

# Supporting Information

## Base Promoter Direct Difunctionalization/Cascade Cyclization of 1,6-Enynes

Ming Li,<sup>[a]</sup> Cui-Tian Wang,<sup>[a]</sup> Yi-Feng Qiu,<sup>[b]</sup> Xin-Yu Zhu,<sup>[a]</sup> Ya-Ping Han,<sup>[a]</sup> Yu-Xia,<sup>[a]</sup>  
Xue-Song Li,<sup>[a]</sup> Yong-Min Liang\*<sup>[a]</sup>

<sup>a</sup>State Key Laboratory of Applied Organic Chemistry, Lanzhou University, Lanzhou  
730000, P.R. China

<sup>b</sup>College of Chemistry and Chemical Engineering, Northwest Normal University,  
Lanzhou, Gansu 730070, P.R. China  
E-mail: liangym@lzu.edu.cn

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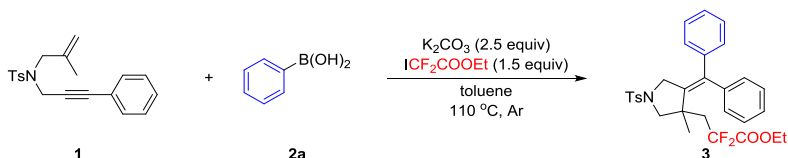
## General Remarks

For column chromatography, silica gel (200-300 mesh) was employed.  $^1\text{H}$  NMR (400 MHz),  $^{13}\text{C}$  NMR (100 MHz) and  $^{19}\text{F}$  NMR (376 MHz) spectra were recorded in  $\text{CDCl}_3$  and chemical shifts (ppm) were recorded with TMS as the internal reference standard. All newly synthesized products were further characterized by HR-MS, copies of their  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR and  $^{19}\text{F}$  NMR spectra are provided in the Supporting Information. Unless otherwise noted, reactions were carried out under an argon atmosphere. Toluene was distilled from  $\text{CaH}_2$  under standard method. Other commercially available reagents and solvents were used without further purification.

## General Procedure

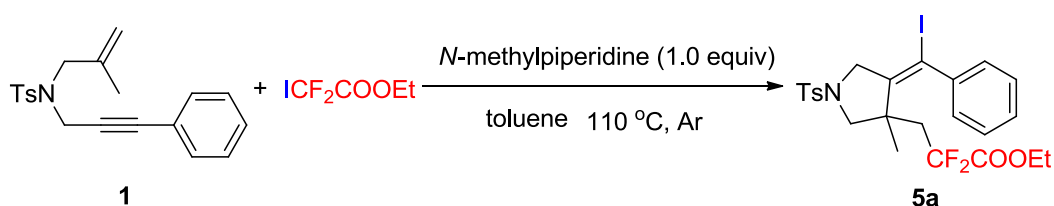
The starting Materials were obtained by the Liang's work.<sup>1</sup>

For the synthesis of new product **3a**



In an oven-dried tube, 1,6-enynes (**1a**; 67.8 mg, 0.2 mmol), borophenylic acid (**2a**; 48.8 mg, 0.4 mmol) and  $\text{K}_2\text{CO}_3$  (69 mg, 0.5 mmol) were added. The tube was charged with argon (repeated three times). Then, toluene (2 mL) was injected after  $\text{ICF}_2\text{COOEt}$  (75 mg, 0.3 mmol) were added. The reaction mixture was stirring at 110 °C for 24 h. After the reaction was completed, the residue was purified by chromatography on silica gel (petroleum ether/ethyl acetate, 8:1) to obtain product **3a**.

For the synthesis of product **5a**



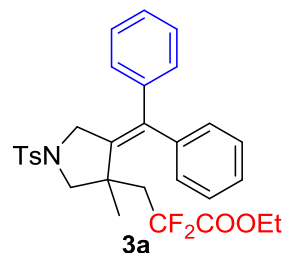
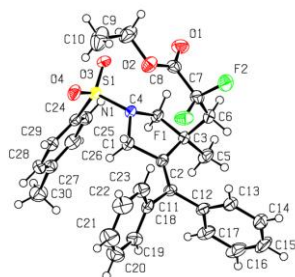
An oven-dried tube charged with 1,6-enynes (**1a**; 67.8 mg, 0.2 mmol) was evacuated and backfilled with argon. Then *N*-methylpiperidine (19.8 mg, 0.2 mmol),  $\text{ICF}_2\text{COOEt}$  (75 mg, 0.3 mmol) and toluene were added respectively. The reaction system was then stirring at 110 °C for 48 h. After the reaction was completed, the residue

was purified by chromatography on silica gel (petroleum ether/ethyl acetate, 8:1) to obtain product **5a**.

## Reference

1 Y.-Q. Wang, Y.-T. He, L.-L. Zhang, X.-X. Wu, X.-Y. Liu and Y.-M. Liang, *Org. Lett.*, 2015, **17**, 4280;

## X-ray Single Crystal Diffraction Data of 3a, 4b and 5a



Bond precision: C-C = 0.0053 Å

Wavelength= 0.71073

Cell: a=13.8373(7) b=14.6324(8) c=16.7936(8)  
 alpha=65.506(5) beta=85.068(4) gamma=61.827(5)  
 Temperature: 173 K

	Calculated	Reported
Volume	2702.0(3)	2702.0(2)
Space group	P -1	P -1
Hall group	-P 1	-P 1
Moiety formula	C30 H31 F2 N O4 S	C30 H31 F2 N O4 S
Sum formula	C30 H31 F2 N O4 S	C30 H31 F2 N O4 S
Mr	539.62	539.62
Dx,g cm-3	1.327	1.327
Z	4	4
Mu (mm-1)	0.170	0.170
F000	1136.0	1136.0
F000'	1137.09	
h,k,lmax	17,18,20	17,18,20
Nref	10642	10621
Tmin,Tmax	0.975,0.980	0.754,1.000
Tmin'	0.975	

Correction method= # Reported T Limits: Tmin=0.754 Tmax=1.000  
 AbsCorr = MULTI-SCAN

Data completeness= 0.998

Theta(max)= 26.020

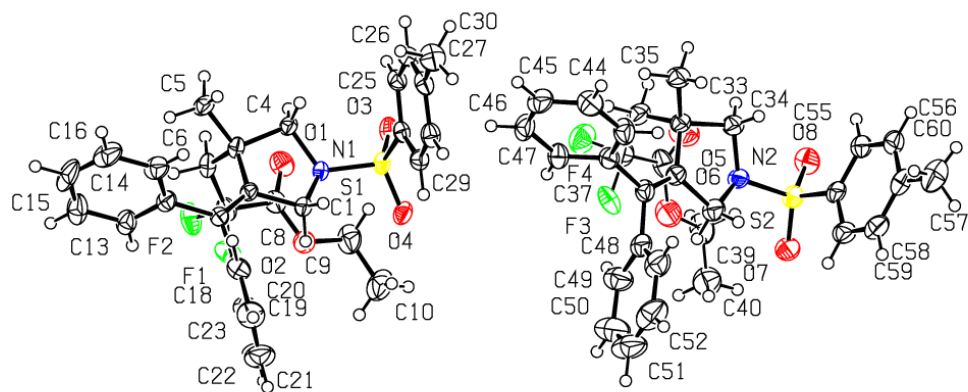
R(reflections)= 0.0594( 7033)

wR2(reflections)= 0.1599( 10621)

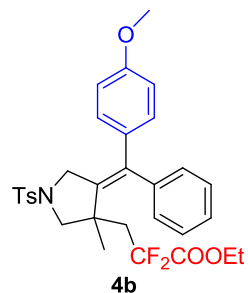
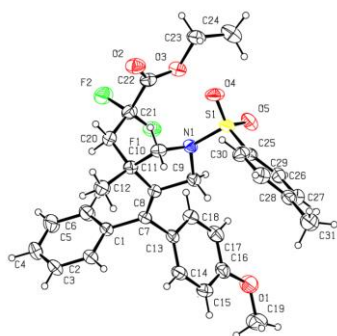
S = 1.034

Npar= 744

Thermal ellipsoids are shown at 50% probability



For 3a there are two molecules in the asymmetric unit, in fact there are same molecules, which just are rotamers due to rotation of ester group



ond precision: C-C = 0.0036 Å Wavelength=1.54184

Cell: a=12.5836(4) b=13.0599(5) c=17.6689(7)  
 alpha=90 beta=91.349(3) gamma=90  
 Temperature: 293 K

	Calculated	Reported
Volume	2902.91(18)	2902.91(19)
Space group	P 21/n	P 1 21/n 1
Hall group	-P 2yn	-P 2yn
Moiety formula	C31 H33 F2 N O5 S	C31 H33 F2 N O5 S
Sum formula	C31 H33 F2 N O5 S	C31 H33 F2 N O5 S
Mr	569.64	569.64
Dx, g cm <sup>-3</sup>	1.303	1.303
Z	4	4
Mu (mm <sup>-1</sup> )	1.442	1.442
F000	1200.0	1200.0
F000'	1205.13	
h,k,lmax	14,15,21	14,15,21
Nref	5125	4980
Tmin,Tmax	0.805,0.841	0.922,1.000
Tmin'	0.805	

Correction method= # Reported T Limits: Tmin=0.922 Tmax=1.000

AbsCorr = MULTI-SCAN

Data completeness= 0.972

Theta(max)= 66.593

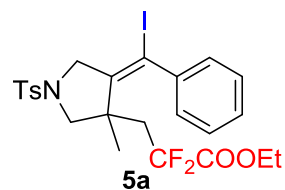
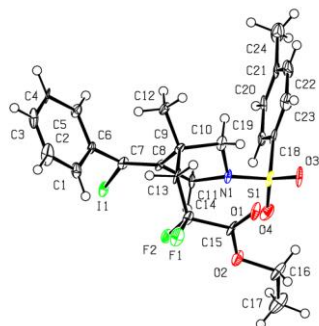
R(reflections)= 0.0473( 4041)

wR2(reflections)= 0.1381( 4980)

S = 1.037

Npar= 365

Thermal ellipsoids are shown at 30% probability



Bond precision: C-C = 0.0123 Å

Wavelength=1.54178

Cell: a=12.1269(6) b=15.7054(7) c=25.7543(12)

alpha=90

beta=91.456(2)

gamma=90

Temperature: 150 K

	Calculated	Reported
Volume	4903.5(4)	4903.5(4)
Space group	P 21/n	P 1 21/n 1
Hall group	-P 2yn	-P 2yn
Moiety formula	C24 H26 F2 I N O4 S	C24 H26 F2 I N O4 S
Sum formula	C24 H26 F2 I N O4 S	C24 H26 F2 I N O4 S
Mr	589.42	589.42
Dx, g cm <sup>-3</sup>	1.597	1.597
Z	8	8
Mu (mm <sup>-1</sup> )	11.458	11.458
F000	2368.0	2368.0
F000'	2375.12	
h,k,lmax	14, 18, 30	14, 18, 30
Nref	8722	8282
Tmin,Tmax	0.136, 0.201	0.120, 0.753
Tmin'	0.038	

Correction method= # Reported T Limits: Tmin=0.120 Tmax=0.753

AbsCorr = MULTI-SCAN

Data completeness= 0.950

Theta(max)= 66.827

R(reflections)= 0.1176( 7190)

wR2(reflections)= 0.3344( 8282)

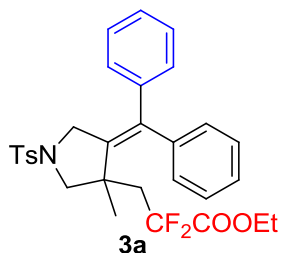
S = 1.189

Npar= 601

Thermal ellipsoids are shown at 50% probability



## Characterization Data



### *ethyl*

### **3-(4-(diphenylmethylene)-3-methyl-1-tosylpyrrolidin-3-yl)-**

### **2,2-difluoropropanoate**

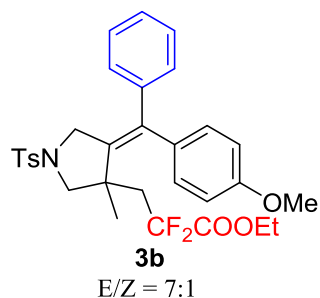
White solid; melting point 40–42 °C; 75.5 mg; 70% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8.4 Hz, 2H), 7.34 (d,  $J$  = 8 Hz, 2H), 7.29–7.26 (m, 4H), 7.23–7.20 (m, 2H), 7.16 (d,  $J$  = 8 Hz, 2H), 7.07 (d,  $J$  = 8 Hz, 2H), 4.27–4.19 (m, 1H), 3.77 (d,  $J$  = 14.8 Hz, 1H), 3.68 (d,  $J$  = 14.8 Hz, 1H), 3.22 (d,  $J$  = 9.6 Hz, 1H), 3.15 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.10 (t,  $J$  = 18.4 Hz, 2H), 1.27 (t,  $J$  = 7.2 Hz, 3H), 1.20 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.2 Hz), 143.8 (s), 142.5 (s), 140.2 (s), 140.2 (s), 137.7 (s), 131.6 (s), 129.6 (s), 128.8 (s), 128.7 (s), 128.7 (s), 128.2 (s), 128.0 (s), 127.2 (s), 127.1 (s), 115.7 (t,  $J$  = 252.0 Hz), 63.0 (s), 59.9 (s), 52.1 (s), 43.6 (d,  $J$  = 3.3 Hz), 41.2 (t,  $J$  = 21.0 Hz), 25.7 (s), 25.5 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.6 (d,  $J$  = 263.7 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{31}\text{F}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 562.1834. Found: 562.1834.



***(E)-ethyl***

***2,2-difluoro-3-(4-((4-methoxyphenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate***

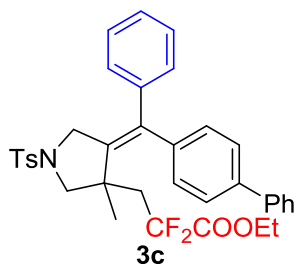
White solid; melting point 50–52 °C; 60.3 mg; 53% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8.4 Hz, 2H), 7.35 (d,  $J$  = 8.0 Hz, 2H), 7.29–7.26 (m 2H), 7.21–7.20 (m 1H), 7.07–7.02 (m, 4H), 6.82–6.80 (m, 2H), 4.28–4.22 (m, 2H), 3.78 (d,  $J$  = 14.8 Hz, 1H), 3.76 (s, 3H), 3.68 (d,  $J$  = 14.8 Hz, 1H), 3.19 (d,  $J$  = 9.2 Hz, 1H), 3.13 (d,  $J$  = 9.2 Hz, 1H), 2.48 (s, 3H), 2.18–2.08 (m, 2H), 1.29 (t,  $J$  = 7.2 Hz, 3H), 1.22 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 164.2 (t,  $J$  = 32.0 Hz), 158.6 (s), 143.8 (s), 142.8 (s), 140.2 (s), 137.3 (s), 132.5 (s), 131.4 (s), 129.8 (s), 129.6 (s), 128.7 (s), 128.0 (s), 127.1 (s), 127.0 (s), 115.8 (t,  $J$  = 252.0 Hz), 113.6 (s), 63.0 (s), 59.9 (s), 55.1 (s), 52.2 (s), 43.6 (d,  $J$  = 2.0 Hz), 41.2 (t,  $J$  = 22.0 Hz), 25.8 (s), 21.6 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz), -103.6 (d,  $J$  = 263.2 Hz).

HRMS (ESI) Calcd for  $\text{C}_{31}\text{H}_{33}\text{F}_2\text{NO}_5\text{S}$ :  $[\text{M}] + \text{Na}$  = 592.1940. Found: 592.1940.



***(E)-ethyl***

***3-(4-([1,1'-biphenyl]-4-yl(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate***

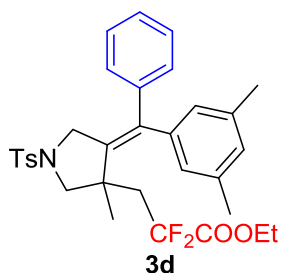
White solid; melting point 62–64 °C; 76.3 mg; 62% yield.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 7.63 (d, *J* = 8.0 Hz, 2H), 7.54–7.50 (m, 4H), 7.42–7.38 (m 2H), 7.35–7.33 (m 2H), 7.31–7.27 (m, 3H), 7.24–7.21 (m, 3H), 7.12–7.10 (m, 2H), 4.23–4.17 (m, 2H), 3.78 (d, *J* = 14.4 Hz, 1H), 3.72 (d, *J* = 14.4 Hz, 1H), 3.26 (d, *J* = 9.6 Hz, 1H), 3.14 (d, *J* = 9.6 Hz, 1H), 2.45 (s, 3H), 2.23–2.14 (m, 2H), 1.24 (s, 3H), 1.21 (t, *J* = 7.2 Hz, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 163.8 (t, *J* = 32.0 Hz), 143.8 (s), 142.5 (s), 140.4 (s), 140.2 (s), 140.0 (s), 139.2 (s), 137.3 (s), 131.6 (s), 129.7 (s), 129.1 (s), 128.8 (s), 128.7 (s), 128.0(s), 127.4(s), 127.2(s), 126.9(s), 126.8 (s), 115.7 (t, *J* = 253.0 Hz), 63.0 (s), 59.9 (s), 52.2 (s), 43.7 (d, *J* = 2.0 Hz), 41.3 (t, *J* = 21.0 Hz), 25.8 (s), 21.5 (s), 13.7 (s).

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>) δ ppm -100.1 (d, *J* = 263.2Hz), -103.6 (d, *J* = 263.2 Hz).

HRMS (ESI) Calcd for C<sub>36</sub>H<sub>35</sub>F<sub>2</sub>NO<sub>4</sub>S: [M]<sup>+</sup>Na = 620.1889. Found: 620.1890.



***(E)-ethyl***

***3-(4-((3,5-dimethylphenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-2,2-difluoropropanoate***

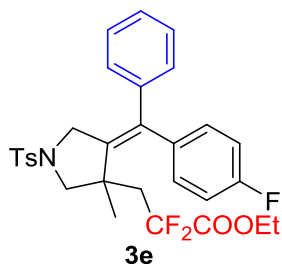
White solid; melting point 46–48 °C; 72.6 mg; 64% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8.0 Hz, 2H), 7.35 (d,  $J$  = 8.0 Hz, 2H), 7.29–7.25 (m, 2H), 7.21–7.20 (m, 1H), 7.09–7.06 (m, 2H), 6.84 (s, 1H), 6.76 (s, 2H), 4.27–4.21 (m, 2H), 3.74 (d,  $J$  = 14.4 Hz, 1H), 3.63 (d,  $J$  = 14.4 Hz, 1H), 3.19 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.24 (s, 6H), 2.17–2.07 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.21 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.9 (t,  $J$  = 32.2 Hz), 143.8 (s), 142.6 (s), 140.0 (s), 139.6 (s), 137.8 (s), 131.3 (s), 129.6 (s), 128.8 (s), 128.7 (s), 128.0 (s), 127.1 (s), 127.0 (s), 126.3 (s), 115.8 (t,  $J$  = 253.0 Hz), 63.0 (s), 59.9 (s), 52.1 (s), 43.6 (d,  $J$  = 2.0 Hz), 41.1 (t,  $J$  = 21.0 Hz), 25.8 (s), 21.6 (s), 21.2 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.7 (d,  $J$  = 263.2 Hz, 1F), -103.7 (d,  $J$  = 263.7 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{32}\text{H}_{35}\text{F}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 590.2147. Found: 590.2147.



***(E)-ethyl***

***2,2-difluoro-3-(4-((4-fluorophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate***

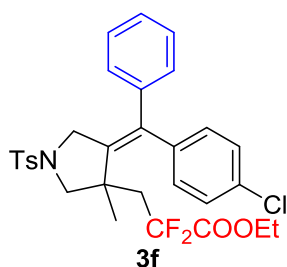
White solid; melting point 42–44 °C; 40.1 mg; 36% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8. Hz, 2H), 7.36–7.34 (m, 2H), 7.31–7.26 (m, 2H), 7.23–7.20 (m, 1H), 7.15–7.12 (m, 2H), 7.06–7.04 (m, 2H), 7.00–6.96 (m, 2H), 4.30–4.21 (m, 2H), 3.75 (d,  $J$  = 14.8 Hz, 1H), 3.68 (d,  $J$  = 14.8 Hz, 1H), 3.23 (d,  $J$  = 9.6 Hz, 1H), 3.13 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.15–2.04 (m, 2H), 1.29 (t,  $J$  = 7.2 Hz, 2H), 1.19 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 30 Hz), 161.9 (d,  $J$  = 245,6 Hz), 143.9 (s), 142.3 (s), 140.9 (s), 136.6 (s), 136.2 (d,  $J$  = 3,6 Hz), 131.6 (s), 130.3 (d,  $J$  = 7.8 Hz), 129.7 (s), 128.9 (s), 128.1 (s), 127.3 (s), 127.1 (s), 115.7 (d,  $J$  = 249,4 Hz), 115.3 (d,  $J$  = 21,4 Hz), 63.1 (s), 60.0 (s), 52.2 (s), 43.7 (d,  $J$  = 2.6 Hz), 41.2 (t,  $J$  = 21.8 Hz), 25.8 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.5 (d,  $J$  = 263.2 Hz, 1F), -114.5 (1F)

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{30}\text{F}_3\text{NO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 580.1740. Found: 580.1740.



***(E)-ethyl***

***3-(4-((4-chlorophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate***

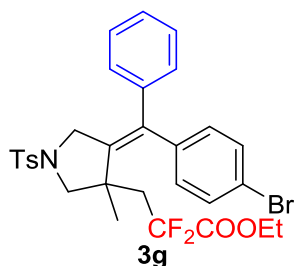
White solid; melting point 56–58 °C; 75.7 mg; 66% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8.0 Hz, 2H), 7.34 (d,  $J$  = 8.0 Hz, 2H), 7.30–7.20 (m, 5H), 7.11 (d,  $J$  = 8.0 Hz, 2H), 7.05–7.03 (m, 2H), 4.29–4.31 (m, 2H), 3.75 (d,  $J$  = 14.8 Hz, 1H), 3.68 (d,  $J$  = 11.2 Hz, 1H), 3.24 (d,  $J$  = 9.2 Hz, 1H), 3.12 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.16–2.07 (m, 2H), 1.30 (t,  $J$  = 7.2 Hz, 3H), 1.19 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.3 Hz), 143.9 (s), 142.1 (s), 140.1 (s), 138.7 (s), 136.4 (s), 133.3 (s), 131.5 (s), 130.1 (s), 129.7 (s), 128.9 (s), 128.5 (s), 128.1 (s), 127.4 (s), 127.1 (s), 115.6 (t,  $J$  = 253.0 Hz), 63.1 (s), 59.9 (s), 52.2 (s), 43.7 (d,  $J$  = 3.0 Hz), 41.3 (t,  $J$  = 22.0 Hz), 25.9 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.5 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{30}\text{ClF}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{H} = 574.1625$ . Found: 574.1625



***(E)-ethyl***

***3-(4-((4-bromophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate***

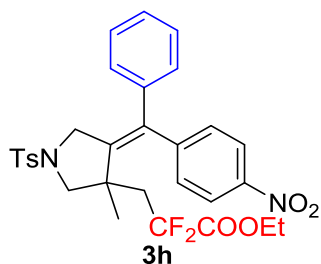
White solid; melting point 58–60 °C; 76.5 mg; 62% yield.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 7.62 (d, *J* = 8.0 Hz, 2H), 7.41 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.30–7.26 (m 2H), 7.22 (d, *J* = 8 Hz, 1H), 7.06–7.02 (m, 4H), 4.30–4.21 (m, 2H), 3.74 (d, *J* = 16.0 Hz, 1H), 3.68 (d, *J* = 16.0 Hz, 1H), 3.24 (d, *J* = 9.2 Hz, 1H), 3.12 (d, *J* = 9.6 Hz, 1H), 2.45 (s, 3H), 2.17–2.08 (m, 2H), 1.30 (t, *J* = 7.2 Hz, 3H), 1.18 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 163.7 (t, *J* = 32.0 Hz), 143.9 (s), 141.9 (s), 140.9 (s), 139.2 (s), 136.4 (s), 131.5 (s), 130.4 (s), 129.7 (s), 128.9 (s), 128.0 (s), 127.4 (s), 127.1 (s), 121.4 (s), 115.6 (t, *J* = 253.0 Hz), 63.1 (s), 59.9 (s), 52.2 (s), 43.7 (d, *J* = 3.0 Hz), 41.3 (t, *J* = 22.0 Hz), 25.8 (s), 21.5 (s), 13.8 (s).

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>) δ ppm -100.1 (d, *J* = 263.2 Hz), -103.55 (d, *J* = 263.2 Hz).

HRMS (ESI) Calcd for C<sub>30</sub>H<sub>30</sub>BrF<sub>2</sub>NO<sub>4</sub>S: [M]<sup>+</sup>+H = 618.1120. Found: 618.1126.



***(E)-ethyl***

***2,2-difluoro-3-(3-methyl-4-((4-nitrophenyl)(phenyl)methylene)-1-tosylpyrrolidin-3-yl)propanoate***

Yellow solid; melting point 66–68 °C; 39.7 mg; 34% yield.

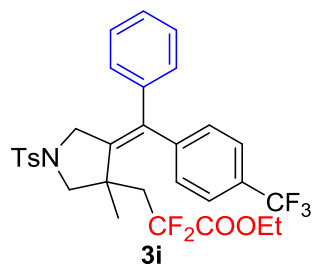
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 8.16 (d,  $J$  = 8.4 Hz, 2H), 7.62 (d,  $J$  = 8.0 Hz, 2H), 7.39–7.35 (m, 4H), 7.32–7.30 (m 2H), 7.27–7.25 (m, 1H), 7.07–7.05 (m, 2H), 4.30–4.24 (m, 2H), 3.74 (s, 2H), 3.30 (d,  $J$  = 9.6 Hz, 1H), 3.08 (d,  $J$  = 9.6 Hz, 1H), 2.47 (s, 3H), 2.17–2.08 (m, 2H), 1.29 (t,  $J$  = 7.2 Hz, 3H), 1.15 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.6 (t,  $J$  = 32.2 Hz), 147.2 (s), 147.0 (s), 144.0 (s), 141.7 (s), 141.1 (s), 135.6 (s), 131.5 (s), 129.8 (s), 129.7 (s), 129.2 (s), 128.1 (s), 127.8 (s), 127.2 (s), 123.6 (s), 115.5 (t,  $J$  = 250.7 Hz), 63.3 (s), 59.9 (s), 52.3 (s), 43.7 (d,  $J$  = 2.0 Hz), 41.4 (t,  $J$  = 22.0 Hz), 25.8 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.2 (d,  $J$  = 267.0 Hz, 1F), -103.3 (d,  $J$  = 267.0 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{30}\text{F}_2\text{N}_2\text{O}_6\text{S}$ :  $[\text{M}] + \text{Na}$  = 607.1685. Found: 607.1686.





***(E)-ethyl***

***2,2-difluoro-3-(3-methyl-4-(phenyl(4-(trifluoromethyl)phenyl)methylene)-1-tosylpyrrolidin-3-yl)propanoate***

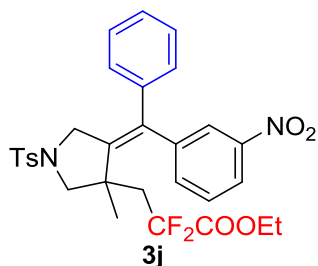
White solid; melting point 52–54 °C; 76.5 mg; 63% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8.4 Hz, 2H), 7.56 (d,  $J$  = 8.0 Hz, 2H), 7.36 (d,  $J$  = 8.0 Hz, 2H), 7.33–7.29 (m 4H), 7.26–7.24 (m, 1H), 7.08–7.06 (m, 2H), 4.28–4.21 (m, 2H), 3.76–3.68 (m, 4H), 3.10 (d,  $J$  = 9.6 Hz, 1H), 2.47 (s, 3H), 2.14–2.05 (m, 2H), 1.27 (t,  $J$  = 7.2 Hz, 3H), 1.17 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.7 (t,  $J$  = 32.1 Hz), 144.0 (s), 144.0 (s), 141.6 (s), 141.1 (s), 136.2 (s), 131.2 (s), 129.7 (s), 129.4 (q,  $J$  = 32.8 Hz), 129.1 (s), 129.0 (s), 128.0 (s), 127.5 (s), 127.1 (s), 125.3–125.2 (m), 123.9 (q,  $J$  = 270.4 Hz), 115.6 (t,  $J$  = 249.4 Hz), 63.1 (s), 59.8 (s), 52.2 (s), 43.6 (d,  $J$  = 2.8 Hz), 41.3 (t,  $J$  = 21.0 Hz), 25.8 (s), 21.6 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -62.6 (s, 3F), -99.9 (d,  $J$  = 263.2 Hz, 1F), -103.9 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{31}\text{H}_{30}\text{F}_5\text{NO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 630.1708. Found: 630.1704.



**(E)-ethyl**

**2,2-difluoro-3-(3-methyl-4-((3-nitrophenyl)(phenyl)methylene)-1-tosylpyrrolidin-3-yl)propanoate**

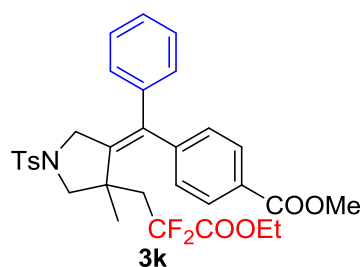
Yellow solid; melting point 54–56 °C; 58.4 mg; 50% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 8.12–8.10 (m, 1H), 8.03 (s, 1H) 7.62 (d,  $J$  = 8.0 Hz, 2H), 7.57–7.49 (m, 2H), 7.37–7.30 (m 4H), 7.27–7.23 (m, 1H), 7.09–7.07 (m, 2H), 4.28–4.22 (m, 2H), 3.75 (s, 2H), 3.30 (d,  $J$  = 9.6 Hz, 1H), 3.09 (d,  $J$  = 9.6 Hz, 1H), 2.47 (s, 3H), 2.17–2.08 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.15 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.9 (t,  $J$  = 32.0 Hz), 148.0 (s), 144.0 (s), 142.1 (s), 141.9 (s), 141.2 (s), 135.3 (s), 134.8 (s), 131.4 (s), 129.7 (s), 129.4 (s), 129.1 (s), 128.0 (s), 127.8 (s), 127.2 (s), 123.6 (s), 122.3 (s), 115.5 (t,  $J$  = 253.0 Hz), 63.2 (s), 59.8 (s), 52.3 (s), 43.7 (d,  $J$  = 2.0 Hz), 41.4 (t,  $J$  = 22.0 Hz), 25.8 (s), 21.5 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.5 (d,  $J$  = 267.0 Hz, 1F), -103.4 (d,  $J$  = 267.0 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{30}\text{F}_2\text{N}_2\text{O}_6\text{S}$ :  $[\text{M}] + \text{Na}$  = 607.1685. Found: 607.1684.



***(E)*-methyl**

***4-((4-(3-ethoxy-2,2-difluoro-3-oxopropyl)-4-methyl-1-tosylpyrrolidin-3-ylidene)(phenyl)methyl)benzoate***

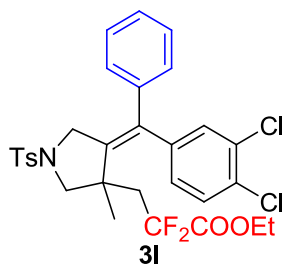
White solid; melting point 192–194 °C; 46.6 mg; 39% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.96 (d,  $J$  = 8.4 Hz, 2H), 7.62 (d,  $J$  = 8.0 Hz, 2H), 7.36–7.34 (m 2H), 7.31–7.22 (m 5H), 7.08–7.06 (m, 2H), 4.28–4.20 (m, 2H), 3.88 (s, 3H), 3.76 (d,  $J$  = 14.4 Hz, 1H), 3.73 (d,  $J$  = 14.4 Hz, 1H), 3.25 (d,  $J$  = 9.6 Hz, 1H), 3.11 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.16–2.06 (m, 2H), 1.27 (t,  $J$  = 7.2 Hz, 3H), 1.17 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 166.5 (s), 163.7 (t,  $J$  = 32.0 Hz), 145.1 (s), 143.9 (s), 141.7 (s), 140.9 (s), 136.7 (s), 131.5 (s), 129.7 (s), 129.6 (s), 129.1 (s), 128.9 (s), 128.9 (s), 128.0 (s), 127.4 (s), 127.2 (s), 115.6 (t,  $J$  = 249.0 Hz), 63.1 (s), 59.9 (s), 52.2 (s), 52.1 (s), 43.7 (d,  $J$  = 3.0 Hz), 41.3 (t,  $J$  = 22.0 Hz), 25.7 (s), 21.5 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz), -103.4 (d,  $J$  = 263.2 Hz).

HRMS (ESI) Calcd for  $\text{C}_{32}\text{H}_{33}\text{F}_2\text{NO}_6\text{S}$ :  $[\text{M}] + \text{Na}$  = 620.1889. Found: 620.1890.



**(E)-ethyl**

**3-(4-((3,4-dichlorophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

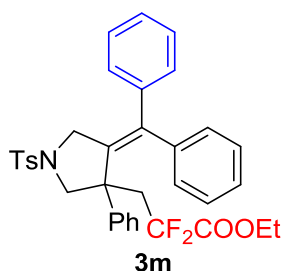
White solid; melting point 54–56 °C; 43.7 mg; 36% yield.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 7.61 (d, *J* = 8.4 Hz, 2H), 7.39–7.33 (m, 3H), 7.30–7.28 (m, 2H), 7.26–7.24 (m, 2H), 7.06–7.02 (m, 3H), 4.31–4.24 (m, 2H), 3.74 (d, *J* = 14.8 Hz, 1H), 3.68 (d, *J* = 14.8 Hz, 1H), 3.26 (d, *J* = 9.6 Hz, 1H), 3.11 (d, *J* = 9.6 Hz, 1H), 2.46 (s, 3H), 2.18–2.09 (m, 2H), 1.30 (t, *J* = 7.2 Hz, 3H), 1.19 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 163.7 (t, *J* = 32.2 Hz), 143.9 (s), 141.6 (s), 141.5 (s), 140.2 (s), 135.2 (s), 132.4 (s), 131.6 (s), 131.4 (s), 130.6 (s), 130.3 (s), 129.7 (s), 129.0 (s), 128.2 (s), 128.0 (s), 115.5 (t, *J* = 253.0 Hz), 63.2 (s), 59.9 (s), 52.3 (s), 43.7 (d, *J* = 2 Hz), 41.3 (t, *J* = 21.0 Hz), 25.9 (s), 21.5 (s), 13.8 (s).

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>) δ ppm -100.4 (d, *J* = 263.2 Hz, 1F), -103.5 (d, *J* = 263.7 Hz, 1F).

HRMS (ESI) Calcd for C<sub>30</sub>H<sub>29</sub>Cl<sub>2</sub>F<sub>2</sub>NO<sub>4</sub>S: [M]<sup>+</sup>+Na = 638.2147. Found: 638.2147.



**ethyl**

**3-(4-(diphenylmethylene)-3-phenyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

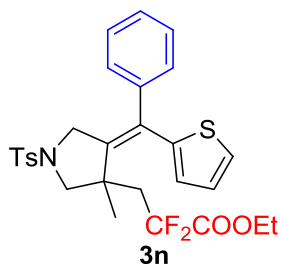
White solid; melting point 54–56 °C; 80.6 mg; 67% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8.0 Hz, 2H), 7.33 (d,  $J$  = 8.0 Hz, 2H), 7.28–7.24 (m, 2H), 7.21–7.18 (m, 6H), 7.06–7.00 (m, 5H), 6.75–6.73 (m, 2H), 4.11 (q,  $J$  = 7.2 Hz, 2H), 3.88 (s, 2H), 3.68 (d,  $J$  = 10.0 Hz, 1H), 3.56 (d,  $J$  = 10.0 Hz, 1H), 2.73–2.60 (m, 1H), 2.53–2.41 (m, 1H), 2.46 (s, 3H), 1.24 (t,  $J$  = 7.2 Hz, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.5 (t,  $J$  = 32.0 Hz), 144.3 (s), 143.8 (s), 142.4 (s), 139.6 (s), 139.5 (s), 137.7 (s), 131.5 (s), 129.6 (s), 128.6 (s), 128.5 (s), 128.2 (s), 128.0 (s), 127.7 (s), 127.2 (s), 127.2 (s), 126.9 (s), 126.7 (s), 126.3 (s), 115.6 (t,  $J$  = 254.0 Hz), 63.0 (s), 59.7 (s), 52.7 (s), 50.0 (d,  $J$  = 4.2 Hz), 39.7 (t,  $J$  = 22.4 Hz), 21.6 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -96.8 (d,  $J$  = 263.2 Hz, 1F), -102.0 (d,  $J$  = 267.0 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{35}\text{H}_{33}\text{F}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 624.1991. Found: 624.1991.



***(E)-ethyl***

***2,2-difluoro-3-(3-methyl-4-(phenyl(thiophen-2-yl)methylene)-1-tosylpyrrolidin-3-yl)propanoate***

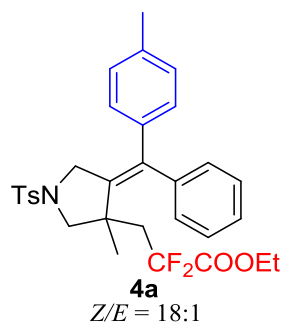
White solid; melting point 44–46 °C; 38.2 mg; 35% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.61 (d,  $J$  = 8.0 Hz, 2H), 7.34 (d,  $J$  = 8.0 Hz, 2H), 7.29 (d,  $J$  = 8.0 Hz, 2H), 7.25–7.22 (m, 2H), 7.08–7.06 (m, 2H), 6.93–6.91 (m, 1H), 6.88–6.87 (m, 1H), 4.30–4.24 (m, 2H), 3.74 (d,  $J$  = 15.2 Hz, 1H), 3.63 (d,  $J$  = 15.2 Hz, 1H), 3.21 (d,  $J$  = 9.6 Hz, 1H), 3.18 (d,  $J$  = 9.6 Hz, 1H), 2.45 (s, 3H), 2.39–2.17 (m, 1H), 1.34 (s, 3H), 1.30 (t,  $J$  = 7.2 Hz, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.2 Hz), 144.5(s), 143.9(s), 142.2 (s), 141.0 (s), 131.4 (s), 130.3 (s), 129.7 (s), 128.8 (s), 128.0 (s), 127.4 (s), 127.1 (s), 126.8 (s), 126.6 (s), 126.1 (s), 115.8 (t,  $J$  = 252.8 Hz), 63.0 (s), 60.0 (s), 52.4 (s), 43.9 (d,  $J$  = 3.0 Hz), 40.5 (t,  $J$  = 21.0 Hz), 25.3 (d,  $J$  = 2.0 Hz), 21.5 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.5 (d,  $J$  = 263.2 Hz, 1F), -103.4 (d,  $J$  = 263.2 Hz, 1F)

HRMS (ESI) Calcd for  $\text{C}_{28}\text{H}_{29}\text{F}_2\text{NO}_4\text{S}_2$ :  $[\text{M}] + \text{Na} = 568.1398$ . Found: 568.1399.



**(Z)-ethyl**

**2,2-difluoro-3-(3-methyl-4-(phenyl(*p*-tolyl)methylene)-1-tosylpyrrolidin-3-yl)propanoate**

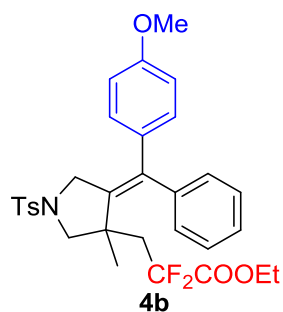
White solid; melting point 43–45 °C; 75.2 mg; 68% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.63 (d,  $J$  = 8.4 Hz, 2H), 7.35 (d,  $J$  = 8.0 Hz, 2H), 7.29–7.25 (m, 2H), 7.21 (d,  $J$  = 8.0 Hz, 1H), 7.09–7.07 (m, 2H), 6.95 (d,  $J$  = 8.0 Hz, 2H), 4.27–4.18 (m, 2H), 3.78 (d,  $J$  = 14.4 Hz, 1H), 3.68 (d,  $J$  = 14.4 Hz, 1H), 3.19 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.47 (s, 3H), 2.30 (s, 3H), 2.13–2.04 (m, 2H), 1.27 (t,  $J$  = 7.2 Hz, 3H), 1.19 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.4 Hz), 143.8 (s), 140.4 (s), 139.8 (s), 139.6 (s), 137.5 (s), 136.8 (s), 131.3 (s), 129.6 (s), 129.4 (s), 128.6 (s), 128.2 (s), 128.0 (s), 127.1 (s), 127.0 (s), 115.7 (t,  $J$  = 253.0 Hz), 62.9 (s), 59.9 (s), 52.1 (s), 43.5 (d,  $J$  = 3.0 Hz), 41.1 (t,  $J$  = 22.0 Hz), 25.7 (s), 21.5 (s), 21.0 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.8 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{31}\text{H}_{33}\text{F}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 576.1991. Found: 576.1991.



***(Z)*-ethyl**

***2,2-difluoro-3-(4-((4-methoxyphenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate***

White solid; melting point 42–44 °C; 75.1 mg; 66% yield.

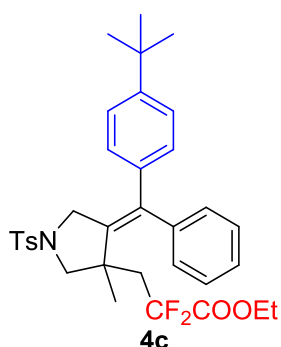
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.64 (d,  $J$  = 8.0 Hz, 2H), 7.34 (d,  $J$  = 8.0 Hz, 2H), 7.29–7.25 (m, 2H), 7.22–7.21 (m, 1H), 7.14–7.12 (m, 2H), 6.99 (d,  $J$  = 8.4 Hz 2H), 6.79 (d,  $J$  = 8.4 Hz 2H), 4.26–4.19 (m, 2H), 3.81–3.69 (m, 5H), 3.21 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.45 (s, 3H), 2.14–2.03 (m, 2H), 1.27 (t,  $J$  = 7.2 Hz, 3H), 1.18 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.8 Hz), 158.5 (s), 143.8 (s), 140.1 (s), 139.9 (s), 137.2 (s), 134.9 (s), 131.6 (s), 129.6 (s), 128.6 (s), 128.4 (s), 128.2 (s), 128.0 (s), 127.1 (s), 115.8 (t,  $J$  = 251.0 Hz), 114.0 (s), 62.9 (s), 59.9 (s), 55.2 (s), 52.2 (s), 43.6 (d,  $J$  = 2.0 Hz), 41.2 (t,  $J$  = 22.0 Hz), 25.8 (s), 21.5 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.7 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{31}\text{H}_{33}\text{F}_2\text{NO}_5\text{S}$ :  $[\text{M}] + \text{Na}$  = 592.1940. Found: 592.1939.





**(Z)-ethyl**

**3-(4-((4-(tert-butyl)phenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

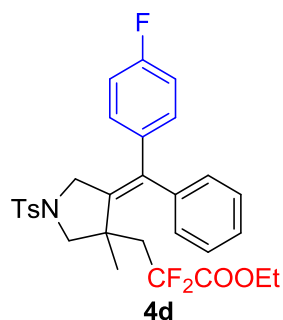
White solid; melting point 42–44 °C; 75.0 mg; 63% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.65 (d,  $J$  = 8.0 Hz, 2H), 7.36 (d,  $J$  = 8.0 Hz, 2H), 7.28–7.26 (m, 4H), 7.23–7.21 (m, 1H), 7.16–7.14 (m, 2H), 6.98 (d,  $J$  = 8.0 Hz 2H), 4.26–4.19 (m, 2H), 3.83 (d,  $J$  = 14.4 Hz 1H) 3.73 (d,  $J$  = 14.4 Hz 1H), 3.20 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.13–2.04 (m, 2H), 1.29 (s, 9H), 1.27–1.26 (m, 3H), 1.18 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.9 (t,  $J$  = 32.0 Hz), 149.9 (s), 143.8 (s), 140.5 (s), 139.9 (s), 139.4 (s), 137.6 (s), 131.7 (s), 129.7 (s), 128.8 (s), 128.2 (s), 128.1 (s), 127.1 (s), 126.8 (s), 125.6 (s), 115.8 (t,  $J$  = 253.0 Hz), 62.9 (s), 60.0 (s), 52.2 (s), 43.6 (d,  $J$  = 3.0 Hz), 41.2 (t,  $J$  = 22.0 Hz), 34.4 (s), 31.3 (s), 25.8 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.4 (d,  $J$  = 263.2 Hz, 1F), -103.7 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{34}\text{H}_{39}\text{F}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{H} = 596.2641$ . Found: 596.2650.



***(Z)*-ethyl**

***2,2-difluoro-3-(4-((4-fluorophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate***

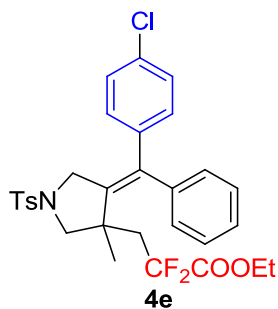
White solid; melting point 42–44 °C; 73.6 mg; 66% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.63 (d,  $J$  = 8.4 Hz, 2H), 7.35 (d,  $J$  = 8.0 Hz, 2H), 7.31–7.23 (m, 3H), 7.15–7.13 (m, 2H), 7.07–7.03 (m, 2H), 6.97 (t,  $J$  = 8.8 Hz, 2H), 4.27–4.20 (m, 2H), 3.74 (d,  $J$  = 14.8 Hz, 1H), 3.66 (d,  $J$  = 14.4 Hz, 1H), 3.22 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.14–2.05 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.19 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.9 (t,  $J$  = 32.2 Hz), 160.5 (s), 143.9 (s), 140.8 (s), 140.2 (s), 138.5 (d,  $J$  = 3.0 Hz), 136.7 (s), 131.6 (s), 129.7 (s), 129.0 (s), 129.0 (s), 128.7 (s), 128.4 (s), 128.1 (s), 127.5 (s), 115.8 (t,  $J$  = 21.2 Hz), 115.7 (t,  $J$  = 253.0 Hz), 63.1 (s), 60.0 (s), 52.2 (s), 43.7 (d,  $J$  = 3.0 Hz), 41.2 (t,  $J$  = 21.6 Hz), 25.9 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.6 (d,  $J$  = 263.2 Hz, 1F), -114.8 (s, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{30}\text{F}_3\text{NO}_4\text{S}$ :  $[\text{M}]^+\text{H} = 558.1920$ . Found: 558.1924.



**(Z)-ethyl**

**3-(4-((4-chlorophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

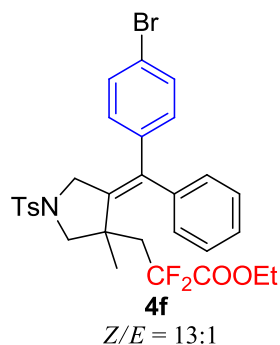
White solid; melting point 42–44 °C; 74.5 mg; 65% yield.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 7.63 (d, *J* = 8.4 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.29–7.25 (m, 5H), 7.15–7.13 (m, 5H), 7.03–7.01 (m, 2H), 4.27–4.21 (m, 2H), 3.72 (d, *J* = 14.4 Hz, 1H), 3.64 (d, *J* = 14.4 Hz, 1H), 3.21 (d, *J* = 9.6 Hz, 1H), 3.13 (d, *J* = 9.6 Hz, 1H), 2.46 (s, 3H), 2.14–2.04 (m, 2H), 1.28 (t, *J* = 7.2 Hz 3H), 1.19 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 163.8 (t, *J* = 32.4 Hz), 143.9 (s), 140.8 (s), 140.8 (s), 139.7 (s), 136.4 (s), 133.0 (s), 131.3 (s), 129.7 (s), 129.0 (s), 128.6 (s), 128.6 (s), 128.4 (s), 128.0 (s), 127.5 (s), 115.7 (t, *J* = 249.1 Hz), 63.0 (s), 59.8 (s), 52.1 (s), 43.7 (d, *J* = 2.8 Hz), 41.1 (t, *J* = 21.4 Hz), 25.8 (s), 21.6 (s), 13.8 (s).

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>) δ ppm -100.2 (d, *J* = 263.2 Hz, 1F), -103.7 (d, *J* = 263.2 Hz, 1F).

HRMS (ESI) Calcd for C<sub>30</sub>H<sub>30</sub>ClF<sub>2</sub>NO<sub>4</sub>S: [M]<sup>+</sup>+H = 574.1625. Found: 574.1620.



**(Z)-ethyl**

**3-(4-((4-bromophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

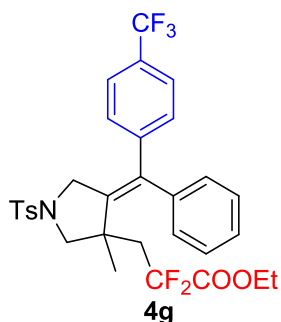
White solid; melting point 46–48 °C; 58.0 mg; 47% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.63 (d,  $J$  = 8.4 Hz, 2H), 7.41 (d,  $J$  = 8.4 Hz, 2H), 7.36 (d,  $J$  = 8.4 Hz, 2H), 7.31–7.25 (m, 3H), 7.14–7.12 (m, 2H), 6.96 (d,  $J$  = 8.4 Hz, 2H), 4.26–4.21 (m, 2H), 3.72 (d,  $J$  = 14.4 Hz, 1H), 3.64 (d,  $J$  = 14.4 Hz, 1H), 3.21 (d,  $J$  = 9.6 Hz, 1H), 3.13 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.14–2.05 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.19 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.4 Hz), 143.9 (s), 141.3 (s), 140.7 (s), 139.6 (s), 136.4 (s), 131.9 (s), 131.2 (s), 129.7 (s), 128.9 (s), 128.6 (s), 128.4 (s), 128.0 (s), 127.5 (s), 121.2 (s), 115.6 (t,  $J$  = 253.0 Hz), 63.0 (s), 59.8 (s), 52.1 (s), 43.7 (d,  $J$  = 2.6 Hz), 41.1 (t,  $J$  = 21.4 Hz), 25.8 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.1 (d,  $J$  = 263.2 Hz, 1F), -103.7 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{30}\text{BrF}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{H} = 618.1120$ . Found: 618.1123.



**(Z)-ethyl**

**2,2-difluoro-3-(3-methyl-4-(phenyl(4-(trifluoromethyl)phenyl)methylene)-1-tosylpyrrolidin-3-yl)propanoate**

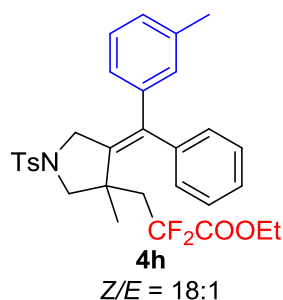
White solid; melting point 44–46 °C; 48.6 mg; 40% yield.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 7.63 (d, *J* = 8.0 Hz, 2H), 7.55 (d, *J* = 8.0 Hz, 2H), 7.36 (d, *J* = 8.0 Hz, 2H), 7.33–7.29 (m, 2H), 7.27–7.25 (m, 1H), 7.22 (d, *J* = 8.0 Hz, 2H), 7.18–7.16 (m, 2H), 4.28–4.22 (m, 2H), 3.71 (d, *J* = 14.4 Hz, 1H), 3.64 (d, *J* = 14.4 Hz, 1H), 3.23 (d, *J* = 9.6 Hz, 1H), 3.14 (d, *J* = 9.6 Hz, 1H), 2.46 (s, 3H), 2.17–2.07 (m, 2H), 1.29 (t, *J* = 7.2 Hz 3H), 1.21 (s, 3H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 163.7 (t, *J* = 32.0 Hz), 145.9 (s), 144.0 (s), 141.2 (s), 139.3 (s), 136.3 (s), 131.1 (s), 129.7 (s), 129.2 (q, *J* = 32.2 Hz), 128.6, 128.5 (s), 128.0 (s), 127.7 (s), 127.6 (s), 125.9–125.8 (m) 123.9 (q, *J* = 269.2 Hz), 115.7 (t, *J* = 248.2 Hz), 63.1 (s), 59.8 (s), 52.0 (s), 43.8 (d, *J* = 2.6 Hz), 41.1 (t, *J* = 21.0 Hz), 25.8 (s), 21.6 (s), 13.8 (s).

<sup>19</sup>F NMR (376 MHz, CDCl<sub>3</sub>) δ ppm -62.509(s, 3F), -100.0 (d, *J* = 263.2 Hz, 1F), -103.7 (d, *J* = 263.2 Hz, 1F).

HRMS (ESI) Calcd for C<sub>31</sub>H<sub>30</sub>F<sub>5</sub>NO<sub>4</sub>S: [M]<sup>+</sup>+H = 608.1888. Found: 608.1899.



**(Z)-ethyl**

**2,2-difluoro-3-(3-methyl-4-(phenyl(*m*-tolyl)methylene)-1-tosylpyrrolidin-3-yl)propanoate**

White solid; melting point 42–44 °C; 74.1 mg; 67% yield.

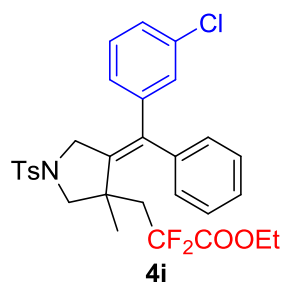
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.62 (d,  $J$  = 8.0 Hz, 2H), 7.35 (d,  $J$  = 8.0 Hz, 2H), 7.29–7.26 (m, 2H), 7.22 (d,  $J$  = 7.2 Hz, 1H), 7.16–7.15 (m, 2H), 7.01 (d,  $J$  = 7.6 Hz 1H), 6.88–6.85 (m, 2H), 4.27–4.20 (m, 2H), 3.76 (d,  $J$  = 14.4 Hz, 1H), 3.66 (d,  $J$  = 14.4 Hz, 1H), 3.19 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.29 (s, 3H), 2.13–2.04 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.20 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.2 Hz), 143.8 (s), 142.4 (s), 140.3 (s), 139.8 (s), 138.4 (s), 137.7 (s), 131.3 (s), 129.6 (s), 128.5 (s), 128.2 (s), 128.0 (s), 127.9 (s), 127.7 (s), 127.1 (s), 115.7 (t,  $J$  = 249.0 Hz), 62.9 (s), 59.9 (s), 52.1 (s), 43.5 (d,  $J$  = 2.0 Hz), 41.1 (t,  $J$  = 21.4 Hz), 25.7 (s), 21.5 (s), 21.4 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.8 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{31}\text{H}_{33}\text{F}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 576.1991. Found:

576.1994.



**(Z)-ethyl**

**3-(4-((3-chlorophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

White solid; melting point 42–44 °C; 86.0 mg; 75% yield.

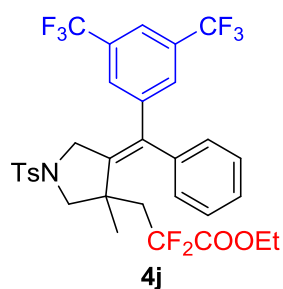
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.63 (d,  $J$  = 8.0 Hz, 2H), 7.35 (d,  $J$  = 8.0 Hz, 2H), 7.29–7.27 (m, 2H), 7.26–7.24 (m, 1H), 7.22–7.19 (m, 2H), 7.16–7.14 (m, 2H), 7.06 (s, 1H), 6.98–6.97 (m, 1H), 4.28–4.20 (m, 2H), 3.74 (d,  $J$  = 14.8 Hz, 1H), 3.66 (d,  $J$  = 14.4 Hz, 1H), 3.22 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.46 (s, 3H), 2.14–2.03 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz 3H), 1.18 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.7 (t,  $J$  = 32.4 Hz), 144.1 (s), 143.9 (s), 141.1 (s), 139.5 (s), 136.3 (s), 134.5 (s), 131.4 (s), 130.2 (s), 129.7 (s), 128.6 (s), 128.0 (s), 127.5 (s), 127.3 (s), 127.3 (s), 125.4 (s), 115.8 (t,  $J$  = 252.8 Hz), 63.0 (s), 59.8 (s), 52.1 (s), 43.7 (d,  $J$  = 2.0 Hz), 41.1 (t,  $J$  = 21.6 Hz), 25.7 (s), 21.5 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263,2 Hz, 1F), -103.5 (d,  $J$  = 263,2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{30}\text{ClF}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{H} = 574.1625$ . Found:

574.1628.



**(Z)-ethyl**

**3-(4-((3,5-bis(trifluoromethyl)phenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

White solid; melting point 46–48 °C; 52.7 mg; 39% yield.

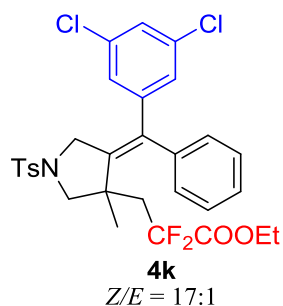
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.77 (s, 1H), 7.61 (d,  $J$  = 8.4 Hz, 2H), 7.51 (s, 2H) 7.39–7.31 (m, 5H), 7.18–7.16 (m, 2H), 4.29–4.23 (m, 2H), 3.66 (d,  $J$  = 14.4 Hz, 1H), 3.58 (d,  $J$  = 14.4 Hz, 1H), 3.21 (d,  $J$  = 9.6 Hz, 1H), 3.14 (d,  $J$  = 9.6 Hz, 1H), 2.49 (s, 3H), 2.16–2.07 (m, 2H), 1.30 (t,  $J$  = 7.2 Hz 3H), 1.23 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.7 (t,  $J$  = 32.4 Hz), 144.3 (s), 144.2 (s), 143.0 (s), 138.3 (s), 134.9 (s), 132.2 (q,  $J$  = 33.2 Hz), 130.4 (s), 129.8 (s), 128.8 (s), 128.7 (s), 128.2 (s), 128.1 (s), 127.7 (s), 123.0 (q,  $J$  = 271.2 Hz), 121.3–121.2 (m) 115.6 (t,  $J$  = 252.8 Hz), 63.1 (s), 59.9 (s), 52.3 (s), 44.0 (d,  $J$  = 2.6 Hz), 41.0 (t,  $J$  = 21.6 Hz), 25.8 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -62.78(s, 6F), -100.3 (d,  $J$  = 265.3 Hz, 1F), -103.5 (d,  $J$  = 265.3 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{32}\text{H}_{29}\text{F}_8\text{NO}_4\text{S}$ :  $[\text{M}] + \text{H} = 676.1762$  Found: 676.1770.





**(Z)-ethyl**

**3-(4-((3,5-dichlorophenyl)(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

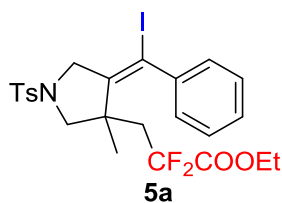
White solid; melting point 54–56 °C; 70.4 mg; 58% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.65 (d,  $J$  = 8.4 Hz, 2H), 7.38 (d,  $J$  = 8.0 Hz, 2H), 7.33–7.27 (m, 3H), 7.23–7.22 (s, 1H), 7.14–7.13 (m, 2H), 6.97–6.96 (m, 2H), 4.28–4.22 (m, 2H), 3.72 (d,  $J$  = 14.4 Hz, 1H), 3.65 (d,  $J$  = 14.4 Hz, 1H), 3.22 (d,  $J$  = 9.6 Hz, 1H), 3.12 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.12–2.03 (m, 2H), 1.29 (t,  $J$  = 7.2 Hz 3H), 1.18 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.7 (t,  $J$  = 32.2 Hz), 145.0 (s), 144.1 (s), 141.8 (s), 138.8 (s), 135.3 (s), 135.1 (s), 131.0 (s), 129.8 (s), 128.6(s), 128.6(s), 128.0(s), 127.8 (s), 127.4 (s), 125.7 (s), 115.6 (t,  $J$  = 253.0 Hz), 63.1 (s), 59.8 (s), 52.0 (s), 43.8 (d,  $J$  = 2.6 Hz), 41.0 (t,  $J$  = 21.4 Hz), 25.7 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 267.0 Hz, 1F), -103.7 (d,  $J$  = 267.0 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{30}\text{H}_{29}\text{Cl}_2\text{F}_2\text{NO}_4\text{S}$ :  $[\text{M}] + \text{H} = 608.1235$ . Found: 608.1238.



**(Z)-ethyl**

**2,2-difluoro-3-(4-(iodo(phenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

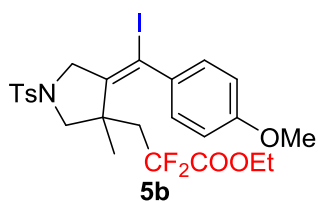
White solid; melting point 36–38 °C; 90.7 mg; 77% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.75 (d,  $J$  = 8.0 Hz, 2H), 7.41 (d,  $J$  = 8.0 Hz, 2H), 7.33–7.29 (m, 2H), 7.18–7.16 (m, 2H), 4.28–4.194 (m, 2H), 3.95 (d,  $J$  = 15.2 Hz, 1H), 3.79 (d,  $J$  = 15.2 Hz, 1H), 3.34 (d,  $J$  = 9.6 Hz, 1H), 3.25 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.07–1.92 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.10 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.6 (t,  $J$  = 32.2 Hz), 148.6 (s), 144.1 (s), 142.7 (s), 131.3 (s), 129.9 (s), 128.5 (s), 128.4 (s), 128.1 (s), 127.8 (s), 115.3 (t,  $J$  = 253.1 Hz), 93.5 (s), 63.1 (s), 61.0 (s), 60.7 (s), 45.3 (d,  $J$  = 2.0 Hz), 40.8 (t,  $J$  = 21.0 Hz), 24.8 (d,  $J$  = 2.0 Hz), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.4 (d,  $J$  = 263.2 Hz, 1F), -103.9 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{24}\text{H}_{26}\text{F}_2\text{INO}_4\text{S}$ :  $[\text{M}] + \text{Na} = 612.0487$ . Found: 612.0482.



**(Z)-ethyl**

**2,2-difluoro-3-(4-(iodo(4-methoxyphenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

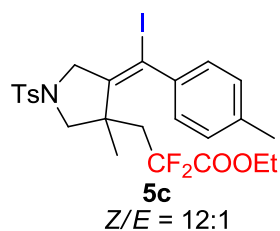
White solid; melting point 40–42 °C; 99.0 mg; 80% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 8.21 (d,  $J$  = 9.2 Hz, 2H), 7.75 (d,  $J$  = 8.4 Hz, 2H), 7.42 (d,  $J$  = 8.0 Hz, 2H), 7.37 (d,  $J$  = 8.4 Hz, 2H), 4.30–4.24 (m, 2H), 3.90 (s, 2H), 3.45 (d,  $J$  = 9.6 Hz, 1H), 3.16 (d,  $J$  = 9.6 Hz, 1H), 2.49 (s, 3H), 2.13–1.97 (m, 2H), 1.29 (t,  $J$  = 7.2 Hz, 3H), 1.05 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.4 (t,  $J$  = 32.2 Hz), 150.3 (s), 148.9 (s), 147.3 (s), 144.3 (s), 131.0 (s), 129.9 (s), 129.1 (s), 128.1 (s), 123.7 (s), 115.0 (t,  $J$  = 253.0 Hz), 89.4 (s), 63.4 (s), 61.2 (s), 60.6 (s), 45.3 (d,  $J$  = 3.0 Hz), 41.1 (t,  $J$  = 21.9 Hz), 24.9 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -99.9(d,  $J$  = 267.0 Hz, 1F), -103.6 (d,  $J$  = 267.0 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{25}\text{H}_{28}\text{F}_2\text{INO}_5\text{S}$ :  $[\text{M}] + \text{Na}$  = 657.0338. Found: 657.0328.



**(Z)-ethyl**

**2,2-difluoro-3-(4-(iodo(*p*-tolyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

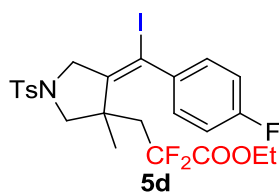
White solid; melting point 40–42 °C; 85.6 mg; 71% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.0 Hz, 2H), 7.40 (d,  $J$  = 8.0 Hz, 2H), 7.11 (d,  $J$  = 8.0 Hz, 2H), 7.05 (d,  $J$  = 8.2 Hz, 2H), 4.27–4.21 (m, 2H), 3.92 (d,  $J$  = 15.2 Hz, 1H), 3.79 (d,  $J$  = 15.2 Hz, 1H), 3.34 (d,  $J$  = 9.6 Hz, 1H), 3.23 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.33 (s, 3H), 2.09–1.95 (m, 2H), 1.27 (t,  $J$  = 7.2 Hz, 3H), 1.10 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.6 (t,  $J$  = 32.2 Hz), 148.3 (s), 144.0 (s), 139.8 (s), 138.5 (s), 131.2 (s), 129.8 (s), 129.0 (s), 128.1 (s), 127.7 (s), 115.3 (t,  $J$  = 254.0 Hz), 94.0 (s), 63.0 (s), 61.0 (s), 60.6 (s), 45.2 (d,  $J$  = 2.0 Hz), 40.8 (t,  $J$  = 21.8 Hz), 24.8 (s), 21.6 (s), 21.2 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.4 (d,  $J$  = 263.2 Hz, 1F), -103.8 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{25}\text{H}_{28}\text{F}_2\text{INO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 626.0644. Found: 626.0645.



**(Z)-ethyl**

**2,2-difluoro-3-(4-((4-fluorophenyl)iodomethylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

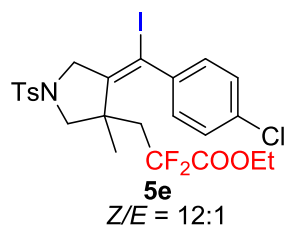
White solid; melting point 42–44 °C; 85.0 mg; 70% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.0 Hz, 2H), 7.40 (d,  $J$  = 8.0 Hz, 2H), 7.18–7.15 (m, 2H), 7.04–7.00 (m, 2H), 4.29–4.22 (m, 2H), 3.92 (d,  $J$  = 15.2 Hz, 1H), 3.79 (d,  $J$  = 15.2 Hz, 1H), 3.36 (d,  $J$  = 9.6 Hz, 1H), 3.22 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.08–1.94 (m, 2H), 1.29 (t,  $J$  = 7.2 Hz, 3H), 1.09 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.5 (t,  $J$  = 32.3 Hz), 162.1 (d,  $J$  = 248.5 Hz), 149.3 (s), 144.1 (s), 138.7 (d,  $J$  = 3.6 Hz), 131.0 (s), 129.8 (s), 129.7 (s), 128.1 (s), 115.5 (t,  $J$  = 21.7 Hz), 115.2 (t,  $J$  = 253.4 Hz), 112.7 (s), 92.1 (s), 63.2 (s), 61.1 (s), 60.6 (s), 45.3 (d,  $J$  = 2.6 Hz), 40.9 (t,  $J$  = 21.7 Hz), 24.8 (d,  $J$  = 1.6 Hz), 21.6 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.8 (d,  $J$  = 263.2 Hz, 1F), -111.6 (s, 1F).

HRMS (ESI) Calcd for  $\text{C}_{24}\text{H}_{25}\text{F}_3\text{INO}_4\text{S}$ :  $[\text{M}] + \text{Na} = 630.0393$ . Found: 630.0391.



**(Z)-ethyl**

**3-(4-((4-chlorophenyl)iodomethylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

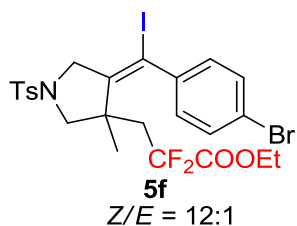
White solid; melting point 42–44 °C; 99.7 mg; 80% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.0 Hz, 2H), 7.41 (d,  $J$  = 8.0 Hz, 2H), 7.30 (d,  $J$  = 8.6 Hz, 2H), 7.12 (d,  $J$  = 8.4 Hz, 2H), 4.30–4.22 (m, 2H), 3.91 (d,  $J$  = 15.2 Hz, 1H), 3.80 (d,  $J$  = 15.2 Hz, 1H), 3.37 (d,  $J$  = 9.6 Hz, 1H), 3.21 (d,  $J$  = 9.5 Hz, 1H), 2.48 (s, 3H), 2.09–1.96 (m, 2H), 1.30 (t,  $J$  = 7.2 Hz, 3H), 1.08 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.5 (t,  $J$  = 32.2 Hz), 149.4 (s), 144.1 (s), 141.1 (s), 134.4 (s), 131.1 (s), 129.9 (s), 129.3 (s), 128.7 (s), 128.1 (s), 115.1 (t,  $J$  = 254.0 Hz), 91.7 (s), 63.2 (s), 61.1 (s), 60.6 (s), 45.3 (d,  $J$  = 3.0 Hz), 40.9 (t,  $J$  = 21.9 Hz), 24.9 (s), 21.6 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.2 (d,  $J$  = 267.0 Hz, 1F), -103.8 (d,  $J$  = 267.0 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{24}\text{H}_{25}\text{ClF}_2\text{INO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 646.0095. Found: 646.0098.



**(Z)-ethyl**

**3-(4-((4-bromophenyl)iodomethylene)-3-methyl-1-tosylpyrrolidin-3-yl)-  
2,2-difluoropropanoate**

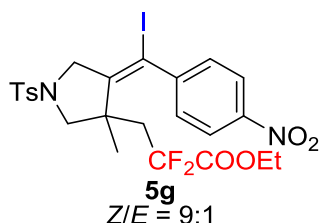
White solid; melting point 44–46 °C; 98.7 mg; 74% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.4 Hz, 2H), 7.46 (d,  $J$  = 8.4 Hz, 2H), 7.40 (d,  $J$  = 8.0 Hz, 2H), 7.06 (d,  $J$  = 8.4 Hz, 2H), 4.31–4.22 (m, 2H), 3.91 (d,  $J$  = 15.2 Hz, 1H), 3.80 (d,  $J$  = 15.2 Hz, 1H), 3.37 (d,  $J$  = 9.6 Hz, 1H), 3.21 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.09–1.96 (m, 2H), 1.30 (t,  $J$  = 7.2 Hz, 3H), 1.08 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.5 (t,  $J$  = 32.2 Hz), 149.4 (s), 144.2 (s), 141.6 (s), 131.6 (s), 131.1 (s), 129.9 (s), 129.5 (s), 128.1 (s), 122.6 (s), 115.1 (t,  $J$  = 253.6 Hz), 91.6 (s), 63.3 (s), 61.1 (s), 60.6 (s), 45.4 (d,  $J$  = 3.0 Hz), 40.9 (t,  $J$  = 21.6 Hz), 24.9 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.1 (d,  $J$  = 266.0 Hz, 1F), -103.8 (d,  $J$  = 266.0 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{24}\text{H}_{25}\text{BrF}_2\text{INO}_4\text{S}$ :  $[\text{M}] + \text{H} = 667.9773$ . Found: 667.9770.



**(Z)-ethyl**

**2,2-difluoro-3-(4-(iodo(4-nitrophenyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

Yellow solid; melting point 44–46 °C; 67.2 mg; 53% yield.

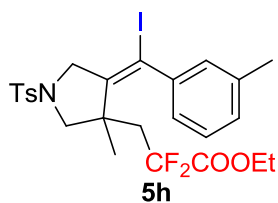
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.4 Hz, 2H), 7.40 (d,  $J$  = 8.0 Hz, 2H), 7.10 (d,  $J$  = 8.8 Hz, 2H), 6.82 (d,  $J$  = 8.8 Hz, 2H), 4.28–4.22 (m, 2H), 3.91 (d,  $J$  = 15.2 Hz, 1H), 3.80 (s, 3H), 3.77 (d,  $J$  = 15.2 Hz, 1H), 3.33 (d,  $J$  = 9.6 Hz, 1H), 3.23 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.09–1.96 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.11 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.6 (t,  $J$  = 32.4 Hz), 159.4 (s), 148.6 (s), 144.1 (s), 135.1 (s), 131.2 (s), 129.8 (s), 129.2 (s), 128.1 (s), 115.3 (t,  $J$  = 253.0 Hz), 112.8 (s), 94.2 (s), 63.1 (s), 61.1 (s), 60.6 (s), 55.2 (s), 45.2 (d,  $J$  = 2.6 Hz), 40.8 (t,  $J$  = 22.0 Hz), 24.9 (s), 21.6 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 263.2 Hz, 1F), -103.7 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{24}\text{H}_{25}\text{F}_2\text{IN}_2\text{O}_6\text{S}$ :  $[\text{M}] + \text{Na}$  = 642.0593. Found: 642.0593





**(Z)-ethyl**

**2,2-difluoro-3-(4-(iodo(*m*-tolyl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

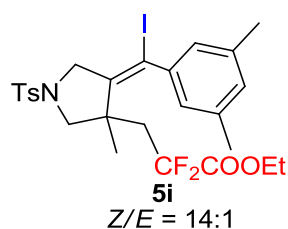
White solid; melting point 39–41 °C; 91.7 mg; 76% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.4 Hz, 2H), 7.40 (d,  $J$  = 8.0 Hz, 2H), 7.21–7.17 (m, 1H), 7.07 (d,  $J$  = 7.6 Hz, 1H), 6.99–6.96 (m, 2H), 4.27–4.20 (m, 2H), 3.93 (d,  $J$  = 15.2 Hz, 1H), 3.78 (d,  $J$  = 15.2 Hz, 1H), 3.33 (d,  $J$  = 9.6 Hz, 1H), 3.25 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.31 (s, 3H), 2.09–1.90 (m, 2H), 1.27 (t,  $J$  = 7.2 Hz, 3H), 1.10 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.6 (t,  $J$  = 32.4 Hz), 148.2 (s), 144.1 (s), 142.5 (s), 138.1 (s), 131.2 (s), 129.8 (s), 129.3 (s), 128.4 (s), 128.2 (s), 128.1 (s), 124.8 (s), 115.3 (t,  $J$  = 253.0 Hz), 93.8 (s), 63.0 (s), 61.0 (s), 60.6 (s), 45.3 (d,  $J$  = 2.6 Hz), 40.8 (t,  $J$  = 21.7 Hz), 24.8 (d,  $J$  = 2.0 Hz), 21.6 (s), 21.3 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.4 (d,  $J$  = 263.2 Hz, 1F), -103.9 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{25}\text{H}_{28}\text{F}_2\text{INO}_4\text{S}$ :  $[\text{M}] + \text{H} = 604.0825$ . Found: 604.0821.



**(Z)-ethyl**

**3-(4-((3,5-dimethylphenyl)iodomethylene)-3-methyl-1-tosylpyrrolidin-3-yl)-2,2-difluoropropanoate**

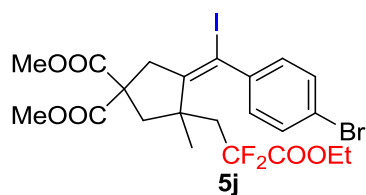
White solid; melting point 42–44 °C; 96.3 mg; 78% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.0 Hz, 2H), 7.40 (d,  $J$  = 8.0 Hz, 2H), 6.89 (s, 1H), 6.78 (s, 2H), 4.27–4.21 (m, 2H), 3.94 (d,  $J$  = 14.8 Hz, 1H), 3.76 (d,  $J$  = 14.8 Hz, 1H), 3.32 (d,  $J$  = 9.6 Hz, 1H), 3.25 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.26 (s, 6H), 2.08–1.95 (m, 2H), 1.28 (t,  $J$  = 7.2 Hz, 3H), 1.11 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.6 (t,  $J$  = 32.2 Hz), 147.9 (s), 144.0 (s), 142.4 (s), 137.9 (s), 131.1 (s), 130.2 (s), 128.1 (s), 125.5 (s), 115.3 (t,  $J$  = 253.0 Hz), 94.1 (s), 63.0 (s), 61.0 (s), 60.6 (s), 45.2 (d,  $J$  = 2.0 Hz), 40.7 (t,  $J$  = 21.0 Hz), 24.9 (s), 21.6 (s), 21.2 (s), 13.7 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.7 (d,  $J$  = 263.2 Hz, 1F), -103.8 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{26}\text{H}_{30}\text{F}_2\text{INO}_4\text{S}$ :  $[\text{M}] + \text{Na}$  = 640.0800. Found: 640.0801



***(E)*-dimethyl**

***4-((4-bromophenyl)iodomethylene)-3-(3-ethoxy-2,2-difluoro-3-oxopropyl)-3-methylcyclopentane-1,1-dicarboxylate***

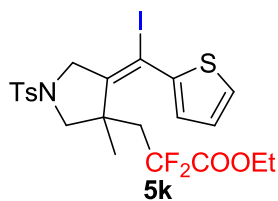
White solid; melting point 43–45 °C; 89.2 mg; 71% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.46 (d,  $J$  = 8.8 Hz, 2H), 7.00 (d,  $J$  = 8.0 Hz, 2H), 4.24–4.20 (m, 2H), 3.80 (s, 3H), 3.77 (s, 3H), 3.48–3.43 (m, 1H), 3.17 (d,  $J$  = 18.0 Hz, 1H), 2.86 (d,  $J$  = 14.0 Hz, 1H), 2.65 (d,  $J$  = 14.0 Hz, 1H), 2.06–1.92 (m, 2H), 1.29 (t,  $J$  = 7.2 Hz, 3H), 1.02 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 171.9 (s), 171.7 (s), 163.9 (t,  $J$  = 32.0 Hz), 153.7 (s), 142.6 (s), 131.4 (s), 130.0 (s), 122.2 (s), 115.5 (t,  $J$  = 252.0 Hz), 92.4 (s), 63.0 (s), 56.6 (s), 53.2 (s), 53.1 (s), 50.5 (s), 48.1 (s), 44.9 (d,  $J$  = 1.4 Hz), 42.9 (t,  $J$  = 21.2 Hz), 27.3 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -101.4 (d,  $J$  = 263.2 Hz, 1F), -103.3 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{22}\text{H}_{24}\text{BrF}_2\text{IO}_6$ :  $[\text{M}] + \text{Na}$  = 650.9661. Found: 650.9656.



**(Z)-ethyl**

**2,2-difluoro-3-(4-(iodo(thiophen-2-yl)methylene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

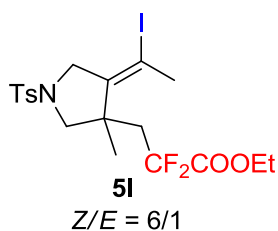
White solid; melting point 38–40 °C; 71.4 mg; 60% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.74 (d,  $J$  = 8.0 Hz, 2H), 7.40 (d,  $J$  = 8.0 Hz, 2H), 7.36–7.34 (m, 1H), 6.98–6.97 (m, 1H), 6.93–6.90 (m, 1H), 4.29–4.25 (m, 2H), 3.93 (d,  $J$  = 15.2 Hz, 1H), 3.76 (d,  $J$  = 15.2 Hz, 1H), 3.34 (d,  $J$  = 9.6 Hz, 1H), 3.28 (d,  $J$  = 9.6 Hz, 1H), 2.48 (s, 3H), 2.21–2.05 (m, 2H), 1.31 (t,  $J$  = 7.2 Hz, 3H), 1.21 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.6 (t,  $J$  = 32.0 Hz), 153.2 (s), 144.2 (s), 144.1 (s), 131.1 (s), 129.9 (s), 128.1 (s), 127.6 (s), 126.9 (s), 126.7 (s), 115.4 (t,  $J$  = 252.0 Hz), 83.7 (s), 63.2 (s), 61.3 (s), 60.7 (s), 45.8 (d,  $J$  = 3.0 Hz), 40.2 (t,  $J$  = 22.0 Hz), 24.4 (s), 21.6 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.7 (d,  $J$  = 263.2 Hz, 1F), -103.7 (d,  $J$  = 263.2 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{22}\text{H}_{24}\text{F}_2\text{INO}_4\text{S}_2$ :  $[\text{M}] + \text{Na}$  = 618.0052. Found: 618.0049.



**(Z)-ethyl**

**2,2-difluoro-3-(4-(1-iodoethylidene)-3-methyl-1-tosylpyrrolidin-3-yl)propanoate**

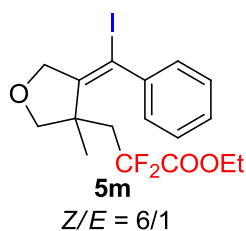
White liquid; 81.2 mg; 77% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.70 (d,  $J$  = 8.4 Hz, 2H), 7.38 (d,  $J$  = 8.0 Hz, 2H), 4.37–4.31 (m, 2H), 3.79–3.74 (m, 1H), 3.63–3.62 (m, 1H), 3.54 (d,  $J$  = 15.2 Hz, 1H), 2.98 (d,  $J$  = 9.6 Hz, 1H), 2.59 (s, 3H), 2.53–2.32 (m, 2H), 2.46 (s, 3H), 1.42–1.35 (m, 2H), 1.37 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 32.0 Hz), 145.4 (s), 144.1 (s), 131.3 (s), 129.8 (s), 128.1 (s), 115.6 (t,  $J$  = 249.0 Hz), 94.0 (s), 63.4 (s), 61.5 (s), 44.1 (d,  $J$  = 3.0 Hz), 40.3 (t,  $J$  = 22.0 Hz), 30.5 (s), 23.0 (s), 21.6 (s), 13.9 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -100.3 (d,  $J$  = 267.7 Hz, 1F), -103.2 (d,  $J$  = 267.3 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{19}\text{H}_{24}\text{F}_2\text{INO}_4\text{S}$ :  $[\text{M}] + \text{H} = 528.0512$ . Found: 528.0513.



**(Z)-ethyl**

**2,2-difluoro-3-(4-(iodo(phenyl)methylene)-3-methyltetrahydrofuran-3-yl  
l)propanoate**

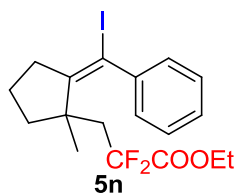
White liquid; 26.4 mg; 30% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.37–7.34 (m, 2H), 7.31–7.26 (m, 3H), 4.43 (d,  $J$  = 14.8 Hz, 1H), 4.39 (d,  $J$  = 14.8 Hz, 1H), 4.26–4.20 (m, 2H), 4.05 (d,  $J$  = 8.8 Hz, 1H), 3.83–3.81 (m, 1H), 2.18–1.95 (m, 2H), 1.29 (t,  $J$  = 8.0 Hz, 3H), 1.05 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.7 (t,  $J$  = 32.0 Hz), 151.8 (s), 142.7 (s), 128.4 (s), 128.3 (s), 128.1 (s), 115.5 (t,  $J$  = 253.0 Hz), 89.5 (s), 81.0 (s), 80.1 (s), 62.9 (s), 46.6 (d,  $J$  = 3.0 Hz), 40.8 (t,  $J$  = 22.0 Hz), 23.4 (t,  $J$  = 2.0 Hz), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -99.2 (d,  $J$  = 265.1 Hz, 1F), -104.3 (d,  $J$  = 264.7 Hz, 1F).

HRMS (ESI) Calcd for  $\text{C}_{17}\text{H}_{19}\text{F}_2\text{IO}_3$ :  $[\text{M}] + \text{Na}$  = 459.0239. Found: 459.0240.



***(E)-ethyl***

***2,2-difluoro-3-(2-(iodo(phenyl)methylene)-1-methylcyclopentyl)propanoate***

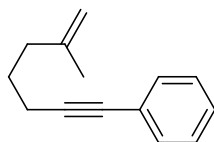
White liquid; 60.2 mg; 69% yield.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.32–7.28 (m, 2H), 7.25–7.23 (m, 3H), 4.22–4.17 (m, 2H), 2.71–2.54 (m, 2H), 2.01–1.99 (m, 2H), 1.91–1.81 (m, 2H), 1.79–1.72 (m, 2H), 1.26 (t,  $J = 7.2$  Hz, 3H), 1.05 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 164.7 (t,  $J = 32.0$  Hz), 156.4 (s), 144.4 (s), 128.6 (s), 128.1 (s), 127.8 (s), 116.0 (t,  $J = 250.0$  Hz), 93.3 (s), 62.7 (s), 45.4 (s), 44.3 (s), 42.4 (d,  $J = 7.2$  Hz), 26.5 (s), 21.9 (s), 13.8 (s).

$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -101.9 (s, 1F), -101.9 (s, 1F).

HRMS (ESI) Calcd for  $\text{C}_{18}\text{H}_{21}\text{F}_2\text{IO}_2$ :  $[\text{M}] + \text{Na} = 457.0447$ . Found: 457.0449.

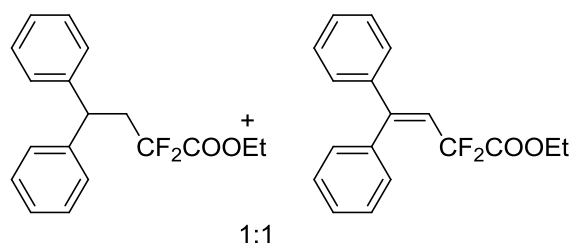


***(6-methylhept-6-en-1-yn-1-yl)benzene***

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.41–7.38 (m, 2H), 7.29–7.24 (m, 3H), 4.75–4.73 (m, 2H), 2.40 (t,  $J = 7.2$  Hz, 2H), 2.18 (t,  $J = 2.0$  Hz, 2H), 1.79–1.71 (m, 2H), 1.74 (s, 3H).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 145.0 (s), 131.5 (s), 128.2 (s), 127.5 (s), 124.0 (s), 110.4 (s), 90.0 (s), 80.8 (s), 36.9 (s), 26.7 (s), 22.4 (s), 18.9 (s).





***ethyl 2,2-difluoro-4,4-diphenylbutanoate***

***ethyl 2,2-difluoro-4,4-diphenylbut-3-enoate***

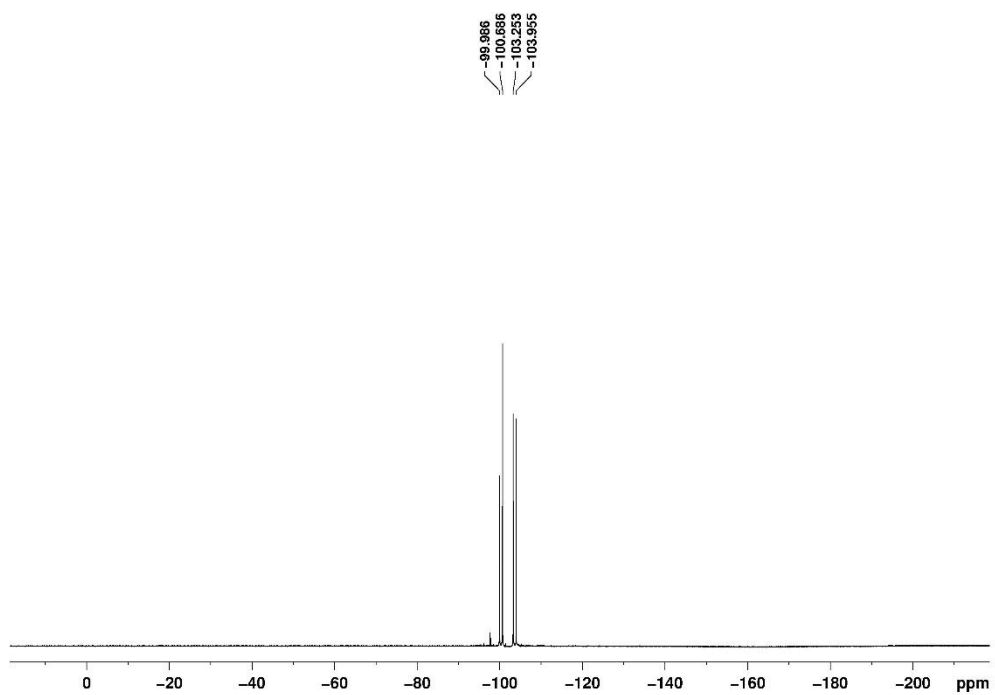
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 7.37–7.18 (m, 20H), 6.27 (d,  $J$  = 12.0 Hz, 1H), 4.27 (d,  $J$  = 7.2Hz, 1H), 3.89 (dd,  $J$  = 7.2Hz,  $J$  = 14.4Hz, 2H), 3.82 (dd,  $J$  = 7.2Hz,  $J$  = 14.4Hz, 2H), 2.98–2.89 (m, 2H), 1.16 (t,  $J$  = 7.2Hz, 3H), 1.16 (t,  $J$  = 7.2Hz, 3H).

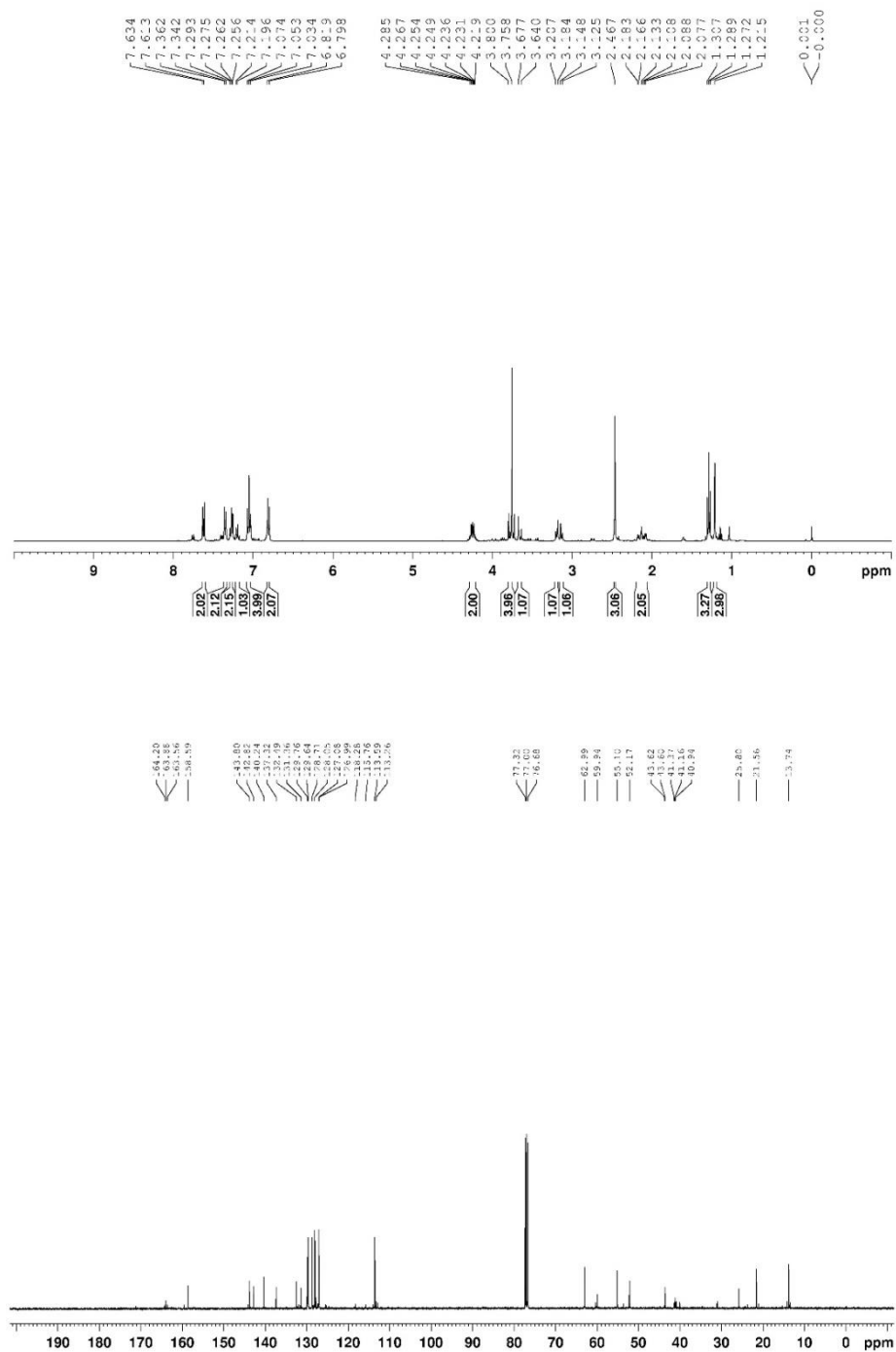
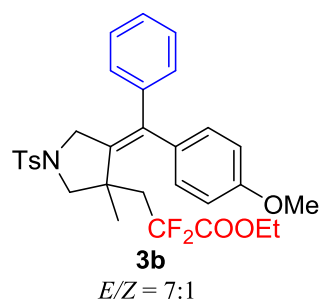
$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 163.8 (t,  $J$  = 33.0 Hz), 163.8 (t,  $J$  = 33.0 Hz), 150.1 (t,  $J$  = 9.0 Hz), 142.8 (s), 140.4 (s), 137.0 (s), 129.8 (s), 129.1 (s), 128.6 (s), 128.4 (s), 128.0 (s), 127.9 (s), 127.7 (s), 126.7 (s), 119.5 (t,  $J$  = 28.0 Hz), 115.6 (t,  $J$  = 249.0Hz), 112.5 (t,  $J$  = 243.0Hz), 62.7(s), 62.7 (s), 44.8 (t,  $J$  = 5.0Hz), 40.2 (t,  $J$  = 23.0Hz), 13.6 (s).

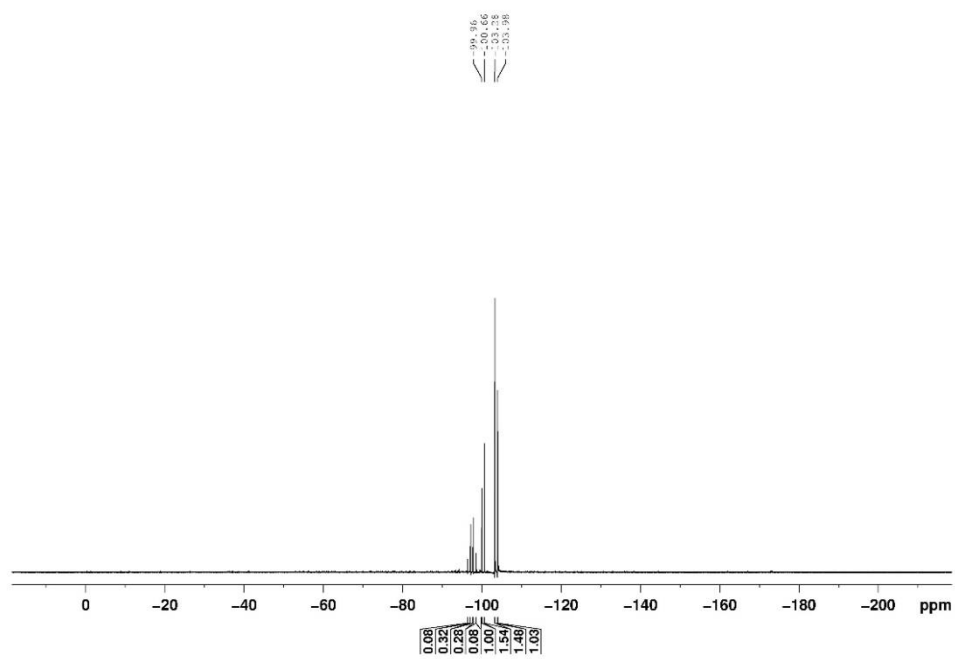
$^{19}\text{F}$  NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm -90.9 (s, 2F), -103.5 (s, 2F).

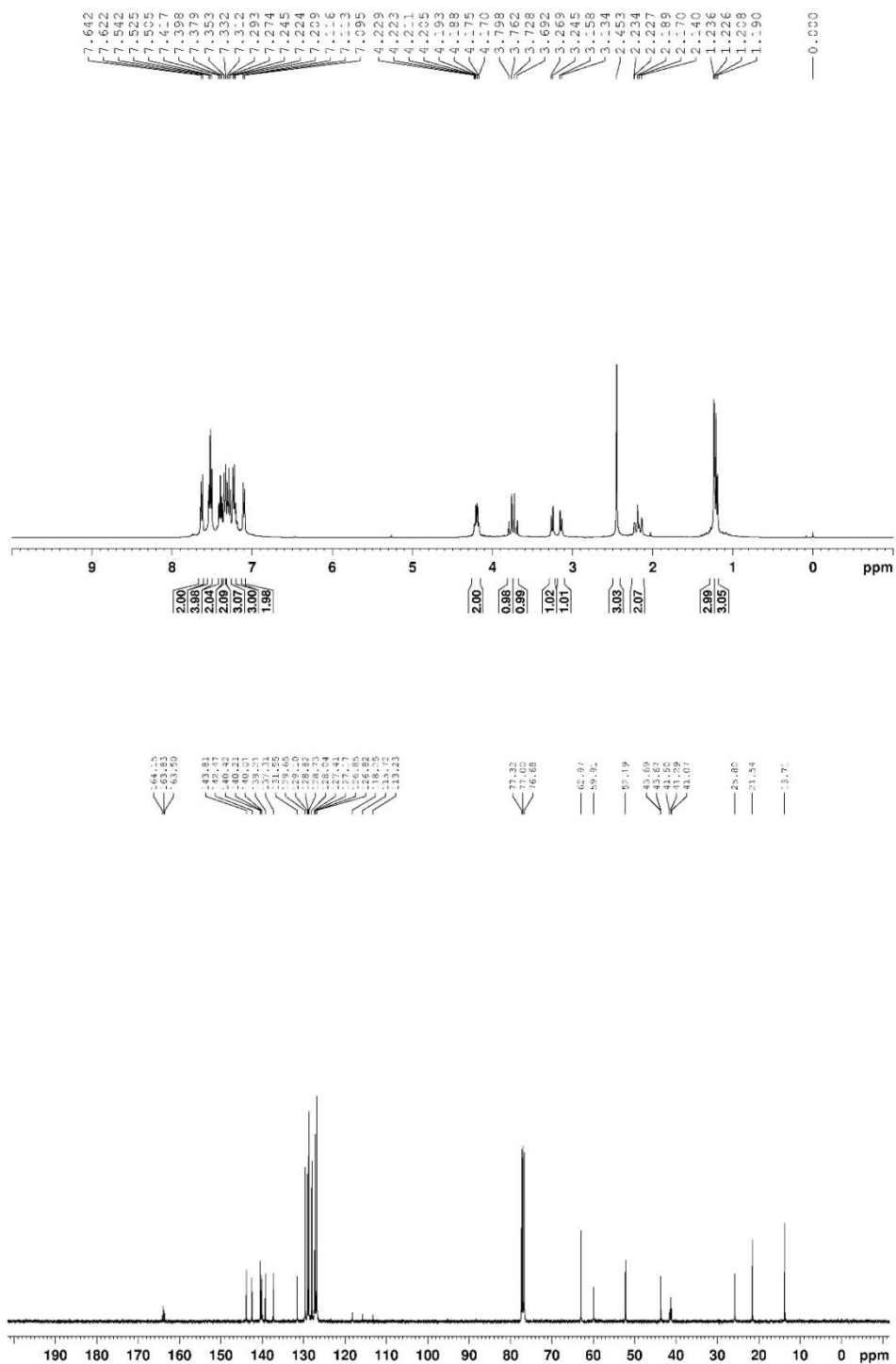
Chemical structure of compound **3a** is shown. It features a bicyclic core with a TsN group, a phenyl ring, and a  $\text{CF}_2\text{COOEt}$  group.

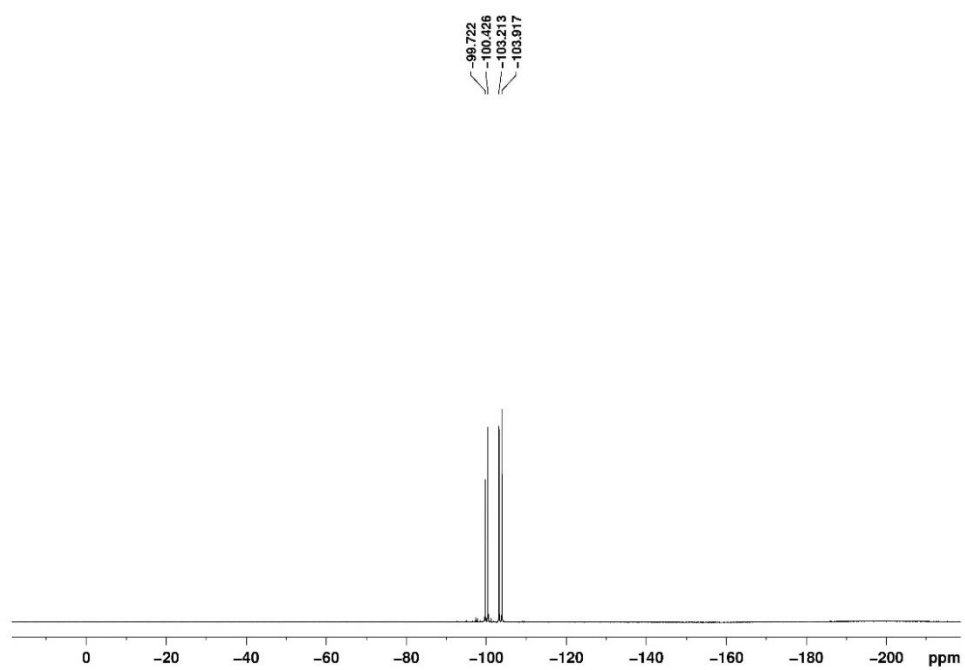


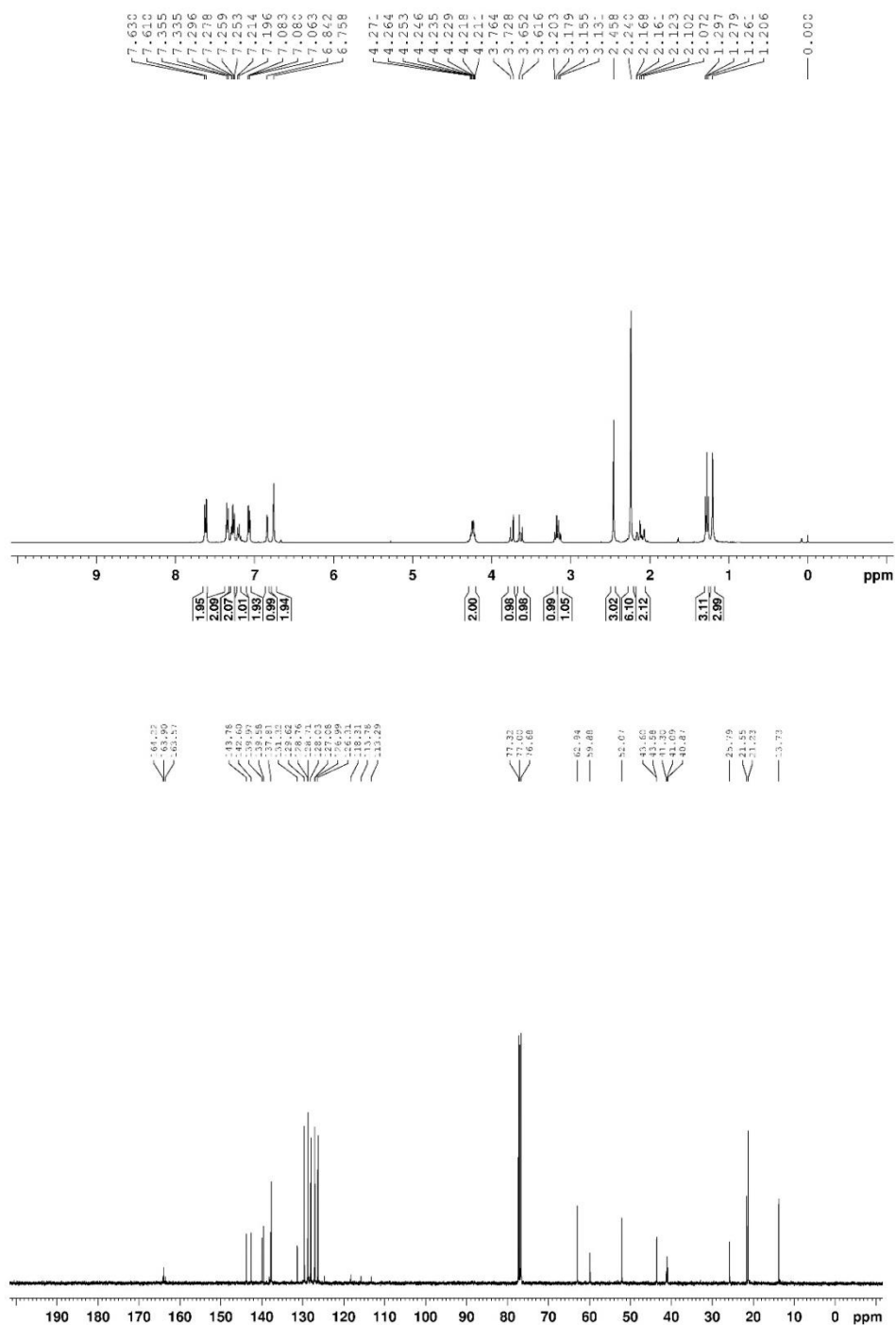




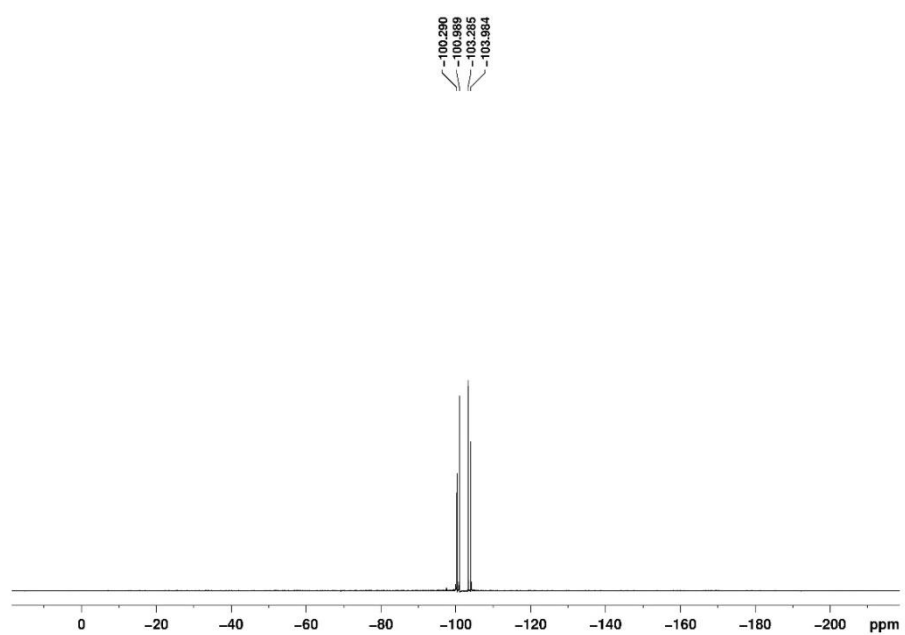


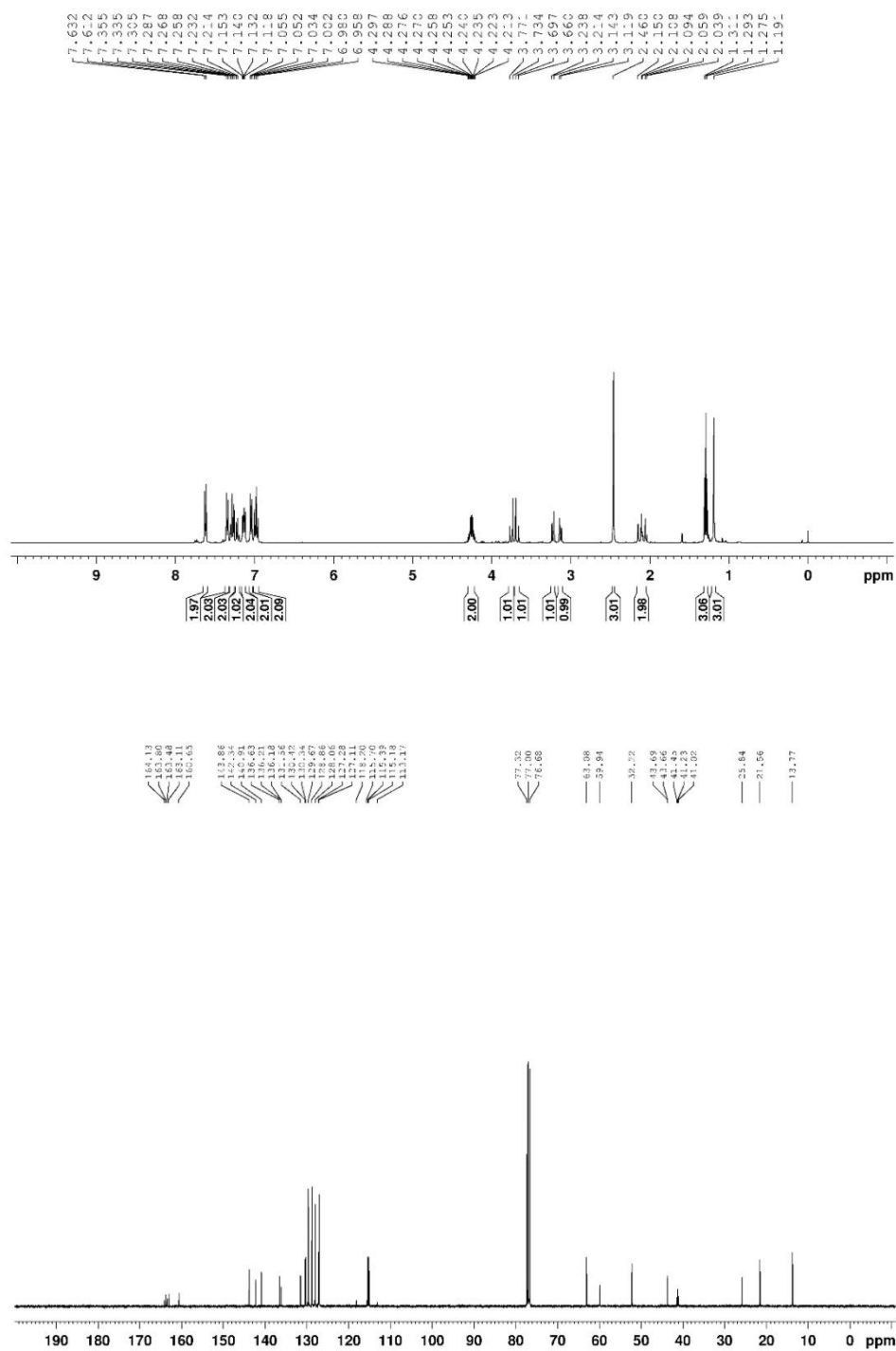
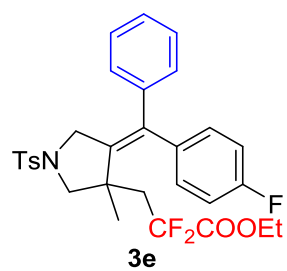


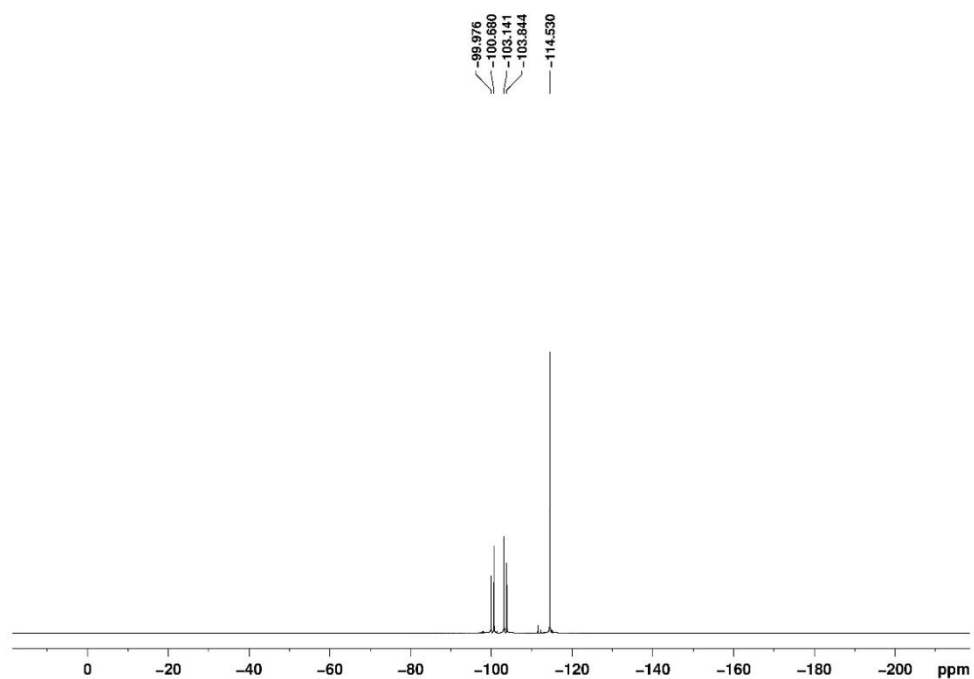


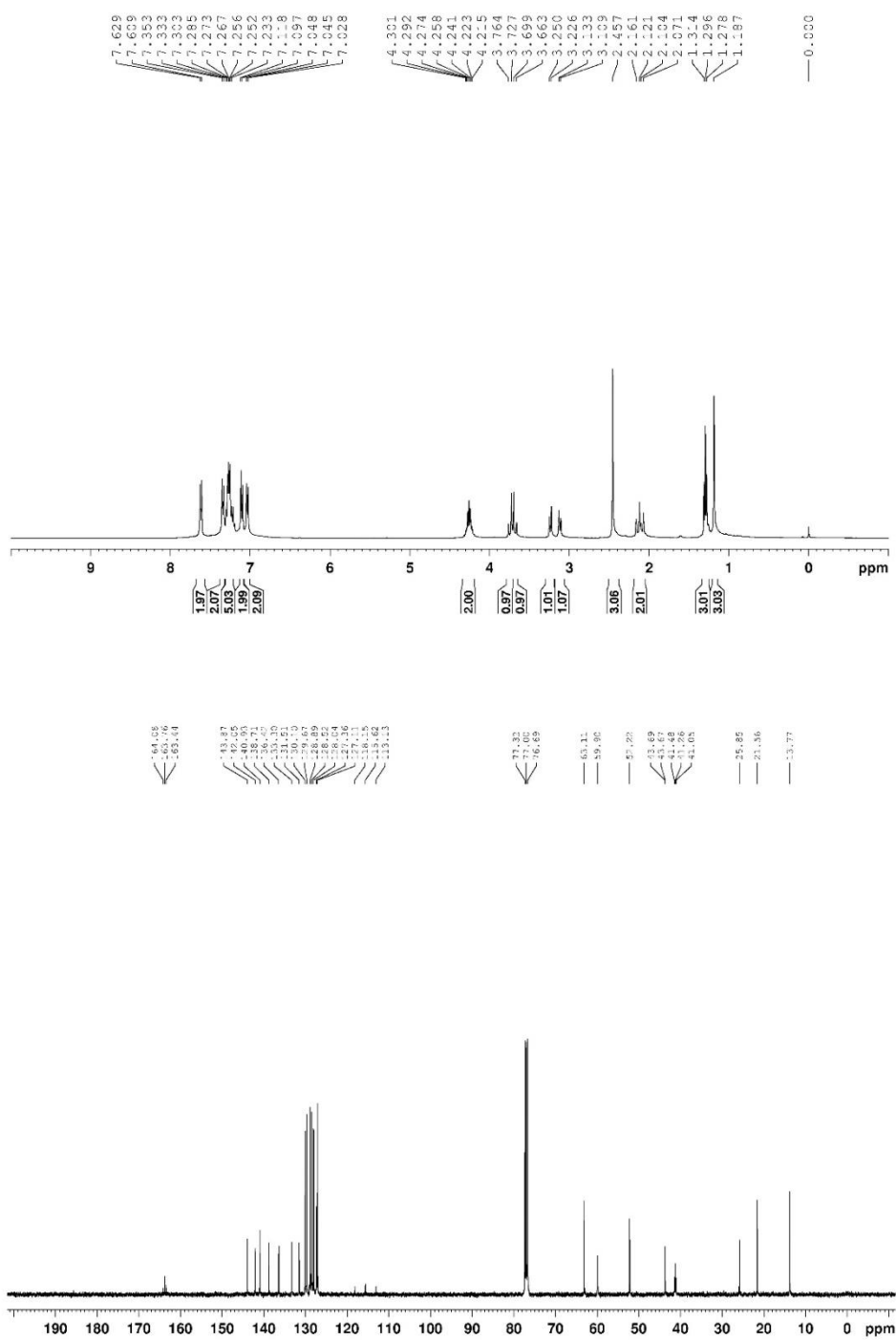
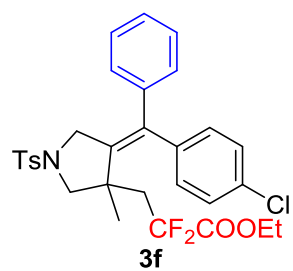


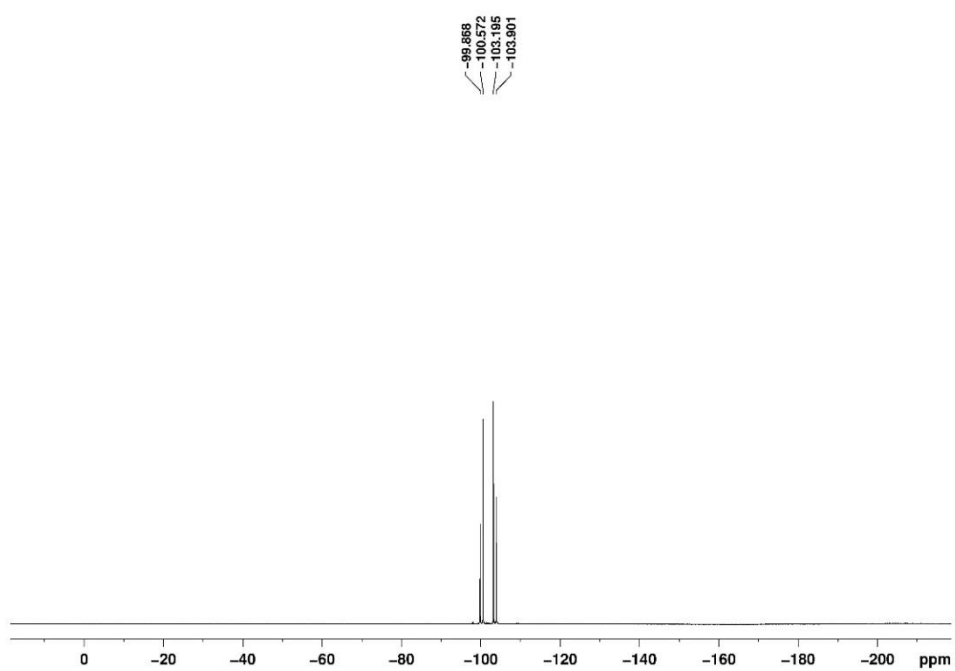


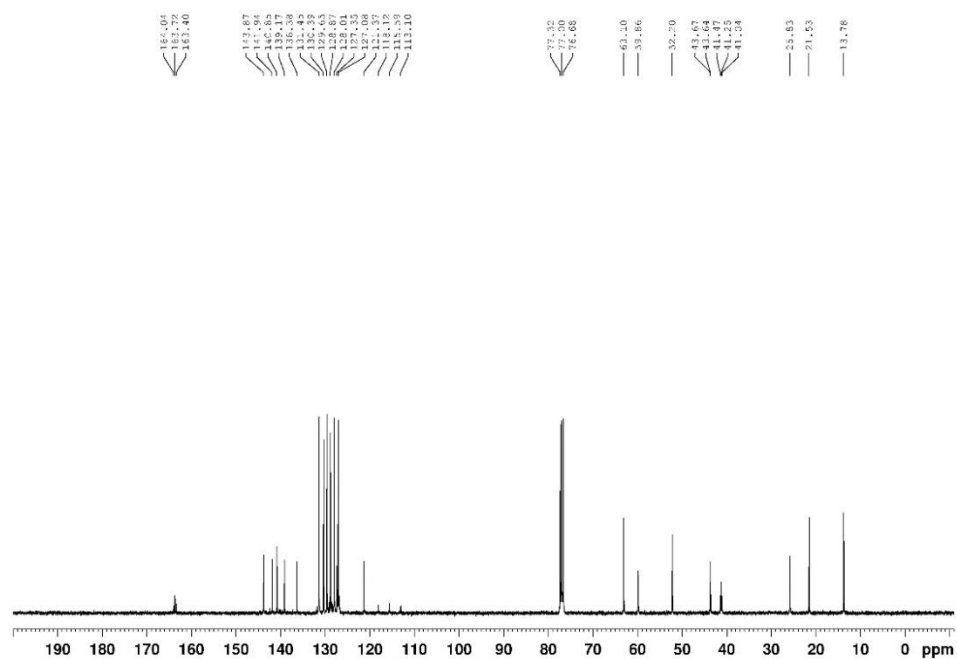
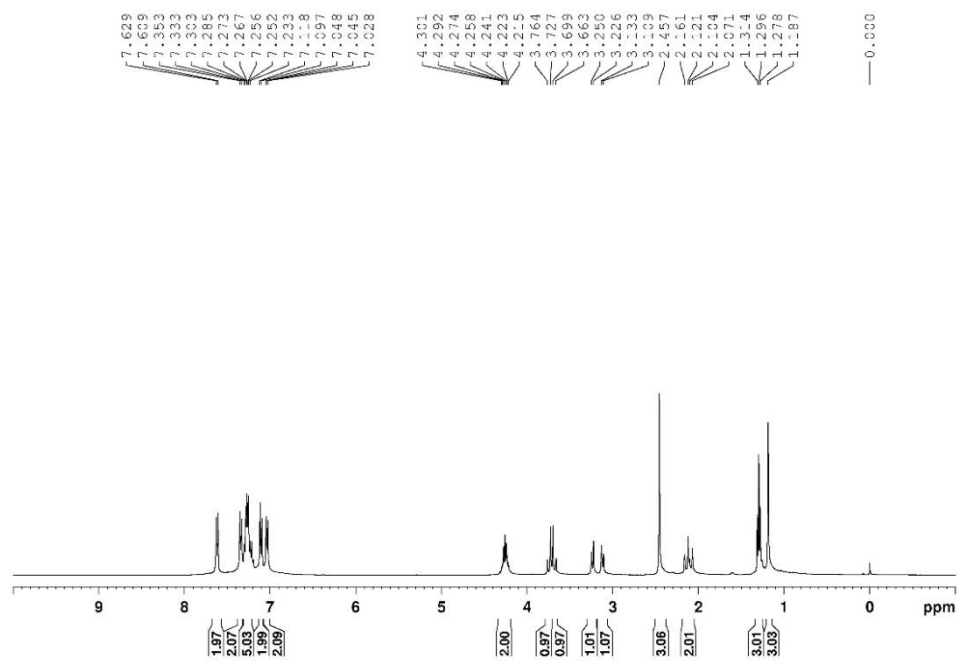
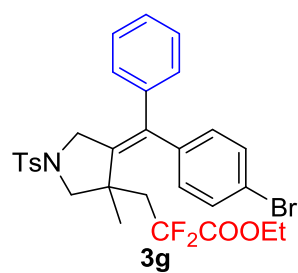


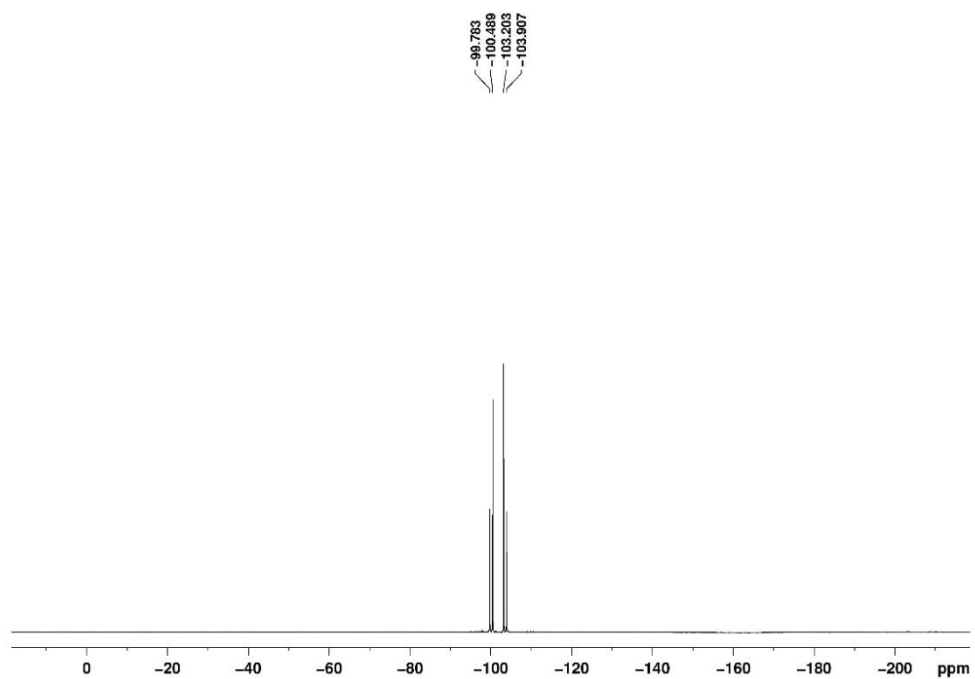


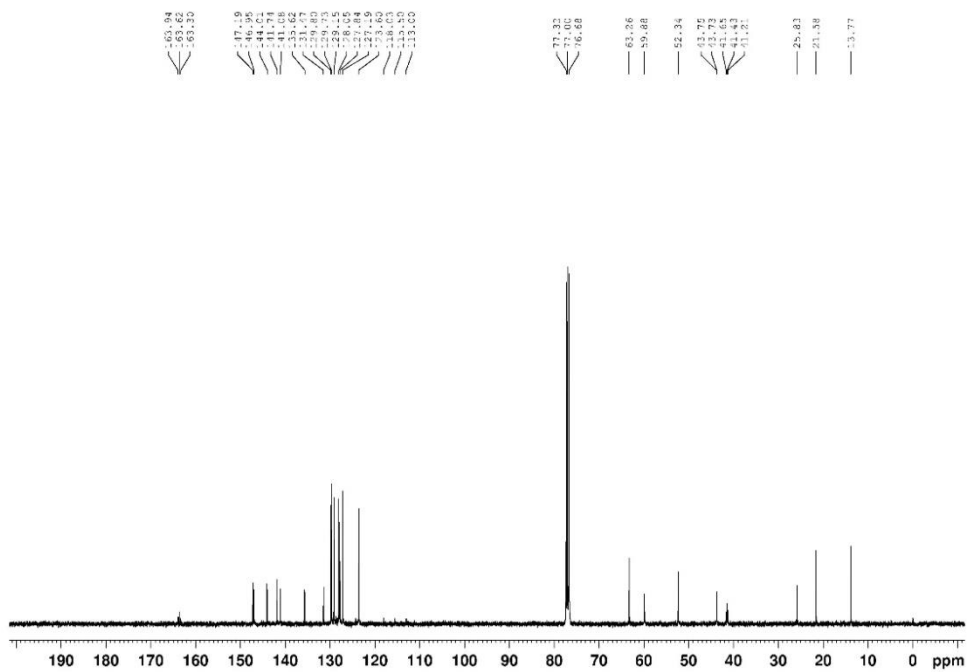
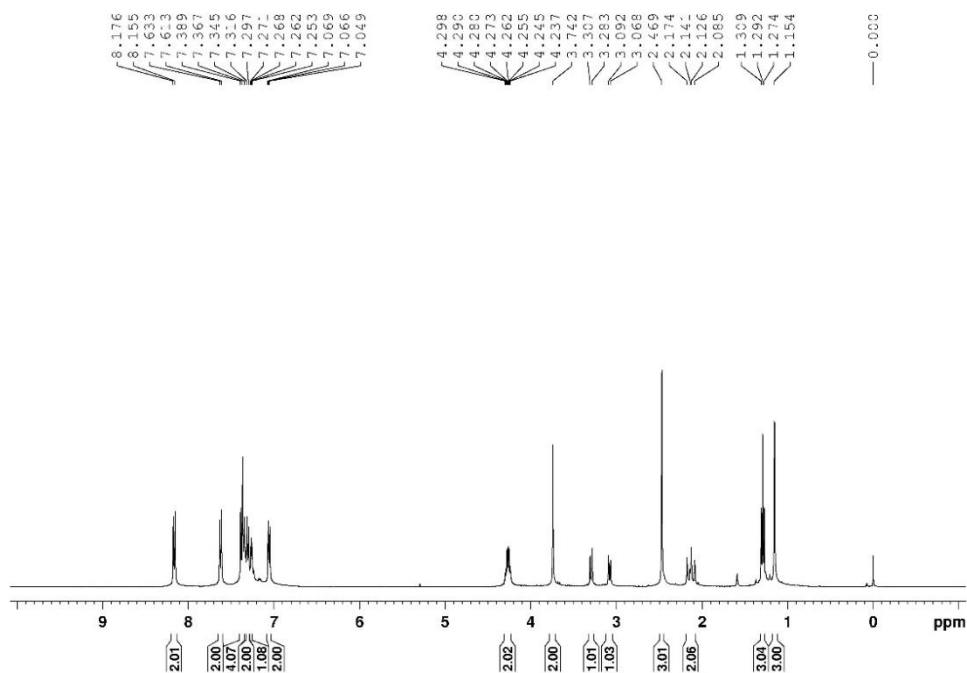
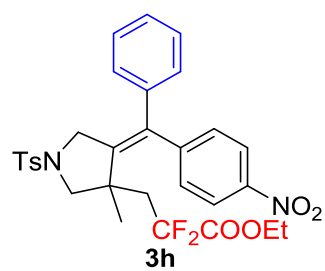




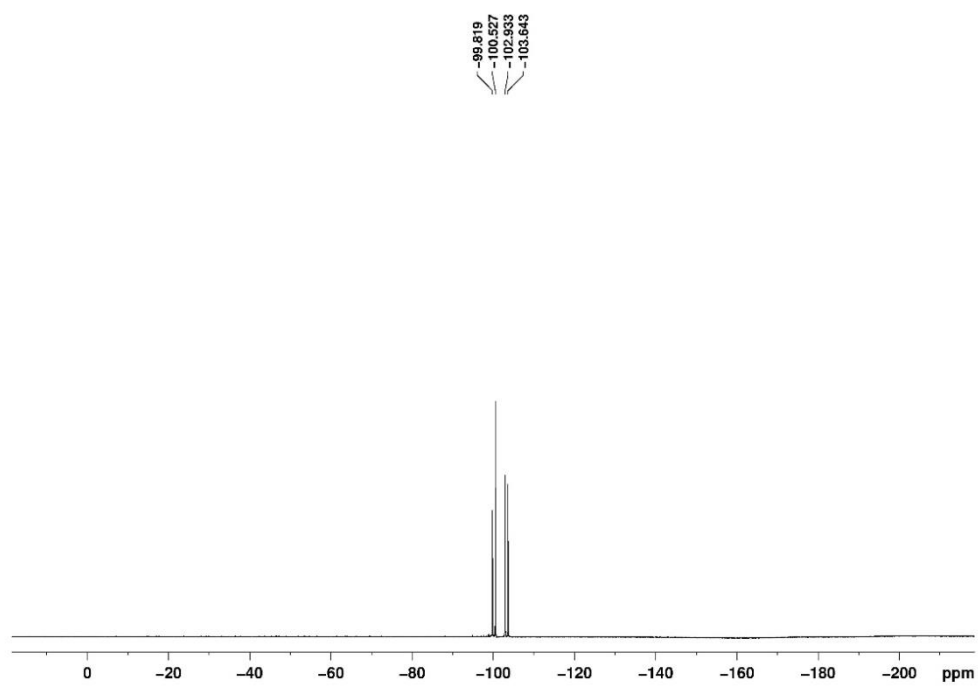


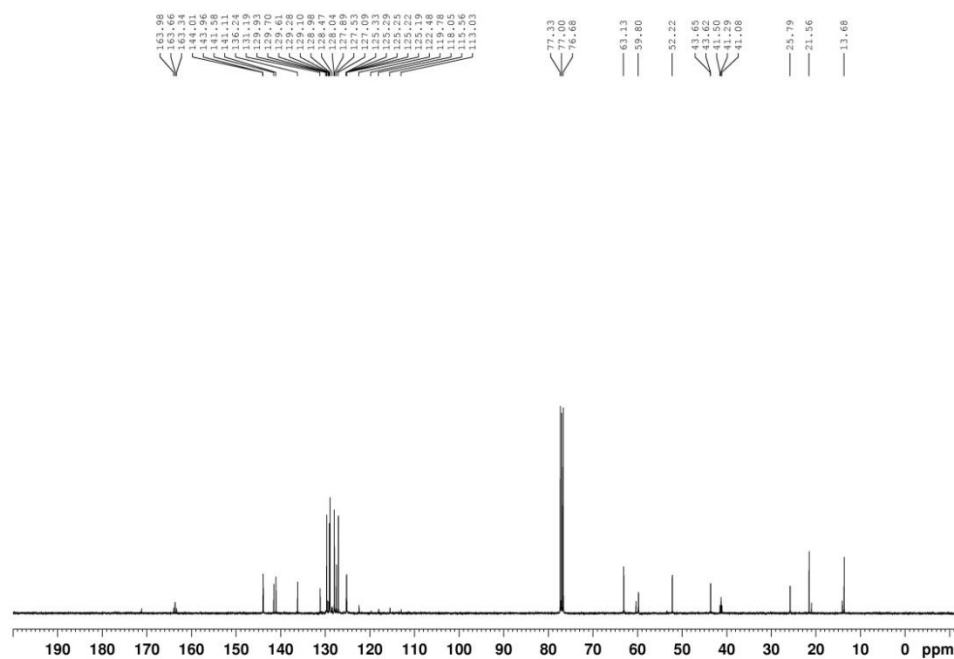
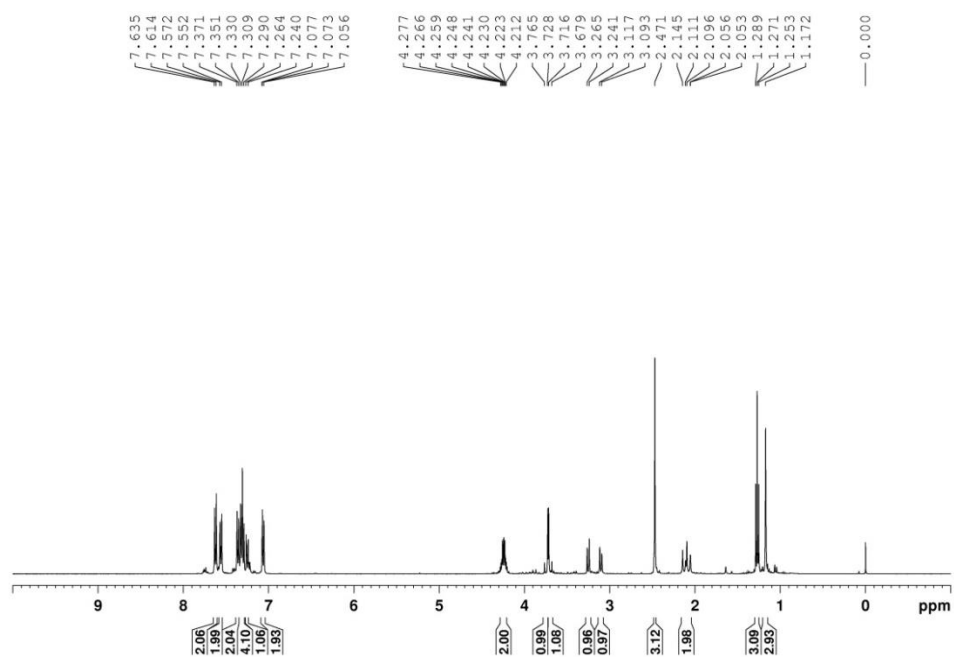
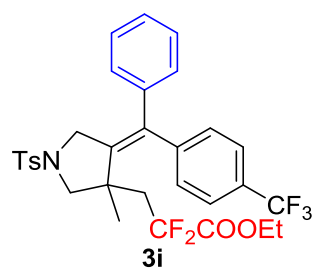


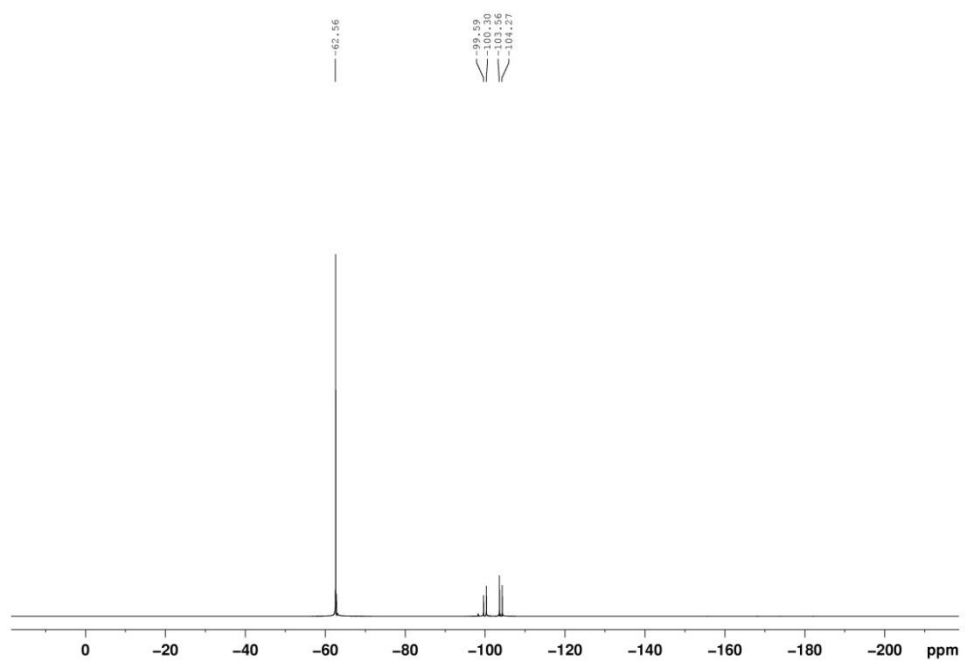


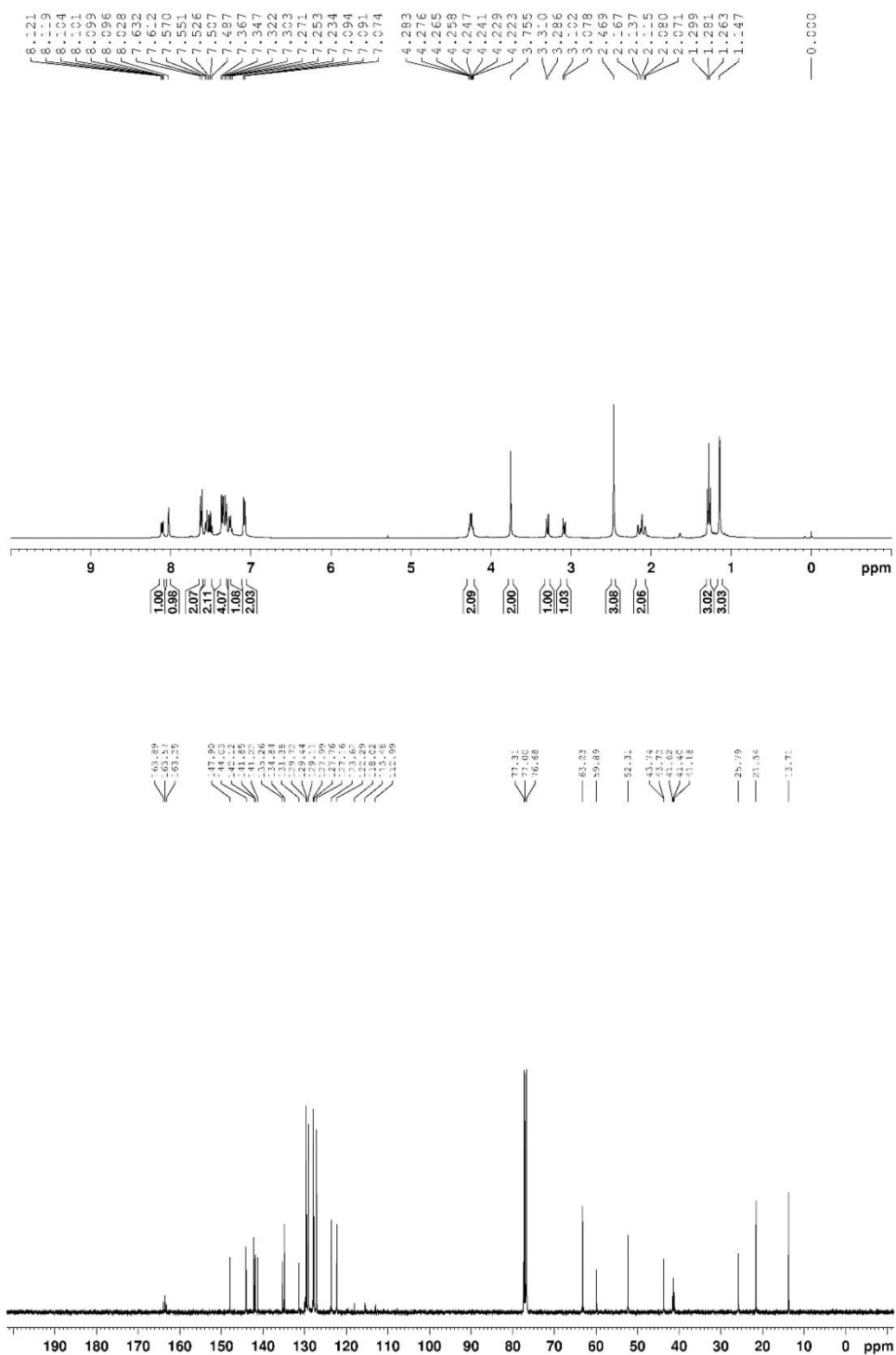


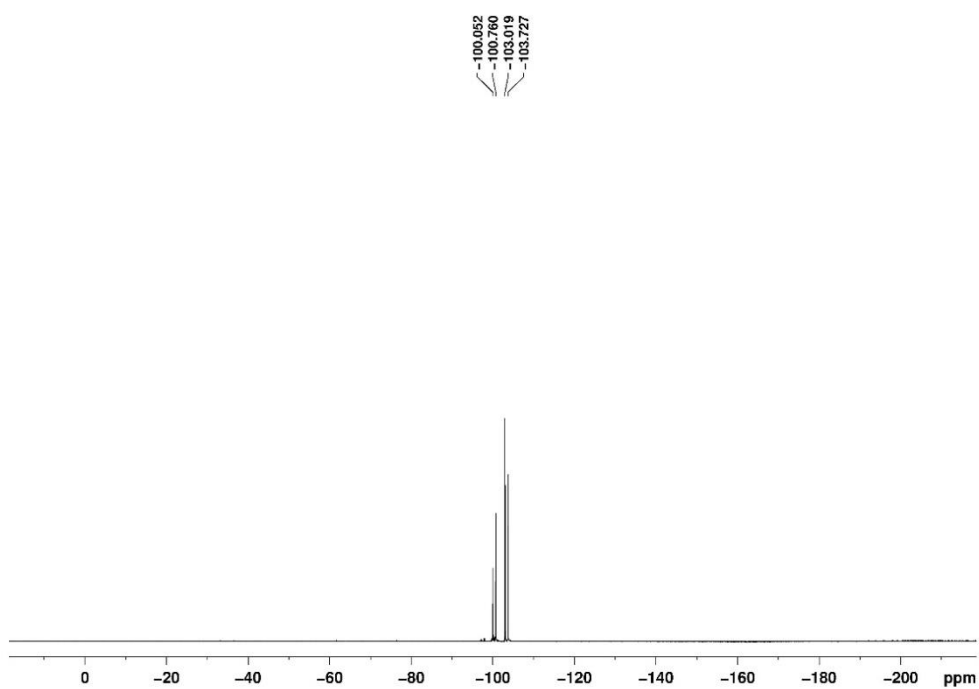


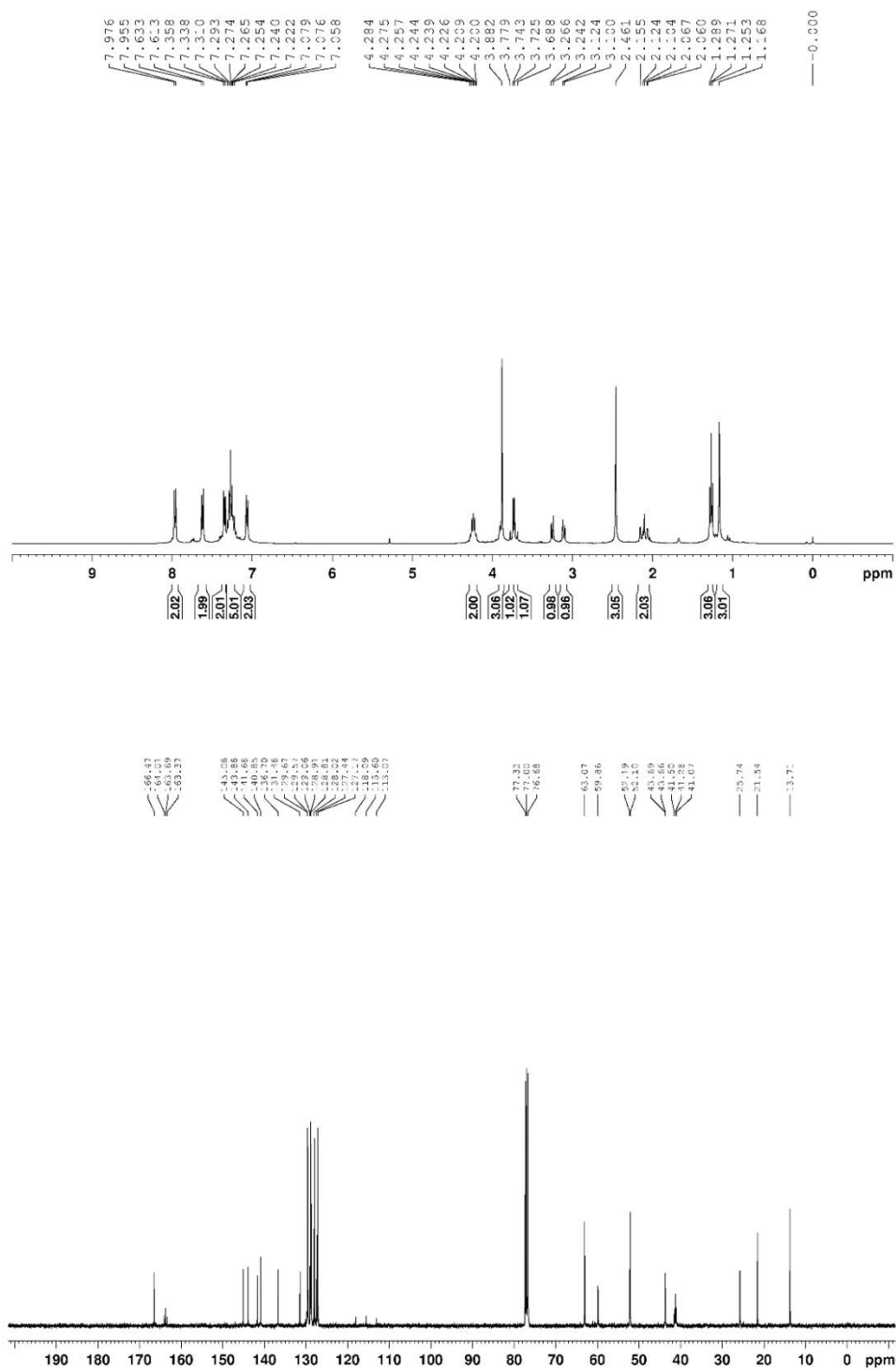


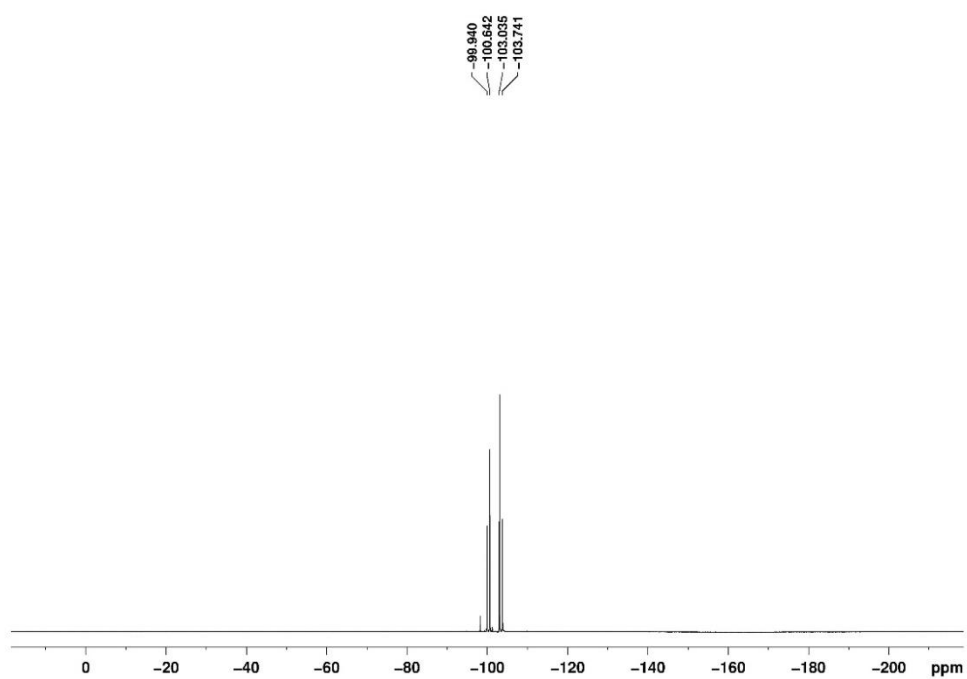


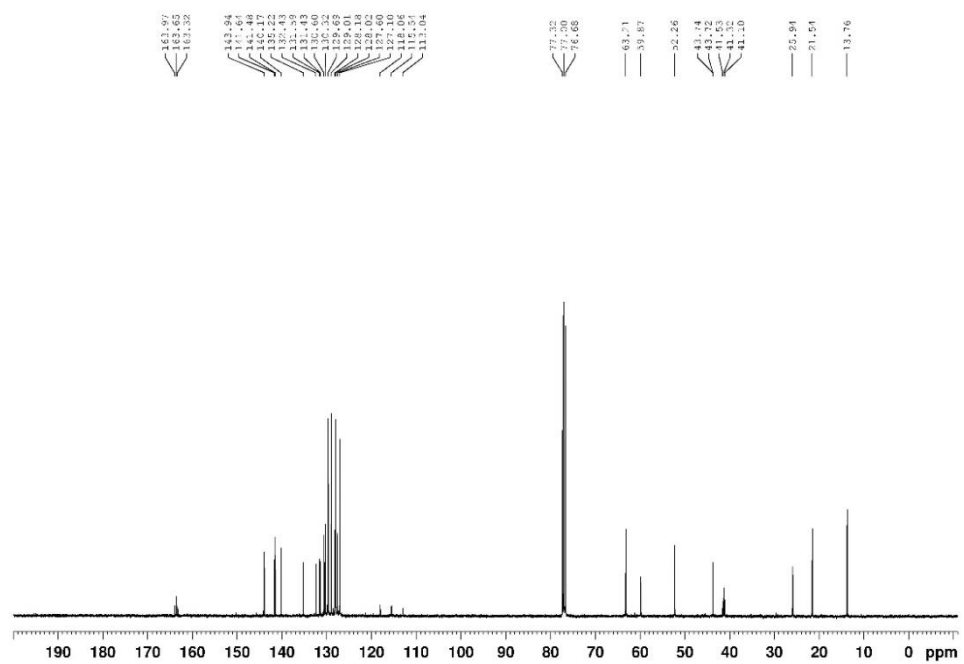
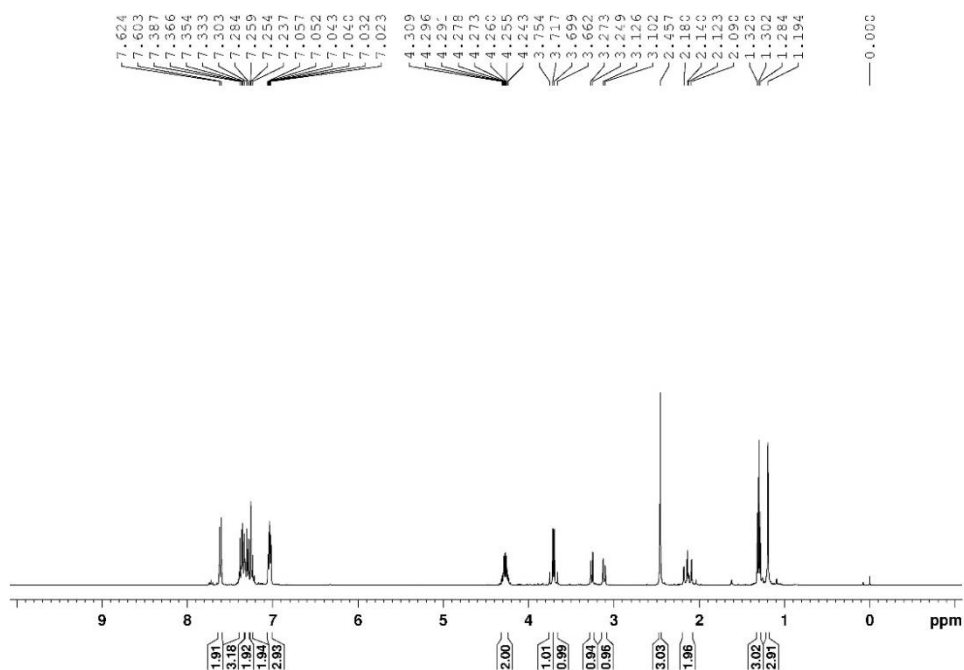
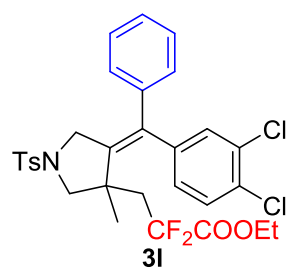




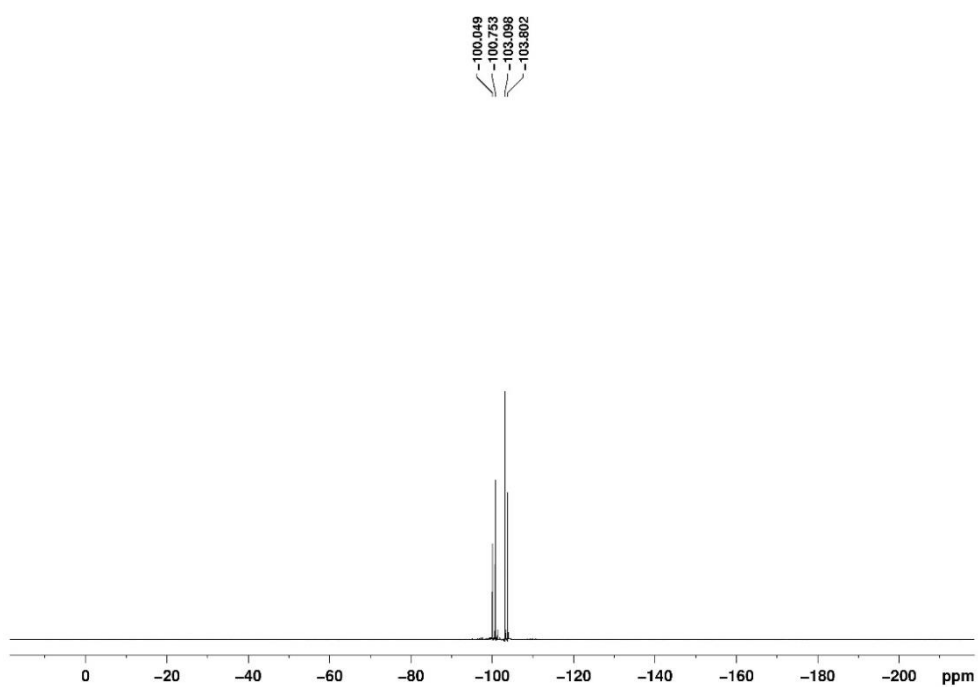


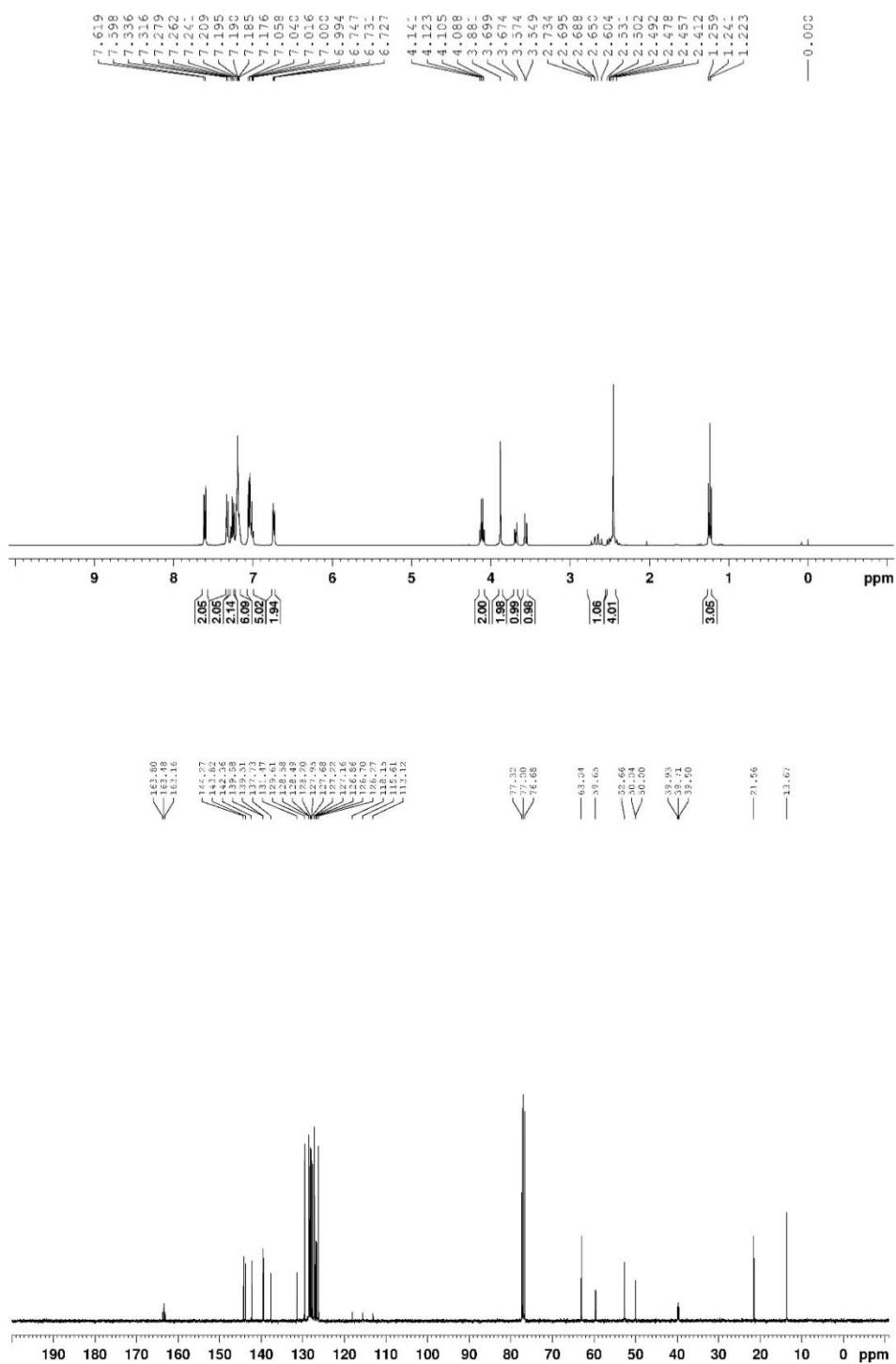


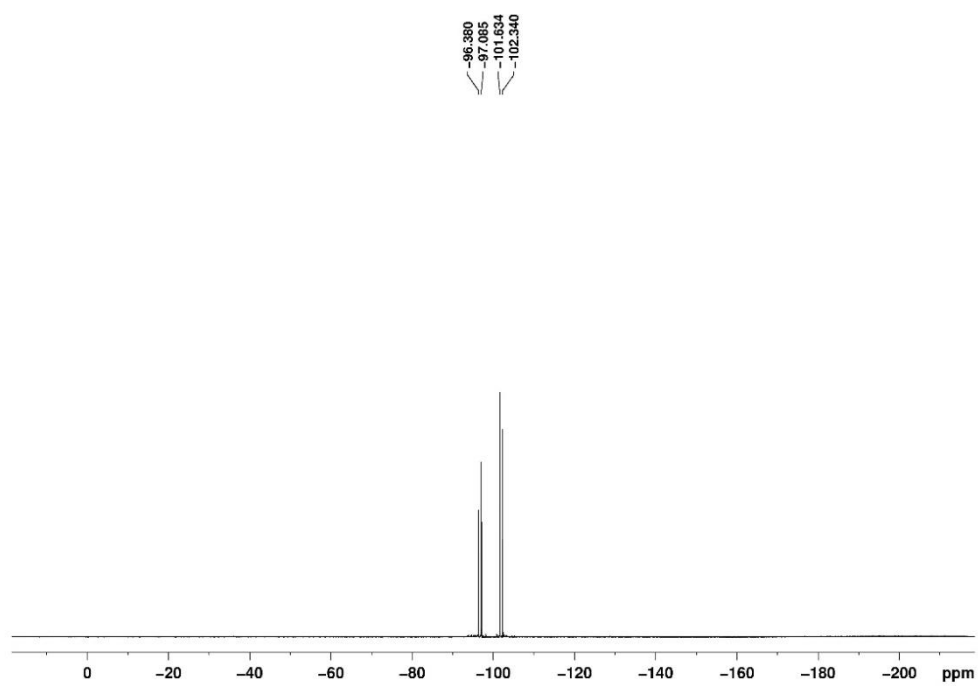


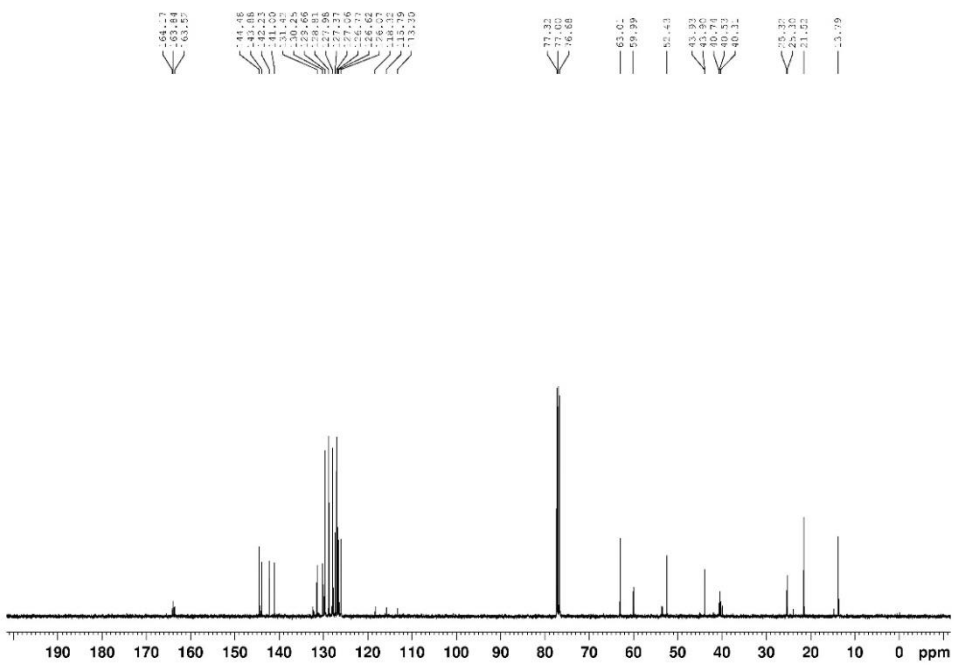
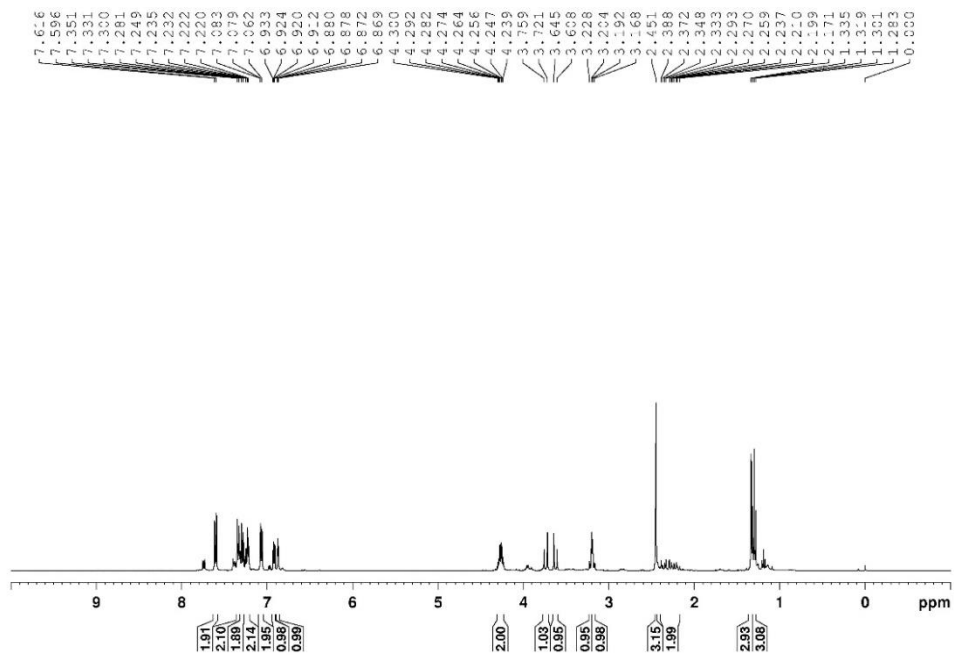
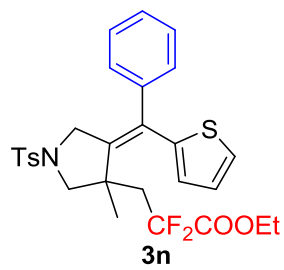


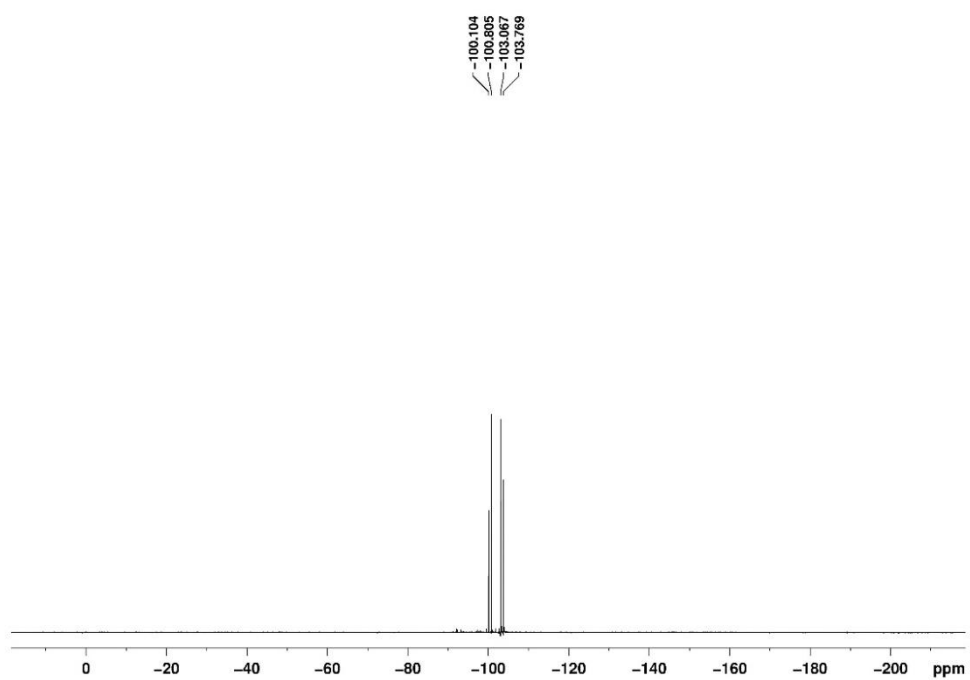


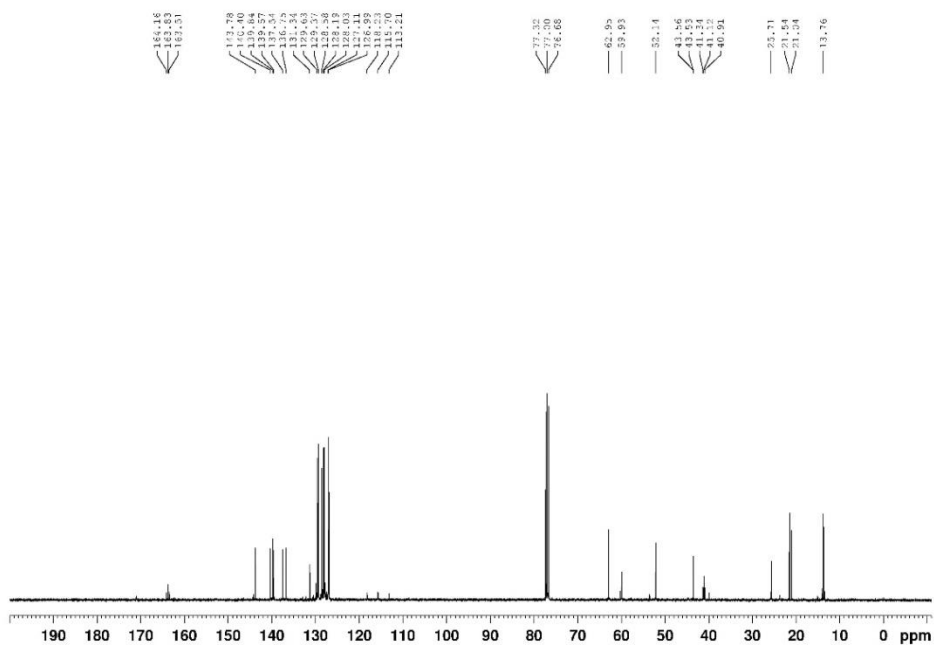
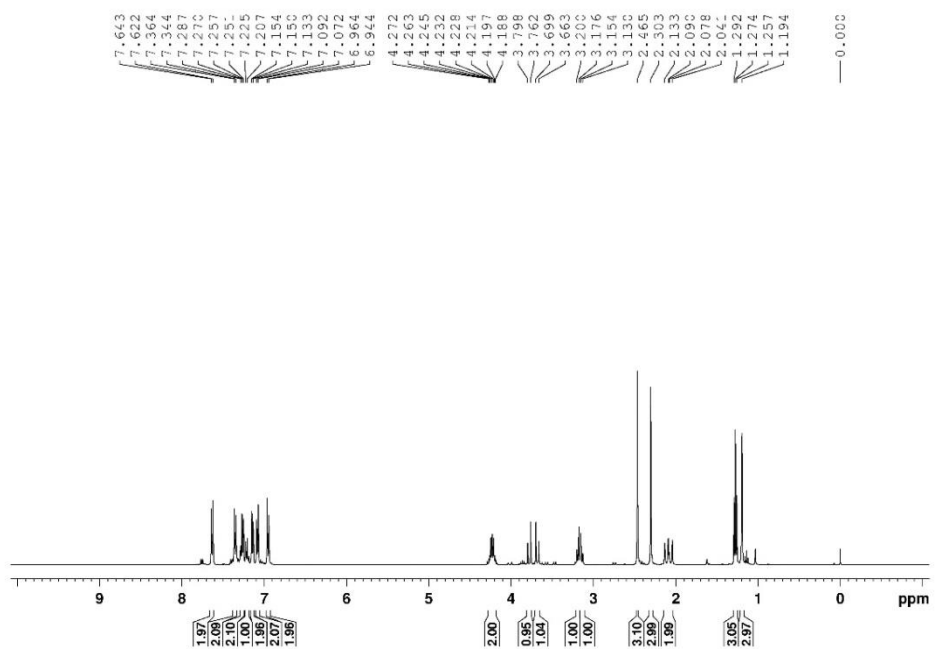
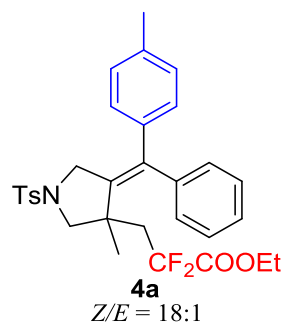


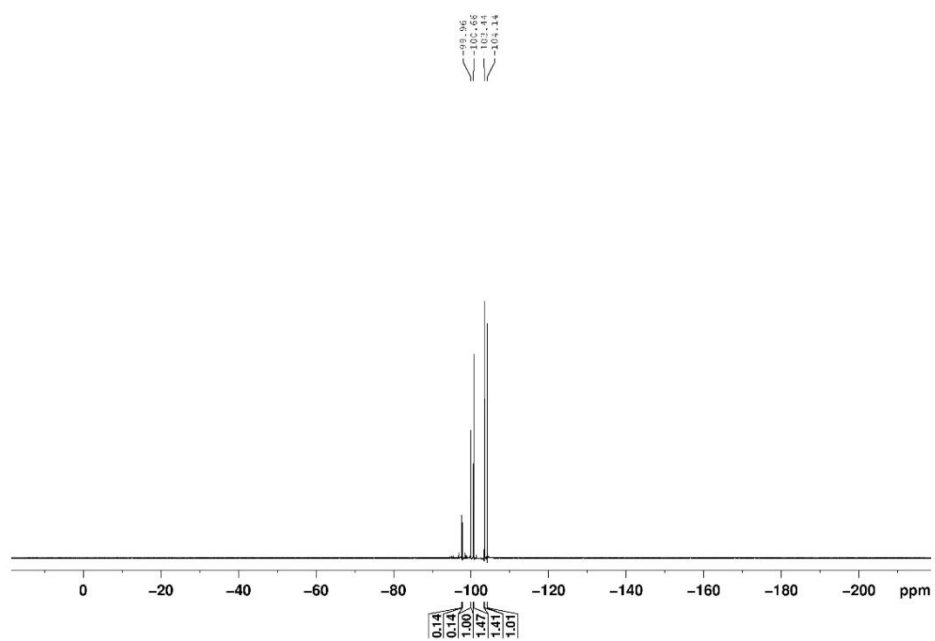


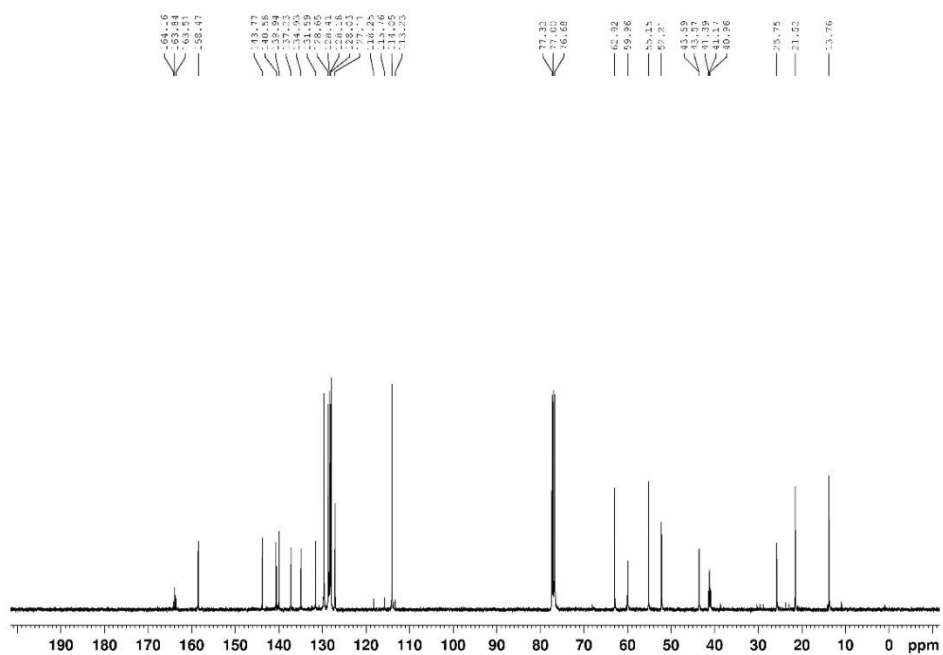




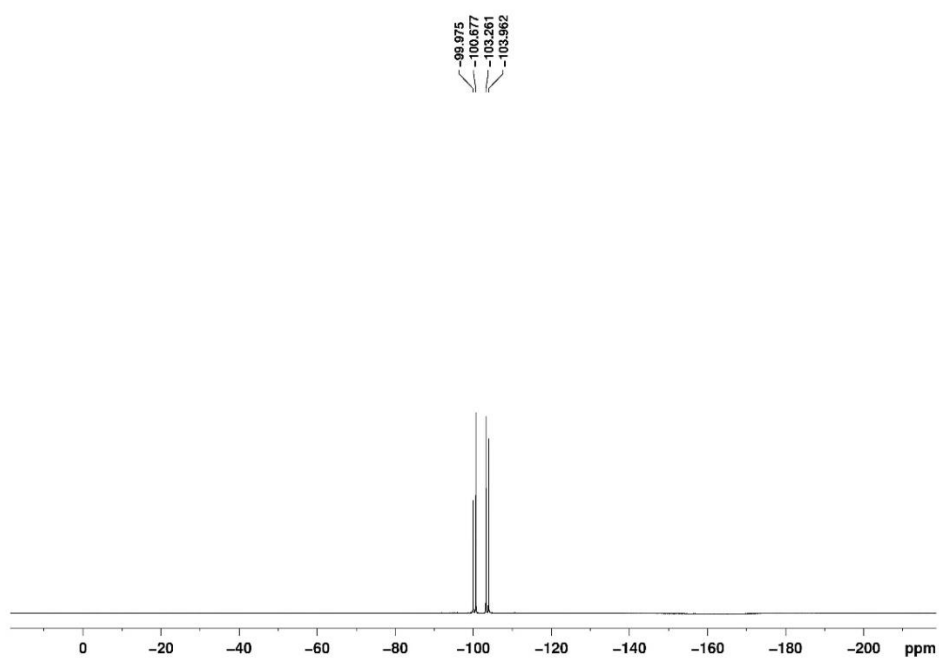




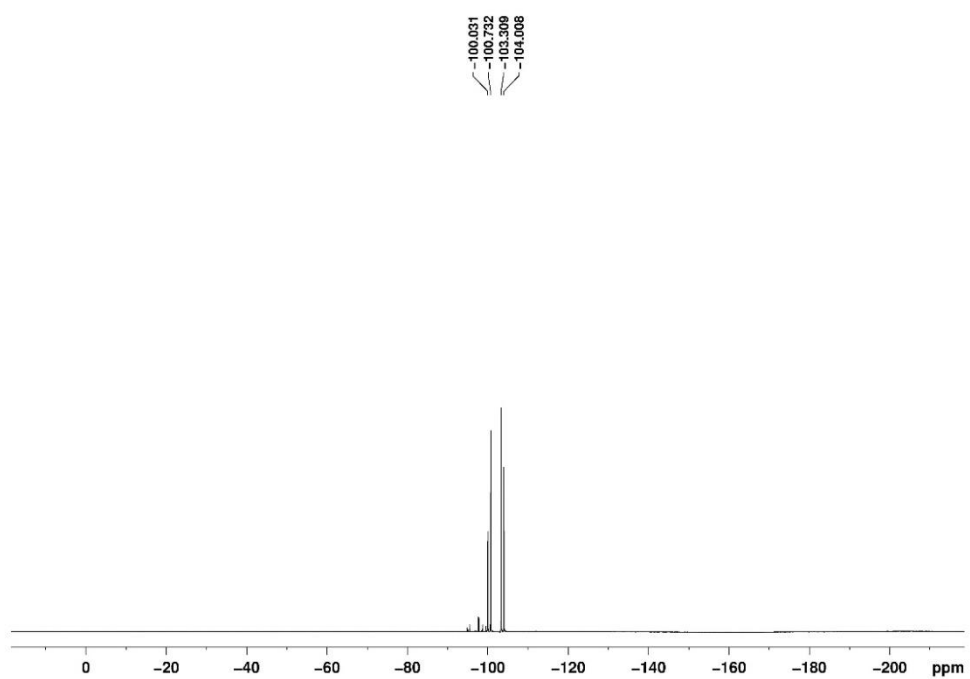


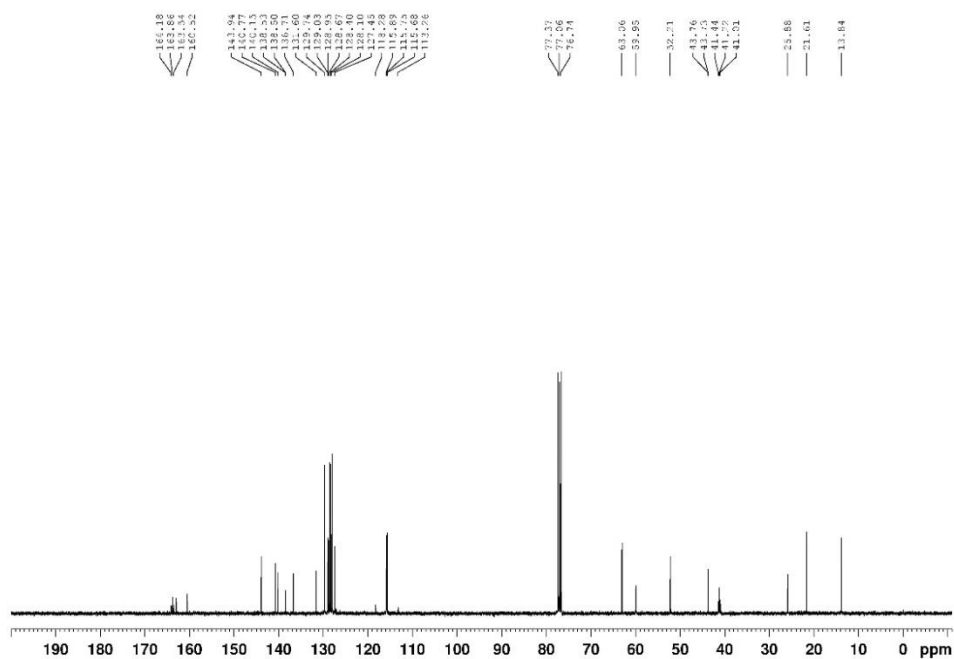
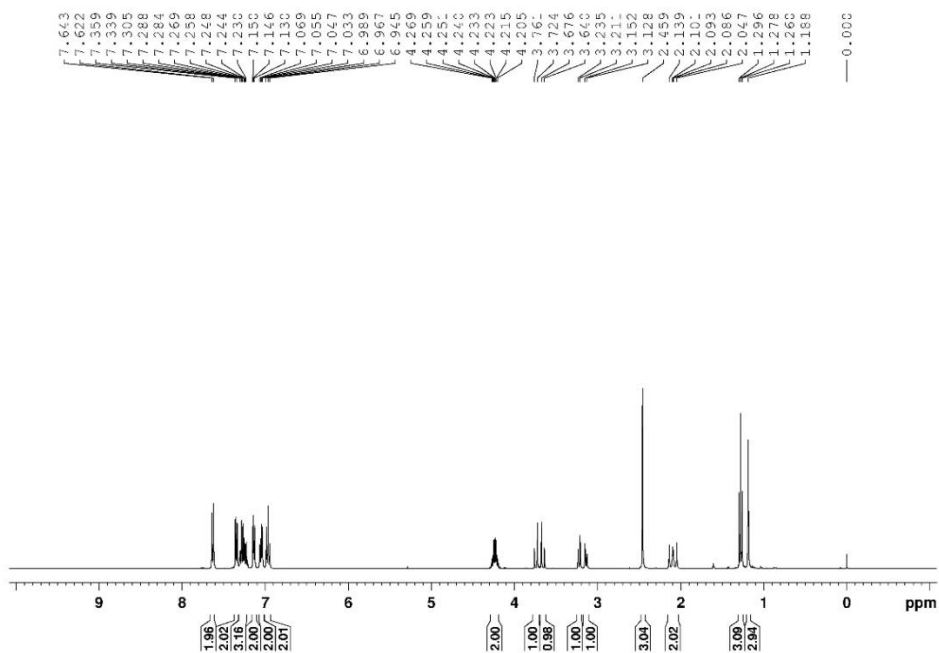
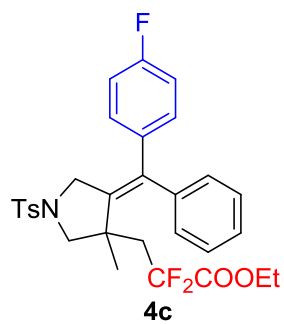


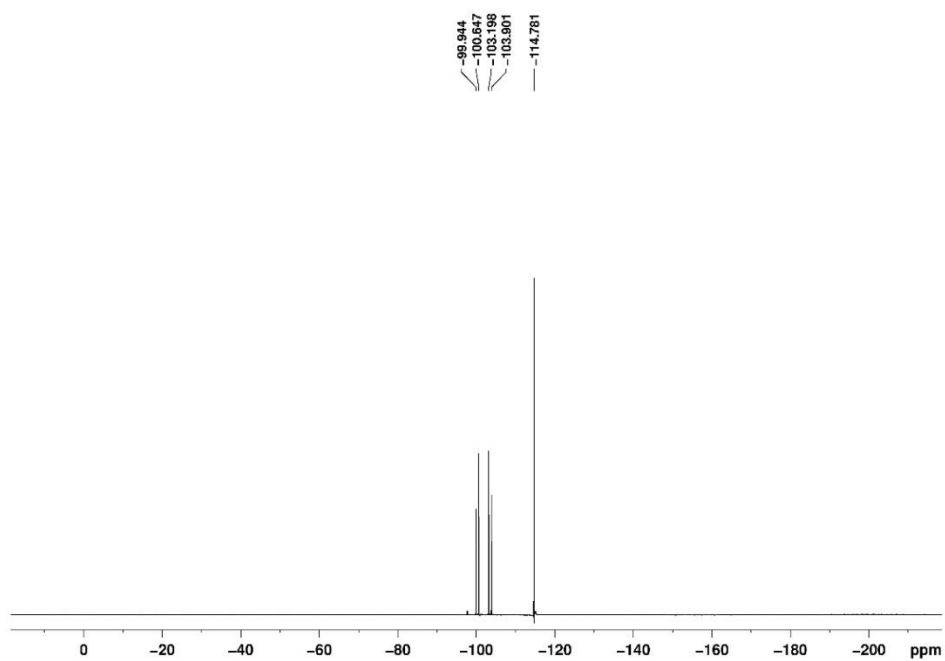


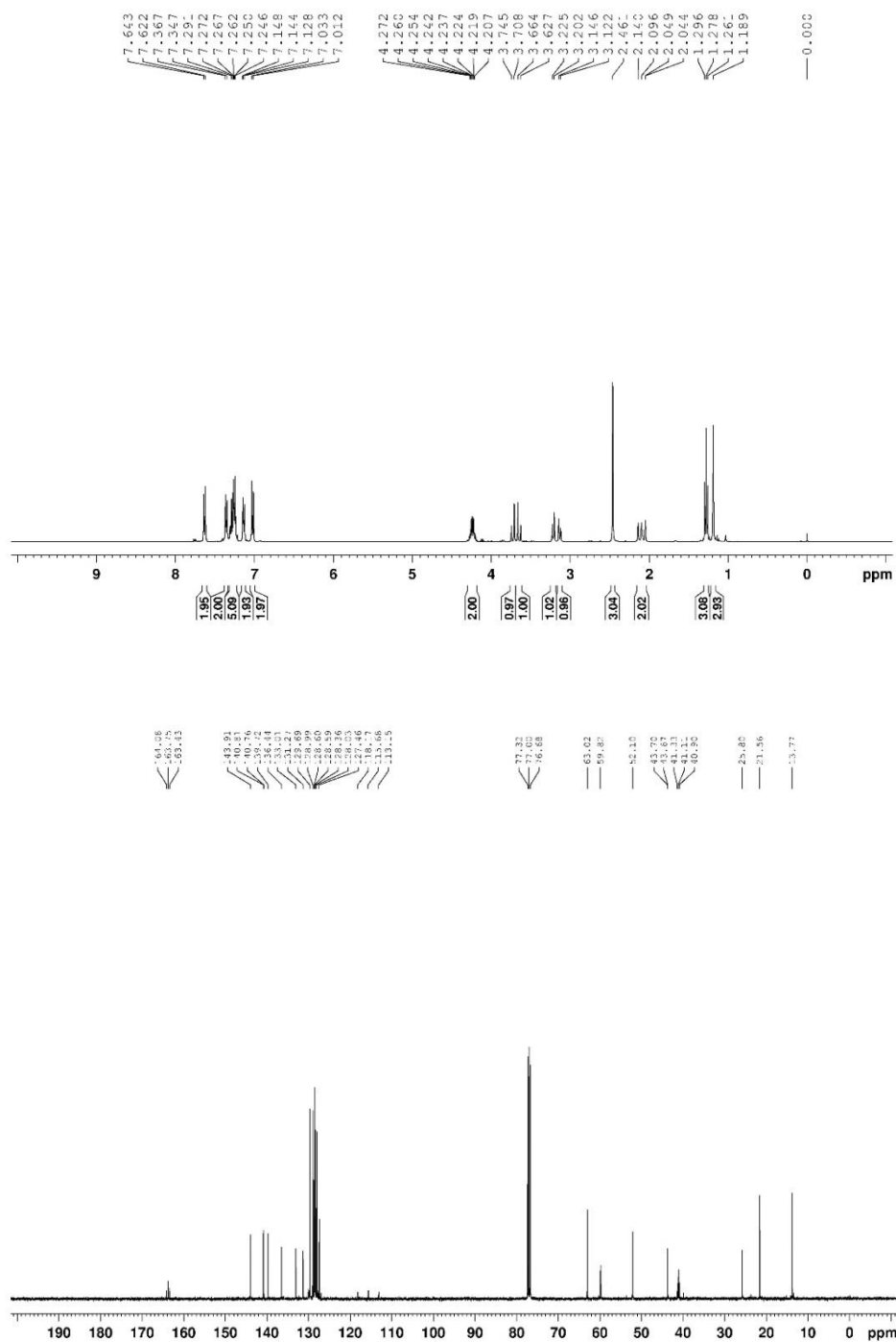
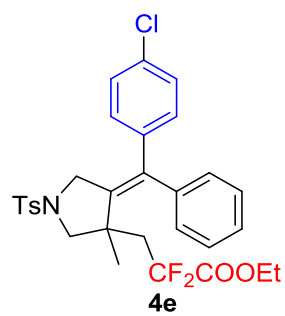


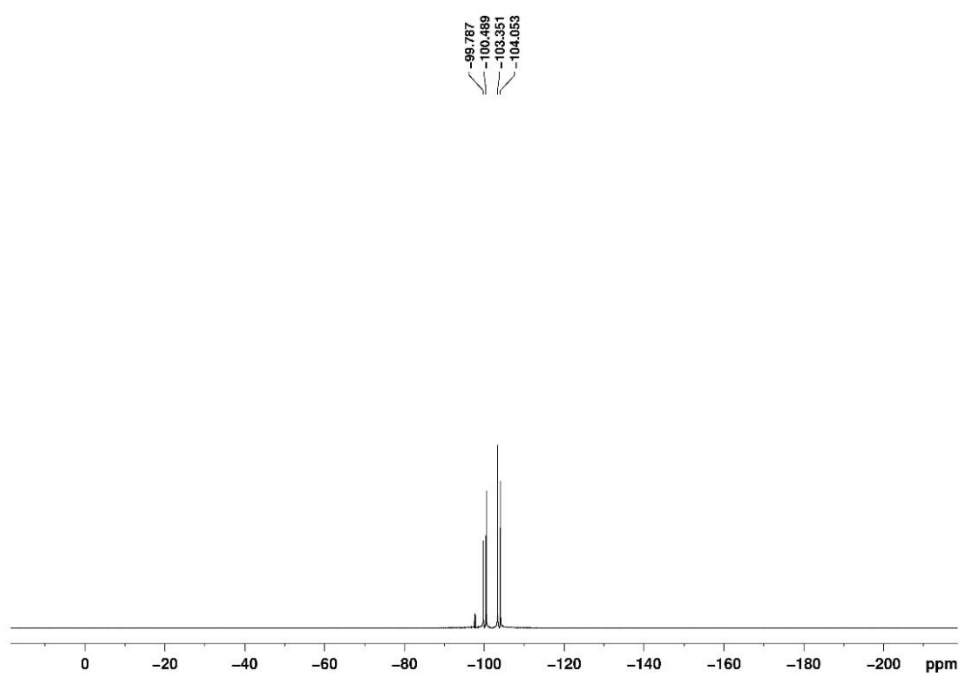


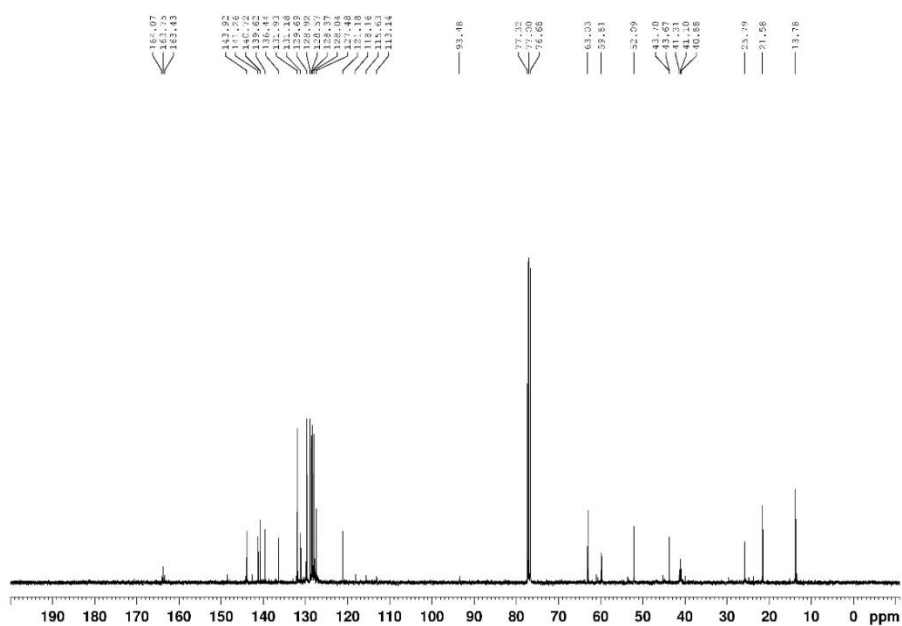
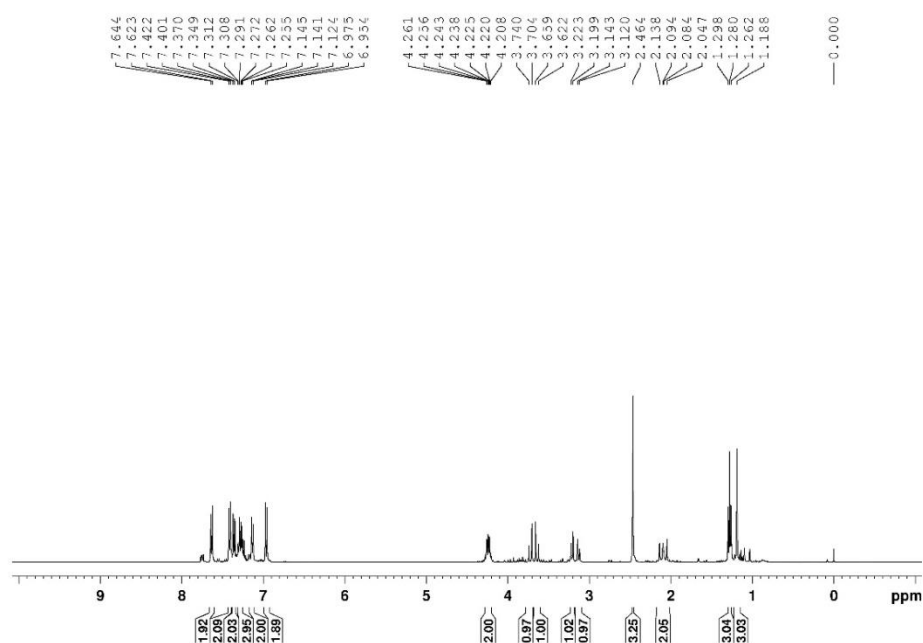
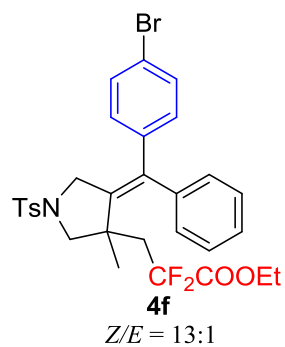




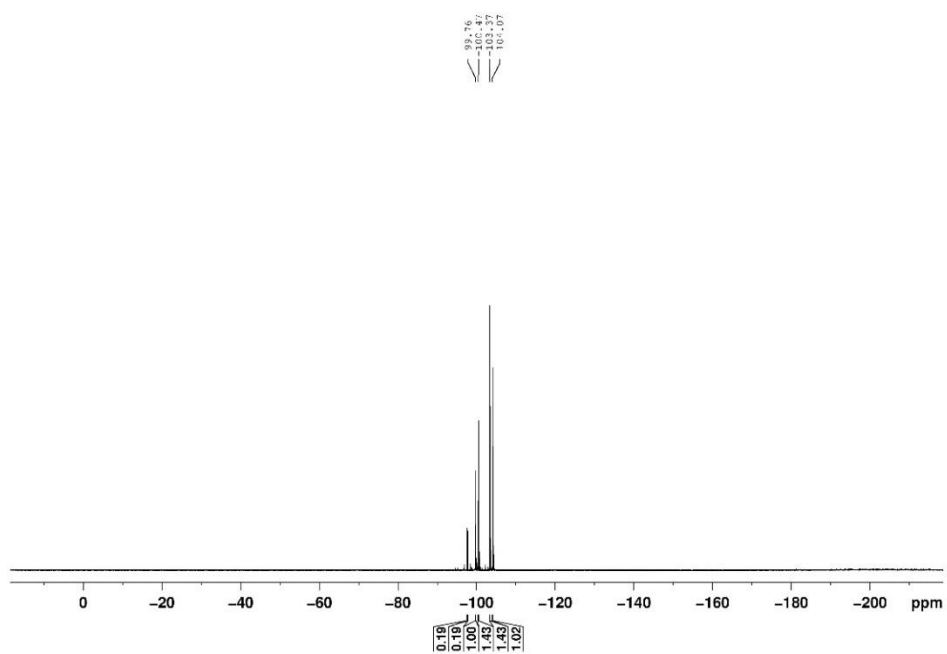


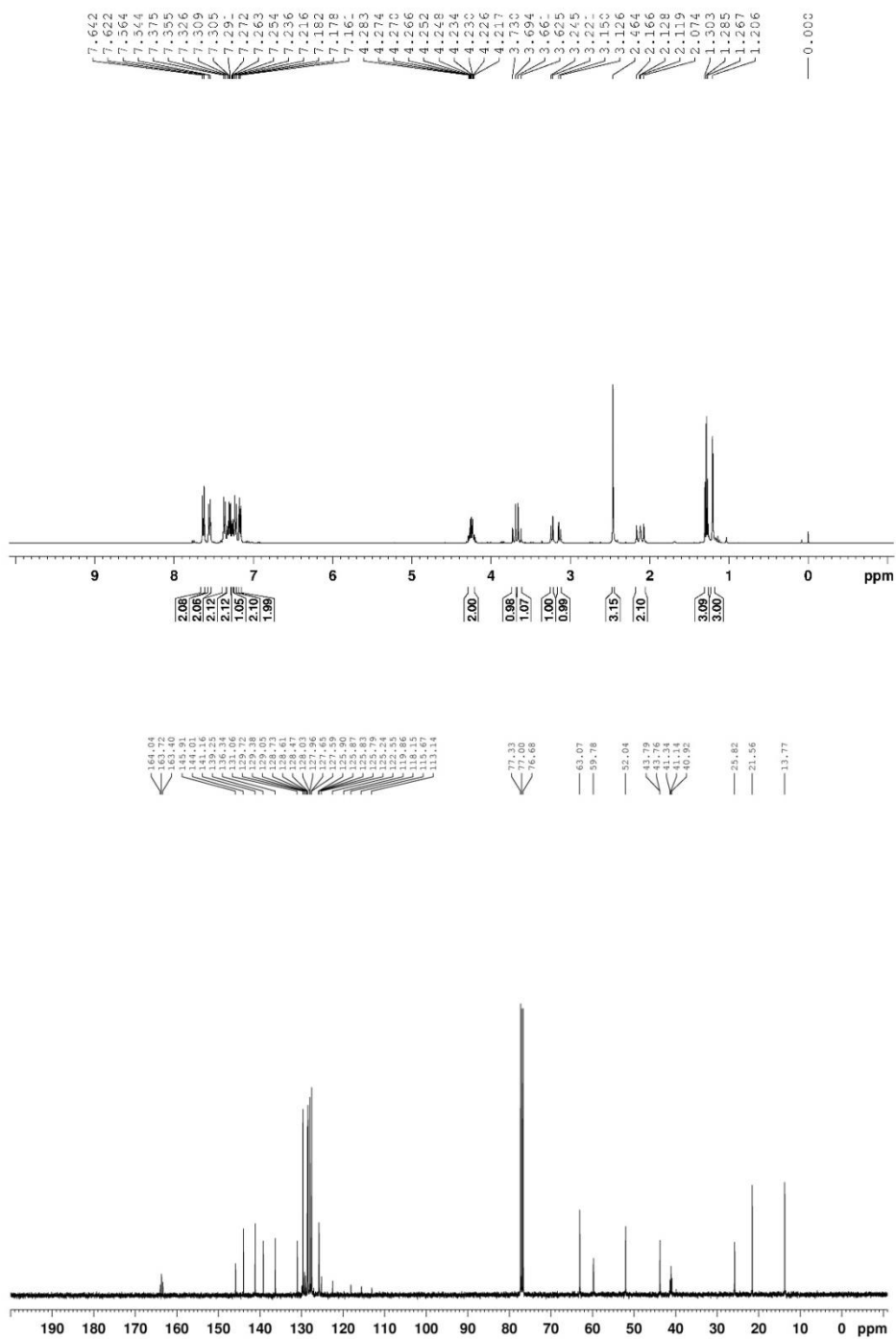
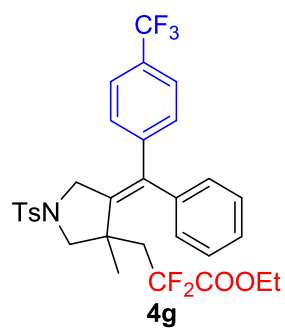


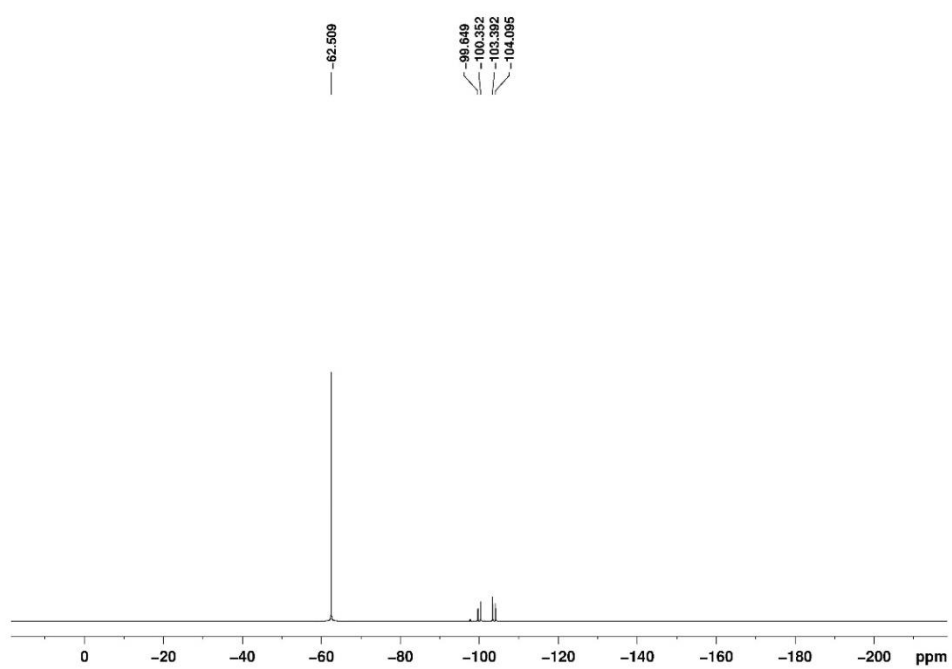


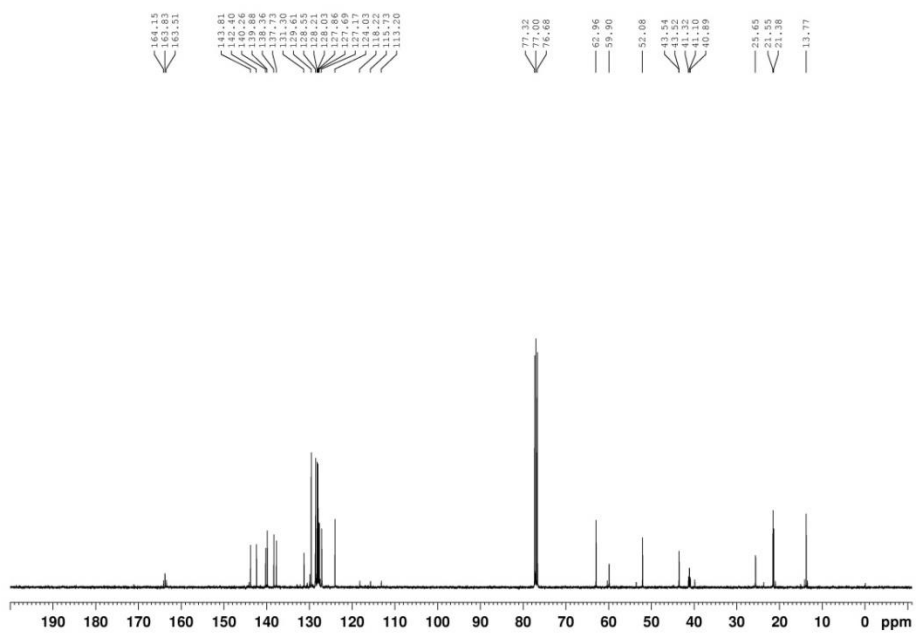
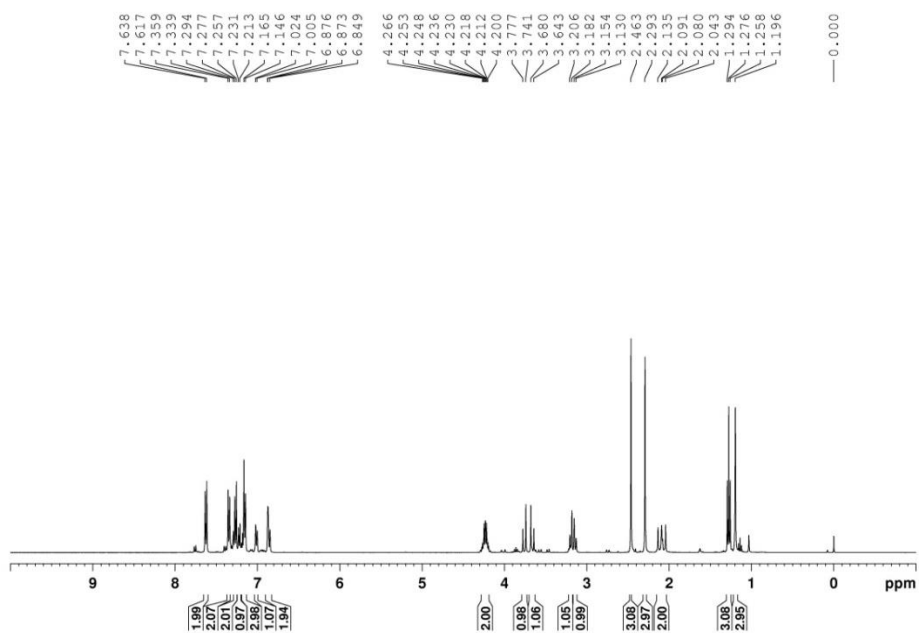
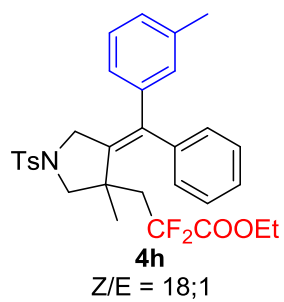


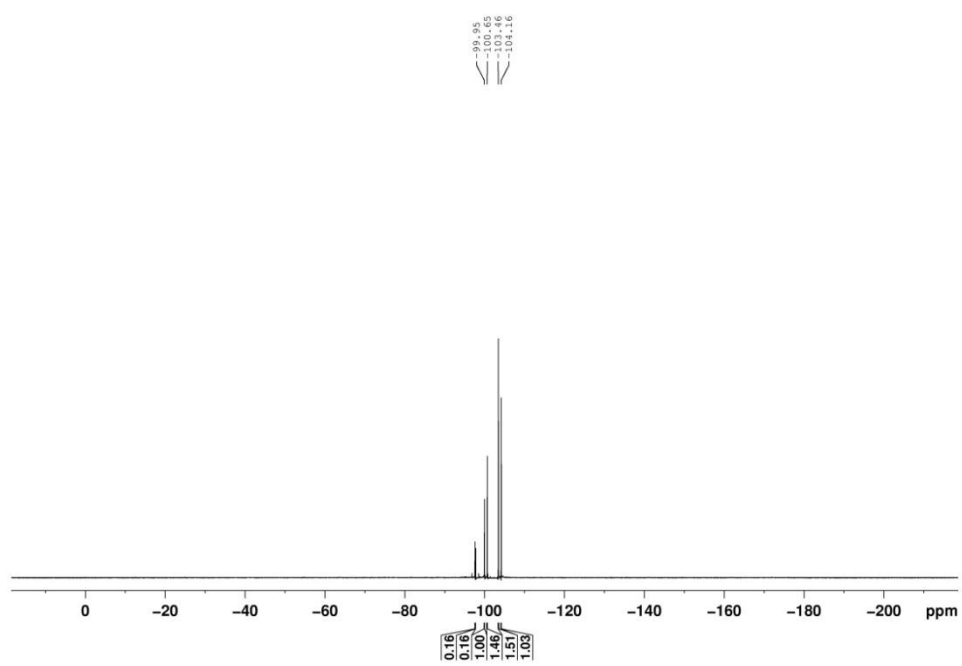


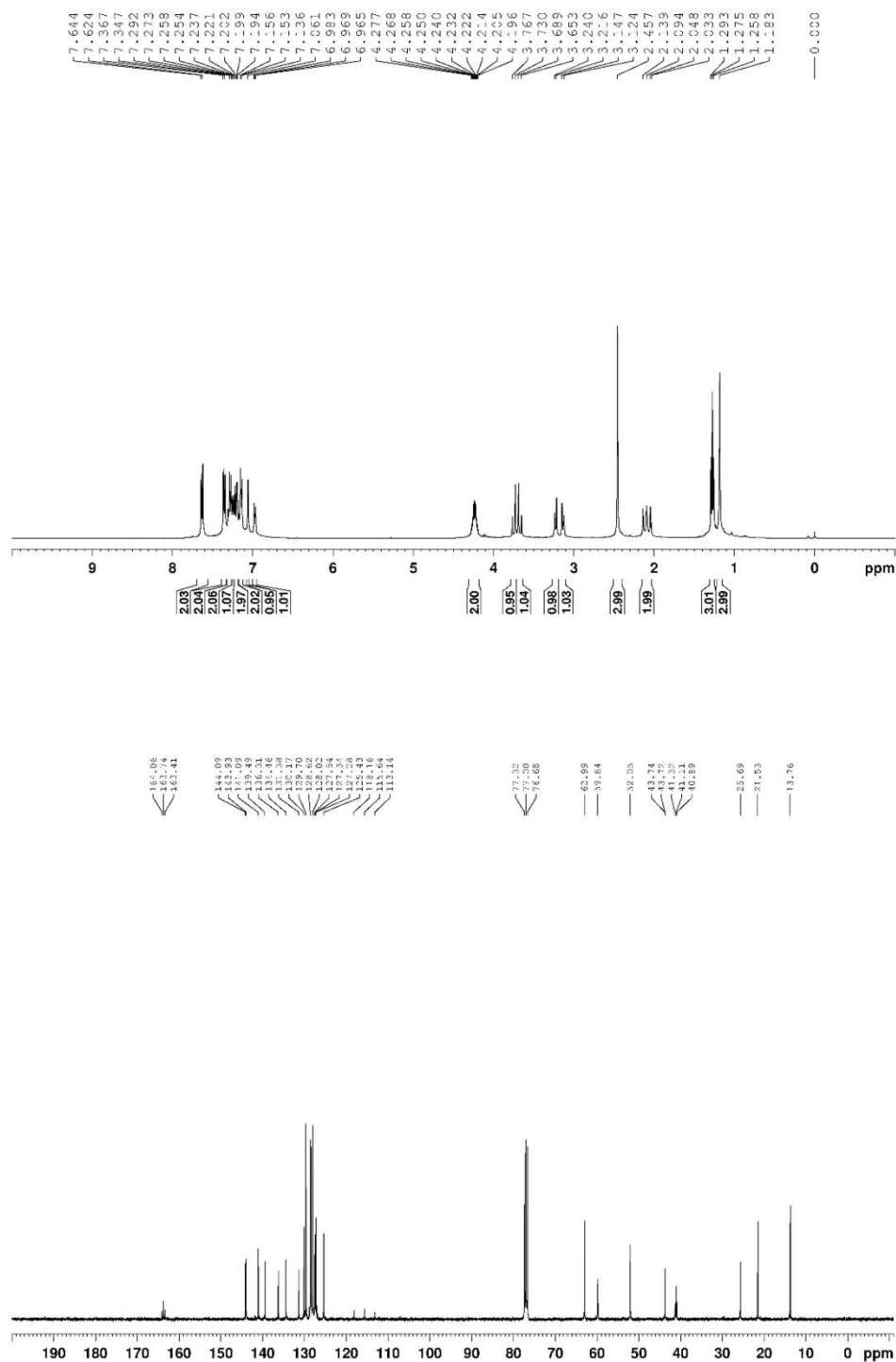
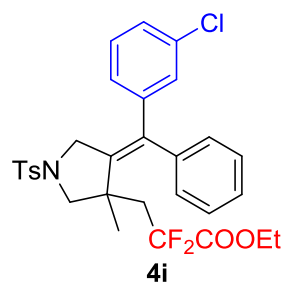


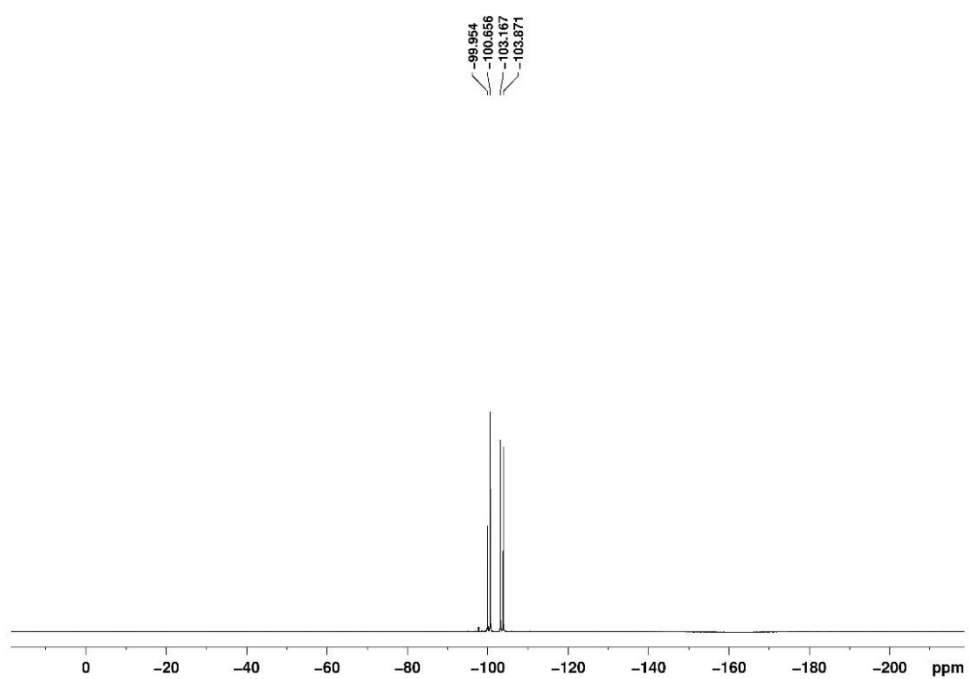


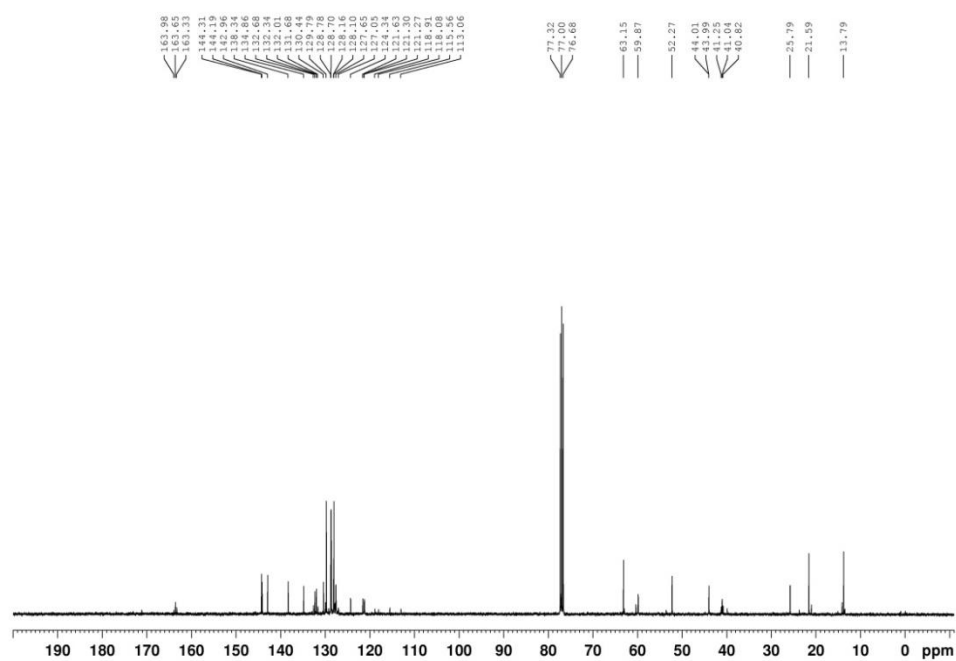
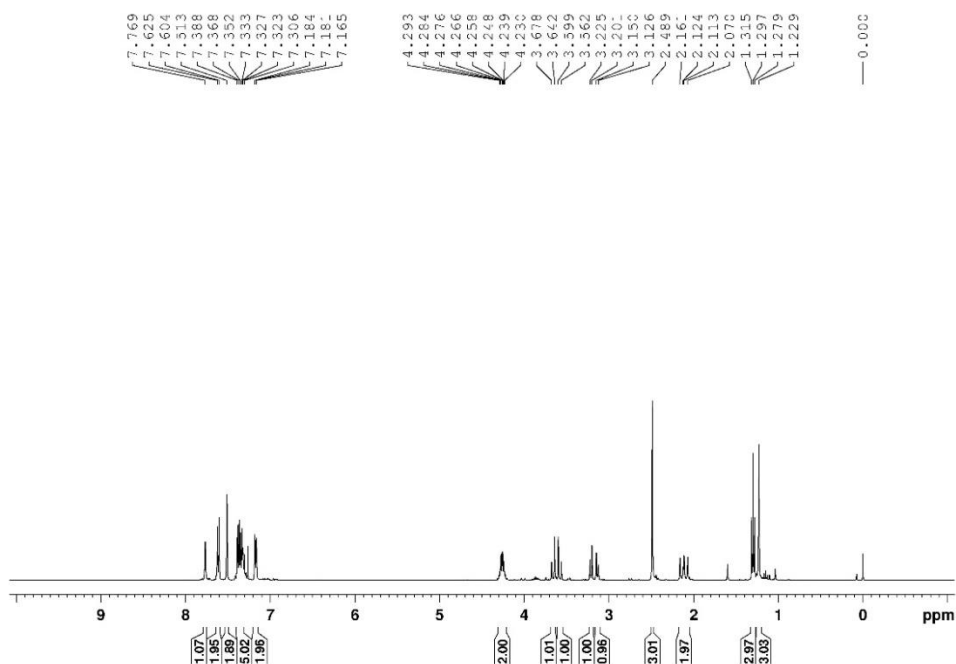
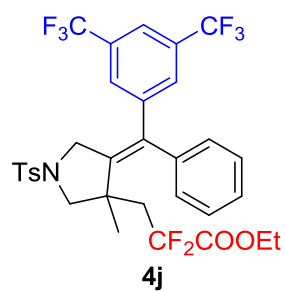




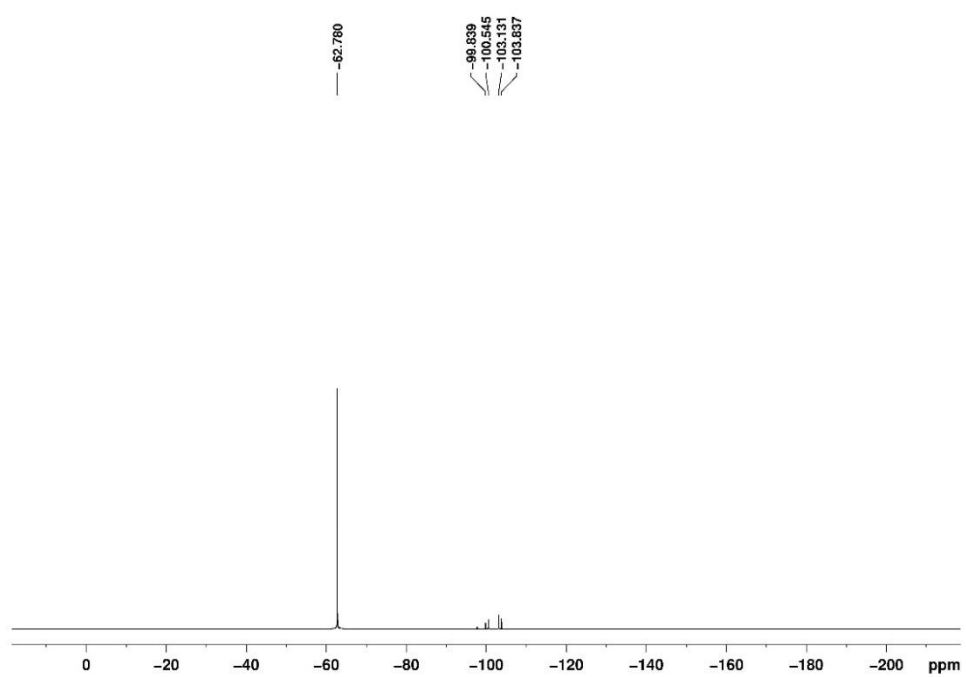


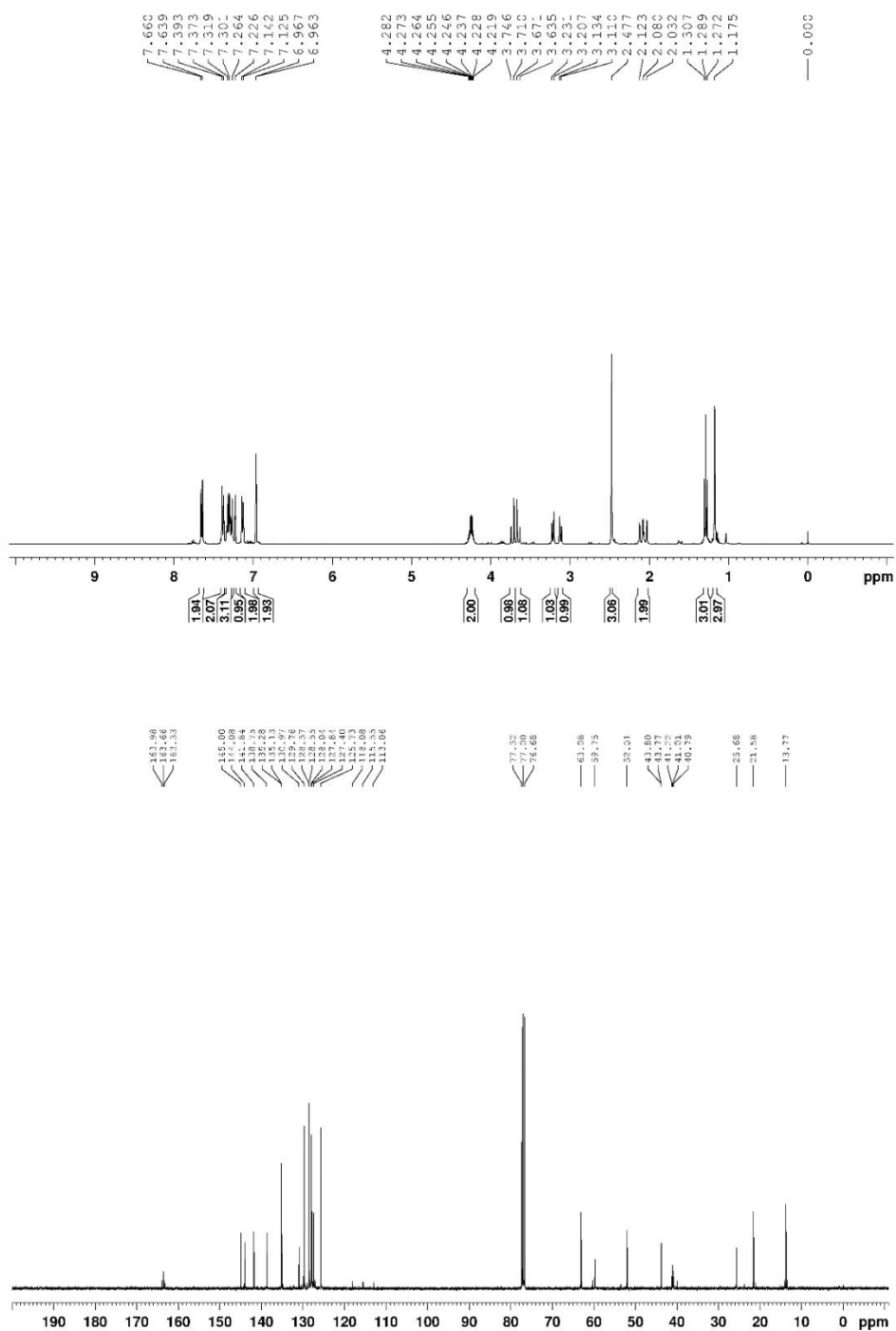
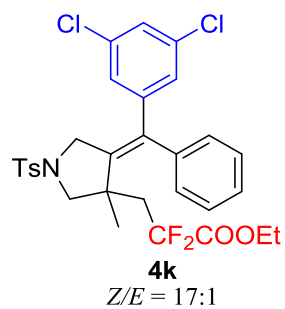


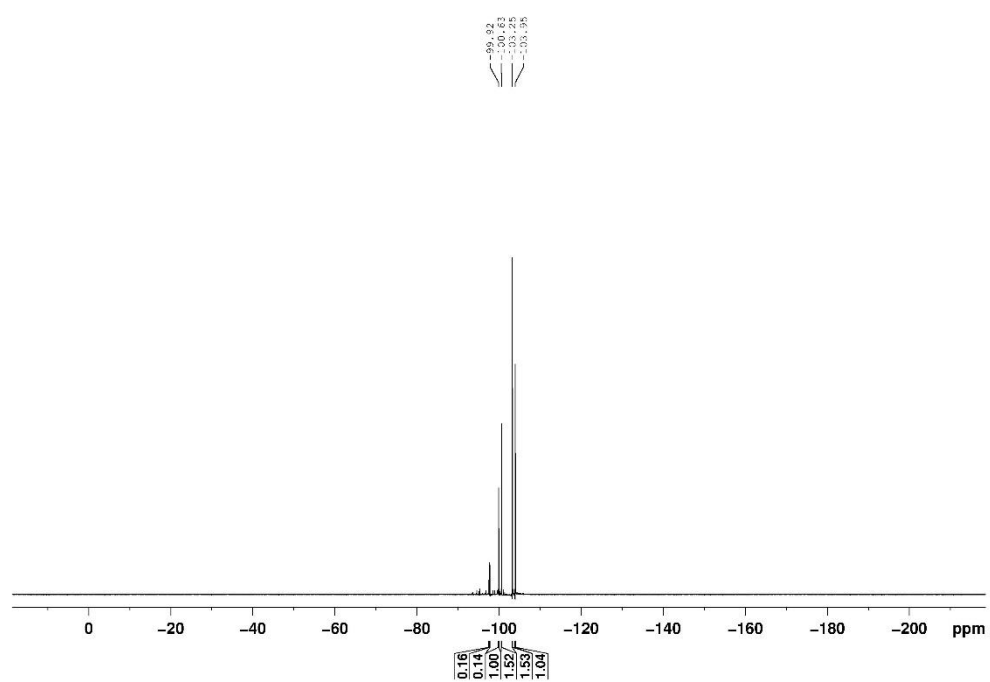


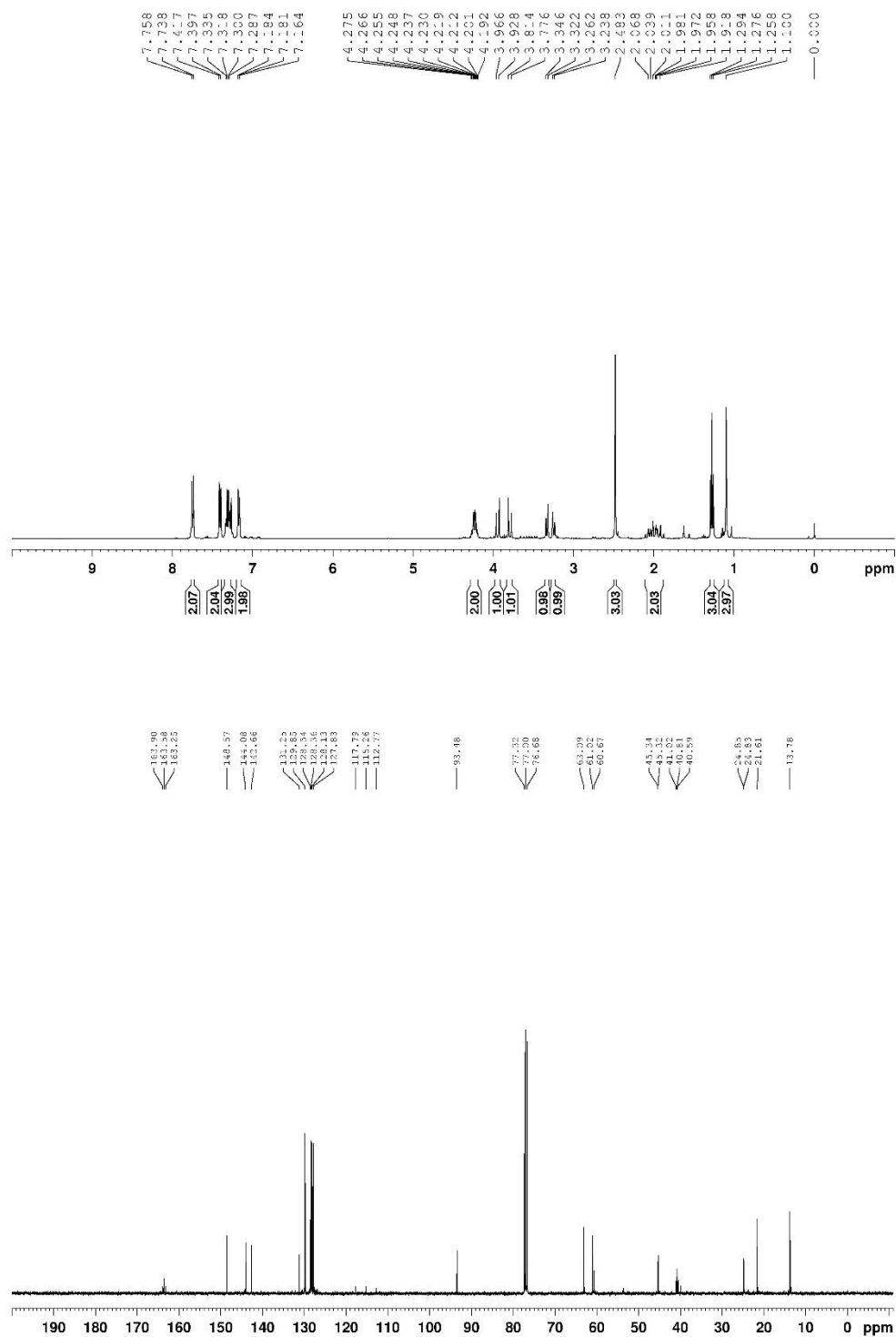
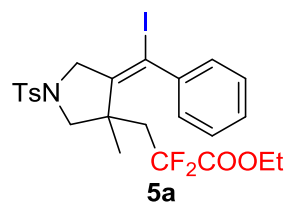


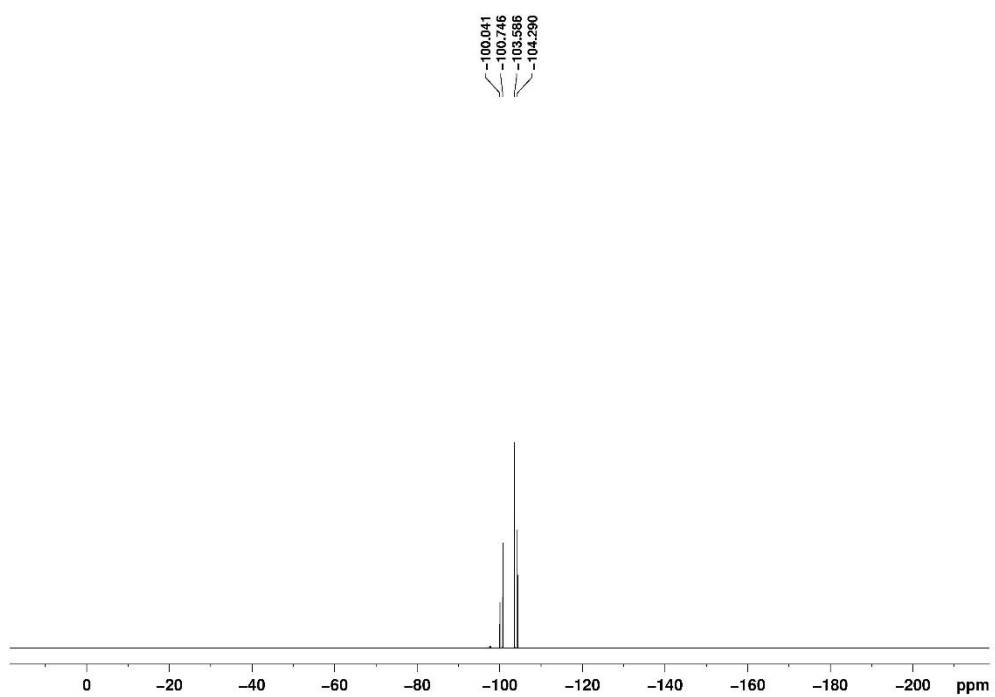


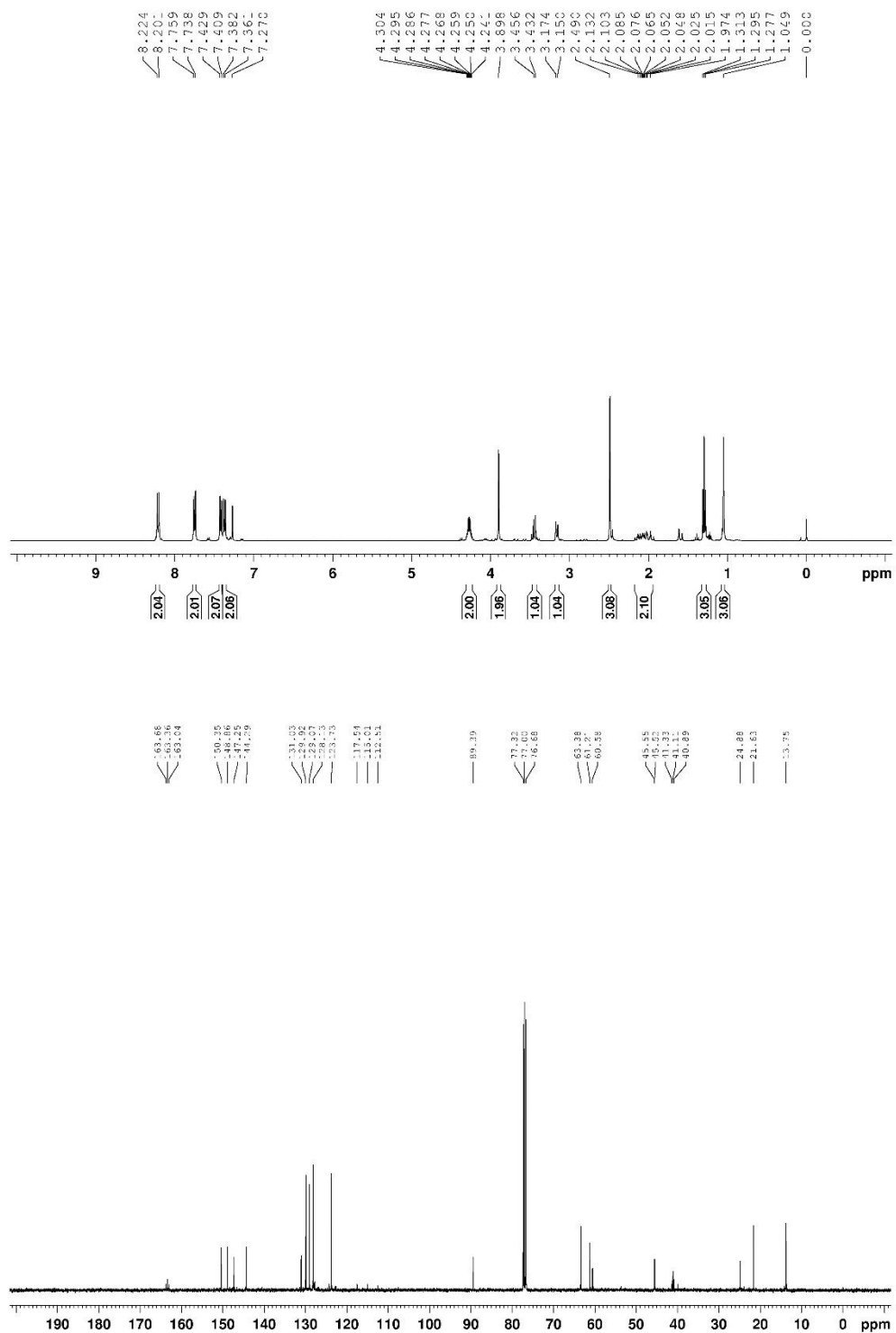
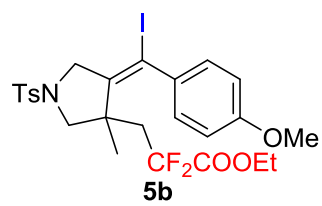


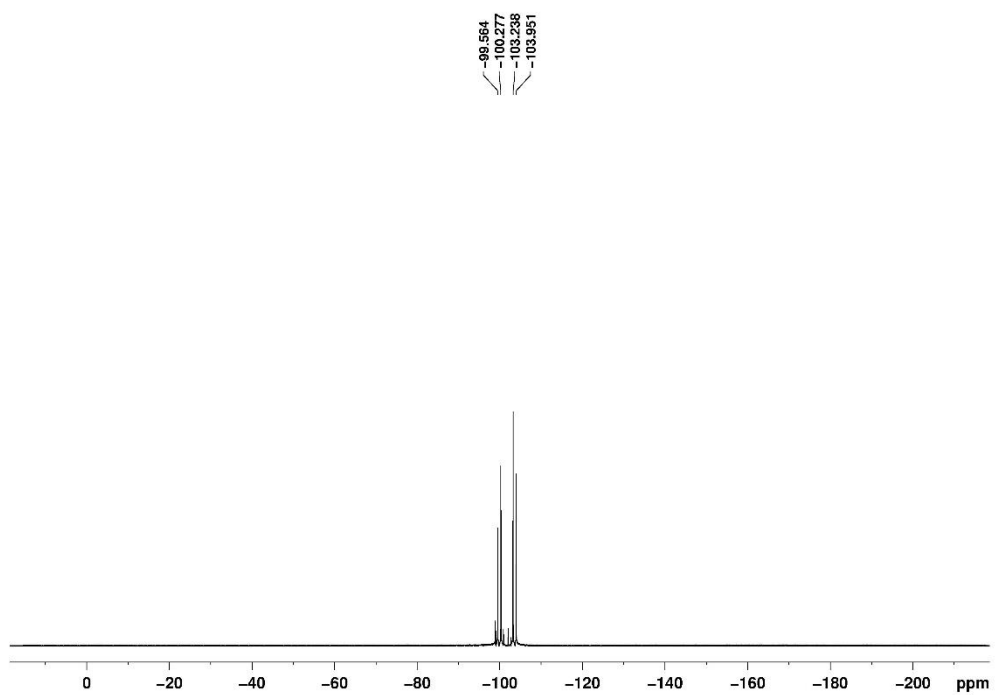


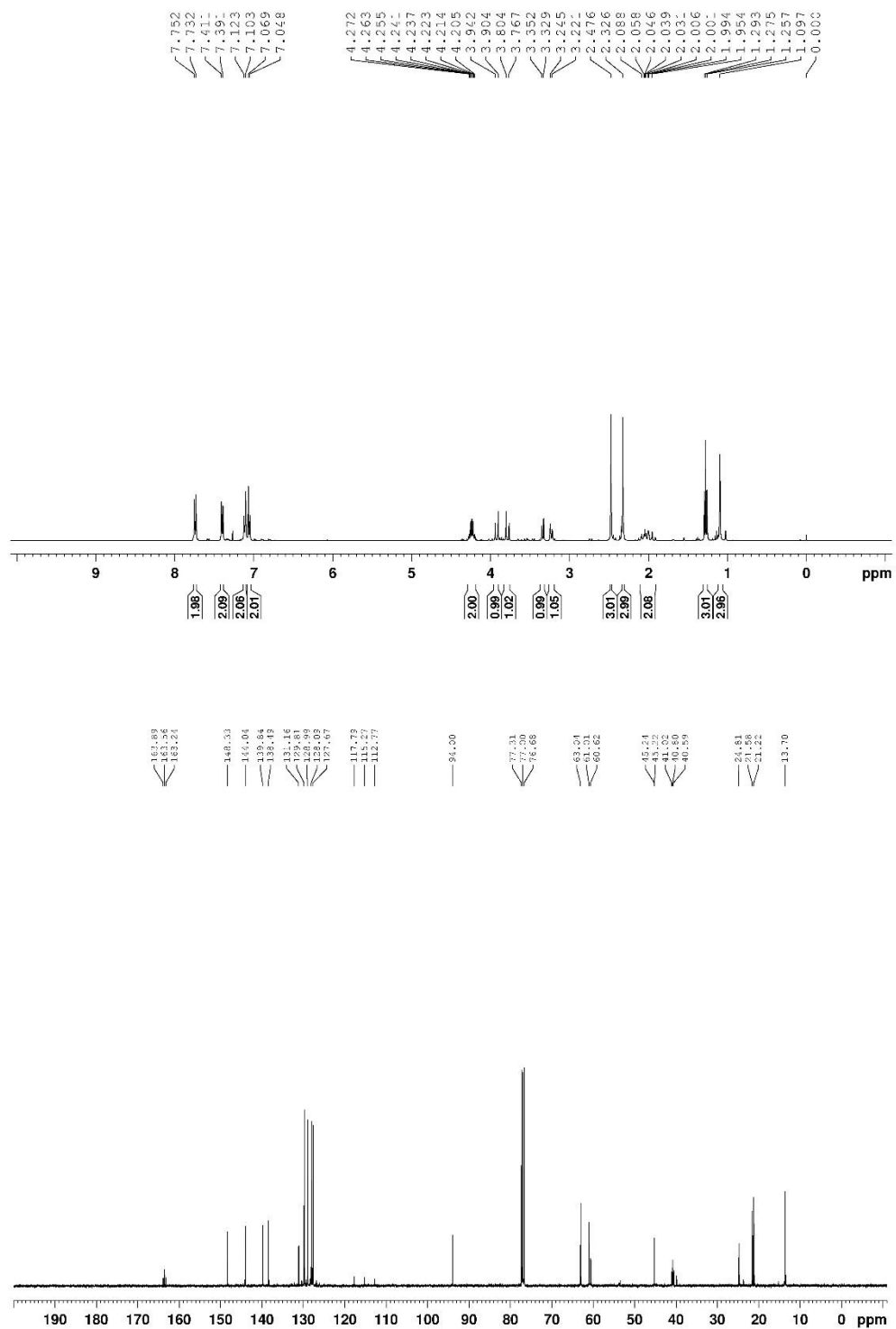
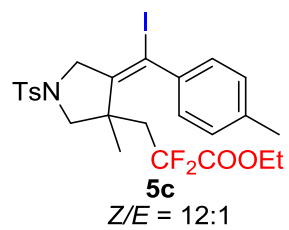




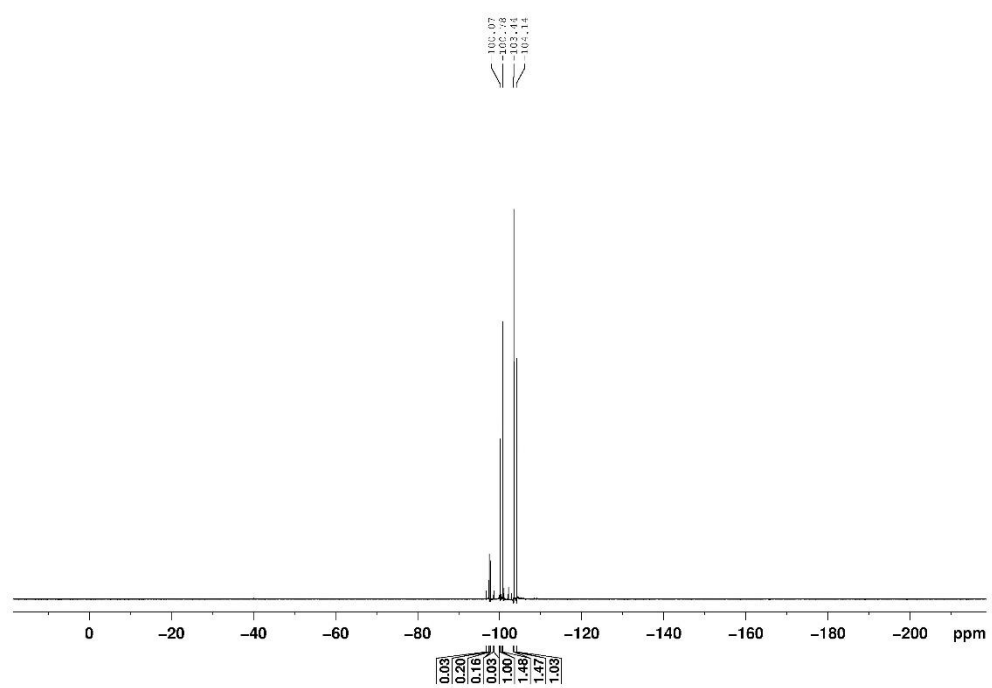


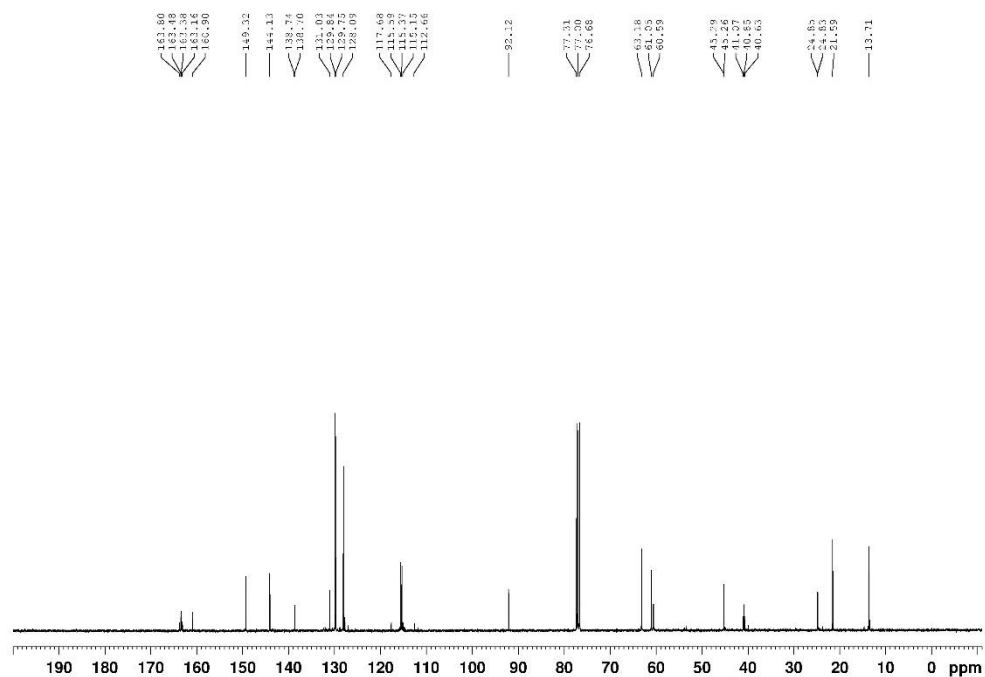
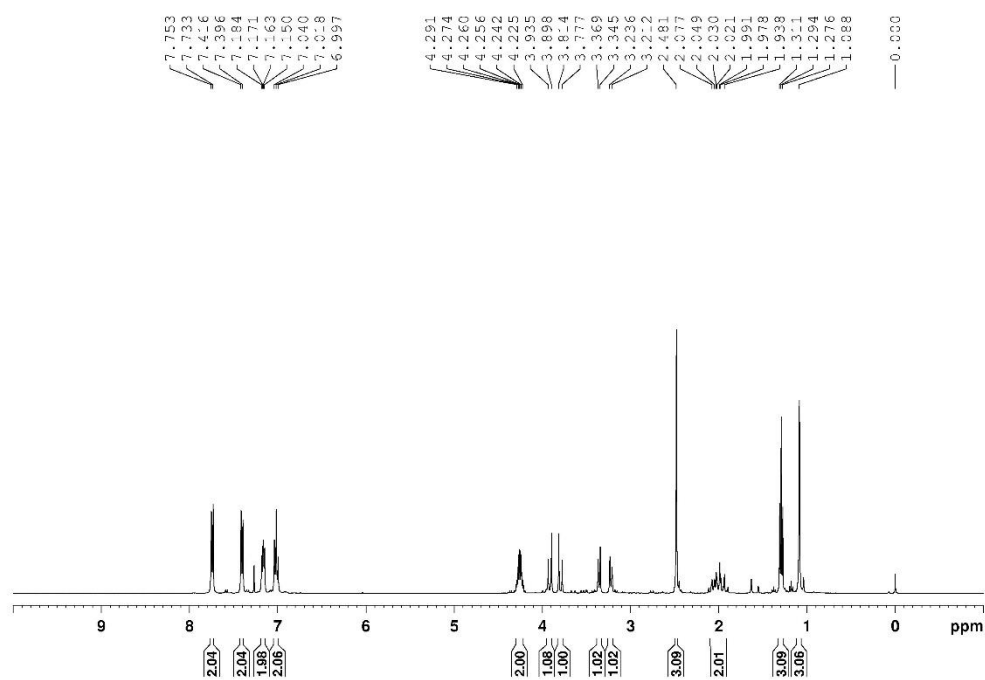
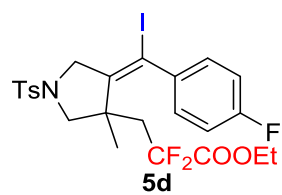


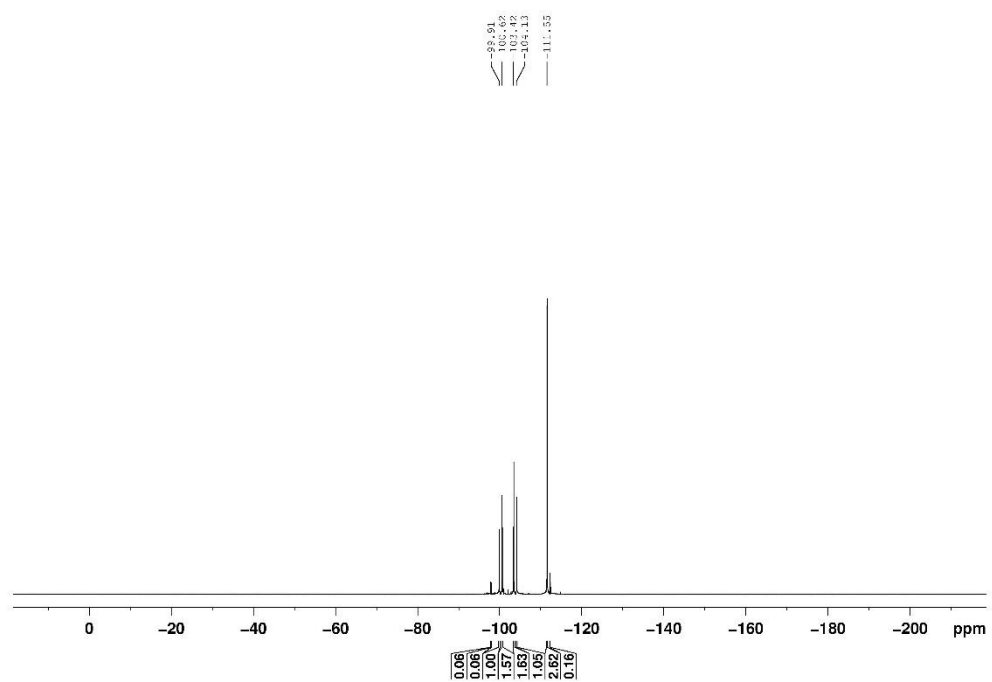


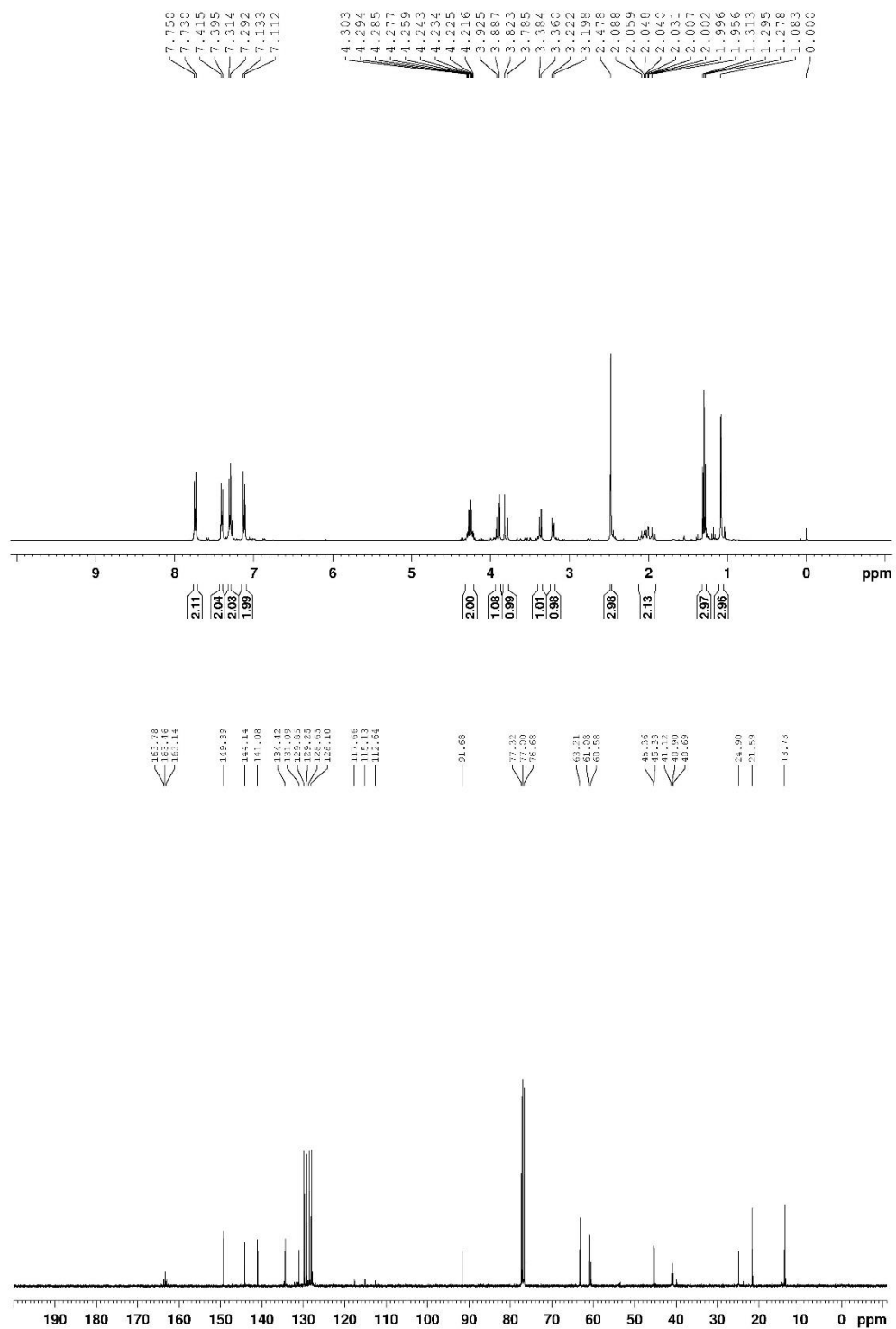
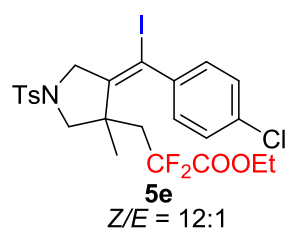


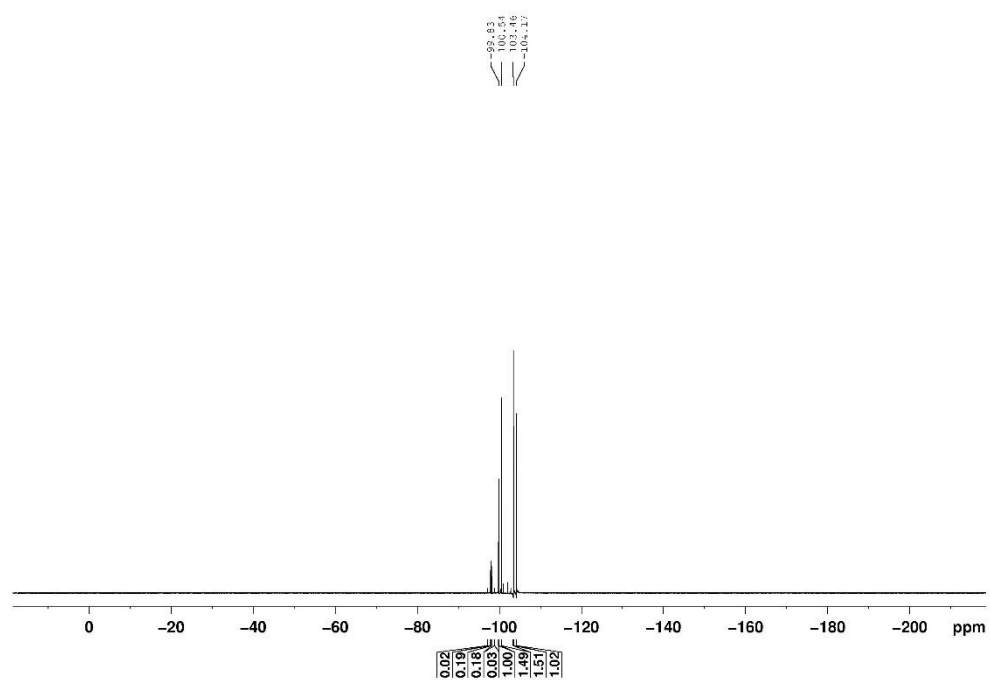


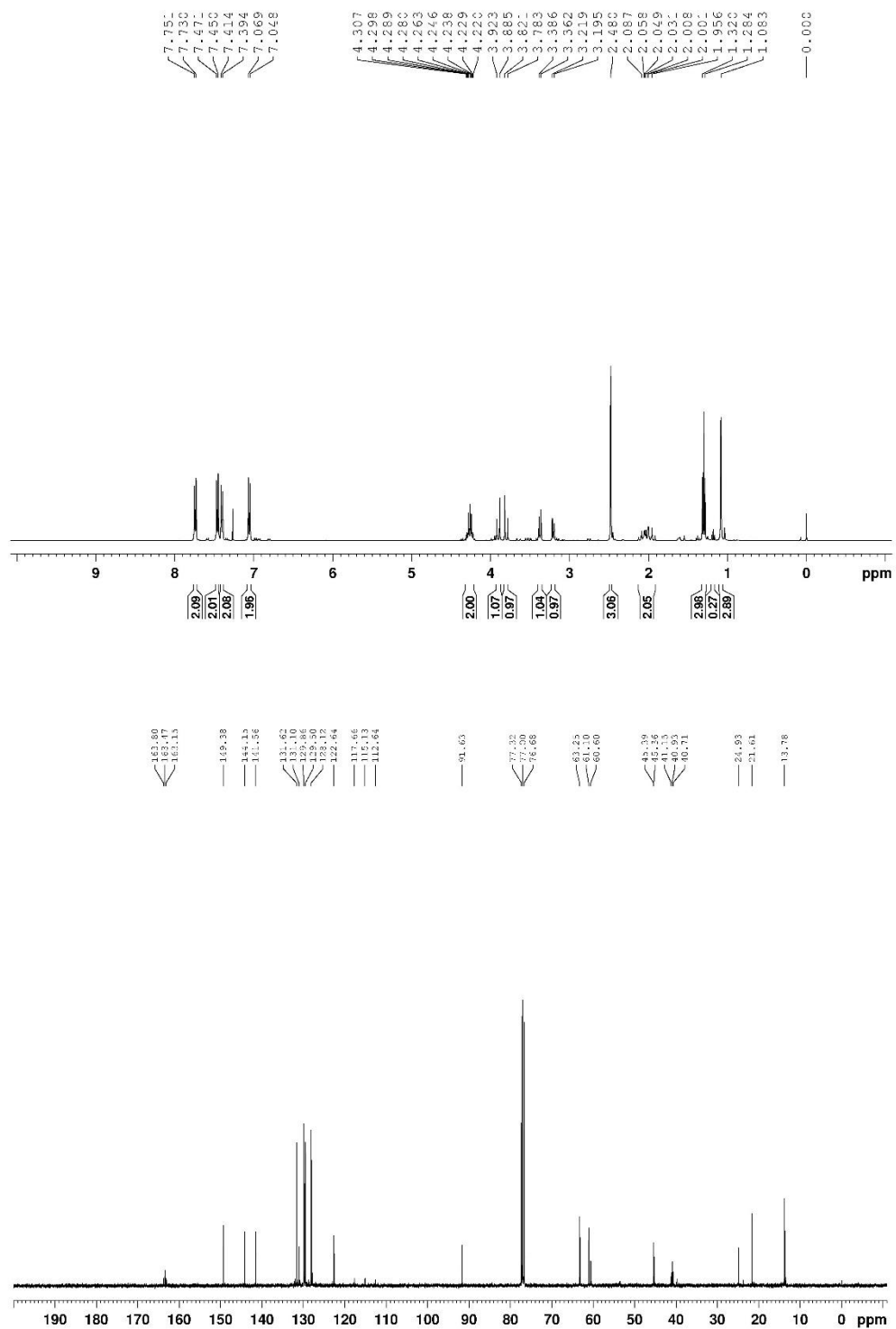
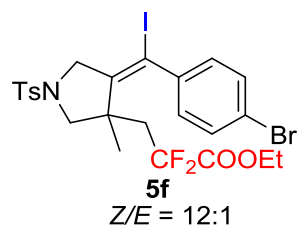


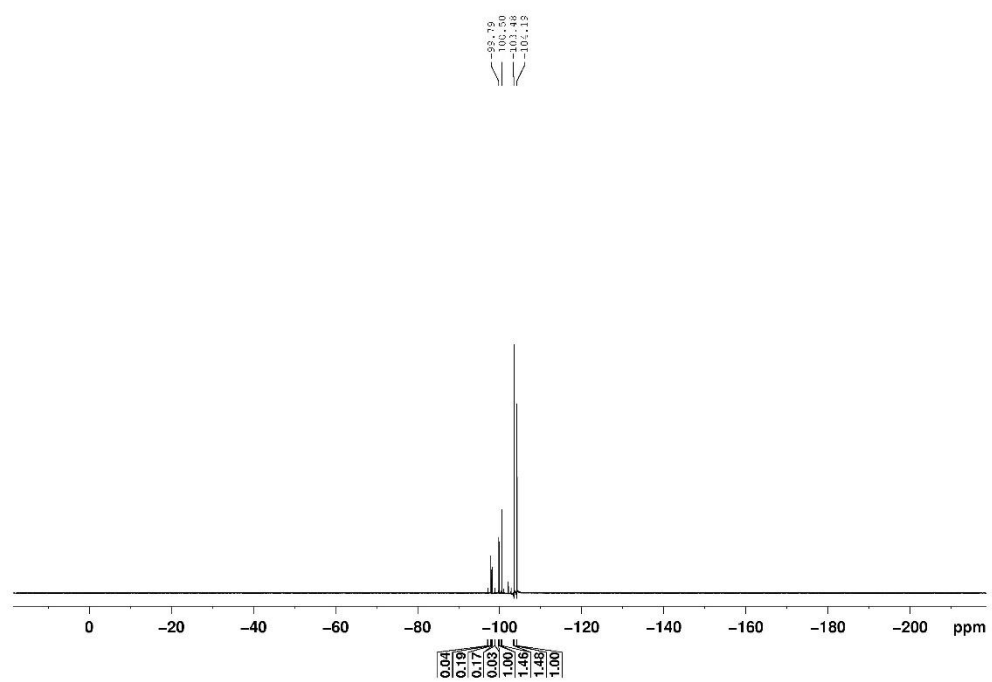


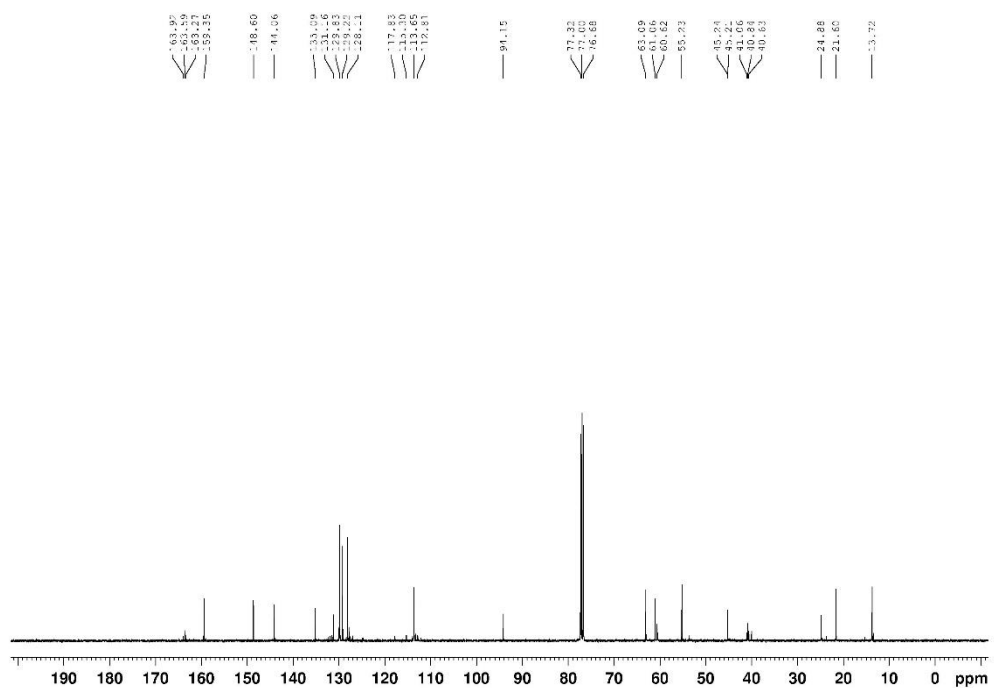
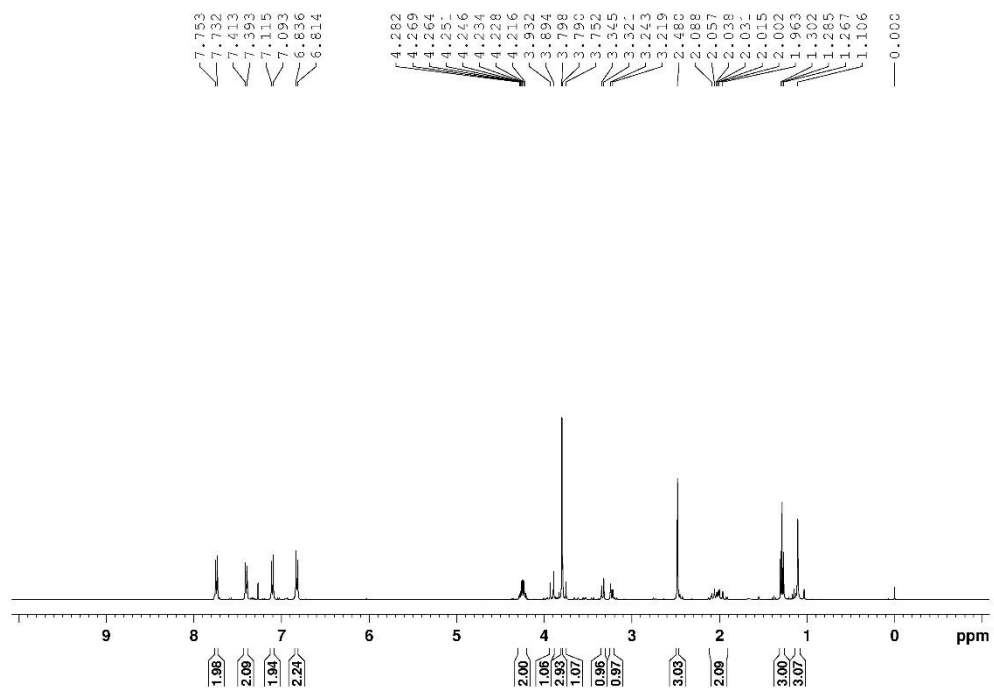
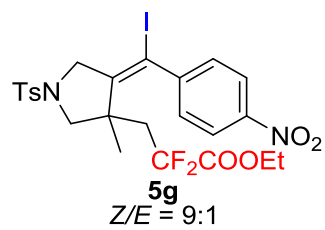




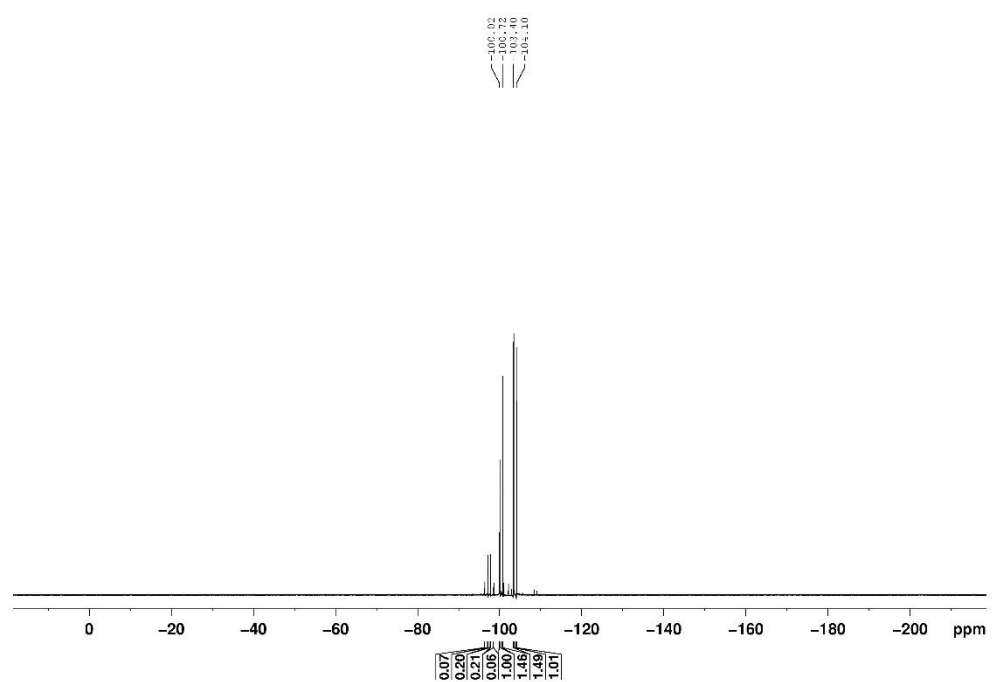


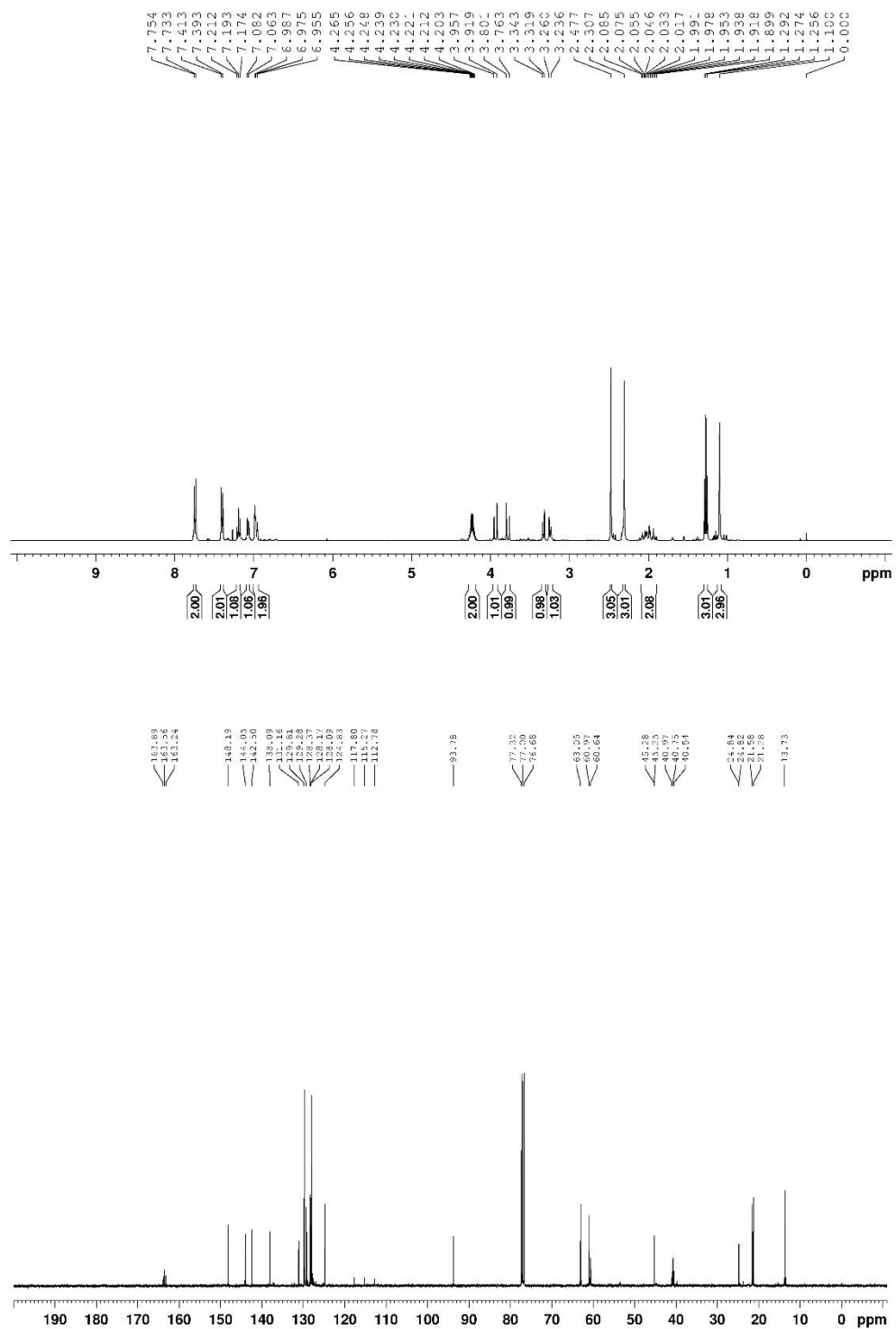
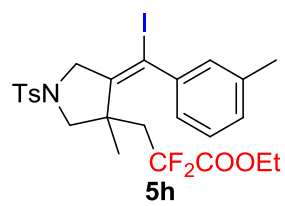


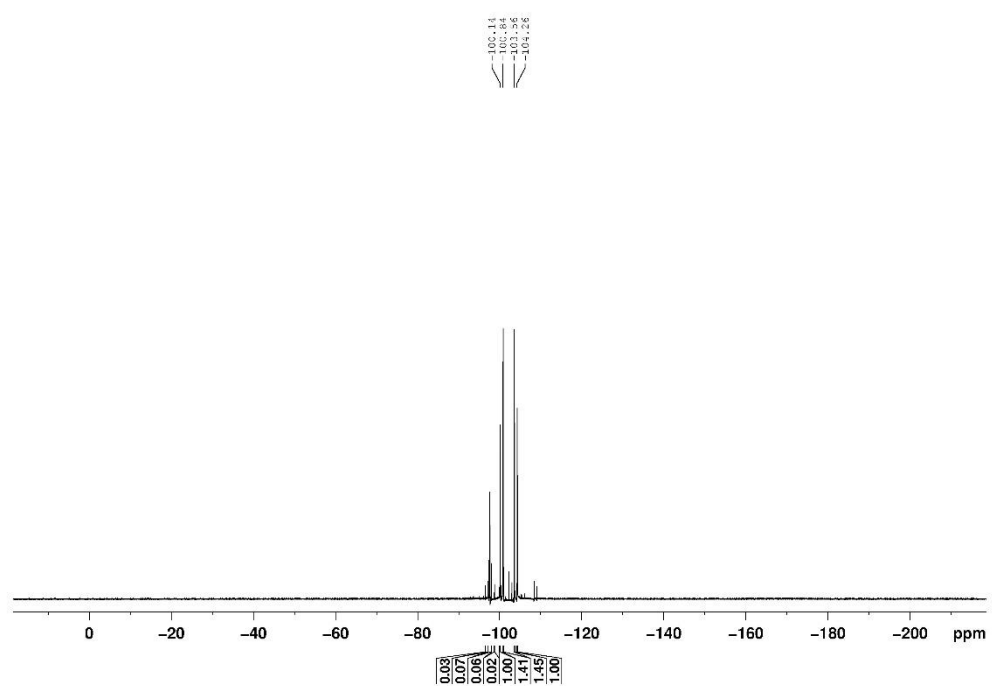


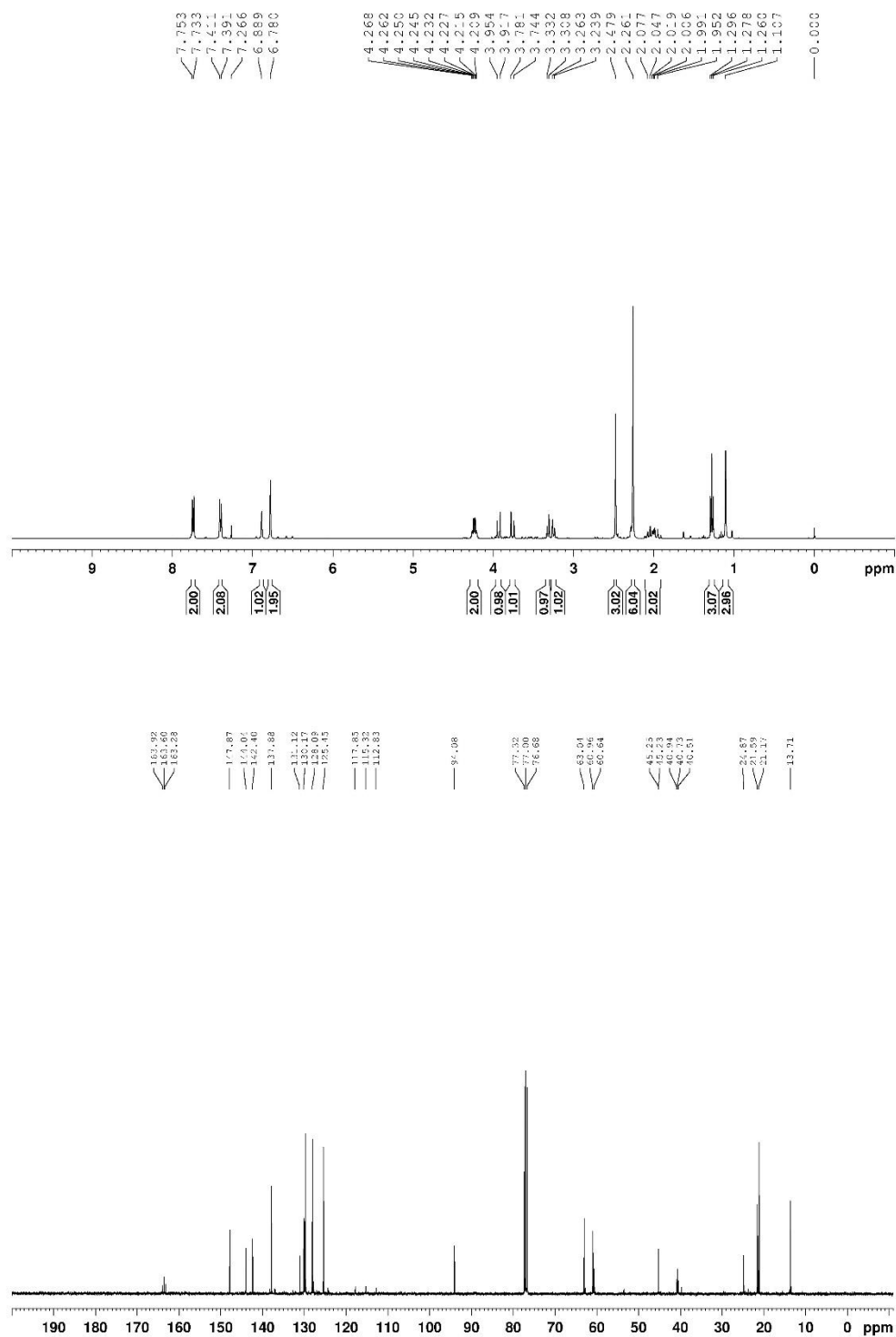
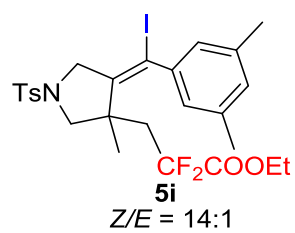


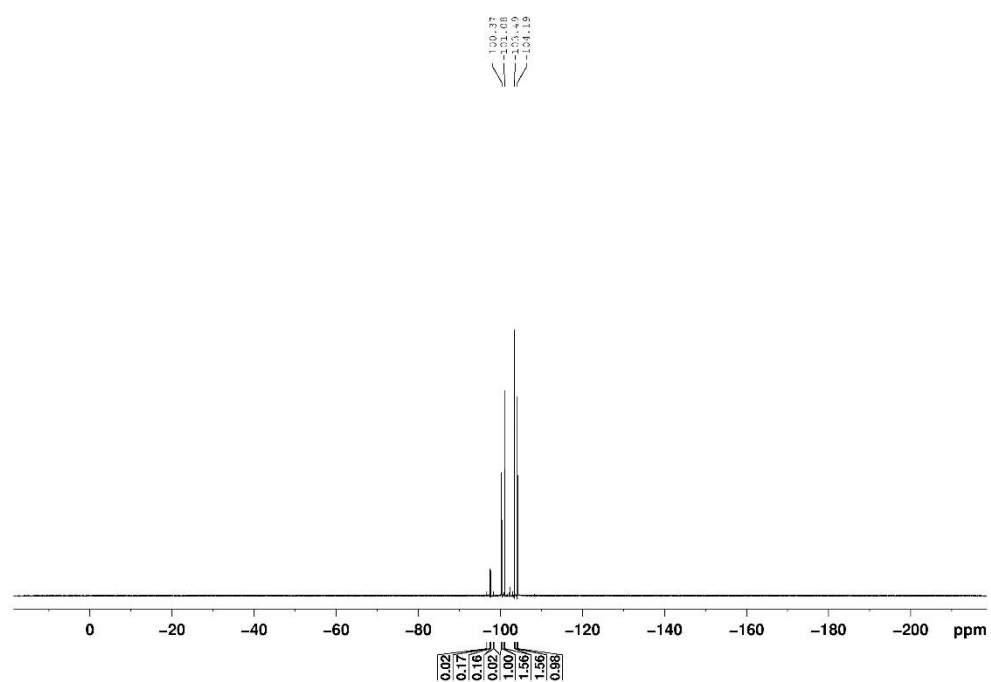


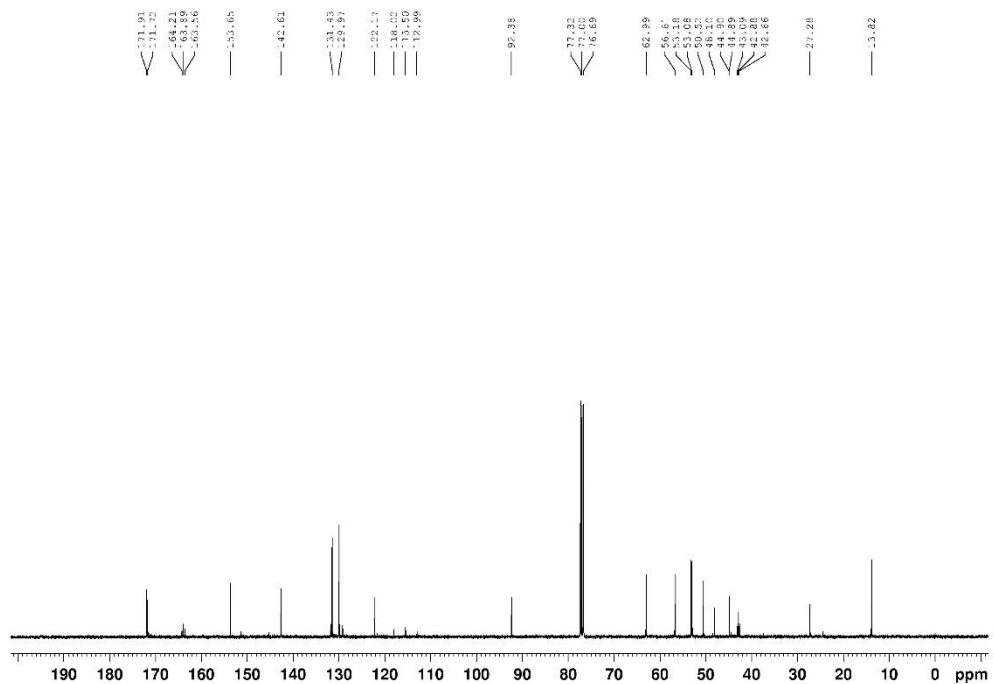
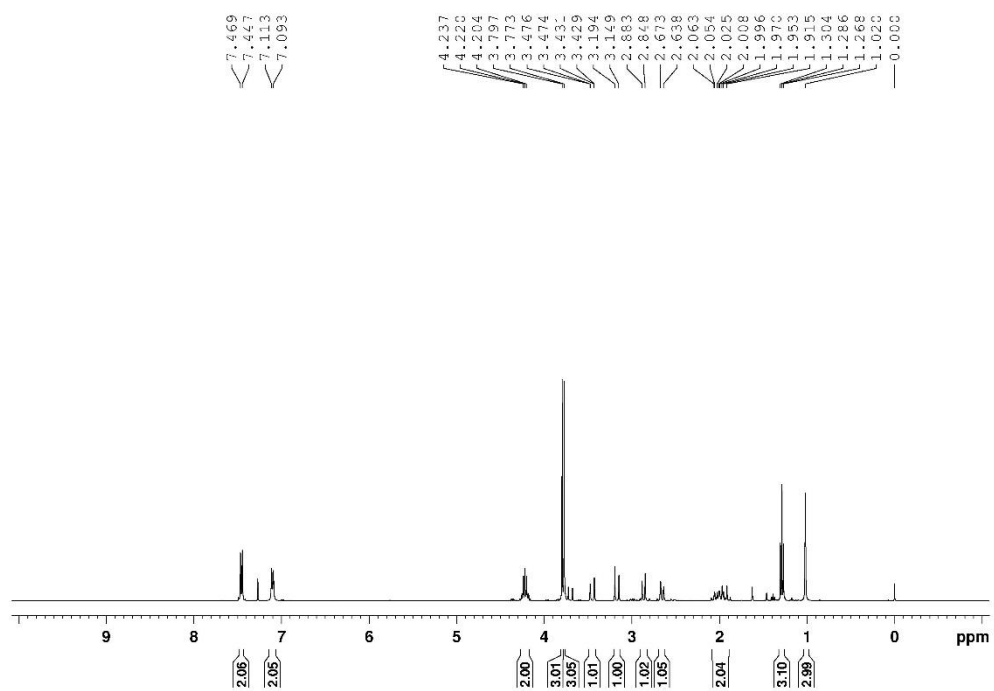
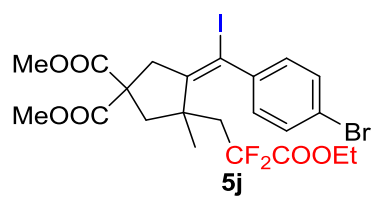


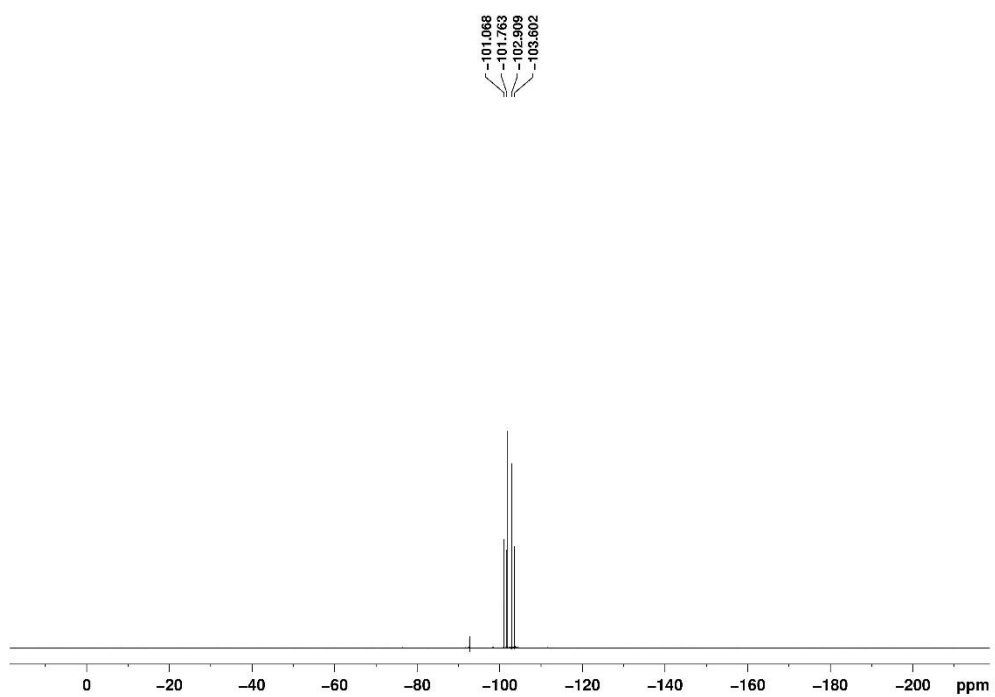


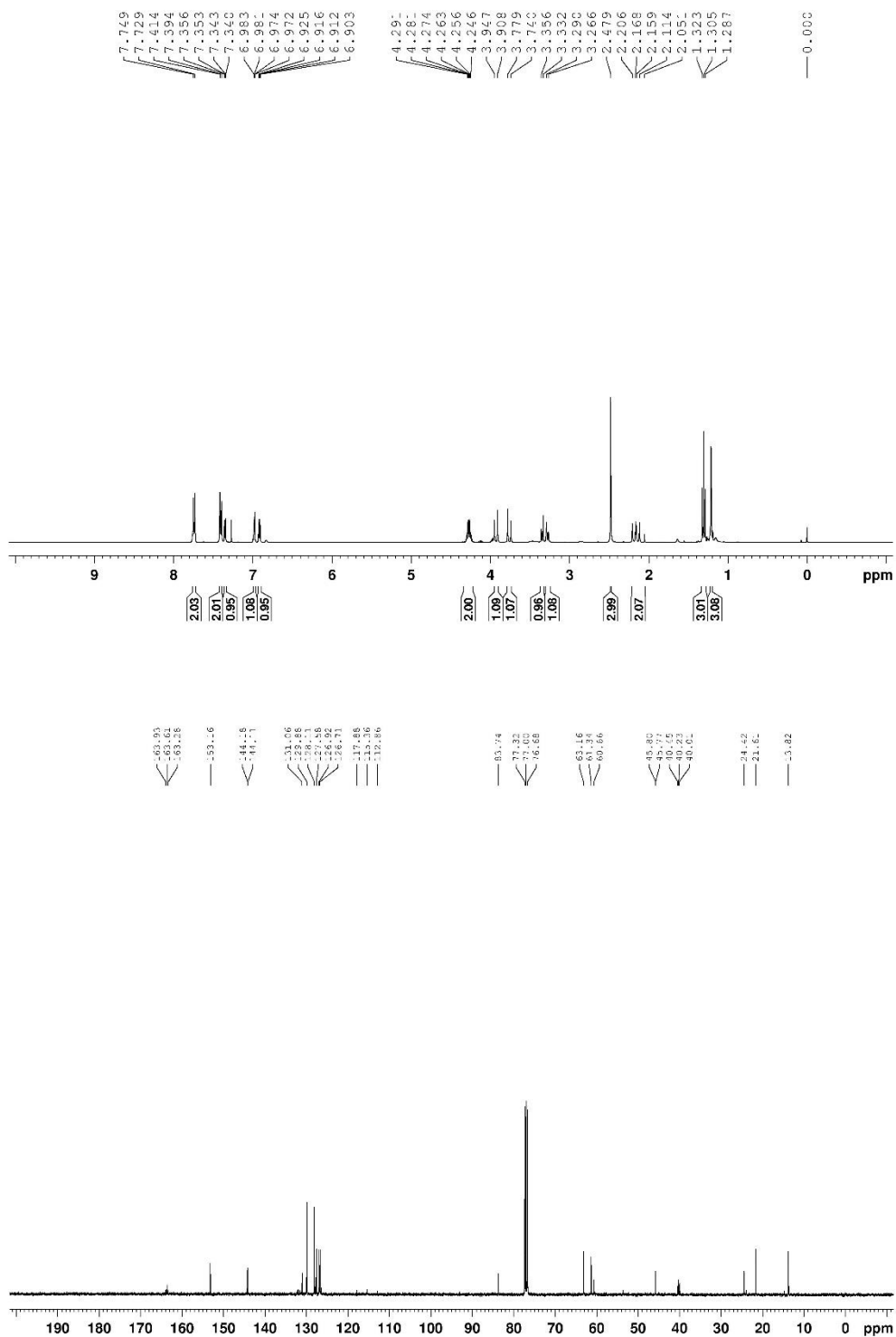
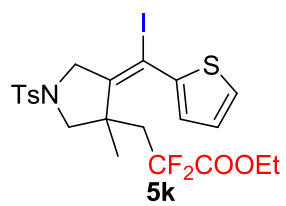




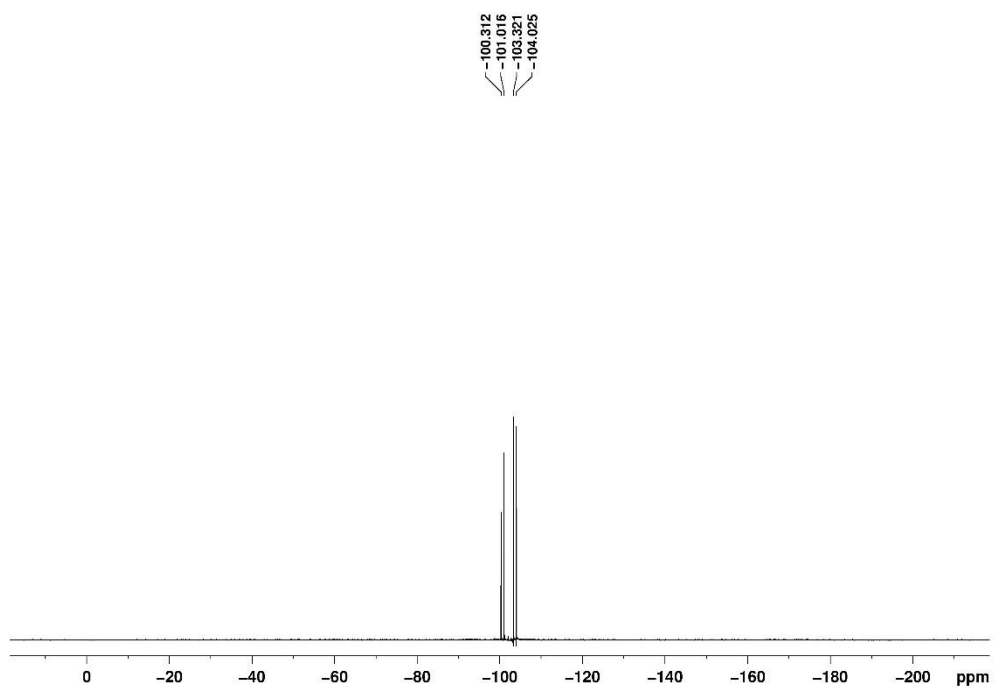


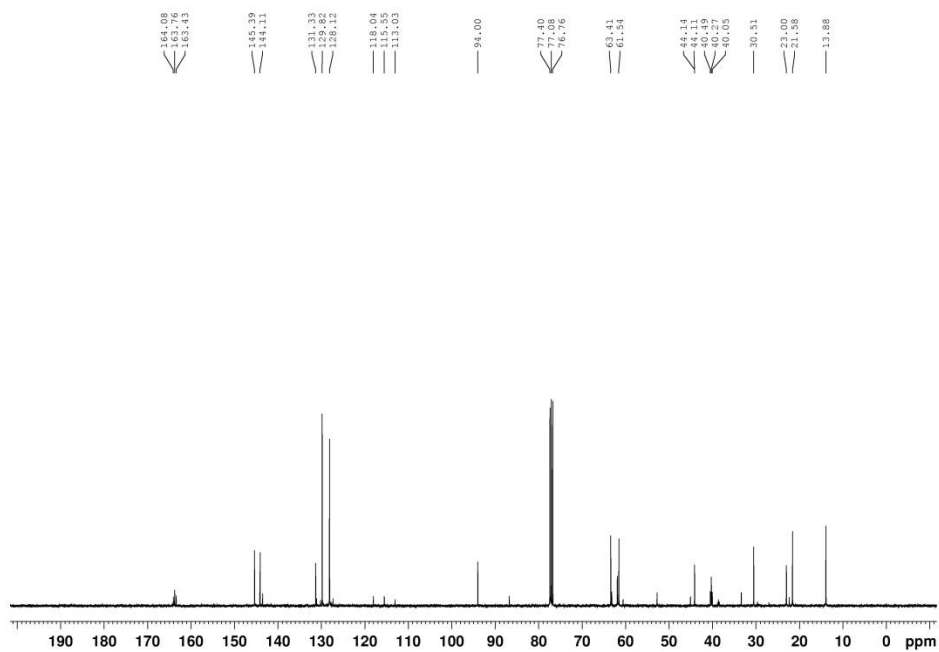
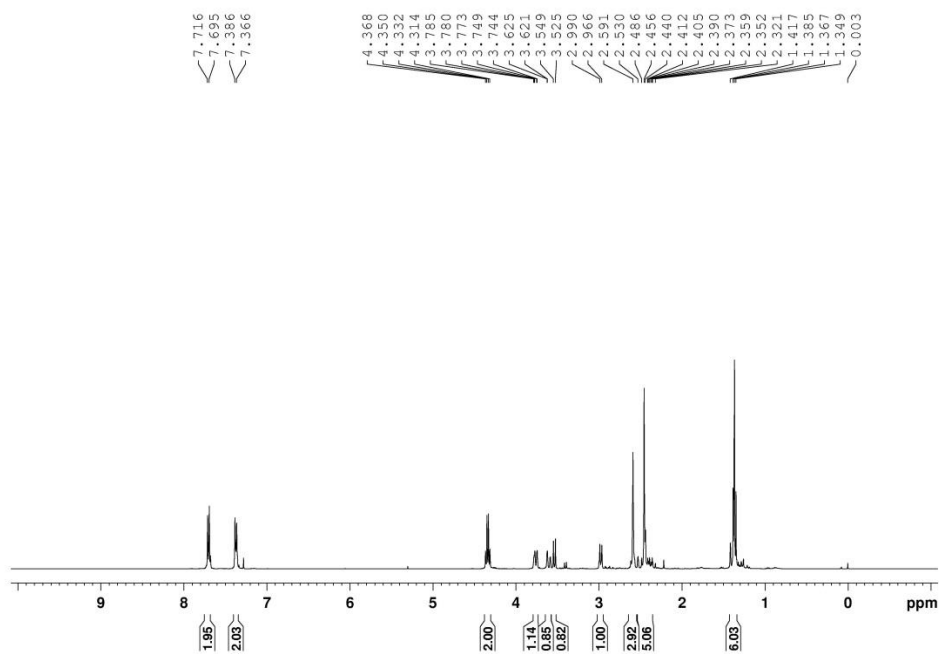
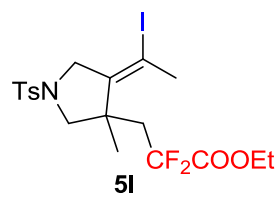


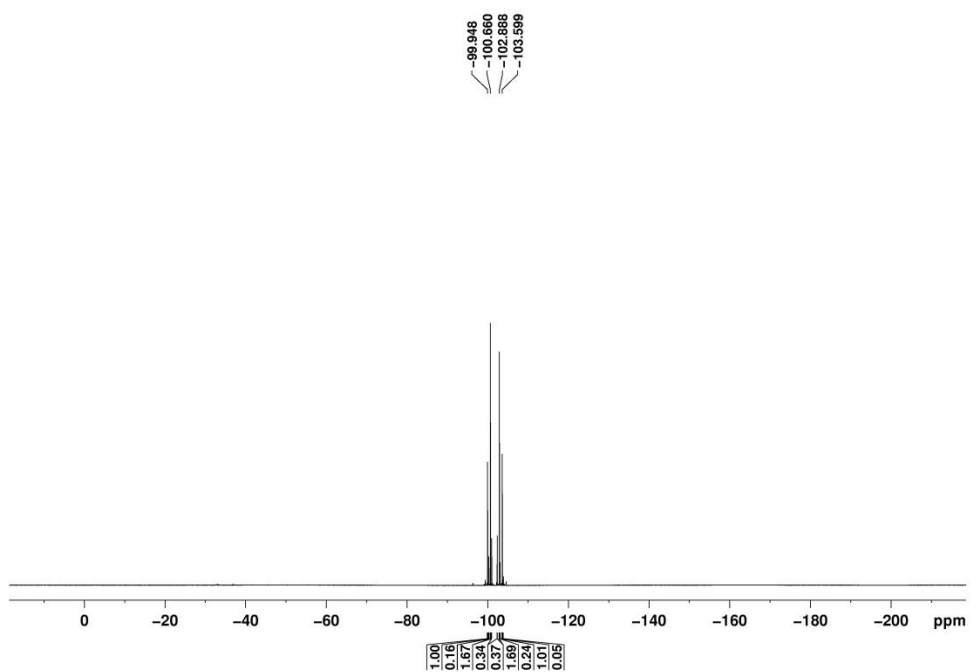


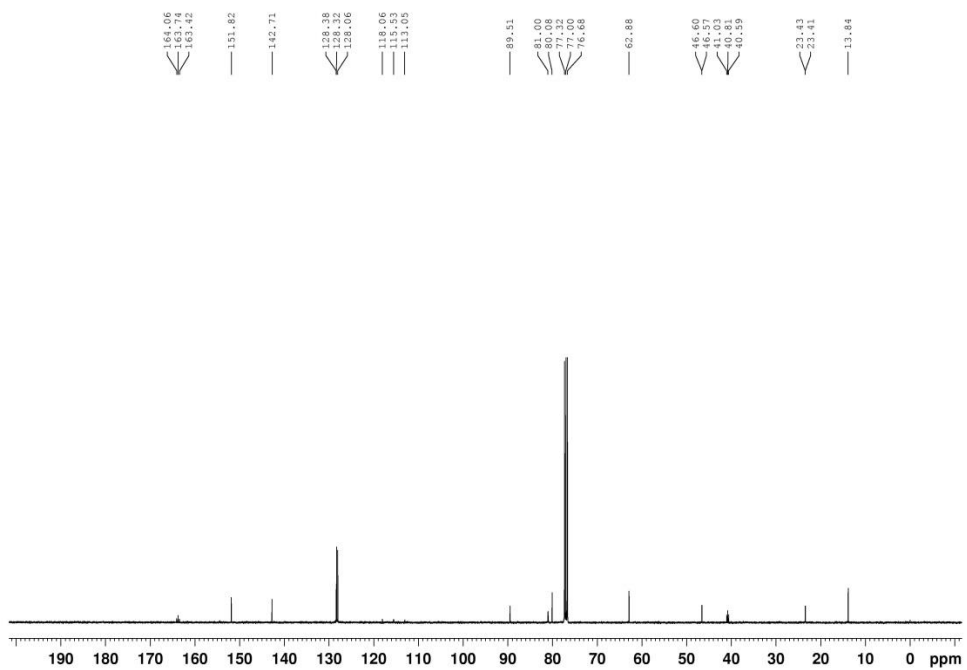
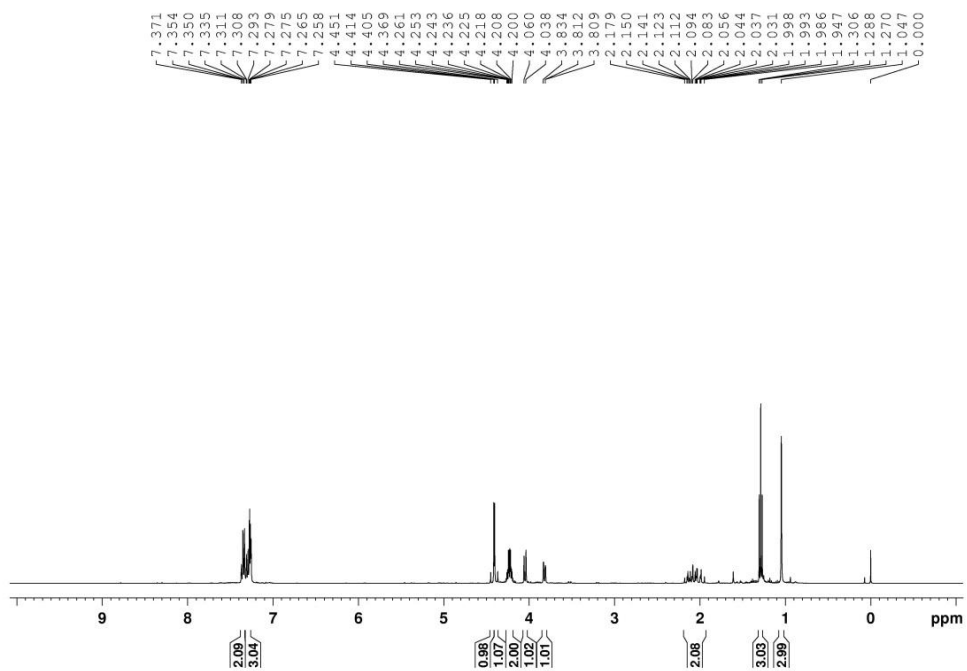
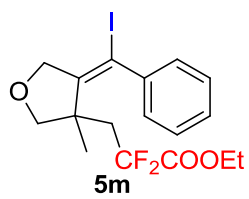


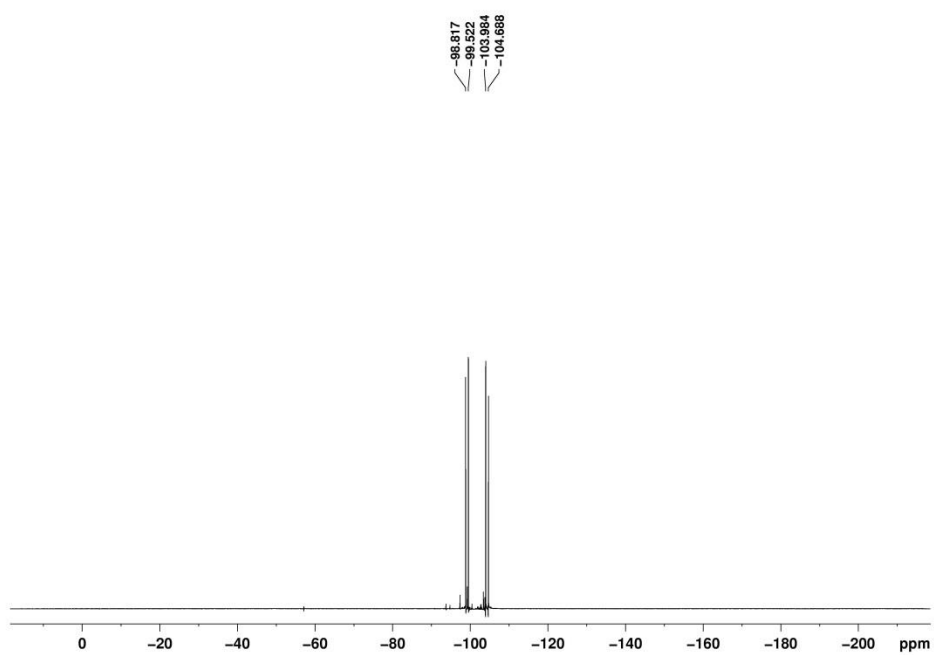


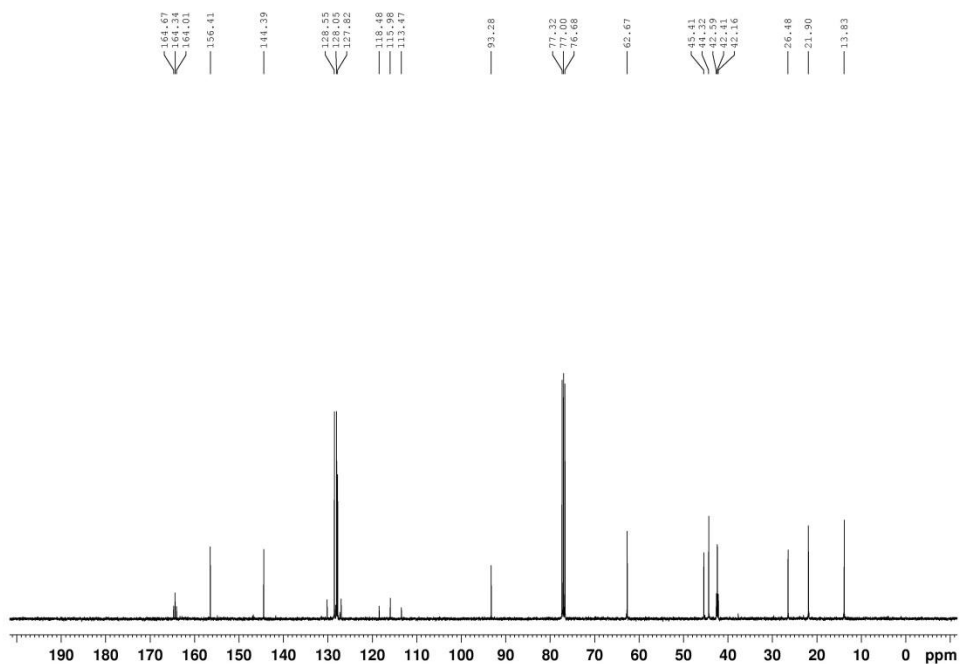
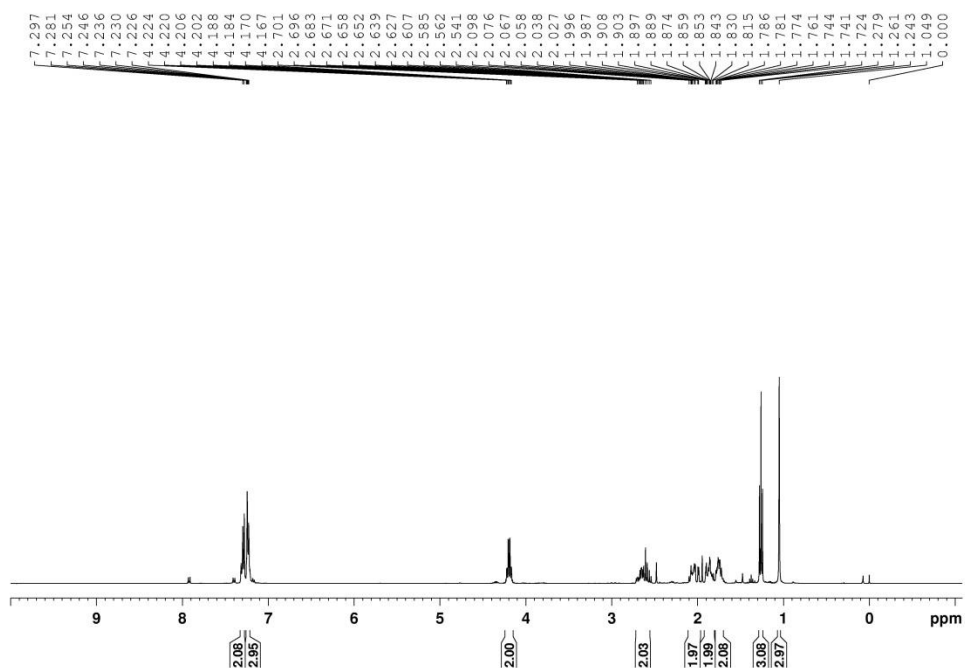
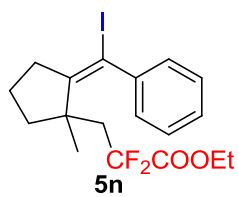


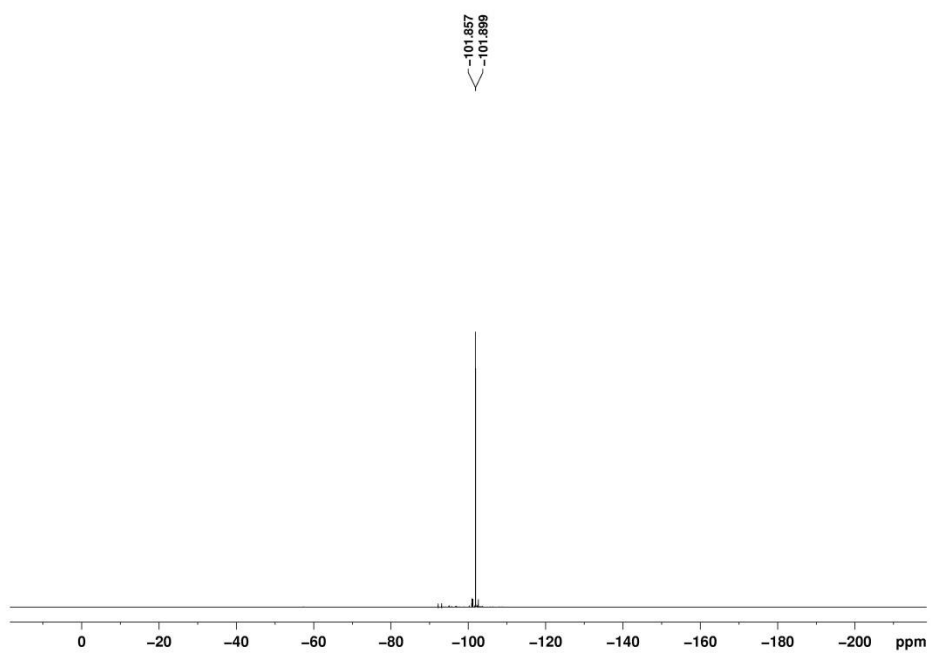


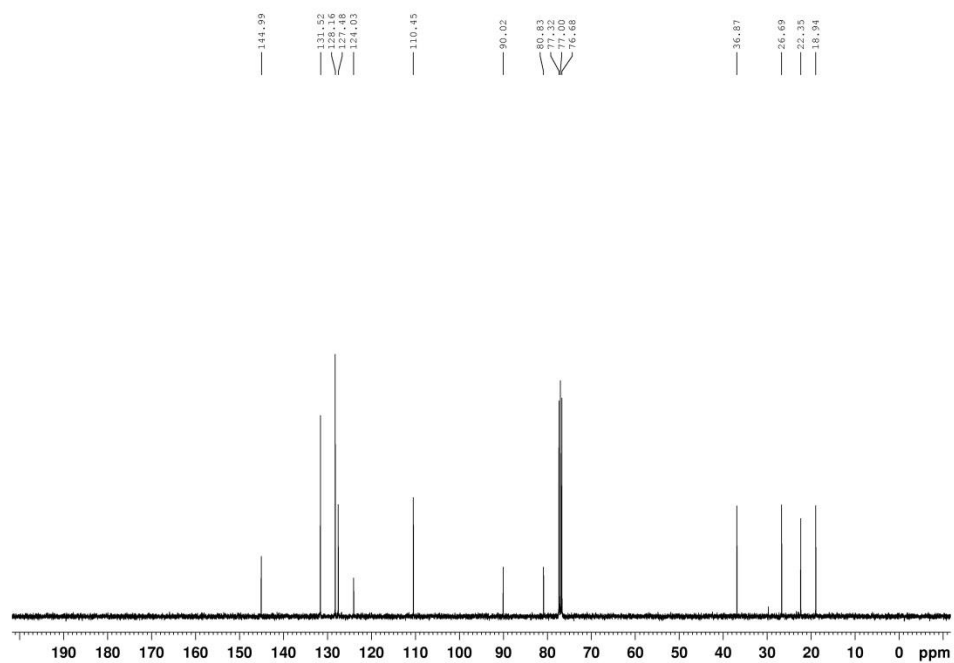
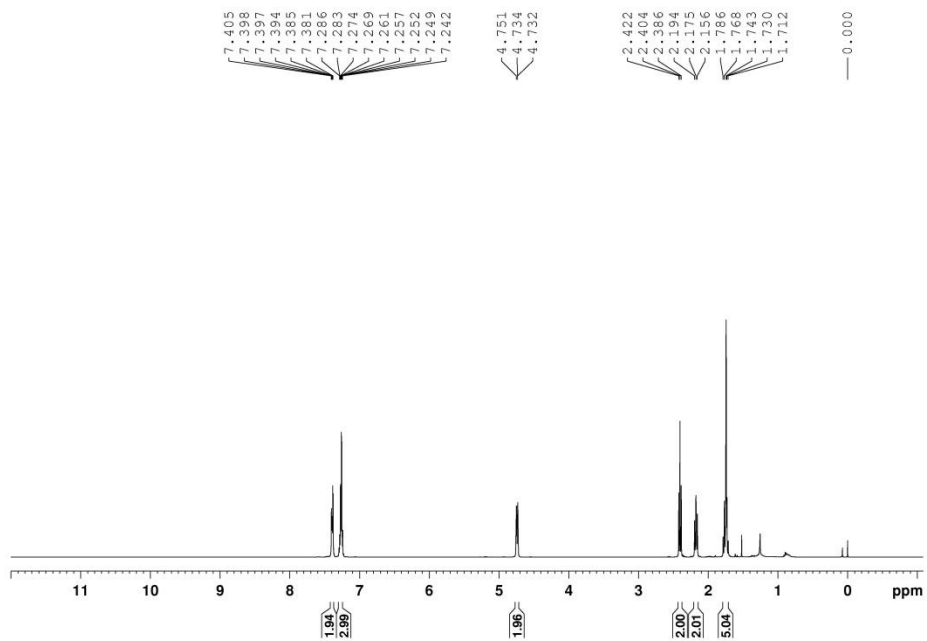
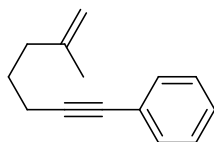




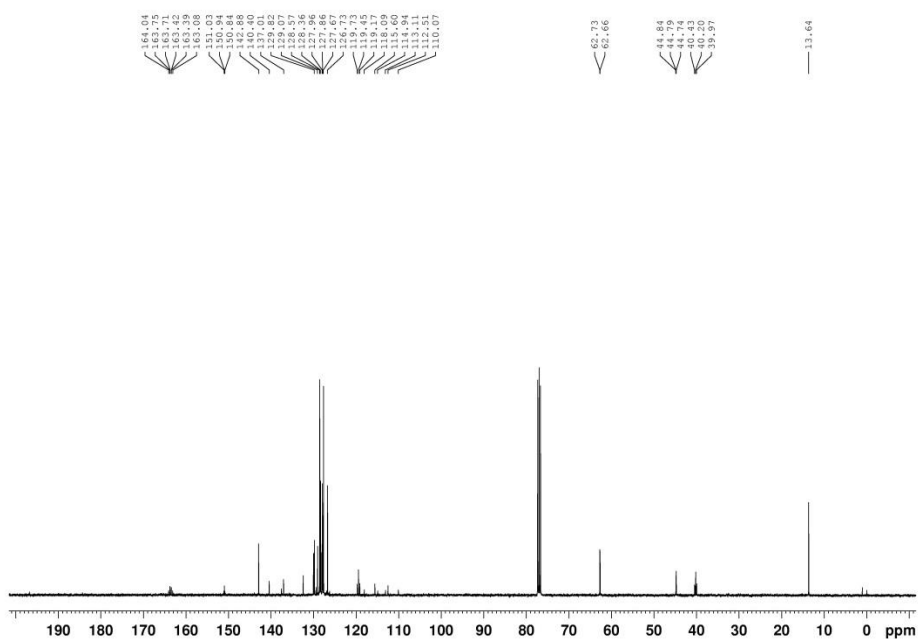
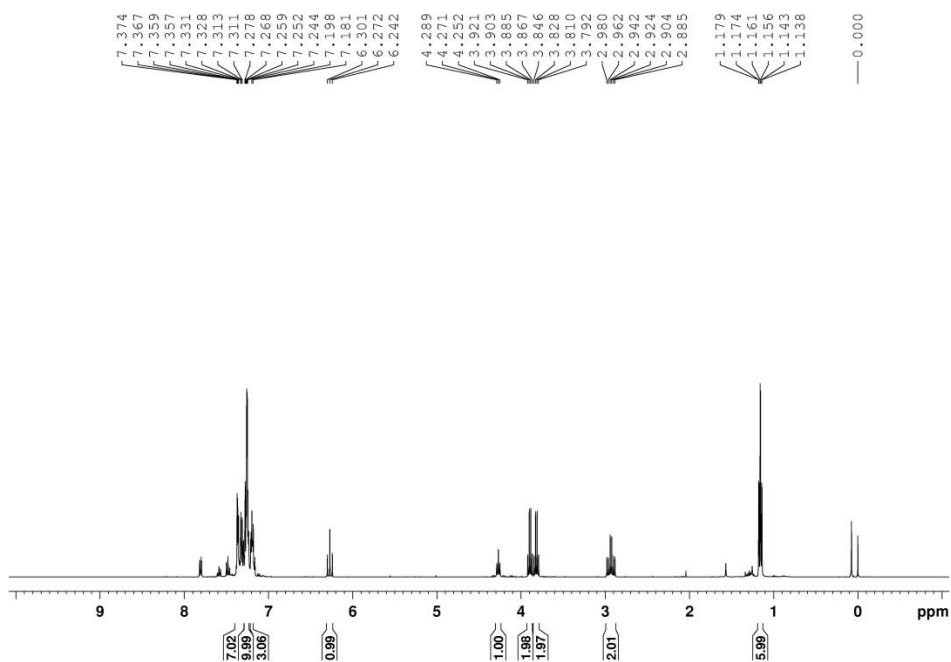
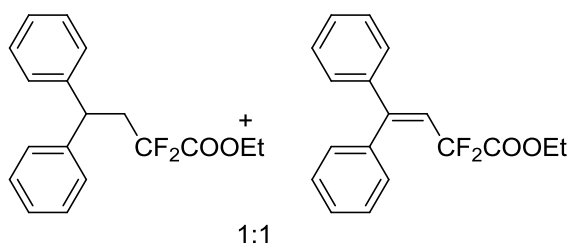


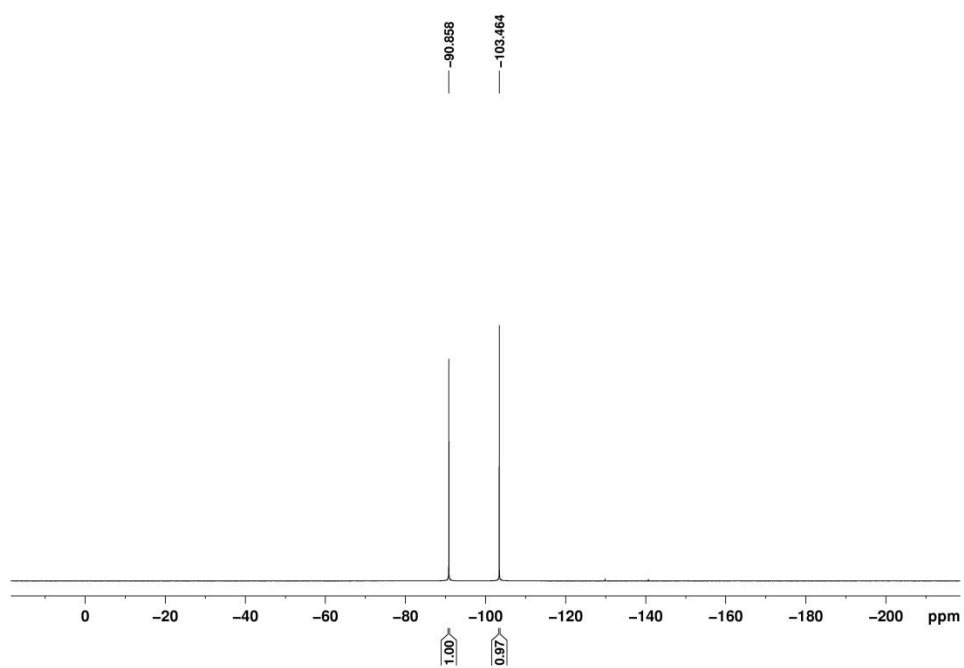


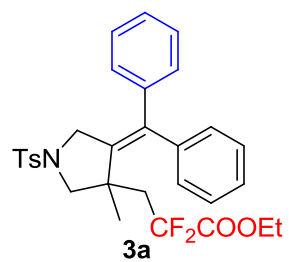




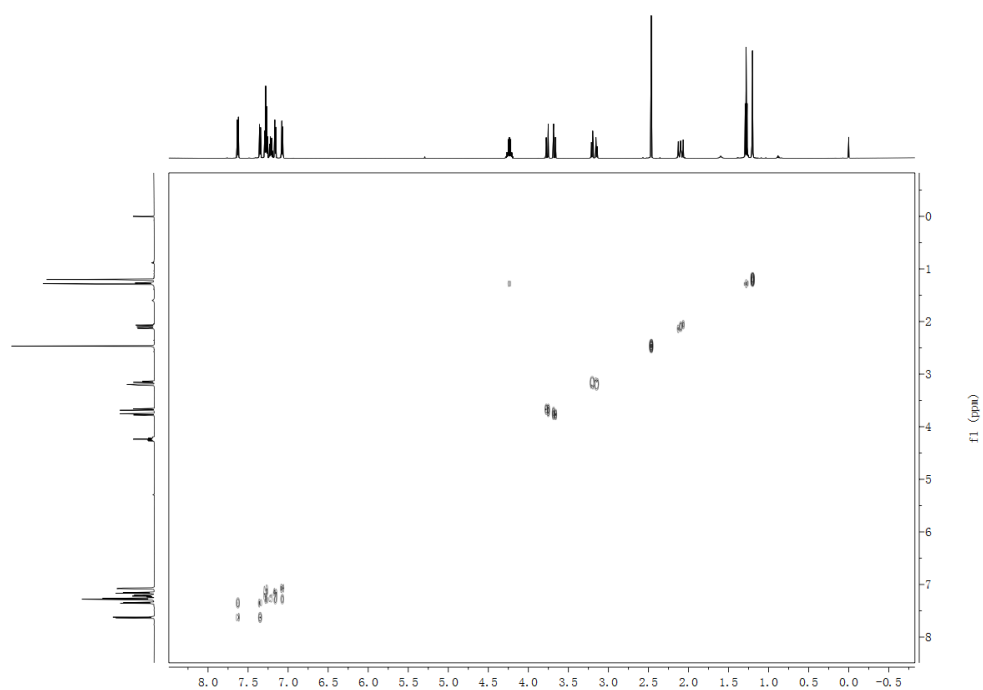




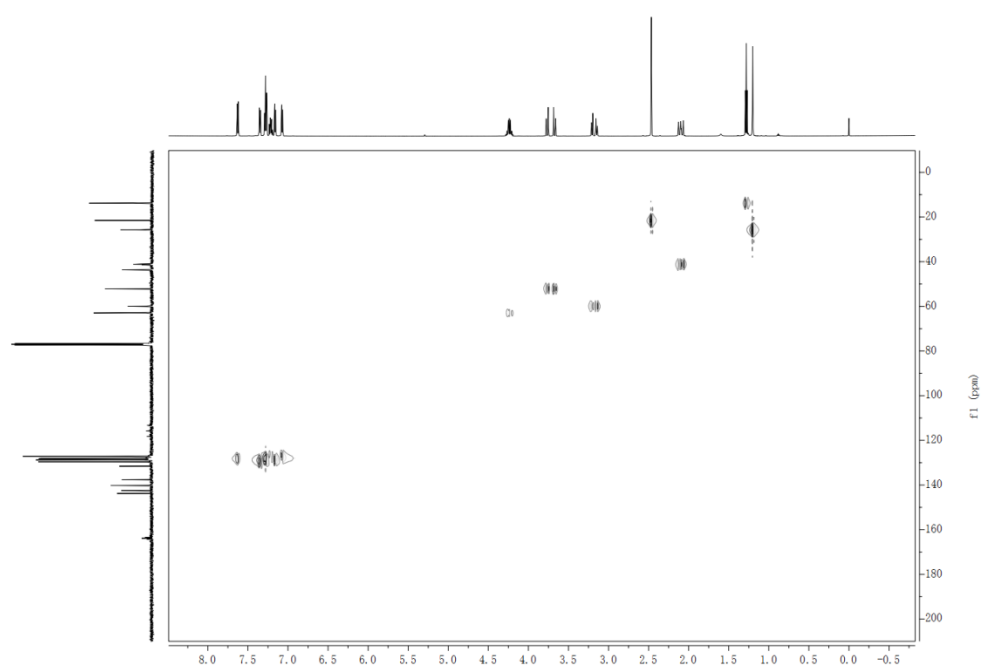




H-H COSY



HMQC



## H-H Cosy and NOE spectra for 3d

