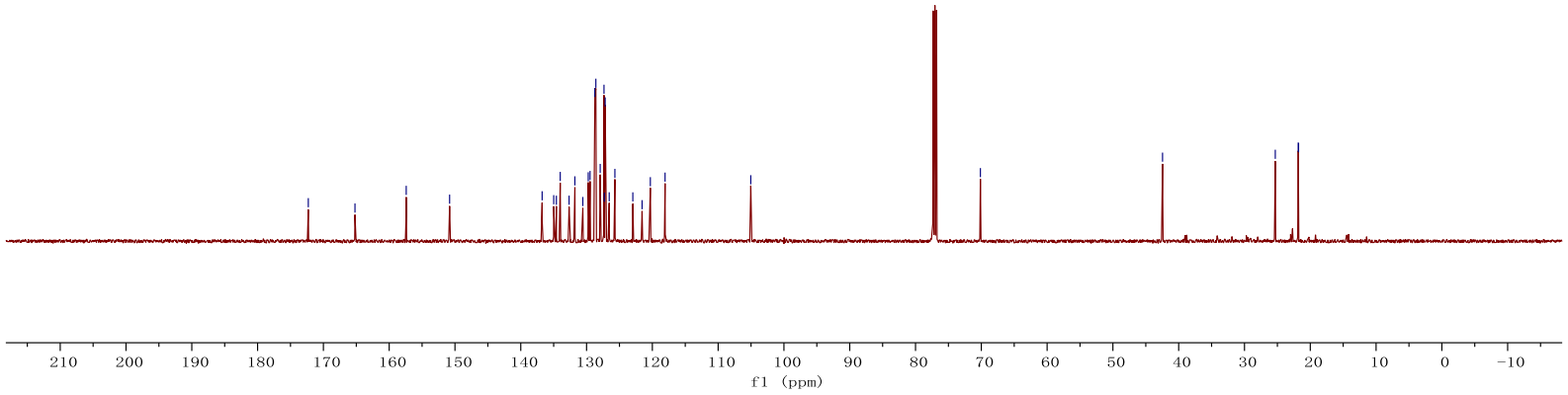

172.28
165.21
157.42
150.96
137.23
136.74
135.33
135.25
134.53
132.86
131.79
129.77
129.52
128.74
128.58
128.25
128.14
127.94
127.38
127.16
126.59
122.28
120.34
119.67
118.04
105.01
70.11
42.47
25.33
21.82
21.77
BnO
NHBz
Cl
O
O
Cl
9v, CDCl3
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

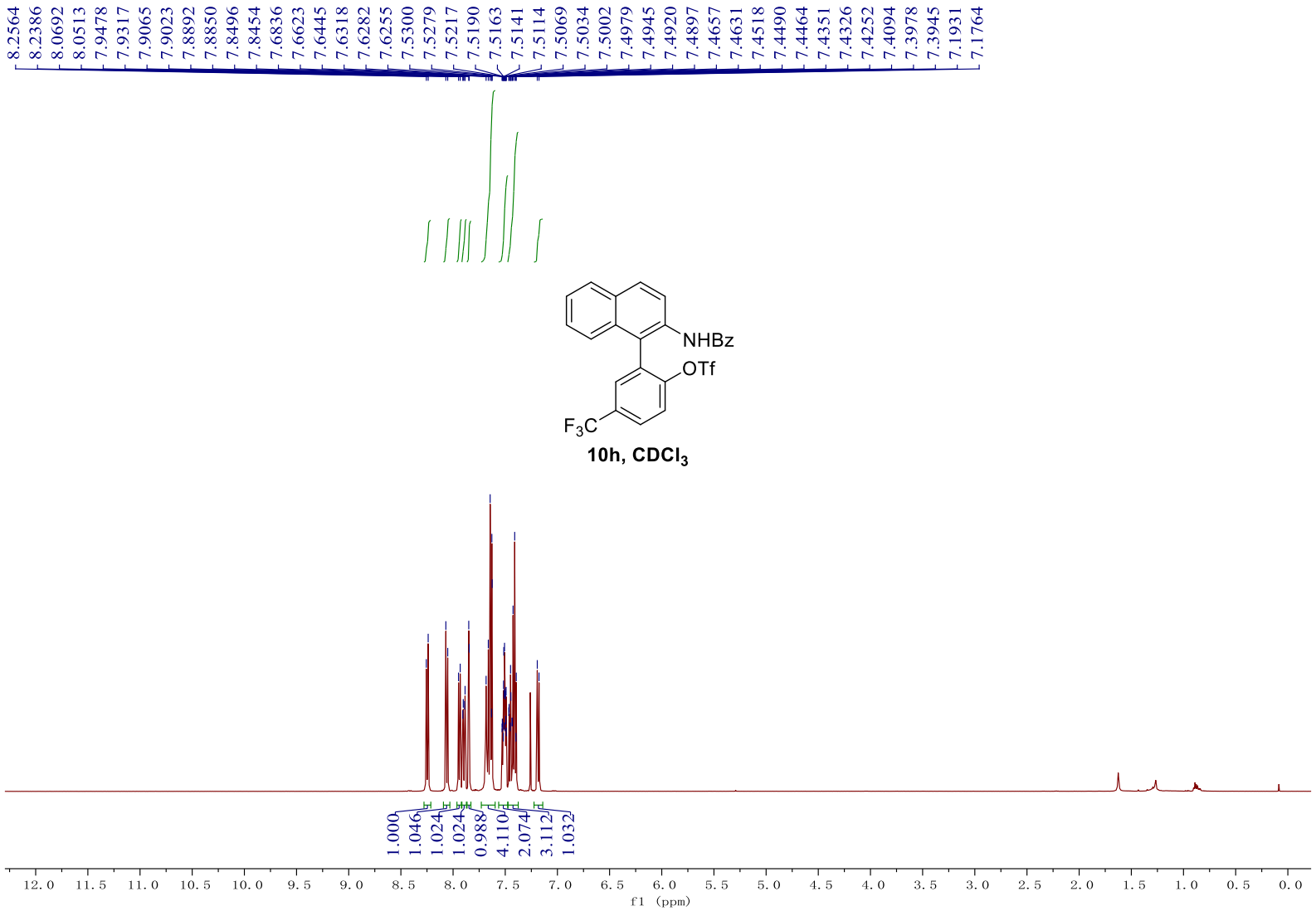

8.1783
8.1605
8.0129
7.8918
7.8740
7.8347
7.8309
7.7961
7.7819
7.7789
7.7695
7.7655
7.7624
7.5103
7.4982
7.4955
7.4544
7.4509
7.4415
7.4385
7.4243
7.4222
7.3727
7.3688
7.3607
7.3580
7.3550
7.3496
7.3440
7.3389
7.3351
7.3273
7.3251
7.3218
7.3185
7.3164
7.3107
7.2166
7.2117
7.1988
7.1938
6.4356
6.4306
5.0187
1.9577
1.9433
1.9279
1.9136
1.8762
1.8624
1.8326
1.5437
1.5302
1.5166
0.5296
0.5222
0.5118
0.5089
0.4986
BnO
NHBz
Br
O
O
Br
9w, CDCl3
1.024
1.094
1.063
1.071
3.000
1.117
2.295
6.168
1.031
1.017
2.086
2.164
1.168
6.123
12.0 11.5 11.0 10.5 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
f1 (ppm)

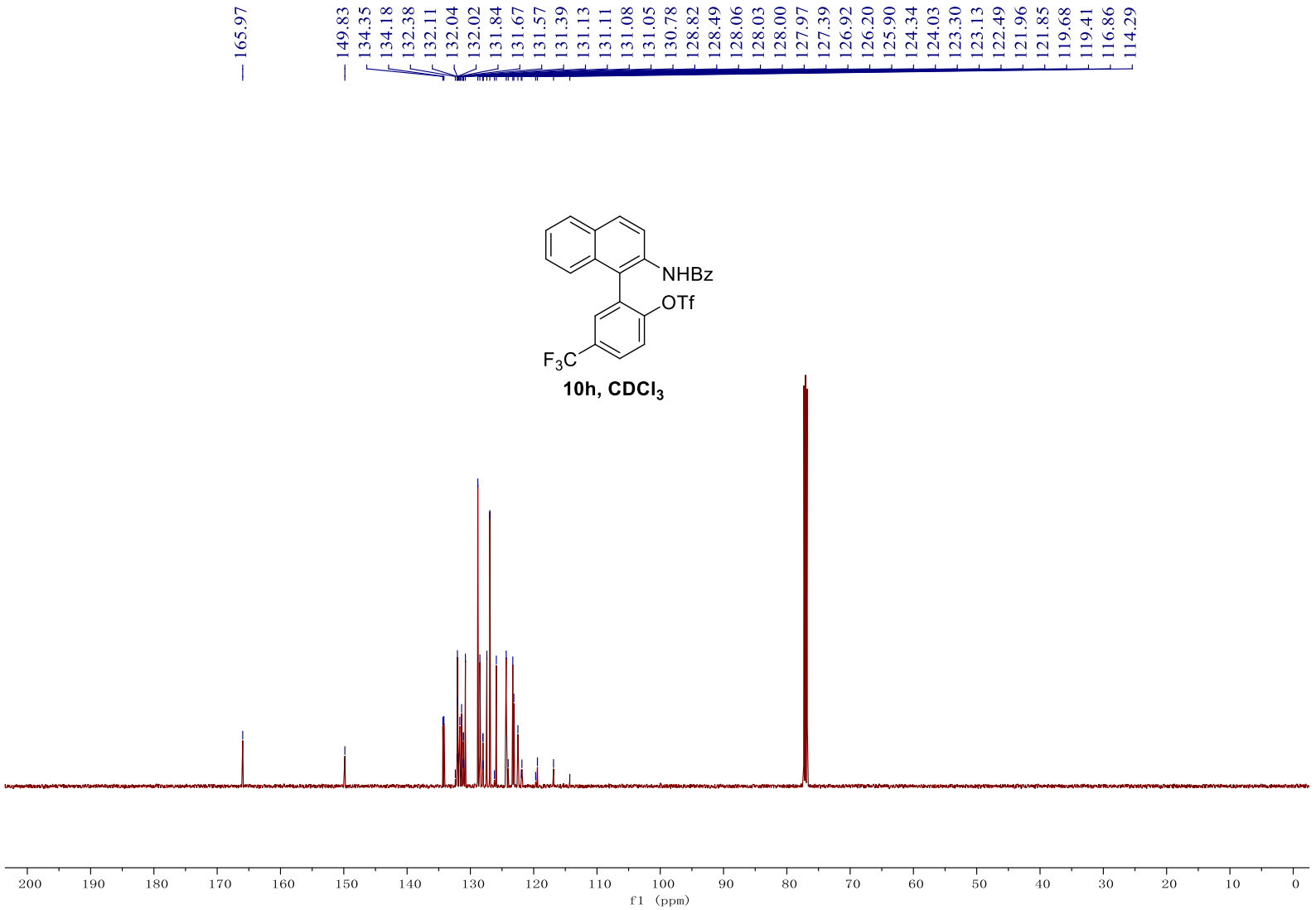

172.29
165.20
157.41
150.82
136.75
134.99
134.59
134.00
132.66
131.77
130.57
129.74
129.47
128.74
128.59
127.93
127.35
127.30
127.17
126.56
125.69
122.97
121.56
120.30
118.07
105.04
70.14
42.46
25.32
21.83
21.78

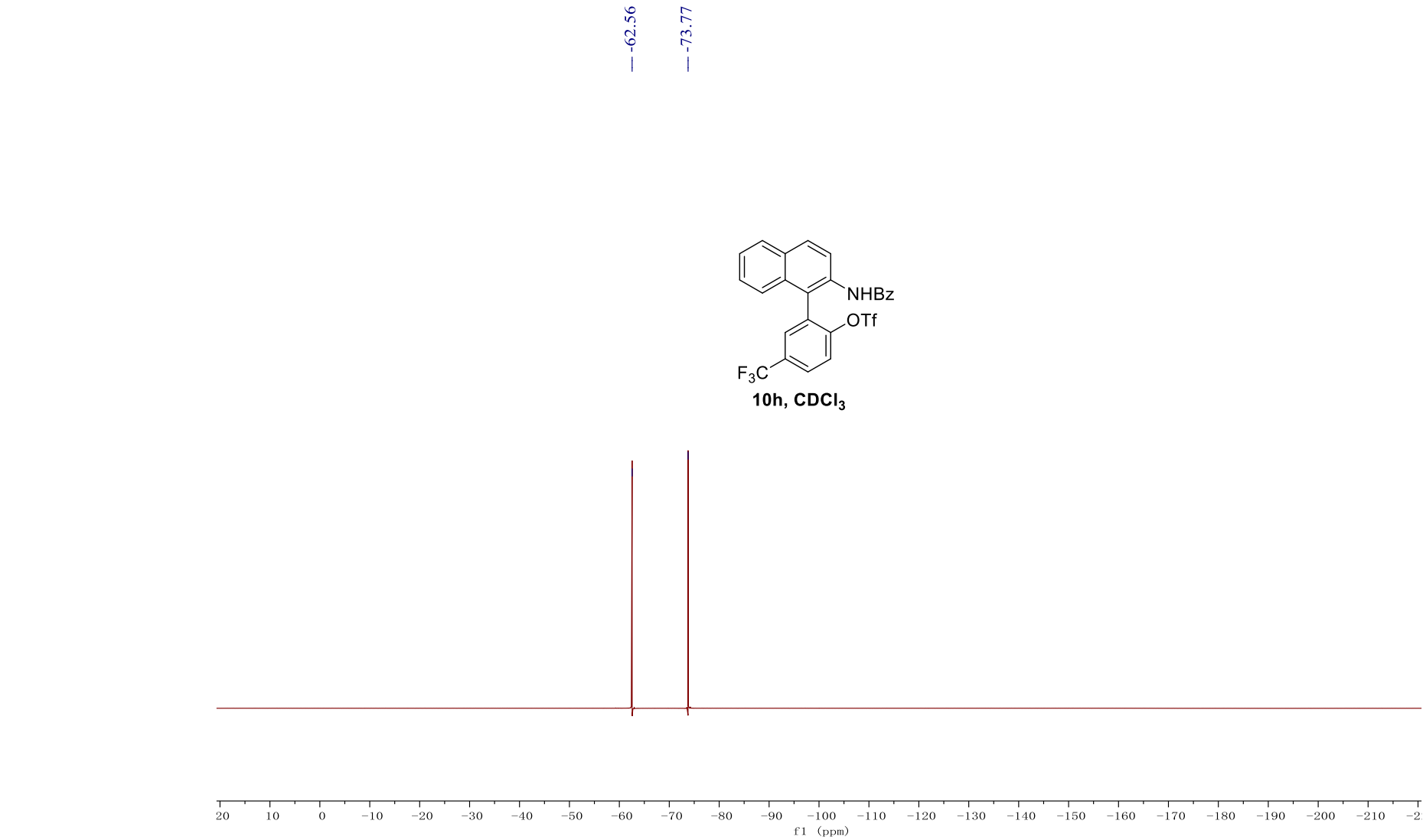

BnO
NHBz
Br
O
O
Br

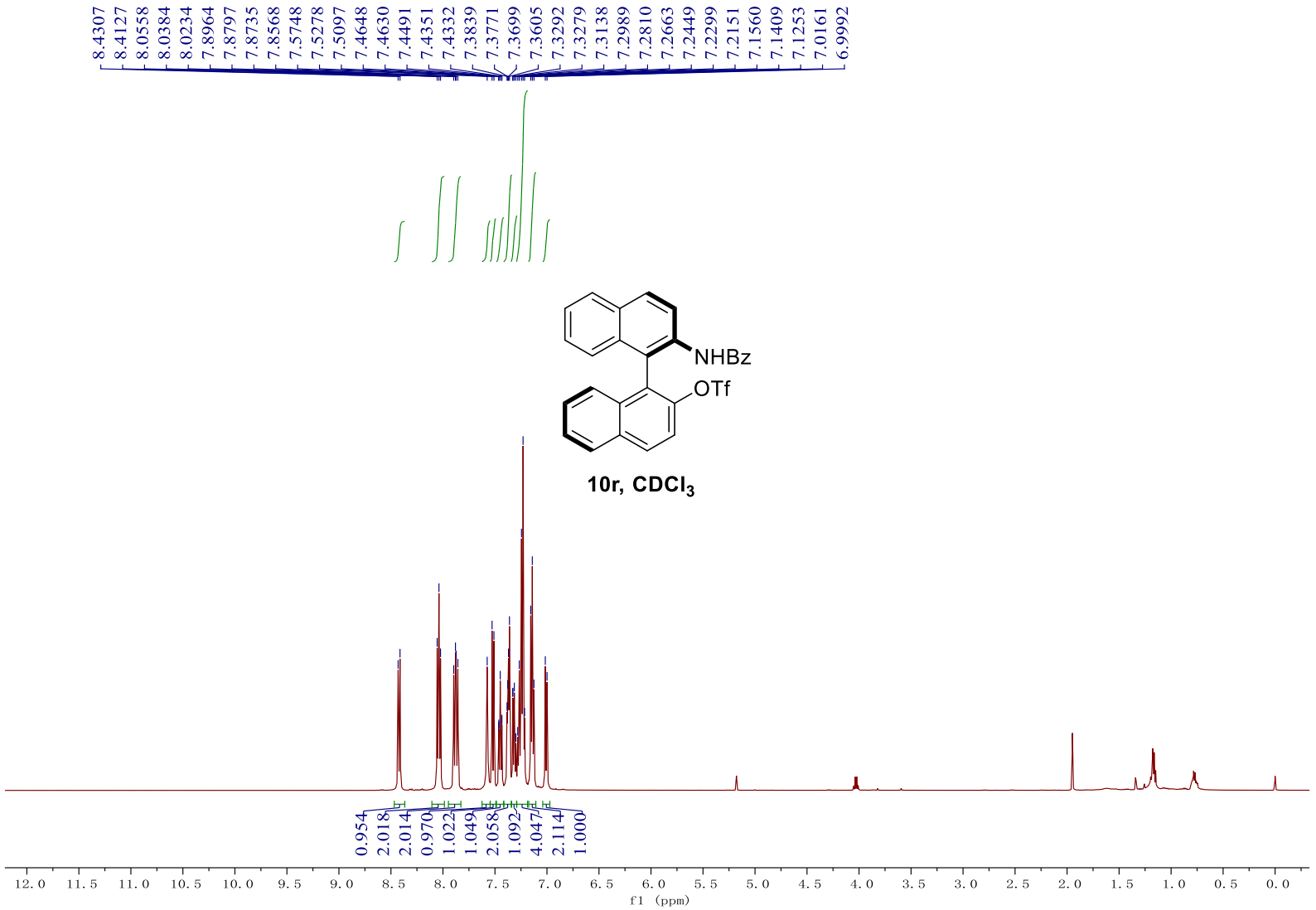
9w, $CDCl_3$


210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

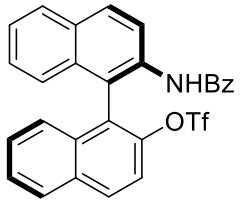

8.2564
8.2386
8.0692
8.0513
7.9478
7.9317
7.9065
7.9023
7.8892
7.8850
7.8496
7.8454
7.6836
7.6623
7.6445
7.6318
7.6282
7.6255
7.5300
7.5279
7.5217
7.5190
7.5163
7.5141
7.5114
7.5069
7.5034
7.5002
7.4979
7.4945
7.4920
7.4897
7.4657
7.4631
7.4518
7.4490
7.4464
7.4351
7.4326
7.4252
7.4094
7.3978
7.3945
7.1931
7.1764
NHBz
OTf
F3C
10h, CDCl3
1.000
1.046
1.024
1.024
0.988
4.110
2.074
3.112
1.032
12.0 11.5 11.0 10.5 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
f1 (ppm)


165.97
149.83
134.35
134.18
132.38
132.11
132.04
132.02
131.84
131.67
131.57
131.39
131.13
131.11
131.08
131.05
130.78
128.82
128.49
128.06
128.03
128.00
127.97
127.39
126.92
126.20
125.90
124.34
124.03
123.30
123.13
122.49
121.96
121.85
119.68
119.41
116.86
114.29
NHBz
OTf
F3C
10h, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

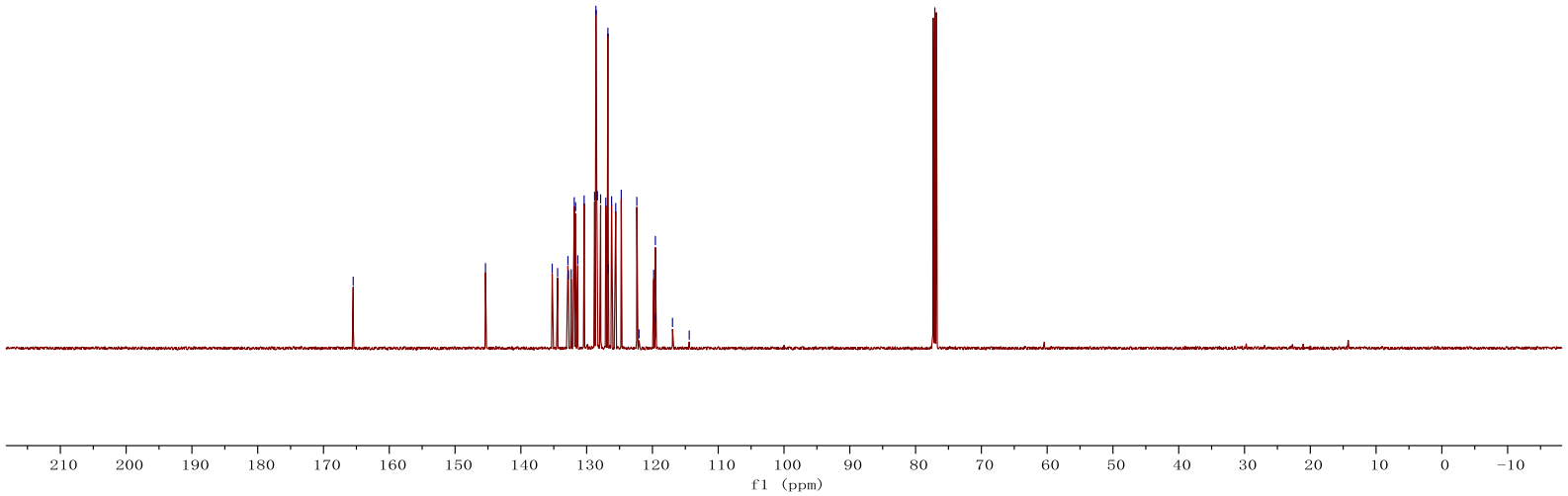

-62.56
-73.77
NHBz
OTf
F3C
10h, CDCl3
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)

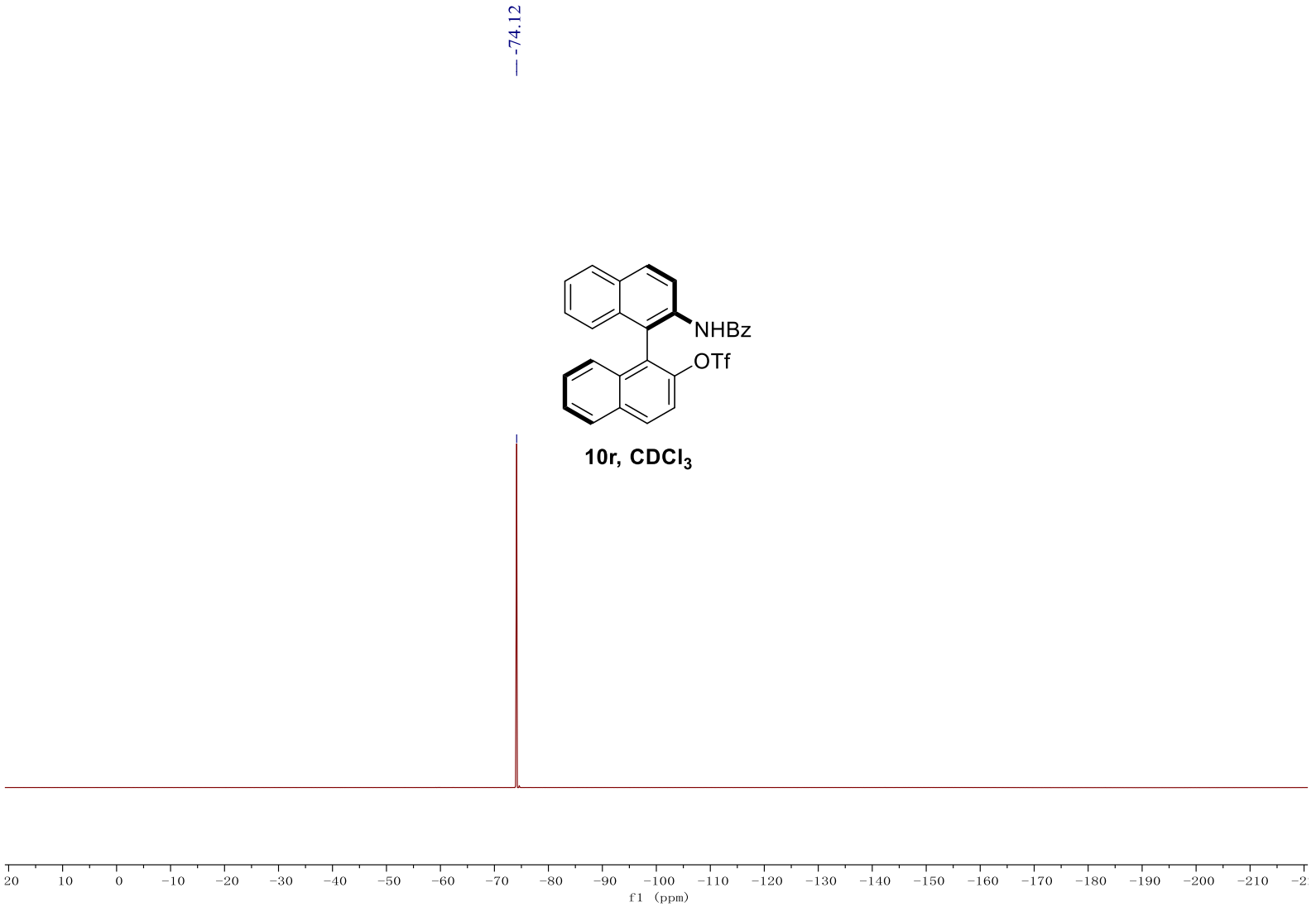

8.4307
8.4127
8.0558
8.0384
8.0234
7.8964
7.8797
7.8735
7.8568
7.5748
7.5278
7.5097
7.4648
7.4630
7.4491
7.4351
7.4332
7.3839
7.3771
7.3699
7.3605
7.3292
7.3279
7.3138
7.2989
7.2810
7.2663
7.2449
7.2299
7.2151
7.1560
7.1409
7.1253
7.0161
6.9992
NHBz
OTf
10r, CDCl3
0.954
2.018
2.014
0.970
1.022
1.049
2.058
1.092
4.047
2.114
1.000
12.0 11.5 11.0 10.5 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
f1 (ppm)

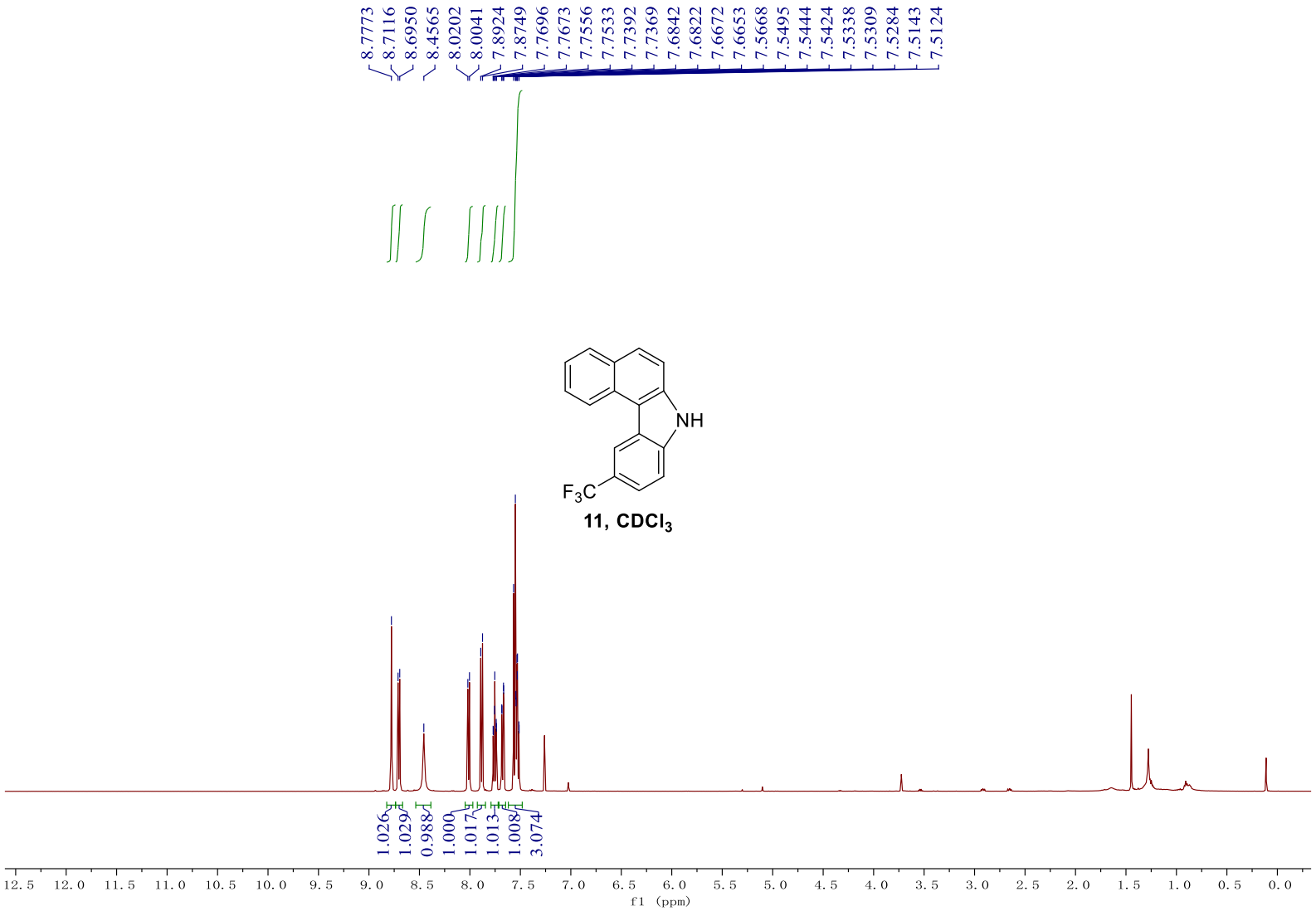

165.48
145.38
135.24
134.41
132.85
132.78
132.35
131.88
131.68
131.35
130.38
128.79
128.59
128.45
128.37
127.87
127.09
126.77
126.70
126.21
125.58
124.74
122.37
122.04
119.81
119.55
119.50
116.95
114.40

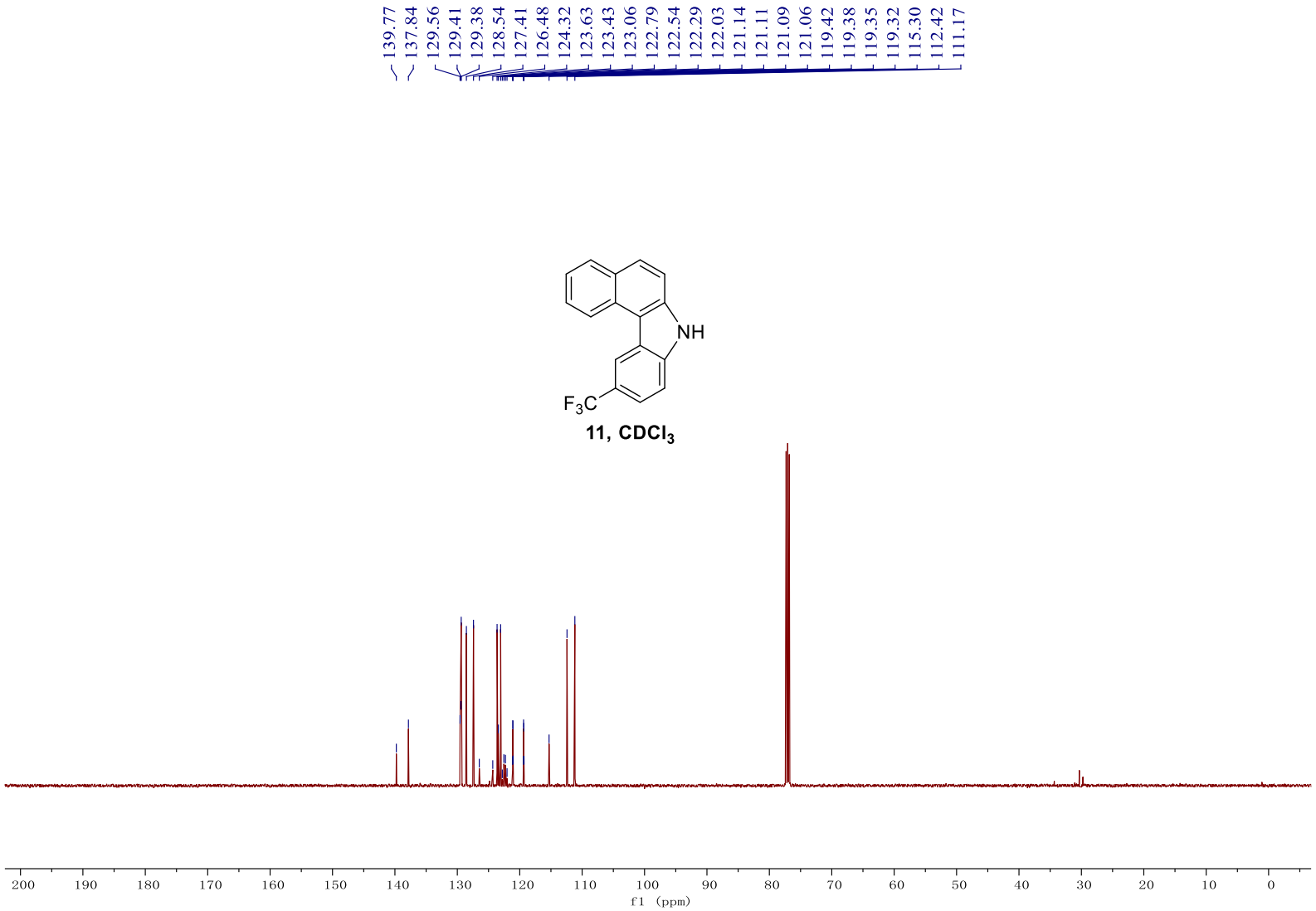

NHBz
OTf

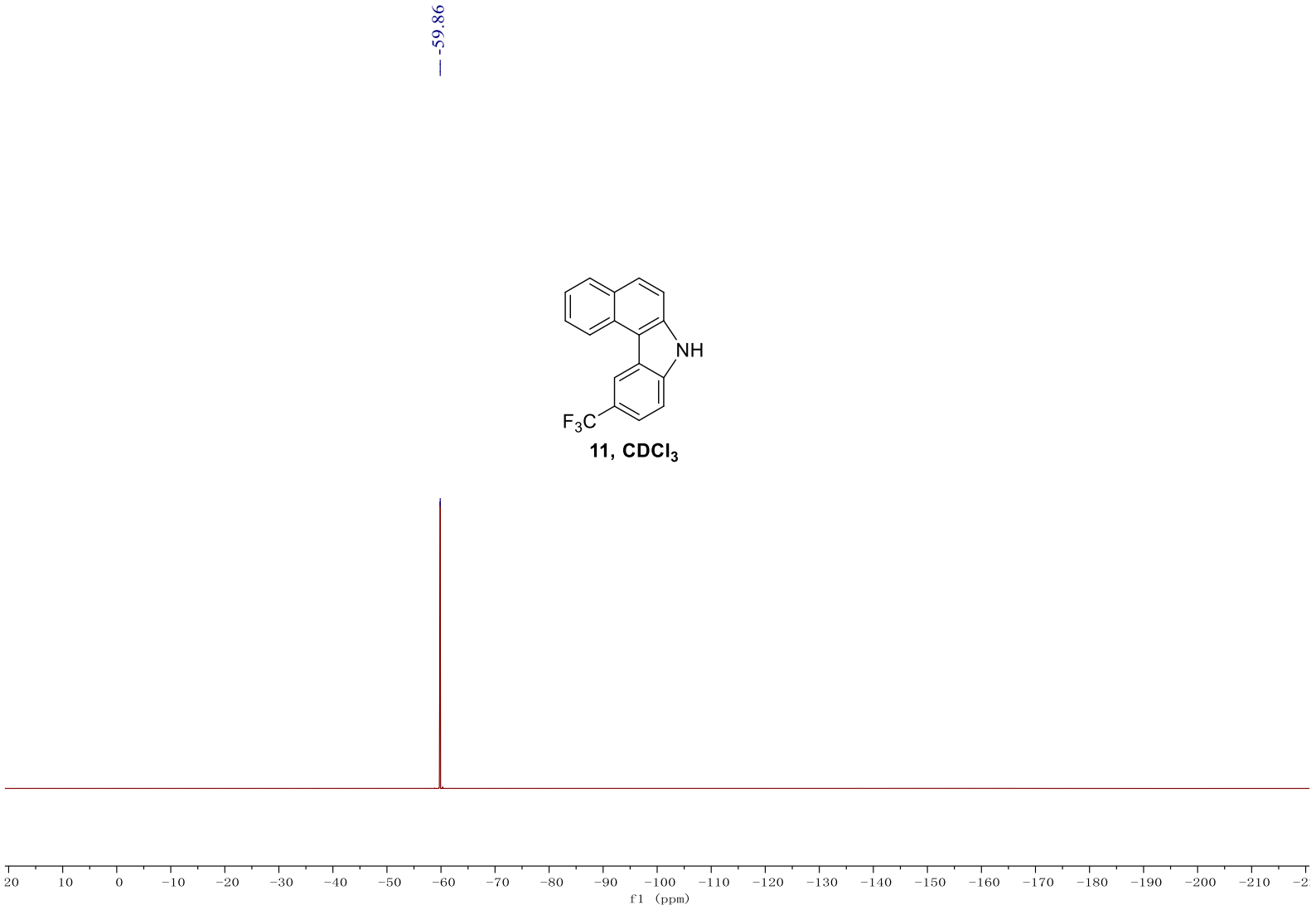
10r, $CDCl_3$

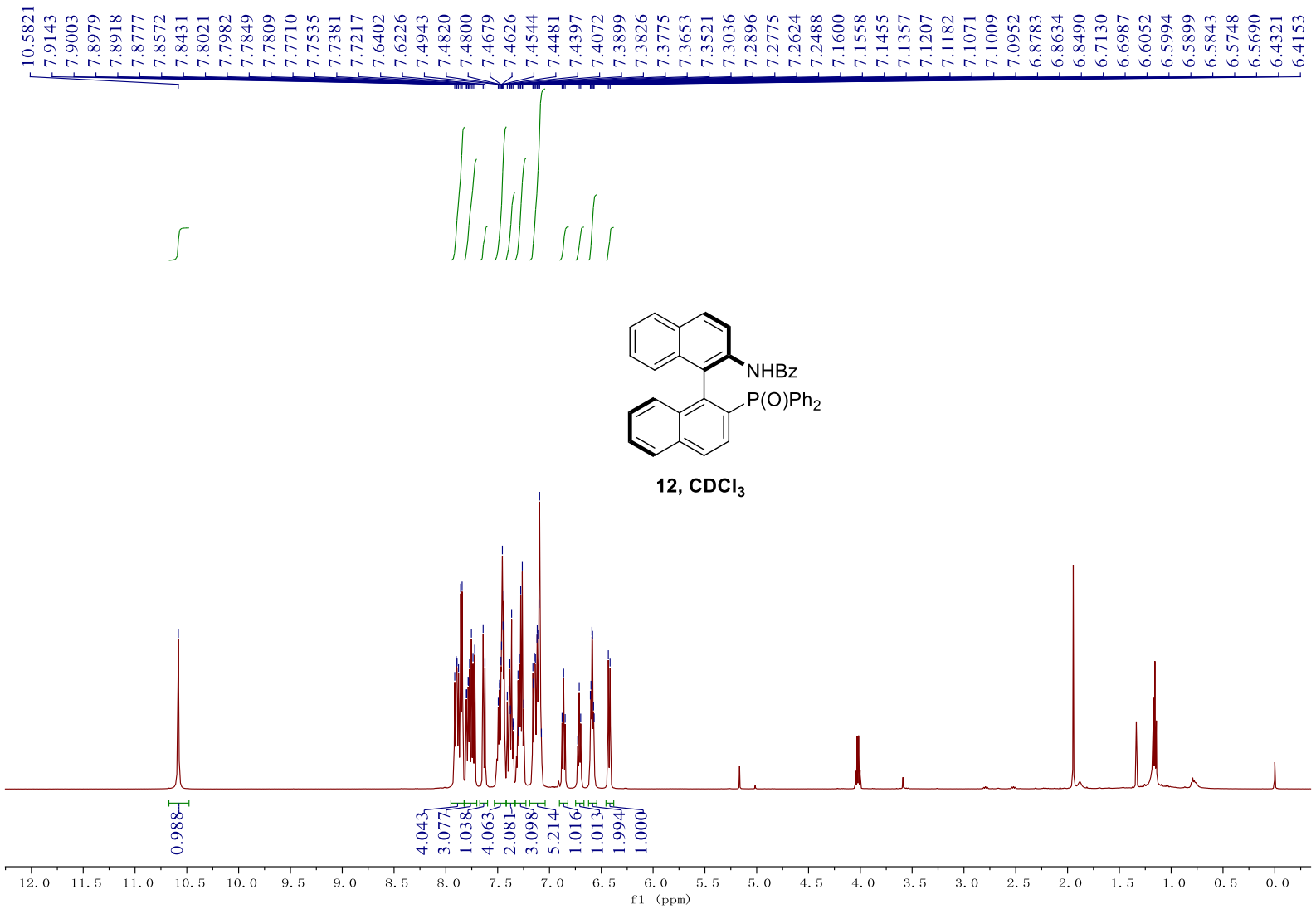

210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)


-74.12
NHBz
OTf
10r, CDCl3
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)


8.7773
8.7116
8.6950
8.4565
8.0202
8.0041
7.8924
7.8749
7.7696
7.7673
7.7556
7.7533
7.7392
7.7369
7.6842
7.6822
7.6672
7.6653
7.5668
7.5495
7.5444
7.5424
7.5338
7.5309
7.5284
7.5143
7.5124
NH
F3C
11, CDCl3
1.026
1.029
0.988
1.000
1.017
1.013
1.008
3.074
12.5 12.0 11.5 11.0 10.5 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
f1 (ppm)


139.77
137.84
129.56
129.41
129.38
128.54
127.41
126.48
124.32
123.63
123.43
123.06
122.79
122.54
122.29
122.03
121.14
121.11
121.09
121.06
119.42
119.38
119.35
119.32
115.30
112.42
111.17
NH
F3C
11, CDCl3
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-59.86
NH
F3C
11, CDCl3
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −2
f1 (ppm)


10.5821
7.9143
7.9003
7.8979
7.8918
7.8777
7.8572
7.8431
7.8021
7.7982
7.7849
7.7809
7.7710
7.7535
7.7381
7.7217
7.6402
7.6226
7.4943
7.4820
7.4800
7.4679
7.4626
7.4544
7.4481
7.4397
7.4072
7.3899
7.3826
7.3775
7.3653
7.3521
7.3036
7.2896
7.2775
7.2624
7.2488
7.1600
7.1558
7.1455
7.1357
7.1207
7.1182
7.1071
7.1009
7.0952
6.8783
6.8634
6.8490
6.7130
6.6987
6.6052
6.5994
6.5899
6.5843
6.5748
6.5690
6.4321
6.4153
NHBz
P(O)Ph2
12, CDCl3
0.988
4.043
3.077
1.038
4.063
2.081
3.098
5.214
1.016
1.013
1.994
1.000
f1 (ppm)


165.99
141.35
141.28
136.16
134.93
134.91
134.56
133.43
133.34
133.04
132.16
132.09
132.06
131.25
131.22
131.12
130.76
130.21
130.19
129.94
129.79
129.71
129.62
129.57
129.53
129.49
128.81
128.71
128.52
128.48
128.38
128.30
127.73
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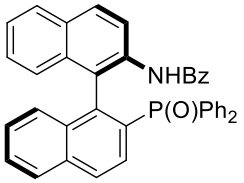
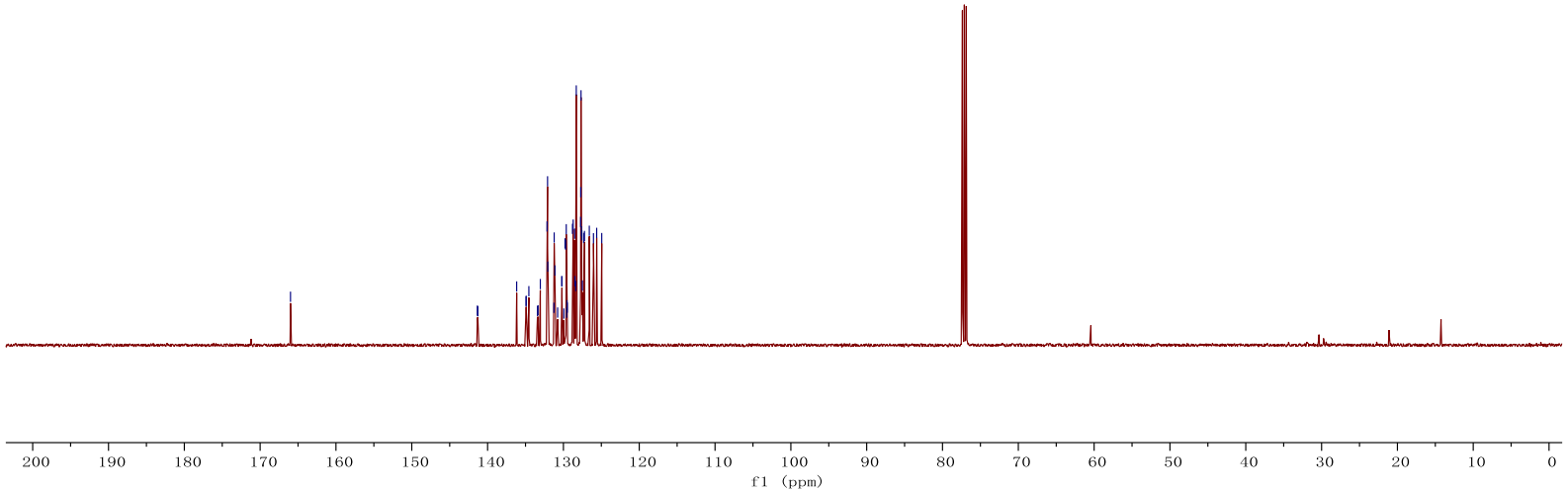
127.68
127.62
127.57
127.50
127.32
127.22
126.59
126.04
125.61
124.94


NHBz
P(O)Ph2

12, $CDCl_3$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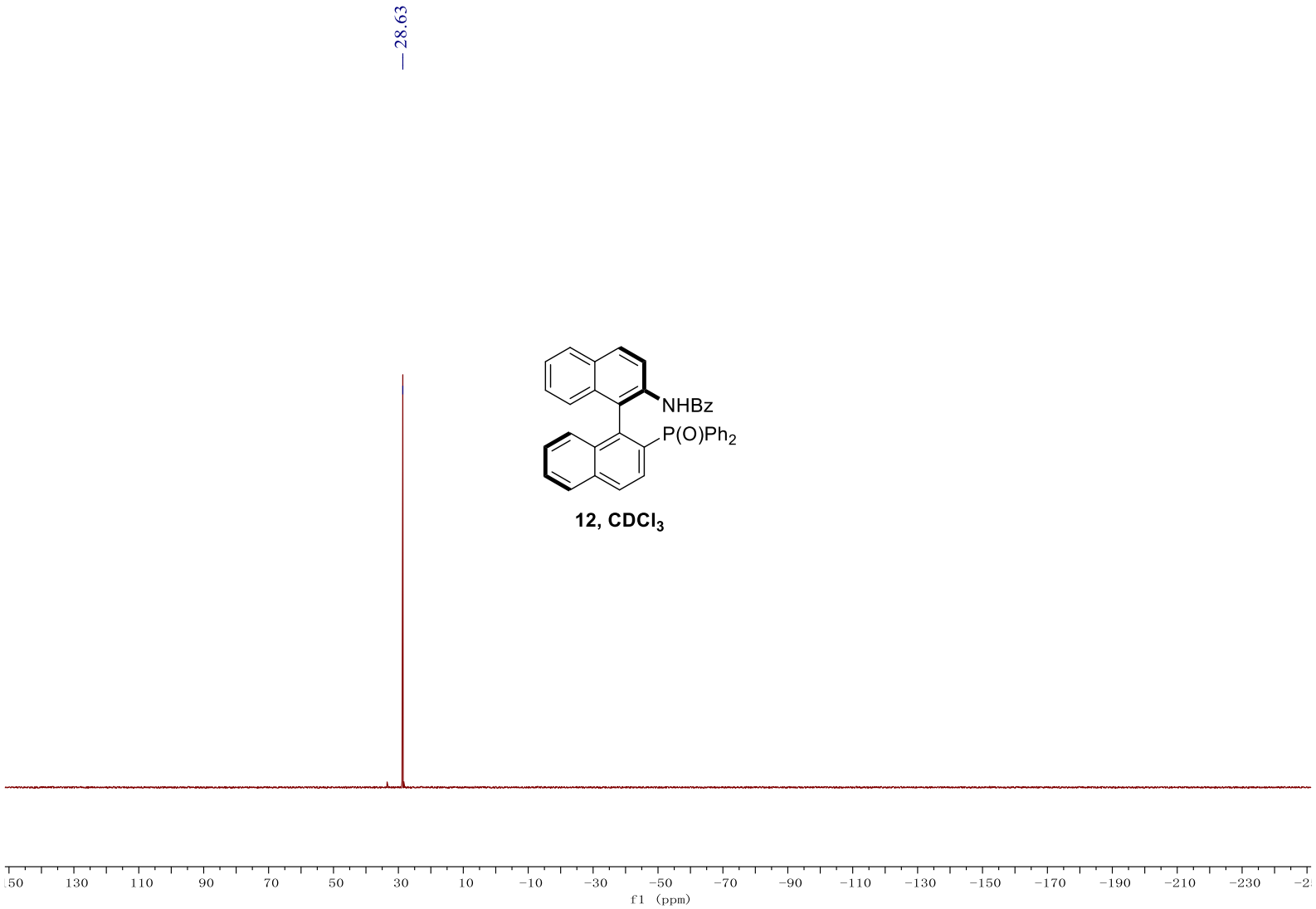
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


28.63
NHBz
P(O)Ph2
12, CDCl3
150
130
110
90
70
50
30
10
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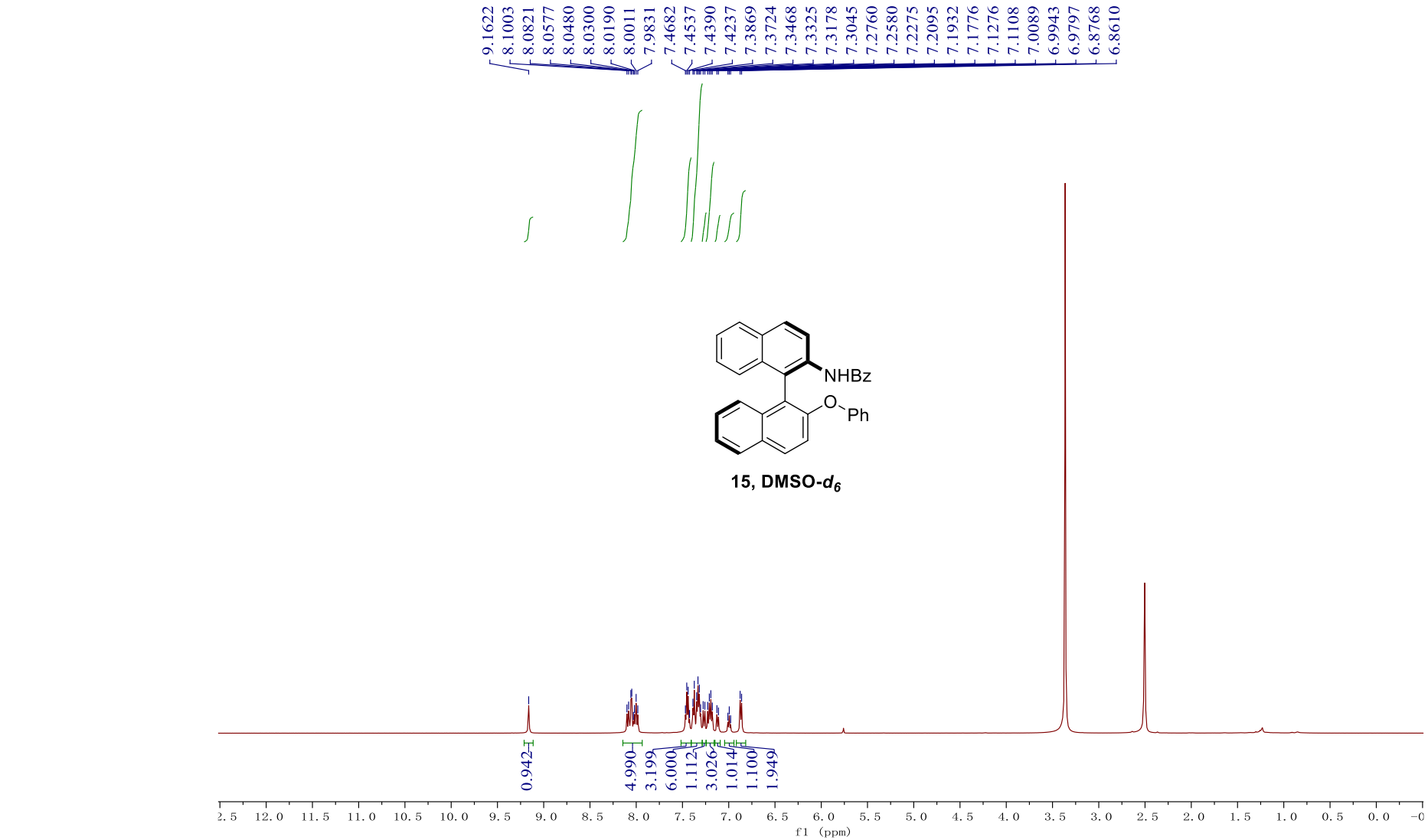
−30
−50
−70
−90
−110
−130
−150
−170
−190
−210
−230
f1 (ppm)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8.0190
8.0011
7.9831
7.4682
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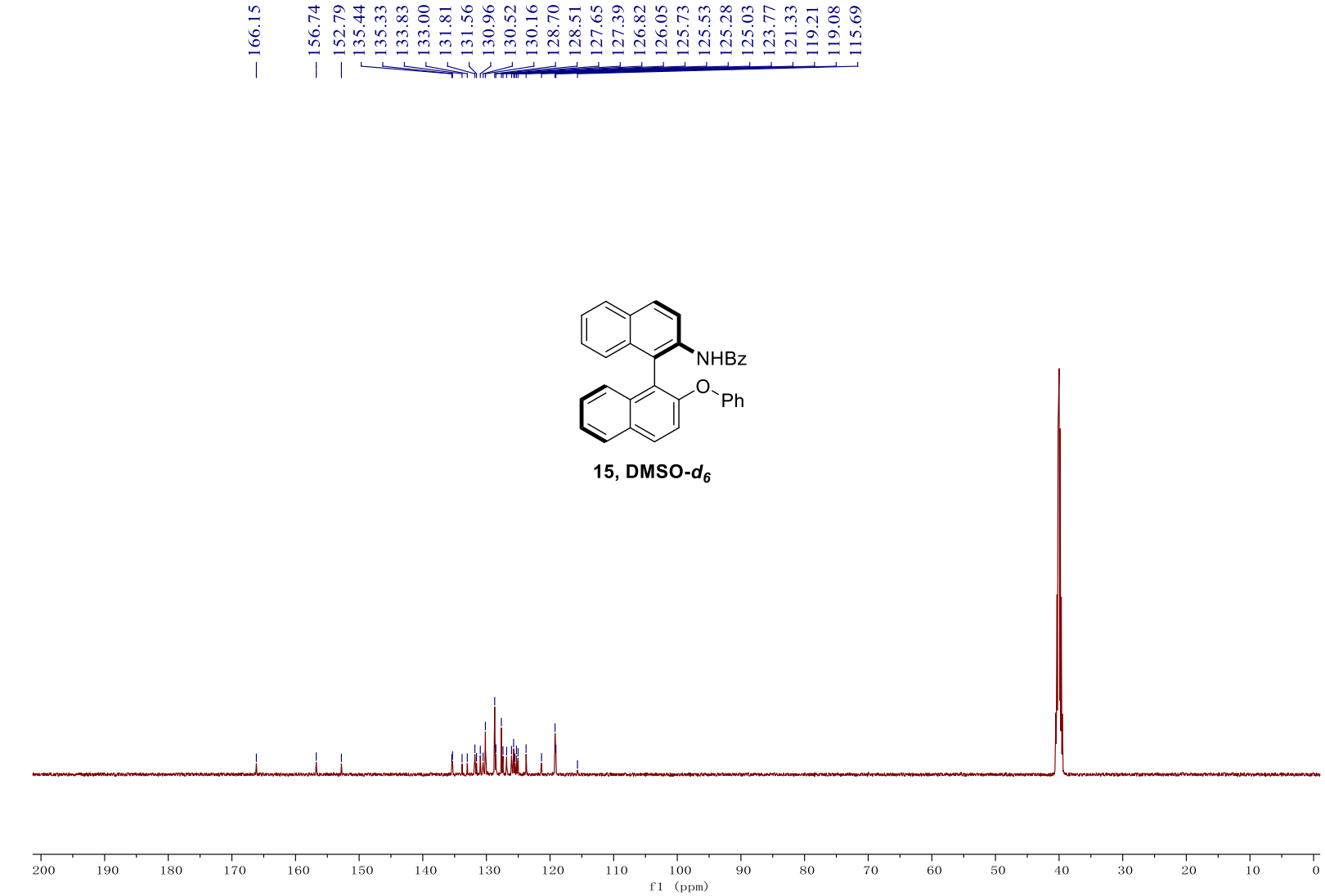
7.4390
7.4237
7.3869
7.3724
7.3468
7.3325
7.3178
7.3045
7.2760
7.2580
7.2275
7.2095
7.1932
7.1776
7.1276
7.1108
7.0089
6.9943
6.9797
6.8768
6.8610
NHBz
O
Ph
0.942
4.990
3.199
6.000
1.112
3.026
1.014
1.100
1.949
f1 (ppm)

15, DMSO-d_6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131.81
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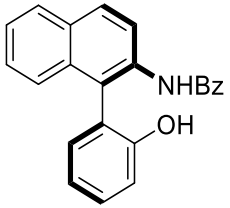
130.52
130.16
128.70
128.51
127.65
127.39
126.82
126.05
125.73
125.53
125.28
125.03
123.77
121.33
119.21
119.08
115.69
NHBz
O
Ph
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

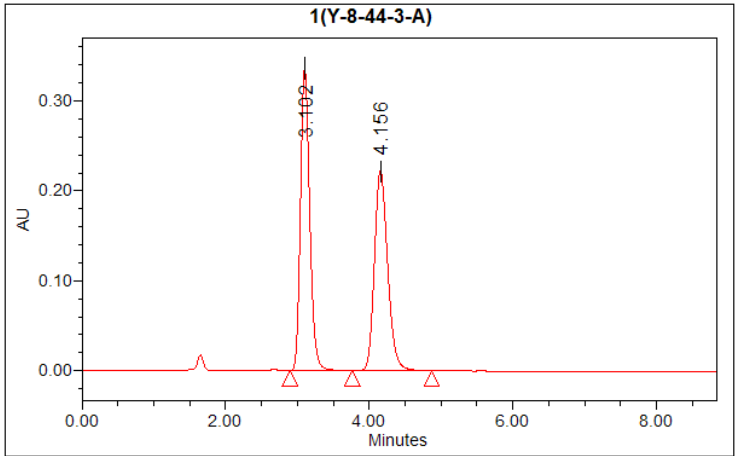
15, DMSO-d_6

HPLC Traces:

(*R*)-*N*-(1-(2-hydroxyphenyl)naphthalen-2-yl)benzamide ((***R*)-7a**)

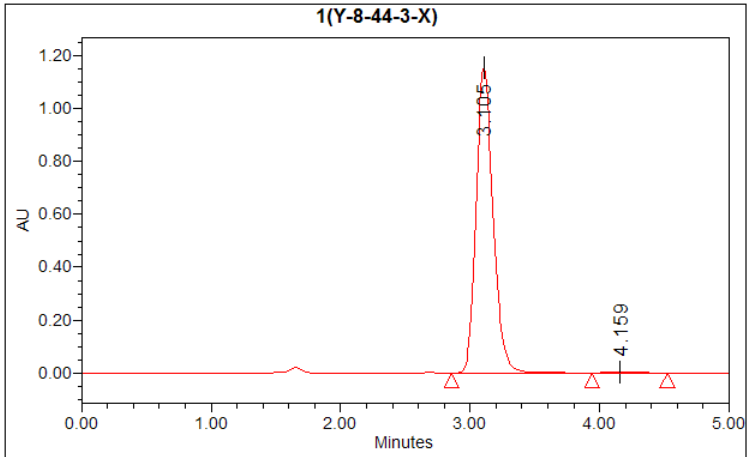


(*R*)-7a



Integration Results

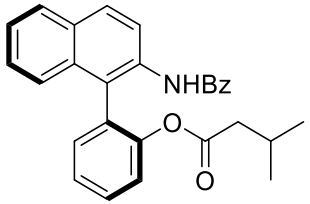
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	51.32	3.102	2.892	3.767	336504	52.500	2976681
2	48.68	4.156	3.767	4.867	222194	66.000	2823598
Sum	100.0						



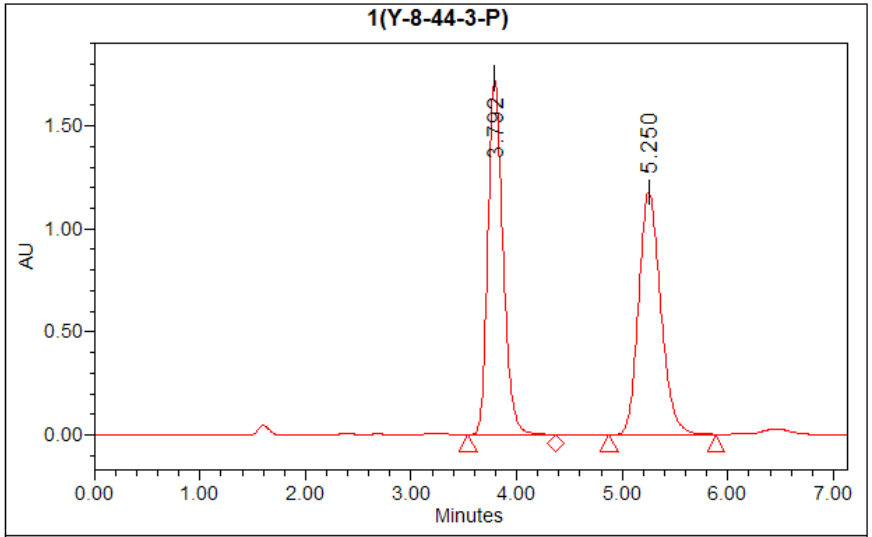
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.43	3.105	2.858	3.942	1154772	65.000	10588267
2	0.57	4.159	3.942	4.525	4798	35.000	60255
Sum	100.0						

(*S*)-2-(2-benzamidonaphthalen-1-yl)phenyl 3-methylbutanoate (**9a**)

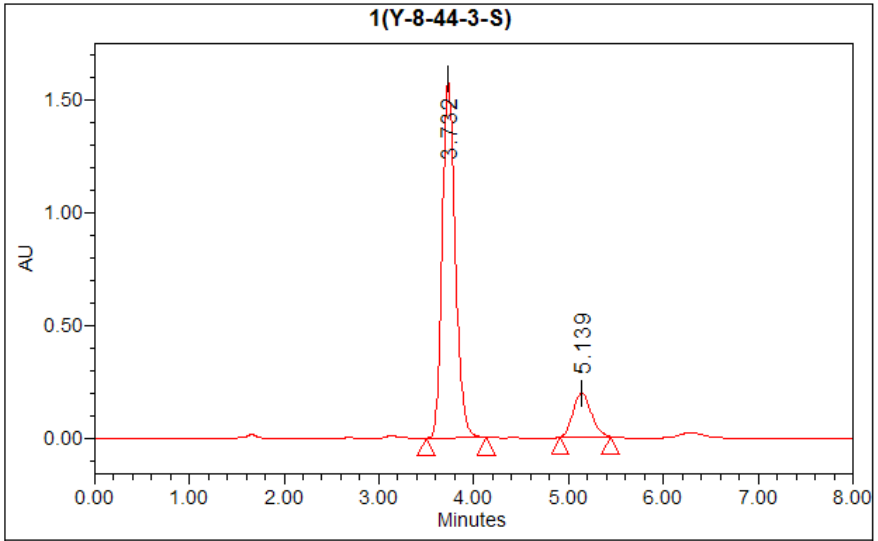


9a



Integration Results

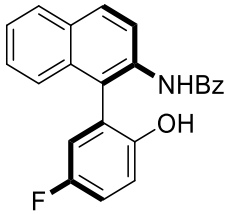
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.03	3.792	3.542	4.367	1725483	49.500	17127482
2	49.97	5.250	4.875	5.892	1178836	61.000	17103895
Sum	100.0						



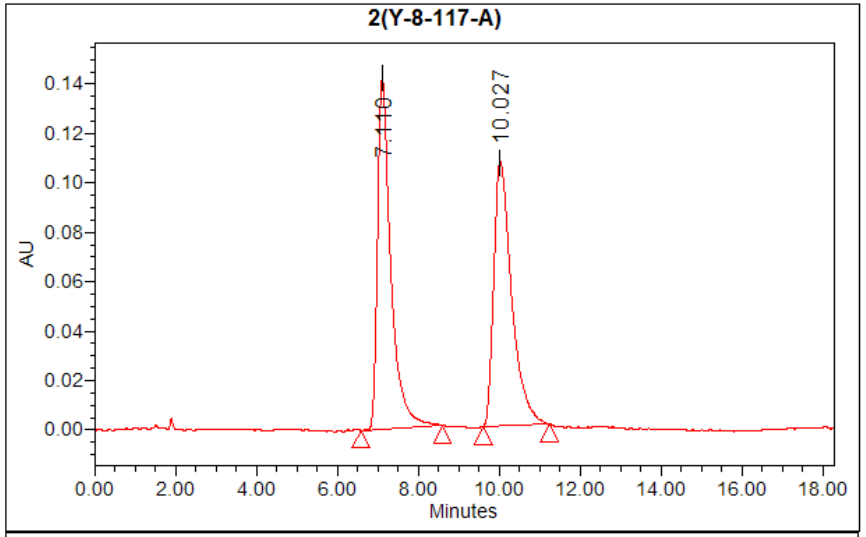
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	85.56	3.732	3.500	4.133	1589965	38.000	15293553
2	14.44	5.139	4.917	5.442	193934	31.500	2580707
Sum	100.0						

(*R*)-*N*-(1-(5-fluoro-2-hydroxyphenyl)naphthalen-2-yl)benzamide (**(*R*)-7b**)

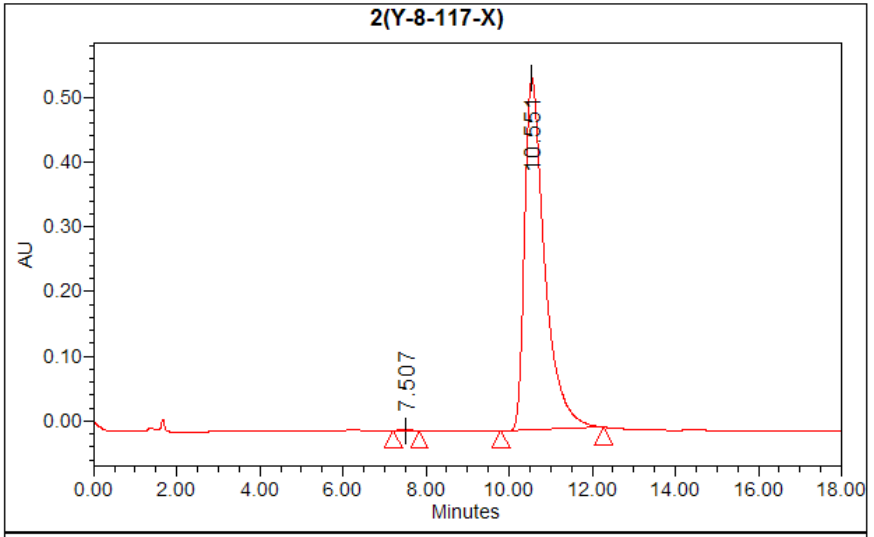


(*R*)-7b



Integration Results

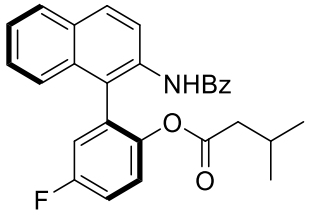
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.01	7.110	6.583	8.592	142090	120.500	3273262
2	49.99	10.027	9.608	11.242	106816	98.000	3271335
Sum	100.0						



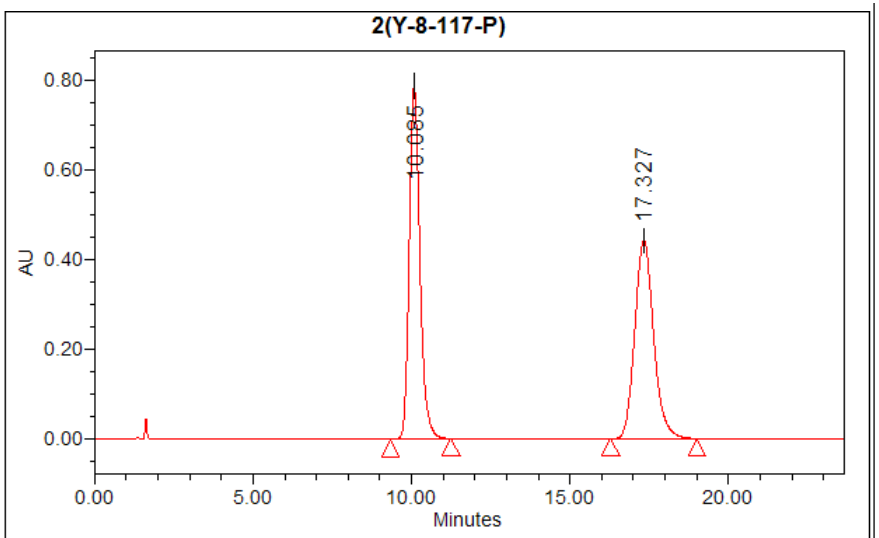
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	0.14	7.507	7.217	7.842	1329	37.500	26359
2	99.86	10.551	9.808	12.267	542871	147.500	18268747
Sum	100.0						

(*S*)-2-(2-benzamidonaphthalen-1-yl)-4-fluorophenyl 3-methylbutanoate (**9b**)

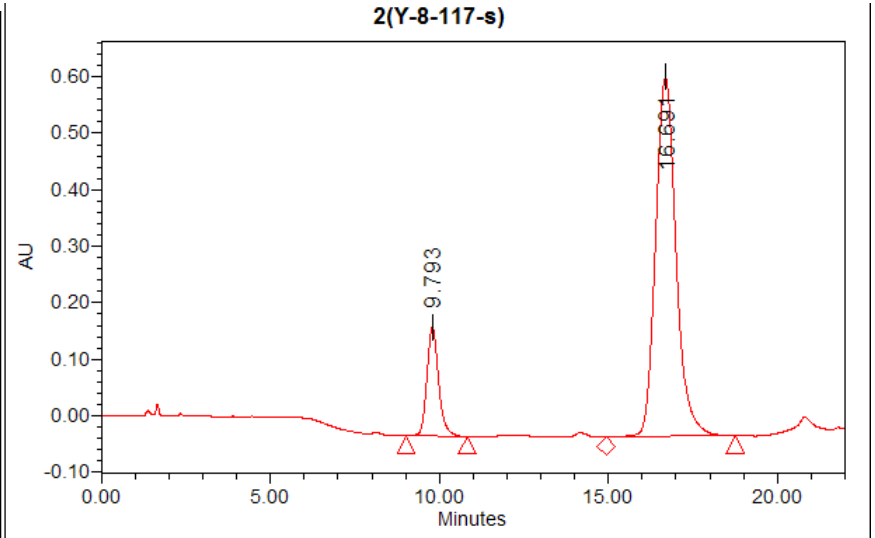


9b



Integration Results

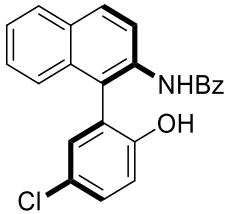
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.81	10.085	9.325	11.250	787145	115.500	18133778
2	50.19	17.327	16.292	19.017	443374	163.500	18275691
Sum	100.0						



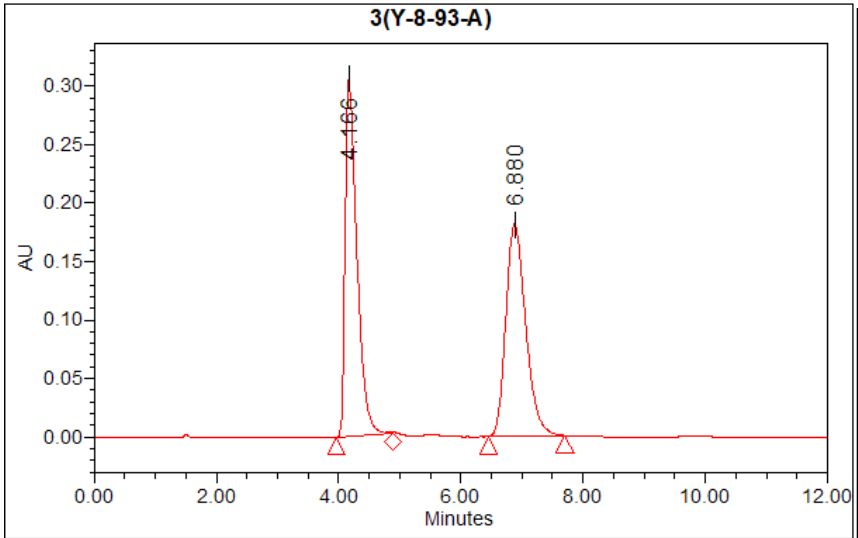
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	14.81	9.793	9.008	10.833	193048	109.500	4682270
2	85.19	16.691	14.933	18.750	635932	229.000	26934606
Sum	100.0						

(*R*)-*N*-(1-(5-chloro-2-hydroxyphenyl)naphthalen-2-yl)benzamide ((***R***)-**7c**)

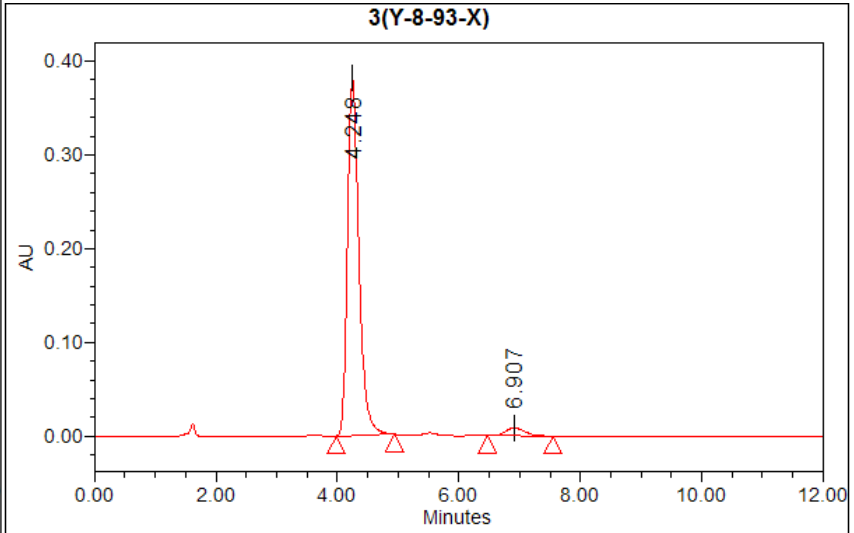


(***R***)-**7c**



Integration Results

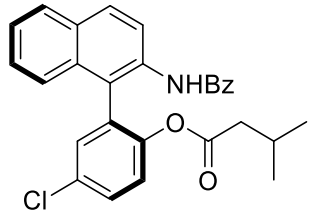
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.91	4.166	3.967	4.892	305015	55.500	4069422
2	50.09	6.880	6.450	7.700	181346	75.000	4084848
Sum	100.0						



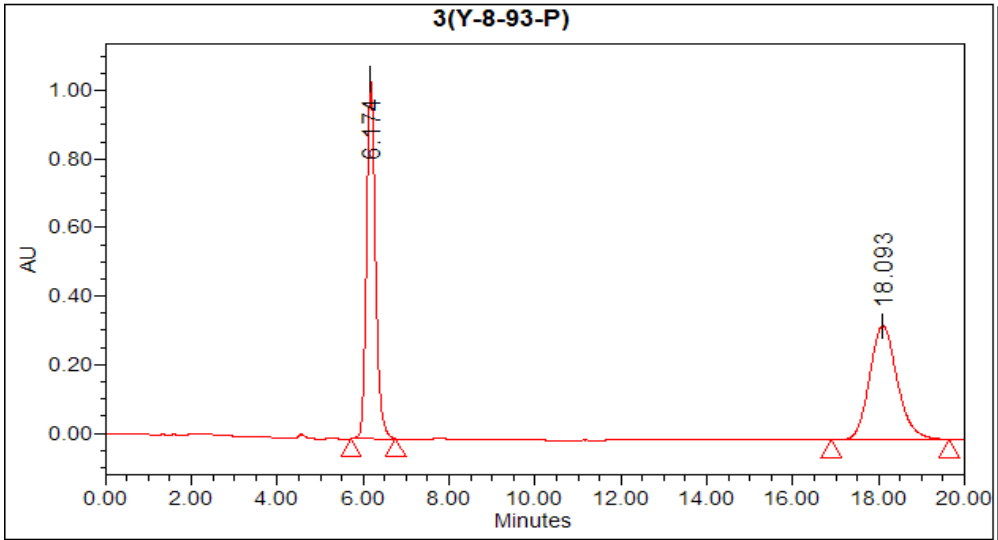
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	96.64	4.248	3.983	4.942	380899	57.500	5015335
2	3.36	6.907	6.467	7.550	8408	65.000	174539
Sum	100.0						

(*S*)-2-(2-benzamidonaphthalen-1-yl)-4-chlorophenyl 3-methylbutanoate (**9c**)

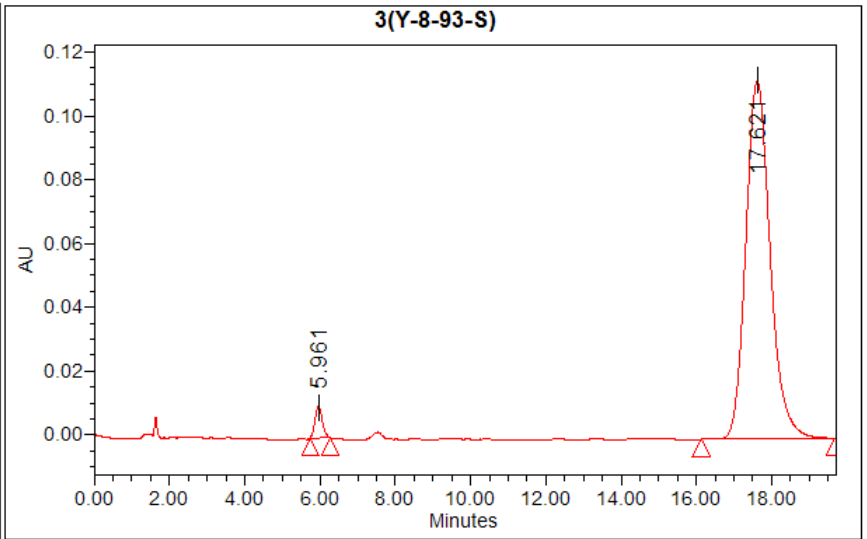


9c



Integration Results

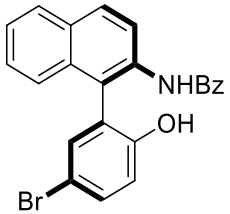
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.29	6.174	5.717	6.758	1047616	62.500	15103542
2	49.71	18.093	16.900	19.642	333399	164.500	14929594
Sum	100.0						



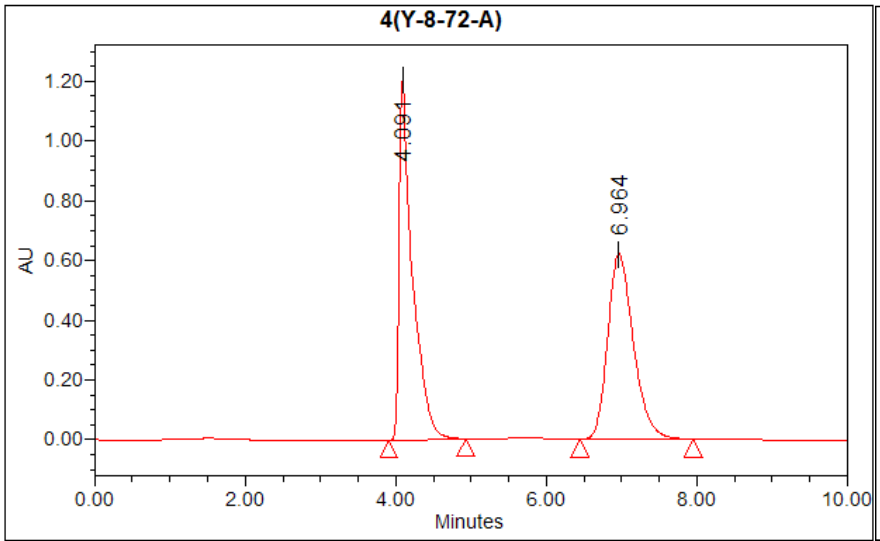
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	2.54	5.961	5.742	6.267	9778	31.500	132089
2	97.46	17.621	16.125	19.692	112365	214.000	5058508
Sum	100.0						

(*R*)-*N*-(1-(5-bromo-2-hydroxyphenyl)naphthalen-2-yl)benzamide ((***R*)-7d**)

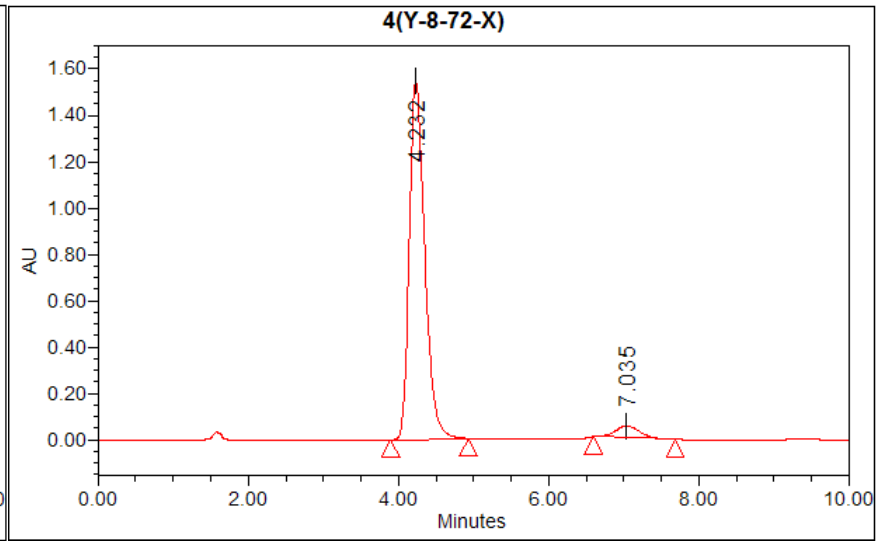


(*R*)-7d



Integration Results

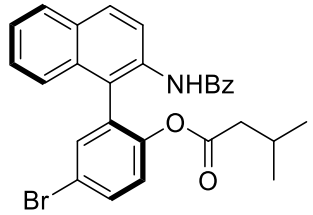
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.98	4.091	3.908	4.933	1201866	61.500	14794127
2	50.02	6.964	6.442	7.950	620657	90.500	14803924
Sum	100.0						



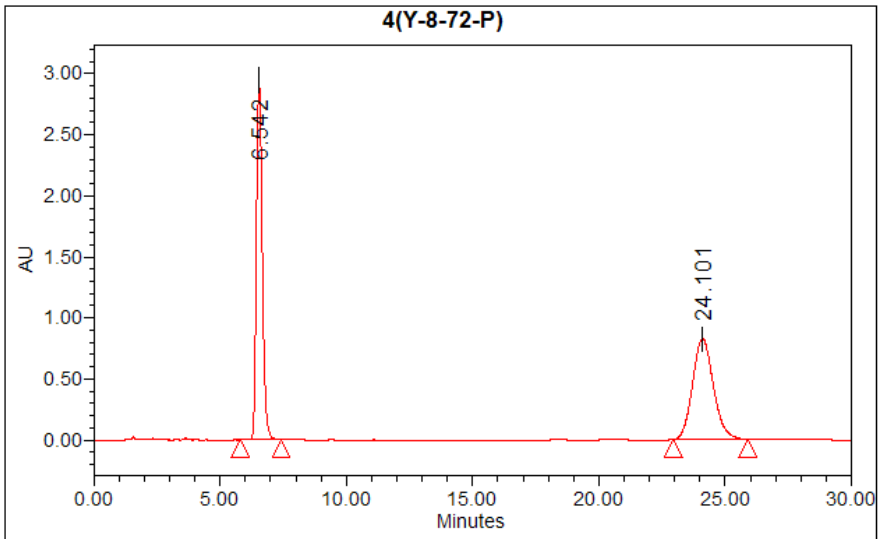
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	95.01	4.232	3.900	4.933	1543513	62.000	21999551
2	4.99	7.035	6.592	7.683	50832	65.500	1156341
Sum	100.0						

(*S*)-2-(2-benzamidonaphthalen-1-yl)-4-bromophenyl 3-methylbutanoate (**9d**)

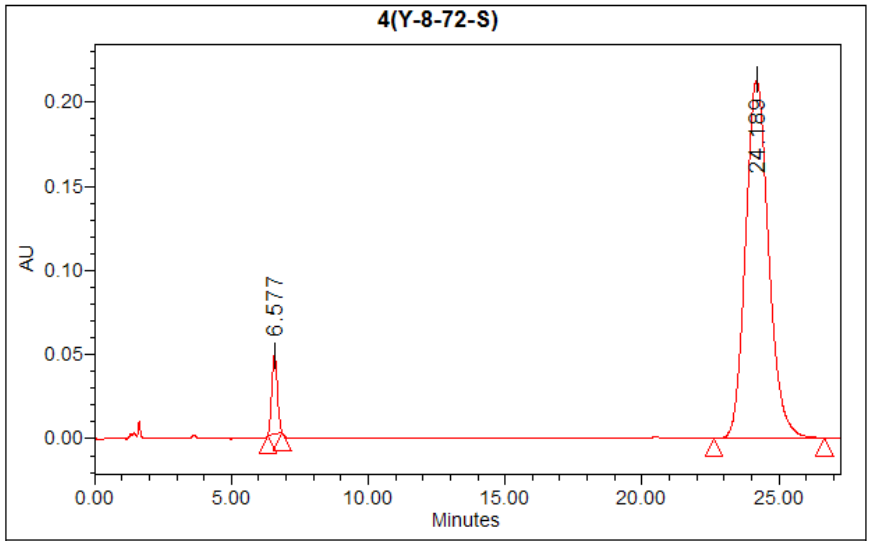


9d



Integration Results

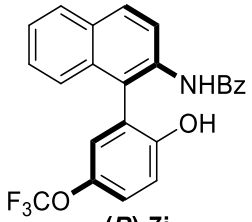
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.92	6.542	5.792	7.417	2939092	97.500	47501645
2	50.08	24.101	22.958	25.892	825661	176.000	47656812
Sum	100.0						



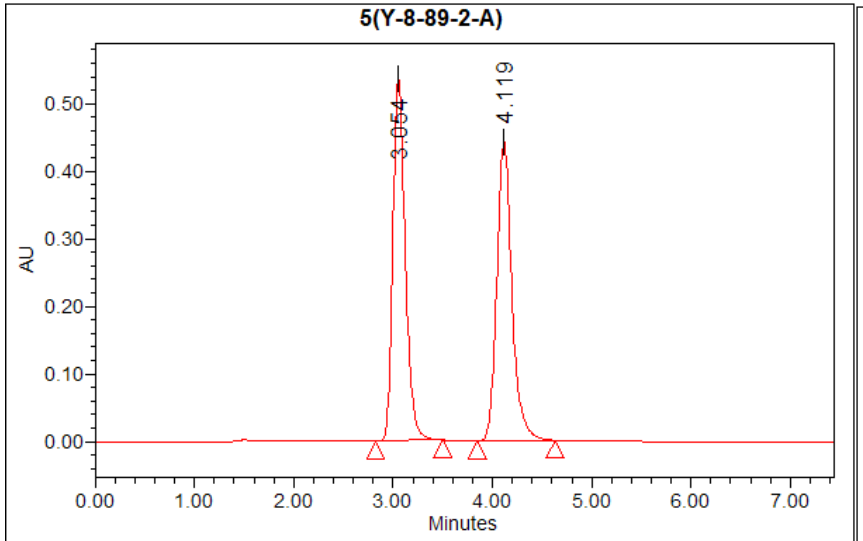
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	5.13	6.577	6.325	6.858	47455	32.000	676106
2	94.87	24.189	22.633	26.675	212818	242.500	12508563
Sum	100.0						

(*R*)-*N*-(1-(2-hydroxy-5-(trifluoromethoxy)phenyl)naphthalen-2-yl)benzamide (**(*R*)-7i**)

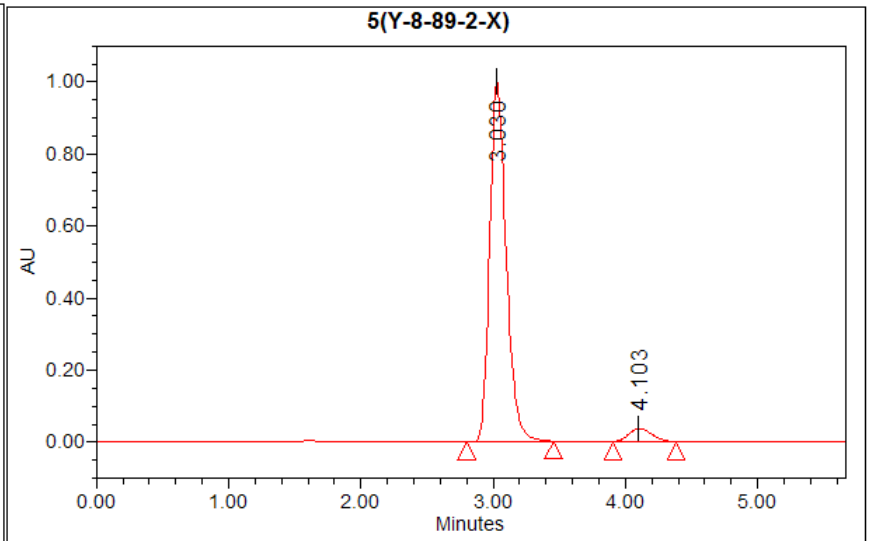


(*R*)-7i



Integration Results

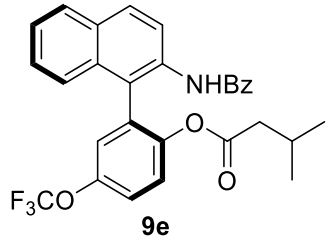
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (µV)	Width (sec)	Area (µV*sec)
1	50.04	3.054	2.825	3.500	535839	40.500	4682392
2	49.96	4.119	3.850	4.633	443264	47.000	4674375
Sum	100.0						



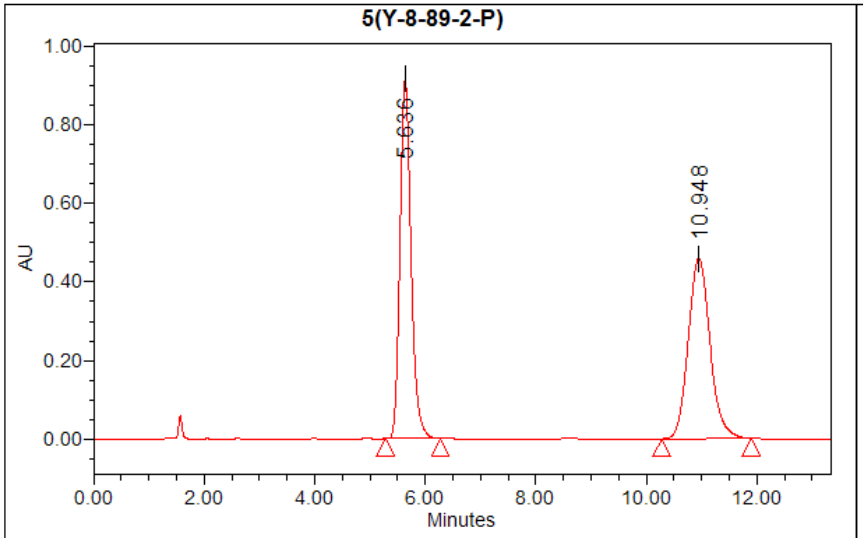
Integration Results

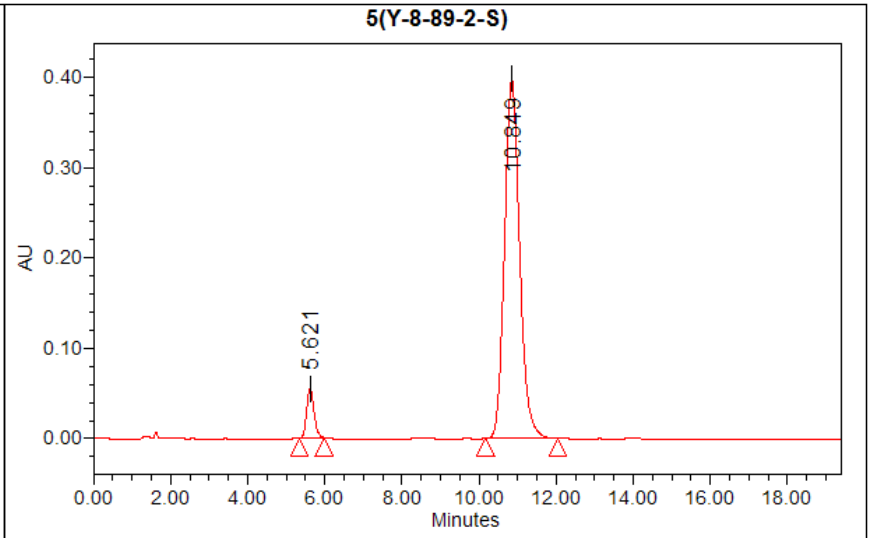
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (µV)	Width (sec)	Area (µV*sec)
1	95.02	3.030	2.800	3.458	1000318	39.500	8643995
2	4.98	4.103	3.908	4.383	37019	28.500	453483
Sum	100.0						

(S)-2-(2-benzamidonaphthalen-1-yl)-4-(trifluoromethoxy)phenyl 3-methylbutanoate (**9e**)



9e





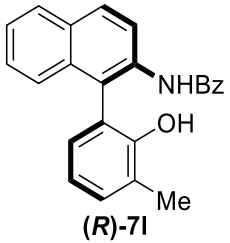
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.09	5.636	5.275	6.267	913192	59.500	12586104
2	49.91	10.948	10.275	11.892	458971	97.000	12539747
Sum	100.0						

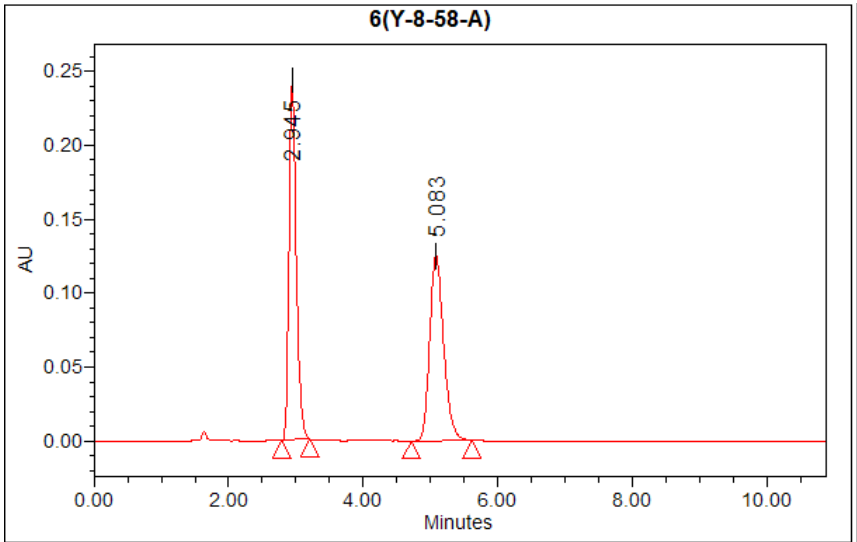
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	6.34	5.621	5.342	5.983	54719	38.500	734687
2	93.66	10.849	10.175	12.050	397649	112.500	10857367
Sum	100.0						

(*R*)-*N*-(1-(2-hydroxy-3-methylphenyl)naphthalen-2-yl)benzamide (**(*R*)-7l**)

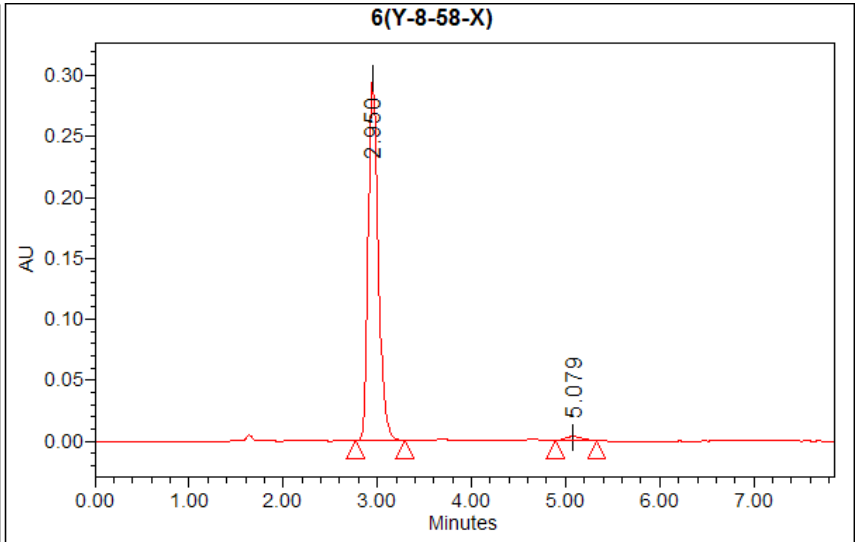


(*R*)-7l



Integration Results

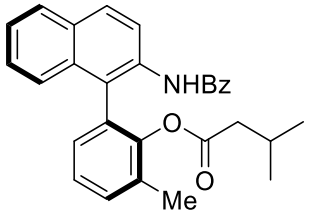
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.27	2.945	2.792	3.208	243647	25.000	1816257
2	49.73	5.083	4.717	5.617	125318	54.000	1796909
Sum	100.0						



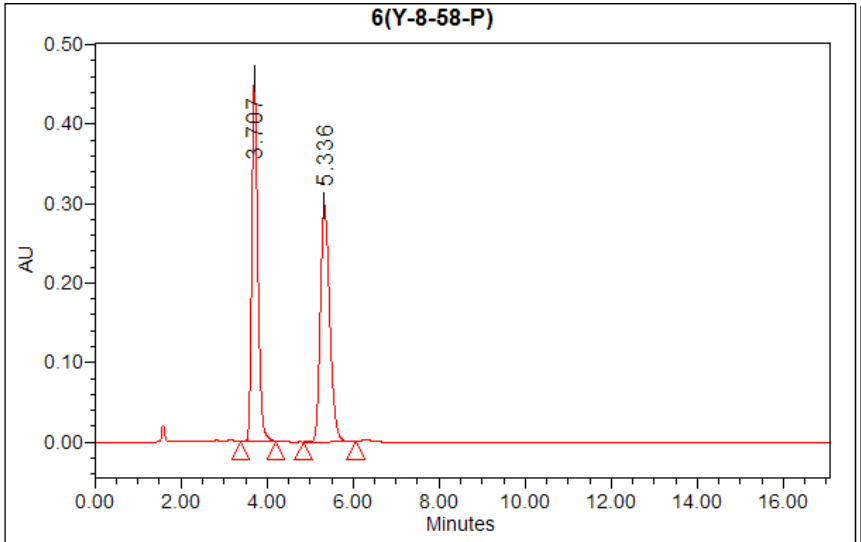
Integration Results

*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	98.07	2.950	2.767	3.292	296792	31.500	2187472
2	1.93	5.079	4.892	5.333	3381	26.500	42964
Sum	100.0						

(*S*)-2-(2-benzamidonaphthalen-1-yl)-6-methylphenyl 3-methylbutanoate (**9f**)

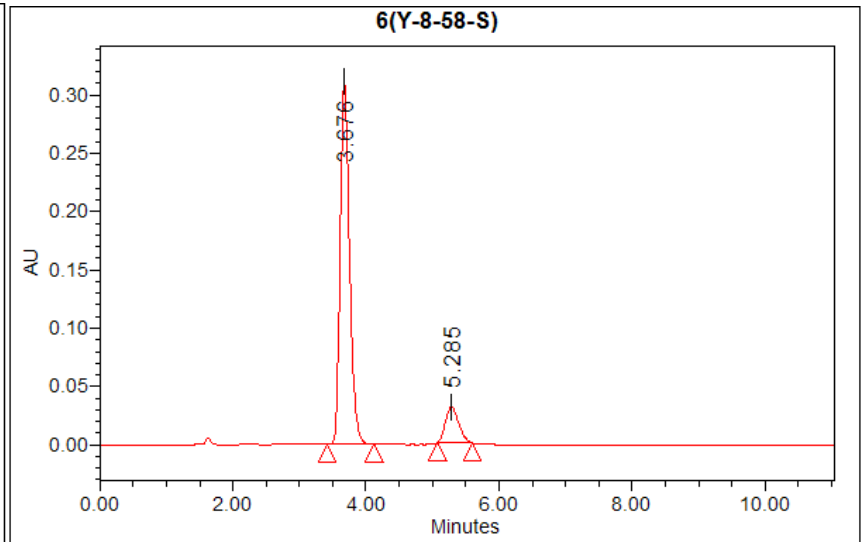


9f



Integration Results

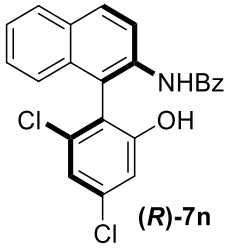
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.26	3.707	3.392	4.200	456136	48.500	4523772
2	49.74	5.336	4.850	6.058	298598	72.500	4476426
Sum	100.0						

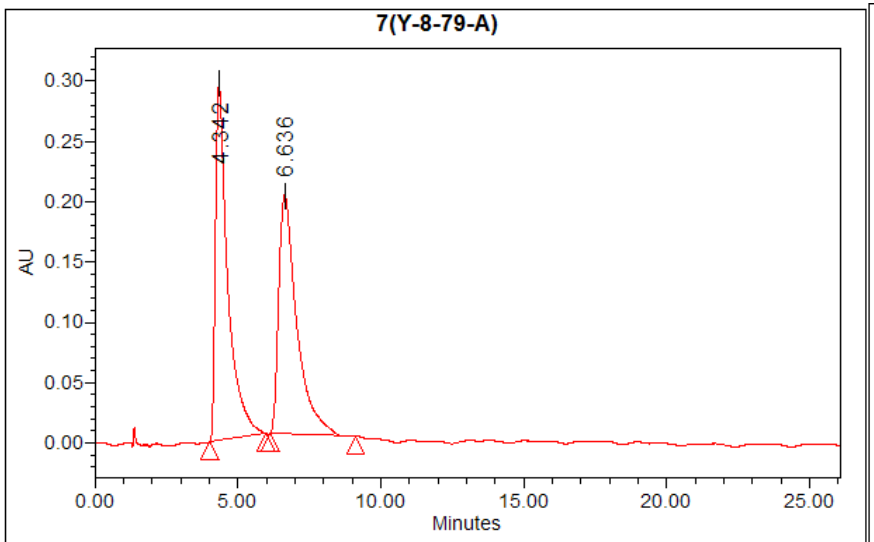


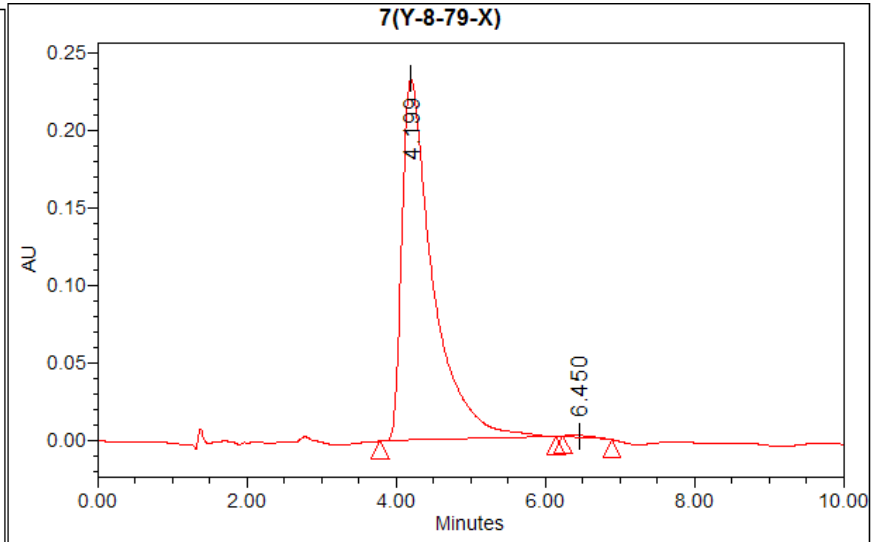
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	87.54	3.676	3.417	4.125	310572	42.500	3015050
2	12.46	5.285	5.075	5.600	31113	31.500	429189
Sum	100.0						

(*S*)-*N*-(1-(2,4-dichloro-6-hydroxyphenyl)naphthalen-2-yl)benzamide (**(*R*)-7n**)







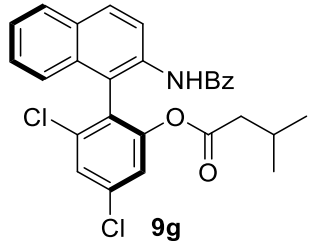
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.68	4.342	4.017	5.983	295436	118.000	8969266
2	49.32	6.636	6.142	9.125	198061	179.000	8729256
Sum	100.0						

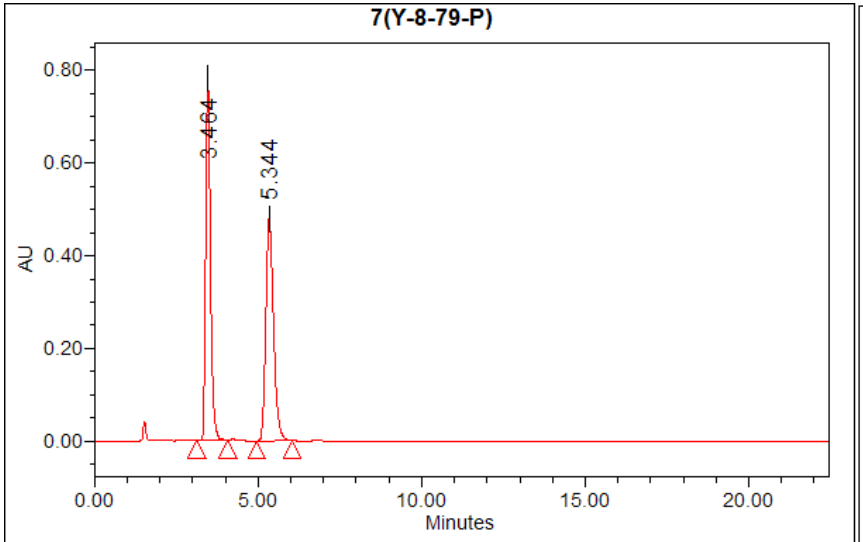
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.59	4.199	3.783	6.142	232617	141.500	6695816
2	0.41	6.450	6.233	6.892	1175	39.500	27517
Sum	100.0						

(*R*)-2-(2-benzamidonaphthalen-1-yl)-3,5-dichlorophenyl 3-methylbutanoate (**9g**)

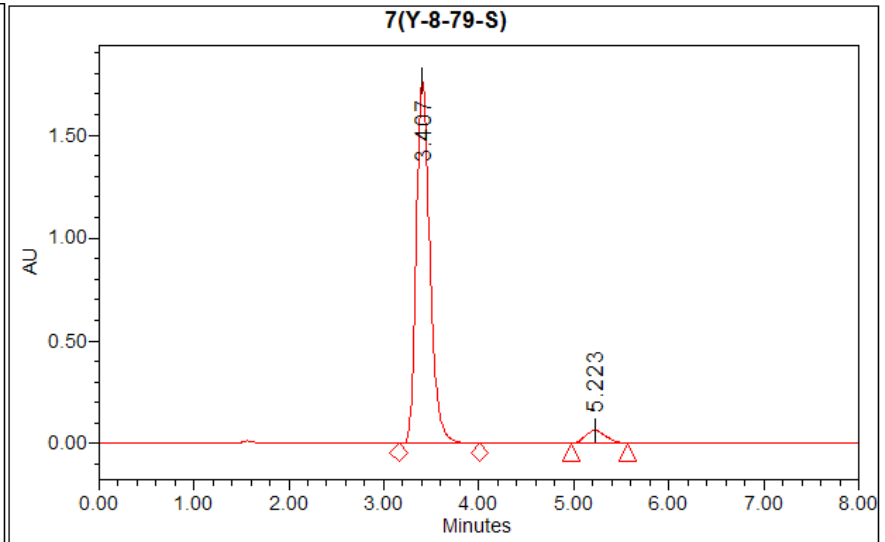


9g



Integration Results

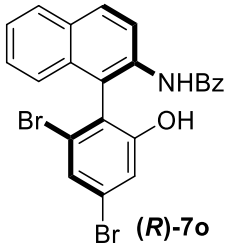
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.10	3.464	3.125	4.075	780916	57.000	7947355
2	49.90	5.344	4.967	6.042	480248	64.500	7915921
Sum	100.0						



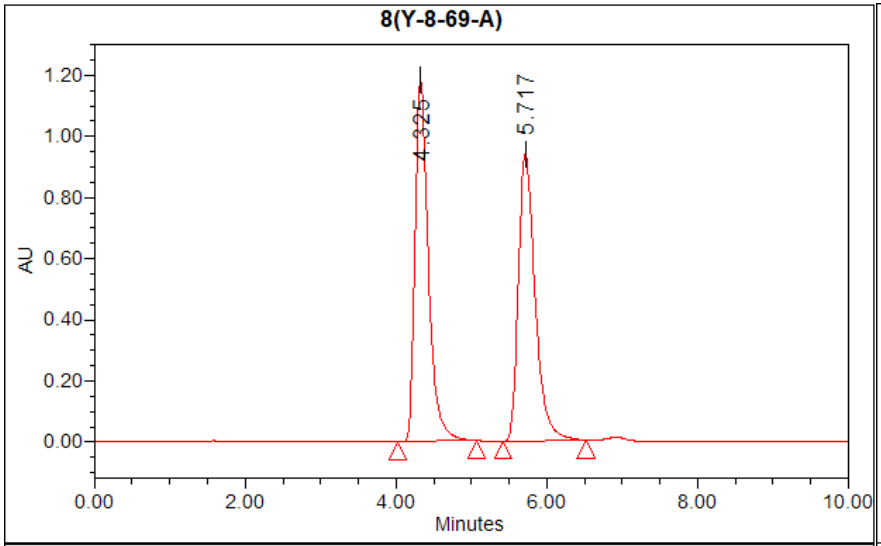
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	94.94	3.407	3.158	4.008	1760354	51.000	17501896
2	5.06	5.223	4.975	5.567	62863	35.500	933306
Sum	100.0						

(S)-*N*-(1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzamide ((***R***)-**7o**)

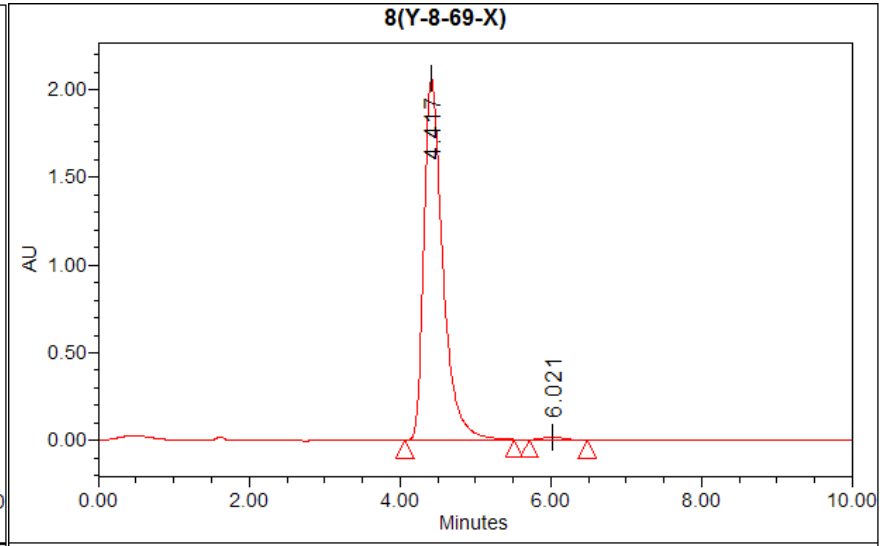


(***R***)-**7o**



Integration Results

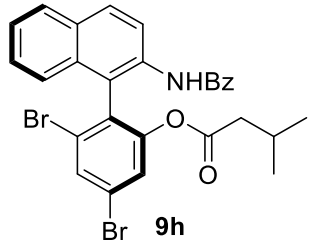
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.05	4.325	4.025	5.067	1180800	62.500	14634364
2	49.95	5.717	5.425	6.517	938914	65.500	14607636
Sum	100.0						



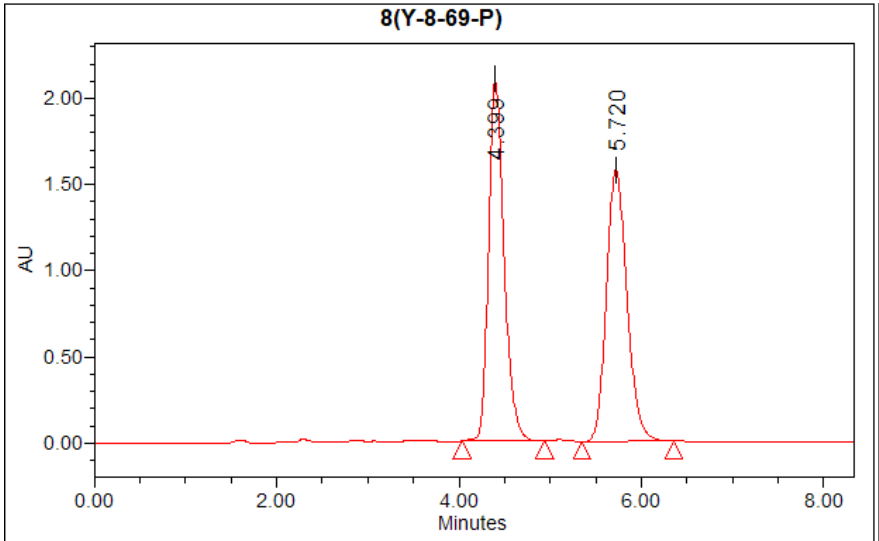
Integration Results

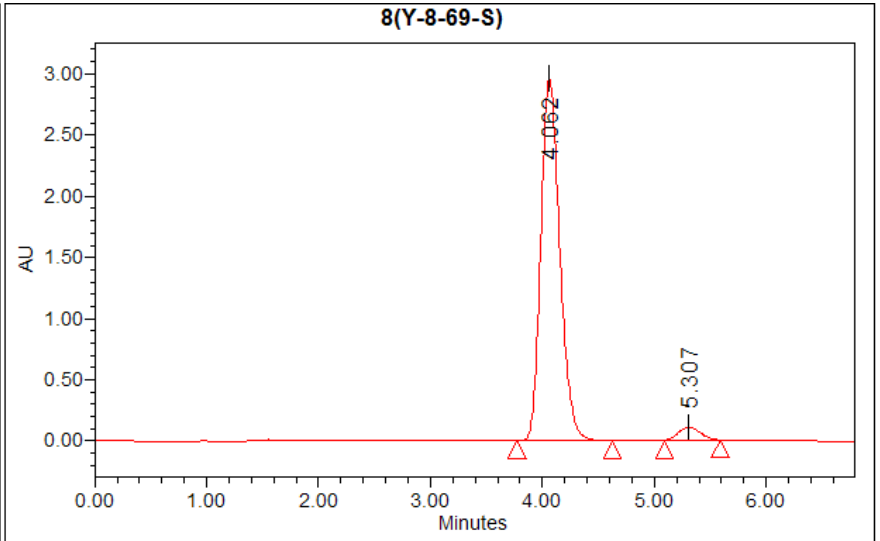
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.16	4.417	4.067	5.517	2058973	87.000	36008312
2	0.84	6.021	5.717	6.483	16368	46.000	304814
Sum	100.0						

(*R*)-2-(2-benzamidonaphthalen-1-yl)-3,5-dibromophenyl 3-methylbutanoate (**9h**)



9h





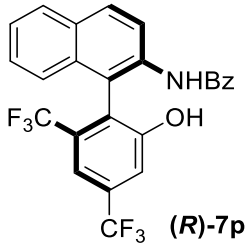
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.12	4.399	4.033	4.942	2096693	54.500	24925930
2	49.88	5.720	5.350	6.358	1579437	60.500	24803492
Sum	100.0						

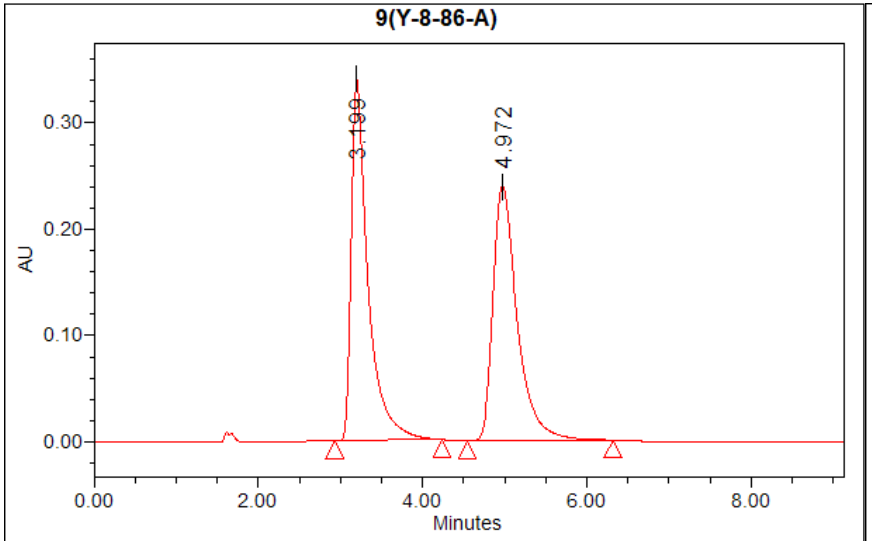
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	95.95	4.062	3.775	4.625	2958973	51.000	34675885
2	4.05	5.307	5.092	5.592	105546	30.000	1464543
Sum	100.0						

(*R*)-*N*-(1-(2-hydroxy-4,6-bis(trifluoromethyl)phenyl)naphthalen-2-yl)benzamide ((***R***)-**7p**)

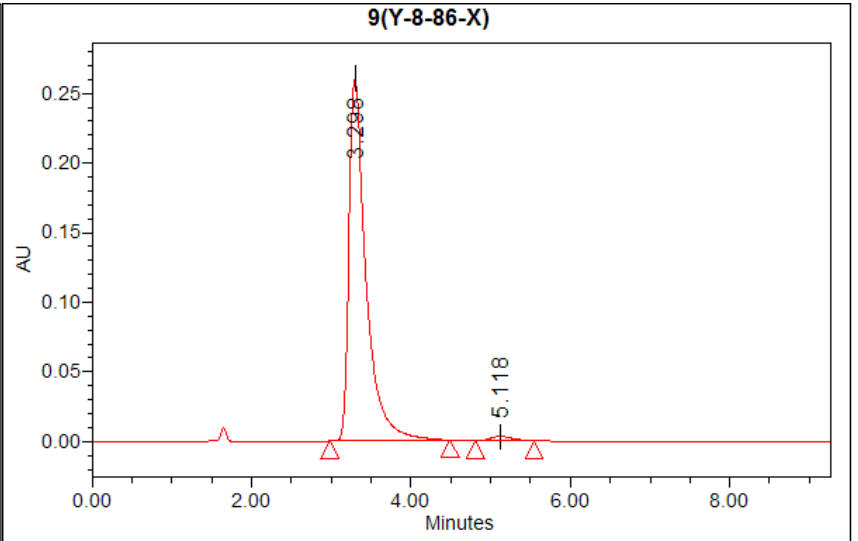


(***R***)-**7p**



Integration Results

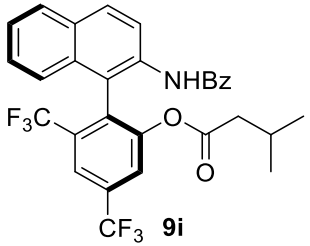
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.92	3.199	2.925	4.233	339563	78.500	4877861
2	50.08	4.972	4.542	6.317	239523	106.500	4893674
Sum	100.0						



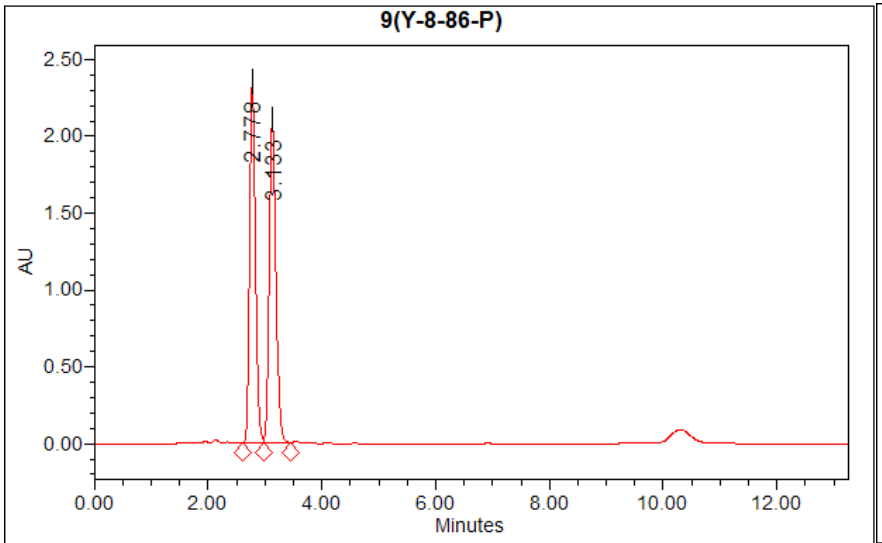
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	98.56	3.298	2.983	4.492	259765	90.500	3872666
2	1.44	5.118	4.808	5.542	3091	44.000	56672
Sum	100.0						

(*S*)-2-(2-benzamidonaphthalen-1-yl)-3,5-bis(trifluoromethyl)phenyl 3-methylbutanoate (**9i**)

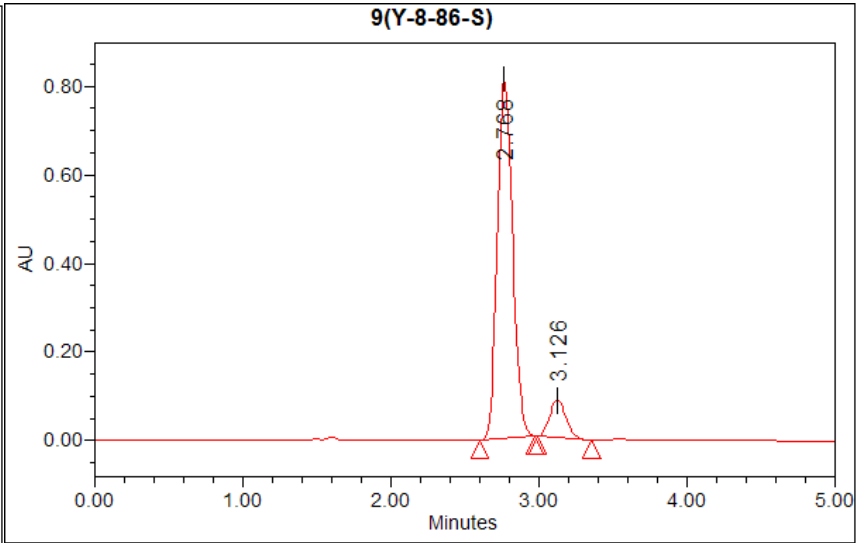


9i



Integration Results

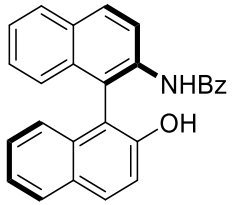
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.75	2.778	2.608	2.975	2358998	22.000	17003862
2	50.25	3.133	2.975	3.450	2106507	28.500	17176282
Sum	100.0						



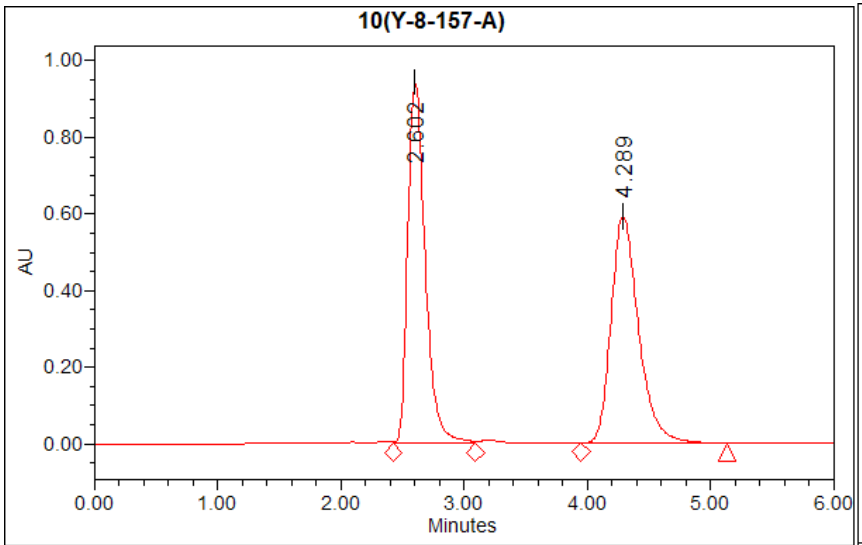
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	89.77	2.768	2.600	2.975	812274	22.500	5828070
2	10.23	3.126	2.992	3.358	85744	22.000	664390
Sum	100.0						

(*R*)-*N*-(2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((***R***)-**7r**)

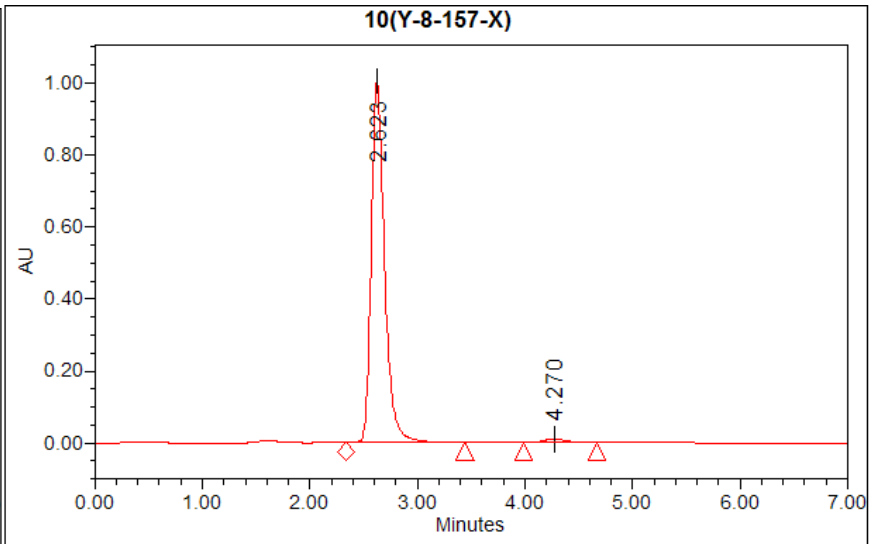


(***R***)-**7r**



Integration Results

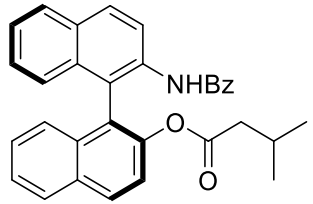
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.24	2.602	2.425	3.092	944218	40.000	9304295
2	49.76	4.289	3.950	5.133	593799	71.000	9214213
Sum	100.0						



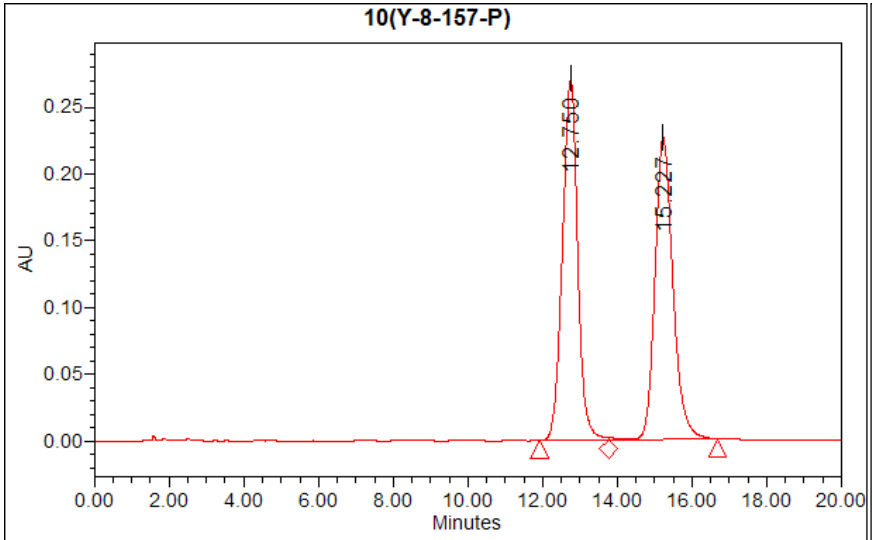
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	98.33	2.623	2.333	3.442	1005913	66.500	8688332
2	1.67	4.270	3.983	4.667	10166	41.000	147955
Sum	100.0						

(*S*)-2'-benzamido-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9j**)

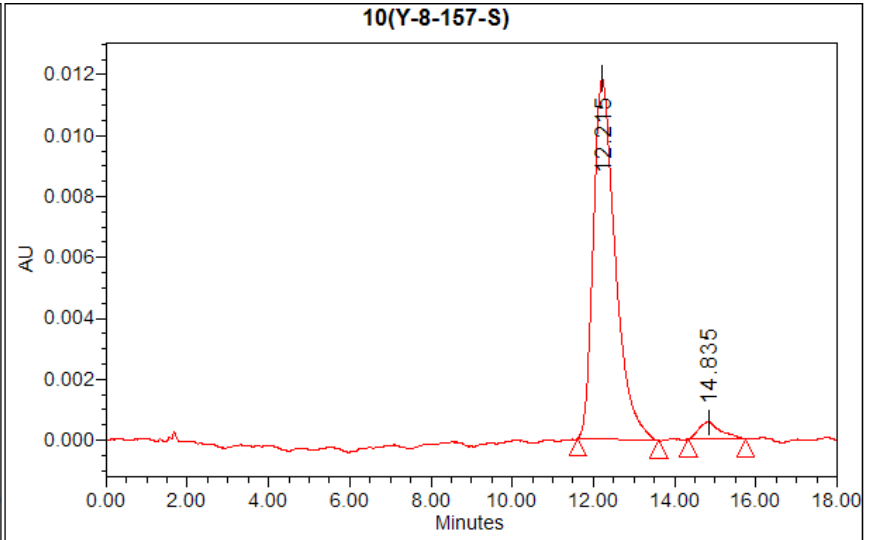


9j



Integration Results

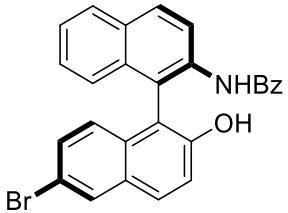
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.26	12.750	11.917	13.767	270310	111.000	7680157
2	49.74	15.227	13.767	16.675	225607	174.500	7599884
Sum	100.0						



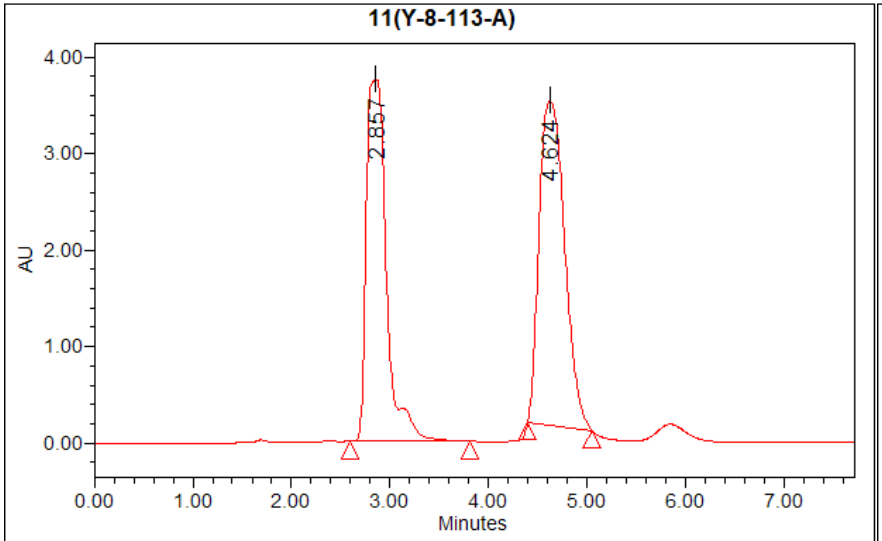
Integration Results

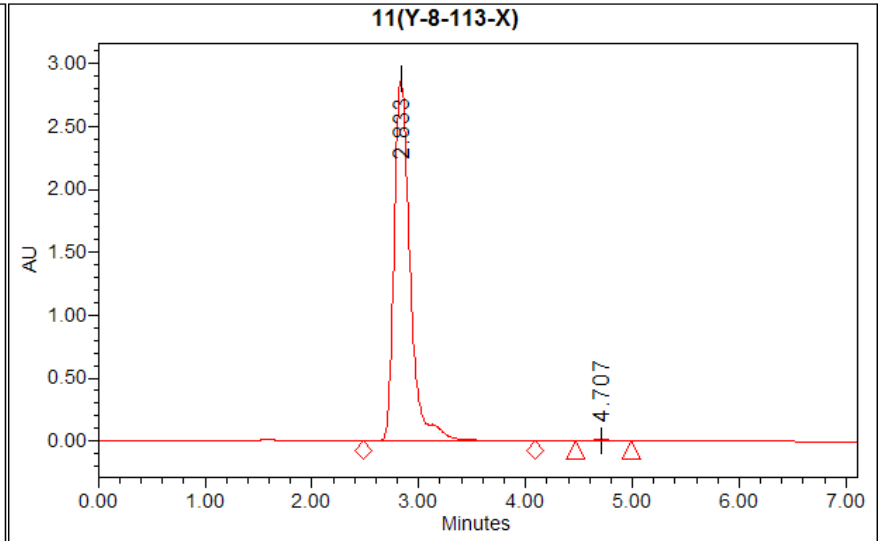
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	95.58	12.215	11.617	13.608	11810	119.500	444283
2	4.42	14.835	14.333	15.742	556	84.500	20525
Sum	100.0						

(*R*)-*N*-(6'-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (**(*R*)-7s**)



(*R*)-7s





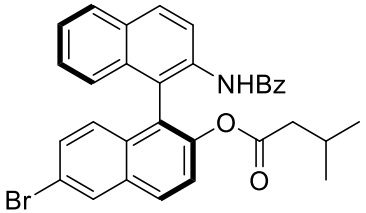
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	46.92	2.857	2.592	3.808	3749441	73.000	53143655
2	53.08	4.624	4.400	5.050	3360220	39.000	60110425
Sum	100.0						

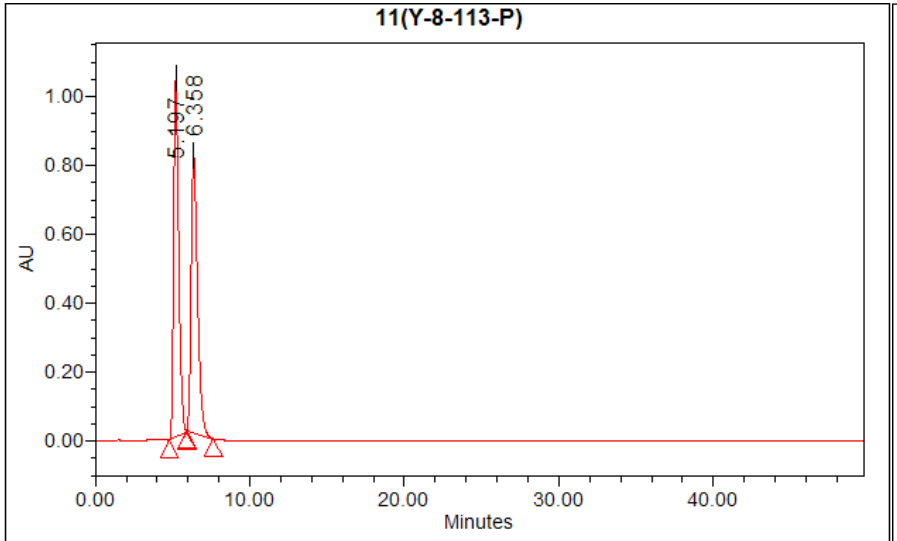
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.55	2.833	2.483	4.092	2873774	96.500	30285858
2	0.45	4.707	4.467	4.992	8044	31.500	137029
Sum	100.0						

(*S*)-2'-benzamido-6-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9k**)

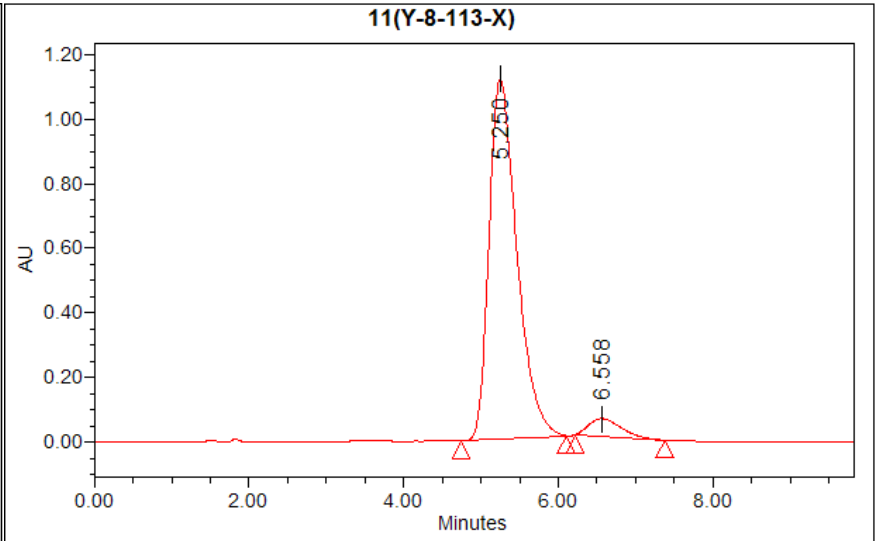


9k



Integration Results

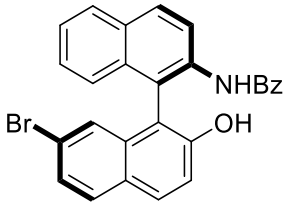
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.44	5.197	4.783	5.917	1039565	68.000	23616526
2	49.56	6.358	5.942	7.650	805893	102.500	23202920
Sum	100.0						



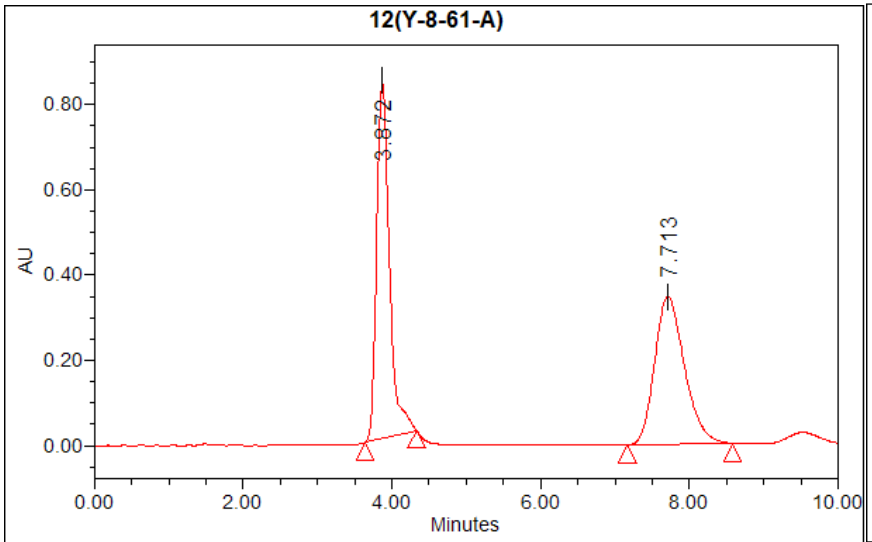
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	94.54	5.250	4.742	6.100	1114016	81.500	27891602
2	5.46	6.558	6.217	7.375	55306	69.500	1611456
Sum	100.0						

(*R*)-*N*-(7'-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (**(*R*)-7t**)

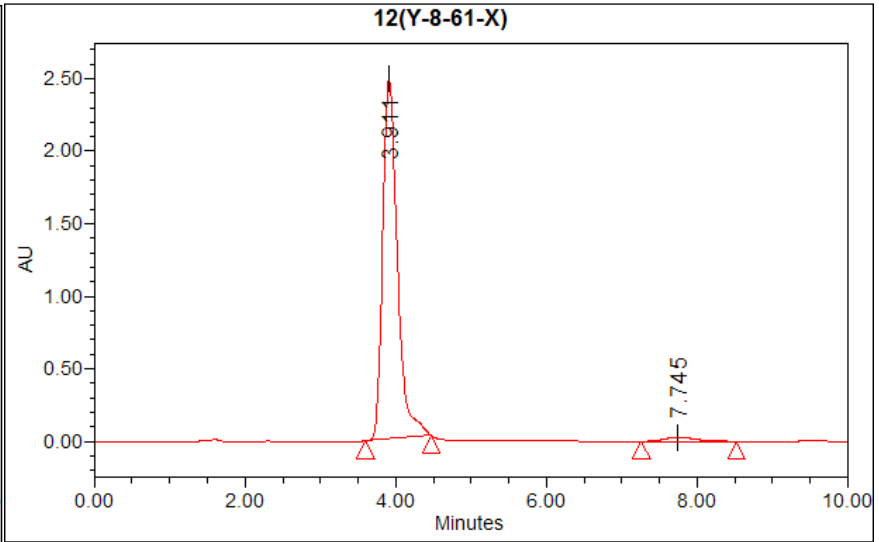


(*R*)-7t



Integration Results

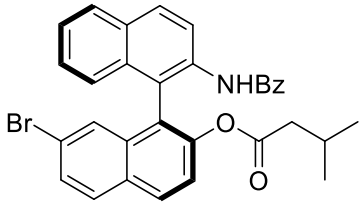
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.99	3.872	3.642	4.333	839277	41.500	10086401
2	49.01	7.713	7.167	8.583	347016	85.000	9695497
Sum	100.0						



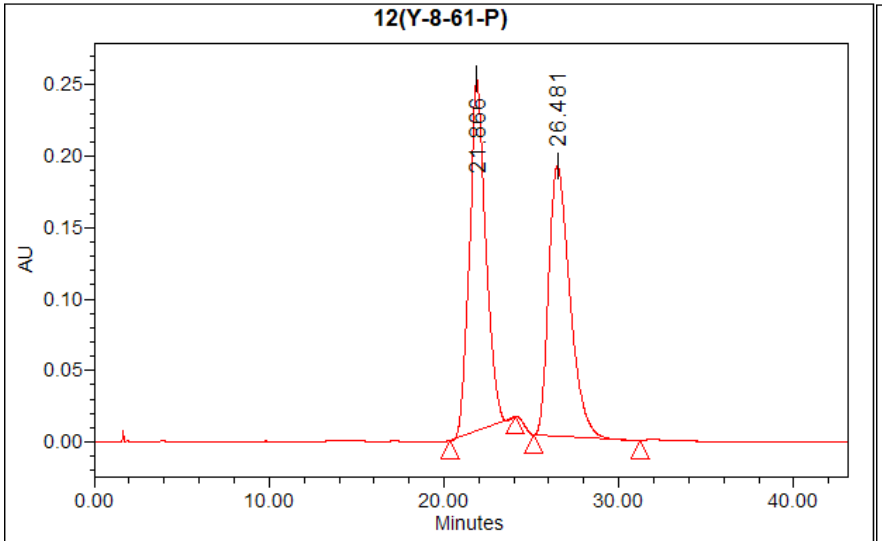
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	97.70	3.911	3.600	4.467	2478461	52.000	33809408
2	2.30	7.745	7.258	8.525	28475	76.000	794678
Sum	100.0						

(*S*)-2'-benzamido-7-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9l**)

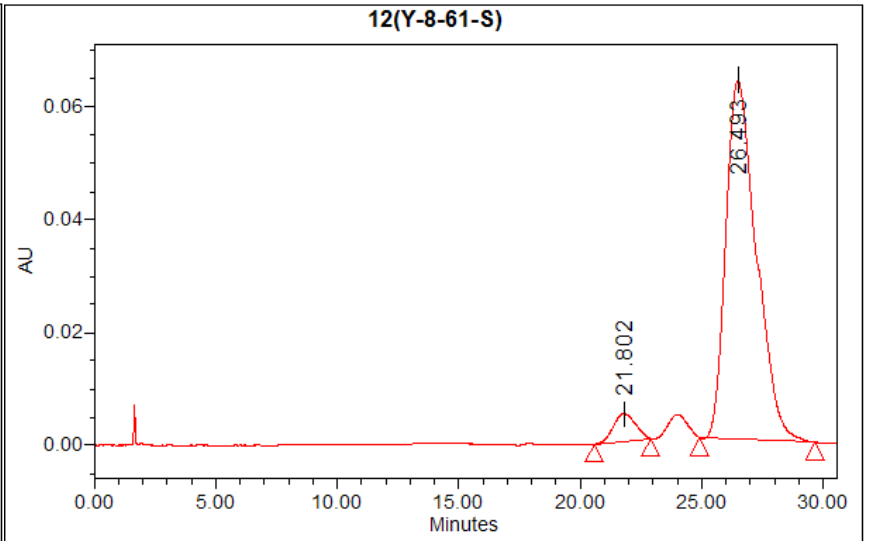


9l



Integration Results

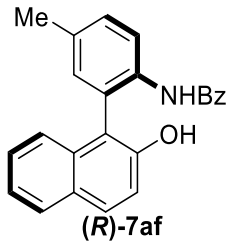
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.93	21.866	20.350	24.067	246088	223.000	15935285
2	50.07	26.481	25.117	31.233	189536	367.000	15979866
Sum	100.0						



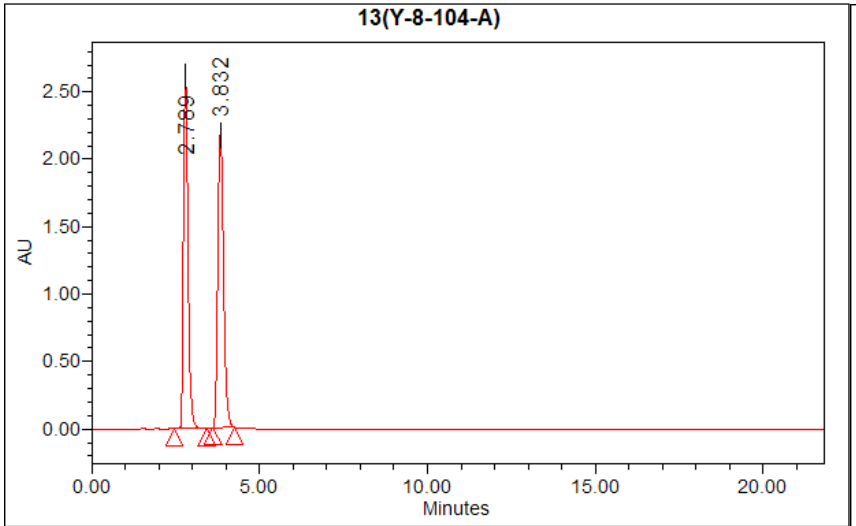
Integration Results

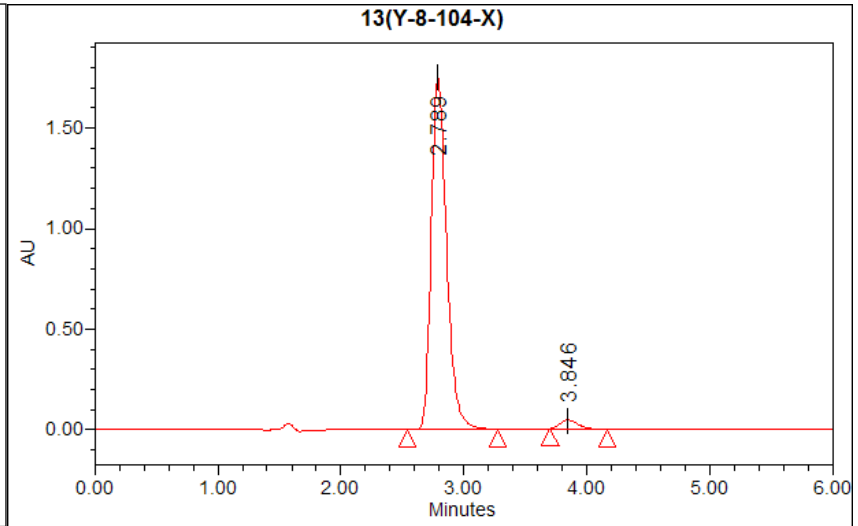
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	5.22	21.802	20.592	22.892	4871	138.000	305598
2	94.78	26.493	24.908	29.675	63617	286.000	5546249
Sum	100.0						

(R)-N-(2-(2-hydroxynaphthalen-1-yl)-4-methylphenyl)benzamide ((***R***)-**7af**)



(***R***)-**7af**





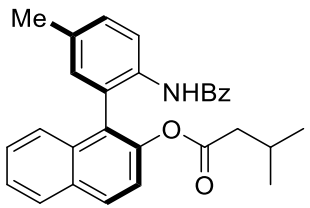
Integration Results

*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	48.89	2.789	2.467	3.425	2608549	57.500	24382971
2	51.11	3.832	3.617	4.250	2171659	38.000	25485145
Sum	100.0						

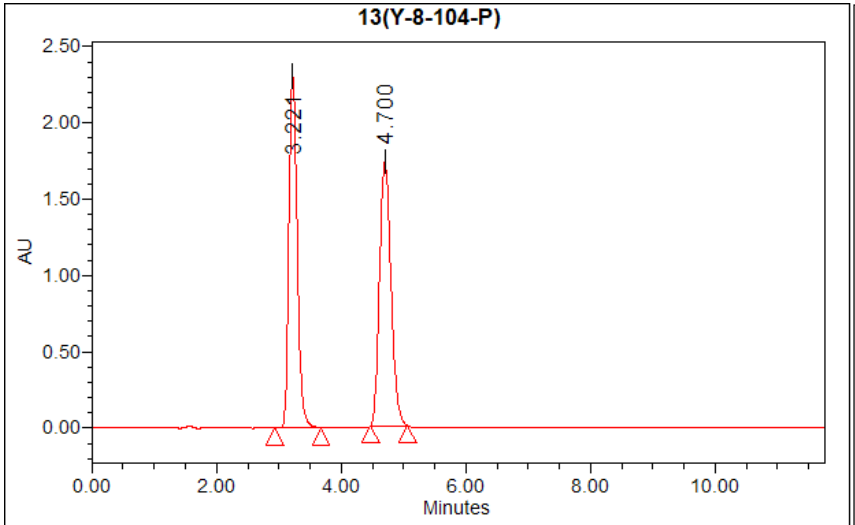
Integration Results

*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	96.98	2.789	2.542	3.275	1748584	44.000	15185589
2	3.02	3.846	3.700	4.167	44745	28.000	473048
Sum	100.0						

(*S*)-1-(2-benzamido-5-methylphenyl)naphthalen-2-yl 3-methylbutanoate (**9m**)

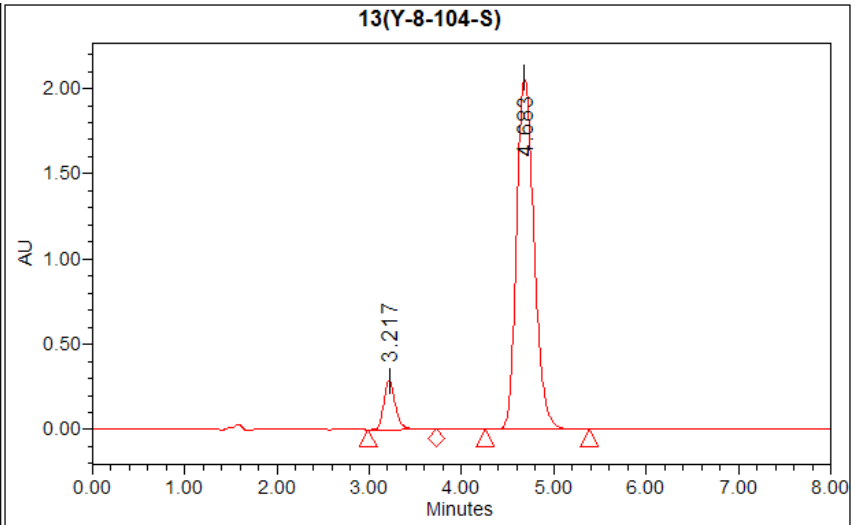


9m



Integration Results

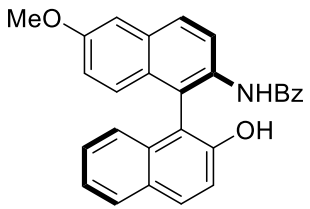
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.07	3.221	2.933	3.675	2302826	44.500	21355259
2	50.93	4.700	4.475	5.067	1734084	35.500	22160366
Sum	100.0						



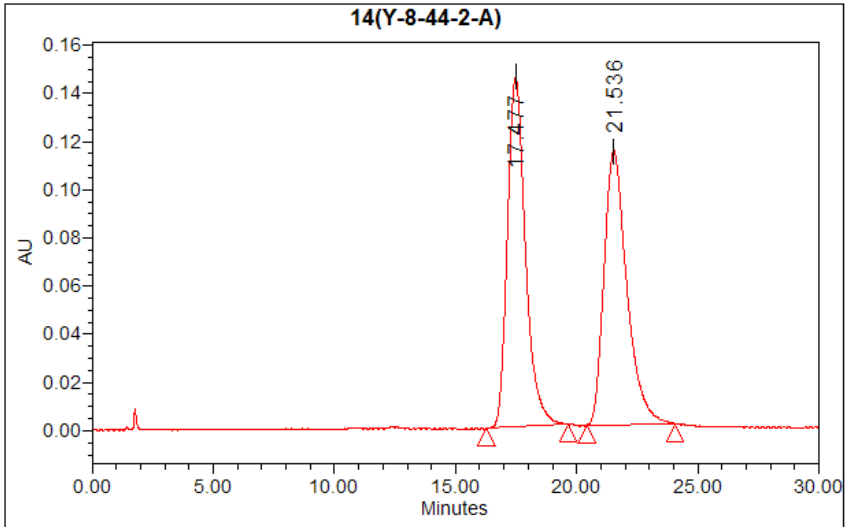
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	8.50	3.217	2.992	3.725	289878	44.000	2519513
2	91.50	4.683	4.258	5.383	2059157	67.500	27123668
Sum	100.0						

(*R*)-*N*-(2'-hydroxy-6-methoxy-[1,1'-binaphthalen]-2-yl)benzamide (**(*R*)-7ah**)

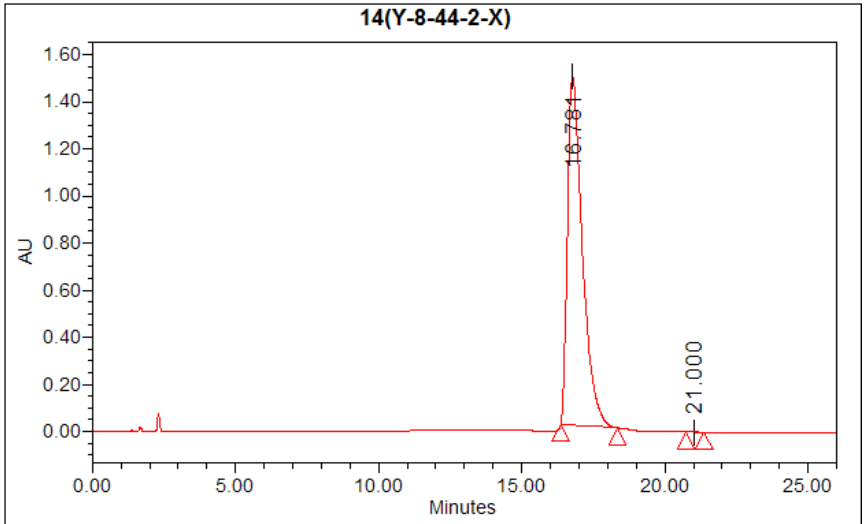


(*R*)-7ah



Integration Results

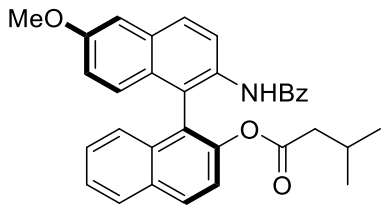
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.25	17.477	16.283	19.642	145078	201.500	7546313
2	49.75	21.536	20.417	24.058	113872	218.500	7471664
Sum	100.0						



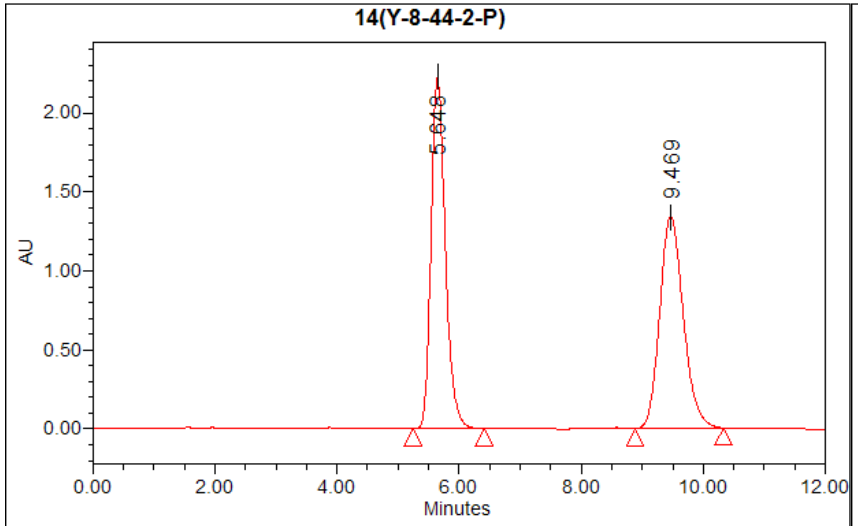
Integration Results

*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.99	16.781	16.367	18.350	1476400	119.000	53400718
2	0.01	21.000	20.725	21.375	379	39.000	7763
Sum	100.0						

(*S*)-2'-benzamido-6'-methoxy-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9n**)

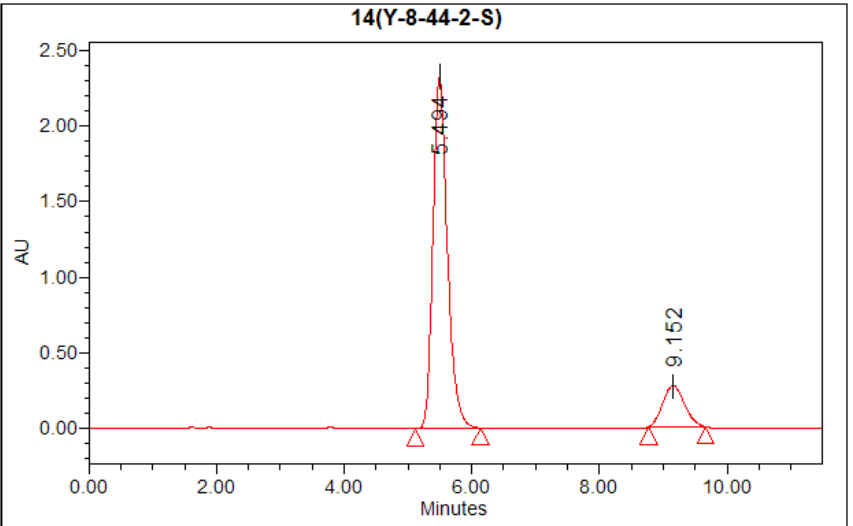


9n



Integration Results

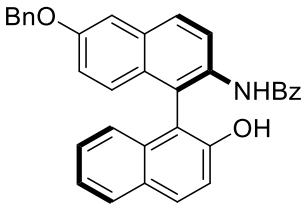
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.18	5.648	5.242	6.408	2223827	70.000	36226888
2	49.82	9.469	8.883	10.333	1339942	87.000	35962256
Sum	100.0						



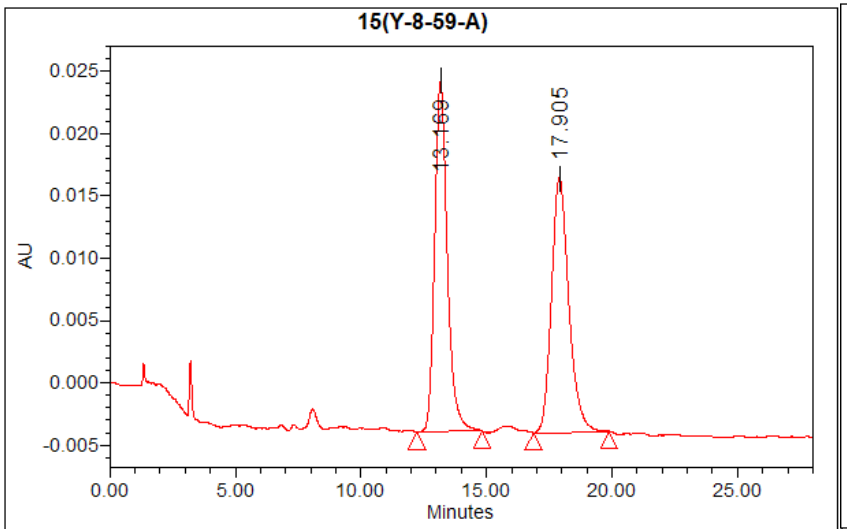
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	84.97	5.494	5.117	6.142	2320772	61.500	36392500
2	15.03	9.152	8.775	9.667	270940	53.500	6437175
Sum	100.0						

(*R*)-*N*-(6-(benzyloxy)-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((***R*)-7ai**)

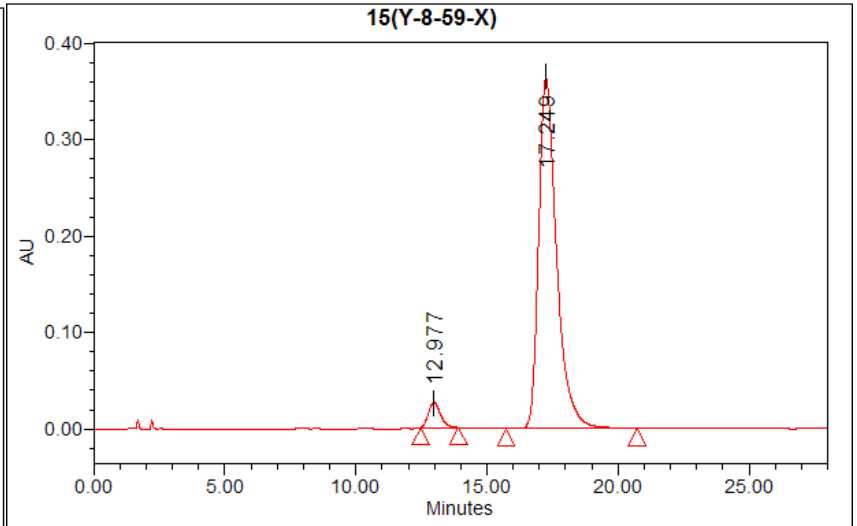


(*R*)-7ai



Integration Results

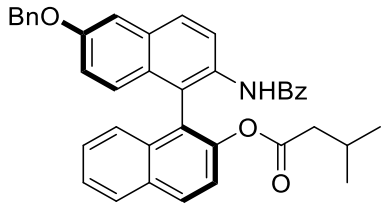
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.15	13.169	12.225	14.825	28124	156.000	986845
2	49.85	17.905	16.875	19.892	20424	181.000	981096
Sum	100.0						



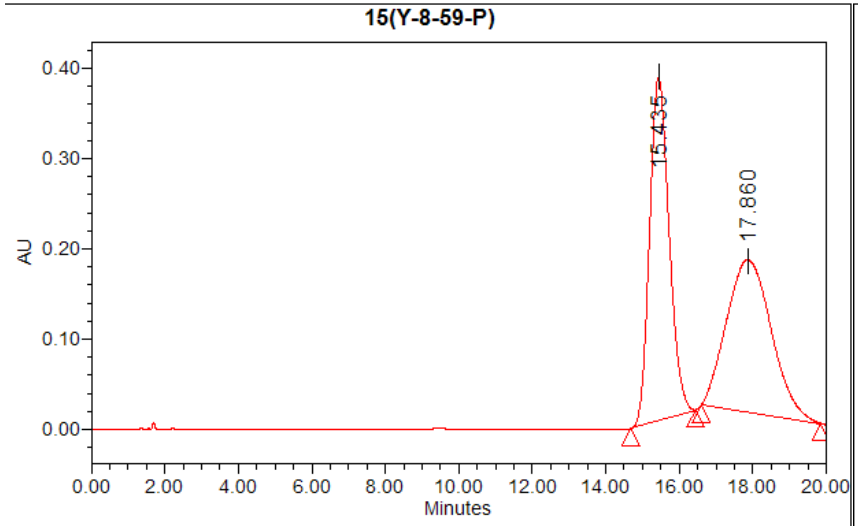
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	4.61	12.977	12.475	13.925	26028	87.000	834817
2	95.39	17.249	15.717	20.725	364031	300.500	17255710
Sum	100.0						

(*S*)-2'-benzamido-6'-(benzyloxy)-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9o**)

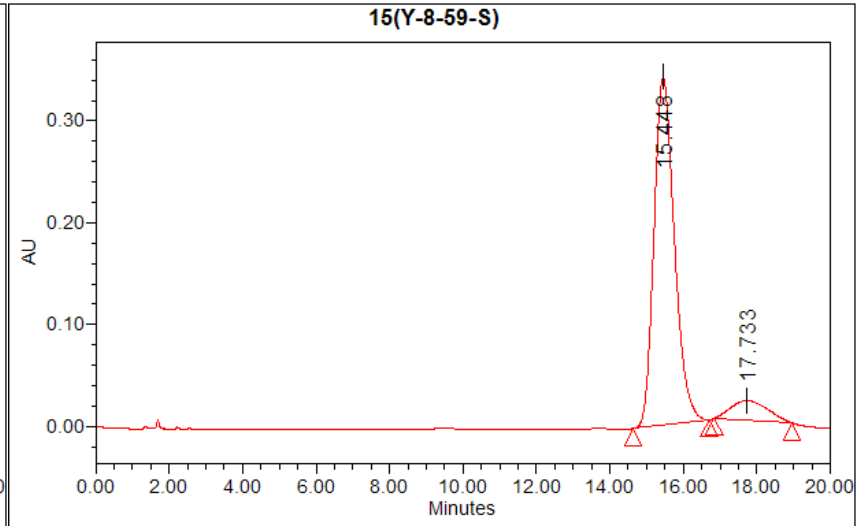


9o



Integration Results

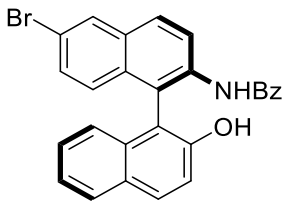
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.35	15.435	14.675	16.442	380004	106.000	13985017
2	50.65	17.860	16.592	19.850	168923	195.500	14356009
Sum	100.0						



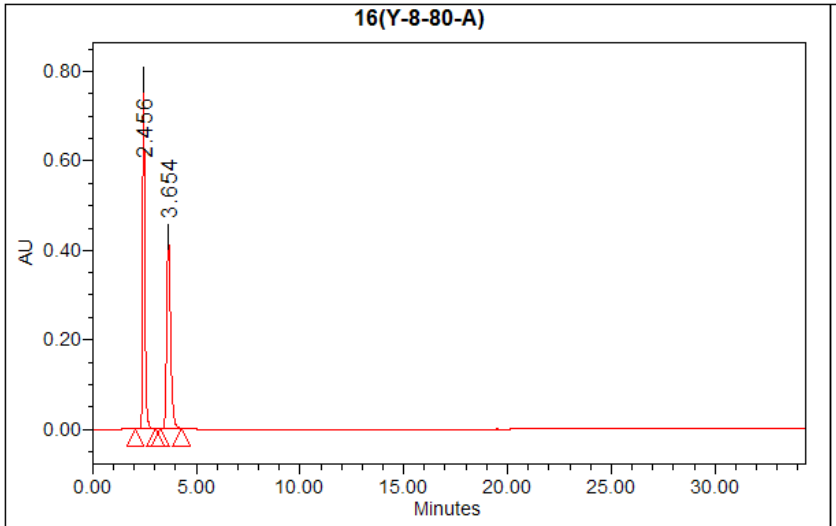
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	90.65	15.448	14.625	16.708	341100	125.000	13135359
2	9.35	17.733	16.842	18.958	19505	127.000	1354934
Sum	100.0						

(*R*)-*N*-(6-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide ((***R*)-7aj**)

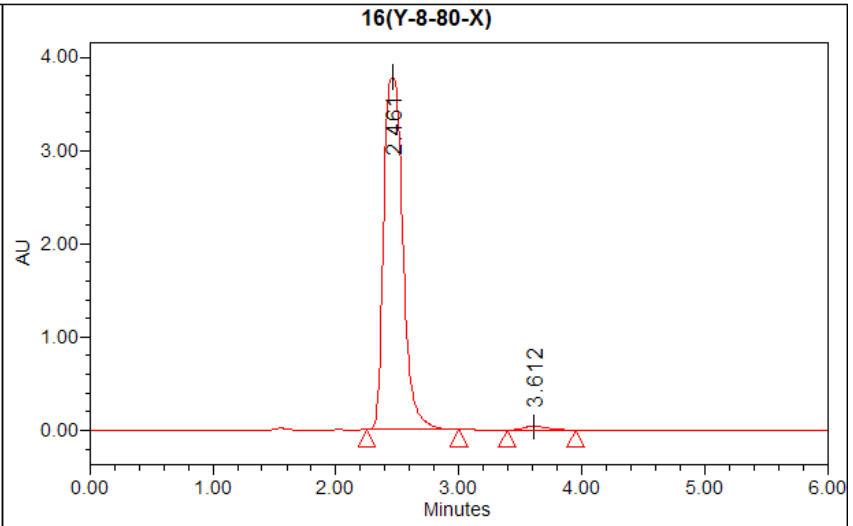


(*R*)-7aj



Integration Results

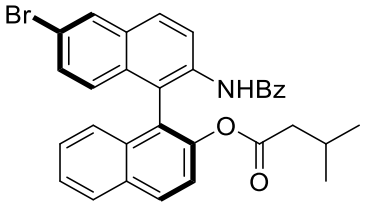
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.22	2.456	2.058	3.033	786185	58.500	5874778
2	49.78	3.654	3.275	4.292	431438	61.000	5824247
Sum	100.0						



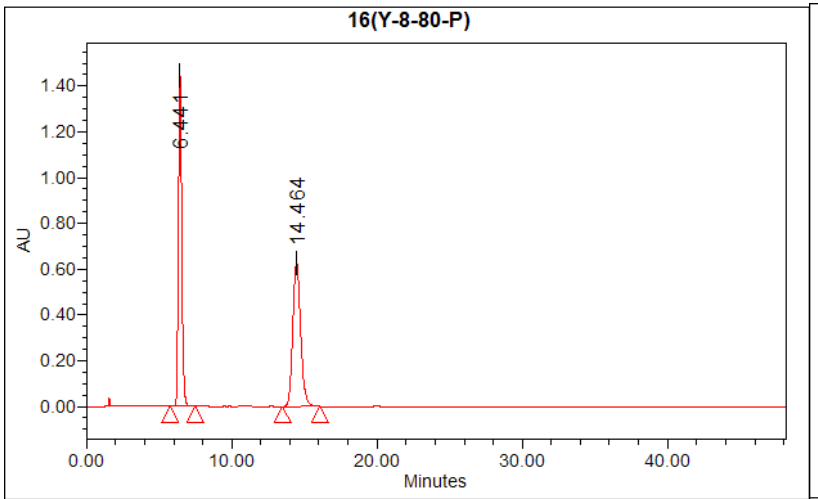
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	98.66	2.461	2.250	3.000	3770576	45.000	40869230
2	1.34	3.612	3.392	3.950	40978	33.500	557028
Sum	100.0						

(*S*)-2'-benzamido-6'-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9p**)

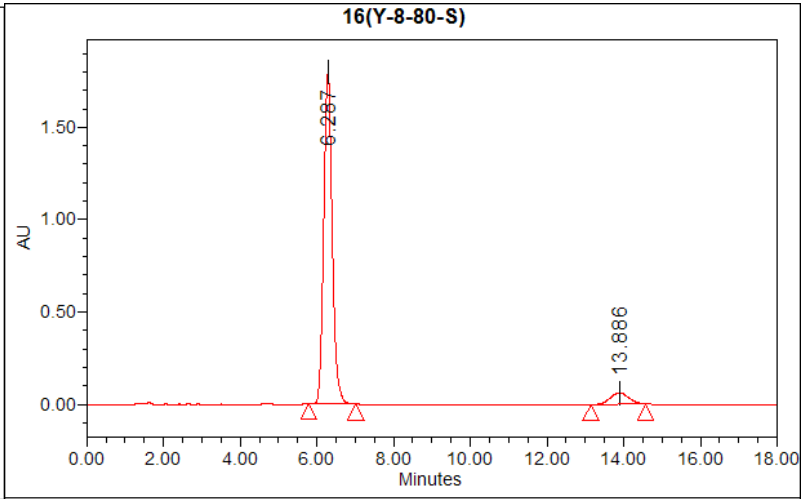


9p



Integration Results

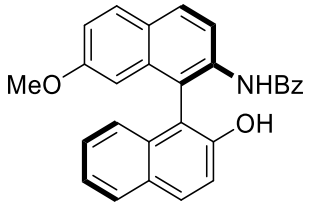
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.90	6.441	5.758	7.492	1442964	104.000	23274281
2	50.10	14.464	13.517	16.075	627560	153.500	23368062
Sum	100.0						



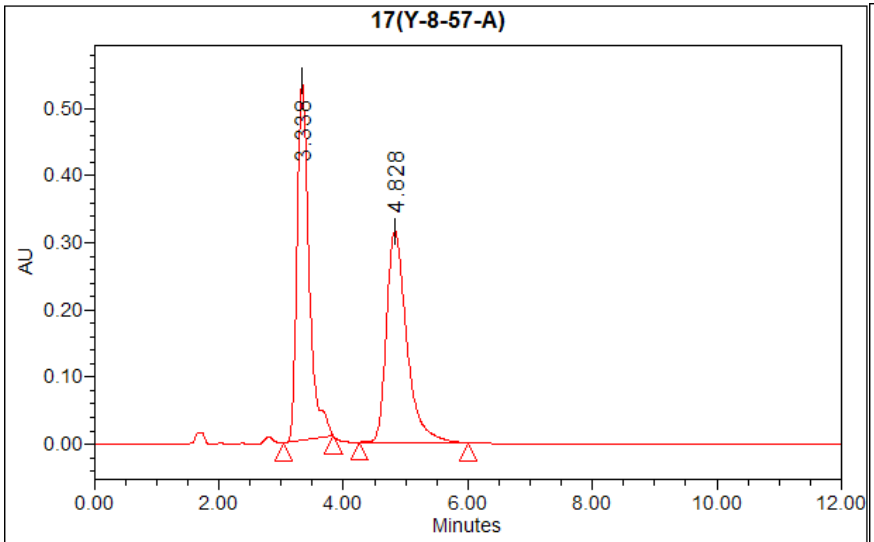
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	93.15	6.287	5.792	7.017	1791621	73.500	28189375
2	6.85	13.886	13.150	14.575	62335	85.500	2073519
Sum	100.0						

(*R*)-*N*-(2'-hydroxy-7-methoxy-[1,1'-binaphthalen]-2-yl)benzamide (**(*R*)-7ak**)

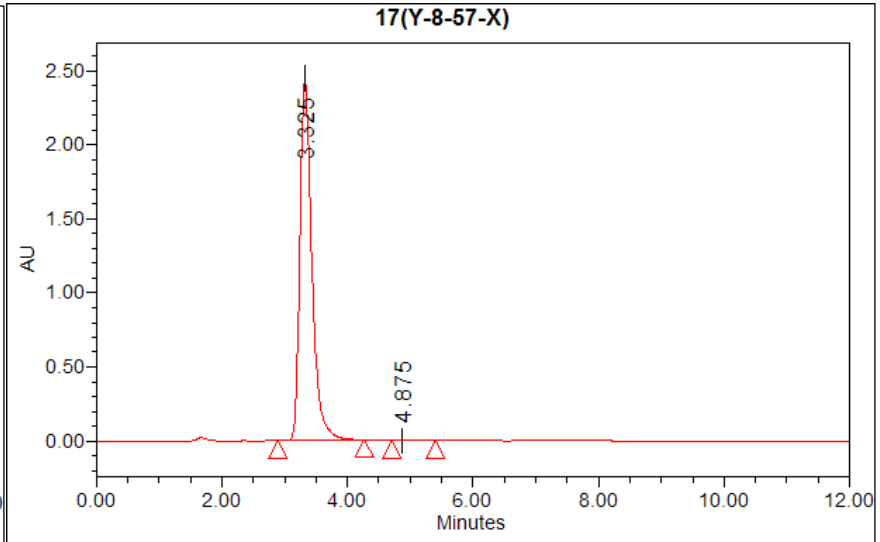


(*R*)-7ak



Integration Results

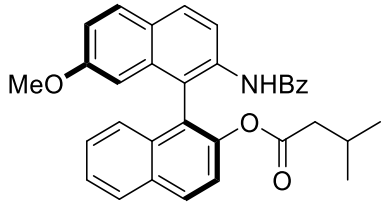
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.40	3.338	3.042	3.842	535991	48.000	7234356
2	49.60	4.828	4.267	6.000	316236	104.000	7120709
Sum	100.0						



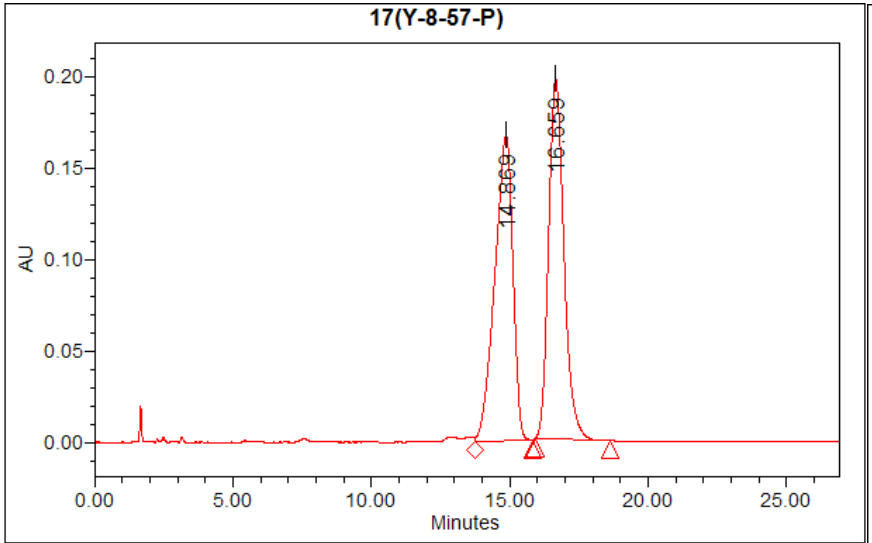
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.92	3.325	2.892	4.275	2440329	83.000	32533754
2	0.08	4.875	4.708	5.400	1581	41.500	25825
Sum	100.0						

(S)-2'-benzamido-7'-methoxy-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9q**)

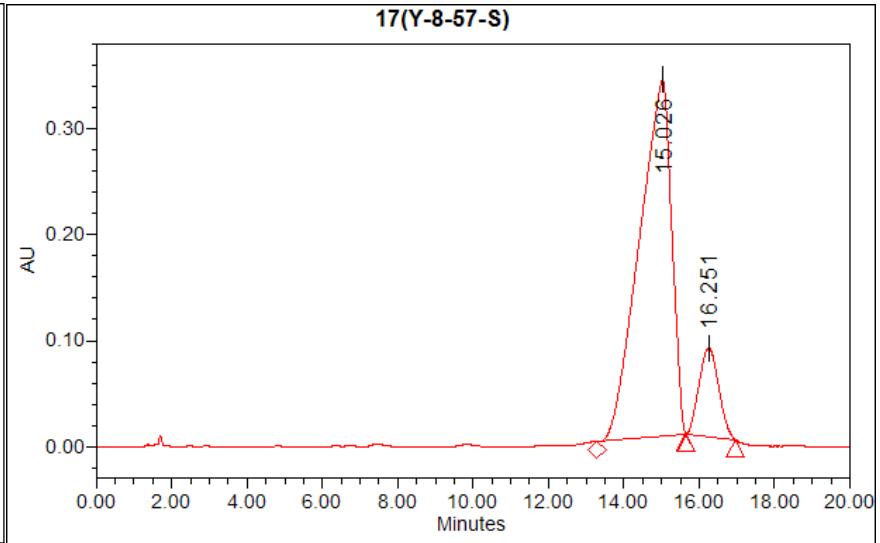


9q



Integration Results

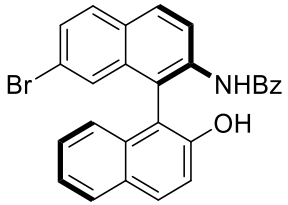
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.85	14.869	13.750	15.825	166877	124.500	7549820
2	50.15	16.659	15.917	18.633	197192	163.000	7594008
Sum	100.0						



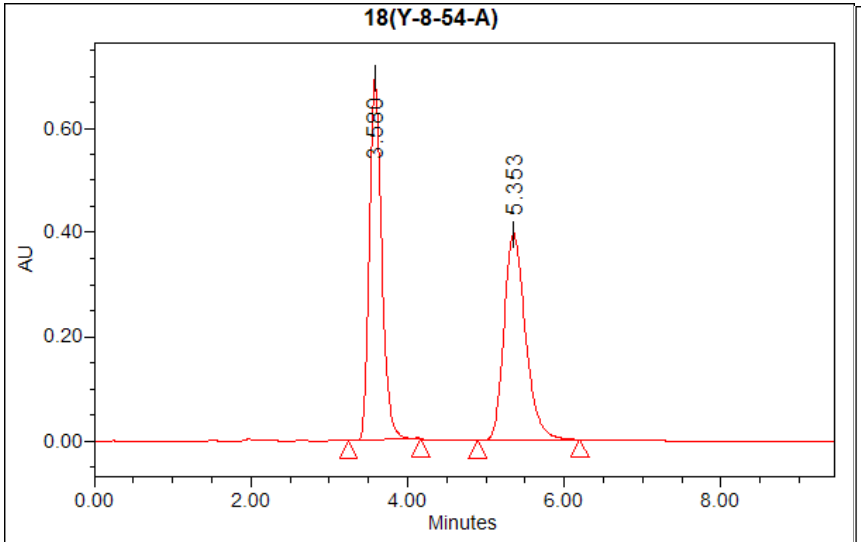
Integration Results

*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	86.72	15.026	13.292	15.642	336041	141.000	19883544
2	13.28	16.251	15.667	16.967	83931	78.000	3045350
Sum	100.0						

(*R*)-*N*-(7-bromo-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (**(*R*)-7am**)

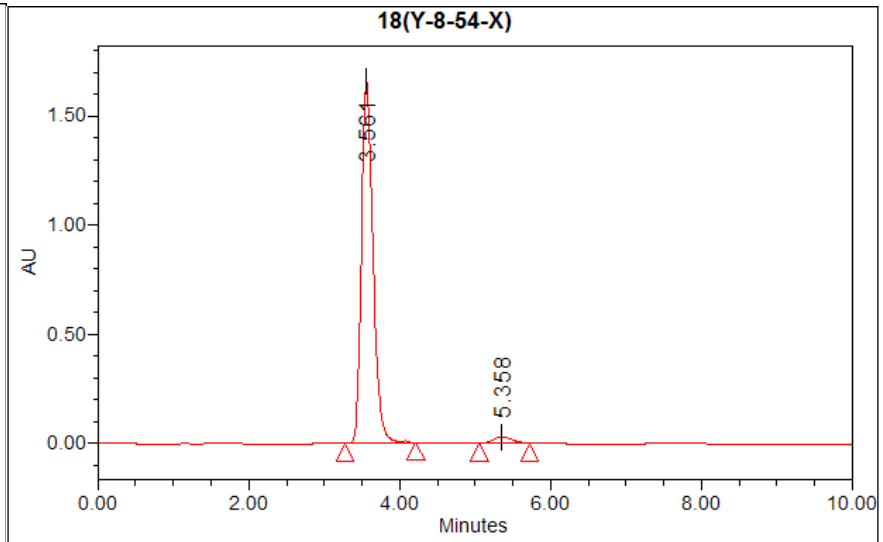


(*R*)-7am



Integration Results

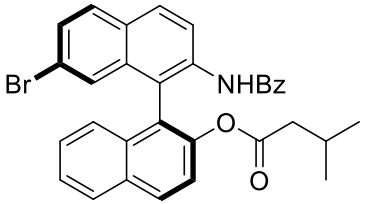
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.09	3.580	3.242	4.167	693172	55.500	7606945
2	49.91	5.353	4.892	6.200	397158	78.500	7578897
Sum	100.0						



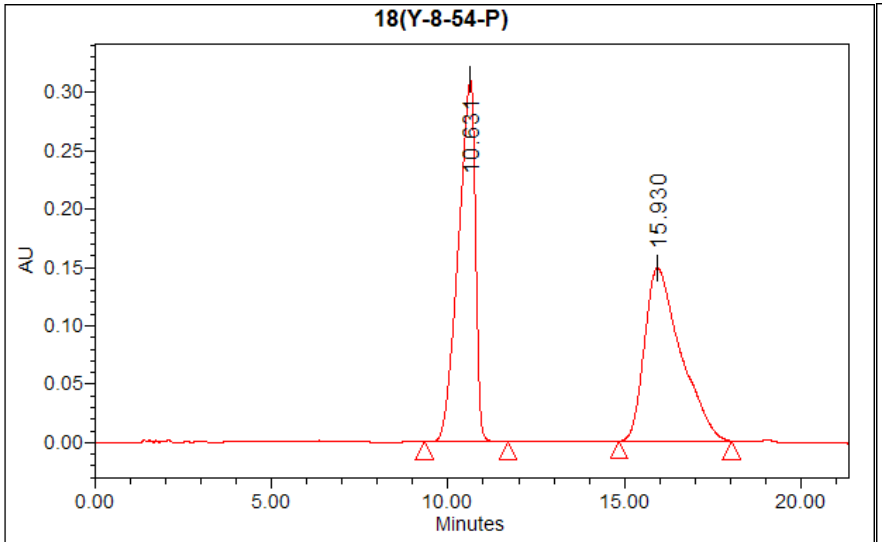
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	97.11	3.561	3.275	4.217	1654623	56.500	17644826
2	2.89	5.358	5.058	5.725	30072	40.000	524462
Sum	100.0						

(*S*)-2'-benzamido-7'-bromo-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9r**)

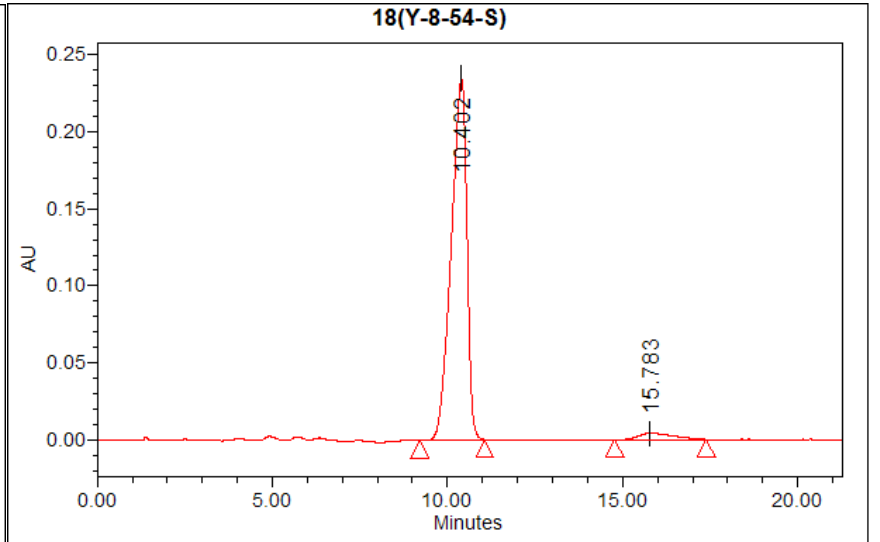


9r



Integration Results

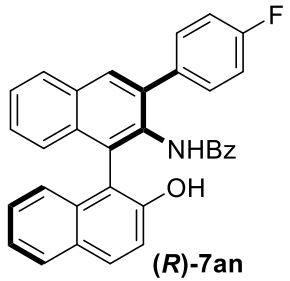
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.58	10.631	9.325	11.700	309699	142.500	10411414
2	50.42	15.930	14.842	18.025	148826	191.000	10586810
Sum	100.0						



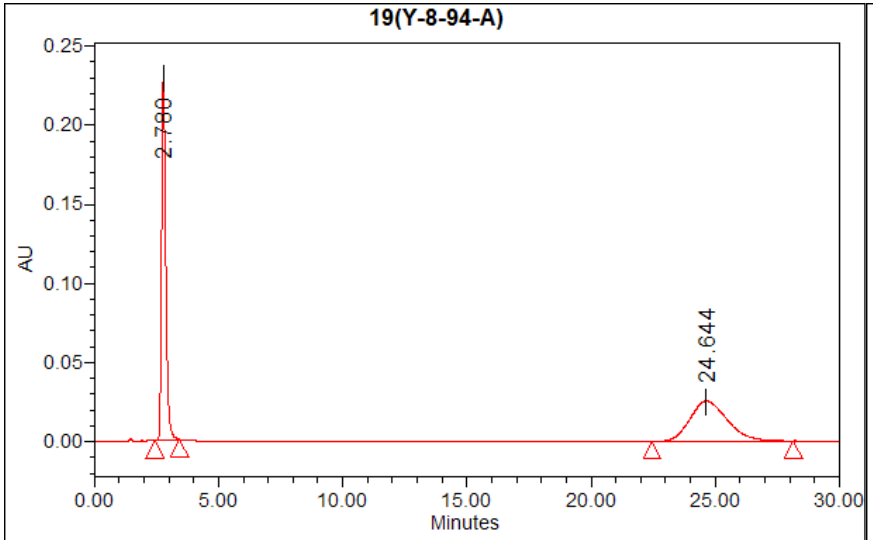
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	96.11	10.402	9.200	11.075	233944	112.500	7243208
2	3.89	15.783	14.783	17.400	4385	157.000	293309
Sum	100.0						

(*R*)-*N*-(3-(4-fluorophenyl)-2'-hydroxy-[1,1'-binaphthalen]-2-yl)benzamide (**(*R*)-7an**)

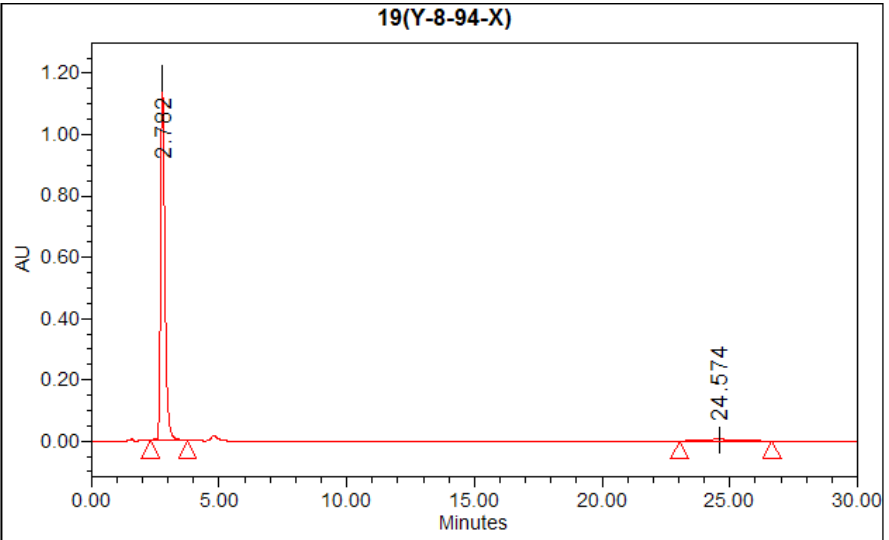


(*R*)-7an



Integration Results

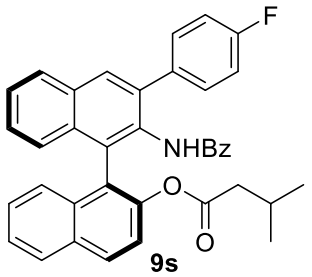
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.36	2.780	2.433	3.442	228492	60.500	2660358
2	49.64	24.644	22.467	28.150	25267	341.000	2622073
Sum	100.0						



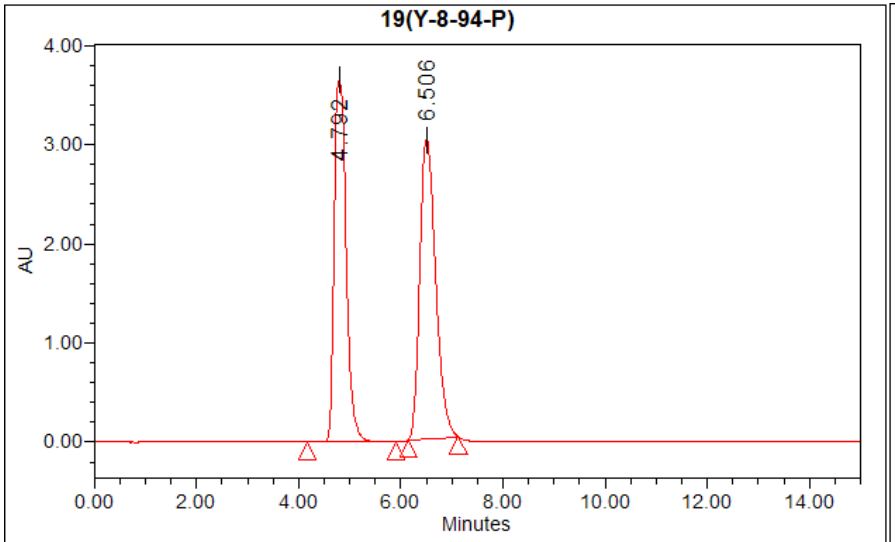
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	96.43	2.782	2.317	3.775	1180001	87.500	13766774
2	3.57	24.574	23.042	26.650	5334	216.500	510161
Sum	100.0						

(*S*)-2'-benzamido-3'-(4-fluorophenyl)-[1,1'-binaphthalen]-2-yl 3-methylbutanoate (**9s**)

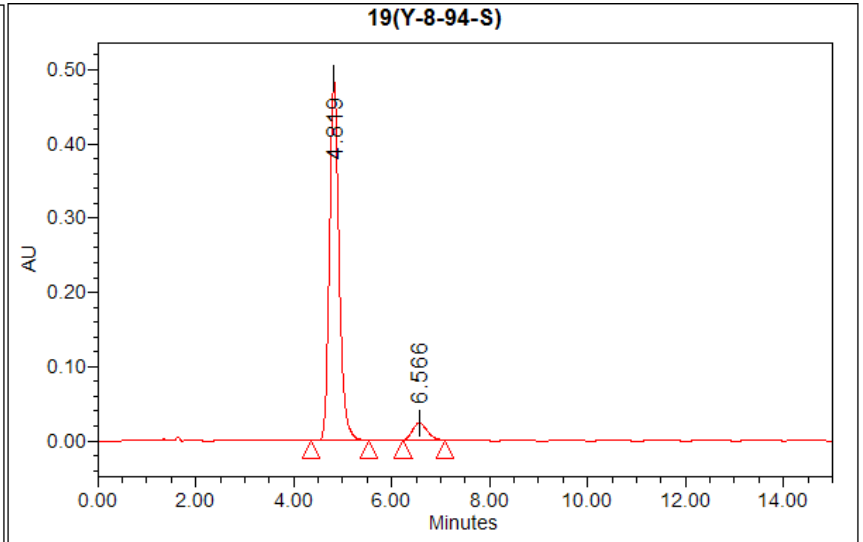


9s



Integration Results

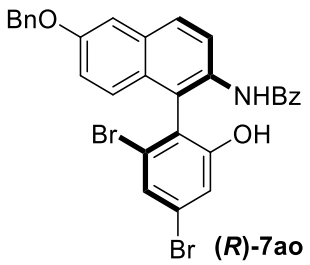
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	47.69	4.792	4.175	5.908	3643085	104.000	59516514
2	52.31	6.506	6.150	7.125	3020844	58.500	65293034
Sum	100.0						



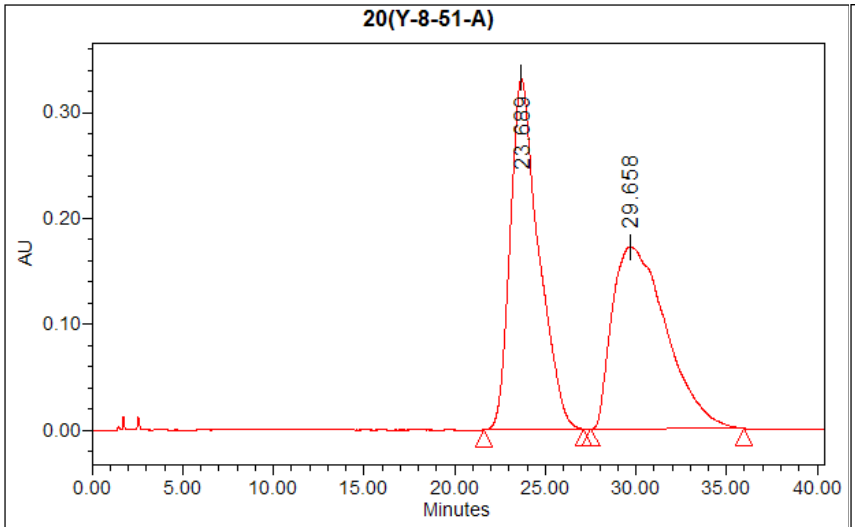
Integration Results

*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	93.22	4.819	4.358	5.533	487043	70.500	6649264
2	6.78	6.566	6.233	7.083	23184	51.000	483247
Sum	100.0						

(*S*)-*N*-(6-(benzyloxy)-1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzamide (**(*R*)-7ao**)

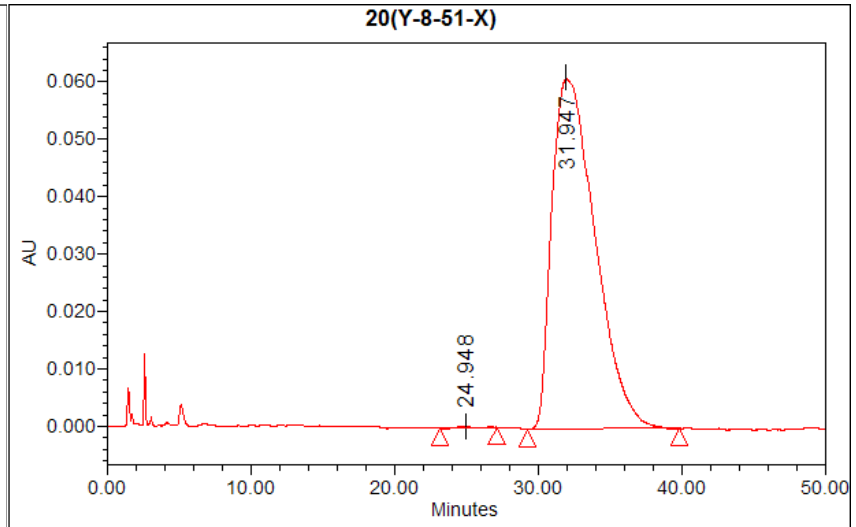


(*R*)-7ao



Integration Results

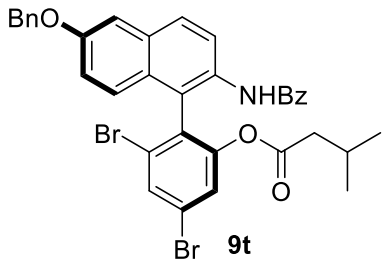
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.26	23.689	21.617	27.125	331748	330.500	36115652
2	49.74	29.658	27.533	35.967	172014	506.000	35738744
Sum	100.0						



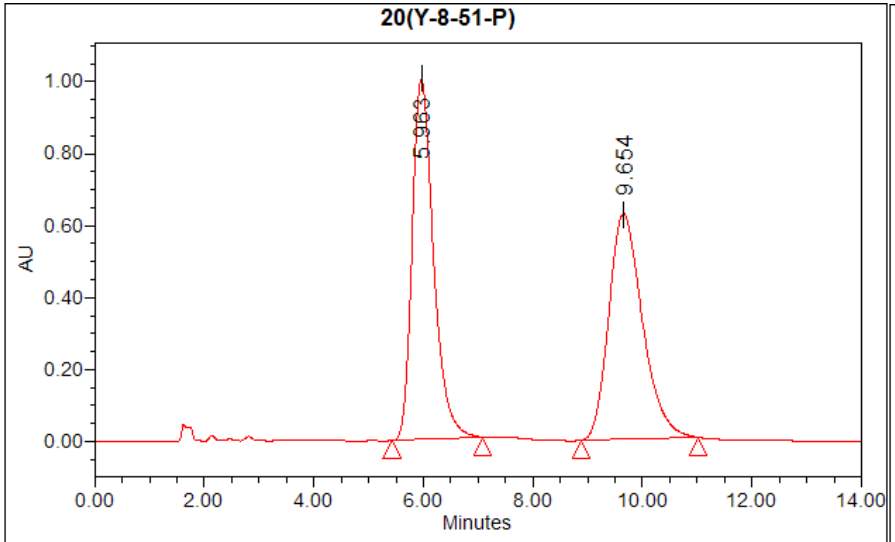
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	0.24	24.948	23.175	27.133	362	237.500	30500
2	99.76	31.947	29.250	39.825	61240	634.500	12826087
Sum	100.0						

(*R*)-2-(2-benzamido-6-(benzyloxy)naphthalen-1-yl)-3,5-dibromophenyl 3-methylbutanoate (**9t**)

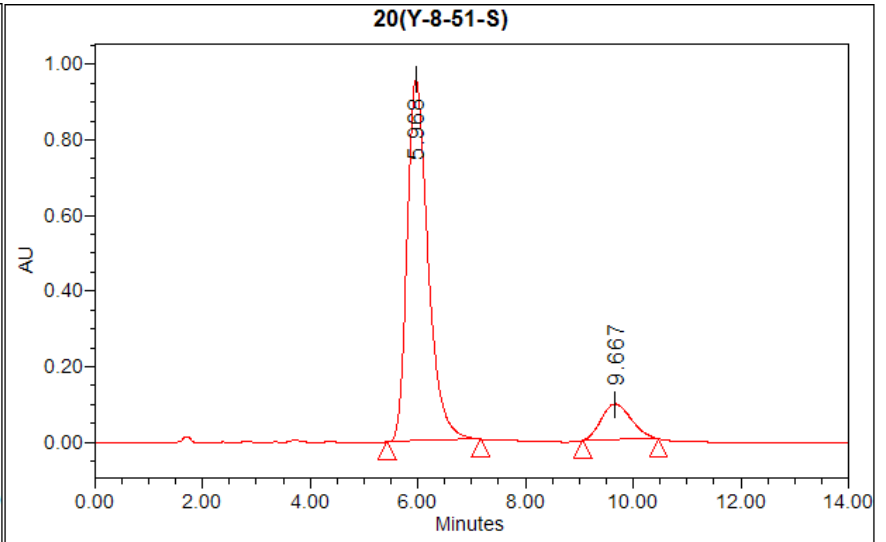


9t



Integration Results

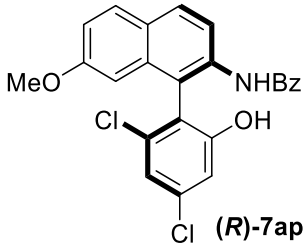
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.22	5.963	5.425	7.083	1002055	99.500	27059955
2	49.78	9.654	8.883	11.017	627021	128.000	26824982
Sum	100.0						



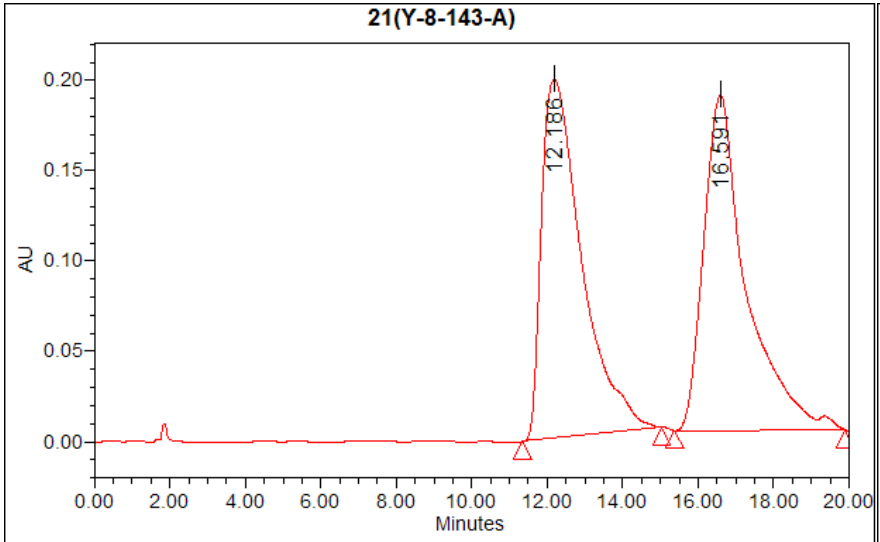
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	87.39	5.968	5.433	7.167	954916	104.000	25784238
2	12.61	9.667	9.067	10.475	94786	84.500	3719844
Sum	100.0						

(*S*)-*N*-(1-(2,4-dichloro-6-hydroxyphenyl)-7-methoxynaphthalen-2-yl)benzamide (**(*R*)-7ap**)

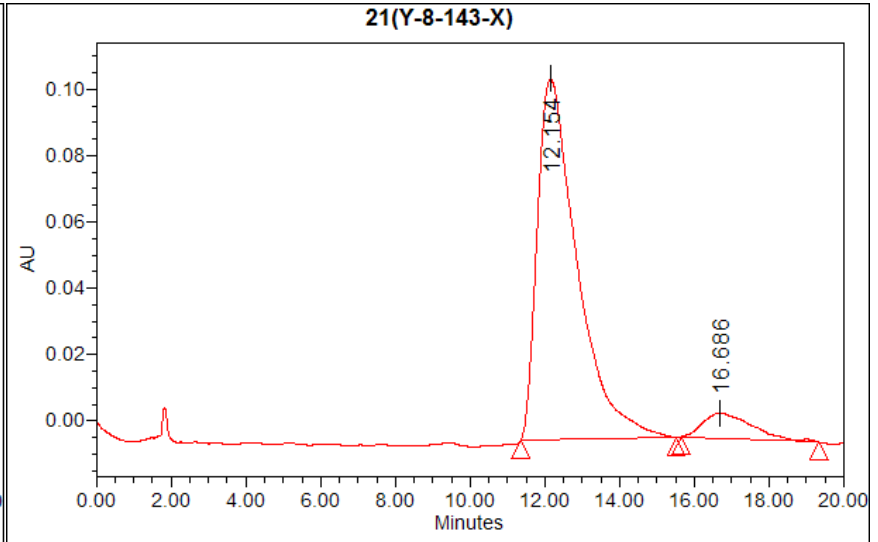


(*R*)-7ap



Integration Results

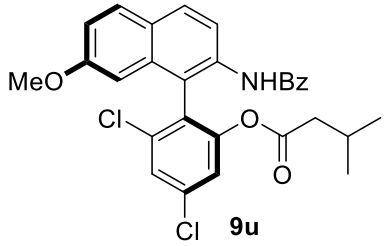
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.20	12.186	11.350	15.025	198660	220.500	14670397
2	49.80	16.591	15.383	19.883	185582	270.000	14553851
Sum	100.0						



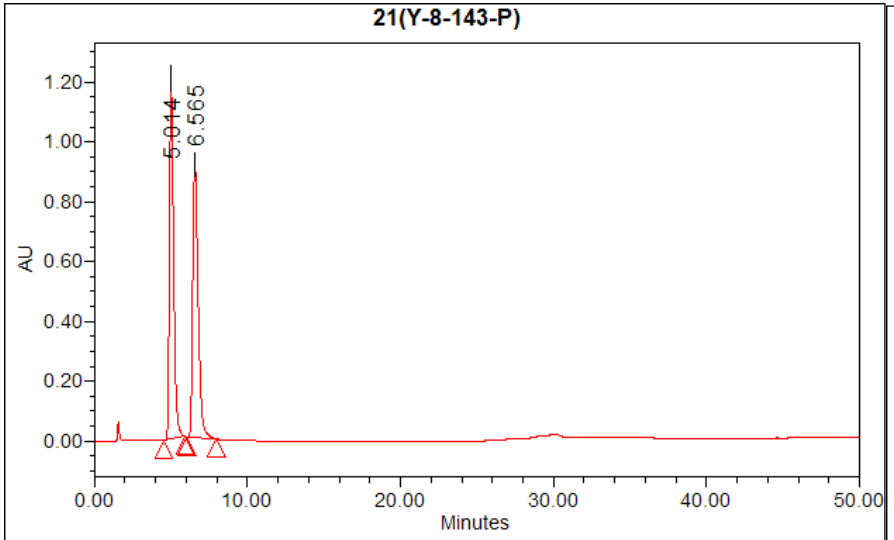
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	92.02	12.154	11.350	15.517	108828	250.000	8062427
2	7.98	16.686	15.650	19.333	7653	221.000	699388
Sum	100.0						

(*R*)-2-(2-benzamido-7-methoxynaphthalen-1-yl)-3,5-dichlorophenyl 3-methylbutanoate (**9u**)

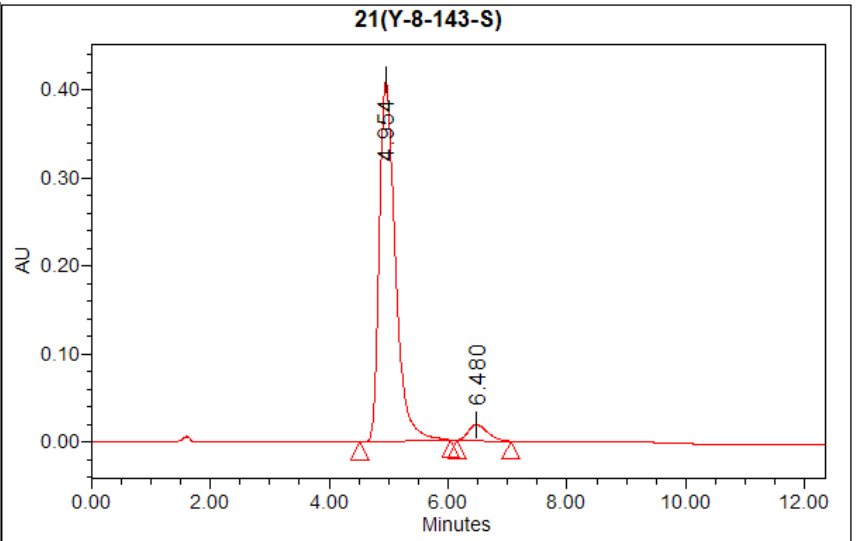


9u



Integration Results

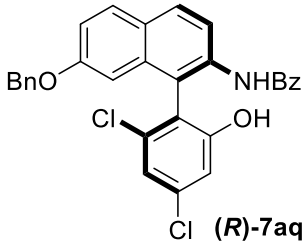
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.03	5.014	4.525	5.933	1204544	84.500	22622635
2	49.97	6.565	6.050	7.975	915157	115.500	22596927
Sum	100.0						

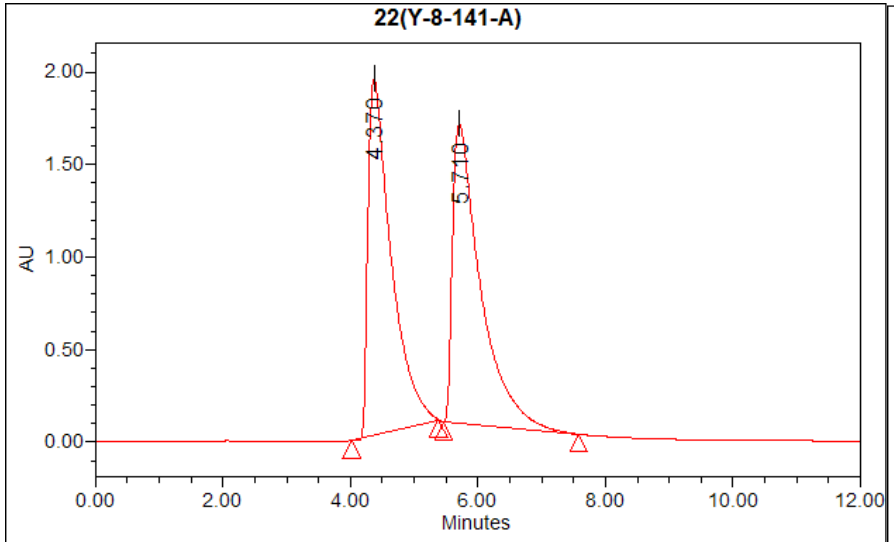


Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	95.02	4.954	4.517	6.050	409751	92.000	7742603
2	4.98	6.480	6.150	7.058	18127	54.500	405929
Sum	100.0						

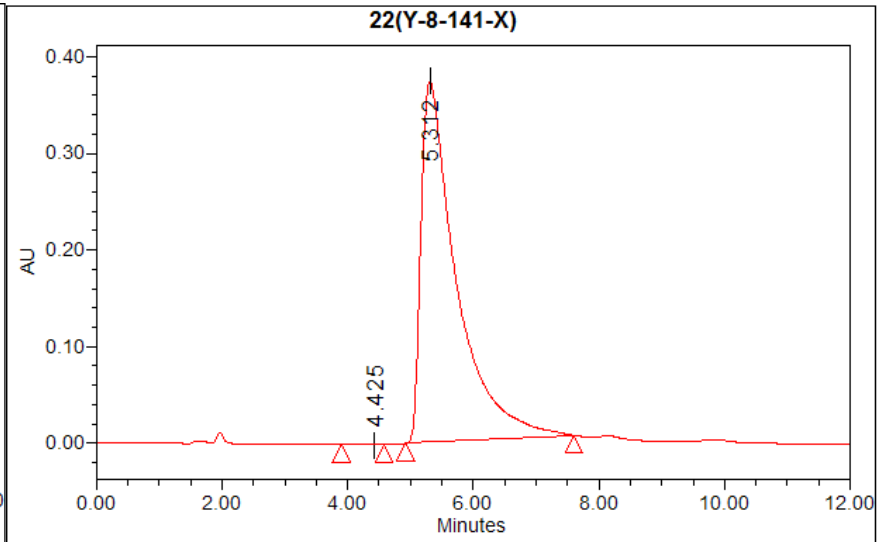
(*S*)-*N*-(7-(benzyloxy)-1-(2,4-dichloro-6-hydroxyphenyl)naphthalen-2-yl)benzamide (**(*R*)-7aq**)





Integration Results

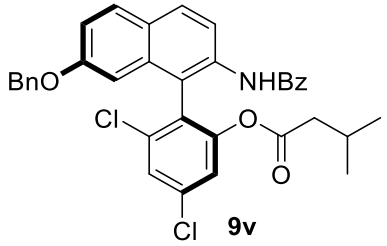
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.64	4.370	4.017	5.383	1926118	82.000	48754990
2	50.36	5.710	5.458	7.583	1620591	127.500	49452830
Sum	100.0						



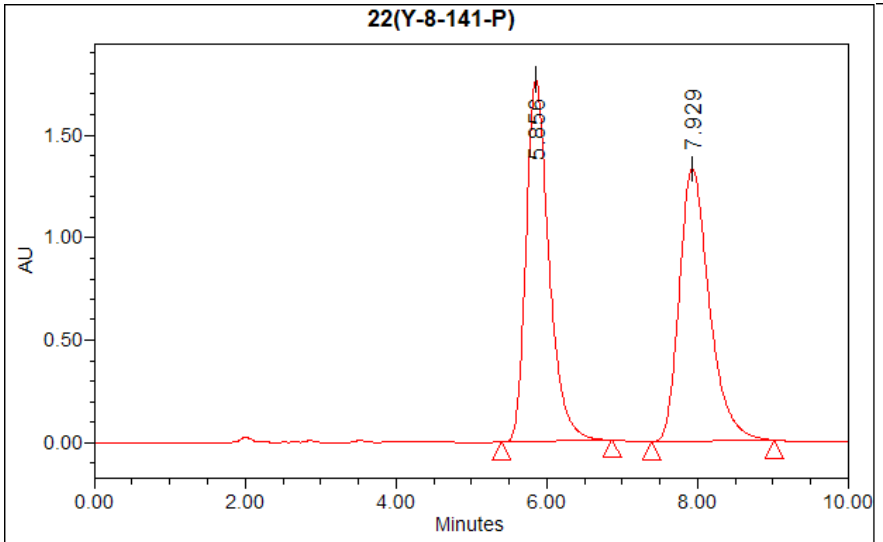
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	0.01	4.425	3.900	4.575	86	40.500	1389
2	99.99	5.312	4.925	7.608	373438	161.000	14675993
Sum	100.0						

(*R*)-2-(2-benzamido-7-(benzyloxy)naphthalen-1-yl)-3,5-dichlorophenyl 3-methylbutanoate (**9v**)

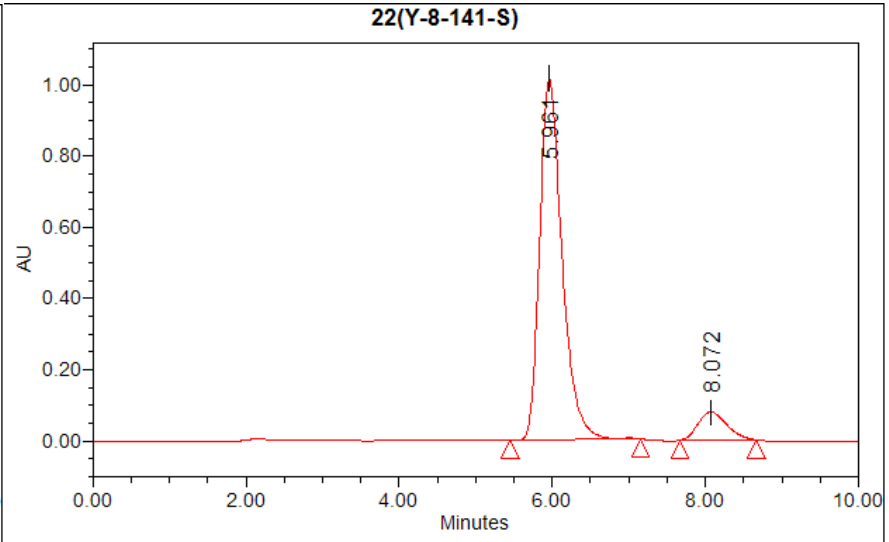


9v



Integration Results

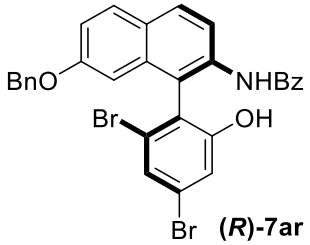
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.22	5.856	5.400	6.867	1762051	88.000	37147753
2	49.78	7.929	7.392	9.017	1331617	97.500	36816571
Sum	100.0						



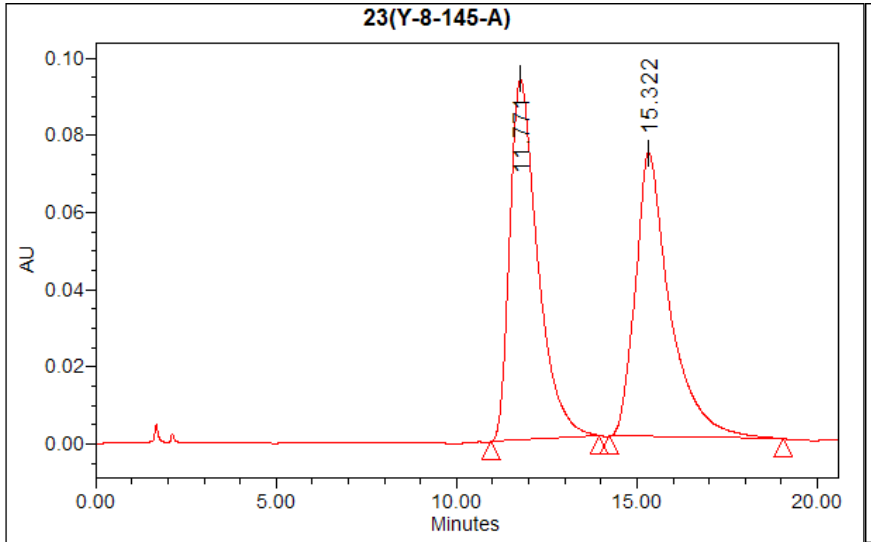
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	90.84	5.961	5.450	7.150	1014670	102.000	20589832
2	9.16	8.072	7.667	8.667	79573	60.000	2076906
Sum	100.0						

(*S*)-N-(7-(benzyloxy)-1-(2,4-dibromo-6-hydroxyphenyl)naphthalen-2-yl)benzamide (**(*R*)-7ar**)

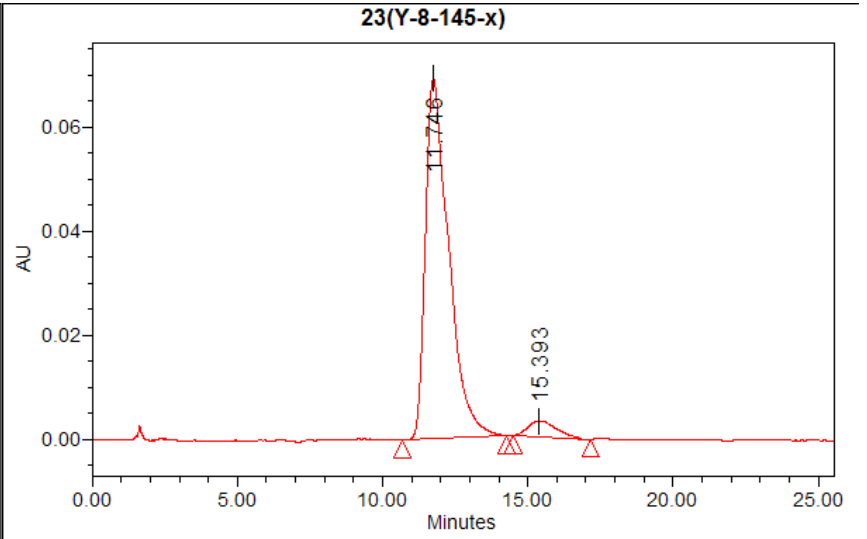


(*R*)-7ar



Integration Results

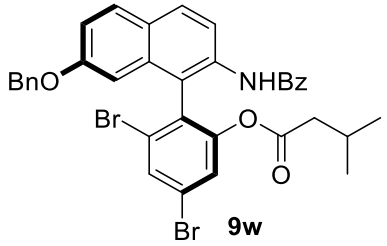
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.82	11.771	10.958	13.942	93501	179.000	5064577
2	49.18	15.322	14.233	19.042	73679	288.500	4901961
Sum	100.0						



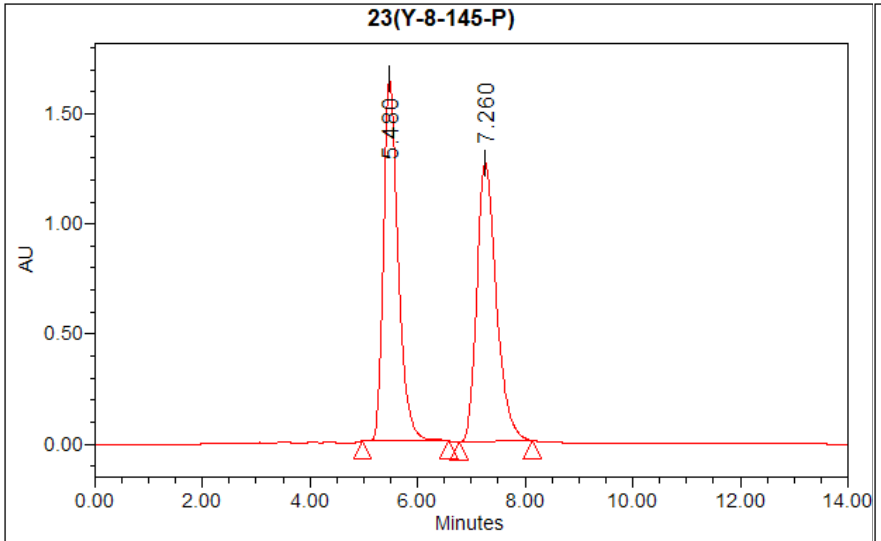
Integration Results

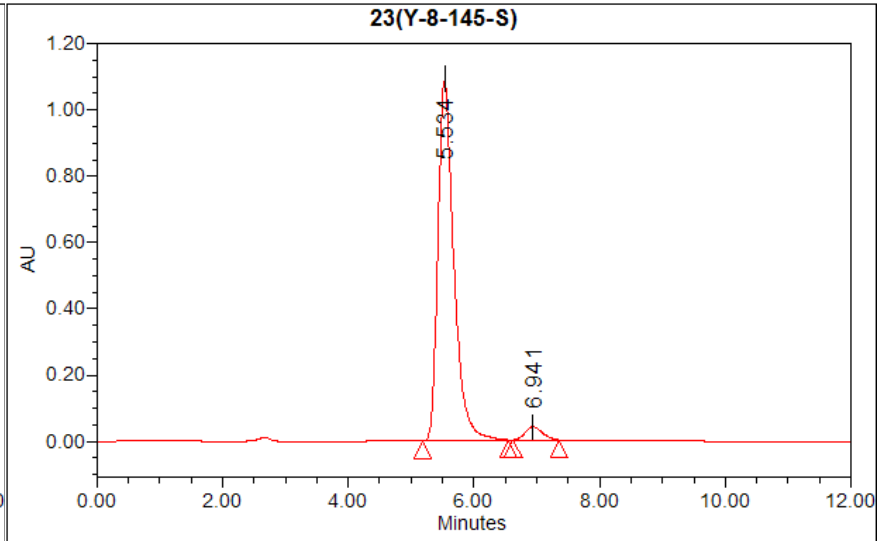
*	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	94.63	11.746	10.683	14.267	69255	215.000	3885740
2	5.37	15.393	14.483	17.167	3162	161.000	220597
Sum	100.0						

(*R*)-2-(2-benzamido-7-(benzyloxy)naphthalen-1-yl)-3,5-dibromophenyl 3-methylbutanoate (**9w**)



9w





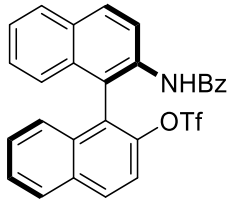
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.52	5.480	4.975	6.583	1641856	96.500	31397772
2	50.48	7.260	6.775	8.133	1267027	81.500	32012525
Sum	100.0						

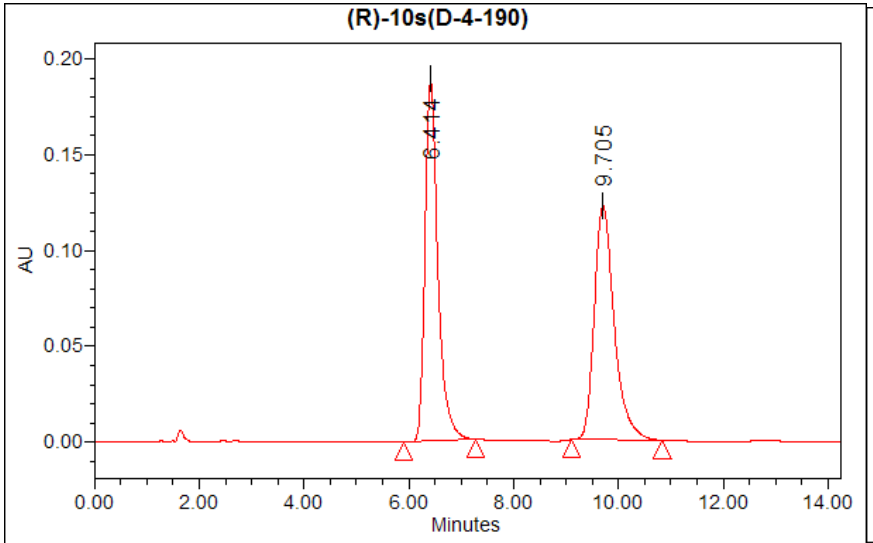
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	96.22	5.534	5.183	6.550	1090626	82.000	19188652
2	3.78	6.941	6.625	7.358	39891	44.000	754621
Sum	100.0						

(*R*)-2'-benzamido-[1,1'-binaphthalen]-2-yl trifluoromethanesulfonate (**10r**)

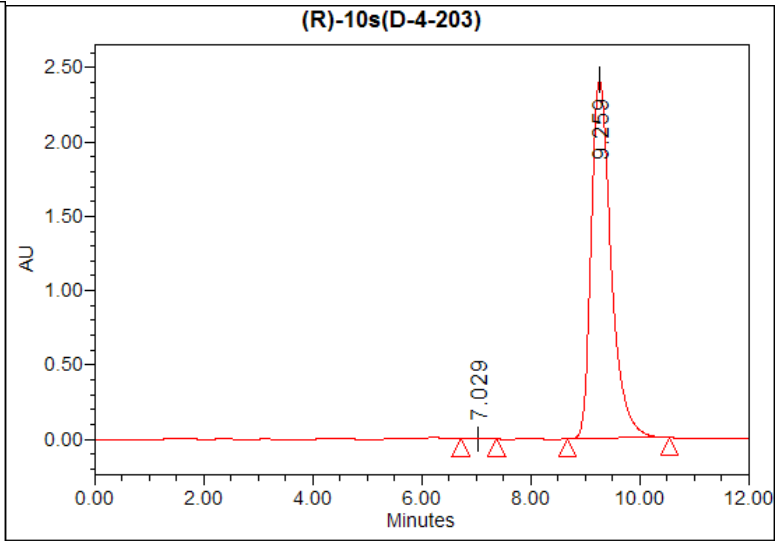


10r



Integration Results

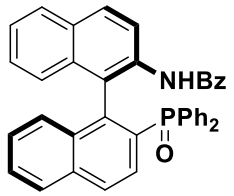
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.15	6.414	5.908	7.267	188786	81.500	3238923
2	49.85	9.705	9.100	10.833	122352	104.000	3219539
Sum	100.0						



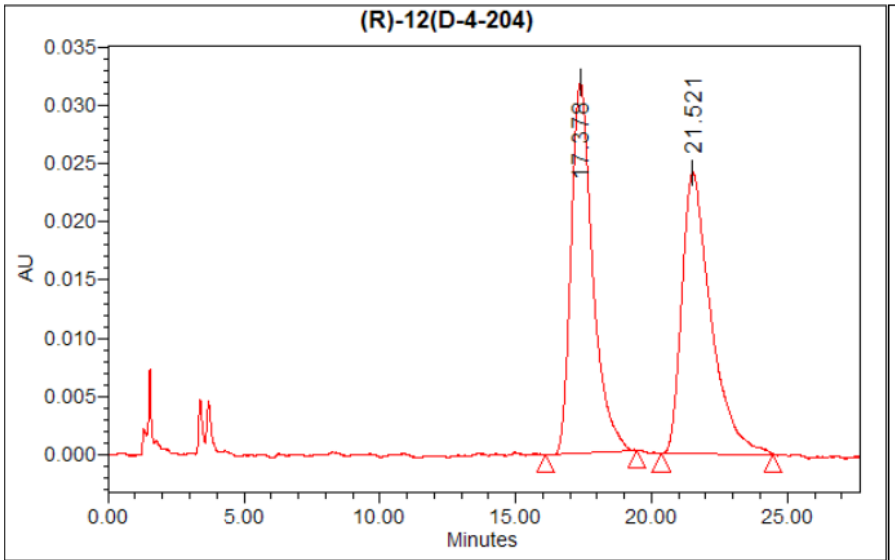
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)
1	0.11	7.029	6.708	7.367	3896	39.500
2	99.89	9.259	8.675	10.542	2408780	112.000
Sum	100.0					

(*R*)-N-(2'-(diphenylphosphoryl)-[1,1'-binaphthalen]-2-yl)benzamide (**12**)

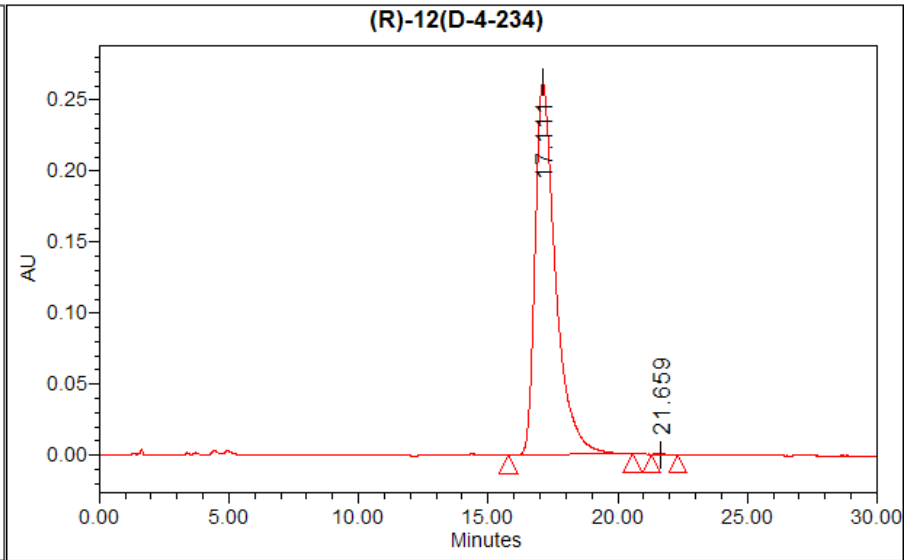


12



Integration Results

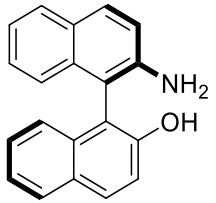
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.53	17.378	16.117	19.467	31725	201.000	1762750
2	50.47	21.521	20.358	24.483	24152	247.500	1795945
Sum	100.0						



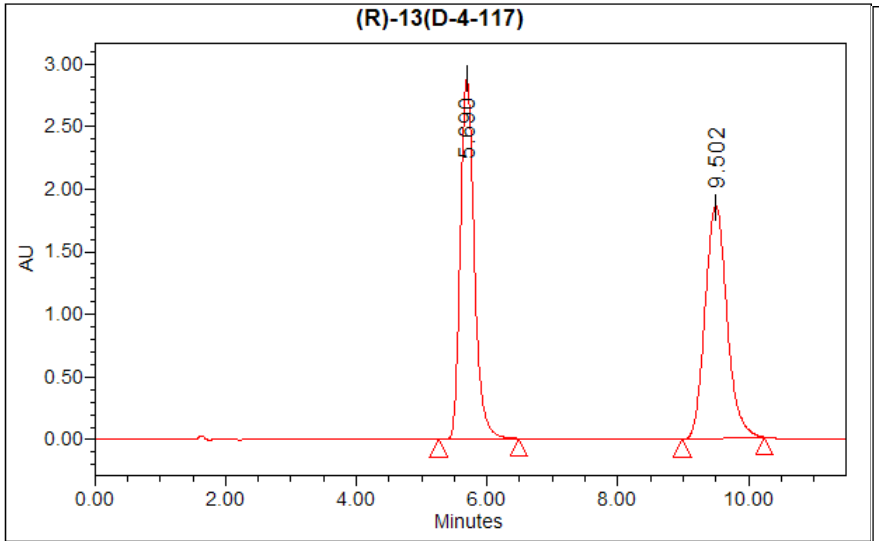
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.94	17.111	15.783	20.558	262089	286.500	14454248
2	0.06	21.659	21.317	22.333	312	61.000	8724
Sum	100.0						

(*R*)-2'-amino-[1,1'-binaphthalen]-2-ol (**13**)

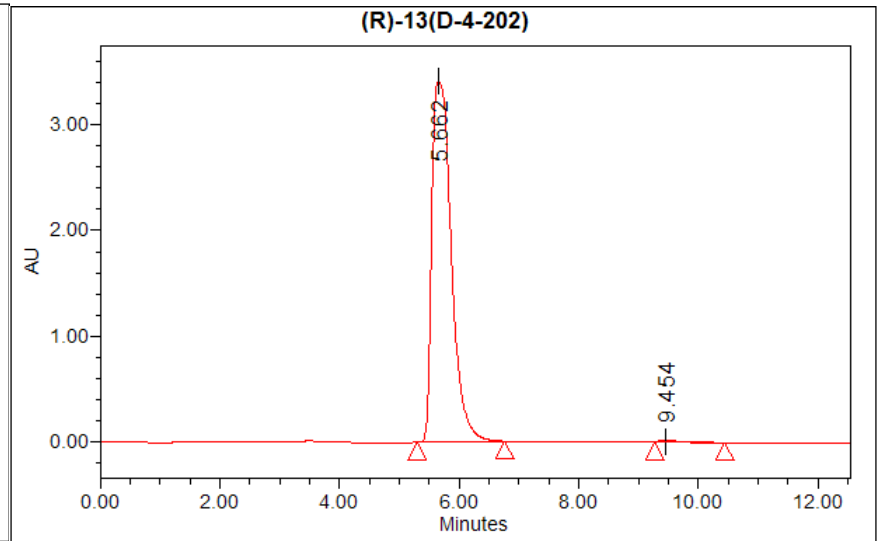


13



Integration Results

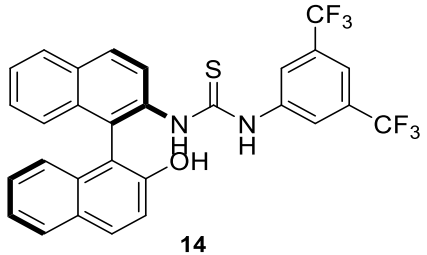
	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.55	5.690	5.258	6.492	2875101	74.000	42667138
2	50.45	9.502	8.992	10.250	1854721	75.500	43436272
Sum	100.0						



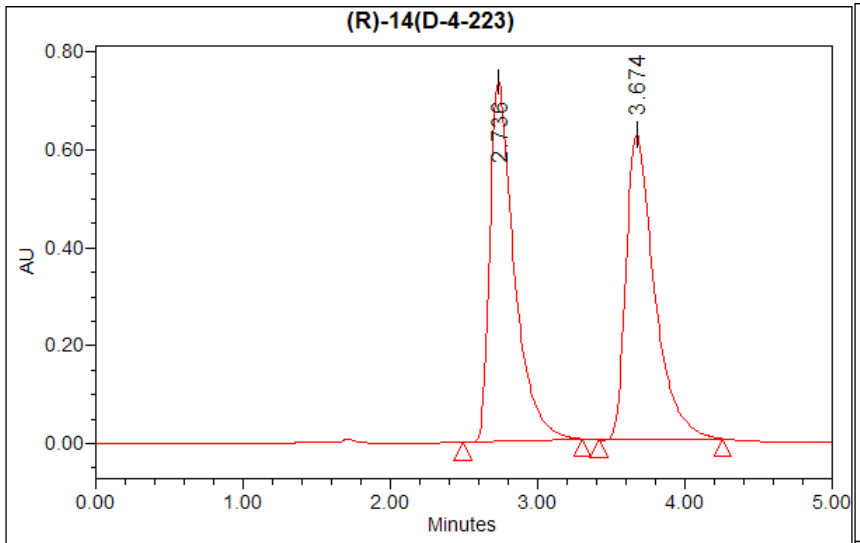
Integration Results

	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.68	5.662	5.300	6.767	3403017	88.000	77393211
2	0.32	9.454	9.275	10.450	10733	70.500	247489
Sum	100.0						

(*R*)-1-(3,5-bis(trifluoromethyl)phenyl)-3-(2'-hydroxy-[1,1'-binaphthalen]-2-yl)thiourea (**14**)

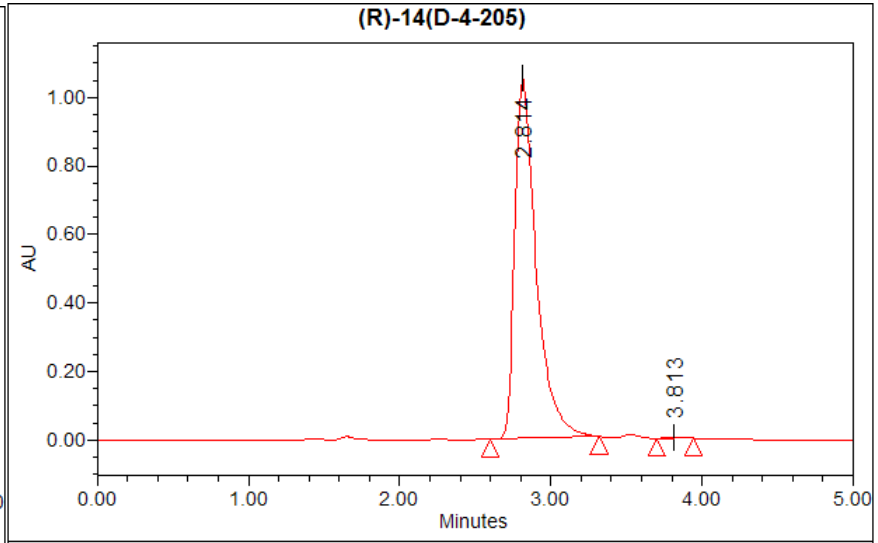


14



Integration Results

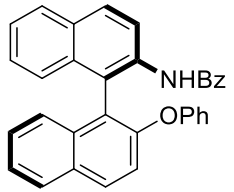
•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	50.26	2.736	2.492	3.308	736177	49.000	8475021
2	49.74	3.674	3.417	4.258	624887	50.500	8388357
Sum	100.0						



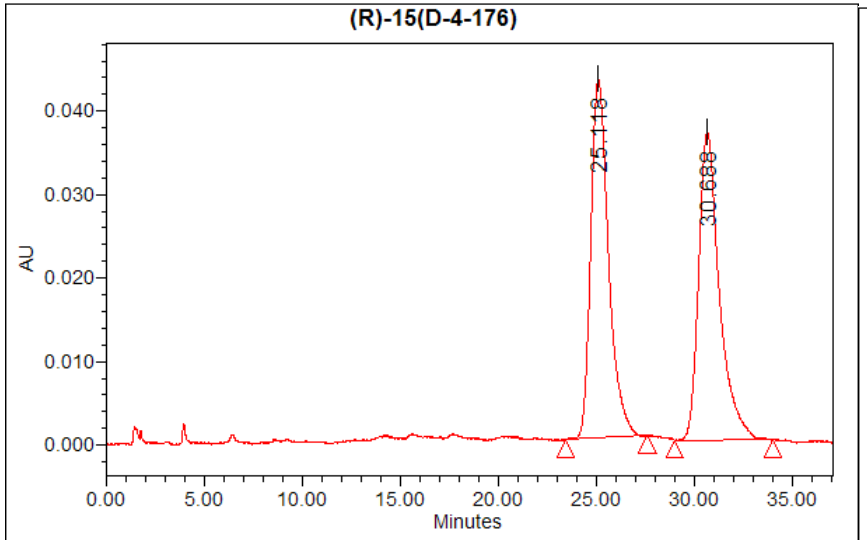
Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.78	2.814	2.600	3.317	1048651	43.000	10370758
2	0.22	3.813	3.700	3.942	2961	14.500	23097
Sum	100.0						

(*R*)-N-(2'-phenoxy-[1,1'-binaphthalen]-2-yl)benzamide (**15**)

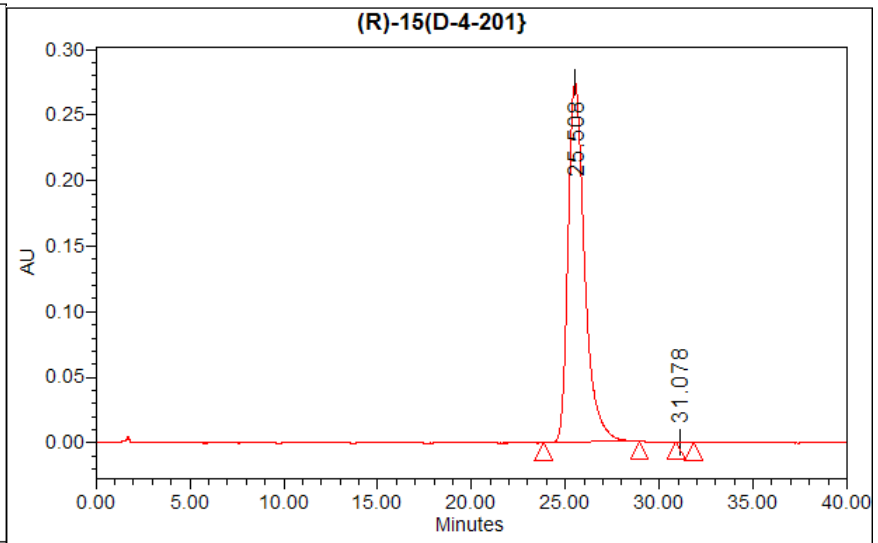


15



Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	49.80	25.118	23.433	27.608	42971	250.500	2693216
2	50.20	30.688	29.042	34.033	36783	299.500	2714771
Sum	100.0						



Integration Results

•	Relative Area %	Retention Time (min)	Start Time (min)	End Time (min)	Height (μV)	Width (sec)	Area (μV*sec)
1	99.99	25.508	23.833	28.950	274040	307.000	16986816
2	0.01	31.078	30.908	31.842	94	56.000	1876
Sum	100.0						