Supporting Information

Electrochemical Regioselective C–H Selenylation of 2*H*-Indazole Derivatives

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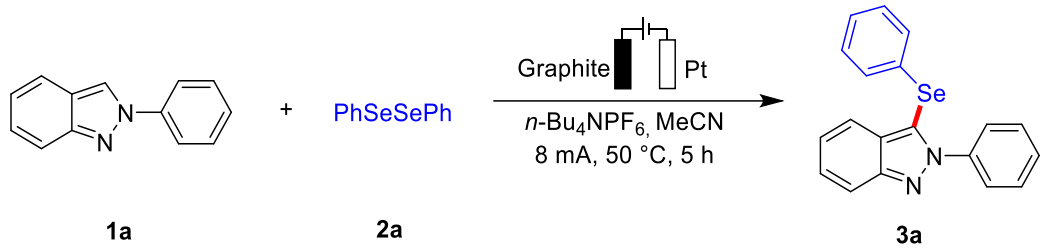
General Remarks

Electrochemical reactions were performed under air using undivided glassware cell. The substrate **1a**–**1z** and diselenides were synthesized according to previously described methods.[1-3] Other chemicals were obtained from commercial sources and were used without further purification. Platinum electrodes are commercially available from Tianjin Aida. Graphite plates are commercially available from Beijing Jinglong Special Carbon Technology Co., Ltd. Electrochemical reactions were conducted using an AXIOMET AX-3003P potentiostat in constant current mode. Yields refer to isolated compounds, estimated to be > 95% pure as determined by ^{1}H-NMR. TLC: Macherey-Nagel, TLC plates Alugram®Sil G/UV254. Detection under UV light at 254 nm. Chromatography separations were carried out on silica gel 60H (200-300 mesh) manufactured by Qingdao Haiyang Chemical Group Co. (China). High resolution mass spectrometry (HRMS) was measured on Thermo-DFS mass spectrometer. NMR spectra were recorded on JEOL 400 NMR (^{1}H 400 MHz; ^{13}C 100 MHz; ^{19}F 376 MHz) in $CDCl_3$. If not otherwise specified, chemical shifts (δ) are given in ppm.

Optimization Studies

Table S1. Optimization of the reaction conditions[a]



1a **2a** **3a**

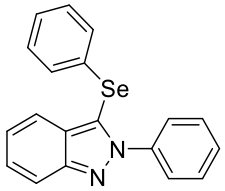
Entry	Deviation from standard conditions	Yield (%)[b]
1	none	85
2	No *n*-Bu_4NPF_6	0
3	MeCN/DCE (2:1) as solvent	30
4	MeOH as solvent	0
5	*n*-Bu_4NClO_4 instead of *n*-Bu_4NPF_6	29
6	MeCN/THF (2:1) as solvent	0
7	$LiClO_4$ instead of *n*-Bu_4NPF_6	38
8	C(+)-C(-)	78
9	Pt plate as anode	31
10	16 mA instead of 8 mA	75
11	MeCN/HFIP (2:1) as solvent	trace
12	RT instead of 50 ℃	21
13	Ni plate as cathode	76
14	80 ℃ instead of 50 ℃	50
15	*n*-Bu_4NBF_4 instead of *n*-Bu_4NPF_6	22
16	No electricity	0
17	**2a** (0.24 mmol) instead of **2a** (0.3 mmol)	45
18	**2a** (0.4 mmol) instead of **2a** (0.3 mmol)	83
19	4 h instead of 5 h	68

[a]Reaction conditions: undivided cell, graphite anode(1.5 cm × 1 cm × 0. 2 cm), Pt cathode (1 cm × 1 cm × 0.01 cm), **1a** (0.2 mmol), **2a** (0.3 mmol), *n*-Bu_4NPF_6 (0.5 mmol), MeCN (5.0 mL), constant current = 8.0 mA, 5 h, under air, 50 ℃. [b]Yields of isolated products. RT = room temperature

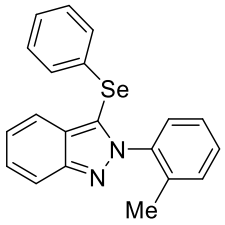
General Procedure for Electrochemical Reactions

General Procedures A: In an undivided cell (20 mL) equipped with a stirring bar, a mixture of 2*H*-Indazole derivatives (0.2 mmol), diphenyl diselenide (0.3 mmol, 93.6 mg), *n*-Bu_4NPF_6 (0.5 mmol, 194 mg) and MeCN (5.0 mL) were added. The cell was equipped with graphite (1.5 cm × 1 cm × 0.2 cm) as the anode and platinum plate (1 cm × 1 cm × 0.01 cm) as the cathode, and connected to a DC power supply. The reaction mixture was stirred and electrolyzed at 50 ℃ under a constant current of 8 mA for 5 h. After the reaction was completed, the residue was purified by silica gel column chromatography to afford the desired product **3**.

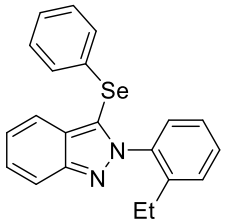
General procedure B: In an undivided cell (20 mL) equipped with a stirring bar, a mixture of 2-Phenyl-2*H*-indazole (0.2 mmol, 38.8 mg), diphenyl diselenide derivative (0.3 mmol), *n*-Bu_4NPF_6 (0.5 mmol, 194 mg) and MeCN (5.0 mL) were added. The battery was equipped with graphite (1.5 cm × 1 cm × 0.2 cm) as the anode and platinum plate (1 cm × 1 cm × 0.01 cm) as the cathode, and connected to a DC power supply. The reaction mixture was stirred and electrolyzed at 50 ℃ under a constant current of 8 mA for 5 h. After the reaction was completed, the residue was purified by silica gel column chromatography to afford the desired product **4**.



2-Phenyl-3-(phenylselanyl)-2*H*-indazole (3a). The general procedure **A** was followed using substrate **1a** (0.2 mmol, 39 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3a** (60 mg, 85%) as white solid. Mp: 77.6–78.8 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (d, J = 8.7 Hz, 1H), 7.72 (d, J = 8.5 Hz, 1H), 7.54 – 7.50 (m, 2H), 7.48 – 7.44 (m, 3H), 7.40 (dd, J = 8.5, 7.9 Hz, 1H), 7.21 (dd, J = 8.7, 7.9 Hz, 1H), 7.17 – 7.09 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 140.3, 131.4, 130.5, 129.6, 129.1, 128.8, 128.1, 127.3, 127.3, 126.6, 123.5, 121.1, 120.0, 118.4. HRMS (ESI) *m/z* calcd for $C_{19}H_{15}N_2Se$ $[M+H]^+$ 351.0395, found 351.0397.

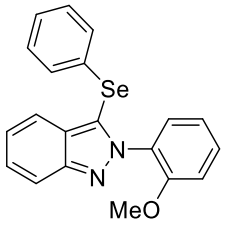


3-(Phenylselanyl)-2-(*o*-tolyl)-2*H*-indazole (3b). The general procedure **A** was followed using substrate **1b** (0.2 mmol, 42 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3b** (54 mg, 74%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, J = 8.7 Hz, 1H), 7.75 (d, J = 8.5 Hz, 1H), 7.43 – 7.37 (m, 2H), 7.32 – 7.28 (m, 1H), 7.25 – 7.20 (m, 2H), 7.17 (m, 1H), 7.14 – 7.08 (m, 5H), 1.86 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ = 149.3, 139.6, 135.9, 131.8, 130.8, 130.3, 129.8, 129.4, 128.0, 127.6, 127.0, 126.9, 126.1, 123.3, 121.6, 121.0, 118.5, 17.3. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2Se$ $[M+H]^+$ 365.0551, found 365.0541.

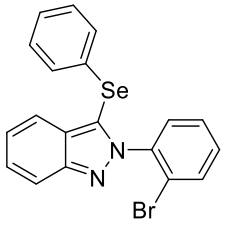


2-(2-Ethylphenyl)-3-(phenylselanyl)-2*H*-indazole (3c). The general procedure **A** was followed using substrate **1c** (0.2 mmol, 45 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3c** (63 mg, 84%) as colorless liquid.

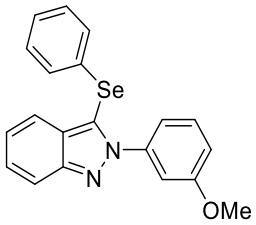
^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, J = 8.7 Hz, 1H), 7.73 (d, J = 8.4 Hz, 1H), 7.49 – 7.36 (m, 3H), 7.25 – 7.16 (m, 3H), 7.15 – 7.11 (m, 4H), 7.07 (dd, J = 7.8, 1.2 Hz, 1H), 2.16 (q, J = 7.4 Hz, 2H), 1.00 (t, J = 7.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.2, 141.5, 139.0, 131.6, 130.4, 130.0, 129.4, 128.9, 128.0, 127.5, 127.0, 126.9, 126.0, 123.3, 121.8, 121.0, 118.5, 23.8, 14.3. HRMS (ESI) *m/z* calcd for $C_{21}H_{19}N_2Se$ $[M+H]^+$ 379.0708, found 379.0702.



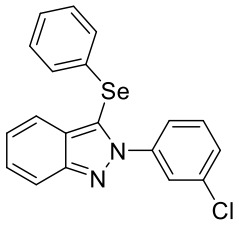
2-(2-Methoxyphenyl)-3-(phenylselanyl)-2*H*-indazole (3d). The general procedure **A** was followed using substrate **1d** (0.2 mmol, 45 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3d** (46 mg, 60%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, J = 8.7 Hz, 1H), 7.66 (d, J = 8.5 Hz, 1H), 7.49 – 7.44 (m, 1H), 7.40 (dd, J = 8.5, 7.4 Hz, 1H), 7.32 (dd, J = 7.9, 1.8 Hz, 1H), 7.20 – 7.10 (m, 6H), 7.08 – 6.98 (m, 2H), 3.59 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 154.7, 149.5, 131.1, 130.9, 130.8, 130.7, 129.4, 129.2, 129.0, 127.0, 126.9, 123.1, 122.5, 121.0, 120.5, 118.5, 111.7, 55.6. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2OSe$ $[M+H]^+$ 381.0501, found 381.0493.



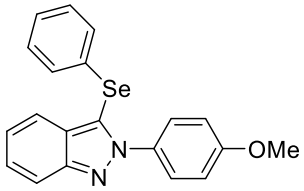
2-(2-Bromophenyl)-3-(phenylselanyl)-2*H*-indazole (3e). The general procedure **A** was followed using substrate **1e** (0.2 mmol, 55 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3e** (38 mg, 44%) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83 (d, J = 8.8 Hz, 1H), 7.72 (d, J = 7.7 Hz, 2H), 7.45 – 7.32 (m, 3H), 7.25 – 7.19 (m, 2H), 7.15 (d, J = 6.8 Hz, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.6, 139.9, 133.3, 131.4, 131.2, 130.5, 129.8, 129.4, 127.8, 127.5, 127.4, 127.0, 123.6, 122.4, 122.3, 121.1, 118.6. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}BrN_2Se$ $[M+H]^+$ 428.9500, found 428.9494.



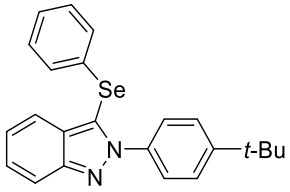
2-(3-Methoxyphenyl)-3-(phenylselanyl)-2*H*-indazole (3f). The general procedure **A** was followed using substrate **1f** (0.2 mmol, 45 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3f** (52 mg, 68%) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.86 (d, *J* = 8.7 Hz, 1H), 7.73 (d, *J* = 8.6 Hz, 1H), 7.41 (dd, *J* = 8.6, 7.5, 1H), 7.36 (t, *J* = 8.2 Hz, 1H), 7.21 (dd, *J* = 8.7, 7.5, 1H), 7.15 – 7.12 (m, 6H), 7.07 – 7.04 (m, 1H), 7.01 (dd, *J* = 8.5, 1.3 Hz, 1H), 3.70 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 159.7, 149.2, 141.2, 131.5, 130.2, 129.5, 129.4, 128.2, 127.3, 127.1, 123.5, 121.0, 119.8, 118.8, 118.3, 115.6, 111.6, 55.4. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2OSe$ $[M+H]^+$ 381.0501, found 381.0501. Analytical data for compound **3f** was consistent with the literature.[1]



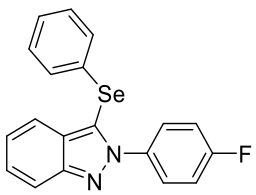
2-(3-Chlorophenyl)-3-(phenylselanyl)-2*H*-indazole (3g). The general procedure **A** was followed using substrate **1g** (0.2 mmol, 46 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3g** (70 mg, 91%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, *J* = 8.7 Hz, 1H), 7.72 (d, *J* = 8.4 Hz, 1H), 7.49 – 7.45 (m, 2H), 7.44 – 7.38 (m, 3H), 7.22 (dd, *J* = 8.7, 7.4, 1H), 7.14 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.5, 138.8, 135.1, 131.2, 130.4, 129.8, 129.7, 129.0, 128.4, 127.8, 127.6, 127.4, 123.8, 122.2, 121.1, 120.1, 118.4. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}ClN_2Se$ $[M+H]^+$ 385.0005, found 384.9994. Analytical data for compound **3g** was consistent with the literature.[1]



2-(4-Methoxyphenyl)-3-(phenylselanyl)-2*H*-indazole (3h). The general procedure **A** was followed using substrate **1h** (0.2 mmol, 45 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3h** (51 mg, 67%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, J = 8.7 Hz, 1H), 7.69 (d, J = 8.3 Hz, 1H), 7.44 – 7.36 (m, 3H), 7.22 – 7.10 (m, 6H), 6.98 – 6.93 (m, 2H), 3.86 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 160.0, 149.2, 133.5, 131.5, 130.4, 129.6, 128.0, 127.8, 127.2, 127.2, 123.4, 121.1, 120.1, 118.3, 113.9, 55.7. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2OSe$ $[M+H]^+$ 381.0501, found 381.0500. Analytical data for compound **3h** was consistent with the literature.[1]

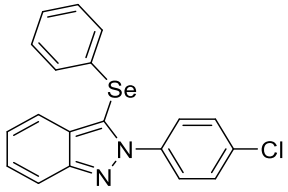


2-(4-(*tert*-Butyl)phenyl)-3-(phenylselanyl)-2*H*-indazole (3i). The general procedure **A** was followed using substrate **1i** (0.2 mmol, 50 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3i** (80 mg, 90%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (d, J = 8.7 Hz, 1H), 7.70 (d, J = 8.5 Hz, 1H), 7.49 – 7.44 (m, 4H), 7.42 – 7.36 (m, 1H), 7.22 – 7.12 (m, 6H), 1.37 (s, 9H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 152.2, 149.3, 137.8, 131.5, 130.4, 129.5, 128.0, 127.1, 126.0, 125.7, 123.4, 121.1, 119.7, 118.4, 34.9, 31.4. HRMS (ESI) *m/z* calcd for $C_{23}H_{23}N_2Se$ $[M+H]^+$ 407.1021, found 407.1019.

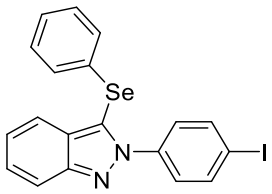


2-(4-Fluorophenyl)-3-(phenylselanyl)-2*H*-indazole (3j). The general procedure **A** was followed using substrate **1j** (0.2 mmol, 42 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3j** (59 mg, 80%) as colorless liquid.

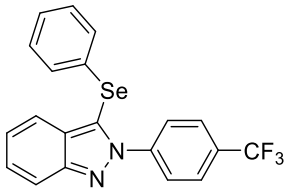
^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, J = 8.7 Hz, 1H), 7.72 (d, J = 8.4 Hz, 1H), 7.50 – 7.45 (m, 2H), 7.40 (dd, J = 8.4, 7.5, 1H), 7.22 (dd, J = 8.7, 7.5, 1H), 7.19 – 7.08 (m, 7H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.8 (d, $^{1}J_{C\text{-}F}$ = 249.2 Hz), 149.4, 136.4 (d, $^{4}J_{C\text{-}F}$ = 3.2 Hz), 131.2, 130.5, 129.6, 128.4 (d, $^{3}J_{C\text{-}F}$ = 8.2 Hz), 128.2, 127.5, 127.4, 123.7, 121.1, 120.3, 118.4, 115.8 (d, $^{2}J_{C\text{-}F}$ = 23.1 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ = -111.73. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}FN_2Se$ $[M+H]^+$ 369.0301, found 369.0296.



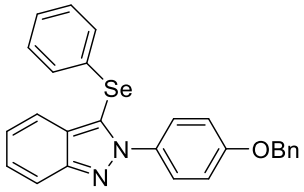
2-(4-Chlorophenyl)-3-(phenylselanyl)-2*H*-indazole (3k). The general procedure **A** was followed using substrate **1k** (0.2 mmol, 46 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3k** (58 mg, 76%) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.82 (d, J = 8.7 Hz, 1H), 7.74 (d, J = 8.5 Hz, 1H), 7.57 – 7.51 (m, 1H), 7.46 – 7.34 (m, 4H), 7.25 – 7.20 (m, 1H), 7.20 – 7.11 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 141.2, 134.4, 131.0, 130.7, 129.7, 129.6, 129.2, 128.3, 127.6, 127.5, 126.9, 124.7, 123.8, 121.1, 120.3, 118.4. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}ClN_2Se$ $[M+H]^+$ 385.0005, found 385.0000.



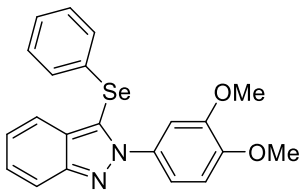
2-(4-Iodophenyl)-3-(phenylselanyl)-2*H*-indazole (3l). The general procedure **A** was followed using substrate **1l** (0.2 mmol, 64 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3l** (83 mg, 87%) as white solid. Mp: 84.2–86.3 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.72 (d, J = 8.8 Hz, 1H), 7.68 (d, J = 8.6 Hz, 2H), 7.61 (d, J = 8.5 Hz, 1H), 7.30 (dd, J = 8.5, 7.4 Hz, 1H), 7.18 (d, J = 8.6 Hz, 2H), 7.11 (dd, J = 8.8, 7.4 Hz, 1H), 7.09 – 6.97 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.5, 140.0, 137.9, 131.2, 130.4, 129.7, 128.4, 128.2, 127.6, 127.4, 123.8, 121.1, 119.9, 118.4, 94.7. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}IN_2Se$ $[M+H]^+$ 476.9361, found 476.9358.



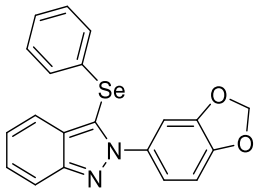
3-(Phenylselanyl)-2-(4-(trifluoromethyl)phenyl)-2*H*-indazole (3m). The general procedure **A** was followed using substrate **1m** (0.2 mmol, 52 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3m** (79 mg, 95%) as white solid. Mp: 108.9–109.9 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83 (d, J = 8.8 Hz, 1H), 7.76 – 7.67 (m, 5H), 7.42 (dd, J = 8.8, 7.6 Hz, 1H), 7.23 (dd, J = 8.5, 7.6 Hz, 1H), 7.20 – 7.09 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.6, 143.0, 131.0, 130.9 (q, $^{2}J_{C\text{-}F}$ = 32.3 Hz), 130.4, 129.7, 128.6, 127.8, 127.5, 126.9, 126.0 (q, $^{3}J_{C\text{-}F}$ = 3.4 Hz), 124.0, 123.8 (q, $^{1}J_{C\text{-}F}$ = 272.2 Hz), 121.1, 120.1, 118.4. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -62.42. HRMS (ESI) *m/z* calcd for $C_{20}H_{14}F_3N_2OSe$ $[M+H]^+$ 419.0269, found 419.0262.



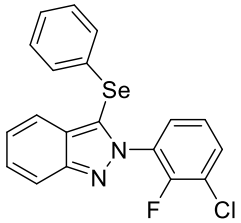
2-(4-(Benzyloxy)phenyl)-3-(phenylselanyl)-2*H*-indazole (3n). The general procedure **A** was followed using substrate **1n** (0.2 mmol, 60 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3n** (85 mg, 93%) as yellow solid. Mp: 106.6–108.8 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.86 (d, J = 8.7 Hz, 1H), 7.66 (d, J = 8.5 Hz, 1H), 7.45 – 7.34 (m, 3H), 7.26 – 7.21 (m, 3H), 7.20 – 7.12 (m, 4H), 7.12 – 7.08 (m, 2H), 7.08 – 7.01 (m, 4H), 4.99 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.8, 149.5, 136.4, 131.0, 131.0, 130.8, 130.0, 129.2, 129.1, 127.8, 127.0, 126.9, 126.7, 123.0, 122.6, 121.0, 120.9, 118.4, 113.8, 70.6. HRMS (ESI) *m/z* calcd for $C_{26}H_{21}N_2OSe$ $[M+H]^+$ 457.0814, found 457.0808.



2-(3,4-Dimethoxyphenyl)-3-(phenylselanyl)-2*H*-indazole (3o). The general procedure **A** was followed using substrate **1o** (0.2 mmol, 51 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3o** (51 mg, 62%) as white solid. Mp: 131.6–133.4 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83 (d, J = 8.6 Hz, 1H), 7.71 (d, J = 8.5 Hz, 1H), 7.40 (ddd, J = 8.6, 8.5, 1.1 Hz, 1H), 7.21 (ddd, J = 8.6, 8.5, 1.1 Hz, 1H), 7.18 – 7.11 (m, 5H), 7.08 (dd, J = 8.6, 2.5 Hz, 1H), 6.94 (d, J = 2.5 Hz, 1H), 6.91 (d, J = 8.6 Hz, 1H), 3.94 (s, 3H), 3.67 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.9, 149.5, 149.1, 133.8, 132.2, 130.5, 129.9, 128.6, 127.6, 127.5, 123.9, 121.4, 120.2, 119.1, 118.7, 110.8, 110.4, 56.6, 56.2. HRMS (ESI) *m/z* calcd for $C_{21}H_{19}N_2O_2Se$ $[M+H]^+$ 411.0606, found 411.0608.

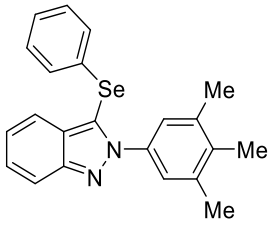


2-(Benzo[d][1,3]dioxol-5-*yl*)-3-(phenylselanyl)-2*H*-indazole (3p). The general procedure **A** was followed using substrate **1p** (0.2 mmol, 48 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3p** (61 mg, 77%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.81 (d, J = 8.7 Hz, 1H), 7.68 (d, J = 8.4 Hz, 1H), 7.39 (dd, J = 8.4, 7.6 Hz, 1H), 7.22 – 7.12 (m, 6H), 6.97 – 6.93 (m, 2H), 6.84 (d, J = 8.0 Hz, 1H), 6.05 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.2, 148.3, 147.7, 134.4, 131.3, 130.5, 129.6, 128.0, 127.3, 127.3, 123.5, 121.1, 120.5, 120.3, 118.3, 107.9, 107.8, 102.1. HRMS (ESI) *m/z* calcd for $C_{20}H_{15}N_2O_2Se$ $[M+H]^+$ 395.0293, found 395.0289.

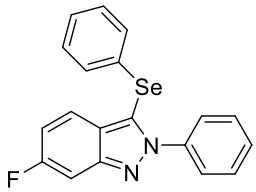


2-(3-Chloro-2-fluorophenyl)-3-(phenylselanyl)-2*H*-indazole (3q). The general procedure **A** was followed using substrate **1q** (0.2 mmol, 53 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3q** (32 mg, 40%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.81 (d, J = 8.7 Hz, 1H), 7.72 (d, J = 8.6 Hz, 1H),

7.54 (ddd, J = 8.6, 7.3, 1.3 Hz, 1H), 7.41 (ddd, J = 8.6, 7.3, 1.3 Hz, 1H), 7.28 – 7.19 (m, 2H), 7.19 – 7.07 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.4 (d, $^1J_{C\text{-}F}$ = 254.8 Hz), 149.9, 131.9, 131.1, 130.1, 129.6 (d, $^3J_{C\text{-}F}$ = 12.7 Hz), 129.5, 127.7 (d, $^2J_{C\text{-}F}$ = 21.2 Hz), 127.7, 127.2, 124.4 (d, $^4J_{C\text{-}F}$ = 3.9 Hz), 123.8, 122.7, 122.4 (d, $^3J_{C\text{-}F}$ = 13.7 Hz), 121.0, 118.4. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -120.74. HRMS (ESI) *m/z* calcd for $C_{19}H_{13}ClFN_2Se$ $[M+H]^+$ 402.9911, found 402.9905.

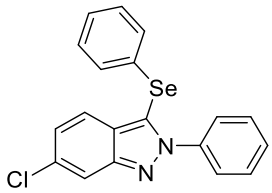


3-(Phenylselanyl)-2-(3,4,5-trimethylphenyl)-2*H*-indazole (3r). The general procedure **A** was followed using substrate **1r** (0.2 mmol, 47 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3r** (54 mg, 69%) as white solid. Mp: 114.3-116.9 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, J = 8.7 Hz, 1H), 7.70 (d, J = 8.5 Hz, 1H), 7.38 (dd, J = 8.5, 7.4 Hz, 1H), 7.22 – 7.15 (m, 6H), 7.10 (s, 2H), 2.28 (s, 6H), 2.23 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.1, 137.3, 137.0, 136.3, 131.9, 130.6, 129.5, 128.0, 127.2, 127.0, 125.3, 123.3, 121.0, 119.9, 118.3, 20.7, 15.5. HRMS (ESI) *m/z* calcd for $C_{22}H_{21}N_2Se$ $[M+H]^+$ 393.0864, found 393.0861.

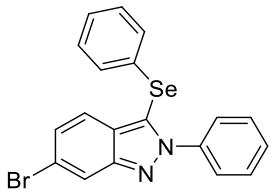


6-Fluoro-2-phenyl-3-(phenylselanyl)-2*H*-indazole (3s). The general procedure **A** was followed using substrate **1s** (0.2 mmol, 42 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3s** (55 mg, 72%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.65 (dd, J = 9.1, 5.3 Hz, 1H), 7.52 – 7.45 (m, 5H), 7.40 (dd, J = 9.7, 2.2 Hz, 1H), 7.20 – 7.09 (m, 5H), 6.99 (ddd, J = 9.7, 9.6, 2.4 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.7 (d, $^1J_{C\text{-}F}$ = 245.4 Hz), 149.4 (d, $^3J_{C\text{-}F}$ = 13.3 Hz), 140.5, 131.2, 131.1, 130.0, 129.6, 129.2, 127.8, 126.8, 125.5, 123.4 (d, $^3J_{C\text{-}F}$ = 11.0 Hz), 121.3, 115.5 (d, $^2J_{C\text{-}F}$ = 28.2 Hz), 101.8 (d, $^2J_{C\text{-}F}$ = 23.8 Hz). ^{19}F NMR

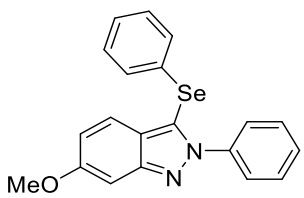
(376 MHz, $CDCl_3$): δ = -112.68. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}FN_2Se$ $[M+H]^+$ 369.0301, found 369.0303.



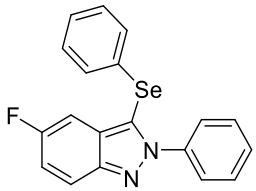
6-Chloro-2-phenyl-3-(phenylselanyl)-2*H*-indazole (3t). The general procedure **A** was followed using substrate **1t** (0.2 mmol, 46 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3t** (51 mg, 66%) as white solid. Mp: 77.6–79.5 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.80 (s, 1H), 7.62 (d, *J* = 8.9 Hz, 1H), 7.51 – 7.45 (m, 5H), 7.22 – 7.09 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 140.1, 133.2, 130.8, 130.8, 129.7, 129.4, 128.9, 127.6, 126.5, 126.4, 125.0, 122.5, 121.1, 117.3. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}ClN_2Se$ $[M+H]^+$ 385.0005, found 384.9992.



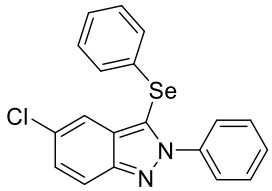
6-Bromo-2-phenyl-3-(phenylselanyl)-2*H*-indazole (3u). The general procedure **A** was followed using substrate **1u** (0.2 mmol, 55 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3u** (51 mg, 60%) as white solid. Mp: 71.5–74.2 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.00 (s, 1H), 7.56 (d, *J* = 8.9 Hz, 1H), 7.51 – 7.45 (m, 5H), 7.29 – 7.23 (m, 1H), 7.19 – 7.09 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.9, 140.1, 130.8, 130.8, 129.7, 129.4, 128.9, 127.6, 127.3, 126.6, 126.5, 122.6, 121.3, 121.2, 120.7. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}BrN_2Se$ $[M+H]^+$ 428.9500, found 428.9492.



6-Methoxy-2-phenyl-3-(phenylselanyl)-2*H*-indazole (3v). The general procedure **A** was followed using substrate **1v** (0.2 mmol, 45 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3v** (33 mg, 44%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.42 (s, 1H), 7.80 (d, J = 8.2 Hz, 2H), 7.75 (d, J = 9.1 Hz, 1H), 7.45 (m, 4H), 7.35 (tt, J = 7.4, 1.3 Hz, 1H), 7.18 – 7.13 (m, 3H), 7.03 (d, J = 9.1 Hz, 1H), 3.90 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 158.9, 151.9, 140.6, 132.5, 131.1, 129.5, 128.8, 127.9, 126.0, 122.8, 121.2, 121.1, 119.4, 112.6, 102.7, 57.7. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2OSe$ $[M+H]^+$ 381.0501, found 381.0496.

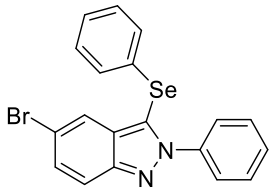


5-Fluoro-2-phenyl-3-(phenylselanyl)-2*H*-indazole (3w). The general procedure **A** was followed using substrate **1w** (0.2 mmol, 42 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3w** (70 mg, 95%) as white solid. Mp: 81.7–83.5 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.81 (dd, J = 9.1, 4.5 Hz, 1H), 7.54 –7.44 (m, 5H), 7.29 (dd, J = 8.9, 2.6 Hz, 1H), 7.23 – 7.09 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 159.4 (d, $^{1}J_{C\text{-}F}$ = 243.0 Hz), 146.7, 140.2, 131.1, 130.5, 129.6, 129.3, 128.9, 128.0 (d, $^{3}J_{C\text{-}F}$ = 12.4 Hz), 127.4, 126.5, 120.6 (d, $^{3}J_{C\text{-}F}$ = 10.2 Hz), 120.1 (d, $^{4}J_{C\text{-}F}$ = 6.9 Hz), 119.0 (d, $^{2}J_{C\text{-}F}$ = 27.3 Hz), 103.7 (d, $^{2}J_{C\text{-}F}$ = 24.8 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ = -117.05. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}FN_2Se$ $[M+H]^+$ 369.0301, found 369.0297.

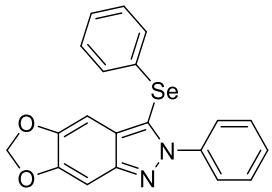


5-Chloro-2-phenyl-3-(phenylselanyl)-2*H*-indazole (3x). The general procedure **A** was followed using substrate **1x** (0.2 mmol, 46 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3x** (70 mg, 91%) as white solid. Mp: 108.9–109.8 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.76 (d, J = 9.1 Hz, 1H), 7.69 (s, 1H), 7.53 – 7.43 (m, 5H), 7.32 (dd, J = 9.1, 1.9 Hz, 1H), 7.22 – 7.13 (m, 3H), 7.13 – 7.08 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 147.7, 140.1, 130.9, 130.6, 129.7,

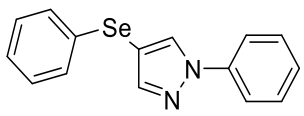
129.4, 129.3, 128.9, 128.8, 128.7, 127.5, 126.5, 120.0, 119.9, 119.9. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}ClN_2Se$ $[M+H]^+$ 385.0005, found 385.0006. Analytical data for compound **3x** was consistent with the literature.[1]



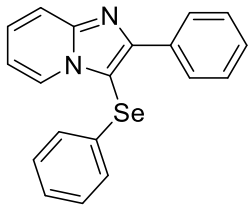
5-Bromo-2-phenyl-3-(phenylselanyl)-2*H*-indazole (3y). The general procedure **A** was followed using substrate **1y** (0.2 mmol, 55 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3y** (76 mg, 88%) as yellow solid. Mp: 122.5–124.9 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.89 (s, 1H), 7.71 (d, J = 9.1 Hz, 1H), 7.52 – 7.43 (m, 6H), 7.19 – 7.08 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 147.7, 140.0, 131.0, 130.8, 130.6, 129.7, 129.4, 129.3, 128.9, 127.5, 126.5, 123.3, 120.2, 119.7, 117.2. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}BrN_2Se$ $[M+H]^+$ 428.9500, found 428.9491.



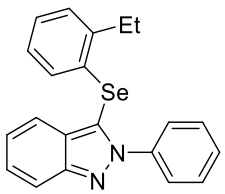
2-Phenyl-3-(phenylselanyl)-2*H*-[1,3]dioxolo[4,5-*f*]indazole (3z). The general procedure **A** was followed using substrate **1z** (0.2 mmol, 48 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3z** (50 mg, 63%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.51 – 7.47 (m, 2H), 7.44 – 7.40 (m, 3H), 7.18 – 7.14 (m, 3H), 7.13 – 7.08 (m, 2H), 7.07 (s, 1H), 6.91 (s, 1H), 6.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 150.1, 147.0, 146.7, 140.4, 131.6, 130.0, 129.6, 128.8, 128.7, 127.1, 126.3, 124.8, 118.7, 101.3, 95.9, 94.6. HRMS (ESI) *m/z* calcd for $C_{20}H_{15}N_2O_2Se$ $[M+H]^+$ 395.0293, found 395.0298.



1-Phenyl-5-(phenylselanyl)-1*H*-pyrazole (3aa). The general procedure **A** was followed using substrate **1aa** (0.2 mmol, 29 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3aa** (37 mg, 62%) as white solid. Mp: 98.6–101.3 ℃. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.09 (s, 1H), 7.81 (s, 1H), 7.74 – 7.67 (m, 2H), 7.47 (dd, *J* = 7.9 Hz, 2H), 7.36 – 7.29 (m, 3H), 7.25 – 7.14 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 146.7, 139.7, 132.8, 132.5, 129.6, 129.3, 127.1, 126.5, 119.2, 103.7. HRMS (ESI) *m/z* calcd for $C_{15}H_{13}N_2Se$ $[M+H]^+$ 301.0238, found 301.0235.

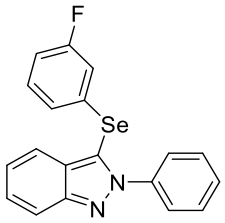


2-Phenyl-3-(phenylselanyl)imidazo[1,2-*a*]pyridine (3ab). The general procedure **A** was followed using substrate **1ab** (0.2 mmol, 39 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **3ab** (56 mg, 80%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.35 (d, *J* = 6.8 Hz, 1H), 8.15 (d, *J* = 7.4 Hz, 2H), 7.76 – 7.69 (m, 1H), 7.44 (m, *J* = 7.4 Hz, 2H), 7.38 (m, *J* = 7.3 Hz, 1H), 7.34 – 7.28 (m, 1H), 7.17 (d, *J* = 5.1 Hz, 3H), 7.11 (m, *J* = 7.0, 2.1 Hz, 2H), 6.85 (m, *J* = 6.8 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 152.0, 147.9, 133.9, 131.0, 129.8, 128.9, 128.6, 128.4, 128.3, 126.8, 126.6, 125.7, 117.6, 113.1, 102.9. HRMS (ESI) *m/z* calcd for $C_{19}H_{15}N_2Se$ $[M+H]^+$ 351.0395, found 351.0386. Analytical data for compound **3ab** was consistent with the literature.[4]

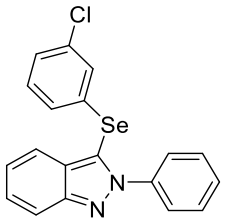


3-((2-Ethylphenyl)selanyl)-2-phenyl-2*H*-indazole (4a). The general procedure **B** was followed using substrate **2a** (0.3 mmol, 111 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4a** (30 mg, 40%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (d, *J* = 8.7 Hz, 1H), 7.67 (d, *J* = 8.5 Hz, 1H), 7.52 – 7.48 (m, 2H), 7.44 – 7.37 (m, 4H), 7.19 (dd, *J* = 8.5, 7.6 Hz, 1H), 7.16 – 7.09 (m, 2H), 6.89 (ddd, *J* = 8.0, 7.4, 1.7 Hz, 1H), 6.78 (d, *J* = 7.8 Hz, 1H), 2.66 (q, *J* = 7.6 Hz, 2H), 1.17 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 143.3,

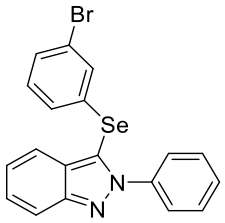
140.4, 131.8, 130.6, 129.1, 128.8, 128.8, 128.5, 127.4, 127.3, 127.1, 126.5, 123.5, 121.1, 119.7, 118.5, 28.6, 14.8. HRMS (ESI) *m/z* calcd for $C_{21}H_{19}N_2Se$ $[M+H]^+$ 379.0708, found 379.0705.



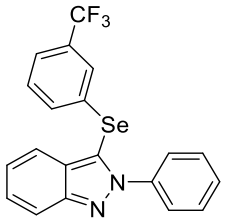
3-((3-Fluorophenyl)selanyl)-2-phenyl-2*H*-indazole (4b). The general procedure **B** was followed using substrate **2b** (0.3 mmol, 104 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4b** (68 mg, 93%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (d, *J* = 8.7 Hz, 1H), 7.70 (d, *J* = 8.4 Hz, 1H), 7.54 – 7.45 (m, 5H), 7.41 (dd, *J* = 8.4, 7.3 Hz, 1H), 7.23 (dd, *J* = 8.7, 7.3 Hz, 1H), 7.14 – 7.07 (m, 1H), 6.89 – 6.82 (m, 2H), 6.81 – 6.77 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.0 (d, $^1J_{C\text{-}F}$ = 251.2 Hz), 149.4, 140.2, 133.2 (d, $^3J_{C\text{-}F}$ = 6.9 Hz), 130.8 (d, $^3J_{C\text{-}F}$ = 7.7 Hz), 129.3, 128.9, 128.2, 127.4, 126.6, 125.7 (d, $^4J_{C\text{-}F}$ = 2.8 Hz), 123.9, 120.8, 119.0, 118.6, 117.1 (d, $^2J_{C\text{-}F}$ = 23.3 Hz), 114.3 (d, $^2J_{C\text{-}F}$ = 21.3 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ = -110.95. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}FN_2Se$ $[M+H]^+$ 369.0301, found 369.0294.



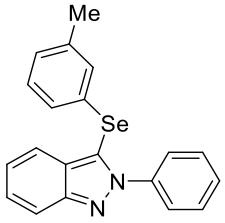
3-((3-Chlorophenyl)selanyl)-2-phenyl-2*H*-indazole (4c). The general procedure **B** was followed using substrate **2c** (0.3 mmol, 114 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4c** (48 mg, 62%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (d, *J* = 8.7 Hz, 1H), 7.70 (d, *J* = 8.4 Hz, 1H), 7.53 – 7.45 (m, 5H), 7.41 (dd, *J* = 8.4, 7.6 Hz, 1H), 7.23 (dd, *J* = 8.7, 7.6 Hz, 1H), 7.16 – 7.11 (m, 1H), 7.09 (s, 1H), 7.07 – 7.01 (m, 1H), 6.97 – 6.90 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 140.2, 135.2, 132.9, 130.5, 130.0, 129.3, 128.9, 128.4, 128.2, 127.5, 127.4, 126.6, 123.9, 120.9, 119.1, 118.6. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}ClN_2Se$ $[M+H]^+$ 385.0005, found 384.9996.



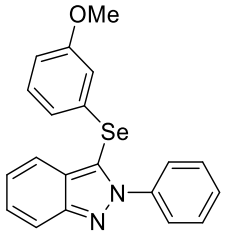
3-((3-Bromophenyl)selanyl)-2-phenyl-2*H*-indazole (4d). The general procedure **B** was followed using substrate **2d** (0.3 mmol, 141 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4d** (52 mg, 61%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (d, J = 8.7 Hz, 1H), 7.71 (d, J = 8.4 Hz, 1H), 7.53 – 7.45 (m, 5H), 7.41 (dd, J = 8.7, 7.7 Hz, 1H), 7.31 – 7.27 (m, 1H), 7.26 – 7.20 (m, 2H), 7.02 – 6.96 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 140.2, 133.2, 132.8, 130.9, 130.4, 129.3, 128.9, 128.9, 128.1, 127.4, 126.6, 123.9, 123.3, 120.8, 119.1, 118.5. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}BrN_2Se$ $[M+H]^+$ 428.9500, found 428.9492.



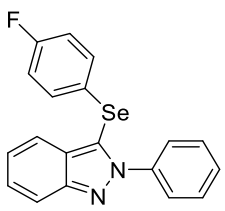
2-Phenyl-3-((3-(trifluoromethyl)phenyl)selanyl)-2*H*-indazole (4e). The general procedure **B** was followed using substrate **2e** (0.3 mmol, 134 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4e** (35 mg, 42%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (d, J = 8.7 Hz, 1H), 7.71 (d, J = 8.5 Hz, 1H), 7.50 – 7.44 (m, 5H), 7.44 – 7.34 (m, 3H), 7.26 – 7.17 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 140.1, 133.8, 132.3, 131.7 (q, $^{2}J_{C\text{-}F}$ = 31.6 Hz), 129.9, 129.4, 128.9, 128.1, 127.5, 127.1 (q, $^{3}J_{C\text{-}F}$ = 4.1 Hz), 126.6, 124.2 (q, $^{3}J_{C\text{-}F}$ = 3.7 Hz), 124.0, 123.5 (q, $^{1}J_{C\text{-}F}$ = 272.5 Hz), 120.7, 118.9, 118.6. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -62.77. HRMS (ESI) *m/z* calcd for $C_{20}H_{14}F_3N_2Se$ $[M+H]^+$ 419.0269, found 419.0266.



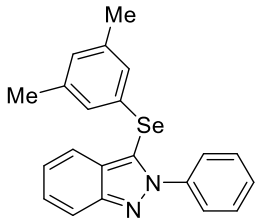
2-Phenyl-3-(*m*-tolylselanyl)-2*H*-indazole (4f). The general procedure **B** was followed using substrate **2f** (0.3 mmol, 102 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4f** (67 mg, 92%) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (d, J = 8.7 Hz, 1H), 7.72 (d, J = 8.5 Hz, 1H), 7.56 – 7.51 (m, 2H), 7.49 – 7.44 (m, 3H), 7.40 (dd, J = 8.5, 7.2 Hz, 1H), 7.20 (dd, J = 8.7, 7.2 Hz, 1H), 7.05 – 7.00 (m, 1H), 6.99 – 6.95 (m, 2H), 6.91 (d, J = 7.5 Hz, 1H), 2.21 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.3, 140.4, 139.4, 131.1, 131.0, 129.3, 129.0, 128.8, 128.2, 128.1, 127.6, 127.2, 126.6, 123.4, 121.2, 120.1, 118.3, 21.4. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2Se$ $[M+H]^+$ 365.0551, found 365.0547.



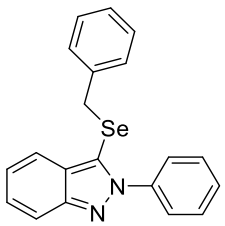
3-((3-Methoxyphenyl)selanyl)-2-phenyl-2*H*-indazole (4g). The general procedure **B** was followed using substrate **2g** (0.3 mmol, 112 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4g** (43 mg, 56%) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83 (d, J = 8.7 Hz, 1H), 7.72 (d, J = 8.5 Hz, 1H), 7.57 – 7.50 (m, 2H), 7.50 – 7.44 (m, 3H), 7.39 (dd, J = 8.5, 7.3 Hz, 1H), 7.21 (dd, J = 8.7, 7.3 Hz, 1H), 7.06 (dd, J = 9.1, 7.9 Hz, 1H), 6.73 – 6.65 (m, 3H), 3.65 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 160.1, 149.3, 140.3, 132.4, 130.3, 129.1, 128.8, 128.2, 127.3, 126.6, 123.6, 122.5, 121.1, 119.8, 118.4, 115.7, 112.9, 55.3. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2OSe$ $[M+H]^+$ 381.0501, found 381.0496.



3-((4-Fluorophenyl)selanyl)-2-phenyl-2*H*-indazole (4h). The general procedure **B** was followed using substrate **2h** (0.3 mmol, 104 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4h** (45 mg, 61%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.82 (d, J = 8.7 Hz, 1H), 7.71 (d, J = 8.5 Hz, 1H), 7.51 – 7.45 (m, 5H), 7.38 (dd, J = 8.5, 7.7 Hz, 1H), 7.21 (dd, J = 8.7, 7.7 Hz, 1H), 7.14 – 7.07 (m, 2H), 6.88 – 6.80 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.6 (d, $^{1}J_{C\text{-}F}$ = 247.6 Hz), 149.3, 140.3, 133.2 (d, $^{3}J_{C\text{-}F}$ = 7.9 Hz), 129.2, 128.9, 127.8, 127.3, 126.7, 125.4 (d, $^{4}J_{C\text{-}F}$ = 3.2 Hz), 123.6, 120.9, 120.4, 118.5, 116.7 (d, $^{2}J_{C\text{-}F}$ = 21.9 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ = -113.88. HRMS (ESI) *m/z* calcd for $C_{19}H_{14}N_2Se$ $[M+H]^+$ 369.0301, found 369.0301.

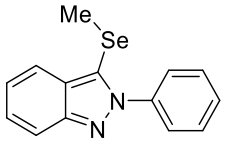


3-((3,5-Dimethylphenyl)selanyl)-2-phenyl-2*H*-indazole (4i). The general procedure **B** was followed using substrate **2i** (0.3 mmol, 111 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4i** (19 mg, 25%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (d, J = 8.7 Hz, 1H), 7.73 (d, J = 8.5 Hz, 1H), 7.56 – 7.51 (m, 2H), 7.50 – 7.45 (m, 3H), 7.43 – 7.37 (m, 1H), 7.21 (t, J = 7.5 Hz, 1H), 6.80 (s, 1H), 6.75 (s, 2H), 2.16 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.3, 140.4, 139.2, 130.6, 129.2, 129.0, 128.7, 128.3, 128.1, 127.2, 126.7, 123.3, 121.3, 120.3, 118.3, 21.3. HRMS (ESI) *m/z* calcd for $C_{21}H_{19}N_2Se$ $[M+H]^+$ 379.0708, found 379.0704.

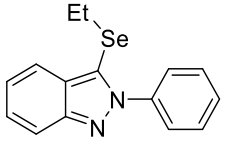


3-(Benzylselanyl)-2-phenyl-2*H*-indazole (4j). The general procedure **B** was followed using substrate **2j** (0.3 mmol, 102 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4j** (51 mg, 70%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.78 (d, J = 8.7 Hz, 1H), 7.63 (d, J = 8.4 Hz, 1H), 7.48 – 7.40 (m,

3H), 7.40 – 7.31 (m, 3H), 7.20 – 7.14 (m, 1H), 7.13 – 7.05 (m, 3H), 6.80 (d, J = 7.0 Hz, 2H), 3.86 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 149.2, 140.3, 137.7, 128.9, 128.7, 128.7, 128.6, 128.1, 127.3, 127.1, 126.8, 123.0, 121.0, 120.4, 118.3, 33.8. HRMS (ESI) *m/z* calcd for $C_{20}H_{17}N_2Se$ $[M+H]^+$ 365.0551, found 365.0554.

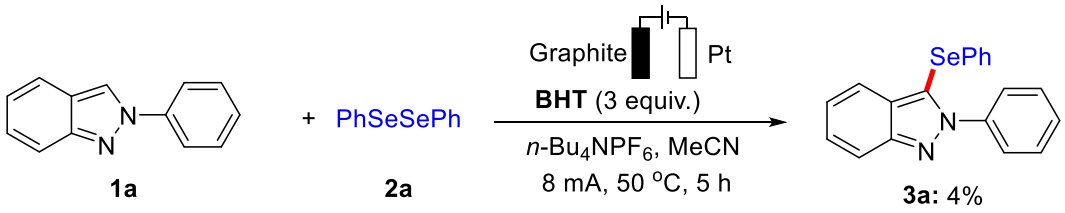


3-(Methylselanyl)-2-phenyl-2H-indazole (4k). The general procedure **B** was followed using substrate **2k** (0.3 mmol, 56 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4k** (39 mg, 68%) as colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.78 (dd, *J* = 9.3, 8.9 Hz, 2H), 7.70 – 7.63 (m, 2H), 7.60 – 7.49 (m, 3H), 7.37 (dd, *J* = 8.6, 7.3 Hz, 1H), 7.20 (dd, *J* = 8.8, 7.3 Hz, 1H), 2.13 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.3, 140.6, 129.1, 129.0, 127.2, 127.2, 126.6, 122.8, 121.2, 121.1, 118.3, 10.2. HRMS (ESI) *m/z* calcd for $C_{14}H_{13}N_2Se$ $[M+H]^+$ 289.0238, found 289.0239.



3-(Ethylselanyl)-2-phenyl-2*H*-indazole (4l). The general procedure **B** was followed using substrate **2l** (0.3 mmol, 65 mg). Isolation by column chromatography (PE/EtOAc: 30/1→15/1) yielded **4l** (25 mg, 41%) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83 – 7.73 (m, 2H), 7.68 – 7.62 (m, 2H), 7.57 – 7.47 (m, 3H), 7.38 (dd, *J* = 8.8, 7.4 Hz, 1H), 7.20 (dd, *J* = 8.4, 7.4 Hz, 1H), 2.66 (q, *J* = 7.5 Hz, 2H), 1.18 (t, *J* = 7.5 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 148.9, 140.3, 128.7, 128.5, 127.8, 126.8, 126.5, 122.6, 121.0, 120.1, 117.9, 23.8, 15.6. HRMS (ESI) *m/z* calcd for $C_{15}H_{15}N_2Se$ $[M+H]^+$ 303.0395, found 303.0396.

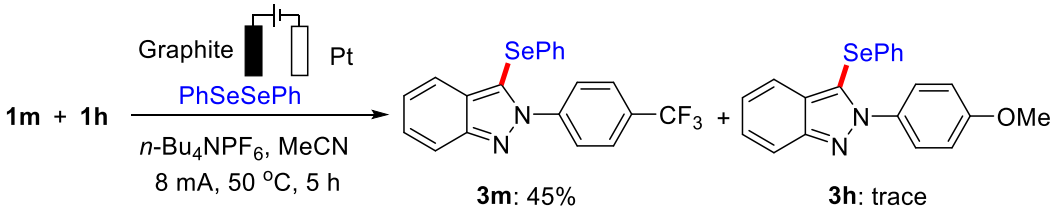
Radical Scavenger Experiments



1a **2a** **3a:** 4%

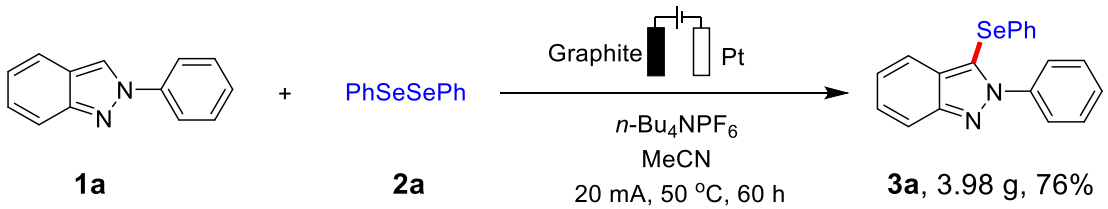
In an undivided cell (20 mL) equipped with a stirring bar, a mixture of **1a** (0.2 mmol), **2a** (0.3 mmol), BHT (3 equiv.), *n*-Bu_4NPF_6 (0.5 mmol) and MeCN (5 mL) were added. The cell was equipped with graphite plate (1.5 cm × 1 cm × 0.2 cm) as the anode and platinum plate (1 cm × 1 cm × 0.01 cm) as the cathode and connected to a DC regulated power supply. The reaction mixture was stirred and electrolyzed at a constant current of 8 mA at 50 ℃ (heating module) for 5 h. When the reaction was finished, the mixture was concentrated under reduced pressure. Purification by column chromatography on silica gel (eluent: petroleum ether/ethyl acetate: 15/1) yielded product **3a** (3 mg, 4%) as white solid.

Intermolecular Competition Experiments



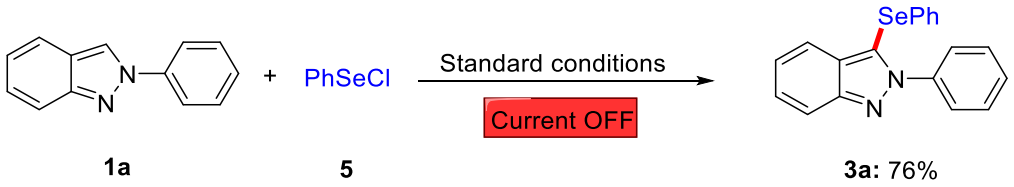
In an undivided cell (20 mL) equipped with a stirring bar, a mixture of **1m** (0.2 mmol), **1h** (0.2 mmol), **2a** (0.2 mmol), *n*-Bu_4NPF_6 (0.5 mmol) and MeCN (5 mL) were added. The cell was equipped with graphite plate (1.5 cm × 1 cm × 0.2 cm) as the anode and platinum plate (1 cm × 1 cm × 0.01 cm) as the cathode and connected to a DC regulated power supply. The reaction mixture was stirred and electrolyzed at a constant current of 8 mA at 50 ℃ by heating the aluminum block for 5 h. When the reaction was finished, the mixture was concentrated under reduced pressure. Purification by column chromatography on silica gel (eluent: petroleum ether/ethyl acetate: 15/1) yielded solo product **3m** (38 mg, 45%) as white solid.

Gram-scale Synthesis

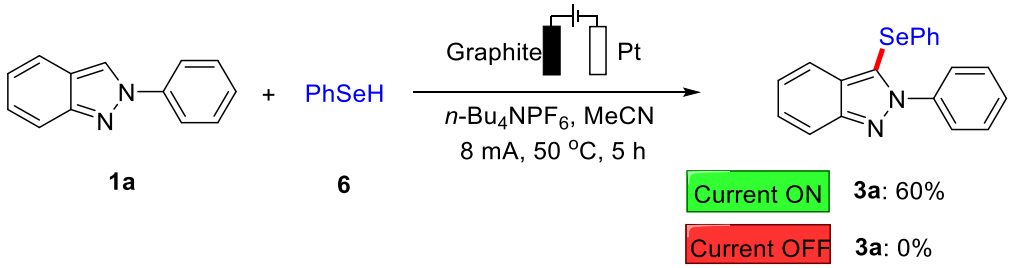


In an undivided cell (250 mL) equipped with a stir bar, a mixture of substrates **1a** (15.0 mmol, 2.91 g), **2a** (22.5 mmol, 7.02 g), *n*-Bu_4NPF_6 (15.0 mmol, 5.81 g) and MeCN (150 mL) were added. The cell was equipped with a graphite plate (3 cm x 3 cm x 0.6 cm) as the anode and platinum plate (3 cm x 3 cm x 0.01 cm) as the cathode and connected to a DC regulated power supply. The reaction mixture was stirred and electrolyzed at a constant current of 20 mA at 50 ℃ in an oil bath for 60 h. When the reaction was finished, the mixture was concentrated under reduced pressure. Purification by column chromatography on silica gel (eluent: petroleum ether/ethyl acetate: 15/1) yielded solo product **3a** (3.98 g, 76%) as white solid.

Control Experiments



In an undivided cell (20 mL) equipped with a stirring bar, a mixture of **1a** (0.2 mmol), **2a** (0.3 mmol), **5** (0.3 mmol), *n*-Bu_4NPF_6 (0.5 mmol) and MeCN (5 mL) were added. The cell was equipped with graphite plate (1.5 cm × 1 cm × 0. 2 cm) as the anode and platinum plate (1 cm × 1 cm × 0.01 cm) as the cathode and connected to a DC regulated power supply. The reaction mixture was stirred and electrolyzed at a constant current of 8 mA at 50 ℃ by heating the aluminum block for 5 h. When the reaction was finished, the mixture was concentrated under reduced pressure. Purification by column chromatography on silica gel (eluent: petroleum ether/ethyl acetate: 15/1) yielded product **3a** (58 mg, 82%) as white solid. In addition, when performing the reaction without current, the product **3a** (53 mg, 76%) was also isolated as white solid.



In an undivided cell (20 mL) equipped with a stirring bar, a mixture of **1a** (0.2 mmol), **2a** (0.3 mmol), **6** (0.3 mmol), *n*-Bu_4NPF_6 (0.5 mmol) and MeCN (5 mL) were added. The cell was equipped with graphite plate (1.5 cm × 1 cm × 0. 2 cm) as the anode and platinum plate (1 cm × 1 cm × 0.01 cm) as the cathode and connected to a DC regulated power supply. The reaction mixture was stirred and electrolyzed at a constant current of 8 mA at 50 ℃ by heating the aluminum block for 5 h. When the reaction was finished, the mixture was concentrated under reduced pressure. Purification by column chromatography on silica gel (eluent: petroleum ether/ethyl acetate: 15/1) yielded product **3a** (42 mg, 60%) as white solid. In addition, when performing the reaction without current, no product of **3a** was formed.

Cyclic Voltammetry Experiments

Cyclic voltammetry experiments were carried out on an IGS 1230 electrochemical work station (Ingsens instruments, Guangzhou) 0.1 M *n*-Bu_4NPF_6 was dissolved in acetonitrile. Working electrode: glassy carbon, counter electrode: Pt, reference electrode: Ag-AgCl (3 M KCl). Scan rate: 100 mV/s.

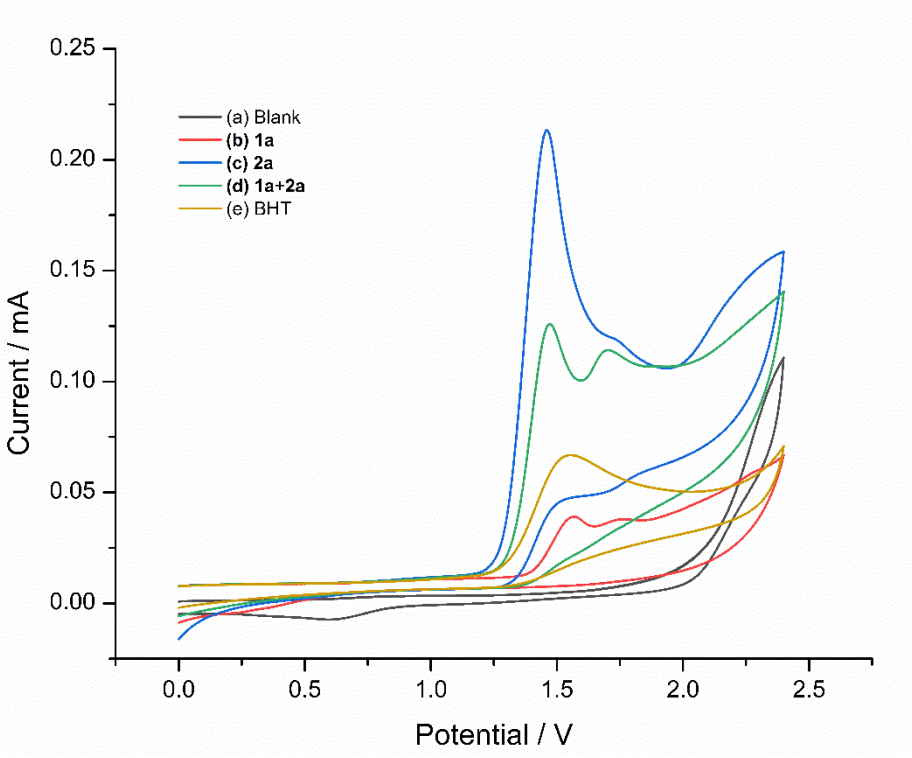


Figure S1. Cyclic voltammograms. Conditions: a glassy carbon working electrode, a Ag/AgCl (3 M KCl) reference electrode, and a platinum wire counter electrode, *n*-Bu_4NPF_6 (0.1 M in MeCN), 100mV/s scan rate. (a) Background; (b) **1a** (1 mM); (c) **2a** (1 mM); (d) **1a** (1 mM) + **2a** (1 mM)

References

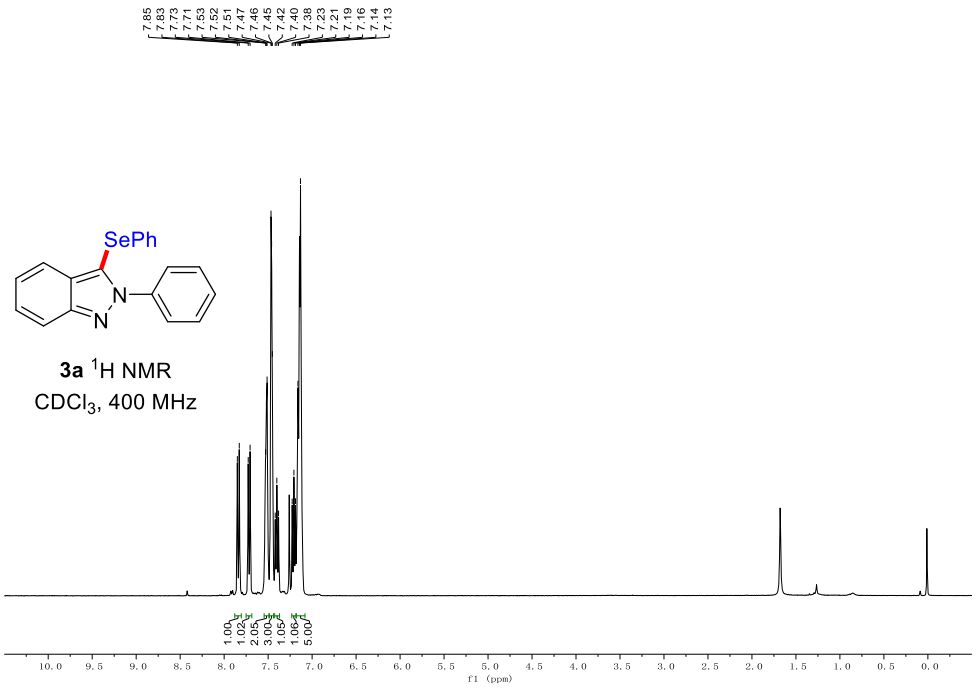
[1] A. Dey, A. Hajra, *J. Org. Chem.* **2019**, *84*, 14904–14910.

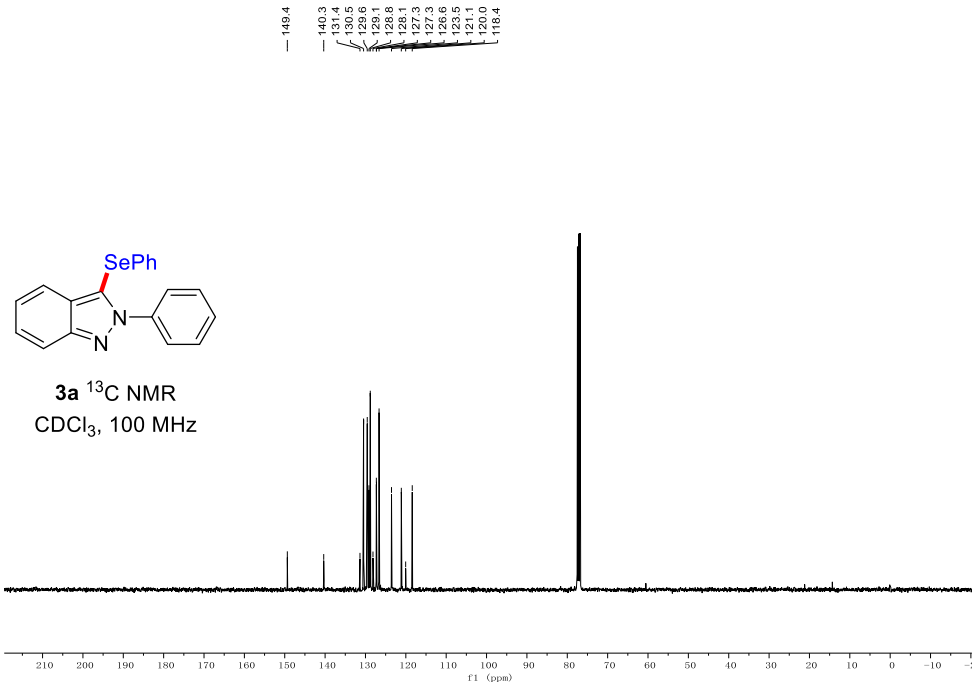
[2] F. Li, D. Wang, H. Chen, Z. He, L. Zhou, Q. Zeng, *Chem. Commun.* **2020**, *56*, 13029–13032.

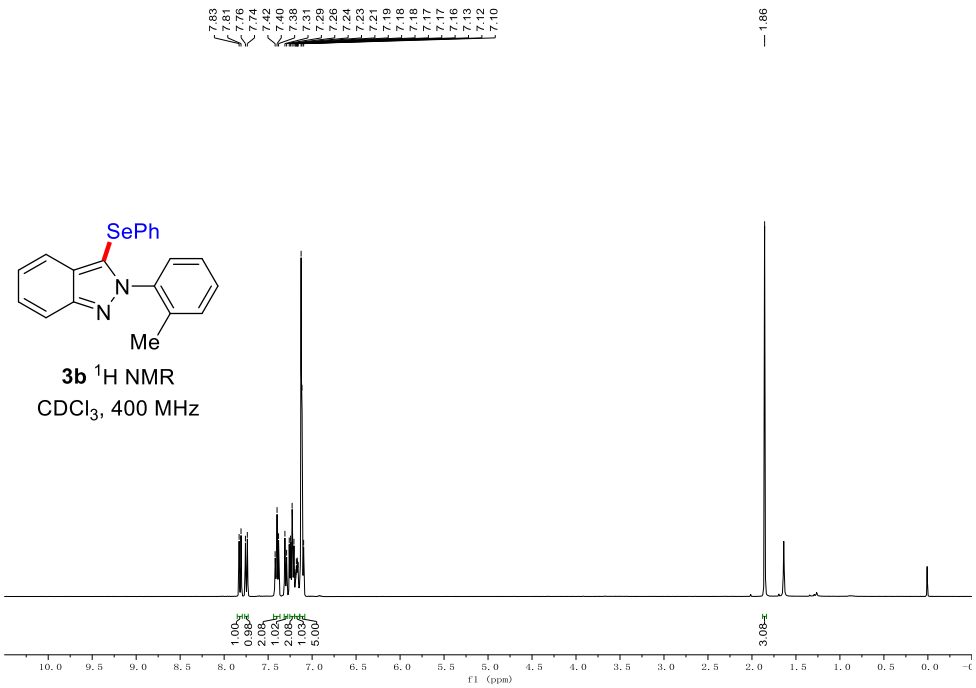
[3] K. C. C. Aganda, J. Kim, A. Lee, *Org. Biomol. Chem.* **2019**, *17*, 9698–9702.

[4] Y. J. Kim and D. Y. Kim, *Tetrahedron Lett.*, **2019**, *60*, 739-742.

^{1}H-, ^{13}C- and ^{19}F-NMR Spectra



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N
Me
3b 1H NMR
CDCl3, 400 MHz
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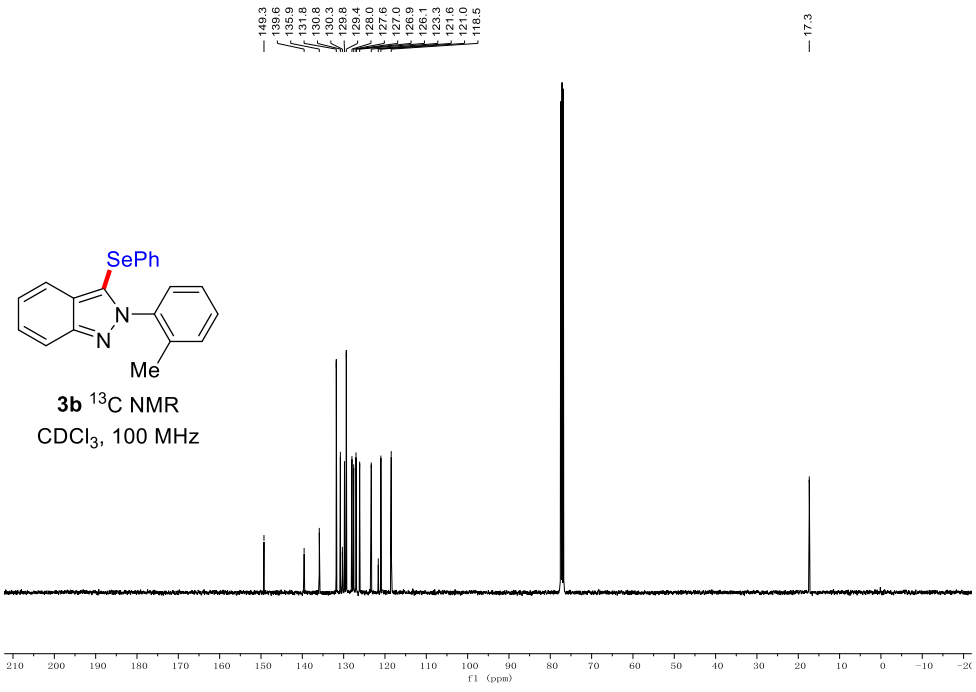
7.81
7.76
7.74
7.42
7.40
7.38
7.31
7.29
7.26
7.24
7.23
7.21
7.19
7.18
7.18
7.17
7.17
7.16
7.13
7.12
7.10
1.86
1.00
0.98
2.08
1.02
2.08
1.03
5.00
3.08
f1 (ppm)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N
N
Me
3b 13C NMR
CDCl3, 100 MHz
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139.6
135.9
131.8
130.8
130.3
129.8
129.4
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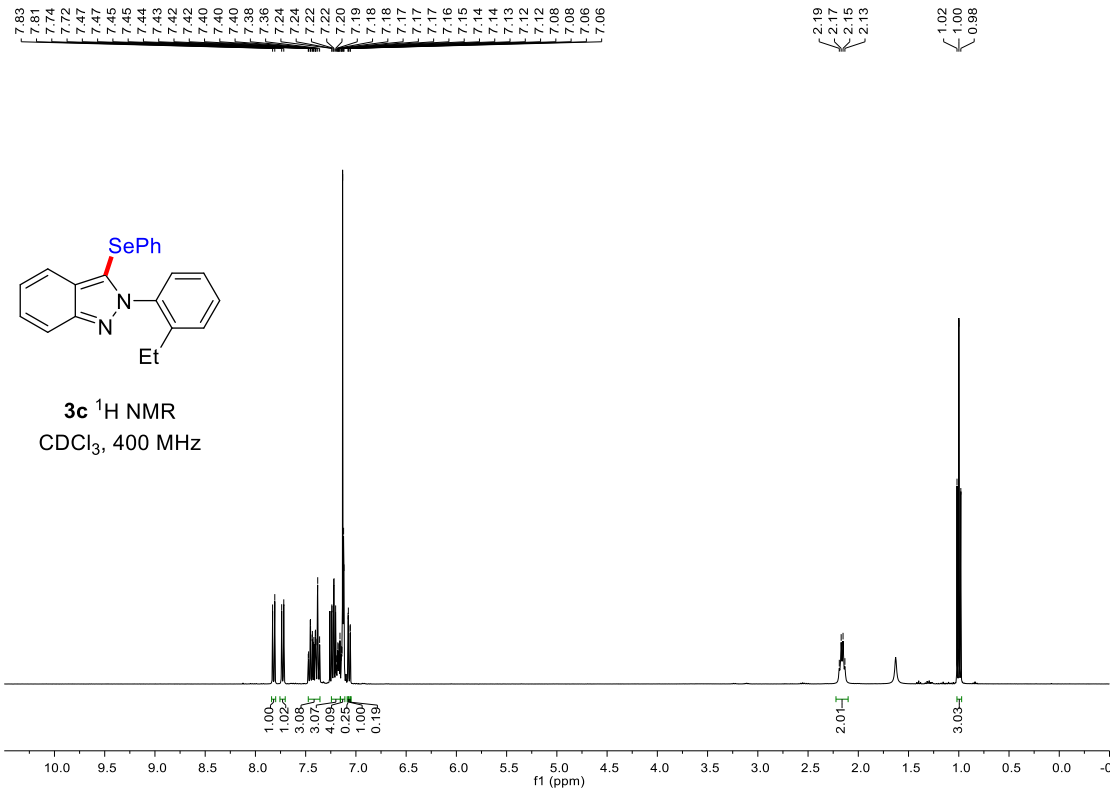
126.1
123.3
121.6
121.0
116.5
17.3
f1 (ppm)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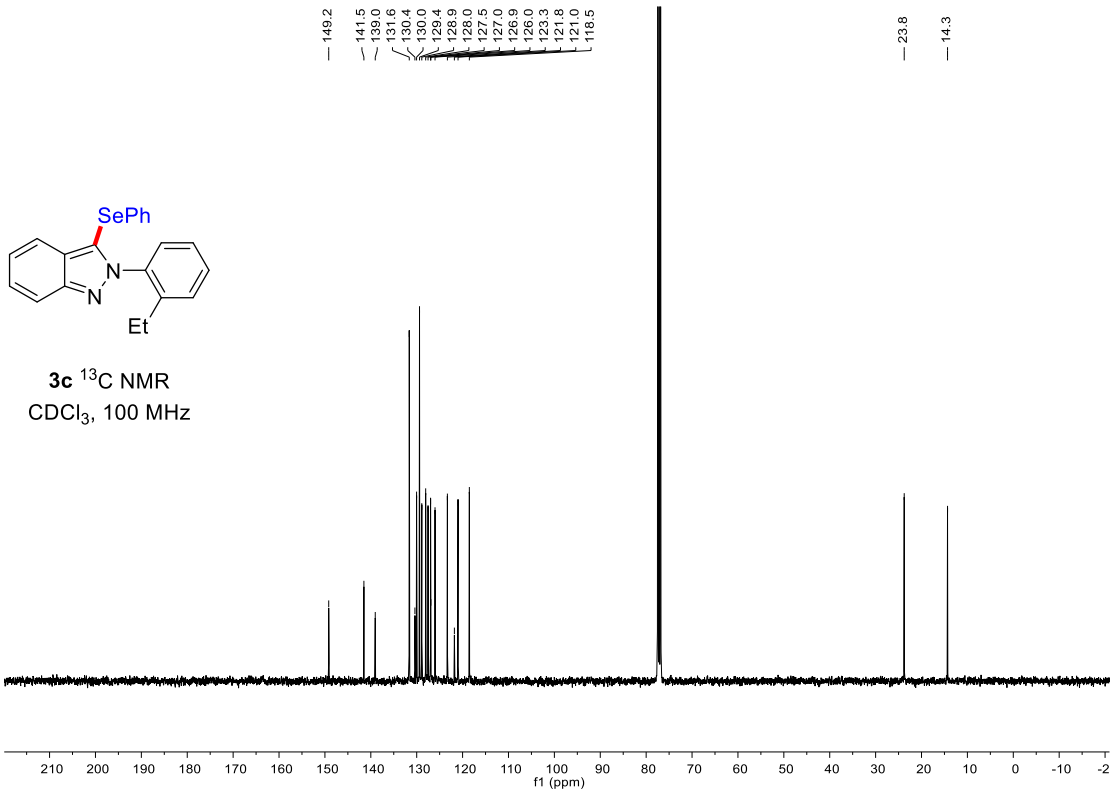
2.19 2.17 2.15 2.13
1.02 1.00 0.98
SePh
N
N
Et
3c 1H NMR
CDCl3, 400 MHz
1.00 1.02 3.08 3.07 4.09 0.25 1.00 0.19
2.01
3.03
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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131.6
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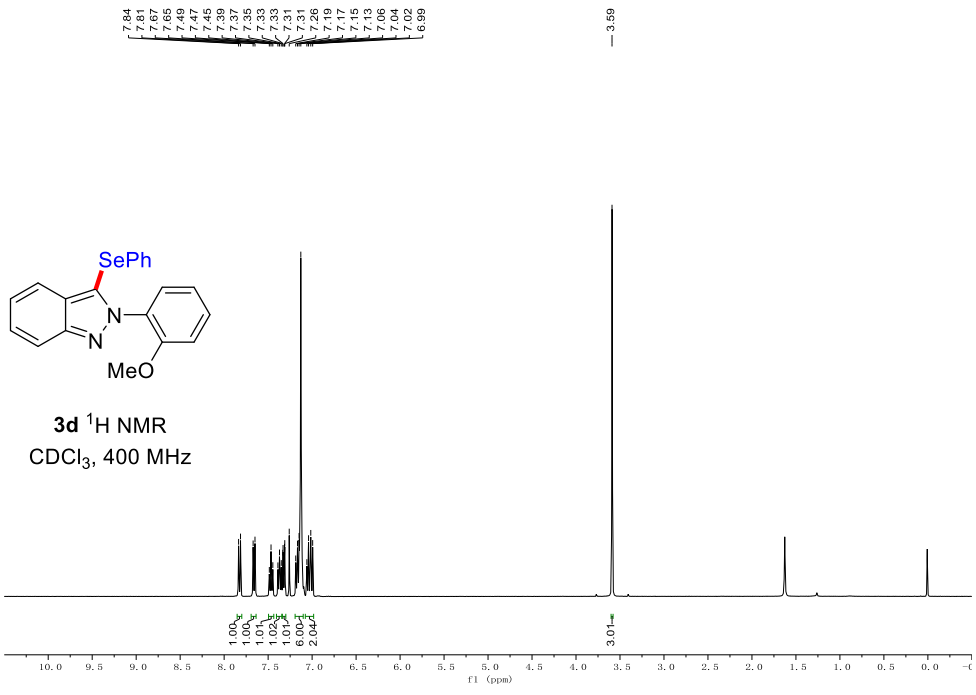
129.4
128.9
128.0
127.5
127.0
126.9
126.0
123.3
121.8
121.0
118.5
23.8
14.3
SePh
N
N
Et
3c 13C NMR
CDCl3, 100 MHz
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -2
f1 (ppm)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7.35
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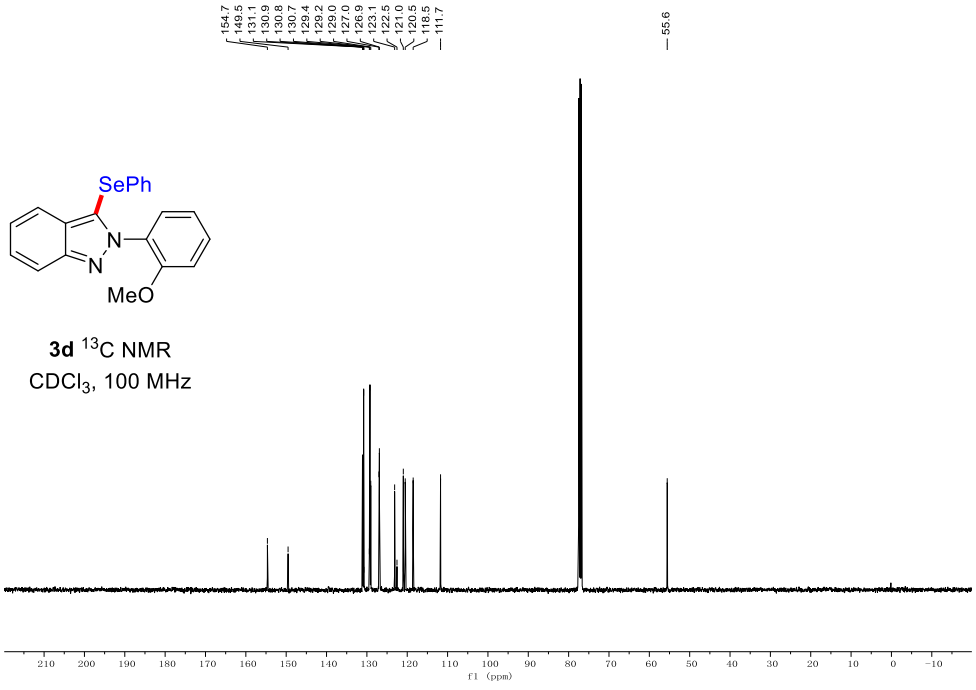
7.31
7.31
7.26
7.19
7.17
7.15
7.13
7.06
7.04
7.02
6.99
3.59
SePh
N
N
MeO
3d 1H NMR
CDCl3, 400 MHz
1.00
1.00
1.01
1.02
1.01
6.00
2.04
3.01
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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129.2
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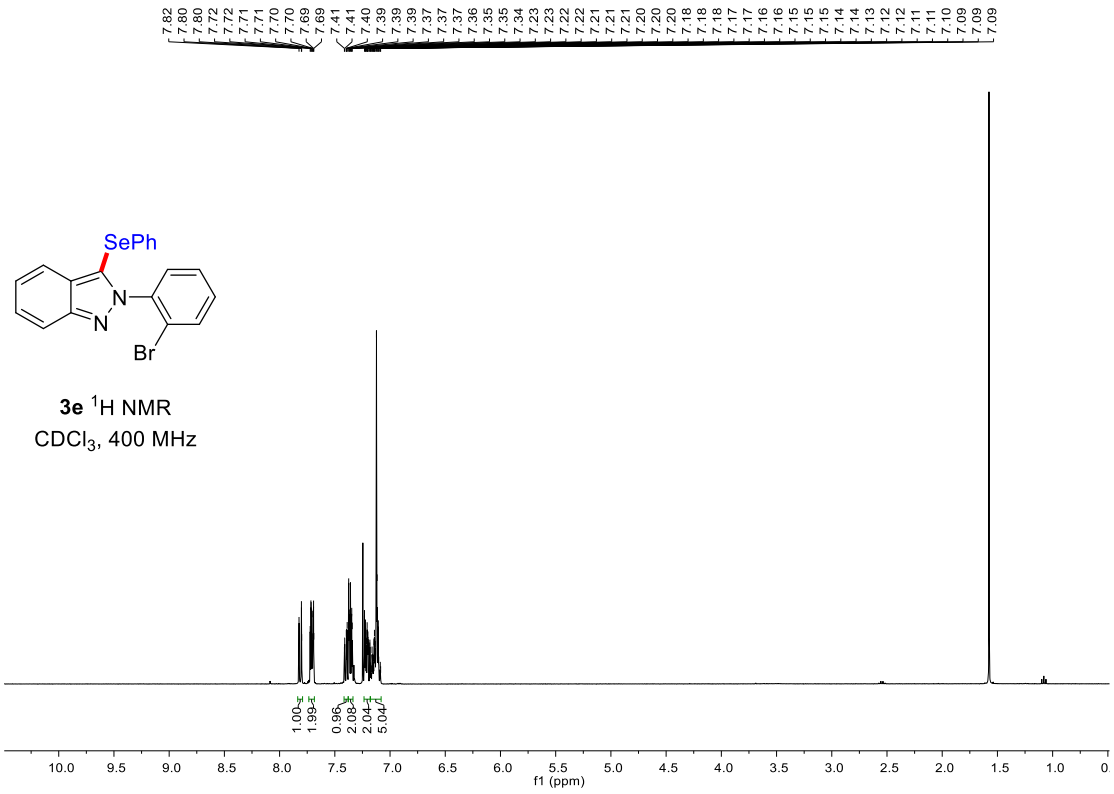
123.1
122.5
121.0
120.5
118.5
111.7
55.6
SePh
N
N
MeO
3d 13C NMR
CDCl3, 100 MHz
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


SePh
N
N
Br
3e 1H NMR
CDCl3, 400 MHz
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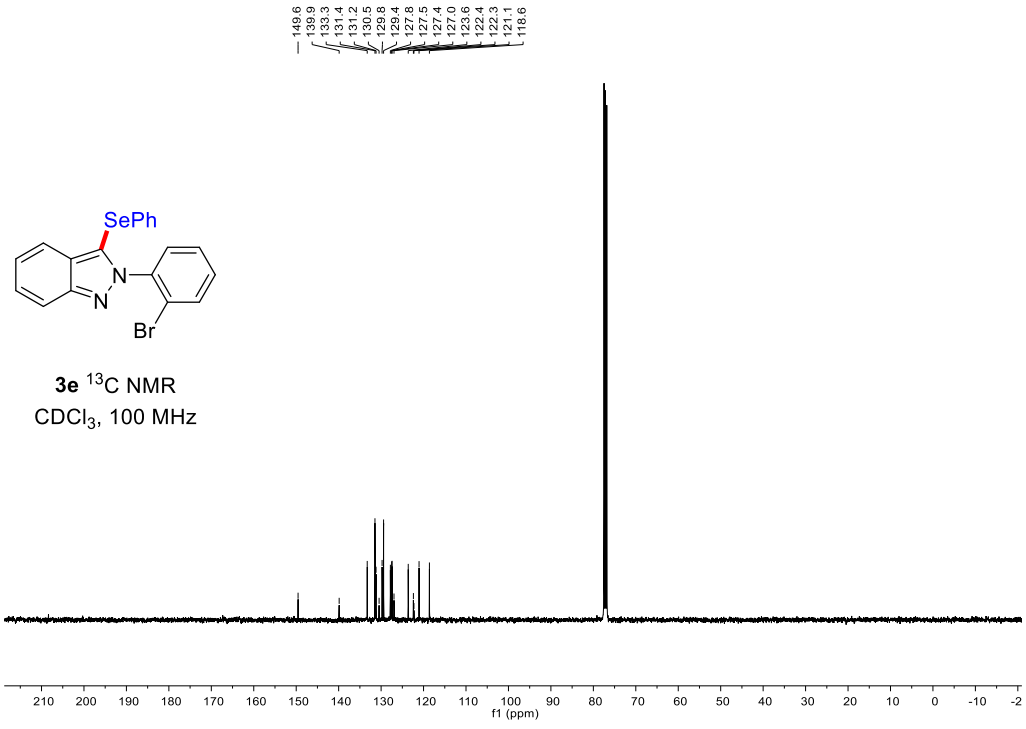
1.00 1.99 0.96 2.08 2.04 5.04
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0
f1 (ppm)


SePh
N
N
Br
3e 13C NMR
CDCl3, 100 MHz
149.6 139.9 133.3 131.4 131.2 130.5 129.8 129.4 127.8 127.5 127.4 127.0 123.6 122.4 122.3 121.1 118.6
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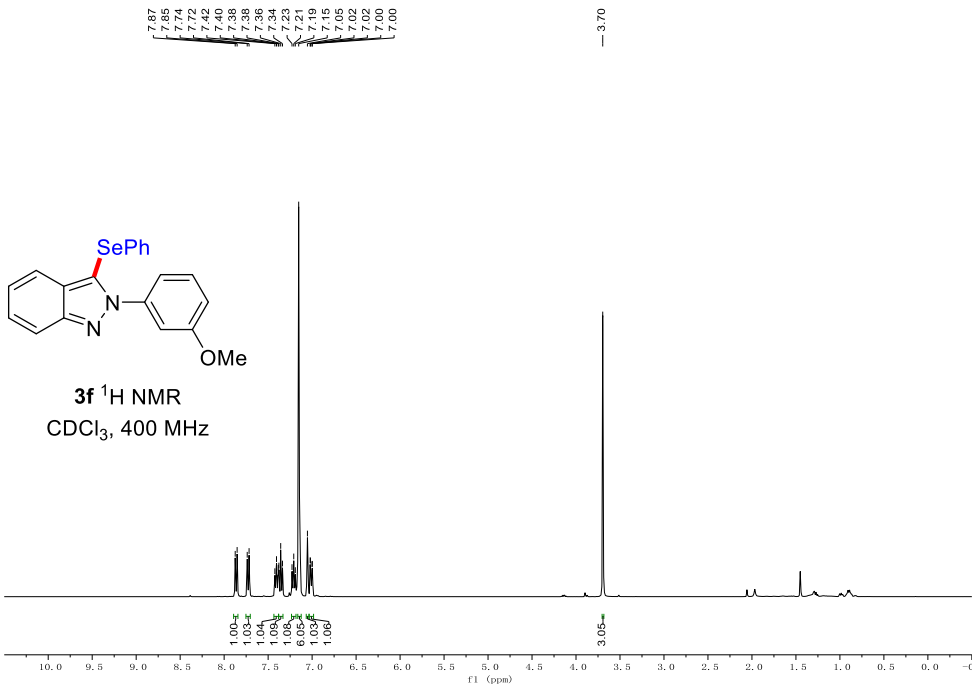
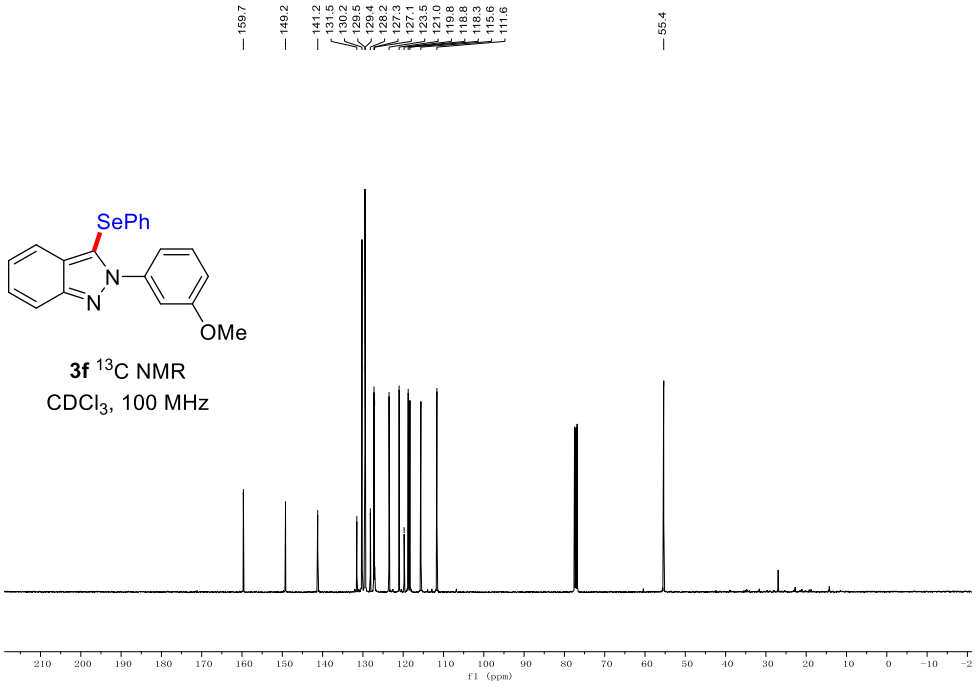
f1 (ppm)



3f ^{1}H NMR
$CDCl_3$, 400 MHz



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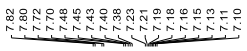
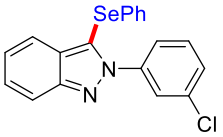
$CDCl_3$, 100 MHz





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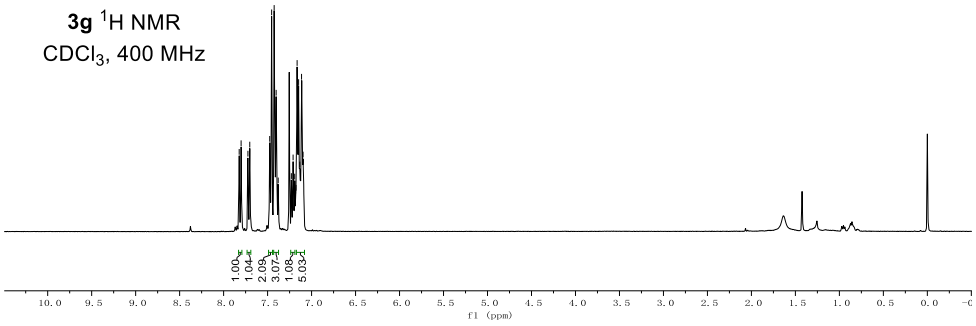

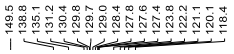

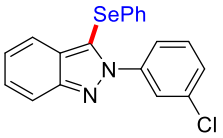

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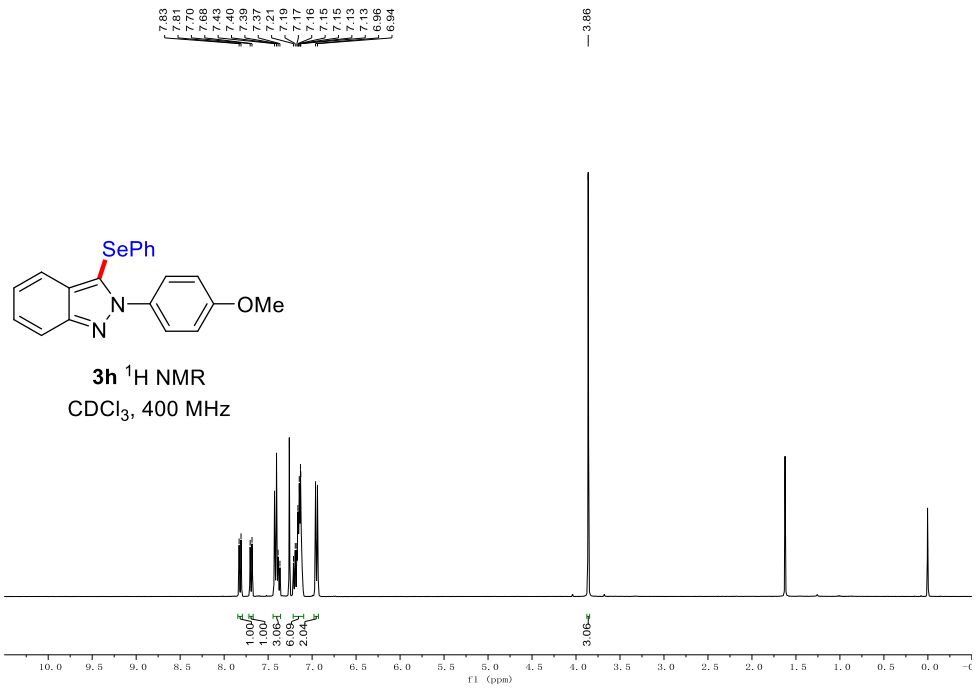
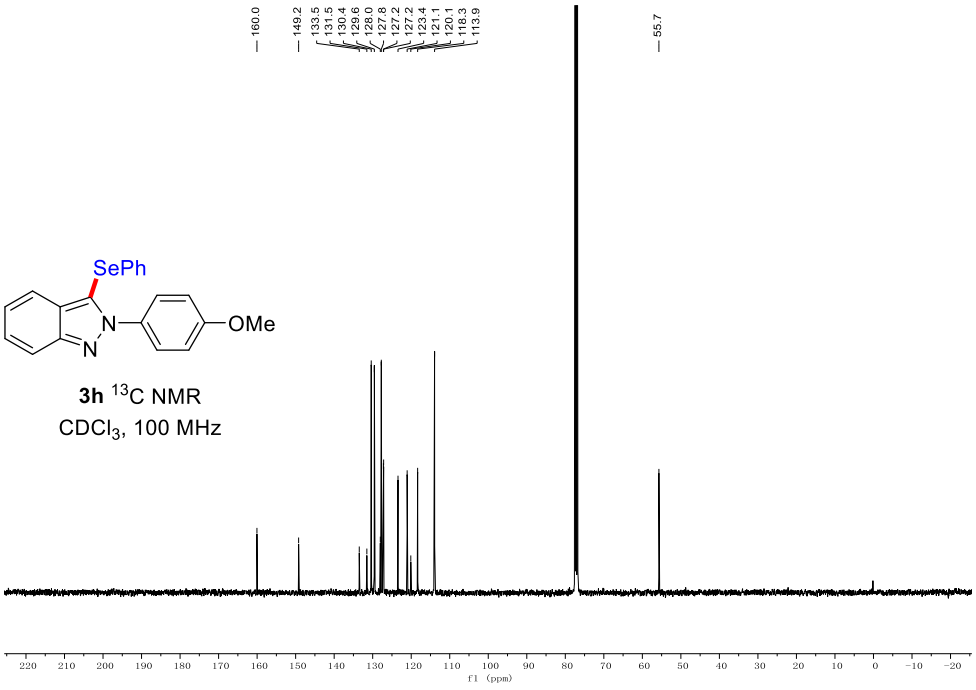


3h ^{1}H NMR

$CDCl_3$, 400 MHz



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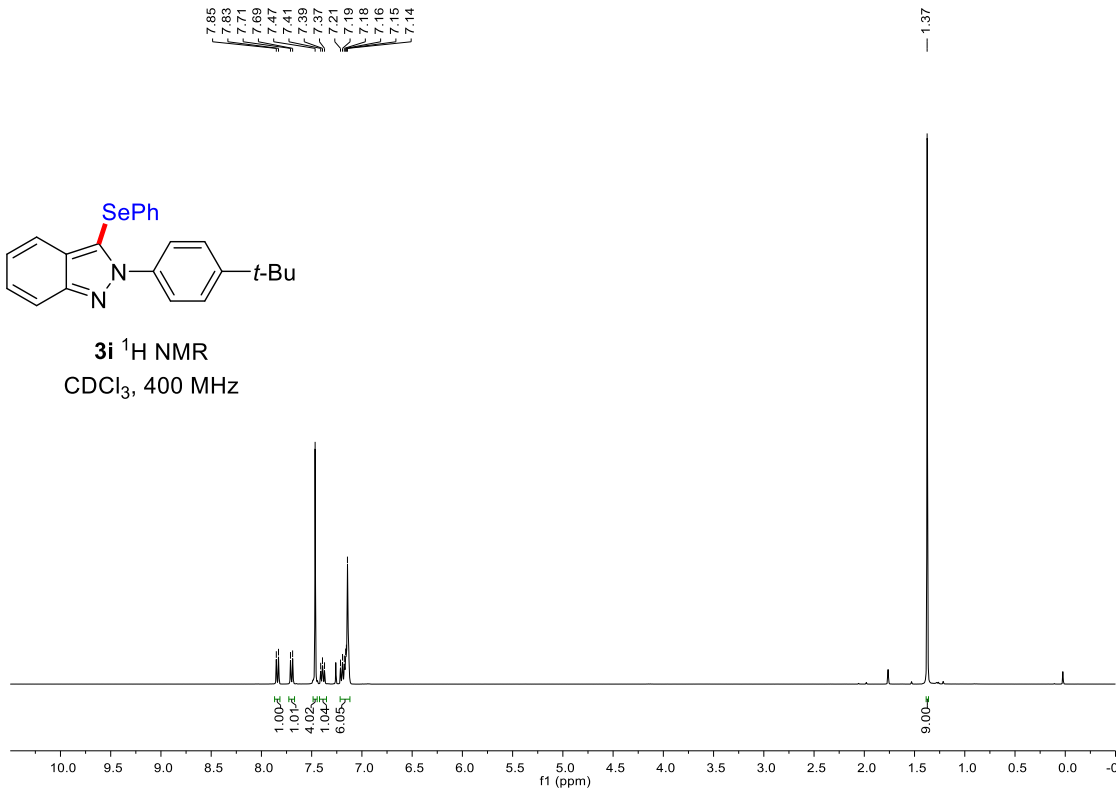

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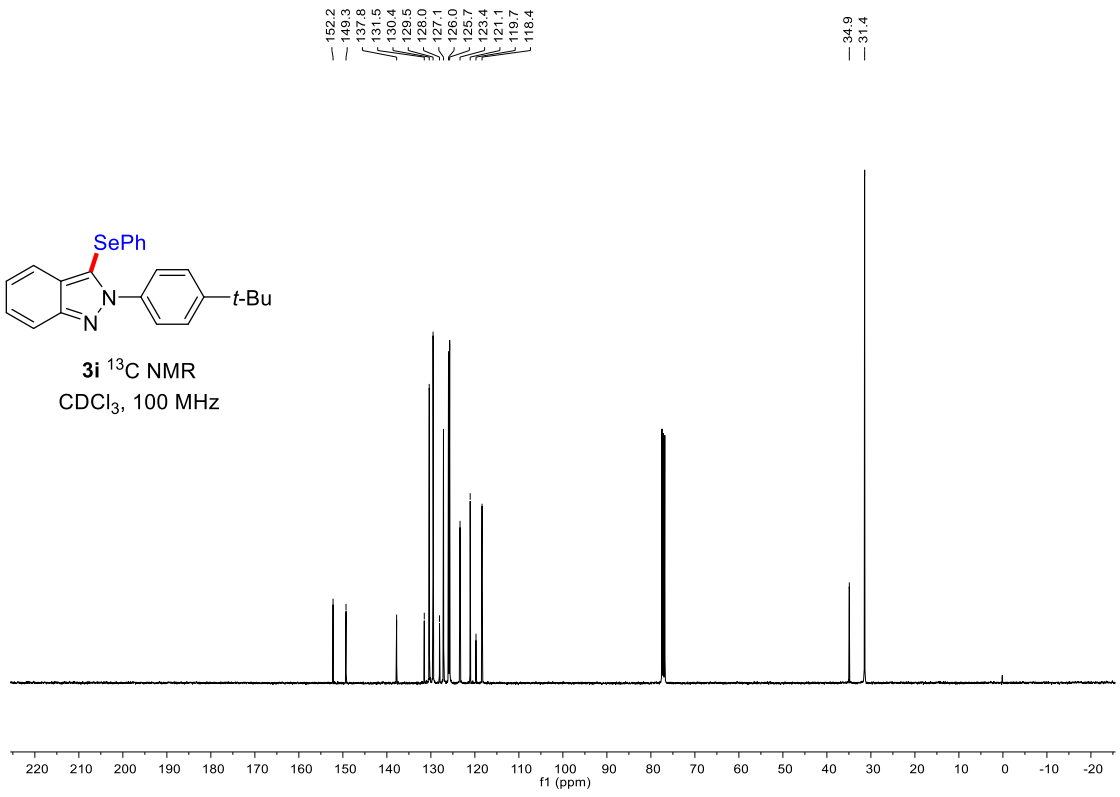

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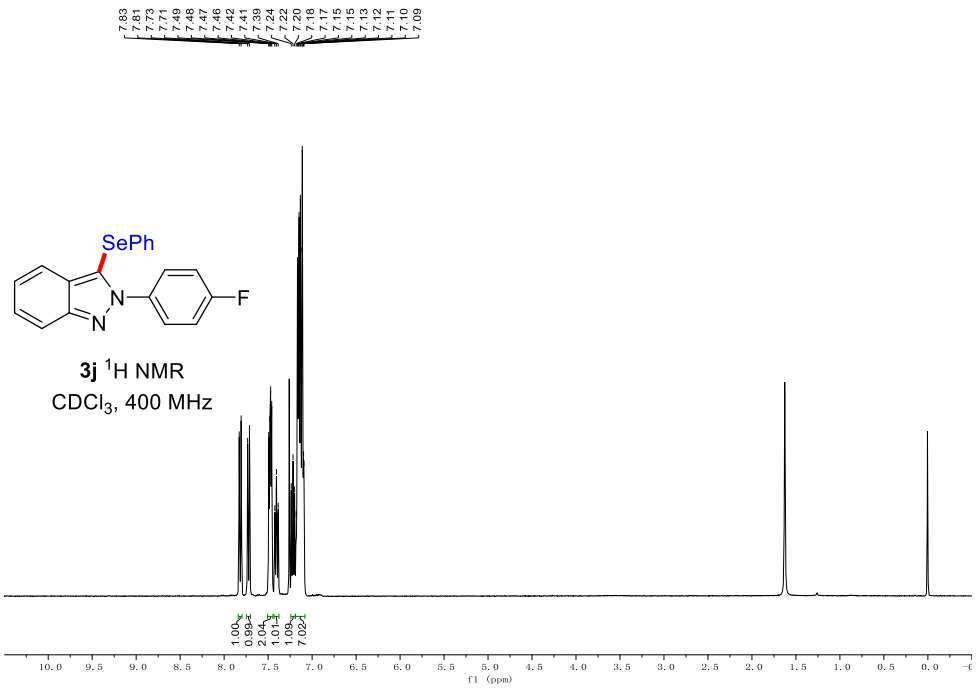
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7.13
7.12
7.11
7.10
7.09
SePh
N
N
F
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CDCl3, 400 MHz
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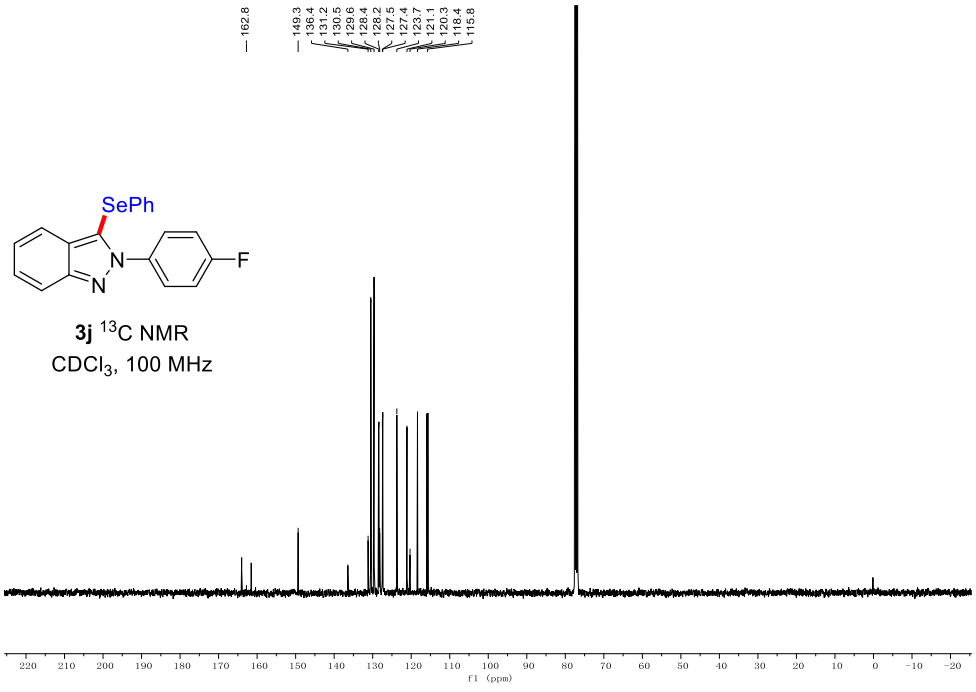
0.99
2.04
1.01
1.09
7.02
f1 (ppm)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F
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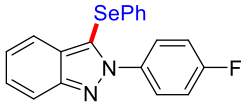
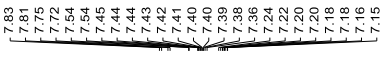
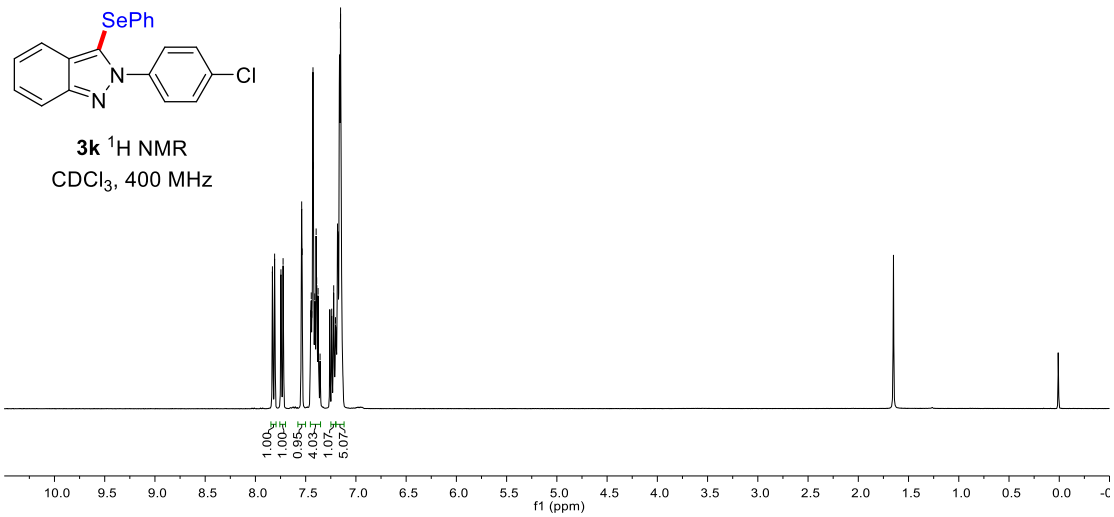
f1 (ppm)

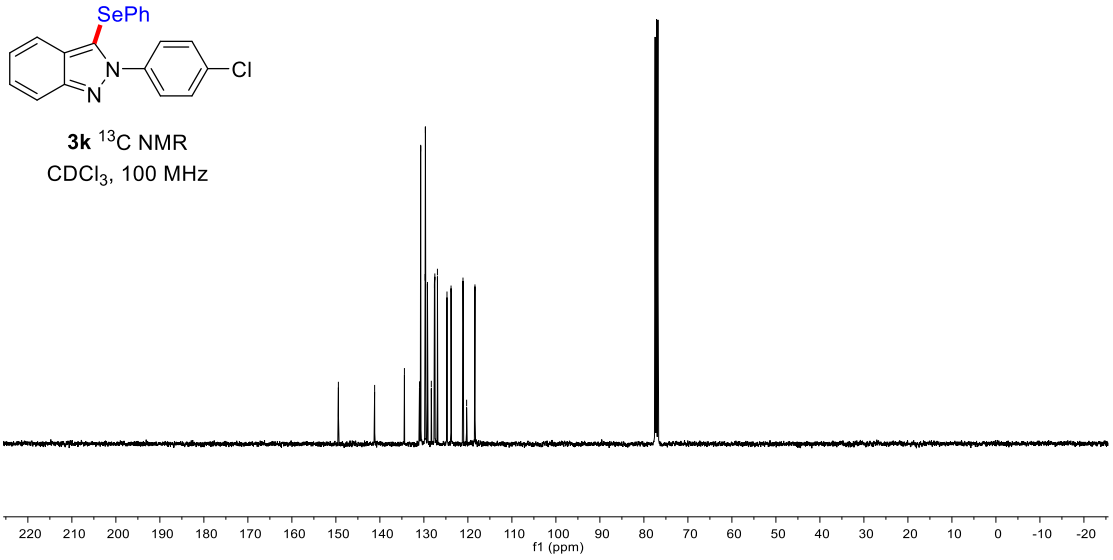


3j ^{19}F NMR
$CDCl_3$, 376 MHz

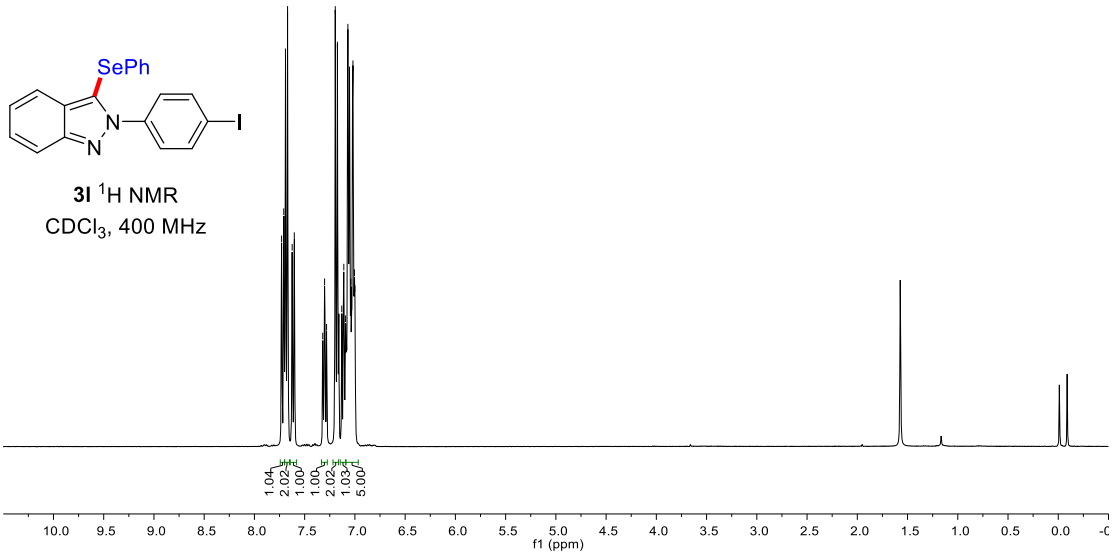


3k ^{1}H NMR
$CDCl_3$, 400 MHz





3k ^{13}C NMR
$CDCl_3$, 100 MHz



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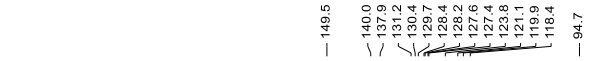

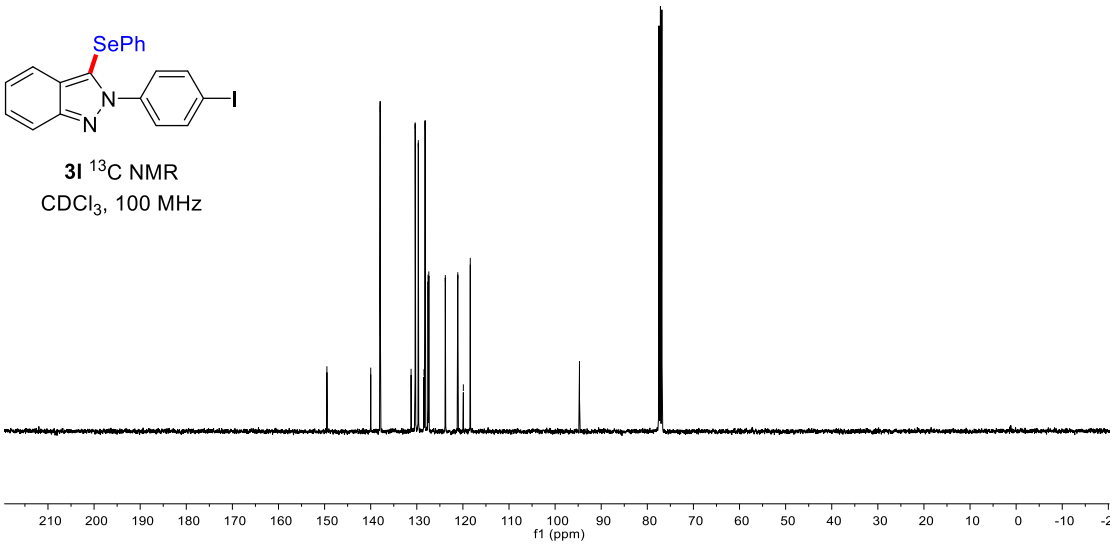

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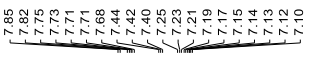
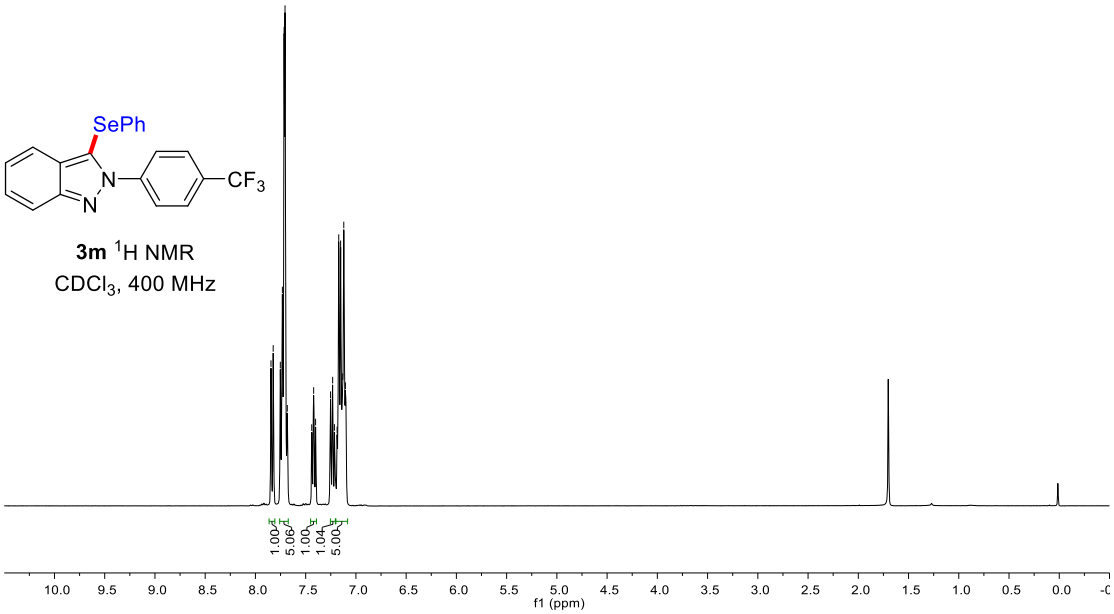
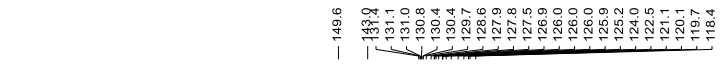
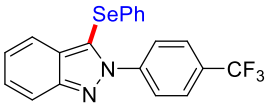


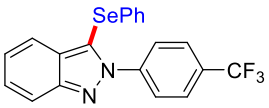


3m ^{1}H NMR
$CDCl_3$, 400 MHz





3m ^{13}C NMR
$CDCl_3$, 100 MHz



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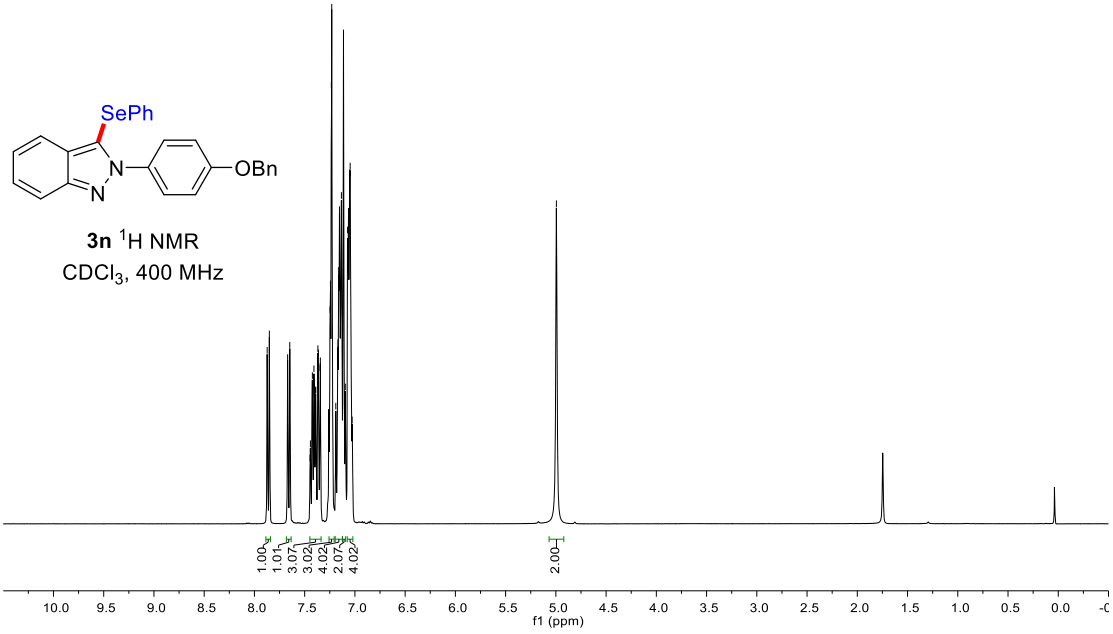
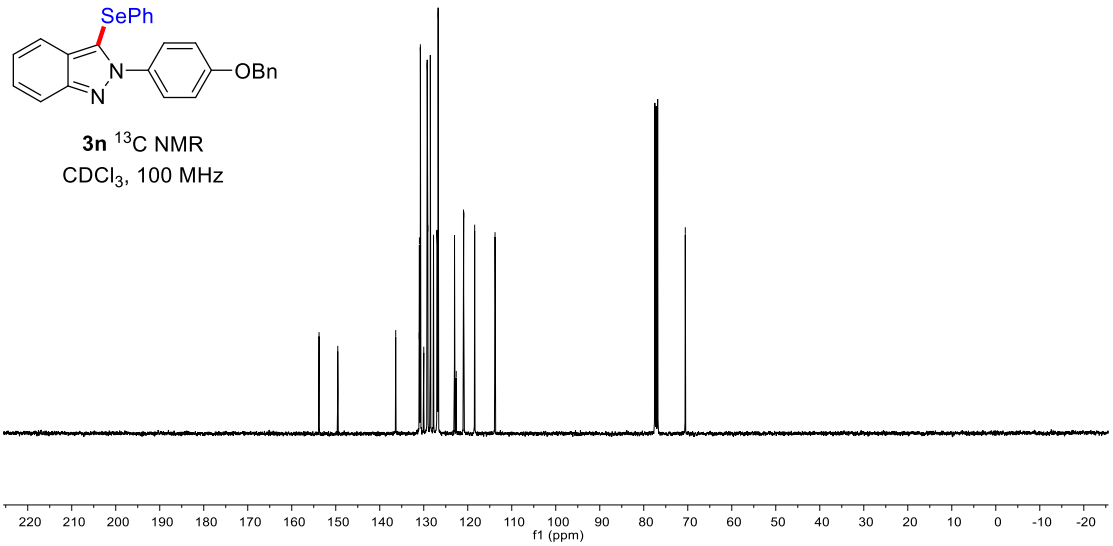
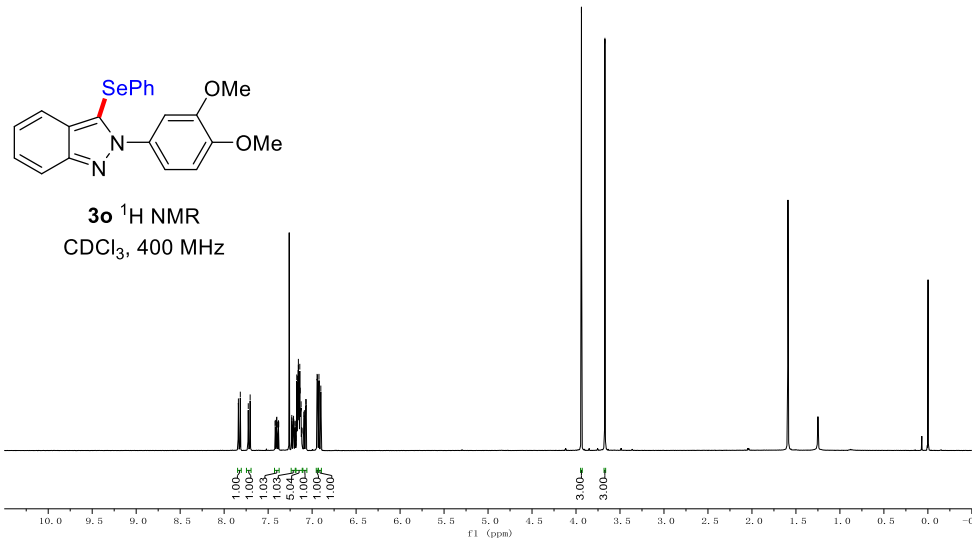


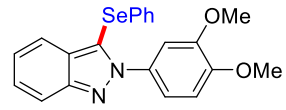
3n ^{1}H NMR
$CDCl_3$, 400 MHz



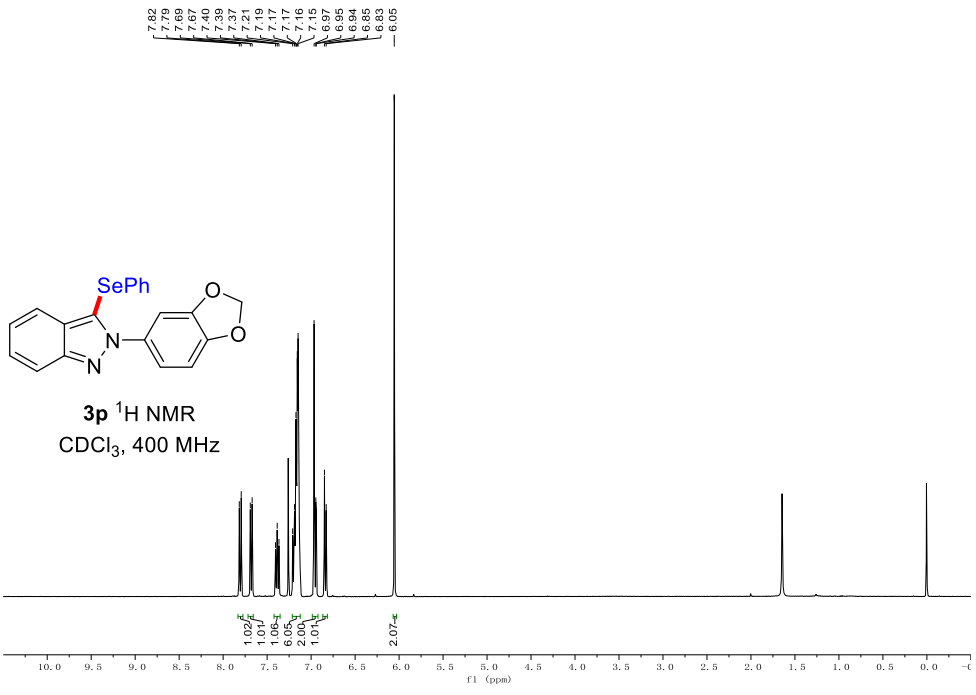
3n ^{13}C NMR
$CDCl_3$, 100 MHz



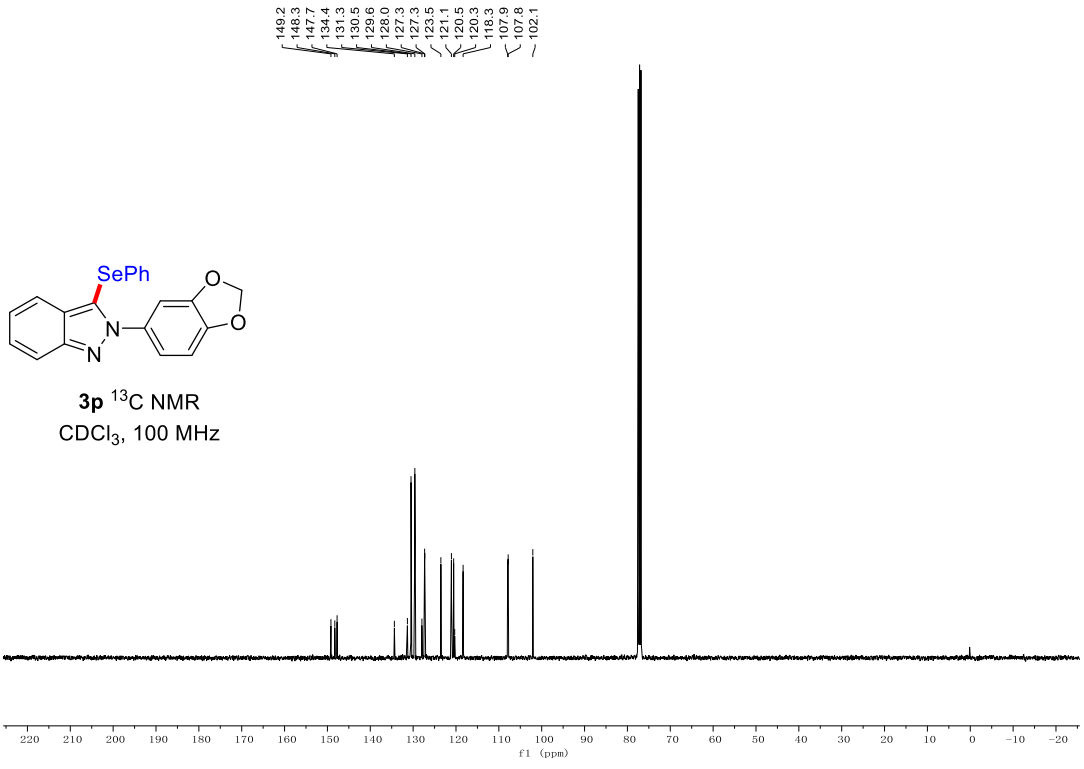
3o ^{1}H NMR
$CDCl_3$, 400 MHz



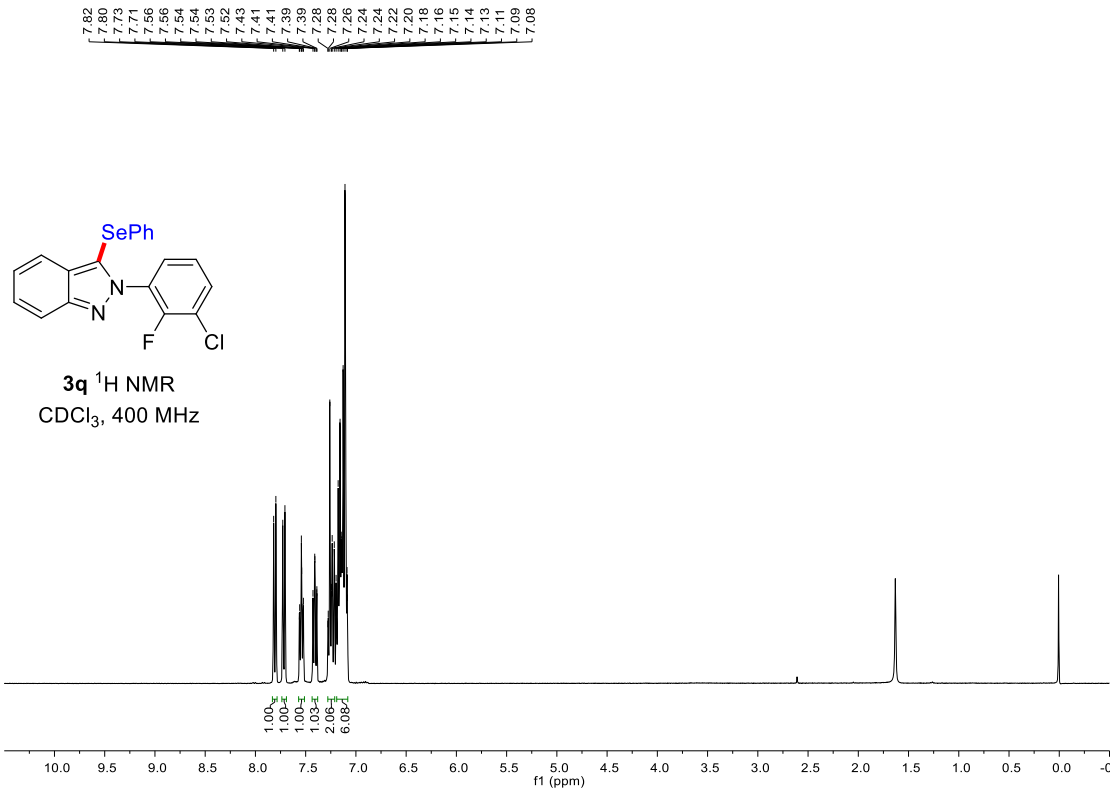
3o ^{13}C NMR
$CDCl_3$, 100 MHz



3p ^{1}H NMR
$CDCl_3$, 400 MHz



3p ^{13}C NMR
$CDCl_3$, 100 MHz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7.80
7.73
7.71
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7.56
7.54
7.54
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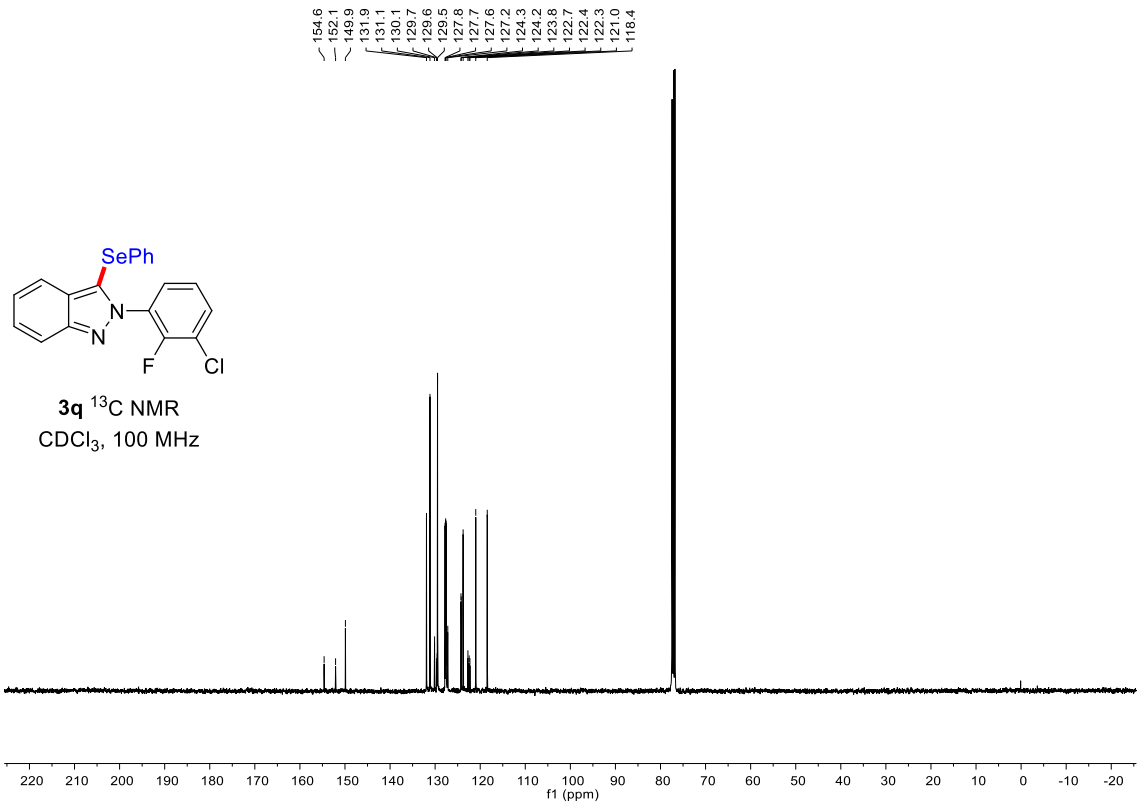
7.43
7.41
7.41
7.39
7.39
7.28
7.28
7.26
7.24
7.24
7.22
7.20
7.18
7.16
7.15
7.14
7.13
7.11
7.09
7.08
SePh
N
N
F
Cl
3q 1H NMR
CDCl3, 400 MHz
1.00
1.00
1.00
1.03
2.06
6.08
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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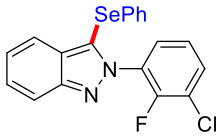
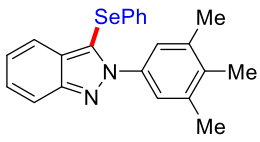
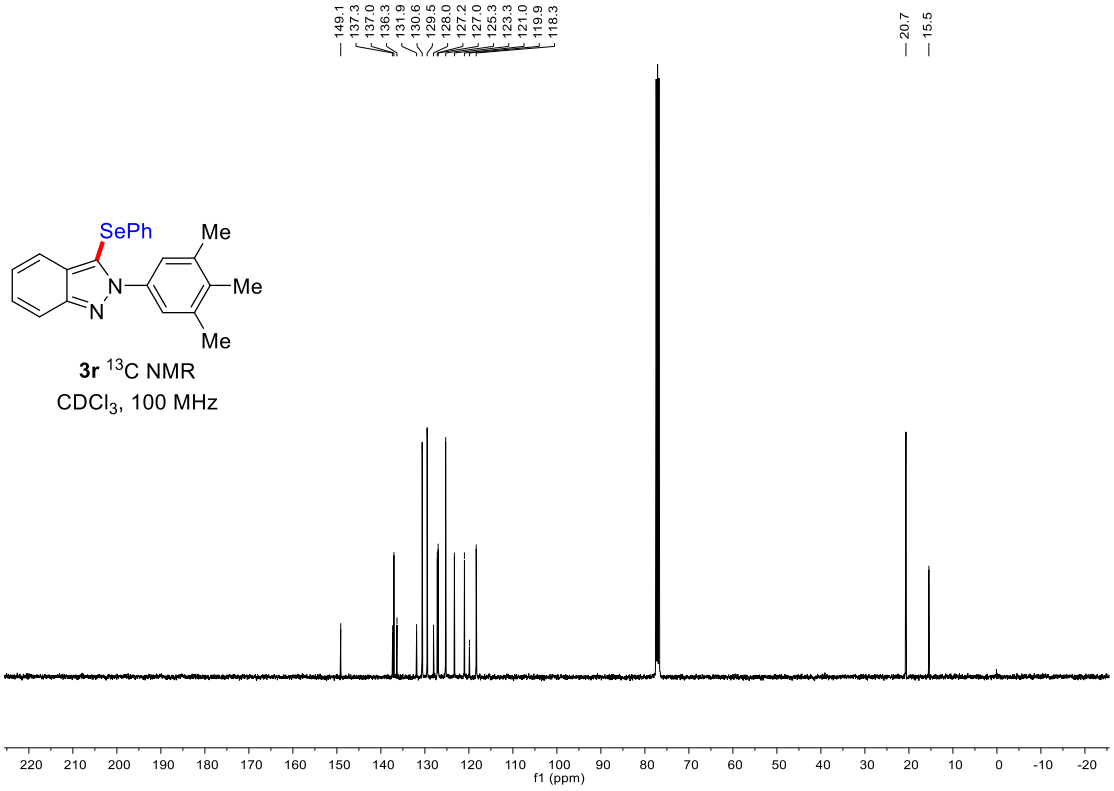
131.9
131.1
130.1
129.7
129.6
129.5
127.8
127.7
127.6
127.2
124.3
124.2
123.8
122.7
122.4
122.3
121.0
118.4
SePh
N
N
F
Cl
3q 13C NMR
CDCl3, 100 MHz
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)



3q ^{19}F NMR
$CDCl_3$, 376 MHz

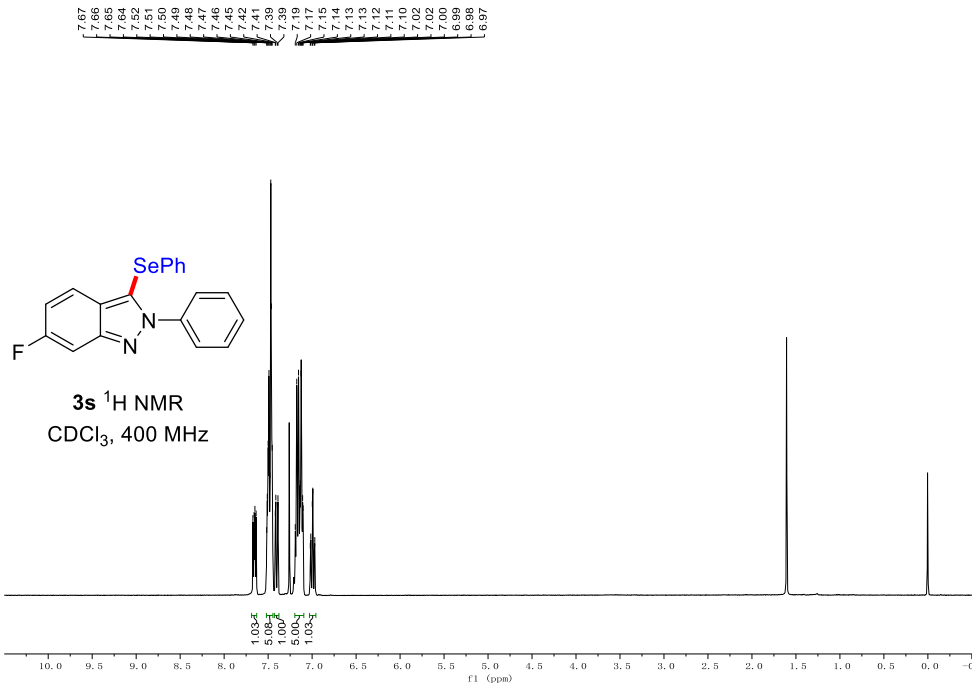


3r ^{1}H NMR
$CDCl_3$, 400 MHz



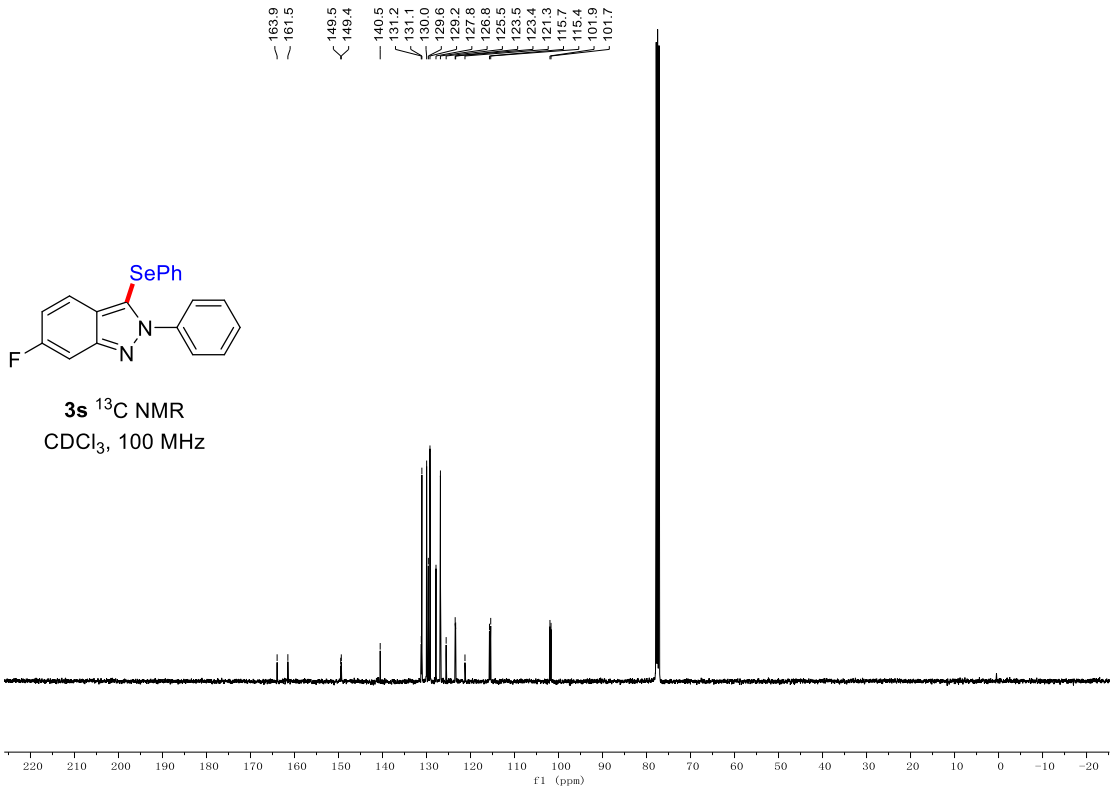
3r ^{13}C NMR

$CDCl_3$, 100 MHz

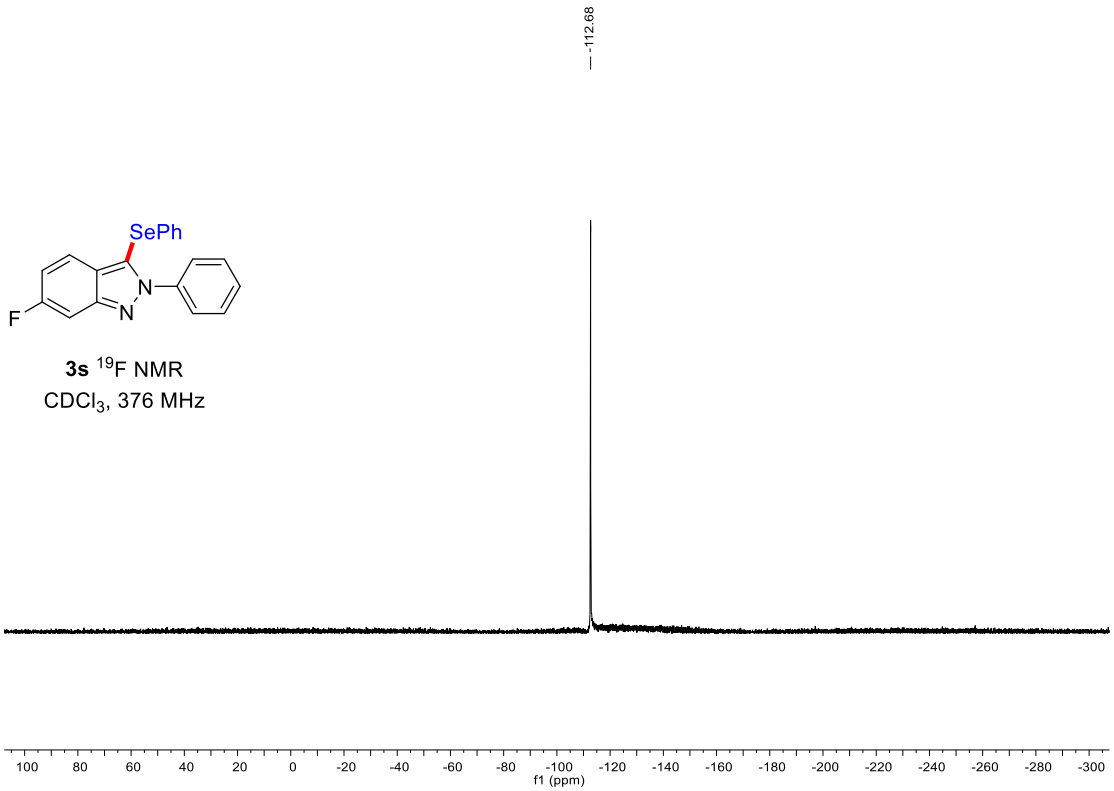


3s ^{1}H NMR

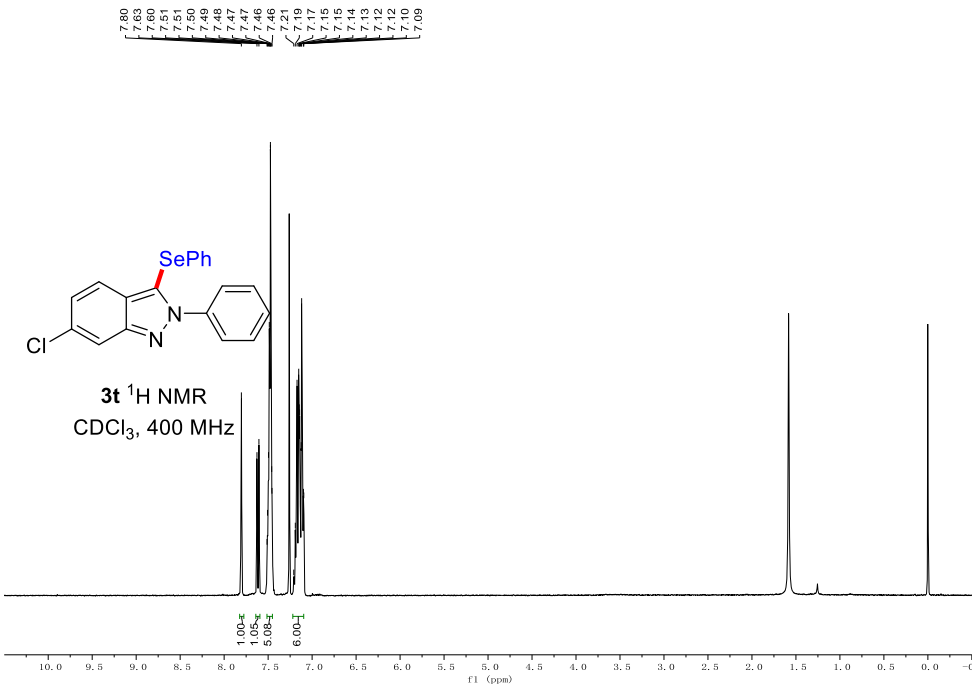
$CDCl_3$, 400 MHz



3s ^{13}C NMR
$CDCl_3$, 100 MHz



3s ^{19}F NMR
$CDCl_3$, 376 MHz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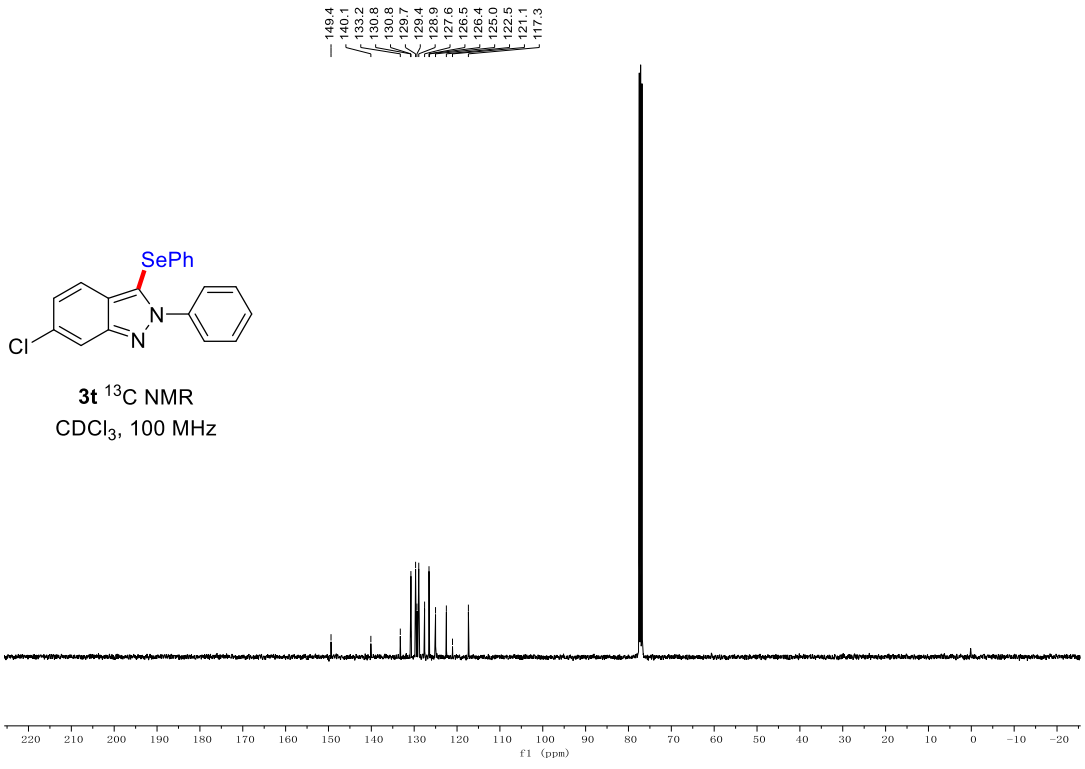
7.63
7.60
7.51
7.51
7.50
7.49
7.48
7.47
7.47
7.46
7.46
7.21
7.19
7.17
7.15
7.15
7.14
7.13
7.12
7.12
7.10
7.09
SePh
N
N
Cl
3t 1H NMR
CDCl3, 400 MHz
1.00
1.05
5.00
6.00
f1 (ppm)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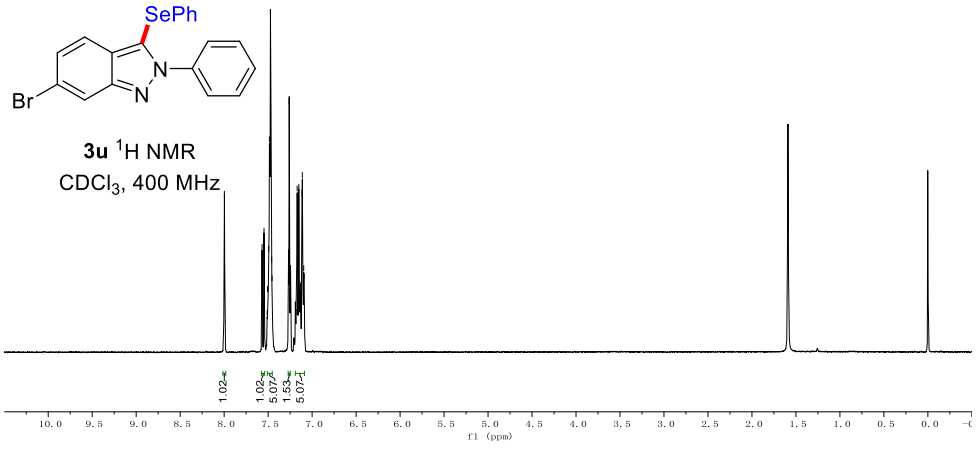
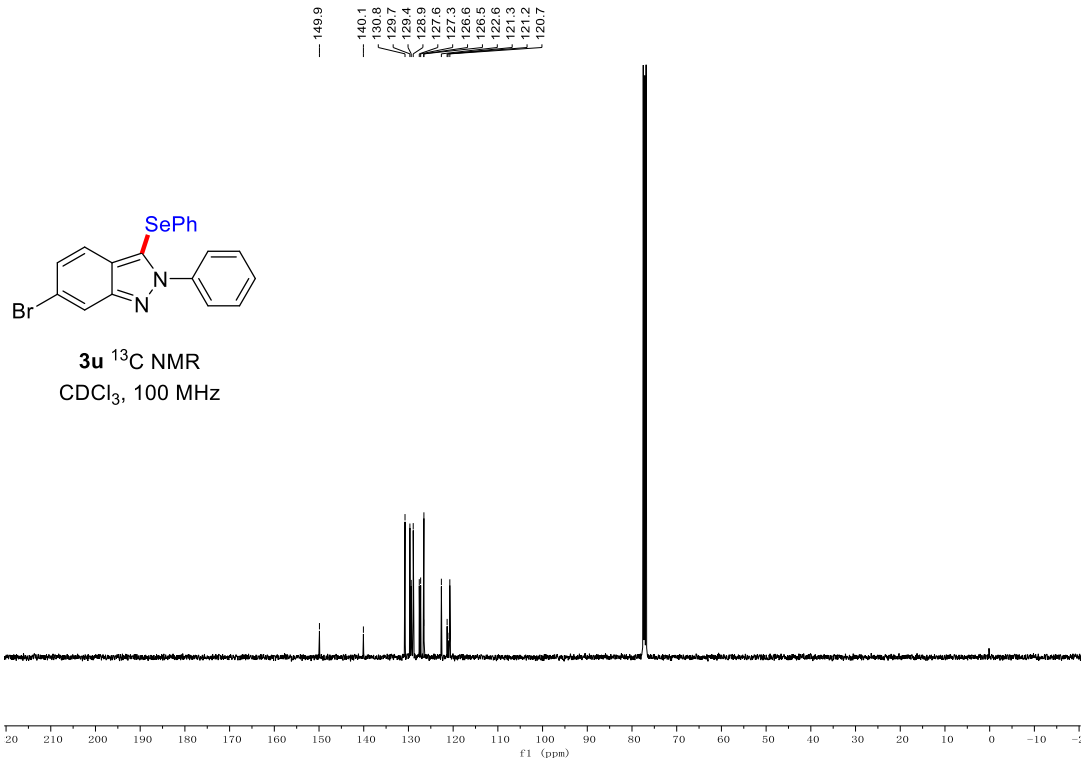
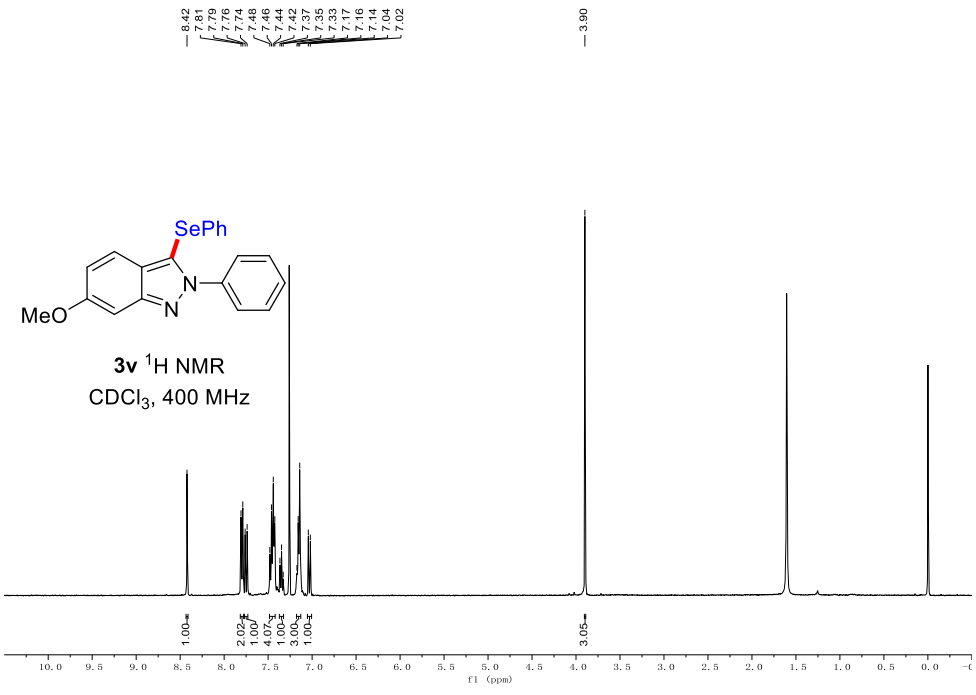
140.1
133.2
130.8
130.8
129.7
129.4
128.9
127.6
126.5
126.4
125.0
122.5
121.1
117.3
SePh
N
N
Cl
3t 13C NMR
CDCl3, 100 MHz
f1 (ppm)



3u ^{1}H NMR
$CDCl_3$, 400 MHz



3u ^{13}C NMR
$CDCl_3$, 100 MHz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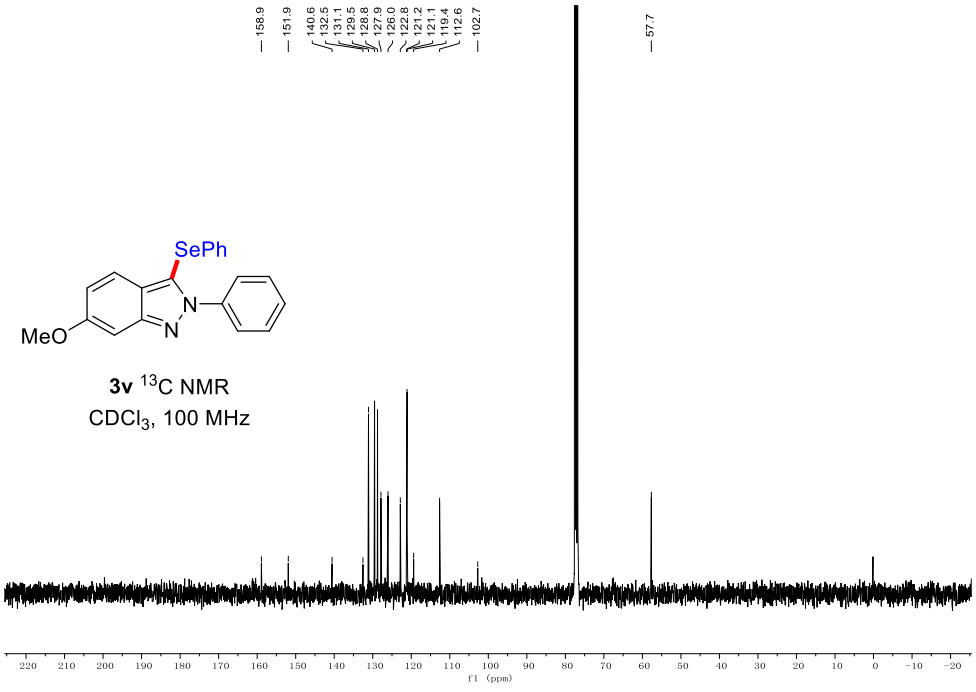
7.81
7.79
7.76
7.74
7.48
7.46
7.44
7.42
7.37
7.35
7.33
7.17
7.16
7.14
7.04
7.02
3.90
SePh
N
N
MeO
3v 1H NMR
CDCl3, 400 MHz
1.00
2.02
1.00
4.07
1.00
3.00
1.00
3.05
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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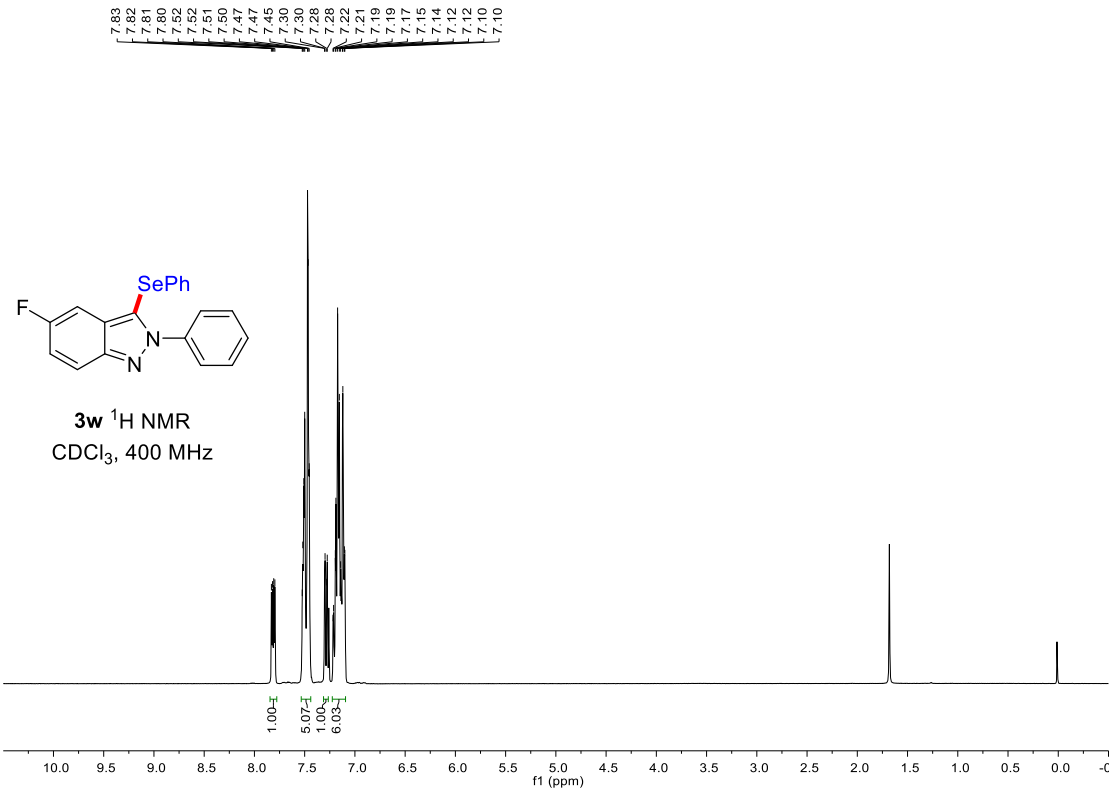
151.9
140.6
132.5
131.1
129.5
128.8
127.9
126.0
122.8
121.2
121.1
119.4
112.6
102.7
57.7
SePh
N
N
MeO
3v 13C NMR
CDCl3, 100 MHz
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10 −20
f1 (ppm)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7.80
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7.52
7.51
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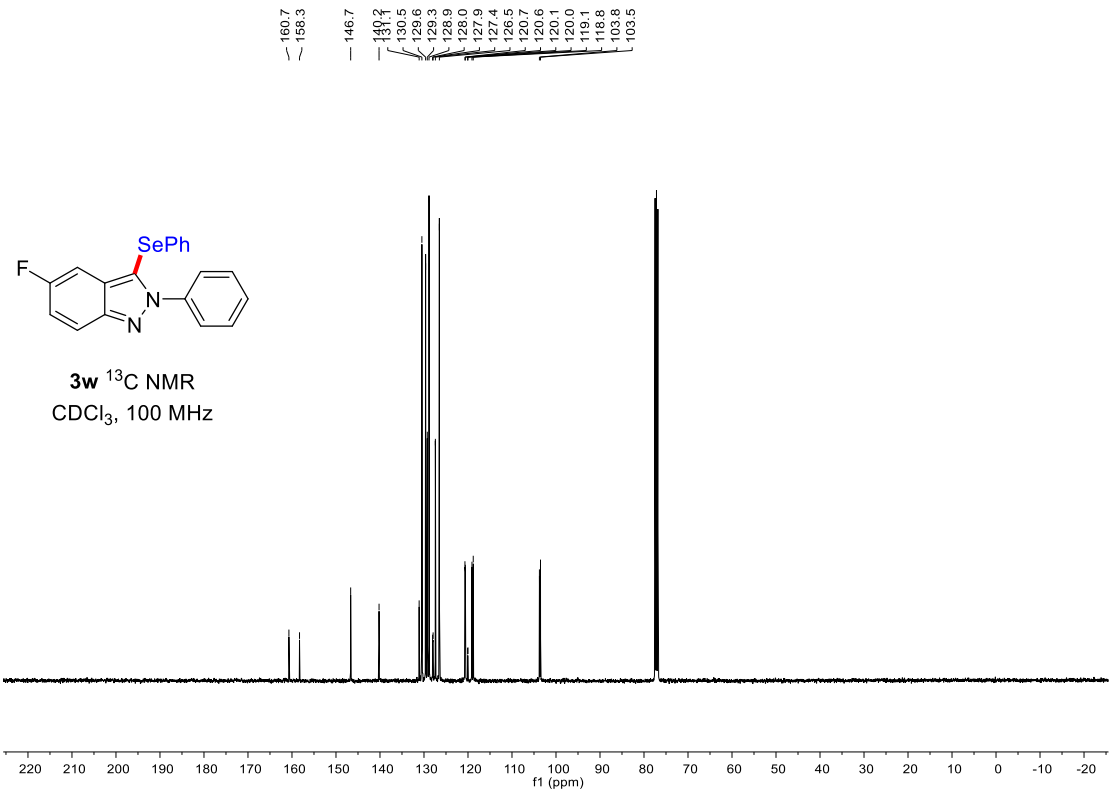
7.47
7.45
7.30
7.30
7.28
7.28
7.22
7.21
7.19
7.19
7.17
7.15
7.14
7.12
7.12
7.10
7.10
SePh
F
N
N
3w 1H NMR
CDCl3, 400 MHz
1.00
5.07
1.00
6.03
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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146.7
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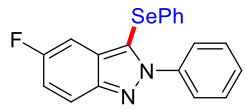
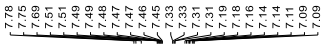
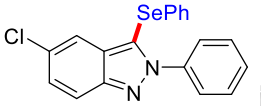
131.1
130.5
129.6
129.3
128.9
128.0
127.9
127.4
126.5
120.7
120.6
120.1
120.0
119.1
118.8
103.8
103.5
SePh
F
N
N
3w 13C NMR
CDCl3, 100 MHz
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

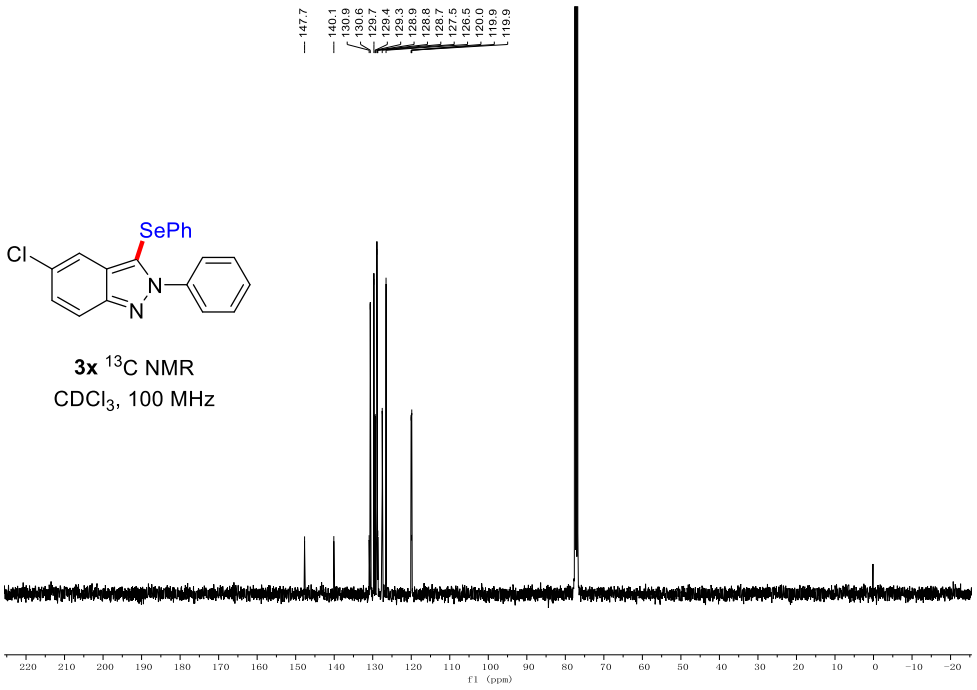


3w ^{19}F NMR
$CDCl_3$, 376 MHz

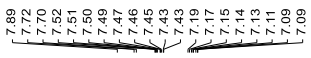


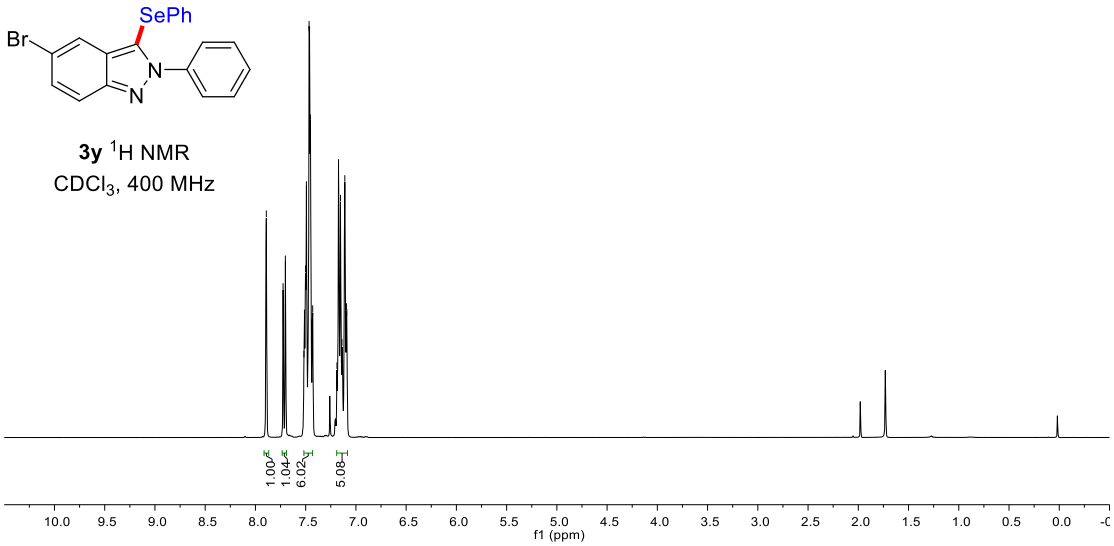


3x ^{1}H NMR
$CDCl_3$, 400 MHz

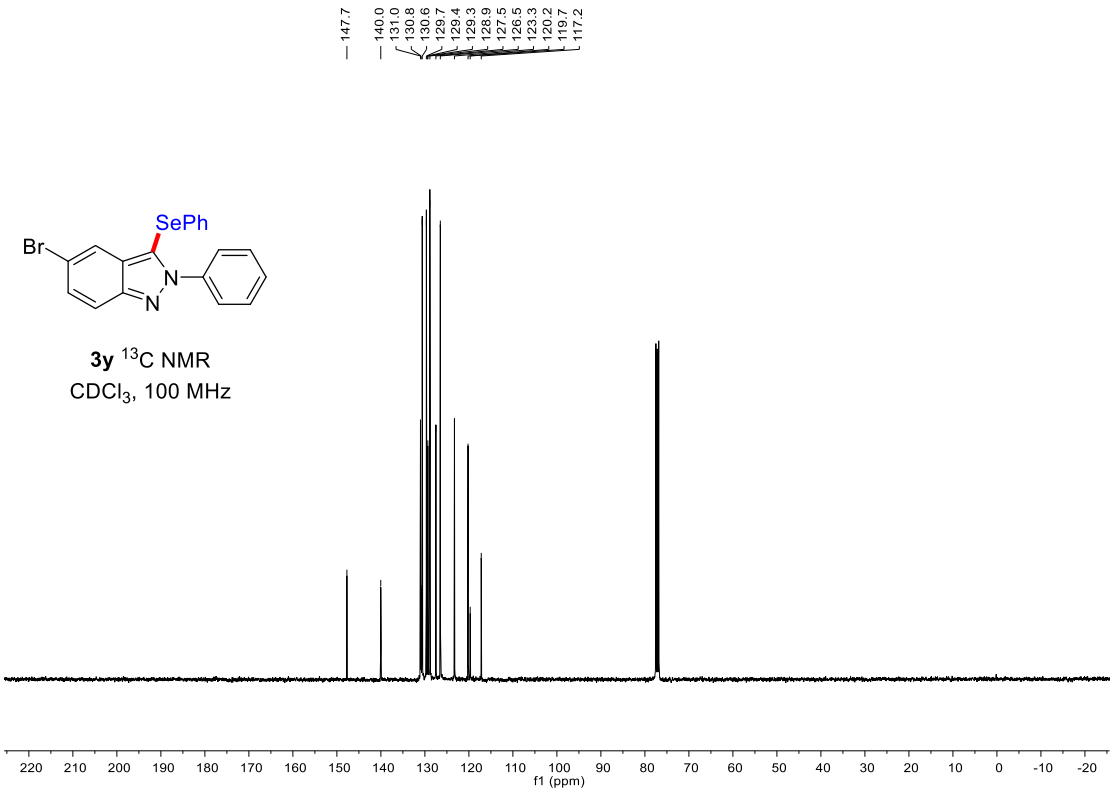


3x ^{13}C NMR
$CDCl_3$, 100 MHz

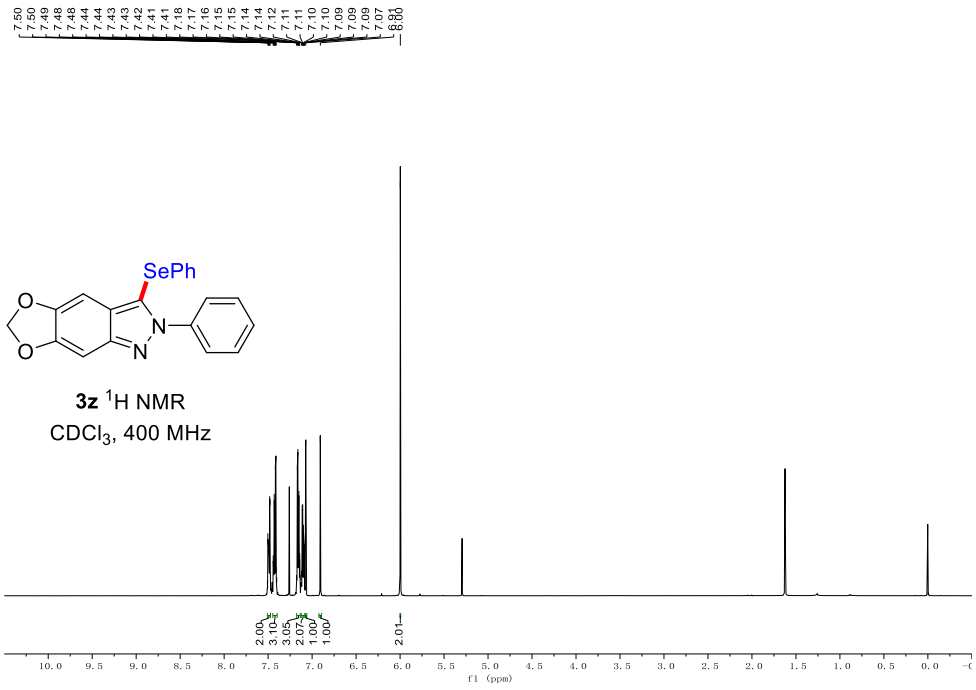




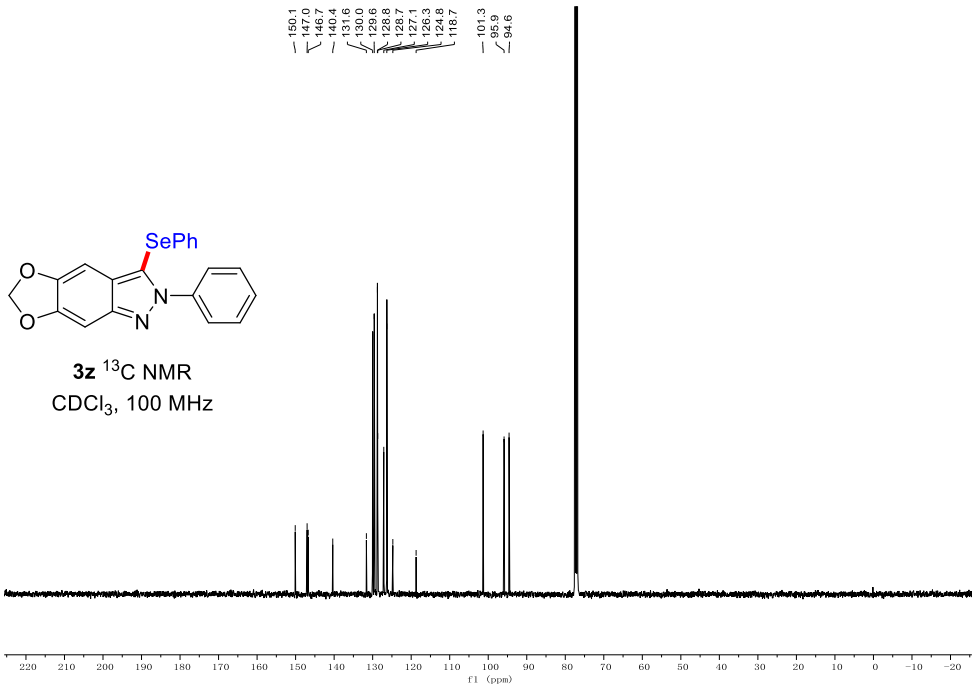
3y ^{1}H NMR
$CDCl_3$, 400 MHz



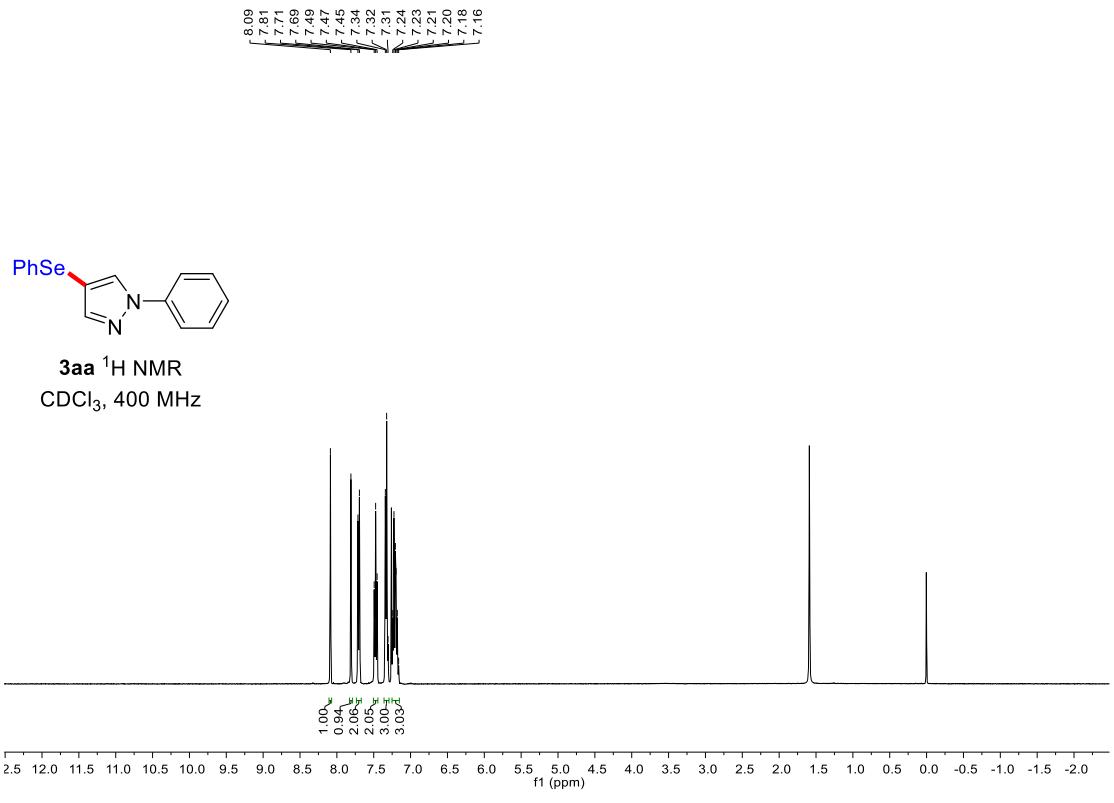
3y ^{13}C NMR
$CDCl_3$, 100 MHz



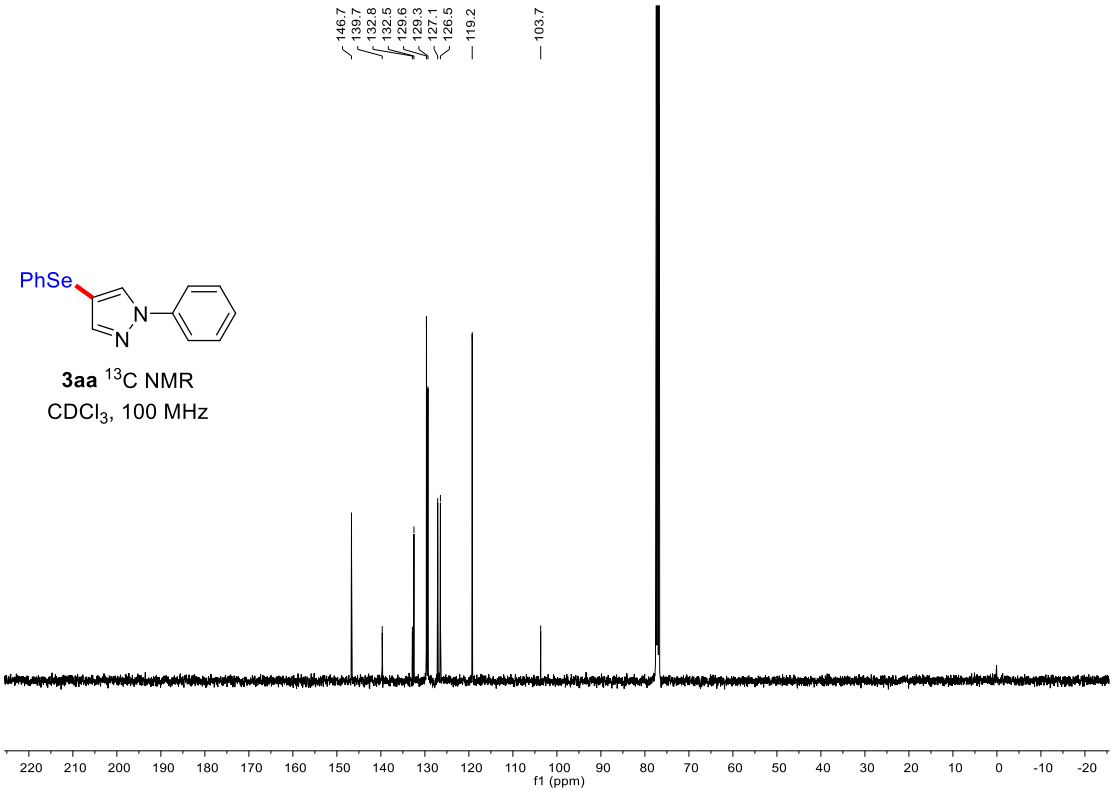
3z ^{1}H NMR
$CDCl_3$, 400 MHz



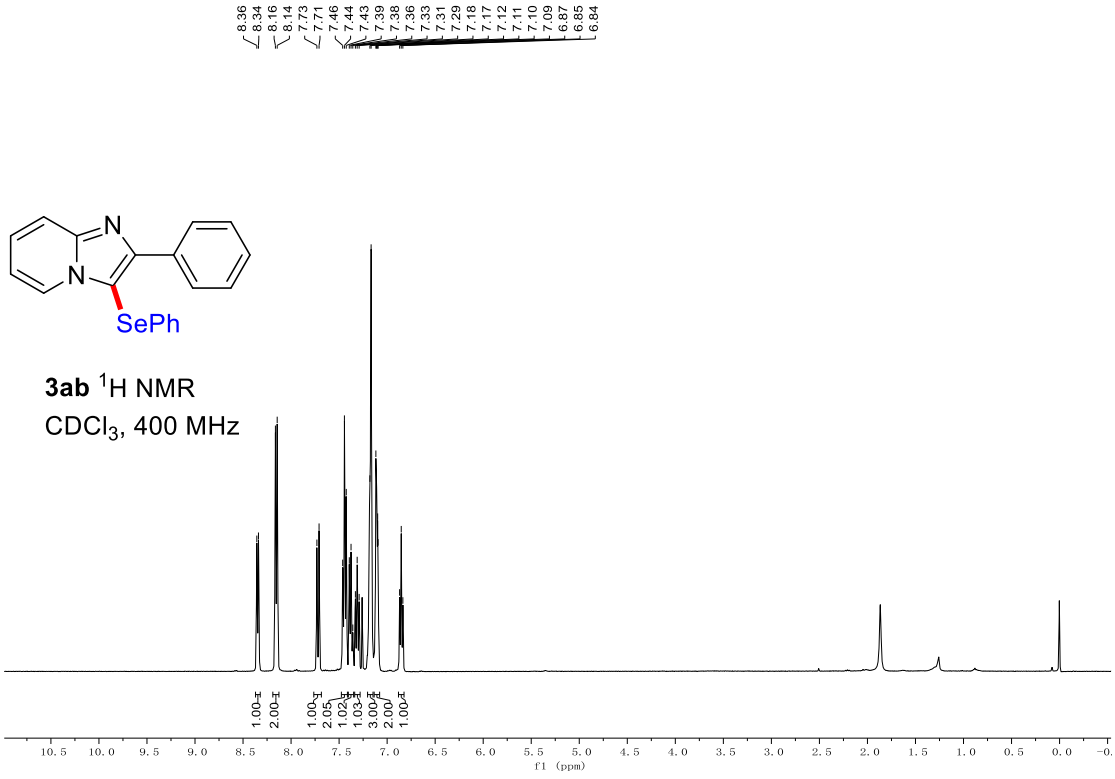
3z ^{13}C NMR
$CDCl_3$, 100 MHz



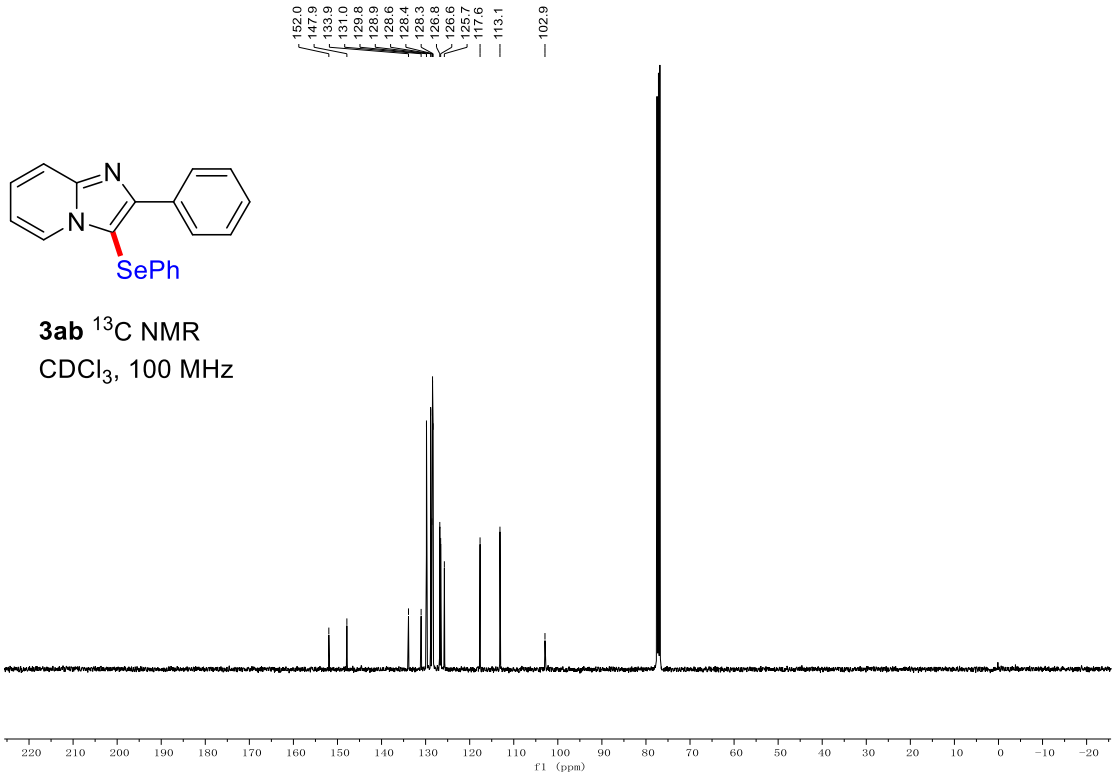
3aa ^{1}H NMR
$CDCl_3$, 400 MHz



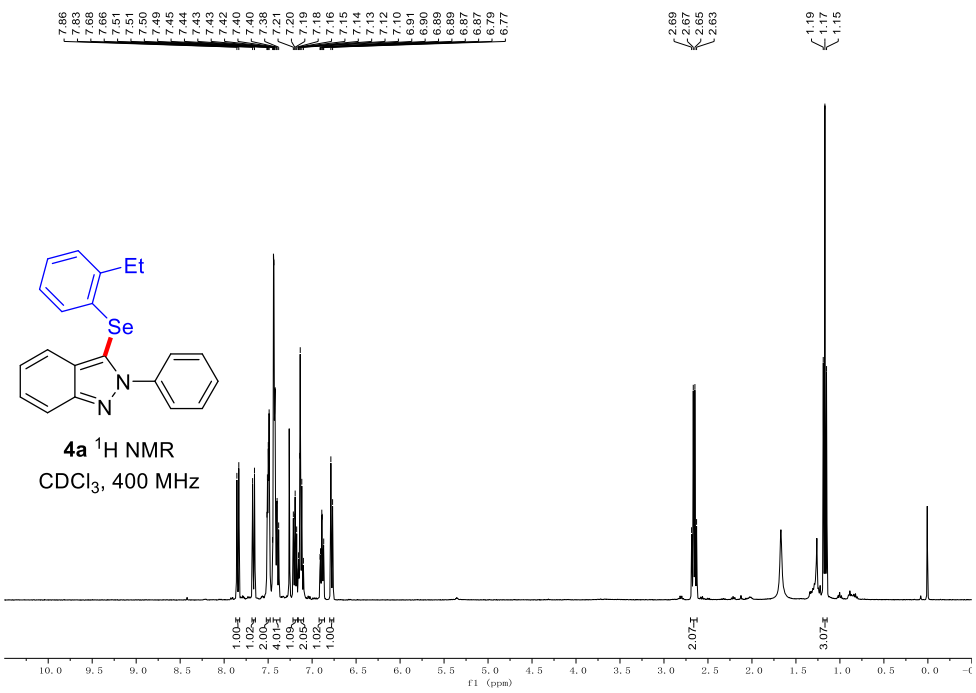
3aa ^{13}C NMR
$CDCl_3$, 100 MHz



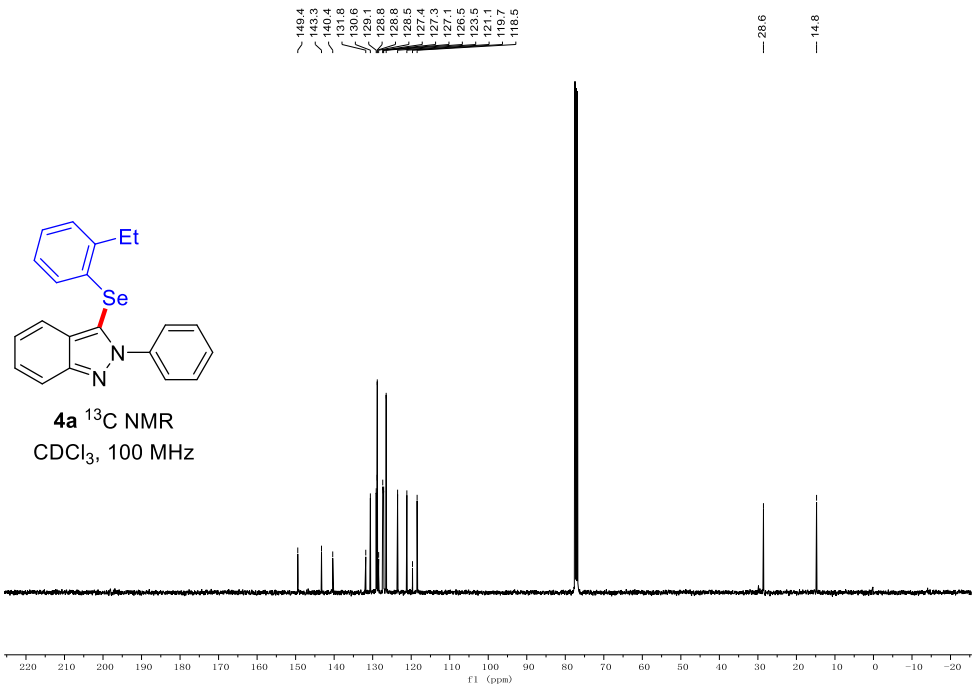
3ab ^{1}H NMR
$CDCl_3$, 400 MHz



3ab ^{13}C NMR
$CDCl_3$, 100 MHz



4a ^{1}H NMR
$CDCl_3$, 400 MHz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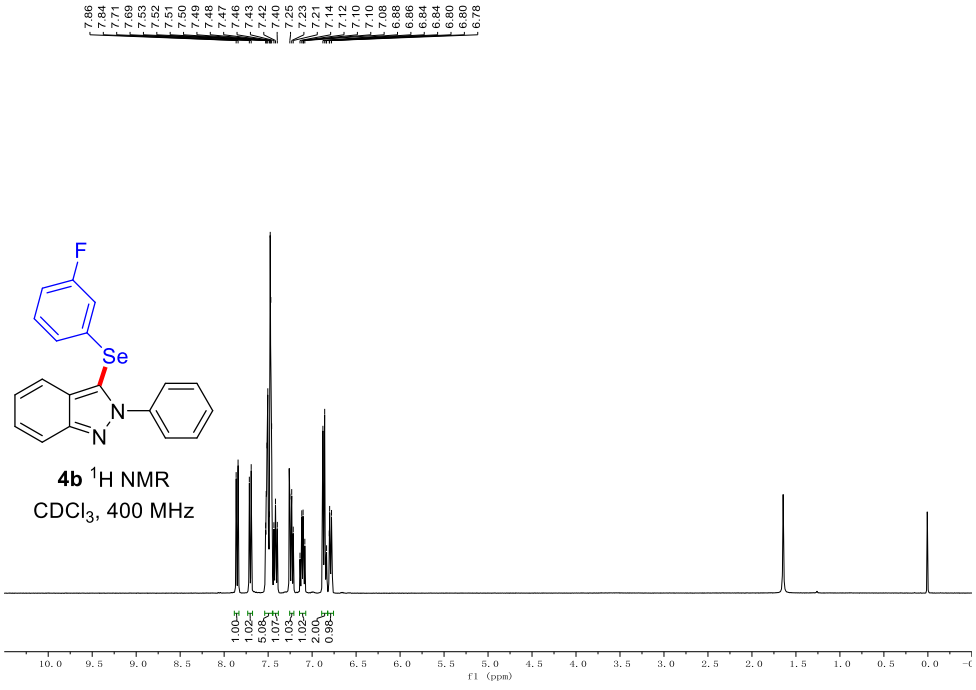
143.3
140.4
131.8
130.6
129.1
128.8
128.8
128.5
127.4
127.3
127.1
126.5
123.5
121.1
119.7
118.5
28.6
14.8
Et
Se
N
N
4a 13C NMR
CDCl3, 100 MHz
f1 (ppm)


7.86
7.84
7.71
7.69
7.53
7.52
7.51
7.50
7.49
7.48
7.47
7.46
7.43
7.42
7.40
7.25
7.23
7.21
7.14
7.12
7.10
7.08
6.88
6.86
6.84
6.84
6.80
6.80
6.78
F
Se
N
N
4b 1H NMR
CDCl3, 400 MHz
1.00
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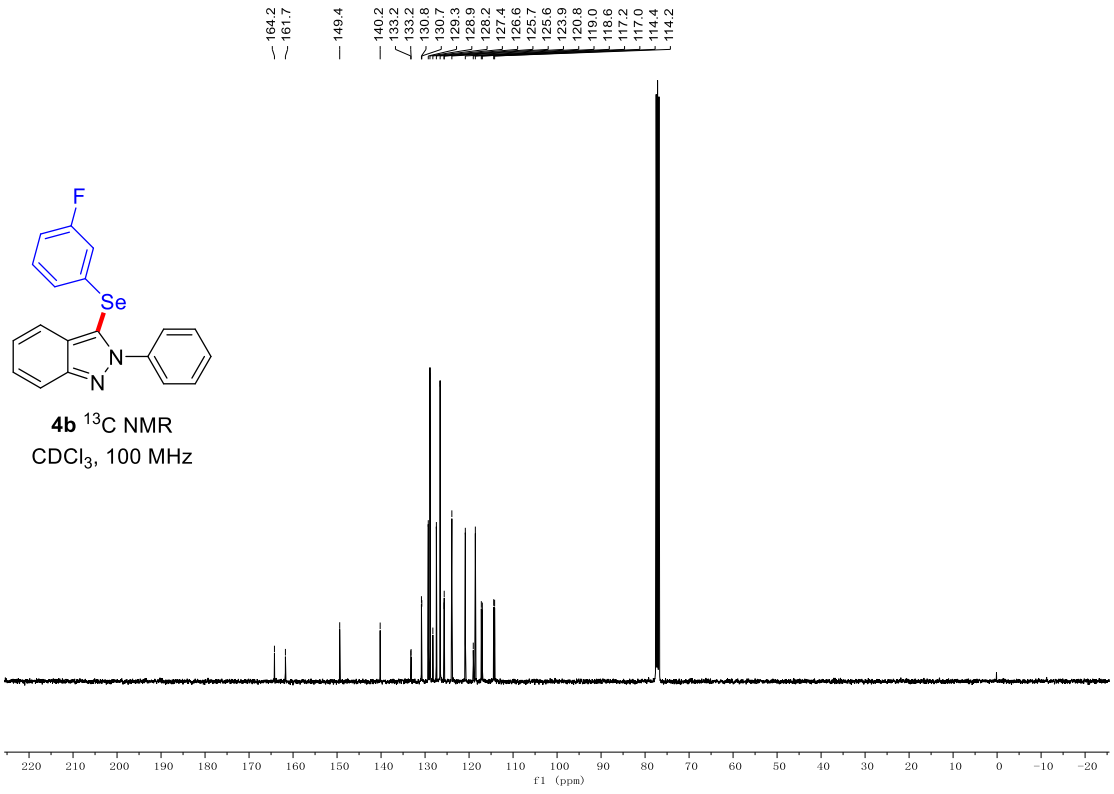
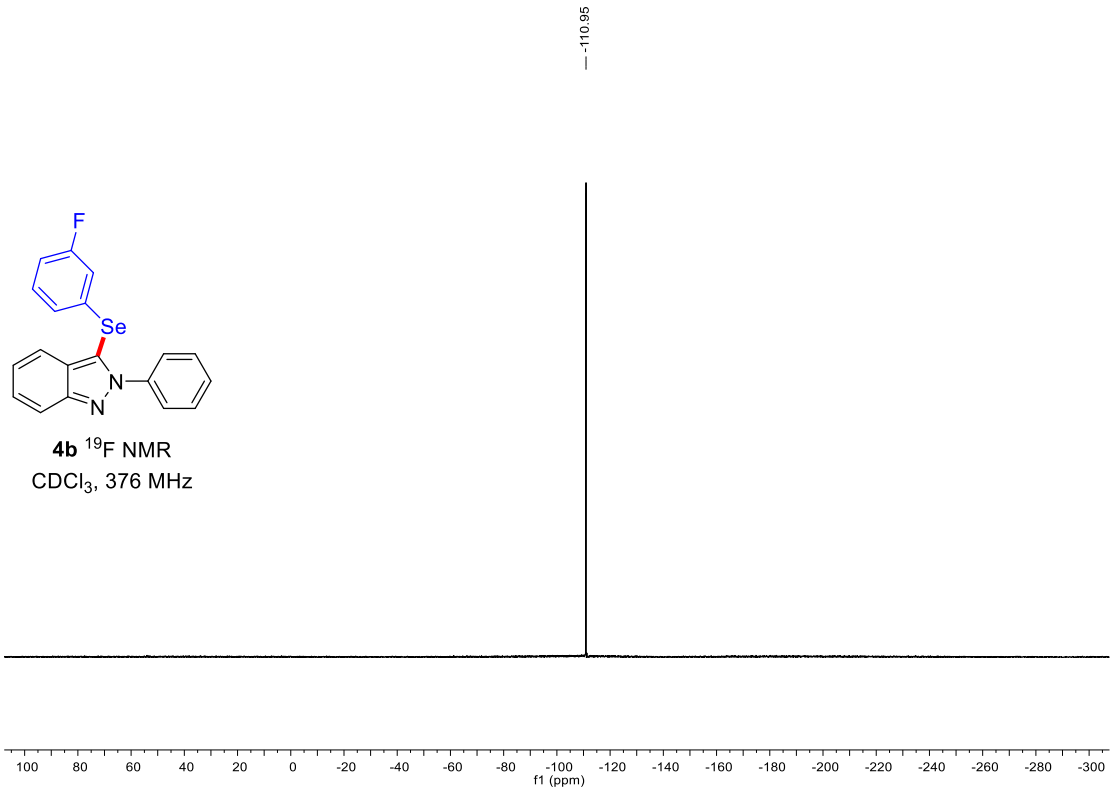
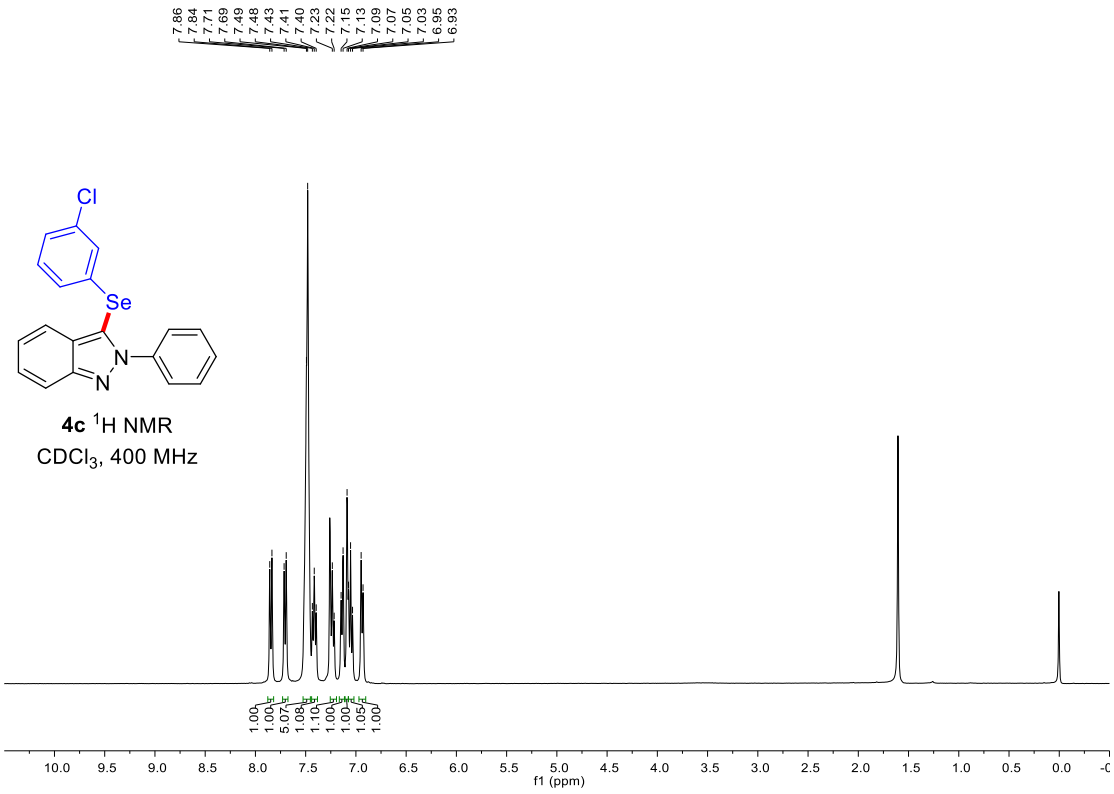
5.08
1.07
1.03
1.02
2.00
0.98
f1 (ppm)

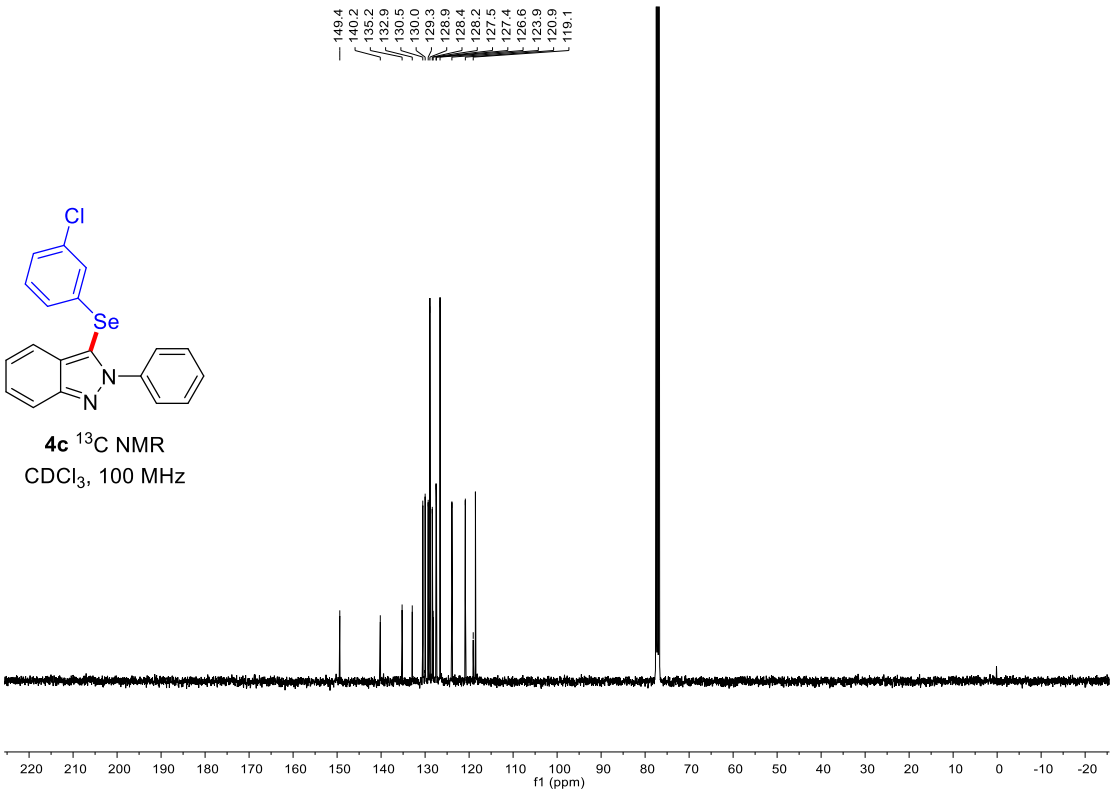


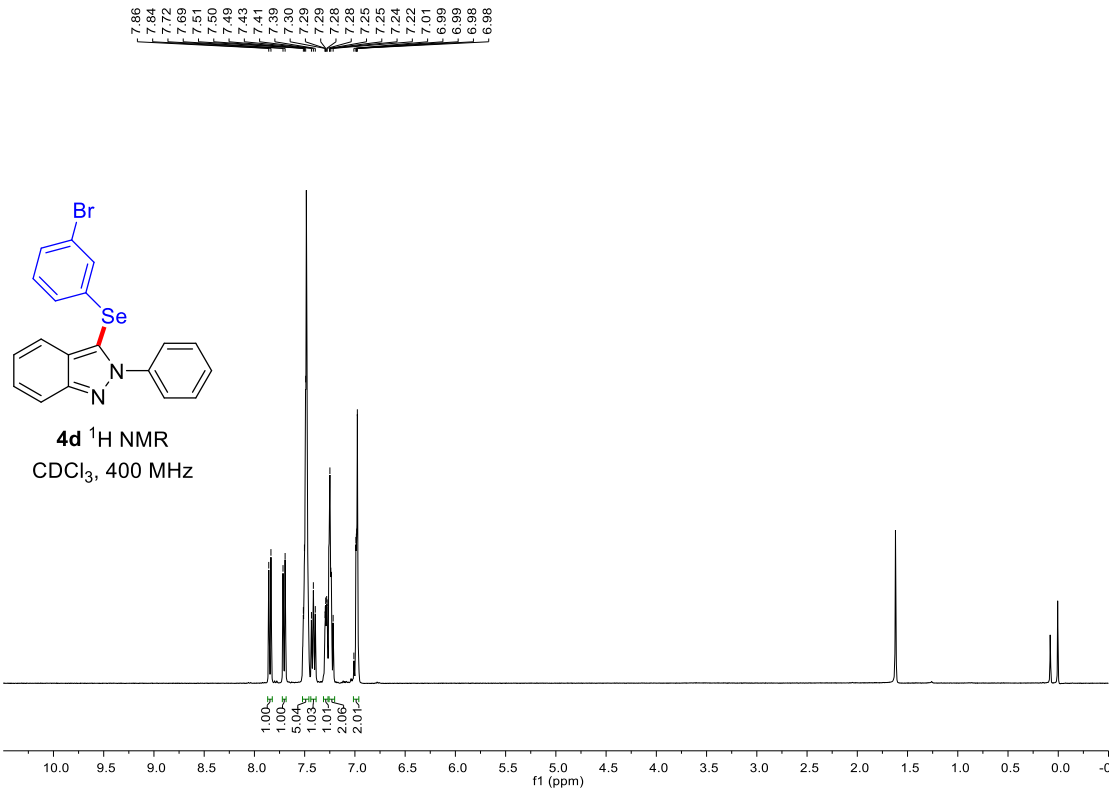
4b ^{13}C NMR
$CDCl_3$, 100 MHz



4b ^{19}F NMR
$CDCl_3$, 376 MHz


7.86
7.84
7.71
7.69
7.49
7.48
7.43
7.41
7.40
7.23
7.22
7.15
7.13
7.09
7.07
7.05
7.03
6.95
6.93
Cl
Se
N
N
4c 1H NMR
CDCl3, 400 MHz
1.00
1.00
5.07
1.08
1.10
1.00
1.00
1.05
1.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


149.4
140.2
135.2
132.9
130.5
130.0
129.3
128.9
128.4
128.2
127.5
127.4
126.6
123.9
120.9
119.1
Cl
Se
N
N
4c 13C NMR
CDCl3, 100 MHz
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)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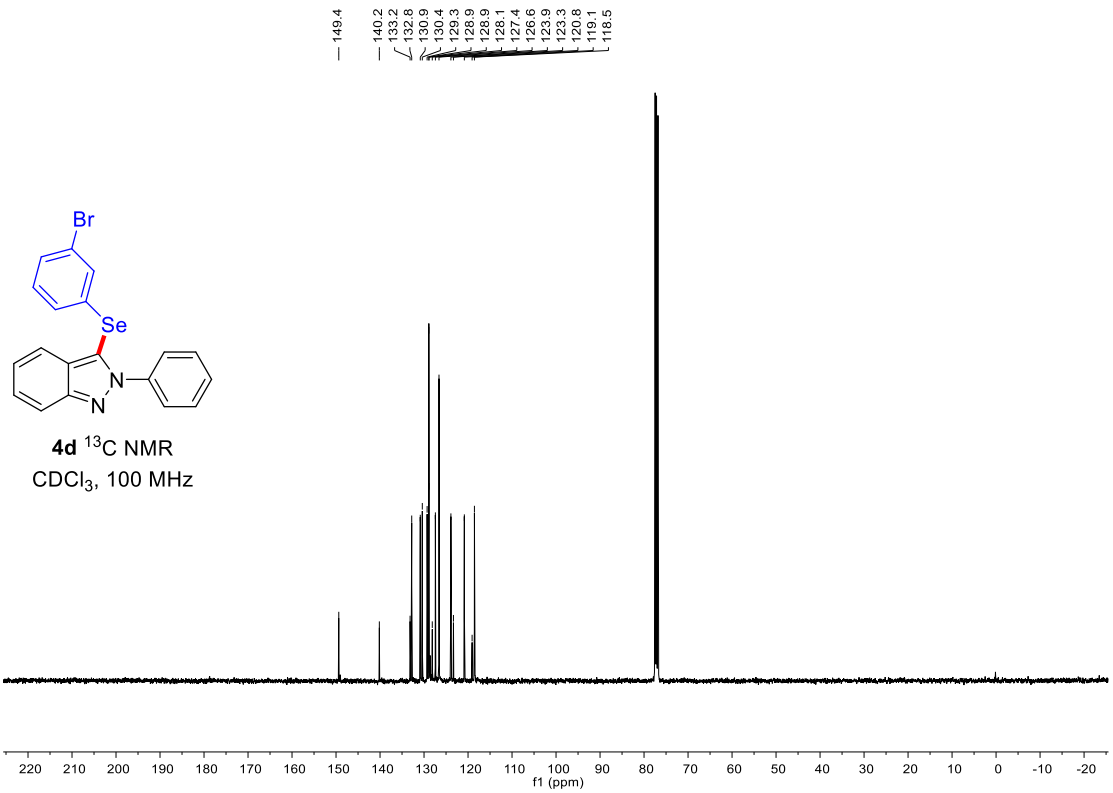
7.84
7.72
7.69
7.51
7.50
7.49
7.43
7.41
7.39
7.30
7.29
7.29
7.28
7.28
7.25
7.25
7.24
7.22
7.01
6.99
6.99
6.98
6.98
Br
Se
N
N
4d 1H NMR
CDCl3, 400 MHz
1.00
1.00
5.04
1.03
1.01
2.06
2.01
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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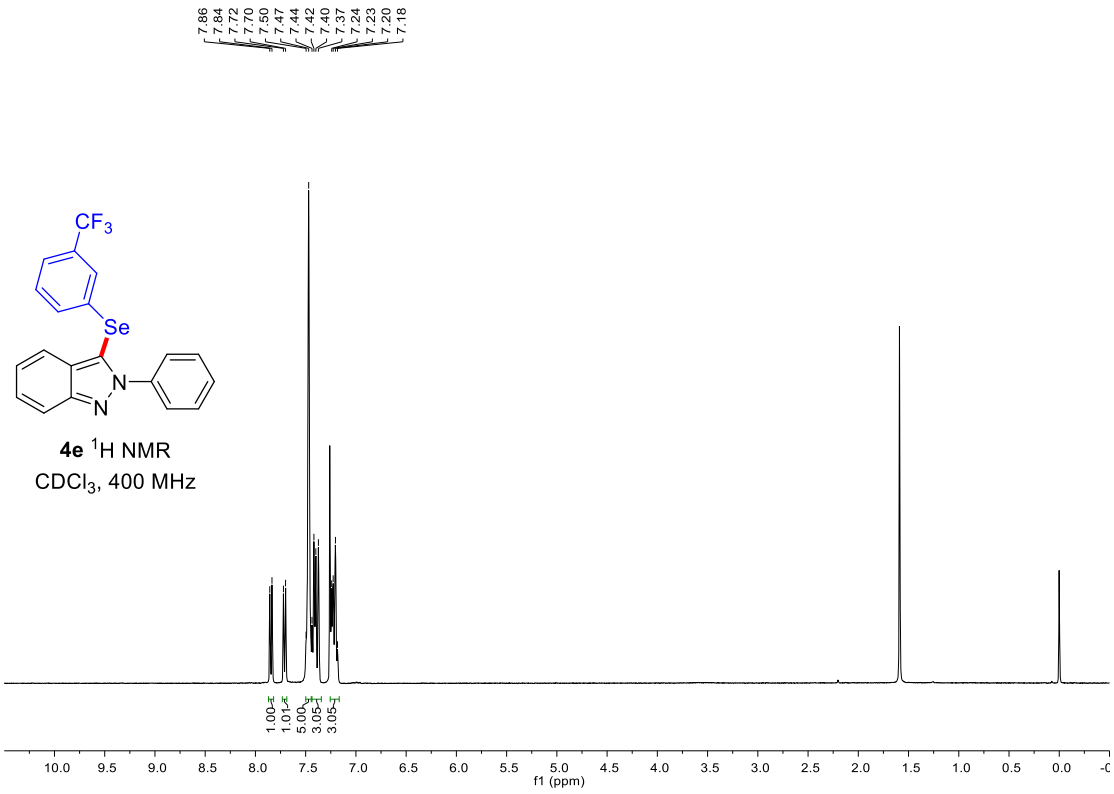
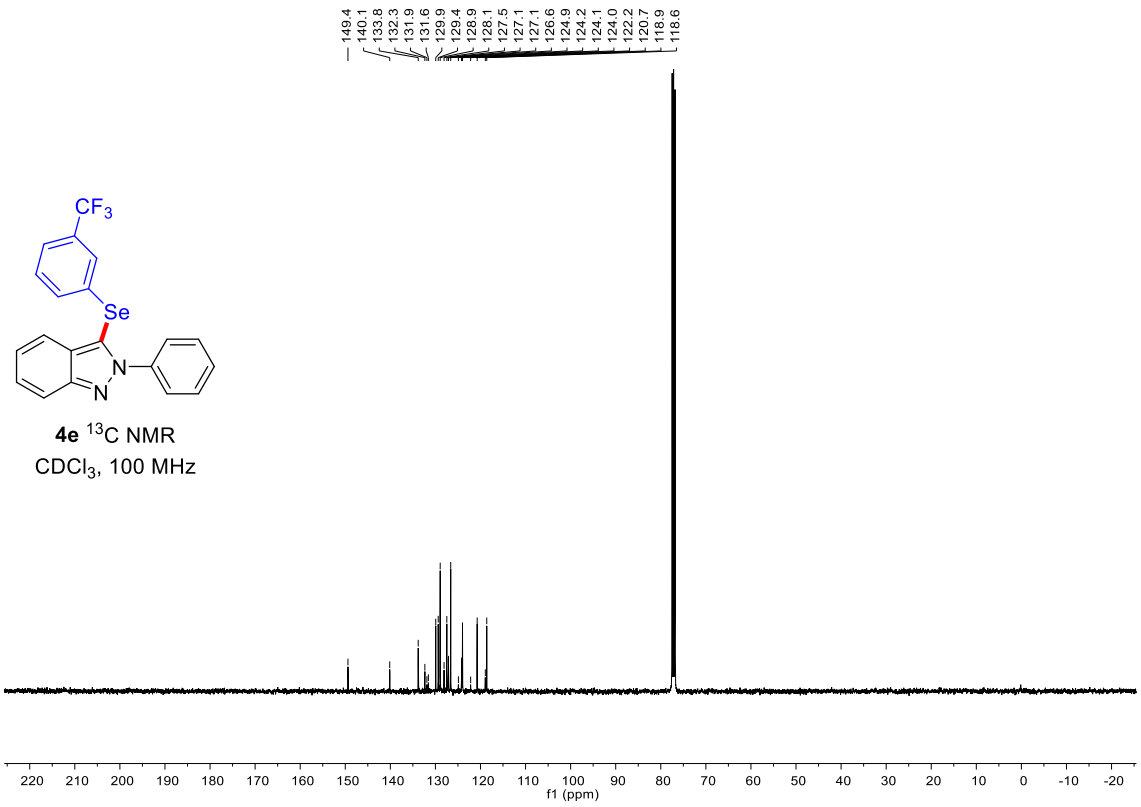
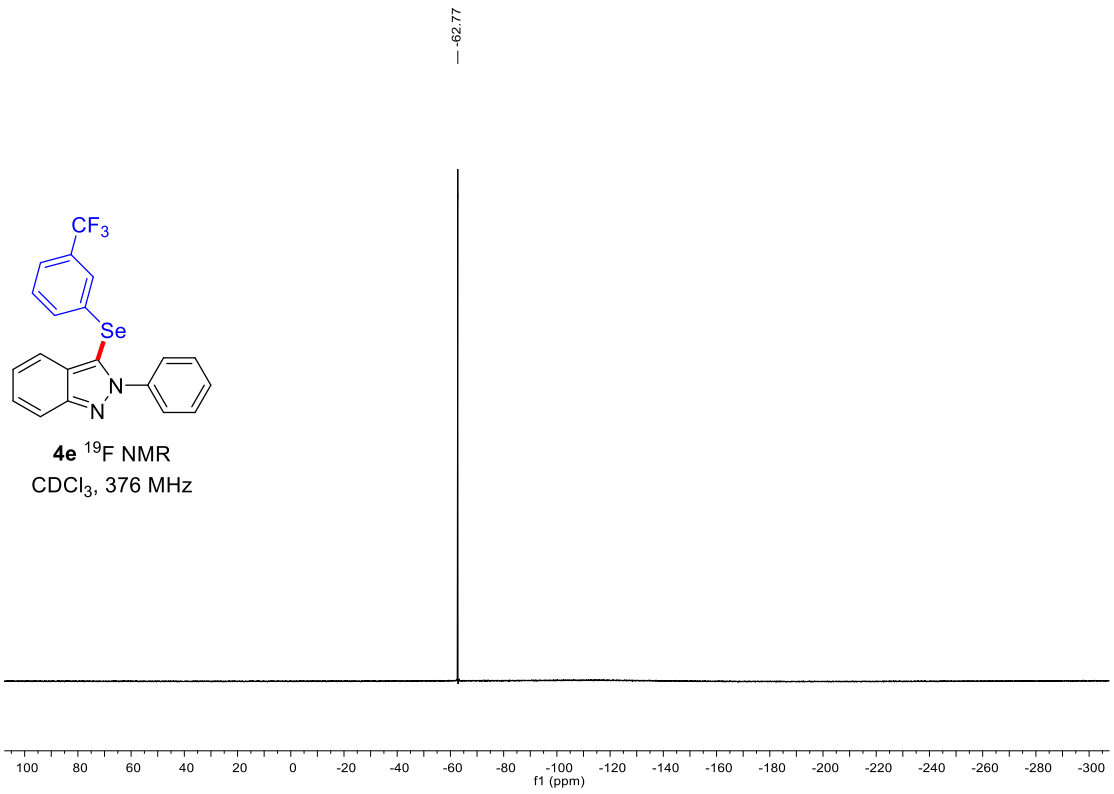
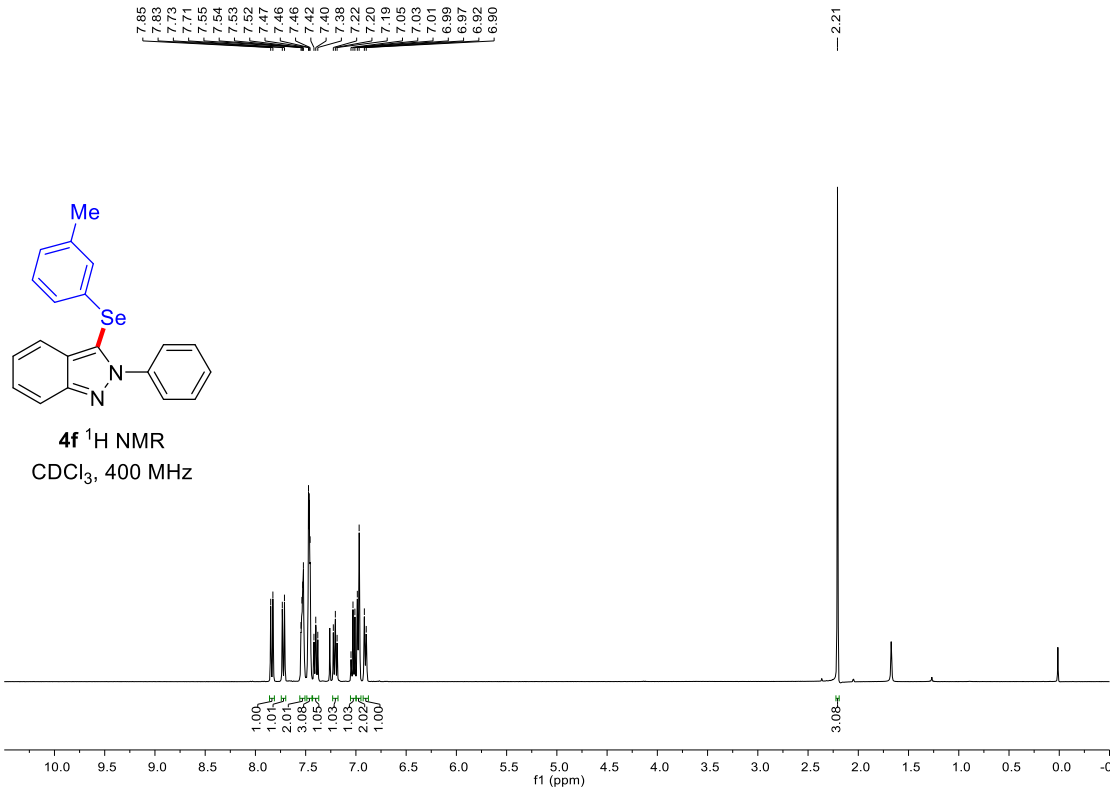
140.2
133.2
132.8
130.9
130.4
129.3
128.9
128.9
128.1
127.4
126.6
123.9
123.3
120.8
119.1
118.5
Br
Se
N
N
4d 13C NMR
CDCl3, 100 MHz
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
f1 (ppm)


7.86
7.84
7.72
7.70
7.50
7.47
7.44
7.42
7.40
7.37
7.24
7.23
7.20
7.18
CF3
Se
N
N
4e 1H NMR
CDCl3, 400 MHz
1.00
1.01
5.00
3.05
3.05
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

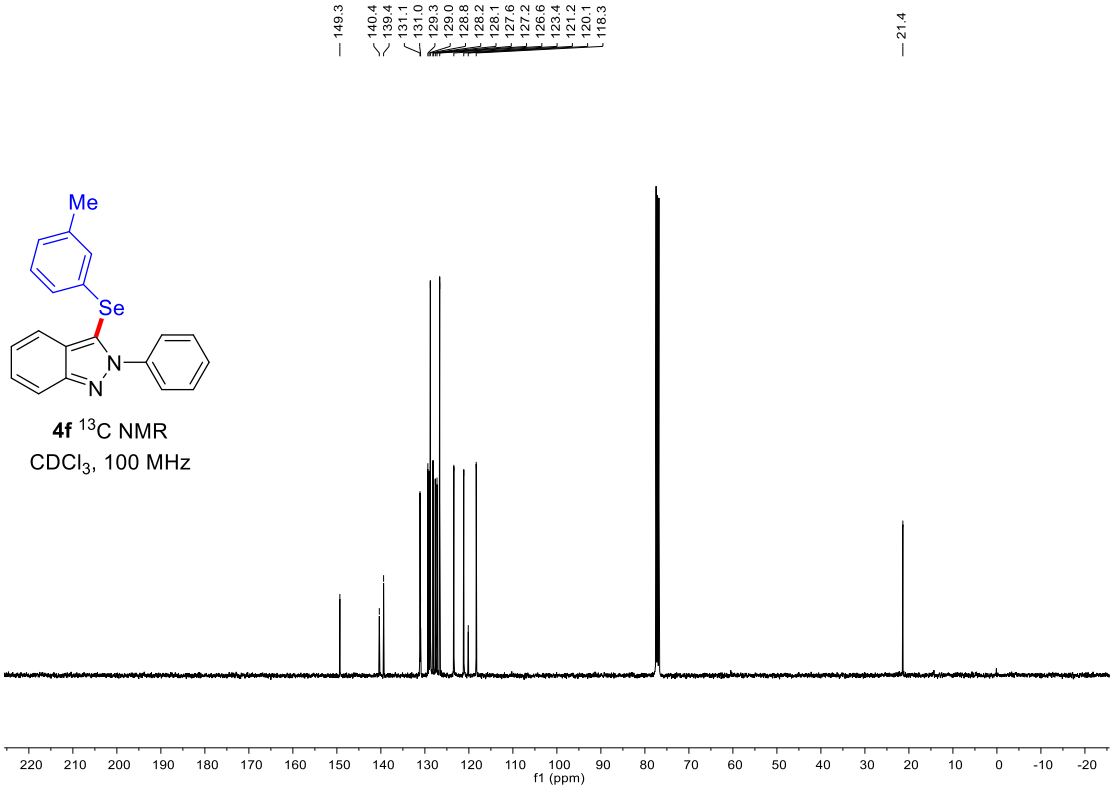

149.4
140.1
133.8
132.3
131.9
131.6
129.9
129.4
128.9
128.1
127.5
127.1
127.1
126.6
124.9
124.2
124.1
124.0
122.2
120.7
118.9
118.6
CF3
Se
N
N
4e 13C NMR
CDCl3, 100 MHz
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)



4e ^{19}F NMR
$CDCl_3$, 376 MHz



4f ^{1}H NMR
$CDCl_3$, 400 MHz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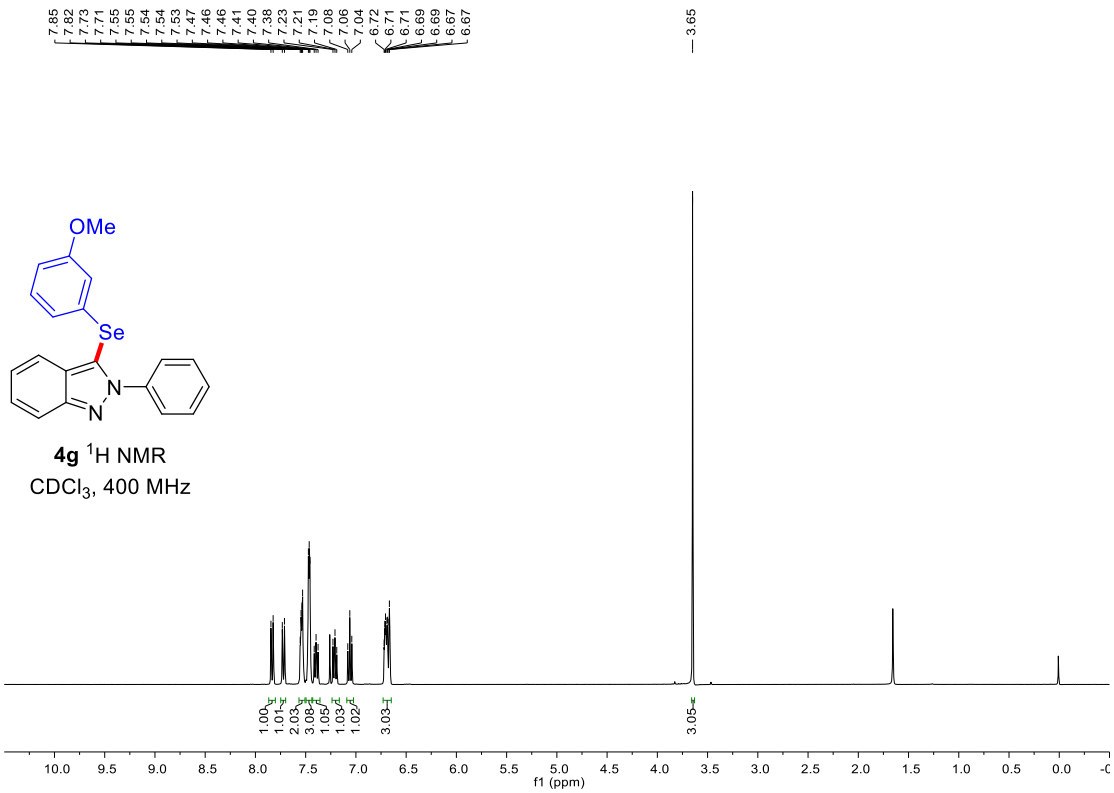
140.4
139.4
131.1
131.0
129.3
129.0
128.8
128.2
128.1
127.6
127.2
126.6
123.4
121.2
120.1
118.3
21.4
Me
Se
N
N
4f 13C NMR
CDCl3, 100 MHz
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)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7.71
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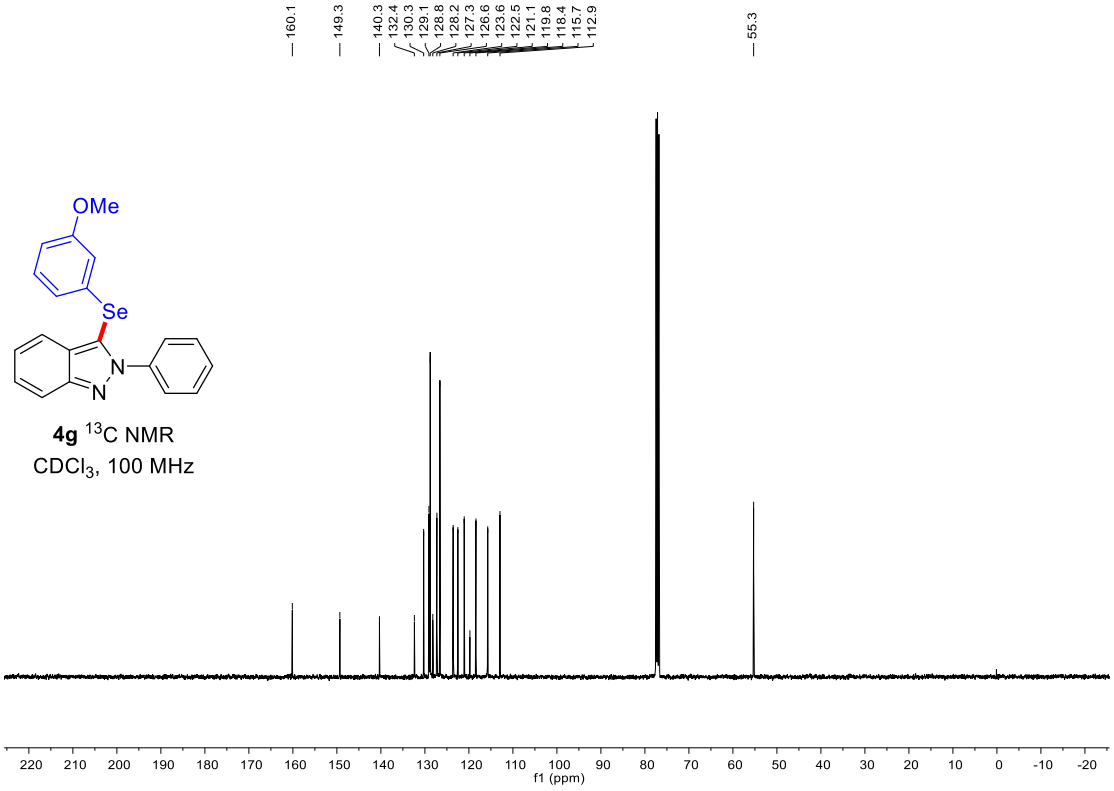
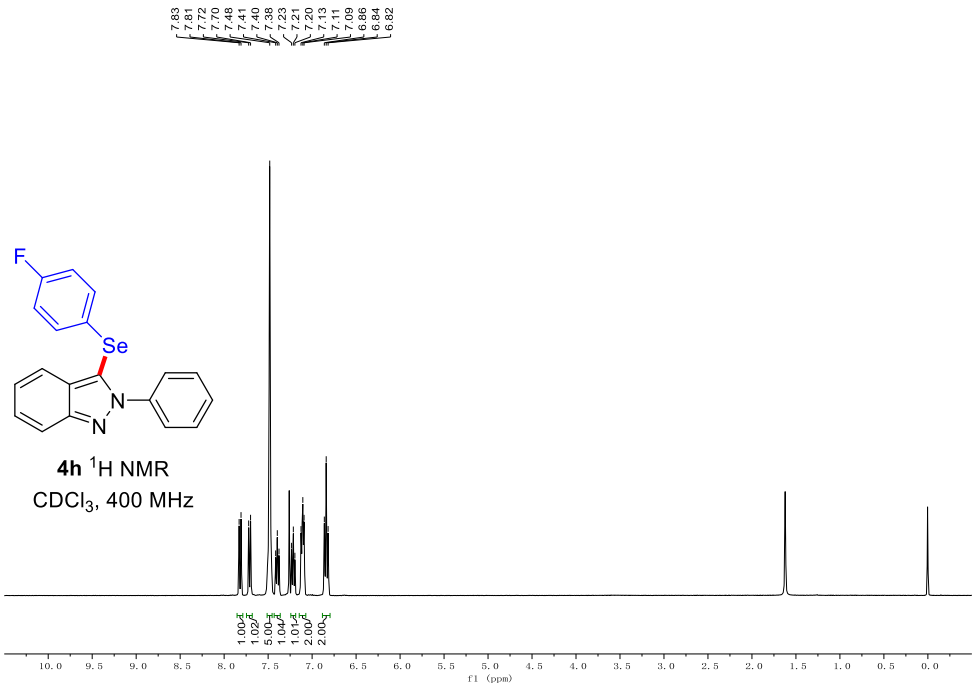
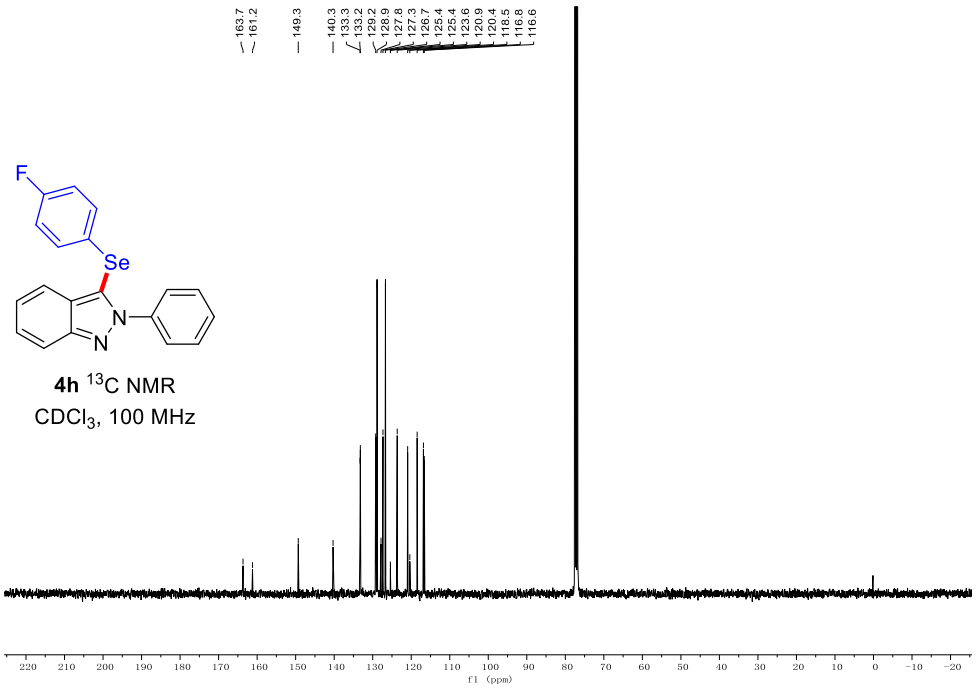
7.47
7.46
7.46
7.41
7.40
7.38
7.23
7.21
7.19
7.08
7.06
7.04
6.72
6.71
6.71
6.69
6.69
6.67
6.67
3.65
OMe
Se
N
N
4g 1H NMR
CDCl3, 400 MHz
1.00
1.01
2.03
3.08
1.05
1.03
1.02
3.03
3.05
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)



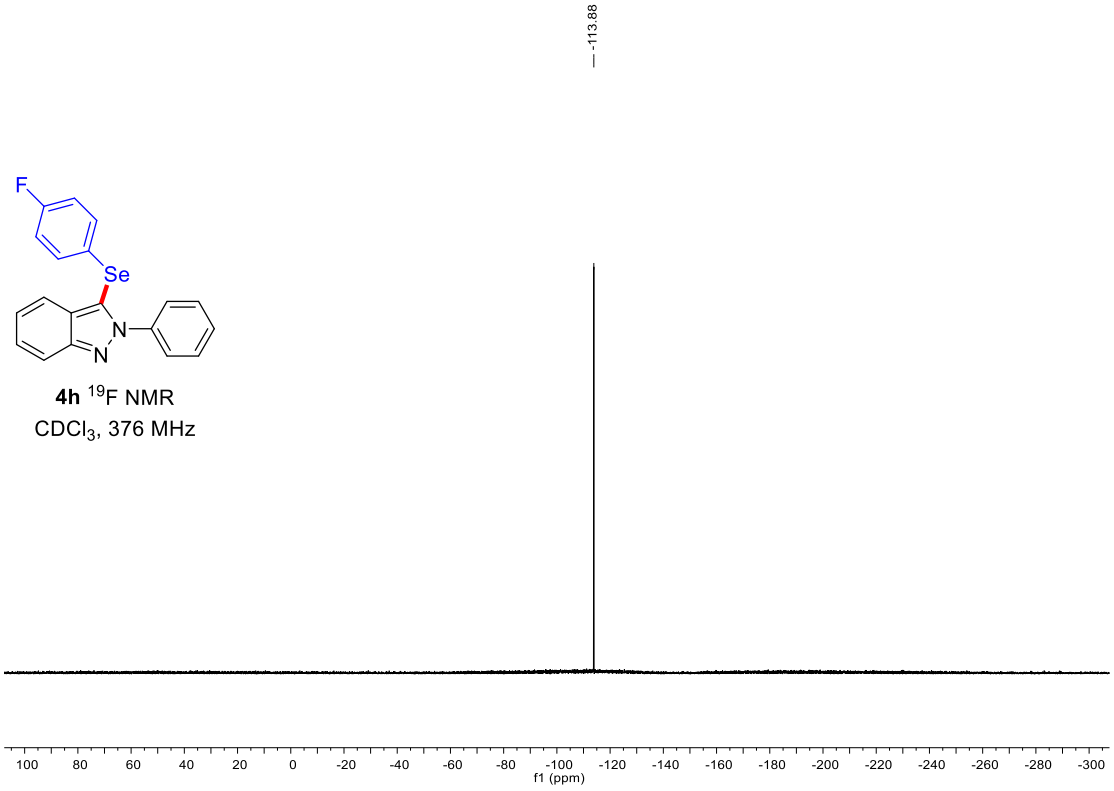
4g ^{13}C NMR
$CDCl_3$, 100 MHz



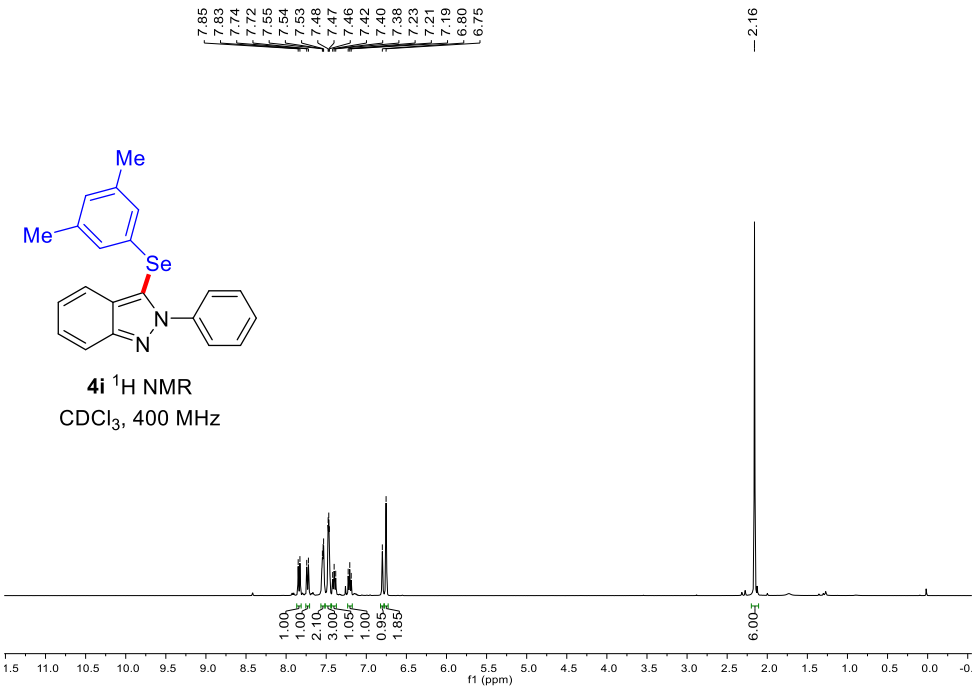
4h ^{1}H NMR
$CDCl_3$, 400 MHz



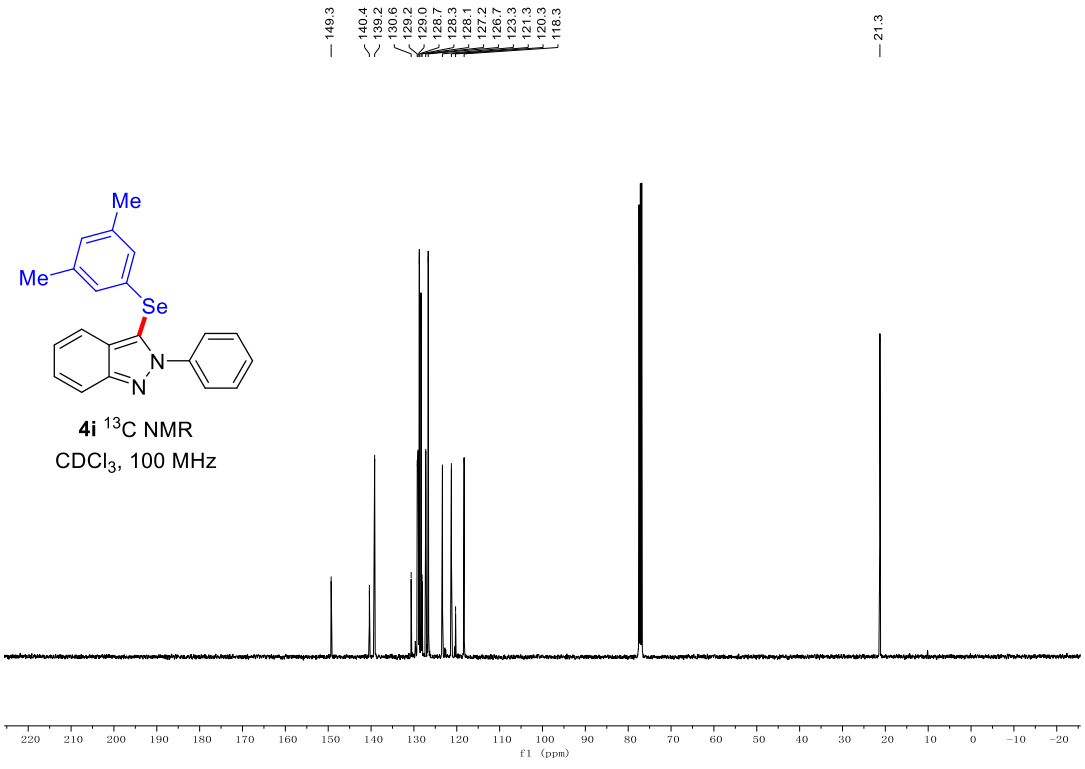
4h ^{13}C NMR
$CDCl_3$, 100 MHz



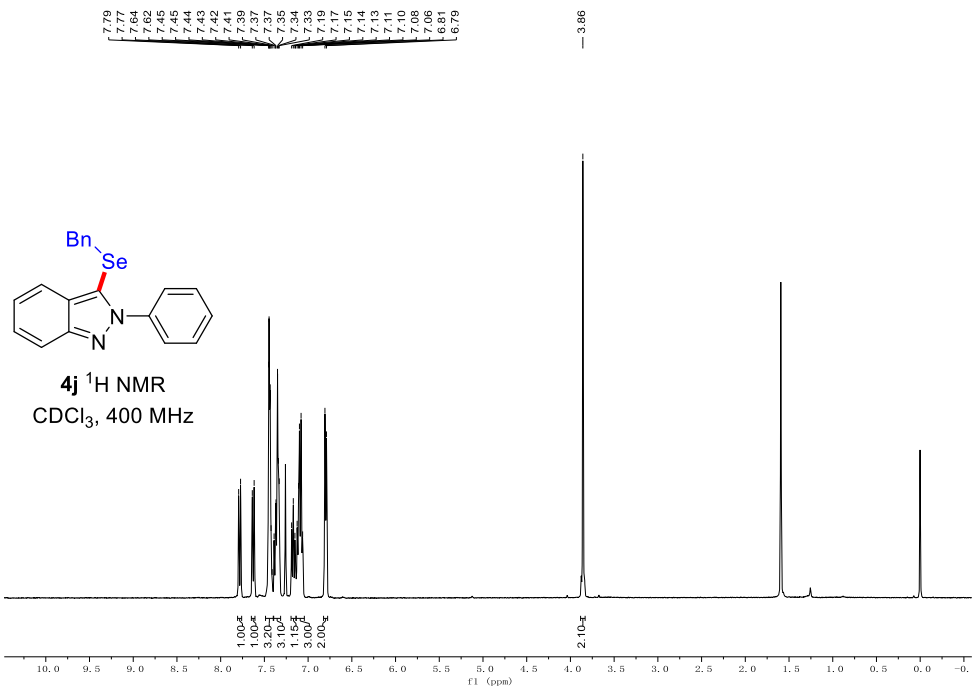
4h ^{19}F NMR
$CDCl_3$, 376 MHz



4i ^{1}H NMR
$CDCl_3$, 400 MHz



4i ^{13}C NMR
$CDCl_3$, 100 MHz


7.79
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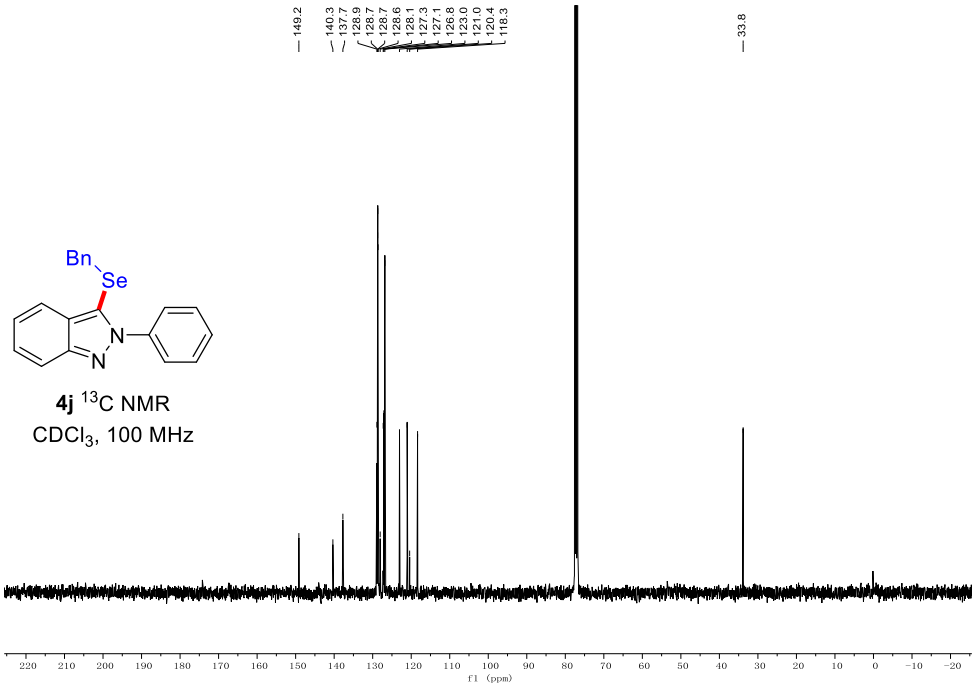
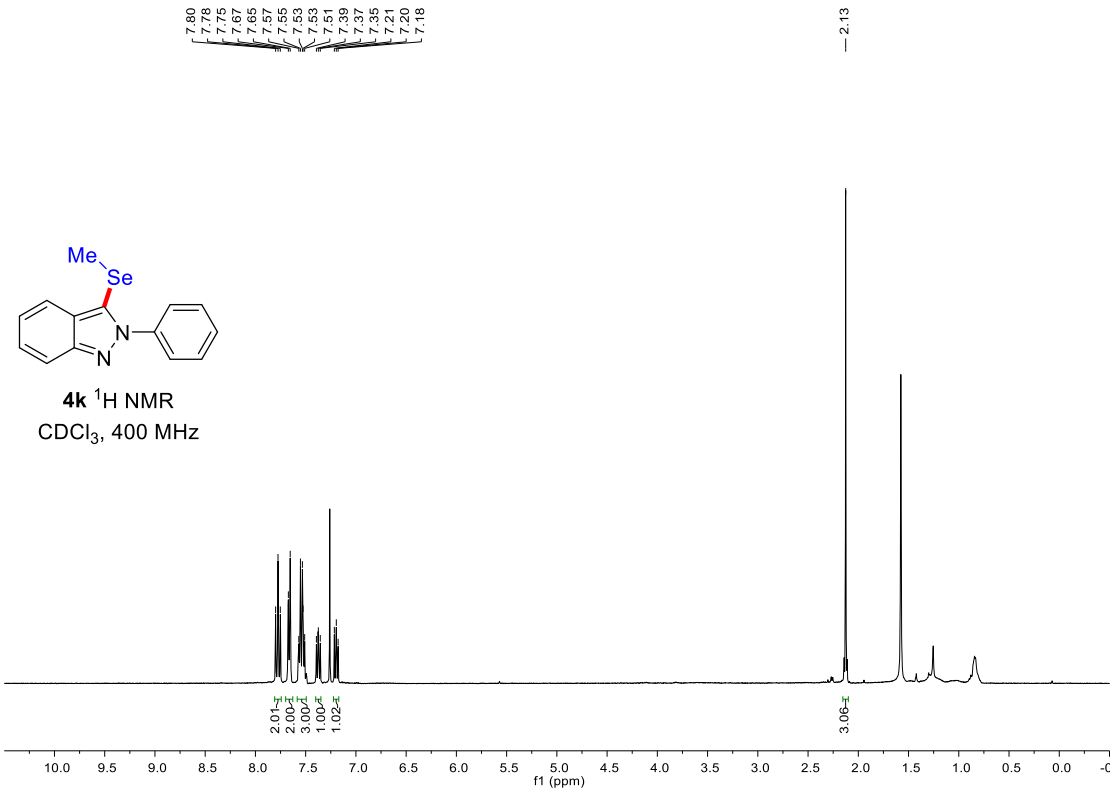
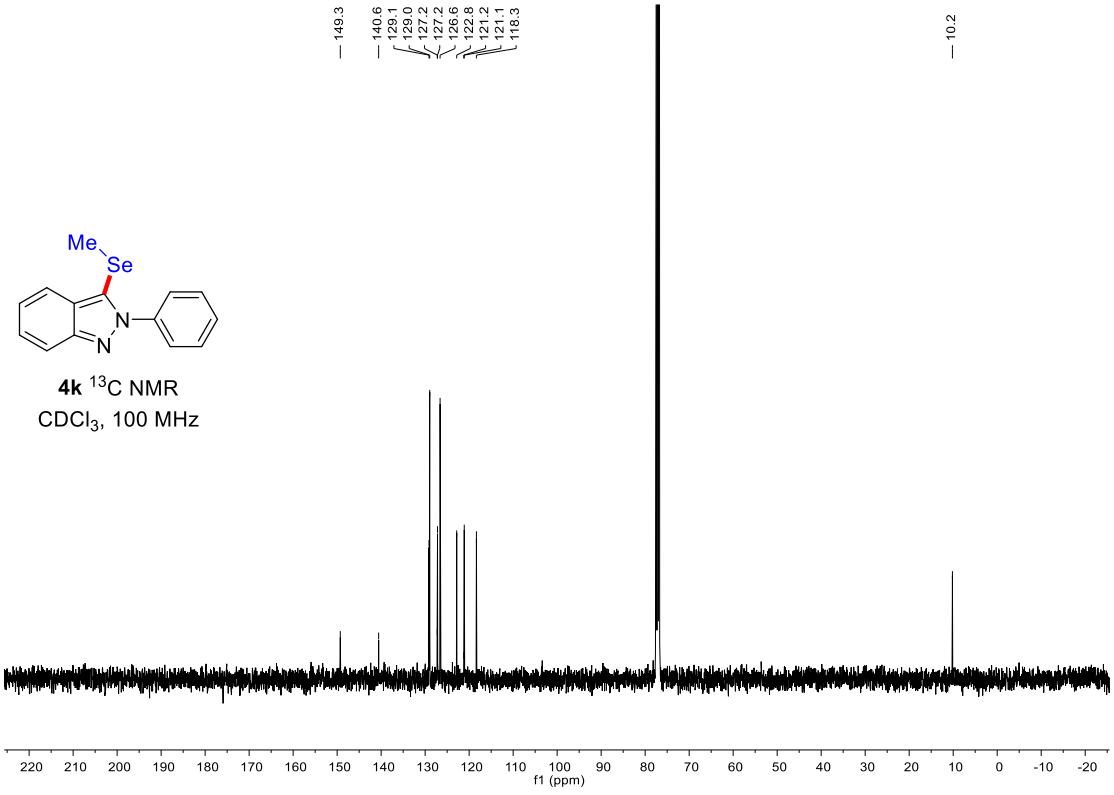
7.45
7.45
7.44
7.43
7.42
7.41
7.39
7.37
7.37
7.35
7.34
7.33
7.19
7.17
7.15
7.14
7.13
7.11
7.10
7.08
7.06
6.81
6.79
3.86
Bn
Se
N
N
4j 1H NMR
CDCl3, 400 MHz
1.00
1.00
3.10
1.15
3.00
2.00
2.10
f1 (ppm)

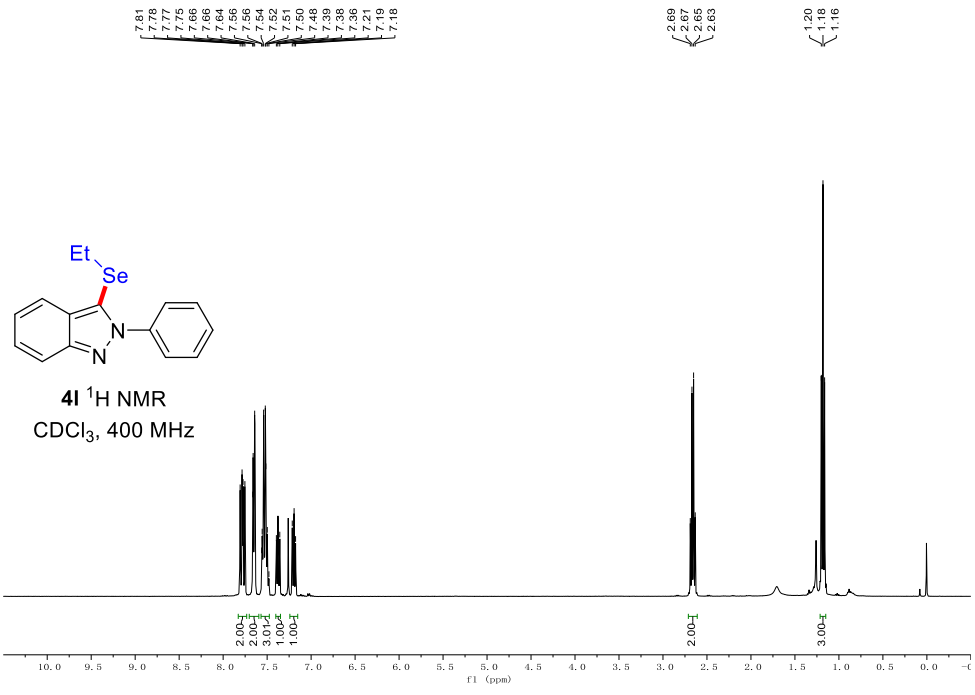

149.2
140.3
137.7
128.9
128.7
128.7
128.6
128.1
127.3
127.1
126.8
123.0
121.0
120.4
118.3
33.8
Bn
Se
N
N
4j 13C NMR
CDCl3, 100 MHz
f1 (ppm)

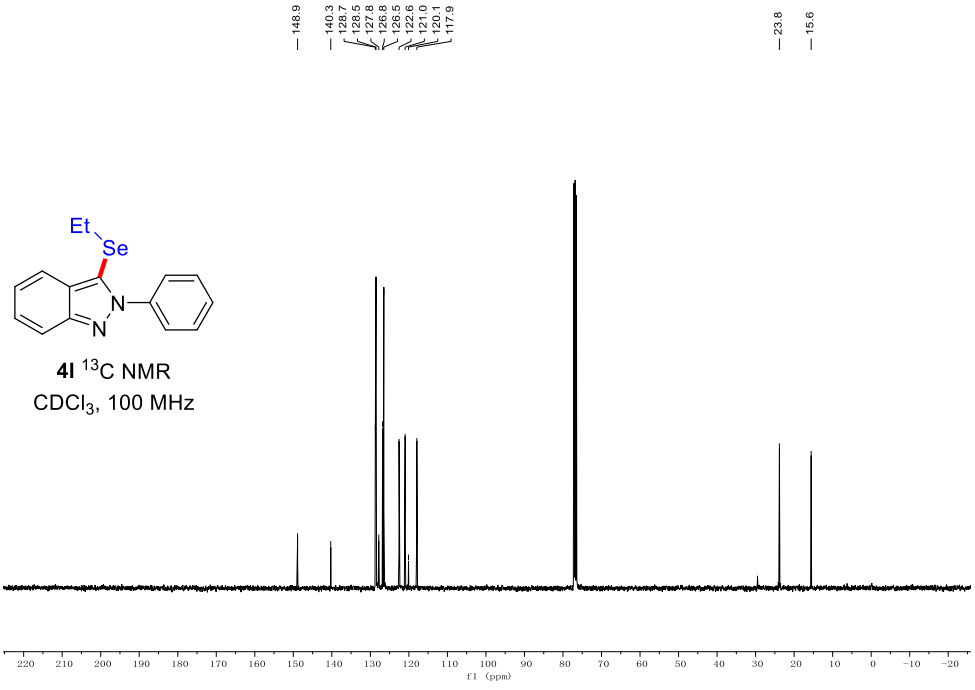


4k ^{1}H NMR
$CDCl_3$, 400 MHz



4k ^{13}C NMR
$CDCl_3$, 100 MHz


7.81
7.78
7.77
7.75
7.66
7.66
7.64
7.56
7.56
7.54
7.52
7.51
7.50
7.48
7.39
7.38
7.36
7.21
7.19
7.18
2.69
2.67
2.65
2.63
1.20
1.18
1.16
Et
Se
N
N
4l ^{1}H NMR
$CDCl_3$, 400 MHz
2.00
2.00
3.01
1.00
1.00
2.00
3.00
f1 (ppm)


148.9
140.3
128.7
128.5
127.8
126.8
126.5
122.6
121.0
120.1
117.9
23.8
15.6
Et
Se
N
N
4l ^{13}C NMR
$CDCl_3$, 100 MHz
f1 (ppm)