Supporting Information

for

A one-pot telescopic synthesis of benzo[*b*]carbazoles and exploration of their liquid crystalline properties

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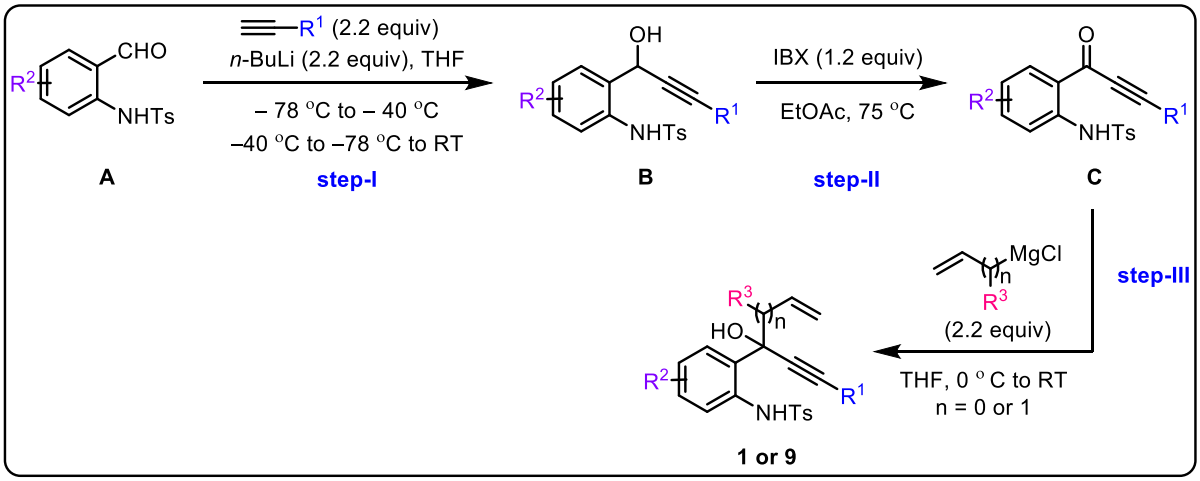
General experimental methods

All the reagents, solvents, and catalysts employed in this study were procured from Sigma-Aldrich and were used without further purification. For thin-layer chromatography (TLC), silica aluminum foils with fluorescent indicator 254 nm (from Aldrich) were used, and compounds were visualized by irradiation with UV light and/or by treatment with a solution of *p*-anisaldehyde (23 mL), conc. H_2SO_4 (35 mL) and acetic acid (10 mL) in ethanol (900 mL) followed by heating. Column chromatography was performed using SD Fine silica gel 60-120 mesh (approximately 15–20 g per 1 g of the crude product). Dry THF was obtained by distillation over sodium and stored over sodium wire. As indicated, IR spectra were recorded on a Perkin–Elmer FT IR spectrometer as thin films or KBr pellets, with *ν*max in inverse centimeters. Melting points were recorded on a digital melting point apparatus Stuart SMP30. ^{1}H NMR, ^{13}C NMR, and ^{19}F NMR spectra were recorded on a 400 MHz Bruker Biospin Avance III FT-NMR spectrometer. NMR shifts are reported as delta (δ) units in parts per million (ppm), and coupling constants (*J*) are reported in Hertz (Hz). The following abbreviations are utilized to describe peak patterns when appropriate: br=broad, s=singlet, d=doublet, t=triplet, q=quartet, and m=multiplet. Proton chemical shifts are given in δ relative to tetramethylsilane (δ 0.00 ppm) in $CDCl_3$ (δ 7.26 ppm) or in $(CD_3)_2SO$ (δ 2.50 ppm). Carbon chemical shifts are internally referenced to the deuterated solvent signals in $CDCl_3$ (δ 77.1 ppm) or (($(CD_3)_2SO$ (δ 39.5 ppm). Single crystal X-ray analysis was carried out on a Rigaku XtaLAB mini diffractometer. High-resolution mass spectra were recorded on a Waters QTOF mass spectrometer.

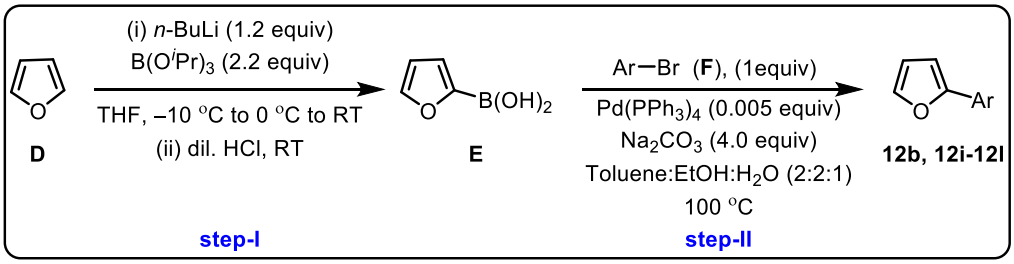
General procedure-1: Synthesis of 3-(2-aminophenyl)hex-5-en-1-yn-3-ols (1a-1h and 1p-1r) and 3-(2-aminophenyl)hept-6-en-1-yn-3-ol (9a)

All the 3-(2-aminophenyl)hex-5-en-1-yn-3-ols (**1**) or 3-(2-aminophenyl)hept-6-en-1-yn-3-ols (**9**) employed in this study were prepared by following a three-step protocol starting from 2-aminobenzaldehydes **A**.[1]



Scheme S1: General representation for the synthesis of **1a, 1c-1h, 1p-1r** and **9a**

General procedure-2: Synthesis of 2-arylfurans (12b and 12i-12l)



Scheme S2: General representation for the synthesis of **12b** and **12i-12l**

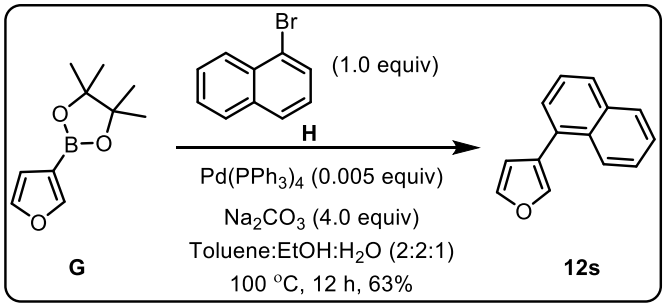
A representative procedure for step I: An oven-dried RB flask was charged with furan (1.0 equiv, 20.0 mmol), 10 mL anhydrous THF and placed at –10 °C under nitrogen atmosphere. *n*-Butyllithium (2.5 M solution in hexane, 1.2 equiv) was added dropwise, and the resulting solution was allowed to warm to 0 °C and stirred for 1 h. Then, triisopropyl borate (2.2 equiv) was added, and the reaction mixture was allowed to warm to room temperature and stirred for 30 min, before addition of 50 mL of a 3 M HCl solution. Upon completion, the reaction mixture was quenched with saturated *aq*. NH_4Cl (5-6 mL) and extracted using diethyl ether (2×6 mL).

[1] (a) S. Dhiman and S. S. V. Ramasastry, *Chem. Commun*., 2015, **51**, 557; (b) S. Dhiman, U. K. Mishra and S. S. V. Ramasastry, *Angew. Chem., Int. Ed*., 2016, **55**, 7737; (c) U. K. Mishra, S. Yadav and S. S. V. Ramasastry, *J. Org. Chem*., 2017, **82**, 6729.

The organic extracts were combined, dried over anhydrous Na_2SO_4, and concentrated under reduced pressure to afford furan-2-ylboronic acid **E** as a pale yellow solid, which was used for the next step without further purification (1.32 g, 59% yield).[2]

A representative procedure for step II: $Pd(PPh_3)_4$ (0.005 mmol), Na_2CO_3 (4.0 mmol), 2-arylbromide (1.0 mmol), furan-2-ylboronic acid (1.2 mmol), and solvent toluene (2.0 mL), EtOH (2.0 mL) and H_2O (1.0 mL) were added to a sealed tube. The reaction mixture was degassed with nitrogen, and stirred at 100 °C for 12 h. It was then cooled to ambient temperature and quenched with saturated *aq*. NH_4Cl (1-2 mL) and extracted using ethyl acetate (2×3 mL). The organic extracts were combined, dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The crude product was purified by silica gel column chromatography using hexane-ethyl acetate (99:1 to 4:1) to afford 2-arylfuran **12b** and **12i-12l** (yield 65-74%).

Synthesis of 3-(naphthalen-1-yl)furan (12s): The procedure described to synthesize **E** to **12b** (Scheme S2) was followed for the conversion of **G** to **12s**.



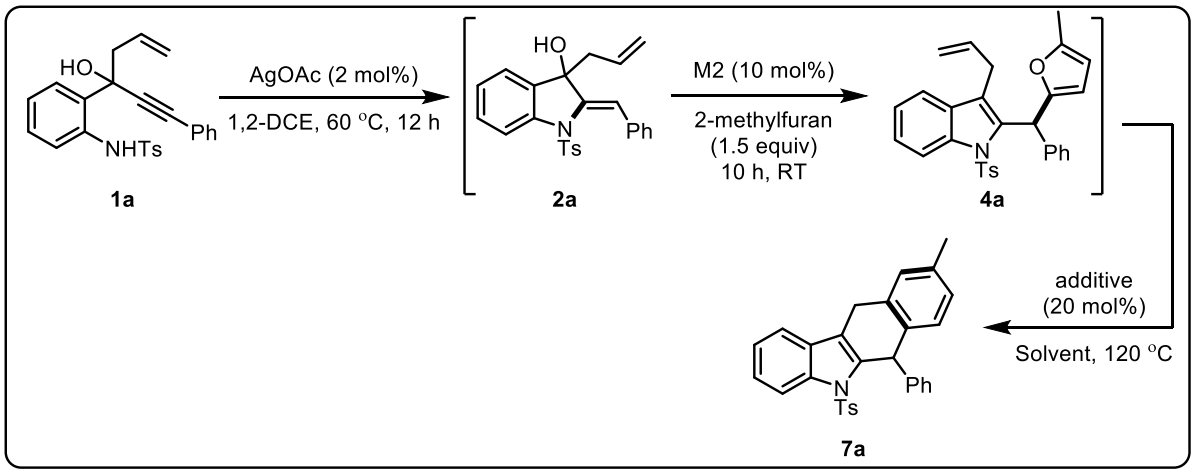
Scheme S3: General representation for the synthesis of 3-(napthalen-1-yl)furan **12s**

General procedure-3: Optimization of the reaction parameters for 7a

An oven-dried 5 mL glass vial was charged with **1a** (20 mg, 1.0 equiv, 0.04 mmol), AgOAc (2 mol%) in 1,2-DCE (1 mL) and stirred at 60 °C. Upon disappearance of **1a**, the reaction mixture was cooled to ambient temperature, and then 2-methylfuran (6 mg, 1.5 equiv, 0.07 mmol) and M2 (10 mol%) were introduced and continued stirring at room temperature until intermediate **2a** disappeared. On complete formation of intermediate **4a**, 1,2-DCE was evaporated under reduced pressure, and an appropriate additive (20 mol%) and solvent (2.0 mL) were introduced and continued stirring at 120 °C until intermediate **4a** disappeared on TLC. The reaction

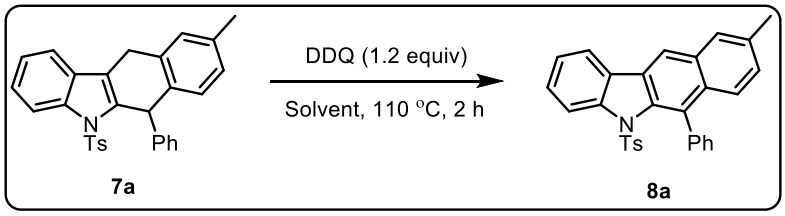
[2] S. Nejrotti, F. Marra, E. Priola, A. Maranzana and C. Prandi, *J. Org. Chem*., 2021, **86**, 8307.

mixture was then cooled to ambient temperature and quenched by adding saturated *aq*. $NaHCO_3$ (1-2 mL) and extracted with ethyl acetate (2 × 2 mL). The combined organic layers were washed with brine, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography using hexane-ethyl acetate (9:1) to afford **7a**.



Scheme S4: Optimization of the reaction parameters for **7a**

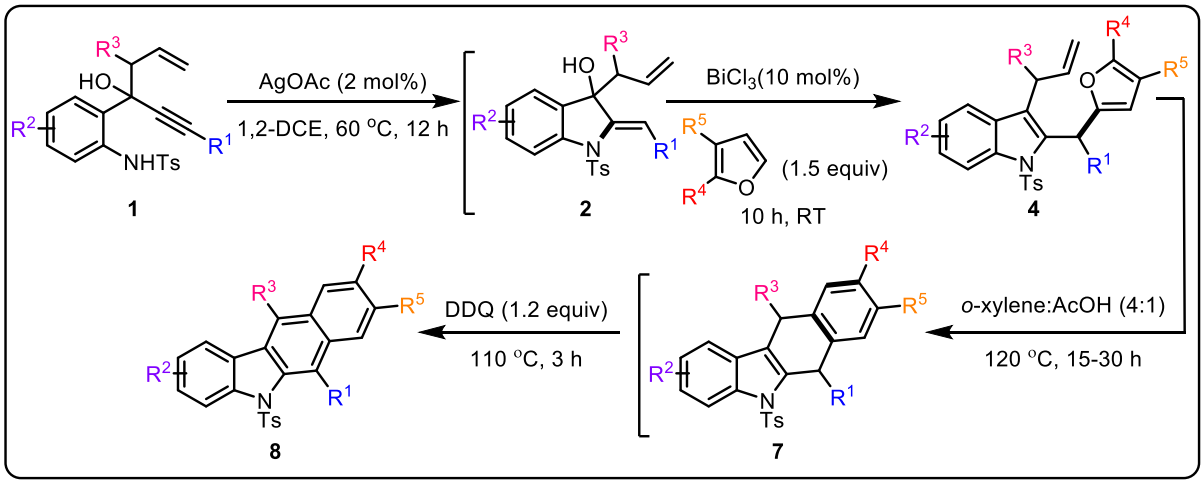
General procedure-4: Optimization of the reaction parameters for 8a



Scheme S5: Optimization of the reaction parameters for **8a**

An oven-dried 5 mL glass vial was charged with **7a** (30 mg, 1.0 equiv, 0.06 mmol) and an appropriate solvent (2.0 mL). Then, 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (DDQ) (17 mg. 1.2 equiv, 0.07 mmol) was introduced and the reaction mixture was stirred at 110 °C for 2 h. Upon completion, the reaction mixture was cooled to ambient temperature and quenched by adding saturated *aq*. $NaHCO_3$ (1-2 mL) and extracted with ethyl acetate (2 × 2 mL). The combined organic layers were washed with brine, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography using hexane-ethyl acetate (9:1) to afford **8a**.

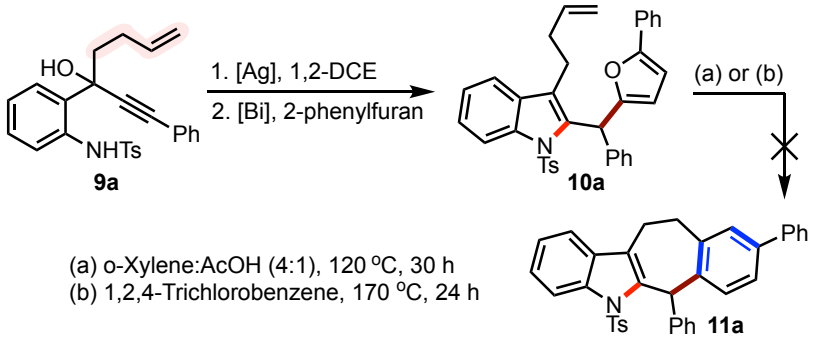
General procedure-5: One-pot synthesis of benzo[*b*]carbazole (8)



Scheme S6: One-pot synthesis of benzo[*b*]carbazole **8**

An oven-dried 5 mL glass vial was charged with **1** (20 mg, 1.0 equiv, 0.04 mmol), AgOAc (2 mol%) in 1,2-DCE (1 mL) and stirred at 60 °C. Upon disappearance of **1**, the reaction mixture was cooled to ambient temperature, and then, furan (1.5 equiv, 0.07 mmol) and $BiCl_3$ (10 mol%) were introduced and continued stirring at room temperature for 10 h until intermediate **2** disappeared. On complete formation of intermediate **4**, 1,2-DCE was evaporated under reduced pressure, and a 4:1 mixture of *o*-Xylene and AcOH (2.0 mL) was introduced and continued stirring at 120 °C until intermediate **4** disappeared on TLC. Upon disappearance of **4**, DDQ (1.2 equiv) was added and stirred the reaction mixture at 110 °C for 3 h until intermediate **7** disappeared on TLC. The reaction mixture was then cooled to ambient temperature and quenched by adding saturated *aq*. $NaHCO_3$ (1-2 mL) and extracted with ethyl acetate (2 × 2 mL). The combined organic layers were washed with brine, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography using hexane/ethyl acetate (9:1 to 7:3) as an eluent to afford **8**.

Attempt to synthesize benzo[5,6]cyclohepta[1,2-b]indole 11a: Our attempts to synthesize **11a** did not progress beyond the intermediate **10a** despite forcing conditions.



Characterization of the Liquid Crystalline compounds (8t-8w)

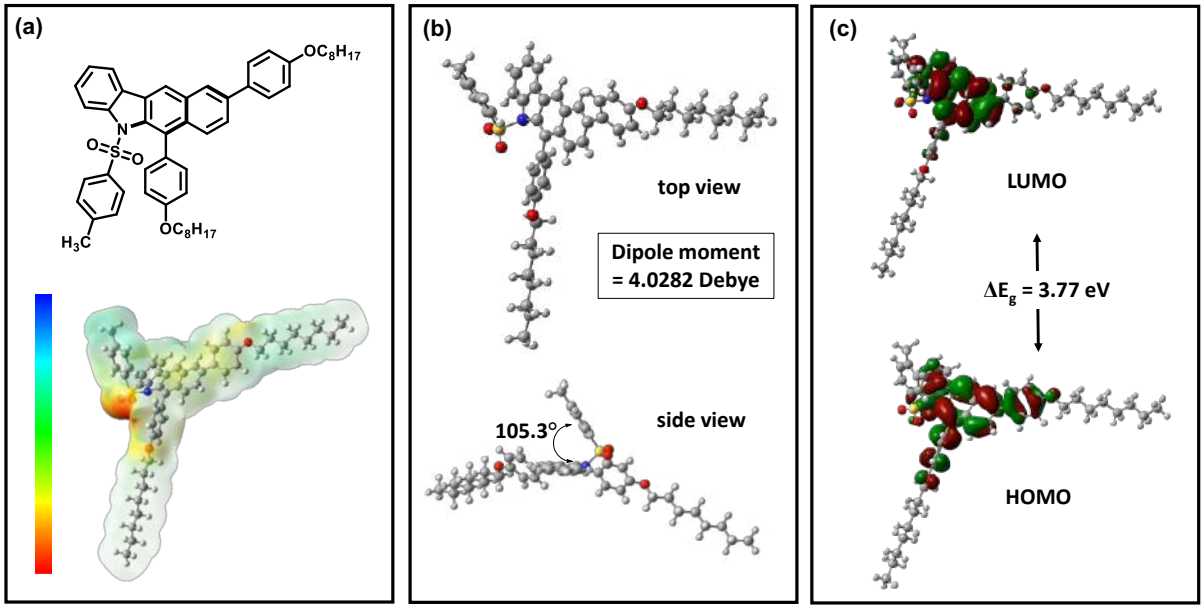


Figure S1: Theoretical studies: (a) Molecular design of the representative compound **8u** with its electrostatic surface potential map. From red to blue, the color scale represents the most electron-dense to the most electron-deficient centers of the molecule (b) Optimized molecular geometry of **8u** (c) Visual representation of the frontier molecular orbitals and the calculated band gap

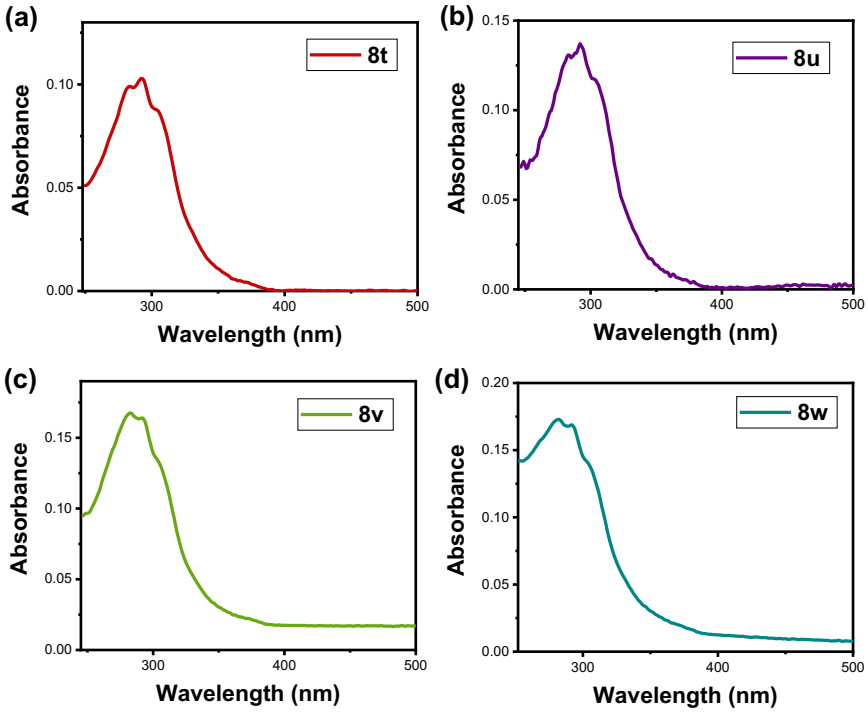


Figure S2: Absorption spectra of compounds (a) **8t**, (b) **8u**, (c) **8v** and (d) **8w** in chloroform solvent at 10^{-5} M concentration

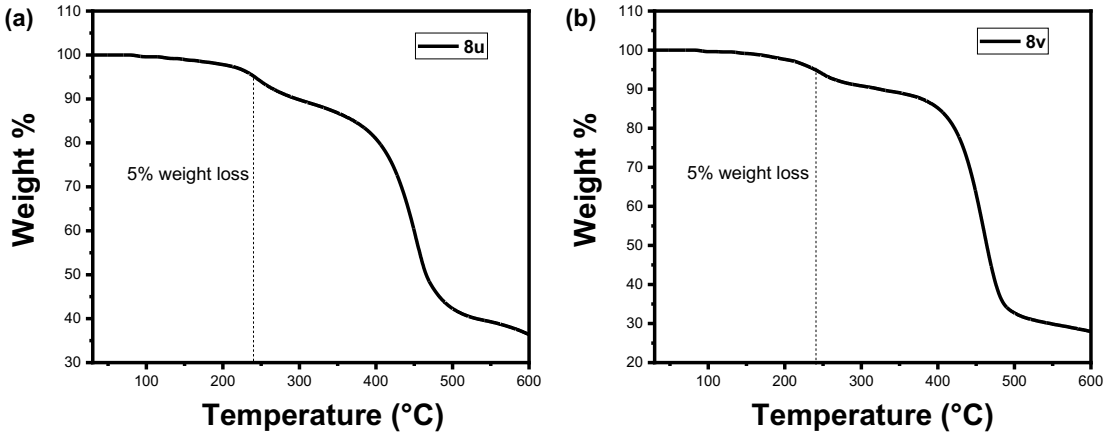


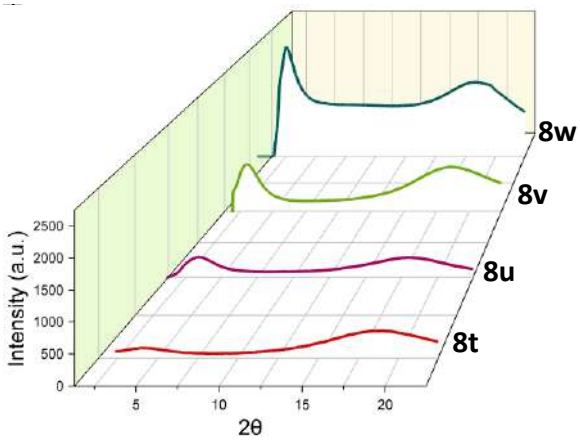
Figure S3: Thermogravimetric analysis of two representative compounds (a) **8u** and (b) **8v**. The measurements were performed under a nitrogen atmosphere, with heating and cooling rates of 10 °C/min

Table S1: Experimental data of phase transitions of compounds (**8t-8w**)

Mesogen	Heating Scan	Cooling Scan
8t	N 69 Iso[a]	Iso 55 N[a]
8u	N 87 Iso[a]	Iso 76 N[a]
8v	N 103 Iso[a]	Iso 88 N[a]
8w	N 81 Iso[a]	Iso 67 N[a]
[a] Transition temperatures (in °C) obtained from POM. Abbreviations: N = Nematic, Iso = Isotropic liquid.		

Table S2: Correspondence between the theoretically calculated molecular lengths and experimentally observed X-ray scattering data at room temperature for **8t-8w**

Compound	Molecular length in Å (from DFT)	Observed *d*-spacing from of the small-angle peak in Å	FWHM of the small-angle peak (with 2Θ in degrees)
8t	23.3	21.8	2.217
8u	25.8	25.6	2.080
8v	28.4	29.9	1.843
8w	30.9	35.3	1.547



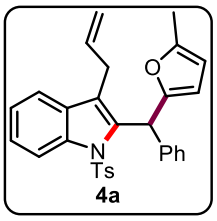
Compound	Assigned LC phases
8t	**Nematic (N)**
8u	**Nematic (N)**
8v	**Nematic (N)**
8w	**Nematic (N)**

Figure S4: X-ray scattering patterns (at 20 °C) with variations in alkyl chain length, along with the LC phases assigned to each derivative (where 2Θ is in degrees)

Spectroscopic data of the newly synthesized compounds in this study

3-Allyl-2-((5-methylfuran-2-yl)(phenyl)methyl)-1-tosyl-1*H*-indole (4a).

This compound was isolated as yellow sticky oil by following the general procedure-**5**. 20 mg

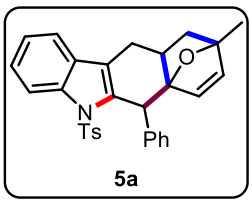


4a

of **1a** afforded 19 mg of **4a** (82% yield). R_f = 0.5 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3063, 2927, 1599, 1563, 1449, 1368, 1265, 1173, 955, 787. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.28 (d, *J* = 8.3 Hz, 1H), 7.46 (d, *J* = 7.7 Hz, 1H), 7.41 (d, *J* = 8.2 Hz, 2H), 7.32 (t, *J* = 7.8 Hz, 1H), 7.25-7.22 (m, 4H), 7.14-7.12 (m, 2H), 7.01 (d, *J* = 8.2 Hz, 2H), 6.76 (s, 1H), 5.86 (d, *J* = 2.6 Hz, 1H), 5.68 (d, *J* = 2.8 Hz, 1H), 5.51-5.41 (m, 1H), 4.83 (dd, *J* = 10.0, 0.9 Hz, 2H), 3.16 (qd, *J* = 16.0, 5.6 Hz, 2H), 2.29 (s, 3H), 2.25 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 152.56, 151.49, 144.36, 140.18, 136.85, 136.08, 135.75, 135.09, 131.07, 129.38 (2C), 128.65 (2C), 128.34 (2C), 126.77, 126.65 (2C), 124.67, 123.37, 121.48, 119.64, 115.68, 115.61, 109.60, 106.13, 42.02, 29.10, 21.55, 13.68. **HRMS (ESI):** m/z calcd for $C_{30}H_{27}NNaO_3S$ $(M+Na)^+$: 504.1609, found: 504.1610.

9-Methyl-6-phenyl-5-tosyl-5,6,9,10,10a,11-hexahydro-6a,9-epoxybenzo[*b*]carbazole (5a).

This compound was isolated as brown semi-solid by following the general procedure-**5**. 20 mg

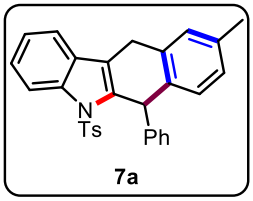


5a

of **1a** afforded 12 mg of **5a** (51% yield). R_f = 0.2 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3062, 2924, 1591, 1446, 1370, 1264, 1174, 1033, 752, 667. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.02 (d, *J* = 7.3 Hz, 1H), 7.43 (d, *J* = 6.0 Hz, 1H), 7.28-7.26 (m, 7H), 7.22 (d, *J* = 8.1 Hz, 2H), 6.94 (d, *J* = 7.4 Hz, 2H), 6.24 (d, *J* = 3.3 Hz, 1H), 5.81 (d, *J* = 3.2 Hz, 1H), 5.42 (s, 1H), 3.44 (dd, *J* = 17.6, 9.6 Hz, 1H), 2.84 (d, *J* = 17.2 Hz, 1H), 2.25-2.22 (m, 4H), 2.05 (t, *J* = 10.0 Hz, 1H), 1.63 (s, 3H), 1.48 (d, *J* = 11.4 Hz, 1H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.89, 140.80, 140.73, 136.78, 136.76, 135.63, 134.71, 129.77 (3C), 129.30 (2C), 128.54 (2C), 127.04, 126.75 (2C), 124.34, 123.16, 118.32, 117.34, 114.82, 91.00, 85.87, 47.38, 43.70, 31.50, 27.64, 21.45, 19.13. **HRMS (ESI):** m/z calcd for $C_{30}H_{27}NNaO_3S$ $(M+Na)^+$: 504.1609, found: 504.1611.

9-Methyl-6-phenyl-5-tosyl-6,11-dihydro-5*H*-benzo[*b*]carbazole (7a).

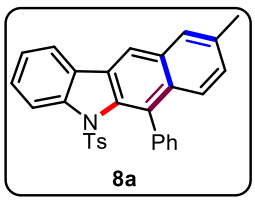
This compound was isolated as pale-yellow solid by following the general procedure-**5**. 20 mg of **1a** afforded 16 mg of **7a** (72% yield). R_f = 0.4 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 179-181 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3058, 2928, 1600, 1452, 1370, 1265, 1173, 1026, 976, 897, 737. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.07-8.05 (m, 1H), 7.56-7.54 (m, 1H), 7.32-7.29 (m, 3H), 7.23-7.18 (m, 5H), 7.16-7.12 (m, 3H), 7.01 (d, *J* = 7.8 Hz, 1H), 6.93 (d, *J* = 8.2 Hz, 2H), 6.03 (s, 1H), 4.14 (qd, *J* = 20.3, 2.9 Hz, 2H), 2.31 (s, 3H), 2.23 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 145.24, 144.17, 136.83, 136.00, 135.89, 135.52, 131.60, 129.49, 129.43 (2C), 129.32, 129.27, 128.64 (2C), 128.03 (3C), 127.74, 126.60 (2C), 126.42, 124.59, 123.45, 118.54, 118.23, 115.02, 45.40, 26.93, 21.46, 20.97. **HRMS (ESI):** m/z calcd for $C_{30}H_{25}NNaO_2S$ $(M+Na)^+$: 486.1504, found: 486.1505.



7a

9-Methyl-6-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8a).

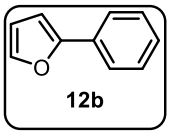
This compound was isolated as pale-yellow solid by following the general procedure-**5**. 20 mg of **1a** afforded 14 mg of **8a** (60% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 191-193 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3047, 2934, 1598, 1459, 1301, 1268, 1170, 1025, 911, 816, 737. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.15 (d, *J* = 8.1 Hz, 1H), 8.08 (s, 1H), 7.92 (d, *J* = 8.8 Hz, 1H), 7.79 (d, *J* = 7.5 Hz, 1H), 7.72 (s, 1H), 7.61-7.59 (m, 2H), 7.54 (t, *J* = 7.2 Hz, 2H), 7.48-7.41 (m, 2H), 7.34 (t, *J* = 7.4 Hz, 1H), 7.28 (dd, *J* = 8.8, 1.5 Hz, 1H), 6.95 (d, *J* = 9.0 Hz, 2H), 6.79 (d, *J* = 8.2 Hz, 2H), 2.53 (s, 3H), 2.17 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.78, 142.97, 138.13, 137.02, 135.41, 132.94, 132.37, 131.39 (3C), 130.56 (2C), 129.94, 129.56, 128.67 (2C), 128.56, 128.00 (2C), 127.86, 127.35, 127.24, 126.80 (2C), 125.62, 120.10, 120.06, 117.54, 21.45, 21.44. **HRMS (ESI):** m/z calcd for $C_{30}H_{23}NNaO_2S$ $(M+Na)^+$: 484.1347, found: 484.1331.



8a

2-Phenylfuran (12b).

This compound was isolated as reddish-brown oil by following the general procedure-**2**. 250 mg of **F** afforded 161 mg of **12b** (70% yield), R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2923, 1604, 1277, 1158, 803. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.76-7.49 (m, 2H), 7.53 (s, 1H), 7.47-7.43 (m, 2H), 7.34-7.30 (m, 1H), 6.71 (d, *J* = 3.2 Hz, 1H), 6.52 (dd, *J* = 2.2, 0.8 Hz, 1H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 154.06, 142.14, 130.97, 128.77 (2C), 127.41, 128.87

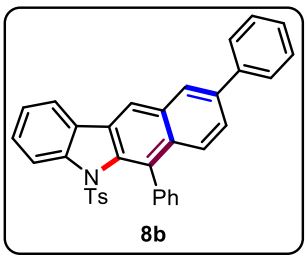


12b

(2C), 111.73, 105.06. **HRMS (ESI):** m/z calcd for $C_{10}H_7O$ $(M–H)^+$: 143.0497, found: 143.0475.

6,9-Diphenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8b).

This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of

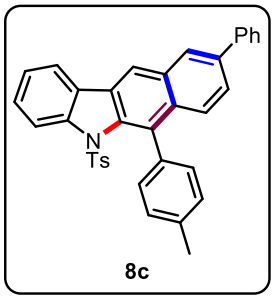


8b

1b afforded 19 mg of **8b** (75% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 222-224 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3049, 2952, 1597, 1483, 1372, 1271, 1092, 939, 836, 749. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.23 (s, 1H), 8.18-8.16 (m, 2H), 8.09 (d, *J* = 9.0 Hz, 1H), 7.83 (dd, *J* = 7.5, 0.4 Hz, 1H), 7.75-7.70 (m, 3H), 7.65-7.63 (m, 2H), 7.56 (t, *J* = 7.1 Hz, 2H), 7.52-7.44 (m, 4H), 7.42-7.35 (m, 2H), 6.99 (d, *J* = 8.3 Hz, 2H), 6.82 (d, *J* = 8.0 Hz, 2H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.85, 143.01, 140.55, 138.25, 137.96, 137.63, 133.07, 132.38, 131.50, 131.39 (2C), 130.54, 130.31, 129.30, 128.97 (2C), 128.73 (2C), 128.06 (3C), 127.589, 127.581, 127.47, 127.36 (2C), 126.77 (2C), 126.00, 125.83, 125.65, 120.18, 120.00, 118.45, 21.48. **HRMS (ESI):** m/z calcd for $C_{35}H_{25}NNaO_2S$ $(M+Na)^+$: 546.1504, found: 546.1504.

9-Phenyl-6-(p-tolyl)-5-tosyl-5*H*-benzo[*b*]carbazole (8c).

This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of

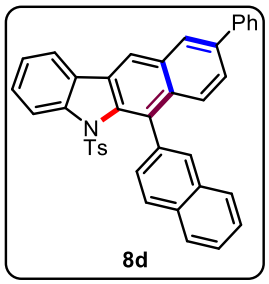


8c

1c afforded 18 mg of **8c** (70% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 224-226 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3041, 2923, 1599, 1462, 1370, 1266, 1173, 1025, 908, 820, 746. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.23 (s, 1H), 8.17-8.15 (m, 2H), 8.09 (d, *J* = 8.9 Hz, 1H), 7.84 (d, *J* = 7.5 Hz, 1H), 7.73 (d, *J* = 7.5 Hz, 2H), 7.70 (dd, *J* = 9.0, 1.6 Hz, 1H), 7.52-7.44 (m, 5H), 7.41-7.31 (m, 4H), 7.02 (d, *J* = 8.2 Hz, 2H), 6.84 (d, *J* = 8.1 Hz, 2H), 2.49 (s, 3H), 2.20 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.72, 143.05, 140.61, 138.17, 137.69, 137.00, 134.84, 133.44, 132.35, 131.72, 131.24 (2C), 130.50, 130.25, 129.29, 128.95 (3C), 128.76, 128.68, 127.99, 127.60, 127.54, 127.35 (3C), 126.68 (2C), 125.98, 125.73, 125.56, 120.18, 119.94, 118.25, 21.54, 21.48. **HRMS (ESI):** m/z calcd for $C_{36}H_{27}NNaO_2S$ $(M+Na)^+$: 560.1660, found: 560.1661.

6-(Naphthalen-2-yl)-9-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8d).

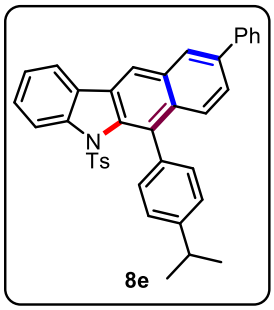
This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of **1d** afforded 16 mg of **8d** (64% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 228-230 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3046, 2924, 1598, 1464, 1374, 1265, 985, 862, 753. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.42 (s, 1H), 8.20 (s, 1H), 8.14 (d, *J* = 8.1 Hz, 1H), 7.98 (dd, *J* = 7.4, 0.7 Hz, 1H), 7.94-7.89 (m, 2H), 7.71-7.69 (m, 2H), 7.61-7.56 (m, 2H), 7.53-7.52 (m, 2H), 7.50-7.44 (m, 4H), 7.43-7.36 (m, 3H), 7.30-7.26 (m, 1H), 6.97 (d, *J* = 8.3 Hz, 2H), 6.78 (d, *J* = 8.0 Hz, 2H), 2.20 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.47, 142.91, 140.56, 138.45, 138.18, 135.52, 134.19, 133.43, 133.41, 132.25, 131.97, 129.89, 129.63, 128.93 (2C), 128.75 (2C), 128.62, 128.44, 128.41, 128.08 (2C), 127.57, 127.53, 127.33 (2C), 126.61, 126.11 (2C), 125.87, 125.81, 125.74, 125.44, 125.41, 125.29, 120.21, 119.42, 118.92, 21.47. **HRMS (ESI):** m/z calcd for $C_{39}H_{27}NNaO_2S$ $(M+Na)^+$: 596.1660, found: 596.1662.



8d

6-(4-Isopropylphenyl)-9-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8e).

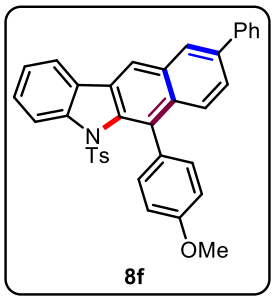
This compound was isolated as white solid by following the general procedure-**5**. 20 mg of **1e** afforded 18 mg of **8e** (73% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 181-183 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3052, 2959, 1598, 1464, 1368, 1265, 1171, 1093, 944, 733. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.22 (s, 1H), 8.16-8.14 (m, 2H), 8.11 (d, *J* = 9.0 Hz, 1H), 7.83 (d, *J* = 7.5 Hz, 1H), 7.75-7.70 (m, 3H), 7.54-7.44 (m, 5H), 7.42-7.34 (m, 4H), 7.01 (d, *J* = 8.3 Hz, 2H), 6.83 (d, *J* = 8.1 Hz, 2H), 3.11-3.01 (m, 1H), 2.19 (s, 3H), 1.39 (d, *J* = 6.9 Hz, 6H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 147.78, 143.73, 143.08, 140.62, 138.14, 137.67, 135.16, 133.30, 132.37, 131.77, 131.21 (2C), 130.71, 130.29, 129.37, 128.97 (2C), 128.71 (2C), 127.99, 127.73, 127.55, 127.35 (2C), 126.73 (2C), 126.04 (2C), 125.97, 125.70, 125.59, 120.19, 119.97, 118.23, 33.89, 24.09 (2C), 21.48. **HRMS (ESI):** m/z calcd for $C_{38}H_{31}NNaO_2S$ $(M+Na)^+$: 588.1973, found: 588.1976.



8e

6-(4-Methoxyphenyl)-9-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8f).

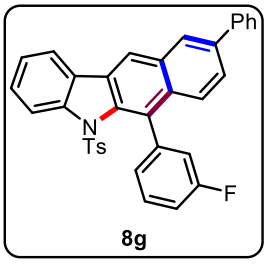
This compound was isolated as pale-yellow solid by following the general procedure-**5**. 20 mg of **1f** afforded 16 mg of **8f** (62% yield). R_f = 0.3 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 218-220 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3048, 2924, 1606, 1512, 1463, 1370, 1290, 1175, 1096, 915, 834, 754. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.23 (s, 1H), 8.16-8.14 (m, 2H), 8.07 (d, *J* = 8.9 Hz, 1H), 7.84 (d, *J* = 7.5 Hz, 1H), 7.74-7.69 (m, 3H), 7.52-7.44 (m, 5H), 7.41-7.34 (m, 2H), 7.05-7.02 (m, 4H), 6.85 (d, *J* = 8.2 Hz, 2H), 3.92 (s, 3H), 2.21 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.94, 143.70, 143.06, 140.61, 138.16, 137.83, 133.61, 132.47 (2C), 132.36, 131.95, 130.23, 130.15, 130.10, 129.27, 128.96 (3C), 128.72 (2C), 127.99, 127.55 (2C), 127.36 (2C), 126.63 (2C), 126.00, 125.74, 125.54, 120.20, 119.90, 118.18, 113.44, 55.18, 21.48. **HRMS (ESI):** m/z calcd for $C_{36}H_{27}NNaO_3S$ $(M+Na)^+$: 576.1609, found: 576.1610.



8f

6-(3-Fluorophenyl)-9-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8g).

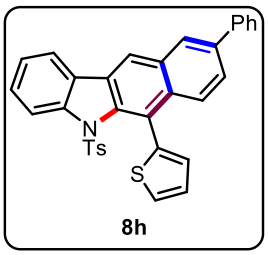
This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of **1g** afforded 18 mg of **8g** (70% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 208-210 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3058, 2925, 1589, 1483, 1265, 1174, 1092, 960, 897, 733. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.25 (s, 1H), 8.20 (d, *J* = 8.2 Hz, 1H), 8.15 (d, *J* = 1.8 Hz, 1H), 8.08 (d, *J* = 8.9 Hz, 1H), 7.84 (d, *J* = 7.6 Hz, 1H), 7.75-7.73 (m, 3H), 7.56-7.45 (m, 5H), 7.44-7.34 (m, 3H), 7.20 (td, *J* = 8.0, 1.8 Hz, 1H), 7.03 (d, *J* = 8.3 Hz, 2H), 6.85 (d, *J* = 8.1 Hz, 2H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 162.80 (d, J_{C-F} = 243.0 Hz), 144.10, 142.96, 140.40, 140.08 (d, J_{C-F} = 8.1 Hz), 138.38, 137.59, 132.73 (d, J_{C-F} = 78.4 Hz), 131.15, 130.29, 129.52 (d, J_{C-F} = 8.3 Hz), 129.03 (3C), 128.94 (d, J_{C-F} = 1.9 Hz), 128.86 (2C), 128.22, 127.70, 127.40, 127.36 (3C), 127.17, 126.72 (2C), 126.10 (2C), 125.79, 120.29, 119.95, 118.97, 118.48 (d, J_{C-F} = 21.5 Hz), 114.46 (d, J_{C-F} = 20.7 Hz), 21.47. **^{19}F NMR (376.4 MHz, $CDCl_3$):** -113.61. **HRMS (ESI):** m/z calcd for $C_{35}H_{24}FNNaO_2S$ $(M+Na)^+$: 564.1409, found: 564.1404.



8g

9-Phenyl-6-(thiophen-2-yl)-5-tosyl-5*H*-benzo[*b*]carbazole (8h).

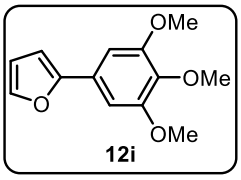
This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of **1h** afforded 16 mg of **8h** (62% yield). R_f = 0.4 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 204-206 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3055, 2924, 1598, 1460, 1372, 1174, 1026, 907, 814. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.43 (d, *J* = 8.9 Hz, 1H), 8.21 (s, 1H), 8.19 (d, *J* = 8.1 Hz, 1H), 8.14 (d, *J* = 1.9 Hz, 1H), 7.81-7.77 (m, 2H), 7.75-7.73 (m, 2H), 7.58 (dd, *J* = 5.1, 1.1 Hz, 1H), 7.53-7.39 (m, 5H), 7.36 (td, *J* = 7.3, 0.8 Hz, 1H), 7.30 (dd, *J* = 5.1, 3.5 Hz, 1H), 7.01 (d, *J* = 8.3 Hz, 2H), 6.82 (d, *J* = 8.0 Hz, 2H), 2.17 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.96, 143.02, 140.44, 138.99, 138.50, 138.40, 132.82, 132.37, 131.93, 130.39, 129.74, 129.19, 129.00 (2C), 128.72 (2C), 128.16, 127.66, 127.40, 127.37 (2C), 127.01, 126.87 (2C), 126.57, 126.27, 126.01, 125.77, 123.22, 120.17, 120.15, 119.15, 21.48. **HRMS (ESI):** m/z calcd for $C_{33}H_{23}NNaO_2S_2$ $(M+Na)^+$: 552.1068, found: 552.1066.



8h

2-(3,4,5-Trimethoxyphenyl)furan (12i).

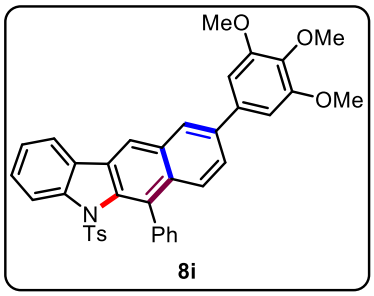
This compound was isolated as brown oil by following the general procedure-**2**. 250 mg of **F** afforded 177 mg of **12i** (74% yield), R_f = 0.3 (3:7 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2930, 1586, 1458, 1176, 735. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.44 (d, *J* = 1.4 Hz, 1H), 6.89 (s, 2H), 6.58 (d, *J* = 3.3 Hz, 1H), 6.46 (dd, *J* = 3.2, 1.8 Hz, 1H), 3.91 (s, 6H), 3.86 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 153.76, 153.52 (2C), 141.89, 137.58, 126.63, 111.74, 104.71, 101.06 (2C), 61.01, 56.16, 56.12. **HRMS (ESI):** m/z calcd for $C_{13}H_{15}O_4$ $(M+H)^+$: 235.0970, found: 235.0965.



12i

6-Phenyl-5-tosyl-9-(3,4,5-trimethoxyphenyl)-5*H*-benzo[*b*]carbazole (8i).

This compound was isolated as greenish-white solid by following the general procedure-**5**. 20 mg of **1i** afforded 19 mg of **8i** (63% yield). R_f = 0.2 (2:3 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 217-219 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3056, 2926, 1584, 1499, 1367, 1244, 1172, 1005, 913. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.25 (s, 1H), 8.17 (d, *J* = 8.1 Hz, 1H), 8.11-8.07 (m, 2H), 7.83 (d, *J* = 7.5 Hz, 1H), 7.67 (dd, *J* = 9.0, 1.9 Hz, 1H), 7.64-7.62 (m, 2H), 7.57-7.53 (m, 2H), 7.50-7.44 (m, 2H), 7.36 (td, *J* = 7.5, 0.8 Hz, 1H), 6.99 (d, *J* = 8.3 Hz,

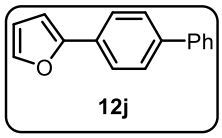


8i

2H), 6.92 (s, 2H), 6.82 (d, J = 8.0 Hz, 2H), 3.96 (s, 6H), 3.93 (s, 3H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 153.62 (2C), 143.87, 143.02, 138.38, 137.92, 137.85, 137.61, 136.56, 133.12, 132.29, 131.51, 131.38 (2C), 130.53, 130.40, 129.24, 128.74 (2C), 128.11, 128.06 (2C), 127.60, 127.50, 126.75 (2C), 125.81 (2C), 125.68, 120.17, 119.99, 118.36, 104.59 (2C), 61.06, 56.28, 56.24, 21.49. **HRMS (ESI):** m/z calcd for $C_{38}H_{31}NNaO_5S$ $(M+Na)^+$: 636.1821, found: 636.1826.

2-([1,1'-Biphenyl]-4-yl)furan (12j).

This compound was isolated as yellowish-orange solid by following the general procedure-**2**.

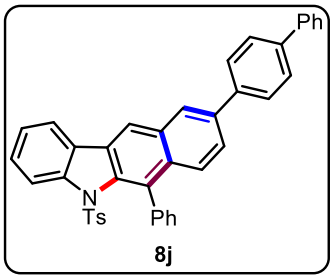


12j

250 mg of **F** afforded 158 mg of **12j** (66% yield), R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 206-208 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3052, 1479, 1415, 897, 734. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.78-7.76 (m, 2H), 7.66-7.64 (m, 4H), 7.51 (s, 1H), 7.49-7.45 (m, 2H), 7.40-7.38 (m, 1H), 6.71 (d, J = 3.1 Hz, 1H), 6.52 (dd, J = 2.4, 1.3 Hz, 1H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 153.79, 142.22, 140.63, 140.00, 129.89, 128.87 (2C), 127.40 (3C), 126.95 (2C), 124.23 (2C), 111.80, 105.20. **HRMS (ESI):** m/z calcd for $C_{16}H_{13}O$ $(M+H)^+$: 221.0966, found: 221.0956.

9-([1,1'-Biphenyl]-4-yl)-6-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8j).

This compound was isolated as pale-yellow solid by following the general procedure-**5**. 20 mg

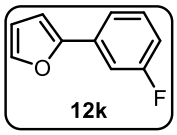


8j

of **1j** afforded 19 mg of **8j** (66% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 218-220 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3054, 2922, 1598, 1466, 1372, 1265, 919, 787. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.25 (s, 1H), 8.21-8.17 (m, 2H), 8.12 (d, J = 8.9 Hz, 1H), 7.85-7.81 (m, 3H), 7.77-7.73 (m, 3H), 7.69-7.64 (m, 4H), 7.58-7.55 (m, 2H), 7.51-7.45 (m, 4H), 7.40-7.35 (m, 2H), 7.00 (d, J = 8.3 Hz, 2H), 6.83 (d, J = 8.2 Hz, 2H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.87, 143.03, 140.60, 140.44, 139.40, 137.97, 137.71, 137.66, 133.08, 132.41, 131.55, 131.41 (2C), 130.57, 130.36, 129.29, 128.90 (3C), 128.75, 128.09 (3C), 127.70 (5C), 127.65, 127.50, 127.08 (3C), 126.78, 125.87, 125.68 (2C), 120.21, 120.02, 118.48, 21.48. **HRMS (ESI):** m/z calcd for $C_{41}H_{29}NNaO_2S$ $(M+Na)^+$: 622.1817, found: 622.1819.

2-(3-Fluorophenyl)furan (12k).

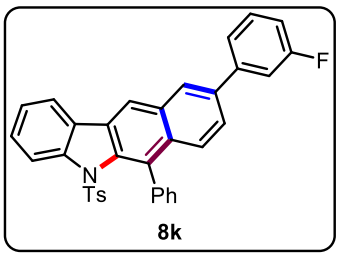
This compound was isolated as yellow oil by following the general procedure-**2**. 250 mg of **F**



afforded 162 mg of **12k** (66% yield), R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by 254 nm UV light. **IR (thin film, neat):** ν_{max}/cm^{-1} 2927, 1589, 1452, 1159, 930. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.48 (s, 1H), 7.45-7.43 (m, 1H), 7.38-7.31 (m, 2H), 6.97-6.92 (m, 1H), 6.68 (d, *J* = 3.3 Hz, 1H), 6.48 (dd, *J* = 3.2, 1.8 Hz, 1H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 163.16 (d, J_{C-F} = 143.3 Hz), 152.78 (d, J_{C-F} = 3.2 Hz), 142.53, 132.90 (d, J_{C-F} = 8.6 Hz), 130.27 (d, J_{C-F} = 8.5 Hz), 119.41 (d, J_{C-F} = 2.7 Hz), 114.09 (d, J_{C-F} = 21.2 Hz), 111.8, 110.67 (d, J_{C-F} = 23.3 Hz), 106.03. **^{19}F NMR (376.4 MHz, $CDCl_3$):** -112.97. **HRMS (ESI):** m/z calcd for $C_{10}H_8FO$ $(M+H)^+$: 163.0559, found: 163.0539.

9-(3-Fluorophenyl)-6-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8k).

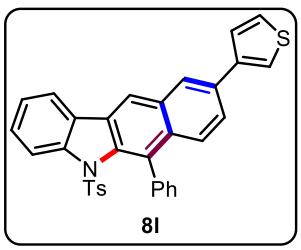
This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of



1k afforded 16 mg of **8k** (59% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 218-220 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3042, 2923, 1586, 1460, 1373, 1270, 1172, 1092, 933, 753. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.23 (s, 1H), 8.18 (d, *J* = 8.1 Hz, 1H), 8.13 (d, *J* = 1.8 Hz, 1H), 8.10 (d, *J* = 9.0 Hz, 1H), 7.83 (d, *J* = 7.5 Hz, 1H), 7.68-7.63 (m, 3H), 7.58-7.54 (m, 2H), 7.51-7.40 (m, 5H), 7.37 (td, *J* = 7.5, 0.7 Hz, 1H), 7.11-7.06 (m, 1H), 7.00 (d, *J* = 8.3 Hz, 2H), 6.83 (d, *J* = 8.1 Hz, 2H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 163.30 (d, J_{C-F} = 244.2 Hz), 143.47 (d, J_{C-F} = 88.0 Hz), 142.82 (d, J_{C-F} = 7.4 Hz), 137.85, 136.90 (d, J_{C-F} = 1.9 Hz), 133.12, 132.25, 131.74, 131.39 (2C), 130.54, 130.50, 130.47, 130.41, 129.16, 128.77 (2C), 128.17, 128.10 (2C), 127.76, 127.55, 126.75 (2C), 126.18, 125.69, 125.43, 122.95 (d, J_{C-F} = 2.5 Hz), 120.24, 119.99, 118.52, 114.49, 114.28, 114.06, 21.48. **^{19}F NMR (376.4 MHz, $CDCl_3$):** -112.71. **HRMS (ESI):** m/z calcd for $C_{35}H_{24}FNNaO_2S$ $(M+Na)^+$: 564.1409, found: 564.1402.

6-Phenyl-9-(thiophen-3-yl)-5-tosyl-5*H*-benzo[*b*]carbazole (8l).

This compound was isolated as pale-yellow solid by following the general procedure-**5**. 20 mg

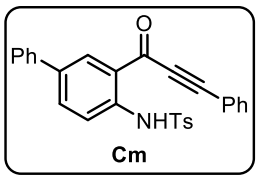


of **1l** afforded 14 mg of **8l** (56% yield). R_f = 0.4 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 226-228 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2935, 1654, 1597, 1461, 1377, 1265, 1023, 936, 842, 783. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.20 (s, 1H), 8.17-8.14 (m, 2H), 8.04 (d, *J* = 9.0 Hz, 1H), 7.82 (d, *J* = 7.5 Hz, 1H), 7.70 (dd, *J* = 9.0,

1.8 Hz, 1H), 7.63-7.53 (m, 6H), 7.50-7.44 (m, 3H), 7.36 (td, *J* = 7.4, 0.6 Hz, 1H), 6.98 (d, *J* = 8.3 Hz, 2H), 6.81 (d, *J* = 8.2 Hz, 2H), 2.18 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.84, 143.02, 141.73, 137.91, 137.54, 133.04, 132.93, 132.40, 131.38 (3C), 130.59, 130.37, 129.30, 128.71 (4C), 128.05 (2C), 127.58, 127.47, 126.76, 126.58, 126.33, 125.65, 125.30, 124.96, 120.94, 120.16, 120.02, 118.26, 21.46. **HRMS (ESI):** m/z calcd for $C_{33}H_{23}NNaO_2S_2$ $(M+Na)^+$: 552.1068, found: 552.1062.

4-Methyl-*N*-(3-(3-phenylpropioloyl)-[1,1'-biphenyl]-4-yl)benzenesulfonamide (Cm).

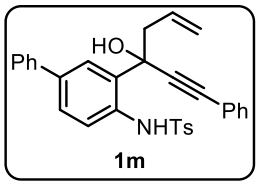
This compound was isolated as pale-yellow solid by following the general procedure-**1**. 150 mg of **Bm** afforded 118 mg of **Cm** (79% yield). R_f = 0.3 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 156-158 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3041, 2200, 1617, 1486, 1338, 1269, 1092, 854. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 11.27 (s, 1H), 8.48 (d, *J* = 2.1 Hz, 1H), 7.82-7.79 (m, 3H), 7.71 (dd, *J* = 8.6, 2.2 Hz, 1H), 7.61-7.59 (m, 2H), 7.55-7.53 (m, 2H), 7.49-7.42 (m, 3H), 7.41-7.33 (m, 3H), 7.25-7.22 (m, 2H), 2.32 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 180.57, 144.30, 139.97, 138.98, 136.46, 135.69, 134.25, 133.18 (2C), 133.05, 131.44, 129.91 (2C), 129.21 (2C), 128.92 (2C), 127.90, 127.38 (2C), 126.59 (2C), 122.79, 119.50, 118.88, 95.86, 86.70, 21.63. **HRMS (ESI):** m/z calcd for $C_{28}H_{22}NO_3S$ $(M+H)^+$: 452.1320, found: 452.1296.



Cm

***N*-(3-(3-Hydroxy-1-phenylhex-5-en-1-yn-3-yl)-[1,1'-biphenyl]-4-yl)-4-methylbenzene-sulfonamide (1m).**

This compound was isolated as white solid by following the general procedure-**1**. 100 mg of **Cm** afforded 101 mg of **1m** (92% yield). R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 96-98 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3439, 3260, 3056, 2229, 1598, 1486, 1391, 1093, 814. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 9.29 (s, 1H), 7.88 (d, *J* = 2.0 Hz, 1H), 7.81 (d, *J* = 8.2 Hz, 2H), 7.69 (d, *J* = 8.4 Hz, 1H), 7.54-7.52 (m, 2H), 7.49-7.46 (m, 3H), 7.41 (t, *J* = 7.8 Hz, 2H), 7.37-7.30 (m, 4H), 7.22 (d, *J* = 8.1 Hz, 2H), 5.92-5.82 (m, 1H), 5.21 (d, *J* = 10.2 Hz, 1H), 5.09 (d, *J* = 17.0 Hz, 1H), 3.47 (brs, 1H), 2.68-2.58 (m, 2H), 2.35 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.89, 140.14, 137.13, 136.14, 134.97, 132.05, 131.84 (2C), 130.38, 129.80 (2C), 129.05, 128.90 (2C), 128.49 (2C), 127.59, 127.30, 127.25 (2C), 127.10, 126.76

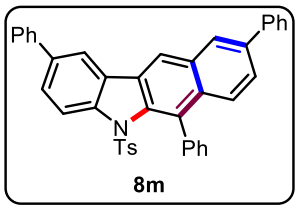


1m

(2C), 121.82, 121.00, 120.50, 89.26, 88.37, 74.83, 47.50, 21.57. **HRMS (ESI):** m/z calcd for $C_{31}H_{27}NNaO_3S$ $(M+Na)^+$: 516.1609, found: 516.1595.

2,6,9-Triphenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8m).

This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of

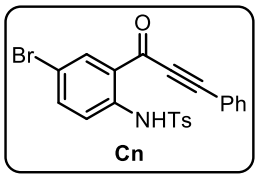


8m

1m afforded 18 mg of **8m** (74% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 143-145 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2923, 1598, 1467, 1371, 1264, 1174, 1011, 898, 755. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.31 (s, 1H), 8.22 (d, *J* = 8.5 Hz, 1H), 8.17 (d, *J* = 1.8 Hz, 1H), 8.10-8.06 (m, 2H), 7.75-7.69 (m, 6H), 7.65-7.63 (m, 2H), 7.58-7.54 (m, 2H), 7.53-7.48 (m, 5H), 7.42-7.38 (m, 2H), 7.05 (d, *J* = 8.3 Hz, 2H), 6.85 (d, *J* = 8.1 Hz, 2H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.93, 142.33, 140.54, 138.86, 138.30, 137.92, 137.90, 133.23, 132.36, 131.63, 131.40 (2C), 130.50, 130.23, 129.74, 128.99 (3C), 128.96 (3C), 128.84, 128.08 (2C), 127.60 (2C), 127.56, 127.52, 127.37 (3C), 127.23 (3C), 126.78 (2C), 126.03, 125.92, 120.13, 118.56, 21.50. **HRMS (ESI):** m/z calcd for $C_{41}H_{29}NNaO_2S$ $(M+Na)^+$: 622.1817, found: 622.1820.

***N*-(4-Bromo-2-(3-phenylpropioloyl)phenyl)-4-methylbenzenesulfonamide (Cn).**

This compound was isolated as pale-yellow solid by following the general procedure-**1**. 150

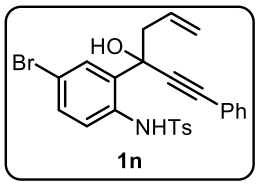


Cn

mg of **Bn** afforded 121 mg of **Cn** (81% yield). R_f = 0.3 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 125-177 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2922, 2199, 1737, 1616, 1480, 1265, 1168, 914. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 11.13 (s, 1H), 8.37 (d, *J* = 2.2 Hz, 1H), 7.77 (d, *J* = 8.3 Hz, 2H), 7.70-7.66 (m, 3H), 7.61 (dd, *J* = 9.6, 2.2 Hz, 1H), 7.57-7.53 (m, 1H), 7.48-7.45 (m, 2H), 7.27 (d, *J* = 7.3 Hz, 2H), 2.38 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 179.22, 144.41, 139.87, 138.33, 136.90, 136.10, 133.26 (2C), 131.56, 129.89 (2C), 128.89 (2C), 127.30 (2C), 123.86, 120.29, 119.23, 115.09, 96.37, 86.25, 21.57. **HRMS (ESI):** m/z calcd for $C_{22}H_{17}BrNO_3S$ $(M+H)^+$: 454.0113, found: 454.0081.

***N*-(4-Bromo-2-(3-hydroxy-1-phenylhex-5-en-1-yn-3-yl)phenyl)-4-methylbenzene-sulfonamide (1n).**

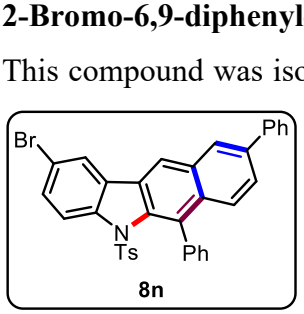
This compound was isolated as white sticky-oil by following the general procedure-**1**. 100 mg of **Cn** afforded 100 mg of **1n** (91% yield). R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3443, 3229, 2925, 2230, 1595, 1383, 1161, 817. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 9.12 (s, 1H), 7.75-7.73 (m, 2H), 7.71 (d, *J* = 2.3 Hz, 1H), 7.51 (d, *J* = 8.7 Hz, 1H), 7.48-7.45 (m, 2H), 7.40-7.32 (m, 4H), 7.22 (d, *J* = 8.0 Hz, 2H), 5.87-5.77 (m, 1H), 5.22 (dd, *J* = 10.2, 1.7 Hz, 1H), 5.07 (dd, *J* = 17.1, 1.6 Hz, 1H), 3.22 (brs, 1H), 2.52 (d, *J* = 7.2 Hz, 2H), 2.36 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 144.09, 136.79, 134.86, 132.03, 132.00, 131.85 (2C), 131.59, 131.21, 129.82 (2C), 129.24, 128.50 (3C), 127.19 (2C), 121.72, 121.45, 116.44, 88.71, 88.43, 74.12, 42.25, 21.56. **HRMS (ESI):** m/z calcd for $C_{25}H_{22}BrNNaO_3S$ $(M+Na)^+$: 518.0401, found: 518.0388.



1n

2-Bromo-6,9-diphenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8n).

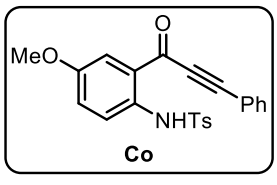
This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of **1n** afforded 15 mg of **8n** (60% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 217-219 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2922, 1598, 1457, 1372, 1263, 1174, 1088, 815, 698. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.19 (s, 1H), 8.14 (d, *J* = 1.8 Hz, 1H), 8.09 (d, *J* = 9.0 Hz, 1H), 8.04 (d, *J* = 8.7 Hz, 1H), 7.96 (d, *J* = 1.9 Hz, 1H), 7.74-7.72 (m, 3H), 7.63-7.58 (m, 3H), 7.56-7.49 (m, 5H), 7.43-7.39 (m, 1H), 7.00 (d, *J* = 8.3 Hz, 2H), 6.86 (d, *J* = 8.1 Hz, 2H), 2.21 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 144.21, 141.83, 140.37, 138.49, 137.68, 137.58, 132.87, 132.29, 131.82, 131.31 (2C), 131.18, 130.78, 130.66, 129.01 (3C), 128.96 (2C), 128.13 (2C), 127.70, 127.62 (2C), 127.36 (2C), 126.74 (2C), 126.27, 126.07, 123.17, 121.39, 119.09, 118.91, 21.50. **HRMS (ESI):** m/z calcd for $C_{35}H_{24}BrNNaO_2S$ $(M+Na)^+$: 624.0609, found: 624.0601.



8n

***N*-(4-Methoxy-2-(3-phenylpropioloyl)phenyl)-4-methylbenzenesulfonamide (Co).**

This compound was isolated as yellow solid by following the general procedure-**1**. 150 mg of **Bo** afforded 113 mg of **Co** (75% yield). R_f = 0.3 (3:7 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 118-120 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2986, 2199, 1693, 1603, 1339, 1035, 738. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 10.62 (s, 1H), 7.71 (d, *J* = 3.0 Hz, 1H), 7.69 (d, *J* = 9.0 Hz, 1H), 7.66-7.64 (m, 2H), 7.61-7.59 (m, 2H), 7.50-7.46 (m, 1H), 7.42-7.38 (m, 2H),

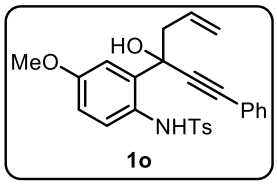


Co

7.18 (d, *J* = 8.1 Hz, 2H), 7.08 (dd, *J* = 9.0, 3.0 Hz, 1H), 3.81 (s, 3H), 2.29 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 180.04, 155.21, 143.96, 136.14, 133.66, 133.13 (2C), 131.41, 129.69 (2C), 128.87 (2C), 127.23 (2C), 124.43, 121.73 (2C), 119.41, 118.42, 95.37, 86.57, 55.67, 21.51. **HRMS (ESI):** m/z calcd for $C_{23}H_{19}NNaO_4S$ $(M+Na)^+$: 428.0932 found 428.0905.

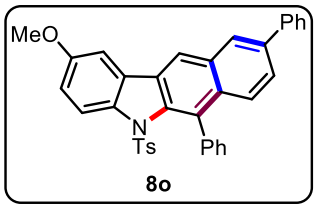
***N*-(2-(3-hydroxy-1-phenylhex-5-en-1-yn-3-yl)-4-methoxyphenyl)-4-methylbenzene-sulfonamide (1o).**

This compound was isolated as yellow semi-solid by following the general procedure-**1**. 100 mg of **Co** afforded 105 mg of **1o** (95% yield). R_f = 0.2 (3:7 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3434, 3264, 2926, 2225, 1602, 1393, 1208, 816. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.78 (s, 1H), 7.72 (d, *J* = 8.3 Hz, 2H), 7.54 (d, *J* = 8.9 Hz, 1H), 7.46-7.43 (m, 2H), 7.36-7.32 (m, 3H), 7.21 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 2.9 Hz, 1H), 6.79 (dd, *J* = 8.9, 0.2 Hz, 1H), 5.84-5.74 (m, 1H), 5.19 (dd, *J* = 10.2, 1.8 Hz, 1H), 5.05 (dd, *J* = 17.1, 1.6 Hz, 1H), 3.75 (s, 3H), 3.05 (s, 1H), 2.44-2.42 (m, 2H), 2.35 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 155.78, 143.65, 137.31, 132.50, 132.02, 131.77 (2C), 129.67 (2C), 129.04, 128.46, 128.44 (2C), 127.15 (2C), 122.85, 121.70, 120.94, 114.63, 113.46, 89.16, 88.11, 74.51, 55.45, 47.38, 21.51. **HRMS (ESI):** m/z calcd for $C_{26}H_{25}NNaO_4S$ $(M+Na)^+$: 470.1402, found: 470.1384.



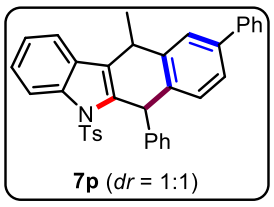
2-Methoxy-6,9-diphenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8o).

This compound was isolated as yellow solid by following the general procedure-**5**. 20 mg of **1o** afforded 11 mg of **8o** (53% yield). R_f = 0.4 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 155-157 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2921, 1601, 1478, 1273, 1169, 1028, 901, 739. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.17 (s, 1H), 8.14-8.11 (m, 2H), 8.08 (d, *J* = 8.9 Hz, 1H), 7.74-7.66 (m, 5H), 7.59 (t, *J* = 7.2 Hz, 2H), 7.51 (t, *J* = 7.3 Hz, 3H), 7.40 (t, *J* = 7.2 Hz, 1H), 7.28 (d, *J* = 2.4 Hz, 1H), 7.03 (dd, *J* = 8.9, 2.5 Hz, 1H), 6.98 (d, *J* = 8.2 Hz, 2H), 6.82 (d, *J* = 8.2 Hz, 2H), 3.90 (s, 3H), 2.18 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.07, 143.83, 140.53, 138.31, 138.27, 137.94, 136.77, 132.59, 132.38, 131.47, 131.38 (2C), 130.86, 130.60, 129.00 (3C), 128.73 (2C), 128.12 (2C), 127.62 (2C), 127.49, 127.35 (2C), 126.97 (2C), 126.02, 125.87, 121.12, 118.49, 115.27, 103.91, 55.82, 21.49. **HRMS (ESI):** m/z calcd for $C_{36}H_{27}NNaO_3S$ $(M+Na)^+$: 576.1609, found: 576.1613.



11-Methyl-6,9-diphenyl-5-tosyl-6,11-dihydro-5*H*-benzo[*b*]carbazole (major isomer) (7p).

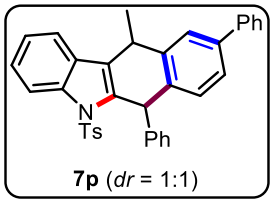
This compound was isolated as yellow semi-solid by following the general procedure-**5**. 20 mg of **1p** afforded 19 mg of **7p** (75% yield). R_f = 0.4 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3053, 2926, 1598, 1484, 1369, 1262, 1053, 849. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.15-8.12 (m, 1H), 7.60-7.55 (m, 6H), 7.40-7.36 (m, 3H), 7.35-7.33 (m, 4H), 7.26-7.22 (m, 5H), 6.96 (d, *J* = 8.2 Hz, 2H), 6.15 (d, *J* = 2.1 Hz, 1H), 4.47-4.42 (m, 1H), 2.26 (s, 3H), 1.69 (d, *J* = 6.9 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 145.77, 144.23, 140.85, 139.53, 138.58, 137.18, 136.84, 135.68, 135.11, 130.65, 129.88, 129.35, 128.79 (3C), 128.66 (2C), 128.40 (2C), 127.23, 127.07 (2C), 126.58 (3C), 126.42, 125.76, 124.56, 123.57, 123.42, 119.71, 115.66, 45.30, 31.93, 24.98, 21.50. **HRMS (ESI):** m/z calcd for $C_{36}H_{30}NO_2S$ $(M+H)^+$: 540.1997, found: 540.1987.



7p (*dr* = 1:1)

11-Methyl-6,9-diphenyl-5-tosyl-6,11-dihydro-5*H*-benzo[*b*]carbazole (minor isomer) (7p).

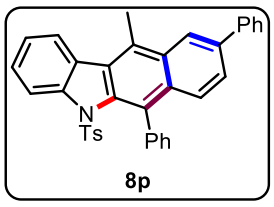
^{1}H NMR (400 MHz, $CDCl_3$): δ 7.98-7.95 (m, 1H), 7.68-7.64 (m, 3H), 7.46-7.40 (m, 6H), 7.30-7.29 (m, 2H), 7.20-7.18 (m, 4H), 7.17-7.10 (m, 3H), 7.00 (d, *J* = 8.2 Hz, 2H), 6.07 (d, *J* = 2.7 Hz, 1H), 4.61-4.55 (m, 1H), 2.25 (s, 3H), 1.78 (d, *J* = 7.2 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 144.33, 144.19, 140.81, 139.47, 138.04, 137.05, 136.10, 135.27, 135.25, 129.50, 129.42, 128.79 (2C), 128.69 (2C), 128.63, 128.46 (2C), 127.29 (2C), 127.08 (2C), 126.94, 126.62 (2C), 125.55, 124.53, 123.64, 123.57, 122.81, 118.99, 115.08, 45.26, 32.95, 24.71, 21.47.



7p (*dr* = 1:1)

11-Methyl-6,9-diphenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8p).

This compound was isolated as brown solid by following the general procedure-**5**. 20 mg of **1p** afforded 17 mg of **8p** (68% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 165-167 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2924, 1598, 1455, 1372, 1266, 1088, 878. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.42 (s, 1H), 8.18-8.14 (m, 2H), 8.03 (d, *J* = 7.7 Hz, 1H), 7.77-7.72 (m, 3H), 7.65-7.63 (m, 2H), 7.56-7.50 (m, 4H), 7.48-7.41 (m, 3H), 7.38-7.35 (m, 1H), 6.94 (d, *J* = 8.0 Hz, 2H), 6.81 (d, *J* = 8.0 Hz, 2H), 3.05 (s, 3H), 2.20 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.72, 143.16, 141.20, 138.24, 138.06, 137.53, 132.98, 131.90 (3C), 131.74, 131.17, 130.74, 128.97 (3C), 128.73, 128.69, 128.57, 128.37, 128.00, 127.94

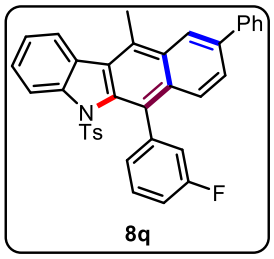


8p

(2C), 127.54 (3C), 127.30, 127.22, 126.88, 125.61, 125.57, 123.33, 122.13, 120.06, 21.47, 15.40. **HRMS (ESI):** m/z calcd for $C_{36}H_{27}NNaO_2S$ $(M+Na)^+$: 560.1660, found: 560.1663.

6-(3-Fluorophenyl)-11-methyl-9-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8q).

This compound was isolated as pale-yellow solid by following the general procedure-**5**. 20 mg

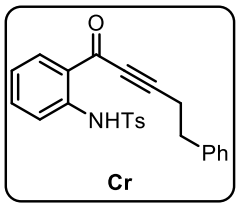


8q

of **1q** afforded 15 mg of **8q** (60% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 178-180 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3057, 2923, 1598, 1492, 1369, 1263, 1091, 986, 812. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.43 (d, *J* = 1.4 Hz, 1H),), 8.18 (d, *J* = 8.1 Hz, 1H), 8.12 (d, *J* = 8.9 Hz, 1H), 8.03 (d, *J* = 7.7 Hz, 1H), 7.77-7.74 (m, 3H), 7.54-7.48 (m, 3H), 7.46-7.42 (m, 2H), 7.40-7.32 (m, 3H), 7.15 (td, *J* = 7.9, 1.6 Hz, 1H), 6.95 (d, *J* = 8.2 Hz, 2H), 6.83 (d, *J* = 8.2 Hz, 2H), 3.05 (3H), 2.20 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 162.68 (d, J_{C-F} = 242.9 Hz), 143.90, 143.06, 141.07, 140.32 (d, J_{C-F} = 8.0 Hz), 138.19, 137.48, 132.96, 131.70, 130.80, 130.56, 129.32 (d, J_{C-F} = 8.3 Hz), 129.25, 129.01 (2C), 128.65 (2C), 128.35, 127.80 (d, J_{C-F} = 2.1 Hz), 127.60 (2C), 127.54 (2C), 127.35, 127.13 (d, J_{C-F} = 1.3 Hz), 126.81 (2C), 125.82, 125.70, 123.36, 122.22, 120.03, 118.91 (d, J_{C-F} = 21.6 Hz), 114.25 (d, J_{C-F} = 20.8 Hz), 21.49, 15.46. **^{19}F NMR (376.4 MHz, $CDCl_3$):** -113.94. **HRMS (ESI):** m/z calcd for $C_{36}H_{26}FNNaO_2S$ $(M+Na)^+$: 578.1566 found 578.1629.

4-Methyl-*N*-(2-(5-phenylpent-2-ynoyl)phenyl)benzenesulfonamide (Cr).

This compound was isolated as yellowish-orange solid by following the general procedure-**1**.

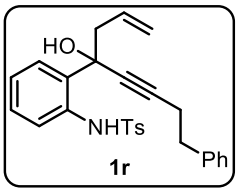


Cr

150 mg of **Br** afforded 123 mg of **Cr** (82% yield). R_f = 0.3 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 104-106 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3061, 2928, 2213, 1611, 1490, 1399, 1249, 1091, 815. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 11.23 (s, 1H), 7.89 (dd, *J* = 7.9, 1.4 Hz, 1H), 7.77 (d, *J* = 8.3 Hz, 2H), 7.67 (dd, *J* = 8.3, 0.5 Hz, 1H), 7.46 (td, *J* = 7.5, 1.5 Hz, 1H), 7.37-7.33 (m, 2H), 7.30-7.23 (m, 5H), 6.99 (t, *J* = 7.1 Hz, 1H), 2.98 (t, *J* = 7.0 Hz, 2H), 2.83 (t, *J* = 7.1 Hz, 2H), 2.37 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 180.66, 144.04, 140.78, 139.44, 136.47, 135.52, 135.11, 129.73 (2C), 128.68 (2C), 128.49 (2C), 127.30 (2C), 126.79, 122.46, 122.22, 118.03, 97.82, 80.01, 33.70, 21.54, 21.37. **HRMS (ESI):** m/z calcd for $C_{24}H_{21}NNaO_3S$ $(M+Na)^+$: 426.1140 found 426.1107.

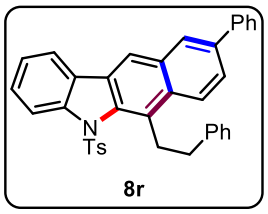
***N*-(2-(4-Hydroxy-8-phenyloct-1-en-5-yn-4-yl)phenyl)-4-methylbenzenesulfonamide (1r).**

This compound was isolated as yellow sticky-oil by following the general procedure-**1**. 100 mg of **Cr** afforded 103 mg of **1r** (93% yield). R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3458, 3239, 2983, 2238, 1592, 1494, 1266, 1018, 815. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 9.31 (s, 1H), 7.78 (d, *J* = 8.3 Hz, 2H), 7.61 (dd, *J* = 8.2, 0.9 Hz, 1H), 7.41 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.35-7.31 (m, 2H), 7.28-7.19 (m, 6H), 6.97 (td, *J* = 7.8, 1.2 Hz, 1H), 5.69-5.59 (m, 1H), 5.10 (dd, *J* = 10.2, 1.8 Hz, 1H), 4.93 (dd, *J* = 17.1, 1.6 Hz, 1H), 3.39 (s, 1H), 2.88 (t, *J* = 7.3 Hz, 2H), 2.63 (t, *J* = 7.2 Hz, 2H), 2.48-2.38 (m, 2H), 2.37 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.78, 140.32, 137.18, 135.58, 132.39, 130.36, 129.72 (2C), 128.86, 128.73, 128.59 (2C), 128.48 (2C), 127.18 (2C), 126.46, 123.31, 120.21, 119.88, 88.25, 81.76, 74.53, 47.51, 34.62, 21.54, 20.77. **HRMS (ESI):** m/z calcd for $C_{27}H_{27}NNaO_3S$ $(M+Na)^+$: 468.1609, found: 468.1585.



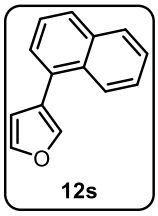
6-Phenethyl-9-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8r).

This compound was isolated as yellow semi-solid by following the general procedure-**5**. 20 mg of **1r** afforded 13 mg of **8r** (53% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2920, 1597, 1459, 1372, 1244, 1085, 961, 817, 745. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.44 (d, *J* = 8.8 Hz, 1H), 8.14-8.12 (m, 2H), 7.98 (s, 1H), 7.90 (dd, *J* = 8.8, 1.8 Hz, 1H), 7.80-7.77 (m, 2H), 7.65 (d, *J* = 7.4 Hz, 1H), 7.53 (t, *J* = 7.4 Hz, 2H), 7.42 (t, *J* = 7.4 Hz, 2H), 7.31-7.27 (m, 4H), 7.26-7.24 (m, 1H), 7.16-7.13 (m, 1H), 6.84 (d, *J* = 8.2 Hz, 2H), 6.74 (d, *J* = 8.0 Hz, 2H), 4.19 (t, *J* = 8.2 Hz, 2H), 3.05 (t, *J* = 8.4 Hz, 2H), 2.15 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 144.05, 143.35, 141.98, 140.60, 138.61, 138.20, 133.09, 131.50, 131.36, 131.22, 130.90, 130.54, 128.99 (2C), 128.48 (2C), 128.46 (2C), 128.27 (2C), 127.83, 127.59, 127.34 (4C), 126.67, 126.09, 125.99, 125.87, 125.62, 120.66, 120.16, 116.99, 36.53, 31.76, 21.45. **HRMS (ESI):** m/z calcd for $C_{37}H_{29}NNaO_2S$ $(M+Na)^+$: 574.1817, found: 574.1805.



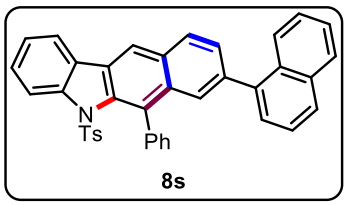
3-(Naphthalen-1-yl)furan (12s).

This compound was isolated as yellow oil by following the general procedure-**2**. 250 mg of **H** afforded 148 mg of **12s** (63% yield). R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2927, 1506, 1361, 1160, 872. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.21-8.19 (m, 1H), 7.94-7.92 (m, 1H), 7.87 (dd, *J* = 6.1, 3.1 Hz, 1H), 7.72-7.71 (m, 1H), 7.63-7.62 (m, 1H), 7.57-7.51 (m, 4H), 6.75 (s, 1H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 142.92, 140.47, 133.90, 131.82, 130.82, 128.48, 127.86, 126.90, 126.25, 125.94, 125.66, 125.52, 124.83, 112.52. **HRMS (ESI):** m/z calcd for $C_{14}H_9O$ $(M-H)^+$: 193.0653, found: 193.0657.



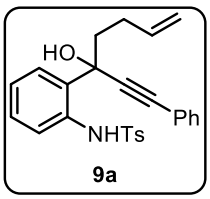
8-(Naphthalen-1-yl)-6-phenyl-5-tosyl-5*H*-benzo[*b*]carbazole (8s).

This compound was isolated as brown solid by following the general procedure-**5**. 20 mg of **1s** afforded 15 mg of **8s** (54% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 191-193 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3054, 2924, 1595, 1457, 1369, 1262, 1020, 889, 737. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.27 (s, 1H), 8.07 (dd, *J* = 8.1, 1.2 Hz, 1H), 7.96 (d, *J* = 7.8 Hz, 1H), 7.80 (dd, *J* = 7.3, 0.6 Hz, 1H), 7.62-7.56 (m, 2H), 7.45 (d, *J* = 8.0 Hz, 1H), 7.43-7.32 (m, 3H), 7.31-7.26 (m, 2H), 7.17 (t, *J* = 7.0 Hz, 1H), 7.13-7.08 (m, 3H), 6.99 (brs, 1H), 6.81-6.76 (m, 4H), 6.67 (brs, 1H), 6.54 (t, *J* = 7.4 Hz, 1H), 6.15 (brs, 1H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.74, 143.51, 141.93, 140.16, 139.43, 136.54, 133.67, 133.08, 133.03, 132.76, 132.51, 132.23, 131.42, 129.85, 129.77, 129.19, 128.47 (3C), 127.84, 127.18, 127.67, 126.82 (4C), 126.47, 126.19, 125.78 (2C), 125.18, 125.08, 125.05 (2C), 124.92, 120.62, 120.12, 119.04, 21.46. **HRMS (ESI):** m/z calcd for $C_{39}H_{27}NNaO_2S$ $(M+Na)^+$: 596.1660, found: 596.1644.



***N*-(2-(3-Hydroxy-1-phenylhept-6-en-1-yn-3-yl)phenyl)-4-methylbenzenesulfonamide (9a).**

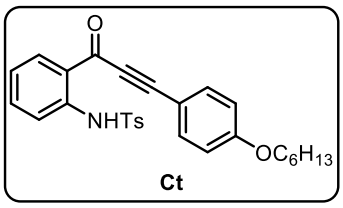
This compound was isolated as pale-yellow solid by following the general procedure-**1**. 100 mg of **Ca** afforded 105 mg of **9a** (91% yield). R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 106-108 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3447, 3250, 2925, 2230, 1590, 1493, 1265, 813. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.87 (s, 1H), 7.74 (d, *J* = 8.2 Hz, 2H), 7.66 (dd, *J* = 8.2, 0.7 Hz, 1H), 7.62 (dd, *J* = 7.8, 1.3 Hz, 1H), 7.49-7.46 (m, 2H), 7.39-7.32 (m, 3H), 7.26-7.24 (m, 1H), 7.20 (d, *J* = 8.1 Hz, 2H), 7.02 (td, *J* = 7.8, 1.0 Hz, 1H), 5.71-5.61 (m, 1H), 4.98-4.93 (m,



2H), 3.10 (s, 1H), 2.35 (s, 3H), 2.31-2.24 (m, 1H), 2.04-1.96 (m, 1H), 1.90 (qd, *J* = 12.8, 4.6 Hz, 1H), 1.82-1.75 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 143.75, 137.48, 137.10, 135.65, 131.76 (2C), 130.40, 129.75 (2C), 129.13, 129.06, 128.48 (3C), 127.12 (2C), 123.42, 121.74, 120.22, 115.24, 89.37, 88.30, 76.34, 41.69, 29.44, 21.54. **HRMS (ESI):** m/z calcd for $C_{26}H_{25}NNaO_3S$ $(M+Na)^+$: 454.1453, found: 454.1458.

***N*-(2-(3-(4-(Hexyloxy)phenyl)propioloyl)phenyl)-4-methylbenzenesulfonamide (Ct).**

This compound was isolated as brown solid by following the general procedure-**1**. 150 mg of

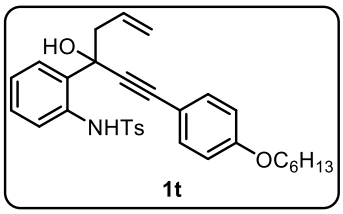


Ct

Bt afforded 115 mg of **Ct** (76% yield). R_f = 0.3 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 116-118 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2930, 2188, 1596, 1496, 1397, 1164, 833. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 11.32 (s, 1H), 8.26 (dd, *J* = 7.9, 1.3 Hz, 1H), 7.76 (d, *J* = 8.2 Hz, 2H), 7.71 (d, *J* = 8.1 Hz, 1H), 7.59 (d, *J* = 8.8 Hz, 2H), 7.50-7.46 (m, 1H), 7.22 (d, *J* = 8.1 Hz, 2H), 7.14-7.10 (m, 1H), 6.91 (d, *J* = 8.8 Hz, 2H), 3.99 (t, *J* = 6.5 Hz, 2H), 2.34 (s, 3H), 1.83-1.76 (m, 2H), 1.49-1.42 (m, 2H), 1.36-1.31 (m, 4H), 0.90 (t, *J* = 6.4 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 180.53, 161.76, 144.03, 140.79, 136.45, 135.44, 135.29 (2C), 134.65, 129.74 (2C), 127.30 (2C), 122.65, 122.62, 118.46, 115.00 (2C), 110.96, 96.99, 86.81, 68.34, 31.53, 29.03, 25.65, 22.59, 21.57, 14.05. **HRMS (ESI):** m/z calcd for $C_{28}H_{30}NO_4S$ $(M+H)^+$: 476.1896, found: 476.1902.

***N*-(2-(1-(4-(Hexyloxy)phenyl)-3-hydroxyhex-5-en-1-yn-3-yl)phenyl)-4-methylbenzene-sulfonamide (1t).**

This compound was isolated as pale-yellow sticky-oil by following the general procedure-**1**.



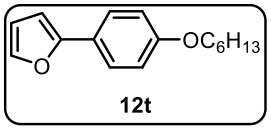
1t

100 mg of **Ct** afforded 104 mg of **1t** (95% yield). R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3451, 3229, 2932, 2226, 1602, 1503, 1256, 1019, 733. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 9.26 (s, 1H), 7.76 (d, *J* = 8.2 Hz, 2H), 7.60 (td, *J* = 7.9, 1.4 Hz, 2H), 7.38 (d, *J* = 8.8 Hz, 2H), 7.21-7.19 (m, 3H), 7.01 (td, *J* = 7.7, 1.1 Hz, 1H), 6.84 (d, *J* = 8.8 Hz, 2H), 5.87-5.77 (m, 1H), 5.17 (d, *J* = 10.2 Hz, 1H), 5.04 (d, *J* = 17.8 Hz, 1H), 3.95 (t, *J* = 6.5 Hz, 2H), 3.33 (brs, 1H), 2.53 (t, *J* = 7.3 Hz, 2H), 2.34 (s, 3H), 1.81-1.74 (m, 2H), 1.49-1.41 (m, 2H), 1.36-1.31 (m, 4H), 0.90 (t, *J* = 6.8 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 159.70, 143.74, 137.18, 135.68, 133.28 (2C), 132.24, 130.21, 129.70 (2C), 129.03, 128.51, 127.20 (2C), 123.38, 120.69, 120.00, 114.57 (2C), 113.55, 88.32,

87.89, 74.77, 68.14, 47.48, 31.57, 29.12, 25.68, 22.61, 21.53, 14.07. **HRMS (ESI):** m/z calcd for $C_{31}H_{35}NNaO_4S$ $(M+Na)^+$: 540.2184 found 540.2187.

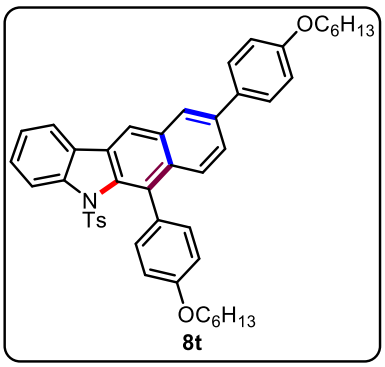
2-(4-Hexylphenyl)furan (12t).

This compound was isolated as brown semi-solid by following the general procedure-**2**. 250 mg of **F** afforded 171 mg of **12t** (72% yield). R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2932, 1515, 1475, 1294, 1014, 797. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.62 (d, *J* = 8.7 Hz, 2H), 7.45 (d, *J* = 0.9 Hz, 1H), 6.94 (d, *J* = 8.8 Hz, 2H), 6.53 (d, *J* = 3.2 Hz, 1H), 6.47 (dd, *J* = 3.1, 1.7 Hz, 1H), 3.98 (t, *J* = 6.6 Hz, 2H), 1.85-1.78 (m, 2H), 1.54-1.46 (m, 2H), 1.39-1.36 (m, 4H), 0.96 (t, *J* = 6.4 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.66, 154.18, 141.34, 125.23 (2C), 123.84, 114.70 (2C), 111.58, 103.29, 68.08, 31.68, 29.30, 25.80, 22.69, 14.12. **HRMS (ESI):** m/z calcd for $C_{16}H_{21}O_2$ $(M+H)^+$: 245.1542, found: 245.1539.



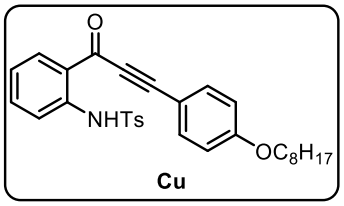
6,9-Bis(4-(hexyloxy)phenyl)-5-tosyl-5*H*-benzo[*b*]carbazole (8t).

This compound was isolated as brown sticky-oil by following the general procedure-**5**. 20 mg of **1t** afforded 21 mg of **8t** (74% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3055, 2941, 1606, 1420, 1375, 1023, 743. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.19 (s, 1H), 8.15 (d, *J* = 8.1 Hz, 1H), 8.08 (d, *J* = 1.4 Hz, 1H), 8.05 (d, *J* = 9.0 Hz, 1H), 7.83 (d, *J* = 7.5 Hz, 1H), 7.68-7.64 (m, 3H), 7.49-7.43 (m, 3H), 7.36 (t, *J* = 7.4 Hz, 1H), 7.04-7.00 (m, 6H), 6.84 (d, *J* = 8.2 Hz, 2H), 4.07-4.00 (m, 4H), 2.20 (s, 3H), 1.91-1.79 (m, 4H), 1.55-1.48 (m, 4H), 1.43-1.34 (m, 8H), 0.97-0.91 (m, 6H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.97, 158.55, 143.64, 143.05, 137.79, 137.57, 133.61, 132.78, 132.45, 132.42, 131.62, 130.22, 130.14, 129.86, 129.35, 128.72 (2C), 128.32 (3C), 127.92, 127.48, 126.62 (2C), 125.56, 125.51, 125.12, 120.19, 119.90, 117.99, 114.96 (2C), 113.88 (2C), 68.14, 68.87, 31.73, 31.64, 29.47, 29.29, 25.94, 25.79, 27.72, 22.67, 21.48, 14.14, 14.11. **HRMS (ESI):** m/z calcd for $C_{47}H_{49}NNaO_4S$ $(M+Na)^+$: 746.3280, found: 746.3263.



4-Methyl-*N*-(2-(3-(4-(octyloxy)phenyl)propioloyl)phenyl)benzenesulfonamide (Cu).

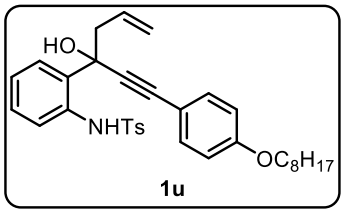
This compound was isolated as yellow solid by following the general procedure-**1**. 150 mg of



Bu afforded 117 mg of **Cu** (78% yield), R_f = 0.3 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 110-120 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2930, 2189, 1596, 1495, 1330, 1262, 1016, 733. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 11.33 (s, 1H), 8.25 (dd, *J* = 7.9, 1.3 Hz, 1H), 7.75 (d, *J* = 8.2 Hz, 2H), 7.70 (d, *J* = 8.3 Hz, 1H), 7.58 (d, *J* = 8.7 Hz, 2H), 7.47 (t, *J* = 8.7 Hz, 1H), 7.21 (d, *J* = 8.2 Hz, 2H), 7.12 (t, *J* = 7.3 Hz, 1H), 6.90 (d, *J* = 8.7 Hz, 2H), 3.98 (t, *J* = 6.5 Hz, 2H), 2.32 (s, 3H), 1.82-1.75 (m, 2H), 1.48-1.41 (m, 2H), 1.36-1.24 (m, 8H), 0.88 (t, *J* = 6.6 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 180.54, 161.79, 144.06, 140.76, 136.42, 135.46, 135.30 (2C), 134.67, 129.75 (2C), 127.29 (2C), 122.68, 122.65, 118.44, 115.01 (2C), 110.91, 97.07, 86.82, 68.35, 31.81, 29.33, 29.23, 29.07, 25.98, 22.67, 21.56, 14.14. **HRMS (ESI):** m/z calcd for $C_{30}H_{34}NO_4S$ $(M+H)^+$: 504.2209, found: 504.2206.

_N_-(2-(3-Hydroxy-1-(4-(octyloxy)phenyl)hex-5-en-1-yn-3-yl)phenyl)-4-methylbenzene-sulfonamide (1u).

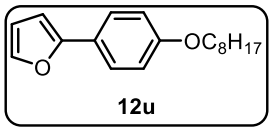
This compound was isolated as pale-yellow solid by following the general procedure-**1**. 100



mg of **Cu** afforded 99 mg of **1u** (91% yield). R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 80-82 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 3447, 3247, 2928, 2226, 1603, 1505, 1337, 1261, 829. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 9.21 (s, 1H), 7.77 (d, *J* = 8.2 Hz, 2H), 7.60 (td, *J* = 8.0, 1.3 Hz, 2H), 7.38 (d, *J* = 8.7 Hz, 2H), 7.24-7.20 (m, 3H), 7.03-6.99 (m, 1H), 6.84 (d, *J* = 8.8 Hz, 2H), 5.88-5.78 (m, 1H), 5.18 (dd, *J* = 10.2, 1.3 Hz, 1H), 5.06 (dd, *J* = 17.1, 1.2 Hz, 1H), 3.95 (t, *J* = 6.5 Hz, 2H), 3.18 (s, 1H), 2.60-2.51 (m, 2H), 2.35 (s, 3H), 1.87-1.74 (m, 2H), 1.48-1.41 (m, 2H), 1.33-1.28 (m, 8H), 0.88 (t, *J* = 7.0 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 159.74, 143.73, 137.23, 135.68, 133.27 (2C), 132.21, 130.18, 129.69 (2C), 129.04, 128.46, 127.20 (2C), 123.39, 120.79, 120.03, 114.57 (2C), 113.50, 88.35, 87.85, 74.73, 68.14, 47.46, 31.81, 29.34, 29.23, 29.15, 26.00, 22.66, 21.52, 14.12. **HRMS (ESI):** m/z calcd for $C_{33}H_{40}NO_4S$ $(M+H)^+$: 546.2678, found: 546.2671.

2-(4-Octylphenyl)furan (12u).

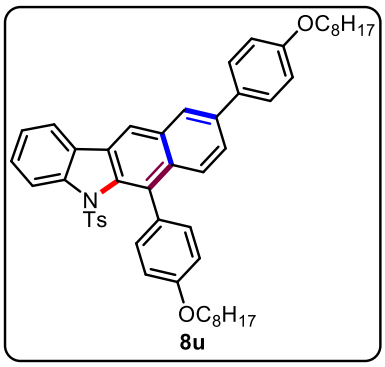
This compound was isolated as bluish-white solid by following the general procedure-**2**. 250 mg of **F** afforded 172 mg of **12u** (72% yield). R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by



254 nm UV light). **M.P** = 43-45 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2926, 1514, 1297, 1175, 1013, 833. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.59 (d, *J* = 8.7 Hz, 2H), 7.42 (d, *J* = 0.76 Hz, 1H), 6.91 (d, *J* = 8.7 Hz, 2H), 6.51 (d, *J* = 3.2 Hz, 1H), 6.44 (dd, *J* = 2.9, 1.7 Hz, 1H), 3.97 (t, *J* = 6.6 Hz, 2H), 1.83-1.76 (m, 2H), 1.50-1.43 (m, 2H), 1.39-1.26 (m, 8H), 0.90 (t, *J* = 6.3 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.61, 154.14, 141.33, 125.20 (2C), 123.80, 114.68 (2C), 111.54, 103.26, 68.08, 31.85, 29.40, 29.29 (2C), 26.07, 22.70, 14.15. **HRMS (ESI):** m/z calcd for $C_{18}H_{25}O_2$ $(M+H)^+$: 273.1855 found 273.1841.

6,9-Bis(4-(octyloxy)phenyl)-5-tosyl-5*H*-benzo[*b*]carbazole (8u).

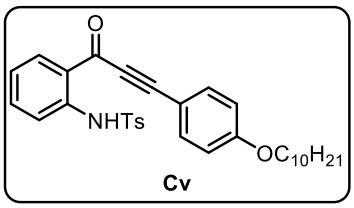
This compound was isolated as brown sticky-oil by following the general procedure-**5**. 20 mg



of **1u** afforded 24 mg of **8u** (83% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2928, 1607, 1467, 1262, 1028, 733. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.18-8.16 (m, 2H), 8.08-8.05 (m, 2H), 7.83 (d, *J* = 7.4 Hz, 1H), 7.68-7.64 (m, 3H), 7.50-7.44 (m, 3H), 7.35 (t, *J* = 7.8 Hz, 1H), 7.06-7.01 (m, 6H), 6.85 (d, *J* = 8.2 Hz, 2H), 4.06 (t, *J* = 6.4 Hz, 2H), 4.02 (t, *J* = 6.5 Hz, 2H), 2.20 (s, 3H), 1.90-1.80 (m, 4H), 1.58-1.48 (m, 4H), 1.41-1.33 (m, 16H), 0.96-0.91 (m, 6H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.99, 158.58, 143.65, 143.06, 137.78, 137.58, 133.67, 132.76, 132.45 (2C), 131.64, 130.21, 130.14, 129.87, 129.35, 128.74 (2C), 128.31 (3C), 127.92, 127.48, 126.63 (2C), 125.56, 125.52, 125.12, 120.21, 119.90, 118.02, 114.96 (2C), 113.90 (2C), 68.15, 67.88, 31.93, 31.89, 29.53 (2C), 29.45, 29.37, 29.35, 29.33, 26.29, 26.14, 22.77, 22.74, 21.51, 14.22, 14.20. **HRMS (ESI):** m/z calcd for $C_{51}H_{57}NNaO_4S$ $(M+Na)^+$: 802.3906, found: 802.3868.

***N*-(2-(3-(4-(Decyloxy)phenyl)propioloyl)phenyl)-4-methylbenzenesulfonamide (Cv).**

This compound was isolated as yellowish-brown solid by following the general procedure-**1**.

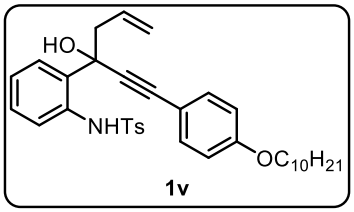


150 mg of **Bv** afforded 114 mg of **Cv** (76% yield). R_f = 0.3 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 99-101 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2927, 2188, 1596, 1494, 1331, 1259, 1092, 735. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 11.33 (s, 1H), 8.25 (dd, *J* = 7.9, 1.2 Hz, 1H), 7.76 (d, *J* = 8.2 Hz, 2H), 7.71 (d, *J* = 8.4 Hz, 1H), 7.59 (d, *J* = 8.4 Hz, 2H), 7.48 (t, *J* = 8.2 Hz, 1H), 7.22 (d, *J* = 8.0 Hz, 2H), 7.12 (t, *J* = 7.9 Hz, 1H), 6.91

(d, *J* = 8.6 Hz, 2H), 3.99 (t, *J* = 6.5 Hz, 2H), 2.33 (s, 3H), 1.82-1.75 (m, 2H), 1.48-1.41 (m, 2H), 1.36-1.26 (m, 12H), 0.87 (t, *J* = 6.6 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 180.54, 161.78, 144.05, 140.78, 136.43, 135.45, 135.30 (2C), 134.66, 129.75 (2C), 127.30 (2C), 122.65 (2C), 118.45, 115.01 (2C), 110.93, 97.05, 86.82, 68.35, 31.91, 29.57 (2C), 29.36, 29.34, 29.07, 25.98, 22.70, 21.57, 14.16. **HRMS (ESI):** m/z calcd for $C_{32}H_{38}NO_4S$ $(M+H)^+$: 532.2522, found: 532.2524.

***N*-(2-(1-(4-(Decyloxy)phenyl)-3-hydroxyhex-5-en-1-yn-3-yl)phenyl)-4-methylbenzene-sulfonamide (1v).**

This compound was isolated as pale-yellow sticky-oil by following the general procedure-**1**.

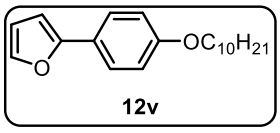


1v

100 mg of **Cv** afforded 102 mg of **1v** (94% yield), R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3454, 3261, 2926, 2226, 1602, 1463, 1260, 1093, 733. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 9.23 (s, 1H), 7.77 (d, *J* = 8.2 Hz, 2H), 7.60 (t, *J* = 9.1 Hz, 2H), 7.38 (d, *J* = 8.7 Hz, 2H), 7.23-7.20 (m, 3H), 7.03-6.99 (m, 1H), 6.84 (d, *J* = 8.7 Hz, 2H), 5.88-5.77 (m, 1H), 5.18 (dd, *J* = 10.2, 1.1 Hz, 1H), 5.05 (d, *J* = 17.1 Hz, 1H), 3.95 (t, *J* = 6.5 Hz, 2H), 3.27 (s, 1H), 2.60-2.50 (m, 2H), 2.34 (s, 3H), 1.81-1.74 (m, 2H), 1.48-1.40 (m, 2H), 1.30-1.27 (m, 12H), 0.88 (t, *J* = 6.4 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 159.71, 143.74, 137.20, 135.68, 133.28 (2C), 132.23, 130.18, 129.70 (2C), 129.04, 128.49, 127.20 (2C), 123.39, 120.76, 120.00, 114.56 (2C), 113.52, 88.33, 87.86, 74.76, 68.14, 47.46, 31.91, 29.57 (2C), 29.39, 29.34, 29.15, 26.01, 22.71, 21.54, 14.16. **HRMS (ESI):** m/z calcd for $C_{35}H_{43}NNaO_4S$ $(M+Na)^+$: 596.2810, found: 596.2808.

2-(4-Decylphenyl)furan (12v).

This compound was isolated as white solid by following the general procedure-**2**. 250 mg of **F**



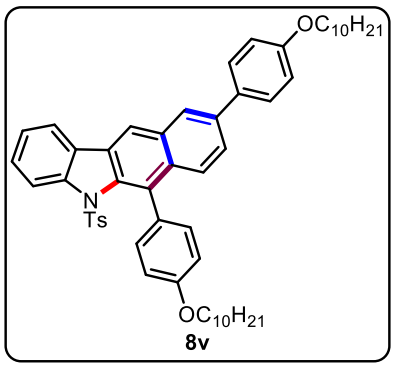
12v

afforded 177 mg of **12v** (73% yield), R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 56-58 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2926, 1516, 1385, 1175, 735. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.59 (d, *J* = 8.7 Hz, 2H), 7.42 (d, *J* = 1.2 Hz, 1H), 6.91 (d, *J* = 8.7 Hz, 2H), 6.51 (d, *J* = 3.2 Hz, 1H), 6.44 (dd, *J* = 3.2, 1.8 Hz, 1H), 3.97 (t, *J* = 6.6 Hz, 2H), 1.82-1.75 (m, 2H), 1.49-1.42 (m, 2H), 1.37-1.28 (m, 12H), 0.89 (t, *J* = 6.4 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.61, 154.14, 141.32, 125.20 (2C), 123.80, 114.67 (2C), 111.53, 103.25, 68.08, 31.93, 29.61, 29.60,

29.44, 29.36, 29.29, 26.07, 22.72, 14.16. **HRMS (ESI):** m/z calcd for $C_{20}H_{29}O_2$ $(M+H)^+$: 301.2168, found: 301.2154.

6,9-Bis(4-(decyloxy)phenyl)-5-tosyl-5*H*-benzo[*b*]carbazole (8v).

This compound was isolated as yellow sticky-oil by following the general procedure-**5**. 20 mg

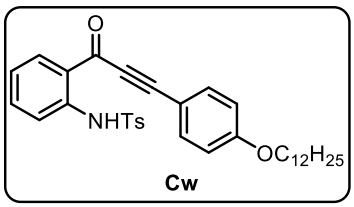


8v

of **1v** afforded 18 mg of **8v** (61% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2924, 1608, 1513, 1245, 1175, 825. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.18-8.16 (m, 2H), 8.07-8.04 (m, 2H), 7.83 (d, *J* = 8.1 Hz, 1H), 7.68-7.64 (m, 3H), 7.50-7.44 (m, 3H), 7.35 (t, *J* = 6.5 Hz, 1H), 7.06-7.01 (m, 6H), 6.85 (d, *J* = 8.2 Hz, 2H), 4.08-4.00 (m, 4H), 2.20 (s, 3H), 1.90-1.80 (m, 4H), 1.58-1.48 (m, 4H), 1.42-1.31 (m, 24H), 0.94-0.90 (m, 6H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.99, 158.58, 143.65, 143.07, 137.78, 137.58, 133.69, 132.76, 132.46, 132.45 (2C), 131.64, 130.21, 130.13, 129.88, 128.74 (2C), 128.31 (3C), 127.92, 127.48, 126.63 (2C), 125.56, 125.52, 125.11, 120.21, 119.90, 118.02, 114.97 (2C), 113.90 (2C), 68.15, 67.88, 31.99, 31.97, 29.72, 29.68, 29.67, 29.64, 29.58, 29.54, 29.48, 29.43, 29.40, 29.35, 26.29, 26.14, 22.77, 22.76, 21.50, 14.21 (2C). **HRMS (ESI):** m/z calcd for $C_{55}H_{65}NNaO_4S$ $(M+Na)^+$: 858.4532, found: 858.4532.

***N*-(2-(3-(4-(Dodecyloxy)phenyl)propioloyl)phenyl)-4-methylbenzenesulfonamide (Cw).**

This compound was isolated as brown solid by following the general procedure-**1**. 150 mg of



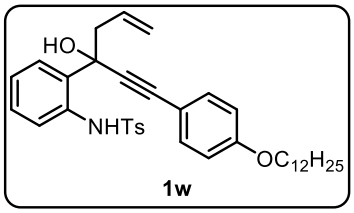
Cw

Bw afforded 117 mg of **Cw** (78% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 88-90 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2924, 2188, 1596, 1494, 1257, 917, 751. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 11.33 (s, 1H), 8.25 (dd, *J* = 7.9, 1.3 Hz, 1H), 7.75 (d, *J* = 8.2 Hz, 2H), 7.70 (d, *J* = 8.3 Hz, 1H), 7.59 (d, *J* = 8.8 Hz, 2H), 7.50-7.45 (m, 1H), 7.21 (d, *J* = 8.1 Hz, 2H), 7.12 (t, *J* = 7.3 Hz, 1H), 6.90 (d, *J* = 8.8 Hz, 2H), 3.98 (t, *J* = 6.5 Hz, 2H), 2.33 (s, 3H), 1.82-1.75 (m, 2H), 1.48-1.41 (m, 2H), 1.33-1.25 (m, 16H), 0.87 (t, *J* = 6.5 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 180.53, 161.78, 144.05, 140.77, 136.43, 135.45, 135.30 (2C), 134.66, 129.75 (2C), 127.29 (2C), 122.65 (2C), 118.45, 115.01 (2C), 110.93, 97.06, 86.82, 68.35, 31.93, 29.67, 29.66, 29.61, 29.57, 29.37 (2C), 29.07, 25.98,

22.72, 21.56, 14.16. **HRMS (ESI):** m/z calcd for $C_{34}H_{42}NO_4S$ $(M+H)^+$: 560.2835, found: 660.2831.

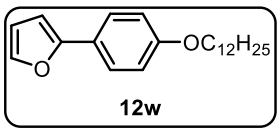
***N*-(2-(1-(4-(Dodecyloxy)phenyl)-3-hydroxyhex-5-en-1-yn-3-yl)phenyl)-4-methylbenzene-sulfonamide (1w).**

This compound was isolated as brown sticky-oil by following the general procedure-**1**. 100 mg of **Cw** afforded 97 mg of **1w** (90% yield). R_f = 0.2 (1:4 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 3449, 3218, 2925, 2227, 1602, 1503, 1407, 1160, 923. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 9.29 (s, 1H), 7.76 (d, *J* = 8.3 Hz, 2H), 7.62-7.58 (m, 2H), 7.37 (d, *J* = 8.8 Hz, 2H), 7.21-7.17 (m, 3H), 7.03-6.97 (m, 1H), 6.83 (d, *J* = 8.8 Hz, 2H), 5.87-5.76 (m, 1H), 5.16 (dd, *J* = 10.2, 1.8 Hz, 1H), 5.03 (dd, *J* = 17.1, 1.5 Hz, 1H), 3.94 (t, *J* = 6.5 Hz, 2H), 3.47 (s, 1H), 2.60-2.50 (m, 2H), 2.33 (s, 3H), 1.83-1.74 (m, 2H), 1.48-1.41 (m, 2H), 1.36-1.27 (m, 16H), 0.88 (t, *J* = 6.4 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 159.68, 143.75, 137.15, 135.69, 133.29, 132.27 (2C), 130.23, 129.70 (2C), 129.01, 128.55, 127.20 (2C), 123.38, 120.59, 119.97, 114.56 (2C), 113.58, 88.29, 87.92, 74.80, 68.14, 47.51, 31.95, 29.69, 29.67, 29.63, 29.60, 29.40, 29.39, 29.16, 26.02, 22.73, 21.50, 14.18. **HRMS (ESI):** m/z calcd for $C_{37}H_{47}NNaO_4S$ $(M+Na)^+$: 624.3123, found: 624.3120.



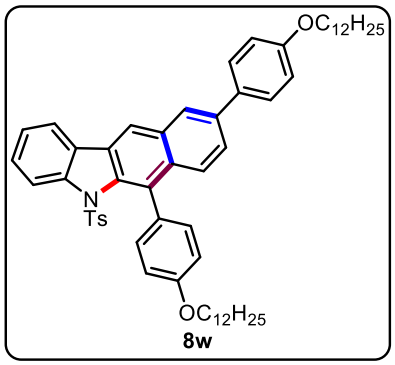
2-(4-Dodecylphenyl)furan (12w).

This compound was isolated as brown solid by following the general procedure-**2**. 250 mg of **F** afforded 159 mg of **12w** (66% yield), R_f = 0.5 (1:99 EtOAc: Hexanes, visualized by 254 nm UV light). **M.P** = 65-67 °C. **IR (thin film, neat):** ν_{max}/cm^{-1} 2926, 1514, 1472, 1175, 736. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 7.59 (d, *J* = 8.7 Hz, 2H), 7.42 (d, *J* = 2.3 Hz, 1H), 6.91 (d, *J* = 8.7 Hz, 2H), 6.51 (d, *J* = 3.2 Hz, 1H), 6.44 (dd, *J* = 3.0, 1.6 Hz, 1H), 3.97 (t, *J* = 6.5 Hz, 2H), 1.82-1.75 (m, 2H), 1.48-1.43 (m, 2H), 1.32-1.27 (m, 16H), 0.89 (t, *J* = 6.2 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.61, 154.14, 141.32, 125.20 (2C), 123.80, 114.67 (2C), 111.53, 103.25, 68.08, 31.95, 29.70, 29.67, 29.64, 29.62, 29.44, 29.39, 29.29, 26.07, 22.73, 14.17. **HRMS (ESI):** m/z calcd for $C_{22}H_{33}O_2$ $(M+H)^+$: 329.2481, found: 329.2480.



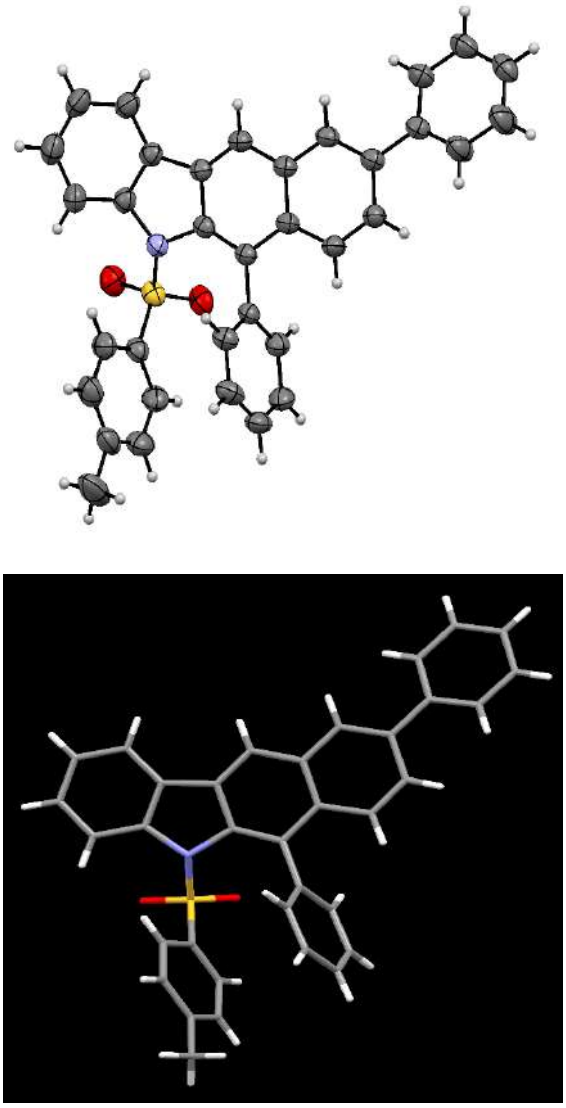
6,9-Bis(4-(dodecyloxy)phenyl)-5-tosyl-5*H*-benzo[*b*]carbazole (8w).

This compound was isolated as brown sticky-oil by following the general procedure-**5**. 20 mg of **1w** afforded 19 mg of **8w** (63% yield). R_f = 0.3 (1:9 EtOAc: Hexanes, visualized by 254 nm UV light). **IR (thin film, neat):** ν_{max}/cm^{-1} 2927, 1606, 1514, 1368, 1175, 825. **^{1}H NMR (400 MHz, $CDCl_3$)**: δ 8.19 (s, 1H), 8.14 (d, *J* = 8.1 Hz, 1H), 8.08 (d, *J* = 1.7 Hz, 1H), 8.04 (d, *J* = 9.0 Hz, 1H), 7.83 (d, *J* = 7.2 Hz, 1H), 7.68-7.64 (m, 3H), 7.48-7.43 (m, 3H), 7.36 (t, *J* = 7.6 Hz, 1H), 7.03-6.99 (m, 6H), 6.84 (d, *J* = 8.2 Hz, 2H), 4.07-4.00 (m, 4H), 2.20 (s, 3H), 1.86-1.80 (m, 4H), 1.53-1.46 (m, 4H), 1.39-1.28 (m, 26H), 1.27-1.24 (m, 6H), 0.90-0.87 (m, 6H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ 158.97, 158.55, 143.63, 143.05, 137.80, 137.57, 133.62, 132.80, 132.45, 132.41, 131.63, 130.22, 130.14, 129.85, 129.35, 128.98, 128.71, 128.31 (2C), 127.91, 127.48, 127.26, 126.62 (2C), 125.56, 125.49, 125.12, 120.17, 119.90, 117.97, 114.96 (2C), 113.88 (2C), 68.15, 67.88, 31.95 (2C), 29.73, 29.69 (4C), 29.64 (2C), 29.55, 29.50, 29.44, 29.39 (3C), 29.32, 26.26, 26.10, 22.73 (2C), 21.50, 14.17 (2C). **HRMS (ESI):** m/z calcd for $C_{59}H_{73}NNaO_4S$ $(M+Na)^+$: 914.5158, found: 914.5115.



8w

Crystal Structure of 8b (CCDC 2322120): In a 5 mL glass vial, **8b** was dissolved in DCM (1.0 mL) and hexanes (1.0 mL) and the solution were kept at room temperature for slow evaporation. After 2-3 days, suitable single crystals were obtained.



ORTEP diagram of **8b** with 50% ellipsoidal probability

Crystal Data for $C_{35}H_{25}NO_2S$ (M = 523.66 g/mol): triclinic, space group P-1, a = 8.8511(3) Å, b = 10.7751(3) Å, c = 14.2389(4) Å, α = 81.330(2)°, β = 88.876(2)°, γ = 74.316(7)°, V = 1292.16(7) $Å^3$, Z = 2, T = 298 K, ρ_{calc} = 1.346 g/cm^3, μ(Mo Kα) = 0.160 mm^{-1}, 28604 reflections measured (5.26° ≤ 2Θ ≤ 65.28°), 8863 unique (R_{int} = 0.0242, R_{sigma} = 0.0218) which were used in all calculations. The final R1 was 0.0526 (>2σ (I)) and wR2 was 0.1768

Table S3: Crystal data and structure refinement for 8b

Identification code	8b
Empirical formula	$C_{35}H_{25}NO_2S$
Formula weight	523.66
Temperature/K	298
Crystal system	triclinic
Space group	P-1
a/Å	8.8511(3)
b/Å	10.7751(3)
c/Å	14.2389(4)
α/°	81.330(2)
β/°	88.876(2)
γ/°	74.316(7)
Volume/Å^3	1292.16(7)
Z	2
ρ_{calc}g/cm^3	1.346
μ/mm^{-1}	0.160
F(000)	548.5
Crystal size/mm^3	0.4 × 0.3 × 0.3
Radiation	Mo Kα (λ = 0.71073)
2Θ range for data collection/°	5.26 to 65.28
Index ranges	$-12 \leq h \leq 13$, $-15 \leq k \leq 16$, $-21 \leq l \leq 21$
Reflections collected	28604
Independent reflections	8863 [R_{int} = 0.0242, R_{sigma} = 0.0218]
Data/restraints/parameters	8863/0/353
Goodness-of-fit on F^2	1.048
Final R indexes [I>=2σ (I)]	R_1 = 0.0526, wR_2 = 0.1438
Final R indexes [all data]	R_1 = 0.0702, wR_2 = 0.1768
Largest diff. peak/hole / e Å^{-3}	0.31/-0.54

Screening of various Lewis and Brønsted acids to optimize step-2:

Further to the screening data presented in Table 1, we screened various Lewis and Brønsted acids to improve the efficiency of the overall transformation.

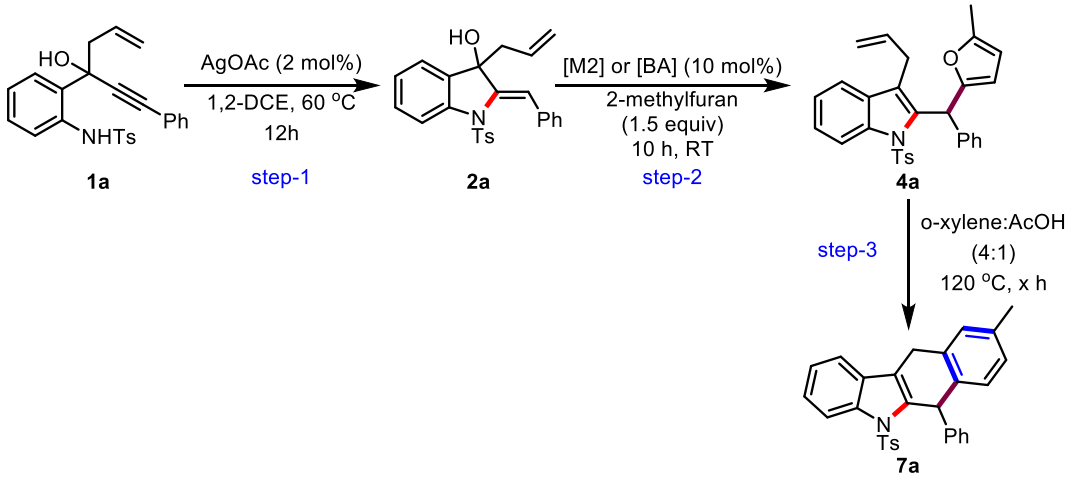


Table S4: Optimization of step-2

Entry	Step-2: M2 or BA (10 mol%)	Time (h)/ Yield (%)
1	$Sc(OTf)_3$	18/45
2[a]	$La(OTf)_3$	20/48
3	$BF_3.OEt_2$	23/Trace
4	TMSOTf	12/22
5	TfOH	15/36
6	*p*TSA	21/63
7	TFA	24/64
8	-	24/-

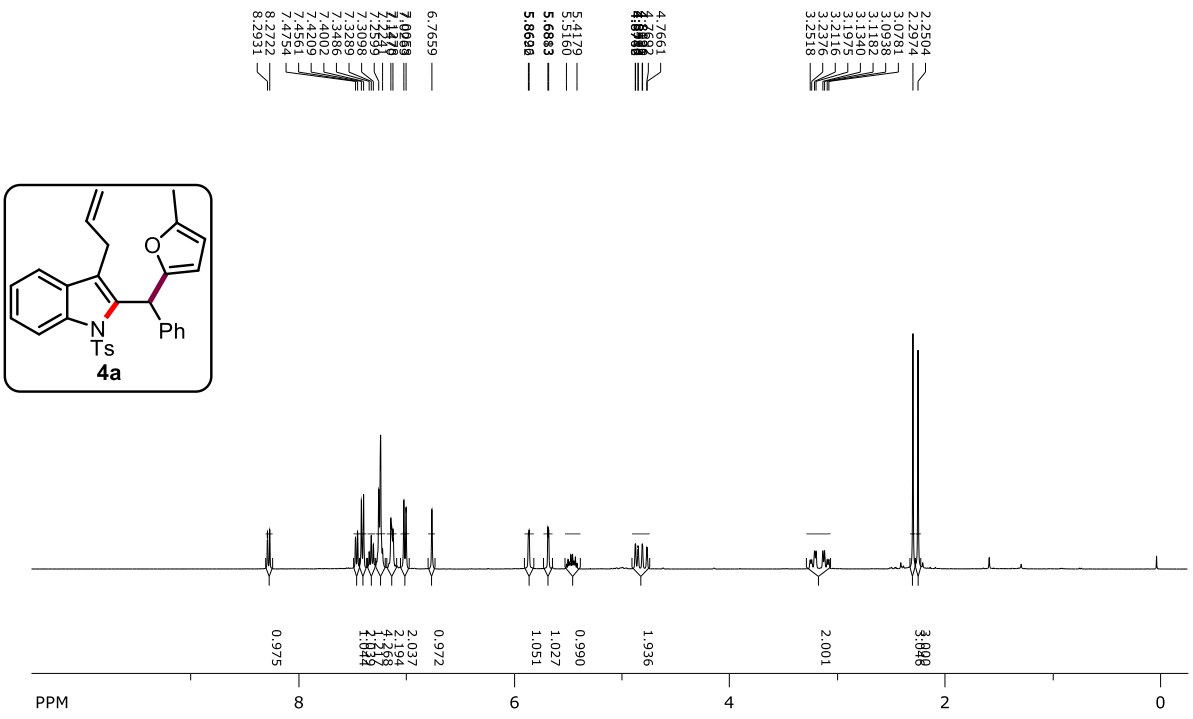
[a]In the case of $La(OTf)_3$, step-2 was performed at 60 °C because **2a** was not consumed fully at room temperature even after stirring for 24 h.

It is to be noted that **1a** remains as such in the absence of Lewis or Brønsted acids (in step-2). The TLC of the reaction after 24 h is as follows.

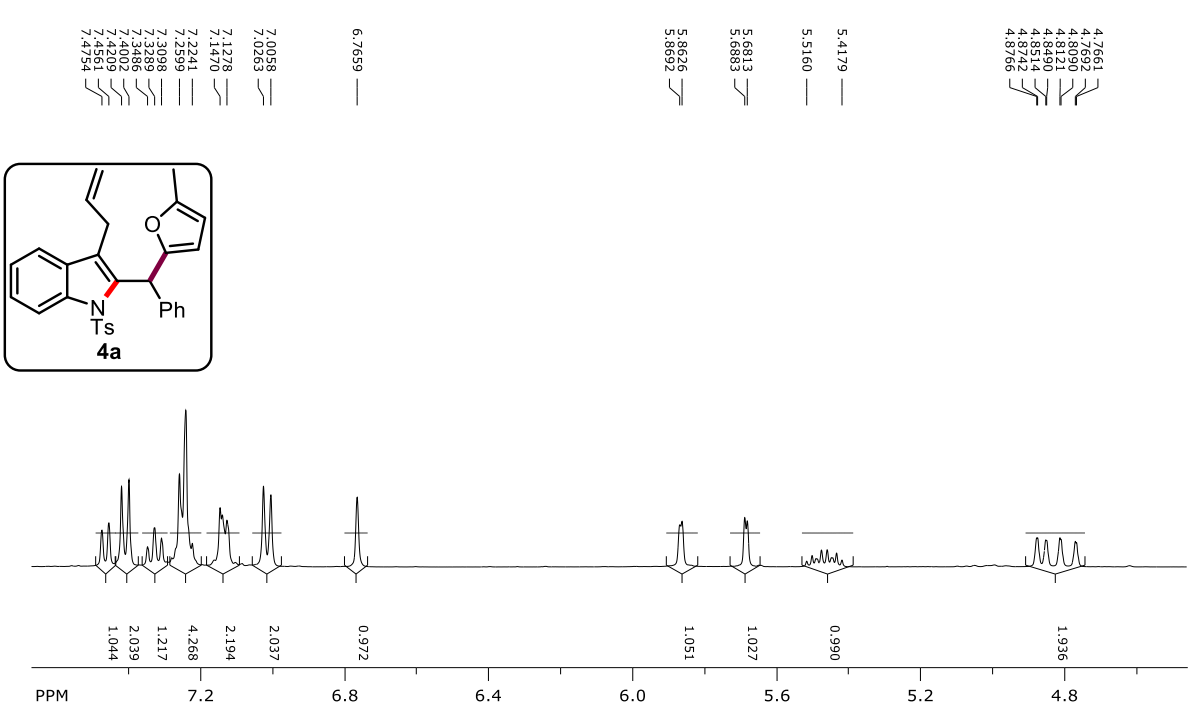
(Rx: reaction mixture)

Copies of ^{1}H and ^{13}C spectra of all the new compounds reported in this study

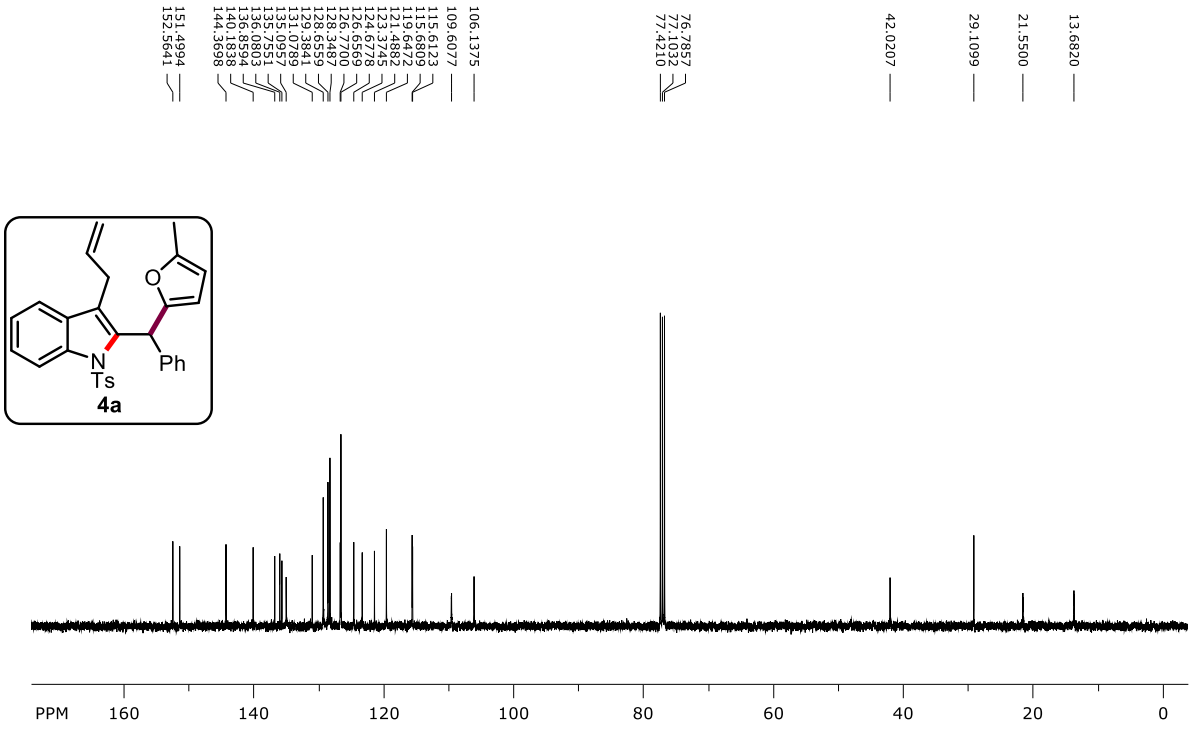
^{1}H NMR (400 MHz, $CDCl_3$)



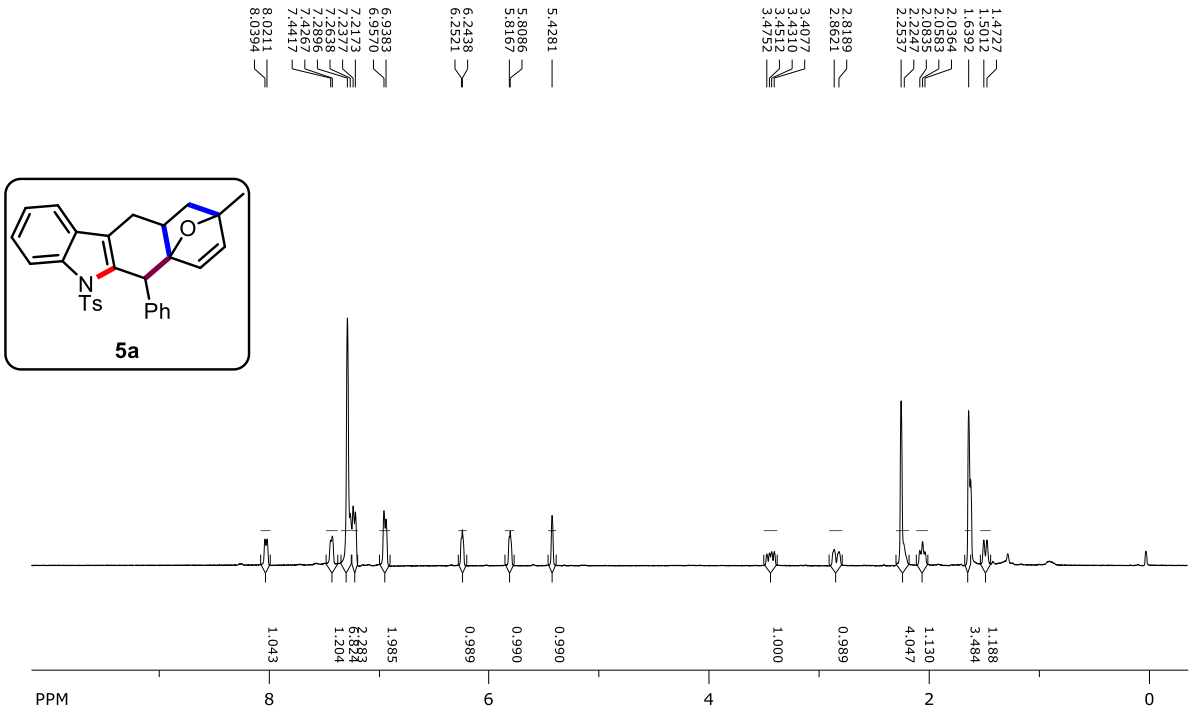
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.5-4.5 ppm region



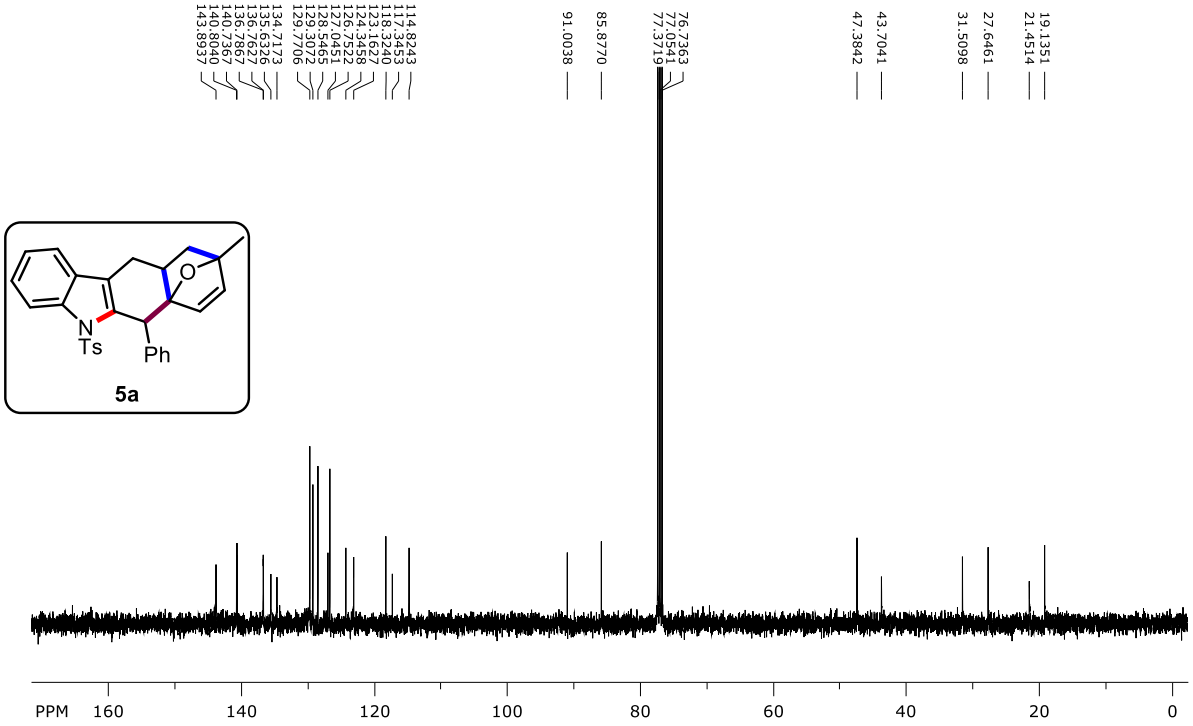
^{13}C NMR (100 MHz, $CDCl_3$)



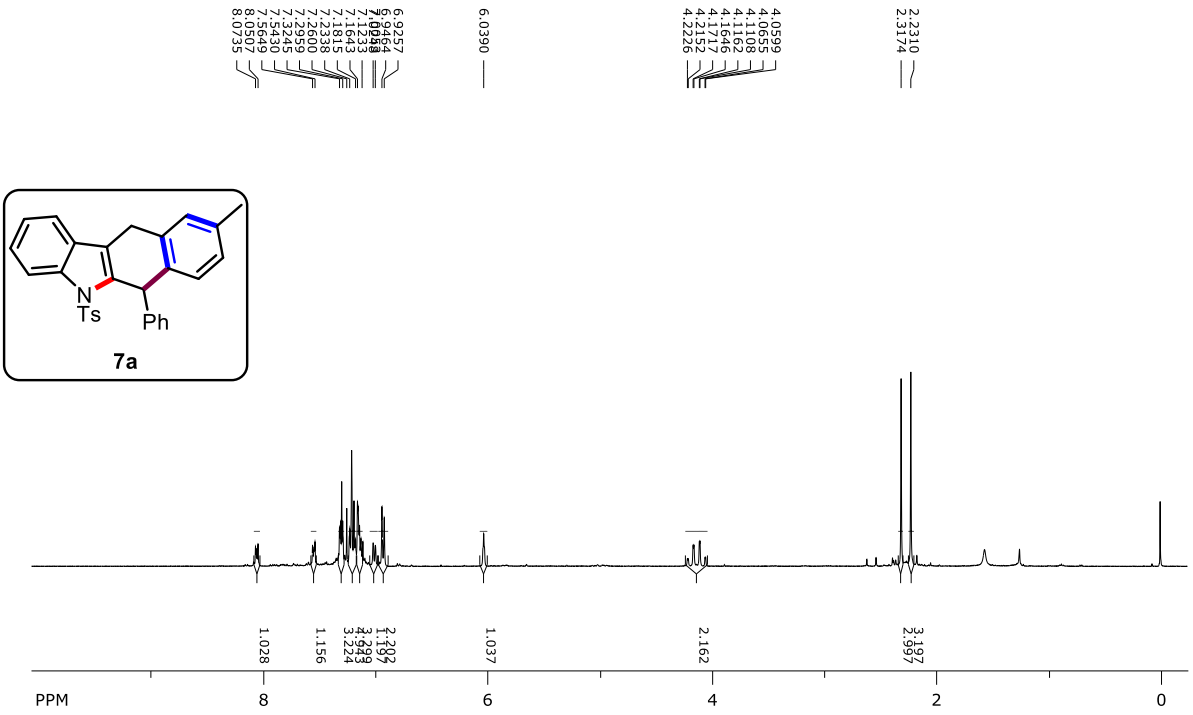
^{1}H NMR (400 MHz, $CDCl_3$)



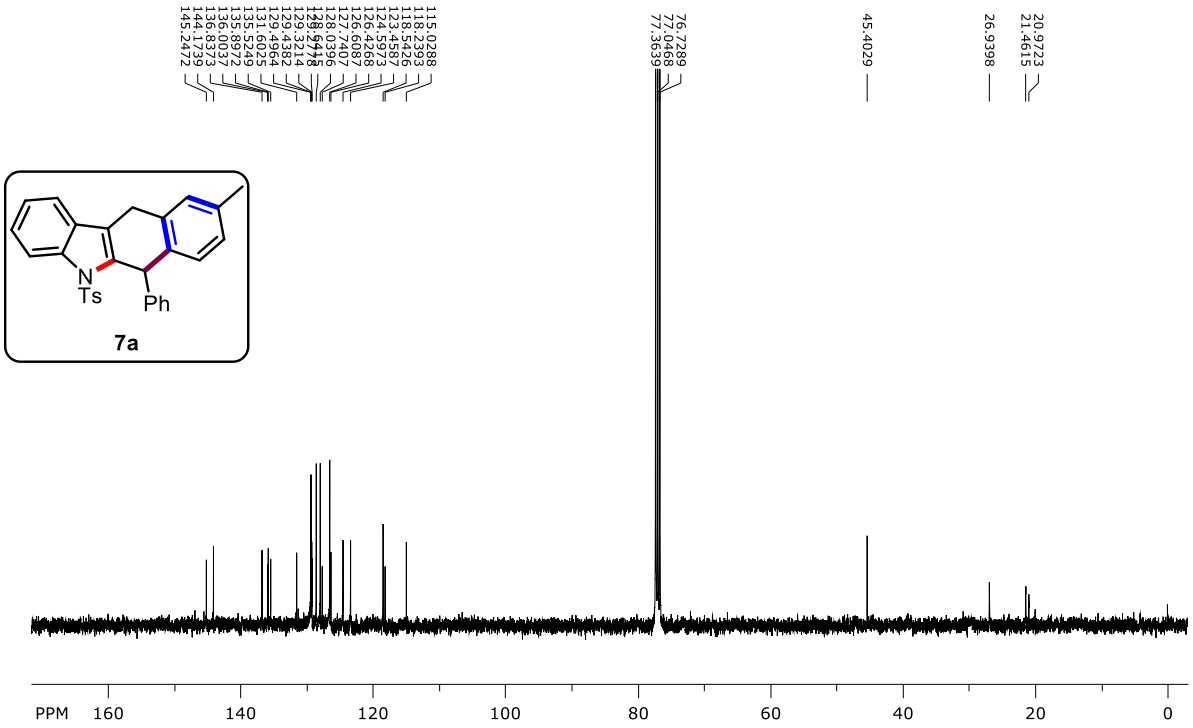
^{13}C NMR (100 MHz, $CDCl_3$)



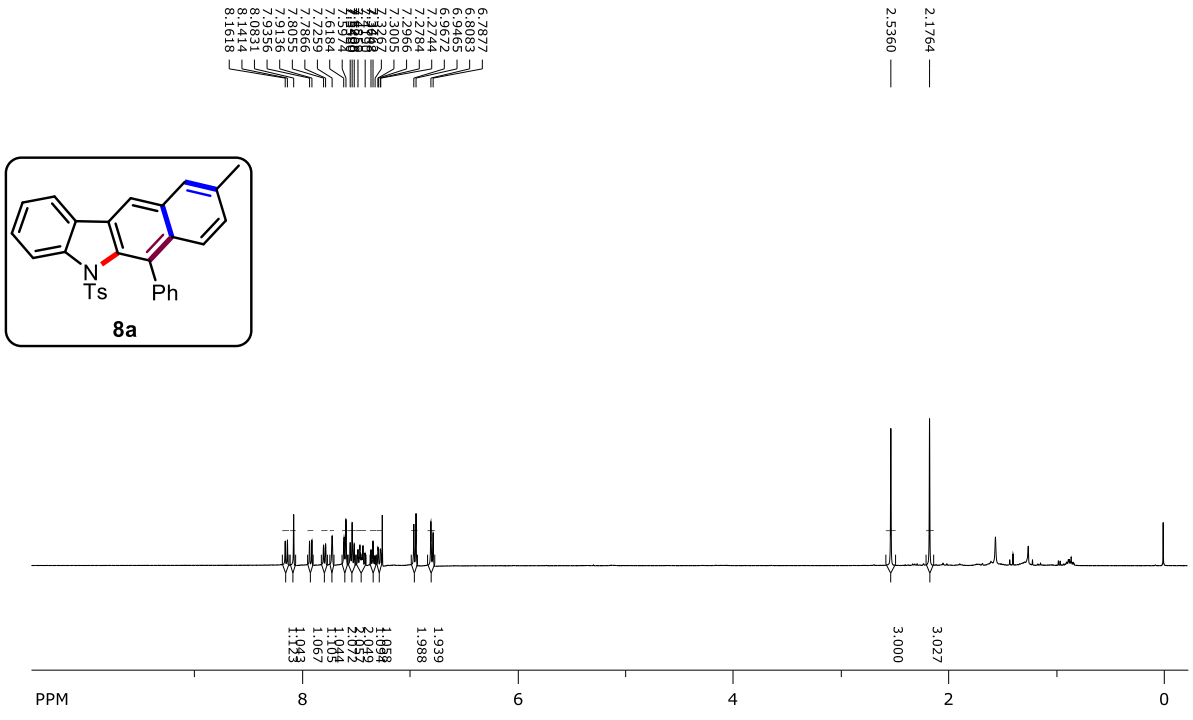
^{1}H NMR (400 MHz, $CDCl_3$)



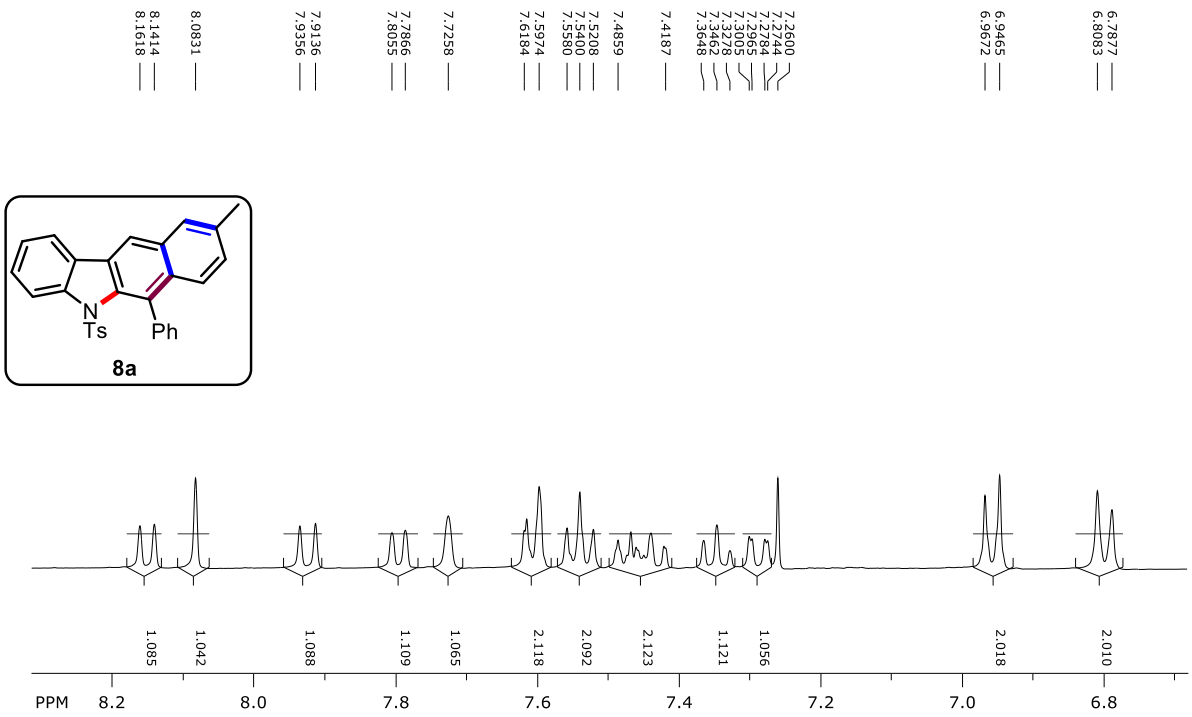
^{13}C NMR (100 MHz, $CDCl_3$)



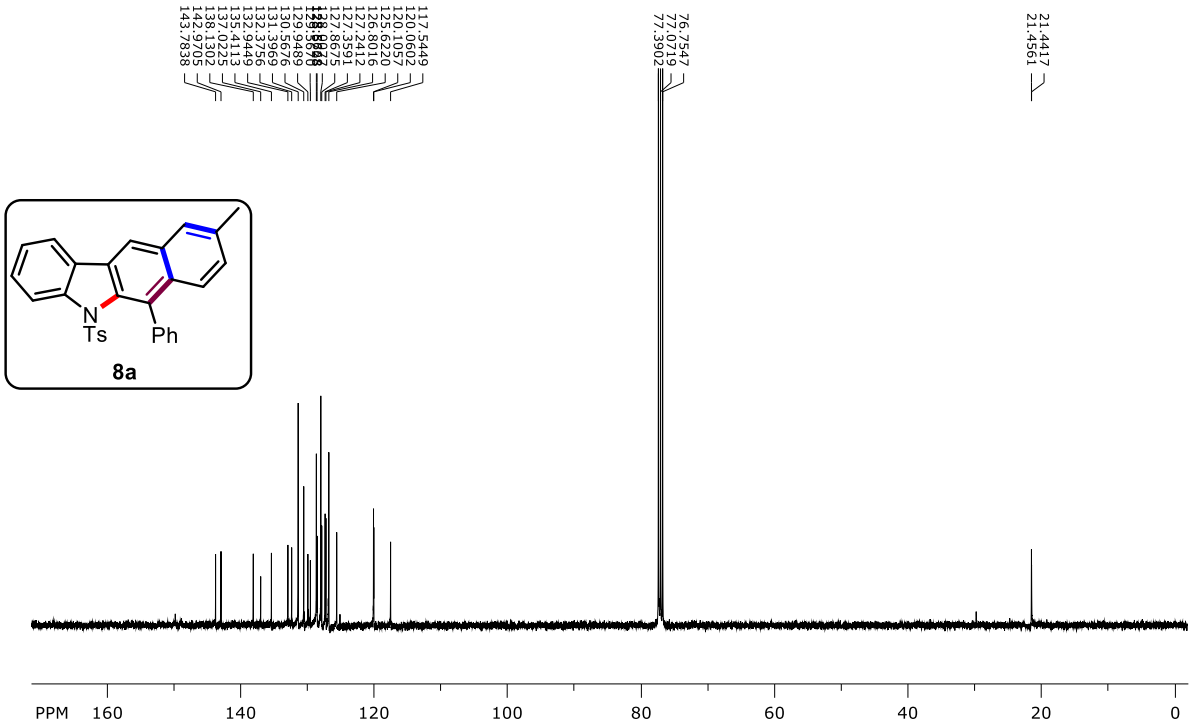
^{1}H NMR (400 MHz, $CDCl_3$)



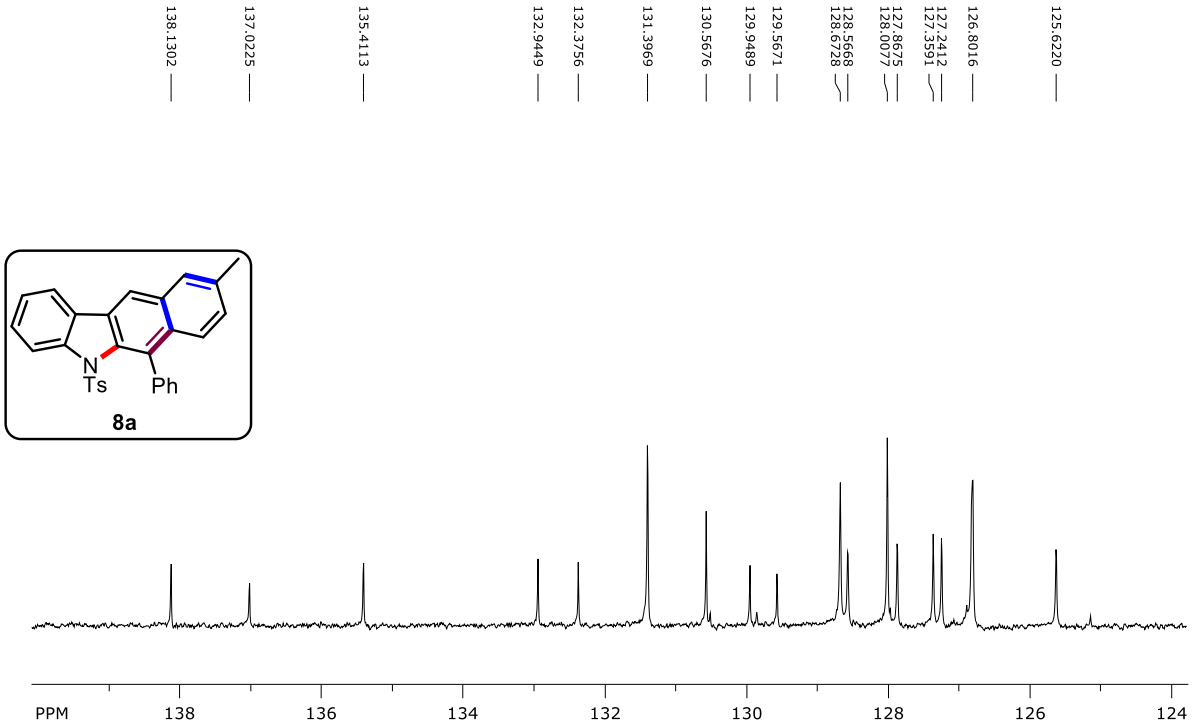
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.3-6.7 ppm region



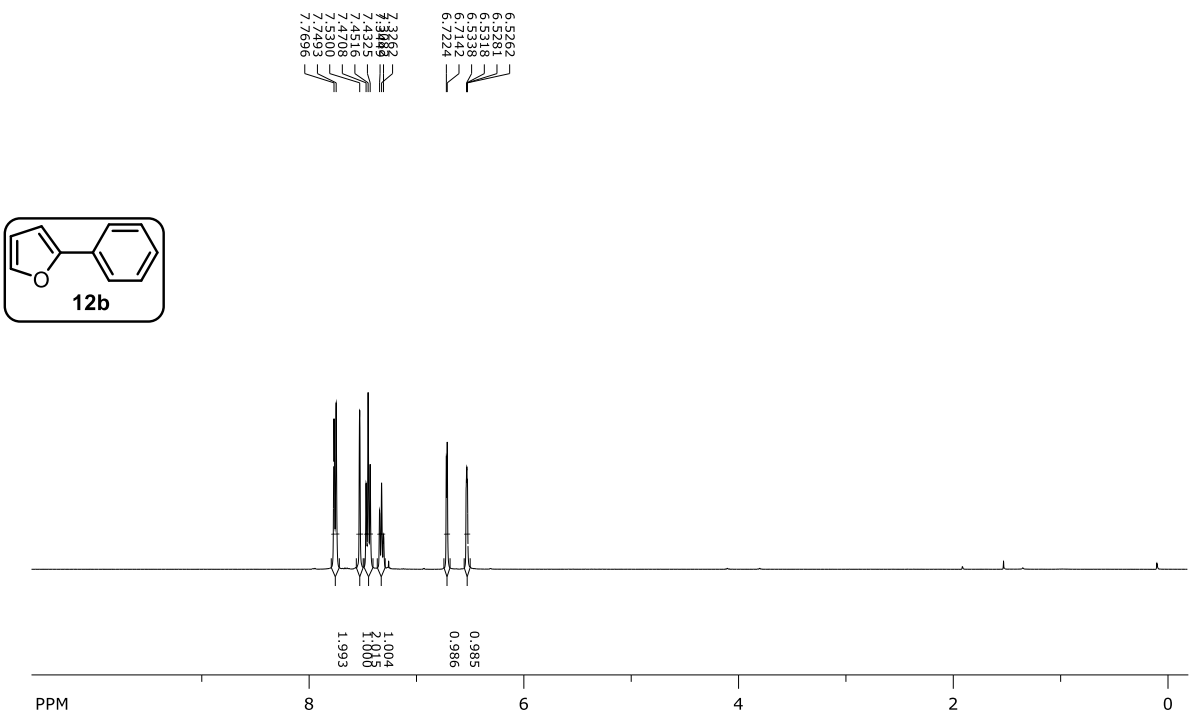
^{13}C NMR (100 MHz, $CDCl_3$)



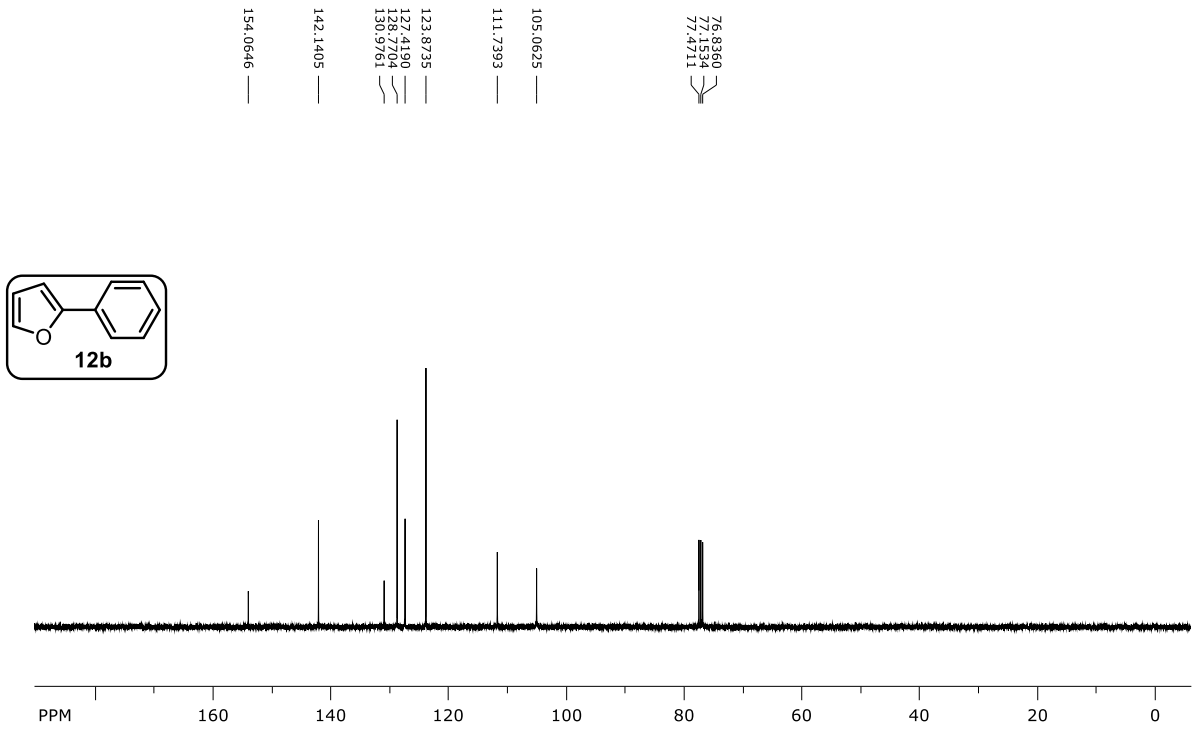
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 140.0-124.0 ppm region



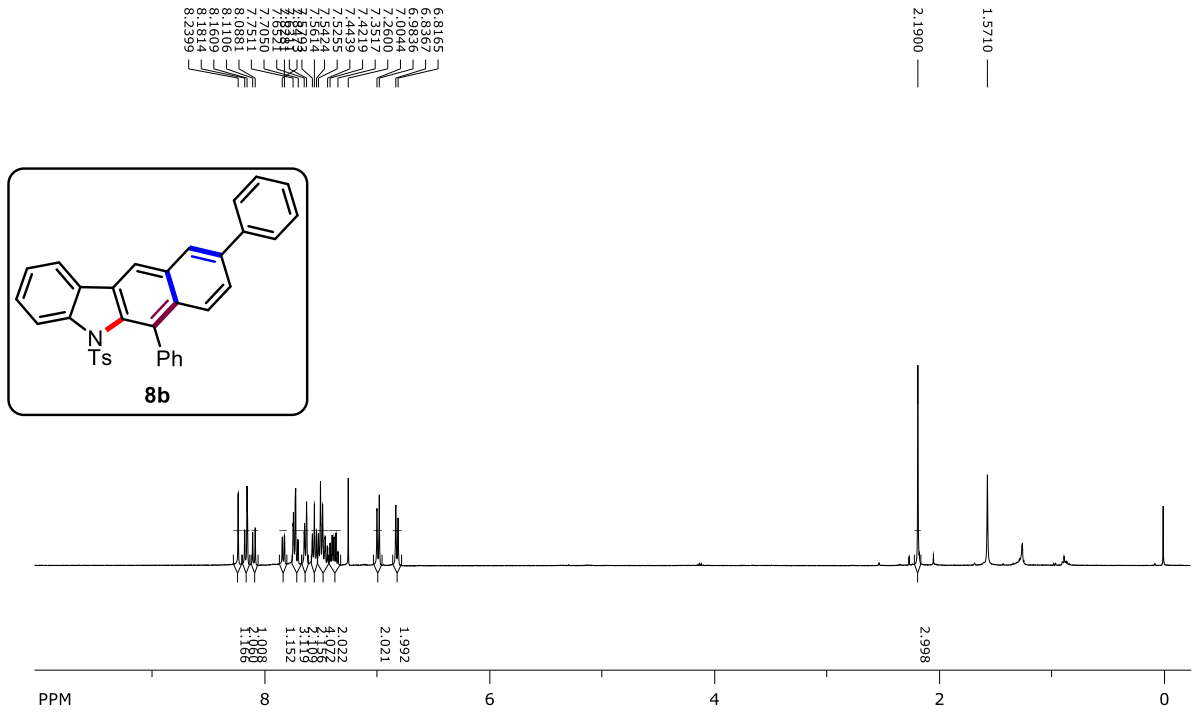
^{1}H NMR (400 MHz, $CDCl_3$)



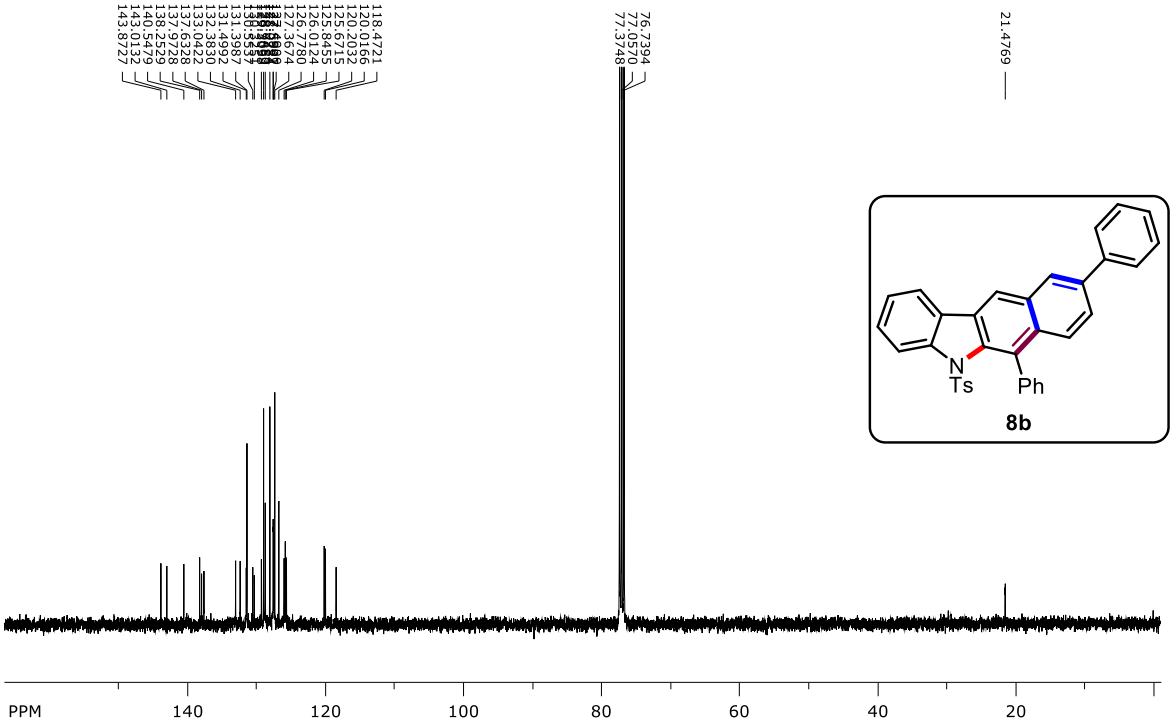
^{13}C NMR (100 MHz, $CDCl_3$)



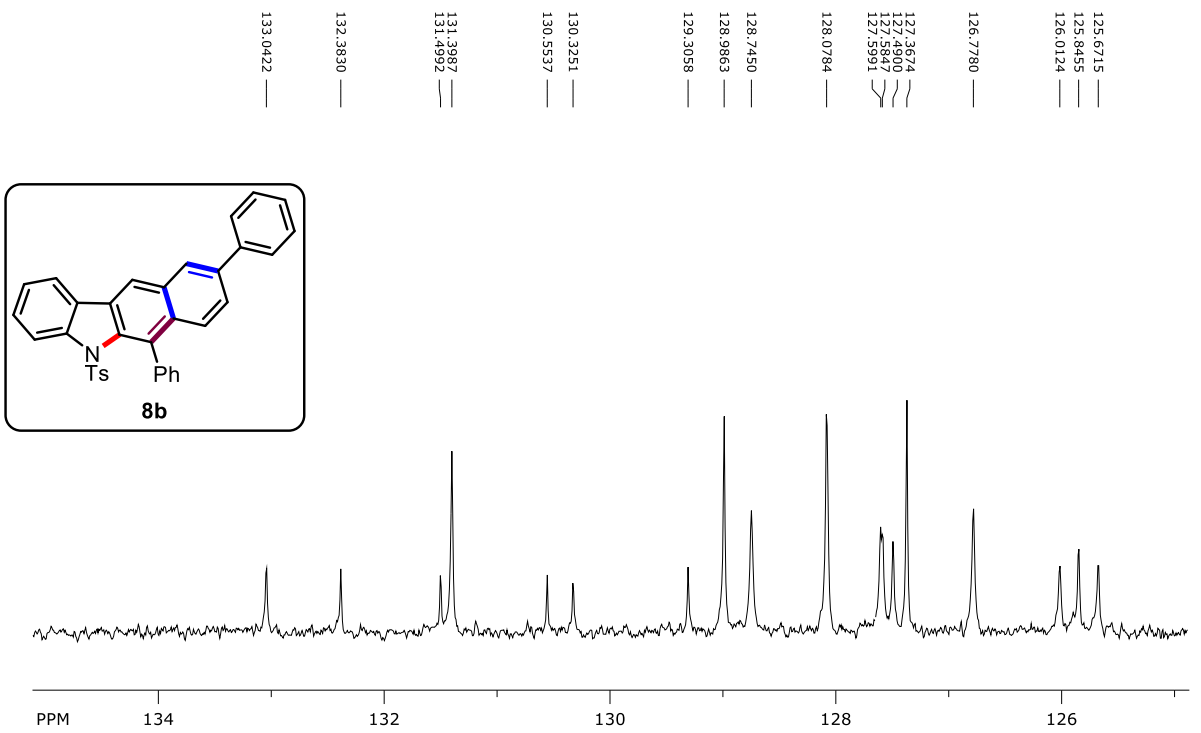
^{1}H NMR (400 MHz, $CDCl_3$)



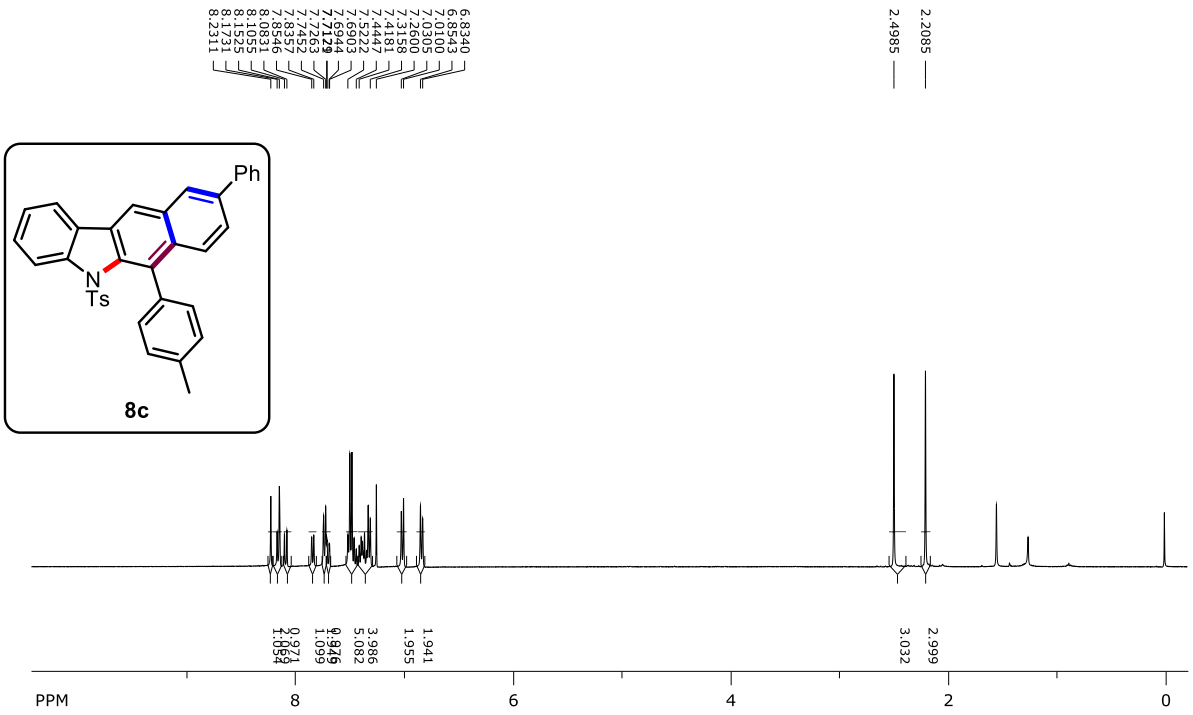
^{13}C NMR (100 MHz, $CDCl_3$):



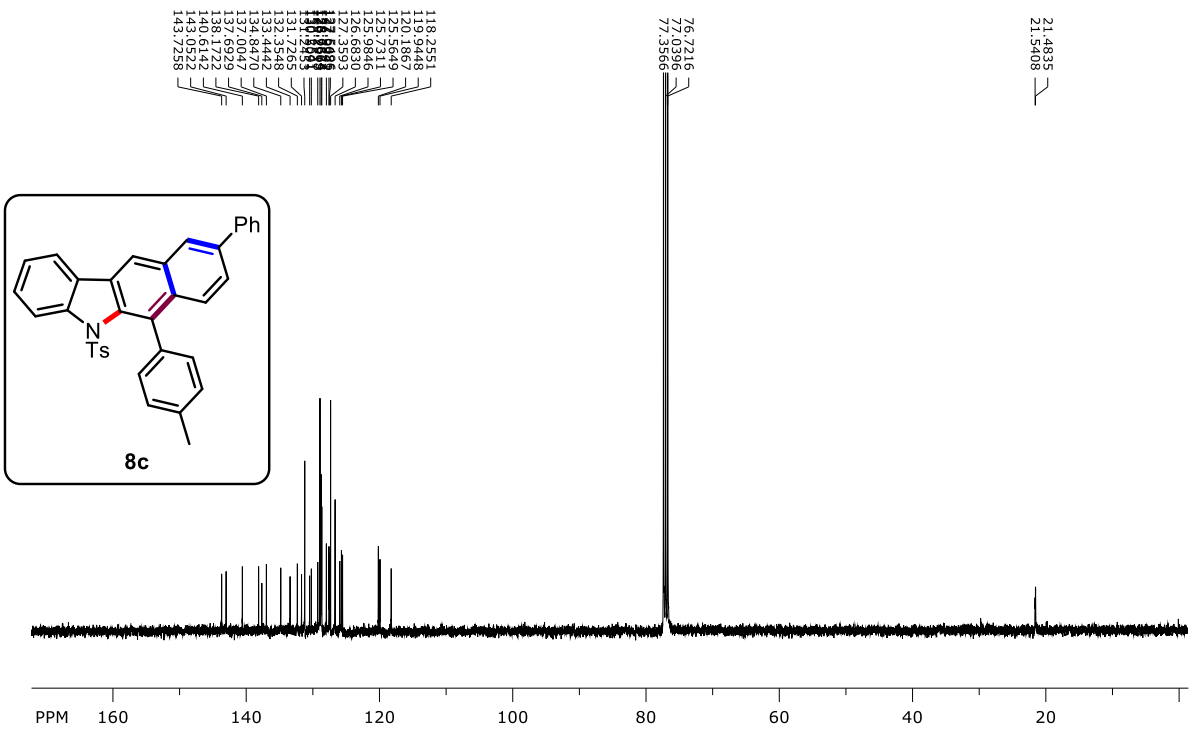
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 135.0-125.0 ppm region



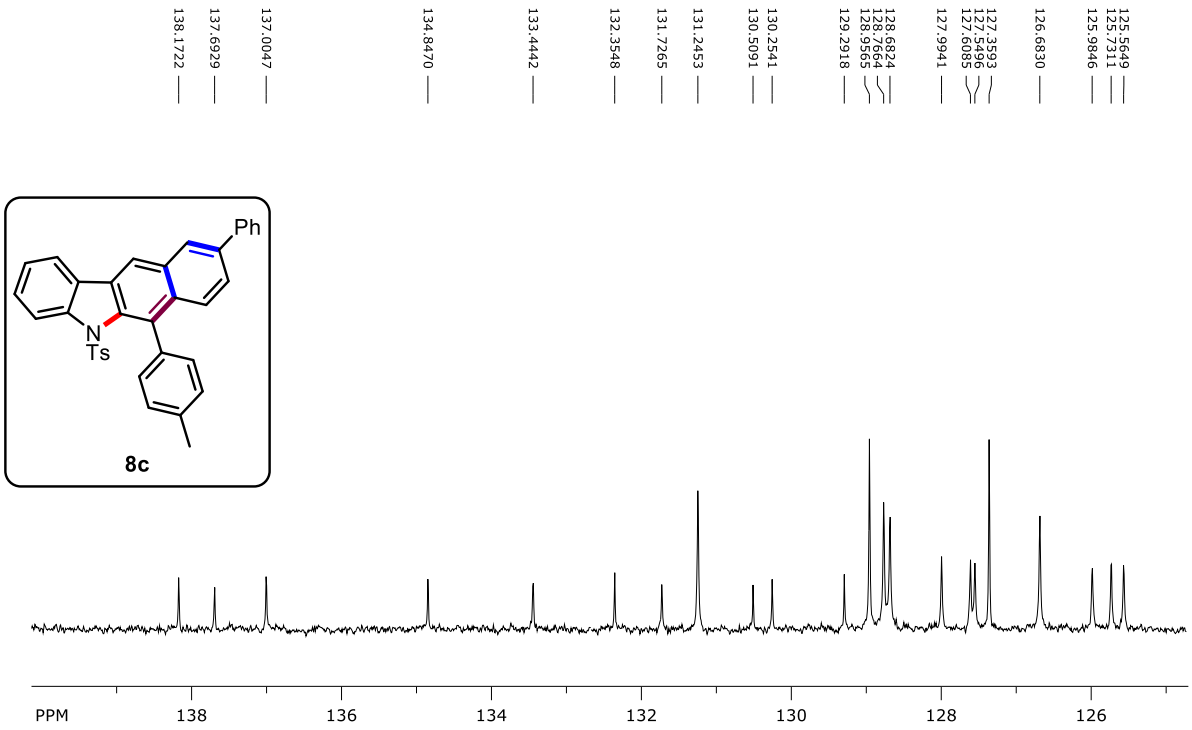
^{1}H NMR (400 MHz, $CDCl_3$)



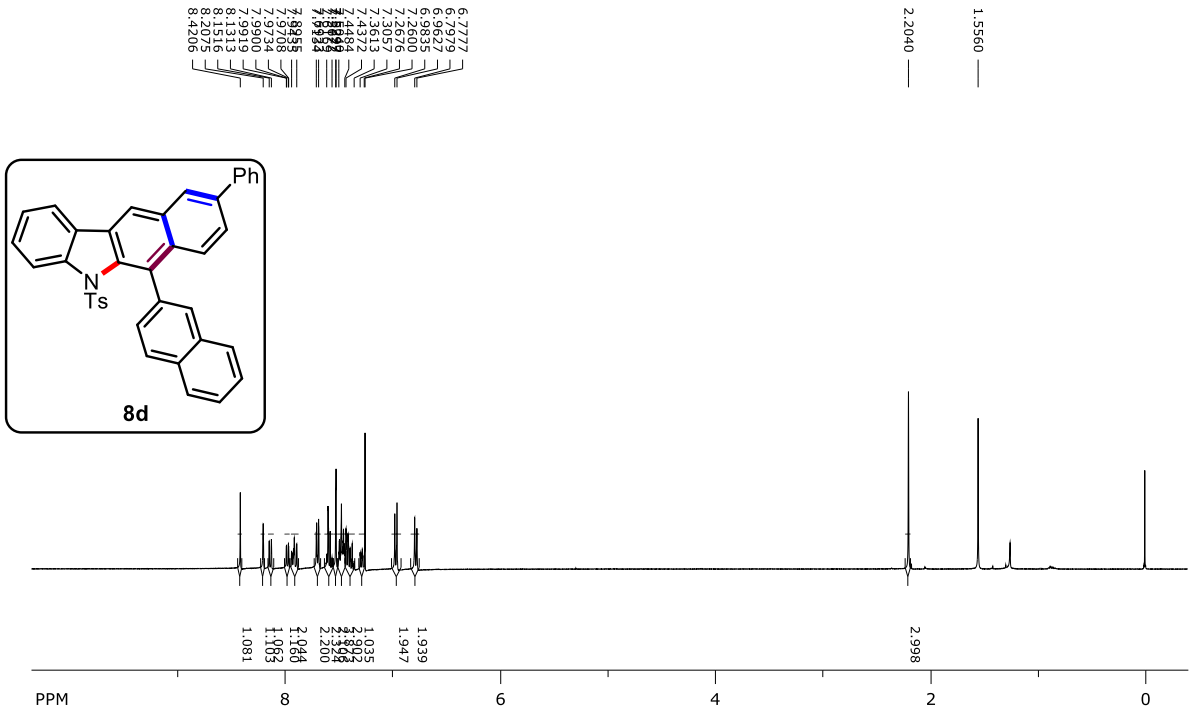
^{13}C NMR (100 MHz, $CDCl_3$)



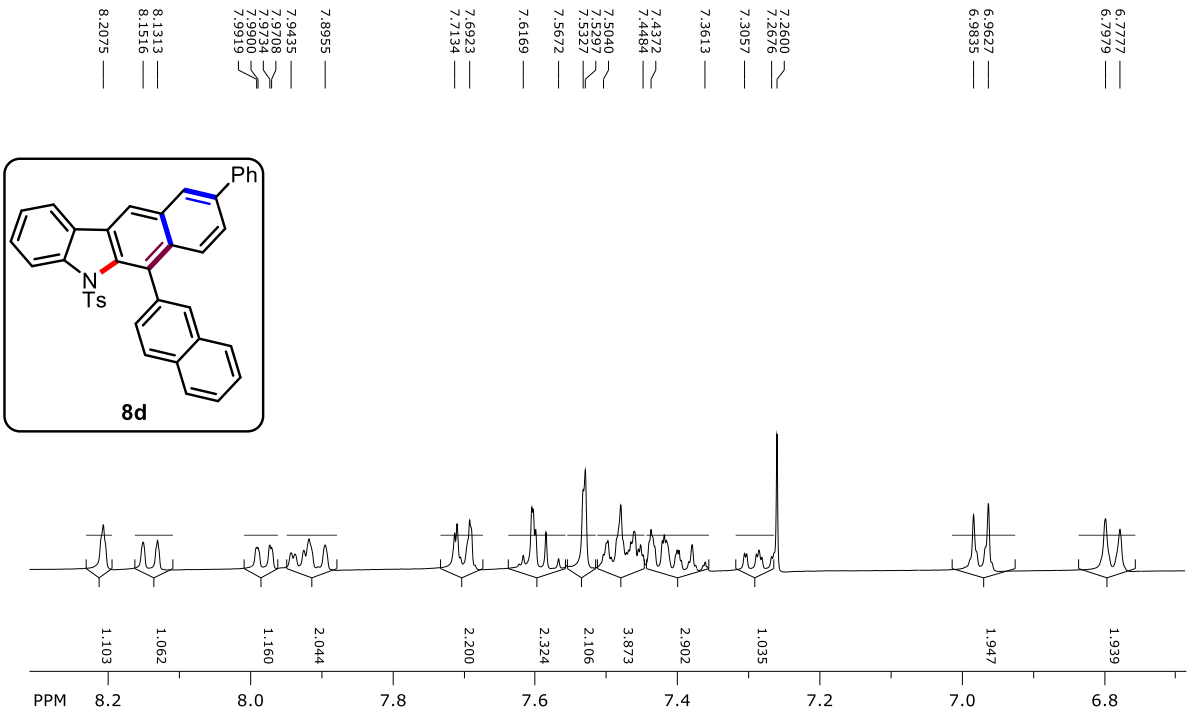
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 140.0-125.0 ppm region



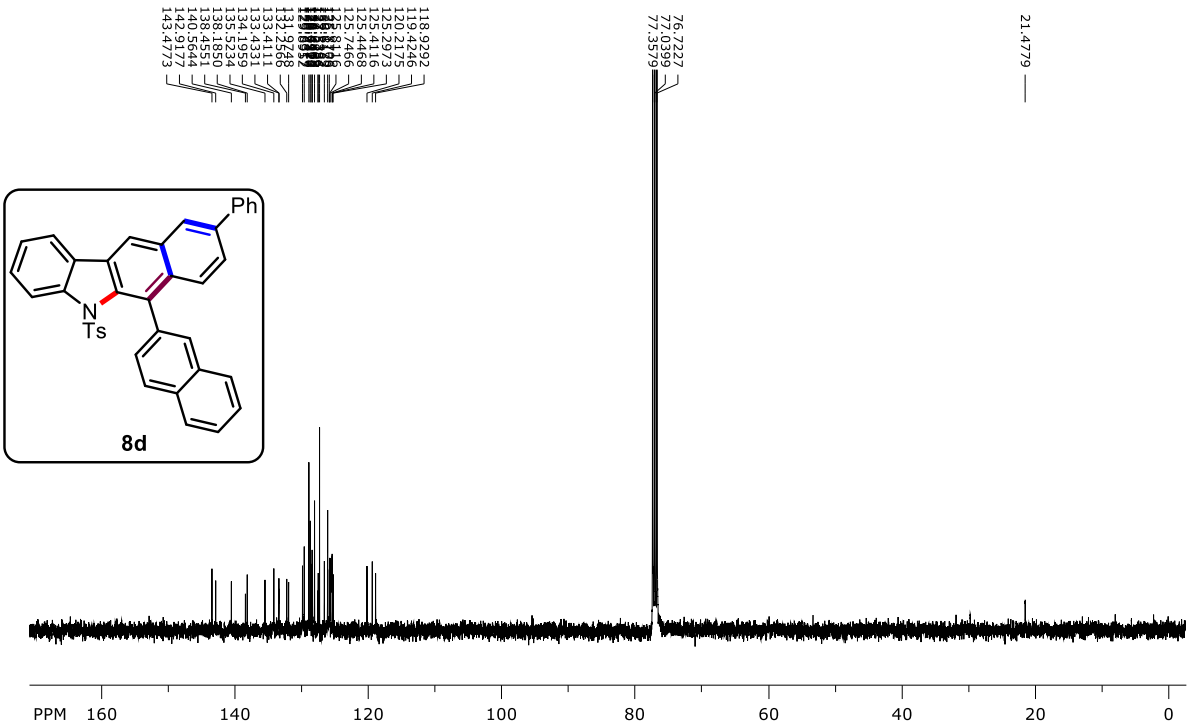
^{1}H NMR (400 MHz, $CDCl_3$)



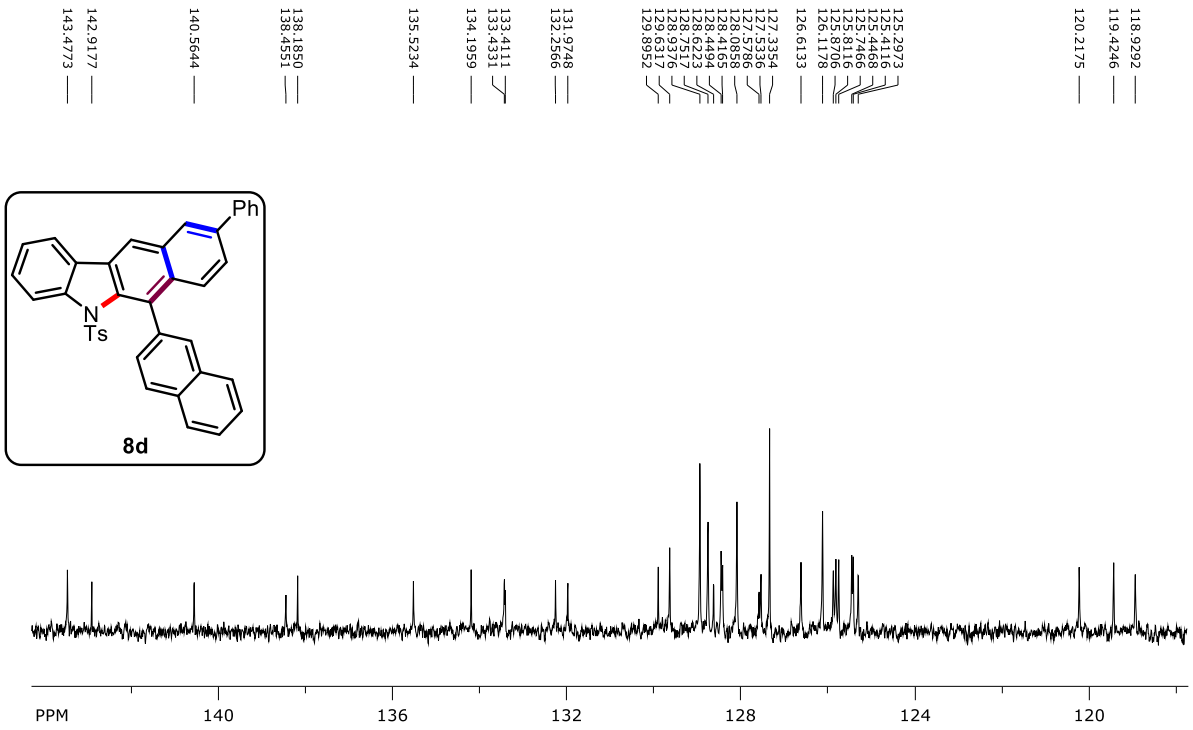
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.3-6.5 ppm region



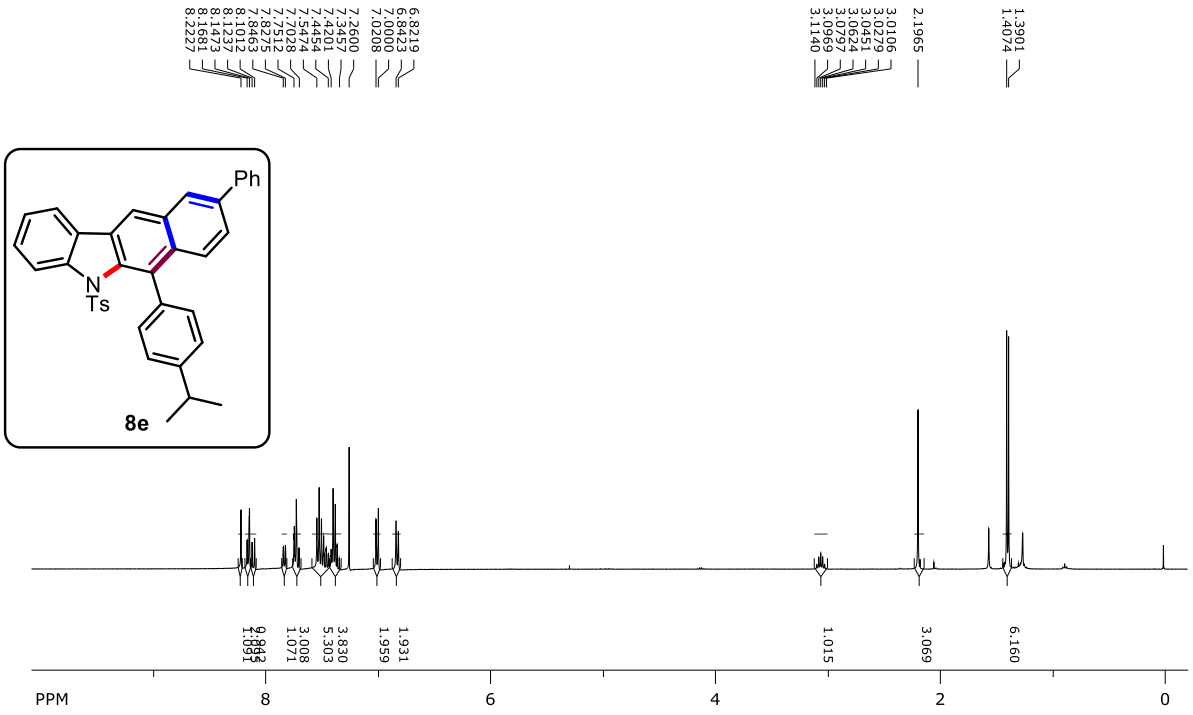
^{13}C NMR (100 MHz, $CDCl_3$)



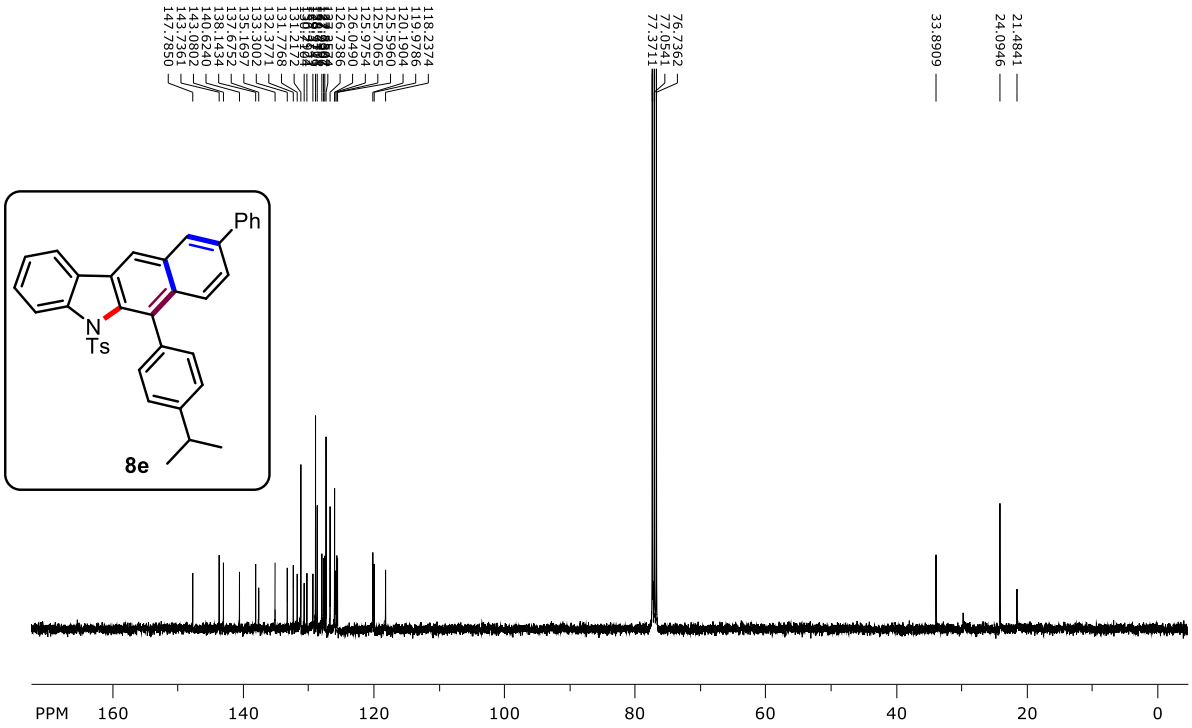
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 144.0-118.0 ppm region



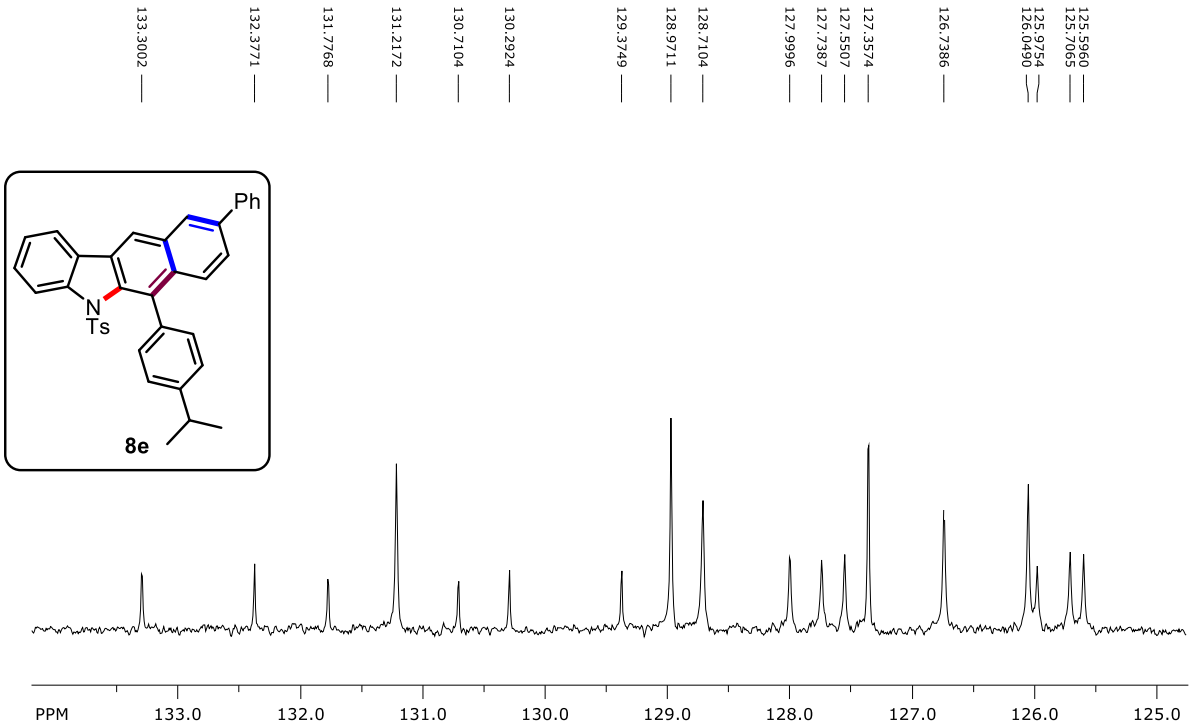
^{1}H NMR (400 MHz, $CDCl_3$)



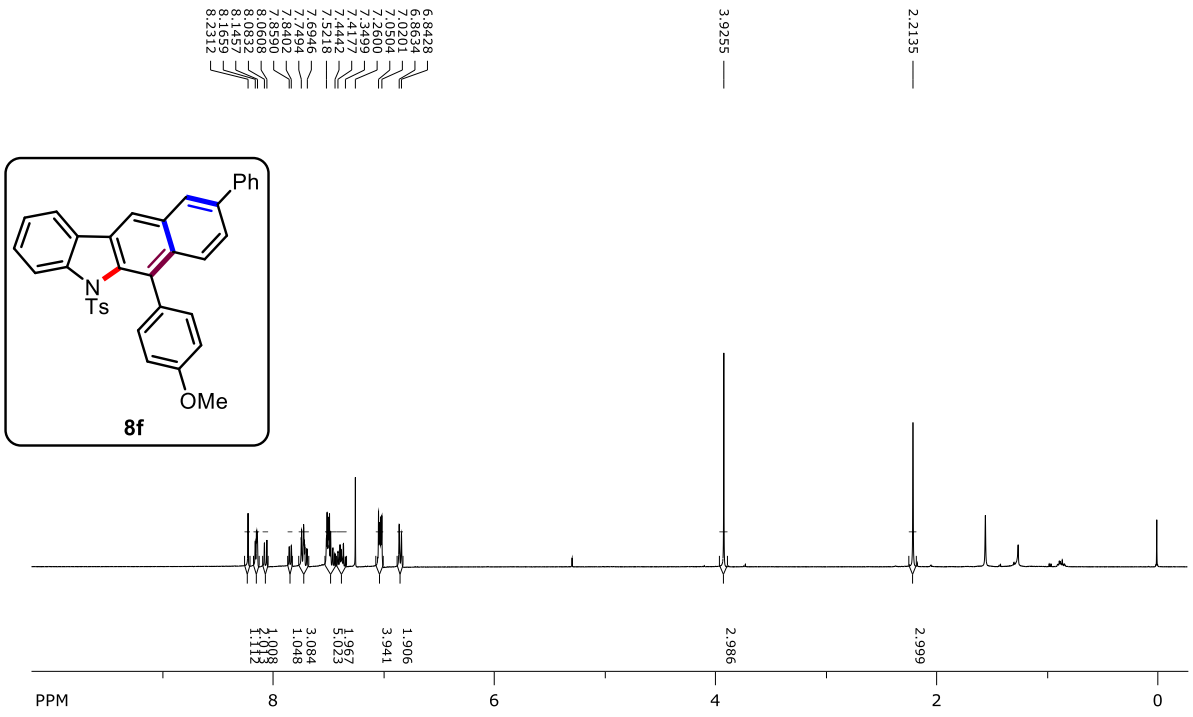
^{13}C NMR (100 MHz, $CDCl_3$)



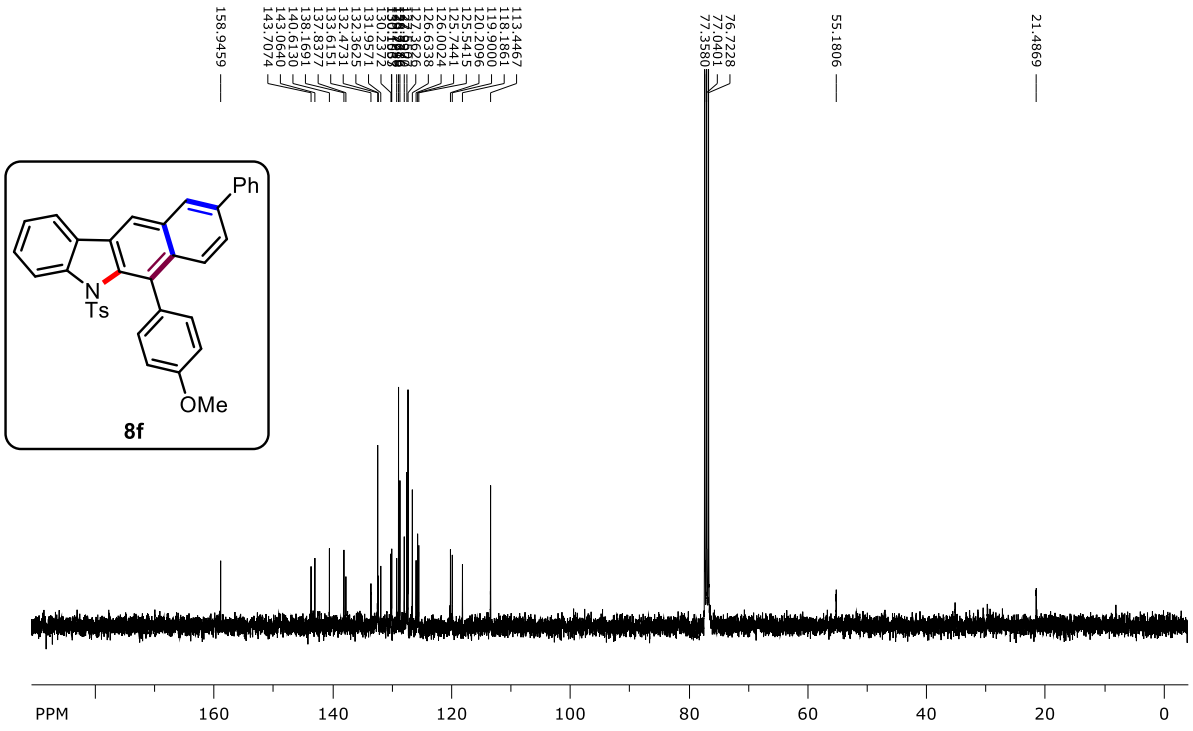
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-122.0 ppm region



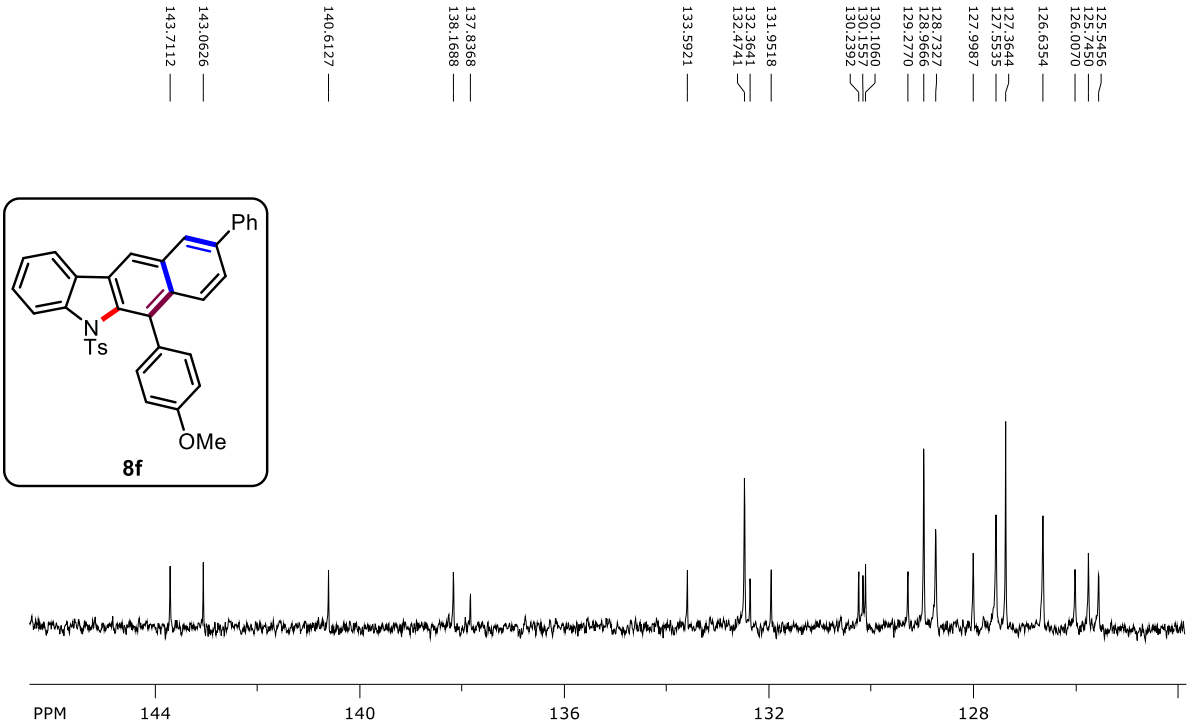
^{1}H NMR (400 MHz, $CDCl_3$)



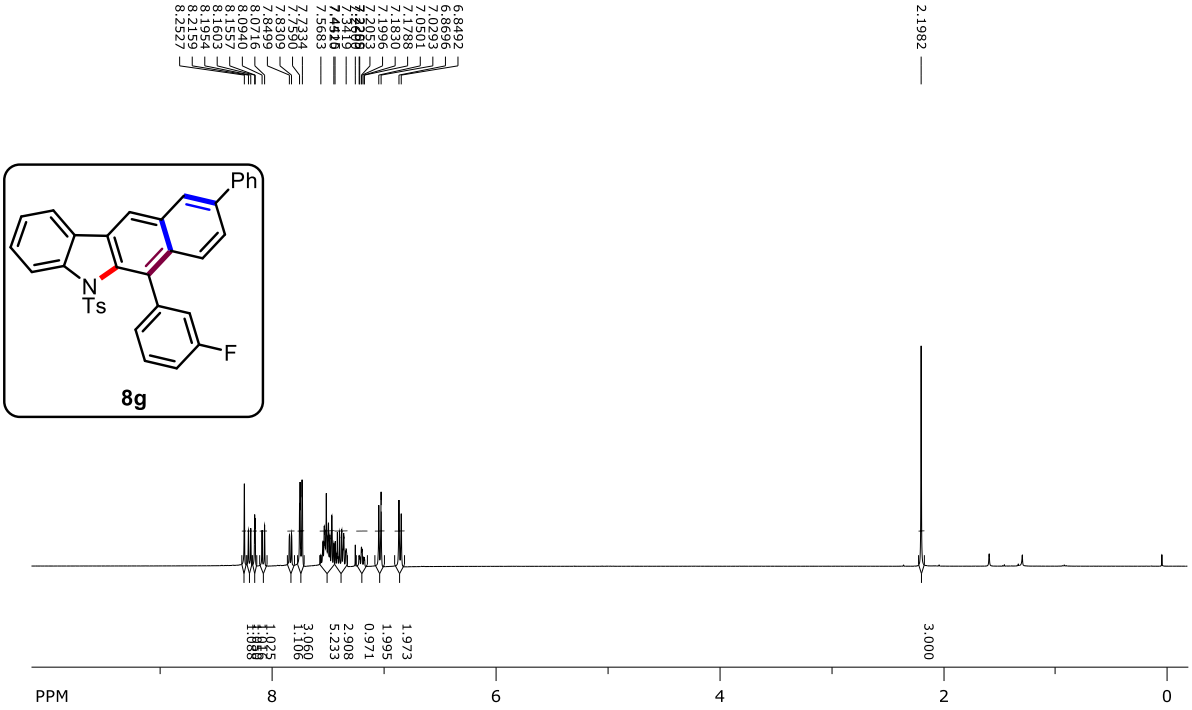
^{13}C NMR (100 MHz, $CDCl_3$)



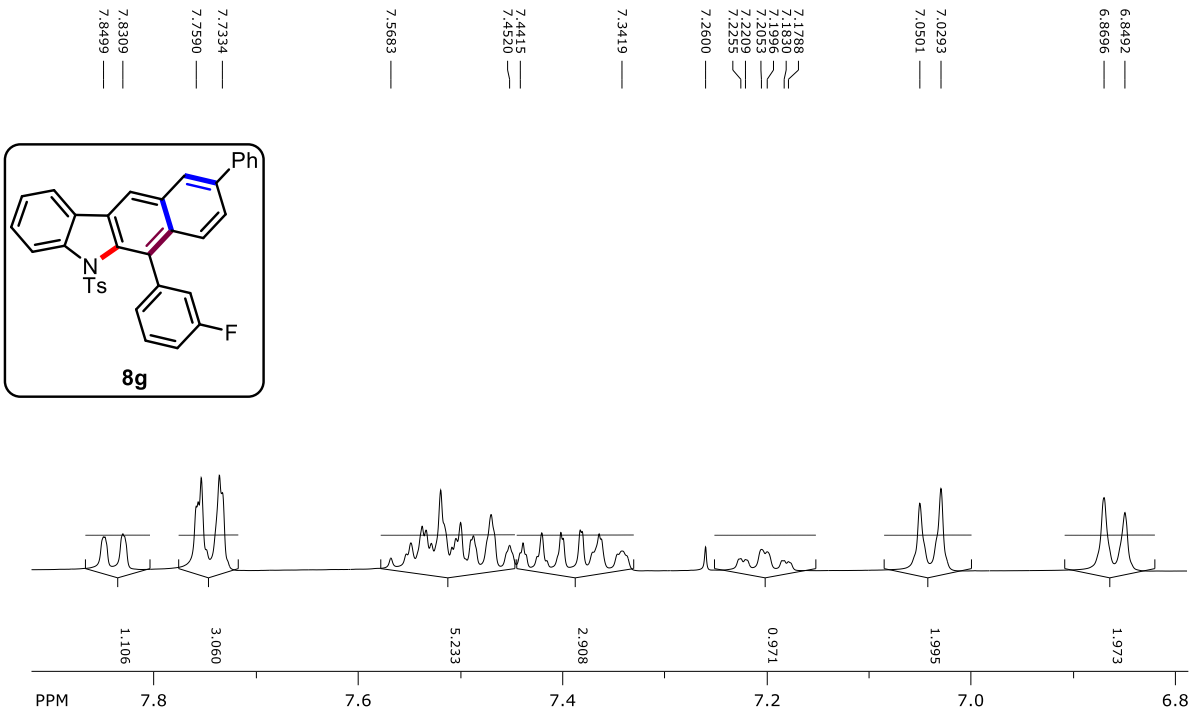
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 135.0-125.0 ppm region



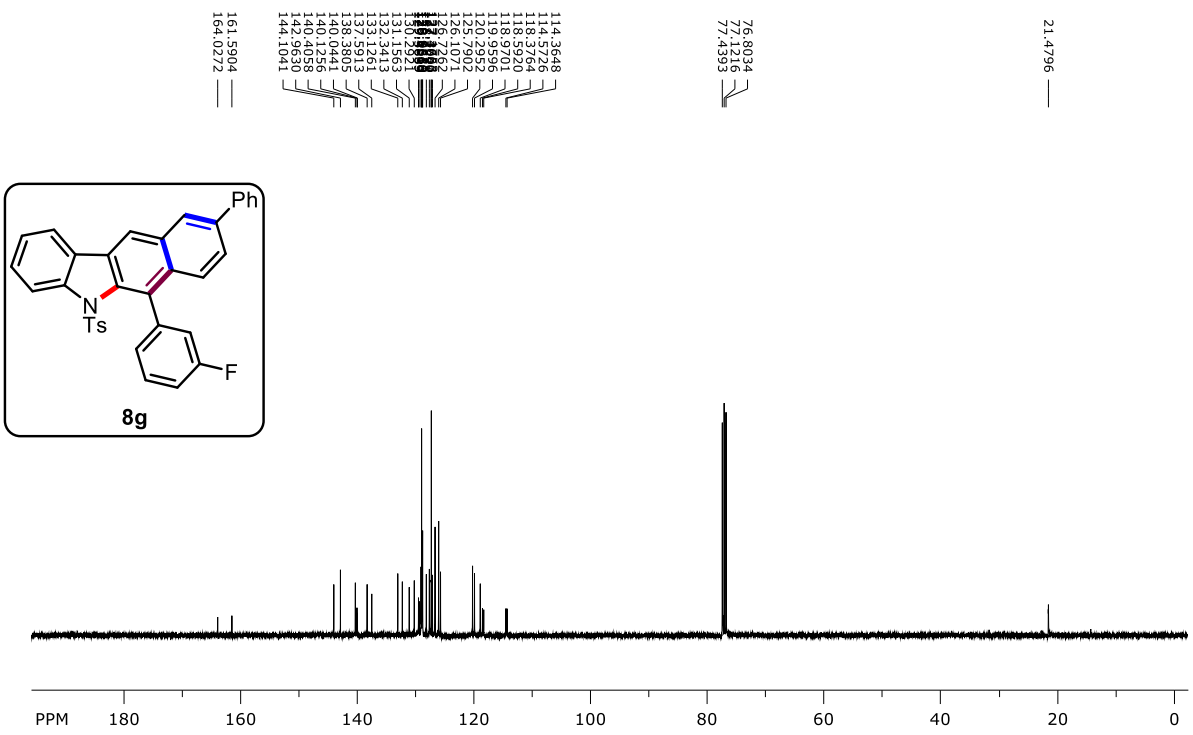
^{1}H NMR (400 MHz, $CDCl_3$)



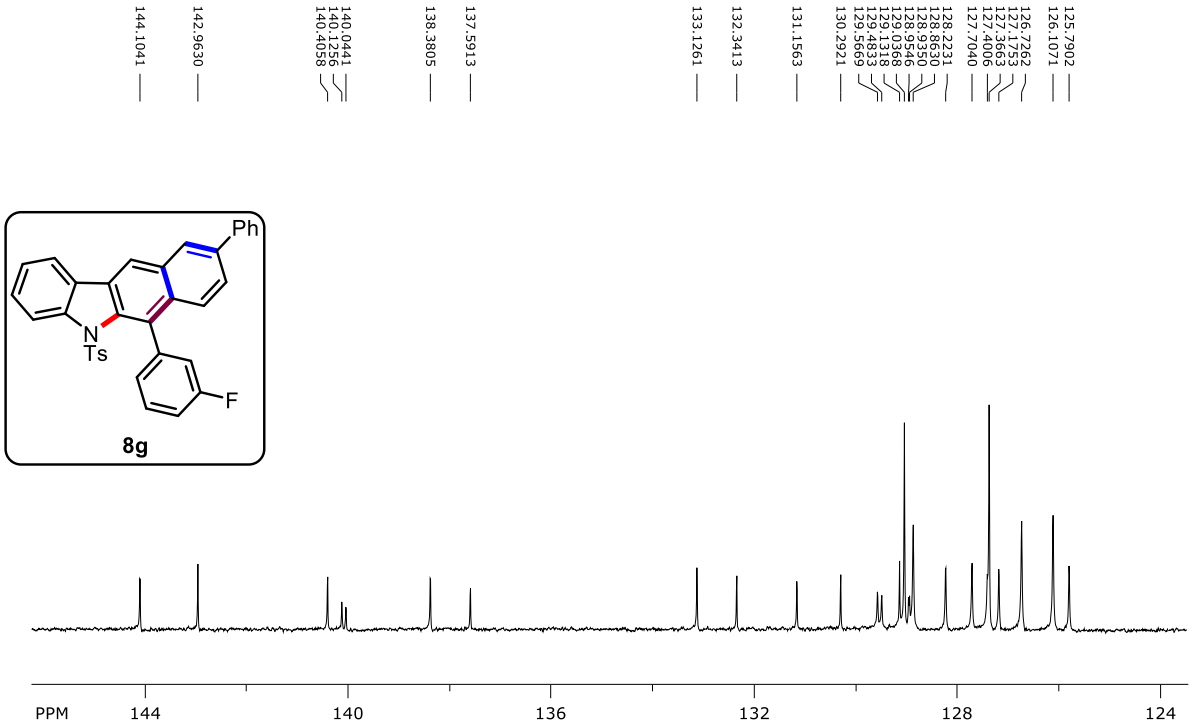
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.9-6.8 ppm region



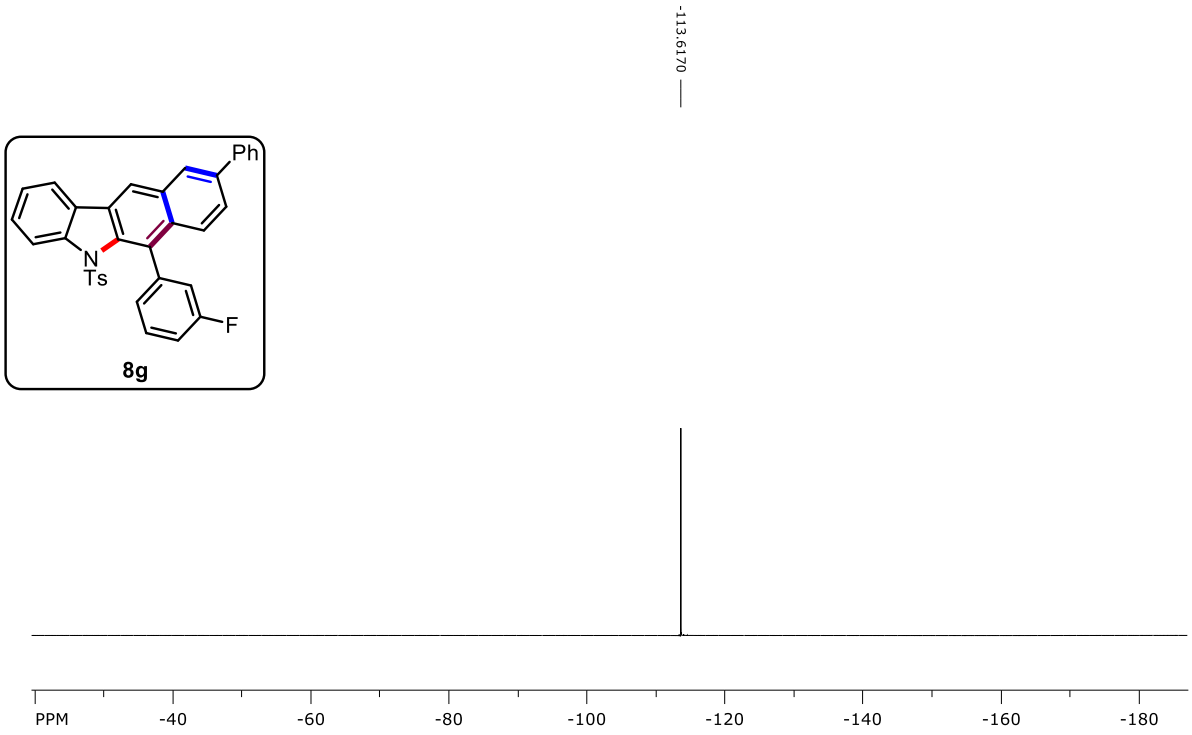
^{13}C NMR (100 MHz, $CDCl_3$)



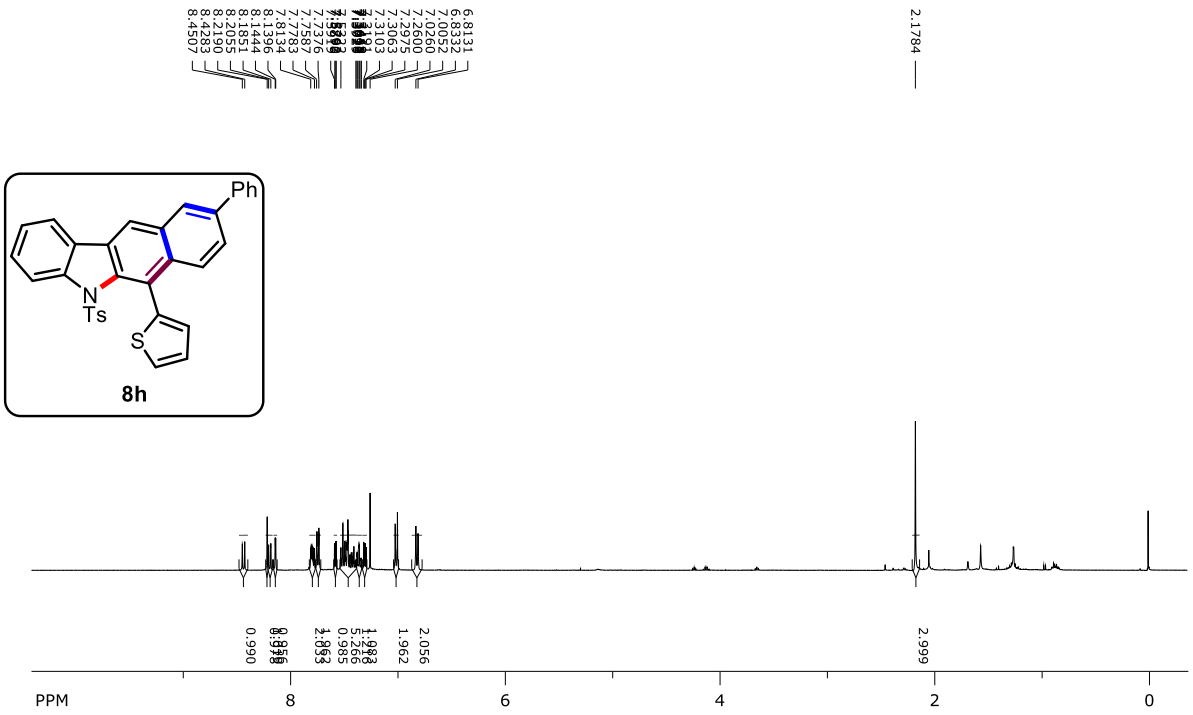
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 146.0-124.0 ppm region



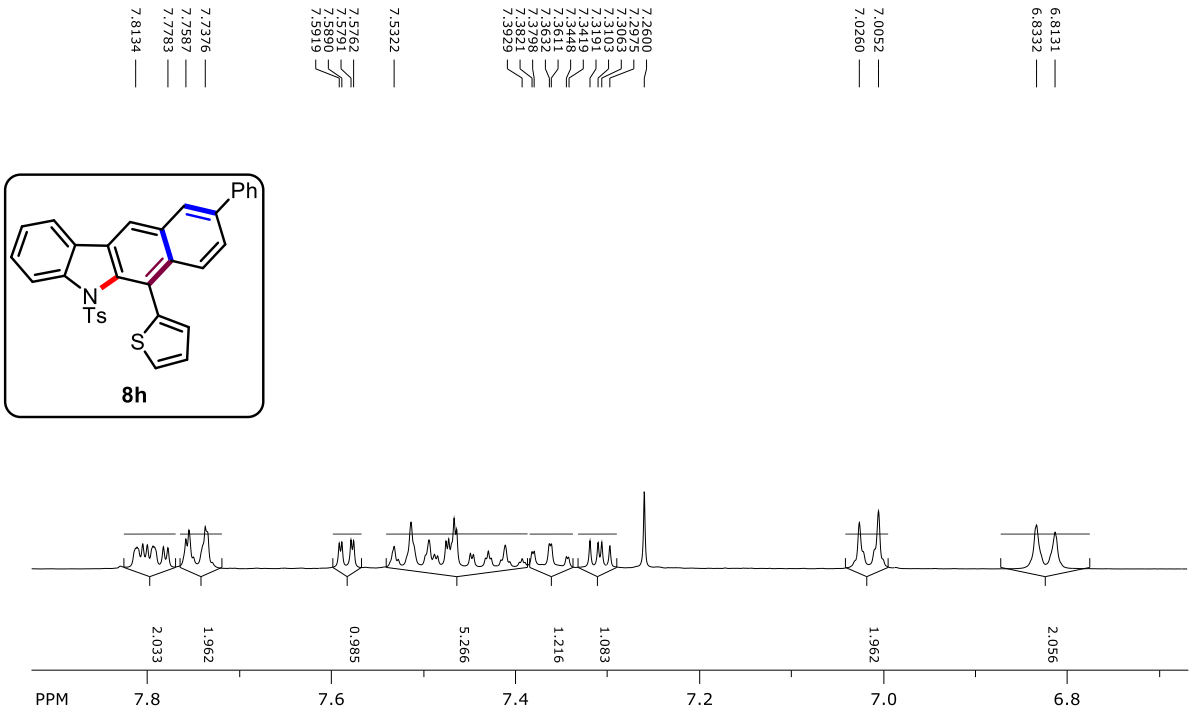
^{19}F NMR (376.4 MHz, $CDCl_3$)



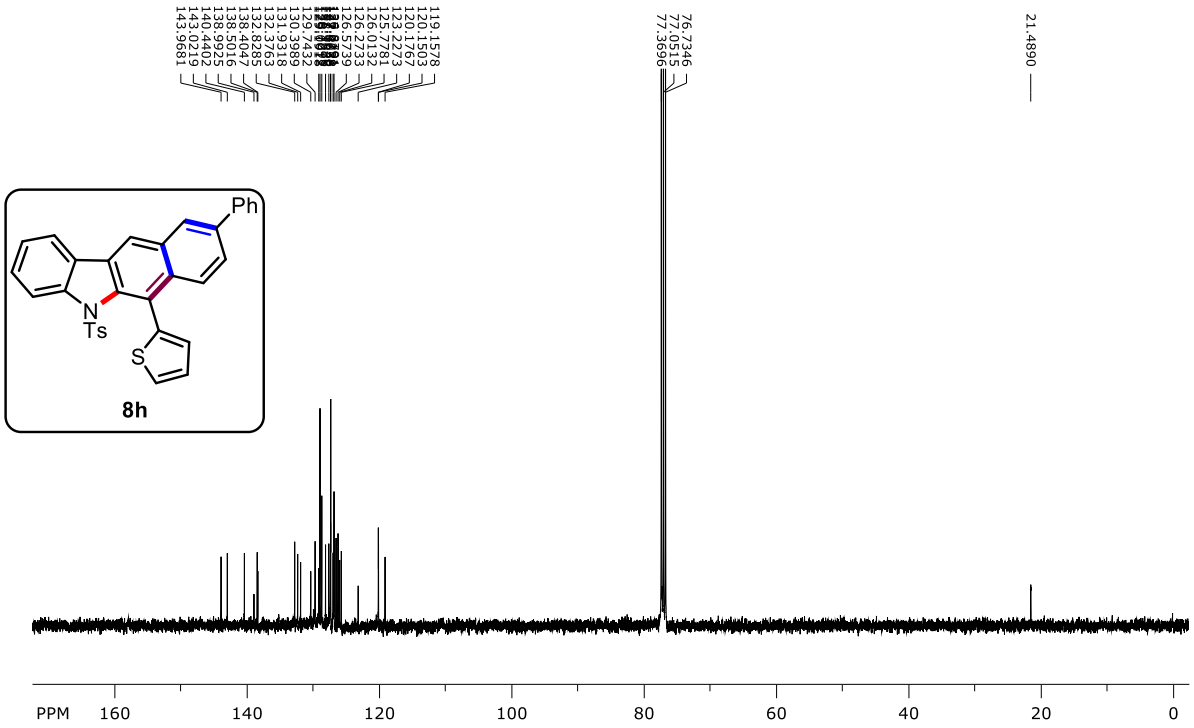
^{1}H NMR (400 MHz, $CDCl_3$)



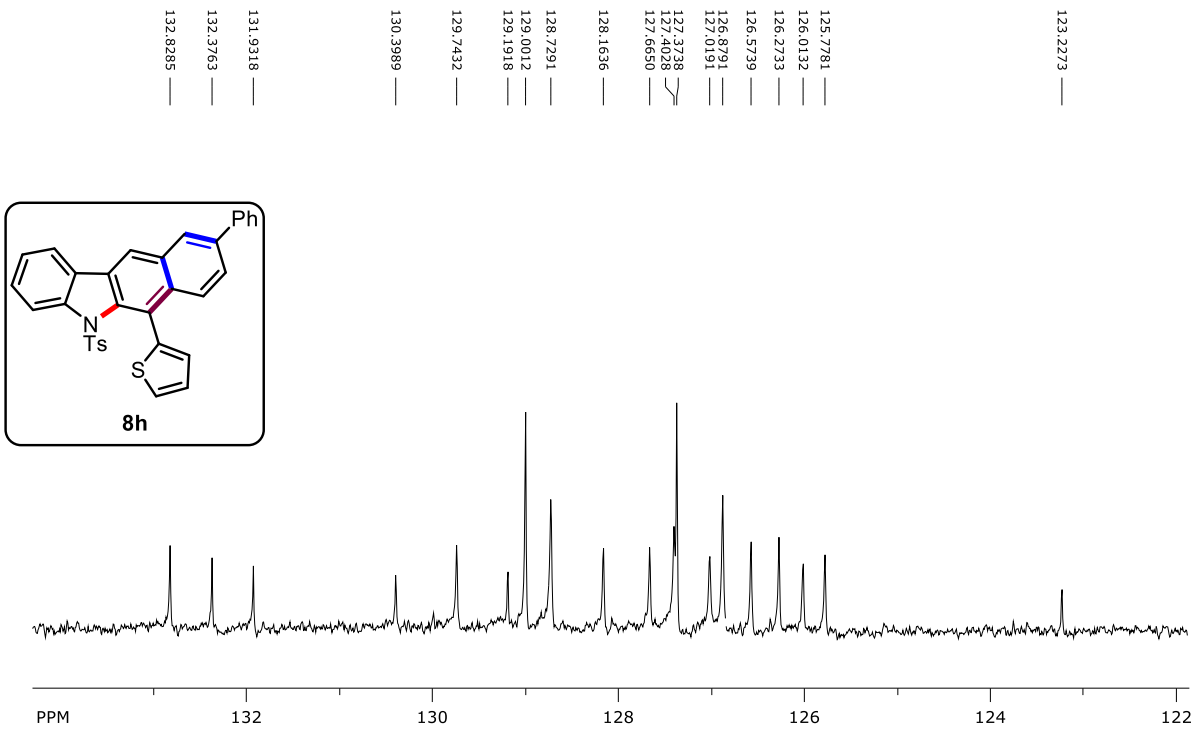
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.9-6.7 ppm region



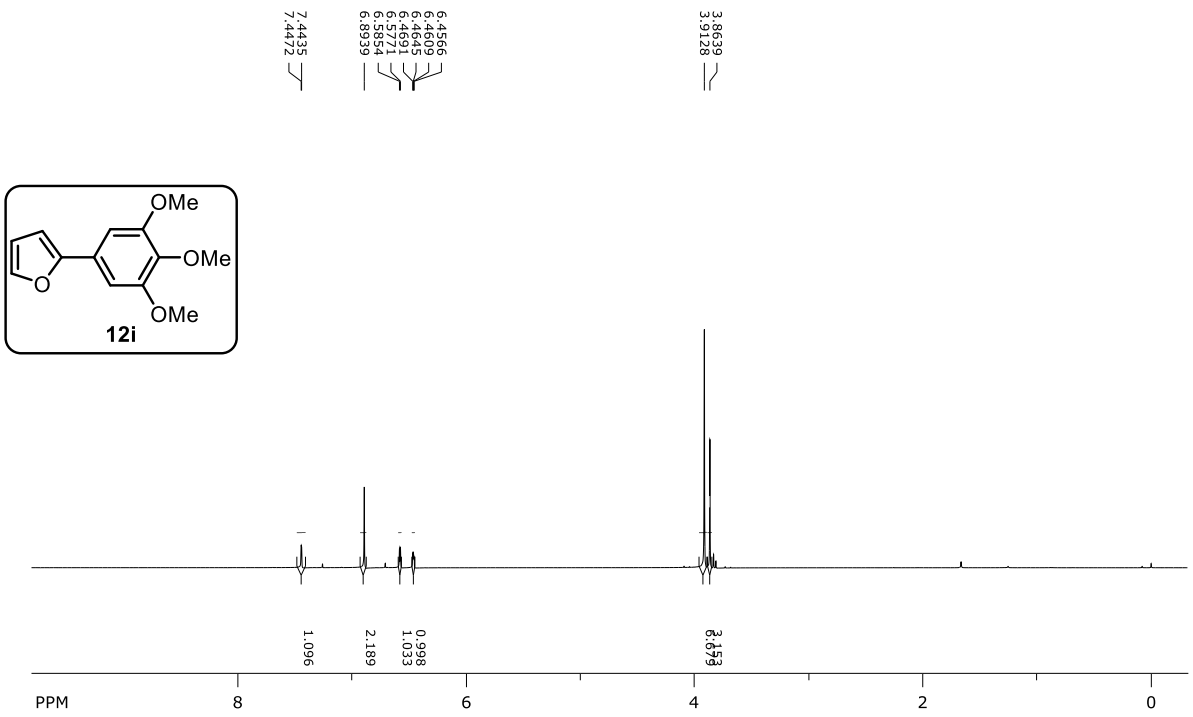
^{13}C NMR (100 MHz, $CDCl_3$)



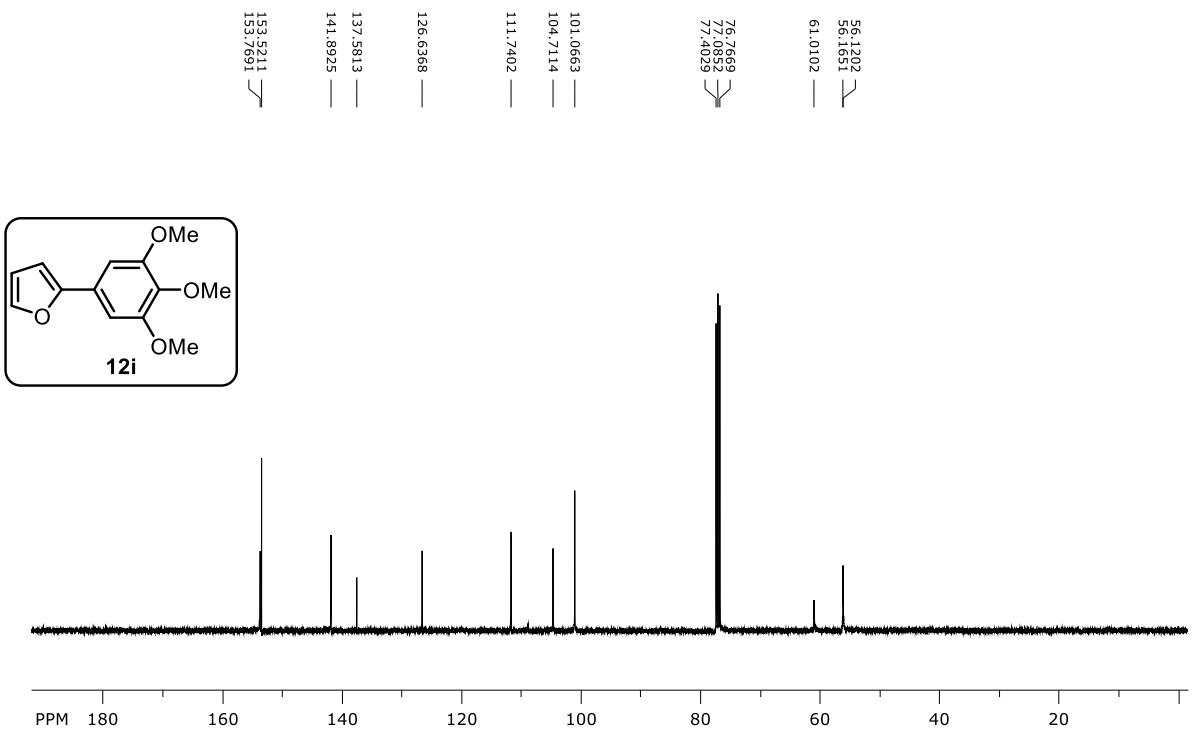
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-122.0 ppm region



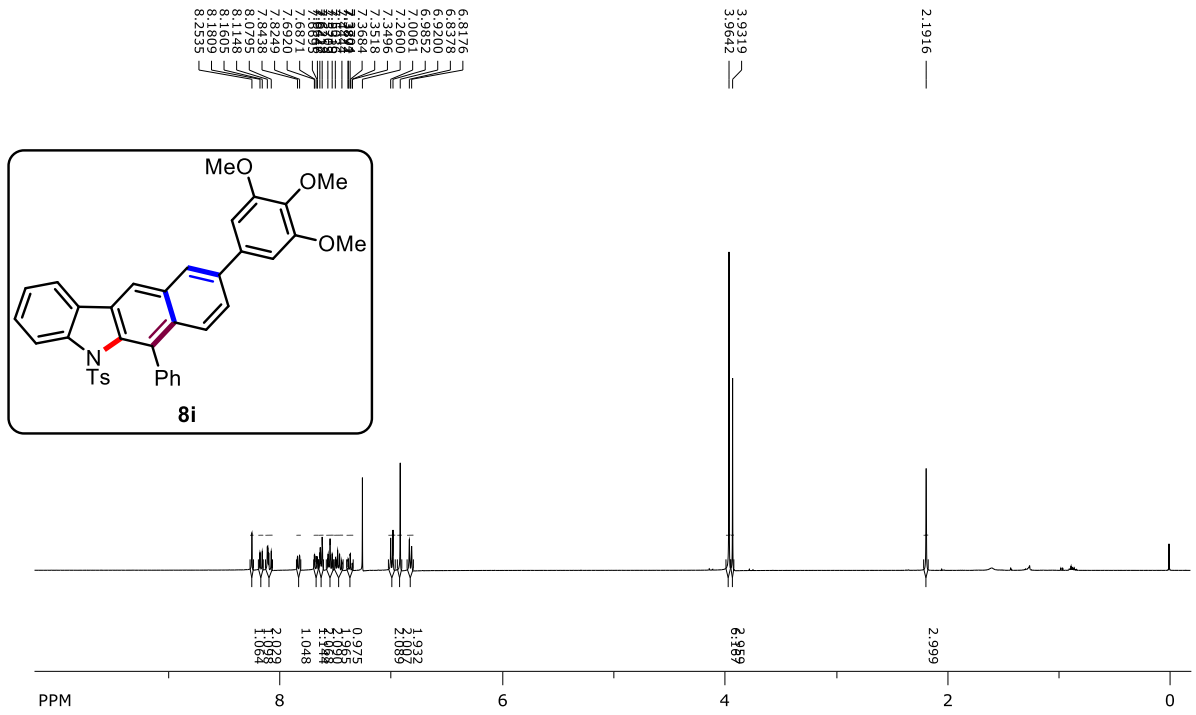
^{1}H NMR (400 MHz, $CDCl_3$)



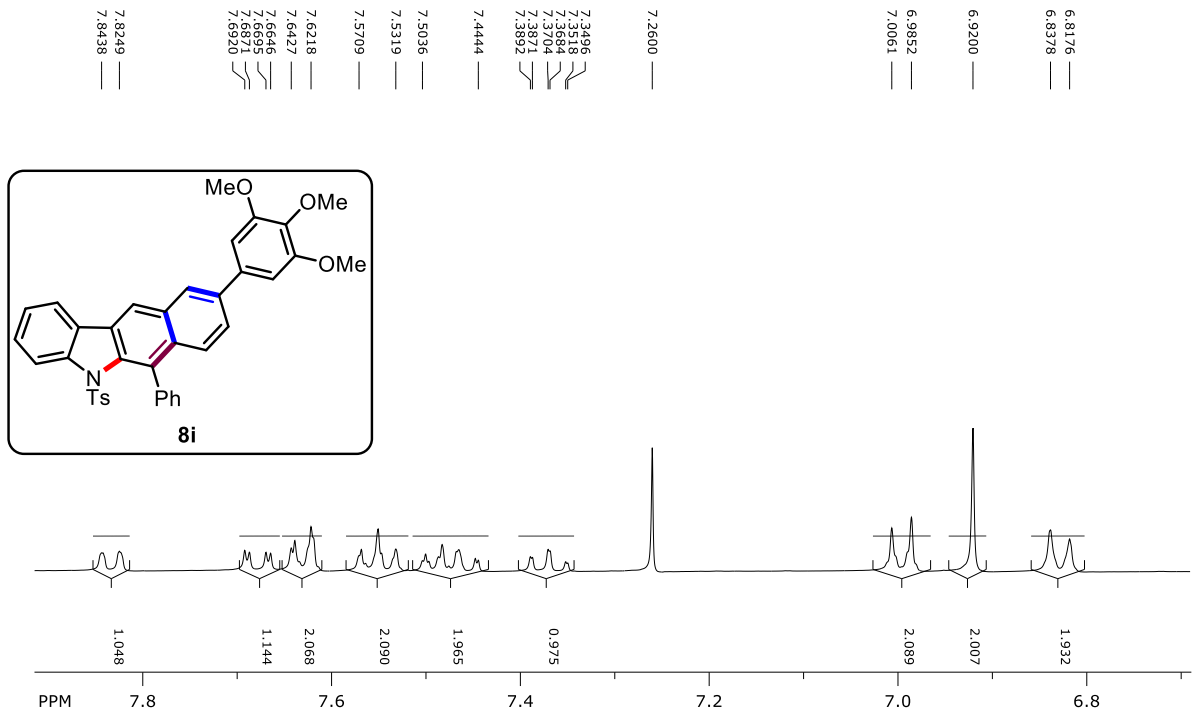
^{13}C NMR (100 MHz, $CDCl_3$)



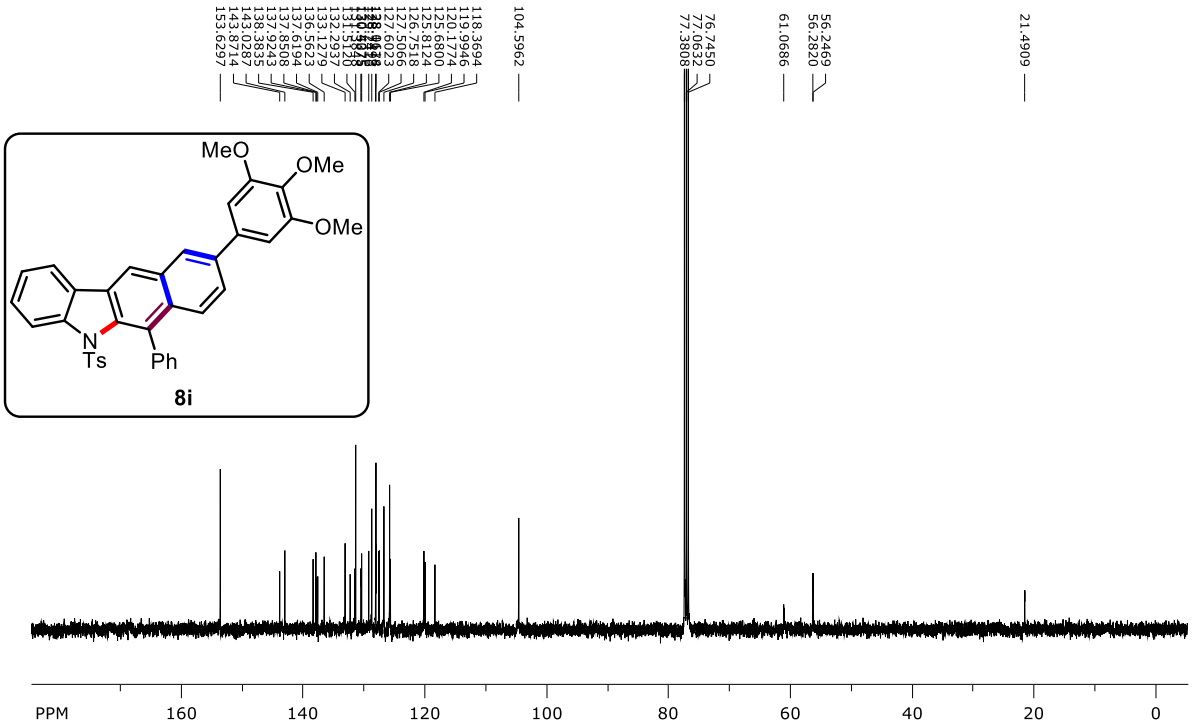
^{1}H NMR (400 MHz, $CDCl_3$)



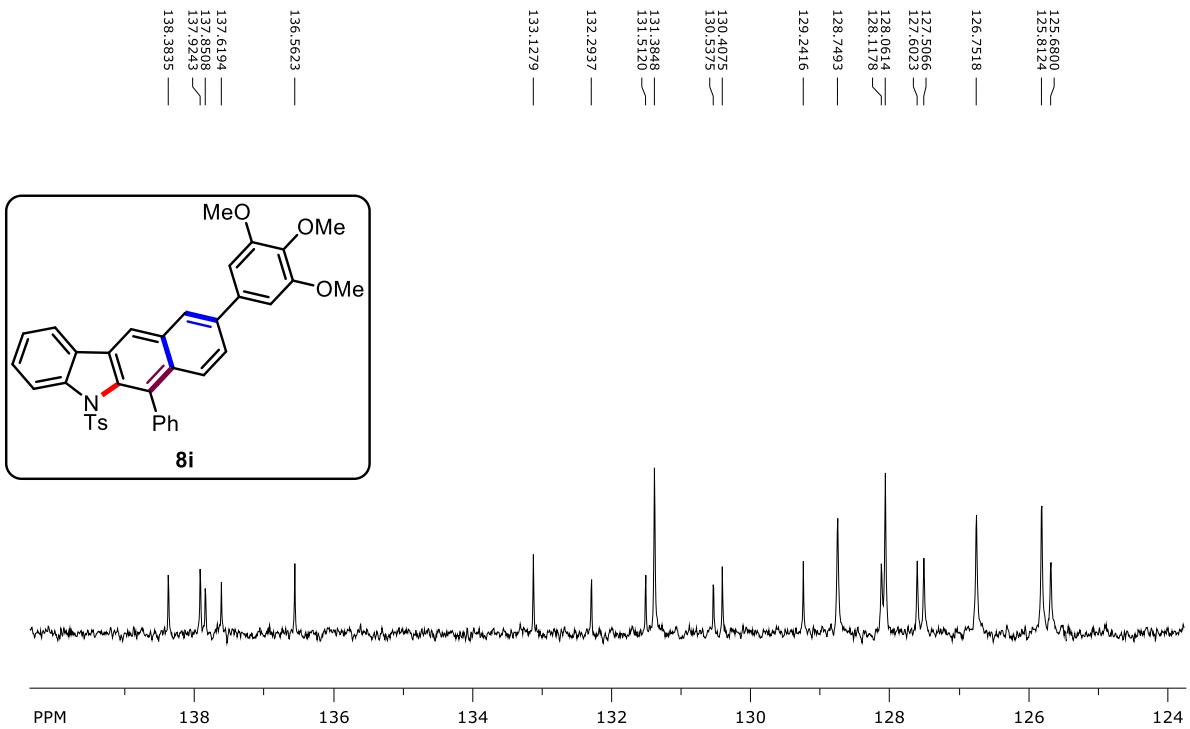
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.9-6.7 ppm region



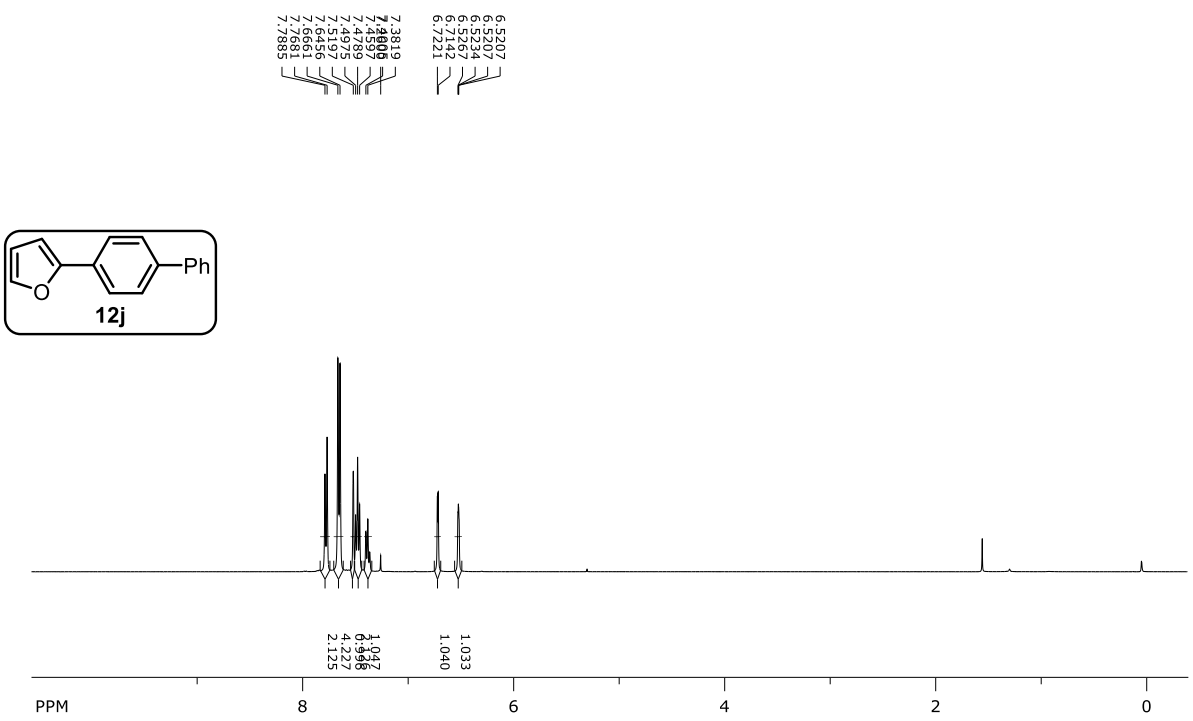
^{13}C NMR (100 MHz, $CDCl_3$)



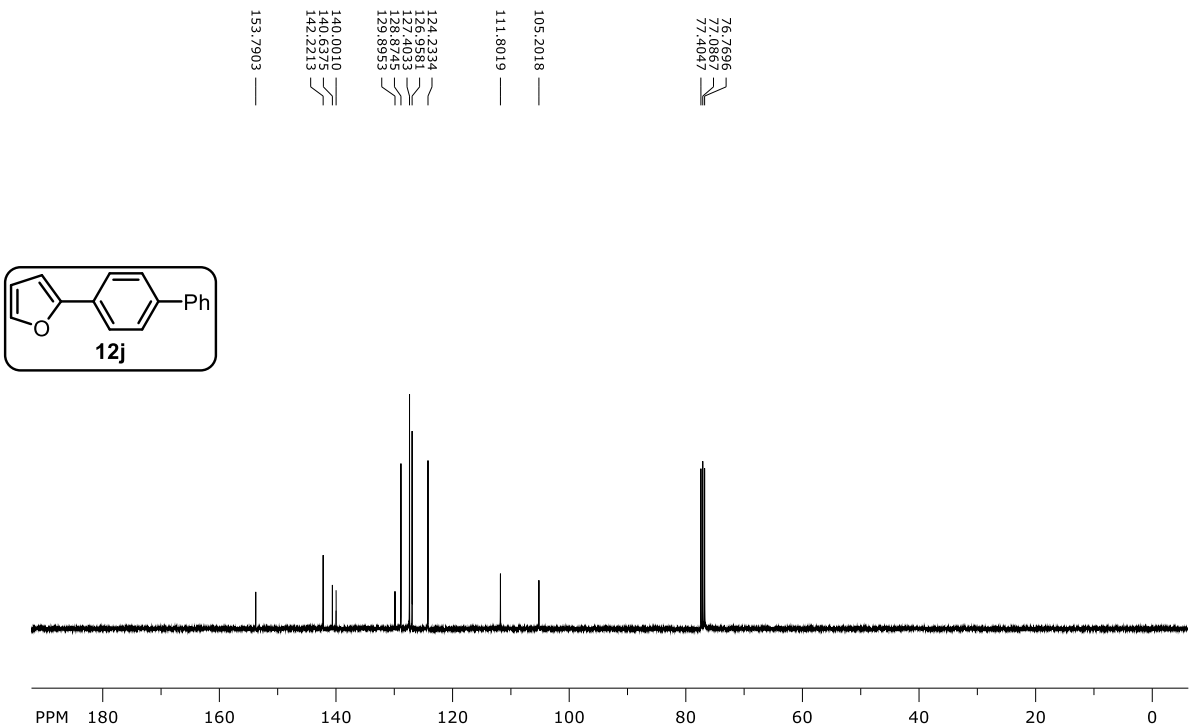
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-122.0 ppm region



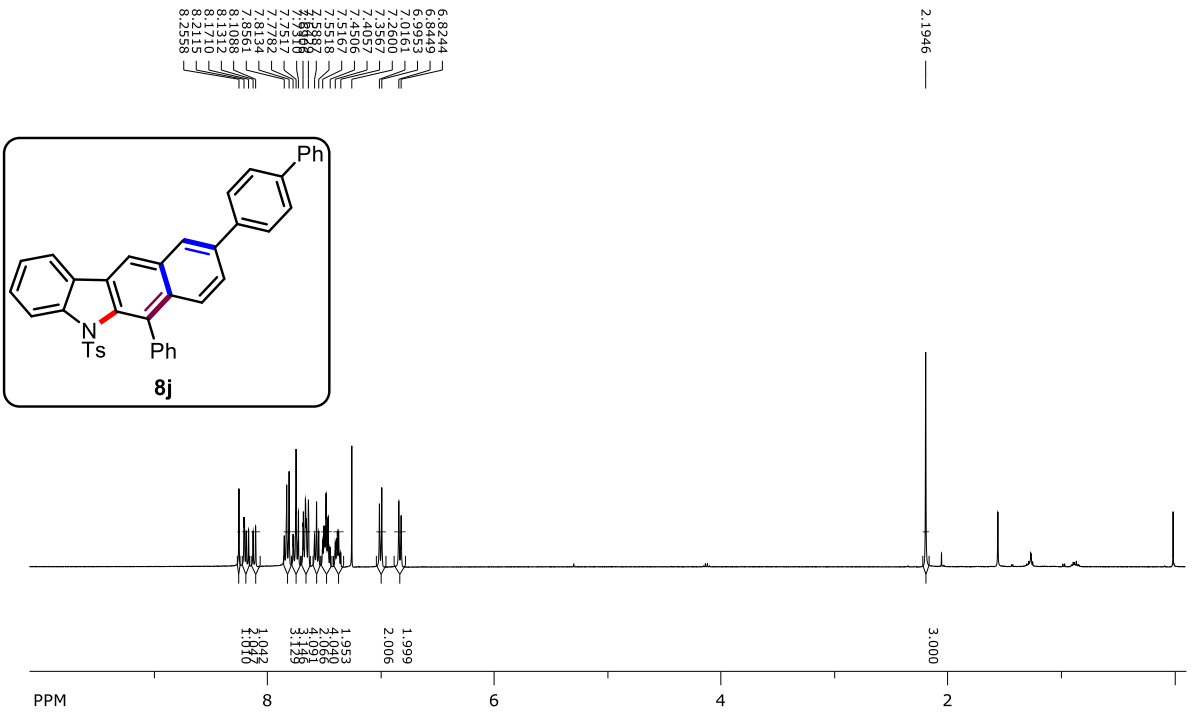
^{1}H NMR (400 MHz, $CDCl_3$)



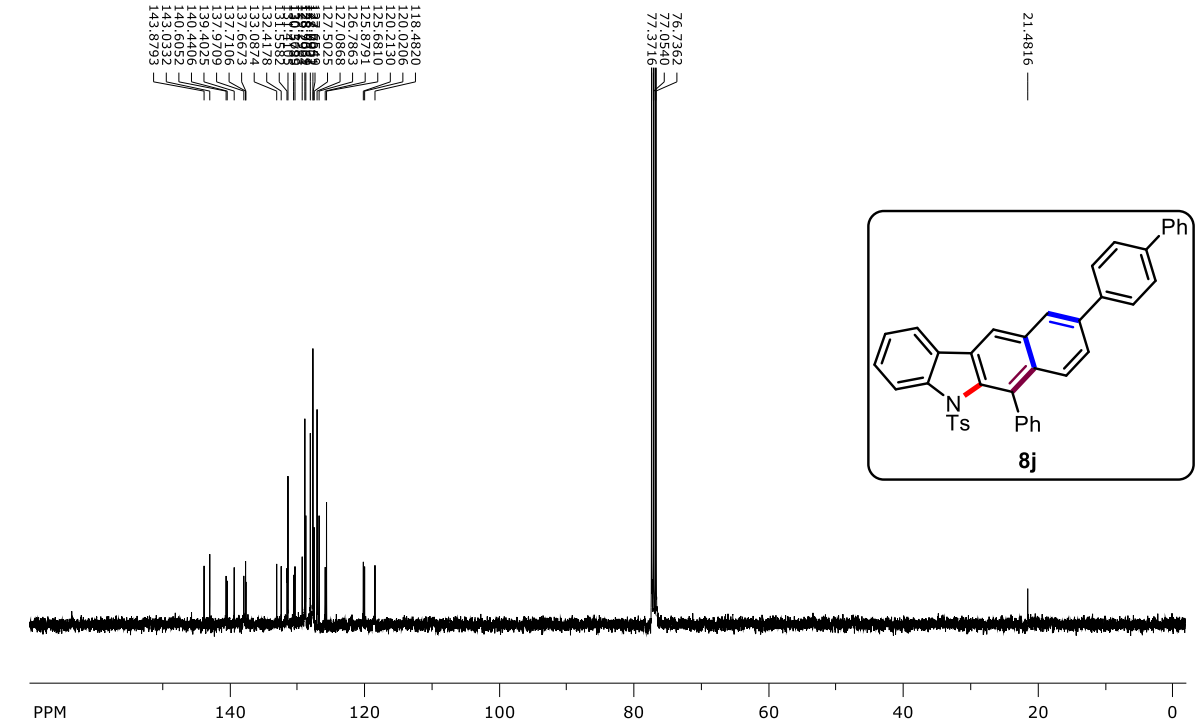
^{13}C NMR (100 MHz, $CDCl_3$)



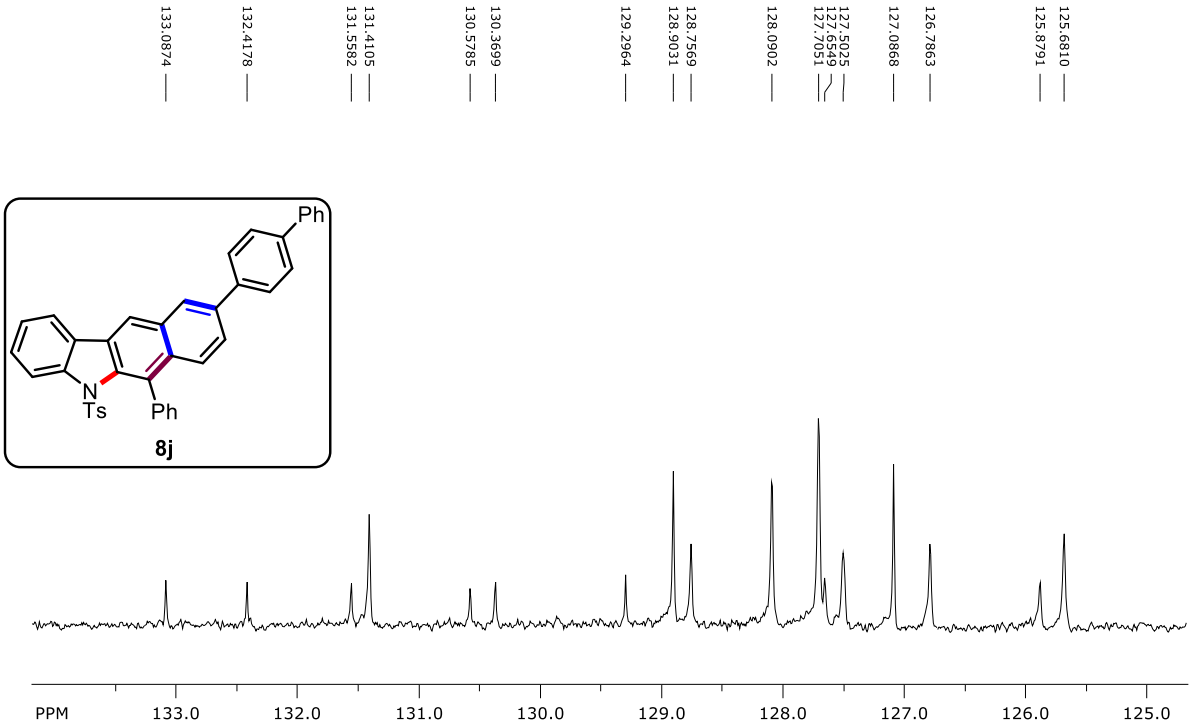
^{1}H NMR (400 MHz, $CDCl_3$)



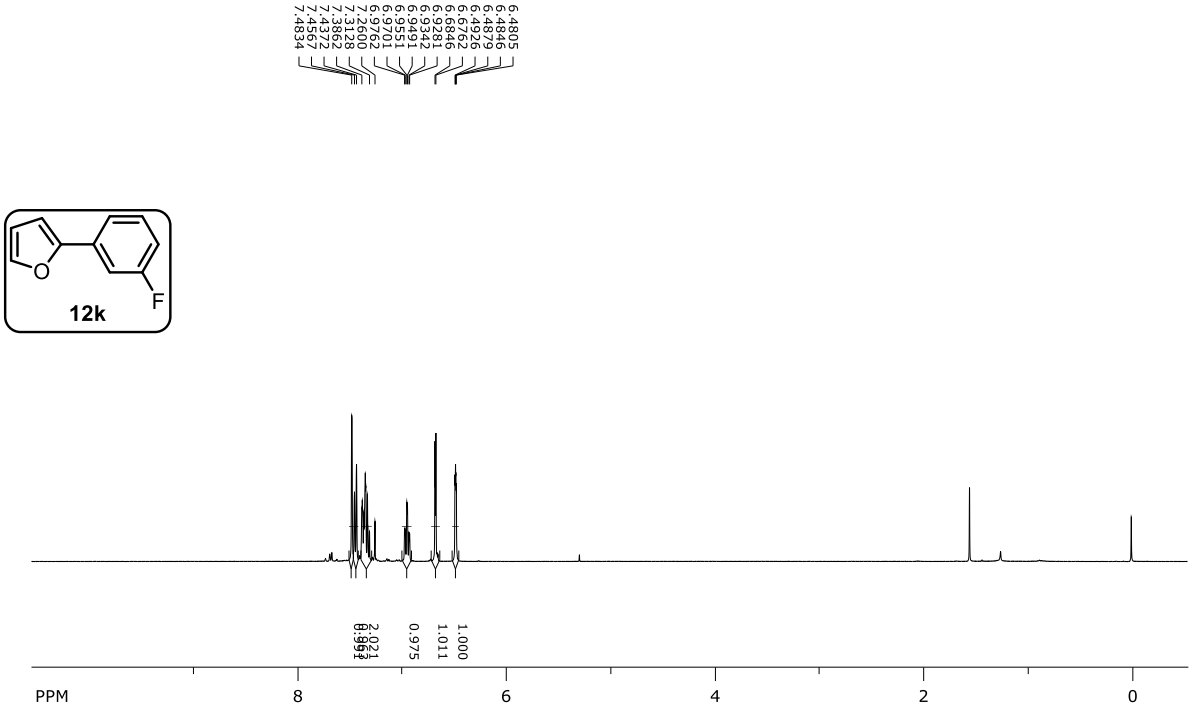
^{13}C NMR (100 MHz, $CDCl_3$)



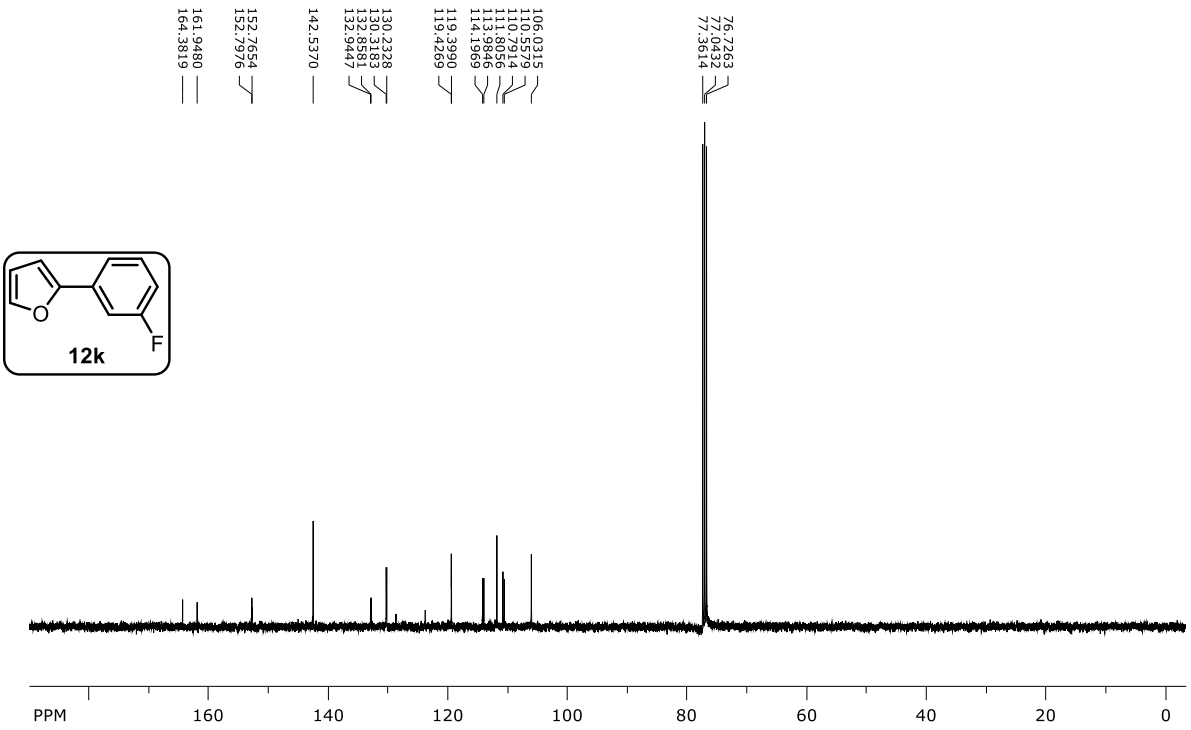
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-125.0 ppm region



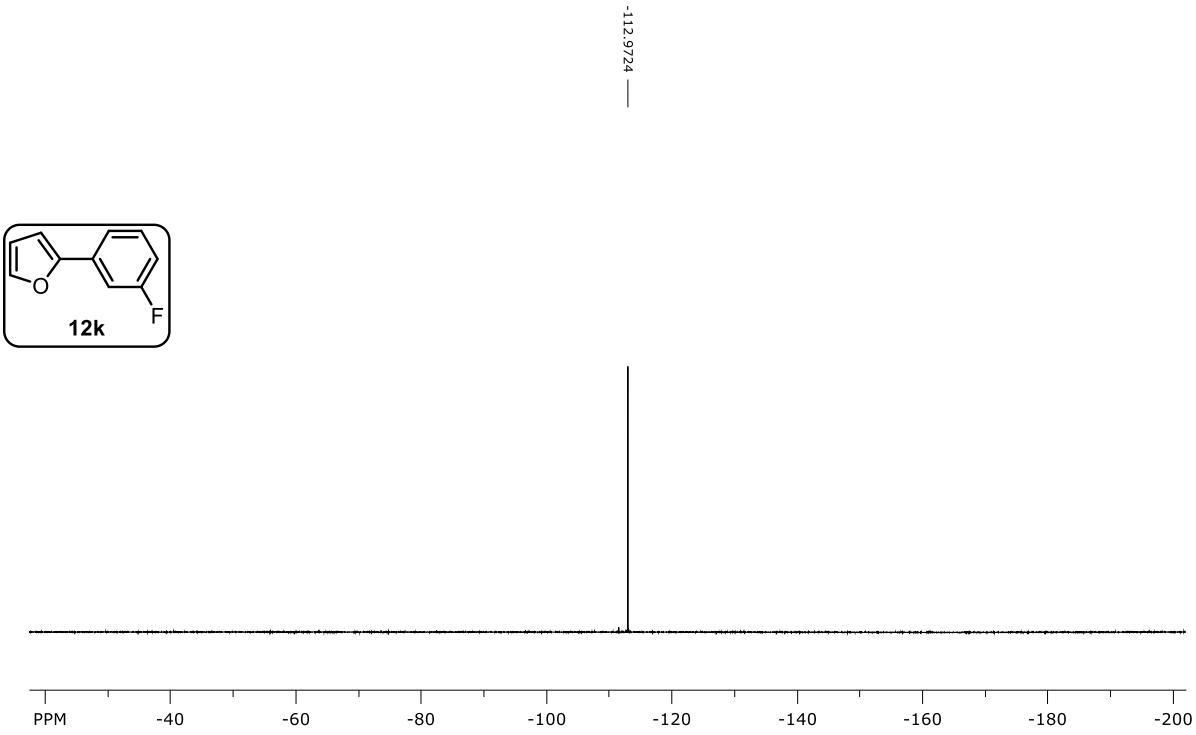
^{1}H NMR (400 MHz, $CDCl_3$)



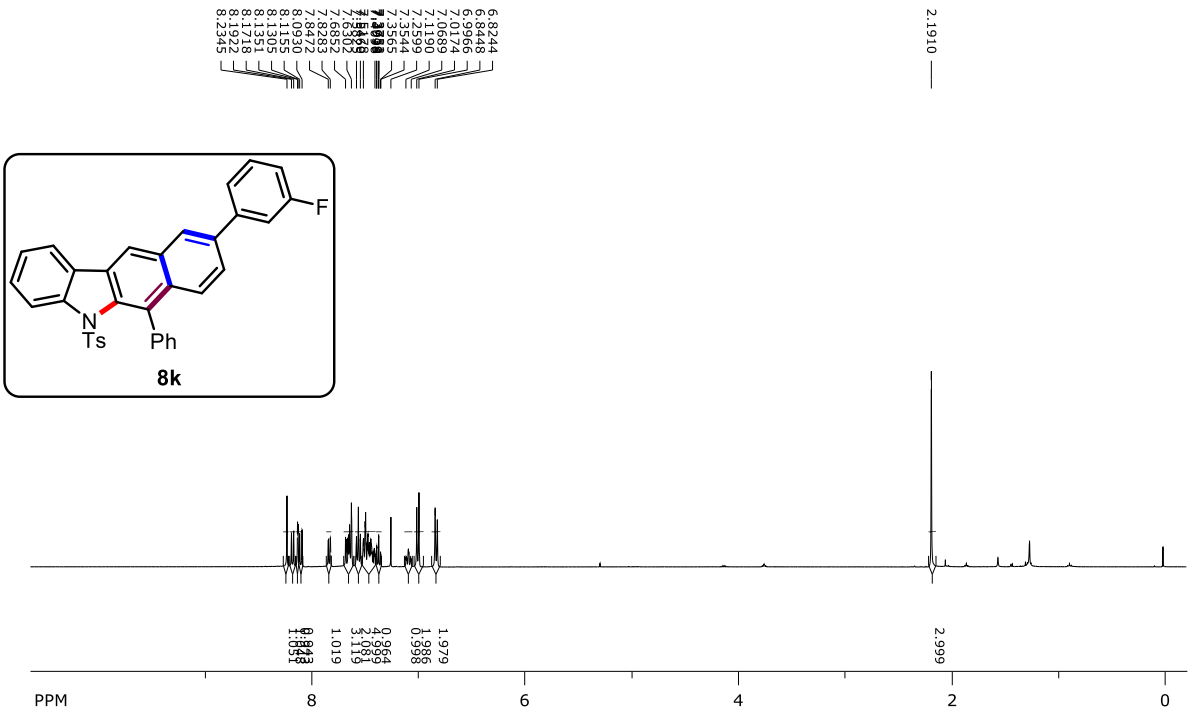
^{13}C NMR (100 MHz, $CDCl_3$)



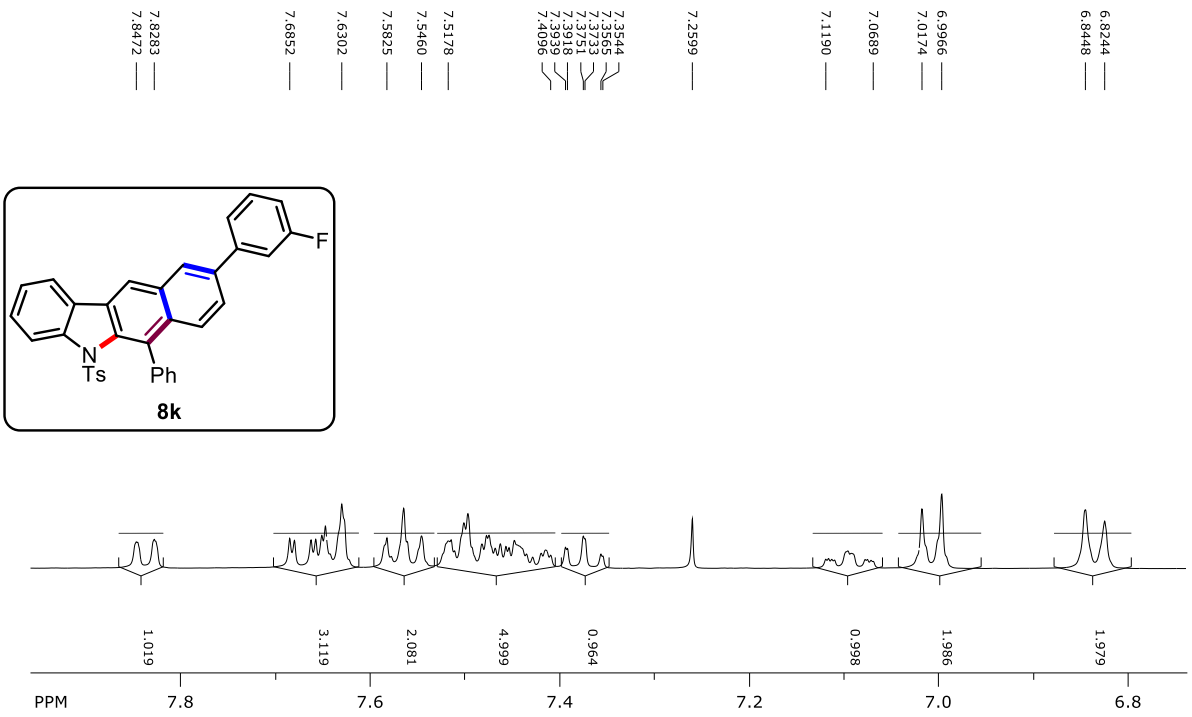
^{19}F NMR (376.4 MHz, $CDCl_3$)



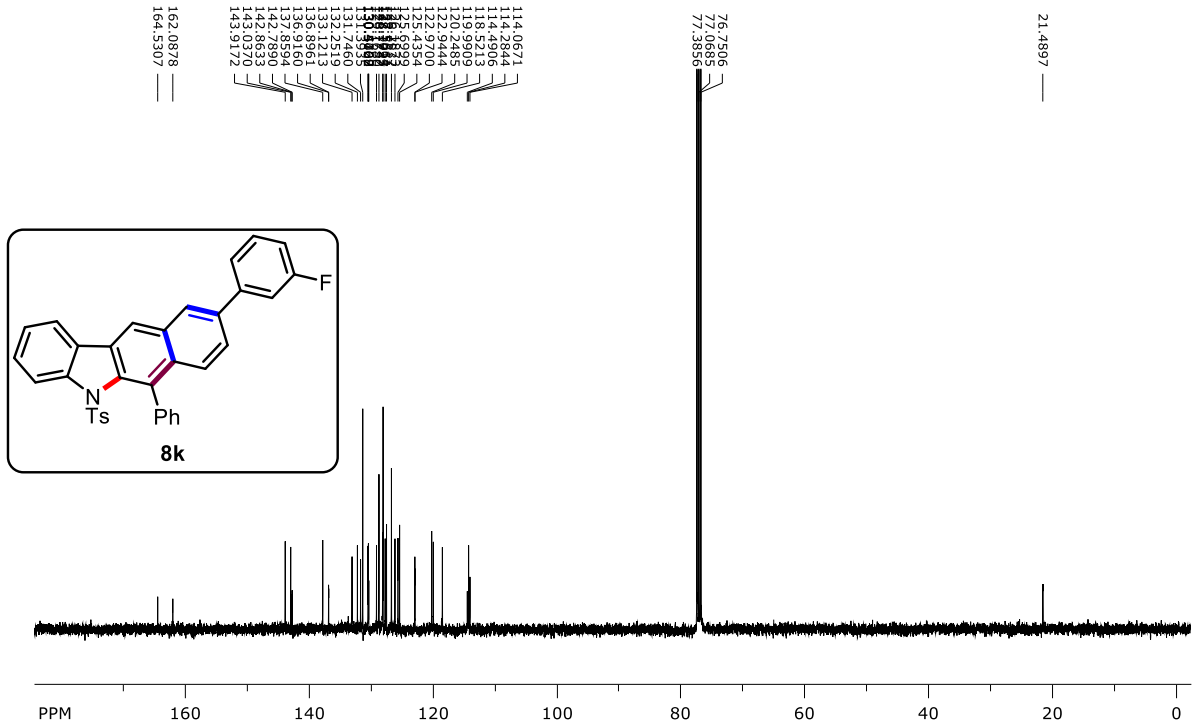
^{1}H NMR (400 MHz, $CDCl_3$)



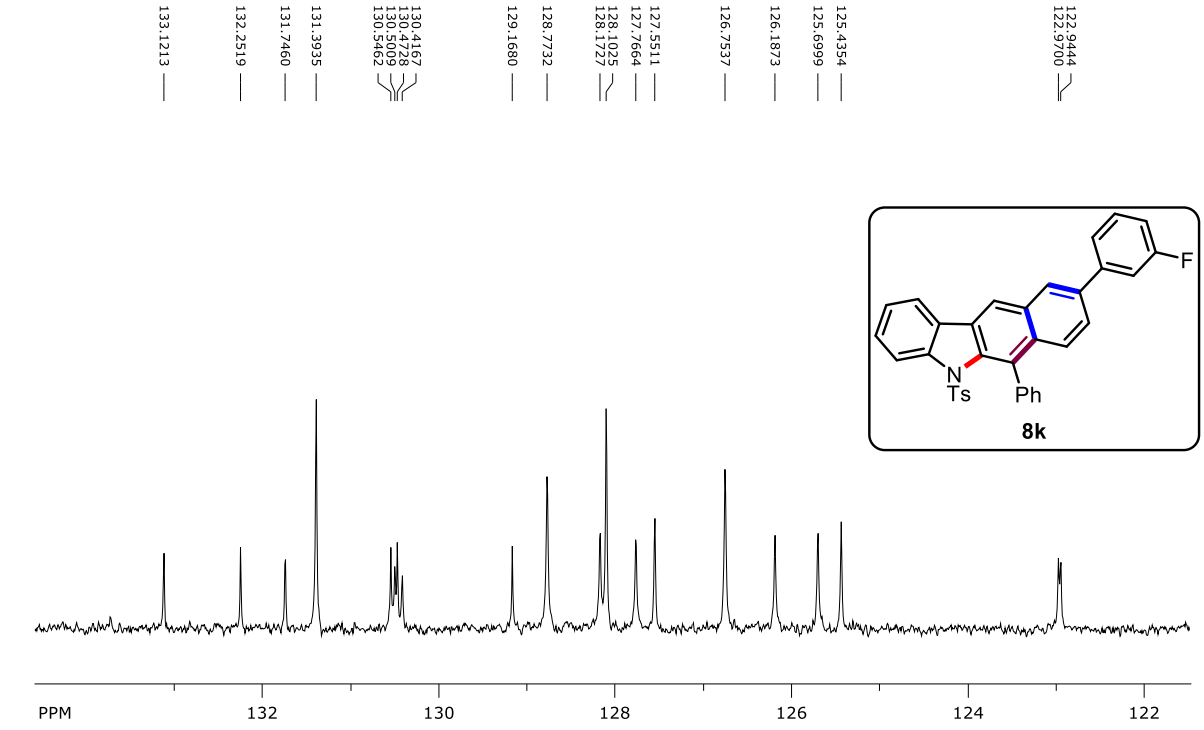
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.0-6.5 ppm region



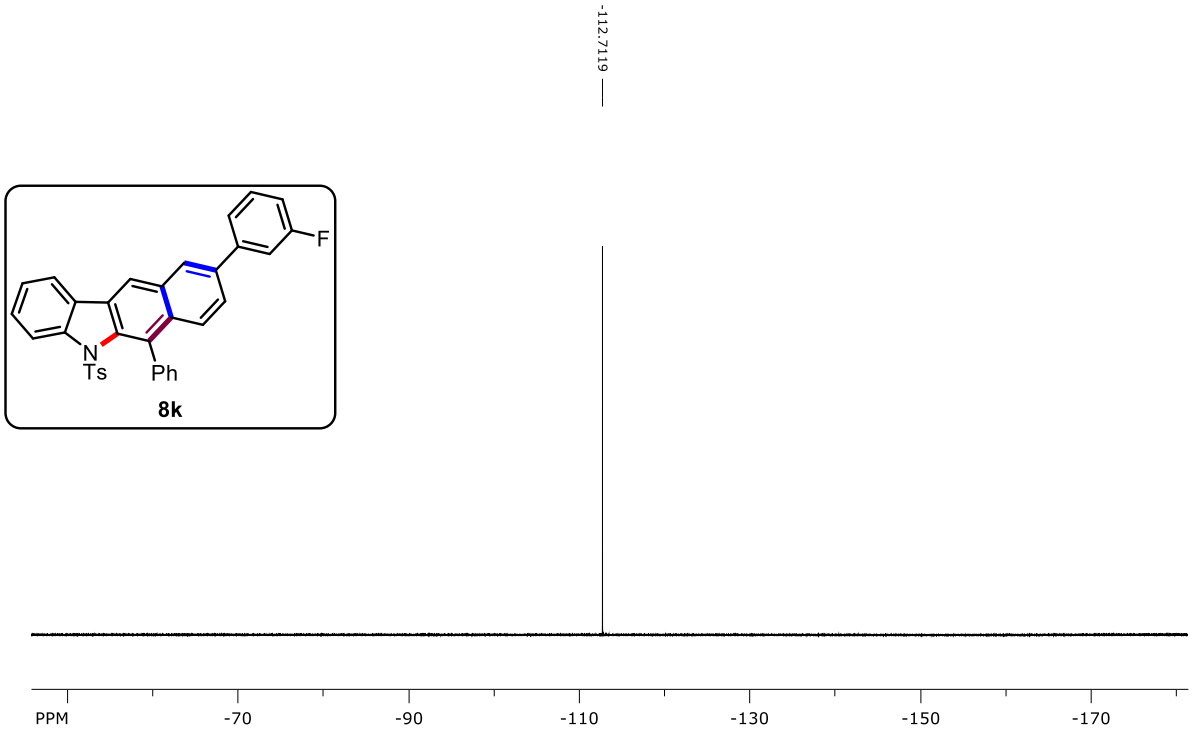
^{13}C NMR (100 MHz, $CDCl_3$):



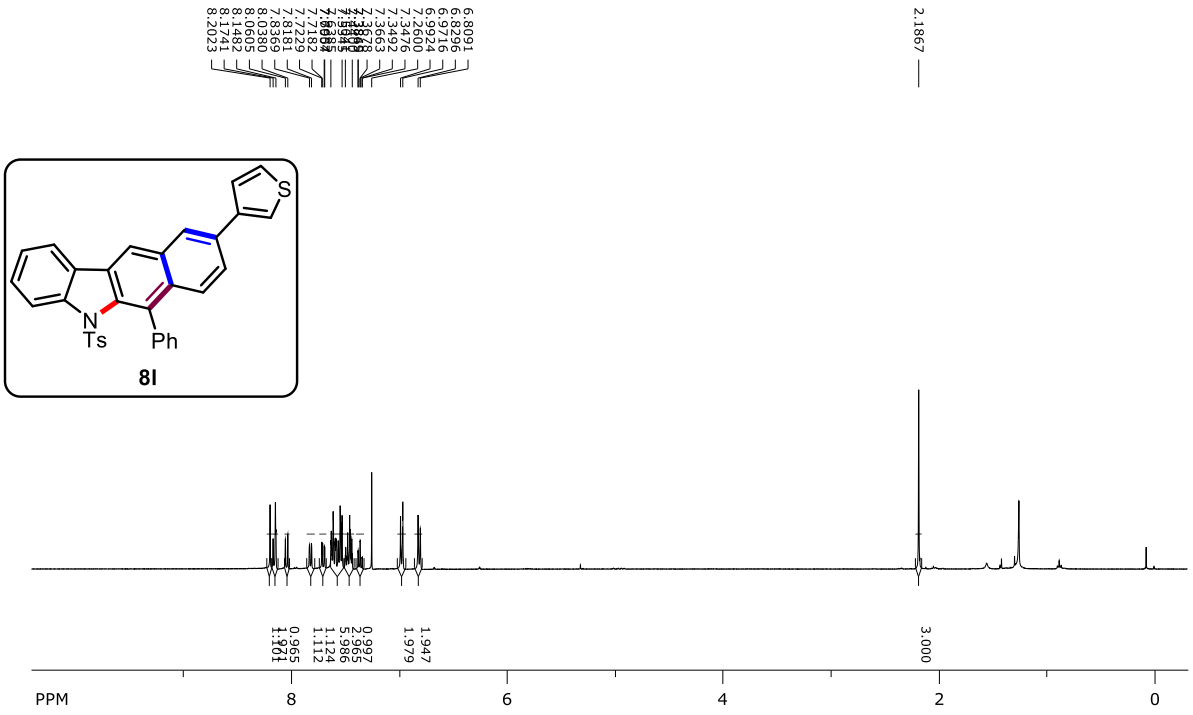
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-122.0 ppm region



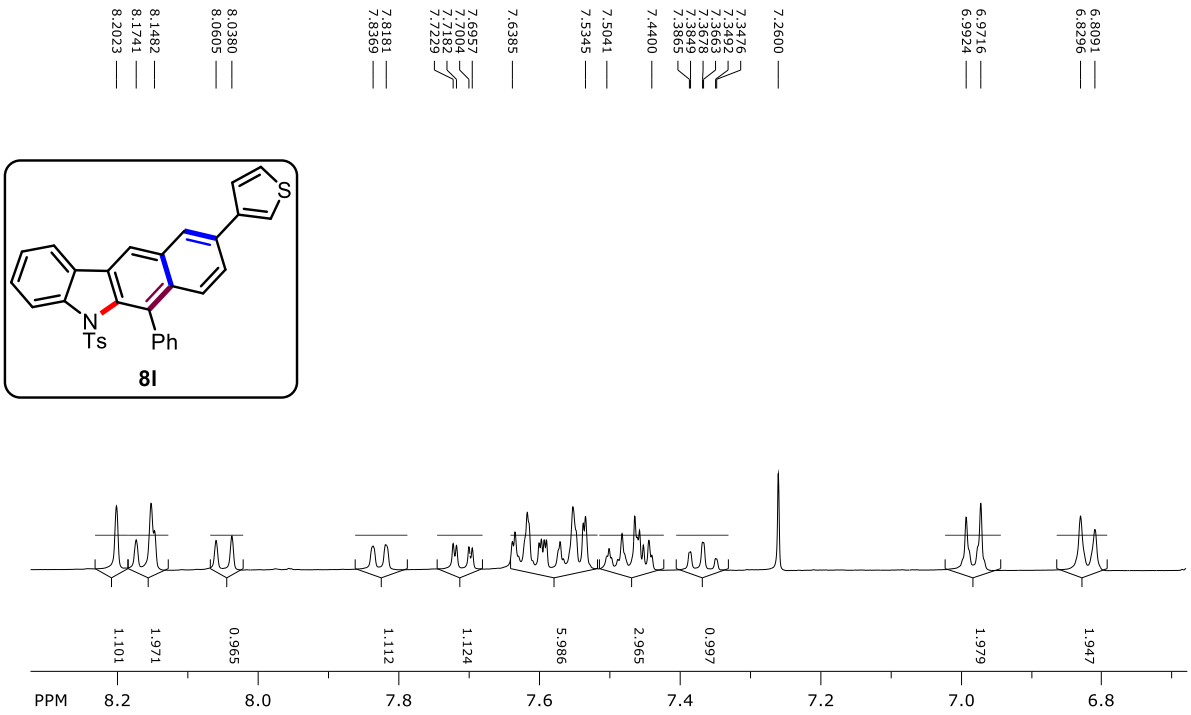
^{19}F NMR (376.4 MHz, $CDCl_3$)



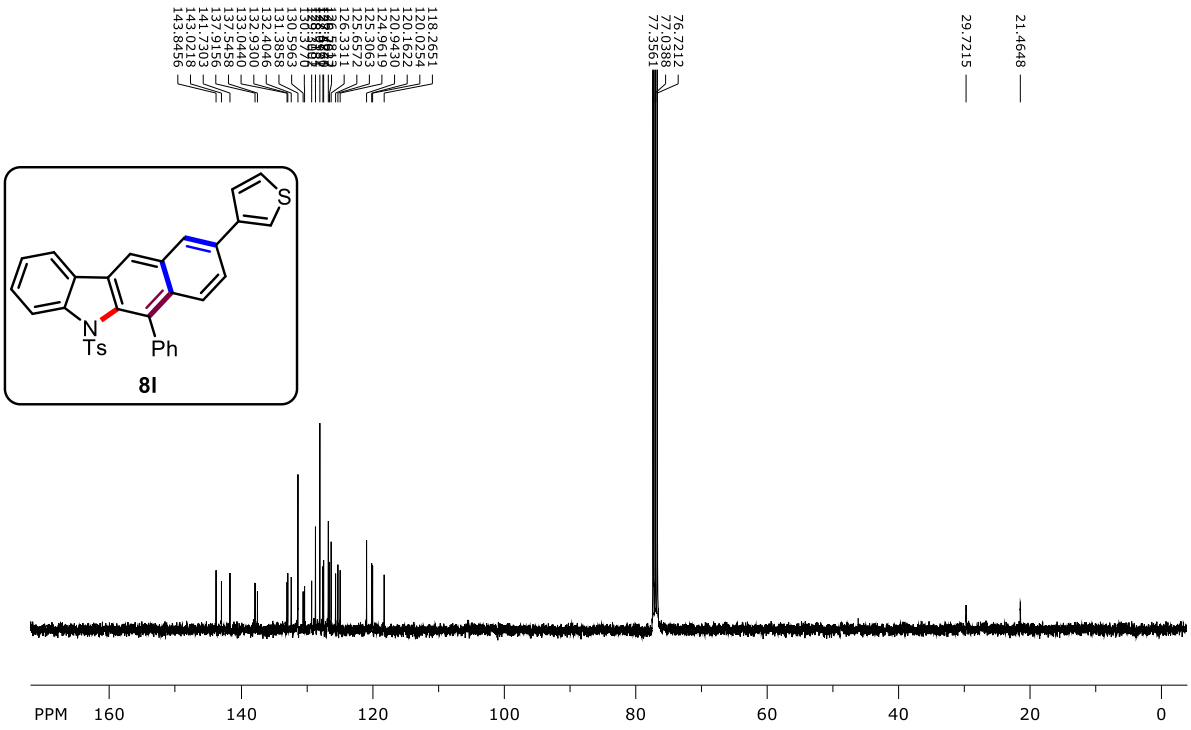
^{1}H NMR (400 MHz, $CDCl_3$)



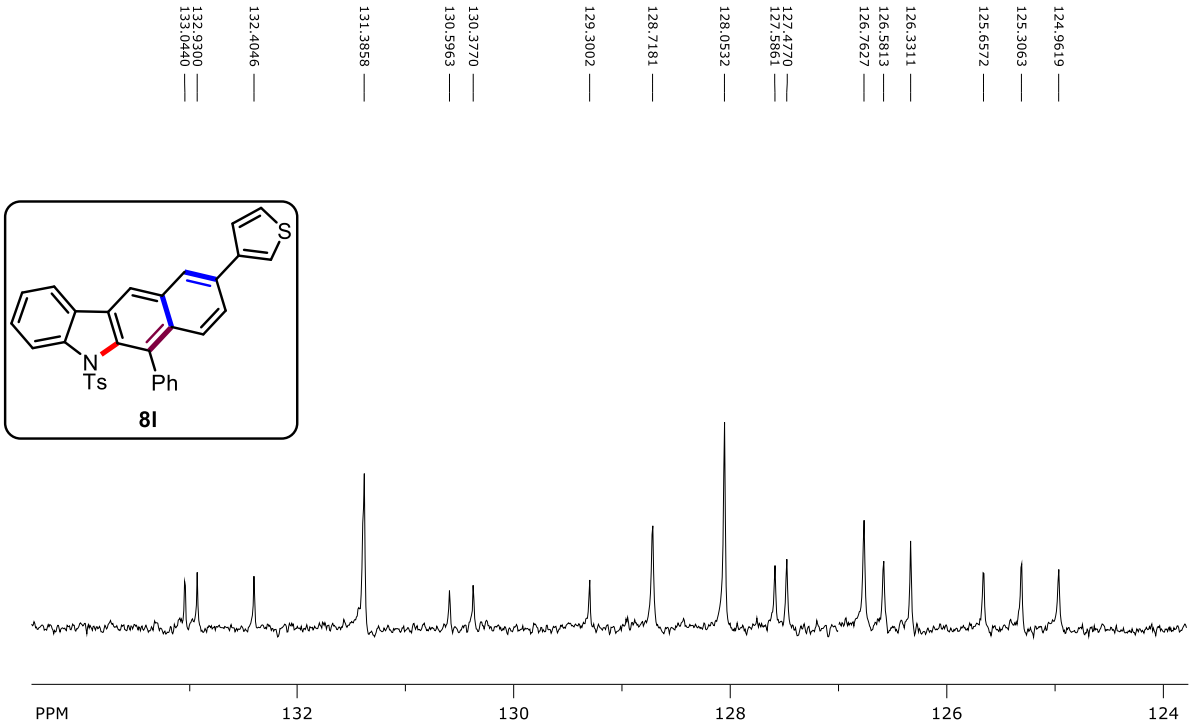
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.3-6.5 ppm region



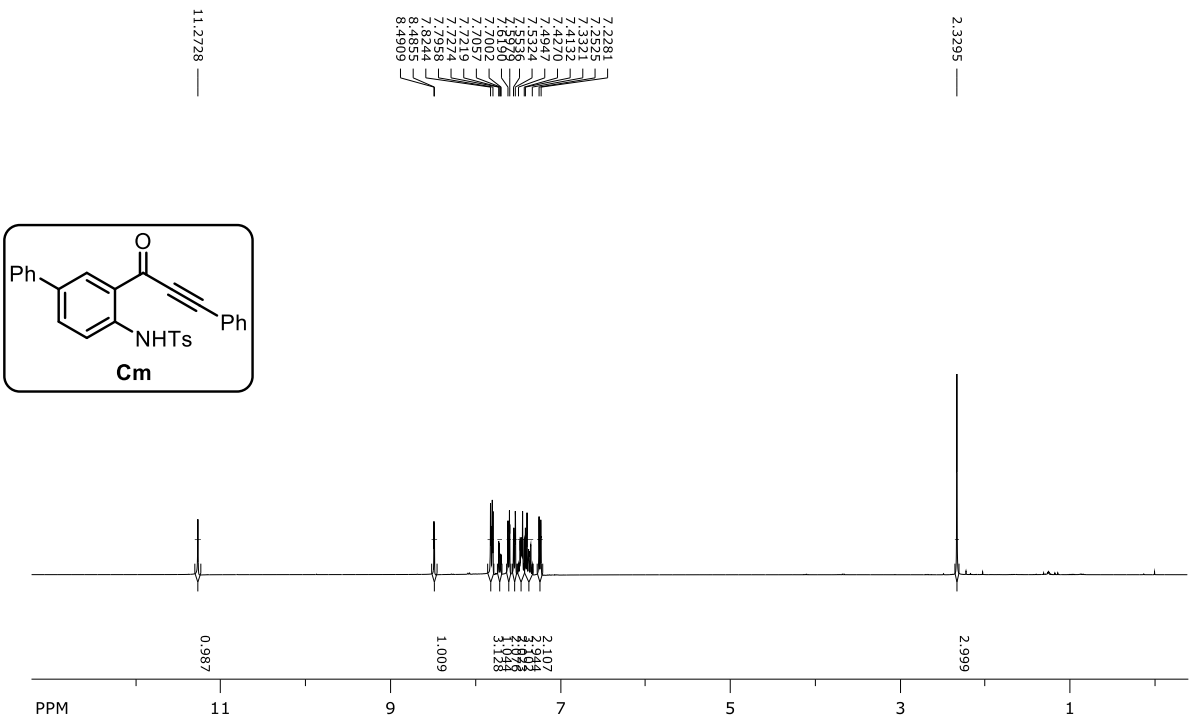
^{13}C NMR (100 MHz, $CDCl_3$)



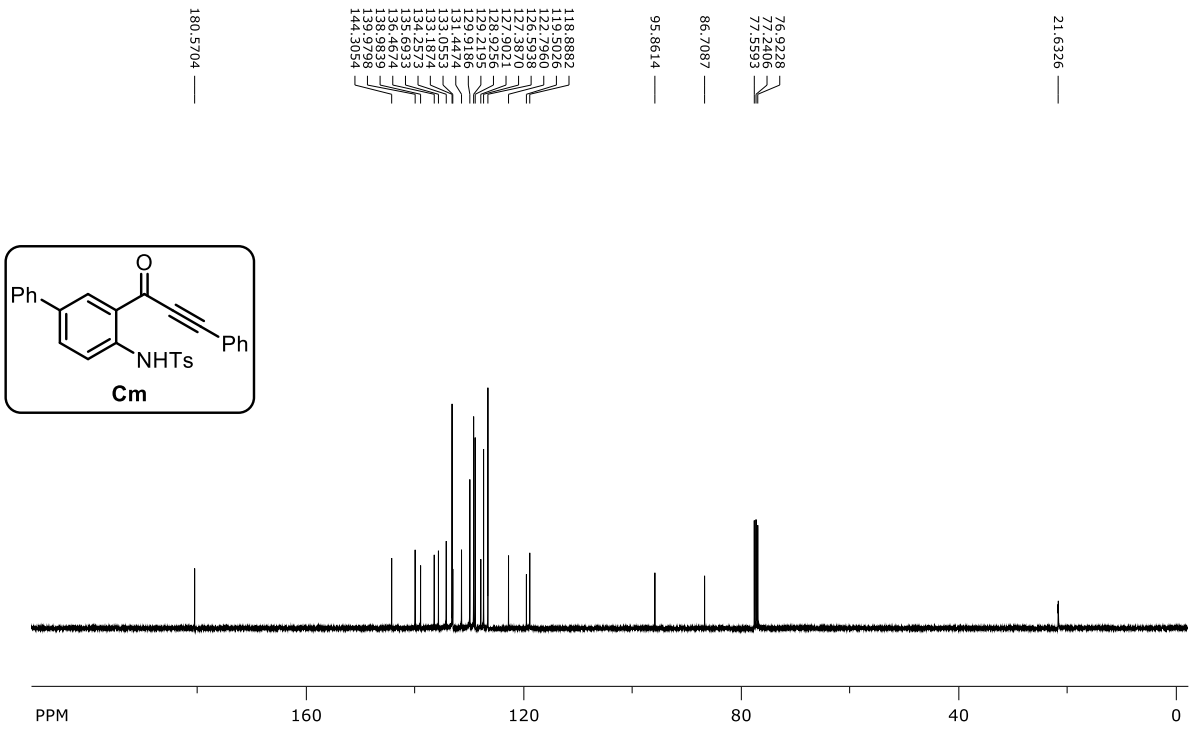
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-124.0 ppm region



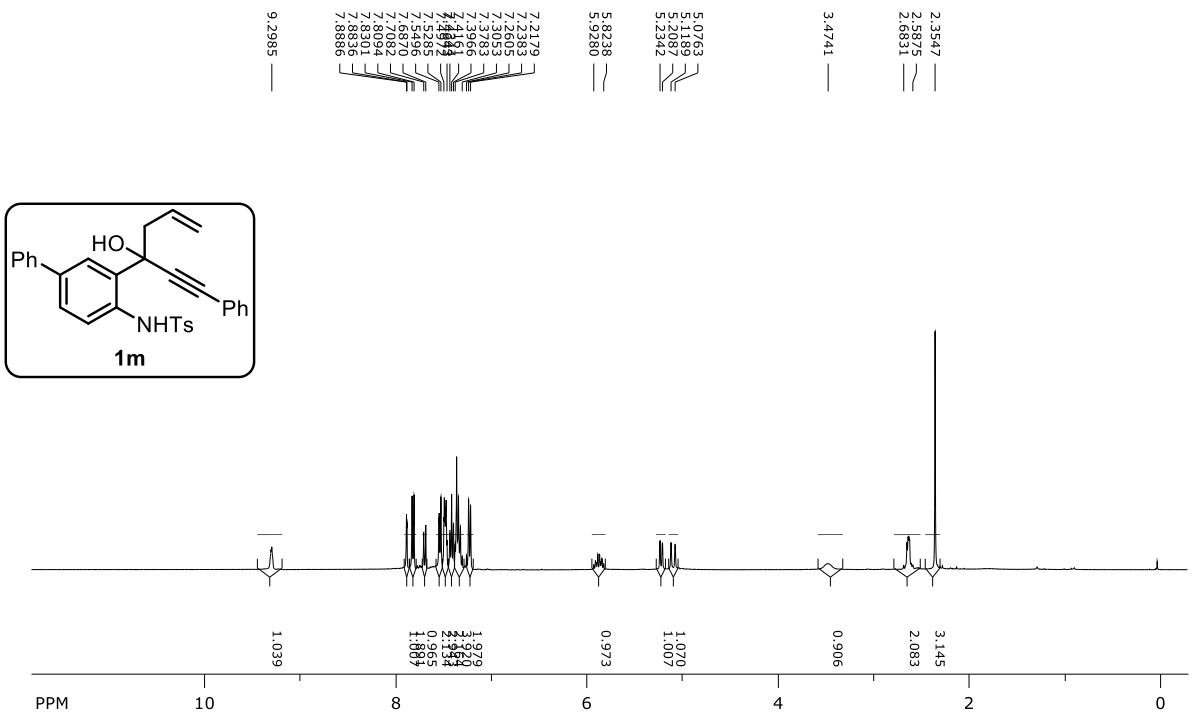
^{1}H NMR (400 MHz, $CDCl_3$)



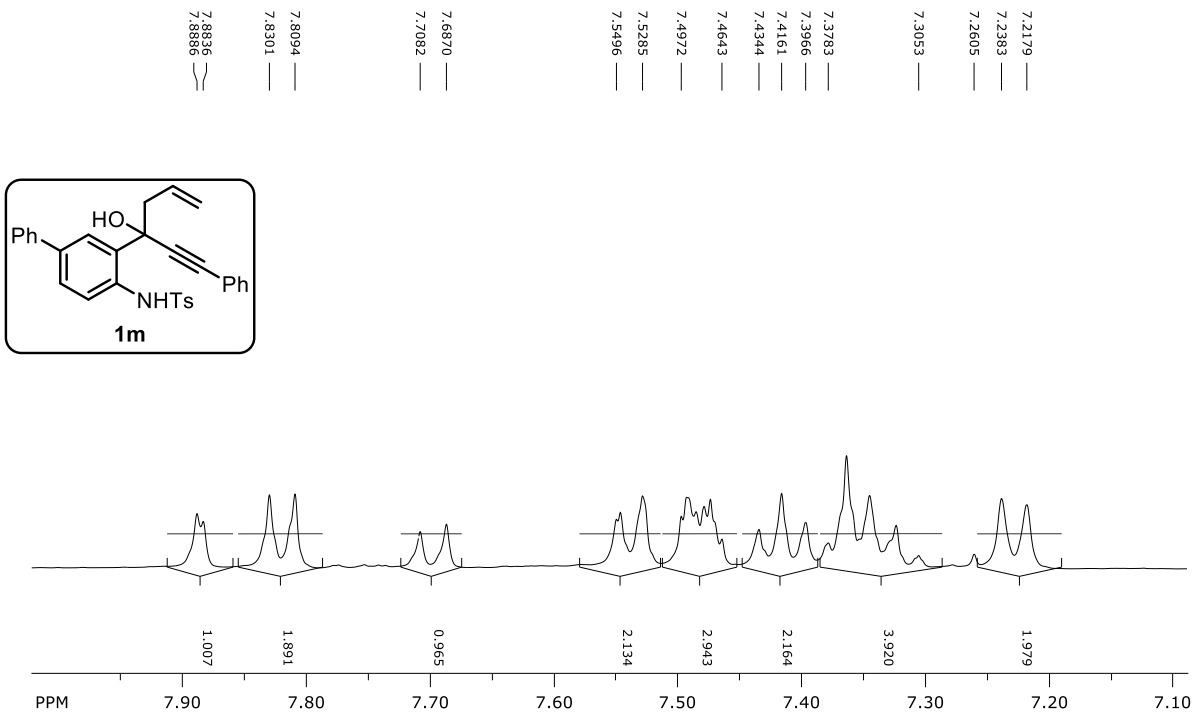
^{13}C NMR (100 MHz, $CDCl_3$)



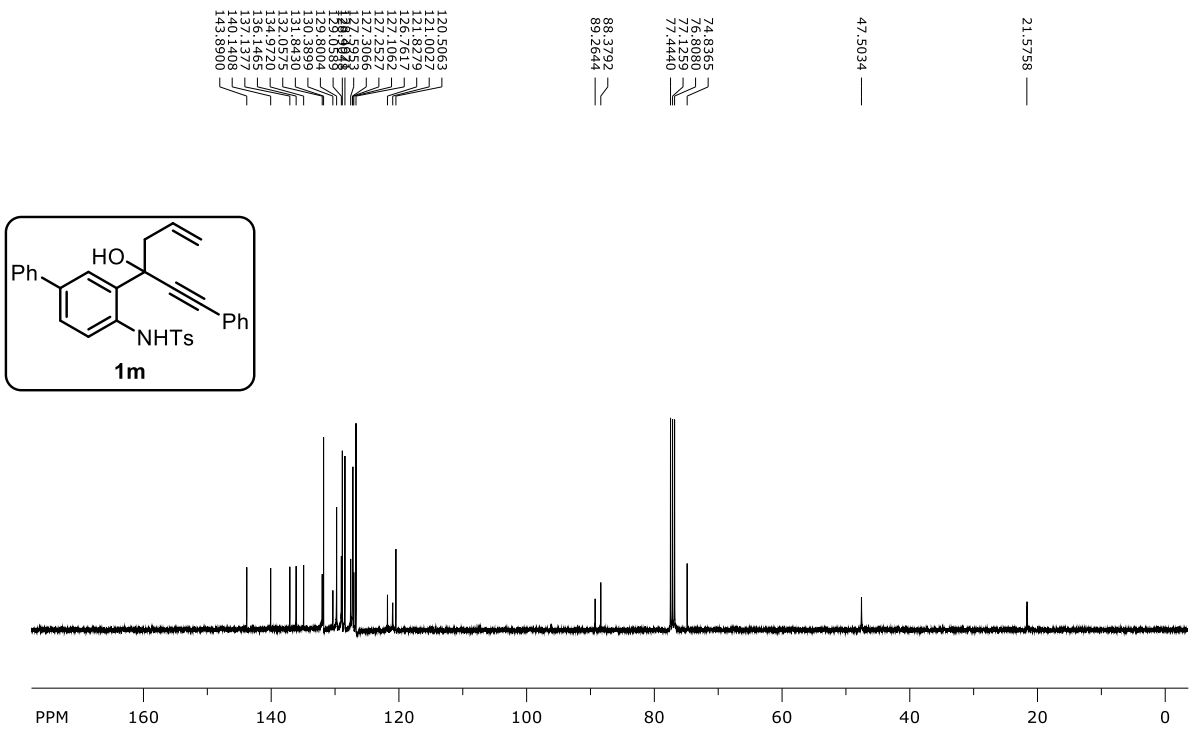
^{1}H NMR (400 MHz, $CDCl_3$)



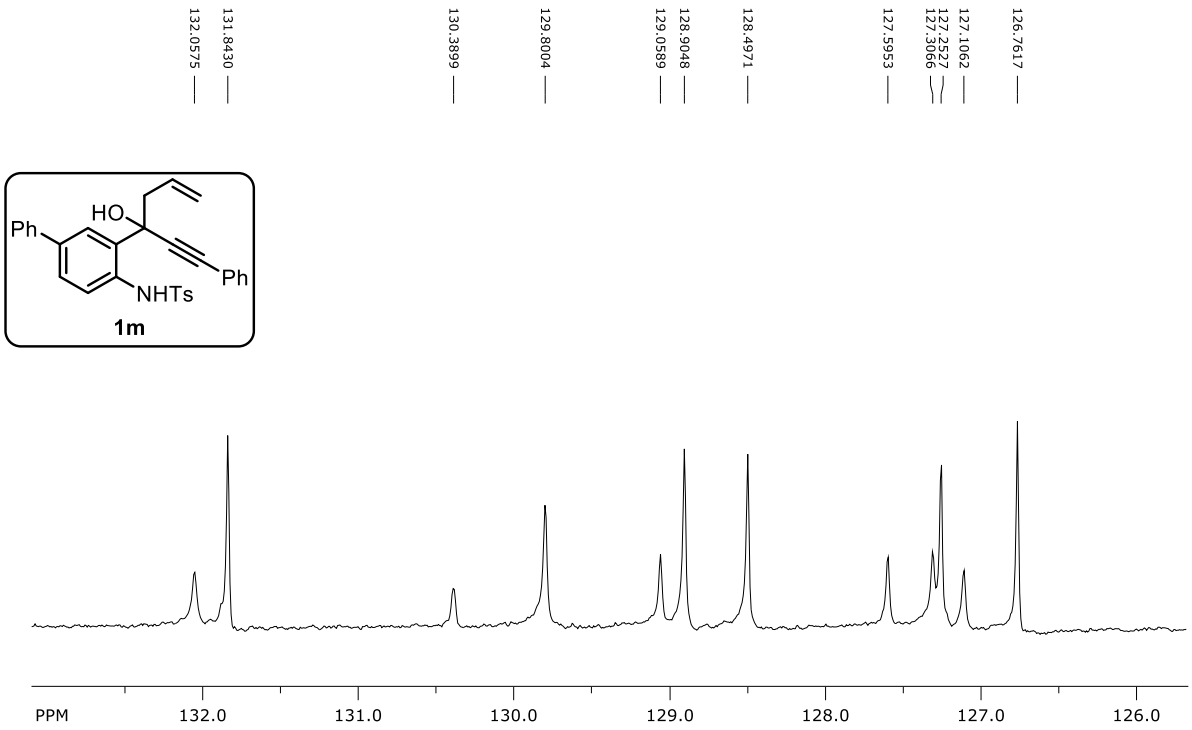
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.0-7.1 ppm region



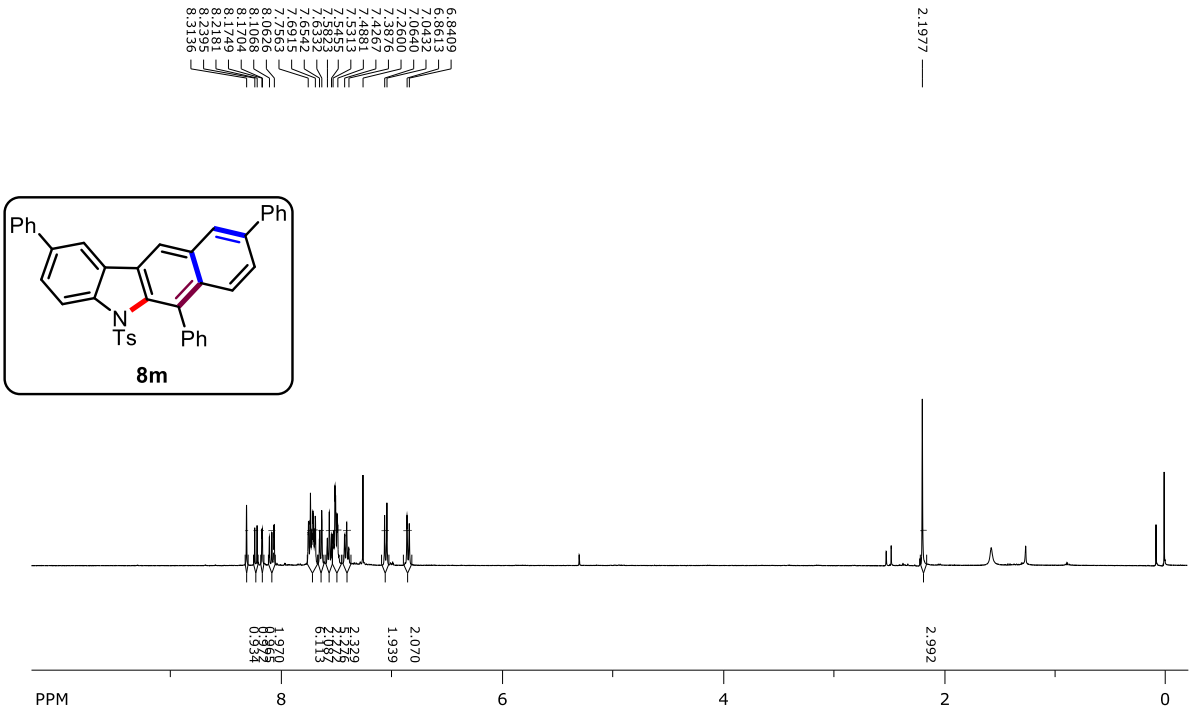
^{13}C NMR (100 MHz, $CDCl_3$)



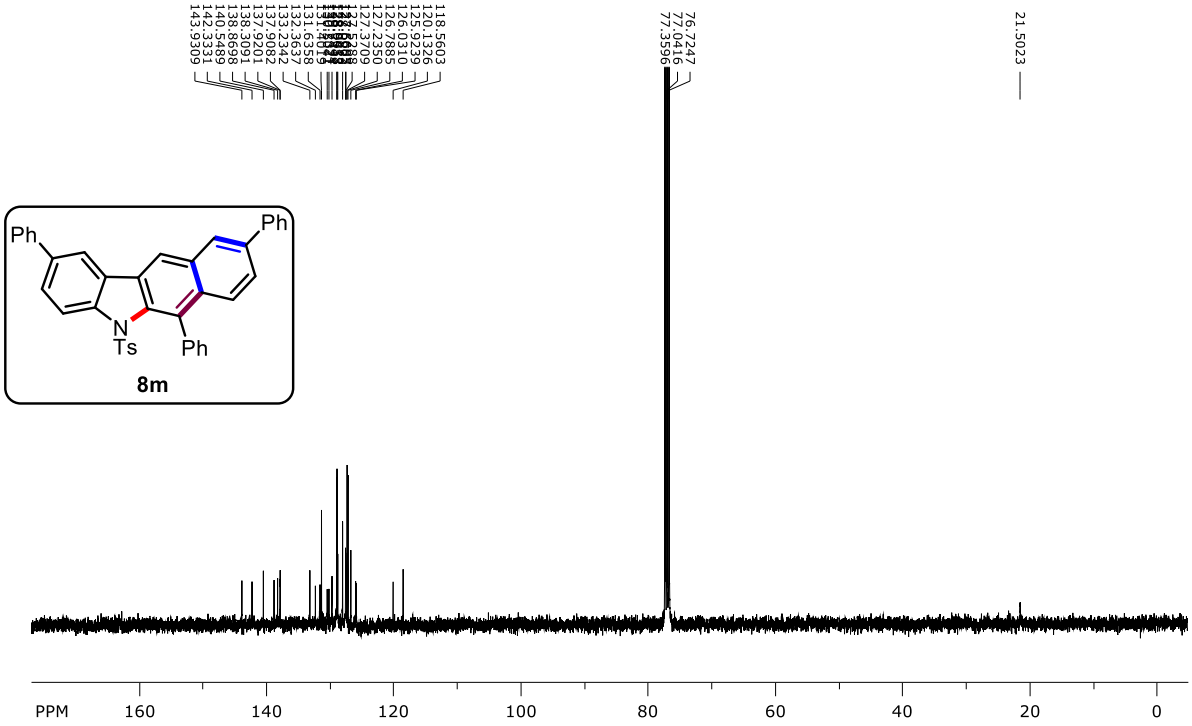
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 133.0-126.0 ppm region



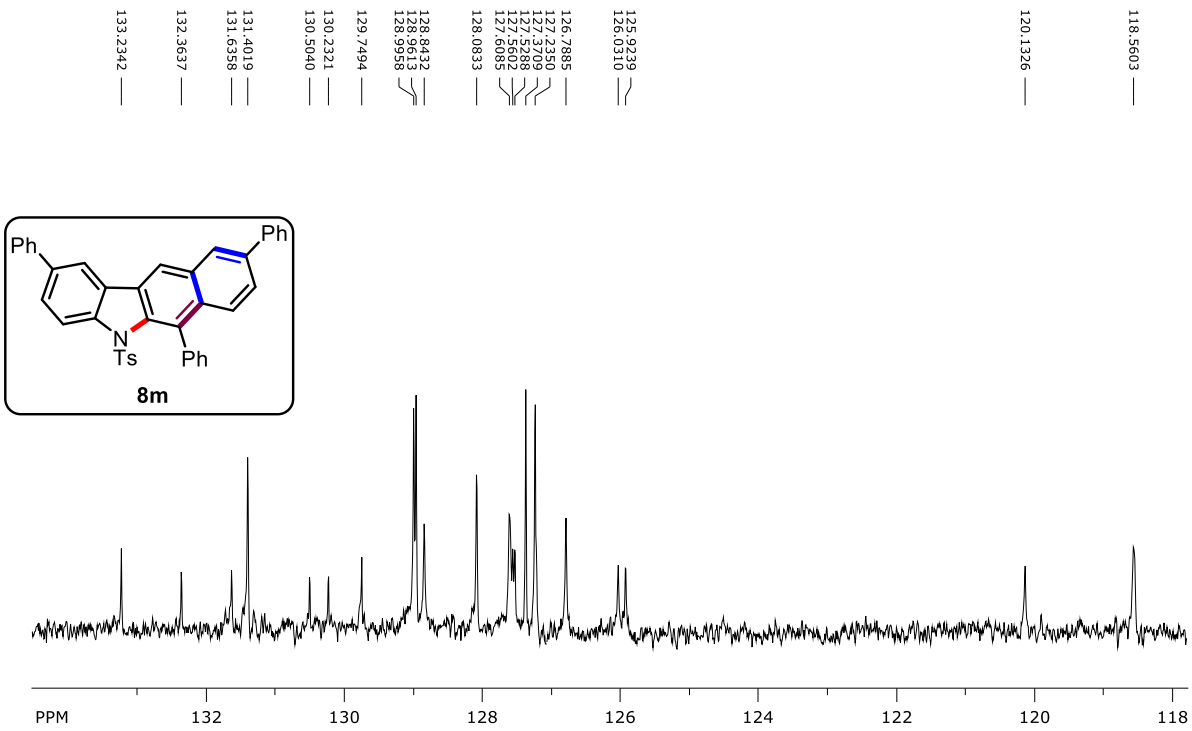
^{1}H NMR (400 MHz, $CDCl_3$)



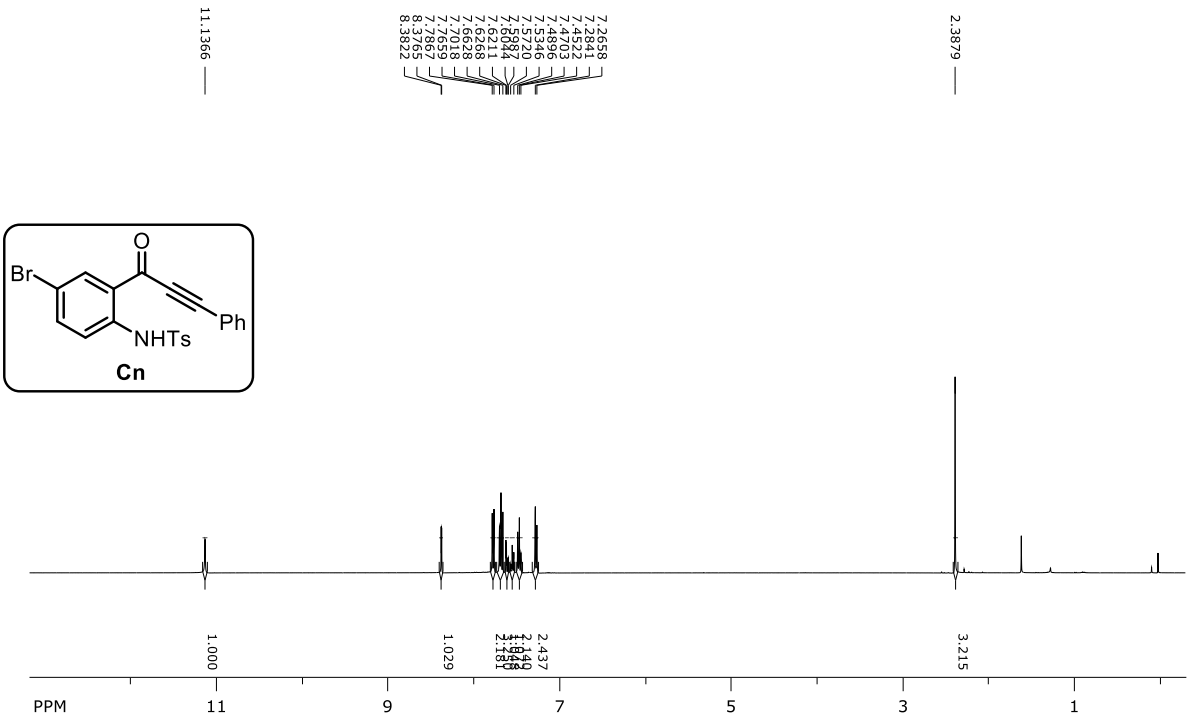
^{13}C NMR (100 MHz, $CDCl_3$)



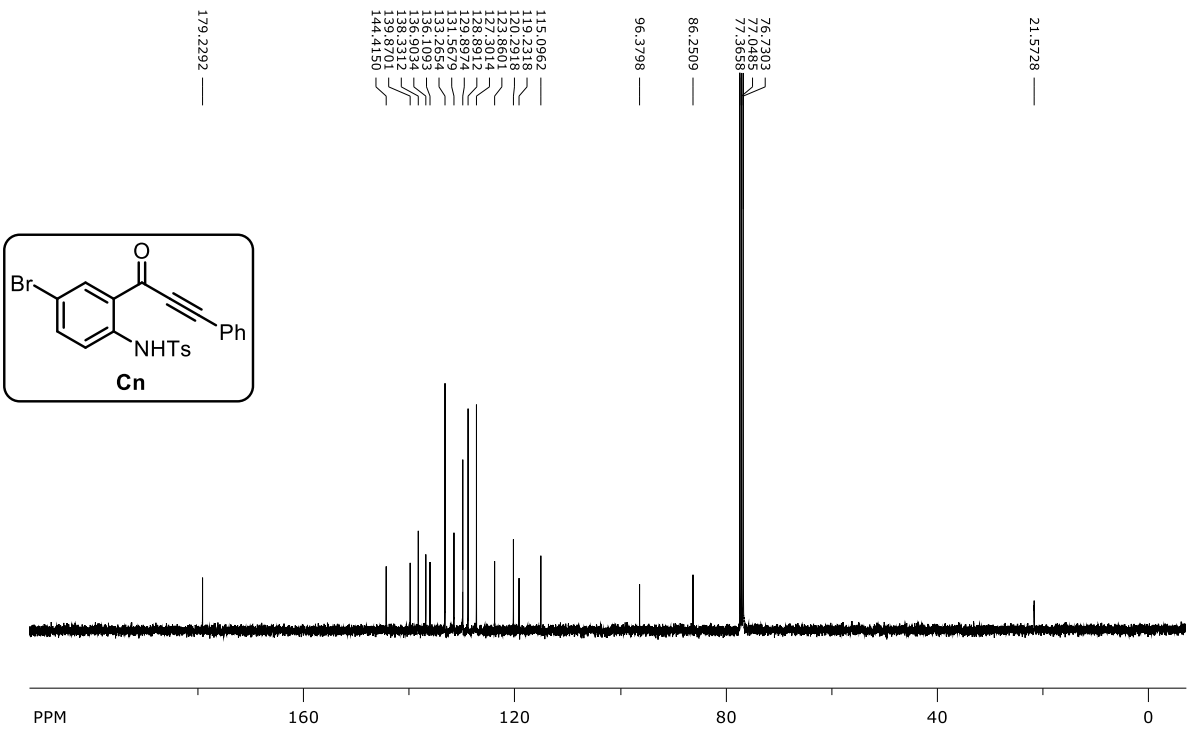
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-118.0 ppm region



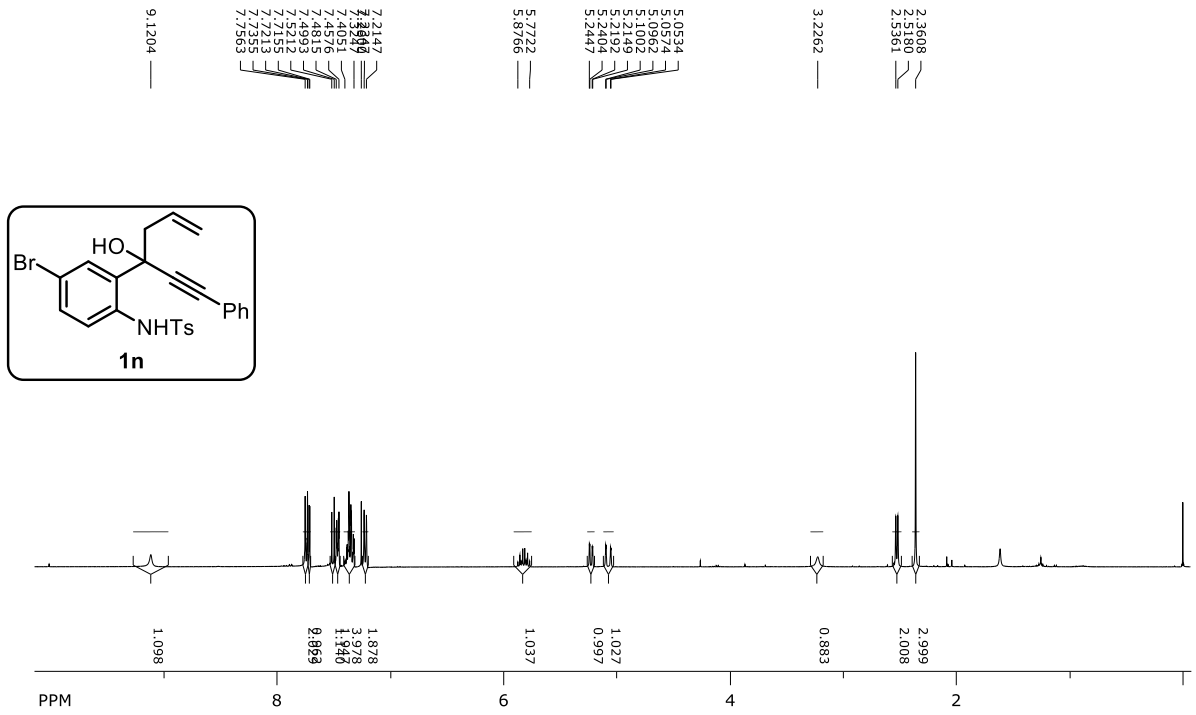
^{1}H NMR (400 MHz, $CDCl_3$)



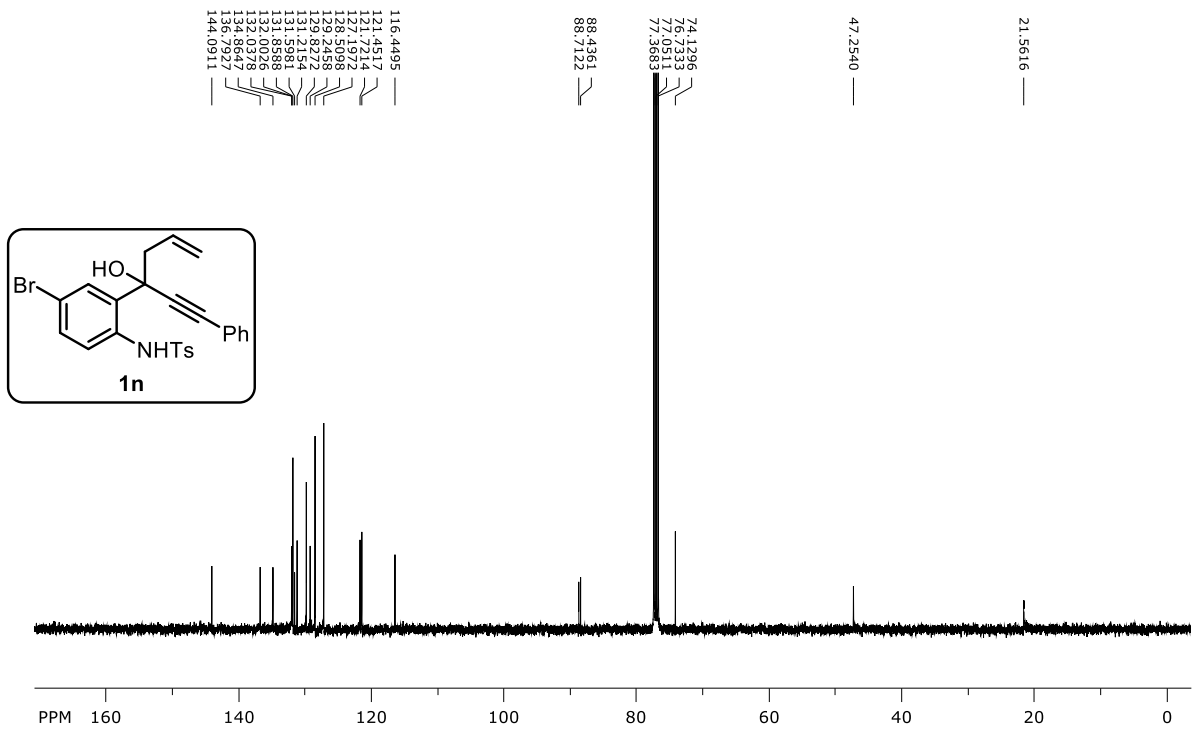
^{13}C NMR (100 MHz, $CDCl_3$)



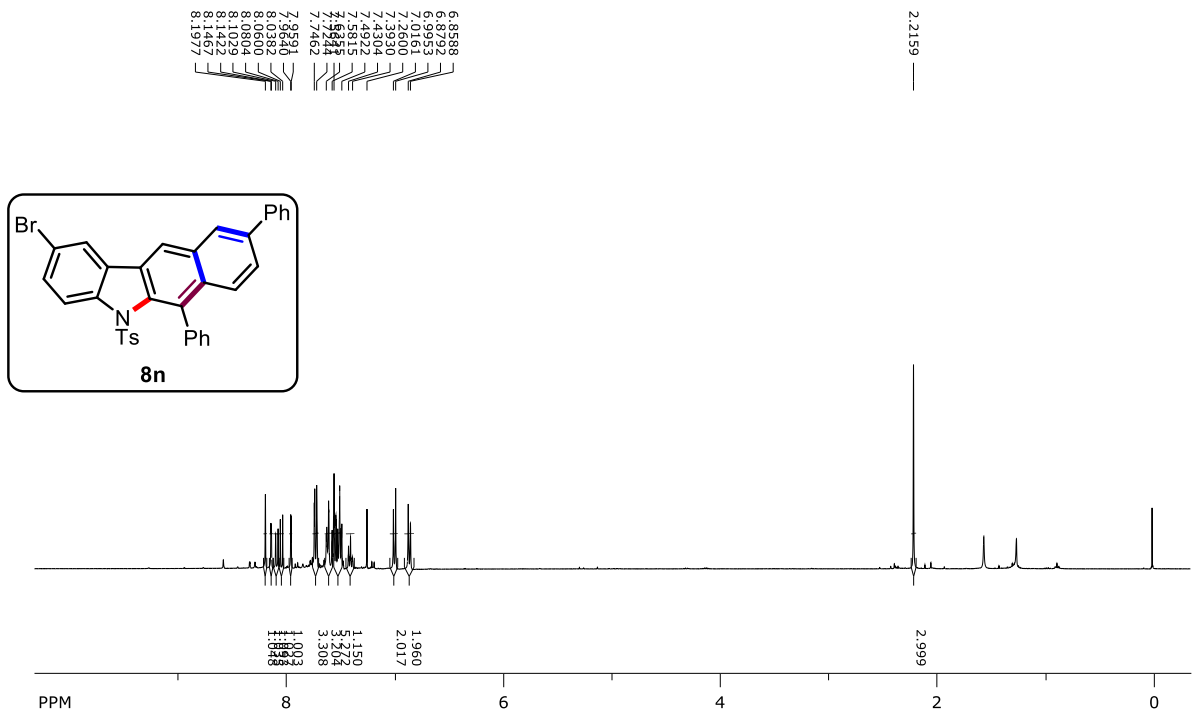
^{1}H NMR (400 MHz, $CDCl_3$)



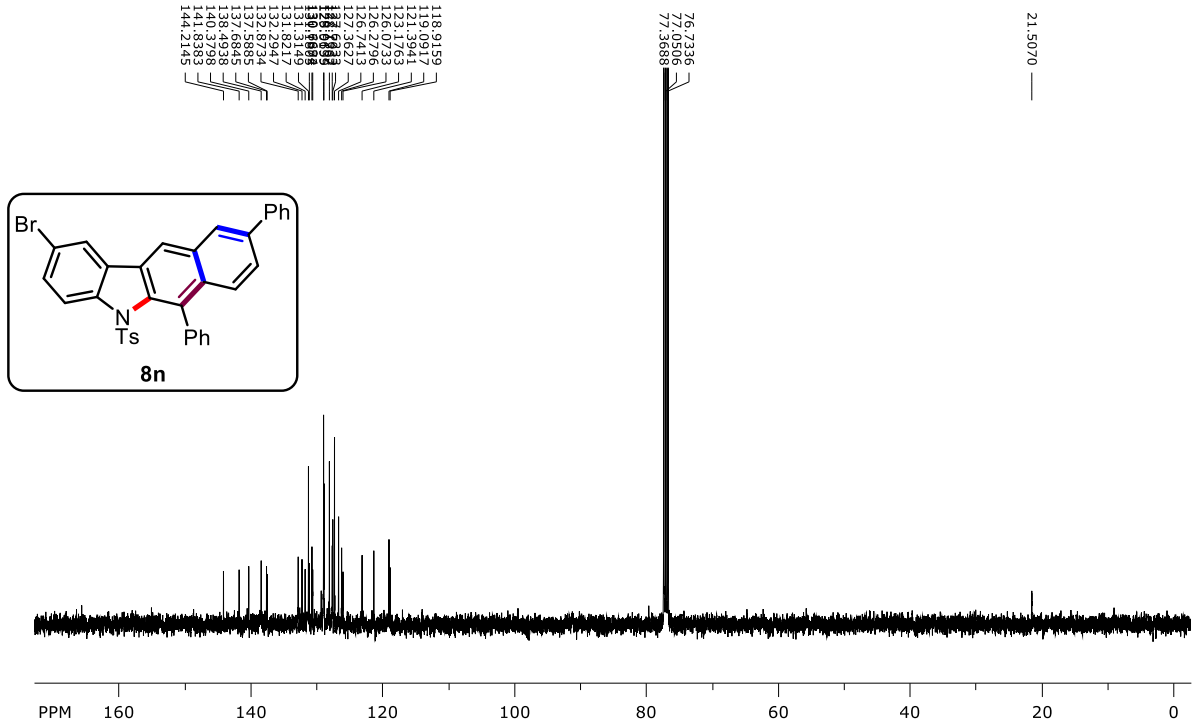
^{13}C NMR (100 MHz, $CDCl_3$)



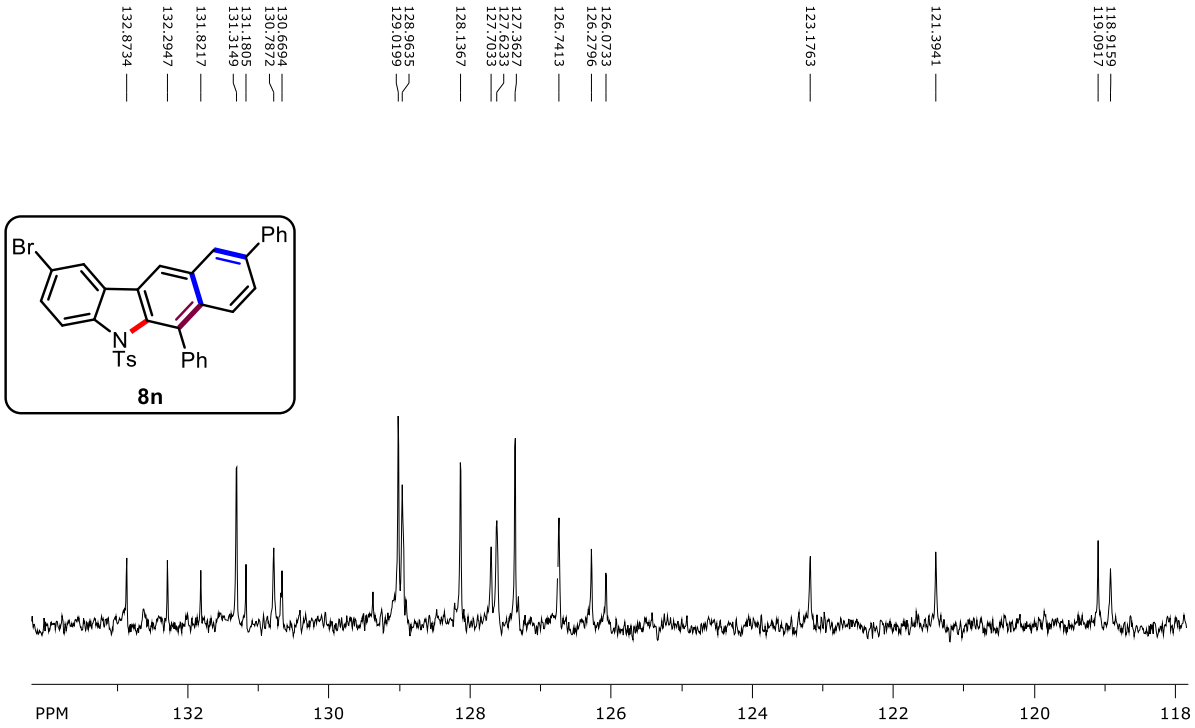
^{1}H NMR (400 MHz, $CDCl_3$)



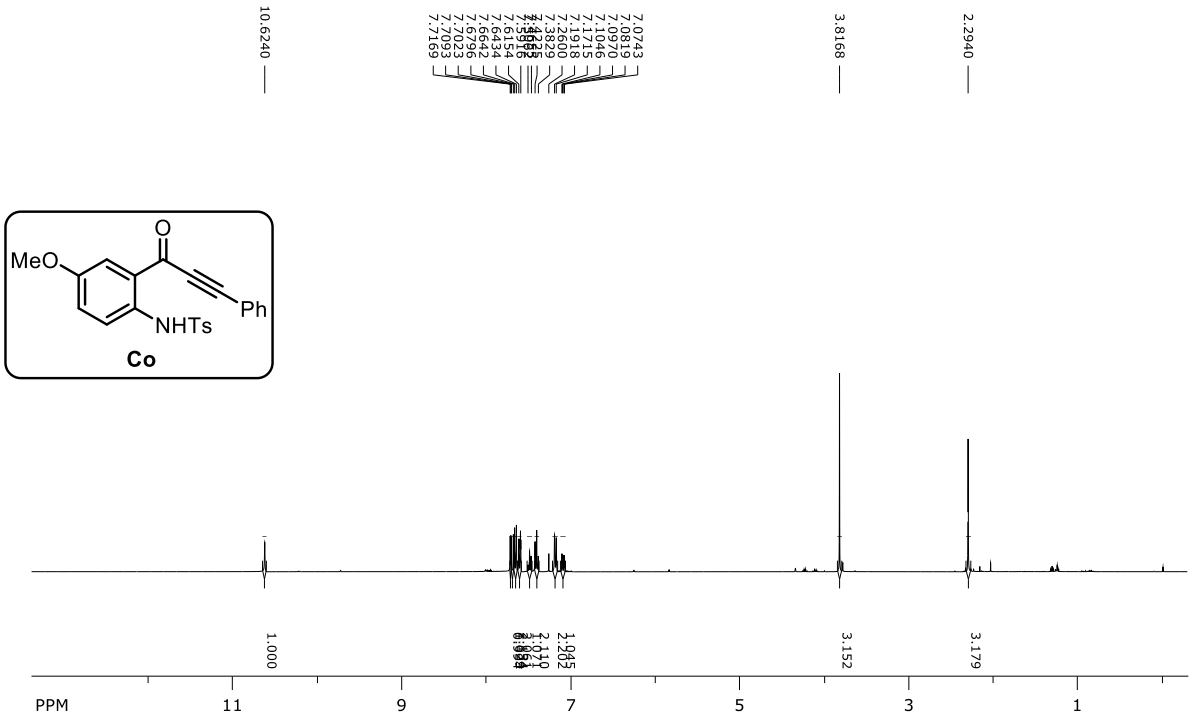
^{13}C NMR (100 MHz, $CDCl_3$)



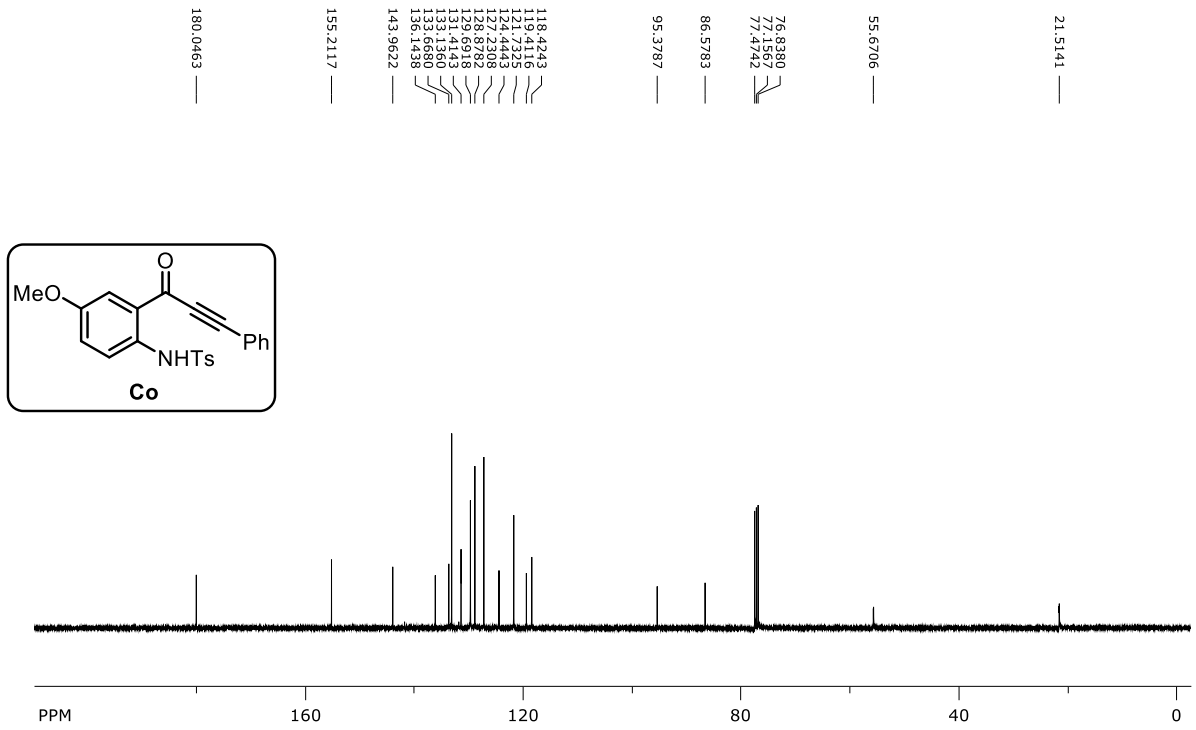
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-118.0 ppm region



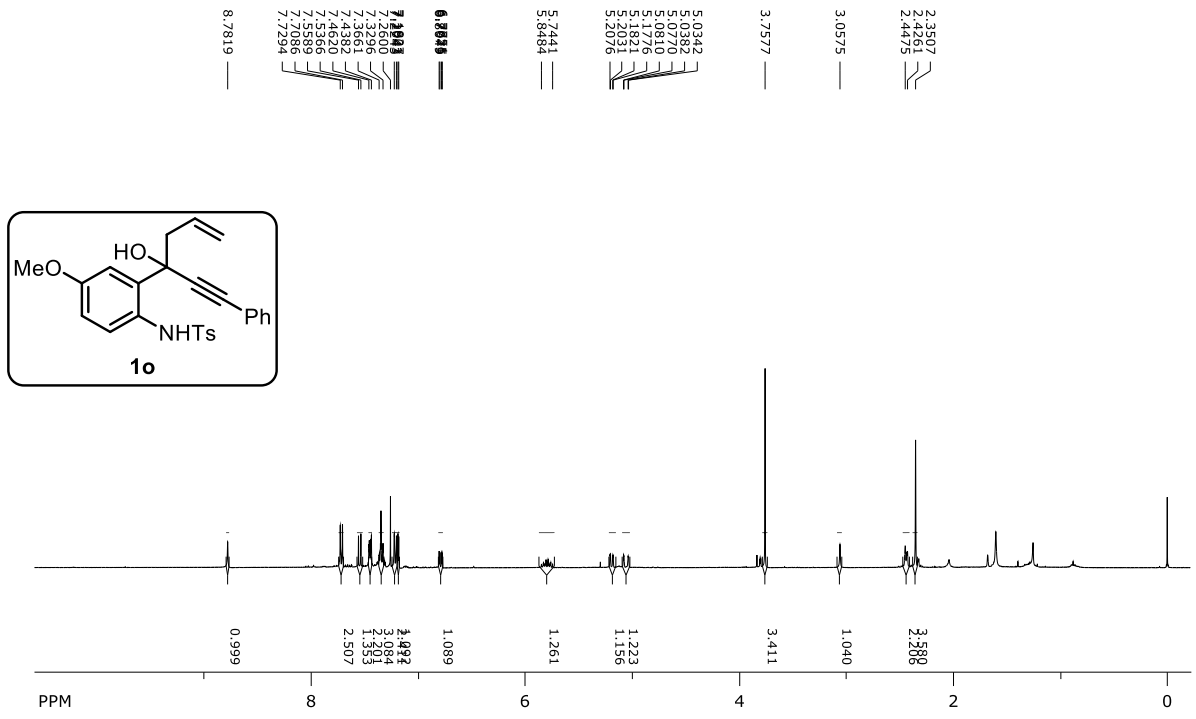
^{1}H NMR (400 MHz, $CDCl_3$)



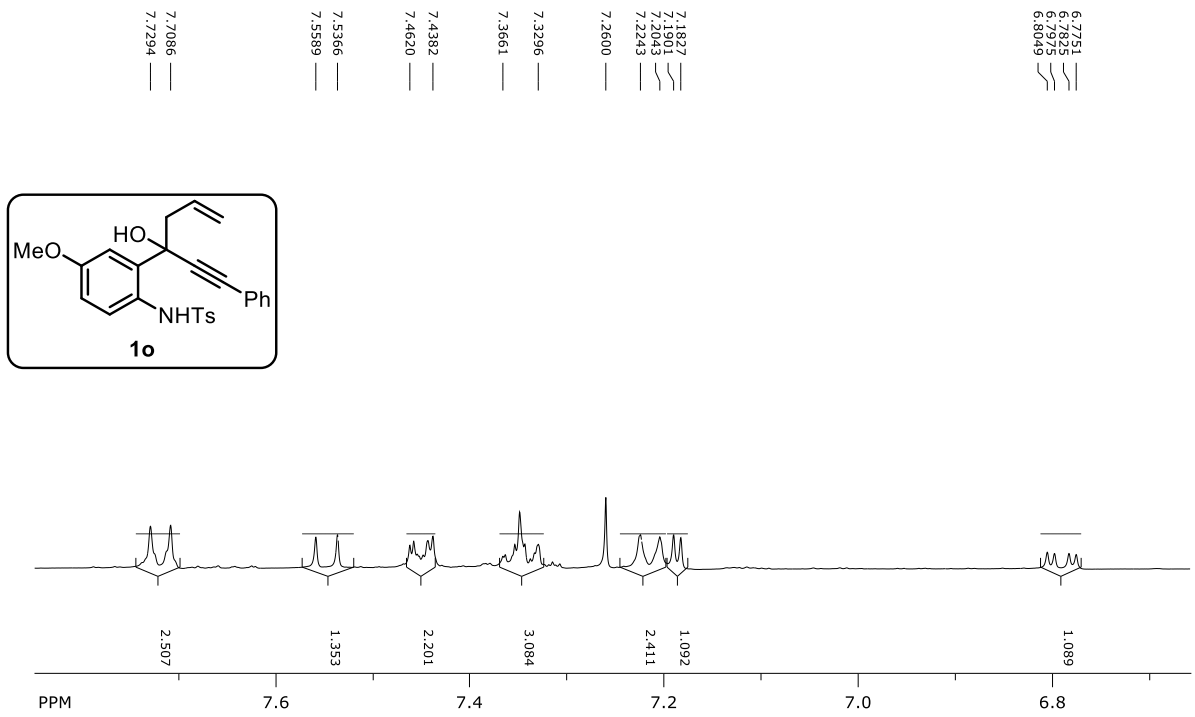
^{13}C NMR (100 MHz, $CDCl_3$)



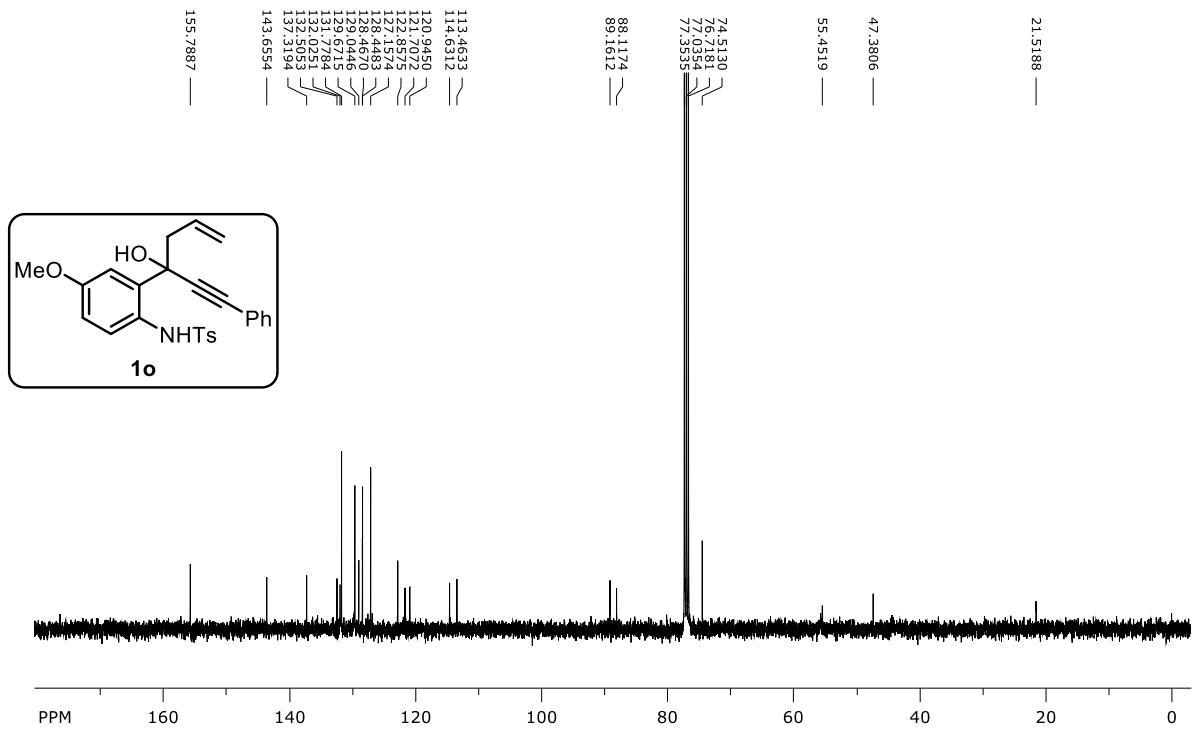
^{1}H NMR (400 MHz, $CDCl_3$)



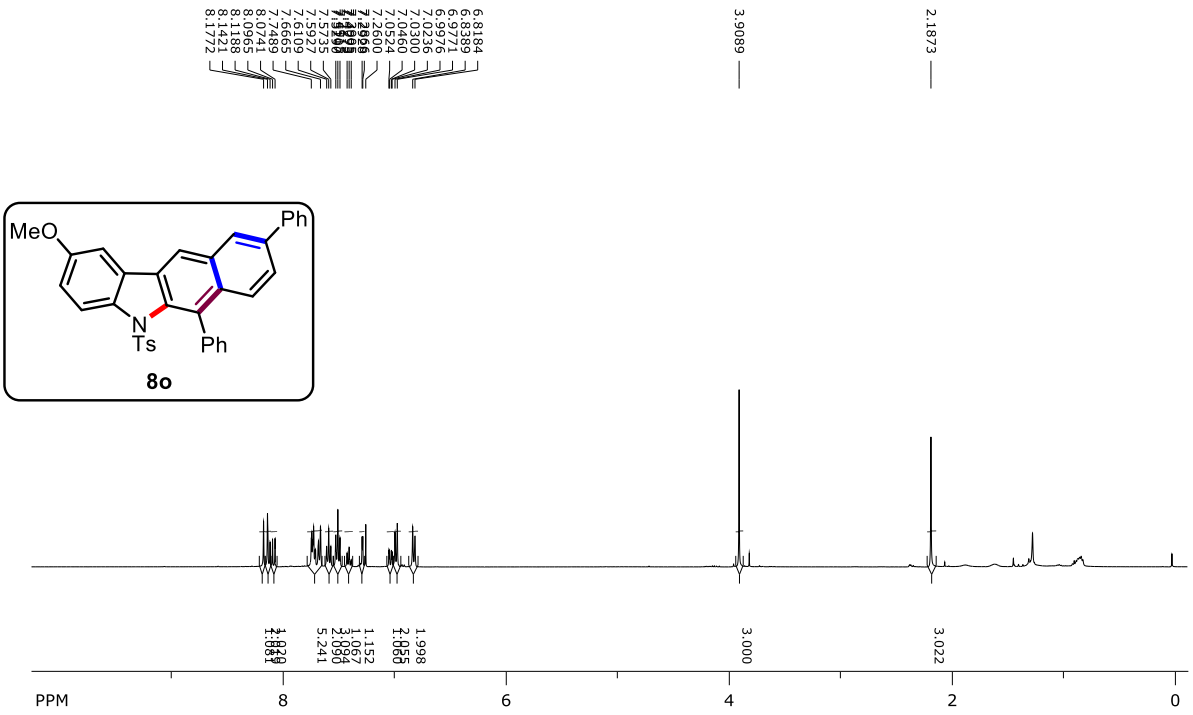
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.8-6.7 ppm region



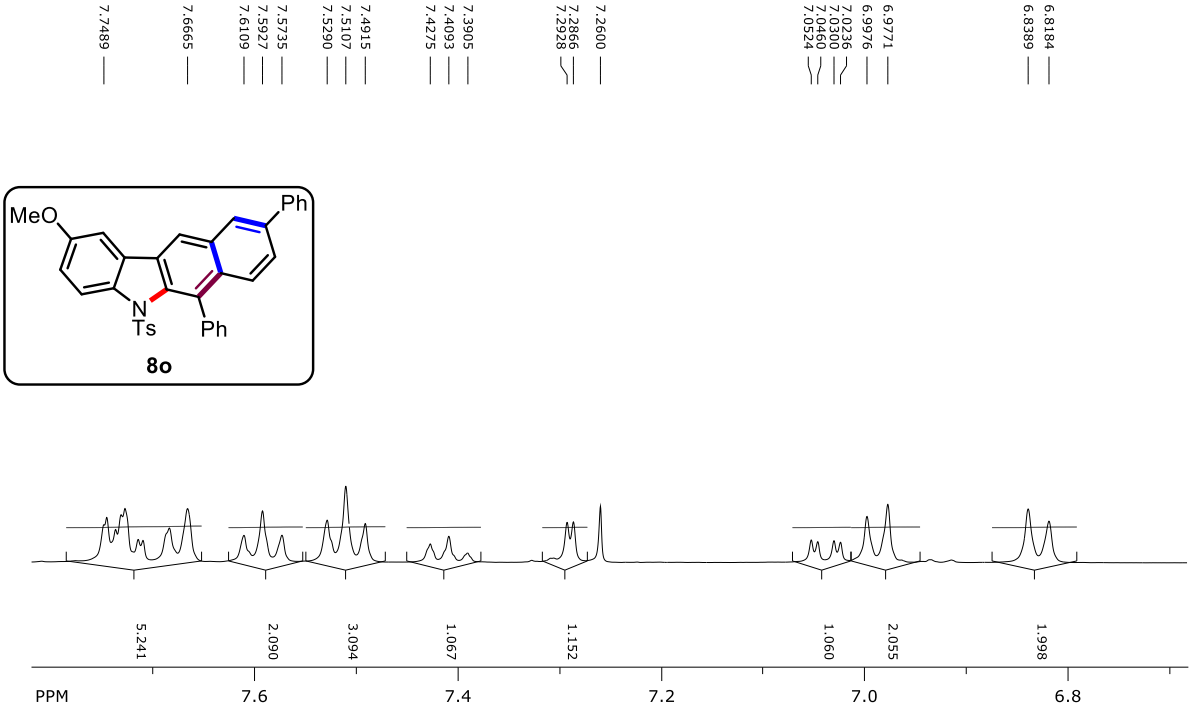
^{13}C NMR (100 MHz, $CDCl_3$)



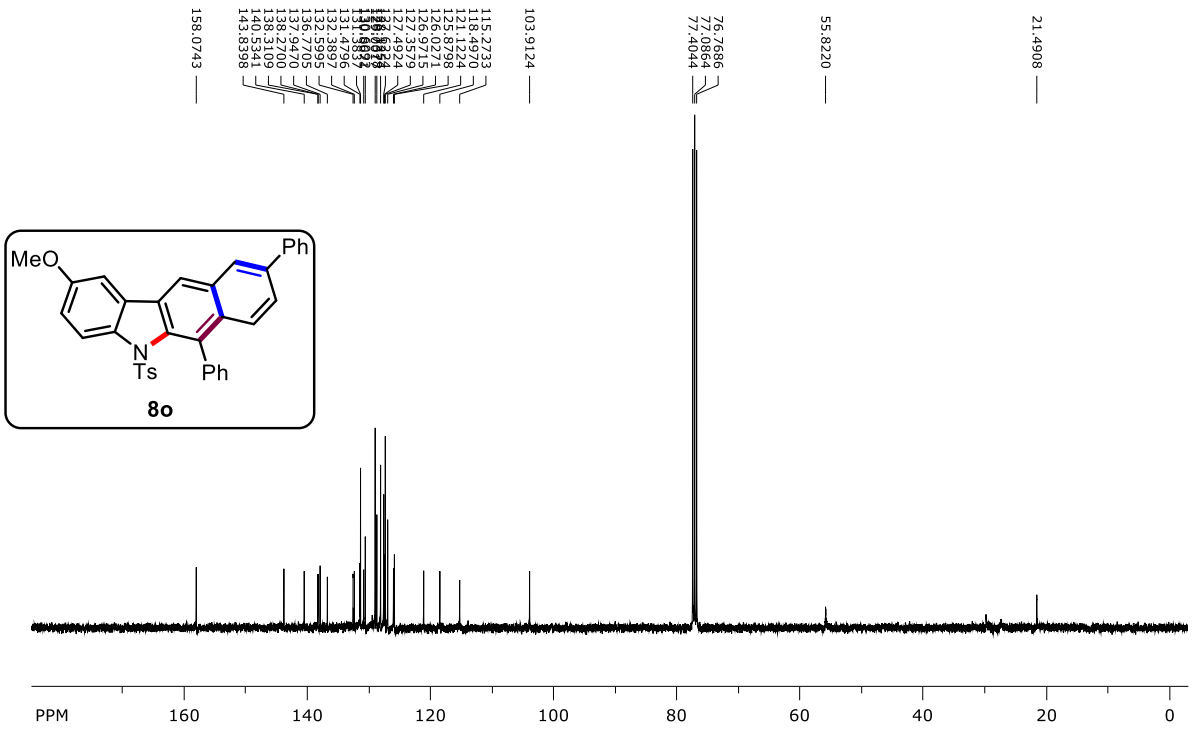
^{1}H NMR (400 MHz, $CDCl_3$)



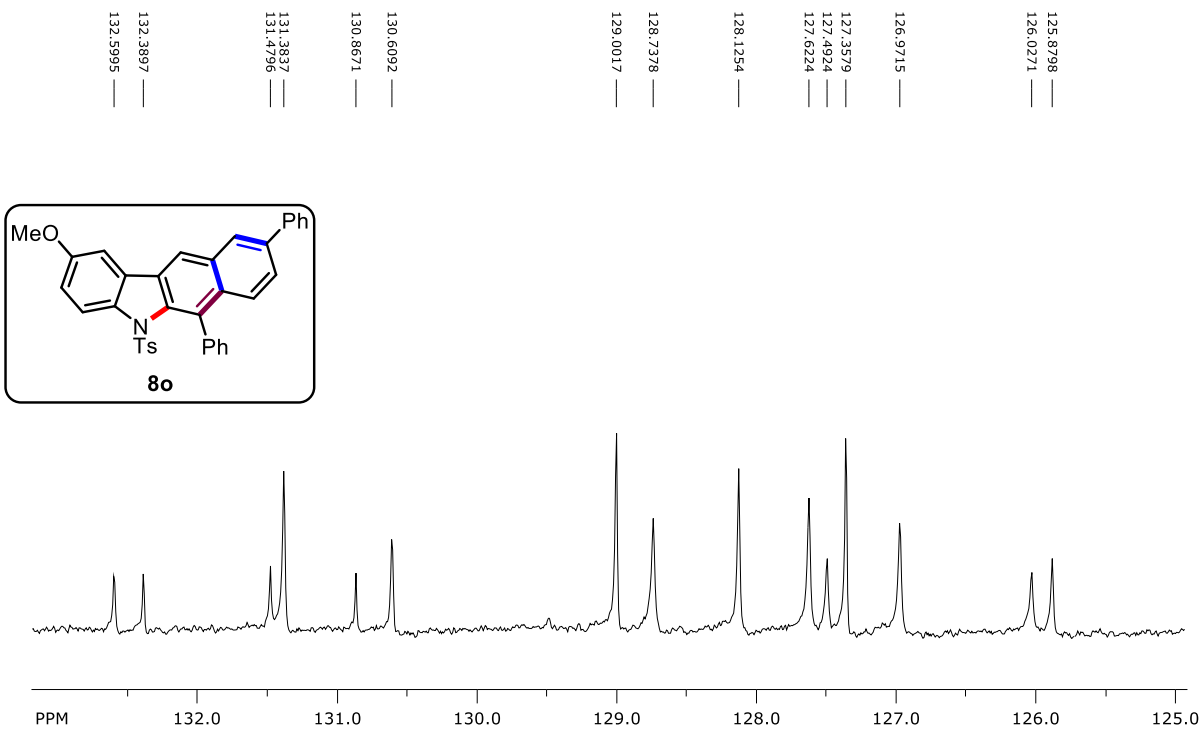
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.8-6.7 ppm region



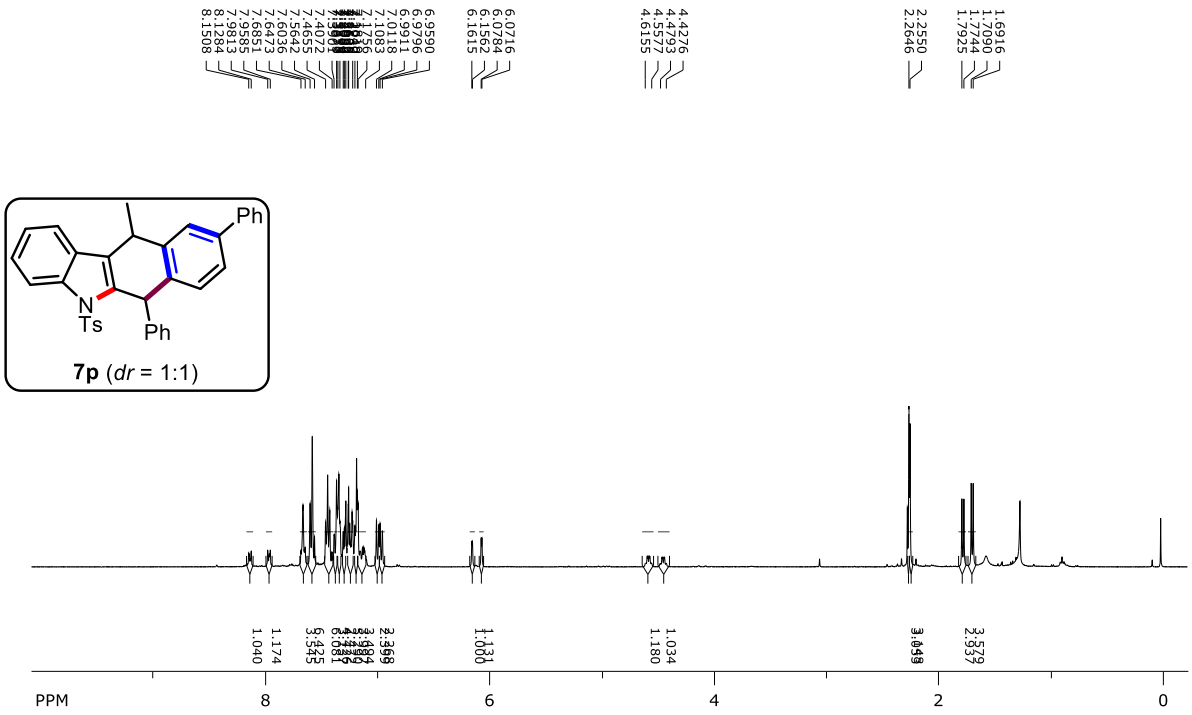
^{13}C NMR (100 MHz, $CDCl_3$)



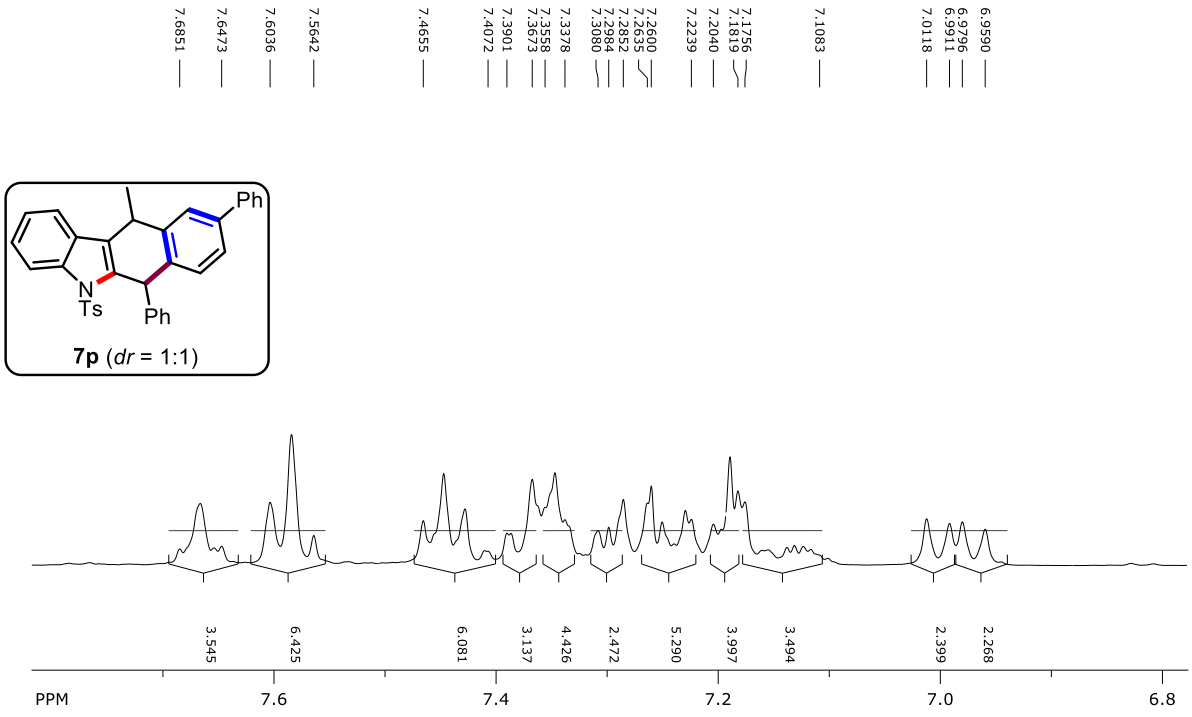
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 133.0-125.0 ppm region



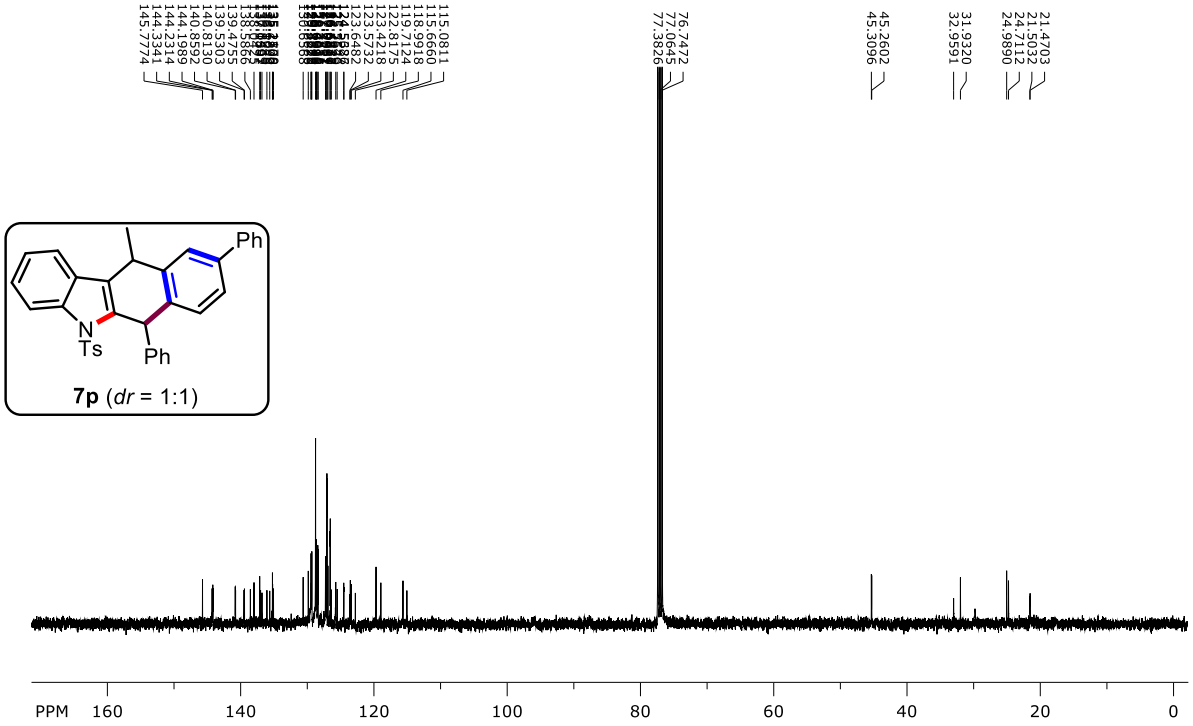
^{1}H NMR (400 MHz, $CDCl_3$)



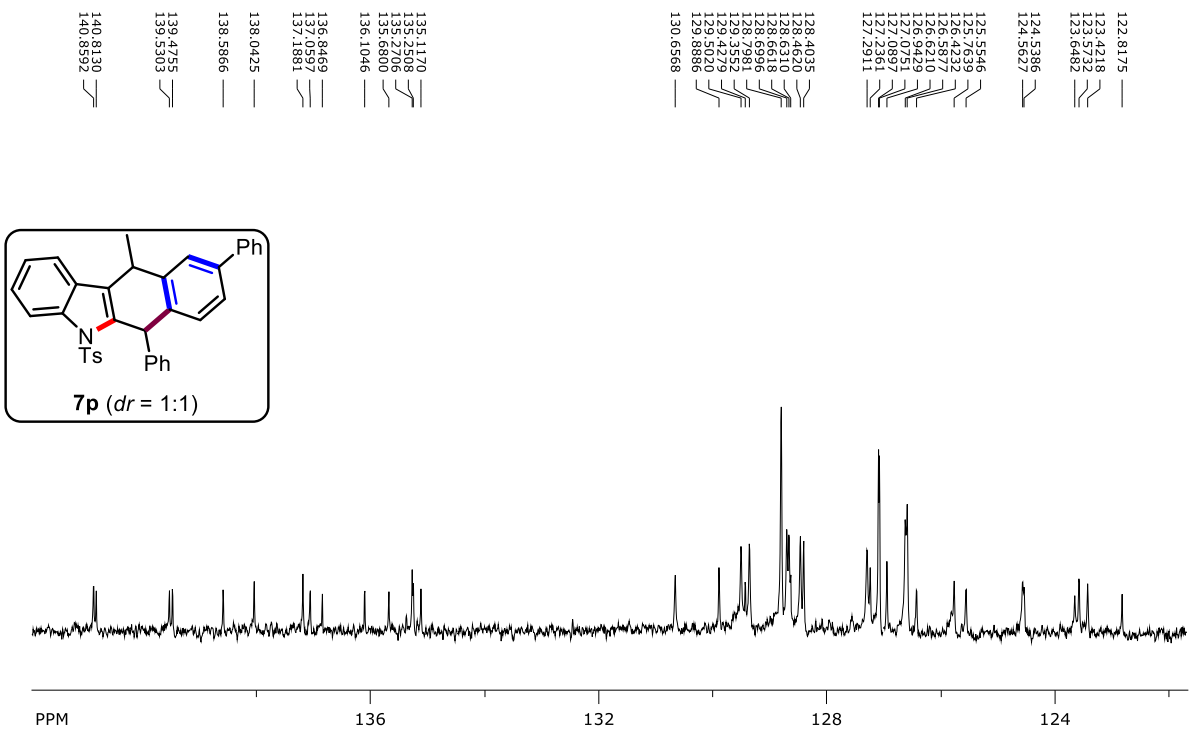
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.8-6.8 ppm region



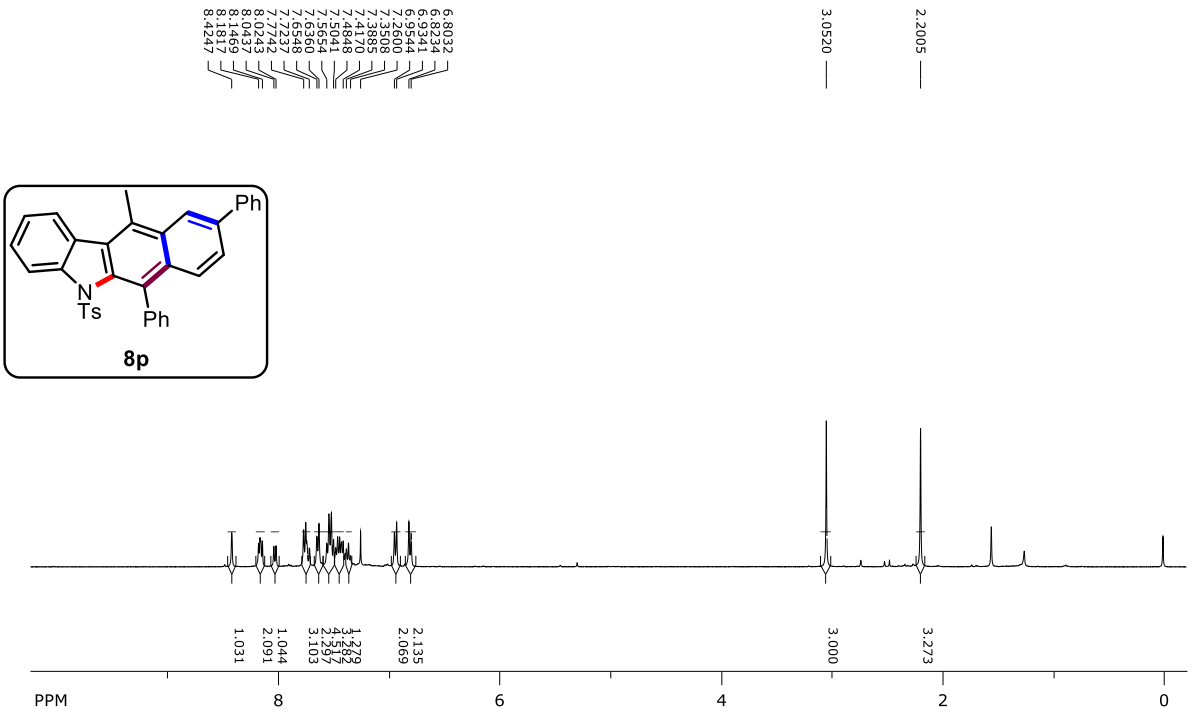
^{13}C NMR (100 MHz, $CDCl_3$)



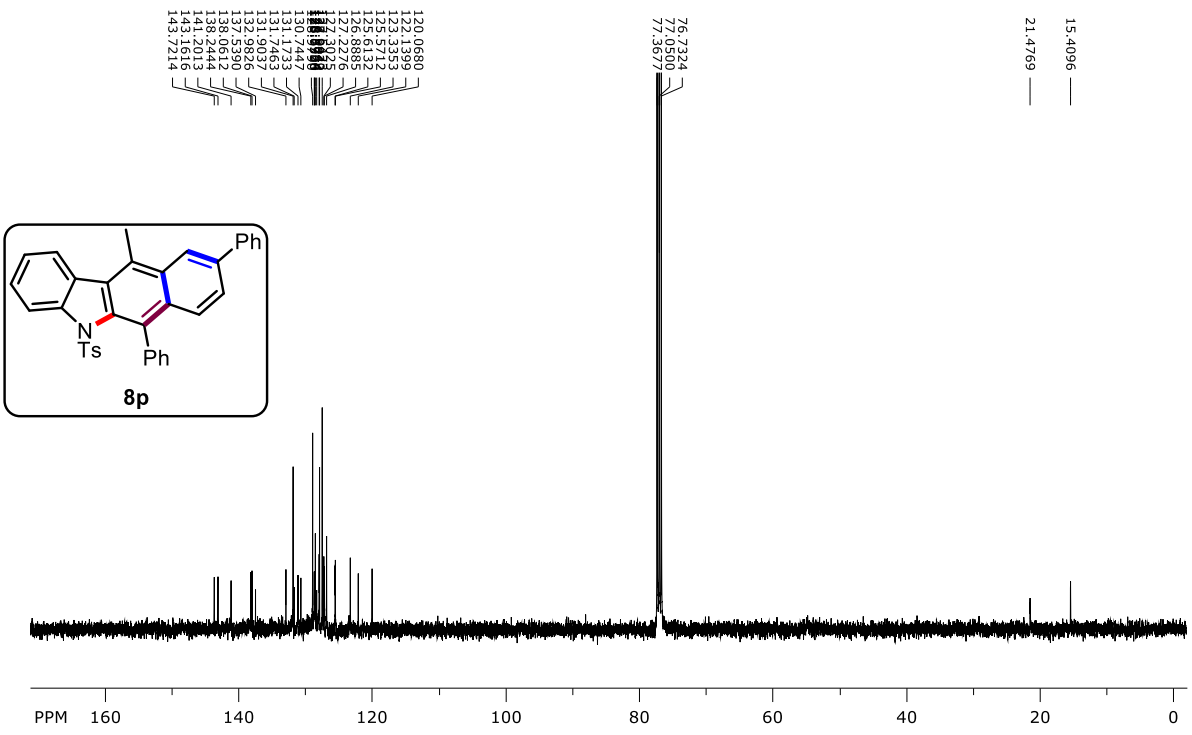
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 142.0-122.0 ppm region



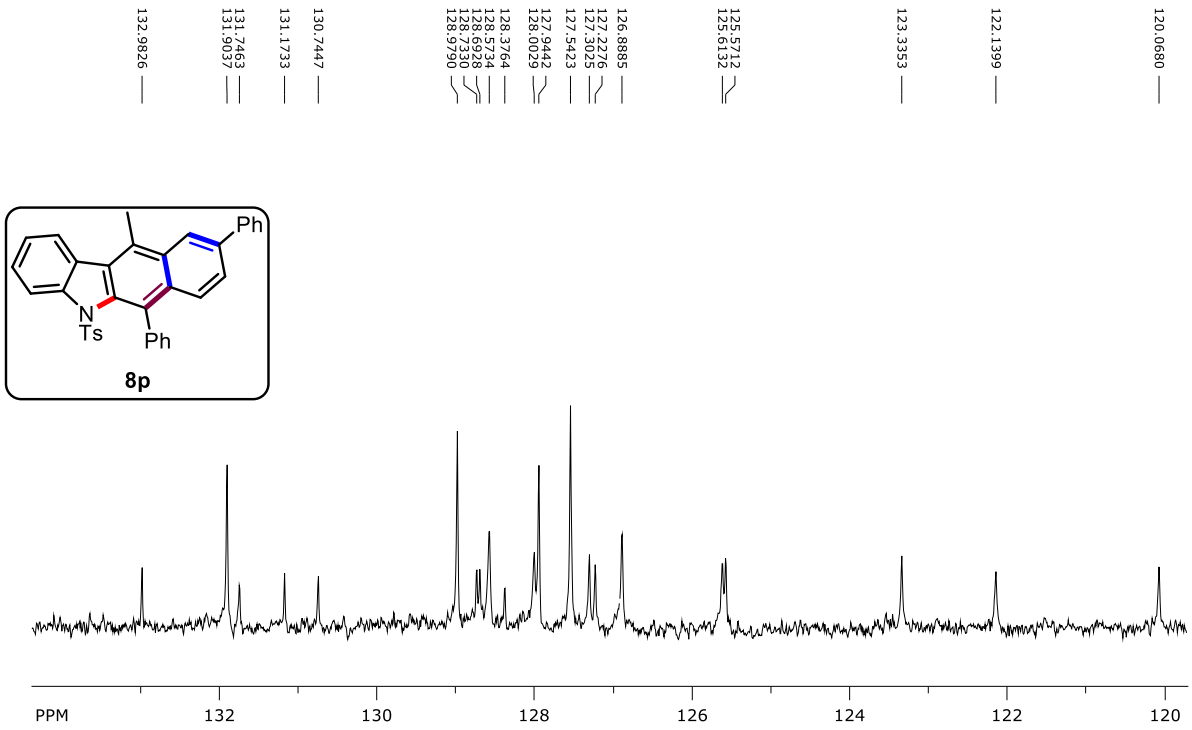
^{1}H NMR (400 MHz, $CDCl_3$)



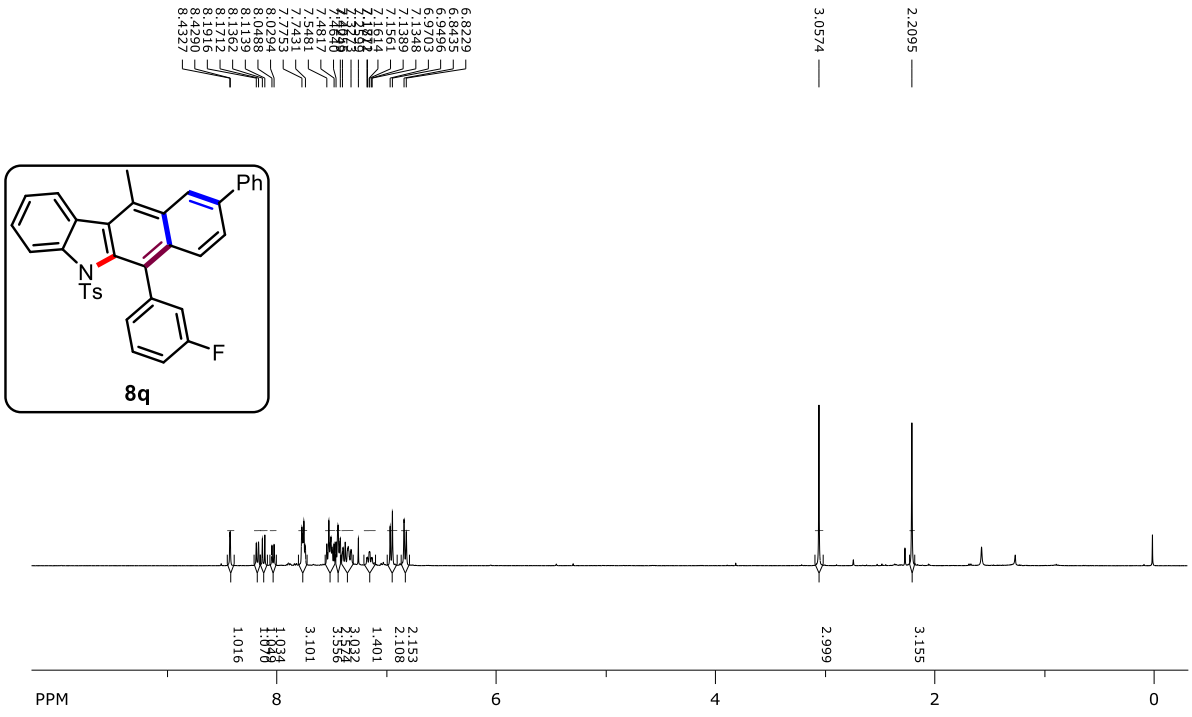
^{13}C NMR (100 MHz, $CDCl_3$)



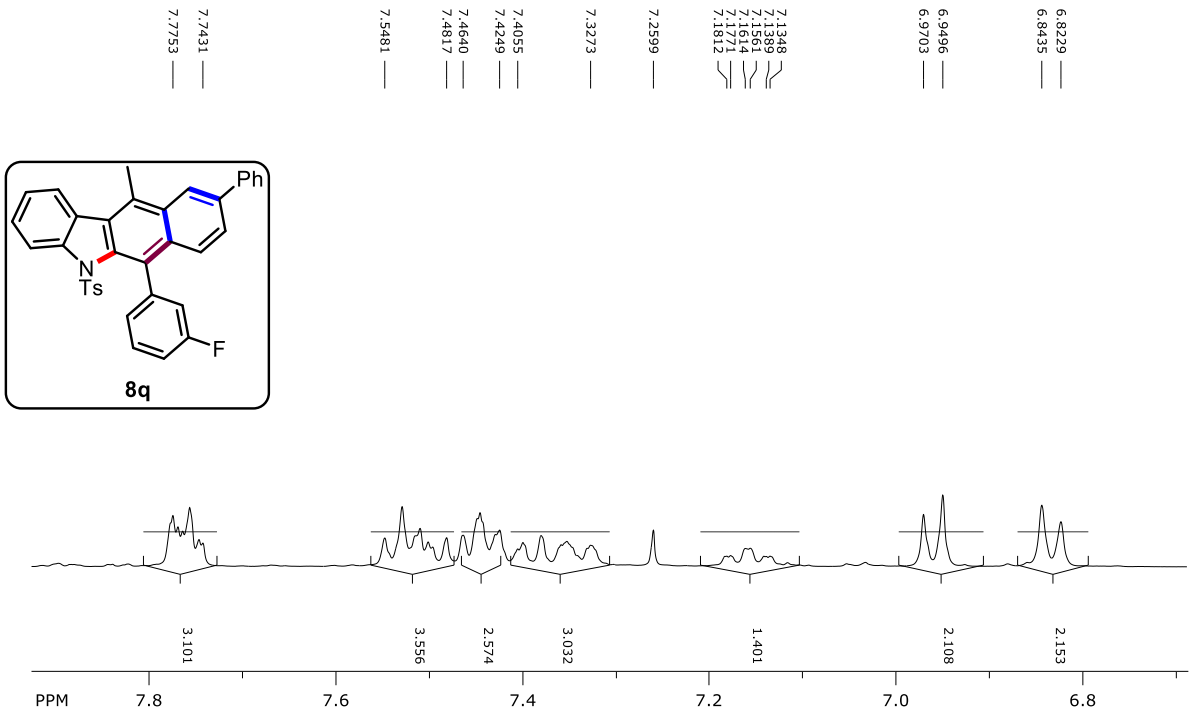
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-120.0 ppm region



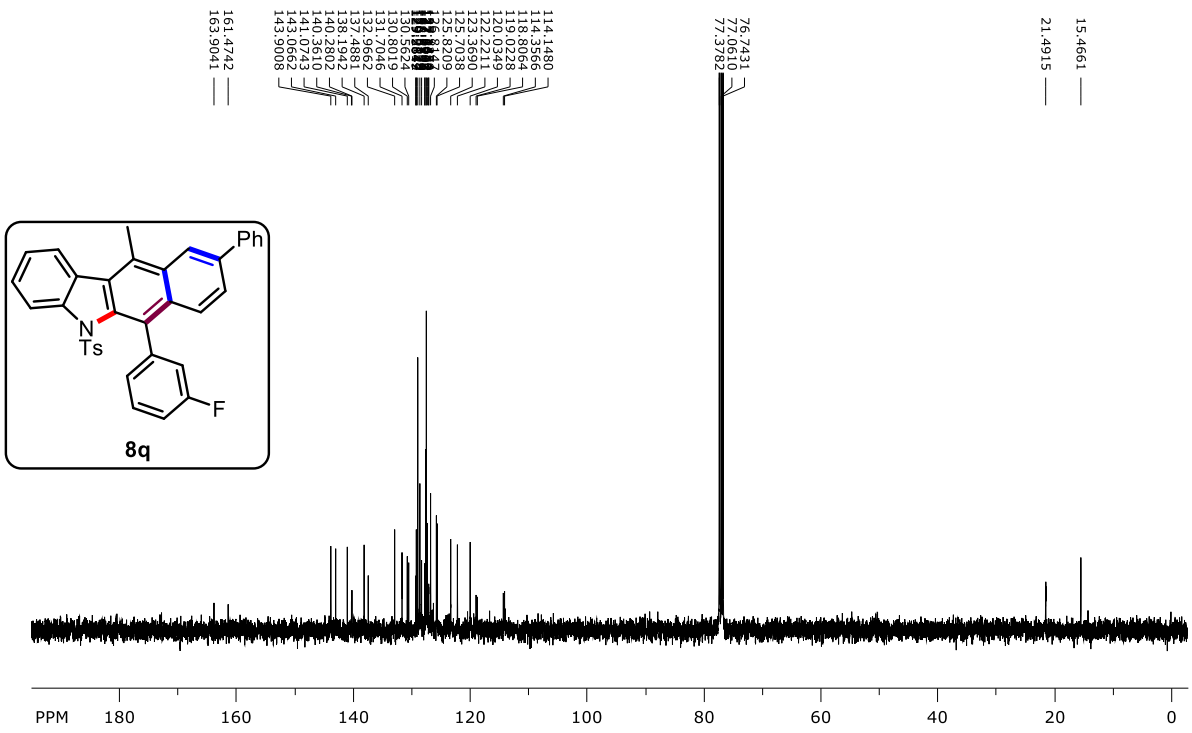
^{1}H NMR (400 MHz, $CDCl_3$)



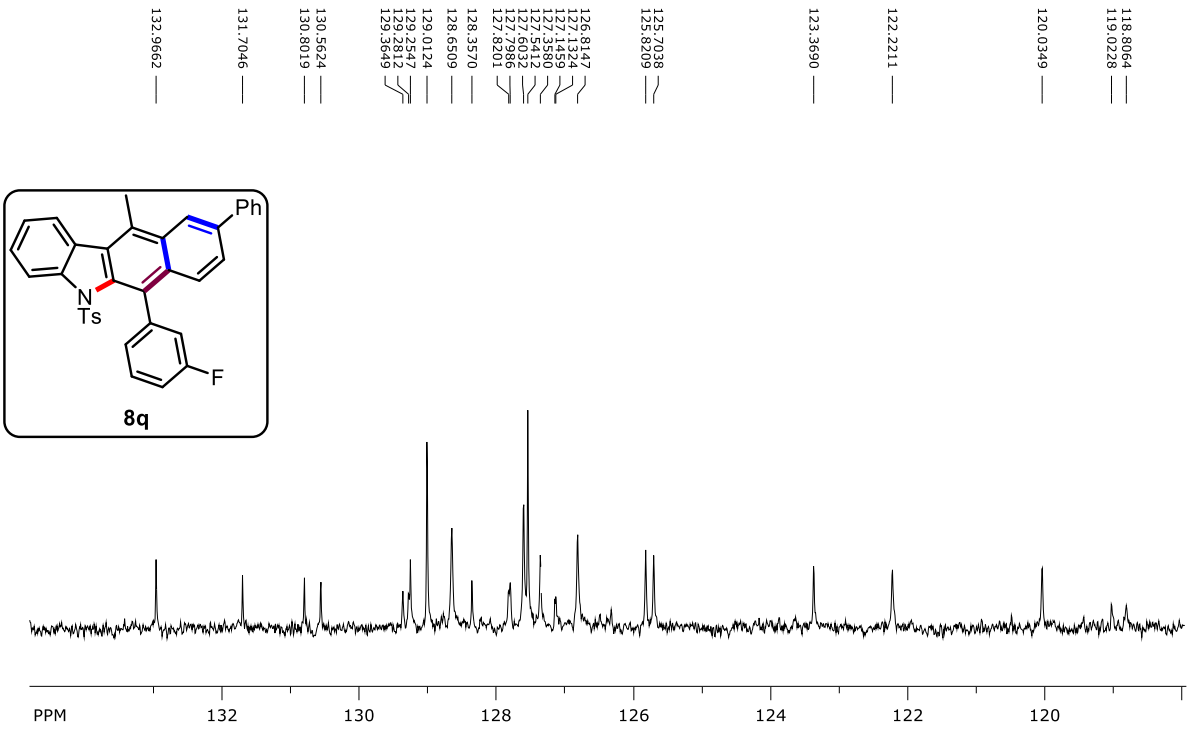
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.9-6.7 ppm region



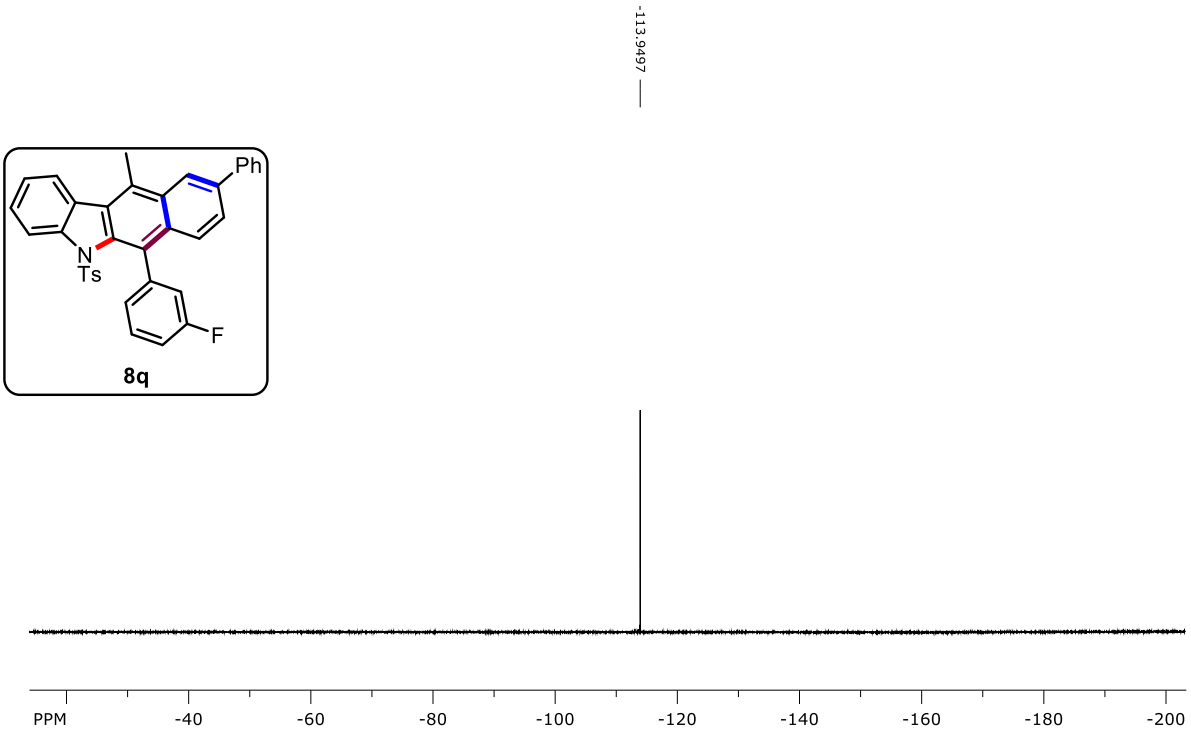
^{13}C NMR (100 MHz, $CDCl_3$)



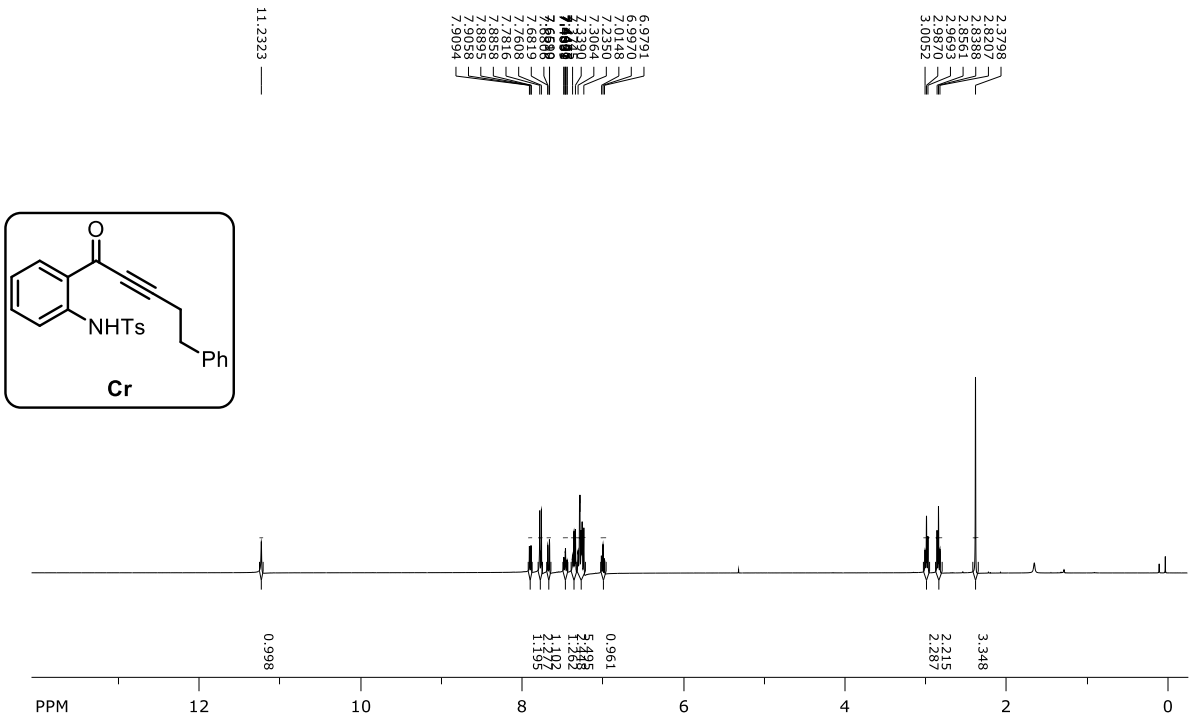
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-118.0 ppm region



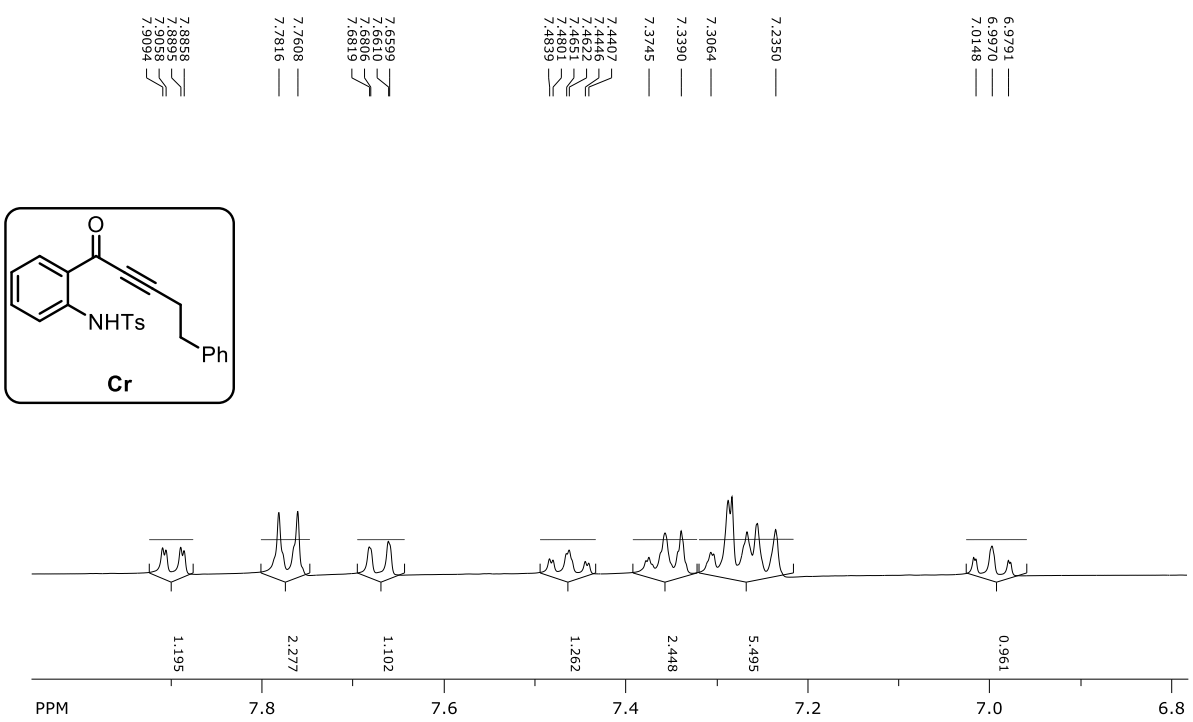
^{19}F NMR (376.4 MHz, $CDCl_3$)



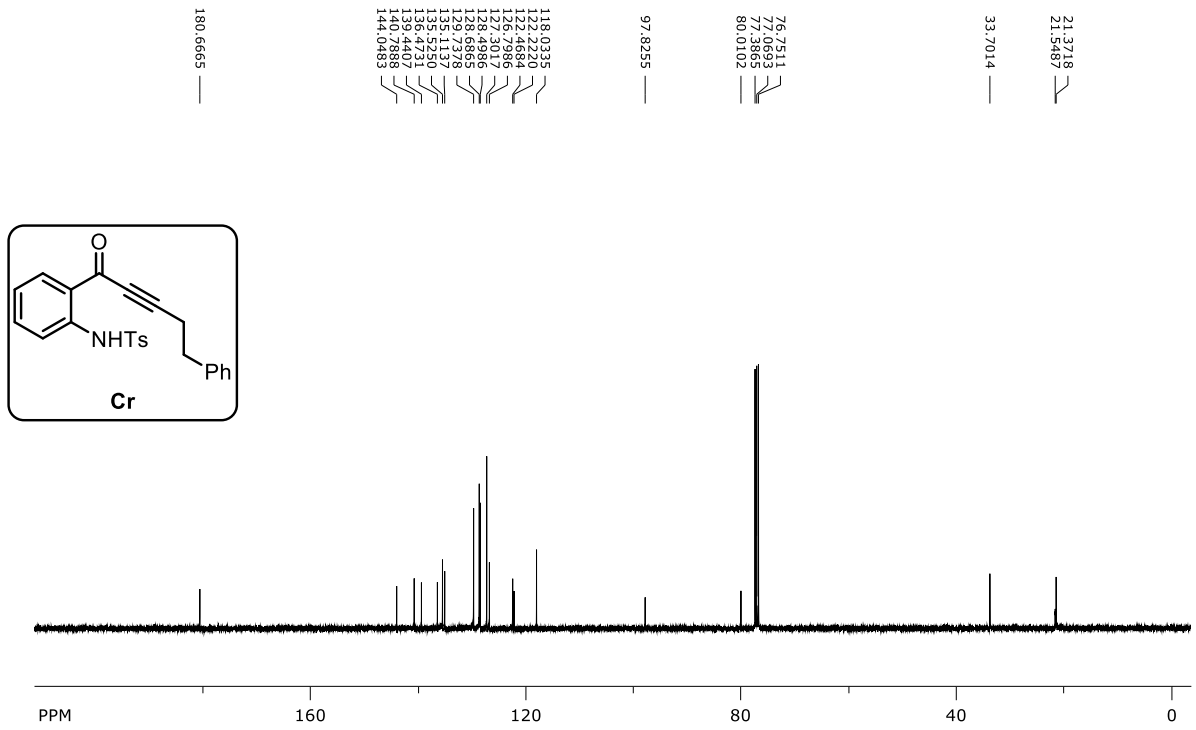
^{1}H NMR (400 MHz, $CDCl_3$)



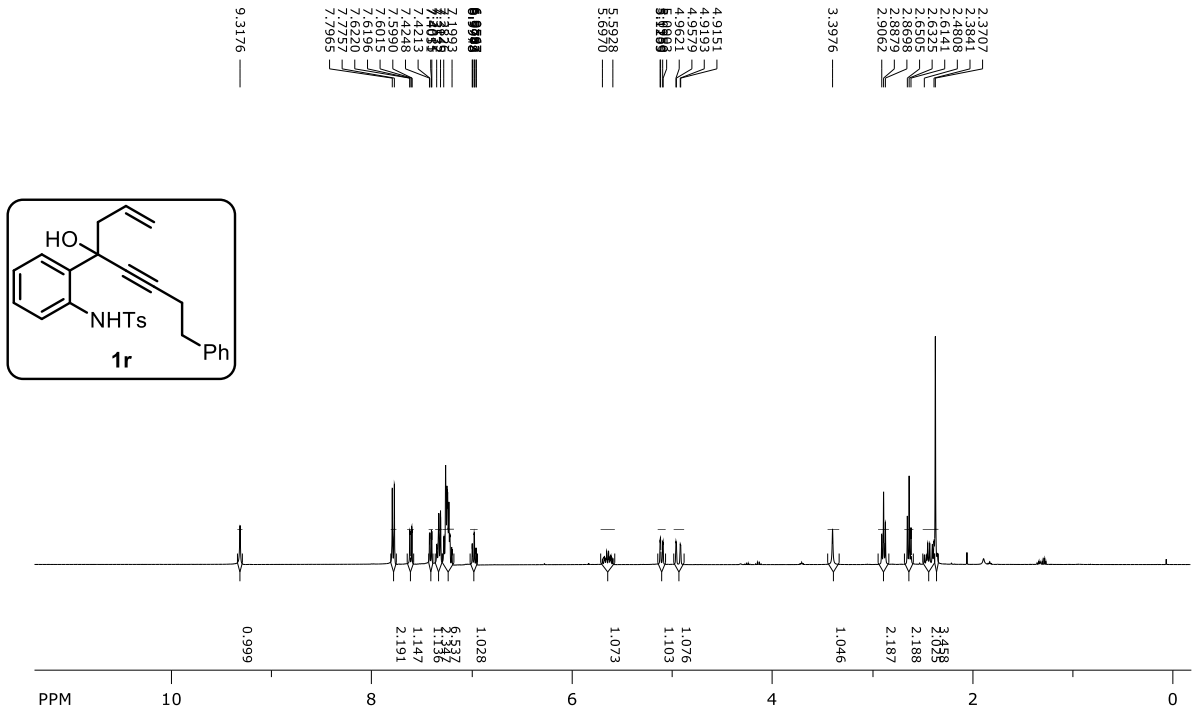
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.0-6.8 ppm region



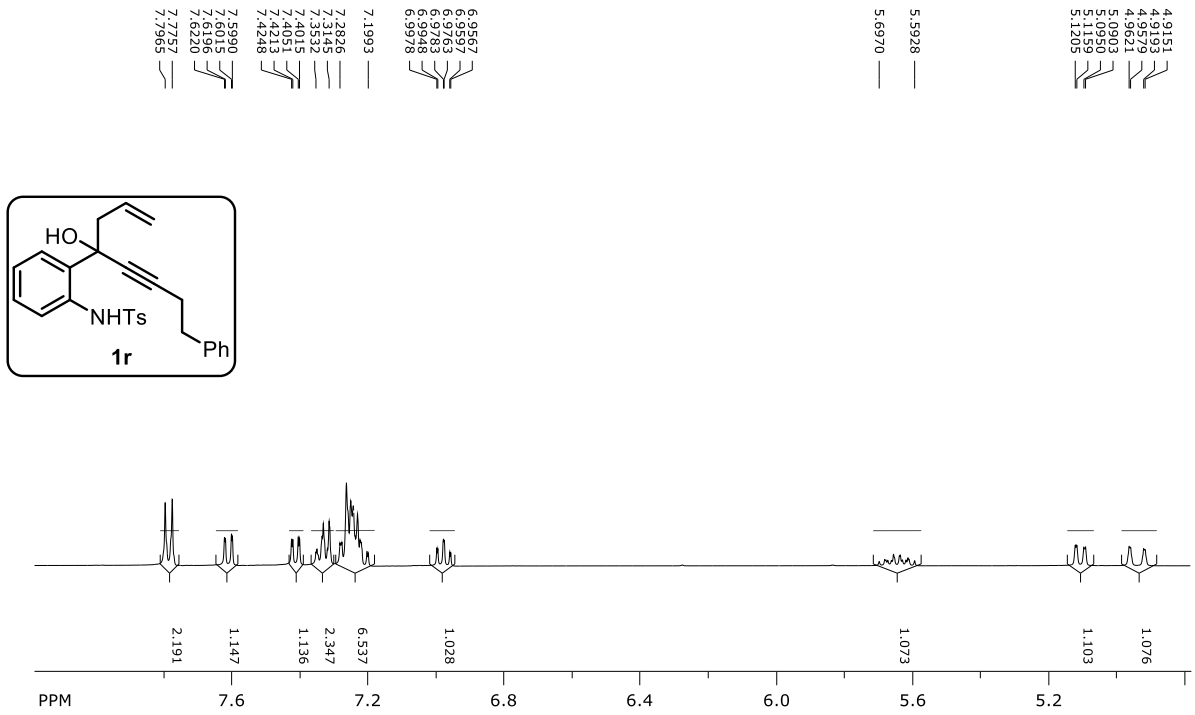
^{13}C NMR (100 MHz, $CDCl_3$)



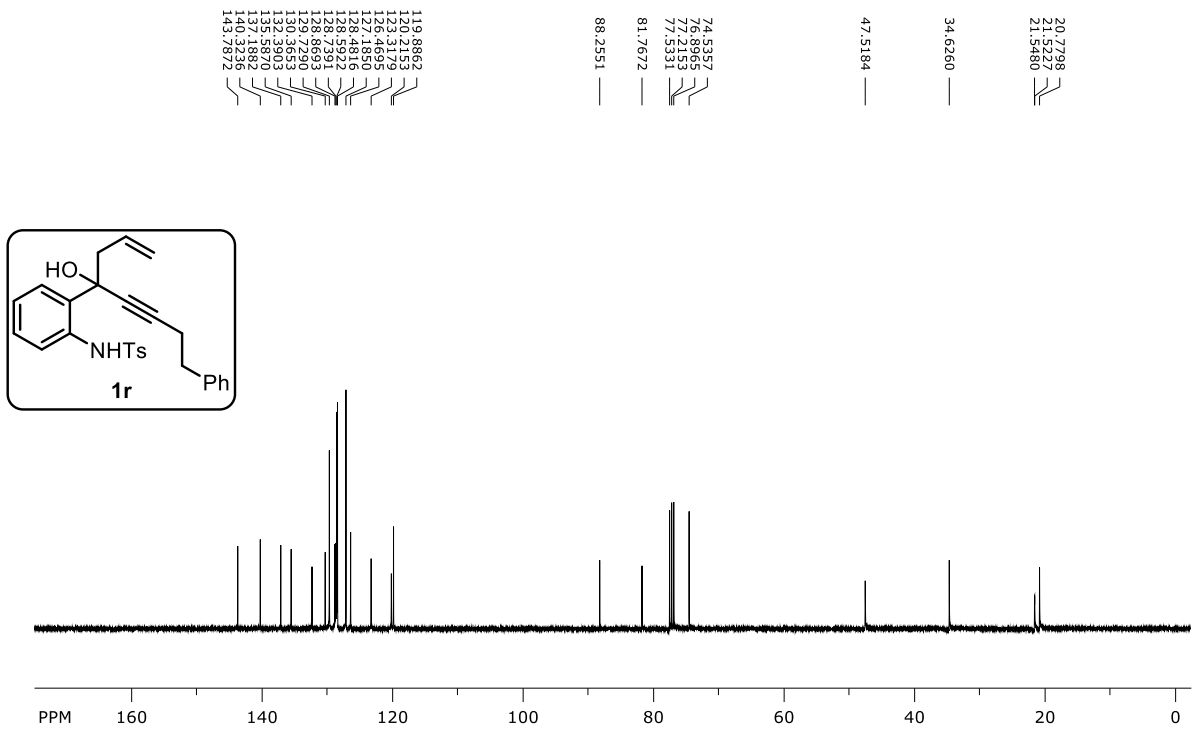
^{1}H NMR (400 MHz, $CDCl_3$)



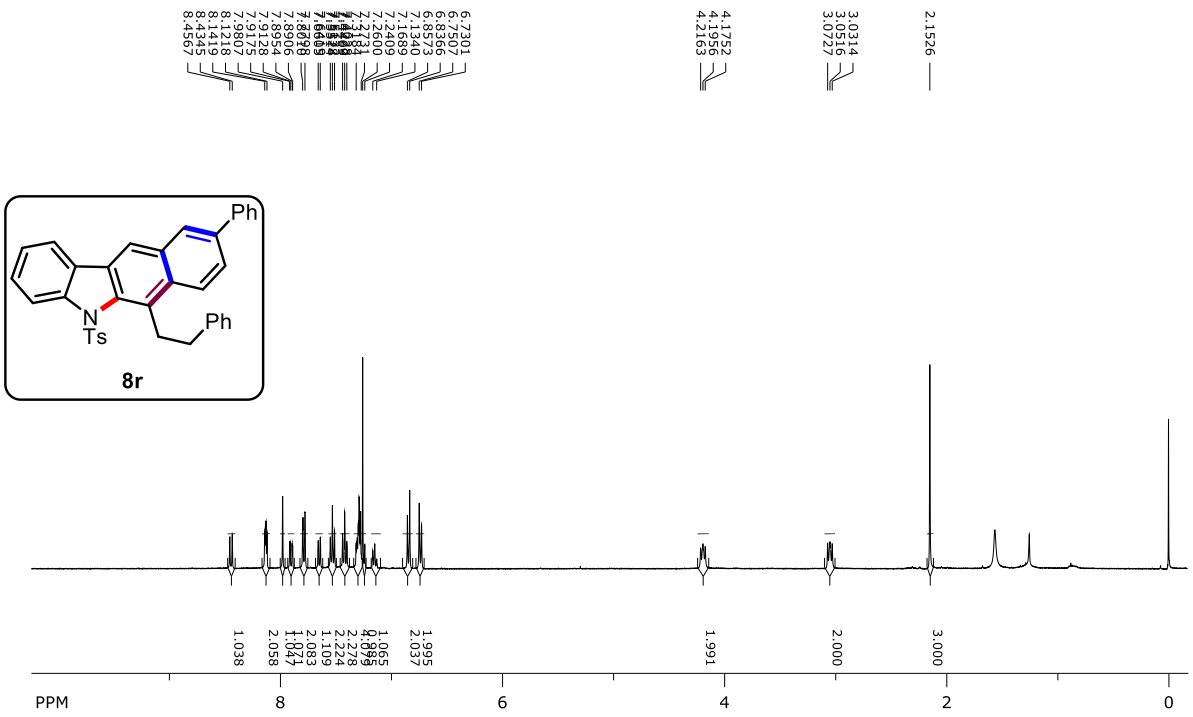
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.0-5.0 ppm region



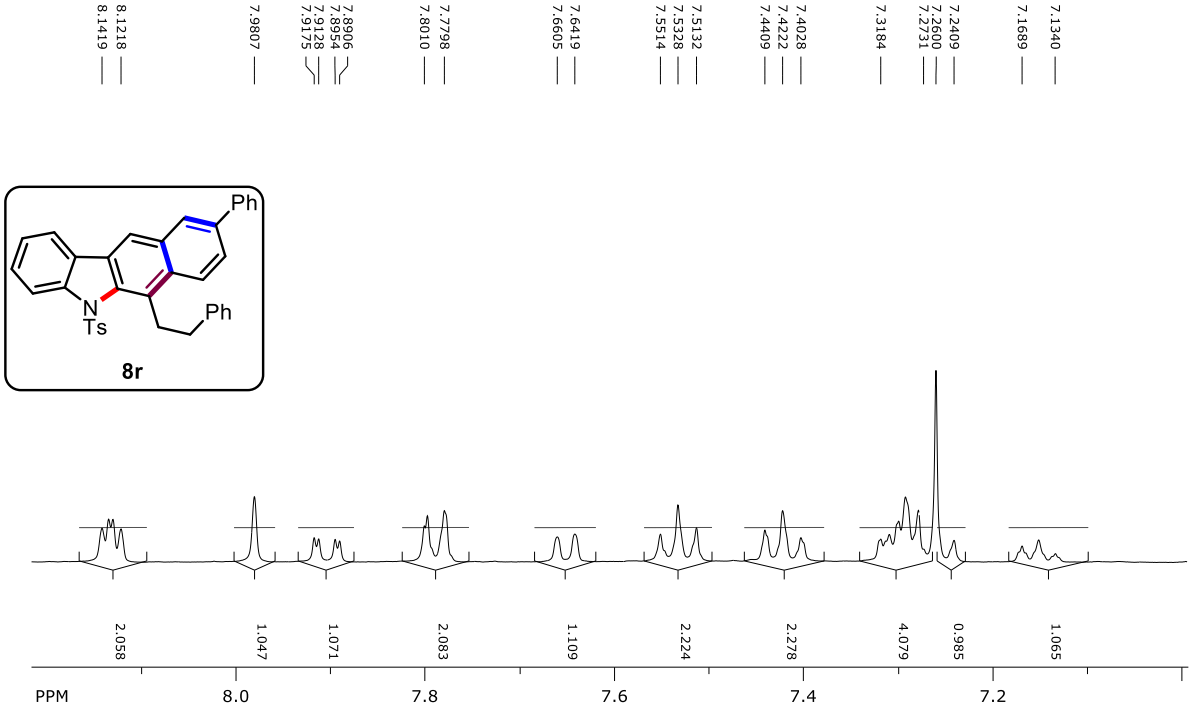
^{13}C NMR (100 MHz, $CDCl_3$)



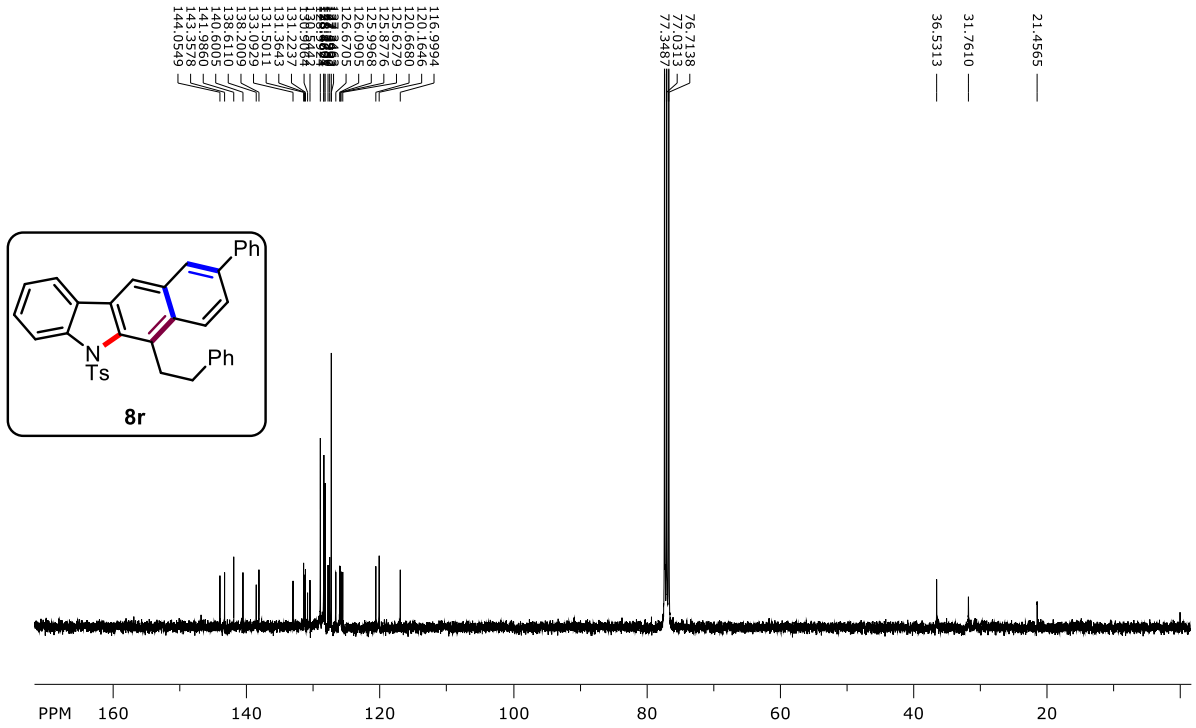
^{1}H NMR (400 MHz, $CDCl_3$)



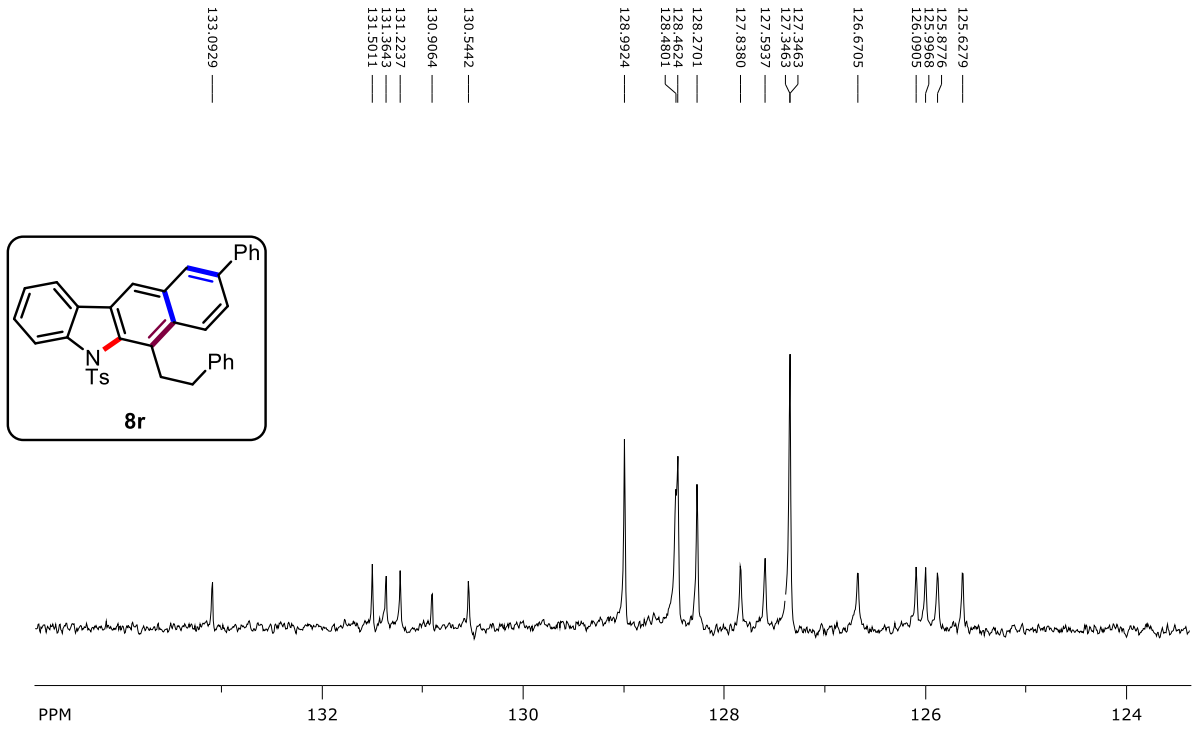
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.2-7.0 ppm region



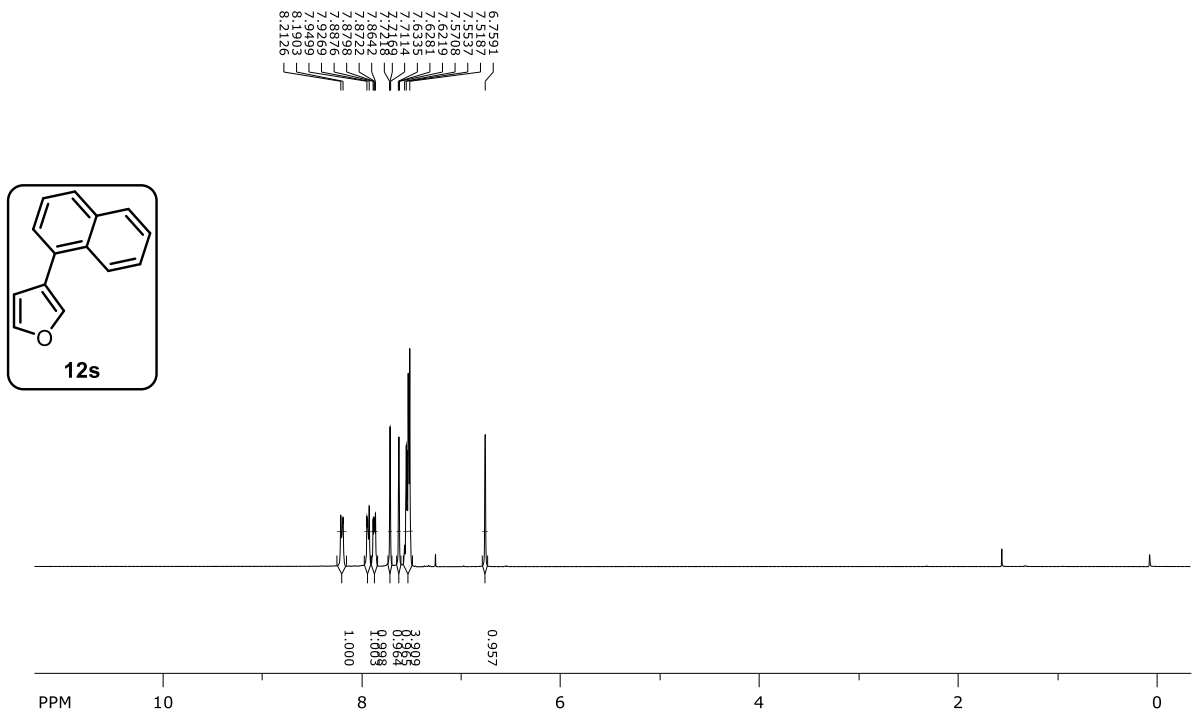
^{13}C NMR (100 MHz, $CDCl_3$)



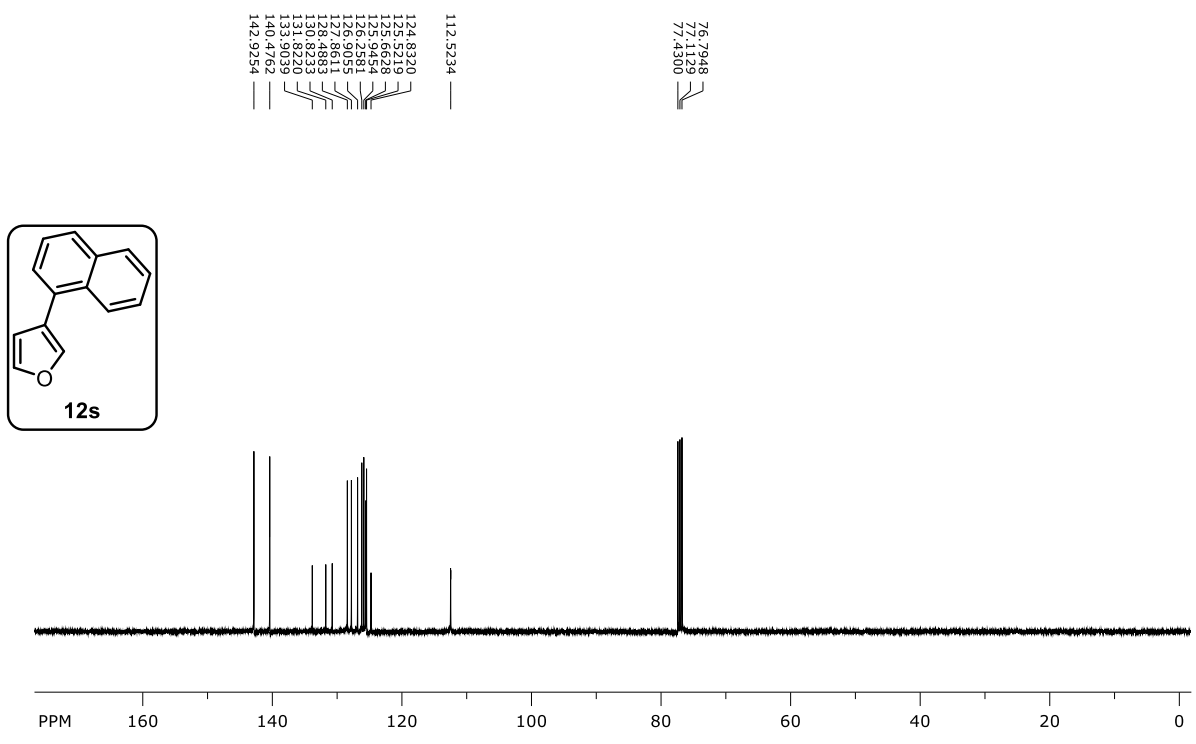
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-122.0 ppm region



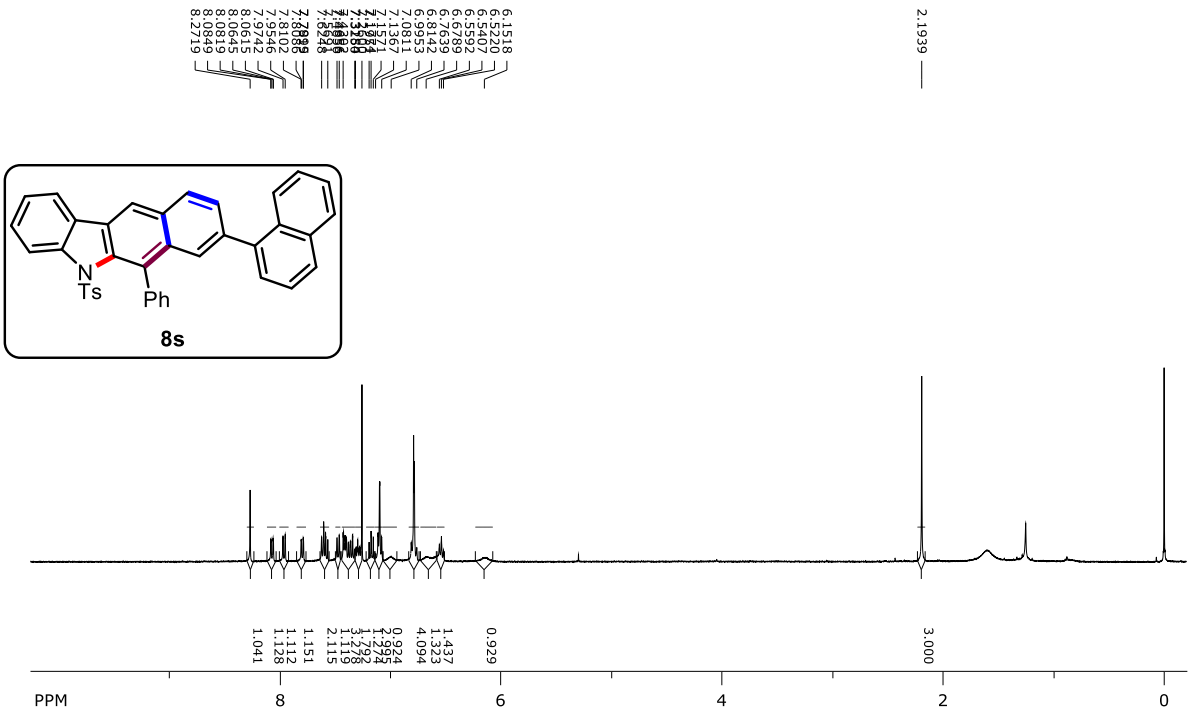
^{1}H NMR (400 MHz, $CDCl_3$)



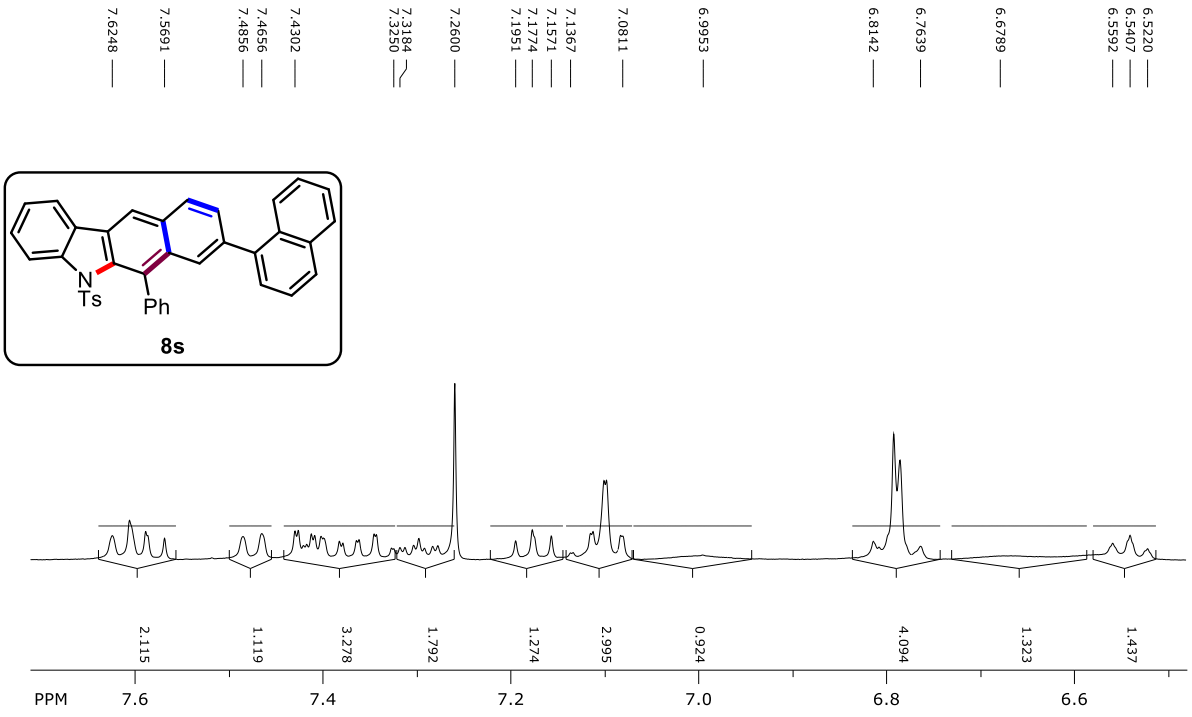
^{13}C NMR (100 MHz, $CDCl_3$)



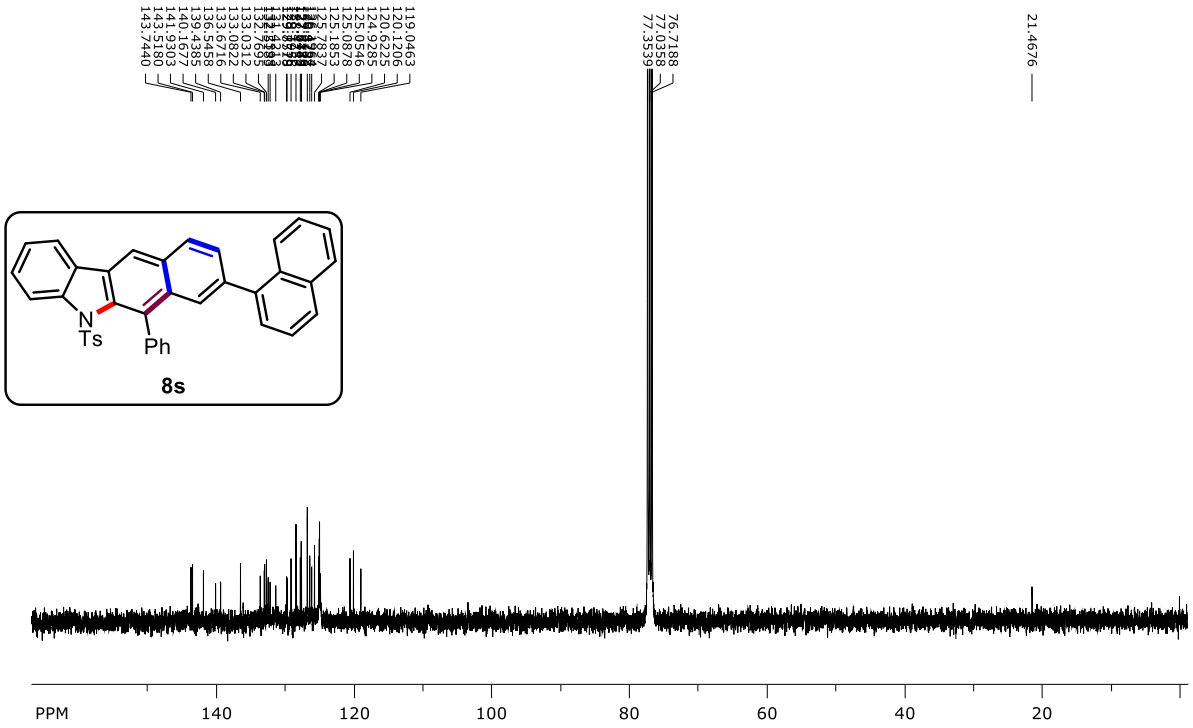
^{1}H NMR (400 MHz, $CDCl_3$)



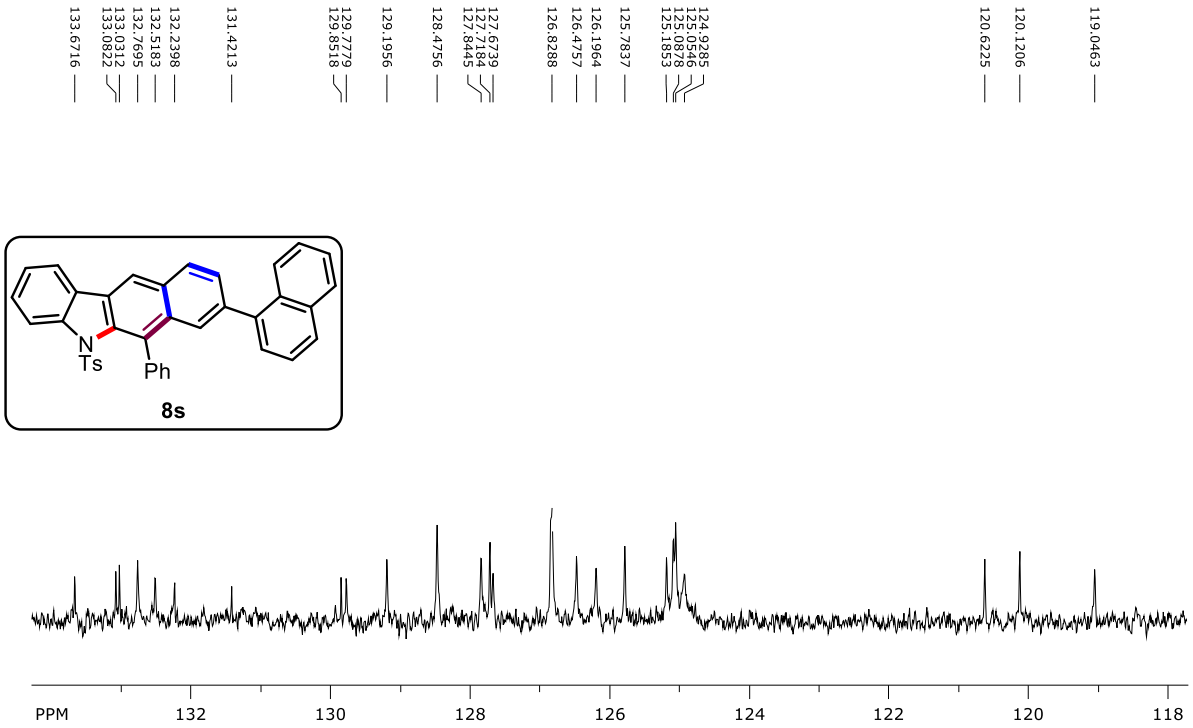
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.7-6.7 ppm region



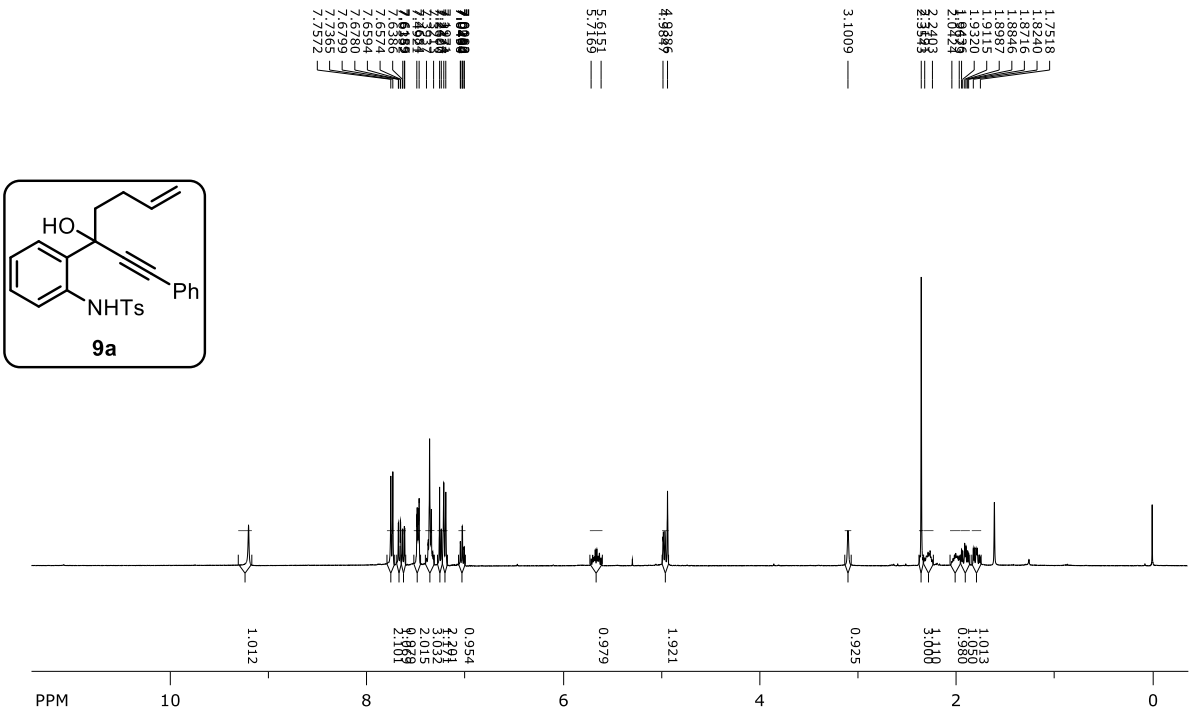
^{13}C NMR (100 MHz, $CDCl_3$)



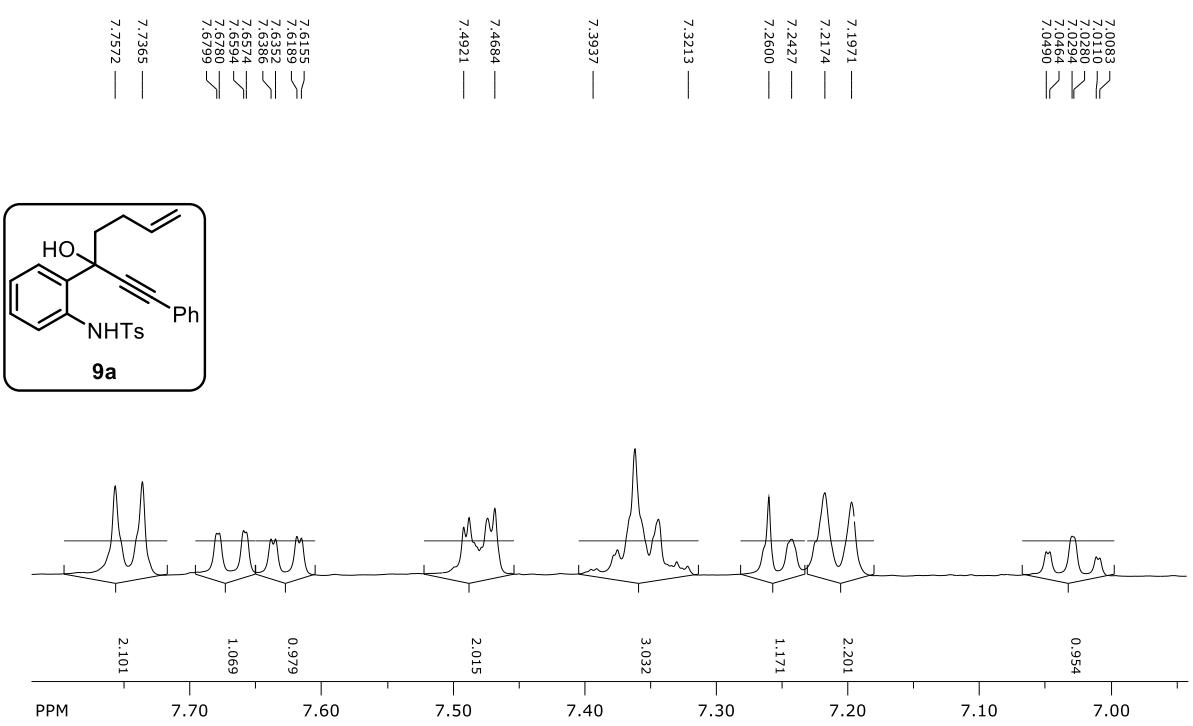
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 134.0-118.0 ppm region



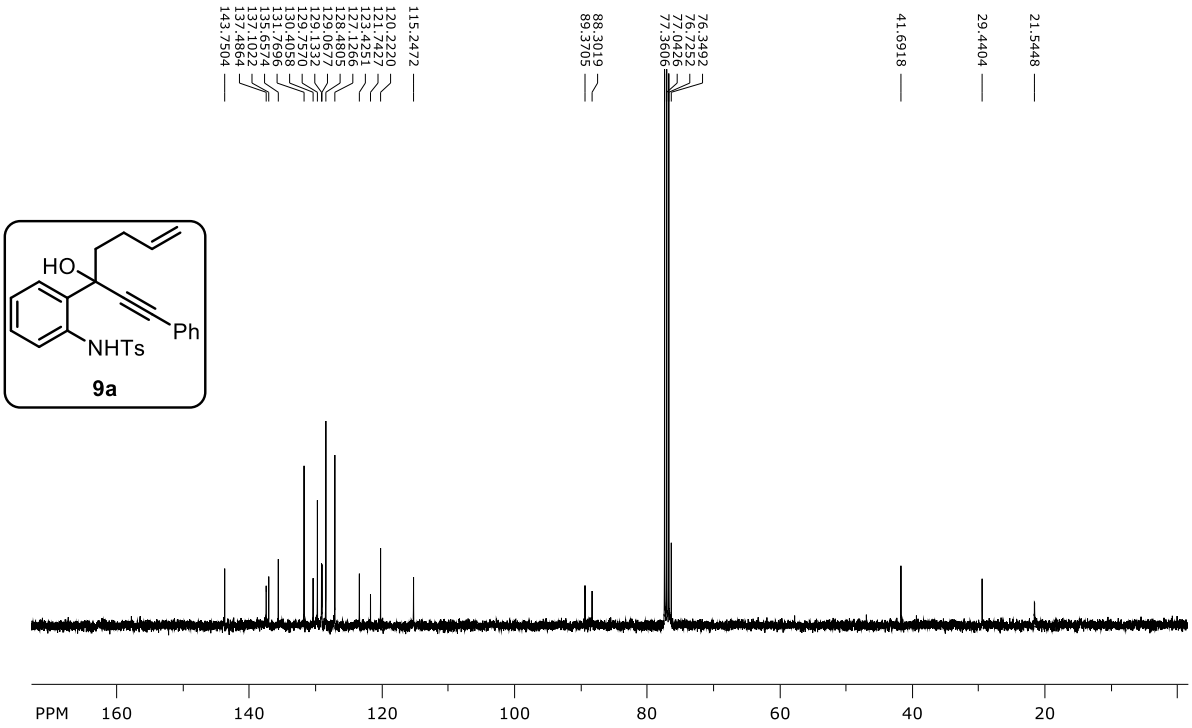
^{1}H NMR (400 MHz, $CDCl_3$)



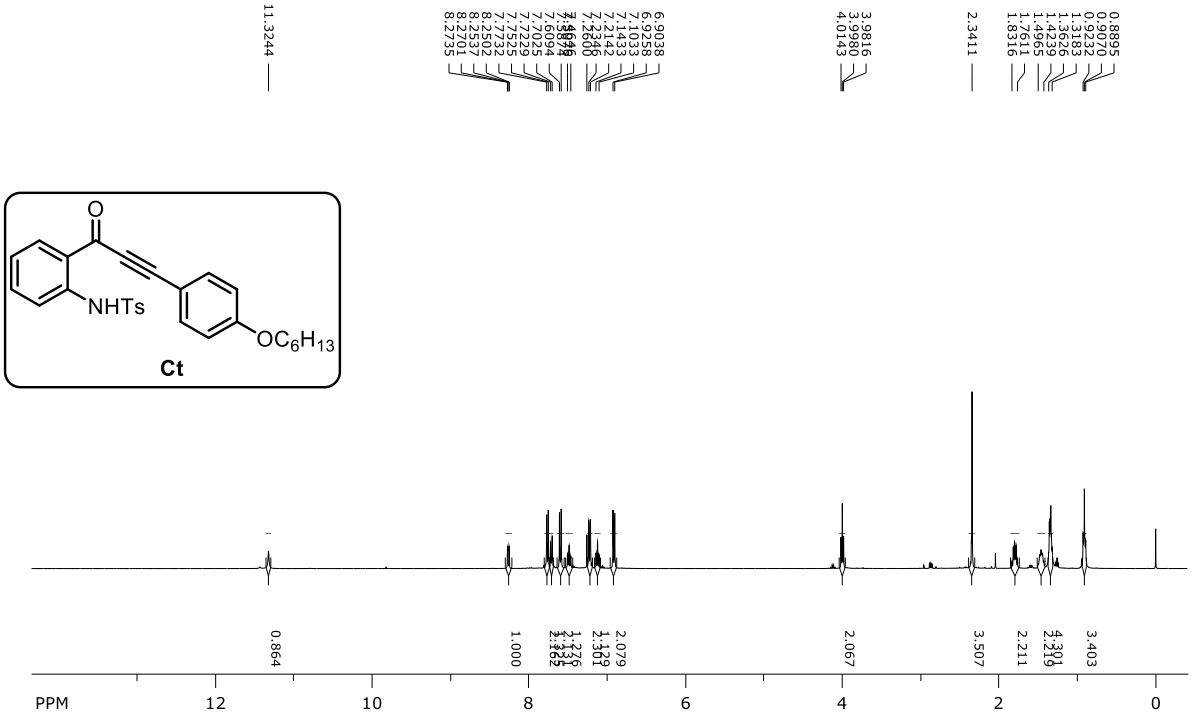
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.8-6.5 ppm region



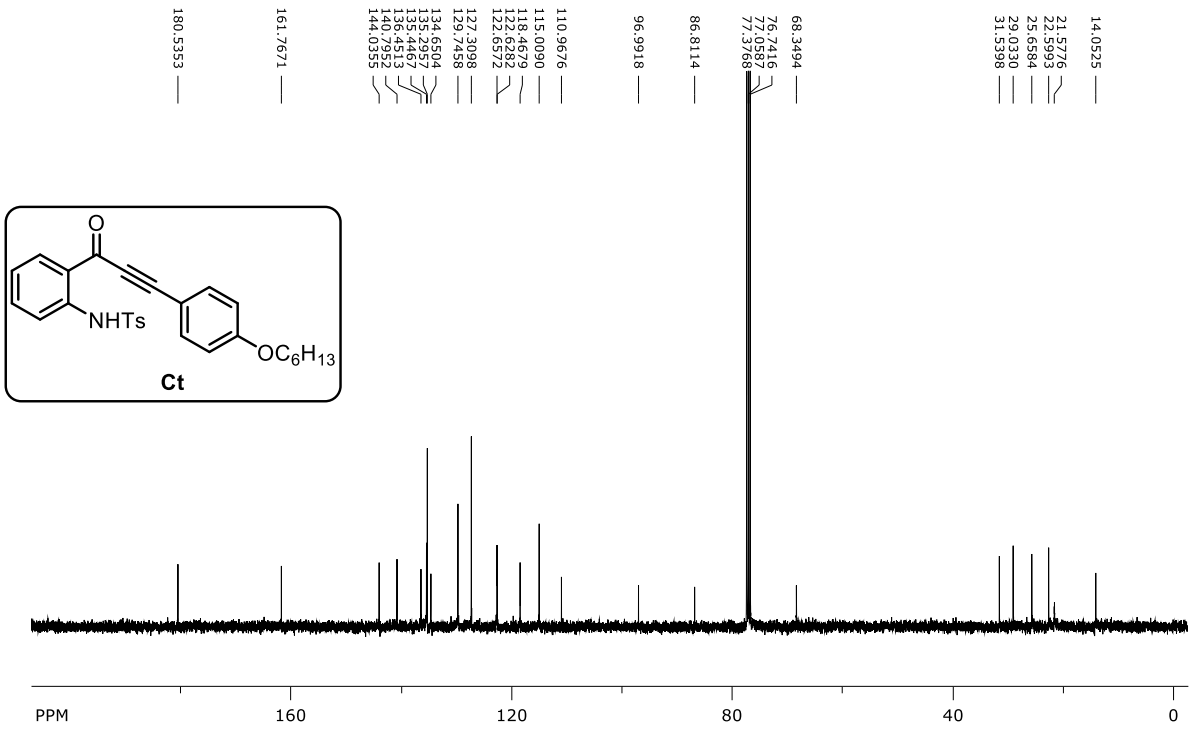
^{13}C NMR (100 MHz, $CDCl_3$)



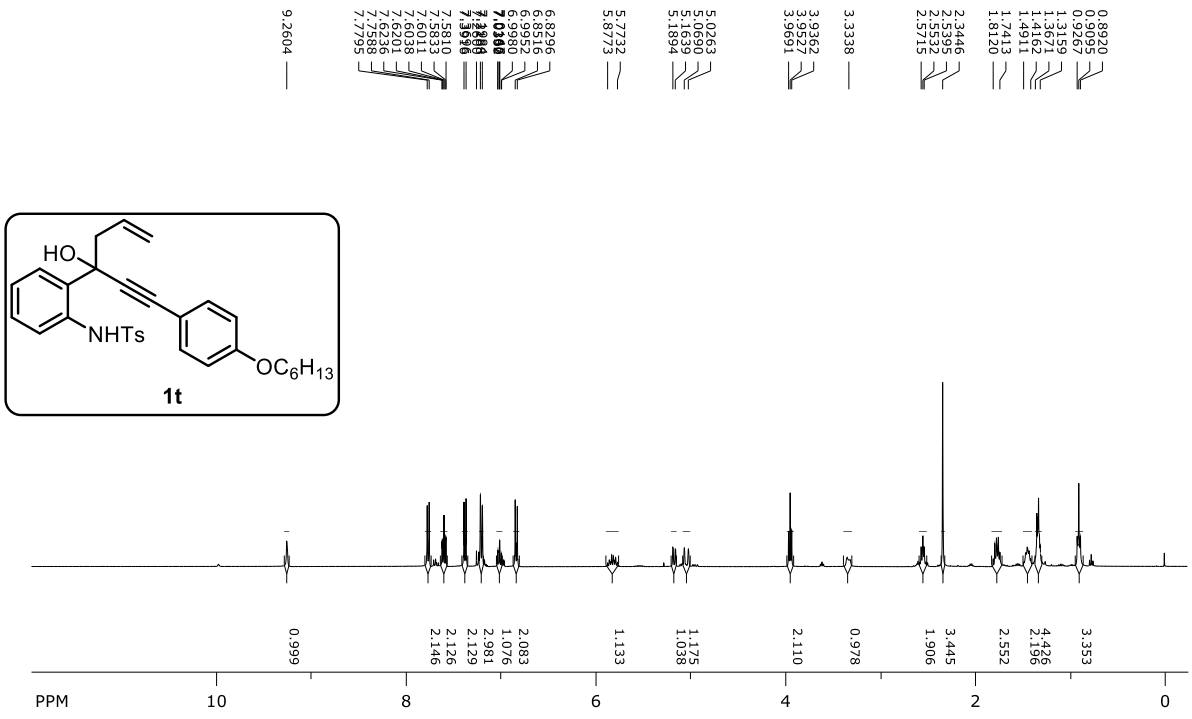
^{1}H NMR (400 MHz, $CDCl_3$)



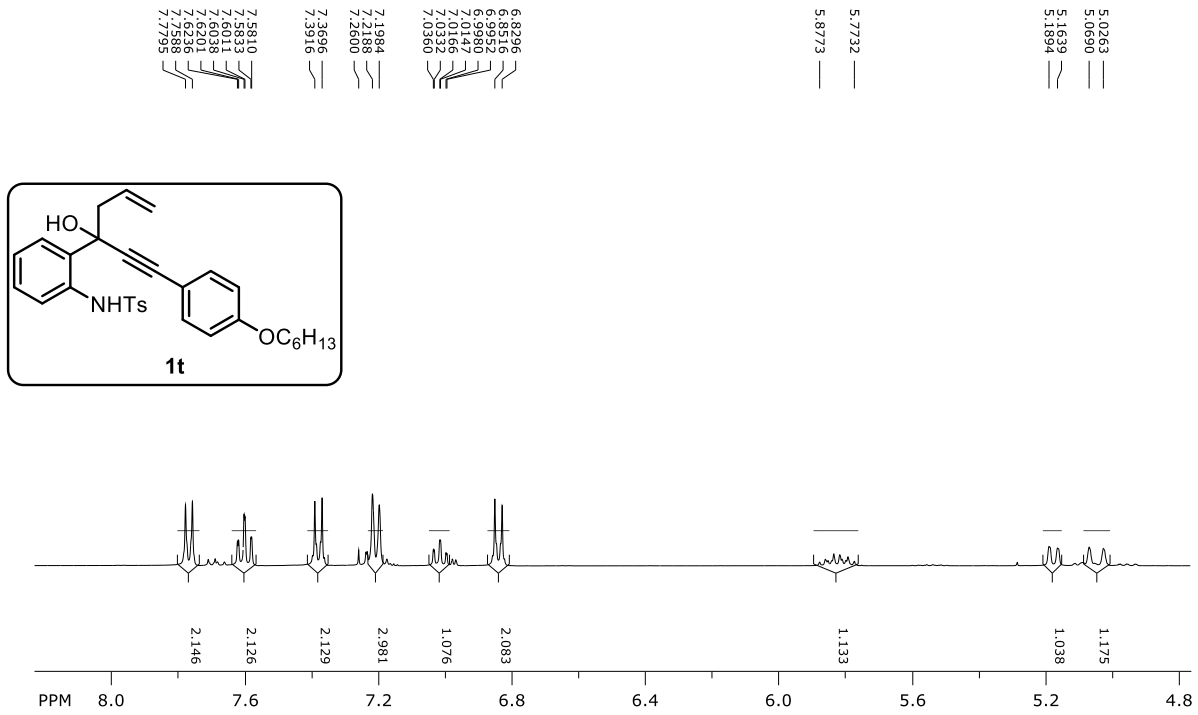
^{13}C NMR (100 MHz, $CDCl_3$)



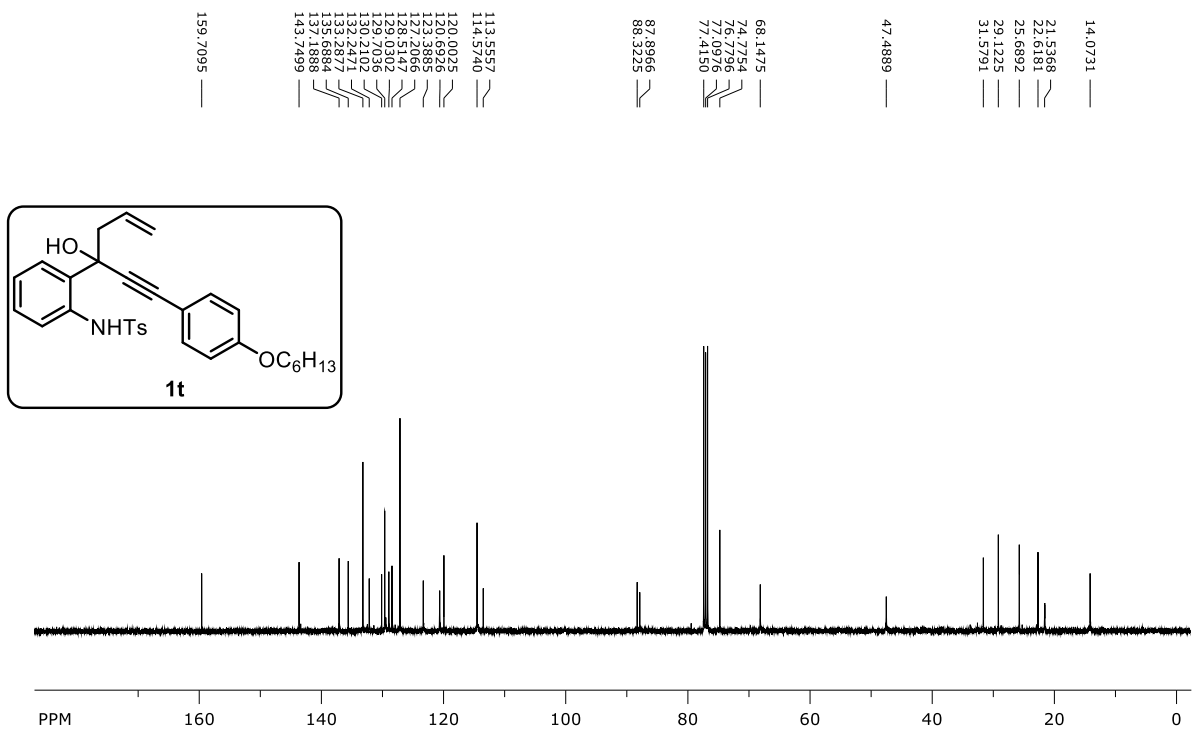
^{1}H NMR (400 MHz, $CDCl_3$)



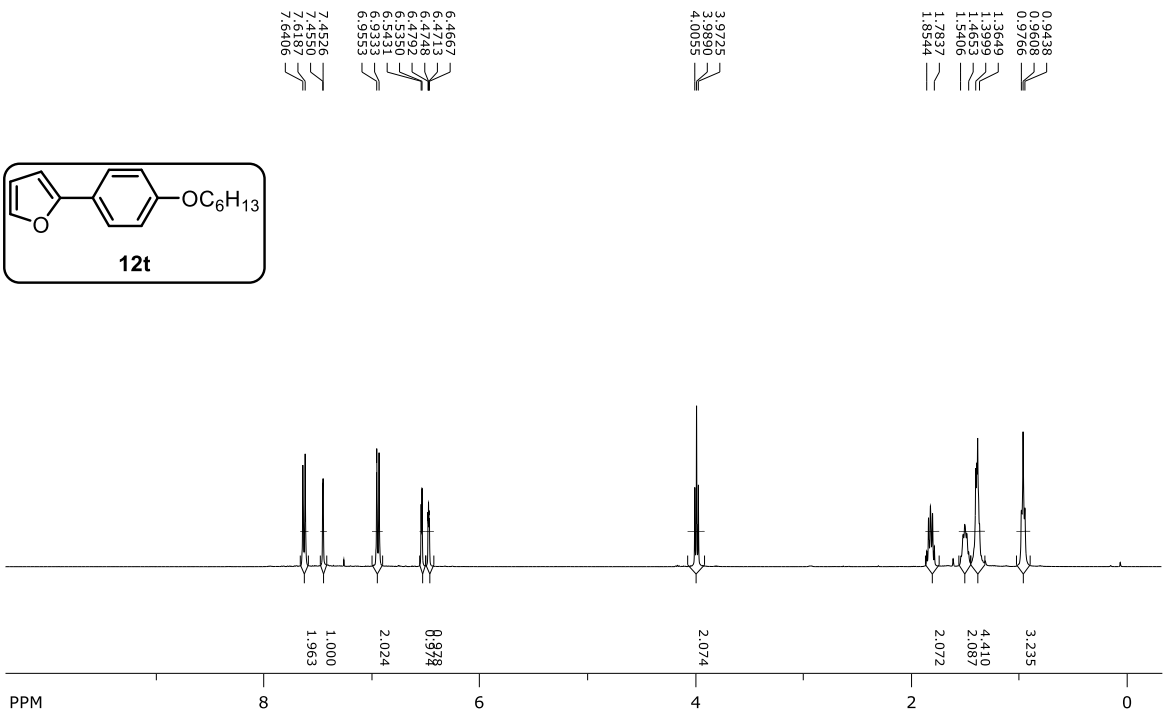
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.0-5.0 ppm region



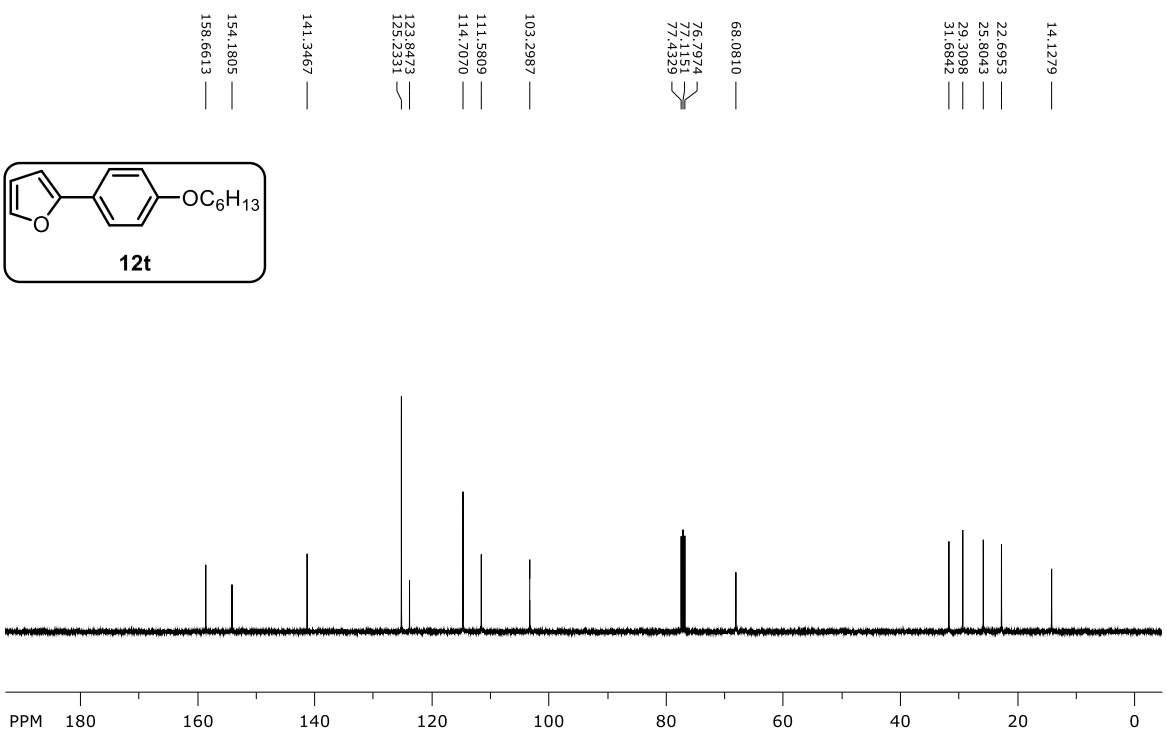
^{13}C NMR (100 MHz, $CDCl_3$)



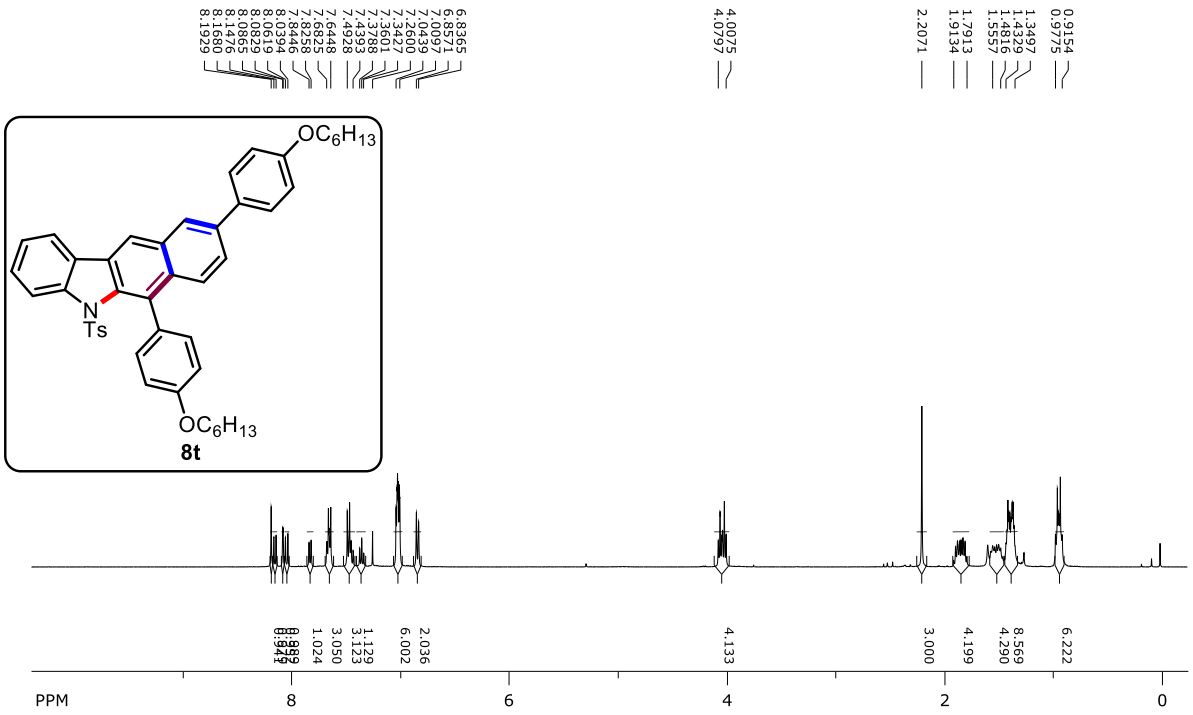
^{1}H NMR (400 MHz, $CDCl_3$)



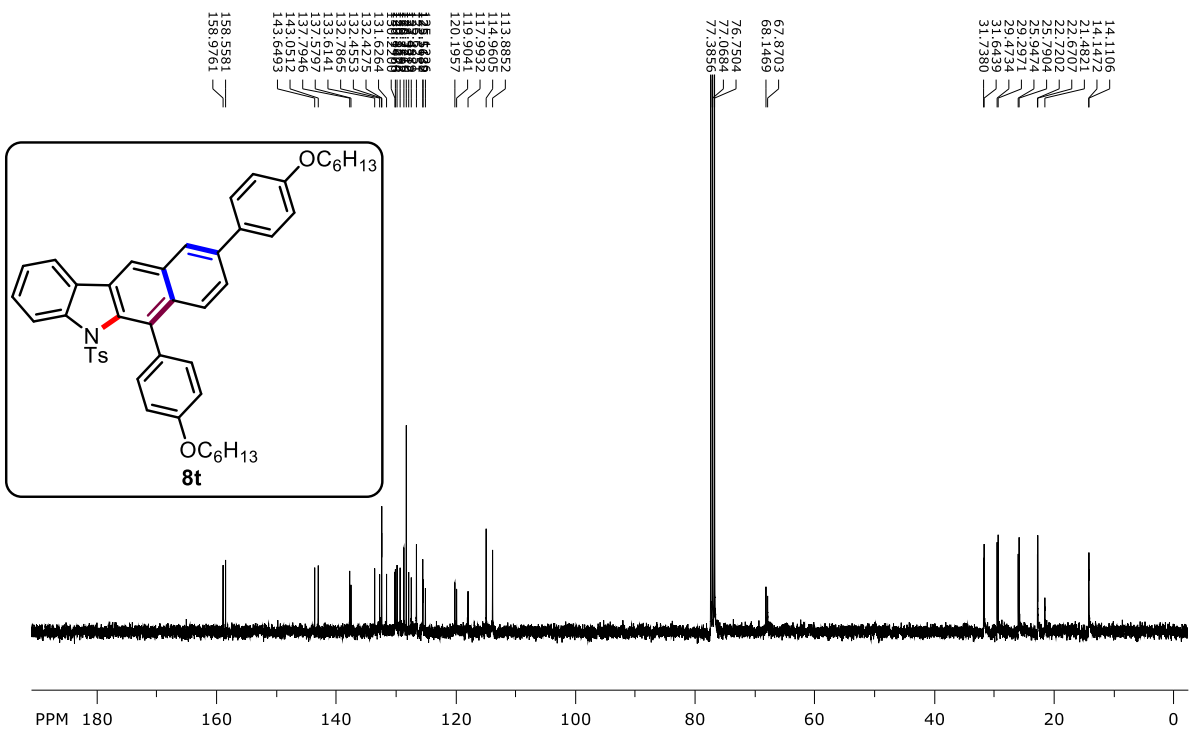
^{13}C NMR (100 MHz, $CDCl_3$)



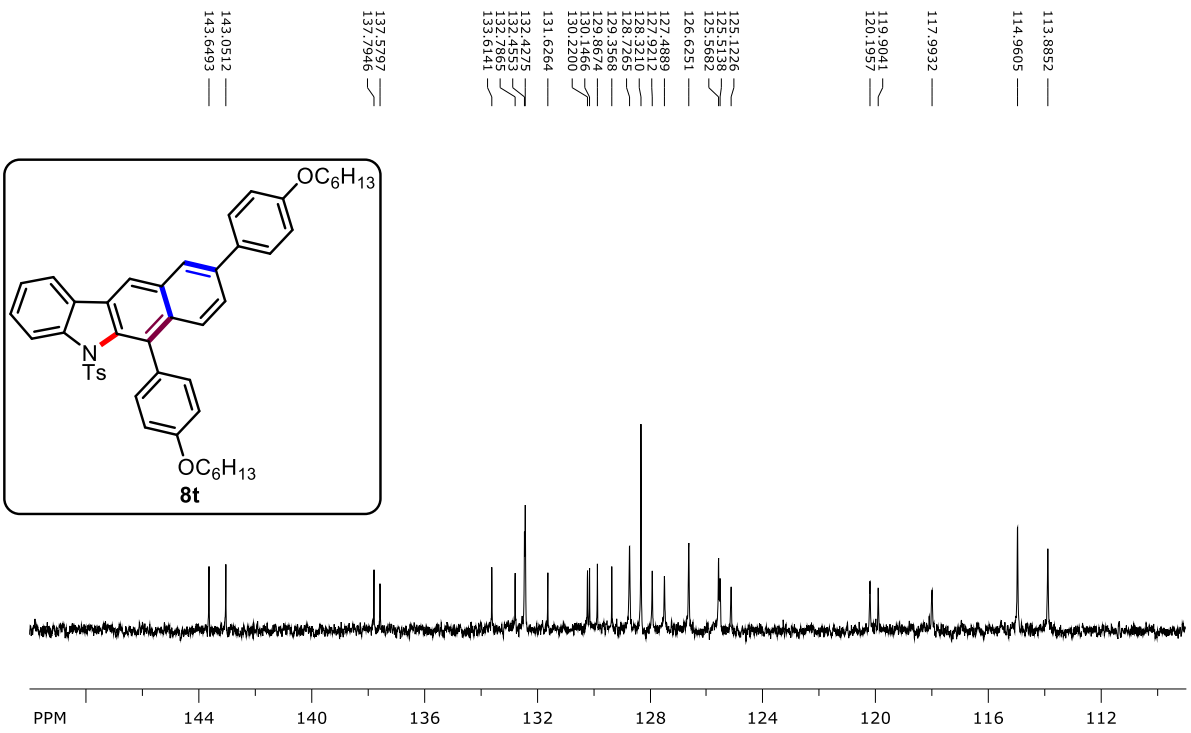
^{1}H NMR (400 MHz, $CDCl_3$)



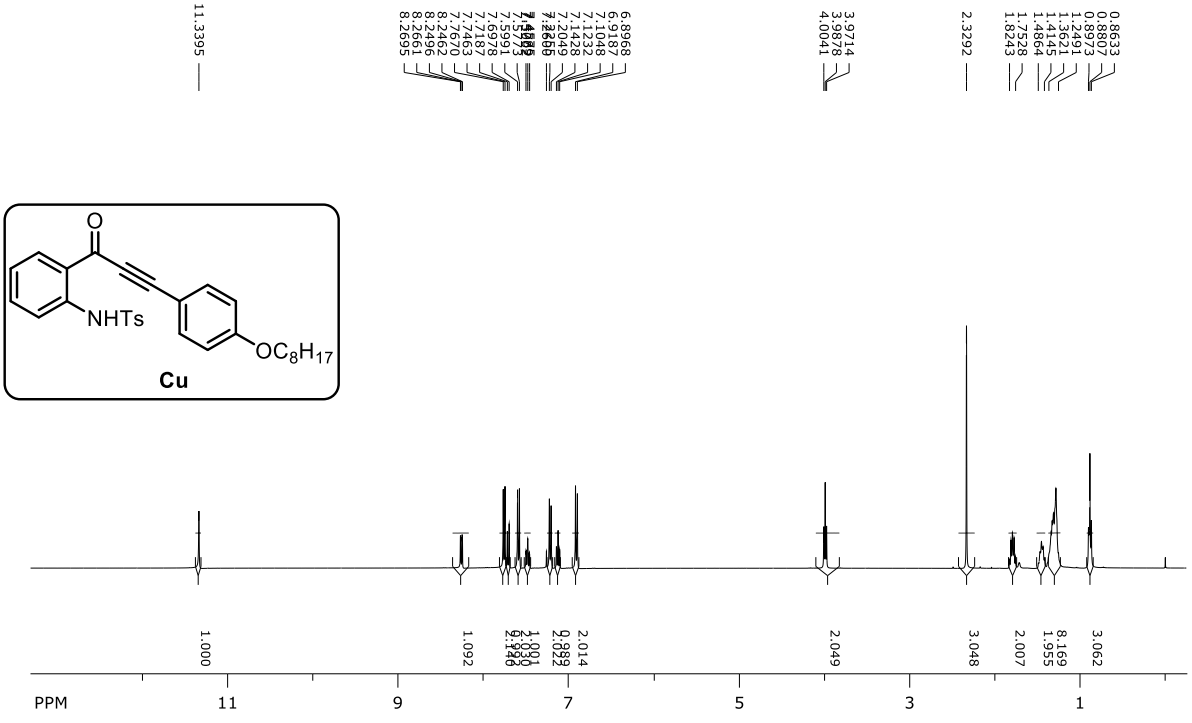
^{13}C NMR (100 MHz, $CDCl_3$)



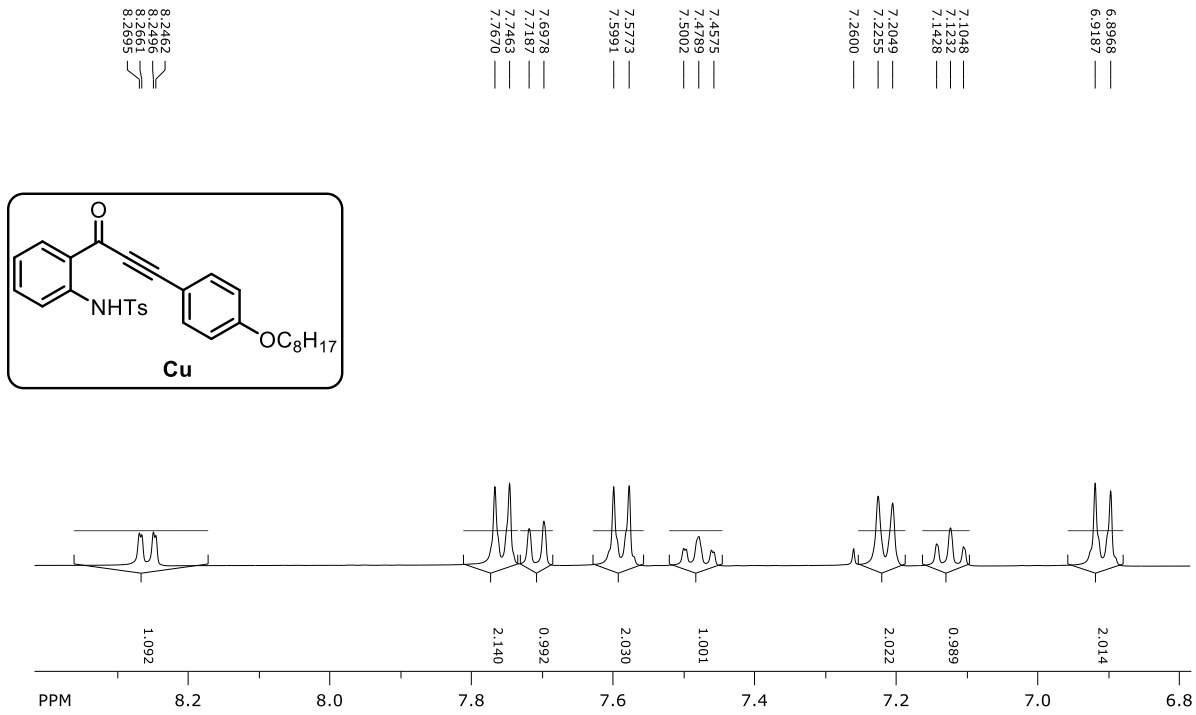
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 150.0-110.0 ppm region



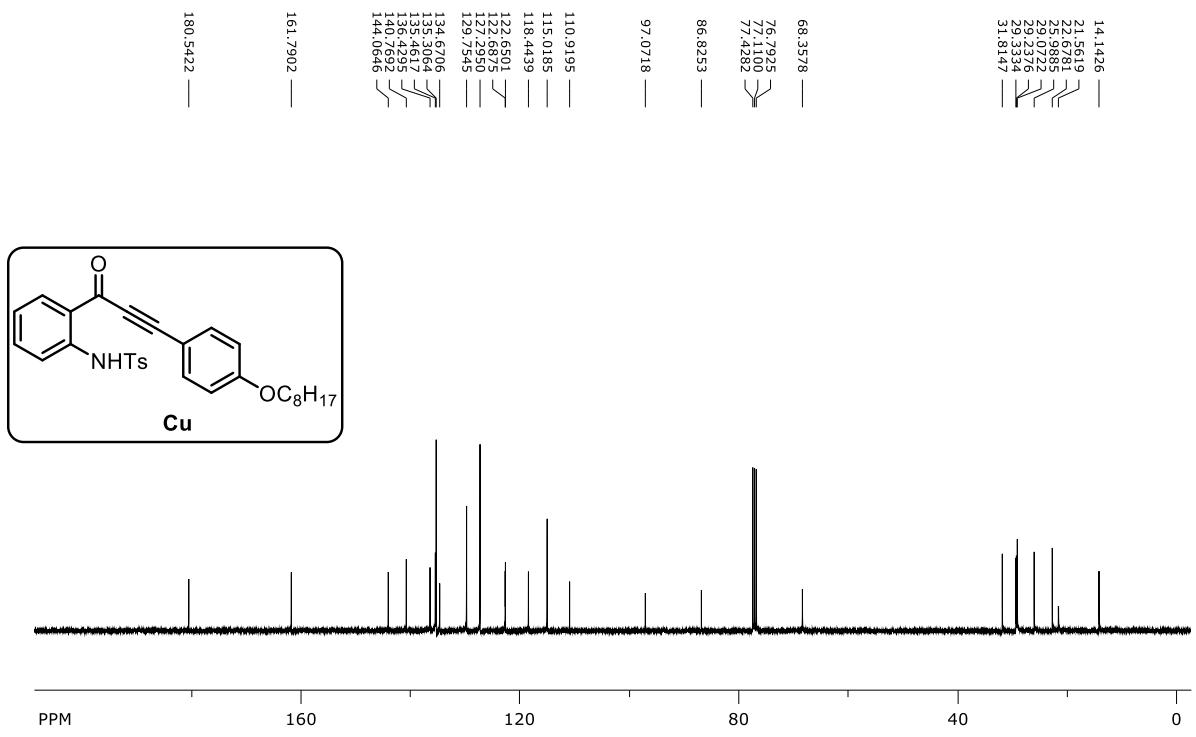
^{1}H NMR (400 MHz, $CDCl_3$)



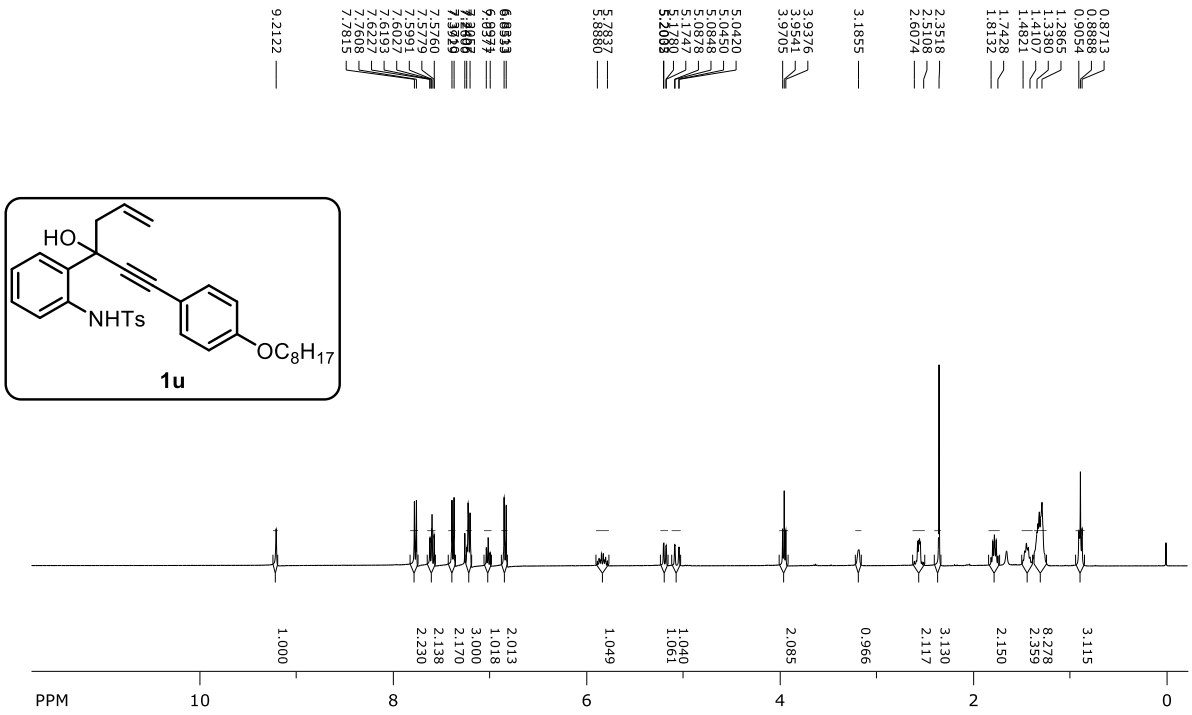
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.4-6.8 ppm region



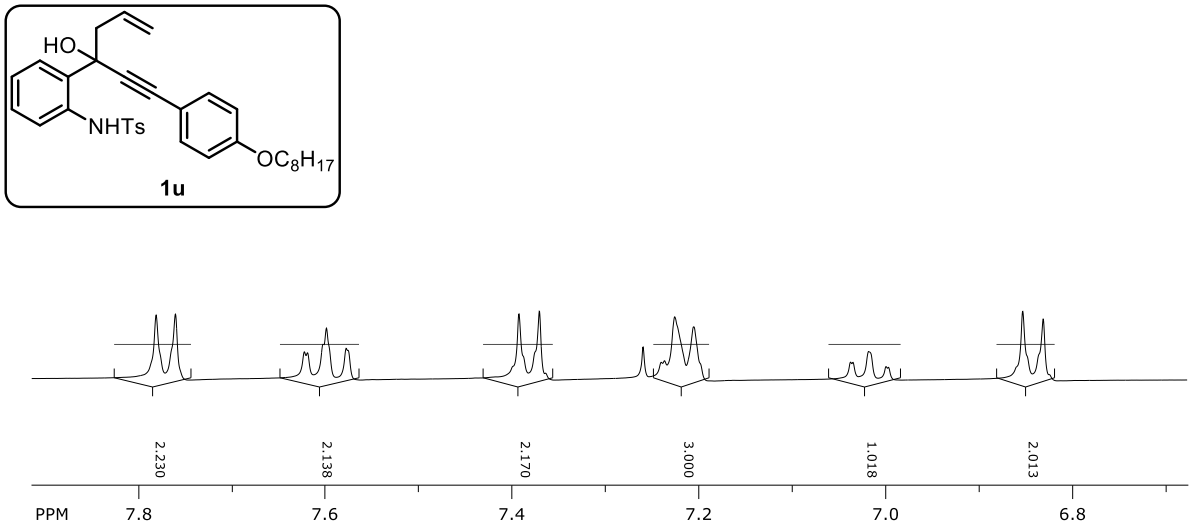
^{13}C NMR (100 MHz, $CDCl_3$)



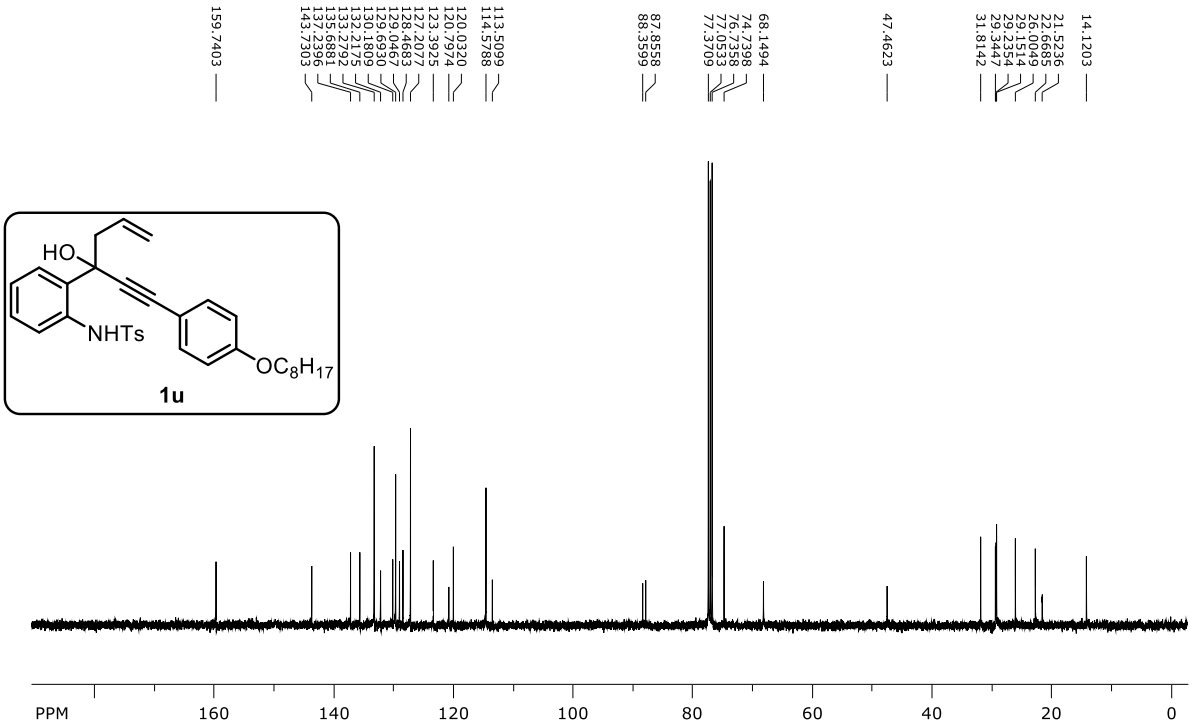
^{1}H NMR (400 MHz, $CDCl_3$)



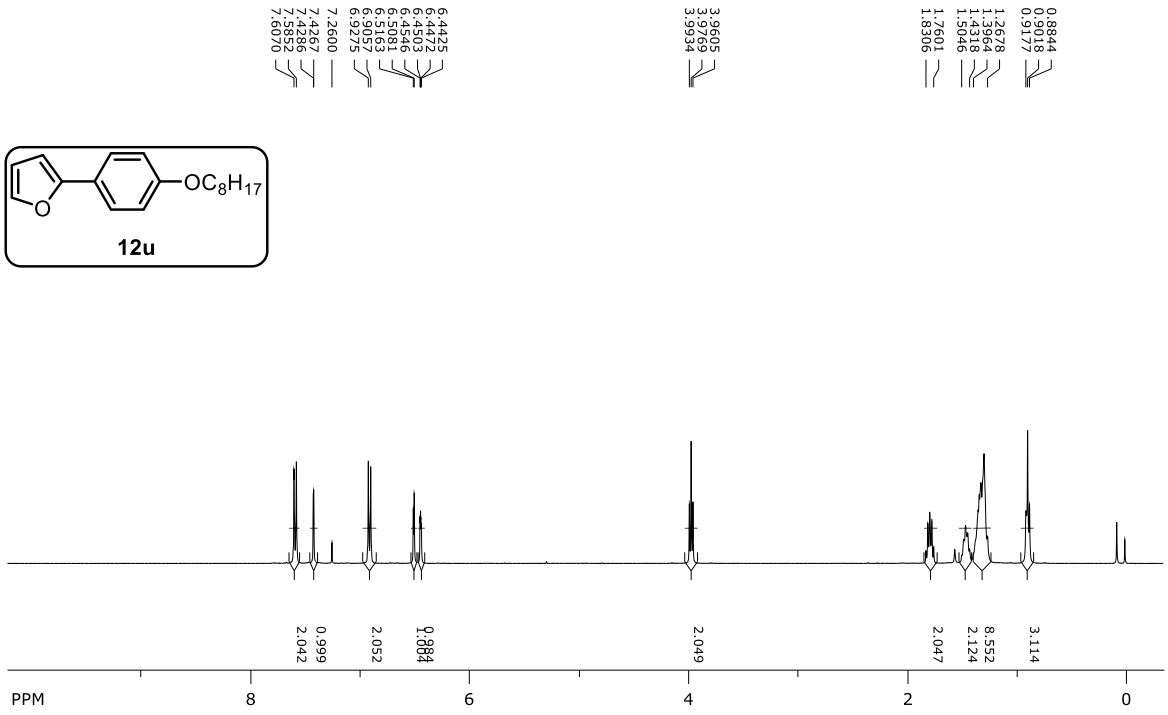
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 7.9-6.7 ppm region



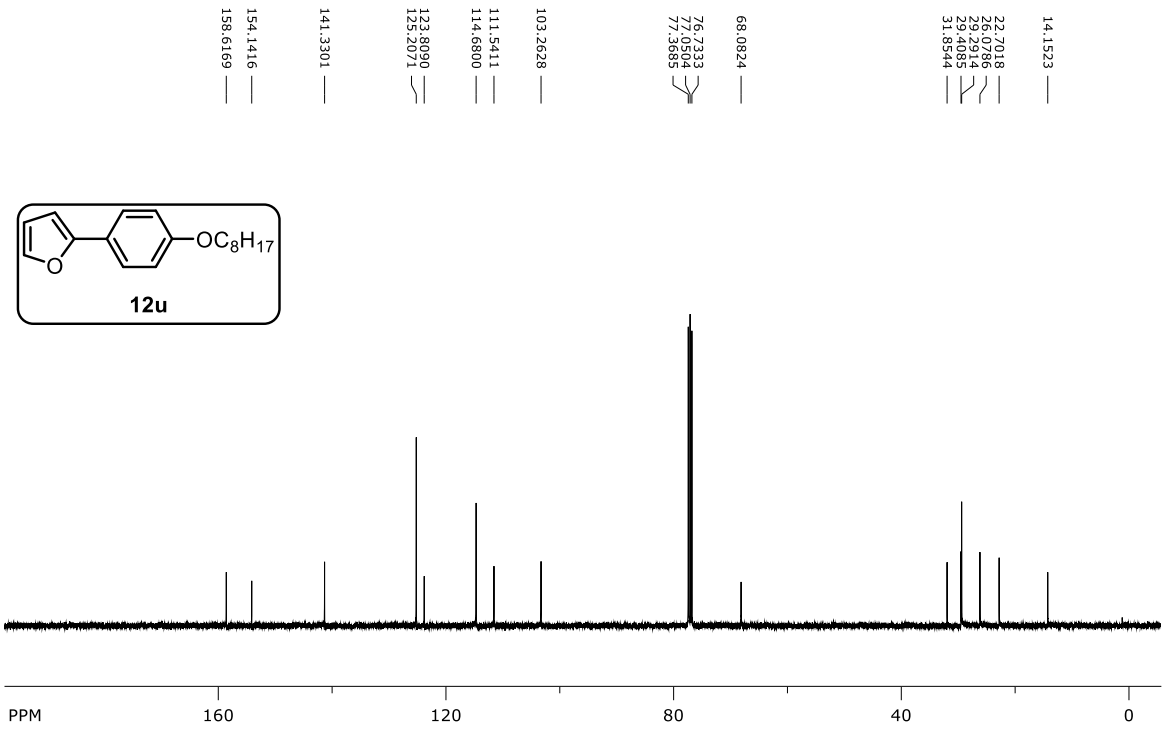
^{13}C NMR (100 MHz, $CDCl_3$)



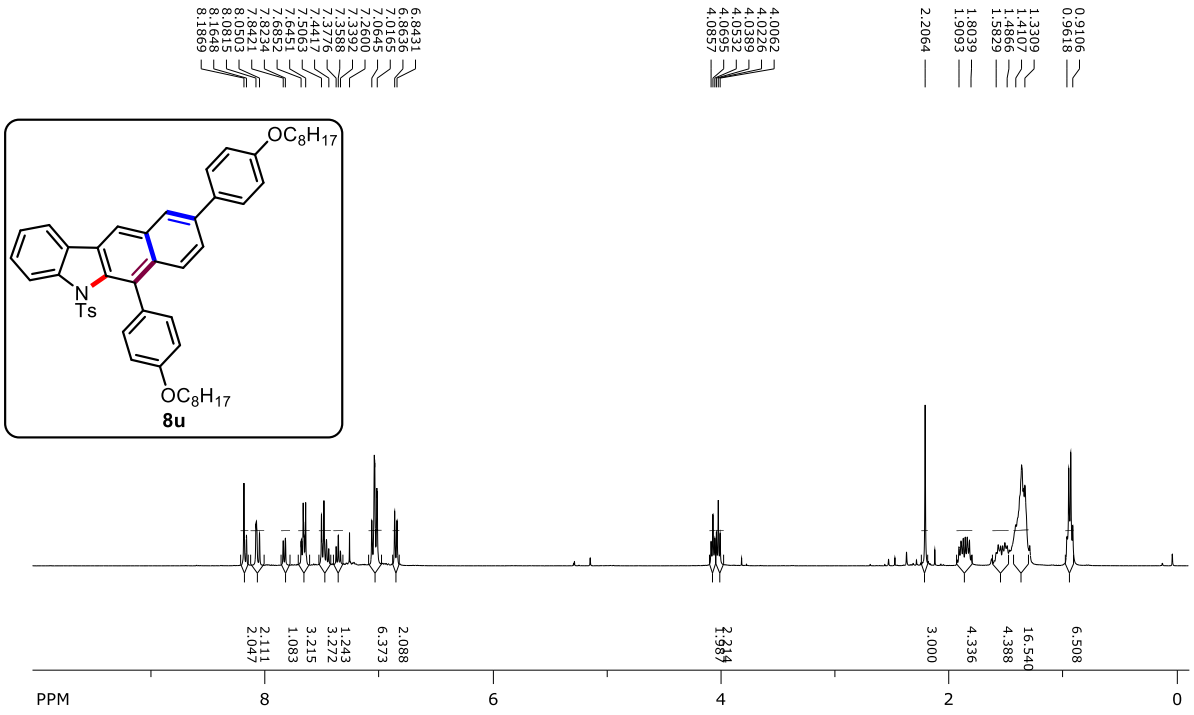
^{1}H NMR (400 MHz, $CDCl_3$)



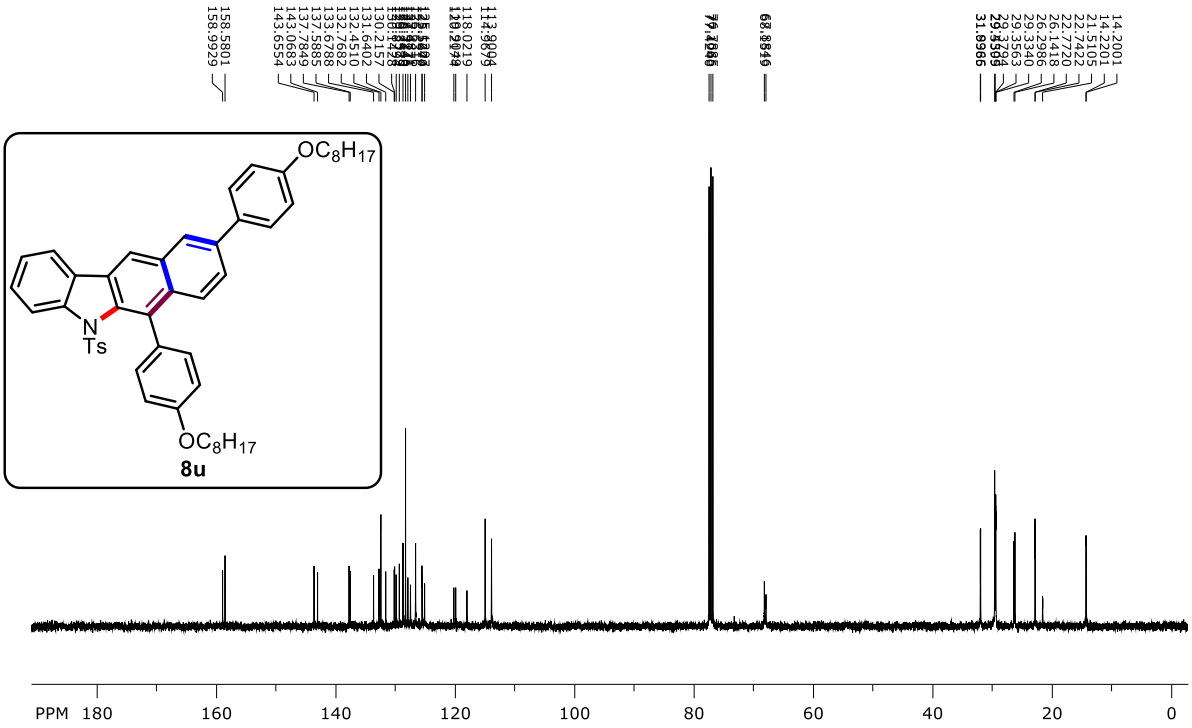
^{13}C NMR (100 MHz, $CDCl_3$)



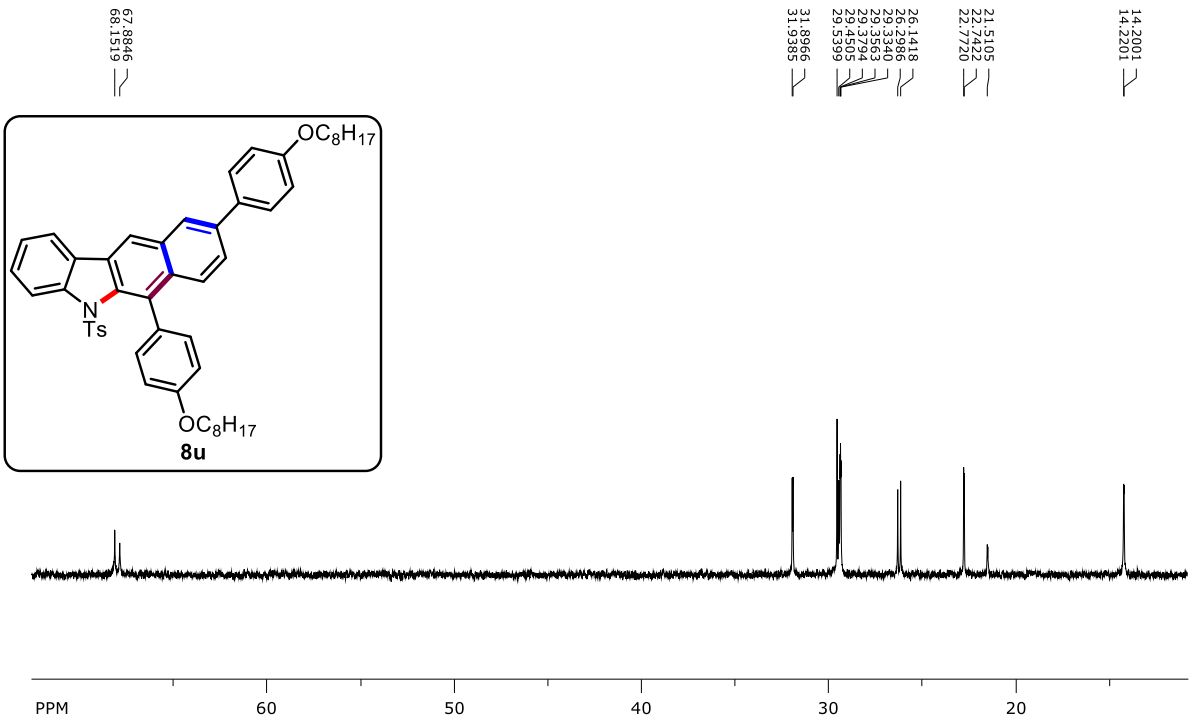
^{1}H NMR (400 MHz, $CDCl_3$)



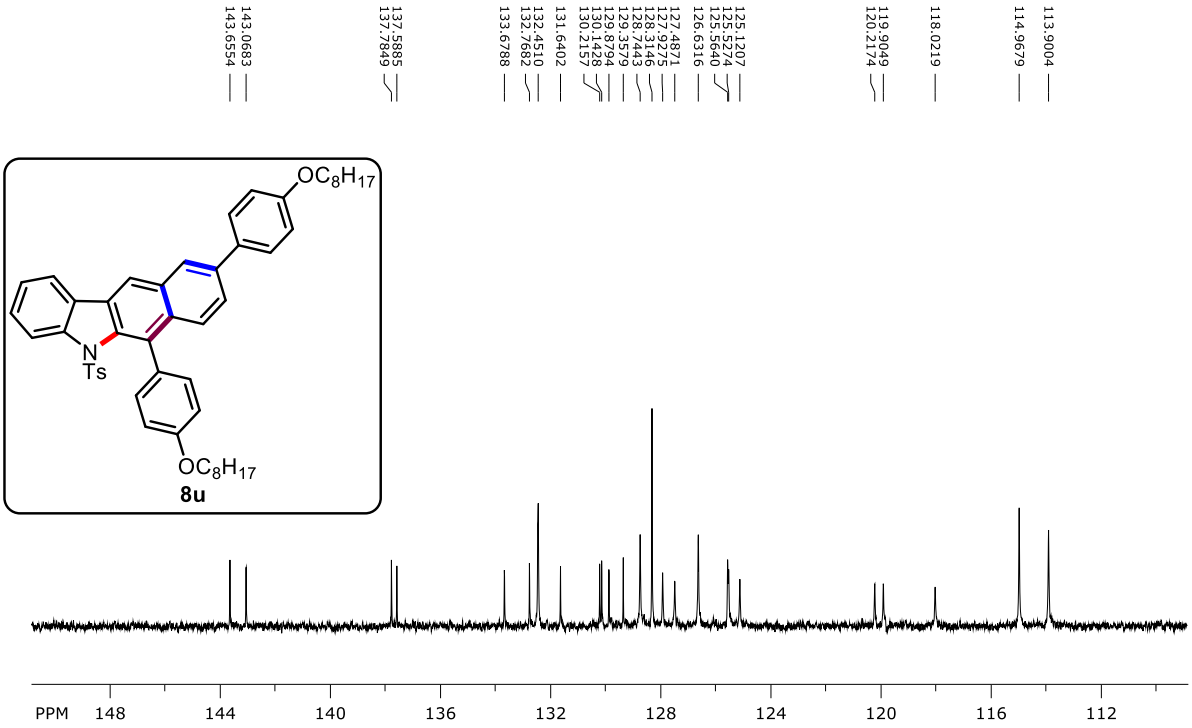
^{13}C NMR (100 MHz, $CDCl_3$)



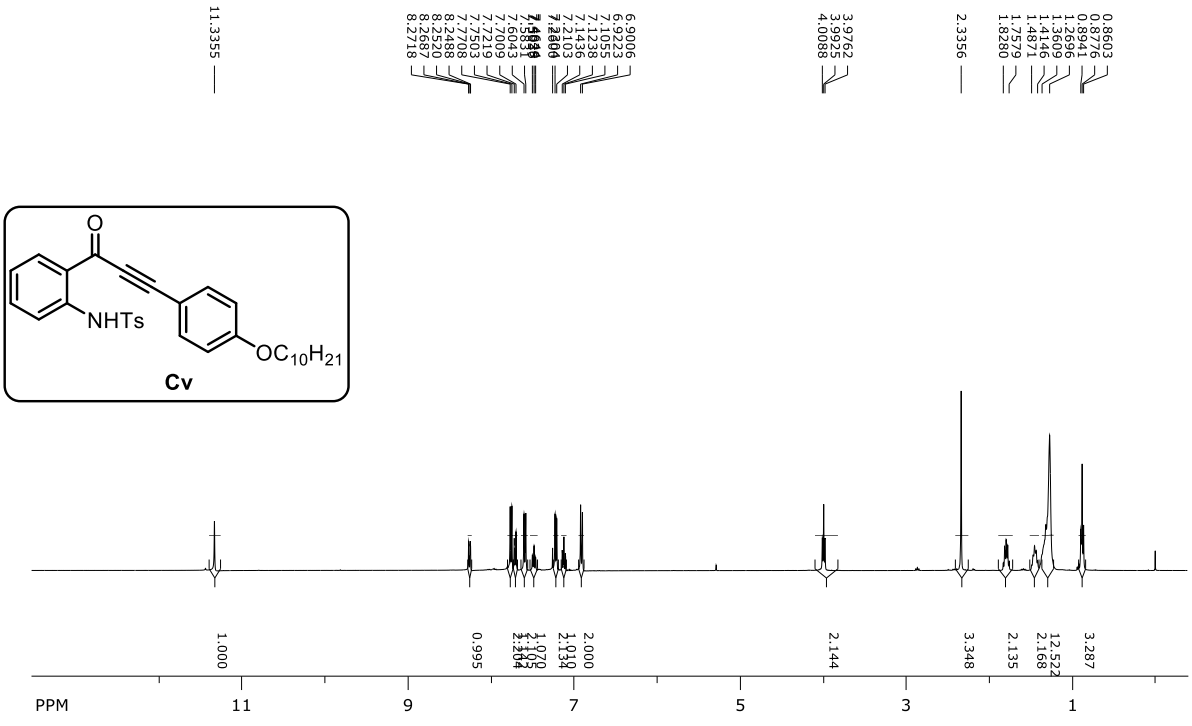
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 70.0-10.0 ppm region



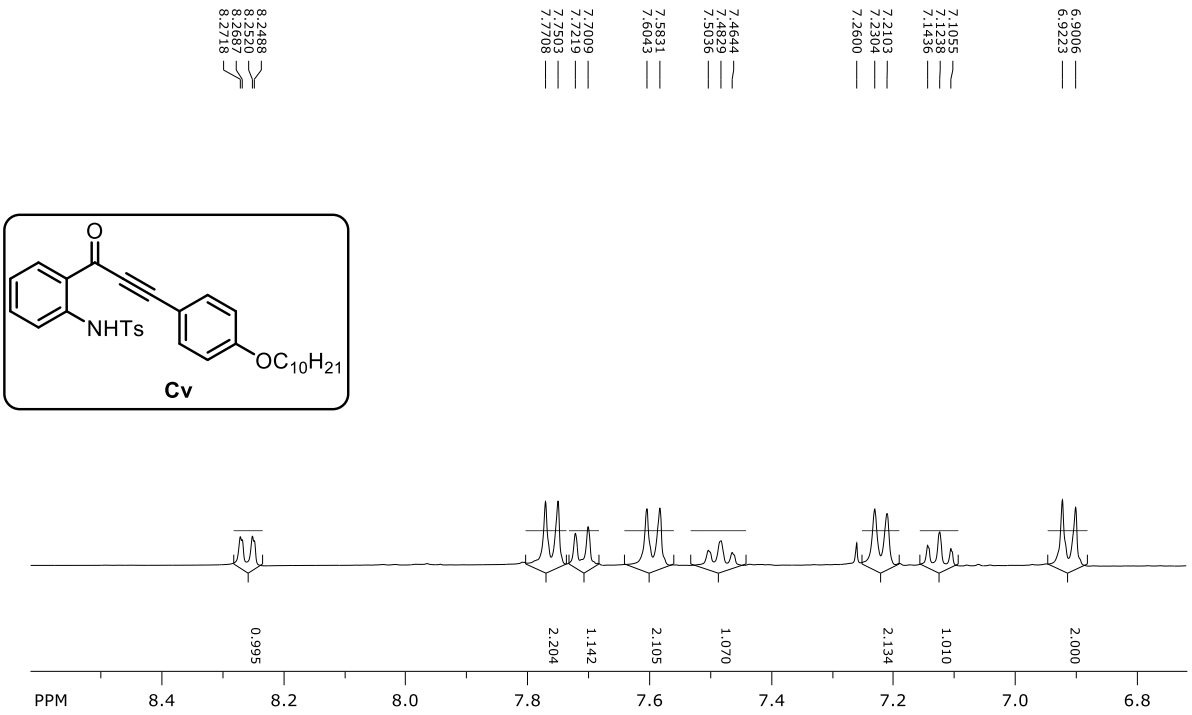
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 150.0-110.0 ppm region



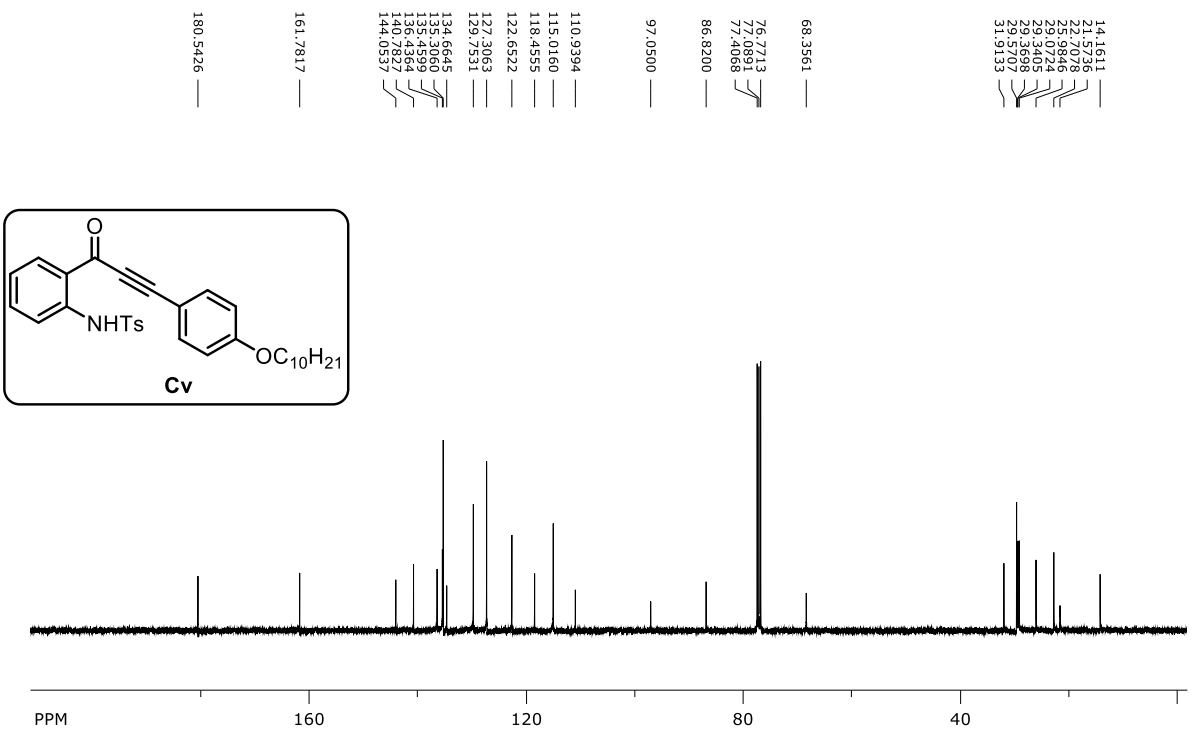
^{1}H NMR (400 MHz, $CDCl_3$)



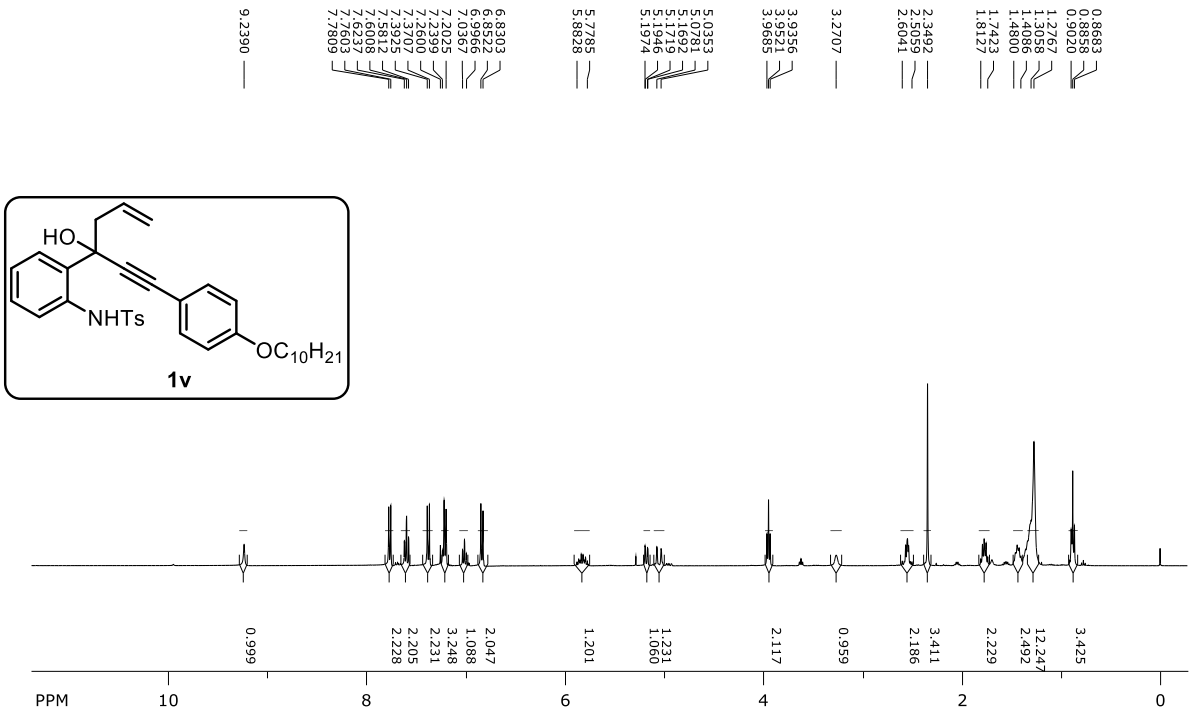
^{1}H NMR (400 MHz, $CDCl_3$): expansion of 8.2-6.7 ppm region



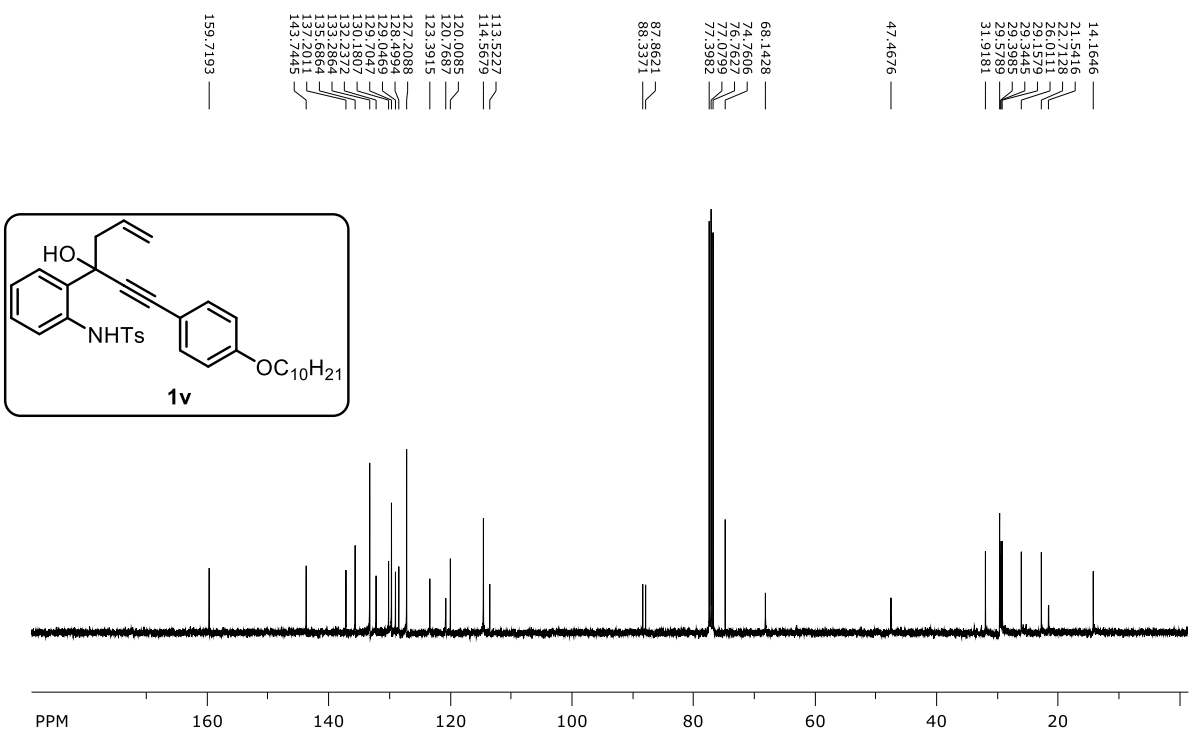
^{13}C NMR (100 MHz, $CDCl_3$)



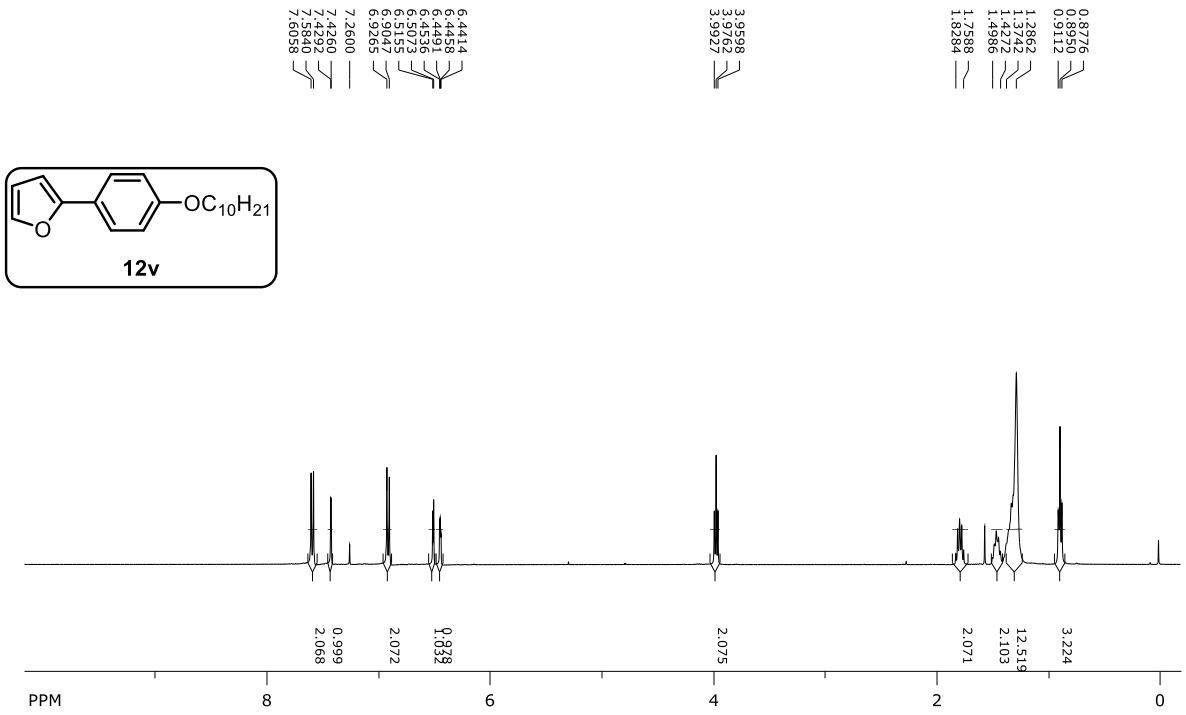
^{1}H NMR (400 MHz, $CDCl_3$)



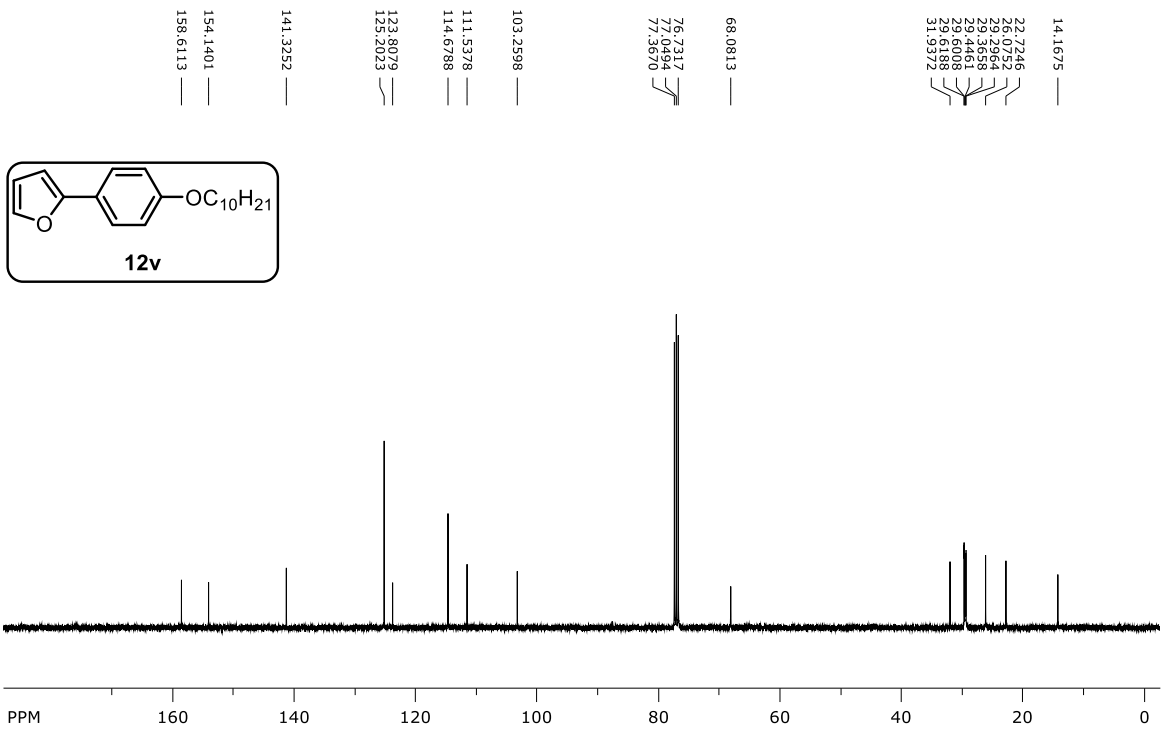
^{13}C NMR (100 MHz, $CDCl_3$)



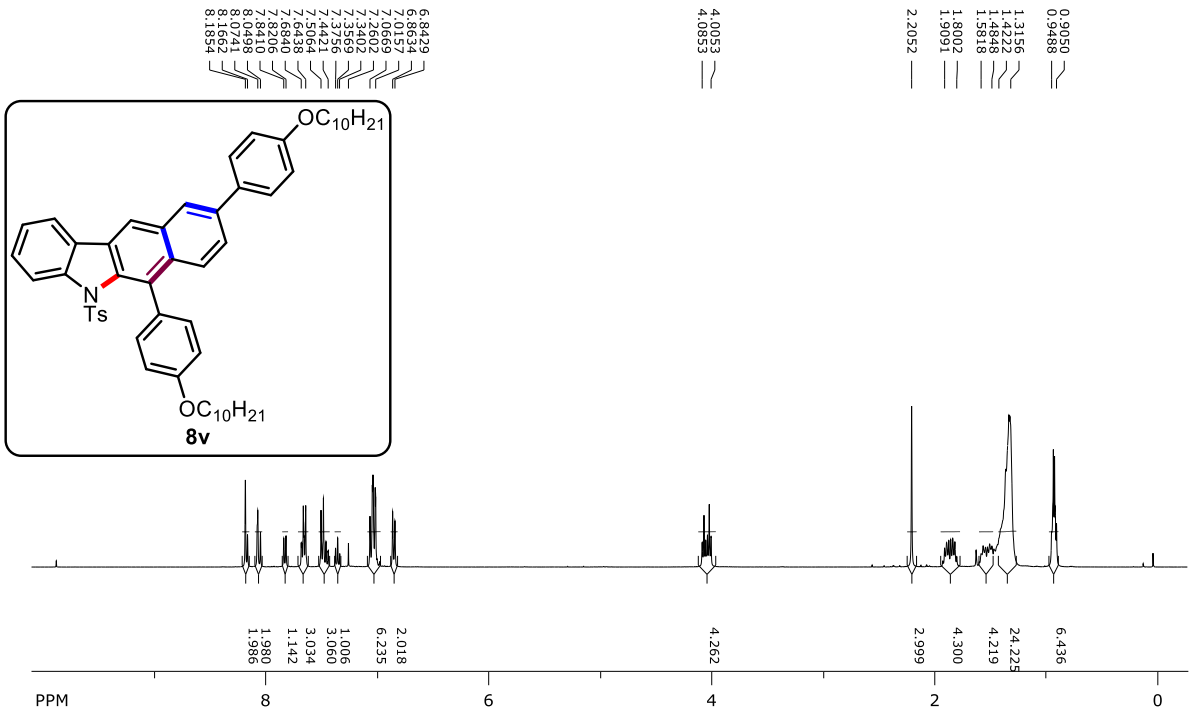
^{1}H NMR (400 MHz, $CDCl_3$)



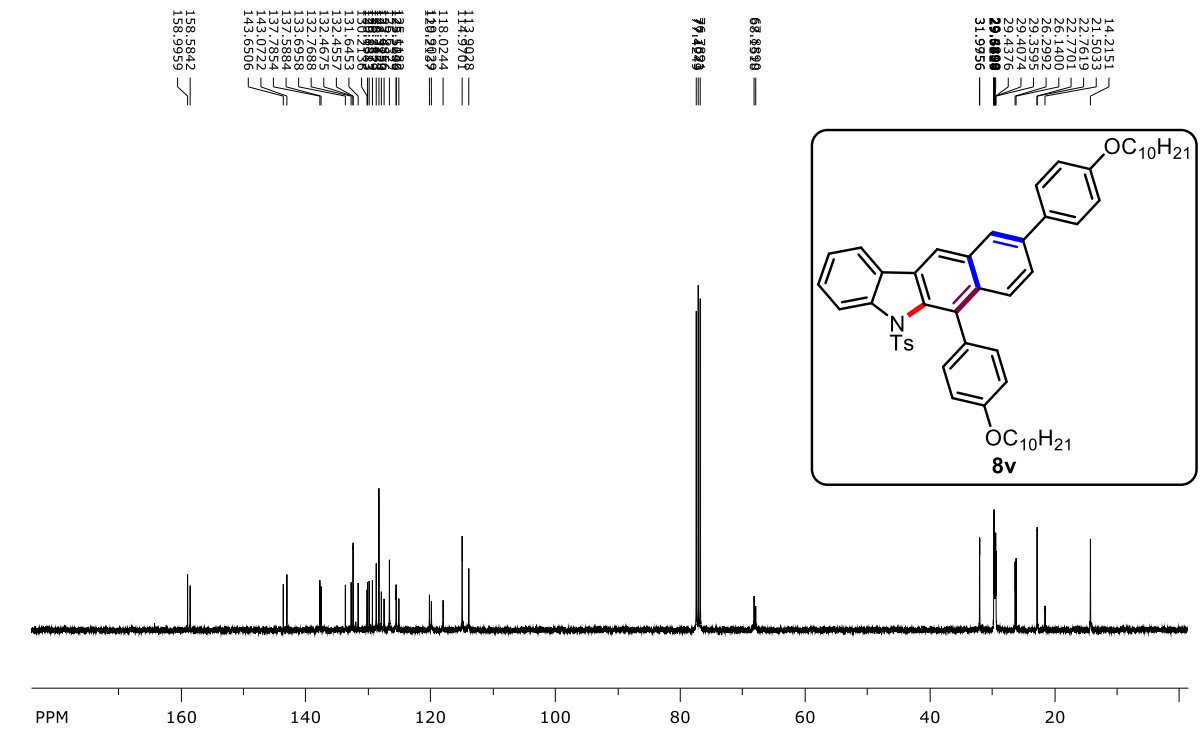
^{13}C NMR (100 MHz, $CDCl_3$)



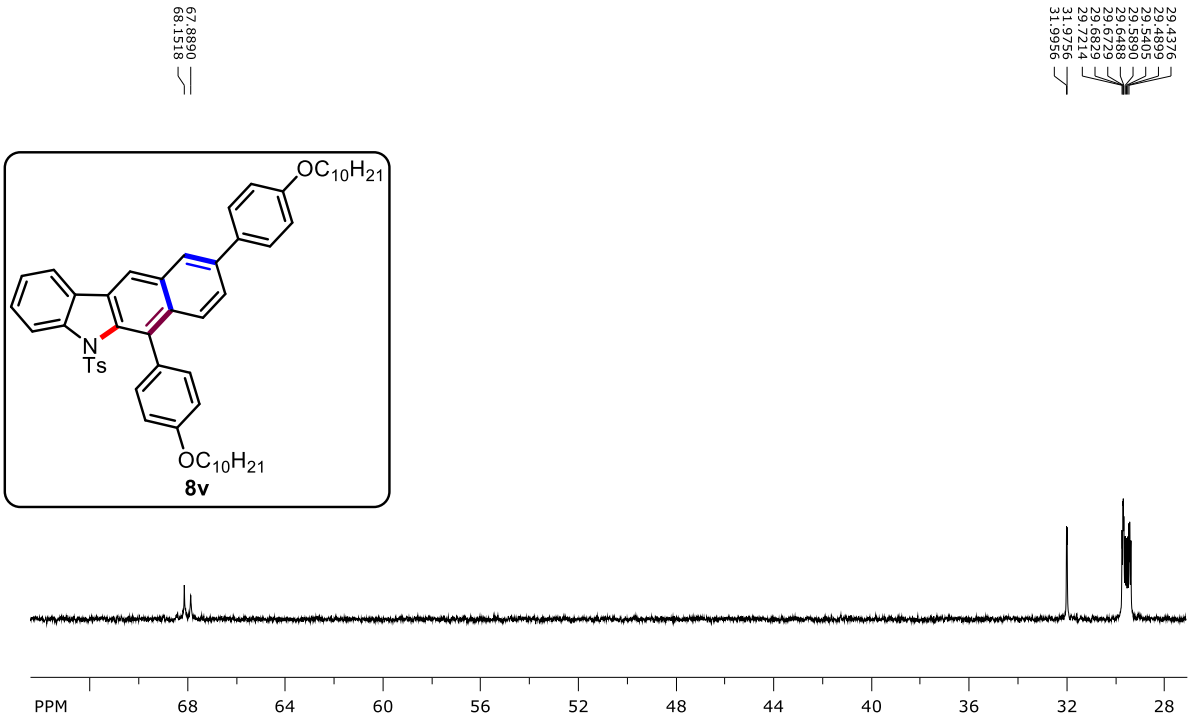
^{1}H NMR (400 MHz, $CDCl_3$)



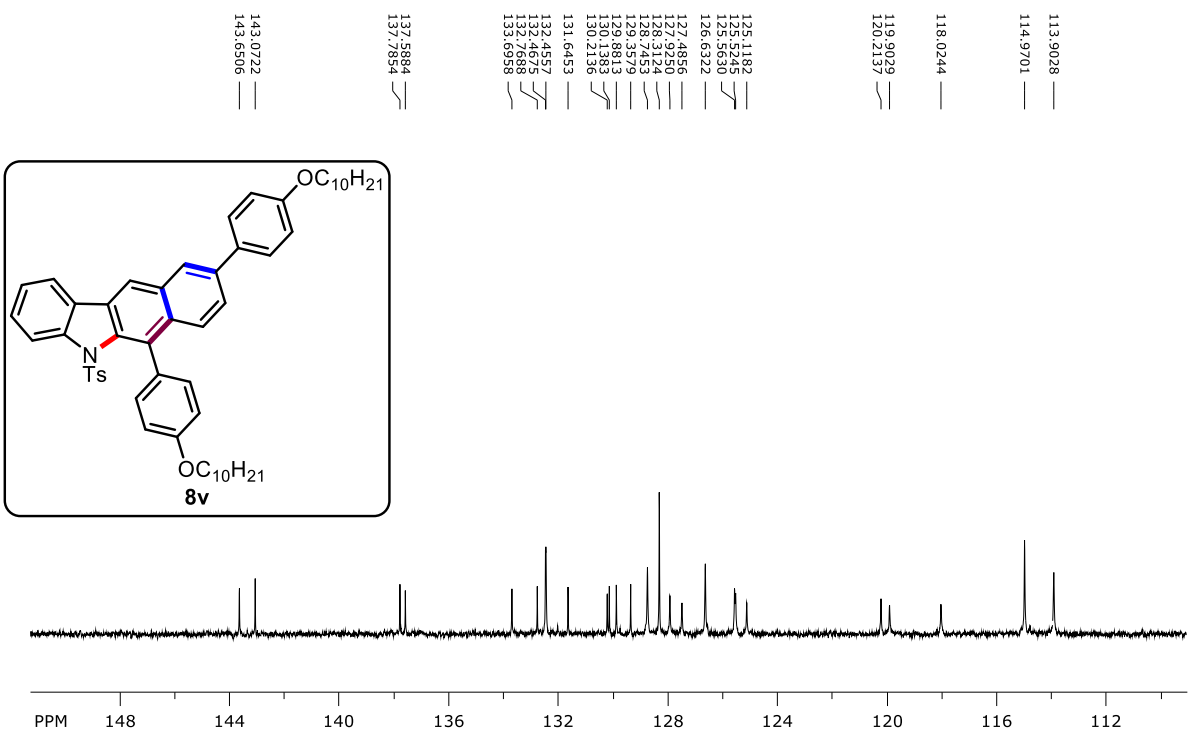
^{13}C NMR (100 MHz, $CDCl_3$)



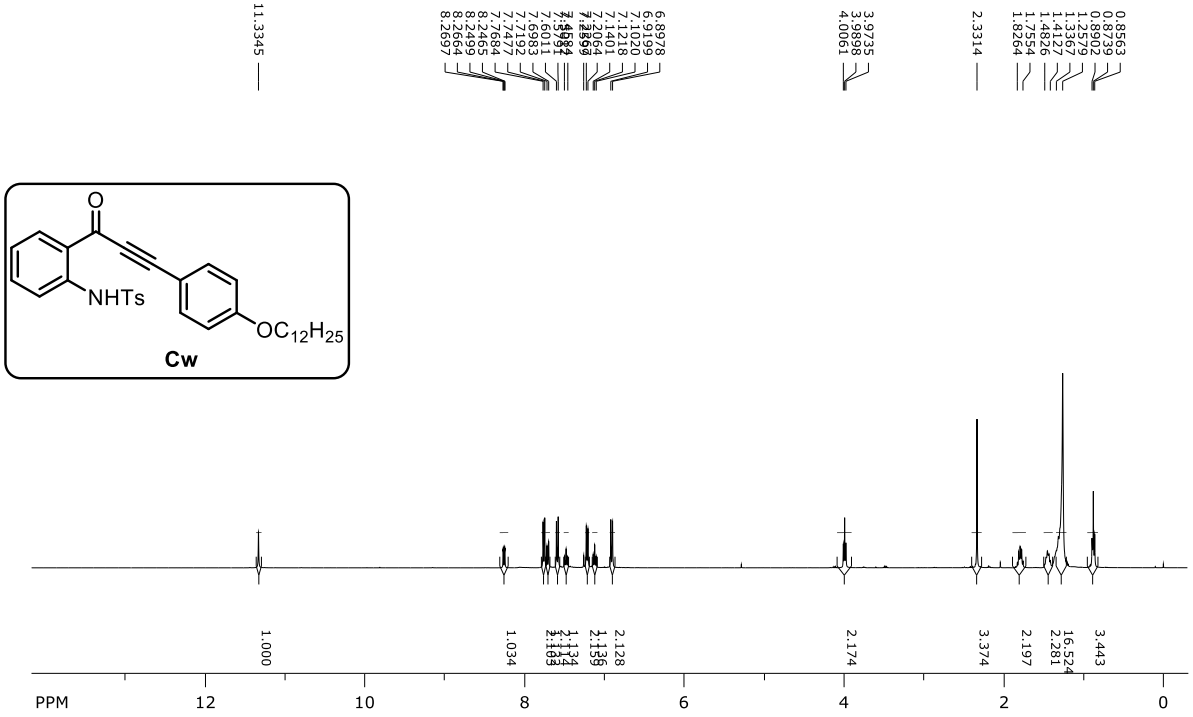
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 70.0-28.0 ppm region



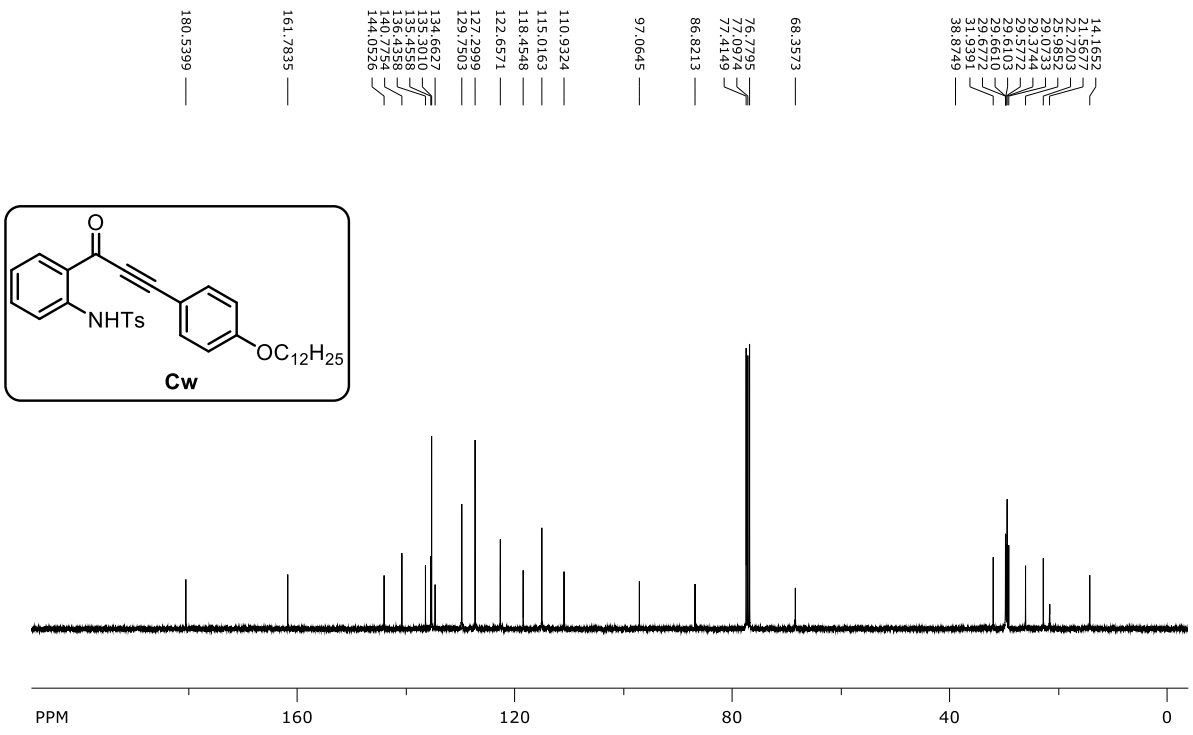
^{13}C NMR (100 MHz, $CDCl_3$): expansion of 150.0-110.0 ppm region



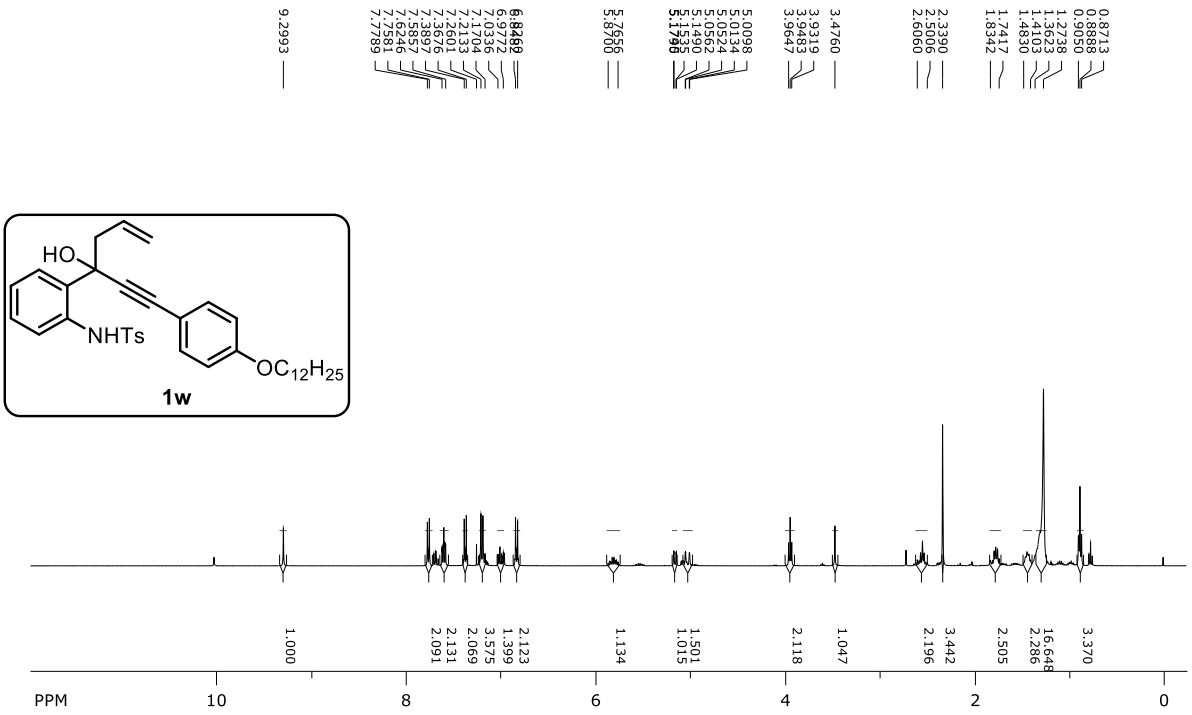
^{1}H NMR (400 MHz, $CDCl_3$)



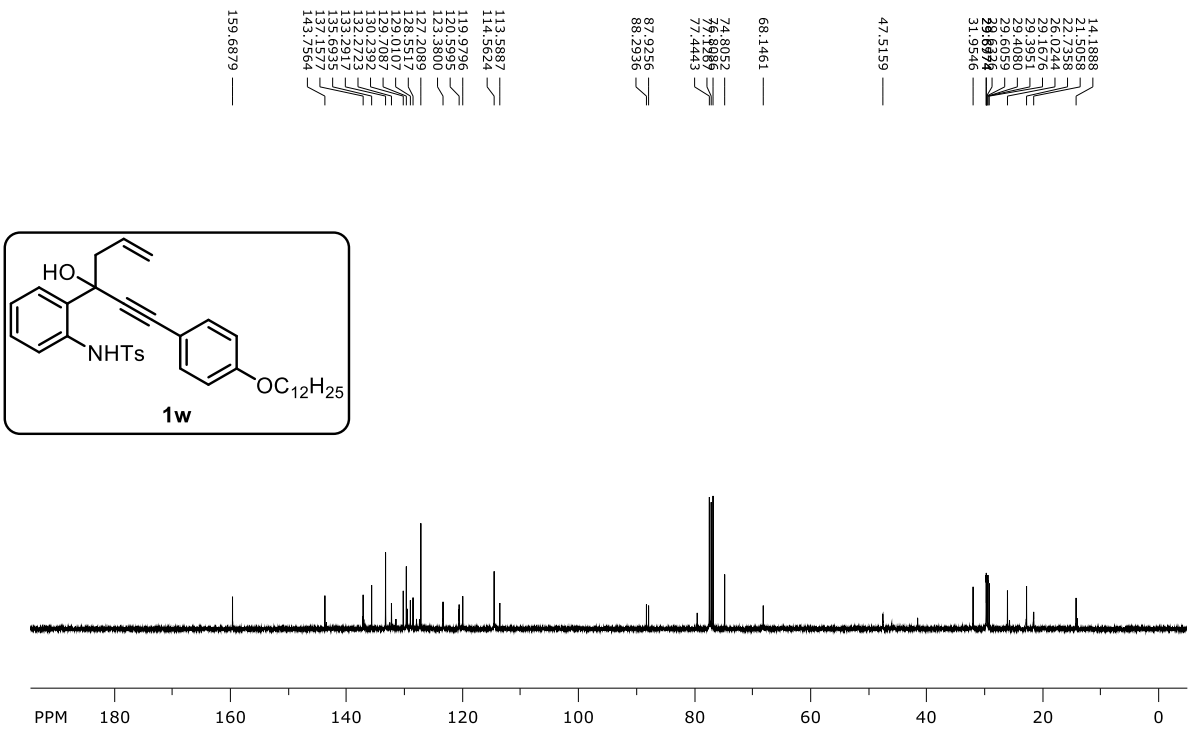
^{13}C NMR (100 MHz, $CDCl_3$)



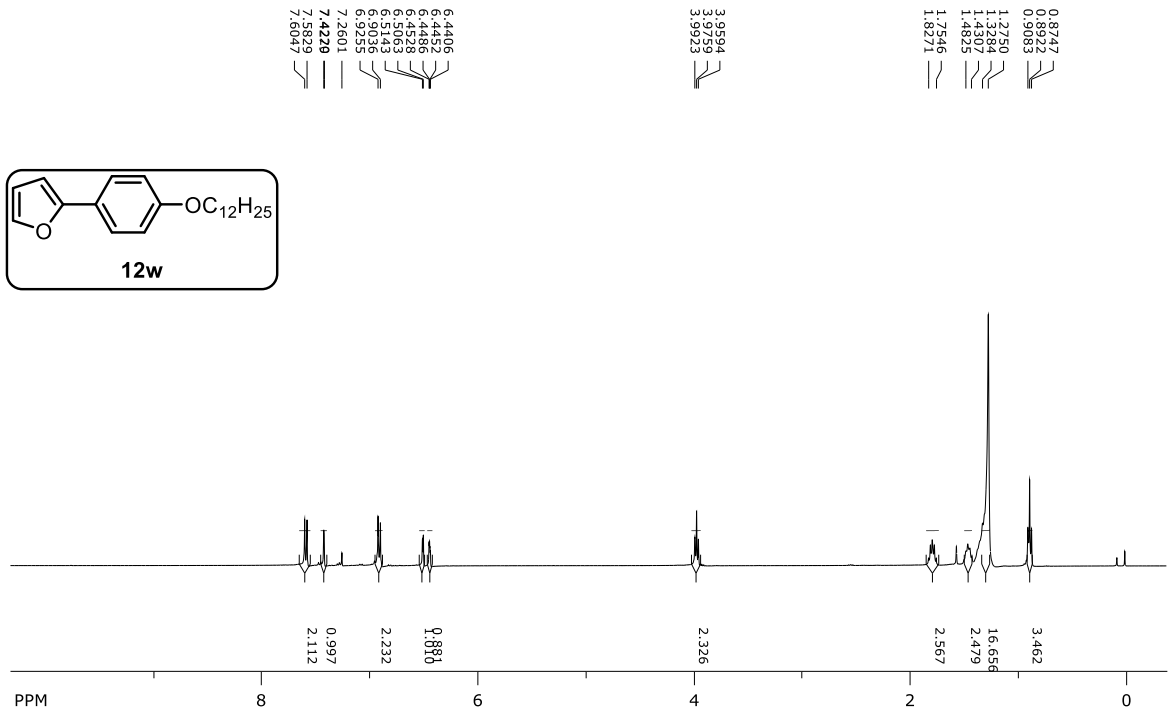
^{1}H NMR (400 MHz, $CDCl_3$)



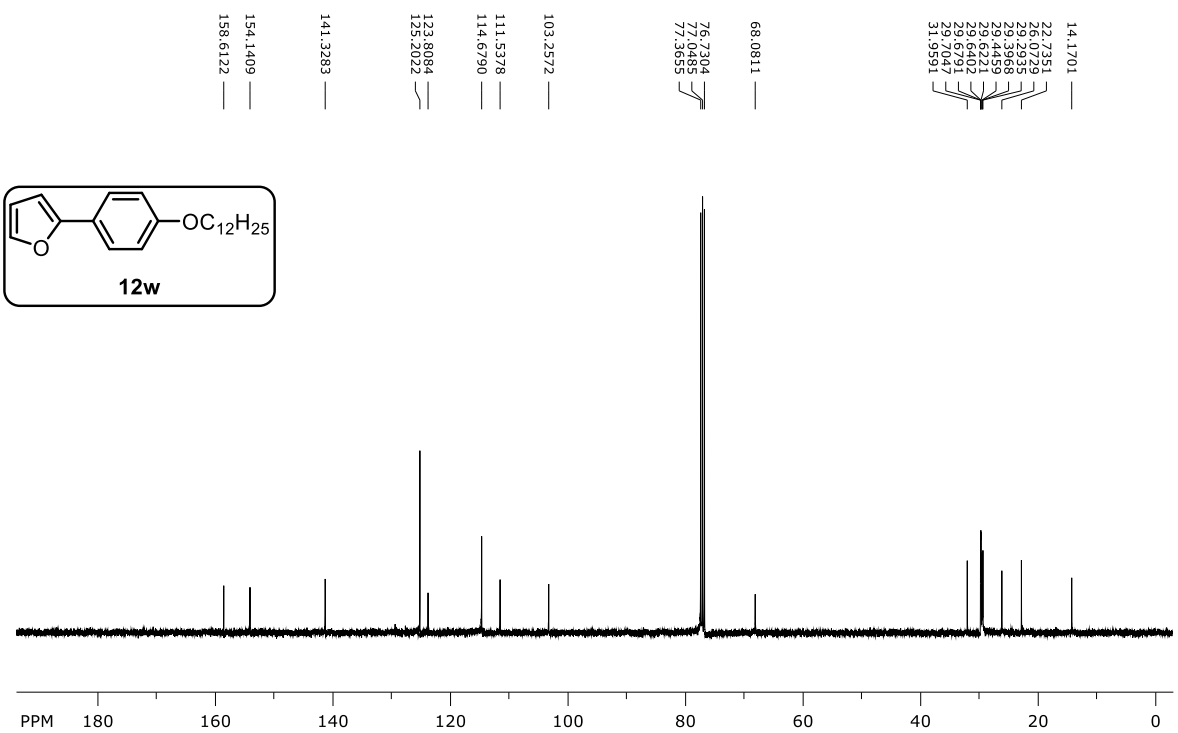
^{13}C NMR (100 MHz, $CDCl_3$)



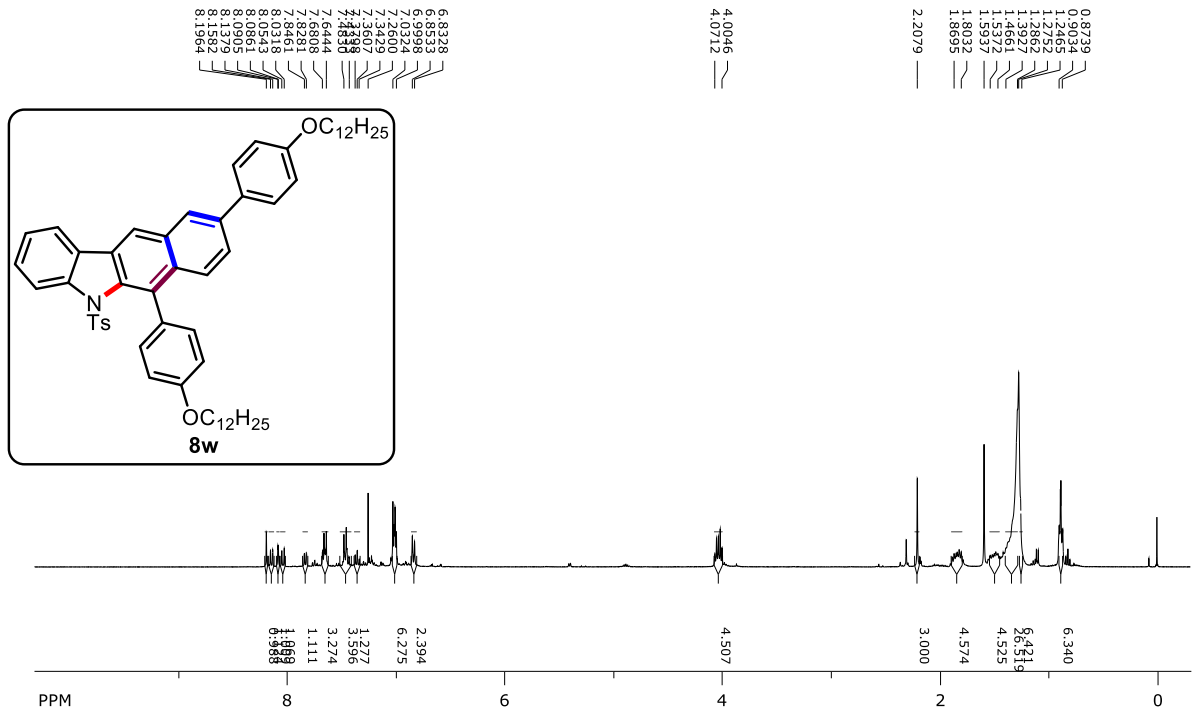
^{1}H NMR (400 MHz, $CDCl_3$)



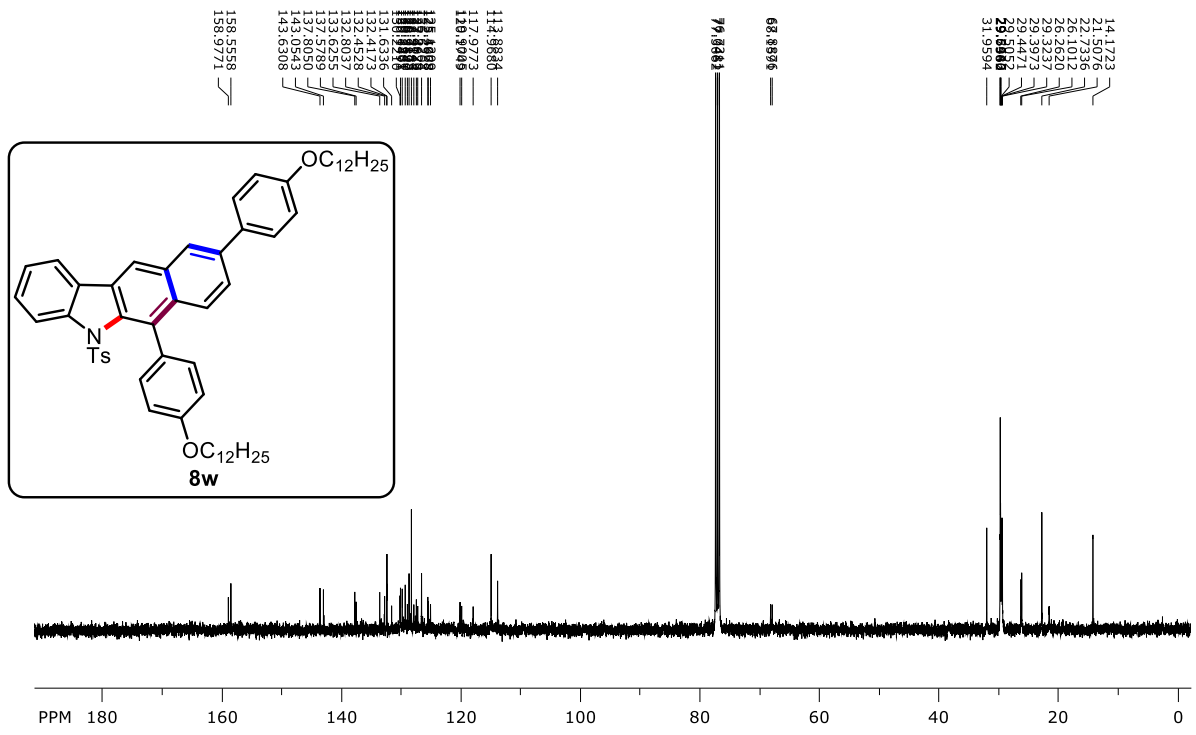
^{13}C NMR (100 MHz, $CDCl_3$)



^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C NMR (100 MHz, $CDCl_3$)



^{13}C NMR (100 MHz, $CDCl_3$): expansion of 150.0-110.0 ppm region