Supporting Information

Organocatalytic Enantioselective and (Z)-Selective Allylation of 3-Indolylmethanol via Hydrogen-bond Activation

Yan Liu,[a,b] Hong-Hao Zhang,[a] Yu-Chen Zhang,[a] Yan Jiang,[b] Feng Shi[a,*] and Shu-Jiang Tu[a]

[a]*School of Chemistry and Chemical Engineering, Jiangsu Normal University, Xuzhou, 221116, China*

[b]*Jiangsu Provincial Key laboratory of Fine Petrochemical engineering, Changzhou University, Changzhou, 213164, China*

Email: fshi@jsnu.edu.cn

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1. General method

NMR spectra were measured respectively at 400 and 100 MHz, respectively. The solvent used for NMR spectroscopy was $CDCl_3$, using tetramethylsilane as the internal reference. HRMS (ESI) was determined by a micrOTOF-Q Ⅱ HRMS/MS instrument (Bruker). Enantiomeric excesses (*ee*) were determined by chiral high-performance liquid chromatography (chiral HPLC). The chiral columns used for the determination of enantiomeric excesses by chiral HPLC were Chiralpak AD-H, IC and IA columns. Optical rotation values were measured with instruments operating at λ = 589 nm, corresponding to the sodium D line at the temperatures indicated. Analytic grade solvents for the column chromatography and commercially available reagents were used as received. Substrates **1** and **2** were synthesized according to the literature methods.[1]

2. General procedure for the synthesis of products 3 and control experiments

The solution of *o*-hydroxystyrene derivatives **2** (0.1 mmol) in EtOAc (1 mL) was added to the mixture of 3-indolylmethanols **1** (0.15 mmol) and the catalyst **5a** or **6a** (0.01 mmol). After the reaction mixture was stirred at 35 ^oC for 12 h, the resultant solution was concentrated under the reduced pressure to give the residue, which was purified through preparative thin layer chromatography to afford pure products **3**. In all cases, analytic grade EtOAc was used as received, and the reaction was performed under air.

3. Characterization data of products 3

Note: The proton of the phenol moiety is not observed in ^1H NMR for most compounds.

(*R*)-1-benzyl-3-(2-(2-hydroxyphenyl)allyl)-3-(1H-indol-3-yl)indolin-2-one (3aa):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 77%; pale yellow solid; m.p. 197.1−198.0; $[\alpha]_D^{20}$ = +18.0 (c 0.20, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.47 (s, 1H), 7.29−7.27 (m, 3H), 7.25−7.23 (m, 3H), 7.17 (t, *J* = 7.7 Hz, 1H), 7.09−7.00 (m, 3H), 6.99 (d, *J* = 2.4 Hz, 1H), 6.95 (d, *J* = 8.1 Hz, 1H), 6.88 (t, *J* = 7.6 Hz, 2H), 6.85−6.79 (m, 2H), 6.76−6.70 (m, 2H), 5.90 (s, 1H), 5.22 (s, 1H), 5.02 (s, 1H), 4.87 (d, *J* = 15.5 Hz, 1H), 4.39 (d, *J* = 15.5 Hz, 1H), 4.12 (d, *J* = 13.6 Hz, 1H), 3.41 (d, *J* = 13.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.9, 152.7, 142.8, 142.0, 136.9, 135.9, 132.1, 128.9, 128.8, 128.7, 128.3, 127.9, 127.8, 127.8, 125.3, 125.1, 123.2, 122.8, 122.1, 120.5, 120.0, 119.8, 119.5, 115.7, 115.3, 111.6, 109.5, 53.0, 44.1, 43.3; IR (KBr): γ 3650, 3569, 3399, 2928, 1687, 1611, 1486, 1370, 1234, 1014, 908, 801, 748, 692, 645 cm^{-1}; ESI FTMS exact mass calcd for $(C_{32}H_{26}N_2O_2+Na)^+$ requires m/z 493.1892, found m/z 493.1916; Enantiomeric excess: 90%, determined by HPLC (Daicel Chirapak AD-H, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 ^oC, 254 nm): t_R = 14.640 min (minor), t_R = 26.580 min (major).

1. (a) Guo, Q.−X.; Peng, Y.−G.; Zhang, J.−W.; Song, L.; Feng, Z.; Gong, L.−Z. *Org. Lett.* **2009,** *11* (20), 4620−4623; (b) L. Song, Q.−X. Guo, X.−C. Li, J. Tian, Y.−G. Peng , *Angew. Chem. Int. Ed.* **2012**, *51*, 1899.

(*S*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3ab):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 71%; >20:1 *Z*/*E*; pale yellow sticky oil; $[\alpha]_D^{20}$ = +15.6 (c 0.34, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.12 (s, 1H), 7.32−7.29 (m, 5H), 7.19−7.14 (m, 3H), 7.09−7.00 (m, 2H), 6.97 (d, *J* = 7.5 Hz, 1H), 6.90−6.81 (m, 5H), 6.71−6.66 (m, 2H), 6.25 (s, 1H), 5.71 (s, 1H), 4.89 (d, *J* = 15.5 Hz, 1H), 4.66 (d, *J* = 15.4 Hz, 1H), 4.03 (d, *J* = 13.7 Hz, 1H), 3.14 (s, 1H), 1.39 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 152.6, 142.1, 136.7, 136.0, 131.9, 130.1, 128.9, 128.8, 128.2, 128.0, 127.7, 127.7, 125.7, 125.3, 124.6, 122.9, 122.7, 121.9, 120.6, 119.6, 119.4, 115.1, 111.3, 109.4, 53.2, 45.4, 44.0, 14.9; IR (KBr): γ 3551, 3413, 2924, 1688, 1638, 1614, 1488, 1368, 1263, 1013, 801, 749, 699, 617 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{28}N_2O_2+Na)^+$ requires m/z 507.2048, found m/z 507.2067; Enantiomeric excess: 97%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 ºC, 254 nm): t_R = 11.130 min (minor), t_R = 12.610 min (major).

(*S*,*Z*)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)-1-methylindolin-2-one (3bb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 76%; >20:1 *Z*/*E*; pale yellow sticky oil; $[\alpha]_D^{20}$ = +21.4 (c 0.14, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.20 (s, 1H), 7.31−7.28 (m, 1H), 7.24−7.19 (m, 2H), 7.10−7.04 (m, 2H), 7.00−6.86 (m, 6H), 6.70−6.64 (m, 2H), 5.68 (s, 1H), 4.03 (d, *J* = 13.8 Hz, 1H), 3.12 (s, 1H), 3.03 (s, 3H), 1.39 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.3, 152.5, 143.3, 136.8, 132.1, 129.8, 129.1, 128.3, 125.3, 124.6, 122.9, 122.6, 121.9, 120.5, 120.2, 119.6, 119.5, 114.8, 111.4, 108.6, 52.9, 45.4, 26.2, 14.8; IR (KBr): γ 3651, 3414, 2972, 1701, 1638, 1618, 1385, 1263, 1133, 749, 619 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{27}H_{24}N_2O_2+Na)^+$ requires m/z 839.3573, found m/z 839.3569; Enantiomeric excess: 94%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 ºC, 254 nm): t_R = 20.473 min (minor), t_R = 31.163 min (major).

(*S*,*Z*)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)-1-phenylindolin-2-one (3cb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 62%; 5:1 *Z*/*E* (inseparable isomers); pale yellow sticky oil; $[\alpha]_D^{20}$ = −55.1 (c 0.12, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.25 (s, 1H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.40−7.3 (m, 2H), 7.23−7.21 (m, 2H), 7.15−7.13 (m, 2H), 7.07−7.02 (m, 2H), 7.00−6.88 (m, 6H), 6.71 (t, *J* = 7.4 Hz, 1H), 6.65−6.62 (m, 1H), 5.84 (s, 1H), 5.75 (s, 1H), 4.11 (d, *J* = 13.8 Hz, 1H), 3.30 (s, 1H), 1.44 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.0, 153.0, 143.2, 136.9, 134.5, 132.2, 130.3, 129.5, 129.4, 129.2, 128.1, 128.0, 126.6, 125.4, 124.8, 123.2, 123.1, 122.0, 120.4, 119.9, 119.6, 115.3, 111.6, 109.9, 53.4, 45.3, 15.0; IR (KBr):

γ 3550, 3412, 3055, 1702, 1638, 1613, 1499, 1485, 1371, 1292, 1225, 1175, 1013, 742, 698, 614 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{32}H_{26}N_2O_2+Na)^+$ requires m/z 963.3886, found m/z 963.3905; Enantiomeric excess: 94%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 10.233 min (major), t_R = 20.103 min (minor).

(*R*,*Z*)-1-(4-bromobenzyl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3db):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 82%; 8:1 *Z*/*E* (inseparable isomers); colorless sticky oil; $[\alpha]_D^{20}$ = −37.2 (c 0.42, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.29 (s, 1H), 7.38 (d, *J* = 8.4 Hz, 2H), 7.23−7.19 (m, 2H), 7.15 (d, *J* = 8.4 Hz, 3H), 7.09−7.05 (m, 2H), 7.01−6.99 (m, 2H), 6.88−6.83 (m, 3H), 6.76 (d, *J* = 7.8 Hz, 1H), 6.73−6.66 (m, 2H), 5.70 (s, 1H), 4.83 (d, *J* = 15.7 Hz, 1H), 4.47 (d, *J* = 15.7 Hz, 1H), 4.03 (d, *J* = 13.7 Hz, 1H), 3.18 (s, 1H), 1.39 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.6, 178.5, 152.6, 142.0, 136.7, 135.0, 132.0, 131.9, 131.7, 130.0, 129.5, 129.4, 129.1, 128.4, 128.1, 125.2, 124.8, 123.0, 122.9, 122.0, 121.6, 120.4, 119.7, 119.4, 115.0, 111.4, 109.3, 53.1, 45.3, 43.4, 14.9; IR (KBr): γ 3527, 3444, 3378, 2978, 1629, 1524, 1388, 1263, 1167, 1012, 803, 749, 692, 556 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}BrN_2O_2+Na)^+$ requires m/z 585.1154, found m/z 585.1165; Enantiomeric excess: 95%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 90/ 10, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 22.923 min (major), t_R = 31.977 min (minor).

(*R*,*Z*)-1-(4-chlorobenzyl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3eb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 70%; 7:1 *Z*/*E* (inseparable isomers); colorless sticky oil; $[\alpha]_D^{20}$ = −50.1 (c 0.33, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.23 (s, 1H), 7.23−7.15 (m, 6H), 7.09−6.99 (m, 4H), 6.94−6.83 (m, 4H), 6.77 (d, *J* = 7.8 Hz, 1H), 6.73−6.65 (m, 2H), 5.71 (s, 1H), 4.85 (d, *J* = 15.6 Hz, 1H), 4.50 (d, *J* = 15.6 Hz, 1H), 4.02 (d, *J* = 13.7 Hz, 1H), 3.18 (s, 1H), 1.39 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 152.7, 152.6, 142.0, 136.7, 134.5, 133.5, 131.9, 130.1, 129.1, 129.1, 129.0, 128.9, 128.8, 128.4, 128.1, 125.2, 122.9, 122.9, 122.0, 120.4, 119.7, 119.4, 115.0, 111.4, 109.3, 53.1, 45.3, 43.3, 14.9; IR (KBr): γ3526, 3443, 3272, 2925, 1696, 1629, 1576, 1488, 1367, 1263, 1094, 1015, 803, 743, 556 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}ClN_2O_2+Na)^+$ requires m/z 541.1659, found m/z 541.1639; Enantiomeric excess: 91%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 90/ 10, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 22.553 min (major), t_R = 30.647 min (minor).

(*R*,*Z*)-1-(3-chlorobenzyl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3fb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 64%; 9:1 *Z*/*E* (inseparable isomers); colorless sticky oil; $[\alpha]_D^{20}$ = −101.0 (c 0.33, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.17 (s, 1H), 7.30 (s, 1H), 7.24−7.19 (m, 4H), 7.17−7.14 (m, 2H), 7.11−6.97 (m, 4H), 6.91−6.87 (m, 3H), 6.78 (d, *J* = 7.7 Hz, 1H), 6.72−6.64 (m, 2H), 5.94 (s, 1H), 5.72 (s, 1H), 4.84 (d, *J* = 15.7 Hz, 1H), 4.55 (d, *J* = 15.7 Hz, 1H), 4.03 (d, *J* = 13.8 Hz, 1H), 3.15 (s, 1H), 1.40 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 152.6, 141.9, 138.0, 136.7, 134.6, 131.9, 130.1, 129.0, 128.3, 128.1, 127.9, 127.7, 125.8, 125.3, 124.7, 124.6, 122.9, 122.0, 120.4, 119.6, 115.2, 115.0, 111.3, 109.3, 53.1, 45.4, 43.4, 14.9; IR (KBr): γ 3588, 3440, 3179, 2928, 1700, 1626, 1542, 1508, 1488, 1384, 1169, 749, 680 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}ClN_2O_2+Na)^+$ requires m/z 541.1659, found m/z 541.1660; Enantiomeric excess: 92%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 90/ 10, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 22.673 min (major), t_R = 31.397 min (minjor).

(*R*,*Z*)-1-(3,4-dichlorobenzyl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3gb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 68%; 8:1 *Z*/*E* (inseparable isomers); colorless sticky oil; $[\alpha]_D^{20}$ = −22.7 (c 0.35, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.27 (s, 1H), 7.38 (d, *J* = 2.0 Hz, 1H), 7.31 (d, *J* = 8.2 Hz, 1H), 7.24−7.19 (m, 2H), 7.09−7.06 (m, 3H), 7.03−6.98 (m, 3H), 6.92−6.85 (m, 3H), 6.76−6.67 (m, 3H), 5.72 (s, 1H), 4.80 (d, *J* = 15.6 Hz, 1H), 4.42 (d, *J* = 15.8 Hz, 1H), 4.04 (d, *J* = 13.7 Hz, 1H), 3.18 (s, 1H), 1.39 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.6, 152.5, 141.9, 136.7, 136.3, 132.8, 131.9, 131.8, 130.7, 130.1, 129.5, 129.4, 129.1, 128.4, 128.2, 127.0, 127.0, 125.2, 124.9, 123.1, 123.0, 122.0, 120.2, 119.7, 119.6, 114.9, 111.4, 109.1, 53.0, 45.4, 42.9, 14.9; IR (KBr): γ 3525, 3441, 3276, 2925, 1898, 1697, 1603, 1542, 1487, 1365, 1169, 749, 680 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{26}Cl_2N_2O_2+Na)^+$ requires m/z 575.1269, found m/z 575.1241; Enantiomeric excess: 95%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 90/ 10, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 20.170 min (major), t_R = 31.663 min (minor).

(*S*,*Z*)-1-benzyl-5-fluoro-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3hb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 84%; 10:1 *Z*/*E* (inseparable isomers); pale yellow sticky oil; $[\alpha]_D^{20}$ = +166.7 (c 0.16, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.10 (s, 1H), 7.30−7.28 (m, 5H), 7.21 (d, *J* = 7.4 Hz, 1H), 7.12−7.05 (m, 2H), 7.01−6.94 (m, 2H), 6.89−6.80 (m, 4H), 6.73−6.63 (m, 3H), 6.39 (s, 1H), 5.76 (s, 1H), 4.90 (d, *J* = 15.5 Hz, 1H), 4.69 (d, *J* = 15.5 Hz, 1H), 3.98 (d, *J* = 13.5 Hz, 1H), 3.14 (s, 1H), 1.42 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$,

100 MHz) δ (ppm): 178.2, 136.7, 135.7, 131.7, 130.4, 128.8, 128.3, 127.8, 127.8, 125.5, 125.1, 122.9, 122.1, 120.3, 119.7, 119.6, 115.1, 114.4, 114.2, 112.7, 111.4, 109.9, 53.6, 45.3, 44.2, 14.9; IR (KBr): γ 3549, 3475, 3008, 1638, 1619, 1489, 1456, 1397, 1264, 749, 616 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{33}H_{27}FN_2O_2+Na)^+$ requires m/z 1027.4011, found m/z 1027.3988; Enantiomeric excess: 93%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 8.543 min (minor), t_R = 11.930 min (major).

(*S*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)-5-methylindolin-2-one (3ib): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 59%; 15:1 *Z*/*E* (inseparable isomers); colorless sticky oil; $[\alpha]_D^{20}$ = +10.6 (c 0.13, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.18 (s, 1H), 7.36−7.28 (m, 6H), 7.24−7.21 (m, 1H), 7.13−7.05 (m, 2H), 6.99−6.93 (m, 2H), 6.88−6.82 (m, 3H), 6.73−6.62 (m, 3H), 5.72 (s, 1H), 4.88 (d, *J* = 15.2 Hz, 1H), δ 4.77 (d, *J* = 15.1 Hz, 1H), 3.95 (d, *J* = 13.5 Hz, 1H), 3.10 (s, 1H), 2.12 (s, 3H), 1.39 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.6, 152.5, 136.7, 136.1, 132.3, 130.1, 128.8, 128.3, 128.1, 127.9, 127.7, 126.1, 125.4, 123.0, 121.9, 120.6, 119.5, 119.4, 115.1, 111.3, 109.1, 100.0, 53.4, 45.2, 44.1, 21.1, 14.9; IR (KBr): γ 3550, 3474, 3416, 2922, 1638, 1619, 1489, 1385, 1261, 749, 615 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{34}H_{30}N_2O_2+Na)^+$ requires m/z 1019.4512, found m/z 1019.4486; Enantiomeric excess: 94%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 10.940 min (minor), t_R = 18.500 min (major).

(*S*,*Z*)-1-benzyl-6-bromo-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3jb): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 45%; 10:1 *Z*/*E* (inseparable isomers); pale yellow sticky oil; $[\alpha]_D^{20}$ = +41.0 (c 0.17, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.08 (s, 1H), 7.30−7.27 (m, 6H), 7.25−7.23 (m, 1H), 7.15−7.07 (m, 2H), 7.01−6.97 (m, 2H), 6.93−6.87 (m, 3H), 6.78 (d, *J* = 7.1 Hz, 1H), 6.68−6.63 (m, 2H), 6.12 (s, 1H), 5.74 (s, 1H), 4.87 (d, *J* = 15.5 Hz, 1H), 4.63 (d, *J* = 15.5 Hz, 1H), 3.96 (d, *J* = 13.5 Hz, 1H), 3.13 (s, 1H), 1.41 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.2, 152.4, 136.7, 135.4, 131.7, 128.9, 128.3, 127.9, 127.7, 125.8, 125.5, 125.1, 122.9, 122.2, 121.4, 120.5, 119.7, 115.1, 112.6, 111.3, 52.9, 45.4, 44.1, 14.9; IR (KBr): γ 3350, 3475, 3416, 2923, 1638, 1618, 1486, 1385, 1260, 749, 617 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{33}H_{27}BrN_2O_2+Na)^+$ requires m/z 1147.2410, found m/z 1147.2399; Enantiomeric excess: 91%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 7.967 min (minor), t_R = 10.853 min (major).

(*S*,*Z*)-1-benzyl-7-fluoro-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3kb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 58%; >20:1 *Z*/*E*; colorless sticky oil; $[\alpha]_D^{20}$ = −105.5 (c 0.18, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.11 (s, 1H), 7.39 (d, *J* = 5.7 Hz, 2H), 7.28−7.27 (m, 3H), 7.24−7.15 (m, 2H), 7.11−7.03 (m, 2H), 6.99−6.77 (m, 6H), 6.70−6.65 (m, 2H), 6.30 (s, 1H), 5.69 (s, 1H), 4.98 (d, *J* = 15.0 Hz, 1H), 4.88 (d, *J* = 15.1 Hz, 1H), 3.97 (d, *J* = 13.6 Hz, 1H), 3.09 (s, 1H), 1.37 (d, *J* = 5.2 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.4, 152.8, 149.0, 146.5, 137.2, 136.8, 131.7, 130.5, 128.9, 128.7, 128.4, 128.3, 127.8, 125.6, 125.2, 123.4, 123.1, 122.1, 120.5, 119.7, 119.6, 116.2, 116.0, 115.2, 111.4, 53.5, 45.7, 45.6, 15.0; IR (KBr): γ 3549, 3470, 3415, 2930, 1697, 1637, 1487, 1456, 1384, 1243, 1182, 749, 615 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}FN_2O_2+Na)^+$ requires m/z 525.1954, found m/z 525.1924; Enantiomeric excess: 95%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 ºC, 254 nm): t_R = 7.320 min (minor), t_R = 11.823 min (major).

(*S*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(1H-indol-3-yl)-7-methylindolin-2-one (3lb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 71%; >20:1 *Z*/*E*; colorless sticky oil; $[\alpha]_D^{20}$ = +129.3 (c 0.17, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.25 (s, 1H), 7.24−7.19 (m, 4H), 7.17 (d, *J* = 8.0 Hz, 1H), 7.13−7.10 (m, 2H), 7.08−6.99 (m, 3H), 6.94−6.86 (m, 5H), 6.73−6.68 (m, 2H), 5.99 (s, 1H), 5.70 (s, 1H), 5.05 (d, *J* = 15.7 Hz, 1H), 4.86−4.81 (m, 1H), 4.08 (d, *J* = 13.8 Hz, 1H), 3.15 (s, 1H), 2.33 (s, 3H), 1.42 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 179.8, 152.8, 140.5, 138.0, 136.8, 132.2, 132.1, 130.1, 129.2, 128.8, 128.4, 127.2, 126.1, 125.4, 123.4, 123.3, 122.9, 121.9, 120.8, 120.4, 119.7, 119.4, 115.04, 111.5, 52.5, 46.2, 45.2, 19.2, 15.0; IR (KBr): γ 3548, 3476, 3415, 2924, 1688, 1638, 1602, 1486, 1446, 1354, 1262, 1160, 1009, 794, 599, 549 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{34}H_{30}N_2O_2+Na)^+$ requires m/z 1019.4512, found m/z 1019.4506; Enantiomeric excess: 93%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 ºC, 254 nm): t_R = 8.240 min (major), t_R = 10.673 min (minor).

(*S*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(5-methyl-1H-indol-3-yl)indolin-2-one (3mb):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 71%; >20:1 *Z*/*E*; colorless sticky oil; $[\alpha]_D^{20}$ = −45.3 (c 0.13, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.07 (s, 1H), 7.33−7.28 (m, 4H), 7.25−7.11 (m, 4H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.91−6.76 (m, 6H), 6.73−6.66 (m, 2H), 5.96 (s, 1H), 5.72 (s, 1H), 4.89 (d, *J* = 15.5 Hz, 1H), 4.58 (d, *J* = 15.8 Hz, 1H), 4.02 (d, *J* = 13.6 Hz, 1H), 3.14 (s, 1H), 2.23 (s, 3H), 1.39 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.6, 152.6, 142.3, 136.0, 135.1, 132.0, 130.0, 128.9, 128.8, 128.5, 128.3, 128.0, 127.7, 127.6, 125.5, 124.6, 123.6, 123.0, 122.7, 120.2, 119.6, 115.0, 110.9, 109.4, 53.1, 45.3, 44.0, 21.7, 14.9; IR

(KBr): γ 3548, 3474, 3415, 2928, 1685, 1616, 1487, 1384, 1261, 1169, 1106, 794, 750, 697, 609 cm^{-1}; ESI FTMS exact mass calcd for $(C_{34}H_{30}N_2O_2+Na)^+$ requires m/z 521.2205, found m/z 521.2199; Enantiomeric excess: 95%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 90/ 10, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 18.683 min (major), t_R = 22.827 min (minor).

(*S*,*Z*)-1-benzyl-3-(5-chloro-1H-indol-3-yl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)indolin-2-one (3nb): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 54%; 5:1 *Z*/*E* (inseparable isomers); colorless sticky oil; $[\alpha]_D^{20}$ = +39.4 (c 0.11, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.38 (s, 1H), 7.32−7.28 (m, 5H), 7.21−7.13 (m, 2H), 7.05−7.02 (m, 2H), 6.97−6.92 (m, 3H), 6.90−6.82 (m, 3H), 6.71−6.61 (m, 2H), 6.21 (s, 1H), 5.70 (s, 1H), 4.90 (d, *J* = 15.6 Hz, 1H), 4.65 (d, *J* = 15.6 Hz, 1H), 3.96 (d, *J* = 13.7 Hz, 1H), 3.06 (s, 1H), 1.39 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 152.5, 135.8, 135.0, 131.6, 128.94, 128.9, 128.3, 127.7, 127.5, 127.4, 126.2, 125.1, 124.5, 123.0, 122.2, 119.8, 119.6, 115.0, 112.3, 109.7, 53.0, 45.5, 44.1, 14.9; IR (KBr): γ 3549, 3478, 3416, 2942, 1637, 1618, 1542, 1508, 1385, 1261, 1139, 749, 617 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}ClN_2O_2+Na)^+$ requires m/z 541.1659, found m/z 541.1659; Enantiomeric excess: 96%, determined by HPLC (Daicel Chirapak IA, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 10.160 min (minor), t_R = 15,560 min (major).

(*S*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(6-methyl-1H-indol-3-yl)indolin-2-one (3ob): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 60%; >20:1 *Z*/*E*; colorless sticky oil; $[\alpha]_D^{20}$ = −146.7 (c 0.13, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.02 (s, 1H), 7.30−7.27 (m, 5H), 7.23−7.12 (m, 2H), 7.00−6.99 (m, 3H), 6.93−6.79 (m, 4H), 6.74−6.66 (m, 3H), 5.98 (s, 1H), 5.71 (s, 1H), 4.87 (d, *J* = 15.5 Hz, 1H), 4.62 (d, *J* = 15.2 Hz, 1H), 3.99 (d, *J* = 13.8 Hz, 1H), 3.15 (s, 1H), 2.36 (s, 3H), 1.38 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 152.6, 142.2, 137.2, 136.0, 132.0, 131.7, 130.0, 128.9, 128.7, 128.3, 128.0, 127.8, 127.6, 124.6, 123.1, 122.7, 122.3, 121.2, 120.2, 119.6, 115.1, 111.2, 109.4, 53.1, 45.3, 44.0, 21.5, 14.9; IR (KBr): γ 3550, 3474, 3416, 2920, 1695, 1616, 1487, 1466, 1384, 1263, 1170, 1106, 799, 749, 698, 609 cm^{-1}; ESI FTMS exact mass calcd for $(C_{34}H_{30}N_2O_2+Na)^+$ requires m/z 521.2205, found m/z 521.2209; Enantiomeric excess: 93%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 9.497 min (minor), t_R = 13.667 min (major).

(*S*,*Z*)-1-benzyl-3-(6-fluoro-1H-indol-3-yl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)indolin-2-one (3pb): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 87%; >20:1 *Z*/*E*; colorless sticky oil; $[\alpha]_D^{20}$ = +37.8 (c 0.14, $CHCl_3$); ^1H NMR ($CDCl_3$, 400 MHz) δ (ppm):

8.19 (s, 1H), 7.30−7.27 (m, 6H), 7.18 (t, *J* = 7.2 Hz, 1H), 7.01−6.93 (m, 3H), 6.85−6.79 (m, 4H), 6.70 (t, *J* = 7.4 Hz, 1H), 6.65−6.56 (m, 2H), 6.14 (s, 1H), 5.70 (s, 1H), 4.89 (d, *J* = 15.4 Hz, 1H), 4.63 (d, *J* = 15.3 Hz, 1H), 3.97 (d, *J* = 13.6 Hz, 1H), 3.10 (s, 1H), 1.39 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 160.8, 158.4, 152.6, 136.8, 136.7, 135.8, 131.7, 130.2, 128.9, 128.8, 128.3, 128.2, 127.8, 125.5, 124.5, 123.3, 122.8, 121.8, 121.2, 119.7, 115.1, 109.5, 108.2, 108.0, 97.6, 97.3, 53.0, 45.4, 44.0, 14.9; IR (KBr): γ 3548, 3472, 3417, 2928, 1638, 1618, 1543, 1509, 1458, 1385, 1262, 749, 613 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{33}H_{27}FN_2O_2+Na)^+$ requires m/z 1027.4011, found m/z 1027.4017; Enantiomeric excess: 92%, determined by HPLC (Daicel Chirapak IA, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 13.380 min (minor), t_R = 15.637 min (major).

(*S*,*Z*)-1-benzyl-3-(6-bromo-1H-indol-3-yl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)indolin-2-one (3qb): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 64%; >20:1 *Z*/*E*; pale yellow solid; $[\alpha]_D^{20}$ = −85.6 (c 0.14, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.30 (s, 1H), 7.30−7.28 (m, 7H), 7.20−7.16 (m, 1H), 7.02−6.98 (m, 1H), 6.92−6.84 (m, 6H), 6.74−6.66 (m, 2H), 6.04 (s, 1H), 5.69 (s, 1H), 4.88 (d, *J* = 15.4 Hz, 1H), 4.62 (d, *J* = 15.3 Hz, 1H), 3.94 (d, *J* = 13.6 Hz, 1H), 3.09 (s, 1H), 1.38 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 152.7, 137.6, 135.9, 131.7, 128.9, 128.5, 128.3, 127.9, 127.9, 124.6, 124.3, 123.7, 123.0, 122.8, 121.8, 119.8, 115.7, 115.2, 114.3, 109.7, 53.1, 45.6, 44.2, 15.0; IR (KBr): γ 3549, 3478, 3416, 2930, 1684, 1618, 1542, 1508, 1483, 1458, 1364, 1261, 1079, 798, 749, 618 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}BrN_2O_2+Na)^+$ requires m/z 585.1154, found m/z 585.1141; Enantiomeric excess: 91%, determined by HPLC (Daicel Chirapak IA, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 17.110 min (minor), t_R = 20.563 min (major).

(*S*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)-3-(7-methyl-1H-indol-3-yl)indolin-2-one (3rb): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 53%; >20:1 *Z*/*E*; colorless sticky oil; $[\alpha]_D^{20}$ = −76.3 (c 0.12, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.01 (s, 1H), 7.32−7.28 (m, 5H), 7.25−7.14 (m, 2H), 6.99−6.94 (m, 3H), 6.91−6.76 (m, 5H), 6.69−6.65 (m, 2H), 6.12 (s, 1H), 5.72 (s, 1H), 4.88 (d, *J* = 15.5 Hz, 1H), 4.64 (d, *J* = 15.5 Hz, 1H), 4.03 (d, *J* = 13.6 Hz, 1H), 3.15 (s, 1H), 2.33 (s, 3H), 1.39 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.5, 152.7, 142.2, 136.2, 136.0, 132.0, 130.0, 128.9, 128.7, 128.2, 128.0, 127.8, 127.7, 124.8, 124.6, 122.7, 122.5, 120.3, 119.6, 119.5, 118.3, 115.0, 109.4, 53.2, 45.3, 44.0, 16.5, 14.9; IR (KBr): γ 3548, 3475, 4316, 2926, 1638, 1618, 1541, 1507, 1488, 1456, 1397, 1261, 1092, 750, 616 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{34}H_{30}N_2O_2+Na)^+$ requires m/z 1019.4512, found m/z 1019.4502; Enantiomeric excess: 86%,

determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 ^{o}C, 254 nm): t_R = 10.923 min (minor), t_R = 12.240 min (major).

(*S*,*Z*)-1-benzyl-3-(7-bromo-1H-indol-3-yl)-3-(2-(2-hydroxyphenyl)but-2-en-1-yl)indolin-2-one (3sb): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 44%; >20:1 *Z*/*E*; pale yellow sticky oil; $[\alpha]_D^{20}$ = −71.4 (c 0.11, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.12 (s, 1H), 7.30−7.28 (m, 6H), 7.23−7.13 (m, 4H), 6.96 (t, *J* = 7.6 Hz, 2H), 6.83 (d, *J* = 7.7 Hz, 2H), 6.75 (t, *J* = 7.9 Hz, 1H), 6.66−6.62 (m, 2H), 6.34 (s, 1H), 5.70 (s, 1H), 4.89 (d, *J* = 15.4 Hz, 1H), 4.67 (d, *J* = 15.5 Hz, 1H), 3.99 (d, *J* = 13.7 Hz, 1H), 3.04 (s, 1H), 1.39 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.1, 152.7, 136.0, 135.4, 131.8, 130.5, 128.9, 128.8, 128.4, 128.3, 127.9, 126.7, 124.5, 123.5, 122.9, 120.8, 120.1, 119.7, 115.2, 109.7, 104.9, 53.3, 45.6, 44.1, 15.0; IR (KBr): γ 3551, 3492, 3416, 2918, 1637, 1620, 1556, 1539, 1472, 1416, 1258, 1078, 770, 615 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}BrN_2O_2+Na)^+$ requires m/z 585.1154, found m/z 585.1174; Enantiomeric excess: 93%, determined by HPLC (Daicel Chirapak IA, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 ^{o}C, 254 nm): t_R = 11.860 min (minor), t_R = 22.987 min (major).

(*R*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)pent-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3ac): Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 62%; 6:1 *Z*/*E* (inseparable isomers); pale yellow sticky oil; $[\alpha]_D^{20}$ = −44.2 (c 0.18, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.16 (s, 1H), 7.30−7.29 (m, 3H), 7.24−7.13 (m, 5H), 7.08−7.03(m, 2H), 6.97−6.94 (m, 2H), 6.90−6.81 (m, 4H), 6.70−6.64 (m, 2H), 6.20 (s, 1H), 5.55 (s, 1H), 4.90 (d, *J* = 15.5 Hz, 1H), 4.59 (d, *J* = 15.5 Hz, 1H), 3.98 (d, *J* = 13.7 Hz, 1H), 3.05 (s, 1H), 1.72−1.66 (m, 2H), 0.79 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.6, 152.7, 137.8, 136.7, 136.0, 130.1, 129.0, 128.7, 128.6, 128.2, 128.0, 127.8, 127.7, 125.3, 123.1, 122.8, 121.9, 120.5, 119.5, 119.4, 111.3, 109.4, 53.2, 45.3, 44.0, 22.5, 13.7; IR (KBr): γ 3651, 3437, 2942, 1700, 1738, 1612, 1543, 1509, 1489, 1458, 1385, 1243, 1098, 748, 698 cm^{-1}; ESI FTMS exact mass calcd for $(C_{34}H_{30}N_2O_2+Na)^+$ requires m/z 521.2205, found m/z 521.2192; Enantiomeric excess: 97%, determined by HPLC (Daicel Chirapak IA, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 ^{o}C, 254 nm): t_R = 25.100 min (minor), t_R = 29.987 min (major).

(*R*,*Z*)-1-benzyl-3-(2-(2-hydroxyphenyl)-4-phenylbut-2-en-1-yl)-3-(1H-indol-3-yl)indolin-2-one (3ad): Preparative thin layer chromatography: dichloromethane/acetic ether = 10/1; Reaction time = 12 h; yield: 75%; 6:1 *Z*/*E* (inseparable isomers); colorless oil; $[\alpha]_D^{20}$ = +48.1 (c 0.16, $CHCl_3$); ^{1}H NMR (400 MHz, CDCl3) δ 8.10 (s, 1H), 7.31-7.30 (m, 3H), 7.28-7.24 (m, 7H), 7.22-7.16 (m, 5H), 7.07-7.02 (m, 4H), 6.85 (d, J = 7.7 Hz, 2H), 6.73 (d, J = 8.0 Hz, 2H), 5.87 (s, 1H), 5.74 (s, 1H), 4.95 (d, J = 15.5 Hz, 1H), 4.56 (d,

J = 12.4 Hz, 1H), 4.04 (d, J = 11.5 Hz, 1H), 3.16-3.07 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.7, 153.1, 140.4, 136.7, 135.9, 134.0, 129.2, 128.7, 128.7, 128.5, 128.4, 128.4, 128.0, 127.7, 127.7, 126.1, 125.9, 125.8, 125.3, 124.6, 123.0, 121.9, 120.5, 119.6, 119.4, 115.5, 111.3, 109.4, 100.0, 53.2, 52.6, 44.0, 35.3; IR (KBr): γ 3547, 3474, 3314, 2923, 1686, 1648, 1487, 1451, 1400, 1364, 1168, 1014, 741, 697 cm^{-1}; ESI FTMS exact mass calcd for $(2C_{39}H_{32}N_2O_2+Na)^+$ requires m/z 1143.4825, found m/z 1143.4817; Enantiomeric excess: 90%, determined by HPLC (Daicel Chirapak IA, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 ºC, 254 nm): t_R = 13.317 min (minor), t_R = 18.390 min (major).

(*R*)-1-(4-chlorobenzyl)-3-(2-(2-hydroxy-5-methylphenyl)allyl)-3-(1H-indol-3-yl)indolin-2-one (3ed):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 47%; colorless sticky oil; $[\alpha]_D^{20}$ = −70.4 (c 0.25, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.49 (s, 1H), 7.25−7.16 (m, 6H), 7.10−7.05 (m, 2H), 6.98 (d, *J* = 2.6 Hz, 1H), 6.91−6.78 (m, 2H), 6.85−6.79 (m, 2H), 6.73 (d, *J* = 7.8 Hz, 1H), 6.61 (d, *J* = 8.2 Hz, 1H), 6.54 (d, *J* = 1.8 Hz, 1H), 5.74 (s, 1H), 5.20 (s, 1H), 5.00 (d, *J* = 1.6 Hz, 1H), 4.84 (d, *J* = 15.6 Hz, 1H), 4.32 (d, *J* = 15.6 Hz, 1H), 4.10 (d, *J* = 13.5 Hz, 1H), 3.40 (d, *J* = 13.6 Hz, 1H), 2.15 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.8, 150.3, 142.4, 142.2, 136.8, 134.4, 133.5, 132.1, 129.4, 129.2, 129.1, 128.8, 128.7, 128.2, 127.4, 125.1, 125.1, 123.1, 122.9, 122.0, 120.2, 119.7, 119.4, 115.3, 115.1, 111.5, 109.1, 52.8, 43.3, 43.1, 20.4; IR (KBr): γ 3527, 3442, 3275, 2925, 1701, 1629, 1598, 1542, 1265, 1200, 1015, 814, 744, 556 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}ClN_2O_2+Na)^+$ requires m/z 541.1659, found m/z 541.1641; Enantiomeric excess: 89%, determined by HPLC (Daicel Chirapak AD-H, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 ºC, 254 nm): t_R = 15.590 min (minor), t_R = 36.027 min (major).

(*R*)-1-(4-bromobenzyl)-3-(2-(2-hydroxy-5-methoxyphenyl)allyl)-3-(1H-indol-3-yl)indolin-2-one (3de):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 47%; colorless sticky oil; $[\alpha]_D^{20}$ = −111.7 (c 0.20, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 7.48 (s, 1H), 7.39 (d, *J* = 8.3 Hz, 2H), 7.31−7.26 (m, 2H), 7.21 (d, *J* = 8.3 Hz, 2H), 7.09−7.00 (m, 2H), 6.90 (d, *J* = 7.3 Hz, 1H), 6.76−6.69 (m, 4H), 6.54−6.47 (m, 2H), 5.70 (d, *J* = 2.9 Hz, 1H), 5.18 (s, 1H), 4.93 (d, *J* = 1.8 Hz, 1H), 4.74 (d, *J* = 15.6 Hz, 1H), 4.56 (d, *J* = 15.7 Hz, 1H), 4.00 (d, *J* = 13.1 Hz, 1H), 3.76 (d, *J* = 13.0 Hz, 1H), 3.45 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 179.2, 151.9, 147.0, 144.1, 142.1, 136.8, 134.9, 132.0, 131.4, 129.6, 129.4, 127.5, 124.9, 124.8, 122.9, 122.5, 121.2, 119.6, 119.0, 118.5, 115.4, 114.7, 113.9, 113.7, 111.2, 108.4, 55.0, 53.1, 43.1, 41.3; IR (KBr): γ 3527, 3444, 3269, 2962, 1698, 1541, 1487, 1260, 1092, 1017, 869, 799, 744, 556 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{27}BrN_2O_3+Na)^+$ requires m/z 601.1103, found m/z 601.1102; Enantiomeric excess: 89%, determined by HPLC (Daicel

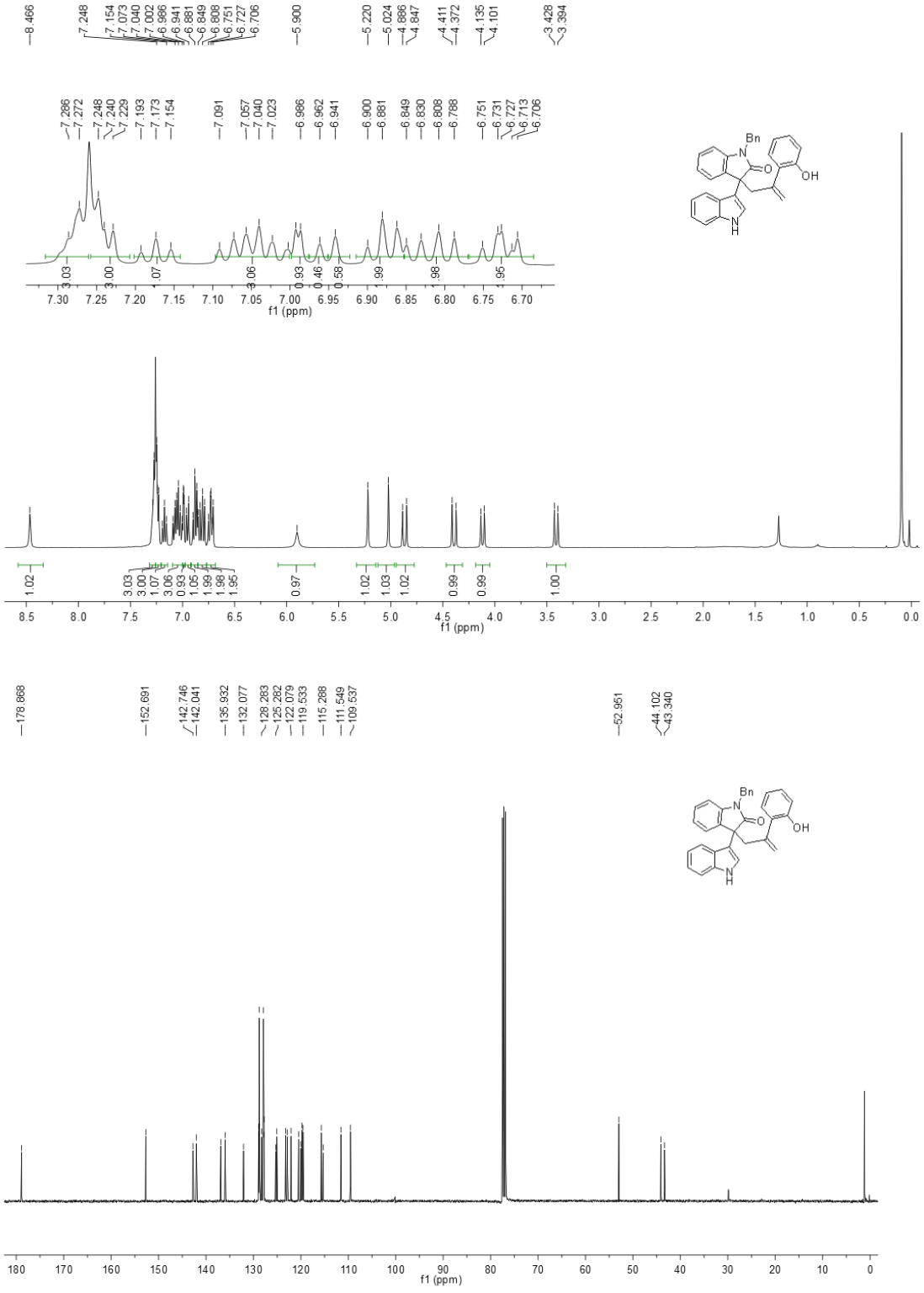
Chirapak IC, hexane/ isopropanol = 70/ 30, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 6.737 min (major), t_R = 7.470 min (minor).

1-benzyl-3-(1H-indol-3-yl)-3-(2-(2-methoxyphenyl)allyl)indolin-2-one (3af):

Preparative thin layer chromatography: toluene/acetic ether = 5/1; Reaction time = 12 h; yield: 29%; colorless sticky oil; ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.21 (s, 1H), 7.29−7.27 (m, 3H), 7.25−7.21 (m, 3H), 7.10−7.03 (m, 5H), 6.91 (d, *J* = 7.3 Hz, 1H), 6.83 (t, *J* = 7.6 Hz, 1H), 6.72 (t, *J* = 7.5 Hz, 1H), 6.66 (t, *J* = 8.6 Hz, 2H), 6.56 (t, *J* = 7.4 Hz, 1H), 6.22 (d, *J* = 7.4 Hz, 1H), 5.22 (s, 1H), 4.93 (s, 1H), 4.82 (d, *J* = 15.5 Hz, 1H), 4.38 (d, *J* = 15.6 Hz, 1H), 4.10 (d, *J* = 13.2 Hz, 1H), 3.79 (s, 3H), 3.62 (d, *J* = 13.2 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 178.3, 156.2, 144.4, 143.1, 136.8, 136.2, 131.7, 131.1, 129.7, 128.5, 128.2, 127.8, 127.7, 127.5, 125.4, 125.1, 122.6, 122.0, 120.9, 119.9, 119.6, 119.4, 116.5, 111.2, 109.9, 108.6, 55.2, 53.0, 43.9, 41.9; IR (KBr): γ 3677, 3630, 3414, 1700, 1638, 1612, 1543, 1489, 1458, 1385, 1243, 1098, 748, 698 cm^{-1}; ESI FTMS exact mass calcd for $(C_{33}H_{28}N_2O_2+Na)^+$ requires m/z 507.2048, found m/z 507.2046; Enantiomeric excess: 4%, determined by HPLC (Daicel Chirapak IC, hexane/ isopropanol = 80/ 20, flow rate 1.0 mL/min, T = 30 °C, 254 nm): t_R = 8.973 min (minor), t_R = 16.283 min (major).

Copies of NMR spectra for products 3

3aa：



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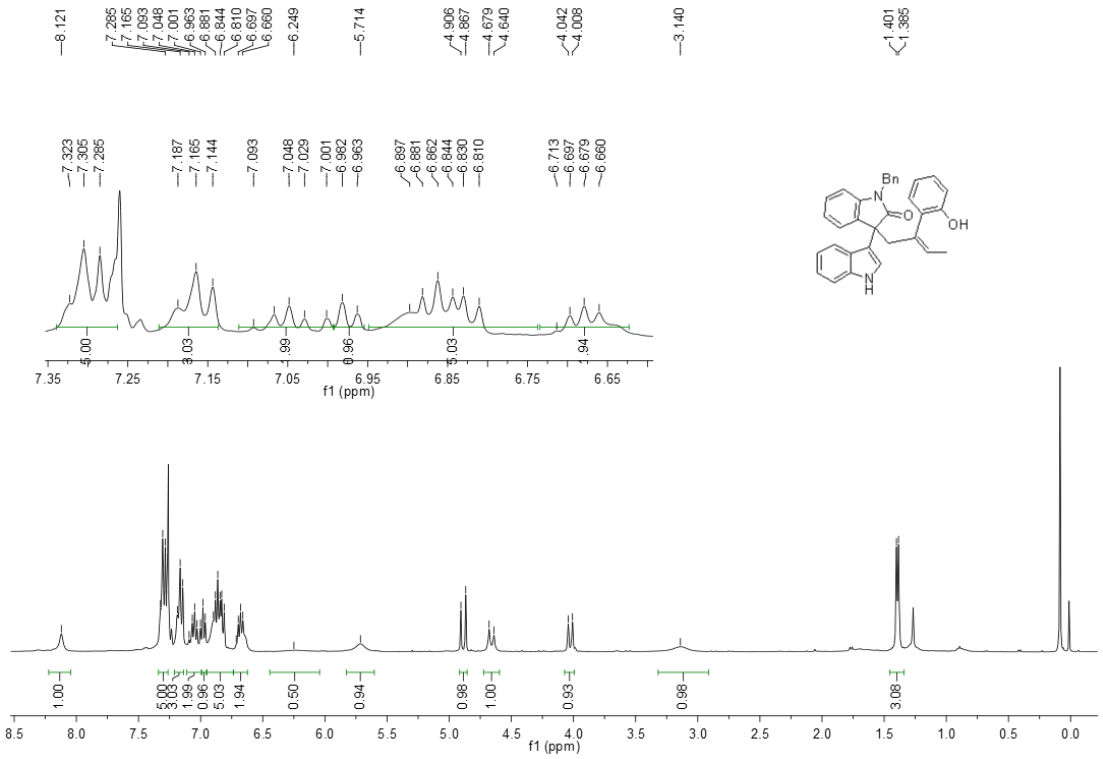
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5.714
4.906
4.867
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Bn
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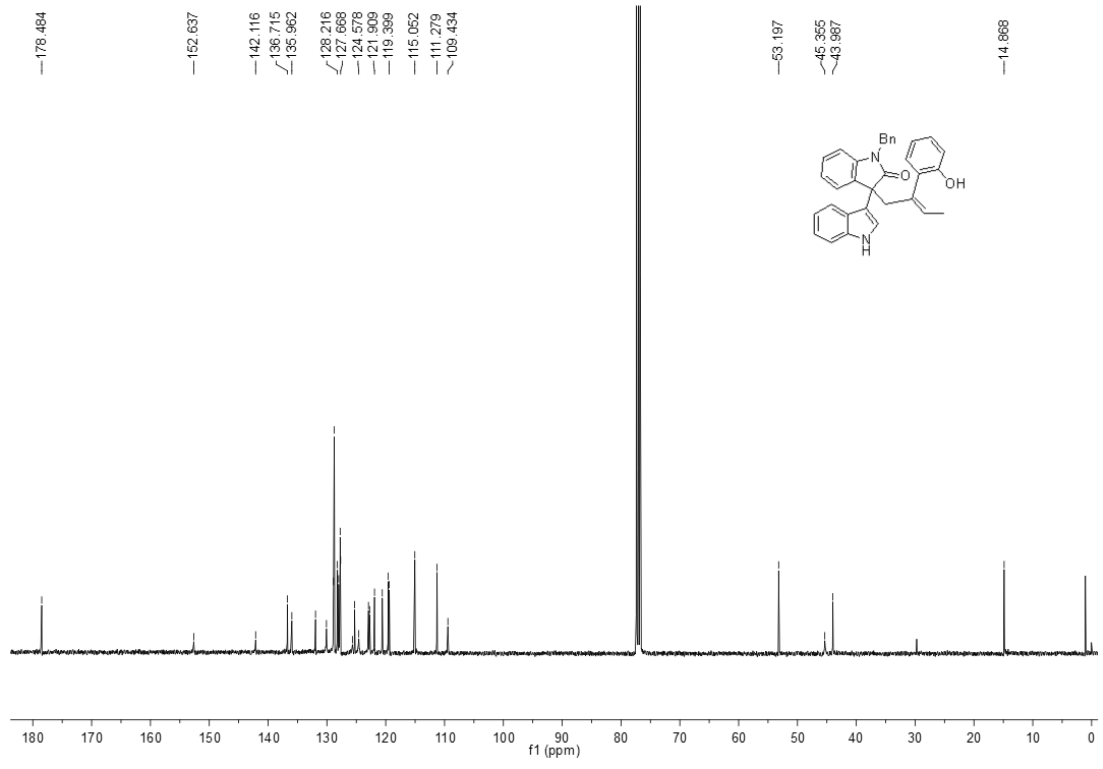
O
OH
H
f1 (ppm)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O
OH
H
f1 (ppm)

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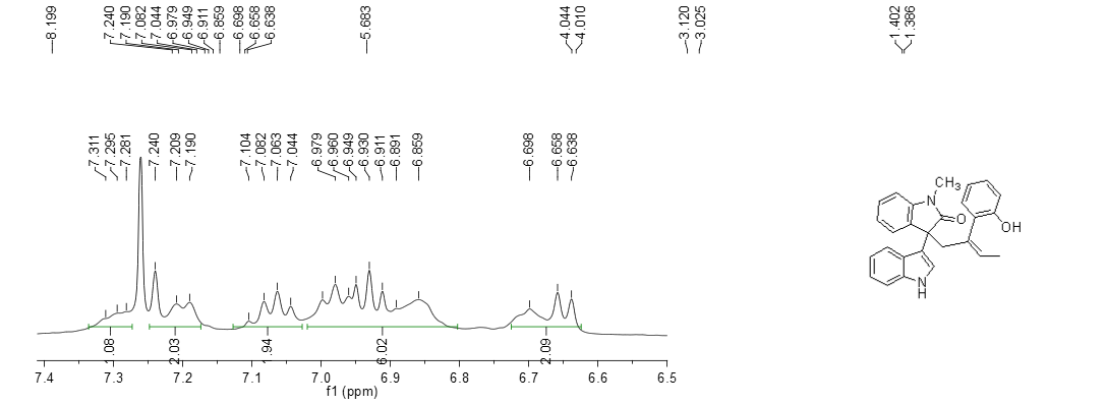
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6.698
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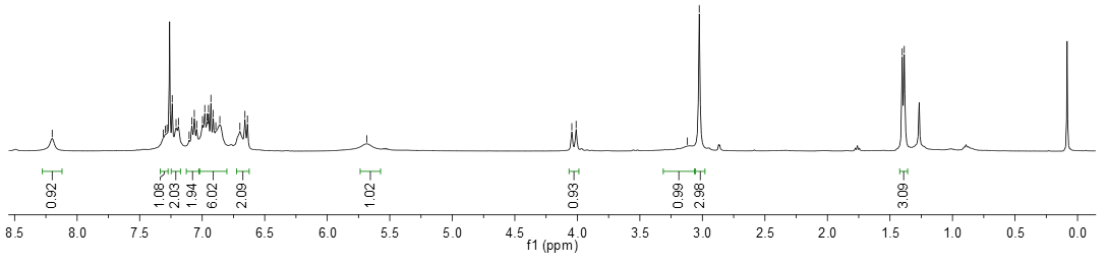
6.638
5.683
4.044
4.010
3.120
3.025
1.402
1.386
7.311
7.295
7.281
7.240
7.209
7.190
7.104
7.082
7.063
7.044
6.979
6.960
6.949
6.930
6.911
6.891
6.859
6.698
6.658
6.638
1.08
2.03
1.94
6.02
2.09
f1 (ppm)
CH3
N
O
OH
H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2.09
1.02
0.93
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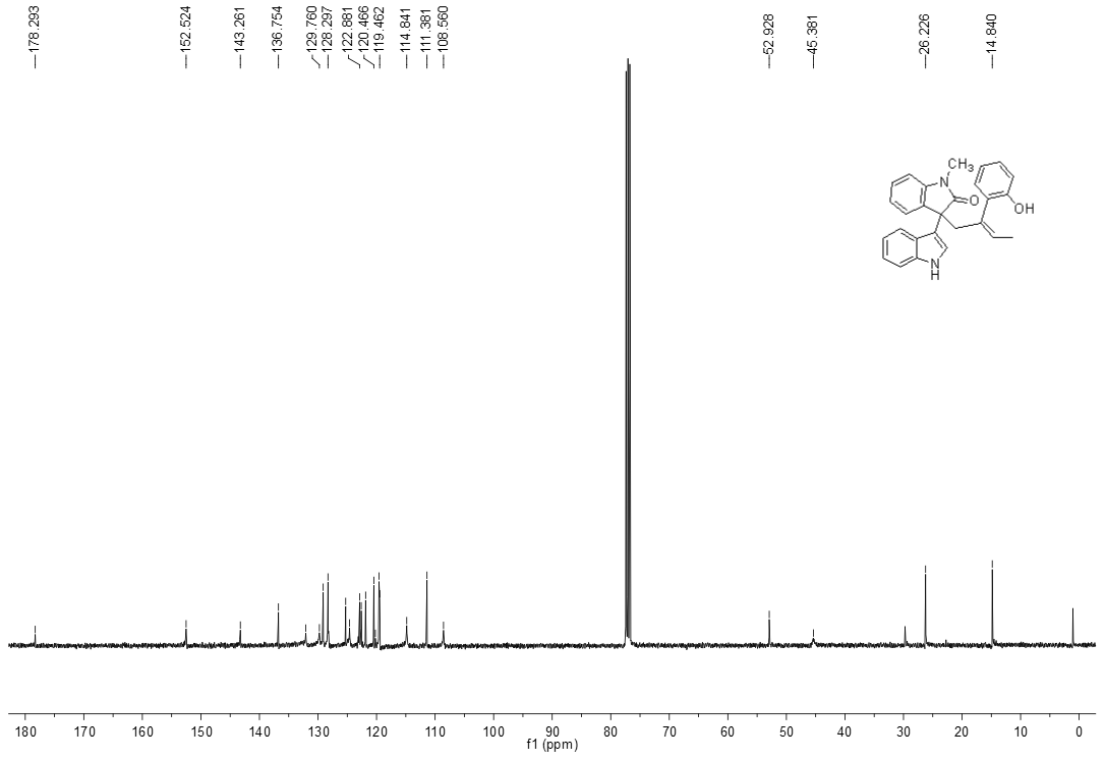
3.09
f1 (ppm)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52.928
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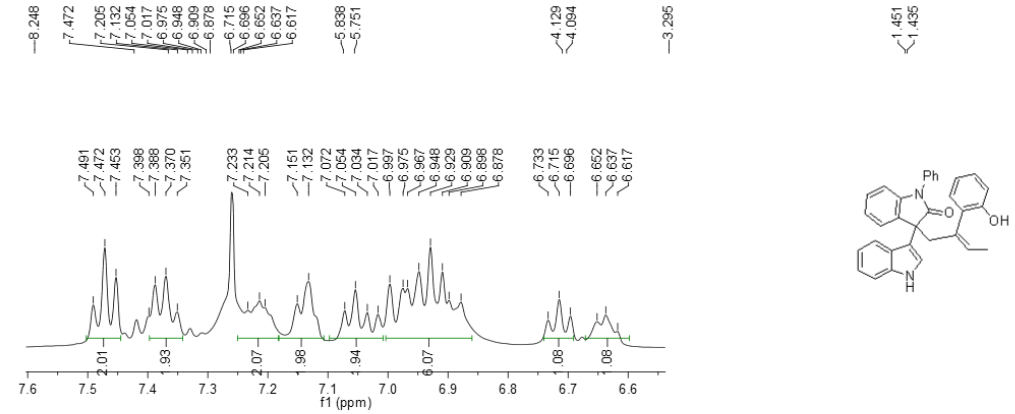
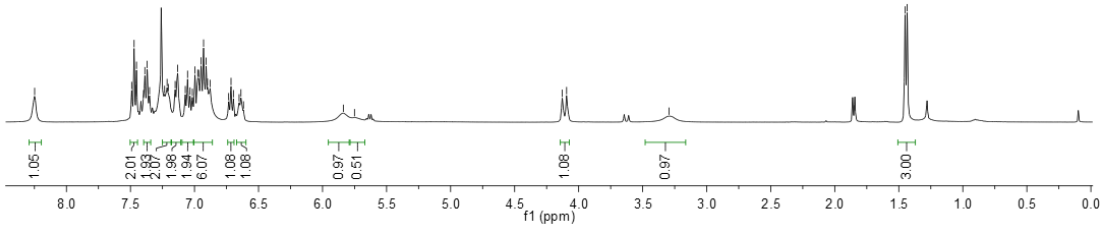
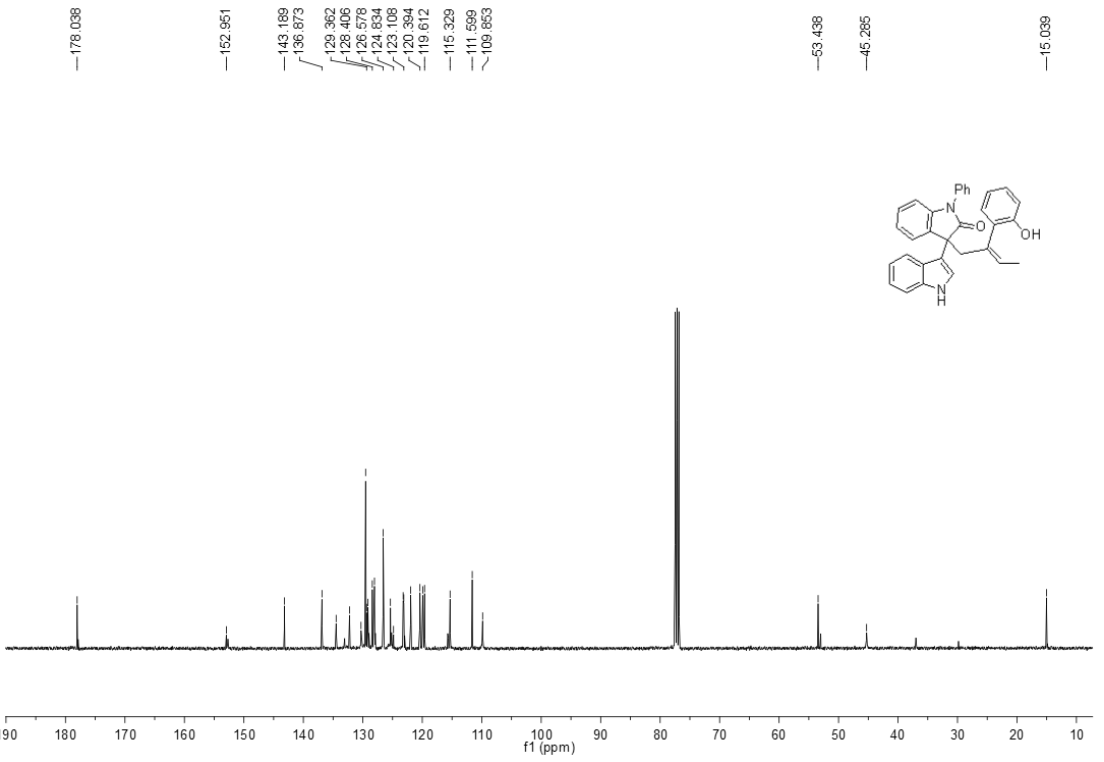
14.840
f1 (ppm)
CH3
N
O
OH
H

3cb: (inseparable 5:1 *Z*/*E* isomers)







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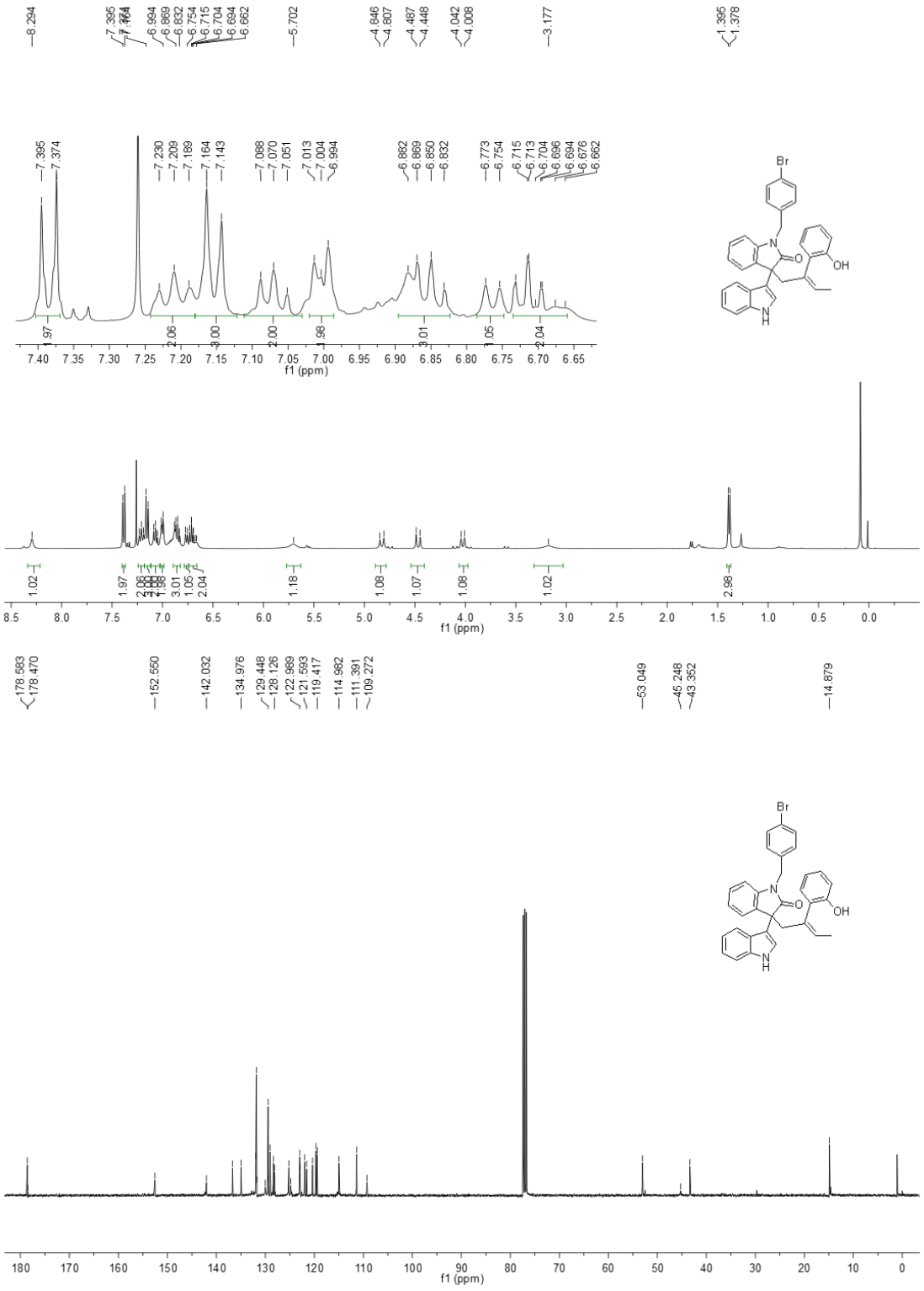

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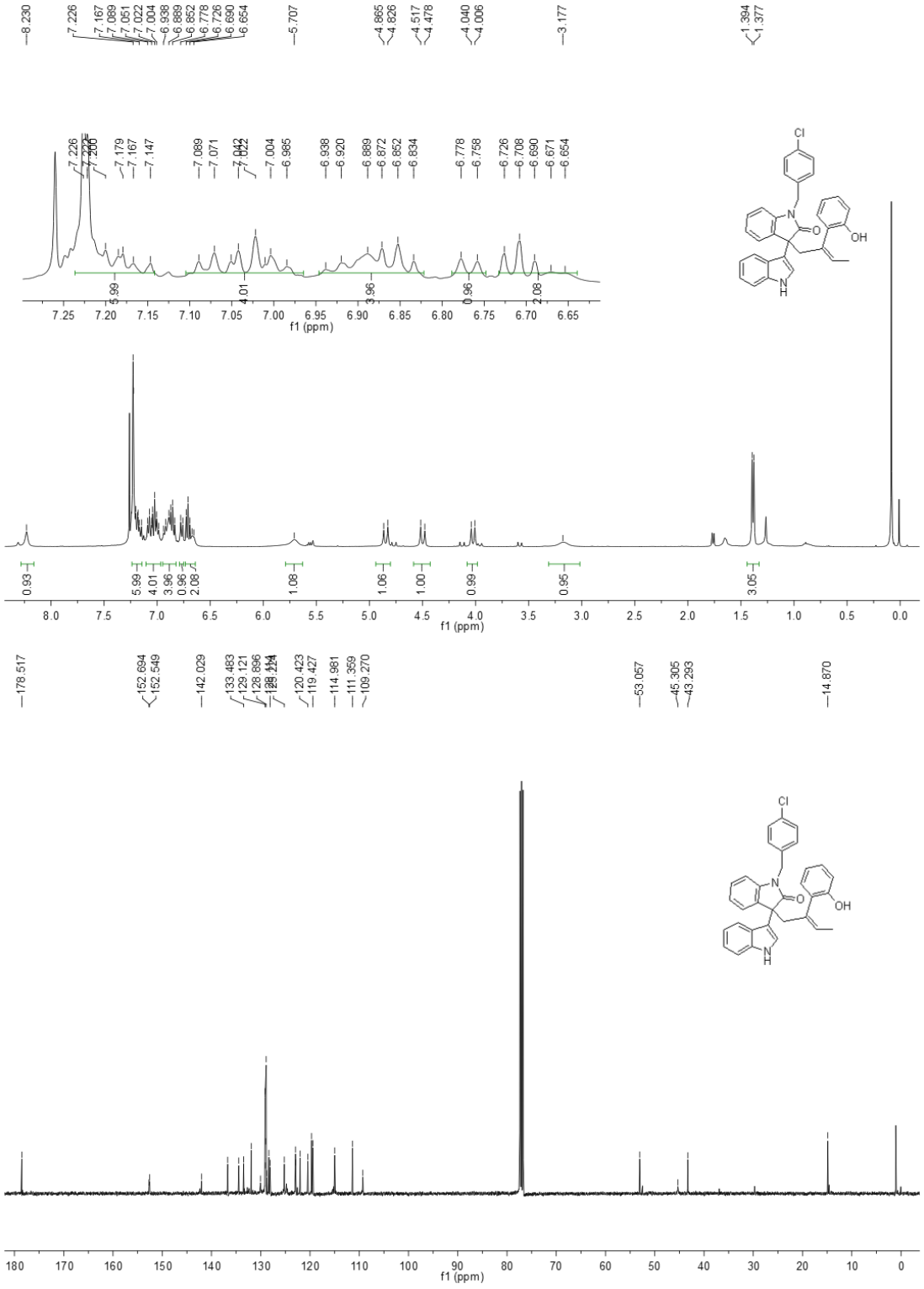
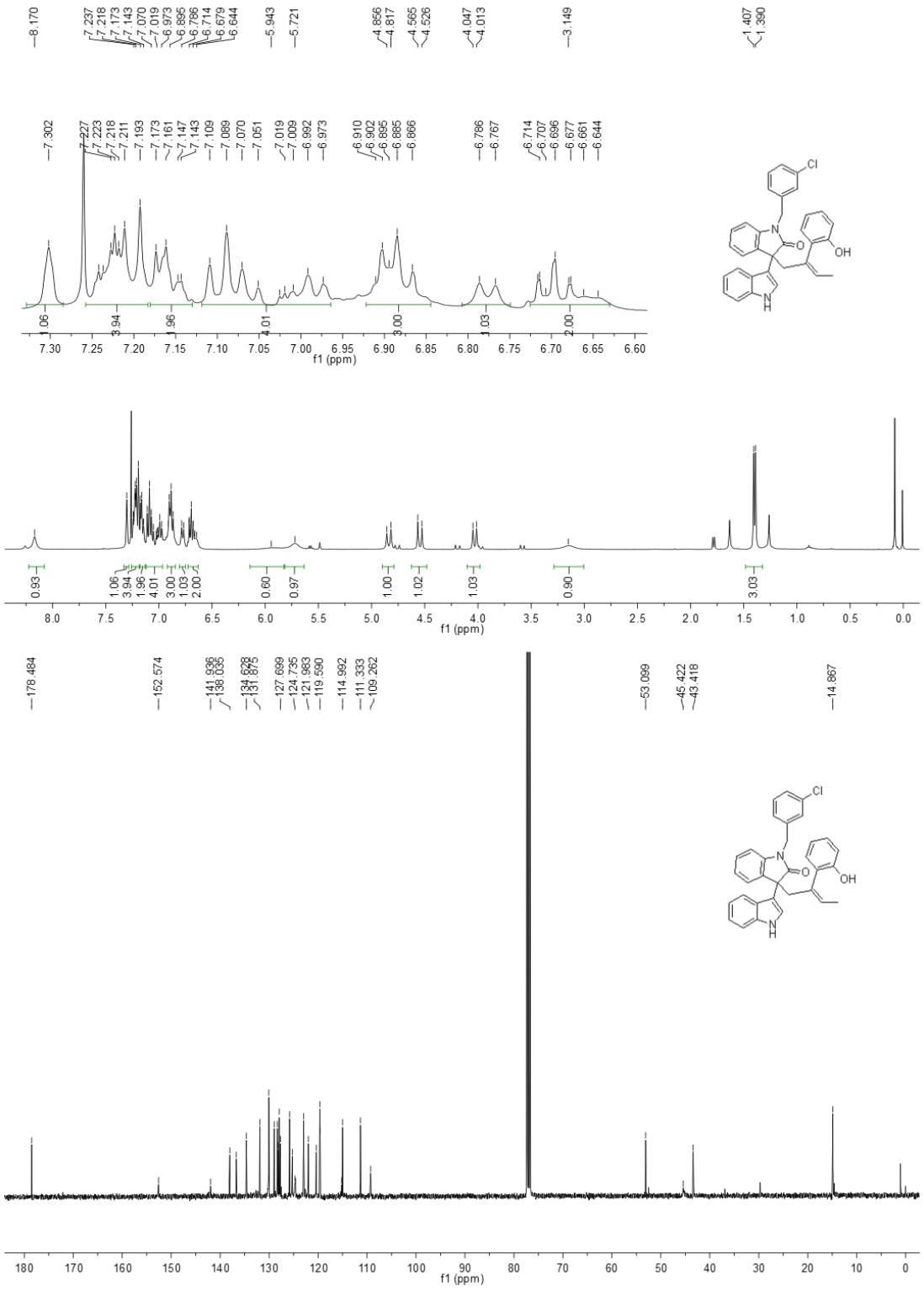
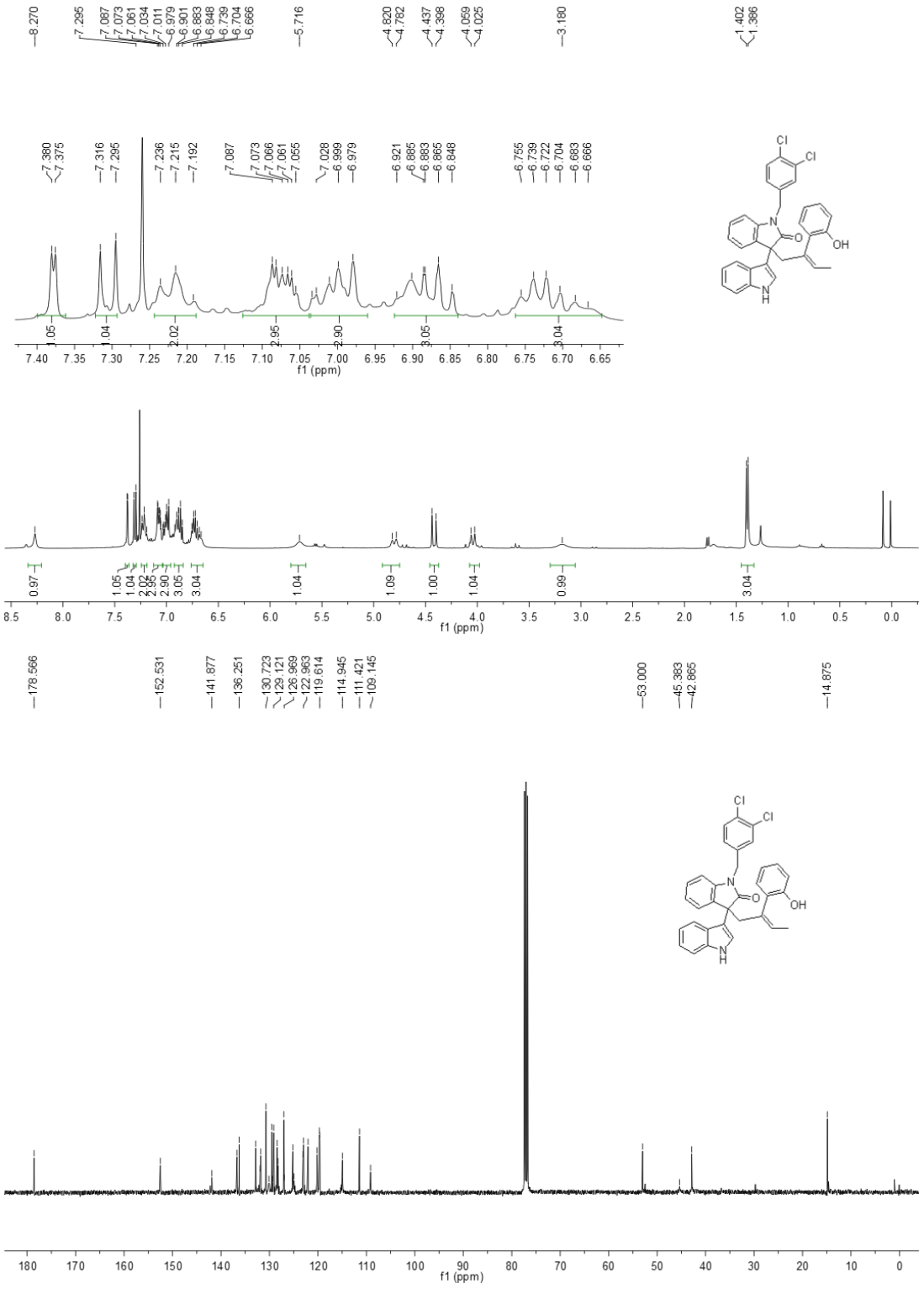


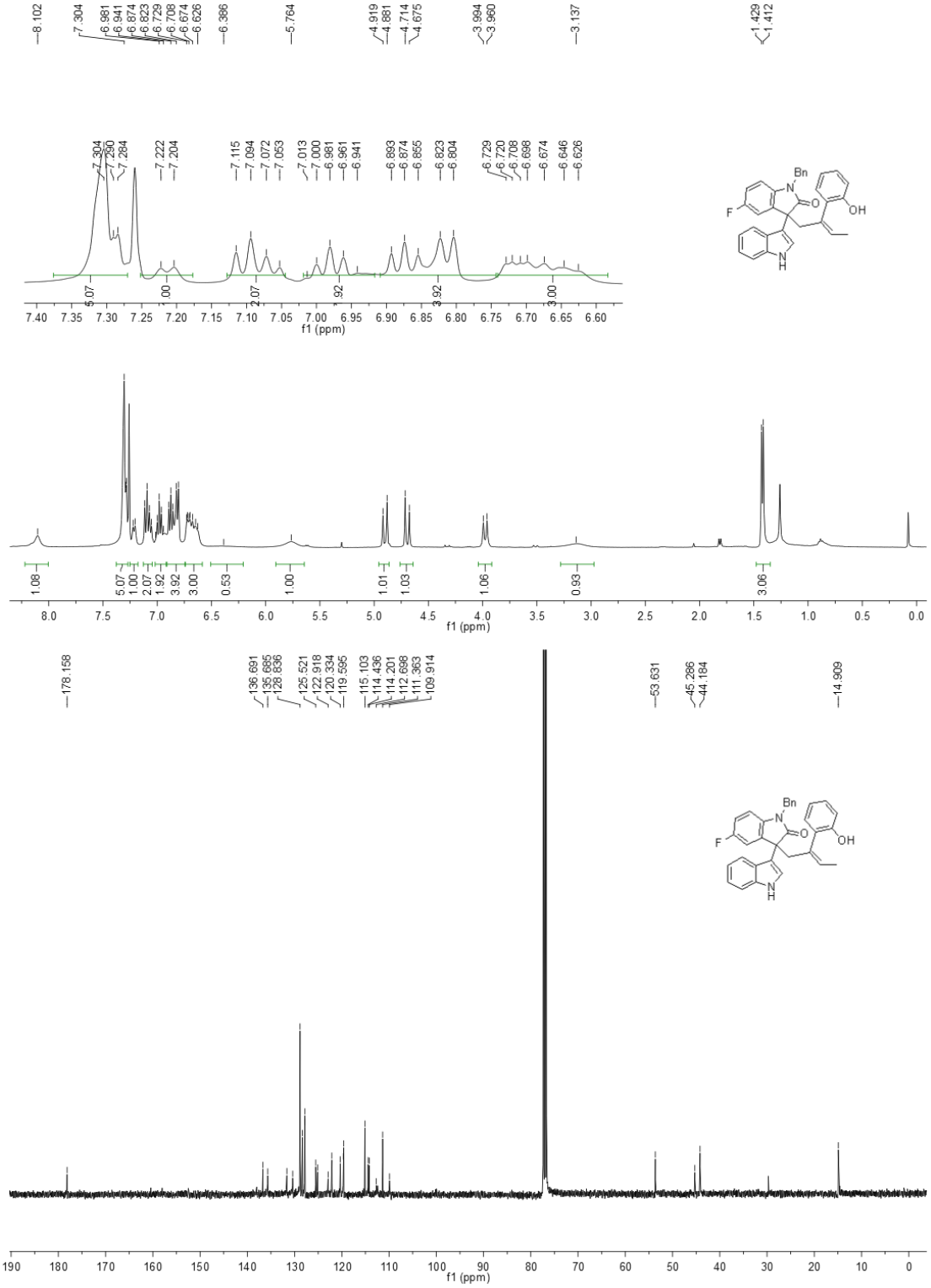
3fb: (inseparable 9:1 *Z*/*E* isomers)



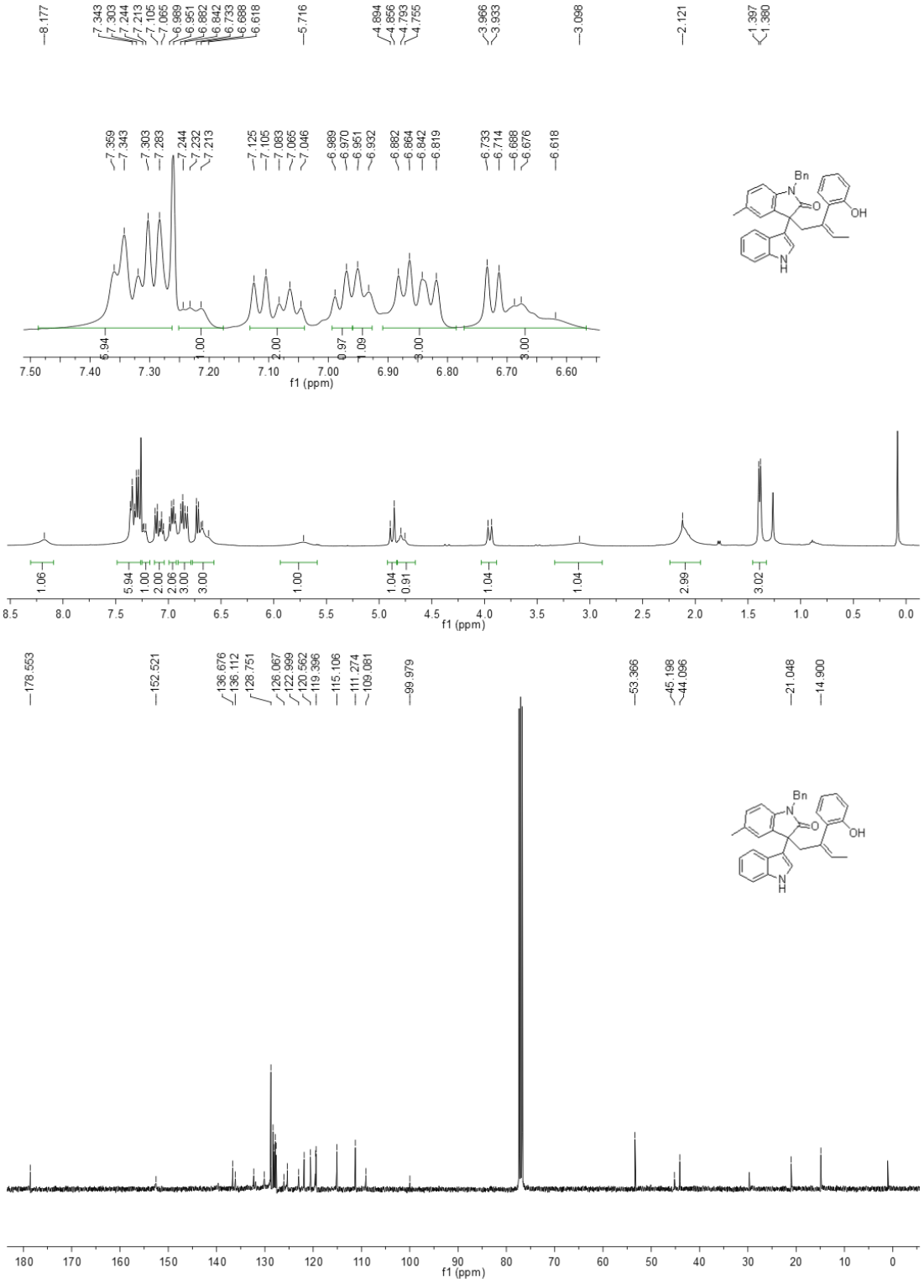
3gb: (inseparable 8:1 *Z*/*E* isomers)



3hb: (inseparable 10:1 *Z*/*E* isomers)



3ib: (inseparable 15:1 *Z*/*E* isomers)



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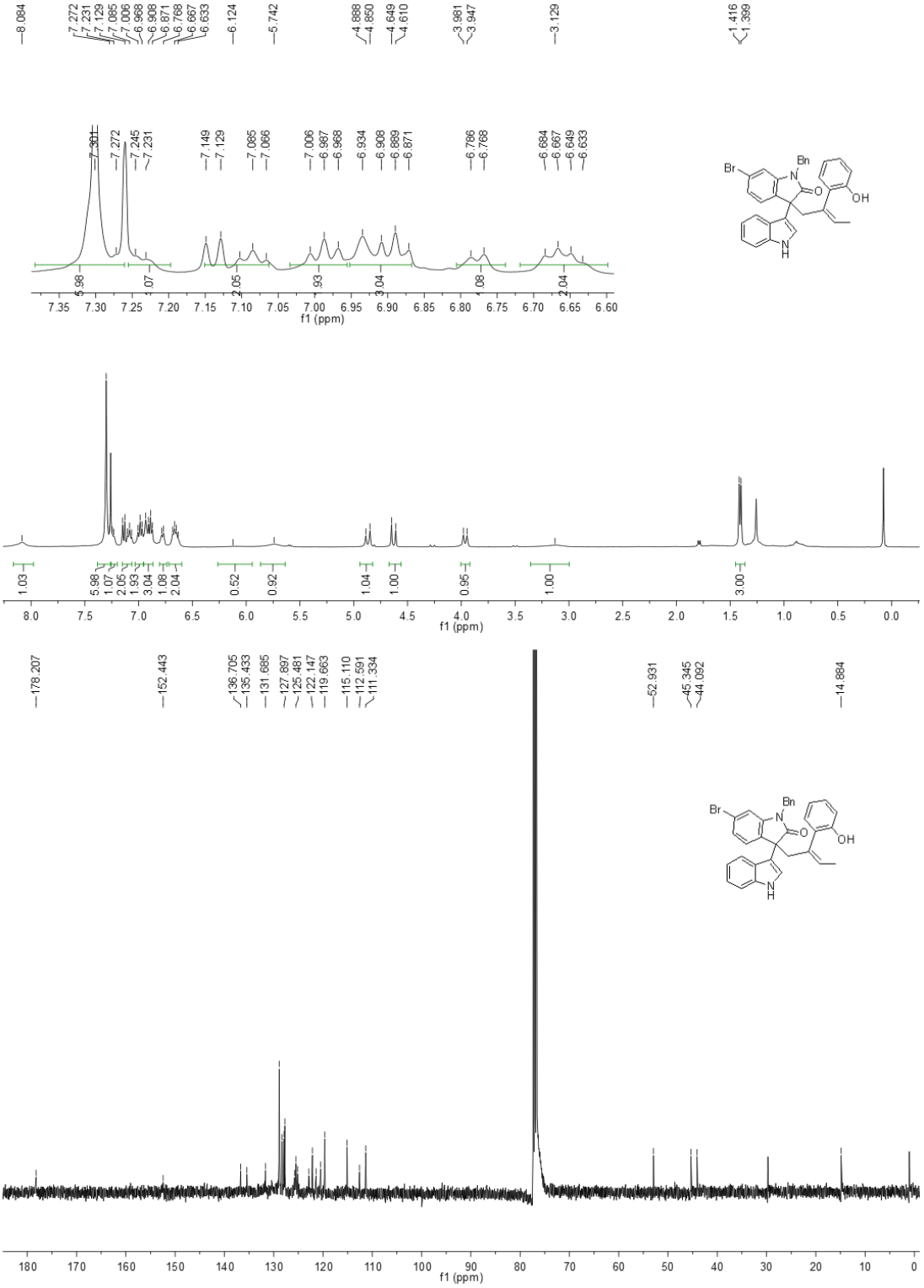

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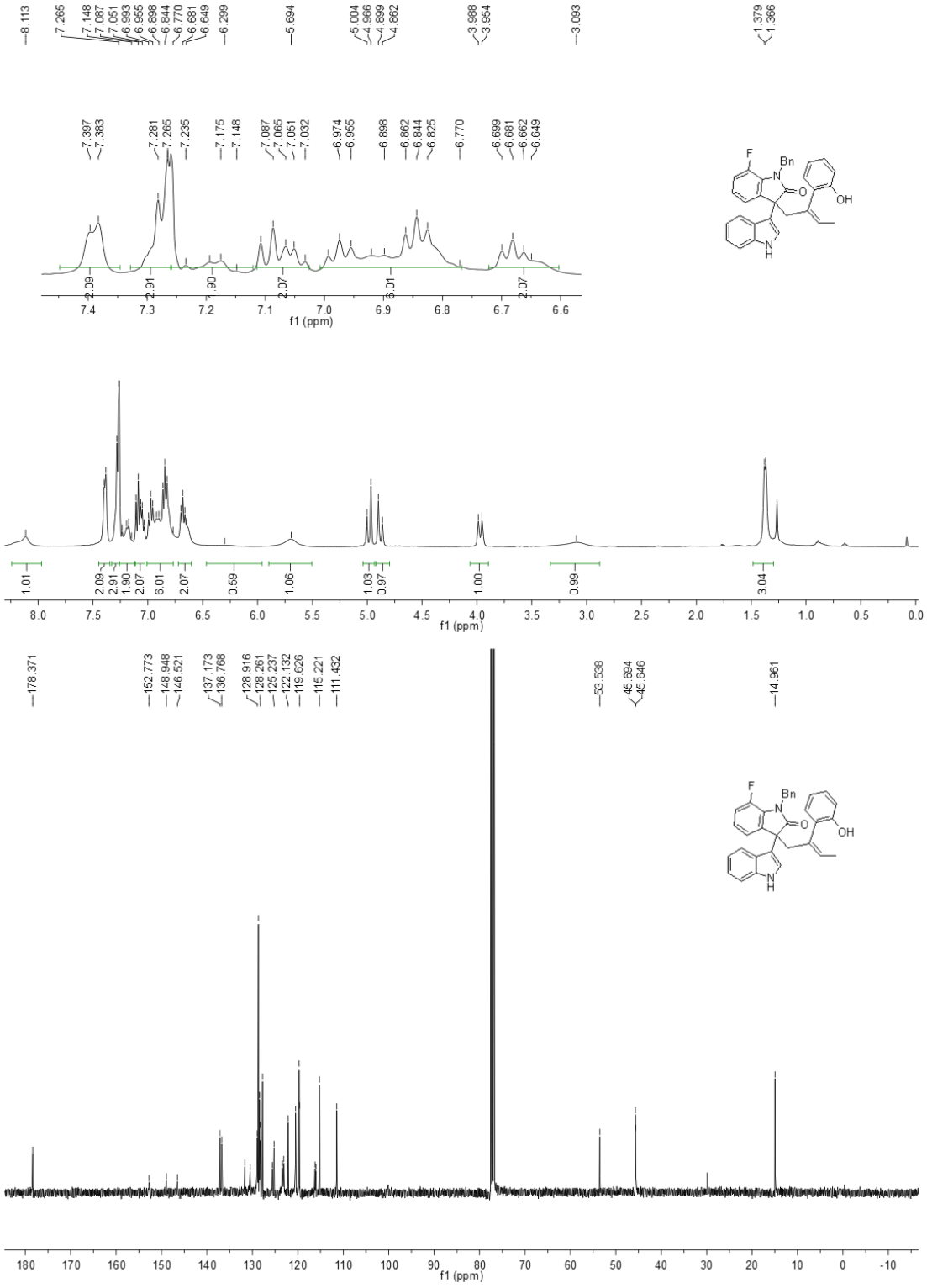
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5.694
5.004
4.966
4.899
4.862
3.988
3.954
3.093
1.379
1.366
7.397
7.383
7.281
7.265
7.235
7.175
7.148
7.087
7.065
7.051
7.032
6.974
6.955
6.898
6.862
6.844
6.825
6.770
6.699
6.681
6.662
6.649
2.09
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2.07
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N
O
OH
H
1.01
2.09
2.91
1.90
2.07
6.01
2.07
0.59
1.06
1.03
0.97
1.00
0.99
3.04
f1 (ppm)
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152.773
148.948
146.521
137.173
136.768
128.916
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45.646
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f1 (ppm)

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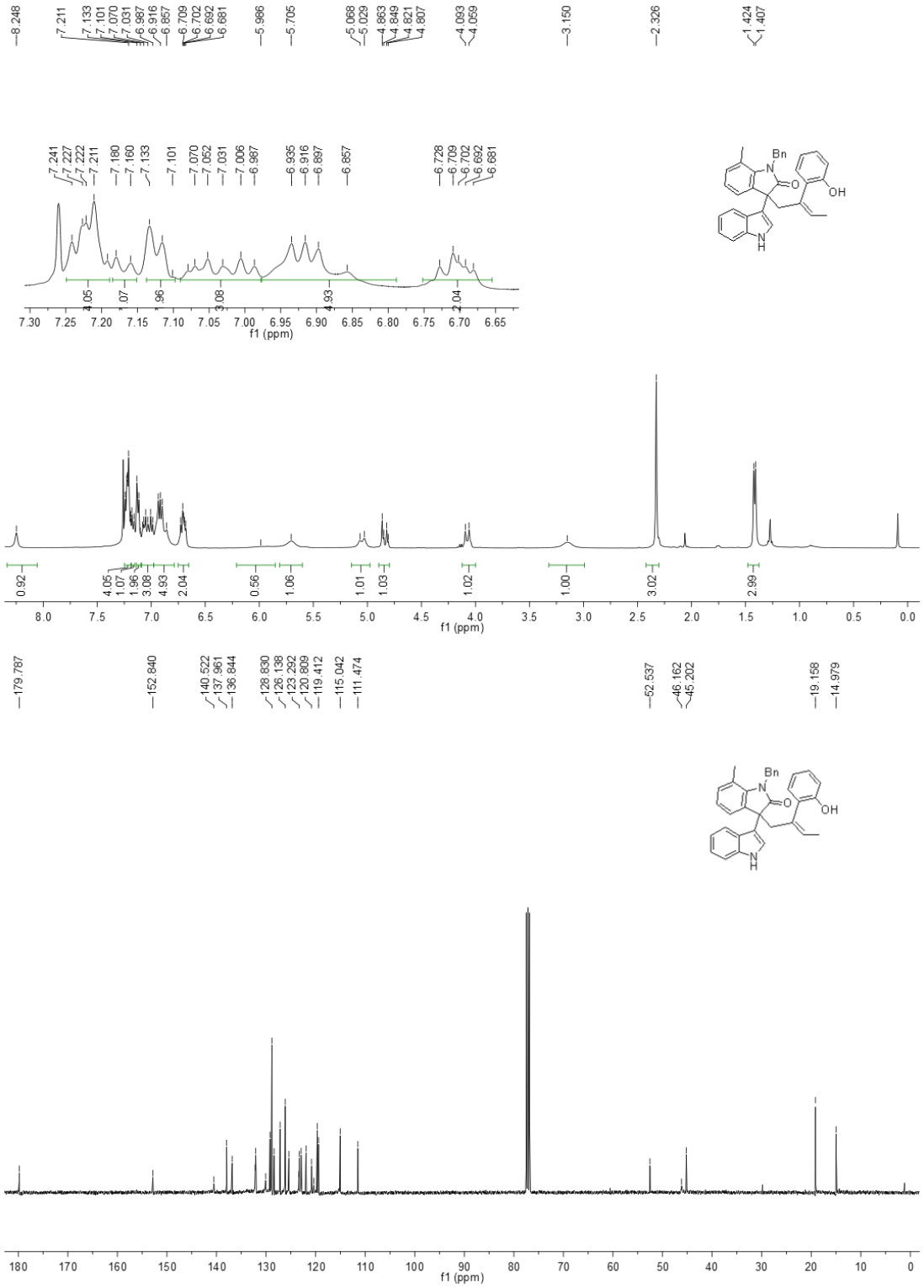
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6.681
5.986
5.705
5.068
5.029
4.863
4.849
4.821
4.807
4.093
4.059
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2.326
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Bn
N
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OH
H
f1 (ppm)
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136.844
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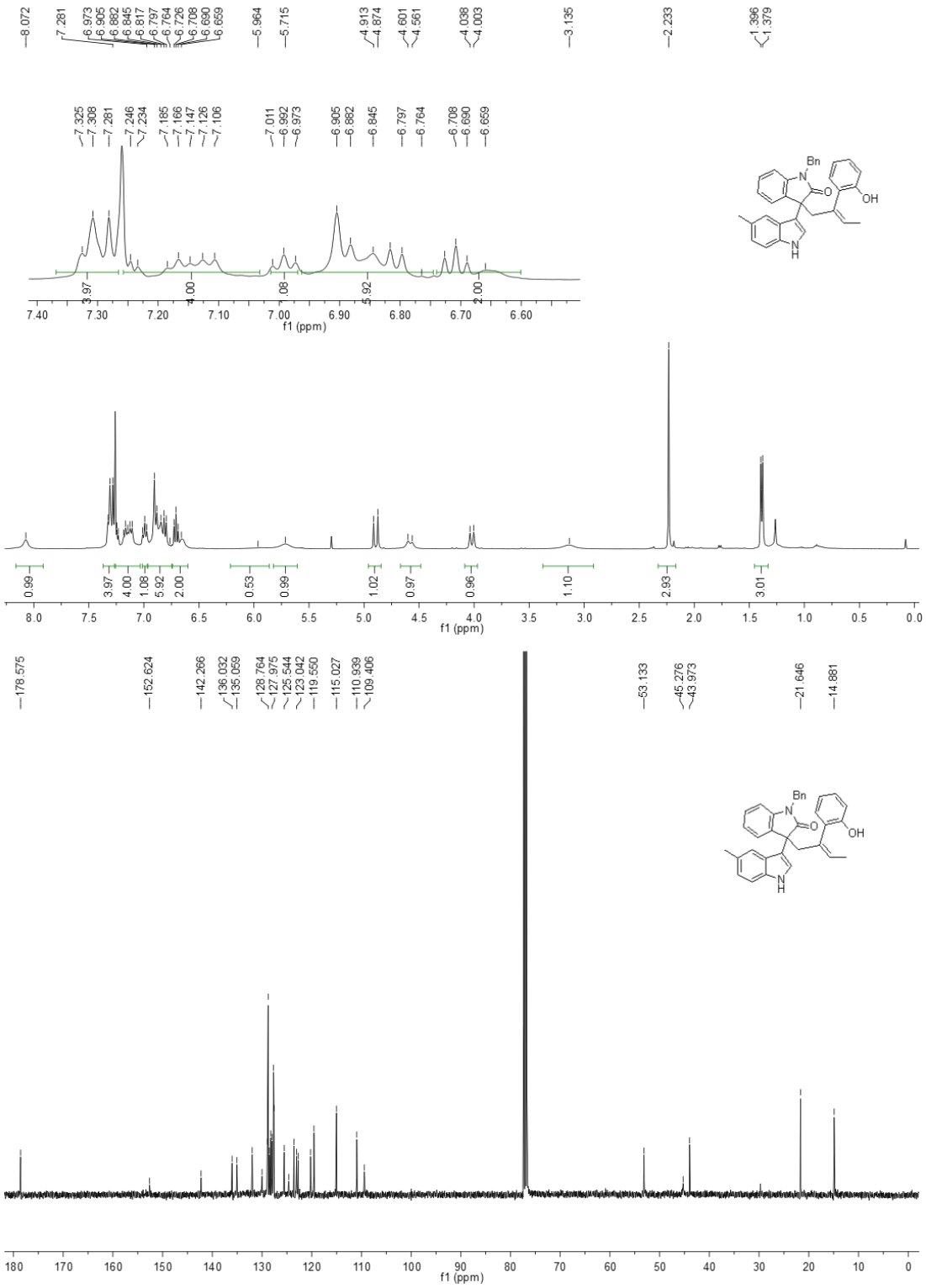
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6.690
6.659
5.964
5.715
4.913
4.874
4.601
4.561
4.038
4.003
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2.233
1.396
1.379
Bn
OH
N
O
H
f1 (ppm)
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152.624
142.266
136.032
135.059
128.764
127.975
125.544
123.042
119.550
115.027
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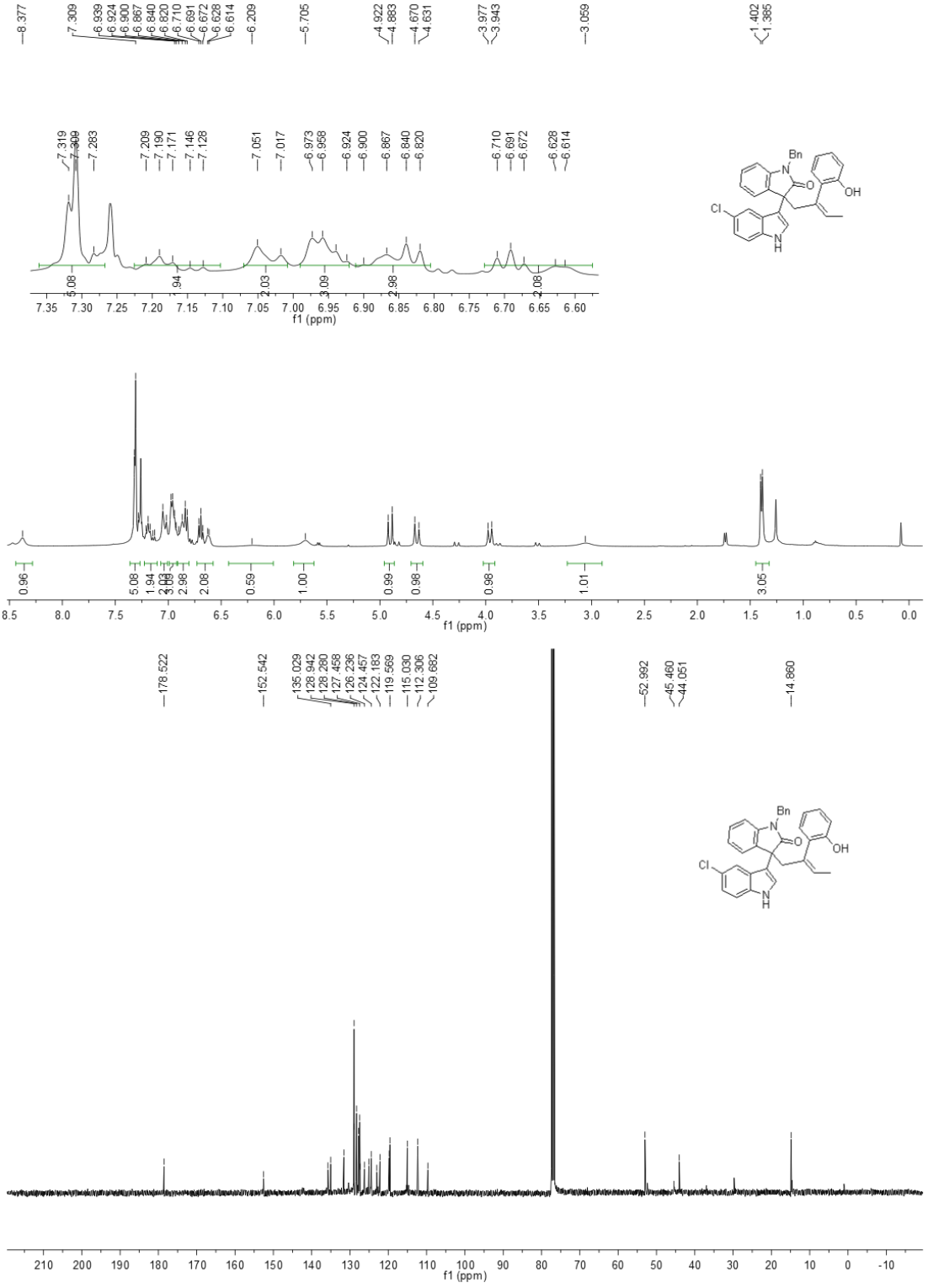
45.276
43.973
21.646
14.881

3nb: (inseparable 5:1 *Z*/*E* isomers)



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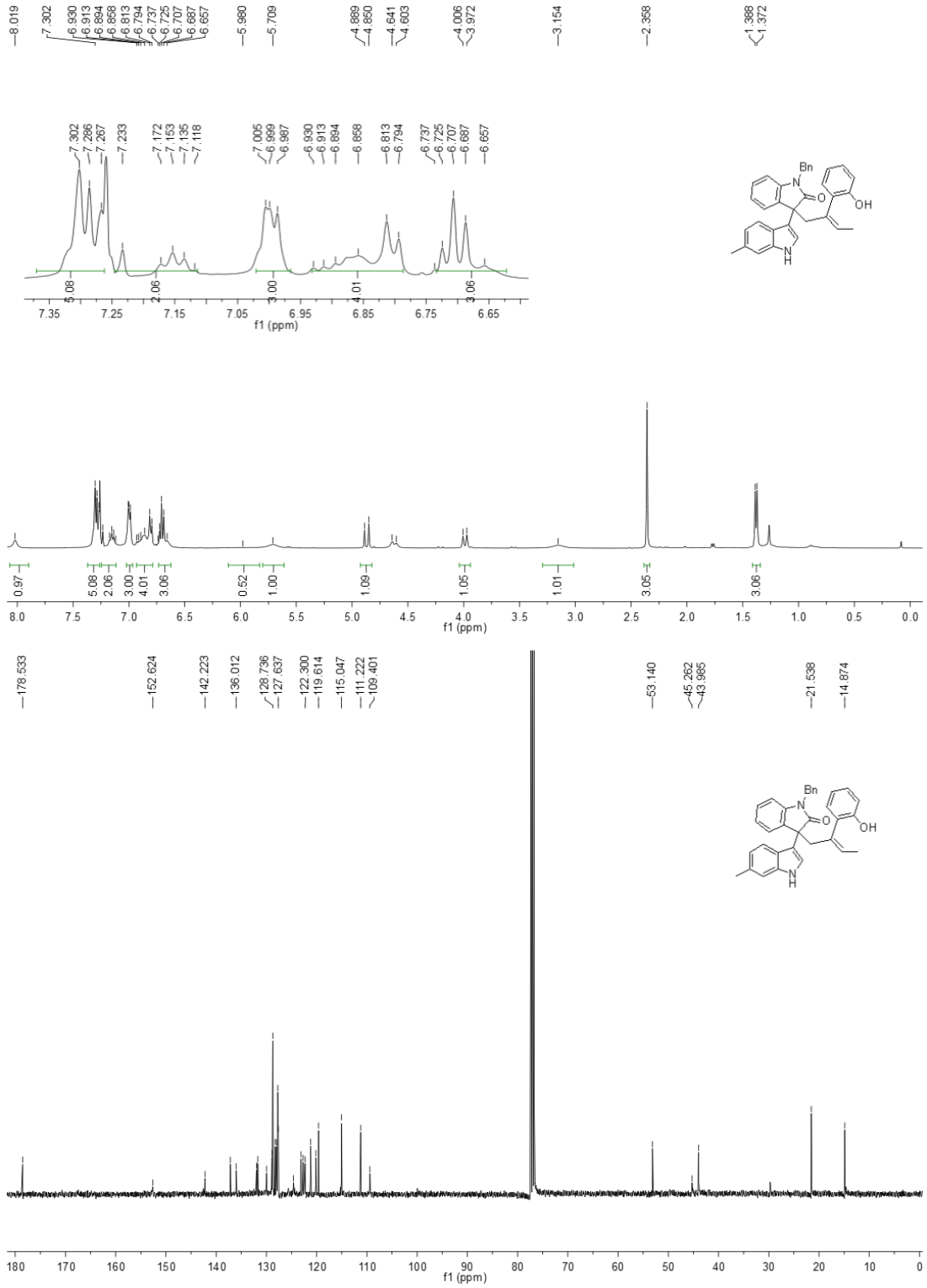
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5.980
5.709
4.889
4.850
4.641
4.603
4.006
3.972
3.154
2.358
1.388
1.372
7.302
7.286
7.267
7.233
7.172
7.153
7.135
7.118
7.005
6.999
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6.913
6.894
6.858
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6.794
6.737
6.725
6.707
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3.06
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7.25
7.15
7.05
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6.65
f1 (ppm)
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O
OH
H
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3.06
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1.09
1.05
1.01
3.05
3.06
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
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f1 (ppm)
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115.047
111.222
109.401
53.140
45.262
43.985
21.538
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180
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30
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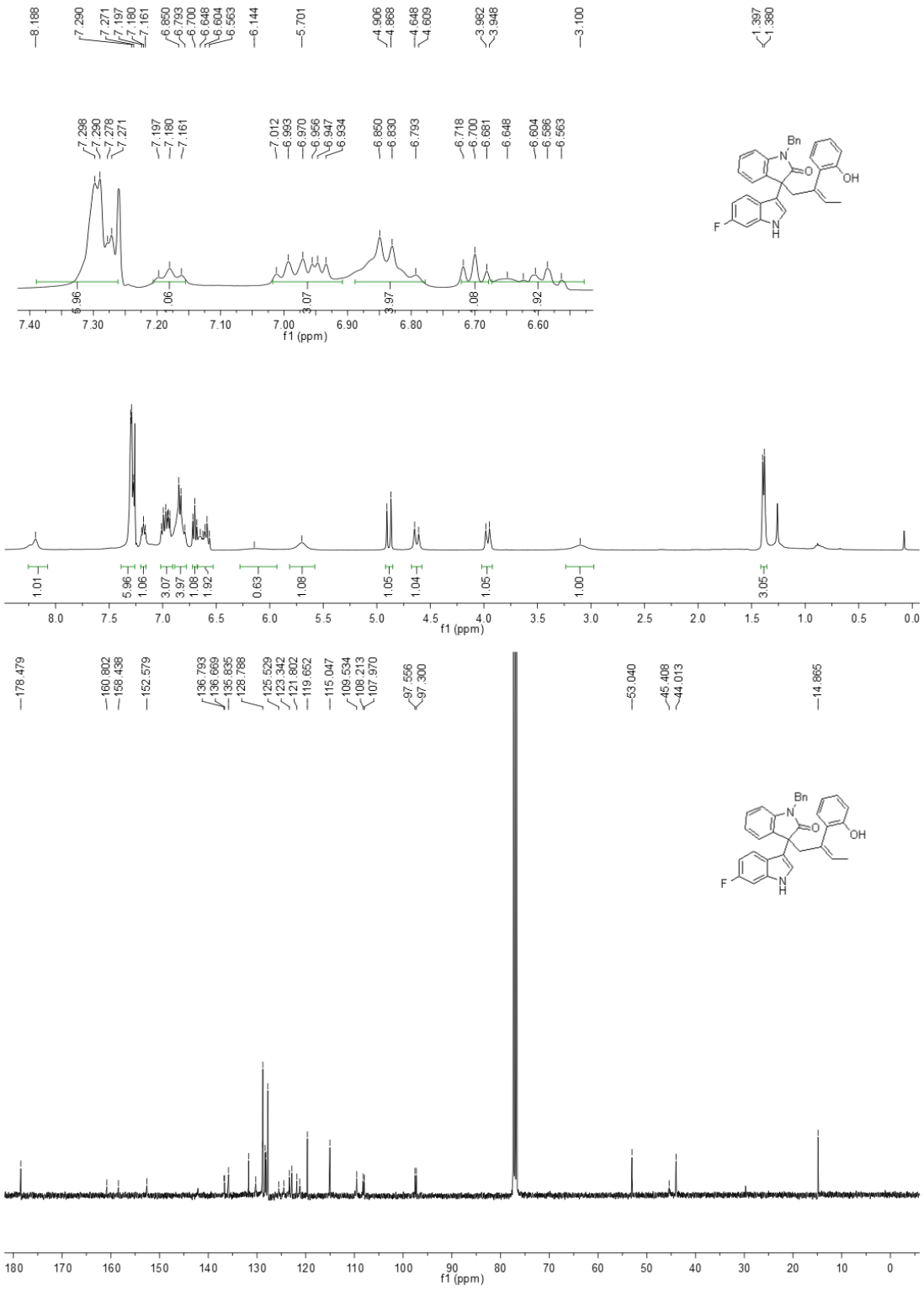
f1 (ppm)

3pb: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5.701
4.906
4.868
4.648
4.609
3.962
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3.100
1.397
1.380
Bn
N
O
OH
F
H
f1 (ppm)
178.479
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158.438
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136.793
136.669
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128.788
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123.342
121.802
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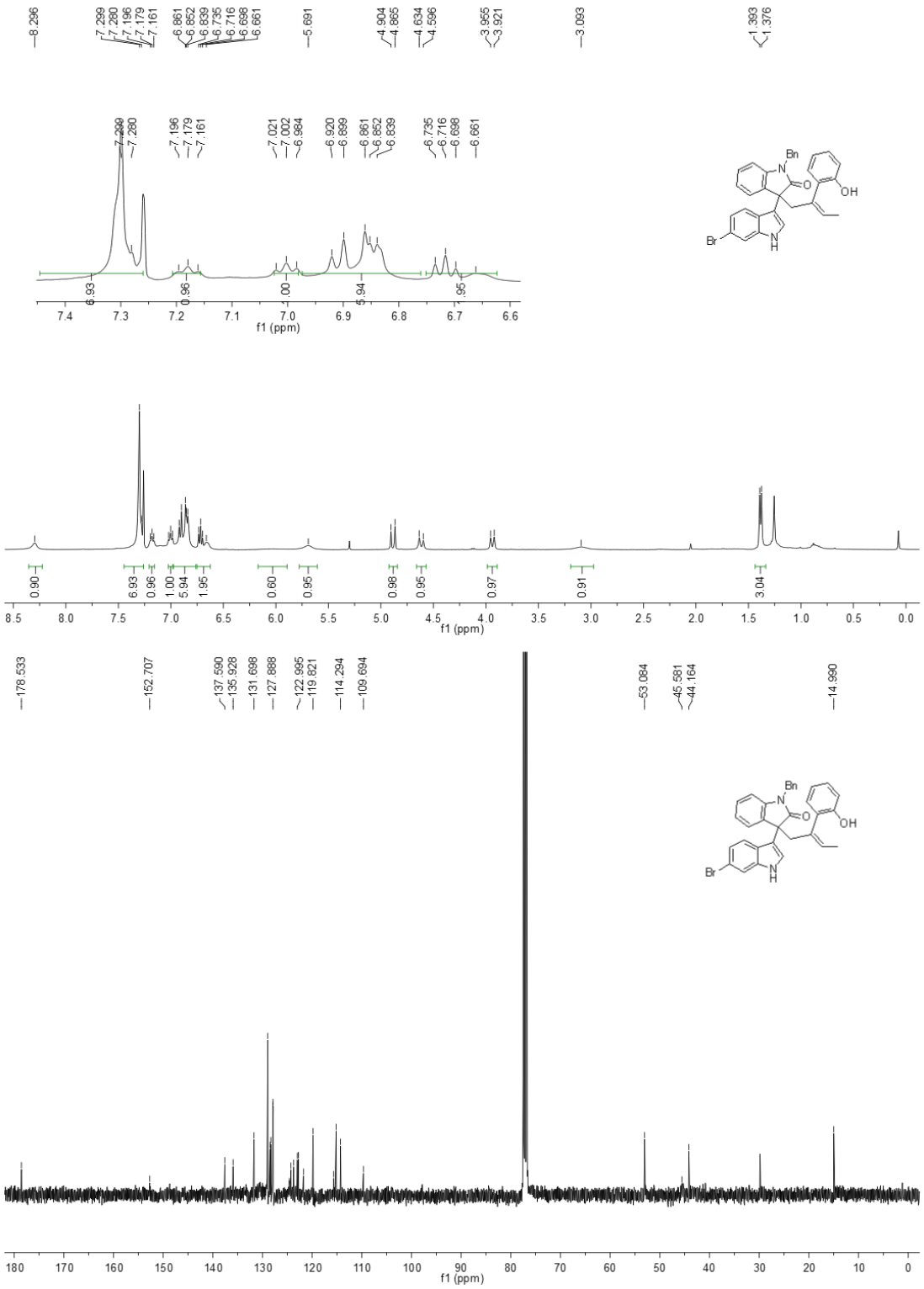
3qb: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7.196
7.179
7.161
6.861
6.852
6.839
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6.716
6.698
6.661
5.691
4.904
4.865
4.634
4.596
3.955
3.921
3.093
1.393
1.376
Bn
N
O
OH
Br
H
f1 (ppm)
178.533
152.707
137.590
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122.995
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114.294
109.694
53.084
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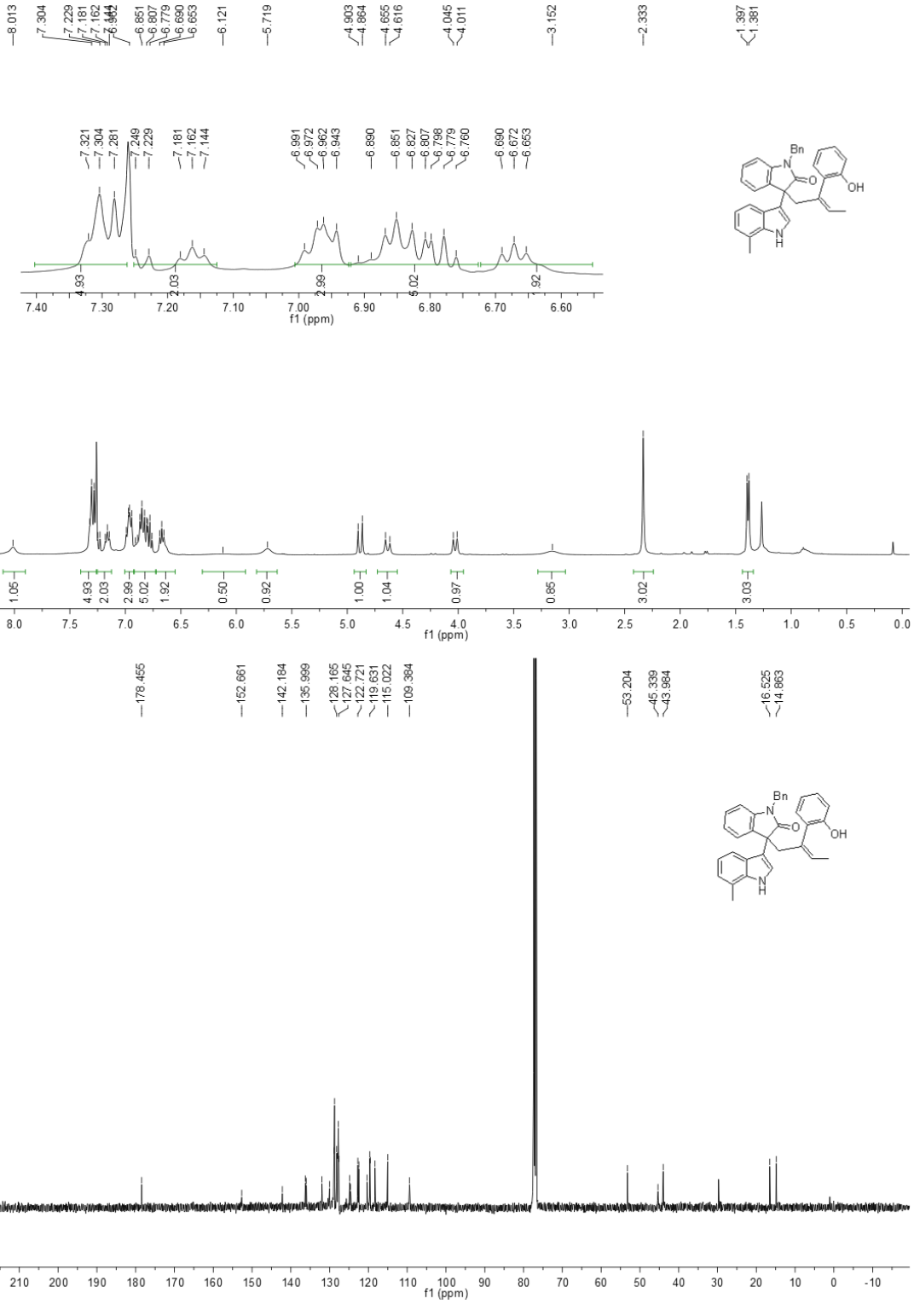
44.164
14.990

3rb :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5.719
4.903
4.864
4.655
4.616
4.045
4.011
3.152
2.333
1.397
1.381
7.321
7.304
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7.249
7.229
7.181
7.162
7.144
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6.972
6.962
6.943
6.890
6.851
6.827
6.807
6.798
6.779
6.760
6.690
6.672
6.653
4.93
2.03
2.99
5.02
.92
f1 (ppm)
Bn
OH
1.05
4.93
2.03
2.99
5.02
1.92
0.50
0.92
1.00
1.04
0.97
0.85
3.02
3.03
f1 (ppm)
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135.999
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OH
f1 (ppm)

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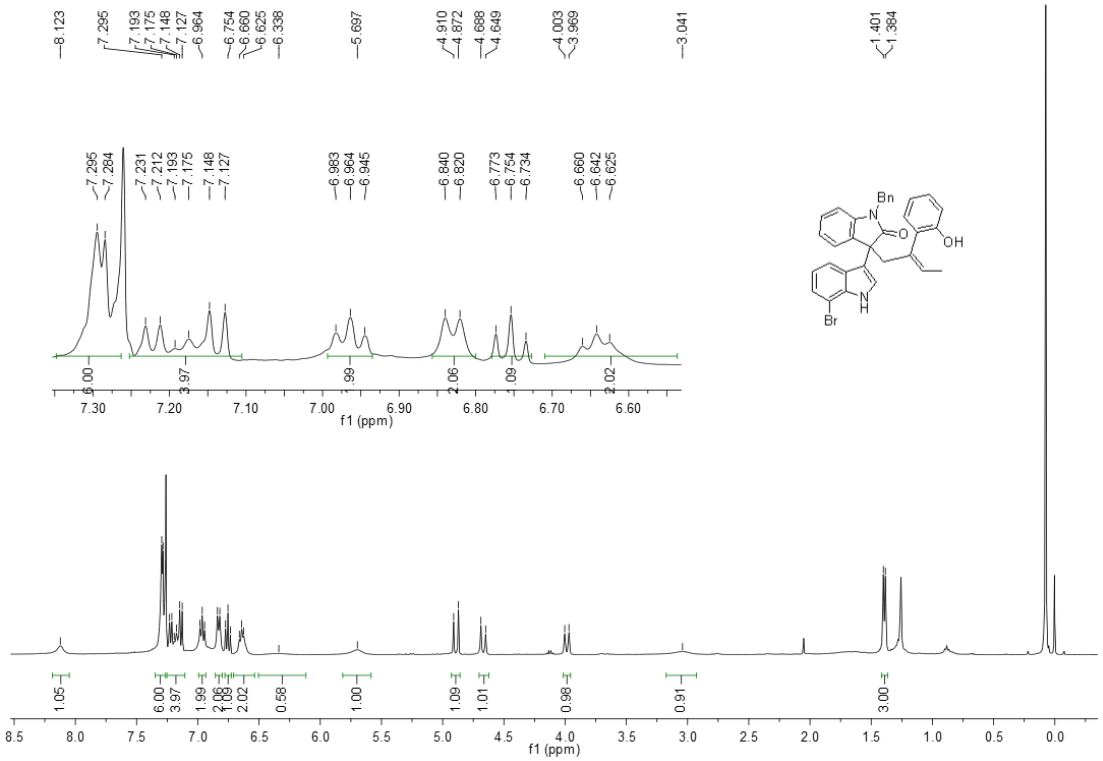
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4.872
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4.649
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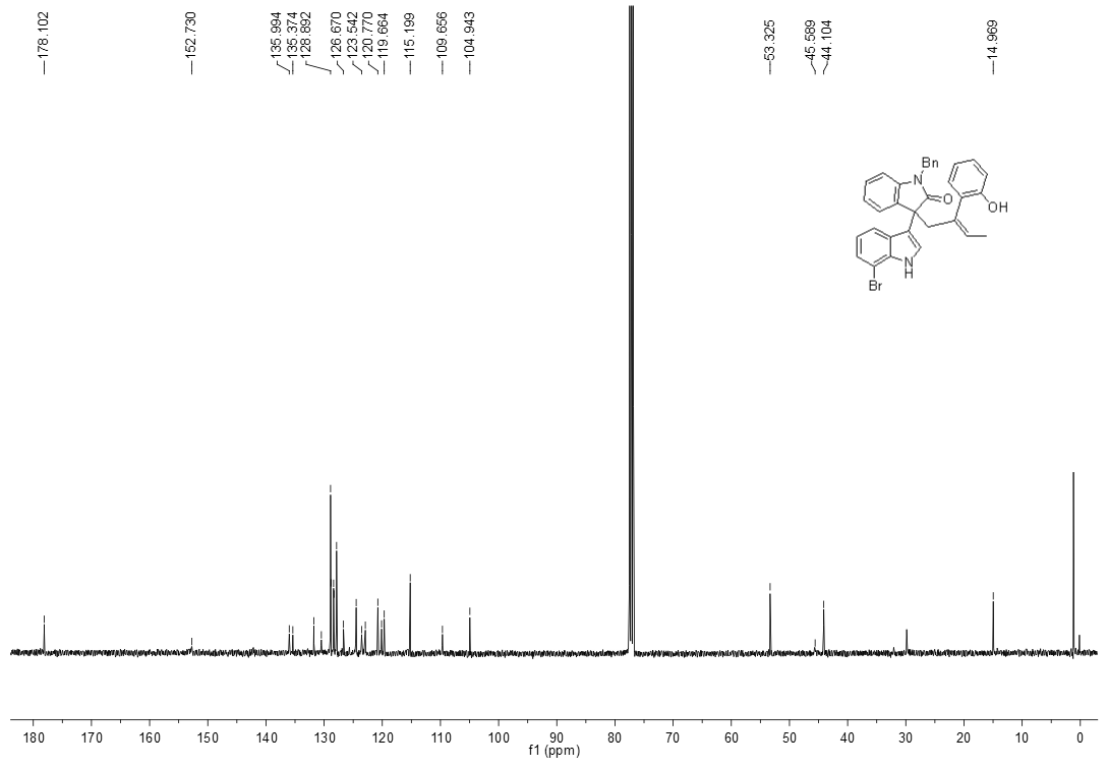
3.969
3.041
1.401
1.384
Bn
N
O
OH
H
Br
f1 (ppm)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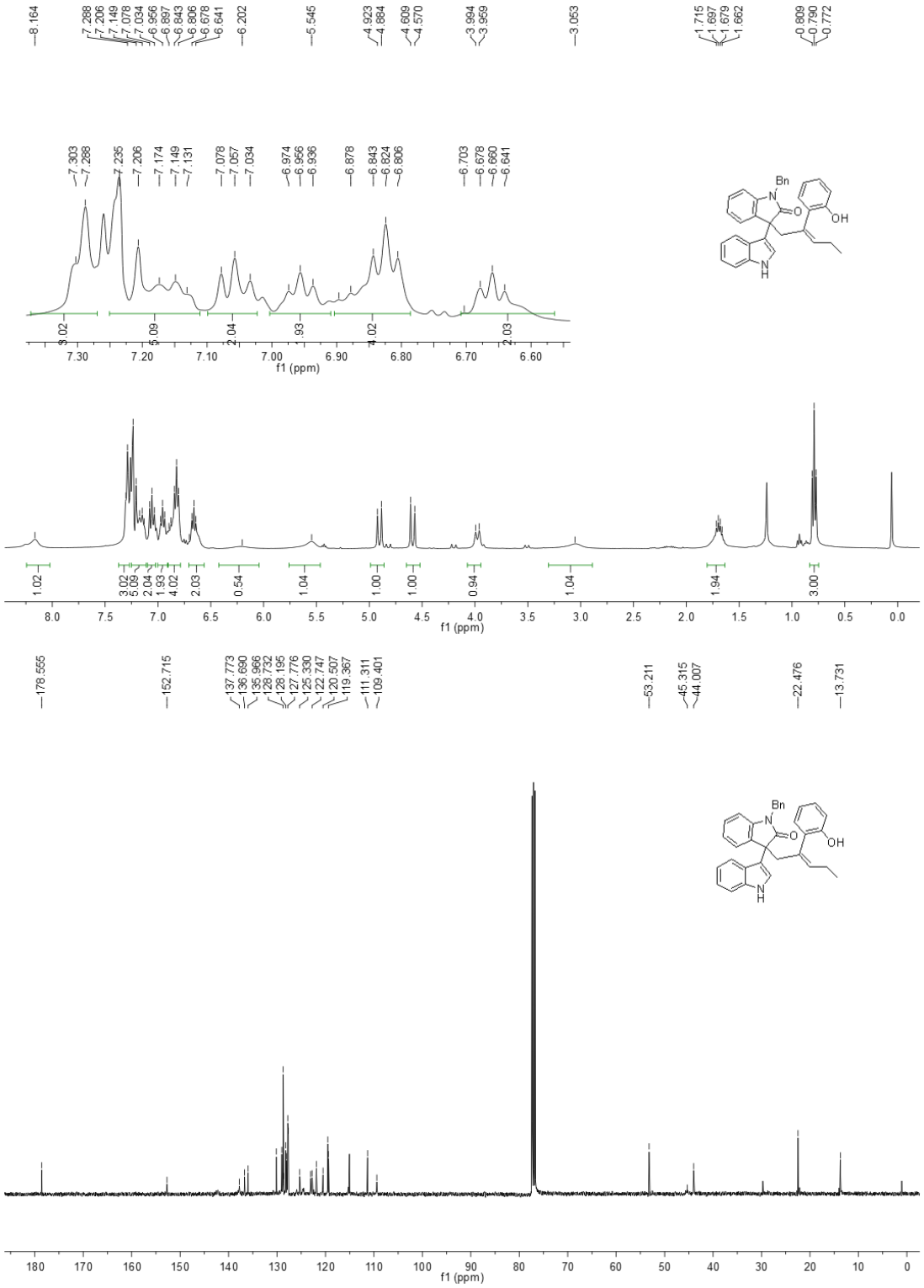
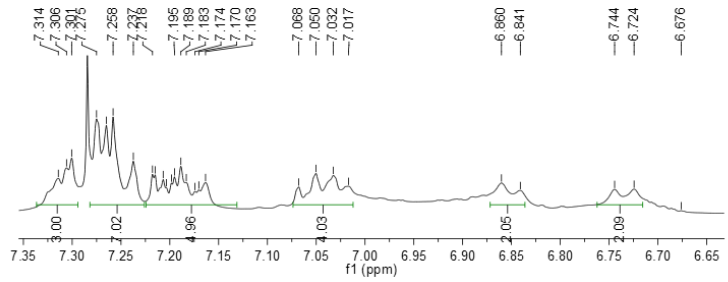
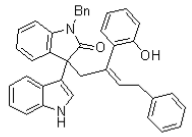
Bn
N
O
OH
H
Br
f1 (ppm)

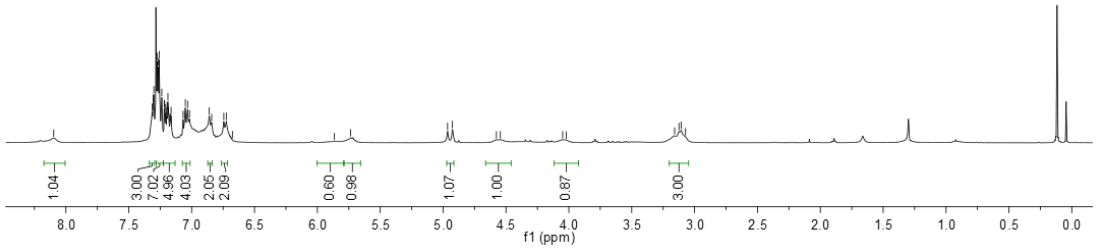
3ac: (inseparable 6:1 *Z*/*E* isomers)

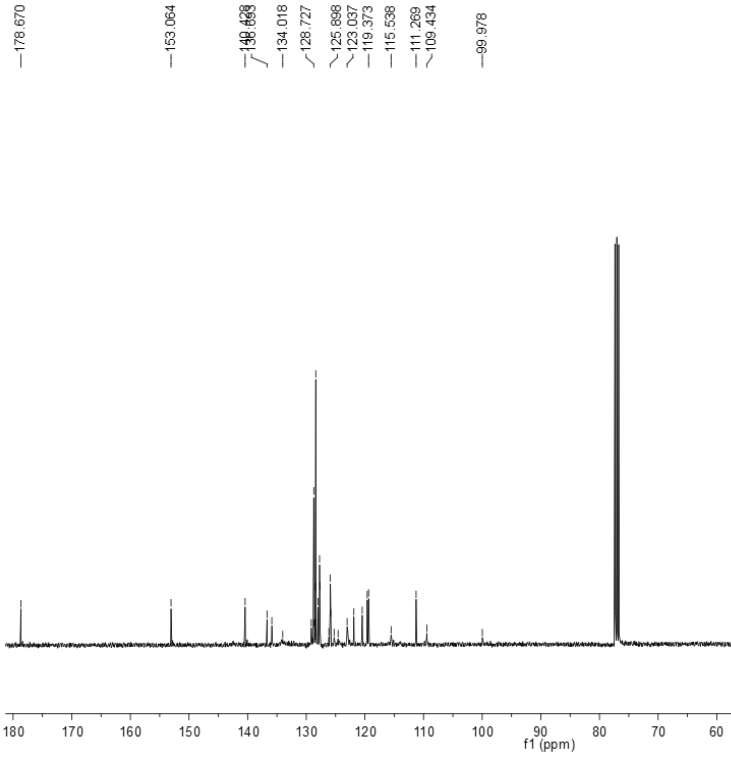


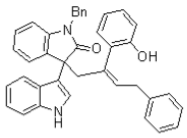
3ad: (inseparable 6:1 *Z*/*E* isomers)











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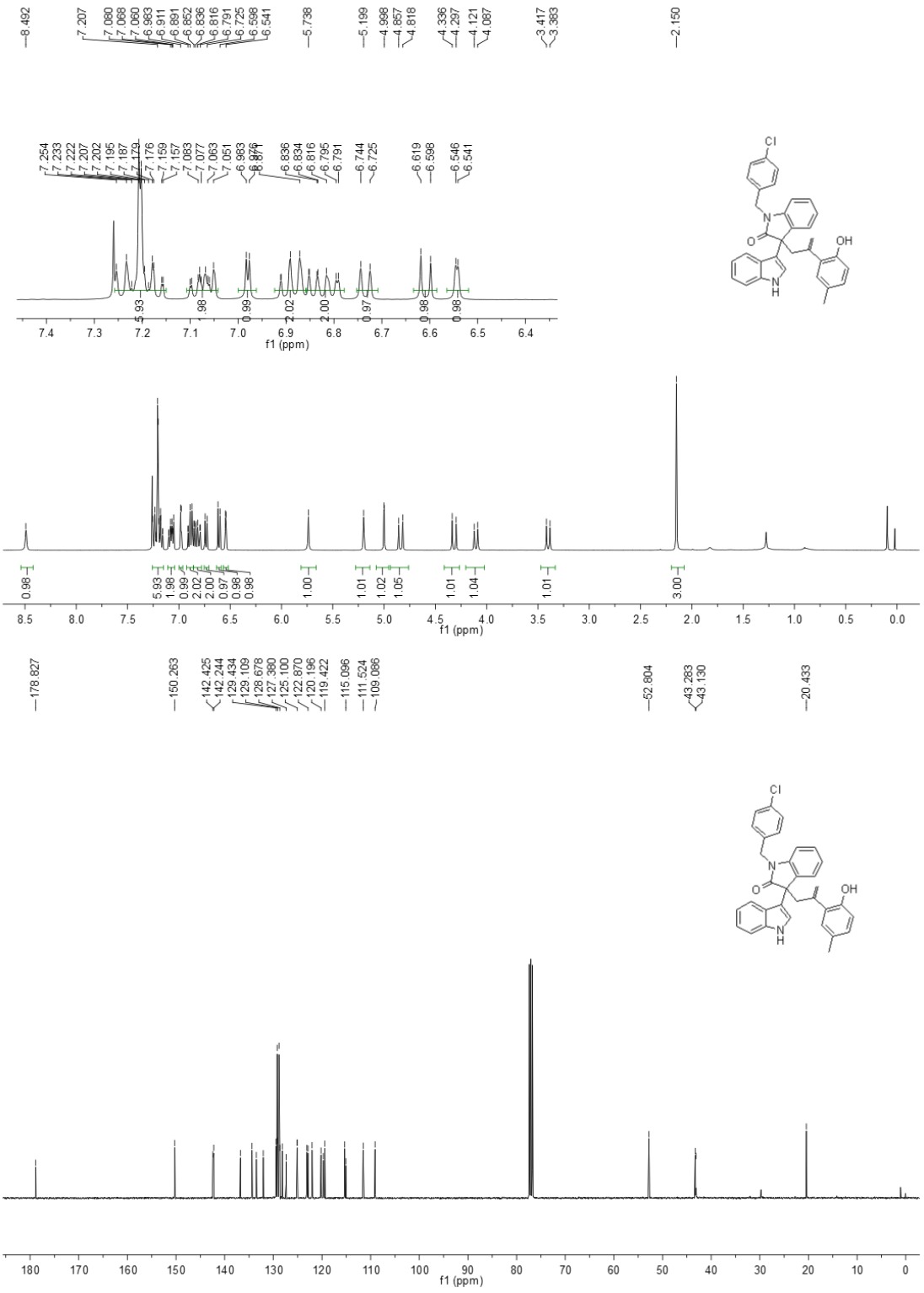
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6.598
6.541
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4.998
4.857
4.818
4.336
4.297
4.121
4.087
3.417
3.383
2.150
Cl
OH
f1 (ppm)
178.827
150.263
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129.434
129.109
128.678
127.380
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122.870
120.196
119.422
115.096
111.524
109.086
52.804
43.283
43.130
20.433

3de:


7.483
7.396
7.376
7.291
7.260
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7.066
7.040
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7.004
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6.760
6.739
6.724
6.705
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6.542
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6.495
6.488
6.474
6.466
5.707
5.700
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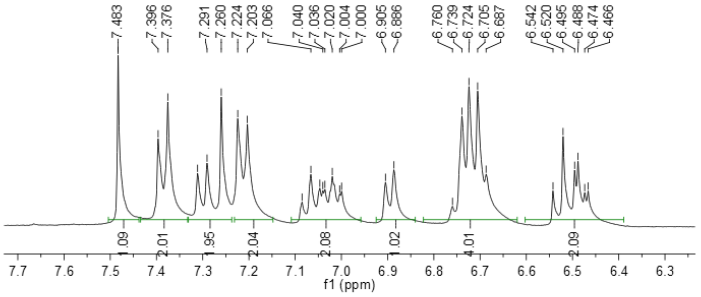
3.452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1.02
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2.09
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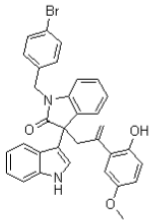
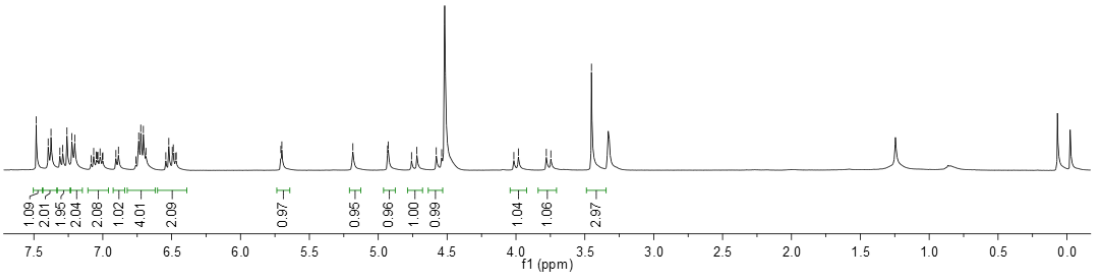
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
f1 (ppm)


Br
N
O
OH
N
H
O


1.09
2.01
1.95
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2.08
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0.99
1.04
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2.97
7.5
7.0
6.5
6.0
5.5
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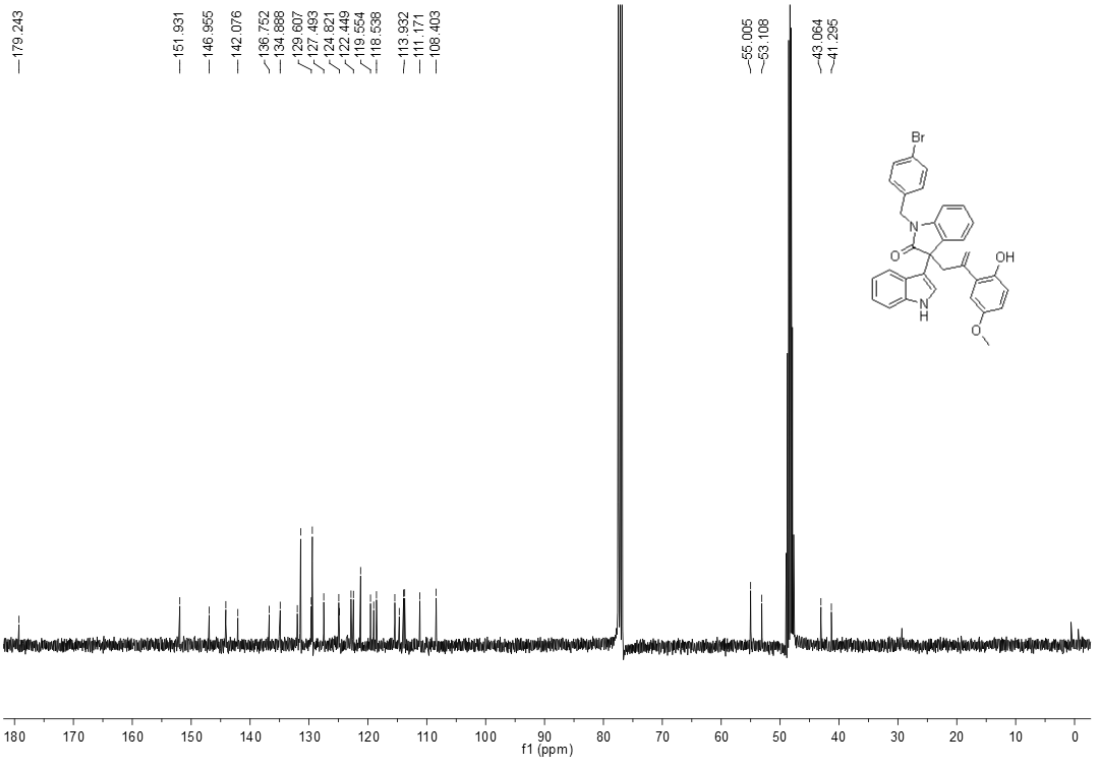
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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151.931
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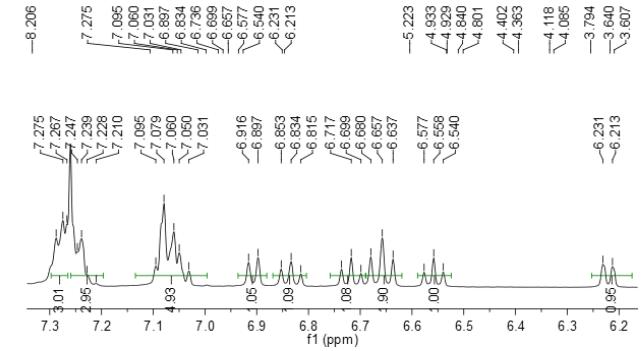
111.171
108.403
55.005
53.108
43.064
41.295
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Br
N
O
OH
N
H
O

3af: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6.213
5.223
4.933
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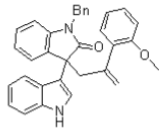
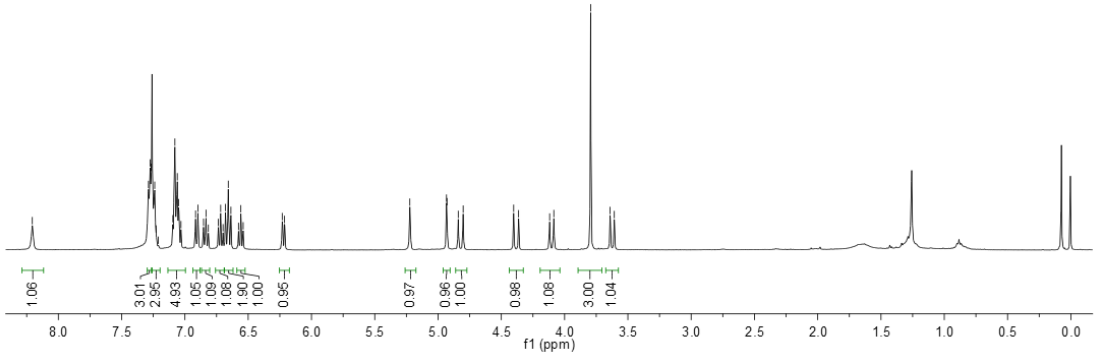
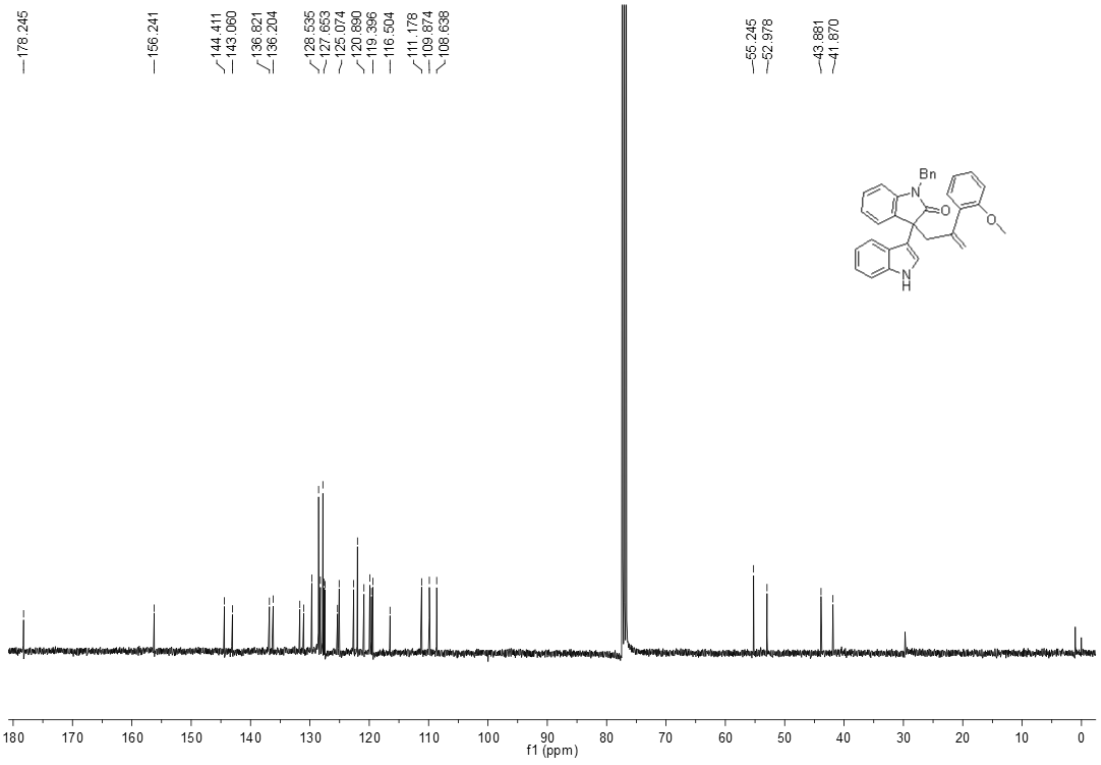
3.794
3.640
3.607
f1 (ppm)


Bn
N
O
O
N
H


f1 (ppm)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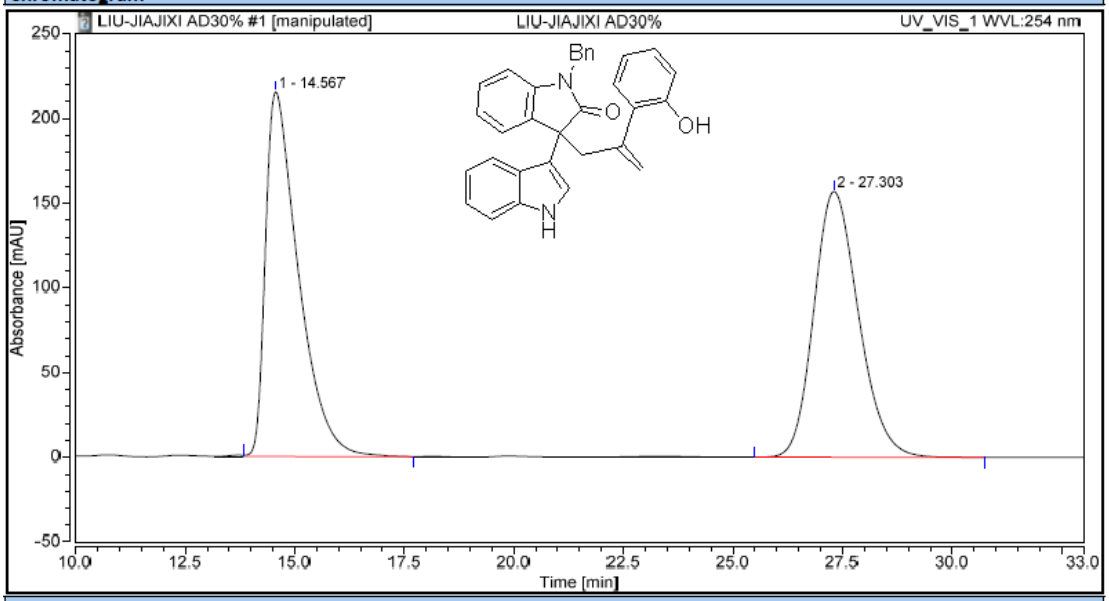
116.504
111.178
109.874
108.638
55.245
52.978
43.881
41.870
f1 (ppm)

Bn
N
O
O
N
H

Chiral HPLC analyses of products 3

3aa:

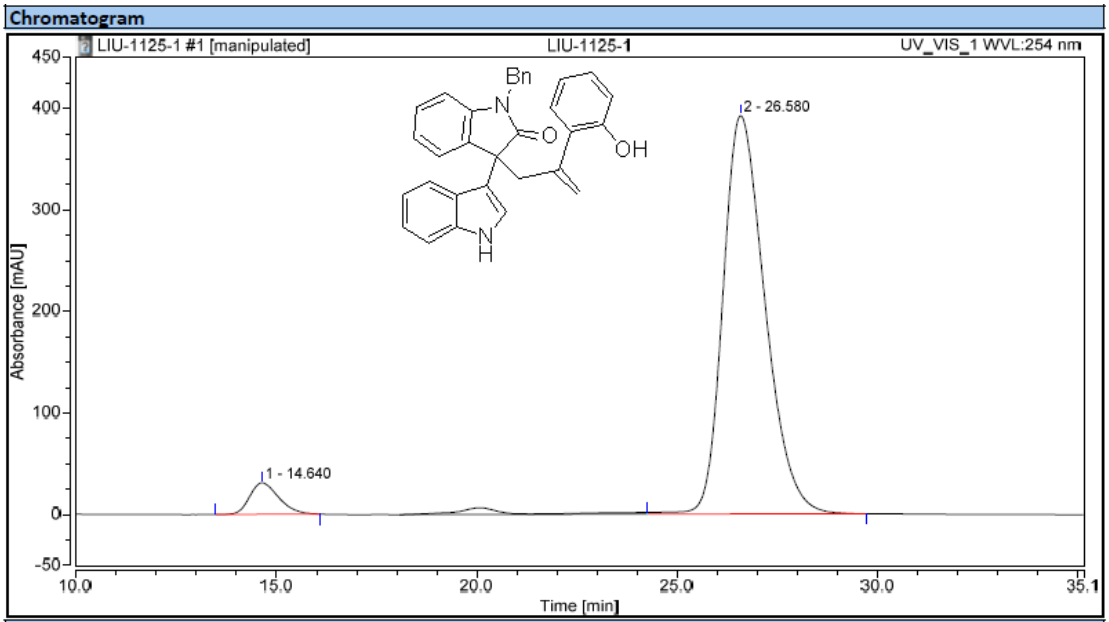
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.567	187.912	215.365	50.26	57.85	n.a.
2		27.303	185.936	156.918	49.74	42.15	n.a.
Total:			**373.848**	**372.283**	**100.00**	**100.00**	

Chromatogram

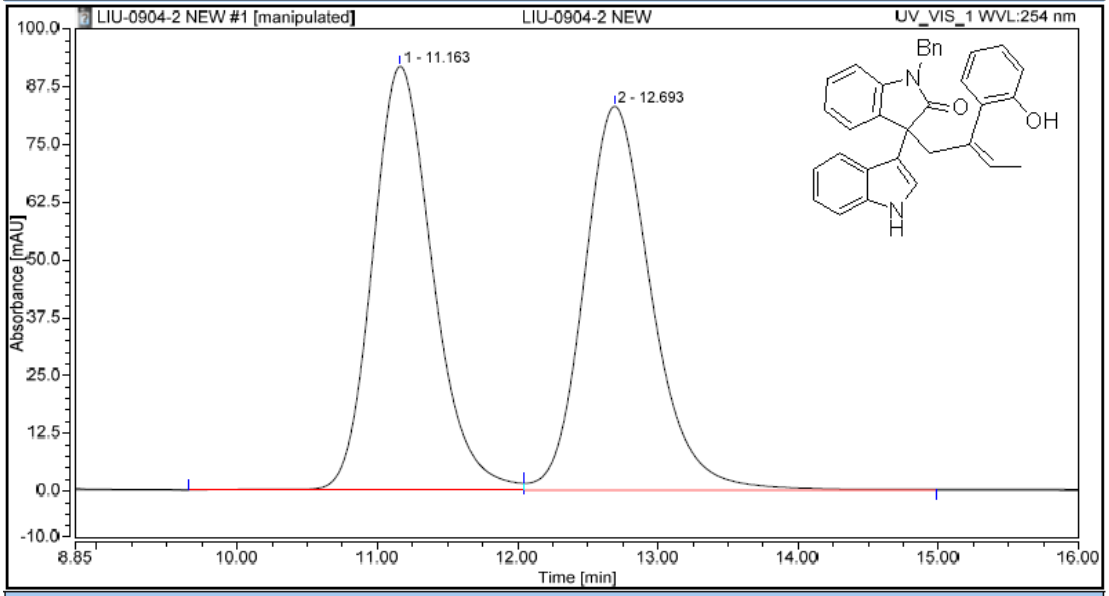


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.640	25.987	30.951	5.18	7.32	n.a.
2		26.580	475.839	392.095	94.82	92.68	n.a.
Total:			**501.826**	**423.047**	**100.00**	**100.00**	

3ab:

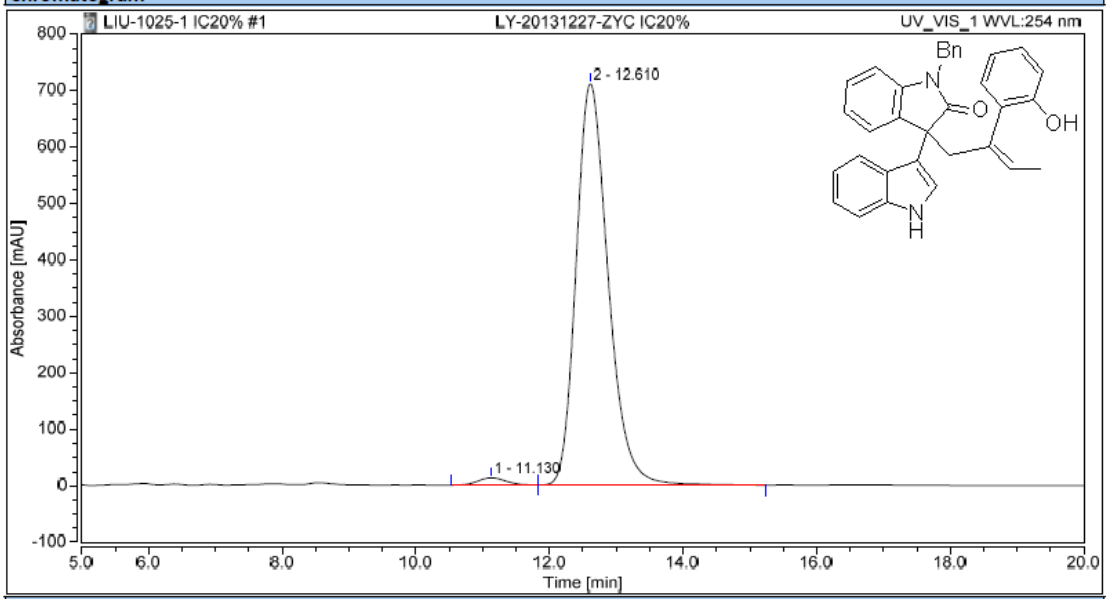
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.163	45.494	91.765	49.46	52.47	n.a.
2		12.693	46.485	83.112	50.54	47.53	n.a.
Total:			**91.978**	**174.877**	**100.00**	**100.00**	

Chromatogram

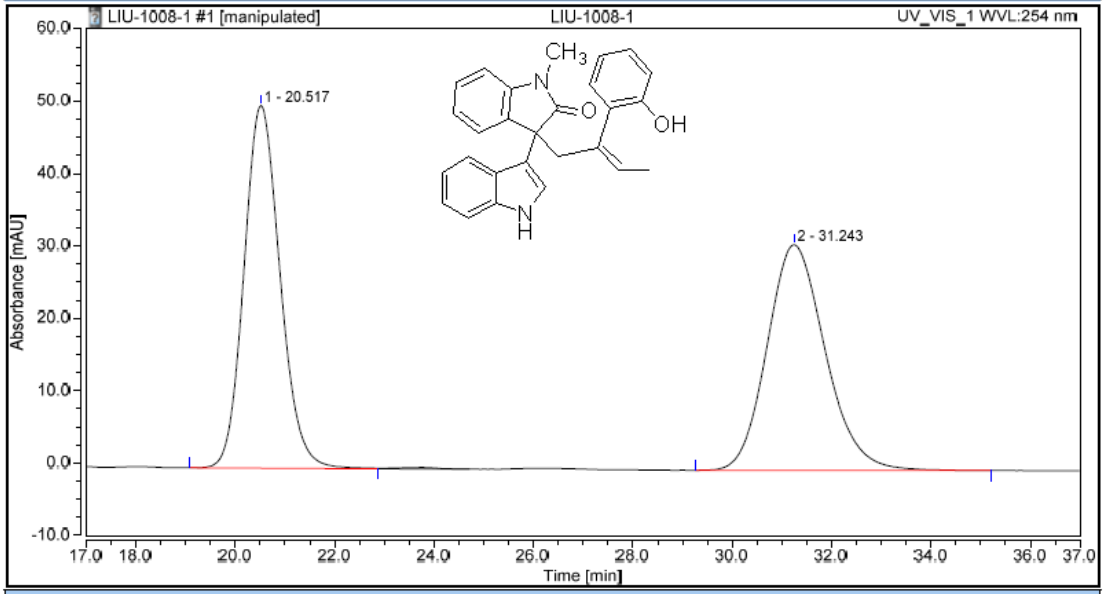


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.130	6.246	12.916	1.56	1.78	n.a.
2		12.610	395.222	711.359	98.44	98.22	n.a.
Total:			**401.468**	**724.275**	**100.00**	**100.00**	

3bb:

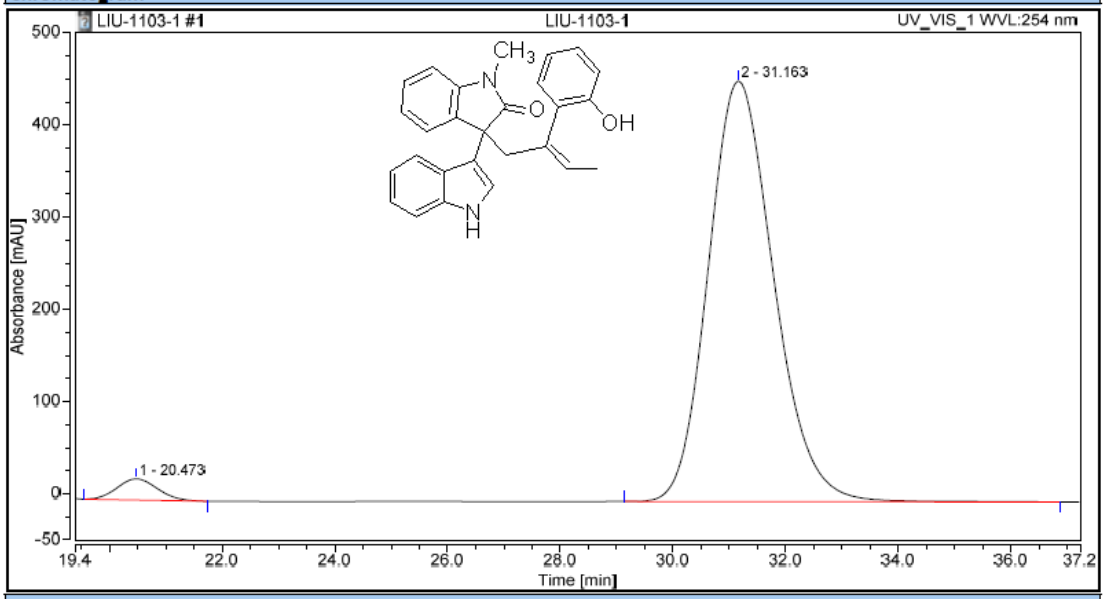
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		20.517	42.150	50.100	49.96	61.66	n.a.
2		31.243	42.215	31.151	50.04	38.34	n.a.
Total:			**84.365**	**81.250**	**100.00**	**100.00**	

Chromatogram

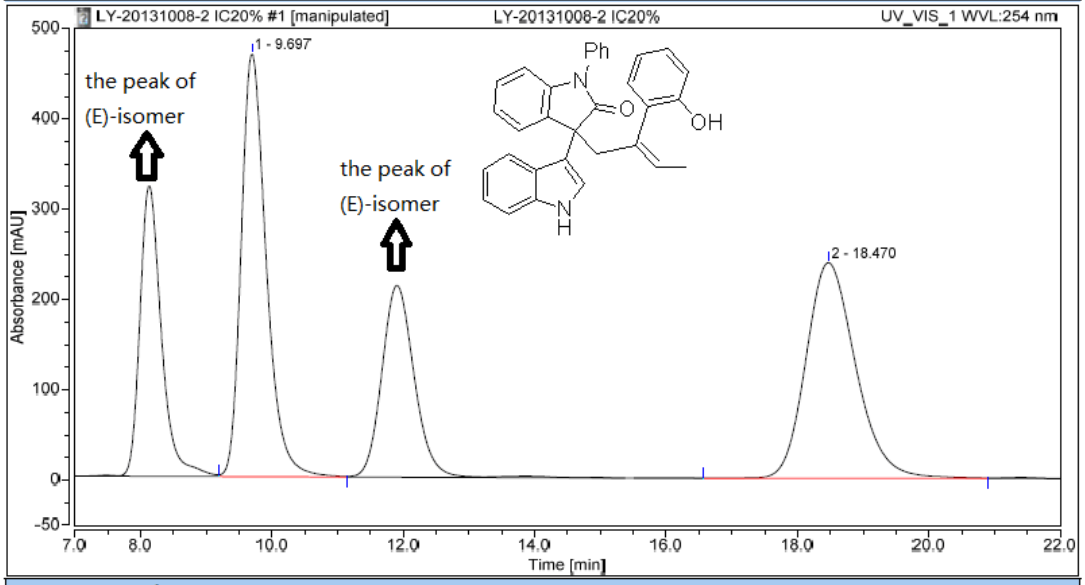


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		20.473	19.077	22.934	3.02	4.79	n.a.
2		31.163	613.581	456.028	96.98	95.21	n.a.
Total:			**632.658**	**478.963**	**100.00**	**100.00**	

3cb:

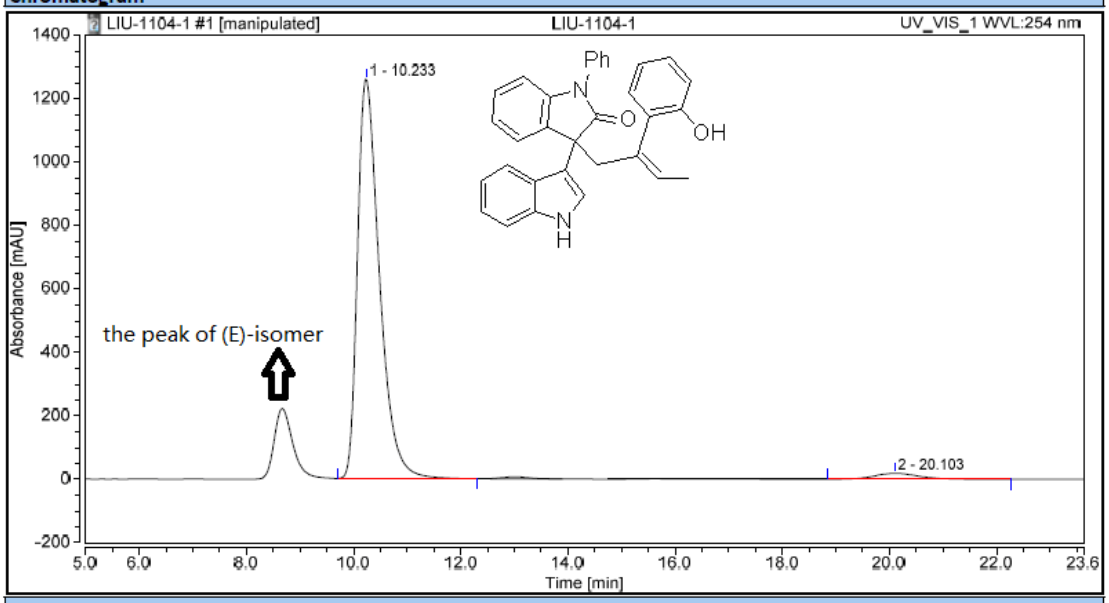
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.697	206.949	468.469	49.66	66.23	n.a.
2		18.470	209.801	238.889	50.34	33.77	n.a.
Total:			**416.750**	**707.358**	**100.00**	**100.00**	

Chromatogram

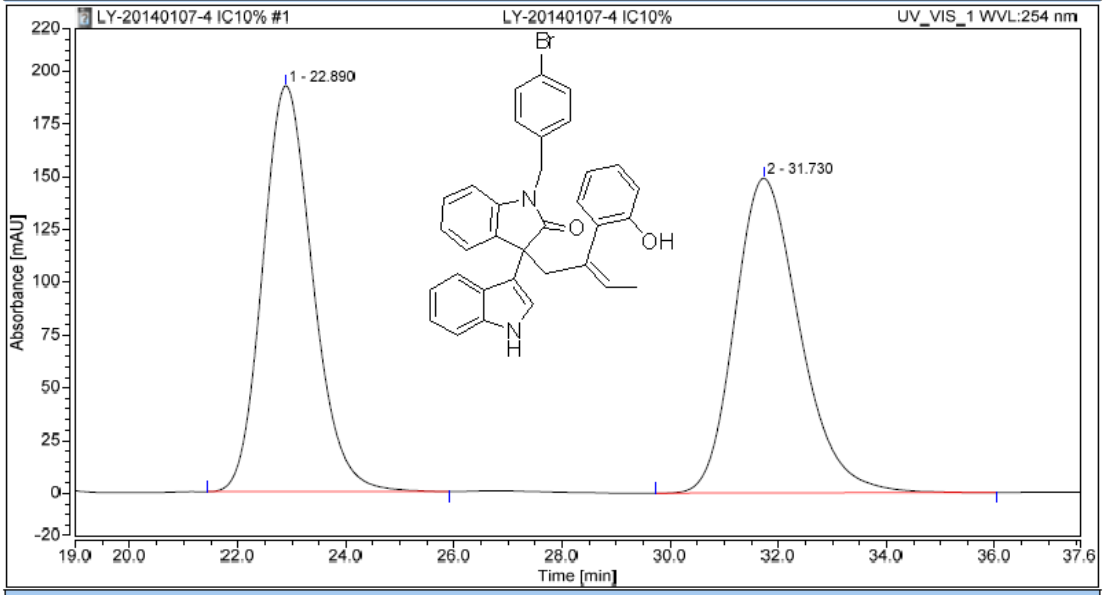


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.233	597.573	1259.792	97.10	98.54	n.a.
2		20.103	17.840	18.703	2.90	1.46	n.a.
Total:			**615.414**	**1278.495**	**100.00**	**100.00**	

3db:

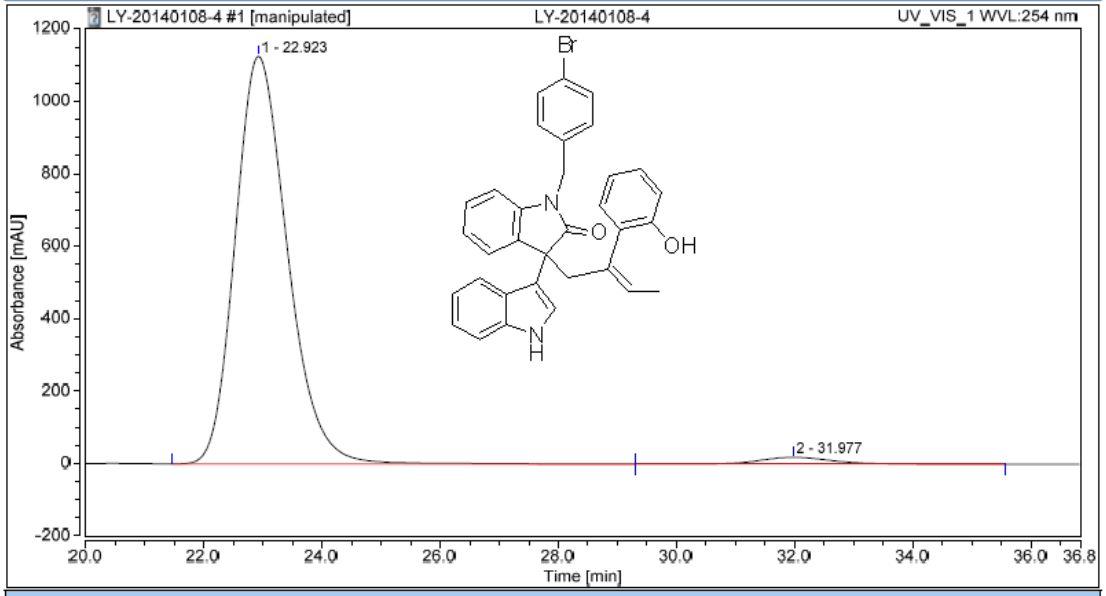
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.890	206.594	192.349	49.90	56.33	n.a.
2		31.730	207.454	149.095	50.10	43.67	n.a.
Total:			**414.048**	**341.444**	**100.00**	**100.00**	

Chromatogram

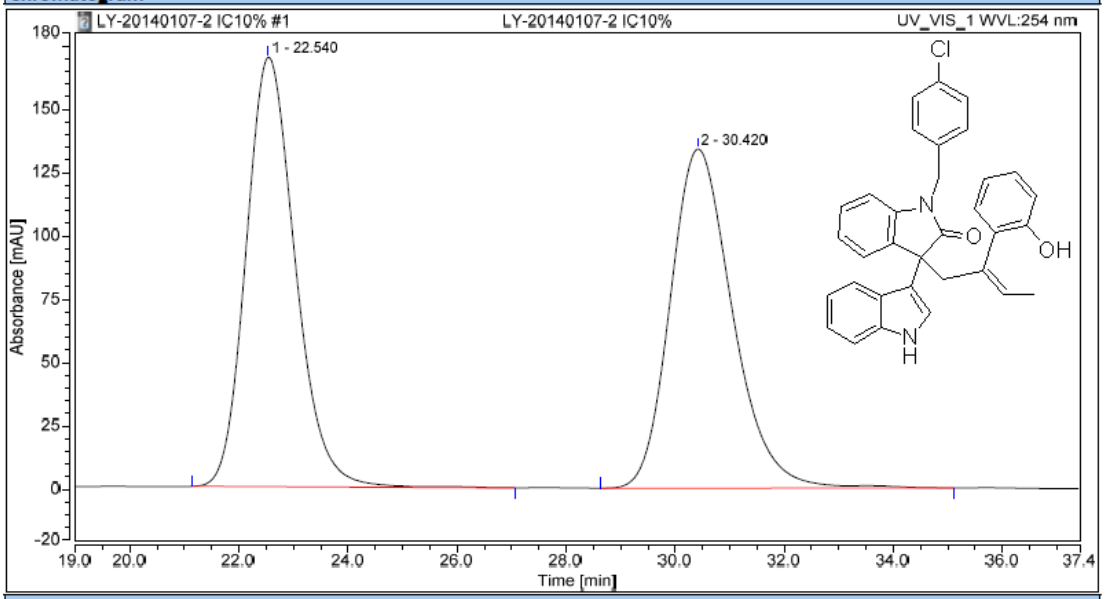


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.923	1152.861	1125.489	97.66	98.32	n.a.
2		31.977	27.673	19.174	2.34	1.68	n.a.
Total:			**1180.535**	**1144.663**	**100.00**	**100.00**	

3eb:

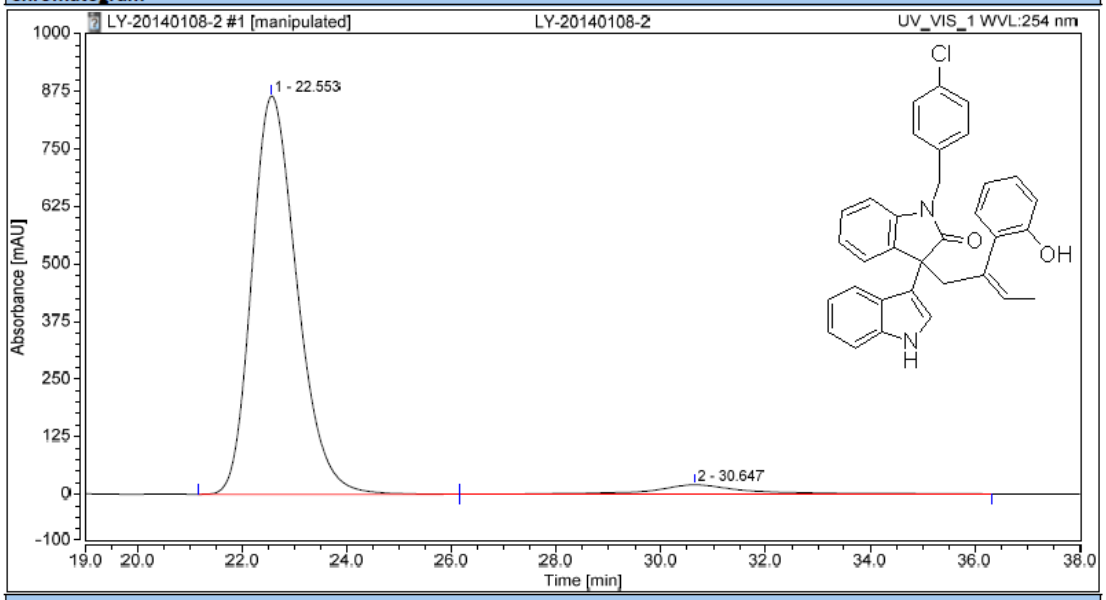
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.540	176.965	169.423	49.99	55.88	n.a.
2		30.420	177.012	133.747	50.01	44.12	n.a.
Total:			**353.977**	**303.170**	**100.00**	**100.00**	

Chromatogram

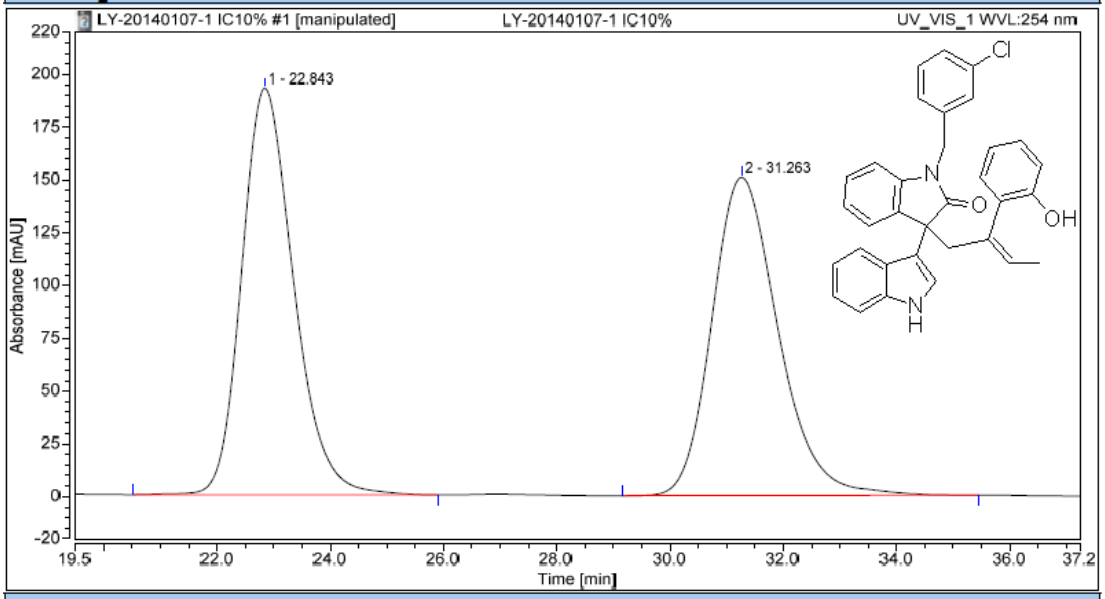


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.553	866.423	865.266	95.35	97.72	n.a.
2		30.647	42.285	20.174	4.65	2.28	n.a.
Total:			**908.708**	**885.440**	**100.00**	**100.00**	

3fb:

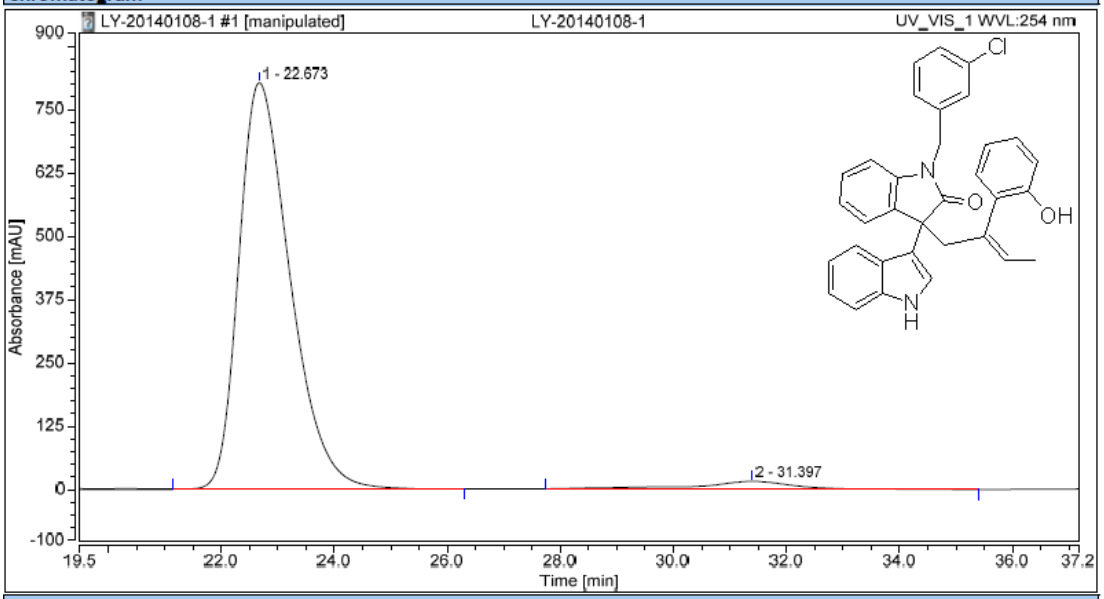
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.843	204.487	192.595	50.03	56.09	n.a.
2		31.263	204.233	150.744	49.97	43.91	n.a.
Total:			408.720	343.339	100.00	100.00	

Chromatogram

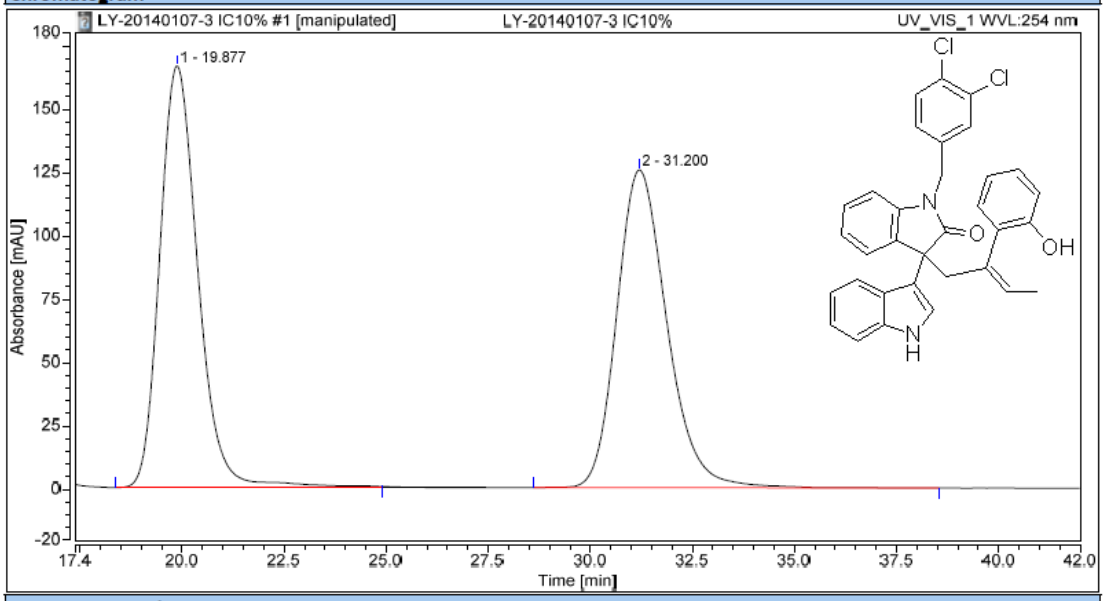


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.673	843.635	802.116	96.04	98.06	n.a.
2		31.397	34.776	15.880	3.96	1.94	n.a.
Total:			878.411	817.996	100.00	100.00	

3gb:

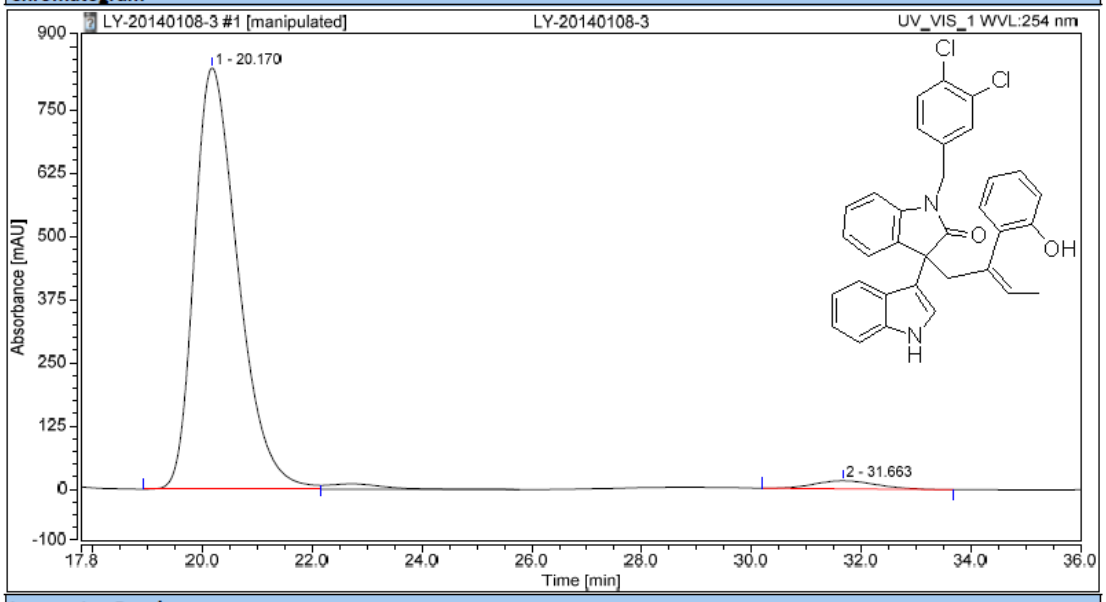
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		19.877	180.134	166.265	50.29	57.03	n.a.
2		31.200	178.052	125.274	49.71	42.97	n.a.
Total:			**358.186**	**291.539**	**100.00**	**100.00**	

Chromatogram

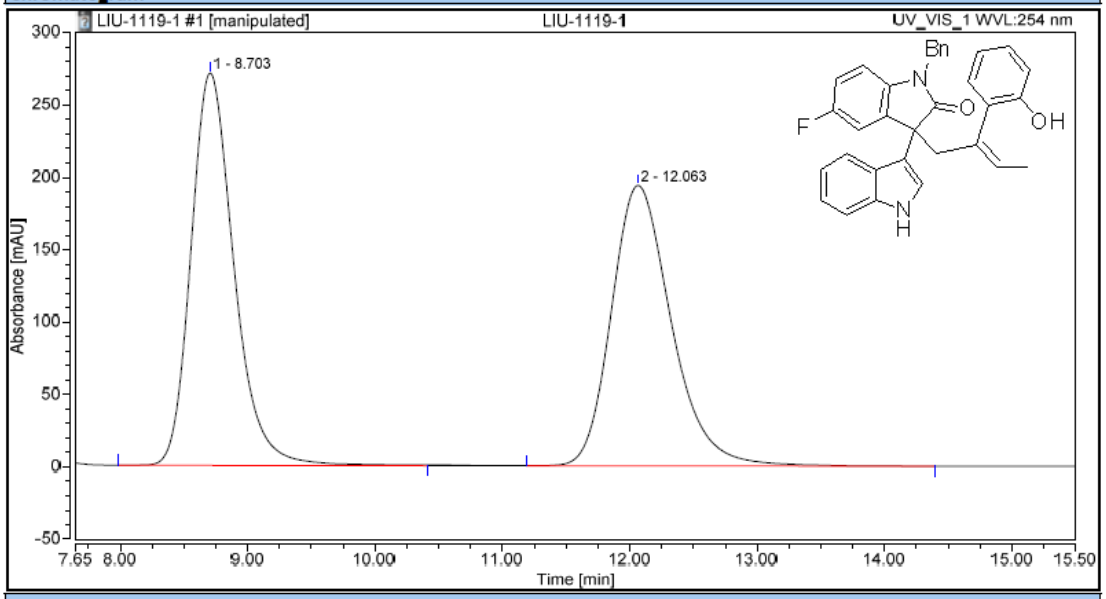


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		20.170	768.049	831.644	97.40	98.13	n.a.
2		31.663	20.530	15.865	2.60	1.87	n.a.
Total:			**788.580**	**847.509**	**100.00**	**100.00**	

3hb:

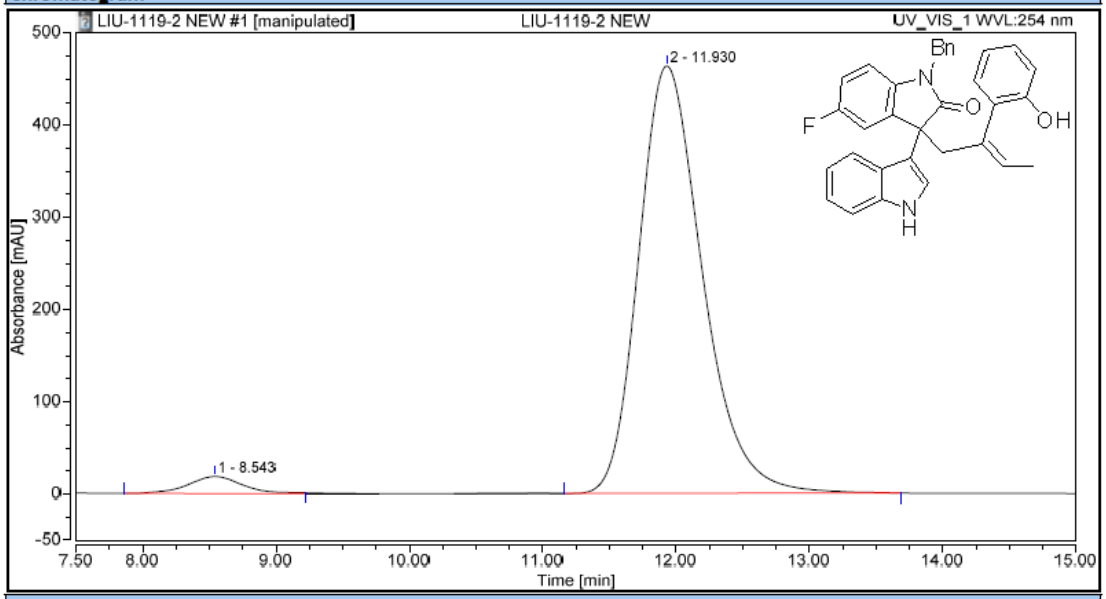
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.703	106.164	271.207	50.10	58.31	n.a.
2		12.063	105.744	193.888	49.90	41.69	n.a.
Total:			**211.908**	**465.095**	**100.00**	**100.00**	

Chromatogram

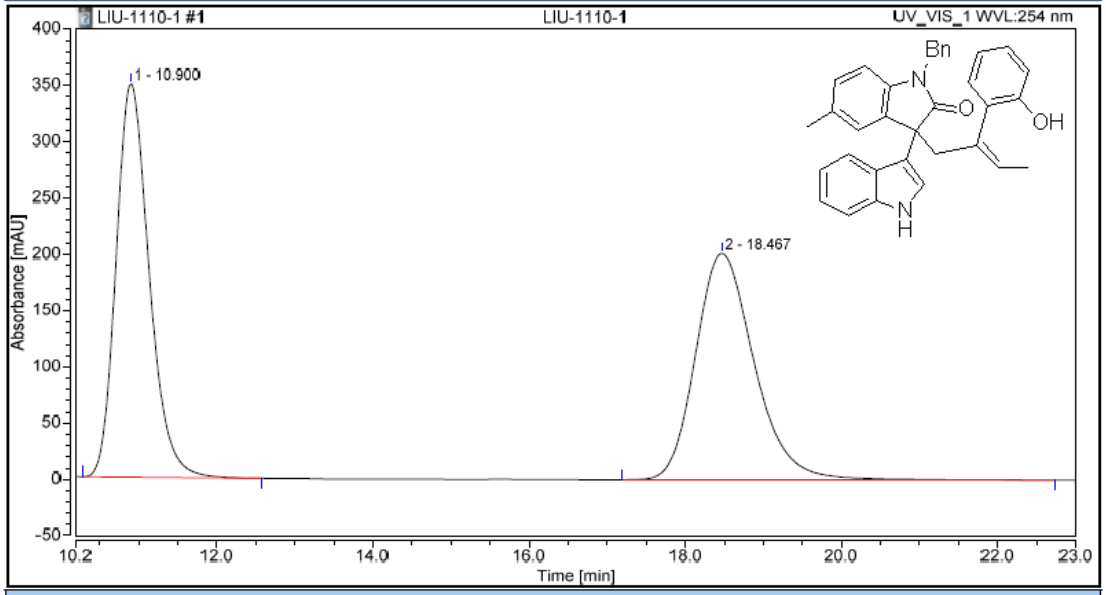


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.543	8.690	18.391	3.28	3.82	n.a.
2		11.930	256.405	463.551	96.72	96.18	n.a.
Total:			**265.095**	**481.942**	**100.00**	**100.00**	

3ib:

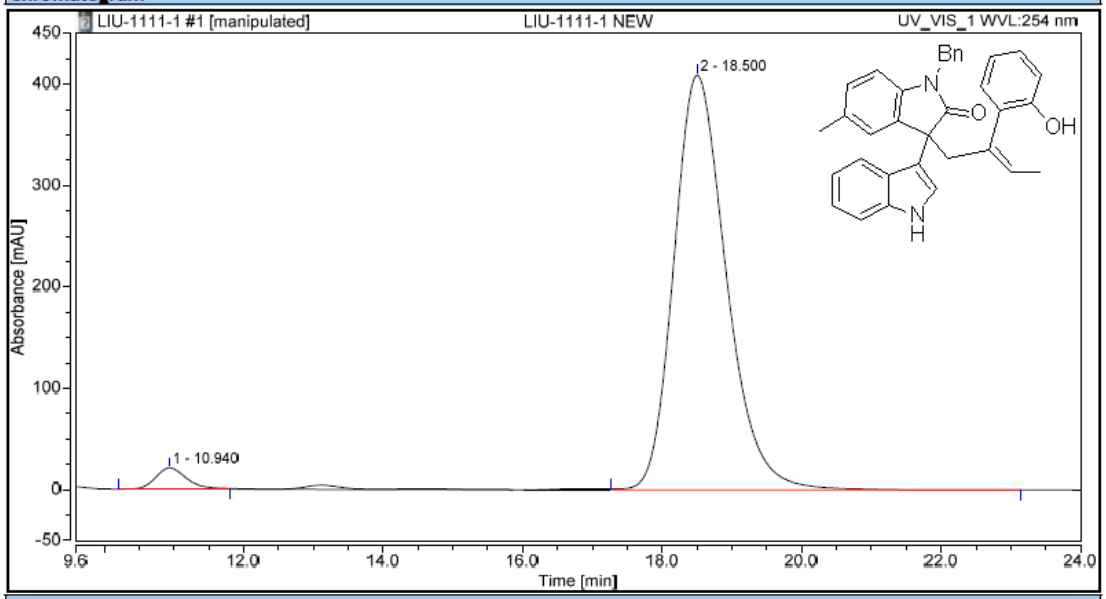
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.900	171.714	349.545	49.53	63.47	n.a.
2		18.467	174.958	201.138	50.47	36.53	n.a.
Total:			346.672	550.682	100.00	100.00	

Chromatogram

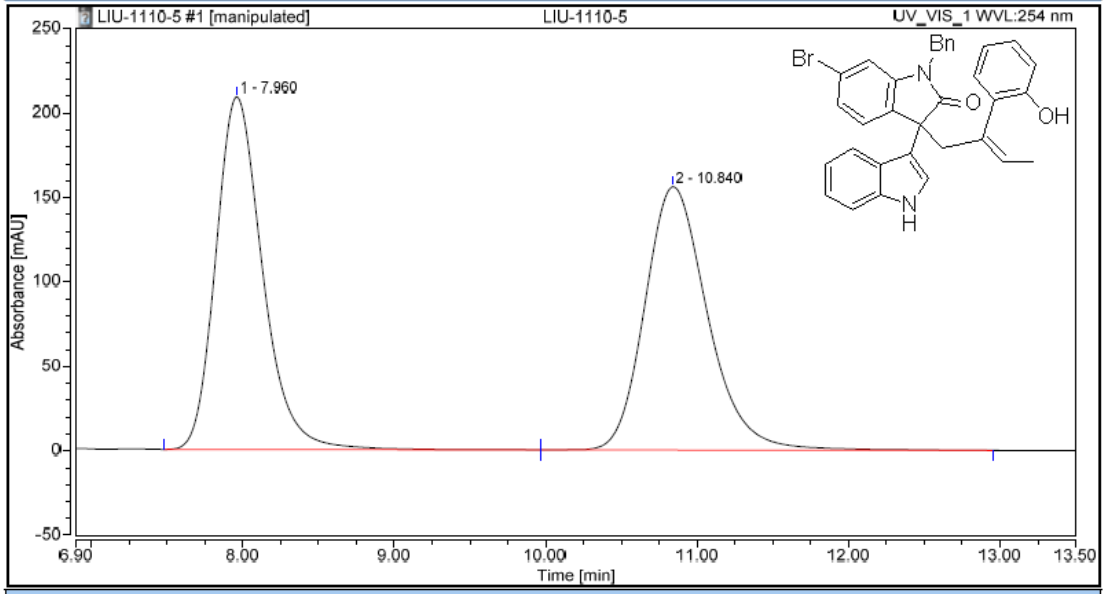


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.940	10.966	20.998	2.99	4.88	n.a.
2		18.500	356.030	408.883	97.01	95.12	n.a.
Total:			366.997	429.882	100.00	100.00	

3jb:

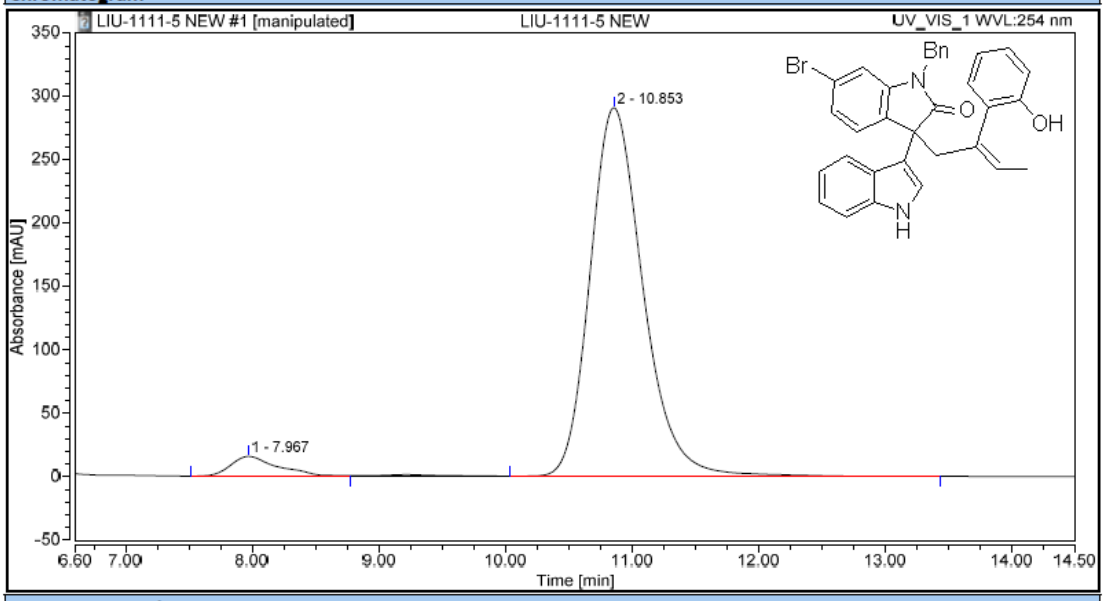
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.960	74.631	208.783	49.84	57.24	n.a.
2		10.840	75.110	155.974	50.16	42.76	n.a.
Total:			149.741	364.758	100.00	100.00	

Chromatogram

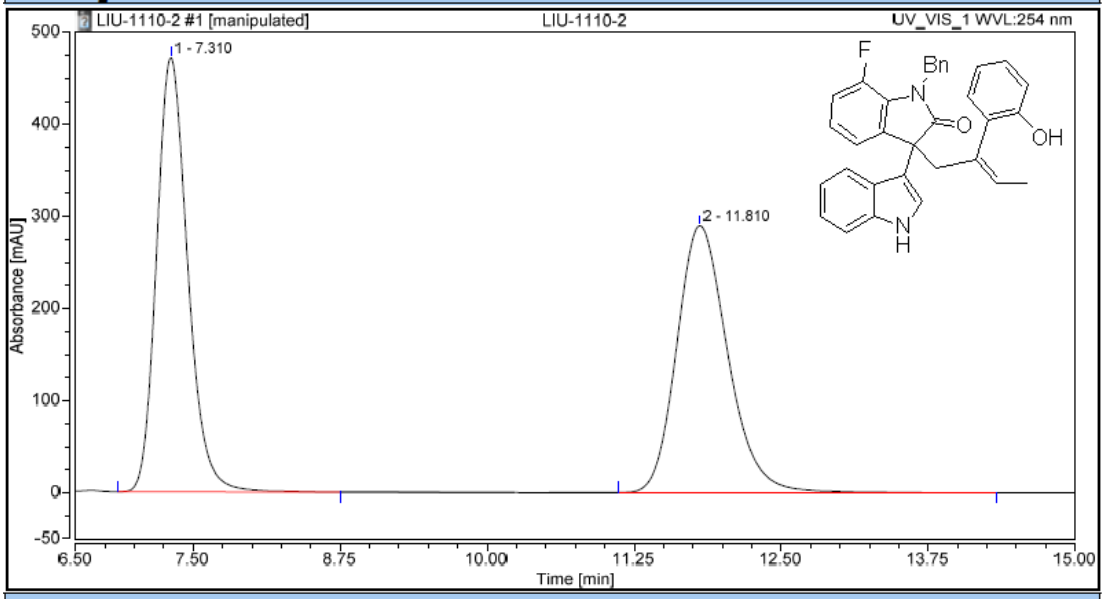


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.967	6.682	15.484	4.53	5.06	n.a.
2		10.853	140.957	290.658	95.47	94.94	n.a.
Total:			147.639	306.142	100.00	100.00	

3kb:

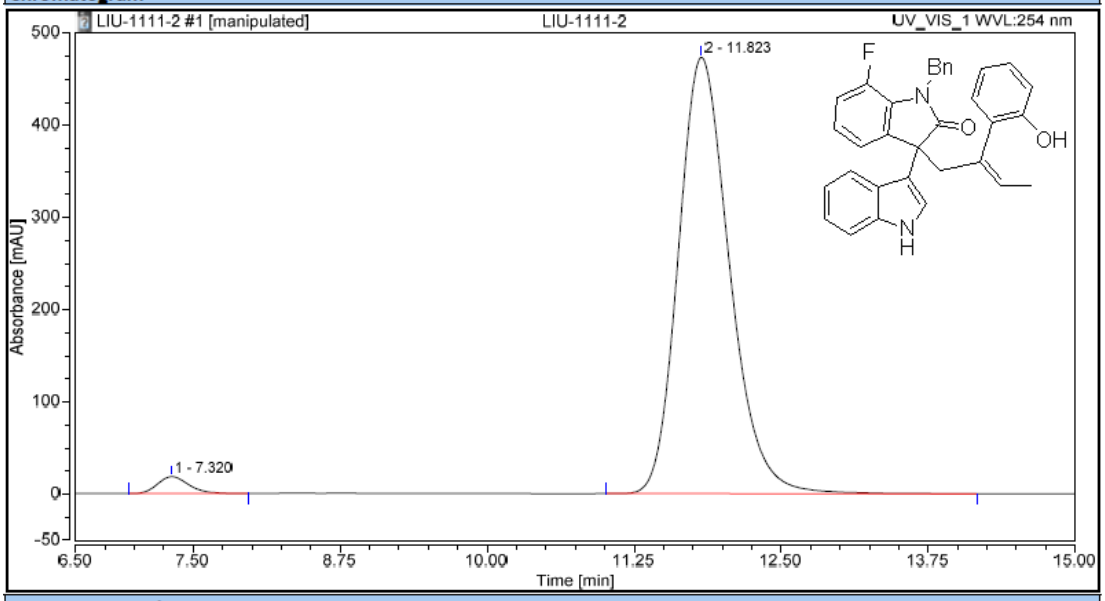
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.310	144.747	471.374	49.85	61.93	n.a.
2		11.810	145.630	289.811	50.15	38.07	n.a.
Total:			**290.378**	**761.185**	**100.00**	**100.00**	

Chromatogram

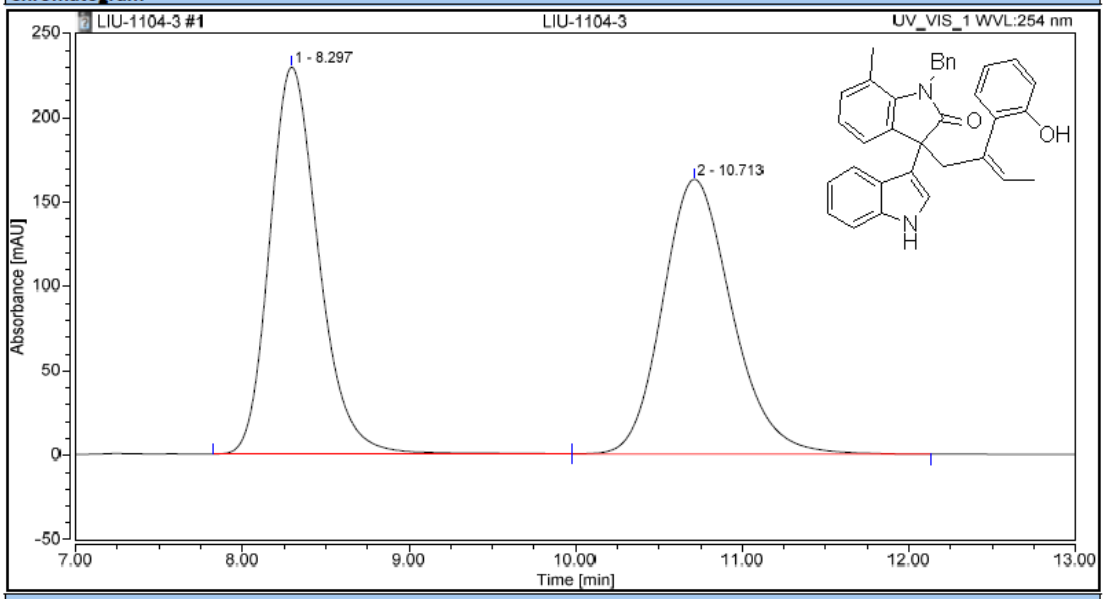


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.320	5.616	18.263	2.30	3.72	n.a.
2		11.823	238.414	473.253	97.70	96.28	n.a.
Total:			**244.030**	**491.516**	**100.00**	**100.00**	

3lb:

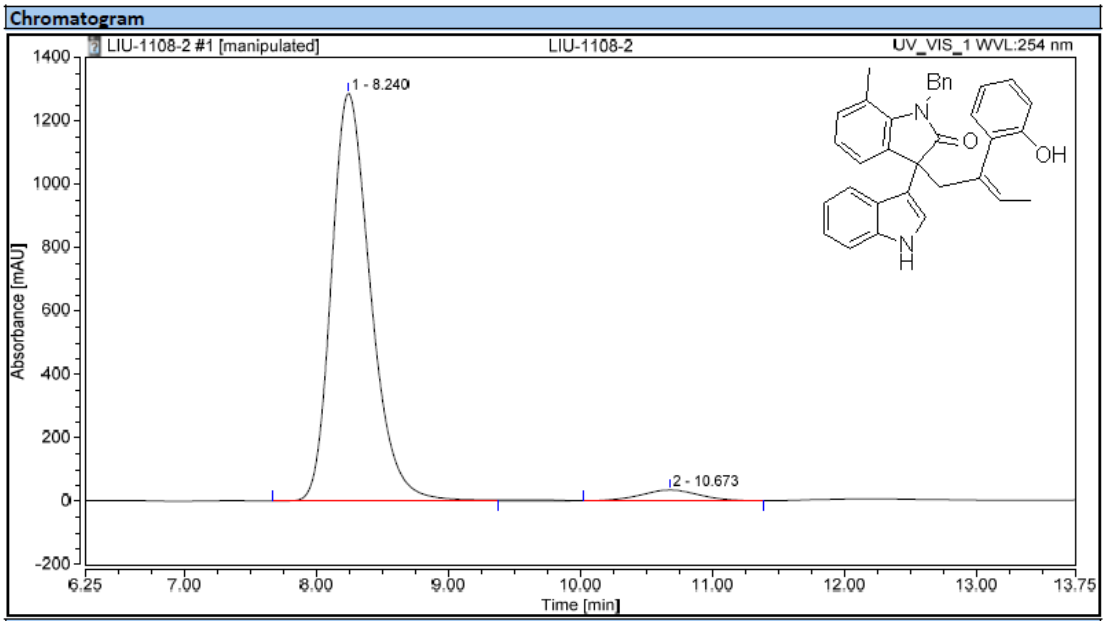
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.297	78.304	229.354	49.89	58.49	n.a.
2		10.713	78.653	162.798	50.11	41.51	n.a.
Total:			**156.957**	**392.152**	**100.00**	**100.00**	

Chromatogram

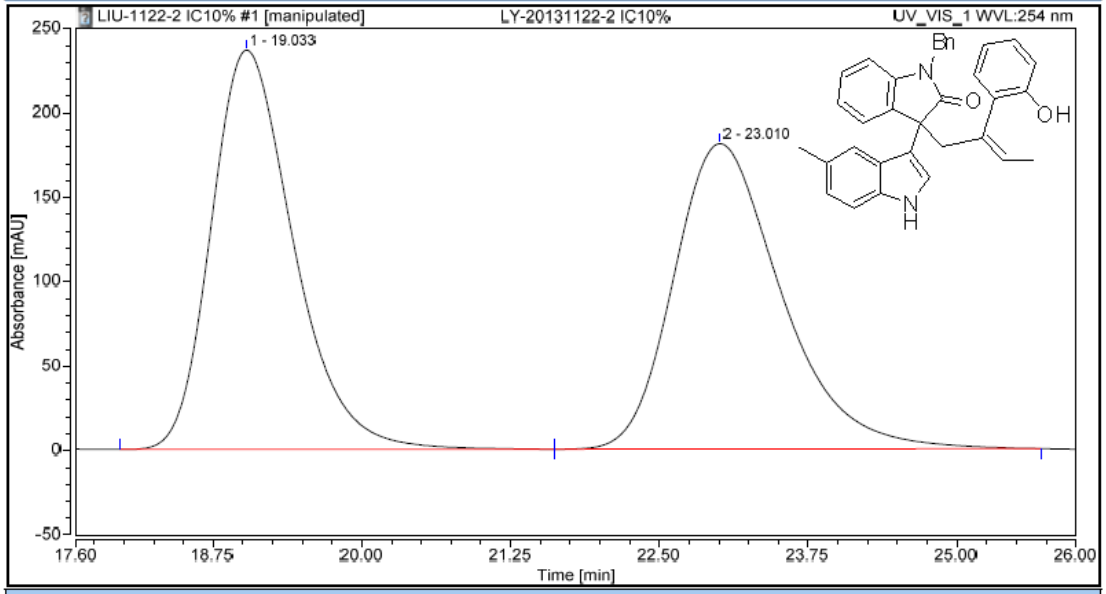


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.240	441.535	1286.932	96.25	97.44	n.a.
2		10.673	17.223	33.822	3.75	2.56	n.a.
Total:			**458.757**	**1320.754**	**100.00**	**100.00**	

3mb:

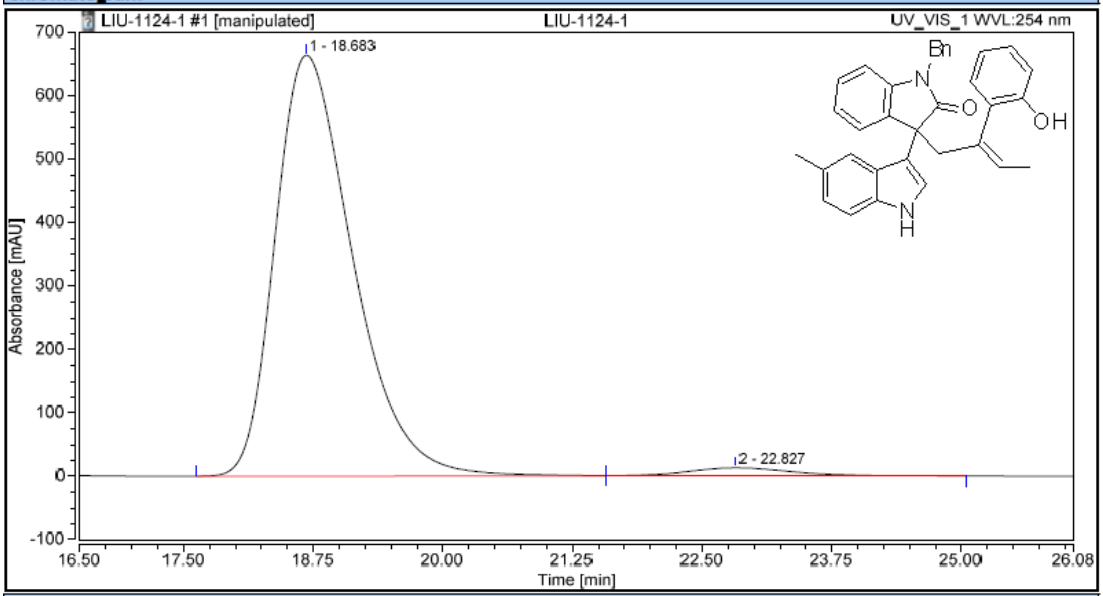
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		19.033	189.664	236.637	49.99	56.67	n.a.
2		23.010	189.758	180.965	50.01	43.33	n.a.
Total:			379.422	417.601	100.00	100.00	

Chromatogram

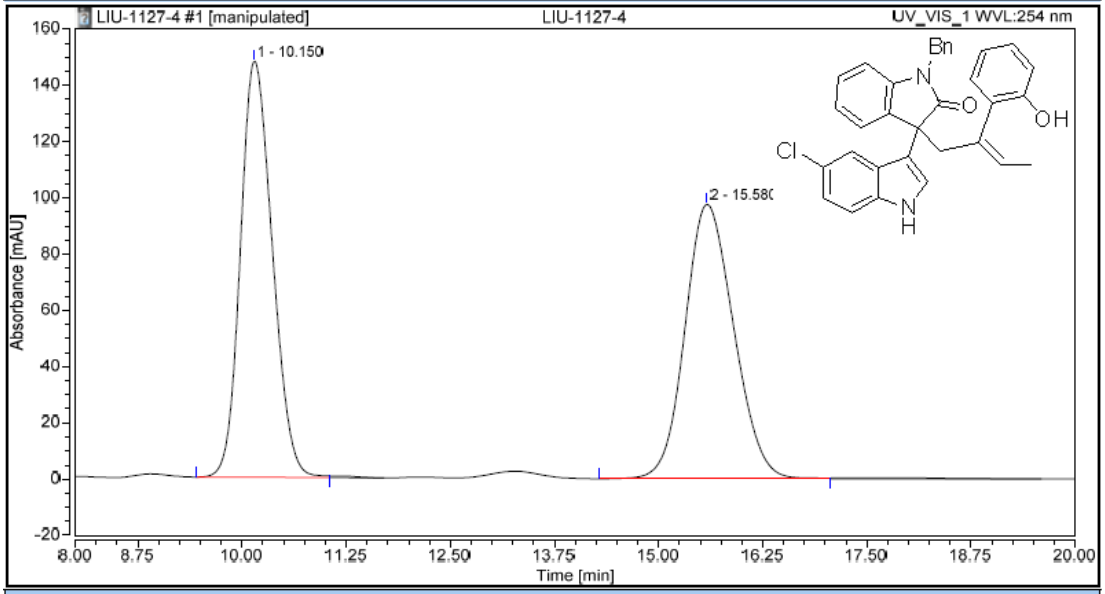


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		18.683	577.300	664.417	97.36	98.07	n.a.
2		22.827	15.655	13.093	2.64	1.93	n.a.
Total:			592.956	677.510	100.00	100.00	

3nb:

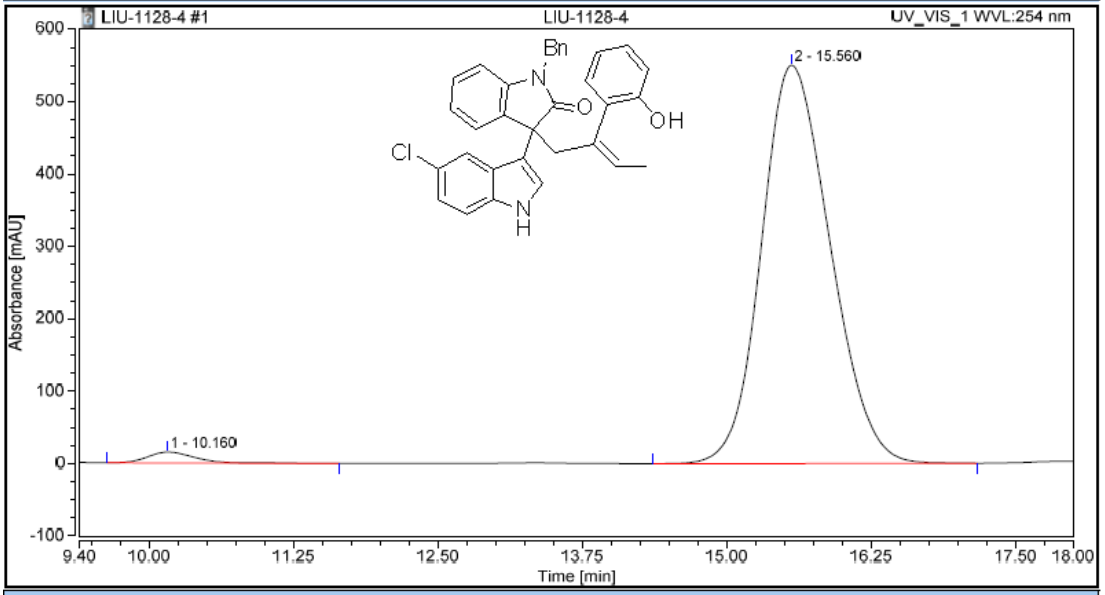
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.150	65.757	147.993	49.83	60.26	n.a.
2		15.580	66.214	97.586	50.17	39.74	n.a.
Total:			**131.972**	**245.579**	**100.00**	**100.00**	

Chromatogram

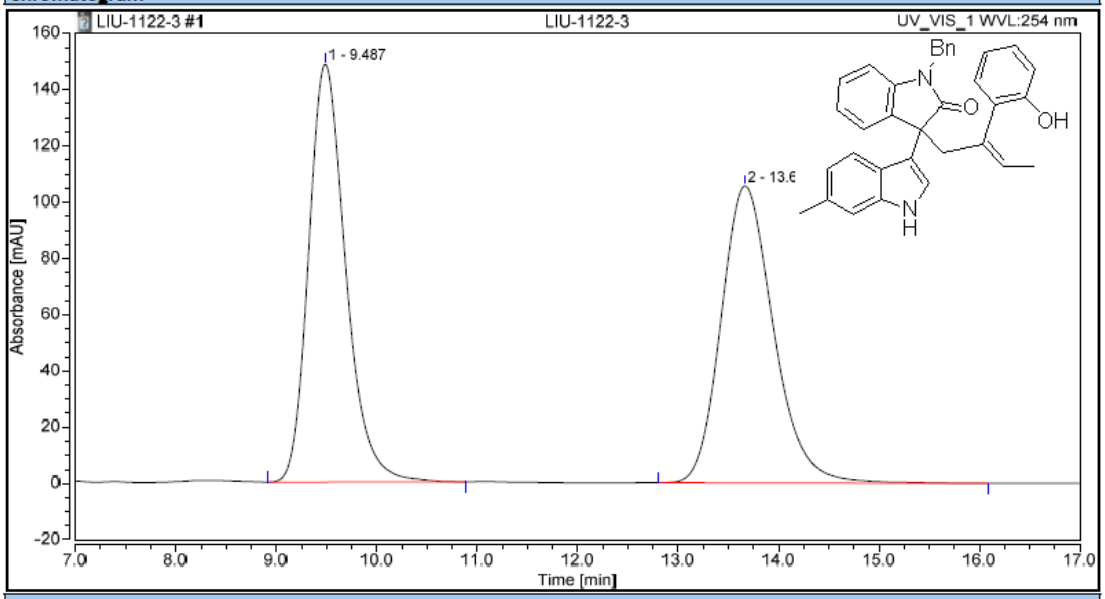


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.160	7.129	14.958	1.85	2.65	n.a.
2		15.560	378.738	549.962	98.15	97.35	n.a.
Total:			**385.867**	**564.921**	**100.00**	**100.00**	

3ob:

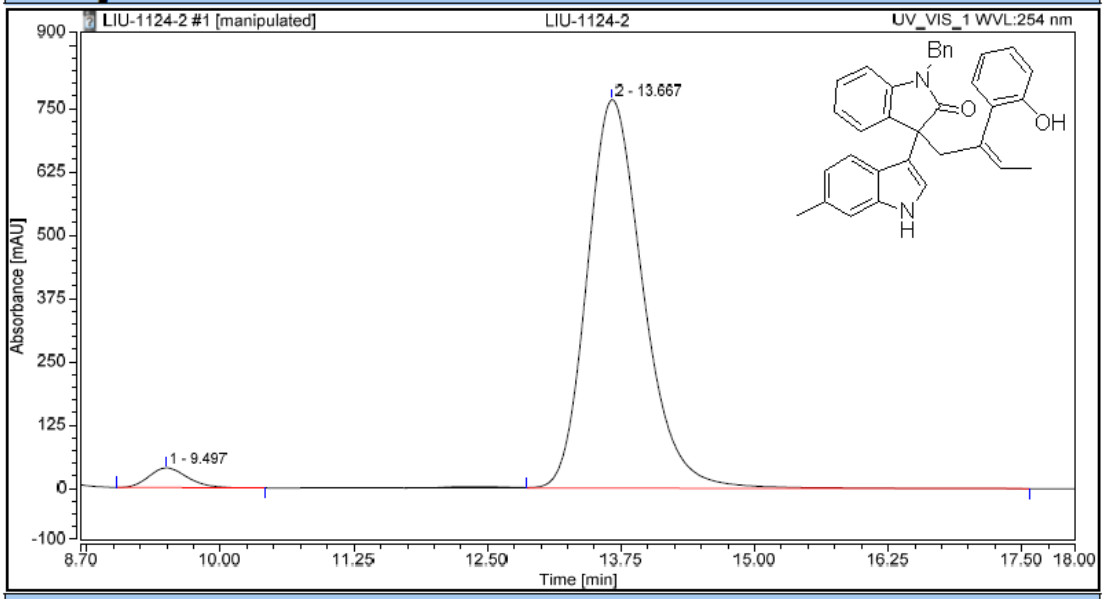
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.487	63.488	148.604	49.85	58.47	n.a.
2		13.667	63.874	105.556	50.15	41.53	n.a.
Total:			**127.362**	**254.160**	**100.00**	**100.00**	

Chromatogram

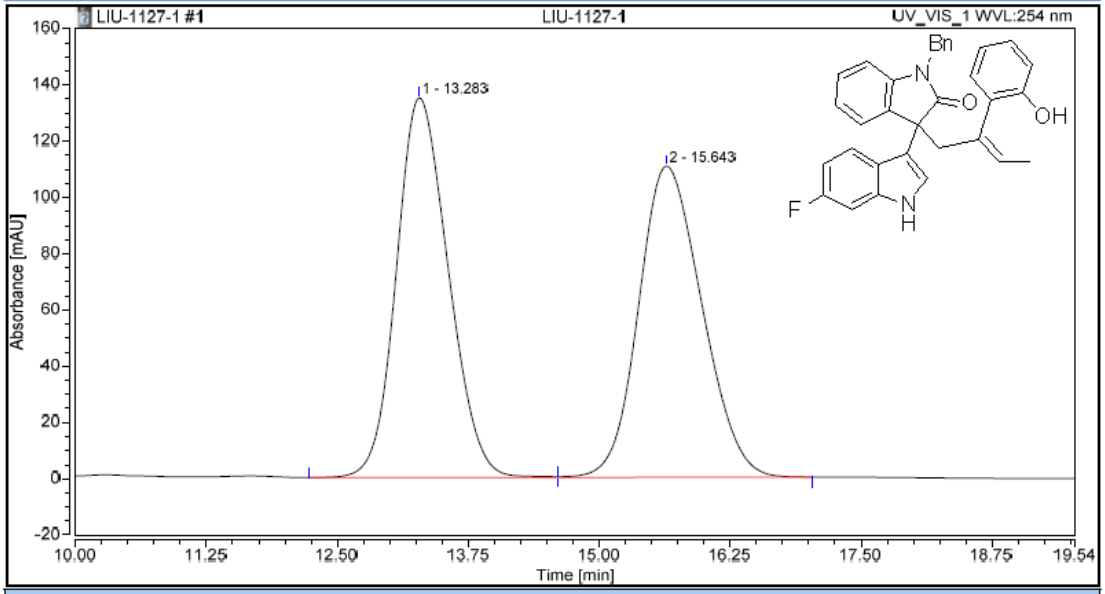


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.497	16.216	38.829	3.38	4.82	n.a.
2		13.667	463.705	766.284	96.62	95.18	n.a.
Total:			**479.922**	**805.113**	**100.00**	**100.00**	

3pb:

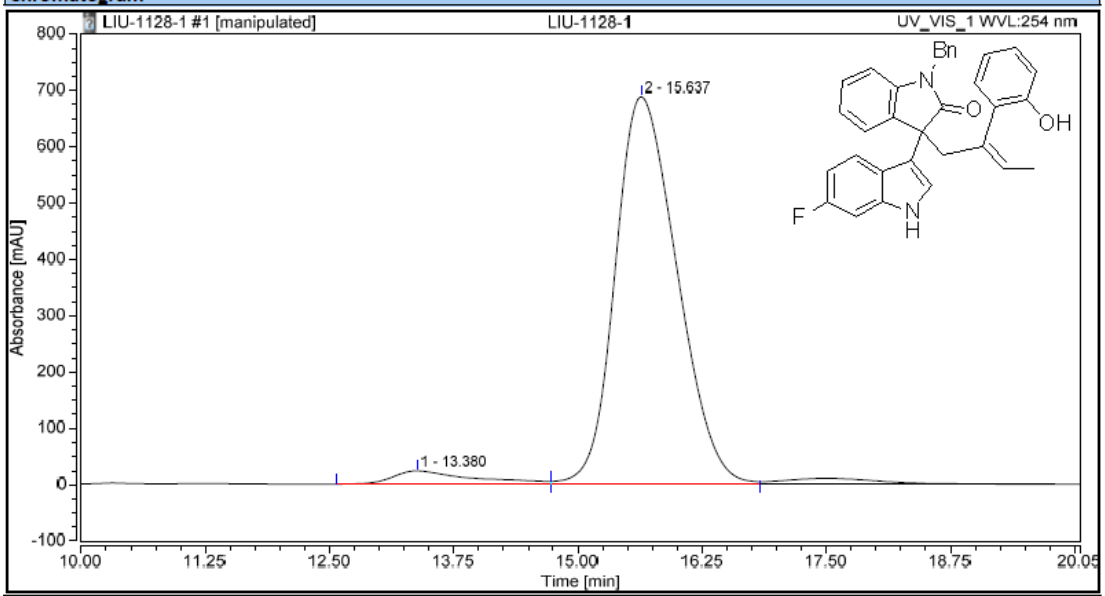
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		13.283	77.449	135.032	49.99	54.97	n.a.
2		15.643	77.471	110.610	50.01	45.03	n.a.
Total:			**154.920**	**245.642**	**100.00**	**100.00**	

Chromatogram

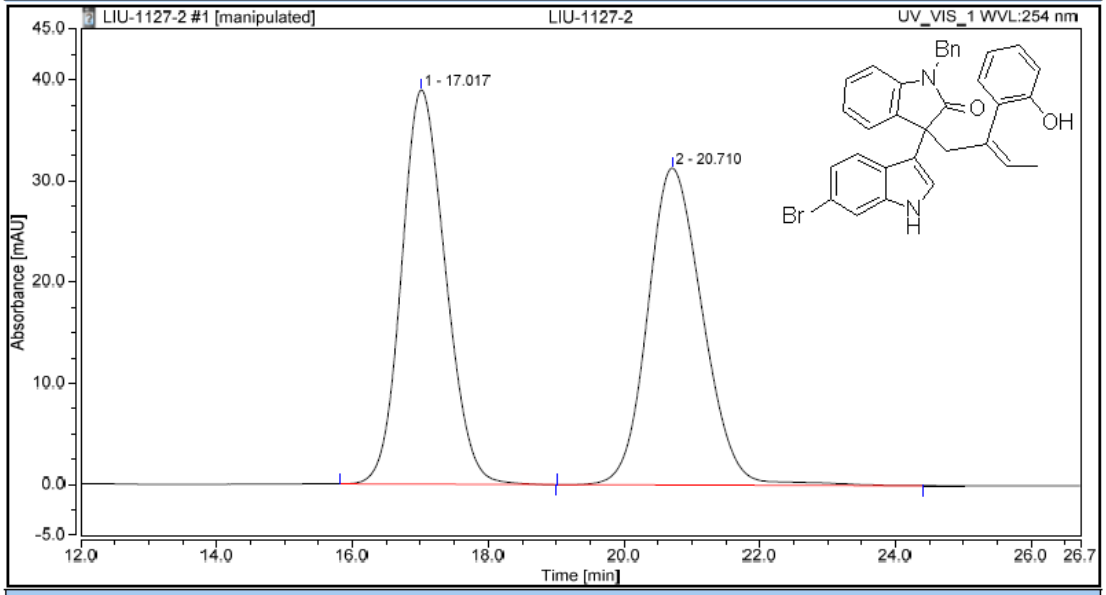


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		13.380	21.900	23.625	4.24	3.32	n.a.
2		15.637	494.716	687.704	95.76	96.68	n.a.
Total:			**516.615**	**711.329**	**100.00**	**100.00**	

3qb:

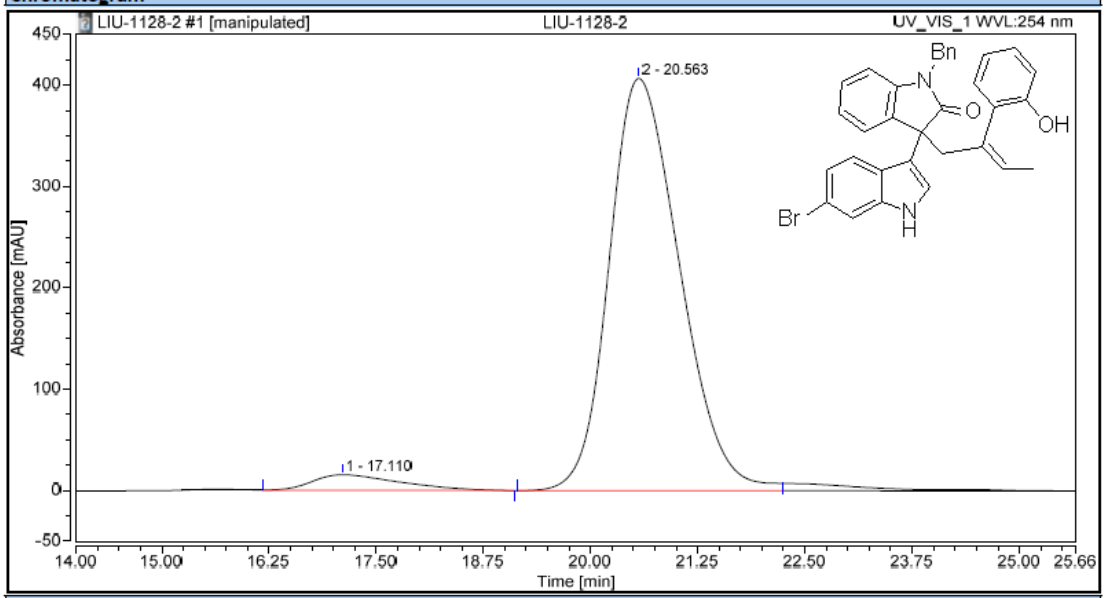
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.017	29.196	38.934	49.80	55.44	n.a.
2		20.710	29.427	31.294	50.20	44.56	n.a.
Total:			58.623	70.228	100.00	100.00	

Chromatogram

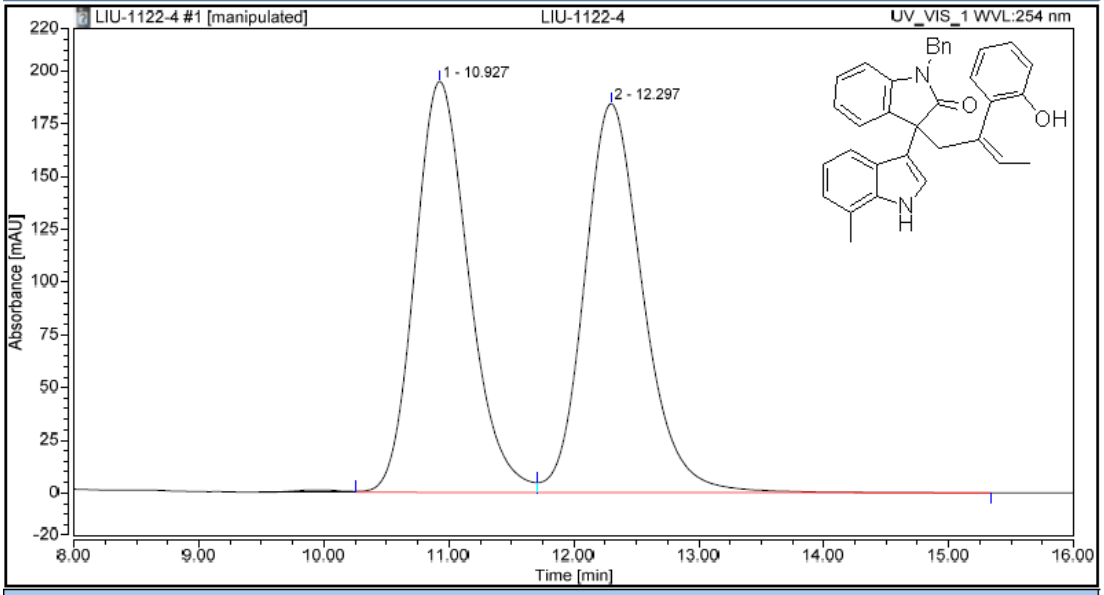


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.110	18.071	15.371	4.46	3.64	n.a.
2		20.563	387.385	406.567	95.54	96.36	n.a.
Total:			405.456	421.939	100.00	100.00	

3rb:

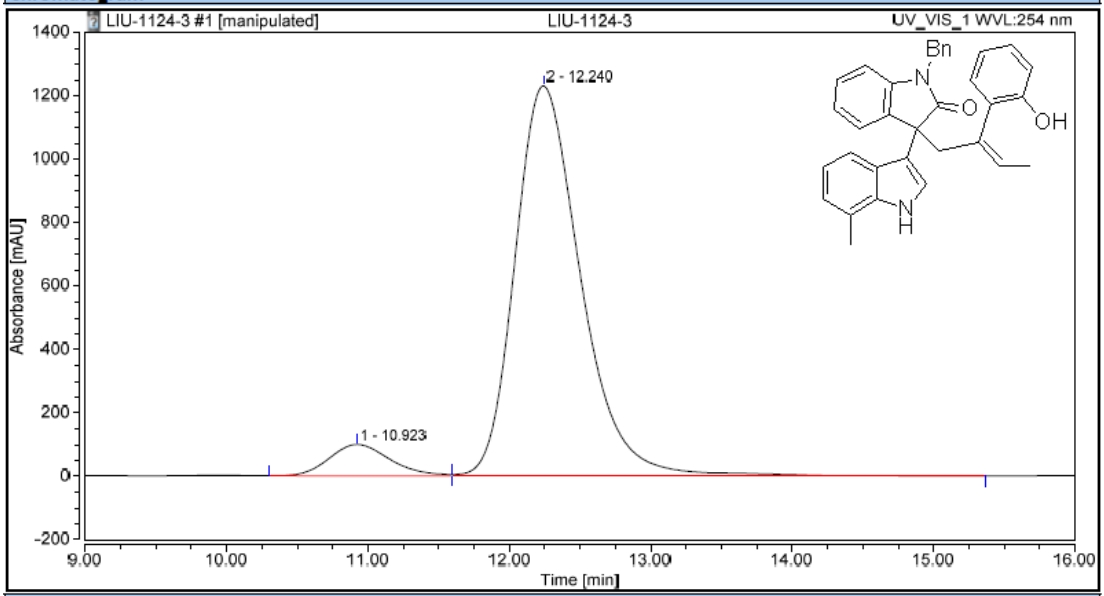
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.927	97.147	194.830	49.27	51.38	n.a.
2		12.297	100.014	184.350	50.73	48.62	n.a.
Total:			197.161	379.181	100.00	100.00	

Chromatogram

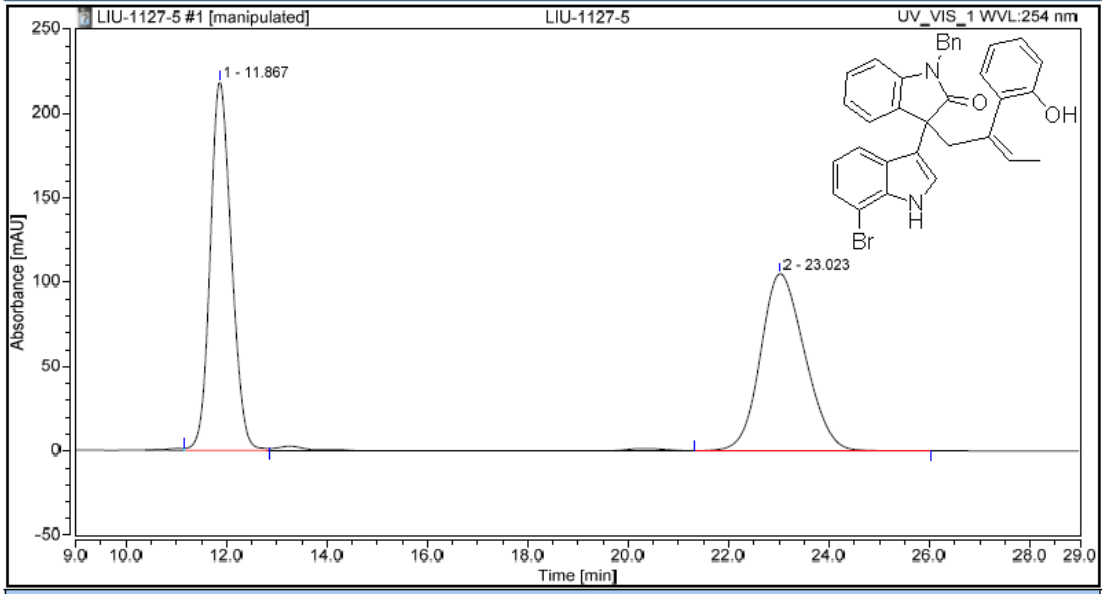


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.923	49.267	98.928	6.92	7.44	n.a.
2		12.240	662.353	1230.948	93.08	92.56	n.a.
Total:			711.619	1329.875	100.00	100.00	

3sb:

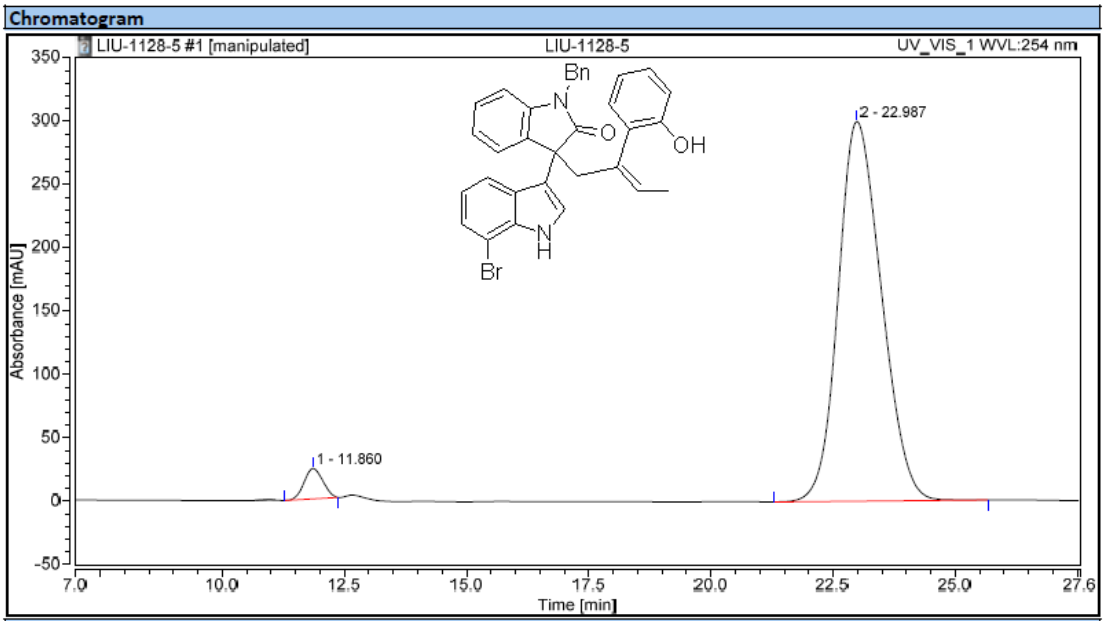
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.867	106.679	218.493	49.86	67.55	n.a.
2		23.023	107.299	104.949	50.14	32.45	n.a.
Total:			**213.978**	**323.442**	**100.00**	**100.00**	

Chromatogram

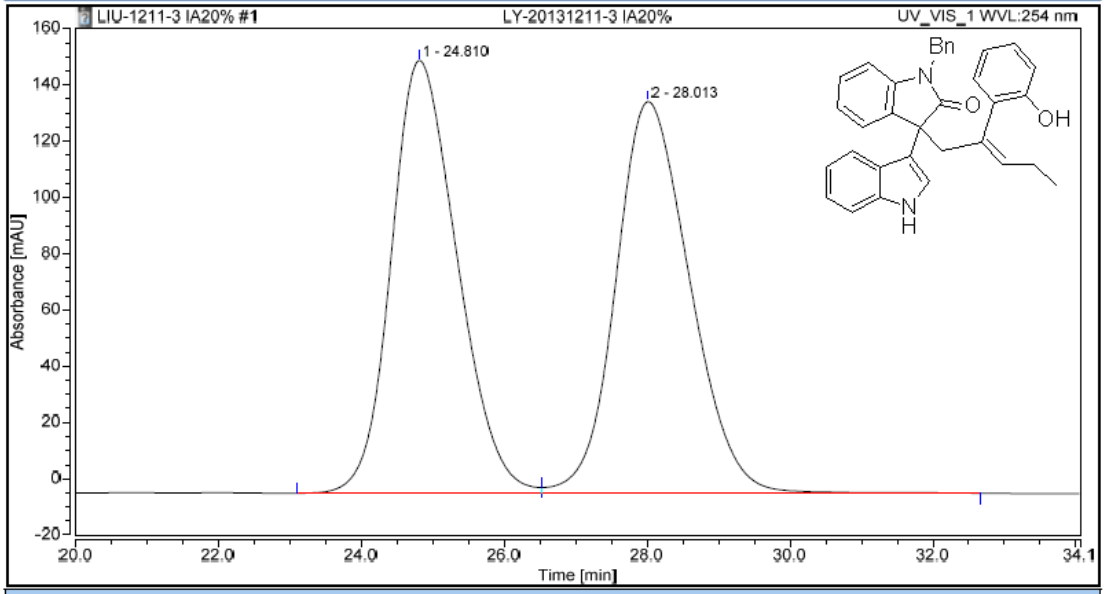


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.860	10.612	23.898	3.34	7.39	n.a.
2		22.987	307.088	299.622	96.66	92.61	n.a.
Total:			**317.700**	**323.520**	**100.00**	**100.00**	

3ac:

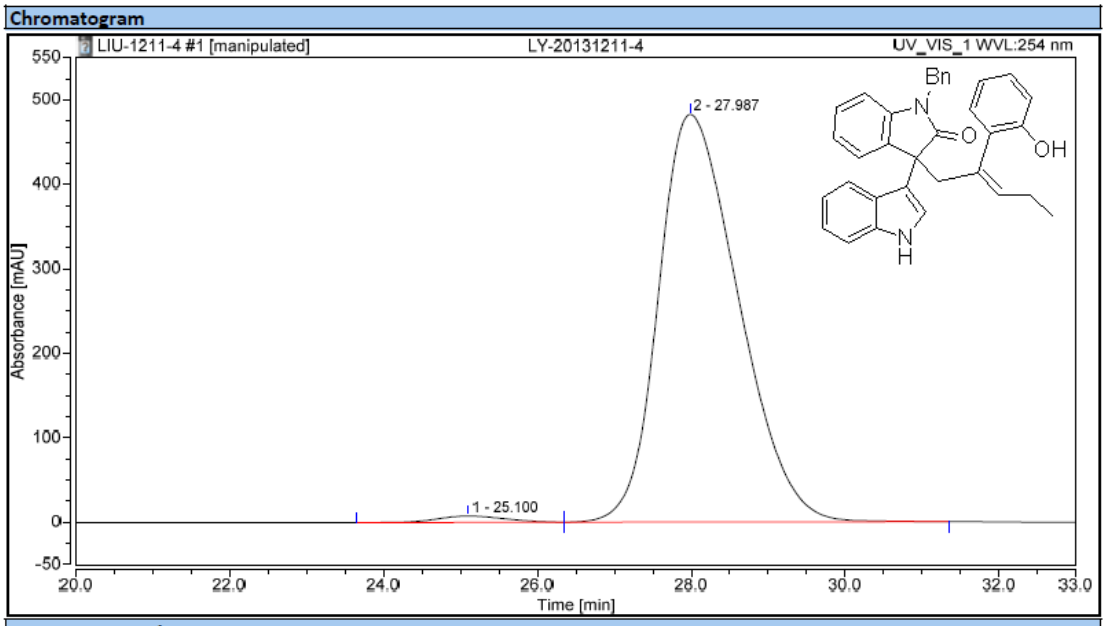
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		24.810	164.574	153.884	49.60	52.50	n.a.
2		28.013	167.215	139.227	50.40	47.50	n.a.
Total:			331.789	293.112	100.00	100.00	

Chromatogram

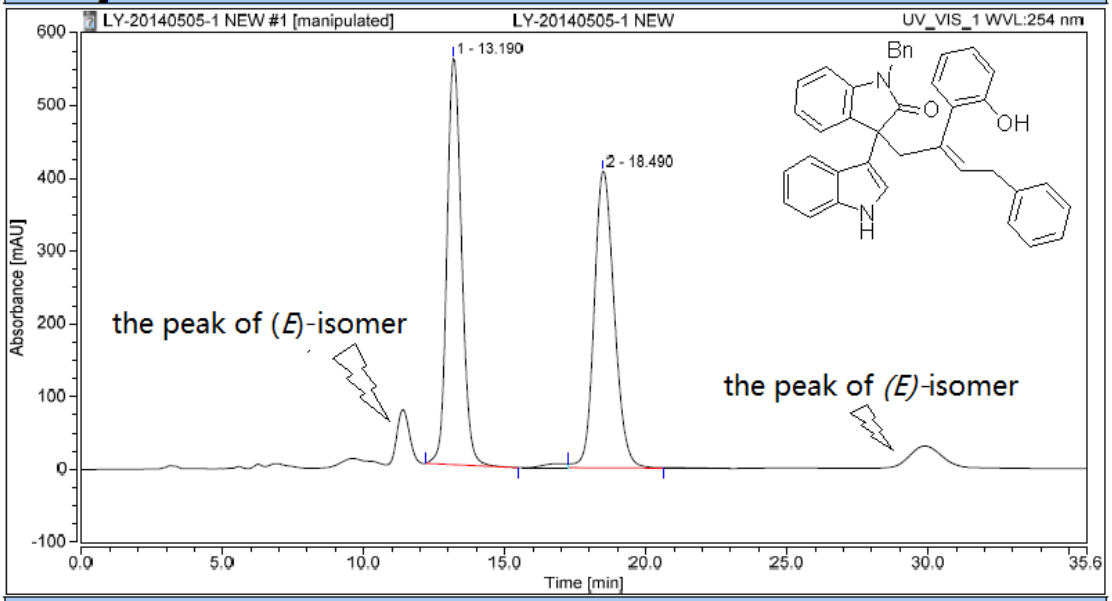


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		25.100	7.746	7.617	1.31	1.55	n.a.
2		27.987	582.014	482.608	98.69	98.45	n.a.
Total:			589.760	490.225	100.00	100.00	

3ad:

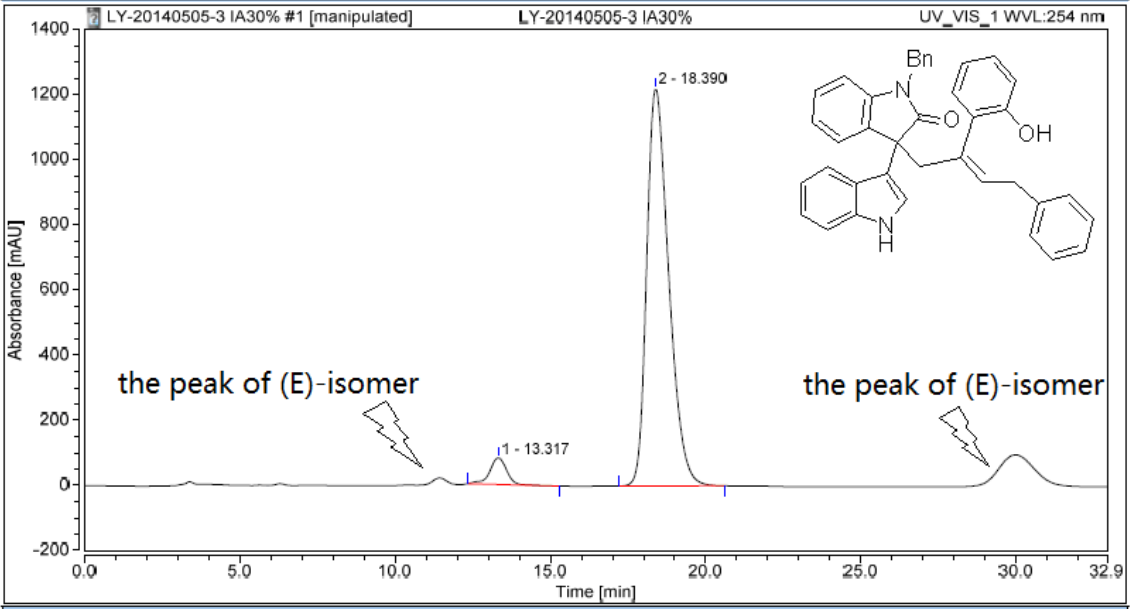
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		13.190	335.241	558.938	49.95	57.79	n.a.
2		18.490	335.867	408.222	50.05	42.21	n.a.
Total:			**671.108**	**967.160**	**100.00**	**100.00**	

Chromatogram

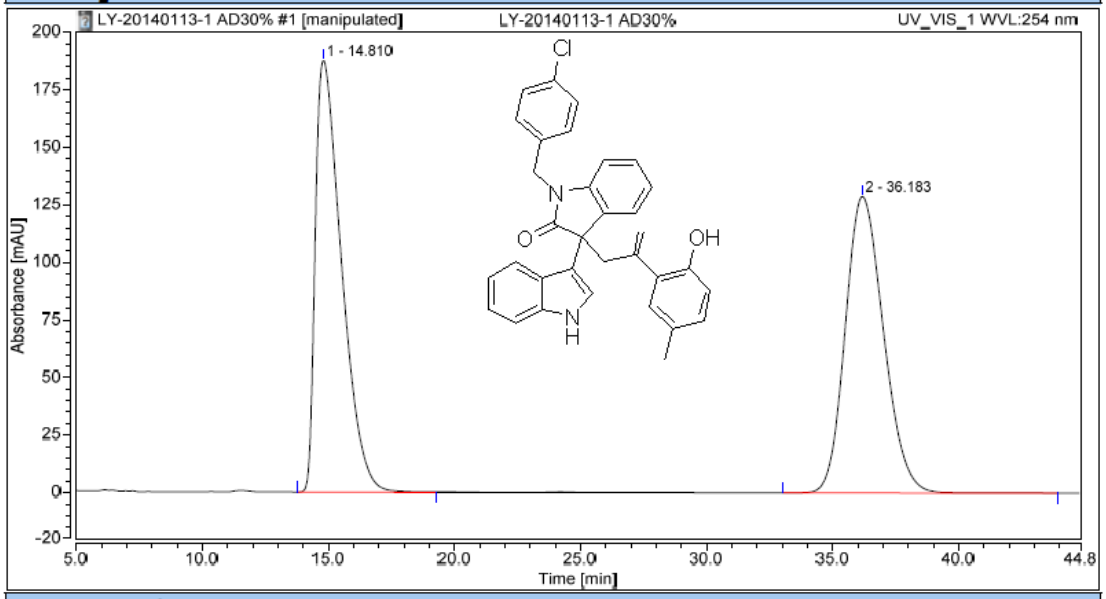


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		13.317	51.432	81.812	4.88	6.28	n.a.
2		18.390	1002.176	1221.343	95.12	93.72	n.a.
Total:			**1053.608**	**1303.155**	**100.00**	**100.00**	

3ed:

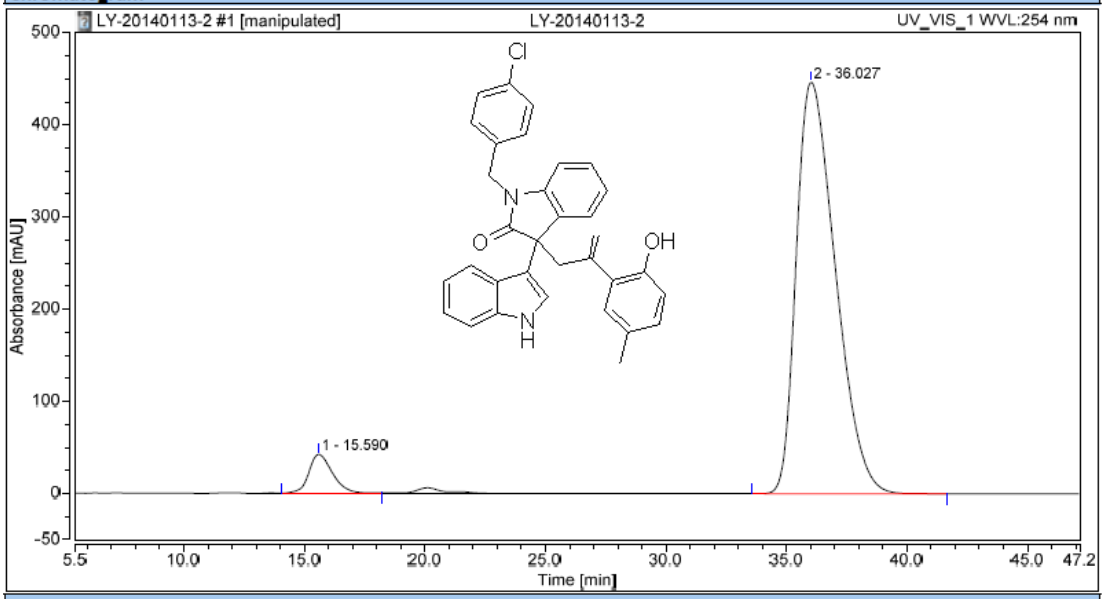
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.810	226.414	187.714	50.01	59.30	n.a.
2		36.183	226.354	128.846	49.99	40.70	n.a.
Total:			452.768	316.560	100.00	100.00	

Chromatogram

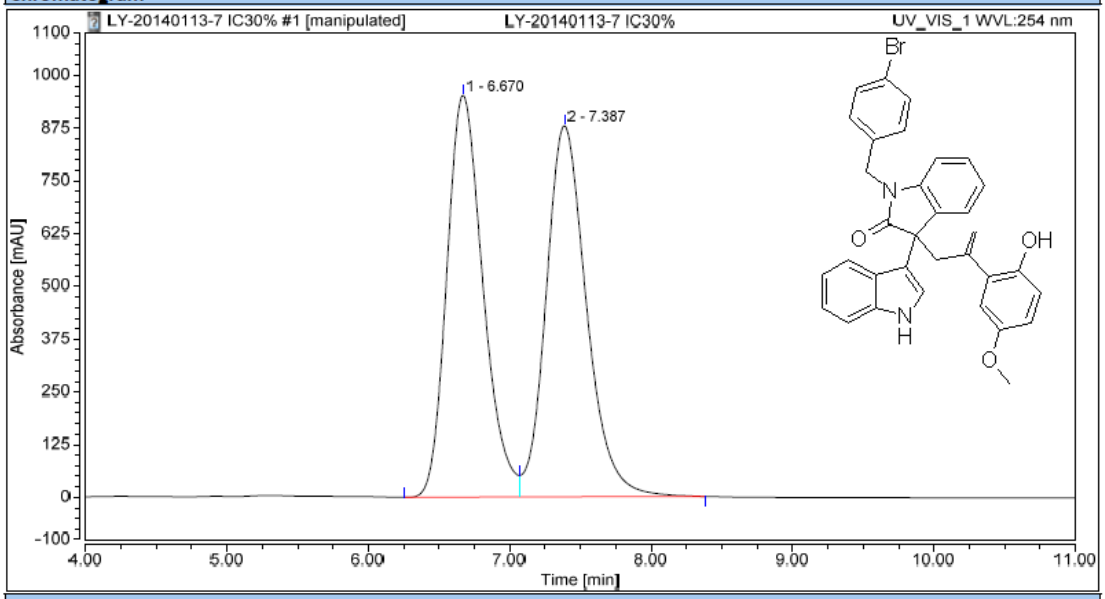


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		15.590	49.319	42.489	5.54	8.69	n.a.
2		36.027	840.431	446.595	94.46	91.31	n.a.
Total:			889.750	489.085	100.00	100.00	

3de:

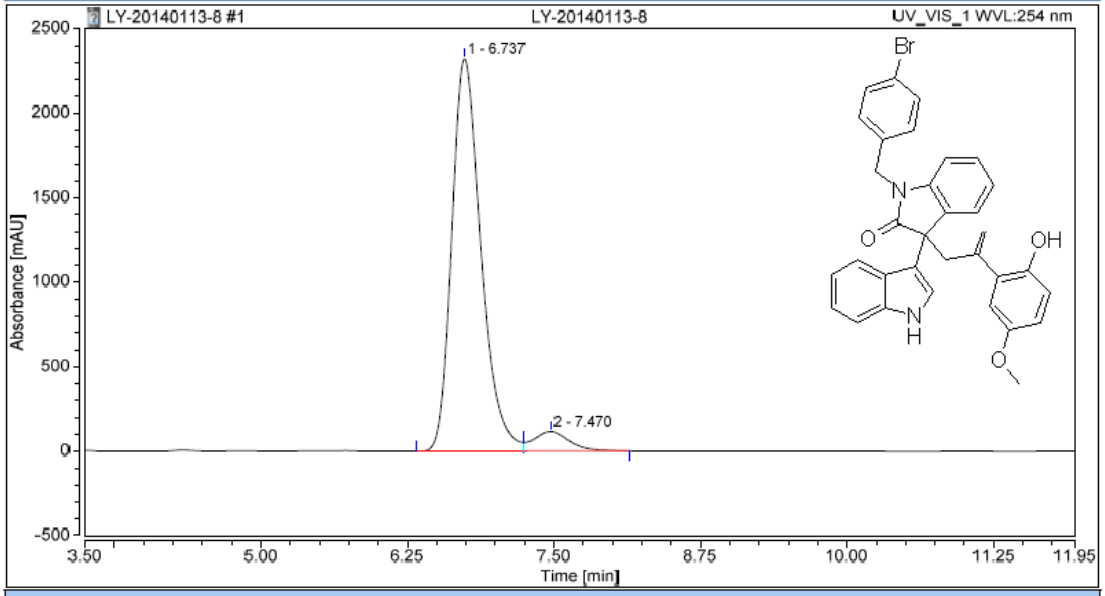
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		6.670	282.398	952.687	49.22	51.99	n.a.
2		7.387	291.387	879.642	50.78	48.01	n.a.
Total:			**573.785**	**1832.330**	**100.00**	**100.00**	

Chromatogram

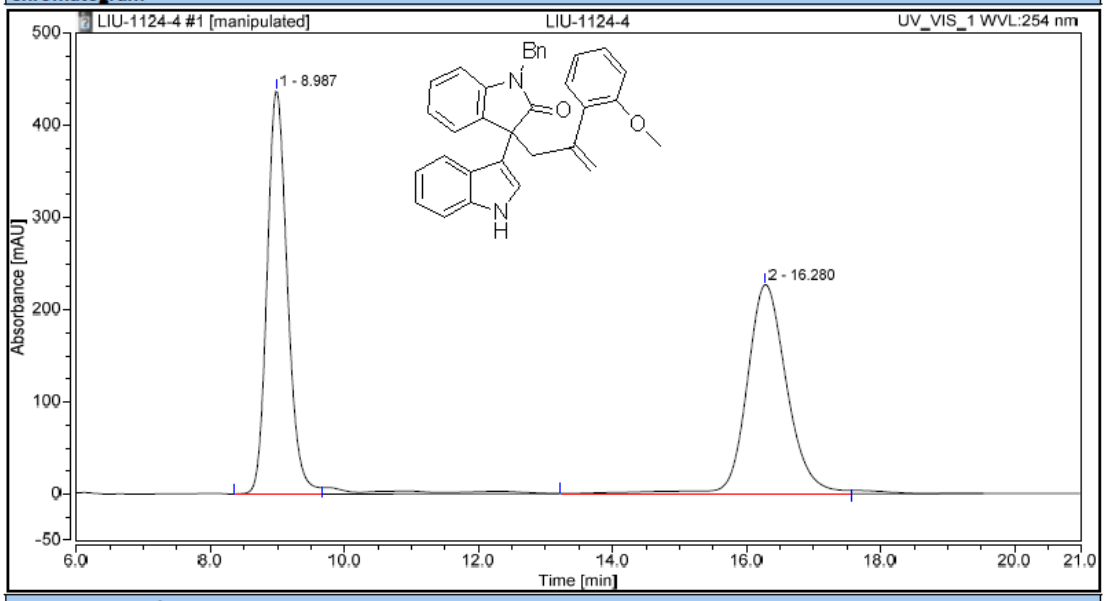


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		6.737	669.277	2322.006	94.39	95.35	n.a.
2		7.470	39.815	113.343	5.61	4.65	n.a.
Total:			**709.092**	**2435.350**	**100.00**	**100.00**	

3af:

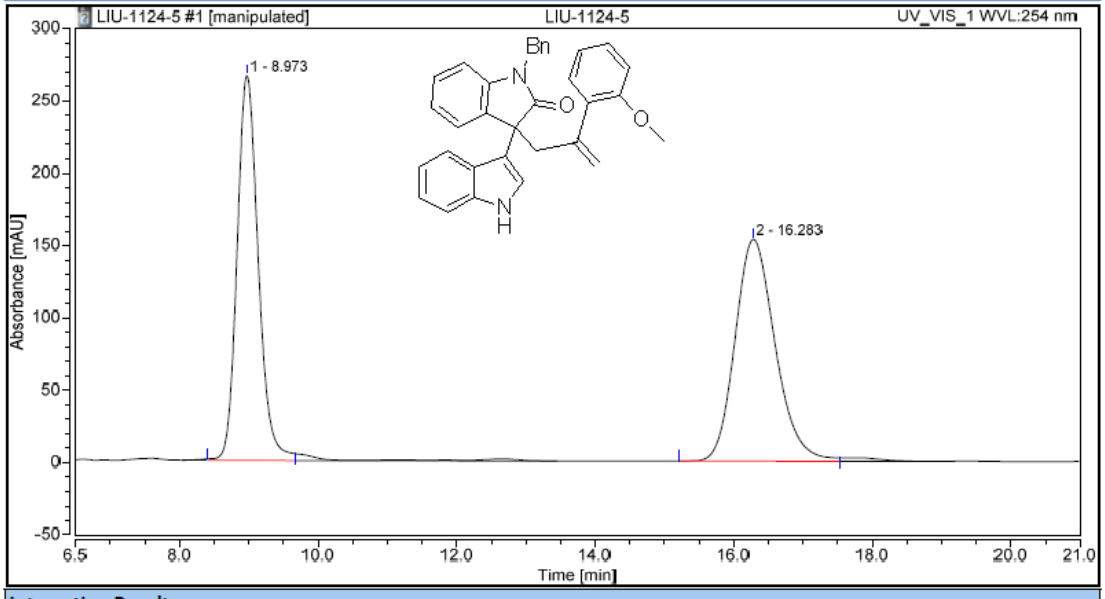
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.987	152.960	437.883	49.32	65.86	n.a.
2		16.280	157.152	226.970	50.68	34.14	n.a.
Total:			**310.112**	**664.853**	**100.00**	**100.00**	

Chromatogram

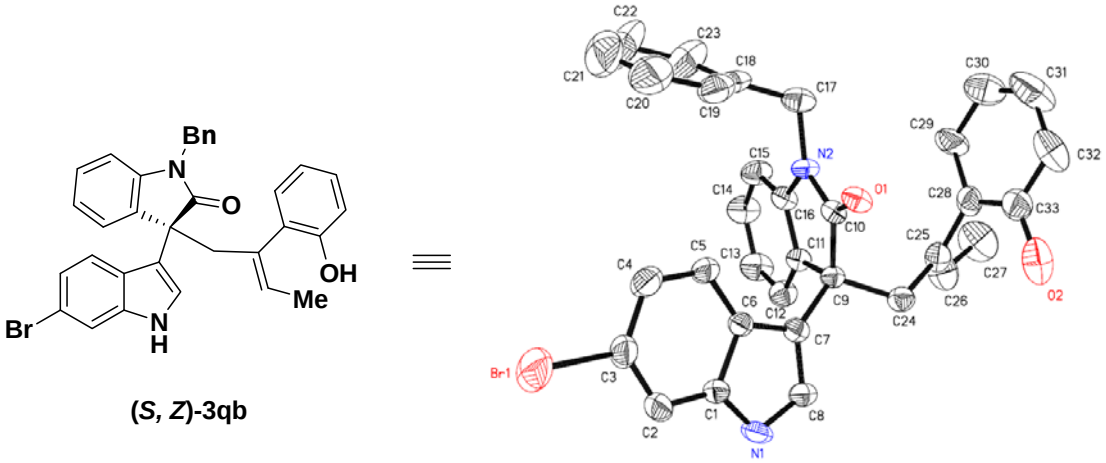


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.973	94.250	266.077	47.88	63.45	n.a.
2		16.283	102.617	153.295	52.12	36.55	n.a.
Total:			**196.867**	**419.372**	**100.00**	**100.00**	

X-ray single crystal data for 3qb:

Absolute configuration and olefin geometry of 3qb:



Crystal system	orthorhombic
Space group	P 21 21 21
Hall group	P 2ac 2ab
Unit cell dimensions	*a* = 8.9032(6) α =90
	b = 11.1649(7) *β* = 90
	c = 27.772(2) *γ* = 90
Volume	2760.6(3)
Z	4
Density (calculated)	1.356
Mu (mm-1)	1.521
F(000)	1160.0
h,k,lmax	11,14,35
Nref	6298
Tmin,Tmax	0.603,0.741
Data completeness	1.76/0.99
Theta(max)	27.474
R(reflections)	0.0580(2682)
wR2(reflections)	0.1508(6298)
refine_ls_abs_structure_Flack	0.025(9)