

Supporting information *for*

Aerobic copper-mediated domino process for the synthesis of 3-(trifluoromethylseleno)indoles

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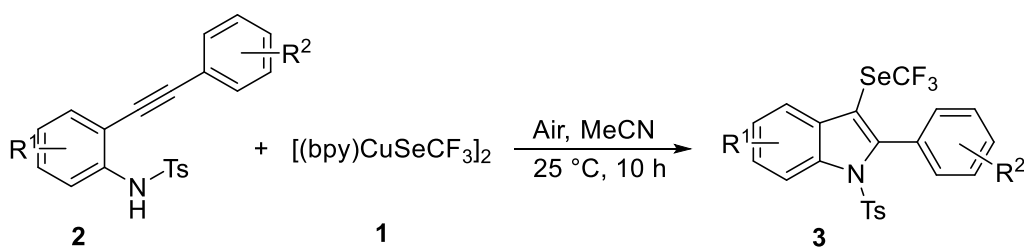
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General information

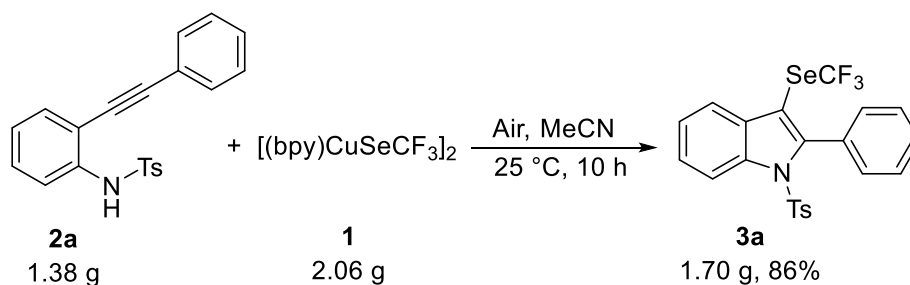
^1H NMR, ^{19}F NMR and ^{13}C NMR spectra were recorded using Bruker AVIII 400 spectrometer. ^1H NMR and ^{13}C NMR chemical shifts were reported in parts per million (ppm) downfield from tetramethylsilane and ^{19}F NMR chemical shifts were determined relative to CFCl_3 as the external standard and low field is positive. Coupling constants (J) are reported in Hertz (Hz). The residual solvent peak was used as an internal reference: ^1H NMR (CDCl_3 δ 7.26), ^{13}C NMR (CDCl_3 δ 77.0). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. $[(\text{bpy})\text{CuSeCF}_3]_2$ (**1**)¹ and *N*-Ts 2-alkynylaniline derivatives^{2, 3} were prepared according to the published procedures. Other reagents were received from commercial sources. Solvents were freshly dried and degassed according to the published procedures prior to use.

General procedure for the synthesis of 3-((trifluoromethyl)selanyl)-1*H*-indole (**3**)



N-Ts 2-alkynylaniline derivatives **2** (0.20 mmol), $[(bpy)Cu(SeCF_3)_2]$ **1** (103.0 mg, 0.28 mmol based on Cu, 1.4 equiv), MeCN (2 mL) were added to a reaction tube equipped with a stir bar. The reaction mixture was stirred in air at 25 °C for 10 hours, then filtered through a pad of celite. The filtrate was concentrated by rotary evaporation and the residue was purified by column chromatography on silica gel with petroleum ether/ ethyl acetate.

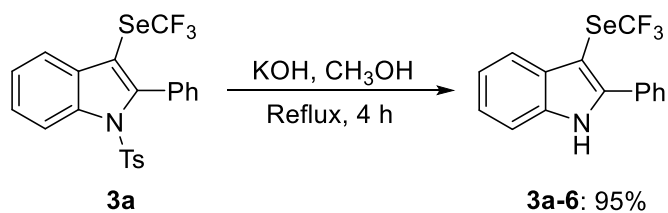
Procedure for gram scale reaction for synthesis of 2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1*H*-indole (3a)



N-Ts 2-alkynylaniline **2a** (1.38 g, 4.00 mmol), $[(bpy)Cu(SeCF_3)_2]$ **1** (2.06 g, 5.60 mmol based on Cu, 1.4 equiv), MeCN (25 mL) were added to a round-bottomed flask equipped with a stir bar. The reaction mixture was stirred in air at 25 °C for 10 hours, then filtered through a pad of celite. The filtrate was concentrated by rotary evaporation and the residue was purified by column chromatography on silica gel with petroleum ether/ethyl acetate.

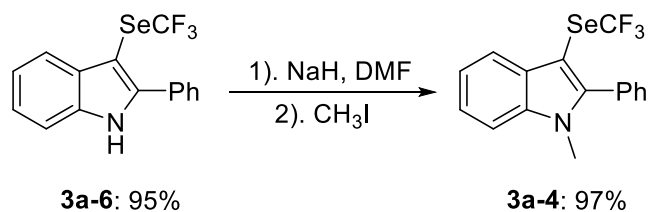
Procedures for derivatization of **3a**

(a)



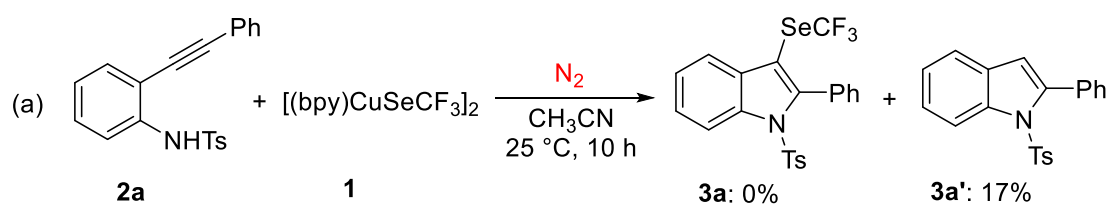
To a solution of **3a** (99.0 mg, 0.20 mmol) in MeOH (2 mL) was added KOH (336.0 mg, 6.00 mmol), and the mixture was refluxed for 4 h. To the mixture was added HCl (3.0 M, 2 mL), and the organic compounds were extracted with AcOEt. Organic layers were washed with brine and dried over Na₂SO₄. The solvents were filtered and evaporated under reduced pressure. The obtained residue was purified by column chromatography (petroleum ether/ethyl acetate = 8:1) to give **3a-6** as a white solid (65 mg, 95%).

(b)

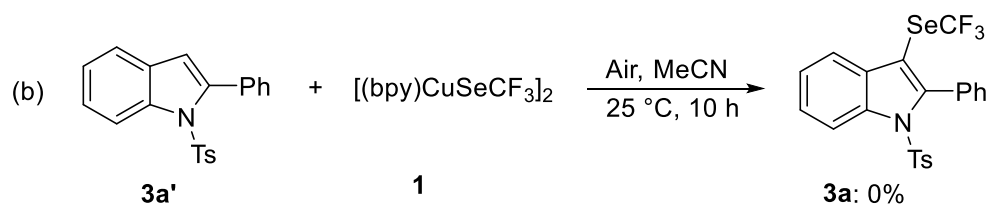


To a stirred solution of indole **3a-6** (68.2 mg, 0.20 mmol) in dry DMF (2.0 mL) was added NaH (12.0 mg, 60% suspension in mineral oil, 0.30 mmol) under nitrogen atmosphere at room temperature and the resulting reaction mixture was stirred at r.t. for 1 h. CH₃I (19 μL, 0.30 mmol) was added and then the reaction mixture was stirred overnight. The reaction was quenched with water (5 mL) and the aqueous layer was extracted with AcOEt. The combined organic layers were washed with brine, dried over anhydrous Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (petroleum ether/ethyl acetate = 10:1) to give compound **3a-4** as a white solid (68.9 mg, 97% yield).

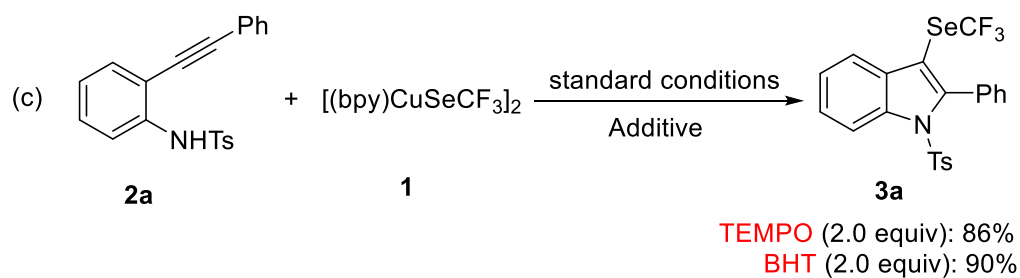
Control experiments



In a nitrogen-filled glovebox, *N*-Ts 2-alkynylaniline **2a** (34.7 mg, 0.10 mmol), $[(bpy)Cu(SeCF_3)]_2$ **1** (51.5 mg, 0.14 mmol based on Cu, 1.4 equiv), MeCN (1 mL) were added to a reaction tube equipped with a stir bar. The reaction mixture was stirred at $25\text{ }^\circ\text{C}$ for 10 hours under N_2 atmosphere. The resulting solution was filtered through a layer of celite and the filtrate was transferred to an NMR tube. An ^{19}F NMR spectrum was acquired. The desired product **3a** was not detected. Instead, the yield of the the background 3-*H* indole by-product **3a'** was calculated to be 17%.

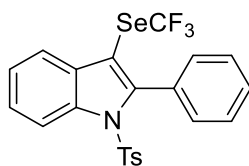


2-Phenyl-1-tosyl-1*H*-indole **3a'** (34.7 mg, 0.10 mmol), $[(bpy)Cu(SeCF_3)]_2$ **1** (51.5 mg, 0.14 mmol based on Cu, 1.4 equiv), and MeCN (1 mL) were added to a reaction tube equipped with a stir bar. The reaction mixture was stirred in air at $25\text{ }^\circ\text{C}$ for 10 hours under air atmosphere. The resulting solution was filtered through a layer of celite and the filtrate was transferred to an NMR tube. An ^{19}F NMR spectrum was acquired, and the desired product **3a** was not detected.



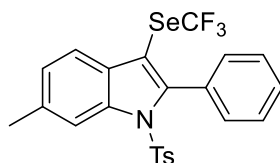
N-Ts 2-alkynylaniline **2a** (34.7 mg, 0.10 mmol), [(bpy)Cu(SeCF₃)₂]**1** (51.5 mg, 0.14 mmol based on Cu, 1.4 equiv), TEMPO (31.2 mg, 0.20 mmol) or BHT (44.1 mg, 0.20 mmol), and MeCN (1 mL) were added to a reaction tube equipped with a stir bar. The reaction mixture was stirred at 25 °C for 10 h under air atmosphere. The resulting solution was filtered through a layer of celite and the filtrate was transferred to an NMR tube. An ¹⁹F NMR spectrum was acquired, and the yields of the desired product **3a** was calculated to be 86% and 90%, respectively.

Data for compounds 3



2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3a)

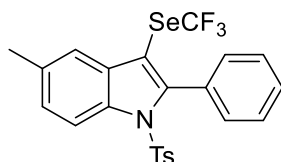
Obtained as a white solid in 89% yield (88.0 mg). Mp: 148.0–150.1 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.60. ^1H NMR (400 MHz, CDCl_3) δ 8.37 (d, J = 8.0 Hz, 1H), 7.71 (d, J = 8.0 Hz, 1H), 7.52 – 7.38 (m, 5H), 7.34 (d, J = 8.0 Hz, 2H), 7.26 (d, J = 7.8 Hz, 2H), 7.11 (d, J = 8.0 Hz, 2H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.1 (s), 145.4 (s), 136.9 (s), 135.5 (s), 131.9 (s), 131.6 (s), 130.2 (s), 129.7 (s), 129.6 (s), 127.4 (s), 127.0 (s), 126.1 (s), 124.8 (s), 121.1 (s), 122.0 (q, J = 335.9 Hz), 115.8 (s), 104.5 (d, J = 1.5 Hz), 21.7 (s). IR (ATR): ν 3054, 1596, 1487, 1445, 1376, 1303, 1264, 1220, 1189, 1177, 1128, 1085, 1037, 919, 831, 734, 697, 660, 569, 542 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{15}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 493.9946; found: 493.9946.



6-methyl-2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3b)

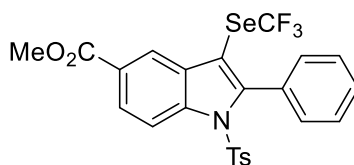
Obtained as a white solid in 87% yield (88.0 mg). Mp: 172.1–174.2 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.73. ^1H NMR (400 MHz, CDCl_3) δ 8.19 (s, 1H), 7.58 (d, J = 8.0 Hz, 1H), 7.50 – 7.44 (m, 1H), 7.39 (t, J = 7.5 Hz, 2H), 7.33 (d, J = 8.3 Hz, 2H), 7.25 – 7.21 (m, 3H), 7.09 (d, J = 8.1 Hz, 2H), 2.55 (s, 3H), 2.31 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 146.4 (s), 145.3 (s), 137.3 (s), 136.4 (s), 135.6 (s), 131.9 (s), 130.3 (s), 129.6 (s), 129.5 (s), 129.4 (s), 127.3 (s), 127.0 (s), 126.3 (s), 122.0 (q, J = 335.9 Hz), 120.6 (s), 115.8 (s), 104.4 (d, J

= 1.7 Hz), 22.2 (s), 21.7 (s). IR (ATR): ν 2919, 1597, 1494, 1380, 1293, 1260, 1179, 1083, 1035, 1017, 963, 922, 874, 809, 772, 735, 695, 576, 544 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{17}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 508.0103; found: 508.0101.



5-methyl-2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3c)

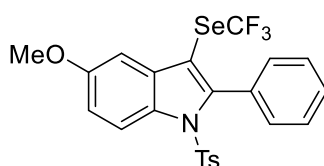
Obtained as a white solid in 89% yield (91.0 mg). Mp: 112.1–114.6 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.73. ^1H NMR (400 MHz, CDCl_3) δ 8.23 (d, J = 8.0 Hz, 1H), 7.51 – 7.46 (m, 2H), 7.41 (t, J = 7.5 Hz, 2H), 7.33 (d, J = 8.4 Hz 2H), 7.28 – 7.26 (m, 3H), 7.09 (d, J = 8.0 Hz, 2H), 2.48 (s, 3H), 2.31 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.2 (s), 145.3 (s), 135.5 (s), 135.2 (s), 134.6 (s), 131.9 (s), 131.8 (s), 130.3 (s), 129.6 (s), 129.6 (s), 127.6 (s), 127.3 (s), 127.0 (s), 122.0 (q, J = 335.9 Hz), 120.8 (s), 115.5 (s), 104.3 (q, J = 1.7 Hz), 21.7 (s), 21.5 (s). IR (ATR): ν 2922, 1597, 1376, 1291, 1220, 1178, 1120, 1083, 1039, 919, 857, 808, 771, 736, 656, 580, 544 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{18}\text{F}_3\text{NNaO}_2\text{SSe}$ $[\text{M}+\text{Na}]^+$: 532.0068; found: 532.0068.



methyl 2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole-5-carboxylate (3d)

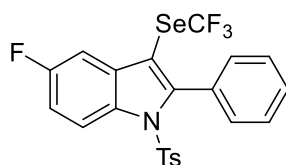
Obtained as a white solid in 86% yield (95.0 mg). Mp: 202.4–203.1 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.49. ^1H NMR (400 MHz, CDCl_3) δ 8.44 – 8.42 (m, 2H), 8.17 – 8.15 (m, 1H), 7.52 (t, J = 7.5 Hz, 1H), 7.43 (t, J = 7.5 Hz, 2H), 7.33 (d, J = 8.4

Hz, 2H), 7.25 (d, $J = 6.8$ Hz, 2H), 7.12 (d, $J = 8.2$ Hz, 2H), 3.97 (s, 3H), 2.34 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 167.0 (s), 148.4 (s), 145.8 (s), 139.5 (s), 135.2 (s), 131.9 (s), 131.5 (s), 129.9 (s), 129.8 (s), 129.6 (s), 127.4 (s), 127.2 (s), 127.1 (s), 126.9 (s), 123.2 (s), 121.9 (q, $J = 335.8$ Hz), 115.6 (s), 104.6 (d, $J = 1.8$ Hz), 52.4 (s), 21.7 (s). IR (ATR): ν 2957, 1719, 1616, 1548, 1486, 1374, 1307, 1241, 1175, 1079, 1041, 985, 921, 777, 669, 577, 544 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{24}\text{H}_{17}\text{F}_3\text{NO}_4\text{SSe}$ $[\text{M}-\text{H}]^-$: 552.0001; found: 552.0005.



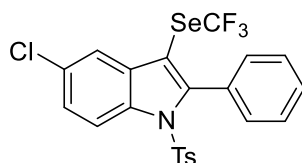
5-methoxy-2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3e)

Obtained as a white solid in 87% yield (91.0 mg). Mp: 149.4–151.7 °C. R_f (petroleum ether/ ethyl acetate = 8:1) = 0.65. ^1H NMR (400 MHz, CDCl_3) δ 8.25 (d, $J = 9.1$ Hz, 1H), 7.52 – 7.46 (m, 1H), 7.42 (t, $J = 7.5$ Hz, 2H), 7.33 – 7.25 (m, 4H), 7.09 (m, 4H), 3.87 (s, 3H), 2.31 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 157.6 (s), 147.8 (s), 145.3 (s), 135.3 (s), 132.9 (s), 131.9 (s), 131.4 (s), 130.2 (s), 129.7 (s), 129.6 (s), 127.3 (s), 126.9 (s), 122.0 (q, $J = 336.0$ Hz), 116.9 (s), 115.3 (s), 104.5 (d, $J = 1.8$ Hz), 102.9 (s), 55.8 (s), 21.7 (s). IR (ATR): ν 2937, 1611, 1581, 1469, 1374, 1264, 1206, 1189, 1170, 1127, 1085, 1033, 960, 921, 864, 801, 770, 735, 696, 585, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{17}\text{F}_3\text{NO}_3\text{SSe}$ $[\text{M}-\text{H}]^-$: 524.0052; found: 524.0048.



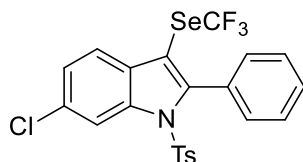
5-fluoro-2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3f)

Obtained as a white solid in 81% yield (83.0 mg). Mp: 190.6–192.8 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.55. ^1H NMR (400 MHz, CDCl_3) δ 8.33 (dd, $J = 9.2, 4.3$ Hz, 1H), 7.51 (t, $J = 7.3$ Hz, 1H), 7.42 (t, $J = 7.6$ Hz, 2H), 7.35 (dd, $J = 8.4, 2.7$ Hz, 1H), 7.31 (d, $J = 8.2$ Hz, 2H), 7.28 – 7.23 (m, 2H), 7.18 (td, $J = 9.1, 2.7$ Hz, 1H), 7.11 (d, $J = 8.1$ Hz, 2H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F), -117.4 - -117.5 (m, 1F). ^{13}C NMR (101 MHz, CDCl_3) δ 160.5 (d, $J = 242.5$ Hz), 148.8 (s), 145.6 (s), 135.2 (s), 133.2 (s), 133.1 (s), 133.0 (s), 131.9 (s), 129.9 (s), 129.8 (s), 129.7 (s), 127.4 (s), 127.1 (s), 121.9 (q, $J = 335.8$ Hz), 117.2 (d, $J = 9.0$ Hz), 114.1 (d, $J = 25.3$ Hz), 106.7 (d, $J = 24.9$ Hz), 21.71 (s). IR (ATR): ν 2917, 1596, 1493, 1460, 1385, 1248, 1190, 1179, 1088, 1037, 1016, 921, 858, 808, 774, 696, 655, 583, 545 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{F}_4\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 511.9852; found: 511.9852.



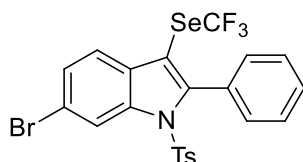
5-chloro-2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3g)

Obtained as a white solid in 66% yield (70 mg). Mp: 157.2–159.0 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.60. ^1H NMR (400 MHz, CDCl_3) δ 8.30 (d, $J = 8.9$ Hz, 1H), 7.67 (d, $J = 2.1$ Hz, 1H), 7.51 (t, $J = 7.4$ Hz, 1H), 7.44 – 7.38 (m, 3H), 7.31 (d, $J = 8.2$ Hz, 2H), 7.24 (d, $J = 7.5$ Hz, 2H), 7.12 (d, $J = 8.1$ Hz, 2H), 2.35 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 148.5 (s), 145.8 (s), 135.3 (s), 135.2 (s), 133.0 (s), 131.9 (s), 130.8 (s), 129.9 (s), 129.8 (s), 129.7 (s), 127.4 (s), 127.1 (s), 126.4 (s), 121.9 (q, $J = 336.0$ Hz), 120.7 (s), 117.0 (s), 103.6 (d, $J = 2.0$ Hz), 21.8 (s). IR (ATR): ν 3083, 1596, 1493, 1378, 1252, 1220, 954, 870, 845, 809, 772, 737, 698, 664, 577, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{15}\text{ClF}_3\text{NO}_2\text{SSe}$ $[\text{M}+\text{H}]^+$: 529.9702; found: 529.9702.



6-chloro-2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3h)

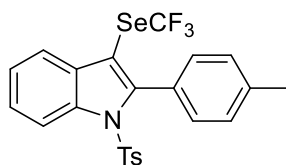
Obtained as a white solid in 86% yield (91.0 mg). Mp: 222.4–224.8 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.66. ^1H NMR (400 MHz, CDCl_3) δ 8.42 (d, J = 1.8 Hz, 1H), 7.62 (d, J = 8.4 Hz, 1H), 7.50 (t, J = 7.4 Hz, 1H), 7.44 – 7.36 (m, 3H), 7.32 (d, J = 8.2 Hz, 2H), 7.23 – 7.19 (m, 2H), 7.13 (d, J = 8.2 Hz, 2H), 2.35 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.5 (s), 145.7 (s), 137.1 (s), 135.2 (s), 131.9 (s), 131.8 (s), 129.9 (s), 129.8 (s), 129.7 (s), 129.6 (s), 127.3 (s), 127.1 (s), 125.3 (s), 121.8 (q, J = 335.8 Hz), 121.7 (s), 115.8 (s), 103.9 (d, J = 2.0 Hz), 21.6 (s). IR (ATR): ν 2961, 1596, 1487, 1376, 1283, 1189, 1174, 1130, 1086, 1038, 952, 810, 773, 735, 697, 662, 604, 572, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{ClF}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 527.9554; found: 527.9554.



6-bromo-2-phenyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3i)

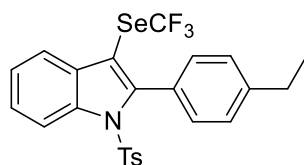
Obtained as a white solid in 79% yield (90.0 mg). Mp: 202.4–204.3 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.61. ^1H NMR (400 MHz, CDCl_3) δ 8.58 (d, J = 1.6 Hz, 1H), 7.57 (d, J = 8.4 Hz, 1H), 7.54 – 7.48 (m, 2H), 7.41 (t, J = 7.7 Hz, 2H), 7.31 (d, J = 8.5 Hz, 2H), 7.21 (m, 2H), 7.13 (d, J = 8.1 Hz, 2H), 2.35 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.4 (s), 145.7 (s), 137.4 (s), 135.2 (s), 131.8 (s), 130.4 (s), 129.8 (s), 129.7 (s), 129.5 (s), 128.0 (s), 127.3 (s), 127.1 (s), 122.1 (s), 121.8 (q, J = 335.8 Hz), 119.7 (s), 118.6 (s), 103.9 (d, J = 2.0 Hz), 21.7. IR (ATR): ν 2961, 1596, 1486, 1444, 1376, 1284, 1188, 1174, 1130,

1085, 1038, 943, 810, 773, 736, 662, 572, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{BrF}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 571.9051; found: 571.9050.



2-(*p*-tolyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1*H*-indole (3j)

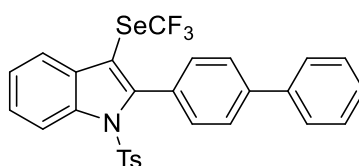
Obtained as a white solid in 87% yield (100.0 mg). Mp: 159.3–160.4 °C. R_f (petroleum ether/ ethyl acetate = 8:1) = 0.67. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, J = 8.3 Hz, 1H), 7.69 (d, J = 7.7 Hz, 1H), 7.47 – 7.42 (m, 1H), 7.41 – 7.38 (m, 1H), 7.35 (d, J = 8.4 Hz, 2H), 7.23 (d, J = 7.9 Hz, 2H), 7.16 (d, J = 8.0 Hz, 2H), 7.10 (d, J = 8.1 Hz, 2H), 2.46 (s, 3H), 2.32 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.4 (s), 145.4 (s), 139.7 (s), 136.9 (s), 135.4 (s), 131.8 (s), 131.7 (s), 129.6 (s), 128.1 (s), 127.2 (s), 127.0 (s), 125.9 (s), 124.8 (s), 122.0 (q, J = 335.9 Hz), 121.0 (s), 115.8 (s), 104.4 (d, J = 1.8 Hz), 21.7 (s), 21.6 (s). IR (ATR): ν 2920, 1595, 1495, 1446, 1374, 1303, 1264, 1189, 1177, 1128, 1085, 1019, 935, 860, 820, 734, 703, 661, 645, 571, 540 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{17}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 508.0103; found: 508.0101.



2-(4-ethylphenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1*H*-indole (3k)

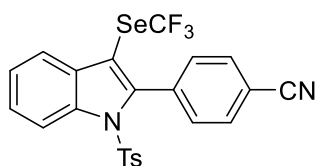
Obtained as a white solid in 80% yield (84.0 mg). Mp: 161.2–161.8 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.73. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, J = 8.3 Hz, 1H), 7.70 (d, J = 7.7 Hz, 1H), 7.47 – 7.43 (m, 1H), 7.41 – 7.37 (m, 1H), 7.33 (d, J = 8.4 Hz, 2H), 7.24 (d, J = 8.2 Hz, 2H), 7.18 (d, J = 8.2 Hz, 2H), 7.09 (d, J = 8.1 Hz,

2H), 2.77 (q, $J = 7.6$ Hz, 2H), 2.32 (s, 3H), 1.33 (t, $J = 7.6$ Hz, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.5 (s), 145.8 (s), 145.3 (s), 136.9 (s), 135.5 (s), 131.9 (s), 131.7 (s), 129.6 (s), 127.3 (s), 127.1 (s), 126.8 (s), 125.9 (s), 124.7 (s), 122.0 (q, $J = 335.9$ Hz), 121.0 (s), 115.8 (s), 104.4 (d, $J = 1.9$ Hz), 28.9 (s), 21.7 (s), 15.3 (s). IR (ATR): ν 2966, 1596, 1494, 1376, 1303, 1189, 1176, 1129, 1023, 1012, 935, 833, 812, 736, 702, 661, 642, 570, 541 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{24}\text{H}_{19}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 522.0259; found: 522.0257.



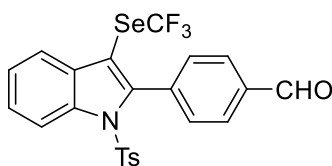
2-([1,1'-biphenyl]-4-yl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (31)

Obtained as a white solid in 45% yield (63.0 mg). Mp: 121.7–123.3 °C. R_f (petroleum ether/ ethyl acetate = 8:1) = 0.62. ^1H NMR (400 MHz, CDCl_3) δ 8.38 (d, $J = 8.3$ Hz, 1H), 7.75 – 7.69 (m, 3H), 7.66 (d, $J = 8.2$ Hz, 2H), 7.51 – 7.45 (m, 3H), 7.44 – 7.39 (m, 2H), 7.38 – 7.32 (m, 4H), 7.11 (d, $J = 8.2$ Hz, 2H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.1 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 146.9 (s), 145.4 (s), 142.3 (s), 140.4 (s), 137.1 (s), 135.5 (s), 132.4 (s), 131.8 (s), 129.7 (s), 129.1 (s), 129.0 (s), 127.9 (s), 127.4 (s), 127.1 (s), 126.2 (s), 125.9 (s), 124.8 (s), 122.0 (q, $J = 335.7$ Hz), 121.1 (s), 115.9 (s), 104.7 (d, $J = 1.6$ Hz), 21.7 (s). IR (ATR): ν 3031, 1723, 1567, 1484, 1377, 1306, 1221, 1188, 1175, 1125, 1083, 1086, 1007, 939, 834, 811, 768, 736, 697, 662, 569, 541 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{28}\text{H}_{19}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 570.0259; found: 570.0258.



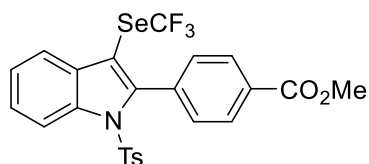
4-(1-tosyl-3-((trifluoromethyl)selanyl)-1H-indol-2-yl)benzonitrile (3m)

Obtained as a white solid in 70% yield (73.0 mg). Mp: 229.7–231.1 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.47. ^1H NMR (400 MHz, CDCl_3) δ 8.35 (d, $J = 8.4$ Hz, 1H), 7.74 – 7.71 (m, 3H), 7.55 – 7.48 (m, 1H), 7.45 – 7.41 (m, 3H), 7.34 (d, $J = 8.1$ Hz, 2H), 7.15 (d, $J = 8.1$ Hz, 2H), 2.34 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.0 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 145.9 (s), 144.6 (s), 136.9 (s), 135.0 (s), 134.9 (s), 132.5 (s), 131.5 (s), 131.1 (s), 129.9 (s), 126.8 (s), 125.2 (s), 121.8 (q, $J = 335.8$ Hz), 121.3 (s), 118.5 (s), 115.8 (s), 113.4 (s), 105.6 (d, $J = 1.8$ Hz), 21.7 (s). IR (ATR): ν 3068, 2227, 1608, 1597, 1490, 1447, 1375, 1309, 1248, 1174, 1085, 1012, 937, 848, 822, 817, 757, 679, 660, 628, 570, 541 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{14}\text{F}_3\text{N}_2\text{O}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 518.9899; found: 518.9897.



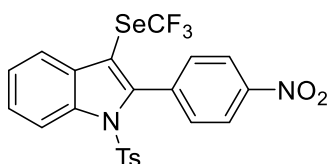
4-(1-tosyl-3-((trifluoromethyl)selanyl)-1H-indol-2-yl)benzaldehyde (3n)

Obtained as a white solid in 87% yield (91.0 mg). Mp: 214.4–215.4 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.31. ^1H NMR (400 MHz, CDCl_3) δ 10.13 (s, 1H), 8.36 (d, $J = 8.4$ Hz, 1H), 7.96 (d, $J = 7.9$ Hz, 2H), 7.72 (d, $J = 7.8$ Hz, 1H), 7.54 – 7.48 (m, 3H), 7.43 (t, $J = 7.5$ Hz, 1H), 7.36 (d, $J = 8.1$ Hz, 2H), 7.14 (d, $J = 8.1$ Hz, 2H), 2.34 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.0 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 191.9 (s), 145.8 (s), 145.4 (s), 136.9 (s), 136.8 (s), 136.4 (s), 135.0 (s), 132.6 (s), 131.6 (s), 129.9 (s), 128.6 (s), 126.9 (s), 126.6 (s), 125.1 (s), 121.9 (q, $J = 335.8$ Hz), 121.3 (s), 115.8 (s), 105.3 (d, $J = 1.5$ Hz), 21.7 (s). IR (ATR): ν 3049, 2841, 1696, 1608, 1544, 1448, 1378, 1307, 1264, 1180, 1128, 1083, 1031, 980, 940, 834, 811, 735, 703, 658, 626, 569, 542 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{15}\text{F}_3\text{NO}_3\text{SSe}$ $[\text{M}-\text{H}]^-$: 521.9895; found: 521.9894.



methyl 4-(1-tosyl-3-((trifluoromethyl)selanyl)-1H-indol-2-yl)benzoate (3o)

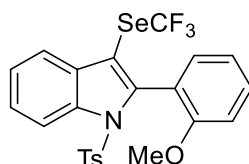
Obtained as a white solid in 29% yield (32.0 mg). Mp: 224.9–225.8 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.44. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, J = 8.4 Hz, 1H), 8.11 (d, J = 8.3 Hz, 2H), 7.72 (d, J = 7.7 Hz, 1H), 7.51 – 7.46 (m, 1H), 7.44 – 7.40 (m, 1H), 7.38 – 7.33 (m, 4H), 7.13 (d, J = 8.2 Hz, 2H), 3.98 (s, 3H), 2.34 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.1 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 166.7 (s), 145.7 (s), 145.6 (s), 136.9 (s), 135.2 (s), 134.8 (s), 131.9 (s), 131.5 (s), 131.0 (s), 129.7 (s), 128.5 (s), 126.9 (s), 126.4 (s), 124.9 (s), 121.8 (q, J = 335.8 Hz), 121.1 (s), 115.7 (s), 104.9 (d, J = 1.8 Hz), 52.3 (s), 21.6 (s). IR (ATR): ν 2951, 1721, 1611, 1596, 1493, 1446, 1378, 1307, 1275, 1176, 1085, 1023, 939, 860, 777, 704, 661, 571, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{24}\text{H}_{17}\text{F}_3\text{NO}_4\text{SSe}$ $[\text{M}-\text{H}]^-$: 552.0001; found: 552.0002.



2-(4-nitrophenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3p)

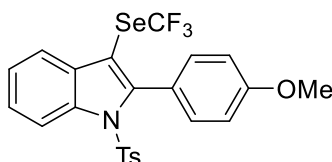
Obtained as a yellow solid in 60% yield (65.0 mg). Mp: 229.6–231.5 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.58. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, J = 8.5 Hz, 1H), 8.31 (d, J = 8.6 Hz, 2H), 7.73 (d, J = 7.8 Hz, 1H), 7.55 – 7.49 (m, 3H), 7.44 (t, J = 7.5 Hz, 1H), 7.36 (d, J = 8.2 Hz, 2H), 7.16 (d, J = 8.1 Hz, 2H), 2.35 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -34.9 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 148.5 (s), 146.0 (s), 144.3 (s), 137.1 (s), 136.9 (s), 134.9 (s), 132.9 (s), 131.6 (s), 129.9 (s), 126.9 (s), 126.8 (s), 125.3 (s), 122.6 (s), 121.8 (q, J = 335.8 Hz), 121.4 (s),

115.8 (s), 105.8 (s), 21.8 (s). IR (ATR): ν 2961, 1601, 1520, 1492, 1446, 1375, 1345, 1307, 1084, 1028, 938, 857, 812, 761, 737, 700, 661, 570, 542 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{F}_3\text{N}_2\text{O}_4\text{SSe}$ $[\text{M}-\text{H}]^-$: 538.9797; found: 538.9797.



2-(2-methoxyphenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3q)

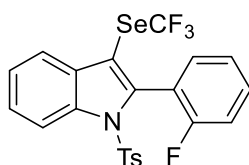
Obtained as a white solid in 78% yield (82.0 mg). Mp: 164.2–165.4 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.51. ^1H NMR (400 MHz, CDCl_3) δ 8.30 (d, J = 8.2 Hz, 1H), 7.72 (d, J = 7.7, 1H), 7.51 – 7.46 (m, 1H), 7.45 – 7.35 (m, 4H), 7.17 – 7.06 (m, 3H), 7.04 – 7.01 (m, 1H), 6.90 (d, J = 8.3 Hz, 1H), 3.59 (s, 3H), 2.32 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.0 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 158.5 (s), 144.9 (s), 143.6 (s), 136.7, 135.8 (s), 133.1 (s), 131.5 (s), 131.4 (s), 129.5 (s), 127.2 (s), 125.6 (s), 124.2 (s), 122.1 (q, J = 335.8 Hz), 120.8 (s), 119.5 (s), 119.4 (s), 115.1 (s), 110.2 (s), 104.1 (q, J = 1.7 Hz), 55.1 (s), 21.6 (s). IR (ATR): ν 2941, 1596, 1546, 1485, 1444, 1376, 1306, 1256, 1176, 1128, 1083, 1048, 1024, 936, 811, 753, 736, 704, 658, 570, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{19}\text{F}_3\text{NO}_3\text{SSe}$ $[\text{M}+\text{H}]^+$: 526.0197; found: 526.0200.



2-(4-methoxyphenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3r)

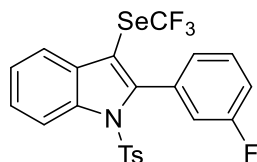
Obtained as a yellow solid in 82% yield (86.0 mg). Mp: 186.6–188.7 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.55. ^1H NMR (400 MHz, CDCl_3) δ 8.37 (d, J = 8.3 Hz, 1H), 7.69 (d, J = 7.7 Hz, 1H), 7.47 – 7.44 (m, 1H), 7.40 – 7.36 (m, 1H),

7.33 (d, $J = 8.4$ Hz, 2H), 7.19 (d, $J = 8.7$ Hz, 2H), 7.09 (d, $J = 8.1$ Hz, 2H), 6.94 (d, $J = 8.8$ Hz, 2H), 3.89 (s, 3H), 2.31 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 160.7 (s), 147.2 (s), 145.3 (s), 136.9 (s), 135.5 (s), 133.4 (s), 131.7 (s), 129.6 (s), 127.0 (s), 125.9 (s), 124.8 (s), 122.2 (s), 122.0 (q, $J = 335.9$ Hz), 120.9 (s), 115.9 (s), 112.8 (s), 104.4 (d, $J = 1.6$ Hz), 55.4 (s), 21.7 (s). IR (ATR): ν 2963, 1612, 1554, 1446, 1376, 1305, 1244, 1188, 1176, 1126, 1084, 1024, 1007, 937, 833, 813, 735, 706, 659, 570, 541 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{23}\text{H}_{17}\text{F}_3\text{NO}_3\text{SSe}$ $[\text{M}-\text{H}]^-$: 524.0052; found: 524.0052.



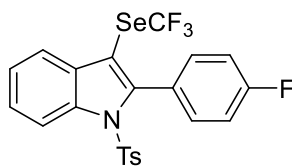
2-(2-fluorophenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3s)

Obtained as a white solid in 88% yield (90.0 mg). Mp: 116.1–118.3 $^{\circ}\text{C}$. R_f (petroleum ether/ethyl acetate = 8:1) = 0.57. ^1H NMR (400 MHz, CDCl_3) δ 8.32 (d, $J = 8.3$ Hz, 1H), 7.73 (d, $J = 7.8$ Hz, 1H), 7.54 – 7.35 (m, 5H), 7.27 – 7.22 (m, 2H), 7.17 – 7.12 (m, 3H), 2.32 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.0 (d, $J = 2.9$ Hz, 3F), -110.2 – -110.26 (m, 1F). ^{13}C NMR (101 MHz, CDCl_3) δ 161.1 (d, $J = 249.4$ Hz), 145.6 (s), 140.6 (s), 136.1 (d, $J = 148.3$ Hz), 133.6 (s), 132.1 (d, $J = 8.4$ Hz), 131.4 (s), 129.8 (s), 127.1 (s), 126.3 (s), 124.7 (s), 123.3 (d, $J = 3.6$ Hz), 122.0 (q, $J = 335.7$ Hz), 121.1 (s), 118.8 (d, $J = 15.2$ Hz), 115.5 (s), 115.3 (s), 115.2 (s), 105.5 (s), 21.7 (s). IR (ATR): ν 2962, 1595, 1482, 1376, 1309, 1250, 1177, 1127, 1084, 1035, 936, 809, 755, 659, 572, 545 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{F}_4\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 511.9852; found: 511.9854.



2-(3-fluorophenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3t)

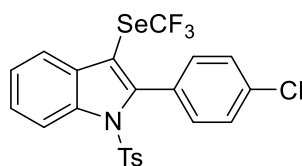
Obtained as a white solid in 83% yield (85.0 mg). Mp: 147.5–149.2 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.72. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, J = 8.4 Hz, 1H), 7.75 – 7.68 (m, 1H), 7.50 – 7.46 (m, 1H), 7.43 – 7.34 (m, 4H), 7.22 – 7.17 (m, 1H), 7.13 (d, J = 8.2 Hz, 2H), 7.10 – 7.08 (m, 1H), 6.95 – 6.92 (m, 1H), 2.34 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.1 (s, 3F), -113.5 – -113.6 (m, 1F). ^{13}C NMR (101 MHz, CDCl_3) δ 161.7 (d, J = 246.6 Hz), 145.7 (s), 145.4 (s), 136.9 (s), 135.3 (s), 132.1 (d, J = 8.5 Hz), 131.4 (s), 129.8 (s), 128.9 (d, J = 8.3 Hz), 127.9 (d, J = 3.0 Hz), 127.0 (s), 126.4 (s), 124.9 (s), 121.9 (q, J = 335.8 Hz), 121.2 (s), 118.9 (d, J = 22.8 Hz), 116.7 (d, J = 20.9 Hz), 115.8 (s), 104.8 (d, J = 1.5 Hz), 21.7 (s). IR (ATR): ν 2965, 1615, 1586, 1481, 1446, 1378, 1307, 1264, 1176, 1125, 1085, 1033, 912, 876, 790, 736, 701, 660, 570, 540 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{F}_4\text{NO}_2\text{SSe}$ [M-H]⁻: 511.9852; found: 511.9850.



2-(4-fluorophenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3u)

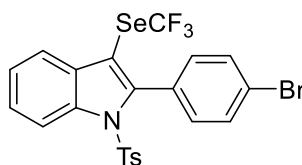
Obtained as a white solid in 81% yield (83.0 mg). Mp: 199.6–201.2 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.69. ^1H NMR (400 MHz, CDCl_3) δ 8.37 (d, J = 8.3 Hz, 1H), 7.71 (d, J = 7.8 Hz, 1H), 7.49 – 7.45 (m, 1H), 7.43 – 7.38 (m, 1H), 7.33 (d, J = 8.1 Hz, 2H), 7.26 – 7.21 (m, 2H), 7.15 – 7.07 (m, 4H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F), -110.7 – -110.8 (m, 1F). ^{13}C NMR (101 MHz, CDCl_3) δ 163.6 (d, J = 250.0 Hz), 145.9 (s), 145.6 (s), 136.9 (s), 135.5 (s), 133.8 (d, J = 8.5 Hz),

131.5 (s), 129.8 (s), 126.9 (s), 126.3 (s), 126.1 (d, $J = 3.5$ Hz), 124.9 (s), 121.9 (q, $J = 335.7$ Hz), 121.1 (s), 115.8 (s), 114.6 (d, $J = 21.9$ Hz), 104.8 (s), 21.7 (s). IR (ATR): ν 2961, 1606, 1554, 1497, 1445, 1374, 1302, 1264, 1223, 1177, 1085, 1002, 934, 840, 759, 736, 702, 663, 570, 540 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{F}_4\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 511.9852; found: 511.9852.



2-(4-chlorophenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3v)

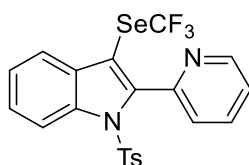
Obtained as a white solid in 80% yield (85.0 mg). Mp: 169.4–171.2 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.64. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, $J = 8.5$ Hz, 1H), 7.71 (d, $J = 7.8$ Hz, 1H), 7.50 – 7.45 (m, 1H), 7.43 – 7.38 (m, 3H), 7.34 (d, $J = 8.4$ Hz, 2H), 7.23 – 7.19 (m, 2H), 7.12 (d, $J = 8.2$ Hz, 2H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.1 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 145.8 (d, $J = 1.5$ Hz), 145.7 (s), 136.9 (s), 135.9 (s), 135.4 (s), 133.2 (s), 131.6 (s), 129.8 (s), 128.6 (s), 127.8 (s), 126.9 (s), 126.4 (s), 124.9 (s), 121.9 (q, $J = 335.8$ Hz), 121.2 (s), 115.8 (s), 104.9 (q, $J = 1.6$ Hz), 21.7 (s). IR (ATR): ν 2924, 1596, 1483, 1445, 1373, 1304, 1264, 1174, 1120, 1081, 1012, 936, 831, 736, 721, 660, 568, 541 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{ClF}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 527.9557; found: 527.9556.



2-(4-bromophenyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3w)

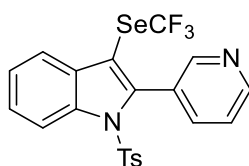
Obtained as a white solid in 82% yield (94.0 mg). Mp: 170.0–171.8 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.64. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, $J = 8.3$ Hz,

1H), 7.70 (d, $J = 7.8$ Hz, 1H), 7.56 (d, $J = 8.4$ Hz, 2H), 7.50 – 7.45 (m, 1H), 7.43 – 7.39 (m, 1H), 7.34 (d, $J = 8.4$ Hz, 2H), 7.16 – 7.11 (m, 4H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.1 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 145.8 (s), 145.7 (s), 136.9 (s), 135.3 (s), 133.4 (s), 131.6 (s), 130.7 (s), 129.8 (s), 129.1 (s), 126.9 (s), 126.4 (s), 124.9 (s), 124.4 (s), 121.9 (q, $J = 335.9$ Hz), 121.2 (s), 115.8 (s), 104.9 (s), 21.7 (s). IR (ATR): ν 2951, 1596, 1482, 1377, 1306, 1250, 1189, 1175, 1125, 1083, 1067, 1009, 938, 828, 750, 736, 660, 568, 541 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{14}\text{BrF}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 571.9051; found: 571.9049.



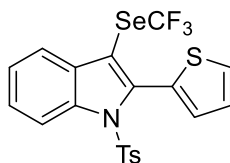
2-(pyridin-2-yl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3x)

Obtained as a white solid in 84% yield (83.0 mg). Mp: 182.7–183.5 °C. R_f (petroleum ether/ethyl acetate = 3:1) = 0.54. ^1H NMR (400 MHz, CDCl_3) δ 8.73 (d, $J = 4.5$ Hz, 1H), 8.18 (d, $J = 8.3$ Hz, 1H), 7.87 – 7.82 (m, 1H), 7.79 (d, $J = 8.1$ Hz, 2H), 7.72 (d, $J = 7.8$ Hz, 1H), 7.60 (d, $J = 7.7$ Hz, 1H), 7.47 – 7.29 (m, 3H), 7.19 (d, $J = 8.1$ Hz, 2H), 2.31 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -34.9 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 150.3 (s), 148.7 (s), 145.5 (s), 145.1 (s), 136.0 (s), 135.8 (s), 135.0 (s), 131.4 (s), 129.8 (s), 127.6 (s), 127.5 (s), 126.3 (s), 124.7 (s), 124.1 (s), 122.1 (q, $J = 335.8$ Hz), 121.3 (s), 115.1 (s), 104.5 (s), 21.7 (s). IR (ATR): ν 3052, 1594, 1447, 1264, 1178, 1126, 1086, 1052, 940, 813, 795, 733, 703, 658, 571, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{21}\text{H}_{14}\text{F}_3\text{N}_2\text{O}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 494.9898; found: 494.9898.



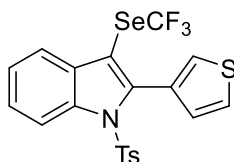
2-(pyridin-3-yl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3y)

Obtained as a white solid in 72% yield (71.0 mg). Mp: 166.5–168.9 °C. R_f (petroleum ether/ethyl acetate = 3:1) = 0.36. ^1H NMR (400 MHz, CDCl_3) δ 8.73 (d, $J = 5.0$ Hz, 1H), 8.39 – 8.37 (m, 2H), 7.77 (d, $J = 7.8$, 1H), 7.73 (d, $J = 7.8$ Hz, 1H), 7.51 (t, $J = 7.4$ Hz, 1H), 7.45 – 7.41 (m, 2H), 7.32 (d, $J = 8.2$ Hz, 2H), 7.14 (d, $J = 8.1$ Hz, 2H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 151.0 (s), 150.3 (s), 145.9 (s), 143.2 (s), 139.9 (s), 137.1 (s), 135.2 (s), 131.4 (s), 129.9 (s), 126.9 (s), 126.8 (s), 126.7 (s), 125.1 (s), 122.5 (s), 121.8 (q, $J = 335.8$ Hz), 121.3 (s), 115.7 (s), 105.8 (d, $J = 1.7$ Hz), 21.7 (s). IR (ATR): ν 3034, 1596, 1445, 1379, 1307, 1264, 1177, 1085, 1064, 937, 882, 812, 753, 706, 660, 569, 542 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{21}\text{H}_{14}\text{F}_3\text{N}_2\text{O}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 494.9899; found: 494.9899.



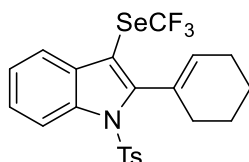
2-(thiophen-2-yl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3z)

Obtained as a yellow solid in 76% yield (76.0 mg). Mp: 144.4–146.6 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.71. ^1H NMR (400 MHz, CDCl_3) δ 8.36 (d, $J = 8.5$ Hz, 1H), 7.70 (d, $J = 7.7$ Hz, 1H), 7.55 (dd, $J = 4.9, 1.5$ Hz, 1H), 7.49 – 7.45 (m, 1H), 7.43 – 7.37 (m, 3H), 7.16 – 7.09 (m, 4H), 2.33 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.1 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 145.5 (s), 139.5 (s), 137.3 (s), 135.3 (s), 133.0 (s), 131.4 (s), 129.7 (s), 129.5 (s), 129.3 (s), 127.1 (s), 126.5 (s), 126.5 (s), 124.8 (s), 121.9 (q, $J = 335.9$ Hz), 121.2 (s), 115.8 (s), 107.1 (d, $J = 1.9$ Hz), 21.7 (s). IR (ATR): ν 3051, 1596, 1568, 1445, 1375, 1307, 1264, 1175, 1116, 1085, 1043, 1021, 985, 933, 858, 808, 734, 701, 663, 570, 539 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{20}\text{H}_{13}\text{F}_3\text{NO}_2\text{S}_2\text{Se}$ $[\text{M}-\text{H}]^-$: 499.9510; found: 499.9510.



2-(thiophen-3-yl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3aa)

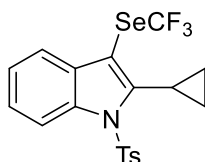
Obtained as a white solid in 86% yield (86.0 mg). Mp: 175.7–177.9 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.71. ^1H NMR (400 MHz, CDCl_3) δ 8.37 (d, J = 8.3 Hz, 1H), 7.69 (d, J = 7.8 Hz, 1H), 7.50 – 7.43 (m, 1H), 7.41 – 7.31 (m, 4H), 7.23 (d, J = 3.5 Hz, 1H), 7.14 – 7.07 (m, 3H), 2.32 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.3 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 145.4 (s), 142.2 (s), 137.1 (s), 135.4 (s), 131.5 (s), 131.1 (s), 129.7 (s), 129.6 (s), 129.0 (s), 126.9 (s), 126.1 (s), 124.7 (s), 124.2 (s), 122.0 (q, J = 335.7 Hz), 121.0 (s), 115.7 (s), 104.9 (d, J = 1.8 Hz), 21.7 (s). IR (ATR): ν 2925, 1595, 1571, 1445, 1371, 1306, 1264, 1174, 1087, 1021, 932, 910, 866, 790, 734, 719, 660, 645, 590, 566 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{20}\text{H}_{13}\text{F}_3\text{NO}_2\text{S}_2\text{Se}$ [M-H]: 499.9510; found: 499.9509.



2-(cyclohex-1-en-1-yl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3ab)

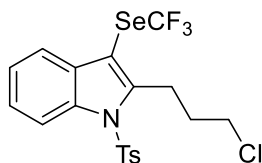
Obtained as a white solid in 44% yield (44.0 mg). Mp: 181.3–183.0 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.70. ^1H NMR (400 MHz, CDCl_3) δ 8.25 (d, J = 8.2 Hz, 1H), 7.66 – 7.58 (m, 3H), 7.40 – 7.30 (m, 2H), 7.15 (d, J = 8.2 Hz, 2H), 5.45 – 5.42 (m, 1H), 2.70 – 2.66 (m, 1H), 2.31 (s, 3H), 2.25 – 2.17 (m, 2H), 2.09 – 2.01 (m, 1H), 1.86 – 1.81 (m, 3H), 1.75 – 1.67 (m, 1H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.3 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 149.8 (s), 145.3 (s), 136.5 (s), 135.8 (s), 133.5 (s), 131.8 (s), 130.2 (s), 129.7 (s), 126.9 (s), 125.6 (s), 124.5 (s), 122.1 (q, J = 335.7 Hz), 121.0 (s), 115.3 (s), 102.5 (d, J = 1.7 Hz), 30.9 (s), 25.7 (s), 22.6 (s), 21.8 (s), 21.7 (s).

IR (ATR): ν 2934, 1597, 1534, 1493, 1446, 1375, 1292, 1187, 1173, 1082, 1046, 1023, 941, 858, 811, 747, 703, 660, 570, 543 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{22}\text{H}_{19}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 498.0259; found: 498.0259.



2-cyclopropyl-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3ac)

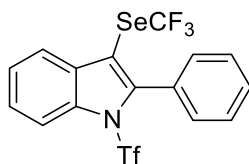
Obtained as a white solid in 68% yield (62.0 mg). Mp: 101.5–102.8 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.63. ^1H NMR (400 MHz, CDCl_3) δ 8.23 (d, J = 8.2 Hz, 1H), 7.66 (d, J = 8.2 Hz, 2H), 7.62 (d, J = 7.8 Hz, 1H), 7.40 – 7.29 (m, 2H), 7.21 (d, J = 8.1 Hz, 2H), 2.36 (s, 3H), 2.21 – 2.14 (m, 1H), 1.16 – 1.11 (m, 2H), 1.01 – 0.96 (m, 2H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.5 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.6 (s), 145.3 (s), 136.9 (s), 136.4 (s), 131.7 (s), 129.9 (s), 126.6 (s), 125.7 (s), 124.3 (s), 122.2 (q, J = 336.9 Hz), 120.5 (s), 115.0 (s), 102.6 (d, J = 1.9 Hz), 21.7 (s), 9.9 (s), 9.6 (s). IR (ATR): ν 3015, 1597, 1539, 1494, 1448, 1371, 1307, 1263, 1224, 1190, 1169, 1120, 1084, 1044, 900, 830, 810, 737, 658, 569, 541 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{19}\text{H}_{15}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]^-$: 457.9946; found: 457.9947.



2-(3-chloropropyl)-1-tosyl-3-((trifluoromethyl)selanyl)-1H-indole (3ad)

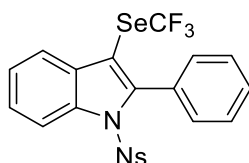
Obtained as a white solid in 33% yield (33.0 mg). Mp: 139.5–141.1 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.74. ^1H NMR (400 MHz, CDCl_3) δ 8.18 – 8.14 (m, 1H), 7.65 – 7.56 (m, 3H), 7.38 – 7.30 (m, 2H), 7.19 (d, J = 8.0 Hz, 2H), 3.64 (t, J = 6.3 Hz, 2H), 3.51 – 3.43 (m, 2H), 2.33 (s, 3H), 2.29 – 2.20 (m, 2H). ^{19}F NMR (376 MHz,

CDCl₃) δ -35.5 (s, 3F). ¹³C NMR (101 MHz, CDCl₃) δ 147.5 (s), 145.6 (s), 136.8 (s), 135.6 (s), 131.6 (s), 130.2 (s), 126.4 (s), 125.7 (s), 124.7, 122.1 (q, *J* = 335.8 Hz), 120.7 (s), 115.2 (s), 103.8 (s), 44.6 (s), 33.6 (s), 26.3 (s), 21.7 (s). IR (ATR): ν 2960, 1597, 1448, 1372, 1307, 1175, 1132, 1087, 1072, 1023, 973, 937, 809, 746, 703, 657, 598, 568 cm⁻¹. HRMS (ESI) *m/z*: calcd. for C₁₉H₁₈ClF₃NO₂SSe [M+H]⁺: 495.9859; found: 495.9860.



2-phenyl-3-((trifluoromethyl)selanyl)-1-((trifluoromethyl)sulfonyl)-1H-indole
(3a-1)

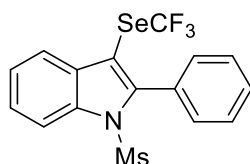
Obtained as a white solid in 48% yield (45 mg). Mp: 134.4–136.6 °C. R_f (petroleum ether/ethyl acetate = 10:1) = 0.59. ^1H NMR (400 MHz, CDCl_3) δ 8.11 – 8.04 (m, 1H), 7.83 – 7.81 (m, 1H), 7.58 – 7.45 (m, 5H), 7.39 – 7.37 (m, 2H). ^{19}F NMR (376 MHz, CDCl_3) δ -34.5 (s, 3F), -73.9 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.3 (s), 136.4 (s), 131.5 (s), 130.2 (s), 129.0 (s), 128.1 (s), 127.8 (s), 127.2 (s), 126.3 (s), 121.9 (q, J = 335.5 Hz), 121.8, 119.6 (q, J = 325.5 Hz), 115.4 (s), 107.9 (s). IR (ATR): ν 1555, 1490, 1450, 1414, 1206, 1137, 1118, 1080, 943, 923, 829, 779, 766, 756, 695, 679, 631, 606, 575 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{16}\text{H}_{10}\text{F}_6\text{NO}_2\text{SSe}$ $[\text{M}+\text{H}]^+$: 473.9496; found: 473.9496.



1-((4-nitrophenyl)sulfonyl)-2-phenyl-3-((trifluoromethyl)selanyl)-1H-indole
(3a-2)

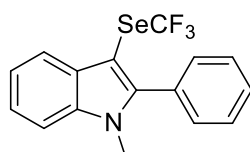
Obtained as a yellow solid in 53% yield (56.0 mg). Mp: 235.1–235.7 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.67. ^1H NMR (400 MHz, CDCl_3) δ 8.35 (d, J = 8.3 Hz, 1H), 8.16 (d, J = 7.9 Hz, 2H), 7.73 (d, J = 7.8 Hz, 1H), 7.61 (d, J = 8.1 Hz, 2H), 7.55 – 7.52 (m, 2H), 7.47 – 7.44 (m, 3H), 7.28 (d, J = 7.7 Hz, 2H). ^{19}F NMR (376 MHz, CDCl_3) δ -34.9 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 150.7 (s), 146.6 (s), 143.2 (s), 136.7 (s), 131.8 (s), 131.7 (s), 130.0 (s), 129.4 (s), 128.3 (s), 127.6 (s),

126.7 (s), 125.5 (s), 124.2 (s), 121.8 (q, $J = 335.7$ Hz), 121.3 (s), 115.6 (s), 105.9 (s). IR (ATR): ν 1606, 1528, 1487, 1444, 1390, 1347, 1317, 1300, 1260, 1185, 1140, 1112, 1085, 1033, 942, 907, 855, 790, 776, 742, 696, 679, 609, 562 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{21}\text{H}_{13}\text{F}_3\text{N}_2\text{NaO}_4\text{SSe}$ $[\text{M}+\text{Na}]^+$: 548.9606; found: 548.9606.



1-(methylsulfonyl)-2-phenyl-3-((trifluoromethyl)selanyl)-1H-indole (3a-3)

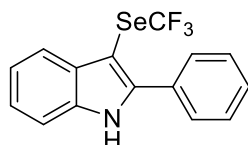
Obtained as a white solid in 68% yield (57.0 mg). Mp: 204.7–206.0 °C. R_f (petroleum ether/ethyl acetate = 8:1) = 0.45. ^1H NMR (400 MHz, CDCl_3) δ 8.22 – 8.19 (m, 1H), 7.90 – 7.84 (m, 1H), 7.58 – 7.47 (m, 7H), 3.03 (s, $J = 2.1$ Hz, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -35.0 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 146.7 (s), 136.3 (s), 131.4 (s), 131.3 (s), 130.1 (s), 129.8 (s), 127.7 (s), 126.3 (s), 124.9 (s), 122.0 (q, $J = 335.6$ Hz), 121.3 (s), 114.9 (s), 104.2 (d, $J = 1.9$ Hz), 41.9 (s). IR (ATR): ν 3010, 2930, 1445, 1362, 1323, 1244, 1217, 1173, 1087, 1070, 1026, 955, 924, 829, 770, 758, 737, 699, 676, 627, 586, 542 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{16}\text{H}_{12}\text{F}_3\text{NO}_2\text{SSe}$ $[\text{M}-\text{H}]$: 417.9633; found: 417.9630.



1-methyl-2-phenyl-3-((trifluoromethyl)selanyl)-1H-indole (3a-4)

Obtained as a white solid in 97% yield (69.0 mg). Mp: 116.1–118.1 °C. R_f (petroleum ether:ethyl acetate = 10:1) = 0.57. ^1H NMR (400 MHz, CDCl_3) δ 7.81 (d, $J = 7.7$ Hz, 1H), 7.56 – 7.48 (m, 3H), 7.44 – 7.38 (m, 3H), 7.38 – 7.28 (m, 2H), 3.67 (s, 3H). ^{19}F NMR (376 MHz, CDCl_3) δ -37.2 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 147.8 (s),

137.5 (s), 131.1 (s), 130.9 (s), 130.7 (s), 129.3 (s), 128.4 (s), 123.2 (s), 122.5 (q, $J = 336.6$ Hz), 121.6 (s), 120.5 (s), 110.0 (s), 91.9 (d, $J = 1.1$ Hz), 31.9 (s). IR (ATR): ν 3060, 2945, 1467, 1442, 1373, 1335, 1235, 1110, 1088, 1022, 1012, 952, 919, 826, 792, 740, 698, 613, 583, 547 cm^{-1} . HRMS (ESI) m/z : calcd. for $\text{C}_{16}\text{H}_{12}\text{F}_3\text{NNaSe}$ $[\text{M}+\text{Na}]^+$: 377.9979; found: 377.9980.



2-phenyl-3-((trifluoromethyl)selanyl)-1H-indole (3a-6)

Obtained as a white solid in 95% yield (65.0 mg). R_f (petroleum ether/ethyl acetate = 8:1) = 0.53. ^1H NMR (400 MHz, CDCl_3) δ 8.57 (br s, 1H), 7.85 – 7.77 (m, 1H), 7.75 – 7.65 (m, 2H), 7.53 – 7.38 (m, 4H), 7.33 – 7.25 (m, 2H). ^{19}F NMR (376 MHz, CDCl_3) δ -36.6 (s, 3F). ^{13}C NMR (101 MHz, CDCl_3) δ 144.2 (s), 135.9 (s), 132.3 (s), 131.5 (s), 129.3 (s), 129.2 (s), 128.8 (s), 123.8 (s), 122.6 (q, $J = 336.5$ Hz), 121.8 (s), 120.8 (s), 111.2 (s), 91.4 (d, $J = 2.0$ Hz).

Crystal structure analyses

The crystal samples of **3w** were prepared by slow volatilization in ethyl acetate. The suitable crystals of **3w** (CCDC 2084131) were mounted on quartz fibers and X-ray data collected on a Bruker AXS APEX diffractometer, equipped with a CCD detector at -50 °C, using CuK α radiation (λ 1.54178 Å). The data was corrected for Lorentz and polarisation effect with the **SMART** suite of programs and for absorption effects with SADABS. Structure solution and refinement were carried out with the SHELXTL suite of programs. The structure was solved by direct methods to locate the heavy atoms, followed by difference maps for the light non-hydrogen atoms.

Table S1. Crystal data and structure refinement for compounds

Compound	3w (CCDC 2084131)
Empirical formula	C ₂₂ H ₁₅ BrF ₃ NO ₂ SSe
Formula weight	573.28
Temperature/K	296.15
Wavelength/Å	1.54178
Crystal system	Triclinic
a/Å	9.0368(4)
b/Å	9.7879(5)
c/Å	12.8089(6)
α/°	72.001(2)
β/°	83.060(2)
γ/°	79.877(2)
Volume/Å ³	1058.06(9)
Z	2
Density (calc.)/cm ³	1.799
Absorption coefficient /mm ⁻¹	5.960
F(000)	564.0
Crystal size/mm	0.05 × 0.04 × 0.01
Theta range for data collection / °	7.28~133.22
Reflections collected	21152
Independent reflections	3696 [R(int) = 0.0301]
Data/restraints/parameters	3969 / 0 / 282
Goodness-of-fit on F ²	1.090
Final R indexes [I>=2σ (I)]	0.0248
Final R indexes [all data]	0.0258
Largest diff. peak and hole / e Å ⁻³	1.25/-0.38

ORTEP diagrams

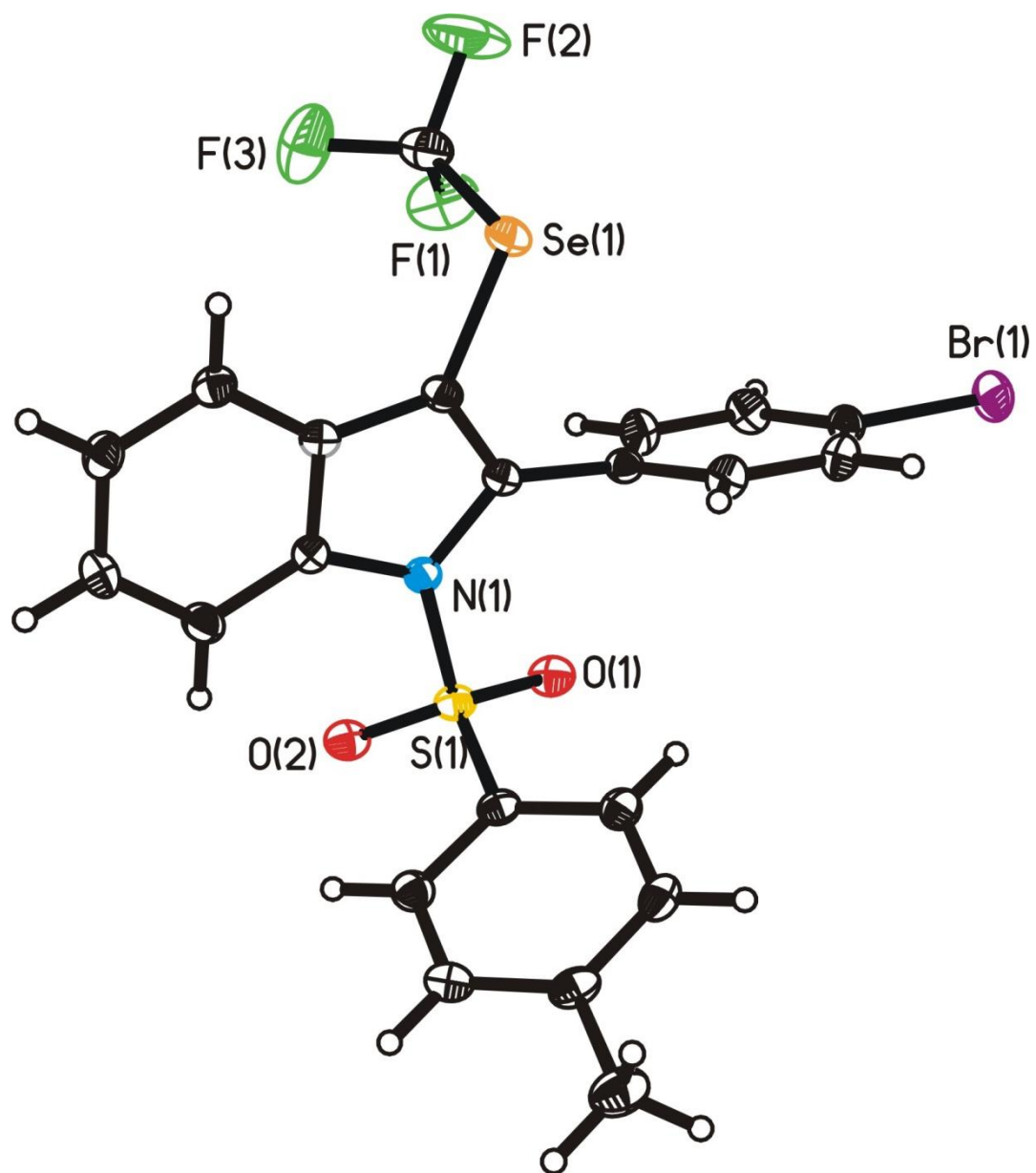


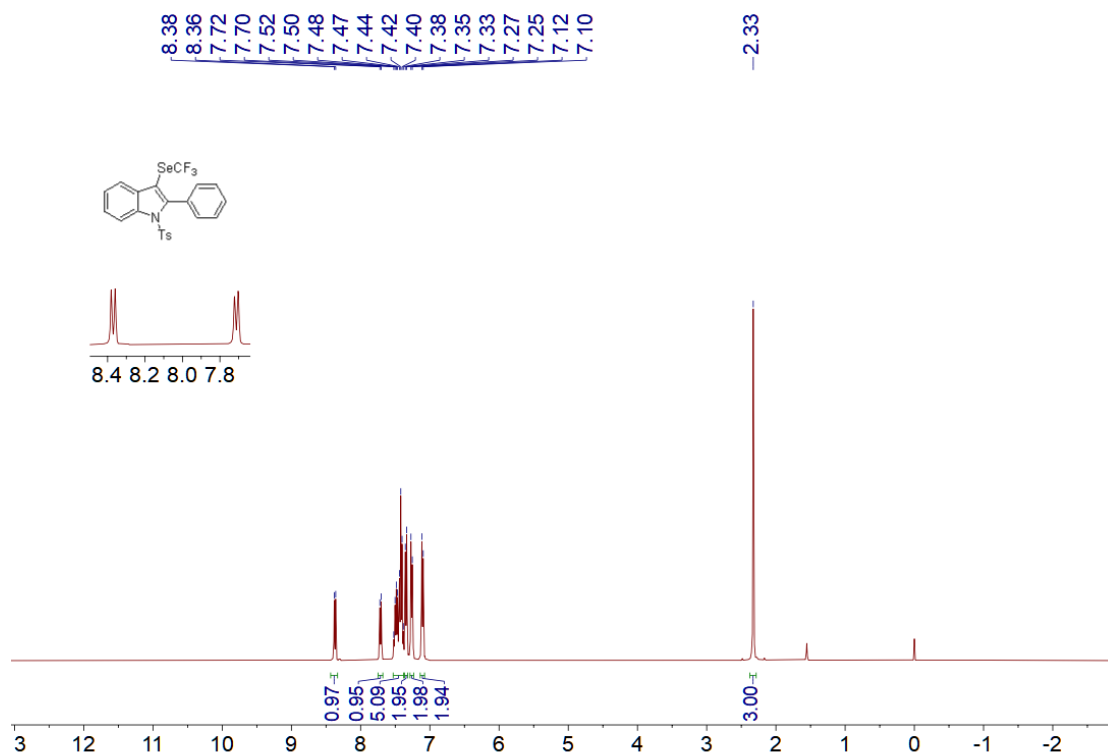
Figure S1. ORTEP diagram of 3w with thermal ellipsoids at the 40% probability level

References

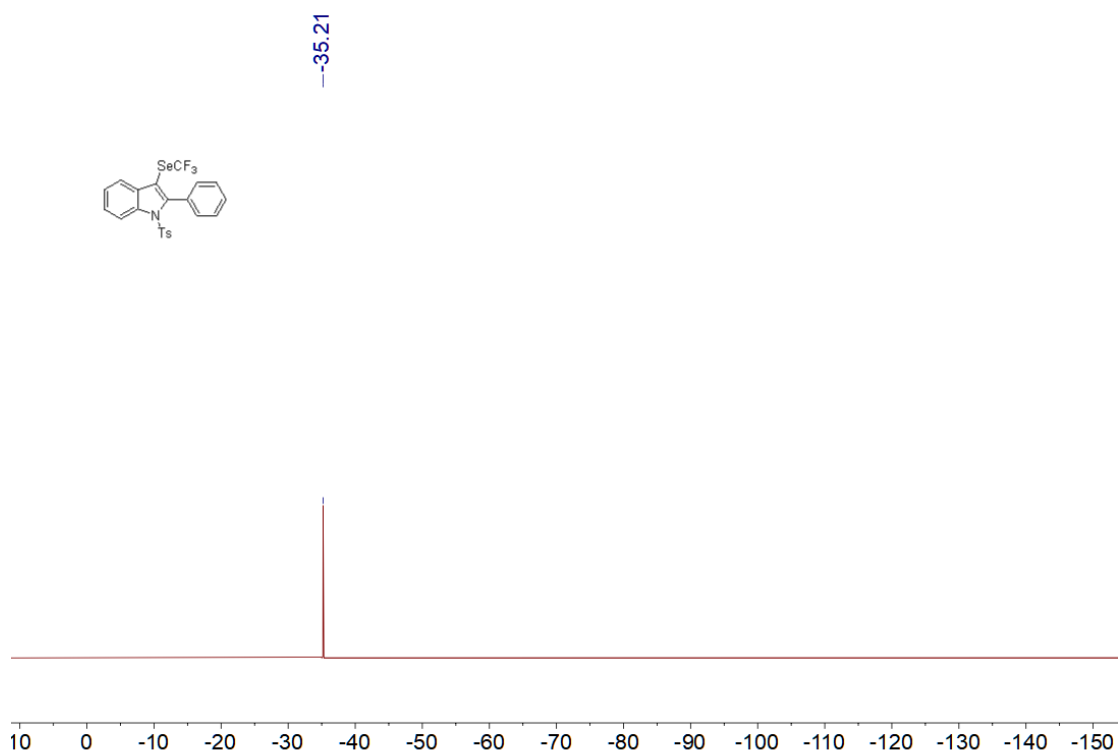
1. C. Chen, L. Ouyang, Q. Lin, Y. Liu, C. Hou, Y. Yuan and Z. Weng, *Chem.-Eur. J.*, 2014, **20**, 657-661.
2. J. Liu, X. Xie and Y. Liu, *Chem. Commun.*, 2013, **49**, 11794-11796.
3. C. M. Le, T. Sperger, R. Fu, X. Hou, Y. H. Lim, F. Schoenebeck and M. Lautens, *J. Am. Chem. Soc.*, 2016, **138**, 14441-14448.

Copies of ^1H NMR, ^{19}F NMR and ^{13}C NMR spectra

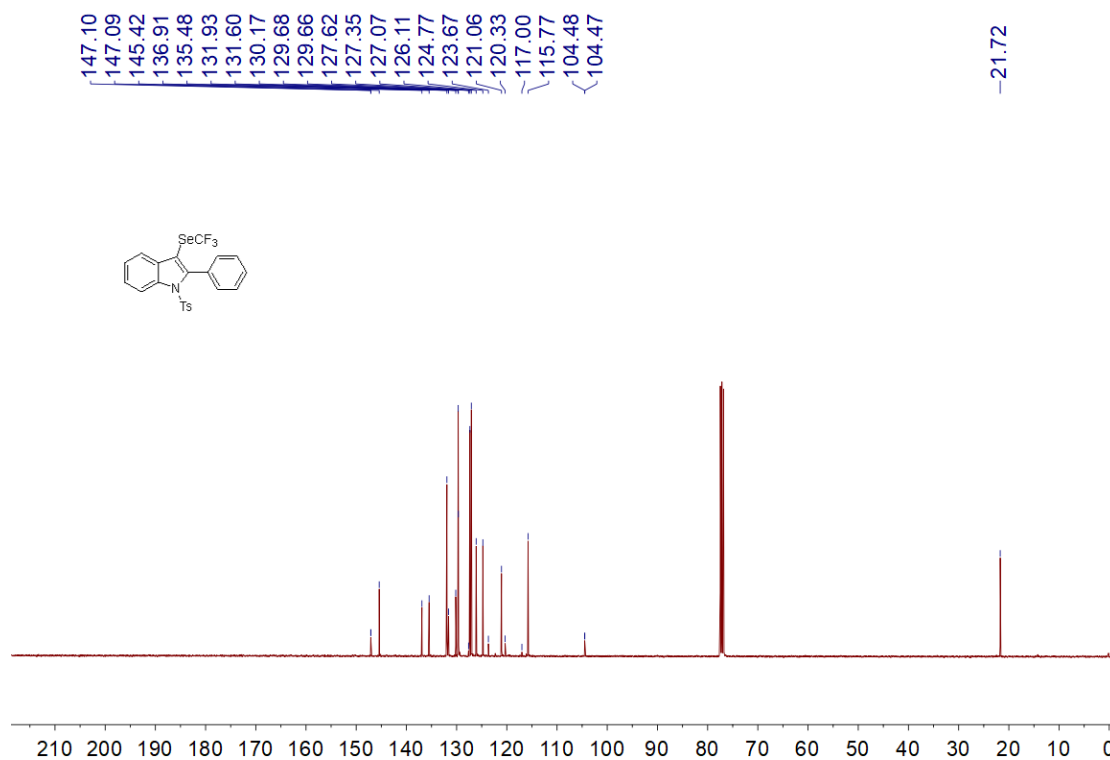
^1H NMR spectra of **3a** in CDCl_3



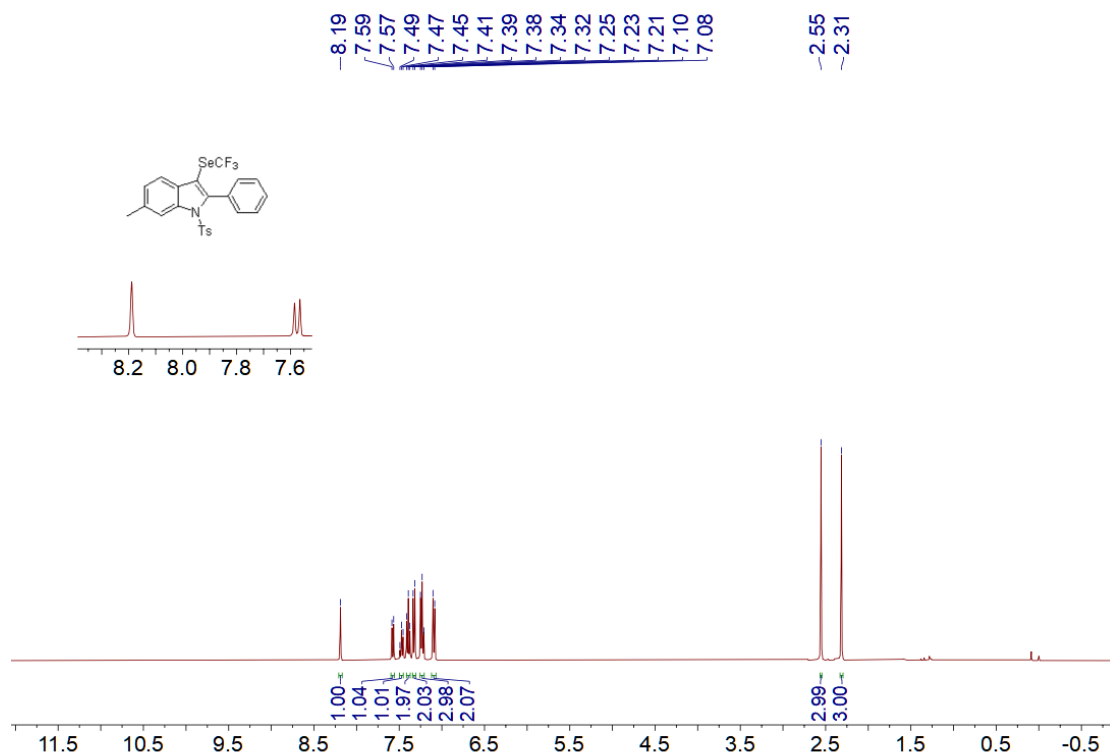
^{19}F NMR spectra of **3a** in CDCl_3



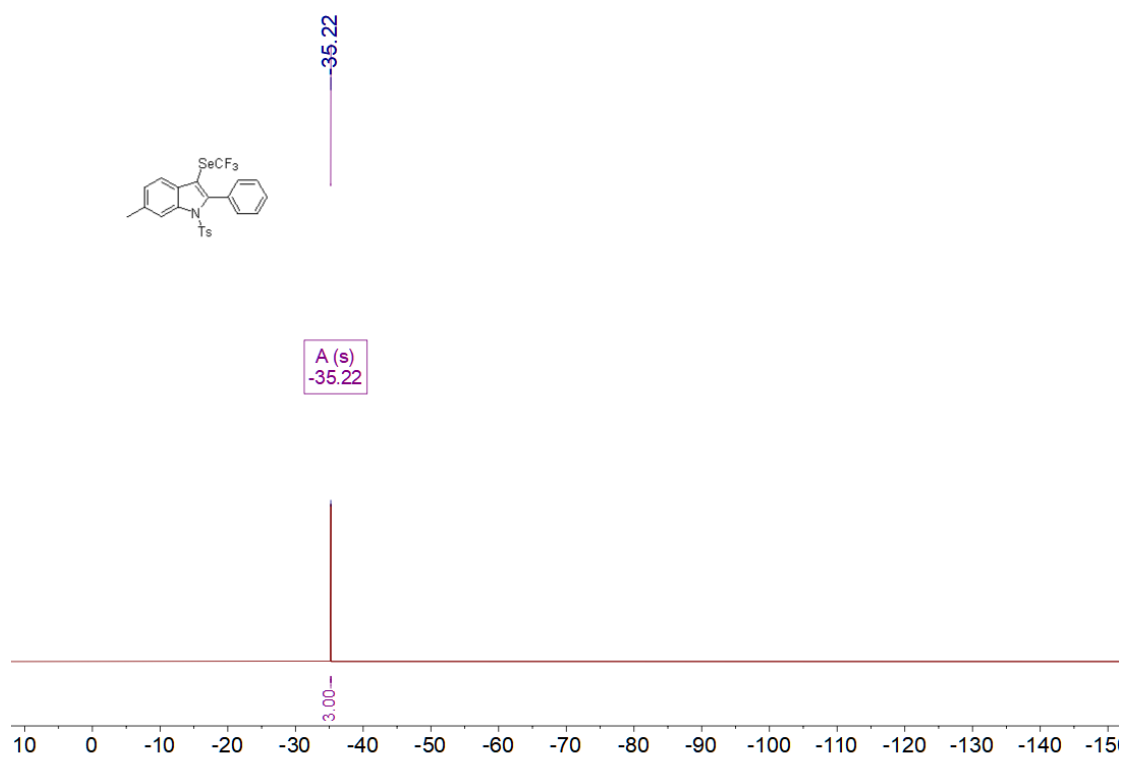
^{13}C NMR spectra of **3a** in CDCl_3



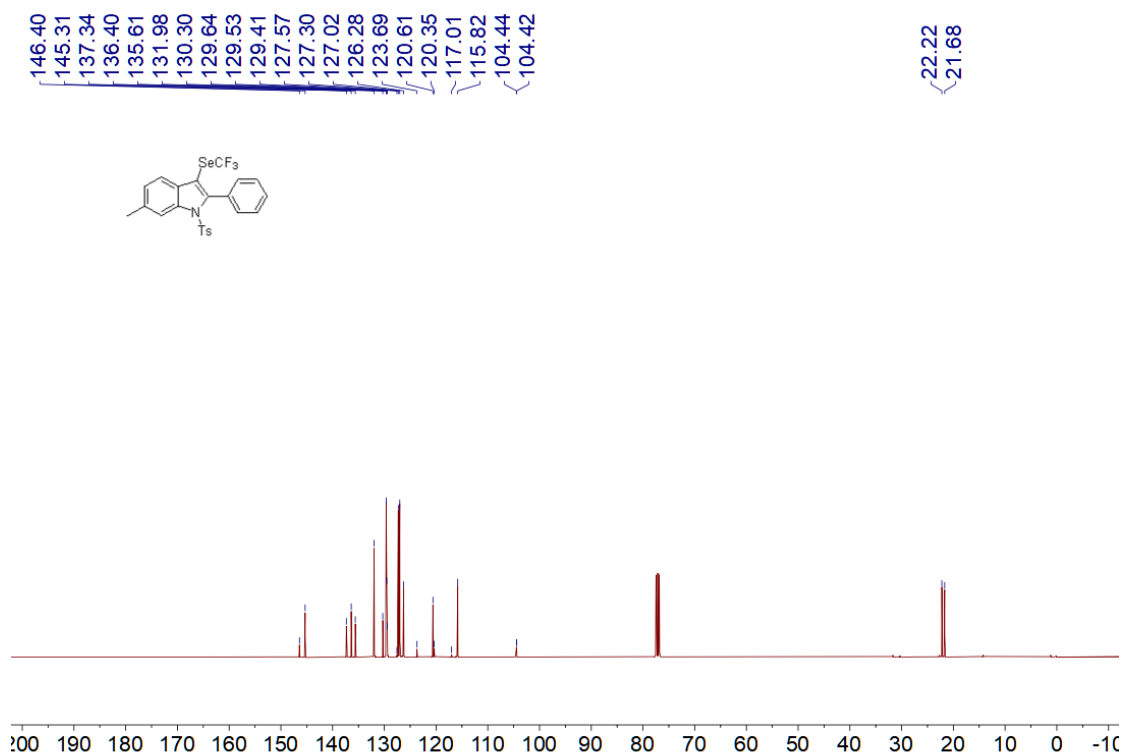
^1H NMR spectra of **3b** in CDCl_3



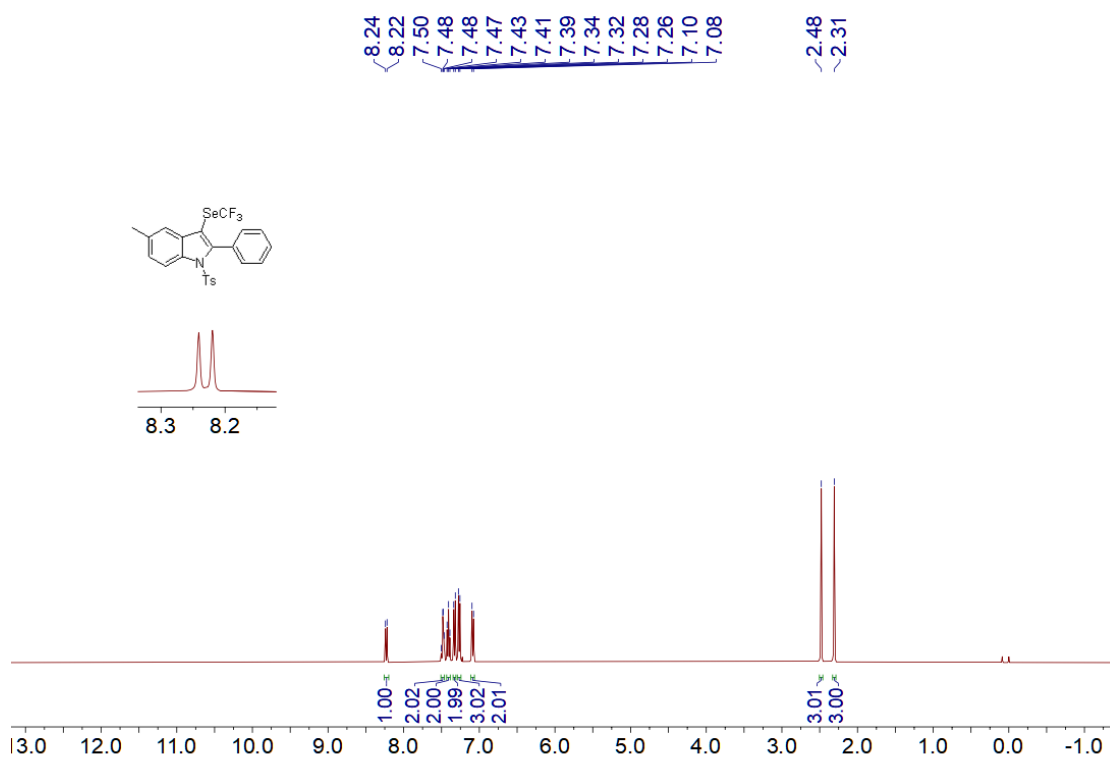
^{19}F NMR spectra of **3b** in CDCl_3



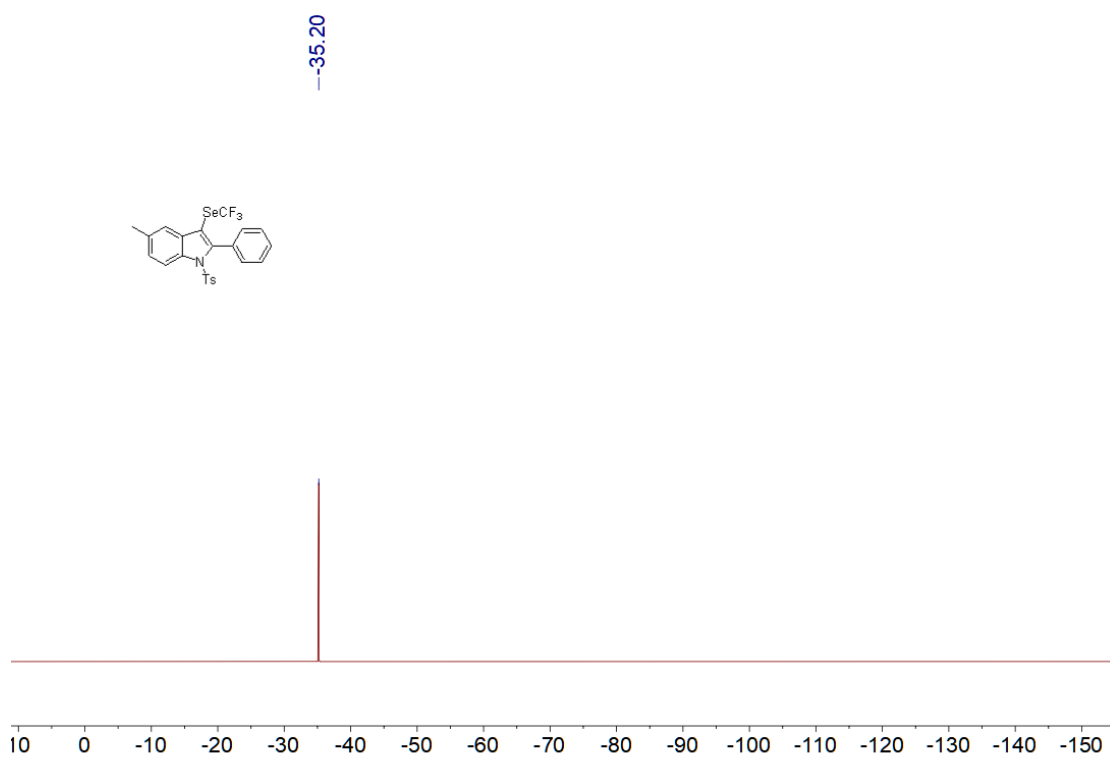
^{13}C NMR spectra of **3b** in CDCl_3



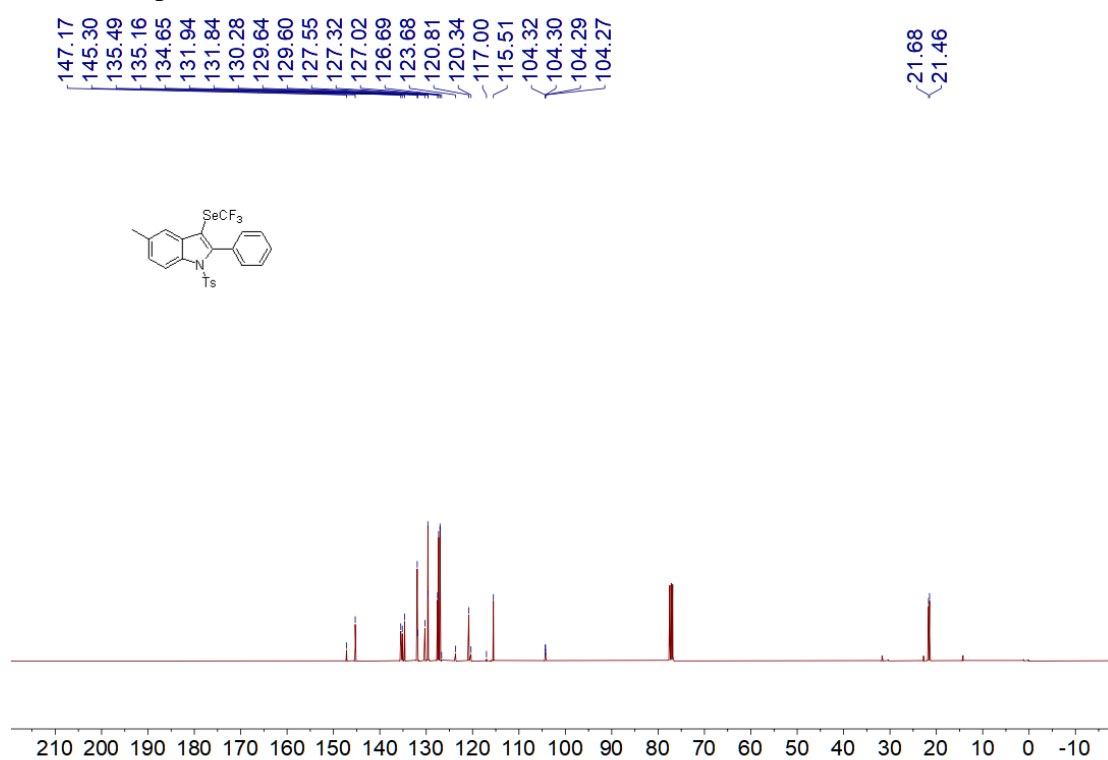
^1H NMR spectra of **3c** in CDCl_3



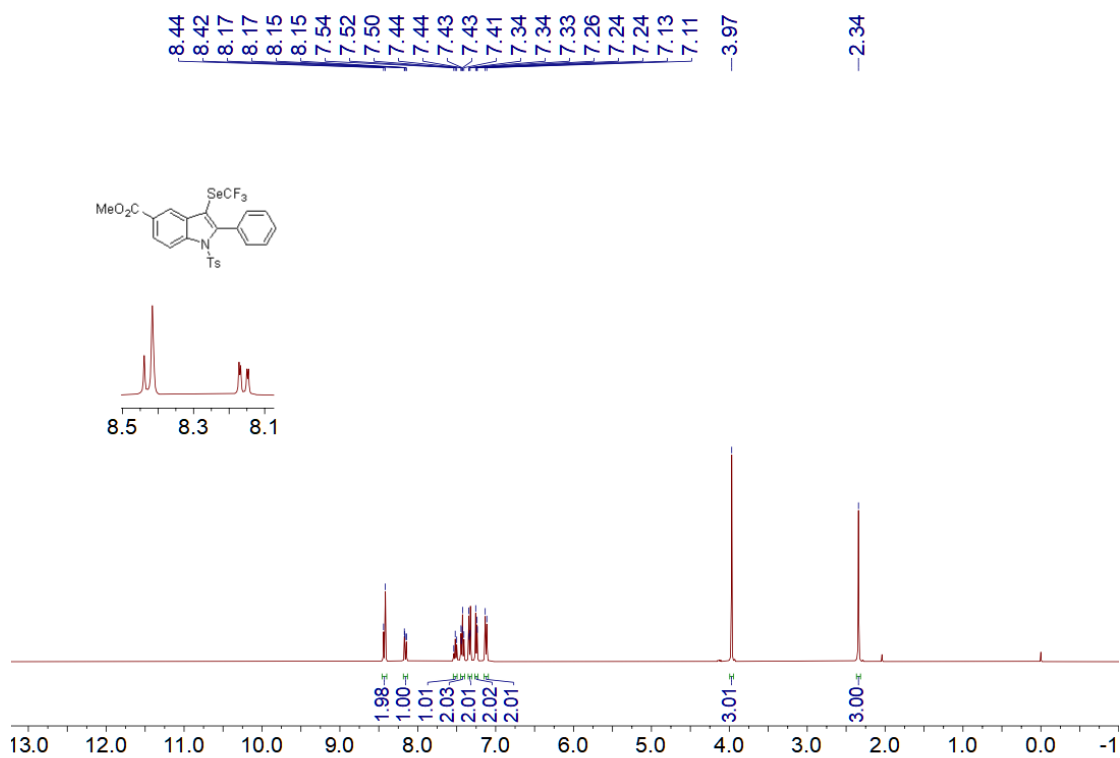
^{19}F NMR spectra of **3c** in CDCl_3



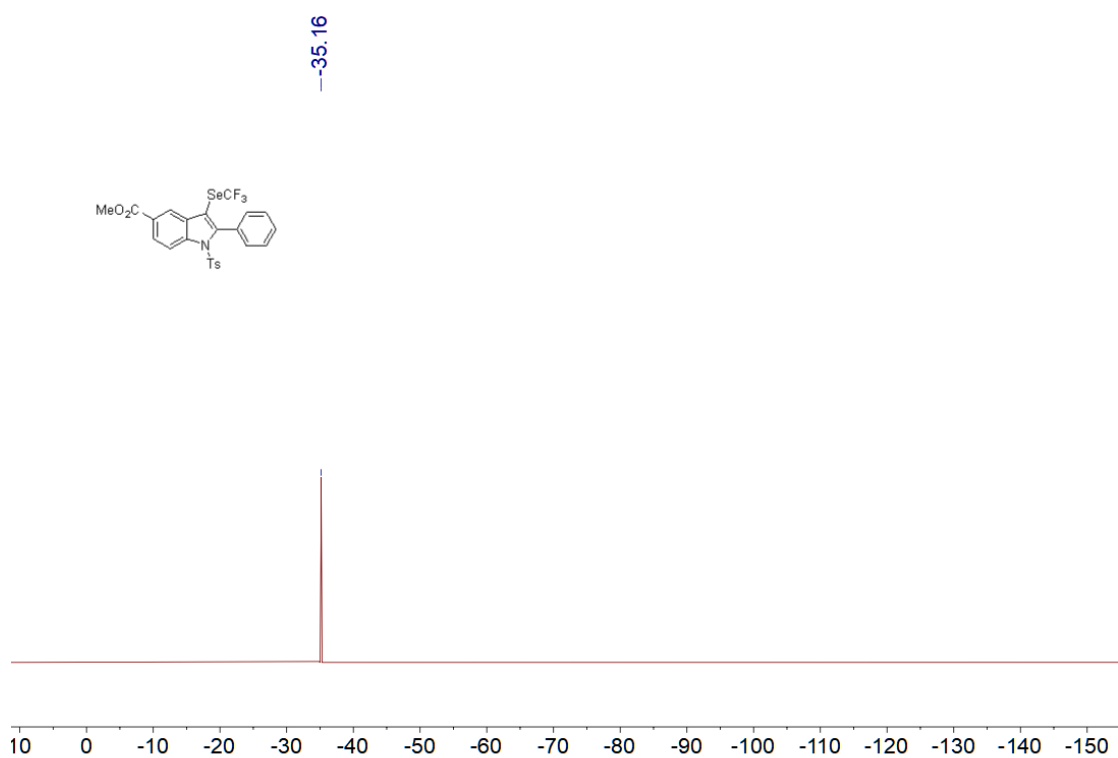
¹³C NMR spectra of **3c** in CDCl₃



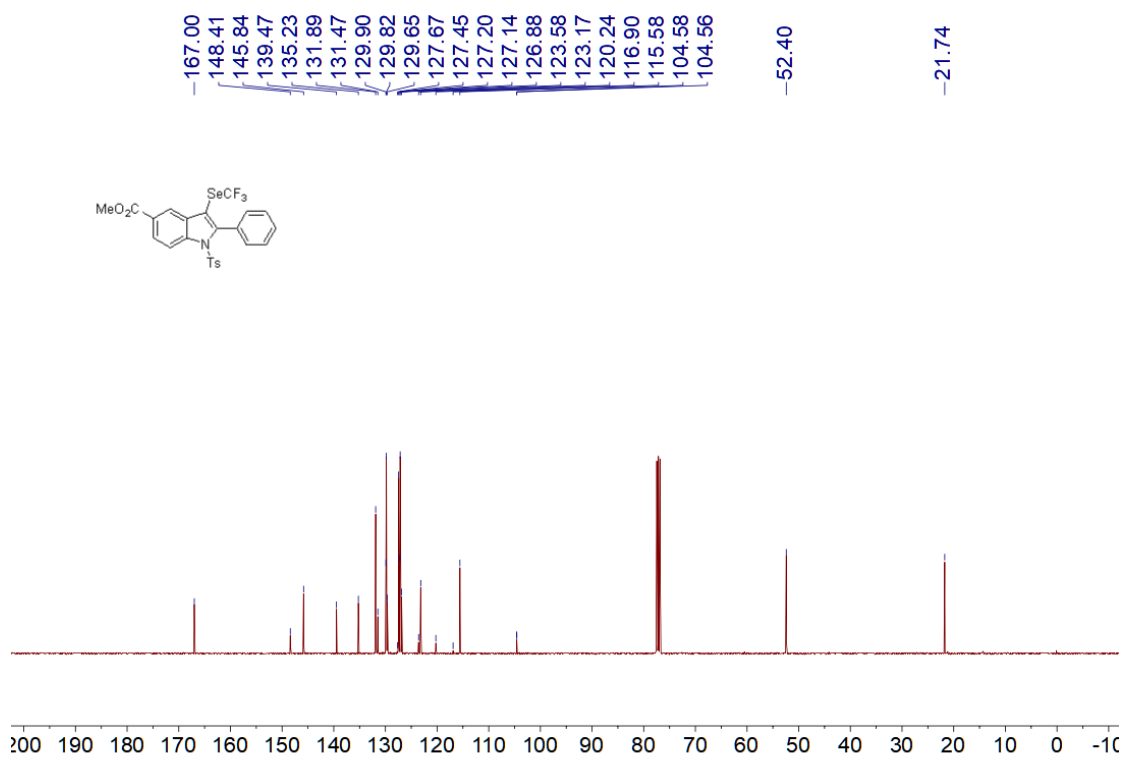
¹H NMR spectra of **3d** in CDCl₃



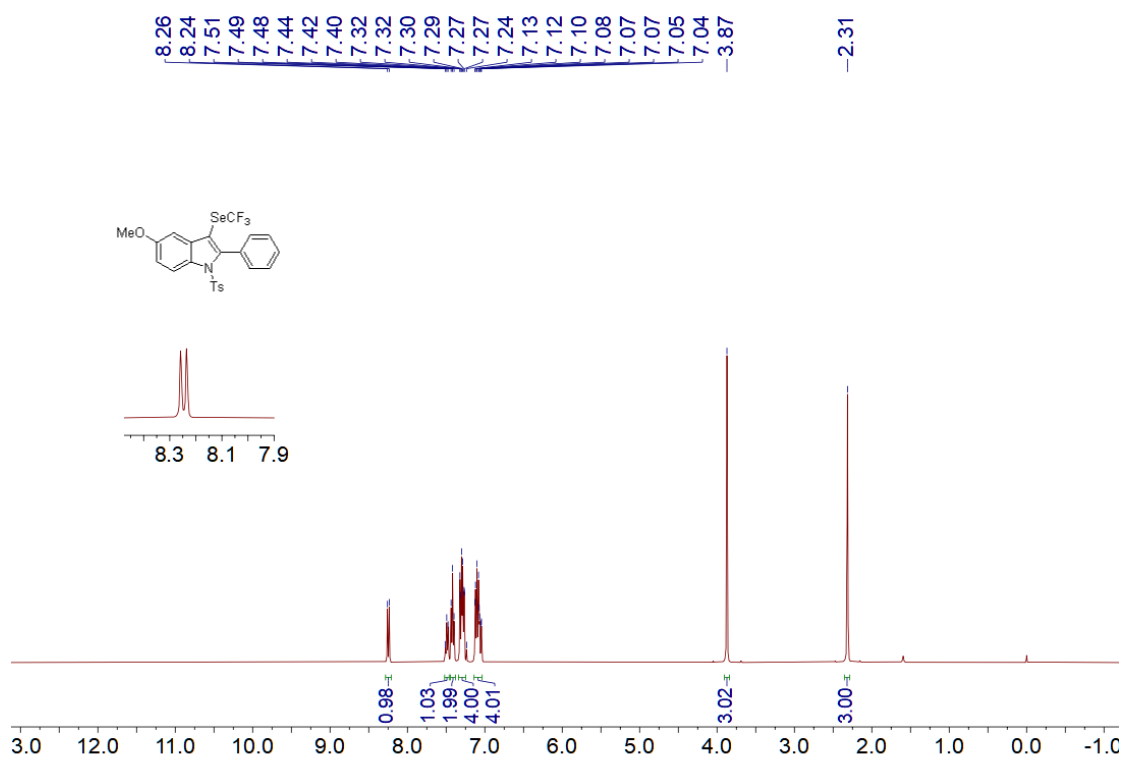
^{19}F NMR spectra of **3d** in CDCl_3



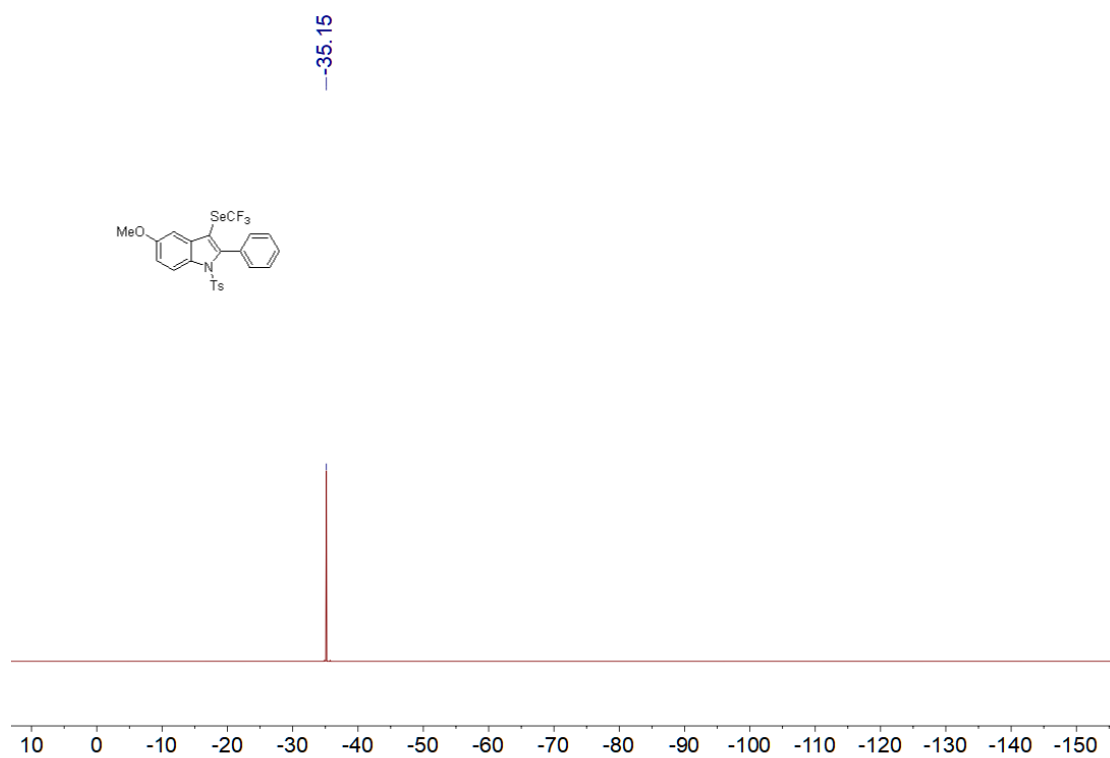
^{13}C NMR spectra of **3d** in CDCl_3



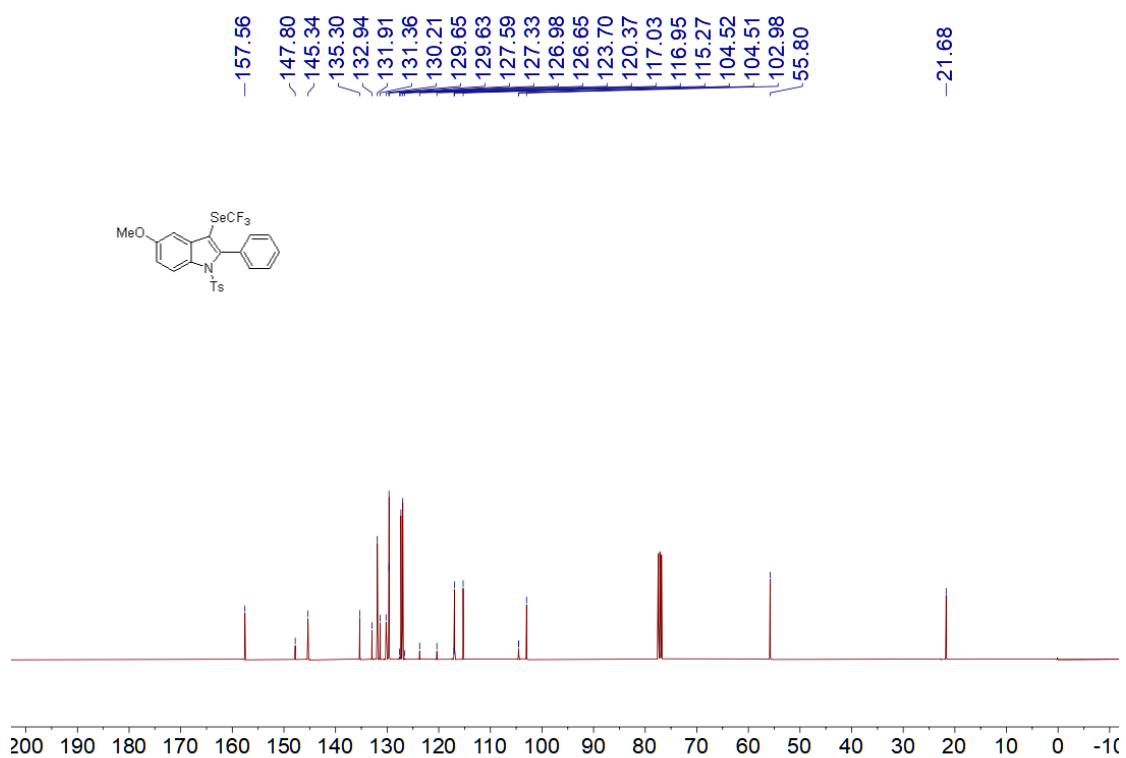
^1H NMR spectra of **3e** in CDCl_3



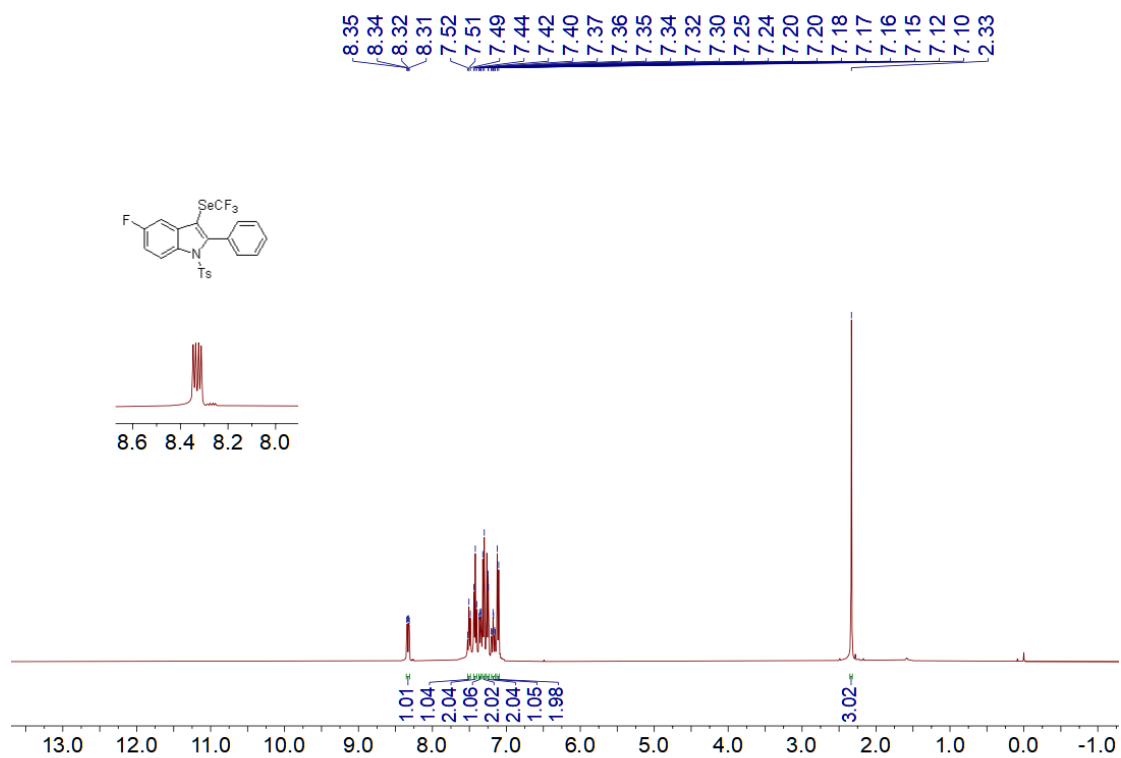
^{19}F NMR spectra of **3e** in CDCl_3



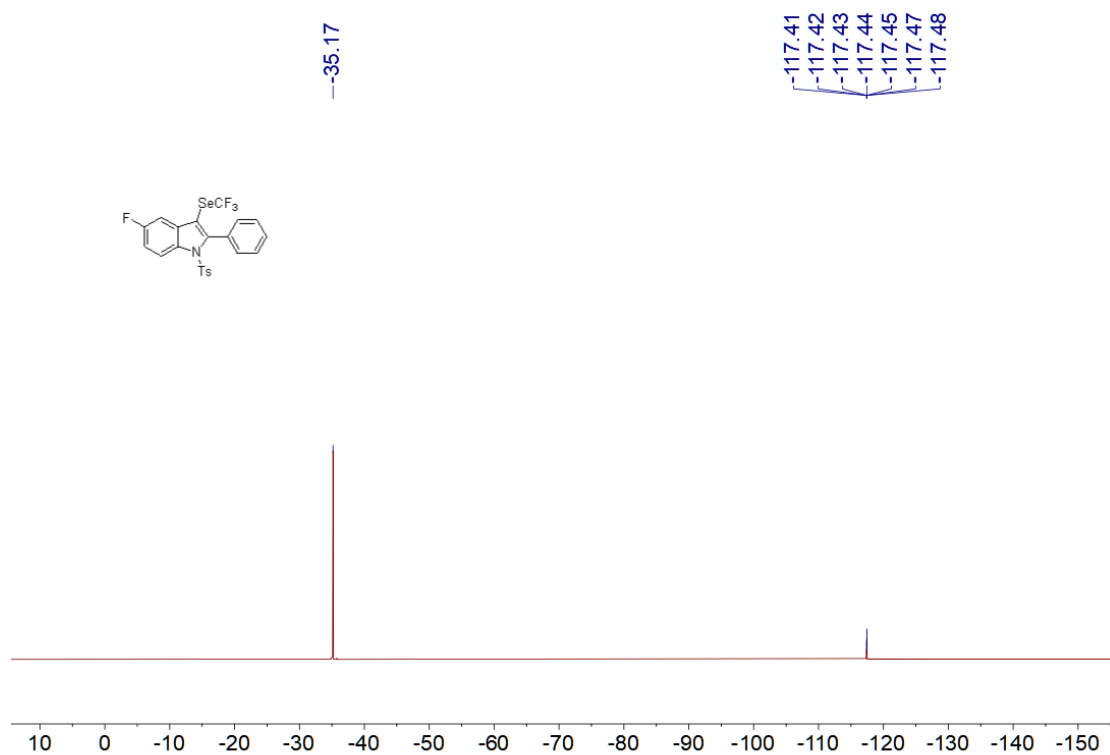
^{13}C NMR spectra of **3e** in CDCl_3



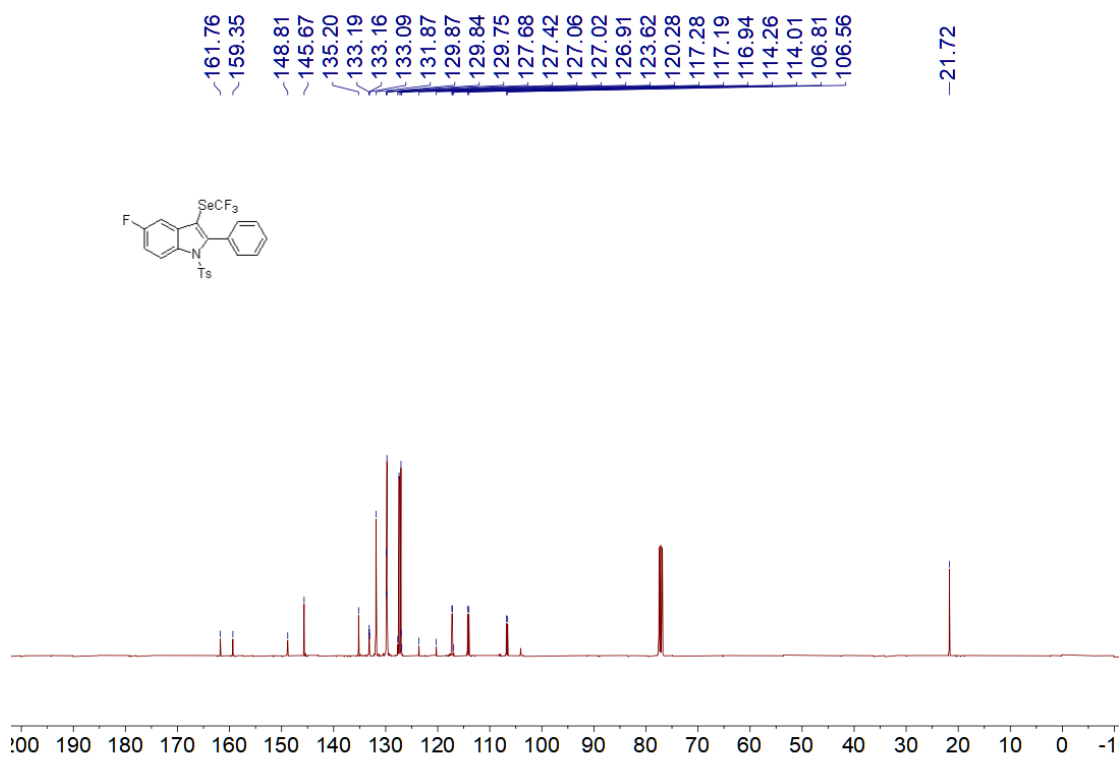
^1H NMR spectra of **3f** in CDCl_3



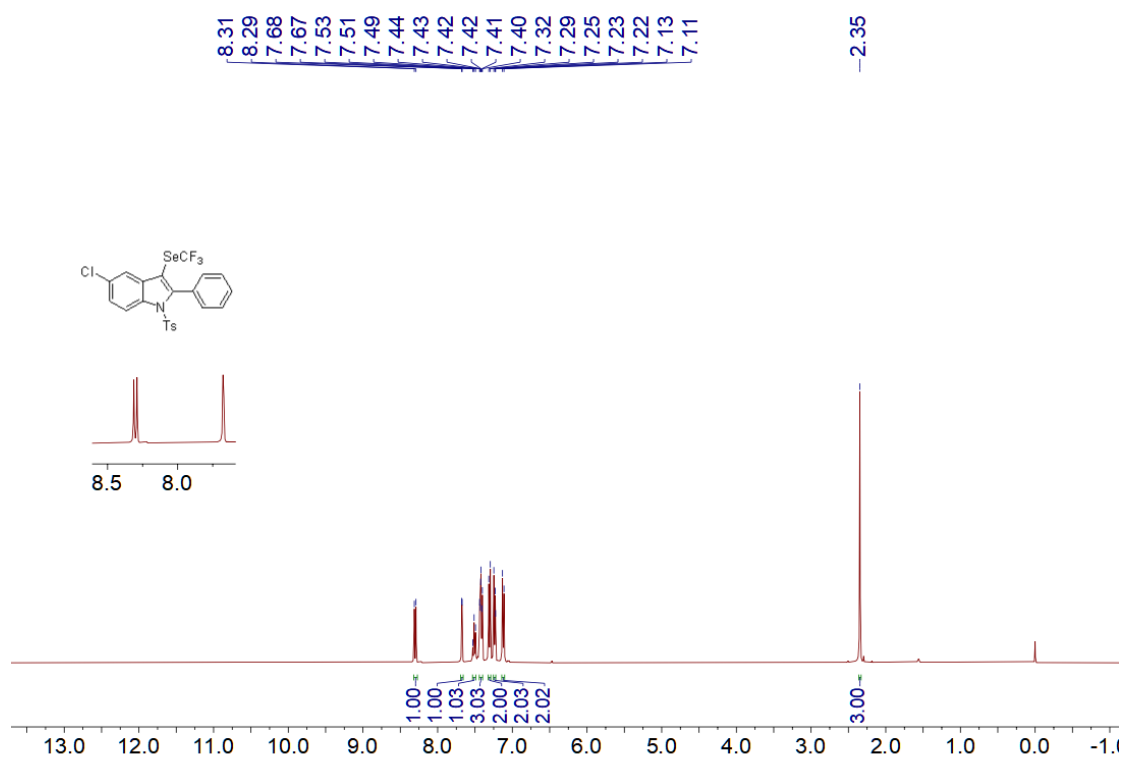
^{19}F NMR spectra of **3f** in CDCl_3



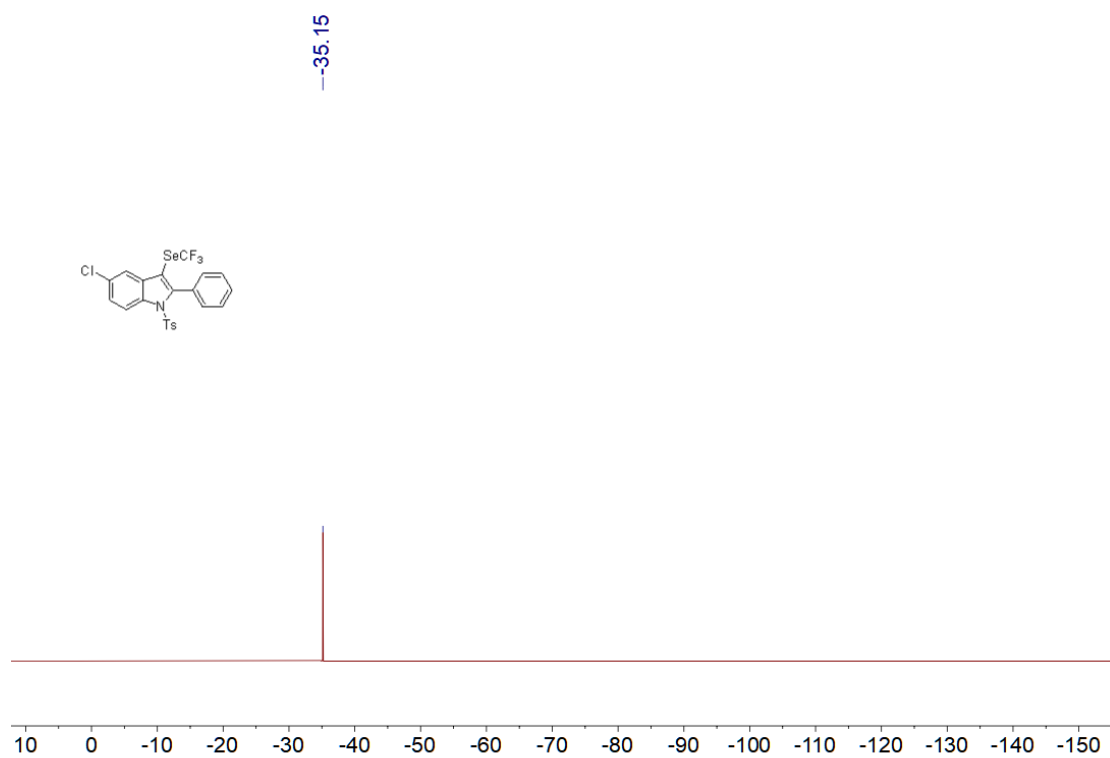
^{13}C NMR spectra of **3f** in CDCl_3



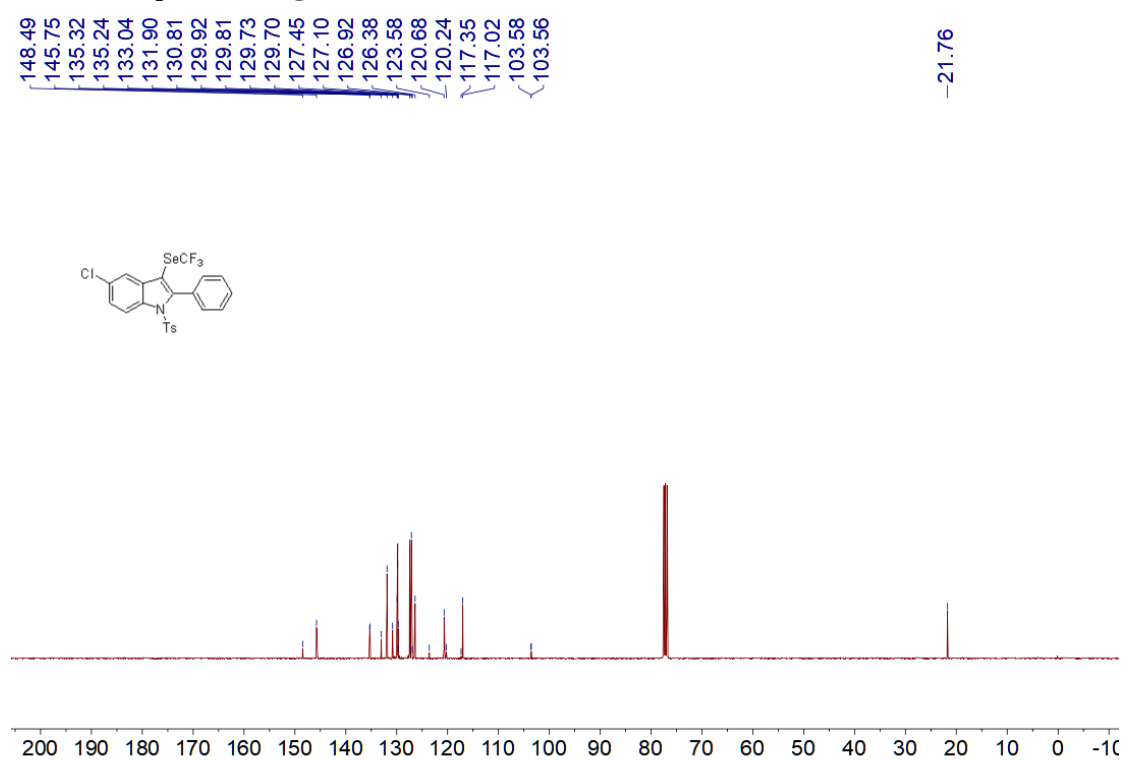
^1H NMR spectra of **3g** in CDCl_3



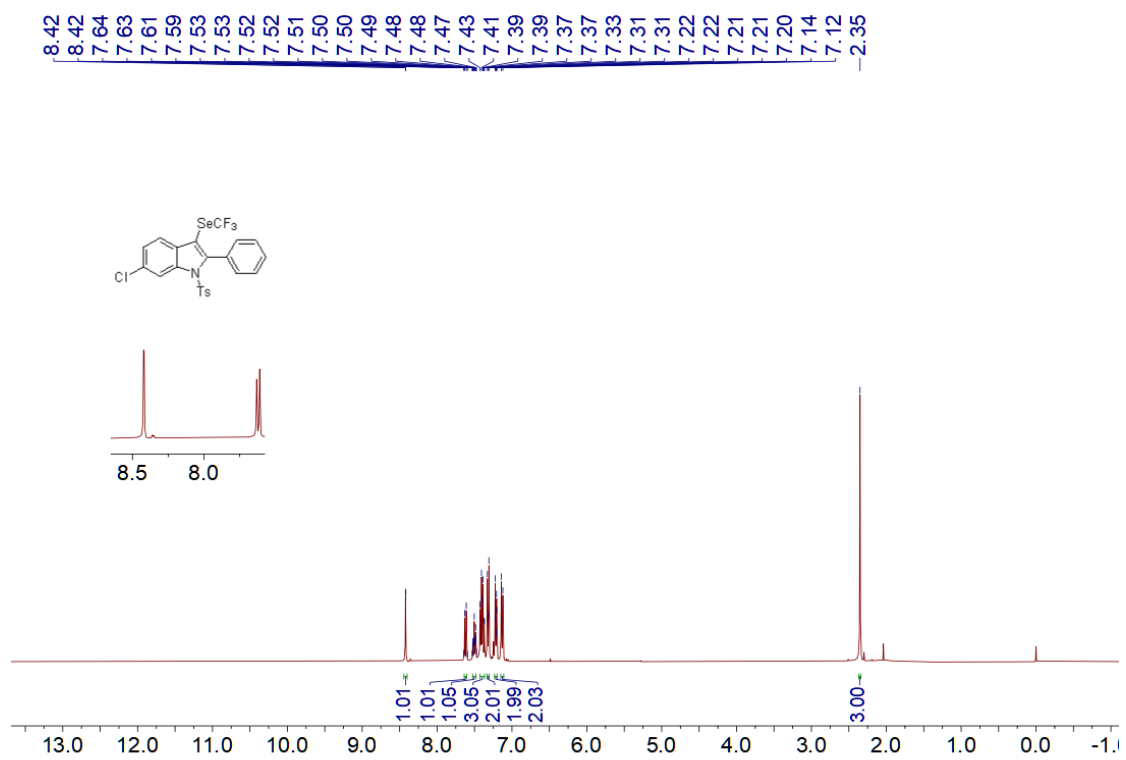
^{19}F NMR spectra of **3g** in CDCl_3



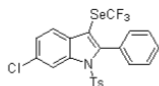
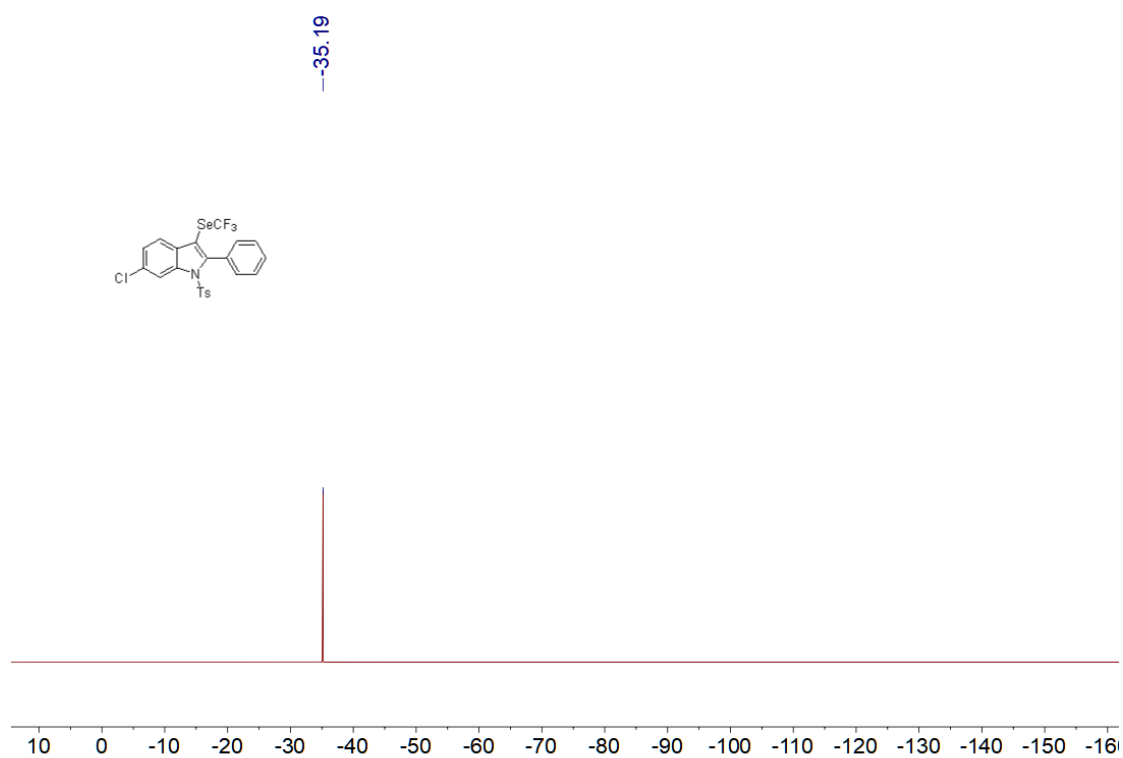
^{13}C NMR spectra of **3g** in CDCl_3



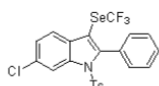
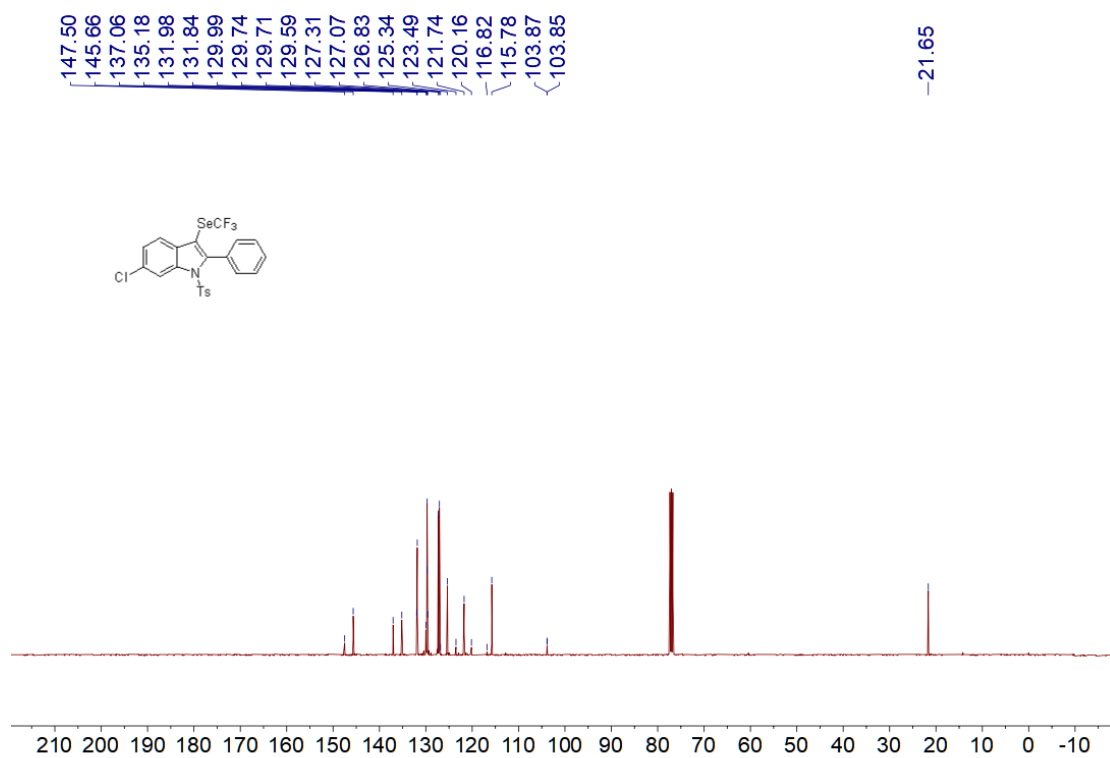
^1H NMR spectra of **3h** in CDCl_3



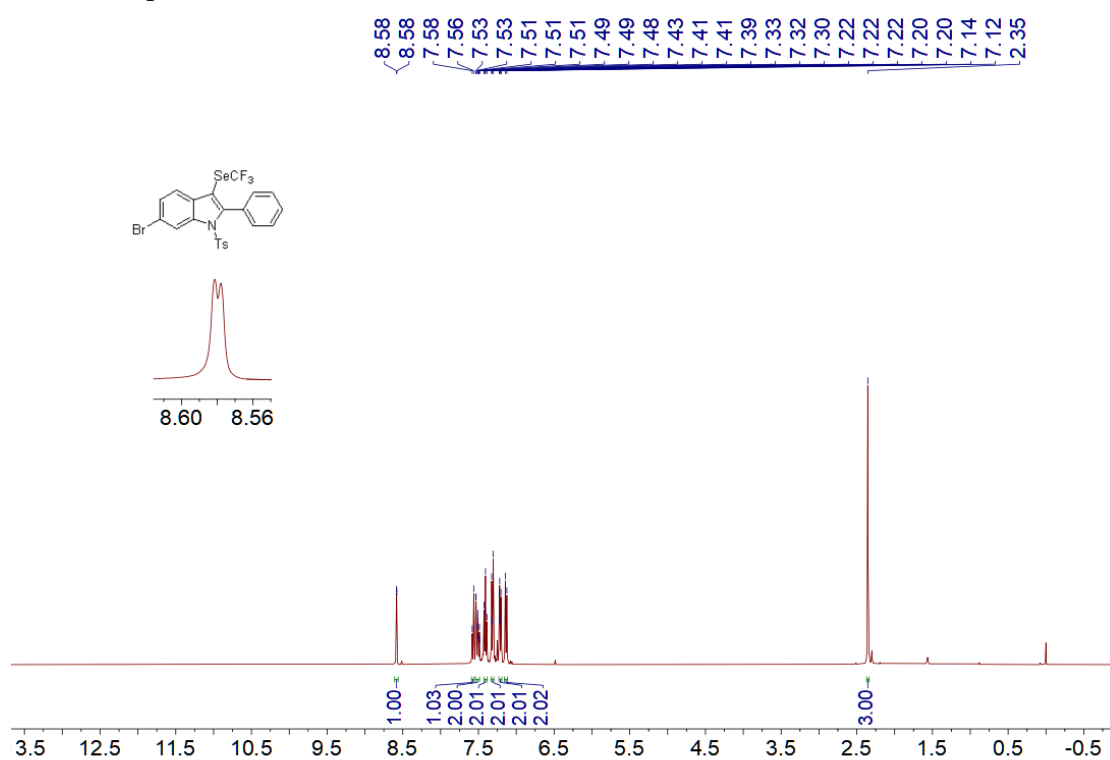
^{19}F NMR spectra of **3h** in CDCl_3



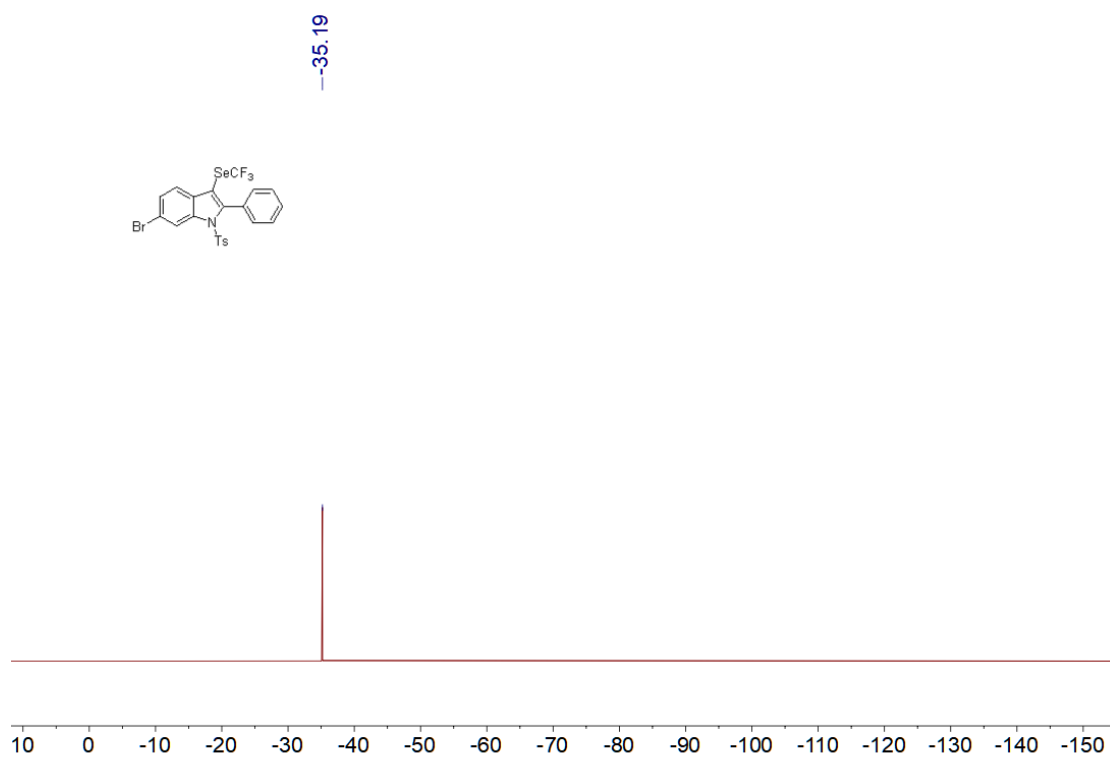
^{13}C NMR spectra of **3h** in CDCl_3



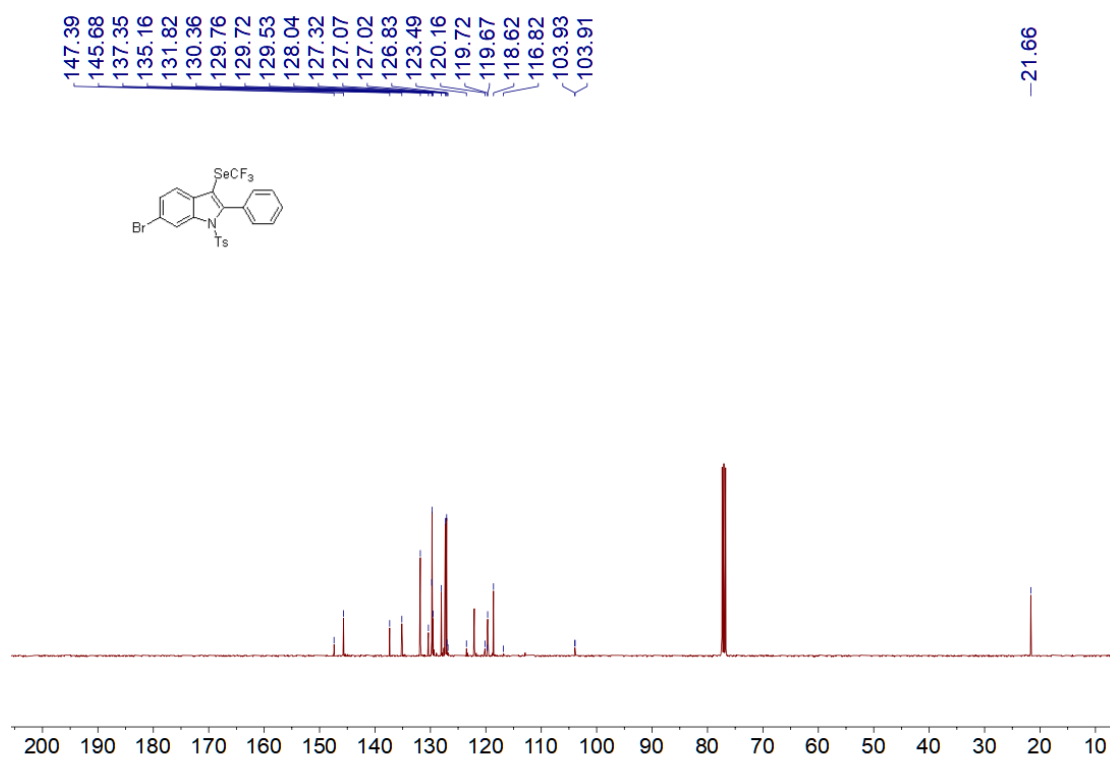
^1H NMR spectra of **3i** in CDCl_3



^{19}F NMR spectra of **3i** in CDCl_3

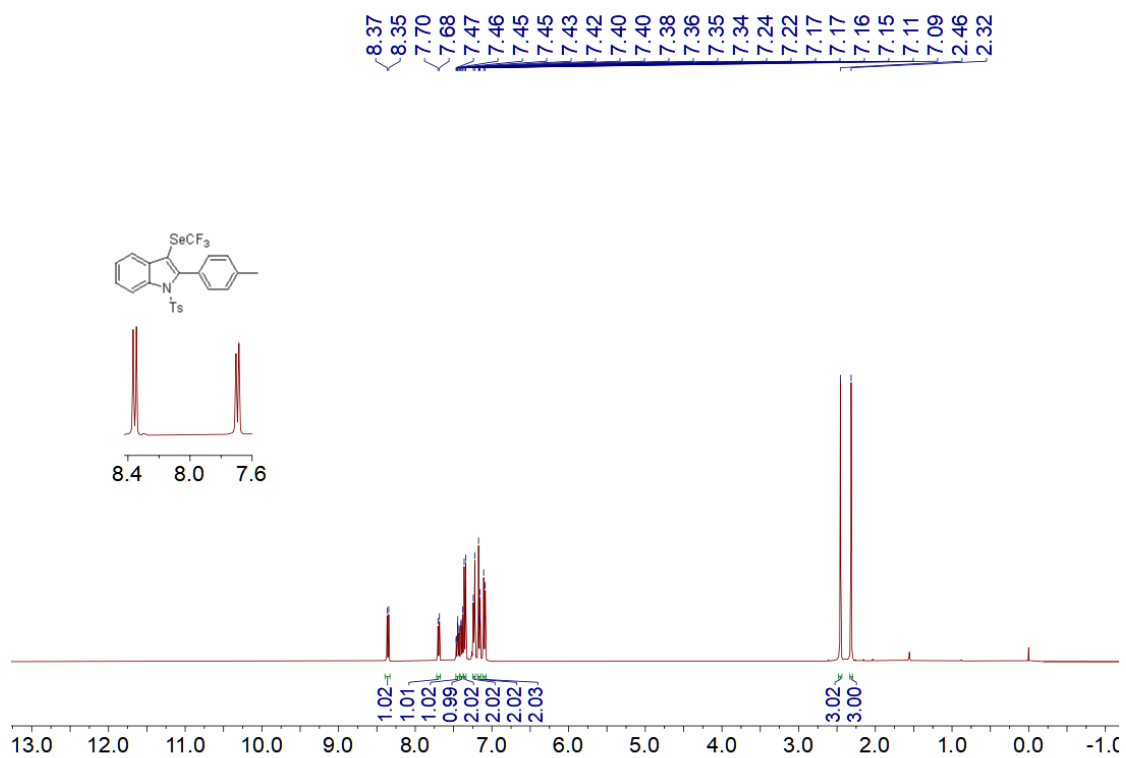


^{13}C NMR spectra of **3i** in CDCl_3

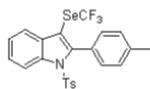
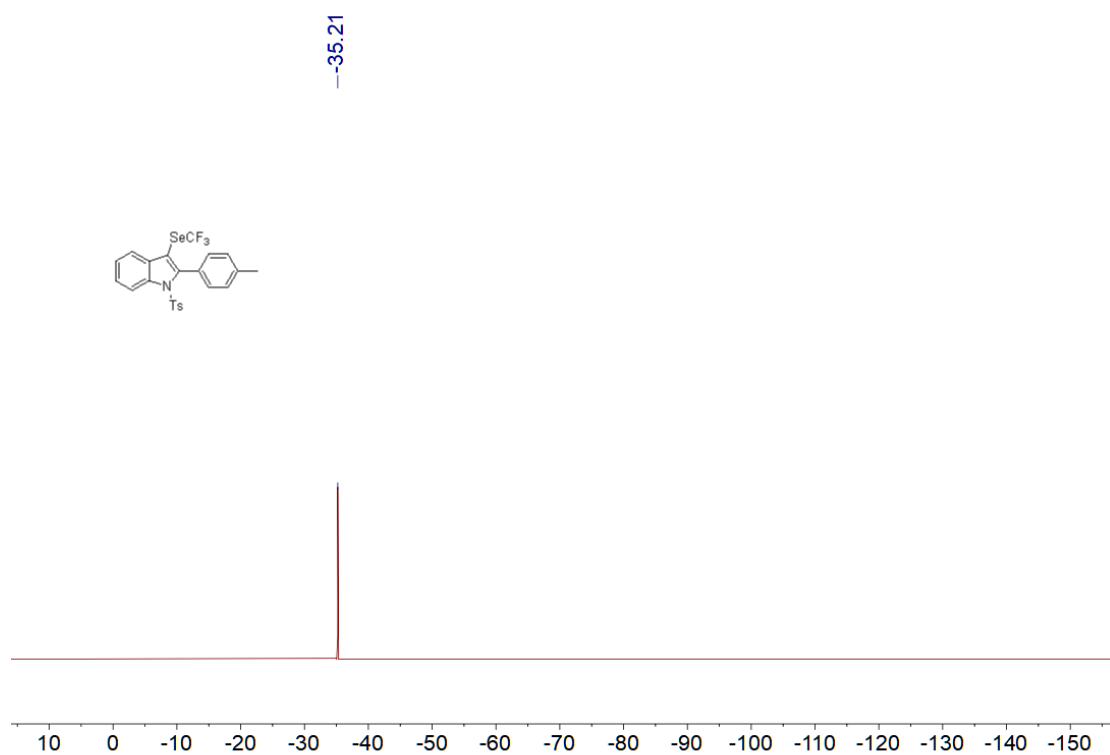


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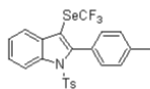
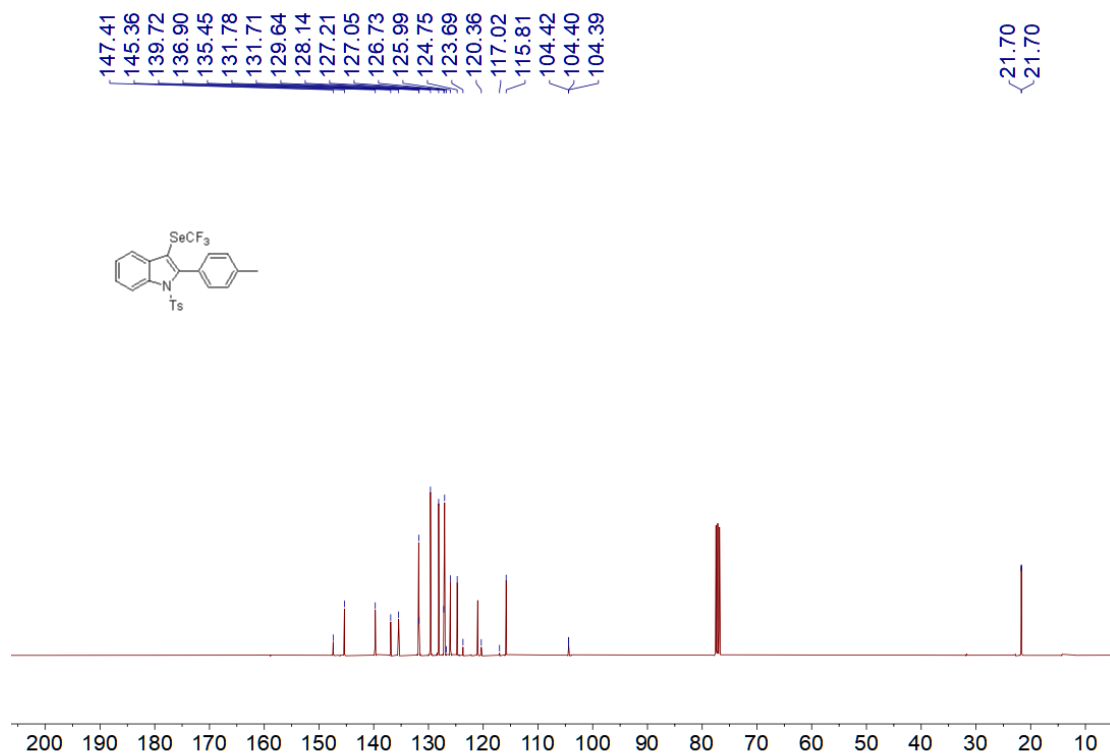
^1H NMR spectra of **3j** in CDCl_3



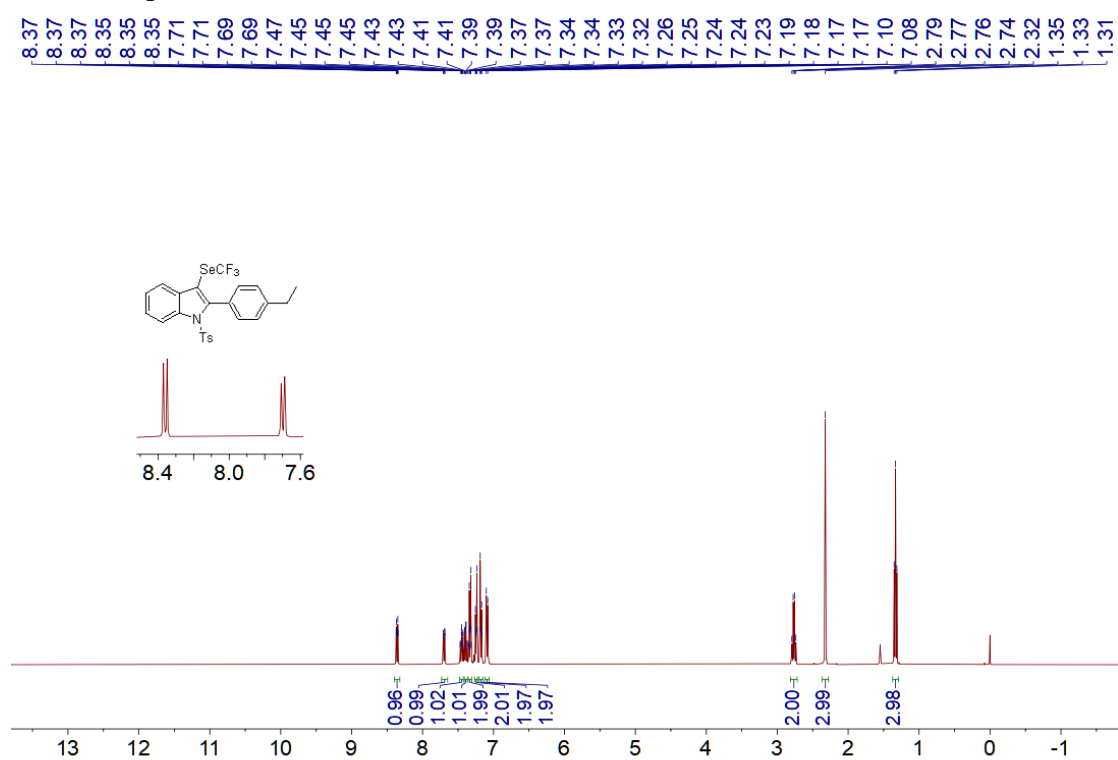
^{19}F NMR spectra of **3j** in CDCl_3



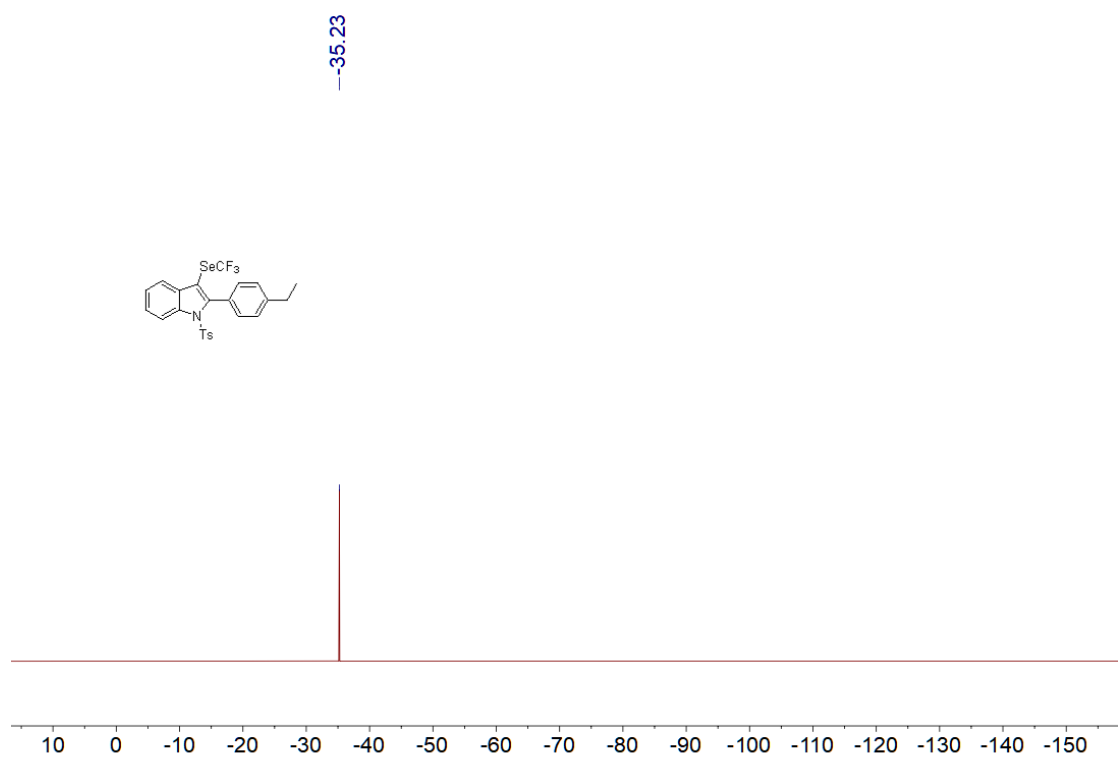
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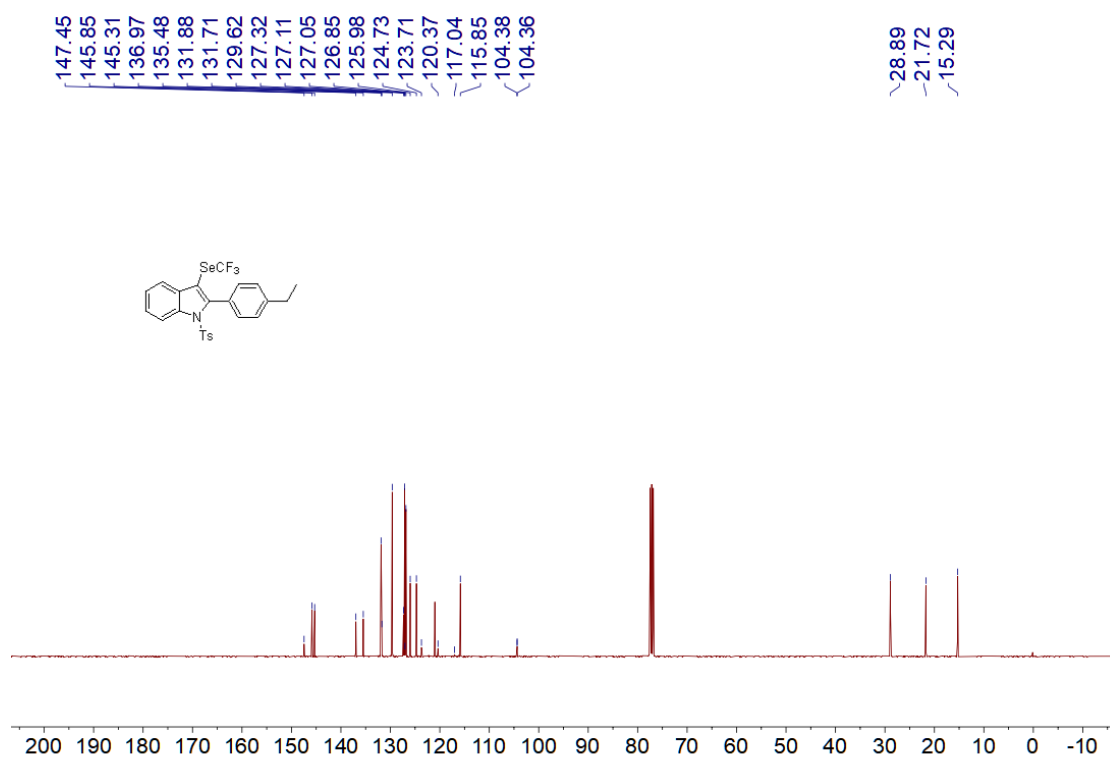
^1H NMR spectra of **3k** in CDCl_3



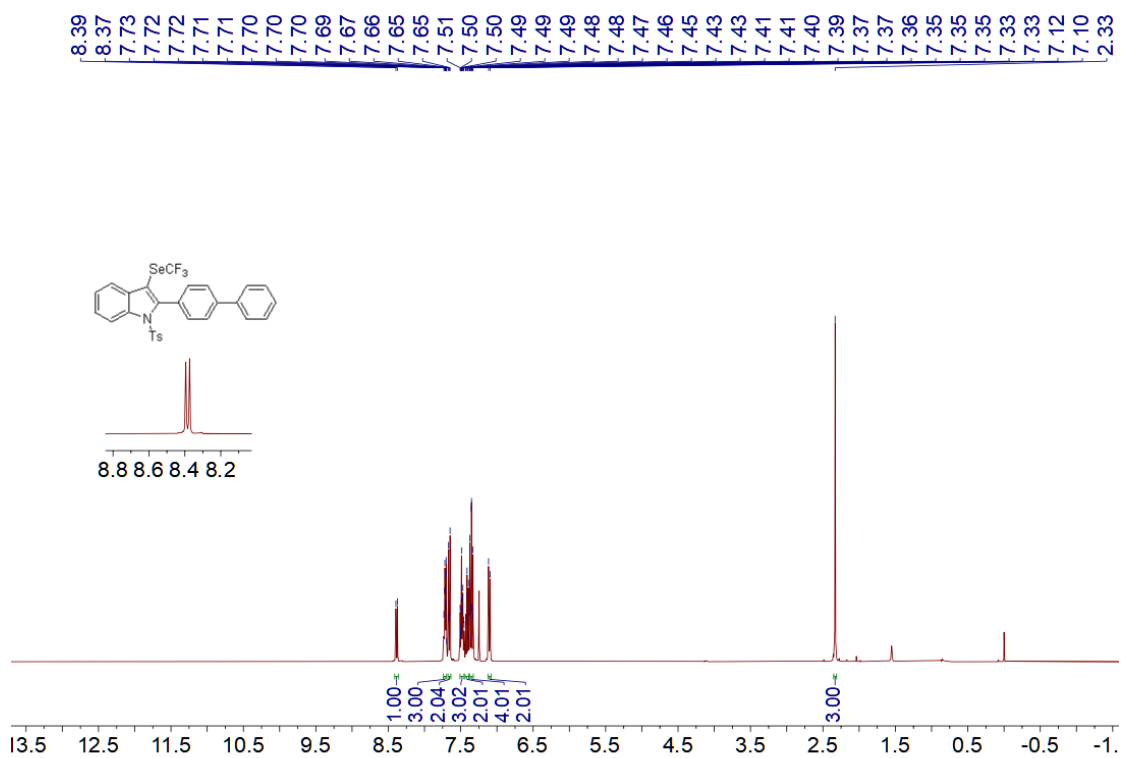
^{19}F NMR spectra of **3k** in CDCl_3



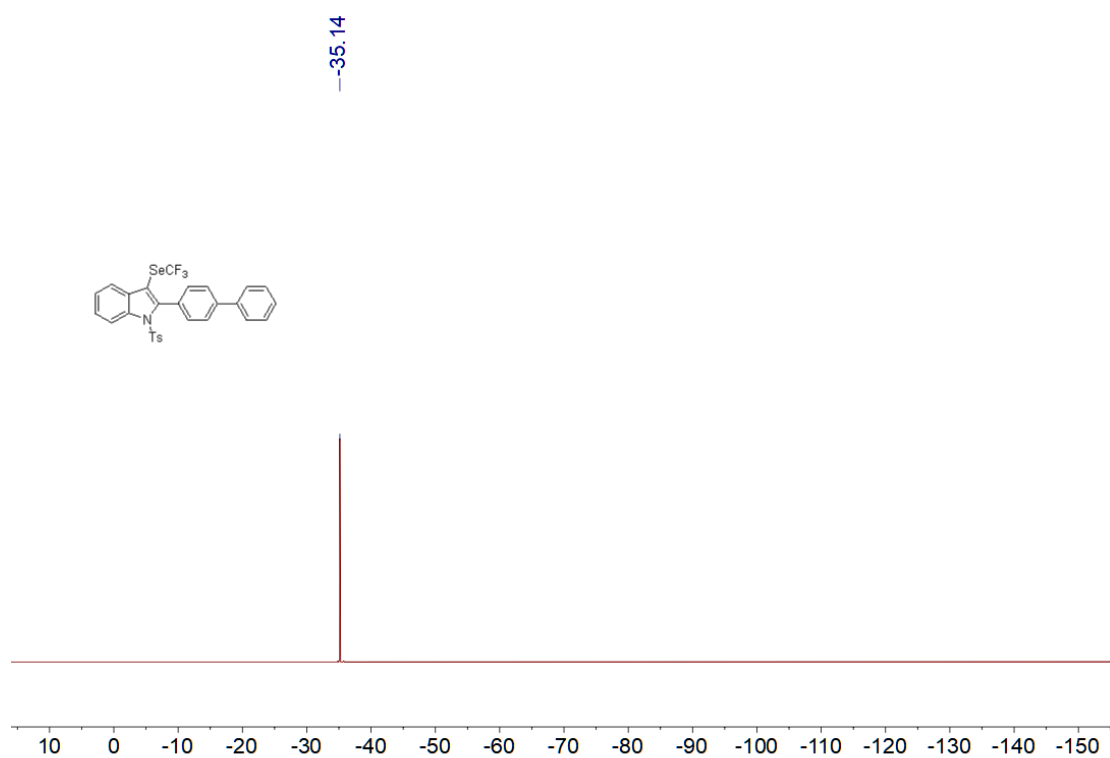
¹³C NMR spectra of **3k** in CDCl₃



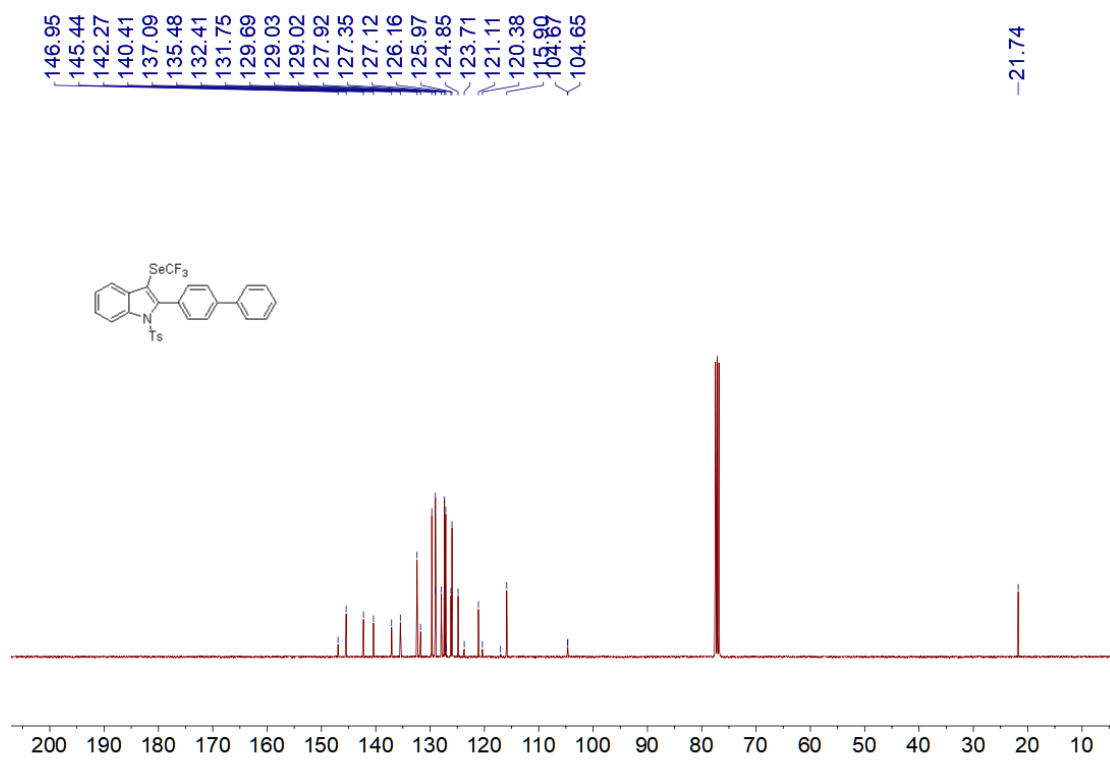
¹H NMR spectra of **3l** in CDCl₃



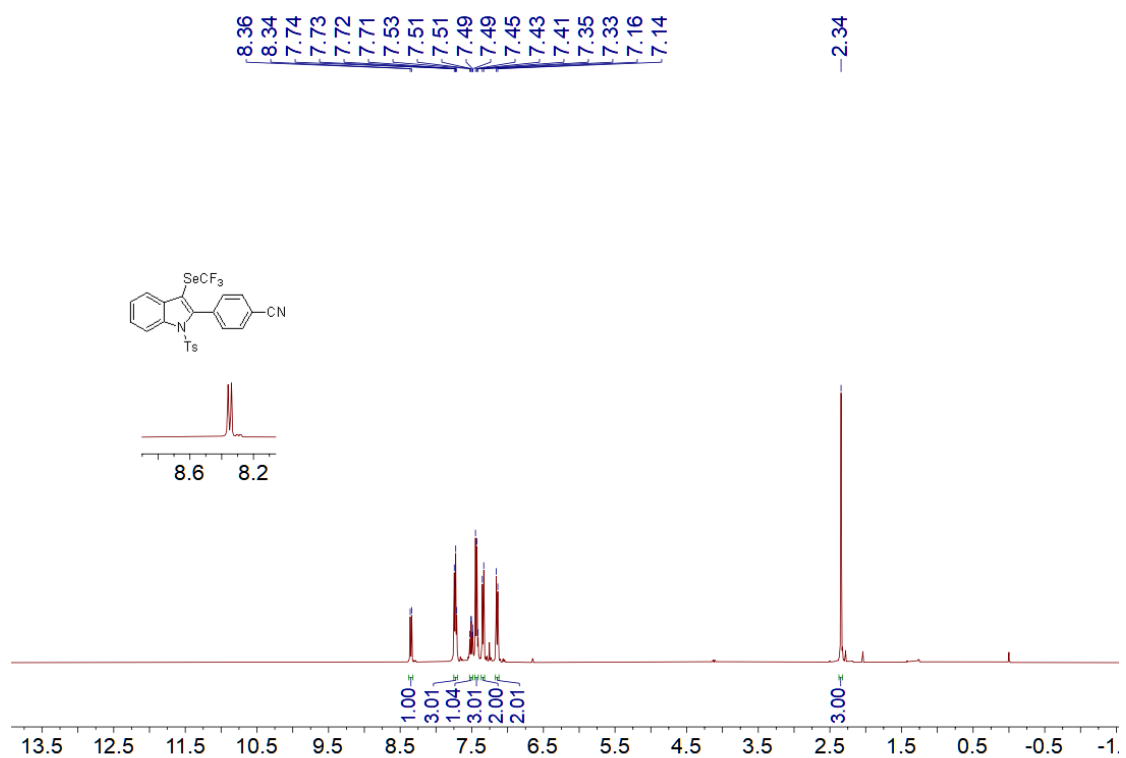
^{19}F NMR spectra of **31** in CDCl_3



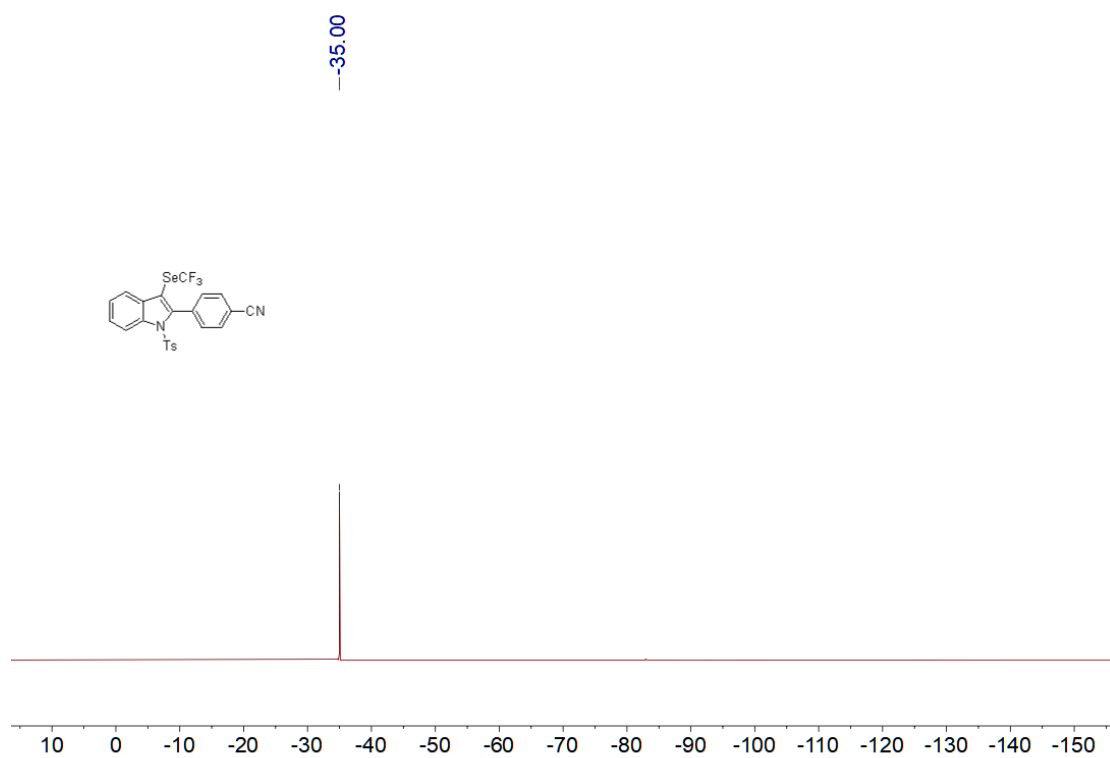
^{13}C NMR spectra of **31** in CDCl_3



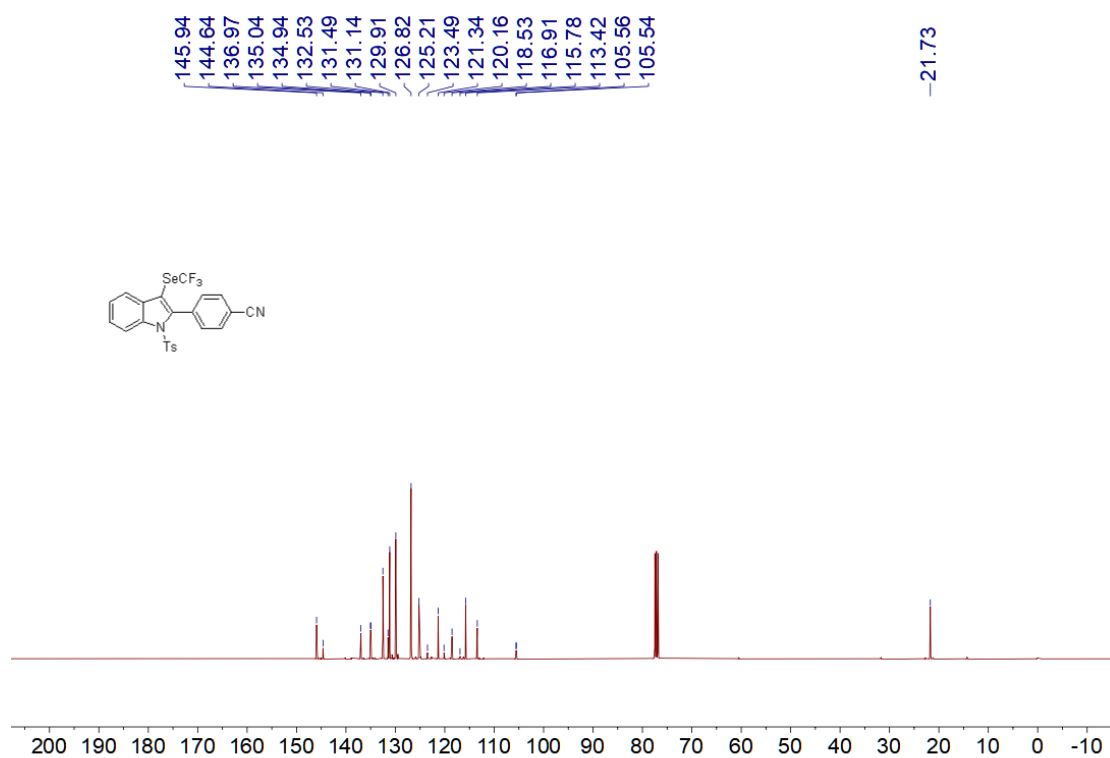
^1H NMR spectra of **3m** in CDCl_3



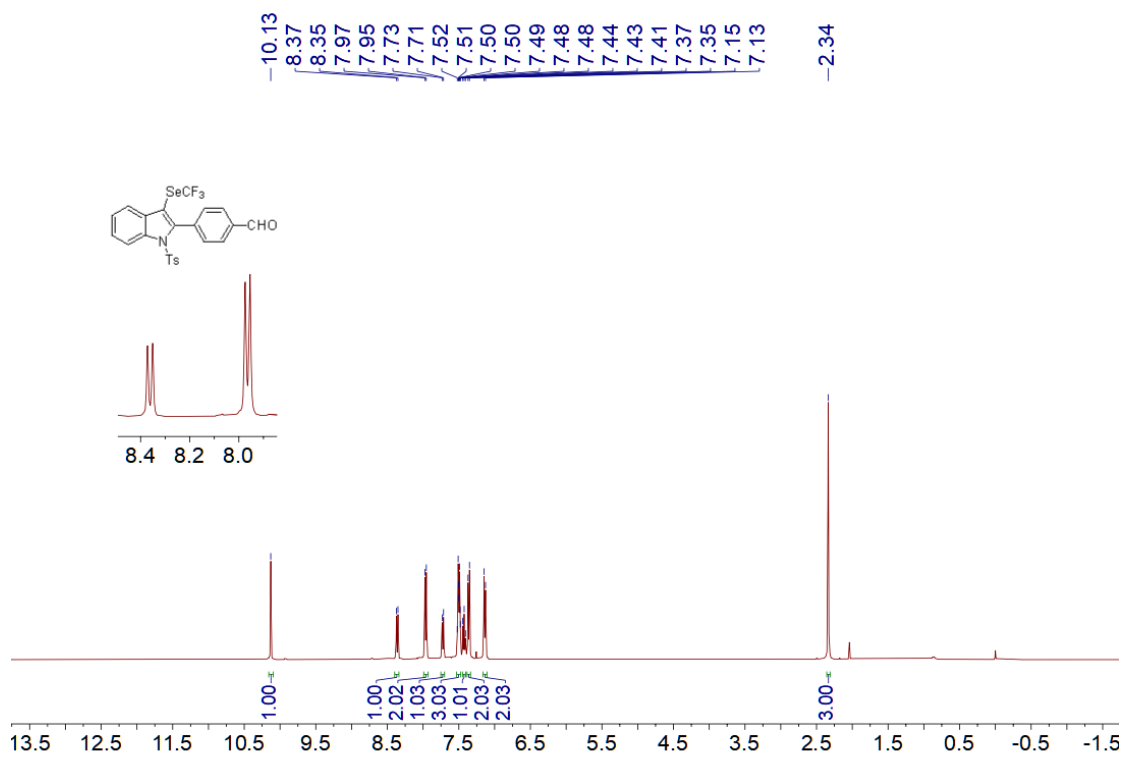
^{19}F NMR spectra of **3m** in CDCl_3



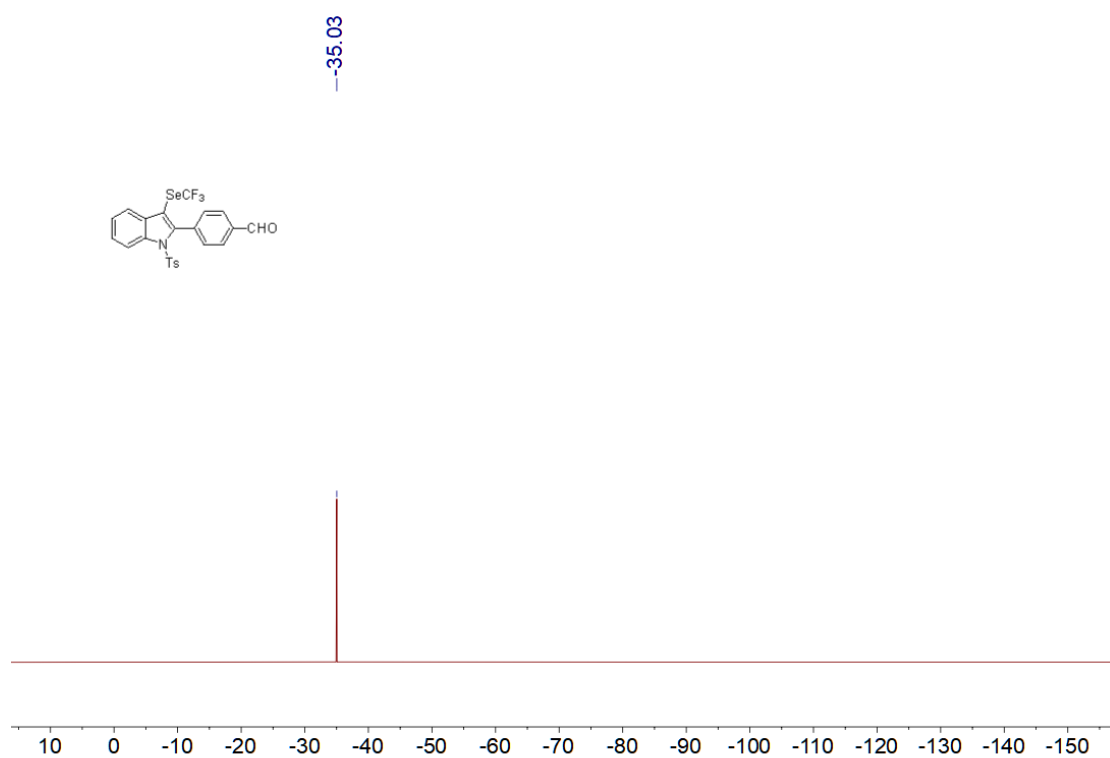
^{13}C NMR spectra of **3m** in CDCl_3



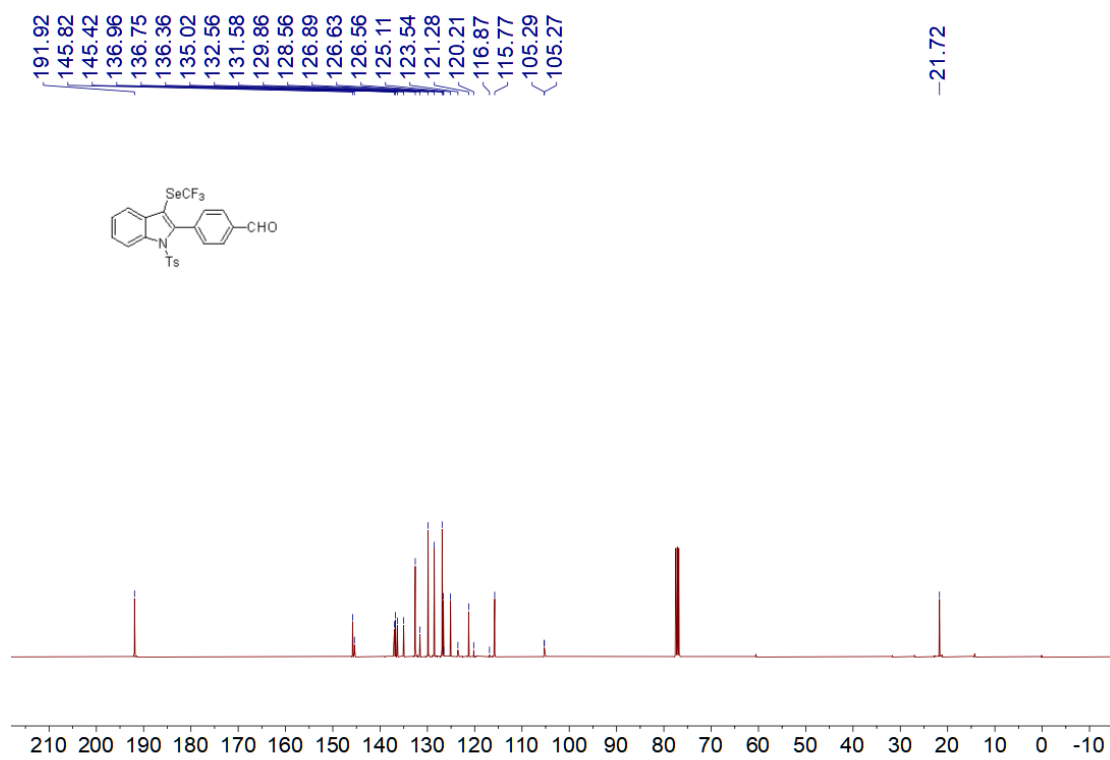
^1H NMR spectra of **3n** in CDCl_3



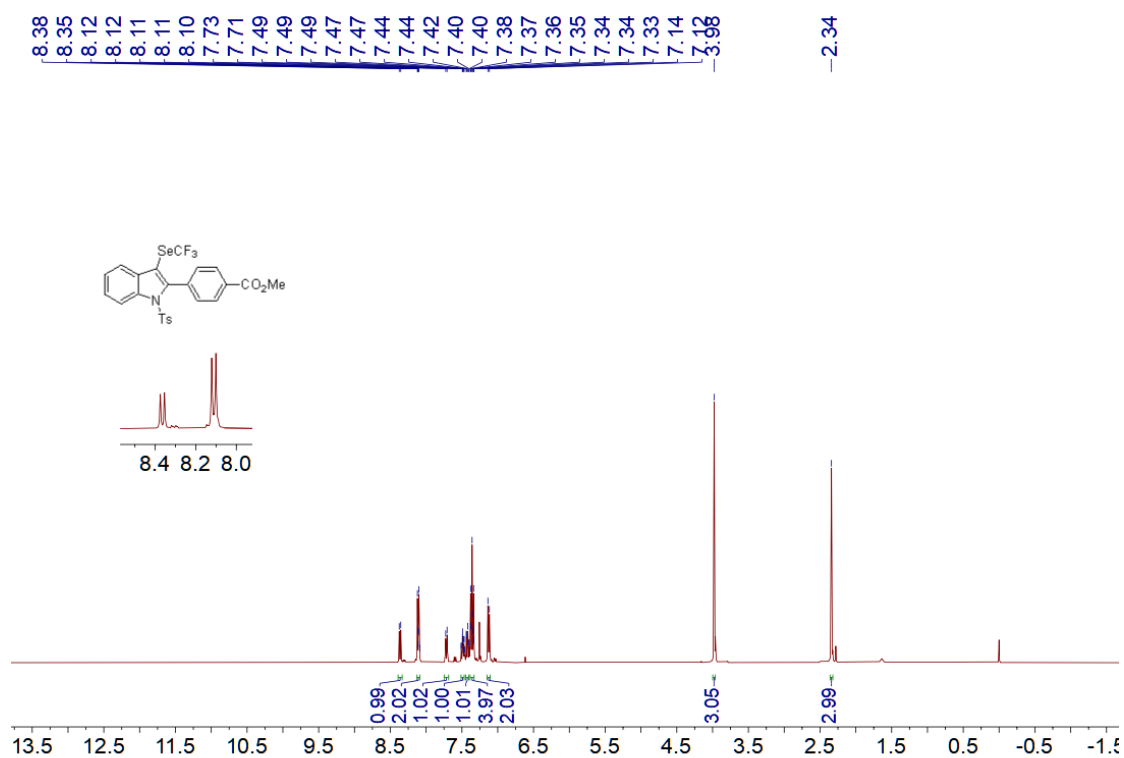
^{19}F NMR spectra of **3n** in CDCl_3



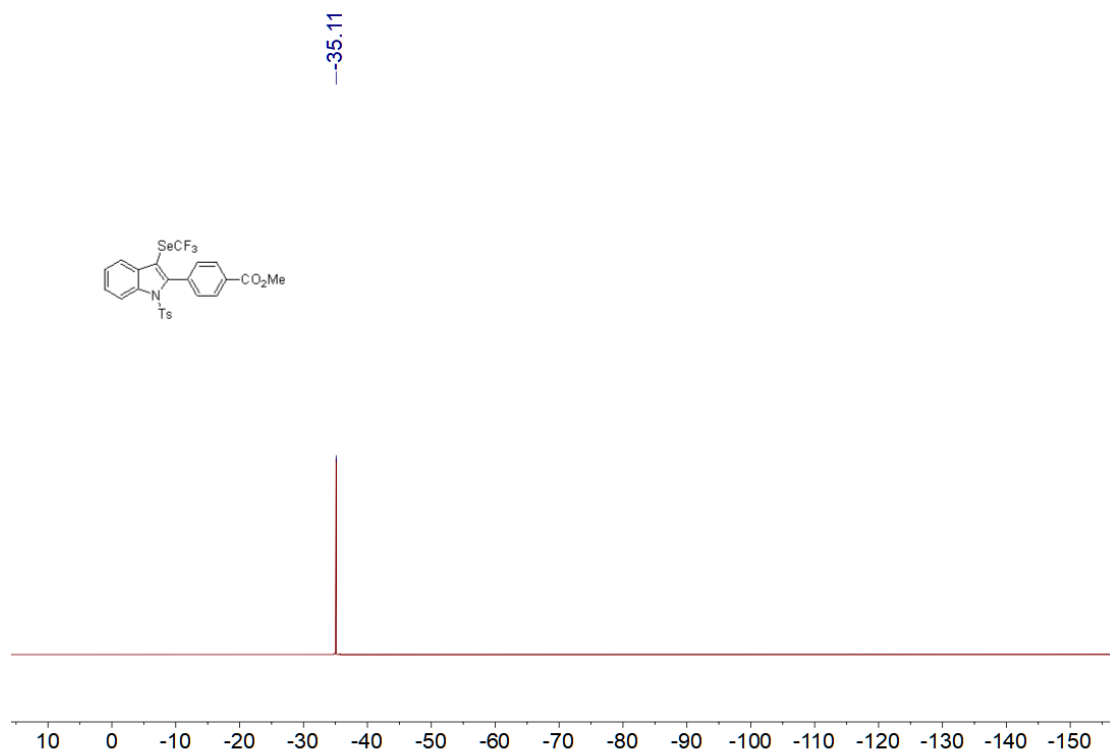
^{13}C NMR spectra of **3n** in CDCl_3



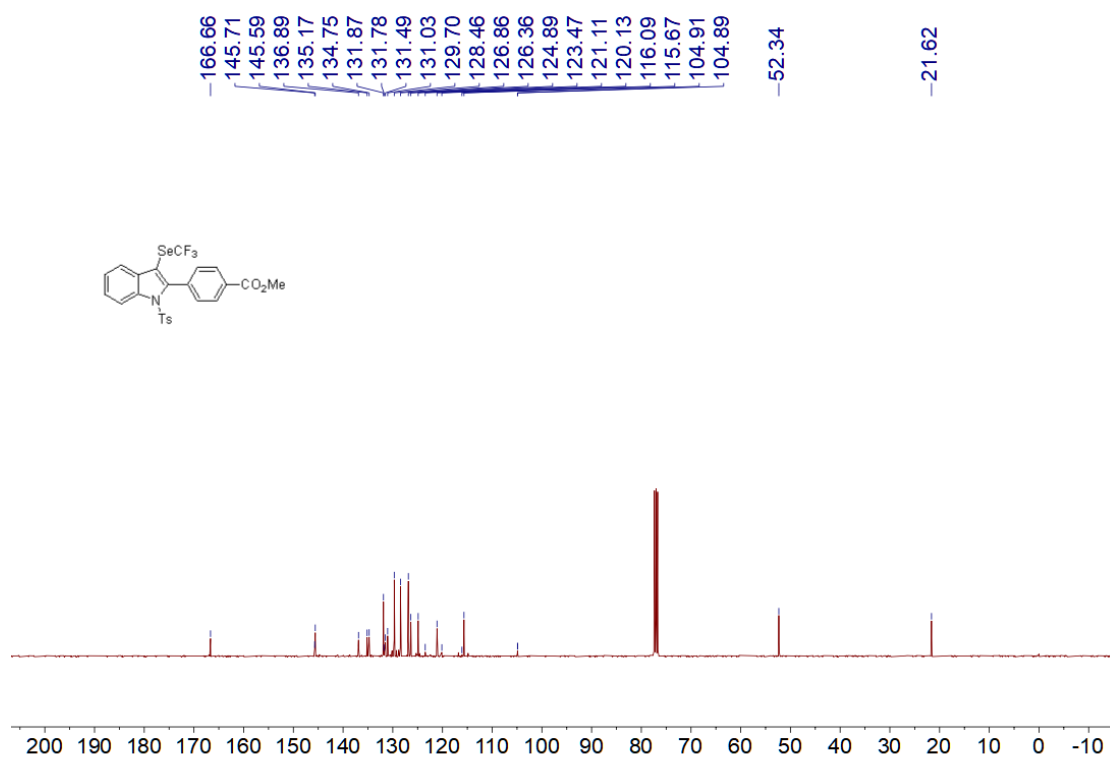
^1H NMR spectra of **3o** in CDCl_3



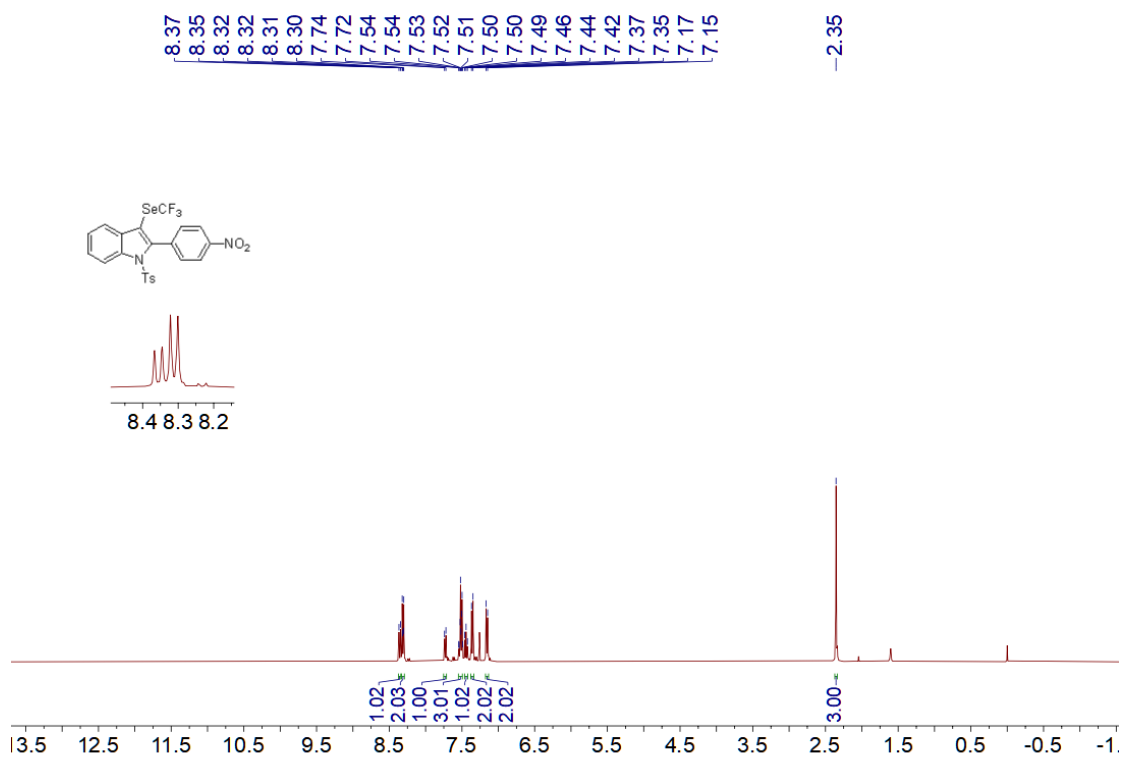
^{19}F NMR spectra of **3o** in CDCl_3



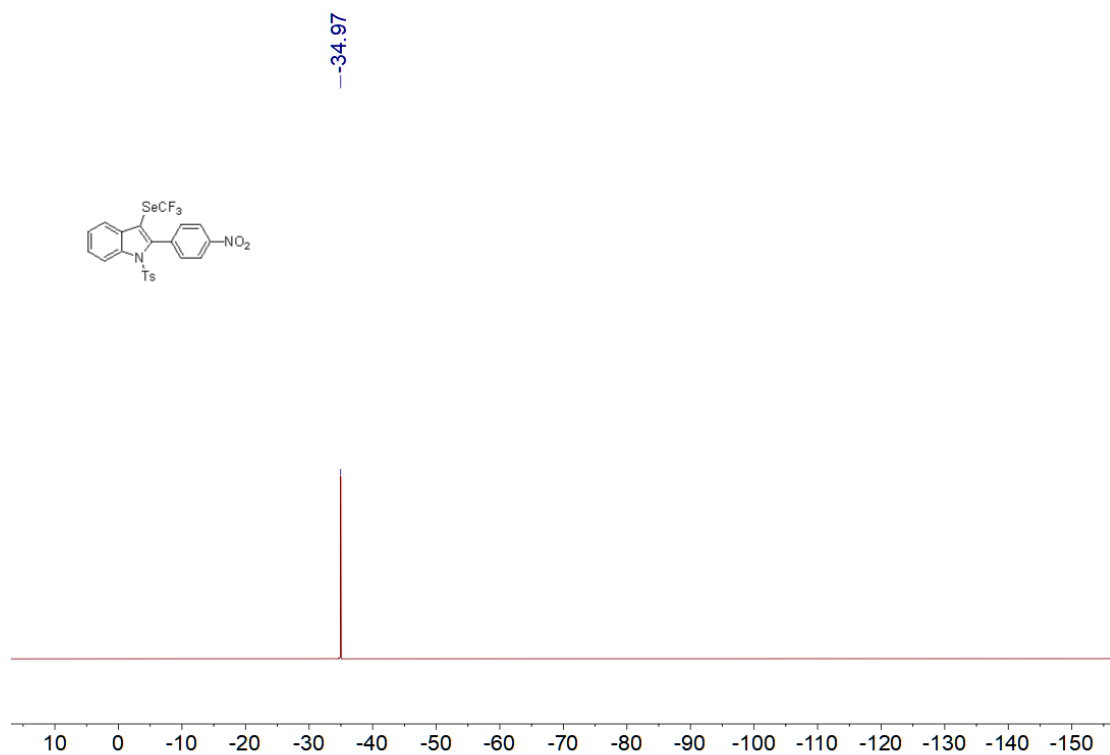
¹³C NMR spectra of **3o** in CDCl₃



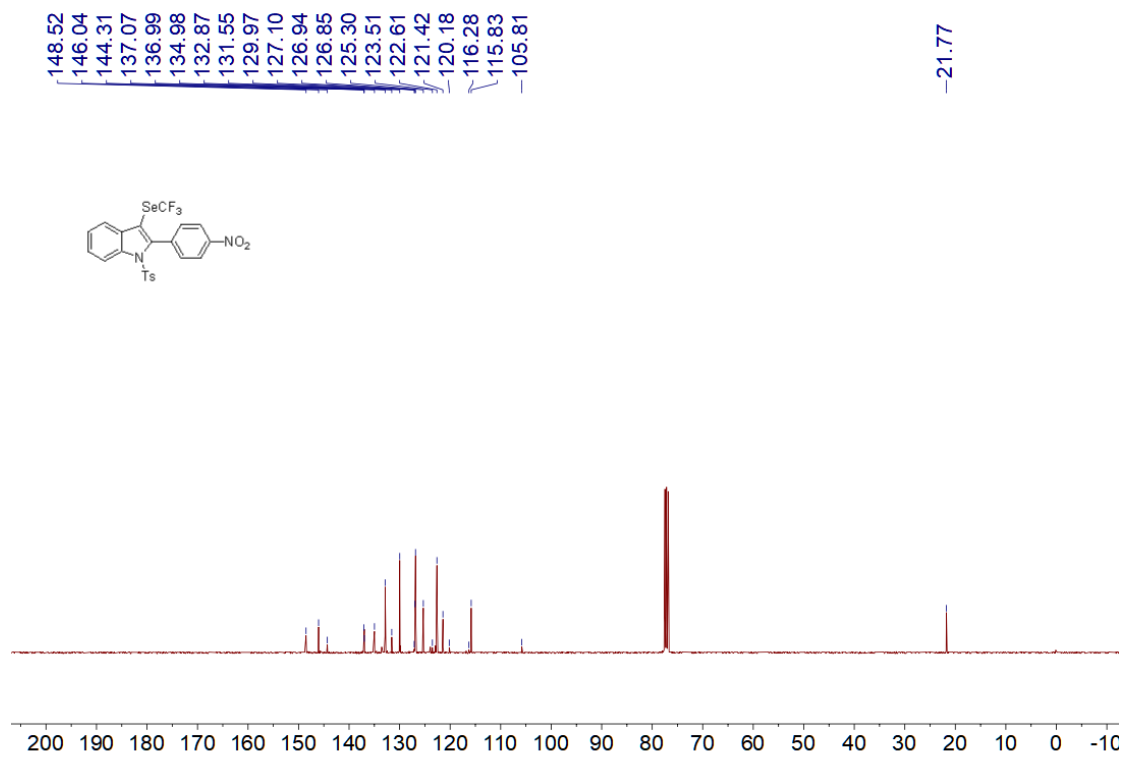
¹H NMR spectra of **3p** in CDCl₃



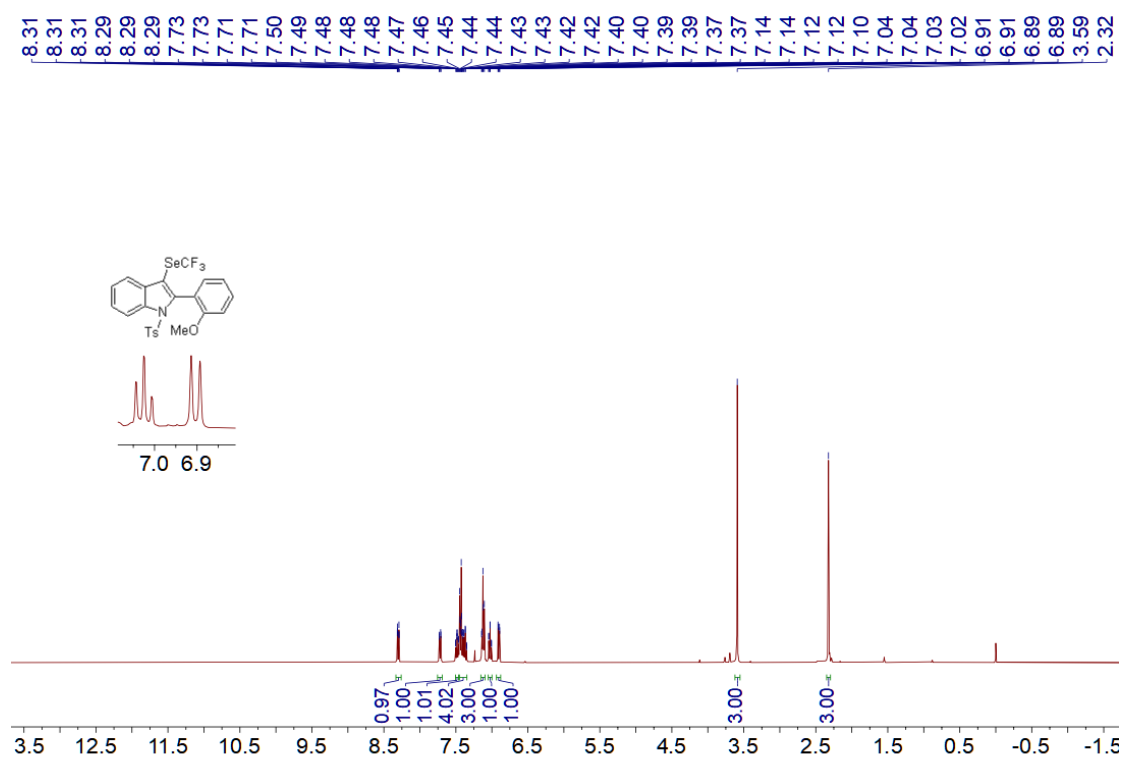
¹⁹F NMR spectra of **3p** in CDCl₃



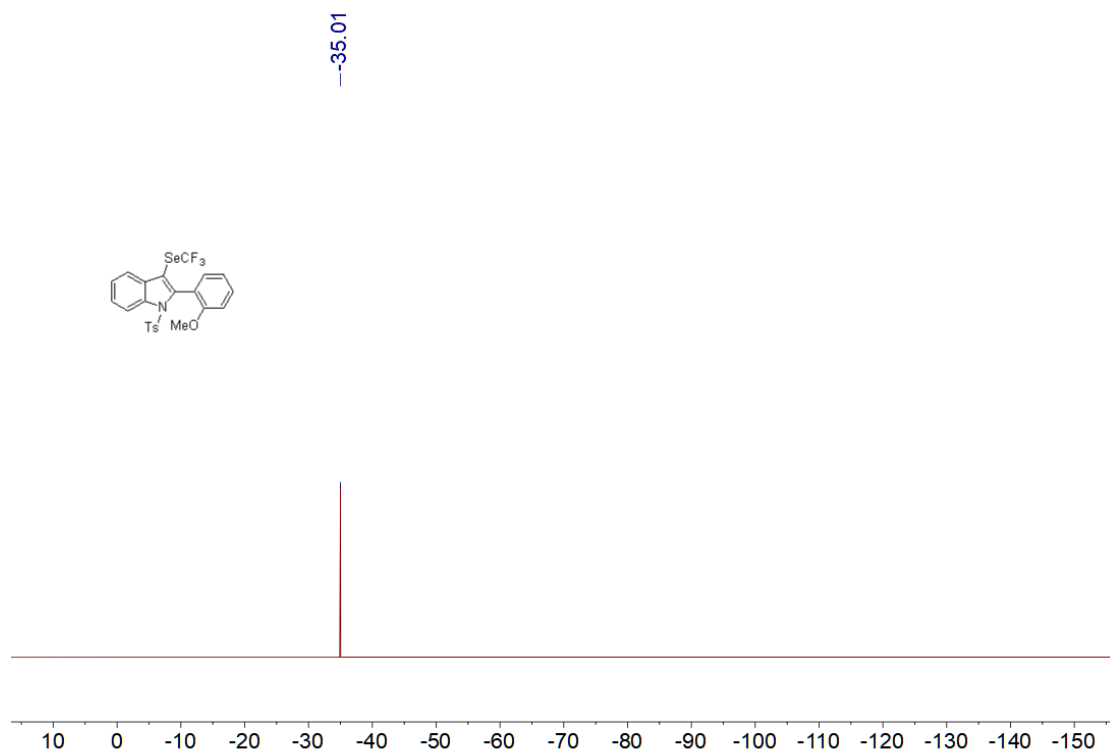
¹³C NMR spectra of **3p** in CDCl₃



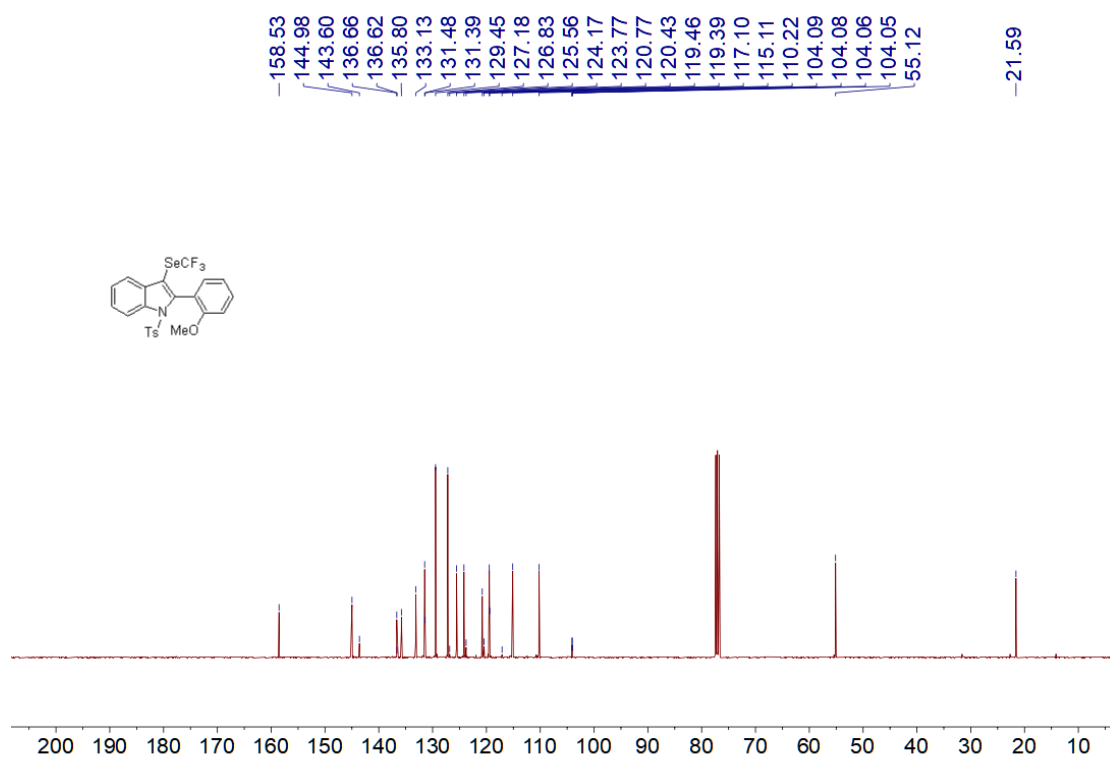
^1H NMR spectra of **3q** in CDCl_3



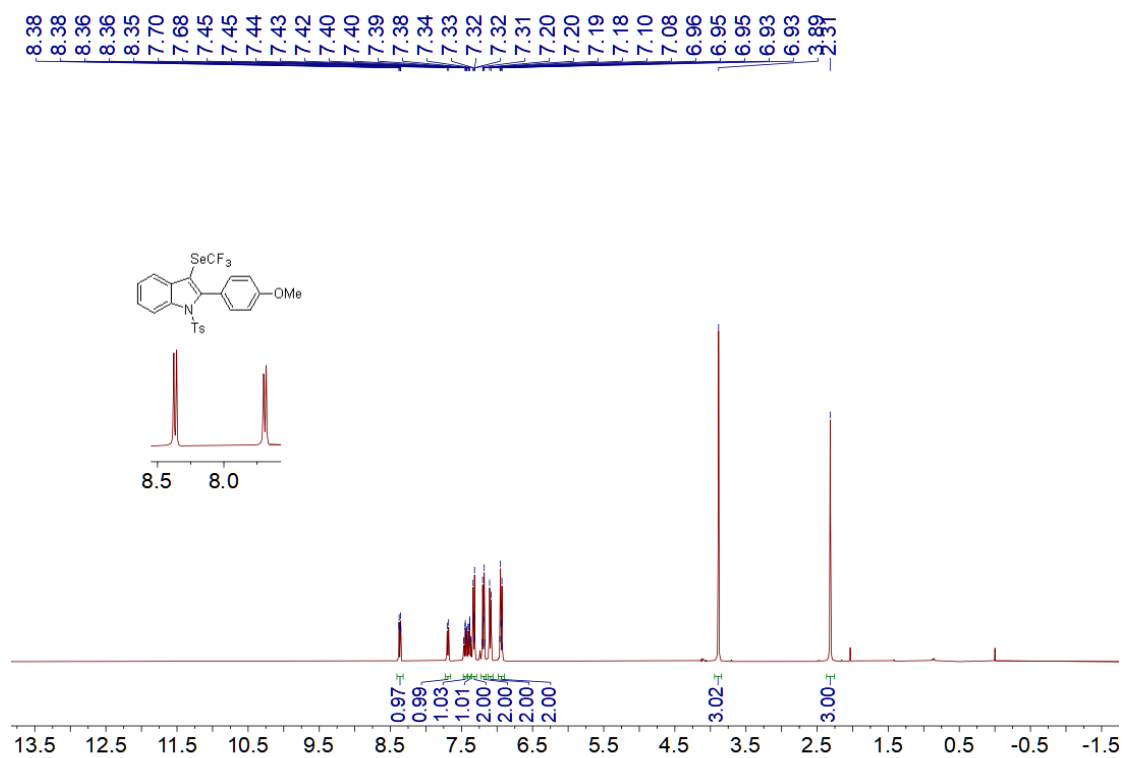
^{19}F NMR spectra of **3q** in CDCl_3



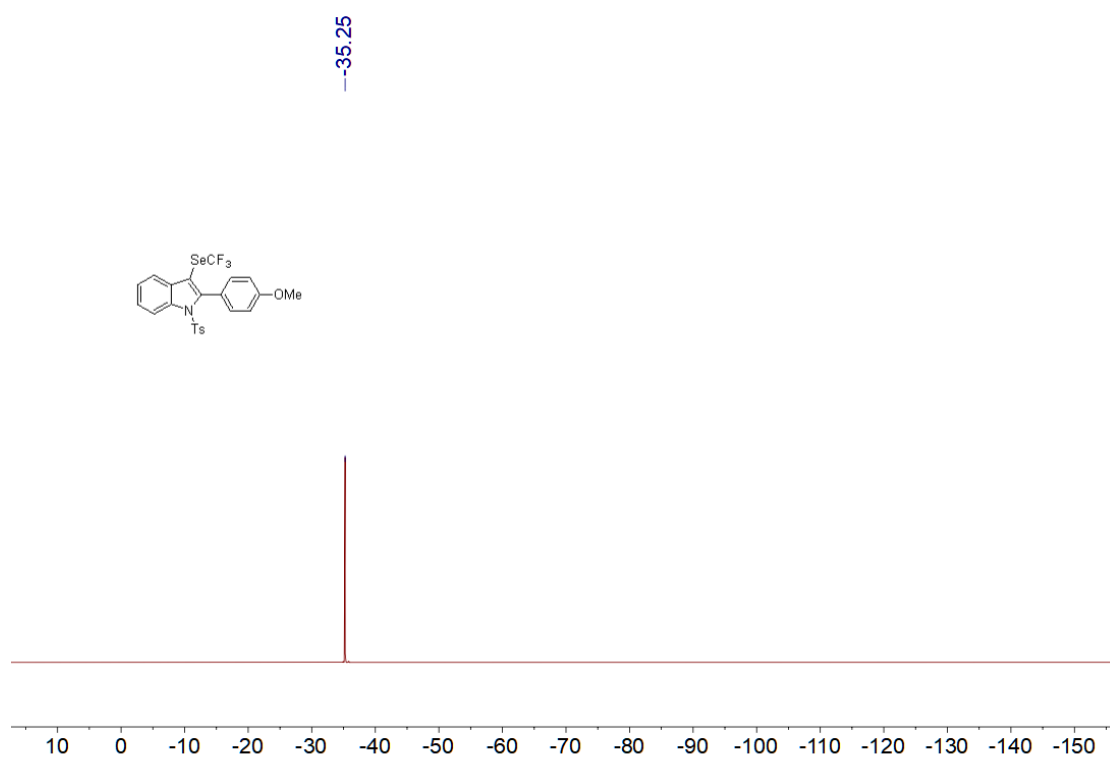
¹³C NMR spectra of **3q** in CDCl₃



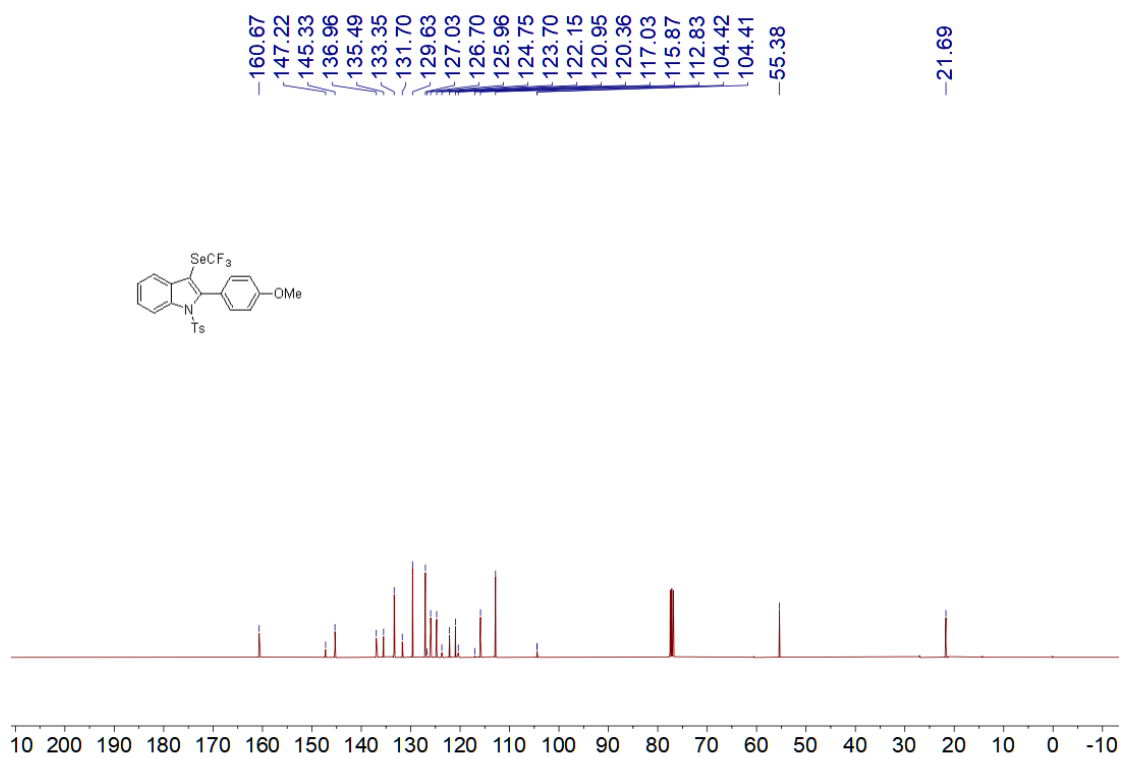
¹H NMR spectra of **3r** in CDCl₃



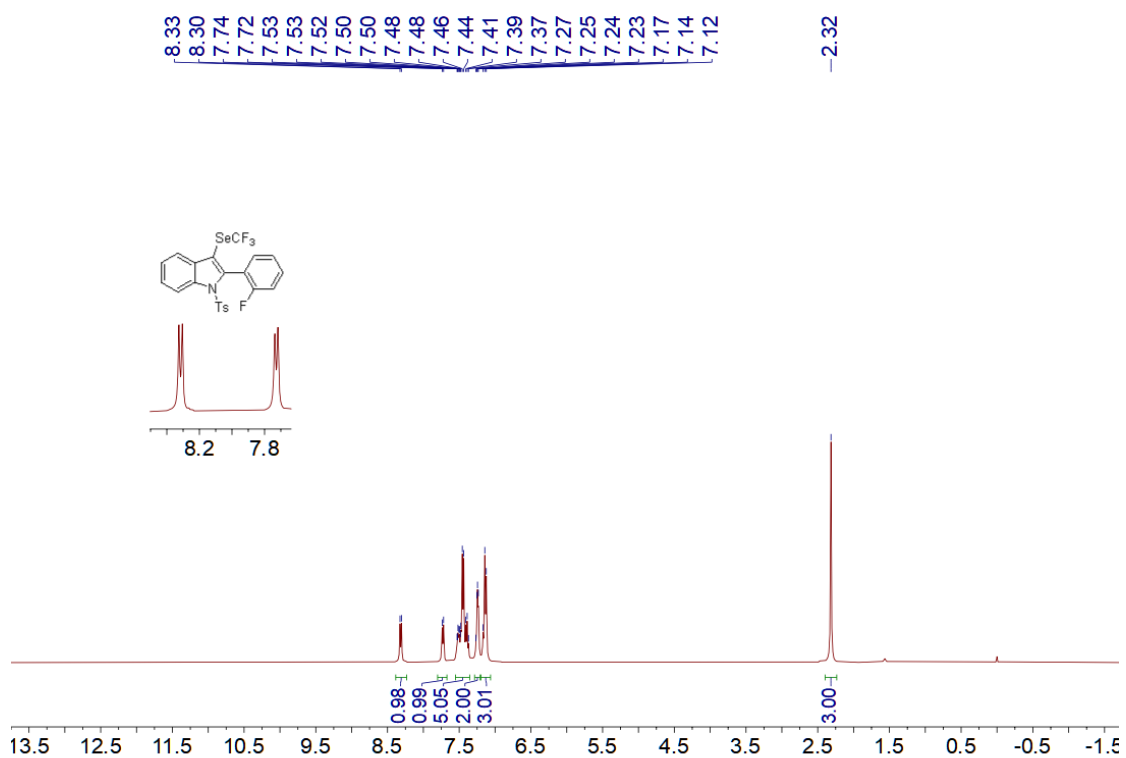
^{19}F NMR spectra of **3r** in CDCl_3



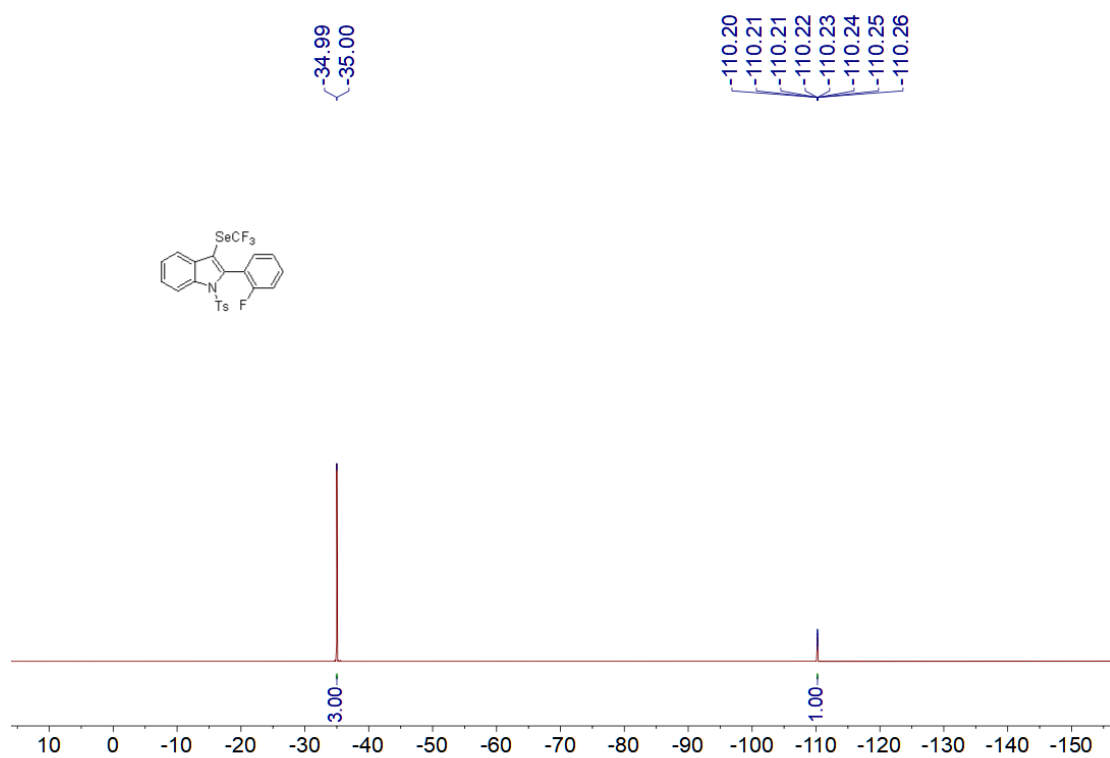
^{13}C NMR spectra of **3r** in CDCl_3



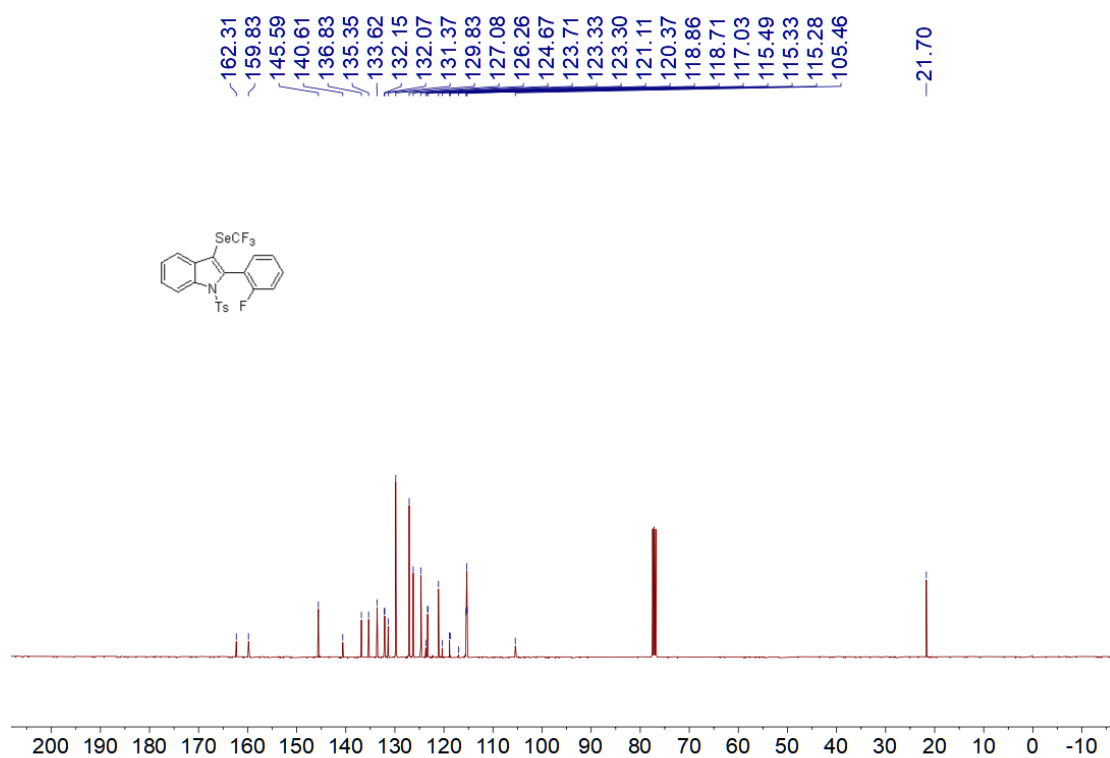
^1H NMR spectra of **3s** in CDCl_3



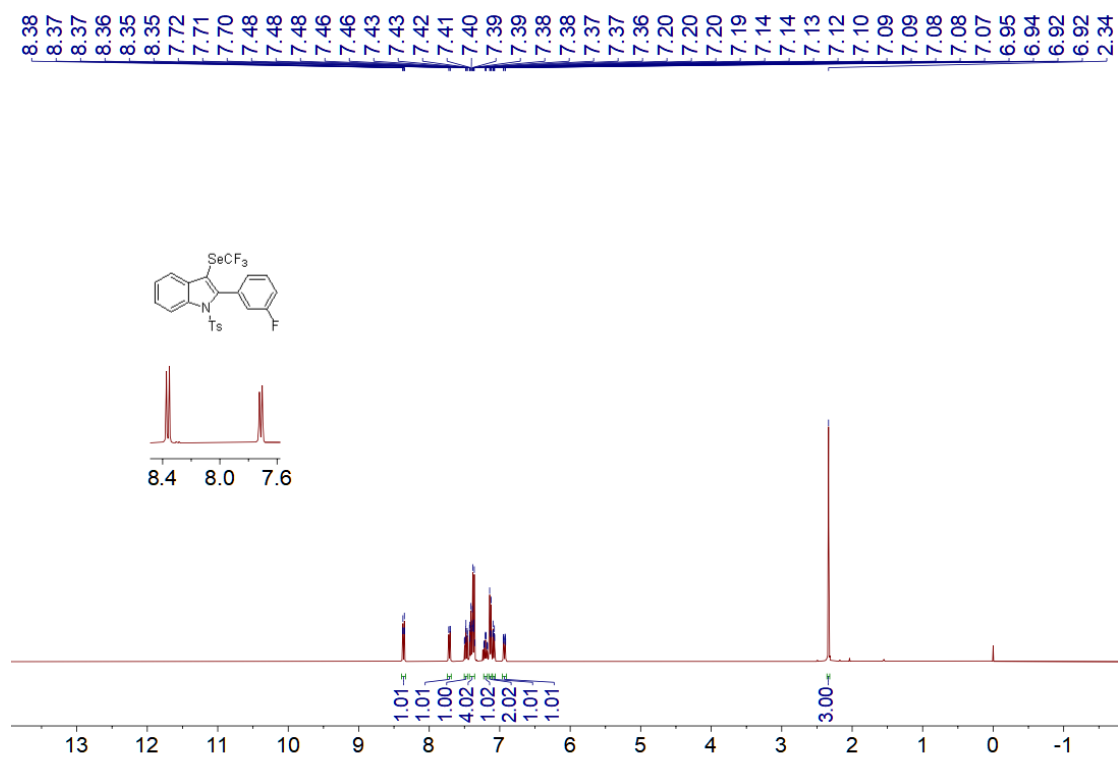
^{19}F NMR spectra of **3s** in CDCl_3



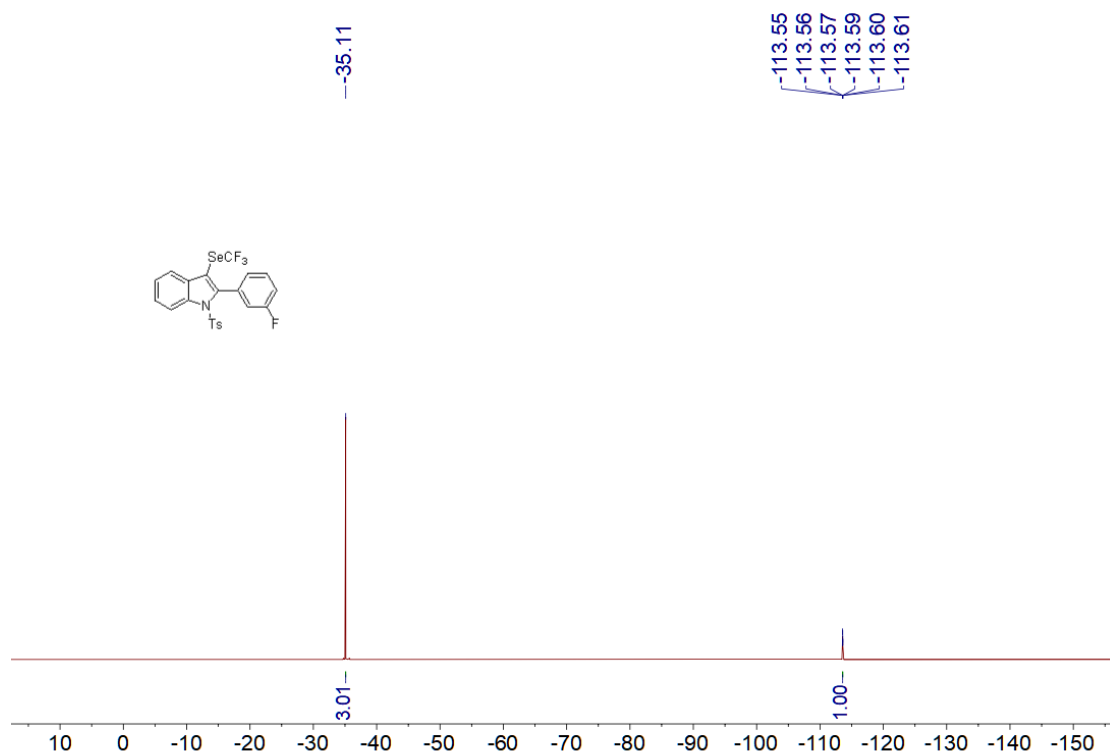
¹³C NMR spectra of **3s** in CDCl₃



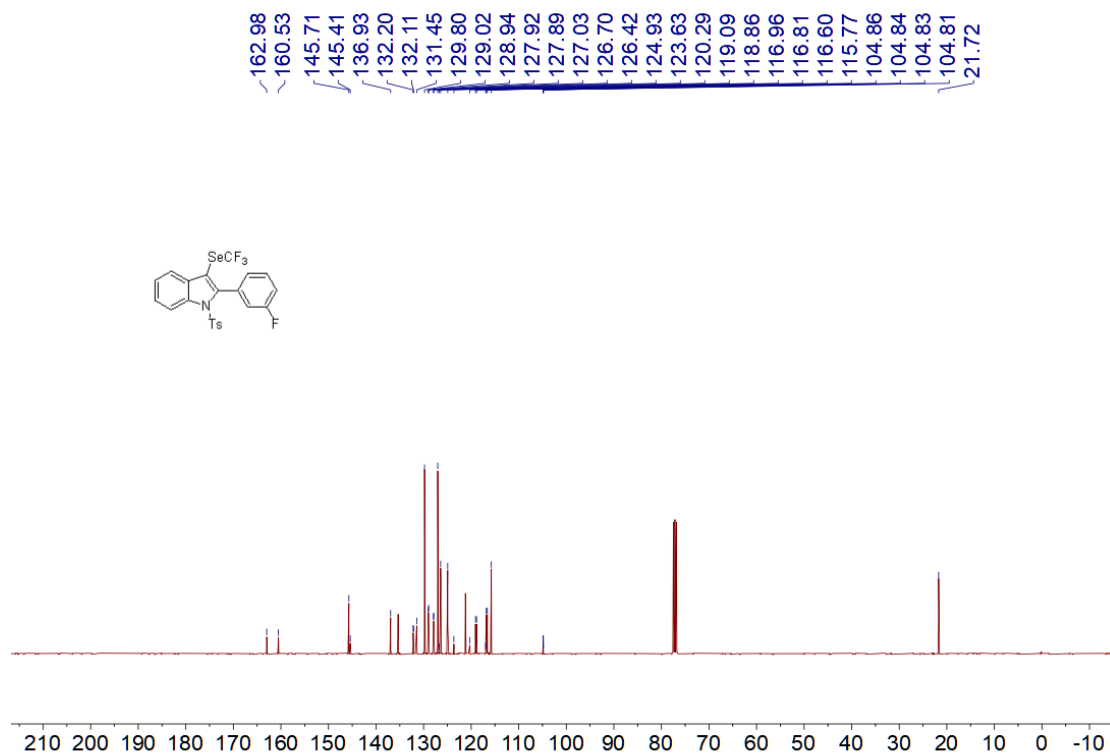
¹H NMR spectra of **3t** in CDCl₃



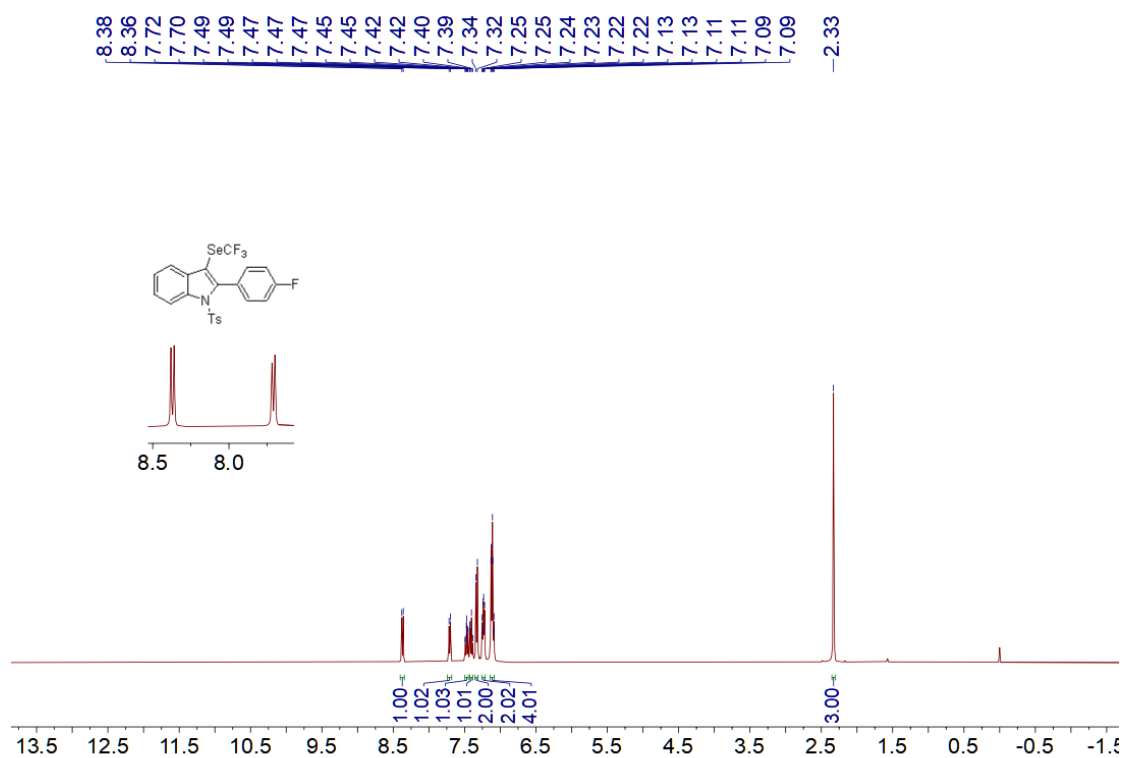
^{19}F NMR spectra of **3t** in CDCl_3



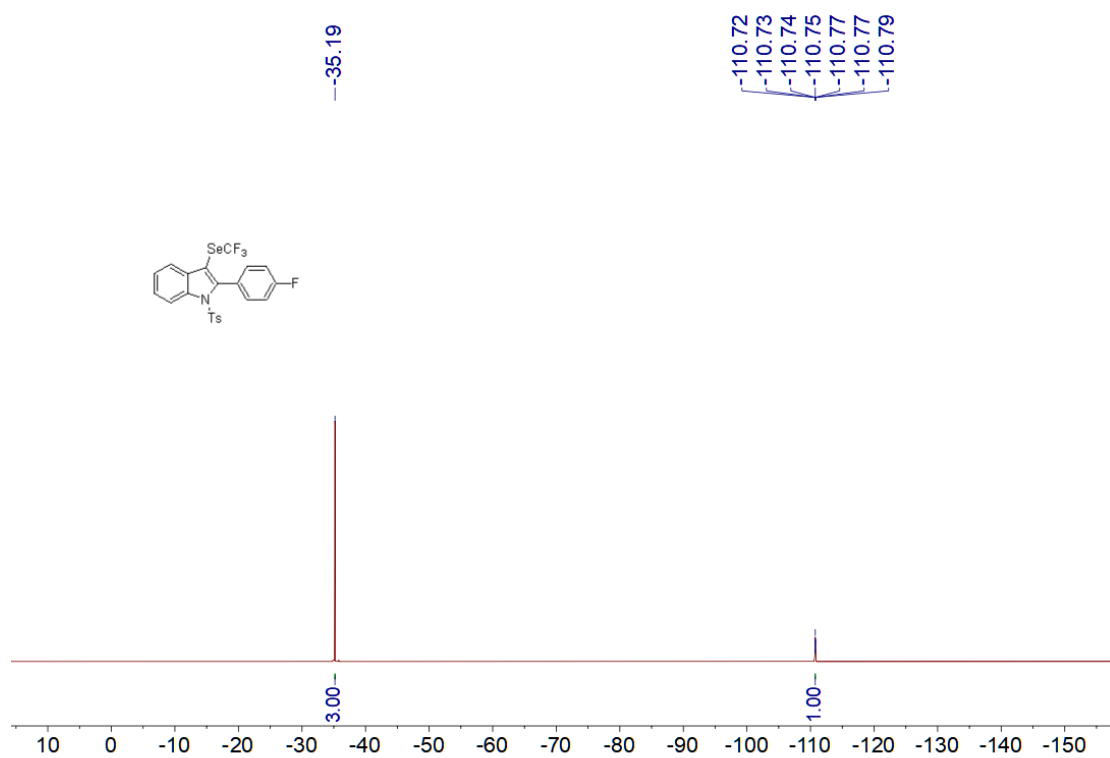
^{13}C NMR spectra of **3t** in CDCl_3



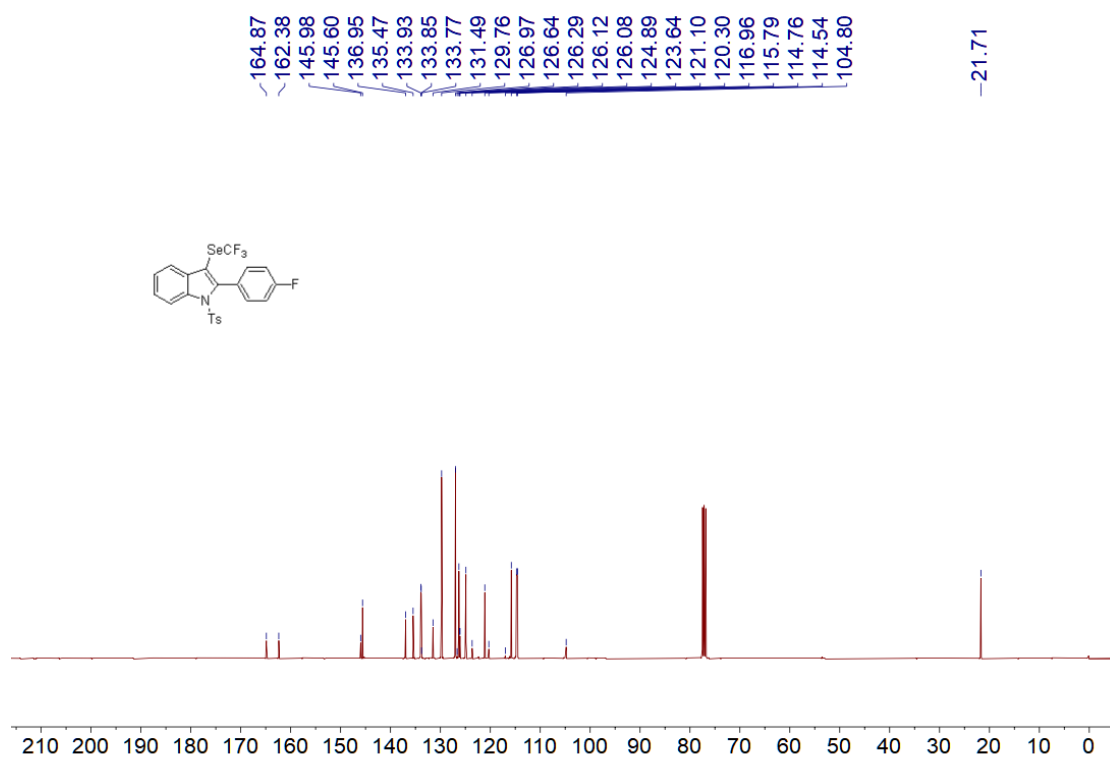
^1H NMR spectra of **3u** in CDCl_3



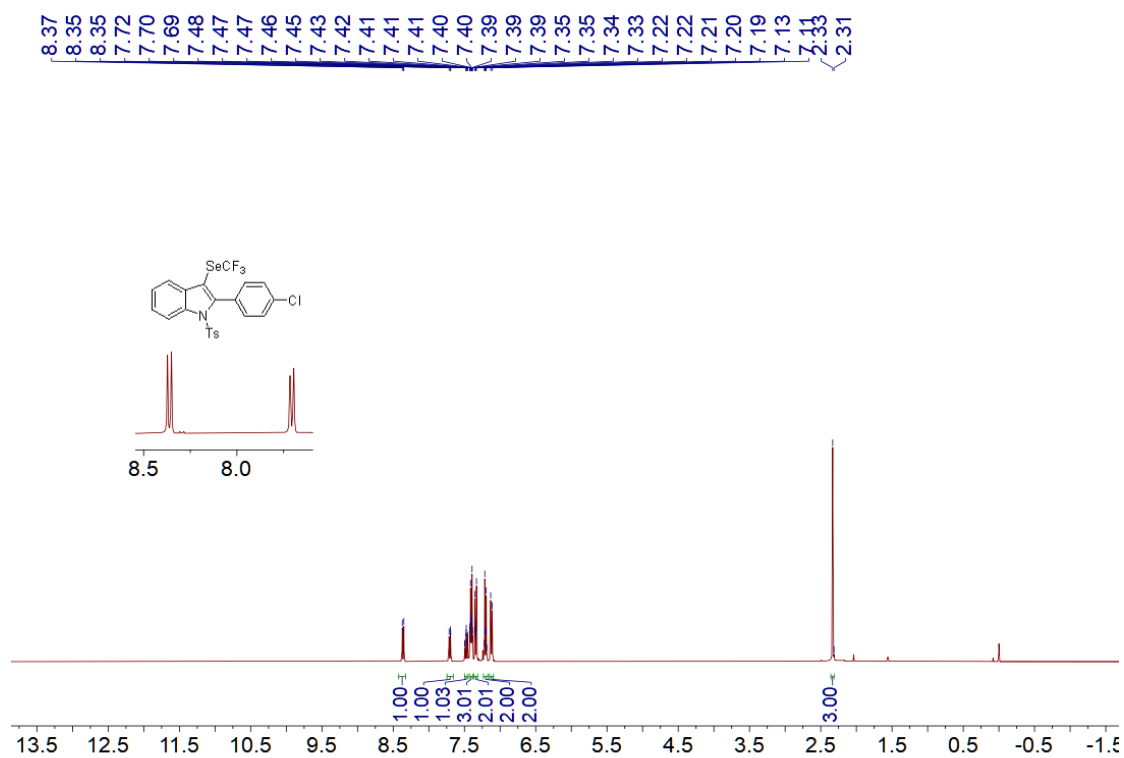
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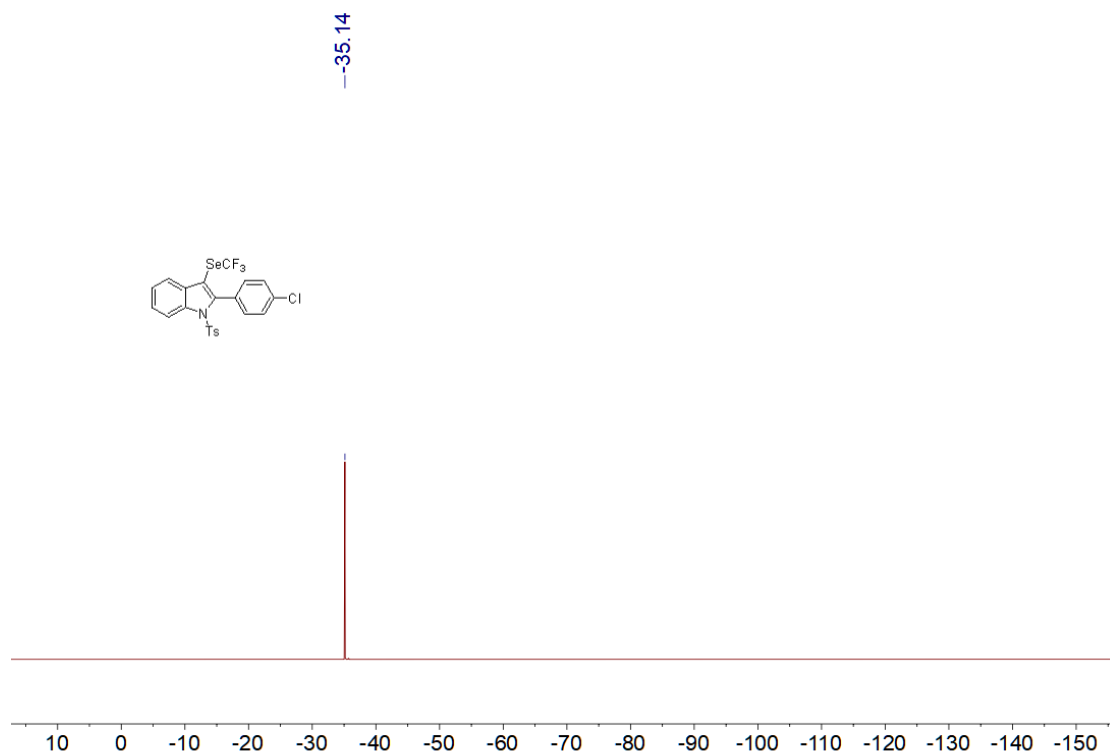
^{13}C NMR spectra of **3u** in CDCl_3



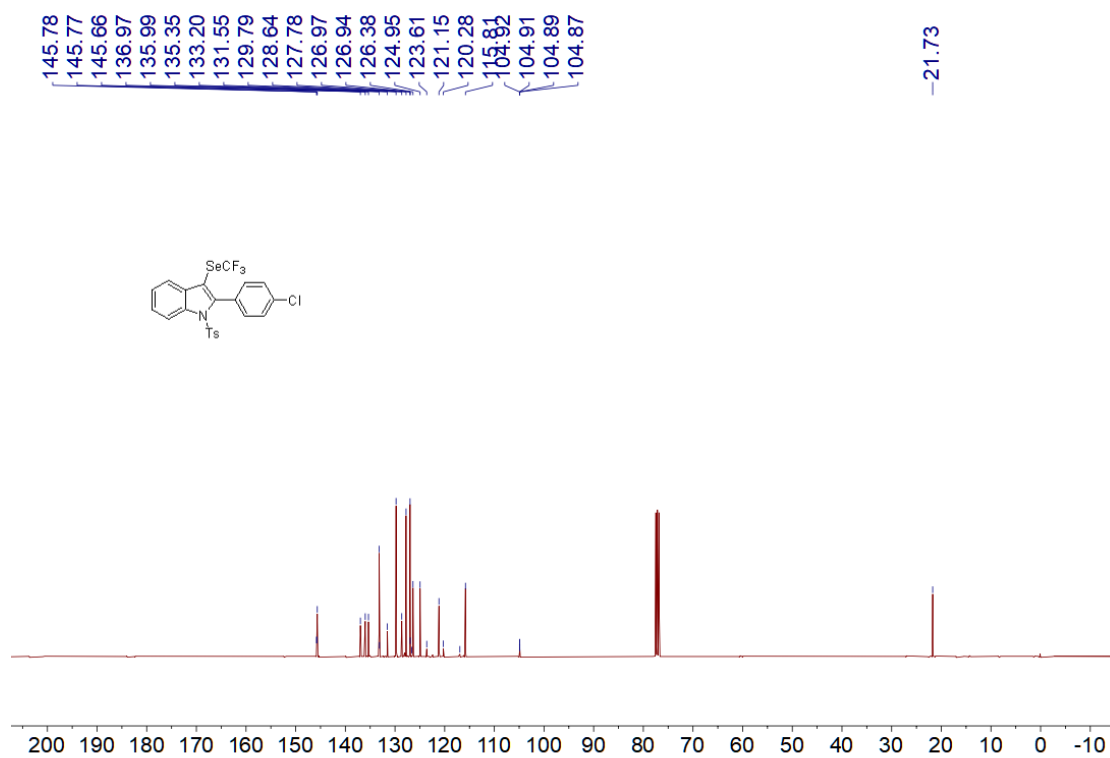
^1H NMR spectra of **3v** in CDCl_3



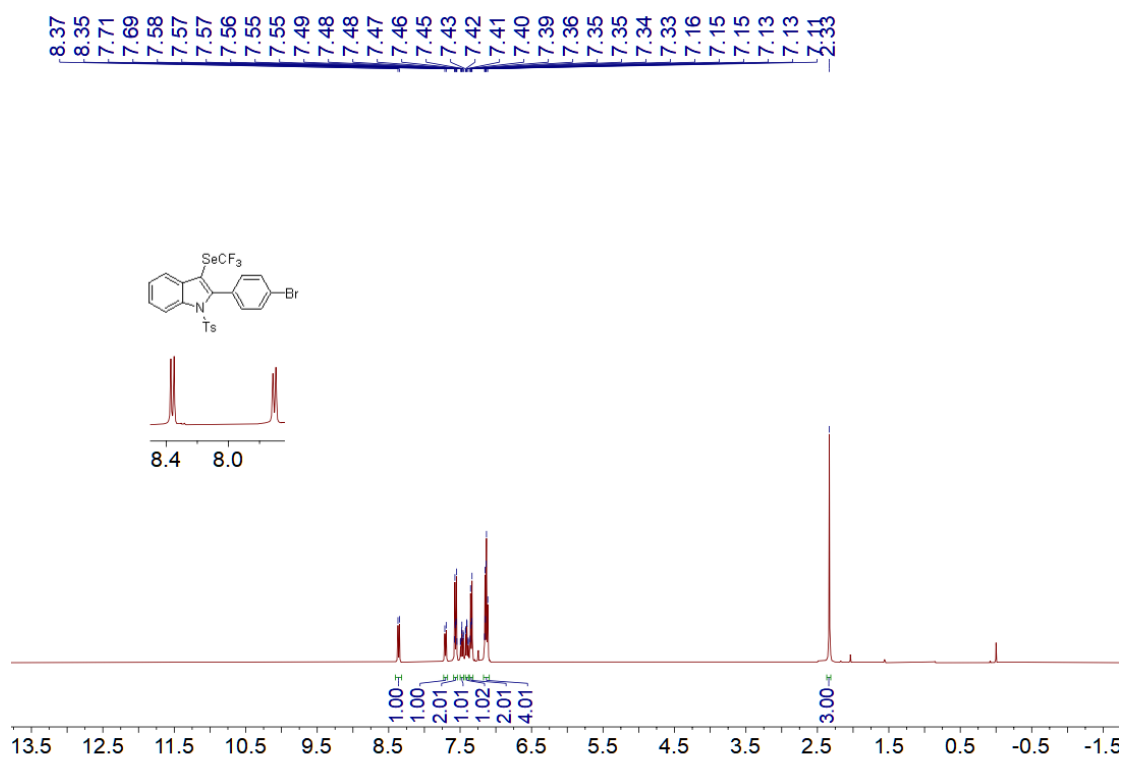
^{19}F NMR spectra of **3v** in CDCl_3



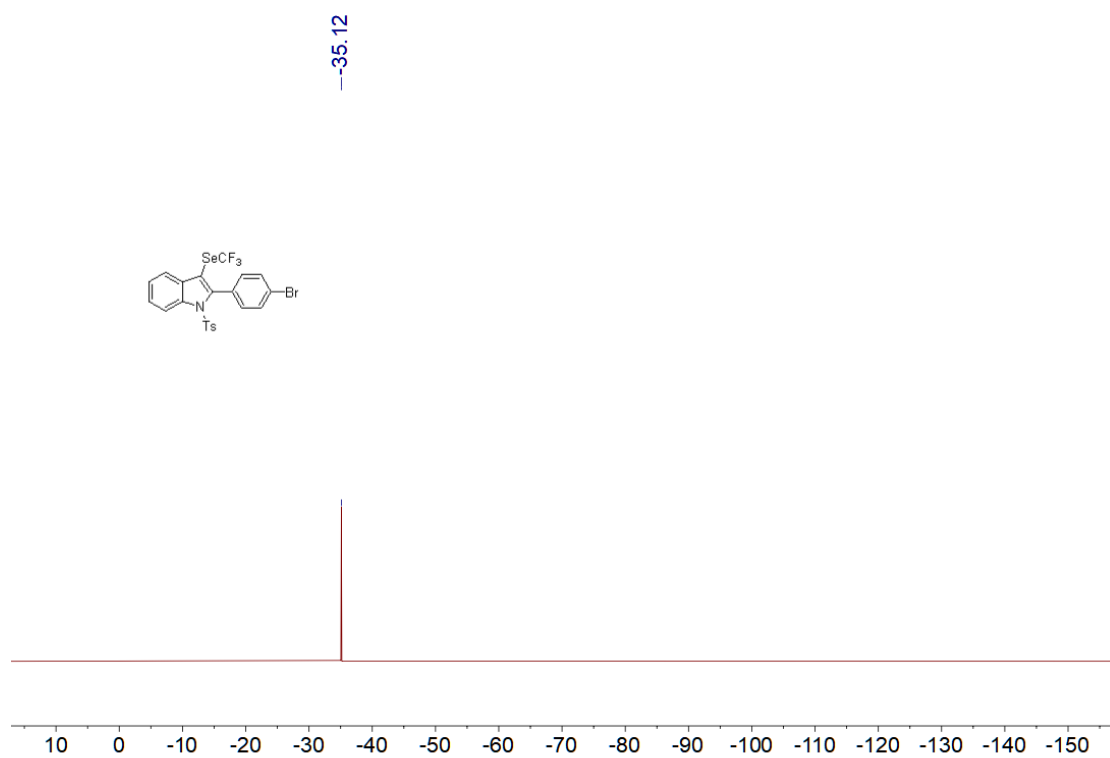
^{13}C NMR spectra of **3v** in CDCl_3



^1H NMR spectra of **3w** in CDCl_3



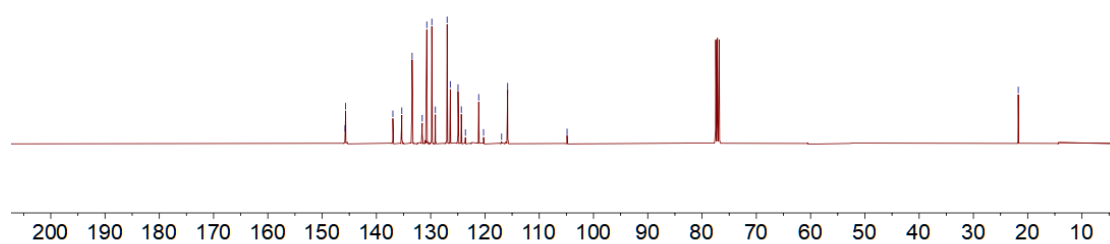
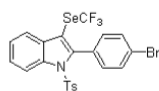
^{19}F NMR spectra of **3w** in CDCl_3



^{13}C NMR spectra of **3w** in CDCl_3

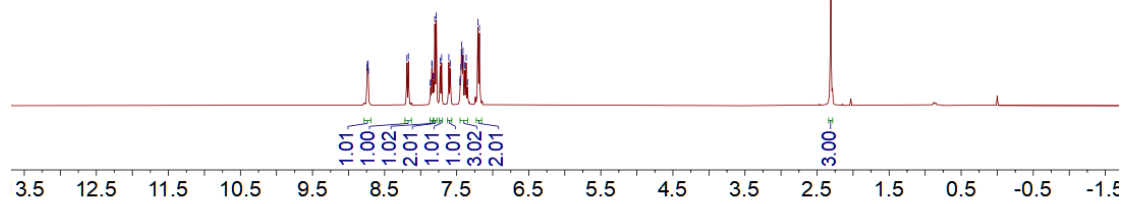
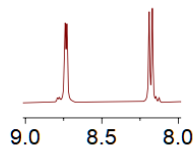
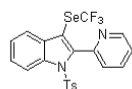
145.78
145.66
136.97
135.32
133.42
131.56
130.72
129.79
129.13
126.97
126.39
124.96
124.36
123.60
121.16
120.26
116.93
115.81
104.87

-21.74

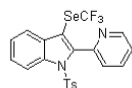
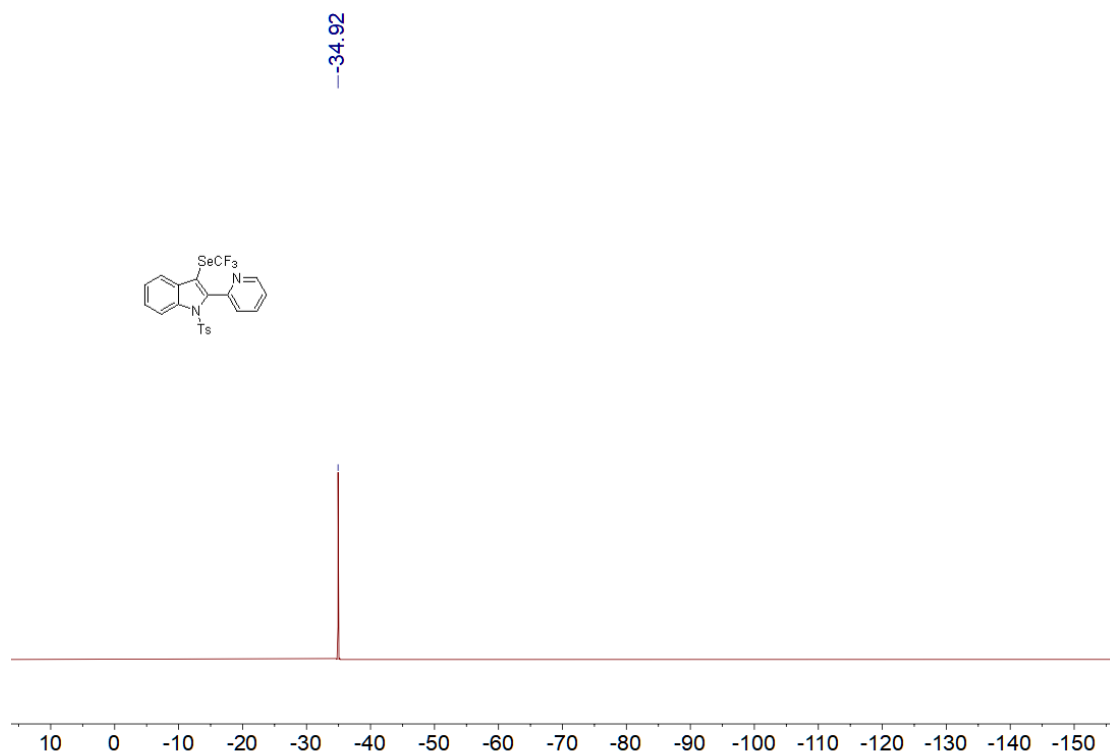


^1H NMR spectra of **3x** in CDCl_3

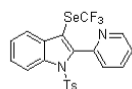
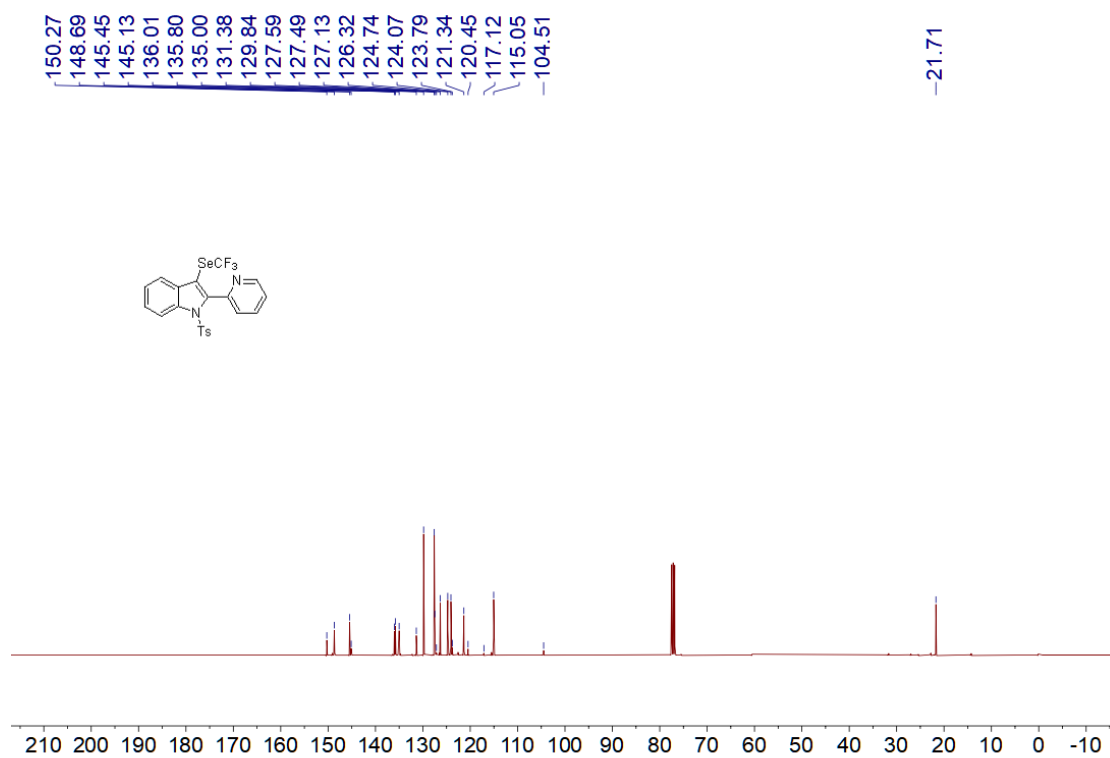
8.74
8.74
8.73
8.73
8.19
8.17
7.87
7.86
7.85
7.84
7.83
7.82
7.80
7.78
7.73
7.71
7.61
7.59
7.45
7.45
7.44
7.44
7.43
7.42
7.41
7.41
7.39
7.37
7.35
7.20
7.18
-2.31



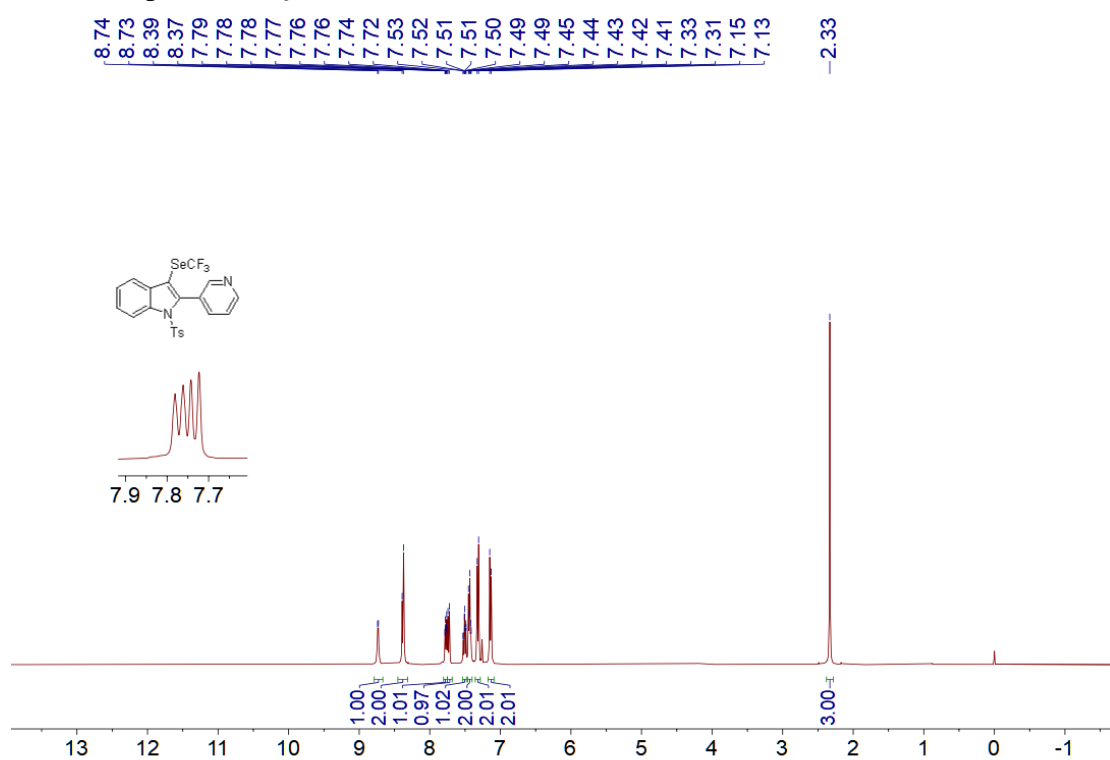
^{19}F NMR spectra of **3x** in CDCl_3



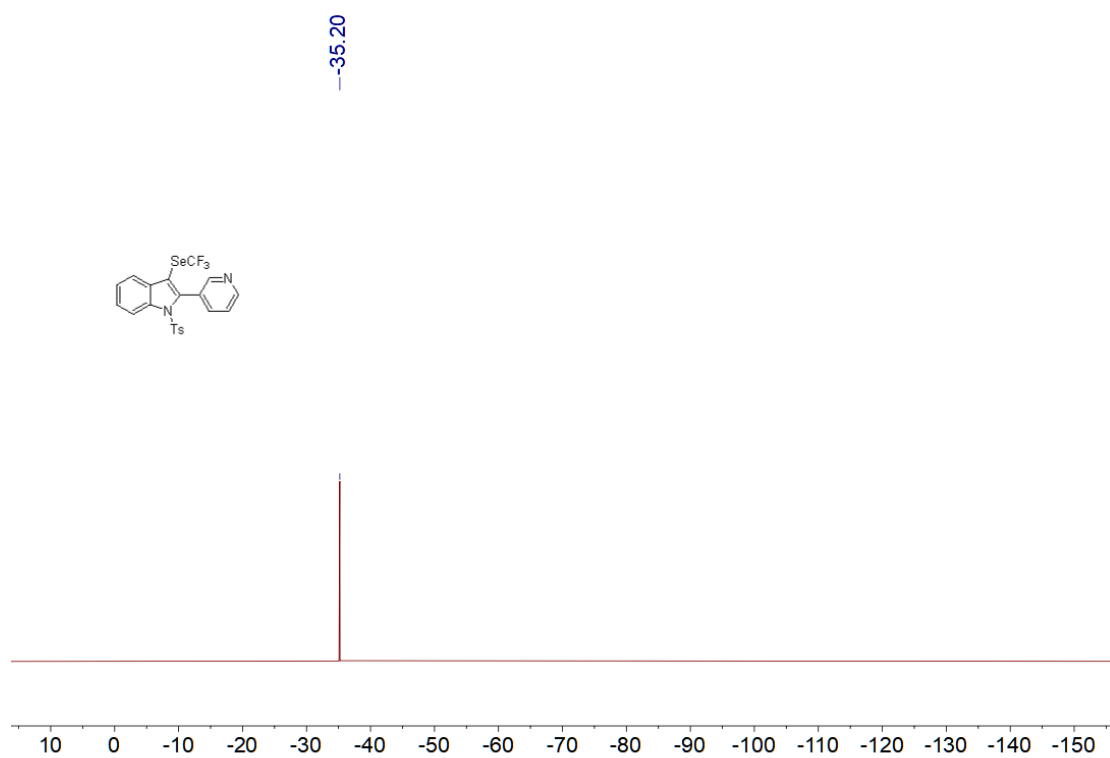
^{13}C NMR spectra of **3x** in CDCl_3



^1H NMR spectra of **3y** in CDCl_3

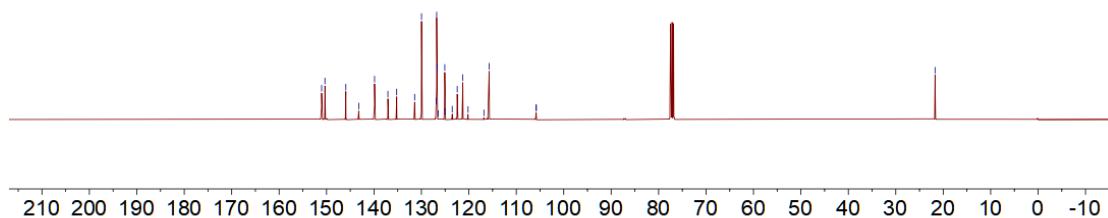
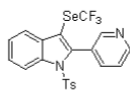


^{19}F NMR spectra of **3y** in CDCl_3



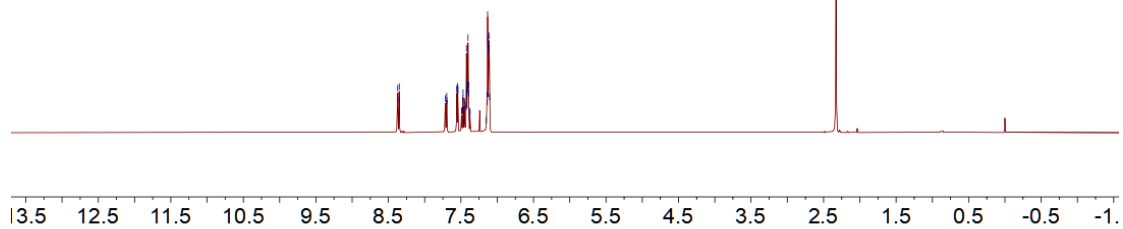
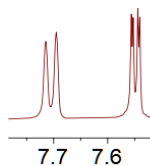
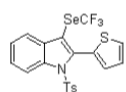
¹³C NMR spectra of **3y** in CDCl₃

151.04
150.34
145.93
143.21
139.88
137.07
135.21
131.43
129.98
126.88
126.79
126.67
126.46
125.08
125.03
123.51
122.45
121.28
120.17
116.83
115.71
105.80
-21.72

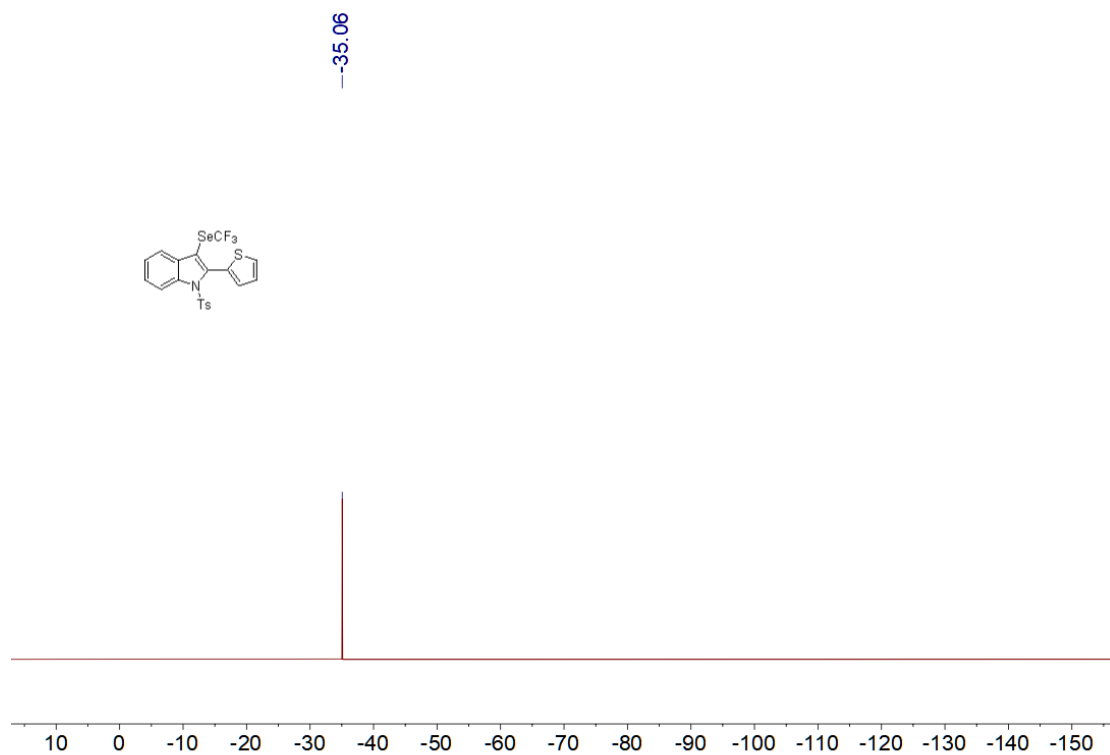


¹H NMR spectra of **3z** in CDCl₃

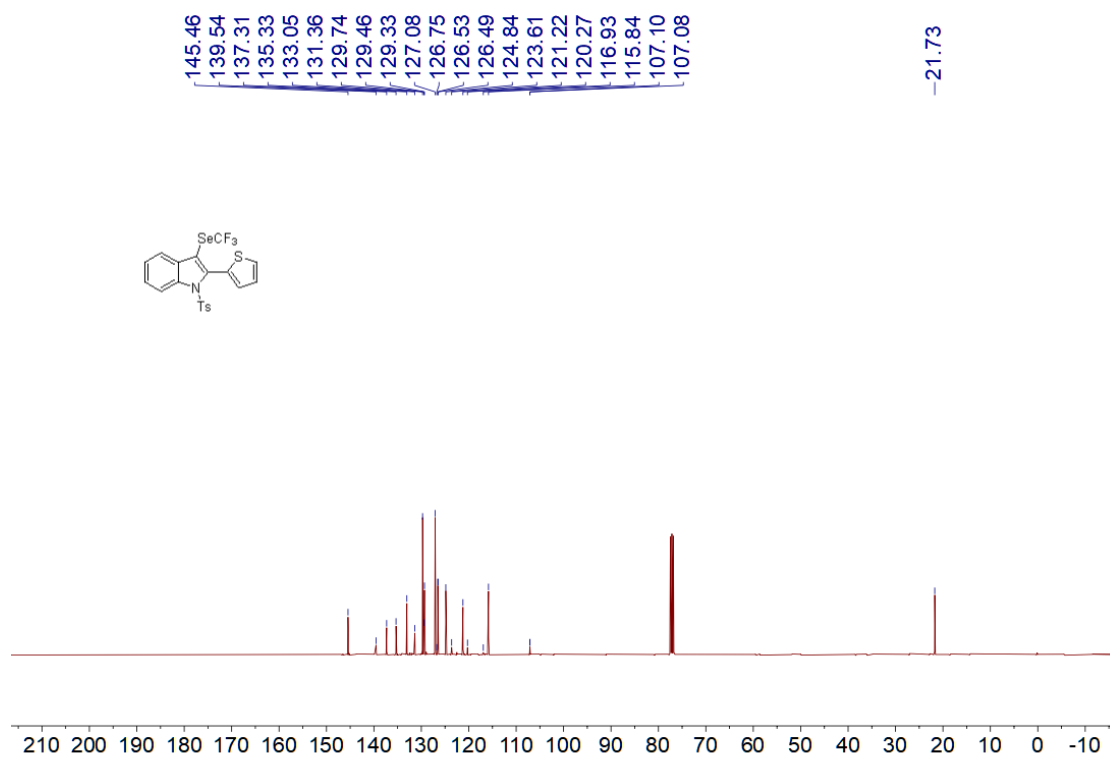
8.37
8.35
8.35
7.71
7.70
7.69
7.56
7.55
7.54
7.54
7.49
7.49
7.47
7.47
7.46
7.45
7.45
7.43
7.42
7.42
7.41
7.41
7.40
7.39
7.39
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7.14
7.13
7.13
7.12
7.12
7.11
7.11
7.10
2.33



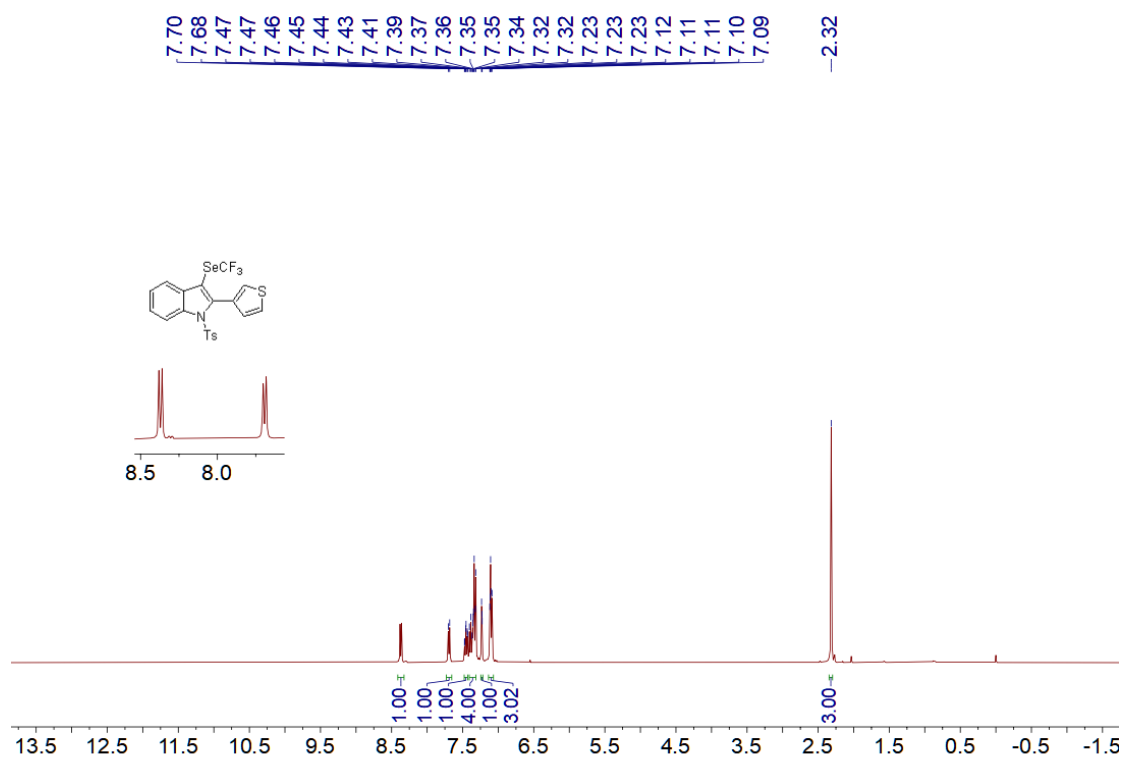
^{19}F NMR spectra of **3z** in CDCl_3



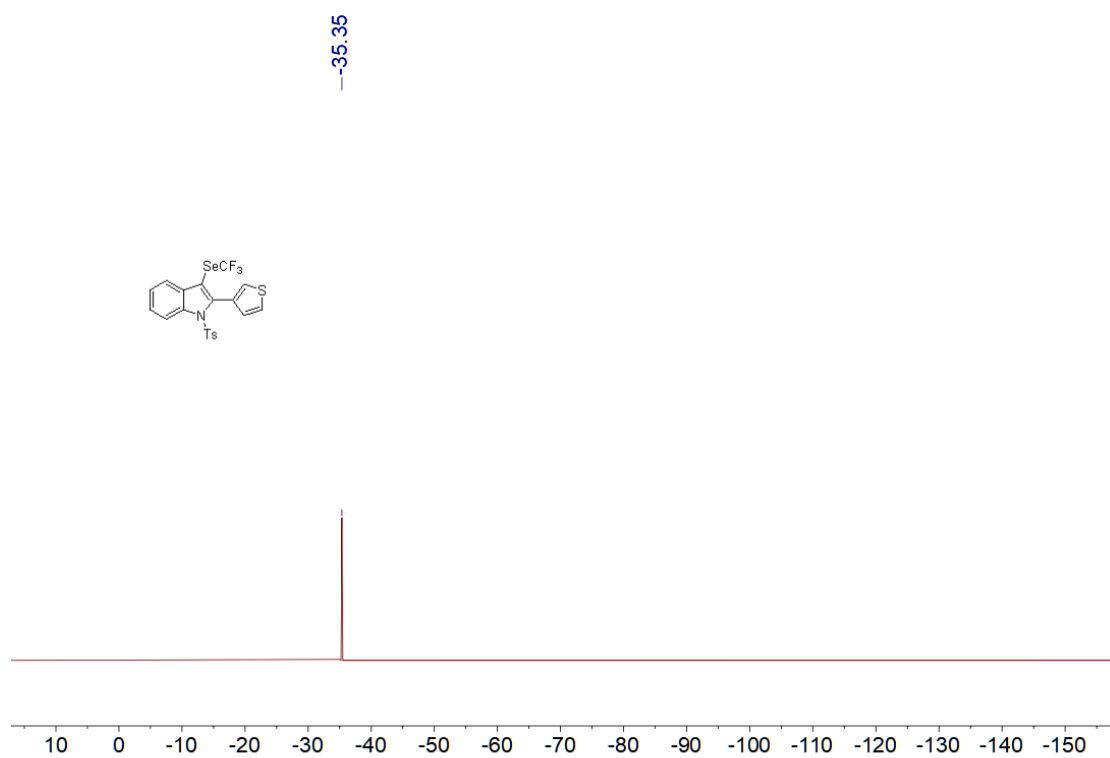
^{13}C NMR spectra of **3z** in CDCl_3



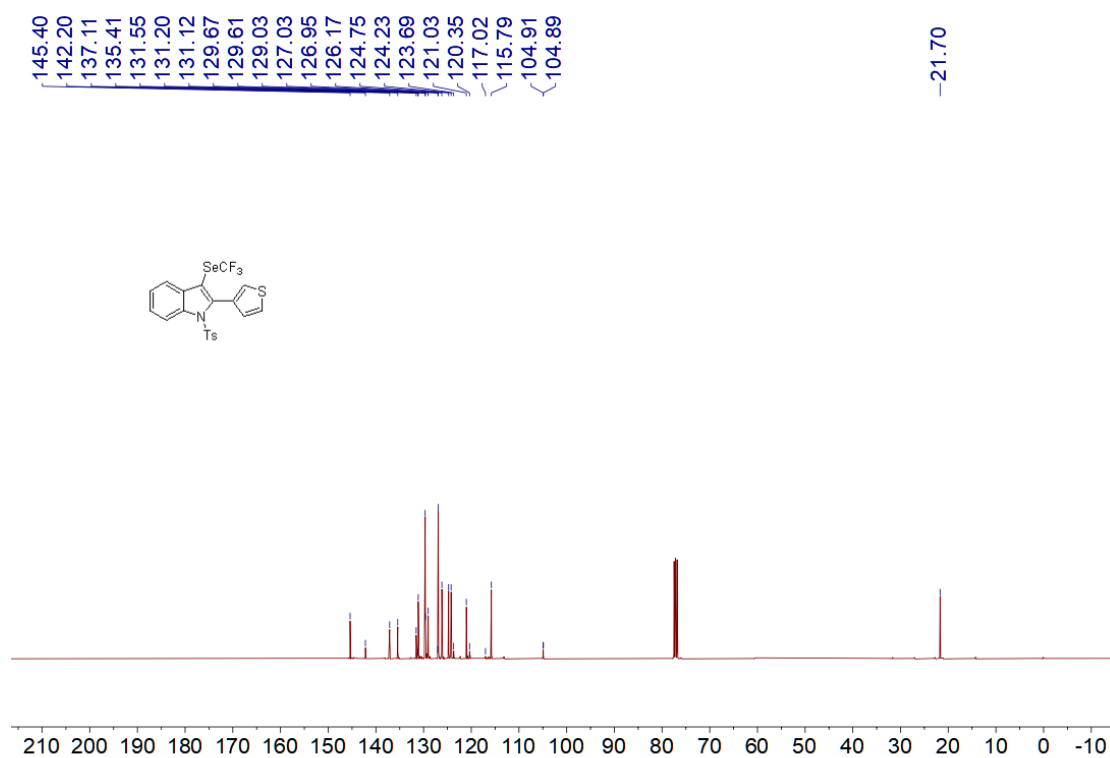
¹H NMR spectra of **3aa** in CDCl₃



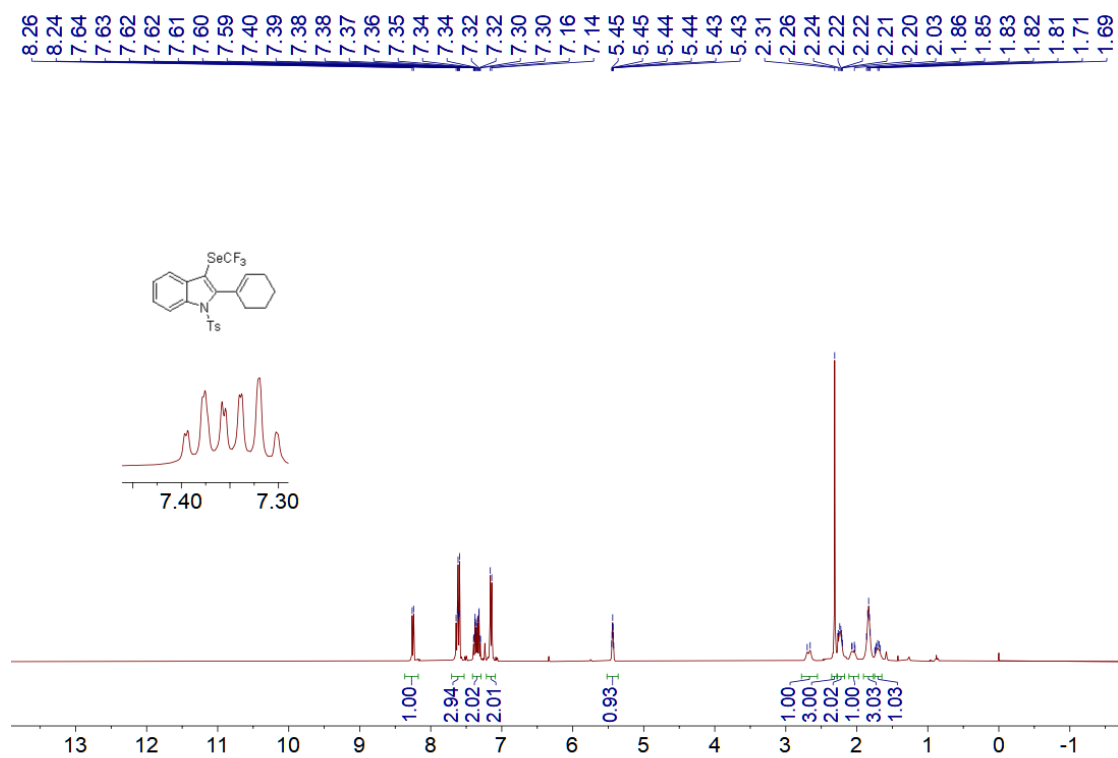
¹⁹F NMR spectra of **3aa** in CDCl₃



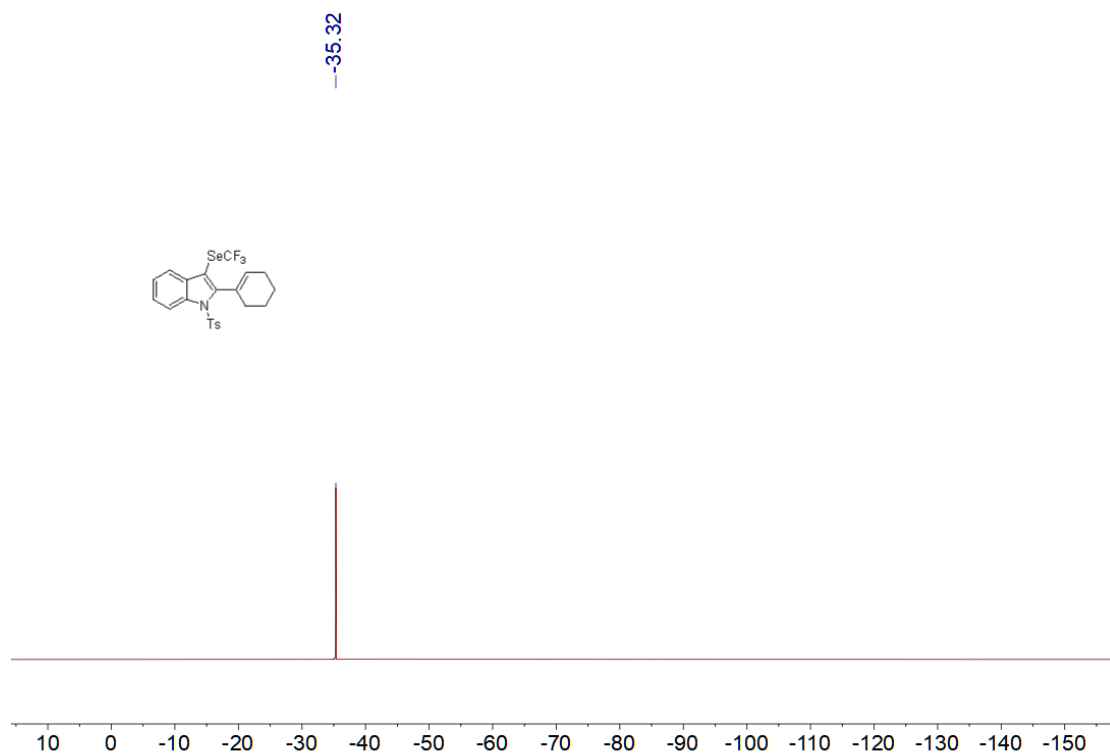
¹³C NMR spectra of **3aa** in CDCl₃



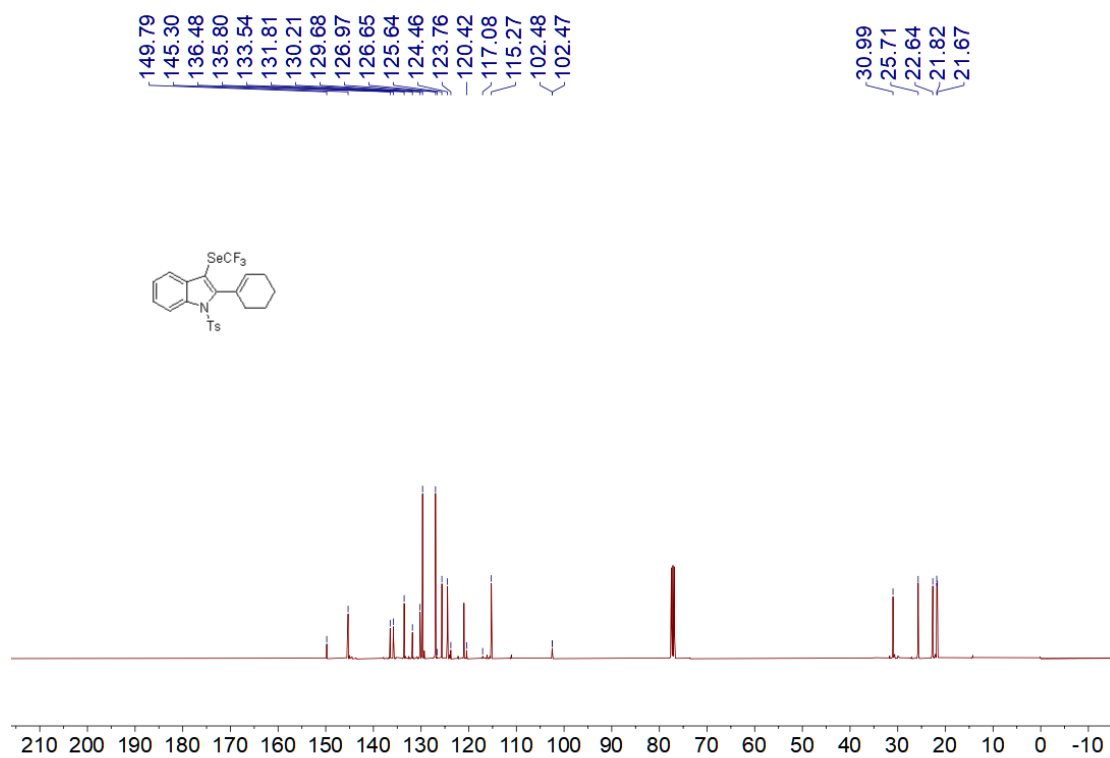
¹H NMR spectra of **3ab** in CDCl₃



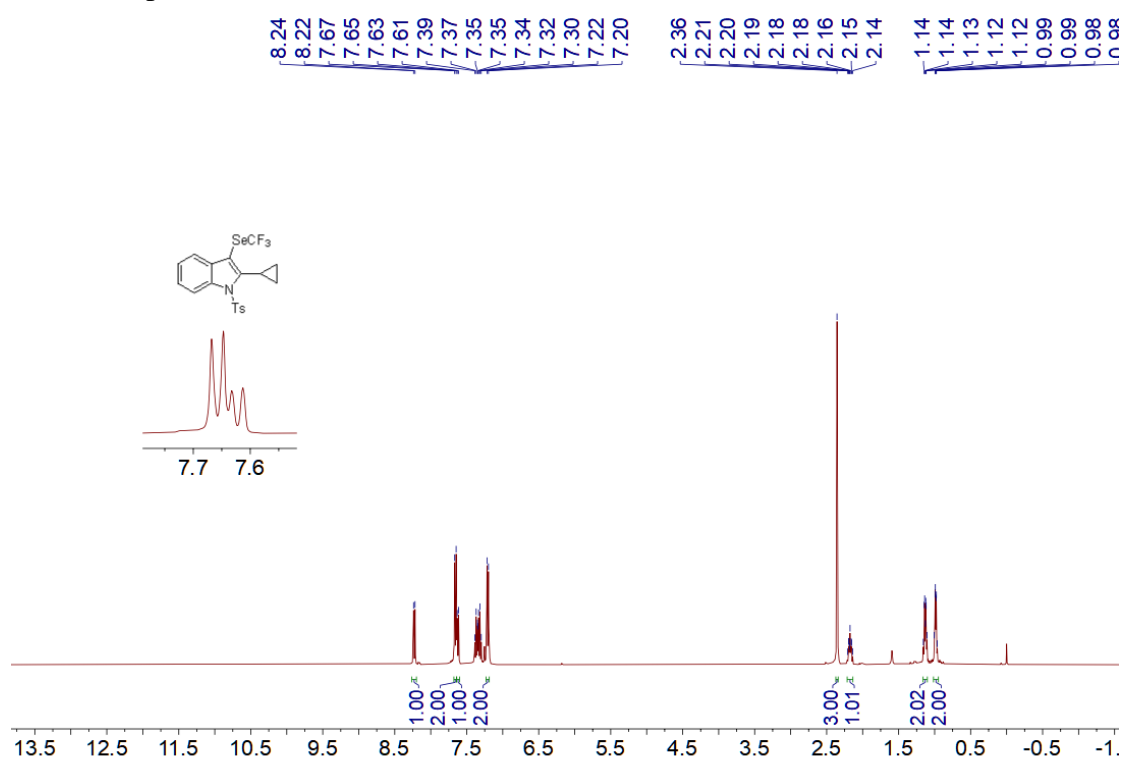
^{19}F NMR spectra of **3ab** in CDCl_3



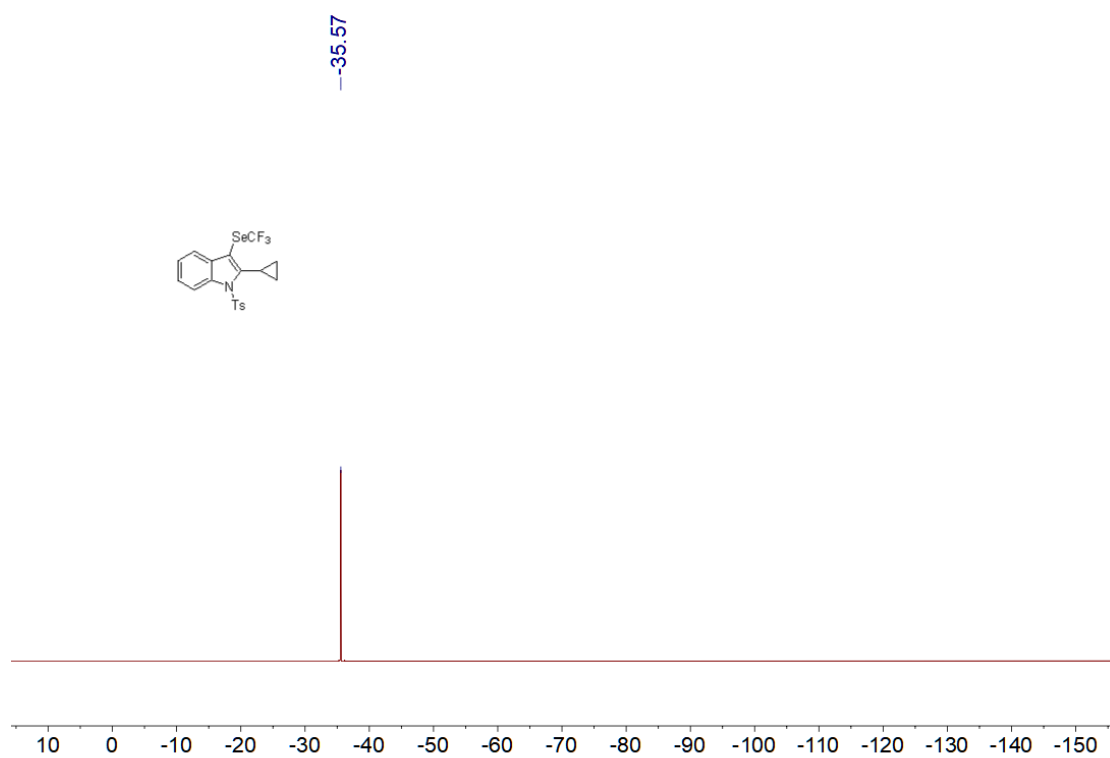
^{13}C NMR spectra of **3ab** in CDCl_3



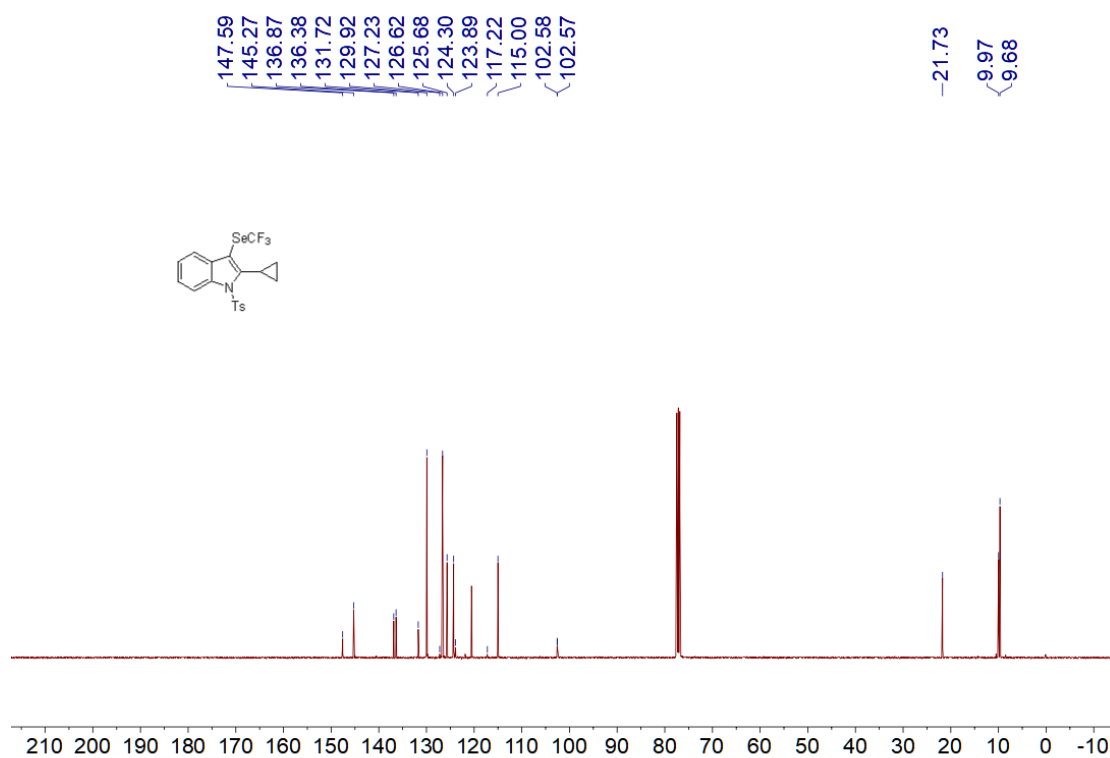
^1H NMR spectra of **3ac** in CDCl_3



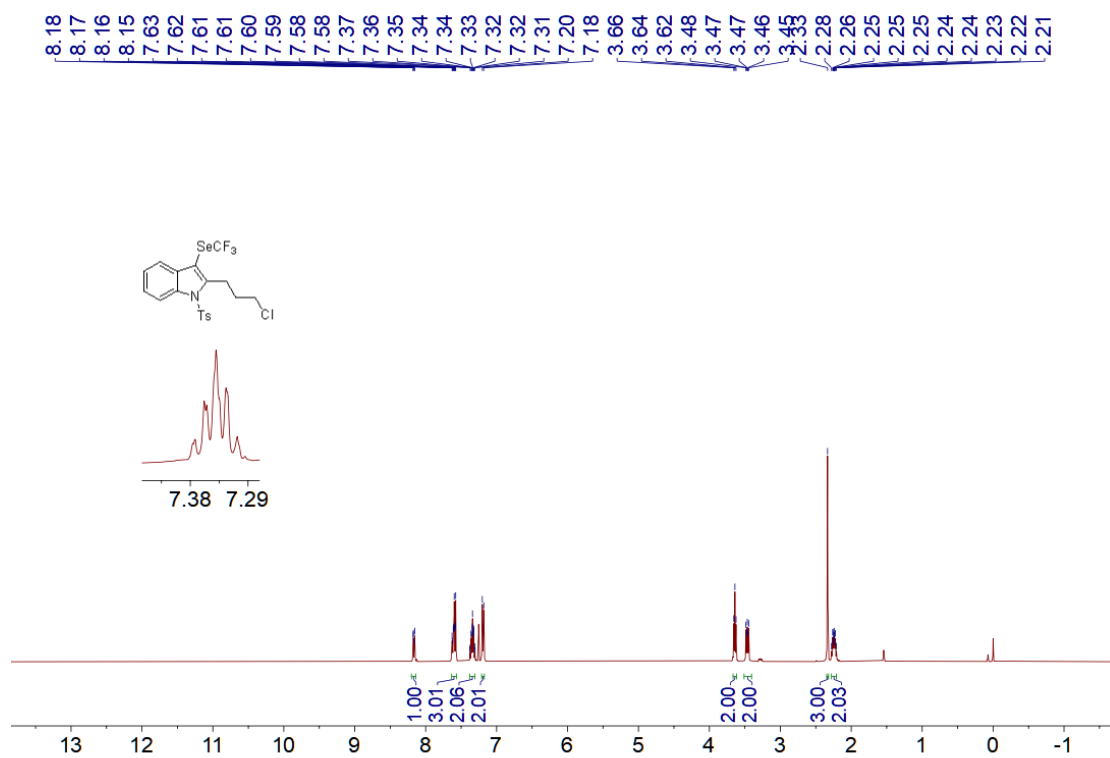
^{19}F NMR spectra of **3ac** in CDCl_3



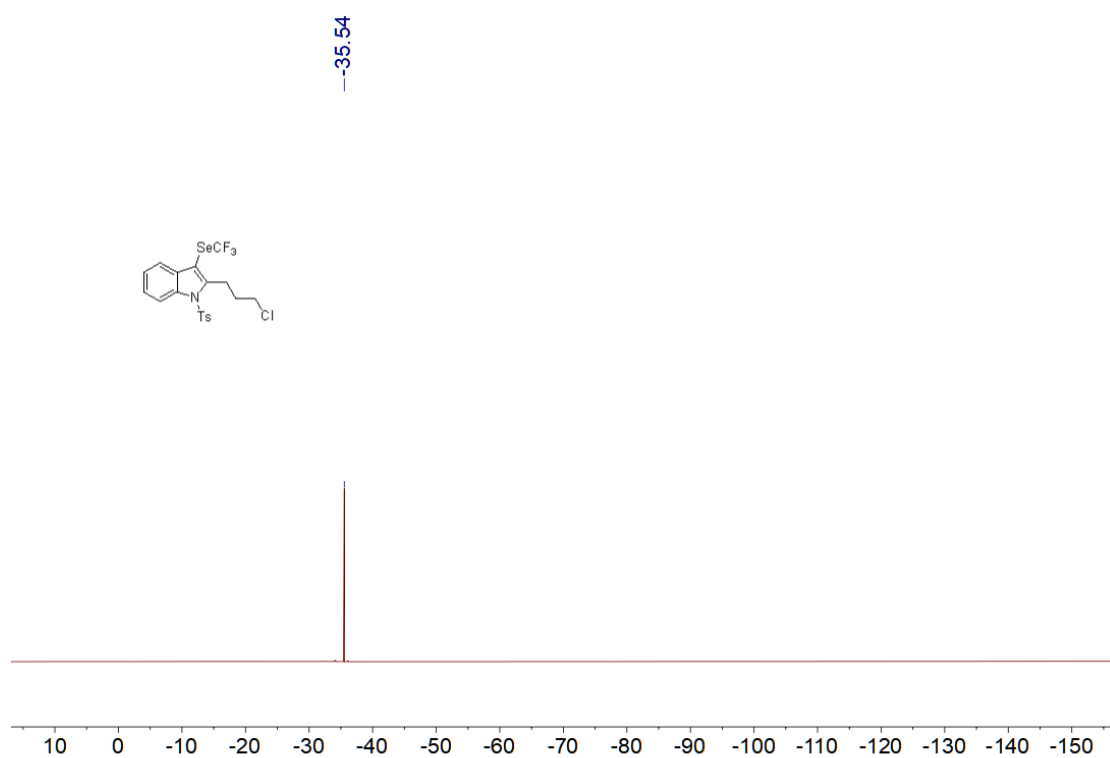
¹³C NMR spectra of **3ac** in CDCl₃



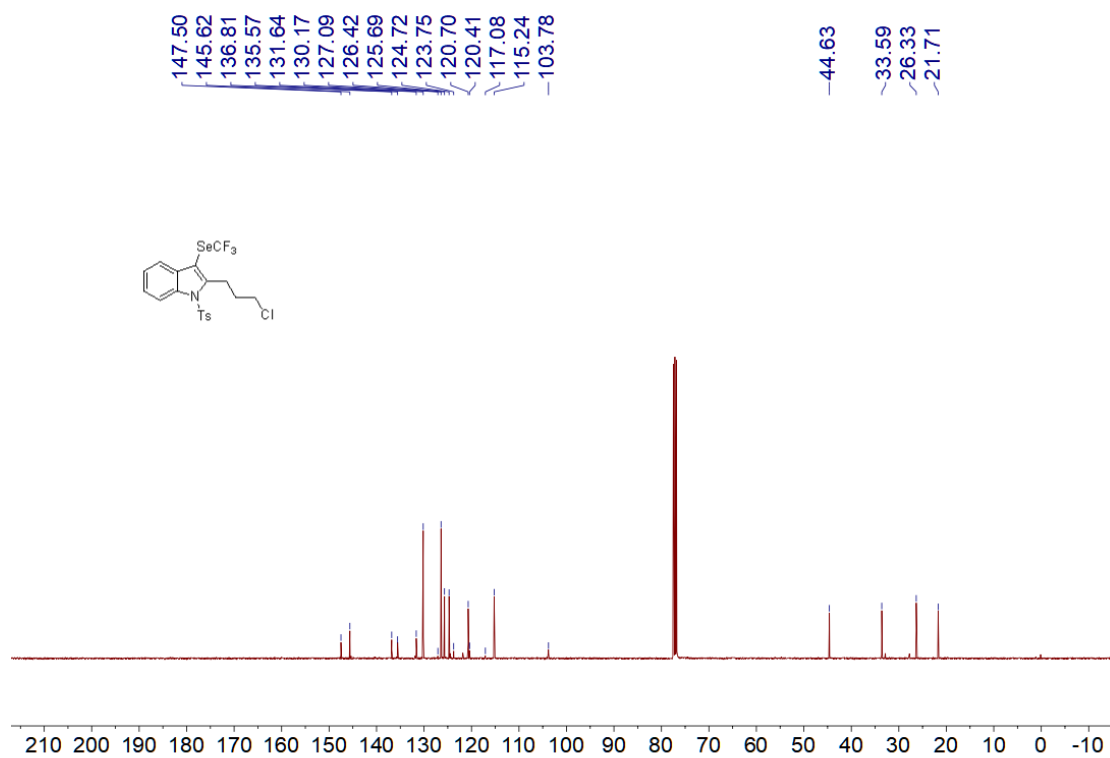
¹H NMR spectra of **3ad** in CDCl₃



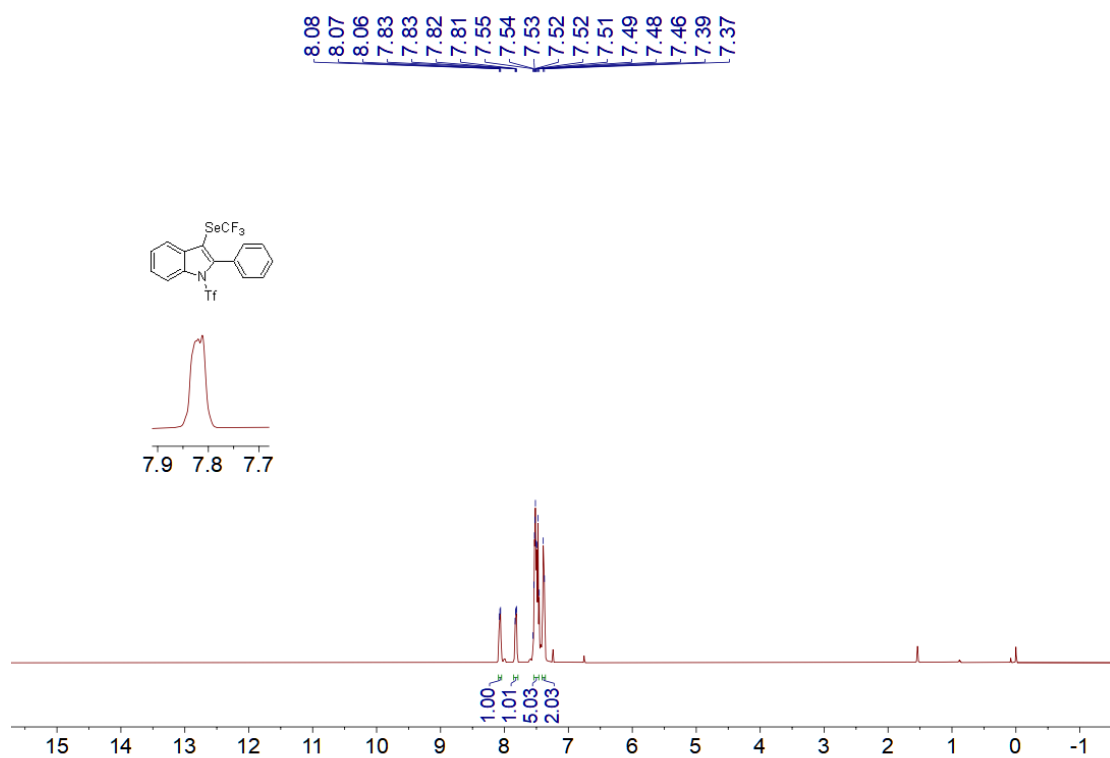
^{19}F NMR spectra of **3ad** in CDCl_3



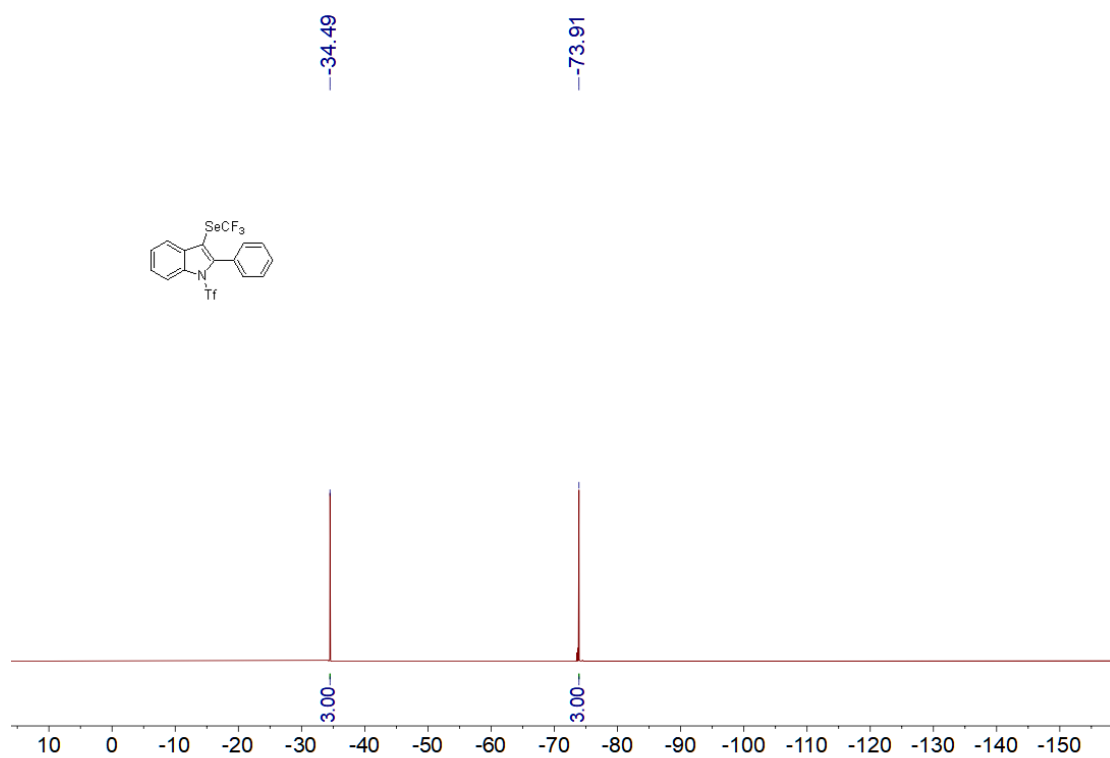
^{13}C NMR spectra of **3ad** in CDCl_3



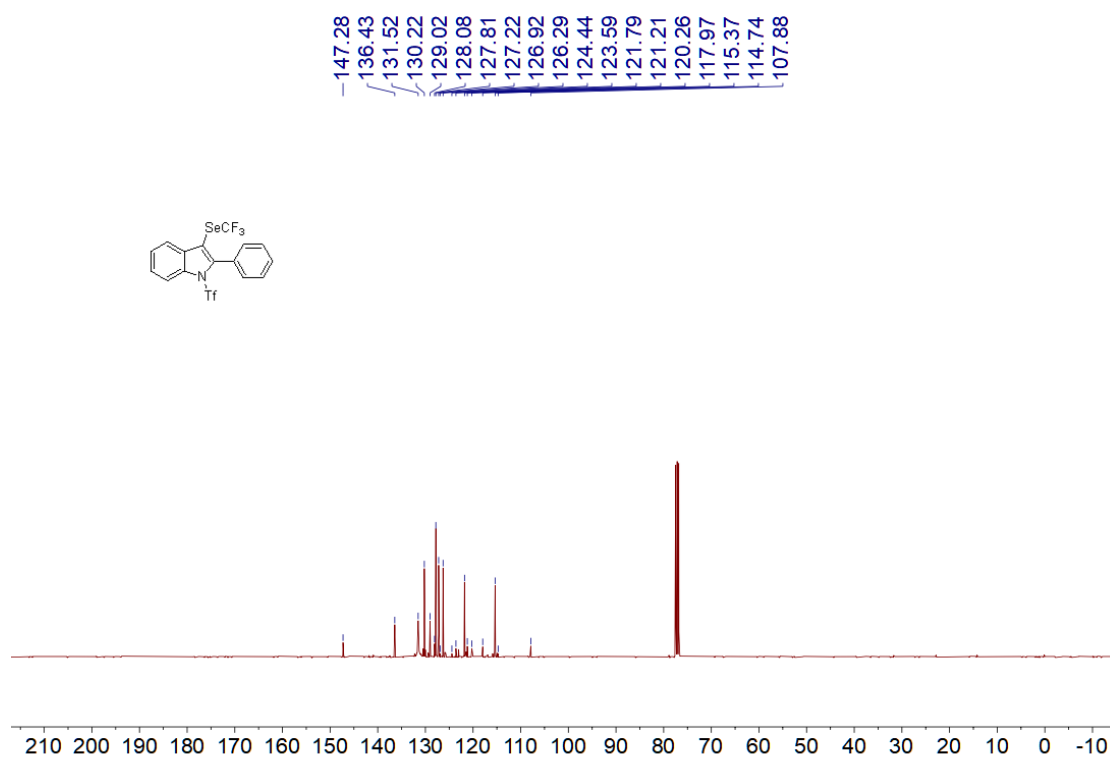
^1H NMR spectra of **3a-1** in CDCl_3



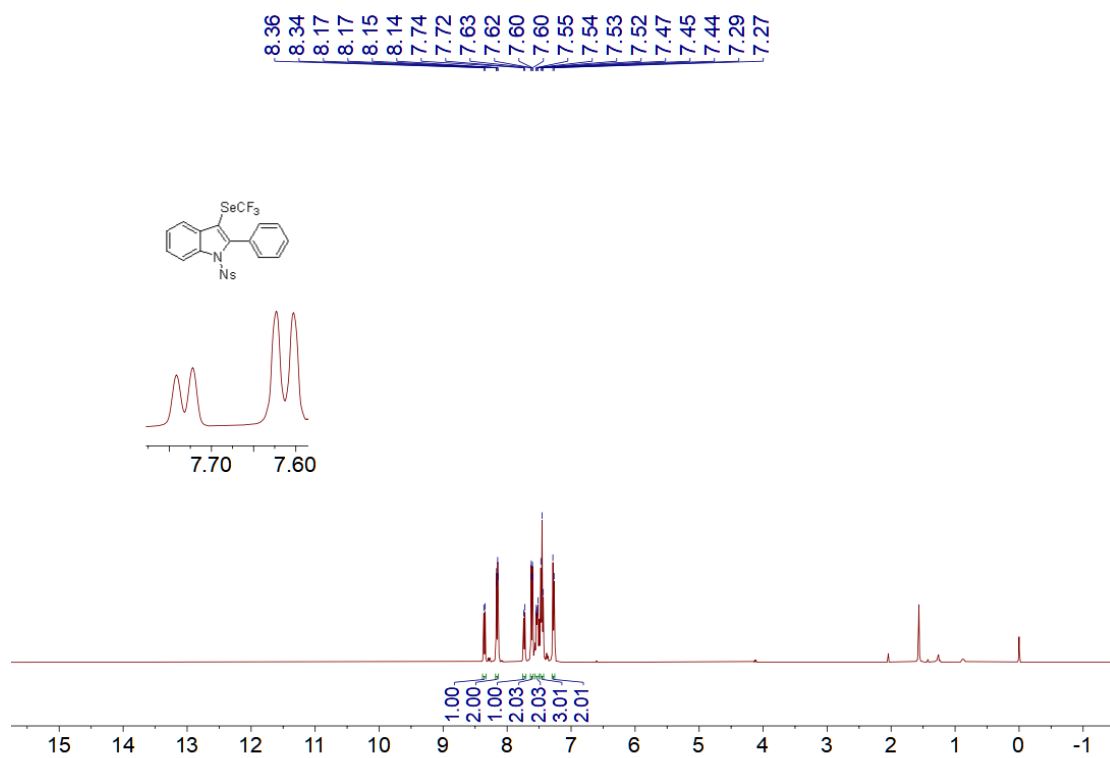
^{19}F NMR spectra of **3a-1** in CDCl_3



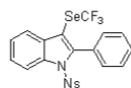
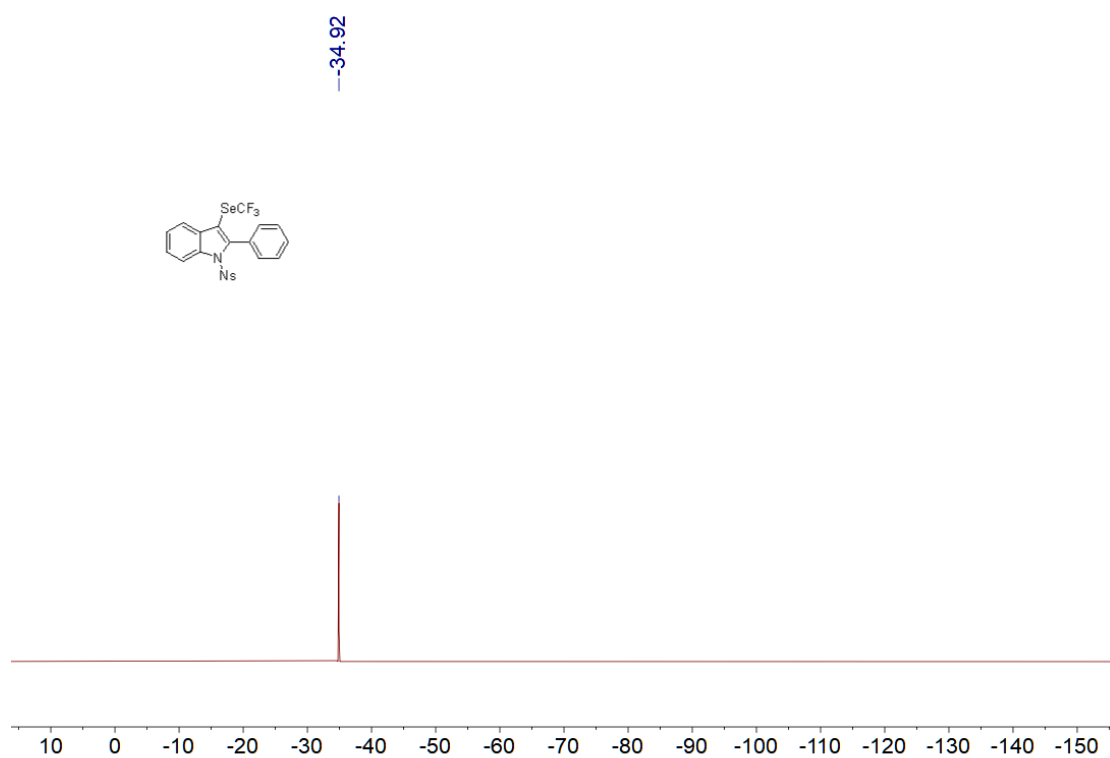
^{13}C NMR spectra of **3a-1** in CDCl_3



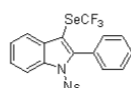
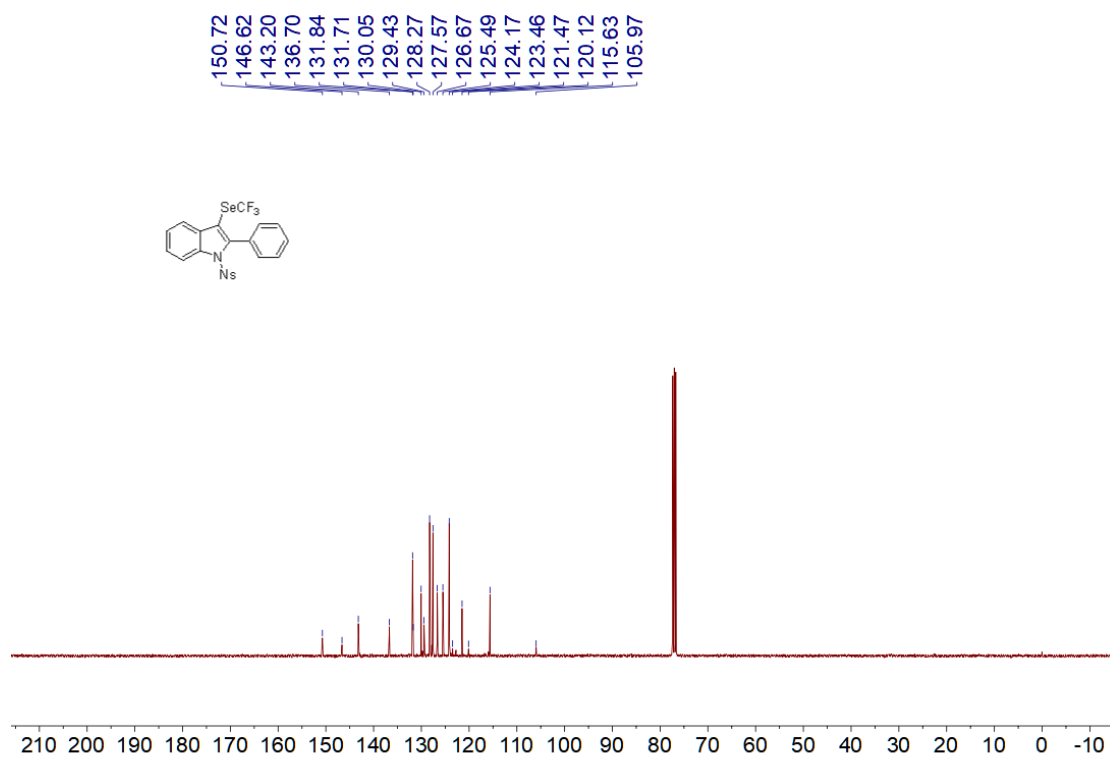
^1H NMR spectra of **3a-2** in CDCl_3



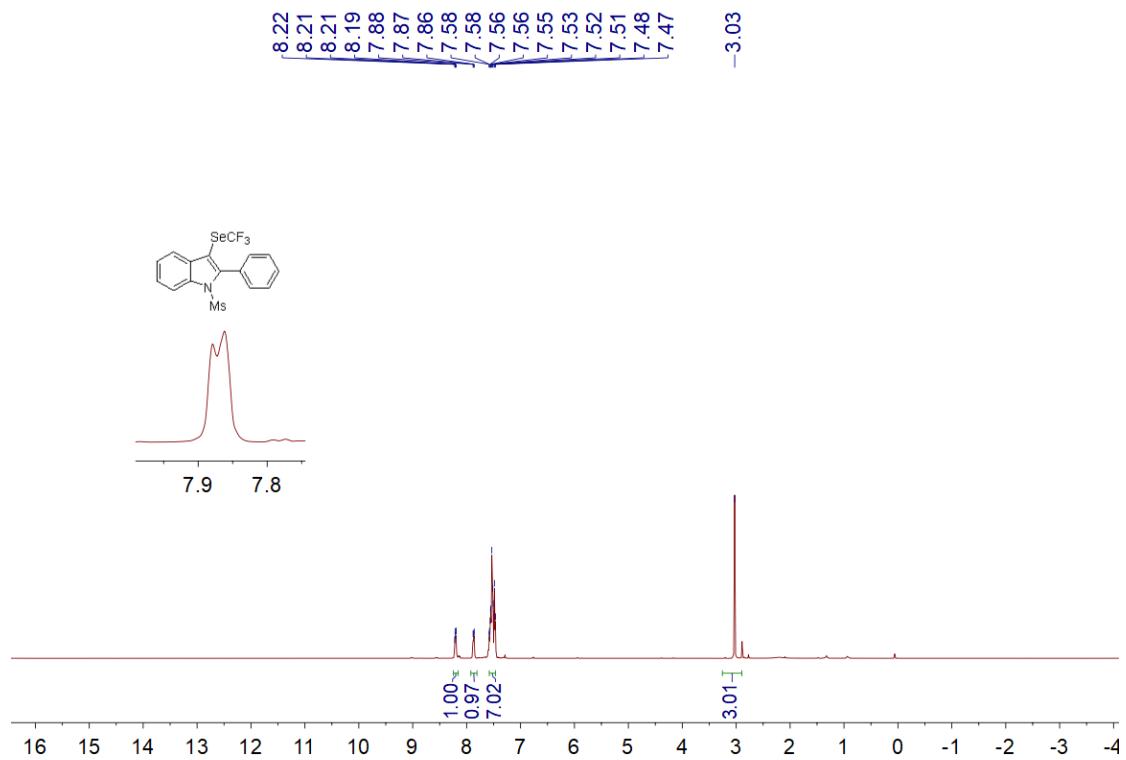
^{19}F NMR spectra of **3a-2** in CDCl_3



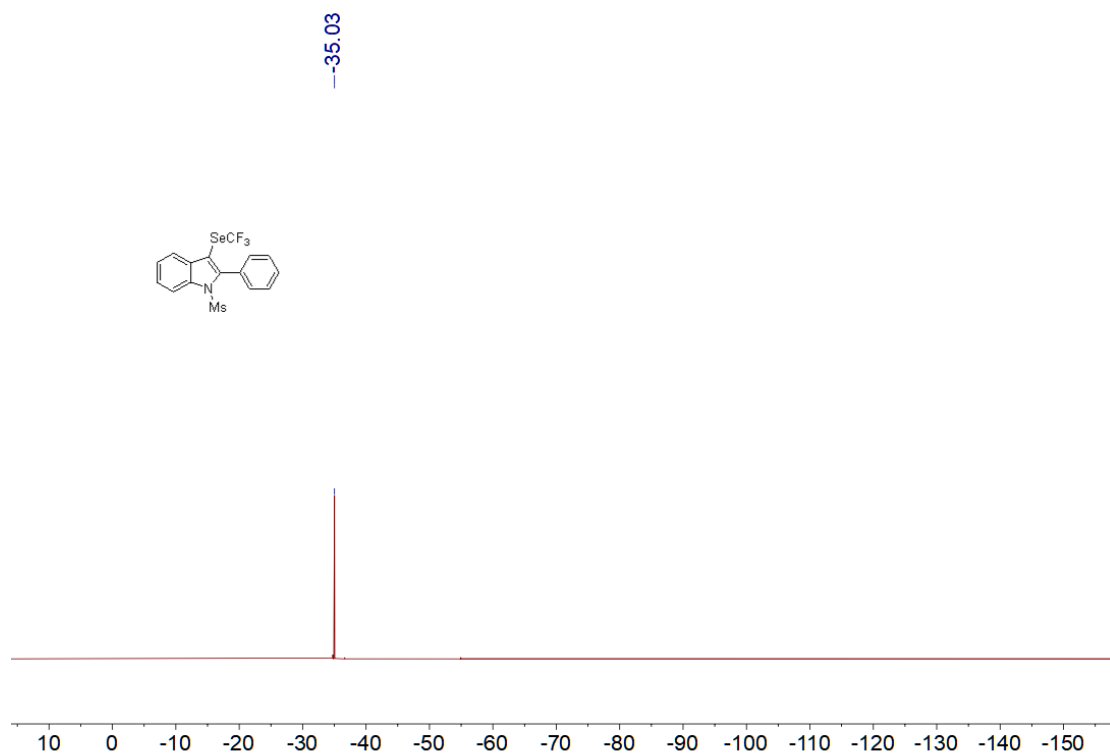
^{13}C NMR spectra of **3a-2** in CDCl_3



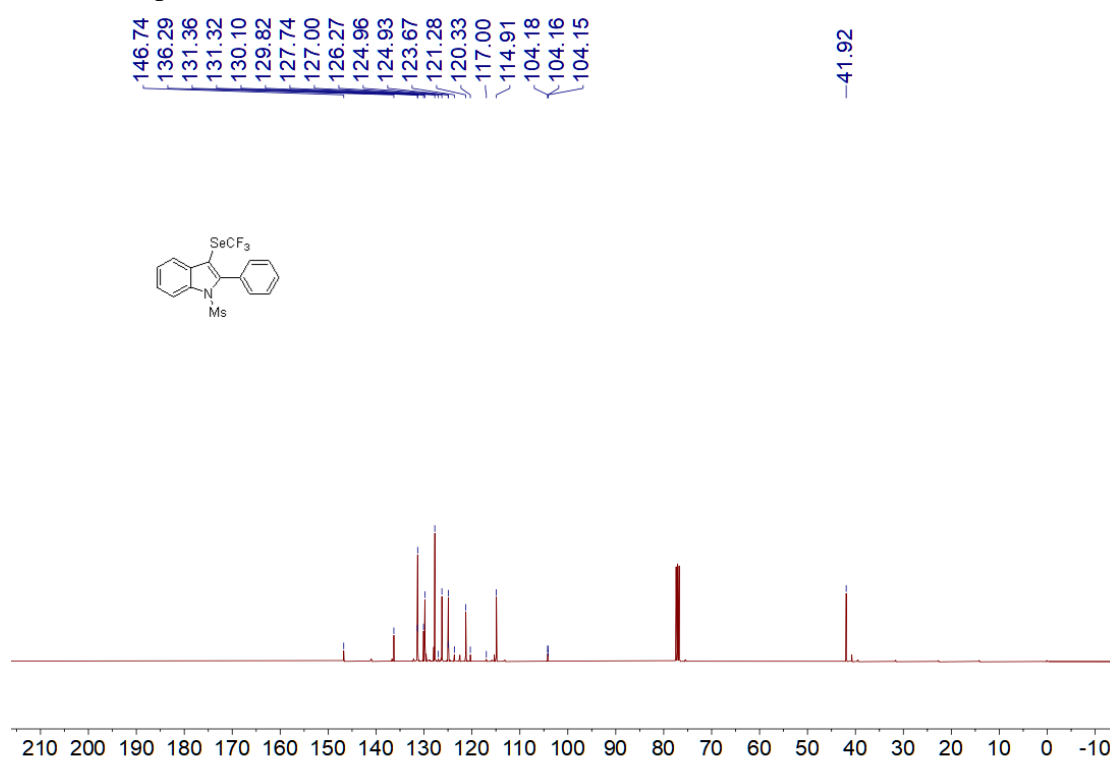
^1H NMR spectra of **3a-3** in CDCl_3



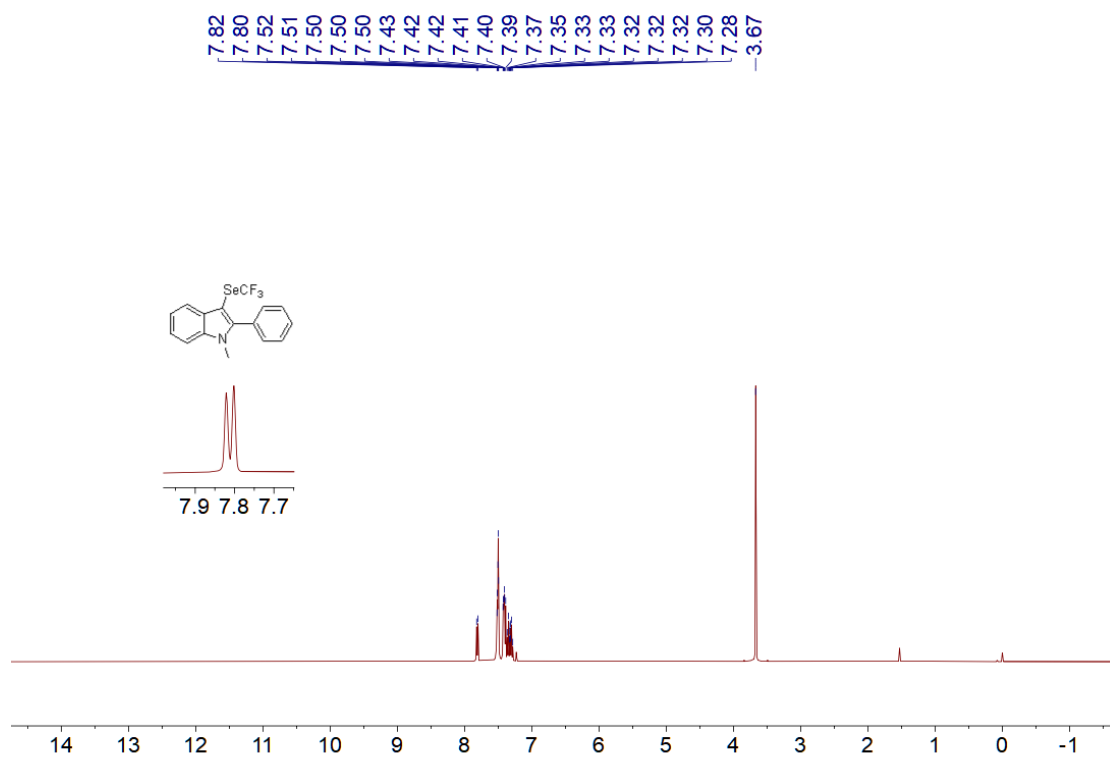
^{19}F NMR spectra of **3a-3** in CDCl_3



^{13}C NMR spectra of **3a-3** in CDCl_3

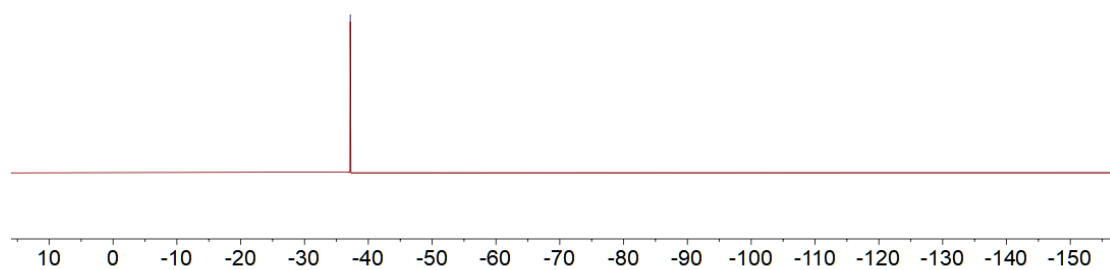
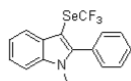


^1H NMR spectra of **3a-4** in CDCl_3



¹⁹F NMR spectra of **3a-4** in CDCl₃

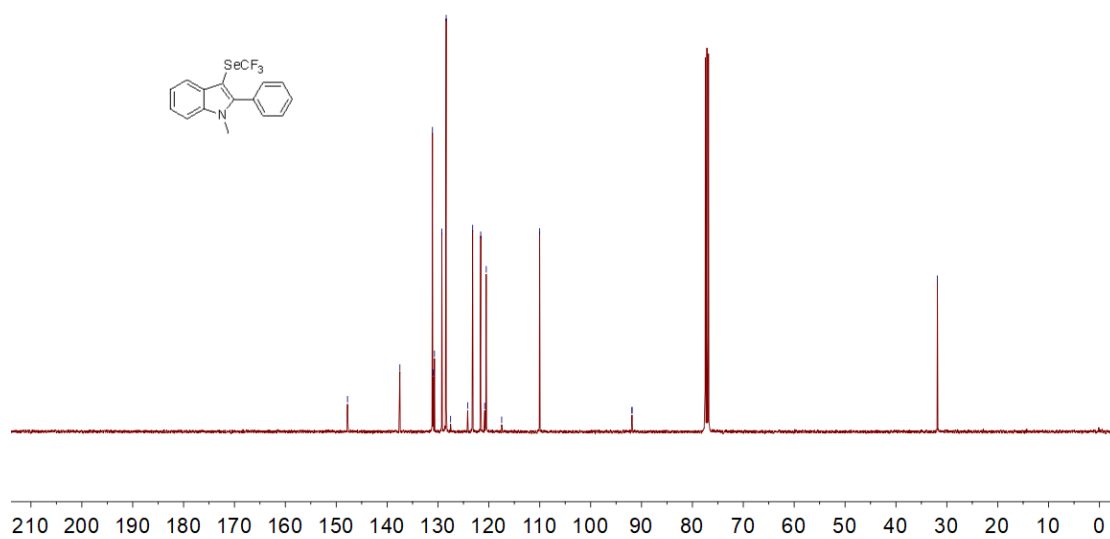
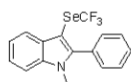
--37.17



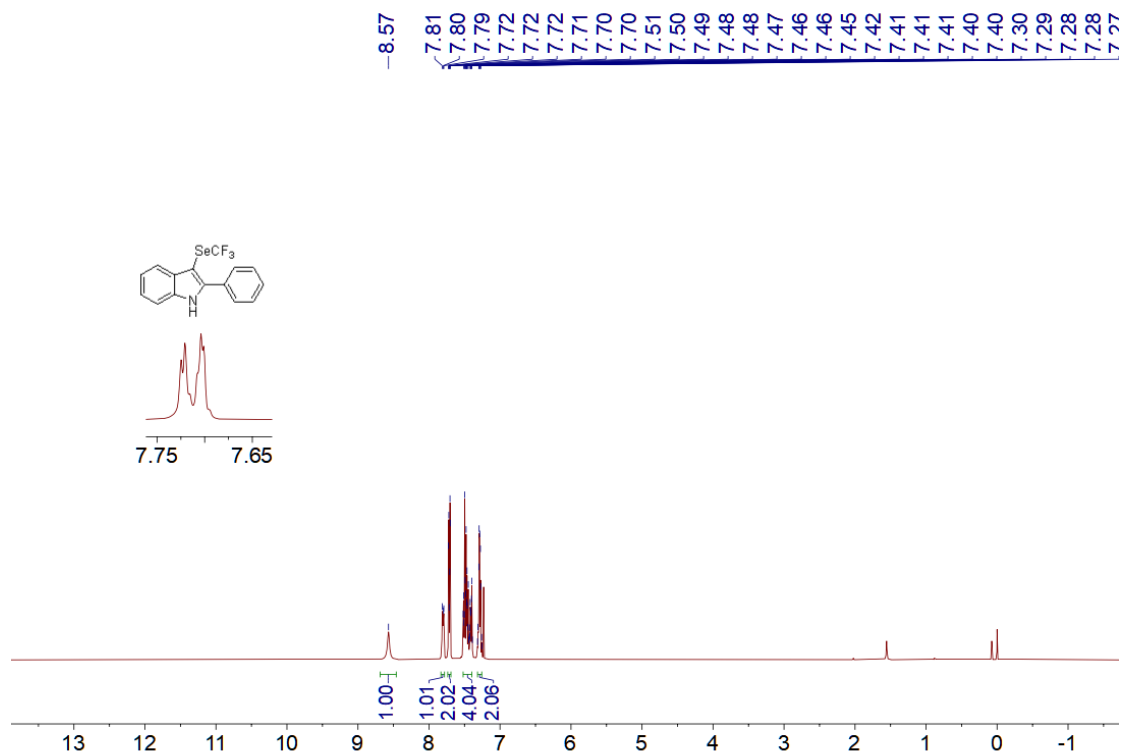
¹³C NMR spectra of **3a-4** in CDCl₃

147.78
137.49
131.09
130.92
130.69
129.25
128.39
127.52
124.18
123.19
121.60
120.83
120.52
117.49
110.02
91.88
91.87

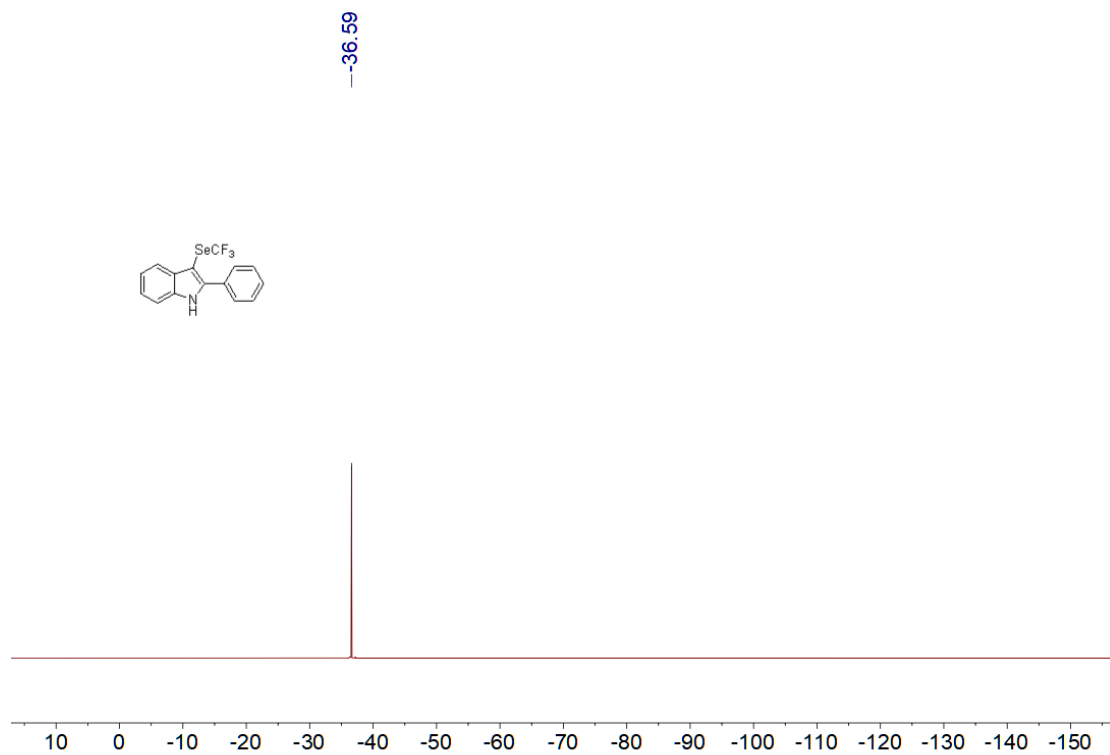
--31.86



^1H NMR spectra of **3a-6** in CDCl_3



^{19}F NMR spectra of **3a-6** in CDCl_3



^{13}C NMR spectra of **3a-6** in CDCl_3

144.21
135.89
132.26
131.50
129.29
129.18
128.85
127.59
124.25
123.75
121.82
120.90
120.79
117.56
111.25
91.42
91.40

