

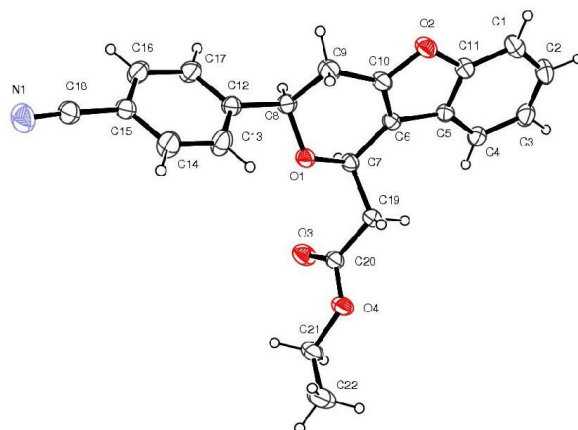
**Stereoselective synthesis of C-fused pyranoindoles,  
pyranobenzofurans and pyranobenzothiophene scaffolds using  
*oxa*-Pictet Spengler type reaction of vinylogous carbonates**

**Santosh J. Gharpure\* and V. Prasath**

E-mail: [sjgharpure@iitb.ac.in](mailto:sjgharpure@iitb.ac.in)

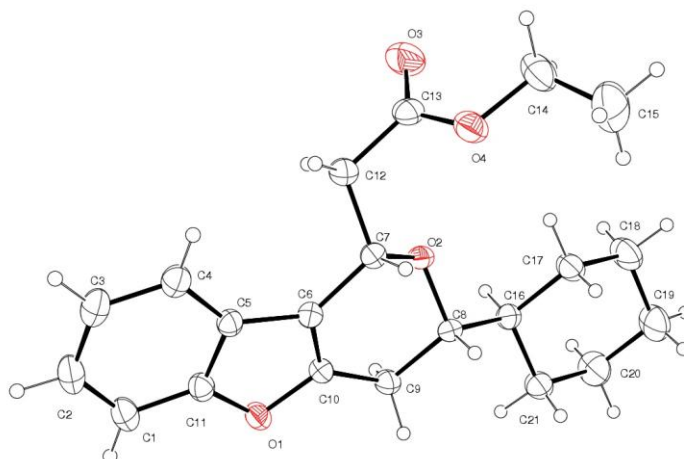
Department of Chemistry, Indian Institute of Technology Bombay, Powai, Mumbai –  
400076

## Crystal data and structure refinement for 1a



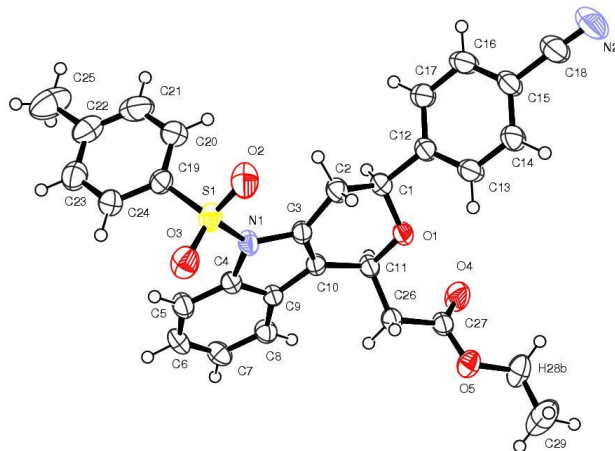
Identification code	<b>1a</b>
Solvent	CH <sub>3</sub> CN
CCDC	971411
Empirical formula	C <sub>22</sub> H <sub>19</sub> NO <sub>4</sub>
Formula weight	361.38
Temperature	298(2) K
Wavelength	0.71073 Å
Crystal system, space group	Triclinic, P-1
Unit cell dimensions	a = 8.2827(3) Å alpha = 98.787(2) deg. b = 8.3250(3) Å beta = 93.426(2) deg. c = 15.0662(7) Å gamma = 114.758(2) deg.
Volume	923.40(6) Å <sup>3</sup>
Z, Calculated density	2, 1.300 Mg/m <sup>3</sup>
Absorption coefficient	0.090 mm <sup>-1</sup>
F(000)	380
Crystal size	0.45 x 0.35 x 0.20 mm
Theta range for data collection	1.38 to 28.59 deg.
Limiting indices	-9 ≤ h ≤ 11, -11 ≤ k ≤ 7, -20 ≤ l ≤ 19
Reflections collected / unique	12745 / 4594 [R(int) = 0.0203]
Completeness to theta = 25.00	99.7 %
Absorption correction	Multi-scan
Max. and min. transmission	0.9823 and 0.9607
Refinement method	Full-matrix least-squares on F <sup>2</sup>
Data / restraints / parameters	4594 / 0 / 245
Goodness-of-fit on F <sup>2</sup>	0.983
Final R indices [I > 2σ(I)]	R1 = 0.0439, wR2 = 0.1041
R indices (all data)	R1 = 0.0546, wR2 = 0.1119
Largest diff. peak and hole	0.246 and -0.211 e.Å <sup>-3</sup>

## Crystal data and structure refinement for 1f



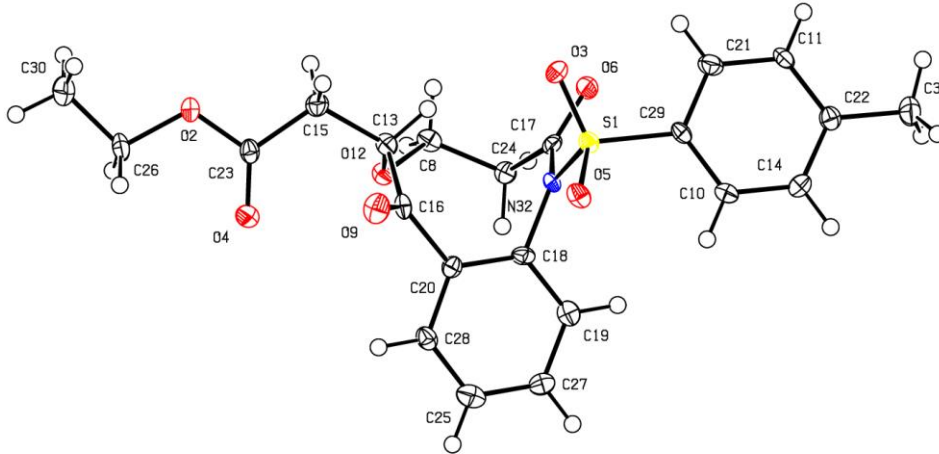
Identification code	<b>1f</b>
Solvent	CH <sub>3</sub> CN
CCDC	971412
Empirical formula	C <sub>29</sub> H <sub>26</sub> N <sub>2</sub> O <sub>5</sub> S
Formula weight	514.58
Temperature	298(2) K
Wavelength	0.71073 Å
Crystal system, space group	Triclinic, P-1
Unit cell dimensions	a = 8.1294(4) Å alpha = 87.310(2) deg. b = 8.2212(4) Å beta = 87.214(2) deg. c = 17.8893(6) Å gamma = 90 deg.
Volume	1295.19(11) Å <sup>3</sup>
Z, Calculated density	2, 1.319 Mg/m <sup>3</sup>
Absorption coefficient	0.167 mm <sup>-1</sup>
F (000)	540
Crystal size	0.45 x 0.35 x 0.12 mm
Theta range for data collection	2.08 to 28.24 deg.
Limiting indices	-10 ≤ h ≤ 10, -10 ≤ k ≤ 9, -26 ≤ l ≤ 26
Completeness to theta = 25.00	98.3 %
Max. and min. transmission	0.9802 and 0.9285
Refinement method	Full-matrix least-squares on F <sup>2</sup>
Data / restraints / parameters	6020 / 0 / 336
Goodness-of-fit on F <sup>2</sup>	1.034
Final R indices [I > 2σ(I)]	R1 = 0.0423, wR2 = 0.1057
R indices (all data)	R1 = 0.0641, wR2 = 0.1182
Largest diff. peak and hole	0.297 and -0.252 e.Å <sup>-3</sup>

## Crystal data and structure refinement for **1k**



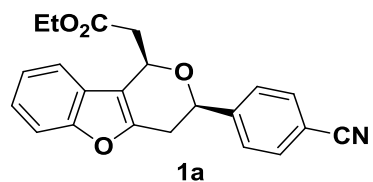
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CCDC	971413
empirical formula	C <sub>29</sub> H <sub>26</sub> N <sub>2</sub> O <sub>5</sub> S
Formula weight	514.58
Temperature	298(2) K
Wavelength	0.71073 Å
Crystal system, space group	Triclinic, P-1
Unit cell dimensions	a = 8.1294(4) Å alpha = 87.310(2) deg. b = 8.2212(4) Å beta = 87.214(2) deg. c = 19.5982(10) Å gamma = 82.233 (2)
deg.	
Z, Calculated density	2,1.319 Mg/m <sup>3</sup>
F(000)	540
Crystal size	0.45 x 0.35 x 0.12 mm
Limiting indices	-10 ≤ h ≤ 10, -10 ≤ k ≤ 9, -26 ≤ l ≤ 26
Reflections collected / unique	16654 / 6020 [R(int) = 0.0220]
Completeness to theta = 25.00	98.3 %
Absorption correction	Multi-scan
Max. and min. transmission	0.9802 and 0.9285
Refinement method	Full-matrix least-squares on F <sup>2</sup>
Data / restraints / parameters	6020 / 0 / 336
Goodness-of-fit on F <sup>2</sup>	1.034
Final R indices [I > 2sigma(I)]	R1 = 0.0423, wR2 = 0.1057
R indices (all data)	R1 = 0.0641, wR2 = 0.1182
Largest diff. peak and hole	0.297 and -0.252 e.Å

## Crystal data and structure refinement for 14

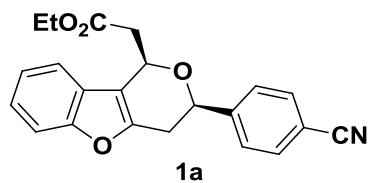
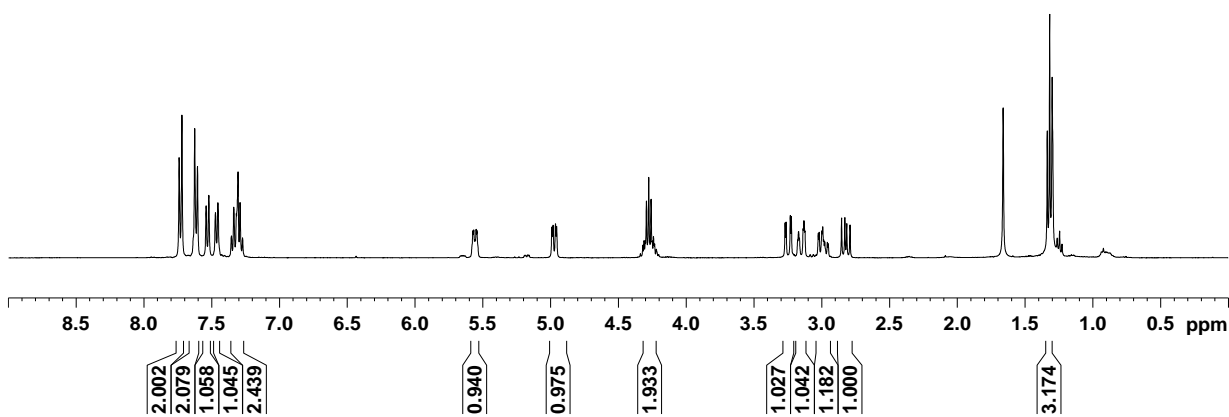


Identification code	<b>14</b>	
Solvent	CH <sub>3</sub> CN	
CCDC	971414	
Bond precision:	C-C = 0.0067 Å	Wavelength = 0.71075
Cell:	a = 7.440 (5) Alpha = 83.084 (17)	b = 10.513 (7) c = 13.472 (9) beta = 86.07 (2)      gamma = 86.796 (18)
Temperature:	100 K	

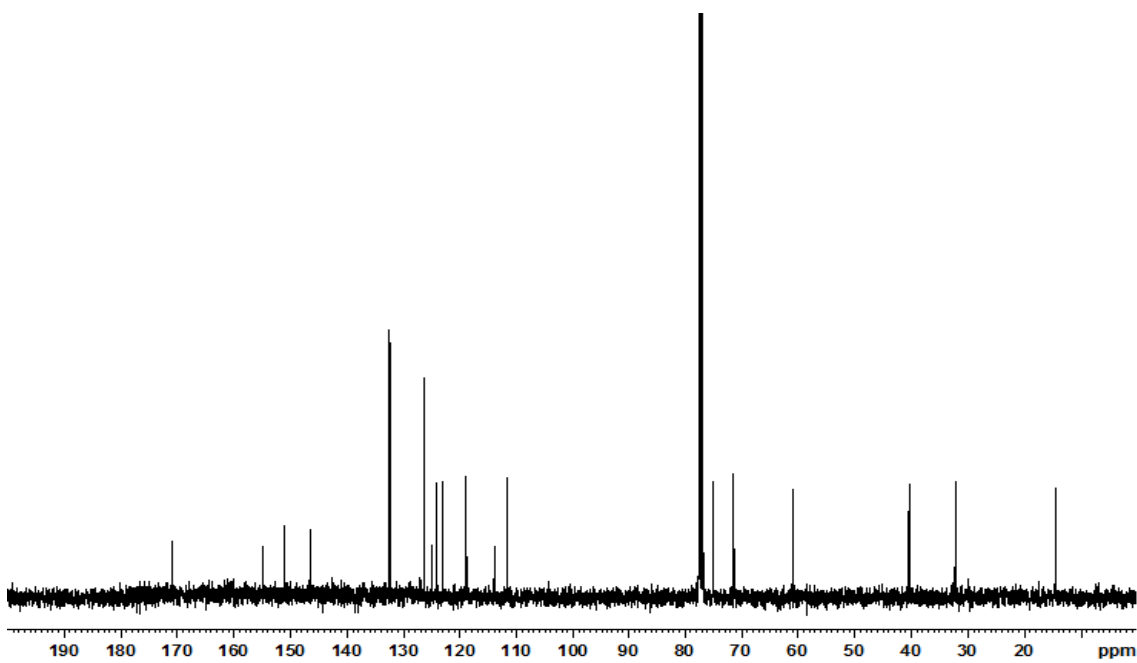
	Calculated	Reported	
Volume	1042.4(12)	1042.4 (12)	
Space group	P -1	P -1	
Hall group	-P 1	-P 1	
Moiety formula	C <sub>22</sub> H <sub>23</sub> NO <sub>7</sub> S	C <sub>22</sub> H <sub>23</sub> NO <sub>7</sub> S	
Sum formula	C <sub>22</sub> H <sub>23</sub> NO <sub>7</sub> S	C <sub>22</sub> H <sub>23</sub> NO <sub>7</sub> S	
Mr	445.48	445.49	
Dx, g cm <sup>-3</sup>	1.419	1.419	
Z	2	2	
Mu (mm <sup>-1</sup> )	0.201	0.201	
F000	468.0	468.0	
F000'	468.50		
h, k, lmax	8,12,15	8,12,15	
Nref	3661	3594	
Tmin, Tmax	0.961, 0.961	0.930, 0.961	
Tmin' 0.961			
Correction method = NUMERICAL			
Data completeness = 0.982		Theta (max) = 25.000	
R (reflections) = 0.0769 (2680)		wR2(reflections) = 0.1773( 3588)	
S = 1.239		Npar= 280	

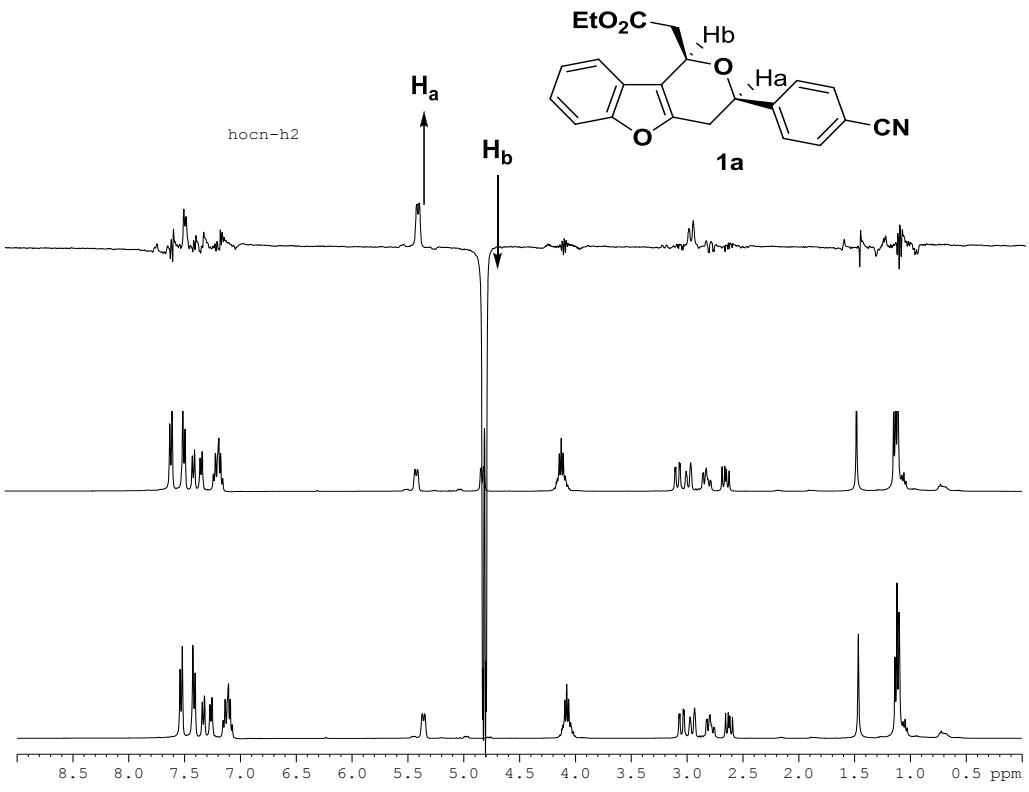
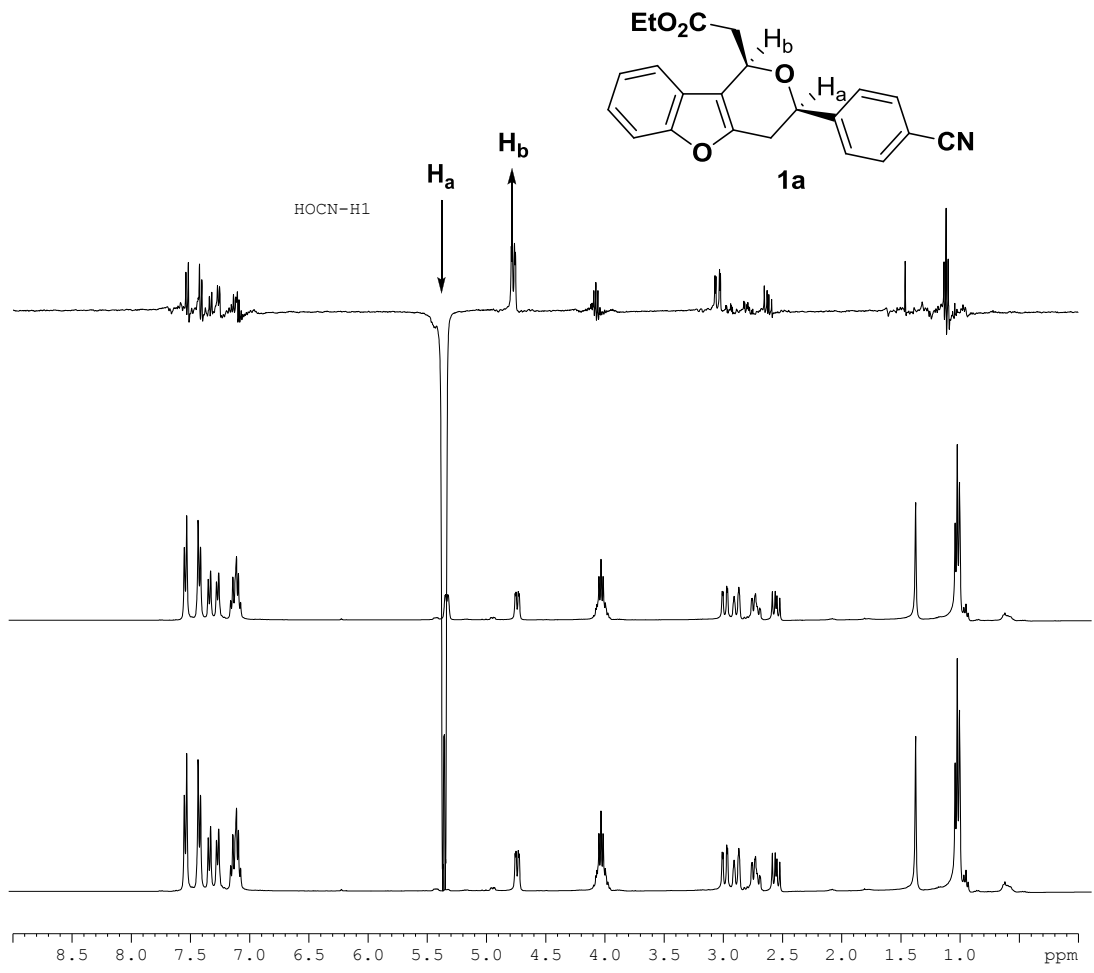


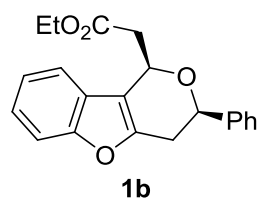
<sup>1</sup>H NMR in CDCl<sub>3</sub>



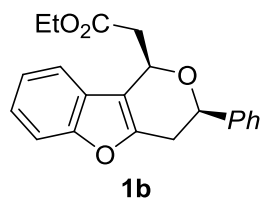
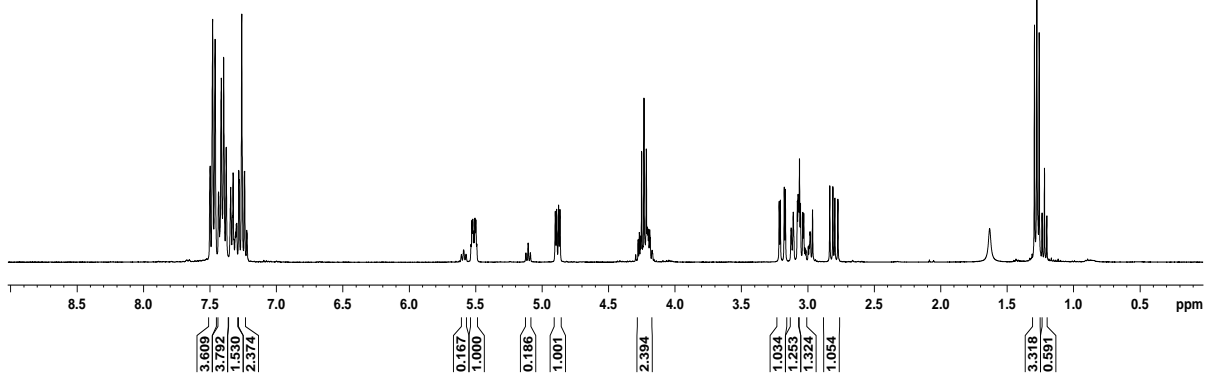
<sup>13</sup>C NMR in CDCl<sub>3</sub>



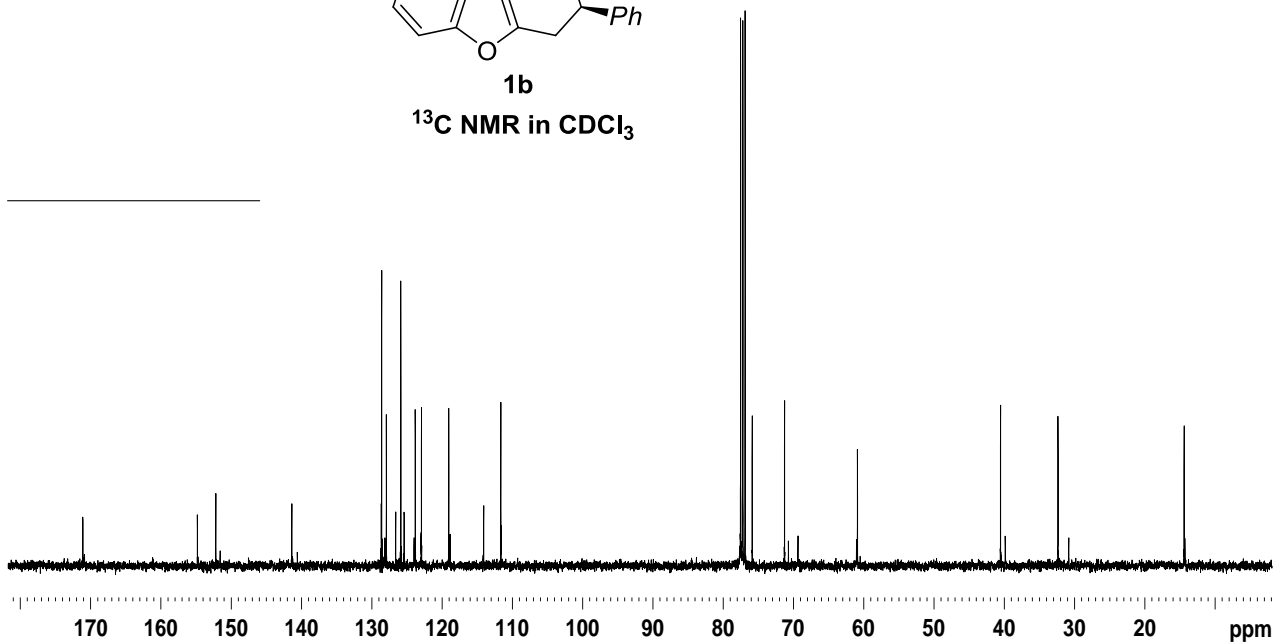




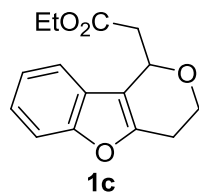
<sup>1</sup>H NMR in CDCl<sub>3</sub>



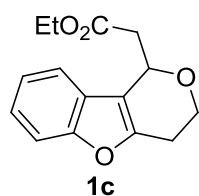
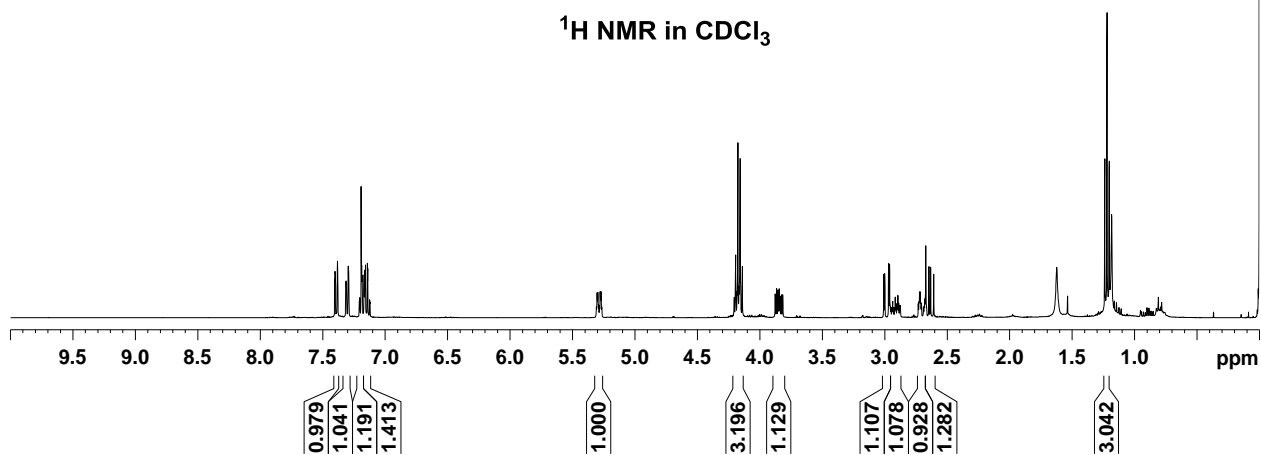
<sup>13</sup>C NMR in CDCl<sub>3</sub>



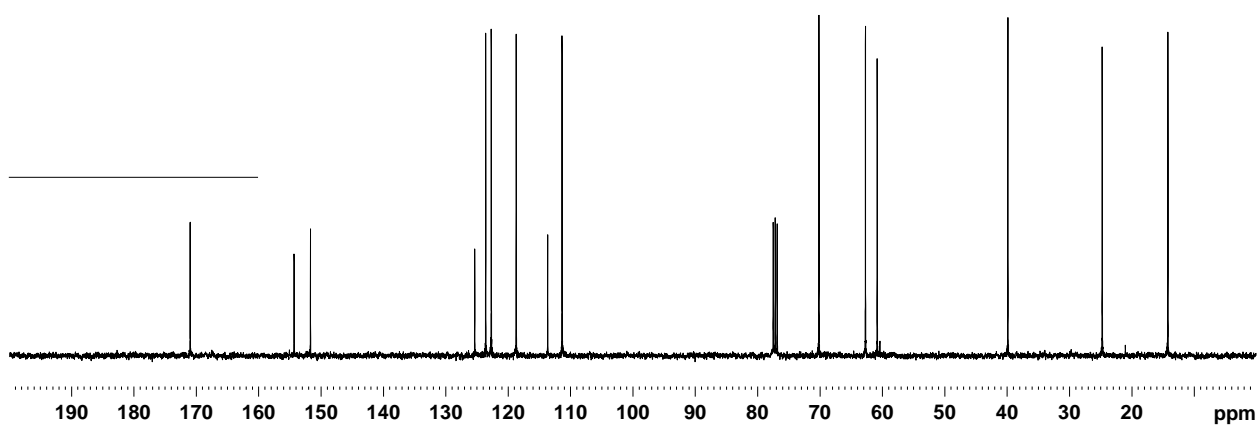


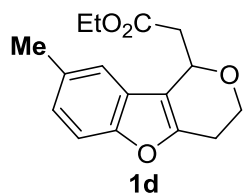


<sup>1</sup>H NMR in CDCl<sub>3</sub>

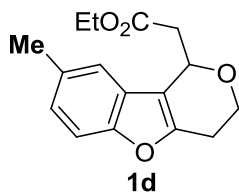
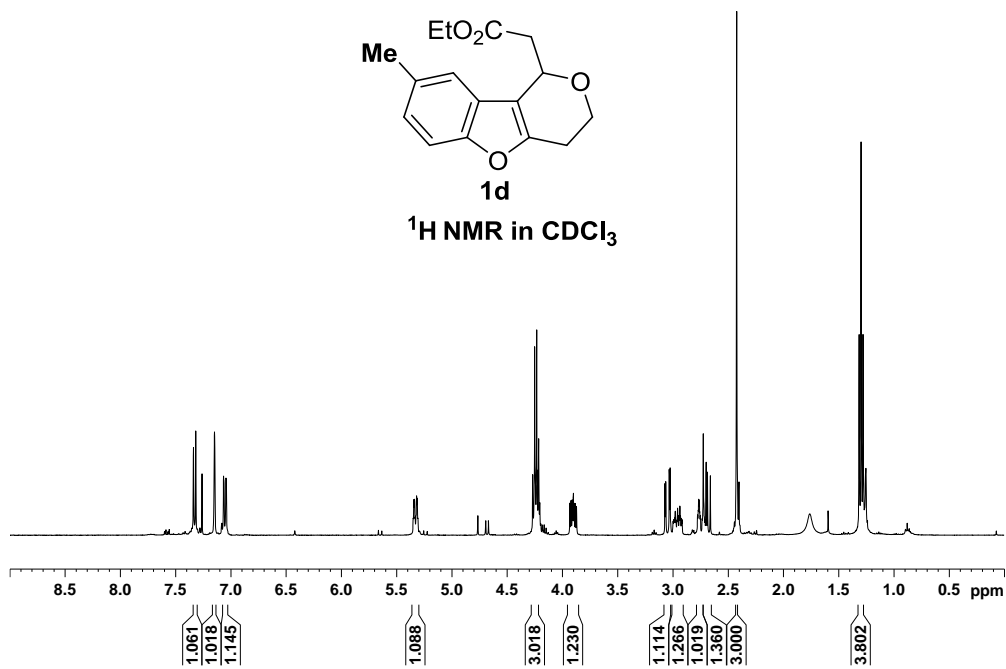


<sup>13</sup>C NMR in CDCl<sub>3</sub>

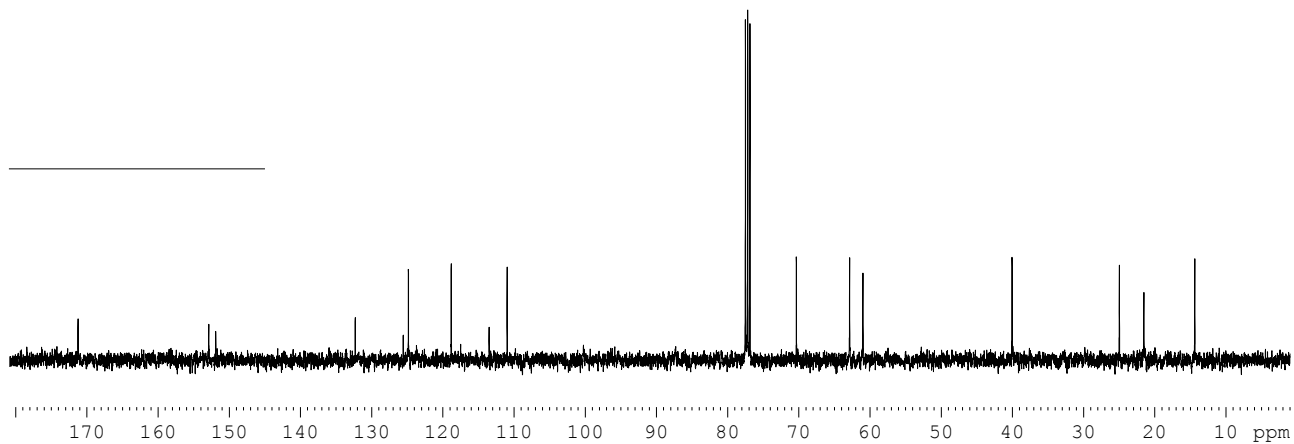


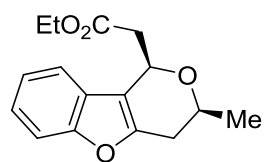


<sup>1</sup>H NMR in CDCl<sub>3</sub>



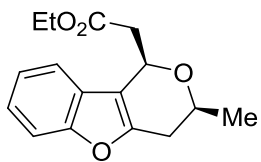
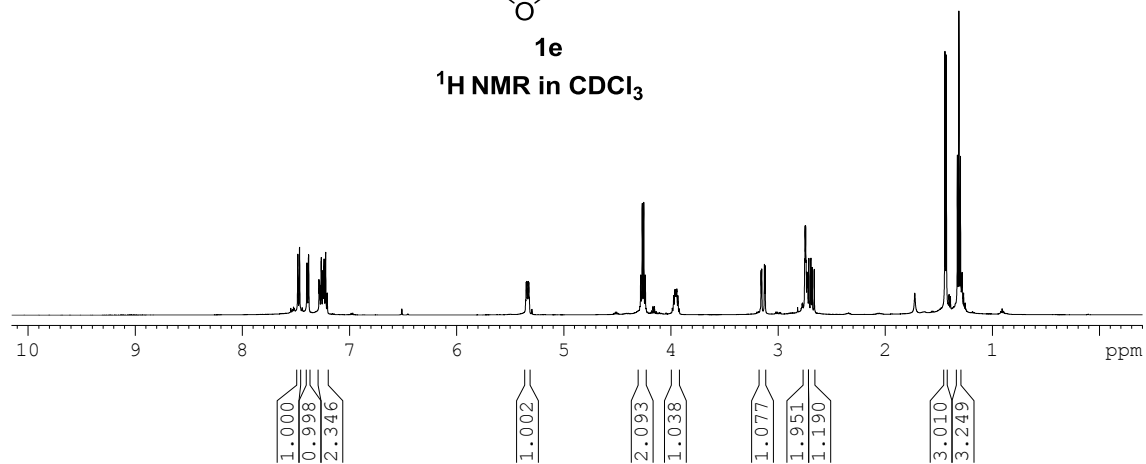
<sup>13</sup>C NMR in CDCl<sub>3</sub>





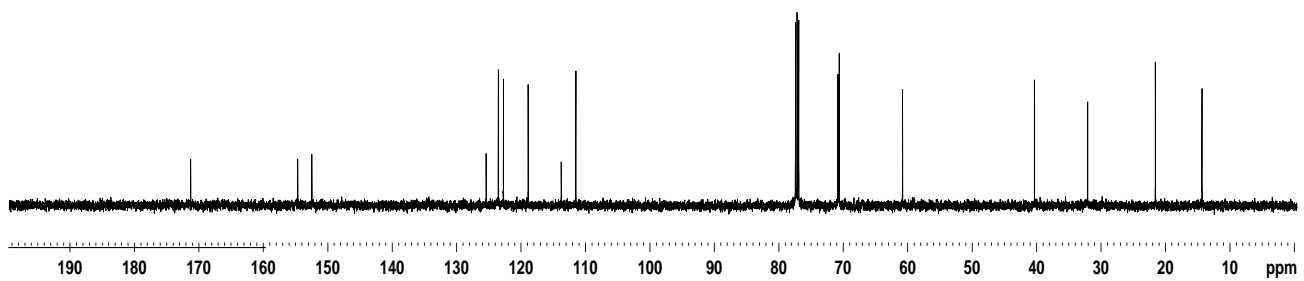
**1e**

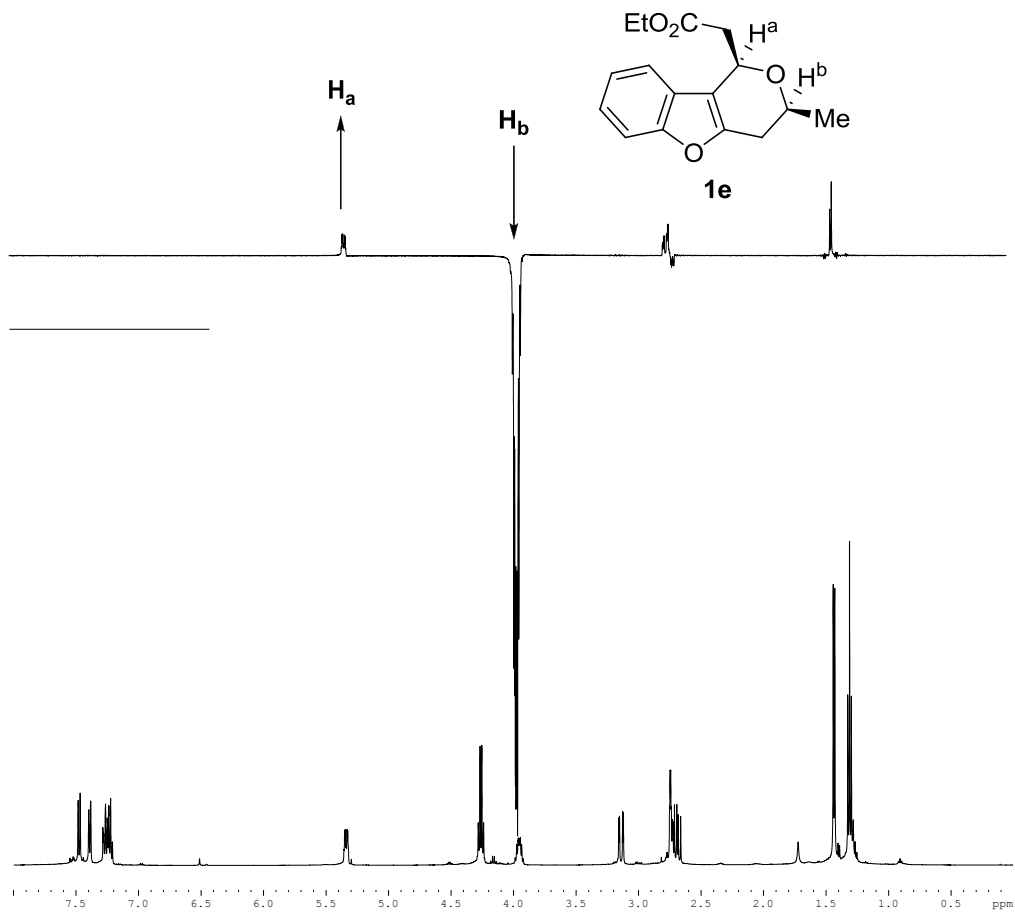
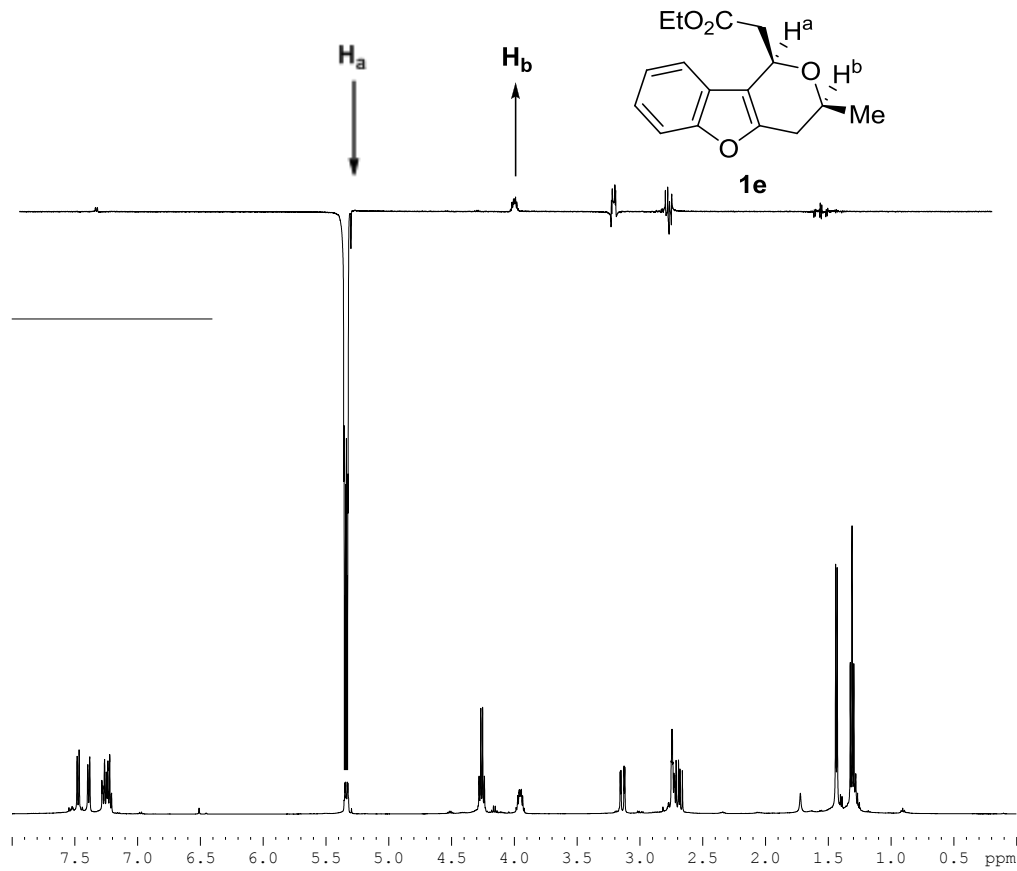
<sup>1</sup>H NMR in CDCl<sub>3</sub>

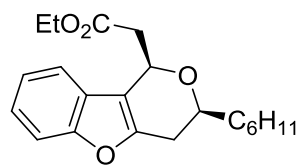


**1e**

<sup>13</sup>C NMR in CDCl<sub>3</sub>

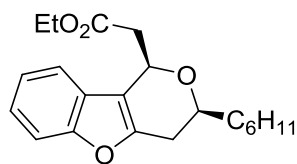
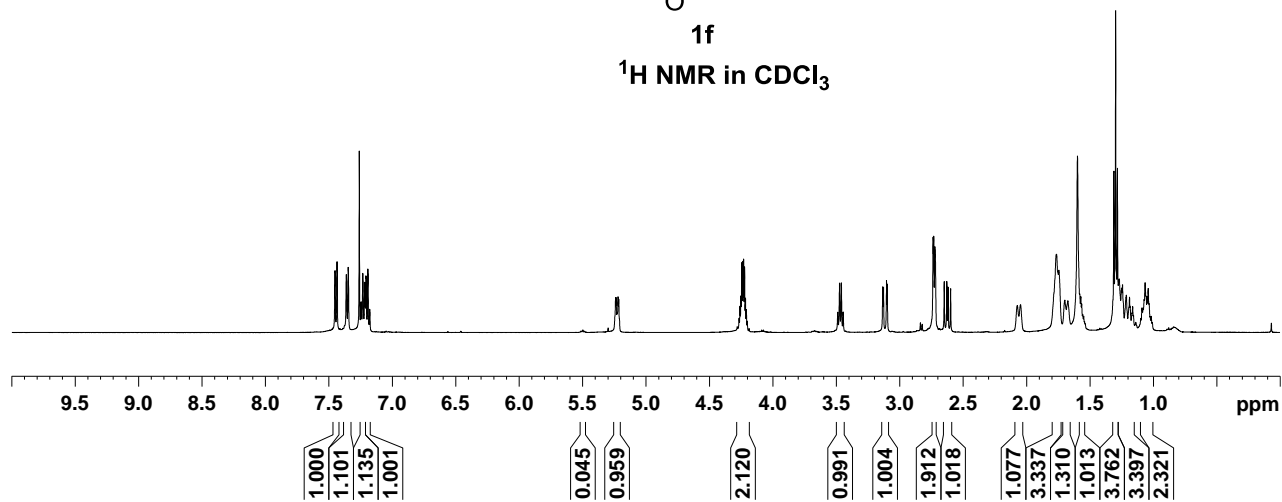






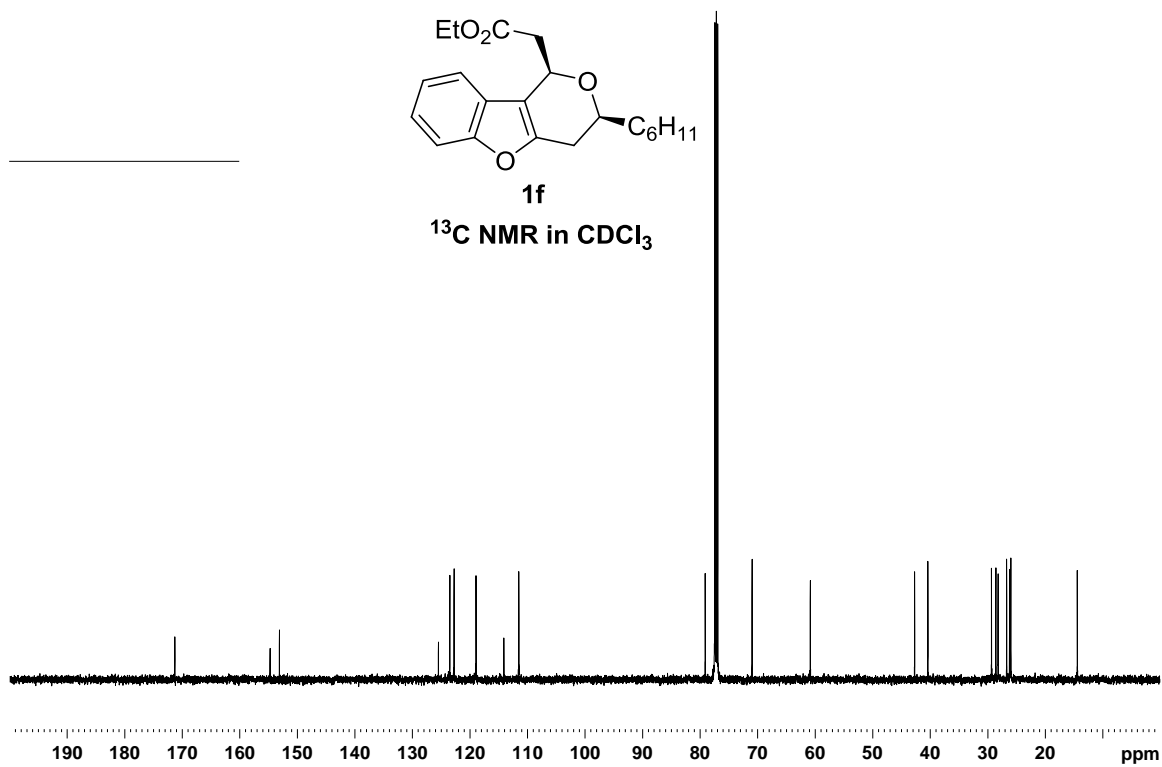
1f

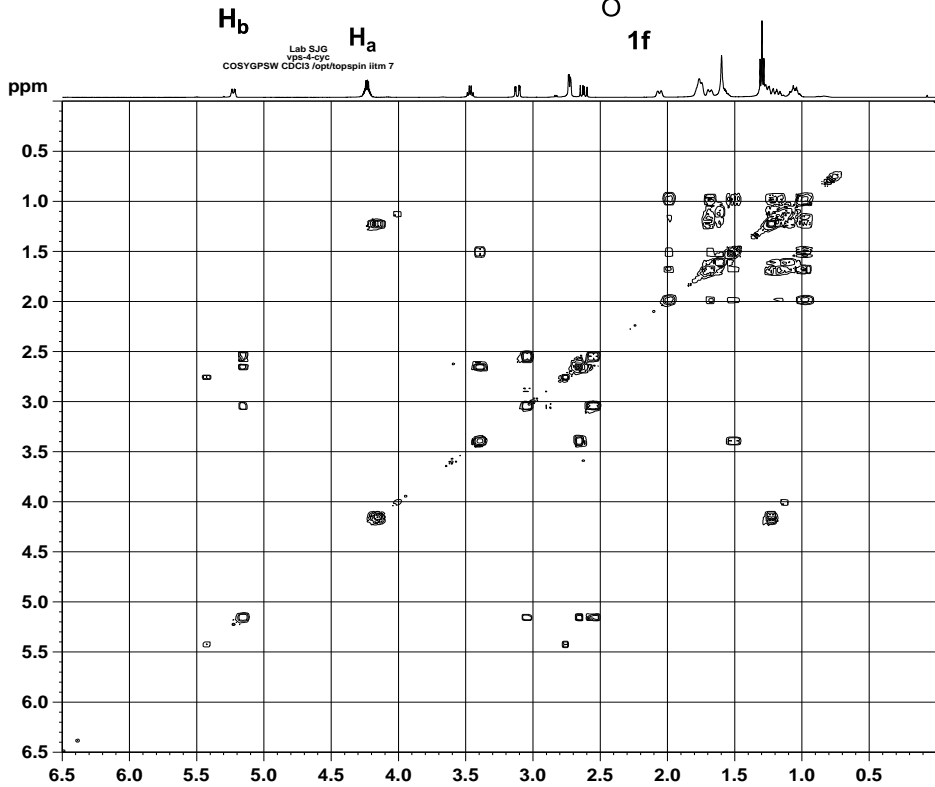
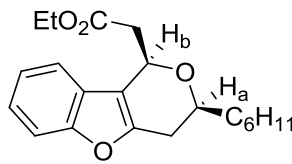
<sup>1</sup>H NMR in CDCl<sub>3</sub>



1f

<sup>13</sup>C NMR in CDCl<sub>3</sub>





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PROCNO 1

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SOLVENT CDC13  
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DS 1  
SWH 4201.681 Hz  
FIDRES 2.051602 Hz  
AQ 0.2437620 sec  
RG 64  
DW 119.000 usec  
EC 6.50 usec  
TE 295.0 K  
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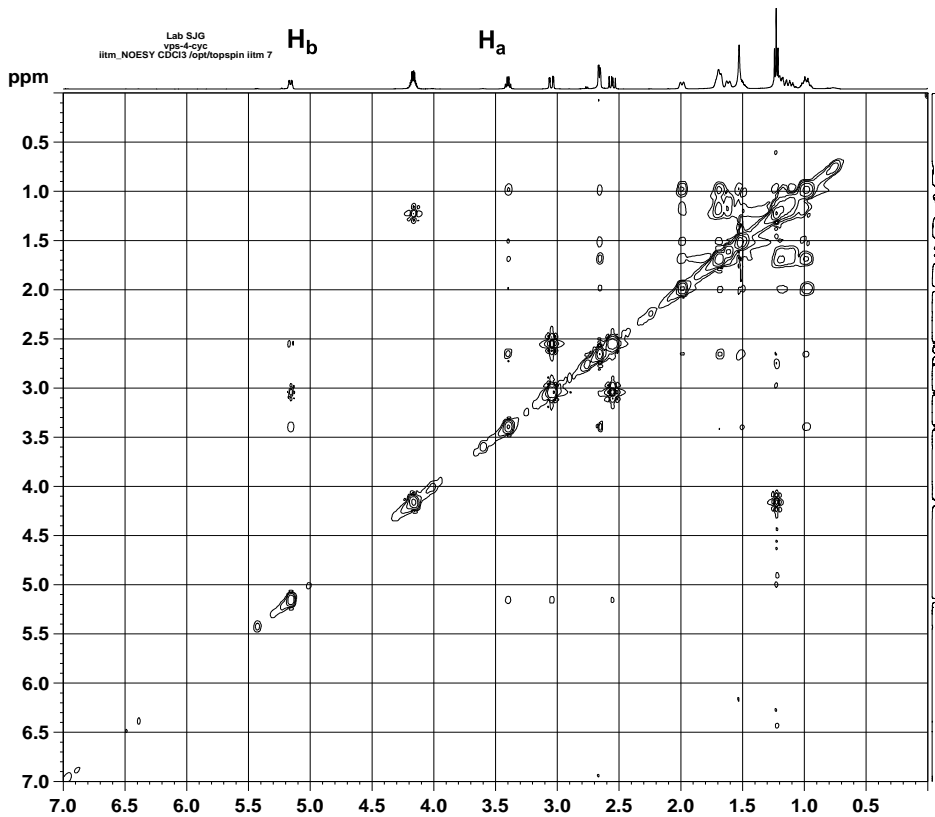
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P1 11.75 usec  
P17 2500.00 usec  
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PLW10 3.1247997 W  
SFO1 500.1520316 MHz

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GP21 10.00 %  
P21 1000.00 usec

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FIDRES 32.825630 Hz  
SW 8.401 ppm  
FMODE QF

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SSB 0  
LB 0 Hz  
GB 0  
PC 1.40

F1 - Processing parameters  
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SF 500.1500468 MHz  
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SSB 0  
LB 0 Hz  
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Current Data Parameters  
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EXPNO 170  
PROCNO 1

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RG 64  
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DE 6.50 usec  
TE 295.2 K  
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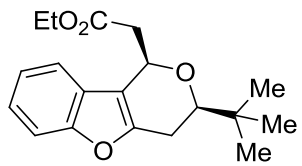
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NUC1 1H  
P1 11.75 usec  
P2 23.50 usec  
P17 2500.00 usec  
PLW1 15.3000019 W  
PLW10 3.1247997 W  
SFO1 500.1519646 MHz

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GP21 40.00 %  
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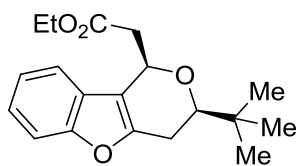
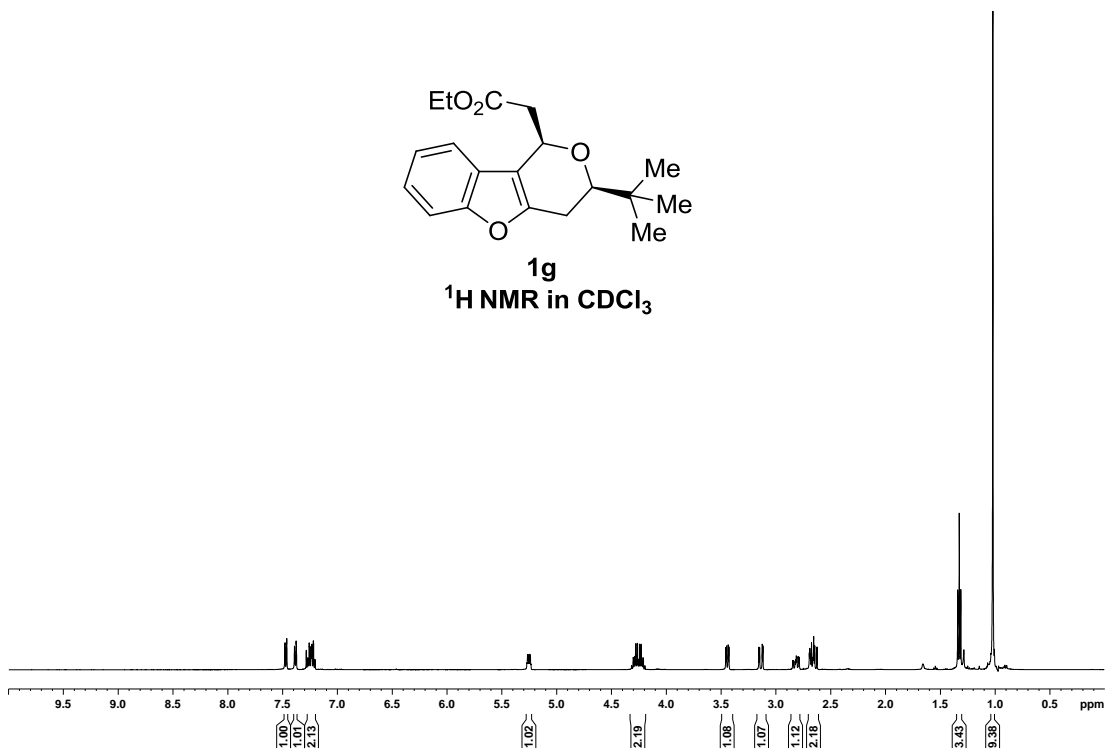
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PC 1.00

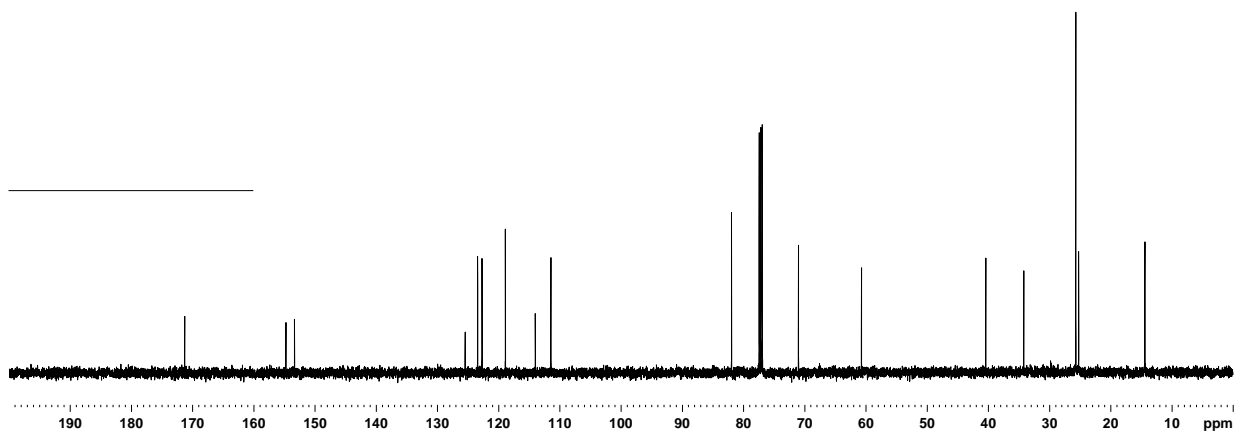
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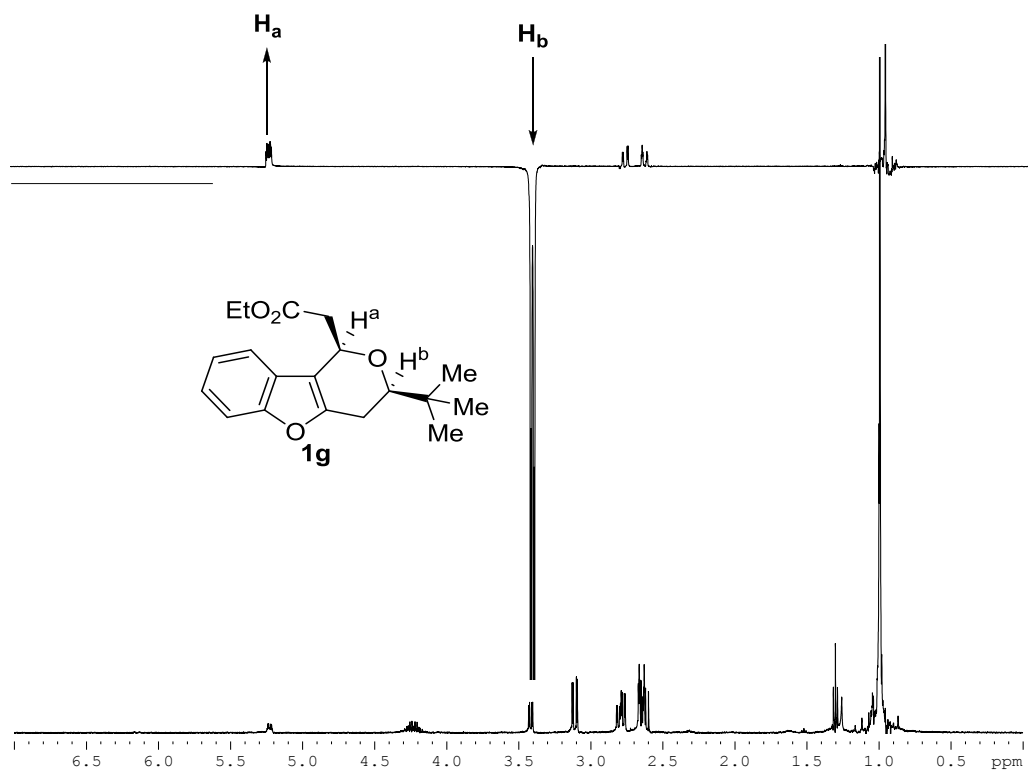
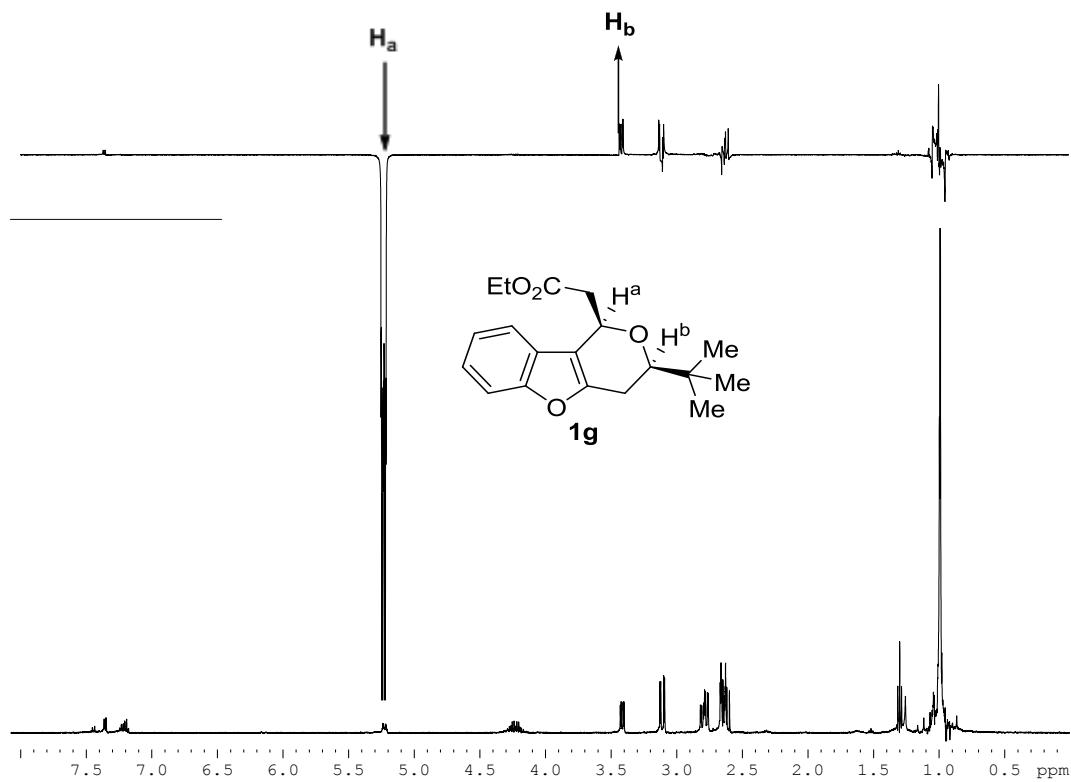


**1g**  
<sup>1</sup>H NMR in CDCl<sub>3</sub>

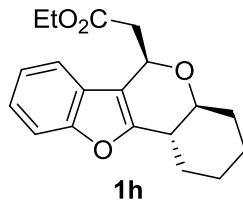


**1g**  
<sup>13</sup>C NMR in CDCl<sub>3</sub>

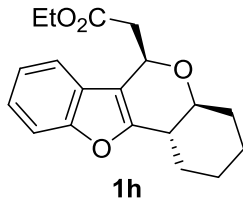
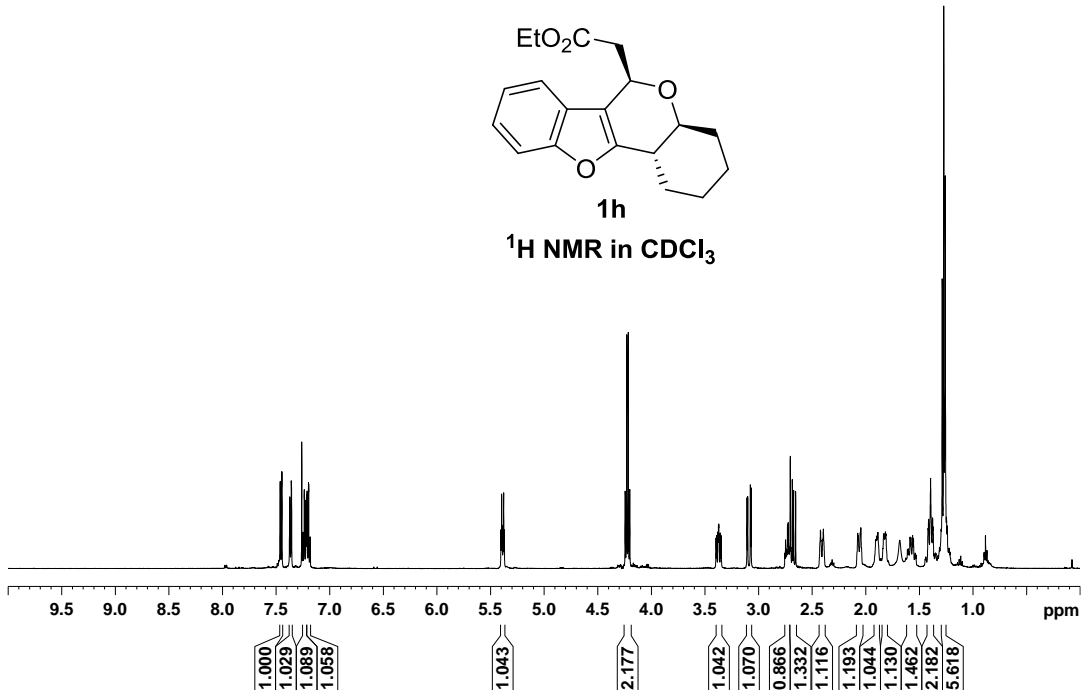




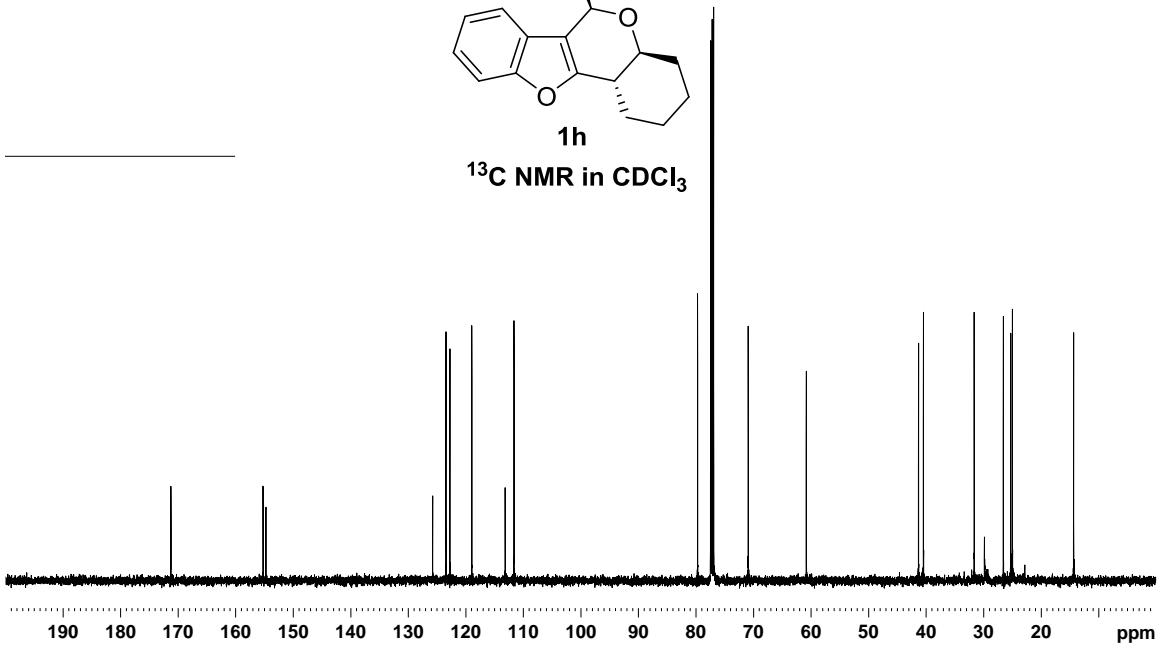


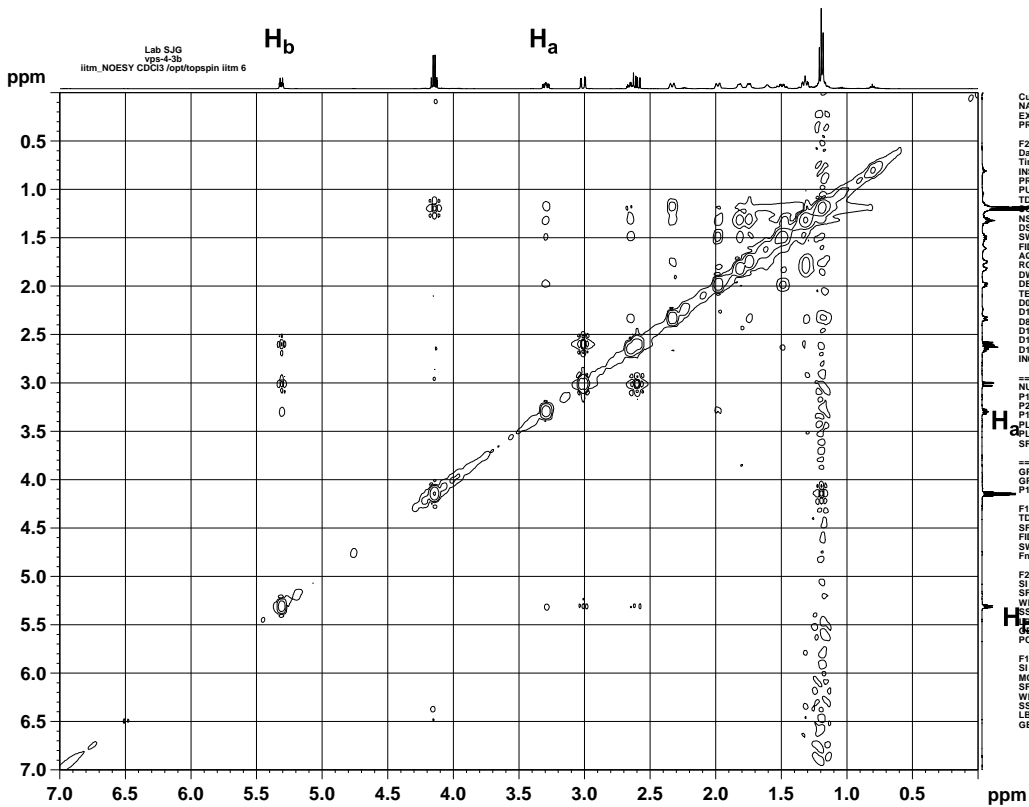
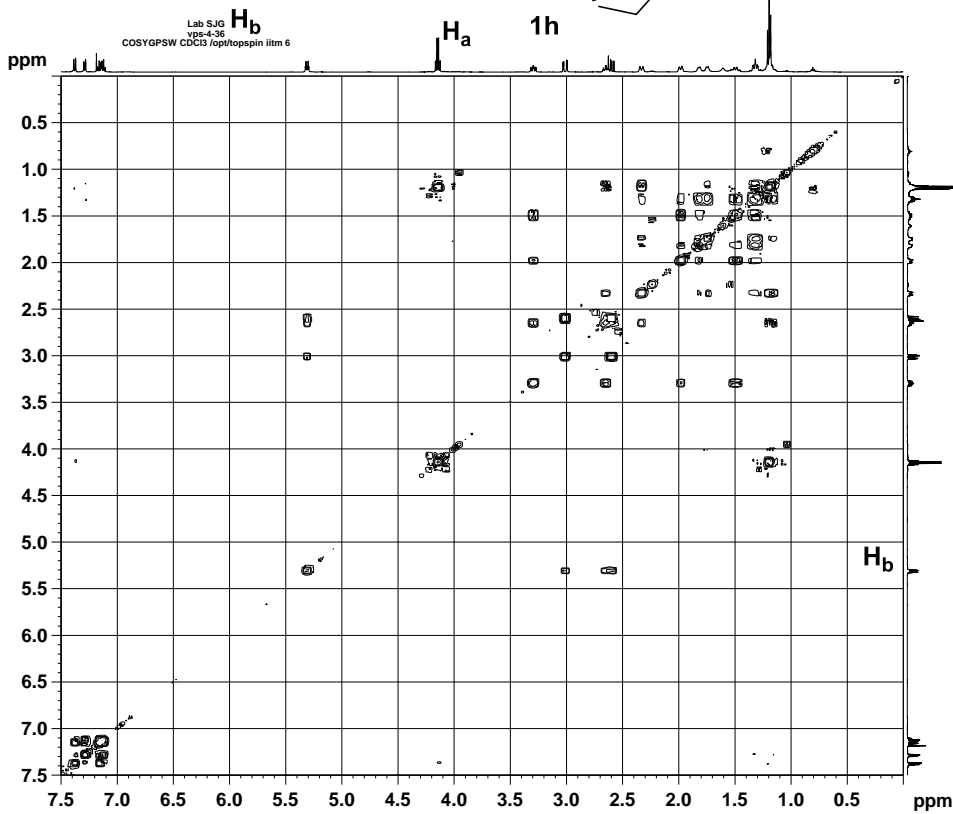
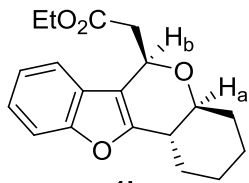


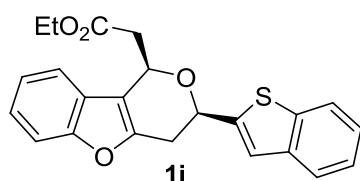
<sup>1</sup>H NMR in CDCl<sub>3</sub>



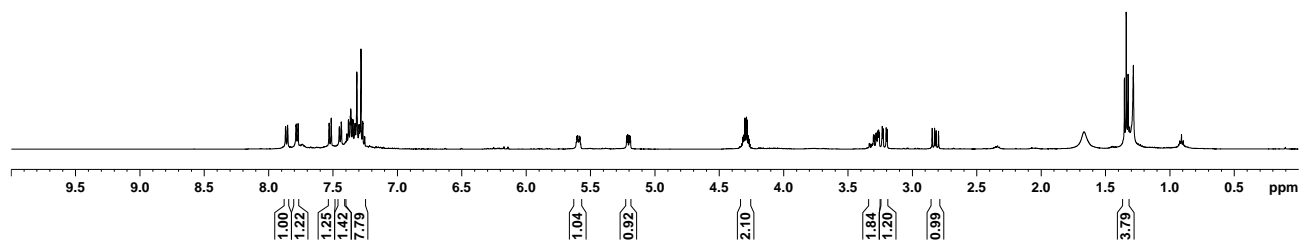
<sup>13</sup>C NMR in CDCl<sub>3</sub>



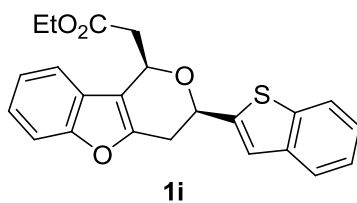




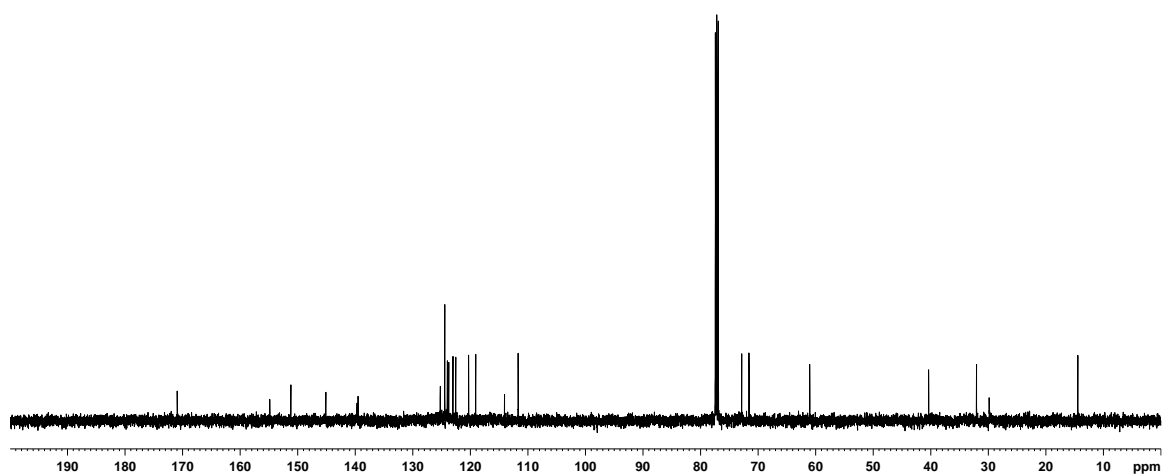
<sup>1</sup>H NMR in CDCl<sub>3</sub>

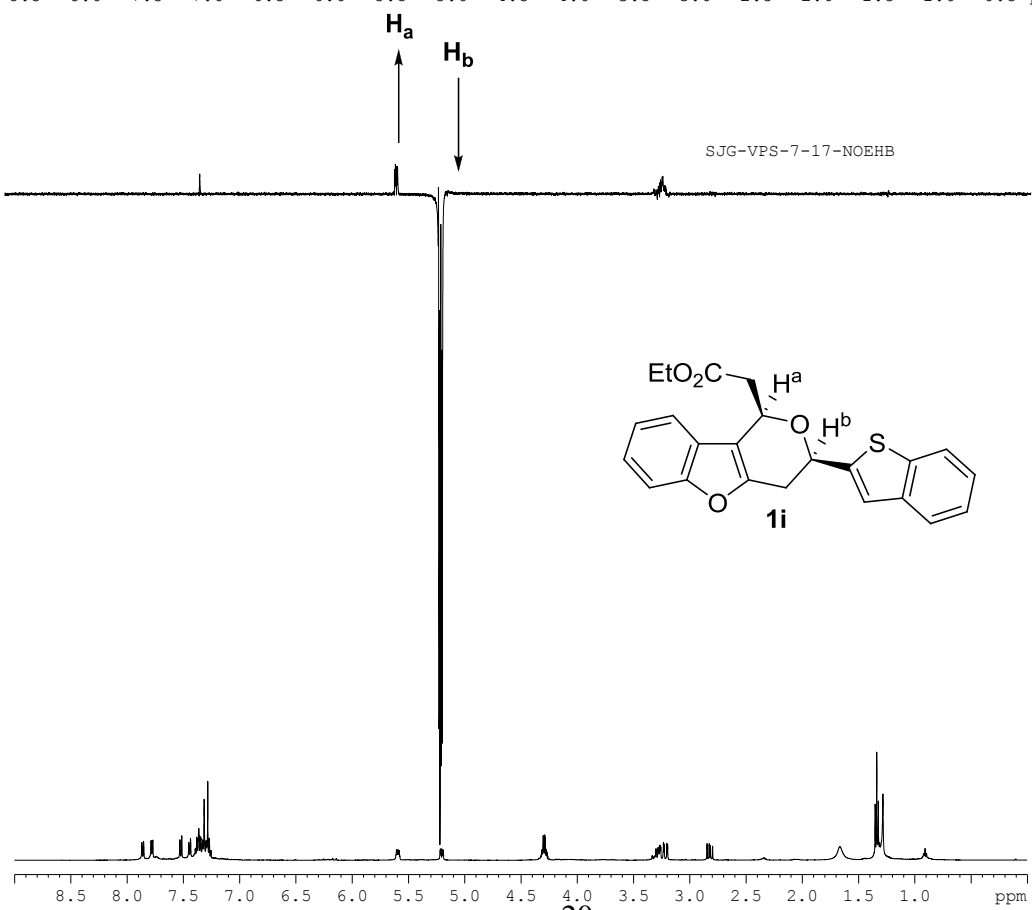
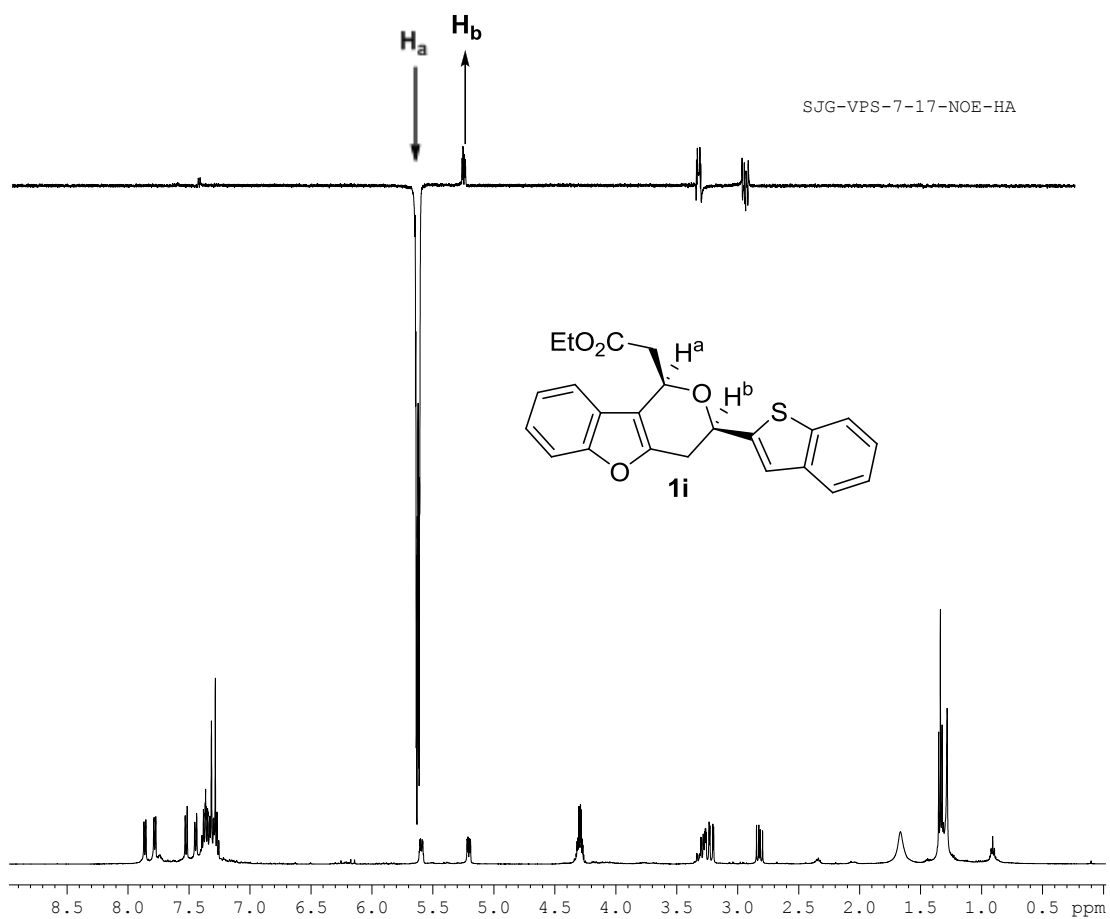


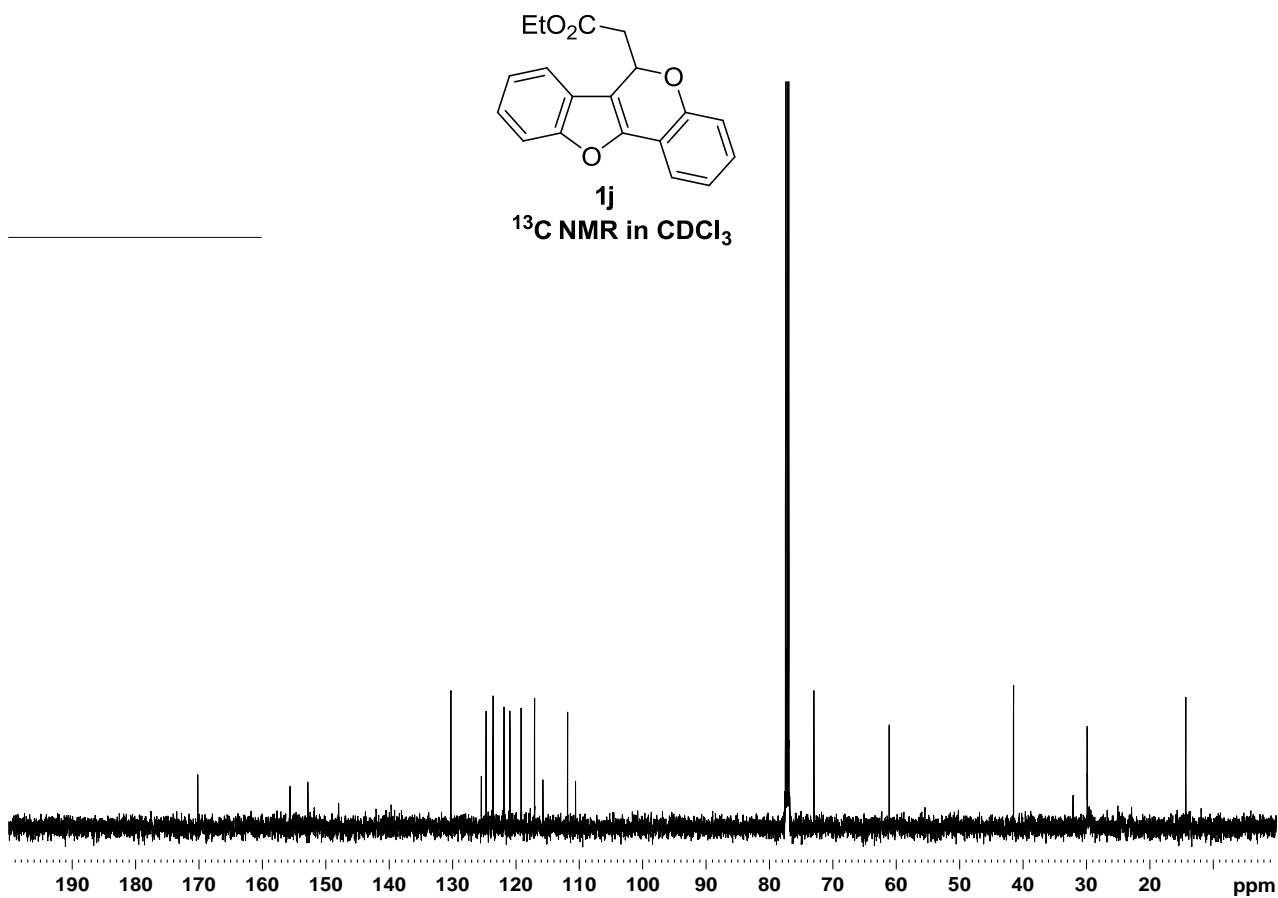
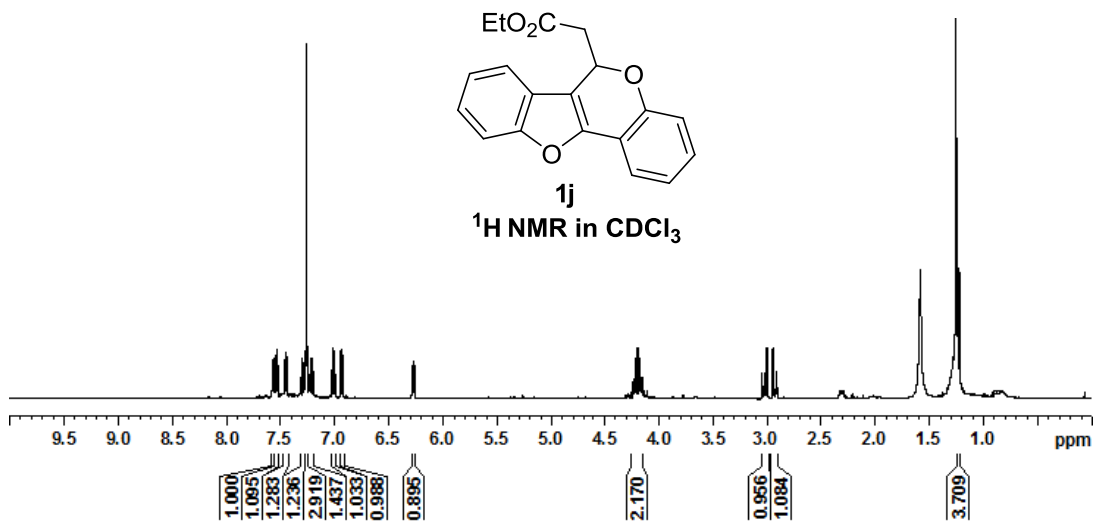
SJG-VPS-7-17-13C

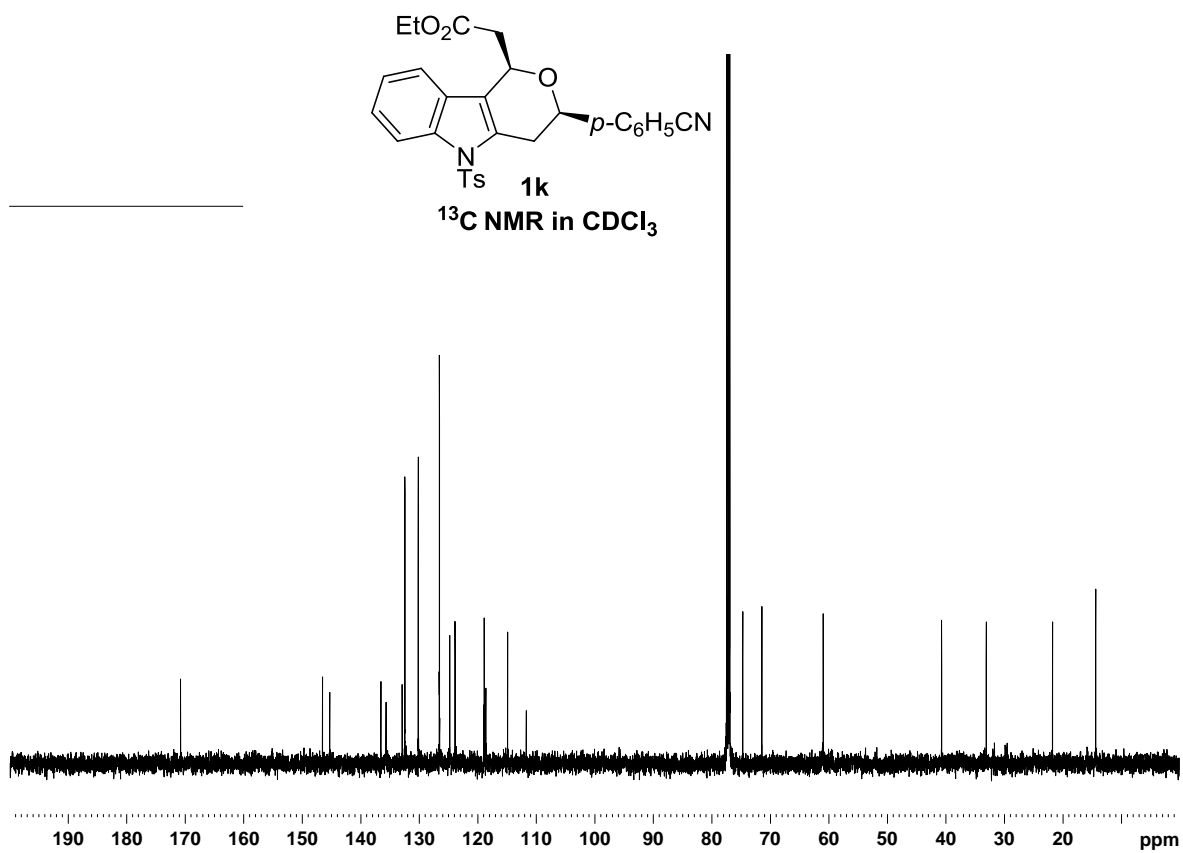
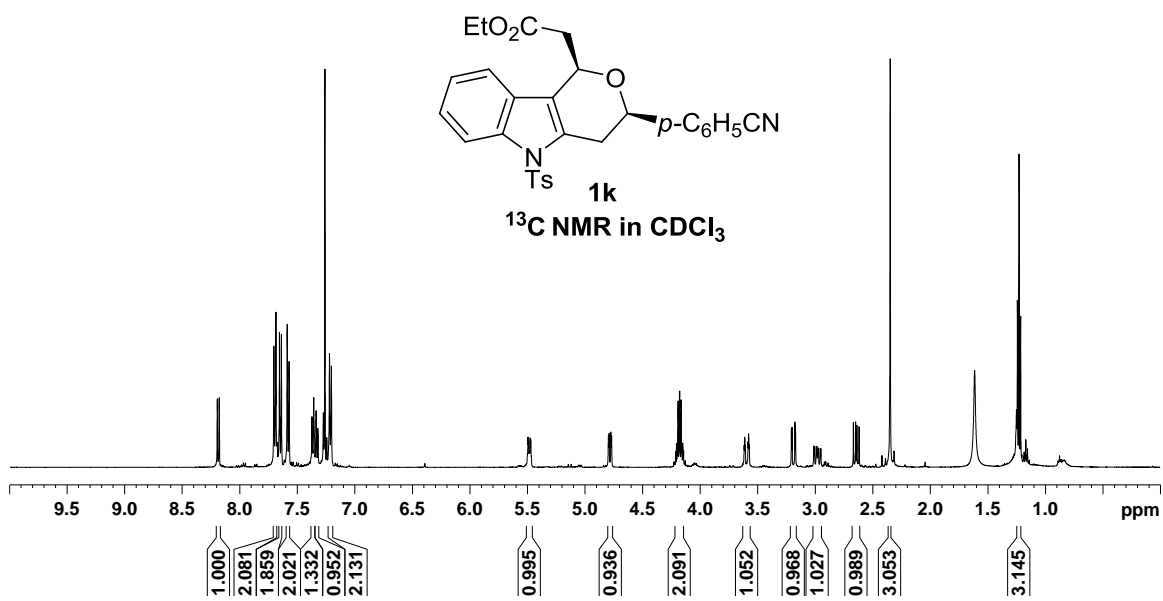


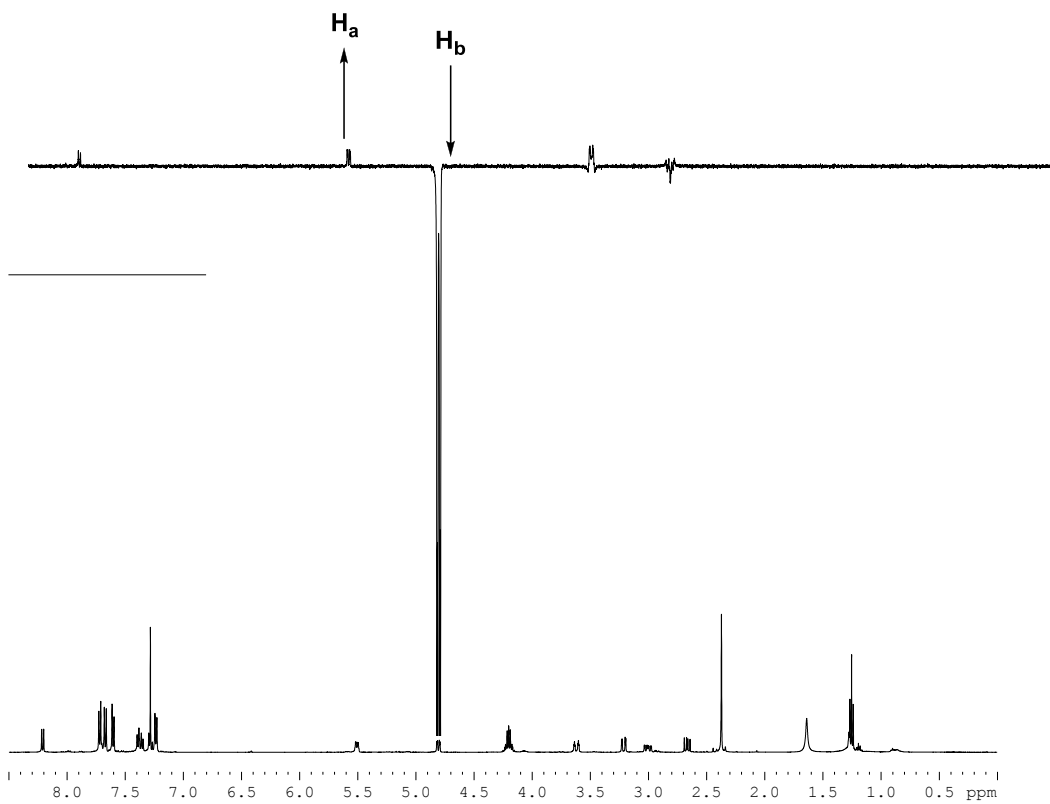
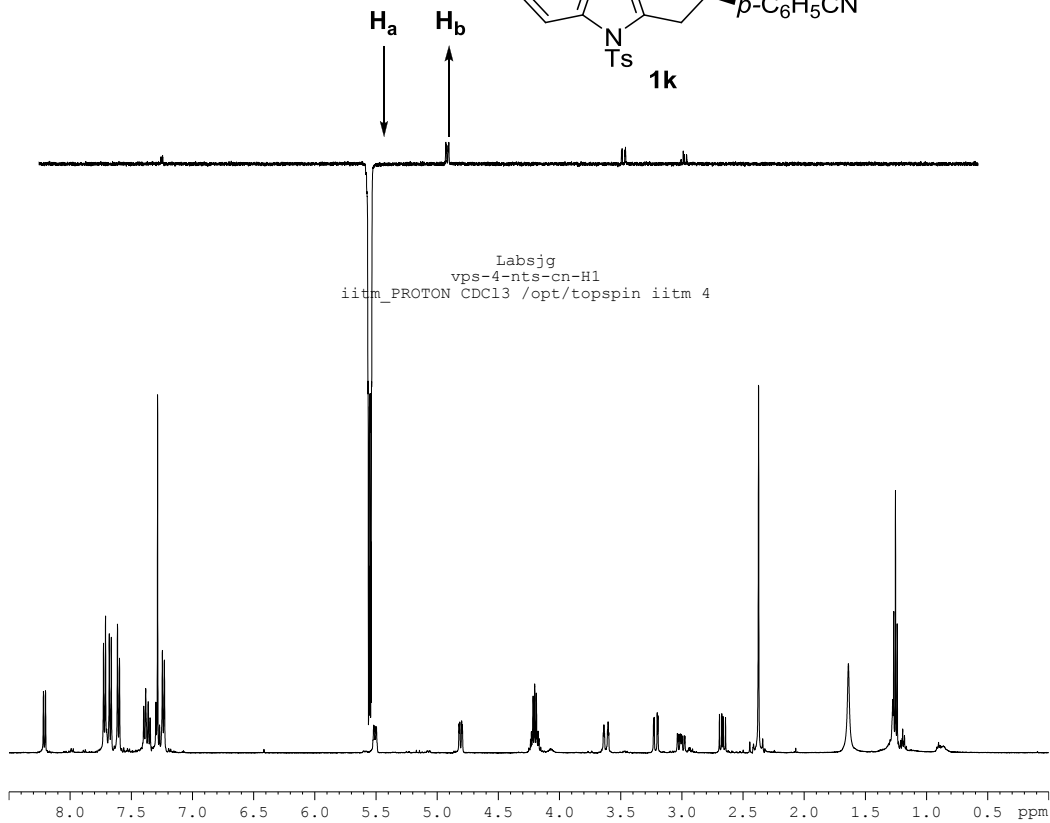
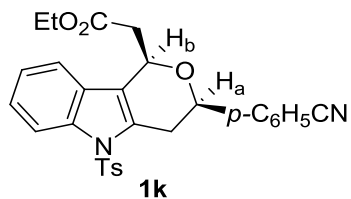
<sup>13</sup>C NMR in CDCl<sub>3</sub>

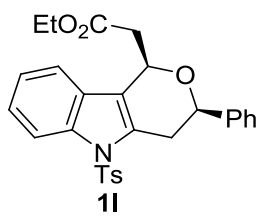




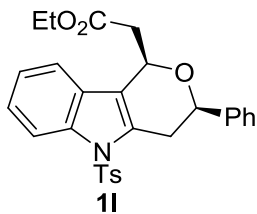
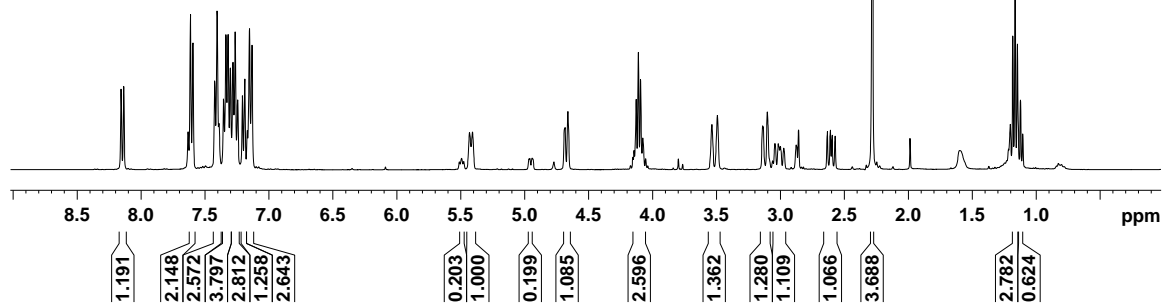




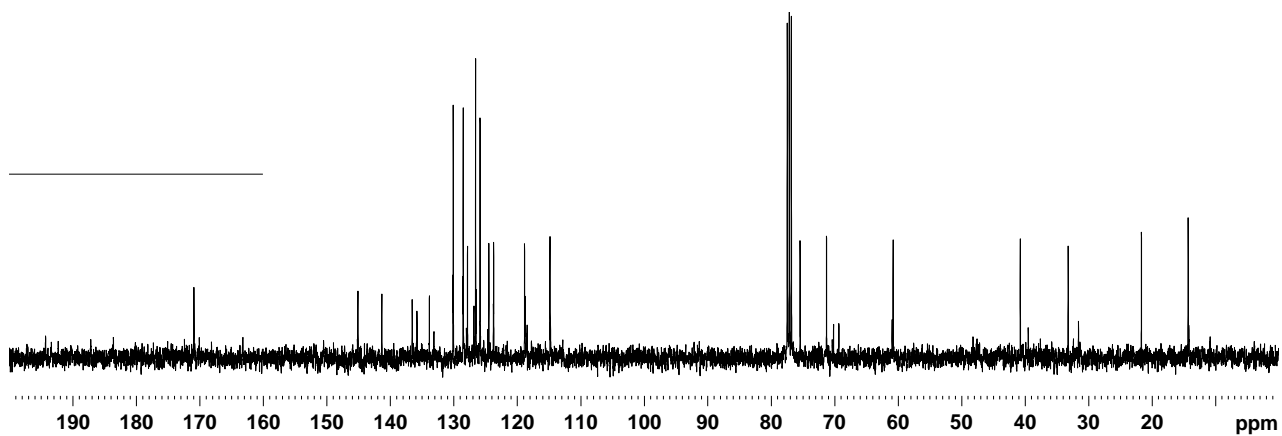




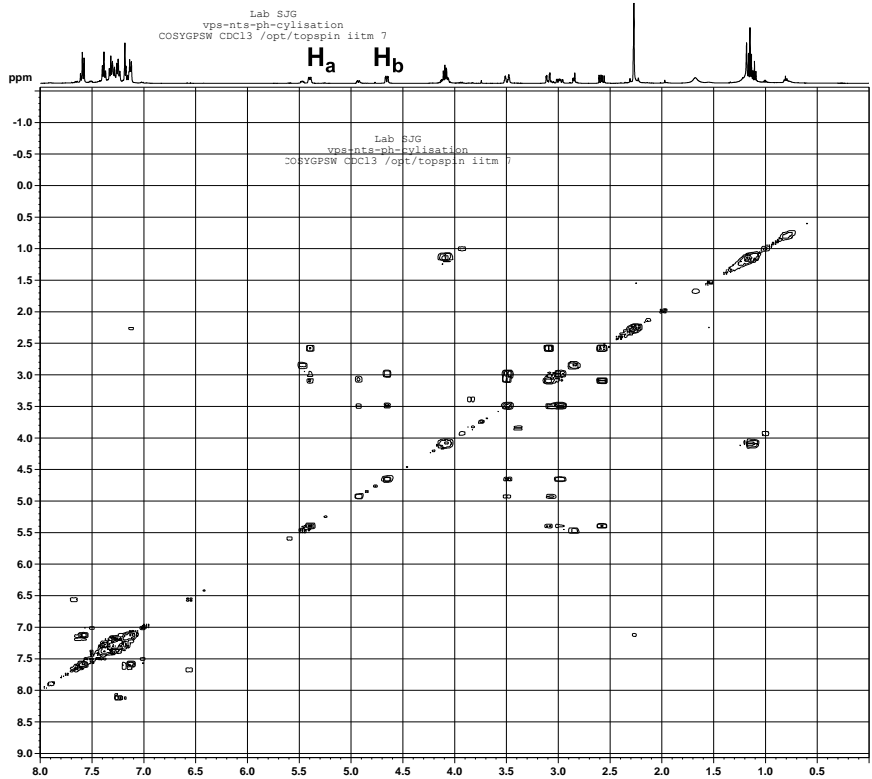
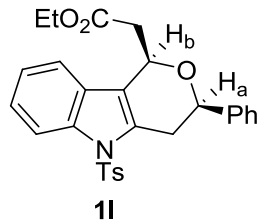
<sup>1</sup>H NMR in CDCl<sub>3</sub>



<sup>13</sup>C NMR in CDCl<sub>3</sub>







Current Data Parameters  
NAME sjg50712  
EXPNO 151  
PROCNO 1

F2 - Acquisition Parameters  
Date\_ 20120730  
Time 11.08  
INSTRUM spect  
PROBHD 5 mm PABBO BB/  
PULPROG cosygpppqf  
TD 2048  
SOLVENT CDC13  
NS 1  
DS 8  
SWH 5319.149 Hz  
FIDRES 2.597241 Hz  
AQ 0.1925620 sec  
RG 64  
DW 94.000 usec  
DE 6.50 usec  
TE 296.0 K  
D0 0.0000300 sec  
D1 1.96067798 sec  
D11 0.03000000 sec  
D12 0.00002000 sec  
D13 0.00000400 sec  
D16 0.00020000 sec  
IN0 0.00018800 sec

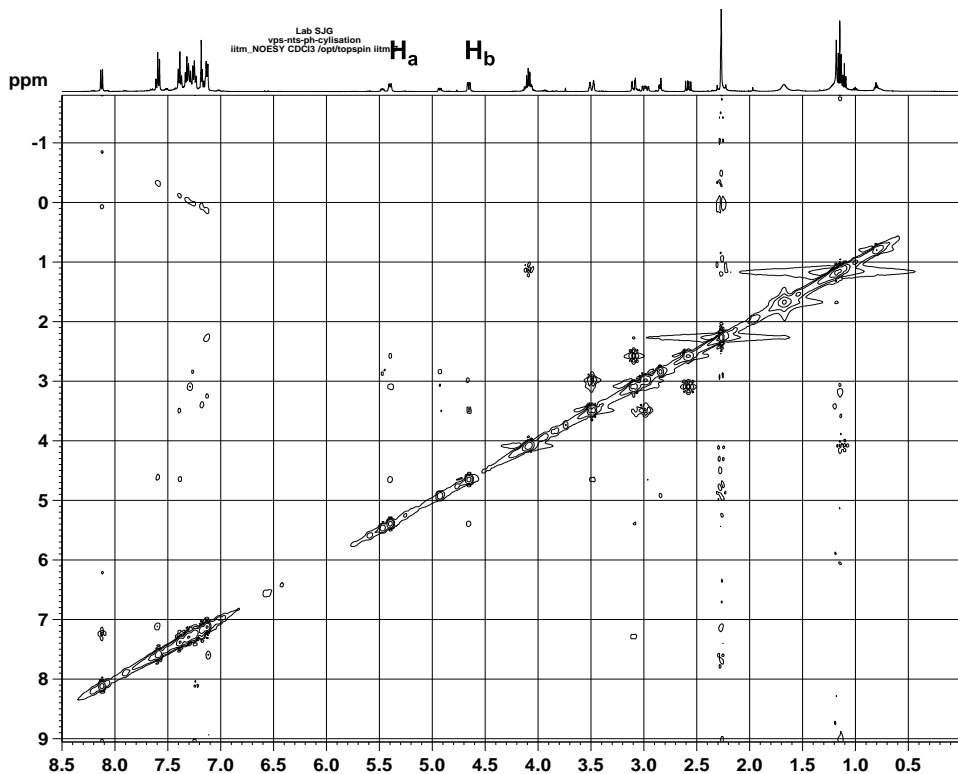
----- CHANNEL f1 -----  
NUC1 1H  
P0 11.75 usec  
P1 11.75 usec  
P17 2500.00 usec  
PLW1 15.3000019 W  
PLW10 3.1247997 W  
SFO1 500.1519253 MHz

----- GRADIENT CHANNEL -----  
GPM1 SMSG10.100  
GP2 10.00 %  
P16 1000.00 usec

F1 - Acquisition parameters  
TD 128  
SFO1 500.1519 MHz  
FIDRES 41.555851 Hz  
AQ 10.635 ppm  
PRMODE QF

F2 - Processing parameters  
SI 1024  
SF 500.1500501 MHz  
WDW 0  
SSB 0  
LB 0 Hz  
GB 0  
PC 1.40

F1 - Processing parameters  
SI 1024  
MC2 QF  
SF 500.1500501 MHz  
WDW States-TPPI  
SSB 0  
LB 0 Hz  
GB 0



Current Data Parameters  
NAME sjg50712  
EXPNO 154  
PROCNO 1

F2 - Acquisition Parameters  
Date\_ 20120730  
Time 12.10  
INSTRUM spect  
PROBHD 5 mm PABBO BB/  
PULPROG noesypppp  
TD 1024  
SOLVENT CDC13  
NS 2  
DS 32  
SWH 5434.783 Hz  
FIDRES 5.307405 Hz  
AQ 0.0942580 sec  
RG 64  
DW 92.000 usec  
DE 6.50 usec  
TE 296.1 K  
D0 0.0000704 sec  
D1 1.00819184 sec  
D8 0.0000001 sec  
D11 0.03000000 sec  
D13 0.00002000 sec  
D16 0.00020000 sec  
IN0 0.00018400 sec

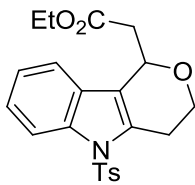
----- CHANNEL f1 -----  
NUC1 1H  
P1 11.75 usec  
P2 23.50 usec  
P7 2500.00 usec  
PLW1 15.3000019 W  
PLW10 3.1247997 W  
SFO1 500.1518625 MHz

----- GRADIENT CHANNEL -----  
GPM1 SMSG10.100  
GP2 40.00 %  
P16 1000.00 usec

F1 - Acquisition parameters  
TD 256  
SFO1 500.1519 MHz  
FIDRES 21.228520 Hz  
AQ 10.866 ppm  
PRMODE States-TPPI

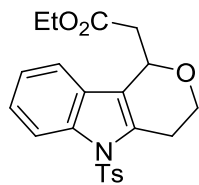
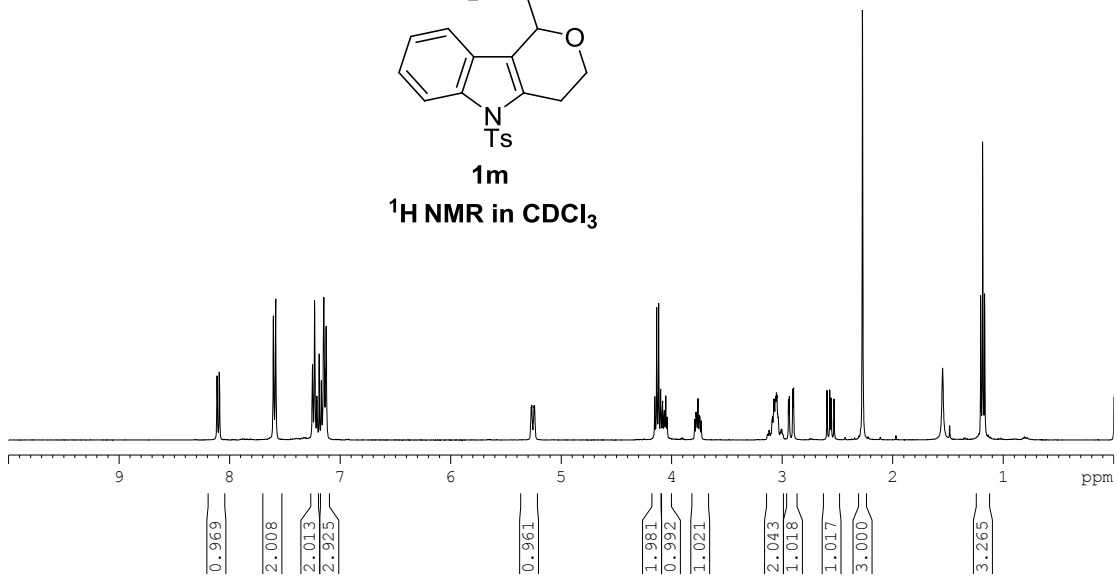
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SI 1024  
SF 500.1500499 MHz  
WDW 0  
SSB 2  
LB 0 Hz  
GB 0  
PC 1.00

F1 - Processing parameters  
SI 1024  
MC2 States-TPPI  
SF 500.1500499 MHz  
WDW SINE  
SSB 2  
LB 0 Hz  
GB 0



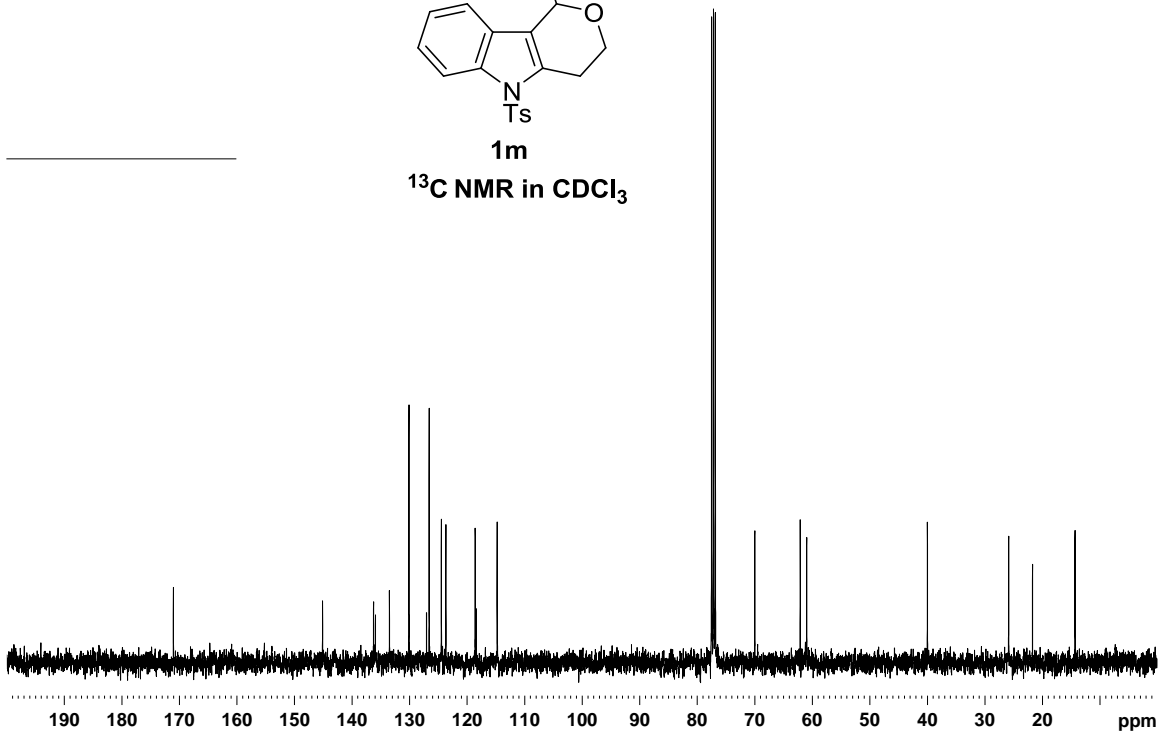
**1m**

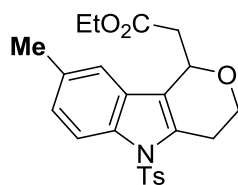
**<sup>1</sup>H NMR in CDCl<sub>3</sub>**



**1m**

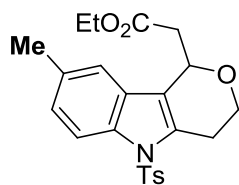
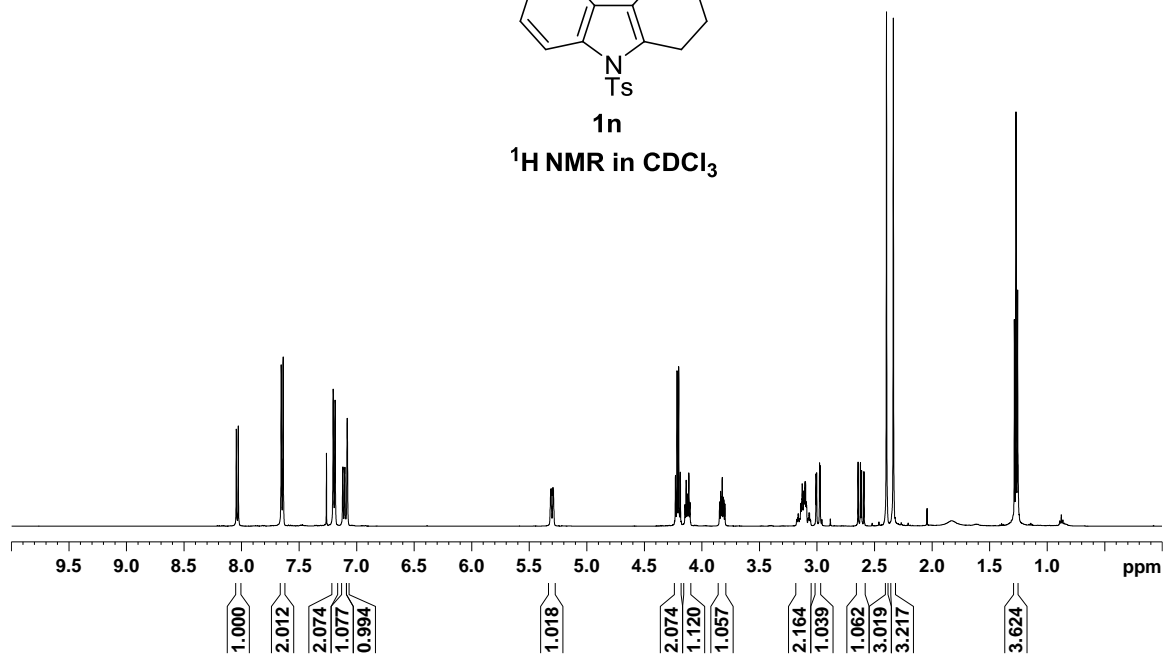
**<sup>13</sup>C NMR in CDCl<sub>3</sub>**





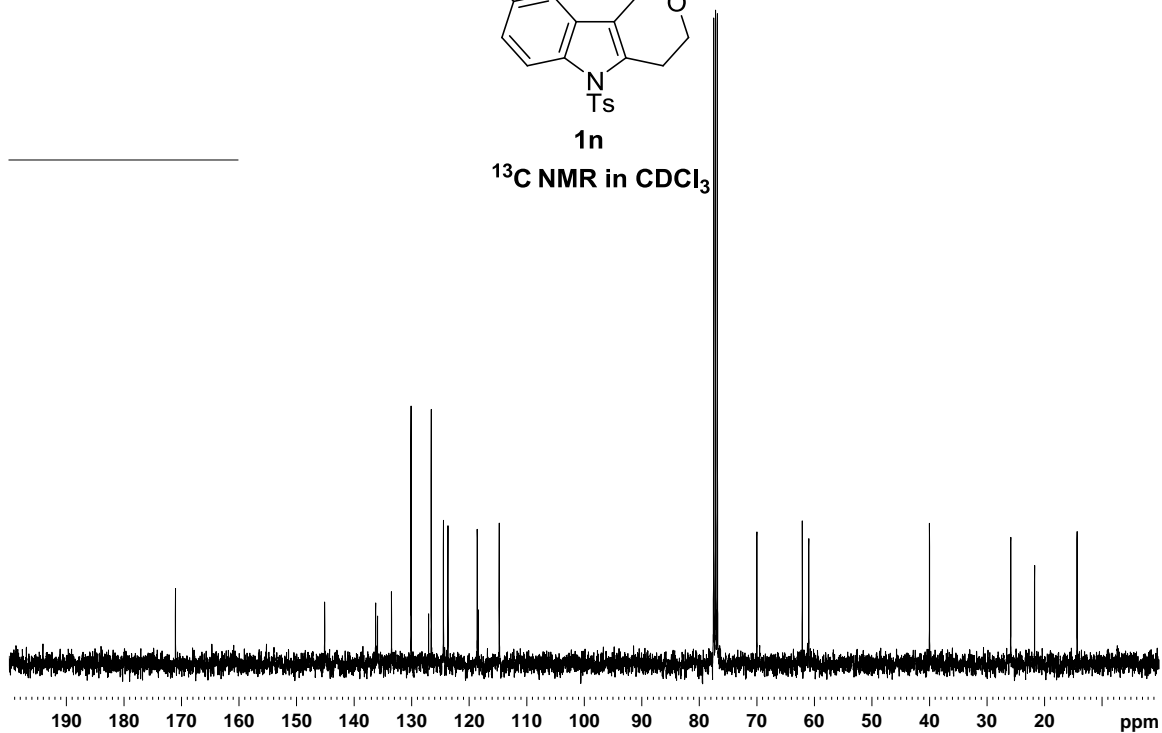
**1n**

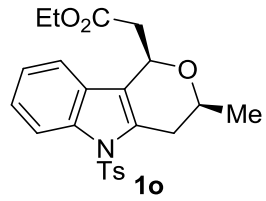
<sup>1</sup>H NMR in CDCl<sub>3</sub>



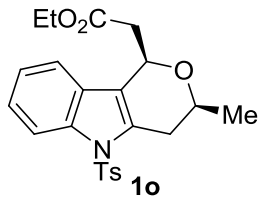
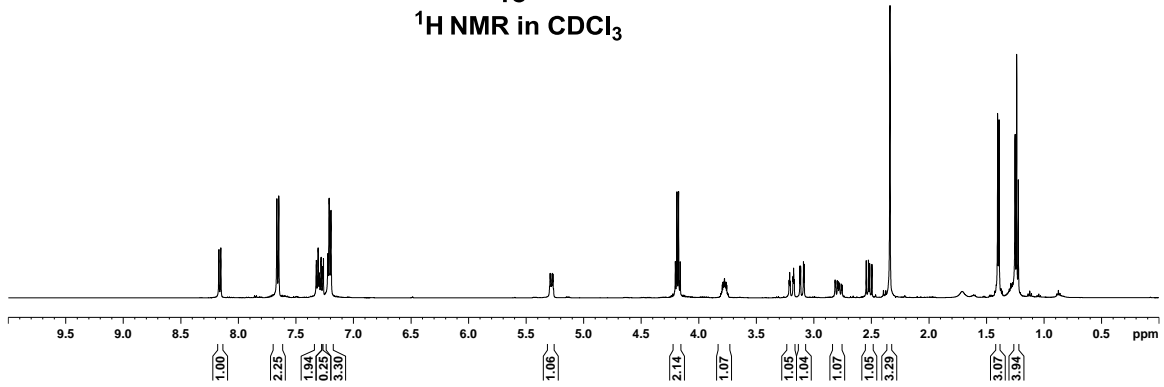
**1n**

<sup>13</sup>C NMR in CDCl<sub>3</sub>

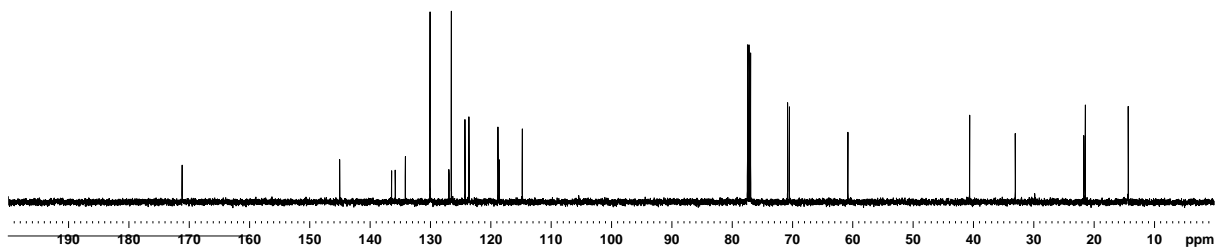


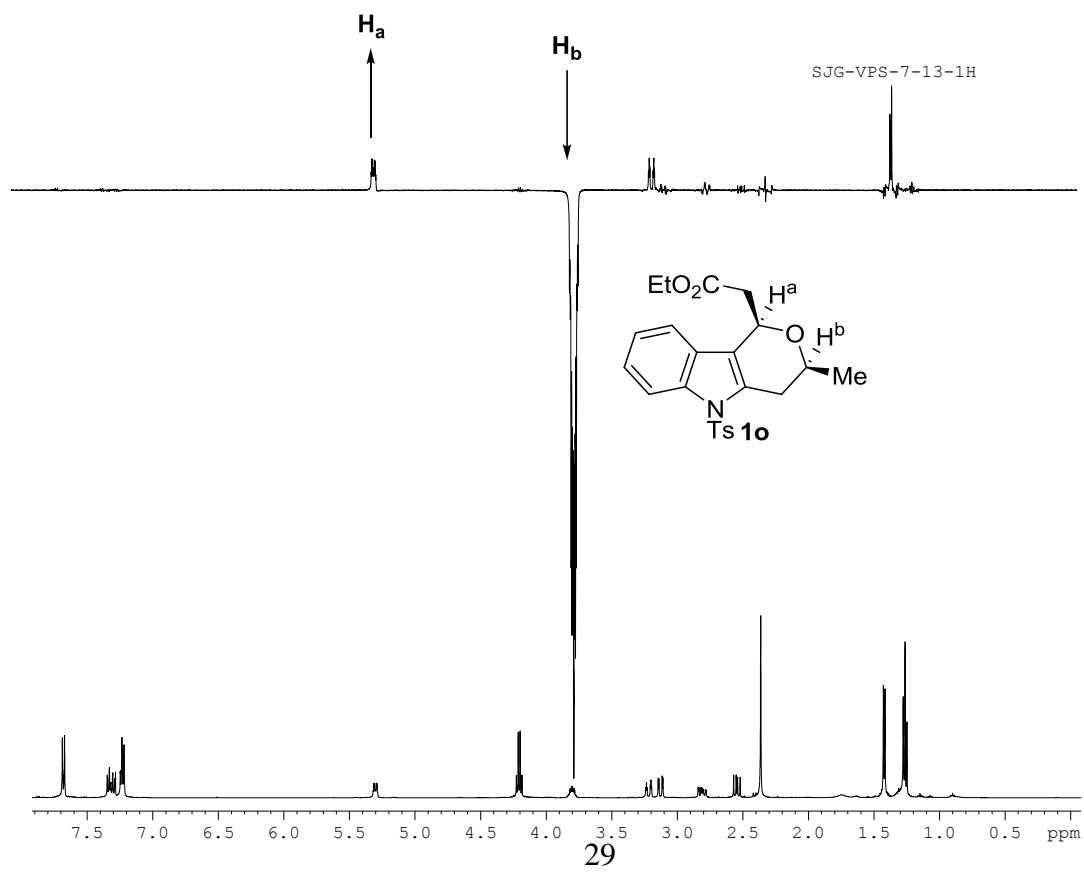
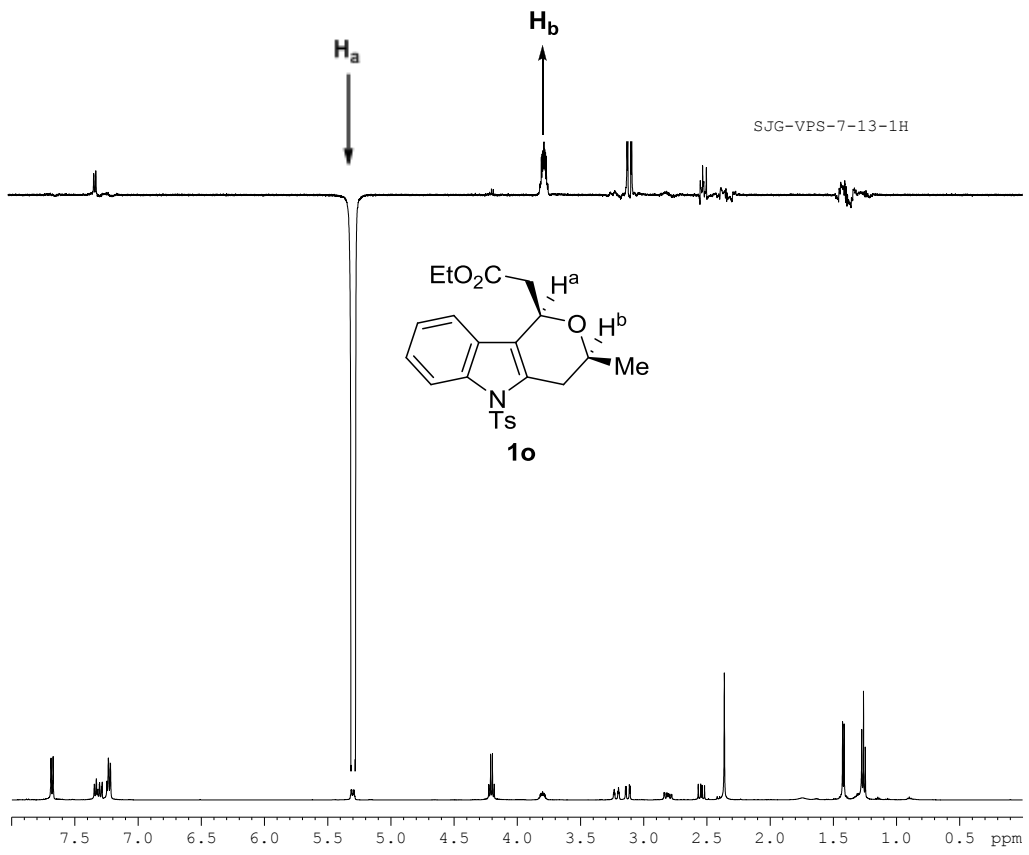


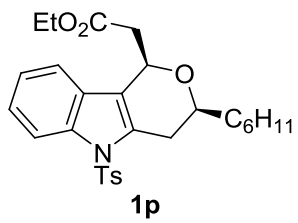
<sup>1</sup>H NMR in CDCl<sub>3</sub>



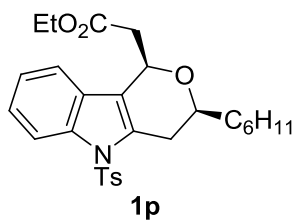
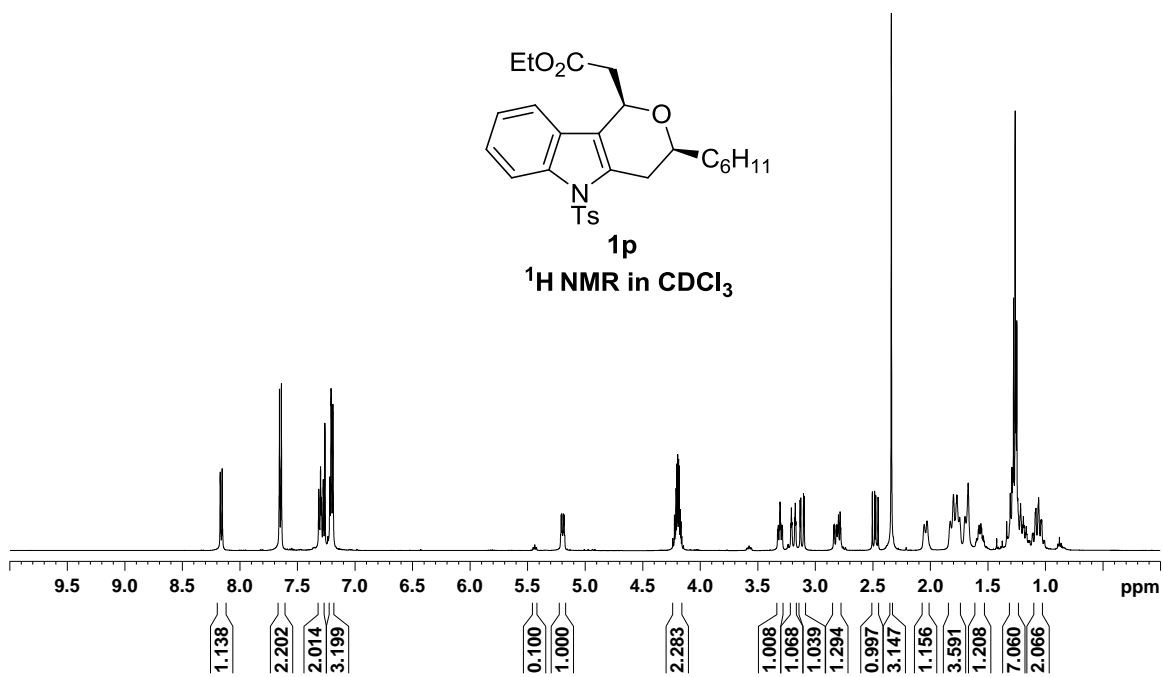
<sup>13</sup>C NMR in CDCl<sub>3</sub>



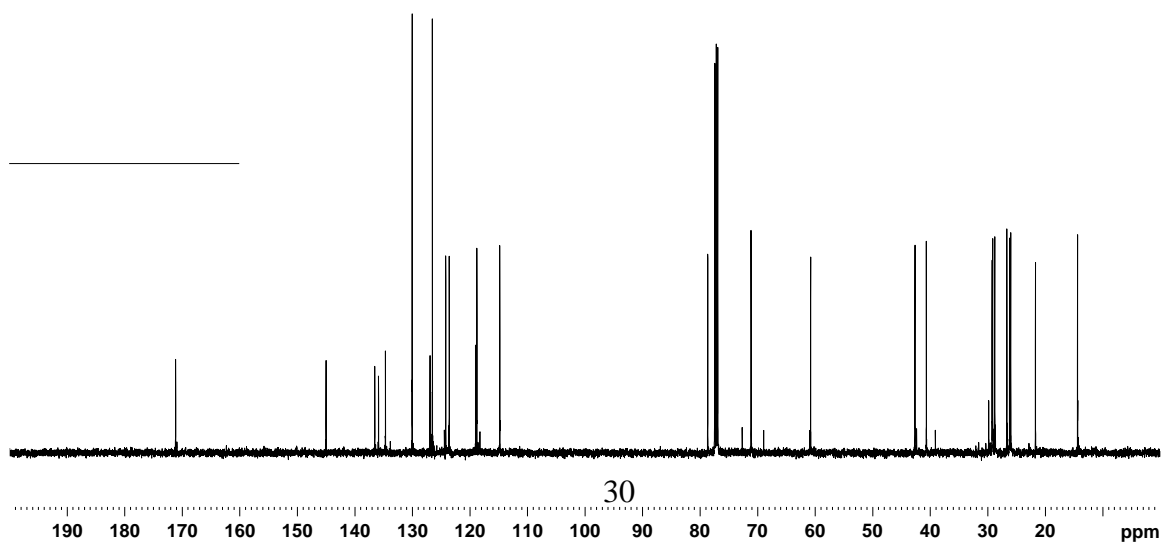


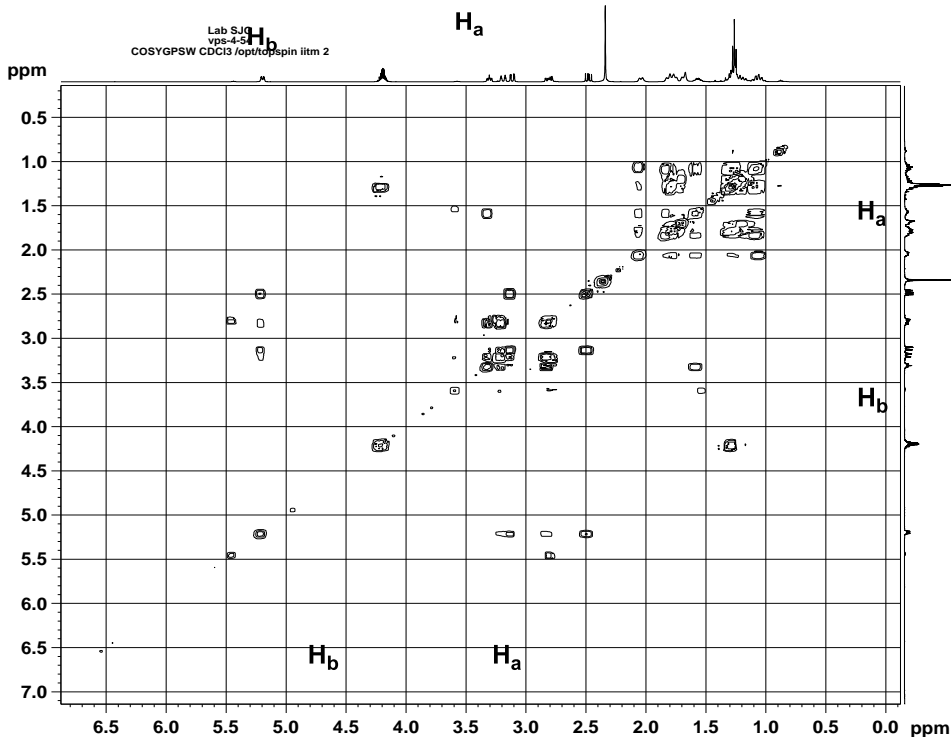
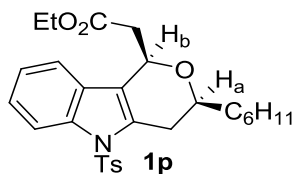


<sup>1</sup>H NMR in CDCl<sub>3</sub>



<sup>13</sup>C NMR in CDCl<sub>3</sub>





Current Data Parameters  
NAME Desktop  
EXPNO 46  
PROCNO 1

F2 - Acquisition Parameters  
Date\_ 20120605  
Time 9.24  
INSTRUM spect  
PROBHD 5 mm F4BBO BB/  
PULPROG cosygpppgf/  
TD 2048  
SOLVENT CDCI3  
NS 1  
DS 8  
SWH 4504.504 Hz  
FIDRES 2.199465 Hz  
AQ 0.2273760 sec  
RG 19.19  
DW 111.000 usec  
DE 6.50 usec  
TE 292.1 K  
D0 0.00000300 sec  
D1 1.92586195 sec  
D11 0.03000000 sec  
D12 0.00002000 sec  
D13 0.00000400 sec  
D16 0.00020000 sec  
IN0 0.00022000 sec

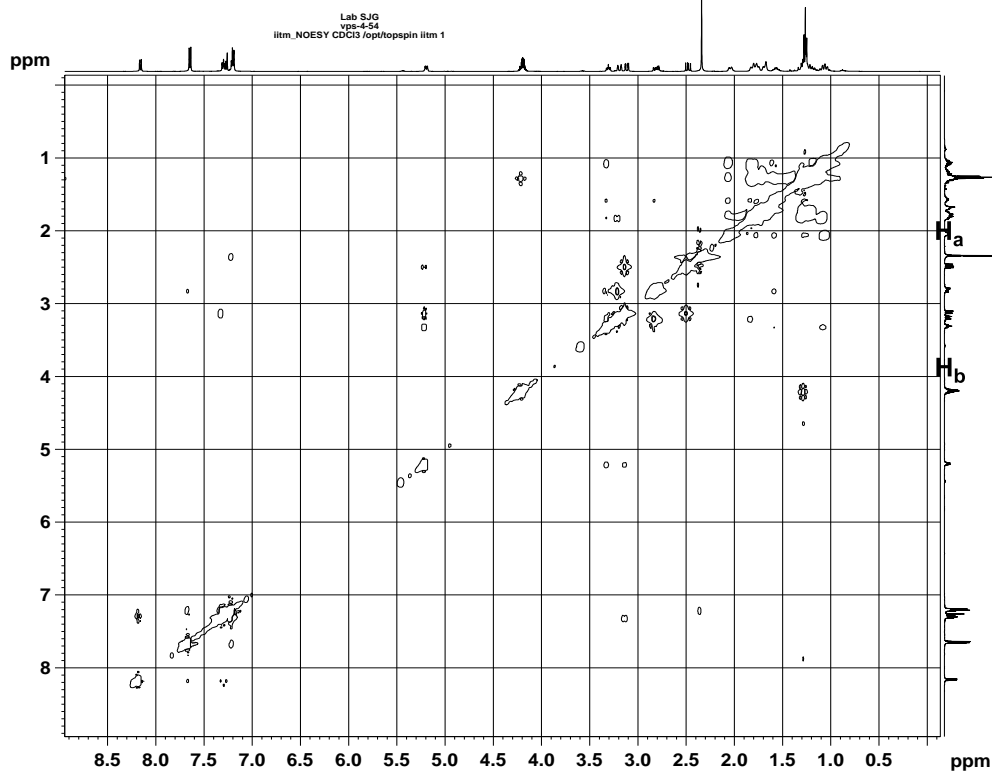
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NUC1 1H  
P1 11.75 usec  
P2 23.50 usec  
PLW1 15.3000019 W  
PLW10 3.12479997 W  
SFO1 500.1521576 MHz

===== GRADIENT CHANNEL =====  
GPNAM1 SMSQ10.100  
GPZ1 10.00 %  
P16 1000.00 usec

F1 - Acquisition parameters  
TD 128  
SFO1 500.1522 MHz  
FIDRES 35.191441 Hz  
SW 9.006 ppm  
FhMODE CF

F2 - Processing parameters  
SI 1024  
SF 500.1500000 MHz  
WDW QSINE  
SSB 0  
LB 0 Hz  
GB 0  
PC 1.40

F1 - Processing parameters  
SI 1024  
MC2 CF  
SF 500.1500000 MHz  
WDW States-TPPI  
SSB 0  
LB 0 Hz  
GB 0



Current Data Parameters  
NAME Desktop  
EXPNO 59  
PROCNO 1

F2 - Acquisition Parameters  
Date\_ 20120605  
Time 14.04  
INSTRUM spect  
PROBHD 5 mm F4BBO BB/  
PULPROG noesygpph  
TD 1024  
SOLVENT CDCI3  
NS 62  
DS 32  
SWH 4545.455 Hz  
FIDRES 4.438920 Hz  
AQ 0.1128900 sec  
RG 21.7  
DW 116.000 usec  
DE 6.50 usec  
TE 291.6 K  
D0 0.00000564 sec  
D1 0.98975992 sec  
D8 0.30000001 sec  
D11 0.03000000 sec  
D12 0.00002000 sec  
D16 0.00020000 sec  
IN0 0.00022000 sec

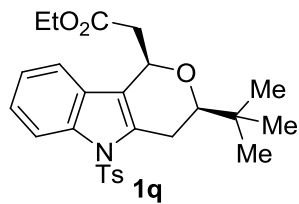
===== CHANNEL f1 =====  
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P1 11.75 usec  
P2 23.50 usec  
PLW1 15.3000019 W  
PLW10 3.12479997 W  
SFO1 500.1522008 MHz

===== GRADIENT CHANNEL =====  
GPNAM1 SMSQ10.100  
GRZ1 40.00 %  
P16 1000.00 usec

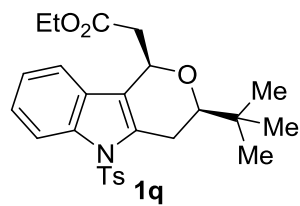
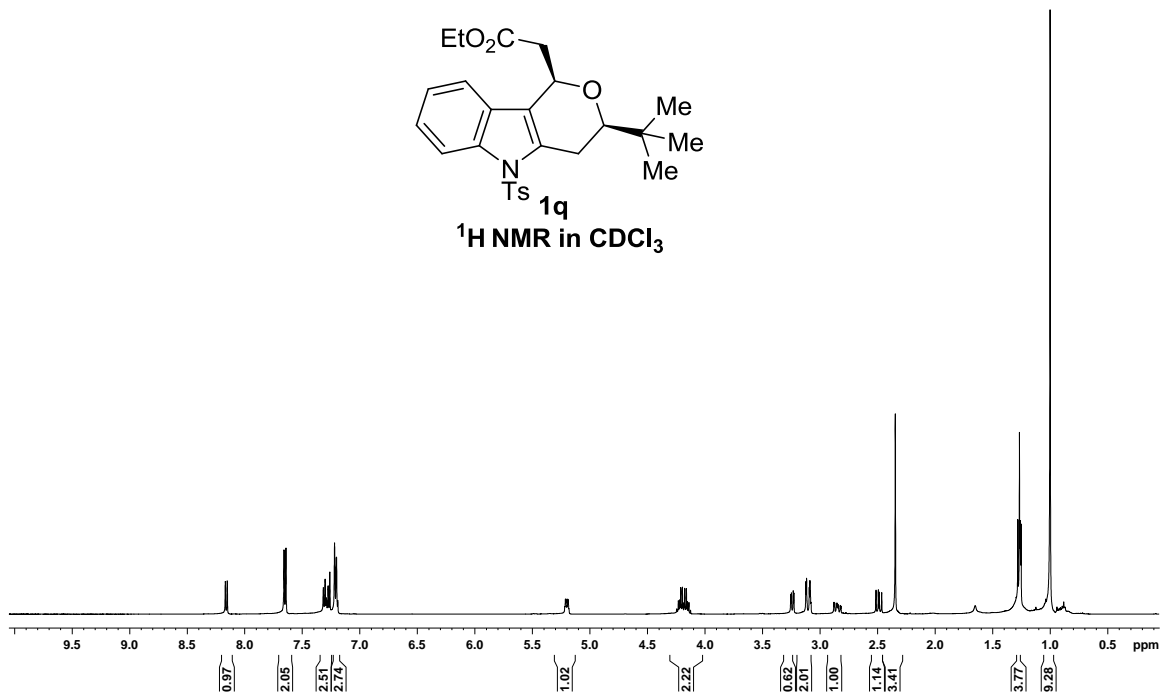
F1 - Acquisition parameters  
TD 256  
SFO1 500.1522 MHz  
FIDRES 17.755682 Hz  
SW 9.006 ppm  
FhMODE States-TPPI

F2 - Processing parameters  
SI 1024  
SF 500.1500000 MHz  
WDW QSINE  
SSB 0  
LB 0 Hz  
GB 0  
PC 1.00

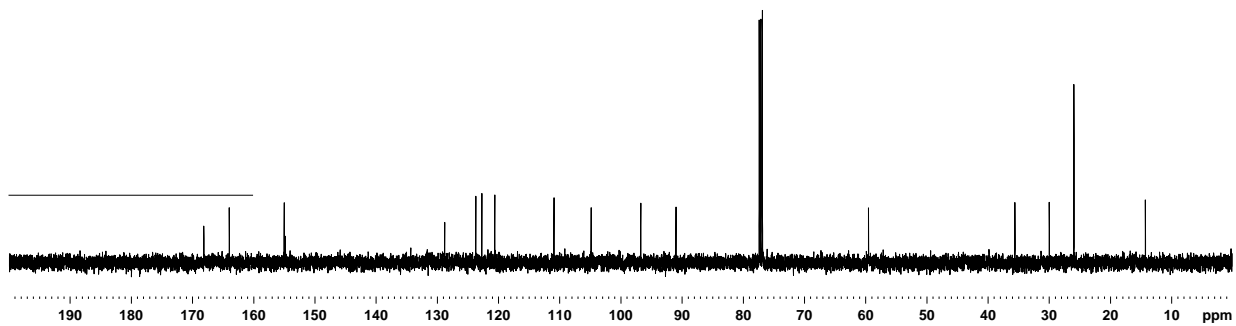
F1 - Processing parameters  
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MC2 States-TPPI  
SF 500.1500000 MHz  
WDW SINE  
SSB 2  
LB 0 Hz  
GB 0



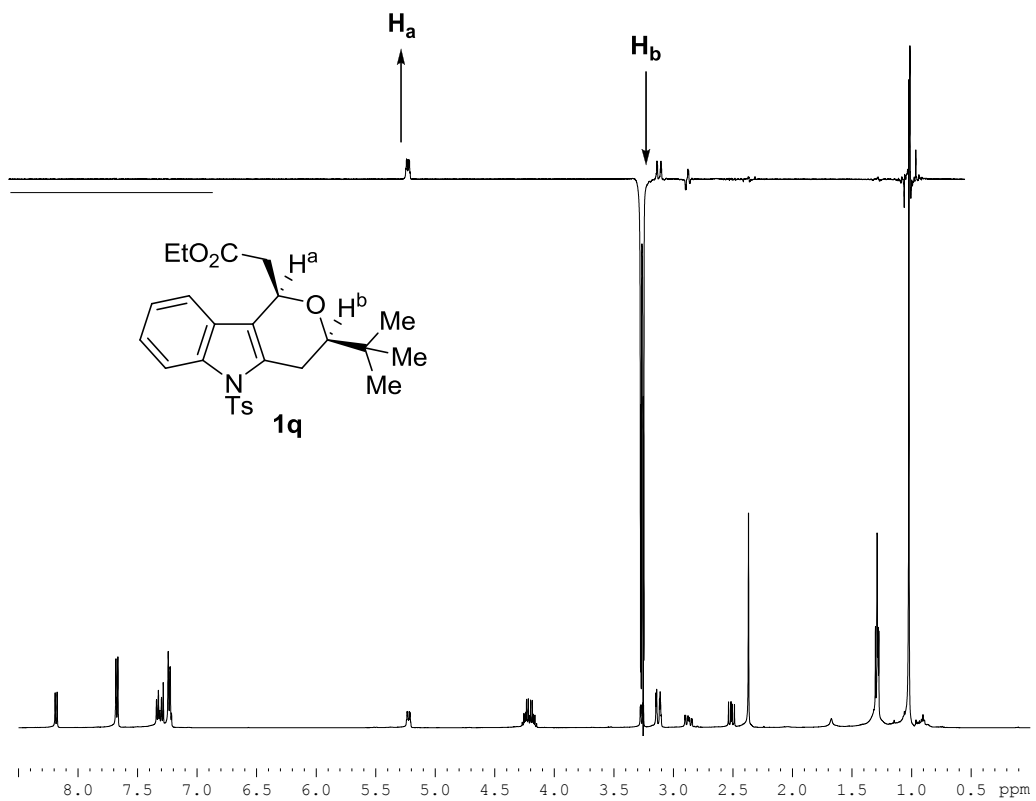
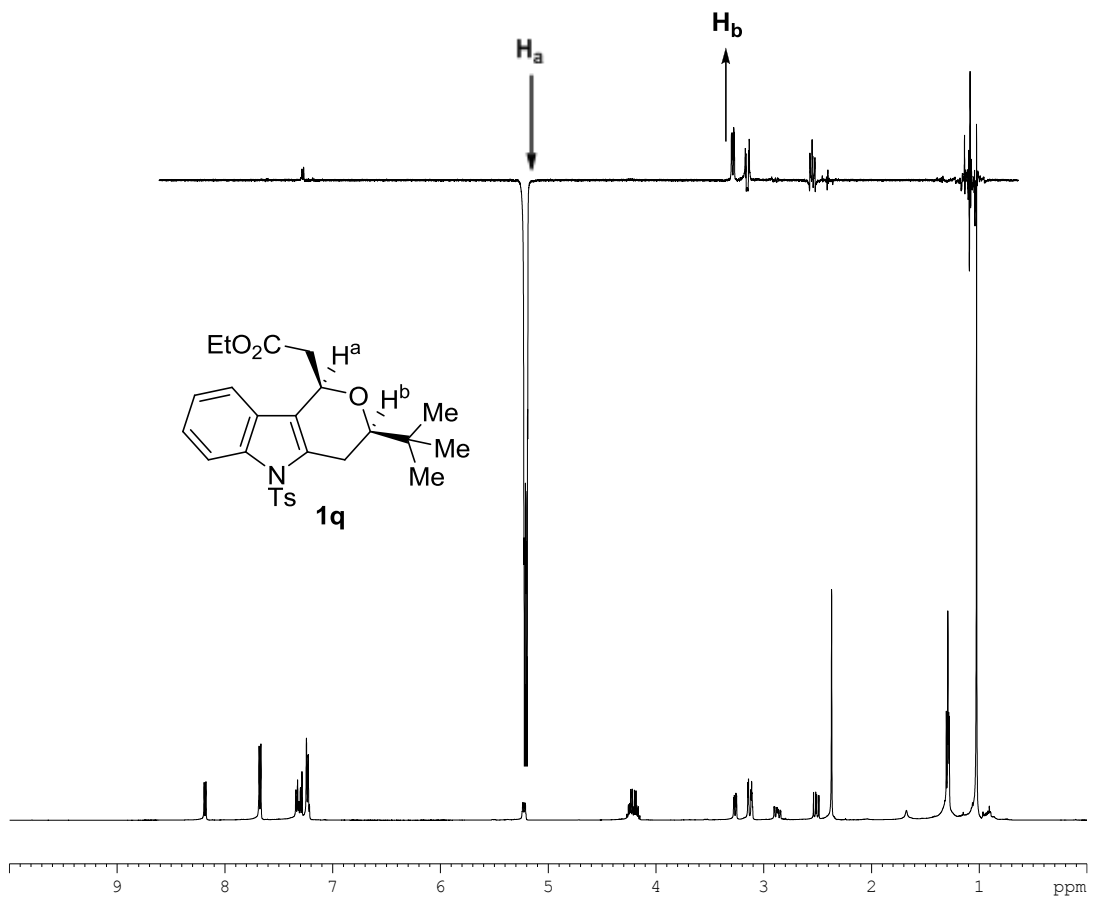
<sup>1</sup>H NMR in CDCl<sub>3</sub>

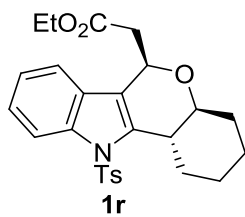


<sup>13</sup>C NMR in CDCl<sub>3</sub>

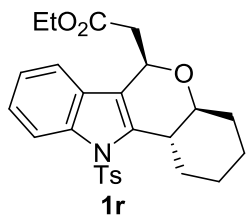
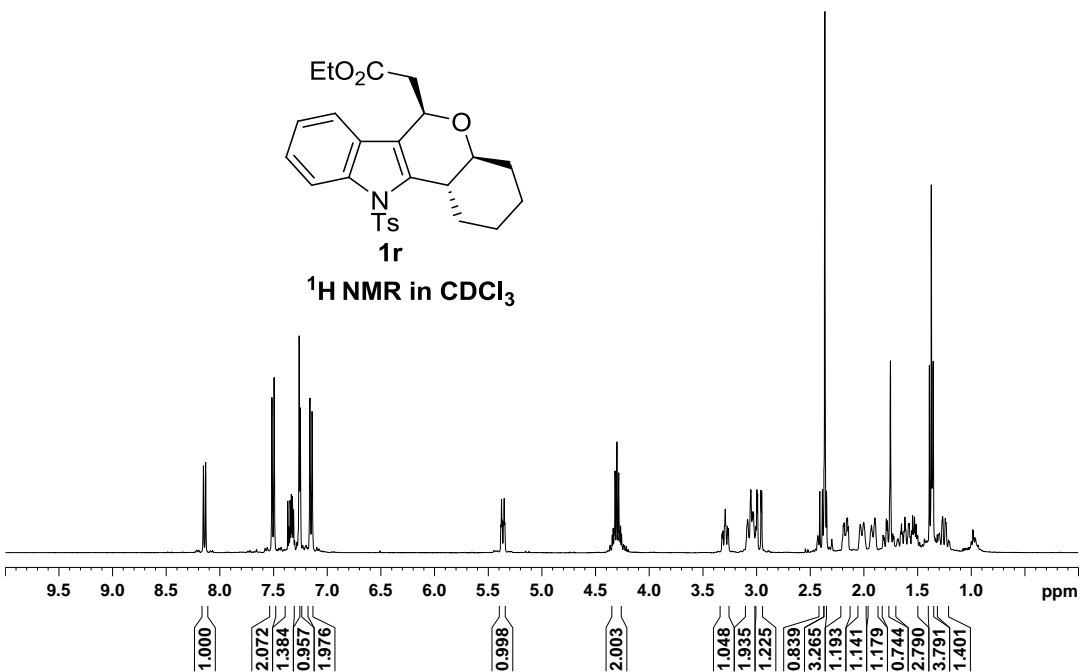




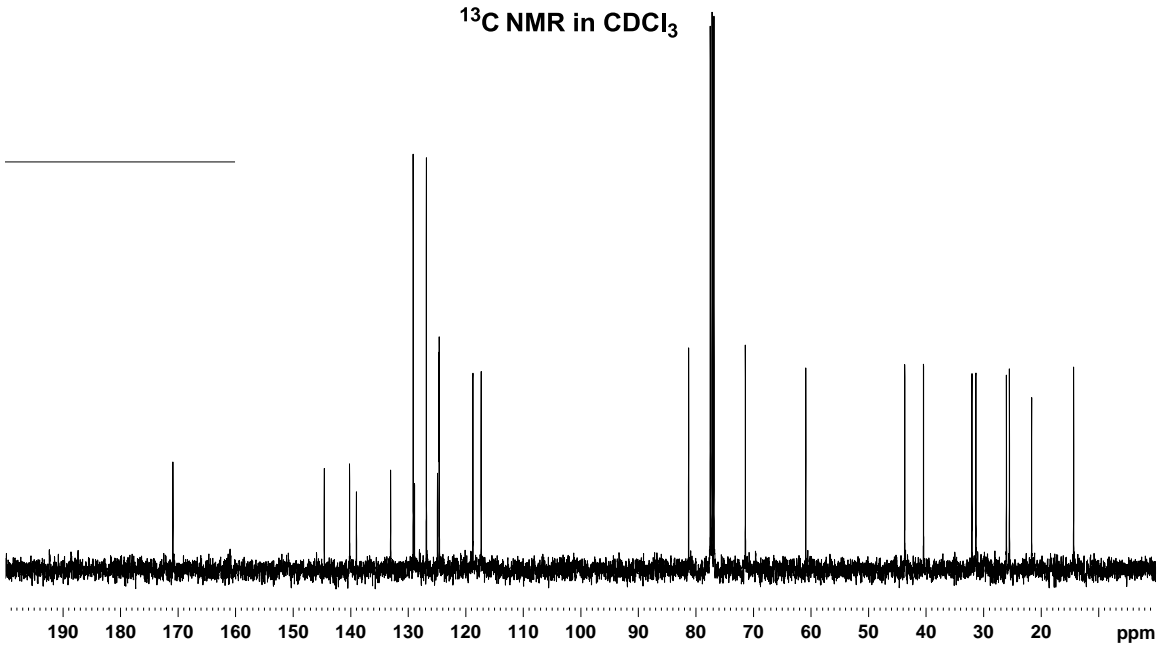


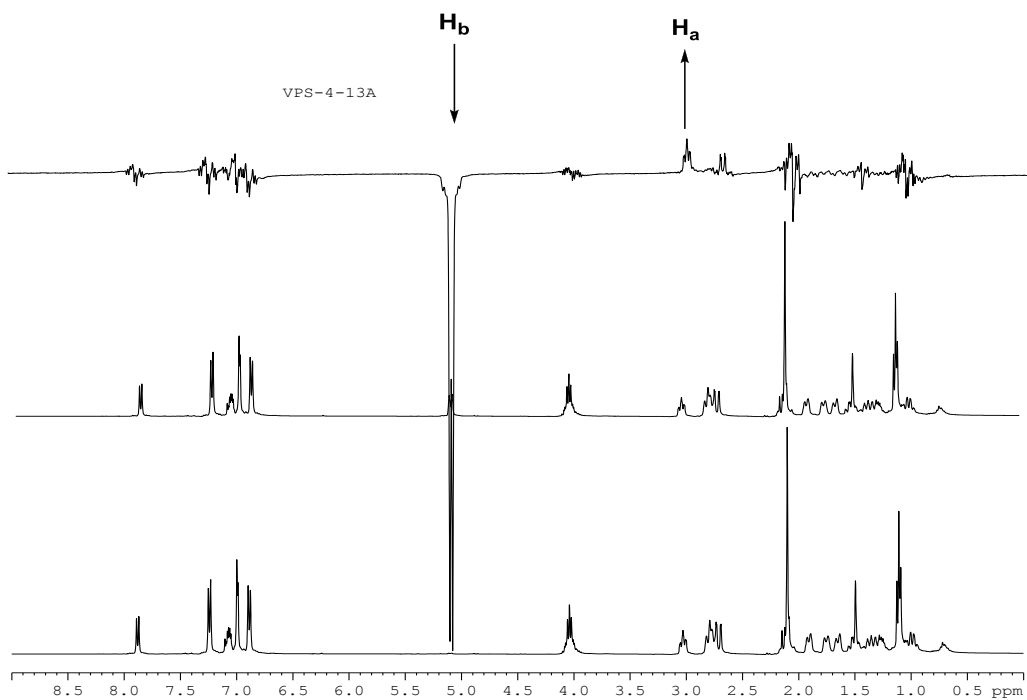
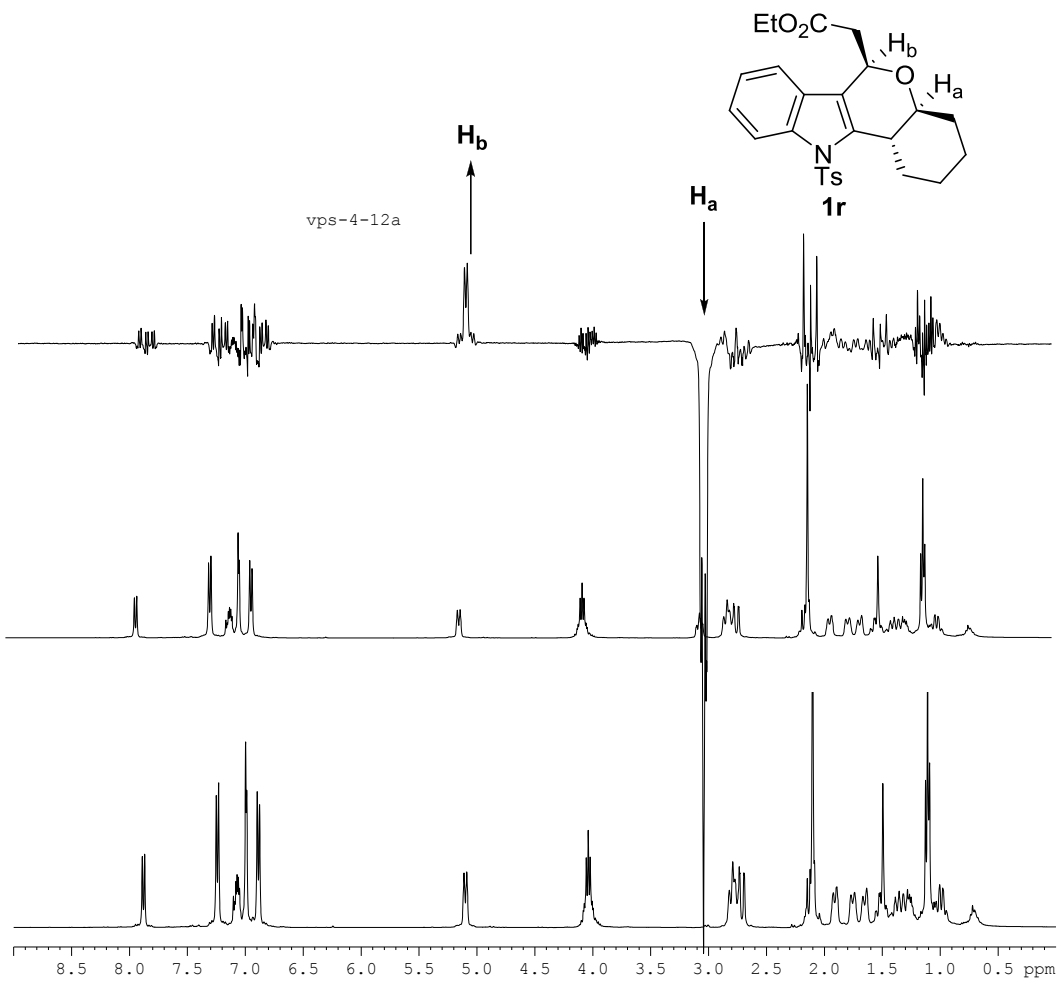


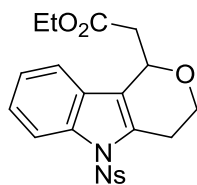
<sup>1</sup>H NMR in CDCl<sub>3</sub>



<sup>13</sup>C NMR in CDCl<sub>3</sub>

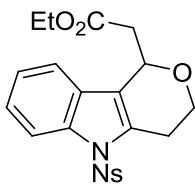
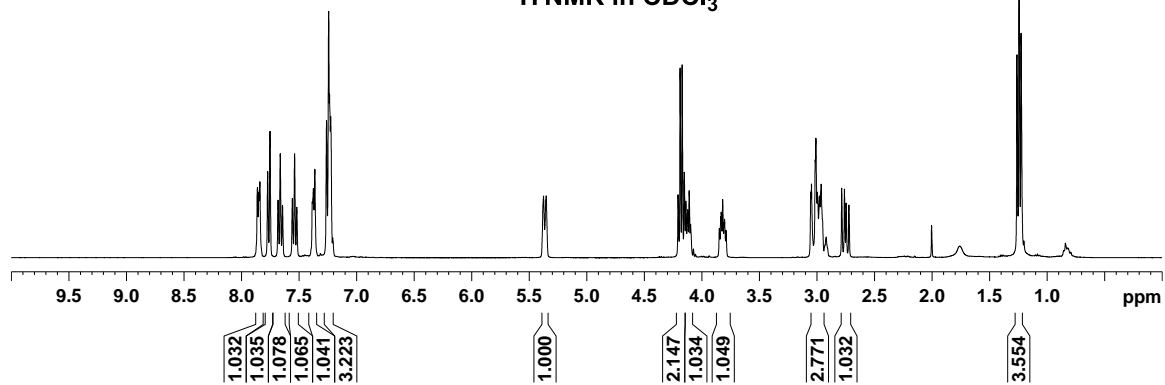






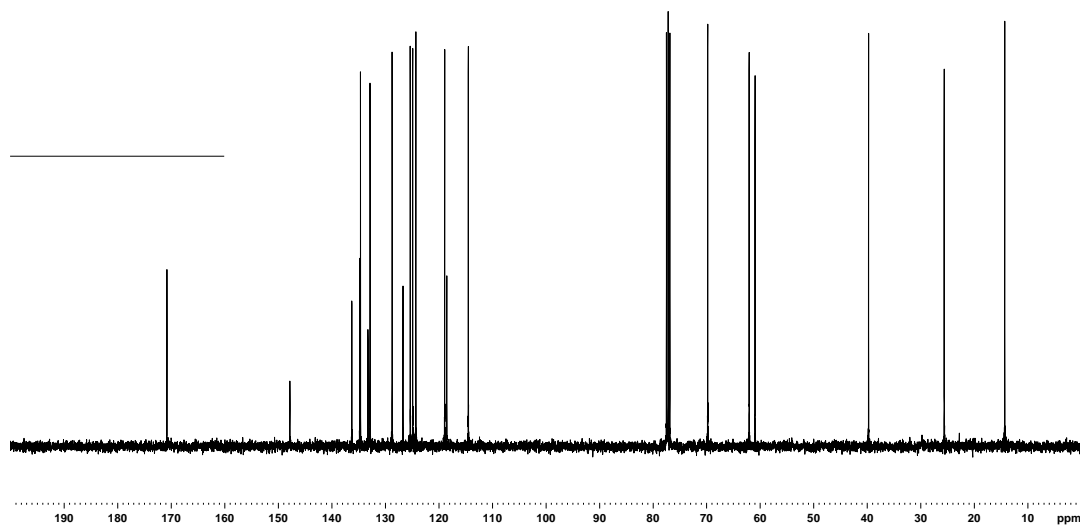
1s

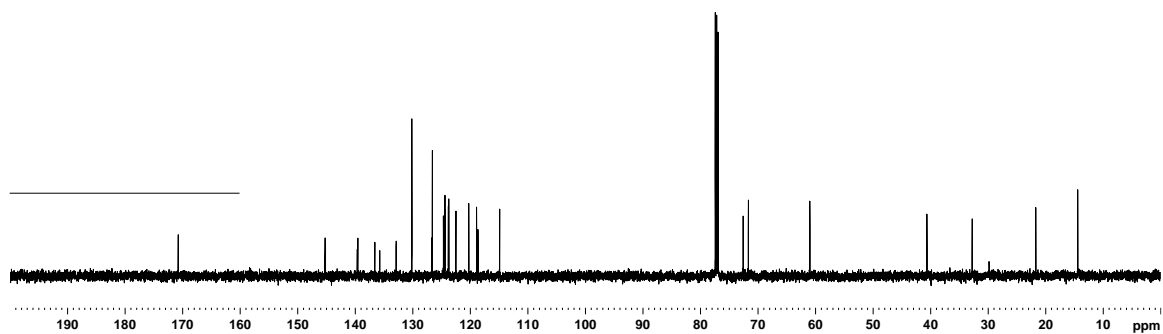
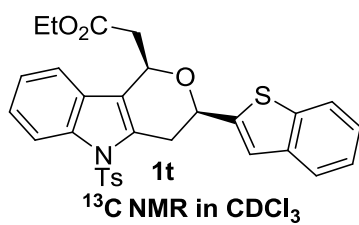
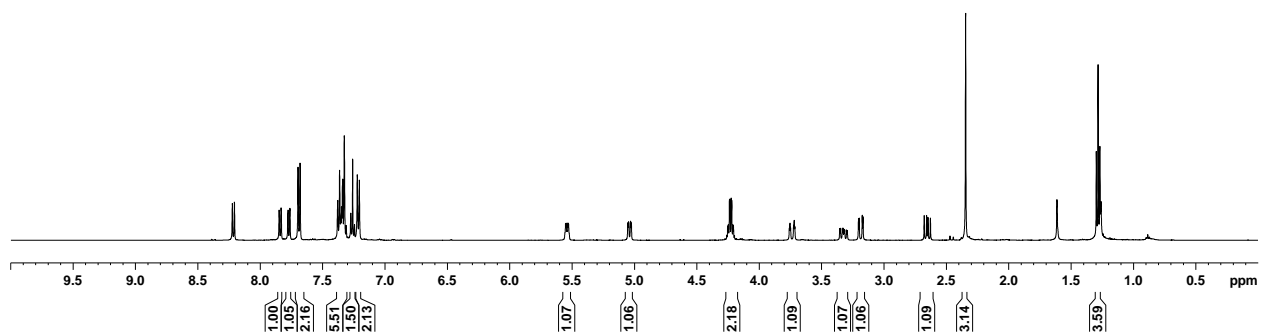
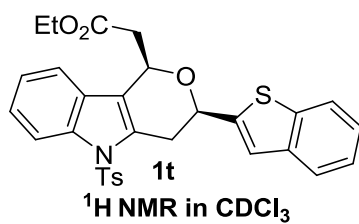
<sup>1</sup>H NMR in CDCl<sub>3</sub>

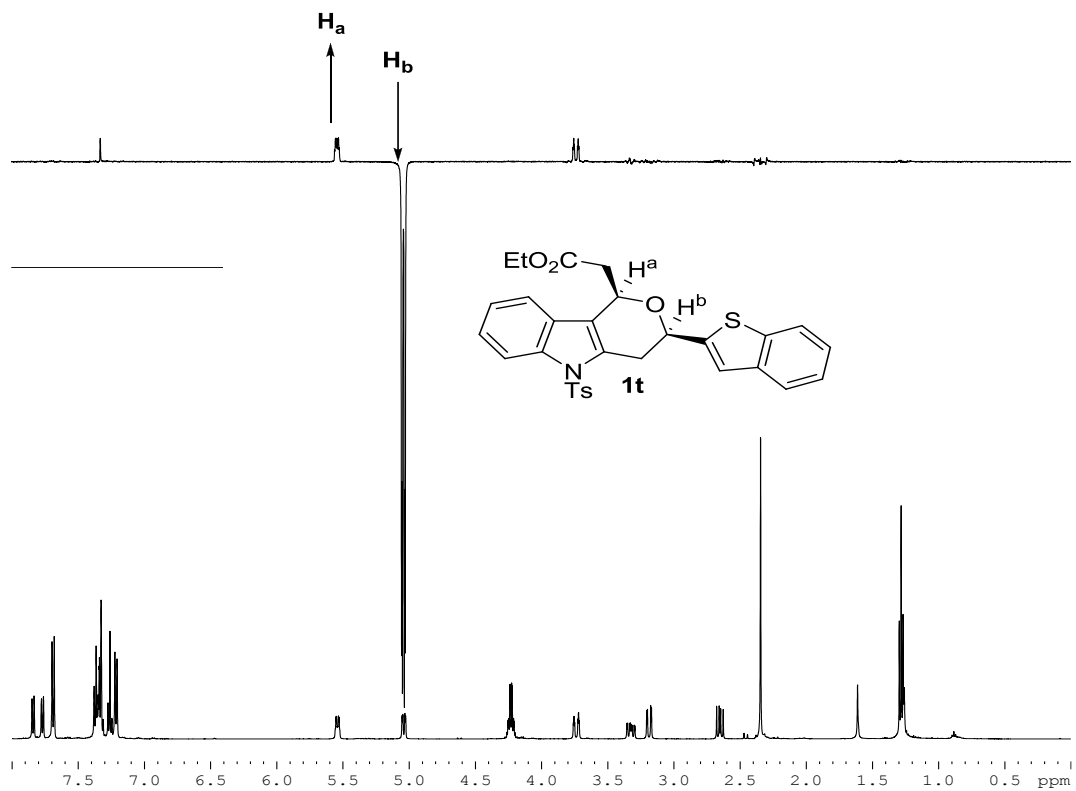
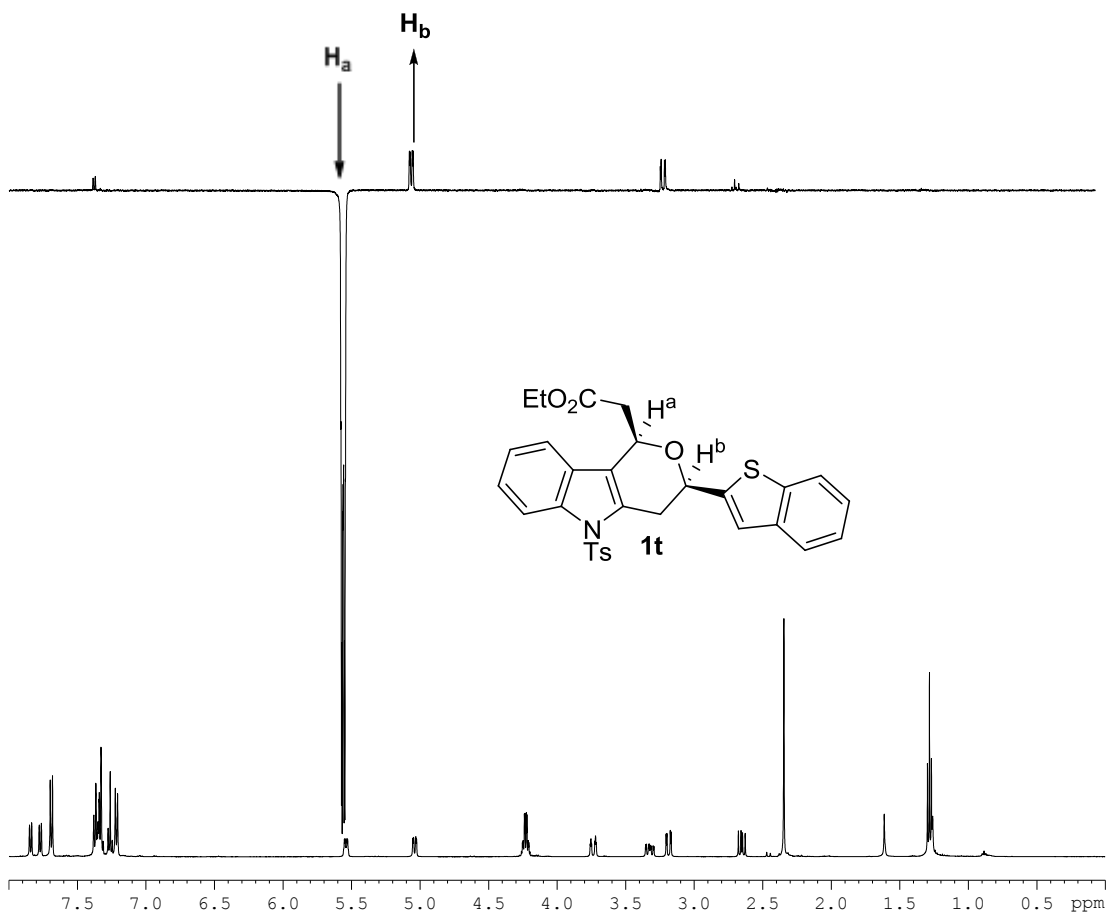


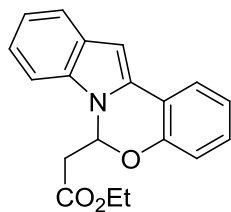
1s

<sup>13</sup>C NMR in CDCl<sub>3</sub>



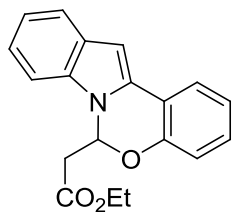
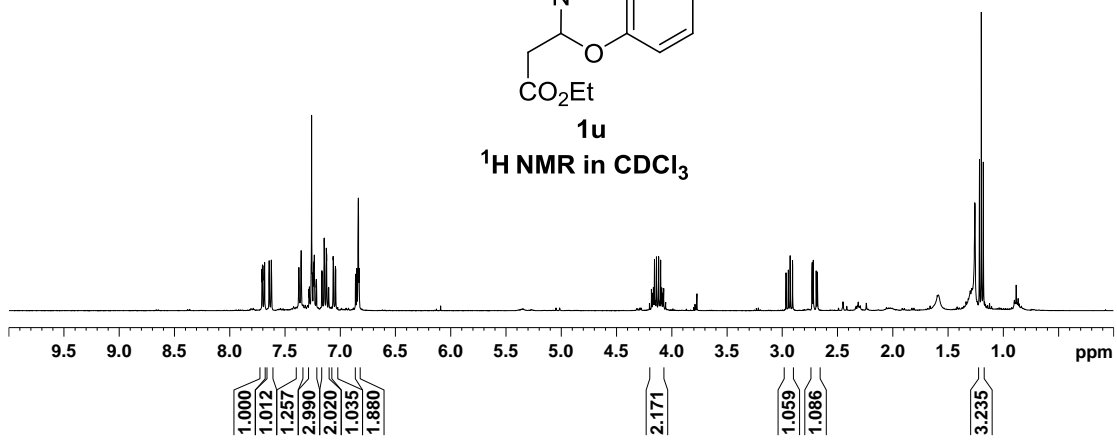






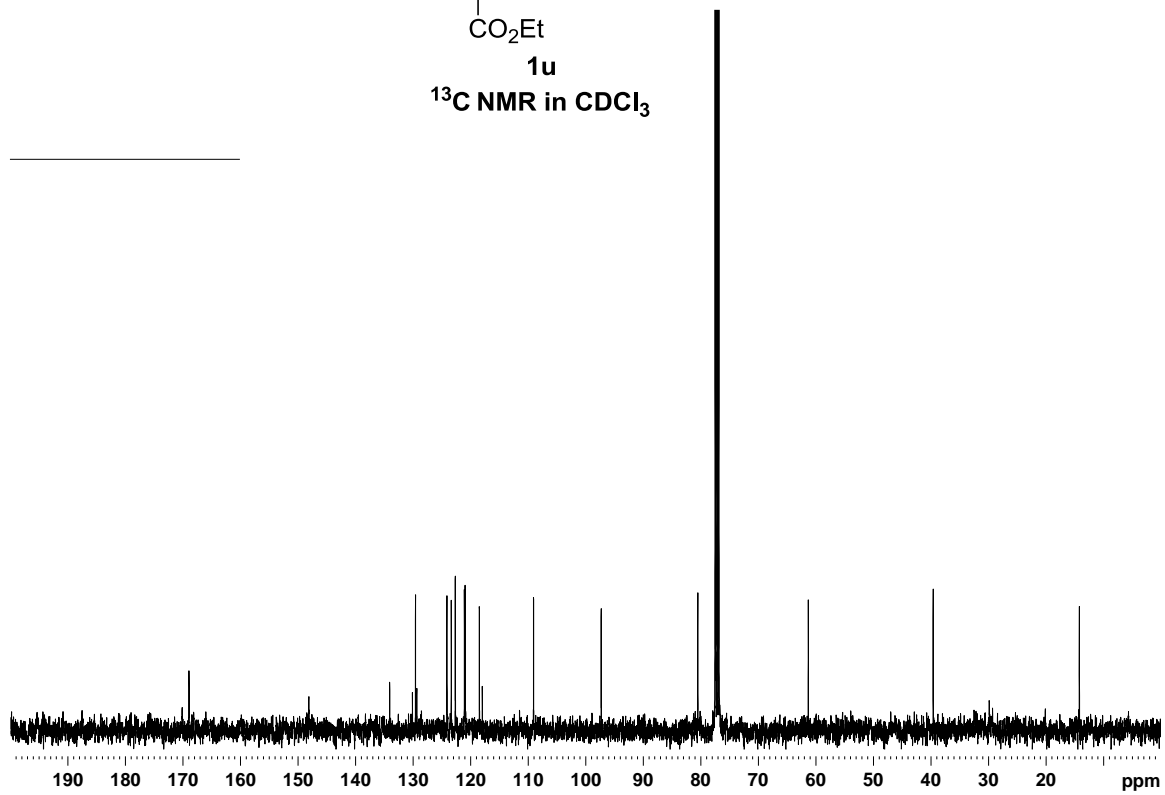
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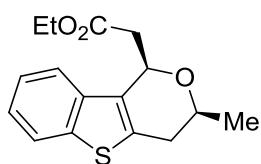
$^1\text{H NMR}$  in  $\text{CDCl}_3$



1u

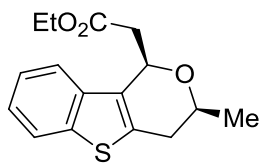
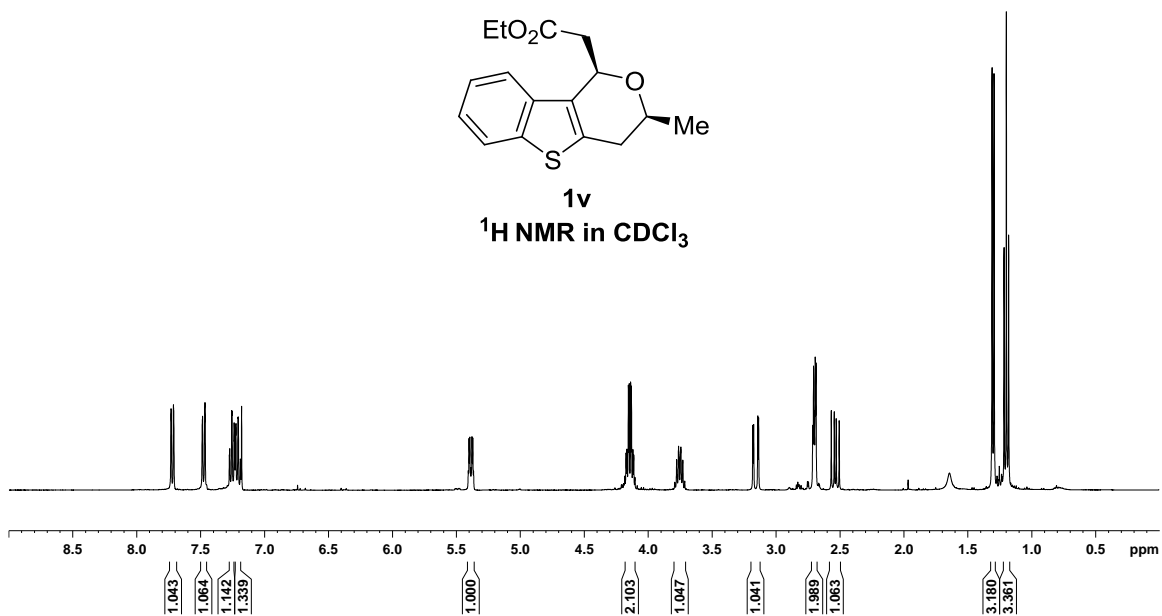
$^{13}\text{C NMR}$  in  $\text{CDCl}_3$





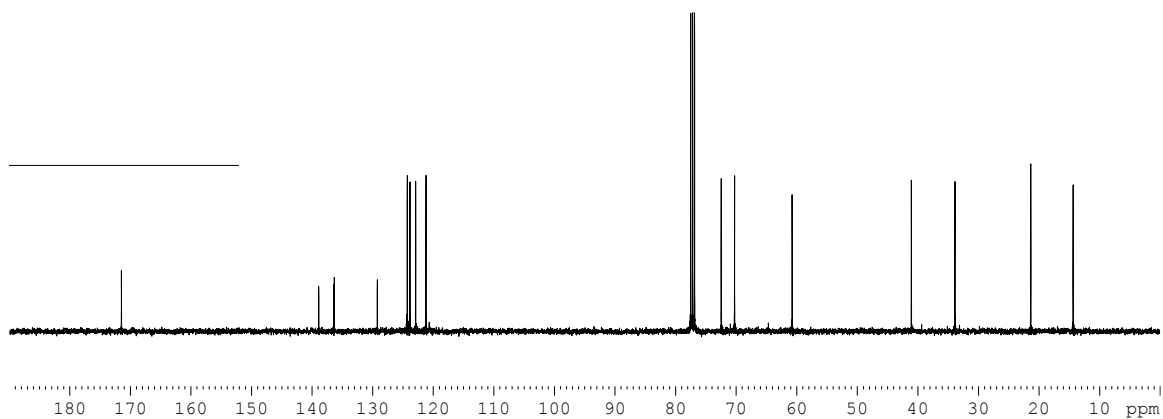
1v

<sup>1</sup>H NMR in CDCl<sub>3</sub>

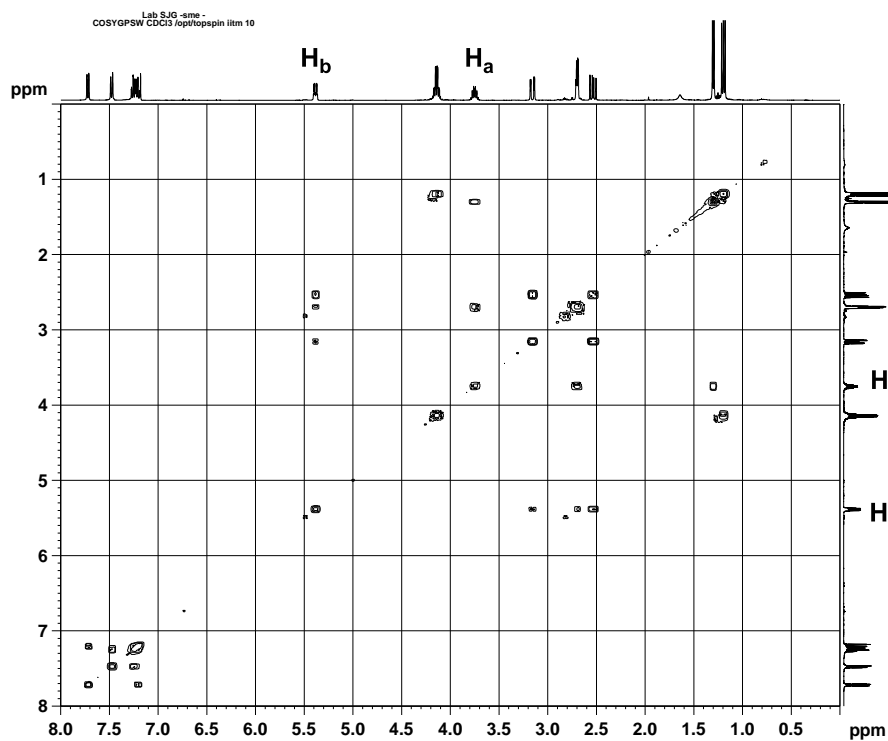
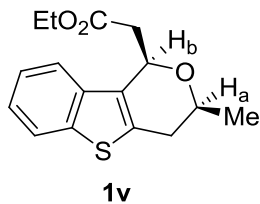


1v

<sup>13</sup>C NMR in CDCl<sub>3</sub>







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Current Data Parameters
NAME      sjg1112
EXPNO    71
PROCNO   1

F2 - Acquisition Parameters
Date_    2012127
Time     18.56
INSTRUM  spect
PROBHD   5 mm PABBO BB/
PULPROG  cosygpsw
TD       2048
SOLVENT  CDC13
NS       1
DS       8
SWH      5494.505 Hz
FIDRES   2.602664 Hz
AQ       0.1864180 sec
RG       27.8
DW       91.000 usec
DE       6.50 usec
TE       298.0 K
D0       0.0000000 sec
D1       1.9668200 sec
D11      0.0000000 sec
D12      0.0000000 sec
D13      0.0000400 sec
D16      0.0002000 sec
IN0      0.00018200 sec

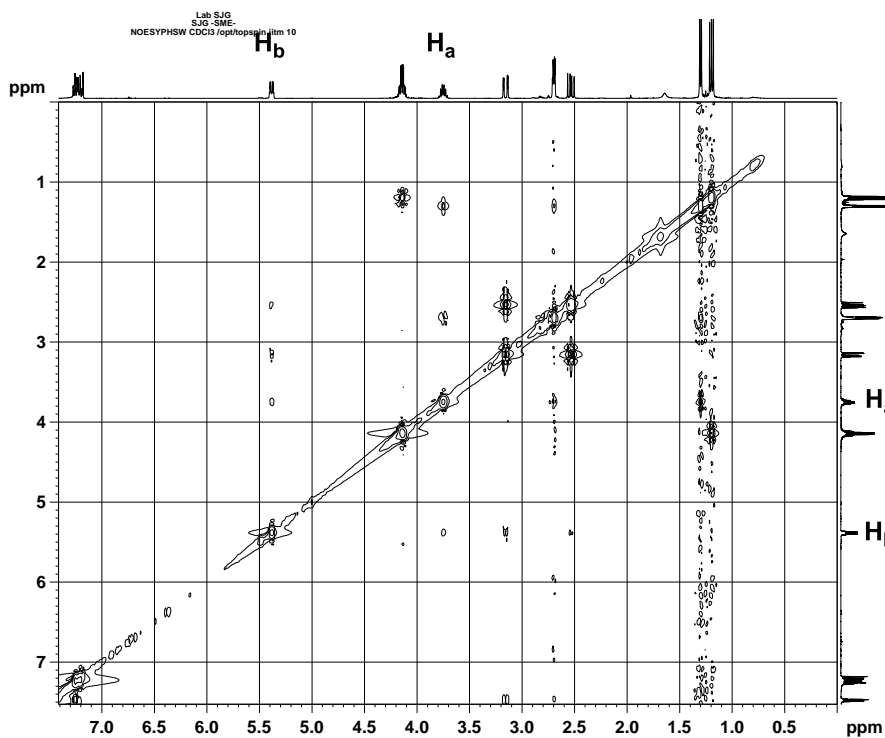
===== CHANNEL f1 =====
NUC1     1H
P0       11.75 usec
P1       11.75 usec
P17      2500.00 usec
PLW1     15.30000019 W
PLW10    3.12479997 W
SFO1     500.1518964 MHz

===== GRADIENT CHANNEL =====
GPNAM1   SMS1Q10.100
GP21     10.00 %
P16      1000.00 usec

F1 - Acquisition parameters
SI       128
SFO1     500.1519 MHz
FIDRES   42.925823 Hz
SW       10.986 ppm
FMODE    QF

F2 - Processing parameters
SI       1024
SF       500.1500536 MHz
WDW      QSINE
SSB      0
LB       0 Hz
GB       0
PC       1.40

F1 - Processing parameters
SI       1024
MC2      QF
SF       500.1500536 MHz
WDW      States-TPPI
SSB      0
LB       0 Hz
GB       0
  
```



```

Current Data Parameters
NAME      sjg1112
EXPNO    72
PROCNO   1

F2 - Acquisition Parameters
Date_    2012127
Time     20.03
INSTRUM  spect
PROBHD   5 mm PABBO BB/
PULPROG  noesygpsw
TD       2048
SOLVENT  CDC13
NS       4
DS       32
SWH      5494.505 Hz
FIDRES   2.602664 Hz
AQ       0.1864180 sec
RG       27.8
DW       91.000 usec
DE       6.50 usec
TE       298.0 K
D0       0.00007604 sec
D1       2.01433611 sec
D8       0.30000001 sec
D11      0.0000000 sec
D12      0.0002000 sec
D16      0.0002000 sec
IN0      0.00018200 sec

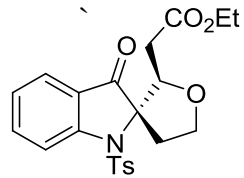
===== CHANNEL f1 =====
NUC1     1H
P1       11.75 usec
P2       23.50 usec
P17      2500.00 usec
PLW1     15.30000019 W
PLW10    3.12479997 W
SFO1     500.1518964 MHz

===== GRADIENT CHANNEL =====
GPNAM1   SMS1Q10.100
GP21     10.00 %
P16      1000.00 usec

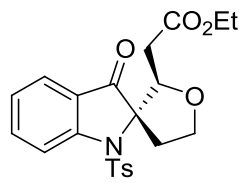
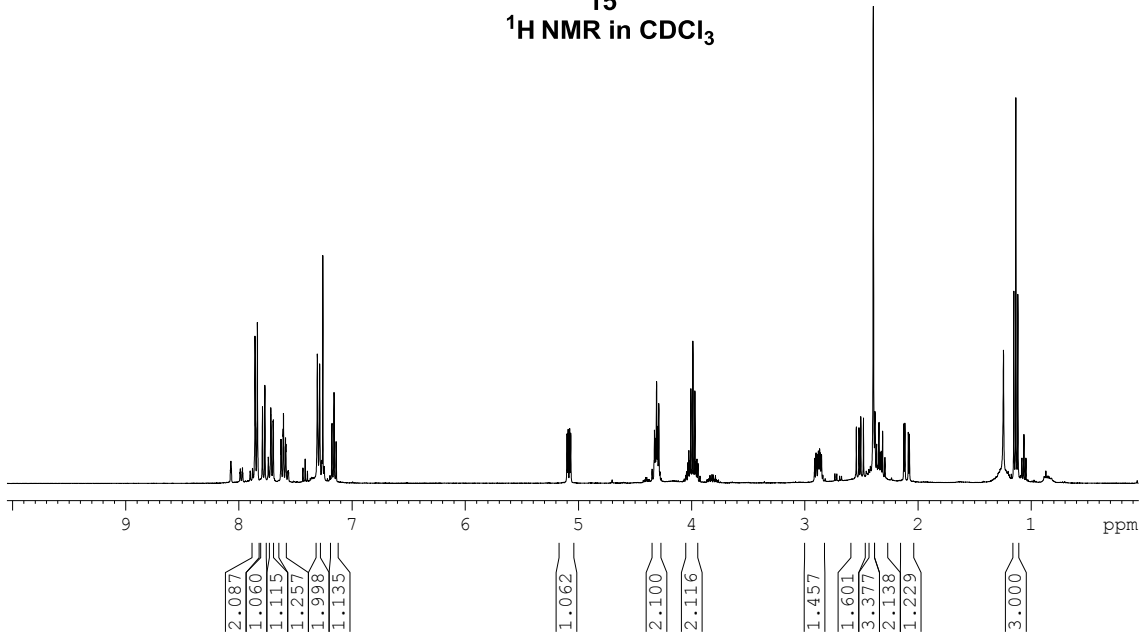
F1 - Acquisition parameters
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SFO1     500.1519 MHz
FIDRES   21.462912 Hz
SW       10.986 ppm
FMODE    States-TPPI

F2 - Processing parameters
SI       1024
SF       500.1500536 MHz
WDW      QSINE
SSB      2
LB       0 Hz
GB       0
PC       1.00

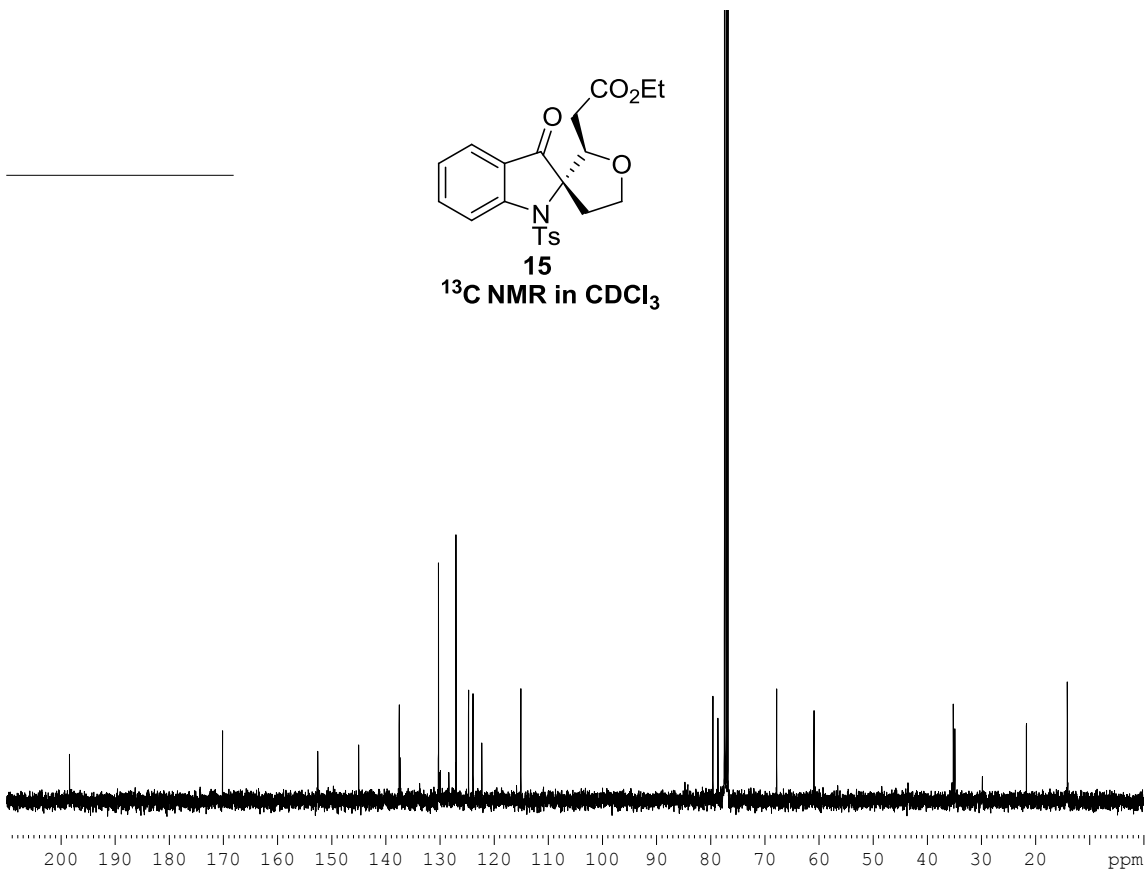
F1 - Processing parameters
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MC2      States-TPPI
SF       500.1500536 MHz
WDW      SINE
SSB      2
LB       0 Hz
GB       0
  
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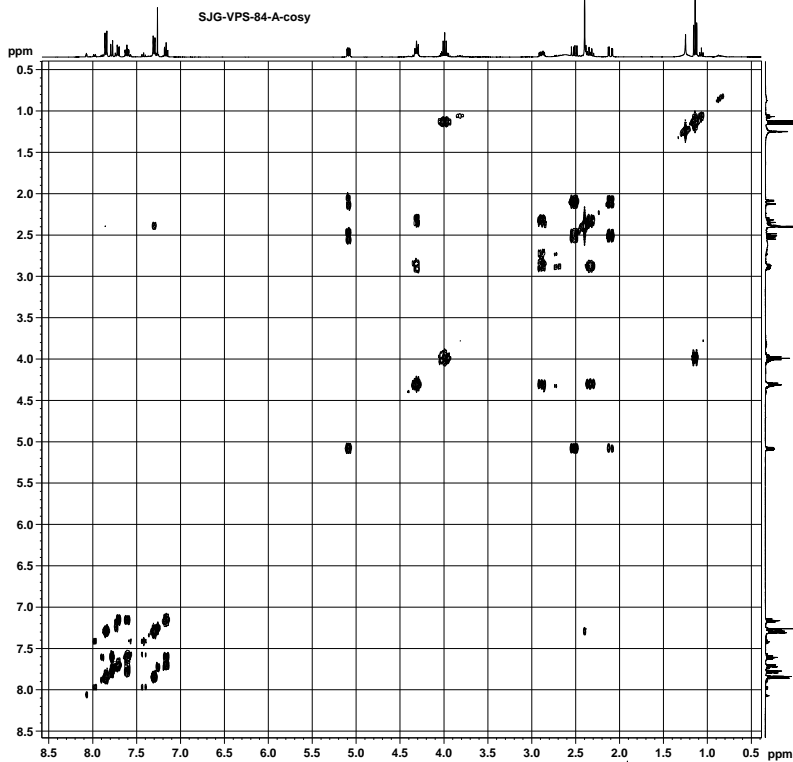
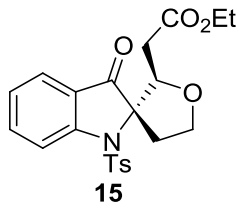


**15**  
 $^1\text{H NMR}$  in  $\text{CDCl}_3$



**15**  
 $^{13}\text{C NMR}$  in  $\text{CDCl}_3$

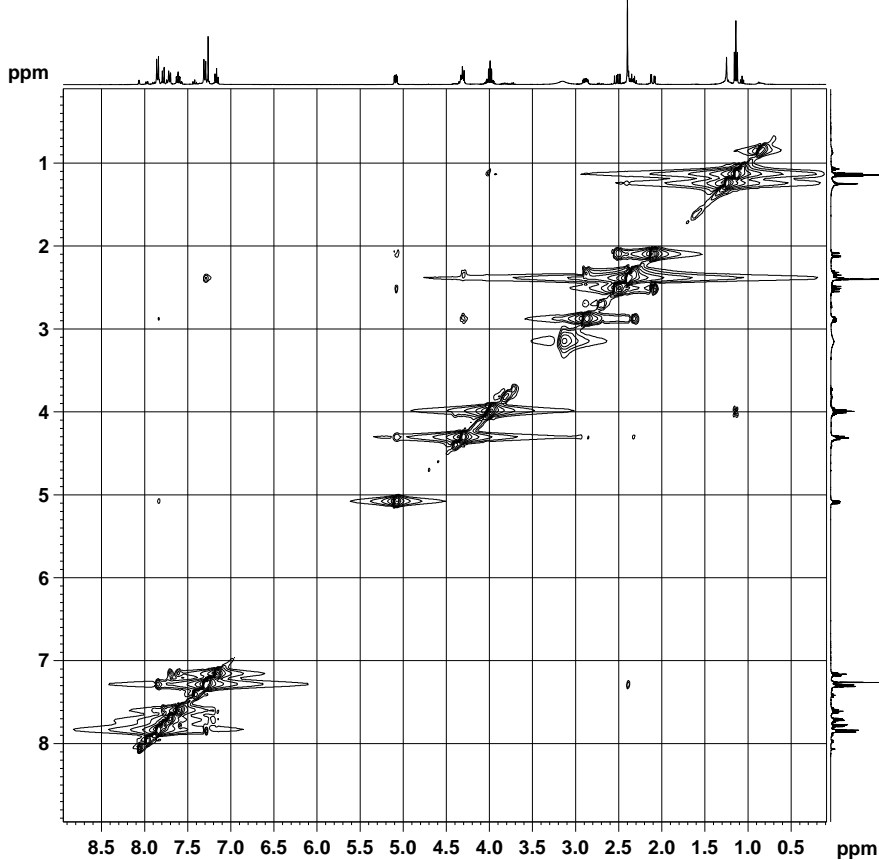


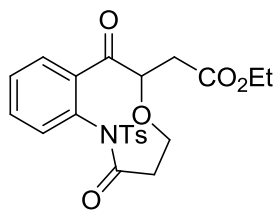


NAME SJG-VPS-84-A-cosy  
 EXPNO 28  
 PROCNO 1  
 Date\_ 20121107  
 Time 15.34  
 INSTRUM spect  
 PROBHD 5 mm PABBO BB-  
 PULPROG cosygpgf  
 TD 2048  
 SOLVENT CDCl3  
 NS 12  
 DS 16  
 SWH 3280.840 Hz  
 FIDRES 1.601973 Hz  
 AQ 0.3121652 sec  
 RG 362  
 DW 152.400 usec  
 DE 6.50 usec  
 TE 294.2 K  
 D0 0.00000300 sec  
 D1 1.00000000 sec  
 D13 0.00000400 sec  
 D16 0.00020000 sec  
 IN0 0.00030480 sec

===== CHANNEL f1 =====  
 NUC1 1H  
 P0 13.50 usec  
 P1 13.50 usec  
 PL1 -1.00 dB  
 PL1W 10.56200695 W  
 SFO1 400.1318023 MHz

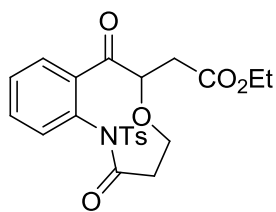
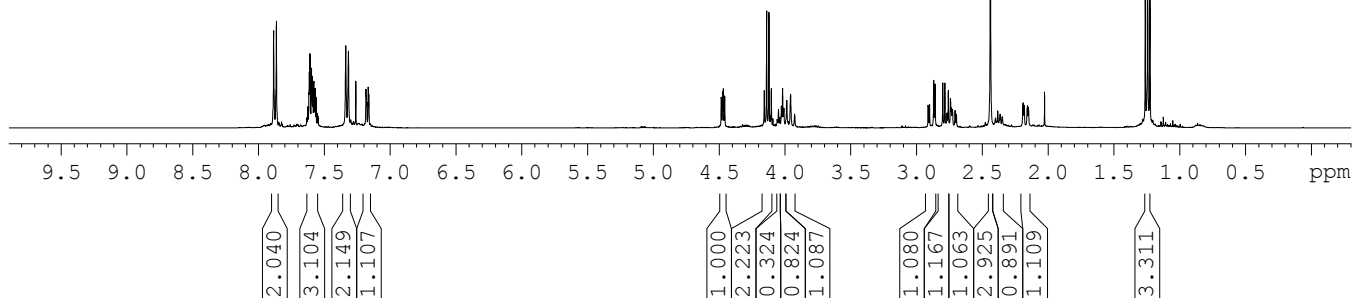
===== GRADIENT CHANNEL =====  
 GPNAM1 SINE.100  
 GPZ1 10.00 %  
 P16 1000.00 usec  
 NDO 1  
 TD 124  
 SFO1 400.1318 MHz  
 FIDRES 26.460329 Hz  
 SW 8.200 ppm  
 FrMODE QF  
 SI 2048  
 SF 400.1300098 MHz  
 WDW SINE  
 SSB 0  
 LB 0.00 Hz  
 GB 0  
 PC 1.40  
 SI 512  
 MC2 QF  
 SF 400.1300098 MHz  
 WDW SINE  
 SSB 0  
 LB 0.00 Hz  
 GB 0





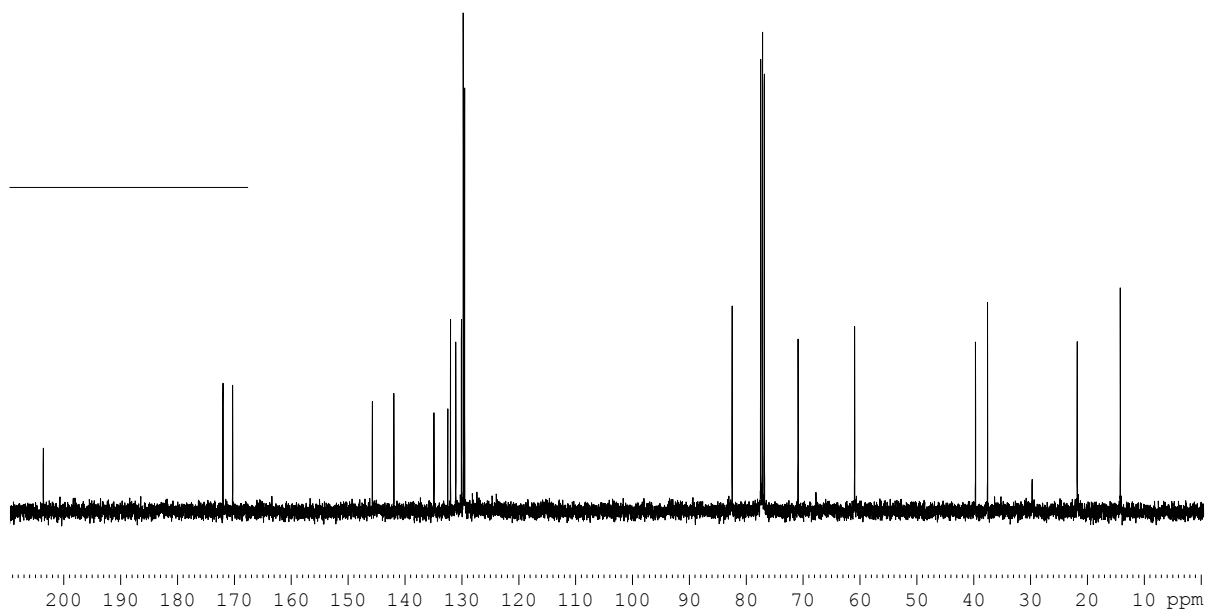
**14**

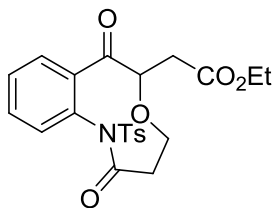
**<sup>1</sup>H NMR in CDCl<sub>3</sub>**



**14**

**<sup>13</sup>C NMR in CDCl<sub>3</sub>**





14

<sup>13</sup>C NMR in CDCl<sub>3</sub>

