

Supporting Information

Palladium(II)-Catalyzed Cascade Reactions of Ene-Ynes Tethered to Cyano/Aldehyde: Access to Naphtho[1,2-*b*]furans and Benzo[*g*]indoles

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1. X-ray crystallographic information of products **1ba, **2aa**, **2ah** and **2bd**:**

Single crystal of products **1ba**, **2aa**, **2ah** and **2bd** were obtained through slow evaporation (at room temperature) of a solution in dichloromethane-petroleum ether (for product **1ba**, **2aa** and **2ah**) or ethyl acetate-petroleum ether (for product **2bd**). A single crystal of **1ba**, **2aa**, **2ah** and **2bd** were attached to a glass fiber with epoxy glue and transferred to a X-ray diffractometer, equipped with a graphite-monochromator. Diffraction data of products **1ba**, **2aa**, **2ah** and **2bd** were measured with MoK α radiation ($\lambda = 0.71073 \text{ \AA}$) at 296 K. The structure was solved by direct methods using the SHELXS-97 program.¹ Refinements were carried out with a full matrix least squares method against F2 using SHELXL-97.² The non-hydrogen atoms were refined with anisotropic thermal parameters. The hydrogen atoms were included in geometric positions and given thermal parameters equivalent to 1.2 times those of the atom to which they were attached. The Ortep diagrams and important crystal data of product **1ba**, **2aa**, **2ah** and **2bd** are given below.

2. ORTEP Diagrams of the products 1ba, 2aa, 2ah and 2bd:

● C
● H
● O

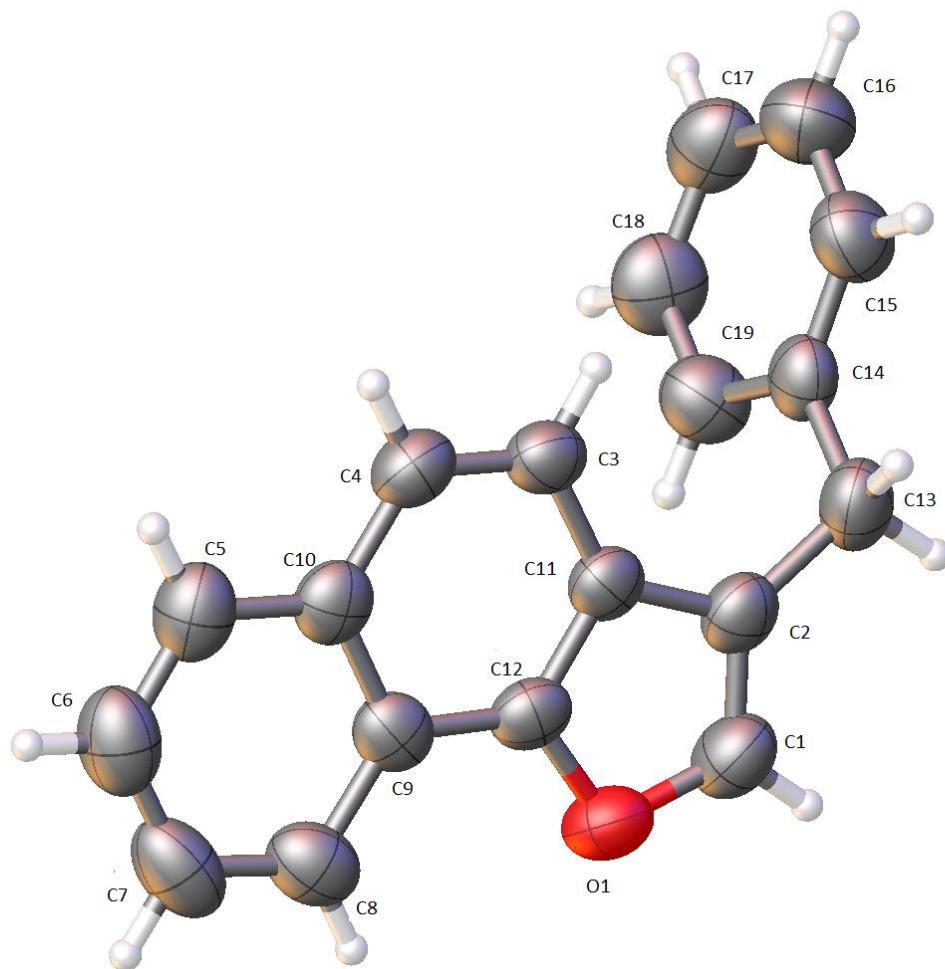


Figure S1. ORTEP Diagram (thermal ellipsoid plot) of Product **1ba** (drawn at 50% probability level)

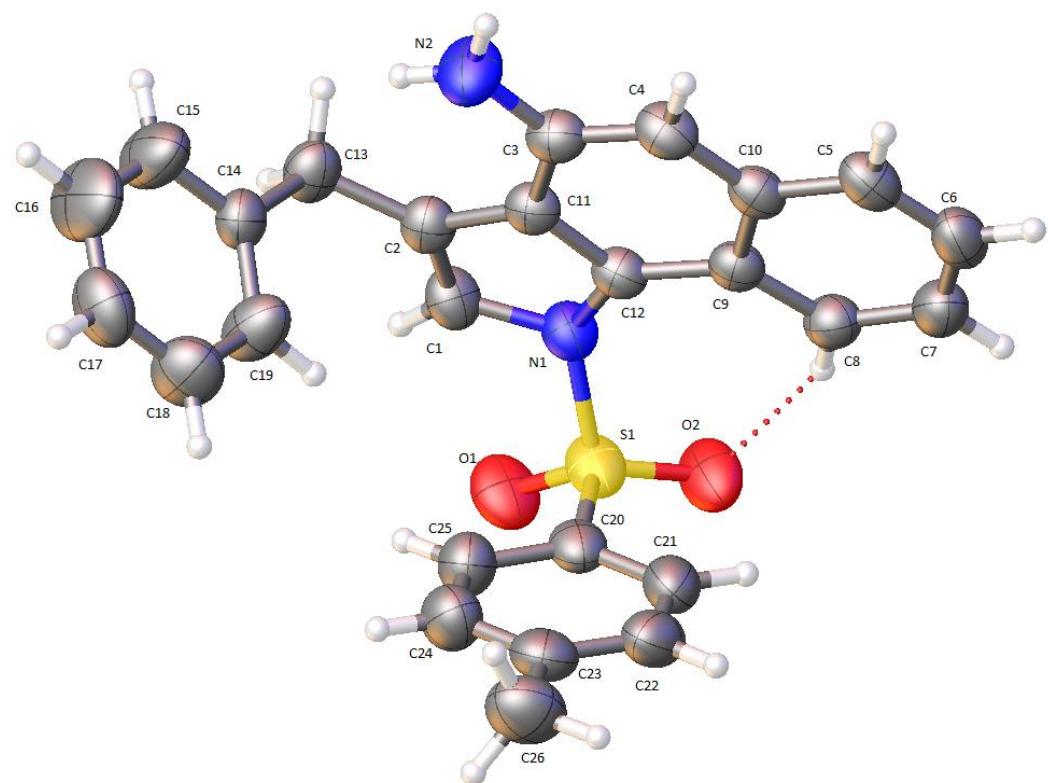
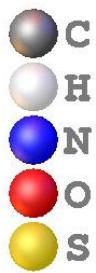


Figure S2. ORTEP Diagram (thermal ellipsoid plot) of Product **2aa** (drawn at 50% probability level)

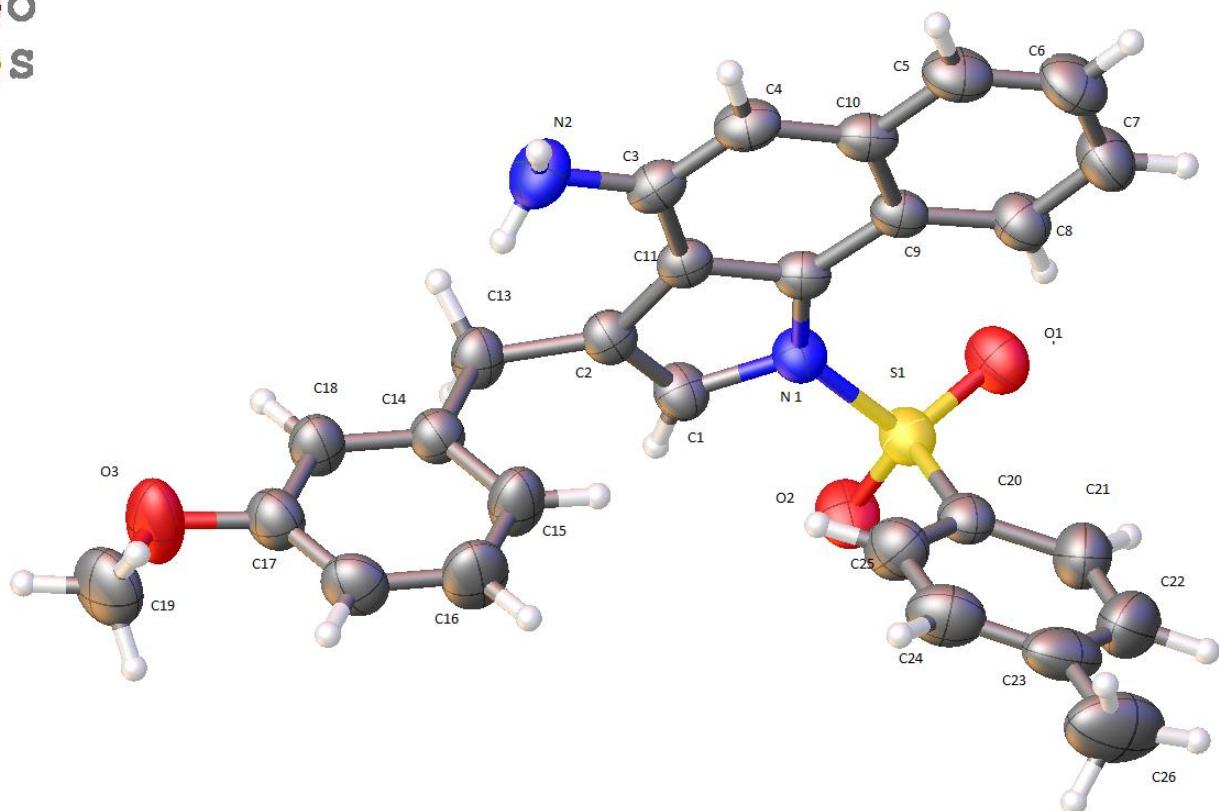
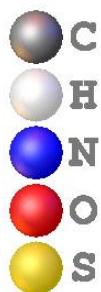


Figure S3. ORTEP Diagram (thermal ellipsoid plot) of Product **2ah** (drawn at 50% probability level)

C
H
F
N
O
S

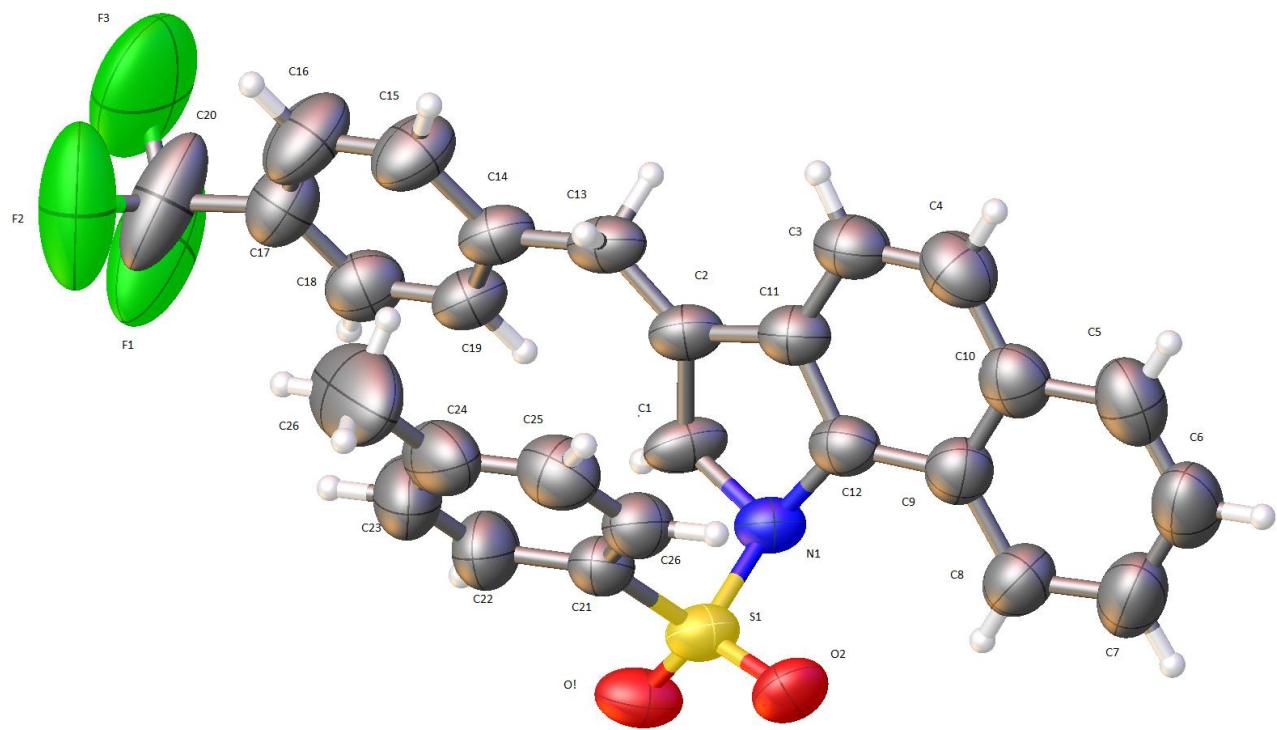


Figure S4. ORTEP Diagram (thermal ellipsoid plot) of Product **2bd** (drawn at 50% probability level)

Table S1: Important crystal data of product **1ba**

Empirical formula	C ₁₉ H ₁₄ O
Formula weight	258.30
Temperature	296 K
Wavelength	0.71073
Crystal system	Monoclinic
Space group	P 1 21/n 1
Unit cell dimensions	a = 6.1367 (17) Å α = 90° b = 10.652 (3) Å β = 90° c = 20.542 (6) Å γ = 90°
Volume	1342.7 (6) Å ³
Z	4
Density (calculated)	1.277 g/cm ³
Absorption coefficient (Mu)	0.077mm ⁻¹
F(000)	544.0
Theta range for data collection	2.75° to 25.55°
Index ranges	-7<=h<=7, -12<=k<=12, -26<=l<=26
Reflection collected	16449
Independent reflections	2566 [R(int) = 0.0391]
Completeness to theta= 25.44°	97.0 %
Absorption correction	multi-scan
Max. and min. transmission	0.85 and 0.7
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	2566 /0/181
Goodness-of-fit on F ²	1.039
Final R indices [I>2sigma(I)]	R1 = 0.0381, wR2 = 0.1003
R indices (all data)	R1 = 0.0463, wR2 = 0.1090
Largest diff. peak and hole	0.160 &-0.120 e.Å ⁻³

The single crystal of the product **1ba** was obtained by slow evaporation of the solution containing a mixture of petroleum-ether and dichloromethane. The crystal data have already been deposited at Cambridge Crystallographic Data Centre. The CCDC reference number is **1897156**.

Table S2: Important crystal data of product **2aa**

Empirical formula	C ₂₆ H ₂₂ N ₂ O ₂ S
Formula weight	426.51
Temperature	296 K
Wavelength	0.71073
Crystal system	Triclinic
Space group	P -1
Unit cell dimensions	a = 9.2355(18) Å α = 101.008(4) ° b = 10.5110(19) Å β = 110.170(4) ° c = 11.803(2) Å γ = 93.425(4) °
Volume	1045.8(3) Å ³
Z	2
Density (calculated)	1.354 g/cm ³
Absorption coefficient (Mu)	0.181mm ⁻¹
F(000)	448.0
Theta range for data collection	2.37 ° to 26.97 °
Index ranges	-10<=h<=10, -12<=k<=12, -14<=l<=14
Reflection collected	20661
Independent reflections	3667 [R(int) = 0.0269]
Completeness to theta= 25.44°	99.9 %
Absorption correction	none
Max. and min. transmission	1.0 and 0.8
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	3667 /0/281
Goodness-of-fit on F ²	0.844
Final R indices [I>2sigma(I)]	R1 = 0.0389, wR2 = 0.1184
R indices (all data)	R1 = 0.0456, wR2 = 0.1304
Largest diff. peak and hole	0.245 & - 0.224e.A ⁻³

The single crystal of the product **2aa** was obtained by slow evaporation of the solution containing a mixture of petroleum ether and dichloromethane. The crystal data have already been deposited at Cambridge Crystallographic Data Centre. The CCDC reference number is **1897157**.

Table S3: Important crystal data of product **2ah**

Empirical formula	C ₂₇ H ₂₄ N ₂ O ₃ S
Formula weight	456.54
Temperature	296 K
Wavelength	0.71073
Crystal system	Triclinic
Space group	P -1
Unit cell dimensions	a = 9.1850(5)Å α = 66.694(2)° b = 10.8127(6)Å β = 82.606(2)° c = 13.1573(7)Å γ = 70.197(2)°
Volume	1129.10(11) Å ³
Z	2
Density (calculated)	1.343g/cm ³
Absorption coefficient (Mu)	0.176 mm ⁻¹
F(000)	480.0
Theta range for data collection	2.18 ° to 27.449 °
Index ranges	-11<=h<=11, -13<=k<=13, -17<=l<=17
Reflection collected	25612
Independent reflections	5136 [R(int) = 0.0276]
Completeness to theta= 25.44°	99.6 %
Absorption correction	multi-scan
Max. and min. transmission	1.0 and 0.7
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	5136 /0/301
Goodness-of-fit on F ²	1.060
Final R indices [I>2sigma(I)]	R1 = 0.0442, wR2 = 0.1218
R indices (all data)	R1 = 0.0491, wR2 = 0.1290
Largest diff. peak and hole	0.403 &-0.237 e.Å ⁻³

The single crystal of the product **2ah** was obtained by slow evaporation of the solution containing a mixture of petroleum ether/ dichloromethane. The crystal data have already been deposited at Cambridge Crystallographic Data Centre. The CCDC reference number is **1897158**.

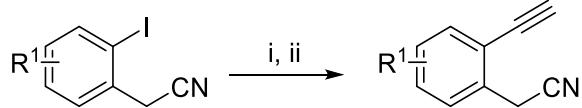
Table S4: Important crystal data of product **2bh**

Empirical formula	C ₂₇ H ₂₀ F ₃ NO ₂ S
Formula weight	456.54
Temperature	296 K
Wavelength	0.71073
Crystal system	Monoclinic
Space group	P 1 21/c 1
Unit cell dimensions	a = 12.690(9) Å, α = 90° b = 11.602(8) Å, β = 95.24(1)° c = 16.618(11) Å, γ = 90°
Volume	2436 (3)Å ³
Z	4
Density (calculated)	1.307 g/cm ³
Absorption coefficient (Mu)	0.180 mm ⁻¹
F(000)	992.0
Theta range for data collection	2.38 ° to 23.34°
Index ranges	-16<=h<=15, -14<=k<=14, -21<=l<=21
Reflection collected	30428
Independent reflections	5464 [R(int) = 0.0766]
Completeness to theta= 25.44°	97.9 %
Absorption correction	multi-scan
Max. and min. transmission	1.0 and 0.7
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	5137 /105/309
Goodness-of-fit on F ²	1.040
Final R indices [I>2sigma(I)]	R1 = 0.0811, wR2 = 0.2393
R indices (all data)	R1 = 0.1562, wR2 = 0.2925
Largest diff. peak and hole	0.706 & -0.452e.Å ⁻³

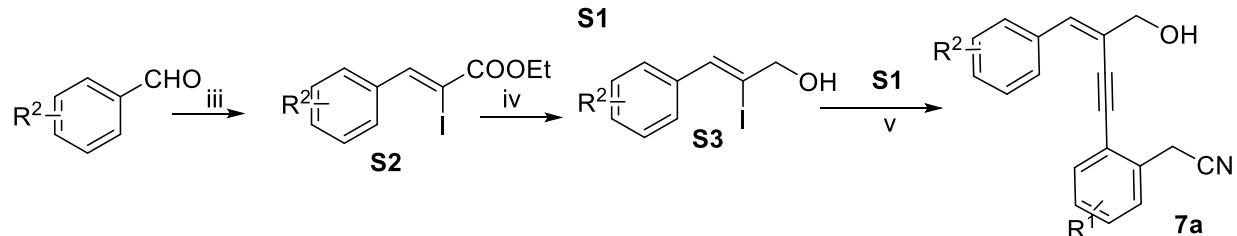
The single crystal of the product **2bh** was obtained by slow evaporation of the solution containing a mixture of petroleum ether/ dichloromethane. The crystal data have already been deposited at Cambridge Crystallographic Data Centre. The CCDC reference number is **1897159**.

3. Schematic Representation for the Preparation of Starting Materials 7a :

(a)

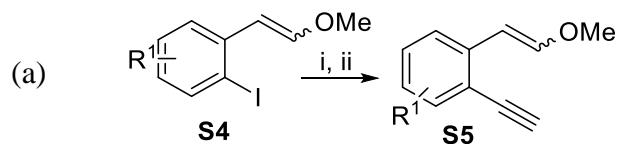


(b)

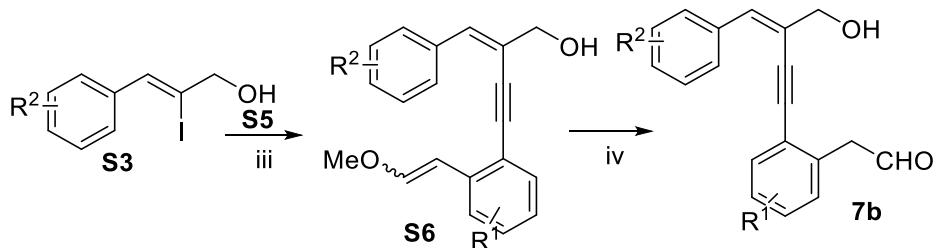


Scheme S1. Reagents and Conditions: (i) Trimethylsilylacetylene, PdCl₂(PPh₃)₂, CuI, Et₃N, 1-2 h, 68-82%; (ii) K₂CO₃, MeOH, 0.5 h, 56-66%; (iii) (a) Ph₃P⁺CH₂CO₂Et.Br⁻, I₂, K₂CO₃, CH₃OH, 0- 5 °C, 1.5 h; (b) Tetrabutylammonium bromide, K₂CO₃, 40 °C, 2-8 h, 60-75%; (iv) DIBAL-H, CH₂Cl₂, -5 °C-rt, 2-6 h, 42-76%; (v) PdCl₂(PPh₃)₂, CuI, Et₃N-DMF (4:1), 65 °C, 2-5 h, 40-80%.

4. Schematic Representation for the Preparation of the Starting Materials 7b:

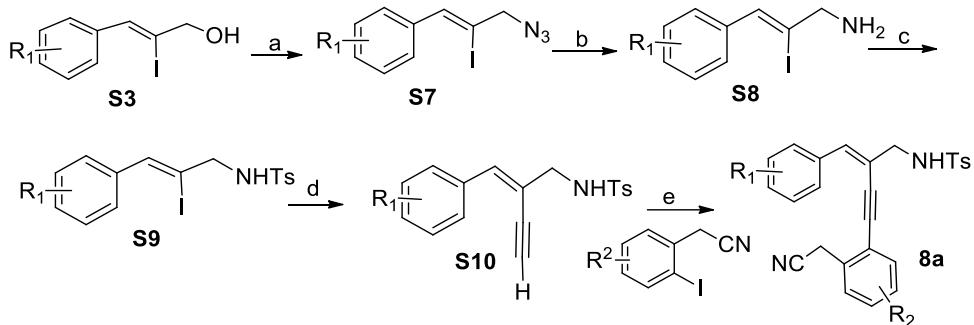


(b)



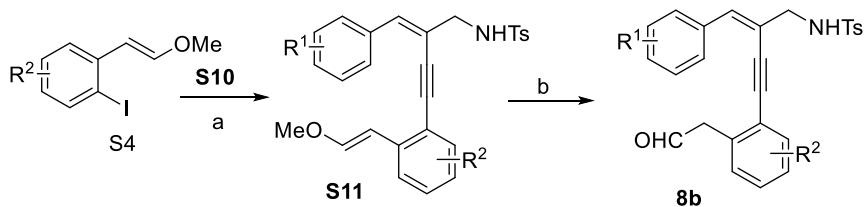
Scheme S2: Reagent and Conditions: (i) PdCl₂(PPh₃)₂, trimethylsilylacetylene, CuI, Et₃N, 1-1.5 h, 90-95%; (ii) K₂CO₃, MeOH, 0.5-1 h, 56-60%; (iii) PdCl₂(PPh₃)₂, CuI, Et₃N, rt, 1-2h, 78-90%; (iv) p-TsOH, acetone, 0 °C- rt, 3-4h, 42-76%.

5. Schematic Representation for the Synthesis of Substrates 8a:



Scheme S3. Reagents and Conditions: (a) (i) MsCl, Et₃N, DCM, 0 °C-rt, 0.25-1.5 h ; (ii) NaN₃, DMF, rt, 1-2.5 h, 50-93%; (b) 1,3-propanedithiol, N,N-diisopropylethylamine, MeOH:MeCN (1:1), rt, 2-4 h, 64-95%; (c) TsCl, pyridine, DCM, 0 °C- rt, 1-4 h; 72-90%; (d) (i) Trimethylsilylacetylene, PdCl₂(PPh₃)₂, CuI, Et₃N, DMF , 0 °C-rt, 1.5-4 h, 70-85%; (ii) K₂CO₃, MeOH, rt, 0.5-1.75 h, 85-96%; (e) PdCl₂(PPh₃)₂, CuI , Et₃N, DMF, 0 °C- rt, 1-8 h, 60-96%.

6. Schematic Representation for the Preparation of the Substrates 8b :



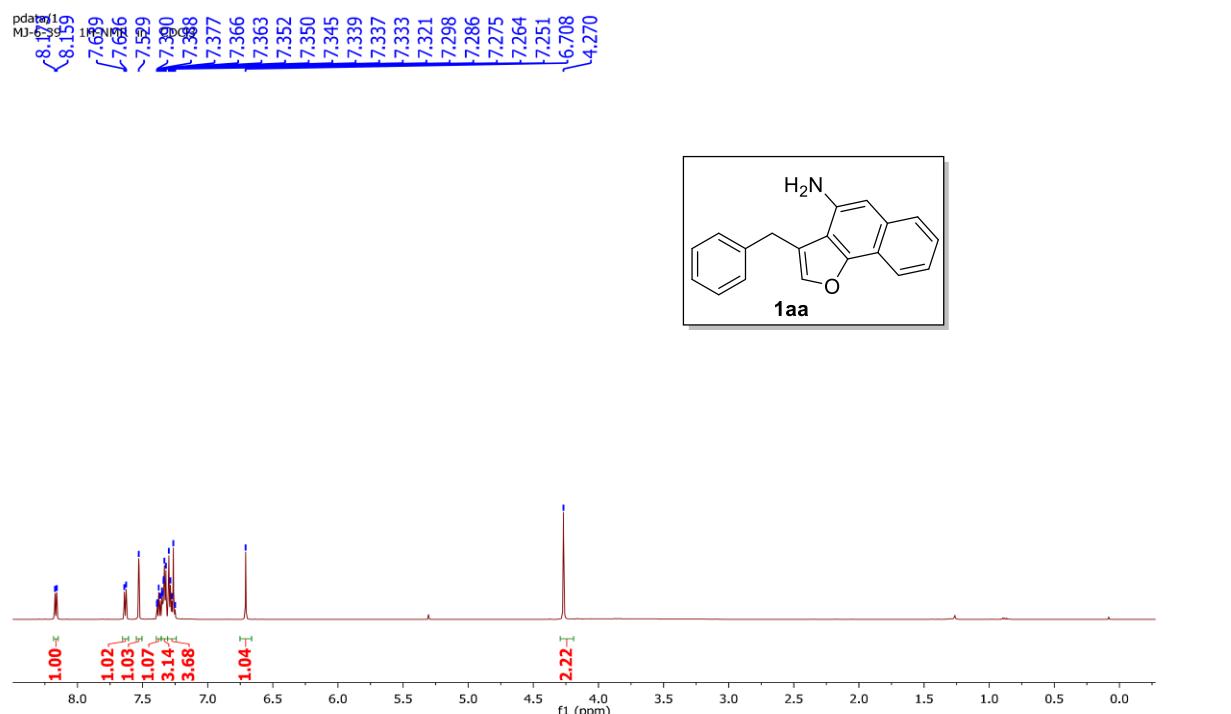
Scheme S4 : Reactions and Conditions : a) Pd(PPh₃)₂Cl₂, CuI, Et₃N, DMF, 0 °C-rt, 2-7 h, 60-85% ; b) *p*-TsOH.H₂O, Acetone, 0 °C-rt, 3.5-5 h, 47-70%.

7. References

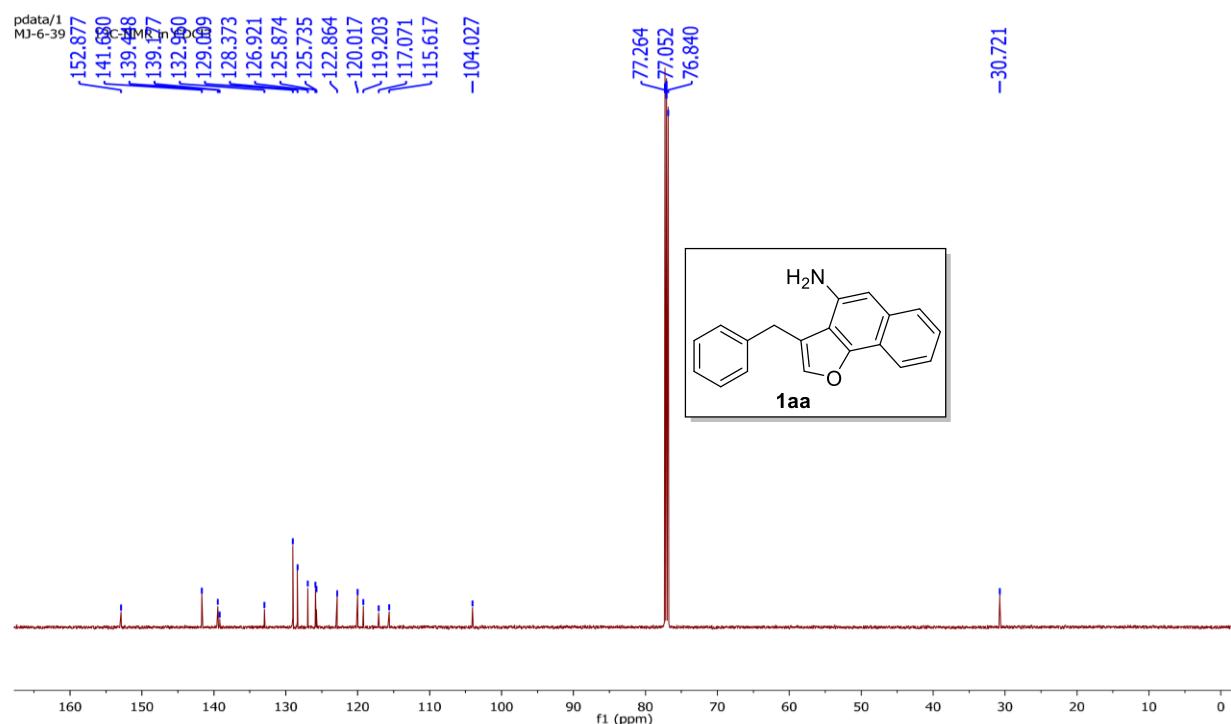
- Sheldrick, G. M. *Acta Crystallogr., Sect. A*, Phase Annealing in SHEXL-90: Direct Methods for Larger Structures. **1990**, *46*, 467.
- Sheldrick, G. M. SHEXL - 97, Program for Crystallography Refinement, University of Gottingen: Gottingen, Germany, **1997**.

8. NMR Spectra of Compounds 1aa-1aj :

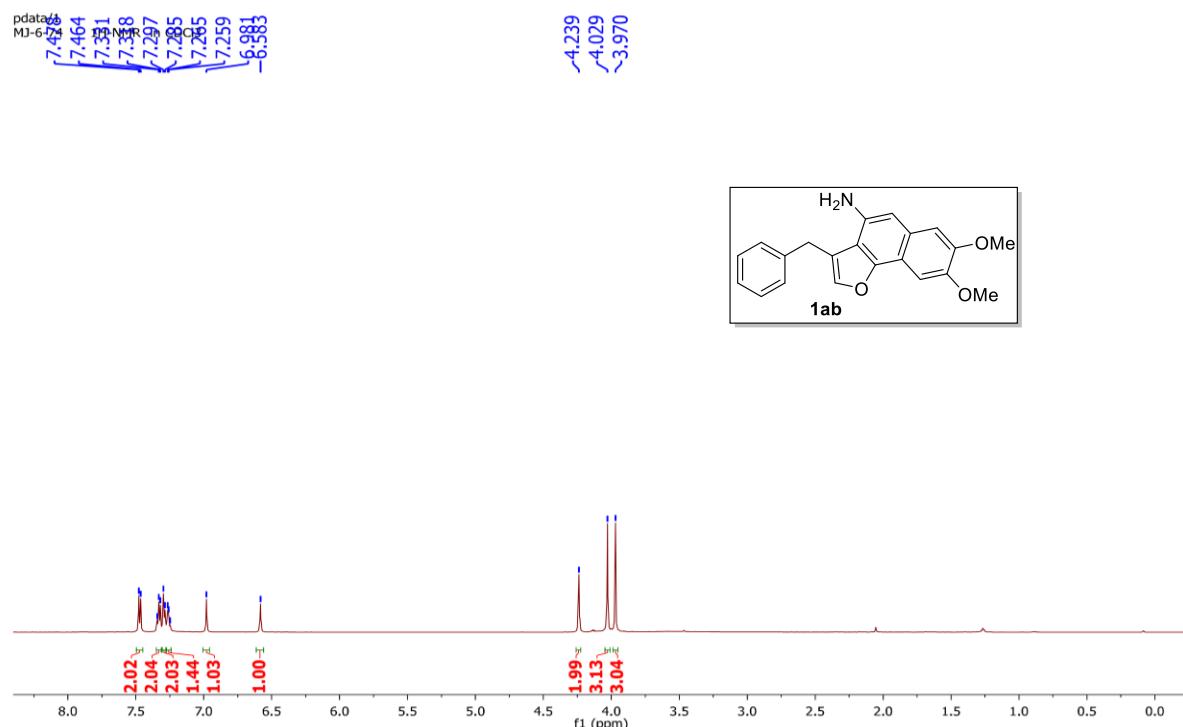
^1H NMR (600 MHz) of 1aa



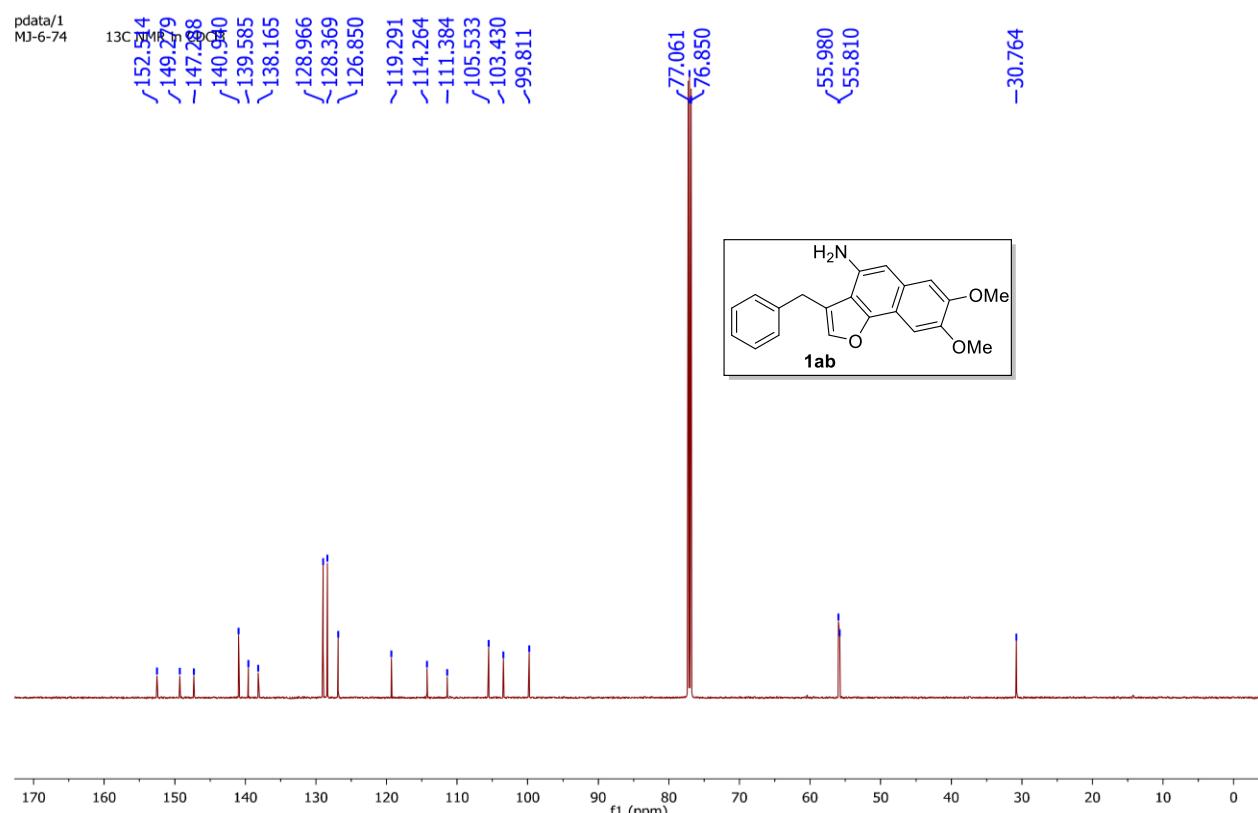
$^{13}\text{C}\{^1\text{H}\}$ NMR (150 MHz) of 1aa



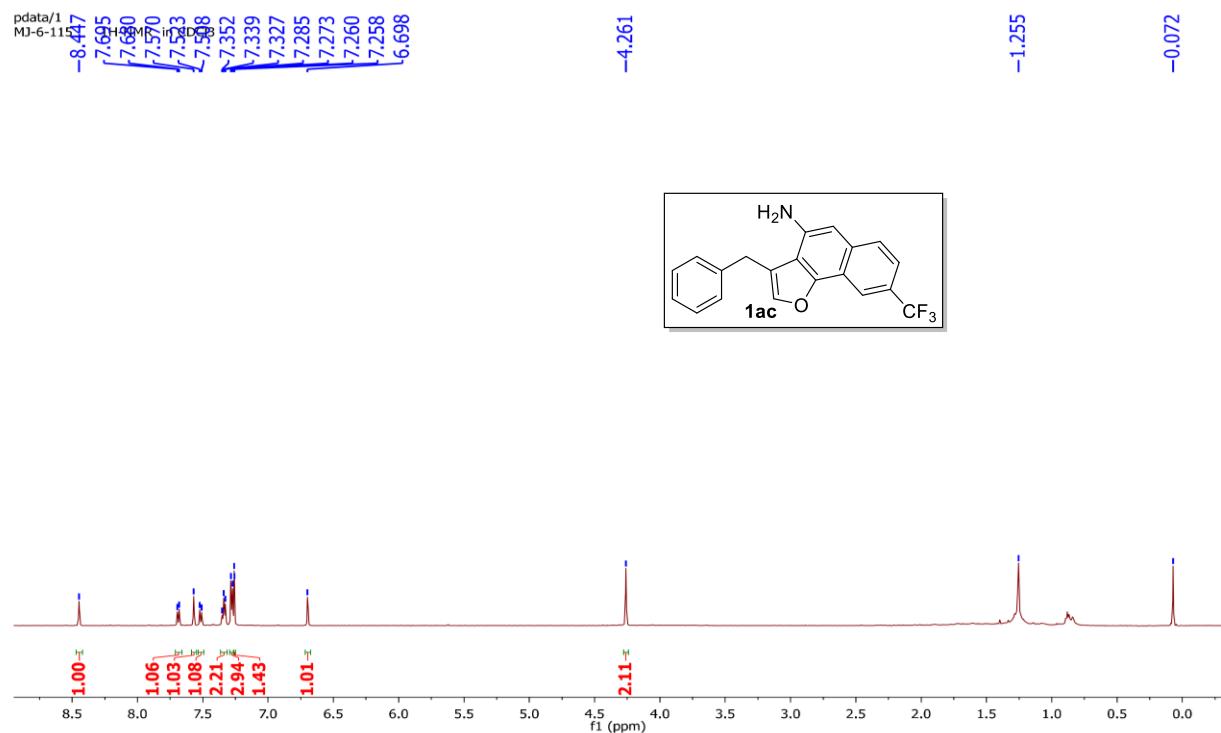
¹H NMR (600 MHz) of **1ab**:



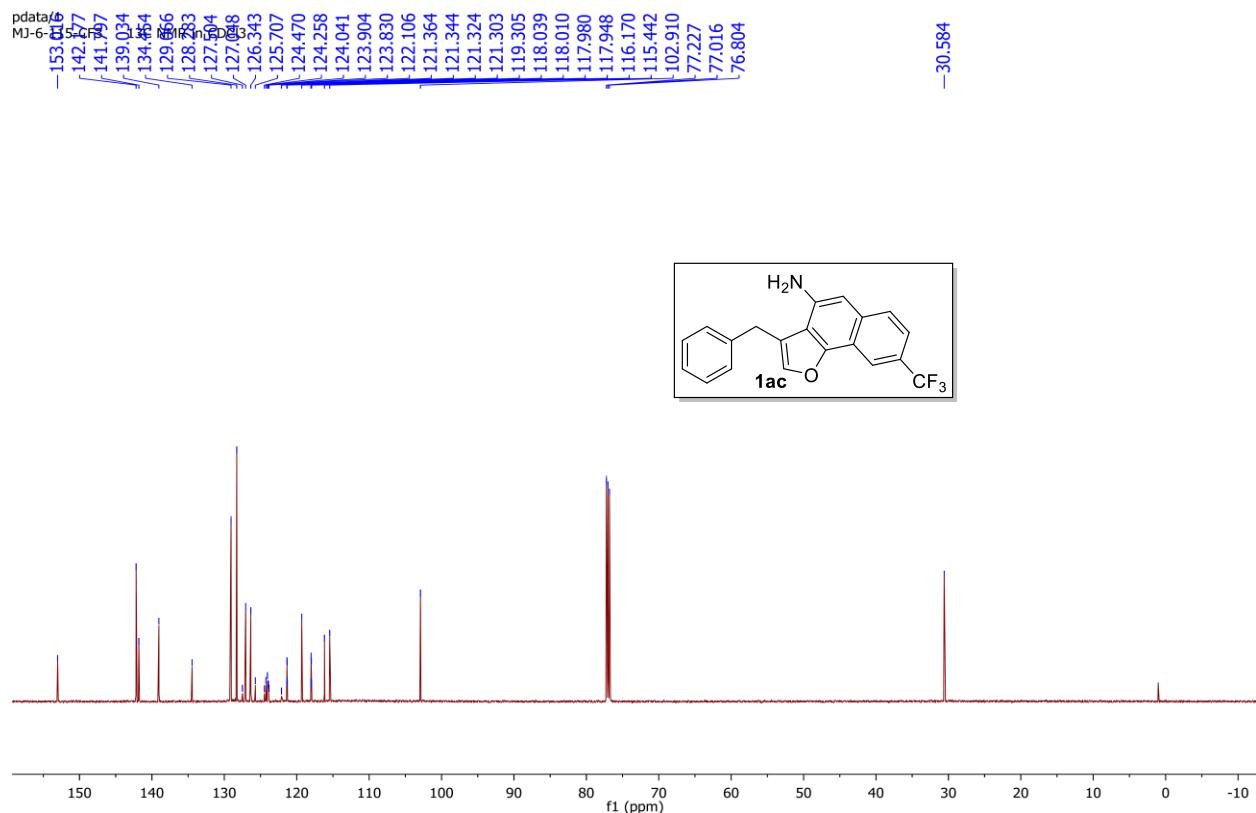
¹³C{¹H} NMR (150 MHz) of **1ab**:



¹H NMR (600 MHz) of **1ac**:

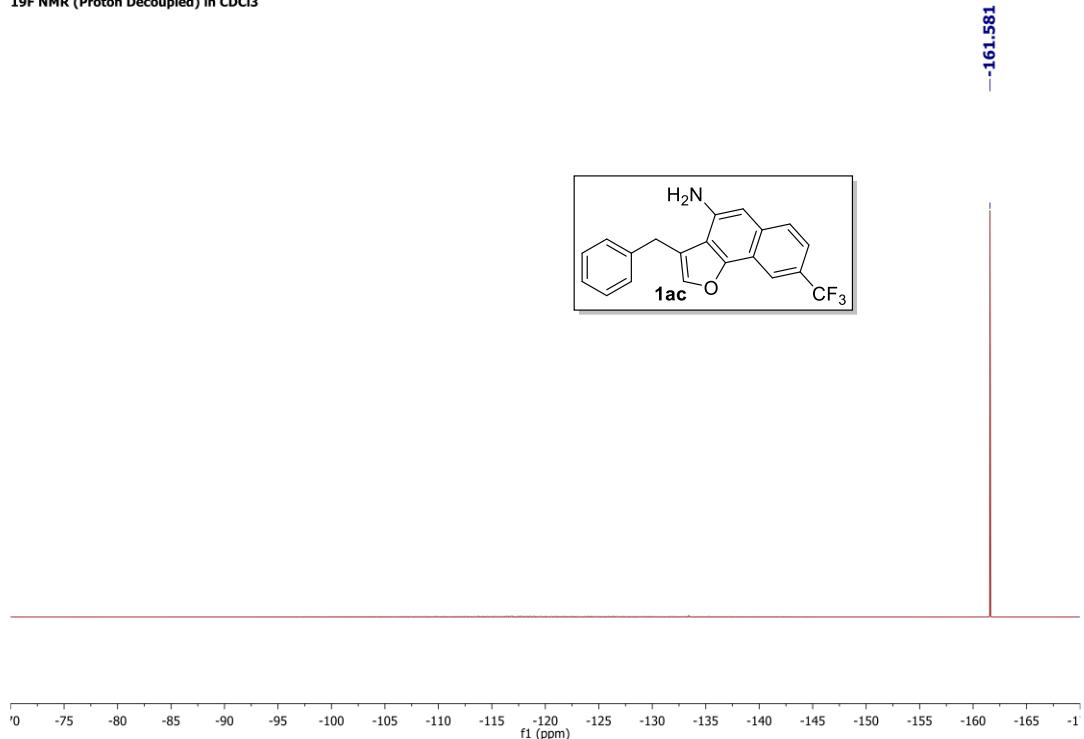


¹³C{¹H} NMR (150 MHz) of **1ac**:

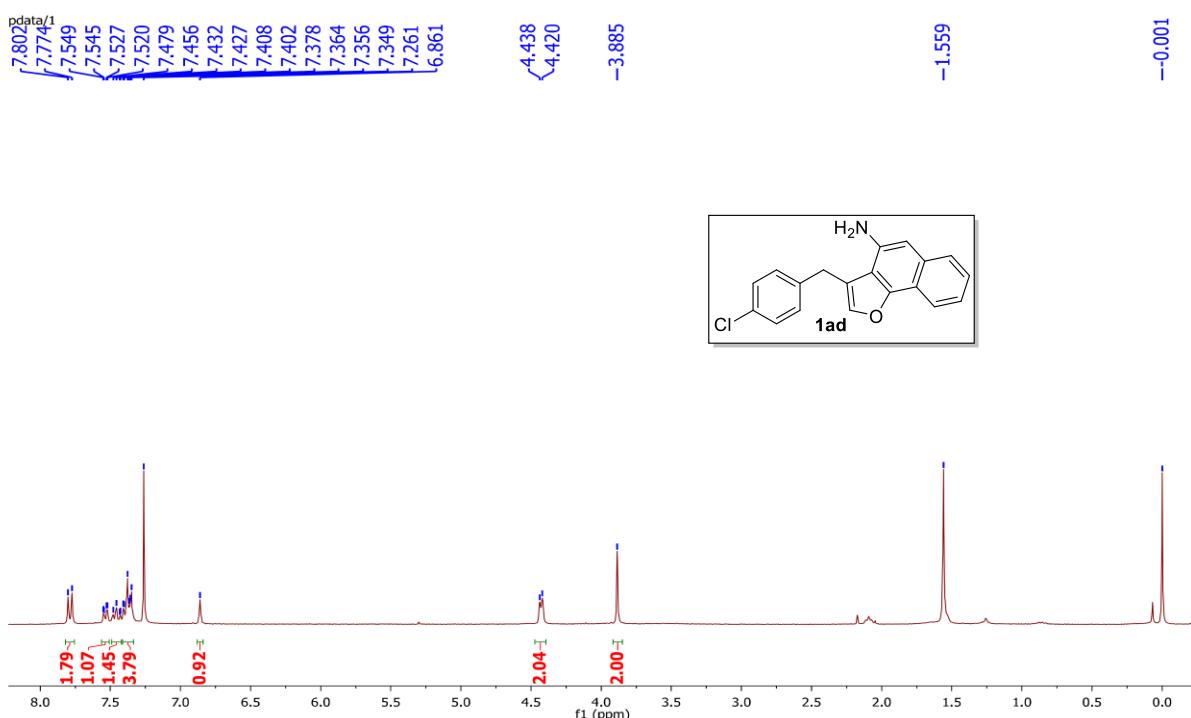


$^{19}\text{F}\{\text{H}\}$ NMR (376 MHz) of **1ac**:

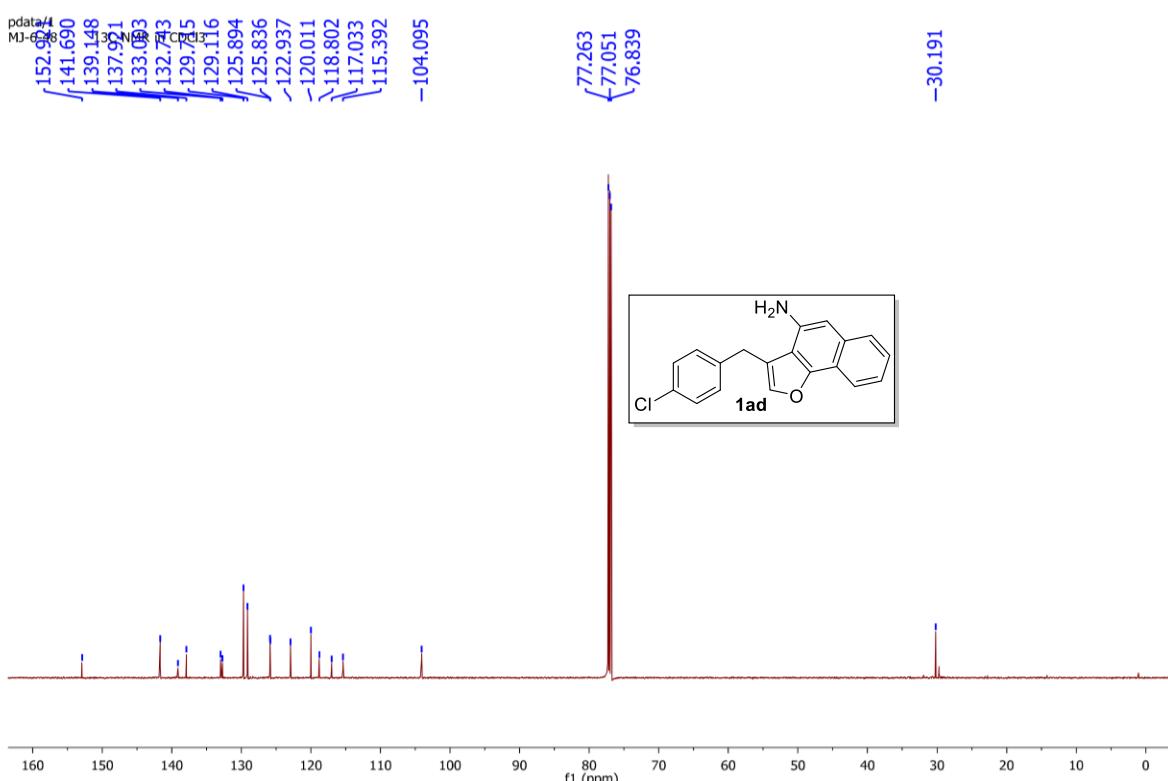
19F NMR (Proton Decoupled) in CDCl₃



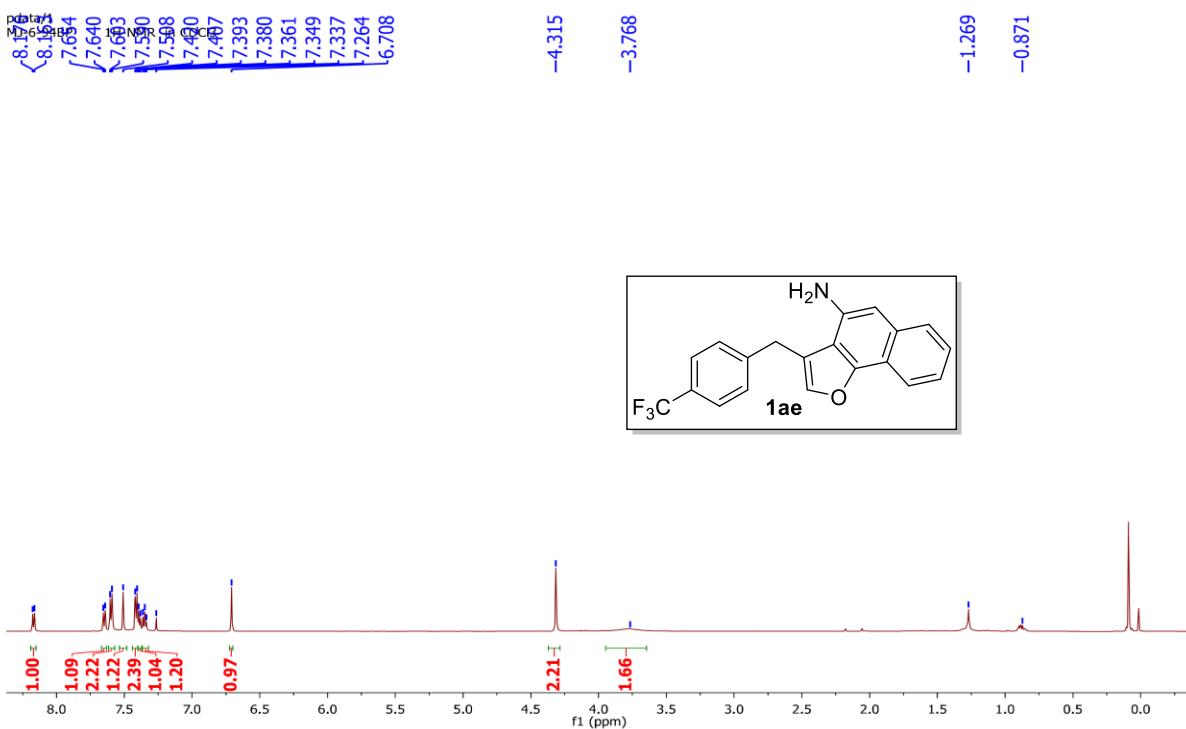
¹H NMR (600 MHz) of 1ad:



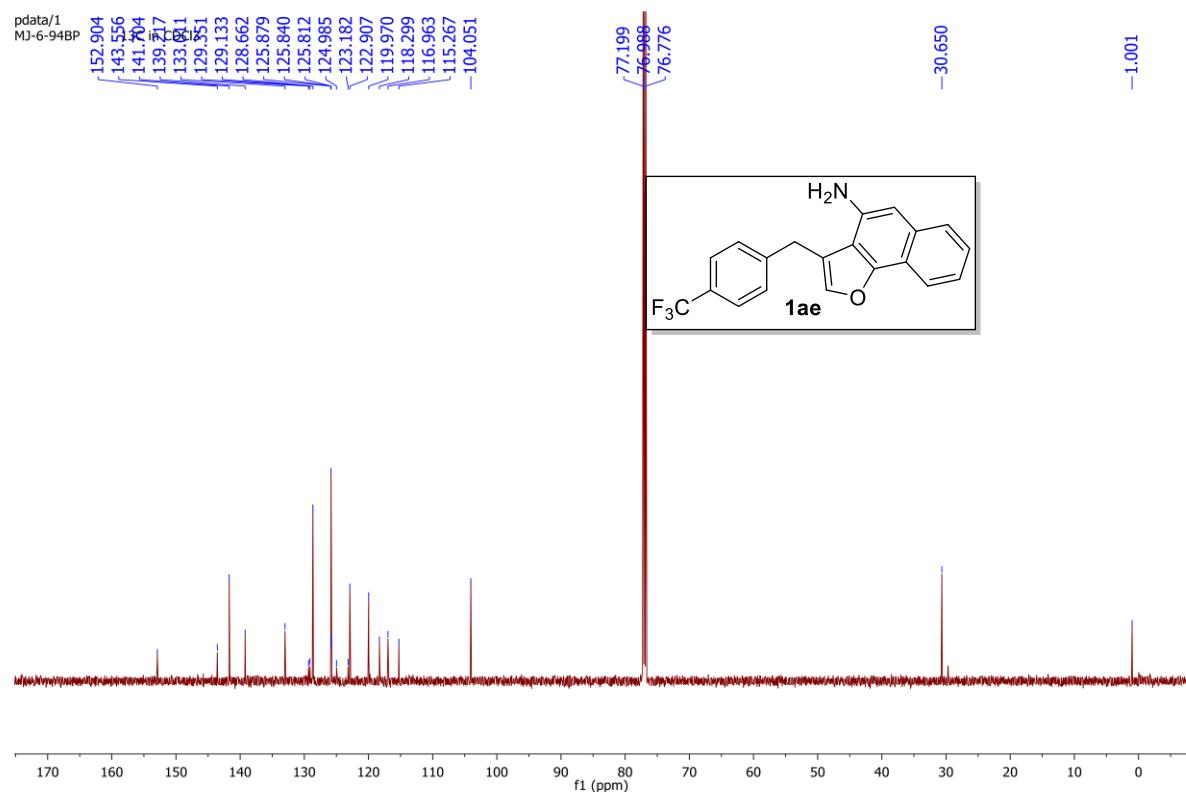
¹³C{¹H} NMR (150 MHz) of **1ad**:



¹H NMR (600 MHz) of **1ae**:



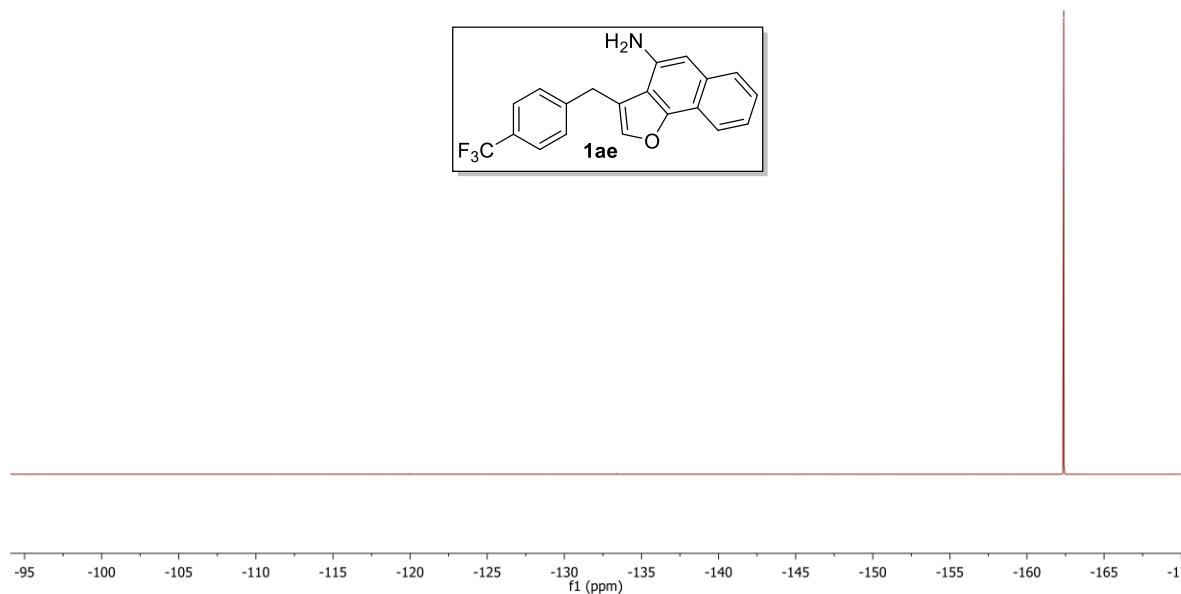
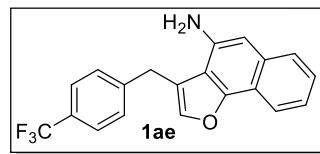
¹³C{¹H} NMR (150 MHz) of **1ae**:



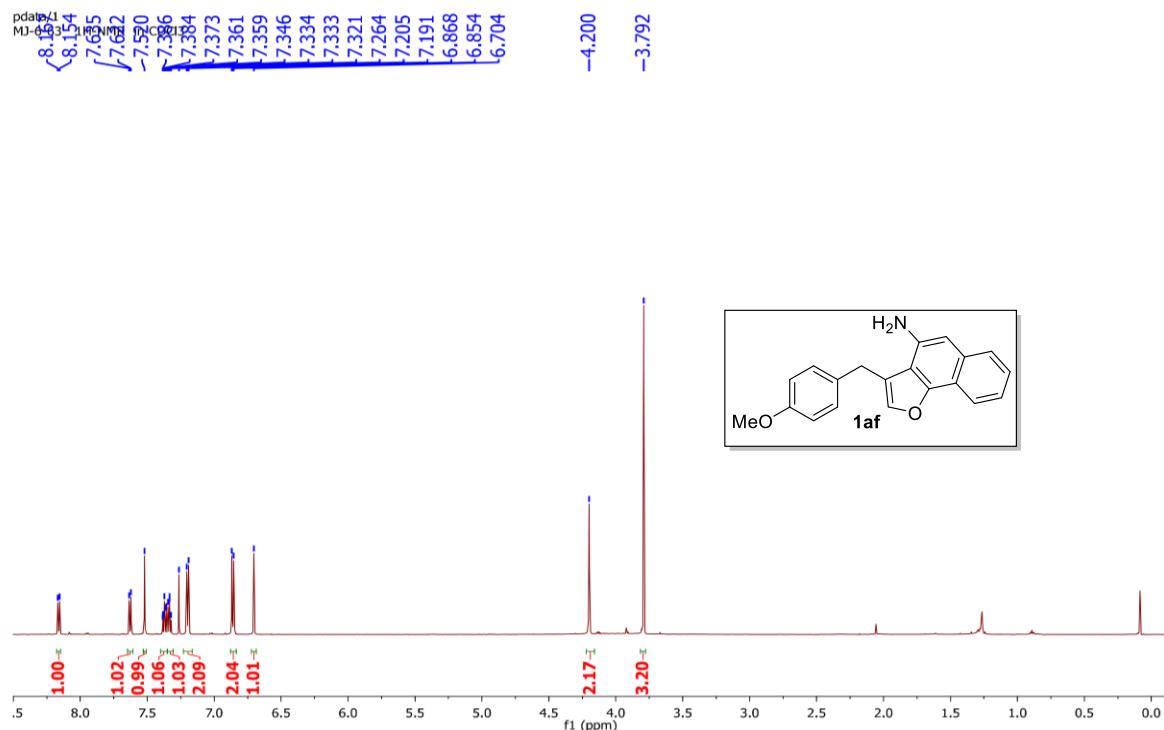
$^{19}\text{F}\{\text{H}\}$ NMR (376 MHz) of **1ae**:

19F NMR (Proton Decoupled) in CDCl₃

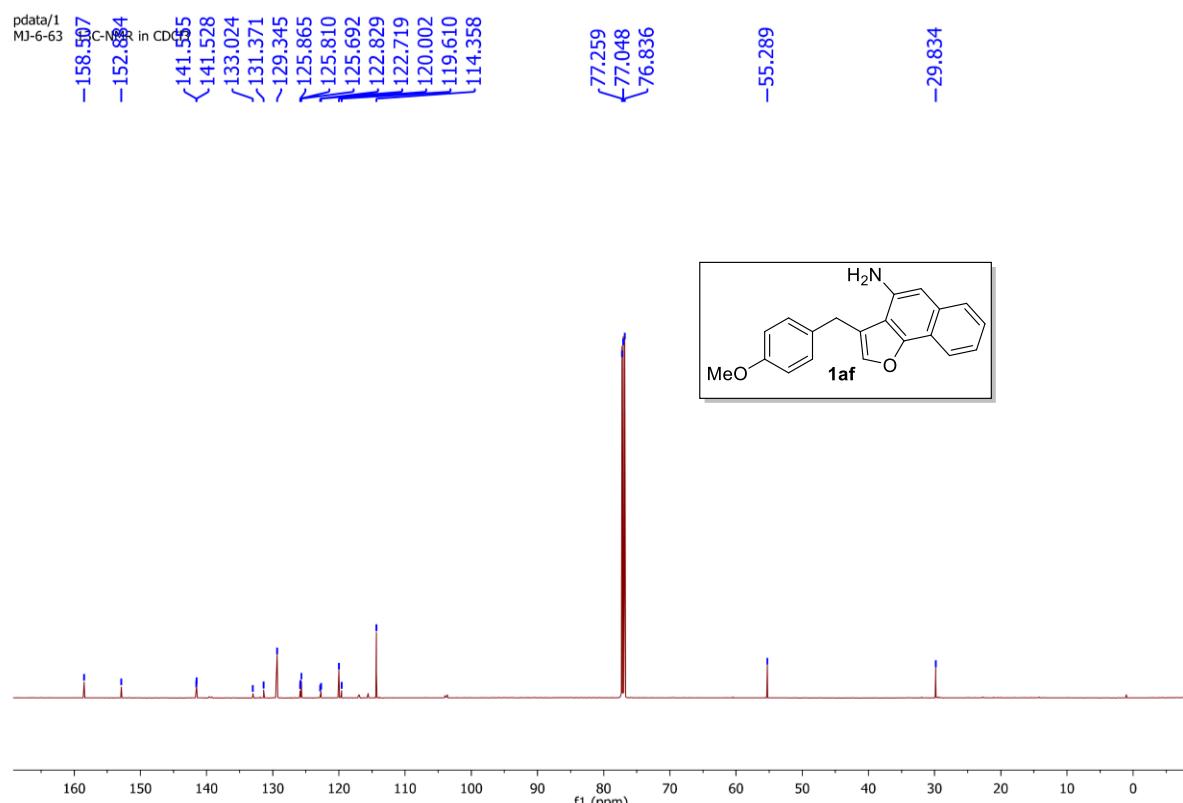
— -162.381



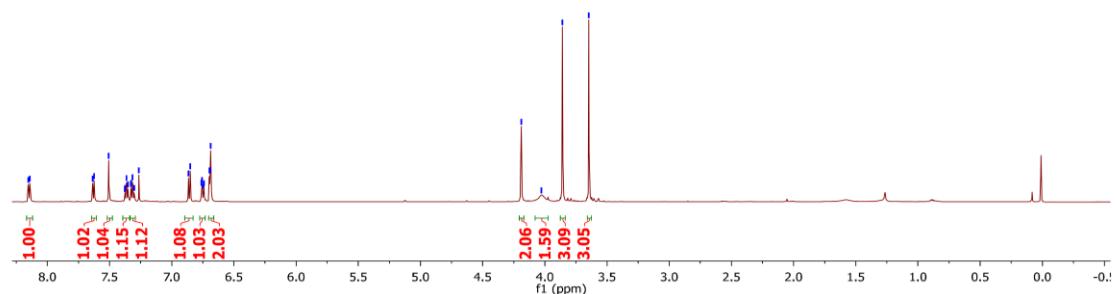
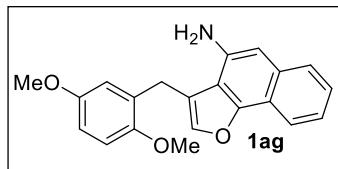
¹H NMR (600 MHz) of **1af**:



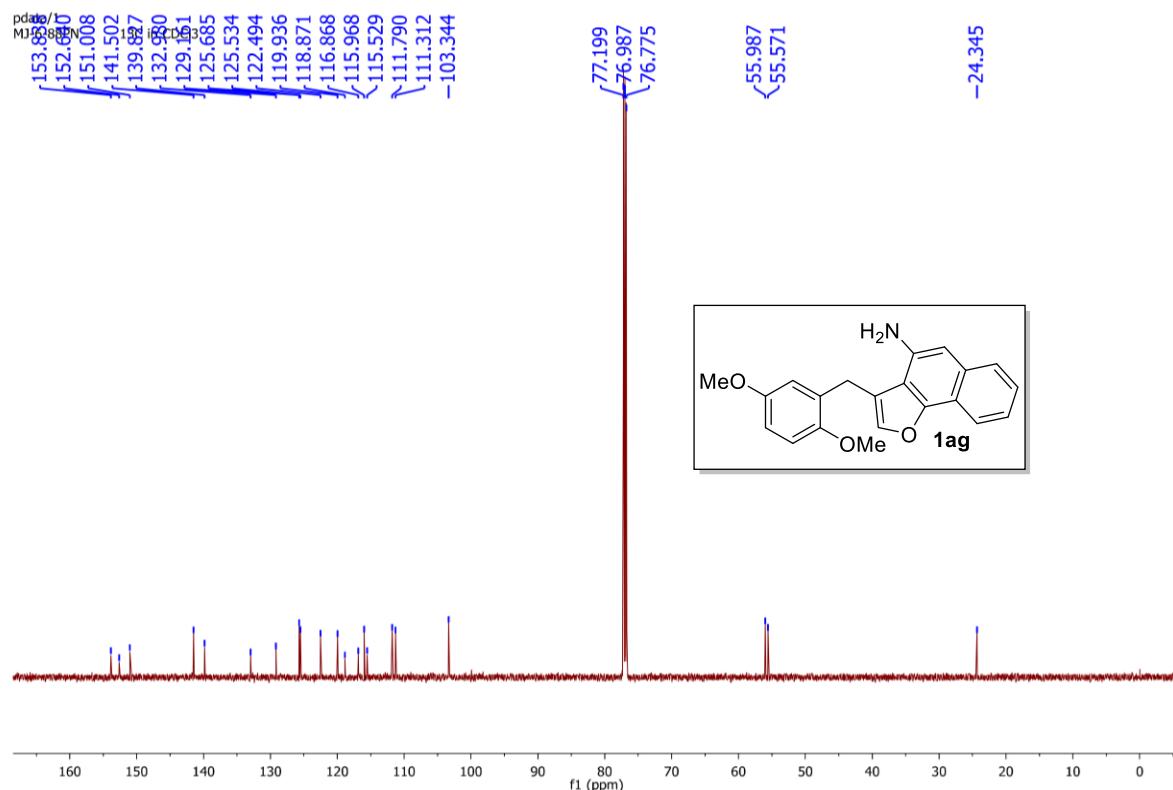
¹³C{¹H} NMR (150 MHz) of **1af**:



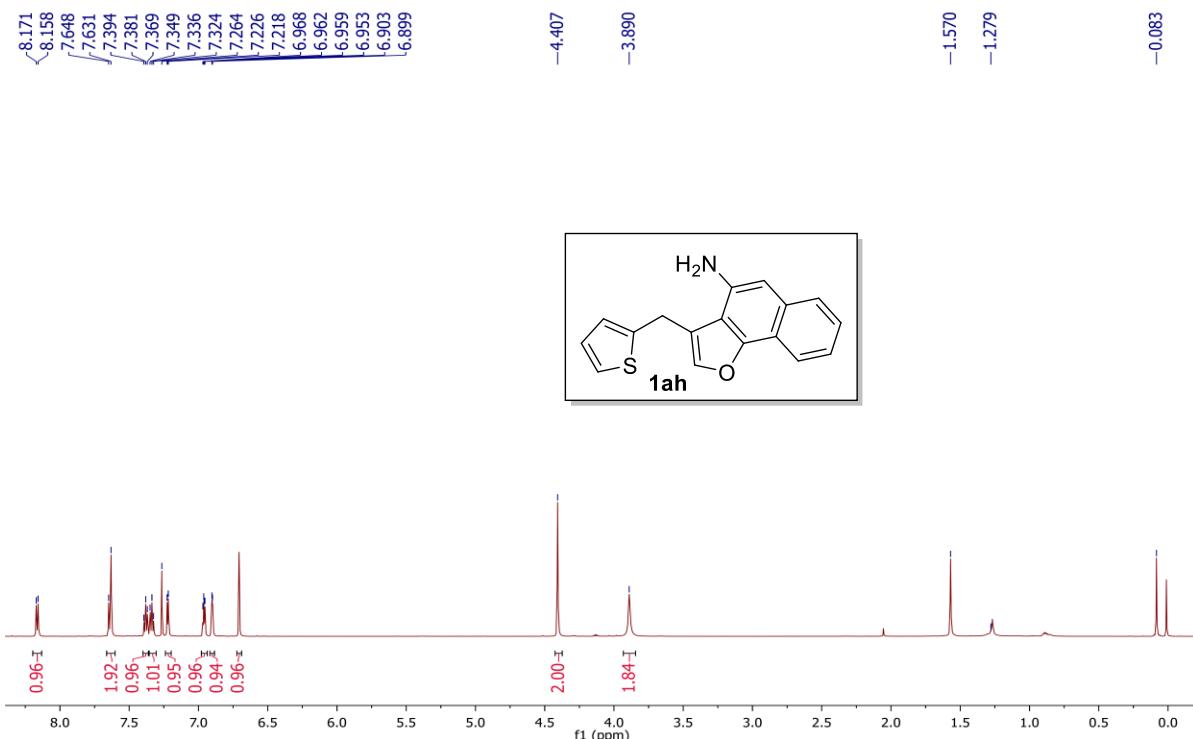
¹H NMR (600 MHz) of 1ag:



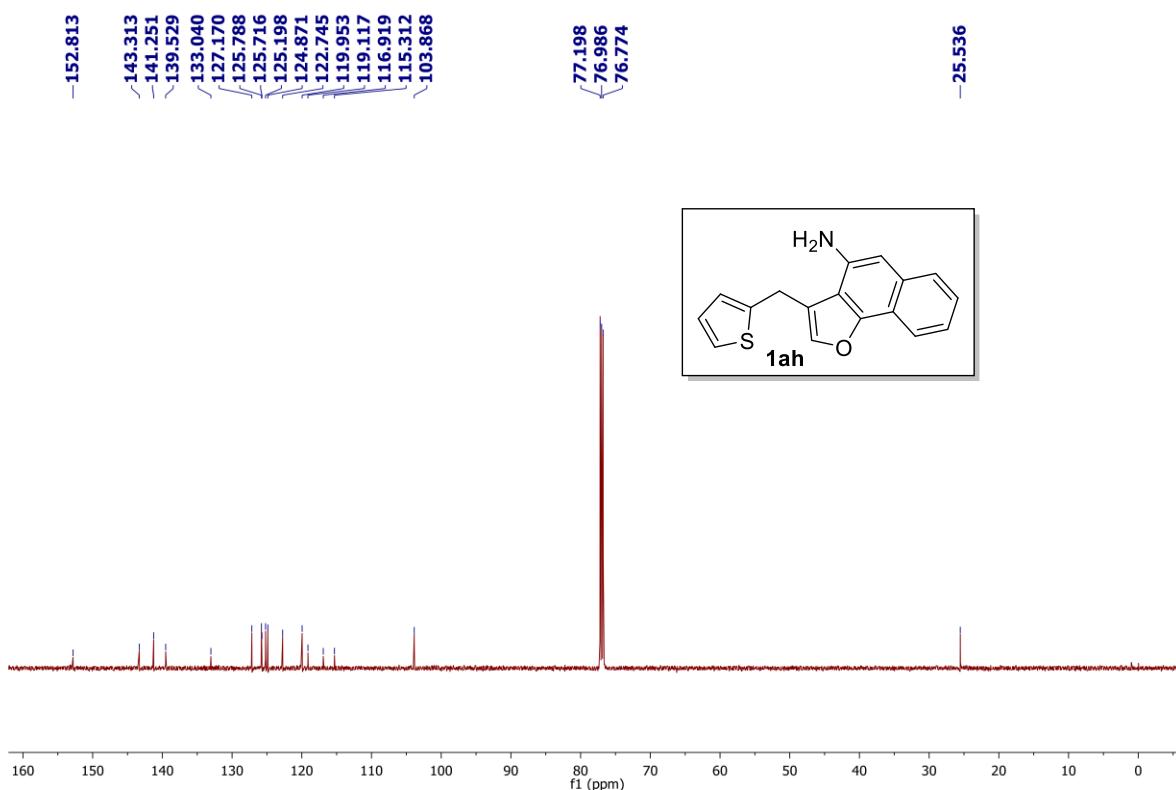
¹³C{¹H} NMR (150 MHz) of **1ag**:



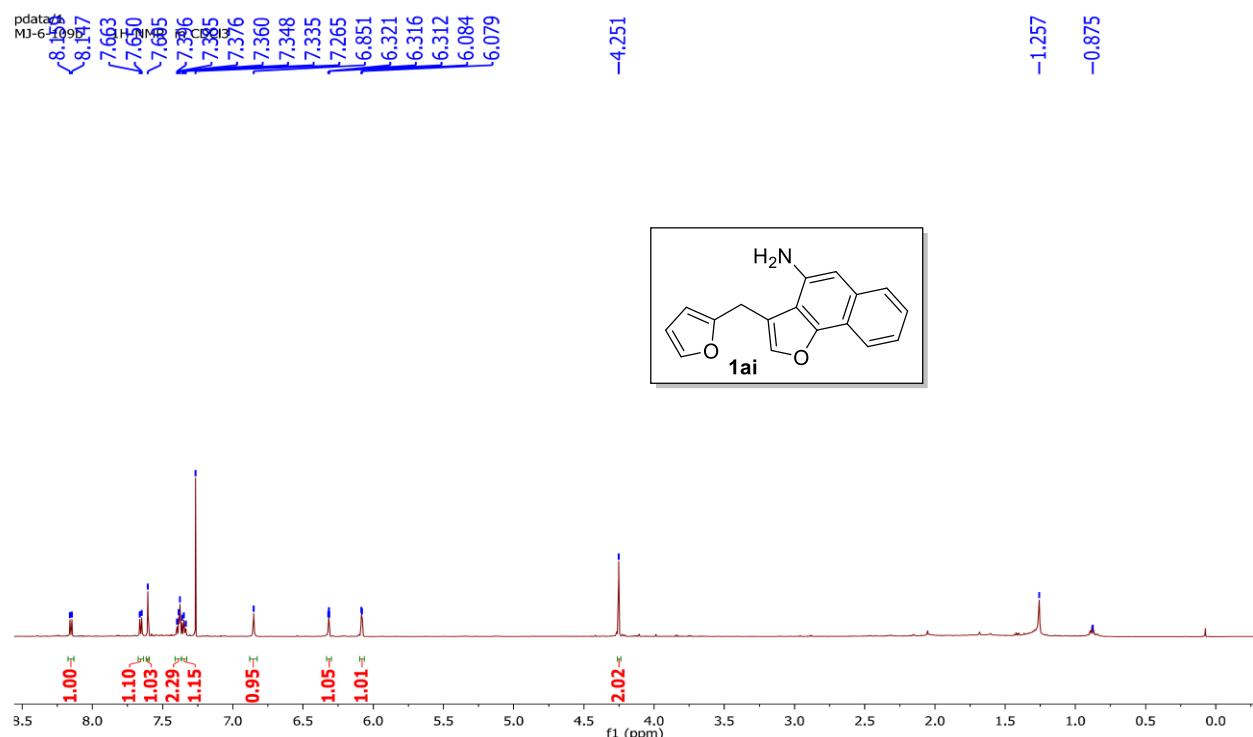
¹H NMR (600 MHz) of 1ah:



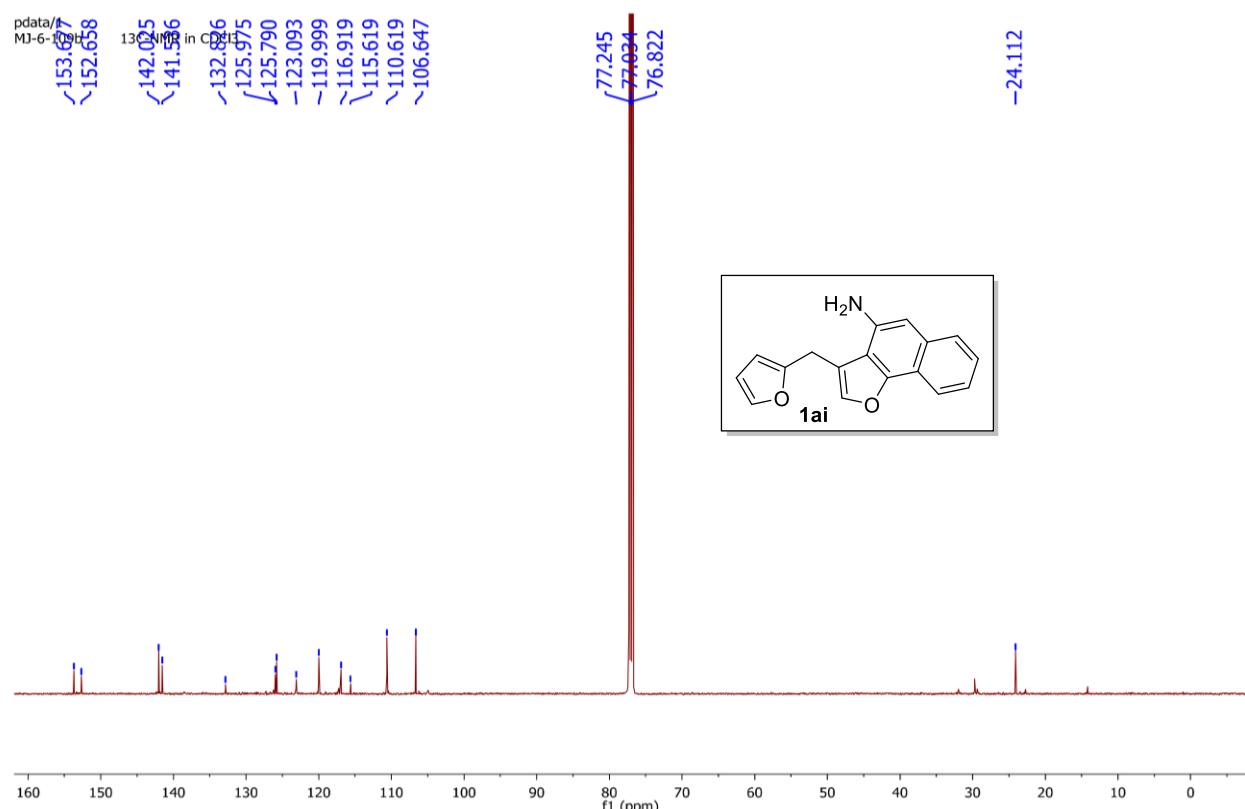
¹³C{¹H} NMR (150 MHz) of **1ah**:



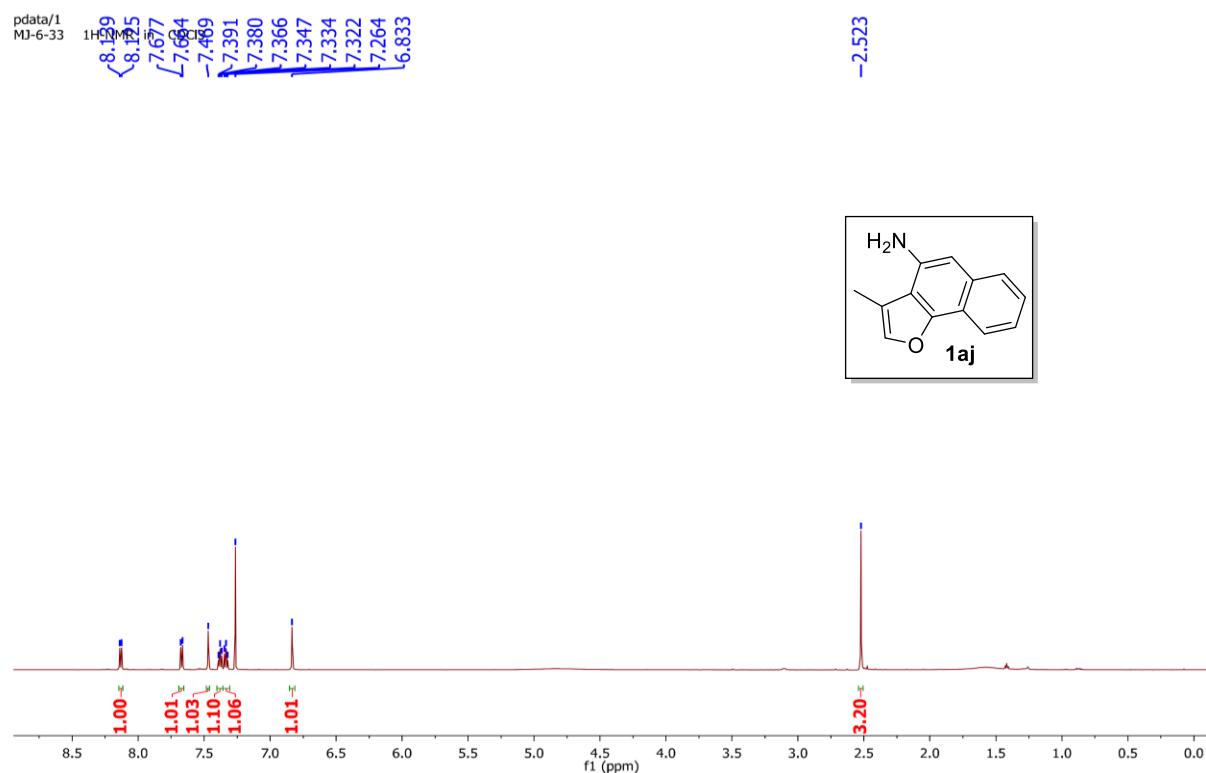
¹H NMR (600 MHz) of **1ai**:



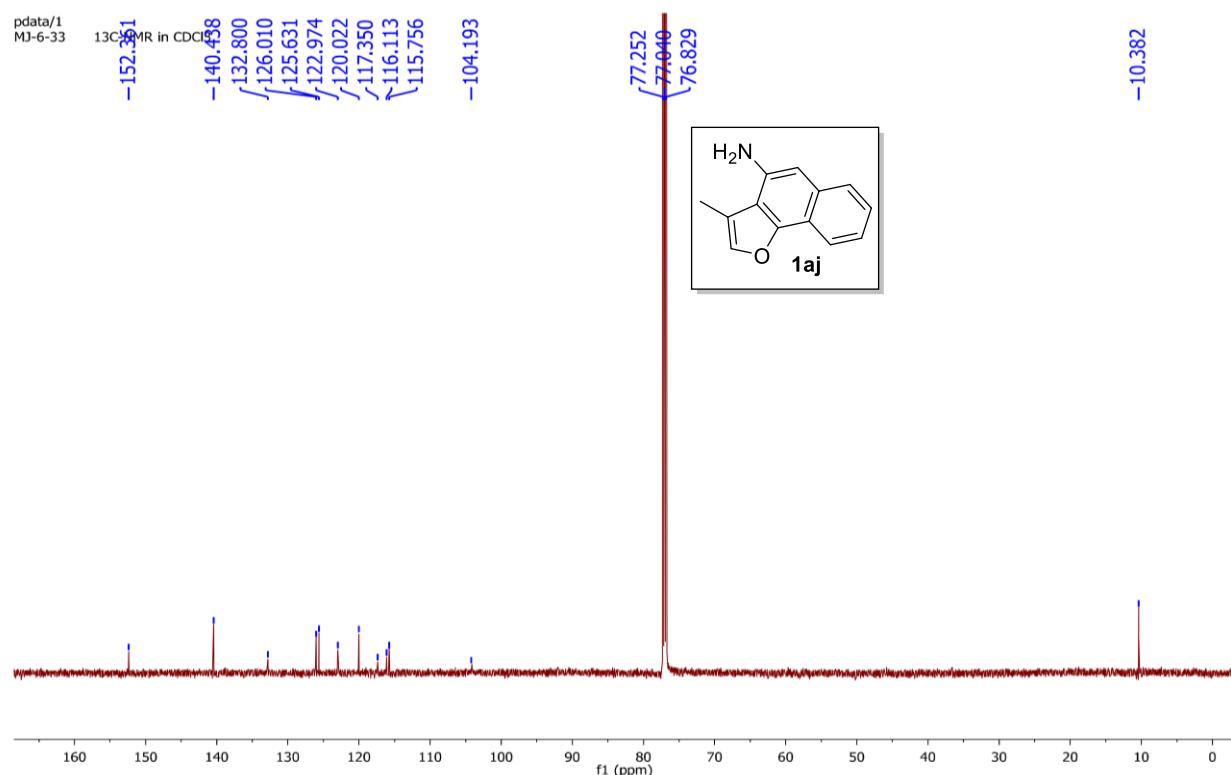
¹³C{¹H} NMR (150 MHz) of **1ai**:



¹H NMR(600 MHz) of **1aj**:

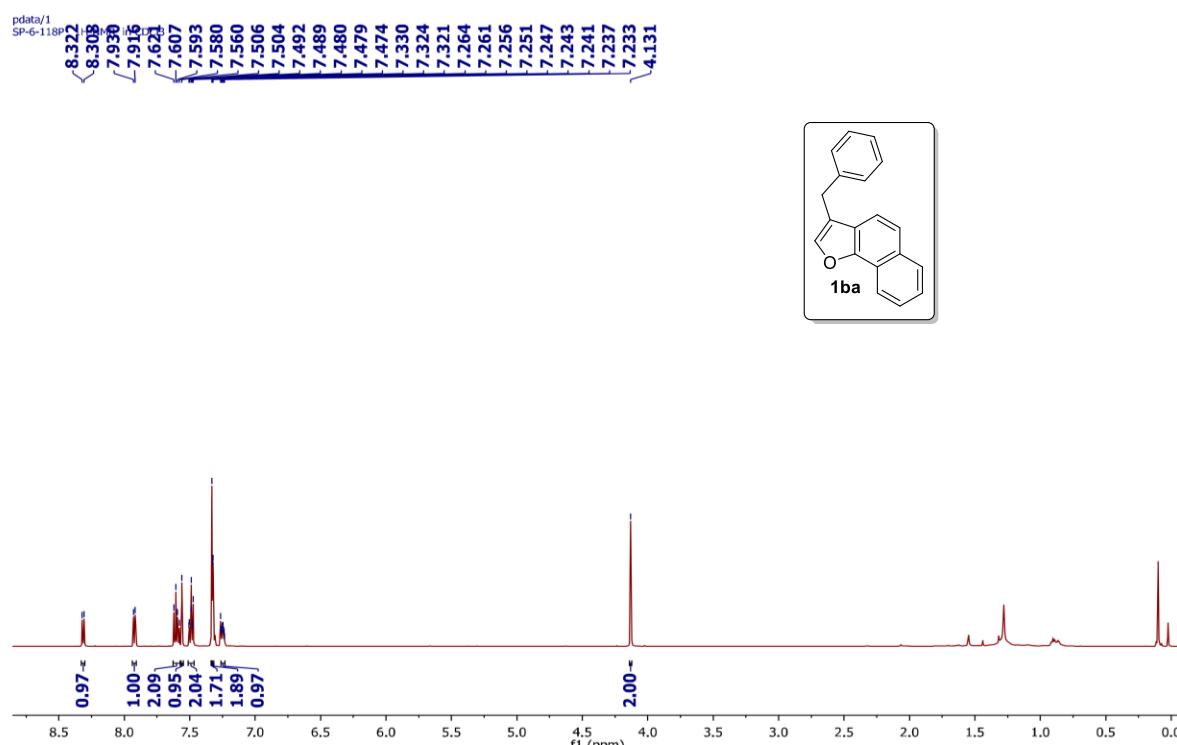


¹³C{¹H} NMR (600 MHz) of **1aj**:

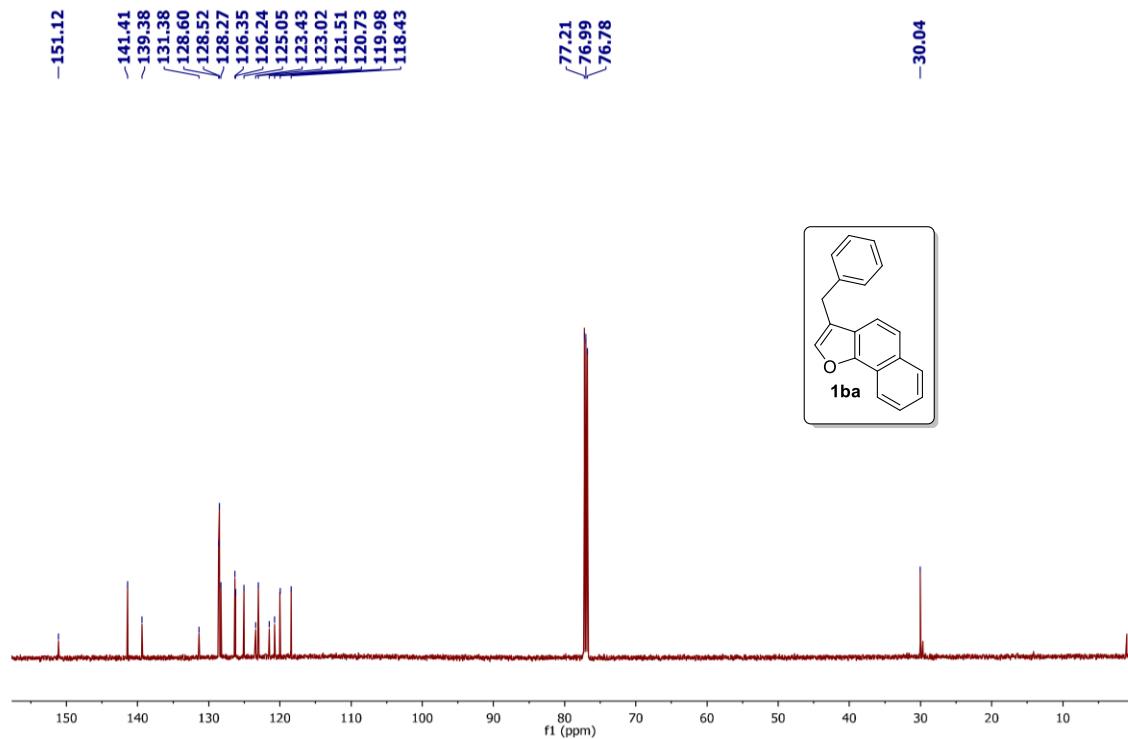


9. NMR Spectra of Compounds **1ba**-**1bg** :

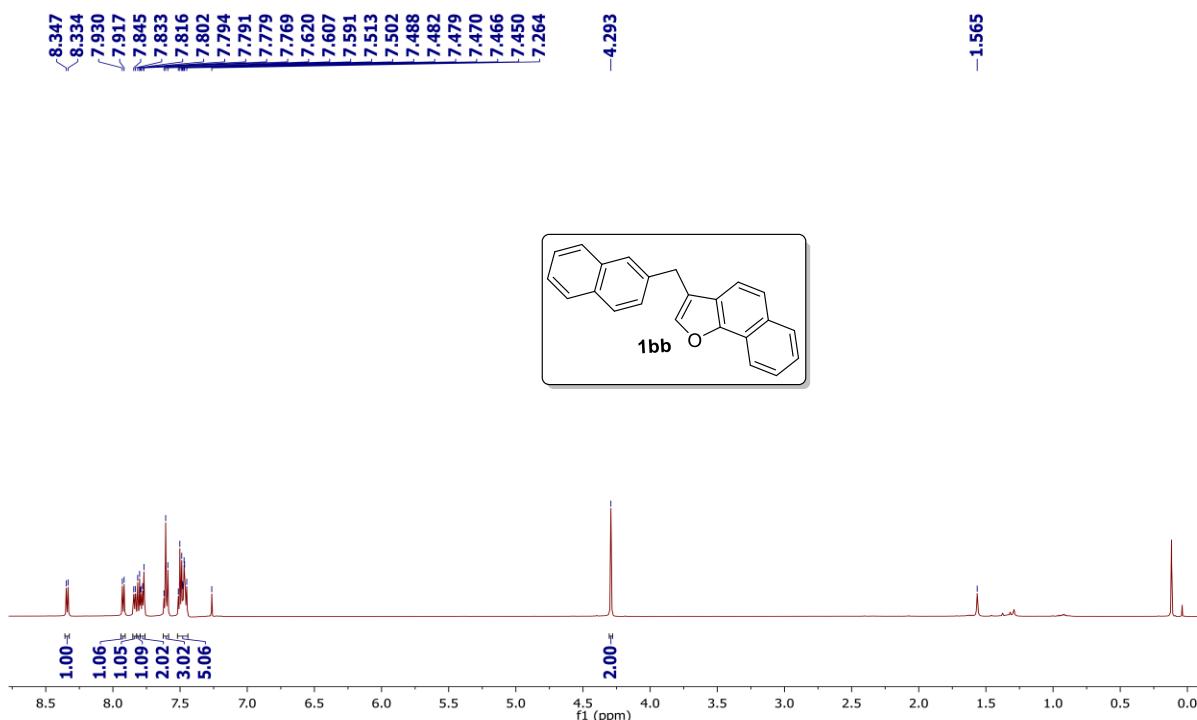
¹H NMR (600 MHz) of **1ba**:



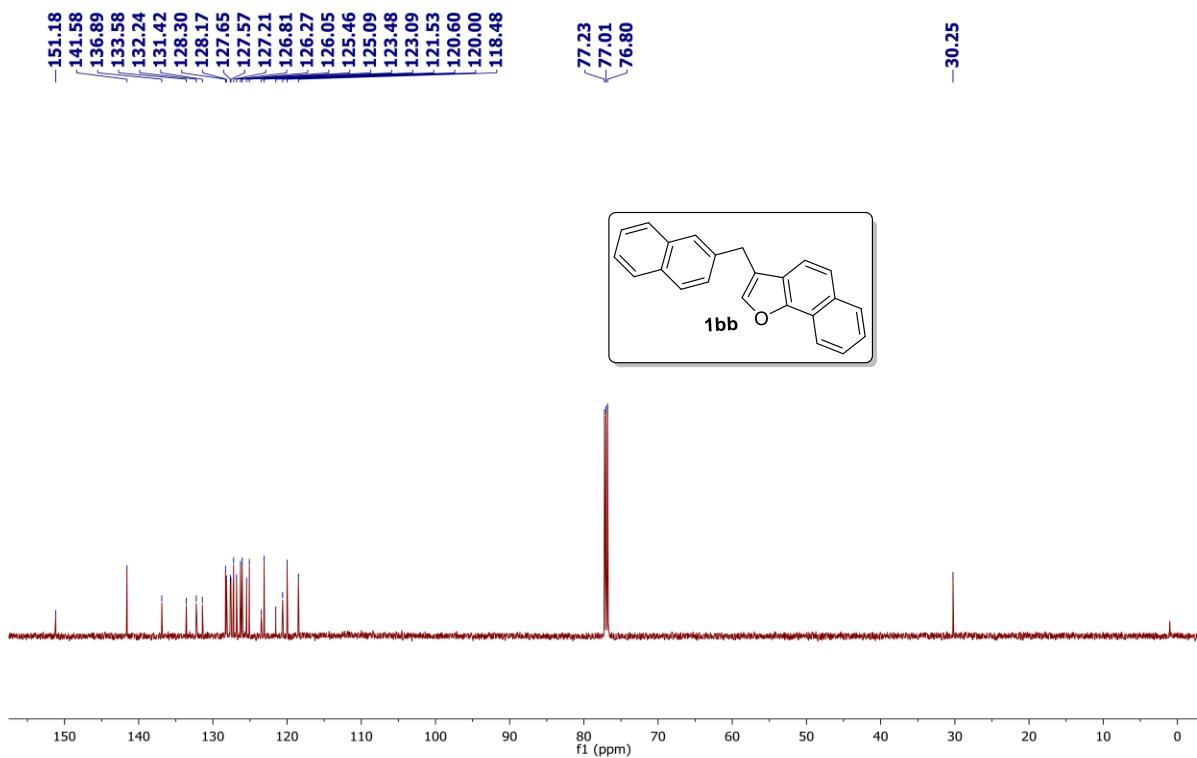
¹³C{¹H} NMR (150 MHz) of **1ba**:



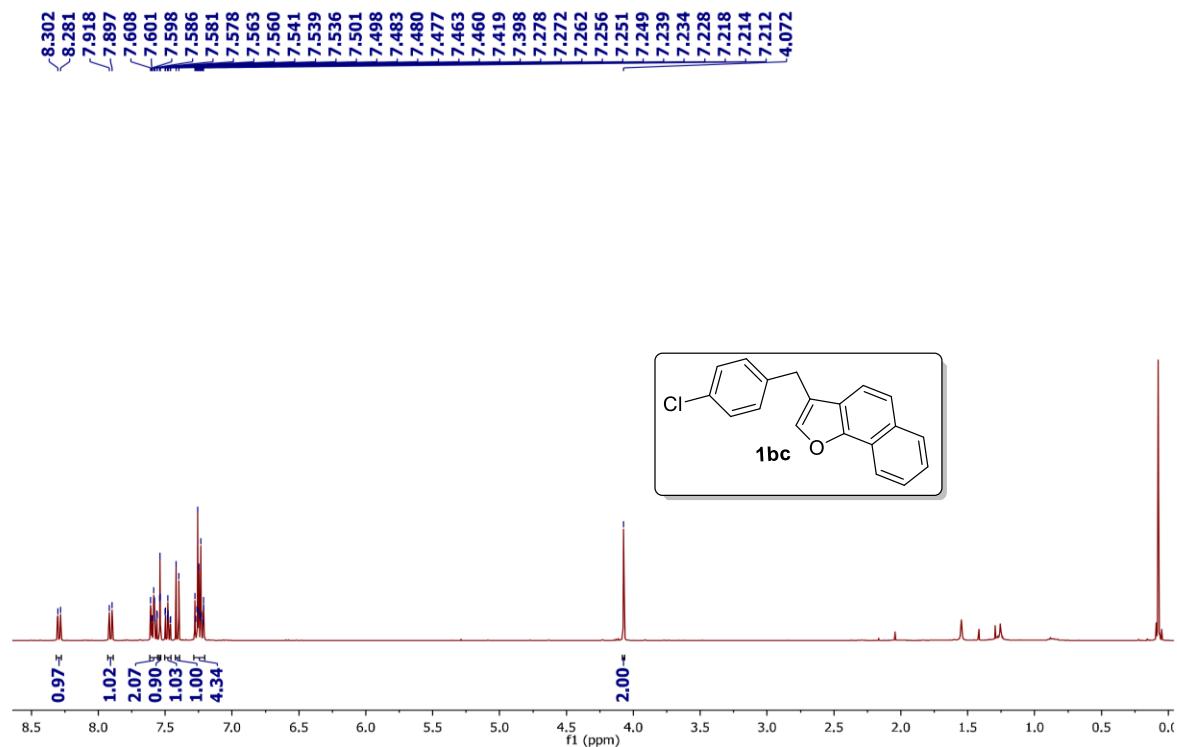
¹H NMR(600 MHz) of **1bb**:



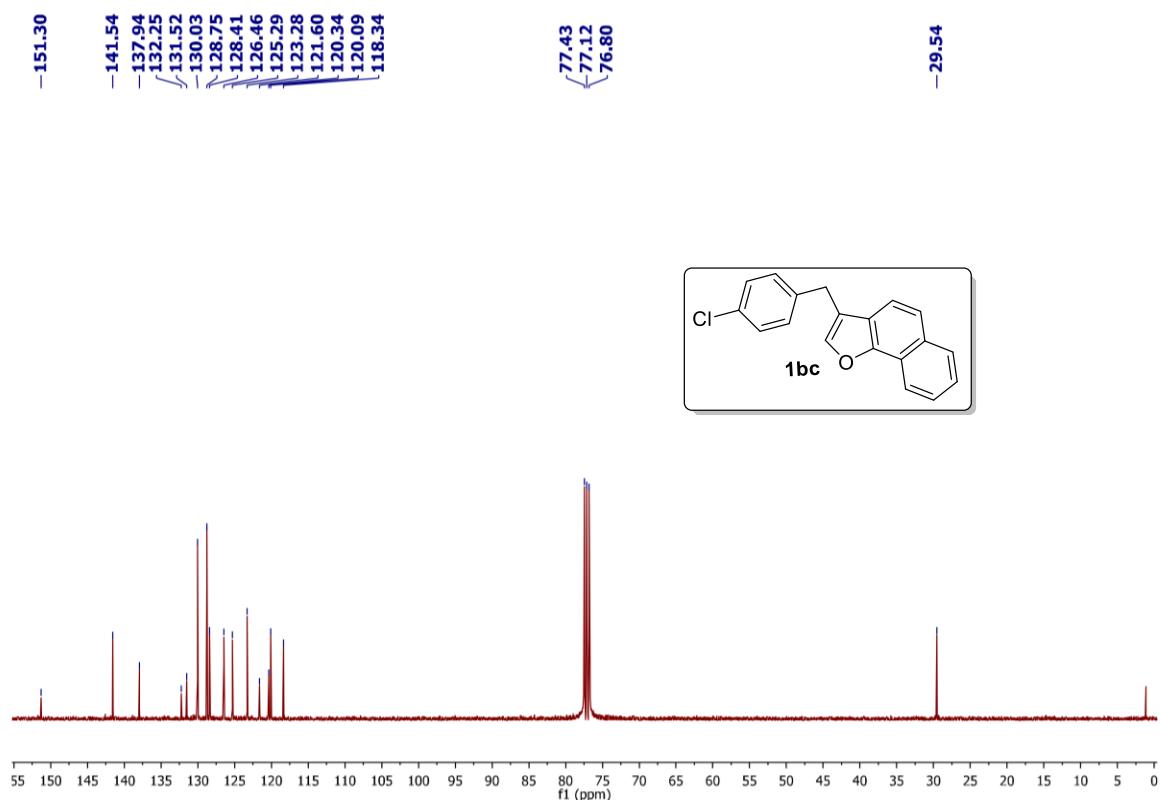
¹³C{¹H} NMR (150 MHz) of **1bb**:



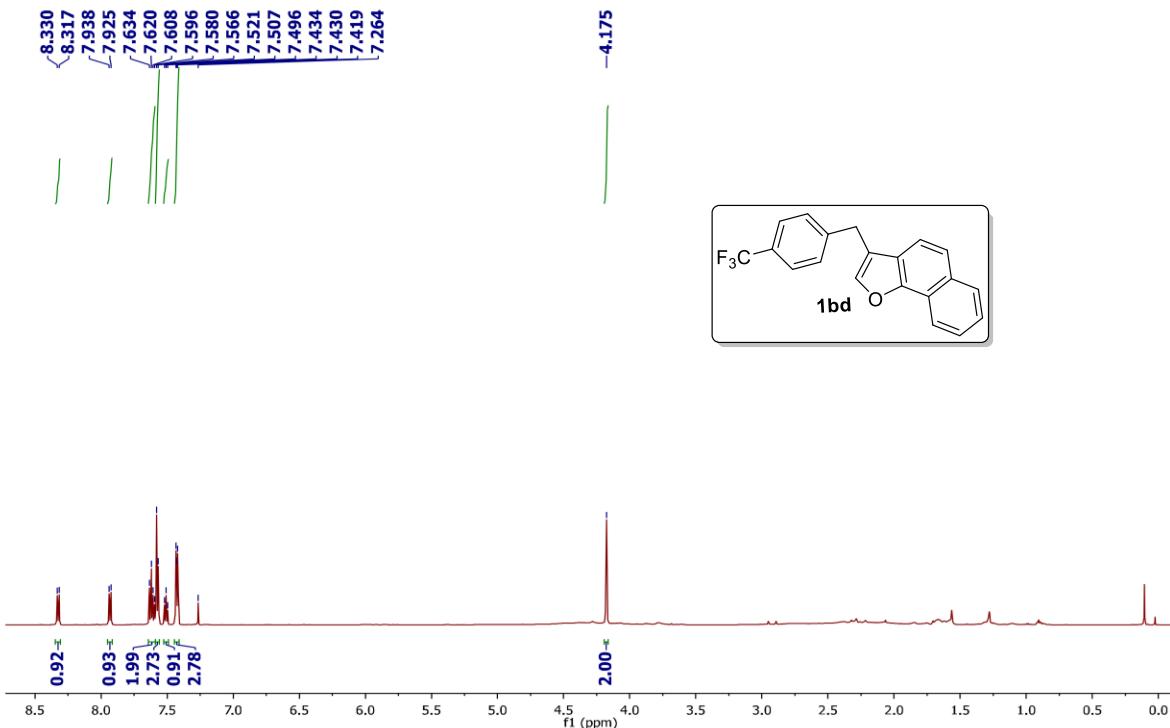
¹H NMR (400 MHz) of **1bc**:



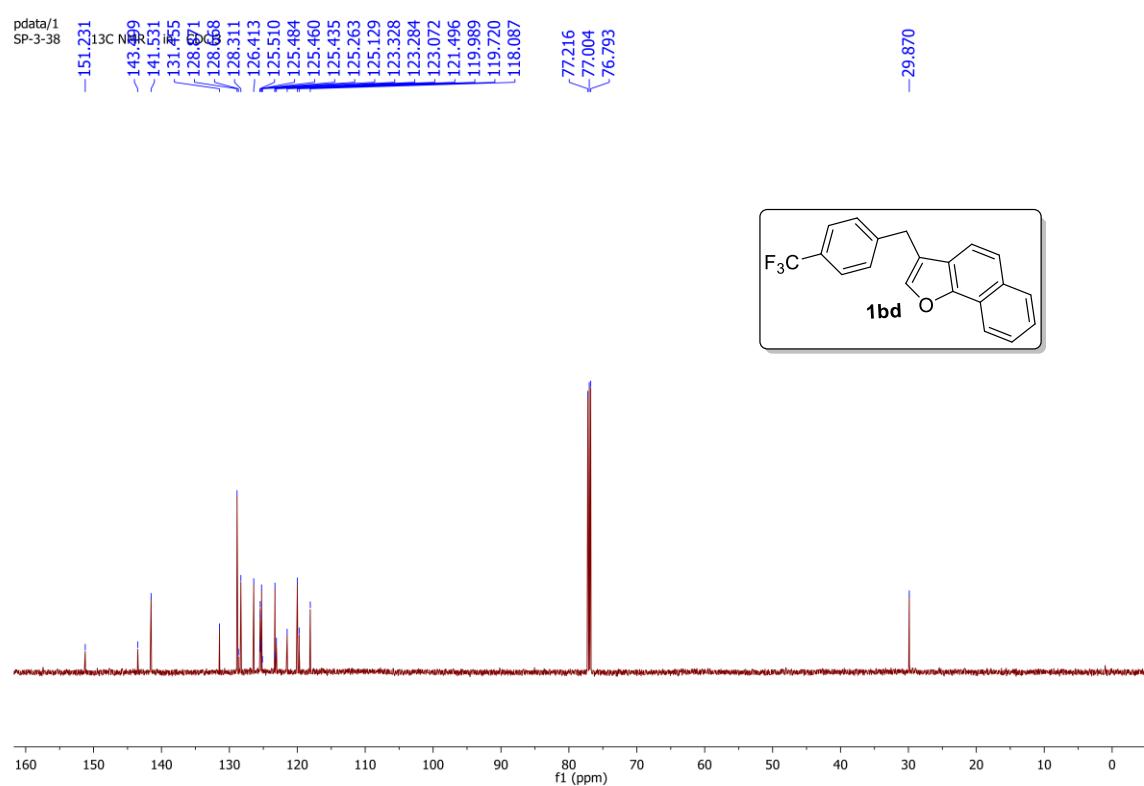
¹³C{¹H} NMR (100 MHz) of **1bc**:



¹H NMR (600 MHz) of **1bd**:

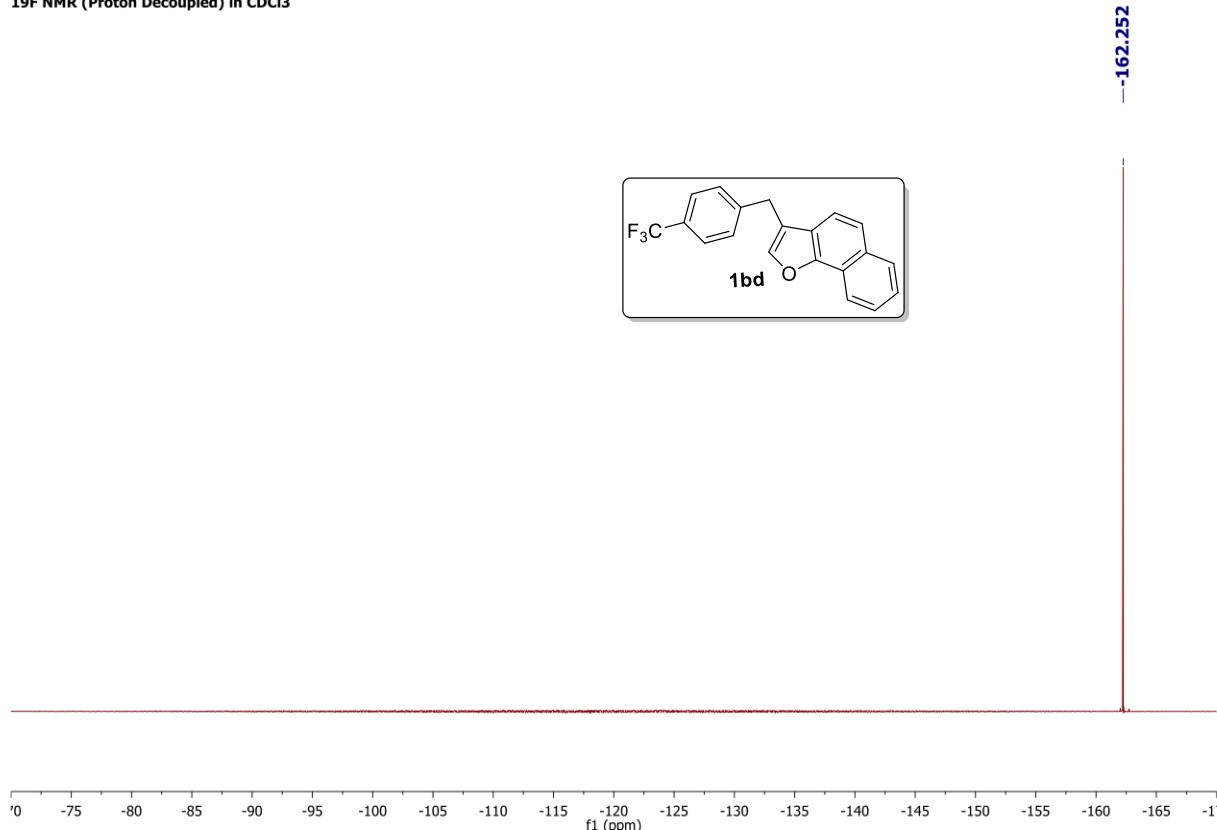


¹³C{¹H} NMR (150 MHz) of **1bd**:

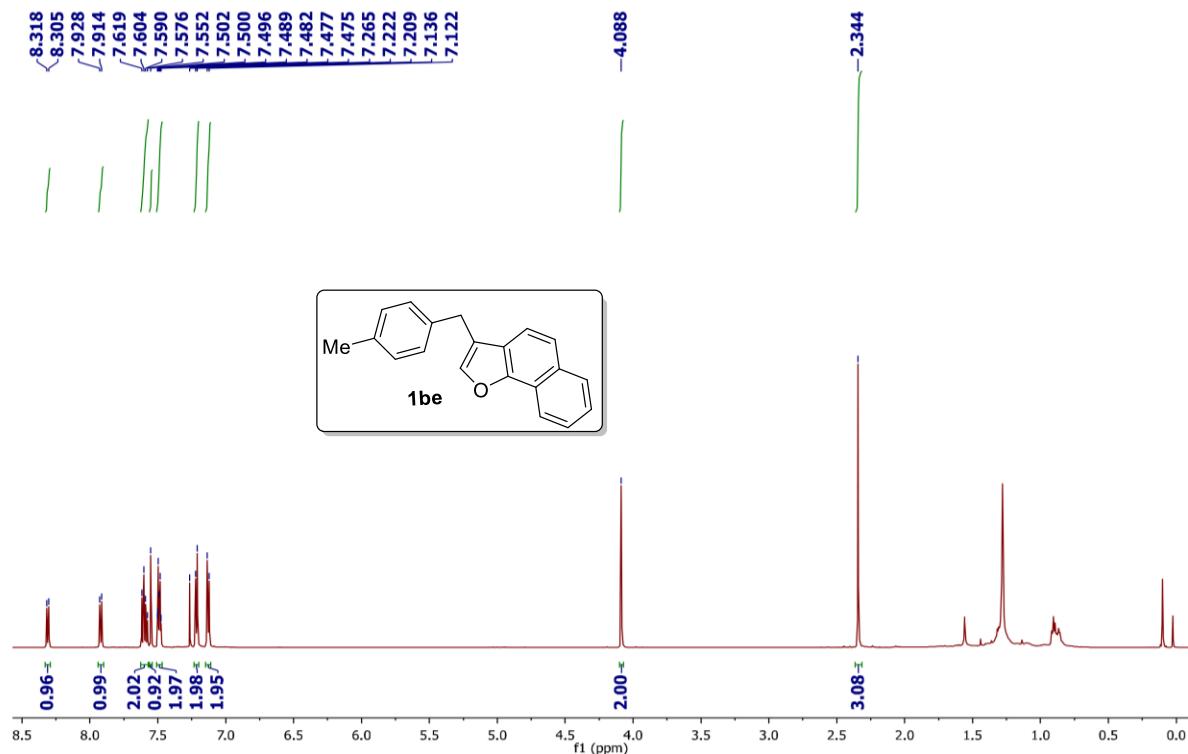


$^{19}\text{F}\{\text{H}\}$ NMR (376 MHz) of **1bd**:

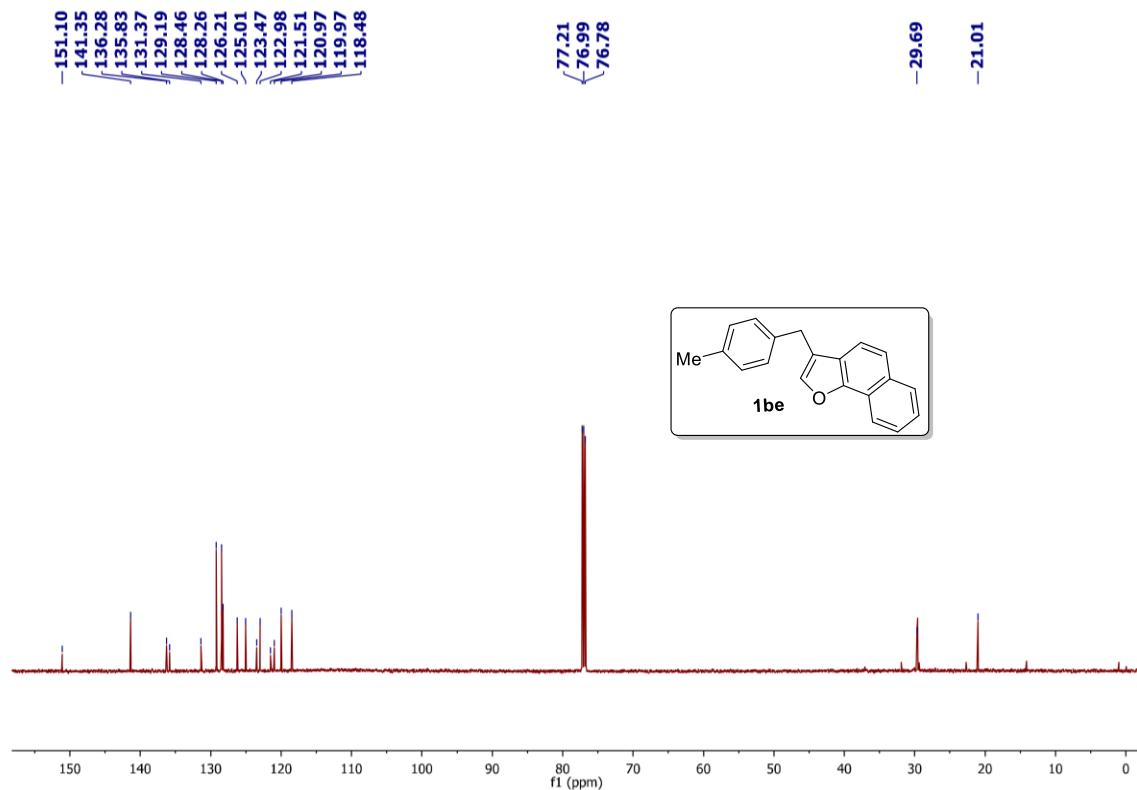
19F NMR (Proton Decoupled) in CDCl₃



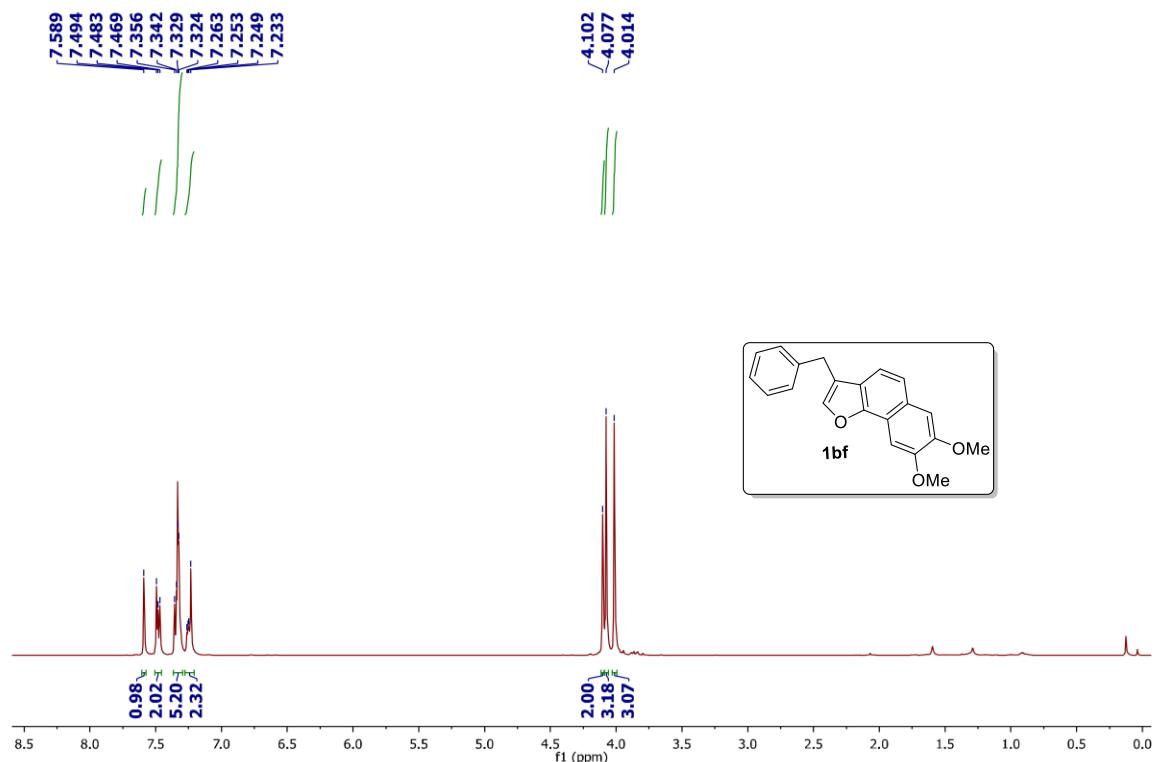
¹H NMR (600 MHz) of **1be**:



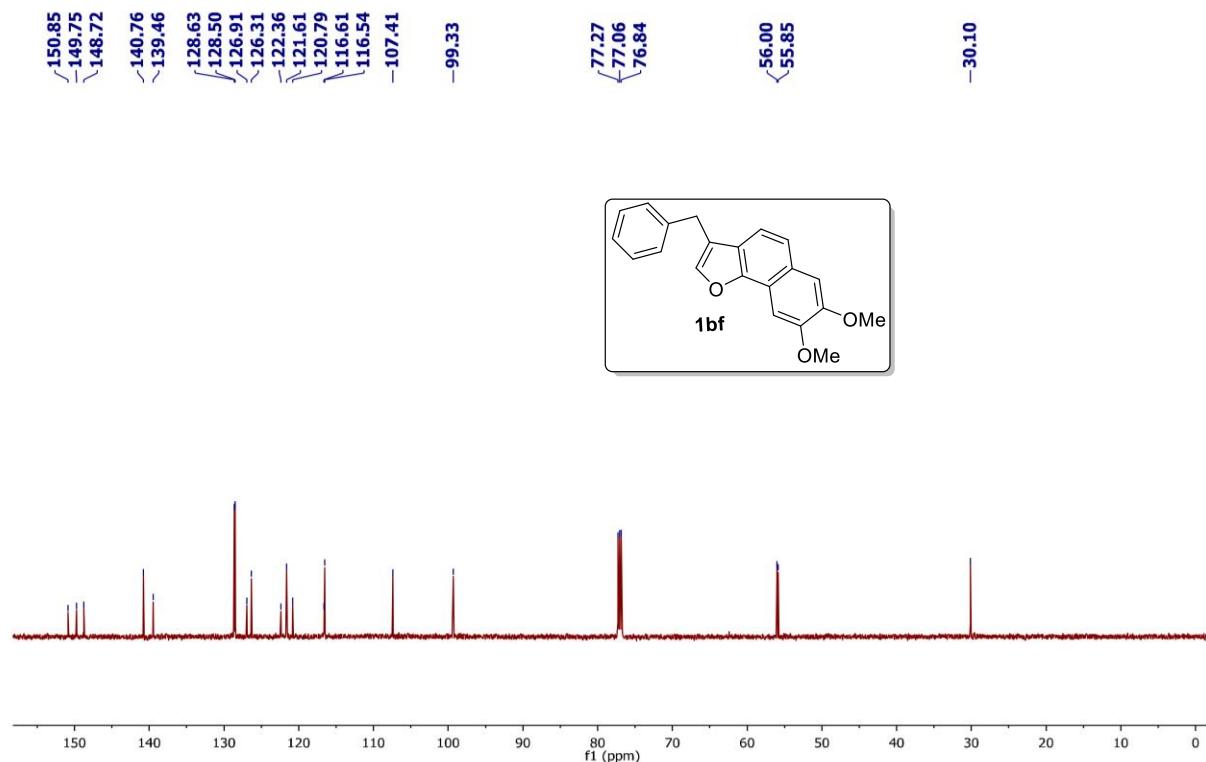
¹³C{¹H} NMR (150 MHz) of **1be**:



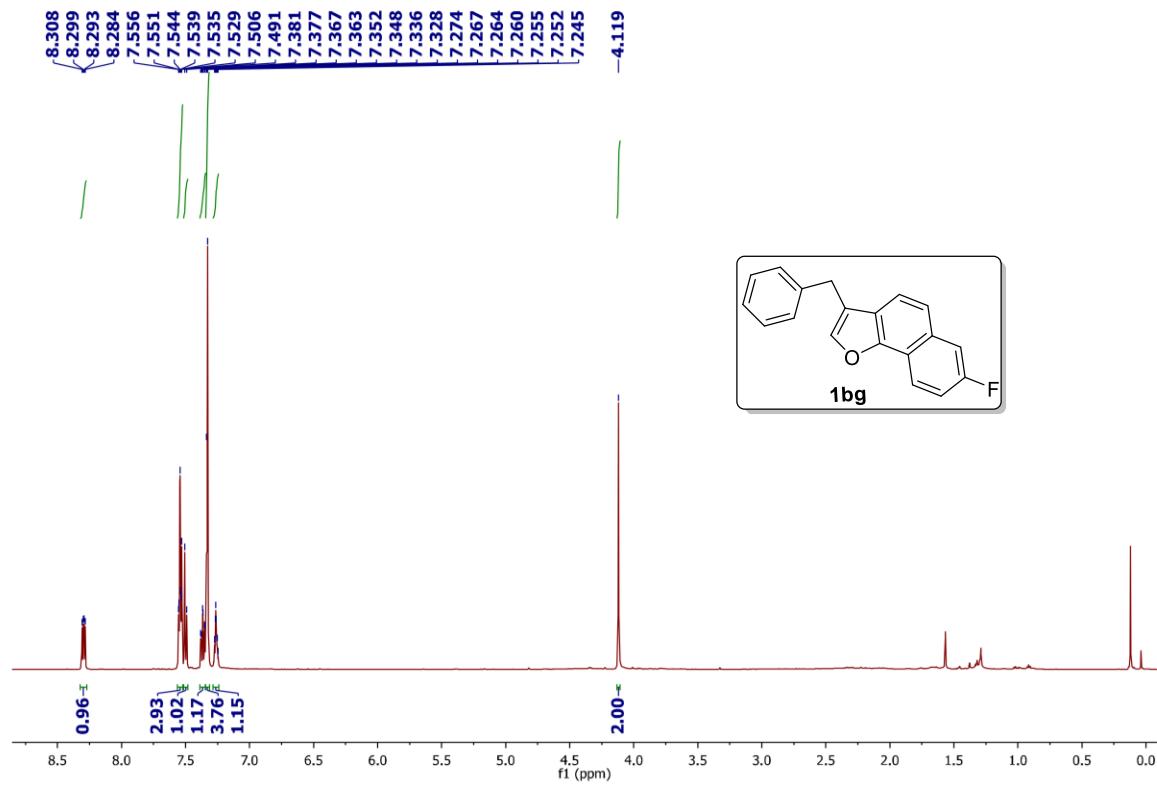
¹H NMR (600 MHz) of **1bf**:



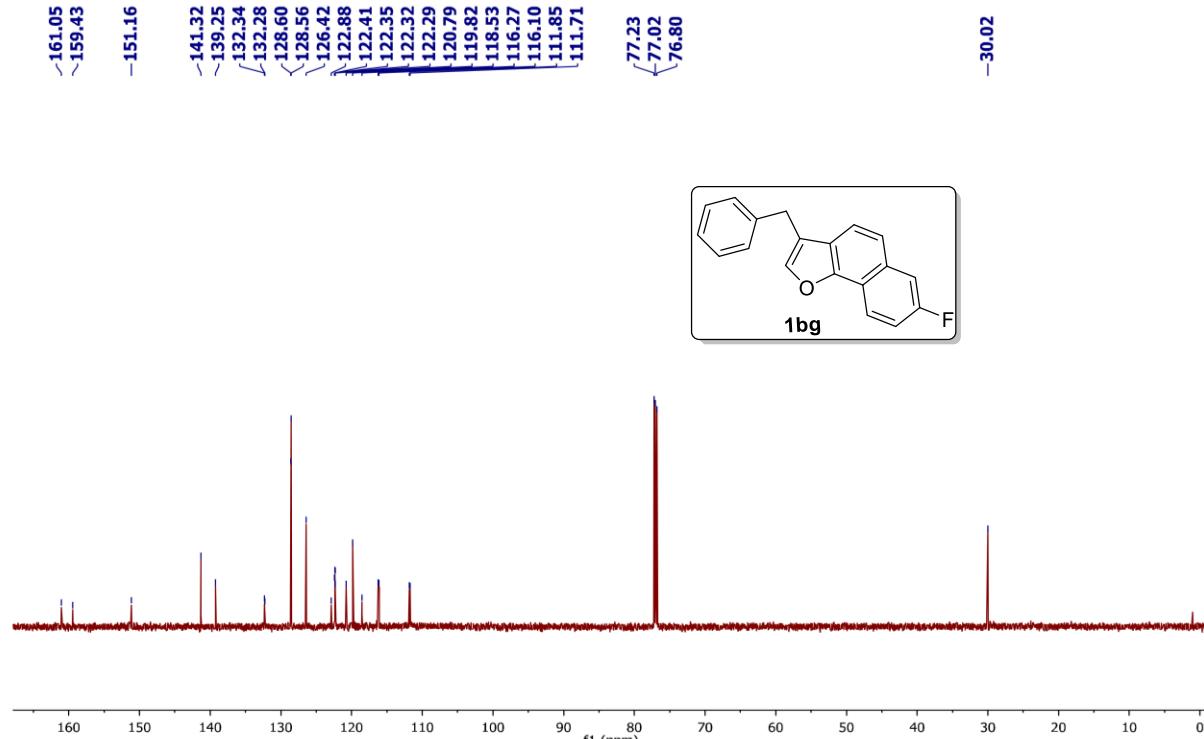
¹³C{¹H} NMR (150 MHz) of **1bf**:



¹H NMR (600 MHz) of **1bg**:

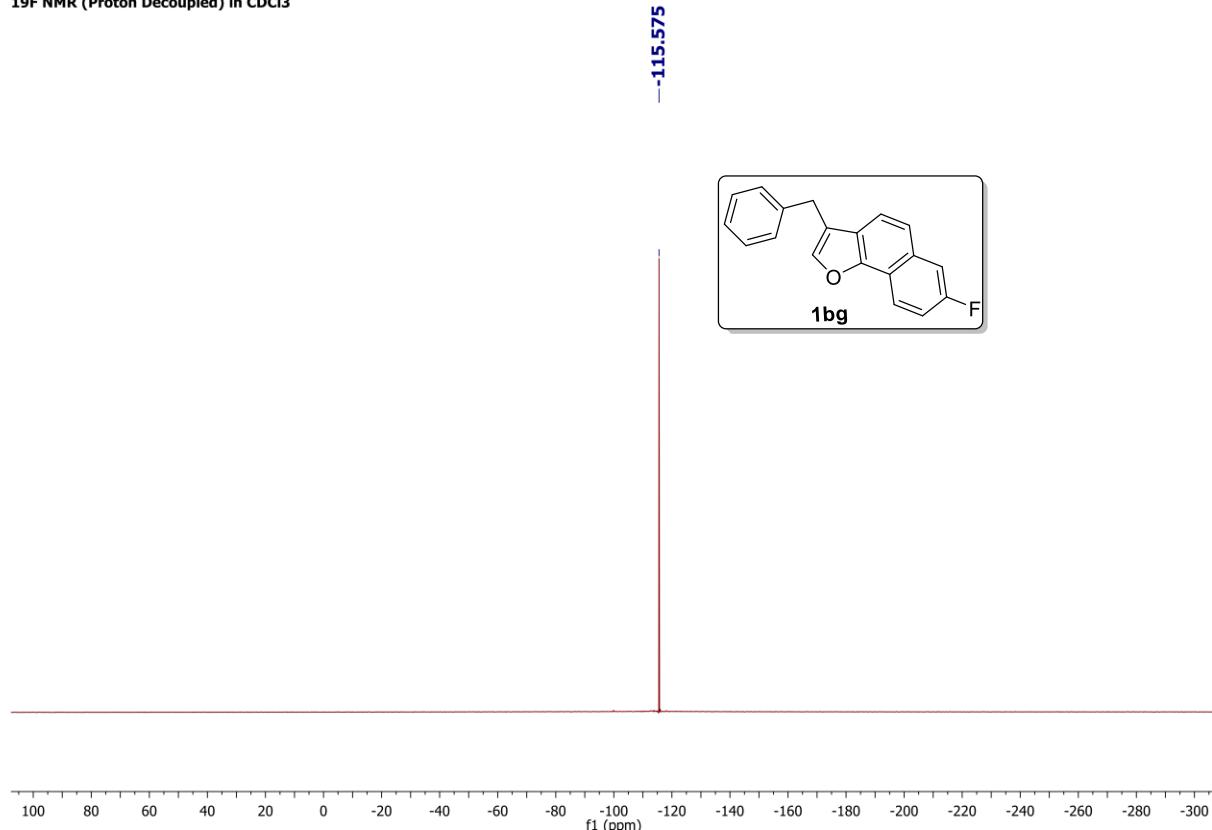


¹³C{¹H} NMR (150 MHz) of **1bg**:

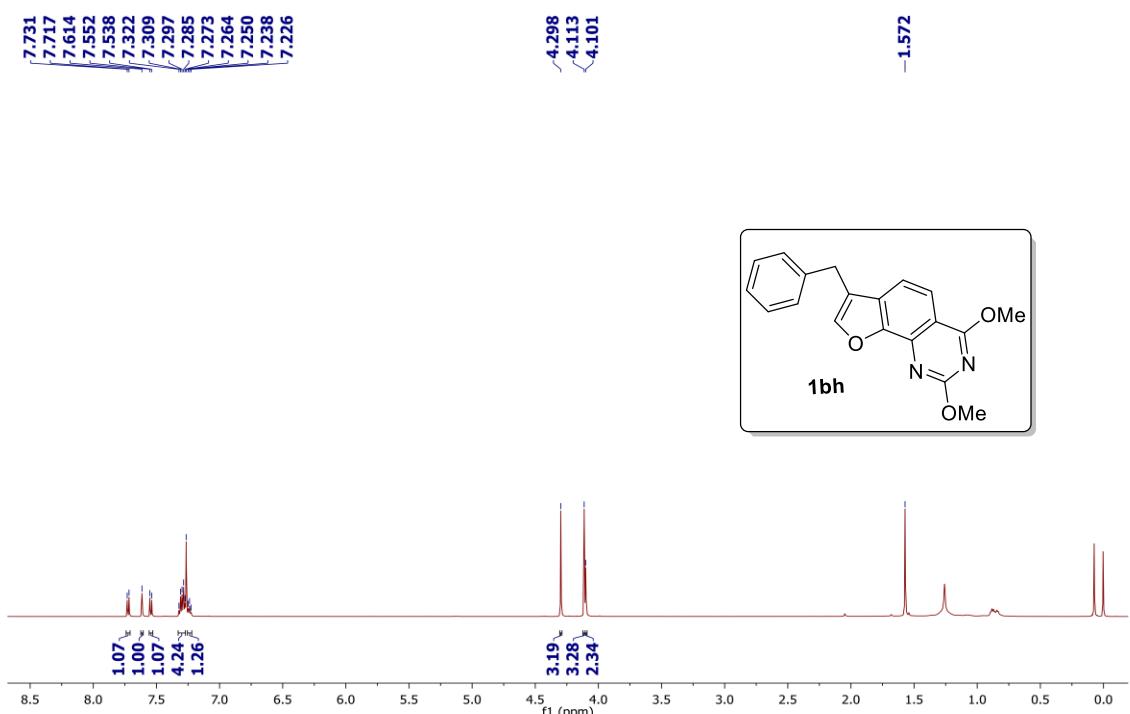


$^{19}\text{F}\{\text{H}\}$ NMR (376 MHz) of **1bg**:

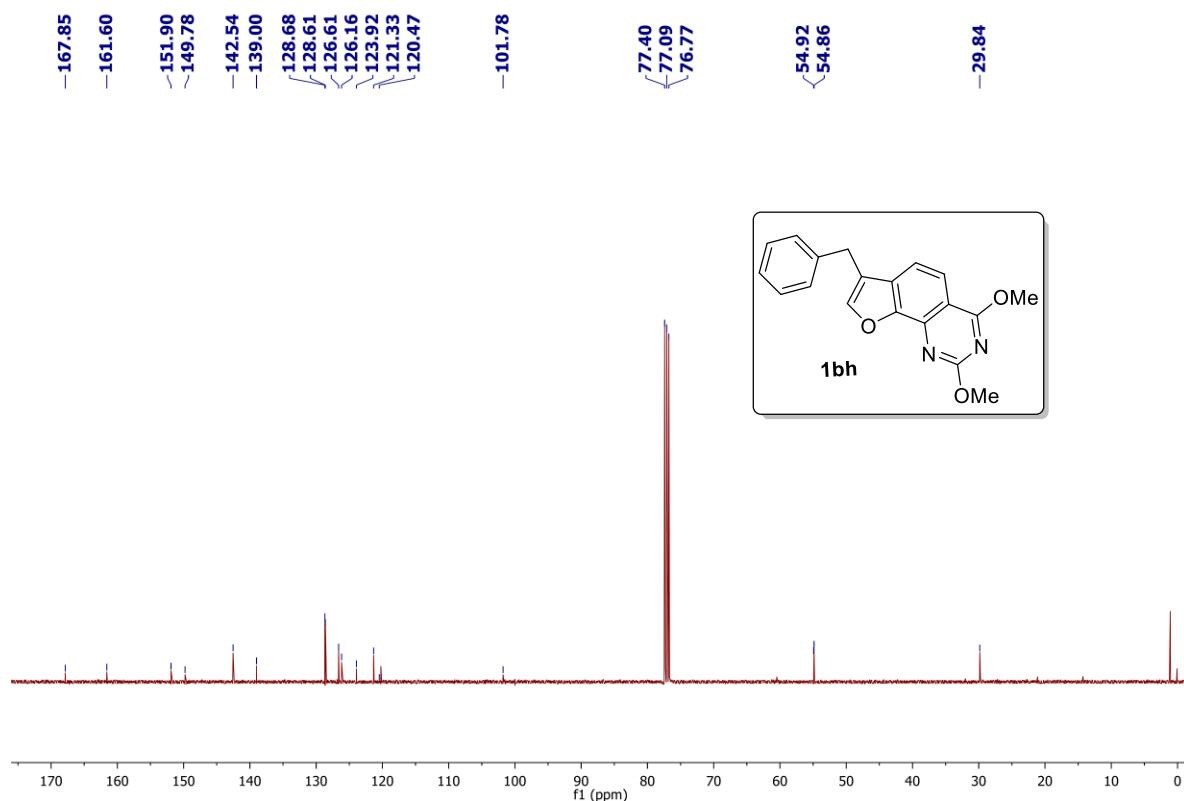
19F NMR (Proton Decoupled) in CDCl_3



¹H NMR (600 MHz) of **1bh**:

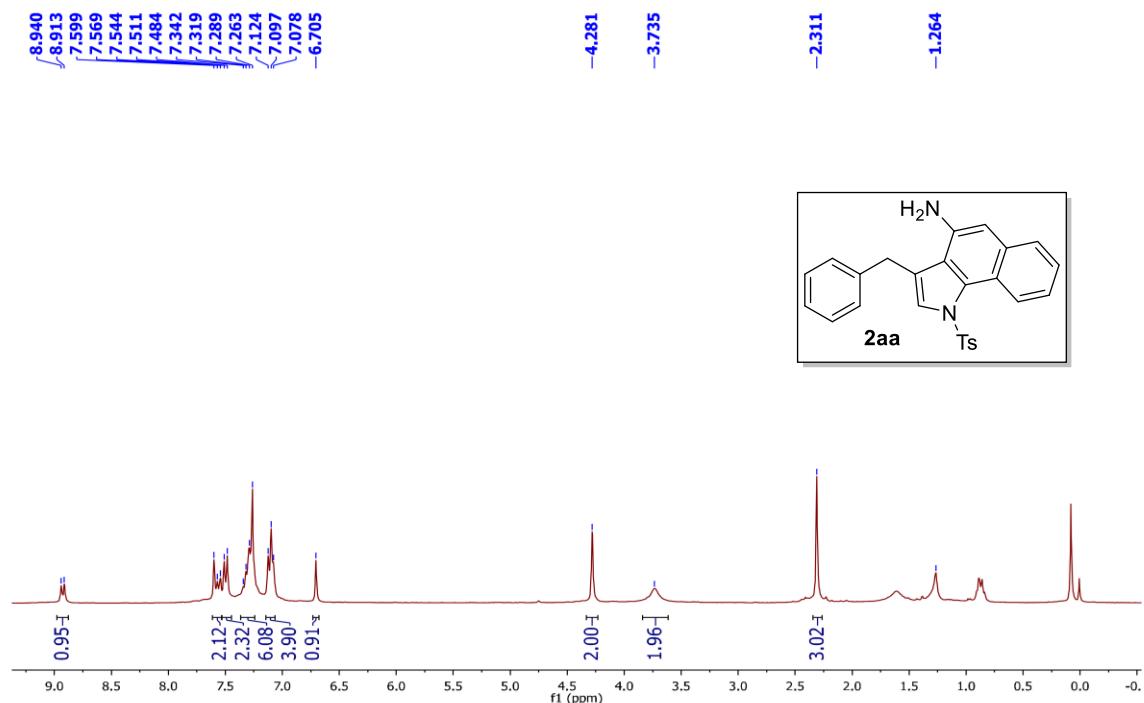


¹³C{¹H} NMR(100 MHz) of **1bh**

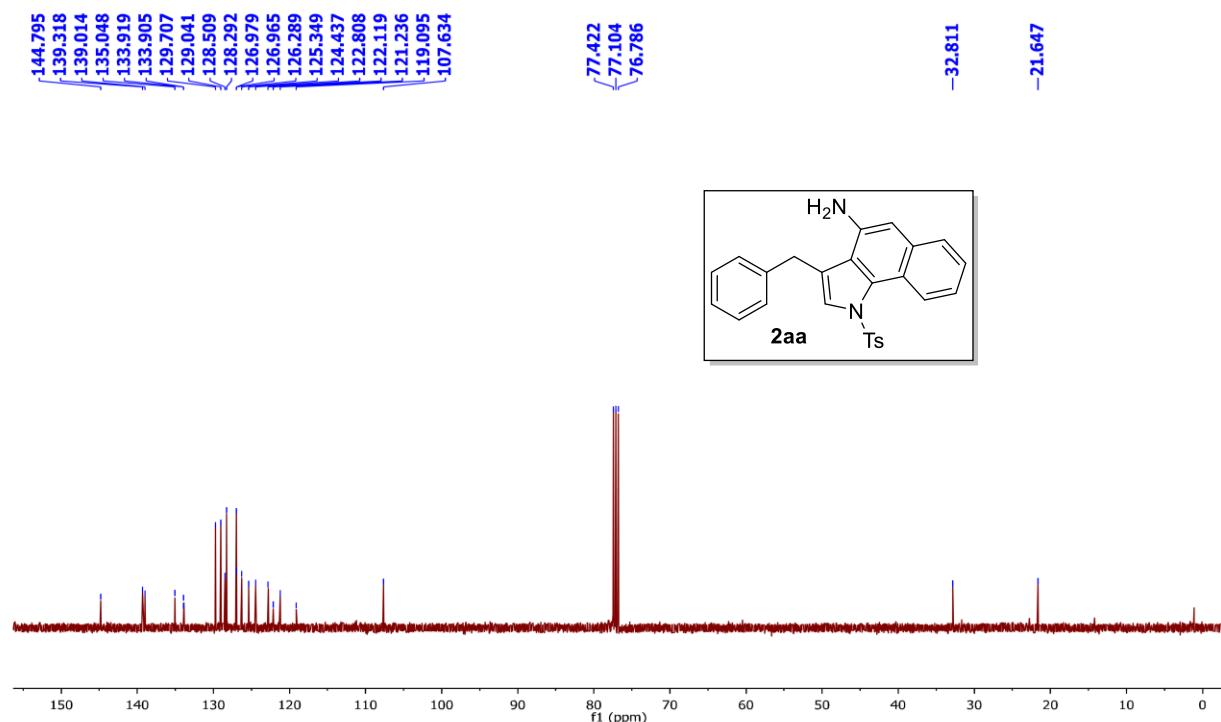


10. NMR Spectra of Compounds 2aa-2ak :

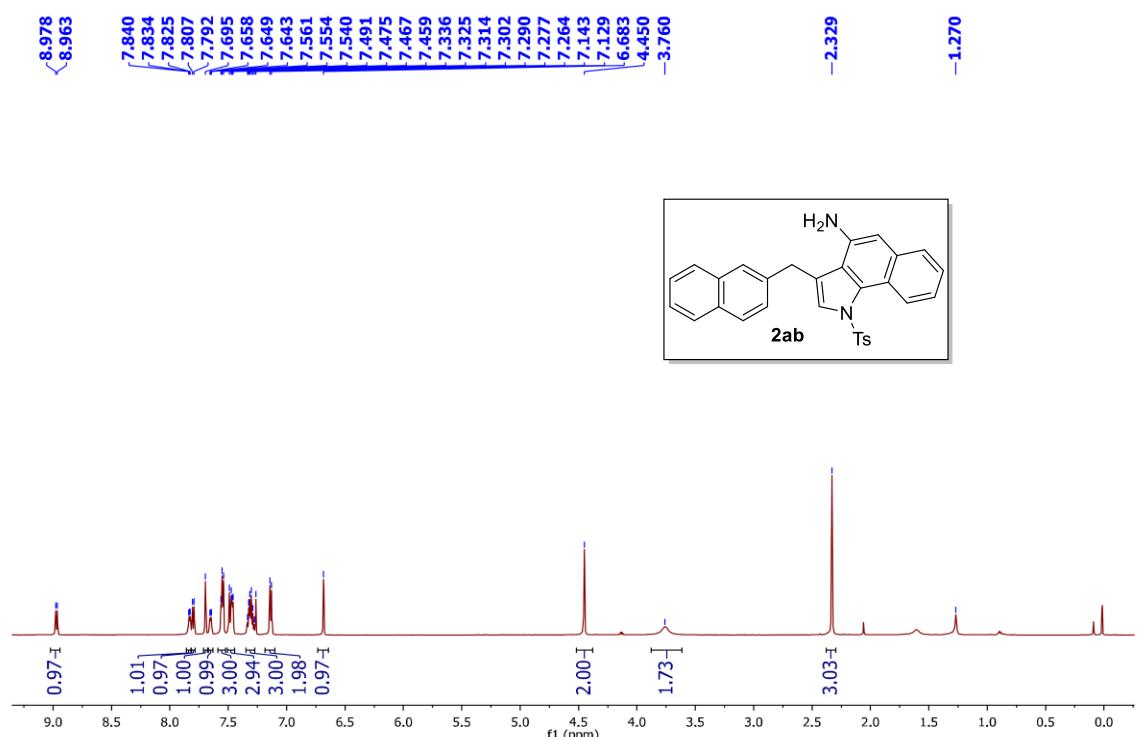
^1H NMR (300 MHz) of 2aa :



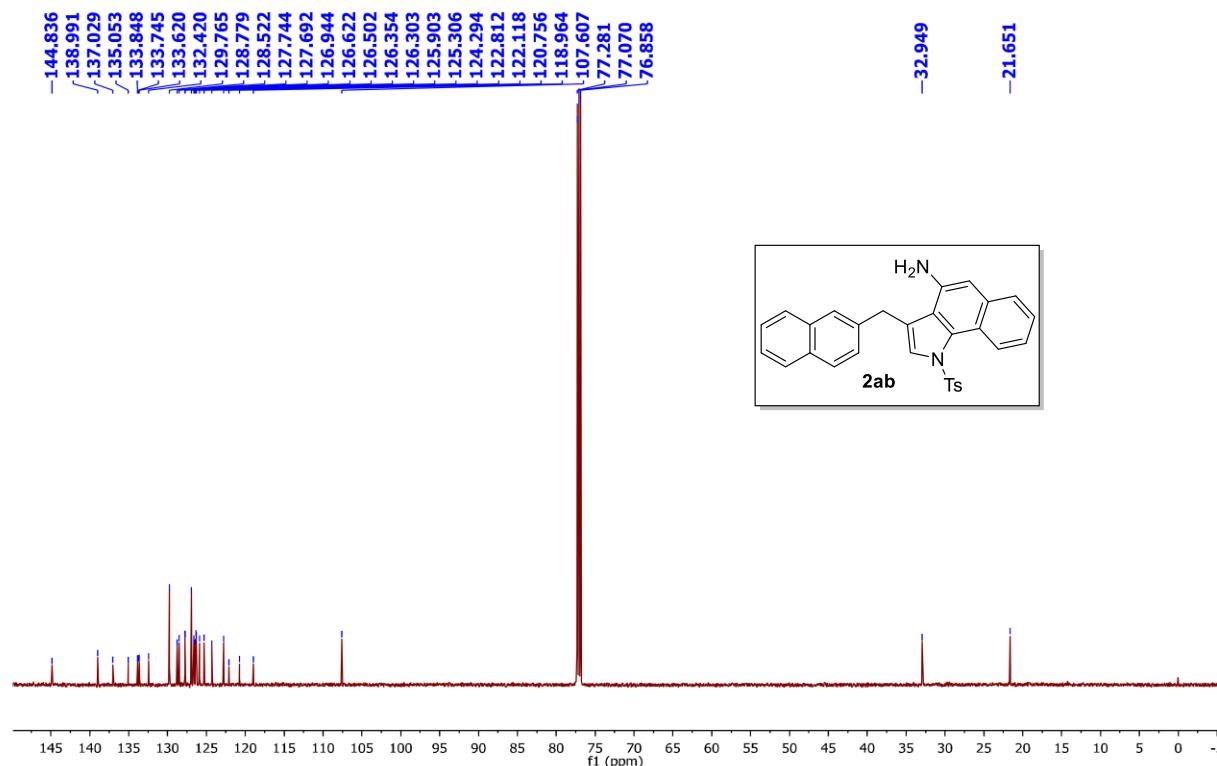
$^{13}\text{C}\{^1\text{H}\}$ NMR (100 MHz) of 2aa :



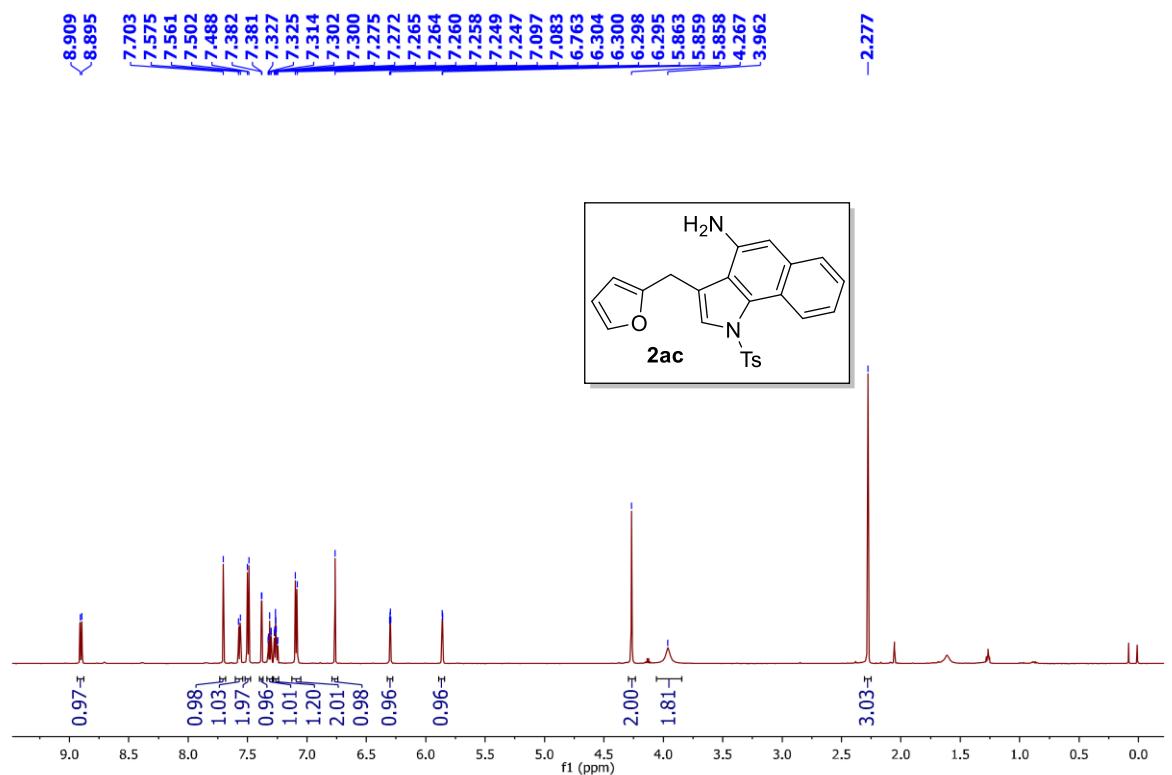
¹H NMR (600 MHz) of 2ab :



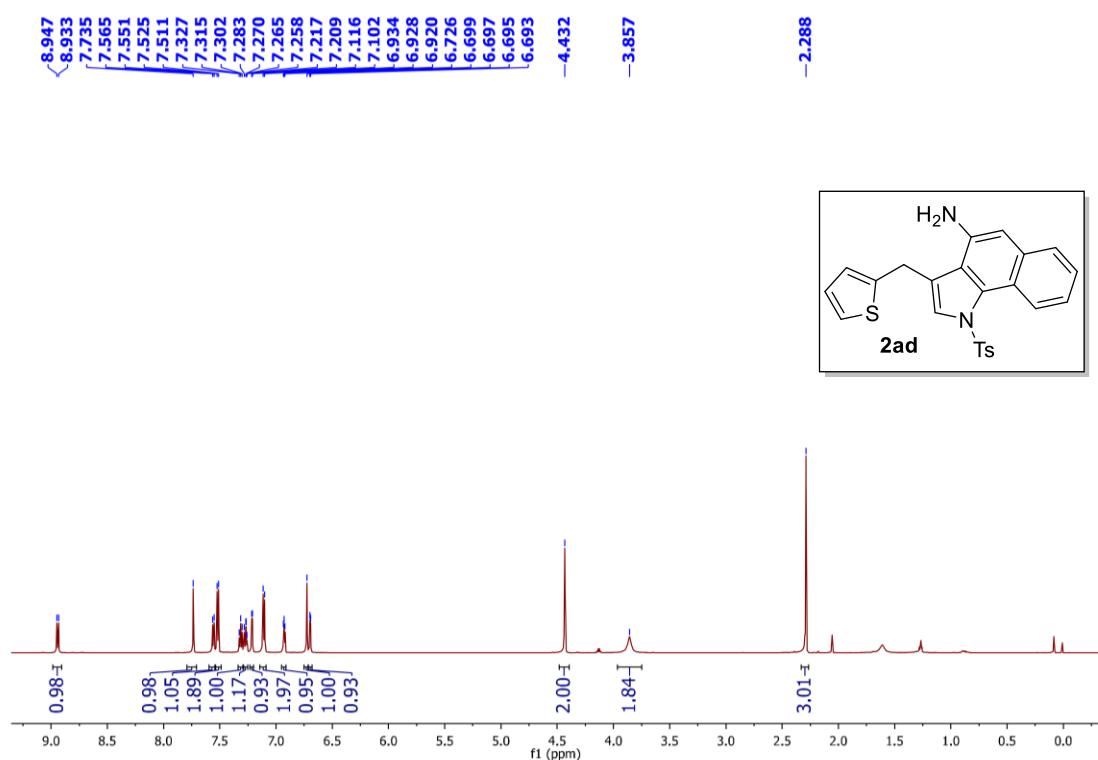
¹³C{¹H} NMR (150 MHz) of 2ab:



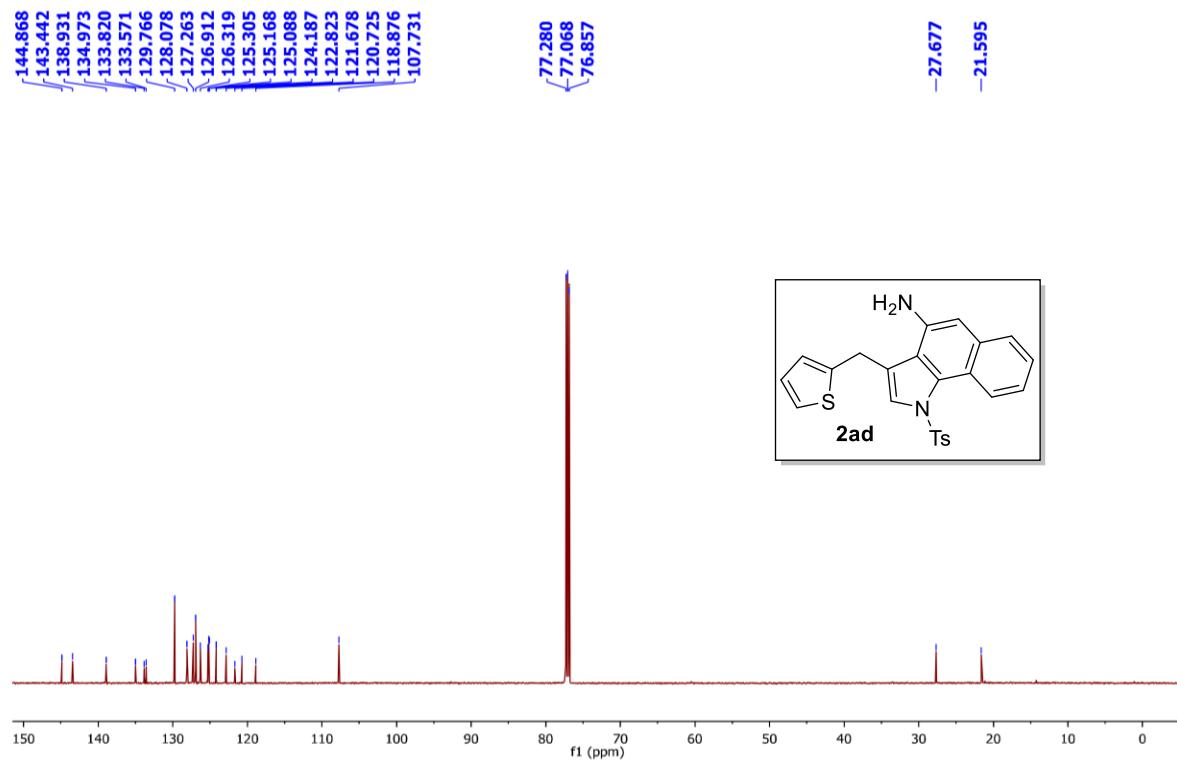
¹H NMR (600 MHz) of **2ac**:



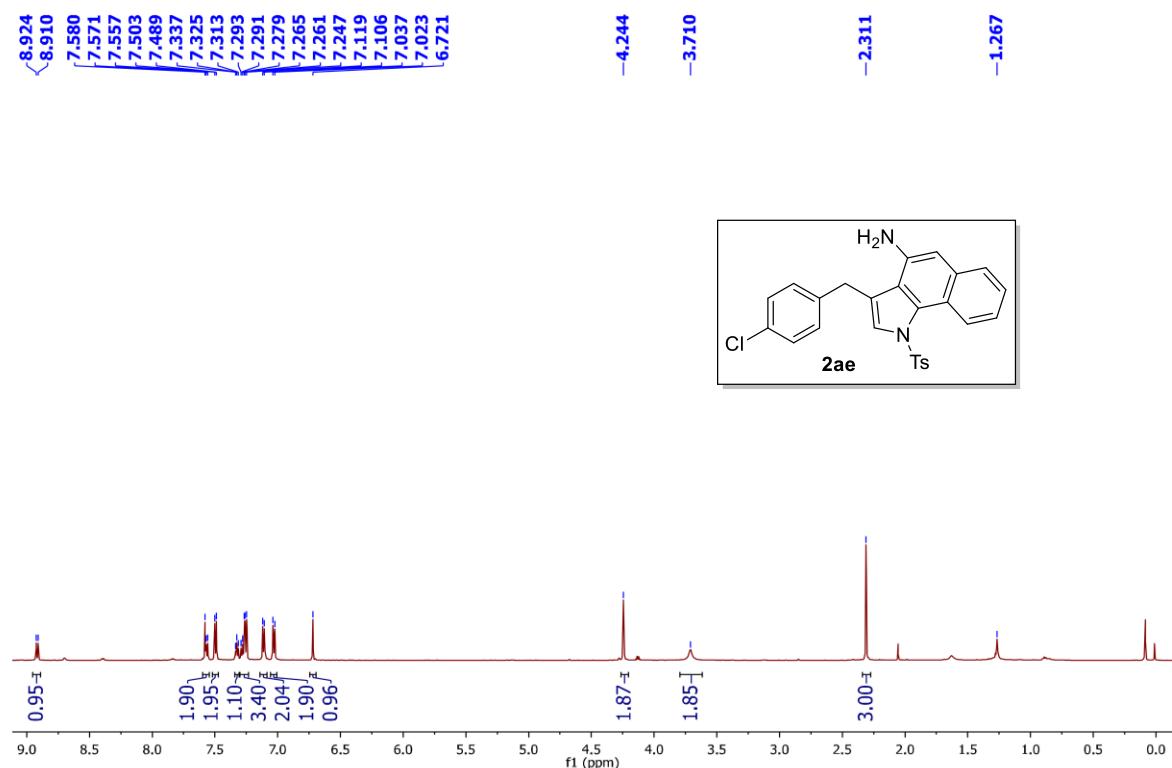
¹H NMR (600 MHz) of **2ad**:



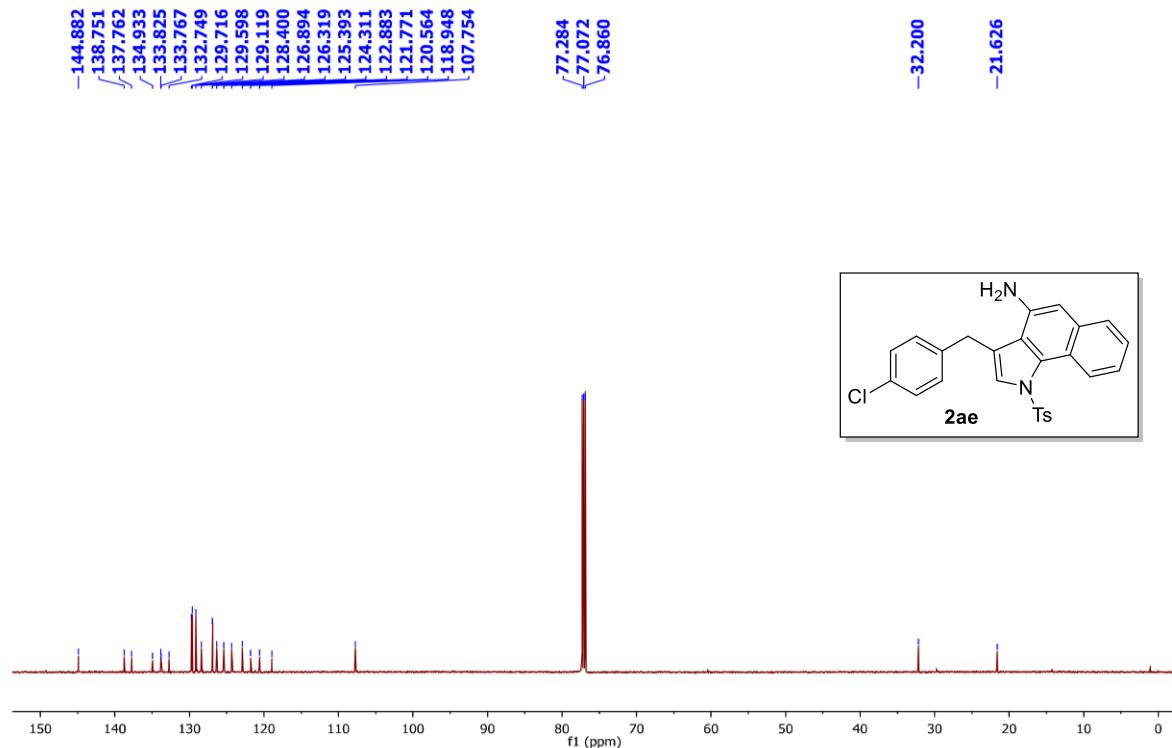
¹³C{¹H} NMR (150 MHz) of **2ad**:



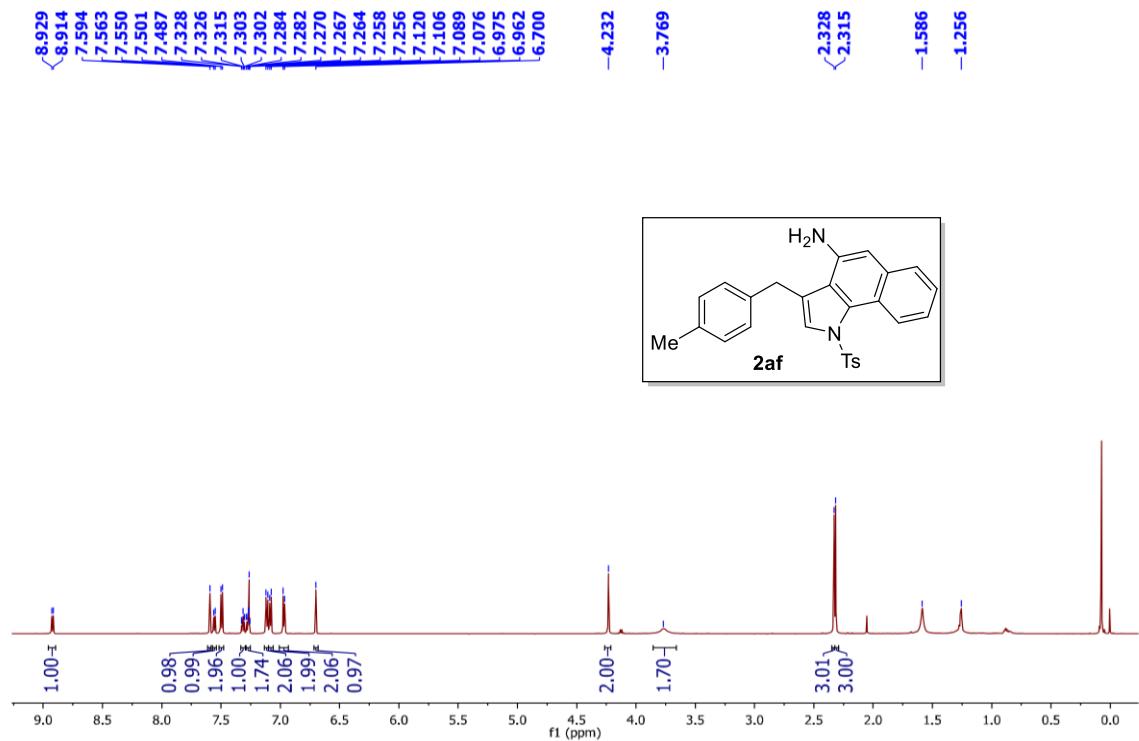
¹H NMR (600 MHz) of **2ae**:



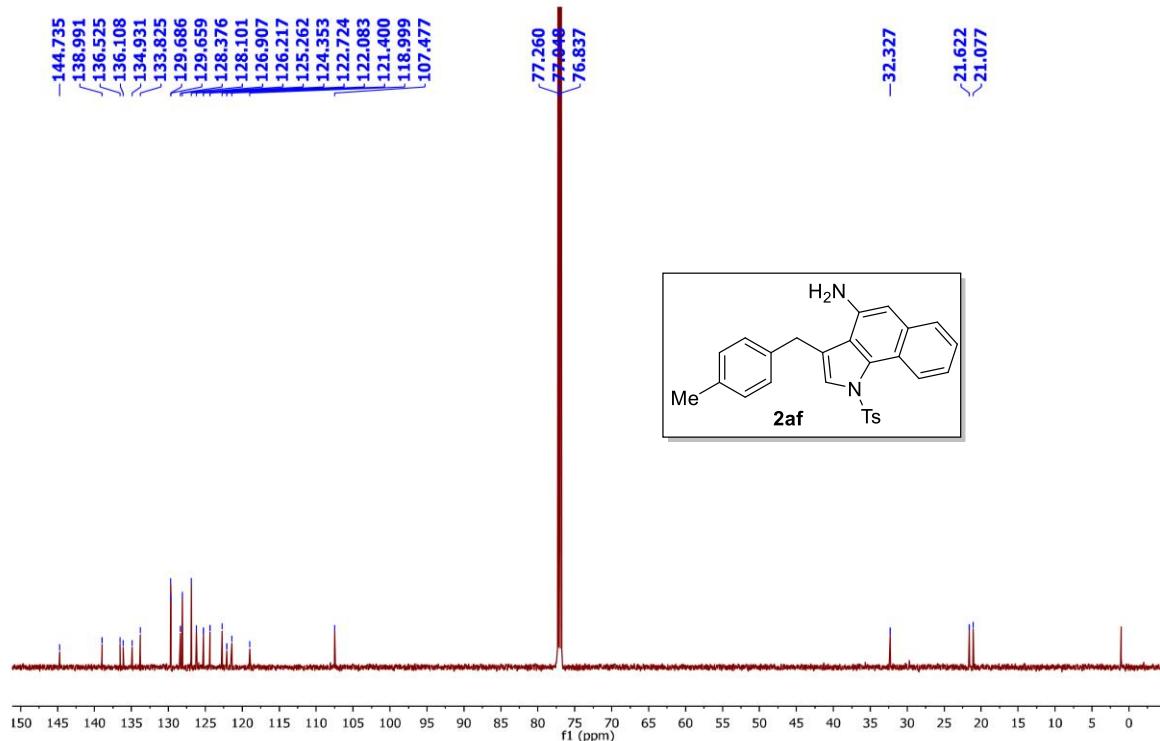
¹³C{¹H} NMR (150 MHz) of **2ae**:



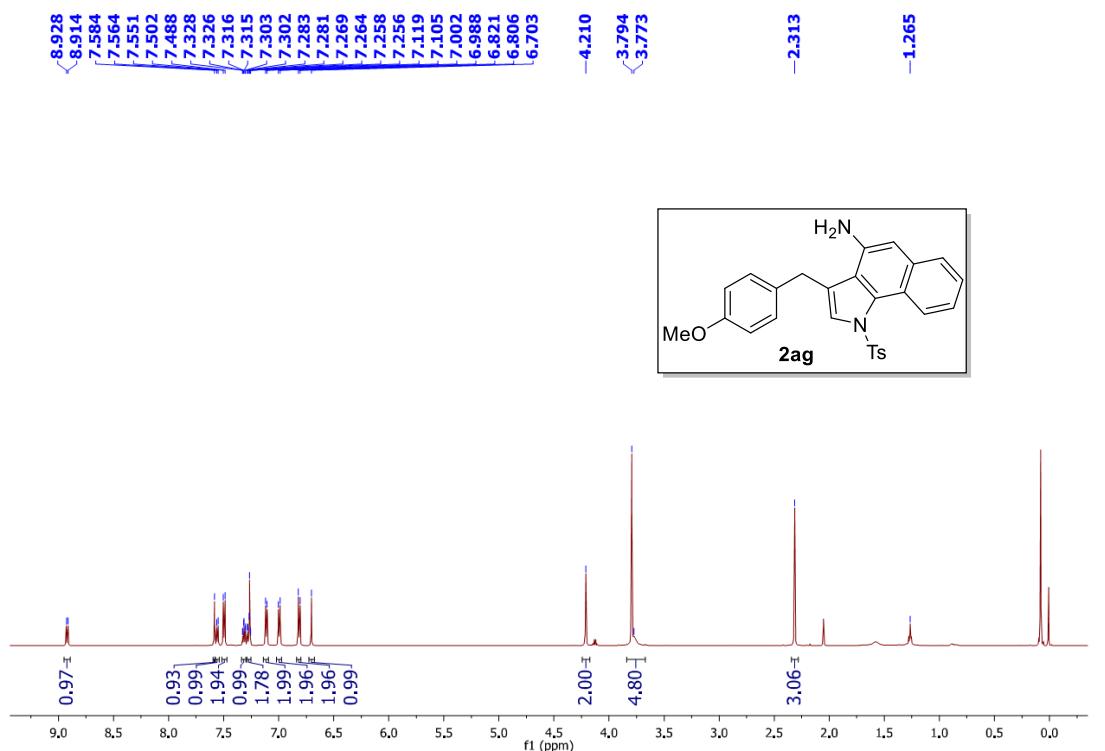
¹H NMR (600 MHz) of **2af**:



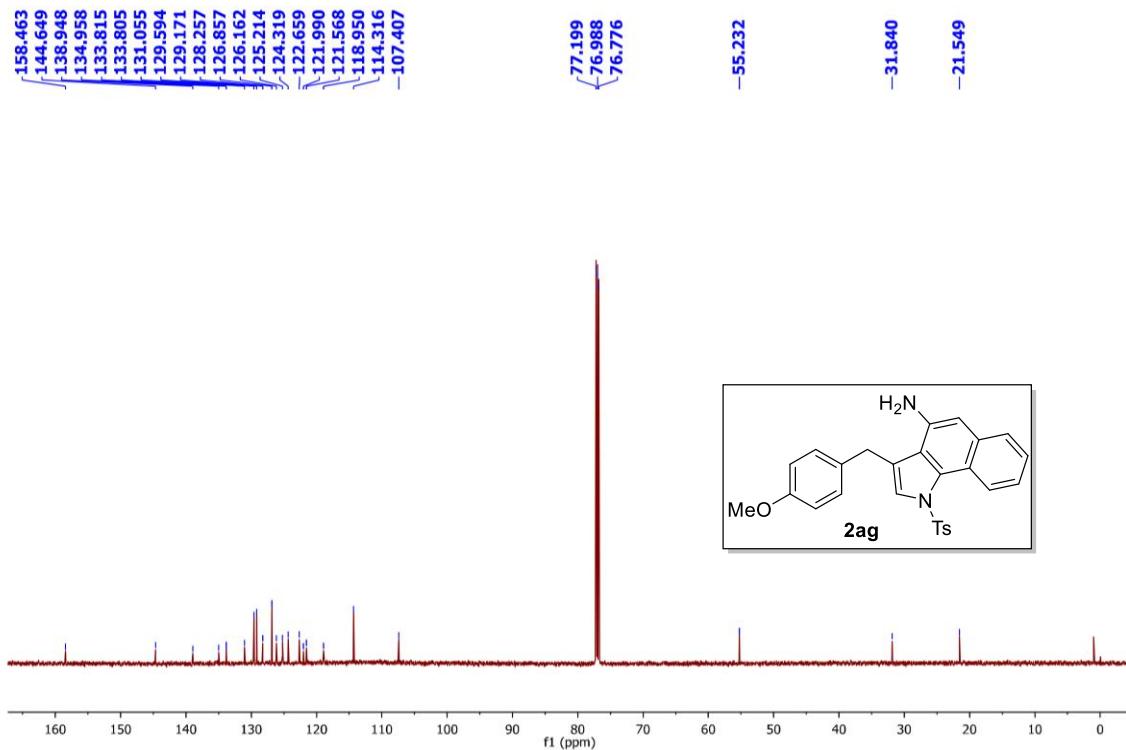
¹³C{¹H} NMR (150 MHz) of **2af**:



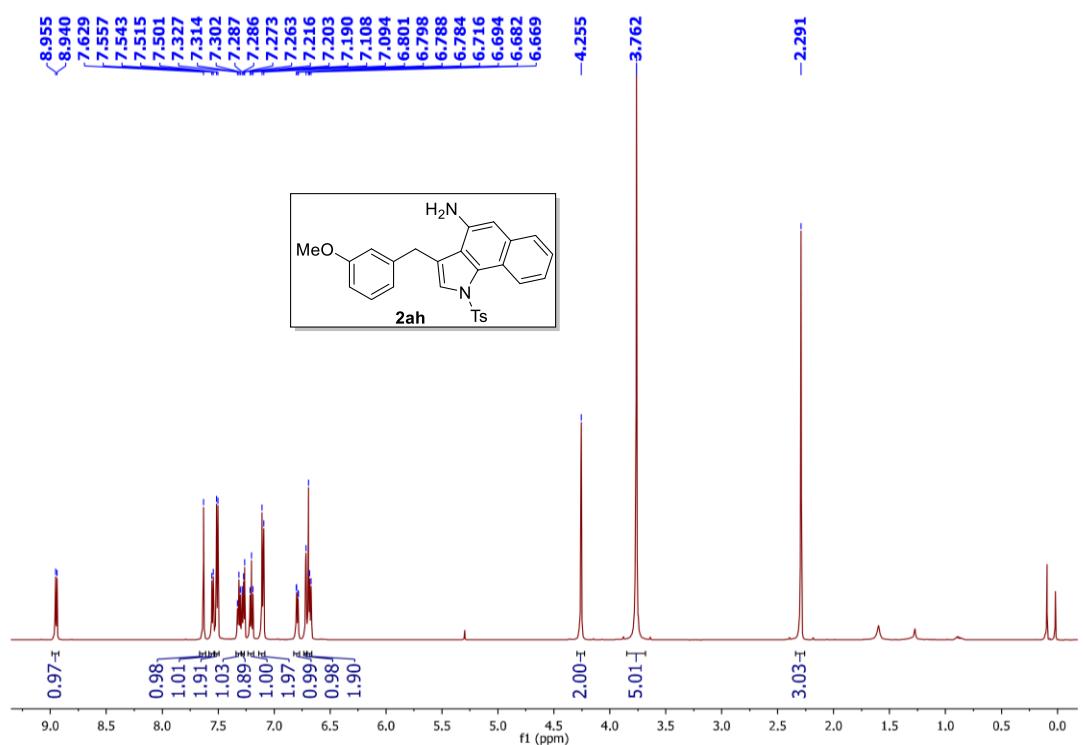
¹H NMR (600 MHz) of **2ag:**



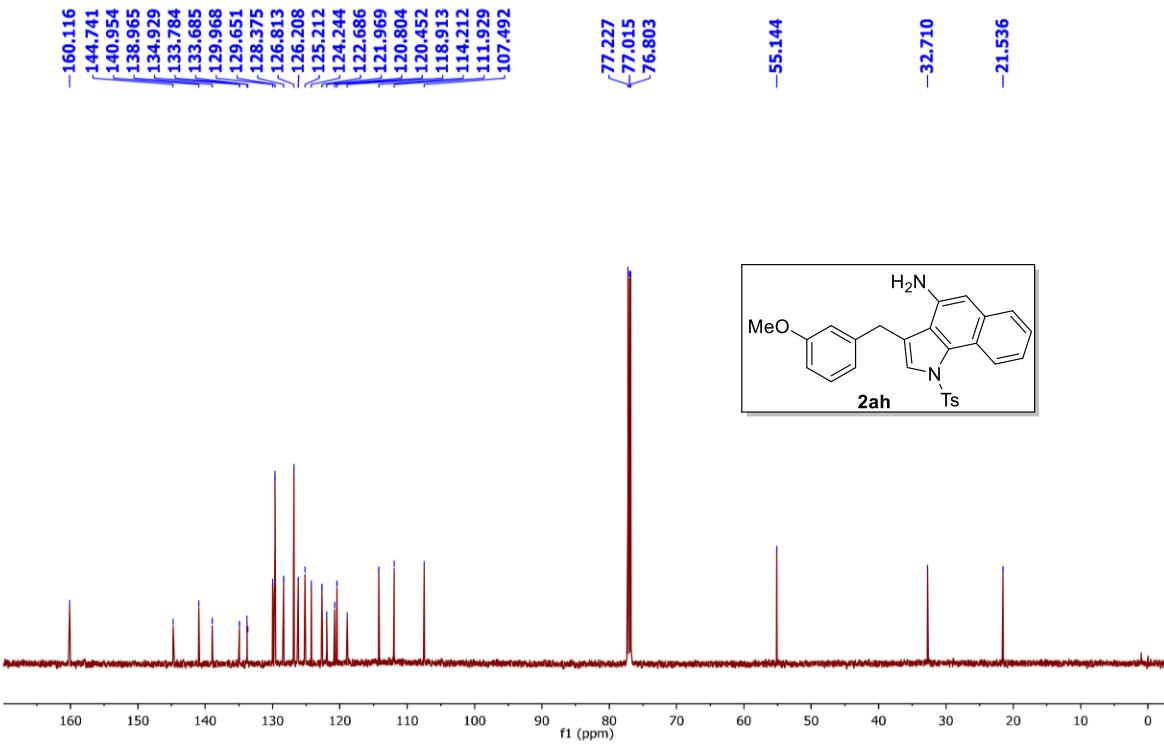
¹³C{¹H} NMR (150 MHz) of **2ag**:



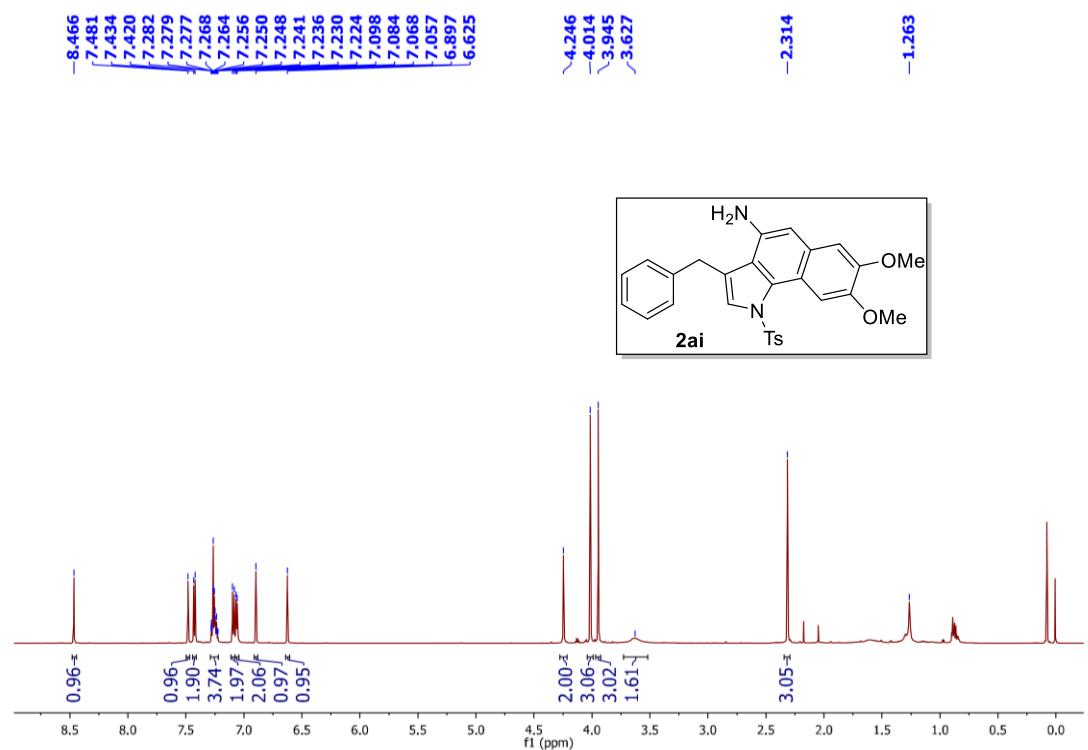
¹H NMR (600 MHz) of 2ah:



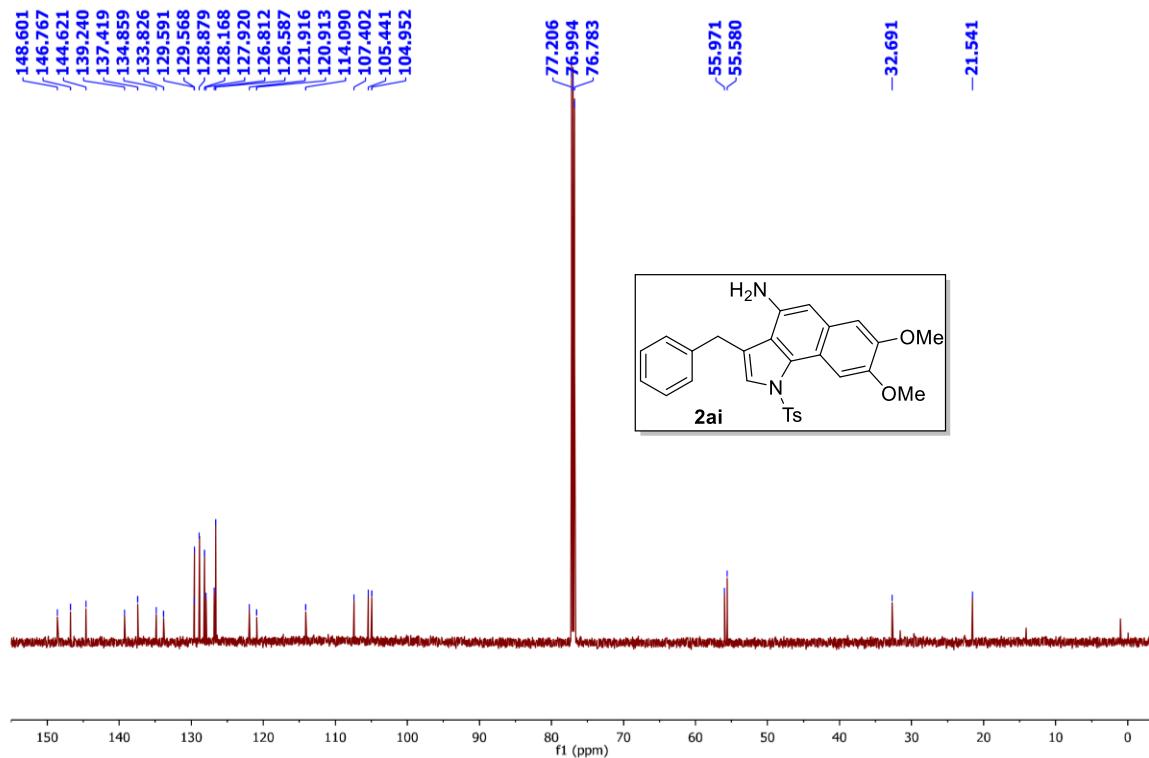
¹³C{¹H} NMR (150 MHz) of **2ah**:



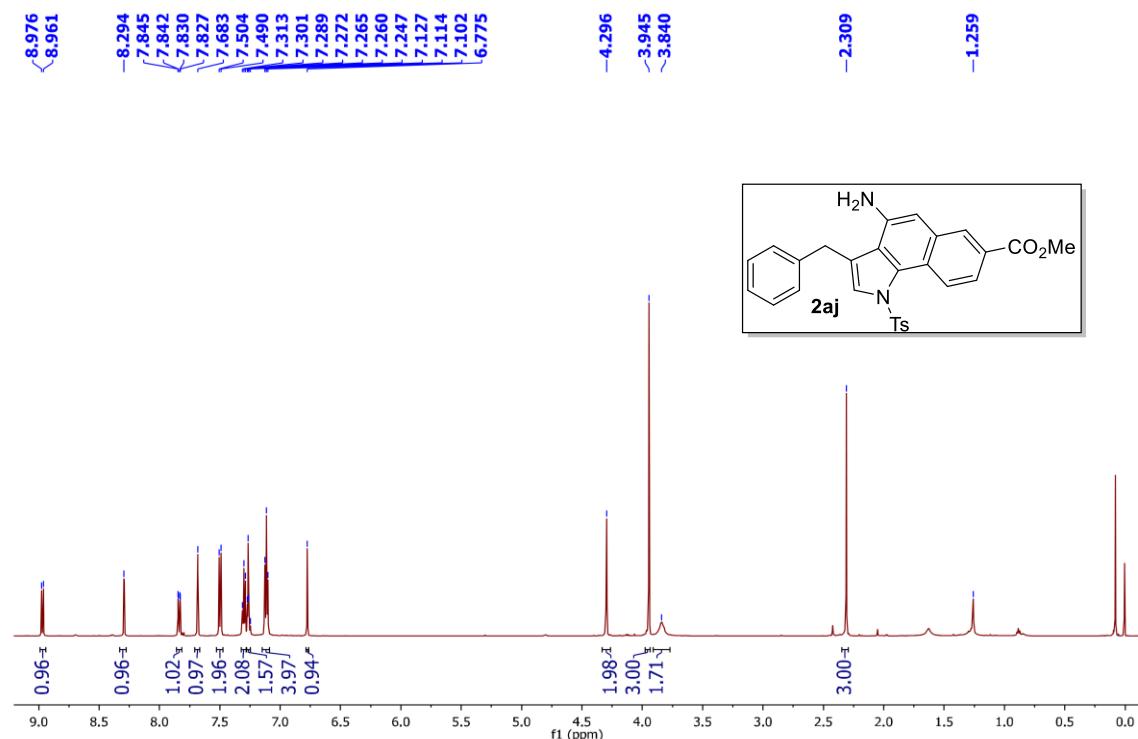
¹H NMR (600 MHz) of **2ai**:



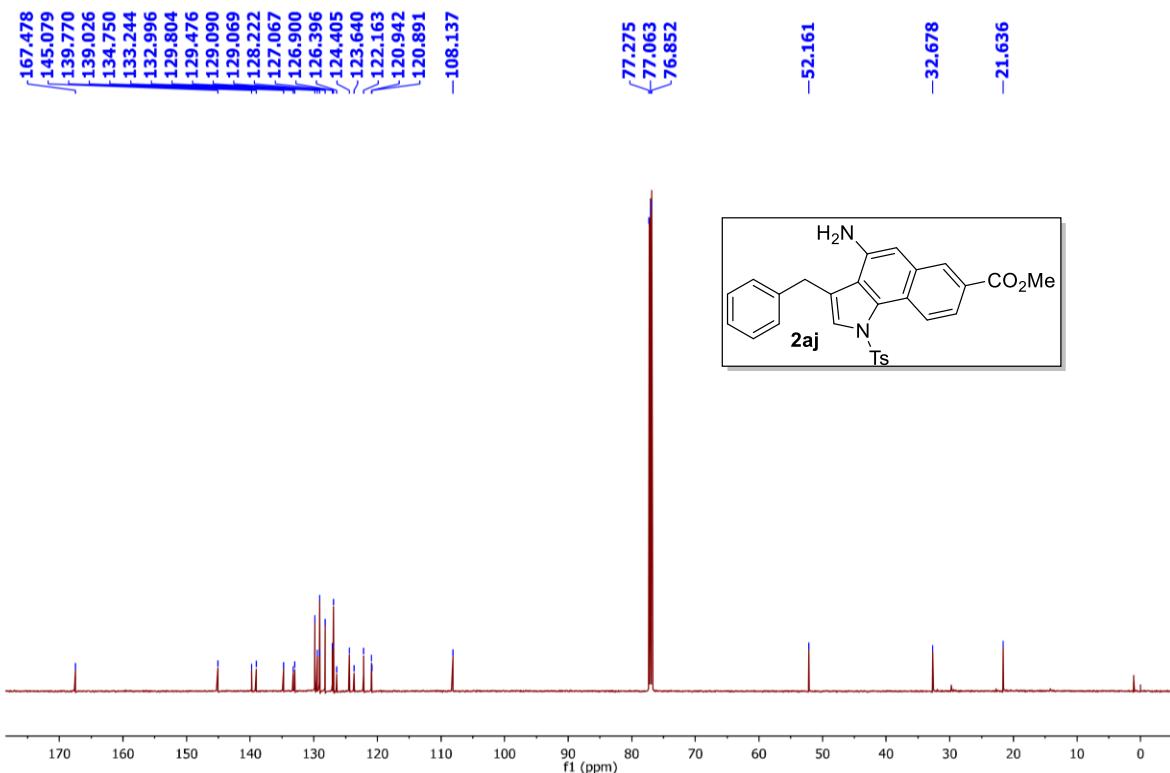
¹³C{¹H} NMR (150 MHz) of **2ai**:



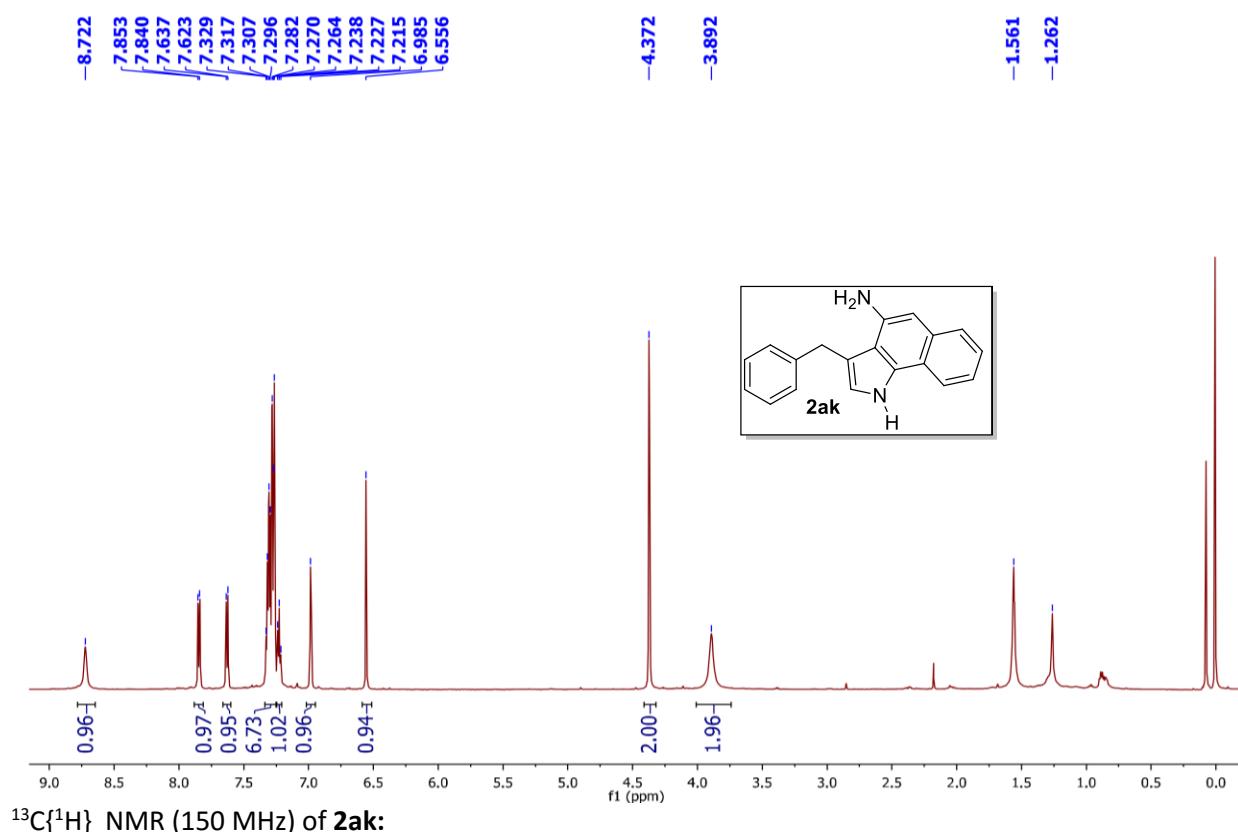
¹H NMR (600 MHz) of 2aj:



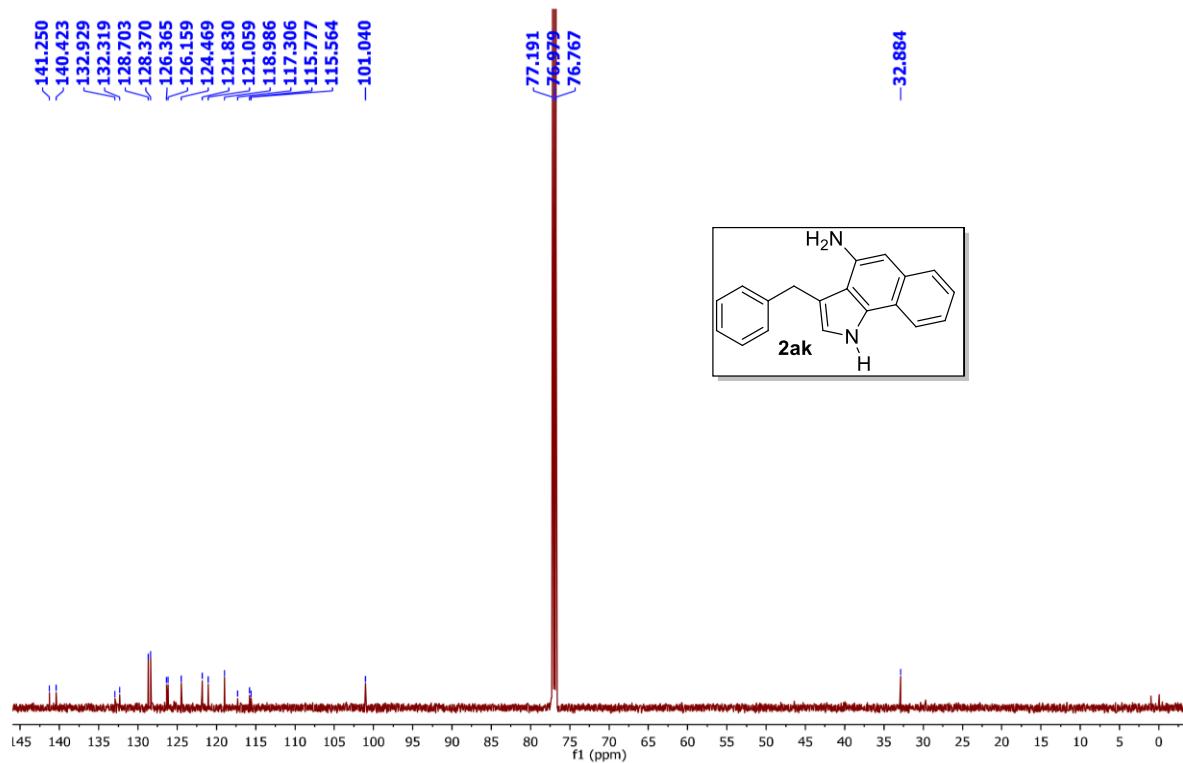
¹³C{¹H} NMR (150 MHz) of 2aj:



¹H NMR (600 MHz) of **2ak**:

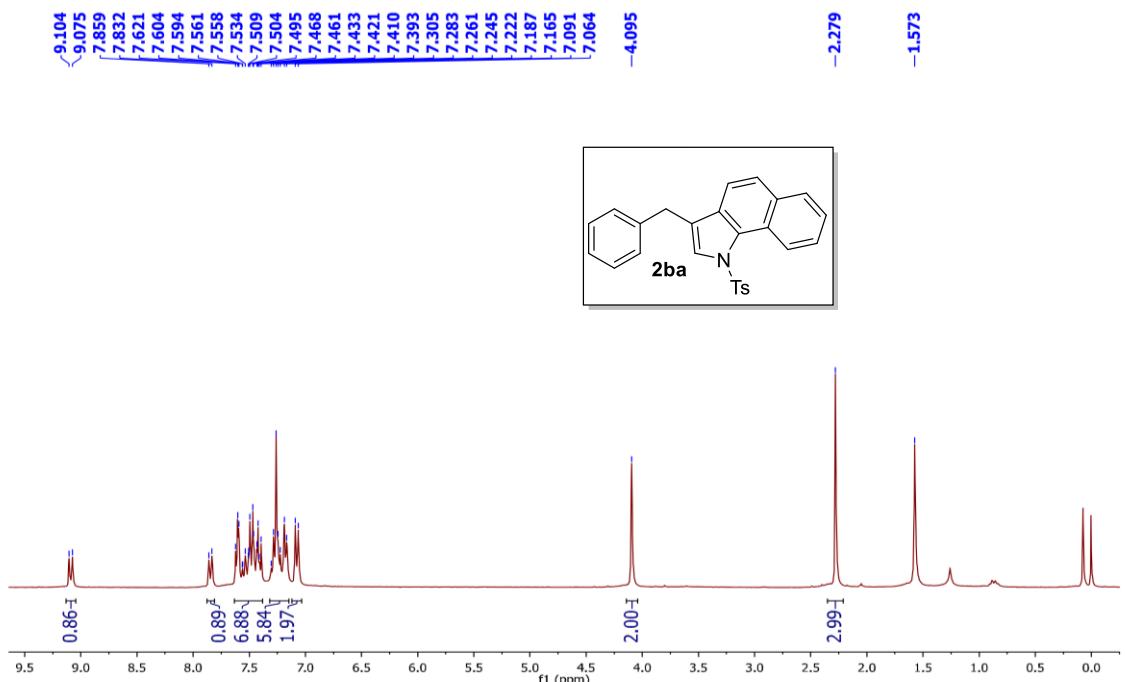


¹³C{¹H} NMR (150 MHz) of **2ak**:

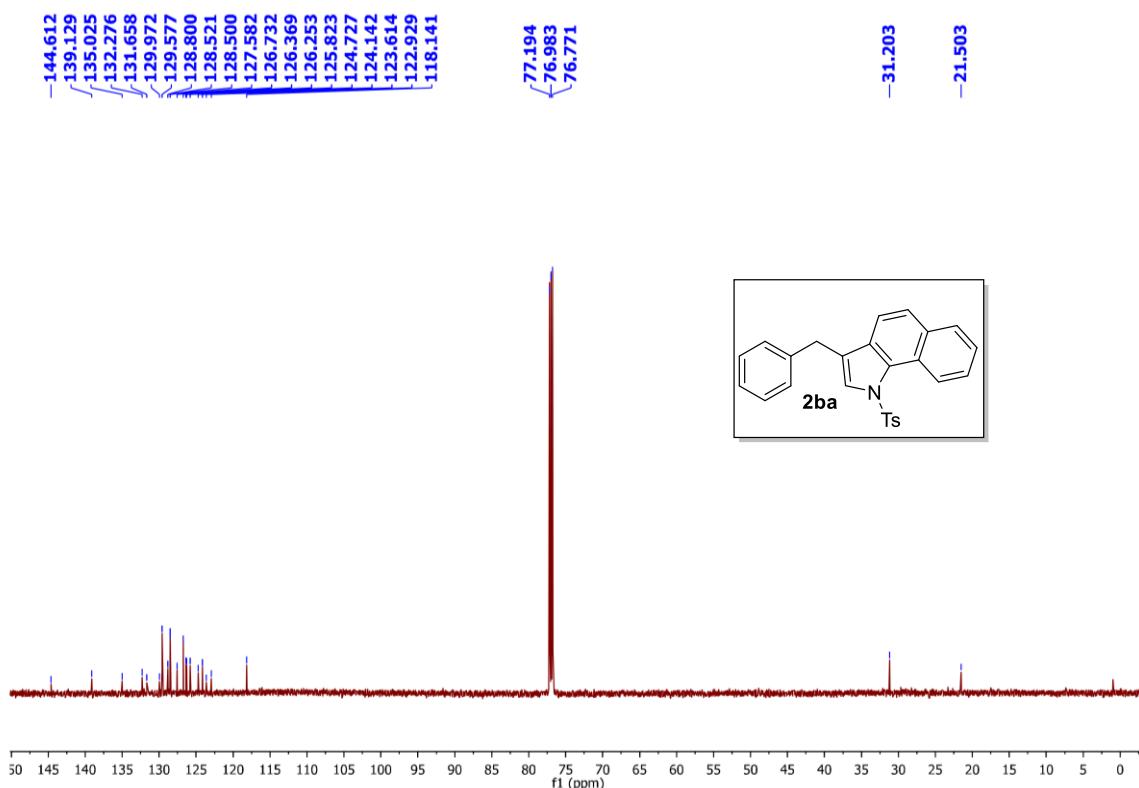


11. NMR Spectra of Compounds 2ba-2bh :

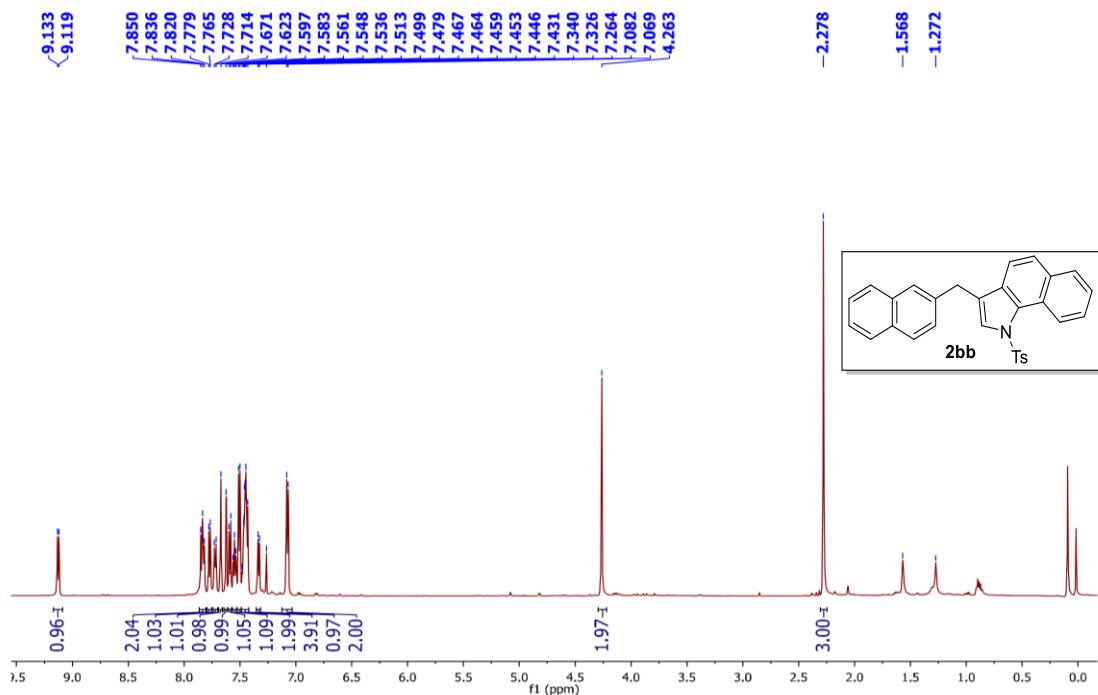
¹H NMR (300 MHz) of **2ba**:



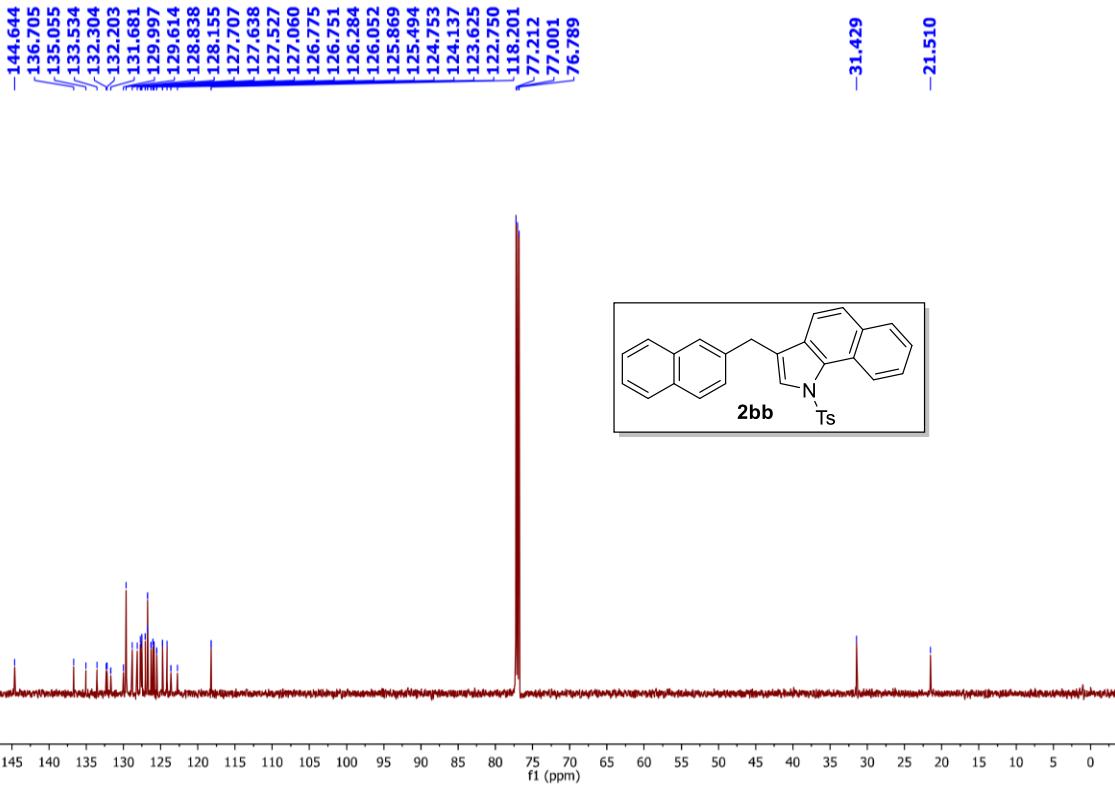
¹³C{¹H} NMR (150 MHz) of **2ba**:



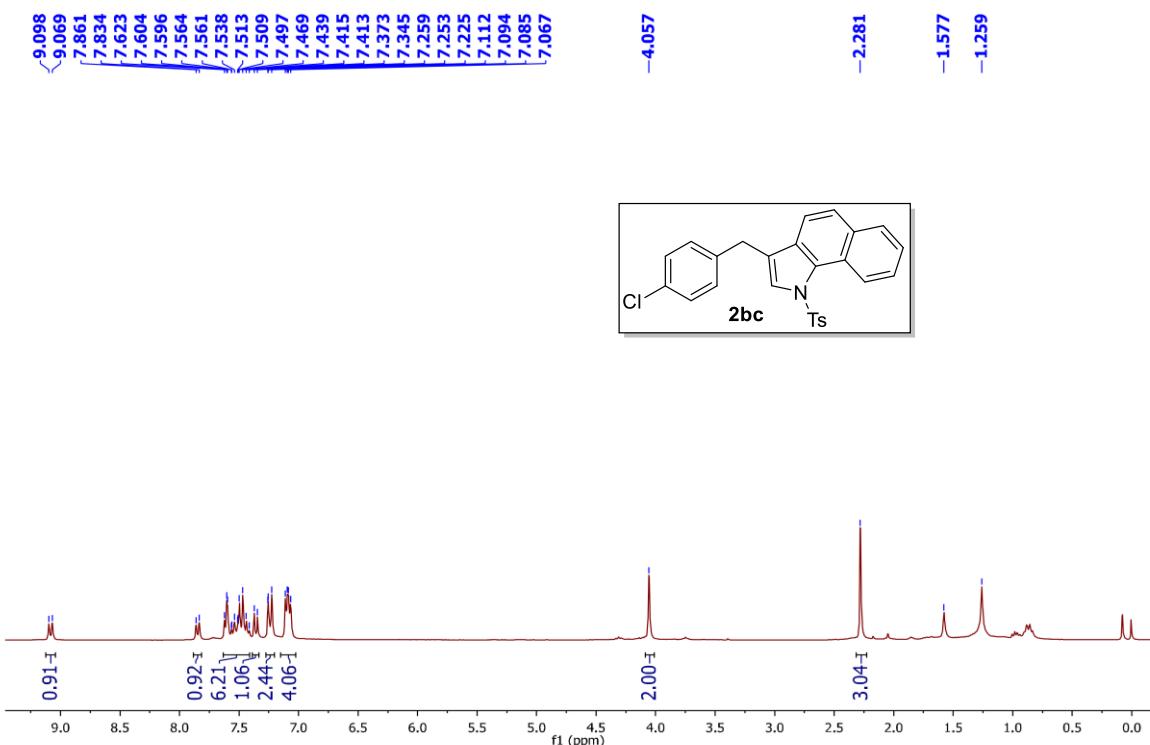
¹H NMR (600 MHz) of **2bb**:



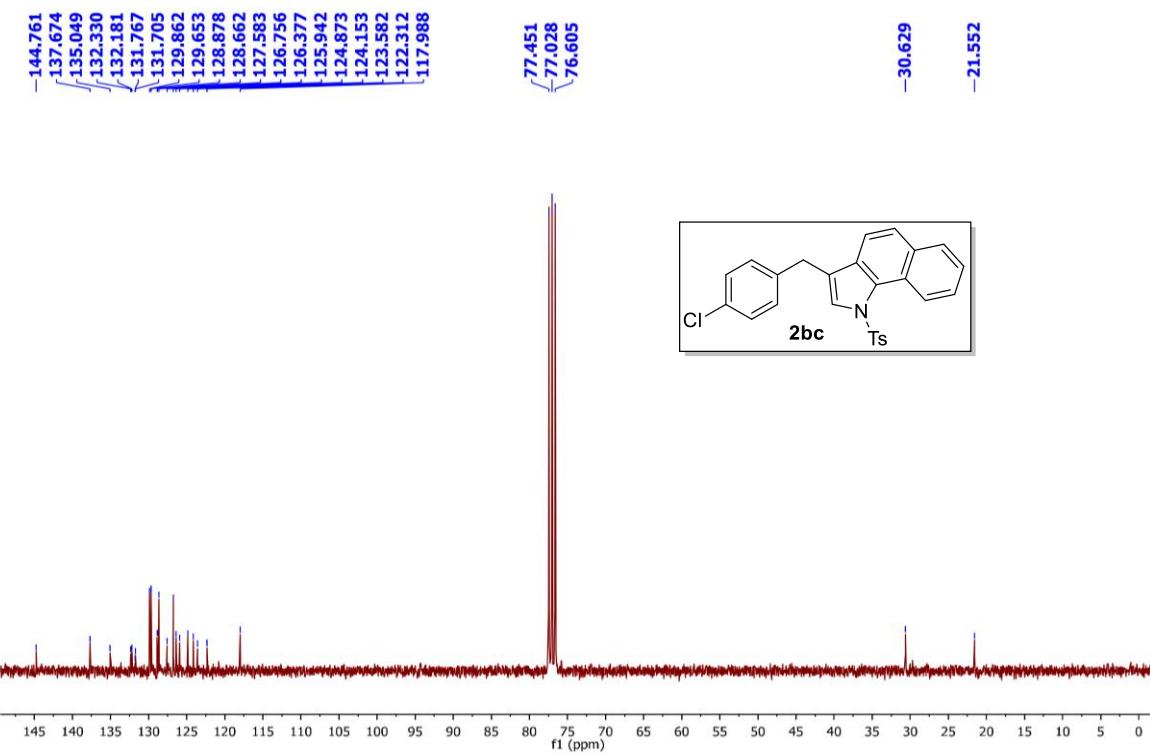
¹³C{¹H} NMR (150 MHz) of **2bb**:



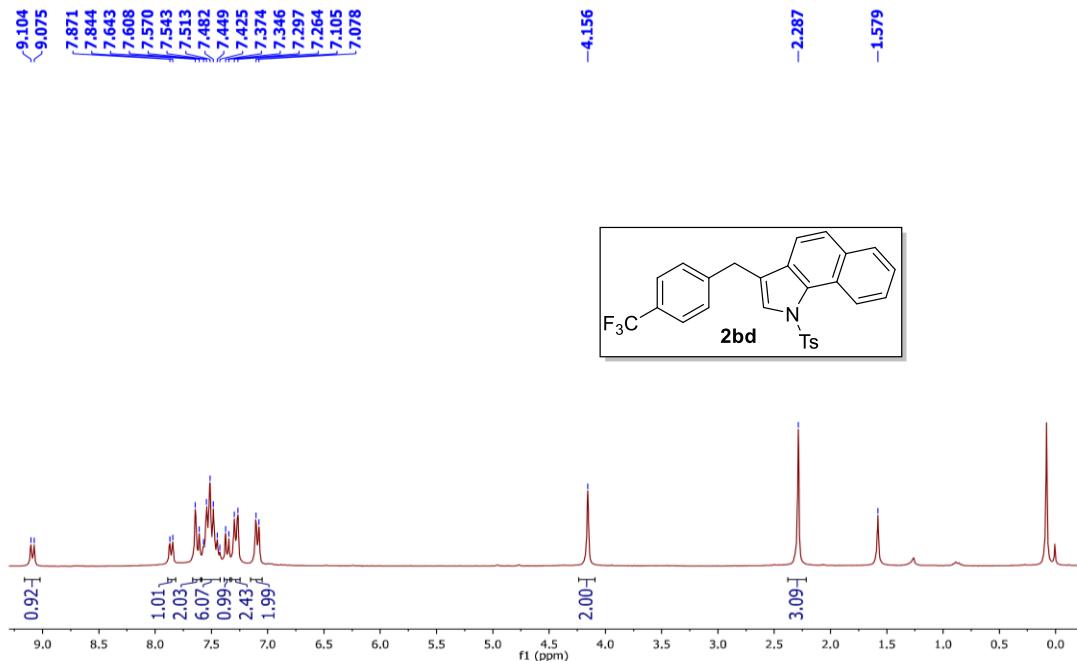
¹H NMR (300 MHz) of **2bc**:



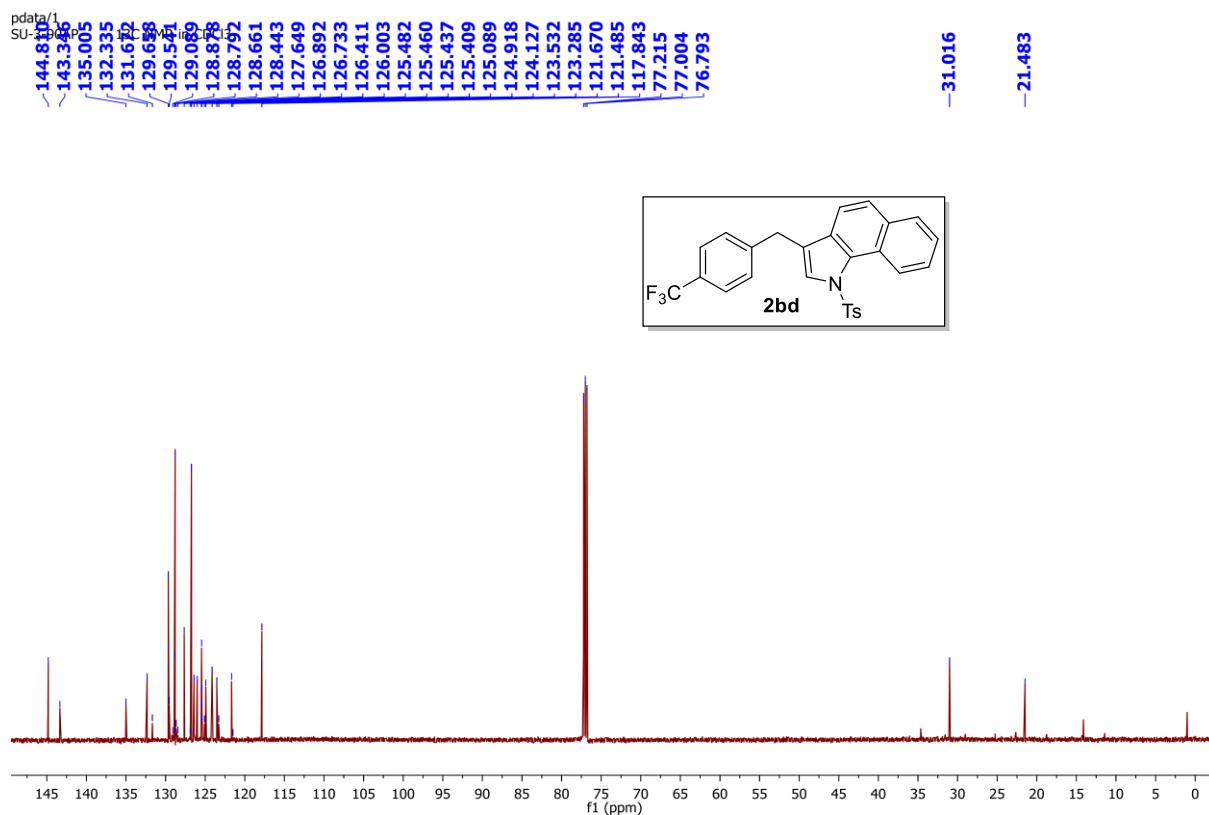
¹³C{¹H} NMR (75 MHz) of **2bc**:



¹H NMR (300 MHz) of **2bd**:

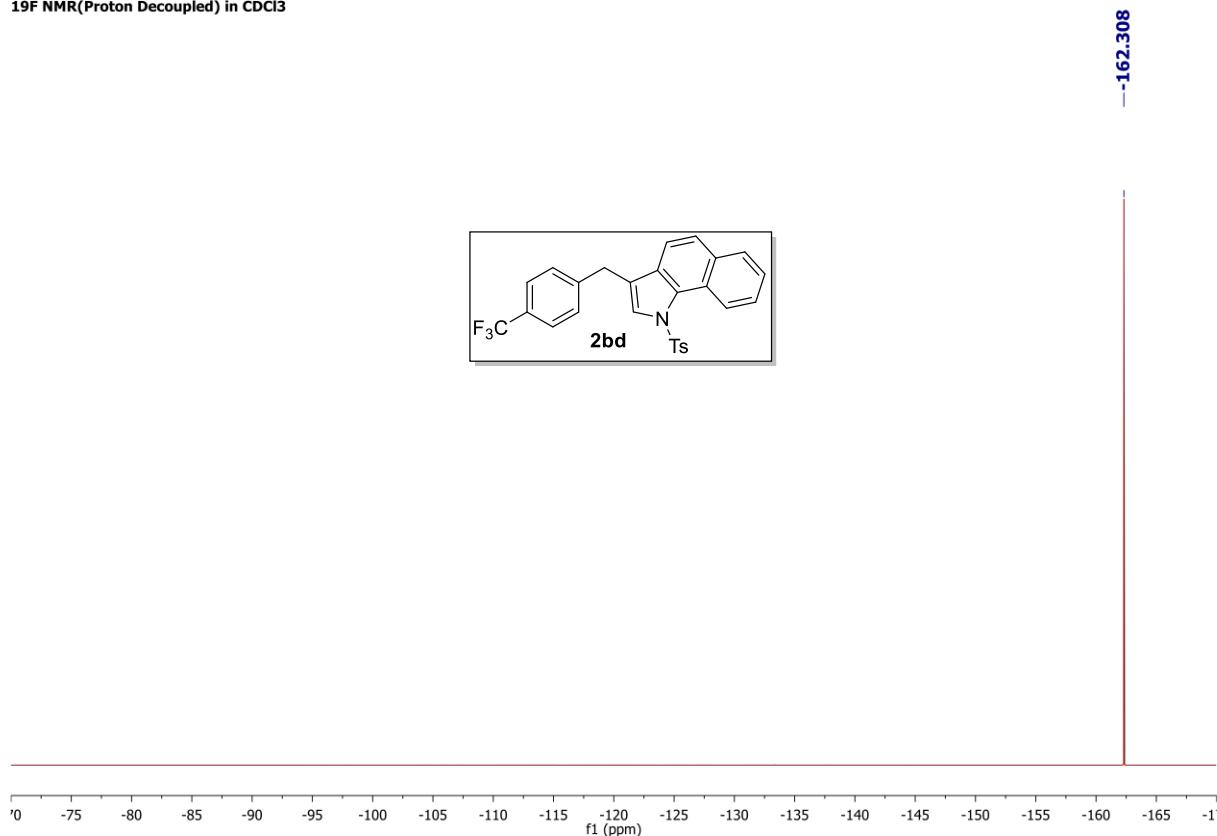


¹³C{¹H} NMR (150 MHz) of **2bd**:

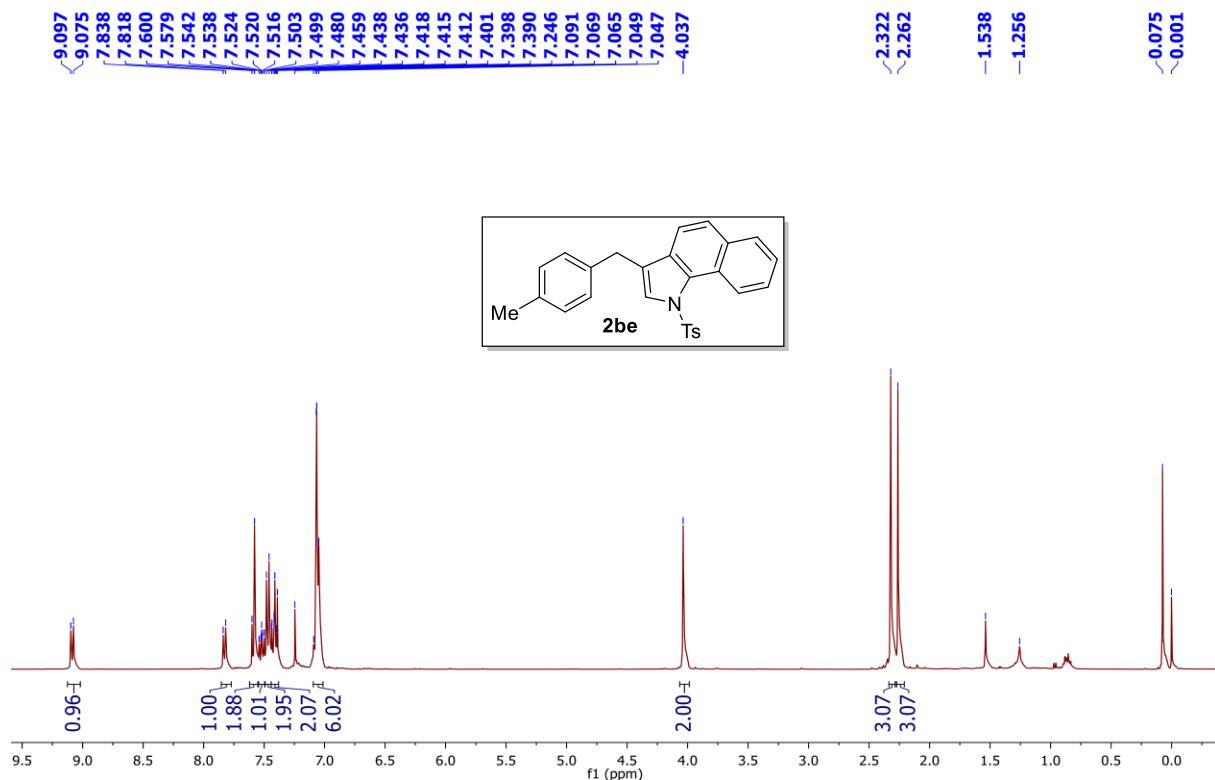


$^{19}\text{F}\{\text{H}\}$ NMR (376 MHz) of **2bd**:

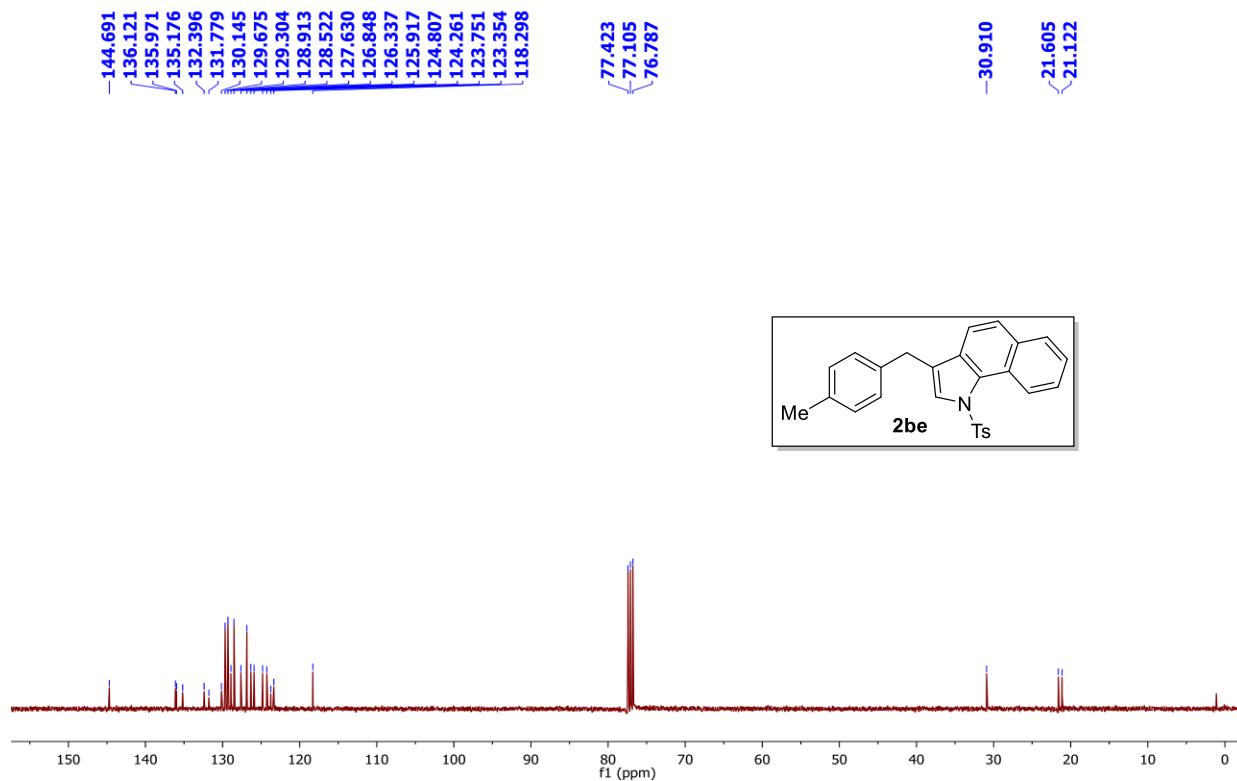
19F NMR(Proton Decoupled) in CDCl₃



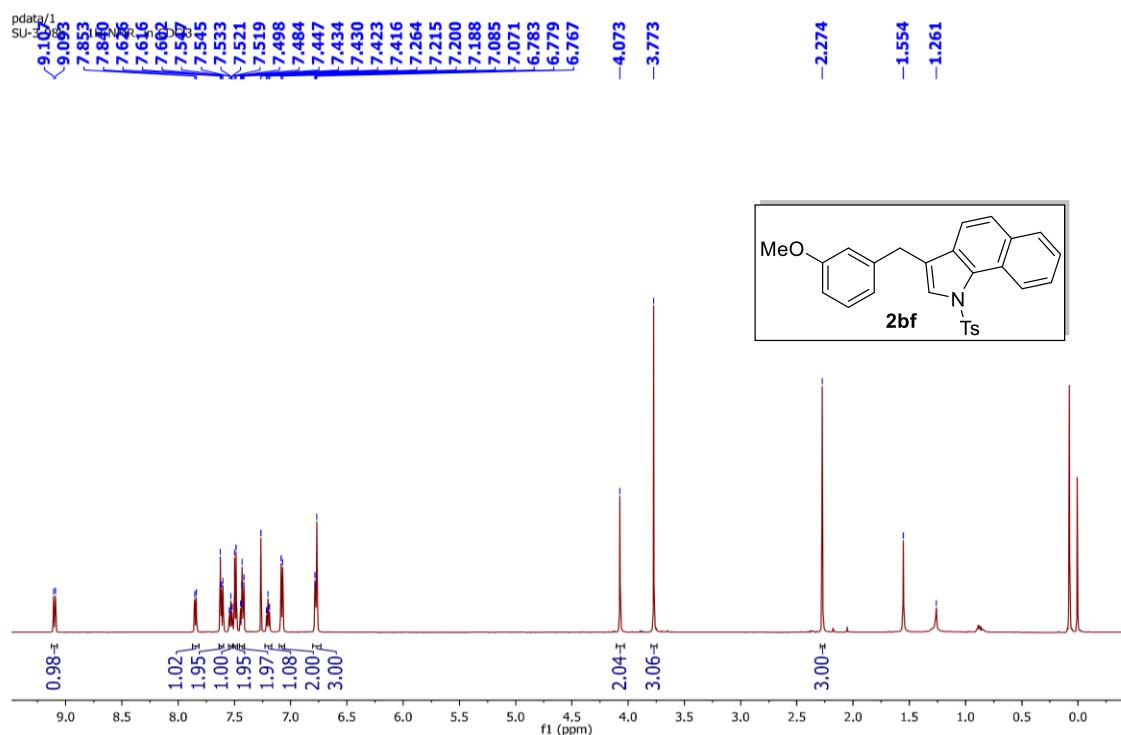
¹H NMR (400 MHz) of **2be**:



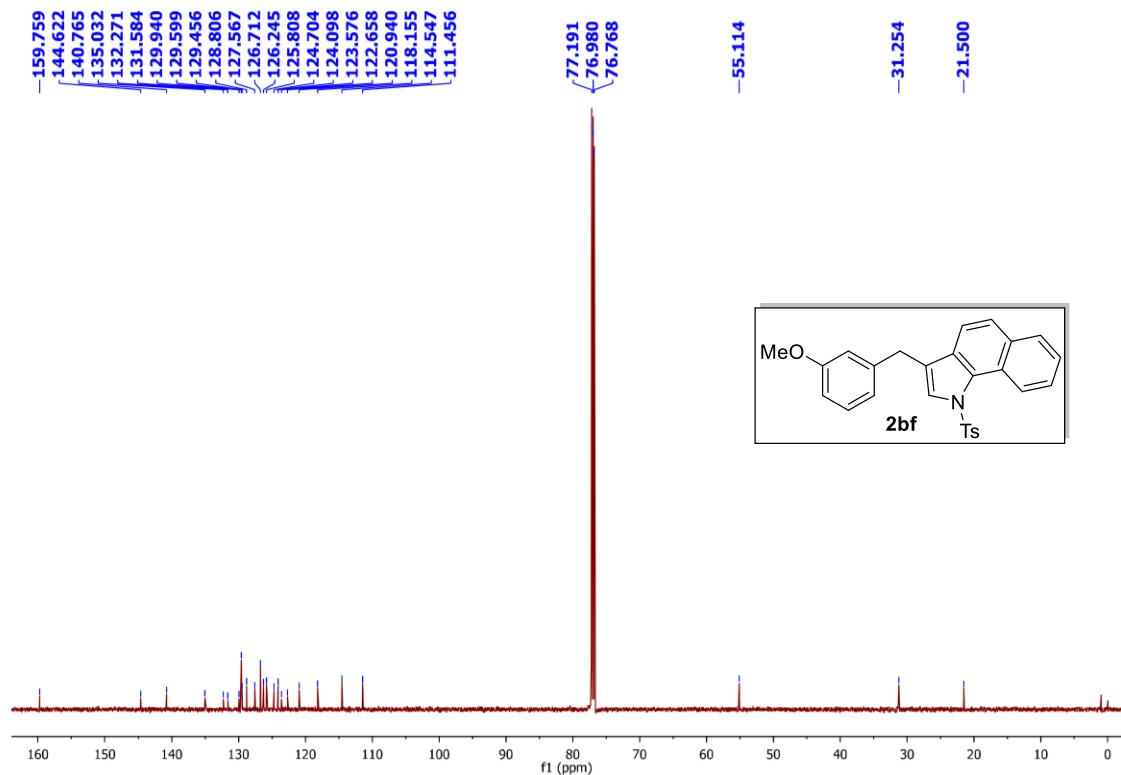
¹³C{¹H} NMR (100 MHz) of **2be**:



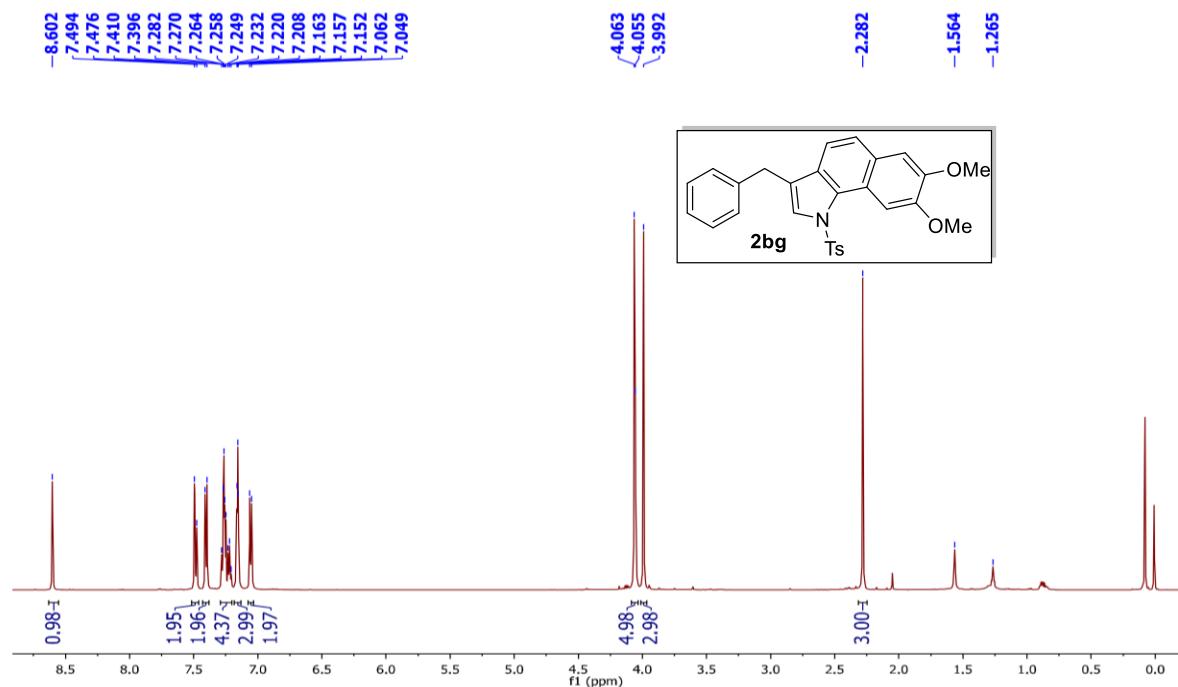
¹H NMR (600 MHz) of **2bf**:



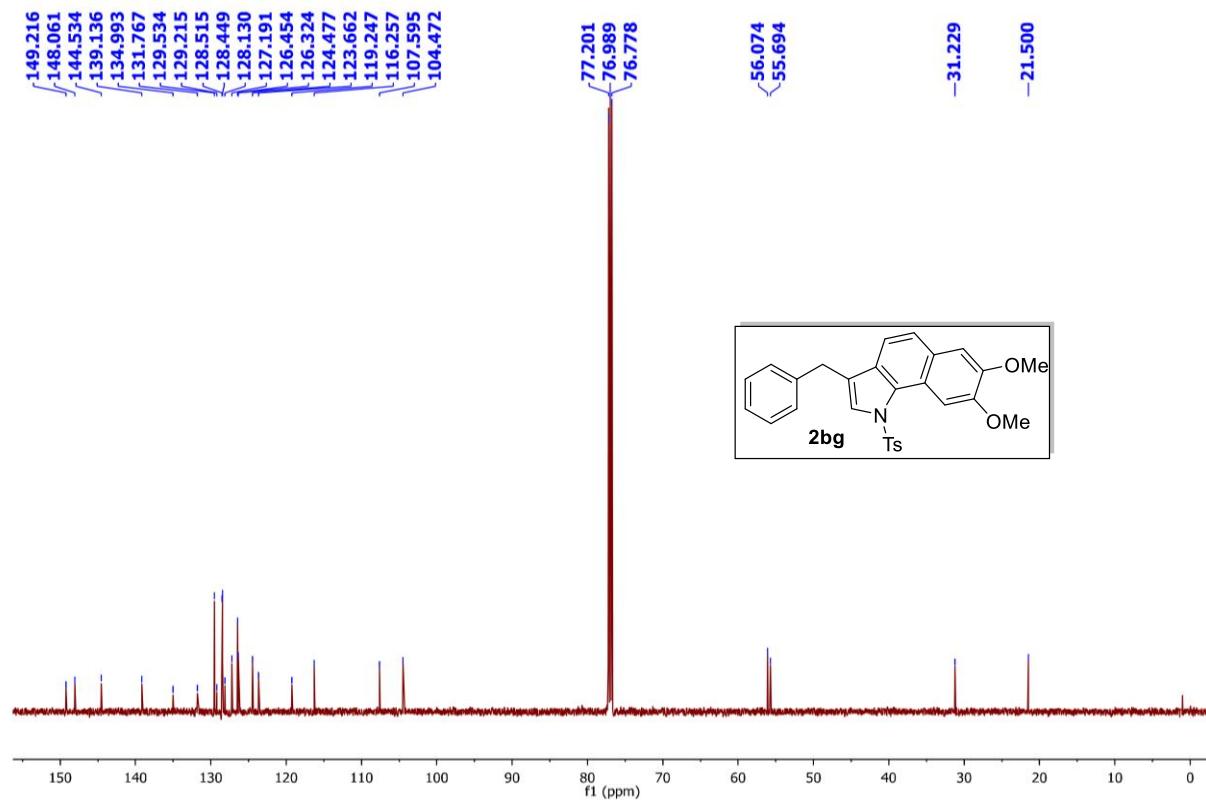
¹³C{¹H} NMR (150 MHz) of **2bf**:



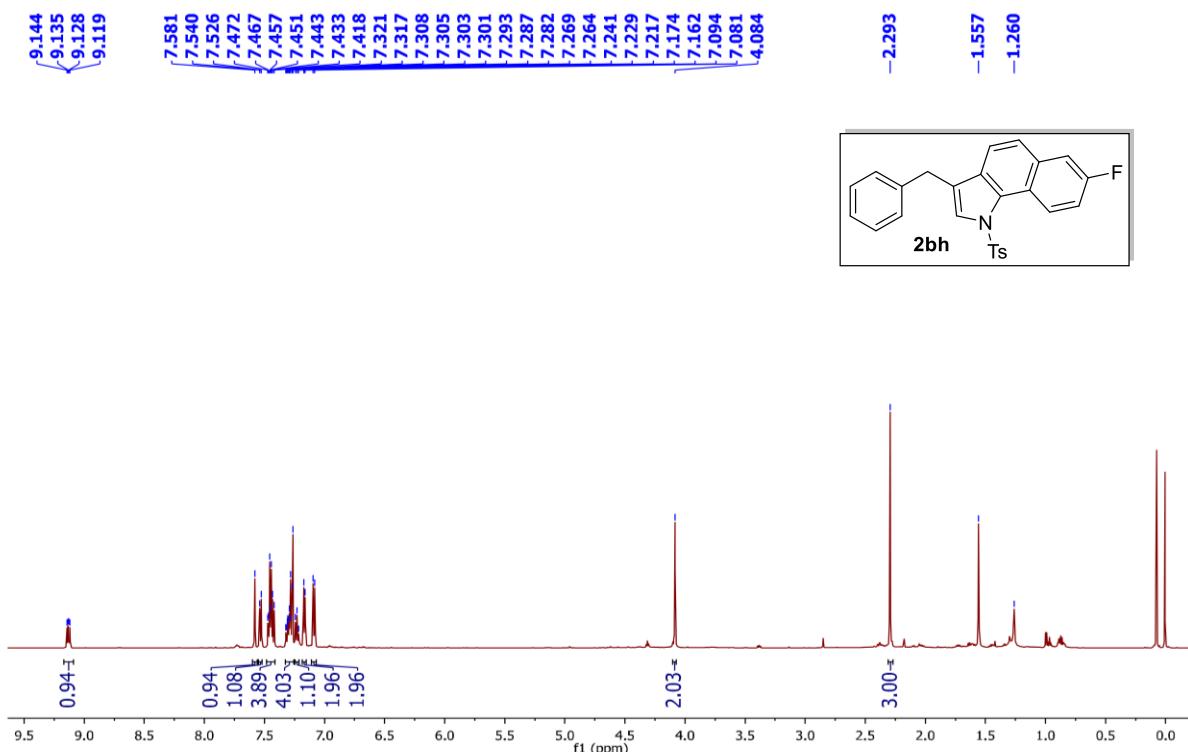
¹H NMR (600 MHz) of **2bg**:



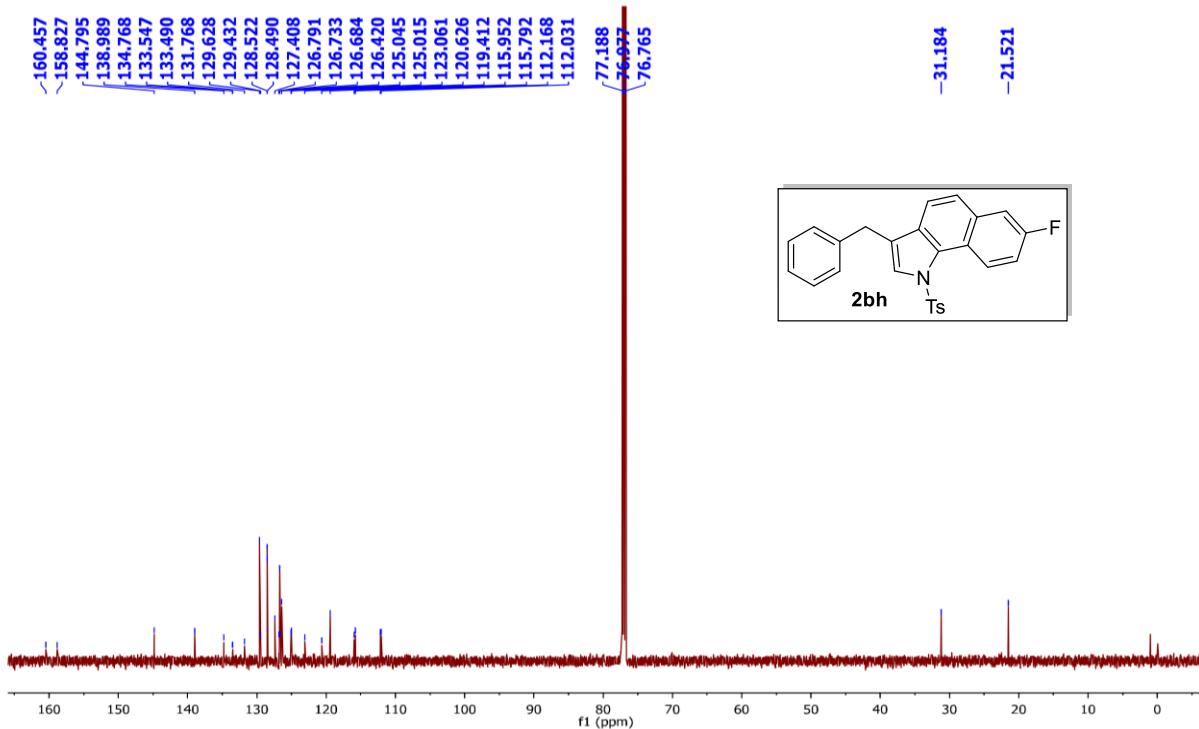
¹³C{¹H} NMR (150 MHz) of **2bg**:



¹H NMR (600 MHz) of **2bh**:

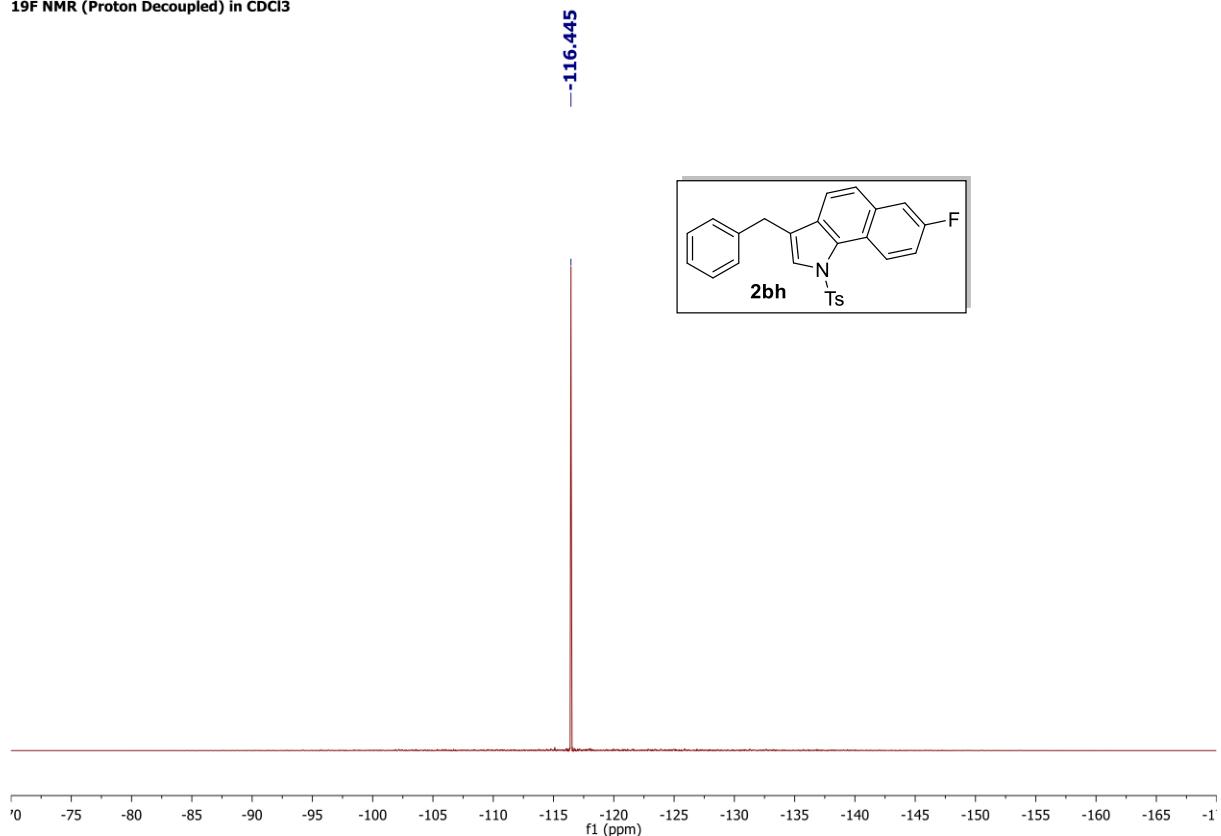


¹³C{¹H} NMR (150 MHz) of **2bh**:

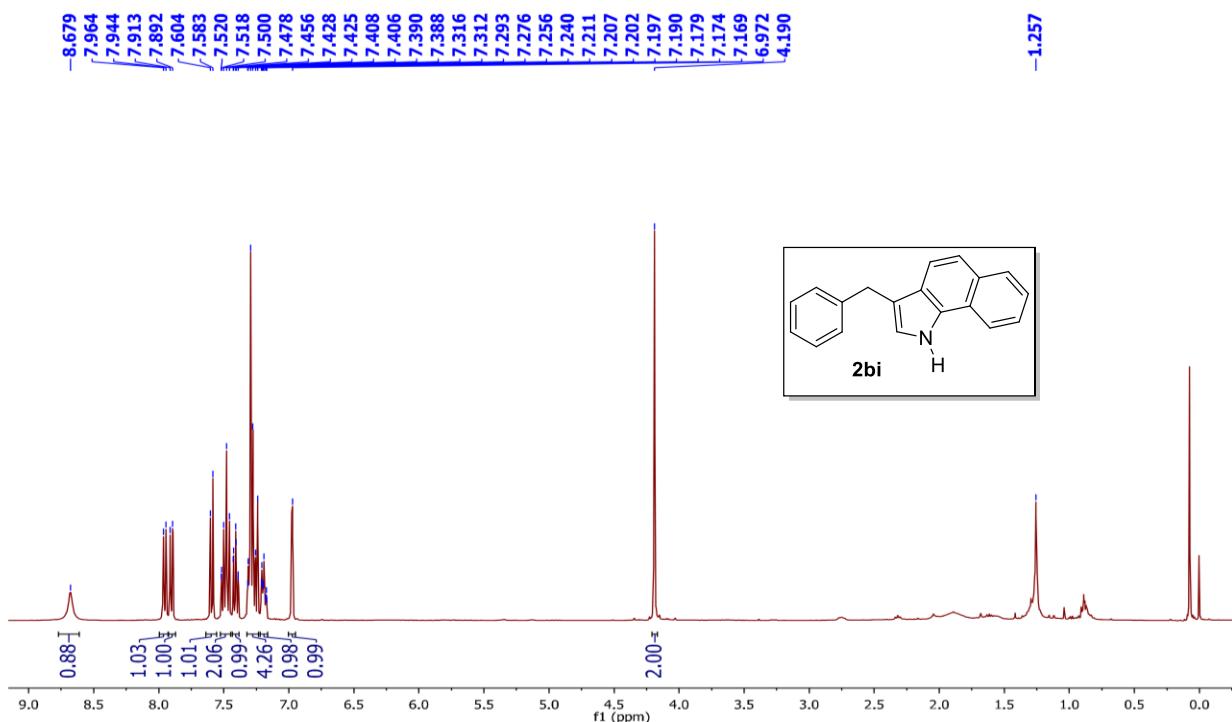


$^{19}\text{F}\{\text{H}\}$ NMR (376 MHz) of **2bh**:

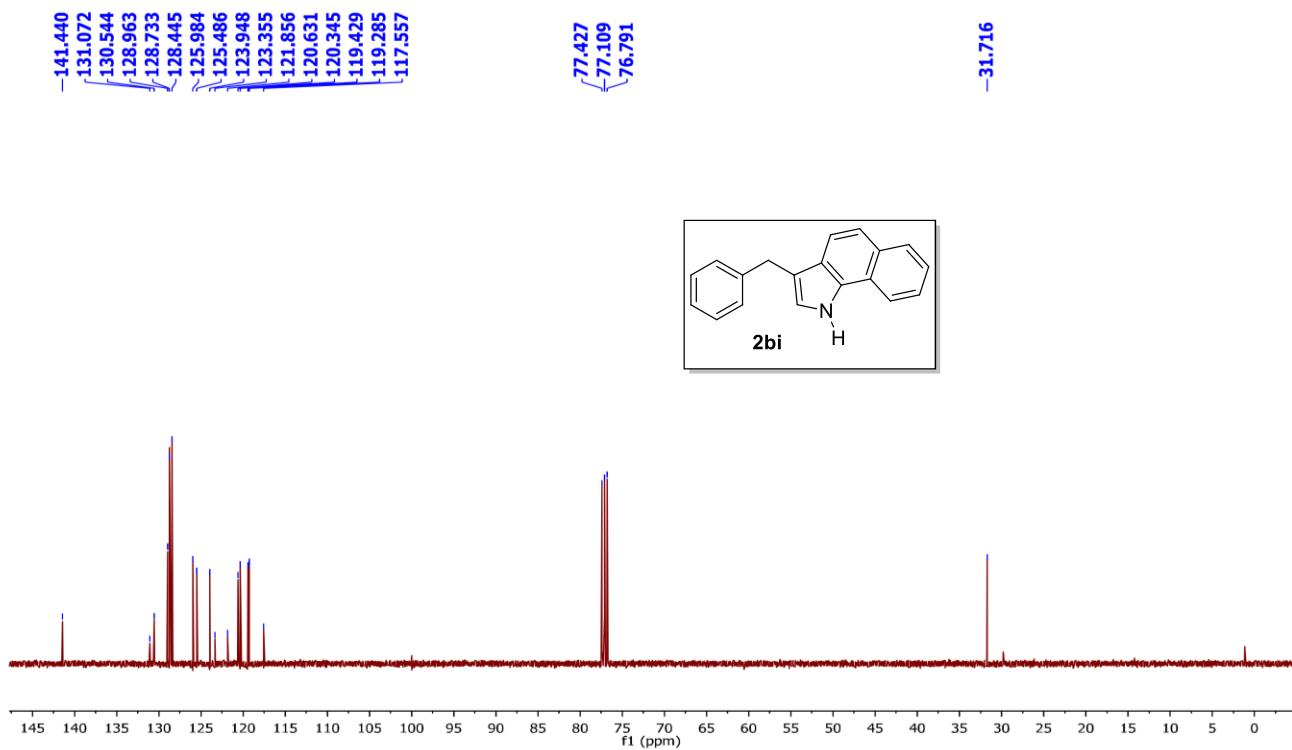
19F NMR (Proton Decoupled) in CDCl₃



¹H NMR (400 MHz) of compound **2bi**:

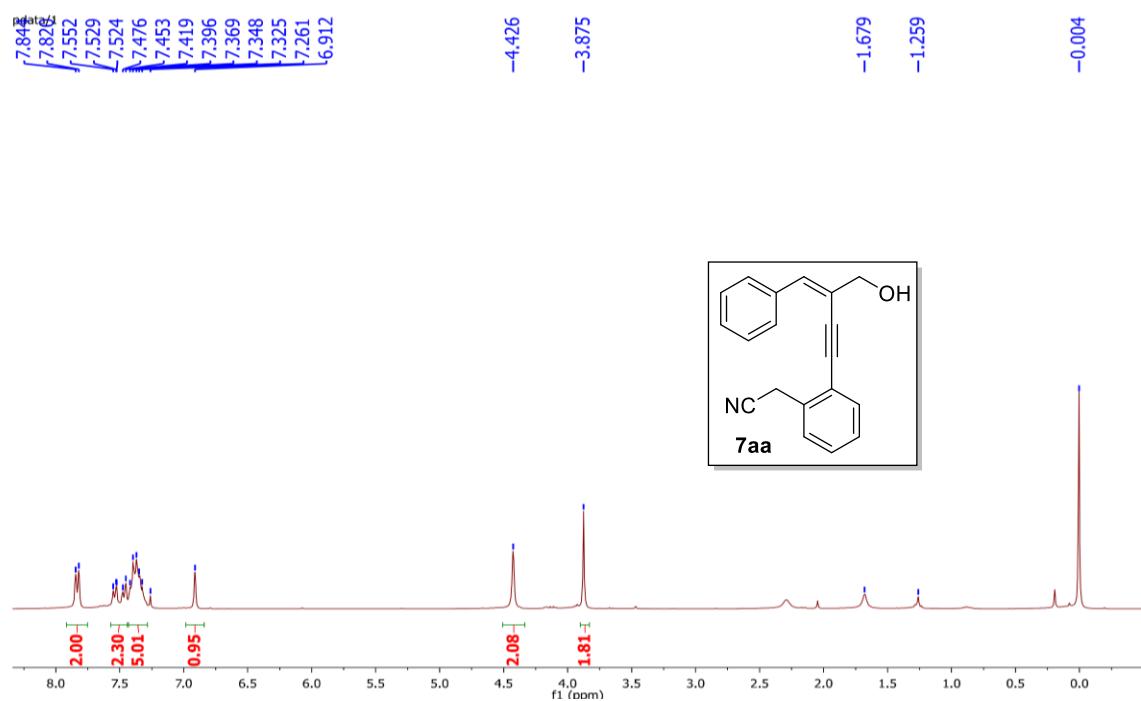


¹³C{¹H} NMR (100 MHz) of **2bi**:

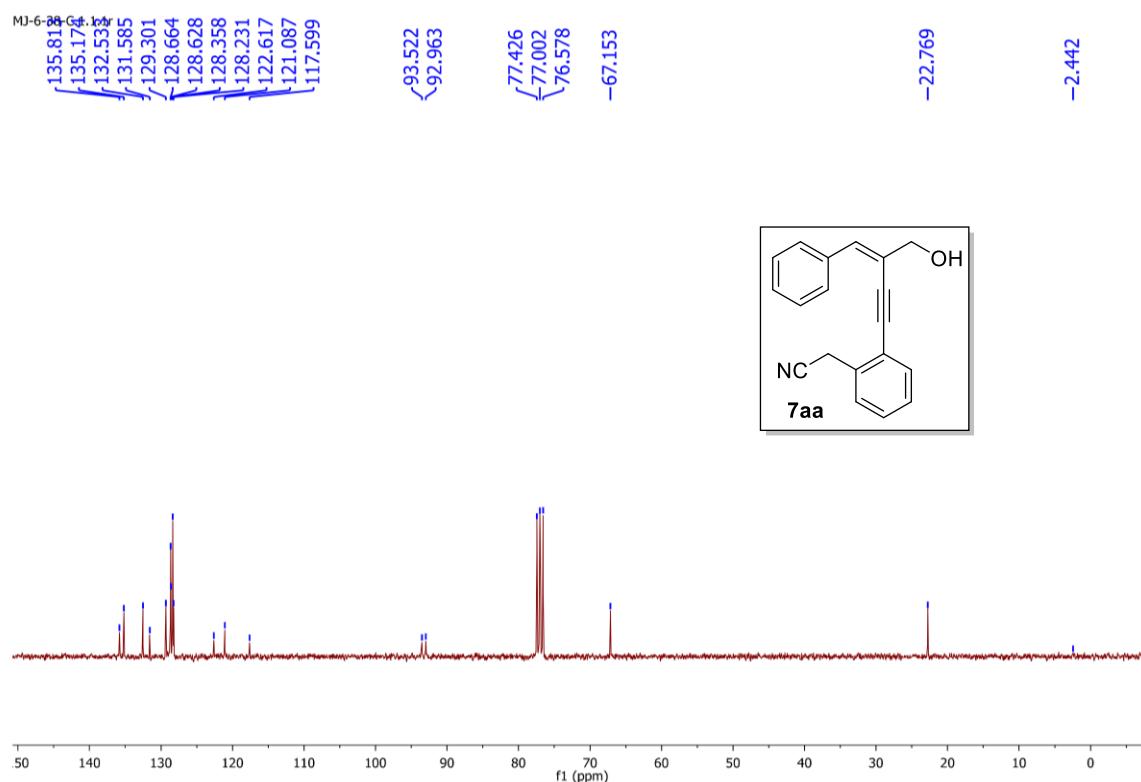


12. NMR Spectra of Compounds 7aa-7aj :

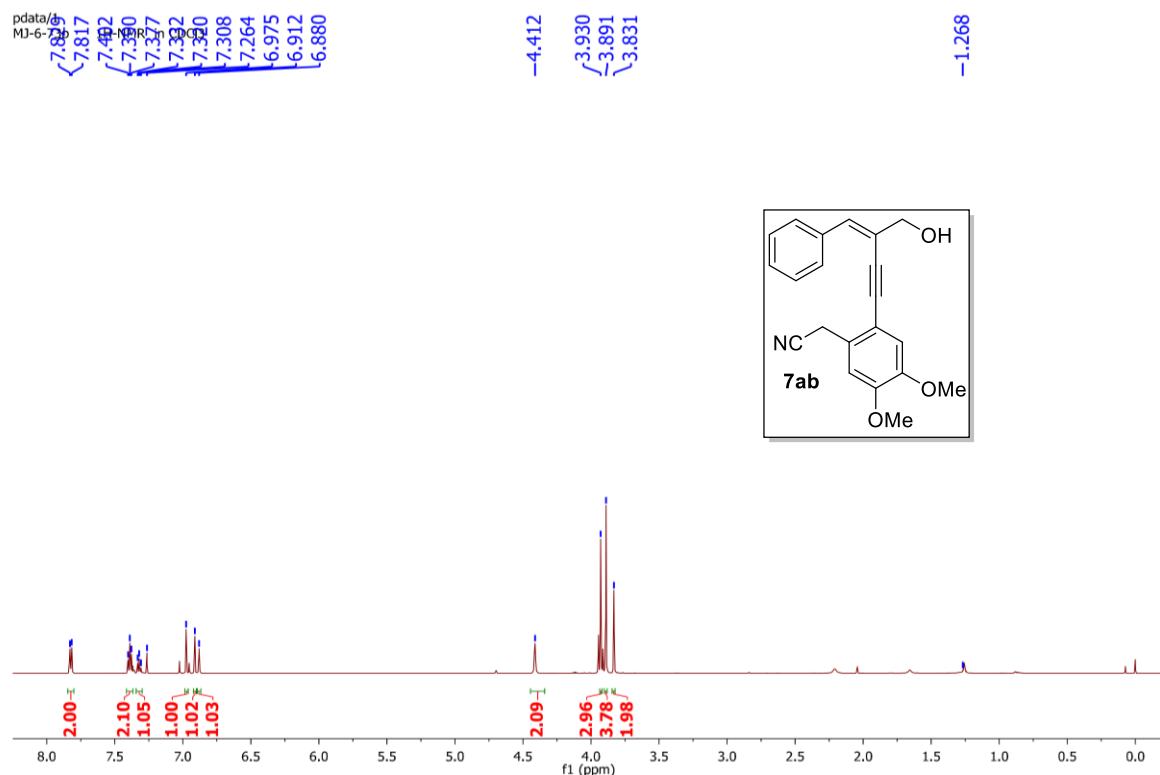
^1H NMR (300 MHz) of 7aa:



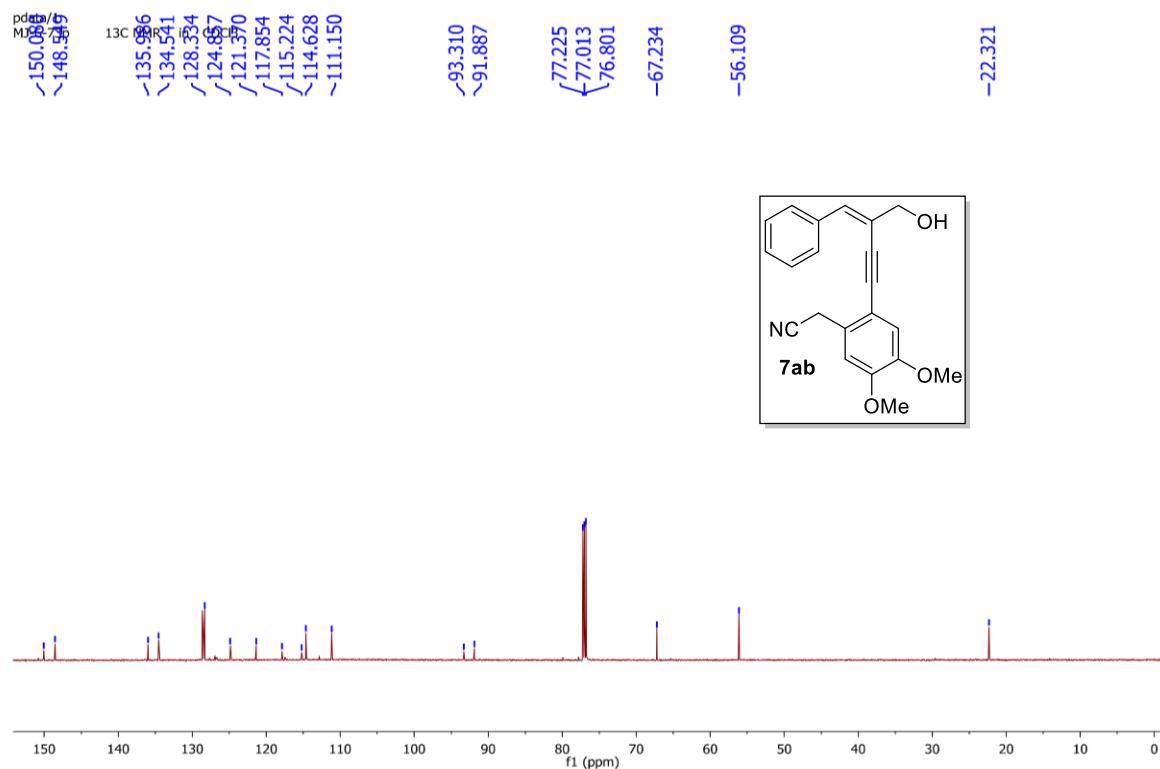
$^{13}\text{C}\{^1\text{H}\}$ NMR (75 MHz) of 7aa:



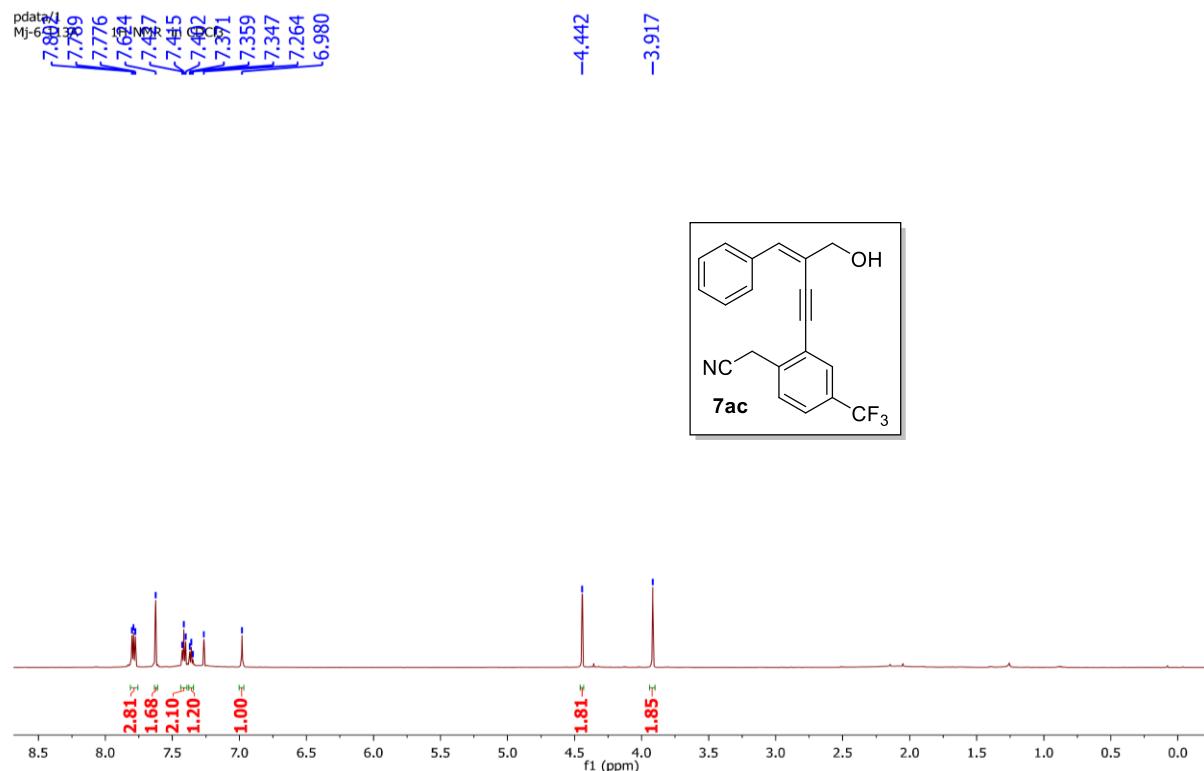
¹H NMR (600 MHz) of 7ab:



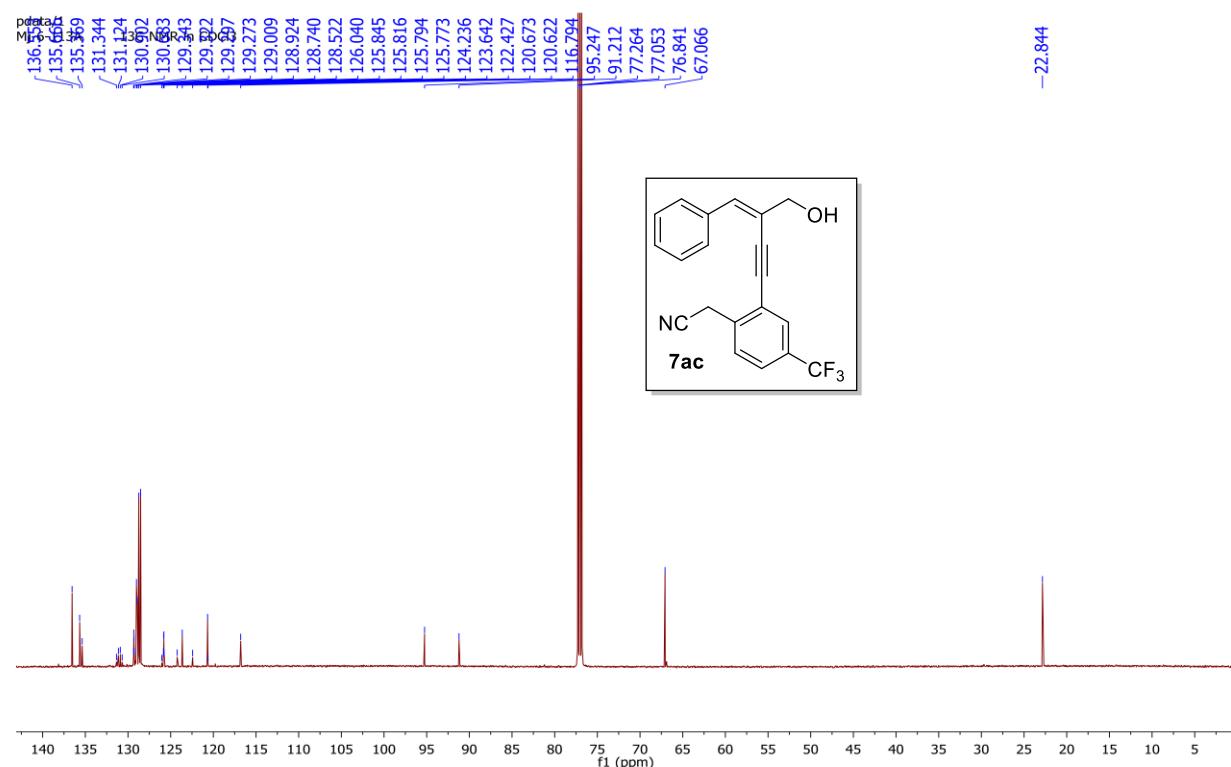
¹³C{¹H} NMR (150 MHz) of 7ab:



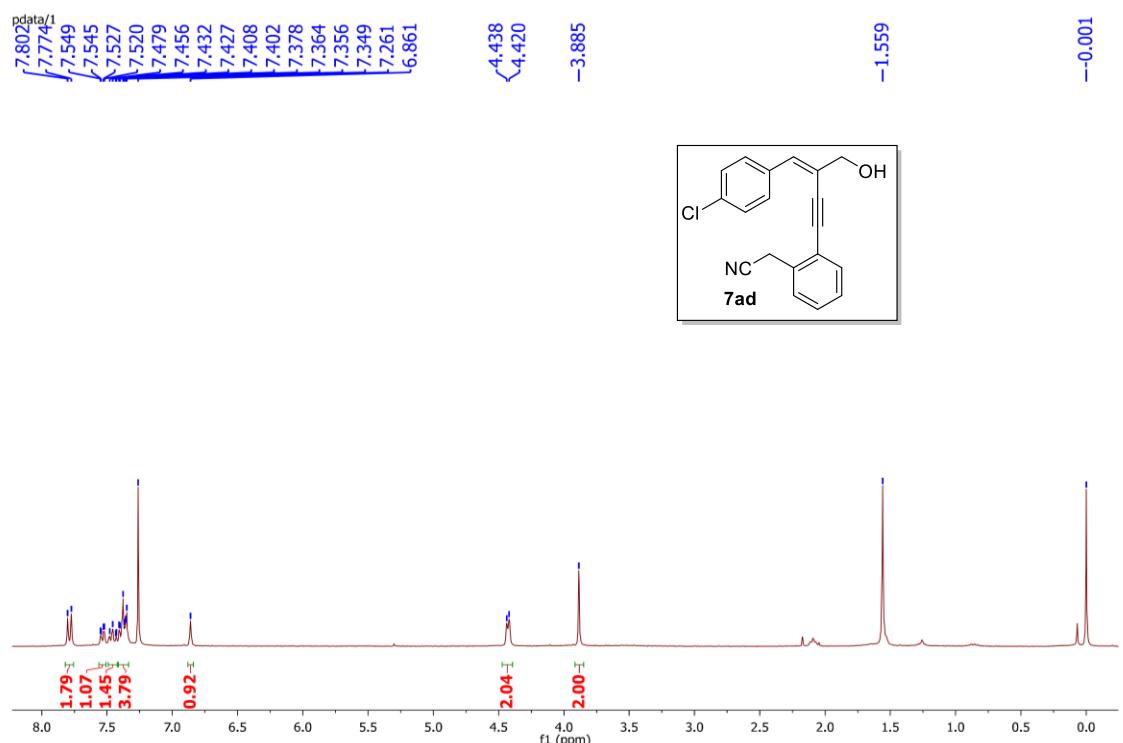
¹H NMR (600 MHz) of 7ac:



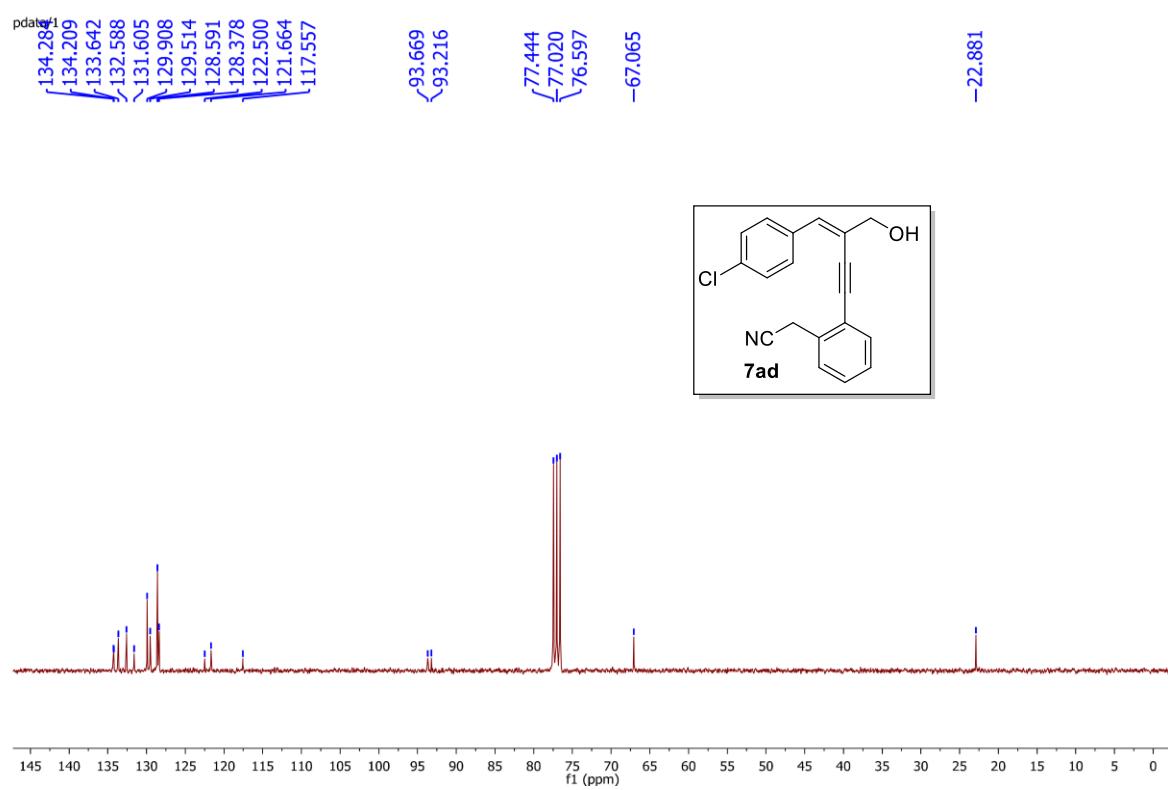
¹³C{¹H} NMR (150 MHz) of 7ac:



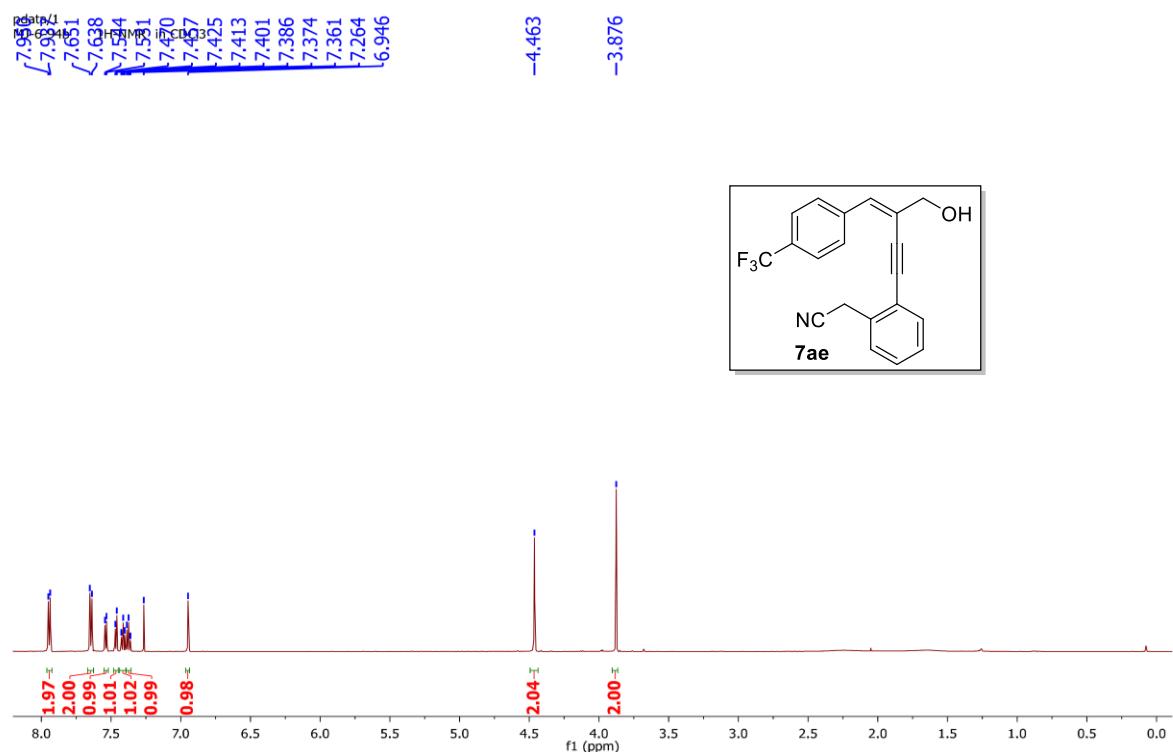
¹H NMR (600 MHz) of 7ad:



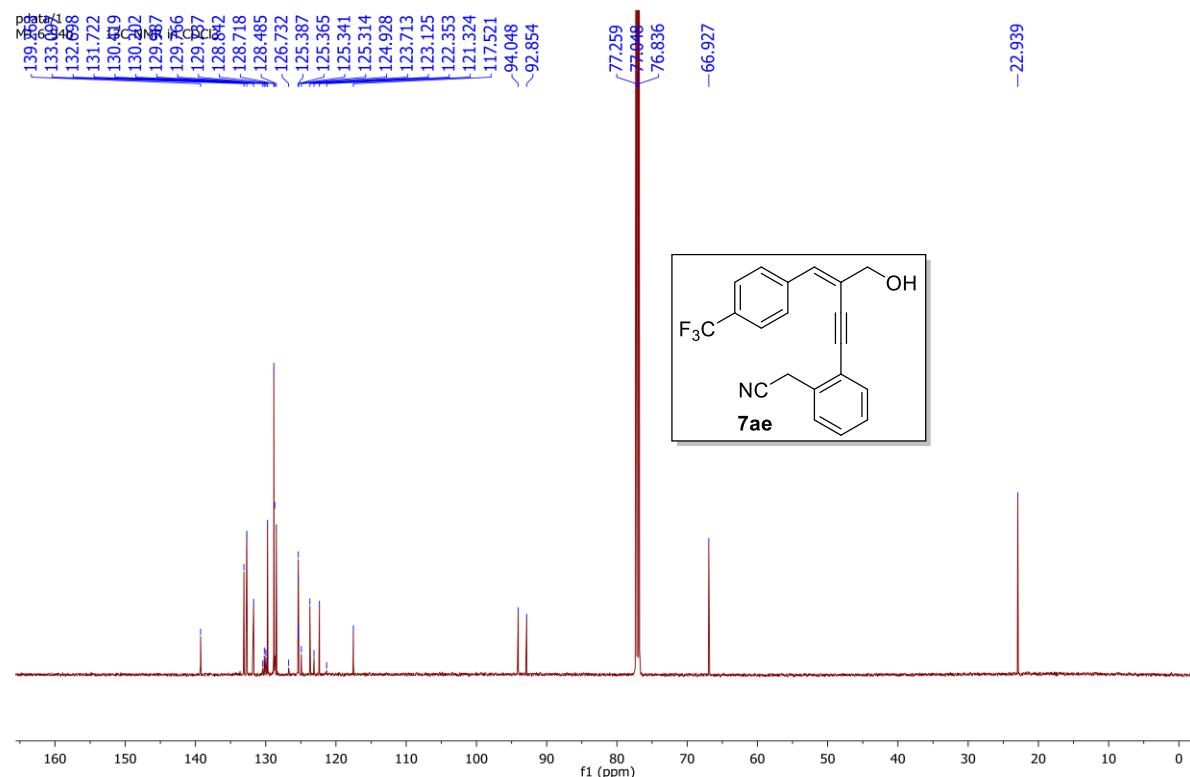
¹³C{¹H} NMR (75 MHz) of 7ad:



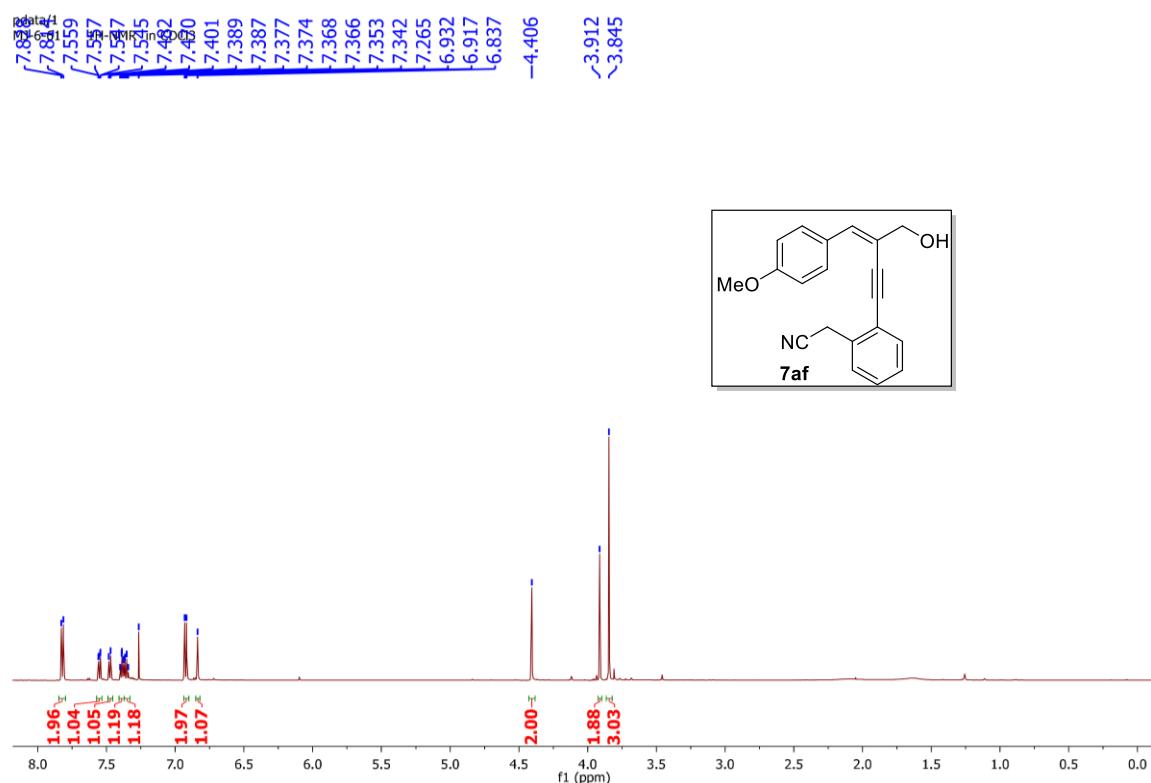
¹H NMR (600 MHz) of 7ae:



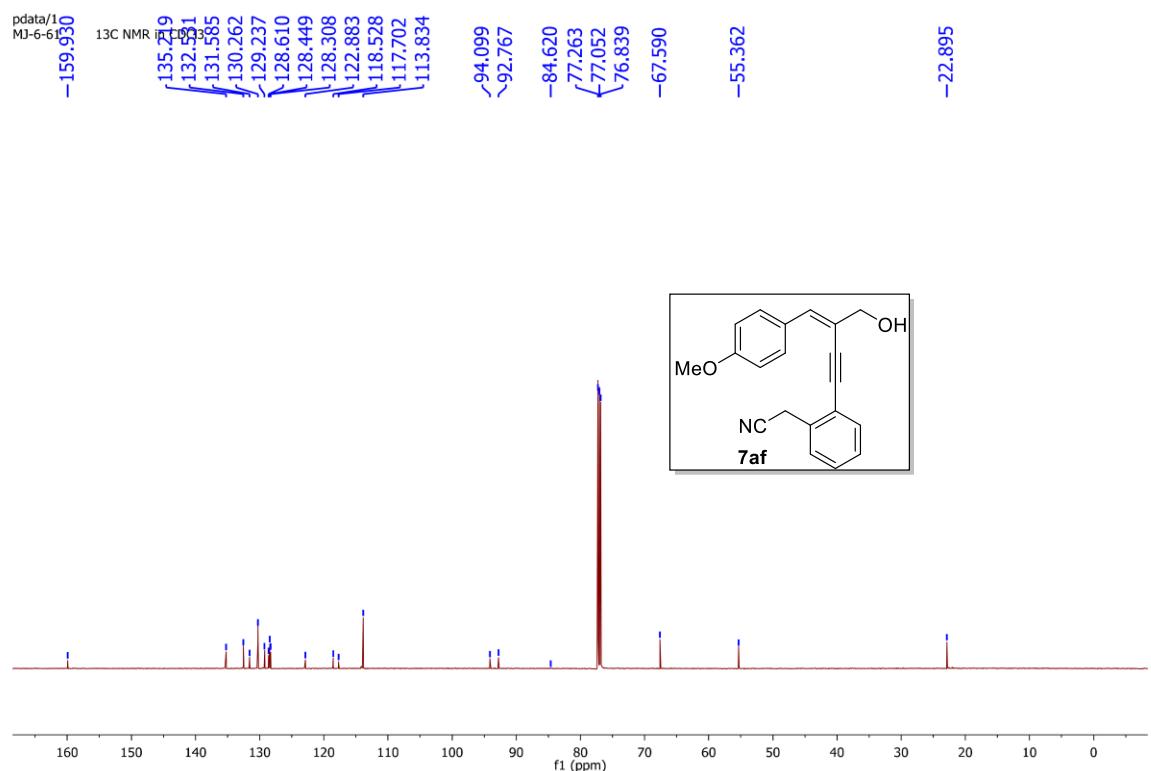
¹³C{¹H} NMR (150 MHz) of 7ae:



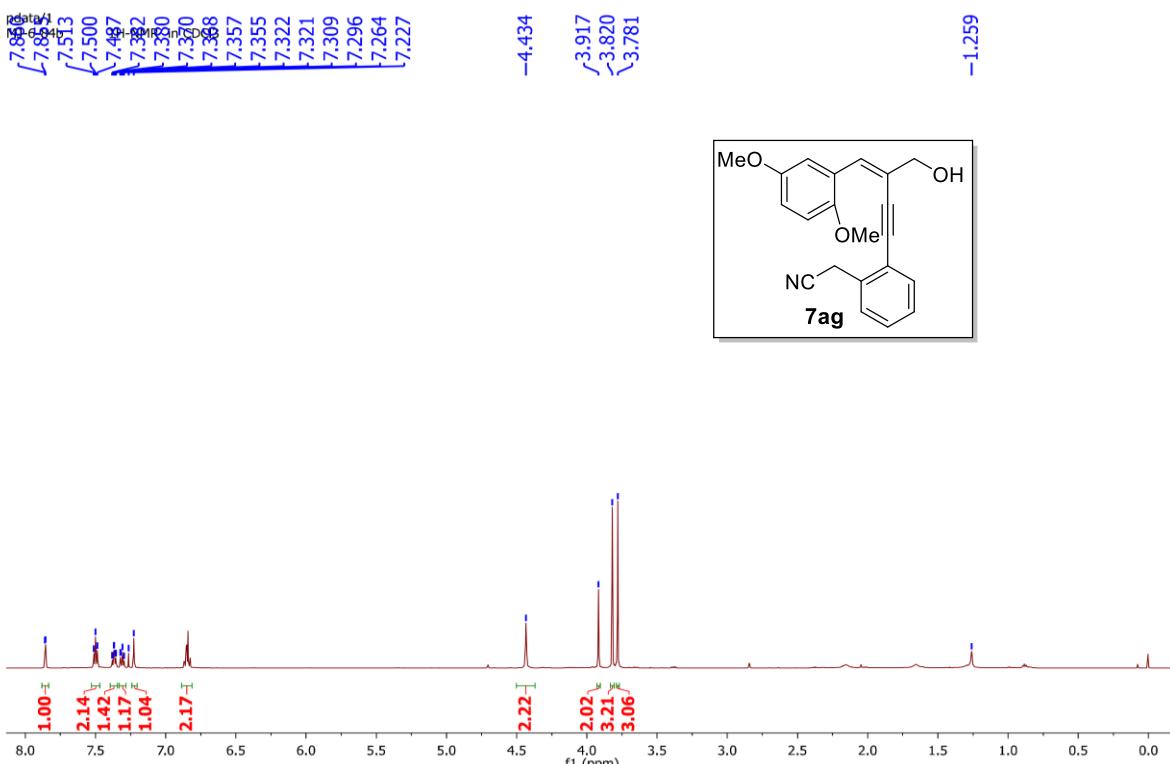
¹H NMR (600 MHz) of **7af**:



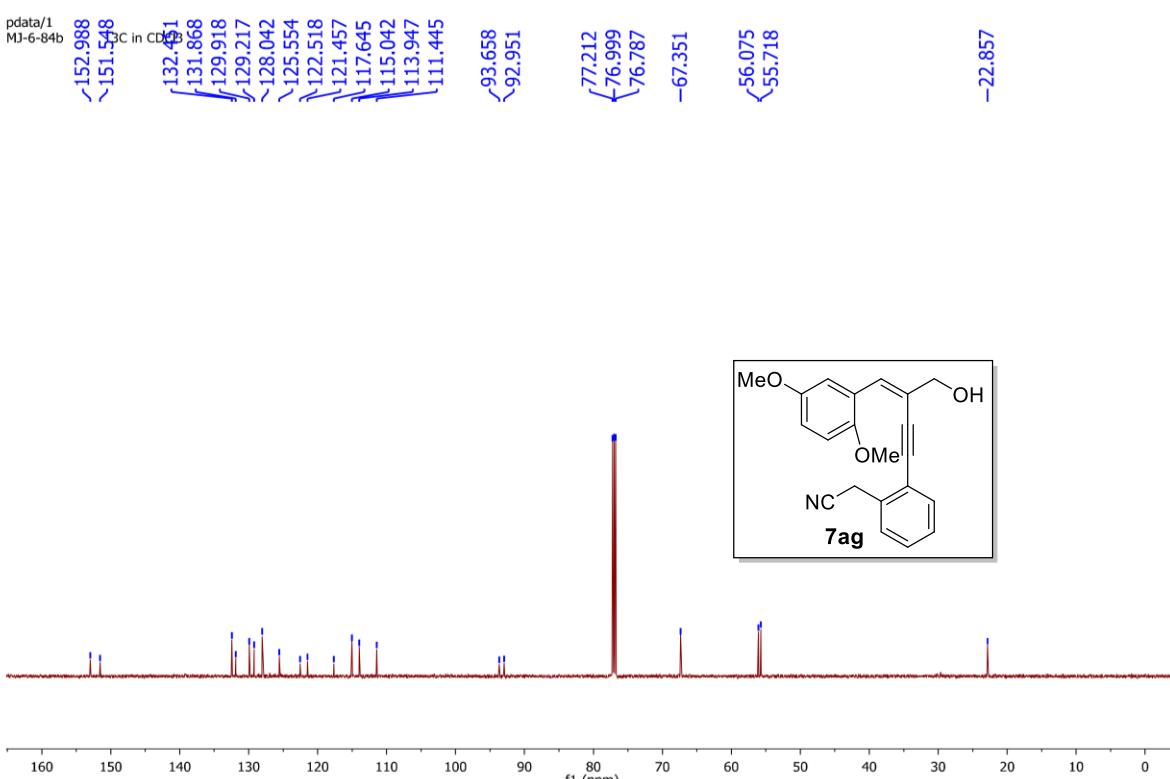
¹³C{¹H} NMR (150 MHz) of **7af**:



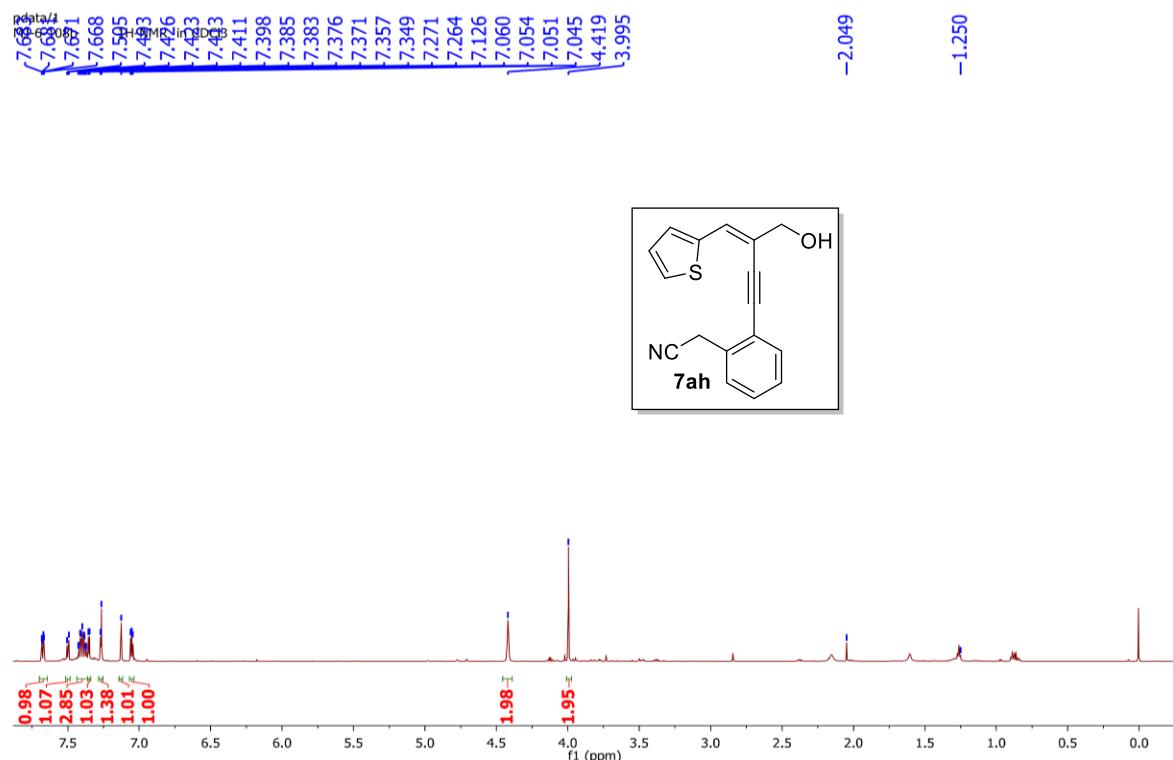
¹H NMR (600 MHz) of **7ag**:



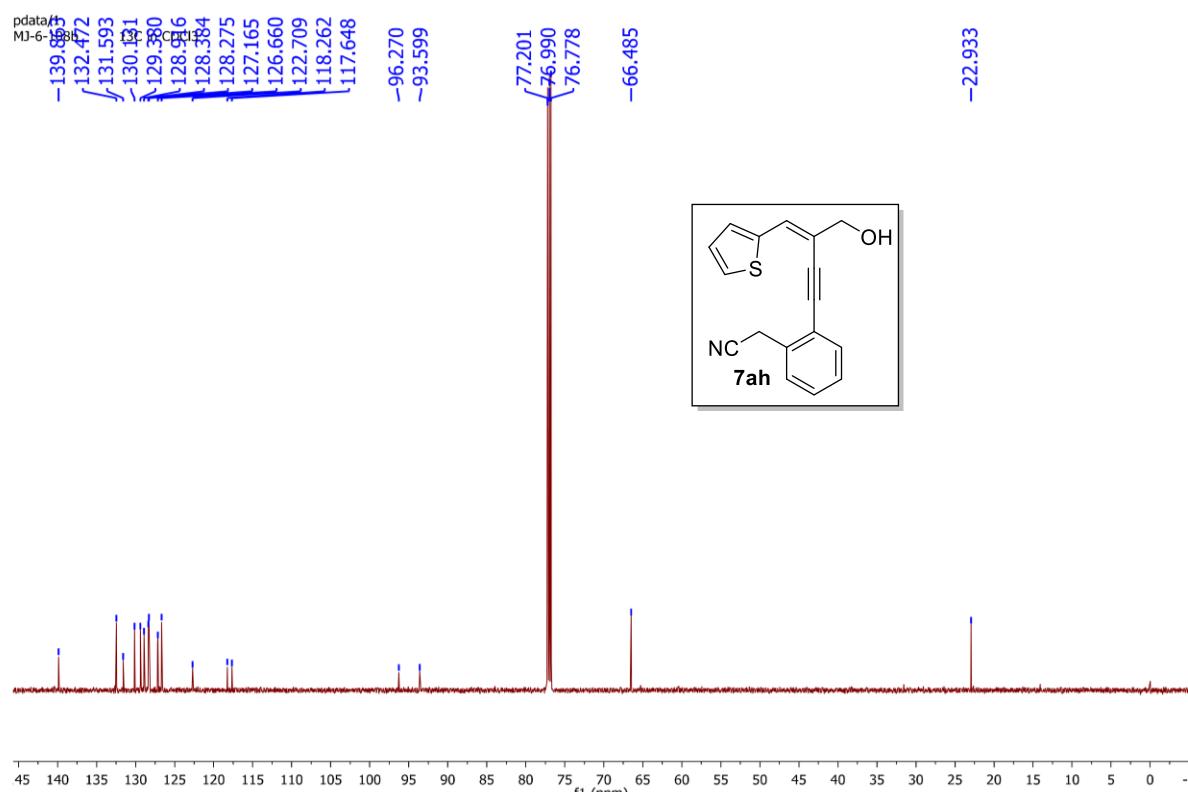
¹³C{¹H} NMR (150 MHz) of **7ag**:



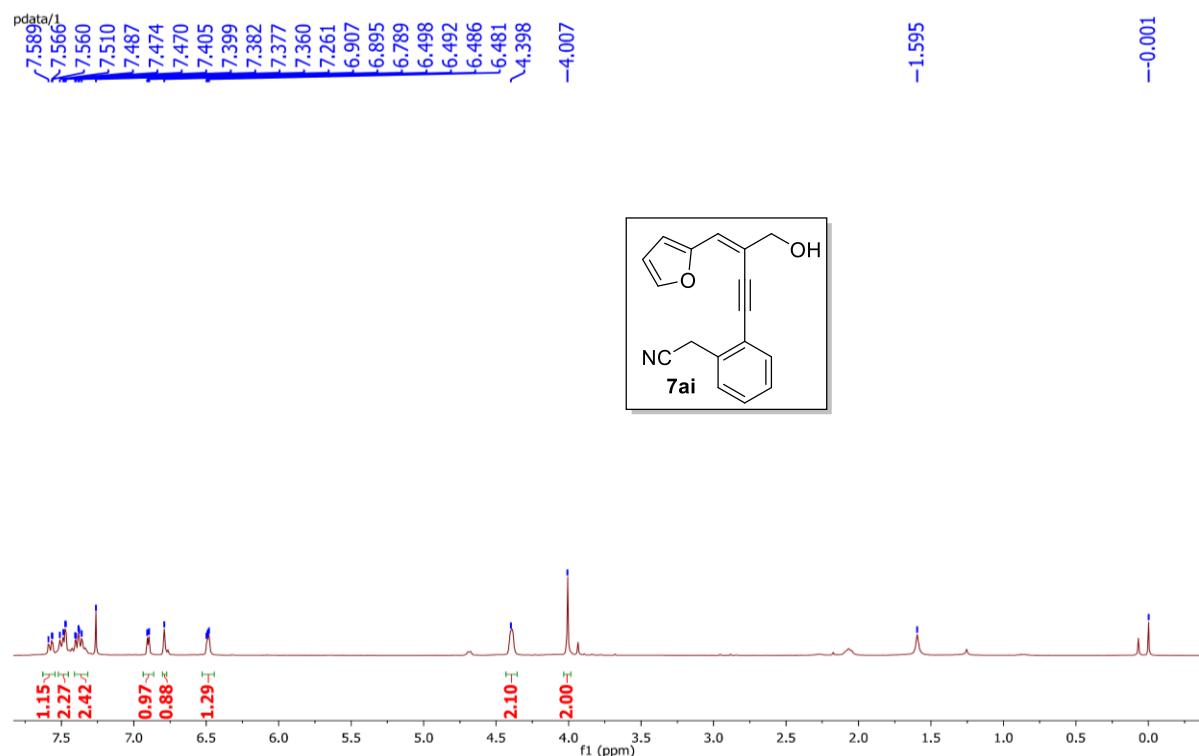
¹H NMR (600 MHz) of 7ah:



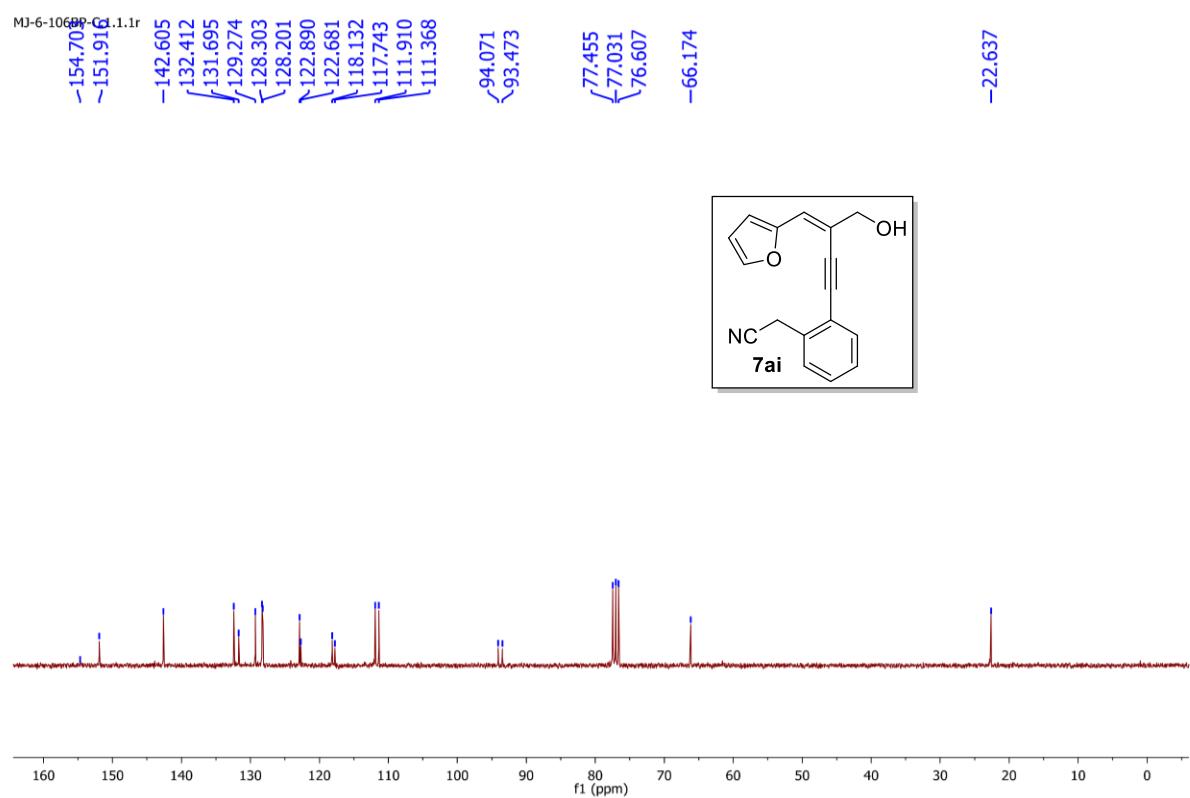
¹³C{¹H} NMR (150 MHz) of 7ah:



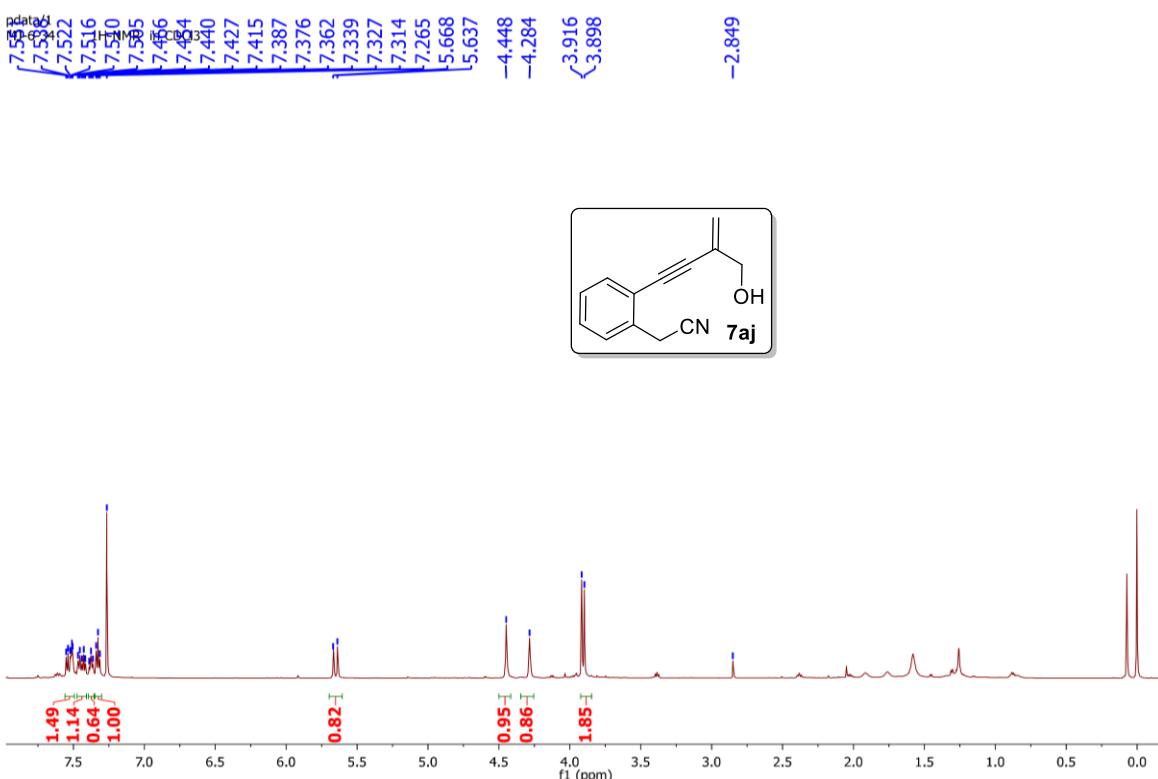
¹H NMR (300 MHz) of 7ai:



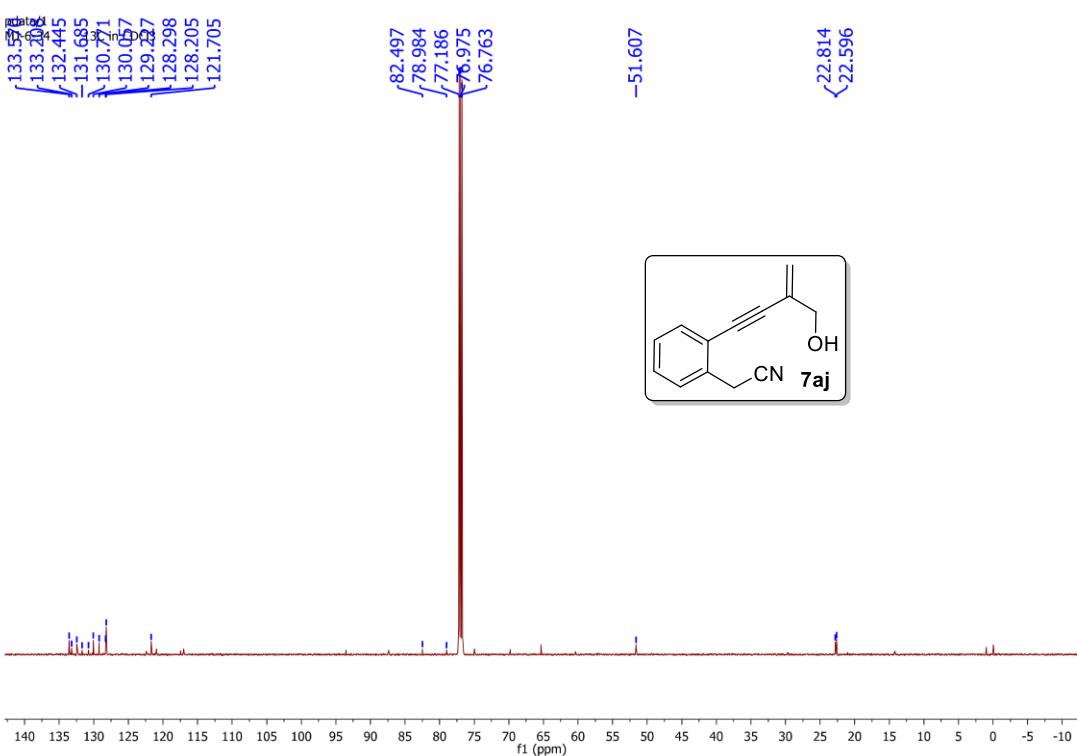
¹³C{¹H} NMR (75 MHz) of 7ah:



¹H NMR (600 MHz) of 7aj:

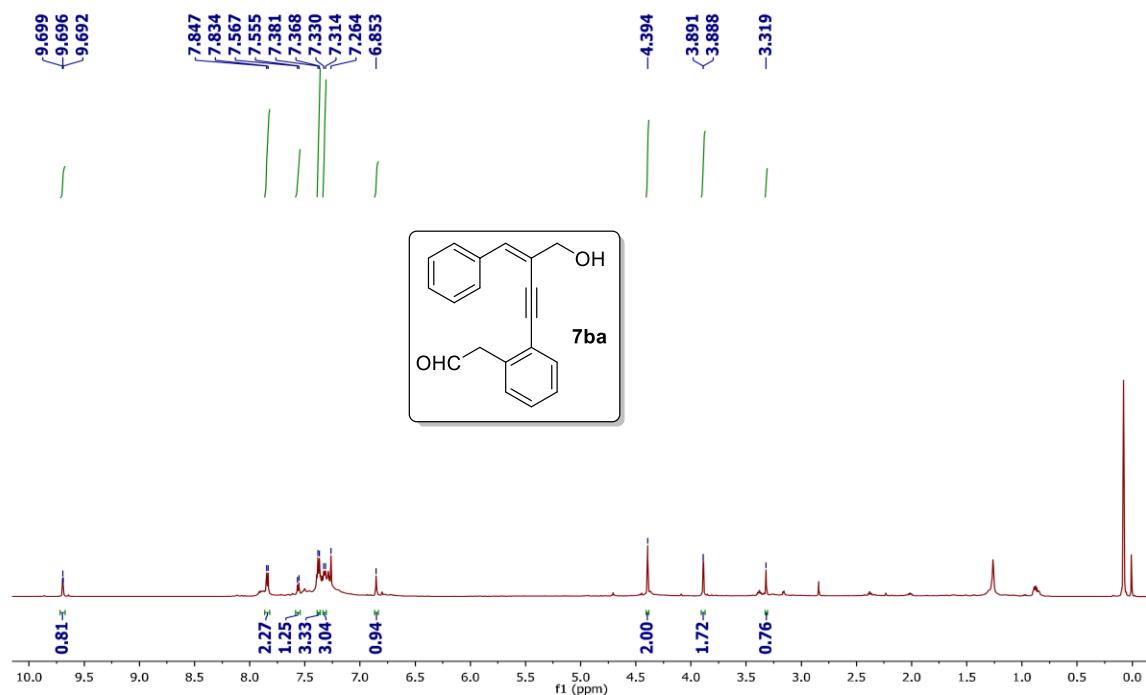


¹³C{¹H} NMR (150 MHz) of 7aj:

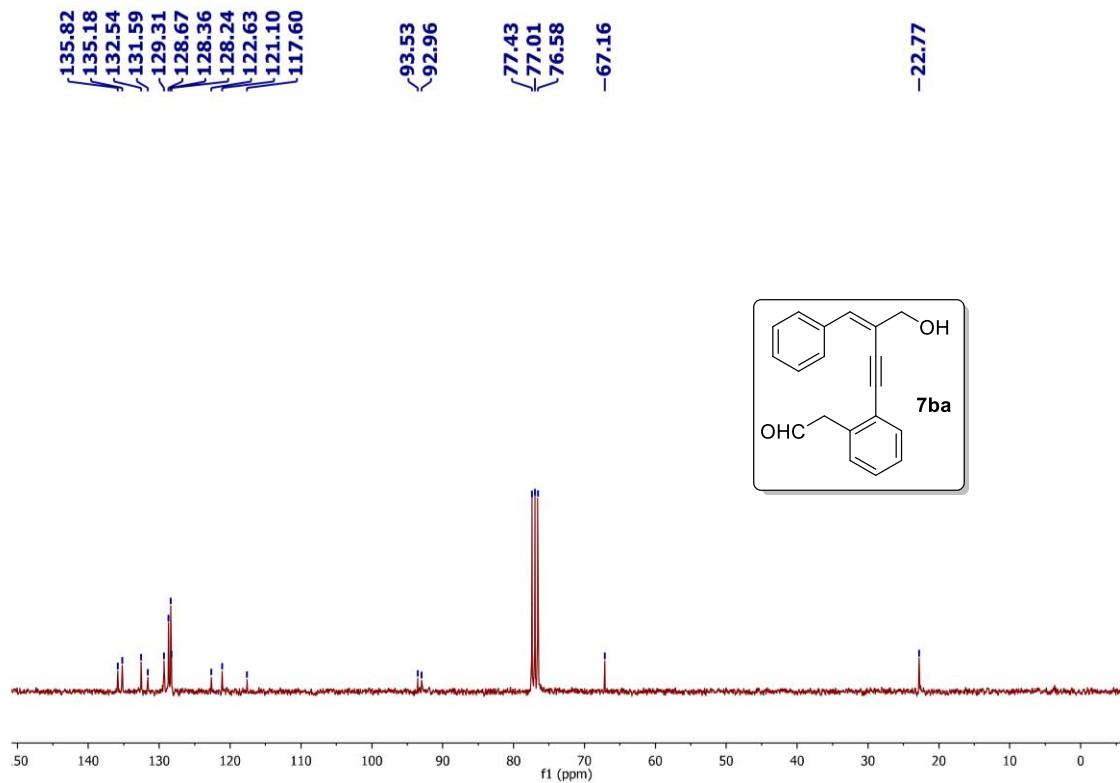


13. NMR Spectra of Compounds 7ba-7bg :

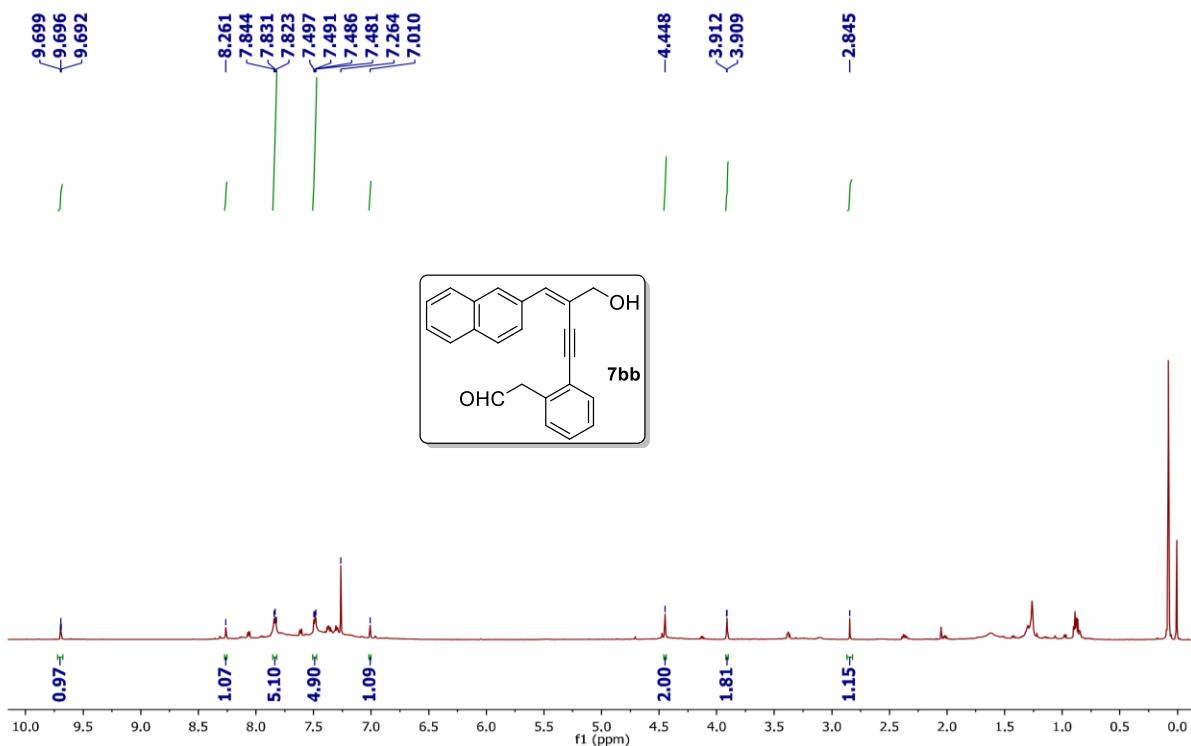
^1H NMR (600 MHz) of 7ba:



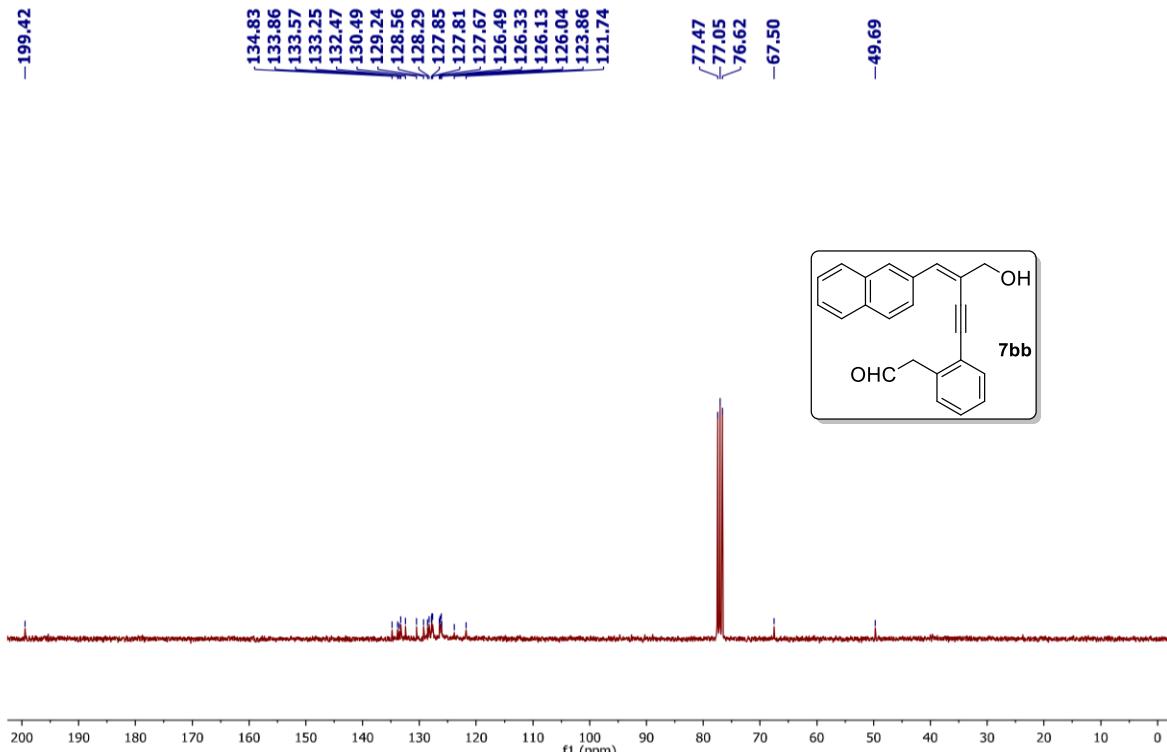
$^{13}\text{C}\{^1\text{H}\}$ NMR (75 MHz) of 7ba:



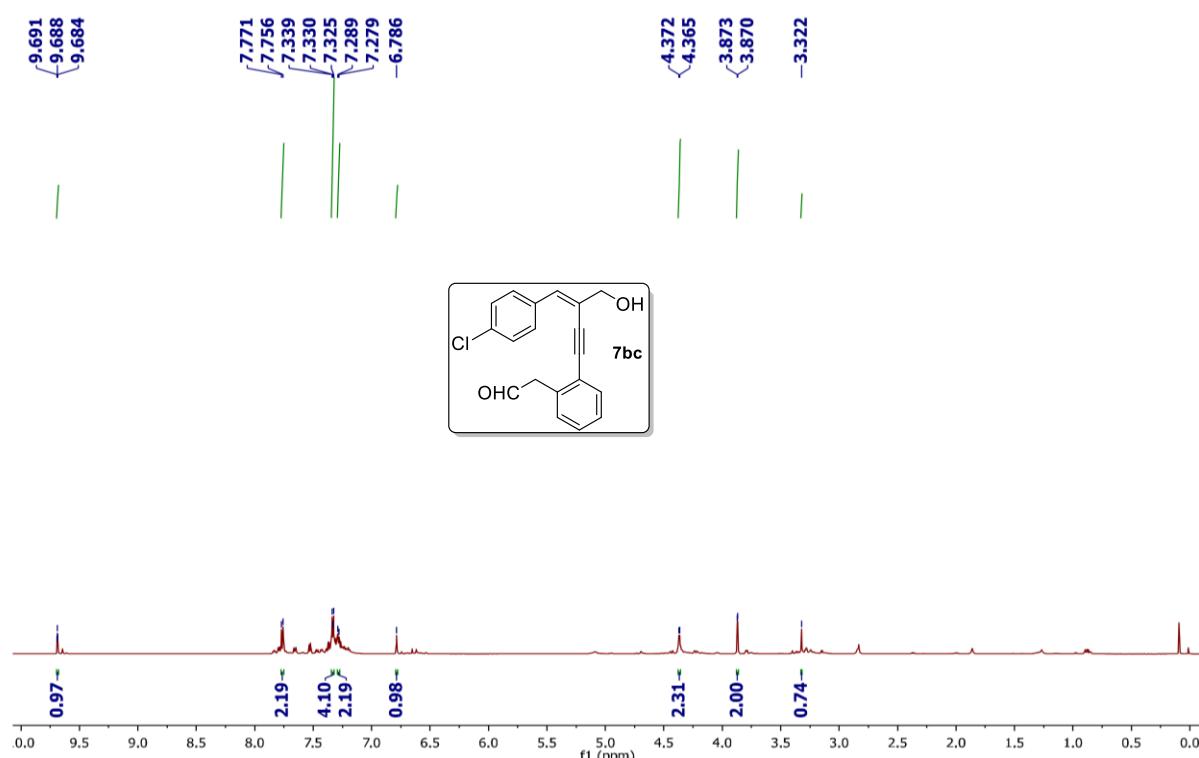
¹H NMR (600 MHz) of **7bb**



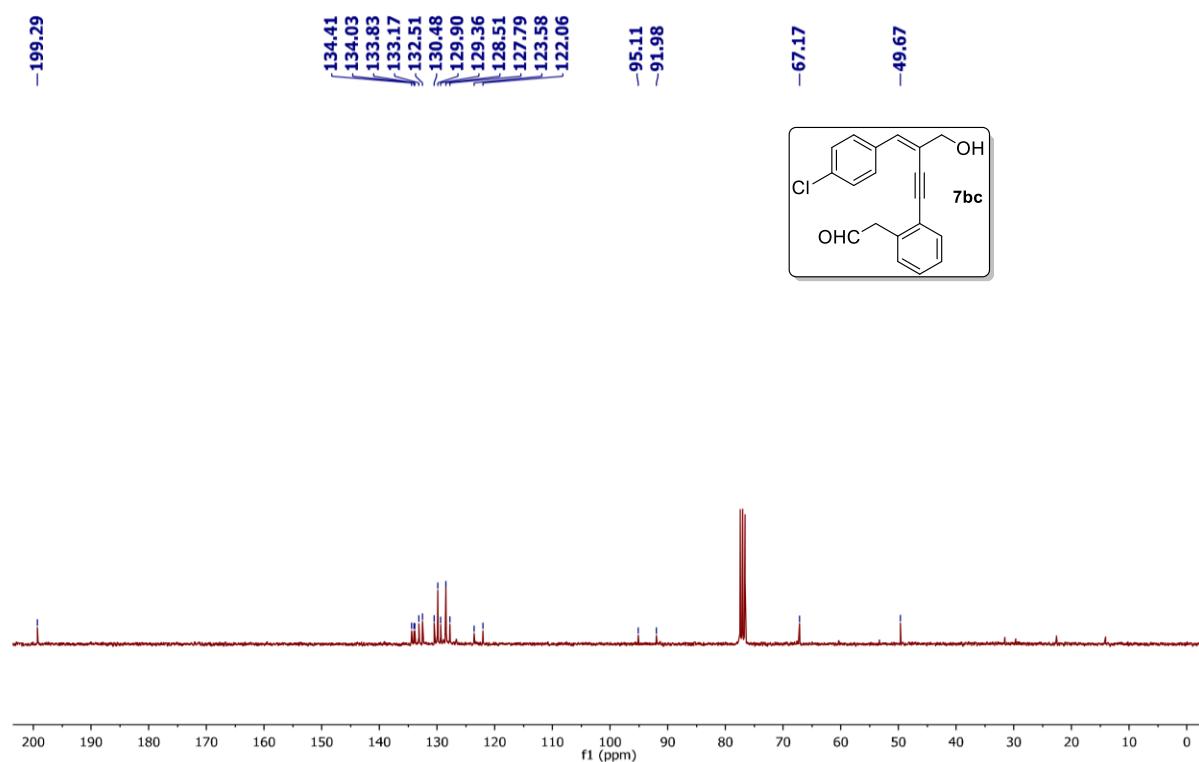
¹³C{¹H} NMR (75 MHz) of **7bb**:



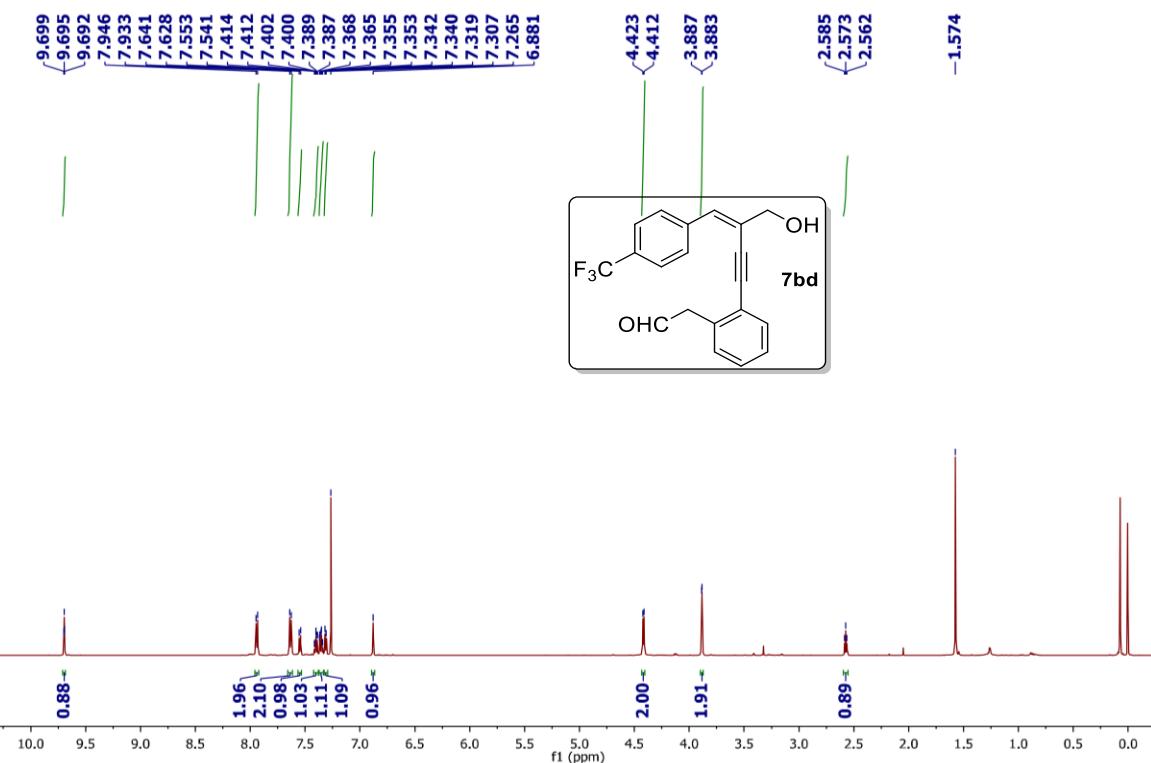
¹H NMR (600 MHz) of 7bc



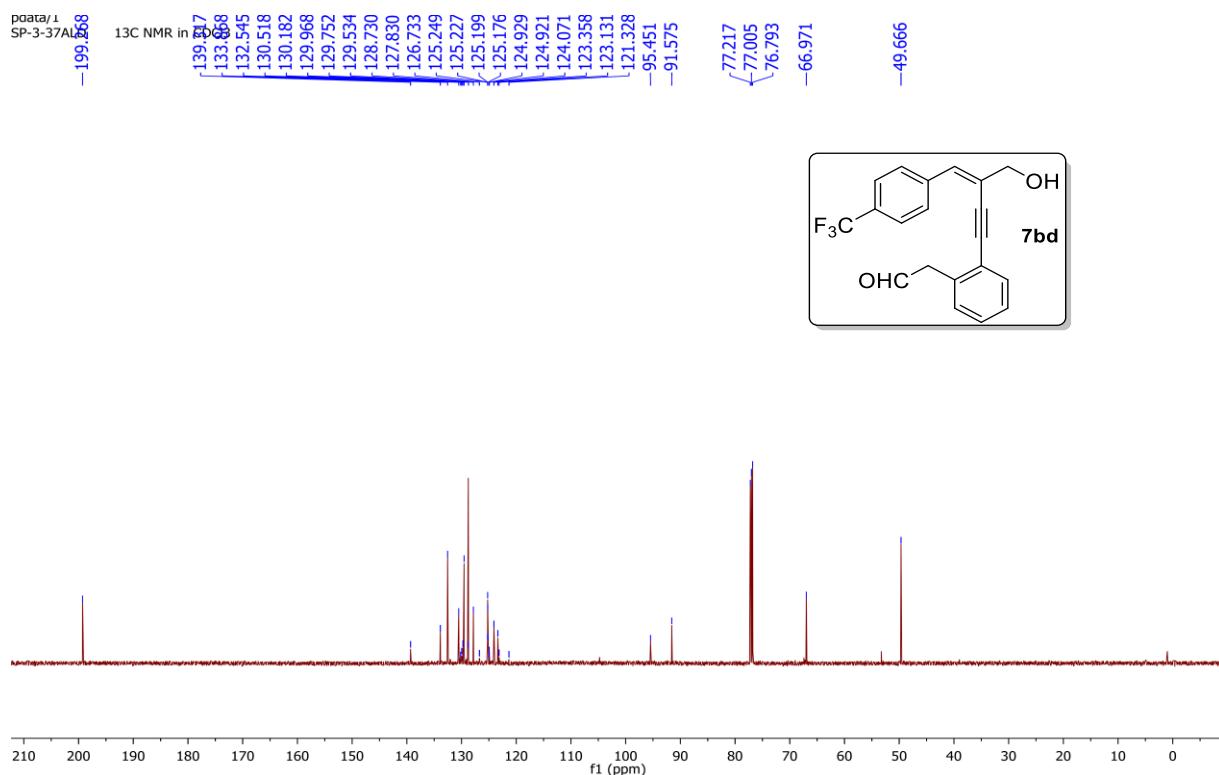
¹³C{¹H} NMR (75 MHz) of 7bc:



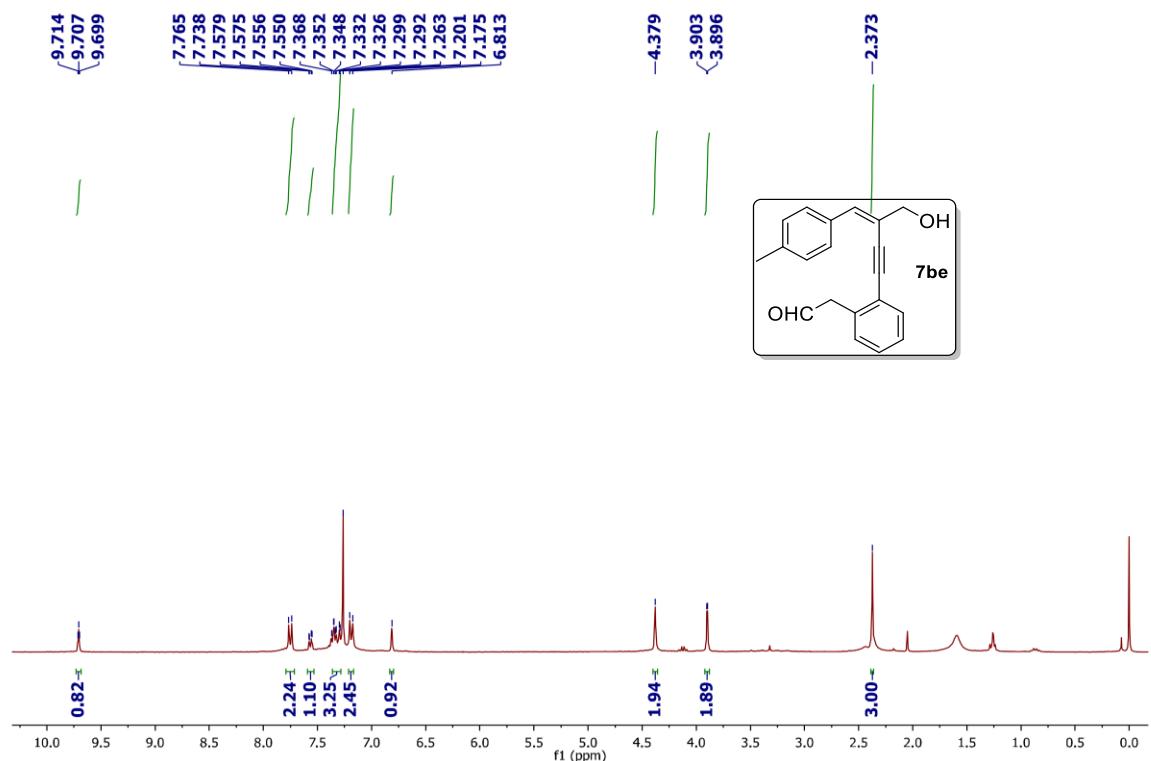
¹H NMR (600 MHz) of **7bd**:



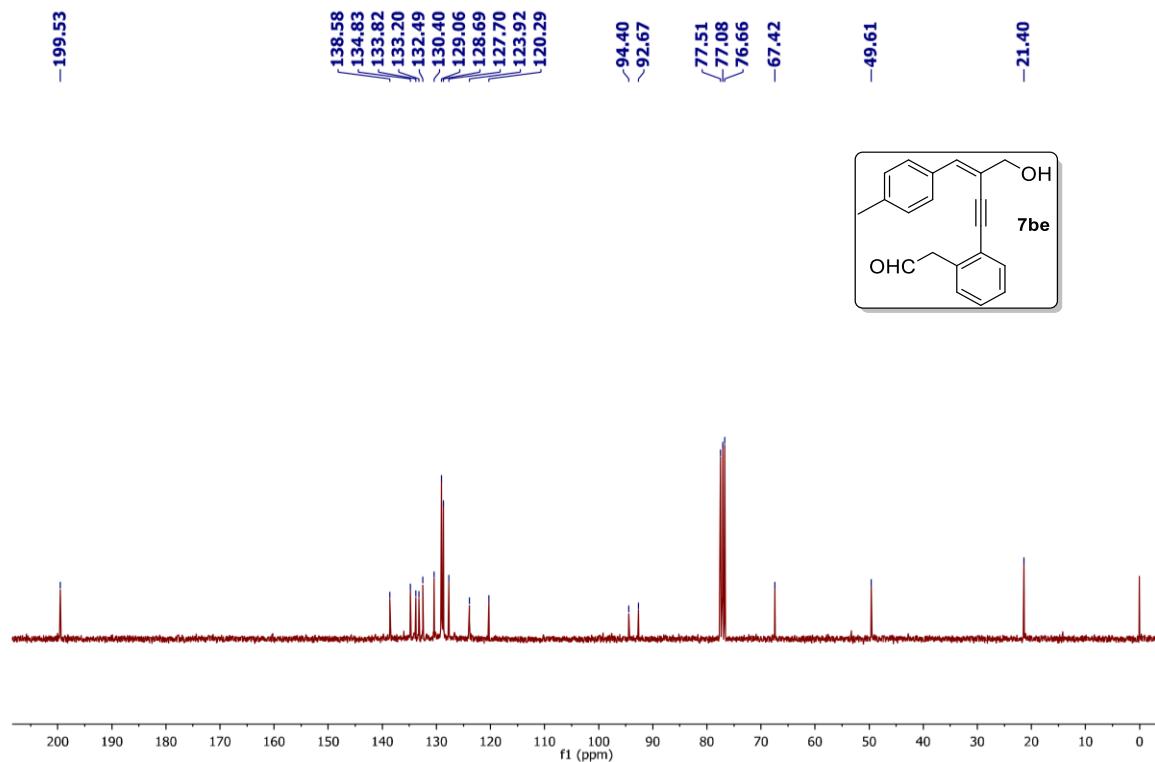
¹³C{¹H} NMR (150 MHz) of **7bd**:



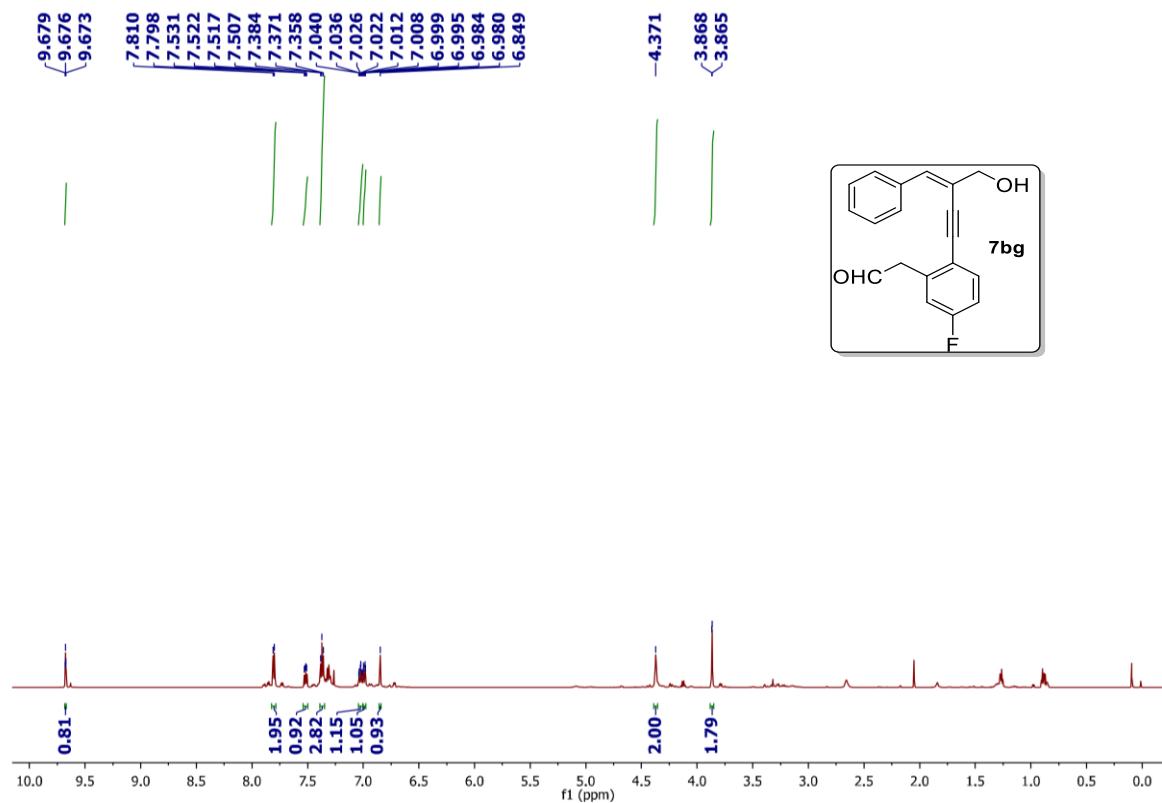
¹H NMR (300 MHz) of 7be:



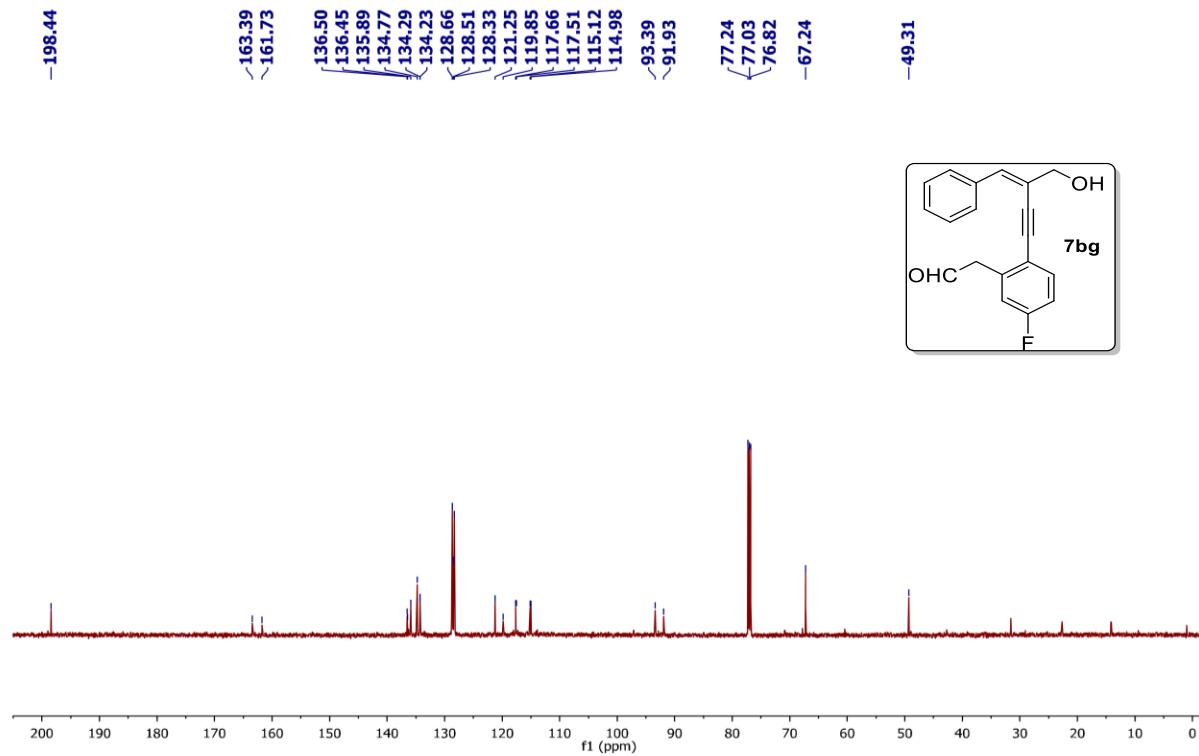
¹³C{¹H} NMR (75 MHz) of 7be:



¹H NMR (600 MHz) of **7bg**:

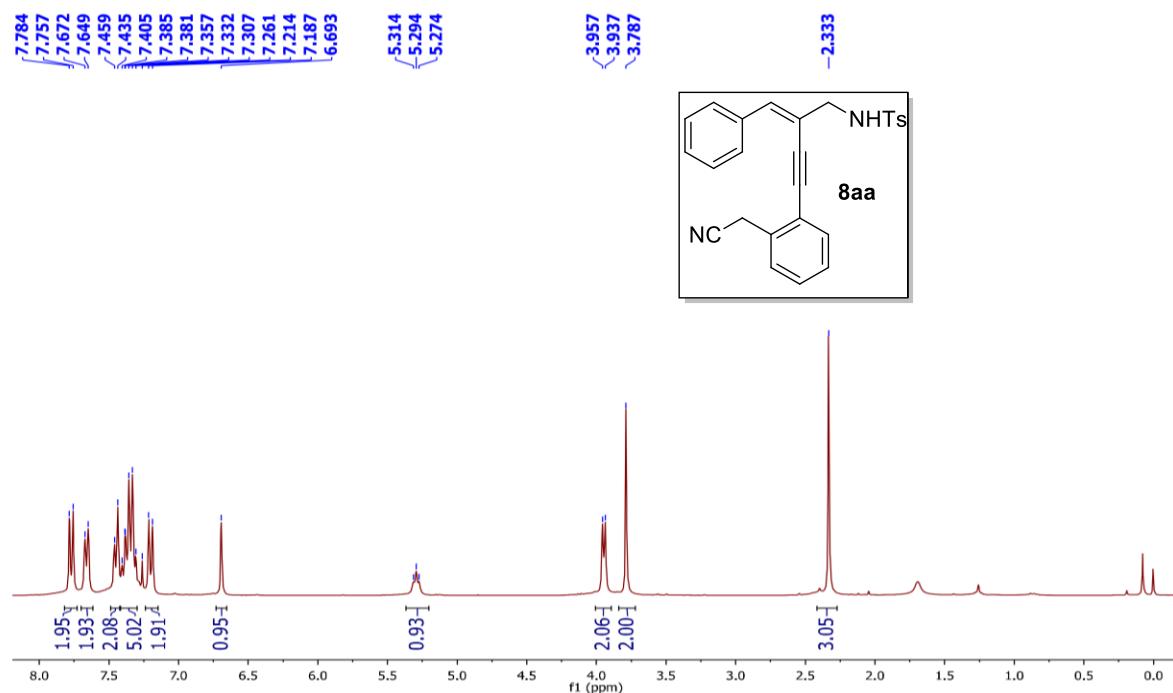


¹³C{¹H} NMR (150 MHz) of **7bg**:

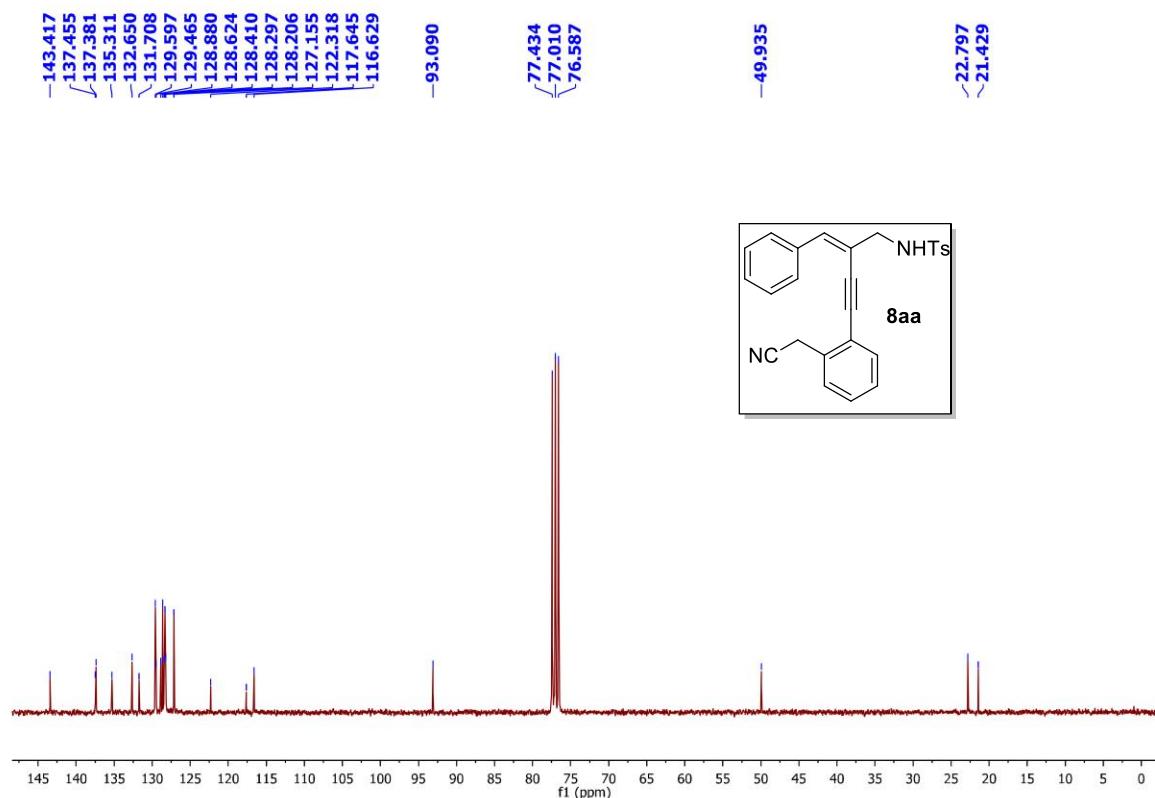


14. NMR Spectra of Compounds 8aa-8aj :

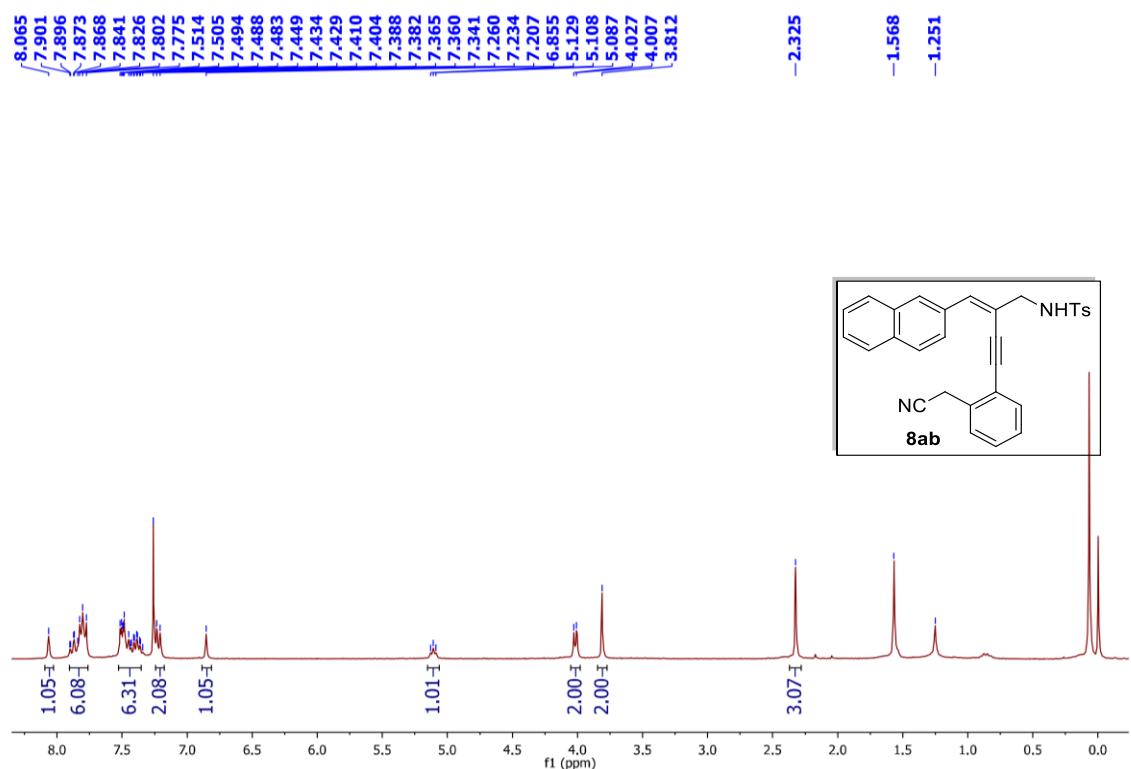
¹H NMR (300 MHz) of 8aa :



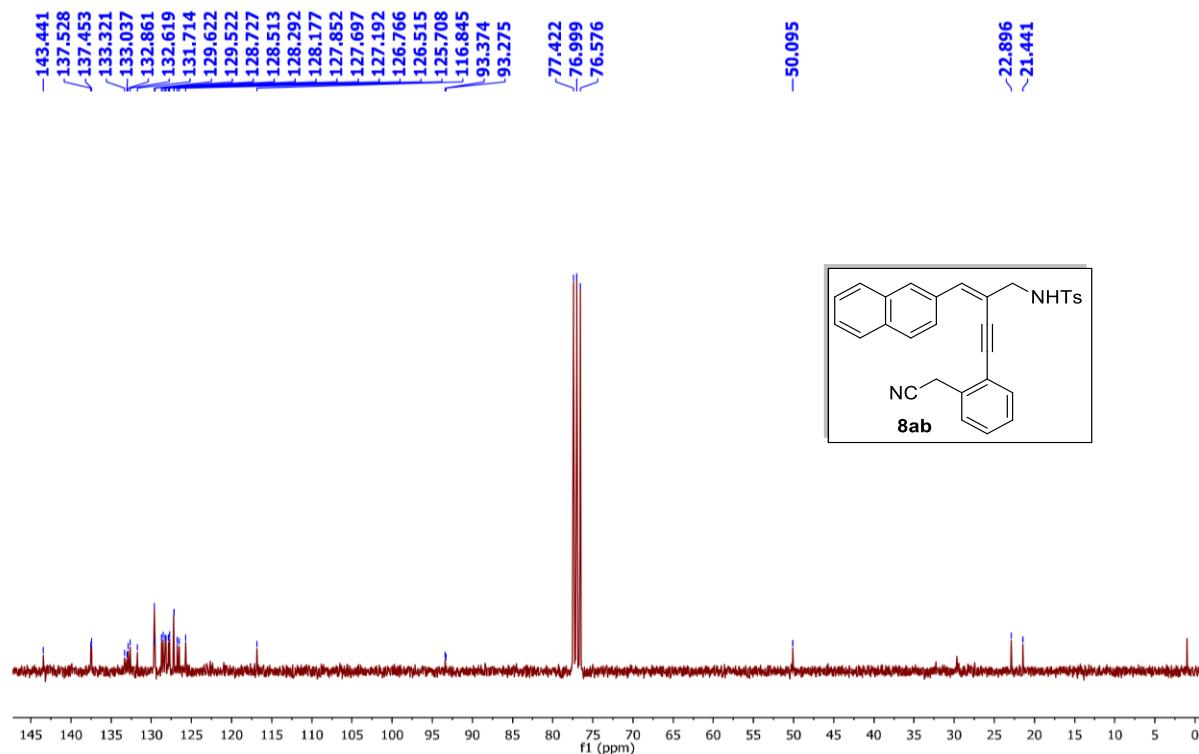
¹³C{¹H} NMR (75 MHz) of 8aa :



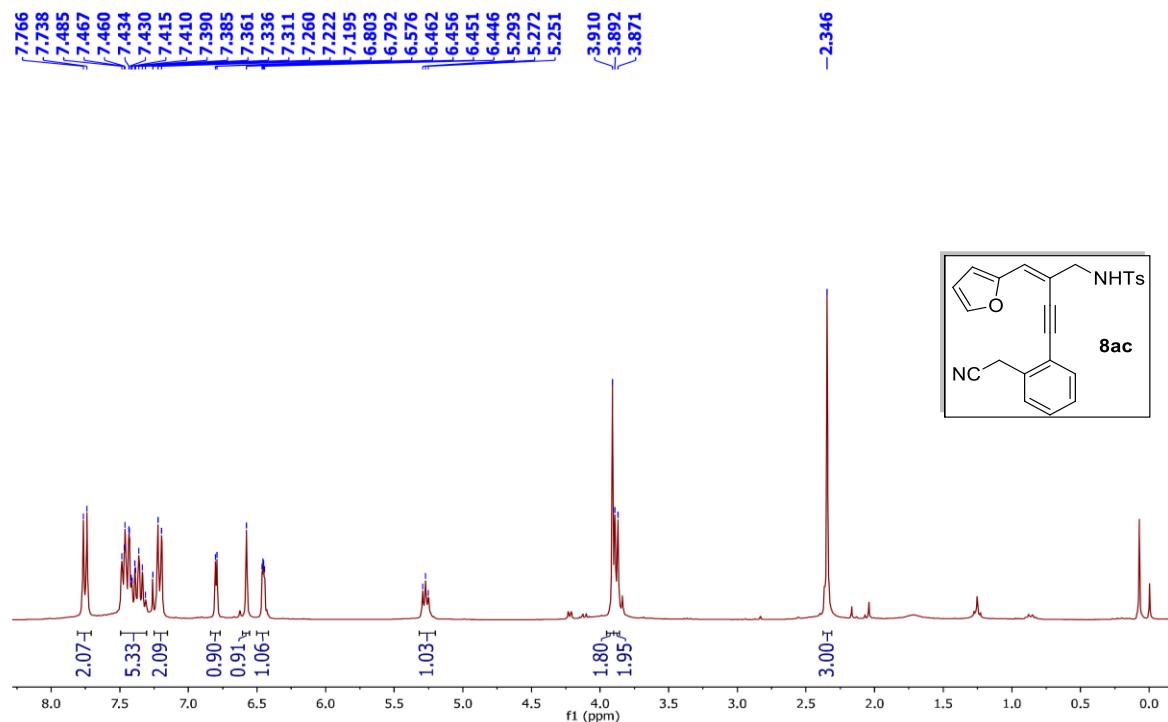
¹H NMR (300 MHz) of **8ab**:



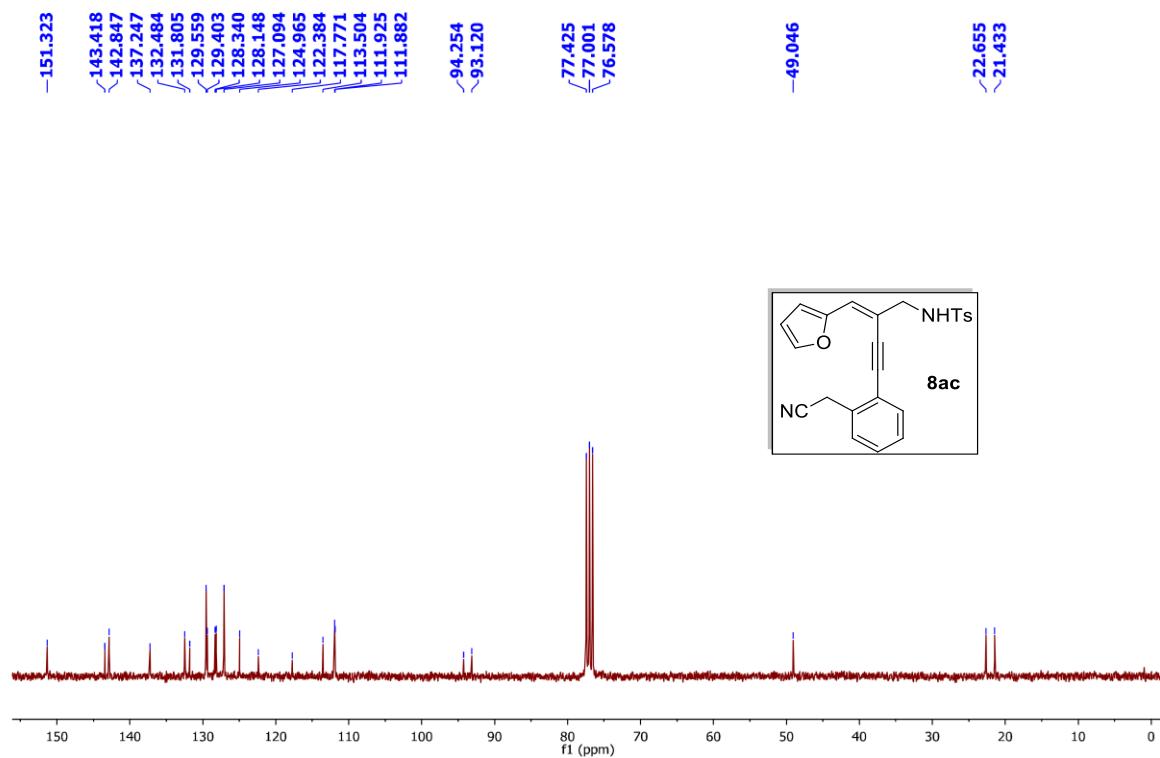
¹³C{¹H} NMR (75 MHz) of **8ab**:



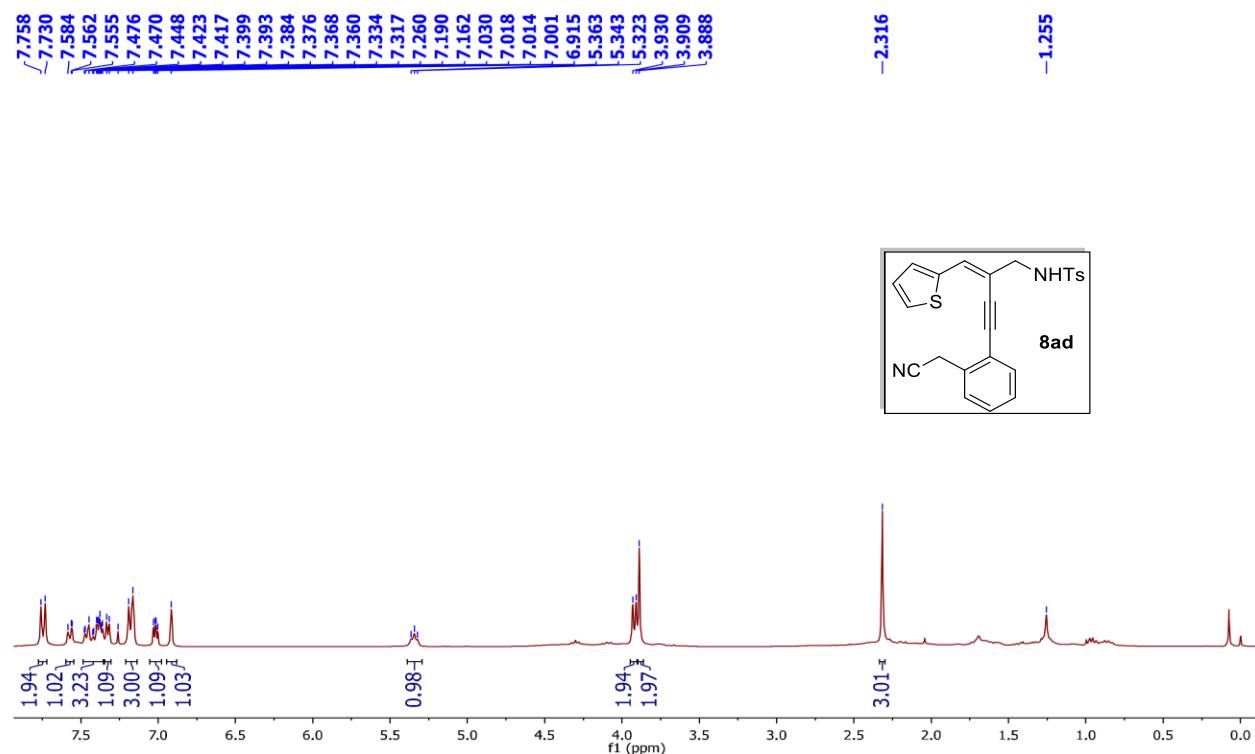
¹H NMR (300 MHz) of **8ac** :



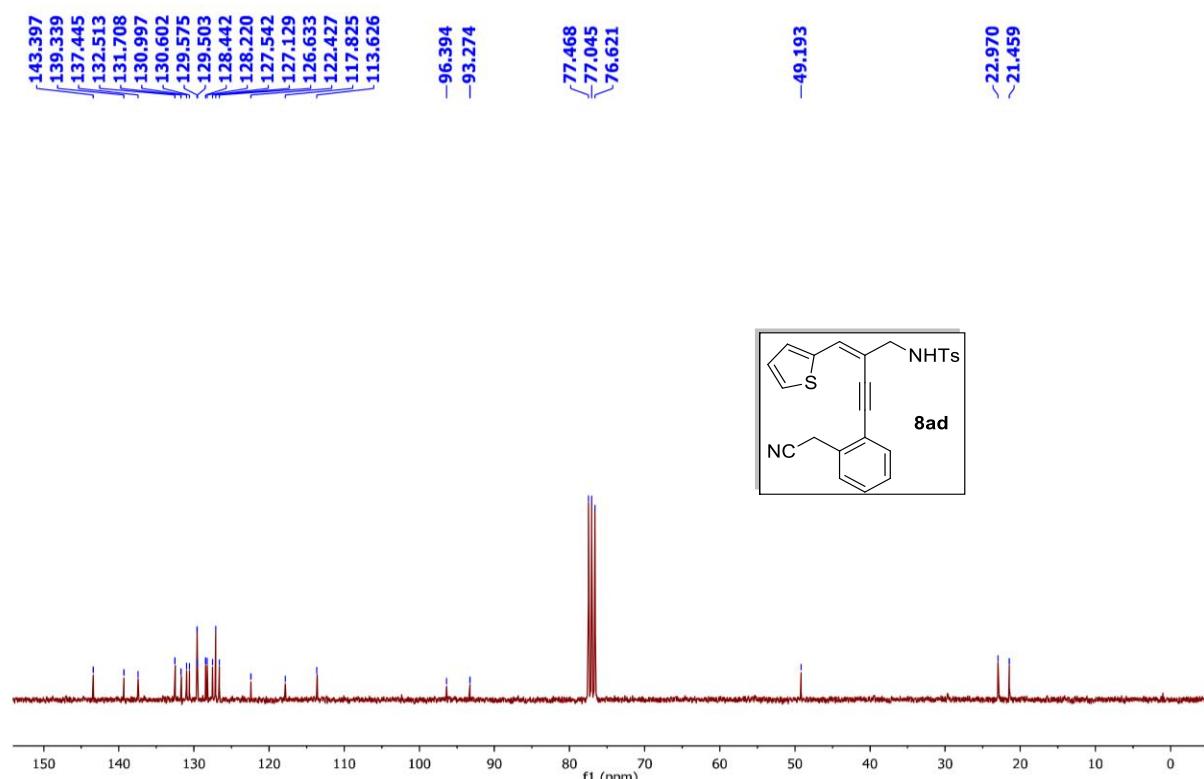
¹³C{¹H} NMR (75 MHz) of **8ac** :



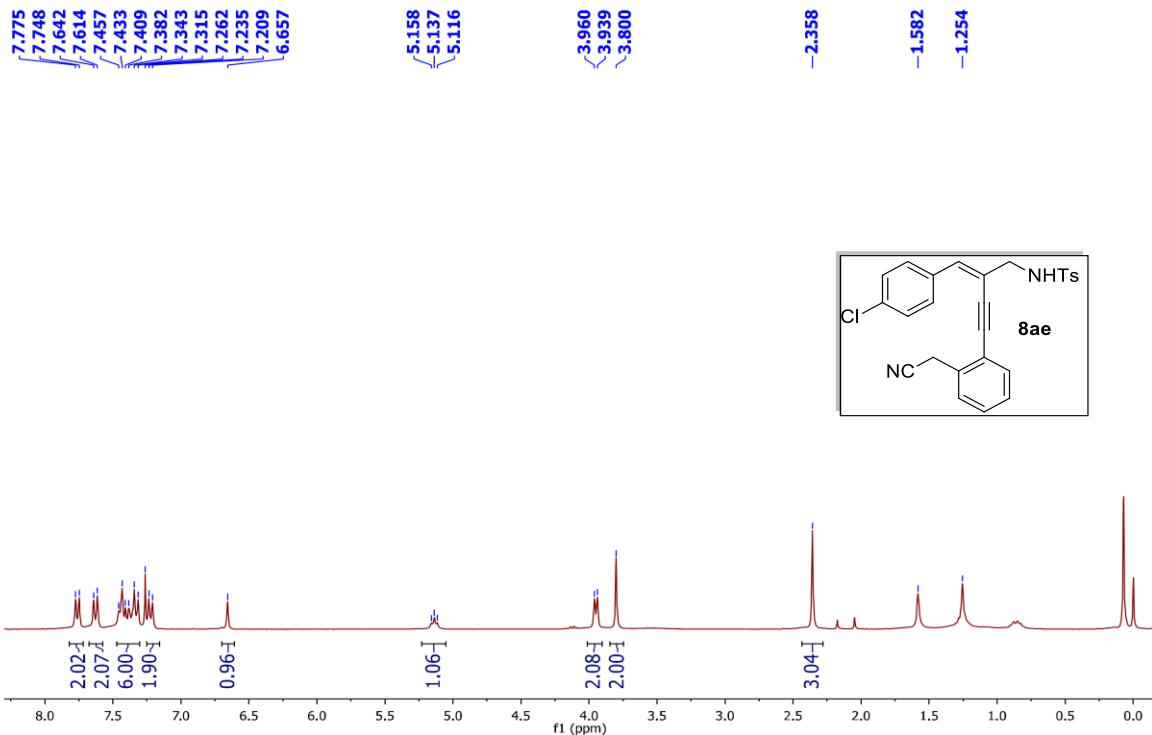
¹H NMR (300 MHz) of **8ad** :



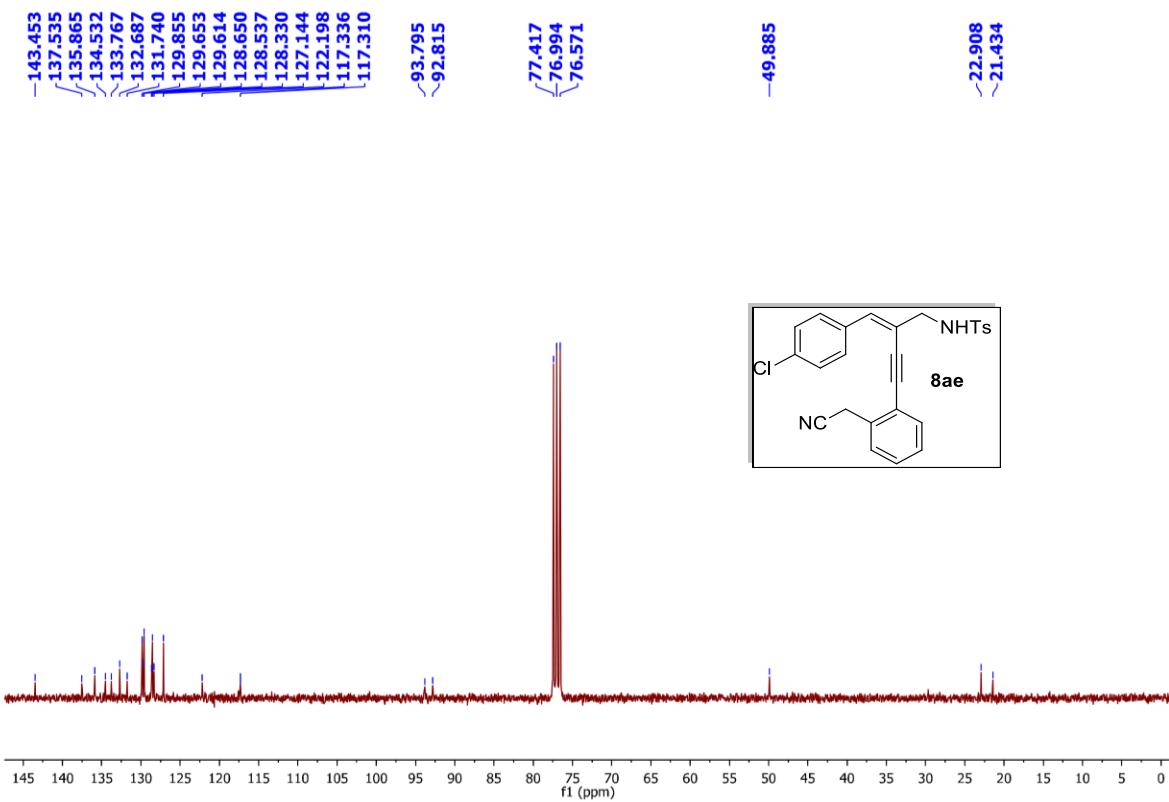
¹³C{¹H} NMR (75 MHz) of **8ad** :



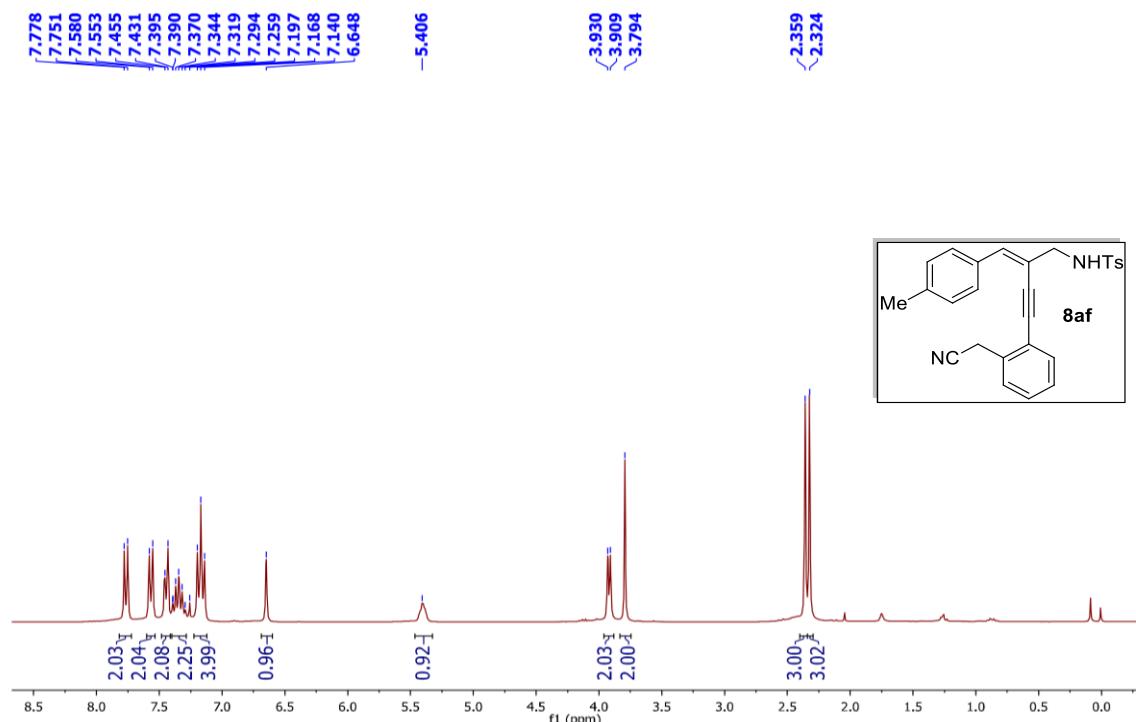
¹H NMR (300 MHz) of **8ae** :



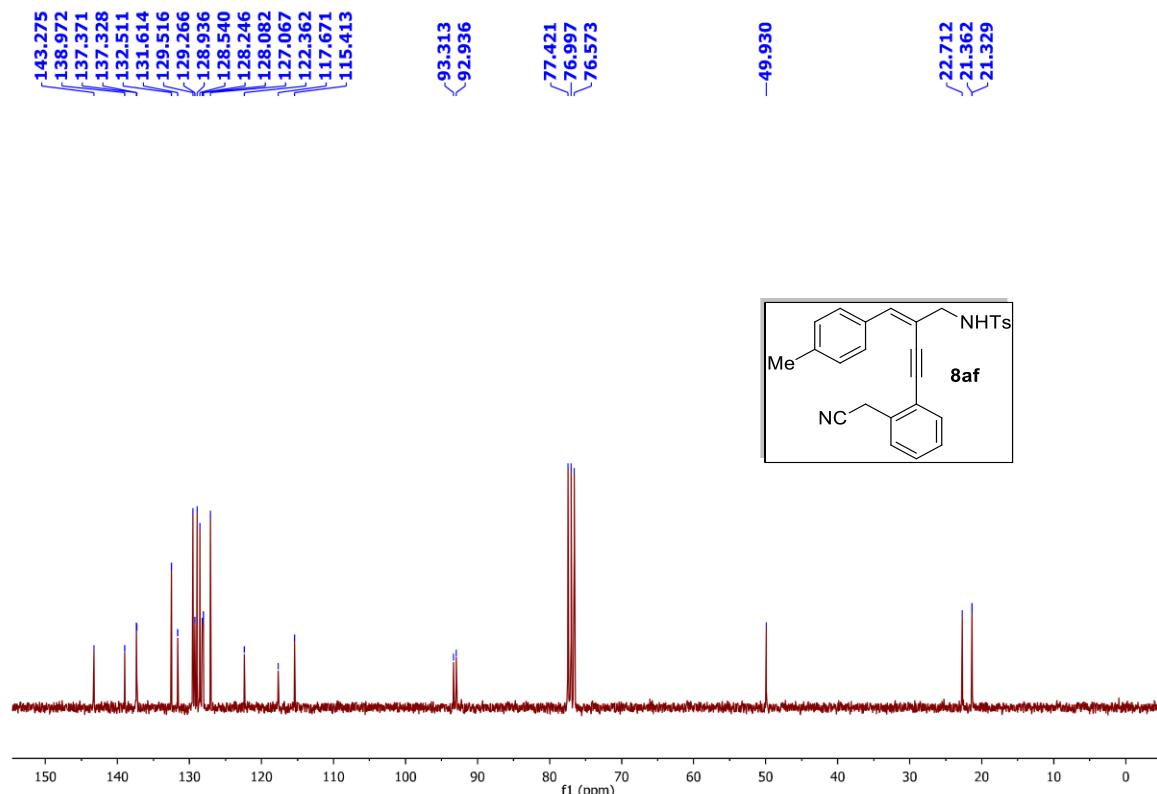
¹³C{¹H} NMR (75 MHz) of **8ae** :



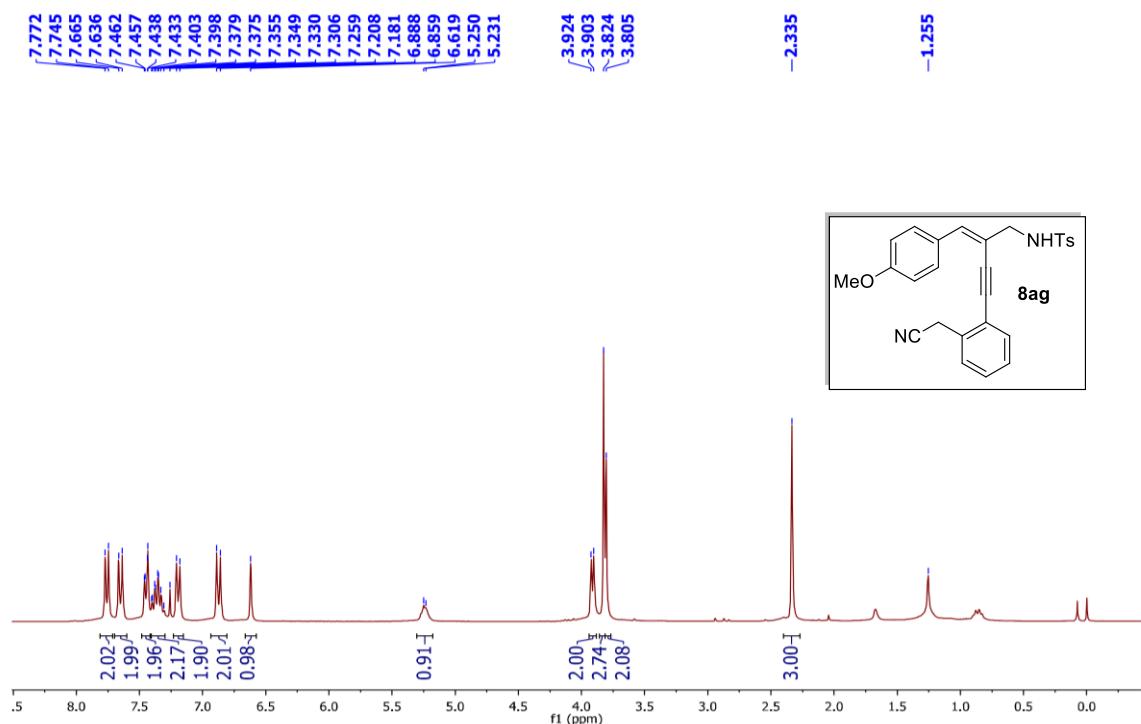
¹H NMR (300 MHz) of **8af**:



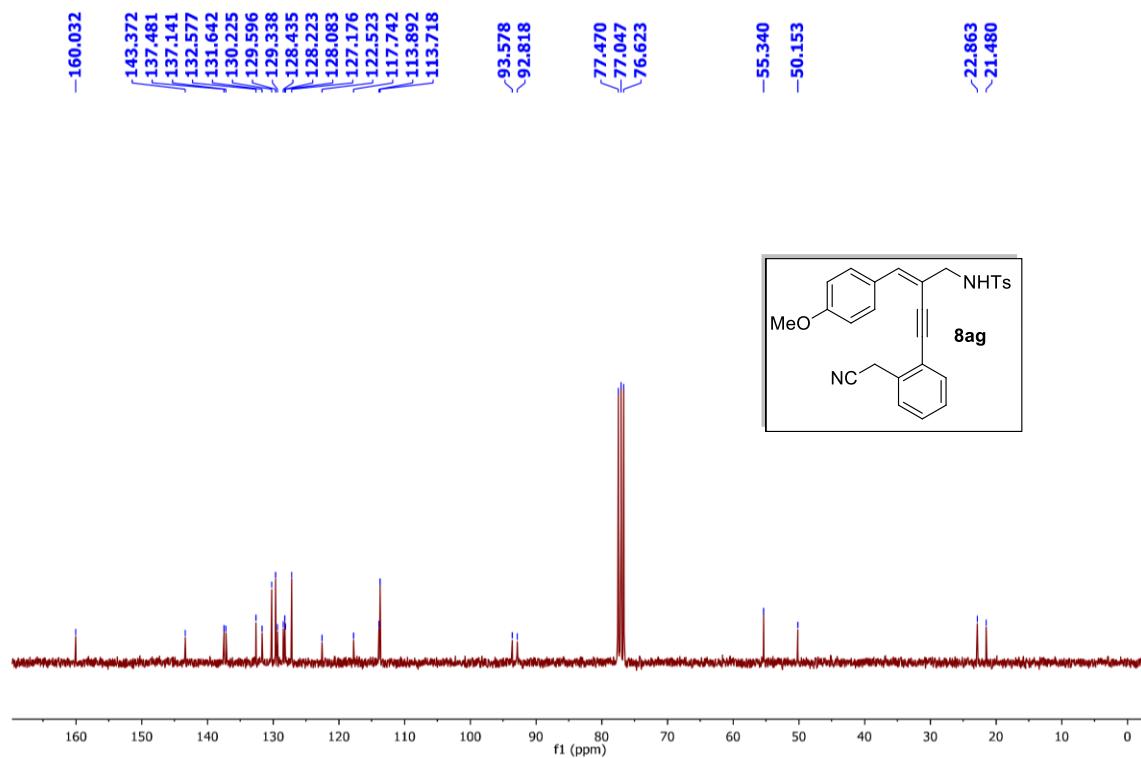
¹³C{¹H} NMR (75 MHz) of **8af**:



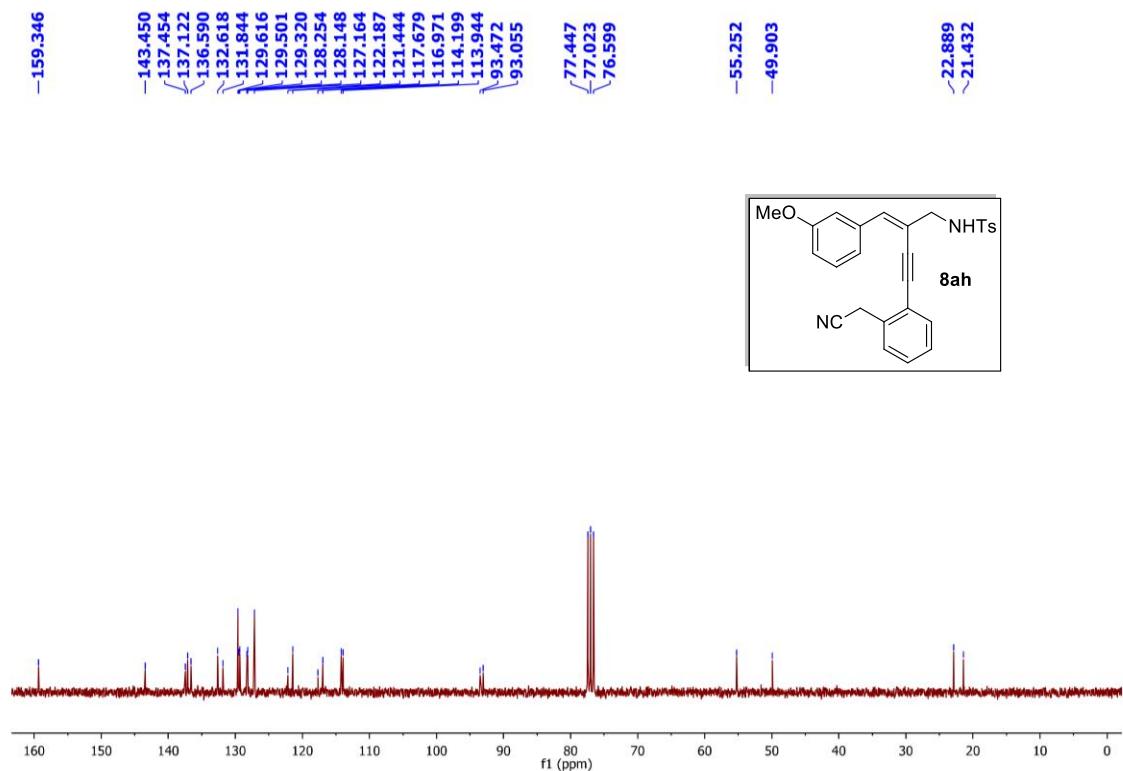
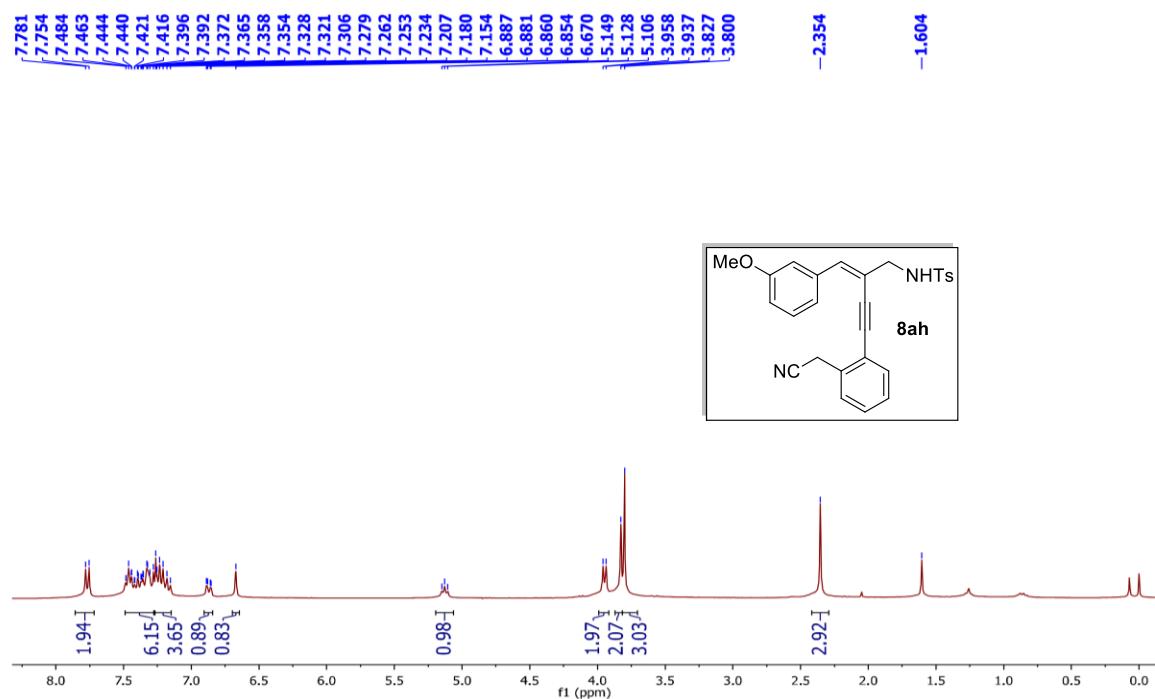
¹H NMR (300 MHz) of **8ag** :



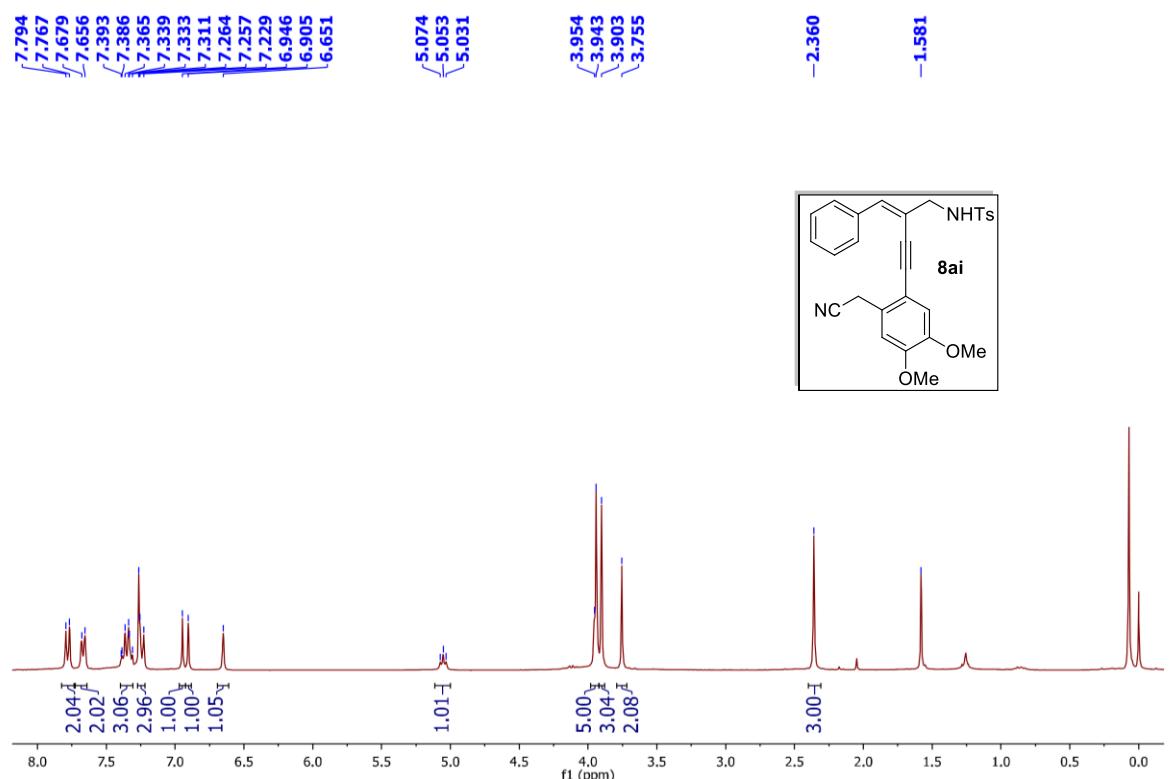
¹³C{¹H} NMR (75 MHz) of **8ag** :



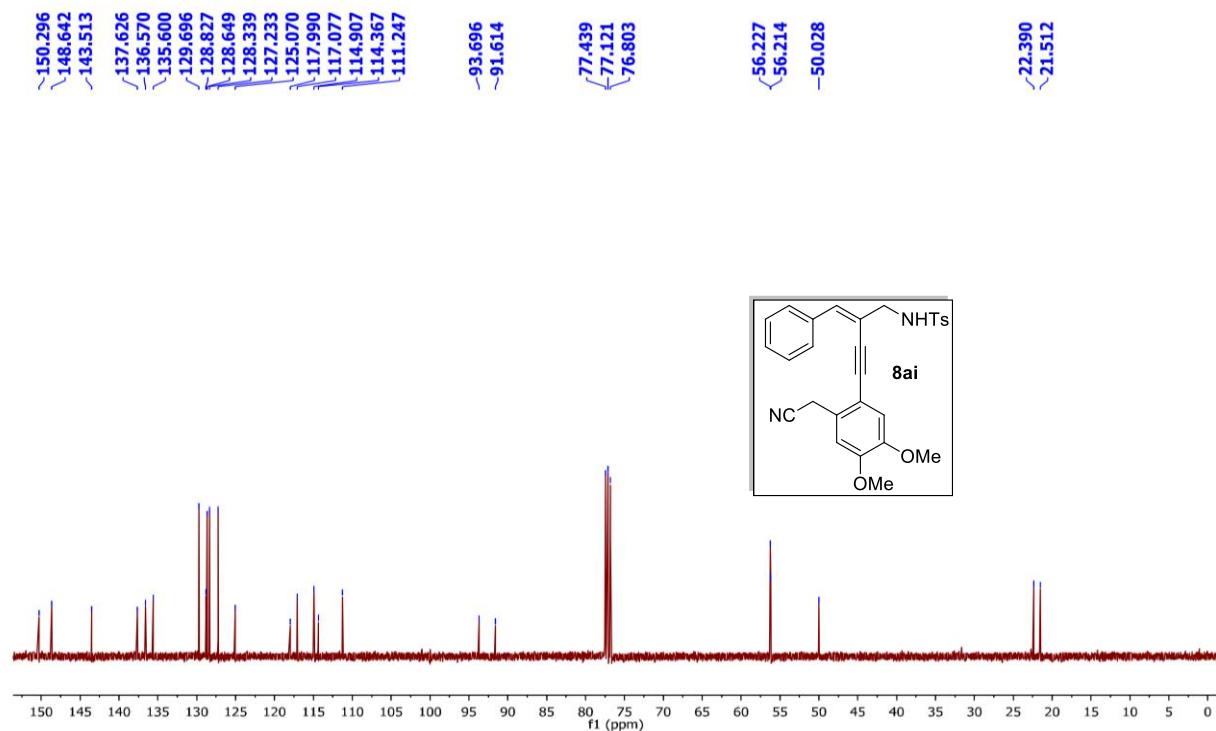
¹H NMR (300 MHz) of **8ah** :



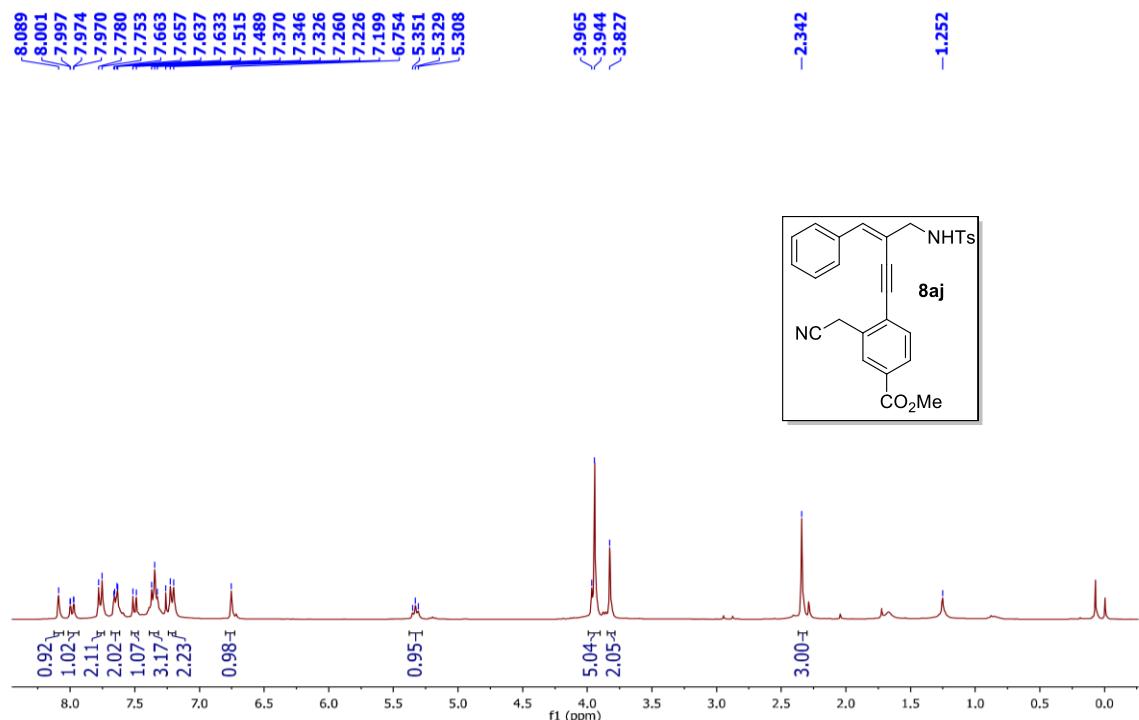
¹H NMR (300 MHz) of **8ai** :



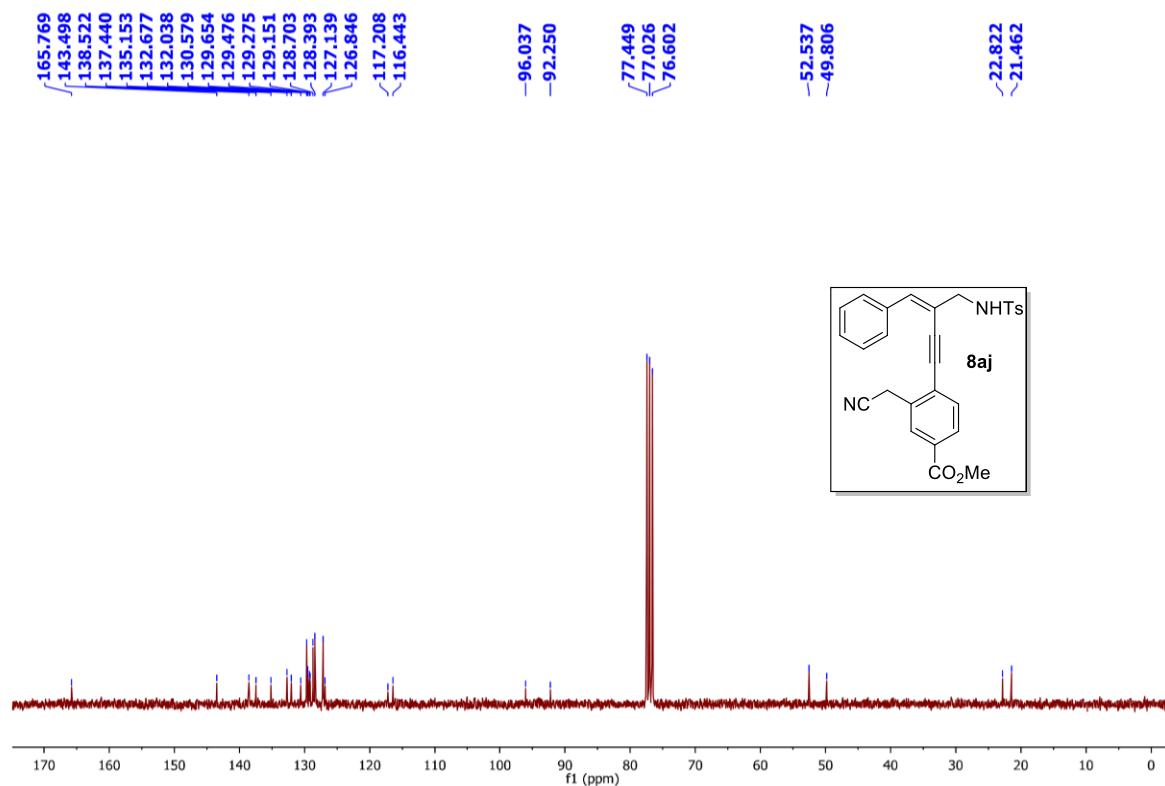
¹³C{¹H} NMR (100 MHz) of **8ai** :



¹H NMR (300 MHz) of **8aj** :

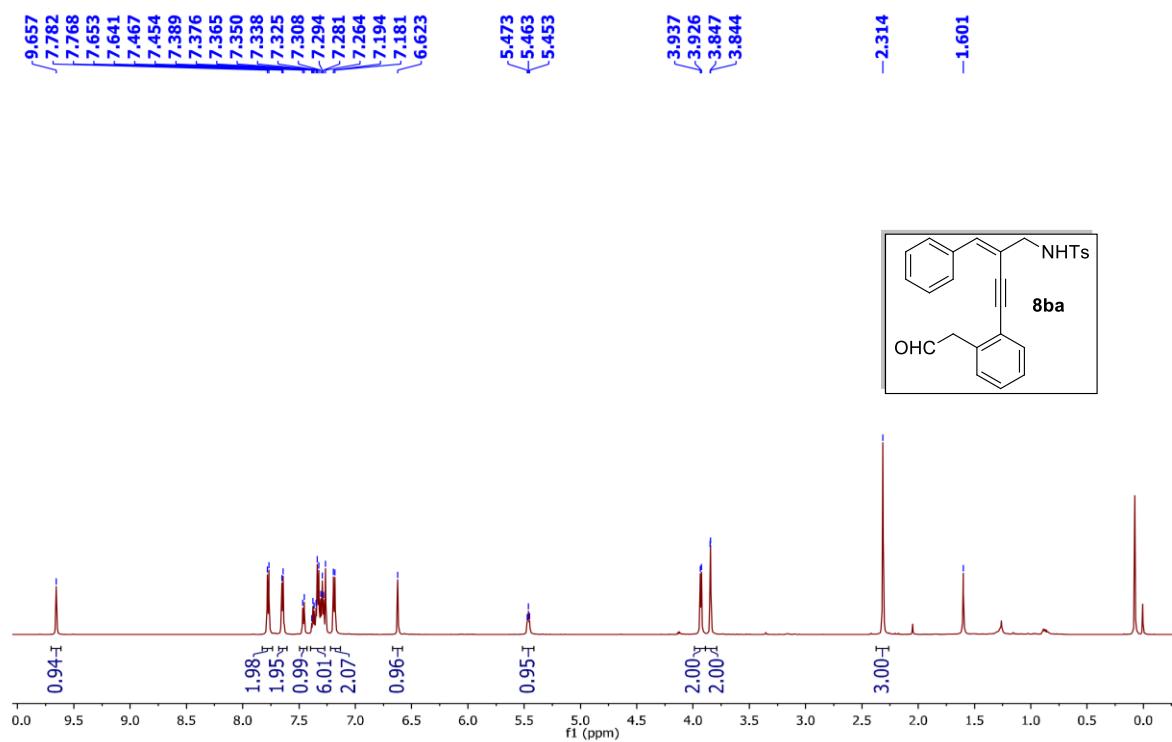


¹³C{¹H} NMR (75 MHz) of **8aj** :

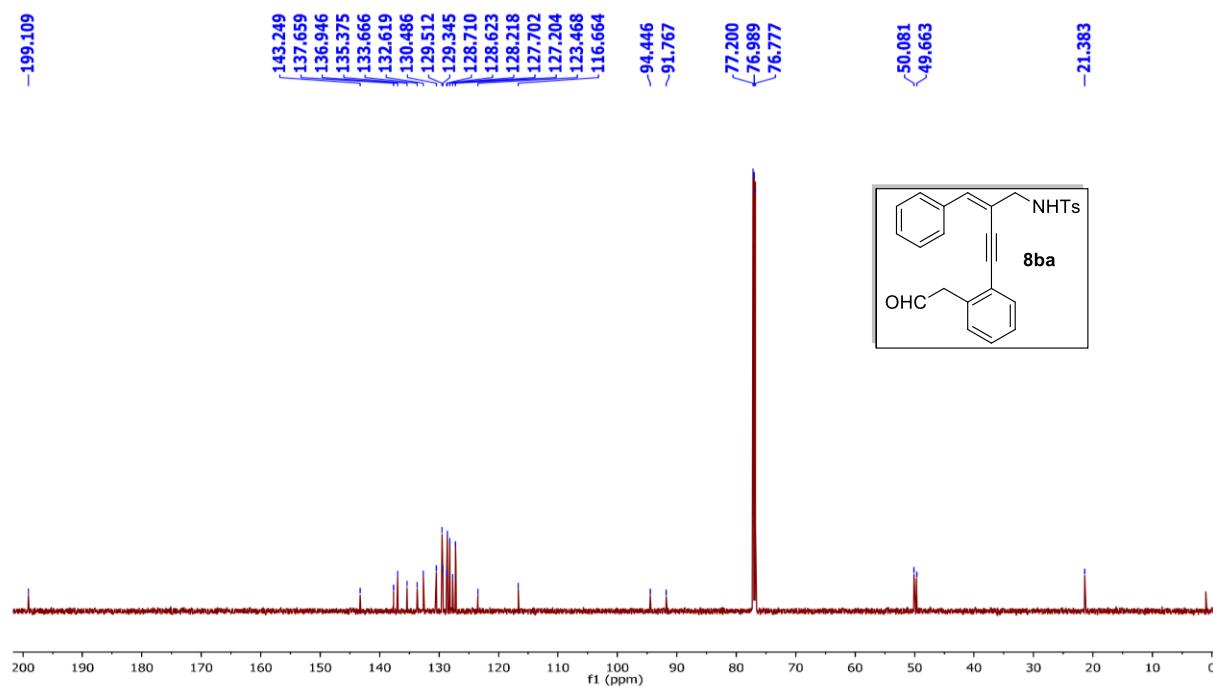


15. NMR Spectra of Compounds 8ba-8bh :

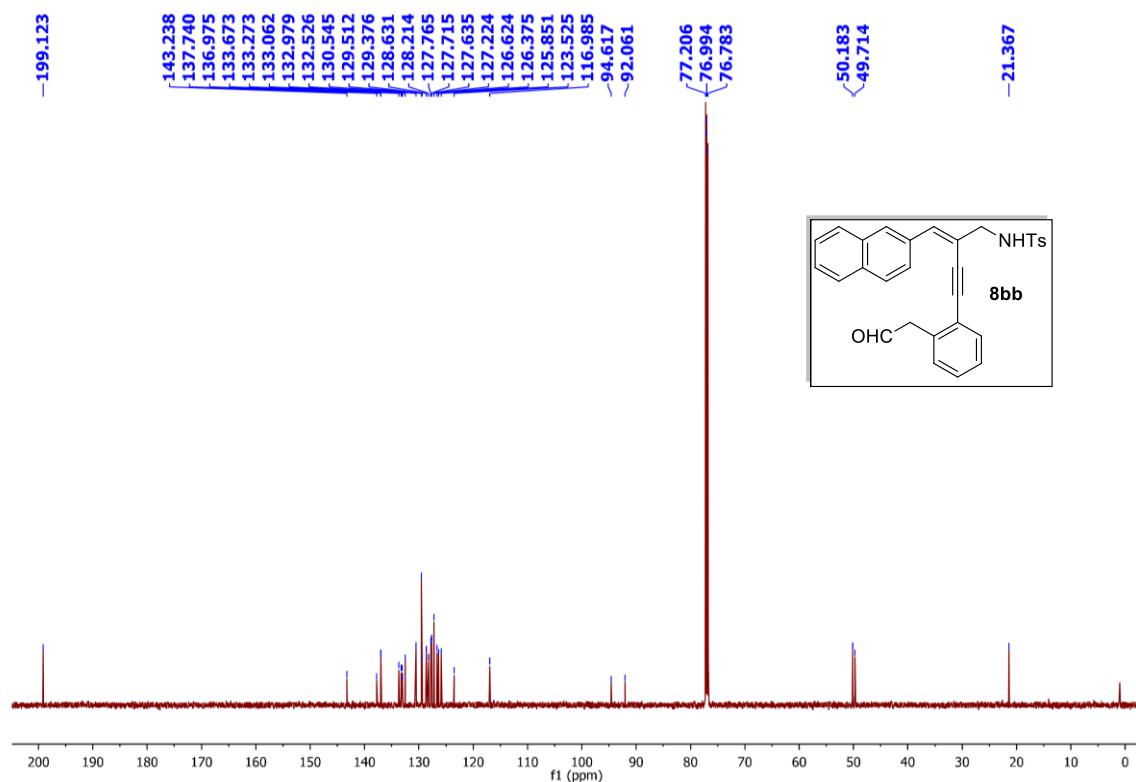
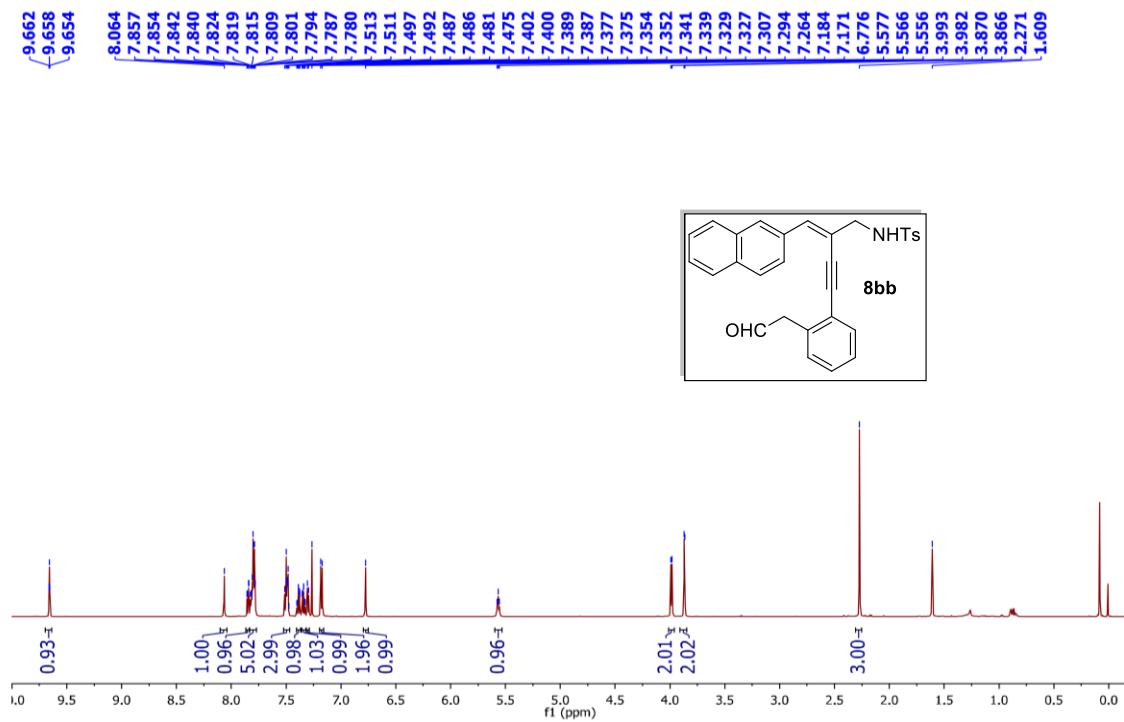
^1H NMR (600 MHz) of **8ba** :



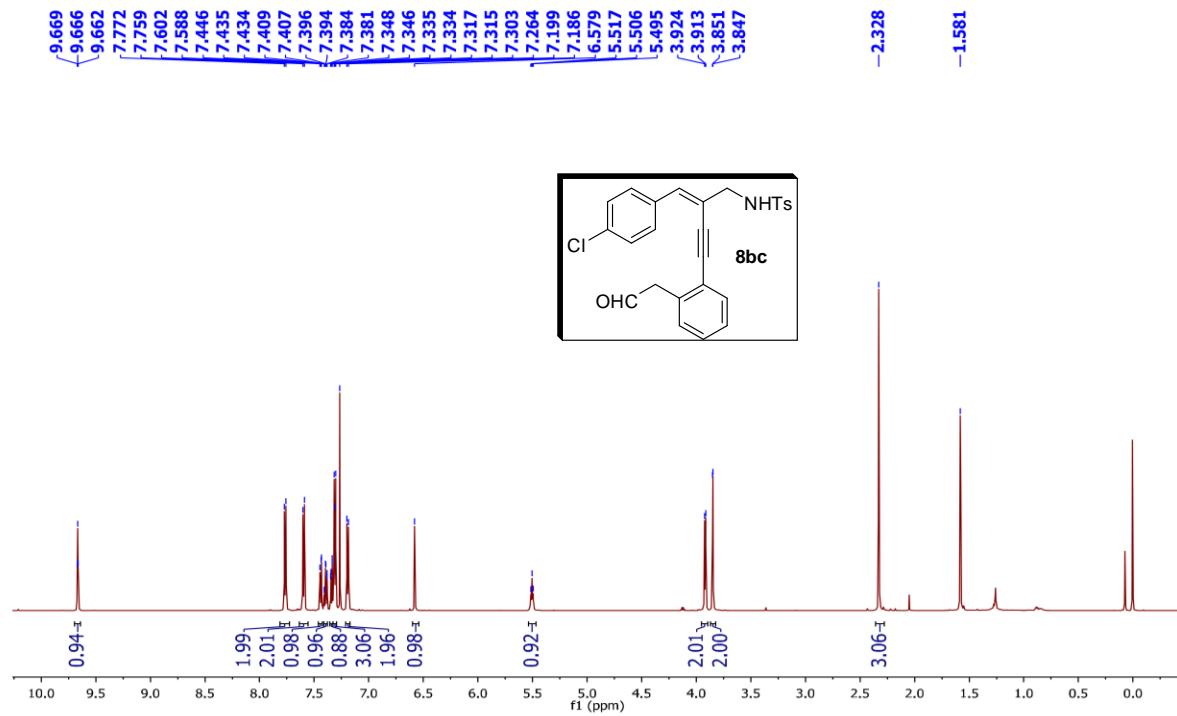
$^{13}\text{C}\{^1\text{H}\}$ NMR (150 MHz) of **8ba** :



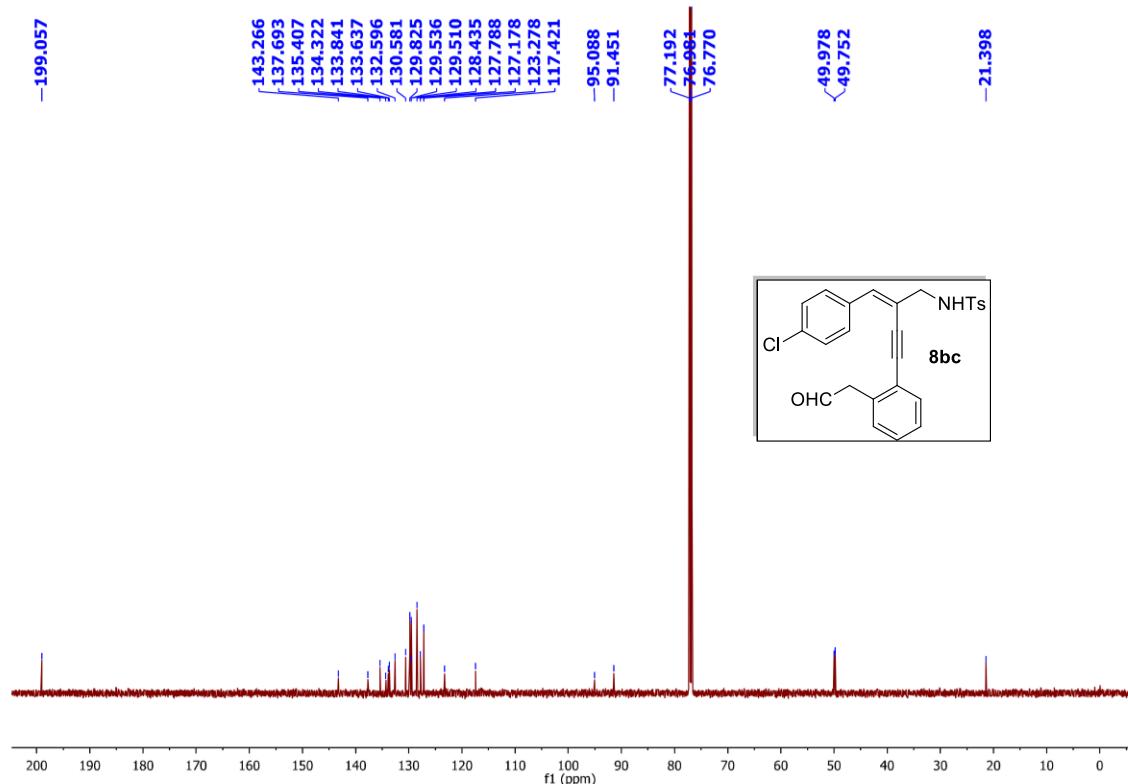
¹H NMR (600 MHz) of **8bb** :



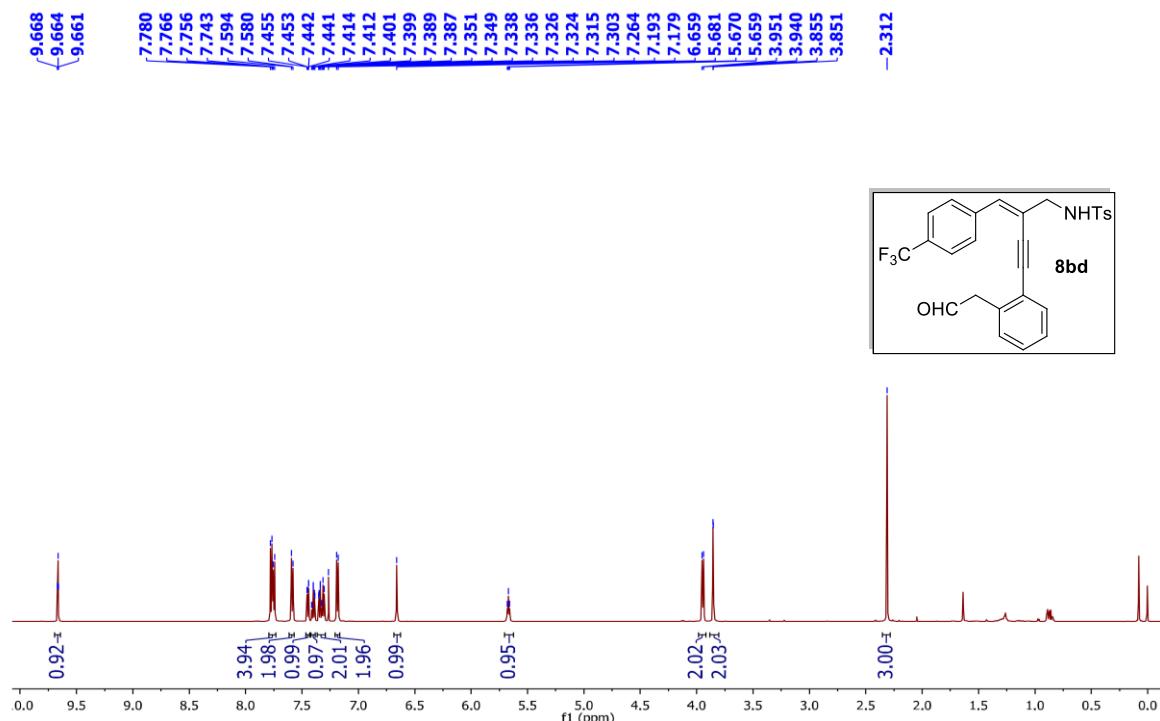
¹H NMR (600 MHz) of **8bc**:



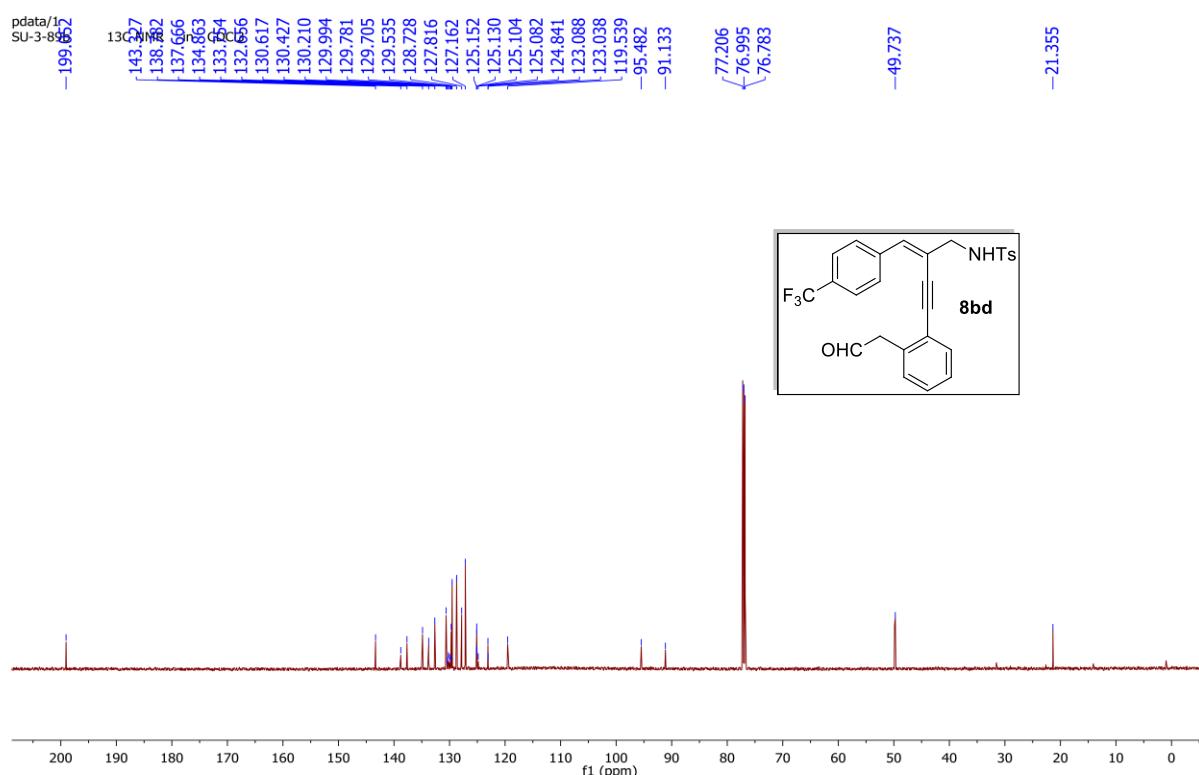
¹³C{¹H} NMR (150 MHz) of **8bc**:



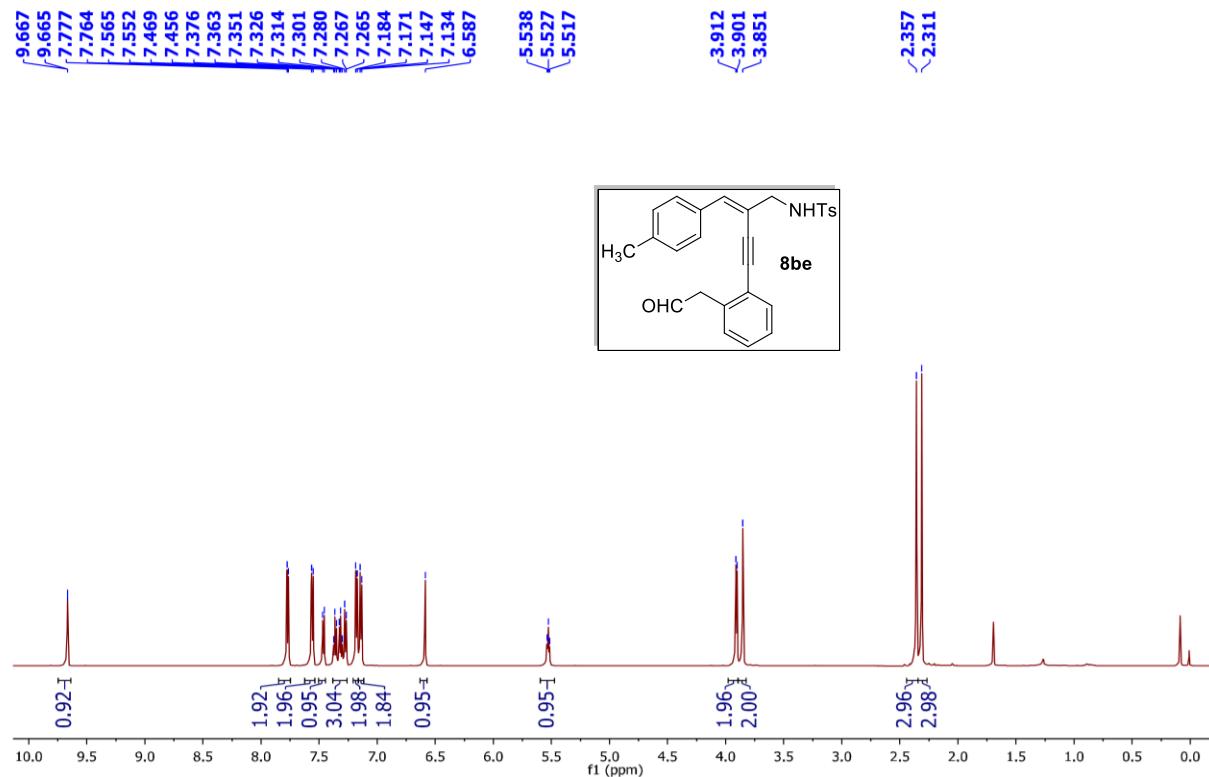
¹H NMR (600 MHz) of **8bd** :



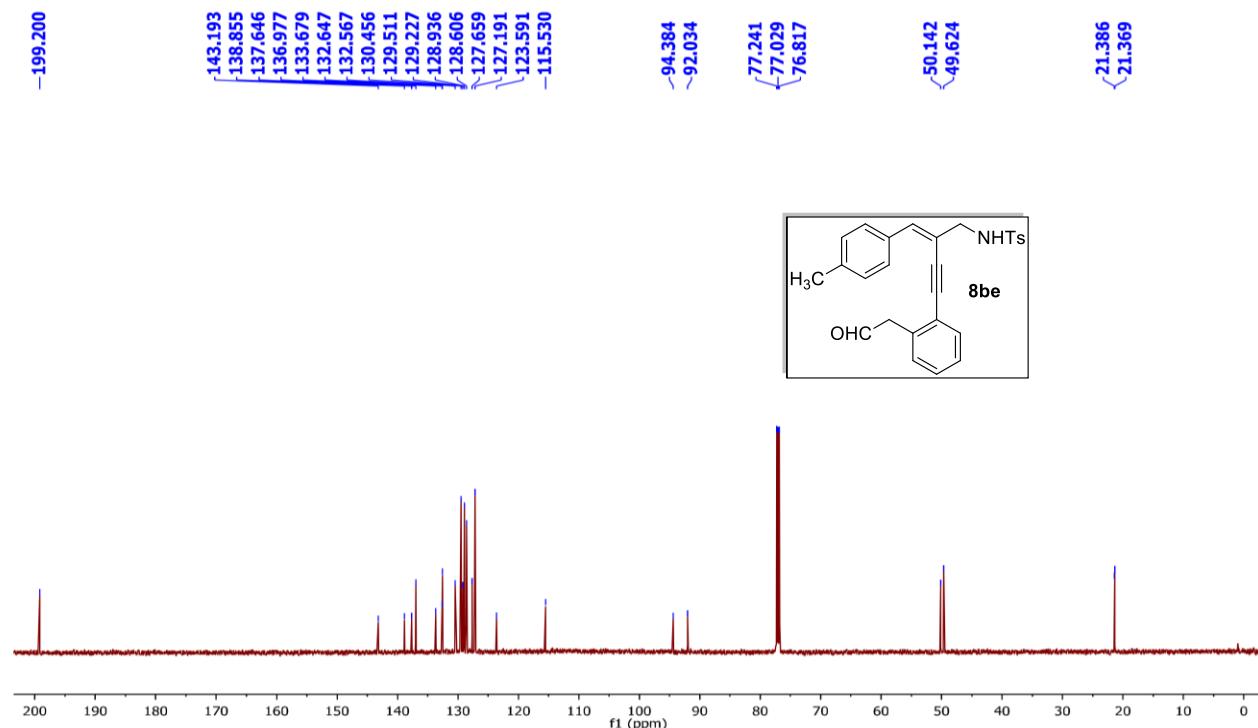
¹³C{¹H} NMR (150 MHz) of **8bd** :



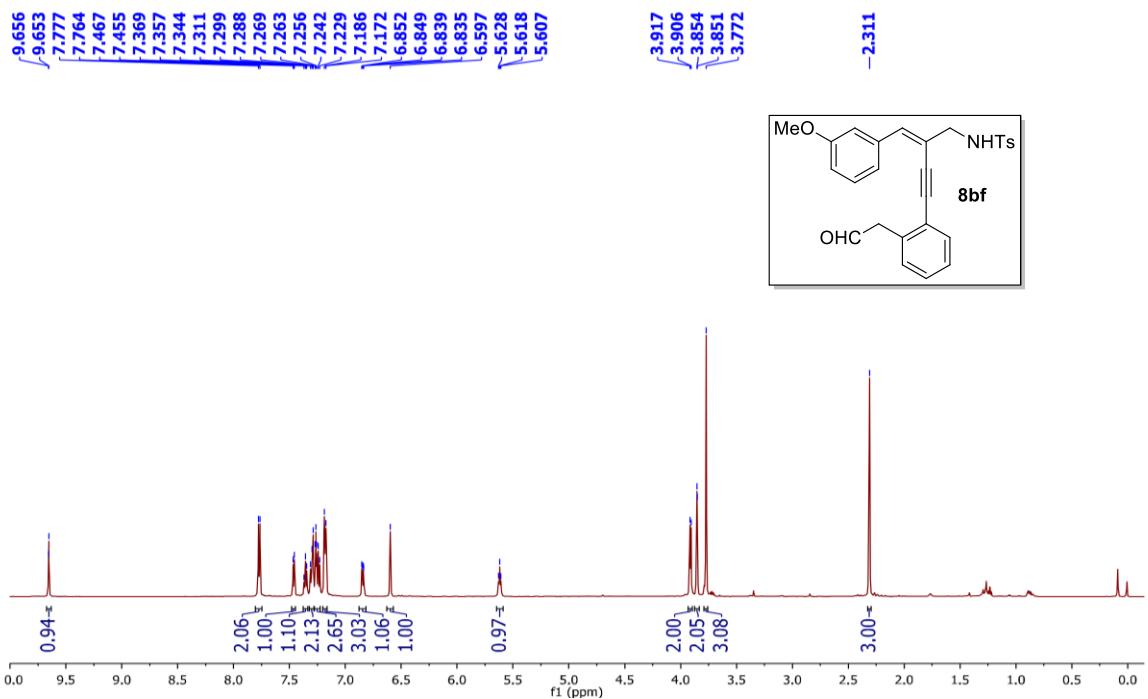
¹H NMR (600 MHz) of **8be** :



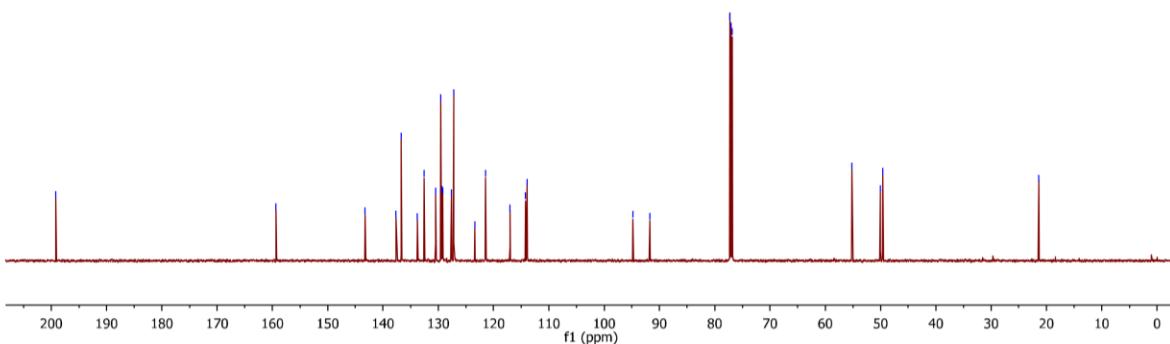
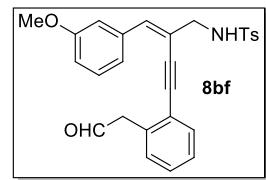
¹³C{¹H} NMR (150 MHz) of **8be** :



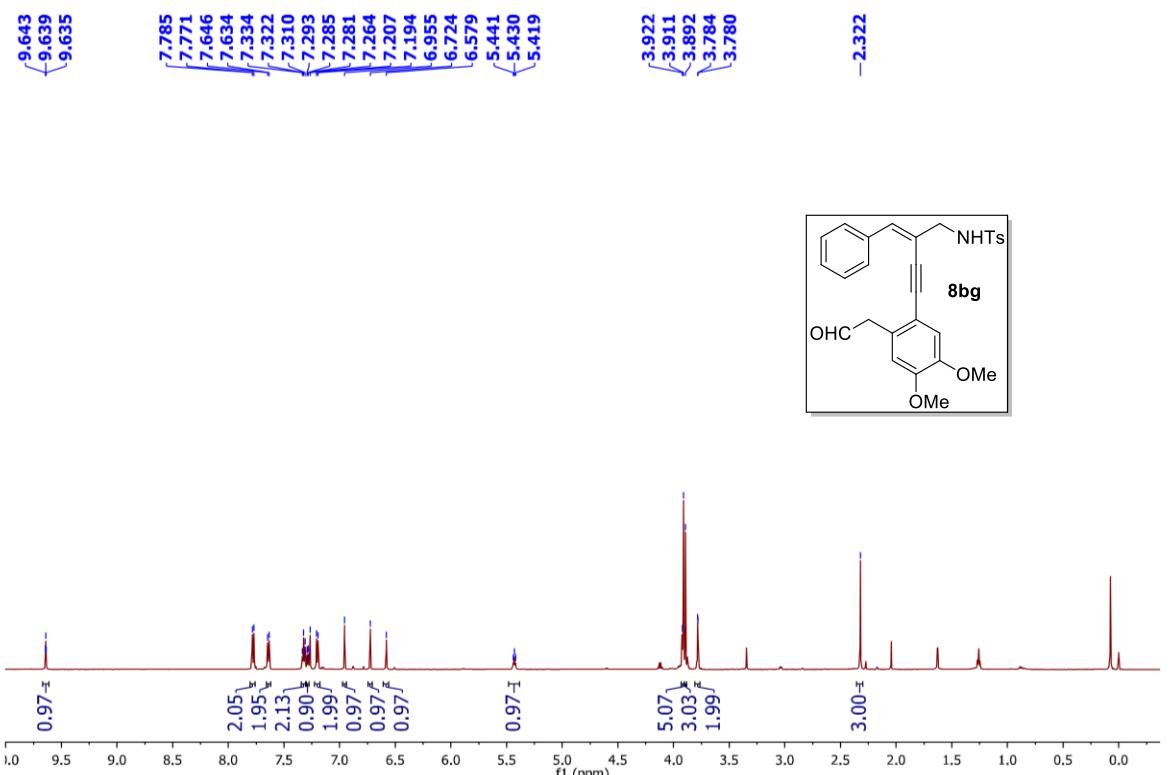
¹H NMR (600 MHz) of **8bf**:



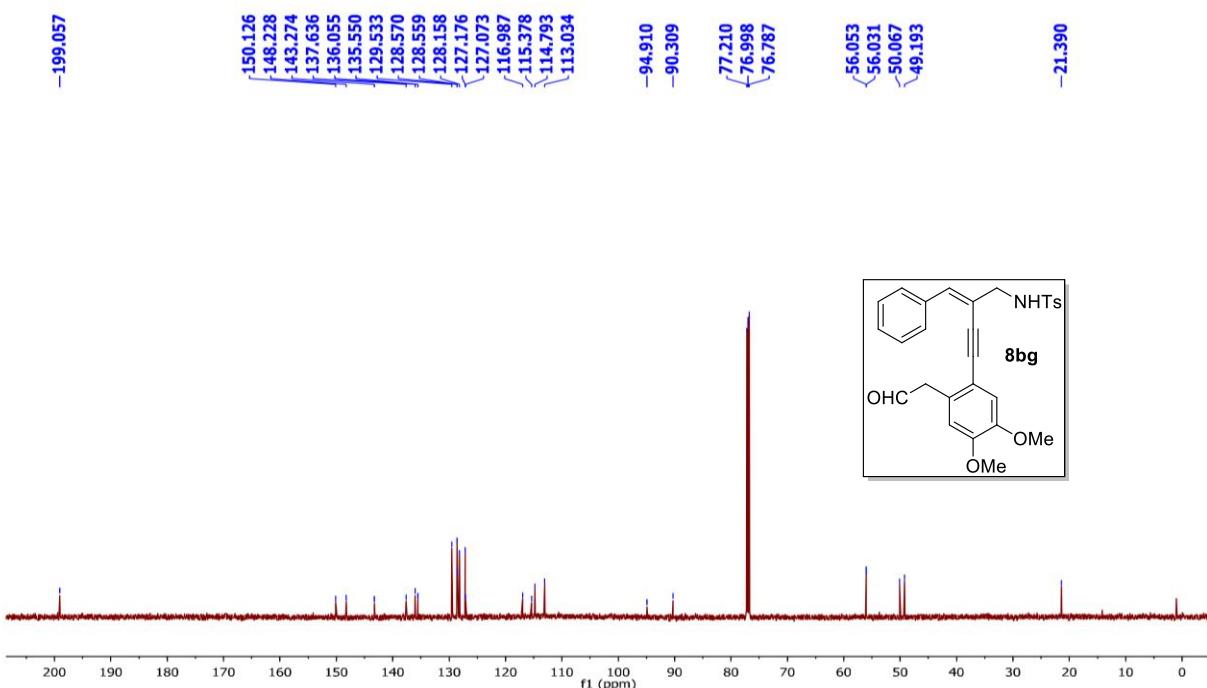
¹³C{¹H} NMR (150 MHz) of **8bf**:



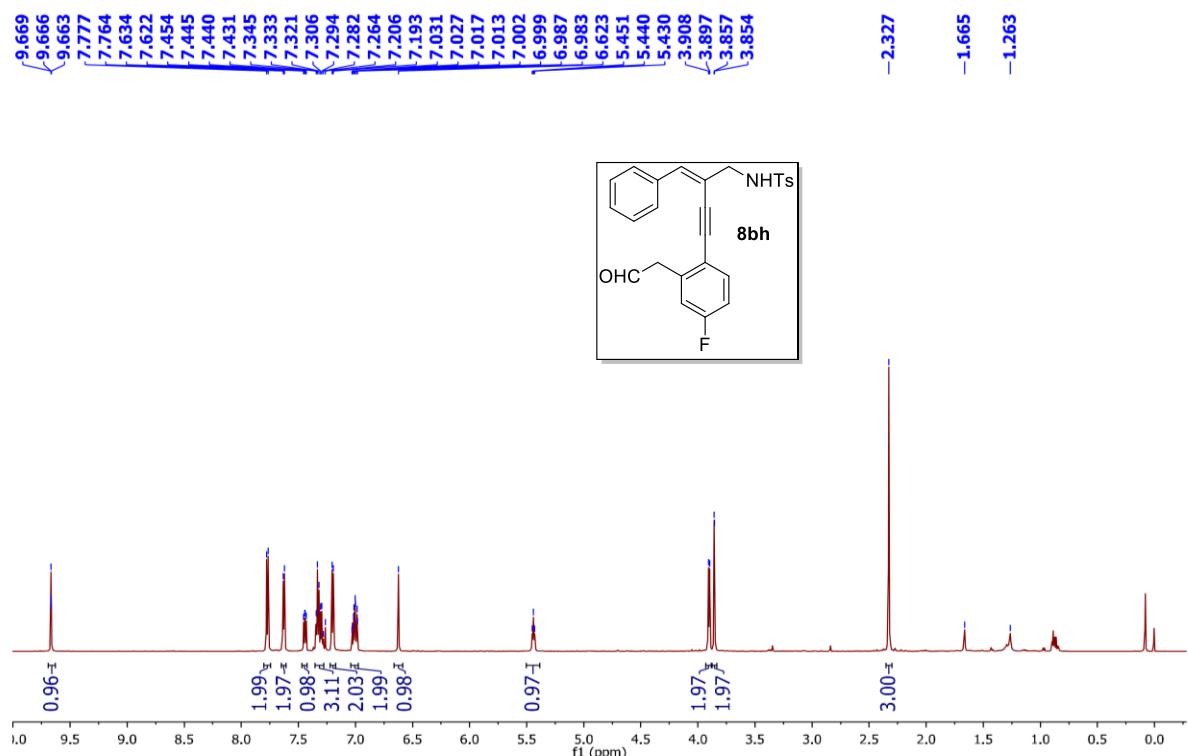
¹H NMR (600 MHz) of **8bg**:



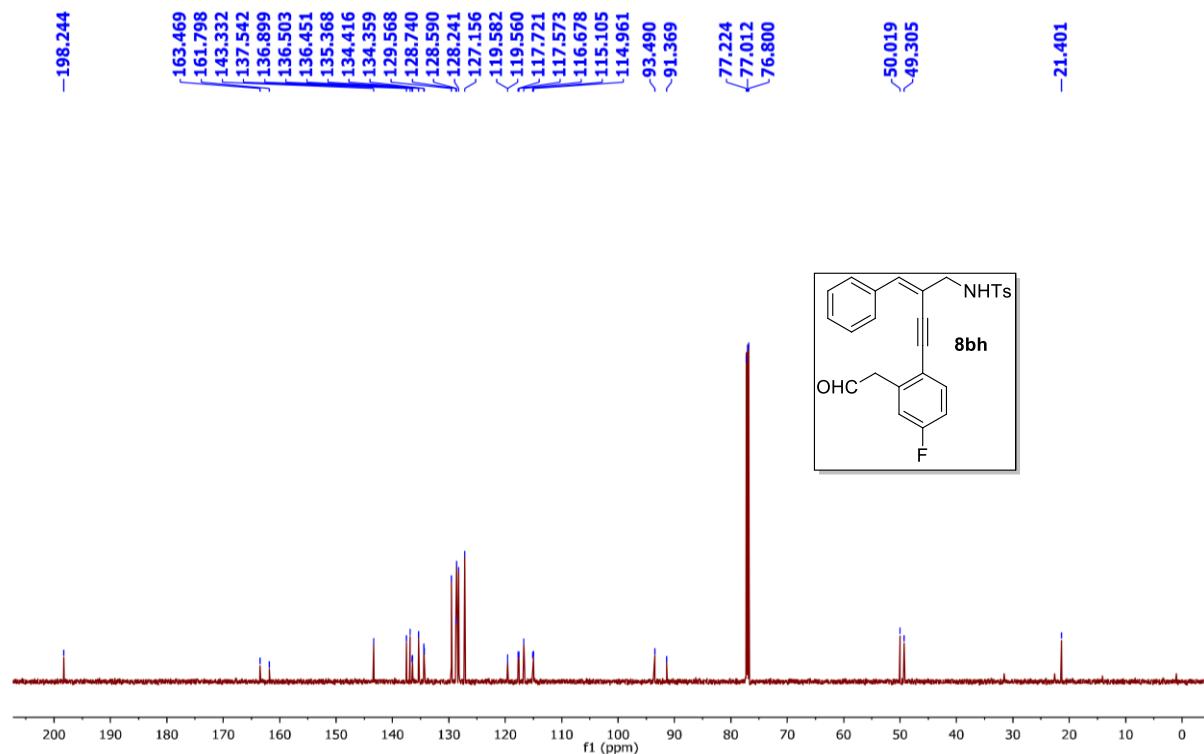
¹³C{¹H} NMR (150 MHz) of **8bg**:



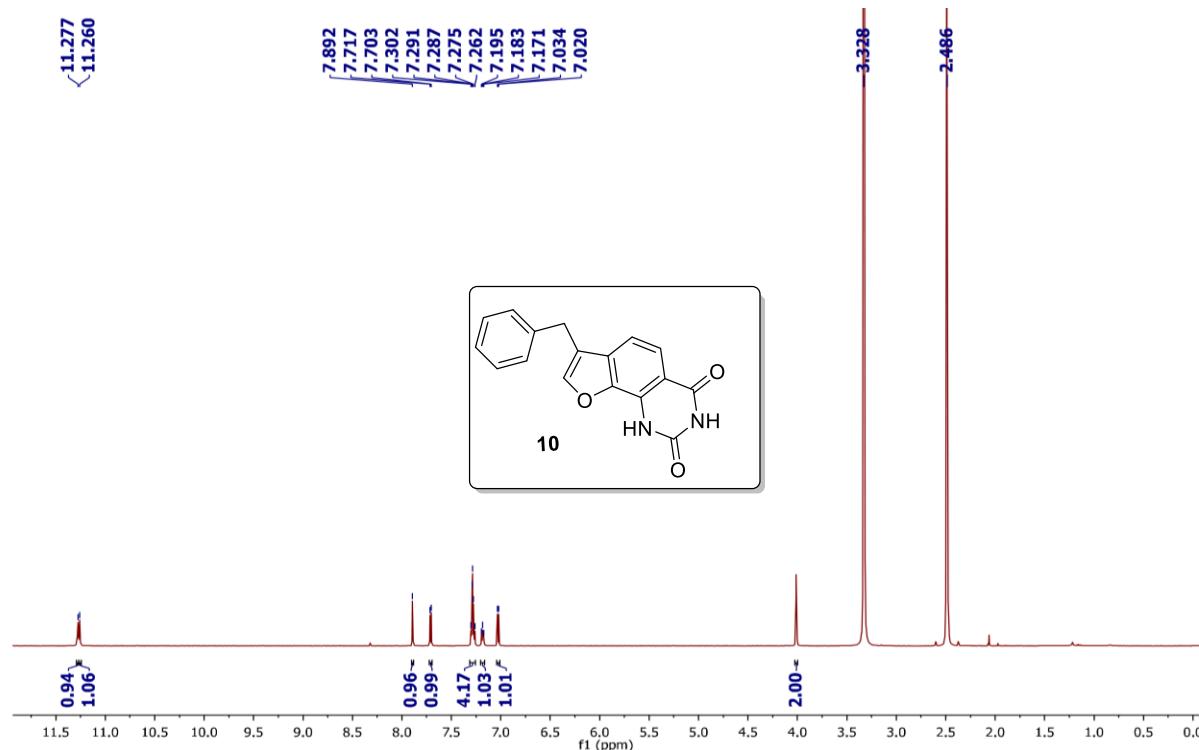
¹H NMR (600 MHz) of 8bh :



¹³C{¹H} NMR (150 MHz) of **8bh**:



16. ^1H NMR (600 MHz) of compound 10



$^{13}\text{C}\{^1\text{H}\}$ NMR (150 MHz)of compound 10

